

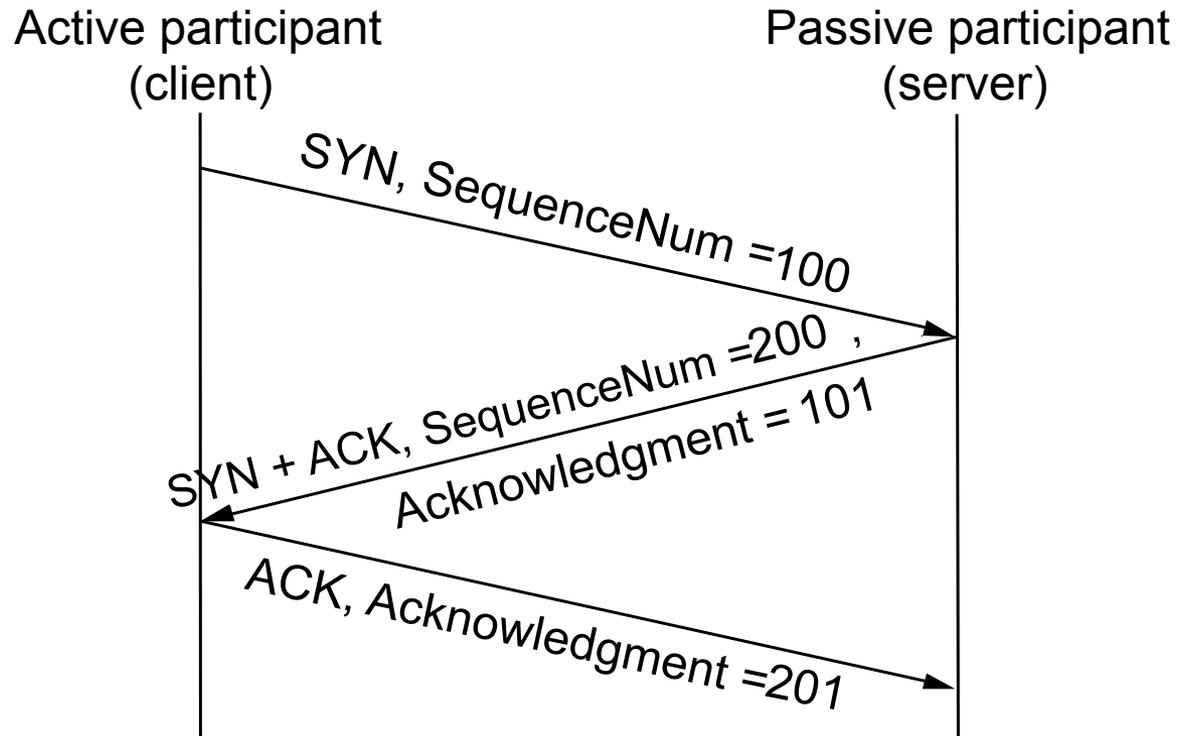
# Review notes

April 12, 2018

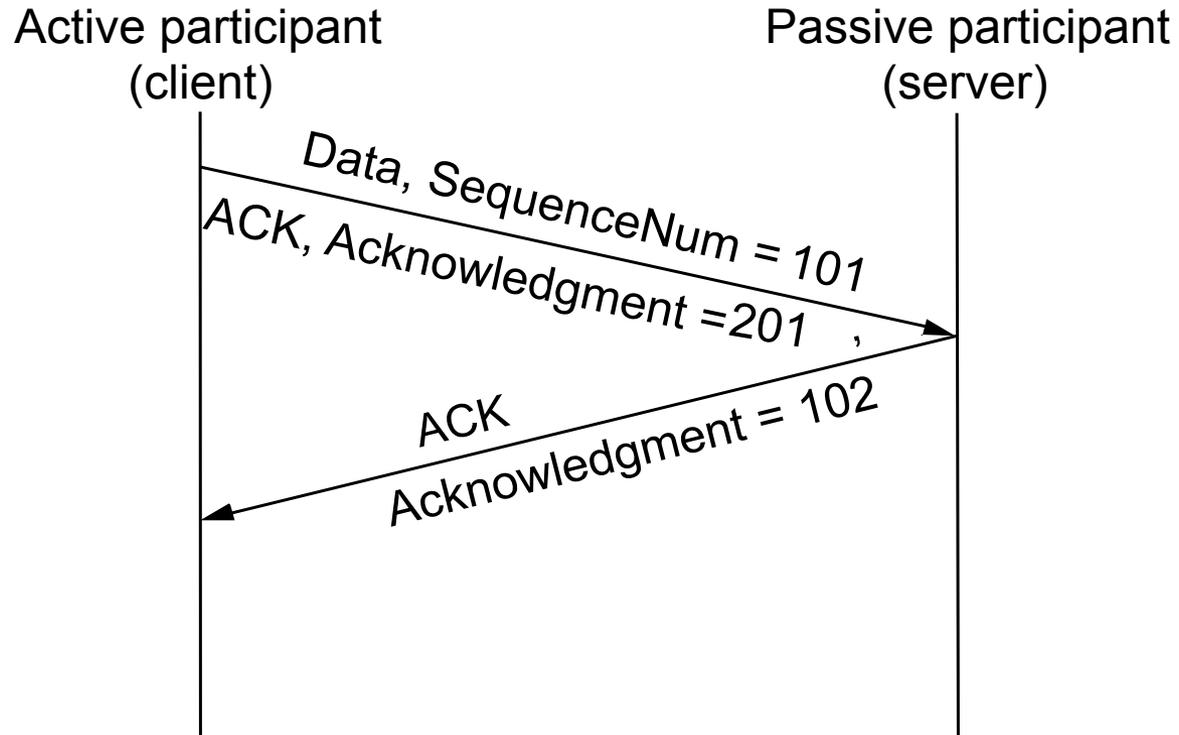
# TCP connection open

- Illustrate a TCP connection open and send one byte of data from the active participant to the receiver, followed by TCP close. No data is send by the receiver to the sender.
- Initial sequence number forward direction is 100 and reverse direction is 200.

