

# Introduction Networking

## Overview

Computer Networking is the practice of connecting computers together to enable communication and data exchange between them.

## Types of Computer Networks

- **LAN:** A Local Area Network (LAN) is a network that covers a small area, such as an office or a home. LANs are typically used to connect computers and other devices within a building or a campus.
- **WAN:** A Wide Area Network (WAN) is a network that covers a large geographic area, such as a city, country, or even the entire world. WANs are used to connect LANs together and are typically used for long-distance communication.

- **Cloud Networks:** Cloud Networks can be visualized with a Wide Area Network (WAN) as they can be hosted on public or private cloud service providers and cloud networks are available if there is a demand. Cloud Networks consist of Virtual Routers, Firewalls, etc.

## **Computer Networking Architecture**

- **Client-Server Architecture:** Client-Server Architecture is a type of Computer Network Architecture in which Nodes can be Servers or Clients. Here, the server node can manage the Client Node Behaviour.
- **Peer-to-Peer Architecture:** In P2P (Peer-to-Peer) Architecture, there is not any concept of a Central Server. Each device is free for working as either client or server.

## **Protocol**

A protocol is a set of rules or algorithms which define the way two entities can communicate across the network and there exists a different protocol defined at

each layer of the OSI model. A few such protocols are TCP, IP, UDP, ARP, DHCP, FTP, and so on.

## **Types of Protocol**

- **TCP/IP:** These are a set of standard rules that allow different types of computers to communicate with each other. The IP protocol ensures that each computer that is connected to the Internet has a specific serial number called the IP address. TCP specifies how data is exchanged over the internet and how it should be broken into IP packets. It also makes sure that the packets have information about the source of the message data, the destination of the message data, the sequence in which the message data should be re-assembled and checks if the message has been sent correctly to the specific destination. The TCP is also known as a connection-oriented protocol.
- **SMTP:** These protocols are important for sending and distributing outgoing emails. This protocol uses the header of the mail to get the

email id of the receiver and enters the mail into the queue of outgoing mail. And as soon as it delivers the mail to the receiving email id, it removes the email from the outgoing list. The message or the electronic mail may consider the text, video, image, etc. It helps in setting up some communication server rules.

- **FTP:** This protocol is used for transferring files from one system to the other. This works on a client-server model. When a machine requests for file transfer from another machine, the FTO sets up a connection between the two and authenticates each other using their ID and Password. And the desired file transfer takes place between the machines.
- **HTTP:** This protocol is used to transfer hypertexts over the internet, and it is defined by the www (world wide web) for information transfer. This protocol defines how the information needs to be formatted and transmitted. And it also defines the various actions the web browsers should take in

response to the calls made to access a particular web page. Whenever a user opens their web browser, the user will indirectly use HTTP as this is the protocol that is being used to share text, images, and other multimedia files on the World Wide Web.

- **Telnet:** TELNET is a standard TCP/IP protocol used for virtual terminal service given by ISO. This enables one local machine to connect with another. The computer which is being connected is called a remote computer and which is connecting is called the local computer. TELNET operation lets us display anything being performed on the remote computer in the local computer. This operates on the client/server principle. The local computer uses the telnet client program whereas the remote computer uses the telnet server program.

## **IP Address**

All the computers of the world on the Internet network communicate with each other with underground or underwater cables or wirelessly. If I want to download a file from the internet or load a web page or literally do anything related to the internet, my computer must have an address so that other computers can find and locate mine in order to deliver that particular file or webpage that I am requesting. In technical terms, that address is called IP Address or Internet Protocol Address.

## **Types of IP Address**

- **IPv4:** Internet Protocol version 4. It consists of 4 numbers separated by the dots. Each number can be from 0-255 in decimal numbers. But computers do not understand decimal numbers, they instead change them to binary numbers which are only 0 and 1. Therefore, in binary, this (0-255) range can be written as (00000000 – 11111111).
- **IPv6:** Internet Protocol Version 6 is a network layer protocol that allows communication to take place over the network. IPv6 was designed by Internet Engineering Task Force (IETF) in December 1998

with the purpose of superseding the IPv4 due to the global exponentially growing internet users.

## **Networking Topologies**

Network topology refers to how the nodes and links in a network are arranged. A network node is a device that can send, receive, store, or forward data. A network link connects nodes and may be either cabled or wireless links.

## **Types of Topologies**

- **Bus Topology** is that when every network node is directly connected to a main cable
- **Ring Topology** is where nodes are connected in a loop, so each device has exactly two neighbors. Adjacent pairs are connected directly; non-adjacent pairs are connected indirectly through multiple nodes
- **Star topology** is that where all nodes are connected to a single, central hub and each node is indirectly connected through that hub

- **Mesh topology** is defined by overlapping connections between nodes. You can create a full mesh topology, where every node in the network is connected to every other node.

## **TCP/IP**

TCP/IP (Transmission Control Protocol/Internet Protocol) is a suite of communication protocols that define the standards for transmitting data over computer networks, including the internet. The TCP/IP protocol is the foundation of the internet and enables devices to communicate with each other using a common language.

## **Characteristic of TCP/IP**

- **Share Data Transfer:** The TCP allows applications to create channels of communication across a network. It also permits a message to be separated into smaller packets before they are transmitted over the web and after that collected in the right order at



the destination address. So, it guarantees the solid transmission of data across the channel.

- **Internet Protocol:** The IP address tells the packets the address and route so that they reach the proper destination. It includes a strategy that empowers portal computers on the internet-connected to arrange forward the message after checking the IP address.
- **Reliability:** The most vital feature of TCP is solid data delivery. In order to supply unwavering quality, TCP must recover information that's harmed, misplaced, copied, or conveyed out of arranging by the Arrange Layer.
- **Multiplexing:** Multiplexing can be achieved through the number of ports.

## TCP/IP Layers

- **Application Layer:** An application layer is the topmost layer within the TCP/IP model. When one application layer protocol needs to communicate with another application layer, it forwards its information to the transport layer.
- **Transport Layer:** It is responsible for the reliability, flow control, and correction of data that is being sent over the network. There are two protocols used in this layer are User Datagram Protocol and Transmission control protocol.

- **Internet/Network Layer:** It is the third layer of the TCP/IP Model and known as the Network layer. The main responsibility of this layer is to send the packets from any network, and they arrive at the goal irrespective of the route they take.
- **Network Access Layer:** It is the lowest layer of the TCP/IP Model. It is the combination of the Physical Layer and the Data link layer which is present in the OSI Model. Its main responsibility is the transmission of information over the same network between two devices.

## **TCP Three Way Handshaking**

The process of communication between devices over the internet happens according to the current **TCP/IP** suite model. The Application layer is a top pile of a stack of TCP/IP models from where network referenced applications like web browsers on the client-side establish a connection with the server. From the application layer, the information is transferred to the transport layer where our topic comes into the picture.

## **Working of TCP Three Way Handshaking**

- **Step 1 (SYN):** In the first step, the client wants to establish a connection with a server, so it sends a segment with SYN(Synchronize Sequence Number) which informs the server that the client is likely to start communication and with what sequence number it starts segments with
- **Step 2 (SYN + ACK):** Server responds to the client request with SYN-ACK signal bits set. Acknowledgement(ACK) signifies the response of the segment it received and SYN signifies with what sequence number it is likely to start the segments with
- **Step 3 (ACK):** In the final part client acknowledges the response of the server and they both establish a reliable connection with which they will start the actual data transfer.