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SUBJECT:PRINCIPLES OF INFORMATION TECHNOLOGY

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UNIT-1

FUNDEMENTALS OF COMPUTER

1.What is Computer :

Computer is an electronic device that is designed to work with Information. The term computer is derived from the Latin term ‘computare’, this means to calculate or programmable machine. Computer cannot do anything without a Program. It represents the decimal numbers through a string of binary digits. The Word 'Computer' usually refers to the Center Processor Unit plus Internal memory.

Charles Babbage is called the "Grand Father" of the computer. The First mechanical computer designed by Charles Babbage was called Analytical Engine. It uses read-only memory in the form of punch cards.

Computer is an advanced electronic device that takes raw data as input from the user and processes these data under the control of set of instructions (called program) and gives the result (output) and saves output for the future use. It can process both numerical and non-numerical (arithmetic and logical) calculations.

Basic characteristics about computer are:

1.Speed:

computer can work very fast. It takes only few seconds for calculations that we take hours to complete. Computer can perform millions (1,000,000) of instructions and even more per second. Therefore, we determine the speed of computer in terms of microseconds or nanoseconds.

2.Accuracy:

The degree of accuracy of computer is very high and every calculation is performed with the same accuracy. The accuracy level is determined on the basis of design of computer. The errors in computer are due to human and inaccurate data.

3.Diligence:

A computer is free from tiredness, lack of concentration, fatigue, etc. It can work for hours without creating any error. If millions of calculations are to be performed, a computer will perform every calculation with the same accuracy.

4.Versatility:

It means the capacity to perform completely different type of work. You may use your computer to prepare payroll slips. Next moment you may use it for inventory management or to prepare electric bills.

5.Power of Remembering:

Computer has the power of storing any amount of information or data. Any information can be stored and recalled as long as you require it, for any numbers of years. It depends entirely upon you how much data you want to store in a computer and when to lose or retrieve these data.

6.No IQ:

Computer is a dumb machine and it cannot do any work without instruction from the user. It performs the instructions at tremendous speed and with accuracy. It is you to decide what you want to do and in what sequence. So a computer cannot take its own decision as you can.

7.Storage:

The Computer has an in-built memory where it can store a large amount of data. You can also store data in secondary storage devices such as floppies, which can be kept outside your computer and can be carried to other computers.

FUNCTIONAL UNITS

The computer system is divided into three separate units for its operation. They are

Arithmetic Logical Unit (ALU) :

Data through the input device it is stored in the primary storage unit. The actual processing of the data and instruction are performed by Arithmetic Logical Unit. The major operations performed by the ALU are addition, subtraction, multiplication, division, logic and comparison.

Control Unit (CU)

The Control Unit, which acts like the supervisor. Control Unit is responsible for coordinating various operations using time signal. The control unit determines the sequence in which computer programs and instructions are executed. It coordinates the activities of computer's peripheral equipment as they perform the input and output.

Central Processing Unit (CPU)

The ALU and the CU of a computer system are jointly known as the central processing unit. CPU as the brain of any computer system. It is just like brain that takes all major decisions, makes all sorts of calculations and directs different parts of the computer functions by activating and controlling the operations.

CLASSIFICATION OF COMPUTERS

Computers differ based on their data processing abilities. They are classified according to purpose, data handling and functionality.

According to purpose, computers are either general purpose or specific purpose. General purpose computers are designed to perform a range of tasks. They have the ability to store numerous programs, but lack in speed and efficiency. Specific purpose computers are designed to handle a specific problem or to perform a specific task. A set of instructions is built into the machine.

1. **According to data handling**:

Computers are analog, digital or hybrid.

- Analog computers work on the principle of measuring, in which the measurements obtained are translated into data. Modern analog computers usually employ electrical parameters, such as voltages, resistances or currents, to represent the quantities being manipulated. Such computers do not deal directly with the numbers. They measure continuous physical magnitudes.
- Digital computers are those that operate with information, numerical or otherwise, represented in a digital form. Such computers process data into a digital value (in 0s and 1s). They give the results with more accuracy and at a faster rate.
- Hybrid computers incorporate the measuring feature of an analog computer and counting feature of a digital computer. For computational purposes, these computers use analog components and for storage, digital memories are used.

2.**According to functionality:**

Type of computers are classified as

Analog Computer

An analog computer (spelt analogue in British English) is a form of computer that uses continuous physical phenomena such as electrical, mechanical, or hydraulic quantities to model the problem being solved.

Digital Computer

A computer that performs calculations and logical operations with quantities represented as digits, usually in the binary number system

Hybrid Computer (Analog + Digital)

A combination of computers those are capable of inputting and outputting in both digital and analog signals. A hybrid computer system setup offers a cost effective method of performing complex simulations.

3.**On the basis of Size:**

Type of Computer

Super Computer

The fastest and most powerful type of computer Supercomputers are very expensive and are employed for specialized applications that require immense amounts of mathematical calculations. For example, weather forecasting requires a supercomputer. Other uses of supercomputers include animated graphics, fluid dynamic calculations, nuclear energy research, and petroleum exploration.

Mainframe Computer

A very large and expensive computer capable of supporting hundreds, or even thousands, of users simultaneously. In the hierarchy that starts with a simple microprocessor at the bottom and moves to super computers at the top, mainframes are just below supercomputers. , mainframes are more powerful than supercomputers because they support more simultaneous programs. But supercomputers can execute a single program faster than a mainframe.

Mini Computer

A midsized computer. In size and power, minicomputers lie between workstations and mainframes. In general, a minicomputer is a multiprocessing system capable of supporting from 4 to about 200 users simultaneously.

Micro Computer or Personal Computer

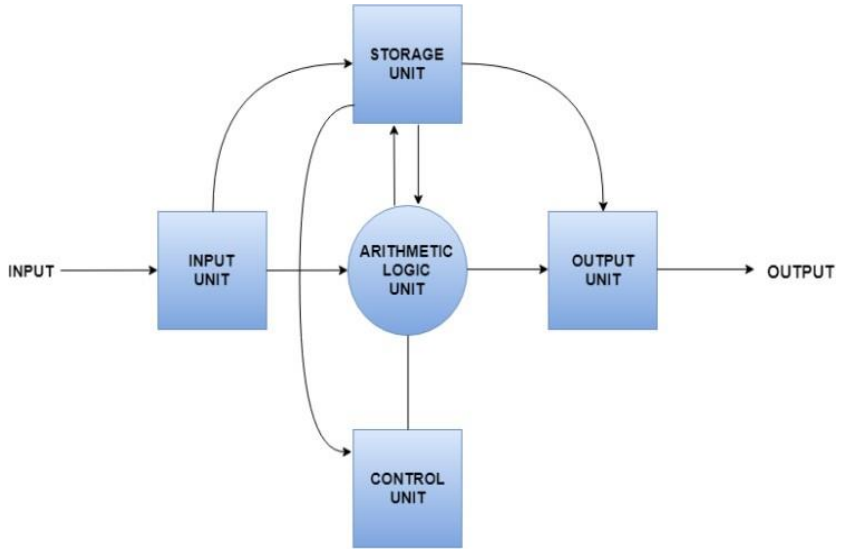
- Desktop Computer: a personal or micro-mini computer sufficient to fit on a desk.
- Laptop Computer: a portable computer complete with an integrated screen and keyboard. It is generally smaller in size than a desktop computer and larger than a notebook computer.
- Palmtop Computer/Digital Diary /Notebook /PDAs: a hand-sized computer. Palmtops have no keyboard but the screen serves both as an input and output device.

Workstations

A terminal or desktop computer in a network. workstation is just a generic term for a user's machine (client machine) in contrast to a "server" or "mainframe."

Computer System Architecture

A computer system is basically a machine that simplifies complicated tasks. It should maximize performance and reduce costs as well as power consumption. The different components in the Computer System Architecture are Input Unit, Output Unit, Storage Unit, Arithmetic Logic Unit, Control Unit etc.



A diagram that shows the flow of data between these units is as follows:

Input Unit

The input unit provides data to the computer system from the outside. So, basically it links the external environment with the computer. It takes data from the input devices, converts it into machine language and then loads it into the computer system. Keyboard, mouse etc. are the most commonly used input devices.

Output Unit

The output unit provides the results of computer process to the users. It links the computer with the external environment. The different output devices are monitors, printers, speakers, headphones etc.

Storage Unit

Storage unit contains many computer components that are used to store data. It is traditionally divided into primary storage and secondary storage.
Primary storage is also known as the main memory and is the memory directly accessible by the CPU.

Secondary or external storage is not directly accessible by the CPU. The data from secondary storage needs to be brought into the primary storage before the CPU can use it. Secondary storage contains a large amount of data permanently.

Arithmetic Logic Unit

All the calculations related to the computer system are performed by the arithmetic logic unit. It can perform operations like addition, subtraction, multiplication, division etc. The control unit transfers data from storage unit to arithmetic logic unit when calculations need to be performed. The arithmetic logic unit and the control unit together form the central processing unit.

Control Unit

This unit controls all the other units of the computer system and so is known as its central nervous system. It transfers data throughout the computer as required including from storage unit to central processing unit and vice versa. The control unit also dictates how the memory, input output devices, arithmetic logic unit etc. should behave.

GENERATIONS OF COMPUTERS:

The various generations of computers :

First Generation (1946-1954) :

In 1946 there was no 'best' way of storing instructions and data in a computer memory. There were four competing technologies for providing computer memory: electrostatic storage tubes, acoustic delay lines (mercury or nickel), magnetic drums (and disks?), and magnetic core storage.

The digital computes using electronic valves (Vacuum tubes) are known as first generation computers. The first 'computer' to use electronic valves (ie. vacuum tubes). The high cost of vacuum tubes prevented their use for main memory. They stored information in the form of propagating sound waves.

The vacuum tube consumes a lot of power. These computers were large in size and writing programs on them was difficult.

Some of the computers of this generation were:

Mark I : Mark I is the first machine to successfully perform a long services of arithmetic and logical operation. Mark I is the First Generation Computer. It was the first operating machine that could execute long computations automatically. . This was the first programmable digital computer made in the U.S. But it was not a purely electronic computer.

ENIAC: It was the first general-purpose electronic computer. It was named Electronic Numerical Integrator and Calculator (ENIAC).

EDVAC: It stands for Electronic Discrete Variable Automatic Computer and was developed in 1950.The concept of storing data and instructions inside the computer was introduced here. This allowed much faster operation since the computer had rapid access to both data and instructions.

EDSAC: It stands for Electronic Delay Storage Automatic Computer and was the first stored-program computer. It performed arithmetic and logical operations without human intervention. EDSAC is the first computer is used to store a program

UNIVAC-1:

It was the first commercial computer.The UNIVAC was also the first computer to come equipped with a magnetic tape unit and was the first computer to use buffer memory.

Second Generation (1955-1964) :

The second-generation computer used transistors for CPU components & ferrite cores for main memory & magnetic disks for secondary memory. They used high-level languages such as FORTRAN (1956), ALGOL (1960) & COBOL (1960 - 1961). I/O processor was included to control I/O operations.

Transistors are smaller than Vacuum tubes and have higher operating speed. They have no filament and require no heating. Manufacturing cost was also very low. Thus the size of the computer got reduced considerably.

It is in the second generation that the concept of Central Processing Unit (CPU), memory, programming language and input and output units were developed. The programming languages such as COBOL, FORTRAN were developed during this period.

iii)**Third Generation (1964-1977)** :

In this generations ,integrated circuit (IC)namely a small chip consisting of the capacity of the 300 transistors. These ICs are popularly known as Chips. A single IC has many transistors, registers and capacitors built on a single thin slice of silicon. So it is quite obvious that the size of the computer got further reduced. Some of the computers developed during this period were IBM-360, ICL-1900, IBM-370, and VAX-750.

Higher level language such as BASIC (Beginners All purpose Symbolic Instruction Code) was developed during this period. Computers of this generation were small in size, low cost, large memory and processing speed is very high. Very soon ICs were replaced by LSI (Large Scale Integration), which consisted about 100 components. An IC containing about 100 components is called LSI. The mini computers were introduced in this generation.

iv)**Fourth Generation :**

An IC containing about 100 components is called LSI (Large Scale Integration) and the one, which has more than 1000 such components, is called as VLSI (Very Large Scale Integration). It uses large scale Integrated Circuits (LSIC) built on a single silicon chip called microprocessors. They used Microprocessor (VLSI) as their main switching element.

Due to the development of microprocessor it is possible to place computer's central processing unit (CPU) on single chip. These computers are called microcomputers.

They have very high speed of processing,accurate,reliable,diligent and versatile. They have very large storage capacity

The personal computer (PC) that you see in is a Fourth Generation Computer Main memory used fast semiconductors chips up to 4 M bits size. Hard disks were used as secondary memory. Keyboards, dot matrix printers etc. were developed. OS-such as MS-DOS, UNIX, Apple's Macintosh were available. Object oriented language, C++ etc were developed.

Example: IBM PC, Apple-Macintosh etc.

v)Fifth Generation (1991- continued) :

5th generation computers use ULSI (Ultra-Large Scale Integration) chips. Millions of transistors are placed in a single IC in ULSI chips. 64 bit microprocessors have been developed during this period. Data flow & EPIC architecture of these processors have been developed. RISC & CISC, both types of designs are used in modern processors.

Memory chips and flash memory up to 1 GB, hard disks up to 600 GB & optical disks up to 50 GB have been developed.Fifth generation digital computer will be Artificial intelligence.

UNIT-2

MEMORY DEVICES

CENTRAL PROCESSING UNIT:

Central Processing Unit (CPU) consists of the following features −

- CPU is considered as the brain of the computer.
- CPU performs all types of data processing operations.
- It stores data, intermediate results, and instructions (program).
- It controls the operation of all parts of the computer.

Components of cpu:

- Memory or Storage Unit
- Control Unit
- ALU(Arithmetic Logic Unit)

Memory or Storage Unit

This unit can store instructions, data, and intermediate results. This unit supplies information to other units of the computer when needed. It is also known as internal storage unit or the main memory or the primary storage or Random Access Memory (RAM).Its size affects speed, power, and capability. Primary memory and secondary memory are two types of memories in the computer.

Control Unit

This unit controls the operations of all parts of the computer but does not carry out any actual data processing operations.

Functions of this unit are −

- It is responsible for controlling the transfer of data and instructions among other units of a computer.
- It manages and coordinates all the units of the computer.
- It obtains the instructions from the memory, interprets them, and directs the operation of the computer.
- It communicates with Input/Output devices for transfer of data or results from storage.
- It does not process or store data.

