# Communication Networks (0368-3030) / Spring 2011

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# TCP Connection Management

Kurose & Ross, Chapter 3 (5th ed.)

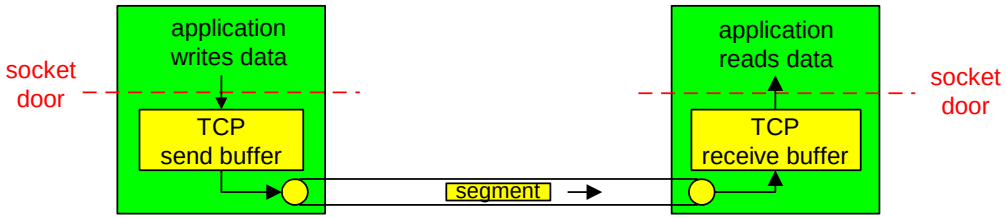
Many slides adapted from:

J. Kurose & K. Ross \
Computer Networking: A Top Down Approach (5th ed.)
Addison-Wesley, April 2009.

# TCP: Overview

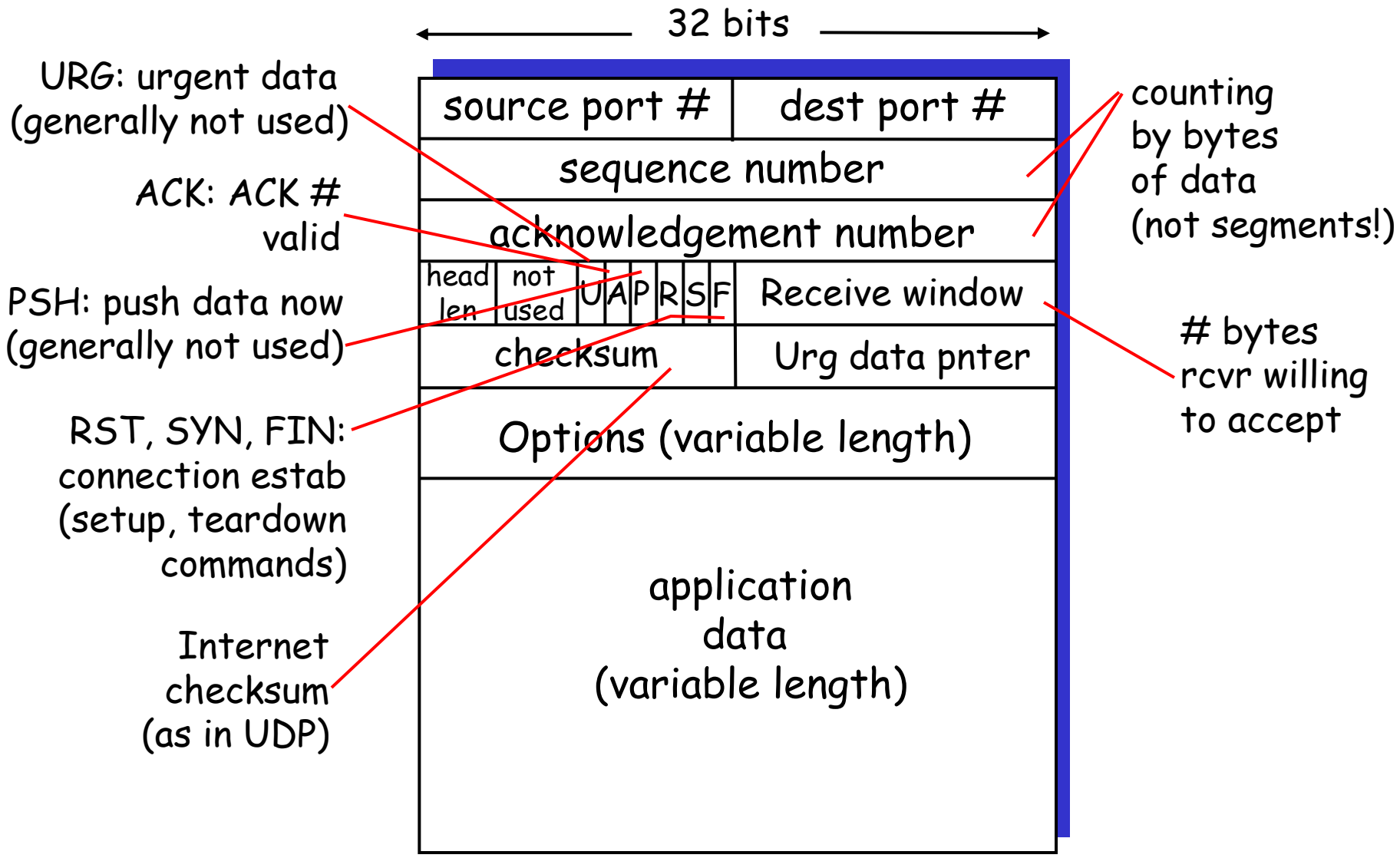
RFCs: 793, 1122, 1323, 2018, 2581

- point-to-point:
  - one sender, one receiver
- reliable, in-order *byte steam:*
  - no "message boundaries"
- pipelined:
  - TCP congestion and flow control set window size
- *send & receive buffers*




- full duplex data:
  - bi-directional data flow in same connection
