

TCP: Connection Management

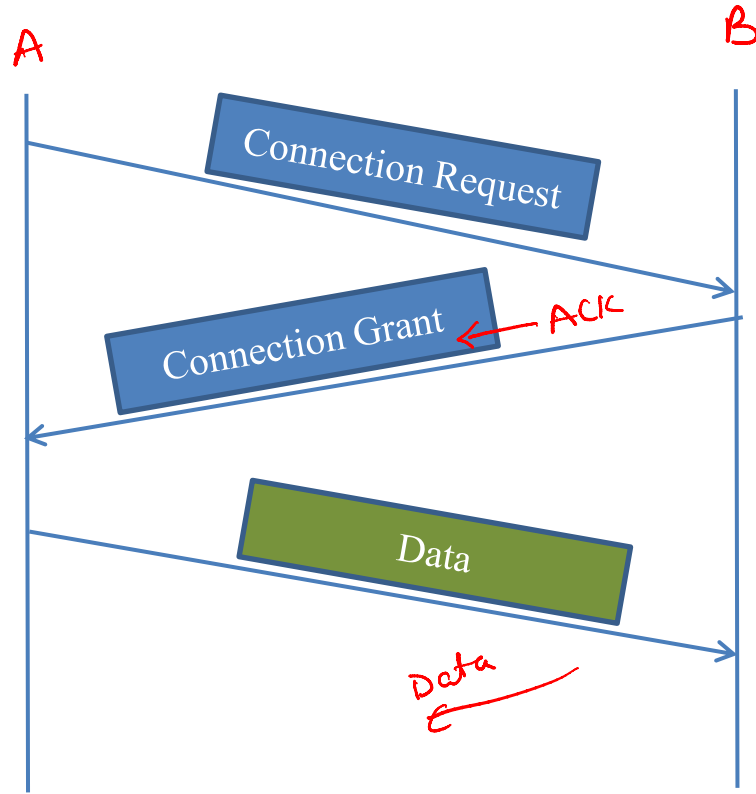
Kameswari Chebrolu

Background

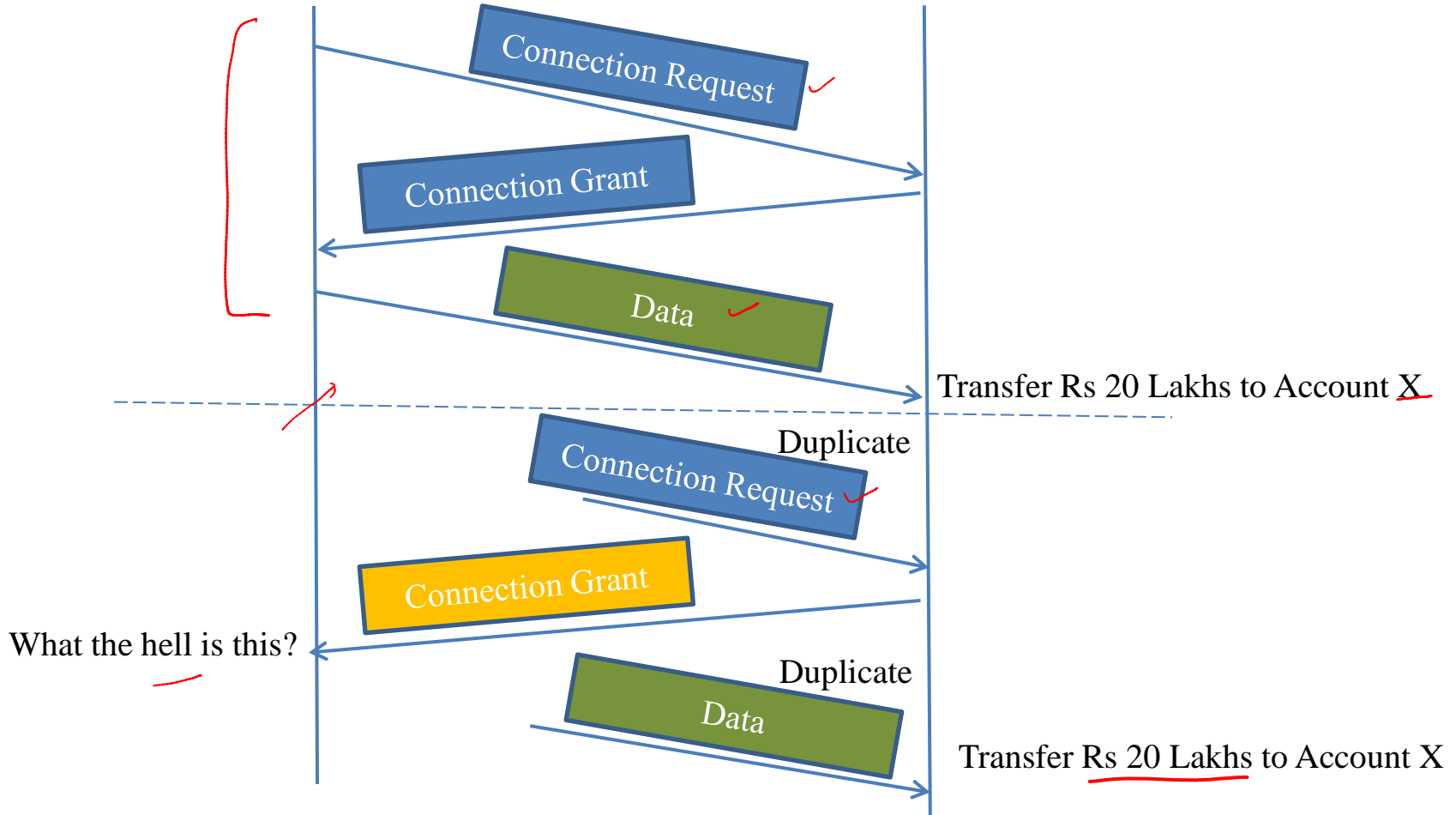


- TCP is a connection oriented protocol
 - Processes can run on any type of machine in the Internet
- Connection establishment helps
 - Exchange and initiate state variables
 - MSS size, initial sequence number, ACK type
 - Allocate resources (buffer space)
 - ↓ send Buffer
4KB - MB
 - ↓ receive Buffer
8KB

