Chapter-1 Introduction to Computers

Basics of Computers

- **What is Computer?**

The word "Computer" comes from the word "Compute" which means to calculate. Even Most people know that a computer is a fast calculator, but it is more than that. To answer the question in one word, "A computer is a machine". Is it? Yes, but it is not complete definition. Computer may be defined as:

"A machine which is able to accept data in a prescribed form, process the data and supply the results of the processing in a specified format as information or as signals for controlling automatically some further machine or process."

- **Application Areas of computers**

The computer is a truly amazing machine. Few tools let you do so many different tasks as computers do. Computers have made their presence felt in the following areas:

1. Telephone / Electricity bills that we receive in our homes every month, are generated on the computer.
2. Telephone complaints are entered through computer to have good control.
3. Railway, Travels and airline tickets for various places can be booked from different places.
4. Most colleges / universities have computerized the process of collecting examinations marks for printing the mark sheets.
5. Banks use computers to make their job of keeping accounts much easier. This process also helps them to give better customer service.
6. Newsreaders keep computer terminals on their desk to receive urgent and important news.
7. Hotel room bookings are done on the computer. This enables the person dealing with bookings to get quick information on the availability of rooms.
8. In business, computers have become very crucial that we can't even think how we will be able to survive without them.
9. In medicine today, computers are used for everything from diagnosing illness to monitoring patients during surgery.
10. Musician and singers have teamed up with computers to create an amazing range of instruments and sounds simply by playing from keyboard
11. Apart from all these areas, there are offices and organizations that use computers to increase their productivity and profits.

The uses of computer presented above are just a fraction of the actual task that this magic machine has been used for. Some other areas are:

- In space technology.
- In the field of medical research.
- In industrial research.

Advantages/Characteristics of Computers

Computers are not just adding machines; they are capable of doing complex activities and operations. They can be programmed to do complex, tedious and monotonous tasks.

1. **Automatic:**

   Computer is start by itself without human inference. It start the booting procedure itself when power is on by the user. In booting process it check out the hardware and software are proper or not.

2. **Speed:**

   A computer is very fast device. It can perform a task in a few seconds, which work human being can do in an entire year – if he worked day and night and did nothing else. To put it in a different manner, a computer does in one minute what would take a man his entire lifetime.

   While talking about the speed of computer, we do not talk in terms of seconds or even milliseconds (10^3). Our units of speed measurement are microseconds (10^6), the nanoseconds (10^9). A powerful computer is capable of performing about 3 to 4 million simple arithmetic operations per seconds.

3. **Accuracy:**

   The accuracy of a computer is constantly high and the degree of accuracy of a particular computer depends upon its design. But for a particular computer, each and every calculation is performed with the same accuracy.

   Errors can occur in a computer, but these are mainly doe to human rather technological weakness, that is doe to imprecise thinking by the programmer or due to inaccurate data. So if a wrong input is given, the output also will be wrong – GIGO (Garbage In Garbage Out).

4. **Diligence/Carefulness:**

   Unlike human beings, a computer is free from monotony, tiredness, lack of concentration, etc. and hence can work for hours together without creating any error and without grumbling. Due to this property, computers obviously score over human beings in doing routing type of jobs, which require great accuracy. Being a machine, a computer does not have any of these human weaknesses. Computers won't get tired or bored. They will not go into depression or lose concentration. They will perform the tasks that are given to them, irrespective of whether it is interesting, creative, monotonous or boring, irrespective of whether it is first time or millionth time, with the same accuracy and speed. If ten million calculations have to be performed, a computer will perform the ten millionth calculation with exactly the same accuracy and speed as the first one.

5. **Versatility / flexibility:**

   Versatility is one of the most wonderful things about the computer. One moment, it is preparing the results of particular examination, the next moment it is busy preparing electricity bills, and in between, it may be helping an office secretary to trace an important letter in seconds. All that is required to change its talent is to slip in a new program into it. Computers can communicate with other computers and can receive and send data in various forms like text, sound, video, graphics, etc. this ability of computer to communicate to one another has led to the development of computer networks. Briefly, a computer is capable of performing almost any task provided that the task can be reduced to a series of logical steps.

6. **Power of Remembering / Storage Capacity:**

As a human being acquires new knowledge, the brain subconsciously selects what it feels to be important and worth retaining in its memory and relegates unimportant details to the back of the mind or just forgets them. With computers, this is not the case. A computer can store and recall any amount of information because of its secondary storage capability. Every piece of information can be retained as long as desired by the user and can be recalled as and when required. Even after several years, the information recalled would be as accurate as on the day when it was fed to the computer. A computer forgets or looses certain information only when it is asked to do so. It is 100% up to the user to make a computer retain or forget particular information.

Disadvantages / Limitations of computer

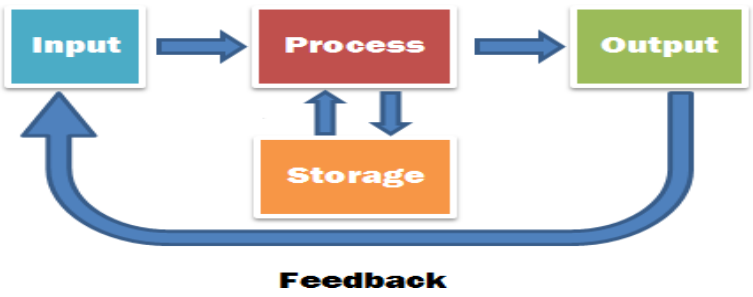
1. **No I.Q.:**

A computer is not a magical device. It can only perform tasks that a human being can. The difference is that it performs these tasks with unthinkable speed and accuracy. It possesses no intelligence if its own. Its I.Q. is zero, at least till today. It has to be told what to do and in what sequence. Hence, only the user can determine what tasks a computer will perform. A computer cannot take its own decision in any regard.

2. **No Feelings:-**

Unlike human beings, a computer is free from monotony, tiredness, lack of concentration, etc.

Data Processing Cycle



Data processing cycle can be defined as the process of transforming raw data into useful information. The cycle entails a process of sequential steps, including input processing, output and interpretation, preparation feedback and storage often are include step of the cycle.

- **Data:-**
  Data is a collection of facts, such as numbers, words, measurements, observations or even just descriptions of things.

- **Process:-**
  a series of actions or steps taken in order to achieve a particular end.

- **Information:-**
  A **computer** is an electronic machine that accepts data, stores and processes Data into **information**.

Classification of Computer by Data Processed

Analog Computer:- Computer use analog signal is known as Analog Computer. Analog signal verifies the values every time. Analog data is of continuous nature and which is not discrete or separate. Such type of data includes temperature, pressure, speed weight, voltage, depth etc. These quantities are continuous and having an infinite variety of values.

Digital Computer:- Computer use digital signal is known as digital Computer. Digital Computer, as its name implies, works with digits to represent numerals, letters or other special symbols. Digital Computers operate on inputs which are ON-OFF type and its output is also in the form of ON-OFF signal. Normally, an ON is represented by a 1 and an OFF is represented by a 0. So we can say that digital computers process information which is based on the presence or the absence of an electrical charge or we prefer to say a binary 1 or 0.

A digital computer can be used to process numeric as well as non-numeric data. It can perform arithmetic operations like addition, subtraction, multiplication and division and also logical operations. The most common examples of digital computers are accounting machines and calculators.

Hybrid Computer:- A hybrid is a combination of digital and analog computers. It combines the best features of both types of computers, i-e. It has the speed of analog computer and the memory and accuracy of digital computer. Hybrid computers are used mainly in specialized applications where both kinds of data need to be processed. Therefore, they help the user, to process both continuous and discrete data. For example a petrol pump contains a processor that converts fuel flow measurements into quantity and price values.

History of Computers

After the invention of numbers people felt the need of a system to keep track of numbers. They used different ways to do so and started evolving tools.

The earlier computing devices B.C. 3000 ‘Abacus’ was created to solve the same purpose. In 1614 John Napier introduced logarithms. Blaise Pascal, a Mathematician built first mechanical calculator, ‘Pascaline’ in 1642.

A mathematician, ‘Charles Babbage’ invented ‘Difference engine’ in 1822 and produced logical idea of computer (knows as ‘Father of computer’). In 1940s program concept presented by Von Neumann. ‘Mark – I’, first mechanical computer invented in 1944. Other major milestones in computer history are as:

Year	Event
3000 BC	**The Abacus** - a rudimentary first computing device developed.
1600	**Hindu-Arabic math** became popular in Europe.
1614	John Napier introduced **logarithms**.
1642	Blaise Pascal, a French Mathematician and experimental Physicist, built the first mechanical digital calculator, Pascaline, that could perform addition and subtraction on whole numbers.
1822	Charles Babbage, Professor of Mathematics at Cambridge University and considered that as "Father of Computers", invented difference engine with mechanical memory to store results.

1840s	Augusta Ada, "The first Programmer" suggested **binary data** storage rather that the decimal.
1850s	George Boole, a self taught English Mathematician, realized that complex mathematical problems could be solved by reducing them to a series of affirmatively or negatively answered questions. The binary system of 1's for positive answers and 0's for negative ones could thus be implemented. This theory of Boolean logic became fundamental to the design of computer circuitry.
1880s	Dr. Herman Hollerith, a Statistician was employed by the Census Bureau, which was falling far behind in its ability to provide census reports. To find a solution to the census problems, Hollerith developed a punched card that would contain data coded in form of punched holes. Hollerith then built tabulating equipment that could read the cards and process the data.
1939	The **first prototype electronic computer** was conceived by Dr. John Vincent Atanasoff, a Professor of Physics an Mathematics at lowa State College. Atanasoff teamed up with Clifford Berry, his graduate assistant, and began to build the first electonic computer. They called it the "Atanasoff-Berry Computer", or ABC. The ABC used vacuum tubes for storage and arithmetic-logic funcition. The ABC was designed for the special purpose of solving systems of simultaneous equations.
1940s	Von Neumann presented a paper, outlinging the stored **program concept**.
1944s	Aiken the **Mark I**, the first automatic, sequence controlled calculator; used by military to compute ballistics data.
1947	Mauchly and Eckert built **ENIAC** (ENIAC is an acronym for Electronic Numeric Integrator And Calculator). It was a second general purpose electronic digital computer.
1949	Englishman Maurice V. Wilkes of Cambridge built **EDSAC** (Electronic Delayed Storage Automatic Computer), the first stored program computer.
1949	Mauchly Eckert and Von Neumann built **EDVAC** (Electronic Discrete Variable Automatic Computer), the second stored program computer.
1949	At Harvard, An Wang, founder of Wang Laboratories developed **magnetic-core memories.**
1949	Jay Forrester at MIT organised **magnatic-core memory** to be more efficient.
1950	Turing built the **ACE** (Automatic Computing Engine), which can be considered the first programmable digital computer.
1950s	Read Admiral (Retd.) Grace Hopper developed **UNIVAC I** Compiler
1951	Mauchly and Eckert built the first computer designed and sold commercially-UNIVAC - I (Universal Automatic Computer).
1957	Backups who was one of a group of IBM (International Business Machines) Engineers developed FORTRAN (FORmula Translation language)
1959	Kilby and Noyce developed and prefected the Intregrated Circuit, to be used in a later computers.
1959	Hopper developed the **COBOL (**Common Business Oriented Language) Programming language.
1960s	Gene Amdahl designed **IBM system/360** series of Mainframe computers, the first general purpose digital computers to use integrate circuits.
1963s	Olsen with Digital Equipment Corporation produced the **PDP-1 (Program Data Processor), the first mini computer.**

1965s	Dr. John Kemeny, a Mathematics Professor at Dartmouth, and his colleague, Dr. Thomas Kurtz, developed the Computer language **BASIC** (**B**eginner's **A**ll-purpose **S**ymbolic **I**nstruction **C**ode)
1970s	Intel created a **memory chip** that could store a kilobit of information. A kilobit translates roughly into 25 five-letter words. Another innovation at Intel came from Ted Hoff, who has integrated circuit by compressing twelve chips into four. The arithmetic and logic function several chips could be contained on one chip, called microprocessor. Hoffs microprocessor was called the Intel 4004 ("forty-oh-four")
1975s	H. Edward Roberts, an electrical engineer who is now generally known as the "Father of the Micro Computer" designed the first **Micro Computer.**
1976s	Seymour Cray's **CRAY-I** Super Computer was delivered to Los Alamos Scientific Laboratory in New Mexico.
1977s	Stephen Wozniak, the technical expert and Steven Jobs designed and built the first **Apple Micro Computer**.
1980s	Lower-cost computer system-**Personal computers** intended for home use were produced. New program products introduced.

History and Generations of computer

Developments that paved (covered) the way for the creation of computers started very early in the history of mankind, computers in the true sense began to popular & used from 1940s onwards. Based on the period of development and the features incorporated, the computers are classified into different generations.

First Generation (1945-1956)

In 1946 first electronic computer, ENIAC developed at pentagon. Consisting of 18,000 vacuum tubes. Which consumed 160 Kilowatts of electrical power. It calculation speed wad 1000 time faster then Mark – I. Von – Neumann designed the EDVAC in 1947 with a memory to hold both a stored program as well as data. Each computer had a different binary – coded program called a machine language that told it how to operate.

Advantages:-

1) Vacuum tubes were the only electronic components available during those days.
2) These computers were the fastest calculating device of their time. They could perform computations in milliseconds.

Disadvantages:-

1) Too bulky in size,
2) Computer result in this generation was unreliable
3) Thousands of vacuum tubes that were used emitted large amount of heat and burnt out frequently
4) Air conditioning required
5) Frequent hardware failures
6) Constant maintenance required
7) This generation computer are Nonportable
8) Manual assembly of individual components into functioning unit required
9) Commercial production was difficult and costly
10) Limited commercial use

Second Generation (1956-1963)

In 1948 transistor invented, which greatly changed computer's development. The transistor replaced the large, vacuum tubes. As a result, the size of computer has been reduced. Second generation computers replaced machine language with assembly language allowing abbreviated programming codes to replace long, difficult binary codes. More sophisticated high – level languages such as COBOL (COmmon Business Oriented Language), FORTRAN (FORrmula TRANslator), BASIC (Beginners All purpose Symbolic Instruction Code) came into use during this time, and have expanded to the current day. These languages replaced binary machine code with words, sentences and mathematical formulae.

Advantages:-

1) Smaller in size as compared to first generation computers
2) More reliable
3) Less neat generated
4) These computers were able to reduce computational times from milliseconds to microseconds.
5) Less prone to hardware failures
6) Better portability
7) Wider commercial use

Disadvantages:-

1) Air-conditioning required
2) Frequent maintenance required
3) Manual assembly of individual components into a functioning unit was required
4) Commercial production was difficult and costly.

Third Generation (1964- 1975)

Though transistor was clearly an improvement over the vacuum tubes, they still generated a great heat. Jack Kilby, an engineer developed Integrated circuit (IC) in 1958. The IC combined three electronic components onto a small silicon disc. Second generation systems were specialized. They were designed to process either scientific problem or business application. That situation has been changed in 1964 when IBM announced a third generation of computing hardware – its system / 360 family of mainframe computers. Third generation computer included the use of an operating system that allowed machines to run many different programs at once with a central program that monitored and co-ordinate the computer's memory.

Advantages:-

1) Smaller in size as compared to previous generation computers.
2) Even more reliable than second-generation computers.
3) Even lower heat generated than second generation computers.
4) These computers were able to reduce computational times from microseconds to nanoseconds.
5) Maintenance cost is low because hardware failures are rare.
6) Easily portable.
7) Totally general purpose. Widely used for various commercial applications all over the world.
8) Less power requirement than previous generation computers.

9) Manual assembly of individual components into a functioning unit not required. So human labour and cost involved at assembly stage reduced drastically.
10) Commercial production was easier and cheaper.

Disadvantages:-

1) Air-conditioning required in many cases.
2) Highly sophisticated technology required for the manufacture of IC chips.

Fourth Generation (1975 –1995)

After the integrated circuits, the only place to go was down in size, that is. Large Scale Integration (LSI) could fit hundreds of components onto one chip. By the 1980s Very Large Scale Integration (VLSI) squeezed hundreds of thousands of components onto a chip. The ability to fit so much onto an area about half the size of one-rupee coin helped reduce the size and price of computers. It also increased their power, efficiency and reliability. As computers became more widespread in the workplace, new ways to harness their potential developed. As smaller computers became more powerful, they could be linked together, or networked, to share memory space, software, information and communication with each other.

Advantages:-

1) Smaller in size because of high component density
2) Very reliable
3) Heat generated is negligible
4) No air conditioning required in most cases
5) Much faster in computation than previous generations
6) Hardware failure is negligible and hence minimal maintenance is required
7) Easily portable because of their small size
8) Totally general purpose
9) Minimal labour and cost involved at assembly stage
10) Cheapest among all generations

Disadvantages:-

1) Highly sophisticated technology required for the manufacture of LSI chips.

Fifth Generation (1995 to till date)

Use ULSI(ultra large scale integration) and use micropr0cessor it have
Ten million electronic components and powerful. Defining the fifth generation of computers is somewhat difficult because the field is in its development face. Many advances in the science of computer design and technology are coming together to enable the creation of fifth generation computers.

Fifth generation computers aim to be able to solve highly complex problems, ones, which require reasoning, intelligence and expertise when solved by people. They are intended to be able to cope (manage) with large subsets of natural languages, and draw on very large knowledge bases.

Japan already started work in this direction few years back. Japan has chosen PROLOG (Programming in Logic) language as its operating software and plans to have the final machine talk with human beings, see and deliver pictures and hear the normal, natural language.

The knowledge base system has a very large store of knowledge with a set of processors, which access and update it. It is likely that knowledge bases will evolve from current work in relational databases.

It is known as personal computer, workstarion and powerfull server, supercomputers,portable notebook computer.

It use storage unit very fast, larger and cd-rom it userd storing programs and data which are only read It use in communication technology in internet,e-mail and in www(world wide web),e-commerce, distance learning course and multimedia application(graphics,animation,audio,video).

Advantages:-

1) smaller size & handy pc than 4th generation computer.
2) not required air condition room
3) less power consumption.
4) less hardware failures.
5) it use larger and more memory unit.
6) it use high level programming so user can easily edit and export from one file to other.
7) it is more user-friendly multimedia.
8) price is less than the other generation computer.

Classification of computer by processing capabilities

- **Micro computers (Personal Computer):-** A microcomputer is the smallest general purpose processing system. The older pc started 8 bit processor with speed of 3.7MB and current pc 64 bit processor with speed of 4.66 GB.

Examples: - IBM PCs, APPLE computers
Microcomputer can be classified into 2 types: Desktops and Portables.

The difference is portables can be used while travelling whereas
desktops computers cannot be carried around.

The different portable computers are: -
1) Laptop 2) Notepad 3) Palmtop(hand held) 4)Wearable computers

- **Minicomputer**: - A minicomputer is a medium-sized computer. That is more powerful than a microcomputer. These computers are usually designed to serve multiple users simultaneously (Parallel Processing). They are more expensive than microcomputers.

Examples: Digital Alpha, Sun Ultra.

- **Mainframe computers**: - Computers with large storage capacities and very high speed of processing (compared to mini- or microcomputers) are known as mainframe computers. They support a large number of terminals for simultaneous use by a number of users like ATM transactions. They are also used as central host computers in distributed data processing system.

Examples: - IBM 370, S/390.

- **Supercomputers**:-Supercomputers have extremely large storage capacity and computing speeds which are many times faster than other computers. A supercomputer is measured in terms of tens of millions Instructions per second

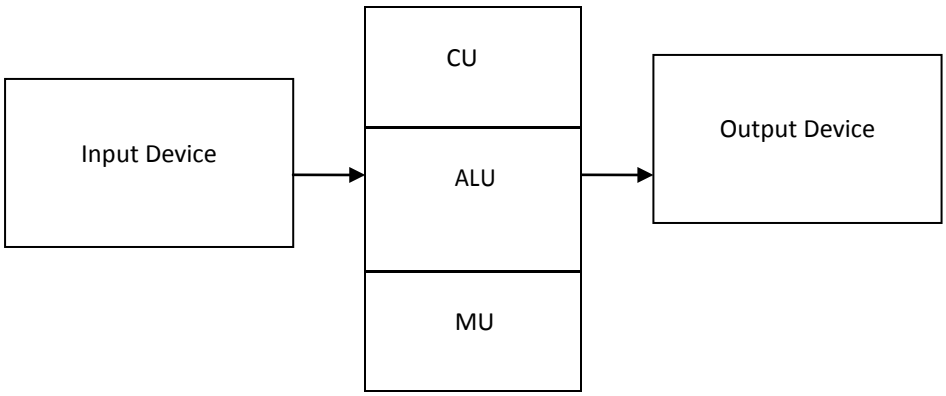
(mips), an operation is made up of numerous instructions. The supercomputer is mainly used for large scale numerical problems in scientific and engineering disciplines such as Weather analysis.

Examples:- IBM Deep Blue.

● **Simple Model of Computer/Computer Organization**

Computer means it is electronics device which retrieve the data from user and give to for the Process (calculation) and get the final result.

Basic three parts:--- 1) Input Devices 2) CPU3) Output Devices



1) **Input devices:-** it retrieve the data from user and reach to the cpu unit that device is known as input device
   Example:- keyboard,mouse,touch screen etc

2) **CPU:-** CPU means central processing unit
   - it is core and important part of the computer
   - it calculate and take decision and store the information.
   - it is between input and output device so it known as central part of the processor. it have main three type 1) CU 2) ALU 3)SU/MU

   1) **Control Unit:-** it control each and every part of the computer
      it handle and control the calculation other decision for read or write the information in unit from user.

   2) **ALU:-** Arithmetic and logical unit
      it is main part of the cpu.
      it can do all the arithmetic operation and logical calculation in that
      it can do decision part of the cpu and which part is store in which that command take from the CU and give the result to the SU/MU.

   3) **SU/MU:-** Storage Unit or Memory Unit
      it store the result and give command to the output device according to the CU.
      it is very important unit in the CPU because it is brain part of the computer.

3) Output Device :- it is device which can retrieve the information from the CPU and provide the information to the out put screen it is known as output device

Example:- monitor,printer,plotter etc

4) internal memory :- In a computer, all of the storage spaces that are accessible by a processor without the use of the computer input-output channels.

Secondary Storage Devices

Secondary storage, sometimes called auxiliary storage or external storage, is non-volatile storage that is not under the direct control of a computer's central processing unit (CPU) or does not directly interact with an application.

Secondary memory (or secondary storage) is the slowest and cheapest form of memory. It cannot be processed directly by the CPU. It must first be copied into primary storage (also known as RAM).

Secondary memory devices include magnetic disks like hard drives and floppy disks ; optical disks such as CDs and CDROMs ; and magnetic tapes, which were the first forms of secondary memory.

Auxiliary memory, also known as **auxiliary storage**, secondary **storage**, secondary memory or external memory, is a non-volatile memory (does not lose **stored** data when the device is powered down) that is not directly accessible by the CPU, because it is not accessed via the input/output channels (it is an external device

Different types of secondary storage devices

There exists different types of secondary storage devices, each of them suitable for a different purpose. They mainly differ in the following aspects:

- Technology used to store data
- Capacity of data they can hold
- Size of storage device
- Portability of storage device and
- Access time to stored data.

Currently the most common forms of secondary storage device are:

- Floppy disks
- Hard disks
- Optical Disks
- Magnetic Tapes.
- Solid State Devices

Internal/External Parts used with computer cabinet.
The size of Primary storage (or) main memory in every computer is limited. With this, the computer can only accommodate a limited sized program and data. To carry out big jobs (or) commercial data processing, it becomes essential that data be held in some expensive form of storage. This is achieved through secondary storage. It is also called as external storage, and can hold data either sequentially (or) at random. Data in storage is not directly accessible and has to be routed through the main storage for processing.

Types of Secondary storage Devices in Computers are:

- Magnetic tape
- Magnetic disk and
- Magnetic drum.

Magnetic tape:

• Tapes are used for recording/storing data for computer processing is plastic reel similar to long lengths of movie film. A tape is usually ½" wide and 2400 feet in length. It is coated with particles of ferric oxide on which data can be recorded magnetically.

• The process of reading and writing of data is carried out on a device is called Tape Drive. Records on magnetic tape are stored in sequential order.

• For example: if the payroll file is to be stored on a magnetic tape, the records would likely to be stored in the sequence of employee numbers.

• Hence, magnetic tapes are referred to as sequential access device.

Magnetic disk:

• Magnetic disk is another type of secondary storage device known as random (direct) access as it permits direct accessing of data.

• An individual disk is a circular metal plate coated on both side by ferrous oxide material.

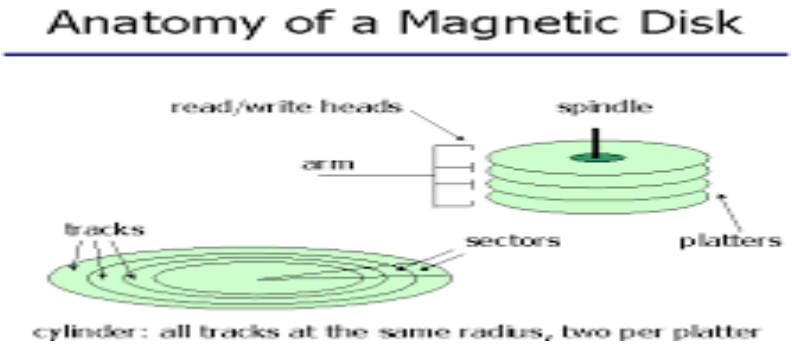
• Data is recorded in the form of magnetized spots on the tracks of the disk, a spot representing the presence by "1" and its absence by "0" enabling representing of data in binary form.

• The surface of the magnetic disk is divided into number of invisible concentric circles called "tracks".

• The tracks are further subdivided into "sectors", "blocks" etc. each its own unique addresses to facilitate the location of data. Disk moves on a vertical rotating spindle.

• Reading /writing on the disks is accomplished by means of series of read/write heads which are placed close to the surfaces of the disks.

• Data on the magnetic disk can be accessed again and again. It can also be recorded erasing the older information.



Magnetic drum:

• It is a metallic cylinder coated with a special magnetic alloy.

• Data is stored in this surface as minute magnetized spoke arranged in binary form in a series of parallel circular tracks.

• The drum rotates at a constant speed and data is recorded (or) retrieved by the read/write head. One for each track.

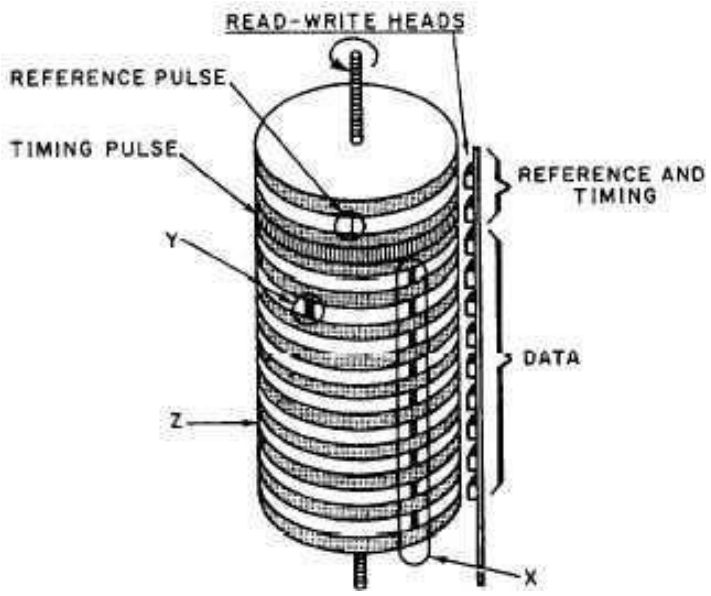
• The magnetic drum provides random access storage.

ADVANTAGES

- Very fast access
- Random access capability
- Stored data is not destroyed until new data is written in the same location is permanent.

DISADVANTAGES

- Drums cannot be removed from the unit and store (or) used elsewhere.
- Storage capacity is limited.
- Requires machine interpretation to read the information. It is not humanly readable



CD-ROM

♦ CD-ROM [Compact Disc Read Only Memory] is a Compact Disc contains data accessible by a computer. While the Compact Disc format was originally designed for music storage and play back, the format was later adapted to hold any form of binary data.

♦ The CR-ROM is also known as a laser disc, which is shiny metal like disk. The diameter of the disk is 5.25 inches (or) 12 cm disk. Information of 650 MD can be stored, which is equal to nearly 2, 50,000 pages of printed text.

♦ The data is recorded as deep holes on the disk surface or burning microscopic bits.

♦ The plain and shiny disk surface and the microscopic bits help to represent the binary numbers 0 and 1, as required by the concentric tracks.

♦ CD-ROMs are popularly used to distribute computer software, including games and multimedia applications, though any data can be stored.

♦ Some CDs hold both computer data and audio with the latter capable of being played on a CD player, while data is only usable on a computer. These are called Enhanced CDs.

♦ The CD-ROM s are pre-recorded disks used for storing a large amount of data (or) information. Hence, the CD-ROM drive has become a standard peripheral device used for retrieval of stored data on the CD-ROM.

♦ A CD-ROM sector contains 2352 bytes, divided into 98 [ninety-eight], 24-byte frames.

♦ A mode-1 CD-ROM, which has the full three layers of error correction data, contains a net 2048 bytes of the available 2352 per sector.

♦ On a mode-2 CD-ROM, which is mostly used for video files, there are 2336 user available bytes per sector. A device called CD-Writer is necessary to record information onto a CD-ROM.

HARD DISK

♦ A hard disk drive [HDD], commonly referred to as a hard drive, hard disk or fixed disk drive. It is a non-volatile storage device which stores digitally encoded data on rapidly rotating platters with magnetic surfaced. The hard disk is an electro mechanical device. The hard disk is also known as Winchester disk. HDDs record data by magnetizing a ferromagnetic material directionally, to represent either a 0 (or) a 1 binary digit. They read the data by detecting the magnetization of the material.

♦ The magnetic hard disk is an electro-mechanical device. This device consists of some smooth metal plates (or) disks coated on either sides or surfaces with a thin-film of magnetic material.

♦ The set of such magnetic disks are fixed on one spindle, one above the other, like a stack of disks. This is called a disk pack, which is sealed into one unit and mounted on a disk drive.

♦ The hard disk drive has a set of magnetic heads or read/write heads for both surfaces of each disk, on the spindle.

♦ The disk drive consists of a motor to rotate the disk pack at a speed of about 3600 revolutions per minute [rpm] about a spindle.

♦ Each magnetic head (or) magnetic read/write heads mounted on arm can move in and out rapidly on the disk surface to perform read and write operations.

♦ The information is recorded /stored (or) retrieved that is read from the magnetic recording surface, while the disk rotates about the spindle at high-speed.

♦ The information is stored on the magnetic surfaces as bits 0's and 1's on the concentric circles as tracks.