  - MSS: maximum segment size
- connection-oriented:
  - handshaking (exchange of control msgs) inits sender, receiver state before data exchange
- flow controlled:
  - sender will not overwhelm receiver

# TCP segment structure



# TCP Connection Management

Recall: TCP sender, receiver establish "connection" before exchanging data segments

- initialize TCP variables:
  - seq. #s
  - buffers, flow control info (e.g. **RcvWindow**)
- *client:* connection initiator

```
Socket clientSocket = new
Socket("hostname","port
number");
```

- *server:* contacted by client

```
Socket connectionSocket =
welcomeSocket.accept();
```

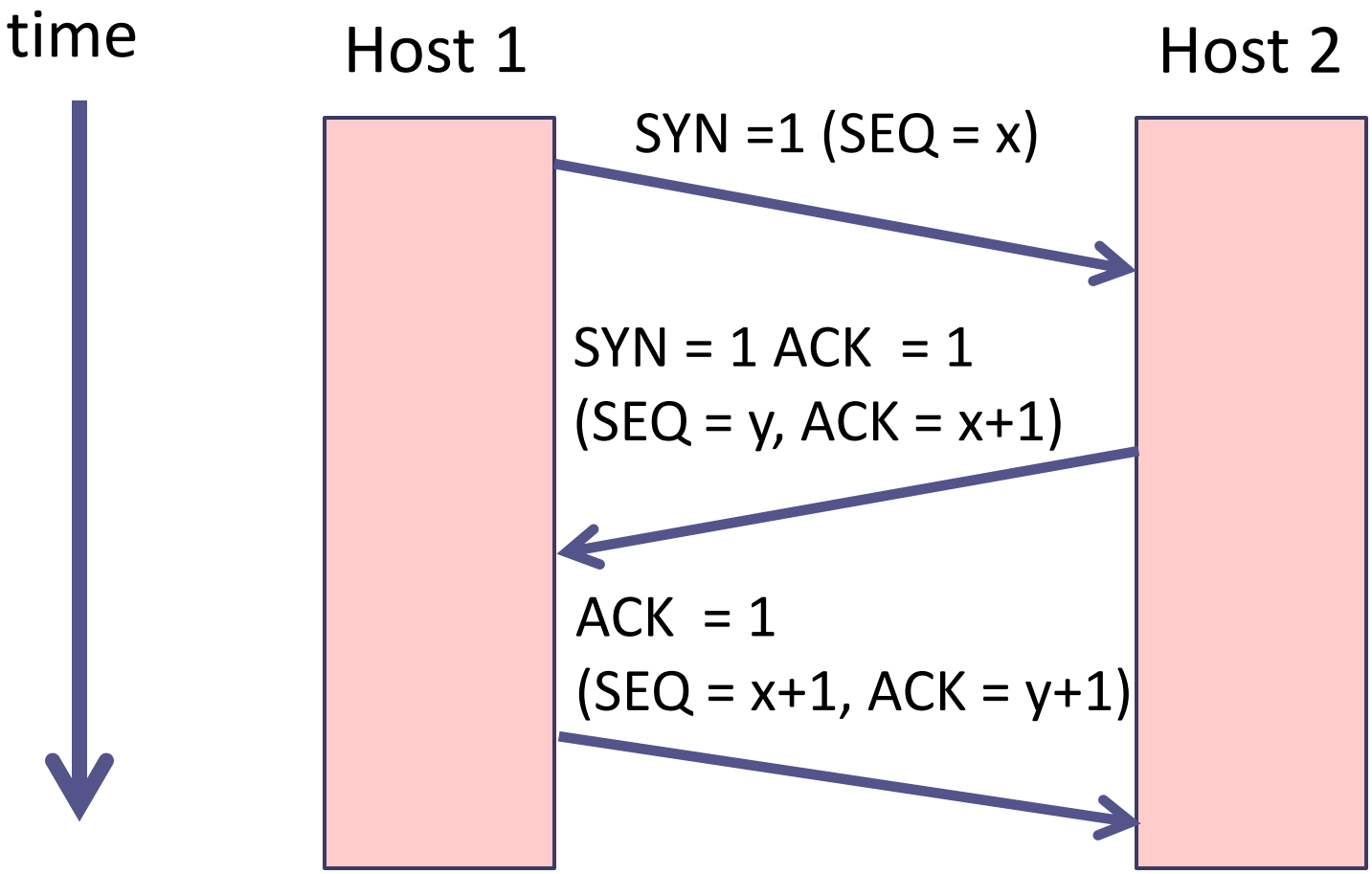
## Three way handshake:

