

What is communication Signal and Technology:-

DATA COMMUNICATION AND COMPUTER NETWORK

Data communications refers to the transmission of this digital data between two or more computers and a computer network or data network is a telecommunications network that allows computers to exchange data. The physical connection between networked computing devices is established using either cable media or wireless media. The best-known computer network is the Internet.

This tutorial will teach you basics of Data Communication and Computer Network (DCN) and will also take you through various advance concepts related to Data Communication and Computer Network.

Transmission of electrical signal/Optical signal by means of communication channel/media from one node to another node is called communication.



Types of signal for network:-

- ✓ Analog Signal 
- ✓ Digital Signal 
- ✓ Light Signal 

Note:- Transmission speed measured in bits per second.

For performing transmission a protocol must be needed. Set of formalized access rule is called protocol.

Example:-

- ✓ TCP/IP Protocol (Transmission Control protocol /Internet protocol).
- ✓ UDP (User data Gram Protocol)
- ✓ SLIP (Serial line Internet protocol)
- ✓ PPP(Point To Point Protocol)
- ✓ ftp(File transfer protocol)
- ✓ http(Hypertext Transfer Protocol)

- ✓ Binary Synchronous protocols (BISNYC)
- ✓ High Level Data Link Control (HDLC) protocols
- Etc.

Role of Protocol:-

- ✓ It transfer error free message.
- ✓ It identifies destination address.
- ✓ It also identifies/Search idle channel for communication.
- ✓ Error recoveries
- ✓ Retransmission control
- ✓ Interface management

What is computer network:-

A network consist of two or more computers connected together on desk or it can consist of many LAN connected together to form a wide area network (WAN) across continent.

What is internet:-

It is interconnected computer network by which Communication must be possible through global interconnected computer network. **Tim Berner Lee at MIT/LCS** (Massatutes Institutes of Technology/Laboratory of Computer science) gives the concept of internet.

Network:-The shairing of resources between two or more people.

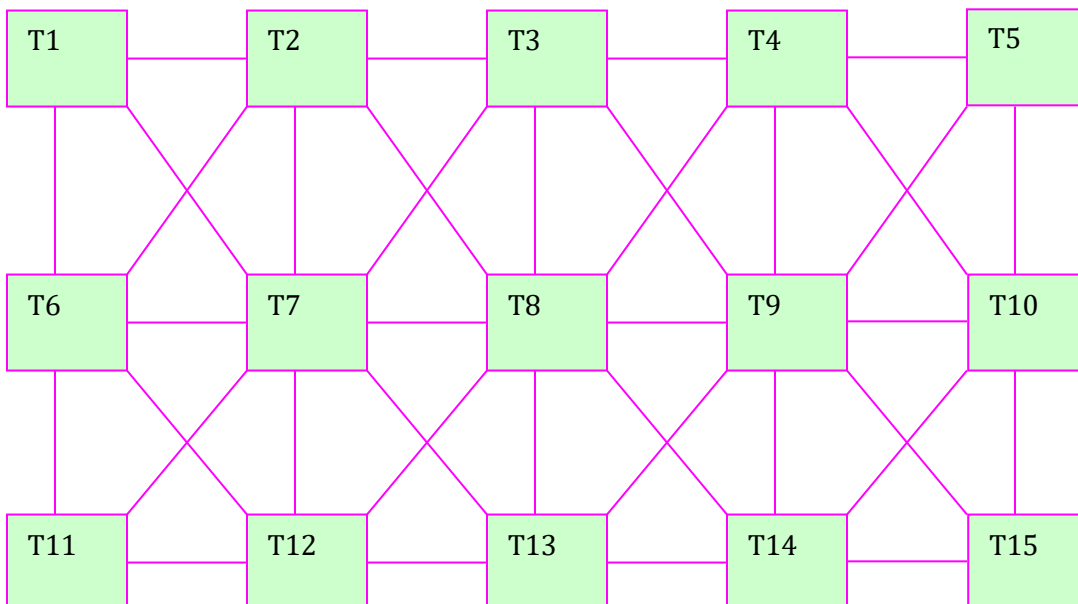
Types of computer Network:-

ॐ Point-To-Point Computer Network. (By Means Wires).

ॐ Broadcast computer network. (By means of microwaves).

Classification of Computer Network:-

1. LAN.(Local Area Network)
2. MAN(Metropolitan Area Network)
3. WAN(Wide Area Network)



LAN :- Area of LANs are limited through which **text,graphics,and other types of information must be communicate.**

Example:-Computer Network in Bank Office,Computer Lab Network etc

MAN:- It is similar to LAN but it must be transmit **audio,video,animation and other types of informations very efficiently.**

Example:-Cable TV Network.

WAN:- It is the largest network across geographical area.

