AN INTRODUCTION TO COMPUTERS

Definition:

"Computer is an electronic device that processes given data to derive the required and useful information".

During the processing the computer performs various functions like

- Accepting instructions from the user
- Accepting data from the user
- Performing various arithmetic and logical operations as per instructions given
- Presenting the information or output to the user

Characteristics of a Computer:

Computers are becoming popular day to day because of their characteristics, which make them the most popular. The characteristics, which make the computer indispensable, are

Large storage capacity:

The basic problem of pre-computer era was the storage of voluminous data which required large amount of paper and storage space. The computer has solved this problem by giving a provision to store large volumes of data in small storage devices.

Fastness:

Computer is able to process the data and give the output in fractions of seconds such that required information is given to the user in time enabling the user to take right decisions on right time. A powerful computer is capable of executing about 3 million calculations per second.

Accuracy:

Inspite of its high speed of processing, errors seldom occur, as computer's accuracy is consistently high enough which avoids any errors. If at all there are errors, they are due to errors in instructions given by the programmer in accurate and inconsistent data or defective programs as well defective system designs.

Reliable:

The output generated by the computer is very reliable, but it is reliable only when the data, which is passing as input to the computer and the program, which gives instructions are correct and reliable. Inconsistent, incorrect and unreliable programs and data make.

Works automatically:

Computer is a device, which is, much more than a calculator, which is capable to do various arithmetic operations and need a human operator to press the necessary keys for any operation to be performed. Whereas computer is different in working once the instructions in form of program are fed to the computer it works automatically without any human intervention until the completion of execution of program.

Diligent:

A computer is a machine, it does not feel tired and distracted. Its performance is consistent even to an extent of more than 10 million calculations, it does each and every calculation with same speed and accuracy.

Limitations of Computer:

1. Computer does not work on itself, it requires set of instructions to be provided for, else computer is waste.
2. Computers are not intelligent, they have to be instructed about each and every step that they have to perform.
3. Computers cannot take decisions on its own, one has to program the computer to take an action if some conditions prevail.
4. Computers, unlike humans cannot learn by experience.

Major components of Computer:

Computer is basically composed of essentially the following:

1. Hardware
2. Software

3. People
4. Data/information

Hardware:

Computer hardware is the collection of various physical components of the computer, like the computer itself, the input-output devices, printers and other peripheral devices. This computer hardware blindly performs some basic operations like addition, subtraction, data transfer, control transfers and simple tests. These components are tangible, which one can see and feel. To enhance the capabilities of the hardware and to perform complex operations, we need to take help of software component.

Software:

Software is set of instructions usually termed as programs, which are required for processing activities of the computer. This set of programs can be used to solve real world problems. The capability of the computer depends largely on the software component. Software refers not only to the programs which make the computer work, but also those programs which are used to solve real life problems.

People:

People constitute the most important part of the system. People operate the computer hardware, create software instructions etc.
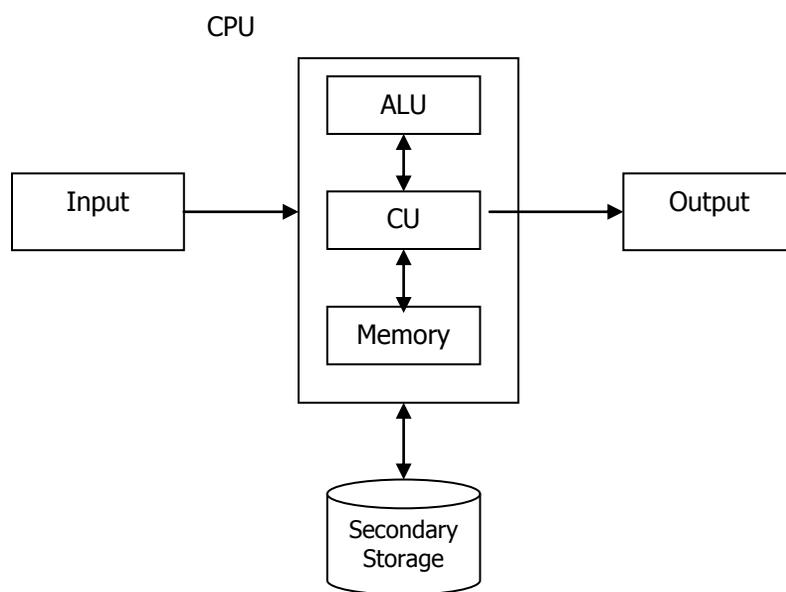
Data:

Data refers to the raw facts the computer can manipulate. Data can consists of letters, numbers, sounds or images.

Information:

Data is processed into useful information. In other words information is the product of data processing.

Logical organization of digital computers:

CPU : Central Processing Unit.

ALU : Arithmetic & Logic Unit.

CU: Control Unit.

Input Unit:

For the computer to work upon the user need to give instructions as well as the data to work upon. These devices translate data from human understandable form into electronic impulses, which are understood by the computer.

The most common input device is the keyboard, mouse, joystick, scanner, digitizer etc.,

Central Processing Unit (CPU):

Once the data is accepted it is fed into central processing unit before the output is generated as data has to be processed, which is done by CPU. This unit of the computer is the brain of computer system, which

does all the processing, calculations, problem solving and controls all other functions of all other elements of the computer. The CPU consists of the following three distinct units namely

(i)   Memory Unit

(ii)   The Control Unit

(iii)   The Arithmetic and Logic Unit

Memory Unit:

This is the unit where the data and results are stored. The major function of this unit is to remember the instructions and data. The data stored can be accessed and used whenever required by the CPU for necessary processing. This unit consists of cells which are capable to store unit of information. These cells can be accessed as they are numbered sequentially, which are called addresses. This memory unit is usually referred as primary storage section.

The Control Unit:

This is that unit of CPU, which coordinates all the activities of each and every element of computer. It decodes the instructions given by various users and it sends commands and signals that determine the sequence of various instructions. Though this unit does not process data but it acts as the central system for data manipulation, as it controls the flow of data to and from the main storage.

Arithmetic and Logic Unit:

This unit performs the arithmetic operations such as addition, subtraction, multiplication and division. It also does logical operations such as comparison of numbers etc. Thus this unit helps by processing data and taking logical decisions.

Output unit:

After processing the data, the computer has to provide the result of the processing to the user. For this, computer uses output devices. The output device is that device which is used to provide the user with the desired output. Commonly used output devices are VDU (visual display unit) i.e. monitor, printers, plotter, magnetic media like floppy, hard disks etc.

This computer performs all the required functions and processing using the above units. We can say that these units are integral part of a computer system.

Classification of computers:

Computers can be classified into two categories,

1. Classification according to the logic used.

2. Classification according to the size.

Classification according to the logic used:

a. Analog computers:

These computers recognize data as a continuous measurement of a physical property. They assign numeric values by physically measuring from actual property. Such as length of an object, an angle created by two lines etc. Analog computers derive all their data from some form of measurement. The accuracy of the data used in an analog computer is directly related to the precision of its measurements.

Examples: Thermometers, speedometers, barometers etc.

b. Digital computers:

Digital computers represent data as numbers or separate units. Counting on fingers is the simplest form of digital computer. Each finger represents one unit of the item being counted. Unlike the analog computer, which is limited to the accuracy of the measurements made, the digital computer can accurately represent data using as many positions and numbers as necessary.

Examples: Adding machines, pocket calculator and personal computer

Digital computers are further grouped into two categories

1. **General purpose computers:** The digital computers, which can theoretically be used for any type of application, are called general-purpose digital computers. These computers can be used in solving a business problem as well as mathematical equation with same accuracy and consistency.

Example: The computers that are used for payroll, graphs, analysis, account, banking etc.

2. Special purpose computers:

These are those digital computers, which are designed, made and used for specific job. These are usually used for those purposes, which are critical, and need great accuracy and response like satellite launching, weather forecasting etc.

3. Hybrid computers:

Hybrid computers combine the best features of analog and digital computers. They have the speed of analog and the accuracy of digital computers. They are usually used for special problems in which input data derived from measurements is converted into digits and processed by the computers. The computer can act like an analog computer converting measurement into numeric input. It can act as a digital computer processing stored data for management.

Classification according to size (Shapes of Computers)

There are both large and small computers.

Large computer system:

They have been traditionally divided into three main categories

1. super computers
2. Main-frame computers
3. Mini computers
4. Micro computers

1. Super computer:

A super computer is generally characterized as being fastest, most powerful and most expensive computer. Super Computers recognize the largest word lengths of 64 bits or more. They calculate at rates up to 1.2 billion instructions per second. They can take input form over 10,000 workstations.

Super Computers are widely used in scientific applications such as Aerodynamic design and simulation, processing of geological data, processing of data regarding genetic coding and collecting and processing weather data.

Example: The most powerful Super Computer today, the **CRAY-2** is setup in a C-shape, it is not as tall as a person and is small enough to fit in the space of a large business desk.

2. Main Frame Computers:

The largest type of computer in common use is the Mainframe. Mainframe computers are used where many people in a large organization need frequent access to the same information, which is usually organized into one or more huge databases. A technique that allows many people at terminals to access the same compute at one time is called time-sharing. [A terminal is a keyboard and screen wired to the mainframe. It does not have its own CPU or storage. It is just an input/output (storage) device]

Mainframe process data at several million instructions per second (MPIS). More than thousand workstations can be accommodated by a typical mainframe computer.

Example: Mainframes are used by banks and many businesses to update inventory etc.,

3. Mini Computers:

Mini computers are smaller than mainframes. The capabilities of mini computes lie in between the mainframes and personal computers. Like mainframes, mini computers can handle a great deal more input and output than personal computers can. Although some minis are designed for single use. Many can handle dozens or even hundreds of terminals.

Example: IBM AS 400

4. Personal Computers or Micro Computers:

A microcomputer is the smallest, least expensive of all the computers. The prefix micro refers mainly to the physical size of the computer and its circuitry rather than its capabilities.

The essential differences between micro computers and mainframe or mini computers are that micro computers has smallest memory and less power and are physically smaller and permit fewer peripherals to be attached.

Microcomputers available in different capabilities and size are

1. Desktop Models
2. Notebook Computers
3. Personal Digital Assistance

Desktop Models:

Desktop computers are actually small enough to fit on a desk but are a little too big to carry around. In the tower model, the main case which is called the system unit sits vertically and has more space for devices. Because of its design this model is often placed on the floor to preserve desk space, allowing more room to place external components such as removable disk drives or scanners on the desktop.

Notebook Computers:

Notebook computers, as their name implies, approximate the shape of an 8.5 by 11-inch notebook and can fit easily inside a briefcase. Also called laptops, they can operate on plugin current or with special batteries. Notebooks are fully functional microcomputers. Some models can plug into a dock that includes a large monitor, a full sized keyboard and some times an additional disk drive.

Personal Digital Assistants (PDA):

PDA's are among the smallest of portable computers. Often, they are no larger than a checkbook. PDA's also sometimes called palmtops are much less powerful than notebook or desktop models. They are normally used for special applications, such as creating small spreadsheets, displaying important telephone numbers and addresses, and keeping track of dates and agendas. Many can be connected to larger computers to exchange data.

Development of computers:

The computer evolved as a result of man's search for fast and precise calculating machines. The following table shows the sequence of evaluation of computers.

<u>**SIGNIFICANT DEVELOPMENTS IN COMPUTERS**</u>

S.No.	Generation	Year	Development
1.		3500 BC	Abacus (Manual device)
2.		Early 17th century	John Napier's bone or cardboard multiplication calculator
3.		1642	Blaise Pascal's adding machine
4.		1694	Leibnitz's stepped calculator
5.		1833	Analytical engine by Charles Babbage (Mechanical device)
6.		1896	Hollerith's tabulating machines
7.		1944	Harvard Mark I (electro-mechanical)
8.	1st generation	1946 to 1952	ENIAC, EDVAC based on the theory of Von Neumann, EDSAC, SEAC & IAS (vacuum tubes)
9.	2nd generation	1952 to 1964	IBM 605; NCR 304; WHIRLWIND I (magnetic drum & transistors)
10.	3rd generation	1964 to 1971	Integrated circuits (IC's) IBM 360
11.	4th generation	1971 to 1980	LSI, VLSI, Microprocessors APPLE Personal computer, IBM PC
12.	5th generation	1980	Artificial intelligence supercomputers CRAY XMP 416

Generations of Computers:

Tradition of referring to computers in terms of generations was to distinguish them on the basis of varying hardware configuration. But subsequently the term generation is now being used in a broader sense.which includes both the hardware and software, which together make up an entire system.

First Generation Computers (1951-1958):

The first generation computers were made up of vaccum tubes. Each computer had as many as thousands of vaccum tubes and hence the first generation computers were extremely large in size and require more space. These computers generated considerable amount of heat and poor reliability. These required constant maintenance.

To enter data into the computer punch cards were used. Punch card is a sheet of thick paper, in which holes are punched accordingly to a coding scheme.

Characteristics of first generation computers:

1. Vaccum tubes were used in electronic circuits.
2. Mercury delay lines were used for memory
3. Magnetic drums were used in internal storage
4. These computers use only machine language
5. These occupy large space
6. The maintenance is tedious as these generate large amount of heat
7. These are mainly used in scientific applications
8. The processing speed is very low

Drawbacks of first generation computers:

1. Input-output (I/O) operation control is very poor
2. Programming of non numeric and logical problems was very low
3. Facilities to save the program, calling subroutines were not provided
4. Floating point arithmetic were not implemented

Second Generation Computers (1959-1964):

With the invention of junction transistors, the vacuum tubes were replaced by transistors. Transistors were more reliable, small in size and required low power when compared with vacuum tubes. The second-generation computers were faster and had increased storage capacity. In the second-generation computers, in addition to the main memory an external or auxiliary storage device like magnetic tapes, magnetic disks were used. Second generation computers lead to the development of high level languages like

FORTRAN→ Formula Translation

COBOL → Common Business Oriented Language

ALGOL → Algorithemic Language

APL   → A Programming Language

With these languages the computers began to find their use in commercial and scientific applications.

Third Generation Computers (1965 - 1971):

Integrated circuits (IC) were intorduced n 1960's. In an IC, hundreds of transistors were incorporated on a single silicon chip and hence with IC's computers could be made even small, more reliable and less expensive. After few years of invention of IC's they were used as main memory. The magnetic discs replaced the magnetic tapes for auxilary memory.

Characterisctics of third generation Computers:

-   High storage capacity which extended upto 3MB
-   Use of integrated circuits and hence small size
-   Simple input output operations
-   Improved reliability and performance
-   Simultaneously processing and time sharing
-   Development of virtually memory by using structured memory systems
-   Ability to handle scientific commercial application
-   High processing speed of about 10 millions instructions per second

Fourth generation computers (1971 - present):

In the early 1970's development of microprocessors revolutionized the computer industry. Very large scale integration (VLSI) and very high speed integration circuits led to the development of microcomputers. These circuits improved the performance of the computer in various aspects like speed, reliability and stability. These occupy less space and required no air- conditioning. With the advent of microprocessors, personal computers were developed. These are user friendly and are very easy to operate. The most popular integrated circuits used for personal computers are Intel's 8008,8080,8085,8086 and Zilog's Z-80.

Characteristics of fourth generation computers:

1. These use large scale and very large scale circuits

2. These have increased storage capacity and high speed

3. Mini computers, microcomputers, microprocessors were extremely used.

4. These can be used for different applications

5. Processing speed had increased to a significant level

Fifth generation computers:

Computers with capabilities to think reasonably make judgements, take decisions with artificial intelligence have the potential to change the world. These computers are classified as fifth generation computers. Very large scale integration will have millions of components on a single chip available at very low cost. Communication between user and systems is likely to be able to emulate performance of human brain where thinking computers will open new horizons in computing arena.

Transforming Data into Information:

Computers cannot understand anything. All they can do is to recognize two distinct physical states produced electricity, magnetic polarity or reflected light. Essentially all they can understand is whether the switch is on or off. The CPU of the computer consists of several million tiny electronic switches called transistors.

