

Network Services

Network services are associated with two main attributes:

- Whether a connection exists between the sender and the recipient.
- The reliability of the service.

The first attribute indicates whether the network service is **connection-oriented** or **connectionless**.

The second attribute indicates whether the service is **reliable** or **unreliable**.

Based on these attributes, a service may be:

- Connection-oriented and unreliable.
- Connectionless and unreliable.
- Connection-oriented and reliable.
- Connectionless and reliable.

Connection-Oriented and Unreliable Service

An example of a connection-oriented but unreliable service is real-time audio or video communication, such as a video call.

The service is connection-oriented because a session is established between the two devices before data is exchanged: the call is initiated, accepted and kept active until it ends.

However, the service may be considered unreliable because it does not necessarily guarantee the retransmission of every lost audio or video fragment.

In real-time communication, retransmitting data that arrives too late would be of little use. If a small audio packet is lost, the system may prefer to ignore it or compensate for it rather than interrupting the communication to recover it.

Connectionless and Unreliable Service

An example of a connectionless and unreliable service is the transmission of real-time location data in a mapping, delivery or tracking application.

The device periodically sends small location updates, for example: "I am at this location", followed a few seconds later by "I am now at this new location". Each update is independent of the others and is mainly useful at the moment when it is sent.

If one of these updates is lost, the system may not retransmit it because more recent information will arrive shortly afterwards. In this case, receiving the updated location quickly is more useful than recovering an outdated one.

Connection-Oriented and Reliable Service

An example of a connection-oriented and reliable service is uploading a file to a cloud service such as Google Drive or Dropbox.

When we upload a file, our device establishes a logical connection with the service's server.

During the transfer, the data is sent in a controlled manner so that the server can receive it correctly.

This service is reliable because the file must arrive complete and intact.

If part of the data is lost or arrives incorrectly, the system must detect the problem and retransmit the missing information. Otherwise, the file may be damaged or impossible to open.

Connectionless and Reliable Service

An example of a connectionless and reliable service is the transmission of an important notification from an application, such as a banking notification or delivery notification.

The message can be sent as an independent unit: there is no need to maintain continuous communication between the sender and the recipient. Each notification contains the information required for it to be delivered to the correct device.

However, the service may be considered reliable because the system attempts to ensure that the notification is actually delivered.

To achieve this, it may use acknowledgements, retransmissions or temporary storage systems. If the device cannot be reached at that moment, the notification can be stored and sent as soon as the device comes back online.

Connection

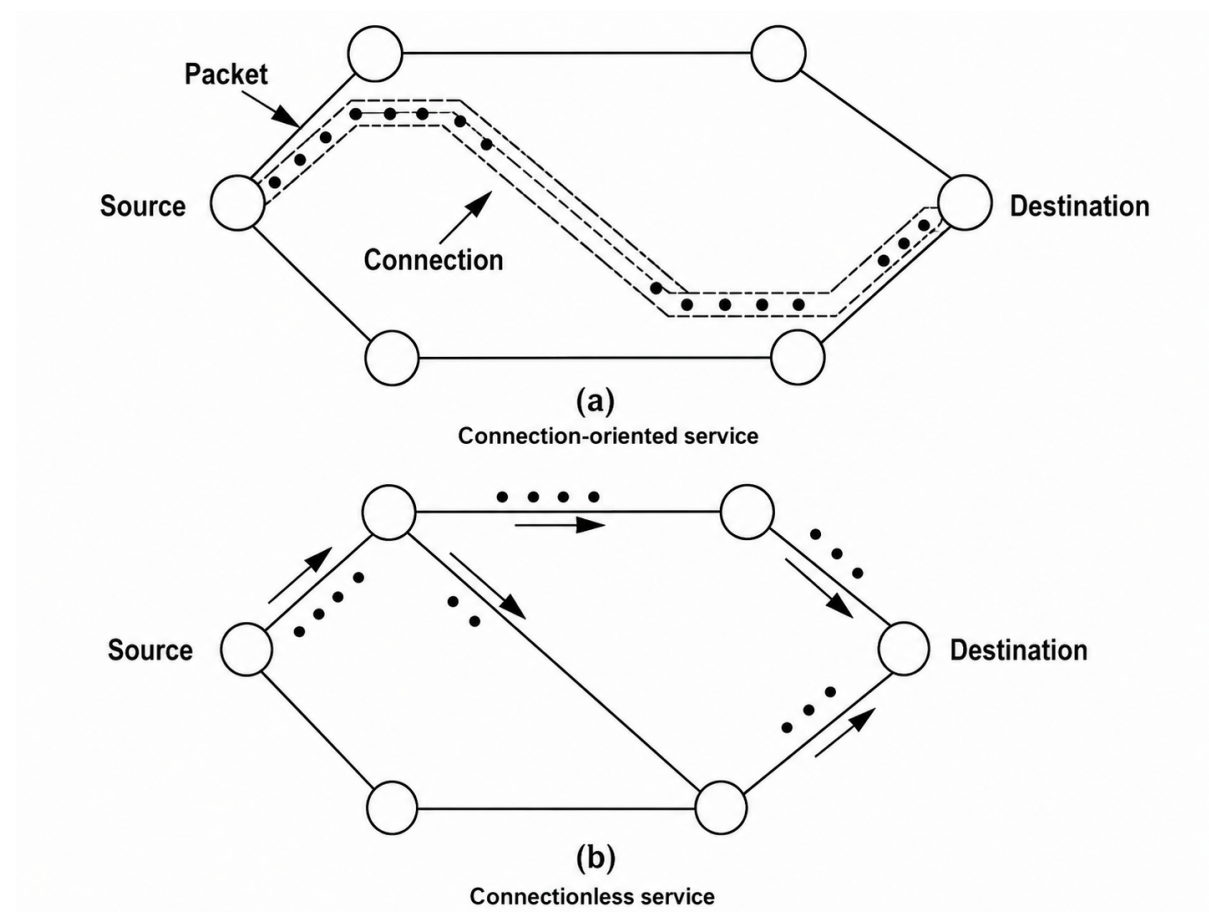
Connection-oriented services are similar in some respects to circuit switching: before data is exchanged, a logical connection is established between the sender and the recipient.

