Overview of Transport layer

o The transport layer is a 4th layer from the top.
o The main role of the transport layer is to provide the communication services directly to the application processes running on different hosts.

Services provided by the Transport Layer

The services provided by the transport layer are similar to those of the data link layer. The data link layer provides the services within a single network while the transport layer provides the services across an internetwork made up of many networks. The data link layer controls the physical layer while the transport layer controls all the lower layers.

The services provided by the transport layer protocols can be divided into five categories:

o End-to-end delivery
o Addressing
o Reliable delivery
o Flow control
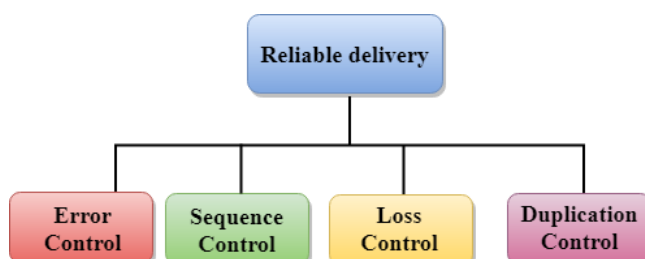o Multiplexing
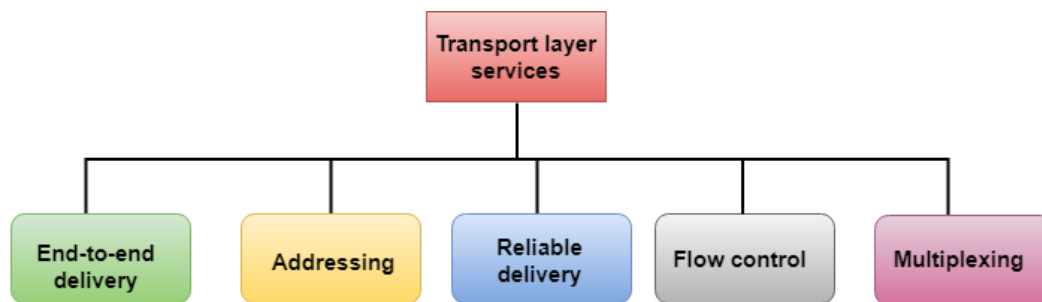
End-to-end delivery:

The transport layer transmits the entire message to the destination. Therefore, it ensures the end-to-end delivery of an entire message from a source to the destination.

Reliable delivery:

The transport layer provides reliability services by retransmitting the lost and damaged packets.

The reliable delivery has four aspects:

o Error control
o Sequence control
o Loss control
o Duplication control

Error Control

- o The primary role of reliability is **Error Control**. In reality, no transmission will be 100 percent error-free delivery. Therefore, transport layer protocols are designed to provide error-free transmission.

- o The data link layer also provides the error handling mechanism, but it ensures only node-to-node error-free delivery. However, node-to-node reliability does not ensure the end-to-end reliability.

Sequence Control

- o The second aspect of the reliability is sequence control which is implemented at the transport layer.

- o On the sending end, the transport layer is responsible for ensuring that the packets received from the upper layers can be used by the lower layers. On the receiving end, it ensures that the various segments of a transmission can be correctly reassembled.

Loss Control

- Loss Control is a third aspect of reliability. The transport layer ensures that all the fragments of a transmission arrive at the destination, not some of them.
- On the sending end, all the fragments of transmission are given sequence numbers by a transport layer.

Duplication Control

- Duplication Control is the fourth aspect of reliability. The transport layer guarantees that no duplicate data arrive at the destination. Sequence numbers are used to identify the lost packets; similarly, it allows the receiver to identify and discard duplicate segments.

Flow Control

- Flow control is used to prevent the sender from overwhelming the receiver.
- If the receiver is overloaded with too much data, then the receiver discards the packets and asking for the retransmission of packets.
- This increases network congestion and thus, reducing the system performance.
- The transport layer is responsible for flow control.
- It uses the sliding window protocol that makes the data transmission more efficient as well as it controls the flow of data so that the receiver does not become overwhelmed.
- Sliding window protocol is byte oriented rather than frame oriented.