TCP/IP Model

TCP/IP stands for Transmission Control Protocol/ Internet Protocol. It is a transport layer protocol that allows packets to be sent from one location to another. The TCP/IP Model aids in determining how a particular computer should connect to the internet and how data should be sent between them. When many computer networks are linked together, it aids in the creation of a virtual network. The TCP/IP model was created to allow communication over long distances. It's a connection-oriented protocol, which means it establishes the connection before the communication between the network's computer units. Because this protocol is used in conjunction with the IP protocol, they are referred to as TCP/IP. TCP/IP Stack is a model for providing a very reliable and end-to-end byte stream over an unreliable internetwork. A file transfer, email, remote login etc. is an example of the application layer. TCP/IP models are divided into four layers:

- **Application layer**

  `The OSI model's highest level, the application layer, communicates with an application program. The OSI layer closest to the end-user is the application layer. It means that users can communicate with other software applications through the OSI application layer. Some of the functionalities of OSI layers are:

  - The application layer aids in the identification of communication partners, resource availability, and communication synchronization.
  - It enables users to connect to a distant server.
  - This layer offers a variety of e-mail services.
  - This application provides access to global information about numerous objects and services from distributed database sources.

- **Transport layer**

  To provide data transmission from a process on a source system computer to a process on a destination system, the transport layer builds on the network layer. It can be hosted on a single or several networks, and it also maintains service quality functions. It specifies how much data and at what rate should be supplied where and when. The messages received from the application layer are built upon in this layer. It ensures that data units are supplied in a timely and error-free manner. Through flow control, error control, and segmentation or de-segmentation, the transport layer aids in the regulation of a link's reliability. TCP is the most well-known example of transport layer. Some of the important functions of Transport layers are:

  - It separates and counts the messages received from the session layer into parts to create a sequence.
  - The message is sent to the relevant process on the destination machine by the transport layer.
  - It also ensures that the complete message arrives without error; otherwise, it must be resent.

- **Internet layer**
  Routing and encapsulation into IP packets are handled by Internet layer protocols. Internet Protocol (IP), Address Resolution Protocol (ARP), Internet Control Message Protocol (ICMP), and Internet Group Management Protocol are all protocols at this layer (IGMP).

- **Network layer**
  Place frames on the network using network layer protocols. LAN topologies (such as Ethernet and Token Ring) and WAN telecommunication service technologies (such as Plain Old Telephone Service (POTS), Integrated Services Digital Network (ISDN), and Asynchronous Transfer Mode) are examples of these protocols (ATM).

UDP

Over the Internet Protocol (IP) network, the UDP protocol allows computer applications to transfer messages in the form of datagram from one machine to another. The UDP protocol is an alternative to the TCP protocol for communication (transmission control protocol). UDP, like TCP, defines a set of rules for how data should be transmitted across the internet. The UDP encapsulates the contents in the packet and adds its own header information. The UDP packet is then encased in an IP packet and dispatched to its intended destination. Some of the features of UDP are given below:

- UDP is an useful protocol for one-way data transmission.
- UDP is a basic protocol that is well suited to query-based communication.
- When acknowledgment of data isn't important, UDP is utilized.
- UDP isn't a connection-oriented protocol.
- The UDP protocol does not provide a congestion control mechanism.
- UDP does not ensure data delivery in a specific order.
- UDP is a stateless protocol.
- UDP is a good protocol for streaming applications like VoIP and multimedia.

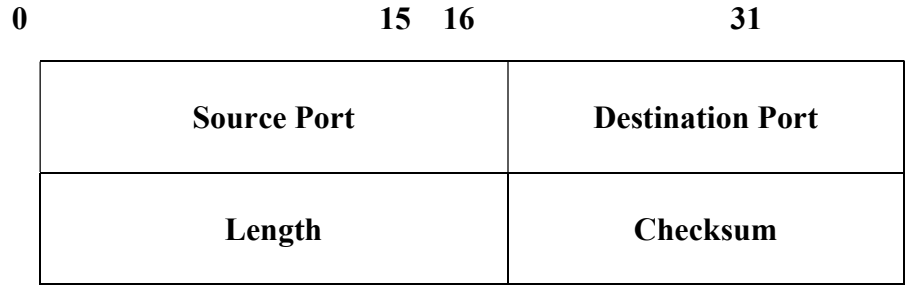
TCP header

Transmission Control Protocol is a dependable transport protocol since it establishes a connection before transmitting any data and the receiver acknowledges everything it sends. In this session, we'll look at the TCP header and its various fields in greater detail.

<table>
<tr><td colspan="3">Source Port</td><td>Destination Port</td></tr>
<tr><td colspan="4">Sequence numbers</td></tr>
<tr><td colspan="4">Acknowledgement Number</td></tr>
<tr><td>Header Length</td><td>Reserved bits</td><td>Flags</td><td>Window Size</td></tr>
<tr><td colspan="3">TCP Checksum</td><td>Urgent pointer</td></tr>
<tr><td colspan="4">Options</td></tr>
</table>

UDP header

A Transport Layer protocol is the User Datagram Protocol (UDP). The Internet Protocol suite, sometimes known as the UDP/IP suite, includes UDP. It is an unreliable and connectionless protocol, unlike TCP. As a result, there is no need to establish a connection before transferring data.



Source Port - This 16-bit value is used to identify the packet's source port.

Destination Port - This 16-bit information is used to identify the application level service on the target machine.

Length – The length of a UDP packet is specified by the length field (including header). It's a 16-bit field with an 8-byte minimum value, which equals the size of the UDP header itself.

Checksum - The checksum value created by the sender before sending is stored in this field. This field is optional in IPv4, therefore if it contains no value, it is set to 0 and all of its bits are set to zero.

Difference between TCP and UDP

- TCP stands for Transmission Control Protocol whereas UDP stands for User Datagram Protocol or Universal Datagram Protocol.
- TCP is Connection oriented whereas UDP is Connectionless.
- TCP connection is reliable and also follows ordering whereas UDP is less reliable and does not follow ordering which transmitting data in form of packets.
- In TCP error control is mandatory whereas error control is optional.
- Transmission of data in TCP is slow as compared to transmission of data in UDP.
- Overhead in TCP (header size is 20 bytes) is more as compared to UDP (header size is 8 bytes).
- In TCP it follows Flow Control, Congestion Control but UDP has no Flow Control or Congestion Control.
- TCP uses protocols like HTTP, FTP etc. but UDP uses protocols like DNS, RIP, and BOOT P etc.

----------XXX----------