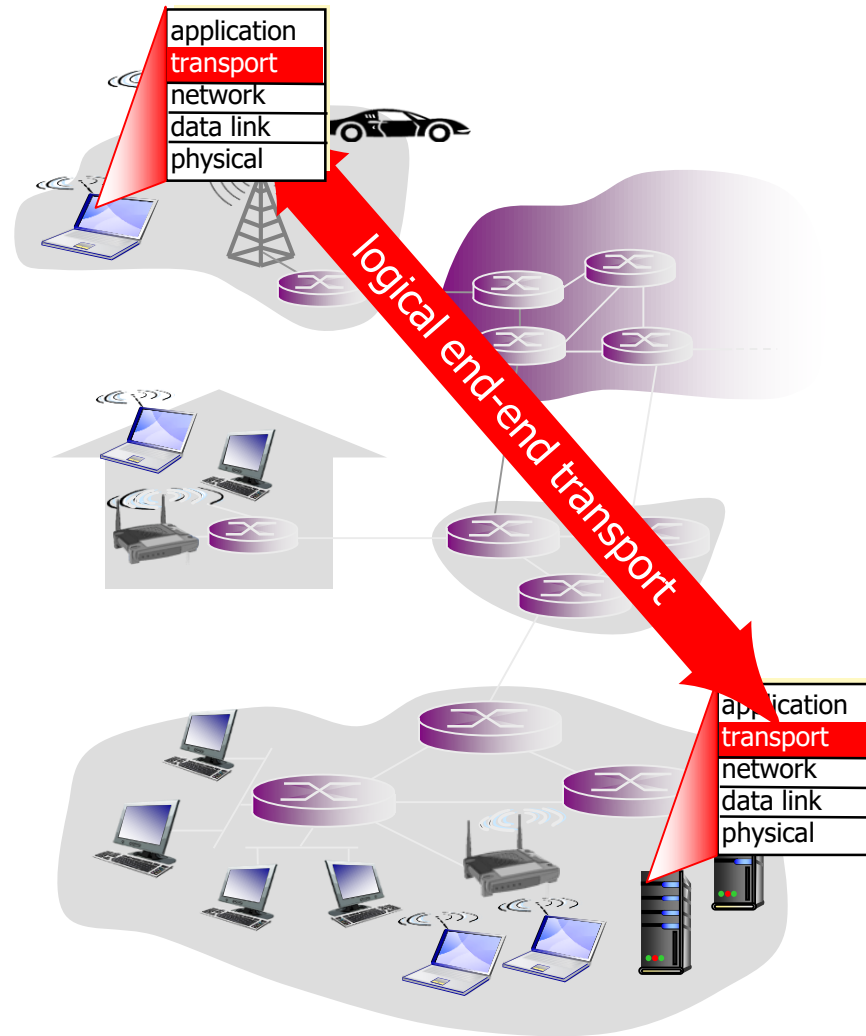


Transport Layer

Peler Levinsky, Roskilde IT

06.09.2023

Transport level



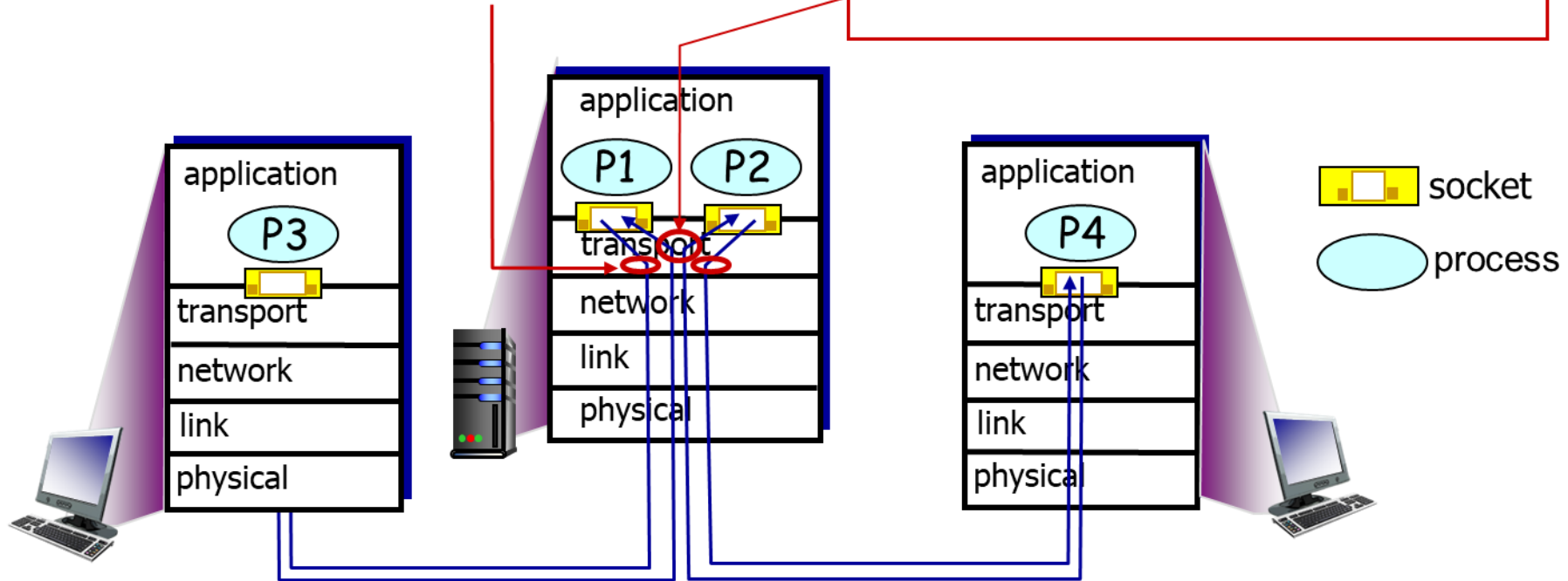