Example:-

Internet,Telephone(PSTN),ISDN,VSAT etc.

PSTN → Public Switched Telephone Network.

VSAT → Very Small Aperture Terminal.

ISDN → Integrated Services digital Network.

Why Computer network:-

- ❖ Communication medium/Channel
- ❖ Resource shairing
- ❖ Higher reliability
- ❖ Cost minimize

Network Topology:-

It is the layout of computer network.There are following types of network topology.

ॐ Star topology.

ॐ Ring topology.

ॐ Bus Topology.

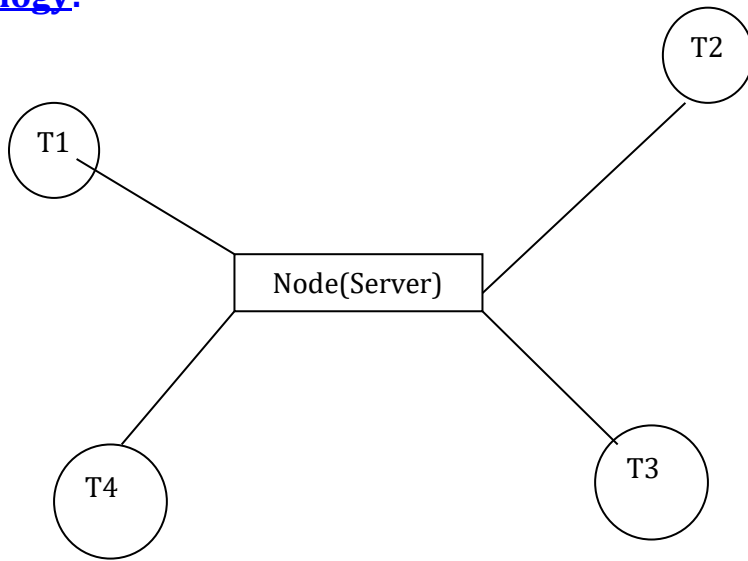
ॐ Tree Topology.

ॐ Mesh Topology.

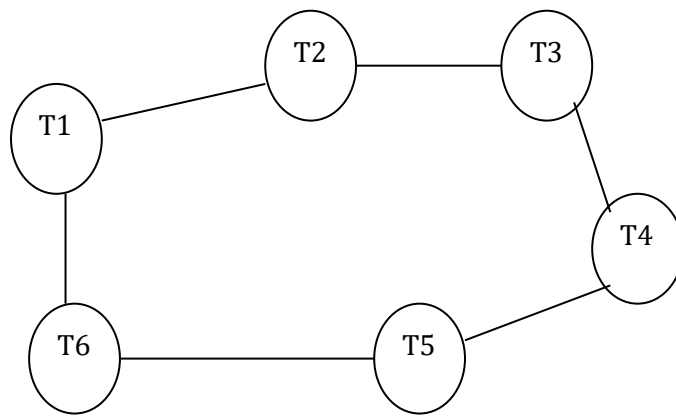
ॐ Combined Topology

- Star-Bus Topology.
- Star-Ring Topology.

