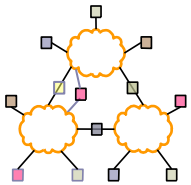
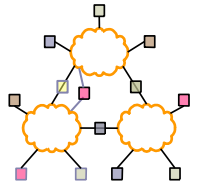
TCP Basics (Part I)

Presenter:

Assist. Prof. Dr. Fatih ABUT

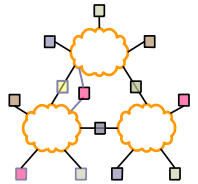


Introduction to TCP



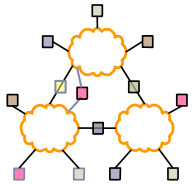
- Point-to-point connection
- Reliable data transfer
- Streaming interface
  - Byte-oriented
  - No boundaries for fragments/segments
- Full duplex
- Flow and congestion controlled
- Protocol implemented entirely at the ends

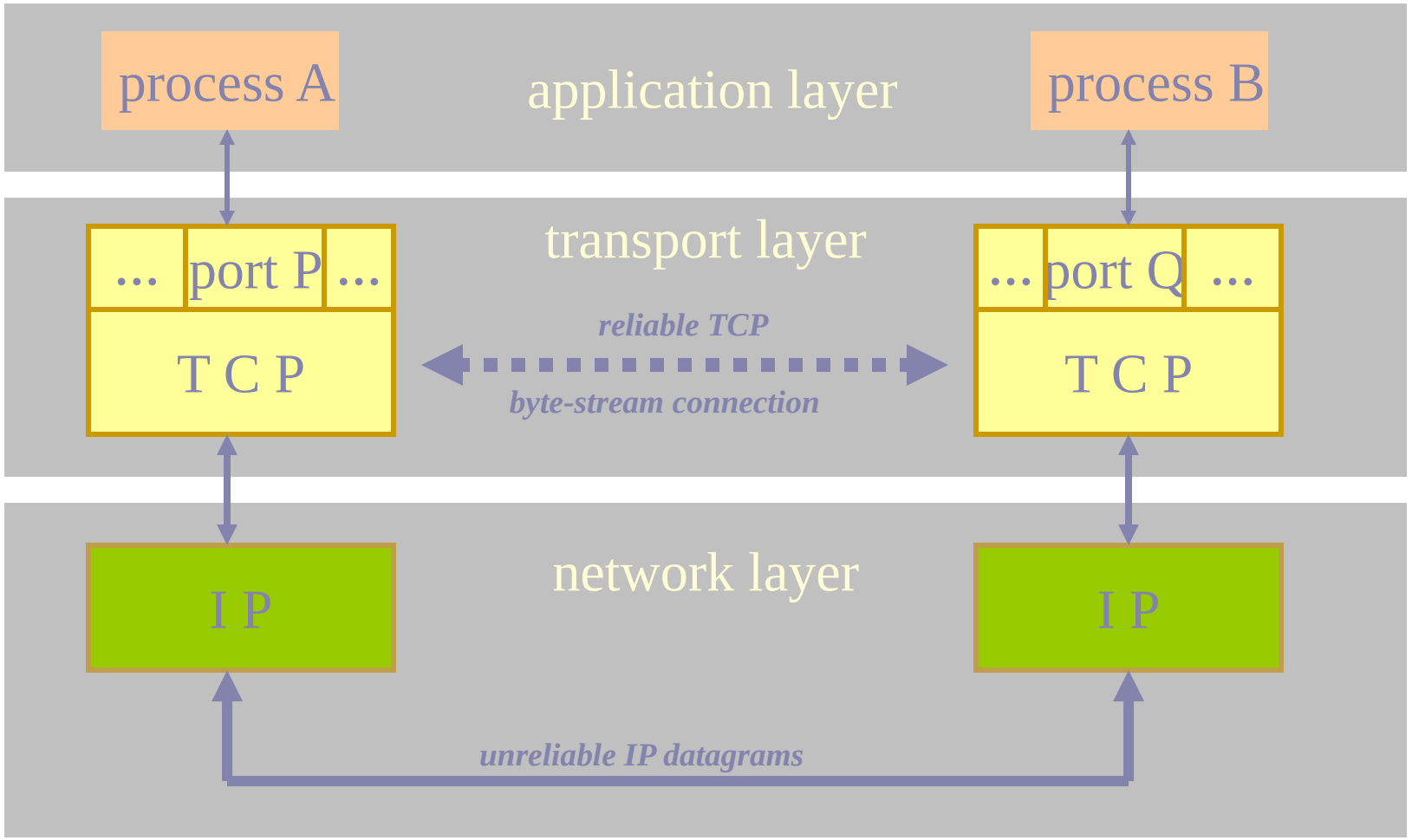
Benefits of TCP



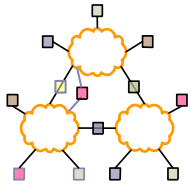
