

**Uppsala University**  
**Department of Information Technology**

**Computer Network I (1DT014, 1TT821)**

2009-08-18 at 8-13

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**Instructions to candidates:**

- This is a **FIVE(5)** hour examination.
- Answer **ALL** questions in English.
- The total mark is 100.

## Section A. Short Questions [40 pts]

### Question 1 [10 pts]

- (a) Specify the Internet five layers (from top to bottom).
- (b) Explain the principal responsibilities of each of these layers.

### Question 2 [6 pts]

Name and explain three services that TCP provides, but UDP does not provide.

### Question 3 [8 pts]

- (a) Name the current version of the Internet Protocol (IP) in the Internet.
- (b) Name the next version of the Internet Protocol (IP).
- (c) State two reasons why we need to move from the current version to the next version.

### Question 4 [8 pts]

- (a) Explain difference between a symmetric key system and a public key system. [2 pts]
- (b) Suppose 10 people want to communicate with each other s secretly. How many keys are required in the system as a whole if symmetric key encryption is used? Similarly, how many keys are required if public key system is used? [6 pts]

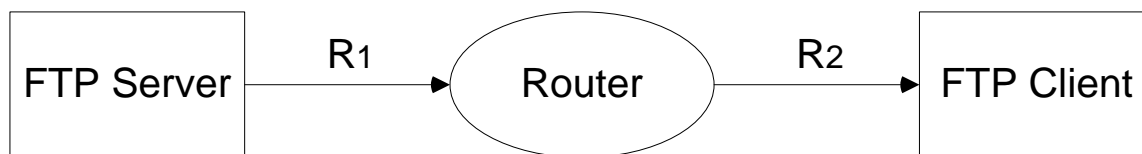
### Question 5 [8 pts]

- (a) Explain the differences between peer to peer architecture and client-server architecture.
- (b) Give an application as example for each of the above architectures.

## Section B. Long Questions [60 pts]

### Question 6 [15 pts]

Assume there is one router and two links between the ftp server and client (see picture below). The first link has transmission rate  $R_1$  and the second link has transmission rate  $R_2$ . Assume the file gets broken into three packets each of size  $L$ . We will ignore all propagation and processing delays.



- How long does it take from the server starts sending the file until the client has received the whole file if  $R_2 \geq R_1$ ?
- What if  $R_2 < R_1$ ?
- In the second case, how long does the second packet spend in the router's queue?

### Question 7 [12 pts]

Suppose users share a 2 Mbps link. Also suppose each user required 200 kbps when transmitting, but each user transmits only 10 percent of the time.

- When circuit switching is used, how many users can be supported?
- For the remainder of this problem, suppose packet switching is used. Find the probability that a given user is transmitting.
- Suppose there are 30 users. Find the probability that there are 11 or more users transmitting simultaneously.

### Question 8 [10 pts]

- (a) Suppose the information content of a packet is the bit pattern 10101010101011 and an even parity scheme is being used. What would the value of the field containing the parity bits be for the case of a two-dimensional parity scheme? Your answer should be such that a minimum-length checksum field is used.
- (b) Suppose the information portion of a packet D contains 10 bytes consisting of the 8-bit unsigned binary representation of the integers 0 to 9.

```
00000000 00000001
00000010 00000011
00000100 00000101
00000110 00000111
00001000 00001001
```

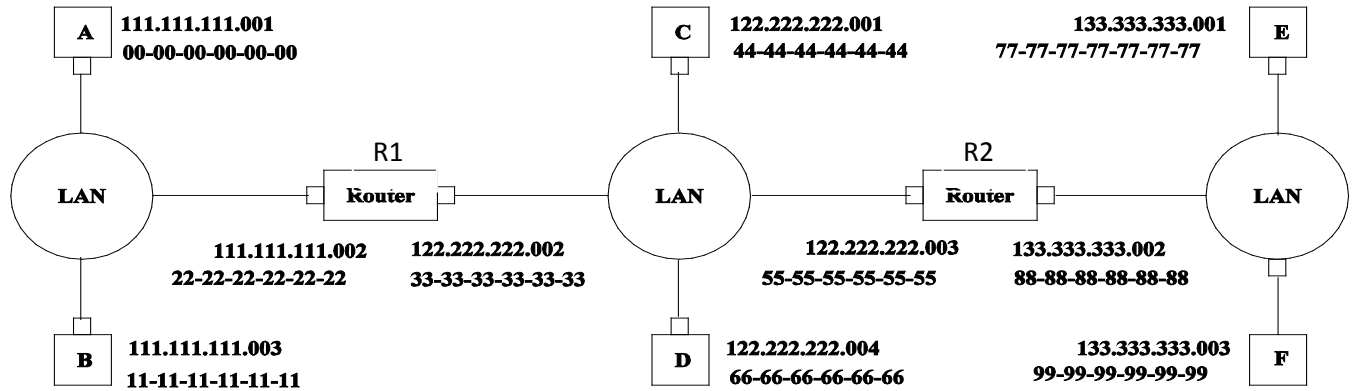
Computer the Internet checksum of D. Note that bytes of data are treated as 16-bit integers.

### Question 9 [10 pts]

- (a) Define the role of a firewall in computer networks. In defining the role of a firewall, you should discuss the techniques that a firewall uses at different levels to prevent external attacks on the network and control traffic flow through the firewall.
- (b) Draw a diagram that shows where a firewall should be positioned with relation to protecting a local network.

### Question 10 [13 pts]

Consider the following network with the following MAC and IP addresses.



Suppose that Host E is sending a message to Host B.

- Please show the path that the message will flow through by indicating the intermediate routers along the path from E to B in sequence.
- For each of the steps above, give the source MAC address, destination MAC address, source IP address and destination IP address in the packet being transmitted.

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