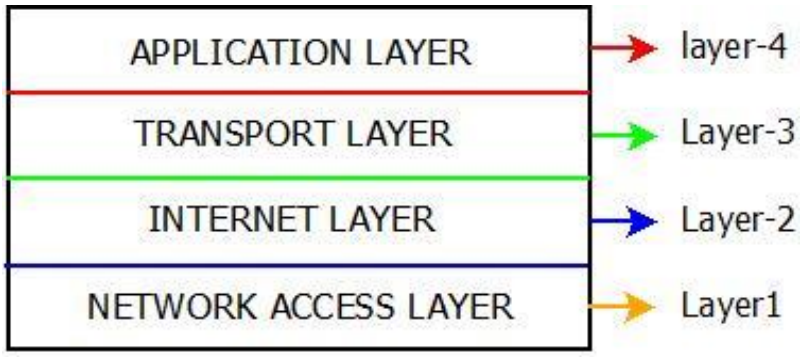
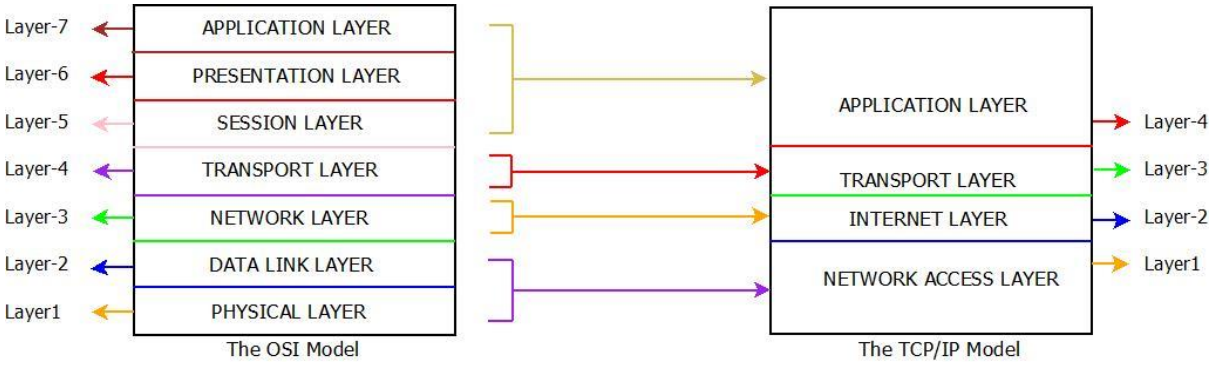
TCP/IP Reference Model: Introduction

- The OSI reference model was the first communication model and was termed as general-purpose .TCP/IP model which is commonly known as Internet Model was developed in year 1983 by US Military Wing called ARPANET.
- In 1983 January 1, TCP/IP was made active permanently for the commercial use. From then, TCP/IP has made a revolution in the field of networking and telecommunication as it was able to overcome the drawbacks of general purpose OSI Model.
- TCP/IP stands for **Transmission Control Protocol** with the help of which, protocol implementation over the network can be achieved.
- The TCP/IP model also has a layered architecture which allows easy data communication along with the facility of integrating multiple protocols. The layout remains similar to OSI Model but the number of layer, their functionalities and properties got changed.
- This Internet Model(TCP/IP) comprises of only four layers as compared to seven layers of OSI Model. These four layers are generated by combining the layers of OSI model internally so that protocols can be implemented. These layers have fixed positions too and their positions cannot be altered.
- **Application Layer, Transport Layer, Internet Layer and Network Access Layers are the four layers of TCP/IP Model.**



The TCP/IP Model

Architecture And Layers : TCP/IP Model



Architecture : TCP/IP Model

a) The Network Access Layer

- The Network Access Layer of TCP/IP reference model is also known as the Host-to-Host or Host-to-Network layer as it is responsible for performing roles of the Physical Layer along with the functions of Data Link Layer.
- Data in the form of bits received in the Network Access Layer are connected in the form of data packets to Internet Layer.
- **Network Access Layer = Data Link Layer + Physical Layer.**
- The physical transmission of data takes place at this layer
- Once the frames are transmitted by a network, encapsulating the IP datagram into these frames is done in this layer
- Also, the mapping of IP address into physical address is done here
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b) The Internet Layer

- Internet layer is also called Network Layer which is responsible for establishment of connection to send or receive data packets between multiple users or nodes or devices or networks. This layer is placed on the 2nd position from bottom.
- The Internet Layer en-routes the data packets from source to destination through the process of routing with the help of various routing techniques and routing protocols.