- Communication is ‘transparently reliable’
- Data is delivered in the proper sequence
- An application programmer does not need to worry about issues such as:
  - Lost or delayed packets
  - Timeouts and retransmissions
  - Duplicated packets
  - Packets arriving out-of-sequence
  - Flow and congestion control

Overview

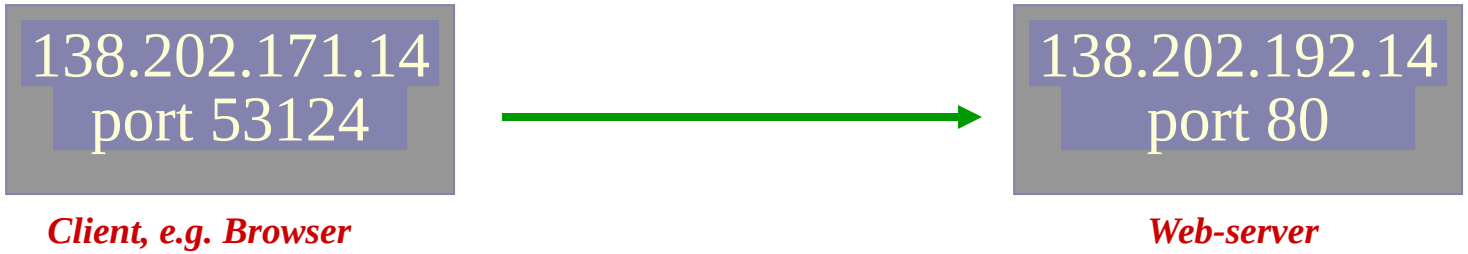



process A
application layer
process B
transport layer
... port P ...
T C P
reliable TCP
byte-stream connection
... port Q ...
T C P
network layer
I P
I P
unreliable IP datagrams

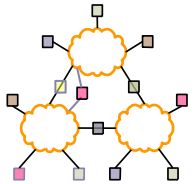
What is a ‘connection’?

