LiTH, Tekniska högskolan vid Linköpings universitet
IDA, Institutionen för datavetenskap
Juha Takkinen
2008-08-25

Written examination in TDTS06 Computer Networks and TDTS41 Computer networks 2008-08-23 at 8–12

Hall

G34.

Helping materials

A basic calculator with memory erased and an English dictionary (not electronical) are allowed.

Results

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

Points

Maximum is 40 points (44 if you passed the optional assignment). For grade 3, 20 points are needed. For grades 4 and 5, 28 points and 36 points, respectively, are needed. ECTS grades are given separately.

Teachers on duty

Juha Takkinen, 0731-50 03 93, will visit the hall around 9 and at 11 o'clock.

Instructions

Read each question carefully and make sure you have answered everything in the question. Justify your answers, if not told otherwise, and state explicitly your assumptions. The use of figures is encouraged, except where other instructions apply. Answers that are not legible will not be graded. You can use either English or Swedish. Be thorough and to the point with your answers. You should convince the examiner that you understand what you are writing about. However, "shotgun" answers will not score any points.

Put only one problem on each sheet of paper, with the exception of subproblems a, b, etc., which can be on the same sheet. Use only one side of each paper. Note: We will only grade one side of each paper!

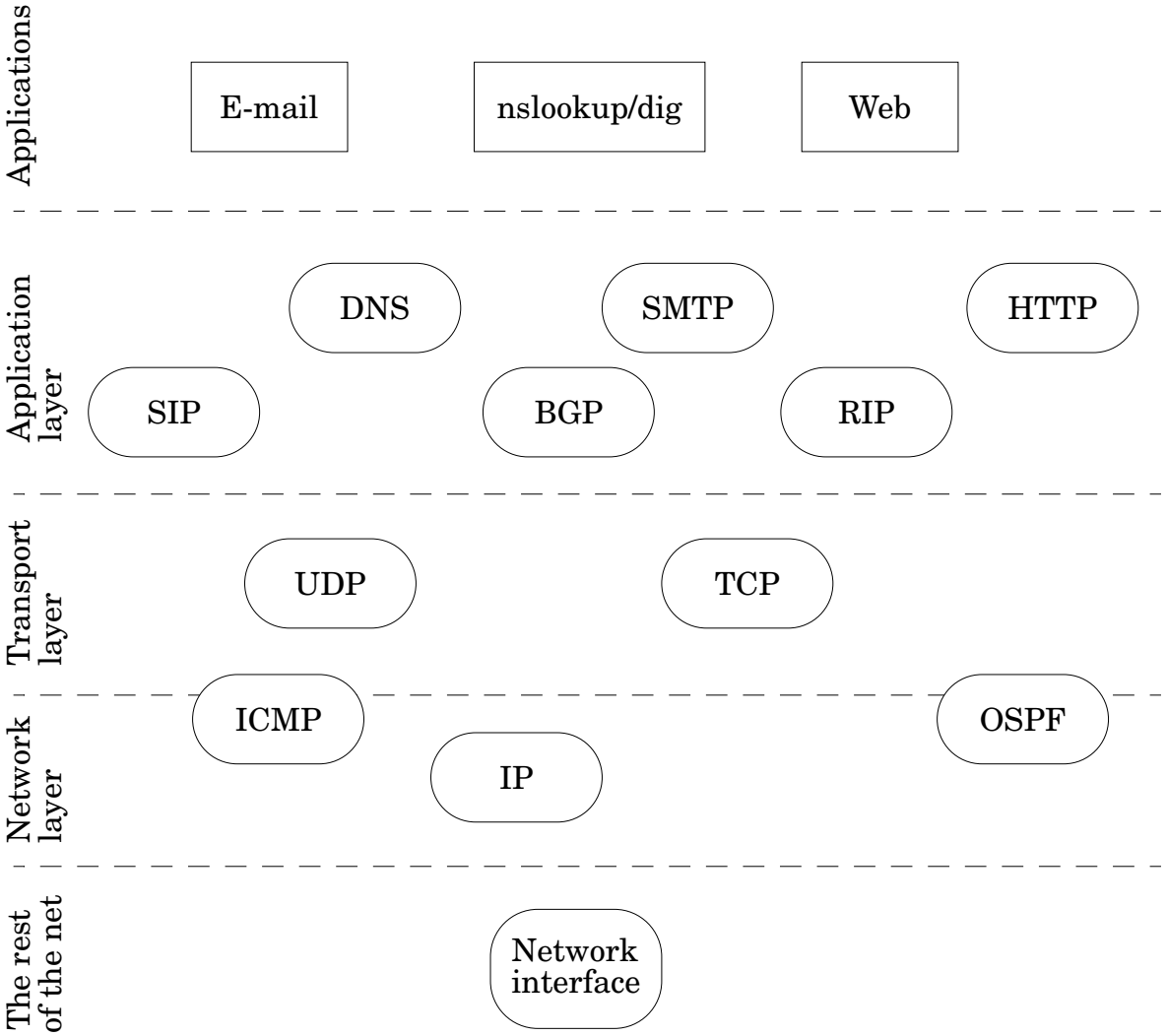
Make sure that you keep *the same order* of each alternative and table entry when you copy answers from the examination paper to your answer sheet.