Step 1: client host sends TCP SYN segment to server
- specifies initial seq #
- no data

Step 2: server host receives SYN, replies with SYNACK segment
- server allocates buffers
- specifies server initial seq. #

Step 3: client receives SYNACK, replies with ACK segment, which may contain data

# Three-way handshake



# TCP Connection Management (cont.)

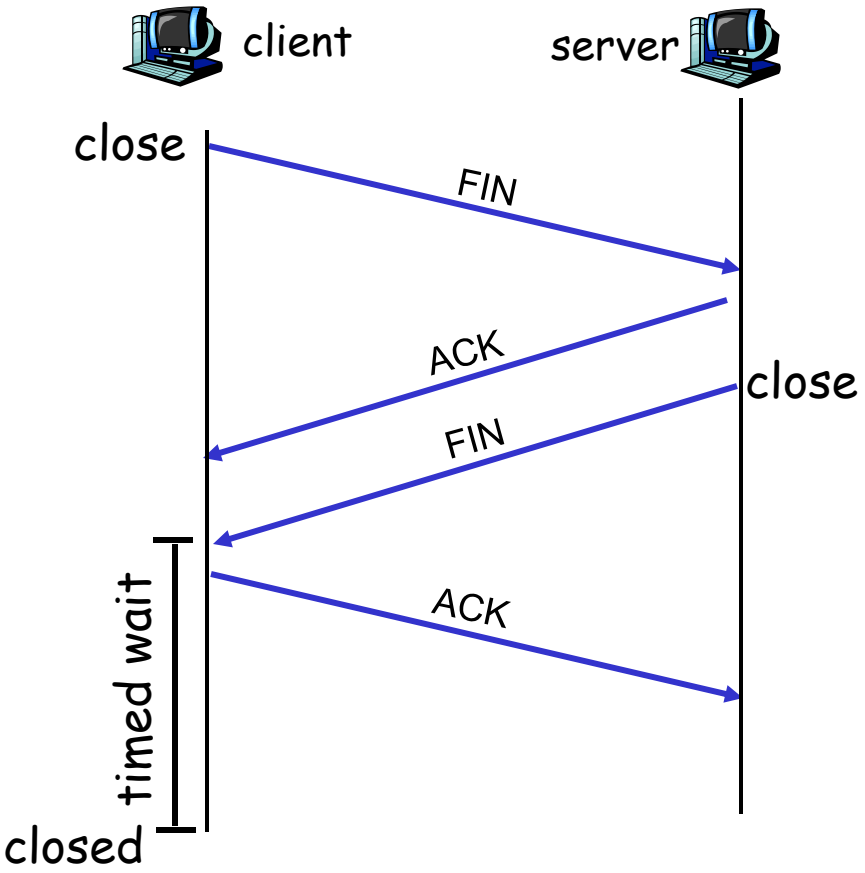
## Closing a connection:

