Telematics

Winter Semester 2008/09

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General information about the exercises
Accompanying the lecture, we will give out some assignments. You shall do the exercises on your own but you do not have to submit your solutions. The solutions will be presented in the tutorial sessions. We expect each student to have solved the exercises and might ask anyone to present these.

Exercise 1, Media Access:

List and explain the different media access approaches. Discuss how these approaches influence the services of upper layer protocols in regard to guarantees, QoS, and time critical applications.

Exercise 2, Network Topologies:

Consider the following four network topologies, each with n nodes:

- Star
- Fully Meshed
- Unidirectional Ring
- Bidirectional Ring

Give a formula to calculate the minimum, maximum, and average number of hops between any two nodes for any number n.

Exercise 3, Network Topologies 2:

Discuss the bus and star topology. Name the disadvantages of each topology. How does a broken cable affect a bus and a star topology? Discuss how these topologies differ in regard to security, e.g., how an unauthorized connected node can be detected.

Exercise 4, Efficiency of Token-Ring:

Discuss how Token-Ring networks perform in full load and in low traffic scenarios.

Exercise 5, Scaling of Token-Ring:

Discuss how a Token-Ring network scales with an increasing ring size. Which layers of the ISO/OSI reference model are defined by IEEE 802.5?

Exercise 6, Ethernet - Capture Effect:

Two hosts (A and B) are connected to an Ethernet. Both have unlimited data to send. The frames belonging to A shall be denoted as $A_1, A_2, \ldots, A_n$ and the frames of B as $B_1, B_2, \ldots, B_n$.
Assume that A and B try to send frames at the same time. The frames collide and the hosts choose a random waiting time. Station A's waiting time is $W_A = 0$ slots and station B's is $W_B = 1$ slot. A "wins" the medium access and transmits frame A_1 while B waits for the next slot.
Station B tries to send frame B_1 again after the transmission of A_1 is finished. Unfortunately, B_1 collides with A_2. In this situation, A either waits for 0 or 1 slot, while B has to choose a random waiting time $W_B \in \{0, 1, 2, 3\}$.

1. Calculate the probability that A wins this contention after the second collision, i.e. that W_A is smaller than W_B.
2. Assume that station A won the contention, i.e. frame A_2 is transmitted. Calculate the probability for A also winning the next contention.
3. Give a formula to calculate the probability that A does win the i-th contention. Calculate the probability of A winning the i-th contention with $i \in \{1..MAX\}$.
4. The term **Capture Effect** denotes a situation in which A wins all contentions after the first collision. Host B cannot send data until the maximum number of retransmissions has been reached and the current frame is dropped. Give the probability of this event.

Exercise 7, Types of Networks:

1. What are host-to-network, network interface, or link layer implementations?
2. Discuss the notion of LAN, MAN, and WAN.
3. Give examples of LANs, MANs, and WANs. Which of these are still relevant today?

Exercise unrelated to Telematics. Solve the following brainteaser to train your brain.

Exercise 8, A Planet of Aliens:

An astronaut from earth visits a planet in a foreign solar system. He meets the inhabitants that are quite curious. Of these there are 167 female ones; 239 are male, 145 are hermaphroditic, and only 34 are of no gender.
How many aliens are there on the planet?

Exercise 9, The usual Suspects:

A famous painting has been stolen! Four suspects are questioned by the police. They state the following:

A: "B stole the painting!"

B: "D is the thief!"

C: "I didn't steal anything!"

D: "B is lying!"

Only one of the suspects is telling the truth. All others are lying. Can you figure out who stole the painting.