The computers only appears to understand the information because it contains so many transistors and operate at such phenomenon speeds assembling its individual on/off switches into patterns that are meaningful to us.

To a computer everything is a number. Numbers are numbers, letters and punctuation are numbers, and sounds and pictures are numbers. Even the computers own instructions are numbers. In a computer all data is reduced to electrical switches which are only two possible states on/off and has symbols '0' for off and '1' for on. Because there are only two symbols, computers are set to function in base 2, which is the binary system.

Bits and Bytes:

When referring to computerized data each switch whether it is on or off is called a bit. The term bit is contraction of binary digit. A bit is the smallest possible unit of data. To represent any information the computer needs group of bits.

After the bit the next larger unit of data is byte which is a group of 8 bits. With one byte the computer can represent upto 256 different values.

Text codes:

Early in the history of computing programmers realized they needed a standard code in which numbers stood for the letters of the alphabet, punctuation marks and other symbols. EBCDIC, ASCII and unicode are three of the most popular systems that were invented.

EBCDIC   ————➤   Extended Binary Code Decimal Interchange Code

ASCII   ————➤   American Standard Code for Information Interchange

Factors Affecting Processing Speed:

The circuitry design of a CPU determines its basic speed, but several additional factors can make chips already designed for speed work even faster. The various components that affect the processing speed are:

      1. CPU Registers

2. Memory
3. Clock speed (or) Internal clock
4. Bus
5. Cache Memory
6. Math co-processor

CPU Registers:- The registers in CPU could hold two bytes-16-bits each. Some powerful computers have 64-bit registers. The size of the registers which is some times called the word size, Indicates the amount of data with which the computer can work at any given time. The bigger the word size, the more quickly the computer can process a set of data. if all other factors are kept equal, a CPU with 32-bit registers can process data twice as fast as one with 16-bit registers.

Memory:- The amount of RAM in a computer can have a profound effect on the computer's power. More RAM means the computer can use bigger data files. More RAM also can make the computer run faster. The computer does not necessarily have to load an entire program into memory to run it. However, the greater the amount of the program that fits into memory, the faster the program runs.

Internal clock:- Every microcomputer has a system clock, but the clock's primary purpose is not to keep the time of the day. The clock is driven by a piece of quartz crystal. When electricity is applied, the molecules in the quartz crystal vibrate millions of times per second. The computer uses the vibrations of the quartz in the system clock to time its processing operations. The clock's speed is measured in 'hertz'. (Hertz is a measure of cycles per second) one cycle means the time it takes to turn a transistor off and back on again. All other factors being equal to a CPU operating at 133 MHz can process data twice as fast as the same one operating at 66 MHz.

The Bus: In microcomputers the term bus refers to the paths between the components of a computer. There are two main buses in a computer. The data bus and the address bus.

Data bus: The data bus is an electrical path that connects the CPU, memory and other hardware devices on the motherboard. Actually, the bus is a group of parallel wires. The number of wires in the bus affects the speed at which data can travel between hardware components. Because each word can transfer one bit at a time, an eight-wire bus can move eight bits at a time, which is a full byte. A sixteen-bit bus can transfer 2 bytes and 32 bits bus can transfer 4 bytes at a time.

Address bus: The second bus that is found in every microcomputer is the address bus. The address bus is a set of wires similar to the data bus that connects the CPU and RAM and carries the memory address. The number of wires in it determines the maximum number of memory addresses. Today most CPU's have 32 bit address buses that can address 4GB of RAM. Some can address even more.

Cache memory: moving data back and forth between RAM and the CPU registers is one of the most time consuming operations a CPU must perform. Simply because RAM is much slower than the CPU.

A partial solution to this problem is to include a cache memory in the CPU. Cache memory is similar to RAM except that it is extremely fast compared to normal memory and it is used in a different way. When a program is running and the CPU needs to read data or instructions from RAM, the CPU first checks to see whether the data is in cache memory. If the data that it needs is not there, it reads the data from RAM into its registers, but it also loads a copy of the data into cache memory. When next time the CPU needs that same data, it finds it in the cache memory and saves time needed to load the data from RAM.

Math co-processor: A math co-processor is a chip that is specially designed to handle complicated mathematical operations. Newer CPU's have math co-processor built-in. The ALU, which handles most processing operations, can manipulate binary code representing numbers, text, images etc. the problem with the general purpose ALU is that it has difficulty performing certain mathematical operations. The math co-processor on the other hand is a processing specialist designed to work with exactly these kinds of numbers. It can execute arithmetic routines much more quickly than the ALU because it uses **floating-point arithmetic**, a computer technique that translates number into scientific notation. This technique simplifies complex arithmetic because the computer is not forced to store large numbers of decimal places.

INTERFACING WITH COMPUTERS

INPUT DEVICES

Before computer processing the data must be entered into the computer by an input device so that they can be translated into a machine-readable form. Let have a look at various input devices available

Punched Cards & Card Readers

It is a rigid piece of paper containing rows and columns of numbers. These cards are put into a keypunch machine, which places holes in the card to represent the data. This pattern of punched holes used to represent characters on the card is called Hollerith card. These holes are interpreted by a card reader that translates the punched information into a machine-readable code and then sense it to the CPU for processing

Key Boards

Standard Keyboard is the most common and familiar input device. A typical computer keyboard contains all letters, numbers, symbols of a regular typewriter, plus other keys which may include: 1. A numeric Keypad, which functions like calculator. 2. Function keys whose operation can be determined by the user or preprogrammed by the software being used 3.Special keys such as those used to control the movement of the cursor (special character or symbol that indicates the user position on the screen or focuses attention to a specific area, to allow communication and interaction between the user and the program) on the computer screen.

Mouse

A mouse is a pointing device. It usually contains one or three buttons; as the user rolls it on a flat surface, the mouse controls cursor movement on the screen. When the user presses one of the buttons the mouse either marks a place on the screen or makes selection from data of the screen. It can be used for many applications ranging from games to designing points with graphics. It can be used as an alternative to keyboard or it can be used in combination with keyboard to enhance input operations.

Joystick

A joystick is a most popular input device used to play video games. A joystick uses a level to control the position and the speed with which the joystick is moved into digital signals that are sent to the computer to control the cursor movement.

Track ball

A trackball uses a hard sphere to control the cursor movement. The ball can be rotated by hand in any direction. The trackball translated the sphere's direction and speed of rotation into a digital signal used to control the cursor.

Touch screen

A touch screen registers input when a finger or other object comes in beams and ultrasonic acoustic waves. Infrared beams crisscross the surface on the screen and when a light beam is broken, that location is recorded.

Light Pen

A light pen is also a pointing device like mouse. It can be used to choose displayed menu option. The pen contains a photocell placed in a small tube. As the user moves the tip of the pen over the surface of the screen it detects the light coming from a limited field of view. The light from the screen causes the photo cell to respond and this electric response is transmitted to the process which can identify the menu option that is triggering the photocell. Light pen is useful for graphics work, especially for Computer Aided Design (CAD) purposes.

Magnetic Ink Character Recognition

MICR is the interpretation by the computer of a line of characters written in special magnetic ink. Humans can read these characters as well. For instance, there are line of numbers and some odd shaped characters on the bottom of bank cheques. These magnetic ink characters are banks processing symbols

representing the cheque number, customer account number and bank identification number. When the bank receives the cheque, the amount of the cheque is also printed in magnetic ink. These cheques are send through a MICR read to interpret the information, update the appropriate accounts and in some cases, sort the cheques after wards.

Optical Recognition

Optical recognition occurs when a device scans a printed surface and translates the image the scanner sees into a machine-readable format that is understandable by the computer. Optical Recognition can be of the following types:

Optical Mark Recognition (OMR)

It employs mark sensing to scan and translate, based on its location which is a series of pen or pencil marks into computer readable form. For instance, the objective type multiple choice question paper we get in the bank recruitment exams. A computerized Optical mark reader scores the tests by identifying the position of the mark.

Optical Bar Recognition (OBR)

This is a slightly more sophisticated type of optical recognition. The bar codes or product codes which are arranged to represent data, such as name of the manufacturer and the type of the product etc. an optical bar reader recognizes and interprets them on the basis of the width of the lines. The bar code is read by a scanner and the price and the product are then matched by the computer.

Optical Character Recognition (OCR)

This is the most sophisticated type of optical recognition. An optical card reader works in much the same way as the human eye. It recognizes specially shaped numeric and alphabetical characters.

The primary advantage of OCR is that it eliminates the some of the duplication of human efforts required to get the data into the computer. This reduction in effort can improve data accuracy and increase the timeliness of the information processed.

Output Devices

An output device is a peripheral device that allows a computer to communicate information to humans or another machine by accepting data from the computer and transforming them into a usable form.

Output is divided into two general categories:

(a) Output that can be readily understood and used by humans.

(b) Output to secondary storage devices that hold the data to be used as input for further processing by computer.

Output that can be understood by humans can be in the form of

1. Hard copy
2. Soft copy

Hard copy: It is output on paper and can be read immediately or stored and read later. This is a relatively stable and permanent form of output.

Soft copy: It is usually a screen displayed output. It is a transient form of output and is lost when the computer is turned off.

Hard copy devices: Hard copy devices can be broadly grouped into two categories:

Printer A printer produces output usually in the form of text.

Types of Printers

Dot Matrix Printer: It uses printer heads containing nine to twenty four pins. These pins produce patterns of dots on the paper to form the individual characters.

Dot matrix printers are very popular, as they are relatively inexpensive and typically print at speed of 100-600 characters per second. These printers can give us draft quality, standard quality and near letter quality prints.

Line Printer: Line printers or line-at-a-time printers can print a whole line at once. They are very fast with speed ranging from 1200-6000 lines per minute.

Ink jet Printers: Ink-jet printers form characters on paper by spraying ink from tiny nozzles through an electrical field that arranges the charged ink particles into characters at the rate of approximately 250 characters per second. The ink is absorbed into the paper and dries instantly. Various colors of ink can also be used. Although this might sound like a messy way of printing, ink-jet printers are reliable, but expensive.

Laser printer: When speed and quality comparable to typeset material are required and cost is no factor, a laser printer is the solution. They produce images on paper by directing a laser beam at a mirror which bounces the beam on to a drum. The laser leaves a negative charge on the drum to which positively charged black toner powder will stick. As the paper rolls by the drum, the toner is transferred to the paper. A hot roller bonds the toner to the paper.

Laser printers use buffers to store an entire page at a time and that is why they print very fast at the rate of approximately 21,000 lines or 437 pages per minute.

Features of Printers

(a) Impact versus Non-impact

An impact printer is one that generally operates by using a hammer to strike a character against an inked ribbon the impact, then, causes an image of the character to be printed.

Impact printers function just as typewriters do. Their main disadvantage is that they are relatively slow, noisy, and subject to mechanical breakdowns. Despite the disadvantages, most printers in use today are impact devices.

Types of impact printers are

- Dot matrix
- Daisy wheel
- Line

Non impact printers were developed to meet some of the needs that were not being satisfied by impact technology. Most high-speed page printers, for example, use some form of non-impact device; but high speed is not the only benefit of nonimpact technology.

Types of non-impact printers are

- Laser-xerographic   - high speed
- Electro sensitive   - high speed
- Electro photo graphic – high speed
- Inkjet –for letter – quality printing

Plotter

A plotter reproduces drawings using pens that are attached to movable arms. The pens are directed across the surface of a stationary piece of paper. High quality bar graphs, pie charts created with a plotter give a very good quality output.

Soft Copy Devices

An output on soft copy devices enables viewing of the work which allows corrections or rearrangement of material to suit specific needs. The most commonly used soft copy device is Monitor.

Visual Display Unit (Monitor)

A monitor is a television like device used to display input data or information, allowing users to view the results of processing. Quality of the monitor is often judged in terms of resolution, which is a measure of the number of picture elements, or pixels, a screen contains. A pixel is the smallest increment of a display screen that can be controlled individually. The higher the number of pixels, the clearer and sharper is the image.

Primary Memory (Semiconductor Memories):

All computers made today use semiconductor elements in their primary storage units. This type of memory is made by etching electronic circuits on to a silicon chip. The two most common forms of semiconductor memory are

- Random Access Memory**(RAM)**
- Read Only Memory**(ROM)**

Random Access Memory:

This is that part of primary storage where data and program instructions are held temporarily while being manipulated or executed. It is called random access memory because any of the location on a chip can be randomly selected and used to directly store and retrieve data and instructions. Ram is volatile that is it depends on a steady supply of electricity and when power is shut off, everything stored is lost.

Read Only Memory:

A ROM is a read only memory. It is non-volatile. It is used for permanent storage. It has also a random access property. It contains assembler, compiler, monitor, debugging program or any other permanent program. ROMs are widely used for function tables (Sine, Cosine, Square root, Logarithm, Exponential etc.), code conversion tables, multiplication and division subroutines etc. The contents of a ROM are decided by the manufacturer. These contents are permanently stored in a ROM at the time of manufacturing. The user cannot write into a ROM, it is not accessible. ROMs are simple, cheap and dense.

PROM:

A PROM is a programmable ROM. The contents of a PROM are decided by the user. The user can write permanent program in a PROM. Special equipment for PROM programming is called PROM programmer.

EPROM:

An EPROM is an erasable PROM. The contents are erased by exposing EPROM to high intensity short wave ultraviolet light for 10 to 20 minutes. There should not be overexposure. An UV source with wavelength of 2537 A is used for this purpose. The process of changing the content is not convenient. The unit has to be removed from the board for exposure to UV source. The user cannot erase the content of a single memory location. The entire contents are erased. EPROMs are cheap, reliable and widely available.

EEPROM:

These are electrically erasable PROM. They need not be removed from a microcomputer board for erasing. The change in contents is made in milliseconds, which is much less than the erasing time of an EPROM. If required single bit can also be erased. Erasing and programming is much easier than EPROM.

Secondary Memory:

This is a non-volatile memory, which is external to a computer. It is a secondary media used for storing volumes of data permanently for long term. Apart from storing data permanently, the secondary storage devices are capable of storing volumes of data and instructions. The capacity of this secondary media in storage is far more than primary storage but the speed of accessing is slower than primary storage. Virtually the size of secondary storage is unlimited it is even much cheaper than the main memory. The following are the main features of secondary storage devices:

- Permanent or Non-volatile Storage
- Voluminous Storage
- Relatively Cheaper
- Computing Capability
- Portable

These secondary storage devices are external to CPU, they can be treated as peripheral device like any input/output device. The following are some of the commonly available categories of Secondary storage devices:

1. Magnetic Tapes
2. Magnetic Disks
3. Optical Disks

Magnetic tape:

Magnetic tapes are convenient, inexpensive devices, which can be used to store large volumes of data. The magnetic tape is similar to the commonly used audio tape recorders. The tape is wound on a spool and threaded manually on the take-up spool. The beginning of tape is indicated by a metal foil called marker. Data is stored one character at a time. Data is written in contiguous blocks called Physical records. Each block is separated by an inter block gap.

Access:

Data on tapes cannot be addressed i.e., to access the data it is not possible to give the address of the data. Data is stored as blocks therefore recording and retrieval is sequential. A tape drive is therefore referenced as a sequential access device. Although if a block is known it is possible to skip the earlier records. The access time in the case of magnetic tape is quite high.

Uses:

➢ Large volumes of data can be stored.

➢ Data can be transported easily

➢ Cost effective

➢ Re-usable medium

Magnetic disks:

A magnetic disk is a circular platter that may be made of smooth metal or Mylar plastic. This is coated with magnetisable material. Data is stored or retrieved form the disks using a conducting coil called head. During a read/write, the head is stationary while the platter rotates beneath it.

Electricity flowing through a coil produces a magnetic field. During a write operation pulses are sent to the head, and magnetic patterns are recorded. There are different patterns for positive and negative currents; when the surface of the disk passes under the head, during a read operation, a current of the same polarity as the one recorded is generated.

Hard disks:

Magnetic disks are smooth metal plates coated on both sides with a thin film of magnetic material. A set of such magnetic plates is fixed to a spindle one below the other to make up a disk pack. The disk pack is sealed and mounted on a disk drive. Such a disk drive is known as Winchester disk drives. The disk consists of a motor to rotate the disk pack about its axis at a speed of about 3600 revolutions per minute.

