

NETWORKING

1.1 Basic Networking Concept (OSI Model, TCP/IP Model):

1. OSI Model:

- OSI stands for Open Systems Interconnection.
- It has 7 layers: Physical, Data link, Network, Transport, Session, Presentation and Application.
- Every layer has its own functionality and every layer works independently.
- Developed by ISO in the early eighties.
- Used for both connection-oriented and connectionless data transfer mediums.
- It is only a reference model.

2. TCP/IP Model:

- TCP/IP stands for Transmission control protocol/Internet Protocol.
- It has 5 layers: Application, Transport, Network, Data Link, Physical.
- Preferred more in communications protocol in Private hosts.
- Preferred more because more scalable, uses a client/server approach, and many routing protocols are being used.
- Attacks can be vulnerable, with no surety of delivering the packets.

1.2 IP Address Configuration (IP CLASS):

- An IP Address is the numerical label to a particular host's device assigned by the network it belongs to dynamically for better communication via the internet and to easily get identified.
- It helps in building the virtual connection between the host and server.
- It is been divided into two parts:
 1. Prefix = network part.
 2. Suffix = host part.
- It is divided into 5 classes:
 - Class A = 1 to 126 : In a class A type of network, the first 8 bits (also called the first octet) identify the network, and the remaining have 24 bits for the host into that network.
 - Class B = 128 to 191: In a class A type of network, the first 8 bits (also called the first octet) identify the network, and the remaining 24 bits for the host into that network.
 - Class C = 192 to 223: In class C, three octets are used to indent the network.

- Class D = 224 to 239: In class C, three octets are used to indent the network. This IP ranges between 192 to 223.
- Class E = 240 to 254: In class C, three octets are used to indent the network. This IP ranges between 192 to 223.

1.3 Subnetting IP Address:

- Step-01: identify the class of the IP.
- Step-02: identify the bits required for the network according to the class identified.
- Step-03: assigning each block of 8 bits.
- Step-04: if no CIDR value is mentioned then the network bits followed by .0's
- Step-05: if the CIDR value is mentioned then allocated that many bits compulsory and then subnetting will be done.
- Step-06: for total number of network = 2^m (m=number of bits borrowed.)
- Step-07: for total number of hosts = 2^n (n=total number of bits remained from that block after borrowing.)
- Step-08: for total number of address assigning = 2^{n-2} (n=total number of bits remained from that block after borrowing.)

1.4 CIDR:

- CIDR stands for Classless Interdomain Routing.
- Classless Inter-Domain Routing (CIDR) allows network routers to route data packets to the respective device based on the indicated subnet. Instead of classifying the IP address based on classes, routers retrieve the network and host address as specified by the CIDR suffix.
- A CIDR block is a collection of IP addresses that share the same network prefix and number of bits. A large block consists of more IP addresses and a small suffix.

1.5 Topology Concept:

1. Bus Topology:

- All the hosts or all the connection required devices can be linked or connected by the dingle cable and it lasts till the devices ended.
- All the devices may either be connected directly to the main cable or connected by the extended connection.
- When a node wants to send a message over the network, it puts a message over the network. All the stations available in the network will receive the message whether it has been addressed or not.
- Used for CSMA/CA and CSMA/CD.

2. Ring Topology:

- It is a kind of limited bus topology by having both ends connected.
- If any devices receive the message, then it will retransmit to the next devices.
- Unidirectional approach to data transmission.
- Endless loop of data flow in a clockwise direction.
- No termination points.

3. Star Topology:

- It is a kind of connection where one single server or router or switch becomes the center of the data transmission source and the device connected to that center source gets the data according to the address assignment.
- RJ-45 cable is used for the connection.

4. Tree Topology:

- Bus + Star = Tree.
- The connection of the devices is been done in a hierarchic manner like the branches on a tree.
- The trunk of the tree refers to the main core cable which reflects the bus topology and the branched also has the inter connection reflects the star topology.

5. Mesh Topology:

- Mesh technology is an arrangement of the network in which computers are interconnected with each other through various redundant connections.
- There are multiple paths from one computer to another computer.
- It does not have any switch or routers connected as the center data transmission medium.
- Mesh topology is good for the data transfer at the critical movements when any of the path is been blocked then the data can travel through different path.
- Number of cables = $(n*(n-1))/2$

6. Hybrid Topology:

- Among all the above-mentioned topologies any of them in combination can be known as Hybrid.
- A Hybrid topology is a connection between different links and nodes to transfer the data.

1.6 Wireless Networking Concept:

- Wireless communication takes place over free space through RF (radio frequency), one device, a Transmitter, sends a signal to another device, a Receiver. Two devices (transmitter and receiver) must use the same frequency (or channel) to be able to communicate with each other. If many wireless devices communicate at the same time, radio frequencies can cause interference with each other. Interference increases as no of devices increases.
- Wireless devices share airtime just like wired devices connect to shared media and share common bandwidth.
- Wireless communication is always half duplex as transmission uses the same frequency or channel. To achieve full duplex mode, devices use different frequency or channel of transmission and receiving of signals. You can say that wireless communication is Full duplex but technically it is not.