Computer Networks

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Transport Layer

- Central piece of network architecture

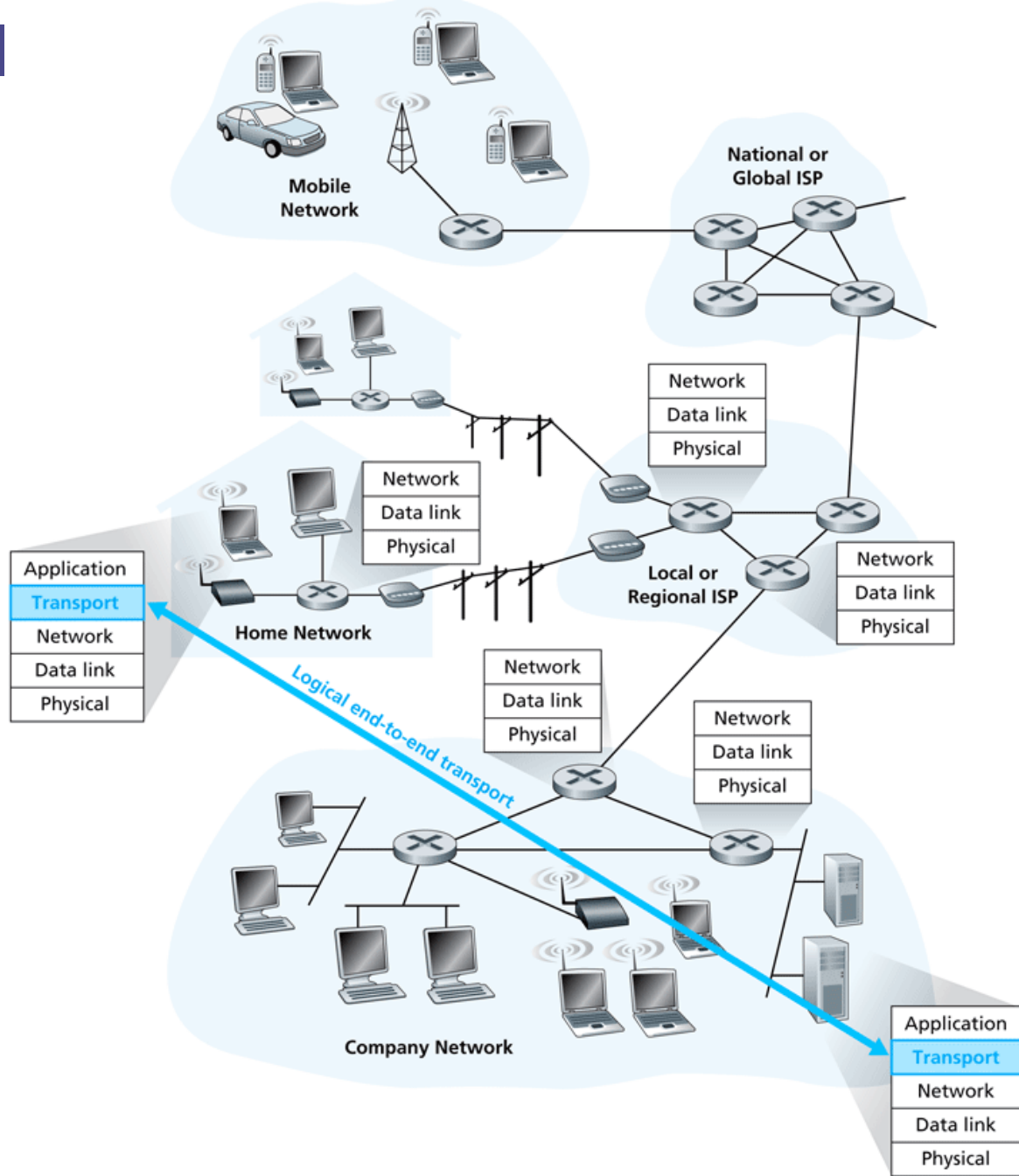- Provides communication services

- Logical communications

Figure 3.1 ♦ The transport layer provides logical rather than physical communication between application processes.

