UNIT -1

NETWORK MODELS

COMPUTER NETWORK:

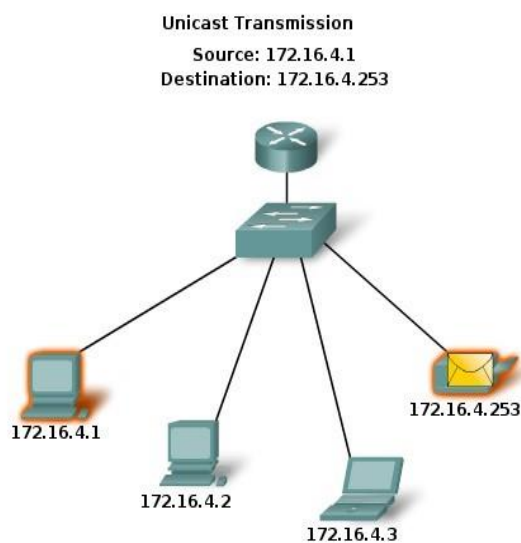A computer network is a number of computers connected by some communication links.

Communication links may be wired or wireless.

Two computer connected to the network can communicate each other through the other nodes if they are not directly connected.
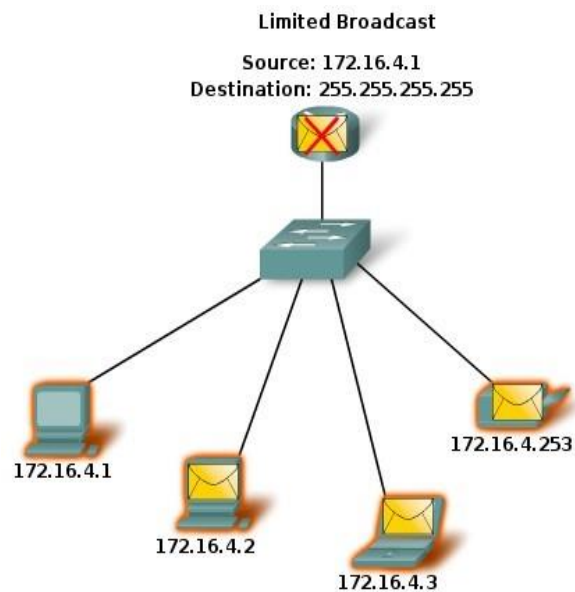
MODES OF COMMUNICATION:
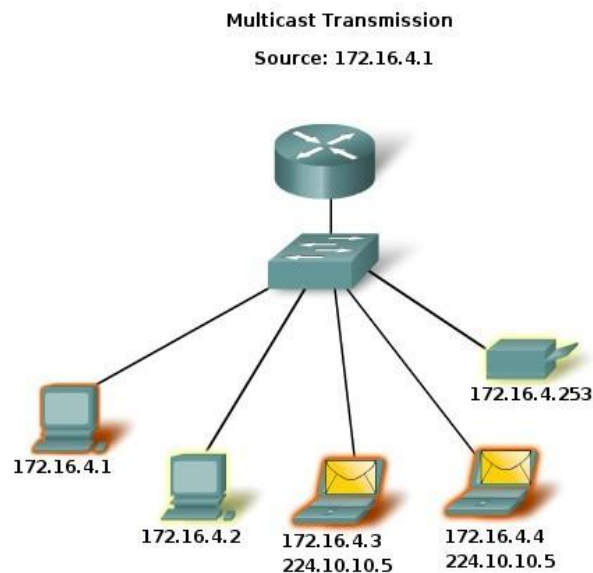
1. Unicast

2. Broad cast

3. Multicast

1. **UNICAST**: The process of sending a packet one host to individual host.

Unicast Transmission
Source: 172.16.4.1
Destination: 172.16.4.253

172.16.4.253

172.16.4.1

172.16.4.2

172.16.4.3

2. BROAD CAST: The process of sending a packet from one host to all other host present in the network.

Limited Broadcast

Source: 172.16.4.1
Destination: 255.255.255.255

172.16.4.1

172.16.4.2

172.16.4.3

172.16.4.253

3. MULTICAST: Sending a packet from one node to selected nodes.

Multicast Transmission

Source: 172.16.4.1

172.16.4.1

172.16.4.2

172.16.4.3
224.10.10.5

172.16.4.4
224.10.10.5

172.16.4.253

MULTIPLEXING: Many number of signal are combined into a single signal and transmitted over the network.

SIMPLEX: One way communication.

HALF DUPLEX: Two way communication but either sender or receiver will work the same time.

FULL DUPLEX: Transmits and receives the data simultaneously.