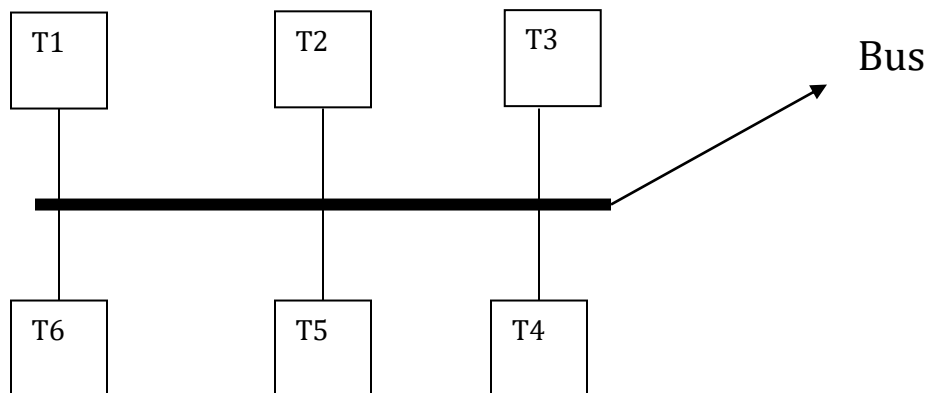
StarTopology:-



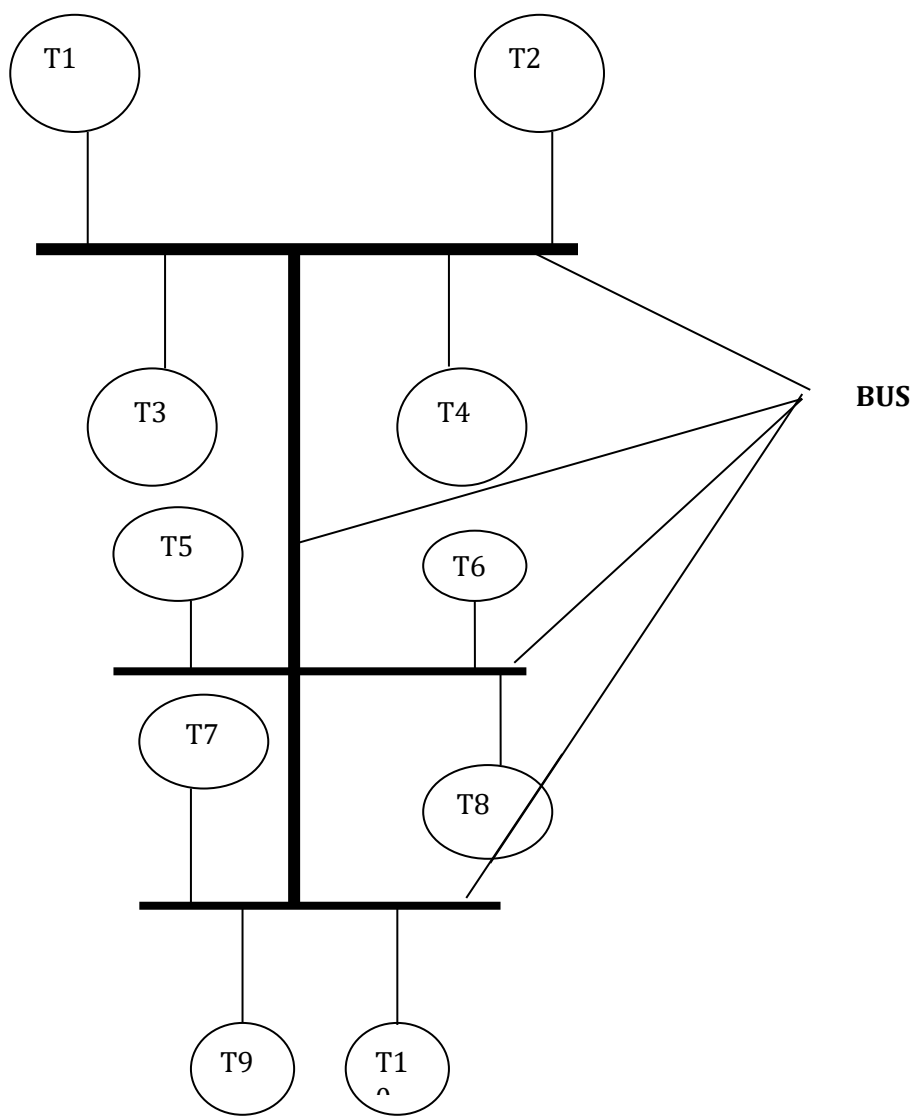
Ring Network:-



Bus Network:-



Tree Topology:-



Protocol:-Set of formalized access rule is called protocol.

1. TCP/IP (Transmission Control Protocol/Internet protocol)
2. Ftp (File Transfer Protocol).
3. Http (Hypertext Transfer Protocol).
4. SLIP (Serial Line Internet Protocol).
5. PPP (Point to Point Protocol).

A protocols defines the following three aspects of communications

- ❖ **Syntax:-**The format of data being exchanged, character set used, type error correctionused, type of coding scheme being used.
- ❖ **Semantics:-**Type and order of messages used to ensures reliable and error free information transfer
- ❖ **Timing:-**Define data rate selection and correct timing for various events during data transfer.

Who Govern Internet:-

ISOC (Internet Society).

IAB (Internet Architecture Board).

IETF (Internet Engineering Task Force).

How Connect Internet:-

1. Broad Band Connection .
2. VSAT(Very Small Aperture terminal).
3. Mobile Phone.
4. Wi-Fi System.
5. USB Modem.

Communication Modes/Data Flow:-

1. Simplex Communication Modes.
2. Half-Duplex communication Modes.

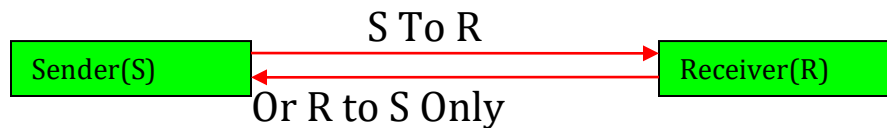
3. Full Duplex Communication Modes.

Simplex Communication Modes.