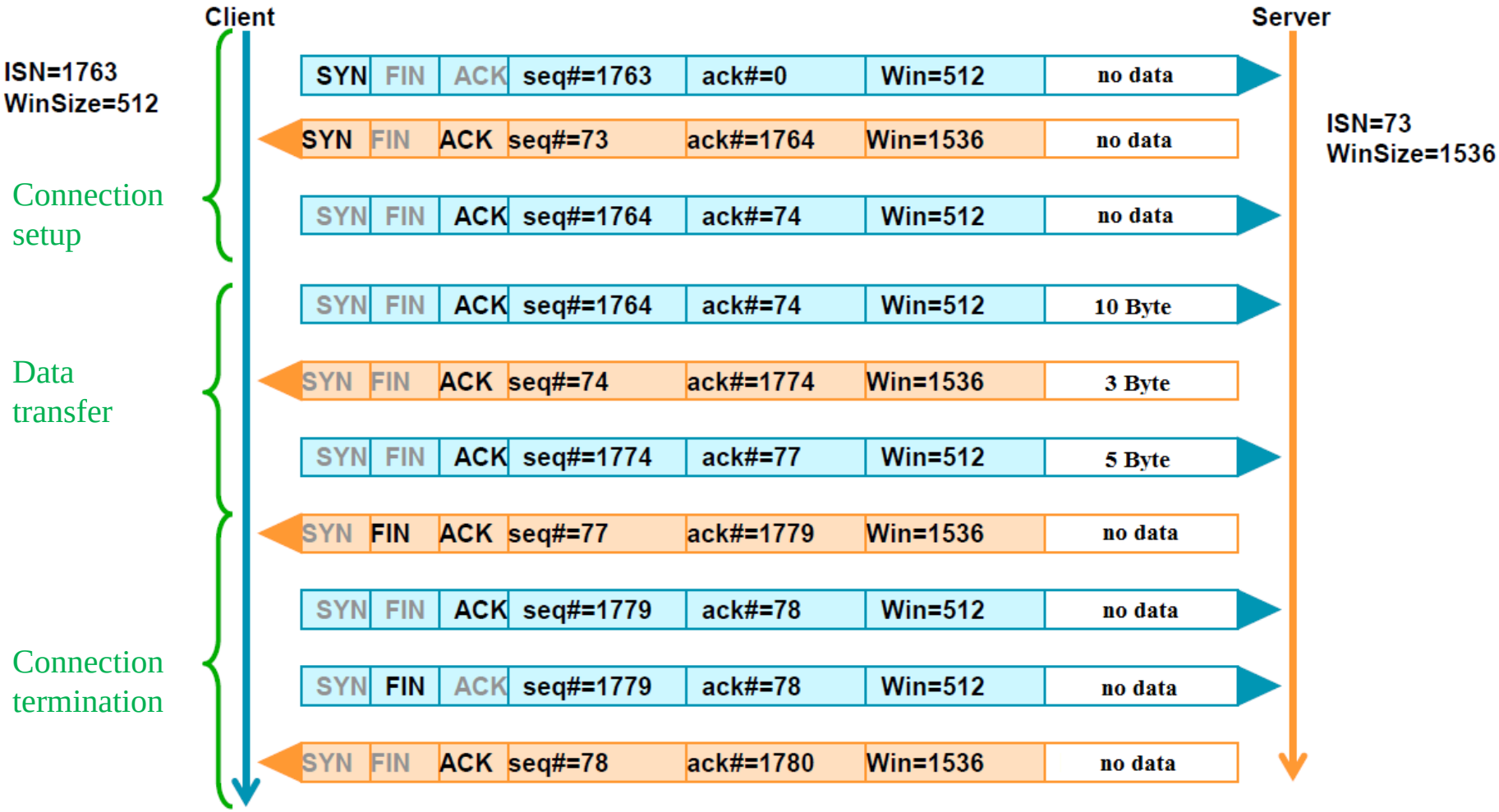


- An application’s socket is ‘connected’ if it has a defined pair of socket-addresses:
  - An IP-address and port-number for the ‘host’
  - An IP-address and port-numbet for the ‘peer’

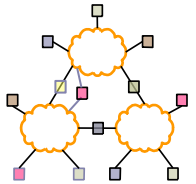


TCP – Normal Procedure (Simplified)





Connection Establishment (cont)