- A connection is established, creating a “communication channel” between the source and the destination by suitable means. This process typically involves several computers along the path between the source and the destination.
- Once established, the connection acts like a digital pipe through which all transmitted data flows. The data arrives in the same order in which it was sent.
- When communication ends, the connection is released. This process once again involves the computers located along the path.

By contrast, **connectionless services** are modelled on the postal system: each letter travels independently of the others. It arrives when it arrives, and it may not arrive at all.

Furthermore, two letters with the same sender and recipient may follow different routes.

In the image below, the upper diagram represents a connection-oriented service, while the lower diagram represents a connectionless service.



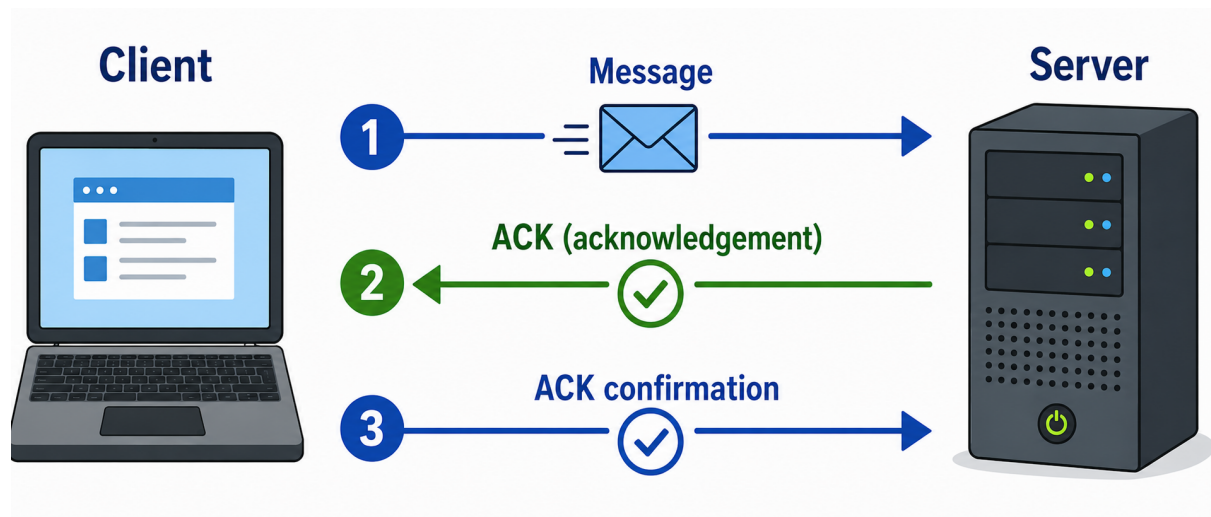
Above: a connection-oriented service. Below: a connectionless service

Reliability

A service is generally classified as either **reliable** or **unreliable**.

A reliable service attempts to ensure that data arrives complete, correct and in the expected order. To achieve this, it uses acknowledgements, error checking and, when necessary, retransmissions.

A reliable service generally requires the receiver to send an **acknowledgement**, or **ACK**, to the source for each packet received.



The image shows an example of a reliable service: whenever a client sends a message, it must receive an acknowledgement from the server. The server must in turn receive confirmation that its previous acknowledgement was received

This reliability introduces **overhead** because ensuring reliable communication requires additional processing and network resources. In some situations, this may not be desirable—for example, in a real-time application such as video streaming.

By contrast, an **unreliable service** does not guarantee that specific data will actually reach its destination.