



Fundamentals Of INFORMATION TECHNOLOGY

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Paper DSC 103:

FUNDAMENTALS OF INFORMATION TECHNOLOGY

UNIT-I: INTRODUCTION TO COMPUTERS:

Introduction, Definition, Characteristics of computer, Evolution of Computer, Block Diagram Of a computer, Generations of Computer, Classification Of Computers, Applications of Computer, Capabilities and limitations of computer. Role of I/O devices in a computer system.

Input Units: Keyboard, Terminals and its types. Pointing Devices, Scanners and its types, Voice Recognition Systems, Vision Input System, Touch Screen,

Output Units: Monitors and its types.

Printers: Impact Printers and its types. Non-Impact Printers and its types, Plotters, types of plotters, Sound cards, Speakers.

UNIT -II: COMPUTER ARITHMETIC & STORAGE FUNDAMENTALS:

Binary, Binary Arithmetic, Number System: Positional & Non Positional, Binary, Octal, Decimal, Hexadecimal, Converting from one number system to another.

Primary Vs Secondary Storage, Data storage & retrieval methods. Primary Storage: RAM, ROM, PROM, EPROM, EEPROM. Secondary Storage: Magnetic Tapes, Magnetic Disks.

Cartridge tape, hard disks, Floppy disks Optical Disks, Compact Disks, Zip Drive, Flash Drives.

UNIT-III: SOFTWARE:

Software and its needs, Types of S/W. System Software: Operating System, Utility Programs

Programming Language: Machine Language, Assembly Language, High Level Language their advantages & disadvantages. Application S/W and its types: Word Processing, Spread Sheets Presentation, Graphics, DBMS s/w.

UNIT-IV: OPERATING SYSTEM:

Functions, Measuring System Performance, Assemblers, Compilers and Interpreters.

Batch Processing, Multiprogramming, Multi-Tasking, Multiprocessing, Time Sharing, DOS, Windows, Unix/Linux.

UNIT-V: DATA COMMUNICATION:

Data, Communication, Basic Networking Devices, Communication Process, Data Transmission speed, Communication Types(modes), Data Transmission Medias, Modem and its working, characteristics, Types of Networks, LAN Topologies, Computer Protocols, Concepts relating to networking.

UNIT-I

INTRODUCTION TO COMPUTERS

Information Technology is any technology that helps to produce, manipulate, store, communicate, and/or disseminate information.

What is IT?

Information technology (IT) is the use of any computers, storage, networking and other physical devices, infrastructure and processes to create, process, store, secure and exchange all forms of electronic data.

Typically, IT is used in the context of enterprise operations as opposed to personal or entertainment technologies. The commercial use of IT encompasses both computer technology and telephony.

The term information technology was coined by the *Harvard Business Review*, in order to make a distinction between purpose-built machines designed to perform a limited scope of functions and general-purpose computing machines that could be programmed for various tasks.

As the IT industry evolved from the mid-20th century, computing capability advanced while device cost and energy consumption fell lower, a cycle that continues today when new technologies emerge.

IT software and hardware

IT includes several layers of physical equipment (hardware), virtualization and management or automation tools, operating systems and applications (software) used to perform essential functions. User devices, peripherals and software, such as laptops, smart phones or even recording equipment, can be included in the IT domain.

IT can also refer to the architectures, methodologies and regulations governing the use and storage of data.

Introduction:

The term *computer* is derived from the Latin word *compute*, which means *to calculate*. A computer is a tool and partner in every sphere of human life and activity. Computers are bringing many changes in industry, government, education, medicine, scientific research, law, social service.

History of Computers

The following are some important inventions in the past:

1. Abacus

Abacus was the first calculating machine used for counting. Abacus was mainly used for addition and subtraction.

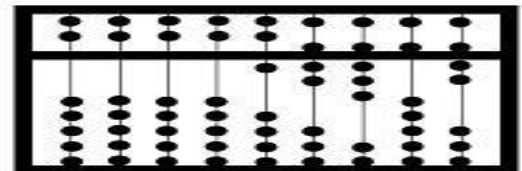


Figure: Abacus

2. Napier's bones:

The Napier's Bones has a set of bones. It was invented by John Napier. He invented this to perform multiplication.



Figure: 1. Napier Bones

3. Slide rule

The Slide Rule was invented by 'William - Oughtred'. The slide rule is has two sets of scales. These scales are useful to perform multiplication and division.

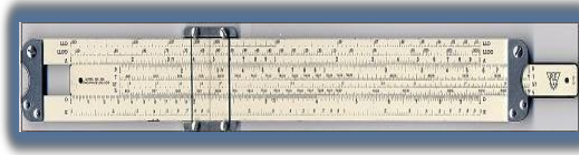


Figure: The Slide Rule

4. Pascal's calculator:

The Pascal Calculator was developed by 'Blaise Pascal'. It has simple components such as gears and levers. Computer scientists honored Pascal by naming a programming language Pascal after him.

5. The difference engine.

The Difference Engine was built by 'Charles Babbage' in 1822. The differential engine is a calculating machine. **Babbage is called the father of computers.**

6. ABC Computer:

In 1937, Dr. John Atanostoff and Berry designed the 'Atanostoff Berry Computer' (ABC). It laid the foundation for the development of electronic digital computer.

7. ENIAC-Electronic Numerical Integrator and Calculator:

In 1947, John Mauchly and Eckart developed ENIAC. It was the first large scale Electronic Digital Computer.

8. UNIVAC- Universal Automatic Computer:

In 1952, John Mauchly and Eckart designed UNIVAC. UNIVAC was the first computer for business applications.

Definition:

A computer is an electronic device that receives input, stores or processes the input as per user instructions and provides output in desired format. Computers have become an integral part of our lives because they can accomplish easy tasks repeatedly without getting bored and complex ones repeatedly without committing errors.

CHARACTERISTICS OF COMPUTER

A Computer system mainly consists the following characteristics or properties. Computers are widely used because of their various characteristics .Computers are not just calculating machines and are capable of doing complex activities and operations because of the following characteristics.

The following are the important features of computer:

1) SPEED:

The processing speed of the computer is generally measured in nanoseconds (10^{-9} seconds). A computer can add two 18 digit numbers within one nano second. A human being on the other hand takes atleast one minute to calculate that number.

2) ACCURACY:

Computers can do calculations without mistakes. A human being may make mistakes in calculating a certain range of calculations. But the results given by computer will always be accurate.

3) RELIABLE:

The major reason behind the reliability of computers is that at hardware level, it does not require any human intervention between its processing operations. A human being sometimes knowingly or unknowingly gives results which may be biased. But a computer being impartial, gives always reliable results which can be relied upon by all.

4) STORAGE CAPACITY:

A computer can store large quantity of data. The modern computers can now hold upto 160 GB memory. The storage capacity of the computer can be increased further by secondary memory devices. The data can be saved and used at any time in future. But a human being can store very small information in his mind.

5) DILIGENCE:

A computer can do the work for days together. It will work without any boredom and tiredness. Even if it does the same work many times, it won't get frustrated like a human being. Moreover a computer will work with same tempo from beginning to end.

6) VERSATILITY:

Computer can perform multiple tasks simultaneously with equal ease. They feed data, calculate sums, perform programming and provide multimedia facilities. That is why they are used in all types of business.

7) NETWORKING CAPACITY:

A computer can be connected with other computers & share the resources like data, printer etc. This feature of connectivity with other computers lead to evolution of computer networking. We can communicate with people in the world because of networking which ultimately leads to evolution of internet.

8) COMPACTNESS:

Computers occupy very small space in offices or organizations. Now-a-days size of computers has decreased a lot due to increased technology. The laptop & notebook computers can be taken outside. They can be operated in cars, railways, buses etc. In spite of their small size, their efficiency has increased a lot.

9) EASY MAINTENANCE:

Computers can be managed easily. They can be repaired immediately. The maintenance cost of computers is small. They need not require much electricity.

10) PROGRAMMABLE:

The computer can be programmed to work automatically. They start the work as per our program and terminate the work until we are satisfied.

LIMITATIONS OF COMPUTER

A computer is a versatile device. Yet it has some limitations. The limitations are as follows:

1.NO THINKING POWER:

A computer cannot think on its own. A computer performs whatever job is assigned to it. A computer can only perform what it is programmed to do.

2.NO CREATIVITY:

A computer cannot sing, act, paint or dance. While a human being has some type of creativity, a computer has no creativity on its own.

3.INITIAL COST:The cost of installation and maintenance of computers is a problem. Small firms cannot afford for the maintenance of computers in labs. The human beings must be trained to learn a lot of programming languages and packages in order to operate the computer.

4.NOT PORTABLE:

Certain types of programs are not suitable for using on other type of computers. The operating system does not support for it.

5.VIRUS PROBLEMS:

Computers are liable to get viruses. The viruses are created by computer hackers in order to infect the computers. These viruses are highly dangerous to computers. Data may be lost or there is damage to the system. However, now-a-days a lot of steps are devised to attack the viruses.

6.Lack of Decision-making

Decision-making is a complicated process involving information, knowledge, intelligence, wisdom, and ability to judge. The computer system does not have the ability to make decisions on their own because they do not possess all the essentials of decision-making.

They can be programmed to take such decisions, which are purely procedure-oriented. If a computer has not been programmed for a particular decision situation, it will not take a decision due to lack of wisdom and evaluation faculties. Human beings, on the other hand, possess this great power of decision-making.

Functionalities of a Computer

If we look at it in a very broad sense, any digital computer carries out the following five functions –

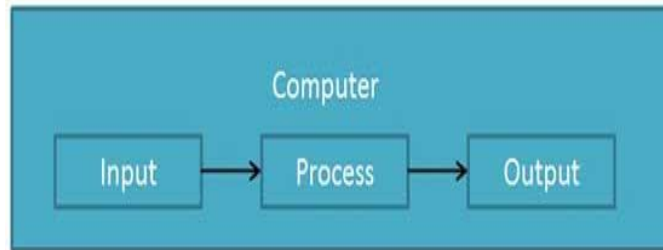
Step 1 – Takes data as input.

Step 2 – Stores the data/instructions in its memory and uses them as required.

Step 3 – Processes the data and converts it into useful information.

Step 4 – Generates the output.

Step 5 – Controls all the above four steps.



Evolution of Computer

A complete history of computing would include a multitude of diverse devices such as the ancient Chinese abacus, the Jacquard loom (1805) and Charles Babbage's "analytical engine" (1834). It would also include discussion of mechanical, analog and digital computing architectures. As late as the 1960s, mechanical devices, such as the Marchant calculator, still found widespread application in science and engineering. During the early days of electronic computing devices, there was much discussion about the relative merits of analog vs. digital computers.

In fact, as late as the 1960s, analog computers were routinely used to solve systems of finite difference equations arising in oil reservoir modeling. In the end, digital computing devices proved to have the power, economics and scalability necessary to deal with large scale computations. Digital computers now dominate the computing world in all areas ranging from the hand calculator to the supercomputer and are pervasive throughout society. Therefore, this brief sketch of the development of scientific computing is limited to the area of digital, electronic computers.

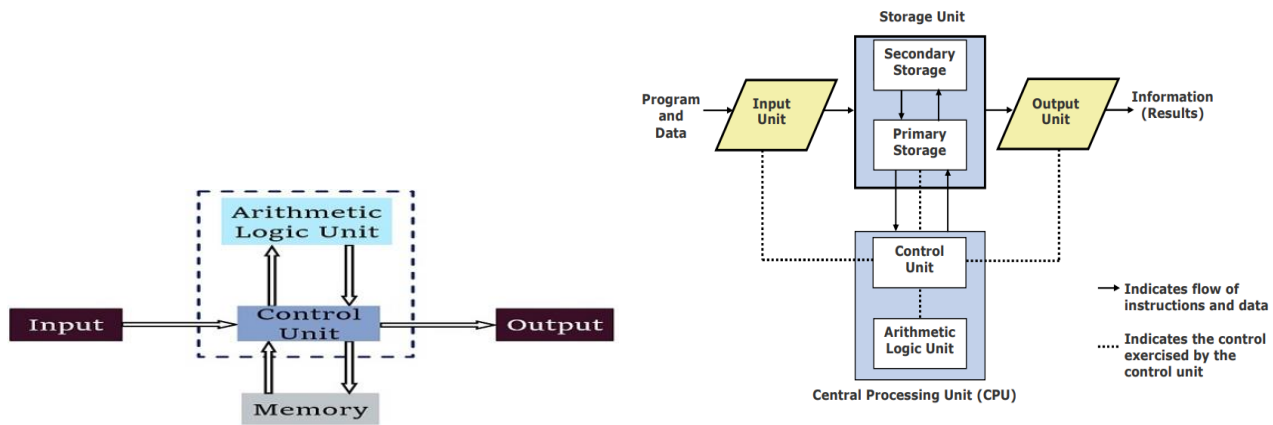
The evolution of digital computing is often divided into *generations*. Each generation is characterized by dramatic improvements over the previous generation in the technology used to build computers, the internal organization of computer systems, and programming languages. Although not usually associated with computer generations, there has been a steady improvement in algorithms, including algorithms used in computational science.

Block Diagram of Computer System

The Computer system consists of mainly three types that are central processing unit (CPU), Input Devices, and Output Devices. The Central processing unit (CPU) again consists of ALU (Arithmetic Logic Unit) and Control Unit. The set of instruction is presented to the computer in the form of raw data which is entered through input devices such as keyboard or mouse.

Later this set of instruction is processed with the help of CPU, and the computer system produces an output with the help of output devices mainly printers and monitors. Large amount of data is stored in the computer memory with the help of primary and secondary storage devices temporarily and permanently. These are called as storage devices.

The CPU is the heart | Brain of a computer because without the necessary action taken by the CPU the user cannot get the desired output. The central processing unit [CPU] is responsible for processing all the instruction which is given to computer system or PC. Below Block Diagram of Computer and Its Components are mentioned For Better Understanding



Block Diagram of Computer

INPUT UNIT:

An input unit accepts data from the user with the help of input devices such as keyboard, mouse, light pen etc. Since the data entered through different input devices will be in different form, the input unit converts them into the form that the computer can understand. After this the input unit supplies the converted data to the computer for further processing.

CPU (CENTRAL PROCESSING UNIT):

The CPU also known as a processor, is the brain of the computer system. It process the data (input) and converts it into meaningful information (output). The CPU itself has 3 parts. They are:

- 1) ALU (Arithmetic logic unit)
- 2) CU (Control unit)
- 3) MM (Main memory)

ALU:

This unit performs the arithmetic (add, subtract) & logical (AND, OR) operations on the data given by user. Whenever an arithmetic or logical operation is performed the required data is transferred from the memory unit to the ALU, the operation is performed and the result is returned to the MU.

CU:

It is just like the nervous system of the body. This part will decide which data to send first, how to send etc. Accordingly it will coordinate the input, output storage devices.

The CU has the following functions.

- a) It sends instructions to other parts.
- b) It sends commands to logical unit.
- c) It facilitates the data flow to be systematic between memory & logical unit.
- d) It builds the way for sending the processed information to output or storage devices.

MAIN MEMORY:

The computer will send the data from ALU to memory. Here memory means data storage system. Memory associated with CPU is known as Primary Memory, primary storage, main storage, internal storage & main memory. The computer stores some information in primary memory and some information permanently in the form of floppy, CD, etc.

OUTPUT UNIT:

The output unit performs just opposite to that of input unit. It accepts the output (which is in machine-coded form) produced by the computer, converts them into the user understandable form and supplies the converted results to the user with the help of an output device such as printer, monitor, etc.

A system has following three characteristics:

1. A system has more than one element

2. All elements of a system are logically related
3. All elements of a system are controlled in a manner to achieve the system goal

A computer is a system as it comprises of integrated components (input unit, output unit, storage unit, and CPU) that work together to perform the steps called for in the executing program

Generation Computers

A generation of computers refers to the specific improvements in computer technology with time. In 1946, electronic pathways called circuits were developed to perform the counting. It replaced the gears and other mechanical parts used for counting in previous computing machines.

In each new generation, the circuits became smaller and more advanced than the previous generation circuits. The miniaturization helped increase the speed, memory and power of computers. There are five generations of computers which are described below;

First Generation Computers

The first generation (1946-1959) computers were slow, huge and expensive. In these computers, vacuum tubes were used as the basic components of CPU and memory. These computers were mainly depended on batch operating system and punch cards. Magnetic tape and paper tape were used as output and input devices in this generation;

Some of the popular first generation computers are:

- **ENIAC** (Electronic Numerical Integrator and Computer)
- **EDVAC** (Electronic Discrete Variable Automatic Computer)
- **UNIVACI**(Universal Automatic Computer)
- **IBM-701**
- **IBM-650**

Second Generation Computers

The second generation (1959-1965) was the era of the transistor computers. These computers used transistors which were cheap, compact and consuming less power; it made transistor computers faster than the first generation computers.

In this generation, magnetic cores were used as the primary memory and magnetic disc and tapes were used as the secondary storage. Assembly language and programming languages like COBOL and FORTRAN, and Batch processing and multiprogramming operating systems were used in these computers.

Some of the popular second generation computers are;

- **IBM 1620**
- **IBM 7094**
- **CDC 1604**
- **CDC 3600**
- **UNIVAC 1108**

Third Generation Computers

The third generation computers used integrated circuits (ICs) instead of transistors. A single IC can pack huge number of transistors which increased the power of a computer and reduced the cost. The computers also became more reliable, efficient and smaller in size. These generation computers used remote

processing, time-sharing, multi programming as operating system. Also, the high-level programming languages like FORTRON-II TO IV, COBOL, PASCAL PL/1, ALGOL-68 were used in this generation.

Some of the popular third generation computers are:

- **IBM-360 series**
- **Honeywell-6000 series**
- **PDP(Personal Data Processor)**
- **IBM-370/168**
- **TDC-316**

Fourth Generation Computers

The fourth generation (1971-1980) computers used very large scale integrated (VLSI) circuits; a chip containing millions of transistors and other circuit elements. These chips made this generation computers more compact, powerful, fast and affordable. These generation computers used real time, time sharing and distributed operating system. The programming languages like C, C++, DBASE were also used in this generation.

Some of the popular fourth generation computers are;

- **DEC 10**
- **STAR 1000**
- **PDP 11**
- **CRAY-1(Super Computer)**
- **CRAY-X-MP(Super Computer)**

Fifth Generation Computers

In fifth generation (1980-till date) computers, the VLSI technology was replaced with ULSI (Ultra Large Scale Integration). It made possible the production of microprocessor chips with ten million electronic components. This generation computers used parallel processing hardware and AI (Artificial Intelligence) software. The programming languages used in this generation were C, C++, Java, .Net, etc.

Some of the popular fifth generation computers are;

- **Desktop**
- **Laptop**
- **NoteBook**
- **UltraBook**
- **ChromeBook**

Classification of Computers

The basic function of any computer is to accept the input and after processing it gives output to the user. Though the basic function of computer is same there are different types of computers in practice according to the needs, size and use of computers.

The computers have been classified into various types depending upon size, use and input as shown below:

TYPES OF COMPUTERS

ON THE BASIS OF INPUT:

On the basis of input accepted by the computer, we can divide them in the following way.

Analog Computer:

These computers will accept input which will constantly change and give output in the same form, i.e., constantly changing output.

For example, if we give constantly changing temperature & pressure as input to it, it gives output in the same form of changing temperature & pressure. The best example for analog computer is cooker. These type of computers are mainly used in scientific and engineering fields.

Digital Computer:

Digital means relating to numbers. Here we will give a combination of numbers, figures, symbols, words as input. The computer will change this input into numerical form. One example of digital computer is calculator. It shows the calculations accurately.

These types of computers are mainly used in educated related matters. As the size of these computers is very small, they will be inserted into watches and pocket size calculators.

Hybrid Computer: These are the computers which have the features of both analog and digital computers. If we give the input in the form of analog and digital calculations, then it is called hybrid computer. The output will also be obtained in the mixed form.

These types of computers are mainly used in hospitals where patient's condition is tested first in analog computer and the results of the analog computer will be converted into digital form to test the condition of the patient.

ON THE BASIS OF USE OF COMPUTERS:

On the basis of use of computers, we can classify them in the following way.

Special Purpose Computer:

Special purpose computers have been made keeping in mind the special objectives and conditions of the institutions or environment. These computers are not useful for general purposes. For example, in order to maintain a definite temperature in iron furnace, special purpose computer is used.

General Purpose Computer:

These are used in day to day works. As these are general computers, we can use them for word processing, calculations, etc. The personal computer is an example of general purpose computer.

ON THE BASIS OF SIZE AND WORKING PRINCIPLE:

The computers can be classified in the following way on the basis of size and working capacity.

Micro Computer: As microprocessor is used in these type of computers, they are called microcomputers. These are also called Personal computers.

Eg : Pentium III, Pentium IV

Characteristics of Micro Computer:

- They are the smallest and cheapest computers.
- Only one person can use the system at a time.
- Only one central processor is used in these type of computers.
- The storage capacity and processing speed are small.

Mini Computer: These computers are slightly bigger than microcomputers. These are used for small business needs. They are multi-user systems. Many people can work on the systems at the same time. We can have time sharing method in this computer.

FEATURES:

CPU Speed – High

Storage Capacity – Above 1000 GB

Areas of Application – Engineering, Scientific Research and Graphic Design

Examples – HP 2000 Model

Mainframe Computer: If we want to calculate millions of calculations, mainframe computers are used. As this computer is having time sharing method, hundreds of people will work at the same time on these computers. A number of processors are used in these computers. Everyone is given some time to do calculations. These computers will occupy a lot of space in the premises.

FEATURES:

CPU Speed – High

Storage Capacity – 5200 GB

Areas of Application – Banks, Insurance, Railways, Government Organizations

Examples – IBM Series, HP 9000 Model

1) Super Computer:

These are the super fastest computers in the world. The high speed in these computers is possible because of a number of processors used in them. They process hundreds of commands at one time instead of one single process at one time. It shares the information with hundreds of computers. These type of computers are mainly used in space research and weather forecasting.

FEATURES:

CPU Speed – Very High

Storage Capacity – Large Capacity

Areas of Application – Space, Defence, Research, Weather forecasting

Examples – Param 10000

PC (Personal Computer)

A PC can be defined as a small, relatively inexpensive computer designed for an individual user. PCs are based on the microprocessor technology that enables manufacturers to put an entire CPU on one chip. Businesses use personal computers for word processing, accounting, desktop publishing, and for running spreadsheet and database management applications. At home, the most popular use for personal computers is playing games and surfing the Internet.



Although personal computers are designed as single-user systems, these systems are normally linked together to form a network. In terms of power, now-a-days high-end models of the Macintosh and PC offer the same computing power and graphics capability as low-end workstations by Sun Microsystems, Hewlett-Packard, and Dell.

Workstation

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

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



Common operating systems for workstations are UNIX and Windows NT. Like PC, workstations are also single-user computers like PC but are typically linked together to form a local-area network, although they can also be used as stand-alone systems.

Computer – Applications

Business

A computer has high speed of calculation, diligence, accuracy, reliability, or versatility which has made it an integrated part in all business organizations. Computer is used in business organizations for –

- Payroll calculations
- Budgeting
- Sales analysis
- Financial forecasting
- Managing employee database
- Maintenance of stocks, etc.

Banking

Today, banking is almost totally dependent on computers. Banks provide the following facilities –

- Online accounting facility, which includes checking current balance, making deposits and overdrafts, checking interest charges, shares, and trustee records.
- ATM machines which are completely automated are making it even easier for customers to deal with banks.

Insurance: Insurance companies are keeping all records up-to-date with the help of computers. Insurance companies, finance houses, and stock broking firms are widely using computers for their concerns. Insurance companies are maintaining a database of all clients with information showing –

- Procedure to continue with policies
- Starting date of the policies
- Next due installment of a policy
- Maturity date
- Interests due
- Survival benefits
- Bonus

Education: **The computer helps in providing a lot of facilities in the education system.**

- The computer provides a tool in the education system known as CBE (Computer Based Education).
- CBE involves control, delivery, and evaluation of learning.
- Computer education is rapidly increasing the graph of number of computer students.

- There are a number of methods in which educational institutions can use a computer to educate the students.
- It is used to prepare a database about performance of a student and analysis is carried out on this basis.

Marketing: In marketing, uses of the computer are following –

- **Advertising** – With computers, advertising professionals create art and graphics, write and revise copy, and print and disseminate ads with the goal of selling more products.
- **Home Shopping** – Home shopping has been made possible through the use of computerized catalogues that provide access to product information and permit direct entry of orders to be filled by the customers.

Healthcare: Computers have become an important part in hospitals, labs, and dispensaries. They are being used in hospitals to keep the record of patients and medicines. It is also used in scanning and diagnosing different diseases. ECG, EEG, ultrasounds and CT scans, etc. are also done by computerized machines.

Following are some major fields of health care in which computers are used.

- **Diagnostic System** – Computers are used to collect data and identify the cause of illness.
- **Lab-diagnostic System** – All tests can be done and the reports are prepared by computer.
- **Patient Monitoring System** – These are used to check the patient's signs for abnormality such as in Cardiac Arrest, ECG, etc.
- **Pharma Information System** – Computer is used to check drug labels, expiry dates, harmful side effects, etc.
- **Surgery** – Nowadays, computers are also used in performing surgery.

Engineering Design: Computers are widely used for Engineering purpose. One of the major areas is CAD (Computer Aided Design) that provides creation and modification of images. Some of the fields are –

- **Structural Engineering** – Requires stress and strain analysis for design of ships, buildings, budgets, airplanes, etc.
- **Industrial Engineering** – Computers deal with design, implementation, and improvement of integrated systems of people, materials, and equipment.
- **Architectural Engineering** – Computers help in planning towns, designing buildings, determining a range of buildings on a site using both 2D and 3D drawings.

