Internetworking/Internetteknik, Examination 2G1305
Date: January 11th 2005 at 9:00 – 13:00

KTH/IMIT/LCN

- ***No help material is allowed - You are not allowed to use dictionaries, books, or calculators!***
- *You may answer questions in English or Swedish.*
- *Students from 2G1507 may also take this exam, but please note on your exam if you are a 2G1507 student.*
- *Please answer each question on a separate page.*
- *Fill in the table on page 2 for each question you have addressed.*
- *The grading of the exam will be completed no later than February 1st 2005.*
- *After grading, the exams will be available for inspection at STEX (Q-building).*
- *Deadline for written complaints is February 15th 2005.*
- *Acting course responsible is Markus Hidell, phone 08-790 42 51.*

Your name:……

Your social security number (personnummer): ……

Your major (utbildningslinje):……..

Total Points: …….	Grade: …….

Question	Answered	Potential points	Received points
1		5	
2		5	
3		5	
4		5	
5		5	
6		5	
7		5	
8		5	
9		5	
10		5	
11		5	
12		5	

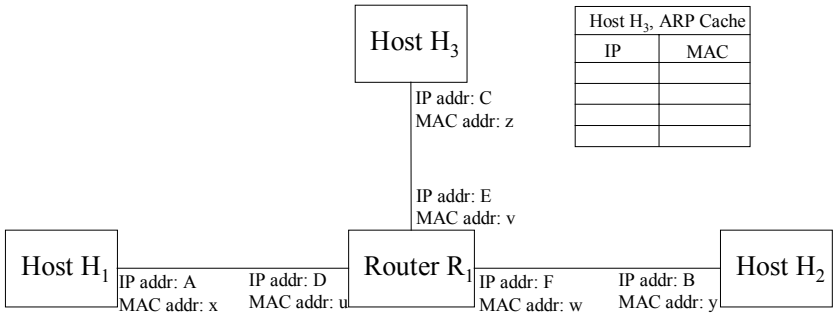
Total	60	

1. General (5p)

a) Place each of the following protocols/functions in the correct TCP/IP layer and note the corresponding OSI layer: Ethernet encapsulation, UDP, IPSec, DHCP, IGMP, and FTP. (3p)

b) Following the OSI reference model (and the terminology used in the course), where would you place each of the following communication devices: Repeater, Bridge, Router, Application Gateway? (2p)

2. ARP (5p)



Host H_3, ARP Cache	
IP	MAC

Host H_1, ARP Cache	
IP	MAC

Router R_1, ARP Cache	
IP	MAC

Host H_2, ARP Cache	
IP	MAC

The figure above illustrates three hosts H_1, H_2 and H_3 running IPv4 over a routed network, connected by router R_1. The IP and MAC addresses of the hosts and the router's interfaces are given in the figure. The ARP cache of each host and the router are shown. Assume the ARP caches are initially empty, and that no packets have been sent yet. Now, host H_1 wants to send an IPv4 unicast datagram to host H_3.
Fill in the state of the four ARP caches as they will appear after the IPv4 unicast datagram has been delivered to host H_3, that is, after dynamic ARP resolution has been made. (5p)

3. IP Addressing (5p)

Assume a network N with address/prefix 25.32.40.32/27. Two nodes are attached to the network: Router R with address 25.32.40.33 and host H with address 25.32.40.40.

a) What is the direct broadcast address of N? (1p)

b) What is the limited broadcast address of N? (1p)

c) What is N's network address? (1p)

d) If H uses DHCP to get an IP address from R, which source address does it use initially? (1p)

e) What is the subnet mask of N? (1p)

4. IPv4 and ICMP (5p)

a) Which fields of the IP header change when a packet passes through a router? Assume that there are no IP options and that no fragmentation occurs. (2p)

b) ICMP messages are grouped into *query* and *error* messages. Error messages are sent when errors in IP datagrams are detected, except for some special cases. Name at least two such special cases. (2p)

c) Why is there need for a header length field in the IP header? (1p)

5. UDP (5p)

Which of the following statements about UDP are true and false respectively:

a) UDP provides a connection-oriented service. (1p)

b) UDP provides an unreliable service. (1p)

c) UDP gives feedback to the sender to adjust the data rate. (1p)

d) A receiving UDP never delivers duplicate messages to the receiving application. (1p)

e) SNMP (Simple Network Management Protocol) uses UDP. (1p)

6. TCP (5p)

a) What is the name of the mechanism used for flow control in TCP? (1p)

b) What is the difference between *offered window* and *usable window* in TCP? (2p)

c) Someone complained about a throughput of 120,000 bits/sec on a 256,000bits/sec link with a 128-ms RTT (Round Trip Time) between the United States and Japan (47% utilization), and a throughput of 33,000 bits/sec when the link was routed over a satellite (13% utilization). Assume a 500 ms RTT for the satellite link.
What does the window size appear to be for both cases? (1p)

d) How large should the window in the previous example be for optimal throughput over the satellite link? (1p)

7. Dynamic Routing (5p)

a) OSPF and RIP are dynamic routing protocols for routing within an autonomous system. How does OSPF handle network topology: How does OSPF partition the network, and what are the limitations of this partitioning (with respect to how partitions are connected)? (2p)

b) OSPF and RIP use fundamentally different algorithms, but OSPF is said to *converge* faster than RIP. What does this mean, and why is this so? In your answer, you should compare the two protocols with respect to convergence. (3p)

8. Autoconfiguration – DHCP and DNS (5p)

a) What is the purpose of a DHCP relay agent? (1p)

b) DHCP uses well-known ports both at the client side and the server side. Why is a well-known port used at the client side? (1p)

c) Assume that two clients use DHCP simultaneously on the same subnet, and that the DHCP replies are broadcast from the server back to the clients. How can a client then distinguish between the replies (1p)?

d) DNS stores its data in general mapping entries called Resource Records (RRs). The following are four examples of such entries: PTR, MX, NS, SOA. What is the purpose of each entry: what mapping does each entry define (for each entry, state “from” and “to” data-type)? (2p)

9. IPv4 Multicast (5p)

a) Briefly describe the IPv4 multicast service model. Mention the two different parts of the model, what kind of protocols that are used in each part, and the purpose of these kinds of protocols. (3p)

b) What does “reverse path forwarding” mean in IP multicast? (2p)

10. Applications (5p)

a) Briefly describe the SNMP (Simple Network Management Protocol) architecture. Your description should cover the following: manager, agent, query, response, client, server, and traps. (3p)

b) RTP (Real-Time Protocol) is used on top of UDP. What are the two main contributions of RTP? (2p)

11. IPv6 (5p)

a) There is no option field in the IPv6 header. However, there is another mechanism used to give more functionality to IP. Briefly describe this IPv6 mechanism. (2p)

b) There are three different transition strategies that have been devised by the IETF to make the transition period from IPv4 to IPv6 smooth. Give the name and meaning of each of these three strategies. (3p)

12. Internet security (5p)

a) IPsec uses two different modes. Which are these modes? When are the two modes used? How do they differ? (2p)

b) Three aspects of IP security are integrity, authentication, and privacy. Briefly describe each aspect. (2p)

c) Which of the aspects in b) can be dealt with through IPSEC AH? (1p)