Information is recorded on the surface of a disk as it rotates about its axis. This is on circular tracks on each disk surface. A set of concentric tracks is recorded on each surface. A set of corresponding tracks in all surfaces of a disk pack called cylinder. A cylinder thus consists of 12 tracks in such a disk pack. A track is divided into sectors.

A set of disk drives is connected to a disk controller. The disk controller accepts commands from the computer and positions the read/write heads of the specified disk for reading or writing.

Floppy disks:

Floppies are made of Mylar plastic coated with magnetic oxide. The flexible material is cut into circular pieces 5 ¼" in diameter. Since it is made of flexible tape unlike the hard disk, they are called "floppy disks".

The circular pieces are packaged in 5 ¼" square plastic covers. The 3 ½" floppy is covered by a rigid plastic case.

A long slit is provided for the read/write head to access the disk. A hub in the center is used for mounting the disk drive. A hole is used to sense index marking.

The floppy disk is inserted into the drive mechanism, which rotates the flexible disk inside. The read/write head is in physical contact with the disk.

Size (inches)	5.25	5.25	3.5	3.5
Capacity (bytes)	360k	1.2M	720k	1.44M
Tracks	40	80	80	80
Sectors/Track	9	15	9	18
Heads	2	2	2	2
Rotations/min	300	360	300	300
Date rate (kbps)	250	500	250	500
Type	Flexible	Flexible	Rigid	Rigid

Optical Disk

Most storage devices are based on the principle of magnetism. Some storage devices however, are based on the use of light. Optical disks use this technology. Streams of digital data, in the form of tiny pits are burned onto a thin coating of metal or other material deposited on a disk. A beam of laser light is used to read these pit patterns. These bits once burned onto the disk cannot be erased. The disk cannot be used for re-recording.

CD-ROM

CD-ROM (Compact disk Read Only Memory) is a non-erasable disk used for storing computer data.

The disk is formed from a resin, such as polycarbonate and coated with a highly reflective surface, usually aluminum. Information is imprinted as a series of microscopic pits on the reflective surface. A master disk is created using a finely focussed, high intensity laser. The master is used to make copies. A topcoat of clear lacquer protects the pitted surface from dust and scratches. A low powered laser in the drive unit is used while a motor spins the disk past it. When it encounters a pit the intensity of the reflected light of the laser changes. The change is detected by photo sensors and converted into a digital signal.

The disk can store up to 550 MB. Data can be addressed by track and sector.

One small optical disk can store the contents of the 33 volumes of the Encyclopedia Britannica and have room to spare.

Erasable optical disk

The Erasable optical disk is a recent development. Data can be repeatedly written and overwritten as done with a magnetic disk. The disk is coated with a magnetic material. A laser beam heats a specific spot on the medium and a magnetic field changes the orientation of that spot while its temperature is elevated.

For reading, the direction of magnetism can be detected by polarized laser light.

3 ¼" and 5 ¼" disks are in use. The typical capacity is 650 MB. These disks are portable.

Software Concepts & Operating Systems

Introduction:

In most organizations the computer is a very valuable resource. Among the resources that a computer has are processing time, storage space, printers, terminals and information. The management of these resources is performed largely by a type of system software called an operating system. When users interact with the computer, much of this interaction is with the system software. System software directly affects the ease with which users interact with the computer. Furthermore, system software is a very significant determinant of whether or not a particular computer's resources are used optimally. For these reasons it is important that users if computer systems have a basic knowledge of system software.

Types of software:

There are two broad categories of software: System software and application software.

System Software:

System software is a set of programs that manage the resources of a computer system (processing time, storage space, and so on) so that they are used in an optimal fashion, provide routine services such as copying data from one file to another, and assist in the development of application programs. System software

consists of general programs that assist the computer in efficient control, support, development and execution of application programs.

Ex: Operating systems, Compilers & Interpreters, Device drivers, Utilities, Data Base Management Systems (DBMS) etc.

Application software:

Application software is a program written for, or by, a user to perform a particular job.

General-purpose application software, such as an electronic spreadsheet, has a wide variety of applications.

Specific-purpose application software, such as payroll and sales analysis, is used only for the applications for which it is designed. Application programmers write these programs.

Ex: General purpose: Spreadsheets, word processors

Special Purpose: Payroll system, Financial accounting systems, account payable systems. Medical & Health care systems, Billing systems, Banking systems, Inventory control & Accounting systems, production planning & Control etc.

Introduction to operating systems:

Operating system (OS) can be defined as **"Set of Programs that are capable to manage resources as well as the operations of a computer".** Part of the Operating system is stored in secondary memory on floppy disk, hard disk, or magnetic tape, while part is stored permanently on read only memory (ROM). When the computer is first started, it automatically begins to execute a program contained in the operating systems portion of ROM. This program reads part of the operating systems into random access memory (RAM), and the computer begins to execute this part of the system. The operating system program now controls the computer.

The basic functions, which are carried by any operating system are:

1. Assigning processors for performing tasks.
2. Allocating memory, managing memory and other storage areas.
3. Command interpretation.
4. Handling job to job transitions.
5. Maintaining internal clock.
6. Scheduling of various jobs/tasks.
7. Establishing and enforcing priorities for different jobs.
8. Co-ordinating and managing peripheral devices.
9. Input/Output management.
10. Establishing data security and integrity.

Types of operating system programs:

An operating system usually consists of hundreds of programs, which fall into the following few broad categories.

1. Booting Loader:

The function of the bootstrap loader program, which is usually contained on ROM is to read the main portion of the operating system from secondary memory when the computer is first turned on.

2. Diagnostic Tests:

The operating system contains a number of diagnostic programs that test the operation of the system components. For example, one diagnostic program might check the operation of the disk drives, while another might check the operation of RAM. Some of these diagnostic programs are contained within ROM and are run automatically when the system is first turned on. Other diagnostic programs are loaded from secondary memory and are run on user request.

3. Operating system Executive:

The operating system executive (also called as monitor) is a program that controls the activities of the system, including executing programs and assigning tasks to hardware devices. In response to user or operator requests

the operating system executive that is read into RAM when the computer first starts. Some sophisticated operating system executives (mostly on minicomputers and mainframes) allow several programs to be run simultaneously. This operating system feature is called multi-tasking. Other operating system executives, called multi user operating systems, allow for several users to have simultaneous access to system devices and data.

4. BIOS:

The Basic input/output system programs consist of the low level routines used to control the most rudimentary functions of the hardware devices, some functions BIOS programs control are:

- ➢ Reading a character from the keyboard
- ➢ Writing a character on the video display.
- ➢ Writing a character to the printer.
- ➢ Determining whether the printer is busy or not.
- ➢ Reading a sector from the disk in a particular disk drive.

The BIOS programs are usually recorded in ROM. They are thus permanently available to programmers and can be used by the programmers to create, write, read and erase data.

5. Utility programs:

Every computer system needs utility programs to perform "house keeping" functions. Some of the functions controlled by utility programs are:

- ➢ Formatting a disk
- ➢ Displaying the contents of a disk.
- ➢ Copying the contents of one disk onto another.
- ➢ Determining the space remaining on the disk.
- ➢ Making a backup copy of the contents of a hard disk.
- ➢ Restoring the contents of a hard disk from backup copy.

6. File maintenance:

The operating system provides service routines that can be used to maintain files on the various secondary memory devices attached to the system. These file maintenance programs allow user programs to create, read, and write files. These routines are not stand-alone utility programs but are designed to be called from with in user programs.

Types of Operating Systems

1. Batch Systems:

A batch operating system accepts jobs and places then in a queue to await to execution. This process is often called spooling. Essentially what happens is the jobs are places in a queue on a disk unit. As execution time becomes available the operating system selects jobs based on priorities from the job queue. Batch jobs may be executed on a serial basis, where one job is executed at a time; or on a multiprogramming basis where multiple jobs are executed concurrently. Most operating systems in personal computers work on a batch-serial basis without using spooling.

2. Interactive systems:

An interactive system allows users to interact directly with a computer from a terminal. In effect, the user can interrupt a low priority batch job and cause the computer to perform his high-priority work. Interactive operating systems must be multiprogramming systems. Also, real time systems must be interactive since real time files must be updated immediately after real world events occur. An interrupt is required, which is the suspension of the execution of a computer program, caused by an event external to the program, and performed in such a way that the execution can later be resumed. Examples of such external events would be request for data, or input of data, form an interactive terminal.

3. Multiprogramming:

Multiprogramming is the capability of a CPU to execute two or more programs concurrently. In fact, multiprogramming operating systems designed for personal computers are called concurrent-processing operating systems. Multiprogramming capability is accomplished through the operating system. Essentially, two or more programs are stored concurrently in primary storage, and the CPU moves from one program to

another, partially executing each program in turn. Early computer systems and many personal computers execute programs on a batch serial basis; that is, each program is executed in the order in which it is read into the system, and only one program is executed in the order in which it is read into the system, and only one program is executed at a time.

4. Time sharing and interactive computing:

A time sharing system allows access to a CPU and data files through many remote terminals. The company often owns the central computer system whose employees use it, but there are also public timesharing systems owned by a timesharing vendor where the users pay for the service. The cost is based on a fixed charge plus a usage charge. The services that you can access with your personal computer to retrieve data or order products execute on public timesharing systems.

From the viewpoint of the user, the computer system appears to be dedicated exclusively to the users terminal because of the fast response of the CPU to commands from the terminal. In reality the CPU is servicing many terminals and perhaps several batch jobs. Multiprogramming is the method of implementing time-shared operations, since fast response to terminal commands is necessary.

Many businesses have used time-sharing as a means of automating information process. Before time sharing a decision to automate involved a choice between investing in an –house system or using a batch service bureau. Time-sharing used to be suitable only in situations where a minimum of input or output was involved. It was not suitable for high-volume, batch-type operations because of the high cost and time required. Time sharing now has the capability of sending or receiving large amounts of data through remote job entry (RJE).

5. Multi processing:

A multiprogramming system executes to or more programs concurrently in single CPU. In contrast, under multi processing a single program is processed by two or more CPUs.

The most typical type of multiprocessing occurs in systems that support both batch mode and many remote terminals. When a system has only few remote terminals to support the main CPU can handle all the terminal interrupts and trivial jobs such as editing. However the processing requirements of a large number of remote terminals can overload the main CPU. In this case terminal interrupts and trivial jobs can be handled by a many computers, which is called a front end processor. The main CPU processes batch jobs and executes interactive programs that the front end processor cannot handle.

The multiprocessing systems can take many forms.

For example, a third CPU equivalent in processing power to the existing main CPU could be added. The new CPU would handle all the time-sharing processing that is not handled by the front-end processor. The existing CPU would be used for batch processing and would be able to accept and execute these jobs from the time sharing CPUs that were originated by a terminal. Usually these jobs have long run times and the output can be directed to high-speed batch printer rather than back to the originating terminal.

PCs often use multiprocessing. Ex: The IBM PC has a math Co-processor that handles mathematical processing at speed upto 80 times faster than PCs micro processor.

a) Multiprocessing system substantially increases the throughput capabilities of the system with an overloaded CPU.

b) Multiprocessing is the backup CPU capability provided by to or more CPUs, which are in some configurations, identical.

6. Multitasking:

The basic idea of multitasking is to allow the devices to perform much of their own processing independent of the CPUs. Whenever a device requires the attention of the CPUs it issues a signal to the CPU this signal is called an interrupt. In response to an interrupt the CPU puts aside its current activity and tends to the device. Then the CPU returns to whatever it was doing when the interrupt occurs. In this way the CPU can carry our several simultaneous or concurrent tasks.

Multitasking was originally found only on operating systems for mini computers and mainframe computers. It has recently been introduced to microcomputers to make their users more efficient. These new

multitasking systems divide the screen into a series of windows. A window environment usually include provisions for moving data between windows allowing programs to exchange information.

The user can run a separate program in each window. This can be extremely useful. The programs in the various windows can keep a no. of system devices working at the same time. Ex: The program in window one could be printing a document, the program in window two could be transmitting a document to another computer via modem, a spread sheet program in window three could be preparing for sales projection.

7. Multi-user OS:

Some operating systems allow a computer to support several users at one time. In a multi-user OS, each user works at a terminal connected to the computer. The computer can be a micro, mini, or mainframe computer. The OS of the computer assigns each user a portion of RAM divides the computer's time among the various users. The computer does a small amount of work for one user, then does a small amount of work for one user, then does a small amount of work for the next user, and so forth. Since the computer operates so quickly, each user feels that the computer is working for him alone. A multi-user system allows many users to simultaneously access the facilities of the host computer. Since all users shared the computing time of the mainframe, the system was called a timesharing system.

A time sharing system may have hundreds of users at the same time. To keep track of what is going on, a multi-user OS required a large amount of RAM. The OS must keep track of parts of memory belonging to each user, the user being served, the next instruction to be performed for each user, and so forth.

Features of OS or OS as a resource manager:

The OS must keep track of the status of each resource, decide which process is to get the resource, allocate it, and eventually reclaim. The important resources that an OS manages are memory, CPU time, disk space, I/O devices etc.

Viewing the OS as a resource manager, each manager must do the following:

1. Keep track of the resources
2. Enforce policy that determines who gets what, when, and how much.
1. Allocate the resource.
2. Reclaim the resource.

We have grouped all the programs of the OS into four categories. They are

- ➢ Processor management
- ➢ Memory management
- ➢ Device management
- ➢ Information management

Processor management functions:

1. Keep track of the resource (processors and the status of processes). The program that does this has been called the traffic controller.
2. Decide who will have a chance to use the processor; the job scheduler chooses from all the jobs submitted to the system and decides which one will be allowed into the system, i.e., have any resources assigned to it. If multiprogramming, decide which process gets the processor, when, and how much; this is called the processor scheduler.
3. Allocate the resource (processor) to a process by setting up necessary hardware registers; this is often called the dispatcher.
4. Reclaim resource (processor) when process relinquished processor usage, terminated, or exceeds allowed amount of usage.

Memory management functions:

1. Keep track of the resource (memory). What parts are in use and by whom? What parts are not in use(called free)?
2. If multiprogramming, decide which process gets memory, when it gets it, and how much.
3. Allocate the resource(memory) when the processes request it and the policy of 2 above allows it.
4. Reclaim the resource (memory) when the process no longer needs it or has been terminated.

Device management functions:

1. Keep track of the resource (devices, channels, control units); this is typically called the I/O traffic controller.

2. Decide what is an efficient way to allocate the resource (device). If it is to be shared, then decide who gets it, and how much he is to get; this is called I/O scheduling.

3. Allocate the resource (device) and initiate the I/O operation.

4. Reclaim resource. In most cases the I/O terminates automatically.

Information management functions:

1. Keep track of the resource (information), its location, use, status etc., these collective facilities are often called the file system.

2. Decide who gets use of the resources enforced protection requirements and provide accessing routines.

3. Allocate the resource (information), ex: open a file.

4. Deallocate the resource, ex: close a file.

Managing files:

The files that the OS works with may be programs or data files. Most programs come with numerous files-some may even include hundreds. When you use the programs, you often create your own data files, such as word processing documents, and store them on a disk under names that you assign to them. A large hard disk often holds thousands of programs and data files. It is the responsibility of the OS to keep track of all these files so it can copy any one of them into ram at a moment's notice.

To accomplish this feat, the OS maintains a list of the contents of a disk on the disk itself as you may recall there is an area called the file allocation table(FAT) that the OS creates when you format the disk. The OS updates the information in the FAT any time a file is created, moved, renamed or deleted. In addition the OS keeps track of different disks or disk drives by assigning names to them.

In windows there are actually two different programs for viewing and managing the contents of a disk, the "My Computer" and "Windows Explorer". In either one you select the icon that represent a disk drive, and a window appears with the list of files on that disk.

Managing hardware:

When programs run they need to use the computer's memory, monitor, disk drives, and other devices, such as printer, modem or a CD-ROM drive. The OS is intermediary between programs and hardware. In a computer network, the OS also mediates between your computer and other devices on the network.