NETWORK TOPOLOGY: The arrangement of nodes to form a computer network. Generally topology means layout for a system.
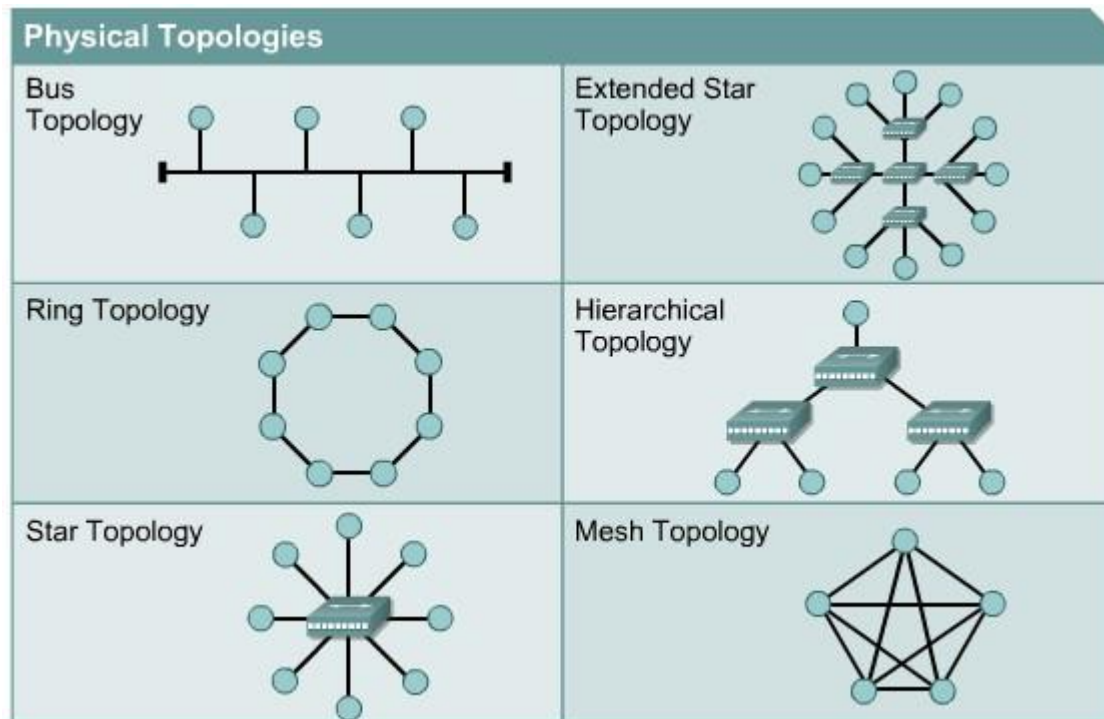
It can be viewed as 1. Physical topology

2. Logical topology

Physical topology: The placement of various modes to make a network.

Logical topology: It deals with the data flow from one system to other system in the network.

TYPES OF NETWORK TOPOLOGY:

1. BUS
2. RING
3. STAR
4. MESH
5. HYBRID

Physical Topologies

Bus Topology

Extended Star Topology

Ring Topology

Hierarchical Topology

Star Topology

Mesh Topology

BUS TOPOLOGY: All data transmitted over the common transmission medium and is able to be received by all nodes present in the network.

A signal can be travelled in both directions.

ADVANTAGES:

1. Only one wire it is less expensive
2. If one mode failures it will not affect entire network.
3. Suited for temporary networks.

DISADVANTAGES:

1. If the transmission medium breaks the entire network will be collapsed.
2. No security
3. Limited cable length.

RING TOPOLOGY:

A Ring topology is a bus topology in a closed loop

Two connections are possible to its nearest neighbours.

It is unidirectional

Sending and receiving the data takes places with the help of token.

ADVANTAGES:

1. Performances better than bus topology.
2. All nodes have equal access.

DISADVANTAGES:

1. It takes long time process
2. It is unidirectional
3. No security

STAR TOPOLOGY: Every node is connected to a central node called hub or switch

It is centralized management

All traffic must pass through switch or hub

ADVANTAGES:

1. Easy to design and implement
2. Centralised administration

DISADVANTAGES:

1. Increased cost due to switch or hub
2. Single point of failure affects the whole network.

MESH TOPOLOGY:

Each node is connected directly to every other node present in the network

ADVANTAGES:

1. Fault tolerance
2. It is reliable

DISAVANTAGES:
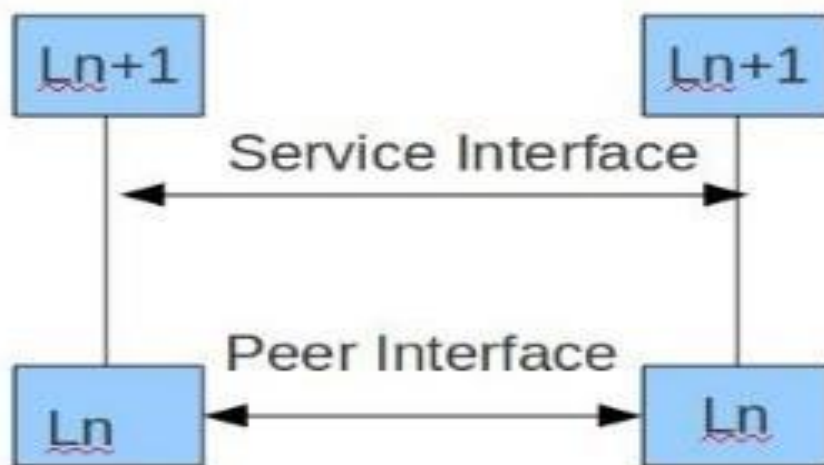
It is very expensive an in practical for large networks

HYBRID TOPOLOGY:

The topology which combines two or more existing topology called as hybrid topology.

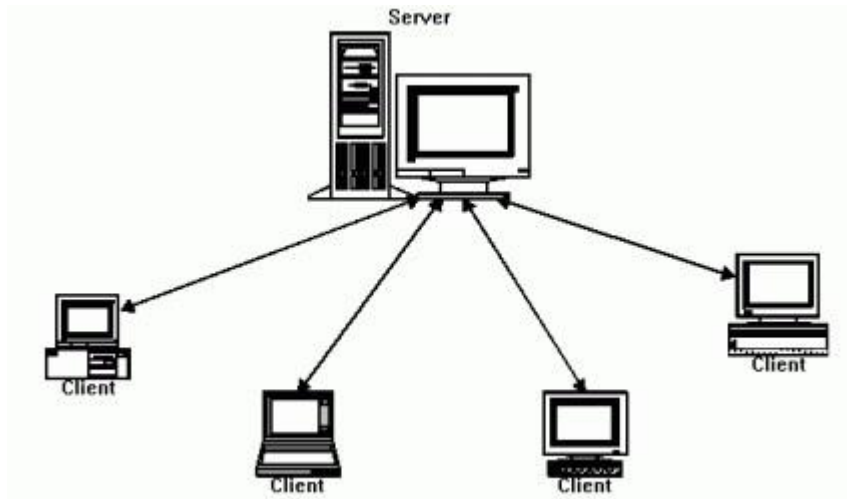PROTOCAL: A Protocol defines the format and the order of messages exchanged between two or more computer

