Computer Networks

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**Lect_9**

Transport Layer
L4

Recap from Lect_2: Transport Layer

- This layer focuses on data delivery between the two endpoint hosts, providing reliable data transfer services to the upper layers. (for example, error recovery).
- The main objective of TCP and UDP is to secure reliable data transport across the network (i.e., from end to end).
- When data arrive to transport layer, three operations occur:
  1. Data segmentation.
  2. Addressing and sequencing.
  3. Error detection.
- The protocols that responsible for the previous tasks in transport layers are:
  - TCP (Transmission Control Layer).
  - UDP (User Datagram Protocol).

Recap from Lect_2: Transport Layer
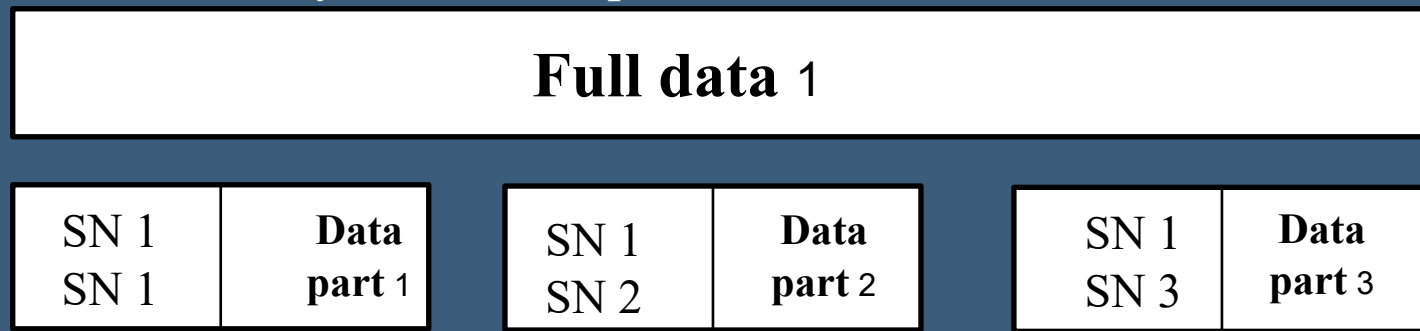
1. Data segmentation
   - When different data types are send, then each data type is divided into small parte called **data parts** , the size of each part is 1460 byte.

Full data 1

Data part 1 1460 byte	Data part 2 1460 byte	Data part 3 1460 byte
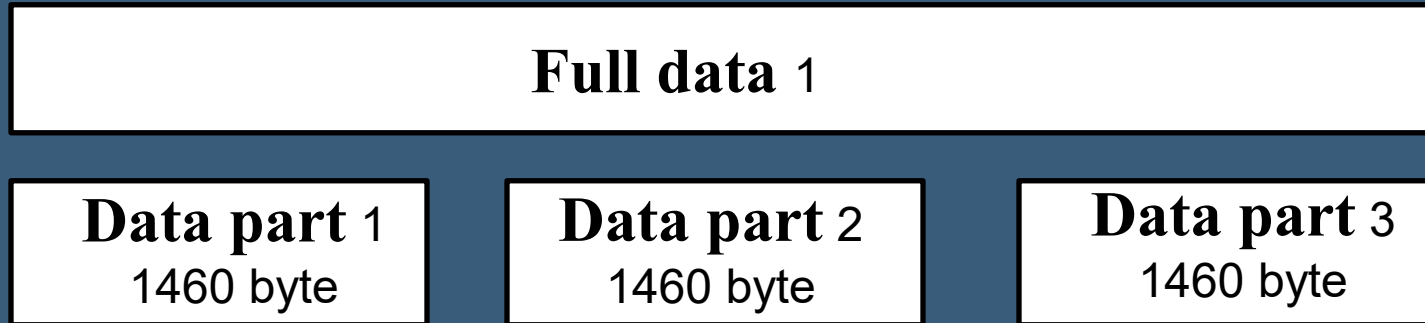
2. Addressing and sequencing
   - In this stage, a header is added to each data part; 4 byte called session number and 4 byte called sequence number.