Transport vs. Network

- Transport - Processes
- Network - Hosts
- Postal Service

- **What is the PDU for the transport layer?**

  1. Packet
  2. Datagram
  3. Message
  4. Segment
  5. Frame

Overview of Transport Layer

- ## User Datagram Protocol (UDP)
  - ☐ Unreliable
  - ☐ Connectionless

- ## Transmission Control Protocol (TCP)
  - ☐ Reliable
  - ☐ Connection Oriented

User Datagram Protocol - UDP

- Unreliable

- Connectionless

- Application programs utilizing UDP accepts full responsibility for packet reliability

Transmission Control Protocol - TCP

- Reliable, connection oriented

- Provides
  - Reliable packet delivery
  - Packet sequencing
  - Error control
  - Congestion control
  - Flow control

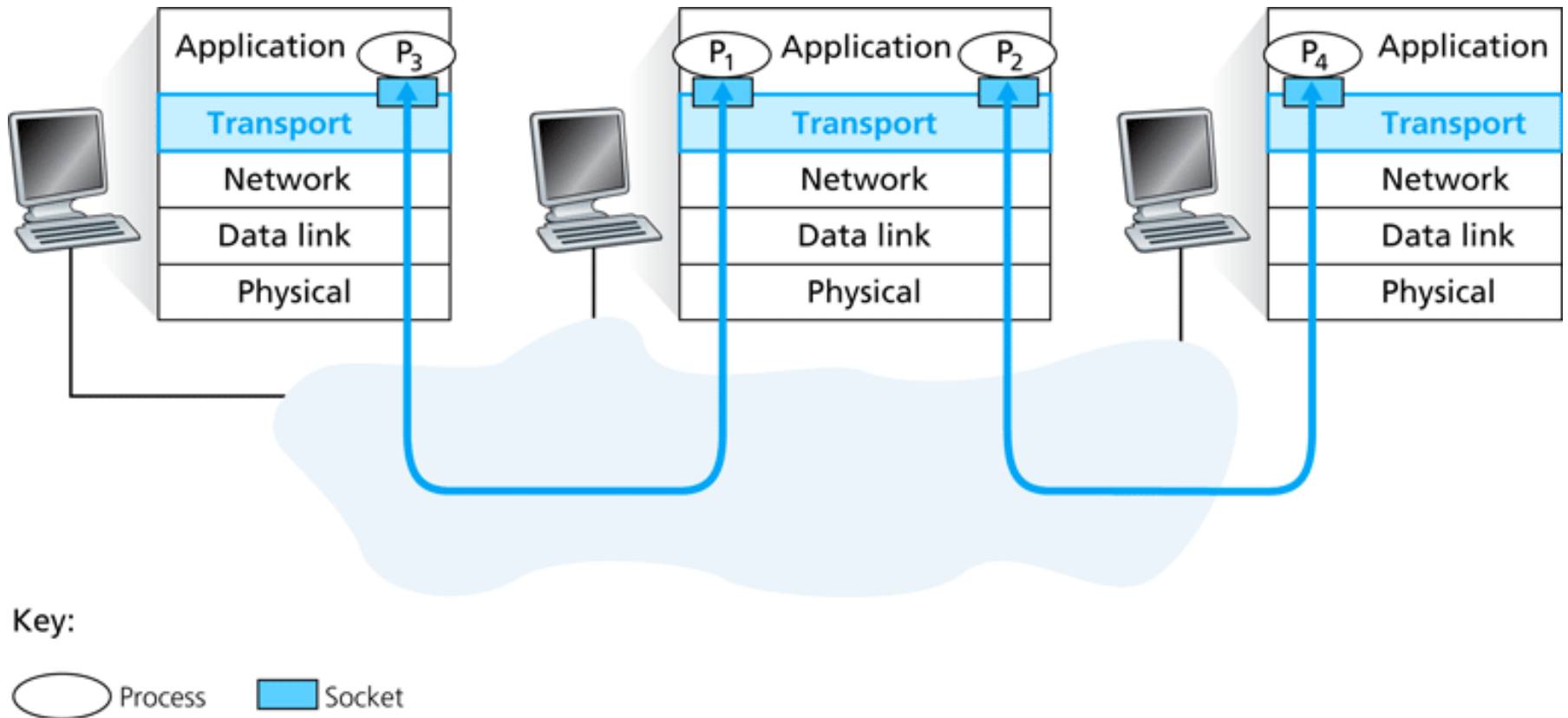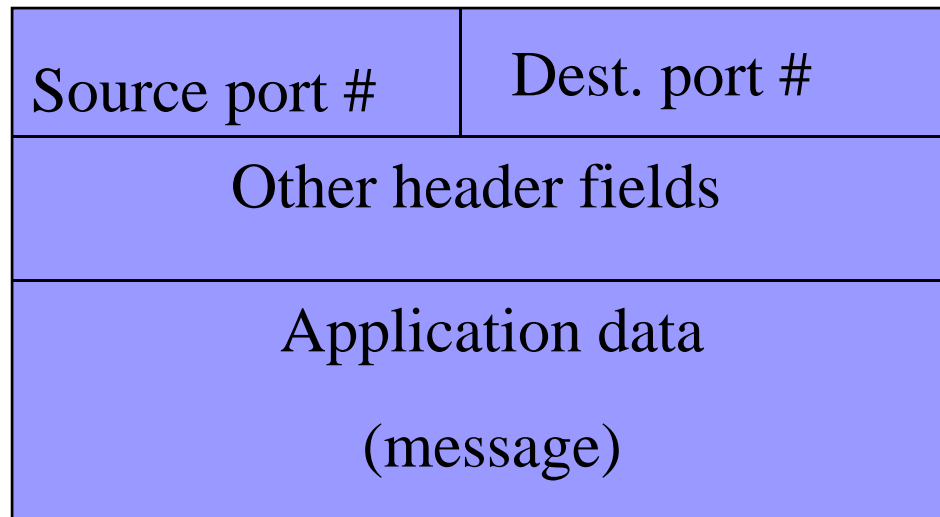# TRANSPORT PROTOCOLS OVERVIEW

