

Exercise Exam Telematics

This is an exercise exam to allow evaluation of your learning progress. Please ask questions about the exam in the Q&A session. Please note: We tried to design this exam similar to the final exam with respect to difficulty, length etc. The final exam can and will cover topics not mentioned here and could be partly even more difficult.

There are 90 Points for the 90 min exam. Try to solve the exercise exam in 90 min.

- 1) (2) Please explain the concept of layering. Name the five layers in the internet stack.
- 2) (2) Please answer in one sentence: What is a network protocol?

Data Link Layer:

- 3) (3) Please briefly explain the concepts of circuit and packet switching. Which switching technology is primarily used in the current internet and why?
- 4) (5) CRC checksums: Please calculate the CRC R of $D = 110111011$. Please use the 4 bit generator $G = 1001$.
- 5) (4) What is the purpose of the Address Resolution Protocol (ARP)? Please sketch the message flow.
- 6) (2) Explain how collisions are prevented in switched Ethernets that use a star topology.

Network Layer:

- 7) (2) Shortly describe the two key functions of the network layer
- 8) (3) Explain what head-of-line blocking is and where and when it occurs.
- 9) (5) Assume you have a 1,500 byte long datagram which needs to be fragmented for a 600 bytes MTU. Please fill the following table with the data of the resulting datagrams.

Datagram nr.	Length	Frag. Flag	Offset

- 10) (4) What is the purpose of the Dynamic Host Configuration Protocol? Illustrate its message exchange with a simple figure.
- 11) (1) What is the initial motivation behind IPv6?

12) (7) A provider has been assigned the network 128.30.0.0/22 and wants to divide it among three customers. Customer A and B need to accommodate up to 200 hosts each while customer C needs to accommodate up to 500 hosts. Please fill the following table with the details of the sub-networks that the provider can create to fit its customers' needs.

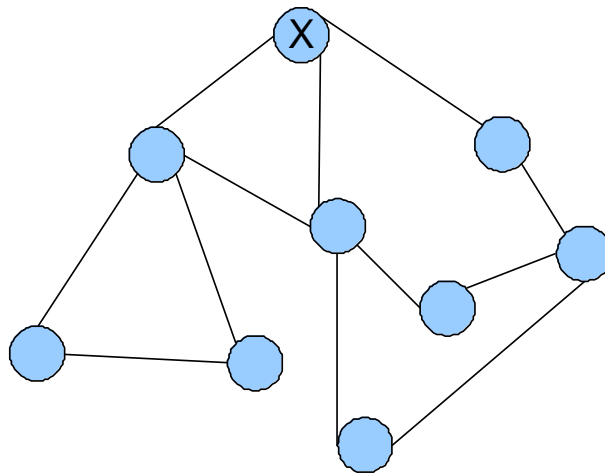
Customer	Network address	Netmask	Host range	No. of hosts
A				
B				
C				

13) (3) What are the main differences between a link state routing algorithm and a distance vector routing algorithm?

14) (3) What is Network Address Translation? What are its advantages and disadvantages?

15) (3) Why is finding a suitable tree important in multicast routing?

16) (2) Given the following network, use Reverse Path Forwarding to create a multicast distribution tree with router X as the source. You can assume that all links have the same weight.



Transport Layer:

17) (2) Please describe the principle of TCP socket identification.

18) (2) Why does TCP introduce an end-to-end congestion control concept? Please provide a short answer.

19) (4) Please calculate the UDP checksum for the following three 8-Bit words: 11010011, 00010100, 01110100

20) (3) Please calculate the utilization rate of the sender U_{sender} for the stop and wait protocol scenario:

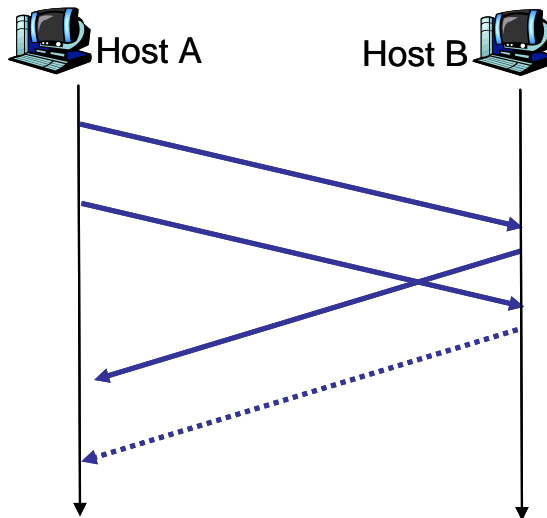
Packet size (L): 10 000 bits (including header)

Transmission rate (R): 1Mbit/s

Round Trip Time (RTT): 100ms

How can one improve this stop and wait algorithm?

- 21) (3) The difference between UDP and IP packets is minimal. What does UDP add over IP that justifies its use?
- 22) (7) TCP sequence numbers. Host A and Host B are communicating over a TCP connection. Host B has already received from Host A all bytes up to byte 144. Suppose that Host A now sends two segments to Host B back-to-back. The first and second segments contain 20 bytes and 40 bytes data, respectively. In the first segment, the sequence number is 145, source port number is 303, and the destination port number is 82. Host B sends an acknowledgement whenever it receives a segment from Host A.



- (a) In the second segment sent from Host A to Host B, what are the sequence number, source port number and destination port number?
- (b) If the first segment arrives before the second segment, in the acknowledgement of the first arrived segment, what are the acknowledgement number, the source port number, and the destination port number?
- (c) If the second segment arrives before the first segment, in the acknowledgement of the first arrived segment, what is the acknowledgement number?

Multimedia Networking:

- 23) (3) Consider a scenario where media is streamed from a streaming server. Please illustrate the four entities involved in such a scenario and their relationship (e.g. message flows).
- 24) (2) What is the purpose of the Real Time Streaming Protocol (RTSP)?

QOS:

- 25) (2) Consider three different queues (a, b, c) that are connected to a sending buffer that implements a WFQ scheduling policy. There should be twice as many packets sent

from queue 'c' than from queue 'a' and 'b' combined.

- a) How would you set the weights for the queues?
- b) Illustrate how the sequence of packets sent from this buffer could look like.
- c) How would the sequence look like if the queue 'c' is empty?

26) (4) Briefly explain the principles behind the IntServ architecture.

Network Security:

- 27) (3) What two basic types of cryptography are there? Which one is computationally much more costly and why is that so?
- 28) (2) How can replay attacks be prevented in an authentication protocol?
- 29) (2) Please explain the purpose of a cryptographic hash function. What is the primary difference to “usual” hash functions?