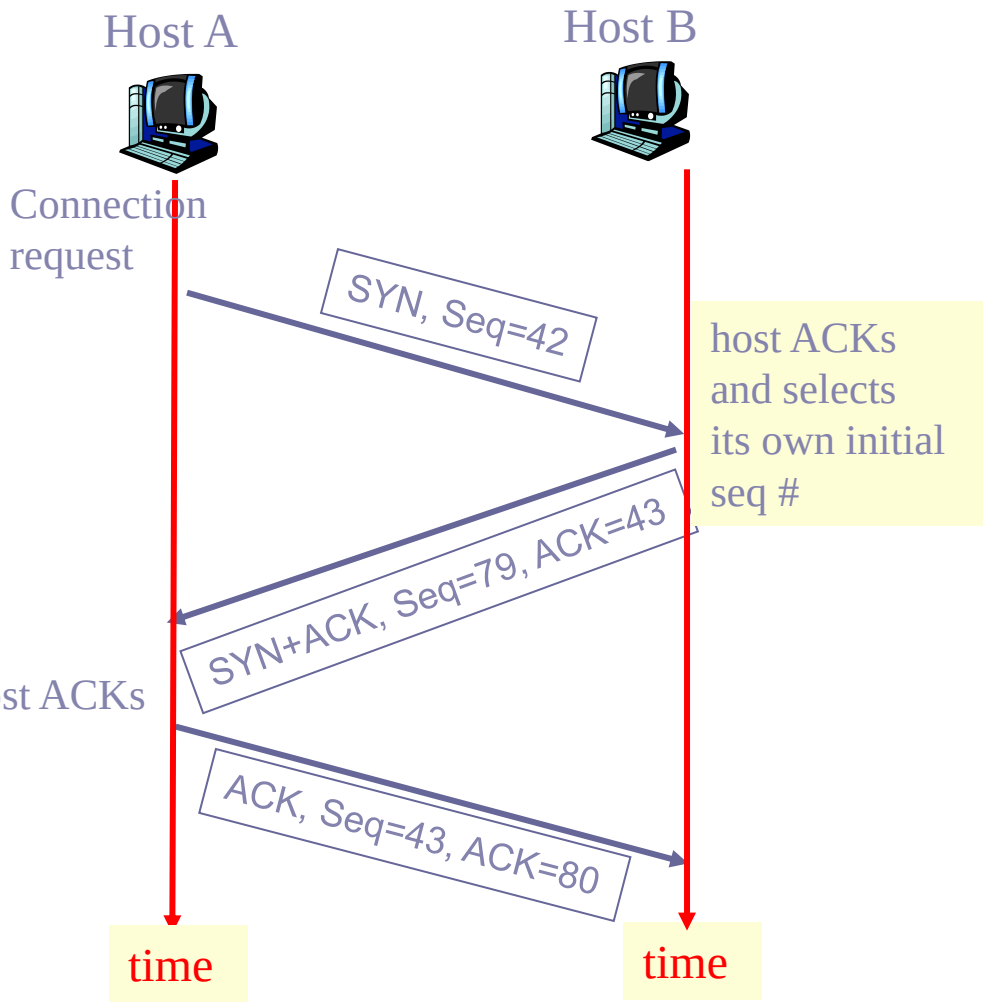


Three way handshake:

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

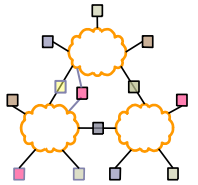
Step 2: server host receives SYN, replies with SYNACK segment
- server allocates buffers
- specifies server initial seq. #

