LUND UNIVERSITY

Department of Electrical and Information Technology

ETSF10 Exam Part A 2013-12-20 08.00 – 13.00

This exam is compulsory to pass for finally passing the course. It is divided into three sections, each section corresponding to the three quizzes in the course.

If you have not passed any of the online quizzes, you need to take the whole exam and try to answer all questions. There are 21 questions in this exam, giving a total of 63 points. Minimum 37.5 (60%) points are needed to pass and get mark 3.

For those of you who passed an online quiz, the exam questions are grouped into three sections. Each section corresponds to a particular online quiz. For each online quiz you have passed, you are exempt from the corresponding section; you need not answer the questions in that section. In other words, your exam will be assessed only on those sections you have not already passed online. The assessment will be section-by-section. Each section has a total of 21 points. Minimum 12.5 points are needed to pass a section.

Please note that, even if you have passed some of the online quizzes, you can choose to waive your quiz results and take the whole final exam instead. In that case, your exam will be assessed according to the top paragraph. ***In case you choose to do so, don't forget to state this at the beginning of your answers.***

You get part of the points for a question if your answer is only partially correct. Use all the time given to you. Answer briefly and clearly. Choose your words carefully in order not to write answers too long. *Keep in mind that none of the questions requires an answer longer than approx. 100 words.* Always motivate your answers if not stated otherwise. Unclear, confused, and too generic answers, containing irrelevant information, will decrease your points!

Make sure that your handwriting is clear and readable. Unreadable answers cannot be marked!

Du får svara på svenska eller engelska.

If you want, you may use a pocket calculator and a notes page (one side of an A4-size paper, handwritten, which must be handed in with your answer sheets).

Routing on the Internet; corresponds to Quiz 1

1 Every router introduces delay. Which parts or functions of the router are the main contributors to delay? Why are these parts or functions needed? *3p*

2 What is the objective of a routing table and a forwarding table in a router? *3p*

3 Routers in a router domain need to know their neighbours or peers. This task is solved diffrently in RIP, OSPF and BGP. How? Descibe shortly for each of the three routing protocols. *3p*

4 Routing loops are a disaster for the forwarding process. How are they prevented or avoided i RIP, OSPF and BGP respectively? *3p*

5 NAT alleviates (temporarlily?) the problem off lack of IPv4 addresses. But it introduces a new problem that is related to transport and application layers. Which, and why? *3p*

6 Explain why multicasting is more efficient than sending multiple unicast streams. *3p*

7 Why is it necessary for a multicast router to check actively the hosts' membership to the different multicast groups? Isn't it enough to keep a record of join and leave messages, or increment a counter when a new host joins the group and decrement it when one leaves? Whenever the counter reached 0, the router would know there weren't any members left in the group. *3p*

Net id	Next hop
195.201.32.192/26	1.2.3.4
191.100.17.0/24	1.2.3.4
191.100.18.0/24	3.4.5.6
195.201.32.0/24	4.3.2.1
191.100.19.0/24	4.3.2.1
199.101.3.0/24	3.4.5.6
199.101.1.0/23	4.3.2.1

Tabell 1: Routing table

Network & Transport Layer Protocols; corresponds to Quiz 2

8 How many TCP segments are sent during the first four rounds of a TCP slow start face? How long time does i take to send and receive ACKs for those segments expressed in Round Trip Time (RTT)? Remember to motivate your answer. *3p*

9 Assume the TCP slow start threshold is set to 16. Four rounds after entering into congestion avoidance state a time out is encountered. How many TCP segments are sent during this phase? Remember to motivate your answer. There is another incident that breaks the congestion avoidance state. Which? *3p*

10 Explain briefly the three way hand-shake that initiates a TCP connection. Which flags are set in the segments? Do the same for the three way handshake that finishes a TCP session. *3p*

11 Why is error detection and error correction needed end-to-end in the transport layer in the TCP/IP suite? Isn't it enough with the link layer error handling ? *3p*

12 What is the objective of the ICMP redirection message? What is the security related problem, that has forced hosts to neglect this message? *3p*

13 In a router the routing table in Table 1 is found. Which network ids would a the router include in an update message if it uses aggregation as much as possible without including address space not included in the original table. Also longest mask matching is assumed. Answer with a new table; no motivation needed. Ignore the cost. *3p*

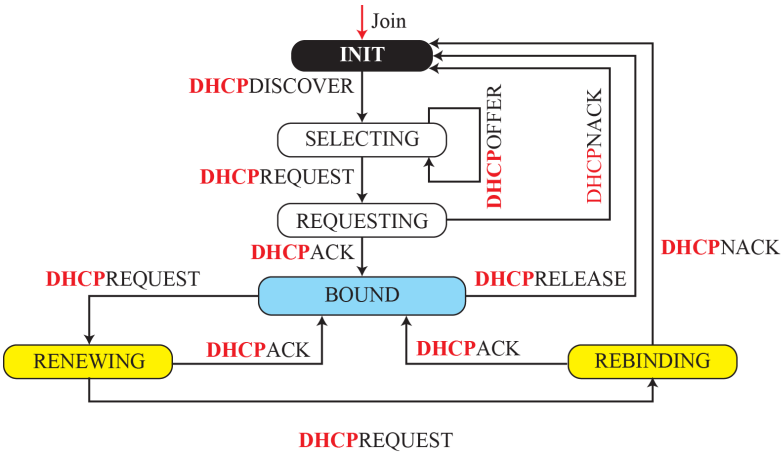
14 For transition from IPv4 to IPv6 three methods have been established: dual stack, header translation and tunneling. Dual stack is the prefered. Why? Compare shortly the three methods. *3p*

Higher Layer Protocols & QoS/Performance; corresponds to Quiz 3

15 A DHCP client is normally switching between the states Bound and Renewing, see Figure 1. Explain the purpose of this behaviour. What is the host asking to renew? When does this happen? *3p*

16 A DNS resolution can be done either recursively or iteratively. Describe shortly the two methods. *3p*

17 Describe shortly the difference between a DNS domain and a DNS zone. Exemplify with using mycomputer.eit.lth.se. *3p*



Figur 1: DHCP states.