♦ Each track is divided into sectors of the same density.

♦ The set of corresponding tracks of all the surfaces of all the disks constitute a cylinder.

♦ The magnetic disk pack is connected to controller by an electronic circuit called as a disk controller (or) hard disk controller HDC.

♦ The controllers accept control signals from the control unit of the computer for specific read and write operation.

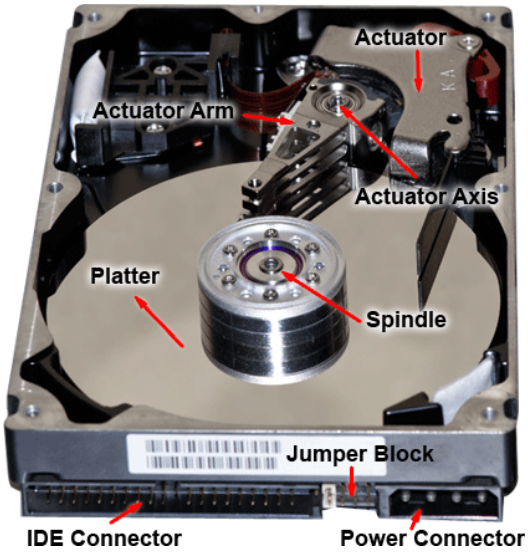
♦ Now days the capacity of hard disk begins from 20 GB, 40 GB and so on, to fulfill the need of large data/information storage.

♦ Hard disk drives are sealed to prevent dust and other sources of contamination from interfering with the operation of the hard disk heads.

♦ The hard drives are not air tight, but rather utilize an extremely fine air filter, to allow for air inside the hard drive enclosure.

♦ The spinning of the disks causes the air to circulate forcing any particulars to become trapped on the filter.

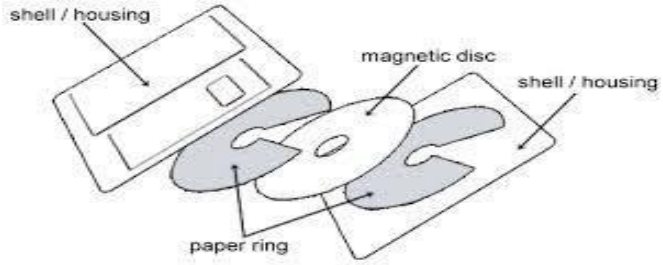
♦ The same air currents also as a gas bearing which enables the heads to float on a cushion of air above the surfaces of the disks.



FLOPPY DISKS

These are also called as flexible disks. These are used in the smallest micro computer systems as well as mini computers. Floppy disks have higher storage capacity and offer direct access capability. The floppy disk is permanently sealed in a plastic coated jacket and the whole package is inserted the floppy drive for data recording and retrieval. The jacket of the disk has a small slot to permit the read/write head to contact the disk. They are 5.25 inch (or) 3.5 inch in diameter. They come in single (or) double density and recorded on one (or) both surface of the diskette. The capacity of a 5.25 inch floppy is mega bytes whereas for 3.5 inch floppy it is 1.44 mega bytes. It is cheaper than that of any other storage devices and is portable too. The floppy is a low-cost device particularly suitable for personal computer system. Once data has been recorded, a

floppy disk reader can be used to enter data into CPU. Again, the disk is loaded and rotated at a constant speed inside its envelope. Tiny magnetic heads in the disk reader access data through the slot in the jacket.



Internal/External parts used with computer cabinet

Introduction to Motherboard

A motherboard is an electronic circuit board in a computer which interconnects hardware devices attached to it. At a minimum it includes one or more Central processing units, and the main processing activity of the computer takes place on it.

However, other connected printed circuit boards may contain their own pre-processing or post-processing CPUs, to take some of the load off of the motherboard these, together with other plug-in boards without CPUs, may be called "daughter boards."

It was called a "mother" board in relation to these. A PC motherboard may have a series of sockets, allowing daughter boards to be plugged in directly.

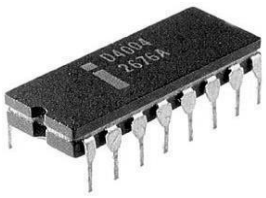
Other connectors on the motherboard allow communication through cables with various peripheral devices, both inside and outside the computer case

Types of processors

A **microprocessor** incorporates the functions of a computer's central processing unit (CPU) on a single integrated circuit (IC),[1] or at most a few integrated circuits.

It is a multipurpose, programmable device that accepts digital data as input, processes it according to instructions stored in its memory, and provides results as output.

It is an example of sequential digital logic, as it has internal memory. Microprocessors operate on numbers and symbols represented in the binary numeral system.



1) The Intel **Pentium Dual-Core** brand refers to mainstream x86-architecture microprocessors from Intel.

   The Intel Pentium Dual-Core processors, which includes 2 MB of native L2 cache, with half disabled leaving only 1 MB. This compares to the higher end Conroe core which features 4 MB L2 Cache natively.

   Intel has shifted its product lines having the Core 2 line as Mainstream/Performance, Pentium Dual-Core as Mainstream, and the new Celeron (based on the Conroe-L core) as Budget/Value.

2) The **Core 2** brand refers to Intel's x86/x86-64 microprocessors with the Core microarchitecture targeted at the consumer and business markets (except servers) above Pentium. The Core 2 solo branch covered single-core CPUs for notebook computers, Core 2 Duo - dual-core CPUs for both desktop and

   notebook computers, Core 2 Quad - quad-core CPUs for both desktop and notebook computers, and Core 2 Extreme - dual-core and quad-core CPUs for both desktop and notebook computers

3) There are only the Core i3, Core i5, and Core i7 processors. Core i2s and Core i6s do not exist. Basically, i3, i5, and i7 are monikers to differentiate different

   lines of processors that are aimed at different types of consumers. The Core i3 is aimed for consumers who do video editing, web browsing, and light gaming.

4) The Core i5 is aimed at consumers who do content creation and moderate gaming.

5) The Core i7 is aimed at people who do content creation or render thing, and heavy gaming.

Memory structure and Types of Memory

- **Memory Unit**
  - In the computer information is store temporary or permenant that unit is known as a primary unit.
  - In memory unit information is store or retrive(read) from command of control unit.
  - Memory unit is use integreted circuit inside information store or retrive from that memory unit have two different types are available.

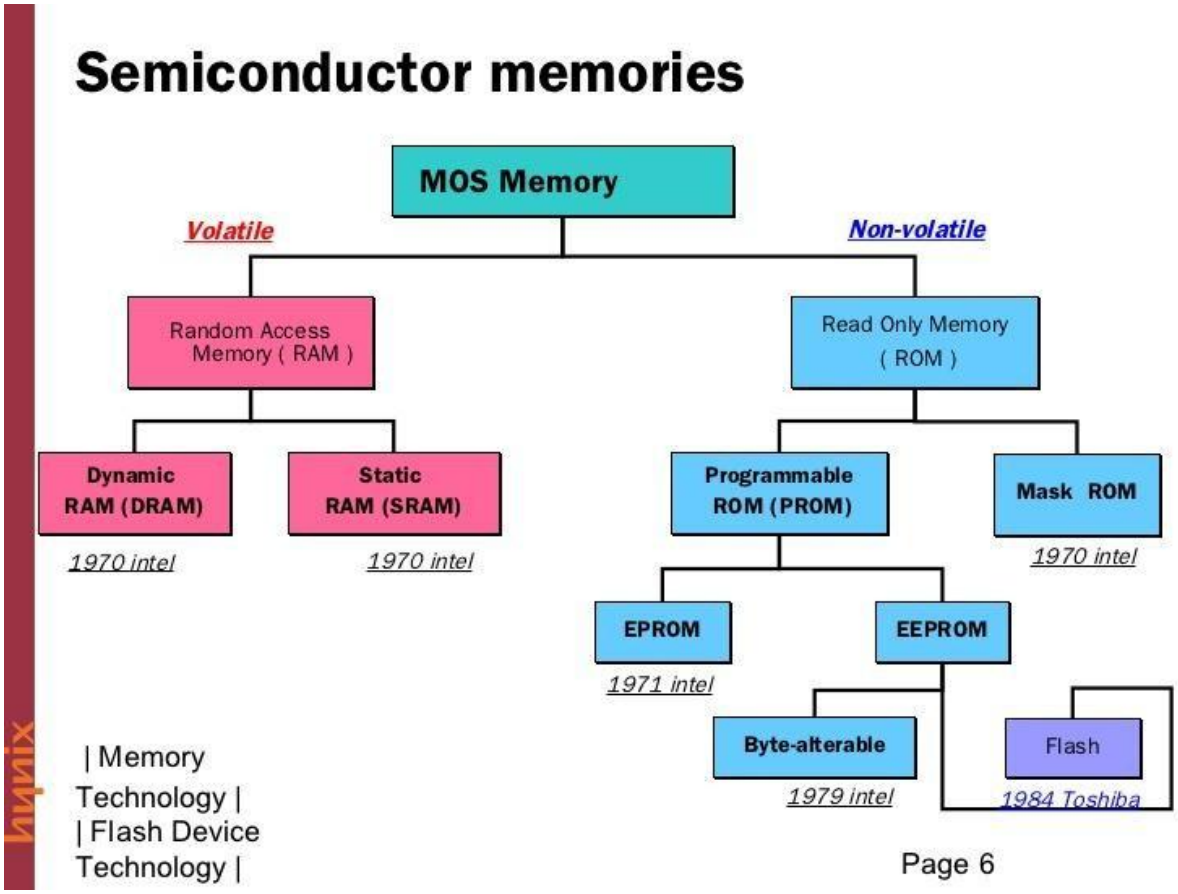
1. Primary memory
2. Secondary memory

I) Primary Memory:-

It is a specific memory unit which is use by computer it self that memory unit is known as a primary memory.

- In primary memory information is store permenantaly that is use by operating system.
- In primary memory how to information is store and how many time retrive the information from that primary memory have two different types are available.

1. **ROM(Read only memory)**
2. **RAM(Random Access memory)**



a) RAM (Random Access Memory)

It means Random Access memory.It is primary memory. In that information is store many times and read the information many times that is known as a random access memory.

- In a random access memory information is store by the command of control unit.
- In a random access memory how much the information is store from that it have four different types are available.

1) SRAM:-Static Random Access Memory

It means Static Random Access memory.In SRAM predefine the information is store and retrive and it have fixed size of memory that is known as a SRAM.

2) DRAM:-Dynamic Random Access Memory

It means Dynamic Random Access memory.DRAM have one type is available that is known as a SDRAM syncronous dynamic random access memory.In DRAM not predefine the information is store and retrive and it have no fixed size of memory.

3) SD:- Synchronous dynamic random access memory takes advantage.

4) DDR:- Double data rate synchronous dynamic random-access memory (DDR SDRAM) is a class of memory integrated circuits used in computers.

DDR SDRAM (sometimes referred to as DDR1 SDRAM) has been superseded by DDR2 SDRAM and DDR3 SDRAM, neither of which are either forward or backward compatible with DDR SDRAM, meaning that DDR2 or DDR3 memory modules will not work in DDR equipped motherboards, and vice versa.

Compared to single data rate (SDR) SDRAM, the DDR SDRAM interface makes higher transfer rates possible by more strict control of the timing of the electrical data and clock signals.

b) Read Only Memory (ROM):

It means read only memory. In primary memory store the information only one time and read the information many time that memory is known as a read only memory.

- In read only memory information is store by manufacturing company and read the information by computer it self.
- In read only memory whenever power is off it doesn't delete the information so
- read only memory is known as a volatile memory. The read only memory store the information only one time and edit the program from that it have three types are available.

- **Programmable Read Only Memory (PROM)**:-It means programmable read only memory. In a prom information is store using of electric signal are laser signal that is done by the manufacturing company.

- **Erasable Programmable Read Only Memory (EPROM)**:-It means Erasable programmable read only memory. Whenever at once time the information is store if there are some error are available the information is delete by manufacturing company. So that is known as a erasable programmable read only memory.

- **Electrically Erasable and Programmable Read Only Memory (EEROM)**:-It means Electrical Erasable programmable read only memory.
  Whenever some addition are available at that time information is delete by electric signal so that memory is known as EEPROM.

- **<u>Slots</u>**
  - In computer system printed circuit board is available in that different types of box are available that is known as a computer slot.
  - In computer system that specific box attached different types of hardware devices so that is known as computer slot.
  - In computer slot which type of Hardware device are attach from that it have three different types are available.

1) ISA Slots: - "Industry Standard Architecture."

It is specific box is available with that attach a specific card which is useful in the system that is known as a ISA slot.

- In ISA slot attach networking card and video card.

2) PCI Slot: - Peripheral Component Interconnect

It is computer bus for attaching hardware devices in a computer. These devices can take either the form of an integrated circuit fitted onto the motherboard itself, called a planar device in the PCI specification, or an expansion card that fits into a slot.

Typical PCI cards used in PCs include: network cards, sound cards, modems, extra ports such as USB or serial, TV tuner cards and disk controllers. PCI video cards replaced ISA and VESA cards, until growing bandwidth requirements outgrew the capabilities of PCI; the preferred interface for video cards became AGP, and then PCI Express. PCI video cards remain available for use with old PCs without AGP or PCI Express slots.

Many devices previously provided on PCI expansion cards are now commonly integrated onto motherboards or available in universal serial bus and PCI Express versions

3) **Memory Slots:-M**emory Slot is what allows computer memory (RAM) chip/stick to be inserted into the computer.

It is specific box is available with that attached the primary memory so it is known as a memory slot.

Depending on the motherboard, there will usually be 2 to 4 memory slots (sometimes more on high-end motherboards) and are what determine the type of RAM used with the computer.

The most common types of RAM are SDRAM and DDR for desktop computers and SODIMM for laptop computers, each having various types and speeds.

In the below picture, is an example of what memory slots may look like inside a desktop computer. In this picture, there are three open available slots for three memory sticks.

- **Sockets**

Computer sockets are the built-in interfaces on motherboards that accept various hardware components. When compatible devices are plugged into computer sockets, they communicate with the system to provide functionality. Dial-up modems, graphics cards and sound cards are just some examples.

The processor socket (also called a CPU socket) is the connector on the motherboard that houses a CPU and forms the electrical interface and contact with the CPU. Processor sockets use a **p**in grid **a**rray (PGA) where pins on the underside of the processor connect to holes in the processor socket. Computers based on the Intel x86 architecture include socket processors.

When a computer program needs to connect to a local or wide area network such as the Internet, it uses a software component called a socket. The socket opens the network connection for the program, allowing data to be read and written over the network. It is important to note that these sockets are software, not hardware, like a wall socket.

- **Cables**

Each and every computer might have different quality of computer cables. Every day, a new computer cable will be invented. This is because of the advancement of technology.

connecting of peripheral devices or hardware component to a computer requires a specific type of cable.

1) **Serial cable**

In computing, a **serial port** is a serial communication physical interface through which information transfers in or out one bit at a time (in contrast to a parallel port). Throughout most of the history of personal computers, data transfer through serial ports connected the computer to devices such as terminals and various peripherals.

While such interfaces as Ethernet, FireWire, and USB all send data as a serial stream, the term "serial port" usually identifies hardware more or less compliant to the RS-232 standard, intended to interface with a modem or with a similar communication device.

Modern computers without serial ports may require serial-to-USB converters to allow compatibility with RS 232 serial devices. Serial ports are still used in applications such as industrial automation systems, scientific instruments, shop till systems and some industrial and consumer products.

Server computers may use a serial port as a control console for diagnostics. Network equipment (such as routers and switches) often use serial console for configuration. Serial ports are still used in these areas as they are simple, cheap and their console functions are highly standardized and widespread. A serial port requires very little supporting software from the host system.

2) Parallel cable

Parallel cable is a type of interface found on computers (personal and otherwise) for connecting various peripherals. In computing, a parallel port is a parallel communication physical interface. It is also known as a **printer port** or **Centronics port**. The IEEE 1284 standard defines the bi-directional version of the port, which allows the transmission and reception of data bits at the same time.

3) USB Cable

Universal Serial Bus (USB) is an industry standard developed in the mid-1990s that defines the cables, connectors and communications protocols used in a bus for connection, communication and power supply between computers and electronic devices.

USB is not a true bus, meaning only the root hub sees the entire electrical communications. Or, there is no method to monitor upstream communications from a down stream device.

USB was designed to standardize the connection of computer peripherals, such as keyboards, pointing devices, digital cameras, printers, portable media players, disk drives and network adapters to personal computers, both to communicate and to supply electric power.

It has become commonplace on other devices, such as smartphones, PDAs and video game consoles.USB has effectively replaced a variety of earlier interfaces, such as serial and parallel ports, as well as separate power chargers for portable devices.

- **Ports**

When referring to a computer or device, a **hardware port** resembles a plug-in or connection commonly found on the back of a computer. Hardware ports allow computers to have access to external devices such as computer printers. Below is a short listing of the different computer ports you may find on a computer.

In computer hardware, a port serves as an interface between the computer and other computers or peripheral devices. Physically, a port is a specialized outlet on a piece of equipment to which a plug or cable connects. Electronically, the several conductors making up the outlet provide a signal transfer between devices.

1) USB Port

A USB port is a standard cable connection interface on personal computers and consumer electronics. USB ports allow stand-alone electronic devices to be connected via cables to a computer (or to each other).

USB stands for Universal Serial Bus, an industry standard for short-distance digital data communications. USB allows data to be transferred between devices. USB ports can also supply electric power across the cable to devices without their own power source.

Both wired and wireless versions of the USB standard exist, although only the wired version involves USB ports and cables.

What Can You Plug Into a USB Port?:

Many types of consumer electronics support USB interfaces. These types of equipment are most commonly used for computer networking:

USB network adapters

USB broadband and cellular modems for Internet
access USB printers to be shared on a home network

2) Serial Port

In computing, a **serial port** is a serial communication physical interface through which information transfers in or out one bit at a time (in contrast to a parallel port).[1] Throughout most of the history of personal computers, data transfer through serial ports connected the computer to devices such as terminals and various peripherals.

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compliant to the RS-232 standard, intended to interface with a modem or with a similar communication device.

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The individual signals on a serial port are unidirectional and when connecting two devices the outputs of one device must be connected to the inputs of ther other. Devices are divided into two categories "data terminal equipment" (DTE) and "data circuit-terminating equipment" (DCE).

A line that is an output on a DTE device is an input on a DCE device and vice-versa so a DCE device can be connected to a DTE device with a straght wired cable. Conventionally computers and terminals are DTE while modems and perhipherals are DCE.

A port, or interface, that can be used for serial communication, in which only 1 bit is transmitted at a time.

Most serial ports on personal computers conform to the RS-232C or RS-422 standards. A serial port is a general-purpose interface that can be used for almost any type of device, including modems, mice, and printers (although most printers are connected to a parallel port).

3) Parallel Port

The parallel port on modern computer systems is an example of a parallel communications connection. The parallel port has 8 data wires, and a large series of ground wires and control wires. IDE harddisk connectors and PCI expansion ports are another good example of parallel connections in a computer system.

A **parallel port** is a type of interface found on computers (personal and otherwise) for connecting various peripherals. In computing, a parallel port is a parallel communication physical interface. It is also known as a **printer port** or **Centronics port**. **The** IEEE 1284 standard defines the bi-directional version of the port, which allows the transmission and reception of data bits at the same time

4) PS2 Port

The **PS/2 connector** is a 6-pin Mini-DIN connector used for connecting some keyboards and mice to a PC compatible computer system. Its name comes from the IBM Personal System/2 series of personal computers, with which it was introduced in 1987.

The PS/2 mouse connector generally replaced the older DE-9 RS-232 "serial mouse" connector, while the PS/2 keyboard connector replaced the larger 5-pin/180° DIN connector used in the IBM PC/AT design.

The PS/2 designs on keyboard and mouse interfaces are electrically similar and employ the same communication protocol. However, a given system's keyboard and mouse port may not be interchangeable since the two devices use a different set of commands.

Type of port developed by IBM for connecting a mouse or keyboard to a PC. The PS/2 port supports a mini DIN plug containing just 6 pins. Most PCs have a PS/2 port so that the serial port can be used by another device, such as a modem. The PS/2 port is often called the mouse port.

- **Power Devices: UPS**
- **uninterruptible power supply (UPS)**

Backup power supply that, in case of power failure or fluctuations, allows enough time for an orderly shutdown of the system or for standby generator to start up. UPS consists usually of a bank of batteries and power sensing and conditioning circuitry, and comes in two basic types: (1) Continuously-Online UPS provides steady and clean (spike free) AC power even when the mains power supply is available, and is recharged continuously by the mains supply. Also called true online backup. (2) Standby UPS automatically comes on when the mains supply fails or fluctuates inordinately.

Its batteries are recharged when it is not in use. Larger UPSs come with the software that allows for automatic, unattended shut down of the system in its proper sequence.

- **Graphics Cards**

A graphics card, also known as a video card, is a piece of hardware installed in a computer that is responsible for rendering the image on the computer‘s monitor or display screen.

A **video card** (also called a **display card**, **graphics card**, **graphics board**, **display adapter** or **graphics adapter**) is an expansion card which generates a feed of output images to a display.

Video hardware can be integrated into the motherboard or (as with more recent designs) the CPU, but all modern motherboards (and some from the 1990s) provide expansion ports to which a video card can be attached.

In this configuration it is sometimes referred to as a video controller or graphics controller.

This graphics chip usually has a small quantity of embedded memory and takes some of the system's main RAM, reducing the total RAM available. This is usually called integrated graphics or on-board graphics, and is usually low in performance and undesirable for those wishing to run 3D applications.

- **Network card**

Network Interface Cards

In the early days of computing, individual computers operated as stand-alone systems. The earliest personal computers did not have an easy way to connect to other computers. In order to transfer files between computers, you had to use a portable storage medium such as a **floppy disk**; however, in modern-day computers, connecting to a network is essential. For example, you need to connect to use e-mail, access information on the Internet, and share documents within a corporate network.

A computer uses a **network interface card** (NIC) to become part of a network. The NIC contains the electronic circuitry required to communicate using a wired connection (e.g., **Ethernet**) or a wireless connection (e.g., **WiFi**). A network interface card is also known as a network interface controller, network adapter, or **Local Area Network** (**LAN**) adapter.

A **Network interface card**, **NIC**, or **Network card** is an electronic device that connects a computer to a computer network, usually a LAN. It is considered a piece of computer hardware. Today, most computers have network cards. Network cards enable a computer to exchange data with the network.

What is a network card?

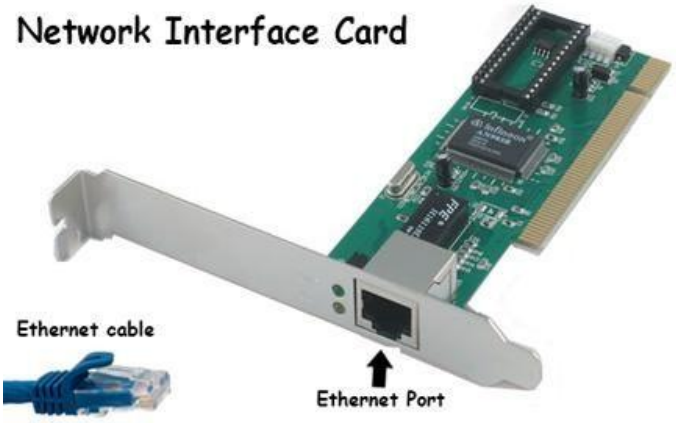
A **network card** (also called a Network Adapter or Network Interface Card, or **NIC** for short) acts as the interface between a computer and a network cable. The purpose of the network card is to prepare, send, and control data on the network.

What is the role of a network card?

A network card is the physical interface between the computer and cable. It converts the data sent by the computer into a form which can be used by the network cable, transfers that data to another computer and controls the dataflow between the computer and cable. It also translates the data coming from the cable into bytes so that the computer's CPU can read it. This is why a network card is an expansion card inserted into an expansion slot.

The role of the identifier

- The card converts data and notifies the rest of the network of its address, so that it can be told apart from the other network cards.
- MAC addresses: Defined by the IEEE (Institute of Electrical and Electronics Engineer), which assigns ranges of addresses to each manufacturer of network cards.
- They are inscribed on the cards' chips, and as a result, each card has a unique MAC address on the network.



Sound card

A sound card converts digital data to sound. This allows you to listen to music from your computer using speakers or headphones. Learn about the different types of sound cards and how they work.

Definition

Most of your music collection is probably in digital format, either on CDs or as files on your computer. In order to be able to listen to your music, a **sound card** converts digital data to analog sound waves you can hear. The output signal is then connected to a headphone or set of speakers. You can also use a sound card to record audio with a microphone.

Sound Card Features and Functions

The motherboard on most computer systems has an integrated sound card, which is often sufficient for many users. However, to get higher quality sound you can upgrade to a separate sound card, which uses better and more expensive components.

Audio files on a computer consist of digital data just like any other file on a computer. Sounds we can hear consist of waves that travel through the air - sounds are analog. The primary function of a sound card is to translate between digital and analog information, just like a video card. Sound cards typically have four major components:

- The digital-to-analog converter (DAC), which makes it possible to convert digital data to analog sound
- The analog-to-digital converter (ADC), which makes it possible to make digital recordings from analog sound inputs
- An interface to connect to the motherboard, typically using Peripheral Component Interconnect (PCI)
- Input and output connectors so you can plug in headphones, speakers or a microphone - many computer systems have speakers and microphone built-in, but connectors allow you to use higher quality external devices to play or record sound

On some sound cards, the two types of converters are integrated into **CODEC** a single coder/decoder chip. Some sound cards also have a **digital signal processor (DSP)**, a built-in processing unit. The DSP takes some of the load of the central processing unit (CPU) to convert between digital and analog. Similarly, some sound cards have their

own memory. Sound cards without a DSP or memory will use the motherboard's CPU and memory.

Computer systems typically have built-in speakers, which are reasonably good if you don't turn up the volume too high. If you want to use your computer for some serious music for a party, you probably want to connect a set of external speakers. Relatively small external speakers can be powered using a USB connection, while larger ones need their own power supply. Similarly, most computer systems have a built-in microphone, but you can also connect an external microphone.

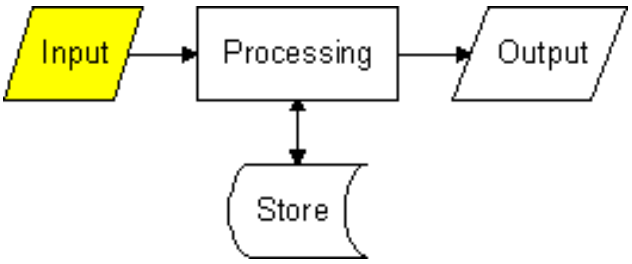
Serious audiophiles who use their computer as their sound system will typically upgrade to a high-end sound card, a set of good external speakers, and a good external microphone (if they want to make their own recordings). A high-end computer system can rival dedicated music equipment. In general, with the improvements in sound and video, computer systems have turned into multimedia systems rather than simply computing devices to run software.

An Expansion board that enables computer to manipulated and output sounds. Sound cards are necessary for nearly all CD-ROMs and have become commonplace on modern personal computers.

Sound cards enable the computer to output sound through speakers connected to the board, to record sound input from a microphone connected to the computer and manipulate sound stored one disk.

- **Introduction:-**

An information system can not do anything until you give it some information to process. Input devices transfer data into a computerised information system so that it can be processed.



An **input device** transfers data from the outside world into a computer.
There are two different categories of input device. They are :

- **Manual Input Devices** : With a manual input device the user must enter data into the computer by hand.
- **Direct Data Entry (DDE) Devices** : A direct data entry device can transfer information automatically from a source document such as a form or barcode into the computer. The user does not need to manually enter the information. Direct data entry devices are used when large volumes of data must be entered into the computer quickly.

There are many different input devices available. Each input device is suitable for a different purpose. Select an input device from the table below to find out about it or read through the rest of this topic to learn more about all of the different input devices.

Keyboards	QWERTY Keyboard
	Concept Keyboard
Pointing Devices	Touch Screen
	Light Pen
	Mouse
	Tracker Ball
	Touch Pad
	Joystick
Graphics Capture	Graphics Tablet
	Scanner
	Digital Camera
	Video Digitiser
Sound Capture	Voice Recognition
Sensors	Sensors
Code Numbers	Bar Codes
	Magentic Ink Character Recognition
	Magnetic Stripe Codes
	Smart Cards
Optical Input Methods	Optical Mark Recognition
	Optical Character Recognition
	Turnaround Documents

- **INPUT DEVICES**

These are devices, which helps you while entering data or giving some instruction to computer processor.

- **Types of Input Devices**

A) KeyBoard

Key-Board is a Primary input device consisting a set of keys on a small flat piece of plastic board computer Key-Boards are similar to traditional mechanical typewriter or just as an electronic Key-Board only difference is that when ever a key is pressed on the Conventional Type Writer, that alphabet appears on paper where as, here it appears on monitor. It contains some additional keys, which are classified as bellow:

: Alphanumeric Keys	[ABCD.....Z,01,2,3. ... 9]	
: Punctuation Keys	[,.?;: etc]	
: Navigation Keys/Arrow	[<-,^|]	
: Function Keys	[F1,F2,. .....F12]	
: Special Keys	[Caps Lock, Insert, Home, Page Up/Down]	
Different Types of Key-Board		
<*> Extended Key-Board (Original P.C. Key-Board)		84 Keys
<*> Standard Key-Board (Enhanced Key-Board)		
101-110 Keys		
<*> Advanced Key-Board		132 Keys

B) Mouse:-

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

Generally it has two buttons called left and right button and a wheel is present between the buttons. Mouse can be used to control the position of cursor on screen, but it cannot be used to enter text into the computer.

Advantages

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

- **CAD**:- Computer-aided drafting (**CAD**) is the use of computer systems to aid in the creation, modification, analysis, or optimization of a design.

C) Trackball

- Trackball is another pointing device. Essentially, a trackball is mouse lying on its back to more the pointer, you rotate the ball with your thumb, your fingers or the palm of your hand. There are usually 2-3 buttons next to the ball, which you just like mouse buttons.

- The advantage of trackballs over mouse is that the track ball does not require much space to use it. In addition, you can place trackball on any type of surface, including your lap too. For both these reasons, trackballs are popular pointing devices for portable computers.
- Track ball is an input device that is mostly used in notebook or laptop computer, instead of a mouse. This is a ball which is half inserted and by moving fingers on ball, pointer can be moved. Since the whole device is not moved, a track ball requires less space than a mouse. A track ball comes in various shapes like a ball, a button and a square.

D) Glide-Pad

- Glide Pad is also known as Touchpad.
  A touch pad is a device for pointing (controlling input positioning) on a computer display screen. It is an alternative to the mouse. Originally incorporated in laptop computers, touch pads are also being made for use with desktop computers. Atouch pad works by sensing the user's finger movement and downward pressure.