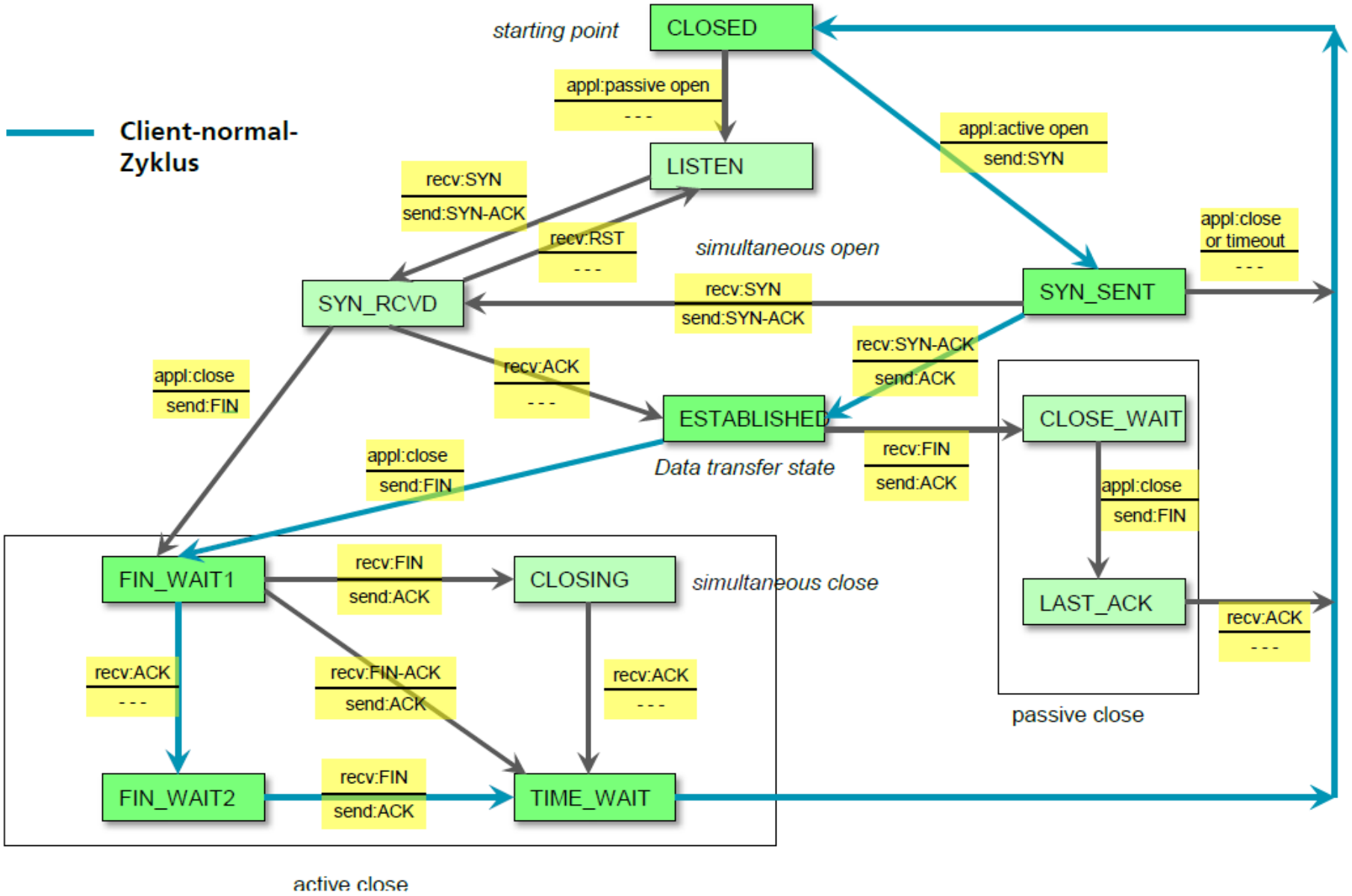
Step 3: client receives SYNACK, replies with ACK segment, which may contain data