Multiplexing/demultiplexing

multiplexing at sender:

handle data from multiple sockets, add transport header (later used for demultiplexing)

demultiplexing at receiver:

use header info to deliver received segments to correct socket



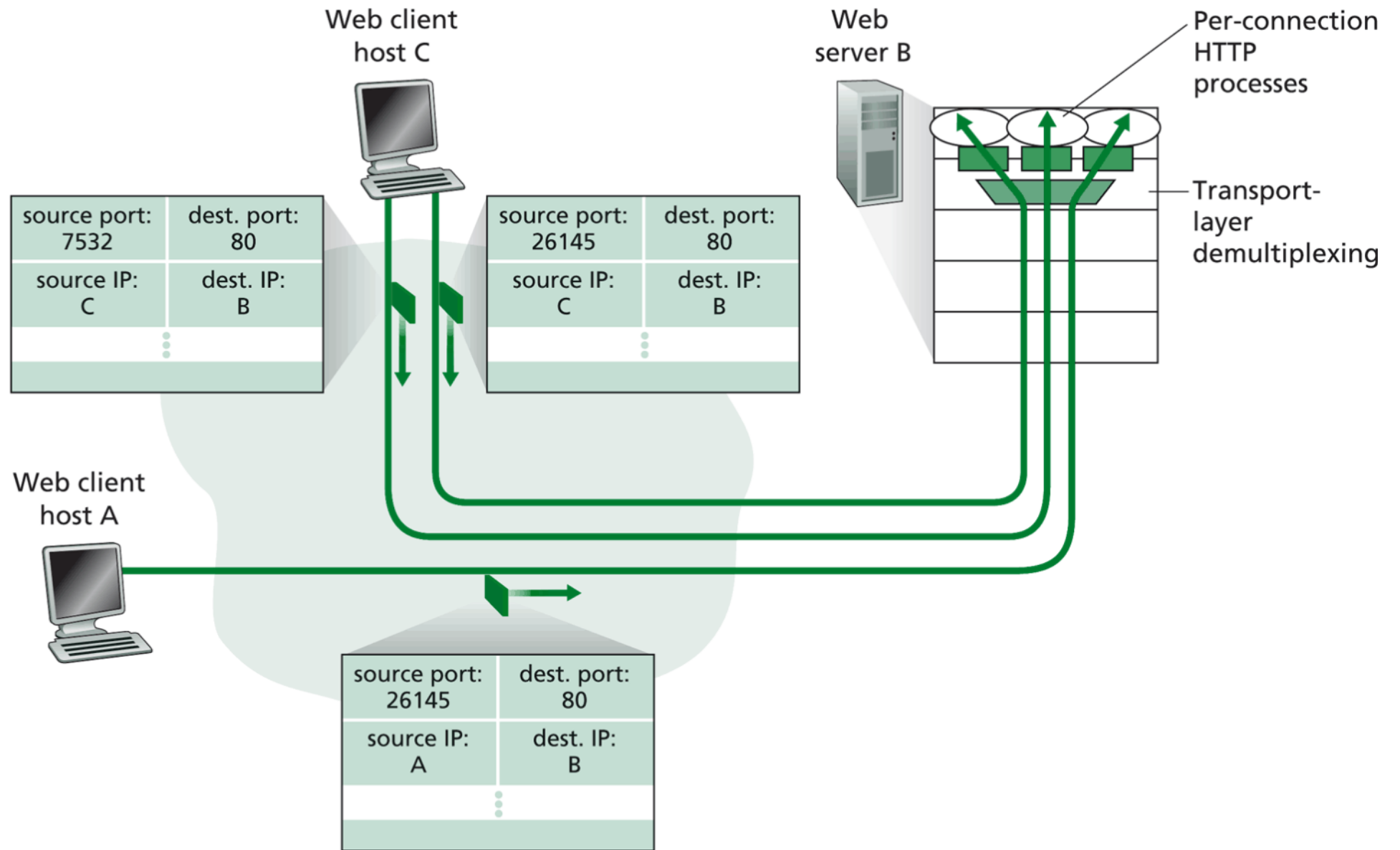
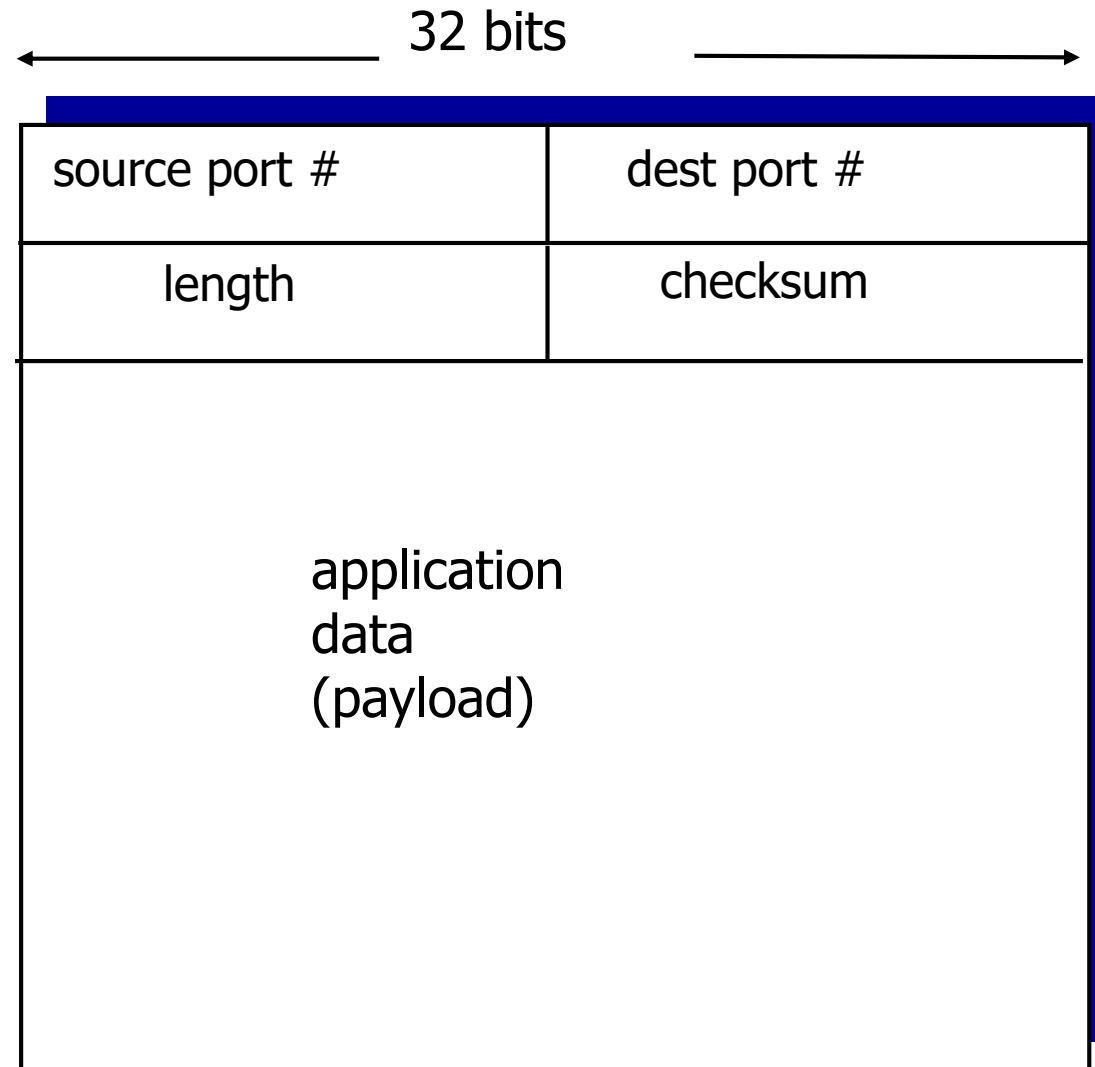