Multiplexing / Demultiplexing

Key:

◯ Process   🟦 Socket
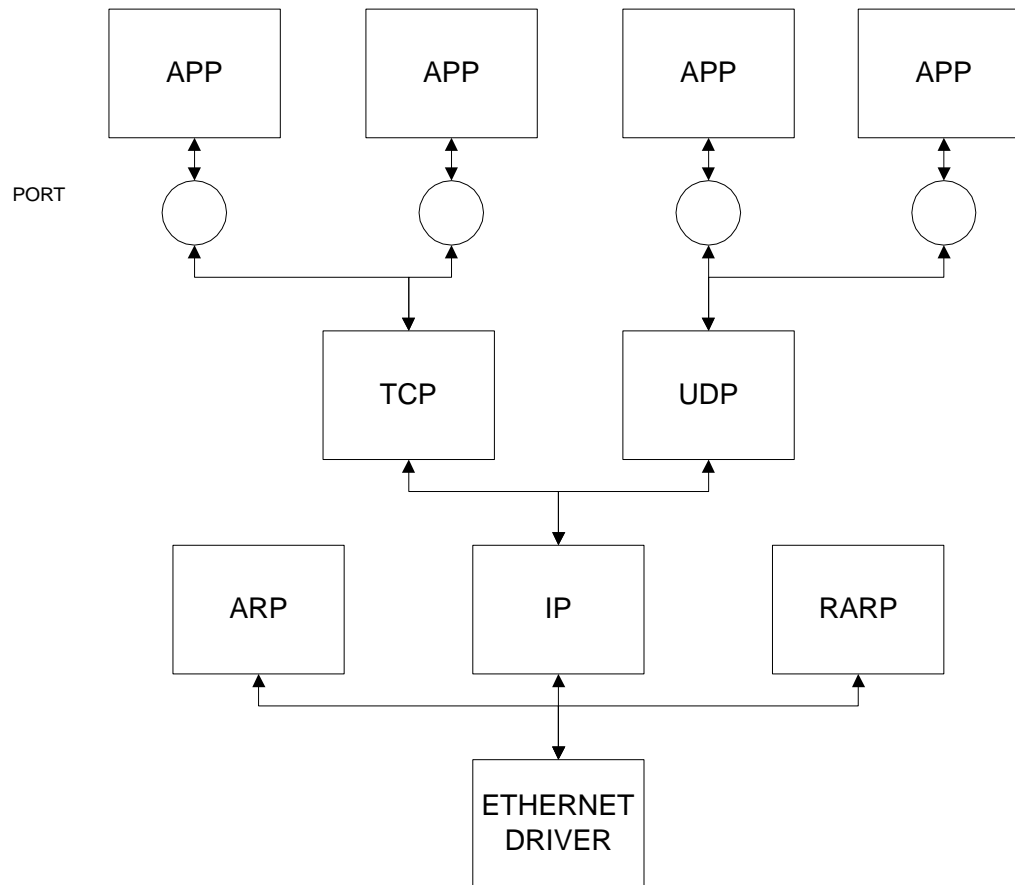
Figure 3.2 ♦ Transport-layer multiplexing and demultiplexing