ALU (Arithmetic Logic Unit)

This unit consists of two subsections namely,

- Arithmetic Section
- Logic Section

Arithmetic Section

Function of arithmetic section is to perform arithmetic operations like addition, subtraction, multiplication, and division. All complex operations are done by making repetitive use of the above operations.

Logic Section

Function of logic section is to perform logic operations such as comparing, selecting, matching, and merging of data.

MEMORY

A memory is just like a human brain. It is used to store data and instructions. Computer memory is the storage space in the computer, where data is to be processed and instructions required for processing are stored. The memory is divided into large number of small parts called cells.

Memory is primarily of three types −

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

Cache Memory

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

Primary Memory (Main Memory)

Primary memory holds only those data and instructions on which the computer is currently working. It has a limited capacity and data is lost when power is switched off. It is generally made up of semiconductor device. These memories are not as fast as registers. The data and instruction required to be processed resides in the main memory. It is divided into two subcategories RAM and ROM.

Characteristics of Main Memory

- These are semiconductor memories.
- It is known as the main memory.
- Usually volatile memory.

- Data is lost in case power is switched off.
- It is the working memory of the computer.
- Faster than secondary memories.
- A computer cannot run without the primary memory.

Secondary Memory

This type of memory is also known as external memory or non- volatile. It is slower than the main memory. These are used for storing data/information permanently. CPU directly does not access these memories, instead they are accessed via input-output routines. The contents of secondary memories are first transferred to the main memory, and then the CPU can access it. For example, disk, CD-ROM, DVD, etc.

Characteristics of Secondary Memory

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

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

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

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

RAM is of two types −

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

Static RAM (SRAM)

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

SRAM uses more chips for storage space, making the manufacturing costs higher. SRAM is thus used as cache memory and has very fast access.

Dynamic RAM (DRAM)

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

READ ONLY MEMORY:

ROM stands for Read Only Memory. The memory from which we can only read but cannot write on it. This type of memory is non-volatile. The information is stored permanently in such memories during manufacture. A ROM stores such instructions that are required to start a computer. This operation is referred to as bootstrap. ROM chips are not only used in the computer but also in other electronic items like washing machine and microwave oven.

Advantages of ROM

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

TYPES OF ROM:

PROM (Programmable Read Only Memory)

PROM is read-only memory that can be modified only once by a user. The user buys a blank PROM and enters the desired contents using a PROM program. Inside the PROM chip, there are small fuses which are burnt open during programming. It can be programmed only once and is not erasable.

EPROM (Erasable and Programmable Read Only Memory)

EPROM can be erased by exposing it to ultra-violet light. During programming, an electrical charge is trapped in an insulated gate region. For erasing this charge, ultra-violet light is passed through a quartz crystal window .

EEPROM (Electrically Erasable and Programmable Read Only Memory)

EEPROM is programmed and erased electrically. It can be erased and reprogrammed about ten thousand times. Both erasing and programming take about 4 to 10 ms (millisecond). In EEPROM, any location can be selectively erased and programmed. EEPROMs can be erased one byte at a time, rather than erasing the entire chip. Hence, the process of reprogramming is flexible but slow.

INPUT DEVICES:

An input device is a hardware or peripheral device used to send data to a computer. An input device allows users to communicate and feed instructions and data to computers for processing, display, storage and/or transmission.

Some of the important input devices which are used in a computer −

Keyboard

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

Keyboards are of two sizes 84 keys or 101/102 keys, but now keyboards with 104 keys or 108 keys are also available for Windows and Internet.

The keys on the keyboard are as follows −

S.No	Keys & Description
1	Typing Keys These keys include the letter keys (A-Z) and digit keys (09) which generally give the same layout as that of typewriters.
2	Numeric Keypad It is used to enter the numeric data or cursor movement. Generally, it consists of a set of 17 keys that are laid out in the same configuration used by most adding machines and calculators.

3	Function Keys The twelve function keys are present on the keyboard which are arranged in a row at the top of the keyboard. Each function key has a unique meaning and is used for some specific purpose.
4	Control keys These keys provide cursor and screen control. It includes four directional arrow keys. Control keys also include Home, End, Insert, Delete, Page Up, Page Down, Control(Ctrl), Alternate(Alt), Escape(Esc).
5	Special Purpose Keys Keyboard also contains some special purpose keys such as Enter, Shift, Caps Lock, Num Lock, Space bar, Tab, and Print Screen.

Mouse

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

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

Joystick

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

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

Light Pen

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

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

Track Ball

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

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

Scanner

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

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

Digitizer

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

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

Microphone

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

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

Magnetic Ink Card Reader (MICR)

MICR input device is generally used in banks as there are large number of cheques to be processed every day. The bank's code number and cheque number are printed on the cheques with a special type of ink that contains particles of magnetic material that are machine readable.

This reading process is called Magnetic Ink Character Recognition (MICR).

Optical Character Reader (OCR)

OCR is an input device used to read a printed text.OCR scans the text optically, character by character, converts them into a machine readable code, and stores the text on the system memory.

Bar Code Readers

Bar Code Reader is a device used for reading bar coded data (data in the form of light and dark lines). Bar coded data is generally used in labelling goods, numbering the books, etc. It may be a handheld scanner or may be embedded in a stationary scanner.

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

Optical Mark Reader (OMR)

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

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

OUTPUT DEVICES:

An output device is any device used to send data from a computer to another device or user. Most computer data output that is meant for humans is in the form of audio or video. Thus, most output devices used by humans are in these categories. Examples include monitors, projectors, speakers, headphones and printers

Some of the important output devices used in a computer.

- Monitors
- Graphic Plotter
- Printer

Monitors

Monitors, commonly called as Visual Display Unit (VDU), are the main output device of a computer. It forms images from tiny dots, called pixels that are arranged in a rectangular form. The sharpness of the image depends upon the number of pixels.

There are two kinds of viewing screen used for monitors.

- Cathode-Ray Tube (CRT)
- Flat-Panel Display

Cathode-Ray Tube (CRT) Monitor

The CRT display is made up of small picture elements called pixels. The smaller the pixels, the better the image clarity or resolution. It takes more than one illuminated pixel to form a whole character, such as the letter ‘e’ in the word help.

A finite number of characters can be displayed on a screen at once. The screen can be divided into a series of character boxes - fixed location on the screen where a standard character can be placed. Most screens are capable of displaying 80 characters of data horizontally and 25 lines vertically.

Flat-Panel Display Monitor

The flat-panel display refers to a class of video devices that have reduced volume, weight and power requirement in comparison to the CRT. You can hang them on walls or wear them on your wrists.

Current uses of flat-panel displays include calculators, video games, monitors, laptop computer, and graphics display.

The flat-panel display is divided into two categories −

- Emissive Displays − Emissive displays are devices that convert electrical energy into light. For example, plasma panel and LED (Light-Emitting Diodes).
- Non-Emissive Displays − Non-emissive displays use optical effects to convert sunlight or light from some other source into graphics patterns. For example, LCD (Liquid-Crystal Device).

Classification of monitors

1.monochrome

Monochrome is a older computer system monitors. Monochrome monitors actually use two colors, one for the display image (the foreground) and one for the background.

Graphic and digital images can also be monochrome, grayscale, or color. In photography a monochromatic image is usually in the form of a black and white photograph, which can be produced using black and white film or by removing colors in post-production.

2.Gray scale

The use of many shades of gray to represent an image. Continuous-tone images, such as black-and-white photographs, use an almost unlimited number of shades of gray.

Gray-scaling is the process of converting a continuous-tone image to an image that a computer can manipulate.

While gray scaling is an improvement over monochrome, it requires larger amounts of memory because each dot is represented by from 4 to 8 bits. At a resolution of 300 dpi, you would need more than 8 megabytes to represent a single 8½ by 11-inch page using 256 shades of gray. This can be reduced considerably through data compression techniques, but gray scaling still requires a great deal of memory.

Many optical scanners are capable of gray scaling, using from 16 to 256 different shades of gray. However, gray scaling is only useful if you have an output device -- monitor or printer -- that is capable of displaying all the shades.

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3. Color or RGB monitor

RGB-Short for red, green, blue monitor, a monitor that requires separate signals for each of the three colors. This differs from color televisions, for example, which use composite video signals, in which all the colors are mixed together. All color computer monitors are RGB monitors.

An RGB monitor 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. When the phosphors are excited by the electron beams, they glow. Depending on which beam excites them, they glow red, green, or blue. Ideally, the three beams should converge for each point on the screen so that each pixel is a combination of the three colors

Characteristics of a monitor:

a) Size:

The most important aspect of a monitor is its size. Screen sizes are measured in diagonal inches, the distance from one corner to another opposite corner diagonally.

b) Resolution:

The resolution of a monitor indicates how density the pixels are packed. Pixel is short for picture element. A pixel is a single point in a graphic image. Graphic monitors display pictures by dividing the display screen into millions of pixels arranged in rows and columns. The quality of a display monitor largely depends on its resolution.

c) Band Width:

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

d) Refresh Rate:

Display monitors must be refresh many times per second. The refresh rate determines how many times per seconds the screen is to be red drawn. The refresh rate of a monitor is measured in Hertz. The faster the refresher is, the less the monitor flickers.

e) Interlacing:

It is a technique in which instead of scanning the image one line at a time, it scans alternately i.e. alternate lines are scanned at each pass. It is used to keep band width down. Since inter leaked displaced have been reported to be more flickery, with better technology available, most monitors are non interlaced now.

f) Dot per Inch:

It is measured for the actual sharpness of the on screen image. This depends on both the resolution & the size of the image. Practical experience shows that a smaller screen has a sharper image at the same resolution than does a large screen. This is because it will require more dots per inch to display the same number of pixels.

g) Dot Pitch:

A measurement that indicates the vertical distance between each pixel on a display screen. It is measured in millimeter. The dot pitch is one of the principle characteristics that determine the quality of display monitors.

h) Convergence:

It refers to how sharply an individual colour pixel on a monitor appears. Each pixel is composed of three dots namely a red, a green and a blue. If the dots are badly mis-converged, the pixel will appear blurry.

Printers

Printer is an output device, which is used to print information on paper.

There are two types of printers −

- Impact Printers
- Non-Impact Printers

Impact Printers

Impact printers print the characters by striking them on the ribbon, which is then pressed on the paper.

These printers are of two types −

- Character printers
- Line printers

Character Printers

Character printers are the printers which print one character at a time.

These are further divided into two types:

- Dot Matrix Printer(DMP)
- Daisy Wheel

Dot Matrix printer

One of the most popular printers is Dot Matrix Printer. These printers are popular because of their ease of printing and economical price. Each character printed is in the form of pattern of dots and head consists of a Matrix of Pins which come out to form a character which is why it is called Dot Matrix Printer.

Daisy Wheel

Head is lying on a wheel and pins corresponding to characters are like petals of Daisy (flower) which is why it is called Daisy Wheel Printer. These printers are generally used for word-processing in offices that require a few letters to be sent here and there with very nice quality.

Line Printers

Line printers are the printers which print one line at a time.

These are of two types −

- Drum Printer
- Chain Printer

Drum Printer

This printer is like a drum in shape hence it is called drum printer. The surface of the drum is divided into a number of tracks. Total tracks are equal to the size of the paper, i.e. for a paper width of 132 characters, drum will have 132 tracks. A character set is embossed on the track. One rotation of drum prints one line. Drum printers are fast in speed and can print 300 to 2000 lines per minute.

Chain Printer

In this printer, a chain of character sets is used, hence it is called Chain Printer. A standard character set may have 48, 64, or 96 characters.

Non-impact Printers

Non-impact printers print the characters without using the ribbon. These printers print a complete page at a time, thus they are also called as Page Printers.

These printers are of two types −

- Laser Printers
- Inkjet Printers

Laser Printers

These are non-impact page printers. They use laser lights to produce the dots needed to form the characters to be printed on a page.

Inkjet Printers

Inkjet printers are non-impact character printers based on a relatively new technology. They print characters by spraying small drops of ink onto paper. Inkjet printers produce high quality output with presentable features.

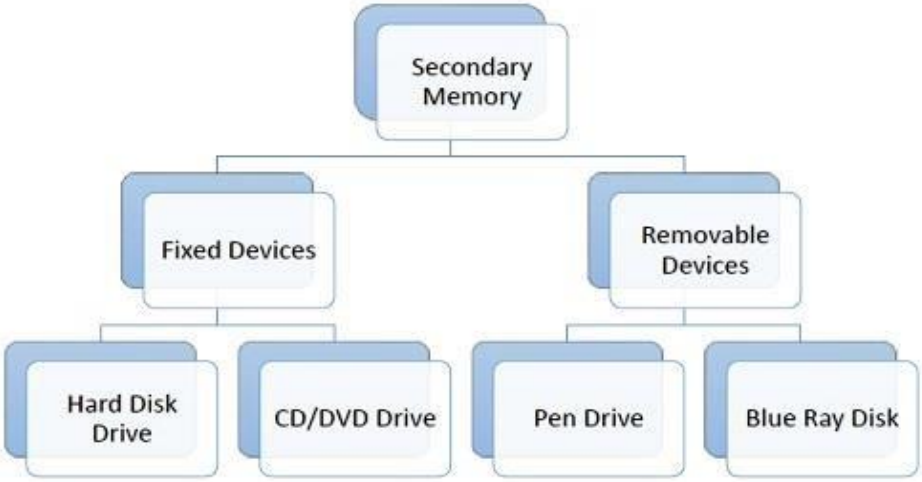
They make less noise because no hammering is done and these have many styles of printing modes available. Color printing is also possible. Some models of Inkjet printers can produce multiple copies of printing also.

SECONDARY MEMORY DEVICES:

If we need to store large amount of data or programs permanently, we need a cheaper and permanent memory. Such memory is called secondary memory. Secondary memory devices that can be used to store large amount of data, audio, video and multimedia files.

There are two types of secondary memory

- Fixed and
- Removable.



FIXED DEVICES:

1.Hard Disk Drive

Hard disk drive is made up of a series of circular disks called platters arranged one over the other almost ½ inches apart around a spindle. Disks are made of non-magnetic material like aluminum alloy and coated with magnetic material.

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

2.CD Drive

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

There are three types of CDs −

CD-ROM (Compact Disk – Read Only Memory)

The data on these CDs are recorded by the manufacturer. Proprietary Software, audio or video are released on CD-ROMs.

CD-R (Compact Disk – Recordable)

Data can be written by the user once on the CD-R. It cannot be deleted or modified later.

CD-RW (Compact Disk – Rewritable)

Data can be written and deleted on these optical disks again and again.