Military: Computers are largely used in defence. Modern tanks, missiles, weapons, etc. Military also employs computerized control systems. Some military areas where a computer has been used are –

- Missile Control
- Military Communication
- Military Operation and Planning
- Smart Weapons

Communication: Communication is a way to convey a message, an idea, a picture, or speech that is received and understood clearly and correctly by the person for whom it is meant. Some main areas in this category are –

- E-mail
- Chatting
- Usenet
- FTP

- Telnet
- Video-conferencing

Government: -Computers play an important role in government services. Some major fields in this category are

- Budgets
- Sales tax department
- Income tax department
- Computation of male/female ratio
- Computerization of voters lists
- Computerization of PAN card
- Weather forecasting

Role of I/O devices in a Computer System:

- I/O is a collection of interfaces that different units of an operational processing system used to communicate to each other.
- Inputs are the signals received by those units, while outputs are the sent signals.
- I/O devices are used by people or by other systems to communicate with the computer.
- Usually, these outputs are called 'results' and they can be addressed to people or can be used for guiding some other machines and robots.
- For instance, in the industrial robot's case, the most important output device is the one that sends all the detailed signals about the mechanical signals to the robot - signals which the robot understands and moves according to them.
- The first generation of computers were equipped with a limited range of i/o devices; reading data and instructions was possible with a perforated card reader or something similar, and for showing the results a printer was used, usually a teleprinter (teletypewriter, teletype or TTY for TeleTYpe/TeleTYpewriter).
- The modern teletypewriters are used by deaf for typed communication over a telephone.
- Technically, i/o devices are the ones that are bi-directional, i.e., they can function as input as well as output devices.
- They are mostly referred to as storage or communications devices.
- In general though, the term 'i/o' refers to input as well as output devices and those that can perform the functionality of both input and output.

Terminals and its types

A **computer terminal** is an electronic or electromechanical hardware device that is used for entering data into, and displaying or printing data from, a computer or a computing system. The teletype was an example of an early day hardcopy terminal, and predated the use of a computer screen by decades,

Early terminals were inexpensive devices but very slow compared to punched cards or paper tape for input, but as the technology improved and video displays were introduced, terminals pushed these older forms of interaction from the industry.

A related development was timesharing systems, which evolved in parallel and made up for any inefficiencies of the user's typing ability with the ability to support multiple users on the same machine, each at their own terminal.

The function of a terminal is confined to display and input of data; a device with significant local programmable data processing capability may be called a "smart terminal" or fat client. A terminal that depends on the host computer for its processing power is called a "dumb terminal" or a thin client.

A personal computer can run terminal emulator software that replicates the function of a terminal, sometimes allowing concurrent use of local programs and access to a distant *terminal host* system.

Input Devices:

Input device enables the user to send data, information, or control signals to a computer. The Central Processing Unit (CPU) of a computer receives the input and processes it to produce the output.

Keyboard

Keyboard is the most common and very popular input device which helps to input data to the computer. The layout of the keyboard is like that of traditional typewriter, although there are some additional keys provided for performing additional functions.



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 –

S.No	Keys & Description
1	<p>Typing Keys</p> <p>These keys include the letter keys (A-Z) and digit keys (09) which generally give the same layout as that of typewriters.</p>
2	<p>Numeric Keypad</p> <p>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.</p>
3	<p>Function Keys</p> <p>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.</p>
4	<p>Control keys</p> <p>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).</p>
5	<p>Special Purpose Keys</p> <p>Keyboard also contains some special purpose keys such as Enter, Shift, Caps Lock, Num Lock, Space bar, Tab, and Print Screen.</p>



Pointing device

An input device used to move the pointer (cursor) on screen. The major pointing device is the mouse for the desktop computer and the touchpad for the laptop, although many road warriors bring along a mouse. Pointing sticks are available on some laptops, and a small number of users prefer trackballs over the mouse. See [mouse](#), [touchpad](#), [trackball](#) and [pointing stick](#).

MOUSE

Mouse is the most popular pointing device. It is a very famous cursor-control device having a small palm size box with a round ball at its base, which senses the movement of the mouse and sends corresponding signals to the CPU when the mouse buttons are pressed.

A **computer mouse** is a handheld hardware [input device](#) that controls a [cursor](#) in a [GUI](#) (graphical user interface) and can move and select [text](#), [icons](#), [files](#), and [folders](#) on your computer. For desktop computers, the mouse is placed on a flat surface such as a [mouse pad](#) or a desk in front of your computer. The picture is an example of a desktop computer mouse with two buttons and a wheel.



Who invented the mouse?

The mouse was originally known as the **X-Y Position Indicator** for a Display System and was invented by [Douglas Engelbart](#) in [1963](#) while working at [Xerox PARC](#). But, due to Alto's lack of success, the first widely used application of the mouse was with the [Apple Lisa computer](#). Today, this pointing device is on virtually every computer.

What are the uses of a mouse?

Computer mouse functions to give you an idea of all the things a mouse is capable of doing.

Move the mouse cursor - The primary function is to move the [mouse pointer](#) on the screen.

Open or execute a program - Once you've moved the pointer to an icon, folder, or other object [clicking](#) or [double clicking](#) that object opens the [document](#) or [executes](#) the [program](#).

Select - A mouse also allows you to [select](#) text or a file or [highlight](#) and [select multiple files at once](#).

Drag-and-drop - Once something is selected, it can also be moved using the [drag-and-drop](#) method.

Hover - Moving the mouse cursor over objects with [hover](#) information can help discover the function of each object on the screen. For example, hover the mouse over the "hover" link to see an example.

Scroll - When working with a long document, or viewing a long [web page](#), you may need to [scroll](#) up or down. To scroll, use the [mouse wheel](#), or click and [drag](#) the [scroll bar](#).

Perform other functions - Many desktop mice also have buttons that can be programmed to perform any function. For example, many mice have two side buttons on the thumb portion of the mouse the button closest to the palm can be programmed to go back on web pages.

Advantages

- Easy to use
- Not very expensive
- Moves the cursor faster than the arrow keys of the keyboard.

Joystick

Joystick is also a pointing device, which is used to move the cursor position on a monitor screen. It is a stick having a spherical ball at its both lower and upper ends. The lower spherical ball moves in a socket. The joystick can be moved in all four directions.



The function of the joystick is similar to that of a mouse. It is mainly used in Computer Aided Designing (CAD) and playing computer games.

Light Pen

Light pen is a pointing device similar to a pen. It is used to select a displayed menu item or draw pictures on the monitor screen. It consists of a photocell and an optical system placed in a small tube.



When the tip of a light pen is moved over the monitor screen and the pen button is pressed, its photocell sensing element detects the screen location and sends the corresponding signal to the CPU.

Track Ball

Track ball is an input device that is mostly used in notebook or laptop computer, instead of a mouse. This is a ball which is half inserted and by moving fingers on the ball, the pointer can be moved.



Since the whole device is not moved, a track ball requires less space than a mouse. A track ball comes in various shapes like a ball, a button, or a square.

Scanner

Scanner is an input device, which works more like a photocopy machine. It is used when some information is available on paper and it is to be transferred to the hard disk of the computer for further manipulation.



Scanner captures images from the source which are then converted into a digital form that can be stored on the disk. These images can be edited before they are printed.

Digitizer

Digitizer is an input device which converts analog information into digital form. Digitizer can convert a signal from the television or camera into a series of numbers that could be stored in a computer. They can be used by the computer to create a picture of whatever the camera had been pointed at.



Digitizer is also known as Tablet or Graphics Tablet as it converts graphics and pictorial data into binary inputs. A graphic tablet as digitizer is used for fine works of drawing and image manipulation applications.

Microphone

Microphone is an input device to input sound that is then stored in a digital form.



The microphone is used for various applications such as adding sound to a multimedia presentation or for mixing music.

Magnetic Ink Card Reader (MICR)

MICR input device is generally used in banks as there are large number of cheques to be processed every day.



The bank's code number and cheque number are printed on the cheques with a special type of ink that contains particles of magnetic material that are machine readable.

This reading process is called Magnetic Ink Character Recognition (MICR). The main advantages of MICR is that it is fast and less error prone.

Optical Character Reader (OCR)

OCR is an input device used to read a printed text.



OCR scans the text optically, character by character, converts them into a machine readable code, and stores the text on the system memory.

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.



Bar Code Reader scans a bar code image, converts it into an alphanumeric value, which is then fed to the computer that the bar code reader is connected to.

Optical Mark Reader (OMR)

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



It is specially used for checking the answer sheets of examinations having multiple choice questions.

Scanner and Its Types

A scanner is a device that captures images from photographic prints, posters, magazine pages, and similar sources for computer editing and display. Scanners come in hand-held, feed-in, and flatbed types and for scanning black-and-white only, or color.

Very high resolution scanners are used for scanning for high-resolution printing, but lower resolution scanners are adequate for capturing images for computer display. Scanners usually come with software, such as Adobe's Photoshop product, that lets you resize and otherwise modify a captured image.

Scanners usually attach to your personal computer with a Small Computer System Interface ([SCSI](#)). An application such as PhotoShop uses the [TWAIN](#) program to read in the image.

Flatbed Scanners

Flatbed scanners are some of the most commonly used scanners as it has both home and office functions.



The way they scan documents is that a mechanism rolls under the document to obtain the image. For businesses that have a need for high processing abilities, the flatbed scanner can scan any number of documents with a click of a button.

Sheet-Fed Scanners

Sheet-fed scanners cost between \$300 and \$800. This type of scanner works like a flatbed scanner except that the image is fed through the scanner and moves along the beam to be read rather than the beam moving. This type is not useful for books, but only single sheets.



The aforementioned scanner types are the most common types of scanners used in homes and small offices.

Integrated Scanners

Integrated scanners are becoming one of the most modern types of scanners when it comes to obtaining images.



ATMs feature this type of built-in scanner for check-processing and approval.

Drum Scanners

These types of scanners are used mainly for capturing a picture and producing at a very high resolution rate.



There are only a few companies that make these scanners, considering the high cost of producing a scanner such as this. It is considered as a tremendous upgrade to a regular flatbed scanner.

Portable Scanners

Portable scanner are designed to capture text and other data while you are on the go.



The scanner is powered by batteries and once you scan the text, the content is stored on the portable scanner. Once you get home, you can transfer the content to a computer. Transferring to your computer is done by using a cable or a wireless connection.

Types of voice recognition systems

Automatic speech recognition is one example of voice recognition. Below are other examples of voice recognition systems.

Speaker dependent system - The voice recognition requires training before it can be used, which requires you to read a series of words and phrases.

Speaker independent system - The voice recognition software recognizes most users' voices with no training.

Discrete speech recognition - The user must pause between each word so that the speech recognition can identify each separate word.

Continuous speech recognition - The voice recognition can understand a normal rate of speaking.

Natural language - The speech recognition not only can understand the voice, but can also return answers to questions or other queries that are being asked.

Touch screen

A touch screen is a display device that allows the user to interact with a computer by using their finger or stylus. They can be a useful alternative to a mouse or keyboard for navigating a GUI(graphical user interface).

Touch screens are used on a variety of devices, such as computer and laptop displays, smartphones, tablets, cash registers, and information kiosks. Some touch screens use a grid of infrared beams to sense the presence of a finger instead of utilizing touch-sensitive input.

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.

Some of the popular output devices are:

1. Monitor
 - CRT Monitor
 - LCD Monitor
 - LED Monitor
 - Plasma Monitor
2. Printer
 - Impact Printers
 - A. Character Printers
 - i. Dot Matrix printers
 - ii. Daisy Wheel printers
 - B. Line printers
 - i. Drum printers
 - ii. Chain printers
 - Non-impact printers
 - A. Laser printers
 - B. Inkjet printers
3. Projector

MONITORS AND its TYPES

Monitors

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.

The monitor is the display unit or screen of the computer. It is the main output device that displays the processed data or information as text, images, audio or video.

The types of monitors are given below.

i) CRT Monitor

CRT monitors are based on the cathode ray tubes. They are like vacuum tubes which produce images in the form of video signals. Cathode rays tube produces a beam of electrons through electron guns that strike on the inner phosphorescent surface of the screen to produce images on the screen. The monitor contains millions of phosphorus dots of red, green and blue color. These dots start to glow when struck by electron beams and this phenomenon is called cathodoluminescence.



The main components of a CRT monitor include the electron gun assembly, deflection plate assembly, fluorescent screen, glass envelope, and base. The front (outer surface) of the screen onto which images are produced is called the face plate. It is made up of fiber optics.

There are three electron beams that strike the screen: red, green, and blue. So, the colors which you see on the screen are the blends of red, blue and green lights. The magnetic field guides the beams of electrons. Although LCDs have replaced the CRT monitors, the CRT monitors are still used by graphics professionals because of their color quality.

ii) LCD Monitor

The LCD monitor is a flat panel screen that is compact and light-weight as compared to CRT monitors. It is based on liquid crystal display technology which is used in the screens of laptops, tablets, smart phones, etc. An LCD screen comprises two layers of polarized glass with a liquid crystal solution between them. When the light passes through the first layer, an electric current aligns the liquid crystals. The aligned liquid crystals allow a varying level of light to pass through the second layer to create images on the screen.

The LCD screen has a matrix of pixels that display the image on the screen. Old LCDs had passive-matrix screens in which individual pixels are controlled by sending a charge. A few electrical charges could be sent each second that made screens appear blurry when the images moved quickly on the screen.

Modern LCDs use active-matrix technology and contain thin film transistors (TFTs) with capacitors. This technology allows pixels to retain their charge. So, they don't make screen blurry when images move fast on the screen as well as are more efficient than passive-matrix displays.



iii) LED monitor

The LED monitor is an improved version of an LCD monitor. It also has a flat panel display and uses liquid crystal display technology like the LCD monitors. The difference between them lies in the source of light to backlight the display.

The LED monitor has many LED panels, and each panel has several LEDs to backlight the display, whereas the LCD monitors use cold cathode fluorescent light to backlight the display. Modern electronic devices such as mobile phones, LED TVs, laptop and computer screens, etc., use a LED display as it not only produces more brilliance and greater light intensity but also consumes less power.



iv) Plasma Monitor

The plasma monitor is also a flat panel display that is based on plasma display technology. It has small tiny cells between two glass panels. These cells contain mixtures of noble gases and a small amount of mercury.

When voltage is applied, the gas in the cells turns into a plasma and emits ultraviolet light that creates images on the screen, i.e., the screen is illuminated by a tiny bit of plasma, a charged gas. Plasma displays are brighter than liquid crystal displays (LCD) and also offer a wide viewing angle than an LCD.



Plasma monitors provide high resolutions of up to 1920 X 1080, excellent contrast ratios, wide viewing angle, a high refresh rate and more. Thus, they offer a unique viewing experience while watching action movies, sports games, and more.

2) 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.

Impact Printers: They are of two types:

Character Printers

- i. Dot Matrix printers
- ii. Daisy Wheel printers

Line printers

- iii. Drum printers
- iv. Chain printers
- o **Non-impact printers: They are of two types:**
 - A. Laser printers
 - B. 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.

- A. Character Printers
- B. Line printers

A) 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. Today, these printers are not in much use due to their low speed and because only the text can be printed. The character printers are of two types, which are as follows:

i) 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 print head of a 24 pin dot matrix contains more pins than a 9 pin dot matrix printer, so it produces more dots which results in better printing of characters. To produce color output, the black ribbon can be changed with color stripes. The speed of Dot Matrix printers is around 200-500 characters per second.

ii) Daisy Wheel Printer

Daisy Wheel Printer was invented by David S. Lee at Diablo Data Systems. 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. It cannot be used to print graphics and is often noisy and slow, i.e., the speed is very low around 25-50 characters per second. Due to these drawbacks, these printers have become obsolete.



B) 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.

i) 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.

The drum rotates at a very high speed and characters are printed by activating the appropriate hammers. Although all the characters are not printed at a time, they are printed at a very high speed. Furthermore, it can print only a predefined style as it has a specific set of characters. These printers are known to be very noisy due to the use of hammering techniques.

ii) 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.

The chain rotates at a very high speed and when the desired character comes at the print location, the corresponding hammer strikes the page against the ribbon and character on the chain. They can type 500 to 3000 lines per minute. They are also noisy due to the hammering action.

Non-Impact Printer:

Non-impact printers don't print characters or images by striking a print head or hammer on the ink ribbon placed against the paper. 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:

i) 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.



Once the document is printed, the drum loses the electric charge, and the remaining toner is collected. The laser printers use powdered toner for printing instead of liquid ink and produce quality print objects with a resolution of 600 dots per inch (dpi) or more.

ii) 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.



An inkjet printer has cartridges that contain ink. Modern inkjet printers are color printers that have four cartridges containing different colors: Cyan, Magenta, Yellow, and Black. It is capable of printing high-quality images with different colors. It can produce print objects with a resolution of at least 300 dots per inch (dpi).

3) 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.



Modern projects (digital projectors) come with multiple input sources such as HDMI ports for newer equipment and VGA ports that support older devices. Some projectors are designed to support Wi-Fi and Bluetooth as well. They can be fixed onto the ceiling, placed on a stand, and more and are frequently used for classroom teaching, giving presentations, home cinemas, etc.

A digital projector can be of two types:

Liquid Crystal Display (LCD) digital projector: This type of digital projectors are very popular as they are lightweight and provide crisp output. An LCD projector uses transmissive technology to produce output. It allows the light source, which is a standard lamp, to pass through the three colored liquid crystal light panels. Some colors pass through the panels and some are blocked by the panels and thus images are on the screen.

Digital Light Processing (DLP) digital projector: It has a set of tiny mirrors, a separate mirror for each pixel of the image and thus provide high-quality images. These projectors are mostly used in theatres as they fulfill the requirement of high-quality video output.

Sound card:

A sound card is an expansion component used in computers to receive and send audio. Sound cards are configured and utilized with the help of a software application and a device driver. The input device attached to receive audio data is usually a microphone, while the device used to output audio data is generally speakers or headphones.

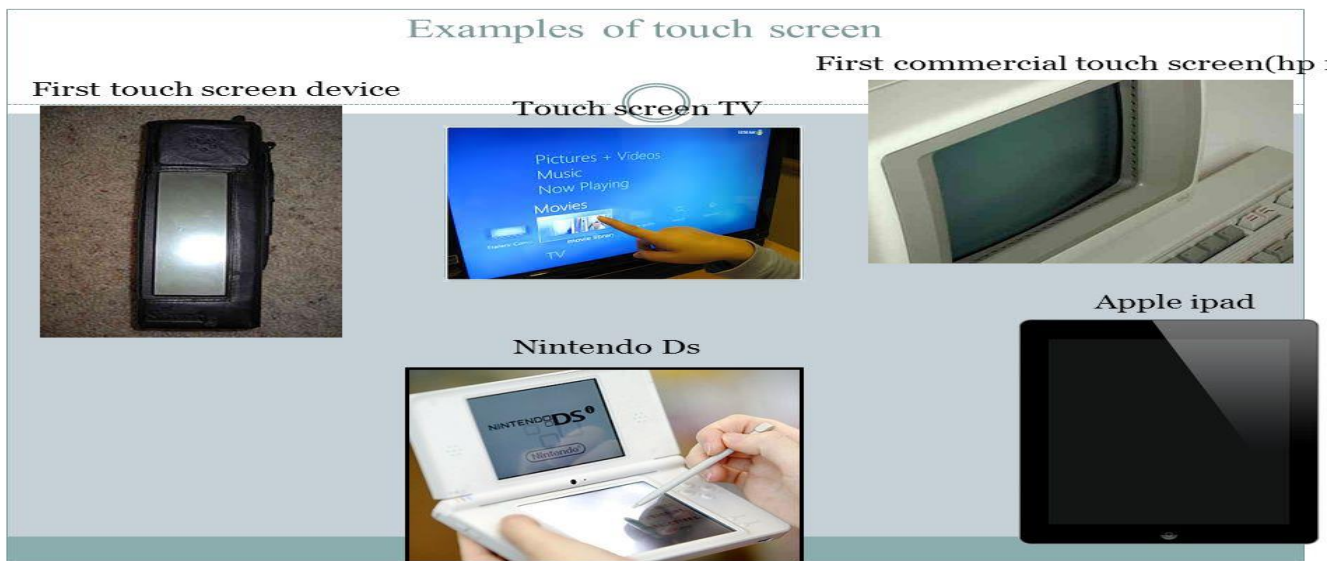
The sound card converts incoming digital audio data into analog audio so that the speakers can play it. In the reverse case, the sound card can convert analog audio data from the microphone into digital data that can be stored on the computer and altered using audio software.

Sound cards are also known as audio adapters.

Touch screen

A touch screen is a display device that allows the user to interact with a computer by using their finger or stylus. They can be a useful alternative to a mouse or keyboard for navigating a GUI(graphical user interface).

Touch screens are used on a variety of devices, such as computer and laptop displays, smartphones, tablets, cash registers, and information kiosks. Some touch screens use a grid of infrared beams to sense the presence of a finger instead of utilizing touch-sensitive input.



VISUAL INPUT SYSTEMS:

Computer vision is an interdisciplinary scientific field that deals with how computers can be made to gain high-level understanding from digital images or videos. From the perspective of engineering, it seeks to automate tasks that the human visual system can do.

Computer Vision

The **scene analysis** stage interprets the results from the image processing stage.

Its output completely depends on the problem that the computer vision system is supposed to solve.

For example, it could be the **number of bacteria** in a microscopic image, or the **identity of a person** whose retinal scan was input to the system.

Computer vision tasks include methods for **acquiring, processing, analyzing** and understanding digital images, and extraction of **high-dimensional** data from the real world in order to produce numerical or symbolic information, e.g. in the forms of decisions. Understanding in this context means the transformation of visual images (the input of the retina) into descriptions of the world that can interface with other thought processes and elicit appropriate action. This image understanding can be seen as the disentangling of symbolic information from image data using models constructed with the aid of geometry, physics, statistics, and learning theory.

Vision - Input Systems

- As a technological discipline, computer vision seeks to apply its theories and models to the construction of computer vision systems. Examples of applications of computer vision include systems for:
- Controlling processes
- Detecting events
- Organizing information
- Modeling objects or environments
- Interaction

As a **scientific discipline**, computer vision is concerned with the theory behind artificial systems that extract information from images. The image data can take many forms, such as video sequences, views from multiple cameras, or multi-dimensional data from a medical scanner. As a technological discipline, computer vision seeks to apply its theories and models for the construction of computer vision systems.

It allows computer to accept input just by seeing an object. Input data is normally an object's shape and feature in the form of an image. Today's objective is to investigate the development of a vision system which utilizes or establishes standards. Current focuses in the field include emotion recognition from the face and hand gesture recognition.



Sub-domains of computer vision include **scene reconstruction**, event detection, video tracking, object recognition, 3D pose estimation, learning, indexing, motion estimation, and image restoration.

UNIT – II

COMPUTER ARITHMETIC & STORAGE FUNDAMENTALS

Number System

The language we use to communicate with each other is comprised of words and characters. We understand numbers, characters and words. But this type of data is not suitable for computers. Computers only understand the numbers.

When we enter data, the data is converted into electronic pulse. Each pulse is identified as code and the code is converted into numeric format by ASCII. It gives each number, character and symbol a numeric value (number) that a computer understands. So to understand the language of computers, one must be familiar with the number systems.

The Number Systems used in computers are:

- Binary number system
- Octal number system
- Decimal number system
- Hexadecimal number system

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.

10^5	10^4	10^3	10^2	10^1	10^0
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Each position represents a specific power of the base (10). For example, the decimal number 1234 consists of the digit 4 in the units position, 3 in the tens position, 2 in the hundreds position, and 1 in the thousands position. Its value can be written as

$$\begin{aligned} &(1 \times 1000) + (2 \times 100) + (3 \times 10) + (4 \times 1) \\ &(1 \times 10^3) + (2 \times 10^2) + (3 \times 10^1) + (4 \times 10^0) \\ &1000 + 200 + 30 + 4 \\ &1234 \end{aligned}$$

As a computer programmer or an IT professional, you should understand the following number systems which are frequently used in computers.

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

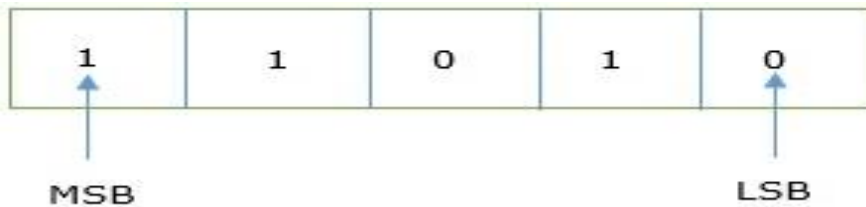
Binary Number System

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.

2^5	2^4	2^3	2^2	2^1	2^0
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In any binary number, the rightmost digit is called **least significant bit (LSB)** and leftmost digit is called **most significant bit (MSB)**.



Example

Binary Number: 10101_2

Calculating Decimal Equivalent –

Step	Binary Number	Decimal Number
Step 1	10101_2	$((1 \times 2^4) + (0 \times 2^3) + (1 \times 2^2) + (0 \times 2^1) + (1 \times 2^0))_{10}$
Step 2	10101_2	$(16 + 0 + 4 + 0 + 1)_{10}$
Step 3	10101_2	21_{10}

Note – 10101_2 is normally written as 10101.

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

8^5	8^4	8^3	8^2	8^1	8^0
-------	-------	-------	-------	-------	-------

Example

Octal Number: 12570_8

Calculating Decimal Equivalent –

Step	Octal Number	Decimal Number
Step 1	12570_8	$((1 \times 8^4) + (2 \times 8^3) + (5 \times 8^2) + (7 \times 8^1) + (0 \times 8^0))_{10}$
Step 2	12570_8	$(4096 + 1024 + 320 + 56 + 0)_{10}$
Step 3	12570_8	5496_{10}

Note – 12570_8 is normally written as 12570.

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

16^5	16^4	16^3	16^2	16^1	16^0
--------	--------	--------	--------	--------	--------

Example

Hexadecimal Number: $19FDE_{16}$

Calculating Decimal Equivalent –

Step	Binary Number	Decimal Number
------	---------------	----------------

Step 1	19FDE ₁₆	$((1 \times 16^4) + (9 \times 16^3) + (F \times 16^2) + (D \times 16^1) + (E \times 16^0))_{10}$
Step 2	19FDE ₁₆	$((1 \times 16^4) + (9 \times 16^3) + (15 \times 16^2) + (13 \times 16^1) + (14 \times 16^0))_{10}$
Step 3	19FDE ₁₆	$(65536 + 36864 + 3840 + 208 + 14)_{10}$
Step 4	19FDE ₁₆	106462 ₁₀

Note – 19FDE₁₆ is normally written as 19FDE.

