Telematics

Winter Semester 2010/11

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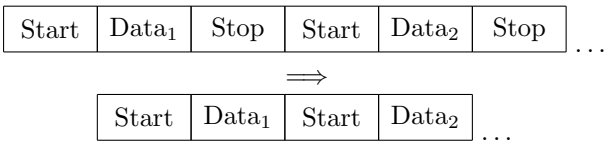
Lecturer:	Prof. Dr. Güneş, Dipl.-Inf. Blywis
Contact:	{guenes, blywis}@inf.fu-berlin.de

Exercise 1, Reducing the Overhead:

As you have learned, frames (often) consist of data that is framed by special flag bytes (start and stop). Discuss if the stop flag can be omitted to save one byte as the start flag of the succeeding frame can be used to implicitly mark that the previous frame has ended.



Exercise 2, Efficiency of Stop-and-Wait:

Assume a channel with a bit rate of 1 Mbps and a delay of 20 ms. A Stop-and-Wait protocol is used which unfortunately introduces waiting times and thus a low efficiency. The efficiency is dependent on the size of the frames. Determine the frame size for which the efficiency is 50%.

Exercise 3, LLC vs. MAC:

Discuss the difference tasks of the LLC and MAC.

Exercise 4, Flow Control:

Repeat and discuss the task of flow control.

Exercise 5, Sliding Window Mechanism:

Consider some host-to-network technology where each frame contains a sequence number SEQ as well as an acknowledgement number ACK. The acknowledgement number acknowledges all frames up to ACK-1. Both numbers are represented by M bits and thus all calculations are modulo 2^M.

1. How many frames can be sent before at least one acknowledgement has to be received?
2. Consider an example with $M = 8$ and window size $W = 7$. The frames with the sequence numbers $5, 6, 7, 0, 1$ have been sent from A to B and no acknowledgement has been received yet. Which of the remaining sequence numbers may be used by A to sent further frames?
3. Which sequence numbers may be used for further frames, if acknowledgements are received with:
   (a) ACK = 2
   (b) ACK = 6
   (c) ACK = 5

   List the acknowledged sequence numbers and the window of remaining sequence numbers.

Exercise 6, Sliding Window and Data Rate:

Consider a host-to-network technology with a sliding window mechanism and a window size of $W = 7$. The frames can have a size of up to 1,500 bytes and the round trip time between two hosts is 50 ms. Calculate the maximum data rate that can be achieved.

Exercise 7, Flow Control and Satellites:

Assume a geostationary satellite sends frames of 1000 bits over a channel with a bit rate of 1 Mbps. The frame take 270 ms to arrive at the station on earth. Calculate the maximum achievable efficiency using a

- Stop-and-Wait protocol
- Sliding Window protocol with window size 13

The acknowledgements are always piggybacked on data frames.

Exercise 8, Sliding Window:

What connection property is required to (efficiently) run a sliding window protocol?

Exercise 9, HDLC vs. PPP:

Compare the HDLC and PPP protocols. Specify appropriate metrics for the comparison.

Exercise 10, The End–to–End Argument:

Read the article *End-to-end arguments in system design* by Saltzer et al. Discuss the ideas of the end–to–end argument and which functions/services should be provided on particular layers of the reference model.