# Transport Layer in OSI Model

The transport layer, or layer 4 of the OSI model, controls network traffic between hosts and end systems to guarantee full data flows. Data volume, destination, and rate are all controlled by transport-layer protocols including TCP, UDP, DCCP, and SCTP.

The transport layer is positioned between the network and session layers in the OSI paradigm. The data packets must be taken and sent to the appropriate machine by the network layer. After that, the transport layer receives the packets, sorts them, and looks for faults. Subsequently, it directs them to the session layer of the appropriate computer program. Now, the properly structured packets are used by the session layer to hold the data for the application.
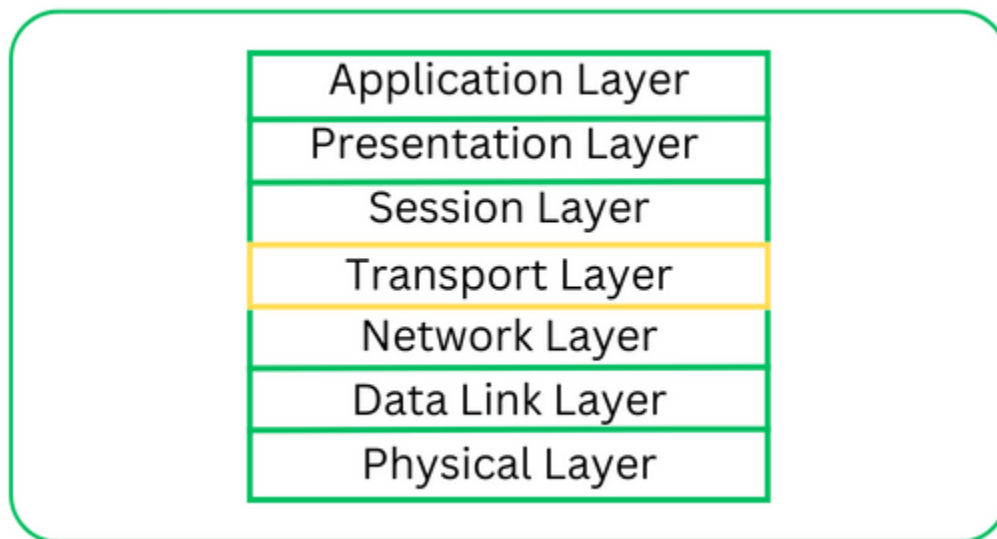
Functions of Transport Layer

The Transport Layer is responsible for end-to-end communication of data packets. It provides a number of important functions that are responsible for reliable, efficient, and organized data transfer between host systems in a networked environment.

The primary functions of the Transport Layer are:

- To enable efficient network transmission, the Transport Layer splits the total amount of data it gets from the applications running at the top layers into smaller units known as segments. The Transport Layer puts these bits back together into the original data stream at the other end.

- In situations when organised data transfer is required, the Transport Layer creates a connection between the source and the destination. In order to create the proper parameters and guarantee that both systems are prepared to communicate data, a handshake protocol is established. When the data transfer is complete, the Transport Layer closes the connection.

- The transport layer also assures dependable data transmission. Receiving acknowledgments, or ACK bits, is how this is accomplished. While waiting for the recipient to acknowledge the parts it

sent, the sender keeps an eye on them. Any damaged segments are retransmitted by the sender if they receive an acknowledgment.

- Flow regulation is one of the Transport Layer's most crucial roles. In order to prevent data overload, it regulates the data transfer rate. This is done by utilising protocols like the sliding window protocol, which is carried out by the receiver telling the sender of the maximum amount of data it may receive by sending back a window.

- Both error detection and repair are handled by the transport layer. Checksums are one of these techniques for error detection. By computing and validating checksums, it can ascertain whether data was tampered with during transmission. The Transport Layer may request retransmission if it finds anything.

Characteristics of Transport Layer

1. Service-point addressing

As a result of computers running many programs at once, data is transmitted from one source to the destination, connecting not only one computer to another, but also different processes. The header with the address known as a service-point address or port address is added by the transport layer. The transport layer is in charge of sending the message to the appropriate process, whereas the network layer is in charge of sending data from one computer to another.

2. Segmentation and reassembly

The message is split up into numerous segments by the transport layer when it receives it from the top layer. Each segment is given a unique sequence number. The transport layer reassembles the message based on sequence numbers once it has reached its destination.