Multiplexing/Demultiplexing

- Demultiplexing
- Multiplexing
- Port Numbers

Source port #	Dest. port #
Other header fields	
Application data (message)	

Port Numbers

- Which port number for an application?
    - Well-known port numbers
    - Send a request

- UDP Sockets
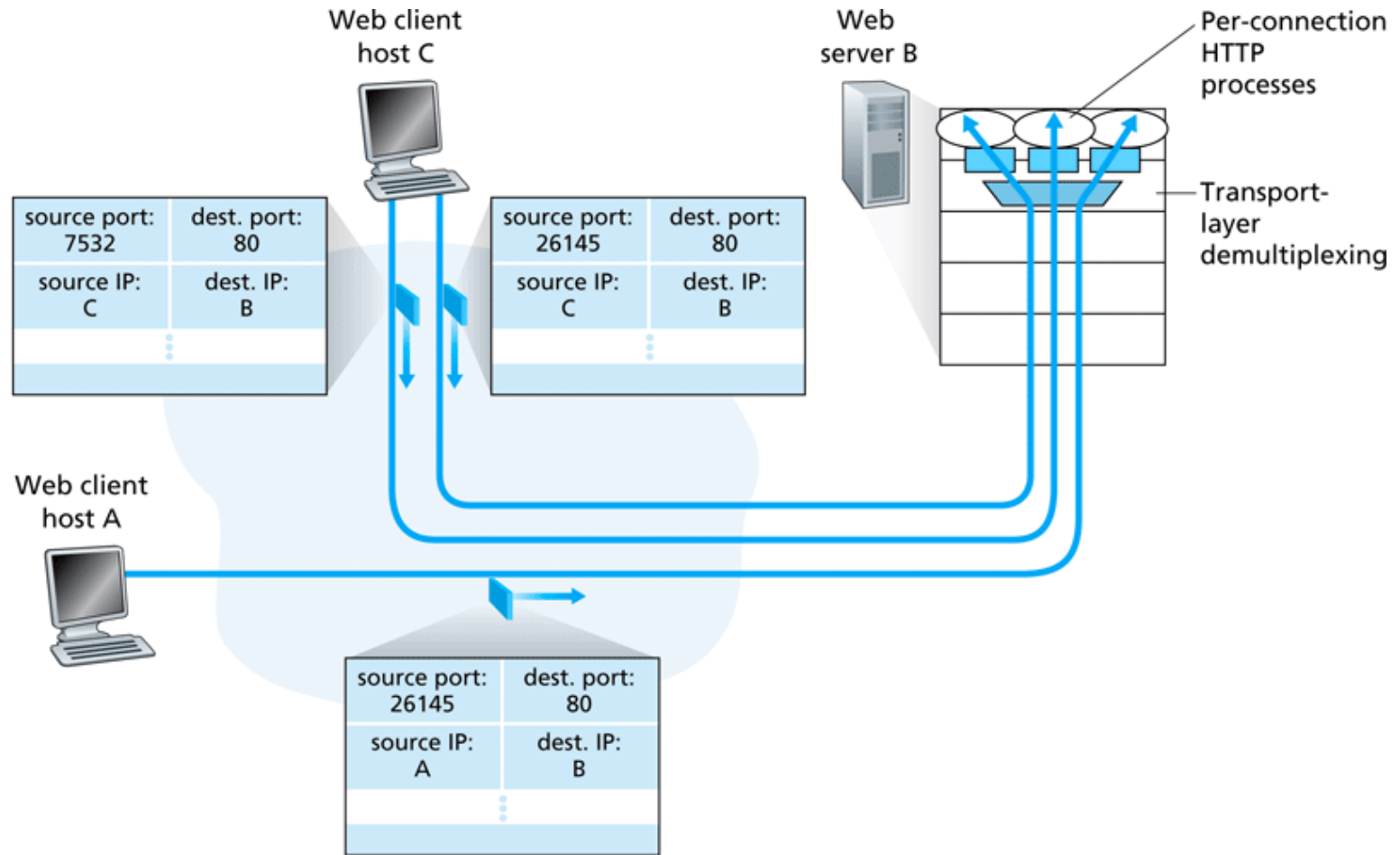- TCP Sockets

Example

Figure 3.5 ♦ Two clients, using the same destination port number (80) to communicate with the same Web server application

■ Consider a TCP connection between Host A and Host B. Suppose that the TCP segments traveling from Host A to Host B have source port number x and destination port number y. What are the source and destination port numbers for the segments traveling from Host B to Host A?

