Transport Layer

Peter Levinsky, Roskilde IT

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Academy of Technologies and Business
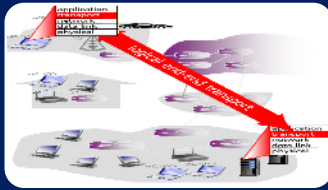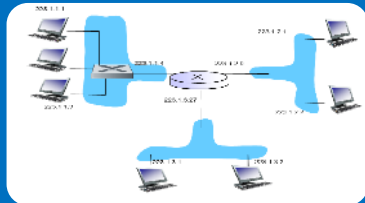
Transport level
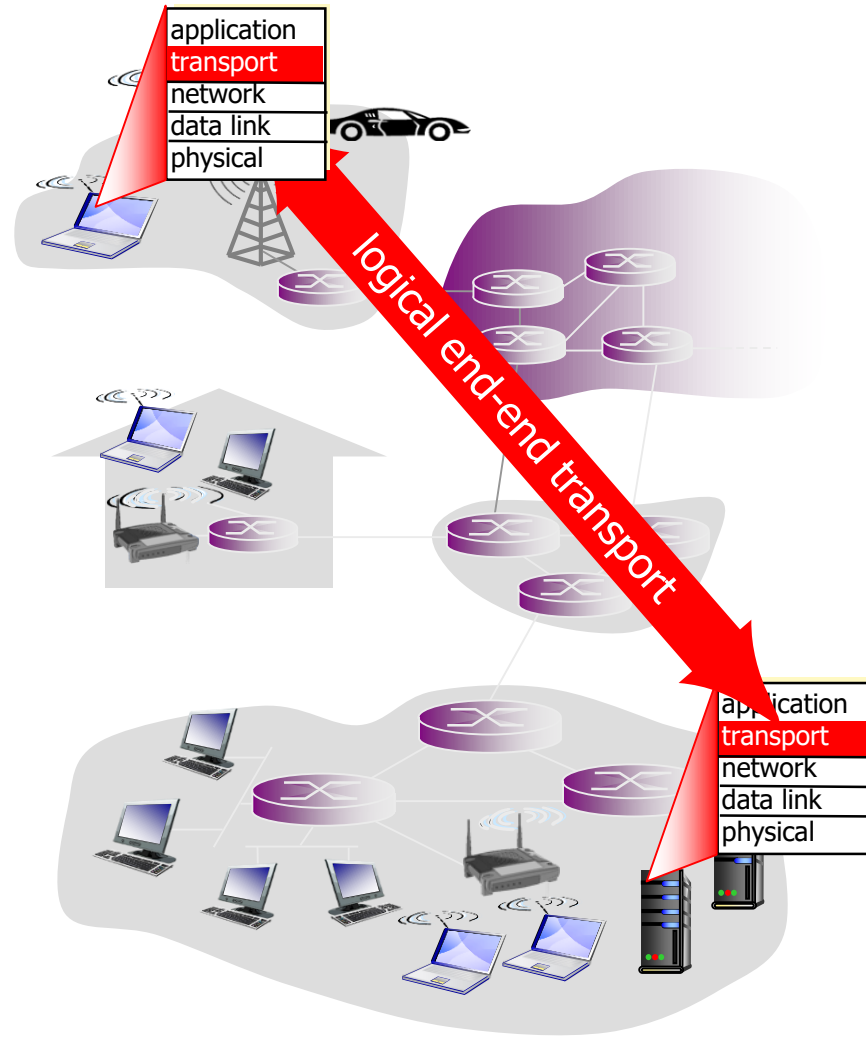
Protokol-stakken

Application

- Web (HTTP/HTTPS), Email, DNS, DHCP, FTP, ...

Transport

- TCP - reliable, connection oriented
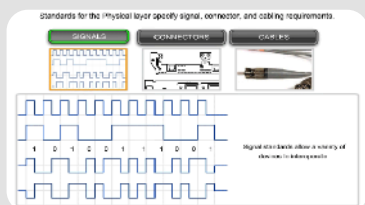- UDP - unreliable, connectionless