Number System Relationship

The following table depicts the relationship between decimal, binary, octal and hexadecimal number systems.

HEXADECIMAL	DECIMAL	OCTAL	BINARY
0	0	0	0000
1	1	1	0001
2	2	2	0010
3	3	3	0011
4	4	4	0100
5	5	5	0101
6	6	6	0110
7	7	7	0111
8	8	10	1000
9	9	11	1001
A	10	12	1010

B	11	13	1011
C	12	14	1100
D	13	15	1101
E	14	16	1110
F	15	17	1111

ASCII

Besides numerical data, computer must be able to handle alphabets, punctuation marks, mathematical operators, special symbols, etc. that form the complete character set of English language. The complete set of characters or symbols are called alphanumeric codes. The complete alphanumeric code typically includes –

- 26 upper case letters
- 26 lower case letters
- 10 digits
- 7 punctuation marks
- 20 to 40 special characters

A computer understands only numeric values, whatever the number system used. So all characters must have a numeric equivalent called the alphanumeric code. The most widely used alphanumeric code is American Standard Code for Information Interchange (ASCII). ASCII is a 7-bit code that has 128 (2⁷) possible codes.

ISCII

ISCII stands for **Indian Script Code for Information Interchange**. IISCI was developed to support Indian languages on computer. Language supported by IISCI include Devanagari, Tamil, Bangla, Gujarati, Gurmukhi, Tamil, Telugu, etc. IISCI is mostly used by government departments and before it could catch on, a new universal encoding standard called **Unicode** was introduced.

Unicode

Unicode is an international coding system designed to be used with different language scripts. Each character or symbol is assigned a unique numeric value, largely within the framework of ASCII. Earlier, each script had its own encoding system, which could conflict with each other.

In contrast, this is what Unicode officially aims to do – *Unicode provides a unique number for every character, no matter what the platform, no matter what the program, no matter what the language.*

Decimal, binary, octal and hexadecimal number systems are positional value number systems. To convert binary, octal and hexadecimal to decimal number, we just need to add the product of each digit with its positional value. Here we are going to learn other conversion among these number systems.

Number Conversion

There are many methods or techniques which can be used to convert numbers from one base to another. In this chapter, we'll demonstrate the following –

- Decimal to Other Base System

- Other Base System to Decimal
- Other Base System to Non-Decimal
- Shortcut method - Binary to Octal
- Shortcut method - Octal to Binary
- Shortcut method - Binary to Hexadecimal
- Shortcut method - Hexadecimal to Binary

Decimal to Other Base System

Step 1 – Divide the decimal number to be converted by the value of the new base.

Step 2 – Get the remainder from Step 1 as the rightmost digit (least significant digit) of the new base number.

Step 3 – Divide the quotient of the previous divide by the new base.

Step 4 – Record the remainder from Step 3 as the next digit (to the left) of the new base number.

Repeat Steps 3 and 4, getting remainders from right to left, until the quotient becomes zero in Step 3.

The last remainder thus obtained will be the Most Significant Digit (MSD) of the new base number.

Example

Decimal to Binary

Decimal numbers can be converted to binary by repeated division of the number by 2 while recording the remainder. Let's take an example to see how this happens.

		Remainder	
2	43		
2	21	1	
2	10	1	
2	5	0	
2	2	1	
2	1	0	
	0	1	

MSB

↑

LSB

The remainders are to be read from bottom to top to obtain the binary equivalent.

$$43_{10} = 101011_2$$

Decimal Number: 29₁₀

Calculating Binary Equivalent –

Step	Operation	Result	Remainder
Step 1	29 / 2	14	1
Step 2	14 / 2	7	0
Step 3	7 / 2	3	1

Step 4	3 / 2	1	1
Step 5	1 / 2	0	1

As mentioned in Steps 2 and 4, the remainders have to be arranged in the reverse order so that the first remainder becomes the Least Significant Digit (LSD) and the last remainder becomes the Most Significant Digit (MSD).

Decimal Number : 29_{10} = Binary Number : 11101_2 .

Other Base System to Decimal System

Step 1 – Determine the column (positional) value of each digit (this depends on the position of the digit and the base of the number system).

Step 2 – Multiply the obtained column values (in Step 1) by the digits in the corresponding columns.

Step 3 – Sum the products calculated in Step 2. The total is the equivalent value in decimal.

Example

Binary Number: 11101_2

Calculating Decimal Equivalent –

Step	Binary Number	Decimal Number
Step 1	11101_2	$((1 \times 2^4) + (1 \times 2^3) + (1 \times 2^2) + (0 \times 2^1) + (1 \times 2^0))_{10}$
Step 2	11101_2	$(16 + 8 + 4 + 0 + 1)_{10}$
Step 3	11101_2	29_{10}

Binary Number : 11101_2 = Decimal Number : 29_{10}

Other Base System to Non-Decimal System

Step 1 – Convert the original number to a decimal number (base 10).

Step 2 – Convert the decimal number so obtained to the new base number.

Example

Octal Number : 25_8

Calculating Binary Equivalent –

Step 1 - Convert to Decimal

Step	Octal Number	Decimal Number
Step 1	25_8	$((2 \times 8^1) + (5 \times 8^0))_{10}$

Step 2	25_8	$(16 + 5)_{10}$
Step 3	25_8	21_{10}

Octal Number : $25_8 =$ Decimal Number : 21_{10}

Step 2 - Convert Decimal to Binary

Step	Operation	Result	Remainder
Step 1	$21 / 2$	10	1
Step 2	$10 / 2$	5	0
Step 3	$5 / 2$	2	1
Step 4	$2 / 2$	1	0
Step 5	$1 / 2$	0	1

Decimal Number : $21_{10} =$ Binary Number : 10101_2

Octal Number : $25_8 =$ Binary Number : 10101_2

Shortcut Method – Binary to Octal

Step 1 – Divide the binary digits into groups of three (starting from the right).

Step 2 – Convert each group of three binary digits to one octal digit.

Example

Binary Number : 10101_2

Calculating Octal Equivalent –

Step	Binary Number	Octal Number
Step 1	10101_2	010 101
Step 2	10101_2	$2_8 5_8$
Step 3	10101_2	25_8

Binary Number : $10101_2 =$ Octal Number : 25_8

Decimal to Octal

Decimal numbers can be converted to octal by repeated division of the number by 8 while recording the remainder. Let's take an example to see how this happens.

		Remainder	
8	473		
8	59	1	MSD ↑ LSD
8	7	3	
	0	7	

Reading the remainders from bottom to top,

$$473_{10} = 731_8$$

Shortcut Method – Octal to Binary

Step 1 – Convert each octal digit to a 3-digit binary number (the octal digits may be treated as decimal for this conversion).

Step 2 – Combine all the resulting binary groups (of 3 digits each) into a single binary number.

Example

Octal Number : 25_8

Calculating Binary Equivalent –

Step	Octal Number	Binary Number
Step 1	25_8	$2_{10} 5_{10}$
Step 2	25_8	$010_2 101_2$
Step 3	25_8	010101_2

Octal Number : $25_8 =$ Binary Number : 10101_2

Shortcut Method – Binary to Hexadecimal

Step 1 – Divide the binary digits into groups of four (starting from the right).

Step 2 – Convert each group of four binary digits to one hexadecimal symbol.

Example

Binary Number : 10101_2

Calculating hexadecimal Equivalent –

Step	Binary Number	Hexadecimal Number
Step 1	10101_2	$0001 0101$

Step 2	10101 ₂	1 ₁₀ 5 ₁₀
Step 3	10101 ₂	15 ₁₆

Binary Number : 10101₂ = Hexadecimal Number : 15₁₆

Shortcut Method - Hexadecimal to Binary

Step 1 – Convert each hexadecimal digit to a 4-digit binary number (the hexadecimal digits may be treated as decimal for this conversion).

Step 2 – Combine all the resulting binary groups (of 4 digits each) into a single binary number.

Example

Hexadecimal Number : 15₁₆

Calculating Binary Equivalent –

Step	Hexadecimal Number	Binary Number
Step 1	15 ₁₆	1 ₁₀ 5 ₁₀
Step 2	15 ₁₆	0001 ₂ 0101 ₂
Step 3	15 ₁₆	00010101 ₂

Hexadecimal Number : 15₁₆ = Binary Number : 10101₂

Decimal to Hexadecimal

Decimal numbers can be converted to octal by repeated division of the number by 16 while recording the remainder. Let's take an example to see how this happens.

		Remainder
16	423	
16	26	7
16	1	A
	0	1

↑

Reading the remainders from bottom to top we get,

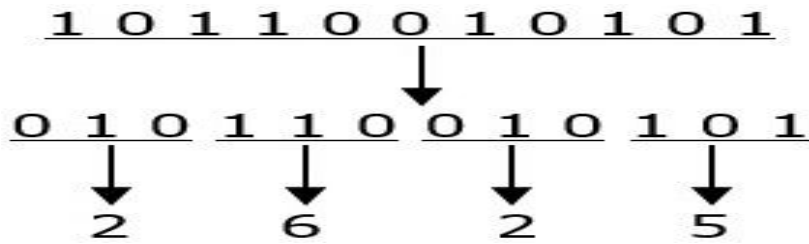
$$423_{10} = 1A7_{16}$$

Binary to Octal and Vice Versa

To convert a binary number to octal number, these steps are followed –

- Starting from the least significant bit, make groups of three bits.
- If there are one or two bits less in making the groups, 0s can be added after the most significant bit
- Convert each group into its equivalent octal number

Let's take an example to understand this.



$$10110010101_2 = 2625_8$$

To convert an octal number to binary, each octal digit is converted to its 3-bit binary equivalent according to this table.

Octal Digit	0	1	2	3	4	5	6	7
Binary Equivalent	000	001	010	011	100	101	110	111

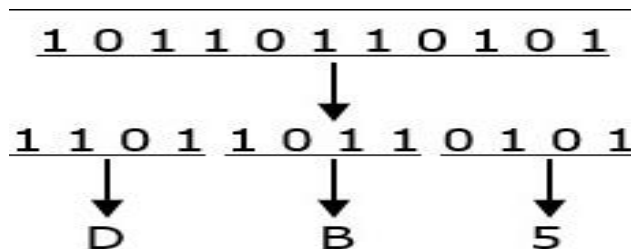
$$54673_8 = 101100110111011_2$$

Binary to Hexadecimal

To convert a binary number to hexadecimal number, these steps are followed –

- Starting from the least significant bit, make groups of four bits.
- If there are one or two bits less in making the groups, 0s can be added after the most significant bit.
- Convert each group into its equivalent octal number.

Let's take an example to understand this.



$$10110110101_2 = DB5_{16}$$

To convert an octal number to binary, each octal digit is converted to its 3-bit binary equivalent.

Data storage & retrieval methods

The Systems which are used to store information gathered from different sources in such a way that it can be retrieved easily and effectively upon request are referred to as information storage and retrieval systems. Collecting information from different resources and storing it in either storage room(maintaining paper records) or the storage devices such as hard disk, DVD, CD is called as information storage. This information may be in any of the form that is audio, video, text.

Information Retrieval System is mainly focus electronic searching and retrieving old documents. The process of searching, fetching and serving of information to the requested users is information retrieval. An IR System is capable of performing operations like methods for adding documents to the database, modifying or deleting them from the database, methods for searching and serving appropriate document to the users. Information Retrieval is an activity of obtaining relevant documents based on user needs from collection of retrieved documents.

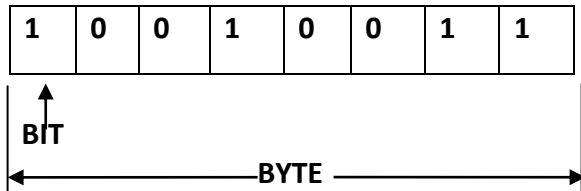
DATA ACCEPTING SYSTEM IN COMPUTER:

The computer converts the data given by user into its own language called machine language. The machine language is only understood by the computer.

The user don't give the data to the computer in the machine language. If the data is in the form of alphabets, numbers etc, the computer will convert it into its own language.

Eg: Binary Form.

The computer will convert the information into 'bits'. The bits are binary numbers. They are just two numbers '0' and '1'. The total of 8 bits is called a 'byte'. Whenever we measure memory of computer we measure it in bytes.



Memory

A memory is just like a human brain. It is used to store data and instructions. Computer memory is the storage space in the computer, where data is to be processed and instructions required for processing are stored.

The memory is divided into large number of small parts called cells. Each location or cell has a unique address, which varies from zero to memory size minus one. For example, if the computer has 64k words, then this memory unit has $64 * 1024 = 65536$ memory locations. The address of these locations varies from 0 to 65535.

Computer memory is measured in terms of how many bits it can store. Here is a chart for memory capacity conversion.

- 1 byte (B) = 8 bits
- 1 Kilobytes (KB) = 1024 bytes
- 1 Megabyte (MB) = 1024 KB
- 1 Gigabyte (GB) = 1024 MB
- 1 Terabyte (TB) = 1024 GB
- 1 Exabyte (EB) = 1024 PB
- 1 Zettabyte = 1024 EB
- 1 Yottabyte (YB) = 1024 ZB

Memory is primarily of three types –

- Cache Memory
- Primary Memory/Main Memory
- Secondary Memory

Cache Memory

Cache memory is a very high speed semiconductor memory which can speed up the CPU. It acts as a buffer between the CPU and the main memory. It is used to hold those parts of data and program which are most frequently used by the CPU. The parts of data and programs are transferred from the disk to cache memory by the operating system, from where the CPU can access them.

Advantages

The advantages of cache memory are as follows –

- Cache memory is faster than main memory.

- It consumes less access time as compared to main memory.
- It stores the program that can be executed within a short period of time.
- It stores data for temporary use.

Disadvantages

The disadvantages of cache memory are as follows –

- Cache memory has limited capacity.
- It is very expensive.

Primary Memory (Main Memory)

Primary memory holds only those data and instructions on which the computer is currently working. It has a limited capacity and data is lost when power is switched off. It is generally made up of semiconductor device.

These memories are not as fast as registers. The data and instruction required to be processed resides in the main memory. It is divided into two subcategories RAM and ROM.

Characteristics of Main Memory

- These are semiconductor memories.
- It is known as the main memory.
- Usually volatile memory.
- Data is lost in case power is switched off.
- It is the working memory of the computer.
- Faster than secondary memories.
- A computer cannot run without the primary memory.

Random Access Memory

RAM (Random Access Memory) is the internal memory of the CPU for storing data, program, and program result. It is a read/write memory which stores data until the machine is working. As soon as the machine is switched off, data is erased.

Access time in RAM is independent of the address, that is, each storage location inside the memory is as easy to reach as other locations and takes the same amount of time. Data in the RAM can be accessed randomly but it is very expensive.

RAM is volatile, i.e. data stored in it is lost when we switch off the computer or if there is a power failure. Hence, a backup Uninterruptible Power System (UPS) is often used with computers. RAM is small, both in terms of its physical size and in the amount of data it can hold.

RAM is of two types –

- Static RAM (SRAM)
- Dynamic RAM (DRAM)

Static RAM (SRAM)

The word **static** indicates that the memory retains its contents as long as power is being supplied. However, data is lost when the power gets down due to volatile nature. SRAM chips use a matrix of 6-transistors and no capacitors. Transistors do not require power to prevent leakage, so SRAM need not be refreshed on a regular basis.



There is extra space in the matrix, hence SRAM uses more chips than DRAM for the same amount of storage space, making the manufacturing costs higher. SRAM is thus used as cache memory and has very fast access.

Characteristic of Static RAM

- Long life
- No need to refresh
- Faster
- Used as cache memory
- Large size
- Expensive
- High power consumption

Dynamic RAM (DRAM)

DRAM, unlike SRAM, must be continually **refreshed** in order to maintain the data. This is done by placing the memory on a refresh circuit that rewrites the data several hundred times per second. DRAM is used for most system memory as it is cheap and small. All DRAMs are made up of memory cells, which are composed of one capacitor and one transistor.

Characteristics of Dynamic RAM

- Short data lifetime
- Needs to be refreshed continuously
- Slower as compared to SRAM
- Used as RAM
- Smaller in size
- Less expensive
- Less power consumption

Read Only Memory

ROM stands for **Read Only Memory**. The memory from which we can only read but cannot write on it. This type of memory is non-volatile. The information is stored permanently in such memories during manufacture.

A ROM stores such instructions that are required to start a computer. This operation is referred to as **bootstrap**. ROM chips are not only used in the computer but also in other electronic items like washing machine and microwave oven.

Types of ROMs and their characteristics.

MROM (Masked ROM)

The very first ROMs were hard-wired devices that contained a pre-programmed set of data or instructions. These kind 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. Inside the PROM chip, there are small fuses which are burnt open during programming. It can be programmed only once and is not erasable.

EPROM (Erasable and Programmable Read Only Memory)

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. During programming, an electrical charge is trapped in an insulated gate region.



The charge is retained for more than 10 years because the charge has no leakage path. For erasing this charge, ultra-violet light is passed through a quartz crystal window (lid). This exposure to ultra-violet light dissipates the charge. During normal use, the quartz lid is sealed with a sticker.

EEPROM (Electrically Erasable and Programmable Read Only Memory)

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 ms (millisecond). In EEPROM, any location can be selectively erased and programmed.

EEPROMs can be erased one byte at a time, rather than erasing the entire chip. Hence, the process of reprogramming is flexible but slow.

Advantages of ROM

The advantages of ROM are as follows –

- Non-volatile in nature
- Cannot be accidentally changed
- Cheaper than RAMs
- Easy to test
- More reliable than RAMs
- Static and do not require refreshing
- Contents are always known and can be verified

Cache Memory

Small piece of high speed volatile memory available to the processor for fast processing is called **cache memory**. Cache may be a reserved portion of main memory, another chip on CPU or an independent high speed storage device. Cache memory is made of fast speed SRAMs. The process of keeping some data and instructions in cache memory for faster access is called **caching**. Caching is done when a set of data or instructions is accessed again and again.

Whenever the processor needs any piece of data or instructions, it checks the cache first. If it is unavailable there, then the main memory and finally secondary memory is accessed. As cache has very high speed, time spent in accessing it every time is negligible as compared to time saved if data indeed is in the cache. Finding data or instruction in cache is called **cache hit**.

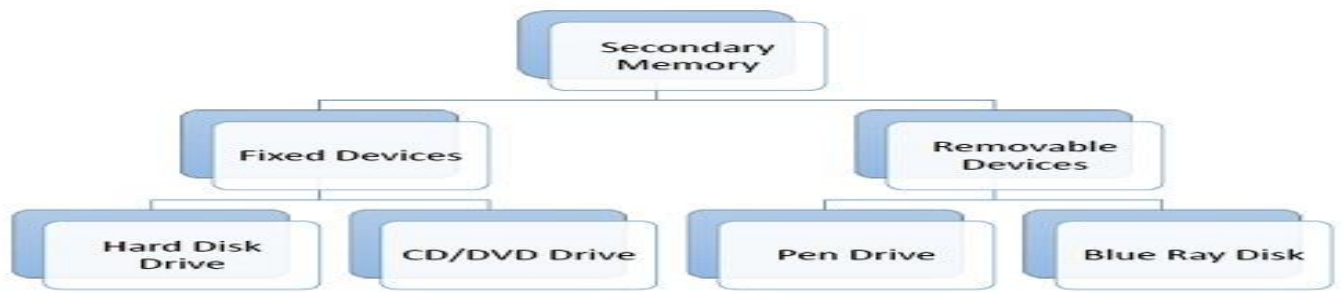
Secondary Memory

Secondary memory is where programs and data are kept on a long-term basis. Common secondary storage devices are the hard disk and optical disks.

- The hard disk has enormous storage capacity compared to main memory.
- The hard disk is usually contained inside the case of a computer.
- The hard disk is used for long-term storage of programs and data.
- Data and programs on the hard disk are organized into files.
- A **file** is a collection of data on the disk that has a name.

A hard disk might have a storage capacity of 500 gigabytes (room for about 500×10^9 characters). This is about 100 times the capacity of main memory. A hard disk is slow compared to main memory. If the disk were the only type of memory the computer system would slow down to a crawl. The reason for having two types of storage is this difference in speed and capacity.

Large blocks of data are copied from disk into main memory. The operation is slow, but lots of data is copied. Then the processor can quickly read and write small sections of that data in main memory. When it is done, a large block of data is written to disk. Often, while the processor is computing with one block of data in main memory, the next block of data from disk is read into another section of main memory and made ready for the processor. One of the jobs of an operating system is to manage main storage and disks this way.



Primary memory	Secondary memory
<ol style="list-style-type: none"> 1. Fast 2. Expensive 3. Low capacity 4. Works directly with the processor 	<ol style="list-style-type: none"> 1. Slow 2. Cheap 3. Large capacity 4. Not connected directly to the processor

Characteristics of Secondary Memory

- These are magnetic and optical memories.
- It is known as the backup memory.
- It is a non-volatile memory.
- Data is permanently stored even if power is switched off.
- It is used for storage of data in a computer.
- Computer may run without the secondary memory.
- Slower than primary memories.

Hard Disk Drive

Hard disk drive is made up of a series of circular disks called **platters** arranged one over the other almost 1/2 inches apart around a **spindle**. Disks are made of non-magnetic material like aluminum alloy and coated with 10-20 nm of magnetic material. Standard diameter of these disks is 14 inches and they rotate with speeds varying from 4200 rpm (rotations per minute) for personal computers to 15000 rpm for servers.



Data is stored by magnetizing or demagnetizing the magnetic coating. A magnetic reader arm is used to read data from and write data to the disks. A typical modern HDD has capacity in terabytes (TB).

CD Drive

CD stands for **Compact Disk**. CDs are circular disks that use optical rays, usually lasers, to read and write data. They are very cheap as you can get 700 MB of storage space for less than a dollar. CDs are inserted in CD drives built into CPU cabinet. They are portable as you can eject the drive, remove the CD and carry it with you. There are three types of CDs –

- **CD-ROM (Compact Disk – Read Only Memory)** – the data on these CDs are recorded by the manufacturer. Proprietary Software, audio or video are released on CD-ROMs.
- **CD-R (Compact Disk – Recordable)** – Data can be written by the user once on the CD-R. It cannot be deleted or modified later.
- **CD-RW (Compact Disk – Rewritable)** – Data can be written and deleted on these optical disks again and again.

DVD Drive

DVD stands for **Digital Video Display**. DVD are optical devices that can store 15 times the data held by CDs. They are usually used to store rich multimedia files that need high storage capacity. DVDs also come in three varieties – read only, recordable and rewritable.

Pen Drive

Pen drive is a portable memory device that uses solid state memory rather than magnetic fields or lasers to record data. It uses a technology similar to RAM, except that it is nonvolatile. It is also called USB drive, key drive or flash memory.

Blu Ray Disk

Blu Ray Disk (BD) is an optical storage media used to store high definition (HD) video and other multimedia files. BD uses shorter wavelength laser as compared to CD/DVD. This enables writing arm to focus more tightly on the disk and hence pack in more data. BDs can store up to 128 GB data.

Magnetic Tape:

A magnetic tape is a thin tape with a coating of magnetic strip. It is used for recording the data. Magnetic tape is a serial access medium. Magnetic tapes are generally used for backup.

Floppy Disk

A Floppy disk is a thin circular disk used for data storage. It is a soft magnetic disk that can be enclosed in a protective sheet. It contains tracks and sectors.



Figure:Floppy Disk

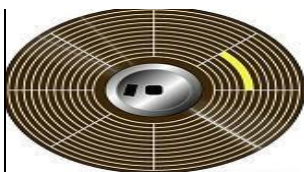


Figure:Internal Structure

A floppy has 3.5" in size. Some floppy disks would be 5.25" in size. A 3.5" floppy disk can hold 1.44 MB of data.

Compact Disk

Compact disk is a secondary memory device that can be written by lasers. It is a random access storage medium. It is also known as read/write CD- ROM. It is a popular and cheap method for storage.

Unit –III

SOFTWARE

Software is the language of a computer. And like human language, there are many different computer languages. Essentially, computer software can be divided into three main groups which depending on their use and application. These are 3 types of **system software** or operating system which referred simply as the OS, application software and programming languages. Usually most of us interact with a computer using **application software**.

Software is a set of programs, which is designed to perform a well-defined function. A program is a sequence of instructions written to solve a particular problem.

There are two types of software –

- System Software
- Application Software

System Software

The system software is a collection of programs designed to operate, control, and extend the processing capabilities of the computer itself. System software is generally prepared by the computer manufacturers.

These software products comprise of programs written in low-level languages, which interact with the hardware at a very basic level. System software serves as the interface between the hardware and the end users.

Some examples of system software are Operating System, Compilers, Interpreter, Assemblers, etc.



Some of the most prominent features of a system software –

- Close to the system
- Fast in speed
- Difficult to design
- Difficult to understand
- Less interactive
- Smaller in size
- Difficult to manipulate
- Generally written in low-level language

OPERATING SYSTEM:

An operating system is a set of programs that makes computer to manage its resources.

OR

A collection of programs necessary to run the computer is called an operating system.

- The operating system manages the execution of the works according to the instructions given by users.
- It provides an interface between the users and the machine.
- It executes the application programs by managing its resources efficiently.
- It provides user-friendly environment.

DOS is a good example of single user operating system and UNIX; windows - NT, LINUX etc, are some of the common multiple user **operating system**.

Application Software

Application software products are designed to satisfy a particular need of a particular environment. All software applications prepared in the computer lab can come under the category of Application software.

Application software may consist of a single program, such as Microsoft's notepad for writing and editing a simple text. It may also consist of a collection of programs, often called a software package, which work together to accomplish a task, such as a spreadsheet package.

An application software is something that is intended to perform a task on a system or a specific program. Depending on the level of language used there are different types of application software:

1) Word processing software

This tool is used to create letters, word sheets, type papers etc.

