Telematics

Winter Semester 2010/11

Number:	8. Assignment
Issued:	09.12.10
Tutorial:	16.12.10
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Exercise 1, Network Components:

Discuss the function(-s) of the following network components: Repeater, hub, switch, bridge, router, and gateway. Which "data" do they handle and on which layer of the ISO/OSI reference model do they operate?

Exercise 2, End of the Ethernet Frame:

Compared to the IEEE 802.3 frame the Ethernet frame has no length but a type field. How can a network interface card actually detect the end of the frame?

Exercise 3, LLC Classes:

As discussed in the 5th tutorial, there are different *Logical Link Control* classes. How do stations actually know which classes are supported by the others?

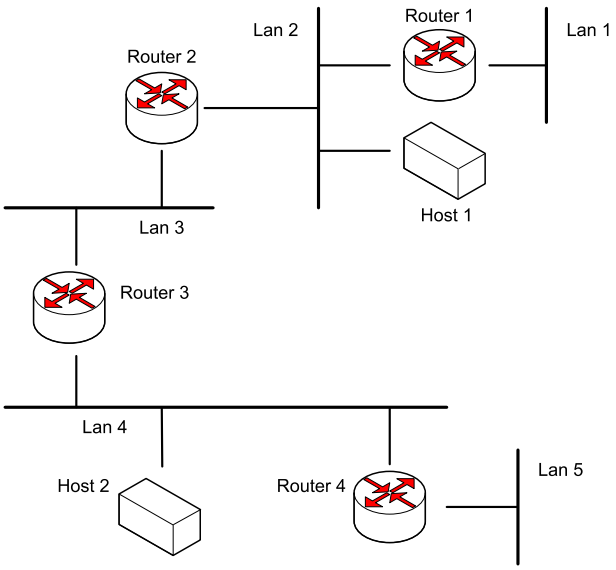
Exercise 4, MTU:

What is the *Maximum Transfer Unit* (MTU) and why is it relevant for bridging and routing?

Exercise 5, Network Layer:

Discuss the tasks of the network layer and how it differs from the lower and upper layers. Name network layer protocols and their historical as well as current relevance.

Exercise 6, Subnets:



Assign IP addreses for the devices in the network depicted above. You have the IP block 137.226.0.0/16 available and should come up with a good assignment of addresses for the networks.
Specify the routing tables of all routers. Assume that *Router 1* has an additional connection to the Internet. Based on the routing information, each router should be able to determine where all packets have to be forwarded to.

Exercise 7, Internet Protocol Version 4:

Answer the following questions regarding the Internet Protocol (IP):

1. How large are IPv4 datagrams usually? Capture some datagrams with Wireshark and evaluate your sample.
2. What is the maximum size of IPv4 datagrams?
3. What happens when datagrams get very large?
4. Consider the following scenario. 13.5 kByte of data shall be send from host A to host B using IP as network layer protocol. How large is the protocol overhead? What happens when the datagrams have to pass a network with a MTU of 500 Bytes and how does this change the overhead?
5. How are datagrams handled by routers when the DF flag is set in the flag field?
6. What purpose has the Type of Service (TOS) field in the IP header?

Exercise 8, Checksum:

The Internet Protocol as well as other protocols use a common checksum algorithm.

1. How is the algorithm called?
2. Give a (pseudo) code implementation.
3. Calculate the checksum over the following sequence of bytes: 0x00, 0x01, 0xf2, 0x03, 0xf4, 0xf5, 0xf6, 0xf7

Exercise 9, Address Resolution Protocol:

Answer the following questions regarding the Address Resolution Protocol (ARP):

1. What is the task of ARP?
2. How does the protocol work?
3. Are there security issues?

Exercise 10, Self-Configuration:

How can hosts self-configure their network layer address? Name and discuss three protocols.

Exercise 11, Tracing:

How can IP be used to trace the route between two hosts? Discuss different approaches and if they always work!

Exercise 12, Address Translation:

Answer the following questions regarding Network Address Translation (NAT):

1. What is NAT and why is it necessary?
2. What types of NAT are available and what are their differences?
3. What problems can arise when using NAT?

Exercise 13, ICMP:

Answer the following questions regarding the Internet Control Message Protocol (ICMP):

1. What services are provided by ICMP?
2. Which of these services are superseded by other protocols or used very rarely?