3.DVD Drive

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

REMOVABLE DEVICE:

1. Pen Drive

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

2. Blue Ray Disk

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

UNIT-3

COMPUTER SOFTWARE

1. SOFTWARE:

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

There are two types of software −

- System Software
- Application Software

System Software

The system software is a collection of programs designed to operate, control, and extend the processing capabilities of the computer itself. System software is generally prepared by the computer manufacturers. These software products comprise of programs written in low-level languages, which interact with the hardware at a very basic level. System software serves as the interface between the hardware and the end users.

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

Application Software

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

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

Examples of Application software are Payroll Software, Railways Reservation Software, Microsoft Word, Microsoft Excel, and Microsoft PowerPoint

2.PROGRAMMING LANGUAGE

Introduction:

A language is the main medium of communicating between the Computer systems and the most common are the programming languages. A Computer only understands binary numbers that is 0 and 1 to perform various operations but the languages are developed for different types of work on a Computer. A language consists of all the instructions to make a request to the system for processing a task.

Computer Language Description:

A Computer language includes various languages that are used to communicate with a Computer machine. Some of the languages like programming language which is a set of codes or instructions used for communicating the machine. Machine code is also considered as a computer language that can be used for programming.

There are different types of languages developed for different types of work to be performed by communicating with the machine. But all the languages that are now available are categorized into two basic types of languages including Low-level language and High level language.

Computer Languages

Languages are means of communication. Normally people interact with each other through a language. On the same Pattern, communication with computer is carried out through a Language. This language is understood by both user and the machine. Every computer language is bound by rules know as syntax of that language. The user is bound by that syntax while communicating with the computer system.

Computer language means an artificial language used to write instructions that can be translated into machine language and then executed by a computer.

Computer Language are broadly classified into two as below:

1) Low Level Language
2) High Level Language

Low Level Language

Low-level languages are designed to operate and handle the entire hardware and instructions set architecture of a computer directly.

Low-level languages are considered to be closer to computers. In other words, their prime function is to operate, manage and manipulate the computing hardware and components. Programs and applications written in low-level language are directly executable on the computing hardware without any interpretation or translation.

There are two types of Low level Languages

1) Machine Language

2) Assemble Language

Machine Language:

The language (in the form of 0's and 1's called binary numbers) understood directly by the computer. It is machine dependent. It is difficult to learn and even more difficult to write programs.

Assemble Language

The language where the machine codes comprising of 0's and 1's are substituted by symbolic codes (called mnemonics) to improve their understanding. it is the first step to improve programming structure.

Assembly Language programming is simpler and less time consuming than Machine Level programming, it is easier to locate and correct errors in assembly language than in machine language programs. It is also machine dependent. Programmers must have knowledge of the machine on which program will run.

High Level Language

Low level language requires extensive knowledge of the Hardware, high level language has been evolved which uses normal English like easy to understand statements to solve any problem. Higher level Language is computer independent and programming become quite easy and simple.

There are five different types of high level Languages are given below.

1) BASIC (Beginner All Purpose symbolic Instruction Code)

It is widely used, easy to learn general purpose language. Mainly used in microcomputer in earlier days.

2) COBOL (Common Business Oriented language)

   A standardized language used for commercial applications.

3) FORTRAN (Formula Translation)

   Developed for solving mathematical and scientific problems. One of the most popular languages among scientific community.

4) C:

Structured Programming Language used for all purpose such as scientific application, commercial application, developing games etc.

5) C++:

Popular object oriented programming language, used for general purpose.

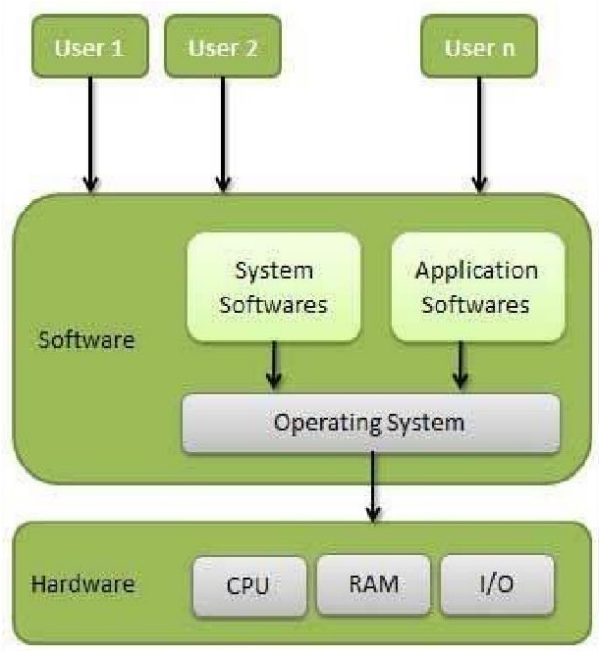
4.OPERATING SYSTEM

Definition

An operating system is a program that acts as an interface between the user and the computer hardware and controls the execution of all kinds of programs.

An operating system is a software which performs all the basic tasks like file management, memory management, process management, handling input and output, and controlling peripheral devices such as disk drives and printers.

Some popular Operating Systems include Linux Operating System, Windows Operating System, VMS, OS/400, AIX, z/OS, etc.



Features:

- An operating system is a program that acts as an interface between the software and the computer hardware.
- It is an integrated set of specialized programs used to manage overall resources and operations of the computer.
- It is a specialized software that controls and monitors the execution of all other programs that reside in the computer, including application programs and other system software.

Objectives of Operating System

- To make the computer system convenient to use in an efficient manner.
- To hide the details of the hardware resources from the users.
- To provide users a convenient interface to use the computer system.
- To act as an intermediary between the hardware and its users, making it easier for the users to access and use other resources.
- To manage the resources of a computer system.
- To keep track of who is using which resource, granting resource requests, and mediating conflicting requests from different programs and users.
- To provide efficient and fair sharing of resources among users and programs.

5. Functions of an operating System.

- Memory Management
- Processor Management
- Device Management
- File Management
- Security
- Control over system performance
- Job accounting
- Error detecting aids
- Coordination between other software and users

Memory Management

Memory management refers to management of Primary Memory or Main Memory. Main memory is a large array of words or bytes where each word or byte has its own address.

Main memory provides a fast storage that can be accessed directly by the CPU. For a program to be executed, it must in the main memory.

An Operating System does the following activities for memory management −

- Keeps tracks of primary memory, i.e., what part of it are in use by whom, what part are not in use.
- In multiprogramming, the OS decides which process will get memory when and how much.
- Allocates the memory when a process requests it to do so.
- De-allocates the memory when a process no longer needs it or has been terminated.

Processor Management

In multiprogramming environment, the OS decides which process gets the processor when and for how much time. This function is called process scheduling. An Operating System does the following activities for processor management −

- Keeps tracks of processor and status of process. The program responsible for this task is known as traffic controller.
- Allocates the processor (CPU) to a process.
- De-allocates processor when a process is no longer required.

Device Management

An Operating System manages device communication via their respective drivers. It does the following activities for device management −

- Keeps tracks of all devices. Program responsible for this task is known as the I/O controller.
- Decides which process gets the device when and for how much time.
- Allocates the device in the efficient way.
- De-allocates devices.

File Management

A file system is normally organized into directories for easy navigation and usage. These directories may contain files and other directions.

An Operating System does the following activities for file management −

- Keeps track of information, location, uses, status etc. The collective facilities are often known as file system.
- Decides who gets the resources.
- Allocates the resources.
- De-allocates the resources.

Security :

Prevents unauthorized access to programs and data by means of passwords and other similar techniques.

Control Over System Performance:

Records delays between the request for a service and from the system.

Job Accounting

Keeps track of time and resources used by various jobs and/or users.

Interaction with the Operators:

Interaction may take place via the console of the computer in the form of instructions. The Operating System acknowledges the same, does the corresponding action, and informs the operation by a display screen.

Error-detecting Aids :

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

Coordination Between Other Software and Users :

Coordination and assignment of compilers, interpreters, assemblers, and other software to the various users of the computer systems.

6. DATABASE MANAGEMENT SYSTEM

What is Database

The database is a collection of inter-related data which is used to retrieve, insert and delete the data efficiently. It is also used to organize the data in the form of a table, schema, views, and reports, etc.

For example: The college Database organizes the data about the admin, staff, students and faculty etc.

Using the database, you can easily retrieve, insert, and delete the information.

Database Management System

- Database management system is a software which is used to manage the database. For example: MySQL, Oracle, etc are a very popular commercial database which is used in different applications.
- DBMS provides an interface to perform various operations like database creation, storing data in it, updating data, creating a table in the database and a lot more.

- It provides protection and security to the database. In the case of multiple users, it also maintains data consistency.

DBMS allows users the following tasks:

- Data Definition:

  It is used for creation, modification, and removal of definition that defines the organization of data in the database.

- Data Updation:

  It is used for the insertion, modification, and deletion of the actual data in the database.

- Data Retrieval:

  It is used to retrieve the data from the database which can be used by applications for various purposes.

- User Administration:

  It is used for registering and monitoring users, maintain data integrity, enforcing data security, dealing with concurrency control, monitoring performance and recovering information corrupted by unexpected failure.

Characteristics of DBMS

- It uses a digital repository established on a server to store and manage the information.
- It can provide a clear and logical view of the process that manipulates data.
- DBMS contains automatic backup and recovery procedures.

- It contains ACID properties which maintain data in a healthy state in case of failure.
- It can reduce the complex relationship between data.
- It is used to support manipulation and processing of data.
- It is used to provide security of data.
- It can view the database from different viewpoints according to the requirements of the user.

Advantages of DBMS

- Controls database redundancy:

  It can control data redundancy because it stores all the data in one single database file and that recorded data is placed in the database.
- Data sharing:

  In DBMS, the authorized users of an organization can share the data among multiple users.
- Easily Maintenance:

  It can be easily maintainable due to the centralized nature of the database system.
- Reduce time:

  It reduces development time and maintenance need.
- Backup:

  It provides backup and recovery subsystems which create automatic backup of data from hardware and software failures and restores the data if required.
- multiple user interface:

  It provides different types of user interfaces like graphical user interfaces, application program interfaces

Disadvantages of DBMS

Cost of Hardware and Software:

It requires a high speed of data processor and large memory size to run DBMS software.

Size:

It occupies a large space of disks and large memory to run them efficiently.

Complexity:

Database system creates additional complexity and requirements.

Higher impact of failure:

Failure is highly impacted the database because in most of the organization, all the data stored in a single database and if the database is damaged due to electric failure or database corruption then the data may be lost forever.

7.Types of Database Management Systems

There are several types of database management systems. Here is a list of seven common database management systems:

1. Hierarchical databases
2. Network databases
3. Relational databases
4. Object-oriented databases
5. ER model databases
6. Document databases
7.

Hierarchical Databases

Hierarchical database management systems (hierarchical DBMSs) model, data is stored in a parent-children relationship node. In a hierarchical database, besides actual data, records also contain information about their groups of parent/child relationships.

In a hierarchical database model, data is organized into a tree like structure. The data is stored in form of collection of fields where each field contains only one value. The records are linked to each other via links into a parent-children relationship. In a hierarchical database model, each child record has only one parent. A parent can have multiple children.

To retrieve a field's data, we need to traverse through each tree until the record is found

The hierarchical database system structure was developed by IBM in early 1960s. While hierarchical structure is simple, it is inflexible due to the parent-child one-to-many relationship. Hierarchical databases are widely used to build high performance and availability applications usually in banking and telecommunications industries.

The IBM Information Management System (IMS) and Windows Registry are two popular examples of hierarchical databases.

Network Databases

Network database management systems (Network DBMSs) use a network structure to create relationship between entities. Network databases are mainly used on a large digital computer. Network databases are hierarchical databases but unlike hierarchical databases where one node can have one parent only, a network node can have relationship with multiple entities. A network database looks more like a interconnected network of records.

In network databases, children are called members and parents are called occupier. The difference between each child or member can have more than one parent.

Data in a network database is organized in many-to-many relationships. Some of the popular network databases are Integrated Data Store (IDS), IDMS (Integrated Database Management System).

Relational Databases

In relational database management systems (RDBMS), the relationship between data is relational and data is stored in tabular form of columns and rows. Each column if a table represents an attribute and each row in a table represents a record. Each field in a table represents a data value.

Structured Query Language (SQL) is a the language used to query a RDBMS including inserting, updating, deleting, and searching records.

Relational databases work on each table has a key field that uniquely indicates each row, and that these key fields can be used to connect one table of data to another. Relational databases are the most popular and widely used databases. Some of the popular DDBMS are Oracle, SQL Server, MySQL, SQLite, and IBM DB2.

Object-Oriented Model

The object oriented Programming takes more than storage of programming language objects. Object DBMS's increase the semantics of the C++ and Java. I t provides full-featured database programming capability, while containing native language compatibility. It adds the database functionality to object programming languages. This approach is the analogical of the application and database development into a constant data model and language environment. Applications require less code, use more natural data modeling, and code bases are easier to maintain. Object developers can write complete database applications with a decent amount of additional effort.

The object-oriented database derivation is the integrity of object-oriented programming language systems and consistent systems. The power of the object-oriented databases comes from the cyclical treatment of both consistent data, as found in databases, and transient data, as found in executing programs.

Object-oriented databases use small, recyclable separated of software called objects. The objects themselves are stored in the object-oriented database. Each object contains of two elements:

1. Piece of data (e.g., sound, video, text, or graphics).
2. Instructions, or software programs called methods, for what to do with the data.

Some OODBMs were designed to work with OOP languages such as Delphi, Ruby, C++, Java, and Python.

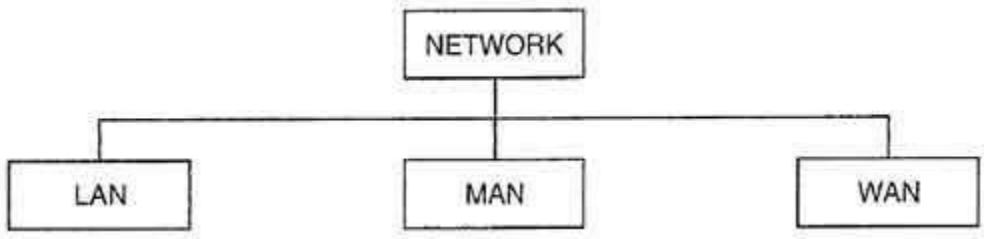
UNIT-4

NETWORKS

What is Network?

A network is consist of group of computer systems, servers, networking devices are linked together to share resources, including a printer or a file server. The connection is established by using either cable media or wireless media.