Interrupt processing: The OS responds to requests to use memory and other devices, keeps track of which programs have access to which devices, and coordinates everything the hardware does so that various activities do not overlap and cause the computer to become confused and stop working. The OS uses **interrupt Requests** to help the CPU coordinate process. For example, if you tell the operating system to list the files in a folder, it sends an interrupt request to the computer's CPU. The basic steps in this process are shown below.

- When you click on a folder, the OS interrupts the action as a command to list the files in that folder.
- The OS sends an interrupt request to the CPU.
- When possible, the CPU pauses any other processing and checks with the OS to see what new processing job is being requested.
- The OS tells the CPU to go to the disk drive and retrieve the names of the files in the folder.
- The CPU retrieves the names of files in the folder.
- The OS intercepts the list of filenames returning from the disk drive and displays it on the screen.
- The contents of highlighted folder are now shown on the right side of the screen.

Providing drivers: In addition to using interrupts, the OS often provides complete programs for working with special devices, such as printers. These programs are called drivers because they allow the OS and other programs to activate use, that is, "drive" the hardware device.

Networking: Besides providing interrupt requests and drivers for working with individual devices, the OS also can allow you to work with multiple computers on a network. On a network, usually each person has a

separate PC with its own operating system. The network server also has its own OS, which manages the flow of data on the file server and around the network.

User interface:

When we start the OS, the on screen items we see and interact with are defined as the user interface. Whenever users interact with a computer the interaction is controlled by an OS. The User interface is the part of an information system that users interact with. Users communicate with an OS through the user interface of that OS.

Parts and services:

Character user interface/command line interface: In DOS (Disk Operating System) users interact with a command-line interface by typing strings of characters at the appearance of a prompt on the screen. In DOS, the prompt usually includes the identification for the active disk drive, followed by a greater-than symbol.

Graphical user interface: In Character user interface the user has to type the commands using keyboard, but the GUI (Graphical User Interface) makes use of icons, buttons, bars and boxes to perform the same task. GUI software save learning time because computing novices do not have to learn different commands for each application.

Components of GUI:

Icons: Icons represent the parts of the computer with –printers, fonts, document files, folders, disk drives etc.

The taskbar and start button: Whenever you start a program in windows 95 , a button for it appears on the Taskbar- an area at the bottom of the screen whose purpose is to hold and display the buttons for programs you are running. When we have multiple programs running, we can shift from one to the other by clicking on a program's button on the task bar. The start button is a permanent feature of taskbar. After you click it a menu is displayed showing the icons for programs in the computer.

Menus: Menu is a collection of commands which is present at the top of the window on a horizontal bar called menu bar. When you click on an item in the menu bar, a menu "drops down" and displays a list of commands.

Dialog boxes: Dialog boxes are special purpose windows that appear when we need to tell the program what to do next.

Software utilities:

These are programs or routines that carry out certain procedures which are common to virtually all applications.

Utility programs are different from application packages. Application packages are complete systems for specific computer applications e.g. Financial Accounting, Inventory control.

Utility software performs needed services such as

• Sorting records into a particular sequence for processing.

e.g. A number of outstanding invoices may be processed in date order; The date is used as the key field. Then all the invoices for one day may be sorted on invoice number, the invoice number can be the monitor key field.

Thus by using the command sort in a source program the computer will provide the necessary routine. The programmer does not have to write a separate program .

• Merging several sorted files into a single large updated file.
• Transferring data from one I/O device to another.
• Printing files held on a backing storage.
• Printing the contents of main memory.

Enhancing the OS with utility software:

OSs are designed to let you do the most of the things you normally would want to do with a computer manage files, load programs, print files, multi tasks and so on. These programs (actually, set of programs) are sold by the behemoths of the software industry.

In 1980s when utilities for PCs first appear some of the most popular were those that helped the user to backup files, detect computer viruses, and retrieve files that have been deleted. A few utility programs

actually replace parts of the OS but the vast majority simply add helpful functionality. Today popular utilities range form programs that can organize or compress the files on a disk to programs that help you remove programs you no longer use from your hard disk.

The utilities are :

1. File Defragmentation
2. Data compression
3. Backup
4. Data recovery
5. Anti virus
6. Screen savers etc.

File Defragmentation:

When you first copy a file to a disk the OS tries to put it all in one place in one or more contiguous sectors. If you later go back and add data to the file, however, the sectors next to the original may no longer be available. In this case the OS puts the new data somewhere else on the disk.

A file that is split up this way is said to be fragmented because, its parts are physically separated. The problem with fragmented files is that it takes the hard drive longer to read and write them because, because the disk must position its read-write heads several times while working with same file

A utility program that defragments files on a disk can speed up the disk drives quite noticeable. Windows 95 comes with a defragmentation utility called "Disk defragmenter".

Data compression:

Data compression, the ability to reduce the storage requirements of a file using mathematical algorithms has several applications including data communications and multimedia. Data compression techniques are built into modems so they can send files faster.

Another use for data compression is to fit more data on a disk. Doing so usually requires a data compression utility, a program specifically designed to abbreviate sequences of bits in order to make files as small as possible. Data compression utilities come in different types. Some utilities compress files on demand, usually to fit data on to a small disk or to reduce the amount of hard disk space taken up by files that are rarely accessed. Ex: PKZIP and WINZIP for the PC and Stuff It for Macintosh.

Another type of utilities compress all the data as it is stored on your hard disk, effectively doubling the capacity of the disk. Drive space, which is built into WIN 95, is an example of this type of utility.

Backup software:

Backup software is designed to help you copy large groups of files from your hard disks to some other storage media such as diskettes , magnetic tapes , removable hard disks , recordable CDs. The real purpose of this utility is to make the backup process as painless as possible. For example most backup software lets you set a timer and automatically copy the contents of a hard disk to magnetic tape or the network server when you are not using your computer usually late at night.

Data recovery software:

Once in a while, you may erase a file from a disk and then realize that you still need it. This is when you need a data recovery utility. Also called an unerased program, which can recover data files that have been mistakenly deleted or somehow rendered unusable.

Both the Macintosh OS and WIN 95 try to help with the problem of mistakenly erased files by providing the Trash (MAC) and Recycle Bin(WIN 95) these are areas to which you can move files that you no longer need .The OS does not actually erase the files until you give the command to empty Trash (MAC) or Recycle Bin(WIN 95).

Data recovery software is designed to make files that have been erased but not written over visible to the user. The user can select them and change their status back to a usable form . The same type of software can also be used to examine a disk and look for damaged files. Files can become unreadable if they were damaged by an error in software or the disk drive or if the storage media itself is damaged. Data recovery software can sometimes piece together the readable parts of such files and make those parts available again

Anti virus : A virus is parasitic program buried within another legitimate program or stored in a special area of a disk called the boot sector. Executing the legitimate program for accessing the disk activates the virus without the users knowledge. Viruses can be programmed to do many things including copy themselves to other programs, display information on the screen, destroy data files or erase an entire hard disk. If you occasionally transfer files or trade diskettes with other computer users you can spread the virus unknowingly.

Tracking viruses down , eradicating them, and preventing their spread is the major objective of anti virus utilities. Anti virus programs examine the boot sector and every file on the disk, identify any viruses and attempt to remove them. You can also configure anti virus programs so that they are active at all times searching for infected files or suspicious programs.

Some common antivirus utilities are McAfee, Virusscan, Norton antivirus, Virex, disinfectant, semantic Antivirus etc.

Screen Savers:

Another popular type of utility is the **Screen Saver,** a program that displays moving images on the screen if no input is received for several minutes. Screen savers originally gained popularity as away to fight "ghosting" a hardware problem of computer monitors, in which an image that was displayed for many hours on the screen became "burned" into the phosphor dots and therefore was permanently visible on the screen's surface. However, even after the hardware was corrected and ghosting no longer took place, programmers had become so creative with the type images displayed by screen savers that users began to buy them just for the sake of novelty, and to protect their data from being seen when they are away from their desks.

Today, we can find screen savers that display Flying Toasters, Far side comic strips, bizarre mathematical color patterns, and scenes from TV shows like Star Trek and The Simpsons.

Features of popular OSs

MS-DOS:

MS-DOS(Microsoft Disk Operating System), along with the similar PC-DOS from IBM and competitors like DR-DOS (Digital Research) was once the most common of all the PC operating systems. There was an overwhelming volume of software available that ran under DOS, and a large installed base of Intel-based PCs that ran DOS .

Features of MS-DOS :

✓ Under DOS, you can load only a single program into memory at a time. To work with second program, you have to close the first- a process that often hinders productivity.

✓ DOS was not designed to handle large amounts of RAM that today's PCs typically use. As a result, you have to use utilities to access memory beyond the 640 kb limit imposed by DOS.

✓ DOS was designed for 16-Bit CPUs and cannot take advantage of the 32-bit architecture of the 486, Pentium later chips. This forces computers to work at speeds below their capacity.

✓ DOS filenames are limited to eight characters, plus a three –character "extension". Windows 95 and upgrades have remedied this situation by allowing names up to 256 characters long.

✓ Finally, DOS command line interface is more difficult to learn than a well designed GUI.

Microsoft Windows 95 and upgrades:

In 1995, Microsoft released Windows 95, a complete OS and a successor to DOS for desktop computers. Windows 95 is a 32-bit preemptive multitasking OS with a revised GUI. Windows 95 contains a good deal of 16-bit code needed for older DOS applications. Though the 16-bit code may have represented a backward glance, it was probably window 95s greatest making strengths.

Features of windows 95/98/2000:

1. It offers preemptive multitasking.
2. It offers 32-bit processing.
3. It allows users to type file names up to 256 characters and to have spaces in those names.
4. It offers plug-and-play standard for connecting new hardware. Under plug-and-play, you simply connect windows certified device to your computer, and the operating system does everything else to make sure that it works properly with the computer.

5. Its asset is compatibility with networking software.
6. It supports multimedia.
7. It comes with a flexibility where one can personalise/customise as per his own requirements, may it be screen, may it be options.
8. It supports screen savers i.e. whenever no one is using the system for specific time the windows screen saver, which is used to hide the work which is ongoing from others, assuming the user has gone for some work.
9. A powerful help facility is provide which will enable a user to sort out his problems.
10. The file management is very easy process.
11. Searching for specific files is very easy as search facility is provided , which is very powerful.
12. It supports Graphic User Interface. So it is an friend friendly operating system
13. It comes with various tools and utility to enhance the productivity of the users.
14. It has a powerful task manager, so that one can manage various tasks which are running currently.
15. It gives users flexibility to work with multiple windows at the same instance of time ,where one can switch between windows as well as move data within and between windows
16. It comes with a menu, thereby removing the need for the user to remember various commands and options.
17. Most of the windows come with scroll bars, so that one can easily look at the data, by scrolling.
18. Windows have various dialog boxes, which are popped out as and when needed, so that one is relieved of accidental mistakes.
19. It comes with entertainment like games etc.
20. It provides many types of fonts, sizes of fonts, colors , screen appearance etc.

Windows NT/2000 server:

Although Windows95 is considered as successor to DOS Microsoft released Windows NT, a 32-bit OS in 1993. WindowsNT is a high-end OS designed primarily for powerful workstations and network servers.

- Networking and Communications
- Cross-Platform Integration
- Directory Services
- File and Print Services
- Management Services
- Security Services
- Terminal Services

Features of UNIX:

Key features of **Unix** operating system are

1. Multi User/Time Sharing /Multitasking Capacity .
2. Modularity.
3. File Structure.
4. Consistent Peripheral Interface.
5. Security.
6. Redirection of Input-Output and Pipes.
7. Portability.
8. Communication and Networking.
9. Utilities and Software Development Tools.

Multi User/Time Sharing /Multitasking Capacity: UNIX operating system can be used by more than one user at a given instance of time. Various users can log on to the system from different terminals and give

commands for getting their work done. When users give commands, they are executed by the UNIX System on time sharing basis, where every user program is given a time slot, known as time slice, after the time slice of a program elapses then the next program gets chance to be executed for its time slice and this continues so that many users can get their jobs executed by the UNIX system.

Multitasking feature of the UNIX allows an user to initiate more than one task from the same terminal.

Modularity: Modularity feature of the UNIX operating system makes it an unique operating system. UNIX operating system is composed of modules, which can be added or removed by the users to fit their needs, without effecting the working of the system. This is very helpful when there is constraint for memory.

File Structure: UNIX follows a hierarchical file structure, which is quite similar to an inverted tree, having the root directory at the top and under it are the files, which expand dynamically. There is no restriction for the number of files or the file size. This hierarchical structure of the file system gives flexibility for the grouping and retrieving files.

Consistent Peripheral Interface: UNIX treats all the peripherals like keyboard, monitor, printer etc. as files, exactly as same as any other files. All the peripheral devices are treated as special device files. As all the files treat the data as the stream of bytes which are unformatted, so are the device files which also work the same way as any other files.

Security: Being a multi user system, there should be special consideration for the security of the data. UNIX provides with different levels of security so that the users need not worry about their data. The security has external and internal levels. At External Levels it maintains security by maintaining the list of the authorised users and their passwords, so that only authorized users can log on to the system. On the internal front it maintains the security by setting permissions for the access of the files and directories.

Redirection of Input-Output and Pipes: All the UNIX commands are such that they take input from the standard input device (key board) and give output to the standard output device (monitor). A user can change the default source of input as well as the default output device, this process is known as redirection of input and output. There is a provision that a commands output can be given as input to other commands, which is done by using pipes.

Portability: This is the ability of the software, which makes it work on different types of machines and platform. UNIX is very portable as it is developed using 'C', a high level language. Only that part of the operating system which depends on the hardware has to be manipulated, so that it works on any other computer with different architecture.

Communication and Networking: UNIX comes with great power for the communication and networking facility. There are several in-built programs, which enable different users to communicate with each other by sending and receiving messages to and from different terminals. There is also provision for interactive conversations. Use of LAN (Local Area Net Work) between the UNIX machines is very popular.

Utilities and Software Development Tools: UNIX comes with more than two hundred utilities, which aid user by providing various facilities like processing text, sorting data, searching etc. One need not write new programs for accomplishing tasks to a great extent.

UNIX comes with several tools that help application developers for developing various softwares. This tools include 'C' Compiler, version control systems, Library management, file processing and syntax analyzer, Debugger, Microprocessor etc.

Above all, the UNIX comes with a unique feature which makes it still popular, it is immune to viruses, i.e., it is not effected by viruses. Thus UNIX, no doubt is a popular operating system.

Translating programs:

Translating programs transform instructions written in humanly convenient form to machine codes required by computers. These translating programs are loaded into the computer where they control the translation process. Compilers and interpreters are used to translate programs to machine language codes.

Interpreter: Interpreter is a special program/software which is used for translating a high-level language program into machine language. The interpreter takes the high-level language program code as input line by line and converts it into machine level language, line by line without producing object code for future use.

If the program needs to be run, then again it has to be interpreted and translated into the machine language. This is an advantage, when the program is modified, but this way of interpreting line by line is bit slow.

Compiler:

A compiler translates a program written in a high level language to executable machine instructions. The compiler treats source-program instructions as data. Each instruction is accessed in turn and translated into one or more lines of object in machine language.

If there are errors in the source program, the error messages are generated by the compiler. These messages explain where the error is and what type of error it was. A compiling run is required before problem data is used to pass computer control to the first program instruction. Program execution then commences.

Programming languages:

A language is a system of communication. A programming language consists of all the symbols, programming languages may be created for a special purpose or they may be general-purpose tools that may be suitable for a many types of applications.

Classification of languages: They classified as

- ✓ Machine language
- ✓ Assembly language
- ✓ High level language

Machine language:

A computer's machine language consists of strings of binary numbers and is the only one the processor directly understands.

When first generation computers were introduced, the programs were in binary-based machine level languages.

Machine language is most basic form of programming and hence explicit instructions are to be given to the machine to perform every operation.