Eg: MS Word, MS Works, AppleWorks

2) Spreadsheet Software

A tool used to compute number intensive problems like forecasting, budgeting etc.

Eg: MS Excel, Quattro Pro, Lotus 1-2-3, MS Works

3) Desktop Publishing Software

This tool is used to create illustrative worksheets, banners, newsletters, signs, gift cards etc.

Eg: MS Word, MS Publisher, Adobe PageMaker

4) Database Software

Used to store data like text information, memberships, address etc. which helps users to sort information accordingly.

Eg: MS Access, FileMaker Pro

5) Communication Software

Allows to connected computers to communicate each other using audio, video or chat-based medium.

Eg: MS Net Meeting, IRC, ICQ

6) Presentation Software

Used to create multimedia stacks of cards/screens

Eg: MS PowerPoint, Hyper Studio, Flash, Super Card, HyperCard

7) Internet Browsers

This tools allows one to surf the web, read their emails and also create web pages.

Eg: Netscape Navigator, MS Internet Explorer

8) Email Programs

This software is mainly used to send and receive emails.

Eg: MS Outlook, Netscape Messenger, Eudora, AOL Browser

As technology and the number of users keep evolving, the types of application software also keep changing with better modifications to perform better virtual tasks to solve real world problems.



Pre-writing application software:

These are those software package, which are developed by group of people or an individual to use by other. The most commonly available prewriting **application software** is:

A) Word processing software:

These are that 3 types of **software**, which usually automate the day to day documentation work of an organization. It helps in creating texts, manipulating, formatting and printing of the text, so that the drafting, redrafting, typing again and again manually now become easy and less paper wastage as well the time taken also is reduce a lot. Word star, WordPerfect, Microsoft word etc. Are some of the available word processors.

B) Electronic spread sheet:

Electronic spread sheet are like sheet of paper with rows and columns. ESS alloelws numbers, characters, formulae and all other **types of** data which has to be entered in tabular form into rows or columns. Usage of ESS gives significant advanteges and benifit over using paper spread sheet. Some of the most commonly available and used spread sheet are lotus 1-2-3, Ms-Exel etc.

C) Data base management system :

Data base is an organized collection of data, which is logically related. The data has to be manege so that the retrieval of information is effective and easy. Managing data involves creating, deleting, updating, adding, modifying data in databases. Along with these querying are printing reports also comes as DBM. DBMS is a software package that allows a user to perform above function. It also allows multiple computers sharing the data files. Some of the DBMS package used by people are Dbase, foxpro, clipper, paradox etc.

This DBMS technology has been subjected to many improvements and advanced DBM software has been evolved which are called RDBMS (Relational database management system), QRDBMS (object ORIENTED RDBMS) etc. Oracle, ingress, SQL server, infomix, Sybase, Db2 etc. Is the some example.

B) Language processors:

As a digital computer accept digits and character as input, however this input is not understable by the computer. To make the computer understand it, the input has to be converted into machine language.

The software make this conversion and increases the productivity of the programer is called language processors or translators.

There are two basic types of translator.

1. **Compiler:** compiler is software that will accept the total program code as input and then converts it into machine code that means converts source code into object codes: COBOL, C.
2. **Interpreters:** interpreters also done the same task of compiler but it does in a different manner. The interpreter takes the program code line by line and converts it into machine.

C). Utility tools: These utilities are those software programs are provided by the manufacturer of various hardware to perform specific task commonly used by all data processing installation. Device drivers, directory and file management utilities are the some examples. 3 types of software.

Features of application software are as follows –

- Close to the user
- Easy to design
- More interactive
- Slow in speed
- Generally written in high-level language
- Easy to understand
- Easy to manipulate and use
- Bigger in size and requires large storage space

Utility Software

Application software that assist OS in carrying out certain specialized tasks are called utility software. Let us look some of the most popular utility software.

Antivirus

A virus can be defined as a malicious program that attaches itself to a host program and makes multiple copies of itself, slowing down, corrupting or destroying the system. A software that assists the OS in providing virus free environment to the users is called **antivirus**. An anti-virus scans the system for any virus and if detected, gets rid of it by deleting or isolating it. It can detect many types of virus like **boot virus, Trojan, worm, spyware**, etc.

When any external storage device like USB drive is attached to the system, anti-virus software scans it and gives an alert if a virus is detected. You can set up your system for periodic scans or scan whenever you feel the need. A combination of both the techniques is advisable to keep your system virus free.

File management tools

As you know, file management is an important function of operating systems as all data and instructions are stored in the computer in form of files. Utility software providing regular file management tasks like browse, search, update, preview, etc. are called file management tools. **Windows Explorer** in Windows OS, **Google desktop, Directory Opus, Double Commander**, etc. are examples of such tools.

Compression tools

Storage space is always at a premium in computer systems. So operating systems are always looking at ways to minimize amount of storage space taken by files. **Compression tools** are utilities that assist operating systems in shortening files so that they take less space. After compression files are stored in a different format and cannot be read or edited directly. It needs to be uncompressed before it can be accessed for further use. Some of the popular compression tools are **WinRAR, PeaZip, The Unarchiver**, etc.

Disk Cleanup

Disk cleanup tools assist users in freeing up disk space. The software scans hard disks to find files that are no longer used and frees up space by deleting them.

Disk Defragmenter

Disk defragmenter is a **disk management utility** that increases file access speeds by rearranging **fragmented files** on **contiguous locations**. Large files are broken down into fragments and may be stores in **non-contiguous** locations if contiguous ones are not available. When such files are

accessed by the user, access speed is slow due to fragmentation. Disk defragmenter utility scans the hard disk and tries to assemble file fragments so that they may be stored in contiguous locations.

Backup

Backup utility enables backing up of files, folders, databases or complete disks. Backups are taken so that data may be restored in case of data loss. Backup is a service provided by all operating systems. In stand-alone systems backup may be taken in the same or different drive. In case of networked systems backup may be done on backup servers.

TYPES OF LANGUAGES:

A language which is used to communicate with a computer system to do a specific task is called a computer language.

In general, Programming Languages are classified into 2 types:

- 1) Low-Level Language
- 2) High-Level Language

1) Low-Level Language:

Low level languages are machine level and assembly level language. In machine level language computer only understand digital numbers i.e. in the form of 0 and 1.

The assembly language is a modified version of machine level language. Where instructions are given in English like word as ADD, SUM, MOV etc.

2) High-Level Language:

These languages are machine independent, means it is portable. The language in this category is Pascal, Cobol, Fortran etc. High level languages are understood by the machine. So it needs to be translated by the translator into machine level

Machine language

A machine language consists of the numeric codes for the operations that a particular computer can execute directly. The codes are strings of 0s and 1s, or binary digits (“bits”), which are frequently converted both from and to hexadecimal (base 16) for human viewing and modification.

Machine language instructions typically use some bits to represent operations, such as addition, and some to represent operands, or perhaps the location of the next instruction. Machine language is difficult to read and write, since it does not resemble conventional mathematical notation or human language, and its codes vary from computer to computer.

Assembly language

Assembly language is one level above machine language. It uses short mnemonic codes for instructions and allows the programmer to introduce names for blocks of memory that hold data. One might thus write “add pay, total” instead of “0110101100101000” for an instruction that adds two numbers.

Assembly language is designed to be easily translated into machine language. Although blocks of data may be referred to by name instead of by their machine addresses, assembly language does not provide more sophisticated means of organizing complex information. Like machine language, assembly language requires detailed knowledge of internal computer architecture. It is useful when such details are important, as in programming a computer to interact with input/output devices (printers, scanners, storage devices, and so forth).

Microsoft Office

Microsoft Office, or simply Office, is a family of client software, server software, and services developed by Microsoft. It was first announced by Bill Gates on August 1, 1988, at COMDEX in Las Vegas. Initially a marketing term for an office suite (bundled set of productivity applications), the first version of Office contained Microsoft Word, Microsoft Excel, and Microsoft PowerPoint.

Office is produced in several versions targeted towards different end-users and computing environments. The original, and most widely used version, is the desktop version, available for PCs running the Windows and macOS operating systems. Office in a browser, previously known as Office Online, is a version of the software that runs within a web browser, while Microsoft also maintains Office apps for Android and iOS.

Since Office 2013, Microsoft has promoted Office 365 as the primary means of obtaining Microsoft Office: it allows use of the software and other services on a subscription business model, and users receive free feature updates to the software for the lifetime of the subscription, including new features and cloud computing integration that are not necessarily included in the "on-premises" releases of Office sold under conventional license terms. In 2017, revenue from Office 365 overtook conventional license sales.

The current on-premises, desktop version of Office is Office 2019, released on September 24, 2018.

Word processing

Word is a word processing program used to create, edit, save, and print the text document. Ms Word is a powerful, popular and easier for the user to learn. It is used to generate any type of printed document including letters, reports, memos, tables, webpage, newsletters, and manuals, create graphs and charts. The main advantage is that matter can be changed, as many times as we like and in any format without retyping the text or wasting the stationery. Ms Word is a very popular word processing application from the Microsoft Corporation.

Feature of ms word:

1. Toolbars: It contains buttons that make easier to perform some common tasks by clicking buttons like saving, printing, etc. we can also design the customized toolbars. Popular toolbars are standard, format, Auto text, mail merge, Drawing, word count. etc.

2. Mail Merge: It provides an ability to create a letter in Word, and then print multiple copies of that letter, each with a different name and address on it. Mail Merge in word may also be used to fill envelopes and labels with data as well.

3. Templates & Wizards: It allows us to work on text document which are pre defined in layout and style. We can also personalize templates.

4. Viewing: Word offers several ways to see documents such as normal, web layout, web page preview, zoom in and out outline, print layout, and print preview.

5. Find and Replace: We can search the specified text or word in the document and replace the text with the other text easily with using find and replace option in the word processor.

6. Auto format: We can apply the style, size, color, and fonts to the data or text by using the formatting toolbar and format.

7. Spell checking:

The feature is very useful for checking and correcting the word in a document. We can also provide the alternative word for misspelling word. Even the grammatical errors can also be rectified in word processor.

8. Email:

It messages can be sent directly from word and word can also be used as an editor for e-mails. Faxes as well can work with word.

9. Creation of tables:

Tables can be created neatly in word processor. if you give directions for required number of rows and columns, word provides a ready-made table to work.

10. Bullets and Numbering:

Bullets are special symbols which can be put for different points or paras in a documents where as numbers are ascending figures like 1,2,3,4...etc. which can be assigned to points in the Paras or documents in word processor.

Advantages of word process:

1. Quality:

The word processing program of a computer system obtains quality of finished text. It produces error free documents. the spelling and grammar check in word processing makes the documents to be neat and error free/ we can get multiple copies of excellent formatted nature in word processing.

2. Storage of text:

We can take any number of copies with word processor. Not only that, if we need that same documents with slight changes, we need not type the same letter again.

3. Time saving:

We can get any number of copies of document in future without retyping. We can get the copy of documents on any printer also.

4. Security:

We can protect the documents in word processing by giving password. So there is less chance of viewing documents by unauthorized persons.

5. High standard:

The electronic document with text is consistently high standard.

6. Edit the document easily:

Word processor provide the facilities to edit the document and store and retrieve them.

Applications of word processing:

1.letters:

Using word processor we can develop the different type letter with different formats.

It provides predefined letters and we can design the different address same letters by using mail merge option.

2. Notice: we design the different type of notices using ms word processing that used to appeal the members.

3. Memorands: we can also design memoranda to give to the higher officials.

4. Brochures: using the word processing we can design the brochures that are used for admission in schools, colleges and real Estate officers.

5. Reports: Using of the ms word we can design the news report and other types of reports.

6. Resumes: we can design the different type of resume that are useful for interviews and it represent marks list and year wise report of the student.

7. Articles:

We can print the articles that are published in the news papers.

Formatting is a process to change the appearance of the text documents to attractive, easier to read.

Spreadsheet

Excel is a software program from Microsoft that is part of the Microsoft Office suite of software programs. Developed by Microsoft and first released on September 30, 1985, Excel is capable of creating and editing spreadsheets that are saved with a **.xls** or **.xlsx** file extension. General uses of Excel include cell-based calculation, pivot tables, and various graphing tools. For instance, with an Excel spreadsheet, you could create a monthly budget, track business expenses, or sort and organize large amounts of data.

Unlike a word processor, such as Microsoft Word, the Excel documents consist of columns and rows of data, made up of individual cells. Each of these cells can contain either text or numerical values that can be calculated using formulas.

Excel has many applications:

- Sorting and organizing data
- Creating visual representations of the data
- Addition, Subtraction, Division, Multiplication of Cells

Statistical analysis

Average (Mean)

Median

Quartile

Standard deviation

t-Test

Covariance

Matrix Operations

Addition/Subtraction

Multiplying

Inverse

Determinant

Workbook

In Microsoft Excel a **workbook** is a collection of one or more spreadsheets, also called

worksheets, in a single file. Below is an example of a spreadsheet called "Sheet1" in an Excel workbook file called "Book1." Our example also has the "Sheet2" and "Sheet3" sheet tabs that are also part of the same workbook.

Worksheet

A **Worksheet** is a collection of cells organized in rows and columns. It is the working surface you interact with to enter data. Each worksheet contains 1048576 rows and 16384 columns and serves as a giant table that allows you to organize information. Typically, a workbook contains several worksheets with related content and only one of the worksheets is active at a time.

Alphabetical letters are usually assigned to columns and numbers are usually assigned to rows. The point where a column and a row meet is called a cell. The address of a cell is given by the letter representing the column and the number representing a row.

Opening a Workbook:

The steps to create a new blank workbook are:

- 1) Select new option from file menu. The new dialog box will be displayed.
- 2) .In the general tab, select the workbook.
- 3) The new workbook is created and opened for use.

Saving a Workbook:

The steps to save a workbook are:

- 1) Select the save option in file menu and give a name for workbook.
- 2) Click on the save button on the standard toolbar.

STARTING MS EXCEL:

The following are the steps to start MS Excel.

- 1) Click on start button and then select programs
- 2) In programs, select MS Office and then click on MS Excel.

CREATING NEW WORKSHEET:

→In order to add a single worksheet, Click on "worksheet" in "insert" menu.

→In order to add multiple worksheets, hold shift and select the number of worksheet tabs that you want to add in the open work book. Now click on "worksheet" in "inset" menu.

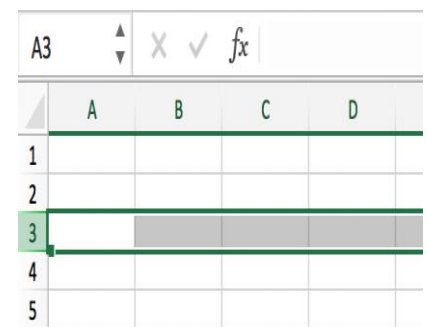
SELECTING CELLS IN WORKSHEET:

We can select cells, rows, columns, ranges in a worksheet to modify the contents.

→**To select a single cell:** click the cell or press arrow keys to move to the cell.

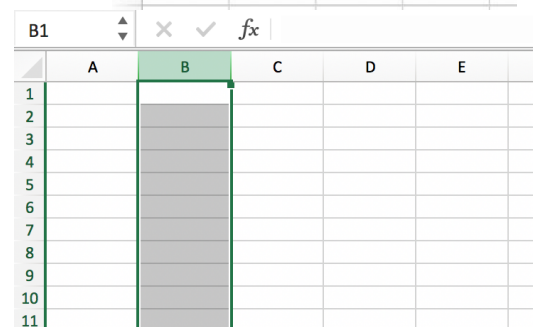
→**To select a range of cells:** click the first cell in the range and drag to the last cell or hold shift and use arrows to extend the selection.

Selection of a Row*In the image above row 3 is selected. This can be done by clicking on the number 3 in front of the row.*



Selection of a Column

In the image above column B is selected. This can be done by clicking on the letter B above the column.



→**To select a large range of cells:** click the first cell in the range, then hold shift while you select last cell in the range.

→**To select all cells on a worksheet:** Click the select all button or press ctrl + A.

→**To select an entire row or column:** click the row or column

heading or select first cell and press ctrl + shift + arrow key (right or left arrow for rows and up and down arrow for columns).

ENTERING AND EDITING TEXT:

Entering data:

Step1: Select a cell and start typing.

Step2: Press enter to type in next cell.

Step3: Press esc to cancel the entry of text.

Editing text:

If there is any error in text simply press backspace to correct it. Select a cell and double click to edit the text or we can use the formula bar.

Entering and editing numbers:

Numbers are the raw material for worksheets. They are referred as constant values or simply values. We can enter numbers in cells by using numerical pad or by the number keys.

There are several formats available in excel used to control the appearance of numbers. We can view or edit a number format by double clicking on a text element.

Entering and editing formulas:

Formulas are equations that perform calculations on values in worksheet. A formula starts with an equal sign (=).

Procedure to enter the formula:

- 1) Click the cell in which we want to enter the formula.
- 2) Type = sign, enter or edit the formula.

Arithmetic operators in formulas:

- 1) A minus sign (-) for inversing a number.
- 2) The percent sign (%) for percentage.
- 3) A caret (^) for raising a number to a power.
- 4) An asterisk (*) for multiplication.
- 5) A forward slash (/) for division.
- 6) A plus sign (+) for addition.
- 7) A minus sign (-) for subtraction.

Comparison operators in formulas:

- 1) Equals sign (=)
- 2) Is not equal to (<>)
- 3) Less than (<)
- 4) Less than or equal to (<=)
- 5) Greater than (>)
- 6) Greater than or equal to (>=)

Concatenation operator in formula:

The joining of two text strings into a single string is called concatenation. The ampersand (&) is known as text operator used to join two strings together in excel formulas.

Reference operator in formula:

The range operator colon (:) is used to refer all cells in the range beginning from referenced cell before the colon and ending with the referenced cell after the colon.

REFERENCING CELLS:

An excel cell reference identifies the location of the cell. It is indicated as an intersection of columns and rows.

Single cell reference:

Single cell references refer to a specific cell.

Range references:

To refer to a range of cell, we can either drag over the desired cells or type the beginning and ending cell addresses separated by colon.

Relative and Absolute references:

Excel accepts cell references called absolute and relative ranges. Absolute ranges have a \$ character before the column/row portion of the reference. Relative ranges do not use \$ character.

The \$ character indicates excel that it should not increment the column/row reference as we fill a range with formula or as we copy a range.

For example, A1 is a relative range, while \$A\$1 is an absolute range. There are 3 absolute reference styles.

\$A\$1 – Both the column and row reference are fixed. Neither will be incremented or changed during a copy nor fill operation.

\$A1 – Only the column reference is fixed. It will not change during a fill or copy but the row will change.

A\$1 – Only the row reference is fixed. It will not change during a fill or copy but the column will change.

MOVING CELLS:

Moving the contents of a cell or cells and other items is as simple as selecting the cell or cells and then edit→cut now pasting with edit→paste. We can also use ctrl +X and ctrl + V.

We can also move cells, rows, and columns by selecting them and using drag and drop.

- 1) Select the cells we want to move.
- 2) Drag at their edges with arrow shaped pointer.
- 3) Release the button to drop the selected items.

COPYING CELLS:

Select the cell or cells then edit→copy now paste with edit→paste. We can also use ctrl + C and ctrl + V.

We can also copy the cells using drag and drop.

- 1) Select the cells we want to move.
- 2) Hold ctrl while dragging. The mouse pointer will have a small plus sign next to it.
- 3) When we release the button, the selected cells will be copied to new location.
- 4) Excel will ask to confirm the copy. Click OK to confirm.

SORTING CELL DATA:

The following are the steps for sorting.

- 1) Open the worksheet that we want to sort.
- 2) Select the data to be sorted.
- 3) Click on “Data” and then “Sort”. This will give sort menu.
- 4) Choose “header row” or “no header row” from the radio buttons on the bottom of the sort menu. Choose “header row” if we want the top row of our selected as column names. Otherwise choose “no header row”.
- 5) Select the sort condition and order. Excel will sort things alphabetically, numerically, or by dates depending on the information in the selected cells. We can also sort in ascending order or descending order.
- 6) Click OK to complete sorting of the list.

INSERTING ROWS:

When we add a row to a worksheet, the rows of data below the cursor are pushed down. The following are the steps to insert rows in excel worksheet.

- 1) Right click on the row header where we want to add a new row.
- 2) Choose “insert” and then “rows”.
- 3) The new row will be inserted above the row we selected.

INSERTING COLUMNS:

When we add a column to a worksheet, the columns of data to the right of cursor are moved to the right side. The following are the steps to insert columns in excel worksheet.

- 1) Right click on the column header where we want to add a new column.
- 2) Choose “insert” and then “columns”.
- 3) The new column will be inserted to the left of the selected column.

INSERTING CELLS:

Select the area where we want to insert new cells and then use insert→cells. The insert cells option asks if we want to shift cells right or down or insert an entire row or an entire column.

DELETING PARTS OF A WORKSHEET:

Use edit→delete option to delete unwanted rows, columns or cells. Deletion of rows, columns or cells will affect the formulas if they are referenced in the formulas.

CLEARING PARTS OF A WORKSHEET:

Clearing removes the cell contents but does not move the contents of other cells to fill the empty space. Select the cells we want to clear and then press DEL or use edit→clear option.

FUNCTIONS IN MS EXCEL:

Functions are the formulas that are used to do the calculations. These functions are pre-written formulas. By using functions we can do various calculations such as mathematical, statistical and engineering calculations. Ms Excel comes with a number of set of functions.

Functions are different formulas. In functions, we give values but not operators like +, -, *, / etc. The following are the steps to use functions.

Use an equal sign (=) to begin a function, specify the function name. Enclose the arguments in the parenthesis (). Arguments are the values on which we perform calculations.

CHARTS & GRAPHS IN EXCEL:

Chart is the graphical representation of data values of any database. By using Charts we can easily analyze the various data values and their differences. A chart has many elements. Some of the elements are displayed by default, others can be added. In Ms Excel We can create any number of charts and graphs.

Terminology:

- 1) The chart area of the chart.
- 2) The plot area of the chart.
- 3) The data points of the data series that are plotted in the chart.
- 4) The horizontal and vertical axis along which the data is plotted in the chart.
- 5) A chart title and axis title.
- 6) A data label that we can use to identify the details of a data point in a data series.

Types of charts:

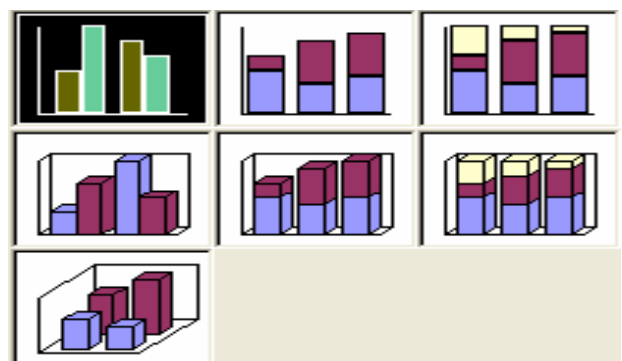
Microsoft Excel supports many kinds of charts that are used to display data in different ways. The following are some of the charts in MS Excel.

1) Column chart:

A column chart shows data changes over a period of time. It is also used to compare items. It has the following sub types.

Clustered Column Chart:-

This type of chart compares values based on categories. It is also available in 3D visual effect. Categories are organized horizontally and values vertically.



Stacked Column Chart:-

This type of chart shows the relationship between individual items and whole items comparing the contribution of each value to a total across categories.

100% Stacked Column Chart:-

This type of chart compares the percentage that each value contributes to a total across categories.

3D Column Chart:-

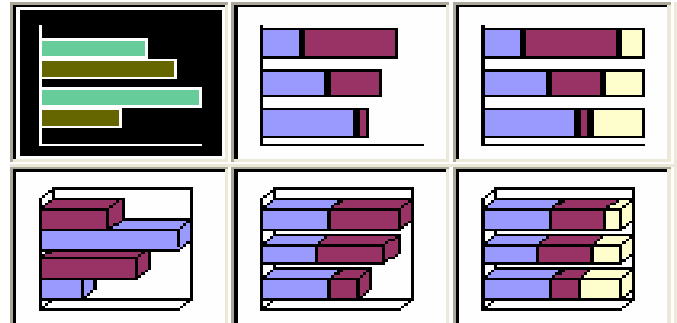
This type of chart compares data points along two axes.

Bar Chart:

A column chart shows the comparisons among individual items. Bar charts have the following sub types.

Clustered Bar Chart:-

This type of chart compares values across categories. It is also available in 3D visual effect. Categories are organized vertically and values horizontally.



Stacked Bar Chart:-

This type of chart shows the relationship between individual items and whole items. It is also available in 3D visual effect.

100% Stacked Bar Chart:-

This type of chart compares the percentage that each value contributes to a total across categories.

Line Chart:

A line chart shows trends in data at equal intervals. Line charts have the following sub types.

Line:-

This type of chart displays trends over time or categories. It is also available with markers displayed at each data value.

Stacked Line Chart:-

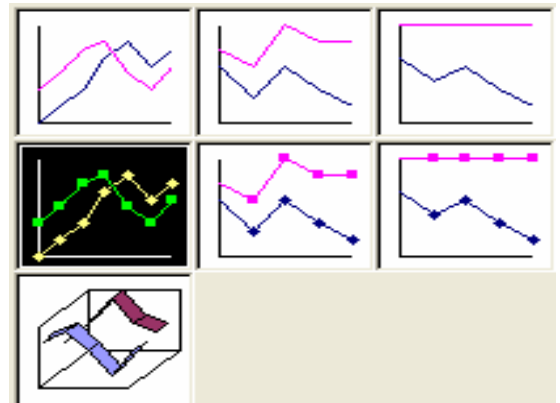
This type of chart displays the trend of the contribution of each value over time or categories. It is also available with markers displayed at each data value.

100% Stacked Line Chart:-

This type of chart displays the trend of the percentage each value contributes over time or categories. It is also available with markers displayed at each data value.

3D Line:-

This type of chart is a line chart with a 3D visual effect.