"A good definition of a network is organic behaviour in a technological matrix." —Kevin Kelly

Good luck!

1. Protocols

a. Connect the protocols in the protocol stack shown below with each other so that the Internet applications at the top can execute properly. Then, select one of the protocols that is left over and explain what it is. (3 p.)



b. Regarding the client's FSM (finite state machine) in TCP's connection-establishment phase: What is the event-action pair in the second leg of the three-way handshake and the name of the state that the client will be in? (2 p.)

2. Networking basics

a. Compare a packet-switched and a circuit-switched network with regard to "call setup time", "potentially wasted bandwidth", "handling of node failures", and "packets arrive in order". (2 p.)

b. Consider a ring-shaped network with bandwidth 100 Mbps and propagation delay of 2×10^8 m/s. What would the circumference of the ring be to exactly contain one 250-byte packet, assuming there was a node every 100 m and each node introduced 10 bits of delay? (2 p.)

c. Explain two types of delay that a packet can experience in a router; what they are and why they occur. (1 p.)

3. Applications

a. What is meant by a push protocol? And a pull protocol? Is HTTP/1.1 a push- or pull-based protocol? How about SMTP? Motivate your answer. (3 p.)

b. In the four items below, tick off True, False, or none of the two. Do not justify your answer. *Copy your answer to your answering sheet*. (2 p.)

	True	False	
i.	❑	❑	The DNS is an example of an P2P overlay network.
ii.	❑	❑	A communication with an FTP server uses one control channel for the transfer of FTP commands and one data channel for the transfer of files.
iii.	❑	❑	HTTP cookies are typically stored in a proxy server and used to check if there is an up-to-date version of a document.
iv.	❑	❑	POP and IMAP can be used to download e-mail to a wireless client.

(+0.5 p. for each correct, –0.5 p. for each wrong, 0 p. for no answer, and min. 0 p.)

4. TCP

a. Assume the threshold value is set to 32 KB and MSS is 1500 bytes when the slow start phase starts in TCP's congestion control mechanism. Assume 1 KB is 1024 bytes. For how long will the phase continue, assuming no loss event occurs, and what happens after that? (2 p.)

b. How often is the TCP retransmission timer updated and (approximately) with what value? Motivate your answer. (2 p.)

c. Name two fields missing from the UDP header that make the protocol unreliable for delivery of data, as compared to TCP. (1 p.)

5. IP

a. Define and exemplify the following concepts: (3 p.)

i. Packet fragmentation.

ii. Address aggregation.

iii. IPv6.

b. Explain if the following statement is true or false: "Before retransmitting an IP packet, the router doing the retransmission does a DNS lookup of the destination address." (2 p.)

6. LANs

a. Assume two stations A and B are located furhtest apart in an Ethernet network. They have just aborted their respective transmissions because of a collision. For station A this is the third collision during the transmission of the same frame, while it is the first collision for station B. Describe what the exponential backoff phase looks like for station A and B, respectively, in this scenario. (2 p.)