Each protoc0l has two interfaces 1. Service interface
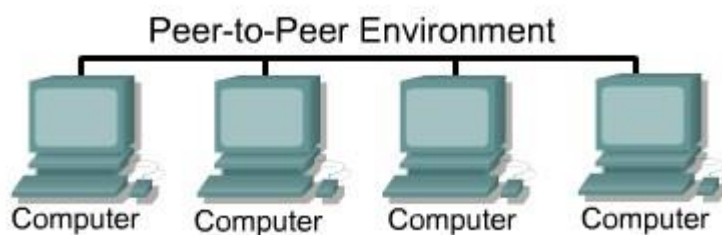
2.peer to peer interface

SERVICE INTERFACE:

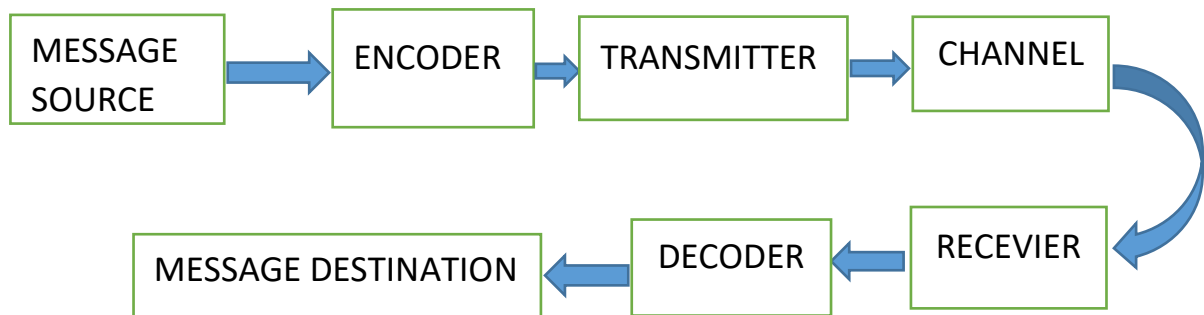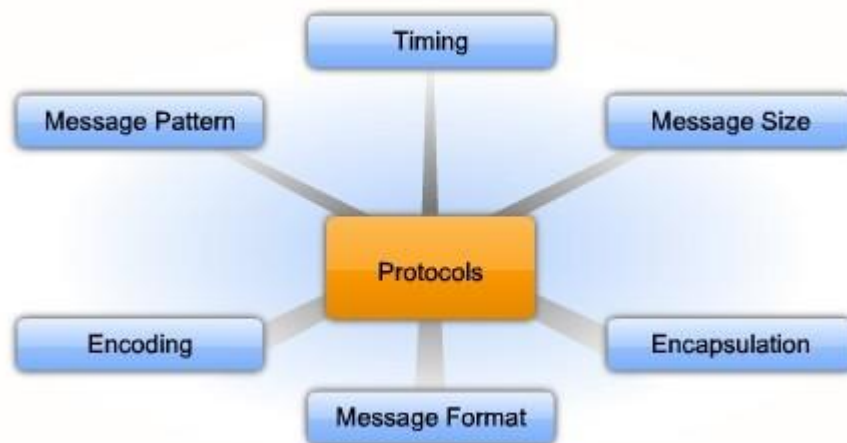The interface which makes with in the host called service interface

PEER TO PEER INTERFACE:

The interface which make connection between two host

Protocal is the building block of network architecture.

PRINCIPLE OF COMMUNICATION

The primary purpose of any network is to provide a communication.

All communication methods have three elements in common

1. TRANSMITTER
2. RECEIVER
3. CHANNEL

TRANSMITTER:

The first element called message source or people or electronic devices that need to communicate a message to other individual or devices

Second element destination it receives the message and interpet

The third element called channel provides the path way over which the messages can travel

Protocal defines the details of how the message is transmitted and delivered

1. Message format
2. Message size
3. Timing
4. Encapsulation
5. Encoding
6. Standard message pattern

MESSAGE FORMAT: Message that is sent over a computer network follows specific format for it to delivered and processed

MESSAGE SIZE: When a long message is sent from one host to another over a network it is necessary to break the messages into smaller pieces

MESSAGE TIMING: One factor that affects how well a message is received and understood within a timing

Ex: response timeout

Service	Protocol ("Rule")
World Wide Web (WWW)	HTTP (Hypertext Transport Protocol)
E-mail	SMTP (Simple Mail Transport Protocol) POP (Post Office Protocol)
Instant Message (Jabber; AIM)	XMPP (Extensible Messaging and Presence Protocol) OSCAR (Open System for Communication in Realtime)
IP Telephony	SIP (Session Initiation Protocol)

ENCAPSUALTION: Just as a letter it is encapsulated in an envelope for safe delivery

Each computer message is encapsulated in a specific format called frames.

