

Transport Layer

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Lecture 8: Transport Layer

Transport-Layer Services

- 1) Process-to-Process Communication.
 - A process is an application-layer entity (running program) that uses the services of the transport layer.
 - Processes are addressed using Port Numbers.
 - Port Number are three types:
 - *Well-known ports*. The ports ranging from 0 to 1023 are assigned to standard protocols.
 - *Registered ports*. The ports ranging from 1024 to 49,151. They can only be registered some applications.
 - *Dynamic ports*. The ports ranging from 49,152 to 65,535. They can be used as temporary port numbers for any client.

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Transport-Layer Services

- Multiplexing and Demultiplexing
 - Whenever an entity accepts items from more than one source, this is referred to as *multiplexing* (many to one); whenever an entity delivers items to more than one source, this is referred to as *demultiplexing* (one to many).
- 3) Flow Control
 - refers to reducing sending speed according to receiver request.
- 4) Congestion Control
 - refers to reducing the sending speed according to message loss or timeout.

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TRANSPORT-LAYER PROTOCOLS

- There are two transport layer protocols:
 - TCP and UDP
- TCP can work in two modes:
 - Stop-and-Wait Protocol
 - In this mode a protocol sends a message and waits until the Acknowledgement comes from the receiver.
 - Pipelining
 - In this mode a protocol sends group of messages (called window) and waits for one a Acknowledgement (Accumulative Acknowledgement)

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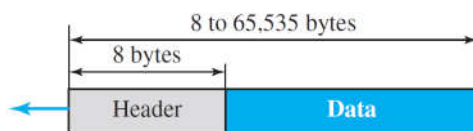
TCP vs UDP

TCP	UDP
TCP = Transmission Control Protocol	UDP= User Datagram Protocol
Connection Oriented Protocol: before sending a message it opens a connection.	Connectionless Protocol: sends a datagram without opening connection.
Reliable: when any message lost, TCP resend it.	Unreliable: when any datagram lost no resend.
TCP Header = 20bytes	UDP Header = 8bytes
Suitable for data transfer applications.	Suitable for voice and video applications.

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UDP Header

User datagram packet format



a. UDP user datagram



b. Header format

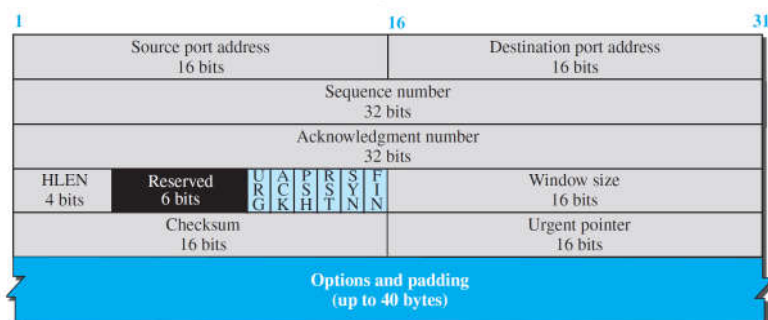
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TCP Header

