Vishwendu Vidya Prasarak Mandal's
(Regd. No: MAH 1906 / F-1614; Dt.5/3/1987)
Abhinav Vidyalay & Junior College
(Govt. Regd. No. Prim.Edu. 6-970,90-91 Dtd:16-8-90; Index No: Sec:16.17.019 / 020; H.Sec: J16.17.24)
Contact: +91(0)251 2472232 admin@abhinav.ac.in; www.abhinav.ac.in

IT11_Computer-Fundamentals

(Compiled by Prodipta Soni)

Introduction to Computers:

A computer is a electronic device that is designed and organized to automatically accept , store , process and produce results under the direction of stored programs.

Data are facts and information that are gathered and entered into the computer. Information can be in the form of text, numbers, symbols, sound pictures graphics etc. organized in a meaning way.

A software is a collection of programs to perform some complicated task and a program is a set of logical sequential instructions which tells the computer to to solve some problem.

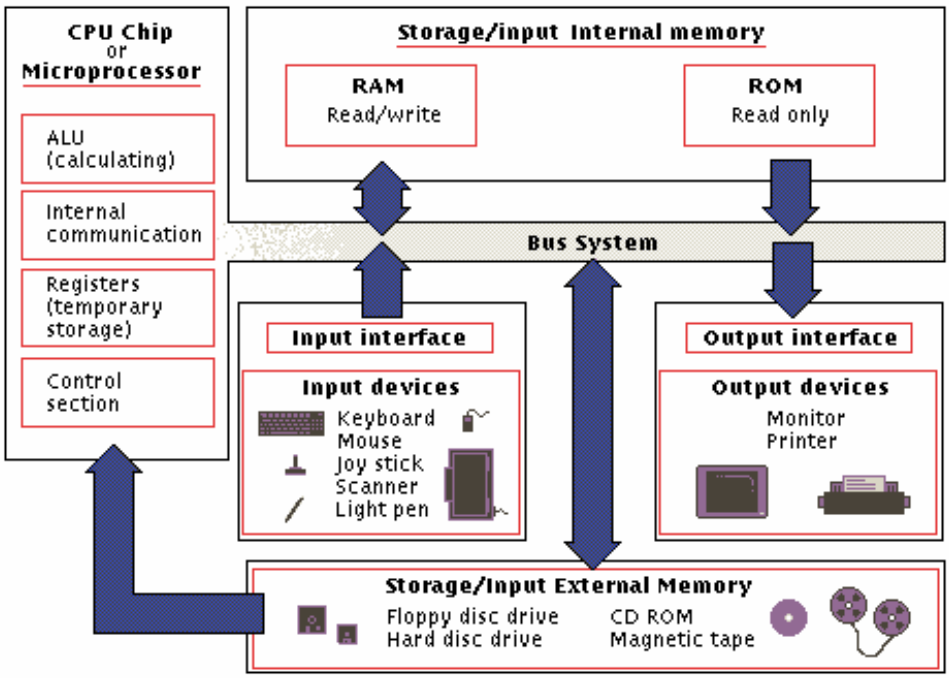
Architecture Of Computers:

System:

A system is a group of integrated parts that have common purpose of achieving some objectives. Since a computer is made up of integrated components that work together for the execution of a certain task it is called a system. All data are processed by a collection of electronic circuits and other devices that make up the computer system. The physical equipments and components, which you can see, touch and feel in the computer system, are called hardware. Like stereo systems, computer systems are built from many components. A digital computer is not a single machine: rather, it is a system composed of five distinct elements: **(1) a central processing unit; (2) input devices; (3) memory storage devices; (4) output devices; and (5) a communications network, called a bus,** which links all the elements of the system and connects the system to the external world.

Computer System

A typical computer system consists of a central processing unit (CPU), input devices, storage devices, and output devices. The CPU consists of an arithmetic/logic unit, registers, control section, and internal bus. The arithmetic/logic unit carries out arithmetical and logical operations. The registers store data and keep track of operations. The control unit regulates and controls various operations. The internal bus connects the units of the CPU with each other and with external components of the system. For most computers, the principal input device is a keyboard. Storage devices include external floppy disk drives and internal memory boards. Output devices that display data include monitors and printers.



Input Devices: These devices enable a computer user to enter data, commands, and programs into the CPU. Input devices include

- The **keyboard**. Information typed at the typewriter-like keyboard is translated by the computer into recognizable patterns.
- The **mouse**, which translates physical motion into motion on a computer video display screen;
- The **joystick**, which performs the same function, and is favoured for computer games;
- The **trackball**, which replaces the mouse on laptops;

- **Scanners**, which "read" words or symbols on a printed page and translate them into electronic patterns that the computer can manipulate and store;
- **Light pens**, which can be used to "write" directly on the monitor screen;
- **Voice recognition systems**, which take spoken words and translate them into digital signals for the computer.
- **Storage devices** can also be used to input data into the processing unit.

Output Device:-

These devices enable the user to see the results of the computer's calculations or data manipulations. The most common output device is the video display unit (VDU), a monitor that displays characters and graphics on a television-like screen. A VDU usually has a cathode ray tube like an ordinary television set, but small, portable computers use liquid crystal displays (LCDs) or electroluminescent screens. Other standard output devices include printers and modems. A modem links two or more computers by translating digital signals into analogue signals so that data can be transmitted via analogue telephone lines.

Central Processing Unit:

The CPU may be a single chip or a series of chips that perform arithmetic and logical calculations and that time and control the operations of the other elements of the system. Miniaturization and integration techniques made possible the development of the microprocessor, a CPU chip that incorporates additional circuitry and memory. The result is smaller computers and reduced support circuitry. Microprocessors are used in personal computers.