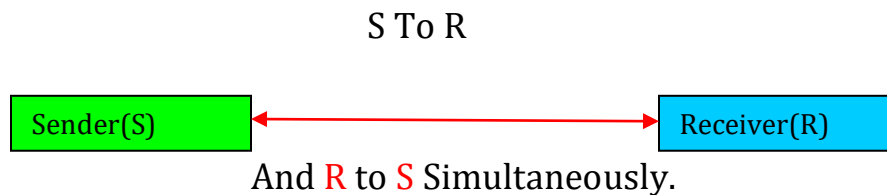
Example:-TV, Radio etc

Half-Duplex Communication Modes.



Example:-Wireless, Walky-Talky.

Full Duplex Communication Modes:-



Example:-Telephone, Mobile etc.

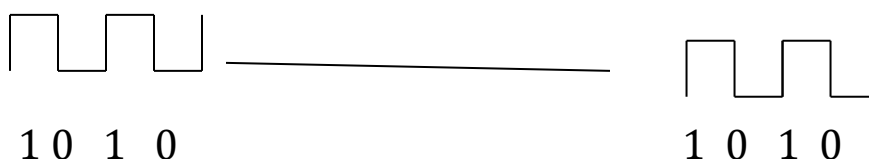
Physical Connections:-

It determines how many bits can be transmitted in a single instance of time.

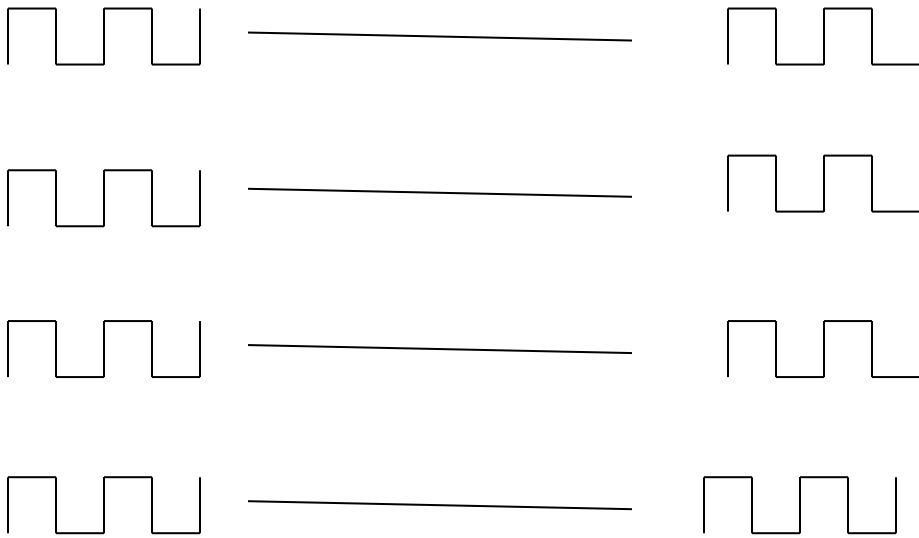
If only 1 bit of information can be transmitted over the data transmission medium at a time then it is considered a **serial transmission**.

If more than 1 bit of informations are transmitted over the data transmission medium at a time then it is considered a **parallel communications**.

Serial Transmission:-



Parallel Transmission:-

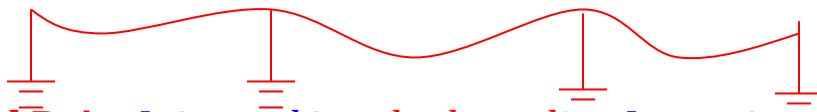


Types of physical connection/Transmission Media/Channel:-

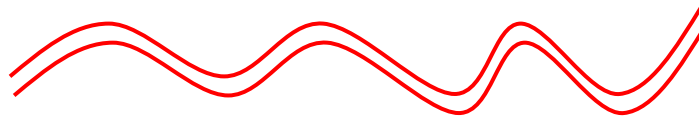
There are two categories of transmission media/Channel

❖ **Guided Transmission Media:-** It uses a cabling system that guided the data signals among a specific path. There are many types of guided transmission media.

- **Open Wire:-** It is used to describe the electrical wire strung along power poles. It is suited for short distances of **less than 40 ft**.



- **Twisted Pair:-** It is used in **telephone line**. It consists of wire used for the +ve data signal and a wire used for negative data signal. It minimizes electromagnetic interference between pairs. Transmission speed up to **9600 bits per seconds** are possible up to distance 100 meters.



- **Coaxial cable:-** A coaxial cable has a stiff copper wire as the core surrounded by insulating material. There are two types of coaxial cable.

- **50 Ohm:-** It is used for cable TV network.
- **75 Ohm:-** It is used for broadband connection.

- **Optical Fiber (OFC):-**It is the latest transmission media, superior than other transmission media.Data are transmitted in the form of light.There are two types of light sources.