- A **touchpad** (or **trackpad**) is a pointing device featuring a tactile sensor, a specialized surface that can translate the motion and position of a user's fingers to a relative position on screen.

- Touchpads are a common feature of laptop computers, and are also used as a substitute for a mouse where desk space is scarce. Because they vary in size, they can also be found on personal digital assistants (PDAs) and some portable media players. Wireless touchpads are also available as detached accessories

- Touchpads are primarily used in self-contained portable laptop computers and do not require a flat surface near the machine.

- The touchpad is close to the keyboard, and only very short finger movements are required to move the cursor across the display screen; while advantageous, this also makes it possible for a user's thumb to move the mouse cursor accidentally while typing. Touchpad functionality is available for desktop computers in keyboards with built-in touchpads.

E) Game Devices Joystick

- Joystick is also a pointing device which is used to move cursor position on a monitor screen. It is a stick having a spherical ball at its both lower and upper ends. The lower spherical ball moves in a socket. The joystick can be moved in all four directions.
- The function of joystick is similar to that of a mouse. It is mainly used in Computer Aided Designing(CAD) and playing computer games.

F) LIGHT PEN

Light pen is a pointing device which is similar to a pen. It is used to select a displayed menu item or draw pictures on the monitor screen. It consists of a photocell and an optical system placed in a small tube. When the tip of a light pen is moved over the monitor screen and pen button is pressed, its photocell sensing element detects the screen location and sends the corresponding signal to the CPU.

G) TOUCH SCREEN

Touch screen is a type of display screen that has a touch sensitive transparent panel covering the screen. Instead of using pointing device such as a mouse or light pen, you can use your finger to point directly to objects on the screen.

A small, touch-sensitive pad used as a pointing device on some portable computers. By moving a finger or other object along the pad, you can move the pointer on the display screen.

A touch panel is a transparent plate which is fitted over the CRT. Input is registered when a finger or any other object comes in contact with the plate.

There are two types of touch panels:

1. Optical touch panels
2. Electric touch panels

H) DIGITIZERS

A digitizer converts a graphical or pictorial data into digital form which can be directly entered and stored in a computer. A digitizer is also called as a graphics tablet. There are two types of digitizers :

Image scan digitizer and flat bed digitizer

In the image scan digitizer the entire image is scanned and reproduced automatically. Therefore the image scan digitizers are more powerful as compared to flat bed digitizers. Flat bed digitizers are mainly used in simple drawings, graphs etc. whereas image scan digitizers are used for photographs and pictures.

I) Graphic Tablet

A **graphics tablet** (also **digitizer**, **digital drawing tablet**, **pen tablet**, **digital art board**) is a computer input device that enables a user to hand-draw images, animations and graphics, with a special pen-like stylus, similar to the way a person draws images with a pencil and paper. These tablets may also be used to capture data or handwritten signatures. It can also be used to trace an image from a piece of paper which is taped or otherwise secured to the tablet surface. Capturing data in this way, by tracing or entering the corners of linear poly-lines or shapes, is called digitizing.

The device consists of a flat surface upon which the user may "draw" or trace an image using the attached stylus, a pen-like drawing apparatus. The image is displayed on the computer monitor, though some graphics tablets now also incorporate an LCD screen for a more realistic or natural experience and usability.

Some tablets are intended as a replacement for the computer mouse as the primary pointing and navigation device for desktop computers.

J) MIC(sound input)

Microphone is an input device to input sound that is then stored in digital form. The microphone is used for various applications like adding sound to a multimedia presentation or for mixing music.

K) DIGITAL CAMERA

Images can be input into a computer using a digital camera. These images can then be manipulated in many ways using the various imaging tools available.

The digital camera takes a still photograph, stores it, and then sends it as digital input into the computer. The images are then stored as digital files.
Video cameras are versatile derives, being able to capture images of any type, including solid objects. Scanners are limited to image on paper but they are able to scan each spot the paper with much greater accuracy than cameras and so are more widely used for this type of input.

l) POS(Point of Sale) Terminal (Scanners,etc):-

A **point of sale terminal** (**POS terminal**) is an electronic device used to process card payments at retail locations. A **POS terminal** generally does the following: Reads the information off a customer's credit or debit card.
A retail **point of sale** system typically includes a cash register (which in recent times comprises a computer, monitor, cash drawer, receipt printer, customer display and a barcode **scanner**) and the majority of retail **POS**systems also include a debit/credit card **reader**.

- **MIDI**

MIDI (Musical Instrument Digital Interface) is a protocol developed in the 1980's which allows electronic instruments and other digital musical tools to communicate with each other. MIDI itself does not make sound, it is just a series of messages like "note on," "note off," "note/pitch," "pitchbend," and many more. These messages are interpreted by a MIDI instrument to produce sound. A MIDI instrument can be a piece of hardware (electronic keyboard, synthesizer) or part of a software environment (ableton, garage band, digital performer, logic...).

The advantages of MIDI include:

compact -an entire song can be stored within a few hundred MIDI messages (compared to audio data which is sampled thousands of times a second)
easy to modify/manipulate notes -change pitch, duration, and other parameters without having to rerecord
change instruments -remember, MIDI only describes which notes to play, you can send these notes to any instrument to change the overall sound of the composition

What is a MIDI controller?

The Musical Instrument Digital Interface (MIDI) protocol was developed by professional audio technicians as a way for their various electronic devices (drum machines, synthesizers, samplers and more) to communicate by sending messages back and forth. Messages like, “play this musical note” and “we’re now in the 3rd beat of the 2nd

measure" are transmitted between devices to help keep all of the devices in sync and reduce the amount of work that people need to do.

- **WIRELESS DEVICES(KEYBOARD,MOUSE,ETC)**
  Wireless keyboard
- A **wireless keyboard** is a computer keyboard that allows the user to communicate with
- computers, tablets, or laptops with the help to radio frequency (RF), infrared (IR) or Bluetooth technology. It is common for wireless keyboards available these days to be accompanied by a wireless mouse.
- A **cordless mouse**, also called a **wireless mouse**, is a **mouse** that connects to a computer without the use of wires. Instead, the **mouse** uses some manner of **wireless** technology, like Bluetooth, RF, or infrared radio waves. Usually, a USB receiver is plugged into the computer and receives signals from the **cordless mouse** .

SCANNERS

- A scanner is an input device that scans documents such as photographs and pages of text. When a document is scanned, it is converted into a digital format. This creates an electronic version of the document that can be viewed and edited on a computer.
- Most scanners are flatbed devices, which means they have a flat scanning surface. This is ideal for photographs, magazines, and various documents. Most flatbed scanners have a cover that lifts up so that books and other bulky objects can also be scanned. Another type of scanner is a sheet-fed scanner, which can only accept paper documents. While sheet-fed scanners cannot scan books, some models include an automatic document feeder, or ADF, which allows multiple pages to be scanned in sequence.
- Scanners work in conjunction with computer software programs, which import data from the scanner. Most scanners include basic scanning software that allows the user to configure, initiate, and import scans. Scanning plug-ins can also be installed, which allow various software programs to import scanned images directly. For example, if a scanner plug-in is installed for Adobe Photoshop, a user can create new images in Photoshop directly from the connected scanner.

- **Types of Scanner:-**

There are a few different kinds of scanners in the world and, as withprinters, the one that's right for you depends on how you intend to use it. The most common types are: flatbed scanners, sheetfed scanners, photo scanners, and portable scanners. Let's take a brief look at these four different types of scanners and what they're good for.

1. **Flatbed Scanners**

Flatbed scanners will take up some desktop space but provide a lot of bang for the buck. They look like miniature printers with a flip-up cover protecting the glass platen. Depending on its size, a flatbed scanner can fit standard or legal-sized documents, and the flexible cover allows you to scan large items such as books. These scanners are great for scanning the occasional newspaper article, book chapter, or photograph; or for those who may need to scan or bulky items such as the cover of a DVD. Flatbed scanners are often built into multifunction printers (MFPs). You can find a decent flatbed scanner for $100 or less.

2. **Photo Scanners**

Scanning documents doesn't require high resolution or color depth; but scanning photos does. Many all-purpose scanners can also scan photos, meaning that you don't need a separate device to handle your photographs. But if you need a scanner primarily to digitize film negatives or slides, a photo scanner is a better deal (even if it is considerably more expensive than an all-purpose scanner). Photo scanners include specialized technology so that they can deal with slides and negatives; they also have built-in software to clean up old photos. Decent photo scanners will start at about $130 (and go way up from there). The Epson Perfection V850 Pro Photo Scanner, for example, is a good photo scanner. It will cost you more, but photo scanners like these come with adapters for scanning slides and negatives, and they scan at exceptionally high resolutions, compared to other types of scanners.

3. **Sheetfed Scanners**

Sheetfed scanners are smaller than flatbed scanners Sheetfed scanners start around $300 and get increasingly more expensive, depending on speed and features. Most sheetfed scanners these days are quite fast and loaded with features for capturing and processing data.

4. **Portable Scanners**

Portable scanners are small enough to bring on the road. In fact, some are small enough to put in your pocket; pen scanners are just a bit bigger than fountain pens and can scan the text of a document line by line. Some are as wide as a page and roll easily down the page. They're not going to give high-resolution scans and so aren't good for scanning photographs or other applications where you need a high-quality result. Since they're not cheaper than flatbed scanners, they're probably only useful if you are a student, a researcher.Figure on spending about $150 for one. Also figure that quality and accuracy are based largely on how steady and accurate you can hold the device while implementing a scan.

1) **OMR**
2) **OCR**
3) **MICR**
4) **OBR**

Scanner is able to directly enter text and images into the computer memory.
Therefore the duplication work of entering data is eliminated and this also results in increased accuracy. The speed of data entry also increases. There are two types of scanners :

1. Optical Scanners
2. Magnetic Ink Character Recognition devices

a) Optical Scanner:
The optical scanner uses a light source and sensor for reading the information on the paper. It can read characters, pictures, graphics from the paper. The common types of optical scanners are:

1. The Optical Mark Reader (OMR): This is capable of reading prespecified marks made by pencils or pens with the help of light. Light is focused on the page that is to be

scanned. The reflected light pattern is detected by the device. These types of scanners are normally used where the data is preprinted for applications. eg. answer papers of the objective tests where the answers are marked with pencils or preprinted forms.
OMR is a special type of optical scanner used to recognize the type of mark made by pen or pencil. It is used where one out of a few alternatives is to be selected and marked. It is specially used for checking the answer sheets of examinations having multiple choice questions.

2. Optical Character Reader : The Optical Character Reader (OCR) can read alphabets, characters and numbers printed on paper. These characters can be either handwritten or typed. However special fonts are required to be used while typing. In case of handwritten data, the characters have to be of standard predefined size. The OCR reads each character as a collection of pixels. The light which is reflected from the page to be scanned is converted into binary data. OCRs are available in various sizes and speeds. These devices are expensive and are mainly used in processing where the data volumes are large.
OCR is an input device used to read a printed text. OCR scans text optically character by character, converts them into a machine readable code and stores the text on the system memory.

3.OBR:-OPTICAL BARCODE READER
Bar code reader is a device which reads bar coded data. Data which is coded in the form of light or dark lines (bars) is a bar code. Bar code readers are normally used in applications like labeling of products in retail shops, super markets etc. A laser beam scanner is used to read the bar code.
The most commonly used bar code is the Universal Product Code (UPC). In this code the bars are coded as 10 digits. The first five digits define the manufacturer or supplier, and the remaining five digits denote the actual product of the manufacturer.
Bar Code Reader is a device used for reading bar coded data (data in form of light and dark lines). Bar coded data is generally used in labelling goods, numbering the books etc. It may be a hand held scanner or may be embedded in a stationary scanner. Bar Code Reader scans a bar code image, converts it into an alphanumeric value which is then fed to the computer to which bar code reader is connected.

b) Magnetic Ink Character Recognition (MICR):
MICR input device is generally used in banks because of a large number of cheques to be processed every day. The bank's code number and cheque number are printed on the cheques with a special type of ink that contains particles of magnetic material that are machine readable. This reading process is called Magnetic Ink Character Recognition (MICR). The main advantages of MICR is that it is fast and less error prone.

DATA STORAGE

- **Introduction:- Data storage** is a general **term** for archiving **data** in electromagnetic or other forms for use by a computer or device. Different types of **data storage** play different roles in a computing environment.

- **Types of Magnetic Storage Devices:-**

Digital data consists of binary information, which is data in the form of zero and ones. There are two **types of magnetic** polarities, each one used to represent either zero or one. Several **types** of magnetized media are used in computer systems, including **magnetic** tape, floppy disks and hard disk **drives**.

Magnetic tape

Magnetic tape is one of the most popular storage mediums for large data that are sequentially access and process. The tape is plastic ribbon, usually ½ inch wide that can be magnetized.

The tape ribbon itself is stored in reels of 50 to 2400 feet or a small cartridge or cassette.

It is similar to the tape used on a tape recorder expect that it is of higher quality and more durable.

Tapes for computers are similar to the tapes used to store music. Storing data on tapes is considerably cheaper than storing data on disks.

Tye	Capacity	Description
Half – Inch	60 M.B. – 400 M.B.	Half Inch tapes come both as 9 track reels and as cartridges. These tapes are relatively cheap, but require expensive tape drives.
Quarter – Inch	40 M.B. – 5 G.B.	Quarter - Inch cartridges are relatively inexpensive and support fast data transfer rates. QIC mini cartridges are less expensive, but their data capacities are smaller and their transfer rates are slower
8 – mm Helical scan	1 G.B. – 5 G.B.	8 – mm helical – scan cartridges use the same technology as VCR tapes and have the greatest capacity. But they require expensive tape drives and have relatively slow data transfer rates
4 – mm DAT	2 G.B. – 24 G.B.	Digital Audio Tapes (DAT) cartridges have the greatest capacity but they require expensive tape drives and have relatively slow data transfer rates.

Tapes also have large storage capacities ranging from few hundred kilobytes to several gigabytes.

Floppy Disk

A floppy disk is made of flexible plastic that is coated with magnetic oxide. The flexible disk is enclosed within a square plastic or cardboard jacket, often referred to as a cartridge.

The jacket gives handling protection to the disk surface. Moreover, it has a special liner that provides a wiping action to remove dust particles that are harmful for the disk surface and the read write head.

The disks are mounted on the disk drive along with the jacket cover and information is written and read through an aperture in the jacket. Floppy disks are

in either single or double density and record on one or both surface of a diskette. Thus, there are five types of diskettes:

Single Sided Single Density Single Sided Double Density

Double Sided Single Density Double Sided Double Density

Double Sided High Density

Floppies come in two basic sizes:

5 ¼ Inch – The common size for PCs made during 1980s. This type of floppy is generally capable of storing between 100 K.B. to 1.2 M.B. of data. The most common sizes are 360 K.B. and 1.2 M.B.

3 ½ Inch – Floppy is something of misnomer for these disks, as they are encased in a rigid envelope. Despite their small size, it has a larger capacity than the 5 ¼ Inch size. The most common size for PCs is 1.44 M.B.

Floppy disks are very cheap as compared to other storage devices. They greatly enhance the one line storage capacity of small systems at affordable price.

They are also convenient off line storage medium for the small systems users. {On line means continuously connected to a computer and under the control of the central processing unit. Off line means not connected to computer system.}

Zip Disks

These are high capacity disk drives developed by the Iomega Corporation. Zip disks are slightly larger than conventional floppy disks, and are about twice as thick they can hold 100 M.B. of data. Hence, its capacity varies from 100 M.B. to some

Because they‘re relatively inexpensive and durable, they have become a popular media for backing up hard disks and for transporting large files.

Magnetic Disks

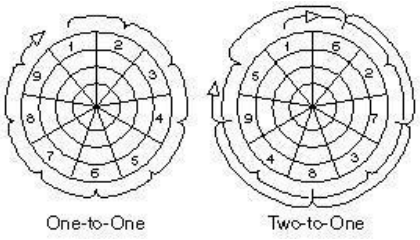
The definition of a magnetic disk is a type of data storage that uses magnetic patterns on a circular surface.
An example of a magnetic disk is a computer’s hard drive.

A magnetic disk is a storage device that uses a magnetization process to write, rewrite and access data. It is covered with a magnetic coating and stores data in the form of tracks, spots and sectors. Hard disks, zip disks and floppy disks are common examples of magnetic disks.

Hard Disk

Hard disk is a magnetic disk on which you can store computer data. The term hard is used to distinguish it from a soft, or floppy disk. Hard disk holds more data and is faster than floppy disks. A hard disk, for example, can store anywhere from megabytes to several gigabytes, whereas most floppies have a maximum storage capacity of 1.4 megabytes.

A single hard disk usually consists of several platters. Each platter requires two read/write heads, one for each side. All the read/write heads are attached to a single access arm so that they cannot move independently. Each platter has the same number of track location that cuts across all the platters is called a cylinder. For example, a typical 84 megabyte hard disk for a PC might have two platters (four sides) and 1,053 cylinders.



A ring on a disk where data can be written. A typical floppy disk has 80 (double density) or 160 (high-density) **tracks**. For hard disks, each platter is divided into tracks, and a single track location that cuts through all platters (and both sidesofeach platter) is called a **cylinder**. Hard disks have many thousands of cylinders.

Each track is further divided into a number of **sectors.** The operating system and disk drive remember where information is stored by noting its track and sector numbers.

The density of tracks (how close together they are) is measured in terms of tracks per inch (TPI).

Cluster:- In a computer system, a cluster is a group of servers and other resources that act like a single system and enable high availability and, in some cases, load balancing and parallel processing.

Sectors:- In computer disk **storage**, a **sector** is a subdivision of a track on a magnetic disk or optical disc. Each **sector** stores a fixed amount of user-accessible **data**, traditionally 512 bytes for hard disk drives (HDDs) and 2048 bytes for CD-ROMs and DVD-ROMs

Reading/Writing Data to and from Storage Devices:-

Refers to the time a program or device takes to locate a particular piece of data.For disk drives, the terms seek time and access time are often used interchangeably. Technically speaking, however, the access time is often longer the seek time because it includes a brief latency period.

Seek Time:-it is the time it takes a hardware device or software program to locate a particular piece of information.

Seek Time=Access Time

Access Time:-Access time is the time from the start of one storage device access to the time when the next access can be started. Access time consists of latency (the overhead of getting to the right place on the device and preparing to access it) and transfer time.

Rotational Delay:-it is a measurement made in milliseconds of how long it takes once the request for information is made and how long it takes the hard drive to move to the sector of where the information is located.

Rotational Latency:- Also called rotational delay, the amount of time it takes for the desired sector of a disk (i.e., the sector from which data is to be read or written) to rotate under the read-write heads of the disk drive. The average rotational latency for a disk is half the amount of time it takes for the disk to make one revolution. The term typically is applied to
rotating storage devices, such as hard disk drives and floppy drives (and even older magnetic drum systems), but not to tape drives.

Response Time:- it is the time a system or functional unit takes to react to a given input.

Optical Disk

Optical disks are a storage medium from which data is read and to which it is written by lasers. Optical disks can store much more data-up to 6 gigabytes – than magnetic media, such as floppies and hard disks. There are three basic types of optical disks;

- CD – ROM: Like audio CDs, CD-ROMs come with data already encoded onto them. The data is permanent and can be read any number of times , but CD-ROMs cannot be modified.
- WORM: This term stands for write-once, read-many. With a WORM disk drive, you can write data onto a WROM disk, but only once. After that, the WROM disk behaves just like a CD-ROM.
- Optical disks that can be erased and loaded with new data, just like magnetic disks. These are often referred to as EO (Erasable Optical) disks.

Other Storage Devices

- **USB – Pen Drive:-**USB drive -- also known as a flash drive or keychain drive -- is a plug-and-play portable storage device that uses flash memory and is lightweight enough to attach to a keychain. A USB drive can be used in place of a floppy disk, Zip drive disk or CD. When the user plugs the device into the USB port, the computer's operating system recognizes the device as a removable drive and assigns it a drive letter.
- **CD:- compact disc (CD)**:-A compact disc [sometimes spelled disk] (CD) is a small, portable, round medium made of molded polymer (close in size to the floppy disk) for electronically recording, storing, and playing back audio, video, text, and other information in digital form. Tape cartridges and CDs generally replaced the phonograph record for playing back music. At home, CDs have tended to replace the tape cartridge although the latter is still widely used in cars and portable playback devices.

These three technologies are not compatible with one another; each requires a different type of disk drive and disk. Even within one category, there are many compatible formats, although CD-ROMs are relatively standardized.

- **DVD:- DVD** ("**digital versatile disc**" or "**digital video disc**") is a digital optical disc storage format invented and co-developed by Philips, Sony, Toshiba, andPanasonic in 1995. The medium can store any kind of digital data and is widely used for software and other computer files as well as video programs watched using DVD players. DVDs offer higher storage capacity than compact discs while having the same dimensions.

- **Blu-Ray Disk:-**

Blu-ray (not Blue-ray) also known as Blu-ray Disc (BD), is the name of a new optical disc format jointly developed by the Blu-ray Disc Association (BDA), a group of the world's leading consumer electronics, personal computer and media manufacturers (including Apple, Dell, Hitachi, HP, JVC, LG, Mitsubishi, Panasonic, Pioneer, Philips, Samsung, Sharp, Sony, TDK and Thomson). The format was developed to enable recording, rewriting and playback of high-definition video (HD), as well as storing large amounts of data. The format offers more than five times the storage capacity of traditional DVDs and can hold up to 25GB on a single-layer disc and 50GB on a dual-layer disc. This extra capacity combined with the use of advanced video and audio codecs will offer consumers an unprecedented HD experience.

The first High Definition-capable DVD format announced was the Blu-ray Disc. This format was developed outside of the DVD Forum, a body that supports the successful DVD-Video format. It was formulated by a consortium of nine manufacturers called the —Blu-ray Disc Founders .

The idea behind this format is to use a new blue-violet laser technology Hence its name), with a shorter wavelength of 405 nanometers (nm). This translates to a smaller laser beam width, so that the spot that represent a single bit of data can be made smaller, taking up less real estate on the disc surface. This means that more bits (or data) can be crammed onto the standard diameter 12-cm optical disc. The data capacity is a maximum of 25 GB for a single-layered Blu-ray Disc and 50 GB for a dual-layered Blu-ray Disc.

Recording is made using phase-change technology, similar to that used in rewriteable recordable DVD format (DVD-RW, DVD+RW, and DVD-RAM) and CD-RW.

For audio, Blu-ray Disc offers dolby digital at a data rate of 32 Kbps - 384 Kbps, or pulse code modulation (PCM) at up to 2.3 Mbps using 16-bit, 20-bit, or 24-bit word lengths.

Applications for the Blu-ray Disc format include pre-recorded high definition movies, home HDTV recording, and computer data storage.

- **Flash memory** is a memory storage device for computers and electronics. It is most often used in devices like digital cameras, USB flash drives, and video games. It is quite similar to EEPROM.
- Flash memory is different from RAM because RAM is volatile (not permanent). When power is turned off, RAM loses all its data. Flash can keep its data intact with no power at all. A hard drive also is permanent (non-volatile) storage, but it is bulky and fragile. Flash memory is slower than

RAM, but faster than hard drives. It is much used in small electronics because it is small and has no moving parts.

- Flash memory is a type of nonvolatile memory that erases data in units called blocks. A block stored on a flash memory chip must be erased before data can be written, or programmed, to the microchip. Flash memory retains data for an extended period of time whether a flash-equipped device is powered on or off.
- **Cloud Storage:-**Cloud storage is a service model in which data is maintained, managed, backed up remotely and made available to users over a network (typically the Internet).

- **OneDrive:-**OneDrive and Google Drive offer many of the same features as Dropbox, although they're integrated within the Microsoft and Google ecosystems respectively.
- OneDrive, which was formerly called SkyDrive, is intrinsically linked with Microsoft's Windows Phone and Windows operating systems, as well as Office Online (formerly known as Office Web Apps).
- If you have a Microsoft email account – Outlook or Hotmail, for example – you already have OneDrive, as well as access to Office Online.

- Windows 8 users will notice OneDrive is one of the apps included with the OS and is accessible from the Start screen.

- **Google Drive:-**
  Google Drive is much the same as OneDrive, only it's integrated with Google Docs, as well as Android and Chrome OS. As with Microsoft's offering, if you have a Gmail account, you already have Google Drive. One thing to note is Microsoft recentlyreneged on OneDrive's unlimited storage for Office365 subscribers.

Chapter-3 OUTPUT DEVICE

Definition of output device: -In Normal terminology Output is anything that comes out of a computer. The complete definition is like : The device that gives the processed data or information is called the output device.

OR

It is specific device which take the information from cpu and provide the output to the user that is known as a output device.

Types of Output Devices:-

- **Output Devices**
- The output device allows the compute to communicate with the outside world by accepting data from the computer and transforming it into user readable form.The various types of output devices are :

Output devices displays the processed form of data to the end user.

Common Output devices include;

- Monitor
- Printer
- Speaker
- Plotter
- **Monitor**

Monitor is the most important output device of a computer system. The monitor is the display screen of a computer. Cathode Rays Tube (CRT) and Liquid Crystal Display (LCD) are the two types of Monitors.

The CRT monitor looks like a television. At one end of CRT Monitor there is a device that produce electrons and bombard it towards the other end where the screen is located, resulting in the screen glowing because of a substance on the screen. The CRT Monitors are expensive and occupies more space as compared to LCD Monitors.

LCD stands for Liquid Crystal Display. It has the properties of both liquid and solid, that's why it has a sharp and better picture quality than CRT Monitors. LCD monitors are relatively expensive then CRT monitors. Basically, the LCD monitors were designed for laptops. Nowadays they are getting popular because of its slim size and flat screen.

- **Printers**

A Printer takes print commands from a computer and print out text / images on a paper. Different types of printers are available for various purposes. A printer for office use must be heavy duty and fast while for photographs it must produce high quality prints. Dot-Matrix, Ink-Jet, Laser-Jet are the different types of printers. Print quality of Laser-Jet printer is excellent as compared to Ink-Jet or other types of printers, but they are relatively more expensive than the others. Most laser printers produce black & whiter prints while some can produce color prints as well. The color laser printers are way too expensive then black & white laser printers.

- **Speakers**

Speaker is an important part of a computer system. Some systems have a built-in speaker, though they are small in size. Speaker is an essential part of a computer because they can notify about various system notifications through various sounds. Big speakers, woofers & sub-woofers are used for enhance sound quality or creating a mini home theater.

Speakers are another type of output device, which allow you to listen to voice like music, and conversation with people

- **Plotter**

Plotter A plotter is a special kind of output device that, like a printer, produces images on paper, but does so in a different way. Plotters are designed to produce large drawings or images, such as construction plans for buildings or blueprints for mechanical objects. A plotter can be connected to the port normally used by a printer. An array of different colored pens in a clip rack and a robotic arm is part of plotter. The instructions that a plotter receives from a computer consist of a color, and beginning and ending coordinates for a line. With that information, the plotter picks up the appropriate pen through its arm, positions it at the beginning coordinates drops the pen down to the surface of the paper and draws to the ending coordinates. Plotters draw curves by creating a sequence of very short straight lines.

The **plotter** is a computer printer for printing vector graphics. In the past, plotters were used in applications such as computer-aided design, though they have generally been replaced with wide-format conventional printers.

It is now commonplace to refer to such wide-format printers as "plotters," even though they technically are not.

Pen plotters print by moving a pen or other instrument across the surface of a piece of paper. This means that plotters are restricted to line art, rather than raster graphics as with other printers.

Pen plotters can draw complex line art, including text, but do so slowly because of the mechanical movement of the pens. They are often incapable of efficiently creating a solid region of color, but can hatch an area by drawing a number of close, regular lines.

Plotters offered the fastest way to efficiently produce very large drawings or color high-resolution vector-based artwork when computer memory was very expensive and processor power was very limited, and other types of printers had limited graphic output capabilities.

Pen plotters have essentially become obsolete, and have been replaced by large-format inkjet printers and LED toner based printers. Such devices may still understand vector languages originally designed for plotter use, because in many uses, they offer a more efficient alternative to raster data.

Plotter

A plotter is a special output device used to produce hardcopies of graphs and designs on the paper. A plotter is typically used to print large-format graphs or maps such as construction maps, engineering drawings and big posters. Plotters are divided into two types:

1. Drum plotters
2. Flatbed plotters

Drum Plotter

A drum plotter is also known as Roller Plotter. It consists of a drum or roller on which a paper is placed and the drum rotates back and forth to produce the graph on the paper. It also consists of mechanical device known as Robotic Drawing Arm that holds a set of colored ink pens or pencils. The Robotic Drawing Arm moves side to side as the paper are rolled back and forth through the roller. In this way, a perfect graph or map is created on the paper. This work is done under the control of computer. Drum Plotters are used to produce continuous output, such as plotting earthquake activity.

Flatbed Plotter

A flatbed plotter is also known as Table Plotter. It plots on paper that is spread and fixed over a rectangular flatbed table. The flatbed plotter uses two robotic drawing arms, each of which holds a set of colored ink pens or pencils. The drawing arms move over the stationary paper and draw the graph on the paper. Typically, the plot size is equal to the area of a bed. The plot size may be 20- by-50 feet. It is used in the design of cars, ships, aircrafts, buildings, highways etc. Flatbed plotter is very slow in drawing or printing graphs. The large and complicated drawing can take several hours to print. The main reason of the slow printing is due to the movement mechanical devices
Today, mechanical plotters have been replaced by thermal, electrostatic and ink jet plotters. These systems are faster and cheaper. They also produce large size drawings.

Plotters usually come in two designs:

1. **Flat Bed:** Plotters of small size to be kept on table with restriction of paper size.
2. **Drum:** These plotters are of big size using rolls of paper of unlimited length.

- **MONITOR**

A person who is not keep in touch of computer may understand monitor like the class monitor you had in school would report to the teacher if there is any mischievous. Similarly, the computer display screen called the monitor which helps the computer user to check correctness of all typed instruction and data. Which is also known as softcopy output All the data that is entered on the keyboard, first appears on the small screen. This allows the user of the computer to see if he has typed correctly.

Most of today monitors are measure 14 inches diagonally. It's _most' and not all because with advancement of technology, larger screens are getting popular. Monitors that measure 15 , 20 and 21 inches across the screen are also available now. They even come equipped with controls like brightness, contrast and screen adjustments, very similar to our Television set. Whatever the size of the monitor, the screen is divided into rows and columns. Typically there are 24 rows and 80 Columns. This aspect becomes necessary when people write instructions for the computer.

Just as there different kinds of Monitors

A) BASED ON COLOUR

I) MONOCHROME:

A monochrome monitors actually displays two colors, one for the background of monitor and another for foreground. The colors can be black and white, green and black. These kind of monitors are out-of-date now a days.

II) GRAY-SCALE

A gray-scale monitor is special type of monochrome monitor. Which are capable to displaying different shades of gray.