Connection Setup

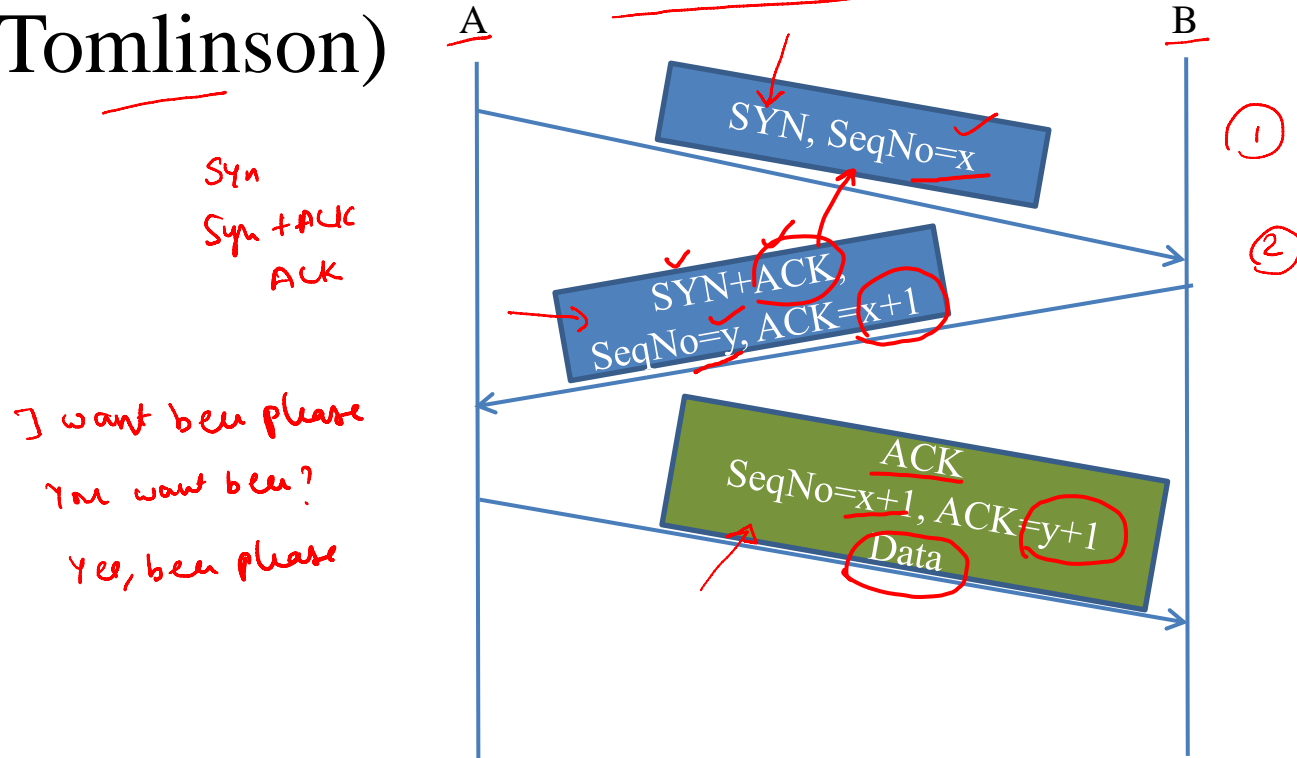


Problem