- LED(Light Emitting Diode).
- LASER(Light Amplification by Stimulated Emission Radiation)

There are many types of OFC:-

a:-8.3 micron core/125 micron cladding.

b:-62.5 micron core/125 micron cladding.

c:-50 micron core/125 micron cladding.

d:-100 micron core /140 micron cladding.

- ❖ **Unguided Transmission Media/Channel:-** It uses wireless communication consists of a means for the data signals to travel but nothing to guide them along a specific path.It is commonly used for **WAN** network.

Above 100 MHz the waves travel in straight lines and can therefore be narrowly focused.Concentrating all the energy into small beam using parabolic antenna gives a much higher signals to noise ratio.There are two types of microwaves signals.

- **Terrestrial Microwaves.**(Frequency Range 4 to 6 Ghz & 21 to 23 Ghz).
- **Satelite Microwaves.**It is suited for 36000 KM area.Frequency range 4GHz to 6 GHz.

Connection Devices:-

- ❖ **Repeaters:-**It is also called regenerator, It boosted up weakened signal.
- ❖ **Hubs:-**It is also called multiport repeaters or concentrators.It is similar to repeater, except that it broadcasts data received by any ports to all other ports on the hubs.
- ❖ **Bridges:-**It has all features of repeaters.It is used to connect dissimilar networks like Ethernet system.

- ❖ Routers:- It is used for connecting dissimilar communication protocols for wide area network.
- ❖ Gateways:- It is much more complex and powerful than routers. There are very expensive.

Network Model:-

❖ OSI Model(Open System Interconnection)

- It consists of hierarchy of 7 layers
 - **Physical Layer** → Bits Orientation Layer
 - **Data Link Layer** → Frames(Collection of bits) Orientation Layer
 - **Network Layer** → Addressing Layer (Put address on each frame)
 - **Transport Layer** → It transmits frames from source to destination.
 - **Session Layer** → Accumulate all incoming frames in specific session.
 - **Presentation Layer** → Resembled all frames into original message.
 - **Application Layer** → It is a layer where user access service of network.

❖ TCP/IP Model(Transmission Control/Internet Protocol)

- It consists of five layers used in wireless media.
 - **Physical Layer** → Bits Orientation Layers.
 - **DLL** → Packets(Discrete messages) orientation Layers.
 - **Network Layers** → Addressing on each packets.
 - **Transport Layers** → Transmission of packets from source to destination.
 - **Application Layers** → It is a layer where user access service of network.

Note:- This model is used for wireless media.

Network Switching Technique:-

There are three types of switching technique.

- ❖ Circuit switching technique.
- ❖ Message switching technique.
- ❖ Packet switching technique.

Circuit switching technique:-

A physical permanent & dedicated connection established between sender to receiver. Example:-PSTN,Cable TV Connection

Message switching technique:-

A physical connection established between sender and receiver during communication session only.

Example:-E-mail through dialup connection.

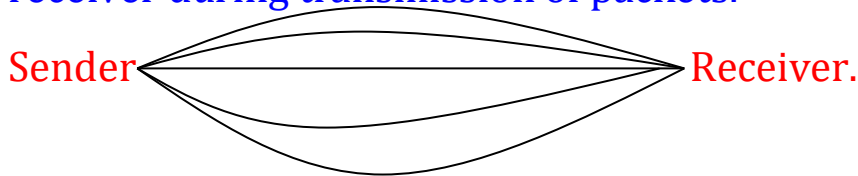
Packet switching technique:-

Data transmitted in the form of packet.It is also called small message. There are two types of packet switching technique.

- ❖ Virtual circuit technique:-A logical and dedicated path established between sender and receiver during communication session.

Sender ————— Receiver.

- ❖ Datagram Circuit technique:-Many logical paths established from sender to receiver during transmission of packets.



LAN H/W and S/w:-

LAN H/W :-

- ✓ Server
- ✓ Terminal
- ✓ Channel/Media
- ✓ LAN card/Network Interface Unit

LAN S/W :-

- ✓ LINUX and Unix OS
- ✓ Windows NT

- ✓ Windows XP
- ✓ Windows Vista.
- ✓ Windows7.
- ✓ Windows8.
- ✓ Server S/W.
- ✓ Terminal/Work station S/w.
- ✓ Antivirus.

WAN H/W :-

- ✓ **Bridges:-** It is used to connect two LANs which are associated identical LAN protocols. It operate at **DLL(Data Link Layer)** of OSI model.
- ✓ **Routers:-** It is used to connect networks that may not be similar.It operate **network layer** of OSI model.
- ✓ **Gateways:-** It is used to connect two dissimilar LANs.It operate **application layer** of OSI model. It converts data packets from one protocol format to another protocol format.