The first part is the command or operation, and it tells the computer what function to perform. Every computer thus has an operation code, or "opcode", for each of its functions. The second part of the instruction is the operand, and it tells the computer where to find or store data or other instructions that are to be manipulated. The number of operands in an instruction varies in computers.

In a two operand machine, the binary representation for "ADD 0184 8672" could cause the value in address 8672 to be added the number in location 0184. The single operand formula is popular in the smallest microcomputers.

Besides having to remember the dozens of code numbers for the commands in machine instruction set, a programmed had to keep track of the storage locations of data and instructions. The initial coding took months and the correction of errors would takes weeks to finish

Advantages:

1. Machine languages make efficient use of storage – language instructions and their storage in computer memory can be controlled.
2. Instructions of a machine language program are immediately executable. They require no compilation or translation steps.
3. Machine-language instructions can be used to manipulate the individual bits in a byte of computer storage.

Disadvantages:

1. Machine languages are machine dependent.
2. Programming in machine language usually results in poor programmer productivity. Due to the level of detail required and the binary code.
3. Computer storage locations must be addressed directly.
4. Machine languages require a high level of programming skill.

Assembly language:

In the 1950's mnemonic operation codes and symbolic address were developed. First introduced in the second-generation computers. The word mnemonic refers to a memory aid. Letter symbols mnemonics was substituted for the numeric machine language operation codes. Each computer now has a mnemonic code although the actual symbols vary among different makes. Machine language is still used by the computer as it processes data. But assembly language software first translates the specified operation code symbol into machine language equivalent.

Symbolic addressing is the practice of expressing an address not in terms of its absolute numeric location, rather in terms of convenient symbols.

The storage address number of the first program instruction was specified, and the assembly language software then automatically stored all others in sequence from that point. So if instructions were added it was not necessary to modify the address of all the instructions. Instead the processor would automatically adjusts storage locations the next time the program was run.

The **assembler** enables the computer to convert the assembly language instructions into machine language. The set of instructions written by the programmer is the source program. After it has been converted into machine language by assembler it is referred as object code.

Advantages:

While writing in assembly language saves time and reduces the need for detail, fewer errors are made, and those made are easier to find. They are also easier to modify.

Disadvantages:

However coding in assembly language is time consuming. Further they are machine oriented, that is they are designed for a specific make and model of processor. Programs may have to be re-coded for a different machine.

High level languages:

The earlier assembly programs produced only one machine instruction for each source program instruction. A single macro instruction might produce several lines of machine language code. The development of macro instruction and mnemonic techniques led to the development of high-level languages, Which are oriented towards certain specific processing problems, which are application specific like mathematics problems, file processing, scientific applications etc.

The computer cannot understand any other language, other than machine language, therefore the computer is unable to understand the instructions given in High Level Languages. We need to convert these high level language problems into machine language, which has to be taken care by the software.

Advantages:

Easy to Learn: These languages are easy to learn, as they are simple and are modular, which do not require much expertise to learn. These languages use commands and statements which are self explanatory.

Easy to understand: The programs written using these languages are easy to understand, as the statements and syntaxes are self documented. A program written by other programmers can be understood without much difficulty.

Easy to program: These languages usually come with tools, which makes the task of writing programs easy for the programmers. Various constructs are provided which ease complex tasks.

Easy to maintain: These programs are quite easy to maintain, as they can be modified and updated easily. Any one can modify them. We can add new features to the existing programs without rewriting the whole program.

Easy for documentation: The programs written in these languages are highly documentable. When we talk about the statements of the programs, they are almost self documented, and they do not need any further documentation.

Easy Debugging: As the programs are modular, the length of the program is short, which makes the detection and correction of errors (Bugs) easy. Usually, there are compilers, which detect and also correct the bugs (syntactical).

Less time consuming: As there are tools available, the time taken for coding and debugging of programs is quite less in case of high level languages, when compared to the other languages.

Portable: The programs written using these languages on one machine are portable to other machines, which will run with slight changes, that too if needed.

Disadvantages:

Selecting a Programming Language:

A large number of programming languages is available. For solving the problem selecting a suitable language is difficult.

Compilation time:

The process of compilation, required to change high level language to machine code may require more time than a necessary to produce actual answers. Also, each time the source program is modified it has to be recompiled, machine code is so complex and may take a longer time.

Insufficient object code:

Some compilers produce inefficient object code and thus require much longer time during execution. But it requires expert programmers to write efficient object code directly and in most cases modern compilers can do equally good.

Difficulties in debugging:

Errors are not easy to locate and compilers does not provide proper diagnostics and debugging tools.

In ability perform all operations:

It is virtually impossible to perform automatic nature operations, like manipulating individual bits and registers by using high level language and one must resort to machine language to deal with it.

Cost: The cost of the software required for the language to be used for application development as well as the cost of the related tools which make the language complete should be looked into, before choosing a language

Software Concepts & Operating Systems

Introduction:

In most organizations the computer is a very valuable resource. Among the resources that a computer has are processing time, storage space, printers, terminals and information. The management of these resources is performed largely by a type of system software called an operating system. When users interact with the computer, much of this interaction is with the system software. System software directly affects the ease with which users interact with the computer. Furthermore, system software is a very significant determinant of whether or not a particular computer's resources are used optimally. For these reasons it is important that users if computer systems have a basic knowledge of system software.

Types of software:

There are two broad categories of software: System software and application software.

System Software:

System software is a set of programs that manage the resources of a computer system (processing time, storage space, and so on) so that they are used in an optimal fashion, provide routine services such as copying data from one file to another, and assist in the development of application programs. System software consists of general programs that assist the computer in efficient control, support, development and execution of application programs.

Ex: Operating systems, Compilers & Interpreters, Device drivers, Utilities, Data Base Management Systems (DBMS) etc.

Application software:

Application software is a program written for, or by, a user to perform a particular job.

General-purpose application software, such as an electronic spreadsheet, has a wide variety of applications.

 Specific-purpose application software, such as payroll and sales analysis, is used only for the applications for which it is designed. Application programmers write these programs.

Ex: General purpose: Spreadsheets, word processors

Special Purpose: Payroll system, Financial accounting systems, account payable systems. Medical & Health care systems, Billing systems, Banking systems, Inventory control & Accounting systems, production planning & Control etc.

Introduction to operating systems:

Operating system (OS) can be defined as **"Set of Programs that are capable to manage resources as well as the operations of a computer".** Part of the Operating system is stored in secondary memory on floppy disk, hard disk, or magnetic tape, while part is stored permanently on read only memory (ROM). When the computer is first started, it automatically begins to execute a program contained in the operating systems portion of ROM. This program reads part of the operating systems into random access memory (RAM), and the computer begins to execute this part of the system. The operating system program now controls the computer.

The basic functions, which are carried by any operating system are:

11. Assigning processors for performing tasks.

12. Allocating memory, managing memory and other storage areas.

13. Command interpretation.

14. Handling job to job transitions.

15. Maintaining internal clock.

16. Scheduling of various jobs/tasks.

17. Establishing and enforcing priorities for different jobs.

18. Co-ordinating and managing peripheral devices.

19. Input/Output management.

20. Establishing data security and integrity.

Types of operating system programs:

An operating system usually consists of hundreds of programs, which fall into the following few broad categories.

1. Booting Loader:

The function of the bootstrap loader program, which is usually contained on ROM is to read the main portion of the operating system from secondary memory when the computer is first turned on.

2. Diagnostic Tests:

The operating system contains a number of diagnostic programs that test the operation of the system components. For example, one diagnostic program might check the operation of the disk drives, while another might check the operation of RAM. Some of these diagnostic programs are contained within ROM and are run automatically when the system is first turned on. Other diagnostic programs are loaded from secondary memory and are run on user request.

3. Operating system Executive:

The operating system executive (also called as monitor) is a program that controls the activities of the system, including executing programs and assigning tasks to hardware devices. In response to user or operator requests the operating system executive that is read into RAM when the computer first starts. Some sophisticated operating system executives (mostly on minicomputers and mainframes) allow several programs to be run simultaneously. This operating system feature is called multi-tasking. Other operating system executives, called multi user operating systems, allow for several users to have simultaneous access to system devices and data.

4. BIOS:

The Basic input/output system programs consist of the low level routines used to control the most rudimentary functions of the hardware devices, some functions BIOS programs control are:

- ➢ Reading a character from the keyboard
- ➢ Writing a character on the video display.
- ➢ Writing a character to the printer.
- ➢ Determining whether the printer is busy or not.
- ➢ Reading a sector from the disk in a particular disk drive.

The BIOS programs are usually recorded in ROM. They are thus permanently available to programmers and can be used by the programmers to create, write, read and erase data.

5. Utility programs:

Every computer system needs utility programs to perform "house keeping" functions. Some of the functions controlled by utility programs are:

- ➢ Formatting a disk
- ➢ Displaying the contents of a disk.
- ➢ Copying the contents of one disk onto another.
- ➢ Determining the space remaining on the disk.
- ➢ Making a backup copy of the contents of a hard disk.
- ➢ Restoring the contents of a hard disk from backup copy.

6. File maintenance:

The operating system provides service routines that can be used to maintain files on the various secondary memory devices attached to the system. These file maintenance programs allow user programs to create, read, and write files. These routines are not stand-alone utility programs but are designed to be called from with in user programs.

Types of Operating Systems

1. Batch Systems:

A batch operating system accepts jobs and places then in a queue to await to execution. This process is often called spooling. Essentially what happens is the jobs are places in a queue on a disk unit. As execution time becomes available the operating system selects jobs based on priorities from the job queue. Batch jobs may be executed on a serial basis, where one job is executed at a time; or on a multiprogramming basis where multiple jobs are executed concurrently. Most operating systems in personal computers work on a batch-serial basis without using spooling.

2. Interactive systems:

An interactive system allows users to interact directly with a computer from a terminal. In effect, the user can interrupt a low priority batch job and cause the computer to perform his high-priority work. Interactive operating systems must be multiprogramming systems. Also, real time systems must be interactive since real time files must be updated immediately after real world events occur. An interrupt is required, which is the suspension of the execution of a computer program, caused by an event external to the program, and performed in such a way that the execution can later be resumed. Examples of such external events would be request for data, or input of data, form an interactive terminal.

3. Multiprogramming:

Multiprogramming is the capability of a CPU to execute two or more programs concurrently. In fact, multiprogramming operating systems designed for personal computers are called concurrent-processing operating systems. Multiprogramming capability is accomplished through the operating system. Essentially, two or more programs are stored concurrently in primary storage, and the CPU moves from one program to another, partially executing each program in turn. Early computer systems and many personal computers execute programs on a batch serial basis; that is, each program is executed in the order in which it is read into the system, and only one program is executed in the order in which it is read into the system, and only one program is executed at a time.

4. Time sharing and interactive computing:

A time sharing system allows access to a CPU and data files through many remote terminals. The company often owns the central computer system whose employees use it, but there are also public

timesharing systems owned by a timesharing vendor where the users pay for the service. The cost is based on a fixed charge plus a usage charge. The services that you can access with your personal computer to retrieve data or order products execute on public timesharing systems.

From the viewpoint of the user, the computer system appears to be dedicated exclusively to the users terminal because of the fast response of the CPU to commands from the terminal. In reality the CPU is servicing many terminals and perhaps several batch jobs. Multiprogramming is the method of implementing time-shared operations, since fast response to terminal commands is necessary.

Many businesses have used time-sharing as a means of automating information process. Before time sharing a decision to automate involved a choice between investing in an –house system or using a batch service bureau. Time-sharing used to be suitable only in situations where a minimum of input or output was involved. It was not suitable for high-volume, batch-type operations because of the high cost and time required. Time sharing now has the capability of sending or receiving large amounts of data through remote job entry (RJE).

5. Multi processing:

A multiprogramming system executes to or more programs concurrently in single CPU. In contrast, under multi processing a single program is processed by two or more CPUs.

The most typical type of multiprocessing occurs in systems that support both batch mode and many remote terminals. When a system has only few remote terminals to support the main CPU can handle all the terminal interrupts and trivial jobs such as editing. However the processing requirements of a large number of remote terminals can overload the main CPU. In this case terminal interrupts and trivial jobs can be handled by a many computers, which is called a front end processor. The main CPU processes batch jobs and executes interactive programs that the front end processor cannot handle.

The multiprocessing systems can take many forms.

For example, a third CPU equivalent in processing power to the existing main CPU could be added. The new CPU would handle all the time-sharing processing that is not handled by the front-end processor. The existing CPU would be used for batch processing and would be able to accept and execute these jobs from the time sharing CPUs that were originated by a terminal. Usually these jobs have long run times and the output can be directed to high-speed batch printer rather than back to the originating terminal.

PCs often use multiprocessing. Ex: The IBM PC has a math Co-processor that handles mathematical processing at speed upto 80 times faster than PCs micro processor.

c) Multiprocessing system substantially increases the throughput capabilities of the system with an overloaded CPU.

d) Multiprocessing is the backup CPU capability provided by to or more CPUs, which are in some configurations, identical.

6. Multitasking:

The basic idea of multitasking is to allow the devices to perform much of their own processing independent of the CPUs. Whenever a device requires the attention of the CPUs it issues a signal to the CPU this signal is called an interrupt. In response to an interrupt the CPU puts aside its current activity and tends to the device. Then the CPU returns to whatever it was doing when the interrupt occurs. In this way the CPU can carry our several simultaneous or concurrent tasks.

Multitasking was originally found only on operating systems for mini computers and mainframe computers. It has recently been introduced to microcomputers to make their users more efficient. These new multitasking systems divide the screen into a series of windows. A window environment usually include provisions for moving data between windows allowing programs to exchange information.

The user can run a separate program in each window. This can be extremely useful. The programs in the various windows can keep a no. of system devices working at the same time. Ex: The program in window one could be printing a document, the program in window two could be transmitting a document to another computer via modem, a spread sheet program in window three could be preparing for sales projection.

7. Multi-user OS:

Some operating systems allow a computer to support several users at one time. In a multi-user OS, each user works at a terminal connected to the computer. The computer can be a micro, mini, or mainframe computer. The OS of the computer assigns each user a portion of RAM divides the computer's time among the various users. The computer does a small amount of work for one user, then does a small amount of work for one user, then does a small amount of work for the next user, and so forth. Since the computer operates so quickly, each user feels that the computer is working for him alone. A multi-user system allows many users to simultaneously access the facilities of the host computer. Since all users shared the computing time of the mainframe, the system was called a timesharing system.

A time sharing system may have hundreds of users at the same time. To keep track of what is going on, a multi-user OS required a large amount of RAM. The OS must keep track of parts of memory belonging to each user, the user being served, the next instruction to be performed for each user, and so forth.

Features of OS or OS as a resource manager:

The OS must keep track of the status of each resource, decide which process is to get the resource, allocate it, and eventually reclaim. The important resources that an OS manages are memory, CPU time, disk space, I/O devices etc.

Viewing the OS as a resource manager, each manager must do the following:

1. Keep track of the resources

2. Enforce policy that determines who gets what, when, and how much.

3.   Allocate the resource.

4.   Reclaim the resource.

We have grouped all the programs of the OS into four categories. They are

> ➢   Processor management
> ➢   Memory management
> ➢   Device management
> ➢   Information management

Processor management functions:

5.   Keep track of the resource (processors and the status of processes). The program that does this has been called the traffic controller.

6.   Decide who will have a chance to use the processor; the job scheduler chooses from all the jobs submitted to the system and decides which one will be allowed into the system, i.e., have any resources assigned to it. If multiprogramming, decide which process gets the processor, when, and how much; this is called the processor scheduler.

7.   Allocate the resource (processor) to a process by setting up necessary hardware registers; this is often called the dispatcher.

8.   Reclaim resource (processor) when process relinquished processor usage, terminated, or exceeds allowed amount of usage.

Memory management functions:

5.   Keep track of the resource (memory). What parts are in use and by whom? What parts are not in use(called free)?

6.   If multiprogramming, decide which process gets memory, when it gets it, and how much.

7.   Allocate the resource(memory) when the processes request it and the policy of 2 above allows it.

8.   Reclaim the resource (memory) when the process no longer needs it or has been terminated.

Device management functions:

5.   Keep track of the resource (devices, channels, control units); this is typically called the I/O traffic controller.

6.   Decide what is an efficient way to allocate the resource (device). If it is to be shared, then decide who gets it, and how much he is to get; this is called I/O scheduling.