III) COLOUR

Color monitors can display anywhere from 16 to over 1 million different colors. Colors monitors are known as SVGA. Generally our colour monitors accepts separate signals red, green and blue. This is some what different from color televisions. All color computer monitors are RGB monitors. An RGB Monitors consists of a vacuum tube with three electron guns one each for red , green and blue at one end and the screen at the other end. The three electron guns fire electrons at the screen, which contains a phosphorous coating.

Colour and gray scaling monitors are often classified by the number of bits they are to represent each pixel. for example an 8 bit monitors represents each pixel with 8 bits. The more bits per pixel, the more colors and shades of gray the monitor can display.

B) BASED ON SIGNALS

I) DIGITAL

A digital monitor accepts digital signals rather than analog signals. All monitors use CRT Technology, which is essentially analog. The term digital therefore, refers only to the type of input received from the video adapter. A digital monitor then translates the digital signals into analog signals that control the actual display. Although digital monitors are fast and produce clear images.

II) ANALOG

These are traditional types of colour display screen that has bee used for years in televisions. In reality, all monitors based on CRT technology are analog. Some monitors however are called digital monitors because they accept digital signals from the video adapter.

CHARACTERISTICS OF A MONITOR

1)SIZE

The most important aspect of a monitor is its screen size. Like televisions, screen sizes are measured in diagonal inches, the distance from one corner to the opposite corner diagonally. A typical size for small today monitors is 14 inches. Monitors that are 16 or more inches diagonally are often called full-page monitors.

2) RESOLUTION

The resolution of a monitor indicates how densely the pixels are packed. Pixel is the short for Picture Element. A pixel is a signal point in a graphical image. Graphics monitors display pictures by dividing the display screen into thousand or millions of pixels, arranged in rows and columns.

The pixels are so close together that they appear connected. The number of bits used to represent each pixel determines how many colors or shades of colors can be displayed.

On color monitors, each pixel is actually composed of three dots- a red, a blue, and a green one. Ideally, the three dots should all converge at the same point, but all monitors have some convergence error that can make colour pixels appear fuzzy.

The quality of a display monitor largely depends on its resolution, how many pixels it can display, and how many bits are used to represent each pixel. VGA monitors display 1,024 by 768, or nearly 800,00 pixels. True color monitors use 24 bits per pixel, allowing them to display more than 16 million colors.

In general, the more number of pixel (often expressed in dots per inch), the shaper the image. Most modern monitors can display 1024 by 768 pixels, the SVGA standard. Some high-end models can display 1280 by 1024, or even 1600 by 1200.

3) BANDWIDTH

The amount of the data can be transmitted in a fixed amount of time. For digital devices, the bandwidth is usually expressed in bits or bytes per second (bps). For analog devices, the bandwidth is expressed in cycles per second, or Hertz(Hz).

4) REFRESH RATE

Display monitors must be refreshed many times per second. The refresh rate determines how many times per second the screen is to be refreshed(redrawn). The refresh rate for a monitor is measured in hertz(Hz) and is also called the vertical frequency or vertical refresh rate. The old standard for monitor refresh rates was 60Hz, but a new standard developed by VESA sets the refresh rate at 75Hz for VGA and SVGA monitors. The faster the refresh rate ,the less the monitor flickers.

5) INTERLACED OR NON-INTERLACED

Interlaced is a display technique that enables a monitors to provide more resolution inexpensively. with interlacing monitors, the electron guns draw only half the horizontal lines with each pass (for ex.all odd lines on one pass and all even lines on the next pass.) Because an many interlacing monitor refreshes only half the lines at one time ,it can display twice as many lines per refresh cycle ,giving it greater resolution. Another way of looking at it is that interlacing provides the same resolution as non-interlacing, but less expensively. A shortcoming refresh rate (animation and video, for example), may experience flickering or streaking . Given monitors that offer the same resolution, the non-interlacing one will generally be better.

6)DOT PITCH

A measurement that indicates the vertical distance between each pixel on a display screen. Measured in millimeters, the dot pitch is one of the principal characteristics that determine the quality of display monitors, the lower the number ,the crisper the image. The dot pitch for color monitors for personal computers ranges from about 0.15 mm to 0.30 mm Another term for dot pitch is phosphor pitch.

7) CONVERGENCE

Convergence refers to how sharply an individual colour pixel on a monitor appears. Each pixel is composed of three dots-a red ,blue , and green one. if the dots are badly misconverged , the pixel will appear blurry . All monitors have some convergence errors, but they differ in degree.

8) VIDEO STANDARDS

There are a variety of video standards that define resolution and colors for displays. Support for a graphics standard is determined by both the monitor and the video adapter . The monitor must be able to show the resolution and colors defined by the standard, and the video adapter must be capable of transmitting the appropriate signals to the monitor.

Listed here, in approximate order of increasing power and sophistication , are the more popular video standards for PCs . Note that many suppliers of video adapters provide greater resolution and more colors.

CRT Monitor - The cathode ray tube (CRT) is a vacuum tube containing an electron gun (a source of electrons) and a fluorescent screen, with internal or external ... Type of desktop monitor that is similar to a standard television because it contains a cathode-ray tube.

Non CRT Display Units - In a non CRT mode it can not use picture eliment. So it is use specific diode and produce the picture on to the output device.
In non CRT mode which type of diode are used from that it have two type are available.

1. **LED**
2. **LCD**

LCD Monitor

LCD (liquid crystal display) is the technology used for displays in notebook and other smaller computers. Like light-emitting diode (LED) and gas-plasma technologies, **LCDs** allow displays to be much thinner than cathode ray tube (CRT) technology

A thin film transistor liquid crystal display (TFT-LCD) is a variant of liquid crystal display (LCD) which uses thin film transistor (TFT ... LCD monitors take up less desk space and they‘re lighter. Many laptop and notebook computers use LCD displays because of their low power requirements.

Gas Plasma Displays

This is also called a gas panel or a plasma panel and is another flat screen technology. A plasma panel contains a grid of electrodes in a flat, gas filled panel. The image can persist for a long time without refreshing in this panel. The disadvantages of the gas plasma displays are that they must use AC power and cannot show sharp contrast.

LED Display

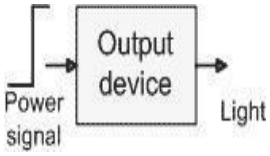
An **LED monitor** (short for **Light Emitting Diode**) or **LED** display is a flat screen, flat panel computer **monitor** or television. It has a very short depth and is light in terms of weight. The actual difference between this and a typical LCD**monitor** is the backlighting.

An **LED display** is a flat panel display, which uses light-emitting diodes as a video display. An **LED panel** is a small display, or a component of a larger display.

They are typically used outdoors in store signs and billboards, and in recent years have also become commonly used in destination signs on public transport vehicles or even as part of transparent glass area.

LED panels are sometimes used as form of lighting, for the purpose of general illumination, task lighting, or even stage lighting rather than display.

The LED (light-emitting diode) subsystem converts the input signal into light.



Plasma Displays

A plasma display is a computer video display in which each pixel on the screen is illuminated by a tiny bit of plasma or charged gas, somewhat like a tiny neon light. Plasma displays are thinner than cathode ray tube (CRT) displays and brighter than liquid crystal displays (LCD). Plasma displays are sometimes marketed as "thin-panel" displays and can be used to display either analog video signals or display modes digital computer input.

LCD Display

A display technology that creates characters by means of reflected light and is commonly used in digital watches and laptop computers. LCDs replaced LEDs (light emitting diodes) because LCDs use less power.

LCDs are difficult to read in a strong light, because they do not emit their own light. Portable computers wanted to have brighter and easier to read displays. Backlit LCDs are used for the purpose now.

Backlit LCDs: This is a type of LCD display having its own light source provided from the back of the screen. The backlit makes the background brighter and clear, as a result the texts and images appear sharper. However, this still is much less clear than CRTs. Thus, better technology is needed.

Active Matrix LCDs: This is an LCD display technique in which every dot on the screen has a transistor to control it more accurately. This uses a transistor for each monochrome or each red, green and blue dot. It provides better contrast, speeds up screen refresh and reduces motion smearing.

Other Output Device

1) **LCD Projector Display**

An LCD projector is a type of video projector for displaying video, images or computer data on a screen.

LCD projector rental is hot today because of the fight Manny Pacquiao. It was announced in a segment in a news that due to insistent demand by malls and other establishments for cheap LCD projector rentals, all was packed by a company offering the said service.

2) Over Head Projector (OHP) Display

An **overhead projector** is a variant of slide projector that is used to display images to an audience.

An overhead projector typically consists of a large box containing a very bright lamp and a fan to cool it.

On top of the box is a large fresnel lens that collimates the light. Above the box, typically on a long arm, is a mirror and lens that focusses and redirects the light forward instead of up.

Transparencies are placed on top of the lens for display. The light from the lamp travels through the transparency and into the mirror where it is shone forward onto a screen for display.

The mirror allows both the presenter and the audience to see the image at the same time, the presenter looking down at the transparency as if writing, the audience looking forward at the screen.

The height of the mirror can be adjusted, to both focus the image and to make the image larger or smaller depending on how close the projector is to the screen

3) Speaker

Speakers / Subwooper - is a device which converts an electrical signal into sound.

A speaker gives you sound output from your computer. Some speakers are built into the computer and some are separate.

In addition most sound cards are Sound Blaster compatible, which means that they can process commands written for a sound blaster card.

DIFFERENT TYPES OF PRINTER

Printer is a device standard from Texas or illustration on paper and in many cases of transparencies and other media, There are many different types of printers. In terms of the technology utilized ,printer fall into the following categories.

Printers:

A printer produces the output from the computer on the paper. It is the most commonly usedoutput device. The printers produce a hard copy i.e. a permanent copy of the results which can be stored and read later. Printers are classified as :

a) Impact Printer
b) Non Impact Printer

a) Impact Printer

Impact printers are similar to typewriters. They use hammer to strike a character against an inked ribbon and the impact of the hammer causes the image of the character to be printed on paper. E.g. Dot matrix printers, line printers, daisy wheel printers.

Advantages of impact printers:

- Their functioning is relatively easy
- Multiple copies can be produced at the same time with the help of carbon paper.
- Impact printers are noisy in operation and are subject to wear and tear of mechanical parts.

Types of impact printers :

1) Dot Matrix Printers

Dot matrix printer prints each character as a pattern of dots. The printer has a printer head with a matrix of pins (needles). Typical heads have a matrix of 7 rows and 9 columns. These pins produce a pattern of dots to form the individual characters. These printers are relatively low in cost and print at speeds of 50-500 characters per second. The programmer can also define the shape of characters for this printer.Therefore it is possible to print many special characters, characters in various sizes as well as charts and graphs on such printers. Dot matrix printers are very commonly used in most computer systems.

Dot-matrix printer create characters by striking pins against an ink ribbon . Each pin makes a dot and combination of dots characters and illustrations.

Dot-matrix printer ate inexpensive and relatively fast but they do not produce high -quality output.

Dot-matrix printer's speed measure in character per second the speed can vary from 50 to over 500 cps. Most dot matrix printers offer different speeds depending on the quality of print desired.

However print quality determined by the number of pins it can be of 9 to 24 pin. The best dot-matrix printers can produce near later quality type although you can still see a difference if look closely.

2) Daisy Wheel Printers

These printers are also called as letter quality printers. These printers have a daisy wheel with a number of petals. A character is embossed on each wheel. There is a motor which spins the wheel at a fast rate. When the desired character is brought to the correct position, a hammer strikes the petal to produce the output. Thus these printers are impact printers. The letter quality of these printers is much superior as compared to the dot matrix printers. But they are slow and typically print in the range of 10-50 characters per second.

Daisy-wheel printer are a type of printer that produces latter-quality type .A daisy-wheel printer works on the same principle as a ball-head typewriter . the daisy wheel is disk made of plastic or metal on which characters stand out in relief along the outer edge.

To print a character the printer rotates the disk until the desired letter is facing the paper. Then a hammer strikes the disk, forcing the character to hit an ink ribbon leaving an impression of the disk , forcing the character to hit an ink ribbon leaving an impression of the character on the paper. you can change the daisy wheel to print different fonts.

Daisy-wheel printer cannot graphics and in general they are noisy and slow printing from 10 to about 75 characters per second of laser and ink-jet printer has declined , and the quality of dot -matrix printer has improved, daisy-wheel printer have become almost obsolete.

3) Line Printer

Line printers are very fast printers which print at speed of 200-2500 lines per minute. These printers are impact printers and normally have 132 print positions per line. Different types of character set are available for different printers. Line printers are normally used in applications where large volumes of data are to be printed.

The two types of line printers are :

(i) Drum printers

This consists of a metallic cylinder. On the surface of this drum there are characters in bands. Each column or band on the drum contains all the characters. Opposite to each band there is a hammer located behind the paper. The drum rotates at a fast rate. The hammer strikes the paper along with the inked ribbon and produces the output. One line is printed in each revolution of the printer.

(ii) Chain printers

In the chain printers there is one print hammer for each print position on a line. There is a fast moving chain called the print chain. W hen this chain rotates, the print hammer and the inked ribbon strike the paper against the proper character on the chain.

b) Non Impact Printer

They use thermal, chemical, electrostatic and inkjet technologies for printing as against the hammer mechanism of impact printers. E.g. Laser printers, InkJet printers.

- **Ink Jet Printer**

Ink jet printer is a non impact printer. It prints characters by spraying ink from tiny nozzles onto the paper. A special type of ink which has a high iron content is used. This

ink is charged electrically when it comes out of the nozzle. This ink is absorbed by the paper and dries instantly. The output of the ink jet printer is of a superior quality. Also it is possible to obtain colored output. A number of character styles and sizes are available.However, being a non impact printer it is not possible to prepare carbon copies with this
printer.

Inkjet printer work by spraying ionized ink at a sheet of paper. Magnetized plates in the ink's path direct the ink onto the paper in the desired shapes.

Inkjet printers are capable of producing high quality print approaching that produced by laser printer provides a resolution of 300 dots per inch, although some newer models offer higher resolutions.

Because inkjet printers require smaller mechanical parts than laser printers, they are especially popular as portable printers. In addition color inkjet printers provide printing in full-color documents.

- **Laser Printers**

These printers are used where a very superior quality output is
desired. The image is created on a photo sensitive drum ; with a laser
beam. The laser is turned on and off when it moves back and forward across the drum. It leaves a negative charge on the drum to which a positively charged black toner powder sticks. When the paper rolls by the drum, the ink is transferred to the paper. Laser printers have a buffer memory to store entire pages and hence their speed is very fast.The biggest advantage of these printers is that no mechanical movement is involved, therefore
they are noiseless in operation. However there are comparatively expensive.

Laser printer utilizes a laser beam to produce an image on a drum. The light of the laser alters the electrical charge on the drum wherever it hits. The drum is then rolled through a reservoir of the drum. Finally, the toner is transferred to the paper through a combination of heat and pressure.

Because an entire page is transmitted to a drum before the toner is applied, laser printers sometimes called page printers.

One of the chief characteristics of laser printers is their resolution how many dots per inch(DPI) they lay down. They available resolutions range from 300 DPI at the low end to 1200 DPI at the high end. By comparison, offset printing usually prints at 1200 or 2400 DPI. Some laser printers achieve higher resolutions with special techniques known generally as resolution enhancement.

In addition to the standard monochrome laser printer, which uses a single toner there also exist color laser printers that use four toners to print in full color. Color laser printers tend to be about five to ten times as expensive as their monochrome.

- **CRT**

An electron beam is moved across a phosphor coated screen to produce the image.The CRT can be monochrome or colored. This screen normally has 25 lines and 80 characters.

• **Flat Panel Display**

The most common flat panel display is the Liquid Crystal Display (LCD). This does not have a picture tube. The other type of display is the gas plasma screen.

• **The Video Display Terminal**

The most popular output device in direct access processing is the Video Display Terminal.These terminals display information instantaneously. The monitor and the keyboard together are called a terminal.

The types of terminals are :-

Dumb Terminal:-This is a combination of a keyboard and monitor which can send or receive data, but cannot process the data.

Smart Terminal: -A smart terminal has an inbuilt microprocessor. It can perform arithmetic, logic and control functions. They also have some memory capacity. So they can store the data before sending to the processor. They can also control the cursormovement.

Intelligent Terminal:- This type of terminal also has an inbuilt microprocessor which can be programmed by the user. These terminals also have limited processing capability.They can communicate with other terminals and processors.

- **LINE**

Line Printers are high speed printers capable of printing an entire line at one time. A fast line printer can print as many 3000 lines per minute. The disadvantages of line printers are that they can print only one font, they cannot print graphics the print quality is very low and they are very noisy.

- **THERMAL**

Thermal printers are printers that produce images by pushing electrically heated pins against a special heat sensitive paper. Thermal printers as used in most calculators and many fax machines. They produce low quality print and the paper tends to curl and fade after few weeks or months.

- **PLOTTER**

Plotter is a device that draws pictures on paper based on commands from a computer. Plotters differ from printers in that they draw lines using a pen. As a result, they can produce continuous lines, whereas printers can only simulate lines by printing a closely spaced series of dots. Multicolor plotters use different colored spends to draw different colors.

In general, plotters are considerably more expensive than printers. They are used in engineering application where precision is mandatory.

CHARACTERICS OF PRINTER

1)Quality

The output produced by printers is said to be either letter quality, Near Letter Quality, Draft Quality Only daisy wheel, inkjet and laser printers produce letter quality. Some dot matrix printers claim letter quality print, but if you look closely, you can see the difference.

2) Speed

Speed of printers is measured in CPS or Page per minute (PPM) the speed of printers varies widely. Daisy wheel printers tend to be slowest printing about 30 cps. Line printers are faster. Dot matrix printers can print up to 500 CPS and laser printers range from about 4 to 20 text pages per minute.

3) Impact Or Non-impact

Impact printers include all printers that work by striking an ink ribbon. Daisy wheel, dot-matrix and line printers are impact printers. Non-impact printers include laser printers and inkjet printers. The important difference between impact and non-impact a printer is that impact printers are much noise but are useful for mankind multiple copies like carbon copies.

4) Graphics

Some printers can print only text other printers can print both text and graphics

Other Devices

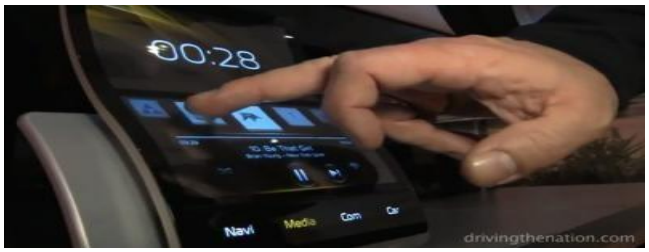
Fascimile(FAX)

Fax (short for **facsimile**), sometimes called telecopying or telefax (the latter short for telefacsimile), is the telephonic transmission of scanned printed material (both text and images), normally to a telephone number connected to a printer or other output device. The original document is scanned with a fax machine (or a telecopier), which processes the contents (text or images) as a single fixed graphic image, converting it into a bitmap, and then transmitting it through the telephone system in the form of audio-frequency tones. The receiving fax machine interprets the tones and reconstructs the image, printing a paper copy.[1] Early systems used direct conversions of image darkness to audio tone in a continuous or analog manner. Since the 1980s, most machines modulate the transmitted audio frequencies using a digital representation of the page which is compressed to quickly transmit areas which are all-white or all-black.

OLED(Organic LED)

OLED panels are made from **organic** (carbon based) materials that emit light when electricity is applied through them. Since **OLEDs** do not require a backlight and filters (unlike **LCD** displays), they are more efficient, simpler to make, and much thinner

OLED panels are made from organic (carbon based) materials that emit light when electricity is applied through them. Since OLEDs do not require a backlight and filters (unlike LCD displays), they are more efficient, simpler to make, and much thinner. OLEDs have a great picture quality - brilliant colors, fast response rate and a wide viewing angle. OLEDs can also be used to make OLED lighting - thin, efficient and without any bad metals.



OLED materials have been discovered back in 1960, but only in the past 20 years or so have researchers started to actually work on the technology. A complete history of

OLEDs can be found here. You can read more about OLED displays and advantages in our OLED introduction page.

Headphone

Sometimes referred to as earphones, headphones are a hardware device that either plugs into your computer (line out) or your speakers to privately listen to audio without disturbing anyone else. The picture is an example of a USB headset fromLogitech with a microphone and a popular solution for computer gaming.

- **SGD(Speech Generating Device)**

Speech-generating devices (SGDs), also known as voice output communication aids, are electronic augmentative and alternative communication (AAC) systems used to supplement or replace speech or writing for individuals with severe speech impairments, enabling them to verbally communicate their needs.
A speech generating device (SGD), also referred to as voice-output communication aids (VOCA), are electronic devices that allow the user to select messages to be spoken aloud, thereby assisting people who are unable to use natural speech to meet the majority of their communication needs. SGD technology ranges from simple to complex. Dedicated devices are intended for communication purposes only, while others are integrated into portable computer systems. Additional components may include but are not limited to environmental controls, switch access, rate enhancement programs, and appointment schedules and reminders.

- **Computer Output Microfilm (COM)**

This technology is used to record the computer output as microscopic filmed images.Information is recorded on a roll of microfilm. A microfilm recorder displays the information onto a screen. An inbuilt camera then takes pictures of this information. A microfilm reader is used to view this information. COM devices are normally used in application where there are large volumes of data. COM devices are much faster than the normal printers. Also since the size of these films is very small the space required for storage is very less as compared to printed output.However since COM systems are highly sophisticated they are relatively expensive and
are mainly used where there are high volumes of data.

- **Google Glass**

Google Glass is an optical head-mounted display, that is designed in the shape of a pair of eyeglasses. It was developed with the mission of producing a ubiquitous computer.Google Glass displayed information in a smartphone-like hands-free format.

Introduction

We use the decimal numbers or the decimal number system for our day-to-day activities. As well as know, in the decimal number system there are ten digits –0 through 9. but computers understand only 0s and 1s- the machine language. But using 0s and 1s to program a computer is a thing in the past. Now we can use the decimal numbers, the alphabets and special characters like +,-,*,?,/, etc. for programming the computer. Inside the computer, these decimal numbers, alphabets and the special characters are converted into 0s and 1s, so that the computer can understand what we are instructing it to do. To understand the working of a computer, the knowledge of binary, octal and hexadecimal number systems is essential.

- **Introduction to Binary Codes:-**

A **binary code** represents text or computer processor instructions using the **binary** number system's two **binary** digits, 0 and 1. The **binary code** assigns a bit string to each symbol or instruction.

Binary numbers, based on 1s and 0s, reflect the practical essence of computer hardware: electricity is either on or off. Learn how to write in binary numbers, and the (not so secret) code to transform English language letters into binary numbers and back again.

When is the letter A not the letter A? Well, computers don't use the letter A. They use the eight character binary number 01000001 to represent A. This binary numbers tutorial describes what binary numbers are and how to calculate them.

Computers transport, calculate, and translate binary numbers because computer hardware circuits only have two electrical states, on or off. These two states can be represented as zero (off) or one (on). All letters of the alphabet, numbers, and symbols are converted to eight character binary numbers as you work with them in software on your computer.

- **Introduction to Nibble:-**
  A **nibble** is four bits or half a byte. For example, the decimal value of 10 in an 8-bit byte is 00001010 that same value in a 4-bit nibble is 1010.

- **Introduction to Bit:-**
  A **bit** (short for binary digit) is the smallest unit of data in a **computer**. A**bit** has a single binary value, either 0 or 1. Although **computers** usually provide instructions that can test and manipulate **bits**, they generally are designed to store data and execute instructions in **bit** multiples called bytes.

- **Introduction to Byte:-**
  A byte is a unit of measurement used to measure data. One byte contains eight binary bits, or a series of eight zeros and ones. Therefore, each byte can be used to represent 2^8 or 256 different values.

The byte was originally developed to store a single character, since 256 values is sufficient to represent all standard lowercase and uppercase letters, numbers, and symbols.

- **Introduction to Carry Bit:-**
  In elementary arithmetic, a **carry** is a digit that is transferred from one column of digits to another column of more significant digits. It is part of the standard algorithm to add numbers together by starting with the rightmost digits and working to the left. For example, when 6 and 7 are added to make 13, the "3" is written to the same column and the "1" is carried to the left. When used in subtraction the operation is called a **borrow**.
  In computer processors the **carry flag** (usually indicated as the C **flag**) is a single **bit** in a system status (**flag**) register used to indicate when an arithmetic **carry** or borrow has been generated out of the most significant ALU **bit** position.

- **Introduction to Parity Bit:-**
- A parity bit is a bit, with a value of 0 or 1, that is added to a block of datafor error detection purposes. It gives the data either an odd or evenparity, which is used to validate the integrity of the data.
- Parity bits are often used in data transmission to ensure that data is not corrupted during the transfer process. For example, every 7 bits of data may include a parity bit (for a total of 8 bits, or one byte). If the data transmission protocol is set to an odd parity, each data packet must have an odd parity. If it is set to even, each packet must have an even parity. If a packet is received with the wrong parity, an error will be produced and the data will need to be retransmitted.

- The parity bit for each data packet is computed before the data is transmitted. Below are examples of how a parity bit would be computed using both odd and even parity settings.

Introduction to Sign Bit:-

The algorithm that creates the representation of the negative of an integer works with both positive and negative integers. Start with Nand form its two's complement: you get -N. Now complement -N and you get the original N.

0110 1101 reflect → 1001 0010 add one → 1001 0011

1001 0011 reflect → 0110 1100 add one → 0110 1101

With N-bit two's comp representation, the high order bit is "0" for positive integers and "1" for negative integers. This is a fortunate result. The high order bit is sometimes called the **sign bit**. But it is not really a sign (it does not play a separate role from the other bits). It takes part in the "binary addition algorithm" just as any bit.

Introduction to KB:-

Short for kilobyte. When used to decribe data storage, **KB** usually represents 1,024 bytes. When used to describe data transfer rates, **KB**represents 1,000 bytes.

Introduction to MB:-

The megabyte is a multiple of the unit byte for digital information. Its recommended unit symbol is **MB**, but sometimes MByte is used. The unit prefix mega is a multiplier of

1000000 (10^6) in the International System of Units (SI). Therefore, one megabyte is one million bytes of information

Introduction to GB:-

A unit of information equal to one thousand million (10^9) or, strictly, 2^{30} bytes.
The **gigabyte** is a multiple of the unit byte for digital information. The prefix giga means 10^9 in the International System of Units (SI), therefore one **gigabyte** is 1000000000bytes. The unit symbol for the **gigabyte** is **GB**.

Introduction to TB:-

A TB (Terabyte) is a THOUSAND times bigger than a GB (Gigabyte).
A terabyte (**TB**) is a measure of **computer**storage **capacity** that is 2 to the 40th power, or approximately a trillion bytes. A terabyte is more precisely **defined** as 1,024 gigabytes (GB). The prefix tera is derived from the Greek word for monster.

Introduction to HB:-

What is the meaning of KB, MB, GB, etc.?
The computer terms such as KB, MB, etc. can be slightly confusing for the PC Beginner. So, here's a little elaboration on these units.
The PC measures the size of the data in terms of its own units called bytes. The collection of these bytes is known as kilobytes (KB), Megabytes (MB), etc. The detailed list of the units for size of data with their full-forms & size, for your understanding, is given below :

Acronym	Full Form	Size
B	Byte	1 byte
KB	Kilo byte	1 KB = 1,024 bytes
MB	Mega byte	1 MB = 1,024 KB
GB	Giga byte	1 GB = 1,024 MB
TB	Tera byte	1 TB = 1,024 GB
PB	Peta byte	1 PB = 1,024 TB
EB	Exa byte	1 EB = 1,024 PB
ZB	Zetta byte	1 ZB = 1,024 EB
YB	Yotta byte	1 YB = 1,024 ZB

Types of Numbering System

1. Decimal NumberSystem

The number system that we use in our day-to-day life is the decimal number system. Decimal number system has base 10 as it uses 10 digits from 0 to 9. In decimal number system, the successive positions to the left of the decimal point represent units, tens, hundreds, thousands and so on.
Each position represents a specific power of the base (10). For example, the decimal number 1234 consists of the digit 4 in the units position, 3 in the tens position, 2 in the hundreds position, and 1 in the thousands position, and its value can be written as
(1x1000)+ (2x100)+ (3x10)+ (4xl)
($1x10^3$)+ ($2x10^2$)+ ($3x10^1$)+ ($4xl0^0$)
1000 + 200 + 30 + 4
1234
As a computer programmer or an IT professional, you should understand the following number systems which are frequently used in computers.

S.N.	Number System and Description
1	Binary Number System Base 2. Digits used : 0, 1
2	Octal Number System Base 8. Digits used : 0 to 7
3	Hexa Decimal Number System Base 16. Digits used : 0 to 9, Letters used : A- F

2. Binary Number System

Characteristics of binary number system are as follows:

Uses two digits, 0 and 1.

Also called base 2 number system

Each position in a binary number represents a 0 power of the base (2). Example 2^0

Last position in a binary number represents a x power of the base (2). Example 2^x where x represents the last position - 1.

Example

Binary Number : 10101_2

Calculating Decimal Equivalent:

Step	Binary Number	Decimal Number
Step 1	101012	((1 x 24) + (0 x 23) + (1 x 22) + (0 x 21) + (1 x 20))10
Step 2	101012	(16 + 0 + 4 + 0 + 1)10
Step 3	101012	2110

Note : 10101_2 is normally written as 10101.

3. OCTAL NUMBER SYSTEM

Octal Number System

Characteristics of octal number system are as follows:

Uses eight digits, 0,1,2,3,4,5,6,7.

Also called base 8 number system

Each position in an octal number represents a 0 power of the base (8). Example 8^0

Last position in an octal number represents a x power of the base (8). Example 8^x where x represents the last position - 1.

Example

Octal Number : 12570_8

Calculating Decimal Equivalent:

Step	Octal Number	Decimal Number
Step 1	125708	((1 x 84) + (2 x 83) + (5 x 82) + (7 x 81) + (0 x 80))10
Step 2	125708	(4096 + 1024 + 320 + 56 + 0)10
Step 3	125708	549610

Note : 12570_8 is normally written as 12570.

Hexadecimal Number System

Characteristics of hexadecimal number system are as follows:

Uses 10 digits and 6 letters, 0,1,2,3,4,5,6,7,8,9,A,B,C,D,E,F.

Letters represents numbers starting from 10. A = 10. B = 11, C = 12, D = 13, E = 14, F = 15.