Most CPU chips and microprocessors are composed of four functional sections: (1) an arithmetic/logic unit; (2) registers; (3) a control section; and (4) an internal bus. The arithmetic/logic unit gives the chip its calculating ability and permits arithmetical and logical operations. The registers are temporary storage areas that hold data, keep track of instructions, and hold the location and results of these operations. The control section has three principal duties. It times and regulates the operations of the entire computer system; its instruction decoder reads the patterns of data in a designated register and translates the pattern into an activity, such as adding or comparing; and its interrupt unit indicates the order in which individual operations use the CPU, and regulates the amount of CPU time that each operation may consume.

The last segment of a CPU chip or microprocessor is its internal **bus**, a network of communication lines that connects the internal elements of the processor and also leads to external connectors that link the processor to the other elements of the computer system. The three types of CPU buses are: (1) a **control bus** consisting of a line that senses input signals and another line that generates control signals from within the CPU; (2) the **address bus**, a one-way line from the processor that handles the location of data in memory addresses; and (3) the **data bus**, a two-way transfer line that both reads data from memory and writes new data into memory.

Storage Unit:

Computer systems can store data internally (in memory) and externally (on storage devices). Internally, instructions or data can be temporarily stored in silicon RAM (Random Access Memory) chips that are mounted directly on the computer's main circuit board, or in chips mounted on peripheral cards that plug into the computer's main circuit board. These RAM chips consist of millions of switches that are sensitive to changes in electric current.

Static RAM chips hold their data as long as current flows through the circuit, whereas **dynamic RAM (DRAM)** chips need high or low voltages applied at regular intervals—every two milliseconds or so—if they are not to lose their information

Another type of internal memory **(ROM)**consists of silicon chips on which all switches are already set. **ROM** contains instructions or data that can be read but not modified.

The patterns on these ROM (Read-Only Memory) chips form commands, data, or programs that the computer needs to function correctly. RAM chips are like pieces of paper that can be written on, erased, and used again; ROM chips are like a book, with its words already set on each page. Both RAM and ROM chips are linked by circuitry to the CPU.

External storage devices, which may actually be located within the computer housing, are external to the main circuit board. These devices store data as charges on a magnetically sensitive medium such as a magnetic tape or, more commonly, on a disk coated with a fine layer of metallic particles. The most common external storage devices are so-called floppy disks and hard disks, although most large computer systems use banks of magnetic tape storage units.

CD-ROM(compact disc read-only memory), a form of storage characterized by high capacity (roughly 600 megabytes) and the use of laser optics rather than magnetic means for reading data.

Memory Systems (Bits & Bytes) :

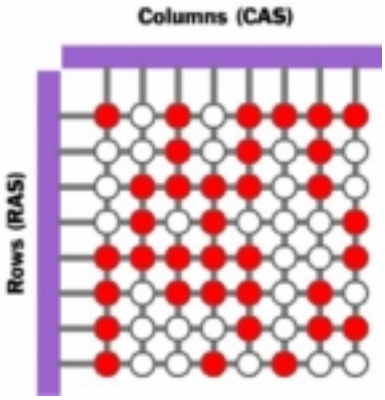
Bits :Computers happen to operate using the base-2 number system, also known as the **binary number system**. The reason computers use the base-2 system is because it makes it a lot easier to implement them with current electronic technology.. So computers use binary numbers, and therefore use **binary digits** in place of decimal digits. The word **bit** is a shortening of the words "Binary digIT." A binary number is composed of only 0s and 1s.

1 bit = smallest unit of storage
8 bits = 1 byte
1024bytes=1KB (Kilo Bytes)
1024KB=1MB (Mega Bytes)
1024MB=1GB(Giga Bytes)

Memory Organization:

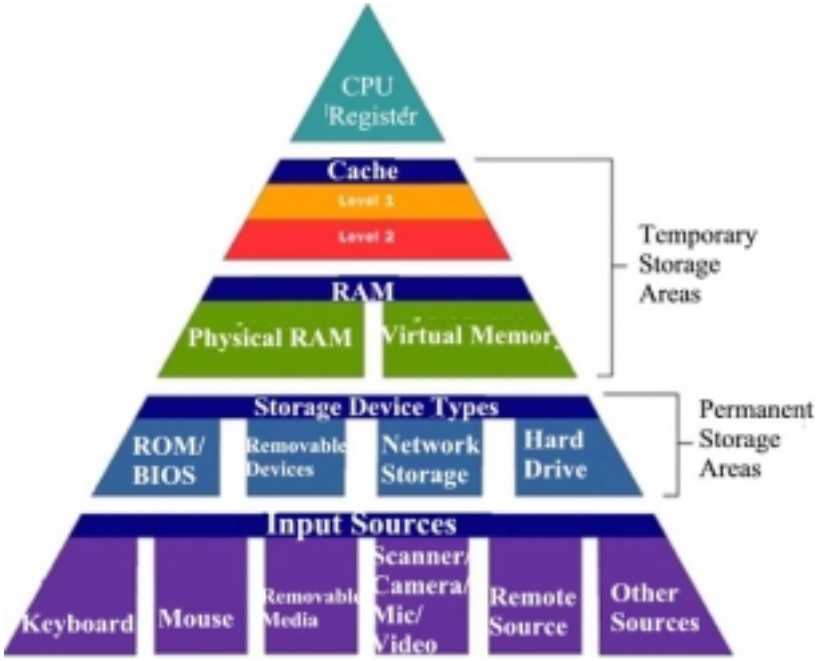
Memory is technically any form of electronic storage

A memory is made up of a large number of cells with each cell capable of storing one bit.Memory cells are etched onto a silicon wafer in an array of columns (**bitlines**) and rows (**wordlines**). The intersection of a bitline and wordline constitutes the **address** of the memory cell.