- There are three different protocols used in this layer. These include:
    - **IP:** One of the most important protocols as it detects the IP address of a device which is later used for internetwork connections. It is using this protocol that the path with which the data shall be transmitted is decided. There are two common IP versions which are used, To know the difference between IPv4 and IPv6, visit the linked article.

- **ARP:** It stands for Address Resolution Protocol. The physical address from the IP address can be determined using ARP.
- **ICMP:** It stands for Internet Control Message Protocol and notification regarding datagram problems can be sent back to the user using this. Any issue with the network is immediately notified to the user by ICMP. It can only inform the user about the errors and cannot rectify the problem

c) The Transport Layer

- The Transport Layer performs the same functions and have similar features as that in OSI Model. The functionality of Transport Layer is, it provides end to end data transfer by using the technique of connection oriented services between sender and receiver with the help of various protocols.

- The error-free delivery of data is the main function of this layer
- There are two main protocols present in this layer:
  - **TCP:** Another integral part, the Transmission Control Protocol is a reliable communication protocol. It manager the flow of data, i.e. the sequence and segmentation of the data
  - **UDP**: It is a connection-free protocol which makes it cost-effective but less reliable.

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d) The Application layer

- The Application Layer resides on the top of the TCP/IP reference model as line in OSI Model. The functionality of Application Layer of TCP/IP reference model is to provide interface between users and the applications. In some cases depending upon the requirements, it can perform the functions of Session Layer(to provide sessions) and Presentation Layer(data representation).
- Application Layer = Session Layer + Presentation Layer + Application Layer .

- Multiple protocols are present in this layer, a few common ones have been mentioned below in brief:
  - **HTTP:** Hypertext Transfer Protocol is used to manage the communication between the server and web browsers

- **NTP:** Network Time Protocol can set one standard time source in our computer, which enables sync between the server and the user
- **TELNET:** Telecommunication Network is used to have access to files present of the Telnet network and manage them on internet
- **FTP:** File Transfer Protocol, as the name suggests allows easy transferring of files

Advantages : TCP/IP Reference Model

- Use of protocols implementation and their support.
- Each layer has its definite structure and functionality which makes OSI model simple and easy to use.
- Use of layered architecture.

Disadvantages : TCP/IP Reference Model

- As some layers has multiple functionalities, it is more complex than OSI Model where each layer has separate functions and services.
- The TCP/IP reference makes use of protocols. But, in case of replacement of any protocol, difficulty and issue might arise.

Difference between TCP/IP and OSI Model:

TCP/IP	OSI
TCP refers to Transmission Control Protocol.	OSI refers to Open Systems Interconnection.
TCP/IP has 4 layers.	OSI has 7 layers.
TCP/IP is more reliable	OSI is less reliable
TCP/IP uses both session and presentation layer in the application layer itself.	OSI uses different session and presentation layers.
TCP/IP developed protocols then model.	OSI developed model then protocol.
Transport layer in TCP/IP does not provide assurance delivery of packets.	In OSI model, transport layer provides assurance delivery of packets.
TCP/IP model network layer only provides connection less services.	Connection less and connection oriented both services are provided by network layer in OSI model.
Protocols cannot be replaced easily in TCP/IP model.	While in OSI model, Protocols are better covered and is easy to replace with the change in technology.

Connection-oriented Services

Connection-oriented Services, are similar to telephone system where parties use handshake method to establish connection between sender and receiver. These services include connection establishment and connection termination.

Connection-less Services

Connection-less Services, are similar to postal system where packets moves from one party to another without establishing a connection first. These services do not include connection establishment and connection termination.

Following are the important differences between Connection-oriented and Connection-less Services.

Sr. No.	Key	Connection-oriented Services	Connection-less Services
1	Analogy	Connection-oriented Services are similar to Telephone System.	Connection-less Services are similar to Postal System.
2	Usage	Connection-oriented Services are used in long and steady communication networks.	Connection-less Services are used in volatile networks.

Sr. No.	Key	Connection-oriented Services	Connection-less Services
3	Congestion	No Congestion in Connection-oriented Service.	Congestion is quiet possible in Connection-less Services.
4	Reliablility	Connection-oriented Service are highly reliable.	In Connection-less Services, no guarantee of reliablity.
5	Packet Routing	In Connection-oriented Service, packets follows same route.	In Connection-less Services, packets can follow any route.