Example of WAN:-

- ✓ PSTN(Public Switched Telephone Network).
- ✓ ISDN(Integrated Service Digital Network).
- ✓ PSDN(Public Switched Data Network).

Application of Network:-

- ✓ E-Mail (Electronic Mail).
- ✓ EDI(Electronic Data Interchange).

EDI:-

It is another technique of transferring large amount of textual information from one organization to another organization.

Some problem based on **traditional system:-**

- ✓ Increased time

- ✓ Low accuracy.
- ✓ High labour charges.
- ✓ Increased Uncertainty.

EDI has become a major means of business communications among large companies in U.S.

EDI can do

- ✓ EFT (Electronic fund transfer).
- ✓ Communication between unrelated companies(Cos).
- ✓ It is used for performing paperless task.

Benefit of EDI:-

- ✓ It handles large volume of repetitive standard actions.
- ✓ It operates on very tight margin.
- ✓ It operates under time constraints (Validation).
- ✓ It improve activity of companies performance.

Network Scenario:-

Services of Internet:-

A:- Global E-mail:-

It is used for transferring messages from one terminal to another terminal. by using E-mail ID.

B:-USENET-Views and news

It is used by BBS of internet.

C:-Telnet-Remote Login:-

It allows an internet user to access a remote host.

D:-ftp(File Transfer Protocol):-

It permits an internet user to transfer a file from one computer to another computer.

E:-Navigators

Accessing of information by using URL from web./cyberspace.

2:-BITNET(Because Its Time Network):-

It is a network of New York and University of Yale established by BITNET.

Function:-

A:-Exchange of data file

B:-Electronic Admission of student

C:-Remote job search

3:-Compuserve

It is commercial network based in US.

Services /Function

A:-Message transfer

B:-Bulletin board services

C:-News report,Sports and weather

D:-Information on computer hardware and software

4:-ISDN

It is the fastest transmission network through which we can transmit data in digital format. It was launched in Singapore in 1990.

Feature of ISDN:-

 Transmission and processing of digital data

 It process of voice,video ,animation etc.

 Teleconferencing

 Telefax,Videofax etc.

NICNET:- (National Information Center Network)

It is a satellite based nationwide network.It contain information about each villages,district and city of India. The basic objectives of NICNET are:

 It help government in better planning administration.

 To help government maintain communication in times of national emergencies and natural disasters.

Security:-

Unauthorized access, destruction/revelation of data can violate individual privacy.

Security threats and Goals:-

Following major security threats perceived by users and provides of computer based system includes.

- Unauthorized disclosure of information.
- Unauthorized alteration or destruction of information.
- Unauthorized use of service.
- Denial of service to legitimate users.

Security Policies:-

Security policies specify what is desired in terms of protection and security.

Security Mechanism:-

It specifies how to affect the security policies and enforce them in a given system.

Penetration Attempts:-

- Hit & Trial error Attempts.
- Logged on Terminal.
- Password
- Trapdoors:-These are the secret points of entry without access authorization
- Trojan horse:-It is a program to steal user password.More sophisticated version of Trojan horse programs can make themselves harder to detect by fully emulating the utility that they are imposter.
- Computer Worms:-It is a program to hack information via network and produce itself propagation.
- Computer viruses

Classification of security:-



Physical security:-

A:-Physically bolt down the PC to a table so that it can be casually lifted and taken away.

B:-Kept records by using pen drive,CD ROM/DVD/Blu ray disk.

C:-Use Keyboard and PC locking system.

D:-Use lockable rooms.

E:-Protect against environmental conditions



Software security

A:-Use original s/w for OS.

B:-Use correct procedures for shutting down.



Network Security



Password Security

Services of Internet:-

- ❖ E-Mail
- ❖ Telnet
- ❖ ftp

Concept of URL (Uniform Resource Locator):-

It is used for accessing internet services.

Example:-

www.uprtou.ac.in

www.bhu.ac.in

www.nic.in

www.google.com

www.rediffmail.com

www.yahoomail.com

www.altavista.com

www.timesofindia.com

www.bseindia.com

www.nseindia.com

etc.

www : -World Wide Web. → it is huge storage area where all URL are stored. Web page written into HTML.

Browser:-

It is software by which we access internet services.

Example: - Internet explorer.

Netscape navigator.

NCSA mosaic.

Chimera.

Net cruiser.

Mozilla.

Opera Mini etc.

Services of Internet:-

Surfing(Clicking and accessing services of internet).

Searching.

E-mail.

E-commerce.(Business through internet).

Etc.

Concept of Domain Name System (DNS):-

DNS categorized into two types

1. Geographical DNS.
2. Non-Geographical DNS.

Example of Geographical DNS:-

.in→India.

.au→Australia.

.cn→China.