Also called base 16 number system

Each position in a hexadecimal number represents a 0 power of the base (16). Example 16^0

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

Example

Hexadecimal Number : $19FDE_{16}$

Calculating Decimal Equivalent:

Step	Binary Number	Decimal Number
Step 1	19FDE16	((1 x 164) + (9 x 163) + (F x 162) + (D x 161) + (E x 160))10
Step 2	19FDE16	((1 x 164) + (9 x 163) + (15 x 162) + (13 x 161) + (14 x 160))10
Step 3	19FDE16	(65536+ 36864 + 3840 + 208 + 14)10
Step 4	19FDE16	10646210

Hexadecimal number system uses 16 as the base or radix. This base-16 number system consists of 16 unique symbols: the numbers 0 to 9 and the letters A to F.

For example, the decimal number 15 represented as F in the hexadecimal numbering system as shown in the Table 6.7.

The hexadecimal system is useful because it can represent every byte (8 bits) as two consecutive hexadecimal digits. Compared to binary numbers, hexadecimal number are easier for humans to read.

Table 6.7 Hexadecimal number system

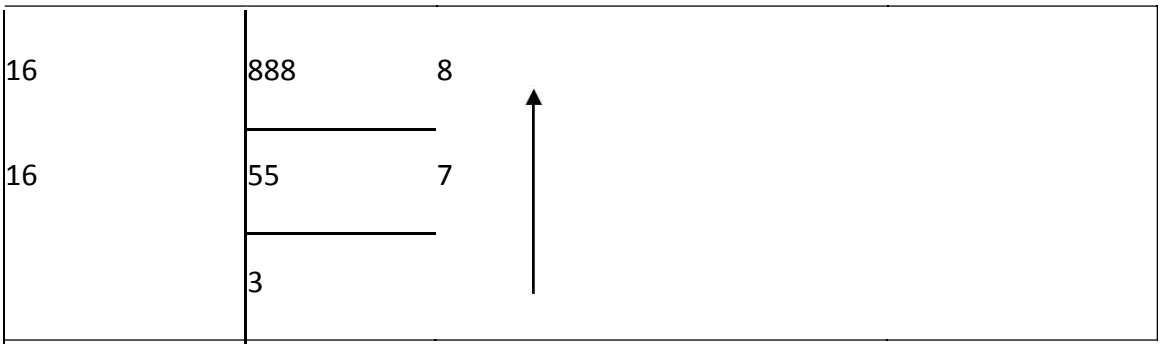
Hexadecimal	**Decimal**	**Binary**
0	0	0000
1	1	0001
2	2	0010
3	3	0011
4	4	0100
5	5	0101
6	6	0110
7	7	0111
8	8	100
9	9	1001
A	10	1010
B	11	1011
C	12	1100
D	13	1101
E	14	1110
F	15	1111

To convert a value from hexadecimal to binary, you merely translate each hexadecimal digit into its 4-bit binary equivalent. For example, the hexadecimal number 3F7A translates to the following binary number: 0011 1111 0111 1010.

To convert a hexadecimal number to decimal, the same method used for binary-decimal conversion is used, the only difference is that instead of 2 the base is 16. For example, the hexadecimal number 24.25 is 36.14453125 in decimal as shown below.

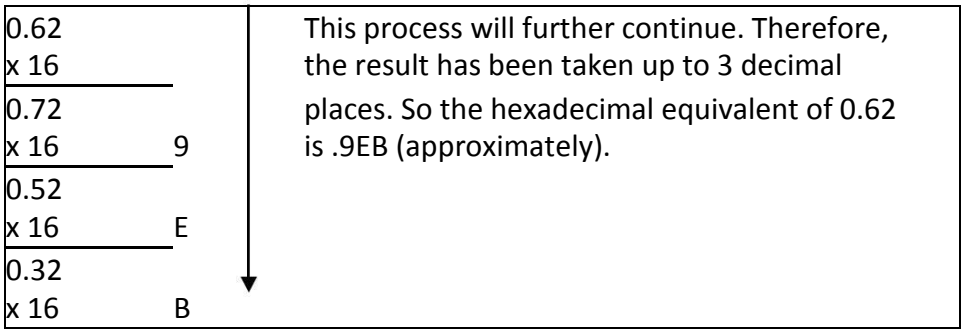
$= 2*16^1 + 4*16^0 + 2*16^{-1} + 5*16^{-2} = 32 + 4 + 0.125 + 0.01953125 = 36.14453125$

To convert a decimal number to hexadecimal system, it repeatedly divided by 16 as illustrated in the following example. To convert 888 to hexadecimal system.



$(888)_{10}$ answer is $(378)_{16}$

If the decimal number has a fractional part, then the fractional part converted into hexadecimal by multiplying it with 16. Only the integer of the result is noted and the fraction repeatedly multiplied by 16 until the fractional part has become 0. This explained using the following example.



Therefore, from the above two examples, we can conclude that the hexadecimal equivalent of the decimal number 888.62 is 378.9EB approximately.

Binary Number Conversion

Binary to Octal, Decimal and Hexa-Decimal

- **Binary to Octal**

An easy way to convert from binary to octal is to group binary digits into sets of three, starting with the least significant (rightmost) digits.

Binary: 11100101 = 11 100 101

011 100 101

Pad the most significant digits with zeros if necessary to complete a group of three.

Then, look up each group in a table:

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

Binary = 011 100 101

Octal = 3 4 5 = 345 oct

- **Binary to Hexadecimal**

An equally easy way to convert from binary to hexadecimal is to group binary digits into sets of four, starting with the least significant (rightmost) digits.
Binary: 11100101 = 1110 0101
Then, look up each group in a table:

Binary:	0000	0001	0010	0011	0100	0101	0110	0111
Hexadecimal:	0	1	2	3	4	5	6	7
Binary:	1000	1001	1010	1011	1100	1101	1110	1111
Hexadecimal:	8	9	A	B	C	D	E	F

Binary = 1110 0101
Hexadecimal = E 5 = E5 hex

- **Binary to Decimal**

They say there are only 10 people in this world: those that understand binary and those that don't. Ha ha.
If you don't get that joke, you'll need a method to convert from binary to decimal. One method involves addition and multiplication.
Start the decimal result at 0.
Remove the most significant binary digit (leftmost) and add it to the result.
If all binary digits have been removed, you're done. Stop.
Otherwise, multiply the result by 2.
Go to step 2.
Here is an example of converting 11100000000 binary to decimal:

Binary Digits	Operation	Decimal Result	Operation	Decimal Result
11100000000	+1	1	× 2	2
1100000000	+1	3	× 2	6
100000000	+1	7	× 2	14
00000000	+0	14	× 2	28
0000000	+0	28	× 2	56
000000	+0	56	× 2	112
00000	+0	112	× 2	224
0000	+0	224	× 2	448
000	+0	448	× 2	896
00	+0	896	× 2	1792
0	+0	1792	done.	

Let's try converting from decimal...

Decimal Number Conversion

A repeated division and remainder algorithm can convert decimal to binary, octal, or hexadecimal.
Divide the decimal number by the desired target radix (2, 8, or 16).
Append the remainder as the next most significant digit.
Repeat until the decimal number has reached zero.

- **Decimal to Binary**

Here is an example of using repeated division to convert 1792 decimal to binary:

Decimal Number	Operation	Quotient	Remainder	Binary Result
1792	÷ 2 =	896	0	0
896	÷ 2 =	448	0	00
448	÷ 2 =	224	0	000
224	÷ 2 =	112	0	0000
112	÷ 2 =	56	0	00000
56	÷ 2 =	28	0	000000
28	÷ 2 =	14	0	0000000
14	÷ 2 =	7	0	00000000
7	÷ 2 =	3	1	100000000
3	÷ 2 =	1	1	1100000000
1	÷ 2 =	0	1	11100000000
0	done.			

- **Decimal to Octal**

Here is an example of using repeated division to convert 1792 decimal to octal:

Decimal Number	Operation	Quotient	Remainder	Octal Result
1792	÷ 8 =	224	0	0
224	÷ 8 =	28	0	00
28	÷ 8 =	3	4	400
3	÷ 8 =	0	3	3400
0	done.			

Converting octal to decimal can be done with repeated division.
Start the decimal result at 0.
Remove the most significant octal digit (leftmost) and add it to the result.
If all octal digits have been removed, you're done. Stop.
Otherwise, multiply the result by 8.
Go to step 2.

Octal Digits	Operation	Decimal Result	Operation	Decimal Result
345	+3	3	× 8	24
45	+4	28	× 8	224
5	+5	229	done.	

The conversion can also be performed in the conventional mathematical way, by showing each digit place as an increasing power of 8.
345 octal = $(3 * 8^2) + (4 * 8^1) + (5 * 8^0) = (3 * 64) + (4 * 8) + (5 * 1) = 229$ decimal
Converting from hexadecimal is next...

- **Decimal to Hexadecimal**

Here is an example of using repeated division to convert 1792 decimal to hexadecimal:

Decimal Number Operation Quotient Remainder Hexadecimal

				Result
1792	÷ 16 =	112	0	0
112	÷ 16 =	7	0	00
7	÷ 16 =	0	7	700
0	done.			

The only addition to the algorithm when converting from decimal to hexadecimal is that a table must be used to obtain the hexadecimal digit if the remainder is greater than decimal 9.

Decimal:	0	1	2	3	4	5	6	7
Hexadecimal:	0	1	2	3	4	5	6	7
Decimal:	8	9	10	11	12	13	14	15
Hexadecimal:	8	9	A	B	C	D	E	F

The addition of letters can make for funny hexadecimal values. For example, 48879 decimal converted to hex is:

Decimal Number	Operation	Quotient	Remainder	Hexadecimal Result
48879	÷ 16 =	3054	15	F
3054	÷ 16 =	190	14	EF
190	÷ 16 =	11	14	EEF
11	÷ 16 =	0	11	BEEF
0	done.			

Other fun hexadecimal numbers include: AD, BE, FAD, FADE, ADD, BED, BEE, BEAD, DEAF, FEE, ODD, BOD, DEAD, DEED, BABE, CAFE, C0FFEE, FED, FEED, FACE, BAD, F00D, and my initials DAC.

Now on to octal conversions...

Octal Number Conversion

Octal to Binary

Converting from octal to binary is as easy as converting from binary to octal. Simply look up each octal digit to obtain the equivalent group of three binary digits.

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

Octal =	3	4	5	
Binary =	011	100	101	= 011100101 binary

Hexadecimal Number Conversion

- **Hexadecimal to Binary**

Converting from hexadecimal to binary is as easy as converting from binary to hexadecimal. Simply look up each hexadecimal digit to obtain the equivalent group of four binary digits.

Hexadecimal:	0	1	2	3	4	5	6	7
Binary:	0000	0001	0010	0011	0100	0101	0110	0111
Hexadecimal:	8	9	A	B	C	D	E	F
Binary:	1000	1001	1010	1011	1100	1101	1110	1111

Hexadecimal =	A	2	D	E	
Binary =	1010	0010	1101	1110	= 1010001011011110 binary

- **Hexadecimal to Octal**

When converting from hexadecimal to octal, it is often easier to first convert the hexadecimal number into binary and then from binary into octal. For example, to convert A2DE hex into octal:
(from the previous example)

Hexadecimal =	A	2	D	E	
Binary =	1010	0010	1101	1110	= 1010001011011110 binary

Add leading zeros or remove leading zeros to group into sets of three binary digits.
Binary: 1010001011011110 = 001 010 001 011 011 110
Then, look up each group in a table:

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

Binary =	001	010	001	011	011	110	
Octal =	1	2	1	3	3	6	= 121336 octal

Therefore, through a two-step conversion process, hexadecimal A2DE equals binary 1010001011011110 equals octal 121336.

➢ Hexadecimal to Decimal

Converting hexadecimal to decimal can be performed in the conventional mathematical way, by showing each digit place as an increasing power of 16. Of course, hexadecimal letter values need to be converted to decimal values before performing the math.

Hexadecimal:	0	1	2	3	4	5	6	7
Decimal:	0	1	2	3	4	5	6	7
Hexadecimal:	8	9	A	B	C	D	E	F
Decimal:	8	9	10	11	12	13	14	15

A2DE hexadecimal:
$= ((A) * 16^3) + (2 * 16^2) + ((D) * 16^1) + ((E) * 16^0)$
$= (10 * 16^3) + (2 * 16^2) + (13 * 16^1) + (14 * 16^0)$
$= (10 * 4096) + (2 * 256) + (13 * 16) + (14 * 1)$
$= 40960 + 512 + 208 + 14$
$= 41694$ decimal

Finally, why you might choose one number system over another...

Octal Number Conversion

- **Octal to Binary**

Converting from octal to binary is as easy as converting from binary to octal. Simply look up each octal digit to obtain the equivalent group of three binary digits.

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

Octal = 3 4 5

Binary = 011 100 101 = 011100101 binary

- **Octal to Hexadecimal**

When converting from octal to hexadecimal, it is often easier to first convert the octal number into binary and then from binary into hexadecimal. For example, to convert 345 octal into hex:

(from the previous example)

Octal = 3 4 5

Binary = 011 100 101 = 011100101 binary

Drop any leading zeros or pad with leading zeros to get groups of four binary digits (bits):

Binary 011100101 = 1110 0101

Then, look up the groups in a table to convert to hexadecimal digits.

Binary:	0000	0001	0010	0011	0100	0101	0110	0111
Hexadecimal:	0	1	2	3	4	5	6	7
Binary:	1000	1001	1010	1011	1100	1101	1110	1111
Hexadecimal:	8	9	A	B	C	D	E	F

Binary = 1110 0101

Hexadecimal = E 5 = E5 hex

Therefore, through a two-step conversion process, octal 345 equals binary 011100101 equals hexadecimal E5.

- **Octal to Decimal**

Converting octal to decimal can be done with repeated division.

1. Start the decimal result at 0.
2. Remove the most significant octal digit (leftmost) and add it to the result.
3. If all octal digits have been removed, you're done. Stop.
4. Otherwise, multiply the result by 8.
5. Go to step 2.

Octal Digits	Operation	Decimal Result	Operation	Decimal Result
345	+3	3	× 8	24
45	+4	28	× 8	224
5	+5	229	done.	

The conversion can also be performed in the conventional mathematical way, by showing each digit place as an increasing power of 8.

345 octal = $(3 * 8^2) + (4 * 8^1) + (5 * 8^0)$ = (3 * 64) + (4 * 8) + (5 * 1) = 229 decimal

Converting from hexadecimal is next...

Binary Arithmetic

Binary arithmetic is essential part of all the digital computers and many other digital system.

Binary Addition

It is a key for binary subtraction, multiplication, division. There are four rules of binary addition.

Case	A + B	Sum	Carry
1	0 + 0	0	0
2	0 + 1	1	0
3	1 + 0	1	0
4	1 + 1	0	1

In fourth case, a binary addition is creating a sum of (1 + 1 = 10) i.e. 0 is written in the given column and a carry of 1 over to the next column.

Example – Addition

0011010 + 001100 = 00100110

```
  1 1          carry
  0 0 1 1 0 1 0  = 26(10)
+ 0 0 0 1 1 0 0  = 12(10)
-----------------
  0 1 0 0 1 1 0  = 38(10)
```

Binary Subtraction

Subtraction and Borrow, these two words will be used very frequently for the binary subtraction. There are four rules of binary subtraction.

Case	A - B	Subtract	Borrow
1	0 - 0	0	0
2	1 - 0	1	0
3	1 - 1	0	0
4	0 - 1	0	1

Example – Subtraction

0011010 - 001100 = 00001110

```
    1 1        borrow
  0 0 1 1 0 1 0  = 26(10)
- 0 0 0 1 1 0 0  = 12(10)
-----------------
  0 0 0 1 1 1 0  = 14(10)
```

Binary Multiplication

Binary multiplication is similar to decimal multiplication. It is simpler than decimal multiplication because only 0s and 1s are involved. There are four rules of binary multiplication.

Case	A x B	Multiplication
1	0 x 0	0
2	0 x 1	0
3	1 x 0	0
4	1 x 1	1

Example – Multiplication

Example:

0011010 x 001100 = 100111000

```
    0 0 1 1 0 1 0   = 26₁₀
  x 0 0 0 1 1 0 0   = 12₁₀
  -----------------
    0 0 0 0 0 0 0
  0 0 0 0 0 0 0
0 0 1 1 0 1 0
0 0 1 1 0 1 0
-----------------
0 1 0 0 1 1 1 0 0 0   = 312₁₀
```

Binary Division

Binary division is similar to decimal division. It is called as the long division procedure.

Example – Division

101010 / 000110 = 000111

```
          1 1 1     = 7₁₀
      ------------
000110 ) 1 0 1 0 1 0   = 42₁₀
       - 1 1 0         = 6₁₀
       -------
         1 0 0 1
       - 1 1 0
       -------
           1 1 0
         - 1 1 0
         -------
               0
```

Notes:-

Binary Number System

System Digits: 0 and 1
Bit (short for binary digit): A single binary digit
LSB (least significant bit): The rightmost bit
MSB (most significant bit): The leftmost bit
Upper Byte (or nybble): The right-hand byte (or nybble) of a pair
Lower Byte (or nybble): The left-hand byte (or nybble) of a pair

Binary Equivalents

1 Nibble (or nibble) = 4 bits
1 Byte = 2 nibbles = 8 bits
1 Kilobyte (KB) = 1024 bytes
1 Megabyte (MB) = 1024 kilobytes = 1,048,576 bytes
1 Gigabyte (GB) = 1024 megabytes = 1,073,741,824 bytes

Binary Addition

The addition of numbers in the binary system shown in the Table 6.2 and is illustrated by the examples.

Table 6.2 Binary Addition

X	Y	X+Y
0	0	0
0	1	1
1	0	1
1	1	Carry -> 1 0

The addition of 101101 and 1111(which are 45 and 15 in the decimal system) done as follows:

Binary		**Decimal**
101101	45	
+001111		+15
111100	**60**	

Similarly, the addition of 1111011 and 11011 (which are 123 and 27 in the decimal system) is:

Binary		**Decimal**
1111011		123
+0011011		+27
10010110	**150**	

Decimal
45 -15
30

Binary Subtraction
The subtraction of 1111 from 101101 (which are 15 and 45 in the decimal system) done as follows:

Binary

101101 -001111

11110

Similarly the subtraction of 11011 from 1111011 (which are 27 and 123 in the decimal system) is:

Binary		**Decimal**
1111011		123
-0011011		-27
1100000		**96**

When you are subtracting a larger number from a smaller number, the result obtained will be the 2‘s complement. That is, instead of getting a negative number, we are getting the 2‘s complement of the negative number.

For example, if we subtract 45 (101101) from (1111), we should get – 30. However, when we do the binary subtraction, instead of getting – 11110 (-30) we will get the

2‘s complement of 11110, which 10.

Binary		Decimal
001111	15	
-101101		-45
Ignore Carry-> **1**	**-30**	
00010		
10		

- **BINARY CODED DECIMAL (BCD)**

The BCD is the simplest binary code that used to represent a decimal number. In the BCD code, 4 bits represent a decimal number. For example, 2 is represented as 0010. If a decimal number consists of more than 1 digit, each decimal digit is represented individually by its 4-bit binary equivalent. For example, 123 is represented as 0001 0010 0011. There is a difference between the binary equivalent of a decimal number and its BCD code. For example, the binary equivalent of 45 is 101101 and its BCD code is 0100 0101. Computers perform subtraction-using complements and there is difficulty in forming complements when numbers are represented in BCD. For example, 1‘s complement of 2(0010) is 1101, which is 13 in the decimal system and is not an acceptable BCD code. To overcome this difficulty, other BCD codes such as Excess-3 are used.

- **EBCDIC CODE**

The EBCDIC is extended binary code decimal information interchange code EBCDIC is extended binary code that used to represent a decimal number. In the EBCDIC code use 8 bits represent a decimal number. So it makes different 256 numbers.

Range of A to I = C1 to C9, J to R=D1 to D9, S to Z=E2 to E9, 0 to 9=Fo to F9

- **ASCII CODE**

ASCII stands for American Standard Code for Information Interchange. ASCII code used extensively in small computers, peripherals, instruments and communications devices. It has replaced many of the special codes that previously used. It is a seven-bit code. When dealing with non-numerical values or data we can use plain text characters and strings. Each character is given a unique identifier and we can use these to store and interpret data. The ASCII (American Standard Code for Information Interchange) is a very common character encryption system is shown in **Error! Reference source not found.**. The table includes the basic written characters, as well as some special characters, and some control codes. Each one is given a unique number. Consider the letter A, it is readily recognized by most computers world-wide when they see the number 65.

Microcomputers using 8-bit word length use 7 bits to represent the basic code. The 8^{th} bit is used for parity or it may be permanently 1 or 0. With 7 bits, up to 128 characters can be coded. A letter, digit or special symbol called a character. It includes upper and lower case alphabets, numbers, punctuation mark and special and control characters.

Range of A to o = 40 to 4E, P to Z=50 to 5A ,0 to 9=30 to 39

ASCII-8 CODE

A newer version of ASCII is the ASCII-8 code, which is an 8-bit code. With 8 bits, the code capacity is extended to 56 characters.

Range of A to o = A1 to AF, P to Z=Bo to BA ,0 to 9=50 to 59

- **UniCode**

A standard for representing characters as integers. Unlike ASCII, which uses 7 bits for each character, Unicode uses 16 bits, which means that it can represent more than 65,000 unique characters. This is a bit of overkill for English and Western-Europeanlanguages, but it is necessary for some other languages, such as Greek, Chinese and Japanese. Many analysts believe that as the software industry becomes increasingly global, Unicode will eventually supplant ASCII as the standard character coding format.

COMPLEMENTS

In digital work, two types of complements of binary number are used for complemental subtraction 1) 1‘s complements 2) 2‘s complements

1‘s complements:-In binary number is obtained by changing its each 0 into a 1 and each 1 into 0.it is also radix-minus-one complement.

For example: -1‘s complement of 100_2 is 011_2 and 1110_2 is 0001_2 .
2‘s complement:-it binary number is obtained by adding 1 to its 1‘s complement

2‘s complement=1‘s complement +1.
For example:-0111_2 it‘s 1‘s complement is 1000_2 now 1 add in least significant number of 1‘s complement result is $1000_2 + 1_2 = 1001_2$.

1‘s and 2‘s complement is use for subtraction method

1‘s complement subtraction method:-In this method instead of a direct second number we add its 1‘s complement to this first number is given.

Step-1) computer the 1‘s complement of the sub trahend by changing all its 1 to 0 and all its 0s to 1.

Step-2) add this complement to the first number Step-3) Perform the operation carry of last 1 or 0

Step-4) If there is no carry from the most significant digit then answer must be recomplemented and a negative sign attached to it.

Step-5) if there is carry from the most significant digit, no complements but add the 1 carry to least significant of the result.

2‘s complement subtraction method:-

Step-1) find the 2‘s complement of the second number Step-2) add this to the first number
Step-4) if the carry is 1 from most significant digit then drop the final carry Step-5) if the carry is 0 from most significant digit then give 2‘s complement of the result and attach negative sign with it.

Introduction of Nibble, bit, byte, carry bit, parity bit, sign bit, word.

Computers store data in the form of bits, bytes, and words using the binary numbering system.

Hexadecimal numbers are formed using four-bit groups called nibbles (or nybbles).

Signed integers can be stored in one‘s
Bit :- it is the most basic unit of information in a computer.

It is a state of —on or —off in a digital circuit.
Sometimes they represent **high** or **low** voltage

Byte :- it is a group of eight bits.. It is the smallest possible addressable unit of computer storage.

Nibble :- it is group of four digit is known as Nibble ex.0010 is one nibble **Word :-** it is a contiguous group of bytes.
Words can be any number of bits or bytes.

Word sizes of 16, 32, or 64 bits are most common. 2 = Binary Base
10 = Decimal Base
8 = Octal Base
16 = Hexadecimal Base

Parity Bit:- Errors often occur when data is transmitted or stored. This is very important when transmitting data in noisy factories, over phone lines, etc. Parity bits can be added to data as a simple check of transmitted data for errors. If the data contains error it can be retransmitted, or ignored.

A parity bit is normally a 9th bit added onto an 8 bit byte. When the data is encoded the number of true bits are counted. The parity bit is then set to indicate if there are an even or odd number of true bits. When the byte is decoded the parity bit is checked to make sure it that there are an even or odd number of data bits true. If the parity bit is not satisfied, then the byte is judged to be in error. There are two types of parity, even or odd. These are both based upon an even or odd number of data bits being true. The odd parity bit is true if there are an odd number of bits on in a binary number. On the other hand the Even parity is set if there are an even number of true bits. This is illustrated in

Parity Bits on a Byte.

	data bits	parity bit
Odd Parity	10101110	1
	10111000	0
Even Parity	00101010	0
	10111101	1

Parity Bits on a Byte Parity bits are normally suitable for single bytes, but are not reliable for data with a number of bits

Sign Bit:-

decimal	binary byte
2	00000010
1	00000001
0	00000000
-0	10000000
-1	10000001
-2	10000010

Note: there are two zeros

An example of 2s compliment numbers are shown in Fig. Basically, if the number is positive, itwill be a regular binary number. If the number is to be negative, we start the positive number, compliment it (reverse all the bits), then add 1. Basically when these numbers are negative, then the most significant bit is set. To convert from a negative 2s compliment number, subtract 1, and then invert the number.

dec imal	binary byte
2	00000010
1	00000001
0	00000000
-1	11111111
-2	11111110

METHOD FOR MAKING A NEGAT IVE NUMBER

write the binary number for the positive for -30 we write 30 = 0001110

Invert (compliment) the number 00011110 becomes 1100001

Add 1

11100001 + 00000001 = **1**100010

Binary numbers come in three basic forms - a bit, a byte and a word. A bit is a single binary digit, a byte is eight binary digits, and a word is 16 digits. Words and bytes are shown in Bytes and Words. Notice that on both numbers the least significant digit is on the right hand side of the numbers. And, in the word there are two bytes, and the right hand one is the least significant byte.

BYTE	WORD	
MSBLSB	MSB	LSB
0110 1011	0110 1011 0100 0010	
	most	least
	significant	significant
	byte	byte

Bytes and Words Base 10 (decimal) numbers developed naturally because the original developers (probably) had ten fingers, or 10 digits. Now consider logical systems that only have wires that can be on or off. When counting with a wire the only digits are 0 and 1, giving a base 2 numbering system. Numbering systems for computers are often based on base 2 numbers, but base 4, 8, 16 and 32 are commonly used. A list of numbering systems is give in. An example of counting in these different numbering systems is shown in Fig.

Carry Bit:-

Figure shows the addition of numbers using 2s compliment numbers. The three operations result in zero, positive and negative values. Notice that in all three operation the top number is positive, while the bottom operation is negative (this is easy to see because the MSB of the numbers is set). All three of the additions are using bytes, this is important for considering the results of the calculations. In the left and right hand calculations the additions result in a 9th bit - when dealing with 8 bit numbers we call this bit the carry C. If the calculation started with a positive and negative value, and ended up with a carry bit, there is no problem, and the carry bit should be ignored. If doing the calculation on a calculator you will see the carry bit, but when using a PLC you must look elsewhere to find it.

00000001 = 1 + 11111111 = -1

C+00000000 = 0

ignore the carry bits

00000001 = 1 + 11111110 = -2

11111111 = -1 C+00000001 = 1

00000010 = 2 + 11111111 = -1

Note: Normally the carry bit is ignored during the oper ation, but some additional logic is required to make sure that the number has notov erf lowed and moved outside of the range of the numbers. Here the 2s com pliment byte can have values from -128 to 127.

Figure 13.12 Adding 2s Compliment Numbers

The integers have limited value ranges, for example a 16 bit word ranges from -32,768 to 32,767 whereas a 32 bit word ranges from - 2,147,483,648 to 2,147,483,647. In some cases calculations will give results outside this range, and the Overflow O bit will be set. (Note: an overflow condition is a major error, and the PLC will probably halt when this happens.) For an addition operation the Overflow bit will be set when the sign of both numbers is the same, but the sign of the result is opposite. When the signs of the numbers are opposite an overflow cannot occur. This can be seen in Carry and Overflow Bits where the numbers two of the three calculations are outside the range. When this happens the result goes from positive to negative, or the other way

01111111 = 127	10000001 = -127	10000001 = -127
+ 00000011 = 3	+ 11111111 = -1	+ 11111110 = -2
10000010 = -126	10000000 = -128	01111111 = 127
C = 0	C = 1	C = 1
O = 1 (error)	O = 0 (no error)	O = 1 (error)

Note: If an overflow bit is set this indicates that a calculation is outside and acceptable range. When this error occurs the PLC will halt. Do not ignore the limitations of the numbers.

Carry and Overflow BitsThese bits also apply to multiplication and division operations. In addition the PLC will alsohave bits to indicate when the result of an operation is zero Z and negative N.

Parity Check:-

Parity checking uses parity bits to check that data has been transmitted accurately. The parity bit is added to every data unit (typically seven or eight bits) that are transmitted. The parity bit for each unit is set so that all bytes have either an odd number or an even number of set bits.

Even Parity System:-

Refers to the parity-checking mode in which each set of transmittedbits must have an even number of set bits. The parity checkingsystem on the sending side ensures even parity by setting the extraparity bit if necessary.

Odd Parity System:-

The mode of parity checking in which each 9-bit combination of a data byte plus a parity bit contains an odd number of set bits.

- **Introduction about computer language:-**

- In computer each and every information is provide using of English alphabet by the user.
- Whenever user provide English alphabet that language is known as a high level language.
- Computer it self cannot understood the English language but computer can know binary numbers that language is low level language.
- Whenever the specific program is available which translet high level language into low level language that program is known as a translator.
- The translator have two different types are available.

Translators

COMPLIERS AND INTERPRETERS

For high-level language to work on the computer it translates into machine language. There are two kinds of translators: Compliers and Interpreters.

Compiler

We know that a computer executes only machine language programs. Hence, a high level-language program must convert into its equivalent machine language program, before it execute on the computer. This translation completes with the help of a translator program, which is known as a compiler. Hence, a compiler is a translator program, which translates a high-level language program into its equivalent machine language program.

A compiler compiles a set of machine language instructions for every program instruction of a high-level language.

A compiler can translate only those source programs, which have been written in the language for which the compiler is meant.

Compilers are large programs, which reside permanently on secondary storage. When a source program is to be translated, the compiler and the source program are copied from secondary storage into the main memory of the computer.

The compiler, being a program, is then executed with the source program as its input as its data. It generates the equivalent object program as its output, which is normally save in a file on secondary storage into the main memory of the computer and executed.

Note that, there is no need to repeat the compilation process every time you wish to execute the program. This is because the object program from the secondary storage into the main memory of the computer and execute it directly. Also, note that compilation is necessary whenever we need to modify the program.

That is, to incorporate changes in the program, you must load the original source program from secondary storage into the main memory of the computer,

carry out necessary changes in the source program recompile the modified source program, and create and updated object program for execution.

In addition to translating high – level language instructions into machine language instructions, compilers also automatically detect and indicate certain types of errors in source programs.