7.   Allocate the resource (device) and initiate the I/O operation.

8.   Reclaim resource. In most cases the I/O terminates automatically.

Information management functions:

5. Keep track of the resource (information), its location, use, status etc., these collective facilities are often called the file system.

6. Decide who gets use of the resources enforced protection requirements and provide accessing routines.

7. Allocate the resource (information), ex: open a file.

8. Deallocate the resource, ex: close a file.

Managing files:

The files that the OS works with may be programs or data files. Most programs come with numerous files-some may even include hundreds. When you use the programs, you often create your own data files, such as word processing documents, and store them on a disk under names that you assign to them. A large hard disk often holds thousands of programs and data files. It is the responsibility of the OS to keep track of all these files so it can copy any one of them into ram at a moment's notice.

To accomplish this feat, the OS maintains a list of the contents of a disk on the disk itself as you may recall there is an area called the file allocation table(FAT) that the OS creates when you format the disk. The OS updates the information in the FAT any time a file is created, moved, renamed or deleted. In addition the OS keeps track of different disks or disk drives by assigning names to them.

In windows there are actually two different programs for viewing and managing the contents of a disk, the "My Computer" and "Windows Explorer". In either one you select the icon that represent a disk drive, and a window appears with the list of files on that disk.

Managing hardware:

When programs run they need to use the computer's memory, monitor, disk drives, and other devices, such as printer, modem or a CD-ROM drive. The OS is intermediary between programs and hardware. In a computer network, the OS also mediates between your computer and other devices on the network.

Interrupt processing: The OS responds to requests to use memory and other devices, keeps track of which programs have access to which devices, and coordinates everything the hardware does so that various activities do not overlap and cause the computer to become confused and stop working. The OS uses **interrupt Requests** to help the CPU coordinate process. For example, if you tell the operating system to list the files in a folder, it sends an interrupt request to the computer's CPU. The basic steps in this process are shown below.

- When you click on a folder, the OS interrupts the action as a command to list the files in that folder.
- The OS sends an interrupt request to the CPU.
- When possible, the CPU pauses any other processing and checks with the OS to see what new processing job is being requested.
- The OS tells the CPU to go to the disk drive and retrieve the names of the files in the folder.
- The CPU retrieves the names of files in the folder.
- The OS intercepts the list of filenames returning from the disk drive and displays it on the screen.
- The contents of highlighted folder are now shown on the right side of the screen.

Providing drivers: In addition to using interrupts, the OS often provides complete programs for working with special devices, such as printers. These programs are called drivers because they allow the OS and other programs to activate use, that is, "drive" the hardware device.

Networking: Besides providing interrupt requests and drivers for working with individual devices, the OS also can allow you to work with multiple computers on a network. On a network, usually each person has a separate PC with its own operating system. The network server also has its own OS, which manages the flow of data on the file server and around the network.

User interface:

When we start the OS, the on screen items we see and interact with are defined as the user interface. Whenever users interact with a computer the interaction is controlled by an OS. The User interface is the part of an information system that users interact with. Users communicate with an OS through the user interface of that OS.

Parts and services:

Character user interface/command line interface: In DOS (Disk Operating System) users interact with a command-line interface by typing strings of characters at the appearance of a prompt on the screen. In DOS, the prompt usually includes the identification for the active disk drive, followed by a greater-than symbol.

Graphical user interface: In Character user interface the user has to type the commands using keyboard, but the GUI (Graphical User Interface) makes use of icons, buttons, bars and boxes to perform the same task. GUI software save learning time because computing novices do not have to learn different commands for each application.

Components of GUI:

Icons: Icons represent the parts of the computer with –printers, fonts, document files, folders, disk drives etc.

The taskbar and start button: Whenever you start a program in windows 95 , a button for it appears on the Taskbar- an area at the bottom of the screen whose purpose is to hold and display the buttons for programs you are running. When we have multiple programs running, we can shift from one to the other by clicking on a program's button on the task bar. The start button is a permanent feature of taskbar. After you click it a menu is displayed showing the icons for programs in the computer.

Menus: Menu is a collection of commands which is present at the top of the window on a horizontal bar called menu bar. When you click on an item in the menu bar, a menu "drops down" and displays a list of commands.

Dialog boxes: Dialog boxes are special purpose windows that appear when we need to tell the program what to do next.

Software utilities:

These are programs or routines that carry out certain procedures which are common to virtually all applications.

Utility programs are different from application packages. Application packages are complete systems for specific computer applications e.g. Financial Accounting, Inventory control.

Utility software performs needed services such as

- Sorting records into a particular sequence for processing.

e.g. A number of outstanding invoices may be processed in date order; The date is used as the key field. Then all the invoices for one day may be sorted on invoice number, the invoice number can be the monitor key field.

Thus by using the command sort in a source program the computer will provide the necessary routine. The programmer does not have to write a separate program .

- Merging several sorted files into a single large updated file.
- Transferring data from one I/O device to another.
- Printing files held on a backing storage.
- Printing the contents of main memory.

Enhancing the OS with utility software:

OSs are designed to let you do the most of the things you normally would want to do with a computer manage files, load programs, print files, multi tasks and so on. These programs (actually, set of programs) are sold by the behemoths of the software industry.

In 1980s when utilities for PCs first appear some of the most popular were those that helped the user to backup files, detect computer viruses, and retrieve files that have been deleted. A few utility programs actually replace parts of the OS but the vast majority simply add helpful functionality. Today popular utilities range form programs that can organize or compress the files on a disk to programs that help you remove programs you no longer use from your hard disk.

The utilities are :

7. File Defragmentation
8. Data compression
9. Backup
10. Data recovery

11. Anti virus

12. Screen savers etc.

File Defragmentation:

When you first copy a file to a disk the OS tries to put it all in one place in one or more contiguous sectors. If you later go back and add data to the file, however, the sectors next to the original may no longer be available. In this case the OS puts the new data somewhere else on the disk.

A file that is split up this way is said to be fragmented because, its parts are physically separated. The problem with fragmented files is that it takes the hard drive longer to read and write them because, because the disk must position its read-write heads several times while working with same file

A utility program that defragments files on a disk can speed up the disk drives quite noticeable. Windows 95 comes with a defragmentation utility called "Disk defragmenter".

Data compression:

Data compression, the ability to reduce the storage requirements of a file using mathematical algorithms has several applications including data communications and multimedia. Data compression techniques are built into modems so they can send files faster.

Another use for data compression is to fit more data on a disk. Doing so usually requires a data compression utility, a program specifically designed to abbreviate sequences of bits in order to make files as small as possible. Data compression utilities come in different types. Some utilities compress files on demand, usually to fit data on to a small disk or to reduce the amount of hard disk space taken up by files that are rarely accessed. Ex: PKZIP and WINZIP for the PC and Stuff It for Macintosh.

Another type of utilities compress all the data as it is stored on your hard disk, effectively doubling the capacity of the disk. Drive space, which is built into WIN 95, is an example of this type of utility.

Backup software:

Backup software is designed to help you copy large groups of files from your hard disks to some other storage media such as diskettes , magnetic tapes , removable hard disks , recordable CDs. The real purpose of this utility is to make the backup process as painless as possible. For example most backup software lets you set a timer and automatically copy the contents of a hard disk to magnetic tape or the network server when you are not using your computer usually late at night.

Data recovery software:

Once in a while, you may erase a file from a disk and then realize that you still need it. This is when you need a data recovery utility. Also called an unerased program, which can recover data files that have been mistakenly deleted or somehow rendered unusable.

Both the Macintosh OS and WIN 95 try to help with the problem of mistakenly erased files by providing the Trash (MAC) and Recycle Bin(WIN 95) these are areas to which you can move files that you no longer need .The OS does not actually erase the files until you give the command to empty Trash (MAC) or Recycle Bin(WIN 95).

Data recovery software is designed to make files that have been erased but not written over visible to the user. The user can select them and change their status back to a usable form . The same type of software can also be used to examine a disk and look for damaged files. Files can become unreadable if they were damaged by an error in software or the disk drive or if the storage media itself is damaged. Data recovery software can sometimes piece together the readable parts of such files and make those parts available again

Anti virus : A virus is parasitic program buried within another legitimate program or stored in a special area of a disk called the boot sector. Executing the legitimate program for accessing the disk activates the virus without the users knowledge. Viruses can be programmed to do many things including copy themselves to other programs, display information on the screen, destroy data files or erase an entire hard disk. If you occasionally transfer files or trade diskettes with other computer users you can spread the virus unknowingly.

Tracking viruses down , eradicating them, and preventing their spread is the major objective of anti virus utilities. Anti virus programs examine the boot sector and every file on the disk, identify any viruses and

attempt to remove them. You can also configure anti virus programs so that they are active at all times searching for infected files or suspicious programs.

Some common antivirus utilities are McAfee, Virusscan, Norton antivirus, Virex, disinfectant, semantic Antivirus etc.

Screen Savers:

Another popular type of utility is the **Screen Saver,** a program that displays moving images on the screen if no input is received for several minutes. Screen savers originally gained popularity as away to fight "ghosting" a hardware problem of computer monitors, in which an image that was displayed for many hours on the screen became "burned" into the phosphor dots and therefore was permanently visible on the screen's surface. However, even after the hardware was corrected and ghosting no longer took place, programmers had become so creative with the type images displayed by screen savers that users began to buy them just for the sake of novelty, and to protect their data from being seen when they are away from their desks.

Today, we can find screen savers that display Flying Toasters, Far side comic strips, bizarre mathematical color patterns, and scenes from TV shows like Star Trek and The Simpsons.

Features of popular OSs

MS-DOS:

MS-DOS(Microsoft Disk Operating System), along with the similar PC-DOS from IBM and competitors like DR-DOS (Digital Research) was once the most common of all the PC operating systems. There was an overwhelming volume of software available that ran under DOS, and a large installed base of Intel-based PCs that ran DOS .

Features of MS-DOS :

✓ Under DOS, you can load only a single program into memory at a time. To work with second program, you have to close the first- a process that often hinders productivity.

✓ DOS was not designed to handle large amounts of RAM that today's PCs typically use. As a result, you have to use utilities to access memory beyond the 640 kb limit imposed by DOS.

✓ DOS was designed for 16-Bit CPUs and cannot take advantage of the 32-bit architecture of the 486, Pentium later chips. This forces computers to work at speeds below their capacity.

✓ DOS filenames are limited to eight characters, plus a three –character "extension". Windows 95 and upgrades have remedied this situation by allowing names up to 256 characters long.

✓ Finally, DOS command line interface is more difficult to learn than a well designed GUI.

Microsoft Windows 95 and upgrades:

In 1995, Microsoft released Windows 95, a complete OS and a successor to DOS for desktop computers. Windows 95 is a 32-bit preemptive multitasking OS with a revised GUI. Windows 95 contains a good deal of 16-bit code needed for older DOS applications. Though the 16-bit code may have represented a backward glance, it was probably window 95s greatest making strengths.

Features of windows 95/98/2000:

21. It offers preemptive multitasking.

22. It offers 32-bit processing.

23. It allows users to type file names up to 256 characters and to have spaces in those names.

24. It offers plug-and-play standard for connecting new hardware. Under plug-and-play, you simply connect windows certified device to your computer, and the operating system does everything else to make sure that it works properly with the computer.

25. Its asset is compatibility with networking software.

26. It supports multimedia.

27. It comes with a flexibility where one can personalise/customise as per his own requirements, may it be screen, may it be options.

28. It supports screen savers i.e. whenever no one is using the system for specific time the windows screen saver, which is used to hide the work which is ongoing from others, assuming the user has gone for some work.

29. A powerful help facility is provide which will enable a user to sort out his problems.
30. The file management is very easy process.
31. Searching for specific files is very easy as search facility is provided , which is very powerful.
32. It supports Graphic User Interface. So it is an friend friendly operating system
33. It comes with various tools and utility to enhance the productivity of the users.
34. It has a powerful task manager, so that one can manage various tasks which are running currently.
35. It gives users flexibility to work with multiple windows at the same instance of time ,where one can switch between windows as well as move data within and between windows
36. It comes with a menu, thereby removing the need for the user to remember various commands and options.
37. Most of the windows come with scroll bars, so that one can easily look at the data, by scrolling.
38. Windows have various dialog boxes, which are popped out as and when needed, so that one is relieved of accidental mistakes.
39. It comes with entertainment like games etc.
40. It provides many types of fonts, sizes of fonts, colors , screen appearance etc.

Windows NT/2000 server:

Although Windows95 is considered as successor to DOS Microsoft released Windows NT, a 32-bit OS in 1993. WindowsNT is a high-end OS designed primarily for powerful workstations and network servers.

- Networking and Communications
- Cross-Platform Integration
- Directory Services
- File and Print Services
- Management Services
- Security Services
- Terminal Services

Features of UNIX:

Key features of **Unix** operating system are

10. Multi User/Time Sharing /Multitasking Capacity .
11. Modularity.
12. File Structure.
13. Consistent Peripheral Interface.
14. Security.
15. Redirection of Input-Output and Pipes.
16. Portability.
17. Communication and Networking.
18. Utilities and Software Development Tools.

Multi User/Time Sharing /Multitasking Capacity: UNIX operating system can be used by more than one user at a given instance of time. Various users can log on to the system from different terminals and give commands for getting their work done. When users give commands, they are executed by the UNIX System on time sharing basis, where every user program is given a time slot, known as time slice, after the time slice of a program elapses then the next program gets chance to be executed for its time slice and this continues so that many users can get their jobs executed by the UNIX system.

Multitasking feature of the UNIX allows an user to initiate more than one task from the same terminal.

Modularity: Modularity feature of the UNIX operating system makes it an unique operating system. UNIX operating system is composed of modules, which can be added or removed by the users to fit their needs, without effecting the working of the system. This is very helpful when there is constraint for memory.

File Structure: UNIX follows a hierarchical file structure, which is quite similar to an inverted tree, having the root directory at the top and under it are the files, which expand dynamically. There is no restriction for the number of files or the file size. This hierarchical structure of the file system gives flexibility for the grouping and retrieving files.

Consistent Peripheral Interface: UNIX treats all the peripherals like keyboard, monitor, printer etc. as files, exactly as same as any other files. All the peripheral devices are treated as special device files. As all the files treat the data as the stream of bytes which are unformatted, so are the device files which also work the same way as any other files.

Security: Being a multi user system, there should be special consideration for the security of the data. UNIX provides with different levels of security so that the users need not worry about their data. The security has external and internal levels. At External Levels it maintains security by maintaining the list of the authorised users and their passwords, so that only authorized users can log on to the system. On the internal front it maintains the security by setting permissions for the access of the files and directories.

Redirection of Input-Output and Pipes: All the UNIX commands are such that they take input from the standard input device (key board) and give output to the standard output device (monitor). A user can change the default source of input as well as the default output device, this process is known as redirection of input and output. There is a provision that a commands output can be given as input to other commands, which is done by using pipes.

Portability: This is the ability of the software, which makes it work on different types of machines and platform. UNIX is very portable as it is developed using 'C', a high level language. Only that part of the operating system which depends on the hardware has to be manipulated, so that it works on any other computer with different architecture.

Communication and Networking: UNIX comes with great power for the communication and networking facility. There are several in-built programs, which enable different users to communicate with each other by sending and receiving messages to and from different terminals. There is also provision for interactive conversations. Use of LAN (Local Area Net Work) between the UNIX machines is very popular.

Utilities and Software Development Tools: UNIX comes with more than two hundred utilities, which aid user by providing various facilities like processing text, sorting data, searching etc. One need not write new programs for accomplishing tasks to a great extent.

UNIX comes with several tools that help application developers for developing various softwares. This tools include 'C' Compiler, version control systems, Library management, file processing and syntax analyzer, Debugger, Microprocessor etc.

Above all, the UNIX comes with a unique feature which makes it still popular, it is immune to viruses, i.e., it is not effected by viruses. Thus UNIX, no doubt is a popular operating system.