Figure 3.5 ♦ Two clients, using the same destination port number (80) to communicate with the same Web server application

UDP: segment header



UDP segment format

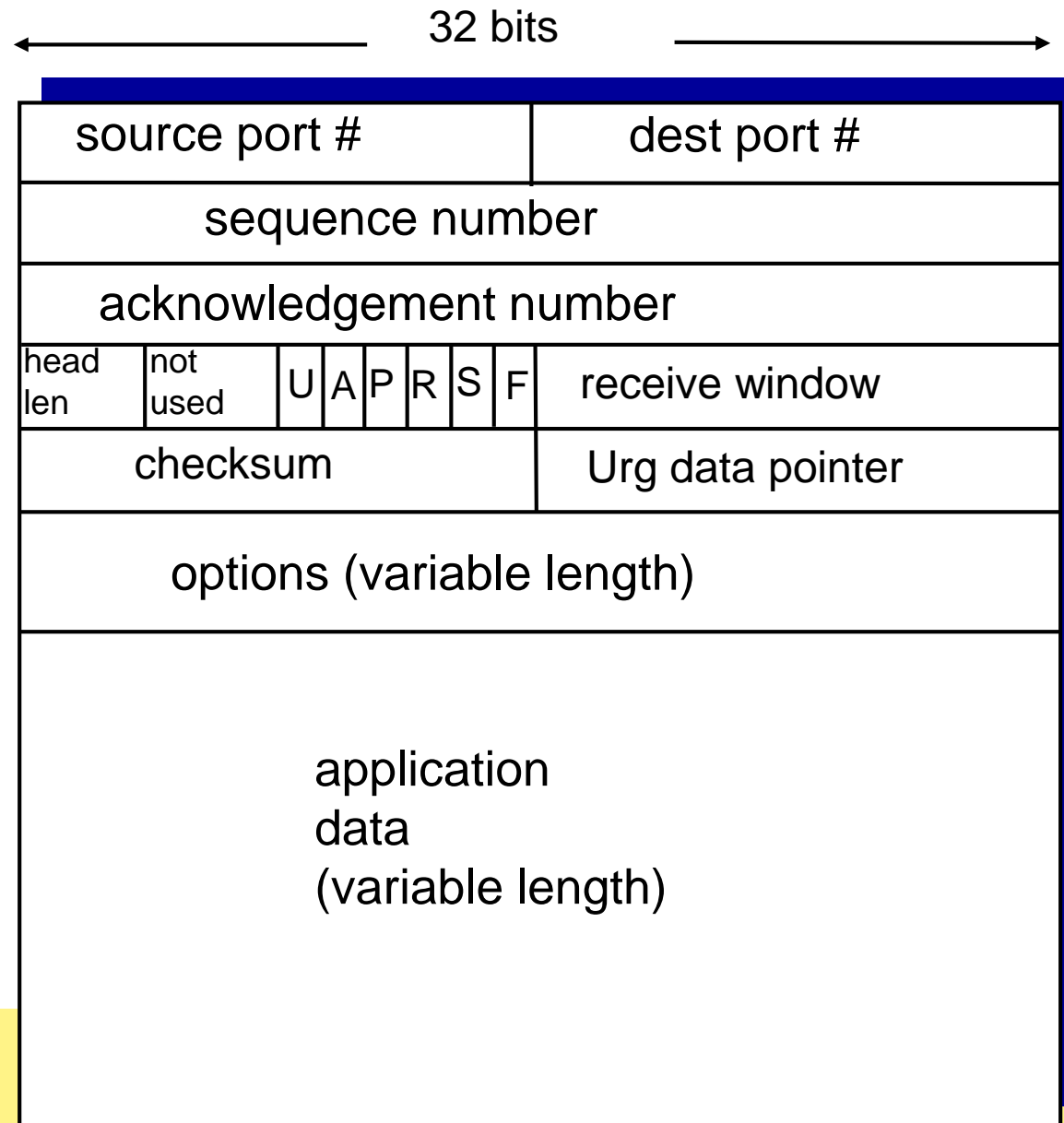
Internet checksum: example

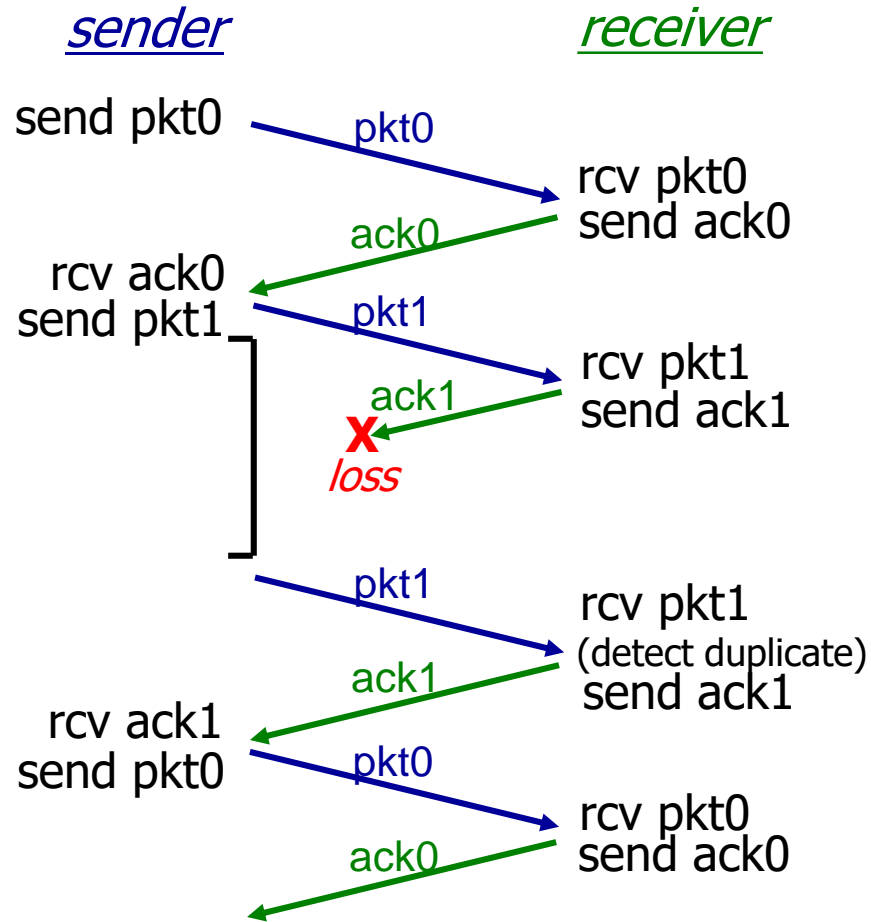
example: add two 16-bit integers

		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
		<hr/>															
wraparound	1	1	0	1	1	1	0	1	1	1	0	1	1	1	0	1	1
		<hr/>															
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