.de→Germany.

.uk→United Kingdom.

.us→United State.

Example of Non-Geographical DNS :-

.com→Commercial purpose.

.org →Non-profit organizations.

.edu→Educational purpose.

.ac→ academic purpose.

Example:-

www.bhu.ac.in

Concept of IP Address:-

IP address consists of four decimal digits. Which values exist between 0 to 255.

IP address must be unique in computer network.

d1.d2.d3.d4

d1→0 to 255 First Octet.

d2→0 to 255 Second Octet.

d3→0 to 255 Third Octet.

d4→0 to 255 Fourth Octet.

Role OF TCP/IP Protocol:-

TCP:- This protocol splits messages into discrete form and resembled at destination/Target.

M → TCP → m1m2m3m4m5m6m7m8...(Packets).

IP → It puts address of destination at each packet.

Concept of Communication channel:-

It is a path through which data are transmitted.

Examples:-

Co axial cable.

Optical fiber cabel (OFC)

Twisted Pair cabel.

Microwaves.

RadioWaves.

etc.

Application of Internet:-

1. Railway reservation.
2. Airlines reservation.
3. On Line Business.
4. On line Share trading.
5. On Line Education.
6. Scientific research and development.
7. On Line banking System.
8. ATM (Automatic Tailor machine).

9. Searching of jobs and desired information.

10. Speed Post.

11. On Line Library System.

12. Video conferencing.

13. On Line Chatting.

14. Teleconferencing.

Etc.

Full form:-

GPRS → Global Packet Radio Services.

MMS → Multimedia Services.

Http → Hypertext Transfer protocol.

FAQ → Frequently asked question.

WILL → Wireless In Local Loop.

OFC → Optical Fiber Cabel.

CSMA → Carrier Sense Multiple access.

ISOC → (Internet Society).

IAB → (Internet Architecture Board).

IETF → (Internet Engineering Task Force).

PSTN → Public Switched Telephone Network.

VSAT → Very Small Aperture Terminal.

ISDN → Integrated Services digital Network.

LAN → Local Area Network.

MAN → Metropolitan Area Network.

WAN → Wide Area Network.

WWW → World wide web.

TCP/IP → Transmission control Protocol/Internet protocol.

SLIP → Serial Line Internet Protocol.

PPP → Point to Point Protocol.

DNS → Domain Name System.

Network

Before discussion the internet first of all we should discuss about the network, because if our concept will not be clear about the network then we cannot understand concept of internet. So let us start the discussion of the network. *Network word made-up with two words.*

Net/work
Net + Work
Web/cobweb + task/function

It means like the spider web (cobweb) some task/function/work is happening so on this concept something is running.

Network

"In information technology a network is a series of points or nodes interconnected by communication path/channel."

Note: A device, generally the computer that is directly attached to the network, is called a node

Computer Network

A **computer network** is a collection of two or more than two where components interconnected by communication channels that allow sharing of resources and information.

Types Computer network

There are three different types of network for different purpose

- 1- LAN
- 2- MAN
- 3- WAN

LAN (Local Area Network)

A Local Area Network is a network that connects computers and devices in a limited geographical area such as home, school, computer laboratory, office building, or closely positioned group of buildings.

Characteristics:

- (i) A diameter not more than a few kms.
- (ii) A total data rate of at least several Mbps.
- (iii) Complete ownership by a single organization.

MAN (Metropolitan Area Network)

A Metropolitan area network is a large computer network that usually spans a city or a large campus.

Characteristics:

- (i) Covers entire city, but uses LAN technology.
- (ii) Have data rates below 1 Mbps.
- (iii) Owned by multiple organizations.

WAN (Wide Area Network)

A (WAN) is a computer network that covers a large geographic area such as a city, country, or spans even intercontinental distances, using a communications channel that combines many types of media such as telephone lines, cables, and air waves.

Characteristics:

- (iv) More scalable than LAN and WAN.
- (v) Connects many sites spread across large geographic distances with many computers at each site.
- (vi) Provides sufficient capacity to permit the computers to communicate simultaneously.