Before it is set over the network

A frame act like an envelope which has source and destination address

ENCODING:

The process of putting a sequences of characters into a specialized format (bit) for efficient transmission

Msg sent across the network are the first converted into bits by the sending host

Each bit is encoded into a pattern of sounds, lightwave depending on network media over which the bit or transmitter

The destination receives and decodes the signal in order to interpret the original message

TYPES OF NETWORK

There are three types of networks

LAN – Local area network

MAN – Metropolitan area network

WAN- Wide area network

LAN – LOCAL AREA NETWORK

It is connection of computers in a limited range.
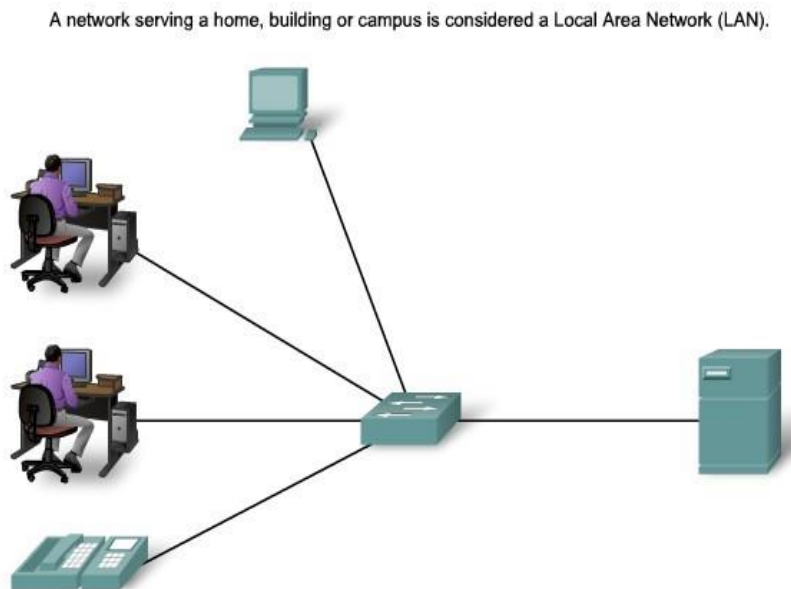
Those are building, colleges, within bank

LAN is the sharing of information of resource

Resource – printing ⟶ software application ⟶ data

LAN is an high security network

DISADVANGES OF LAN:-

One of the major drawback of LAN is lack of privacy

A network serving a home, building or campus is considered a Local Area Network (LAN).

MAN – METROPOLITAN AREA NETWORK

MAN is a connection of different LAN and WAN

It is used in cities [within cities]

Best example for MAN banks [connection of all branches in a city]

MAN is the sharing of data network

It is used for data centralized.

DISADVANTAGES:-

The main disadvantage of MAN is less security

It is connected by the fiber optics or cables

It required more cables
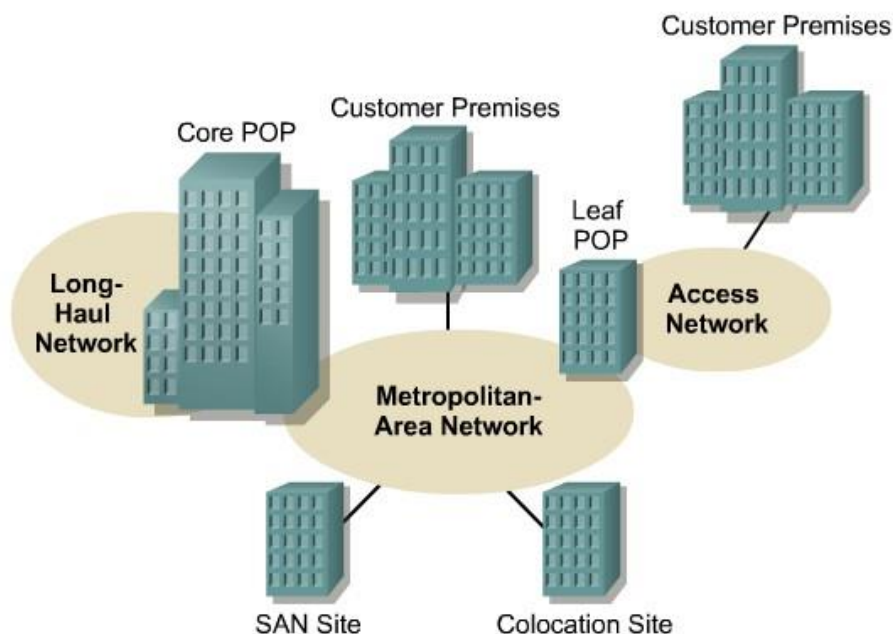
It is a connection among different cities and states

In this transmission media will be satellite, telephone cabled
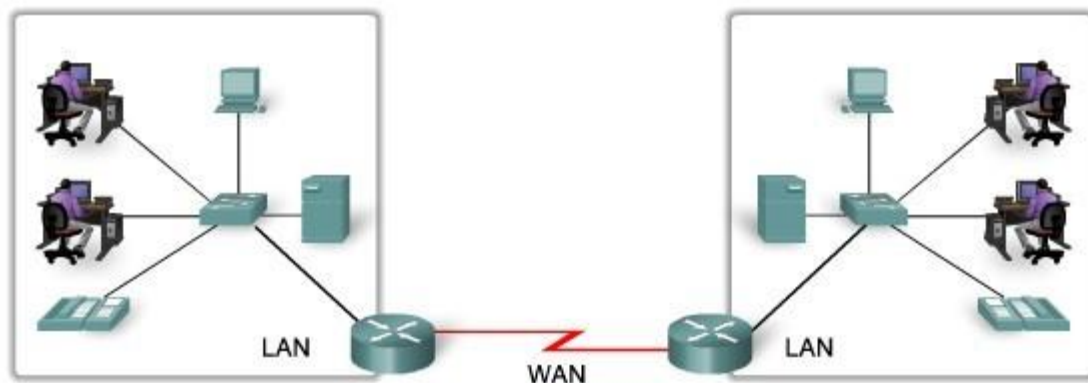
WAN is the connection of MAN's

In this data sharing takes place by the roots

WAN is less security and need to fire wall

Best example for WAN is internet

LANs separated by geographic distance are connected by a network
known as a Wide Area Network (WAN).

