

1 TCP Congestion Control

We consider a TCP connection and the evolution of its operation.

Suppose that:

- the transmission time of a packet is negligible compared to the propagation delay of 100 ms (we can therefore consider the transmission as instantaneous),
- the application that uses TCP always has data to send, except when stated otherwise,
- the maximum segment size is 1 Kbytes,
- the initial `ssthresh` congestion window is 4 Kbytes,
- the retransmission interval is 500 ms.

Consider the following scenario:

- at $t = 0$ ms the source TCP starts transmitting,
- at $t = 800$ ms the first TCP segment in the current window is lost,
- at $t = 1200$ ms the TCP source only has data for one TCP segment; when this segment is sent, it is lost,
- at $t = 1700$ ms the source TCP again has data to send.

Give the chronological sequence of operations performed by TCP for the first 2 seconds. Specify the state of TCP with respect to congestion, the number of segments sent, the values of variables `ssthresh` and `cwnd`, as well as other useful information.