Types of Networks



LAN (Local Area Network)

A Local Area Network is a privately owned computer network covering a small Networks geographical area, like a home, office, or groups of buildings .

A LAN is used to connect the computers and other network devices so that the devices can communicate with each other to share the resources. The resources to be shared can be a hardware device like printer, software like an application program or data. The size of LAN is usually small. The various devices in LAN are connected to central devices called Hub or Switch using a cable.

Now-a-days LANs are being installed using wireless technologies. Such a system makes use of access point or APs to transmit and receive data.

One of the computers in a network can become a server serving all the remaining computers called Clients. LAN offers high speed communication of data rates of 4 to 16 megabits per second (Mbps).

MAN (Metropolitan Area Networks)

MAN stands for Metropolitan Area Networks .A MAN is a relatively new class of network. MAN is larger than a local area network and as its name implies, covers the area of a single city. MANs rarely extend beyond 100 KM and frequently comprise a combination of different hardware and transmission media. It can be single network such as a cable TV network, or it is a means of connecting a number of LANs into a larger network so that resources can be shared LAN to LAN as well as device to device.

A MAN can be created as a single network such as Cable TV Network, covering the entire city or a group of several Local Area Networks (LANs). It this way resource can be shared from LAN to LAN and from computer to computer also. MANs are usually owned by large organizations to interconnect its various branches across a city

The two most important components of MANs are security and standardization. Security is important because information is being shared between dissimilar systems. Standardization is necessary to ensure reliable data communication.

A MAN usually interconnects a number of local area networks using a high-capacity backbone technology, such as fiber-optical links, and provides up-link services to wide area networks and the Internet.

The Metropolitan Area Networks (MAN) protocols are mostly at the data link level (layer 2 in the OSI model).

WAN (Wide Area Networks)

A wide area network (WAN) is a telecommunication network. A wide area network is simply a LAN of LANs or Network of Networks. WANs connect LANs that may be on opposite sides of a building, across the country or around the world. WANS are characterized by the slowest data communication rates and the largest distances. WANs can be of two types: an enterprise WAN and Global WAN.

Computers connected to a Wide Area Networks are often connected through public networks, such as the telephone system. They can also be connected through leased lines or satellites. The largest WAN in existence is the Internet. Some segments of the Internet, like VPN based extranets, are also WANs in themselves. Finally, many WANs are corporate or research networks that utilize leased lines.

Numerous WANs have been constructed, including public packet networks, large corporate networks, military networks, banking networks, stock brokerage networks, and airline reservation networks.

Organizations supporting WANs using the Internet Protocol are known as Network Service Providers (NSPs). These form the core of the Internet.

By connecting the NSP WANs together using links at Internet Packet Interchanges (sometimes called "peering points") a global communication infrastructure is formed.

WANs (wide area networks) generally utilize different and much more expensive networking equipment than do LANs (Local Area Networks). Key technologies often found in WANs (wide area networks) include SONET, Frame Relay, and ATM.

NETWORK TOPOLOGIES:

The term Network Topology defines the geographic Physical or logical arrangement of computer networking devices . The term Topology refers to the way in which the various nodes or computers of a network are linked together. It describes the actual layout of the computer network hardware. Two or more devices connect to a link; two or more links form a topology. Topology determines the data paths that may be used between any pair of devices of the network.

Types of Topologies

While making a selection of a particular topology we consider the relative status of different devices that are to be linked.

The nodes in a network can have following two relationships:

1. Peer to Peer:

   In this relationship, all the devices in the network have equal status in sharing the link. For example, Ring & Mesh topology.

2. Primary-Secondary:

   In this, one device controls the traffic and all other devices transmit through primary device. e.g. Star topology.

Basic Network Topology

The three simple Topology that are combined to form a basic Network Topology. They are,

1.Bus Topology,

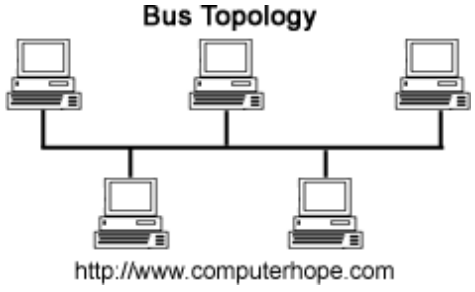
2.Ring Topology and

3.Star Topology.

Bus Topology

The physical Bus Network Topology is the simplest and most widely used of the network designs. It consists of one continuous length of cable (trunk) that is shared by all the nodes in the network and a terminating resistor (terminator) at each end that absorbs the signal when it reaches the end of line. Without a terminator the electrical signal would reach the end of copper wire and bounce back, causing errors on the network.

Bus networks make up what is known as a passive topology, that is before transmitting data, they verify that none of the other computers on the bus are transmitting information, sending packets when the connection is free.



Bus networks usually use coaxial cables that connect to each of the computers through T-shaped connectors. A terminator specific to the type of cable used placed on each end node of the network . Since the bus network is nothing more than a set of cables, connectors, and terminators, the signal is not amplified when traveling through the wiring.

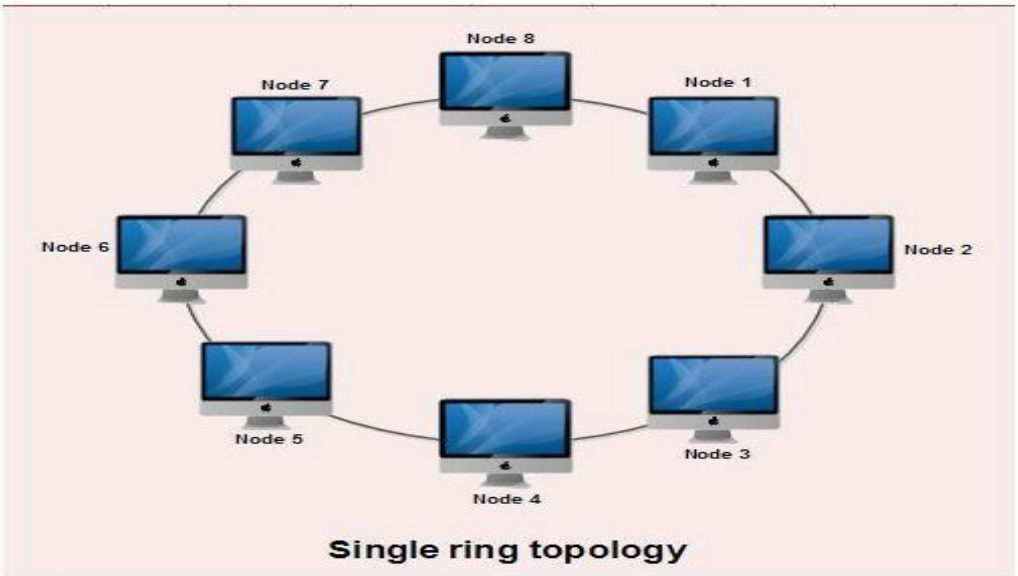
Data communication message travels along the bus in both directions until it is picked up by a workstation or server NIC. If the message is missed or not recognized, it reaches the end of the cabling and dissipates at the terminator. Bus Network Topology requires a multipoint connection .

All nodes on the bus topology have equal access to the trunk. This is accomplished using short drop cables or direct T-connectors. The number of devices and the length of the trunk can be easily expanded.

Bus networks are easy to assemble and expand. They only require a small amount of cable, compared to other network topologies. However, bus networks can suffer cable breakage, loss of information in the connectors and deficiencies in the necessary wiring length, often difficult to resolve. Any physical problem in the network, such as a loose connector, can ground the entire bus network. When bus topology networks do not close properly, the network tends to experience rebounds in signal transmission. If the bus topology used, the physical aspects of the network should always be checked to avoid any problems. Problems with connectors, cables, and terminators often abound in this type of network.

Ring Topology

The physical ring Topology is a circular loop of point-to-point links. Each device connects directly to the ring or indirectly through and interface device or drop cable. Message travel around the ring from node to node in a very organized manner. Each workstation checks the message for a matching destination address. If the address doesn't match the node simply regenerates the message and sends it on its way. If the address matches, the node accepts the message and sends a reply to the originating sender.



Single ring topology

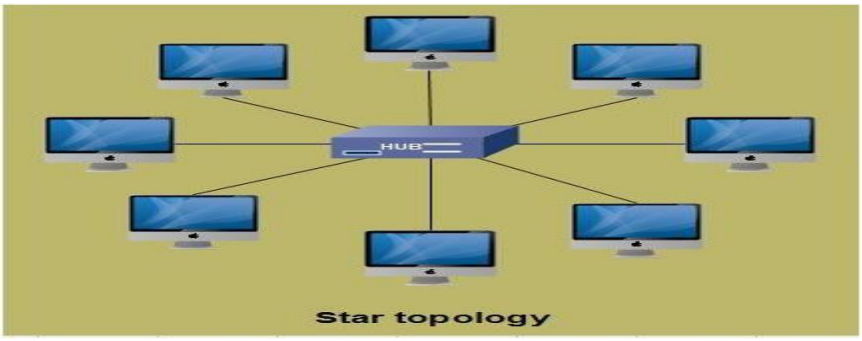
In ring topology, the various nodes are connected in form of a ring or circle (physical ring), in which data flows in a circle, from one station to another station.

It has no beginning or end that needs to be terminated. In this topology, each device or node has a dedicated point to point line configuration with only two devices on either side of it.

Signal is passed along the ring in one direction from one station to another until it reaches destination. Each device in ring incorporates a repeater. When a device receives a signal intended for another device, its repeater regenerates the bits and passes them along.

Star Topology

The physical star Topology uses a central controlling or hub with dedicated legs pointing in all directions – like points of a star. Each network device has a dedicated point-to-point link to the central hub. There is no direct link between these computers and the computers can communicate via central controller only. This strategy prevents troublesome collisions and keeps the lines of communications open and free of traffic. Since in the star topology each computer on the network uses a different cable connection, this type of topology is expandable, only limited by the number of ports available in the hub (although it is possible to join several hubs to increase the number of ports). The expansion of a star topology network does not present any difficulty, since adding another computer to the network means nothing more than placing a cable between the computer and the hub. In fact, the rest of the network users will not even notice the extension.

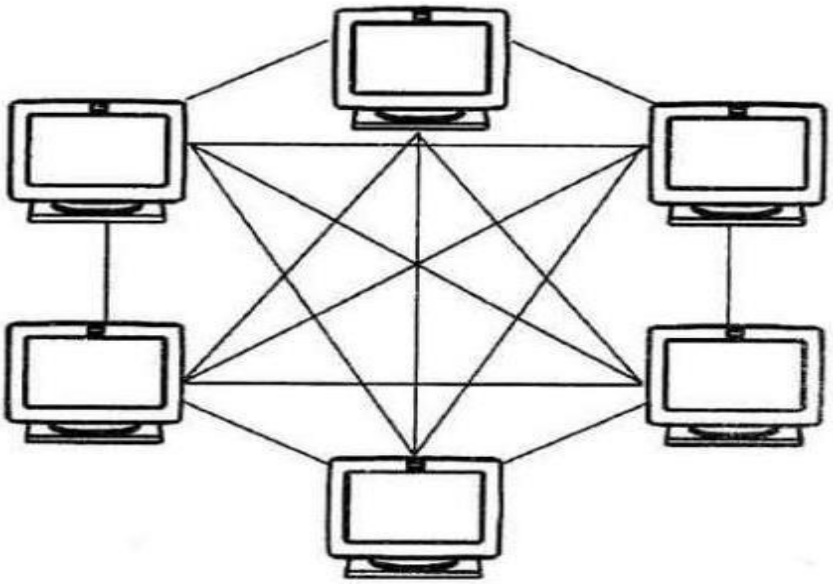


The routing function is performed by the central controller which centrally controls communication between any two computers by establishing a logical path between them. It means that if one computer A wants to send data to another computer B, Computer A sends the data to the controller & this controller then sends the data to computer B.

This Topology, obviously, require a great deal of cabling. This design provides an excellent platform for reconfiguration and trouble-shooting. Changes to the network are as simple as plugging another segment into the hub and a break in the LAN is easy to isolate and doesn't affect the rest of the network.

Mesh Topology

The mesh network topology uses redundant connections between the node on the network, applying a fault tolerance strategy. Each node included in the network connected to the rest of the node, which explains why this type of topology requires extensive wiring. This type of topology can cope with the failure of one or two segments of the network without interrupting traffic since it has redundant lines.



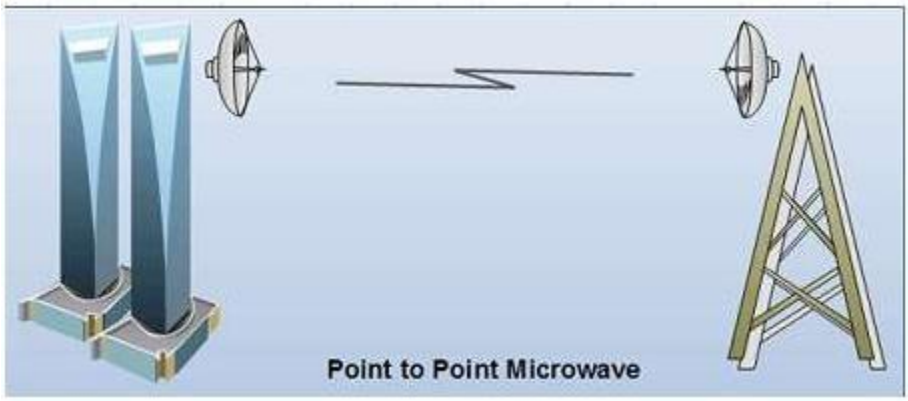
Mesh Topology

Mesh networks are more expensive and difficult to install than other types of network topologies due to the large number of connections they require. In most cases, networks that use this redundant connection strategy included within the broader hybrid networks. In a hybrid network, only the most essential and crucial servers and computers configured with redundant connections. In this way, the fundamental segments of the corporate network protected without using multiple lines for each of the computers connected to the network.

MICROWAVE TRANSMISSION:

Microwave radio, a form of radio transmission that uses ultra-high frequencies with radar.

There are several frequency ranges assigned to microwave systems, all of which are in the Giga Hertz (GHz) range and the wavelength in the millimeter range. This very short wavelength gives rise to the term microwave. Such high frequency signals are especially susceptible to attenuation and, therefore must be amplified or repeated after a particular distance.



In order to maximize the strength of such a high frequency signal and, therefore, to increase the distance of transmission at acceptable levels, the radio beams are highly focused. The transmit antenna is centered in a concave, reflective metal dish which serves to focus the radio beam with maximum effect on the receiving antenna. The receiving antenna, similarly, is centered in a concave metal dish, which serves to collect the maximum amount of incoming signal.