1. Source port number x and destination port number y
2. Source port number y and destination port number x
3. Not enough information

UDP OVERVIEW

- Basic service that passes individual messages to IP for transmission
  - ☐ Connectionless
  - ☐ Little overhead
  - ☐ Unreliable
- DNS
- UDP is appropriate at times. Why?
- What applications are suitable for UDP?

UDP Segment

32 bits

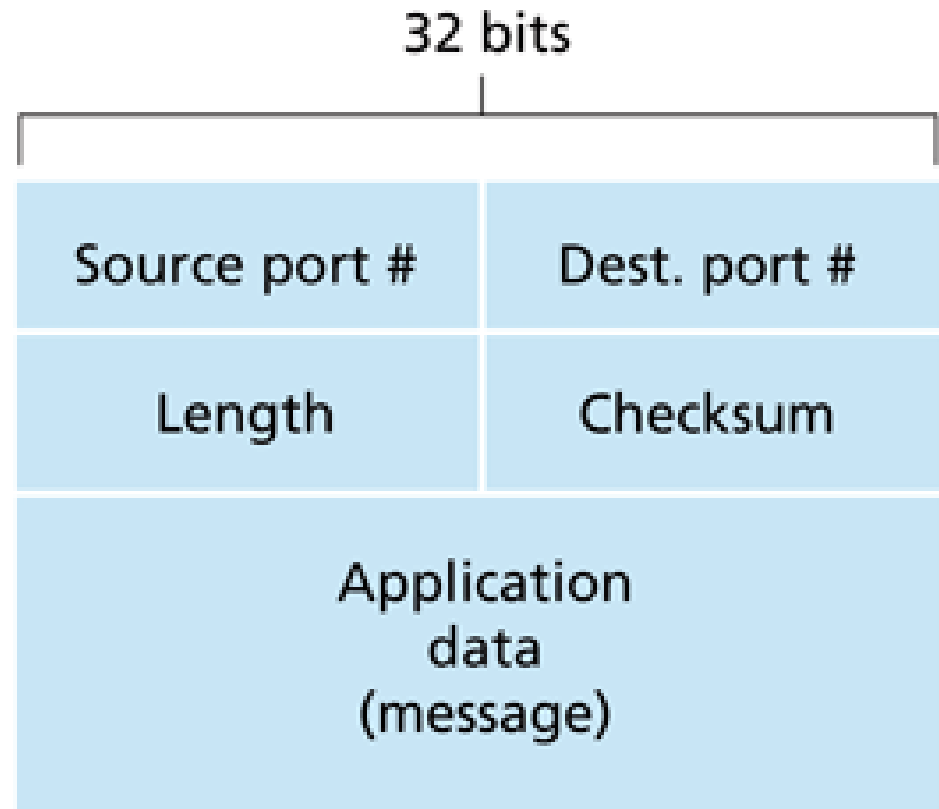| Source port #	Dest. port #
Length	Checksum
Application data (message)	

Figure 3.7 ♦ UDP segment structure

UDP CHECKSUM

- Prepends an IP pseudo-header to UDP
- Calculates the checksum with pseudo-header, UDP header and data
- Uses one's complement

Checksum Example

0110001011011100

1110000010111001

0001110101110011

1000110111000010

- Is it possible for an application to enjoy reliable data transfer even when the application runs over UDP?
  - Yes – true
  - No - false

■ Suppose you have the following three 8-bit bytes: 01010101, 01110000, 01001100. What is the 1s complement of the sum of these 8-bit bytes?

1. **1 1 1 0 1 1 1 1**
2. **1 1 1 0 1 1 1 0**
3. **1 1 1 0 1 1 0 1**
4. **1 1 1 0 0 1 1 0**