client closes socket:

```
clientSocket.close();
```

**Step 1:** client end system sends TCP FIN control segment to server

**Step 2:** server receives FIN, replies with ACK. Closes connection, sends FIN.



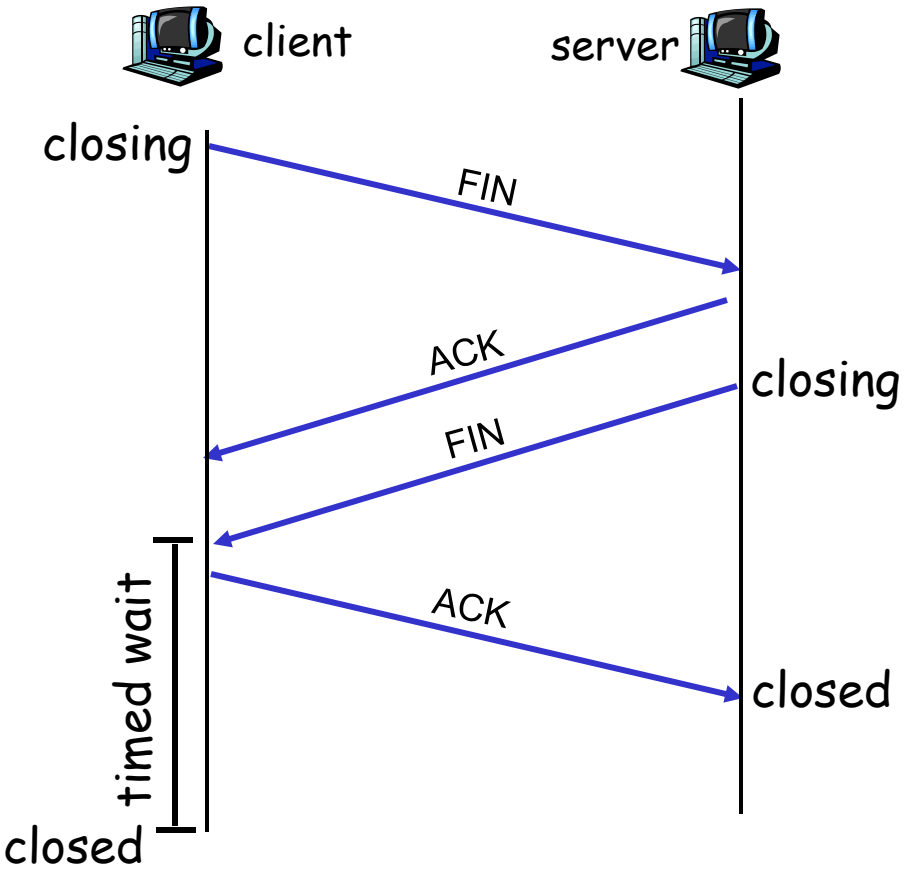
# TCP Connection Management (cont.)

**Step 3:** client receives FIN, replies with ACK.

- Enters "timed wait" - will respond with ACK to received FINs

**Step 4:** server, receives ACK. Connection closed.

**Note:** with small modification, can handle simultaneous FINs.



# TCP's statechart

- On board
  - Statechart appears in RFC 793
- Discussion of:
  - TIME_WAIT state
  - Syn flood attacks