Full data 1

SN 1 SN 1	Data part 1	SN 1 SN 2	Data part 2	SN 1 SN 3	Data part 3

Recap from Lect_2: Transport Layer

Full data 1		

SN 1 SN 1	**Data part** 1		SN 1 SN 2	**Data part** 2		SN 1 SN 3	**Data part** 3

Full data 2		

SN 2 SN 1	**Data part** 1		SN 2 SN 2	**Data part** 2		SN 2 SN 3	**Data part** 3

Recap from Lect_2: Transport Layer

3. Error Detection
    ➢ In this stage, data part, session number and sequence number are compressed into **Cyclic Redundancy Check (CRC)** which has 2 byte size.
    ➢ CRC is used to insure reliable data transport across the network.
    ➢ Each data part with session number, sequence number and CRC is called **segment**

Full data 1

SN 1 SN 1 CRC	**Data part** 1		SN 1 SN 2 CRC	**Data part** 2		SN 1 SN 3 CRC	**Data part** 3

Segment   Segment   Segment
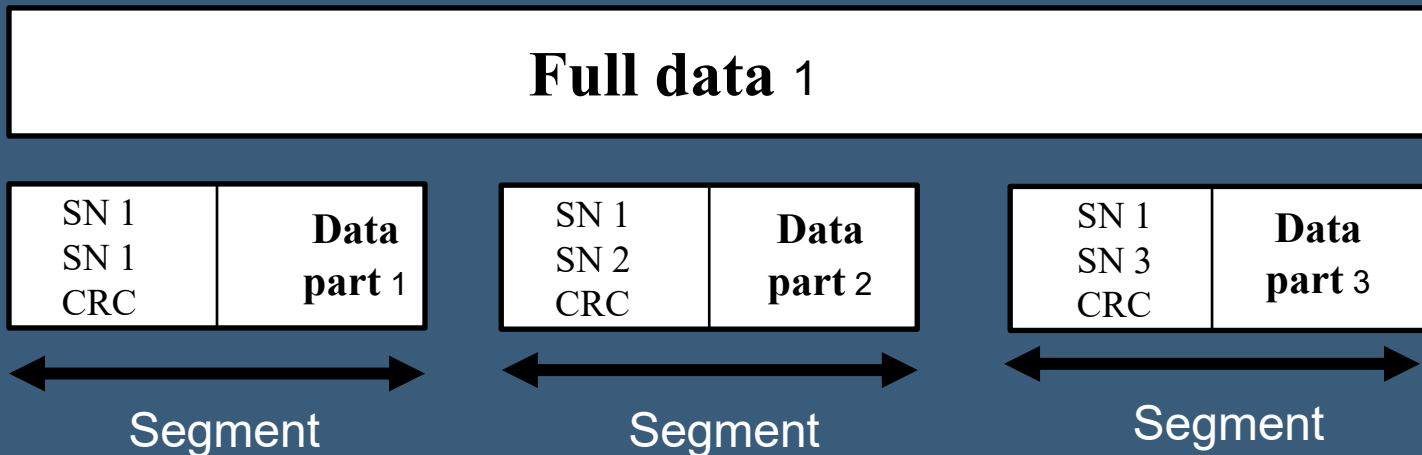
Transport Layer

➢ Transport Layer's tasks include:-
1. Segmenting (data part + header + tail) and de segmenting data before and after it's transported across the network (The transport layer PDU is <u>segment</u> or <u>TCP segment</u>).
2. In case of occurring error while transmitting, transport layer can do the following:-
   1. Error detection, by using User Datagram Protocol (UDP). Un reliable delivery of data.
   2. Error detection and error correction, by using Transmission Control Protocol (TCP). Reliable delivery of data.
3. Addressing by using logical address called port number address (16 bits = 2 byte).

Transport Layer

➢ **What is a port?**

- A port is a virtual point where network connections start and end.

- Ports are software-based and managed by a computer's operating system.

- Each port is associated with a specific process or service.

- Ports allow computers to easily differentiate between different kinds of traffic: emails go to a different port than webpages, for instance, even though both reach a computer over the same Internet connection.

Port Address

➢ Port numbers are numerical values that is assigned to an application in an endpoint of communication.

➢ It used to identify a particular process executing in the device.

Port address 16 bits
0 - 65535

0-1023

- **Well known addresses (ports) assigned to common protocols and services.**

EX:-

   HTTP has port no 80

   FTP has port no 20, 21

   SMTP has port no 25

   POP3 has port no 110

   DHCP has port no 67

   DNS has port 53

   …

1024 - 65535

- **Un registered numbers, used by users (hosts) as session no.**

UDP and TCP

➢ The transport layer is responsible for the actual connection between end devices, where it can provide both reliable and un reliable delivery of data:-

1. For reliable connection, the transport layer is responsible for error detection and correction: when an error is detected, the transport layer will respond the data, thus providing the correction.

   (This is done using Transport Control Protocol TCP)

2. For unreliable connections, the transport layer provides only error detection.

   (This is done using User Datagram Protocol UDP)

UDP

➢ User Datagram Protocol (UDP) is responsible for:-
   1. Data segmentation.
   2. Error detection (by using CRC).
   3. Addressing using port numbers
➢ UDP is considered:-
   ➢ Connectionless protocol
   ➢ Un reliable delivery protocol.