Advantages of Computer Network

- 1- Communication
- 2- Data sharing
- 3- Internet Service
- 4- Video conferencing
- 5- Instant and multiple accesses
- 6- Resource Sharing:
- 7- Speed
- 8- Centralized Software Management

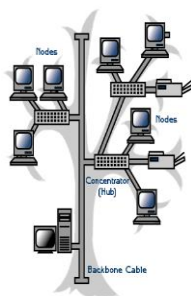
Disadvantages of Computer Networks

- 1- Security Issues:
- 2- Rapid Spread of Computer Viruses:
- 3- Expensive Set Up:
- 4- Dependency on the Main File Server:
- 5- Network faults can cause loss of data.
- 6- Network fault could lead to loss of resources
- 7- User work dependent upon network

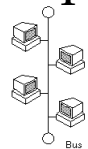
Topologies

A topology is the layout of the network components or the pattern of arrangement of nodes that are connected using cables in a local area network (LAN) environment. There are following study of network topology recognizes eight basic topologies

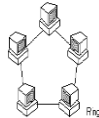
- 1- Bus Topology
- 2- Ring/Circular Topology
- 3- Star Topology
- 4- Tree Topology
- 5- Mesh Topology
- 6- Point-to-Point Topology
- 7- Daisy Chain Topology
- 8- Hybrid Topology



1- Bus Topology: In this topology, the computers are connected to form a network through a single cable that runs from one computer to another. Each node can send messages to all the other nodes in the network. If a node sends a message to a particular node in the network, only that node accepts the message and all the other nodes ignore it.



2- Ring Topology: In this topology, each computer is connected to the computer next to it. Hence, each computer is connected only to two of its neighboring nodes. All the components of the network are connected to a main cable and form a circle. When a node sends a message to any other node on the ring, the message travels (either in clockwise or counter clockwise direction) through every other node in the ring until it reaches its destination node. In this topology, the data is transmitted in one direction and if one node fails to transmit the data the entire network fails.



3- Star Topology: In this topology, all the computers are connected to a central device. The central device can be a switch or a hub. The central device is usually connected to the server and it receives the data from a node and sends it to the destination node.



4- **Tree Topology:** Tree topology is the combination of Bus and Star topology.

5- **Mess Topology:** Every computer has a direct connection to every other computer on the network.

6- **Point-to-point (telecommunication)**

In telecommunication, a **point-to-point** connection refers to a communications connection between two nodes or endpoints. An example is a, in which one telephone is connected with one other, and what is said by one caller can only be heard by the other. This is contrasted with a communication topology, in which many nodes can receive information transmitted by one node.

7- DAISY CHAIN (ELECTRICAL ENGINEERING)

IN ELECTRICAL AND ELECTRONIC ENGINEERING A DAISY CHAIN IS A WIRING SCHEME IN WHICH MULTIPLE DEVICES ARE WIRED TOGETHER IN SEQUENCE OR IN A RING. DAISY CHAINS MAY BE USED FOR POWER, ANALOG SIGNALS, DIGITAL DATA, OR A COMBINATION THEREOF.

8- HYBRID

HYBRID NETWORKS USE A COMBINATION OF ANY TWO OR MORE TOPOLOGIES. A STAR BUS NETWORK CONSISTS OF TWO OR MORE STAR TOPOLOGIES CONNECTED USING A BUS TRUNK (THE BUS TRUNK SERVES AS THE NETWORK'S BACKBONE).

History of Internet

In 1969, the Department of Defense (DOD) of United States of America started a network called ARPANET (Advanced Research Projects Administration Network). It was started with one computer in California and three in Utah

Later, the military allowed universities to join the network for sharing the hardware and software resources, a number of other networks were developed during the late 1970 and early 1980, with BITNET and CSNET among them. BITNET which is acronym for Because It's Time Network began at the City University of New York. It was provide electronic mail and file transfers. CSNET, which is an acronym for Computer Science Network, Its initial purpose was to provide electronic mail. for a variety of reasons, neither BITNET nor CSNET became a dominant national network.

A new national network, NSFnet, was created in 1986. National Science Foundation (NSF) initially connected the NSF-funded supercomputer centers at five universities. By 1990, NSFnet had replaced ARPAnet for most nonmilitary uses and wide variety of organizations had established nodes on this network. By 1992, NSFnet connected more than 1 million computers around the world. In 1995 a small part of NSFnet returned to being a research network. Then it grew bigger and gave birth to the present-day very popular Internet.

Internet

Internet is a network of networks. or

It is an interconnection between several computers of different types belonging to various networks all over the world.

How does internet work?

When information is passed from one computer system to another it is broken up into pieces called packets using the TCP and IP protocol. a message consisting of not more than 1500 bytes or characters is put into a packet. Each packet has the address of sender and the destination. These addresses are called IP addresses.

The packets are passed from one network to another until they reach their destination. At the destination the TCP software reassembles the packets into a complete message, if packets are lost or damaged, a request is sent to resend them. it is not necessary for all packets in a single message to take the same route through the internet or for the same message o take the same route each time it is sent.

Need of Hardware and Software for Internet:-

Need of Hardware

- 1- PC
- 2- Dialup connection/Telephone lines/Mobile Phone
- 3- Modem
- 4- Cable/Channel
- 5- Topology

Need of Software

- 1- Protocol
- 2- Browser
- 3- Standard OS
- 4- ISP(Internet Service Provider)