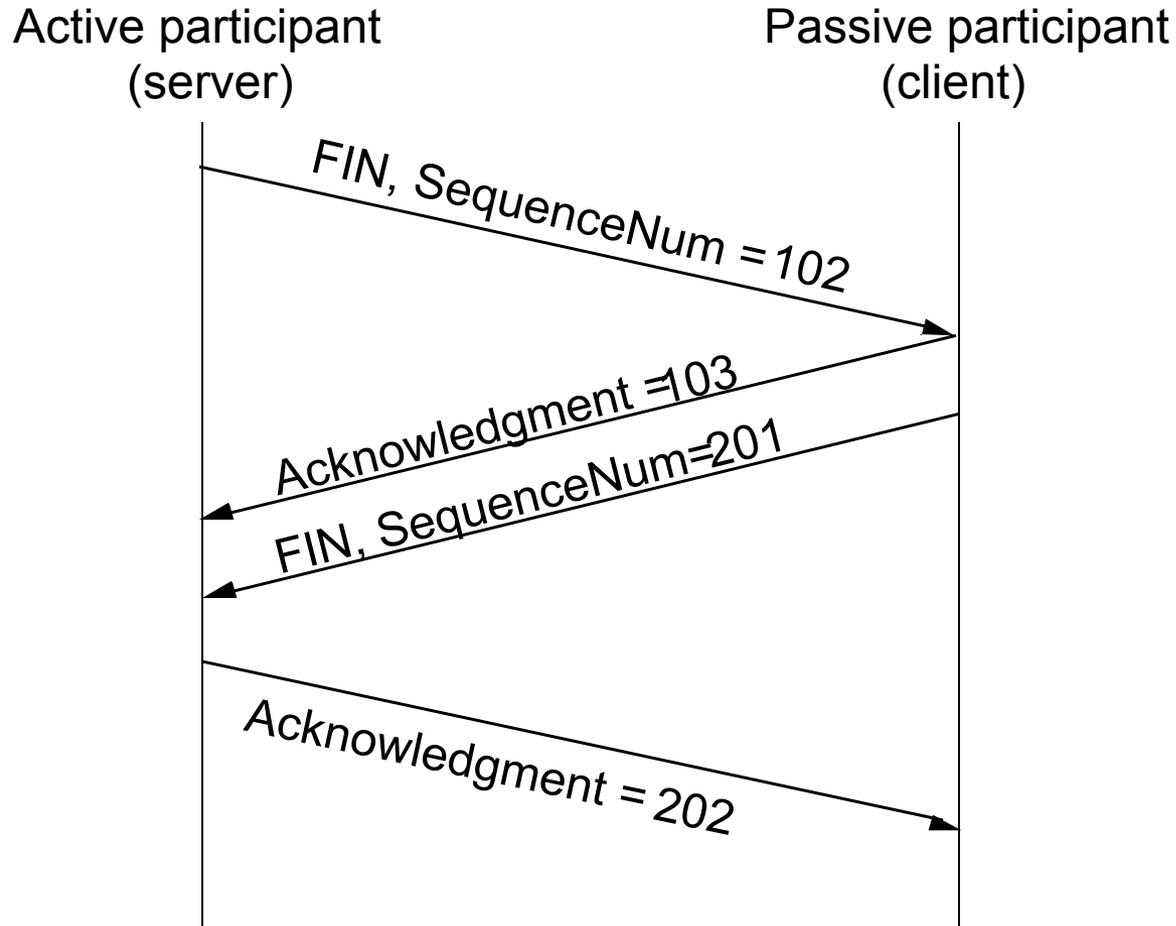
# TCP connection open



# Data transfer



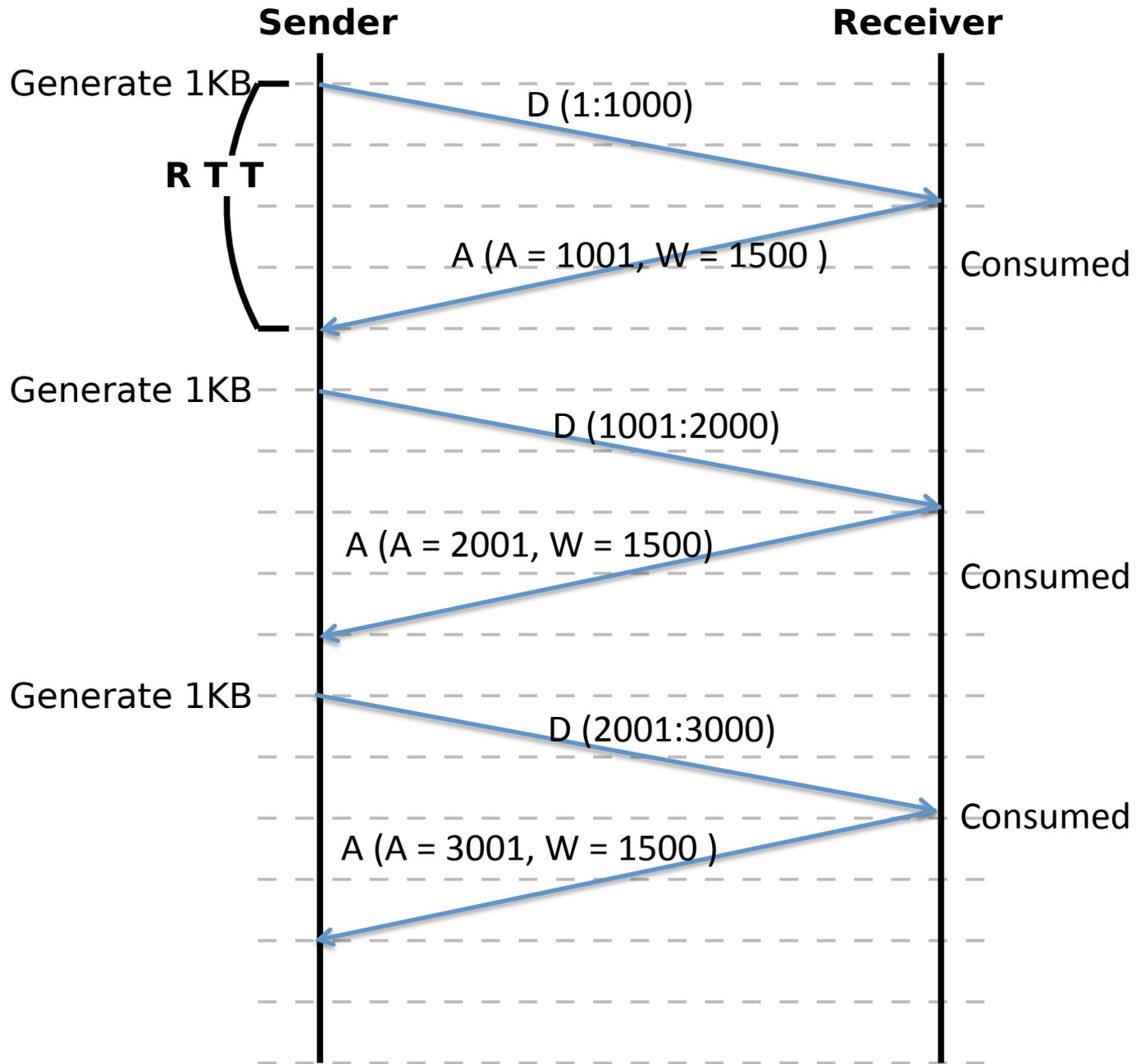
# TCP connection close



# TCP and flow control

Let us use the convention that 1 kB = 1000 bytes.

Assume a sender generates 1kB of data every 50ms and a receiver consumes 1kB of data in 10ms. Furthermore, assume the maximum segment size (MSS) is 1kB, the round trip time (RTT) is 40ms, the sequence number for the first byte of data is 1, and the receiver's buffer size is 2.5kB. Draw a timeline diagram showing the