LAN Vs WAN

LAN	WAN
Connects host within a relatively small geographical area. • Same Building • Same room • Same Campus	Hosts may be widely dispersed. • Across Campuses • Acorss Cities/countries/continent
Faster	Slower
Cheaper	Expensive
Under a control of single ownership.	Not under a control of a single person.
Typical Speeds: 10 Mbps to 10Gbps	Typical Speed: 64 Kbps to 8 Mbps

STANDARDS

It provide guidelines to manufactures, govt agencies and other service provide to ensure the kind of inter connectivity necessary in today's market places and international communication standard agreed upon rules

CATEGORIES OF STANDARD

DEFACTO:

By fact or approved by the organization (HTTP)

DE-JUNE:

By the law or government

Most of the common standards are de-June standards

STANDARD ORGANIZATIONS:

ISO (international organization for standard)

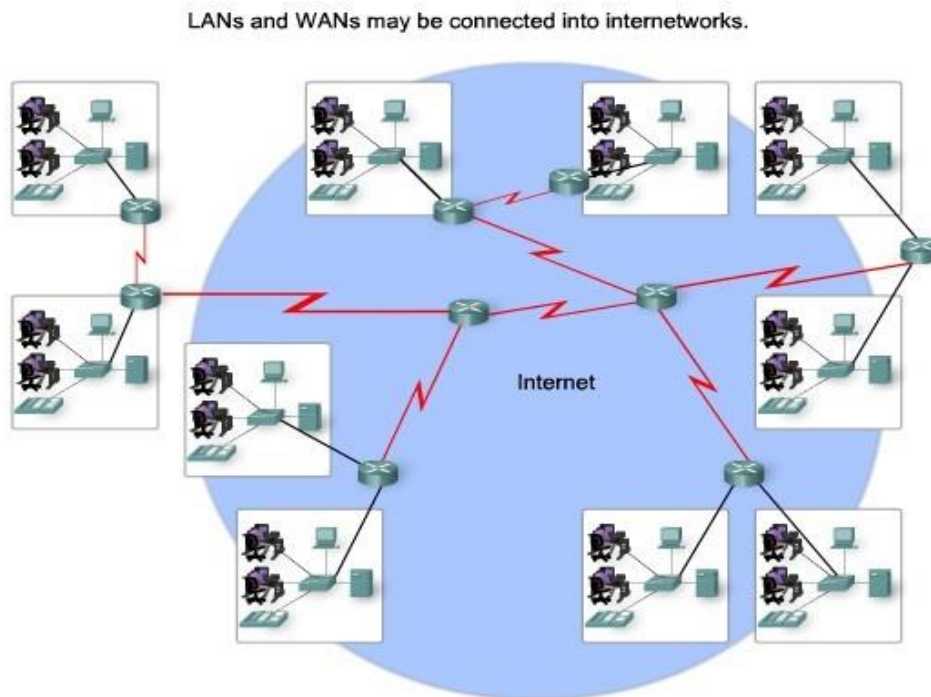ITU-T (international telecommunication union – telecommunication standard sector)

ANST (American national standard institute)

IEEE (institute of electrical and electronic engineer)

EIA (electronic industry association)

INTERNET:-

LANs and WANs may be connected into internetworks.

Internet is a network of networks i.e used to interlink many different types of computers allows the world.

Or

When two or more networks to connected they are called internet work of internet.

It is defined as information super high o access information over the web world wide global s/m interconnected computer network

Internet uses standard internet protocols TCP/IP every computer in internet is identified by unique IP address. IP address is 110.22.33.44 which identifies computer (DNS-Domain name server) is used to give name to the IP address. So that the user can locate a computer by a name.

EVOLUTION:

The concept of the internet was originated in 1969 has undergone several technologies and infrastructural changes. The origin of the internet is from ARPANET [advanced research project agency network]. ARPANET developed by unitedstates. ARPANET provides communication among various bodies of government.

ADVANTAGES OF INTERNET:

Social network: used in fb, twitter,yahoo,google

Education and technology: various topics

Entertainment: online games, online TV, songs, videos

Online service: net banking, shopping, tickects.

DISADVANTAGES OF INTERNET:

Cyber crimes

Virus attack

Threat to personal information

Spamming i.e unwanted emails

ARCHITECTURE OF INTERNET:

Assume our client his/her clip over a dial up telephone line

The modem is a card within personal computer that converts digital signal into analog signal

These signals are passes to the telephone system again these signals are transferred to POP [point of presence] where they are removed from telephone system and injected into ISP region network

From this, it is fully digital

 ISP is local telecommunication the POP will probably be located in telephone switching office where the telephone wires are client terminated If ISP is non local telecommunication it handle over ISP's backbone operator

Regional network consists if inter connected routers in various cities the ISP services provided international backbone network with 1000's of routers connected with high band width fiber optics

Larger co-operations that runs with the server directly connected to backbone.