These errors are referred to as syntax error and are typically of the following types:

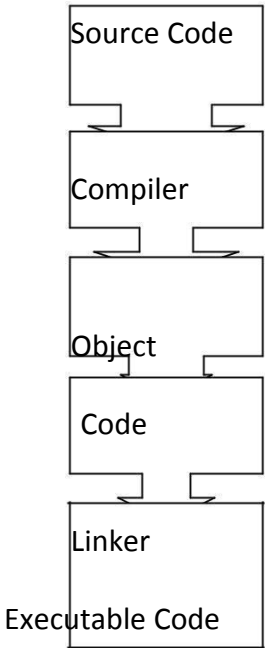
1. Invalid characters
2. Invalid combination of characters
3. Improper sequencing of instructions in a program
4. Use of undefined variable names.

A compiler, however, cannot detect logic errors. It can only detect grammatical errors in the source program. It cannot know ones intentions. Hence, logic errors are detected only after the program is executed, and the result produced does not tally with the desired result.

In a compiled language, a translation program run to convent the programmer‘s entire high-level program, (which is called the source code), into a machine language code. This translation process is called compilation.

THE COMPILATION PROCESS

The objective of the complier is to transform a program written in a high-level programming language from source code into object code. Programmers write programs in a from source code. Source codes most go through several steps before it becomes an excitable program.



The first step is to pass the source code though a compiler, which translate the high-level language instructions into object code. The final step in producing an execrable program after the compiler has produced object code, is to pass the, object code though a linker, The linker combines modules and gives real values to all symbolic addresses.

Every high-level programming language comes with a compiler. In effect, the compiler is the language because it defines which instructions are acceptable.

Because compilers translate source code into object code, which is unique for each type of computer, mane compilers are available for the some language For example; there is a FORTRAN compilers for PCs and another for Apple McIntosh computers. In addition, the compiler industry is quite competitive, so there are

actually many compilers for each language each type of computer. More than a dozen complains develop and sell C compilers for the PC.

While executing program Interpreter remains in memory, so it becomes slow and another thing that it read program code line by line.

Interpreter

An interpreter is another type of translator, which is used for translating programs written in high – level languages. It takes one statement of a high – level language program, translates it into machine language instructions, and then immediately executes the resulting machine language instructions. That is in case of an interpreter, the translation and execution process alternate for each statement encountered in the high – level language program. This differs from a compiler, which merely translates the entire source program into an object program, and is not involved in its execution.

In interpreted languages, a translation program convert each program statement is to be executed. Translation and execution occur immediately, one after another, one statement at a time.

Unlink that complied languages, object code is store and there is no complication. This means that in a program where one statement is executed several times (such reading an employ‘s payroll record), that statement is converted to machine language each time it is execute The most frequently used interpreted language is BASIC.

As compared to compilers, interpreters are easier to write, because they are less complex programs than compilers. They also require less memory space for execution than compilers.

The main advantages of interpreters over compilers is that a syntax error in a program statement is detected and brought to the attention of the programmer as soon as the program statement is interpreted. This allows the programmer to make corrections during interactive program development. Therefore, interpreters make it easier and faster to correct programs.

The main disadvantage of interpreters over compilers is that they are slower than compilers when running a finished program. This is because each statement is translated every time it is executed from the source program. In case of a compiler, each statement is translated only once and saved in the object program. The saved object program can be executed many times as and when needed, and no translation of any statement is required during the execution of the program.

Because the interpreter does not produce an object program, it must perform the translation process each time a program is executed.

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Assembler: A computer will not understand any program written in a language, other than its machine language. The programs written in other languages must be translated into the machine language. Such translation is performed with the help of software. A program which translates an assembly language program into a machine language program is called an assembler. If an assembler which runs on a computer and produces the machine codes for the same computer then it is called self assembler or resident assembler. If an assembler that runs on a computer and produces the machine codes for other computer then it is called Cross Assembler.

Assemblers are further divided into two types: One Pass Assembler and Two Pass Assembler. One pass assembler is the assembler which assigns the memory addresses to the variables and translates the source code into machine code in the first pass simultaneously. A Two Pass Assembler is the assembler which reads the source code twice. In the first pass, it reads all the variables and assigns them memory addresses. In the second pass, it reads the source code and translates the code into object code.

Compiler: It is a program which translates a high level language program into a machine language program. A compiler is more intelligent than an assembler. It checks all kinds of limits, ranges, errors etc. But its program run time is more and occupies a larger part of the memory. It has slow speed. Because a compiler goes through the entire program and then translates the entire program into machine codes. If a compiler runs on a computer and produces the machine codes for the same computer then it is known as a self compiler or resident compiler. On the other hand, if a compiler runs on a computer and produces the machine codes for other computer then it is known as a cross compiler.

Interpreter: An interpreter is a program which translates statements of a program into machine code. It translates only one statement of the program at a time. It reads only one statement of program, translates it and executes it. Then it reads the next statement of the program again translates it and executes it. In this way it proceeds further till all the statements are translated and executed. On the other hand, a compiler goes through the entire program and then translates the entire program into machine codes. A compiler is 5 to 25 times faster than an interpreter.

By the compiler, the machine codes are saved permanently for future reference. On the other hand, the machine codes produced by interpreter are not saved. An interpreter is a small program as compared to compiler. It occupies less memory space, so it can be used in a smaller system which has limited memory space

Different Types of Languages

It is important to note that a computer cannot do anything on its own. it must be instructed to do a desired job. Hence, it is necessary to specify a sequence of instructions that a computer must perform to solve a problem. Such a sequence of instructions written in a language that understood by a computer is a computer program. In other terminology, if you want to get something done by a person, you will tell him want to do in a language that he understands. Similarly, if you want to make the computer to do some task for you, you have to tell the computer want to do in a language that the computer understands – machine language, To

communicate with the computer is to develop a third language – a language that can be understood

by both you and the computer. This is what a programming language is a – set of rules that provides a way of instructing the computer to perform certain operations.

There are more than 150 programming language in existence – and these are just the ones that are still being used; we are not counting the ones that for one reason or other, are considered obsolete.

Programming language are said to be lower or higher, depending on whether they are closer to the language the computer itself uses (lower, which means writing program using, ZEROs and ONEs,) or to the language that people use (higher, which means more English like). There are five levels (or generations) of language.

1. **Machine language/ First-generation**
2. **Assembly Languages/ Second-generation Language**
3. **Procedural Language / Third-generation Language**
4. **Problem -Oriented Languages / Fourth-generation Languages**
5. **Natural Languages / Fifth – generation Language**

1. Machine Language / First Generation Language:

Although computers can be programmed to understand many different computer languages, there is only one language understood by the computer using translation program. This language is called the machine language of the computer. The machine language of computer is normally written as combination of binary. The circuit of a computer is wired in a manner that is immediately recognizes the machine language instructions, and converts them into the electrical signals needed to execute them

In the early days of computers, with machines as the ENIAC, which uses vacuum tubes, one could actually see the tubes lit up (1) or unlit (0), corresponding to the 1/0 bent state – the switch was either on or off.

In addition, in these early days there was no such ting as software, There was only hardware with electrical on /off switches. Whoever a program was to be ton (load), all the switches had to be set – sometimes as many as 6,000 switches for a single program. Then for the next program the switches had to be reset, process that might take weeks.

The language are machine-dependent, and the programs written in machine language for one computer model will not, in all likelihood (portability), run on a different model the manufacture, few application programs are written in machine languages.

The drawbacks of machine level languages are:

1. A programmer needs to write numeric codes for the instructions in the computers instruction set.

2. A programmer needs to write the storage locations of data and instructions in numeric form.

3. A programmer needs to keep track of the storage locations of data and instructions while writing a program.

2. ASSEMBLY LANGUAGE / Second Generation Language:

A language, which allows instructions and storage locations to be represented by letters and symbols, instead of numbers, is called an assembly language or symbolic language. A program written in an assembly language called an assembly language program or a symbolic program.

It uses alphanumeric mnemonic codes, instead of numeric codes for the instructions in the instruction set. This alphanumeric mnemonic code help in storage location representation and for additional instructions. With this feature, the instructions in the instruction set can be much easily remembered and used by the programmers.

Actually, assembly language does not replace machine language. In fact, for an assembly language program to be executed, it must be converted to machine code. The assembly language program is referred to as a source program whereas; the machine language program is an object program.

Assembly language code is very similar in form to machine language code. In fact, the first assembly language had a one-to-one correspondence – 15 assembly statements, for example, would be translated into 15 machine statement. This one-to-one correspondence was still so laborious.

Assembly language offers several advantages

- They are more standardized and easier to use than machine language.
- They operate very efficiently, although not us efficient as the machine language.
- They are easier to debug because programs locate and identify syntax errors.

Assembly language programming, this introduced in 1952, helped in to overcome the limitation of machine level language in following manner.

- By using alphanumeric mnemonic codes, instead of numeric codes for the instructions in the instruction set. For example, using ADD instead of 1110(binary) or 14 decimal for the instruction add, using SUB instead of 1111(binary) or 15 decimal for the instruction to subtract, and so on. With this feature, the instructions in the instruction set can be much easily remembered and used by the programmers.
- By allowing storage locations to be represented in the form of alphanumeric address, instead of numeric address. With this feature a programmer can much

  easily remember and use the storage locations of the data and instructions used in an assembly language program.

Having these facilities, there are still some disadvantages/limitations:

- Assemble language programs are usually very long.
- However, less abstract than machine language assembly language programs are Still complex.
- Though more standardized than machine languages are still machine dependant.

3. HIGH-LEVEL LANGUAGE / Third Generation Language:

High-level programming languages designed to overcome these limitations of low-level programming languages. The advent (arrival) of high- level language has enabled the use of computers to solve problems even by non-expert users. This has allowed many users, without any background in computer science and engineering to become computer programmers. This, in turn, has resulted in the creation of a large number of computer applications in various areas, thus computer today use in every occupation. High-level languages characterized by the following features.

- They are machine independent. That is, a program written in a high-level can be easily ported and executed on any computer, which as the translator software for the high-level language.

- They do not require the programmers to know anything about the internal structure of the computer on which the high-level language programs will be executed. In fact, since high-level languages are machine independent, a programmer writing a program in a high level language may not even know on which computer will his/her program be executed. This allows the programmer to mainly concentrate on the logic of the problem, rather than be concerned with the details of the internal structure of the computer.
-
- They do not deal with the machine-level coding. Rather, they deal with high-level coding, enabling the programmers to write instructions using English words and familiar mathematical symbols and expressions. Each statement of high-level language is normally a macro instruction, which is translated into several machine language instructions. This is one – to – many translation, and not one-to-one as in the case of assembly language. For example, le us consider the same problem of adding two numbers (FRST and SCND) and storing the sum in ANSR. We have already seen that three low-level language, say FORTRAN for instance, to instruct the computer to do this job, only one instruction need be written:

ANSR= FRST+SCND

This instruction is obviously very easy to understand and write, because it resembles the familiar algebraic notation for adding two numbers: a= b+c.

High Level language assisted programmers by reducing further the number of computer operation details they had to specify, so that they could concentrate more on the logic needed to solve the problem.

4. Problem – Oriented Languages (Object Oriented Languages) / Fourth-generation Languages

Soon after the advent first few programming languages, it was realized by the people working in the computer industry that programming is a difficult and time-consuming task. Hence, researchers have been continuously working towards

developing better and better programming languages to make programming simple, easy and fast. The goal of the designers of every new programming language was to introduce some aspects or concepts in their programming language, which will help in achieving the above – mentioned objectives. Object – oriented programming is one such concept used in programming languages. The concept of OOP was first introduce in 1967 by the developers of a programming language named ‗Simula 67'. This concept started gaining popularity in 1980s with the development of another programming language named ‗Smalltalk', which made extensive use of this concept. Today, this concept has been made part of almost all major programming languages, and is being used quite widely in software development.

The basic idea behind OOP is that programming languages used for simulating real-world problems on computers. Since much of the real world made up of objects, a simulation (recreation) of such a world must include simulated objects. Hence the

Third-generation language such as BASIC or pasca1 require you to instruct the computer in step-by-step fashion fourth-generation language, also known as problem-oriented language high-level language designed to sole specific problem are step-by-step procedures for getting there.
Fourth-generation language categorize into several kinds of applications development tools;

- Personal computer applications software Query language and report generators
- Decision support system and financial planning languages Application generators

5.Fifth generation Languages:-

Scientists are working hard on the **5th generation computers** with quite a few breakthroughs. It is based on the technique of **Artificial Intelligence (AI).** Computers can understand spoken words & imitate human reasoning. Can respond to its surroundings using different types of sensors. Scientists are constantly working to increase the processing power of computers. They are trying to create a computer with real IQ with the help of advanced programming and technologies. **IBM Watson** computeris one example that outsmarts **Harvard University Students.** The advancement in modern technologies will revolutionize the computer in future.

Operating System

An Operating system manages and co-ordinates the functions performed by the computer hardware, including the CPU, input / output devices, secondary storage devices, and communication and network equipment. Operating systems are the most important program that runs on a computer. Every general – purpose computer must have an operating system to run other programs. Operating systems performs basic tasks, such as recognizing input from the keyboard, sending output to the display screen, keeping track of files and directories on the disk, and controlling peripheral devices such as disk drives and printers. The operating system software must kept track of each hardware resource, determine who gets what determine when the user will have access to the resource allocate how much of the resource the user will be given and terminate access at the end of the use period.

There is also no universally accepted definition of what is part of the operating system and what is not. A simple & common definition is that an program running at all times on the computer with all else being application programs.

Different Type of Operating System

Batch Processing

This type of operating system, was used for a long time with early computers, known as a main-frame. Routine jobs like data processing were carried out in a batch, one after the other. Data was punched in a punch card. Along with punched cards, job control cards which carried the instructions were also used. This was one of the earliest forms of operating system. In this primitive operating system, the CPU and the peripherals remained idle most of the time. While the cards were being read, the printer was not in use. The throughput, and utilization of the resources was very low.

Multi tasking

In multi tasking, the resources are made to work continuously. The card reader reads one job after another, and is stored in the main or auxiliary memory, depending on the volume of transactions. Similarly, the processed output of various jobs are stored in the main or auxiliary memory, and outputted one by one, to the printer. The CPU switches from one task to another for reading, processing and outputting. Thus, the idle time of the peripherals are minimized drastically. The memory is partitioned, and many jobs are handled simultaneously. This enables more programs to reside in the central memory at the same time, and instructions are executed by CPU. Multiprogramming and multi tasking is the capability of this kind of operating system, which can execute multiple programs. This is possible because many programs can reside in the memory simultaneously, and the CPU can switch from one portion of a program to another. Many users and user terminals, can also be facilitated by these operating system.

Time Sharing

Many users are connected to the computer using an operating system called as "time sharing". In time sharing, the CPU switches from one user's job to another user at a fast rate. After processing a user's job, the operating system proceeds to the second, third, fourth, user and so on, processing each user's job within a short interval of time and thus goes in a cycle continuously. If there are thousand users, the CPU works for 1m sec., and in this 1m sec, the CPU can execute more than 2,50,000 instructions of every user with an average speed of 250 MHz.

Real Time/On-line Operating system

In a real time or an on-line operating system, all the resources are accessible 24 hours (on-line). The computer processes immediately, one or all the inputs, and delivers the outputs instantaneously, as for example, in process control, and space navigation. Airline reservations, flight control, chain of supermarkets or banking are some of the other examples of real time/on-line operating system. These operating systems are generally single application oriented, users are not permitted to prepare or modify programs, but allowed only to input data, make enquiries and get reports. These are dedicated systems meant for only one specific application.

Operator Development System

Earlier systems such as IBM 1620 DEC SYSTEMS and so on, required a computer operator to operate the system. His job was to stack manually, punched cards prepared by various users, along with specific job control cards, load the tapes, replace cartridge discs depending on the user's needs, operate the computer, identify outputs from the line printer and provide them to the respective individuals. Debugging and obtaining correct results by each user involved lot of time, since they did not have direct access to the computer.

Interactive Processing

With the advent of PCs, the computer is completely at the disposal of and dedicated to the user (single). The operating systems, in this case, like, MS-DOS, WINDOWS, etc. enables direct interaction with the compiling process, and errors are displayed on the screen minimizing the duration of getting the result.

Application packages can also be loaded through simple commands by non-programmers. Users can comfortably use the computer with ease. Interactive processing is also facilitated in multi-user systems, using dumb or intelligent terminals.

Multi-user Systems

The principle of multiprocessing and multi tasking, and the need for interactive processing, led to the development of Multi-user systems. Main-frame, super minis and mini systems, were designed to serve the needs of multiple users incorporating the concepts of multiprogramming and time sharing. A mini system

serves 10 to 15 users, a super mini serves 30 to 40 users, and a mainframe 100 to 1000 users. These systems provide each user a terminal (consisting of a monitor and a keyboard). The size, configuration and cost of the computer is decided not only on the software needed, but also on the number of users, and the speed with which the processing is to be carried out.

With the development of communication technologies, embracing microwave and satellite communication and optical fibre systems, large computers are networked across continents, and a terminal connected to a computer in a particular location, can down load files, programs and data from a computer located thousands of kilo meters away, and can send mail to another user, even if he is not logged on to the system when the mail is sent. Such developments in computer and communication technologies, demand standardization of operating systems, communication protocols, networking software and interfaces.

Multiprocessing and Parallel Processing Operating Systems

As the number of users increased, the response time had to be kept up, and when the volume of data to be processed increased, like in the case of weather forecasting, terrain mapping, nuclear research, image processing, simulation etc. just one processor, or increasing the clock speed of the processor did not suffice. In these cases, the speed of the computer had to be enhanced, by adding few more processors.

Two approaches evolved in this technique. Both incorporated multiple processors. One was to route different jobs to different processors, and another was to route each statement in the program to different processors. This was called parallel programming. The functions of an operating system, and design in such environments became more complex. Fault tolerance of processor, interfaces and peripherals had also to be built into such operating systems, like disc mirroring and replication.

- **Uses and applications of Software Packages**

Word processing, spreadsheets and databases are examples of different types of software packages. Licensed software such as Microsoft Office, and open source Linux software which is available for free are also examples off different types of software packages.

Word Processing Packages

Word processing is just a process of using a computer to input and edit text. Word processing packages are readily available for use in office environments on microcomputers. They enable you to create, modify (insert, delete, rearrnge), save, copy, and print documents. The usual method of entering a document is to type it on a keyboard. Another method is to use a scanner to read a printed document and encode it into a digital file for computer processing.

A word processor is a computer application that resembles typewriting but allows instant correction of errors, moving text to different locations, and other editing functions. Microsoft Word is the word processor used in many homes, schools, and businesses.

The primary advantages of a word processing package are:
1. Correction of content inline without a marker/eraser
2. Easy formatting/pagination etc
3. Electronic Storage (this is an advantage vis-a-vis using a type writer)
4. Automatic spell/grammar check

Spread Sheet Packages

Spreadsheet package is an application software that is made up of columns and rows and which is used in data analysis, calculations, etc.

Spreadsheet is a name for all programs designed to handle all accounting and statistical problems.

A spreadsheet is an electronic version of the manual worksheet used to organized and manipulate numbers and displays options for what-if analysis. it is based on the traditional accounting worksheet that have long been used by accountants and managers to work balance sheets, sales projections and expense budgets. spreadsheets are also used by financial analysts, contractors and other businessmen concerned with manipulating numeric data.

Before the introduction of electronic spreadsheet, the ledger was the accountant's primary tool for recording financial transactions. Any application that has to do with rows and columns is an application for spreadsheet.

some of these application includes income statements, demographic data, budget summaries e.t.c. spreadsheets are important because they handle spreadsheet problems exceptionally well. At the heart of any spreadsheet is a column of information, such as set of prices for set items that need to be worked on such as addition with manual spreadsheet, someone would have to look up the prices, perform the calculation, and then write down the result.

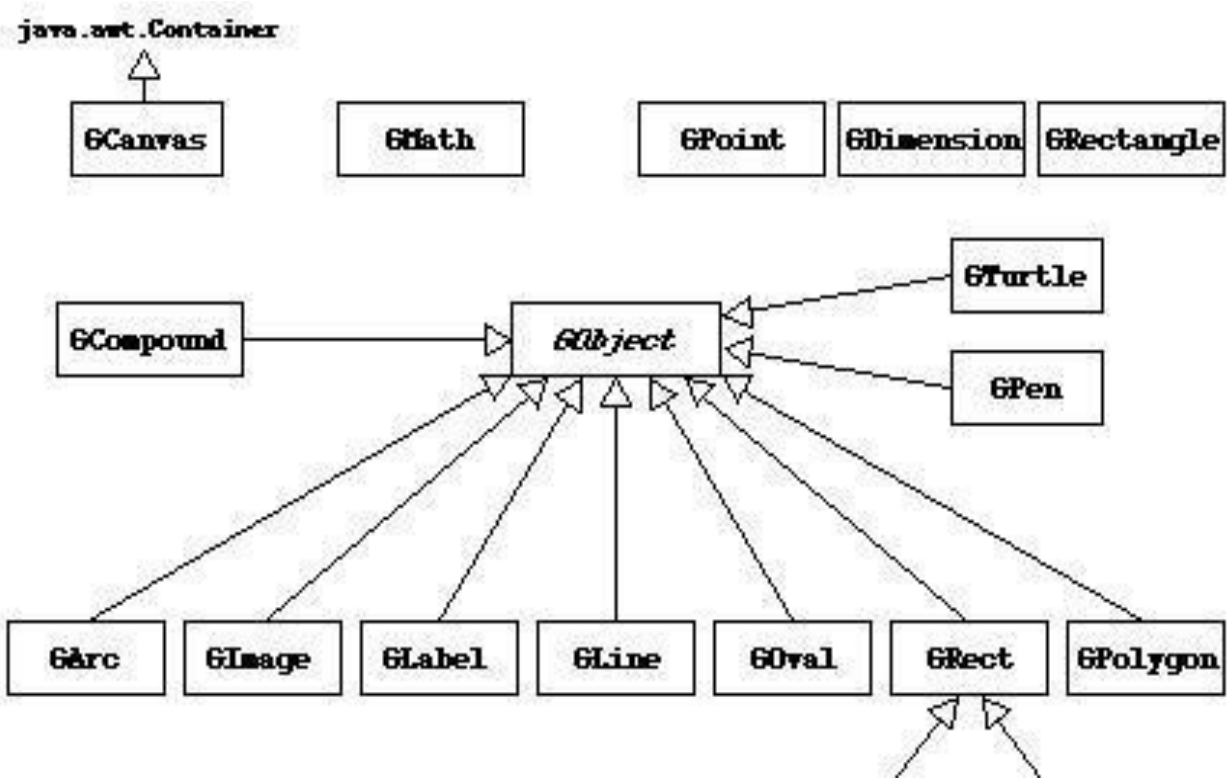
Graphical Packages

A program that allows you to create graphic figures and other things < using this with c++ you can create video games but its very difficult.

Graphics (from Greek γραφικός graphikos) are visual presentations on some surface, such as a wall, canvas, screen, paper, or stone to brand, inform, illustrate, or entertain. Graphics word is derived from the word graph. A graph has x and y axis. Same way something which is created in digital word is seen on a digital screen, this screen also has x and y axis. So the output on any digital device is termed as graphics. In other words an image that is generated by a computer called graphics. The pictorial representation and manipulation of data, as used in computer-aided design and manufacture, in typesetting and the graphic arts, and in educational and recreational programs.

Examples are photographs, drawings, Line Art, graphs, diagrams, typography, numbers, symbols, geometric designs, maps, engineering drawings, or other images. Graphics often combine text, illustration, and color. Graphic design may consist of the deliberate selection, creation, or arrangement of typography alone, as in a brochure, flier, poster, web site, or book without any other element.

Clarity or effective communication may be the objective, association with other cultural elements may be sought, or merely, the creation of a distinctive style. Graphics can be functional or artistic. The latter can be a recorded version, such as a photograph, or an interpretation by a scientist to highlight essential features, or an artist, in which case the distinction with imaginary graphics may become blurred.



Database Packages

Database Package The Database Package accommodates business requirements that need advanced web features such as databases and custom CGI scripts. This package includes all of the above packages as well as database support for advertising more than two hundred products or to offer other advanced services which require quick access to large amounts of data

MySQL, Oracle, MS Access, MS-SQL, pretty much any software that is related or sole purpose is for databases.

Presentation packages

A **presentation program** (also called a **presentation graphics** program) is a computer software package used to display information, normally in the form of a slide show. It typically includes three major functions: an editor that allows text to be inserted and formatted, a method for inserting and manipulating graphic images and a slide-show system to display the content.

Animation Packages

Computer animation is the process used for generating animated images by using computer graphics. The more general term computer generated imagery encompasses both static scenes and dynamic images, while computer animation only refers to moving images.

Video Packages

This is a **list of home computers**, sorted alphanumerically, which lists all relevant details of their **video hardware**.

A home computer was the description of the second generation of desktop computers, entering the market in 1977 and becoming common during the 1980s. A decade later they were generally replaced by IBM PC compatible "PCs", although in actuality home computers are also members of the class known as personal computers

Sound Packages

The Java Sound API is a low-level API for effecting and controlling the input and output of sound media, including both audio and Musical Instrument Digital Interface (MIDI) data. The Java Sound API provides explicit control over the capabilities normally required for sound input and output, in a framework that promotes extensibility and flexibility.

The Java Sound API fulfills the needs of a wide range of application developers. Potential application areas include:

- Communication frameworks, such as conferencing and telephony
- End-user content delivery systems, such as media players and music using streamed content
- Interactive application programs, such as games and Web sites that use dynamic content
- Content creation and editing
- Tools, toolkits, and utilities

- **Different Communication methods**

1. GIS(**geographic information system)**
2. GPS(**Global Positioning System**)
3. CDMA(**Code Division Multiple Access**)
4. GSM**(Global System for Mobile Communications)**

GPS

The Global Positioning System (GPS) constellation of about 24 satellites orbiting the 11,000 miles. is a location system based on a earth at altitudes of approximately GPS was developed by the United States Department of Defense (DOD), for its tremendous application as a military locating utility.

GPS satellites are orbited high enough to avoid the problems associated with land based systems, yet can provide accurate positioning 24 hours a day, anywhere in the world.

Uncorr0ected positions determined from GPS satellite signals produce accuracies in the range of 50 to 100 meters.

When using a technique called differential correction, users can get positions accurate to within 5 meters or less.

GPS is based on satellite ranging - calculating the distances between the receiver and the position of 3 or more satellites (4 or more if elevation is desired) and then applying some good old mathematics.

Assuming the positions of the satellites are known, the location of the receiver can be calculated by determining the distance from each of the satellites to the receiver. GPS takes these 3 or more known references and measured distances and "triangulates" an additional position.

GIS

A geographic information system (GIS) is a computer system for capturing, storing, checking, and displayingdata related to positions on Earth's surface. GIS can show many different kinds of data on one map. This enables people to more easily see, analyze, and understand patterns and relationships.

With GIS technology, people can compare the locations of different things in order to discover how they relate to each other. For example, using GIS, the same map could include sites that produce pollution, such as gas stations, and sites that are sensitive to pollution, such as wetlands. Such a map would help people determine which wetlands are most at risk.

GIS can use any information that includes location. The location can be expressed in many different ways, such as latitude and longitude, address, or ZIP code. Many different types of information can be compared and contrasted using GIS. The system can include data about people, such as population, income, or education level. It can include information about the land, such as the location of streams, different kinds of vegetation, and different kinds of soil. It can include information about the sites of factories, farms, and schools, orstorm drains, roads, and electric power lines.

Data and GIS

Data in many different forms can be entered into GIS. Data that are already in map form can be included in GIS. This includes such information as the location of rivers and roads, hills and valleys. Digital, or computerized, data can also be entered into GIS. An example of this kind of information is data collected bysatellites that show land use—the location of farms,towns, or forests. GIS can also include data in table form, such as population information. GIS technology allows all these different types of information, no matter their source or original format, to be overlaid on top of one another on a single map.

Putting information into GIS is called data capture. Data that are already in digital form, such as images taken by satellites and most tables, can simply beuploaded into GIS. Maps must be scanned, or converted into digital information.

GIS must make the information from all the various maps and sources align, so they fit together. One reason this is necessary is because maps have different scales. A scale is the relationship between the distance on a map and the actual distance on Earth. GIS combines the information from different sources in such a way that it all has the same scale.

Often, GIS must also manipulate the data because different maps have different projections. A projection is the method of transferring information from Earth's curved surface to a flat piece of paper or computer screen. No projection can copy the reality of Earth's curved surface perfectly. Different types of projections accomplish this task in different ways, but all result in some distortion. To transfer a curved, three-dimensional shape onto a flat surface inevitably requires stretching some parts and squeezing other parts. A world map can show either the correct sizes of countries or their correct shapes, but it can't do both. GIS takes data from maps that were made using different projections and combines them so all the information can be displayed using one common projection.

CDMA

What is CDMA?

CDMA (Code-Division Multiple Access) is a channel access method used by various radio communication technologies. It is a form of multiplexing, which allows numerous signals to occupy a single transmission channel, optimizing the use of available bandwidth. The technology is used in ultra-high-frequency (UHF) cellular telephone systems in the 800-MHz and 1.9-GHz bands.

CDMA employs analog-to-digital conversion (ADC) in combination with spread spectrum technology. Audio input is first digitized into binary elements. The frequency of the transmitted signal is then made to vary according to a defined pattern (code), so it can be intercepted only by a receiver whose frequency response is programmed with the same code, so it follows exactly along with the transmitter frequency. There are trillions of possible frequency-sequencing codes, which enhances privacy and makes cloning difficult.

The original CDMA standard, also known as CDMA One and still common in cellular telephones in the U.S offers a transmission speed of only up to 14.4 Kbps in its single channel form and up to 115 Kbps in an eight-channel form. CDMA2000 and Wideband CDMA deliver data many times faster.

Characteristics of CDMA:

Ø spread spectrum techniques use a transmission bandwidth that is several orders of magnitude greater than the minimum required signal bandwidth. These systems were designed using spread spectrum because of its security and resistance to jamming.
Ø CDMA can effectively reject narrow band interference. Since narrow band interference affects only a small portion of the spread spectrum signal, it can easily be removed through notch filtering without much loss of information.
Ø CDMA devices use a rake receiver, which exploits multipath delay components to improve the performance of the system.
Ø In a CDMA system, the same frequency can be used in every cell, because channelization is done using the pseudo-random codes.
Ø Reusing the same frequency in every cell eliminates the need for frequency planning in a CDMA system;
Ø CDMA systems use the soft hand off, which is undetectable and provides a more reliable and higher quality signal.