Memory is made up of bits arranged in a two-dimensional grid.
In this figure, red cells represent 1s and white cells represent 0s.
Memory cells alone would be worthless without some way to get information in and out of them. So the memory cells have a whole support infrastructure of other specialized circuits. These circuits perform functions such as:

- Identifying each row and column (**row address select** [RAS]and **column address select [CAS]**)
- Keeping track of the refresh sequence (**counter**)
- Reading and restoring the signal from a cell (**sense amplifier**)
- Telling a cell whether it should take a charge or not (**write enable**)



Although memory is technically any form of electronic storage, it is used most often to identify fast, temporary forms of storage. If your computer's CPU had to constantly access the hard drive to retrieve every piece of data it needs, it would operate very slowly. When the information is kept in memory, the CPU can access it much more quickly. Most forms of memory are intended to store data temporarily.
As you can see in the diagram , the CPU accesses memory according to a distinct hierarchy. Whether it comes from permanent storage (the hard drive) or input (the keyboard), most data goes in **random access memory** (RAM) first.
Random access memory (RAM) is the best known form of computer memory. RAM is considered "random access" because you can access any memory cell directly if you know the row and column that intersect at that cell.
All of the components in your computer, such as the CPU, the hard drive and the operating system, work together as a team, and memory is one of the most essential parts of this team. From the moment you turn your computer on until the time you shut it down, your CPU is constantly using memory. Let's take a look at a typical scenario
What happens when you turn the computer on.

- The computer loads data from **read-only memory** (ROM) and performs a **power-on self-test** (POST) to make sure all the major components are functioning properly. As part of this test, the **memory controller** checks all of the memory addresses with a quick **read/write** operation to ensure that there are no errors in the memory chips. Read/write means that data is written to a bit and then read from that bit.
- The computer loads the **basic input/output system** (BIOS) from ROM. The BIOS provides the most basic information about storage devices, boot sequence, security, **Plug and Play** (auto device recognition) capability and a few other items.
- The computer loads the **operating system** (OS) from the hard drive into the system's RAM. Generally, the critical parts of the operating system are maintained in RAM as long as the computer is on. This allows the CPU to have immediate access to the operating system, which enhances the performance and functionality of the overall system.
- When you open an application, it is loaded into RAM. To conserve RAM usage, many applications load only the essential parts of the program initially and then load other pieces as needed.
- After an application is loaded, any files that are opened for use in that application are loaded into RAM.
- When you save a file and close the application, the file is written to the specified storage device, and then it and the application are purged from RAM.

In the list above, every time something is loaded or opened, it is placed into RAM. This simply means that it has been put in the computer's **temporary storage area** so that the CPU can access that information more easily.
BIOS:

The **BIOS** is special software that interfaces the major hardware components of your computer with the operating system. It is usually stored on a Flash memory chip on the motherboard, but sometimes the chip is another type of ROM.. The first thing the BIOS does is check the information stored in a tiny (64 bytes) amount of RAM located on a complementary metal oxide semiconductor (CMOS) chip. The CMOS Setup provides detailed information particular to your system and can be altered as your system changes The most important role of the BIOS is to load the operating system

Anatomy of a Computer :

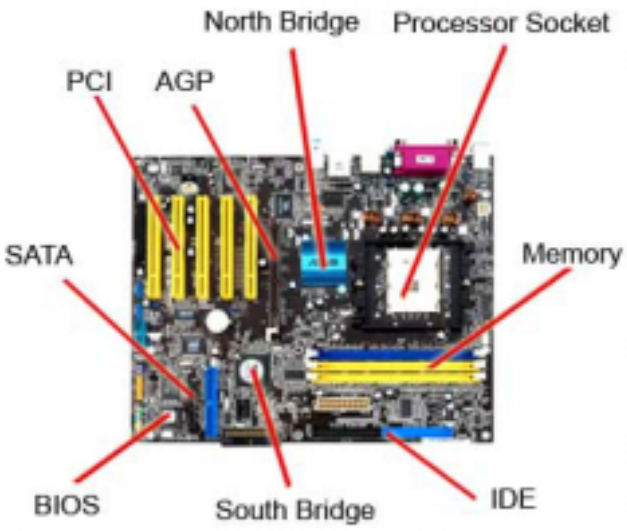
The Motherboard: Motherboard is the main circuit board containing the primary components of a computer system. This board contains the microprocessor, main memory, support circuitry, and bus controller and connector. Other boards, including expansion memory and input/output boards, may attach to the motherboard via the bus connector

A motherboard allows all the parts of your computer to receive power and communicate with one another

The slots and ports found on a motherboard include:

- Peripheral Component Interconnect (PCI)- connections for video, sound and video capture cards, as well as network cards
- Accelerated Graphics Port (AGP) - dedicated port for video cards.
- Integrated Drive Electronics (IDE) - interfaces for the hard drives
- Universal Serial Bus or Firewire - external peripherals
- Memory slots

Some motherboards also incorporate newer technological Advances



A modern Motherboard

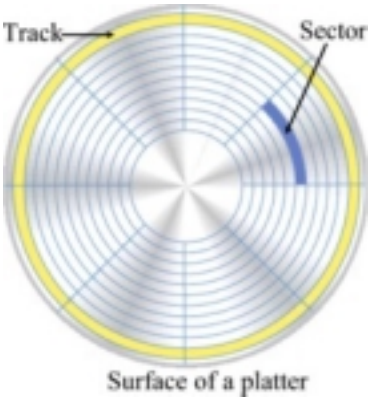
Data Storage

A Disk, is a round, flat piece of flexible plastic (floppy disk) or inflexible metal (hard disk) coated with a magnetic material that can be electrically influenced to hold information recorded in digital (binary) form. A disk is, in most computers, the primary means of storing data on a permanent or semi-permanent basis.

Hard Disk:

The inside of a hard disk displaying the read/write head traveling over the platters.