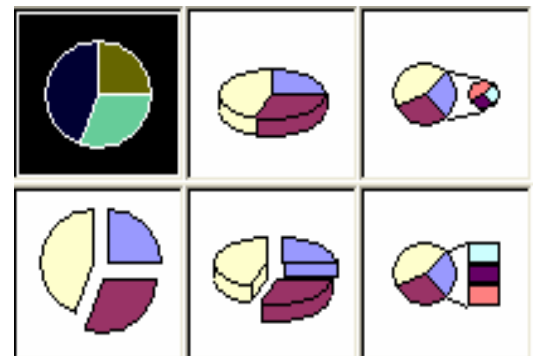
Pie Charts:

A pie chart shows the size of items that make up a data series, proportional to sum of items. Pie charts have the following sub types.

Pie:- This type of chart displays contribution of each value to a total. It is also available with 3D visual effect.

Exploded Pie:-

This type of chart displays the contribution of each value to a total while deriving individual values. It is also available with 3D visual effect.



Pie Of Pie:-

This is a pie chart with user defined values extracted and combined into a second pie.

XY or Scatter Charts:

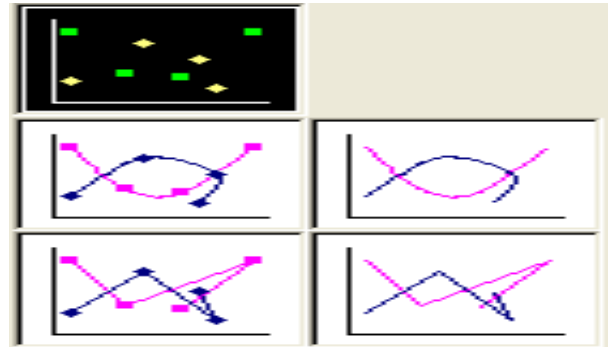
An XY or scatter chart shows the relationships among the numeric values in several data series or plots two groups of numbers as one series of XY coordinates. Scatter charts are commonly used for scientific data and have following chart sub types.

Scatter:-

This type of chart compares pairs of values. When we arrange data for a scatter chart, place X values in one row or column and the enter corresponding Y values in the adjacent rows or columns.

Scatter with Data points connected by Lines:

This type of chart can be displayed with or without straight or smoothed connecting lines between data points. These lines are displayed with or without markers.



Doughnut Charts:

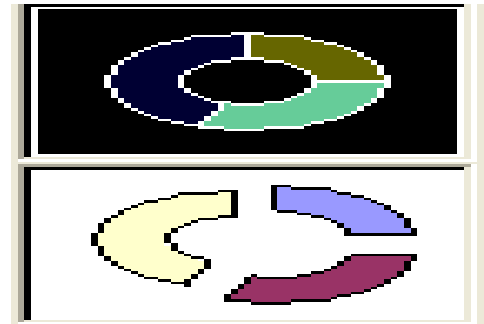
Like a pie chart, a doughnut chart shows the relationship of parts to a whole part. It can contain more than one data series. Doughnut charts have following sub types.

Doughnut:-

This type of chart displays data in rings, where each ring represents a data series.

Exploded Doughnut:-

This type of chart is like exploded pie chart but it can contain more than one data series.



RADAR CHARTS:

A radar chart compares the aggregate values of a number of data series. Radar charts have following sub types.

Radar:-

This type of chart displays changes in values relative to a center point. It can be displayed with markers for each data point.

Filled Radar:-

In this type of chart, the area covered by a data series is filled with a color.



CREATING CHARTS & GRAPHS IN EXCEL:

- 1) Go to start → Microsoft office → Microsoft Excel. Open a new document.
- 2) Enter the information the worksheet.
- 3) Go to Insert → Chart and select a chart.
- 4) The chart window will appear. Click on the first option “columns” and select the type of column chart.
- 5) Now select the data to build column chart.
- 6) Click next to move to other format options. In title tab, enter the title of the chart.
- 7) Click next, a window will appear asking that if we want to place the chart in the same worksheet or as a single object in another worksheet in the same workbook.
- 8) Click on the first option to create the chart in separate worksheet and click finish.
- 9) A new work sheet will be added to the workbook.

DATA FILTER:

This command is implemented to get our desired or required values from the entire database. We can filter the data with our own conditions. To use this command first we have to highlight the database and then select the filter command from data menu. This shows small filter buttons for every individual column (drop down list buttons).

There are two commands for filtering data in MS Excel.

1) **Auto Filter:**

It is used for filtering of data based on simple criteria or condition

2) **Advanced Filter:**

It is used for filtering of data based on more complex criteria or condition.

DATA VALIDATION:

Data Validation is a concept by which we can know the validity of a column of a database. It means with this, we can restrict the unwanted data entries into the columns of a database.

➔ In case of text entries in a column like names we can specify the text length.

➔ In case of numbers we can specify the minimum (starting) value and maximum (ending) value and

➔ In case of a date entry like date of joining, date of births we can specify the start and end dates.

If we enter any data out of given range it alerts us to enter the data within the given range by using some alert messages which can also be created by us.

PIVOT TABLE AND PIVOT CHART:

Pivot table is table concept in Ms Excel by which we can get the totals of rows and columns individually. It is mainly used to know the differences among different values in various duration of times.

Pivot chart is a chart that is the graphical representation of the pivot table.

Uses of Pivot Table Report;

- 1) To compare a long list of figures.
- 2) To compare several facts within each figure.
- 3) To do sorting, sub totaling and totaling of data.

Types of Pivot Table Report:

There are mainly 3 types of pivot table reports.

- 1) **A default Pivot Table** where we will show the data in an indented format. In indented format we can view all the summary figures of the same type in one column.
- 2) **Graphical Pivot Table Report** shows the report graphically.
- 3) **Webpage Pivot Table Report** shows the report available on the web.

Creating a Pivot Table Report:

- 1) Open the Excel and find the workbook.
- 2) Click Data→Pivot Table and Pivot Chart Report.
- 3) Drag each item of the data to the required place.

MS POWER POINT

Microsoft power point is presentation software. It helps in creating attractive and effective slide show presentations. Each presentation can have as many slides as user wants. Each slide can carry text, graphics & sound. The slides can be animated to make them more attractive.

TERMINOLOGY:

-Presentation:

Presentation is the primary type of file created by power point. The file extension of a presentation is .ppt.

-Slides:

Slides are individual parts of a presentation. Slides are similar to the individual pages in a print document.

-Layout:

Layout is the specific arrangement of text and images on a slide. Layouts can be very simple, consisting of simple titles and text, or they can be more complex. We can also include animation, sounds, and other multimedia in layout.

-View:

Power point has 3 main views: normal view, slide sorter view, and slide show view. Normal view is the main editing view. Slide sorter view is an exclusive view of the slides in thumbnail form. Slide show view takes the full computer screen, like an actual slide show presentation.

-Design Template:

It is the specific look of a slide or group of slides. A design template can be very basic with black text on a white background or it can be very colorful and complex.

-Slide Show:

The way a presentation appears is called slide show. When we display our slides in a slide show, the slides will appear in full screen with sequence.

-Place Holder:

Place holder is the box with dotted or hatch-marked outlines that appear when we create a new slide. Place holders are also called as text boxes. These are used to give slide title, text, clip art, charts and tables.

-Sizing Handles:

These are the small circles that appear along the edge of the selection rectangle around an object on the slide. We can drag a sizing handle to change the size.

STARTING POWERPOINT:

To start Power Point go to start menu→select programs→Microsoft Office→Power Point.

Power point opens in a normal view. In normal view, we can see the following,

- A blank slide in the center of the window.
- To the left, a slides pane that will display all the slides in the presentation.
- To the right, a task pane will display the following options,
 - “Open” to open an existing document.
 - “Create a new presentation” to start a new presentation.

Click “Create New Presentation” and click “Blank Presentation”. Other options are “From Design Template”, “From Auto Content Wizard”, and “From Existing Presentation”.

FEATURES OF POWER POINT:

Power point is a powerful instrument to present our ideas through a pictorial way. The following are the important features of power point.

1) Readymade slides:

Since power point is having powerful wizards, we can prepare the slides easily and quickly. The auto content wizard option provides wizards to make slides easily. Template provides a wide range of ready made designs to us.

2) Background colors and effects:

We can have a wide variety of background colors for slides in power point. In addition to colors, we can also get different textures and shades in slides. We can also change the colors of existing wizards and templates.

3) Pictures:

Not only captions and different colors, we can add good pictures either from clip art or from scanning the pictures.

4) Sounds:

Different sounds can be created while presenting the various slides. The sounds will have a pleasing effect on the viewers.

5) Animation:

Different animation techniques are also available in the slides. The letters and pictures will fly from top to bottom and left to right. Not only one technique, we can have many animation options. We can also get preview of various animation effects.

6) Charts and Tables:

We can insert different charts and tables for expressing the data and information to the users. The different charts and tables in the MS Excel can be easily imported into MS Power point.

7) Time for slides:

We can prescribe the time automatically or manually for running and exhibiting slides. For example we can set the time for 5 or 6 seconds for each slide to exhibit on the computer.

8) Speaker Notes:

Speaker notes are the notes that can be included in the bottom of the slide so that new ideas can be discussed during presentation.

9) Other features:

MS Power point includes many other features like macros changing the colors of slides, fonts. We can also change the slide numbers from any direction using slide sorter view.

ADVANTAGES OF POWER POINT:

There are many advantages of computerized presentations.

- 1) The slides can be prepared for different types of audience like literates, illiterates, children, old people etc.
- 2) They can be run automatically. There is no manual interference for running power point show.
- 3) There is no problem of getting slides out of order.
- 4) We can even take printouts of presentations and can be distributed to the audience.
- 5) The audience will easily be attracted by the colorful slides with sound and animation techniques.
- 6) The built in design templates allow the people to create colorful slides very easily.
- 7) If we want to change a part of presentation, we need not change all slides. We can change all slides by changing master slide.

VIEWS:

When preparing a power point presentation, we have several options that will allow us to create the slideshow easily and effectively. Microsoft has provided several view options that we can use to prepare our presentation including views with thumbnails and notes.

The following are the views available in power point.

-Normal View:

Normal view is the default layout for power point's editing mode. It consists of three panes. One pane include two separate tabs. The "outline" tab on which we can create and organize simple outline of our presentation and the "slides" tab which displays our slides as thumbnails. The "slides" pane in the upper right displays the selected slide in a larger editable format. Lastly the "notes" pane in the lower right is used to write notes about each slide.

-Slide Sorter View:

"Slide Sorter" view is similar to the "slides" tab in "normal" view. This view uses entire power point window to display thumbnails of our slides. We can also use "slide sorter" view to prepare a printable version of our presentation.

-Notes Page View:

The "Notes Page" View is an extended version of "notes" pane in "normal" view. This view allows us to use entire power point window to work on our notes.

-Slide Show View:

"Slide Show" view is the standard presentation view in power point. It uses the entire screen to display the slide show of the presentation. It also displays the timings, animations, movies and transitions.

-Presenter View:

"Presenter" view displays both the presentation and the notes of each slide. It also displays thumbnails of our slides so that we can skip or return to the slides needed.

-Reading View:

"Reading" view is designed to allow individuals to view a power point presentation on their own computer. This view is similar to "slide show" view but the presentation opens in a separate window with built-in controls for moving slide show forward and backward.

CREATING PRESENTATIONS:

Creation of a presentation involves choosing slides entering content, formatting text and images of slides, animations in slides inserting audios and videos etc. A power point presentation can be made in several ways. We can create a presentation with the 3 methods such as Blank presentation, Design templates and auto content wizards.

A power point presentation can be created by using the following three methods.

- * Blank presentation

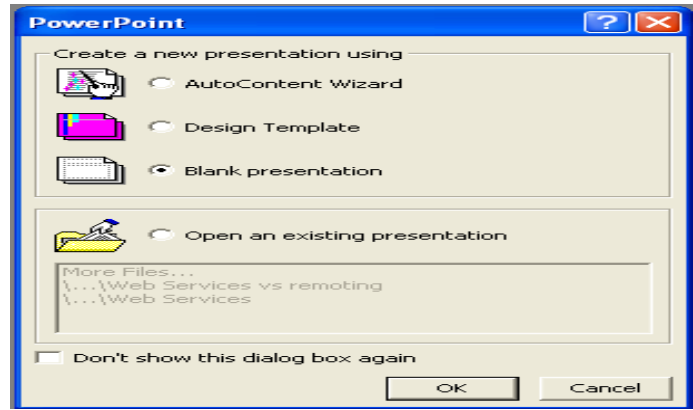
- * Design Template
- * Auto Content Wizard

Using Blank Presentation:

It is one of the of presentation creation methods by which we can create the presentation with blank slides. Once, after choosing this method the slide layout dialog box will be displayed. According to the content we have to use corresponding slides from that dialog box.

Using Design templates:

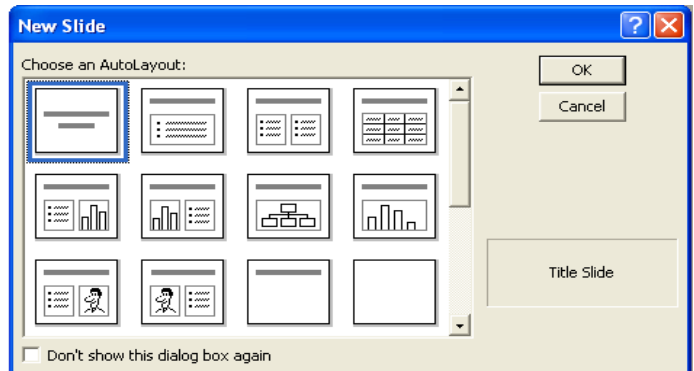
The presentation creation by using the design templates is very similar to the above method but this method will provide background design formats and colors for the slides.



Using Auto content Wizard:

It is the simplest way to create the presentation .With this method we can create pre formatted slides with already existing contents.

For all the above methods the following slide dialog box will be shown.



MANAGEMENT OF SLIDES:

Slide is a basic template for the representation of a particular concept within the presentation. A slide can contain text, images (pictures), tables, Charts and graphs. The collection of a group of slides is called a presentation.

The management of slides mainly includes creating new slides, deleting slides and modifying existing slides.

ADDING NEW SLIDE:

For inserting a new slide we use the insert menu. Select 'insert new slide' option from 'insert' menu.

DELETING SLIDES:

For deleting a slide, we can select the slide and press delete button or we can use 'delete slide option in 'edit' menu.

COPYING THE SLIDES:

For copying slides within the presentation or from one presentation to another presentation we need to use 'edit' menu and select 'copy' option.

MODIFYING EXISTING SLIDES:

We can modify a slide's contents by selecting that slide and applying modifications.

NUMBERING A SLIDE:

We can give numbers for the slides created. Select the 'insert' menu and click 'slide number' option.

SAVING A PRESENTATION:

We can save the presentation similar to a word document. Select 'save' option from 'file' menu or click ctrl + S from the keyboard. Now give a name for the presentation.

CLOSING A PRESENTATION:

We can close the presentation simply by clicking the close button or by selecting 'close' option from 'file' menu.

PRINTING PRESENTATION ELEMENTS:

We can also take the prints of the presentation by selecting 'print' option from 'file' menu or by clicking ctrl + P from keyboard.

MULTIMEDIA EFFECTS IN MS-POWERPOINT:

Multimedia is the process of using more than one media at the same time. We can apply various multimedia effects such as background sounds for the slides, different visual effects and other effects for the slides. We use the following effects in order to provide multimedia effects for the slide presentations.

CUSTOM ANIMATION EFFECTS:

Custom animation is the process of applying various audio and video effects on the slides. With custom animation effects, we can create very attractive slides. We can apply these custom animation effects individually to the

slide contents such as text, pictures and other contents. Some of the custom animation effects are appear, fly, blinds, checkerboard, crawl, dissolve, swivel, wipe, zoom etc and applause, breaking glass, camera etc are the sound effects for the slides.

SLIDE TRANSITION EFFECTS:

Slide Transitions are the visual effects that are applied on the slides. These effects are used for the transformation of one slide to another slide in viewing the presentations. Some of these effects are Box in, Box out, checker board across, down etc.

CREATING A BLANK PRESENTATION:

1. To create a blank presentation choose the presentation creation using blank presentation
2. Select the slides from the slide layout dialog box.
3. We need to select the number of slides one after other by selecting new slide command from insert menu.
4. Now we can start entering the contents into slides according to the presentation.
5. After entering the contents into the slides we need set rehearse timings for the slides by using the command Rehearse Timings command of Slide show menu.
6. Now we can apply various custom animation effects and transition effects for the slides from the same menu Slide show menu.
7. We can run the presentation by selecting the command View Show from the Slide show menu. It will present the slides one by one according to given timings.

MULTIMEDIA:

Multimedia is a combination of text, graphics, sound, animation and video. The computer brings all these components together to produce a variety of applications.

A multimedia needs the following resources:

- 1) Multimedia equipment like audio, video etc.
- 2) An operating system
- 3) Software supporting multimedia equipment.

COMPONENTS OF MULTIMEDIA:

The components of the multimedia are given below:

1) Text:

Any multimedia screen consists of some text. So text is the first step in multimedia. There are many word processors to type the text. Not only typing, we can also edit, format and perform special effects like word art, water marks, etc in a text.

2) Images:

A picture is worth 1000 words. Pictures are extensively used in multimedia to discuss about the concept. The images can be used as background in the screen. The images can be obtained in multimedia from clip art, scanning pictures or from compact disks.

3) Graphics:

Graphics represent the messages in a easy way of expressions in multimedia. The data can be converted into various charts and graphs. The graphics attracts the people easily.

4) Animations:

Now-a-days many advertisers are using animations in the form of films, slides etc. Special effects can be made in animation with 2D or 3D dimensions.

5) Audio (Sound):

Many advertisers and educationists are using sounds effectively in multimedia to explain the concept.

6) Music:

Music plays an important part in attracting the audience. Many advertisers are using music to attract the customers in order to buy the products.

7) Video:

Video is the combination of sound, images, animations etc. A video camera capture images, add sounds and animations and shows the same to the audience. Now-a-days the digital video software packages are used for editing purpose.

APPLICATIONS OR USES OF MULTIMEDIA:

Multimedia is the combination of many media. The following are the applications of multimedia:

1) **Education:**

In education, multimedia plays an important role in the following ways:

- a) The students can learn easily about new subjects through CDs.
- b) Now-a-days many online courses are offering in the internet. These courses are based on elements of multimedia.

2) **Business:**

In business, multimedia provides a lot of opportunities.

- a) Power point slides can be made and presented to the members of business.
- b) Video conferencing can be used for getting good response among the members.

3) **Home:**

At home, multimedia offers a variety of opportunities.

- a) We can hear music through multimedia.
- b) We can view video through multimedia.
- c) Computer games can be played through multimedia.

4) **Training:**

Through simulation process, multimedia offers training to the employees.

5) **Web:**

It is the multimedia that makes the web more attractive. The web pages are made attractive to the viewers through multimedia. We can also add charts, graphs, pictures in web through multimedia.

6) **Printing & Publishing:**

Multimedia is used in printing and publishing to improve quality of print and layouts with a variety of font designs, colors, graphics etc.

Computer Graphics

Computer Graphics involves technology to access. The Process transforms and presents information in a visual form. The role of computer graphics insensible. In today life, computer graphics has now become a common element in user interfaces, T.V. commercial motion pictures.

Computer Graphics is the creation of pictures with the help of a computer. The end product of the computer graphics is a picture it may be a business graph, drawing, and engineering.

In computer graphics, two or three-dimensional pictures can be created that are used for research. Many hardware devices algorithm has been developing for improving the speed of picture generation with the passes of time. It includes the creation storage of models and image of objects. These models for various fields like engineering, mathematical and so on.

Today computer graphics is entirely different from the earlier one. It is not possible. It is an interactive user can control the structure of an object of various input devices.

Definition of Computer Graphics:

It is the use of computers to create and manipulate pictures on a display device. It comprises of software techniques to create, store, modify, represents pictures.

Why computer graphics used?

Suppose a shoe manufacturing company want to show the sale of shoes for five years. For this vast amount of information is to store. So a lot of time and memory will be needed. This method will be tough to understand by a common man. In this situation graphics is a better alternative. Graphics tools are charts and graphs. Using graphs, data can be represented in pictorial form. A picture can be understood easily just with a single look.

Interactive computer graphics work using the concept of two-way communication between computer users. The computer will receive signals from the input device, and the picture is modified accordingly. Picture will be changed quickly when we apply command.

Application of Computer Graphics

1. Education and Training: Computer-generated model of the physical, financial and economic system is often used as educational aids. Model of physical systems, physiological system, population trends or equipment can help trainees to understand the operation of the system.

For some training applications, particular systems are designed. For example Flight Simulator.

Flight Simulator: It helps in giving training to the pilots of airplanes. These pilots spend much of their training not in a real aircraft but on the ground at the controls of a Flight Simulator.

Advantages:

1. Fuel Saving
2. Safety
3. Ability to familiarize the training with a large number of the world's airports.

2. Use in Biology: Molecular biologist can display a picture of molecules and gain insight into their structure with the help of computer graphics.

3. Computer-Generated Maps: Town planners and transportation engineers can use computer-generated maps which display data useful to them in their planning work.

4. Architect: Architect can explore an alternative solution to design problems at an interactive graphics terminal. In this way, they can test many more solutions that would not be possible without the computer.

5. Presentation Graphics: Example of presentation Graphics are bar charts, line graphs, pie charts and other displays showing relationships between multiple parameters. Presentation Graphics is commonly used to summarize

- Financial Reports
- Statistical Reports
- Mathematical Reports
- Scientific Reports
- Economic Data for research reports
- Managerial Reports
- Consumer Information Bulletins
- And other types of reports

6. Computer Art: Computer Graphics are also used in the field of commercial arts. It is used to generate television and advertising commercial.

7. Entertainment: Computer Graphics are now commonly used in making motion pictures, music videos and television shows.

8. Visualization: It is used for visualization of scientists, engineers, medical personnel, business analysts for the study of a large amount of information.

9. Educational Software: Computer Graphics is used in the development of educational software for making computer-aided instruction.

10. Printing Technology: Computer Graphics is used for printing technology and textile design.

Example of Computer Graphics Packages:

1. LOGO

2. COREL DRAW
3. AUTO CAD
4. 3D STUDIO
5. CORE
6. GKS (Graphics Kernel System)
7. PHIGS
8. CAM (Computer Graphics Metafile)
9. CGI (Computer Graphics Interface)

DBMS

What is a Database?

A database is a collection of related data which represents some aspect of the real world. A database system is designed to be built and populated with data for a certain task.

What is DBMS?

Database Management System (also known as DBMS) is a software for storing and retrieving users' data by considering appropriate security measures. It allows users to create their own databases as per their requirement.

It consists of a group of programs which manipulate the database and provide an interface between the database. It includes the user of the database and other application programs.

The DBMS accepts the request for data from an application and instructs the operating system to provide the specific data. In large systems, a DBMS helps users and other third-party software to store and retrieve data.

Let us see a simple example of a university database. This database is maintaining information concerning students, courses, and grades in a university environment. The database is organized as five files:

- The STUDENT file stores data of each student
- The COURSE file stores contain data on each course.
- The SECTION stores the information about sections in a particular course.
- The GRADE file stores the grades which students receive in the various sections
- The TUTOR file contains information about each professor.

To define a database system:

- We need to specify the structure of the records of each file by defining the different types of data elements to be stored in each record.
- We can also use a coding scheme to represent the values of a data item.
- Basically, your Database will have 5 tables with a foreign key defined amongst the various tables.

History of DBMS

- 1960 - Charles Bachman designed first DBMS system
- 1970 - Codd introduced IBM'S Information Management System (IMS)
- 1976- Peter Chen coined and defined the Entity-relationship model also know as the ER model
- 1980 - Relational Model becomes a widely accepted database component
- 1985- Object-oriented DBMS develops.
- 1990s- Incorporation of object-orientation in relational DBMS.

- 1991- Microsoft ships MS access, a personal DBMS and that displaces all other personal DBMS products.
- 1995: First Internet database applications
- 1997: XML applied to database processing. Many vendors begin to integrate XML into DBMS products.

Characteristics of Database Management System

- Provides security and removes redundancy
- Self-describing nature of a database system
- Insulation between programs and data abstraction
- Support of multiple views of the data
- Sharing of data and multiuser transaction processing
- DBMS allows entities and relations among them to form tables.
- It follows the ACID concept (Atomicity, Consistency, Isolation, and Durability).
- DBMS supports multi-user environment that allows users to access and manipulate data in parallel.

Popular DBMS Software

Here, is the list of some popular DBMS system:

- MySQL
- Microsoft Access
- Oracle
- PostgreSQL
- dBASE
- FoxPro
- SQLite
- IBM DB2
- LibreOffice Base
- MariaDB
- Microsoft SQL Server etc.

Database Applications

Applications where we use Database Management Systems are:

Telecom: There is a database to keeps track of the information regarding calls made, network usage, customer details etc. Without the database systems it is hard to maintain that huge amount of data that keeps updating every millisecond.

Industry: Where it is a manufacturing unit, warehouse or distribution centre, each one needs a database to keep the records of ins and outs. For example distribution centre should keep a track of the product units that supplied into the centre as well as the products that got delivered out from the distribution centre on each day; this is where DBMS comes into picture.

Banking System: For storing customer info, tracking day to day credit and debit transactions, generating bank statements etc. All this work has been done with the help of Database management systems.

Sales: To store customer information, production information and invoice details.

Airlines: To travel though airlines, we make early reservations, this reservation information along with flight schedule is stored in database.

Education sector: Database systems are frequently used in schools and colleges to store and retrieve the data regarding student details, staff details, course details, exam details, payroll data, attendance details, fees details etc. There is a hell lot amount of inter-related data that needs to be stored and retrieved in an efficient manner.

Online shopping: You must be aware of the online shopping websites such as Amazon, Flipkart etc. These sites store the product information, your addresses and preferences, credit details and provide you the relevant list of products based on your query. All this involves a Database management system.

Types of DBMS

Hierarchical DBMS

In a Hierarchical database, model data is organized in a tree-like structure. Data is Stored Hierarchically (top down or bottom up) format. Data is represented using a parent-child relationship. In Hierarchical DBMS parent may have many children, but children have only one parent.

