

## Transport Layer

The Transport Layer is one of the seven layers in the OSI (Open Systems Interconnection) model, which is a conceptual framework used to understand and standardize how different networking protocols and technologies interact in a networked system. The Transport Layer is Layer 4 in the OSI model, and its primary function is to ensure reliable end-to-end communication between devices or systems on a network. It provides various services and features to achieve this goal. Here are some key aspects of the Transport Layer in networking:

**End-to-End Communication:** The Transport Layer is responsible for establishing, maintaining, and terminating communication sessions between two devices, even if they are not directly connected. It abstracts the underlying network details, making it easier for applications to communicate over a network.

**Data Segmentation and Reassembly:** It breaks down large messages or data streams into smaller units called segments for transmission over the network. At the receiving end, it reassembles these segments into the original message. This segmentation helps optimize network resource usage.

**Error Detection and Correction:** Many Transport Layer protocols include mechanisms for detecting and correcting errors in data transmission. This ensures the integrity of the data being exchanged between devices.

**Flow Control:** The Transport Layer manages the rate at which data is sent from the sender to the receiver to avoid congestion and prevent overwhelming the recipient. Flow control mechanisms help ensure that data is delivered at an appropriate pace.

**Reliability:** The Transport Layer can offer reliability by ensuring that data is delivered accurately and in the correct order. This is achieved through acknowledgment mechanisms, retransmission of lost data, and sequence number tracking.

**Multiplexing and Demultiplexing:** It allows multiple communication sessions (using ports or sockets) to occur simultaneously on the same device. This is essential for supporting multiple applications and services on a single device.

**Port Numbers:** Port numbers are used to identify specific services or processes on a device. The Transport Layer uses port numbers to direct incoming data to the correct application or service running on the device.

**Transport Layer Protocols:** There are several Transport Layer protocols, including Transmission Control Protocol (TCP) and User Datagram Protocol (UDP). TCP is connection-oriented, offering reliability and error correction, while UDP is connectionless and offers faster, lightweight communication.

**Connection Establishment and Termination:** Connection-oriented protocols like TCP establish, maintain, and terminate connections using specific procedures. This ensures orderly communication between sender and receiver.

**Security:** The Transport Layer can also provide security services such as encryption and authentication to protect the confidentiality and integrity of data during transmission.

In summary, the Transport Layer in networking plays a crucial role in ensuring reliable and efficient communication between devices on a network. It abstracts many of the complexities of lower-level layers and provides essential services that enable applications to transmit and receive data seamlessly over networks.

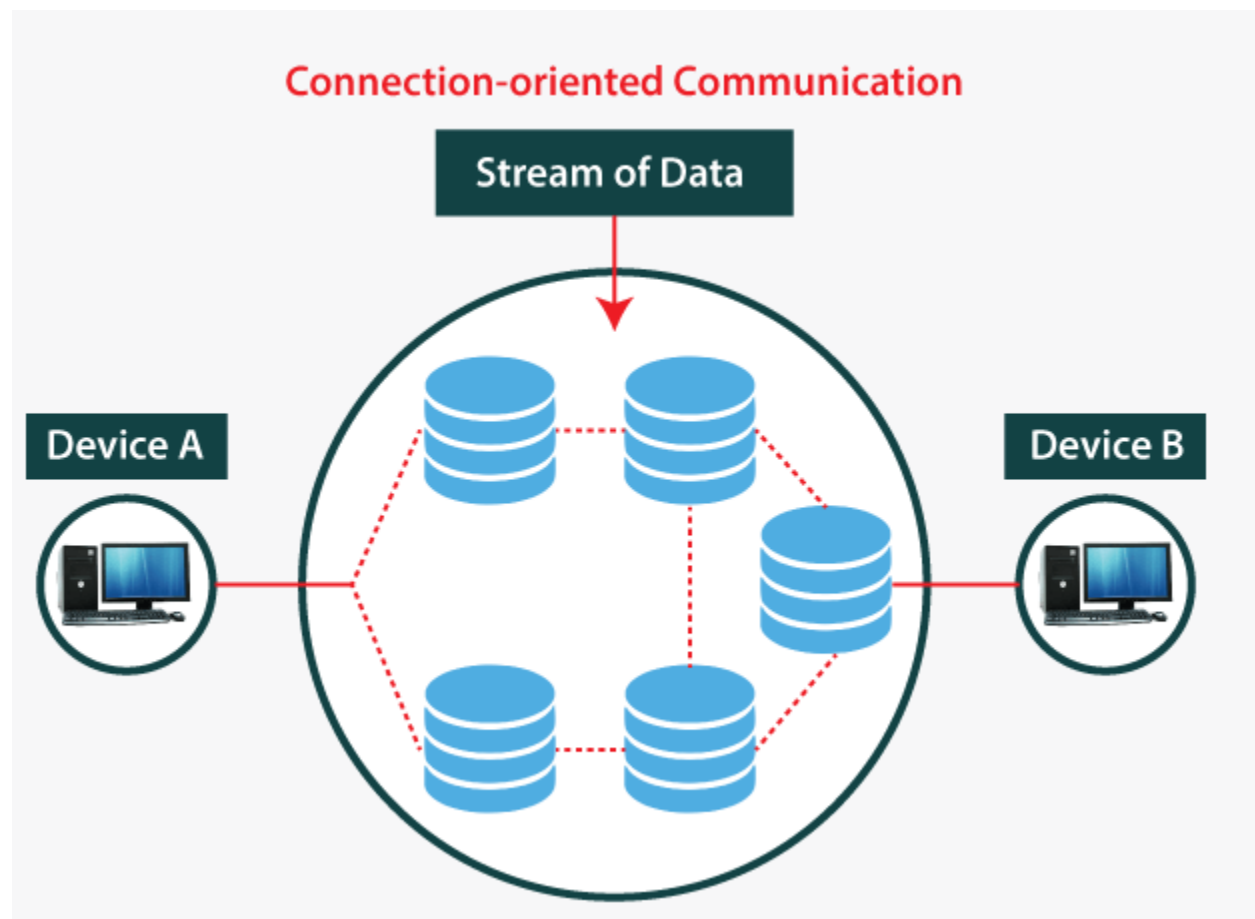
## Difference between Connection-Oriented and Connectionless Service