data and acknowledgement packets that are exchanged to transmit the first 3kB of data. (The gap between each dashed line is 10ms.) For each data packet, specify the sequence number and data length. For each acknowledgement packet, specify the acknowledgement number and advertised window



# TCP and Nagle algorithm

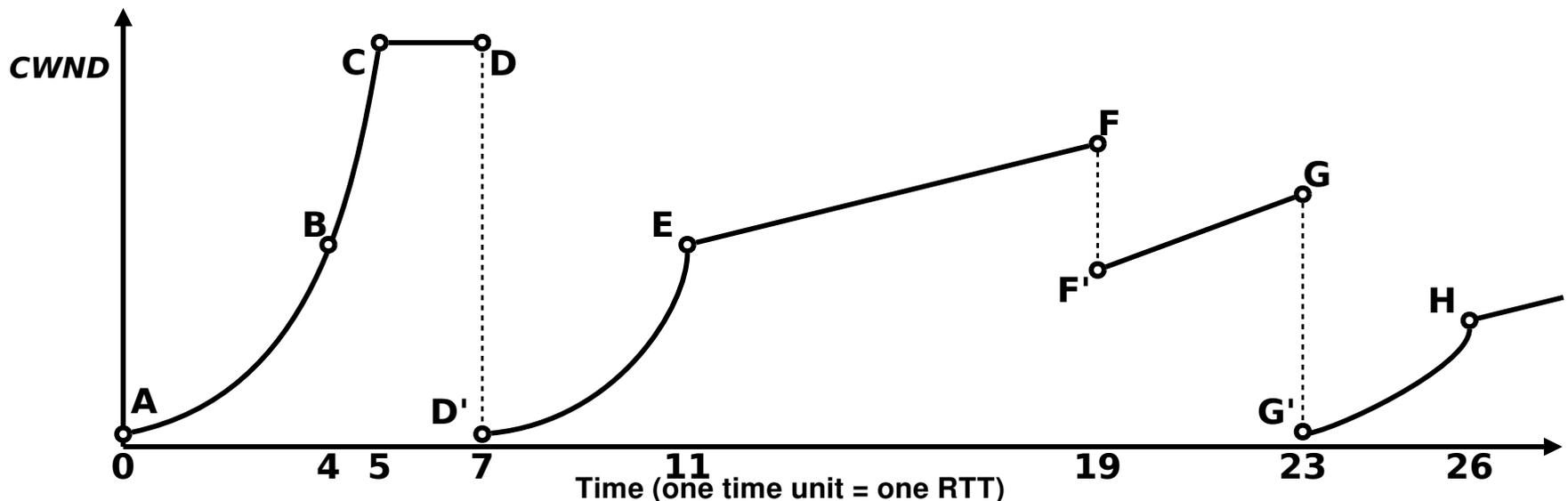
Now, assume the same scenario as above except the sender generates 1kB of data every 30ms and the receiver consumes only 0.2kB of data in 10ms. MSS is still 1kB. Draw a timeline diagram showing the data packets and acknowledgement packets that are exchanged to transmit the first 4kB of data using TCP. Remember to apply Nagle's algorithm when deciding when to transmit.



# Congestion control

The figure below shows the lifetime of a TCP connection and its congestion window.

- (a) During what time periods does slow start occur?
- (b) At what time points does fast recovery occur?
- (c) Label each letter in the figure with the value of the congestion window at that point.



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