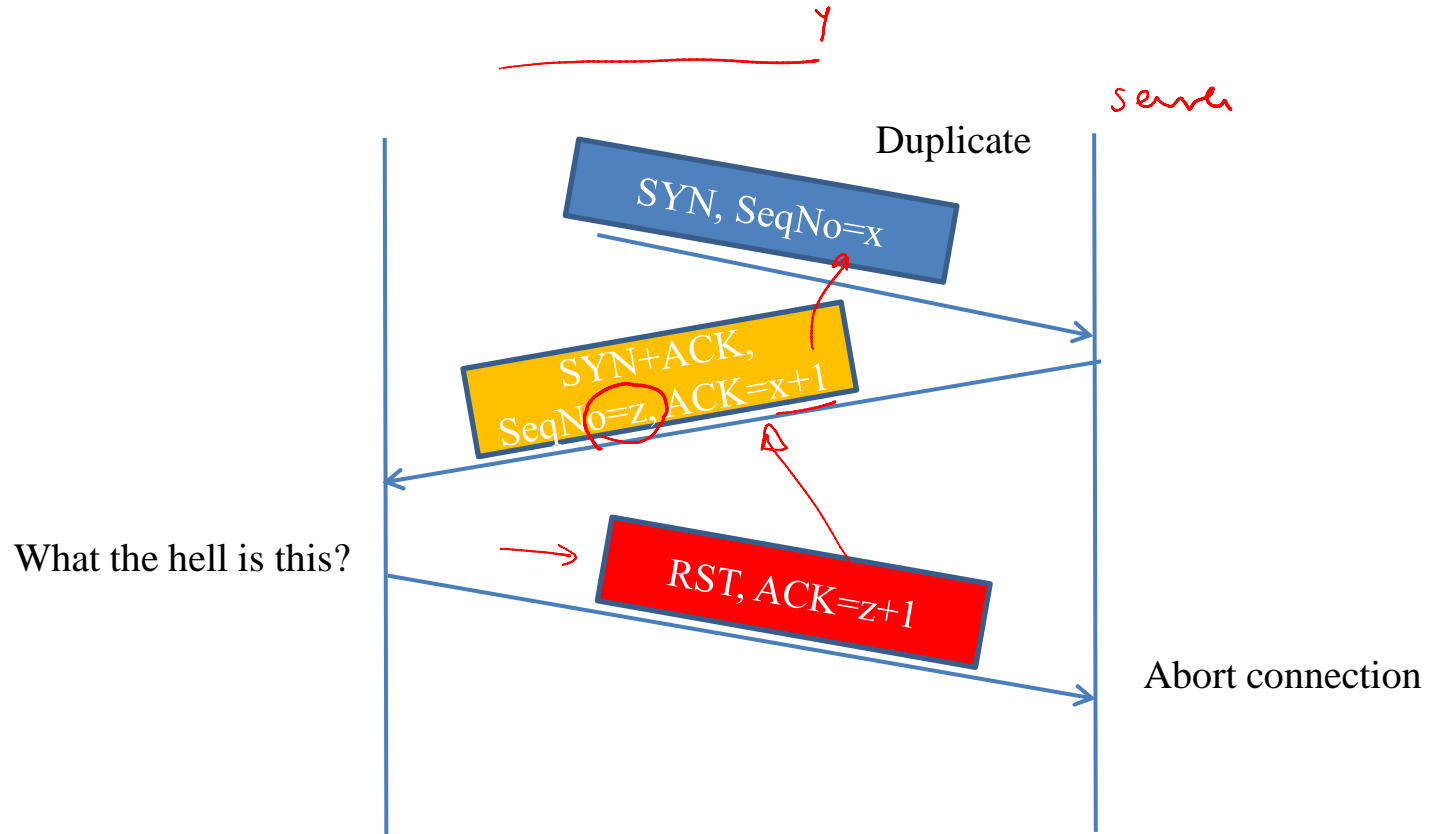


Solution

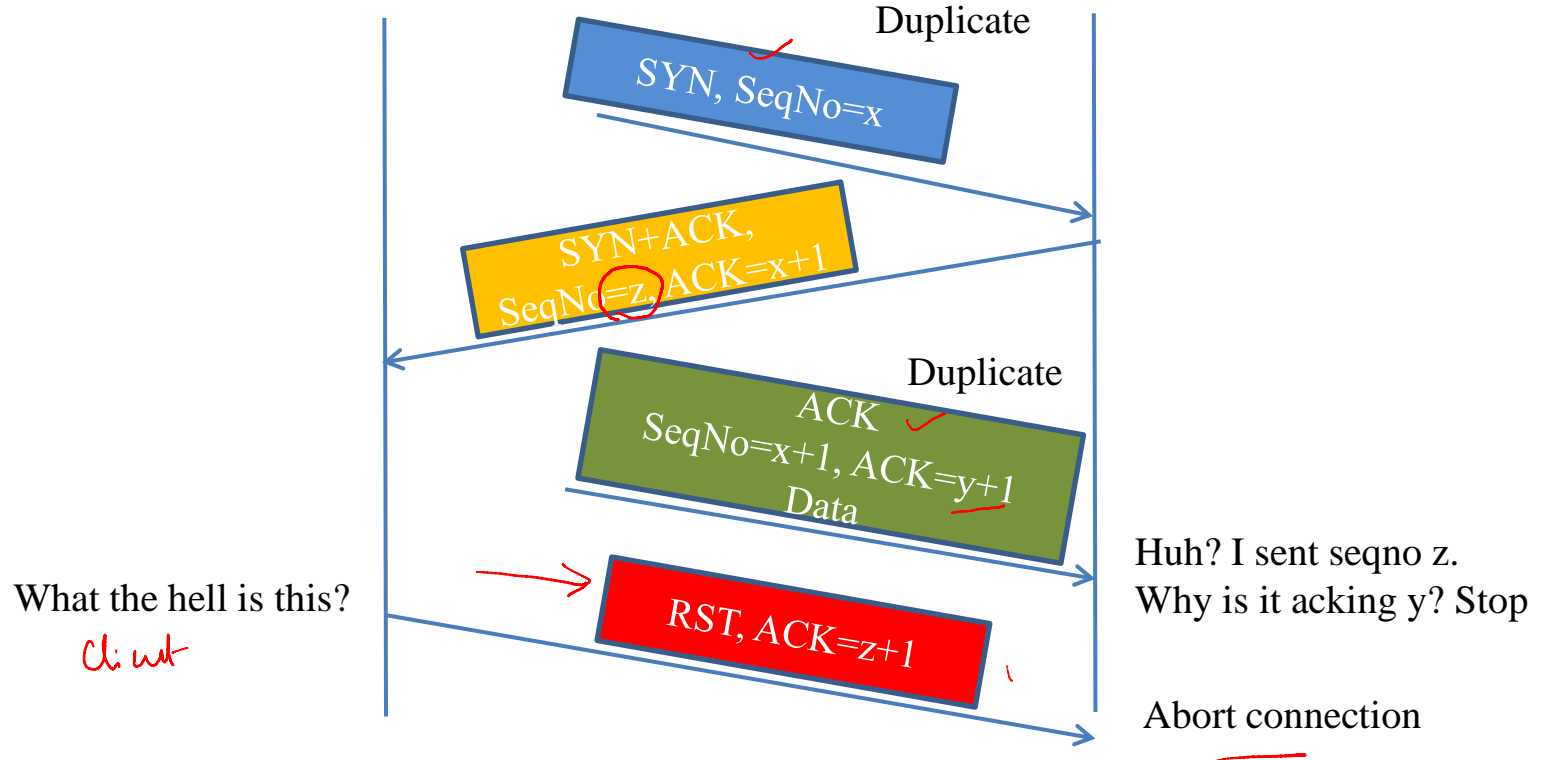
- TCP's famous three-way handshake (idea from Tomlinson)