It is a point-to-point, rather than a broadcast, transmission system. Additionally, each antenna must be within line of sight of the next antenna. The curvature of the earth, and the obvious problems of transmitting through it, microwave hops generally are limited to 50 miles (80 km).

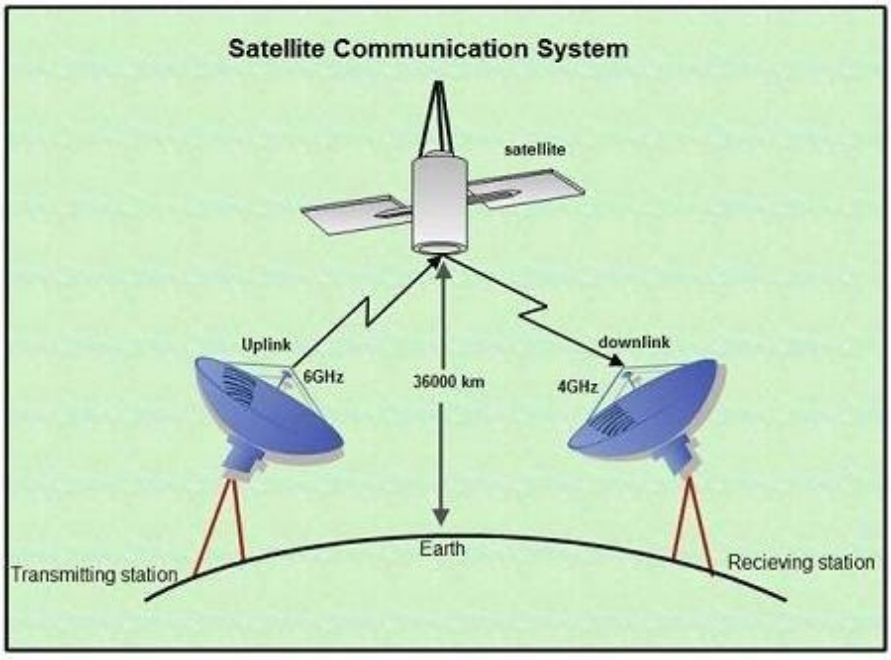
Satellite Transmission

A satellite is a body that revolves around the earth just in same way earth revolves around the sun.

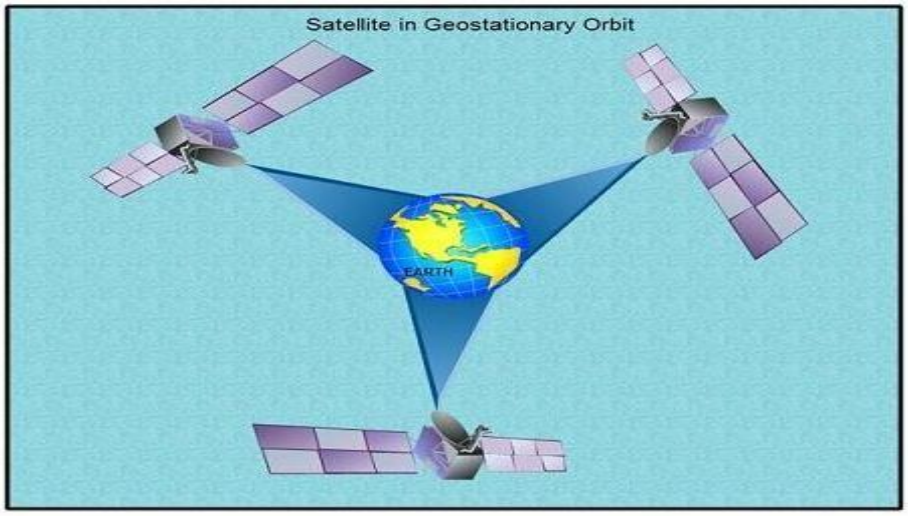
A satellite can be natural such as moon or it can be artificial/manmade (created by human).Manmade satellites are widely being used for communication purposes as they cover maximum area on the earth for a particular transmission.

The paths in which satellites move are called orbits. The orbit can be equatorial, inclined or polar. The period of a satellite, i.e. the time required for a satellite to make a complete trip around the earth.

Satellites process microwaves with bi-directional antennas (line-of-sight). Therefore, the signal from a satellite is normally aimed at a specific area called the footprint. The signal power at the center of footprint is maximum. The power decreases as we move out from the footprint center. A communication satellite acts as a big microwave repeater in the sky



Satellite communication makes use of geostationary satellites. A geostationary satellite is a satellite that is placed approximately 36,000 km above the equator and take exactly 24 hours to complete one revolution around the earth.



A geostationary satellite contains several transponders. The transponder receives signal from one earth station, amplifies it and sends the signal back to other earth stations. A typical satellite has 12-20 transponders each with 36-50 GHz bandwidth.

In case of satellite communication two different frequencies are used as carrier frequencies to avoid interference between incoming and outgoing signals. The signal which is being transmitted upwards to the satellite is called as the uplink. Thus uplink frequency is the frequency used to transmit signal from earth station to satellite.

The signal which is being transmitted back to the receiving earth station is called as the downlink. Thus, downlink frequency is the frequency used to transmit the signal from satellite to earth station.

Satellites are used for variety of purposes as communication, remote sensing, and weather forecasting and for scientific purposes.

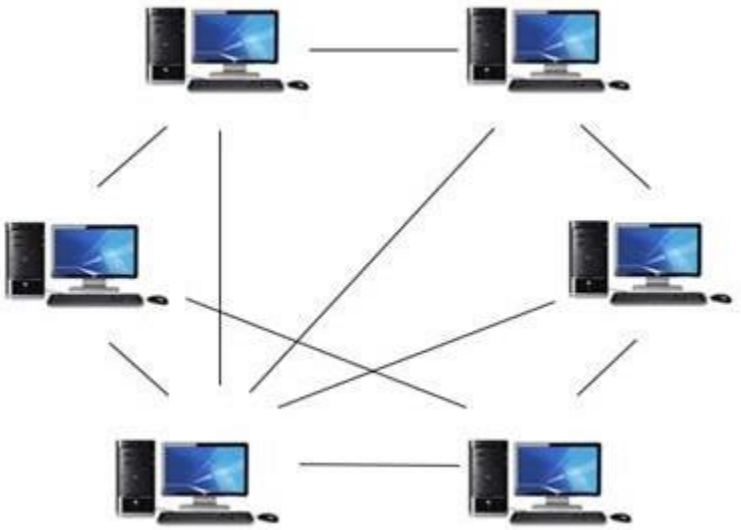
Computer Network Architecture

Computer Network Architecture is defined as the physical and logical design of the software, hardware, protocols, and media of the transmission of data. Simply we can say that how computers are organized and how tasks are allocated to the computer.

The two types of network architectures are used:

1. Peer-To-Peer network
2. Client/Server network

Peer-To-Peer network



Peer-To-Peer network is a network in which all the computers are linked together with equal privilege and responsibilities for processing the data.

- Peer-To-Peer network is useful for small environments, usually up to 10 computers.
- Peer-To-Peer network has no dedicated server.

Special permissions are assigned to each computer for sharing the resources, but this can lead to a problem if the computer with the resource is down.

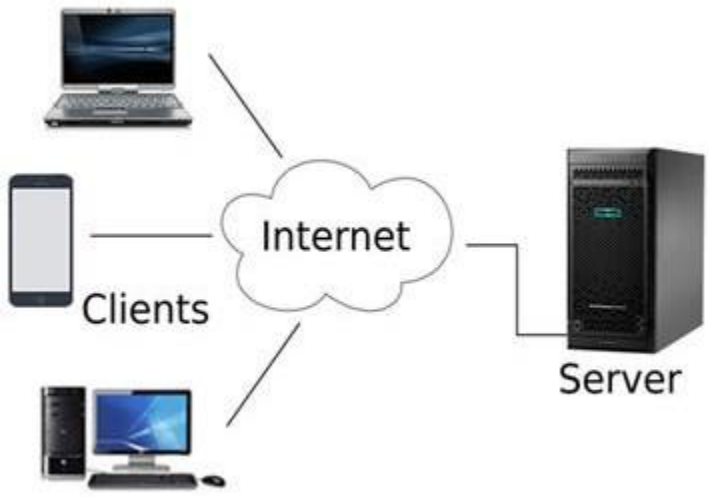
Advantages of Peer-To-Peer Network:

- It is less costly as it does not contain any dedicated server.
- If one computer stops working but, other computers will not stop working.
- It is easy to set up and maintain as each computer manages itself.

Disadvantages of Peer-To-Peer Network:

- In the case of Peer-To-Peer network, it does not contain the centralized system. Therefore, it cannot back up the data as the data is different in different locations.
- It has a security issue as the device is managed itself.

Client/Server Network



Client/Server network is a network model designed for the end users called clients, to access the resources such as songs, video, etc. from a central computer known as Server. The central controller is known as a server while all other computers in the network are called clients.

- A server performs all the major operations such as security and network management.
- A server is responsible for managing all the resources such as files, directories, printer, etc.
- All the clients communicate with each other through a server. For example, if client1 wants to send some data to client 2, then it first sends the request to the server for the permission. The server sends the response to the client 1 to initiate its communication with the client 2.

Advantages of Client/Server network:

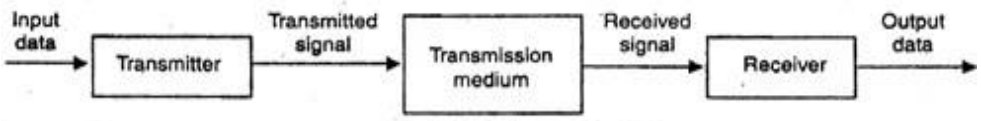
- A Client/Server network contains the centralized system. so we can back up the data easily.
- A Client/Server network has a dedicated server that improves the overall performance of the whole system.
- Security is better in Client/Server network as a single server administers the shared resources.
- It also increases the speed of the sharing resources.

Disadvantages of Client/Server network:

- Client/Server network is expensive as it requires the server with large memory.
- A server has a Network Operating System to provide the resources to the clients.
- The cost of NOS is very high.
- It requires a dedicated network administrator to manage all the resources

DATA COMMUNICATION:

Data communication refers to the exchange of data between a source and a receiver via form of transmission media such as a wire cable. Data communication is said to be local if communicating devices are in the same building or a similarly restricted geographical area.



Simple Data Communication System

The device that transmits the data is known as source and the device that receives the transmitted data is known as receiver. Data communication aims at the transfer of data and maintenance of the data during the process but not the actual generation of the information at the source and receiver. Data can exist in a variety of forms such as numbers, text, bits and bytes.

Components of data communication system

A Communication system has following components:

1. Message:

It is the information or data to be communicated. It can consist of text, numbers, pictures, sound or video or any combination of these.

2. Sender:

It is the device/computer that generates and sends that message.

3. Receiver:

It is the device or computer that receives the message. The location of receiver computer is generally different from the sender computer. The distance between sender and receiver depends upon the types of network used in between.

4. Medium:

It is the channel or physical path through which the message is carried from sender to the receiver. The medium can be wired like twisted pair wire, coaxial cable, fiber-optic cable or wireless like laser, radio waves, and microwaves.

5. Protocol: It is a set of rules that govern the communication between the devices. Both sender and receiver follow same protocols to communicate with each other.

A protocol performs the following functions:

1. Data sequencing.

It refers to breaking a long message into smaller packets of fixed size. Data sequencing rules define the method of numbering packets to detect loss or duplication of packets, and to correctly identify packets, which belong to same message.

2. Data routing.

Data routing defines the most efficient path between the source and destination.

3. Data formatting.

Data formatting rules define which group of bits or characters within packet constitute data, control, addressing, or other information.

4. Flow control.

A communication protocol also prevents a fast sender from overwhelming a slow receiver. It ensures resource sharing and protection against traffic congestion by regulating the flow of data on communication lines.

5. Error control.

These rules are designed to detect errors in messages and to ensure transmission of correct messages. The most common method is to retransmit erroneous message block. In such a case, a block having error is discarded by the receiver and is retransmitted by the sender.

6. Precedence and order of transmission.

These rules ensure that all the nodes get a chance to use the communication lines and other resources of the network based on the priorities assigned to them.

7. Connection establishment and termination.

These rules define how connections are established, maintained and terminated when two nodes of a network want to communicate with each other.

8. Data security.

Providing data security and privacy is also built into most communication software packages. It prevents access of data by unauthorized users.

9. Log information.

Several communication software are designed to develop log information, which consists of all jobs and data communications tasks that have taken place. Such information may be used for charging the users of the network based on their usage of the network resources.

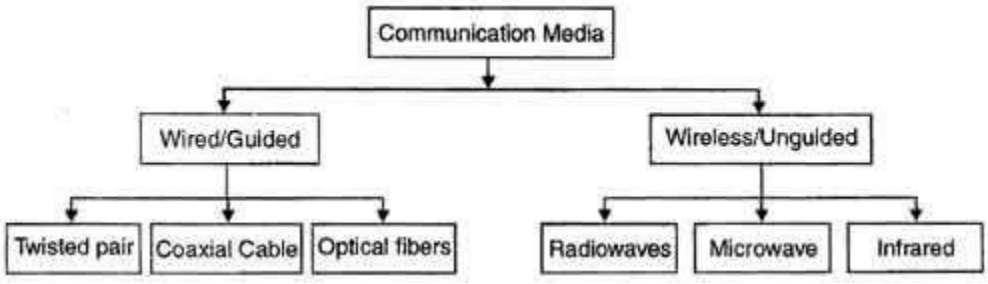
TRANSMISSION MEDIA:

Transmission media is a pathway that carries the information from sender to receiver. We use different types of cables or waves to transmit data. Data is transmitted normally through electrical or electromagnetic signals.

An electrical signal is in the form of current. An electromagnetic signal is series of electromagnetic energy pulses at various frequencies. These signals can be transmitted through copper wires, optical fibers, atmosphere, water and vacuum Different Medias have different properties like bandwidth, delay, cost and ease of installation and maintenance. Transmission media is also called Communication channel.

Types of Transmission Media

Transmission media is broadly classified into two groups.



Wired or Guided Media or Bound Transmission Media:

Bound transmission media are the cables that are tangible or have physical existence and are limited by the physical geography. Popular bound transmission media in use are twisted pair cable, co-axial cable and fiber optical cable. Each of them has its own characteristics like transmission speed, effect of noise, physical appearance, cost etc.

Wireless or Unguided Media or Unbound Transmission Media:

Unbound transmission media are the ways of transmitting data without using any cables. These media are not bounded by physical geography. This type of transmission is called Wireless communication.

