Internetworking/Internetteknik, Examination 2G1305
Date: March 13th 2004 at 14:00 – 17:00

KTH/IMIT/LCN

?? ***No help material is allowed.***
?? *You may answer questions in English or Swedish.*
?? *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 April 5 2004.*
?? *After grading, the exams will be available for inspection at the STEX in the Q building.*
?? *Deadline for written complaints is April 19 2004.*
?? *Course responsible is Olof Hagsand, phone 08-790 42 61.*

Your name:……

Your social security number (personnummer): ……

Your major (utbildningslinje):……..

Total Points: .……	Grade: ……..

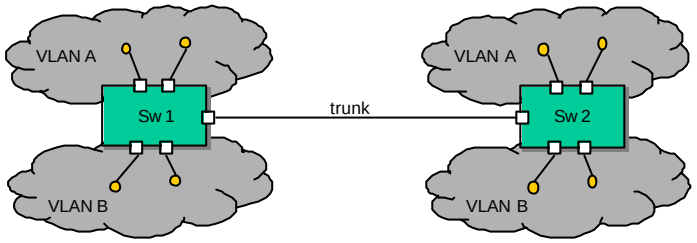
Question	Answered	Potential points	Received points
1		5	
2		5	
3		5	
4		5	
5		5	
6		5	
7		5	
8		5	
9		5	
10		5	
11		5	
12		5	

Total	60	

1. General (5p)

Place each of the following functions/protocols in the correct TCP/IP layer (Application, Transport, Network, or Link/Physical layer): logical host addressing, Cyclic Redundancy Check (CRC), port addressing, end-to-end reliability, network management, name space lookup, SLIP, TCP, IGMP, Spanning Tree Protocol. (5p)

2. Link Layer - VLAN (5p)



The figure above illustrates two VLAN switches (Sw 1 and Sw 2), two VLANs (A and B), and a VLAN trunk between the switches.

a) How do the two switches distinguish between frames belonging to VLAN A and frames belonging to VLAN B on the VLAN trunk between the switches? (1p)

b) How many broadcast domains exist in the network depicted above? (1p)

c) What is needed in order to send a packet from VLAN A to VLAN B? (1p)

d) How does the multiple spanning tree protocol differ from the original spanning tree protocol? (2p)

3. IPv4 Addressing (5p)

For this problem you may need to know the following translations between binary and decimal numbers:

Binary	*Decimal*
1000 0000	128
1100 0000	192
1110 0000	224
1111 0000	240
1111 1000	248
1111 1100	252
1111 1110	254
1111 1111	255

An ISP (Internet Service Provider) is granted a block of addresses starting with 149.70.0.0/16. The ISP creates sub-blocks to customers as follows:

- ?? 200 medium sites, each needing 200 addresses
- ?? 80 small sites, each needing 30 addresses
- ?? 256 households, each needing 5 addresses

a) Design the sub-blocks and give the slash-notation (CIDR notation) for the first and last sub-block in each category (3p)

b) What is the interval of unallocated addresses that the ISP has after the allocation above? (2p)

4. Basic IP routing (5p)

Construct an IPv4 network satisfying the routing table below. The routing table shows the state of one router A. Your assignment is to draw the complete network, including networks, routers and hosts. You may not place a host on a subnet that does not match the host's IP address. Note that there may be many solutions, and you only need to give one.

Destination	*Nexthop*	*Flags*	*Interface*
80.4.5.5/24	-	U	eth0
201.4.0.0/17	80.4.5.1	UG	eth0
193.14.5.160/27	-	U	eth1
201.4.2.4/32	193.14.5.161	UGH	eth1
33.2.3.0/24	-	U	eth2
0.0.0.0/0	33.2.3.1	UG	eth2

5. ARP (5p)

a) Briefly describe proxy ARP and its purpose? (3p)

b) What is the role of the ARP cache (2p)

6. UDP and fragmentation (5p)

For the following problems you may need to know the following:

- ?? Ethernet MTU is 1500 bytes
- ?? UDP header length is 8 bytes
- ?? IP header length is 20 bytes (you can assume there are no IP options)

a) What action does the receiving side of UDP take if the checksum calculation of a UDP datagram results in 0xDEAD (hex)? (2p)

b) A sending UDP protocol peer sends a datagram with 2048 bytes of user data. Sender and receiver are directly connected via Ethernet. How many datagrams will arrive to the receiving UDP protocol peer as a result of the transmission? (2p)

c) Assume a client uses UDP to send 28 bytes of data to a server. What will be the efficiency (ratio of useful bytes to total bytes) of this transmission at the IP level? (1p)

7. TCP (5p)

a) The TCP header contains a header length field, but no information about the total length of the TCP segment. How does a receiving TCP protocol peer determine the total length of a TCP segment? (2p)

b) A TCP connection is using a window size of 8,000 bytes. The sending side receives a segment with acknowledgement number 32,001. Give the window at the sending side as a range of byte numbers after the reception of this ACK. (1p)

c) TCP sends a segment at 4:30:20. It does not receive an acknowledgement. At 4:30:28, it retransmits the previous segment. It receives an acknowledgement at 4:30:30. Give the values of both the RTT (Round Trip Time) and the RTO (Retransmission Time-Out) after reception of the ACK according to Karn's algorithm. When the original TCP segment was sent, the RTT was 4 seconds. (2p)

8. Dynamic routing (5p)

OSPF is an intra-domain routing protocol for dynamic routing within an autonomous system

a) How does OSPF handle network topology: how does OSPF partition the network, and what are the limitations of this partitioning? (1p)

b) OSPF is said to converge faster than RIP. What does this mean, and why is this the case? (2p)

c) A network consists of three routers running OSPF connected by an Ethernet. Which OSPF link type represents the Ethernet? Which OSPF LSAs do the three routers advertise? (2p)

9. Autoconfiguration – DHCP and DNS (5p)

a) What is the major enhancement with DHCP compared to BOOTP? (2p)

b) Which are the two DNS message types defined? (1p)

c) In which DNS message type are resource records used? (1p)

d) What is a DNS pointer query? (1p)

10. IP QoS (5p)

Describe the two IP QoS (Quality of Service) models developed by IETF (Internet Engineering Task Force). You should:

?? Cover basic characteristics of the two models
?? Point out main differences between the two models when it comes to e.g., resource reservation, signalling, flow granularity, and complexity

11. IP Security (5p)

One can classify IP security into four aspects: integrity, authentication, privacy and non-repudiation.

a) Briefly describe each security aspect. (1p)

b) Secret key versus Public key encryption/decryption: Give an advantage of each. (1p)

c) Public key encryption is typically made using the global key for encryption and the private key for decryption. But in some scenarios the opposite method is employed: encryption with private key and decryption with public key. Give an example of such a scenario. (1p)

d) There are two IPSec modes of operation. Briefly describe each mode and in which scenarios the two different modes are useful. Also describe how the original IP header, the ESP and AH headers are handled in the two modes. (2p)

12. IPv6 (5p)

Three transition strategies for deploying IPv6 on the Internet have been devised by the IETF. Describe each strategy, and which scenario each strategy is intended for. Describe how the address mapping between IPv4 and IPv6 addresses is handled in each case. (5p)