Hard disks are used to record computer data magnetically.
A hard disk uses rotating platters (disks) to store data. Each platter has a smooth magnetic surface on which digital data is stored. Information is written to the disk by applying a magnetic field from a read-write head that flies very close over the magnetic surface. The magnetic medium (film) on the disk surface changes its magnetization in microscopic spots (bits) due to the head's write field. The information can be read back by a magnetoresistive (MR) read sensor. A typical hard disk rotates at 3,600 revolutions per minute, and the read/write heads ride over the surface of the disk on a cushion of air 10 to 25 millionths of an inch deep

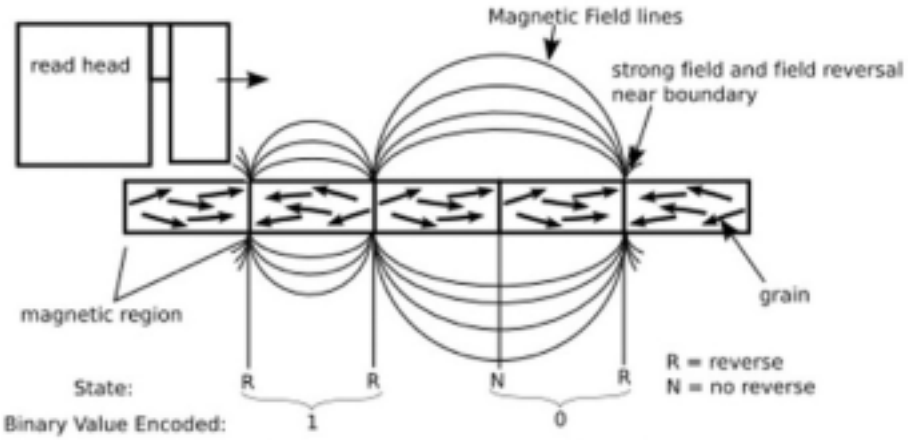


Surface of a platter

Data is stored on the surface of a platter in **sectors** and **tracks**. Tracks are concentric circles, and sectors (A subset of a track)are angular blocks of the disk.. A sector contains a fixed number of bytes -- for example, 256 or 512. Either at the drive or the operating system level, sectors are often grouped together into **clusters**. The process of **low-level formatting** a drive establishes the tracks and sectors on the platter. The starting and ending points of each sector are written onto the platter. This process prepares the drive to hold blocks of bytes. **High-level formatting** then writes the file-storage structures, like the file-allocation table, into the sectors. This process prepares the drive to hold files.

.

The magnetic surface in the hard drive is divided into small magnetic regions, representing a single binary unit of information. Each of these magnetic regions is further subdivided into a few hundred magnetic grains. Each grain is considered to be a single magnetic domain. Each grain will thus be a magnetic dipole which points in a certain direction, creating a magnetic field around it. All of the grains in a magnetic region are expected to point in the same direction, so that the magnetic region as a whole also has a magnetic dipole moment and an associated magnetic field.

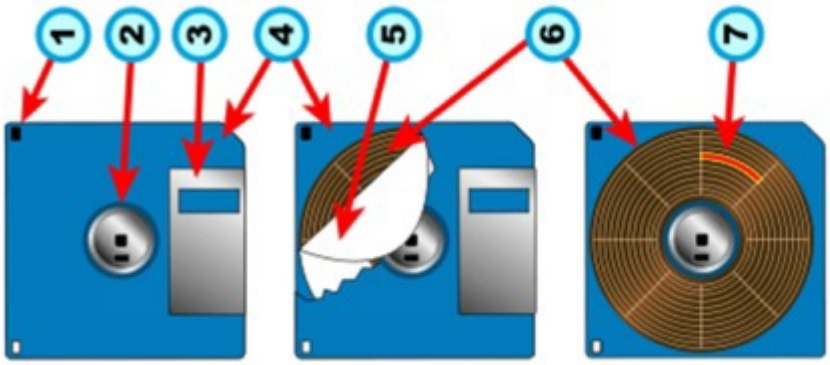


The magnetic surface and how it operates

The data is encoded through the change in magnetization at a region boundary. If the magnetization reverses between two magnetic domains, this signifies one state, while no change in magnetization signifies the other state.. At a boundary where the magnetization reverses, magnetic field lines will be dense and perpendicular to the medium. The read head is designed to detect these changes.

Floppy Disk :

A **floppy disk** is a data storage device that is composed of a disk of thin, flexible ("floppy") magnetic storage medium encased in a square or rectangular plastic shell. Floppy disks are read and written by a **floppy disk drive.** The tracks in a floppy disk are arranged in **concentric rings** so that the software can jump from "file 1" to "file 19" without having to fast forward through files 2-18. The diskette spins like a record and the heads move to the correct track, providing what is known as **direct access storage**.

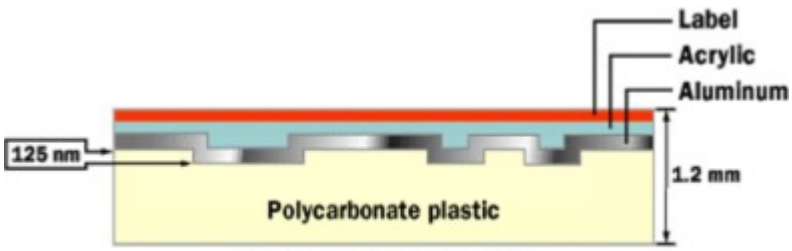


The basic internal components of a 3½-inch floppy disk:
1. Write-protect tab
2. Hub
3. Shutter
4. Plastic housing
5. Paper ring
6. Magnetic disk
7. Disk sector.

Data is stored on a floppy disk by the disk drive's read/write head, which alters the magnetic orientation of the particles. Orientation in one direction represents binary 1; orientation in the other, binary 0. Depending on its capacity, such a disk can hold from a few hundred thousand to over one million bytes of data

Compact Disk :

A Compact Disc (CD) is an optical disc used to store digital data, originally developed for storing digital audio.A CD is a fairly simple piece of plastic, about four one-hundredths (4/100) of an inch (1.2 mm) thick. Most of a CD consists of an injection-molded piece of clear polycarbonate plastic. During manufacturing, this plastic is impressed with microscopic bumps (pits)arranged as a single, continuous, extremely long spiral track of data. . Once the clear piece of polycarbonate is formed, a thin, reflective aluminum layer is sputtered onto the disc, covering the bumps.