Advantages of CDMA techniques:

Ø Efficient practical utilization of fixed frequency spectrum.
Ø Flexible allocation of resources.
Ø Many users of CDMA use the same frequency, TDD or FDD may be used
Ø Multipath fading may be substantially reduced because of large signal bandwidth
Ø No absolute limit on the number of users, Easy addition of more users.
Ø Impossible for hackers to decipher the code sent
Ø Better signal quality
Ø No sense of handoff when changing cells
Ø The CDMA channel is nominally 1.23 MHz wide.
Ø CDMA networks use a scheme called soft handoff, which minimizes signal breakup as a handset passes from one cell to another.
Ø CDMA is compatible with other cellular technologies; this allows for nationwide roaming.
Ø The combination of digital and spread-spectrum modes supports several times as many signals per unit bandwidth as analog modes.

Disadvantages to using CDMA:

Ø As the number of users increases, the overall quality of service decreases
Ø Self-jamming
Ø Near- Far- problem arises

Uses of CDMA:

Ø One of the early applications for code division multiplexing is in GPS. This predates and is distinct from its use in mobile phones.
Ø The Qualcomm standard IS-95, marketed as cdmaOne.
Ø The Qualcomm standard IS-2000, known as CDMA2000. This standard is used by several mobile phone companies, including the Globalstar satellite phone network.
Ø The UMTS 3G mobile phone standard, which uses W-CDMA.
Ø CDMA has been used in the OmniTRACS satellite system for transportation logistics.

GSM

GSM (Global System for Mobile Communications) is a second-generation digital mobile telephone standard using a variation of Time Division Multiple Access (TDMA). It is the most widely used of the three digital wireless telephone technologies - CDMA (Code Division Multiple Access), GSM and TDMA. GSM digitizes and compresses voice data, then sends it down a channel with two other streams of user data, each in its own time slot. It operates at either the 900, 1800 or 1,900MHz frequency bands.

GSM was initially developed as a pan-European collaboration, intended to enable mobile roaming between member countries. As at March 2003, GSM digital wireless services were offered in some form in over 193 countries. In June 2002, about 69% of all digital mobile subscriptions in the world used GSM phones on GSM networks.

TECHNICAL DETAILS

The GSM network can be divided into three broad parts

- The subscriber carries the mobile station
- The base station subsystem controls the radio link with the mobile station
- The network subsystem performs the switching of calls between the mobile users and other mobile and fixed network users

MOBILE STATION

The mobile station consists of the mobile equipment, i.e. the handset, and a smart card called the Subscriber Identity Module (SIM). The SIM provides personal mobility, so that the user can have access to subscribed services irrespective of a specific terminal. By inserting the SIM card into another GSM terminal, the user is able to receive and make calls from that terminal, and receive other subscribed services.

The mobile equipment is uniquely identified by the International Mobile Equipment Identity (IMEI). The SIM card contains the International Mobile Subscriber Identity (IMSI) used to identify the subscriber to the system, a secret key for authentication and other information. The IMEI and the IMSI are independent, thereby allowing personal mobility. The SIM card may be protected against unauthorised use by a password or personal identity number.

BASE STATION SUBSYSTEM

The base station subsystem is composed of two parts, the base transceiver station and the base station controller. These communicate across a standardised "Abis" interface, allowing operation between components made by different suppliers.

The base transceiver station houses the radio transceivers that define a cell and handles the radio-link protocols with the mobile station. In a large urban area, there will potentially be a large number of base transceiver stations deployed, thus the requirements for a base transceiver station are reliability, portability and minimum cost. The base station controller manages the radio resources for one or more base transceiver stations. It is the connection between the mobile station and the mobile services switching center.

NETWORK SUBSYSTEM

The central component of the network subsystem is the mobile services switching center. This acts like a normal switching node of the PSTN (Public Switched Telephone Network) or ISDN (Integrated Services Digital Network) and connects the mobile signal to these fixed networks. It additionally provides all the functionality needed to handle a mobile subscriber, such as registration, authentication, location updating, handovers and call routing to a roaming subscriber.

RADIO SPECTRUM

Since radio spectrum is a limited resource shared by all users, a method must be devised to divide up the bandwidth among as many users as possible. The method chosen by GSM is a combination of Time and Frequency Division Multiple Access (TDMA/FDMA). The FDMA part involves the division by frequency of the (maximum) 25MHz bandwidth into 124 carrier frequencies spaced 200kHz apart. One or more carrier frequencies are assigned to each base station.

SPEECH CODING

GSM is a digital system, so speech, which is inherently analog, has to be digitised. The GSM group studied several speech coding algorithms on the basis of subjective speech quality and complexity (which is related to cost, processing delay and power consumption once implemented) before arriving at the choice of a Regular Pulse Excited - Linear Predictive Coder (RPE-LPC) with a long term predictor loop.

FUTURE OF GSM

GSM, together with other technologies, is part of an evolution of wireless mobile telecommunication that includes High-Speed Circuit-Switched Data (HSCSD), General Packet Radio System (GPRS), Enhanced Data GSM Environment (EDGE), and Universal Mobile Telecommunications Service (UMTS).

- **Communication Devices**

Cell Phones

Introduction

- Wireless phones which receive their signals from towers. A cell is typically the area (several miles) around a tower in which a signal can be received. Cell phones provide an incredible array of functions. Depending on the cell-phone model, you can:

- Small wireless device that has at least the same functions of a standard wired telephone but is smaller and more mobile. A cell phone requires a subscription to a service provider and requires either a prepaid or monthly billing setup. Generally, they have more functions than traditional land lines and need to be charged after a period of time. Also called mobile phone or mobile device.

- **How it can work**

Millions of people in the United States and around the world use **cellular phones**. They are such great gadgets -- with a cell phone, you can talk to anyone on the planet from just about anywhere!

These days, cell phones provide an incredible array of functions, and new ones are being added at a breakneck pace. Depending on the cell-phone model, you can:

- Store contact information
- Make task or to-do lists
- Keep track of appointments and set reminders
- Use the built-in calculator for simple math
- Send or receive e-mail
- Get information (news, entertainment, stock quotes) from the Internet
- Play Games
- Watch TV
- Send text messages
- Integrate other devices such as PDAs, MP3 players and GPS receivers

INSIDE A CELL-PHONE A basic digital cell phone contains just a few individual parts:

- A circuit board containing the brains of the phone
- An antenna
- An Liquid Crystal Display (LCD) screen
- A keyboard
- A microphone
- A speaker
- A battery

The circuit board is the heart of the system and contains several chips. The analog-to-digital and digital-to-analog conversion chips translate the outgoing audio signal from analog to digital and the incoming signal from digital back to analog. The digital signal processor (DSP) is a highly customized processor designed to perform signal-manipulation calculations at high speed. The microprocessor handles all the functions for the keyboard and display, deals with command and control signaling with the base station and also coordinates the rest of the functions on the board.The Read Only Memory (ROM) and Flash Memory chips provide storage for the phone's operating system and customizable features, such as the phone directory. The Radio Frequency (RF) and power section handles power management and recharging, and also deals with the hundreds of FM channels. Finally, the RF amplifiers handle signals traveling to and from the antenna.

Cell Phone Network Technologies: 2G

There are three common technologies used by 2G cell-phone networks for transmitting information (we'll discuss 3G technologies in the 3G section):

- **Frequency division multiple access** (FDMA)
- **Time division multiple access** (TDMA) • **Code division multiple access** (CDMA)

Cell-phone Network Technologies: 3G

3G technology is the latest in mobile communications. 3G stands for "third generation" -- this makes analog cellular technology generation one and digital/PCS generation two. 3G technology is intended for the true multimedia cell phone -- typically called smartphones -- and features increased bandwidth and transfer rates to accommodate Web-based applications and phone-based audio and video files.

Modem

Definition of Modem:-

- A modem modulates outgoing digital signals from a computer or other digital device to analog signals for a conventional copper twisted pair telephone line and demodulates the incoming analog signal and converts it to a digital signal for the digital device.

  Modulator-demodulator. Electronicdevice that allows computers to communicate over telephonewires or cable-TV cable. One computer's modem converts its digital signals (which cannot be sent efficiently over phone lines) into analog signals (which can be). The other computer's modem reconverts the analog signals (that the computer cannot understand) into digital signals (that it can). Conversion of one type of signals to another is called modulation, their reconversion to the original type is called demodulation. Modern modems work at 56 thousand bits per second (Kbps) or higher data transfer speeds, perform automaticerror correction, and allow voice and fax communications
- Cable modems offer 2 million bits per second (Mbps) or higher speeds, whereas advanced types of telephone services (such as ISBN) allow very high speed data transfer without any modem.

1. A **Modem** or **Broadband Modem** is a hardware device that connects a computer or router to a broadband network. For example, a Cable Modem and DSL Modem are two examples of these types of Modems.

2. Short for **MODulator/DEModulator**, the first **Modem** known as the Dataphone was first released by AT&T in 1960. It later became more common for home users when Dennis Hayes and Dale Heatherington released the 80-103A Modem in 1977.

A Modem is a hardware device that allows a computer to send and receive information over telephone lines by converting digital data into an analog signal used on phone lines. In the picture below, is an example of an internal expansion card Modem. Click the image to get a description about each of the components found on the card.

Modems are referred to as an **asynchronous device**, meaning that the device transmits data in an intermittent stream of small packets. Once received, the receiving system then takes the data in the packets and reassembles it into a form the computer can use.

Stop 1 bit	**Data** 8 bits	**Start** 1 bit	**Stop** 1 bit	**Data** 8 bits	**Start** 1 bit
Packet 10 bits			**Packet** 10 bits		

The above chart represents how an asynchronous transmission would be transmitted over a phone line. In asynchronous communication, one byte (eight bits) is transferred within one packet, which is equivalent to one character. However, for the computer to receive this information, each packet must contain a Start and a Stop bit; therefore, the complete packet would be ten bits. In the above chart is a transmission of the word **HI**, which is equivalent to two bytes (16 bits).

What are the speeds of modems?

A Modem speed is measured in bps and Kbps, which is the speed the modem can send and receive data. Today, a 56K (56,000 bps) Modem is the fastest solution and is the only likely speed you will find with a dial-up modem.

Infrared

As next-generation electronic information systems evolve, it is critical that all people have access to the information available via these systems.

Examples of developing and future information systems include interactive television, touchscreen-based information kiosks, and advanced Internet programs. Infrared technology, increasingly present in mainstream applications, holds great potential for enabling people with a variety of disabilities to access a growing list of information resources.

Already commonly used in remote control of TVs, VCRs and CD players, infrared technology is also being used and developed for remote control of environmental control systems, personal computers, and talking signs.

For individuals with mobility impairments, the use of infrared or other wireless technology can facilitate the operation of information
kiosks, environmental control systems, personal computers and associated peripheral devices.

For individuals with visual impairments, infrared or other wireless communication technology can enable users to locate and access talking building directories, street signs, or other assistive navigation devices.

For individuals using augmentative and alternative communication (AAC) devices, infrared or other wireless technology can provide an alternate, more portable, more independent means of accessing computers and other electronic information systems.

Wireless Communication

Wireless co**m**munication, as the term implies, allows information to be exchanged between two devices without the use of wire or cable.

A wireless keyboard sends information to the computer without the use of a keyboard cable; a cellular telephone sends information to another telephone without the use of a telephone cable.

Changing television channels, opening and closing a garage door, and transferring a file from one computer to another can all be accomplished using wireless technology.

In all such cases, information is being transmitted and received using electromagnetic energy, also referred to as electromagnetic radiation.

One of the most familiar sources of electromagnetic radiation is the sun; other common sources include TV and radio signals, light bulbs and microwaves.

To provide background information in understanding wireless technology, the electromagnetic spectrum is first presented and some basic terminology defined.

Application

1. Augmentative communication devices
2. Car locking systems
3. Computers
   a. Mouse
   b. Keyboards
   c. Floppy disk drives
   d. Printers
4. Emergency response systems
5. Environmental control systems
   a. Windows
   b. Doors
   c. Lights
   d. Curtains
   e. Beds
   f. Radios
6. Headphones
7. Home security systems
8. Navigation systems
9. Signage
10. Telephones
11. TVs, VCRs, CD players, stereos
12. Toys

Infrared technology offers several important advantages as a form of wireless communication.

IR Advantages:

1. Low power requirements: therefore ideal for laptops, telephones, personal digital assistants
2. Low circuitry costs: $2-$5 for the entire coding/decoding circuitry
3. Simple circuitry: no special or proprietary hardware is required, can be incorporated into the integrated circuit of a product
4. Higher security: directionality of the beam helps ensure that data isn't leaked or spilled to nearby devices as it's transmitted
5. Portable
6. High noise immunity: not as likely to have interference from signals from other devices

Bluetooth

Bluetooth is a technology through which short range open wireless technology standard for exchanging data over short distances.

Bluetooth provides a secure way to connect and exchange information between devices such as faxes, mobile phones, telephones, laptops, personal computers, printers, Global Positioning System (GPS) receivers, digital cameras, and video game consoles.

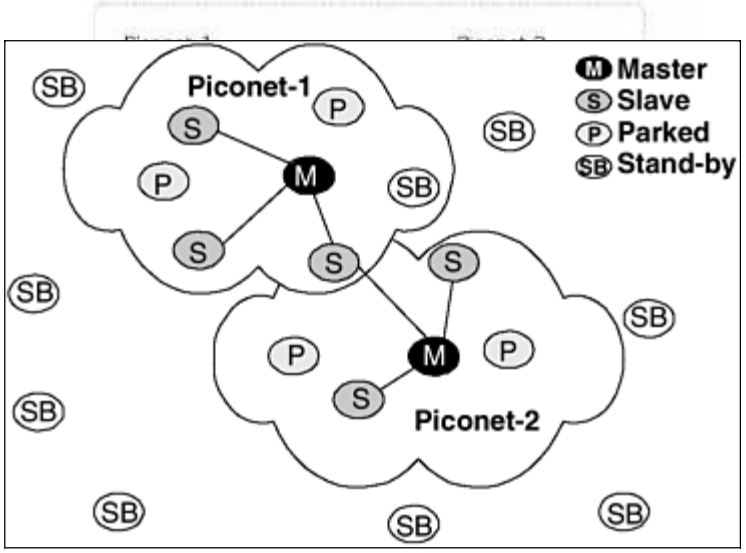
History of Bluetooth

Created by telecoms vendor Ericsson in 1994, it was originally conceived as a wireless alternative to RS-232 data cables. It can connect several devices, overcoming problems of synchronization.

Bluetooth is managed by the Bluetooth Special Interest Group, which has more than 14,000 member companies in the areas of telecommunication, computing, networking, and consumer electronics.

The SIG oversees the development of the specification, manages the qualification program, and protects the trademarks. To be marketed as a Bluetooth device, it must be qualified to standards defined by the SIG.

Architecture of Bluetooth



Bluetooth is a packet-based protocol with a master-slave structure. One master may communicate with up to 7 slaves in a piconet.

A master Bluetooth device can communicate with a maximum of seven devices in a piconet (an ad-hoc computer network using Bluetooth technology), though not all devices support this limit.

The devices can switch roles, by agreement, and the slave can become the master (for example, a headset initiating a connection to a phone will necessarily begin as master, as initiator of the connection; but may subsequently prefer to be slave).

The Bluetooth Core Specification provides for the connection of two or more piconets to form a scatternet, in which certain devices simultaneously play the master role in one piconet and the slave role in another.

In the simple case of single-slot packets the master transmits in even slots and receives in odd slots; the slave, conversely, receives in even slots and transmits in odd slots. Packets may be 1, 3 or 5 slots long but in all cases the master transmits will begin in even slots and the slaves transmit in odd slots.

Applications

- Wireless control of and communication between a mobile phone and a handsfree headset.
- Wireless networking between PCs in a confined space and where little bandwidth is required.
- Wireless communication with PC input and output devices, the most common being the mouse, keyboard and printer.
- Replacement of traditional wired serial communications in test equipment, GPS receivers, medical equipment, bar code scanners, and traffic control devices.
- For low bandwidth applications where higher USB bandwidth is not required and cable-free connection desired.
- Sending small advertisements from Bluetooth-enabled advertising hoardings to other, discoverable, Bluetooth devices.
- Wireless bridge between two Industrial Ethernet (e.g., PROFINET) networks. Dial-up internet access on personal computers or PDAs using a data-capable
- mobile phone as a wireless modem.
- Short range transmission of health sensor data from medical devices to mobile phone, set-top box or dedicated telehealth devices.

Wi-Fi

Wi-fi means wireless Fidelity.802.11 is another name of wi-fi.

Wi-Fi allows cheaper deployment of local area networks (LANs). Also spaces where cables cannot be run, such as outdoor areas and historical buildings, can host wireless LANs.

Wi-Fi is a branded standard for wirelessly connecting electronic devices. A Wi-Fi device, such as a personal computer, video game console, smartphone, or digital audio player can connect to the Internet via a wireless network access point. An access point (or hotspot) has a range of about 20 meters (65 feet) indoors and a greater range outdoors. Multiple overlapping access points can cover large areas.

Manufacturers are building wireless network adapters into most laptops. The price of chipsets for Wi-Fi continues to drop, making it an economical networking option included in even more devices.

Different competitive brands of access points and client network-interfaces can inter-operate at a basic level of service. Products designated as "Wi-Fi Certified" by the Wi-Fi Alliance are backwards compatible. Unlike mobile phones, any standard Wi-Fi device will work anywhere in the world.

Wi-Fi operates in more than 220,000 public hotspots and in tens of millions of homes and corporate and university campuses worldwide.[30] The current version of Wi-Fi Protected Access encryption (WPA2) as of 2010 is widely considered secure, provided users employ a strong passphrase.

Application

Wi-Fi more suitable for latency-sensitive applications (such as voice and video); and power saving mechanisms (WMM Power Save) improve battery operation.

Bluetooth vs. Wi-Fi IEEE 802.11 in networking

Bluetooth and Wi-Fi have many applications: setting up networks, printing, or transferring files.

Wi-Fi is intended for resident equipment and its applications. The category of applications is outlined as WLAN, the wireless local area networks. Wi-Fi is intended as a replacement for cabling for general local area network access in work areas.

Bluetooth was intended for non-resident equipment and its applications. The category of applications is outlined as the wireless personal area network (WPAN).

Bluetooth is a replacement for cabling in a variety of personally carried applications in any setting and can also support fixed location applications such as smart energy functionality in the home (thermostats, etc.).

Wi-Fi is a wireless version of a traditional Ethernet network, and requires configuration to set up shared resources, transmit files, and to set up audio links (for example, headsets and hands-free devices).

Wi-Fi uses the same radio frequencies as Bluetooth, but with higher power, resulting in a faster connection and better range from the base station. The nearest equivalents in Bluetooth are the DUN profile, which allows devices to act as modem interfaces, and the PAN profile, which allows for ad-hoc networking

Lifi

Light Fidelity:-

LiFi is a wireless optical networking technology that uses light-emitting diodes (LEDs) for data transmission.

LiFi is designed to use LED light bulbs similar to those currently in use in many energy-conscious homes and offices. However, LiFi bulbs are outfitted with a chip that

modulates the light imperceptibly for optical data transmission. LiFi data is transmitted by the LED bulbs and received by photoreceptors.

LiFi's early developmental models were capable of 150 megabits-per-second (Mbps). Some commercial kits enabling that speed have been released. In the lab, with stronger LEDs and different technology, researchers have enabled 10 gigabits-per-second (Gbps), which is faster than 802.11ad.

Benefits of LiFi:

- Higher speeds than Wi-Fi.
- 10000 times the frequency spectrum of radio.
  More secure because data cannot be intercepted without a clear line of sight.
- Prevents piggybacking.
- Eliminates neighboring network interference.
- Unimpeded by radio interference.
- Does not create interference in sensitive electronics, making it better for use in environments like hospitals and aircraft.

By using LiFi in all the lights in and around a building, the technology could enable greater area of coverage than a single WiFi router. Drawbacks to the technology include the need for a clear line of sight, difficulties with mobility and the requirement that lights stay on for operation.

How it works

Li-Fi and Wi-Fi are quite similar as both transmit data electromagnetically. However, Wi-Fi uses radio waves while Li-Fi runs on visible light.

As we now know, Li-Fi is a Visible Light Communications (VLC) system. This means that it accommodates a photo-detector to receive light signals and a signal processing element to convert the data into 'stream-able' content.

An LED lightbulb is a semi-conductor light source meaning that the constant current of electricity supplied to an LED lightbulb can be dipped and dimmed, up and down at extremely high speeds, without being visible to the human eye.

For example, data is fed into an LED light bulb (with signal processing technology), it then sends data (embedded in its beam) at rapid speeds to the photo-detector (photodiode).

The tiny changes in the rapid dimming of LED bulbs is then converted by the 'receiver' into electrical signal.

SLM (Spatial Light Modulator)

A **spatial light modulator** (SLM) is an object that imposes some form of spatially varying modulation on a beam of light. A simple example is an overhead projector transparency. Usually when the phrase SLM is used, it means that the transparency can be controlled by a computer. In the 1980s, large SLMs were placed on overhead projectors to project computer monitor contents to the screen. Since then more modern projectors have been developed where the SLM is built inside the projector. These are commonly used in meetings of all kinds for presentations.

Usually, an SLM modulates the intensity of the light beam. However, it is also possible to produce devices that modulate thephase of the beam or both the intensity and the phase simultaneously.

SLMs are used extensively in holographic data storage setups to encode information into a laser beam in exactly the same way as a transparency does for an overhead projector. They can also be used as part of a holographic display technology.

SLMs have been used as a component in optical computing. They also often find application in holographic optical tweezers.

Liquid crystal SLMs can help solve problems related to laser microparticle manipulation. In this case spiral beam parameters can be changed dynamically

A spatial light modulator (SLM) is an electrically programmable device that modulates light according to a fixed spatial (pixel) pattern. SLMs have an expanding role in several optical areas where light control on a pixel-by-pixel basis is critical for optimum system performance. SLMs are typically used to control incident light in amplitude-only, phase-only or the combination (phase-amplitude).

Boulder Nonlinear Systems, Inc. (BNS) manufactures and sells liquid crystal spatial light modulators for a variety of photonics applications. Instead of using off-the-shelf displays, BNS has designed multiple SLMs specifically for these applications. This custom design approach allows us to offer products that are optimized for use in photonics applications. Our manufacturing processes have been developed to yield optically flat devices tuned to maximize performance at a variety of nominal wavelengths from the visible through the near infrared (NIR). Prototype SLMs can also be purchased for ultraviolet (UV) short-wave infrared (SWIR), mid-wave infrared (MWIR), and long-wave infrared (LWIR).

UNIQUE ADVANTAGES

- Phase Only / Amplitude Only / Combined
- High Speed Phase Modulation (up to 500 Hz)
- High Efficiency (up to 95%)
- Low Phase Ripple
- Minimal Crosstalk
- High Optical Resolution

Virus

VIRUS:- Vital Information Resources Under Siege.

Computer viruses are small software programs that are designed to spread from one computer to another and to interfere with computer operation.

A virus might corrupt or delete data on your computer, use your e-mail program to spread itself to other computers, or even erase everything on your hard disk.

Viruses are most easily spread by attachments in e-mail messages or instant messaging messages.

That is why it is essential that you never open e-mail attachments unless you know who it's from and you are expecting it.

Viruses can be disguised as attachments of funny images, greeting cards, or audio and video files.

Viruses also spread through downloads on the Internet. They can be hidden in illicit software or other files or programs you might download.

Once a virus is on your computer, its type or the method it used to get there is not as important as removing it and preventing further infection.

Inventors Of Virus Dr. Alan Solomon and Robert M. Slade
In computers, a virus is a program or programming code that replicates by being copied or initiating its copying to another program, computer boot sector or document. Viruses can be transmitted as attachments to an e-mail note or in a downloaded file, or be present on a diskette or CD. The immediate source of the e-mail note, downloaded file, or diskette you've received is usually unaware that it contains a virus. Some viruses wreak their effect as soon as their code is executed; other viruses lie dormant until circumstances cause their code to be executed by the computer. Some viruses are benign or playful in intent and effect ("Happy Birthday, Ludwig!") and some can be quite harmful, erasing data or causing your hard disk to require reformatting. A virus that replicates itself by resending itself as an e-mail attachment or as part of a network message is known as a worm.

Generally, there are three main classes of viruses:

File infectors. Some file infector viruses attach themselves to program files, usually selected .COM or .EXE files. Some can infect any program for which execution is requested, including .SYS, .OVL, .PRG, and .MNU files. When the program is loaded, the virus is loaded as well. Other file infector viruses arrive as wholly-contained programs or scripts sent as an attachment to an e-mail note.

System or boot-record infectors. These viruses infect executable code found in certain system areas on a disk. They attach to the DOS boot sector on diskettes or the Master Boot Record on hard disks. A typical scenario (familiar to the author) is to receive a diskette from an innocent source that contains a boot disk virus. When your operating system is running, files on the diskette can be read without triggering the boot disk virus. However, if you leave the diskette in the drive, and then turn the computer off or reload the operating system, the computer will look first in your A drive, find the diskette with its boot disk virus, load it, and make it temporarily impossible to use your hard disk. (Allow several days for recovery.) This is why you should make sure you have a bootable floppy.

Macro viruses. These are among the most common viruses, and they tend to do the least damage. Macro viruses infect your Microsoft Word application and typically insert unwanted words or phrases.

History of Virus
1981 - The First Virus in the WORLD

As described in Robert Slade's history, the first virus in the world actually predated the experimental work that defined current-day viruses. It was spread on Apple II floppy disks.

1983 - The First Documented Experimental Virus On November 3, 1983, the first virus was conceived of as an experiment to be presented at a weekly seminar on computer security. The concept was first introduced in this seminar by the author, and the name 'virus' was thought of by Len Adleman.

Virus Origin

A computer virus shares some of these traits. A computer virus must **piggyback** on top of some other program or document in order to launch.

Once it is running, it can infect other programs or documents. Obviously, the analogy between computer and biological viruses stretches things a bit, but there are enough similarities that the name sticks.

People write computer viruses. A person has to write the code, test it to make sure it spreads properly and then release it. A person also designs the virus's attack phase, whether it's a silly message or the destruction of a hard disk. Why do they do it?

There are at least three reasons. The first is the same psychology that drives vandals and arsonists.

Why would someone want to break a window on someone's car, paint signs on buildings or burn down a beautiful forest? For some people, that seems to be a thrill.

If that sort of person knows computer programming, then he or she may funnel energy into the creation of destructive viruses.

The second reason has to do with the thrill of watching things blow up. Some people have a fascination with things like explosions and car wrecks.

When you were growing up, there might have been a kid in your neighborhood who learned how to make gunpowder.

And that kid probably built bigger and bigger bombs until he either got bored or did some serious damage to himself. Creating a virus is a little like that -- it creates a bomb inside a computer, and the more computers that get infected the more "fun" the explosion.

The third reason involves bragging rights, or the thrill of doing it. Sort of like Mount Everest -- the mountain is there, so someone is compelled to climb it. If you are a certain type of programmer who sees a security hole that could be exploited, you might simply be compelled to exploit the hole yourself before someone else beats you to it.

Of course, most virus creators seem to miss the point that they cause real damage to real people with their creations. Destroying everything on a person's hard

disk is real damage. Forcing a large company to waste thousands of hours cleaning up after a virus is real damage.

Even a silly message is real damage because someone has to waste time getting rid of it. For this reason, the legal system is getting much harsher in punishing the people who create viruses.

Types of Virus

SPYWARE VIRUS:-

Spyware collect information about you without appropriate notice and consent. Spyware can get installed on your computer in a number of ways.

it is to skip reading all the documentation on a free program and just click —OK. That‘s often how they get you.

Spyware is computer software that is installed surreptitiously on a personal computer to intercept or take partial control over the user's interaction with the computer, without the user's informed consent Spyware effects cpu activity. Disk usage. Network traffic.

TROJAN VIRUS:-

Trojan at first glance will appear to be useful software but will actually do damage once installed or run on your computer

They appear to be receiving legitimate software or files from a legitimate source Trojans do not reproduce by infecting other files nor do they self-replicate.Trojan are all malicious programs that can cause damage to your computer.

WHEN, Trojan is activated on your computer, the results can vary Changing your desktop.,Adding silly active desktop icons.Serious damage by deleting files and destroying information.

Most computers cannot be reached by their external IP address. Therefore many Trojans now connect to the computer of the attacker, which has been set up to take the connections, instead of the attacker connecting to his or her victim.

MACRO VIRUSES

These viruses infect the files created using some applications or programs that contain macros such as doc, pps, xls and mdb. They automatically infect the files with macros and also templates and documents that are contained in the file. They hide in documents shared through e-mail and networks.

MEMORY RESIDENT VIRUSES

They usually fix themselves inside the computer memory. They get activated every time the OS runs and end up infecting other opened files. They hide in RAM.

OVERWRITE VIRUSES

These types of viruses delete any information in a file they infect, leaving them partially or completely useless once they are infected. Once in the computer, they replaces all the file content but the file size doesn't change.

DIRECT ACTION VIRUSES

These viruses mainly replicate or take action once they are executed. When a certain condition is met, the viruses will act by infecting the files in the directory or the folder specified in the AUTOEXEC.BAT. The viruses are generally found in the hard disk's root directory, but they keep on changing location.

Direct Action Viruses Include:

- Vienna virus

DIRECTORY VIRUS

Also known as cluster virus or file system virus. They infect the computer's directory by changing the path indicating file location. They are usually located in the disk but affect the entire directory.

Directory Viruses Include:

- dir-2 virus

WEB SCRIPTING VIRUS

Most web pages include some complex codes in order to create an interactive and interesting content. Such a code is often exploited to cause certain undesirable actions. They mostly originate from the infected web pages or browsers.

Web Scripting Viruses Include:

- JS.Fortnight – a virus that spreads via malicious emails.

MULTIPARTITE VIRUS

These type of viruses spread in many different ways. Their actions vary depending on the OS installed and presence of certain files. They tend to hide in the computer's memory but do not infect the hard disk.

Virus Evolution

As virus creators became more sophisticated, they learned new tricks. One important trick was the ability to load viruses into memory so they could keep running in the background as long as the computer remained on.

This gave viruses a much more effective way to replicate themselves. Another trick was the ability to infect the **boot sector** on floppy disks and hard disks. The boot sector is a small program that is the first part of the operating system that the computer loads. It contains a tiny program that tells the computer how to load the rest of the operating system. By putting its code in the boot sector, a virus can **guarantee it is executed**.

It can load itself into memory immediately and run whenever the computer is on. Boot sector viruses can infect the boot sector of any floppy disk inserted in the machine, and on college campuses, where lots of people share machines, they could spread like wildfire.

In general, neither executable nor boot sector viruses are very threatening any longer. The first reason for the decline has been the huge size of today's programs. Nearly every program you buy today comes on a compact disc. Compact discs (CDs) cannot be modified, and that makes viral infection of a CD unlikely, unless the manufacturer permits a virus to be burned onto the CD during production.

The programs are so big that the only easy way to move them around is to buy the CD. People certainly can't carry applications around on floppy disks like they did in the 1980s, when floppies full of programs were traded like baseball cards. Boot sector viruses have also declined because operating systems now protect the boot sector.