Network Model

The network database model allows each child to have multiple parents. It helps you to address the need to model more complex relationships like as the orders/parts many-to-many relationship. In this model, entities are organized in a graph which can be accessed through several paths.

Relational model

Relational DBMS is the most widely used DBMS model because it is one of the easiest. This model is based on normalizing data in the rows and columns of the tables. Relational model stored in fixed structures and manipulated using SQL.

Object-Oriented Model

In Object-oriented Model data stored in the form of objects. The structure which is called classes which display data within it. It defines a database as a collection of objects which stores both data members values and operations.

Advantages of DBMS

- DBMS offers a variety of techniques to store & retrieve data
- DBMS serves as an efficient handler to balance the needs of multiple applications using the same data
- Uniform administration procedures for data
- Application programmers never exposed to details of data representation and storage.
- A DBMS uses various powerful functions to store and retrieve data efficiently.
- Offers Data Integrity and Security
- The DBMS implies integrity constraints to get a high level of protection against prohibited access to data.
- A DBMS schedules concurrent access to the data in such a manner that only one user can access the same data at a time
- Reduced Application Development Time

Disadvantage of DBMS

DBMS may offer plenty of advantages but, it has certain flaws-

- Cost of Hardware and Software of a DBMS is quite high which increases the budget of your organization.
- Most database management systems are often complex systems, so the training for users to use the DBMS is required.
- In some organizations, all data is integrated into a single database which can be damaged because of electric failure or database is corrupted on the storage media
- Use of the same program at a time by many users sometimes lead to the loss of some data.
- DBMS can't perform sophisticated calculations

UNIT – IV

Operating Systems

An operating system is a complex program that keeps the hardware and software components of a computer system coordinated and functioning. It is like the owner of a small shop, who keeps everything in order by attending to customers, accepting deliveries, stocking the shelves, doing the bookkeeping, and so on. The shopkeeper must promptly attend to tasks as they arise. Without the shopkeeper the shop could not function.

Most computer systems can potentially run any of several operating systems. For example, most Pentium-based computers can run either Linux or a Windows operating systems. Usually only one operating system is installed on a computer system, although some computers have several. In any case, only one operating system at a time can be in control of the computer system. The computer user makes a choice when the computer is turned on, and that operating system remains in control until the computer is turned off.

Operating system Definition:

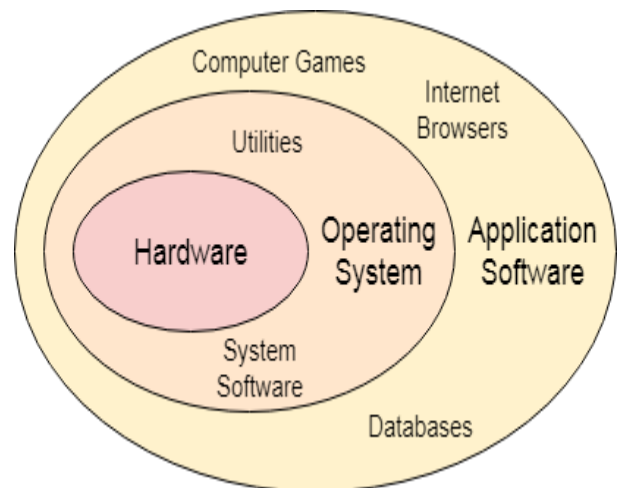
“Operating system can define as set of programs that can be interface between user and system and manages the resource in efficient way.”

“Operating system is set of programs that control and support hardware and provide

Various services which are used for better operating performance of the computer.”

In the Computer System (comprises of Hardware and software), Hardware can only understand machine code (in the form of 0 and 1) which doesn't make any sense to a naive user.

We need a system which can act as an intermediary and manage all the processes and resources present in the system. An **Operating System** can be defined as an **interface between user and hardware**.



Meaning:

An operating system is designed as a huge modular program that manages the overall operation of computer. The operating system is important system software and it is contain all computer. It is first software we see when turn on the computer and we see the last software to when turn off. Operating system hides the hardware to the user.

Popular Operating Systems

Initially computers had no operating systems. Every program needed full hardware specifications to run correctly as processor, memory and device management had to be done by the programs themselves. However, as sophisticated hardware and more complex application programs developed, operating systems became essential. As personal computers became popular among individuals and small businesses, demand for standard operating system grew. Let us look at some of the currently popular operating systems –

- **Windows** – Windows is a GUI operating system first developed by Microsoft in 1985. The latest version of Windows is Windows 10. Windows is used by almost 88% of PCs and laptops globally.

- **Linux** – Linux is an open source operating system mostly used by mainframes and supercomputers. Being open source means that its code is available for free and anyone can develop a new OS based on it.
- **BOSS** – Bharat Operating System Solutions is an Indian distribution of Linux based on Debian, an OS. It is localized to enable use of local Indian languages. BOSS consists of –
 - Linux kernel
 - Office application suite **BharteeyaOO**
 - Web browser
 - Email service **Thunderbird**
 - Chat application **Pidgin**
 - File sharing applications
 - Multimedia applications

Mobile OS

An operating system for smartphones, tablets and other mobile devices is called **mobile OS**. Some of the most popular OS for mobile devices includes –

- **Android** – This Linux-based OS by Google is the most popular mobile OS currently. Almost 85% of mobile devices use it.
- **Windows Phone 7** – It is the latest mobile OS developed by Microsoft.
- **Apple iOS** – This mobile OS is an OS developed by Apple exclusively for its own mobile devices like iPhone, iPad, etc.
- **Blackberry OS** – This is the OS used by all blackberry mobile devices like smartphones and playbooks.

Functions of Operating System:-

An operating system perform following functions:

1.processor management:

In a multi user operating system two or more processes can work at one time. One computer may ask for a file, another for printing the document and so on. The operating system will keep all those works in an order and gives some time for each work is known as the time sharing or process management.

2.memory management:

The operating system allots space for the files in the memory the operating only knows where the particular file has been kept in the system. When the user requires that file, the operating system will search and give the file to user.

3.Input/output device management :

In order to run the program, we need some values of input and output. the operating system not only provides the necessary values to all input parts but also controls them.

4.file management: The operating system manages the files in the system enables the user to create a file, same, open and delete the file. It also rename a file of folder, copying the files, moving the file from one place to another place.

5.security management:

That mean. operating system provide User name and password then unauthorized person can not access the data.

6.software management:

Coordination and assignment of compilers, assemblers, utility programs, and other software to the various of the computer systems.

7.job scheduling management:

The operating system can scheduling jobs according to priority and processing jobs which priority is high. It decreases the vastly processing time of unimportant jobs.

8.errors management: the operating system identify the error or false information is given by the user.

9. operating system provide easy communication between computer system and the computer operator.

Measuring Operating Systems Performance

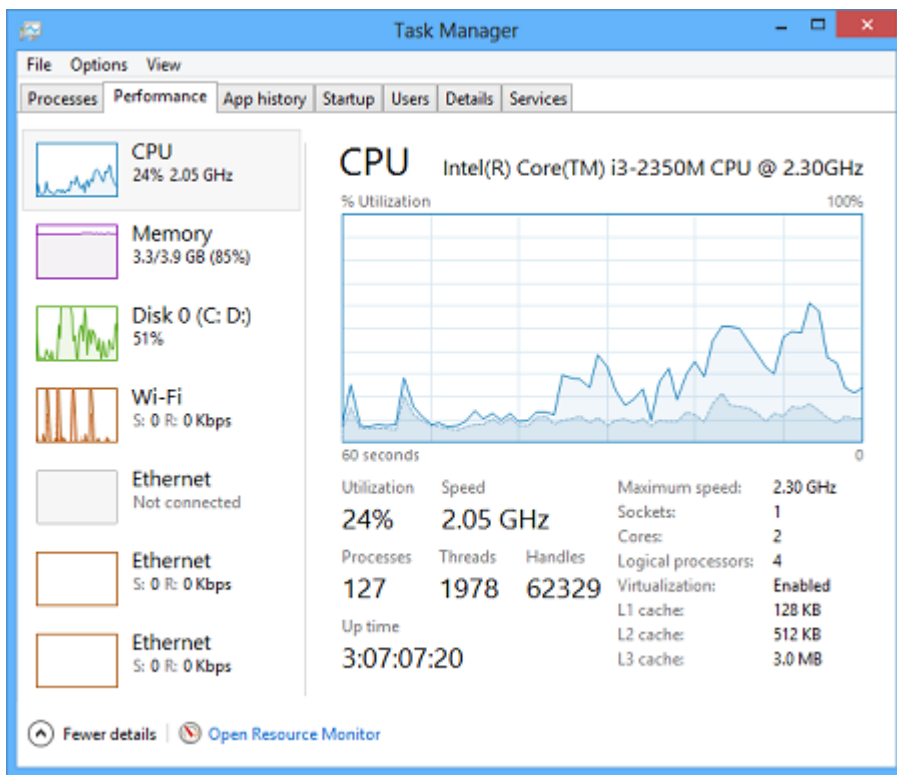
Monitoring performance of a computer system health and vital information needed for troubleshooting performance problems and bottlenecks. Operating system performance metrics are related to performance of disk, memory, processor, and network. Some of the most important system performance metrics are available memory, average bytes per read/write, average read/write time, disk reads/writes per second, network utilization, pages input per second, pages per second, processor queue length, and processor usage.

The choice of metrics that will be used for monitoring will depend on monitoring goals and performance requirements. It's important that, a DBA is able to improve performance based on the monitoring results, but also to recognize potential issues and bottlenecks on time, and fix them before they affect the system.

Windows Task Manager

This is a native Windows monitoring tool that is useful for basic monitoring and troubleshooting. It can be helpful for determining where the bottleneck is: on a disk, processor, memory, or network. Other than that, it doesn't provide enough information for determining the exact problem

- 1 To open it, click Ctrl + Alt + Del and select Task Manager. Alternatively, right click on the Taskbar and select the Task Manager from the context menu
- 2 Select the **Performance** tab
- 3 In the left pane, select the hardware component you want to monitor: processor, memory, disk, or a network adapter



Windows Performance Monitor

Windows Performance Monitor is a native Windows tool. Besides system performance metrics, it supports a wide range of performance metrics, including SQL Server, SQL Agent, database, and many other. It shows performance metrics in real-time graphs and allows custom selecting of the metrics that will be displayed, defining of metric threshold values, reports generation, and insight in historical data (historical data are available only for the period from the last computer restart)

- 1 To start **Windows Performance Monitor**:
 - Click **Start** and go to **Run**. In Windows 8, click Windows + C. Type *perfmon* and press **Enter**
 - Open **Windows Control Panel**, go to **System and Security, Administrative Tools**, and click **Performance Monitor**
- 2 Select **Monitoring tools, Performance Monitor** in the left pane
- 3 Select and configure the performance metrics you want to monitor. To add a metric:
 - Right-click the graph and select **Add Counters** in the context menu
 - Press Ctrl + N
 - Click **Add** (the green plus icon) in the menu
- 4 In the **Add Counters** dialog, select the computer
- 5 Expand the metric group and select the metrics you want to monitor

Types of Operating Systems

An **Operating System** performs all the basic tasks like managing file, process, and memory. Thus operating system acts as manager of all the resources, i.e. **resource manager**. Thus operating system becomes an interface between user and machine.

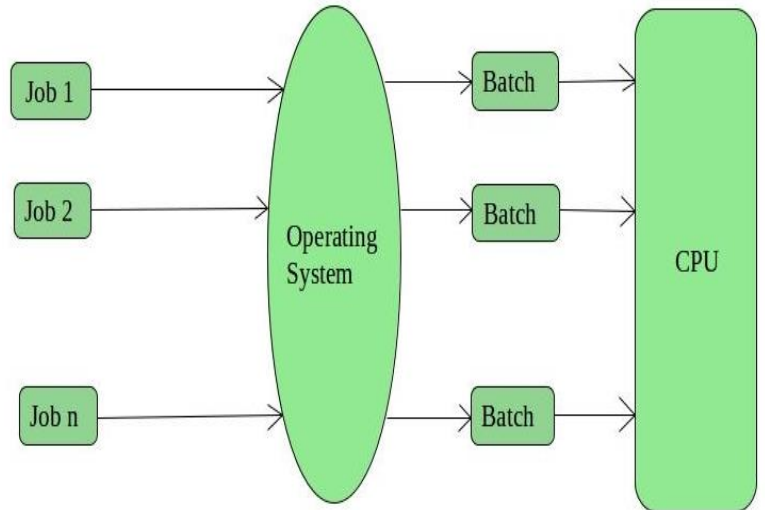
Types of Operating Systems: Some of the widely used operating systems are as follows-

Batch Operating System –

In the era of 1970s, the Batch processing was very popular. The Jobs were executed in batches. People were used to have a single computer which was called mainframe.

In Batch operating system, access is given to more than one person; they submit their respective jobs to the system for the execution.

This type of operating system does not interact with the computer directly. There is an operator which takes similar jobs having same requirement and group them into batches. It is the responsibility of operator to sort the jobs with similar needs.



Advantages of Batch Operating System:

- It is very difficult to guess or know the time required by any job to complete. Processors of the batch systems know how long the job would be when it is in queue
- Multiple users can share the batch systems
- The idle time for batch system is very less
- It is easy to manage large work repeatedly in batch systems

Disadvantages of Batch OS

1. Starvation

Batch processing suffers from starvation. If there are five jobs J1, J2, J3, J4, J4 and J5 present in the batch. If the execution time of J1 is very high then other four jobs will never be going to get executed or they will have to wait for a very high time. Hence the other processes get starved.

2. Not Interactive

Batch Processing is not suitable for the jobs which are dependent on the user's input. If a job requires the input of two numbers from the console then it will never be going to get it in the batch processing scenario since the user is not present at the time of execution.

- Batch systems are hard to debug
- It is sometime costly
- The other jobs will have to wait for an unknown time if any job fails

Examples of Batch based Operating System: Payroll System, Bank Statements etc.

2. Time-Sharing Operating Systems

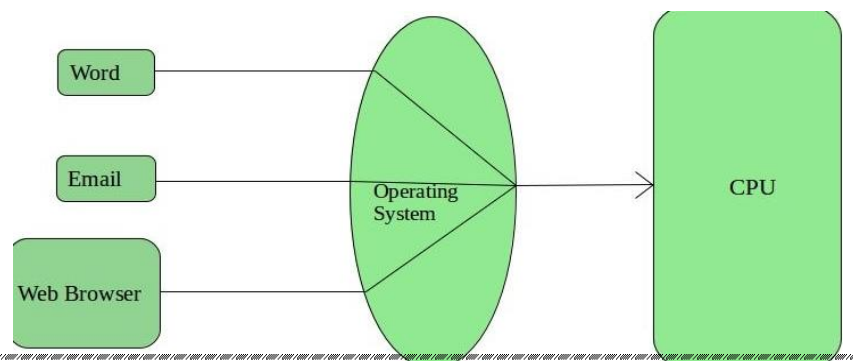
Each task is given some time to execute, so that all the tasks work smoothly. Each user gets time of CPU as they use single system. These systems are also known as Multitasking Systems. The task can be from single user or from different users also. The time that each task gets to execute is called quantum. After this time interval is over OS switches over to next task.

Advantages of Time-Sharing OS:

- Each task gets an equal opportunity
- Less chances of duplication of software
- CPU idle time can be reduced

Disadvantages of Time-Sharing OS:

- Reliability problem



- One must have to take care of security and integrity of user programs and data
- Data communication problem

Examples of Time-Sharing OSs are: Multics, Unix etc.

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.

In Multiprogramming systems, the Operating system schedules the processes on the CPU to have the maximum utilization of it and this procedure is called **CPU scheduling**. The Operating System uses various scheduling algorithm to schedule the processes.

This is a task of the short term scheduler to schedule the CPU for the number of processes present in the Job Pool. Whenever the running process requests some IO operation then the short term scheduler saves the current context of the process (also called PCB) and changes its state from running to waiting. During the time, process is in waiting state; the Short term scheduler picks another process from the ready queue and assigns the CPU to this process. This procedure is called **context switching**.

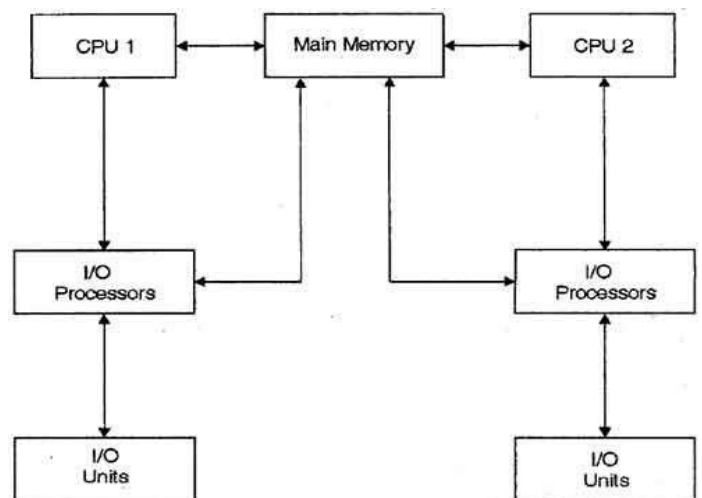
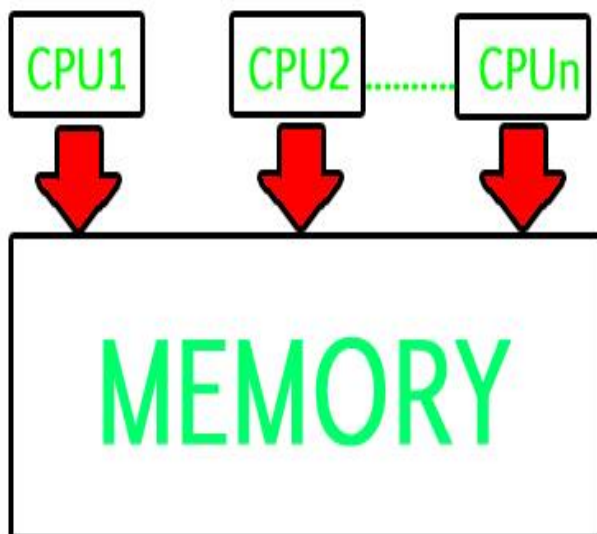
Multiprocessing Operating System

In a uni-processor system, only one process executes at a time.

Multiprocessing is the use of two or more CPUs (processors) within a single Computer system. The term also refers to the ability of a system to support more than one processor within a single computer system. Now since there are multiple processors available, multiple processes can be executed at a time. These multi processors share the computer bus, sometimes the clock, memory and peripheral devices also.

Multi processing system's working –

- With the help of multiprocessing, many processes can be executed simultaneously. Say processes P1, P2, P3 and P4 are waiting for execution. Now in a single processor system, firstly one process will execute, then the other, then the other and so on.
- But with multiprocessing, each process can be assigned to a different processor for its execution. If its a dual-core processor (2 processors), two processes can be executed simultaneously and thus will be two times faster, similarly a quad core processor will be four times as fast as a single processor.



Why use multi processing –

- The main advantage of multiprocessor system is to get more work done in a shorter period of time. These types of systems are used when very high speed is required to process a large volume of data.

Multi processing systems can save money in comparison to single processor systems because the processors can share peripherals and power supplies.

- It also provides increased reliability in the sense that if one processor fails, the work does not halt, it only slows down. e.g. if we have 10 processors and 1 fails, then the work does not halt, rather the remaining 9 processors can share the work of the 10th processor. Thus the whole system runs only 10 percent slower, rather than failing altogether.

Multiprocessing refers to the hardware (i.e., the CPU units) rather than the software (i.e., running processes). If the underlying hardware provides more than one processor then that is multiprocessing. It is the ability of the system to leverage multiple processors' computing power.

Difference between Multi programming and Multi processing –

- A System can be both multi programmed by having multiple programs running at the same time and multiprocessing by having more than one physical processor. The difference between multiprocessing and multi programming is that Multiprocessing is basically executing multiple processes at the same time on multiple processors, whereas multi programming is keeping several programs in main memory and executing them concurrently using a single CPU only.
- Multiprocessing occurs by means of parallel processing whereas Multi programming occurs by switching from one process to other (phenomenon called as context switching).

Multitasking

As the name itself suggests, multi tasking refers to execution of multiple tasks (say processes, programs, threads etc.) at a time. In the modern operating systems, we are able to play MP3 music, edit documents in Microsoft Word, surf the Google Chrome all simultaneously, this is accomplished by means of multi tasking.

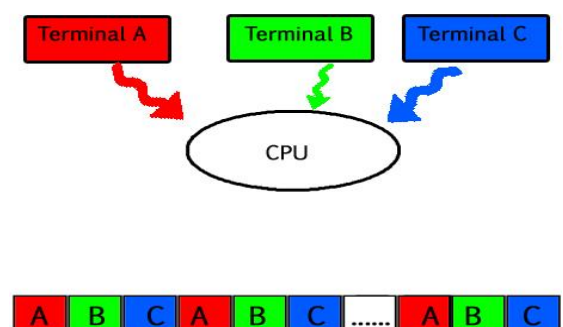
Multitasking is a logical extension of multi programming. The major way in which multitasking differs from multi programming is that multi programming works solely on the concept of context switching whereas multitasking is based on time sharing alongside the concept of context switching.

Multi tasking system's working –

- In a time sharing system, each process is assigned some specific quantum of time for which a process is meant to execute. Say there are 4 processes P1, P2, P3, P4 ready to execute. So each of them are assigned some time quantum for which they will execute e.g time quantum of 5 nanoseconds (5 ns). As one process begins execution (say P2), it executes for that quantum of time (5 ns). After 5 ns the CPU starts the execution of the other process (say P3) for the specified quantum of time.
- Thus the CPU makes the processes to share time slices between them and execute accordingly. As soon as time quantum of one process expires, another process begins its execution.
- Here also basically a context switch is occurring but it is occurring so fast that the user is able to interact with each program separately while it is running. This way, the user is given the illusion that multiple processes/ tasks are executing simultaneously. But actually only one process/ task is executing at a particular instant of time. In multitasking, time sharing is best manifested because each running process takes only a fair quantum of the CPU time.

In a more general sense, multitasking refers to having multiple programs, processes, tasks, threads running at the same time. This term is used in modern operating systems when multiple tasks share a common processing resource (e.g., CPU and Memory).

As depicted in the above image, At any time the CPU is executing only one task while other tasks are waiting for their turn. The illusion of parallelism is achieved when the CPU is reassigned to another task. i.e all the three tasks A, B and C are appearing to occur simultaneously because of time sharing. So for multitasking to take place, firstly there should be multiprogramming i.e. presence of multiple programs ready for execution. And secondly the concept of time sharing.



SINGLE-USER OPERATING SYSTEM:

In this type of operating system, one person can operate on one system. We cannot use more than one application. If we want to open another program, we have to close the current application or program.

MULTI-USER OPERATING SYSTEM:

Many persons can operate the system at the same time in this type of operating system. Here one computer is main computer and there are sub computers for others to work. The main computer will be connected with CPU and other devices, and in other computers, we have only monitors and keyboards.

REAL TIME/ONLINE OPERATING SYSTEM:

In this type of operating system, many inputs and outputs are processed at the same time with great speed. For example, in railway reservation and in banking systems, many requests (inputs) are processed by many users and the outputs are also processed at the same time.

BOOTING PROCESS:

Booting is the process of loading the operating system to the RAM of the computer. It is the initial set of operations that the computer performs when it is switched ON. The 'Booting' is also known as 'Boot Strap Process.'

DISK OPERATING SYSTEM:

Disk Operating System is the old and single user operating system in the computer. It is better to study DOS with a view to understand how the files are created, maintained and copied in the computer. DOS mainly deals with different disks like Floppy, Hard Disk etc.

FUNCTIONS OF DOS:

- 1) It takes commands from keyboard and interprets them.
- 2) It shows all the files in the system.
- 3) It creates new files and allots space for them.
- 4) It changes the name of a file.
- 5) It copies information in a floppy.
- 6) It helps to search a file.
- 7) It gives printout of the data.
- 8) It hides the files and directories.
- 9) It permanently removes the file.

The world wide famous Microsoft Company has developed the DOS and introduced in the commercial world. The DOS is also called as Microsoft Disk Operating System (MS-DOS).

FEATURES OF DOS:

- 1) It is the primary system where the user will get an environment about the input and output devices.
- 2) It is helpful in performing File Management.

- 3) It is a single user operating system. One user can operate at one time in this operating system.
- 4) It is character based interface system. We can type letters or characters in this operating system.

FILE:

A file is used for storing the information given by the user or system data.

OR

A file is a self contained piece of information available to the operating system and its programs.

DIRECTORY:

Directory means a group of files. It is used for classification purpose. There is no information in the directory.

FILE NAME&DIRECTORY NAME:

Every file and directory will have a name. When we give name for a file or directory, then the computer will save that file or directory with the given name.

The file name is divided into two parts. The first part indicates the file name and the second name indicates the extension name which is optional.

The name should not exceed 11 letters. The extension name tells us what type of file it is. i.e. text, batch, executable file, etc. This first name and the second name are separated by a dot (.).

INTRODUCTION TO WINDOWS

Windows makes the computer system user-friendly by providing a graphical display and organizing information so that it can be easily accessed. The operating system utilizes icons and tools that simplify the complex operations performed by computers.

DESKTOP:

When the computer is booted and ready to use, the screen that appears is called desktop. It is the background for all programs and contains the commands needed for accessing the programs. Desktops vary from one operating system to another.

-Wallpaper:

The background graphic that is displayed on the desktop is called wallpaper.

-Icons:

Icons are small pictures that are linked to programs. Double clicking on the icon runs the program or accesses the file.

-My Computer:

One of the most important icons on the desktop is My Computer, which access drivers, printers, other system applications.

-Recycle bin:

Any time you delete a file or folder, it goes into the recycle bin. It goes into the recycle bin where it stays until the bin is emptied.

-Internet Explorer:

Internet Explorer is a browser which is used to view web pages on internet.

-My Documents:

My Documents is a Microsoft windows folder that stores documents, program settings, and other files.