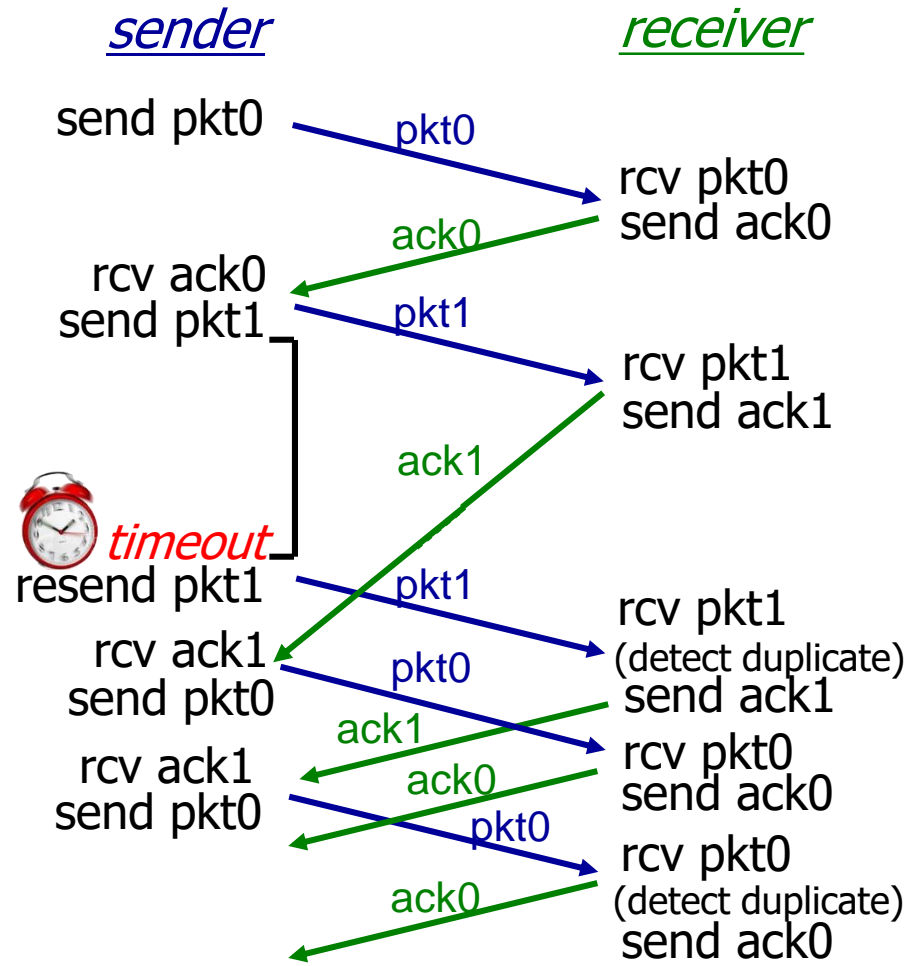
Note: when adding numbers, a carryout from the most significant bit needs to be added to the result

TCP segment structure (TCP Header)