18 Time-stamping and sequence numbers are vital in real-time audio/video communications. For what purposes are time-stampning and sequence numbers used? *3p*

19 The bandwitdh-delay product is an important newtork performance parameter. Discuss **shortly** why, three to five sentences should be enough. Hint: Delay, throughput, efficiency, congestion avoidance are closely related to this subject. Also packet loss and retransmission could be of interest. *3p*

20 Given packet size = 1500 bytes, bandwidth = 100 Mbps, propagation speed 1500 m/s, and link length 1000 m. Calculate the transmission delay and the propagation delay for a packet. Remember to motivate your calculations. *3p*

21 A token bucket traffic shaper is added with one token per millisecond. Each packet can be output per token. A time t_0 the bucket is empty. At $t_0 + 500$ ms the traffic shaper receives and buffers a packet burst of 1000 packets. How long time does it take for the traffic shaper to empty the input buffer. We assume infinite bit rate both on incoming and outgoing links. Remember to motivate your calculations. *3p*

Best of success/Lycka till!

Answers to exam ETSF10 part A 2013-12-20

1 Buffers. Buffers are needed to even out differences in a router's (switching fabric's) receiving and handling capacity. Also to even out burstiness.

2 Routing tables are setup and used by individual routing processes. A router can have more than one routing process active simultaniously. All routing table info is compiled to the single forwarding table that is used when deciding on the next hop for each packet.

3 RIP: Updates are broadcasted to direct neighbours. By receiving a broadcast a neighbour is identified. OSPF: Hello messages are broadcasted to direct neighbours. BGP: TCP sessions are setup/configured between neigthbours/peers.

4 RIP: Split Horizon alleviates, but is not a total guaranty. OSPF: Routing loops is not a problem because each node builds trees from the full knowledge of links and neigbours. BGP: If own AS is found in the path vector the corresponding routing information is discarded.

5 IP addresses are part of checksum calulation i UDP and TCP and is also often used as identifier in applications.

6 Instead of sending duplicate packet streams all the way from the sender to the receivers, multicast routers copy packets where a multicast stream branches off. The sender only sends one packet stream for the whole group of listeners instead of one packet stream per listener.

7 The multicast router cannot rely on the join/leave messages and counters only. Hosts may be shut down suddenly without being able to send a leave message first. The router has to check membership actively.

8 During slow start the congestion window is effectivly doubled in size per round. Thus: $1 + 2 + 4 + 8 = 15$ segments are sent and it takes 4 RTTs.

9 Additive increase is used until time out occurs: So, $16 + 17 + 18 + 19 = 70$ segments are sent. Also the reception of three duplicate ACKs breaks the CA state.

10 Init:The client sends a segment with the SYN flag set. The server answers with a segment with both the ACK and the SYN flags set. The client answers with a segment where the ACK flag is sent.
Finish: The side that whants to finish send a segment with FIN flag set. The remote host answers with a FIN + ACK. The reply to this is an ACK which finishes of both connections.

11 No, the network layer in between these two layers has no error control. It is best effort. And things might go wrong on this layer inside the sender and receiver hosts and in the intermediate routers.

12 To tell a host that there is a better path to the destination (another gateway is a better choise). It effectivley changes the hots's routing table, and that is the security issue.

13

191.100.17.0/24
195.201.32.0/24
199.101.3.0/24
191.100.18.0/23
199.101.1.0/23

14 Dual stack needs the two versions running in parallell. But each host can connect to any reachable IPv4 or IPv6 node. In Tunneling only IPv6 hosts in isolated IPv6 domains can communicate over the IPv4 network. Header translation breaks the end-to-end paradigm and requires special functionality in transliting nodes.

15 When 50% of the lease time remains the client has to renew the lease. So it is requstuíng the use of the used ip address for another full lease time.

16 In recursive resolution the first name server, if it is not the authority for the domain, asks the server on the higher level and so on until the name is resolved. The answer is then sent back via all the involved name servers. In iterative resolution the client's resolver or the first name server has to do all the asking until a full answer is found.

17 A domain is a full subtree, from "sub root" to the leaves, of the total DNS tree. Thus eit.mycomputer is a domain. A zone is part of or a full domain that a DNS server is responsible for. Thus lth can be a zone.

18 Time stamps: Playout of segments correctly in time relation to other segments. The packet following lost packet(s) is played out at the correct time. Seq numbers: Reordering segments at the receiver. Needed since time-stamping alone does not inform receiver on lost or missing segments.

19 The BDP tells how much data you can fill a link with. For efficiency it is important to utilise the link as much as possible without introducing congestion. Congestion leads to packet loss and retransmission which in turn reduces efficiency.

20 Transmission delay: $1500 * 8/100 \times 10^6 = 1.2 \times 10^{-4}$ seconds. Propagation delay: $1000/1500 = 0,67$ seconds.

21 The first 500 packets empty the bucket at once. Then one packet can be transmitted per millisecond. Thus, after 500 ms the buffer is empty.