LiTH, The Institute of Technology at Linköping University
IDA, The Department of Computer and Information Science
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Written examination in TDTS06 Computer Networks 2011-01-13 at 8–12

Rooms

U3, U4 and U6.

Support materials

A basic calculator with memory erased and an English dictionary (not electronical) are allowed. Also four pages with *handwritten* notes on standard *lined* paper, with one line of text on each line on the paper 1 cm apart, are permitted.

Results

The results will be published at latest twelve working days after the exam.

Points

Maximum is 40 points (46 if you have earned bonus points from the optional assignment or handing in labs on time). For grade 3, then 20 points are needed. For grades 4 and 5, 28 points and 36 points, respectively, are needed.

Teacher on duty

Juha Takkinen, 0731-500 393, will visit the hall around 9 am and at 11 am.

Instructions

Write clearly. Explain your answers, if not told otherwise, and show all your steps in calculations. State any relevant assumptions that you make in addition to what is written in the question, but you are not allowed to change the question. Keep the same order on your answers as the questions in the exam. You can answer in either Swedish or English. *Note that only one page of each paper will be graded*. You must also see the wrapper for the common instructions for the exam.

Good luck!

1. Protocols

a. Explain what doing a passive open means. (1 p.)

b. Draw an FSM for the data-transfer phase of the following stop-and-wait protocol for reliable data transfer from a client to a server. Assume the initial handshake has been done. The client starts by sending data to the server. After sending data for a while the client must pause because the server has calculated and transmitted an MD5 sum over the received data and sent it to the client. After receiving the sum, the client continues to send more data. This exchange of data and MD5 sums continues until the client is out of data. All types of messages are sent at-least-once. You must use the same FSM notation as presented in the course. You do not have to model the termination of the data connection. (4 p.)

2. Networking basics

a. Suppose there is a 100-Mbps point-to-point link between Earth and a lunar colony. The distance to the moon is approximately 385,000 km and data travels over the link at the speed of light of 3×10^8 m/s.

i. How many bits can a sender transmit before the first bit arrives at the receiver?(1 p.)

ii. Assuming the link has many errors, explain what type of sliding-window protocol would perform the best: go-back-N or selective-repeat? (2 p.)

b. Explain what delays that the traceroute program measures. (2 p.)

3. Applications

a. Explain if the following statement is true or false: “The FTP protocol is stateless”. (2 p.)

b. HTTP can be persistent and/or use pipelining. Explain what this means. (2 p.)

c. Eaplein the difference betwen a recursive and an iterative query in the DNS system. (1 p.)

4. TCP

a. If an application needs to protect the boundaries of its message, which transport-layer protocol should be used, UDP or TCP? Explain your answer. (2 p.)

b. Explain what slow start and congestion avoidance are, with regard to TCP’s congestion control mechanism. (2 p.)

c. TCP is said to be a reliable transport layer protocol. Explain briefly what is meant by this concept. (1 p.)

5. IP

a. Explain how many responses the sender of a DHCP discover message expects to receive and why. (2 p.)

b. Explain what the purpose of the IP address is, i.e. why it is hierarchical and what it actually is used for. (2 p.)

c. Explain if the following statement is true or false: “IP fragmentation occurs when the TCP segment recieved from the transport layer is too large for the netowrk layer to handle.” (1 p.)

6. LANs

a. Consider the extended LAN in the figure below. Suppose that the forwarding table in the switch (S_1) initially is empty. $H_{1–3}$ are hubs. The table entries are denoted by (N, X) where N is the host ID and X the link ID.

i. Assume that host B sends a frame to host H, and that host H replies back with sending another frame. The list below shows a number of events A–K that may or may not happen in this scenario. Show the correct order of the correct events. (2 p).

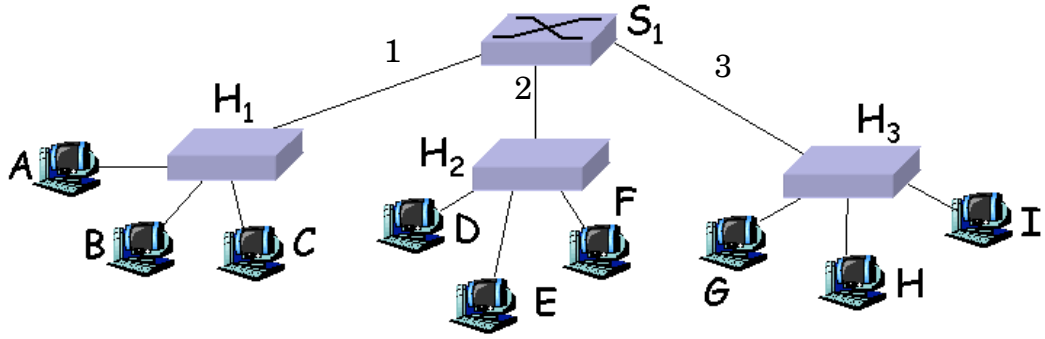

Figure of an extended LAN.

A. The switch receives a frame.
B. Host B receives a frame.
C. The switch sends an acknowledgement back to the sender.
D. The switch broadcasts a frame on all outgoing interfaces except the one where the frame arrived.
E. Host H receives a frame.
F. Host H sends a frame
G. The switch sends a frame on one outgoing link.
H. The switch adds an entry (B, 1) to its forwarding table.
I. The switch adds an entry (H, 3) to its forwarding table.
J. Host B sends a frame.

K. The switch receives a frame.

ii. LAN broadcasts are used by both DHCP and ARP to enable their respective services. How many broadcast domains are there in the extended LAN in the figure shown above? Explain your answer. (1 p.)

b. Describe and explain two types of control packets that are implemented in the IEEE 802.11b standard for WLANs. (2 p.)

7. Routing

a. Explain why flooding is required in the link-state algorithm, as implemented in OSPF, as compared to the distance-vector algorithm, as implemented in RIP. (2 p.)

b. Explain what type of information that is distributed by the BPG protocol, as compared to OSPF and RIP. (2 p.)

c. Describe one solution to the count-to-infinity problem. (1 p.)

8. Network security

a. Explain the following network security concepts in two sentences and as unambigously as possible:

i. message digest (1 p.)

ii. symmetric encryption (1 p.)

b. Explain the difference between an active and a passive intruder, with regard to network security. (2 p.)

c. Explain if it is possible to decrypt a hash of a message. (1 p.)