Infection from boot sector viruses and executable viruses is still possible. Even so, it is a lot harder, and these viruses don't spread nearly as quickly as they once did. Call it "shrinking habitat," if you want to use a biological analogy. The environment of floppy disks, small programs and weak operating systems made these viruses possible in the 1980s, but that environmental niche has been largely eliminated by huge executables, unchangeable CDs and better operating system safeguards.

E-mail viruses are probably the most familiar to you. We'll look at some in the next section.

Problems of virus:-

Computer viruses are a problem. They can destroy files, steal information, slow down Internet traffic and cause havoc to a computer’s performance. Discussed are the top 10 deadliest computer viruses that your PC will want to avoid catching.

HOW PROTECT FROM VIRUSES

You can protect yourself against viruses with a few simple steps:

If you are truly worried about traditional (as opposed to e-mail) viruses, you should be running a more secure operating system like UNIX. You never hear about viruses on these operating systems because the security features keep viruses (and unwanted human visitors) away from your hard disk.

If you are using an unsecured operating system, then buying virus protection software is a nice safeguard. If you simply **avoid programs from unknown sources**

(like the Internet), and instead stick with commercial software purchased on CDs, you eliminate almost all of the risk from traditional viruses.

You should make sure that **Macro Virus Protection** is enabled in all Microsoft applications, and you should NEVER run macros in a document unless you know what they do. There is seldom a good reason to add macros to a document, so avoiding all macros is a great policy.

You should **never double-click on an e-mail attachment that contains an executable.** Attachments that come in as Word files (.DOC), spreadsheets (.XLS), images (.GIF), etc., are data files and they can do no damage (noting the macro virus problem in Word and Excel documents mentioned above). However, some viruses can now come in through .JPG graphic file attachments.

A file with an extension like EXE, COM or VBS is an executable, and an executable can do any sort of damage it wants. Once you run it, you have given it permission to do anything on your machine. The only defense is never to run executables that arrive via e-mail.

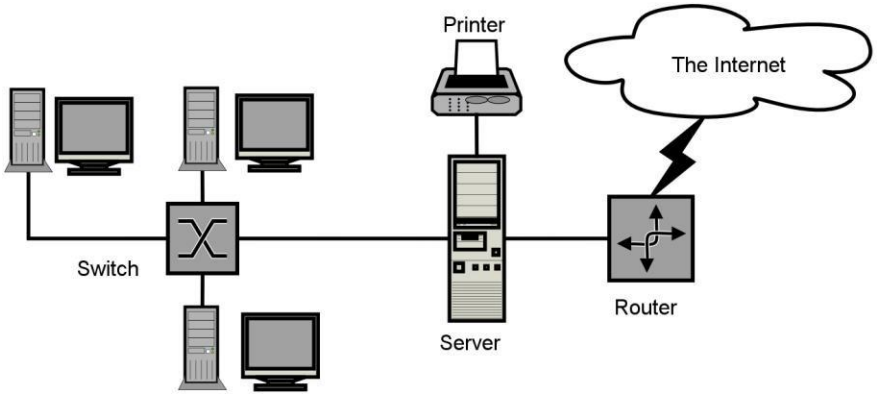
ANTI - VIRUS, ANTI – SPYWARE,ANTI – TROJAN,NORTON UTILITIES,AVG VIRUS SCAN, MacAfee ANTI VIRUS

Cloud Computing:-

- **What is Cloud Computing?**

These are all questions you've probably heard or even asked yourself. The term "cloud computing" is everywhere.

In the simplest terms, cloud computing means storing and accessing data and programs over the Internet instead of your computer's hard drive. The cloud is just a metaphor for the Internet. It goes back to the days of flowcharts and presentations that would represent the gigantic server-farm infrastructure of the Internet as nothing but a puffy, white cumulus cloud, accepting connections and doling out information as it floats.



What cloud computing is not about is your hard drive. When you store data on or run programs from the hard drive, that's called local storage and computing. Everything you need is physically close to you, which means accessing your data is fast and easy, for that one computer, or others on the local network. Working off your hard drive is how the computer industry functioned for decades; some would argue it's still superior to cloud computing, for reasons I'll explain shortly.

CHARACTERISTIC & SERVICE MODELS(IAAS,PAAS,SAAS)

According to the National Institute of Standards and Technologies (NIST), cloud computing is a model for **enabling convenient, on-demand network access to a shared pool of configurable computing resources (networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.** Being a cloud computing provider doesn't mean

just supplementing IT resources, it means providing strategic, core information technology.

This cloud model is composed of **five essential characteristics**:

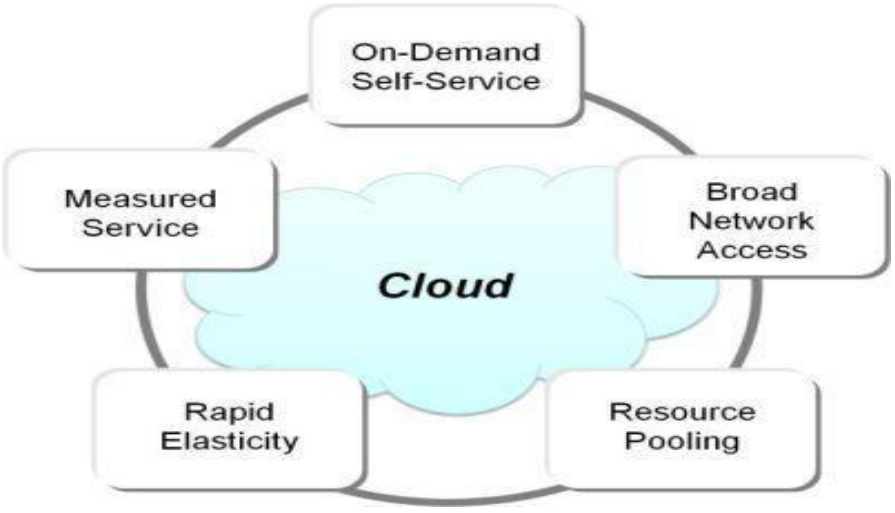
1. **On-demand self-service**
2. **Broad network access**
3. **Resource pooling**
4. **Rapid elasticity**
5. **Measured Service**

(For those who want more detailed information)

What do these five characteristics mean to you?

- **From a developer standpoint**, cloud computing allows you to flexibly deliver integrated content, applications, and services to any device, anywhere, anytime, in a seamlessly scalable model, using and paying for only the resources you need, when you need them.
- **From an IT standpoint**, cloud computing allows organizations to free themselves from having to procure and allocate expensive hardware, software, and networking resources, or employ large teams to manage and support infrastructure.
- **From a business standpoint**, cloud computing enables providers to serve businesses of all sizes, especially SMBs.

From my standpoint, it means a technological evolution.



SAAS: SOFTWARE AS ASERVICE

Cloud application services, or Software as a Service (SaaS), represent the largest cloud market and are still growing quickly. SaaS uses the web to deliver applications that are managed by a third-party vendor and whose interface is accessed on the clients' side. Most SaaS applications can be run directly from a web browser without any downloads or installations required, although some require plugins.

Because of the web delivery model, SaaS eliminates the need to install and run applications on individual computers. With SaaS, it's easy for enterprises to streamline their maintenance and support, because everything can be managed by vendors: applications, runtime, data, middleware, OSes, virtualization, servers, storage and networking.

Popular SaaS offering types include email and collaboration, customer relationship management, and healthcare-related applications. Some large enterprises that are not traditionally thought of as software vendors have started building SaaS as an additional source of revenue in order to gain a competitive advantage.

You May Also Like: Platform-as-a-Service (PaaS) Comparison Guide

SaaS Examples: Google Apps, Salesforce, Workday, Concur, Citrix GoToMeeting, Cisco WebEx
Common SaaS Use-Case: Replaces traditional on-device software
Technology Analyst Examples: Bill Pray (Gartner), Amy DeMartine (Forrester)

PAAS: PLATFORM AS A SERVICE

Cloud platform services, or Platform as a Service (PaaS), are used for applications, and other development, while providing cloud components to software. What developers gain with PaaS is a framework they can build upon to develop or customize applications. PaaS makes the development, testing, and deployment of applications quick, simple, and cost-effective. With this technology, enterprise operations, or a third-party provider, can manage OSes, virtualization, servers, storage, networking, and the PaaS software itself. Developers, however, manage the applications.
Enterprise PaaS provides line-of-business software developers a self-service portal for managing computing infrastructure from centralized IT operations and the platforms that are installed on top of the hardware. The enterprise PaaS can be delivered through a hybrid model that uses both public IaaS and on-premise infrastructure or as a pure private PaaS that only uses the latter.
For the needs of enterprises and other organizations, Apprenda is one provider of a private cloud PaaS for .NET and Java.Enterprise PaaS Examples: Apprenda Common PaaS Use-Case: Increases developer productivity and utilization rates while also decreasing an application's time-to-market Technology Analyst Examples: Richard Watson (Gartner), Eric Knipp (Gartner), Yefim Natis (Gartner), Stefan Ried (Forrester), John Rymer (Forrester).

IAAS: INFRASTRUCTURE AS A SERVICE

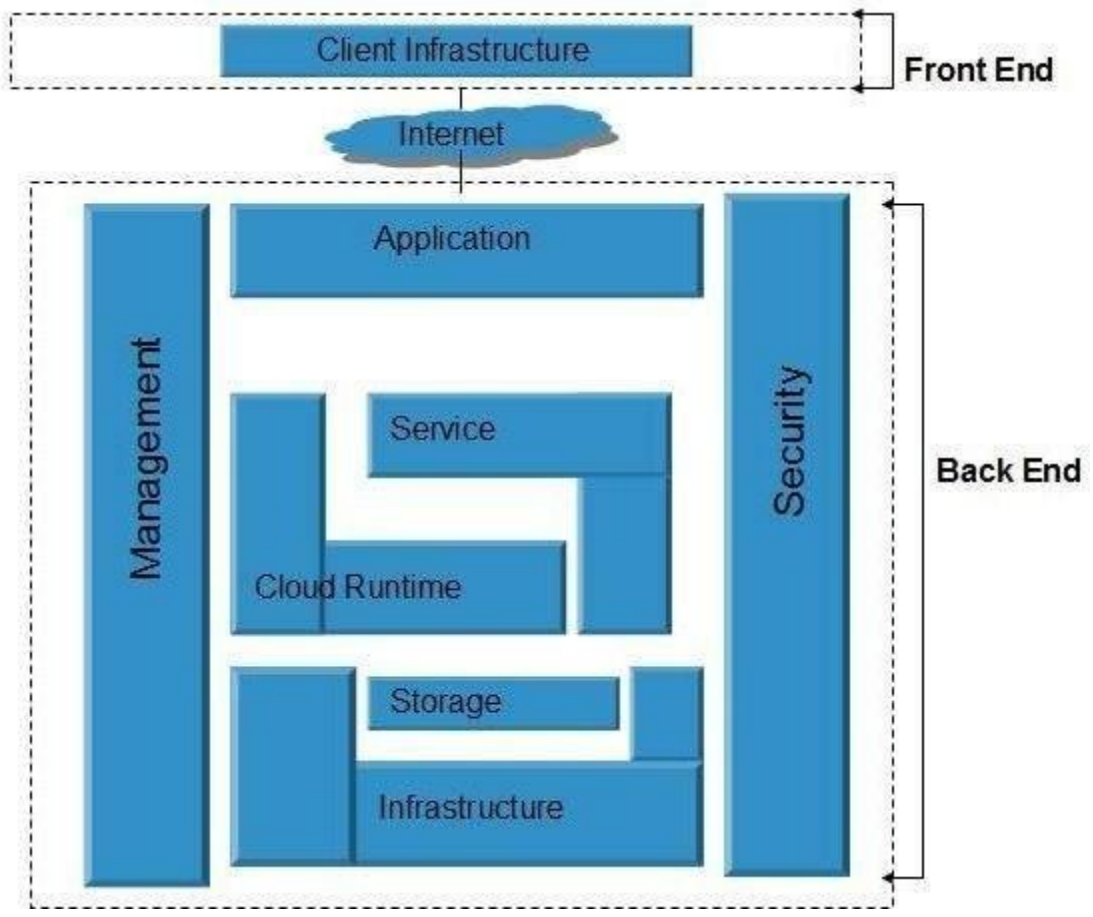
Cloud infrastructure services, known as Infrastructure as a Service (IaaS), are self-service models for accessing, monitoring, and managing remote datacenter infrastructures, such as compute (virtualized or bare metal), storage, networking, and networking services (e.g. firewalls). Instead of having to purchase hardware outright, users can purchase IaaS based on consumption, similar to electricity or other utility billing.
Compared to SaaS and PaaS, IaaS users are responsible for managing applications, data, runtime, middleware, and OSes. Providers still manage virtualization, servers, hard drives, storage, and networking. Many IaaS providers now offer databases, messaging queues, and other services above the virtualization layer as well. Some tech analysts draw a distinction here and use the IaaS+ moniker for these other options. What users gain with IaaS is infrastructure on top of which they can install any required platform. Users are responsible for updating these if new versions are released.
IaaS Examples: Amazon Web Services (AWS), Cisco Metapod, Microsoft Azure, Google Compute Engine (GCE), Joyent Common IaaS Use-Case: Extends current data center infrastructure for temporary workloads (e.g. increased Christmas holiday site traffic) Technology Analyst Examples: Kyle Hilgendorf (Gartner), Drue Reeves (Gartner), Lydia Leong (Gartner), Doug Toombs (Gartner), Gregor Petri (Gartner EU), Tiny Haynes (Gartner EU), Jeffery Hammond (Forrester), James Staten (Forrester)

Architecture of Cloud computing

Cloud Computing architecture comprises of many cloud components, which are loosely coupled. We can broadly divide the cloud architecture into two parts:

- Front End
- Back End

Each of the ends is connected through a network, usually Internet. The following diagram shows the graphical view of cloud computing architecture:



Front End

The **front end** refers to the client part of cloud computing system. It consists of interfaces and applications that are required to access the cloud computing platforms, Example - Web Browser.

Back End

The **back End** refers to the cloud itself. It consists of all the resources required to provide cloud computing services. It comprises of huge data storage, virtual machines, security mechanism, services, deployment models, servers, etc.

Note

- It is the responsibility of the back end to provide built-in security mechanism, traffic control and protocols.

- The server employs certain protocols known as middleware, which help the connected devices to communicate with each other.

- **Security & Privacy**

Cloud computing security

Trust

Trust is not a new research topic in computer science, spanning areas as diverse as security and access control in computer networks, reliability in distributed systems, game theory and agent systems, and policies for decision making under uncertainty Perhaps the most notable example was the development of the Trusted Computer System Evaluation Criteria (TCSEC) in the late 70s and early 80s. Here, trust was used in the process of convincing observers that a system (model, design or implementation) was correct and secure.

Security identification of threats

Essentially securing an Information System (IS), involves identifying unique threats and challenges which need to be addressed by implementing the appropriate countermeasures. Ultimately, the identified security requirements and selected security controls are introduced to the standard systems engineering process, to effectively integrate the security controls with the information systems functional and operational requirements, as well as other pertinent system requirements (e.g., reliability, maintainability, supportability) Cloud computing due to its architectural design and characteristics imposes a number of security benefits, which include centralization of security, data and process segmentation, redundancy and high availability. While many traditional risks are countered effectively, due to the infrastructures singular characteristics, a number of distinctive security challenges are introduced. Cloud computing has “unique attributes that require risk assessment in areas such as availability and reliability issues, data integrity, recovery, and privacy and auditing” Security in general, is related to the important aspects of confidentiality, integrity and availability; they thus become building blocks to be used in designing secure systems. These important aspects of security, apply to the three broad categories of assets which are necessary to be secured, data, software and hardware resources. The cloud infrastructure proposes unique security challenges which need to be considered in detail.

Confidentiality and privacy

Confidentiality refers to only authorized parties or systems having the ability to access protected data. The threat of data compromise increases in the cloud, due to the increased number of parties, devices and applications involved, that leads to an increase in the number of points of access

Integrity

A key aspect of Information Security is integrity. Integrity means that assets can be modified only by authorized parties or in authorized ways and refers to data, software and hardware.

Important Terms and Acronyms

ATM

Acronym for automated teller machine, a machine at a bank branch or other location which enables a customer to perform basic banking activities (checking one's balance, withdrawing or transferring funds) even when the bank is closed.

There are two primary types of automated teller machines, or ATMs. The basic units allow the customer to only withdraw cash and receive a report of the account's balance. The more complex machines will accept deposits, facilitate credit card payments and report account information. To access the advanced features of the complex units, you will usually need to be a member of the bank that operates the machine.

Backup/Restore

Backup and restore is the process of copying data preemptively for the specific purpose of restoring that same data following an event that results in a loss of either hardware storing that data, or the loss of only the data itself. This process, also known as data backup and restore, can be used to restore entire volumes of electronic files and media or restore discrete smaller numbers of files for a variety of purposes, including:

- Accidental deletion or corruption of data
- Hardware failure
- Facilities damage due to natural disasters, fire or flooding

Backup and restore is not the same as data archival. Data archival refers to the process of storing primary copies of inactive or otherwise non-critical data, generally for longer-term storage.

In information technology, a **backup** or the process of **backing up** is making copies of data which may be used to restore the original after a data loss event. The verb form is **back up** in two words, whereas the noun is backup

Soft Copy

A soft copy (sometimes spelled "softcopy") is an electronic copy of some type of data, such as a file viewed on a computer's display or transmitted as an e-mail attachment. Such material, when printed, is referred to as a Softcopy .

Hard Copy

A hard copy (or "hardcopy") is a printed copy of information from a computer.

Bus

A collection of wires through which data is transmitted from one part of a computer to another. You can think of a bus as a highway on which data travels within a computer. When used in reference to personal computers,the term bus usually refers to internal bus.

This is a bus that connects all the internal computer components to the CPU and main memory. There's also an expansion bus that enables expansion boards to access the CPU and memory.

Data Bus

The bus (connections between and within the CPU, memory, and peripherals) used to carry data. Other connections are the address bus and control signals.

A group of parallel conductors (circuit traces) found on the motherboard that is used by the CPU (central processing unit) to send and receive data from all the devices in the computer. Also called the external data bus.

Buffer

A buffer is a data area shared by hardware devices or program processes that operate at different speeds or with different sets of priorities. The buffer allows each device or process to operate without being held up by the other.

In order for a buffer to be effective, the size of the buffer and the algorithms for moving data into and out of the buffer need to be considered by the buffer designer. Like a cache, a buffer is a "midpoint holding place" but exists not so much to accelerate the speed of an activity as to support the coordination of separate activities.

This term is used both in programming and in hardware. In programming, buffering sometimes implies the need to screen data from its final intended place so that it can be edited or otherwise processed before being moved to a regular file or database.

Buffer overflows occur when software attempts to write data outside of its allocated memory block. There are five forms of buffer overflow, each with different causes and results, but most forms are potential security threats to a computer system connected to a network; as hackers can (and often do) use the side-effects of the overflow to attempt to take control of the system. Understanding buffer overflows is essential to maintaining security on a computer network

Buffer Types

Stack Buffer Overflows
Heap Buffer Overflow

Spooling

spool refers to the process of placing data in a temporary working area for another program to process. The most common use is in writing files on a magnetic tape or disk and entering them in the work queue (possibly just linking it to a designated folder in the file system) for another process.

Spooling is useful because devices access data at different rates. Spooling allows one program to assign work to another without directly communicating with it.

Acronym for **s**imultaneous **p**eripheral **o**perations **on-line**, spooling refers to putting jobs in a buffer, a special area in memory or on a disk where a device can access them when it is ready. Spooling is useful because devices access data at different rates. The buffer provides a waiting station where data can rest while the slower device catches up.

Cursor

The mouse cursor is most often an arrow that you can use to point to different objects on your screen. When the cursor is over an object, you can click or double-click the mouse button to perform an action on that object (such as opening a program).

The mouse cursor can change into other images, such as a small hand (when you roll over a link in a Web page), or an hourglass (when Windows is "thinking" so hard, it won't let you click on anything).

A cursor is the position indicator on a computer display screen where a user can enter text. In an operating system with a graphical user interface (GUI), the cursor is also a visible and moving pointer that the user controls with a mouse, touch pad, or similar input device.

The user uses the pointing cursor and special input buttons to establish where the position indicator cursor will be or to select a particular program to run or file to view. Typically, the pointing cursor is an arrow and the text entry position cursor is a blinking underscore or vertical bar.

Pointer

The cursor is a pointer that indicates a link.

Definition: A pointer is a special kind of variable in C and C++ that holds the address of another variable.

A pointer contains an address that points to data.

Icon

A **computer icon** is a pictogram displayed on a computer screen and used to navigate a computer system or mobile device. The icon itself is a small picture or symbol serving as a quick, intuitive representation of a software tool, function or a data file accessible on the system.

It functions as an electronic hyperlink or file shortcut to access the program or data. Computer icons, in conjunction with computer windows, menus and a pointing device, form the graphical user interface (GUI) of the computer system, and enable the user to easily and intuitively navigate the system.

Computer icons belong to the much larger topic of the history of the graphical user interface.

E-mail Attachment

Electronic mail, commonly known as **email** or **e-mail**, is a method of exchanging digital messages from an author to one or more recipients. Modern email operates across the Internet or other computer networks.

Some early email systems required that the author and the recipient both be online at the same time, in common with instant messaging.

Today's email systems are based on a store-and-forward model. Email servers accept, forward, deliver and store messages. Neither the users nor their computers are required to be online simultaneously; they need connect only briefly, typically to an email server, for as long as it takes to send or receive messages.

Attachment

A file attached to an e-mail message. Many e-mail systems only support sending text files as e-mail. If the attachment is a binary file or formatted text file (such as an MS-Word document), it must be encoded before it is sent and decoded once it is received. There are a number of encoding schemes, the two most prevalent being Uuencode and MIME.

CLI

A **command-line interface (CLI)** is a means of interaction between a human user and a computer program, or between two programs, where the user (or client) passes commands in the form of a line of text (a command line) to a computer program.

GUI

In computing, a **graphical user interface** is a type of user interface that allows users to interact with electronic devices using images rather than text commands. GUIs can be used in computers, hand-held devices such as MP3 players, portable media players or gaming devices, household appliances and office equipment.

A GUI represents the information and actions available to a user through graphical icons and visual indicators such as secondary notation, as opposed to text-based interfaces, typed command labels or text navigation. The actions are usually performed through direct manipulation of the graphical elements.

Compiler & its type

A **compiler** is a computer program (or set of programs) that transforms source code written in a programming language (the source language) into another computer language (the target language, often having a binary form known as object code). The most common reason for wanting to transform source code is to create an executable program.

One-pass versus multi-pass compilers

Classifying compilers by number of passes has its background in the hardware resource limitations of computers. Compiling involves performing lots of work and early computers did not have enough memory to contain one program that did all of this work. So compilers were split up into smaller programs which each made a pass over the source (or some representation of it) performing some of the required analysis and translations.

The main types of computer compilers are single pass compilers, multi pass compilers, cross compilers and optimizing compilers. A compiler takes one computer language, called a source code, and converts it into the target language. It enables a computer to be able to read different source codes. A compiler makes software to faster and use less memory.

Drive

Most computers these days will have 2 or 3 drives. Most of the time the C drive is where the operating system is as well as where you store anything you download., D drive is the recovery partition, and the E drive would be your optical drive, either CD or DVD.

Drive/s are usually associated with a hard drive of a pc...The root drive being "C" with your operating system installed on it and so on.....

Drive/s could also refer to video drivers etc A driver acts like a translator between the device and programs that use the device. Each device has its own set of specialized commands that only its driver knows.

In contrast, most programs access devices by using generic commands. The driver, therefore, accepts generic commands from a program and then translates them into specialized commands for the device.

Directory

A computer directory refers to the hierarchy of folders within folders that make up the computer system. At the top is the root directory, which contains all files organized by their location.

Folder

In graphical user interfaces such as Windows and the Macintosh environment, a folder is an object that can contain multiple documents. Folders are used to organize information. In the DOS and UNIX worlds, folders are called directories.

In computing, a **folder**, **directory** is a virtual container within a digital file system, in which groups of computer files and possibly other folders can be kept and organized.

Files are kept organized by storing related files in the same folder. A folder contained inside another folder is called a **subfolder**, **subdirectory**, or **child** of that folder, while the containing folder is called the **parent** folder. The top-most parent folder, which does not have a parent folder of its own, is called the **root** folder within the file system. Together, the folders form a hierarchy, or tree structure of one or more levels.

File

A collection of data or information that has a name, called thefilename. Almost all information stored in a computer must be in a file. There are many different types of files: data files, text files , program files, directory files, and so on. Different types of files store different types of information. For example, program files store programs, whereas text files store text.

Path

In DOS and Windows systems, a path is a list of directories where the operating system looks for executable files if it is unable to find the file in the working directory. You can specify the list of directories with the PATH command.

Menu

A list of commands or options from which you can choose. Most applications now have a menu-driven component. You can choose an item from the menu by highlighting it and then pressing the Enter or Return key, or by simply pointing to the item with a mouse and clicking one of the mouse buttons.

The antithesis of a menu-driven program is a command-driven system, in which you must explicitly enter the command you want rather than choose from a list of possible commands. Menu-driven systems are simpler and easier to learn but are generally not as flexible as command-driven systems, which lend themselves more naturally to interaction with programs.

There are several different types of menus:

1) **pop-up menu:** A menu that appears temporarily when you click the mouse button on a selection. Once you make a selection from a pop-up menu, the menu usually disappears.

2) **Cascading menu:** A submenu that opens when you select a choice from another menu.

3) **pull-down menu :** A special type of pop-up menu that appears directly beneath the command you selected.

4) **moving-bar menu :** A menu in which options are highlighted by a bar that you can move from one item to another. Most menus are moving-bar menus.

5) **menu bar :** A menu arranged horizontally. Each menu option is generally associated with another pull-down menu that appears when you make a selection.

6) **tear-off menu :** A pop-up menu that you can move around the screen like a window.

Toolbar

A series of selectable buttons in a GUI that give the user an easy way to select desktop, application or Web browser functions. Toolbars are typically displayed as either a horizontal row or a vertical column around the edges of the GUI where they are visible while the application is in use. Most applications use toolbars as they give the user another option aside from pull-down menus.

ShutDown

To turn the power off.

In Windows 95 and Windows 98, the normal way to turn a computer off is to select **Start->Shut Down…**

Reboot

To turn the power off.

In Windows 95 and Windows 98, the normal way to turn a computer off is to select **Start->Shut Down…**

Restart

To restart a computer. In DOS, you can reboot by pressing the Alt, Control and Delete keys simultaneously. This is called a warm boot. You can also perform a cold boot by turning the computer off and then on again.

On a PC running Microsoft Windows you reboot by selecting the "Shut Down" option from the Start menu. On Macs, you reboot by selecting the "Restart" option from the Special menu.

Syntax

Refers to the spelling and grammar of a programming language. Computers are inflexible machines that understand what you type only if you type it in the exact form that the computer expects. The expected form is called the syntax.

Each program defines its own syntactical rules that control which words the computer understands, which combinations of words are meaningful, and what punctuation is necessary.

Wild Card Characters

A **WildCard** is a character that may be substituted for any of a defined subset of all possible characters

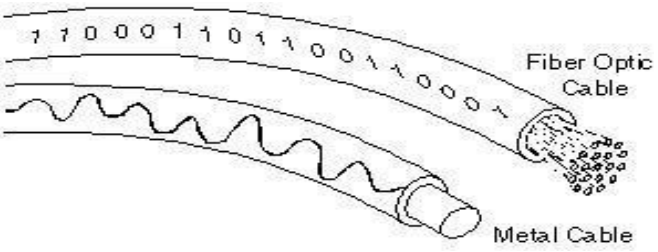
the wildcard character "?" may be substituted for any one of the 36 characters, "A" through "Z" and "0" through "9."

Whether the wildcard character represents a single character or a string of characters must be specified

A wildcard character is a special character that represents one or more other characters. The most commonly used wildcard characters are the asterisk (*), which typically represents zero or more characters in a string of characters, and the question mark (?), which typically represents any one character

A wildcard character is a type of meta character. In various games of playing cards, a wild card is a designated card in the deck of cards (for example, the two of spades) that can be used as though it were any possible card.

Fiber Optic



A technology that uses glass (or plastic) threads (fibers) to transmit data. A fiber optic cable consists of a bundle of glass threads, each of which is capable of transmitting messages modulated onto light waves.

Fiber optics has several advantages over traditional metal communications lines: Fiber optic cables have a much greater bandwidth than metal cables. This means that they can carry more data.

Fiber optic cables are less susceptible than metal cables to interference. Fiber optic cables are much thinner and lighter than metal wires.

Data can be transmitted digitally (the natural form for computer data) rather than analogically.

The main disadvantage of fiber optics is that the cables are expensive to install. In addition, they are more fragile than wire and are difficult to splice.

Fiber optics is a particularly popular technology for local-area networks. In addition, telephone companies are steadily replacing traditional telephone lines with fiber optic cables. In the future, almost all communications will employ fiber optics.

NetMeeting

A product developed by Microsoft Corporation that enables groups to teleconference using the Internet as the transmission medium. NetMeeting supports VoIP, chat sessions, a whiteboard, and application sharing. It's built into Microsoft's Internet Explorer Web browser.

UPS

uninterruptible **p**ower **s**upply, a power supply that includes a battery to maintain power in the event of a power outage. Typically, a UPS keeps a computer running for several minutes after a power outage, enabling you to save data that is in RAM and shut down the computer gracefully. Many UPSs now offer a software component that enables you to automate backup and shut down procedures in case there's a power failure while you're away from the computer.

Printing Speed

A printer's speed refers to how fast the printer can produce output. Printer speed may be measured in lines per minute (**lpm**) for slow printers

CPS=Character Per Second
CPM=Copier Per Minute
LPM =Lines per minute
PPM =Pages per minute
DPI=Dots per Inch

Maximum pages/copies per minute (PPM/CPM) are measured after first page with text patterns in Draft Mode (or Economy Mode, depending on the printer/all-in-one) on plain paper. Actual print/copy times will vary based on system configuration, software, and page complexity.

Printed text and images are usually made up of tiny "dots", so a **printer's** resolution is usually **measured** in **dots per inch** (**dpi**).

Peripherals

A **peripheral** is a device connected to a host computer, but not part of it. It expands the host's capabilities, but does not form part of the core computer architecture.

Other examples of peripherals are Expansion cards, graphics cards, computer printers, image scanners, tape drives, microphones, loudspeakers, webcams, and digital cameras. RAM - random access memory - straddles the line between peripheral and primary component; it is technically a storage peripheral, but is required for every major function of a modern computer and removing the RAM will effectively disable any modern machine.