Translating programs:

Translating programs transform instructions written in humanly convenient form to machine codes required by computers. These translating programs are loaded into the computer where they control the translation process. Compilers and interpreters are used to translate programs to machine language codes.

Interpreter: Interpreter is a special program/software which is used for translating a high-level language program into machine language. The interpreter takes the high-level language program code as input line by line and converts it into machine level language, line by line without producing object code for future use.

If the program needs to be run, then again it has to be interpreted and translated into the machine language. This is an advantage, when the program is modified, but this way of interpreting line by line is bit slow.

Compiler:

A compiler translates a program written in a high level language to executable machine instructions. The compiler treats source-program instructions as data. Each instruction is accessed in turn and translated into one or more lines of object in machine language.

If there are errors in the source program, the error messages are generated by the compiler. These messages explain where the error is and what type of error it was. A compiling run is required before problem data is used to pass computer control to the first program instruction. Program execution then commences.

Programming languages:

A language is a system of communication. A programming language consists of all the symbols, programming languages may be created for a special purpose or they may be general-purpose tools that may be suitable for a many types of applications.

Classification of languages: They classified as

- ✓ Machine language
- ✓ Assembly language
- ✓ High level language

Machine language:

A computer's machine language consists of strings of binary numbers and is the only one the processor directly understands.

When first generation computers were introduced, the programs were in binary-based machine level languages.

Machine language is most basic form of programming and hence explicit instructions are to be given to the machine to perform every operation.

The first part is the command or operation, and it tells the computer what function to perform. Every computer thus has an operation code, or "opcode", for each of its functions. The second part of the instruction is the operand, and it tells the computer where to find or store data or other instructions that are to be manipulated. The number of operands in an instruction varies in computers.

In a two operand machine, the binary representation for "ADD 0184 8672" could cause the value in address 8672 to be added the number in location 0184. The single operand formula is popular in the smallest microcomputers.

Besides having to remember the dozens of code numbers for the commands in machine instruction set, a programmed had to keep track of the storage locations of data and instructions. The initial coding took months and the correction of errors would takes weeks to finish

Advantages:

4. Machine languages make efficient use of storage – language instructions and their storage in computer memory can be controlled.

5. Instructions of a machine language program are immediately executable. They require no compilation or translation steps.

6. Machine-language instructions can be used to manipulate the individual bits in a byte of computer storage.

Disadvantages:

5. Machine languages are machine dependent.

6. Programming in machine language usually results in poor programmer productivity. Due to the level of detail required and the binary code.

7. Computer storage locations must be addressed directly.

8. Machine languages require a high level of programming skill.

Assembly language:

In the 1950's mnemonic operation codes and symbolic address were developed. First introduced in the second-generation computers. The word mnemonic refers to a memory aid. Letter symbols mnemonics was substituted for the numeric machine language operation codes. Each computer now has a mnemonic code although the actual symbols vary among different makes. Machine language is

still used by the computer as it processes data. But assembly language software first translates the specified operation code symbol into machine language equivalent.

Symbolic addressing is the practice of expressing an address not in terms of its absolute numeric location, rather in terms of convenient symbols.

The storage address number of the first program instruction was specified, and the assembly language software then automatically stored all others in sequence from that point. So if instructions were added it was not necessary to modify the address of all the instructions. Instead the processor would automatically adjusts storage locations the next time the program was run.

The **assembler** enables the computer to convert the assembly language instructions into machine language. The set of instructions written by the programmer is the source program. After it has been converted into machine language by assembler it is referred as object code.

Advantages:

While writing in assembly language saves time and reduces the need for detail, fewer errors are made, and those made are easier to find. They are also easier to modify.

Disadvantages:

However coding in assembly language is time consuming. Further they are machine oriented, that is they are designed for a specific make and model of processor. Programs may have to be re-coded for a different machine.

High level languages:

The earlier assembly programs produced only one machine instruction for each source program instruction. A single macro instruction might produce several lines of machine language code. The development of macro instruction and mnemonic techniques led to the development of high-level languages, Which are oriented towards certain specific processing problems, which are application specific like mathematics problems, file processing, scientific applications etc.

The computer cannot understand any other language, other than machine language, therefore the computer is unable to understand the instructions given in High Level Languages. We need to convert these high level language problems into machine language, which has to be taken care by the software.

Advantages:

Easy to Learn: These languages are easy to learn, as they are simple and are modular, which do not require much expertise to learn. These languages use commands and statements which are self explanatory.

Easy to understand: The programs written using these languages are easy to understand, as the statements and syntaxes are self documented. A program written by other programmers can be understood without much difficulty.

Easy to program: These languages usually come with tools, which makes the task of writing programs easy for the programmers. Various constructs are provided which ease complex tasks.

Easy to maintain: These programs are quite easy to maintain, as they can be modified and updated easily. Any one can modify them. We can add new features to the existing programs without rewriting the whole program.

Easy for documentation: The programs written in these languages are highly documentable. When we talk about the statements of the programs, they are almost self documented, and they do not need any further documentation.

Easy Debugging: As the programs are modular, the length of the program is short, which makes the detection and correction of errors (Bugs) easy. Usually, there are compilers, which detect and also correct the bugs (syntactical).

Less time consuming: As there are tools available, the time taken for coding and debugging of programs is quite less in case of high level languages, when compared to the other languages.

Portable: The programs written using these languages on one machine are portable to other machines, which will run with slight changes, that too if needed.

Disadvantages:

Selecting a Programming Language:

A large number of programming languages is available. For solving the problem selecting a suitable language is difficult.

Compilation time:

The process of compilation, required to change high level language to machine code may require more time than a necessary to produce actual answers. Also, each time the source program is modified it has to be recompiled, machine code is so complex and may take a longer time.

Insufficient object code:

Some compilers produce inefficient object code and thus require much longer time during execution. But it requires expert programmers to write efficient object code directly and in most cases modern compilers can do equally good.

Difficulties in debugging:

Errors are not easy to locate and compilers does not provide proper diagnostics and debugging tools.

In ability perform all operations:

It is virtually impossible to perform automatic nature operations, like manipulating individual bits and registers by using high level language and one must resort to machine language to deal with it.

Cost: The cost of the software required for the language to be used for application development as well as the cost of the related tools which make the language complete should be looked into, before choosing a language

Networks

Computers communicate in two main ways: through modems and through networks. Modems enable computers to use telephone lines, cellular connections, or even satellite links to exchange data. Networks connect computers directly, at higher speeds, either through special wiring or by some for of wireless transmission. The process of connecting a computer to a network is known as going online.

Uses of a network:

The word *network* has several definitions. The most commonly used meaning describes the methods people use to maintain relationships with friends and business contacts. Applied to computers, it has a similar definition. A network is a way to connect computers together so that they can communicate, exchanges information, and pool resources.

In business, networks have revolutionized the use of computer technology. Many businesses that used to rely on a centralized system with a mainframe and a collection of terminals now use computer networks in which every employee who needs a computer has one.

In education, schools have also shifted to strategies built around networks. These include local area networks, such as a network that connects the computers and printers in a computer lab, wide area networks-especially the Internet.

Four of the compelling benefits of networks are:

❖ Allowing simultaneous access to critical programs and data

❖ Allowing people to share peripheral devices, such as printers and scanners.

❖ Streamlining personal communication with e-mail.

❖ Making the backup process easier.

Categories of Networks

To understand the different types of networks and how they operate, it is important to know something how networks can be structured. First, there are two main types of networks, distinguished by size. There are local area networks (LANs) and wide area networks (WANs).

Second, either one of these can be classified according to the logical relationships among the computers. There are file server networks and peer-to-peer networks.

LOCAL AREA NETWORKS:

A network of computers located relatively near each other and connected by a cable is a local area network (LAN). A LAN can consists of just two or three PCs connected together to share resources, or it can include several hundred computers of different kinds. Any network that exists with in a single building or even a group of adjacent buildings is considered a LAN.

A LAN permits all the computers connected to it to share hardware, software and data. The most commonly shared resources are disk storage devices and printers. To LAN users, the network is or should be completely transparent, which means that the shared devices on it seems to be directly connected to the user's computer as if they were nearly as if peripherals.

For example, a file server should appear to the LAN user simply as another disk drive.

In addition to shared hardware, LANs can provide all the other benefits of networks including

simultaneous access, enhanced personal communications and easier backup.

WIDE AREA NETWORKS:

Typically, a wide area network(WAN) is two or more LANs that are connected together, generally across a wide geographical area. For example, a company may have its corporate headquarters and manufacturing facility in one city and its marketing office in another. Each site needs resources, data, and programs locally, but it also needs to share data with the other site. To accomplish this feat of data communication, the company should attach a router to each LAN to create a WAN.

The Internet is the ultimate WAN, since it connects many thousands of computers and LANs around the world. Most of the commercial online services and large bulletin roads were not WANs when they started out, because, typically, users dialed into a single computer or a group of computers housed at a single site. However, today most of these systems provide connections to the other specialized services and to the Internet, so they are now more like WANs.

FILE SERVER NETWORKS:

Describing a network as a LAN or a WAN gives a sense of physical area the network covers. However, this classification does not tell anything about how individual computers on a network, called nodes, interact with other computers on the network.

Many networks include not only nodes but also a central computer with a large hard disk that is used for shared storage. This computer is known as the file server, network server or simply server. Files used by more than one user (at different nodes) are generally kept on the server.

One relatively simple implementation of a network with nodes and a file server is a **file server network.** This is a hierarchical arrangement in which each node can have access to the file on the server but not necessarily to files on other nodes. When a node needs information on the server, it request the entire file containing the information. In other words, the file server is used simply to store and forward files.

CLIENT/SERVER NETWORKS:

Another approach for organizing node on a network is called client/server computing, a hierarchical strategy in which individual computers share the processing and storage workload with a central server. This type of arrangement requires specialized software for both the individual node and the network server. It doesn't, however, require any specific type of network. Client/server software can be used for LANs and WANs, and a single client/server program can be used on a LAN where all the other software is based on a simple file server relationship.

Client/server software is valuable to large, modern organizations because it distributes processing and storage workloads among resources efficiently. This means that users get the information they need faster.

Client/server computing is also a commonly used model on the Internet. Users typically have client software that provides an easily used interface for interacting with this giant Wan. Other types of processing, such as receiving, storing, and sending e-mail messages, are carried out by remote computers running the server part of the relevant software.

PEER-TO-PEER COMPUTING:

A third arrangement is a peer-to-peer network, in which all nodes on the network have equal relationships to all others, and all have similar types of software. Typically, each node has access to atleast some of the resources on all other nodes, so the relationship is nonhierarchical. If they are not set up correctly, Windows 95 and its predecessor, windows for workgroups, give users access to the hard disks and printers attached to other computers in the network.

In addition, some very high-end peer-to-peer networks such as networks of UNIX computers allow distributed computing, which enables users to draw on the processing power of other computers in the network. This means people can transfer tasks that take a lot of CPU power-such as creating computer software-to available computers, leaving their own machines free for other work.

Peer-to-peer LANs are commonly setup in small organizations or in schools, where the primary benefit of a network is shared storage, printers and enhanced communication. Where large databases are used, LANs are more likely to include client/server relationships.

A peer-to-peer network can also include a network server. In this case, a peer-to-peer LAN is very similar to a file server network. The only difference them is that the peer-to-peer network gives users greater access to the other nodes than a file server network dose.

NETWORK TOPOLOGIES FOR LANs:

In addition to the size of a network and the relationship between the nodes and the server, another distinguishing feature among LANs is the **topology**- the physical layout of the cables that connect the nodes of the network. There are three basic topologies: bus, star, and ring. Network designers consider a number of factors in determining which topology, or combination of topologies, to use. Among the factors considered are the type of computers currently installed, the type of cabling currently in place, the cost of the components and services required to implement the network, and the speed with which data must travel around the network.

BUS TOPOLOGY:

A bus network, like the bus of a computer itself, is a single conduit to which all the network nodes and the peripheral devices are attached. Nodes on a bus network transmit data at any time, regardless of any data being sent by other nodes. If one set of data happens to collide with another set of data transmitted by other nodes, that is, if two nodes try to send data at the same time, each node waits a small, random amount of time and then attempts to retransmit the data.

Although bus topology is one of the most common, it ha inherent disadvantages. Keeping data transmissions from colliding requires extra circuitry and software, and a broken connection can bring down all or part of the network, rendering it inoperable so that users cannot share data and peripherals until the connection is repaired.

STAR TOPOLOGY:

A star network places a hub in the center of the network nodes. Groups of data are routed through the central hub to their destinations. This scheme has an advantage in that the hub monitors traffic and prevents collisions, and a broken connection does not affect the rest of the network. if the hub is lost, the entire network goes down.

RING TOPOLOGY:

The ring topology connects the nodes of the network in a circular chain in which each node is connected to the next. The final node in the chain connects to the first to complete the ring.

With this methodology, each node examines data that is sent through the ring. If the data is not addressed to the node examining it, that node passes it along to the next node in the ring.

The ring topology has a substantial advantage over the bus topology. There's no danger of collisions because data always flows in one direction. One drawback to the ring, however, is that if a connection is broken the entire network goes down.

THE INTERNET

THE INTERNET:

The Internet is a global system of networked Computers together with their users and data. The system is global in the sense that people from all over the world can connect to it. Also, since the users of the Internet have developed their own culture, they are a defining factor of the Internet. Finally, without the possibility of accessing data or personal information, no one would be excited about connecting to the Internet.

The concept of being able to access the information Quickly & easily to communicate more easily and quickly led to the vision of the Internet. Thirty years ago, information exchange and communication took place Via the backroads i.e. regular postal Mail, telephone call and soon. Today they take place nearly instantaneously over the Internet.

INTERNET HISTORY:

1960's Telecommunications:

Essential to the early Internet concept was packet switching in which data to be transmitted is divided in to small packets of information and labeled to identify to the sender & recipient. The packets were sent over a network and then re-assembled at their destination. If any packet did not arrive, the original sender was requested to resend the packet. In 1969 BBN (Bolt, beranek, Newman Inc.,) designed a network called "ARPANET' (Advanced research projects agency network) for the United States department of defense. Initially only 4 nodes comprised the ARPANET.

The ARPANET later became known as "INTERNET"

1970'S Telecommunications: -

In this decade the ARPANET was used primarily by the military, some of larger companies such as IBM & universities for e-mail. The use of local area Network (LAN) became more prevalent during this period.

The idea of open architecture was promoted. In 1972 the ARPANET was international with nodes in Europe and the number of nodes on the network was up to 23.

1980's Tele Communications: -

In this decade TCP/IP (transmission control protocol / Internet protocol) a set of rules governing how networks making up the ARPANET Communicate was established. For the first time the term Internet was being used to describe the ARPANET. In 1980 the CSNET (computer science network) connected all university computer science departments in the United States.

CSNET joined the APRANET in 1981. The NSFNET (National science foundation networks) was formed to connect N.S.F'S five super computing centers. This allowed researchers to access the most powerful computers in the world. In 1988 the virus called *Internet worm* created by Robert Morris was released. It infected 10% of all Internet hosts. Also in this year, *Internet Relay chat (IRC)* was written by *Jarkko Oikarinen.*

1990's Telecommunications:

During 1990's lots of commercial organization started getting on-line. Graphical Browsing tools were developed, and the programming language HTML allowed users all over the world to publish on what was called the world wide web (WWW). WWW was publicly available in 1992.

In 1993 a Graphical Browser "Mosaic" was released. In 1994 YAHOO, a search engine and directory was developed. In 1995 Java was released by sun Micro Systems

The Way the Internet Works

Network Benefits: - The following are the some of the benefits of Networks in general.

1. Provide convenience :-

    Computer on a Network can backup their files over the Network.

2. Allow Sharing:-

Networked computers can share resources such as disks and Printers.

3. Facilitate Communications:-

Sending & receiving e-mails, transferring Files, and Video conferencing

are examples of how Network promote communication.

4. Generate Savings:-

Net worked computers can provide more computing power for less Money. Several small computers connected on a network can provide as much as or more computing power than a single, large computer and will cost significantly less.