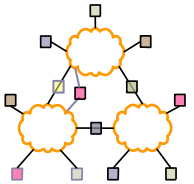
Three-way handshake

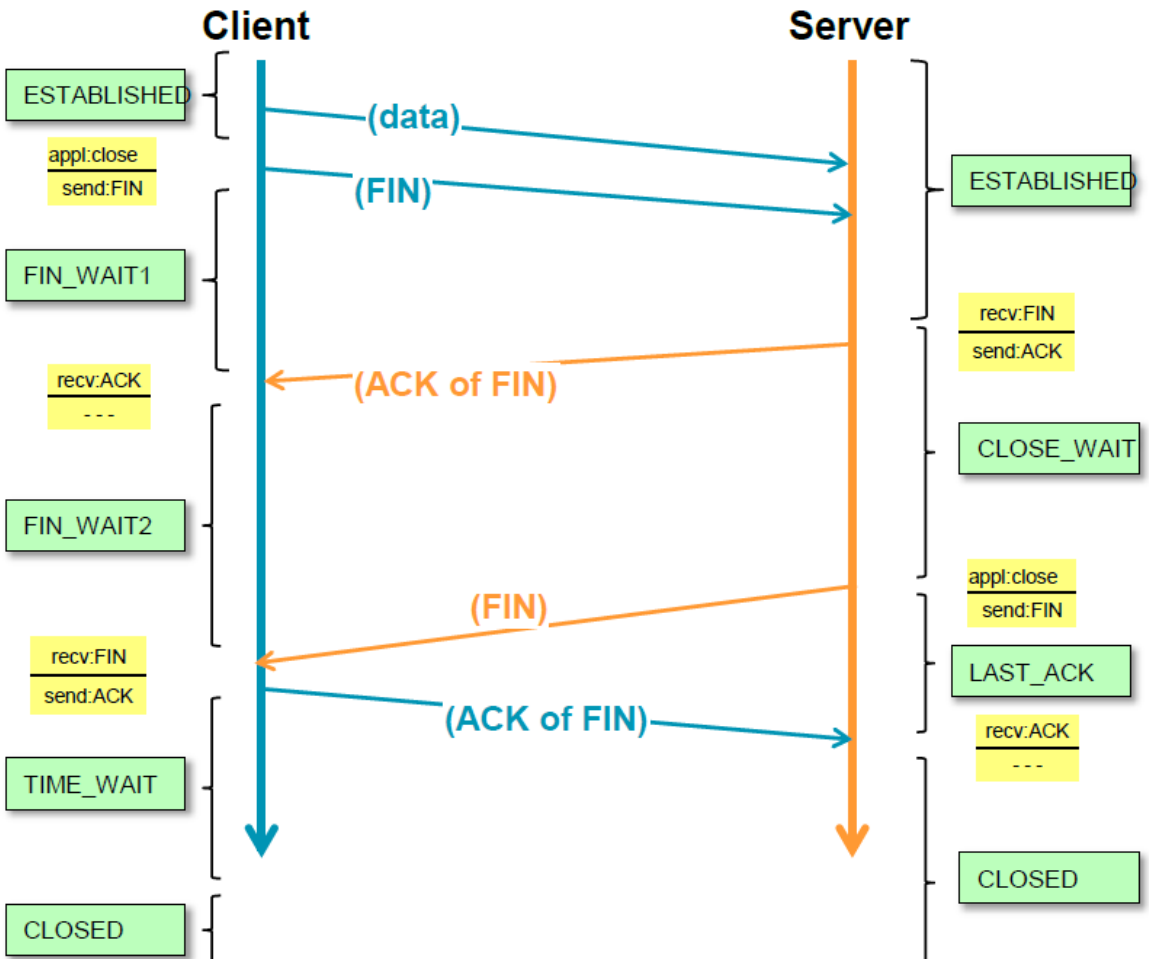
TCP Connection Management



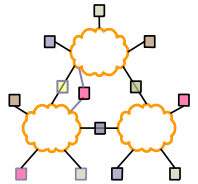


Regular TCP Connection Termination





Evolution of TCP



1974
TCP described by
Vint Cerf and *Bob Kahn*
In IEEE Trans Comm

1975
Three-way handshake
Raymond Tomlinson
In SIGCOMM 75

1982
TCP & IP
RFC 793 & 791

1983
BSD Unix 4.2
supports TCP/IP

1984
Nagel's algorithm
to reduce overhead
of small packets;
predicts congestion
collapse

1986
Congestion collapse
observed

1987
Karn's algorithm
to better estimate
round-trip time

1988
Van Jacobson's algorithms
congestion avoidance
and congestion control
(*most* implemented in
4.3BSD Tahoe)

1990
4.3BSD Reno
fast retransmit
delayed ACK's

1975 1980 1985 1990

TCP Through the 1990s