TCP

➢ Transmission Control Protocol (TCP) is responsible for:-

1. Data segmentation.
2. Error detection (by using CRC) and <u>Correction</u>.
3. Addressing using port numbers

➢ Error correction occur through the following steps:-

   ➢ Consider we have 5 segments

     1. Session establishment (3 – way handshake)

       ➢ In this stage an agreement between both end points occur concern DPORT, SPORT, and Window size.

       ➢ Window size tell the sender how much data it can receive right now, giving the receiving host a way to make the sending host slow down or speed up. The receiver can slide the window size up and down—called a sliding window or dynamic window—to change how much data the sending host can send.
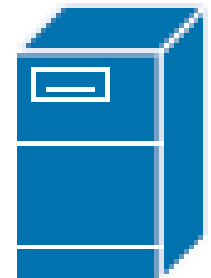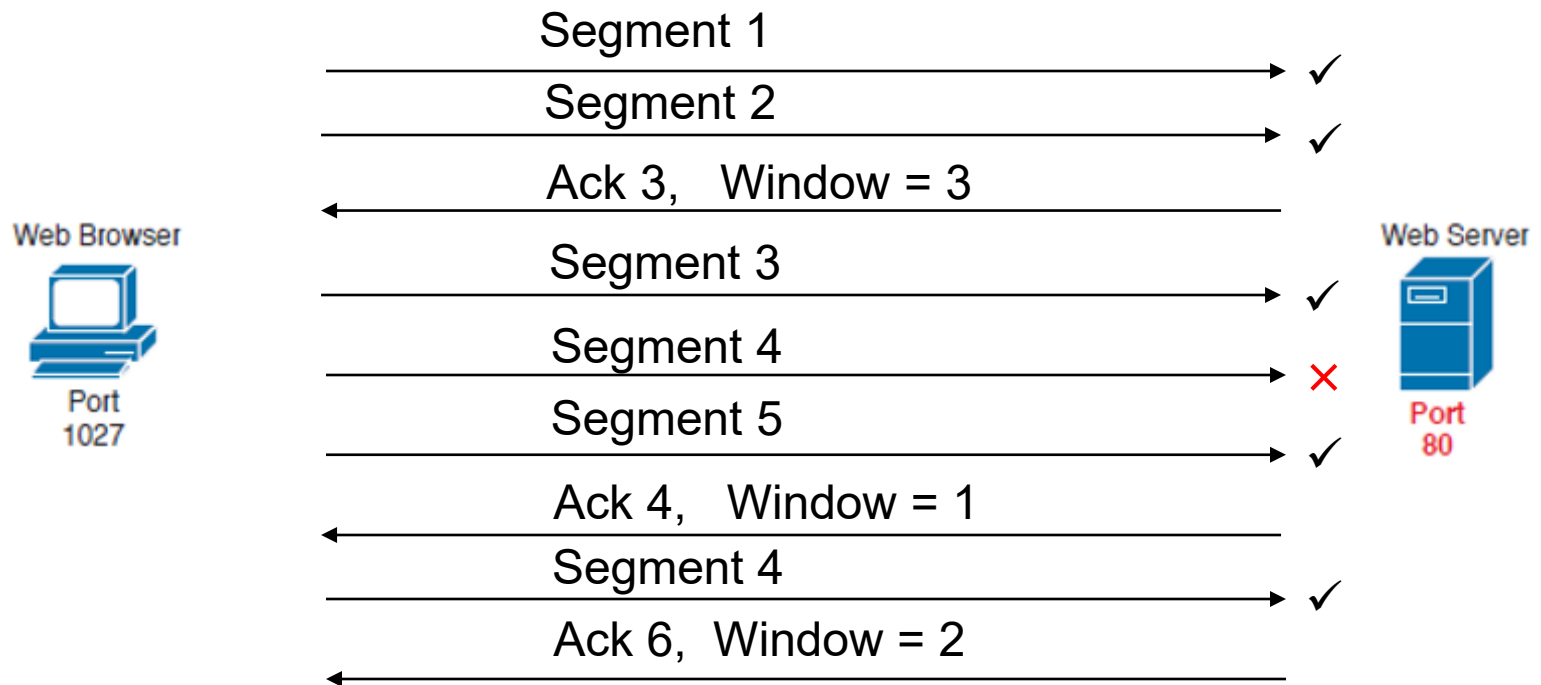
TCP