Nowadays wireless communication is becoming popular. Wireless LANs are being installed in office and college campuses. This transmission uses Microwave, Radio wave, Infra red are some of popular unbound transmission media.

The data transmission capabilities of various Medias vary differently depending upon the various factors. These factors are:

1. Bandwidth.

   It refers to the data carrying capacity of a channel or medium. Higher bandwidth communication channels support higher data rates.
2. Radiation.

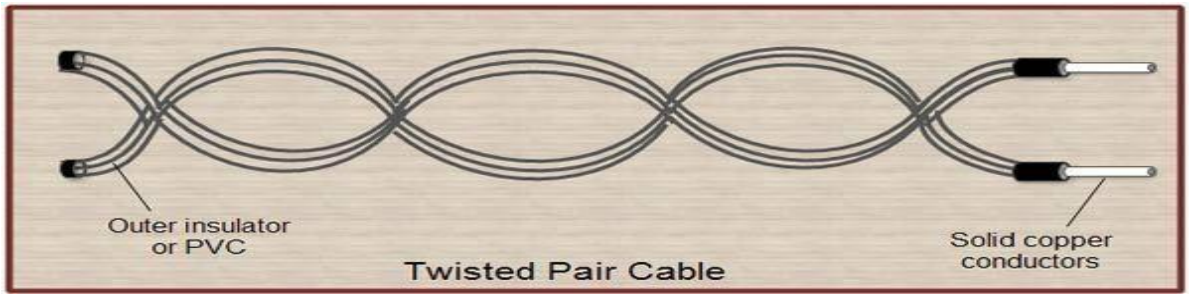
   It refers to the leakage of signal from the medium due to undesirable electrical characteristics of the medium.
3. Noise Absorption

   It refers to the susceptibility of the media to external electrical noise that can cause distortion of data signal.
4. Attenuation.

   It refers to loss of energy as signal propagates outwards. The amount of energy lost depends on frequency. Radiations and physical characteristics of media contribute to attenuation.

Twisted Pair cable

The two wires are typically ``twisted'' together in a helix to reduce interference between the two conductor.



Twisting decreases the crosstalk interference between adjacent pairs in a cable. Typically, a number of pairs are bundled together into a cable by wrapping them in a tough protective sheath. It can carry both analog and digital signals. Actually, they carry only analog signals. However, the ``analog'' signals can very closely correspond to the square waves representing bits, so we often think of them as carrying digital data. Data rates of several Mbps common. Spans distances of several kilometers. Data rate determined by wire thickness and length.

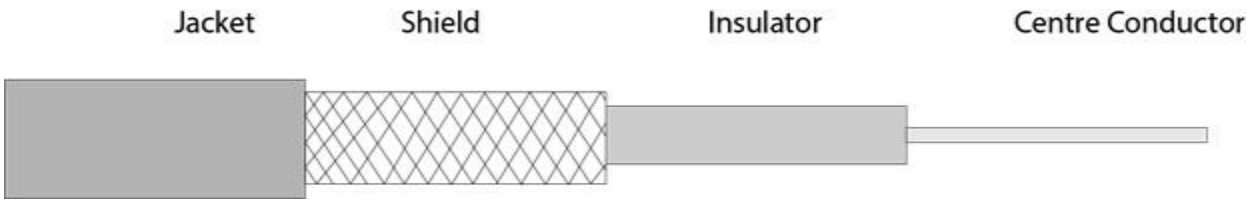
Twisted-pair can be used for both analog and digital communication.
The data rate that can be supported over a twisted-pair is inversely proportional to the square of the line length. Maximum transmission distance of 1 Km can be achieved for data rates up to 1 Mb/s.

To reduce interference, the twisted pair can be shielded with metallic braid. This type of wire is known as Shielded Twisted-Pair (STP) and the other form is known as Unshielded Twisted-Pair (UTP).

The oldest and the most popular use of twisted pair are in telephony. In LAN it is commonly used for point-to-point short distance communication (say, 100m) within a building or a room.

COAXIAL CABLE:

Coaxial cables are the guided media that carries the signal of higher frequency range compared to twisted pair cable. Coaxial cables are also called coax. Two types of coaxial cables are widely used: 50 ohm cable and 75 ohm cable. 50 ohm cable is used for digital transmission and 75 ohm cable is used for analog transmission.



A coaxial cable consists of many small cables in a protective cover. The cover shields the cable from physical dangers as well as from electromagnetic interference. Within the cover, the various cables are shielded from interference with one another. Coaxial cables are used in communication networks that require many simultaneous communication links. Each coaxial cable can provide more than 5000 links. It has a data rate of 10 Mbps which can be increased with the increase in diameter of the inner conductor. The specified maximum number of nodes on a thin net segment is 30 nodes and on a thick net it is 100 nodes.

Coaxial cable is a two-conductor cable in which one conductor forms an electromagnetic shield around the other. The two conductors are separated by insulation. It is a constant impedance transmission cable. This media is used in base band and broadband transmission.

Coaxial cables do not produce external electric and magnetic fields and are not affected by them. This makes them ideally suited, although more expensive, for transmitting signals. This cable is suitable for point to point or point to multipoint applications. In fact this is the most widely used medium for local area networks. These cables are costlier than twisted pair cables but they are cheaper than the optical fiber cables.

Applications of Co-axial Cables:

(1) Analog telephone networks.

(2) Digital telephone network.

(3) Cable TV

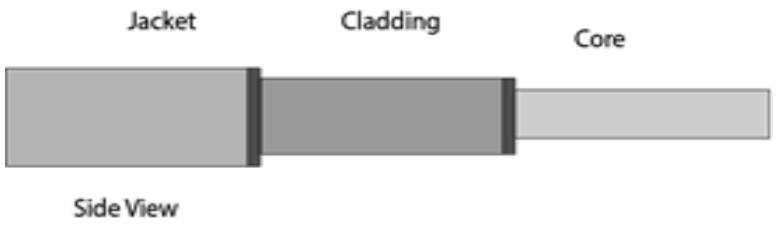
(4) Traditional Ethernet LANs

(5) Digital transmission

(6) Thick Ethernet

Fibre Optic

Fiber optic cable is a cable that uses electrical signals for communication. It is a cable that holds the optical fibers coated in plastic that are used to send the data by pulses of light. The plastic coating protects the optical fibers from heat, cold, electromagnetic interference from other types of wiring. Fibre optics provide faster data transmission than copper wires.



Basic elements of Fibre optic cable:

Core:

The optical fibre consists of a narrow strand of glass or plastic known as a core. A core is a light transmission area of the fibre. The more the area of the core, the more light will be transmitted into the fibre.

Cladding:

The concentric layer of glass is known as cladding. The main functionality of the cladding is to provide the lower refractive index at the core interface as to cause the reflection within the core so that the light waves are transmitted through the fibre.

Jacket:

The protective coating consisting of plastic is known as a jacket. The main purpose of a jacket is to preserve the fibre strength, absorb shock and extra fibre protection.

Advantages of pfiber otic cable :

Greater Bandwidth:

The fibre optic cable provides more bandwidth as compared copper. Therefore, the fibre optic carries more data as compared to copper cable.

Faster speed:

Fibre optic cable carries the data in the form of light. This allows the fibre optic cable to carry the signals at a higher speed.

Longer distances:

The fibre optic cable carries the data at a longer distance as compared to copper cable.

Better reliability:

The fibre optic cable is more reliable than the copper cable as it is immune to any temperature changes while it can cause obstruct in the connectivity of copper cable.

Thinner and Sturdier:

Fibre optic cable is thinner and lighter in weight so it can withstand more pull pressure than copper cable.

INTERNET

Internet, are actually referring to an interconnected network of computers. Some of these computers are web servers, which are just specialized computers that contain and serve content from your favorite websites, and others are just the client devices like our laptops, tablets, and mobile phones.

How does the Internet Work?

Consider a browser is what we call a "client application" and what this simply means is that its a program that allows you to make requests to different web sites and respond to the data that those web sites send back.

When you type in "http:// .com" into your browser, your browser somehow needs to know that this URL (i.e. uniform resource locator) actually means the ip address. So what the browser does is that it contacts the DNS (domain name service) and looks up the ip address for that url. You can think of the DNS as a phone book.

Once the ip address is retrieved, your browser attempts to connect to the web server by opening up a socket connection. Without getting into the details, think of this as you physically calling the tall building (i.e. web server) and seeing if they're still open. If someone responds, then you know they're open and you're connected.

Now that your browser and the server have a open connection with each other, your request to a specific article on ESPN can be made. But before your request can be sent over the internet, it has to follow a set of rules that describe how the request must be formatted. These set of rules are known as TCP/IP and the HTTP protocol. Every request made by your browser and every response sent by a web server must first be chopped up into small packets of data.

Along the way, there are routers (and other similar devices) that basically act as traffic cops and direct the packets to the correct path leading to the ip address.

Once all the packets of data arrive at the web server, the web server will look for the specific article, similar to how you'd look for a file in a cabinet drawer. Once the file has been located, the web server will chop up the response into data packets again, and send them back to your browser.

Finally, when all the data packets arrive back at your browser, your browser will reassemble all packets into the HTML, CSS, JavaScript, and image files that represent the article. Once these files are processed, and see the article displayed on screen.

INTERNET ADDRESSING

IP ADDRESS:

Every machine on a network has a unique identifier. Just as you would address a letter to send in the mail, computers use the unique identifier to send data to specific computers on a network. Most networks today, including all computers on the Internet, use the TCP/IP protocol as the standard for how to communicate on the network. In the TCP/IP protocol, the unique identifier for a computer is called its IP address.

There are two standards for IP addresses: IP Version 4 (IPv4) and IP Version 6 (IPv6). All computers with IP addresses have an IPv4 address, and many are starting to use the new IPv6 address system .

How does your computer get its IP address?

An IP address can be either dynamic or static. A static address is one that you configure yourself by editing your computer's network settings. This type of address is rare, and it can create network issues if you use it without a good understanding of TCP/IP. Dynamic addresses are the most common. They're assigned by the Dynamic Host Configuration Protocol (DHCP), a service running on the network. DHCP typically runs on network hardware such as routers or dedicated DHCP servers.

Dynamic IP addresses are issued using a leasing system, meaning that the IP address is only active for a limited time. If the lease expires, the computer will automatically request a new lease. Sometimes, this means the computer will get a new IP address, too, especially if the computer was unplugged from the network between leases. This process is usually transparent to the user unless the computer warns about an IP address conflict on the network (two computers with the same IP address). An address conflict is rare, and today's technology typically fixes the problem automatically.

DOMAIN NAME:

Domain names function on the Internet in a manner similar to a physical address in the physical world. Each part of the domain name provides specific information.

These pieces of information enable web browsers to locate the web page. The naming system is closely regulated in order to prevent confusion or duplicate addresses. As demand increased exponentially, a new Internet Protocol version, or IPv6, was created to expand the amount of domain names available.

How do Domains Work?

Domain names work because they provide computer users with a short name that is easy to remember. Users enter web addresses into the URL field at the top of their browser's page from left to right. The domain name itself is read from right to left according to the naming hierarchy discussed below. This link provides directions to the network, which ultimately results in a successful page load at the client end of the transaction.

The common fictitious domain name, www.example.com, is comprised of three essential parts:

• .com - This is the top-level domain.

• .example. - This is a sub-domain.

•www. - This is a sub-domain prefix for the World Wide Web. The original use of this prefix was partly accidental, and pronunciation difficulties raised interest in creating viable alternatives.

Many servers use a three-letter naming convention for top-level domains, and they are separated from sub-domains by a dot. The significance of the top-level domain is the most important for new users to grasp. It identifies the highest part of the naming system used on the Internet. This naming system was originally created to identify countries and organizations as well as categories.

The most common categories are easily recognized by new computer users, and they include:

- .com
- .org
- .edu

- .net
- .mil

A significant expansion of the top-level domains occurred, and they now include:

- .biz
- .museum
- .info
- .name

Country codes are also easily recognizable to new users because the abbreviations are the same ones used for other purposes. The organization of the domain name hierarchy and the ability to reserve them for only one purpose has already undergone several modifications. Discussions and debates concerning the availability and affordability of domain names can be expected to continue.

Sub-domains are organized to the left of the top-level domain, and this is the part of the domain system that is most recognizable to humans. It is common to see several levels of sub-domains, and some countries developed specific conventions of organization to communicate information within their internal naming systems.

URL (Uniform Resource Locator):

A URL (Uniform Resource Locator) is a unique identifier used to locate a resource on the internet. It is also referred to as a web address. URLs consist of multiple parts -- including a protocol and domain name -- that tell a web browser how and where to retrieve a resource.

End users use URLs by typing them directly into the address bar of a browser or by clicking a hyperlink found on a webpage, bookmark list, in an email or from another application.

How is a URL structured?

The URL contains the name of the protocol needed to access a resource, as well as a resource name. The first part of a URL identifies what protocol to use as the primary access medium. The second part identifies the IP address or domain name -- and possibly sub domain -- where the resource is located.

URL protocols include HTTP (Hypertext Transfer Protocol) and HTTPS (HTTP Secure) for web resources, mail to for email addresses, FTP for files on a File Transfer Protocol (FTP) server, and telnet for a session to access remote computers. Most URL protocols are followed by a colon and two forward slashes; "mail to" is followed only by a colon.

URL can also specify:

•a path to a specific page or file within a domain;

•a network port to use to make the connection;

•a specific reference point within a file, such as a named anchor in an HTML file; and

•a query or search parameters used -- commonly found in URLs for search results.

Parts of a URL

Using the URL https://whatis.techtarget.com/search/query?q=URL as an example, components of a URL can include:

- The protocol or scheme. Used to access a resource on the internet. Protocols include http, https, ftps, mailto and file. The resource is reached through the domain name system (DNS) name. In this example, the protocol is https.
- Host name or domain name. The unique reference the represents a webpage. For this example, whatis.techtarget.com.
- Port name. Usually not visible in URLs, but necessary. Always following a colon, port 80 is the default port for web servers, but there are other options. For example, :port80.
- Path. A path refers to a file or location on the web server. For this example, search/query.
- Query. Found in the URL of dynamic pages. The query consists of a question mark, followed by parameters. For this example, ?.
- Parameters. Pieces of information in a query string of a URL. Multiple parameters can be separated by ampersands (&). For this example, q=URL.
- Fragment. This is an internal page reference, which refers to a section within the webpage. It appears at the end of a URL and begins with a hashtag (#).