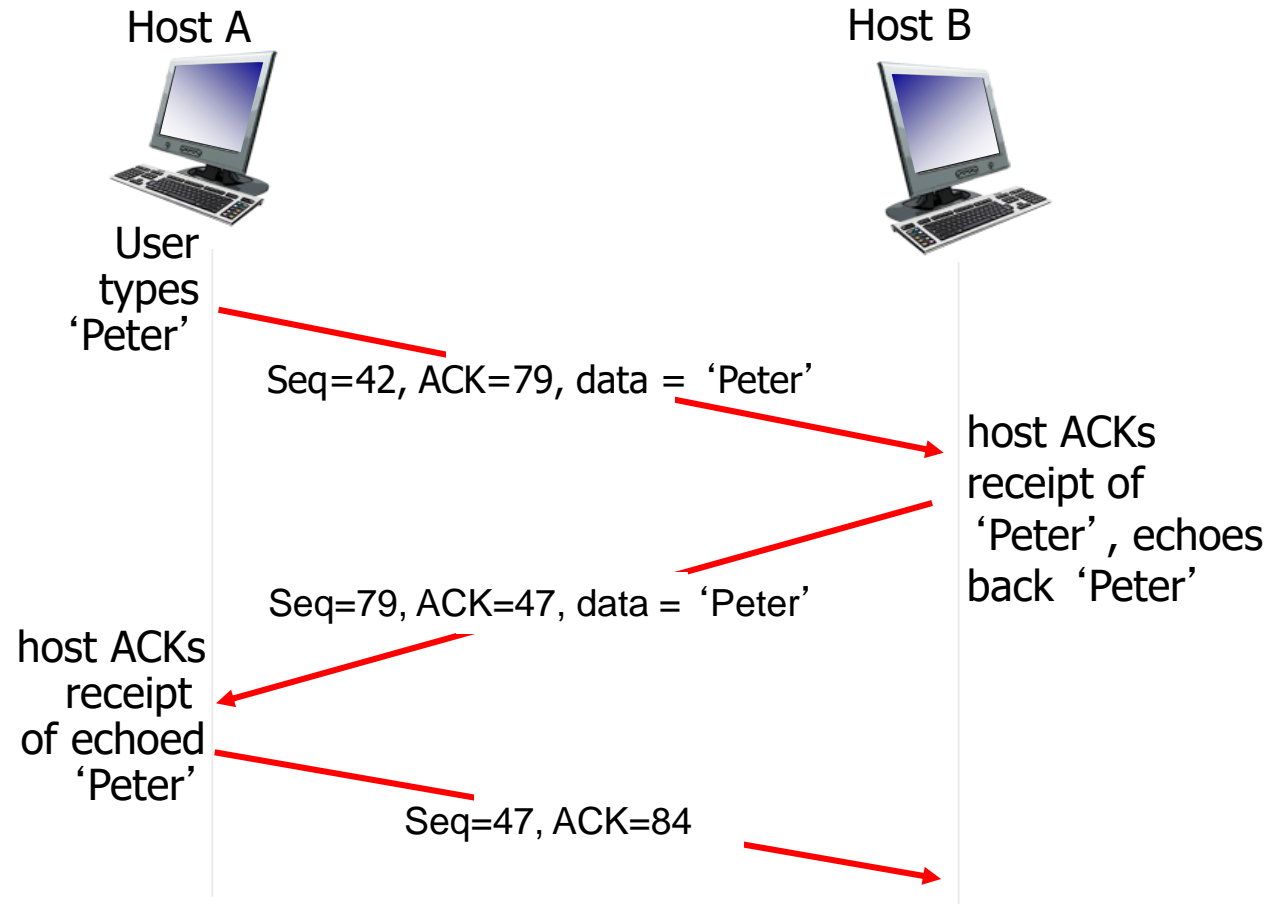


(c) ACK loss



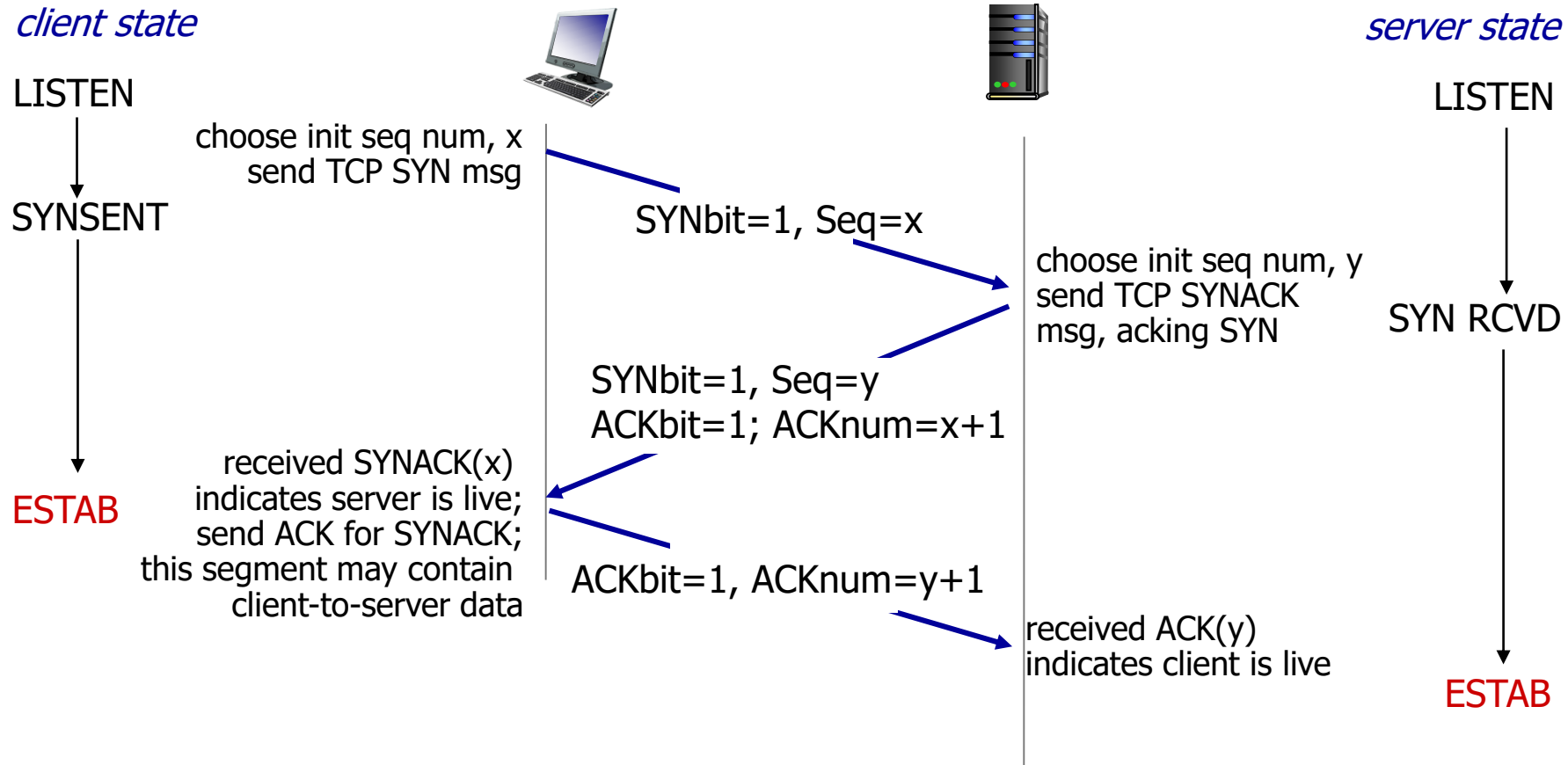
(d) premature timeout/ delayed ACK