Case-1



Case-2



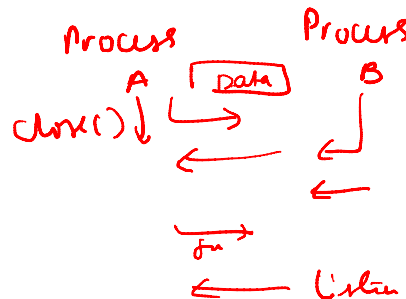
Initial Sequence Number (ISN)

- Why not start with Seqno zero?
- Segments from different connections can get mixed up
- Security risk when ISN's are predictable
- Original solution: Use a clock (e.g. increments every 4 microsec) to choose ISN
 - 32 bit sequence number wraps around in 4 hrs
- Current implementations use random ISN

IP → TTL

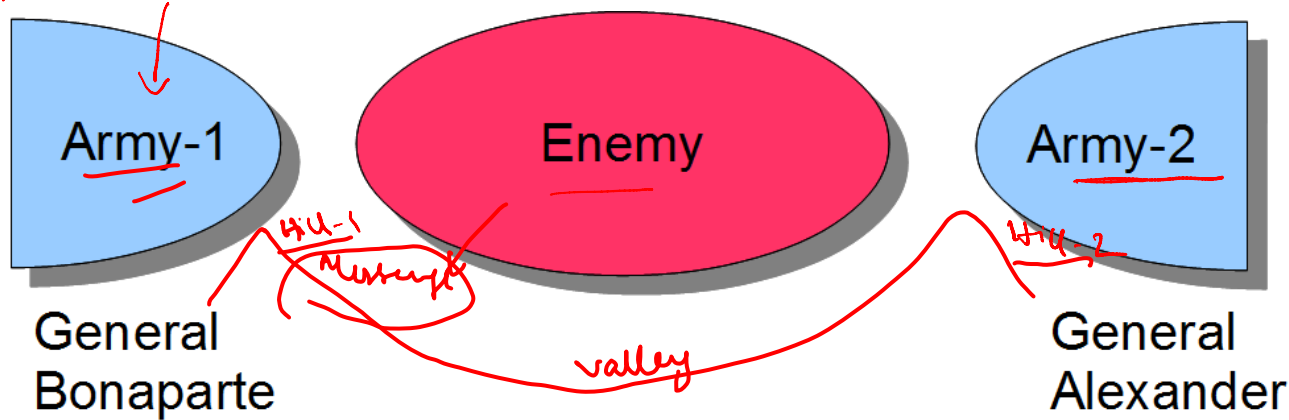
Connection Termination

- Asymmetric release (just hang-up) leads to loss of data
- Symmetric release
 - Treat connection as two separate unidirectional connections
 - Each side should be released separately