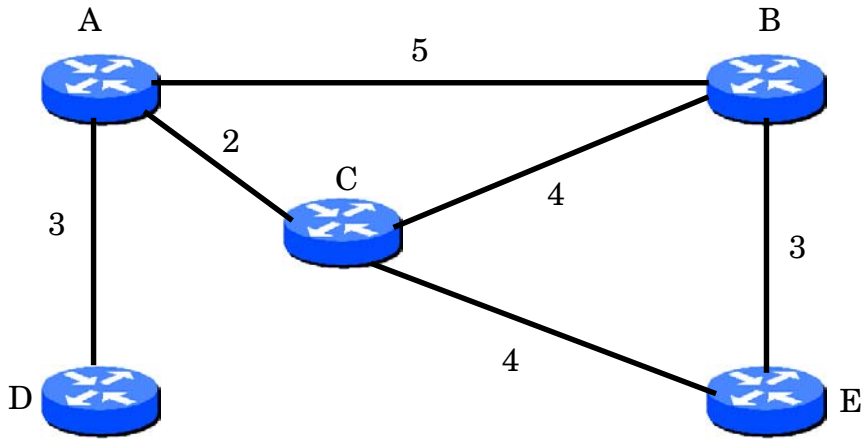
b. Place the steps below for the ARP function in the correct order 1–7: (2 p.)

Step	Description
	Every host and router receives the frame. All machines except the one targeted drop the frame. The target recognizes its IP address.
	IP asks ARP to create an ARP request message, containing the sender MAC address, the sender IP address, and the target IP address, with the target MAC address filled with zeros.
	The IP datagram with data for the target is now encapsulated in a frame and is unicast to the destination.
	The target replies with an ARP reply message containing its MAC address, which is unicast.
	The message is passed to the link layer and put into a frame with the MAC address of the sender as the source address and the LAN broadcast address as the destination address.
	The sender receives the reply message. It knows the MAC address of the target.
	The sender knows the IP address of the target.

c. Define the Basic Service Set (BSS), as used in the IEEE 802.11 standard. (1 p.)

7. Routing

a. Calculate the spanning tree with the least-cost paths for the network below, starting from node A, as it is done in link-state routing. Show the tree and your calculations. Which links will not be used in routing? (2 p.)



b. Compare link-state routing and distance-vector routing with regard to the risc of creating routing loops and the amount of control (routing) messages sent when a new link is discovered. (2 p.)

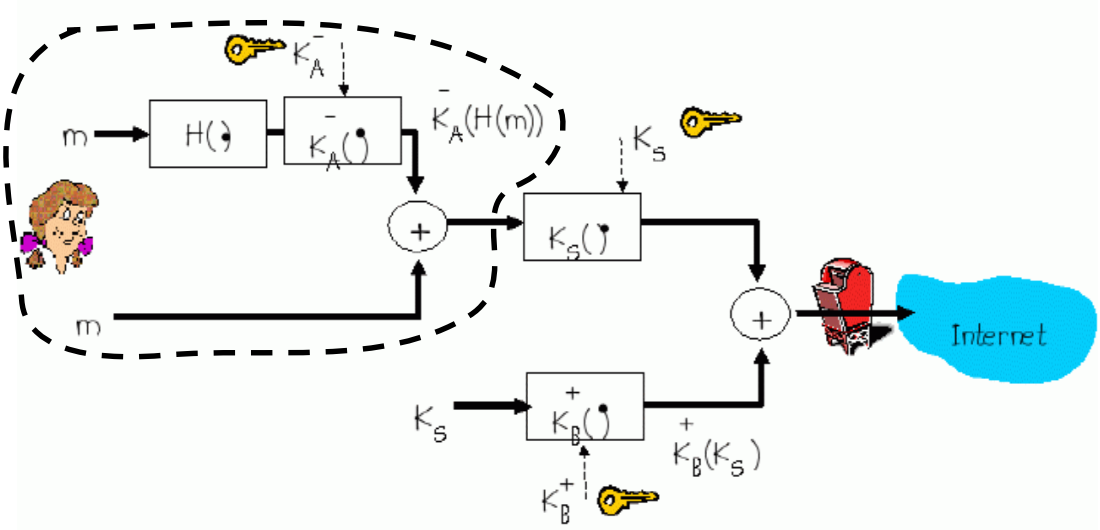
c. Suppose the network in a) above is a backbone network in an autonomous system. Furthermore, assume router A is a boundary router while routers B and E are area border routers. Which routers will then use BGP to exchange routing information? (1 p.)

8. Network security

a. Complete the below table and explain the terms by following the format of the listed example. (2 p.)

Term	Explanation
playback attack	
chosen-plaintext attack	
known-plaintext attack	
packet sniffing	
ip spoofing	The technique of forging the source address of one's IP packets so that it looks like the packets are coming from someone else.

b. The figure below shows how a PGP-based e-mail message is created and then sent. Explain what the dashed area contains. (2 p.)



c. Name a symmetric encryption algorithm and a typical case when it is used (as compared to an asymmetric one). (1 p.)