Data communication is a telecommunication network to send and receive data between two or more computers over the same or different network. There are two ways to establish a connection before sending data from one device to another, that are **Connection-Oriented** and **Connectionless Service**. Connection-oriented service involves the creation and termination of the connection for sending the data between two or

more devices. In contrast, connectionless service does not require establishing any connection and termination process for transferring the data over a network.

## Connection-Oriented Service

A connection-oriented service is a network service that was designed and developed after the telephone system. A connection-oriented service is used to create an end to end connection between the sender and the receiver before transmitting the data over the same or different networks. In connection-oriented service, packets are transmitted to the receiver in the same order the sender has sent them. It uses a handshake method that creates a connection between the user and sender for transmitting the data over the network. Hence it is also known as a reliable network service.



Suppose, a sender wants to send data to the receiver. Then, first, the sender sends a request packet to a receiver in the form of an **SYN** packet. After that, the receiver responds to the sender's request with an (SYN-ACK) signal/packets. That represents the

confirmation is received by the receiver to start the communication between the sender and the receiver. Now a sender can send the message or data to the receiver.

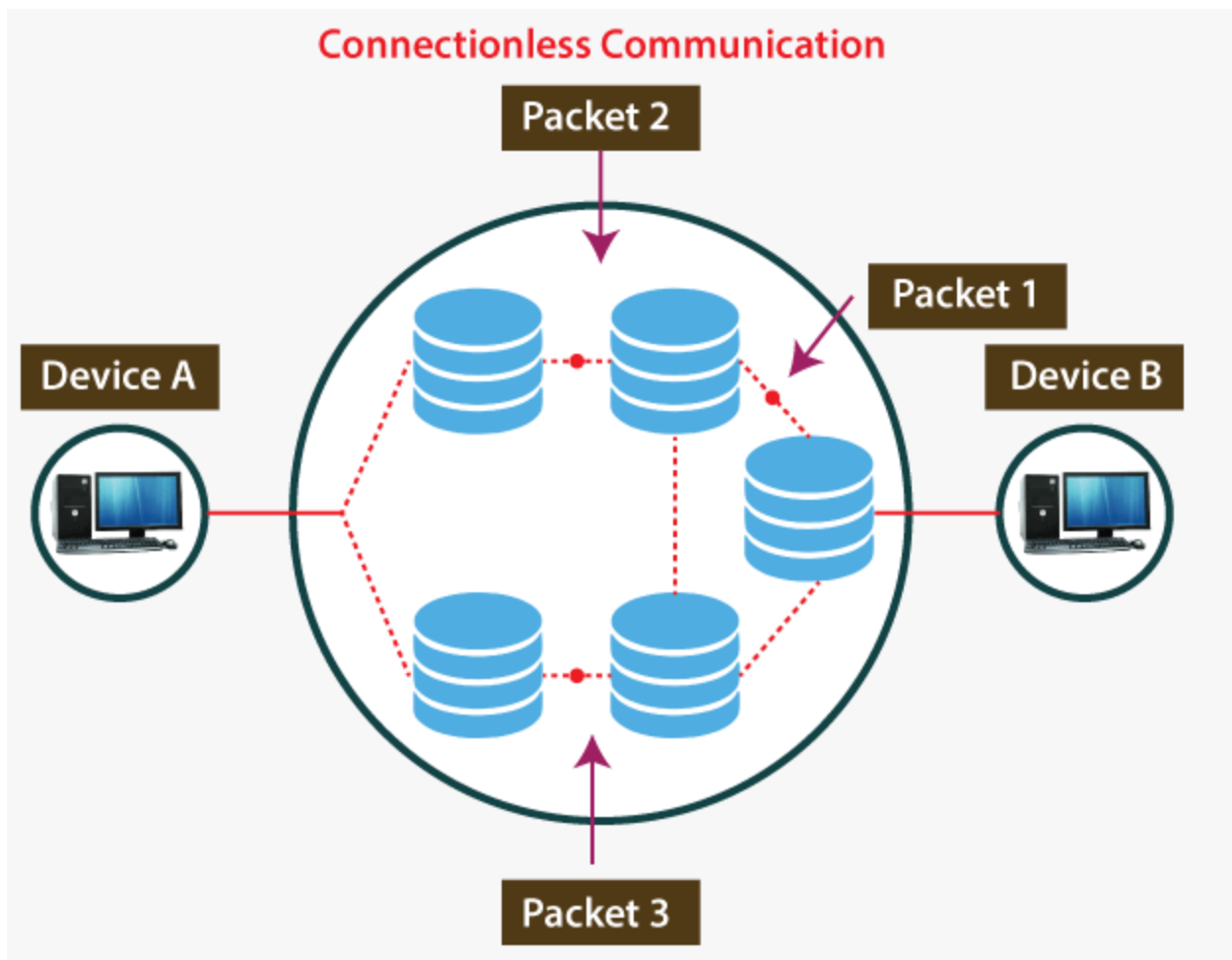
Similarly, a receiver can respond or send the data to the sender in the form of packets. After successfully exchanging or transmitting data, a sender can terminate the connection by sending a signal to the receiver. In this way, we can say that it is a reliable network service.