WORLD WIDE WEB (WWW)

The WWW is the brainchild of Tim Berners Lee a CERN who had the idea of creating an electronic web of research information. The web is currently the fastest growing Internet information system, with new resources being added regularly.

The web relies on a set of protocols, conventions and software to operate. The web is a distributed system of delivering linked documents over the Internet.

It is called a distributed system because information can reside on different computers around the world. It can be easily linked together using hypertext. The web uses hypertext to create links from together using hypertext. The web uses hypertext to create links from one resource to another.

A hypertext link is usually displayed by highlighted and underlined text on the page. A hypertext link or hyperlink can also be graphic that acts as a button linking to another resource.

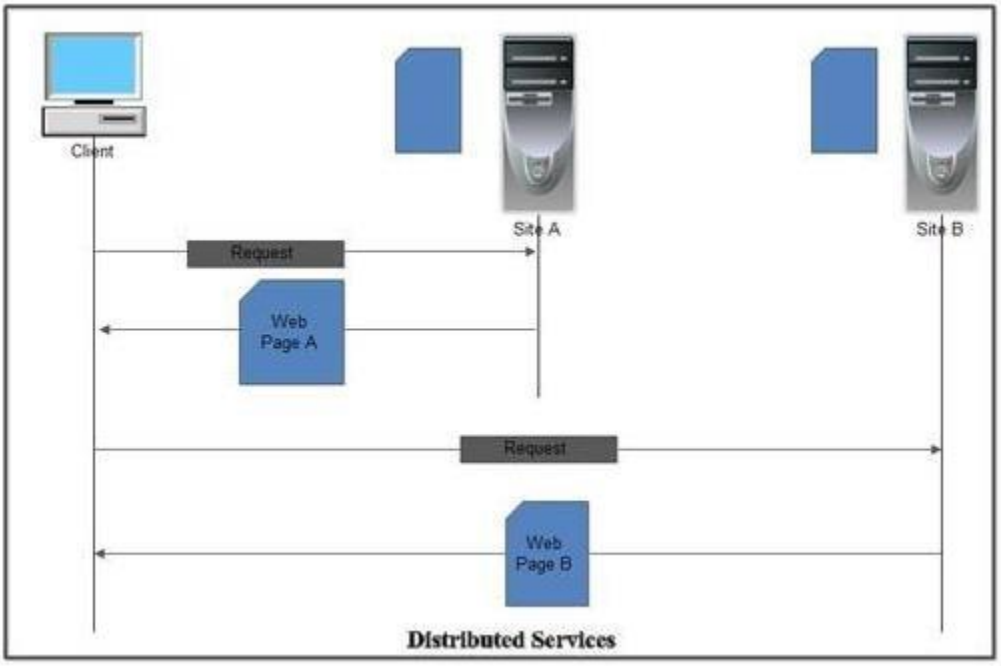
- World Wide Web is an architectural framework for accessing linked documents called web pages that are spread over thousand of computers all over the world.
- WWW is a set of programs, standards and protocols that allow the text, images, animations, sounds and videos to be stored, accessed and linked together in form of web sites.
- It has a unique combination of flexibility, portability, and user-friendly features that distinguishes it from the other services provided by the Internet.

Architecture of WWW

WWW is basically a distributed client-server service. It this, a client can access the services from a server using a browser. These services are usually distributed over many locations called sites or websites.

From the user's point of view web consists of a vast worldwide collection of documents called web pages. These web pages reside on different sites or machines all over the world.

Each web page can contain link to other pages anywhere in the world. By clicking on such link user can access another web page. This kind of link can be in form of string of text or picture, sound, movie clip etc. Such a text or image that enables the user to link to another web page is called hyperlink.



The string of text that points to another web page is called hypertext. The difference between the normal text and hypertext is that, when you take the mouse pointer over it, it changes into a hand shaped cursor. Such a text is sometime, underlined and blue is colour.

Hypermedia is enhanced form of a hyperlink which not only links to the other pages or other sections within the same page but can also link with various medium like sound, animation, movie clip etc, Hypermedia is grouping of different media like sound, graphics, animations and text in a single file.These hyperlinks are created with the help of specialized language called Hypertext Mark up Language (HTML).

In order to access these web pages on different sites, each of these pages has a specific address called Uniform Resource Locator (URL).These Web pages are viewed with a program called a browser.

WEB BROWSER:

A web browser is a software program that allows a user to locate, access, and display web pages. In common usage, a web browser is usually shortened to "browser." Browsers are used primarily for displaying and accessing websites on the internet, as well as other content created using languages such as Hypertext Markup Language (HTML) and Extensible Markup Language (XML).

Browsers translate web pages and websites delivered using Hypertext Transfer Protocol (HTTP) into human-readable content. They also have the ability to display other protocols and prefixes, such as secure HTTP (HTTPS), File Transfer Protocol (FTP), email handling (mailto:), and files (file:).

In addition, most browsers also support external plug-ins required to display active content, such as in-page video, audio and game content. A variety of web browsers are available with different features, and are designed to run on different operating systems.

Common browsers include Internet Explorer from Microsoft, Firefox from Mozilla, Google Chrome, Safari from Apple, and Opera.

INTERNET PROTOCOLS

TCP/IP

TCP / IP is a suite, or family, of protocols that govern the way data is transmitted across networks. TCP / IP protocols work together to break the data into small pieces tht can be efficiently handled by the network, communicate the destination of the data to the network, verify the receipt of the data on the other end of the transmission, and reconstruct the data in its original form.

FTP (File Transfer Protocol) is the protocol, or set of rules, which enables files to be transferred from one computer to another. It is part of the TCP / IP protocol suite. Files that are available for FTP are stored on computers called FTP servers.

An FTP client program is an interface that allows the user to locate the file(s) to be transferred and initiate the transfer process. It is a good idea to have current virus checking software and compression / decompression software before downloading files. Through anonymous FTP, users have access to many types of files including shareware, freeware, upgrades and documents.

HTTP is an acronym for Hypertext Transfer Protocol. HTTP is the set of rules, or protocol, that enables hypertext data to be transferred form one computer to another, and is based on the client / server principle. Hypertext is text that is coded using the Hypertext is text that is coded using the Hypertext Markup Language (HTML). HTTP enables users to retrieve a wide variety of resources such as text, graphics, sound, animation and other hypertext documents, and allows hypertext access to other Internet protocols.

Telnet is the protocol which enables one computer to establish a connection to another computer. The computer establishing the connection is referred to as the local computer; the computer accepting the connection is referred to as the remote, or host, computer.

Although some computer may require an account and password, many computers allow users to access resources stored on them without an account and a password. Telnet can provide access to many resources around the world, such as library catalogs, databases, and other Internet tools and applications.

Gopher is a protocol designed to search, retrieve, and display documents from remote sites on the Internet. In addition to document display, document retrieval, it is possible to initiate on-line connections with other systems via Gopher. Information accessible via Gopher is stored on many computers all over the Internet called Gopher servers. Gopher works on the client / server model and to retrieve and search the information stored on the gopher servers, you need to run a Gopher client application on your computer. Gopher can work with many other Internet protocols.

WAIS is an Internet search tool that has the capability of searching many databases at one time. The databases to be searched can be determined by the user. When WAIS completes a search, it is actually searching an index of the database. A WAIS database index is created by a person.

WAIS retrieves all items from the chosen databases that contain many of the words in the search phrase, provided that the words in the search phrase appear in the indexes of the selected databases. A relevancy ranking is assigned to each retrieved item to help the user determine which items may be most useful. WAIS can be accessed via Telnet, Gopher or a WAIS client program, and increasingly WAIS indexed databases are accessible through the World Wide Web.

HYPER TEXT TRANSFER PROTOCOL

HTTP stands for HyperText Transfer Protocol.It is a protocol used to access the data on the World Wide Web (www).The HTTP protocol can be used to transfer the data in the form of plain text, hypertext, audio, video, and so on.This protocol is known as HyperText Transfer Protocol because of its efficiency that allows us to use in a hypertext environment where there are rapid jumps from one document to another document.

HTTP is similar to the FTP as it also transfers the files from one host to another host. But, HTTP is simpler than FTP as HTTP uses only one connection, i.e., no control connection to transfer the files.HTTP is used to carry the data in the form of MIME-like format.

HTTP is similar to SMTP as the data is transferred between client and server. The HTTP differs from the SMTP in the way the messages are sent from the client to the server and from server to the client. SMTP messages are stored and forwarded while HTTP messages are delivered immediately.

Features of HTTP:
Connectionless protocol:

HTTP is a connectionless protocol. HTTP client initiates a request and waits for a response from the server. When the server receives the request, the server processes the request and sends back the response to the HTTP client after which the client disconnects the connection. The connection between client and server exist only during the current request and response time only.

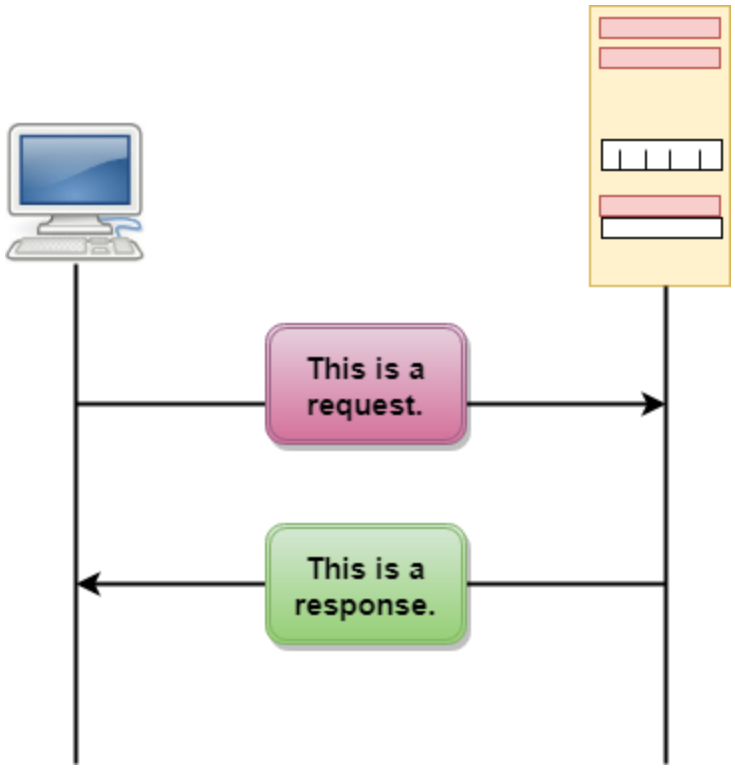
Media independent:

HTTP protocol is a media independent as data can be sent as long as both the client and server know how to handle the data content. It is required for both the client and server to specify the content type in MIME-type header.

Stateless:

HTTP is a stateless protocol as both the client and server know each other only during the current request. Due to this nature of the protocol, both the client and server do not retain the information between various requests of the web pages.

HTTP Transactions



The above figure shows the HTTP transaction between client and server. The client initiates a transaction by sending a request message to the server. The server replies to the request message by sending a response message.

Messages

HTTP messages are of two types: request and response. Both the message types follow the same message format.

Request Message:

The request message is sent by the client that consists of a request line, headers, and sometimes a body.

Response Message:

The response message is sent by the server to the client that consists of a status line, headers, and sometimes a body.

E.mail

Email is a service which allows us to send the message in electronic mode over the internet. It offers an efficient, inexpensive and real time mean of distributing information among people.

E-Mail Address:

Each user of email is assigned a unique name for his email account. This name is known as E-mail address. Different users can send and receive messages according to the e-mail address.

E-mail is generally of the form username@domainname. For example, webmaster@tutorialspoint.com is an e-mail address where webmaster is username and tutorialspoint.com is domain name.

- The username and the domain name are separated by @ (at) symbol.
- E-mail addresses are not case sensitive.

- Spaces are not allowed in e-mail address.

E-mail Message Components

E-mail message comprises of different components: E-mail Header, Greeting, Text, and Signature. These components are described in the following diagram:

E-mail Header

The first five lines of an E-mail message is called E-mail header. The header part comprises of following fields:

From

The From field indicates the sender's address i.e. who sent the e-mail.

Date

The Date field indicates the date when the e-mail was sent.

To

The To field indicates the recipient's address i.e. to whom the e-mail is sent.

Subject

The Subject field indicates the purpose of e-mail. It should be precise and to the point.

CC

CC stands for Carbon copy. It includes those recipient addresses whom we want to keep informed but not exactly the intended recipient.

BCC

BCC stands for Black Carbon Copy. It is used when we do not want one or more of the recipients to know that someone else was copied on the message.

Greeting

Greeting is the opening of the actual message. Eg. Hi Sir or Hi Guys etc.

Text

It represents the actual content of the message.

Signature

This is the final part of an e-mail message. It includes Name of Sender, Address, and Contact Number.

Advantages:

Reliable

Many of the mail systems notify the sender if e-mail message was undeliverable.

Convenience

There is no requirement of stationary and stamps. One does not have to go to post office. But all these things are not required for sending or receiving an mail.

Speed:

E-mail is very fast. However, the speed also depends upon the underlying network.

Inexpensive:

The cost of sending e-mail is very low.

Printable:

It is easy to obtain a hardcopy of an e-mail. Also an electronic copy of an e-mail can also be saved for records.

Global:

E-mail can be sent and received by a person sitting across the globe.

Generality:

It is also possible to send graphics, programs and sounds with an e-mail.

Disadvantages

Forgery

E-mail doesn’t prevent from forgery, that is, someone impersonating the sender, since sender is usually not authenticated in any way.

Overload

Convenience of E-mail may result in a flood of mail.

Misdirection

It is possible that you may send e-mail to an unintended recipient.