Network

- IP - IP-packets, unreliable
- IP-addresses

Datalink

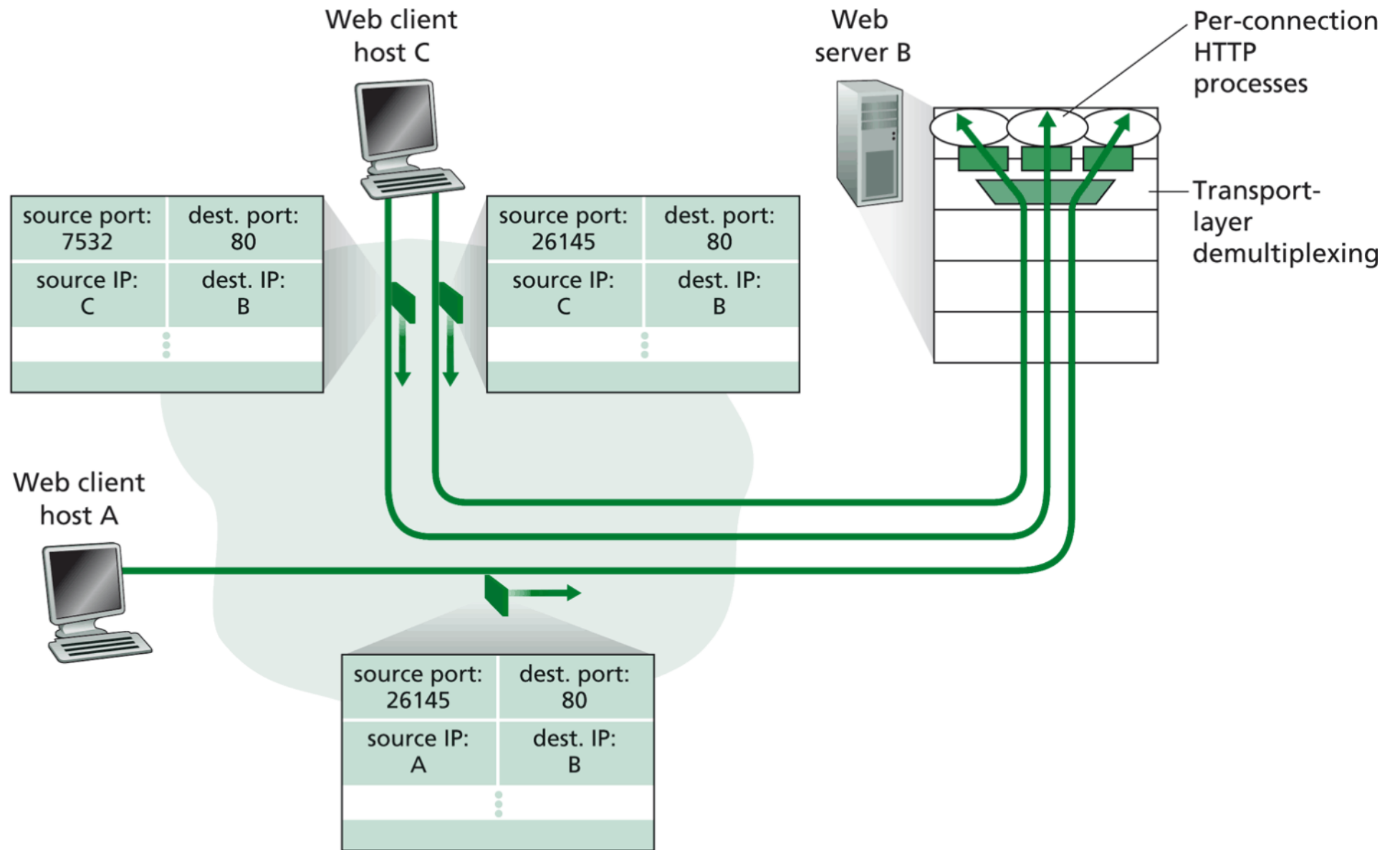- All kind of access - Wifi, Bluetooth, Ethernet, ...
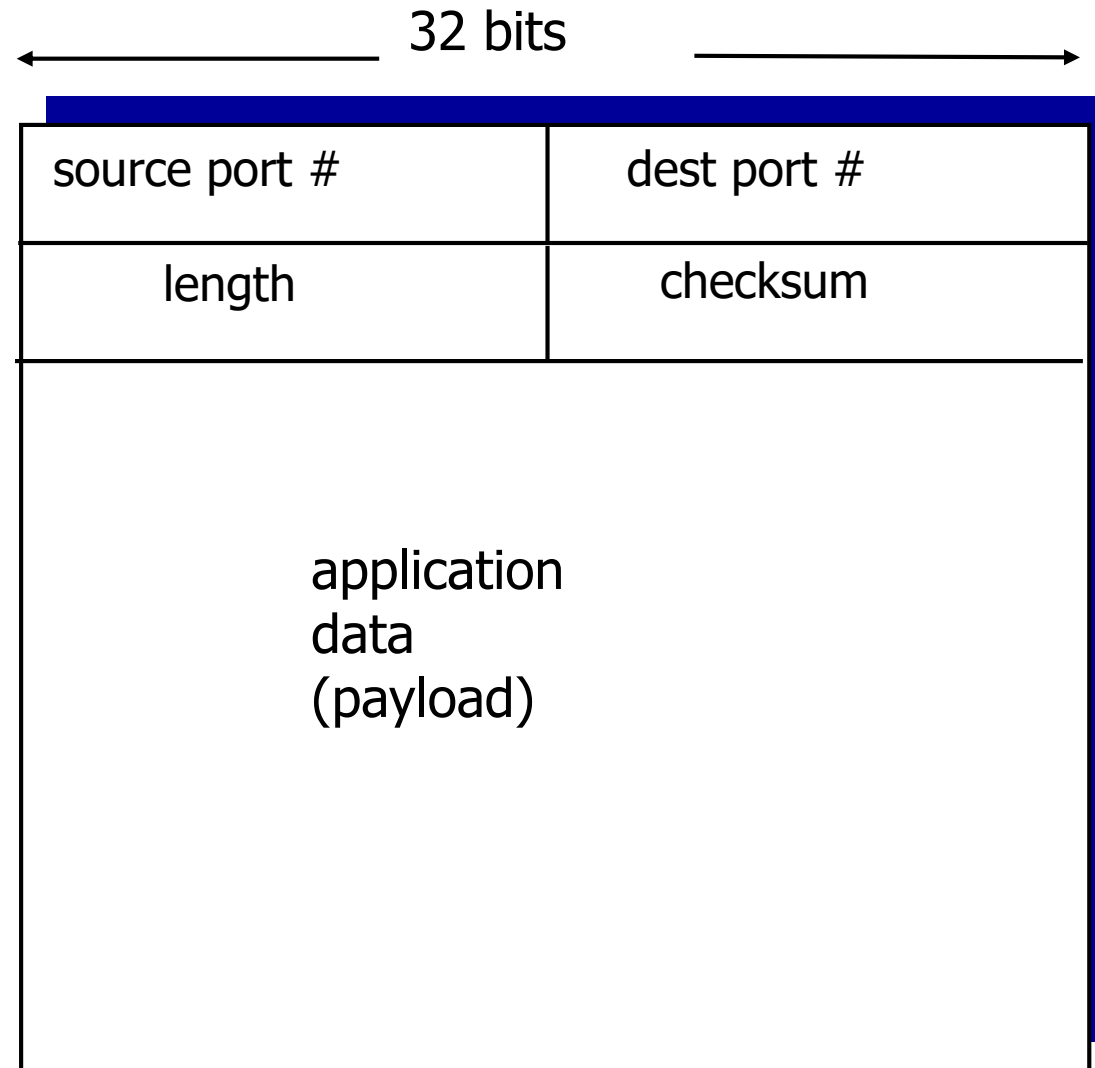- MAC-addresses

Physical

- Connectors
- Bit encoding/decoding

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

UDP: segment header

32 bits

source port #	dest port #
length	checksum
application data (payload)	

UDP segment format

Internet checksum: example

example: add two 16-bit integers

```
           1 1 1 0 0 1 1 0 0 1 1 0 0 1 1 0
           1 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1
         ─────────────────────────────────────
wraparound (1) 1 0 1 1 1 0 1 1 1 0 1 1 1 0 1 1
           ──────────────────────────────────────▶
         ─────────────────────────────────────
      sum    1 0 1 1 1 0 1 1 1 0 1 1 1 1 0 0
 checksum    0 1 0 0 0 1 0 0 0 1 0 0 0 0 1 1
```

Note: when adding numbers, a carryout from the most significant bit needs to be added to the result

TCP segment structure (TCP Header)

32 bits

source port #	dest port #
sequence number	
acknowledgement number	

head len	not used	U	A	P	R	S	F	receive window

checksum	Urg data pointer
options (variable length)	

application
data
(variable length)

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