



## **EXERCISE SHEET 6 – TCP Congestion Control**

### **Task 1**

A sender and receiver are connected via a geostationary satellite (approx. 36,000 km above the equator) with a bidirectional transmission channel. Data is sent in packets up to the size of a maximum Ethernet frame. The transmission speed is 100 Mbps. In this situation, the RTT time between sender and receiver is around 0.5 s. For an optimal transmission with sliding window, we have calculated a sender window larger than 6 MB.

In the following, we assume that the send and receive windows are set to this value and the TCP protocol is used. The MSS is 1 KB, packet loss or overload situations do not occur. Answer the following questions (approximately<sup>1</sup>):

- a. The TCP connection starts the file transfer with the slow start algorithm. After how many RTT times is the transmission window open to 1 MB?
- b. How many RTT times are required for the transfer of the entire 10 MB file?
- c. What is the approximated effective throughput for the transfer of this 10 MB file?

<sup>1</sup>i.e. make simplifying assumptions so that you arrive at a plausible approximated solution. Make sure, however, that the simplification does not lead to any significant falsification of the result.

### **Task 2**

List all header fields included in a TCP segment. Use the following table structure:

<b>TCP Segment</b>	<b>Size (Byte)</b>	<b>Description</b>

### **Task 3**

What is the maximum number of data bytes that can be sent with a UDP packet according to the protocol definitions?



List all header fields included in an UDP datagram. Use the following table structure:

UDP Datagram	Size (Byte)	Description
<div style="text-align: center;">• • •</div>		