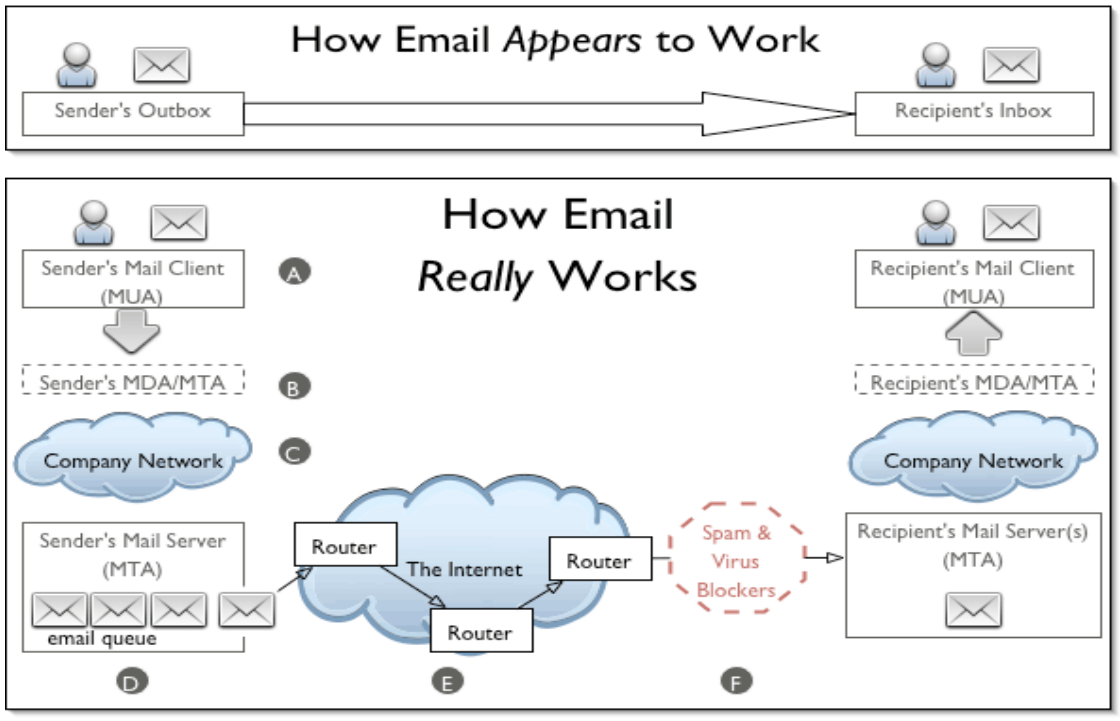
Junk

Junk emails are undesirable and inappropriate emails. Junk emails are sometimes referred to as spam.

No Response

It may be frustrating when the recipient does not read the e-mail and respond on a regular basis.

Working of E-mail



Email working follows the client server approach. In this client is the mailer i.e. the mail application or mail program and server is a device that manages emails.

E-mail System

E-mail system comprises of the following three components:

- Mailer
- Mail Server
- Mailbox

Mailer

It is also called mail program, mail application or mail client. It allows us to manage, read and compose e-mail.

Mail Server

The function of mail server is to receive, store and deliver the email. It is must for mail servers to be Running all the time because if it crashes or is down, email can be lost.

Mailboxes

Mailbox is generally a folder that contains emails and information about them.

Working principle:

- Suppose person A wants to send an email message to person B.
- Person A composes the messages using a mailer program i.e. mail client and then select Send option.
- The message is routed to Simple Mail Transfer Protocol to person B's mail server.
- The mail server stores the email message on disk in an area designated for person B.The disk space area on mail server is called mail spool.
- Now, suppose person B is running a POP client and knows how to communicate with B's mail server.
- It will periodically poll the POP server to check if any new email has arrived for B.As in this case, person B has sent an email for person B, so email is forwarded over the network to B's PC. This is message is now stored on person B's PC.

Web Page

Web page is a document available on world wide web. Web Pages are stored on web server and can be viewed using a web browser.A web page cans contain huge information including text, graphics, audio, video and hyper links. These hyper links are the link to other web pages.

Collection of linked web pages on a web server is known as website. There is unique Uniform Resource Locator (URL) is associated with each web page.

Static Web page

Static web pages are also known as flat or stationary web page. They are loaded on the client's browser as exactly they are stored on the web server. Such web pages contain only static information. User can only read the information but can't do any modification or interact with the information.

Static web pages are created using only HTML. Static web pages are only used when the information is no more required to be modified.

Dynamic Web page

Dynamic web page shows different information at different point of time. It is possible to change a portaion of a web page without loading the entire web page.

Server-side dynamic web page

It is created by using server-side scripting. There are server-side scripting parameters that determine how to assemble a new web page which also include setting up of more client-side processing.

Client-side dynamic web page

It is processed using client side scripting such as JavaScript. And then passed in to Document Object Model (DOM).

Scripting Laguages

Scripting languages are like programming languages that allow us to write programs in form of script. These scripts are interpreted not compiled and executed line by line.Scripting language is used to create dynamic web pages.

Client-side Scripting

Client-side scripting refers to the programs that are executed on client-side. Client- side scripts contains the instruction for the browser to be executed in response to certain user's action.

Client-side scripting programs can be embedded into HTML files or also can be kept as separate files.

Commonly used Client-Side scripting languages:

1. JavaScript

   It is a prototype based scripting language. It inherits its naming conventions from java. All java script files are stored in file having .js extension.

2. ActionScript

   It is an object oriented programming language used for the development of websites and software targeting Adobe flash player.

3. Dart

   It is an open source web programming language developed by Google. It relies on source-to-source compiler to JavaScript.

4. VBScript

It is an open source web programming language developed by Microsoft. It is superset of JavaScript and adds optional static typing class-based object oriented programming.

Server-side Scripting

Server-side scripting acts as an interface for the client and also limit the user access the resources on web server. It can also collects the user's characteristics in order to customize response.

1. ASP

Active Server Pages (ASP)is server-side script engine to create dynamic web pages. It supports Component Object Model (COM) which enables ASP web sites to access functionality of libraries such as DLL.

2. ASP.net

It is used to develop dynamic websites, web applications, and web services.

4. Java

Java Server Pages are used for creating dynamic web applications. The Java code is compiled into byte code and run by Java Virtual Machine (JVM).

5. Python

It supports multiple programming paradigms such as object-oriented, and functional programming. It can also be used as non-scripting language .

UNIT-5

Applications &computer security

Computer at Home

Computer can be used at home in the many different ways. Computer can be used at home in the following ways:

1. Home Budget

Computer can be used to manage the home budget.

You can easily calculate your expenses and income with the help of a software like Microsoft Excel. In MS Excel you can prepare a simple worksheet to calculate your daily expenses and income.

2. Computer Games

An important use of computer at home is playing games. Different types of games are available. And if you have internet connection, then you can play games online, too. You can download PC games free from many websites. Computer games are especially played by school going children.

3. Entertainment

You can watch movies, hear songs and find information on Internet. Video and audio songs, movies, TV shows or dramas are some of the entertainment media that can be accessed by internet enabled computer.

4. Information

You can find any type of information from Internet. You can download books to improve your knowledge. You can use search engine, specially the giant Google Search Engine, to find information you want. Internet is a huge database of knowledge on every topic.

5. E-Mail

You can send and receive messages and information by E-Mail.

6. Chatting / Instant Messaging

You can chat with your friends on Internet by instant messaging. You can also talk with them.

7. Searching For Jobs

You can search jobs sitting at home and browsing internet on your computer.

There are many job searching websites. Most of these websites provide daily Email in your inbox with the jobs postings of your interest.

8. Online Shopping

With the help of your computer and internet, you can buy any thing online and pay by credit cards.

9. Online Banking

E-Banking or online banking is the great facility for maintaining your financial transactions online. Moreover, you can pay your utility bills from your account while sitting at home.

10. Starting Home Based Business

You can use computer with internet to start and run a home based business or you can use computers for online jobs staying at home.

Computers In Education:

1.(Computer Aided Learning -CAL)

Computers are being used actively in educational institutes to improve the learning process. Teachers can use audio video aids through computer to prepare lesson plans. They can use Microsoft Power Point to prepare electronic presentations about their lectures. These electronic presentations will be displayed on multimedia projectors in class rooms. This will be interesting and easy to learn for students.

Multimedia presentations are easy to deliver for teachers too, These presentations save a lot of effort and time. Multimedia presentations are interesting to view and hear sound and visual effects.

Computers will be helpful for:

1. Instructing the students using PowerPoint slides, Word documents or Web pages and using hyperlinks for better concept clarity.
2. Helps in improving pronunciation of students by using microphones, headphones,speakers, specially prepared software and special dedicated websites.
3. Encouraging the students to use internet, surf web pages and gather relevant detailedinformation through search engines. Students will gain a lot of information and knowledge by positive use of internet.

2. CBT (Computer-Based Training)

CBT stands for Computer Based Training. In CBT, we prepare different educational programs with the help of professional teachers and audio visual aids. These educational programs are generally in the shape of lectures on a specific subject. These programs are provided onCDs. Students will learn as and when they wish and at their own homes. They can view CD contents, view lecture notes, books or video lectures about their course work any time they need.

3. Online Education

Many web sites provide online education. You can read or download educational material and books. For example, Virtual University of Pakistan is an Online Educational Institution. Students use internet to access VU website. The students log in to their accounts and e-mail boxes. They interact with different teachers online. They receive and submit their assignments and work through internet to their teachers. Email systems or online chat systems are used for instant communication between students and teachers.

4. Research

Computers are also used for research work. Internet is a huge source of information on any topic. Students of any level can use internet to access useful information about their projects and research work. Moreover different researchers can share their research work with other researchers using computers and Internet. Researchers use computers to organize and store their research materials in computers.

5. Institute Administration

Computers are being used to perform many tasks in educational institutions, easily and quickly:

- Keeping Records of students (admission records, attendance and leave records, fee collection, examination records of students)
- Storing Records of employees(payroll, attendance, assignments, project) of school / college
- Managing Accounts of the institution
- Fees collection and maintenance of fees record.
- Circulation of instruction/notices and getting it in printed form
- Preparation of school/ college magazine, etc. with the help of Microsoft Word, a popular word processing software.

Computer in Medical Field

Computers are an essential part of an hospital. Doctors and administration staff uses computers to manage patient history and medicine stocks etc. Computers play a key role in the medical field. Their uses include storing patient related data, housing knowledge bases, providing the logic and circuitry for medical equipment, scanning and imaging the body, and facilitating speedy communications.
Computers can be used in medical field in the following ways:

Hospital Administration

These days, Computers are being used in hospitals extensively. We can computerize the accounting, payroll and stock system of the hospital. We can keep the record of different medicines.

Recording Medical History Of Patients

Computer can be used to store the medical history of the patients. Medical history is very important for patients as well as doctors. Doctors may better prescribe the medicines on the basis of the medicines used in past for a particular patient and the results obtained. Database Management System software is used to store Patient records efficiently.
Patient records and history are stored on computer databases in the medical field. The medical history of a patient includes physical symptoms, diagnoses, treatments, and even family medical history.
Details of the medications prescribed are stored together with details of any that can not be prescribed, such as an allergy to penicillin.
Appointments are scheduled using a computer database.
Billing information is also stored.
Hospitals and surgeries depend on computers for administrative and financial functions.

Monitoring Systems

Many computerized devices are used to monitor the blood pressure, heartbeat and brain of the patients. Computers guide in some surgical operations, too. For example in laparoscopic surgery, the surgeon inserts the medical tools and a small camera, and conducts the operation with the help of computers and monitors. Computers also monitor heart rates, pulse rates and brain readings. Therefore, we conclude that computers make this possible to deal with such complicated operations. It would be virtually impossible for a human to do this.

Diagnosis of Diseases

Computers are being used to diagnose diseases with the help of software. There are some Medical Software to diagnose diseases and prescribe medicine on the basis of symptoms.

Life Support system

Life support systems are used to help disabled persons, for example hearing aid device for deaf people. Latest life support devices use computer technology to help the disable people, to overcome their disabilities.

Faster and Cheaper Communications

Doctors and other staff can use internet to communicate to doctors in other parts of the world, for sharing information on medical topics or even about a particular patient case. They can exchange pictures, reports and other documents, too.

Clinical Image Processing

Computers are being used in Medical Radiology / Diagnostic Imaging. Computers play an role in all types of clinical image processing like CT scan and ultrasound. Ultrasound uses sound waves that bounce off body parts, producing echoes. A computer translates the echoes into images, showing broken bones, muscle problems, or changes in organs, accurately.

INTRODUCTION TO COMPUTER SECURITY

Computer Security is the process of detecting and preventing any unauthorized use of your laptop/computer. It involves the process of safeguarding against trespassers from using your personal or office based computer resources with malicious intent or for their own gains, or even for gaining any access to them accidentally.

In this tutorial, we will treat the concept of computer security which can be a laptop, a workstation, a server or even a network device. This is an introductory tutorial that covers the basics of Computer Security and how to deal with its various components and sub-components.

Elements in Computer Security:

Confidentiality

Confidentiality is the concealment of information or resources. Also, there is a need to keep information secret from other third parties that want to have access to it, so just the right people can access it.

Integrity

Integrity is the trustworthiness of data in the systems or resources by the point of view of preventing unauthorized and improper changes. Generally, Integrity is composed of two sub-elements – data-integrity, which it has to do with the content of the data and authentication which has to do with the origin of the data as such information has values only if it is correct.

Availability

Availability refers to the ability to access data of a resource when it is needed, as such the information has value only if the authorized people can access at right time. Denying access to data nowadays has become a common attack. Imagine a downtime of a live server how costly it can be.

VIRUSES:

A virus is a computer code or program, which is capable of affecting your computer data badly by corrupting or destroying them.

Computer virus has the tendency to make its duplicate copies at a swift pace, and also spread it across every folder and damage the data of your computer system.

A computer virus is actually a malicious software program or "malware" that, when infecting your system, replicates itself by modifying other computer programs and inserting its own code.

Infected computer programs may include data files, or even the "boot" sector of the hard drive.

Types of Virus

Following are the major types of computer virus −

Worms

This is a computer program that replicates itself at a swift pace. Unlike a computer virus, it is self-contained and hence does not need to be part of another program to propagate itself.

Trojan Horse

A Trojan Horse is also a sort of destructive program that remains disguised in a normal software program. It is not exactly a virus, as it cannot replicate itself. However, there is possibility that virus program may remain concealed in the Trojan Horse.

Bombs

It is similar to Trojan Horse, but Logic bombs have some specialty; these include a timing device and hence it will go off only at a particular date and time.

Does Virus How Affect?

A virus can affect your computer system. The ways are mentioned below –

- By downloading files from the Internet.
- During the removable of media or drives.
- Through pen drive.
- Through e-mail attachments.
- Through unpatched software & services.
- Through unprotected or poor administrator passwords.

Impact of Virus

- Disrupts the normal functionality of respective computer system.
- Disrupts system network use.
- Modifies configuration setting of the system.
- Destructs data.
- Disrupts computer network resources.
- Destructs of confidential data.

Virus Detection

The most fundamental method of detection of virus is to check the functionality of your computer system; a virus affected computer does not take command properly.

However, if there is antivirus software in your computer system, then it can easily check programs and files on a system for virus signatures.

Virus Preventive Measures

A computer system can be protected from virus through the following −

- Installation of an effective antivirus software.
- Patching up the operating system.
- Patching up the client software.
- Putting highly secured Passwords.
- Use of Firewalls.