Backbone is destiny for an internet service provider[ISP],it sends to the closer router and handled . To allow packets to hop between backbone all major backbones connected at NAP

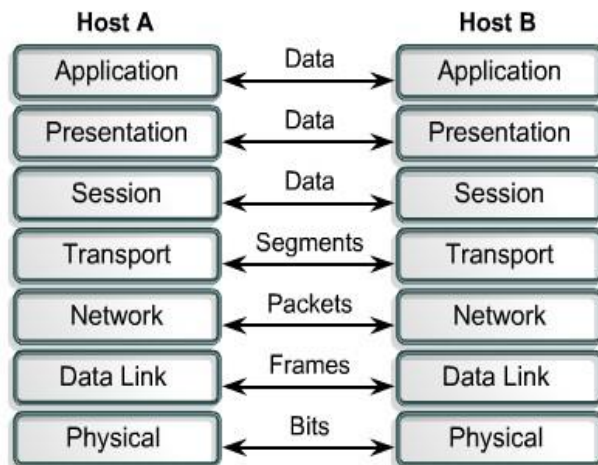A NAP is full of router Atleast one backbone

OSI/ISO REFERENCE MODEL:

OSI – open system interconnection.

To make the system compatible to communication with each

ISO has developed a standard i.e OSI

OSI is a seven layer architecture

DESIGN PRINCIPLE OF OSI REFERENCE MODEL:

A Different abstraction are needed a layer has to be create

Each layer should perform a well defined function.

The number of layer should be international standard

The number of layer should not be two layer

PHYSICAL LAYER: Physical medium to transfer bits

DATA LINK LAYER: Error free frames will be transmitted

NETWORK LAYER: Packets will be moved from source to destination.

TRANSPORT LAYER: Using protocol renewable message will be transmitted.

SESSION LAYER: Establishing terminating of session will be created.

PRESENTATION LAYER: Data compression, Encoding, encrypting

APPLICATION LAYER: Service will be provided directly to user.

1. **PHYSICAL LAYER**:

It is the lower layer or hardware layer
It is responsible for physical connection between two
Device i.e establishment, maintenances, deactivation
Information will be in the form of bits.
In this layer transmission of signals are converted in
0's and 1's.

FUNCTIONS:

BIT SYNCHRONIZATION: By providing clock the synchronization will be achieved between bits.

BITRATE CONTROL: It defined number of bits transmitted per second.

PHYSICAL TOPOLOGY: It is response to know the arrangement of devices in a network either bus, ring, mesh or star.

TRANSMISSION MODE: In which mode data is to be transmitted. It mainly depends up on three types

SIMPLEX

HALF DUPLEX

FULL DUPLEX

SIMPLEX: It is unidirectional.

'A' Can send message to 'B' cannot send message to 'A'.

Ex: monitor, keyboard

HALF DUPLEX: Data can be transmitted one after another.

Data cannot be transmitted at a time.

It is a bi-directional.

Ex: walki talkie

FULL DUPLEX: Data can be transmitted at same time from both the sender and receiver it is a bi-directional.

Ex: telephone lines

2. DATA LINK LAYER:

In data link layer data is represented in frames
It is responsible to transmitted error free data and
To get reliable and efficient communication
It is also responsible to define data in a network.

FRAMING:

Raw bits are converted into frames by adding few more bits as header and trailer. This frames will be transmitted from one devices to another devices.

HEADER	BITS	TRAILOR

FRAMES

PHYSICAL ADDRESSING: Destination hardware address will be included as harder

ERROR CONTROL: Error control mechanism will be implemented and calculated bits will be added in trailer

If any error or data corrupted the receiver send acknowledgment to retransmitted the corrupted data.

FLOW CONTROL: It means control of data to flow It is maintenances constant bit rate In this data will not get corrupted.

ACCESS CONTROL: If more than one device sharping same communication channel then data link layer (DLL) protocols. Are responsible to identify device which have to get control at a given time.

3. NETWORK LAYER:
This is the third layer of OSI model.
In this data is represented in the form of packets
Conversion of physical address to logical address i.e
Address will be included in packets as well as some
Bits will address in header some bits will be
Represented in router for destination.
Routing the packets from source to destination i.e routing will be done by networks layer. Here two different networks will be connected with help of routers.
Packets will be transmitted from one network to another network.
LOGICAL ADDRESSING:

HEADER	ADDRESS	FRAMES

PACKETS

Multiple networks are connected with help of routers

Every routers will maintain forward table

INDEX	O/P
S1	R1
S2	R2
S3	R3

Every packets request at the router the header will be check in the index value if the header contain it will router to the packets to destination i.e output link.

INTER NETWORKING: Logical connection between different networks.

FRAGMENTATION: We know that every network will have different and different bandwidth. Based on bandwidth we can send data or packets to the destination. In such a case, avoids collusion in everything will be possible with the help of network layer.

FUNCTIONS

GAURENTEE DELEIVERED

In order of packet:-

What is the order transmitted the receiver receive the same

GUARENTEE MAXIMUM JITLER

The time between two successful transmission at the sender side is equal to destination side.

SECURITY SERVICE

In order to provide security for packets the source will be encrypted and destination will be decrypted

4. TRANSPORT LAYER

Data is represented in segments

It provides logical communication between the application on the different host i.e applications from sender side and application from receiver side. They will not be physical connection between applicant. But they will be logical communication between source and destination.

It is responsible for end to end message delivery

It provides acknowledgement for successful transmission of data

If error is occurred this layer is responsible to retransmit the data

Transmitter layer protocols is implemented in end system but not at routers

Two major protocols

1. TCP [transmission control protocol]
2. UDP[user defined protocol]

Provides servers to this transport layer

SERVERS:

End to end delivery

Reliable delivery [without any loss of information,without any error , without any interruption

ERROR CONTROL:

If any error during transmission that cannot be detected in datalink layer can be overcome in transmit layer

SEQUENCE CONTROL:

In this message is represented in segment. The message is divided into segments and each segment has one sequences number at the sender side.