3. Connection control

Two services are offered by the transport layer. Both connectionless and connection-oriented services are available. Every segment is handled as a separate packet by a connectionless service, and they all take distinct paths to get there. Every packet in a connection-oriented service follows the same path.
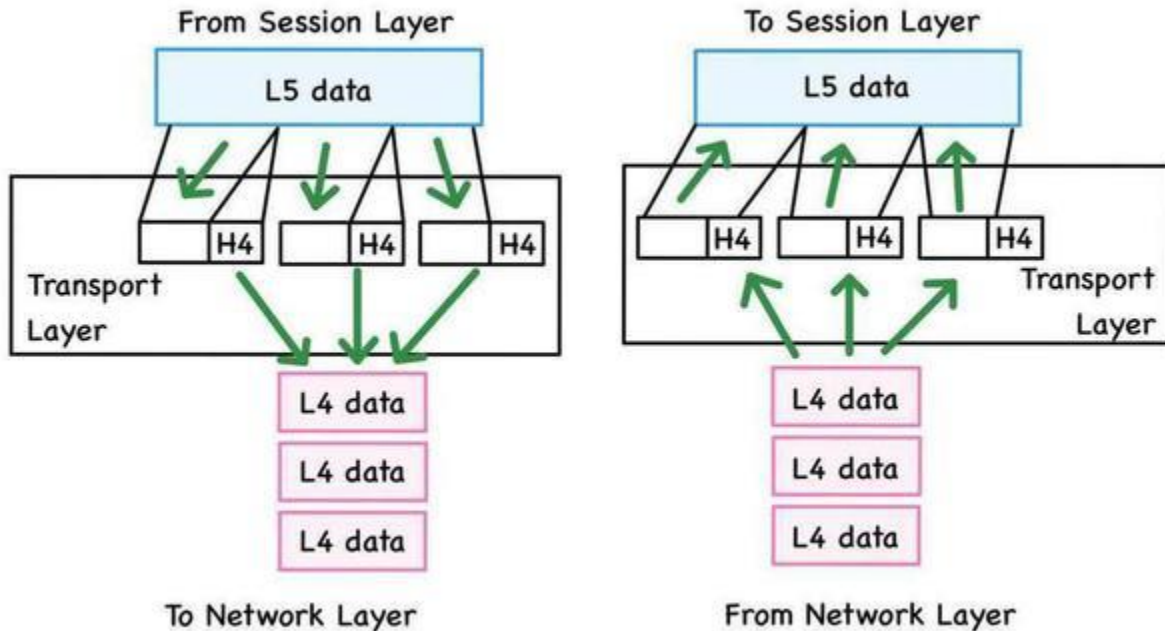
4. Flow control

Although it is carried out end-to-end rather than via a single link, the transport layer is likewise in charge of it. It is very essential because it is possible for sender to transmit data or information at very fast rate and hence receiver can receive this information and process it

5. Error control

This function is likewise carried out by the transport layer. Error control is not carried out across the single link, but rather end-to-end. Error Control ensures that the data packet is received to the destination without any error.

Working of Transport Layer

Communication between end systems is dependable and effective thanks to the Transport Layer. Apart from regulating flow and accommodating numerous applications concurrently, it guarantees data delivery in a manner that guarantees accuracy and minimises mistakes. It accomplishes this by utilising a collection of methods and protocols that provide data transport.

From Session Layer — L5 data — Transport Layer — To Network Layer — L4 data (×3)

To Session Layer — L5 data — Transport Layer — From Network Layer — L4 data (×3)

- The fourth layer down is the transport layer.

- The primary function of the transport layer is to give application processes operating on several hosts direct access to communication services.

- Logical communication between application processes operating on separate hosts is facilitated by the transport layer. Application processes use the logical communication offered by the transport layer to deliver messages to one other even when they are running on different hosts and are not physically connected.

- The network routers do not implement the transport layer protocols; only the end systems do.

- For instance, the network layer receives services from TCP and UDP, two transport layer protocols, which offer distinct functionalities.

- Protocols at the transport layer offer multiplexing and demultiplexing capabilities. In addition, it offers other services including bandwidth assurances, latency guarantees, and dependable data transport.

- Every application at the application layer is capable of sending a message via either TCP or UDP. Either of these two protocols can be used by the application to interact. The internet protocol on the internet layer will then be communicated with by both TCP and UDP. The transport layer is readable and writeable by the applications.

Transport Layer Protocols

Transport Layer Protocol uses different protocol for the better communication between two ends uses of protocol may differ from specifications. Below mention are some protocols used in Transport Layer

1. Transmission Control Protocol(TCP)

- TCP is connection-oriented Protocol.

- TCP is reliable protocol.

- As TCP is connection-oriented protocol, so first the connection is established between two ends and then data is transferred and then the connection is terminated after all data being sent.

2. User Datagram Protocol (UDP)

- UDP is not reliable protocol

- The protocol UDP is connectionless.

- When speed and size are more important than security and dependability, this kind of protocol is employed.

- The data from the higher layer is supplemented with transport-level addresses, checksum error control, and length information by UDP, an end-to-end transport level protocol.

- A user datagram is the packet that the UDP protocol generates.

3. Stream Control Transmission Protocol (SCTP)

- An IP Transport Layer protocol is called Stream Control Transmission Protocol (SCTP).

- Many Internet applications use SCTP to perform transport layer duties, similar to User Datagram Protocol (UDP) and Transmission Control Protocol (TCP).

- On top of a connectionless packet network like IP, SCTP is a dependable transport protocol that facilitates data transfer over the network in scenarios involving one or more IP addresses.

Difference Between TCP and UDP at Transport Layer

TCP	UDP
TCP is a connection-oriented protocol	UDP is the connection-less protocol
TCP is reliable.	UDP is not reliable.
TCP supports error-checking mechanisms.	UDP has only the basic error-checking mechanism using checksums.
An acknowledgment segment is present.	No acknowledgment segment.

TCP	UDP
TCP is slower than UDP	UDP is faster, simpler, and more efficient than TCP.
Retransmission of lost packets is possible in TCP, but not in UDP.	There is no retransmission of lost packets in the User Datagram Protocol (UDP)
TCP has a (20-60) bytes variable length header.	The header length is fixed of 8 bytes.