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Computer Networks and Distributed Systems
Exercise Sheet 7

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Quiz questions

1. What is the purpose of the TIME_WAIT state?
2. Where in the network does the TCP congestion algorithm apply?
3. What is the function of the "P" bit in a TCP segment?
4. How does TCP fast retransmit work?

Exercise 7.1

Consider two TCP connections sharing a channel. Both connections transmit data in the same direction. At time point 1 the value of `CongWin` of connection A 6, for connection B it is 1. The thresholds in the beginning are both 7.

For simplification we consider time frames of size 1 RTT and ignore the transmission time $\frac{S}{R}$. All data segments have the length $S = MSS$, all other segments are being ignored here.

In a time unit, at most 14 data segments can be transmitted. If more than 14 data segments are being pushed onto the data link, then segments are dropped adhering to the following rule.

- Connection A sends 13 segments, connection B sends 7 segments $\rightsquigarrow$ 7 segments of conncection A and 7 segments of connection B are transmitted.
- Connection A sends 6 segments, connection B 12 segments $\rightsquigarrow$ 6 segments of connection A and 8 segmente of connection B are transmitted.
- Connection A sends 11 segments, connection B sends 6 segments $\rightsquigarrow$ 8 segments of connection A and 6 segments of connection B are transmitted.

a) Complete the following table by applying the TCP congestion control algorithm described in the lecture. (Hint: Write a (Java-)program to compute the table.)

t	1	2	...	15	Σ^*
$\texttt{CongWin}_A$	6	12			
$\texttt{CongWin}_B$	1	2			
$\Sigma^\dagger$	7	14			
Threshold_A	7	7			/
Threshold_B	7	7			/

b) Is the TCP congestion control fair?

c) What is the channel load relative to its capacity?

*Total number of transmitted segments
†Number of transmitted segments in a single time unit

Exercise 7.2

A. Nonymous wants to play games with the network and considers the problem of endpoint authorization with UDP and TCP.

(a) Suppose a Server receives a request in a UDP datagram and replies to it again with a UDP datagram (for example, in the context of DNS). If a client, having an IP address X, changes it in the IP header to Y, who will receive the server's response?

(b) Suppose a server receives a TCP SYN with source IP address Y and then, following the three-way handshake, a TCP ACK with source address Y and the correct sequence number. If the server picks sequence numbers randomly (and the IP protocol delivers the packets correctly), can the server be sure that it communicates with IP address Y (and not some other address X which is spoofing its identity)?

Exercise 7.3

What are the potential problems of the TCP congestion control algorithm in mobile networks (especially WWANs such as 3G/4G)?