-The Start Menu and Task Bar:

If you click on the start button a box called menu will appear. The start menu options are:

Programs – Access installed programs

Favorites – Access book marked web pages

Documents – Access most recently opened documents

Settings – Access system applications such as control panel, printers, task bar and start menu options

Search – Searches for specific files and folders

Help – Gives helpful topics for computer use

Run – User can input commands to run specific programs

Log off – Allows a password protected user to log off and another to log on

Shut down – Shuts down or restarts the computer.

At the bottom of the screen, you will see a long thin box called start on one end and a clock on the other end. This is the task bar.

FILE:

A file is the common storage unit in a computer. All programs and data are contained in a file and the computer reads and writes the files. The data in a file can be of different types like text, data, images, audio, video, etc.

Every file consists of a file name. A file name has 3 parts-primary name, a dot, and an extension. Some examples of file names are : abc.txt, xyz.doc, pic.jpg etc.

FOLDER:

A folder holds one or more files and it can be empty with just a name. Folders provide a method for organizing files. Folders are also called directories.

MY COMPUTER:

My Computer allows the user to explore the contents of the computer drives and to manage the files. Double click the My Computer icon in order to open it. Once My Computer is open we can see all available drives on our computer.

MY DOCUMENTS:

My Documents folder is our own personal folder in which we can store our documents, graphics and other personal files.

RECYCLE BIN:

Sometimes it is required to delete unwanted files and folders in our computer. The recycle bin is the place where deleted files and folders are moved. Any file or folder can be restored from the recycle bin back to the original location.

INTERNET EXPLORER:

Internet explorer is a web browser developed by Microsoft and included as a part of the Microsoft windows.

-Address Bar:

It is used to type the web address of the site we want to visit on the internet.

-Main Explorer Tool Bar:

i) Back Button:

This button will take you back to whatever document you were previously viewing.

ii) Forward Button:

This button will take you forward to the next document. You can move forward until you reach the last page that you had browsed.

iii) Stop Button:

The stop button stops any current operations by internet explorer. It will stop any type of file from loading.

iv) Refresh Button:

This button will reload the current document that you are viewing.

v) Home Button:

This button will return you to the page you have selected as the default start-up page for internet explorer.

vi) Search Button:

This button will take you to the page you have selected as the default search page for internet explorer.

vii) Favorites Button:

This button will open the favorites menu. You can choose a favorite that you wish to go from the list.

viii) Print Button:

The print button will bring a print dialog box. In the box, you can decide if you would like to print the contents of the page you are viewing.

ix) Font Button:

This button makes internet explorer to give the available font sizes.

X) Mail Button:

This button will open a drop down menu from which you can send or read e-mail.

CONTROL PANEL – ITS OPTIONS:

The most important part in windows is control panel. In order to start control panel, click on start->settings->control panel.

The important components of control panel are:

1) Add new hardware:

If we want to add a new hardware like a modem or printer we have to click on these hardware and then add or delete the concerned hardware.

2) Add/remove programs:

If we want to add or remove any programs like MS Word, we can add or remove here.

3) Date/Time:

We can adjust the date and time here. If the system shows a different date and time, we can adjust our own date and time.

4) Display:

The color, background and other settings of the computer screen can be adjusted here.

5) Fonts:

We have a variety of styles in computer. They are called fonts. We can choose different fonts here.

6) Joy Stick:

The input device which helps the user in playing games is called joy stick.

7) Key board:

We can increase or decrease the keyboard speed and find other options here.

8) Mail & Fax:

This is related to the options of email and other fax messages.

9) Modems:

We can choose our modem type here to connect to internet.

10) Mouse:

We can change the settings of mouse like speed, pointer etc.

11) Multimedia:

It relates to compact disk, windows media player, etc.

12) Networks:

It relates to options connected with the network of the computer.

13) Passwords:

We can give system password here in order to protect the data from others.

14) Printer:

Printing options can be adjusted here.

15) Sound:

It is related to audio and video sounds.

16) System:

This option is related to the nature and working of our system.

DIALOG BOXES:

Whenever we need some more information, we get a sub window from the main window. That sub window is called a dialog box. Suppose, if we want to open a file, we click on 'open' option, immediately a dialog box will appear.

So if we need more information about any file, document or program, the computer keeps the dialog box in front of us.

SHUT DOWN THE COMPUTER:

After finishing the required tasks, we want to close down the computer, in that case, we have to close all the windows that are opened.

Then click on 'ok' in the dialog box opened. If we have not saved any changes in the documents opened, windows will ask us to save changes to the documents.

After that the computer will be shut down.

Unix / Linux

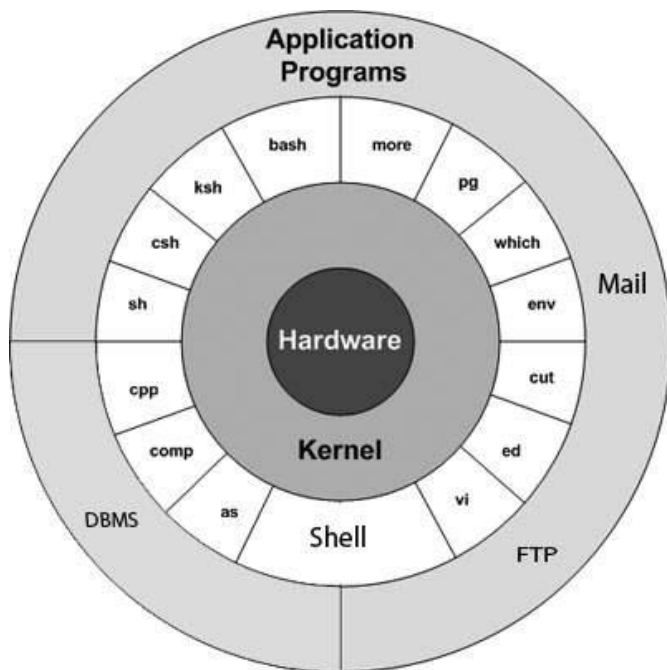
The Unix operating system is a set of programs that act as a link between the computer and the user. The computer programs that allocate the system resources and coordinate all the details of the computer's internals is called the **operating system** or the **kernel**.

Users communicate with the kernel through a program known as the **shell**. The shell is a command line interpreter; it translates commands entered by the user and converts them into a language that is understood by the kernel.

- Unix was originally developed in 1969 by a group of AT&T employees Ken Thompson, Dennis Ritchie, Douglas McIlroy, and Joe Ossanna at Bell Labs.
- There are various Unix variants available in the market. Solaris Unix, AIX, HP Unix and BSD are a few examples. Linux is also a flavor of Unix which is freely available.
- Several people can use a Unix computer at the same time; hence Unix is called a multiuser system.
- A user can also run multiple programs at the same time; hence Unix is a multitasking environment.

Unix Architecture

Here is a basic block diagram of a Unix system –



The main concept that unites all the versions of Unix is the following four basics –

- **Kernel** – The kernel is the heart of the operating system. It interacts with the hardware and most of the tasks like memory management, task scheduling and file management.
- **Shell** – The shell is the utility that processes your requests. When you type in a command at your terminal, the shell interprets the command and calls the program that you want. The shell uses standard syntax for all commands. C Shell, Bourne Shell and Korn Shell are the most famous shells which are available with most of the Unix variants.
- **Commands and Utilities** – There are various commands and utilities which you can make use of in your day to day activities. **cp**, **mv**, **cat** and **grep**, etc. are few examples of commands and utilities. There are over 250 standard commands plus numerous others provided through 3rd party software. All the commands come along with various options.
- **Files and Directories** – All the data of Unix is organized into files. All files are then organized into directories. These directories are further organized into a tree-like structure called the **filesystem**.

System Bootup

If you have a computer which has the Unix operating system installed in it, then you simply need to turn on the system to make it live.

As soon as you turn on the system, it starts booting up and finally it prompts you to log into the system, which is an activity to log into the system and use it for your day-to-day activities.

Login Unix

When you first connect to a Unix system, you usually see a prompt such as the following –

login:

To log in

- Have your userid (user identification) and password ready. Contact your system administrator if you don't have these yet.
- Type your userid at the login prompt, then press **ENTER**. Your userid is **case-sensitive**, so be sure you type it exactly as your system administrator has instructed.
- Type your password at the password prompt, then press **ENTER**. Your password is also case-sensitive.
- If you provide the correct userid and password, then you will be allowed to enter into the system. Read the information and messages that comes up on the screen, which is as follows.

login : amar

amar's password:

Last login: Sun aug 14 09:32:32 2019 from 62.61.164.73

\$

You will be provided with a command prompt (sometime called the \$ prompt) where you type all your commands. For example, to check calendar, you need to type the **cal** command as follows –

\$ cal

June 2009

Su Mo Tu We Th Fr Sa

1 2 3 4 5 6

7 8 9 10 11 12 13

14 15 16 17 18 19 20

21 22 23 24 25 26 27

28 29 30

\$

Change Password

All Unix systems require passwords to help ensure that your files and data remain your own and that the system itself is secure from hackers and crackers. Following are the steps to change your password –

Step 1 – To start, type password at the command prompt as shown below.

Step 2 – Enter your old password, the one you're currently using.

Step 3 – Type in your new password. Always keep your password complex enough so that nobody can guess it. But make sure, you remember it.

Step 4 – You must verify the password by typing it again.

\$ passwd

Changing password for amar

(current) Unix password:*****

New UNIX password:*****

Retype new UNIX password:*****

passwd: all authentication tokens updated successfully

\$

Note – We have added asterisk (*) here just to show the location where you need to enter the current and new passwords otherwise at your system. It does not show you any character when you type.

Listing Directories and Files

All data in Unix is organized into files. All files are organized into directories. These directories are organized into a tree-like structure called the filesystem.

You can use the **ls** command to list out all the files or directories available in a directory. Following is the example of using **ls** command with **-l** option.

```
$ ls -l
total 19621
drwxrwxr-x  2 amar amar    4096 Dec 25 09:59 uml
-rw-rw-r--  1 amar amar    5341 Dec 25 08:38 uml.jpg
drwxr-xr-x  2 amar amar    4096 Feb 15  2006 univ
drwxr-xr-x  2 root  root    4096 Dec  9  2018 urlspedia
-rw-r--r--  1 root  root   276480 Dec  9  2018 urlspedia.tar
drwxr-xr-x  8 root  root    4096 Nov 25  2018 usr
-rwxr-xr-x  1 root  root    3192 Nov 25  2018 webthumb.php
-rw-rw-r--  1 amar amar   20480 Nov 25  2018 webthumb.tar
-rw-rw-r--  1 amar amar    5654 Aug  9  2018 yourfile.mid
-rw-rw-r--  1 amar amar   166255 Aug  9  2018 yourfile.swf
```

\$

Here entries starting with **d.....** represent directories. For example, uml, univ and urlspedia are directories and rest of the entries are files.

Who Are You?

While you're logged into the system, you might be willing to know : **Who am I?**

The easiest way to find out "who you are" is to enter the **whoami** command –

```
$ whoami
amar
```

\$

Try it on your system. This command lists the account name associated with the current login. You can try **who am i** command as well to get information about yourself.

Who is Logged in?

Sometime you might be interested to know who is logged in to the computer at the same time.

There are three commands available to get you this information, based on how much you wish to know about the other users: **users**, **who**, and **w**.

```
$ users
amar aa va
```

```
$ who
amar tty0 Oct 8 14:10 (limbo)
aa  tty2 Oct 4 09:08 (calliope)
va  tty4 Oct 8 12:09 (dent)
```

\$

Try the **w** command on your system to check the output. This lists down information associated with the users logged in the system.

Logging Out

When you finish your session, you need to log out of the system. This is to ensure that nobody else accesses your files.

To log out

- Just type the **logout** command at the command prompt, and the system will clean up everything and break the connection.

System Shutdown

The most consistent way to shut down a Unix system properly via the command line is to use one of the following commands –

Sr.No.	Command & Description
1	halt Brings the system down immediately
2	init 0 Powers off the system using predefined scripts to synchronize and clean up the system prior to shutting down
3	init 6 Reboots the system by shutting it down completely and then restarting it
4	poweroff Shuts down the system by powering off
5	reboot Reboots the system
6	shutdown Shuts down the system

UNIT-V

DATA COMMUNICATION

Data:

In general, **data** is any set of characters that is gathered and translated for some purpose, usually analysis. It can be any character, including text and numbers, pictures, sound, or video. If data is not put into context, it doesn't do anything to a human or computer.

Within a computer's storage, data is a collection of numbers represented as bytes that are in turn composed of bits (binary digits) that can have the value one or zero. Data is processed by the CPU, which uses logical operations to produce new data (output) from source data (input).

The word data is technically a plural noun, as in, "The data are being processed." The singular form of data is datum, from the Latin word meaning "something given."

While using data as a plural noun is technically correct, in modern usage, data is also accepted as a singular noun, as in, "The data is being processed."

The pronunciation of "data" can vary depending on the part of the world of the person speaking the word. Globally, it's pronounced as day-ta, dat-ta, dah-ta, or dar-ta. In America, it's most often pronounced as both day-ta and dat-ta.

Communication

Communication is the process of sending and receiving messages through verbal or nonverbal means, including speech, or oral communication; writing and graphical representations (such as infographics, maps, and charts); and signs, signals, and behavior. More simply, communication is said to be "the creation and exchange of meaning."

Media critic and theorist James Carey defined communication as "a symbolic process whereby reality is produced, maintained, repaired and transformed."

Network

A **network** is a collection of computers, servers, mainframes, network devices, peripherals, or other devices connected to one another to allow the sharing of data. An excellent example of a

network is the Internet, which connects millions of people all over the world.

Basic Networking Devices

1. Repeater – A repeater operates at the physical layer. Its job is to regenerate the signal over the same network before the signal becomes too weak or corrupted so as to extend the length to which the signal can be transmitted over the same network.

An important point to be noted about repeaters is that they do not amplify the signal. When the signal becomes weak, they copy the signal bit by bit and regenerate it at the original strength. It is a 2 port device.

2. Hub – A hub is basically a multiport repeater. A hub connects multiple wires coming from different branches, for example, the connector in star topology which connects different stations. Hubs cannot filter data, so data packets are sent to all connected devices.

In other words, collision domain of all hosts connected through Hub remains one. Also, they do not have intelligence to find out best path for data packets which leads to inefficiencies and wastage.

Types of Hub

- **Active Hub :-** These are the hubs which have their own power supply and can clean , boost and relay the signal along the network. It serves both as a repeater as well as wiring center. These are used to extend maximum distance between nodes.
- **Passive Hub :-** These are the hubs which collect wiring from nodes and power supply from active hub. These hubs relay signals onto the network without cleaning and boosting them and can't be used to extend distance between nodes.

3. Bridge – A bridge operates at data link layer. A bridge is a repeater, with add on functionality of filtering content by reading the MAC addresses of source and destination. It is also used for interconnecting two LANs working on the same protocol. It has a single input and single output port, thus making it a 2 port device.

Types of Bridges

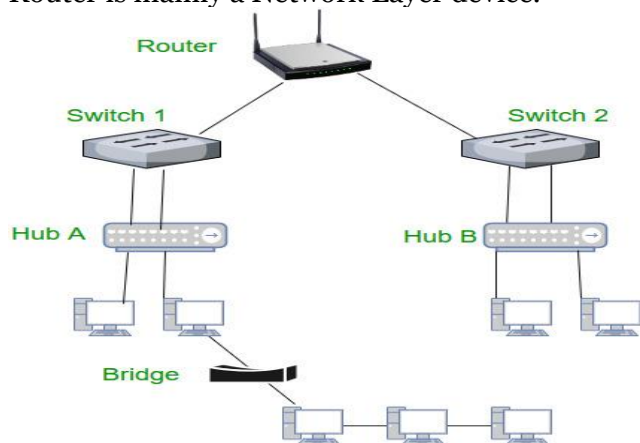
- **Transparent Bridges :-** These are the bridge in which the stations are completely unaware of the bridge's existence i.e. whether or not a bridge is added or deleted from the network , reconfiguration of the stations is unnecessary. These bridges

makes use of two processes i.e. bridge forwarding and bridge learning.

- **Source Routing Bridges :-** In these bridges, routing operation is performed by source station and the frame specifies which route to follow. The host can discover frame by sending a special frame called discovery frame, which spreads through the entire network using all possible paths to destination.

4. Switch – A switch is a multi-port bridge with a buffer and a design that can boost its efficiency (large number of ports imply less traffic) and performance. Switch is data link layer device. Switch can perform error checking before forwarding data, which makes it very efficient as it does not forward packets that have errors and forward good packets selectively to correct port only. In other words, switch divides collision domain of hosts, but **broadcast domain** remains same.

5. Routers – A router is a device like a switch that routes data packets based on their IP addresses. Router is mainly a Network Layer device.



Routers normally connect LANs and WANs together and have a dynamically updating routing table based on which they make decisions on routing the data packets. Router divide broadcast domains of hosts connected through it.

6. Gateway – A gateway, as the name suggests, is a passage to connect two networks together that may work upon different networking models. They basically work as the messenger agents that take data from one system, interpret it, and transfer it to another system. Gateways are also called protocol converters and can operate at any network layer. Gateways are generally more complex than switch or router.

7. Brouter – It is also known as bridging router is a device which combines features of both bridge and router. It can work either at data link layer or at network layer. Working as router, it is capable of routing packets across networks and working as

bridge, it is capable of filtering local area network traffic.

Data Transmission speed

Bandwidth of a communication system refers to its data transfer rate (amount of data that it can transfer per unit of time). It is analogous to a road's width. Wider a road, the more traffic it can handle in a given time. Similarly, higher the bandwidth of a communication system, the more data it can transfer in a given time.

Bandwidth is measured in bits per second , also called baud. Generally, baud is identical to bits per second, hence a rate of 300 baud means 300bps. However, technically, baud refers to number of signal changes per second.

Based on data transmission speeds, there are three basic categories of communication channels (paths):

Narrow band:

Narrow band or sub-voice grade channels have speed in the range of 45 to 300 baud. Low-speed devices and communication systems for low data volumes use narrow channels.

Voice-band:

Voice-band channels have speed up to 9600 baud. Their major application is ordinary telephone voice communication, hence the name "voice-band". Communication systems for data transmission from slow I/O devices to CPU or vice versa use voice-band channels.

Broadband:

Broadband channels have speed of 1 million baud or more. Communication systems for transmission of large volumes of data at high speed (such as high speed computer to computer communication or data transmission to several different devices simultaneously) use broadband channels.

Cost of data transmission service increases with speed. Hence, a thorough analysis of business needs and associated costs is necessary to make a proper choice of communication channel for an application.

Communication Types (modes):

Communication is the process of transmitting the information from one person to

another person. The communication methods have been broadly classified into two categories.

1) Individual Communication:

Individual communication is a communication where two persons interact like email, phone conversation.

2) Group Communication:

When we communicate with large number of persons who feel themselves that they are only talking to other persons at the same time. The chatting and e-commerce are the examples of modern group communications.

1) TELEPHONE:

Telephone is the most popular method of communication. Now-a-days, the telephone technology is increasing at a fast rate in the form of cell phones, digital phones etc. These cell phones are wireless and can be operated at anywhere in country.

TELECONFERENCING:

In teleconferencing, two or more people participate to discuss some issues on telephone. When two or more persons want to engage on phone, this teleconferencing facility is used.

2) VOICE MAIL:

While the email sends text, the voice mail transmits oral communication in computer. Voice mail is a form of communication in which a person sends the message in voice form.

In voice mail, a special device called CODEC converts our analog signals into digital signals and then these digital signals are again converted into analog signals by the codec at the other end. Just like email, we can open voice mail and hear the voice message. For getting voice mail, the sender usually registers his name and identification to the voice mail service providing organization.

FAX (FACSIMILE TRANSMISSION):

The FAX is one of the popular means of business communication. It allows users to transmit the text, graphics and images through telephone lines. It works like a Xerox machine which gives duplicate copies of the documents. When a copy is inserted into FAX machine, a duplicate copy of the same comes out from another machine at the other end. The FAX machine is connected to modem. It converts the documents into analog signals and then into auto digital

Data Transmission Medias

Transmission media is a pathway that carries the [information](#) from sender to receiver. We use different types of cables or waves to transmit data. Data is transmitted normally through electrical or electromagnetic signals.

signals and transmit the message to the receiver's end.

3) ELECTRONIC MAIL (E-MAIL):

E-mail is the most popular and widely used communication. Through email, one can send the data and information to others through computer having an internet connection. In order to send messages, the users must have an email id and password which are freely offered by many websites.

Creation of email id:-

There are many websites offering free emails. In order to get free email, first we have to obtain our own id. For getting own id (identification), we have to register with any of websites which are offering free emails.

Now-a-days, the most famous email sites are given below:

- www.hotmail.com
- www.rediffmail.com
- www.yahoomail.com
- www.gmail.com

We can go to any of the above email providing sites and click on 'New user? Signup' you will be given a form in which you have to fill-up your own information. If the name chosen by you is already taken up by somebody, then you have to choose an alternative name. On completion of the form, you will be given your own id in email. Once you get your own email, you can send and receive emails.

4) VIDEOCONFERENCING:

A group of people at different places will interact without being present at the same place through videoconferencing. The people at different places will come to a room where video cameras are fixed. A television link is established among them. The views are exhibited on TV screens and the people can participate actively by seeing one another on TV. Not only pictures, sound is also transmitted to the other end.

7. INTERNET RELAY CHAT:

It is the process of interactive communication with different persons at the same time on computer. The email facility offers one side communication at one time. In order to overcome this limitation, we can have chatting. In chatting, we can talk to other persons in real time. The information that a person types appears instantly on the screen of another person.

An electrical signal is in the form of current. An electromagnetic signal is series of electromagnetic energy pulses at various frequencies. These signals can be transmitted through copper wires, optical fibers, atmosphere, water and vacuum Different Medias have different properties like bandwidth, delay, cost and ease of installation and maintenance. Transmission media is also called **Communicationchannel**.

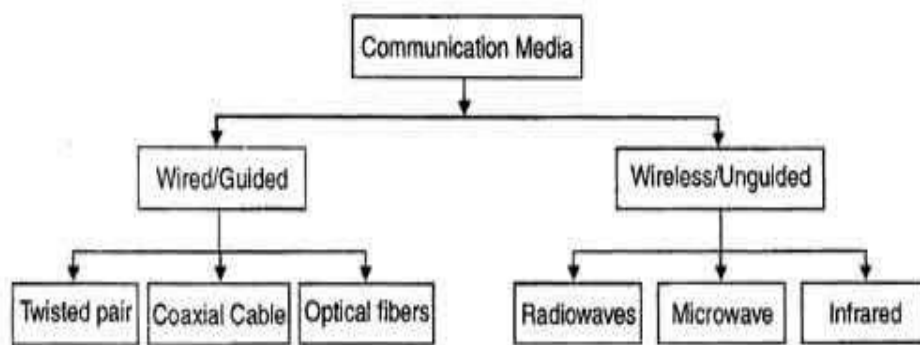
Types of Transmission Media

Transmission media is broadly classified into two groups.

Wired or Guided Media or Bound Transmission Media:

Bound transmission media are the cables that are tangible or have physical existence and are limited by the physical geography. Popular [bound transmission media](#) in use are twisted pair cable, co-axial cable and fiber optical cable. Each of them has its own characteristics like transmission speed, effect of noise, physical appearance, cost etc.

Wireless or Unguided Media or Unbound Transmission Media: Unbound transmission media are the ways of transmitting data without using any cables. These media are not bounded by physical geography. This type of transmission is called **Wireless communication**. Nowadays wireless communication is becoming popular. Wireless LANs are being installed in office and college campuses. This transmission uses Microwave, Radio wave, Infra red are some of popular unbound transmission media.



The data transmission capabilities of various Medias vary differently depending upon the various factors. These factors are:

1. **Bandwidth.** It refers to the data carrying capacity of a channel or medium. Higher bandwidth communication channels support higher data rates.
2. **Radiation.** It refers to the leakage of signal from the medium due to undesirable electrical characteristics of the medium.
3. **Noise Absorption.** It refers to the susceptibility of the media to external electrical noise that can cause distortion of data signal.
4. **Attenuation.** It refers to loss of energy as signal propagates outwards. The amount of energy lost depends on frequency. Radiations and physical characteristics of media contribute to attenuation.

NETWORK:

A network is a collection of computers connected together to share the software, data and devices. A network is connected through devices like modem.

MODEM:

A modem is a device that enables a computer to convert analog signals into digital signals and vice versa., while the telephone lines transmits data in analog (sound) form, the computer transmits the data in digital form. Hence, a device is required to convert the analog data into digital data.

A modem is a device that converts analog signals into digital signals from sender's side. The receiver's modem will again convert these digital signals into analog signals.

Modems are normally used for networking in order to send the signals through telephone lines.

The modems are mainly of two types.

1) **Internal modem:**

It is fixed into the slot of motherboard. Now-a-days these type of modems are rarely used.

2) **External modem:**

It is just connected to the computer. Now-a-days these type of modems are frequently used. The efficiency of modems depends on its speed. A high speed modem always transfers maximum data, while a normal speed modem like 9.6 kbps slows down the data transfer.

DIAL-UP ACCESS:

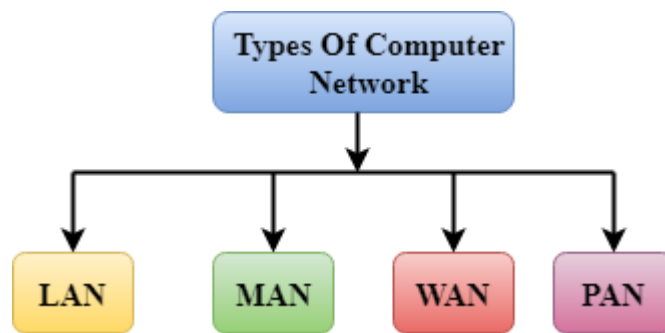
Dial up access is one of the types of internet access where the computer uses a telephone line to dial into an internet service provider (ISP). The dial up access requires a telephone and a modem to connect to the internet.

