

# Worksheet 14: Reliable Transport and TCP

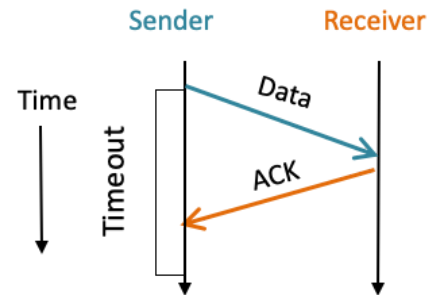
Q1. What is our link utilization with a stop-and-wait protocol? Link utilization is defined as the ratio of the rate at which packets are being sent over the max. rate at which the link can support.

System parameters:

Link rate: 1 Megabyte (1000 Kilobytes) per second

RTT: 100 milliseconds = 0.1 seconds

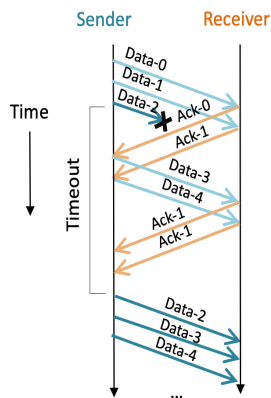
Segment size: 1 Kilobyte



If we now cut the RTT in half, (RTT = 50ms), how does that affect link utilization?

Q2. In a Go-Back-N (GBN) ARQ protocol, if a segment is lost, the sender times out, and only resends from the last ACK-ed segment once the timeout window has expired (as shown below).

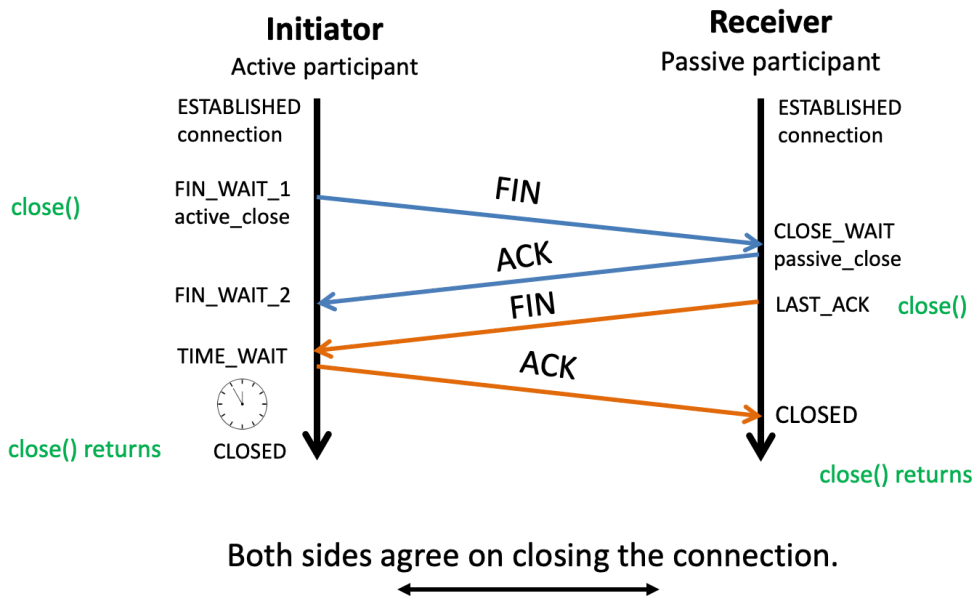
Can we make any performance optimizations on the sender side when resending segments?



- Retransmit from point of loss
  - Segments between loss event and retransmission are ignored
  - “Go-back-N” if a timeout event occurs

- A) No
- B) Yes, wait for three ACKs of the last received packet from the receiver
- C) Yes, wait for two ACKs of the last received packet from the receiver
- D) Yes, wait for one ACK of the last received packet from the receiver

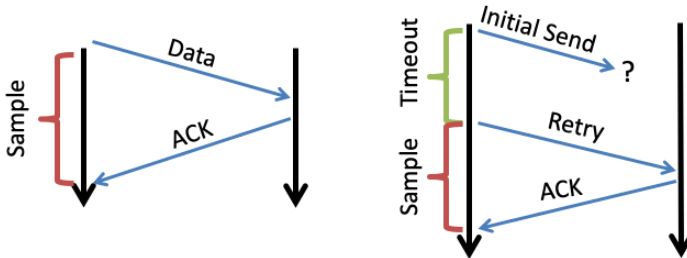
Q3. In the TCP connection teardown why does the Initiator need to wait before transitioning from the TIME\_WAIT to the CLOSED state?



Q4. How should we choose the initial sequence number? (Hint: What can go wrong with choosing a particular sequence number to start from every time? How can this information be used for malicious reasons?)

- A) Start from zero
- B) Start from one
- C) Start from a random number
- D) Start from some other value (such as...?)

Q5. When estimating the Round Trip Time (RTT), TCP usually ignores samples from retransmitted segments. In the following figure, TCP will ignore the sample in the right figure. Why would we want to ignore the sample from retransmissions?



Provide your reasoning here:

### Q3. RTT Estimation:

Suppose that TCP's current estimated values for the round trip time are:

- estimatedRTT = 400ms
- devRTT = 10ms

Suppose that the next two measured values of the RTT are 340 msec and 250 msec.

Compute TCP's new value of DevRTT, estimatedRTT, and the TCP timeout value after each of these two measured RTT values is obtained. Use the values of:

- $\alpha = 0.125$ , and
- $\beta = 0.25$

Estimated RTT is given by:  $(1 - \alpha) * \text{estimatedRTT} + \alpha * \text{sampleRTT}$

DevRTT :  $(1 - \beta) * \text{DevRTT} + \beta * |\text{estimatedRTT} - \text{sampleRTT}|$

1. What is the estimatedRTT and DevRTT after the first RTT?
2. What is the TCP timeout for the first RTT?
3. What is the estimatedRTT and DevRTT after the second RTT?
4. What is the TCP timeout for the second RTT?