TCP seq. numbers, ACKs



simple telnet scenario

TCP 3-way handshake



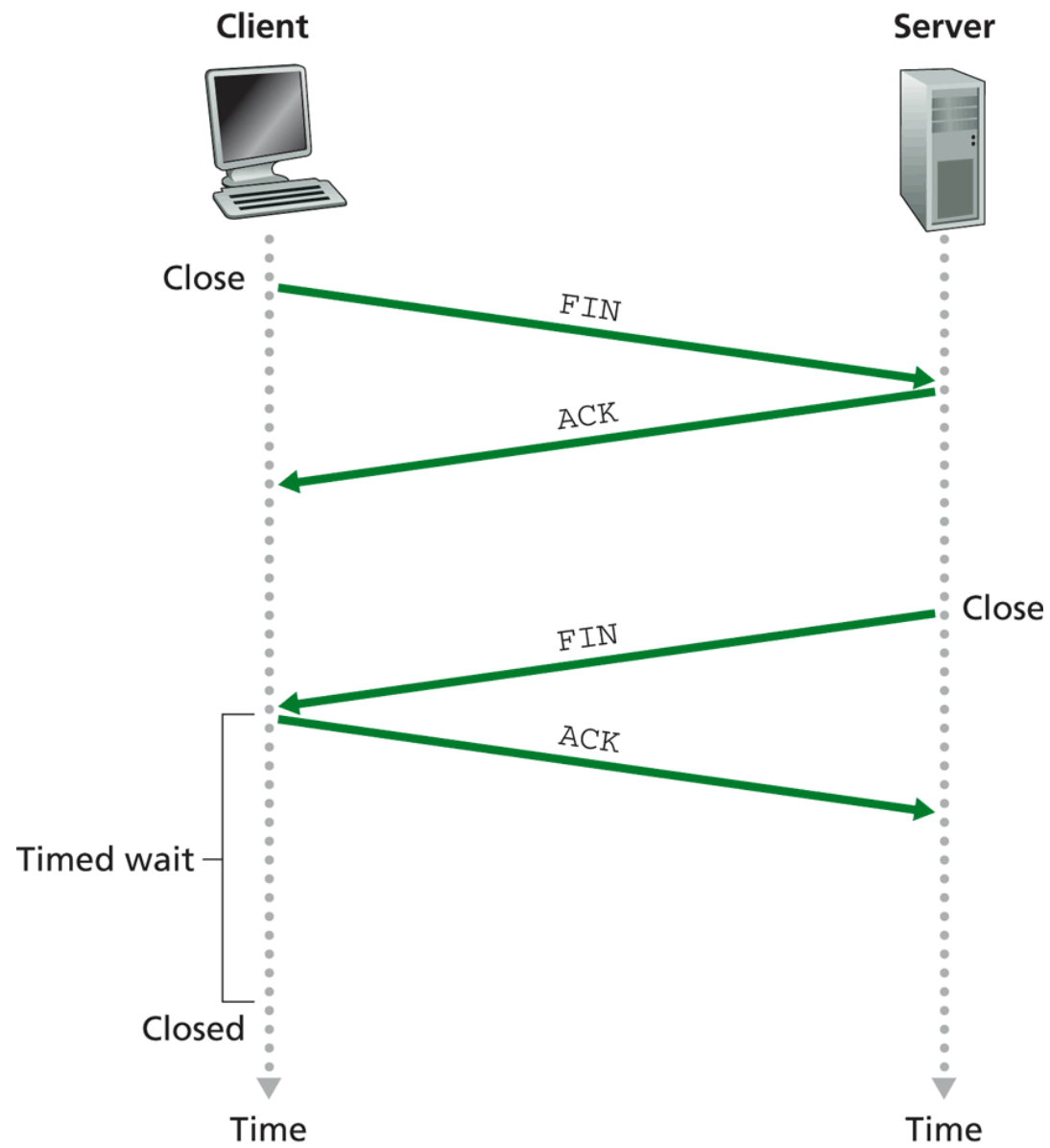
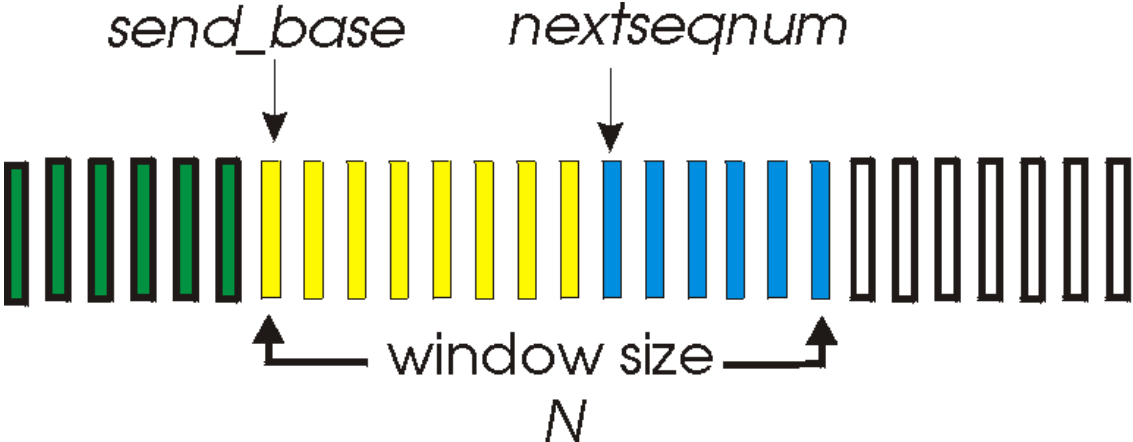