Figure 5-5   TCP Connection Establishment

TCP

2. Session management and control

TCP

2. Session termination (4 – Way handshake)

Figure 5-6 TCP Connection Termination
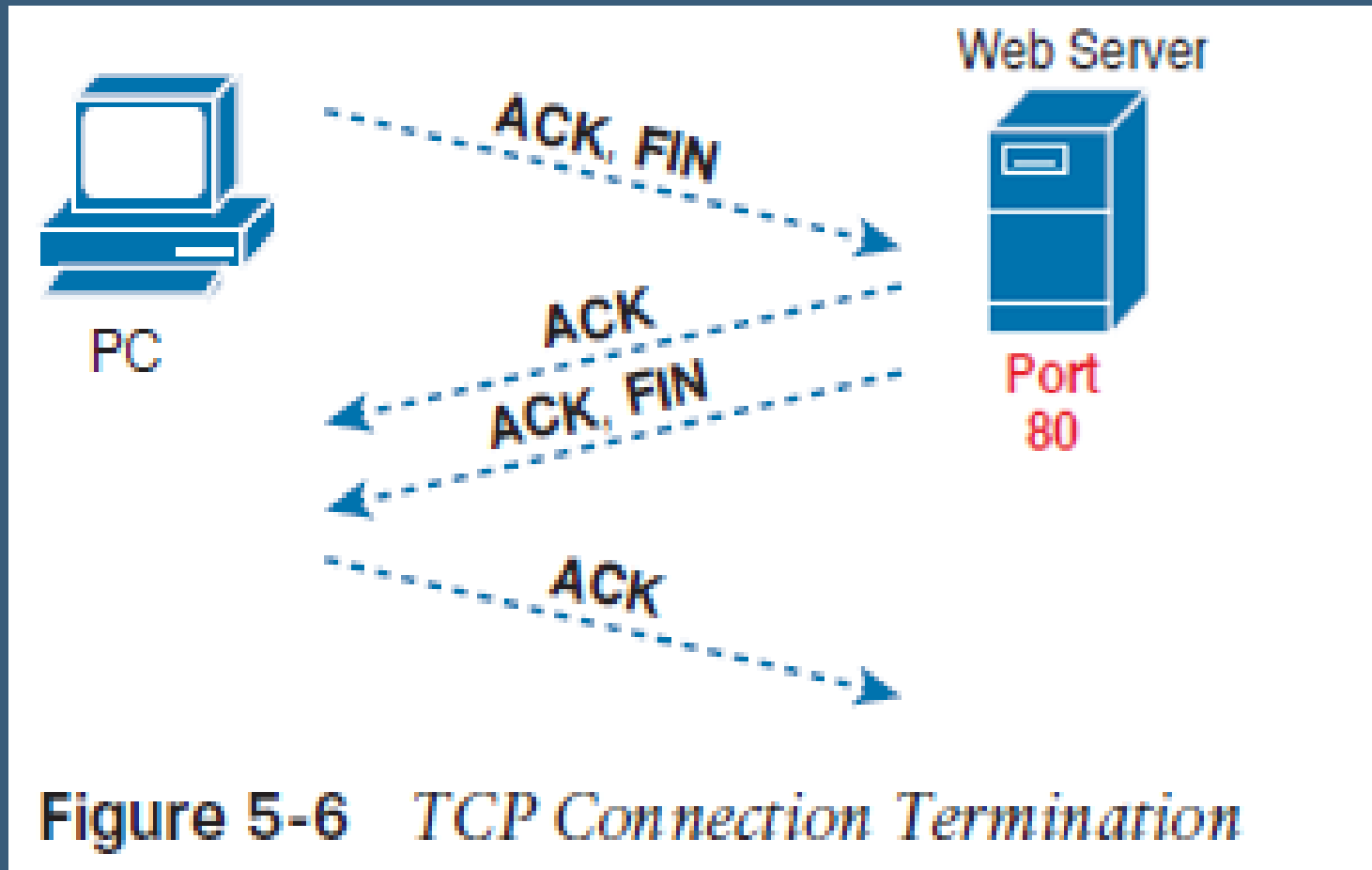
UDP vs TCP

1. From previous we can deduce the following:
   - ➤ UDP is a protocol that does not require an exchange of messages and does not require a pre-established correlation between endpoints.
   - ➤ Overall, UDP is a much faster and simpler; however, retransmission of lost data packets is only possible with TCP.

   - ➤ TCP is a protocol that requires an exchange of messages before data transfer begins, or that has a required a pre-established correlation between endpoints.
   - ➤ TCP is comparatively slower than UDP.

When to use TCP and UDP?

1. TCP is used in applications where reliability is more important than speed such as file upload and download (FTP), send and receive email (SMTP and POP3) and web browsing (HTTP and HTTPs).
    - ➢ FTP
    - ➢ SMTP
    - ➢ POP3
    - ➢ HTTP
    - ➢ HTTPs

2. UDP is used in applications where speed is more important such as video conferencing, live streaming and online gaming.
    - ➢ DHCP
    - ➢ DNS

When to use TCP and UDP?

➢ The service user does not play a role in determining the type of protocol (TCP or UDP) used with the application or service he needs. Only the company providing this service or the manufacturer of this application determines the type of protocol. You are just a user.

SEPARATOR TEXT GOES HERE

THANK YOU

For any questions feel free
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