Cross-section of a CD

Then a thin acrylic layer is sprayed over the aluminum to protect it. The label is then printed onto the acrylic. A cross section of a complete CD (not to scale) looks as shown

Looking through the polycarbonate layer at the bumps, they look something like this:

CD data is stored as a series of tiny indentations (*pits*), encoded in a tightly packed spiral track of pits moulded into the top of the polycarbonate layer. The areas between pits are known as 'lands'. Each pit is approximately 100 nm deep by 500 nm wide,
A CD is read by focusing a 780 nm wavelength semiconductor laser through the bottom of the polycarbonate layer. The difference in height between pits and lands leads to a phase difference between the light reflected from a pit and from its surrounding land. By measuring the intensity with a photodiode, one is able to read the data from the disc. The pits and lands themselves do not represent the zeroes and ones of binary data. Instead a change from pit to land or land to pit indicates a one, while no change indicates a zero.

Computer Peripherals:Inside the PC

Working of the Keyboard :

Pressing a key causes a change in the amount of current flowing through a circuit associated specifically with that key. The microprocessor of the keyboard (A microprocessor built into the keyboard , such as the intel 8048,genetates a number called Scan Code. There are two scan codes for each key one for when the key is pressed and the other for when it is released) built into detects the increase or decrease in current from the key that has been pressed and generates a scan code. It stores the scan code in the memory buffer (The memory buffer is a small set of memory cells that store the scan codes) where it can be read by the computers BIOS Basic Input Output System). The processor also sends a interrupt signal to the CPU which tells it to stop processing for a moment and divert its attention to the service requested.
The **BIOS** reads the scan code from the keyboard buffer and sends a signal that tells the keyboard it can delete the scan code from its buffer. The BIOS converts Scan codes into ASCII characters, then writes them into the queue buffer in the systems memory
The ASCII code is retrieved by the operating system of application software as soon as any current operation is finished.

Working of the Mouse :

The concept of a pointing device, something a computer user could move by hand, causing a corresponding movement on screen, led to the development of the mouse. *The "mouse" is an input device,* with one, two, or three buttons that allows you to point to and select items on the monitor screen. It is called a mouse because of its small size and long "tail". It is small enough to fit comfortably under the palm of your hand, and its 'tail" is the cable that connects it to the PC. The mouse was developed as a means of operating in the GUI (Graphic User Interface) environment, dictated by the high level of physical activity that is required to work within such a system.
The mechanical mouse uses a rubber coated metal ball, located in the center of two different rollers. As you move a mechanical mouse by dragging it across a flat surface, a ball made of rubber or rubber over steel protruding from the underside of the mouse turns in the direction of the movement.
Signals are send to the PC over the mouse's tail-like cable. windows converts the number, combination, and frequency of signals from the two encoders into the distance, direction, and speed necessary to move the onscreen cursor.
Tapping either of the buttons atop the mouse also sends a signal to the PC, which passes the signal to the software. based on how many times you click, and the position on the screen pointer at the time of the click, the software performs the task you want to accomplish.
As the ball rotates , it touches and turns two rollers mounted at a -degree angle to each other. one roller responds to back-and-forth movements of the mouse, which correspond to vertical movements on screen. the other roller senses sideways movements, which correspond to side-to side movements onscreen.

Monitors :

The visual display unit (VDU), also called Monitors are standard output devices. The information appears on the screen as and when it is entered from any of the input devices and after it is processed. The Cathode ray Tube and the display adapter determine features like the number of colours possible and the graphic capabilities. A maximum of 24 to 25 rows and 80 columns per row of information can be displayed in the Text mode

How is an image is formed on the screen:

The CPU sends the data to the monitor in the form of electrical signals , which in turn converts them into Visual Images, to be seen on the screen.
The monitor consists of a Cathode Ray Tube (CRT), which acts as its main component. It consists of the following sub-parts - 1) Electron Gun 2) Magnetic Deflection Yoke 3) Shadow Mask 4) Phosphorus Screen.
1) Electron Gun: - Each electron guns shoots out a stream of electrons, one stream for each of the three primary colors.
2) Magnetic Deflection Yoke: - It uses electromagnetic fields to bend the path of the electrons. This helps in focusing and aiming the electron beams to all the parts of the screen.
3) *Shadow Mask:* - The beam is made to pass through holes in a metal plate called a shadow mask. This helps in keeping the electron beams focused when they reach the screen.

4) *Phosphorus Screen:* - On the inner side of the screen we have a coating of phosphor. This element has the property of phosphorescence (the element glows when struck by a beam of electrons) In the monitor three different phosphor materials are used - one each for Red, Blue and Green. The stronger the electron beam, more light the phosphor emits. If each Red, Blue and Green dot in an arrangement is struck by equally intense electron beams, the result is a dot of white light. To create different colors, the intensity of each of the three beams is varied. In this manner we get a dot of coloured light on the screen using three electron beams. To illuminate the whole screen, the same electron beams are used by deflecting them to all parts of the screen (dots on the screen). These dots are called Pixels (Picture Elements), which together make up an image / Picture on the screen. To illuminate all the Pixels on the screen, the electron beam is deflected to all parts of the screen. This is known as Raster Scanning. The "sharpness" of a monitor is determined by its "dot-pitch". Dot-pitch is a term used to describe the distance in millimeters between like-colored pixels on the monitor's screen. It has a direct effect on the clarity of the image the monitor is capable of displaying - the smaller the dot-pitch,the sharper the image. Most good VGA and SVGA monitors have a dot-pitch of .28mm. A dot-pitch rating higher than this (.31mm or .36mm for example) is usually the sign of a low quality monitor.

Output Devices - Printers :

The printer is the most commonly used output device. The output data is obtained on the paper through the printer. It is called *hardcopy*..Printers are classified as of two types based on their working. Namely, Impact Printers and Non impact printers Examples for *Impact printers are Dot matrix printers, Daisy wheel printers. Laser printers and Inkjet printers are nonimpact printers.*

Working of Impact Printers:

The PC sends the data to be printed and details that control the font, size, etc. to the impact printer in the form of 0s and 1s.These characters are stored in the printer's memory known as buffer till they are printed.