We are sending number segment and at receiver side they have receiver all the transmitted segment

Sequences control two types

LOSS OF DATA

REASSEMBLING

LOSS CONTROL:

To avoid the data loss the loss control is used at the receiver to retransmit the signal.

DUPLICATION CONTROL:

Sequences number provided to all the segment if any segment with the same sequences number that one automatically duplicate segment has received this layer avoid duplication segment.

FLOW CONTROL:

If the receiver having over loaded some segments are missing

Again the receiver request to retransmit the segment such type of avoidness can be controlled by flow control.

Addressing for every segment there will be header that header will be having some part address

| Header | segment |

It transmit the required application at receiver side

CONNECTION ORIENTED

CONNECTION ESTABLISHMENT

DATA TRANSFER

CONNECTION TERIMATION

Acknowledgement is given to free successful transmission of Data

CONNECTION LESS: Data can transfer

No acknowledgement

5.SESSION LAYER:

Session is responsible to keep the data from each section to separate

It is responsible for setting up, managing and tearing down session

It is also provides dialog control and coordinate communication between the system

FUNCTION:

Section establishment, maintenances and termination

SYNCHORIZATION:

To avoid data loss

Sending some check points and if any data is loss will not go to the first packet

And continue with the packets were error is occurred

Ex: 100 pages of data from source to destination

100 pages of data, check point = 20 pages

After transmission 20 pages from destination will get the acknowledgment for those 20 pages

If there is source receives the acknowledgment number that means data is sequences required at the destination

If there is error in transmission at 65 pages can check from the 61 pages.

DIALOG CONTROL:

Allow two system to start communication either half duplex or full duplex.

6.PRESENTATION LAYER:

Is responsible for data translation and encoding

It will take data from application layer and translation into a generic format for transfer across the network

This layer also involved in data compression, decompression

Encryption and decryption.

FUNCTION:

TRANSLATION: Changing the one format of data into another format.

Encryption:

Sender $\implies$ data $\implies$ encrypted $\implies$ cipher text

receiver $\implies$ cipher text $\implies$ decryption $\implies$ plane text

COMPRESSION: The size of data will be reduced in Compression algorithm reduced the size of data and it will be transmitted to the network reduced the size of data.
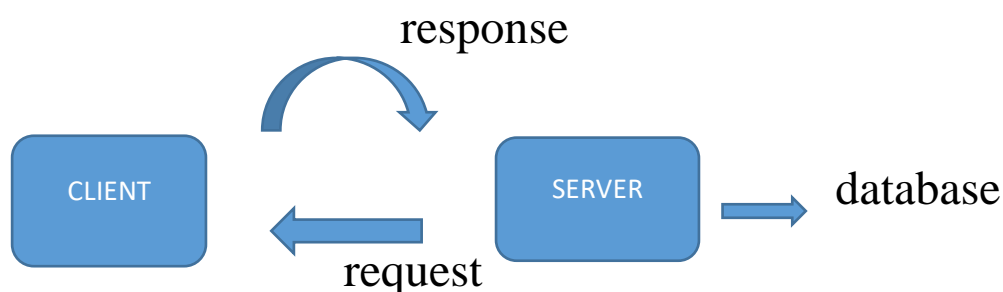
6.APPLICATION LAYER:

It is top layer of OSI model

It is a layer through which user can interact

It provide service to the user

Application layer program are based on client

Client is sending to the server (i.e opening of mail) giving user name, password the server will check with the data base when every server sending the response to client

There are different application to perform in system

Ex: web browser, messenger

Produce the data and that will be transmitted over a net work through all 6 layer

SERVICES:

File transfer, access and management

E-mail services

File or directory services

In this data actually will be transmitted for this layer

This layer provides services to display information in the required format

TCP/IP REFERENCE MODEL:

It is a implementation of OSI reference model. It consist of 4 layer

1. APPLICATION LAYER

2. TRANSPORT LAYER

3. INTERNET LAYER

4. HOST TO NETWORK LAYER

HOST TO NETWORK LAYER: It is a combination of datalink and physical layer

It is used for physical transmission data

It also defined the protocols connected to the host.

This protocols are different from one network to another network.

INTERNET LAYER: It is similar to network layer

In this packets deliver from source to destination

ROUTING: Packets will be routed from one network to another networks.

CONGESTION CONTROL (Bulk of data):

To avoid this congestion this layer is responsible

Each layer has protocol the main protocol for internet layer i.e IP (Internet protocol).

It is used to transfer packet from source to destination.

This layer is responsible to transmit packet independently to source host to destination host.

TRANSPORT LAYER:

It is responsible for segmenting splitting of data

The data will be divided into different segments splitting of

Data based up on bandwidth.

The data will be divided completely in transport layer

It also desire to send the data either in single path or multiple path

APPLICATION LAYER:

It is a combination of session and presentation layer

It act as a interface between host and server provides by the transport layer

It includes high level protocols

TELNET-Tele type network

It allow user on one machine to log in to another machine and work there

It is a two way communication

FTP- File transfer protocol

Transmitting the file data

SMTP- Simple mail transfer protocol

It transport electronics mails

DNS- Domain name system

Mapping host names on their address

APPLICATION LAYER	TELNET	FTP	SMTP	DNS
TRANSPORT LAYER	TCP		UDP	
INTERNET LAYER	IP			
HOST TO NETWORK LAYER	ETHER NET	FRAM E RELAY	TOKEN	RING

DIFFERENCE BETWEEN OSI AND TCP/IP:

	OSI		TCP/IP
1	Reference model	1	Implement of OSI
2	7layer	2	4 layer
3	Session and presentation layer are separated	3	It combines both session and presentation
4	Protocol are independent	4	Protocol are dependent standard
5	Supports to connection less and connection oriented	5	Supports only connection less

ATM:

ATM is also called as cell relay

Asynchronous in ATM devices do not send or receives information at affixed speed or using a timer but transmitted

Speed based on hardware and information flow

ATM transfer information fixed size unit each cell consist of 53 bytes

Header	load or user data
5bytes	48 bytes

ATM CELL FORMAT

Cells are transmitted asynchronously

ATM network is connection oriented making an ATM call request 1st sending a message to setup a connection sub sequentially all cell follow the same path destination.