5. Provide Reliability:-

If one part of a Network is down, useful work may will be possible using

a different network path.

6. Simplify Scalability :-

It is relatively easy to add more computers to an existing Network.

Interconnected Networks and Communication

Internet is essentially a network of networks and its success depends upon 'cooperation'. Since no one person, or organization or Government is responsible for the Internet, cooperation among the Networks and Computers that compose the Internet is paramount. This co-operation is accomplished by a common set of protocols.

The protocols that determines how computers connect, Send and receive information on the Internet is Transmission Control protocol / Internet protocol (TCP/IP). TCP permits communication between the various computers on the Internet, while IP specifies how data is routed from computer to computer. TCP/IP is described as the "language of the Internet". In the same way that a common language allows people of diverse backgrounds to communicate

Assuming that TCP/IP Software is installed in the computer, the Information to be sent is split in to IP packets called "Packets for short", and Transmitted over the Internet.

The advantages of Packets are:

1. **Error Recovery: -**

If a packet gets corrupted, only that packet needs to be resent, not the entire message.

2. **Load Distribution: -**

If one area of the Network is congested, Packets can be routed to less busy areas.

3. **Flexibility: -**

If the Network experiences a disruption in one local, packets can be rerouted

In addition to these message pieces, each packet of data also contains information about the computer that sent it, the computer it is begin sent to, a sequence number

Indicating where the packet fits in the overall message, and error checking information to ensure that the packet is not corrupted while in transit. The packets are reassembled after being received at the destination computer. A message is sent from the destination computer to the sending computer to resend any missing or corrupted packets. Using this method, called packet switching, it is not necessary to send the data packets in sequential order, or even over the same network route. If packets arrive out of order, the sequence number can be used to reconstruct the original message. After receiving this message, the destination computer responds either by delivering the e-mail message to the recipient's mailbox or by servicing the request for a web page, as required.

Physical Components:

In additional to the various Software protocols, the Internet includes a host of Physical Components. These components include such items as servers, routers, and networks them selves.

Servers are computers that answer requests for services. A router is a special purpose computer that directs data packets along the network. Routers can detect whether part of the network is down (or) congested and can then reroute traffic.

Networks provide Physical means to transport packets of information.

The following Mediums are employed

1. **Copper wires:** which transmit messages as electrical impulses.
2. **fiber optic Cable :** which use light waves to transmit messages
3. Radio waves, Microwaves, Infrared light and visible light, which carry messages through air.

Network Connections:

Some one connecting to the Internet from home generally uses a modem and a regular telephone line (copper wire) to connect to an Internet service provider (ISP). A second modem at the ISP's end completes the connection, and the slower of the two modem speeds determine the maximum connection speed, usually 28.8 kilobits per second.

The modem is needed to convert from analog to digital and back again. A business organization (or) School Network typically uses Network Interface cards instead of modems to connect the personal computer that are part of their LAN. Another option is an Integrated Services Digital Network (ISDN), which is slightly more expensive, but uses telephone lines and replaces modems with special adapters up to five times faster than a traditional modem.

The ISP's connect to the larger NSP Network through leased-lines from the local telephone companies. To transmit a message over the Internet, TCP/IP divides the message into packets that are sent over the lines and directed via routers to their destination. When the packets arrive at their destination computer, they are reassembled and the destination computer responds to any request.

IP Address:

Each computer and router on the Internet must have a name so that it can be uniquely identified. While the domain name provides a convenient people oriented computer-naming framework that uses symbolic names.

IP addresses are numerical names that uniquely identify each computer on the Internet. An IP address consists of 32 bits (or) four bytes and each IP address consists of a network component and a host component. IP address plays a vital role in the routing of packets over the Internet. Source and destination IP addresses are included in each packet. The network information center (NIC) is in charge of assigning IP address. Each of the four bytes of an IP address can represent a natural number from 0-255. It is common to express IP addresses as four natural numbers separated by dots.

ELECTRONIC MAIL

E-mail is one of the most popular services available through the Internet. In the early days of the Internet, e-mail emerged as an inexpensive and efficient means of communication between researchers, scientists, people in high-tech jobs and those in academia. E-mail is a lot less expensive than a phone call and nearly as fast and like postal mail a message can be easily printed.

E-mail Advantages & Disadvantages:

As in the early days of the telephone, the original users of e-mail only had a limited no of people with whom they could communicate. Now that e-mail is more prevalent, some of the advantages of using it are

1.) **Convenience:** There are no trips to the post office, and no need to search for stationary & stamps. Sending a memo or short note is easy.
2.) **Speed:** E-mail is fast, based on the speed of the underlying communication network.
3.) **Inexpensive:** Once the user is online, the cost of sending a message is small.
4.) **Printable:** A hard copy is easy to obtain.
5.) **Reliable:** although messages are occasionally lost, this is rare. Many mail systems will notify the sender if an e-mail message was undeliverable.
6.) **Global:** People and business all over the world are using e-mail.
7.) **Generality:** E-mail is not limited to text, it allows the transfer of graphics, programs, and even sounds.

Disadvantages:

1) **Misdirection:** It is far more likely that the user will accidentally send e-mail to an unintended recipient than it is for someone actually to intercept the e-mail.
2) **Forgery:** E-mail dose not preclude forgeries, i.e. someone impersonating the sender, since the sender is usually not authenticated in any way.
3) **Overload:** E-mail can also be too convenient and result in a flood of mail.

4) **Junk:** Another negative development involves junk e-mail or unsolicited commercial e-mail.

5) **No response:** a mild frustration sometimes associates with using e-mail is dealing with recipients who do not read and respond to their e-mail on a regular basis.

Userid's passwords and E-mail addresses

Userid: Synonyms for userid are username and account name. User-id is merely the concatenation of the word user and the abbreviation id, standing for identification. User id identifies the user to the computer. In most settings, user ids have some mnemonic meaning. Uppercase or lowercase is normally not significant in e-mail names.

Password: Password is a secret code that authenticates the user to the computer.The user is the only one who knows the password for his computer account, and no one except the user should be able to log on to his account. A good password should

- Be at least five characters long.

- Contain a non alphabetical symbol such as & , % or !

- Contain a number

- Possess uppercase and lowercase letters.

Case is significant is passwords.Modern systems usually keep an individual history file on passwords, so that the user cannot quickly reverse or switch back to a previous password if the system forces to change pas words.

E-mail address:

The basic form of an e-mail address is,

Username @ host name. Sub-domain. Domain.

The text before the @ sign specified the username of the individual. While the text after the @ sign indicates how the computer can locate that individuals mail box. The no of periods or dots varies from e-mail address to e-mail address. Most address have either one or two dots. A given field in an email address, that is a part separated by dots, can be no more than 63 characters long. All fields combined total must be less than 256 characters.

Message components:

The different components of the message are e-mail header, Greeting, text, Signature & body.
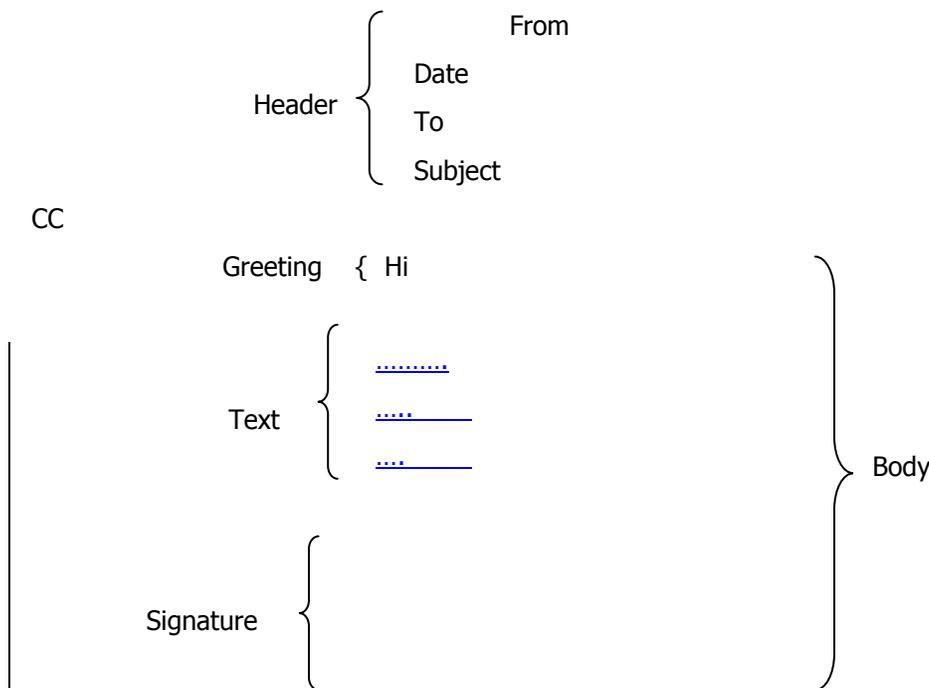
The first five lines of the message are referred to as the e-mail header. Each e-mail client will display slightly different information. The from field indicates who sent the message and when.The subject field provides a hint as to what the message is about. The 'CC' field tells that the message was 'carbon copied' to another user. The opening 'Hi' is called the greeting of the message. More formal messages are addressed like off-line letters and usually begin with 'dear' – the main content is called the text of the message. The greeting, text, and

signature form the body of the message. Most e-mail clients recognize the header and body divisions of e-mail messages.

Message composition:

Composition of an e-mail message may vary from one mail program to another. The basic elements remain the same even if the user is composing e-mail outside the mailer, using a simple text editor.

Structure:

Suppose if the user selects the compose button or command to compose e-mail. The mailer's first field is generally the 'to' field. The user should enter the e-mail address of the person to whom he is sending the message. Rather than going to the 'CC' field to enter other e-mail addresses. Many mailers allow entering a list of names, separated by commas on the line. After entering the 'to' field, the user can specify a file to be attached to the message in the options attachment field. Than the user will be prompted to enter a short description of the message, called the subject the date & time that the e-mail is sent, as well as the users e-mail address. The e-mail address will automatically be filled in by the mailer when the user sends the message. The user will be given the option of sending copies of the message to others when the mailer prompts with 'CC'.

Mailer features:

The best way to learn how to use a mailer effectively is to experiment with it. Most mailers provide functionality for manipulating the mailbox contents, composing messages. And saving messages to disk. A typical mailer opened in a window will contain a series of buttons with names such as compose, copy delete, edit, bile, forward, move, next, reply view and so on.

Compose, file and reply:

A compose button typically provides the following functions

- New   : compose a message from scratch
- Reply   : Reply to the current message.
- Forward   : Pass the message on
- Vacation   : If the user is going away and want automatic responses to be generated, and have e-mail saved.

- **A 'file' button has the following functionality.**

- Save   : Save the current message into a file on disk.
- Insert   : Include a file in the body of the message being composed.
- Exit   : Leave the mailer.
- Open   : open a file from the disk.
- Attach   : Append a file to a message.

The reply button consists of the following items

- To sender
- To all
- Forward
- Include
- Include bracketed

E-mail inner workings:

The three main components mailer, mail server, and mailbox are necessary for the e-mail system to work.

Mailers:

A mailer is also called a mail program or, mail application, or mail client. A mailer is the software that allows to manage, read, and compose e-mail.

Mail servers:

The mail server is a computer whose function is to receive, store, and deliver e-mail. Conceptually, the mail server is always listening for the arrival of new e-mail. If new e-mail arrives for the user, the server keeps track of it. The mailer may be on the same computer that acts as a mail server.

Mail boxes:

An electronic mailbox is a disk file specifically formatted to hold e-mail messages and information about them. The user mailbox is generally created by a systems administrator when the user first establishes his account. The mailbox is private and only the owner can read from it, while everyone else can only send e-mail to it. The mailbox is uniquely identified by the users account name.

<u>Store and forward features:</u>

A mail server needs to be running nearly all the time, waiting for e-mail messages and routing them appropriately. If a mail server crashes or is down for an extend period, e-mail can be lost. Thus, the mail server must be a 7 by 24 machine, i.e. a machine running 7 days a week, 24 hours a day. It is common for PC users to have their inboxes on a very reliable computer on which the mail server is always running. When e-mail arrives, it is saved for the addressee in their inbox until they pick it up by downloading the messages. The save and pick-up processes comprise the store-and-forward function. There is a space limitation on the size of the mailbox. Generally, once this limit is reached, new incoming messages are refused until the space is freed by deleting some messages.

The users rely on post office protocol (POP) to retrieve their e-mail from a remote location. A protocol is a set of rules that computers use for communicating with one another. The following example shows how the store-and forward e-mail process works.

Let us suppose that person A is sending person B an e-mail message. Person A composes the message on his mail client and then selects the send option. The message is routed via simple Mail transfer protocol (SMTP) to person B's server. Once the message arrives, the mail server stores it on disk in an area designated for person B. The disk storage area on a mail server is often called the mailspool, which is the store part of store and forward. Suppose if person B has already logged into his PC when person B sent his message. Person B 's POP client knows how to communicate with person B's mail server. Periodically, It polls the POP server to check if any new e-mail has arrived for person B. In this case, there is a new message from person A. This e-mail is forwarded over the network to person B' PC and stored on the local disk. This is the forward in store and forward.

E-Mail Management

E-mail is a complex communication mechanism with many uses. Here we share a few tips that may be helpful to you. Clearly, you will develop your own e-mail style, but you should not just let it evolve without thought. It is worth spending some time evaluating how you use e-mail and how effective your responses are.

A new e-mail arrival is usually signaled to you by your mailer. If you are already logged on, there may be a beep, which can usually be suppressed if you find it annoying, or perhaps something like an icon of a mailbox with a flag up. If you are just logging on, a note may be printed on the screen that says you have new mail.

When you decide to view your e-mail, your mailer will provide some sort of index of messages, with the subject line displayed. Usually, the messages are numbered in sequence. They might be displayed in either chronological or reverse chronological order. The mailer typically displays the first or current message.

Action Options

If you do not receive a lot of e-mail (say, less than twenty messages per day), it may be tempting to let them "lie around" in your mailbox. However, if the volume of e-mail you receive picks up, either because you find that you really like this method of communicating or because you subscribe to one or more mailing lists, you will need another strategy for dealing with you e-mail.

One recommended strategy, called triage, can be summed up as follows:

1. Skim for the most important messages (from your best friend, boss, and so on).
2. Skim for what you can delete unread.
3. Then work through the remainder.

Another possible strategy, called skim and delete, works as follows:

1. Skim through your mailbox, reading only those messages that are important to you while deleting the rest.
2. If possible, deal with each message immediately and generate a response, if necessary.

3. If the message requires more than a couple of minutes to address, save it for later, if time does not permit handling it now.

    If a message is very important, you should save it. Messages can be stored in folders organized by subject, date, and so on, or they can be saved in your mailbox.

    Naturally, the mileage you get from such strategies will vary. However, it is critical to develop some sort of protocol for dealing with e-mail, especially if you find it becoming a burden.

Vacation Programs:

If you receive a lot of e-mail, you may consider the possibility of configuring a vacation program when you go away for an extended period of time. A vacation program is one that automatically replies to your e-mail. Usually, the program sends a brief reply back to each message you receive. For business purposes, it is customary to include to name and telephone number/e-mail address of someone to contact in your absence. You should be aware that a large number of users despise vacation programs.

Not all vacation programs are created equal. With a good one and the right mailing list server software, things can work very well. Nevertheless, at least think about the points mentioned here before installing such a program.

E-Mail and Business

When working in a business environment that uses e-mail, you should be aware that it is currently legal for an employer to read all company e-mail. Very few companies actually do read employees' e-mail, but you should be aware that they can. A company could maintain backups of all e-mail for a long period of time. If necessary they could go back and review the e-mail messages of an employee. Such backups can also be subpoenaed.

Businesses sometimes use e-mail filters. The filters can work in both directions, to limit either incoming or outgoing e-mail. The filtering mechanism examines each messages e-mail address before deciding whether or not to send the mail on. Business use e-mail filters to restrict with whom their employees can communicate.

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