The processor takes these characters in the memory and are printed in the form of dots from right to left.

Dot Matrix Printer : The characters are produced by a series of pins arranged vertically which strike an inked ribbon against the paper. Each character is produced within a pre-defined matrix of dots. The speed may vary from 180 characters per second to 380 characters per min. it can also print pictures.

Working of Non Impact Printers :

The information is sent to the printer in the same way as in the case of an impact printer.

The main difference in printing is the way in which the data is printed. The non impact printer consists of spraying of ink from the cartridge which falls on the printing area and small dots are formed to make the character to be printed.

Inkjet : The print head of an inkjet printer form characters by spraying a very fine jet of magnetically or electrically charged ink through a nozzle and our horizontal and vertical deflectors. The deflectors enable the printer to vary the direction of the ink spray. They work at speed of 1-2 pages per min.

Laser printer : It uses a laser beam to write characters on a rotating drum that is electronically charged. The drum generates a paper copy in a manner similar to a Xerox copier. The speed varies form 6 to 120 pages per min. They can also print graphics in different colors.

Communications with Peripherals:

Scanner :

Scanner is an input device. Scanners are the eyes of your your personal computers.They allows a PC to convert a drawing or photograph into code that a graphics or desktop publishing program can use to both display the image on the screen and reproduce the image with a graphics printer. Or a scanner can let you convert printed type into editable text with the help of optical character recognition (OCR) software .Scanners are mainly used for scanning pictures, images and photos form the magazine, newspaper, books etc.There are 3 basic types of scanners, they are , *flat bed scanner, drum scanner and sheetfed scanner*.

Flat bed Scanner :

It consists of a light source; a charge coupled device array, a lens and one or more analog to digital converter to collect the optical information about the object to be scanned.

CIS (Contact Image Sensor) is a relatively advanced technology used for the flat bed scanners. It has a single chip that can handle many data processing functions. This type of technology gives good quality of scanning image.

Drum Scanner :

It is higher resolution scanner than that of the flat bed scanner. It uses photo multiplier tubes and other sensitive devices that can capture the high-resolution images. This type of scanner can also capture shadow information that cannot be visible to the human eyes. The operating speed of such scanner is very low as compared to the flat bed scanner. This scanner is useful for scanning transparencies.

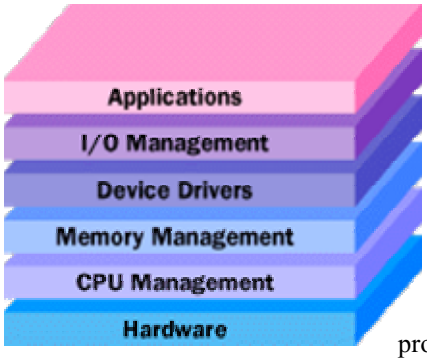
Sheetfed Scanner :

It is small in size and hence takes less desk space. In this type of scanner, tiny rubber wheels pull the paper over the scan head. During this type of operation there is a possibility of crooked scan. It is not possible to get the optimal scan using this type of printers.

Introduction to Operating Systems :

An Operating System is defined as a set of system programs that control and coordinate the operation of a computer system An *operating system* is a program that acts as an intermediary between a user of a computer and the computer hardware. The purpose of an operating system is to provide an environment in which a user can execute programs. The primary goal of an operating system is thus to make the computer system convenient to use. A secondary goal is to use the computer

hardware in an *efficient* manner.
An operating system is an important part of almost every computer system. A computer system can be divided roughly into 4 components : the hardware, the operating system, the applications programs, and the users.
The hardware - the central processing unit (CPU),the memory, and the input/output(I/O) devices - provides the basic computing resources. The application program - such as compilers, database systems, games, and business programs - define the ways in which these resources are used to solve the computing problems of the users.
The operating systems controls and coordinates the use of hardware among the various application programs for the various uses.
The operating system's tasks, in the most general sense, fall into six categories:



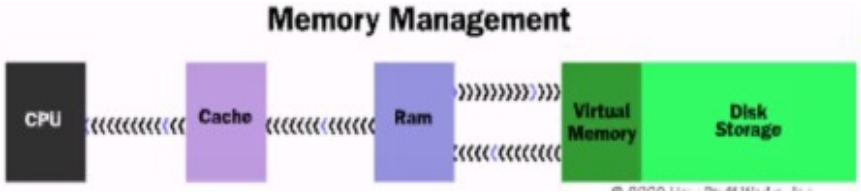
- Processor management
- Memory management
- Device management
- Storage management
- Application interface
- User interface

We can view an operating system as a *resource allocator*.A computer system has many resources (h/w and s/w) that may be required to solve a problem: CPU time, memory space, file storage space, I/O devices and so on. The operating system acts as the manager of these resources and allocates them to specific programs and users as necessary for tasks. Since there may be many requests of resources , the operating systems decide which requests are allocated resources to operate the computer system efficiently and fairly.
It is easier to define operating systems by what they *do* than by what they *are*. The primary goal of an operating system is *convenience for the user*. Every operating system has a *kernel* or a *nucleus* which permanently resides in the main memory of a computer to perform some of the basic functions of OS and to access other portions as and when they are needed. The remaining parts of an OS are normally stored in a disk ready to be loaded into the main memory when required and ordered to do so by the kernel.
Following are the services which are provided for the convenience of the programmer , to make the programming task easier.
1) Processor Management : *Windows XP* and *UNIX* can have dozens of background processes running to handle the network, memory management, disk management, virus checking and so on.
A process, then, is software that performs some action and can be controlled -- by a user, by other applications or by the operating system.
It is processes, rather than applications, that the operating system controls and schedules for execution by the CPU.
The heart of managing the processor comes down to two related issues:

- Ensuring that each process and application receives enough of the processor's time to function properly.
- Using as many processor cycles for real work as is possible.