## What is a TCP?

TCP (Transmission Control Protocol) is a connection-oriented protocol that allows communication between two or more computer devices by establishing connections in the same or different networks. It is the most important protocol that uses **internet protocol** to transfer the data from one end to another. Hence, it is sometimes referred to as TCP/IP. It ensures that the connection is established and maintained until the data packet is transferring between the sender and receiver is complete.

## Connectionless Service

A connection is similar to a **postal system**, in which each letter takes along different route paths from the source to the destination address. Connectionless service is used in the network system to transfer data from one end to another end without creating any connection. So it does not require establishing a connection before sending the data from the sender to the receiver. It is not a reliable network service because it does not guarantee the transfer of data packets to the receiver, and data packets can be received in any order to the receiver. Therefore we can say that the data packet does not follow a **defined** path. In connectionless service, the transmitted data packet is not received by the receiver due to network congestion, and the data may be lost.



For example, a sender can directly send any data to the receiver without establishing any connection because it is a connectionless service. Data sent by the sender will be in the packet or data streams containing the receiver's address. In connectionless service, the data can be travelled and received in any order. However, it does not guarantee to transfer of the packets to the right destination.

## What is UDP?

The UDP (User Datagram Protocol) is a connectionless protocol that allows communication between two or more devices without establishing any connection. In this protocol, a sender sends the data packets to the receiver that holds the destination address. A UDP does not ensure to deliver the data packets to the correct destination, and it does not generate any acknowledgment about the sender's data. Similarly, it does not acknowledge the receiver about the data. Hence, it is an unreliable protocol.

## Connection-Oriented vs Connectionless Service

S. No	Comparison Parameter	Connection-oriented Service	Connection Less Service
1.	Related System	It is designed and developed based on the telephone system.	It is service based on the postal system.
2.	Definition	It is used to create an end to end connection between the senders to the receiver before transmitting the data over the same or different network.	It is used to transfer the data packets between senders to the receiver without creating any connection.
3.	Virtual path	It creates a virtual path between the sender and the receiver.	It does not create any virtual connection or path between the sender and the receiver.
4.	Authentication	It requires authentication before transmitting the data packets to the receiver.	It does not require authentication before transferring data packets.

5.	Data Packets Path	All data packets are received in the same order as those sent by the sender.	Not all data packets are received in the same order as those sent by the sender.
6.	Bandwidth Requirement	It requires a higher bandwidth to transfer the data packets.	It requires low bandwidth to transfer the data packets.
7.	Data Reliability	It is a more reliable connection service because it guarantees data packets transfer from one end to the other end with a connection.	It is not a reliable connection service because it does not guarantee the transfer of data packets from one end to another for establishing a connection.
8.	Congestion	There is no congestion as it provides an end-to-end connection between sender and receiver during transmission of data.	There may be congestion due to not providing an end-to-end connection between the source and receiver to transmit of data packets.
9.	Examples	Transmission Control Protocol (TCP) is an example of a connection-oriented service.	User Datagram Protocol (UDP), Internet Protocol (IP), and Internet Control Message

			Protocol (ICMP) are examples of connectionless service.
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