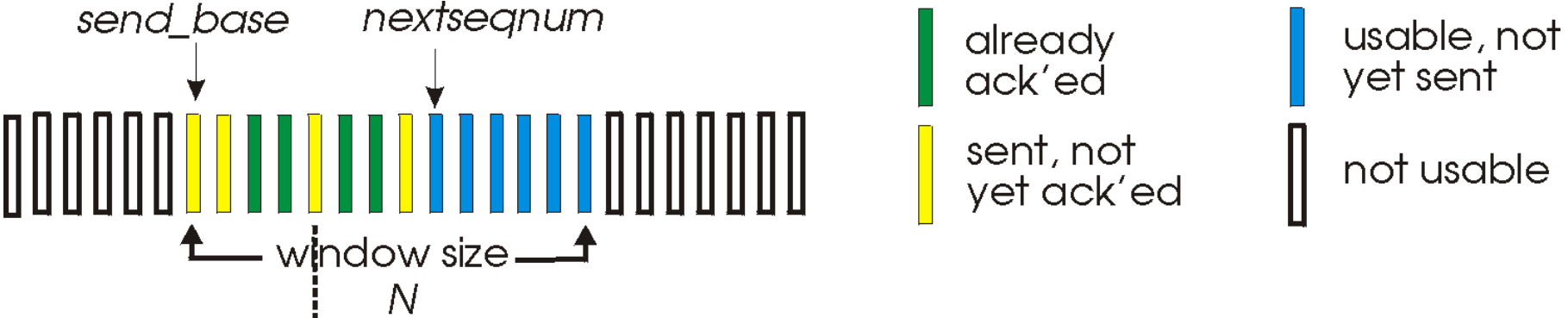
Figure 3.39 ♦ Closing a TCP connection

Go Back N



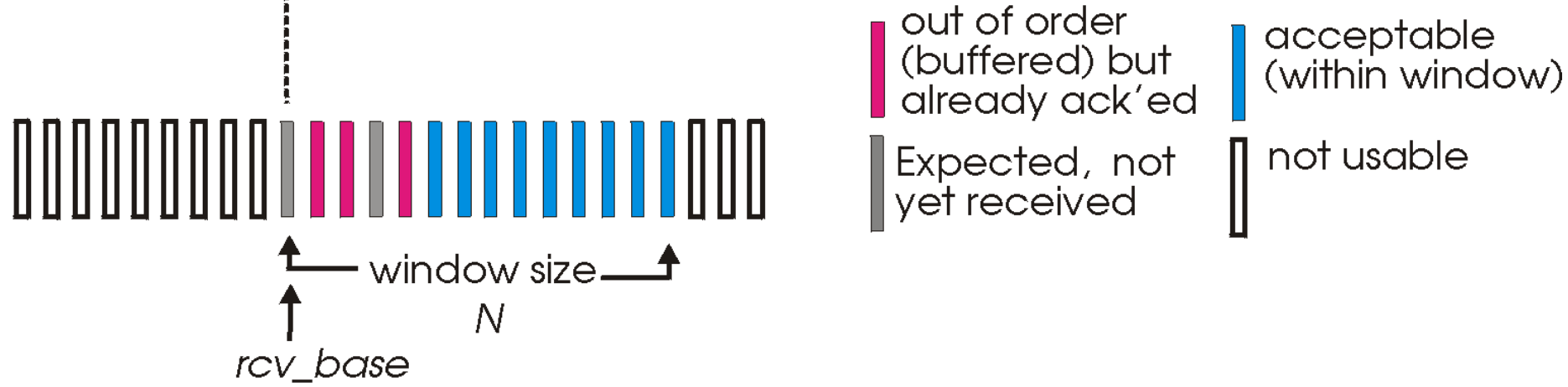
	already ack'ed		usable, not yet sent
	sent, not yet ack'ed		not usable

Selective Repeat



- already ack'ed
- sent, not yet ack'ed
- usable, not yet sent
- not usable

(a) sender view of sequence numbers



- out of order (buffered) but already ack'ed
- Expected, not yet received
- acceptable (within window)
- not usable

(b) receiver view of sequence numbers

TCP segment structure

TCP Header