The basic unit of software that the operating system deals with in scheduling the work done by the processor is either a **process** or a **thread**, depending on the operating system. Even if the operating system is the only software with execution needs, the CPU is not the only resource to be scheduled. Memory management is the next crucial step in making sure that all processes run smoothly.
2) I/O operations : A running program may require I/O.This I/O may involve a file or an I/O device.For specific devices ,special functions may be desired. For efficiency and protection ,users usually cannot control I/O devices directly. Therefore the operating system must provide some means to do I/O. Managing input and output is largely a matter of managing queues and buffers, special storage facilities that take a stream of bits from a device, perhaps a keyboard or a serial port, hold those bits, and release them to the CPU at a rate slow enough for the CPU to cope with. This function is especially important when a number of processes are running and taking up processor time. The operating system will instruct a buffer to continue taking input from the device, but to stop sending data to the CPU while the process using the input is suspended. Then, when the process needing input is made active once again, the operating system will command the buffer to send data. This process allows a keyboard or a modem to deal with external users or computers at a high speed even though there are times when the CPU can't use input from those sources.
3) Memory Storage and Management: When an operating system manages the computer's memory, there are two broad tasks to be accomplished:

1. Each process must have enough memory in which to execute, and it can neither run into the memory space of another process nor be run into by another process.
2. The different types of memory in the system must be used properly so that each process can run most effectively.



The first task requires the operating system to set up memory boundaries for types of software and for individual applications. When applications begin to be loaded into memory, they are loaded in block sizes determined by the operating system. These blocks and boundaries help to ensure that applications won't be loaded on top of one another's space by a poorly calculated bit or two. A processor can only access memory one location at a time, so the vast majority of RAM is unused at any moment. Since disk space is cheap compared to RAM, then moving information in RAM to hard disk can greatly expand RAM space at no cost. This technique is called ***virtual memory*** management. So The operating system must balance the needs of the various processes with the availability of the different types of memory, moving data in blocks (called pages) between available memory as the schedule of processes dictates

4) **Device Management:** The path between the operating system and virtually all hardware not on the computer's motherboard goes through a special program called a driver. Much of a driver's function is to be the translator between the electrical signals of the hardware subsystems and the high-level programming languages of the operating system and application programs. Drivers take data that the operating system has defined as a file and translate them into streams of bits placed in specific locations on storage devices, or a series of laser pulses in a printer.

5) Error detection : The OS constantly needs to be aware of possible errors.Errors may occur in the CPU and memory hardware ,in I/O devices or in the user program. For each type of error ,the operating system should take the appropriate action to ensure correct and consistent computing.

6) Resource allocation : When there are multiple users or multiple jobs running at the same time, resources must be allocated to each of them. Many different types of resources are managed by the operating system. Some may have special allocation code, whereas others may have much more general request and release code. For instance ,in determining how best to use the CPU ,operating systems have CPU-scheduling routines that take into account the speed of the CPU,the jobs that must be executed, the number of registers available and other factors.

There are 2 types of operating systems:

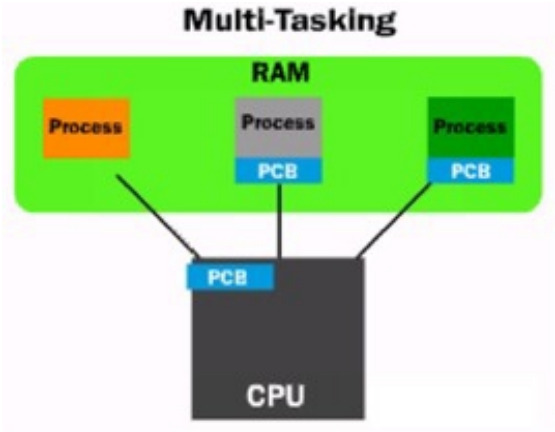
1) *Single user operating system* and 2) *Multi user operating system*

Single User OS : It caters the needs of one user at a time. Most of the single user OS have CUI(Character User Interface) features, as it only allows the commands to be typed in rather than clicking on the icons to perform or execute the corresponding program.E.g. DOS

Multi User OS : It entertains more than one user at a time taking care of all the operations in the respective machines. It supports both the CUI and GUI features E.g. Novel Netware OS,UNIX,Solaris and Windows 2000 Server.

Multi user operating system works in 4 different ways as :

Multasking OS : The OS which monitors multiple task simultaneously with in the stipulated time with perfection is referred as a Multitasking OS.E.g Windows NT,Linux,SCO Unix.



Timesharing OS : In a large network (mostly server centric) the server is equipped with this kind of OS which attends the request from the individual nodes in a time bound manner. The approach of the server to the request made by the individual node referred as a Round Robin League.E.g.Unix,Linux,Solaris,Windows NT.

A time shared operating system allows a user to interact with the computer and it facilitates program development. The response time of a good computer system to users' requests is of the order of 1or 2 seconds. The availability of large disk storage in such systems makes it feasible to store large volumes of data and to retrieve them fast. This facility is very useful in implementing systems such as an airline reservation system. In such a system ,the response time should be very short because a customer's reservation to be done while he waits.

**Time-sharing* systems were developed to provide interactive use of a computer system at a reasonable cost.A time-shared operating systems uses CPU scheduling and multiprogramming to provide each user with a small portion of a time-shared computer.It allows the many users to *share* the computer simultaneously. Since each action or command in a time shared system tends to be short ,only a little CPU time is needed for each user.

Real-Time OS: There are applications in which a computer is expected to control the operation of a physical system. For example, a satellite in orbit may be controlled by a computer. The position,velocity,acceleration and spin information of the satellite may be fed to a computer which may be programmed to compute the orbit and give instructions to rocket motors to correct the orbit. In such an application the operation is in "*real* time", that is, the control has to be exercised during the actual functioning of the system. Any delay beyond that specified for control would be disastrous.Real time OS have to work within strict time limits for critical jobs. Critical jobs are locked in memory and receive the highest priority.

**A real-time system is used when there are rigid time requirements on the operation of a processor or the flow of data ,

and thus often used as a control device in a dedicated application.A real-time task cannot be kept waiting indefinitely for the kernel to run it.