Now-a-days, the cable and broad band connections are becoming popular than the dial up access because dial up connections are noisy. However in rural areas this dial up connections are still popular. Normally dial up connections are slow. Hence we cannot download movies and games easily.

Computer Network Types

A computer network is a group of computers linked to each other that enables the computer to communicate with another computer and share their resources, data, and applications.

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



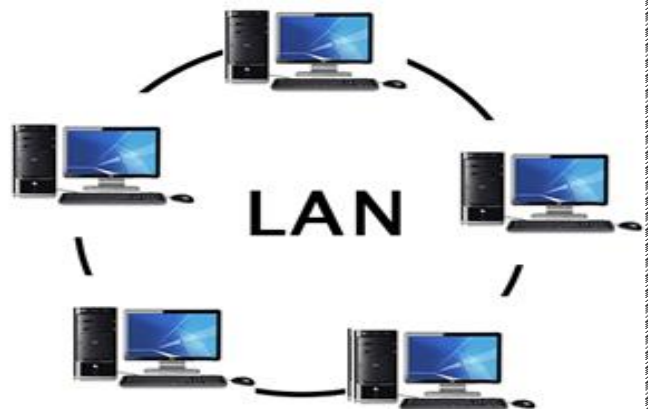
- o LAN(Local Area Network)
- o PAN(Personal Area Network)
- o MAN(Metropolitan Area Network)
- o WAN(Wide Area Network)

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. Local Area Network provides higher security.



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:

- Wired Personal Area Network
- Wireless 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.

Examples Of Personal Area Network:

Body Area Network: Body Area Network is a network that moves with a person. **For example**, a mobile network moves with a person. Suppose a person establishes a network connection and then creates a connection with another device to share the information.

Offline Network: An offline network can be created inside the home, so it is also known as a **home network**. A home network is designed to integrate the devices such as printers, computer, television but they are not connected to the internet.

Small Home Office: It is used to connect a variety of devices to the internet and to a corporate network using a VPN

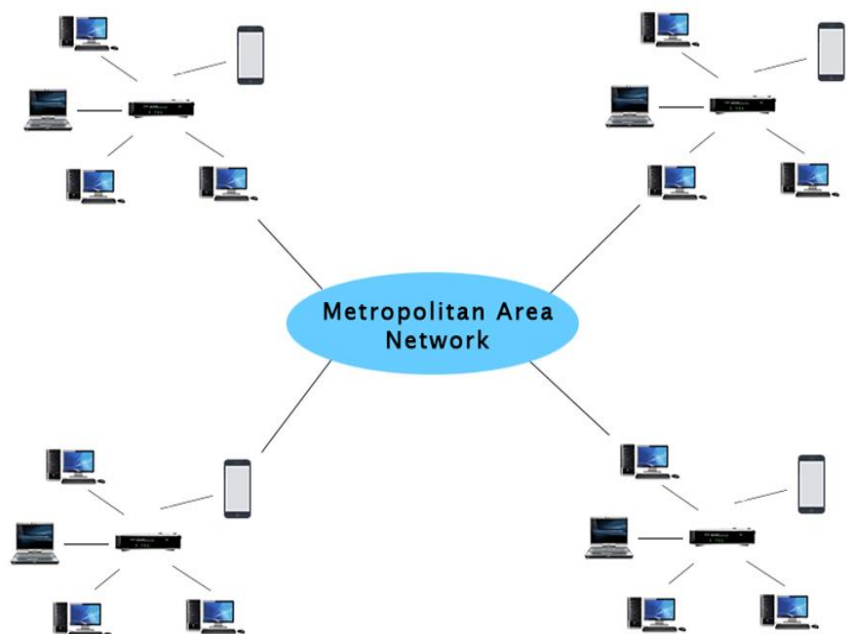
MAN(Metropolitan Area Network)

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.

In MAN, various LANs are connected to each other through a telephone exchange line. The most widely used protocols in MAN are RS-232, Frame Relay, ATM, ISDN, OC-3, ADSL, etc. It has a higher range than Local Area Network(LAN).

Uses Of Metropolitan Area Network:

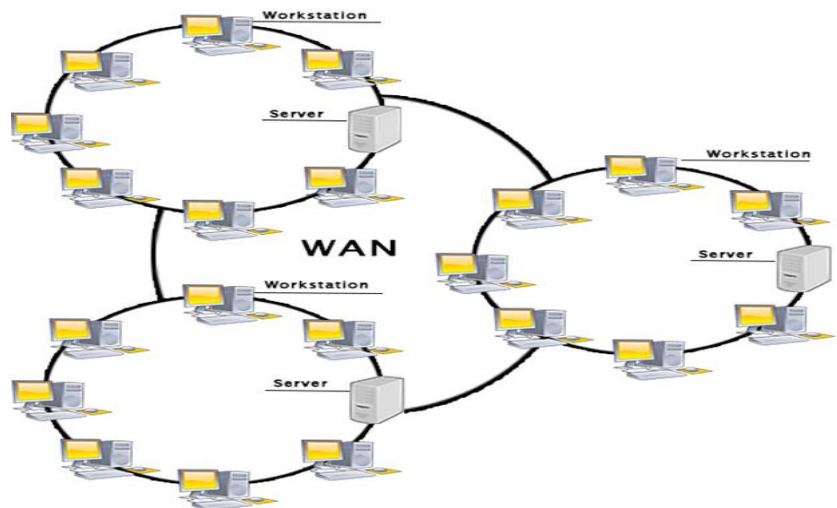
- MAN is used in communication between the banks in a city.
- It can be used in an Airline Reservation.
- It can be used in a college within a city.
- It can also be used for communication in the military.



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.



Examples Of Wide Area Network:

Mobile Broadband: A 4G network is widely used across a region or country.

Last mile: A telecom company is used to provide the internet services to the customers in hundreds of cities by connecting their home with fiber.

Private network: A bank provides a private network that connects the 44 offices. This network is made by using the telephone leased line provided by the telecom company.

Advantages Of Wide Area Network:

Following are the advantages of the Wide Area Network:

Geographical area: A Wide Area Network provides a large geographical area. Suppose if the branch of our office is in a different city then we can connect with them through WAN. The internet provides a leased line through which we can connect with another branch.

Centralized data: In case of WAN network, data is centralized. Therefore, we do not need to buy the emails, files or back up servers.

Get updated files: Software companies work on the live server. Therefore, the programmers get the updated files within seconds.

Exchange messages: In a WAN network, messages are transmitted fast. The web application like Facebook, Whatsapp, Skype allows you to communicate with friends.

Sharing of software and resources: In WAN network, we can share the software and other resources like a hard drive, RAM.

Global business: We can do the business over the internet globally.

High bandwidth: If we use the leased lines for our company then this gives the high bandwidth. The high bandwidth increases the data transfer rate which in turn increases the productivity of our company.

Disadvantages of Wide Area Network:

The following are the disadvantages of the Wide Area Network:

Security issue: A WAN network has more security issues as compared to LAN and MAN network as all the technologies are combined together that creates the security problem.

Needs Firewall & antivirus software: The data is transferred on the internet which can be changed or hacked by the hackers, so the firewall needs to be used. Some people can inject the virus in our system so antivirus is needed to protect from such a virus.

High Setup cost: An installation cost of the WAN network is high as it involves the purchasing of routers, switches.

Troubleshooting problems: It covers a large area so fixing the problem is difficult.

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:

1. **Extranet:** An extranet is a communication network based on the internet protocol such as **Transmission Control protocol** and **internet protocol**. It is used for information sharing. The access to the extranet is restricted to only those users who have login credentials. An extranet is the lowest level of internetworking. It can be categorized as **MAN, WAN** or other computer networks. An extranet cannot have a single **LAN**, atleast it must have one connection to the external network.

2. **Intranet:** An intranet is a private network based on the internet protocol such as **Transmission Control protocol** and **internet protocol**. An intranet belongs to an organization which is only accessible by the **organization's employee** or members. The main aim of the intranet is to share the information and resources among the organization employees. An intranet provides the facility to work in groups and for teleconferences.

Intranet advantages:

Communication: It provides a cheap and easy communication. An employee of the organization can communicate with another employee through email, chat.

Time-saving: Information on the intranet is shared in real time, so it is time-saving.

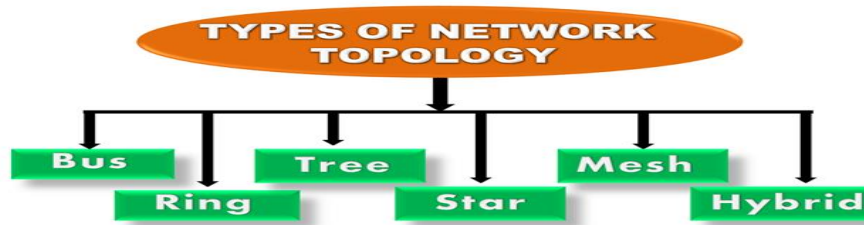
Collaboration: Collaboration is one of the most important advantage of the intranet. The information is distributed among the employees of the organization and can only be accessed by the authorized user.

Platform independency: It is a neutral architecture as the computer can be connected to another device with different architecture.

Cost effective: People can see the data and documents by using the browser and distributes the duplicate copies over the intranet. This leads to a reduction in the cost.

LAN Topology

Topology defines the structure of the network of how all the components are interconnected to each other. There are two types of topology: physical and logical topology. Physical topology is the geometric representation of all the nodes in a network.

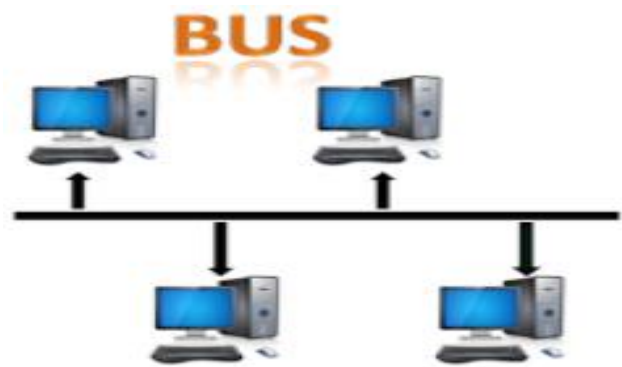


Bus Topology

The bus topology is designed in such a way that all the stations are connected through a single cable known as a backbone cable. Each node is either connected to the backbone cable by drop cable or directly connected to the backbone cable.

When a node wants to send a message over the network, it puts a message over the network. All the stations available in the network will receive the message whether it has been addressed or not.

The bus topology is mainly used in 802.3 (ethernet) and 802.4 standard networks. The configuration of a bus topology is quite simpler as compared to other topologies.



The backbone cable is considered as a "**single lane**" through which the message is broadcast to all the stations. The most common access method of the bus topologies is **CSMA** (Carrier Sense Multiple Access).

CSMA: It is a media access control used to control the data flow so that data integrity is maintained, i.e., the packets do not get lost. There are two alternative ways of handling the problems that occur when two nodes send the messages simultaneously.

CSMA CD: CSMA CD (**Collision detection**) is an access method used to detect the collision. Once the collision is detected, the sender will stop transmitting the data. Therefore, it works on "**recovery after the collision**".

CSMA CA: CSMA CA (**Collision Avoidance**) is an access method used to avoid the collision by checking whether the transmission media is busy or not. If busy, then the sender waits until the media becomes idle. This technique effectively reduces the possibility of the collision. It does not work on "recovery after the collision".

Advantages of Bus topology:

Low-cost cable: In bus topology, nodes are directly connected to the cable without passing through a hub. Therefore, the initial cost of installation is low.

Moderate data speeds: Coaxial or twisted pair cables are mainly used in bus-based networks that support upto 10 Mbps.

Familiar technology: Bus topology is a familiar technology as the installation and troubleshooting techniques are well known, and hardware components are easily available.

Limited failure: A failure in one node will not have any effect on other nodes.

Disadvantages of Bus topology:

Extensive cabling: A bus topology is quite simpler, but still it requires a lot of cabling.

Difficult troubleshooting: It requires specialized test equipment to determine the cable faults. If any fault occurs in the cable, then it would disrupt the communication for all the nodes.

Signal interference: If two nodes send the messages simultaneously, then the signals of both the nodes collide with each other.

Reconfiguration difficult: Adding new devices to the network would slow down the network.

Attenuation: Attenuation is a loss of signal leads to communication issues. Repeaters are used to regenerate the signal.

Ring Topology

Ring topology is like a bus topology, but with connected ends. The node that receives the message from the previous computer will retransmit to the next node. The data flows in one direction, i.e., it is unidirectional. The data flows in a single loop continuously known as an endless loop.

It has no terminated ends, i.e., each node is connected to other node and having no termination point. The data in a ring topology flow in a clockwise direction.

The most common access method of the ring topology is **token passing**.

Token passing: It is a network access method in which token is passed from one node to another node.

Token: It is a frame that circulates around the network.

Working of Token passing

A token moves around the network, and it is passed from computer to computer until it reaches the destination. The sender modifies the token by putting the address along with the data.

The data is passed from one device to another device until the destination address matches. Once the token received by the destination device, then it sends the acknowledgment to the sender. In a ring topology, a token is used as a carrier.

Advantages of Ring topology:

Network Management: Faulty devices can be removed from the network without bringing the network down.

Product availability: Many hardware and software tools for network operation and monitoring are available.

Cost: Twisted pair cabling is inexpensive and easily available. Therefore, the installation cost is very low.



Reliable: It is a more reliable network because the communication system is not dependent on the single host computer.

Disadvantages of Ring topology:

Difficult troubleshooting: It requires specialized test equipment to determine the cable faults. If any fault occurs in the cable, then it would disrupt the communication for all the nodes.

Failure: The breakdown in one station leads to the failure of the overall network

Reconfiguration difficult: Adding new devices to the network would slow down the network.

Delay: Communication delay is directly proportional to the number of nodes. Adding new devices increases the communication delay.

Star Topology

Star topology is an arrangement of the network in which every node is connected to the central hub, switch or a central computer. The central computer is known as a **server**, and the peripheral devices attached to the server are known as **clients**.

Ring topology is like a bus topology, but with connected ends. The node that receives the message from the previous computer will retransmit to the next node. The data flows in one direction, i.e., it is unidirectional. The data flows in a single loop continuously known as an endless loop.

Advantages of Star topology

Efficient troubleshooting: Troubleshooting is quite efficient in a star topology as compared to bus topology. In a bus topology, the manager has to inspect the kilometers of cable. In a star topology, all the stations are connected to the centralized network. Therefore, the network administrator has to go to the single station to troubleshoot the problem.

Network control: Complex network control features can be easily implemented in the star topology. Any changes made in the star topology are automatically accommodated.

Limited failure: As each station is connected to the central hub with its own cable, therefore failure in one cable will not affect the entire network.

Familiar technology: Star topology is a familiar technology as its tools are cost-effective.

Easily expandable: It is easily expandable as new stations can be added to the open ports on the hub.

Cost effective: Star topology networks are cost-effective as it uses inexpensive coaxial cable.

High data speeds: It supports a bandwidth of approx 100Mbps. Ethernet 100BaseT is one of the most popular Star topology networks.

Disadvantages of Star topology

A Central point of failure: If the central hub or switch goes down, then all the connected nodes will not be able to communicate with each other.

Cable: Sometimes cable routing becomes difficult when a significant amount of routing is required.

Tree topology



Tree topology combines the characteristics of bus topology and star topology. A tree topology is a type of structure in which all the computers are connected with each other in hierarchical fashion.

The top-most node in tree topology is known as a root node, and all other nodes are the descendants of the root node. There is only one path exists between two nodes for the data transmission. Thus, it forms a parent-child hierarchy.



Advantages of Tree topology

Support for broadband transmission: Tree topology is mainly used to provide broadband transmission, i.e., signals are sent over long distances without being attenuated.

Easily expandable: We can add the new device to the existing network. Therefore, we can say that tree topology is easily expandable.

Easily manageable: In tree topology, the whole network is divided into segments known as star networks which can be easily managed and maintained.

Error detection: Error detection and error correction are very easy in a tree topology.

Limited failure: The breakdown in one station does not affect the entire network.

Point-to-point wiring: It has point-to-point wiring for individual segments.

Disadvantages of Tree topology

Difficult troubleshooting: If any fault occurs in the node, then it becomes difficult to troubleshoot the problem.

High cost: Devices required for broadband transmission are very costly.

Failure: A tree topology mainly relies on main bus cable and failure in main bus cable will damage the overall network.

Reconfiguration difficult: If new devices are added, then it becomes difficult to reconfigure.

Mesh topology

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. Mesh topology is mainly used for WAN implementations where communication failures are a critical concern. Mesh topology is mainly used for wireless networks. Mesh topology can be formed by using the formula:

$$\text{Number of cables} = (n*(n-1))/2;$$

Where n is the number of nodes that represents the network.

Mesh topology is divided into two categories:



Full Mesh Topology: In a full mesh topology, each computer is connected to all the computers available in the network.

Partial Mesh Topology: In a partial mesh topology, not all but certain computers are connected to those computers with which they communicate frequently.

Advantages of Mesh topology:

Reliable: The mesh topology networks are very reliable as if any link breakdown will not affect the communication between connected computers.

Fast Communication: Communication is very fast between the nodes.

Easier Reconfiguration: Adding new devices would not disrupt the communication between other devices.

Disadvantages of Mesh topology

Cost: A mesh topology contains a large number of connected devices such as a router and more transmission media than other topologies.

Management: Mesh topology networks are very large and very difficult to maintain and manage. If the network is not monitored carefully, then the communication link failure goes undetected.

Efficiency: In this topology, redundant connections are high that reduces the efficiency of the network.

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.

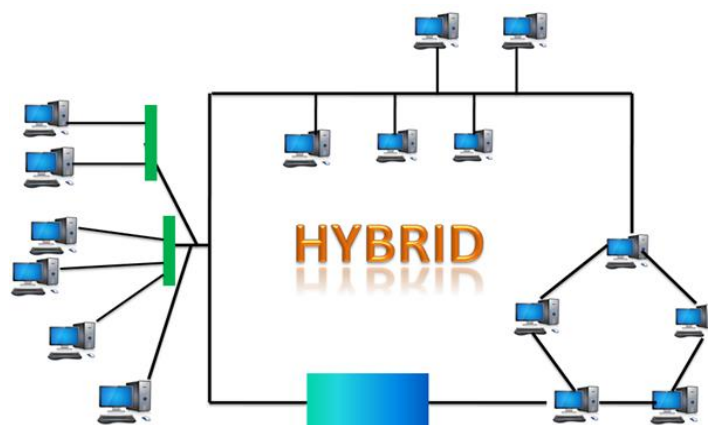
Advantages of Hybrid Topology

Reliable: If a fault occurs in any part of the network will not affect the functioning of the rest of the network.

Scalable: Size of the network can be easily expanded by adding new devices without affecting the functionality of the existing network.

Flexible: This topology is very flexible as it can be designed according to the requirements of the organization.

Effective: Hybrid topology is very effective as it can be designed in such a way that the strength of the network is maximized and weakness of the network is minimized.



Disadvantages of Hybrid topology

Complex design: The major drawback of the Hybrid topology is the design of the Hybrid network. It is very difficult to design the architecture of the Hybrid network.

Costly Hub: The Hubs used in the Hybrid topology are very expensive as these hubs are different from usual Hubs used in other topologies.

Costly infrastructure: The infrastructure cost is very high as a hybrid network requires a lot of cabling, network devices, etc.

Computer Protocols

PROTOCOL– Set of rules or language use by computer and networking devices to communicate with one another. By adopting these rules, two devices can communicate with each other and can interchange information. We can't even think of using the Internet without Protocols.

Each *protocol* is defined in different terms and different use with unique name. Message travel from sender to receiver via a medium (The medium is the physical path over which a message travels) using a protocol.

'Protocols' are developed by industry wide organizations. All data of *protocols* are stored in binary information. Protocol language is a mixture of bits, characters, integers, etc.

Each of it has its own access method of exchanging data over a [computer](#) network, such as LAN, Internet, Intranet, etc. One of the most common and known protocol example is HTTP, that is used over the world wide web. there are different protocols used in [internet](#) that are

- TCP/IP(Transmission Control Protocol/Internet Protocol)
- ARP(Address Resolution Protocol)
- DHCP (Dynamic Host Configuration Protocol)
- DNS (Domain Name System)
- FTP (File Transfer Protocol)

HTTP is an application-layer protocol that is used for transferring files on the internet. It is used by web browsers and servers use to communicate.

There are different types of protocols and different uses of protocol.

Types of Protocols

A *protocol technologies* is required for communication between computers. To connect different types of computers from a variety of computer vendors, protocols must be first standardized.

The ARPA (**Advanced Research Project Agency**) part of the US Defense program was the first to introduce the concept of a standardized protocol. ARPA is a resource sharing network connecting different computers at universities and laboratories in the US.

The concept of the protocol and its layer structure, emerged from the ARPA network. ARPA developed an integrated network using packet protocol and is also renowned for its development of packet switching.

TCP

Transmission control protocol is used for communication over a network. In TCP data is broken down into small packets and then sent to the destination. However, IP is making sure packets are transmitted to the right address.

Internet Protocol (IP)

IP is also working with TCP. It is an addressing Protocol. IP addresses packets route them and show different nodes and network Unless it reaches its right destination. The IP protocol is developed in 1970.

FTP

File transfer protocol is basically used for transferring files to different networks. There may be a mass of files such as text files, multimedia files, etc. This way of file transfer is quicker than other methods.

SMTP

Simple mail transfer protocol manages the transmission and outgoing mail over the internet.

HTTP

HTTP is based on client and server model. HTTP is used for making a connection between the web client and web server. HTTP shows information in web pages.

Ethernet

Ethernet is a most important for LAN communication. Ethernet transmits the data in digital packets. If any computer wants to use this protocol they should contain Ethernet Network Interface Card (NIC). The card is implemented with unique address code fixed in the microchip.

Telnet

Telnet is an established with some rules which are used to connect to another computer. Telnet is mainly used for the remote login process. The computer which is requesting for a connection that is a local computer and which is accepting the connection that is a remote computer. If you give a command in a local computer that command is executed in the remote computer. Telnet is also based on client and server model.

Gopher

Gopher is an application layer protocol, which is used for searching and retrieving documents from remote sites. This is possible to start an online connection with other computers through gopher.

Concepts relating to networking

Connection:

In networking, a connection refers to pieces of related information that are transferred through a network. This generally infers that a connection is built before the data transfer (by following the procedures laid out in a protocol) and then is deconstructed at the at the end of the data transfer.

Packet:

A packet is, generally speaking, the most basic unit that is transferred over a network. When communicating over a network, packets are the envelopes that carry your data (in pieces) from one end point to the other.

Packets have a header portion that contains information about the packet including the source and destination, timestamps, network hops, etc. The main portion of a packet contains the actual data being transferred. It is sometimes called the body or the payload.

Network Interface:

A network interface can refer to any kind of software interface to networking hardware. For instance, if you have two network cards in your computer, you can control and configure each network interface associated with them individually.

Port:

A port is an address on a single machine that can be tied to a specific piece of software. It is not a physical interface or location, but it allows your server to be able to communicate using more than one application.

Firewall:

A firewall is a program that decides whether traffic coming into a server or going out should be allowed. A firewall usually works by creating rules for which type of traffic is acceptable on which ports. Generally, firewalls block ports that are not used by a specific application on a server.

NAT:

NAT stands for network address translation. It is a way to translate requests that are incoming into a routing server to the relevant devices or servers that it knows about in the LAN. This is usually implemented in physical LANs as a way to route requests through one IP address to the necessary backend servers.

VPN:

VPN stands for virtual private network. It is a means of connecting separate LANs through the internet, while maintaining privacy. This is used as a means of connecting remote systems as if they were on a local network, often for security reasons.

OSI Model

OSI stands for Open Systems Interconnect. This model defines seven separate layers. The layers in this model are:

Application: The application layer is the layer that the users and user-applications most often interact with. Network communication is discussed in terms of availability of resources, partners to communicate with, and data synchronization.

Presentation: The presentation layer is responsible for mapping resources and creating context. It is used to translate lower level networking data into data that applications expect to see.

Session: The session layer is a connection handler. It creates, maintains, and destroys connections between nodes in a persistent way.

Transport: The transport layer is responsible for handing the layers above it a reliable connection. In this context, reliable refers to the ability to verify that a piece of data was received intact at the other end of the connection.

This layer can resend information that has been dropped or corrupted and can acknowledge the receipt of data to remote computers.

Network: The network layer is used to route data between different nodes on the network. It uses addresses to be able to tell which computer to send information to. This layer can also break apart larger messages into smaller chunks to be reassembled on the opposite end.

Data Link: This layer is implemented as a method of establishing and maintaining reliable links between different nodes or devices on a network using existing physical connections.

Physical: The physical layer is responsible for handling the actual physical devices that are used to make a connection. This layer involves the bare software that manages physical connections as well as the hardware itself (like Ethernet).

TCP/IP Model

The TCP/IP model, more commonly known as the Internet protocol suite, is another layering model that is simpler and has been widely adopted. It defines the four separate layers, some of which overlap with the OSI model:

Application: In this model, the application layer is responsible for creating and transmitting user data between applications. The applications can be on remote systems, and should appear to operate as if locally to the end user.

The communication is said to take place between peers.

Transport: The transport layer is responsible for communication between processes. This level of networking utilizes ports to address different services. It can build up unreliable or reliable connections depending on the type of protocol used.

Internet: The internet layer is used to transport data from node to node in a network. This layer is aware of the endpoints of the connections, but does not worry about the actual connection needed to get from one place to another. IP addresses are defined in this layer as a way of reaching remote systems in an addressable manner.

Link: The link layer implements the actual topology of the local network that allows the internet layer to present an addressable interface. It establishes connections between neighboring nodes to send data.

Interfaces

Interfaces are networking communication points for your computer. Each interface is associated with a physical or virtual networking device.

Typically, your server will have one configurable network interface for each Ethernet or wireless internet card you have.

In addition, it will define a virtual network interface called the “loopback” or localhost interface. This is used as an interface to connect applications and processes on a single computer to other applications and processes. You can see this referenced as the “lo” interface in many tools.

Many times, administrators configure one interface to service traffic to the internet and another interface for a LAN or private network.