1. Let's attack on Sun @ 9am, Please ACK
2. OK fine. Let's attack, Please ACK
3. OK fine. ACK

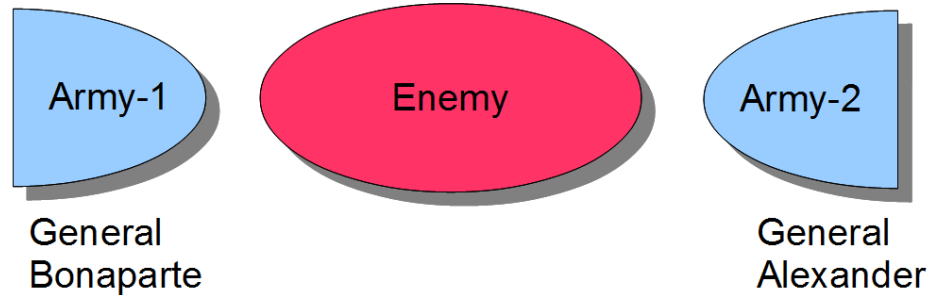
Two Army Problem



The attack will succeed *if and only if* both armies attack the enemy at the same time

What strategy to adopt?

Relevance



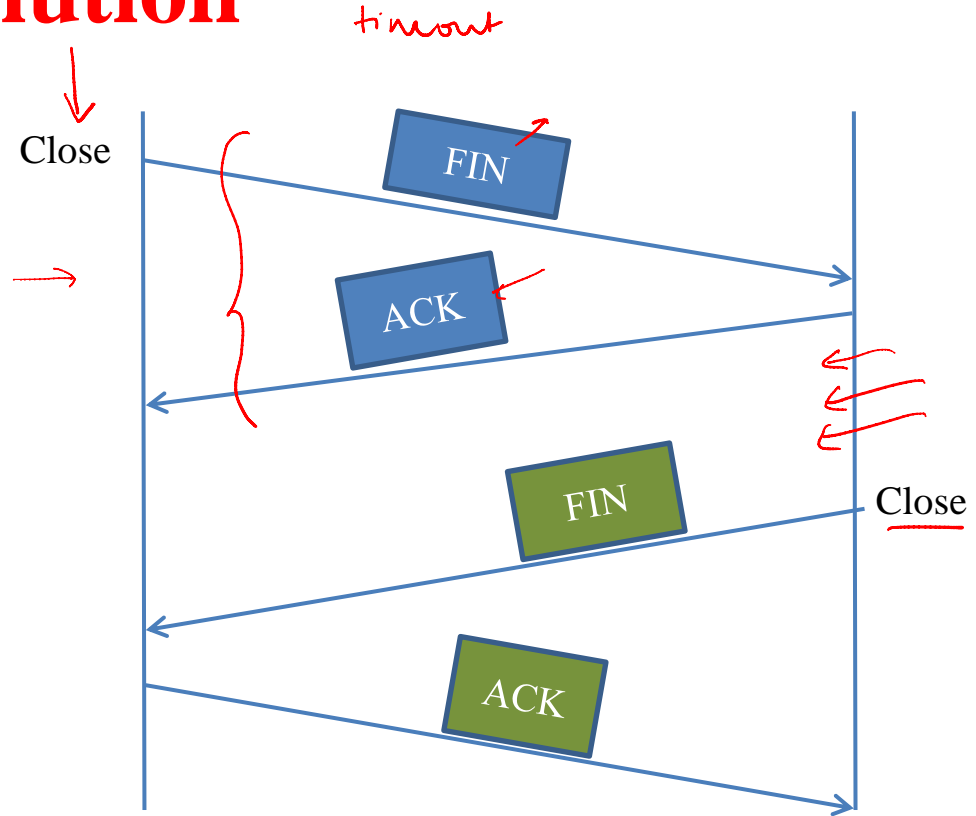
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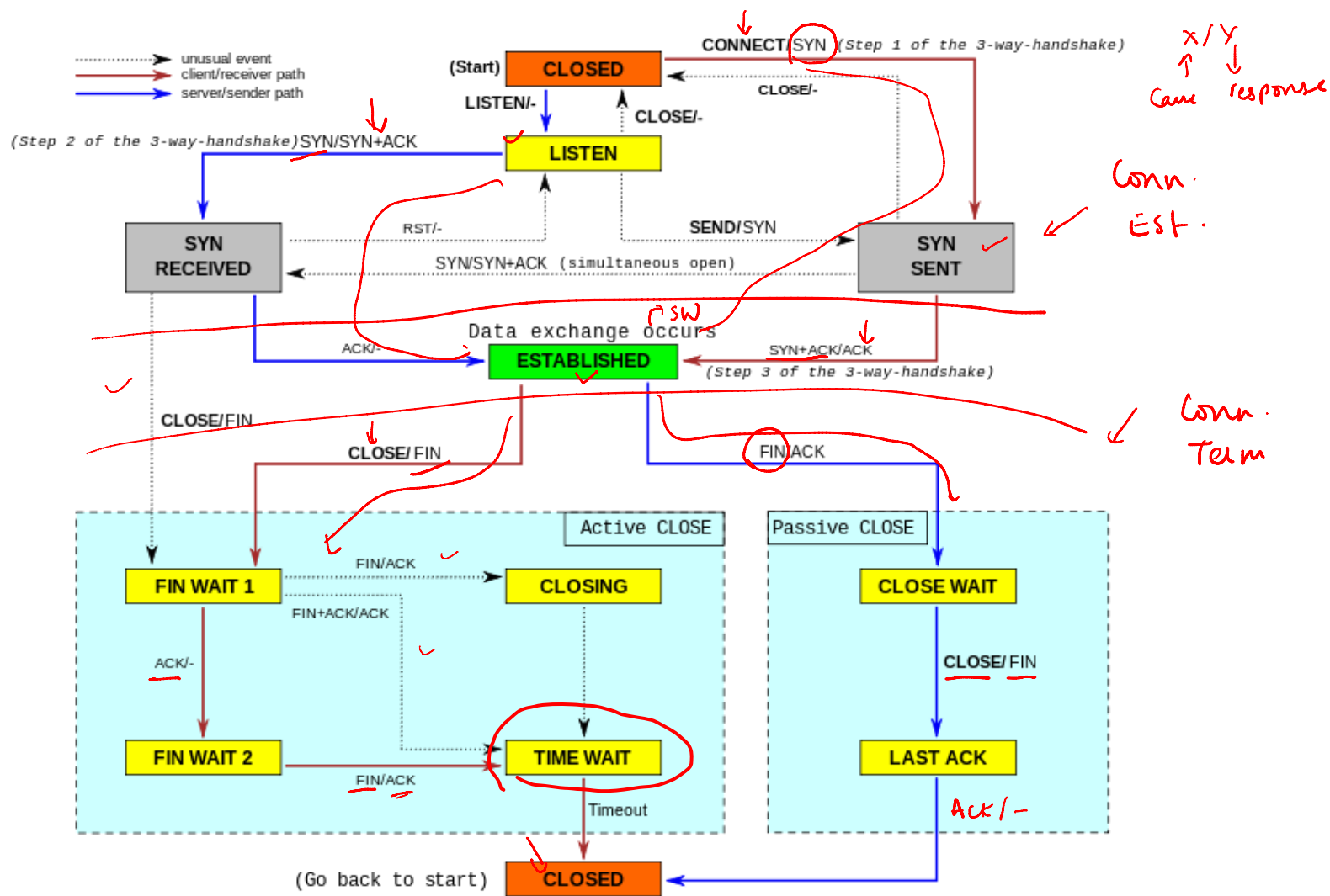
If neither side is ready to disconnect unless it is sure the other side is ready to disconnect, disconnect will never happen

- Follows simple two-way handshake
- Each side independently closes connection

Solution



TCP State Diagram



Time-Wait State



- Wait in time-wait for $2 * \text{MSL}$ (maximum segment lifetime)
 - Helps clear out older packets in the network; prevents them from interfering with new connection
 - Time spent in time-wait range from 30sec to 2 min



"bind failed"

Conn 1:

remote Port #

src dest, src dest
IP IP Port Port

data

→ closed.

Conn 2:

Abort

RST

Summary

- TCP is a connection oriented protocol
- Connection management complicated by the fact that packets can get retransmitted, delayed, delivered out of order etc
- Connection establishment governed by 3-way handshake
- Connection termination is based on symmetric release and managed by 2-way handshake
- Ahead: Sliding window action in the established state