Distributed OS :

The distributed operating system supports the distributed computing environments which consists distributed databases system .This OS coordinates the activities occurring on remote terminals. Example: IBM OS/2.

It improves the performanance of the data mines by providing the proper dead locks.

Interface :

An Interface can be defined as a link between the user and computer. It is a medium and format through which the user communicates with the computer. In actual fact we were communicating with the computer through the Dos. Interface are classified into two:

1) Character User Interface (CUI): - Character User Interface uses characters to help the user to communicate with the computer. DOS is a good example of CUI. To give any command in DOS we have to type it at the DOS prompt.

2) Graphic User Interface (GUI): - Graphic User Interface uses pictures, diagrams and graphics rather than characters, which helps the user to communicate with the computer. It follows the principles of "one picture is worth a thousand words". E.g. Windows

The Windows Operating System: - *Microsoft Windows is a Graphic User Interface* based Operating system. Which is a successor to the Disk Operating Syatem.

Why the name "Windows": - Any application you run in windows will be displayed in a rectangular area, and that is why it is named "Windows". The look or interface of any Windows application is very much common.

An O/S comes in various versions. Windows also have different versions as it is got developed.

Features of Windows: -

i) Can do all DOS's tasks like creating, renaming, deleting folders or directories, copying, moving files, formatting disk etc. No need to remember commands.Nowadays Windows comes with DOS was integrated within it.

ii) Run different programs in multiple windows.

iii) Can interchange data between different applications through the facility of clipboard.

iv) Do all advanced jobs like sending a fax, link up to an outside information service company through terminal etc.

Desktop: - The Desktop is the large blank area along with some system standard icons as shown in the screen. You can customize the Desktop by adding your applications on the desktop in the form of icons.

Desktop Icons: - Icon is a small graphic symbol that represents an image on console. The common desktop icons are My Computer, Network Neighborhood, Recycle Bin, Internet Explorer etc. We can open the application by double-clicking it.

Taskbar: - The taskbar is the bar on your desktop that includes the '**Start**' button. Buttons representing programs currently running on your computer appears on this bar.Taskbar can also be used to switch between two or more applications.

Taskbar Clock: - We can have a Clock on the right bottom of the taskbar. We can change the Time as well as Date of our system. Windows uses the time setting to identify when files are created and modified.

Start Button: - Most of the processes in Windows are performed with the 'Start' Button. It is generally appears at the bottom left corner of the screen. We can get Sub-Menu after clicking on Main Menu 'Start' like Programs, Documents, Settings, Find, Run etc.

Let us see the Sub-Menu of the 'Start' Button: -

'Start' Buttons Sub-Menu	**Description**
Programs	The software installed on your computer
Documents	The recently opened or used Documents
Settings	To personalize the settings of system
Find	To search the files/folders saved on your system
Run	To start the program after specifying the correct path.

Introduction to Control Panel: -

Control panel is a tool to control or manage all the hardware and at the same time to personalize your computer. Some of the options available with control panel are: -

Name	**Description**
Date/Time	Changes date, time and time zone information.
Display	Changes Display Settings.

Accessories: -

'Accessories' is one of the groups created by default in Programs option. This group contains a set of program items used for the following purposes: -

Programs	**Uses**
Paint	For making bitmaps
Calculator	For standard and scientific calculations
Notepad	For creating simple (unformatted) text
Word Pad	For creating formatted documents/letters
Clipboard Viewer	For copying text from a window

Windows Explorer: -

'Windows Explorer' is a tool used for listing files present on your hard disk or on the floppy disk (if you have a floppy drive with a floppy disk in it) or on the CD (if you have CD-Drive with a CD in it). Explorer displays drives, available folders and files in a single window in which you can navigate. Windows Explorer as you notice displays two columns. The left hand side column is titled 'All Folders'. This displays a list of all the folders available on your hard disk. The right hand side column is titled as 'Content of (C:)'. By default, Explorer displays the names of the folders both the columns. However, when you click on any folder in the left hand side column, Explorer will display the content of that folder in the right column.

File: - A named collection of information stored on a disk, usually contains data, graphics or a program.

File Name: - Any name given to information saved on a disk. A filename may be as long as 255 characters and may include a three letter extension, such as CYBERPANET.TXT etc.

Folder/Directory: - A container that allows any collection of objects to be grouped, for example, a set of text files.

FUTURE DEVELOPMENTS

One continuing trend in computer development is microminiaturization, the effort to compress more circuit elements into smaller and smaller chip space. For example, in 1999, scientists developed a circuit the size of a single layer of molecules, and in 2000 IBM announced that it had developed new technology to produce computer chips that operate five times faster than the most advanced models to date. Also in 2000, scientists discovered a way to transfer information on an atomic level without relying on traditional wires or circuits.. Researchers are also trying to speed up circuitry functions through the use of superconductivity, the phenomenon of decreased electrical resistance observed in certain materials at very low temperatures. As the physical limits of silicon-chip computer processors are being approached, scientists are exploring the potential of the next generation of computer technology, using, for instance, devices based on deoxyribonucleic acid (DNA).

The "fifth-generation" computer effort to develop computers that can solve complex problems in ways that might eventually merit the description "creative" is another trend in computer development, the ideal goal being true artificial intelligence. One path actively being explored is parallel processing computing, which uses many chips to perform several different tasks at the same time. Parallel processing may eventually be able to duplicate to some degree the complex feedback, approximating, and assessing functions of human thought. One important parallel processing approach is the neural network, which mimics the architecture of the nervous system. Another ongoing trend is the increase in computer networking, which now employs the worldwide data communications system of satellite and cable links to connect computers globally. There is also a great deal of research into the possibility of "optical" computers—hardware that processes not pulses of electricity but much faster pulses of light.

Source of information:
Microsoft ® Encarta ® Encyclopedia 2003.
http://computer.howstuffworks.com
http://en.wikipedia.org