It can handle both constant rate traffic and variable length traffic

Thus it can carry multiple type of traffic with end to end quality of server.

ATM virtual circuit:
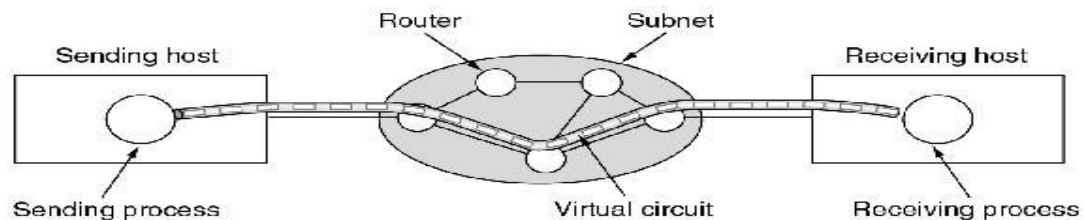
A virtual circuit.

ATM connection are connected oriented

Sending data requires 1st sending packets to setup the connection this setup packet went to the subnet on the path to

all the routers no direction electrical connection from end to end connection are often called virtual circuit.

They are 2 types of virtual circuit

1. Permanent virtual circuit (PVC)
2. Switch virtual circuit (SVC)

PVC:

PVC are connection between 2 nodes that are establish statically by the network

Connection are long period of time

Any failure of this connection cannot be automatically connected by the network requires human help

This is one of the main drawback in PVC

SVC:-

ATM user use second type of connection SVC or temporary connection created for the purpose of information transfer

There are 4 steps to establish SVL connection

1. Call set up
2. Data transfer
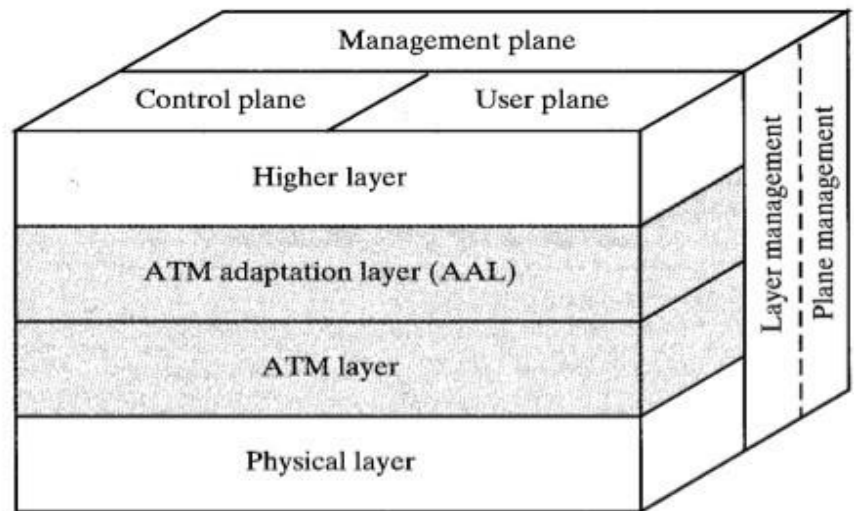3. Ideal
4. Call termination

ATM REFERENCE MODEL

ATM has its own reference model difference from OSI model and also different from TCP/IP model

It consist of three layer and 3 dimensional

1. Physical layer

2. ATM layer
3. ATM adaption
   layer

CS – convergence sublayer

SAR – segmentation and reassemble sublayer

TC – transmission convergence sublayer

PMD – physical medium dependent sublayer

PHYSICAL LAYER

It deals with physical medium i.e voltage bit timing various other issues

ATM does not have set of rules

ATM clues can be send on wire or fiber by themselves

ATM designed to be independent of transmit media

ATM LAYER

It deals with the cell and cell transfer. It defines the layout of the cell and what header field means.

It deals with the establishment and of virtual circuit conjunction control is located

ATM ADAPTATION LAYER

ATM layer allows user to send packets layer than a cell

ATM adaptation layer segment. This packet transmitted to cell individually and reassemble them at other end

USER PLANE

Deals with data transport flow control error correction and other user function.

CONTROL PLANE: It helps in connection management layer and plane management.

LAYER AND PLANE MANAGEMENT

It related to the resource and inter layer management

Physical and ATM adaptive layer are divided into two sublayer

PMD [PHYSICAL MEDIUM DEPENDENT]:-

It move bits ON and OFF and handle the bit timing

TC [TRANSMISSION CONVENGENCE]

It covert bit stream into a cell stream for the ATM layer

SAR [SEGMENTATION AND REASSEMBLE]

Breaks the packets into cells or transmission side and put them again destination

CS [CONVENGENCE SUBLAYER]

ATM system offer different kind of services for different applications

Ex:- File transfers

ATM Layer	ATM sublayer	FUNCTION
AAL	CS	Providing the standard interface (convergence)
	SAR	Segmentation and reassembly
ATM		Flow control Cell header generation/extraction Virtual circuit/path management Cell multiplexing/Demultiplexing
PHYSICAL	TC	Cell rate decoupling Header checksum generation and verification Cell generation Packing/unpacking cells from the enclosing envelope Frame generation
	PMD	Bit timing Physical network access