TCP segment format



a. Segment

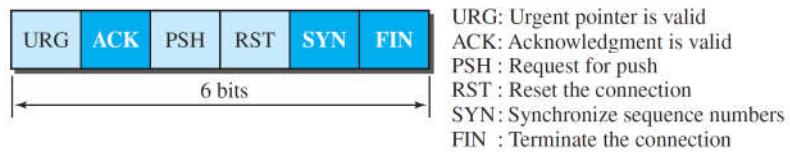


b. Header

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TCP Control Field

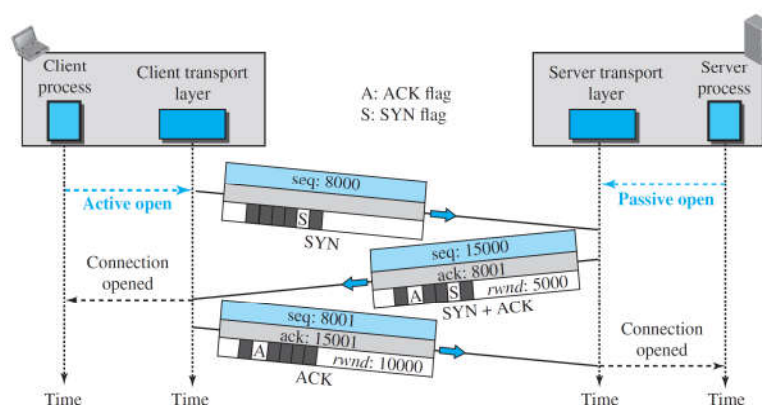
Control field



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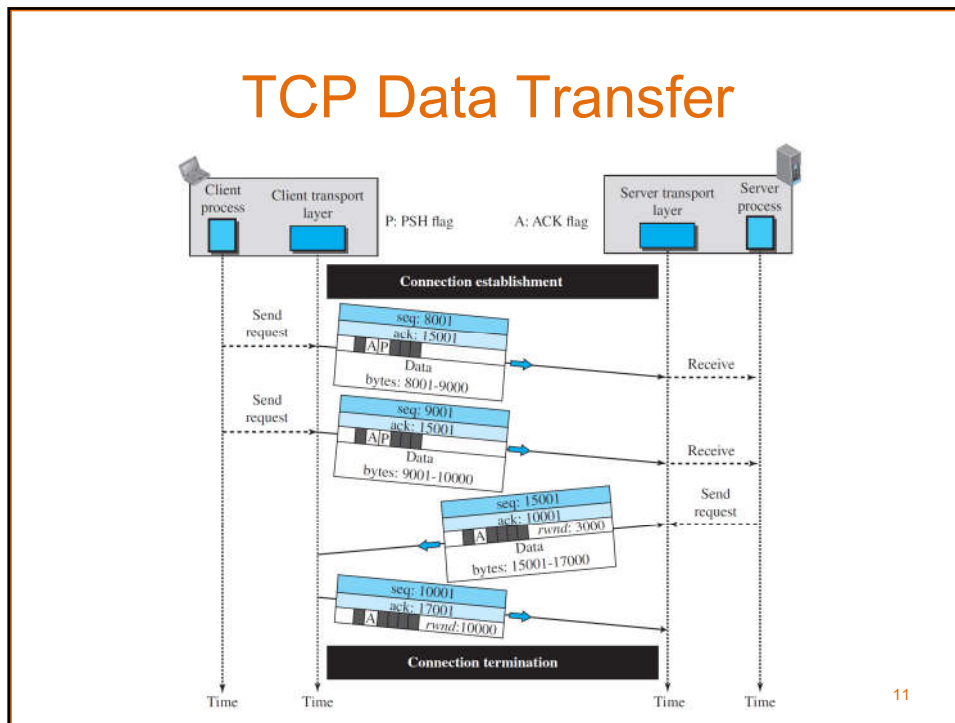
TCP Connection

Connection establishment using three-way handshaking



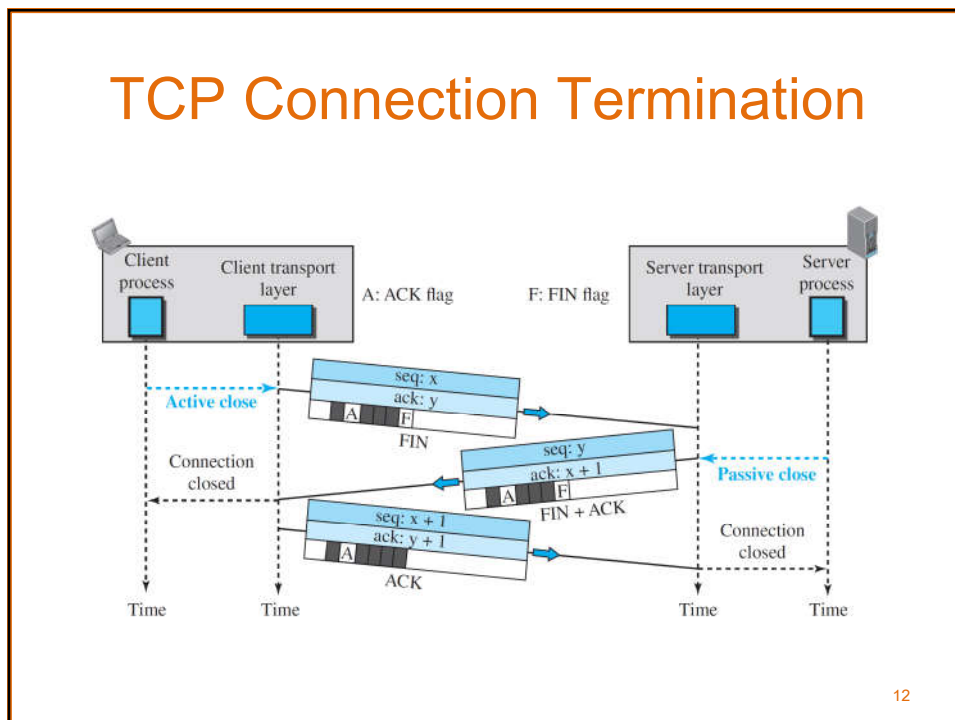
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TCP Data Transfer



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TCP Connection Termination



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TCP Congestion Control

TCP uses different policies to handle the congestion in the network.

- 1) If TCP received un expected Acknowledgement (ACK), then TCP reduces its window size (speed) to $\frac{1}{2}$.
- 2) If TCP received no ACK and timeout reached then TCP reduces its window size (speed) to 1.

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Thank You

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