Assignment #4

CSc 4220/6220 - Computer Networks

November 2, 2017

→ ***For CSc4220, students should answer all question except one option from Question 1 and 7***

→ ***For CSc6220, students have to answer all question.***

→ ***You should submit your own work with programming assignment.***

1. We noted that network layer functionality can be broadly divided into data plane functionality and control plane functionality.
   (a) What are the main functions of the data plane?
   (b) What are the main functions of the control plane?
2. Suppose that an arriving packet matches two or more entries in the forwarding table of a router. With traditional destination-based forwarding, what rule does a router apply to determine which of these rules should be applied to determine the output port to which the arriving packet should be switched?
3. Answer the following three question:
   (a) Do routers have IP addresses? If so, how many?
   (b) When a large datagram is fragmented into multiple smaller datagrams, where are these smaller datagrams reassembled into a single larger datagram?
   (c) What is the 32-bit binary equivalent of the IP address 223.1.3.27?

4. Consider the network as shown in Figure 1.

   (a) Show the forwarding table in router **A**, such that all traffic destined to host **H3** is forwarded through interface 3.

   (b) Can you write down a forwarding table in router **A**, such that all traffic from **H1** destined to host **H3** is forwarded through interface 3, while all traffic from **H2** destined to host **H3** is forwarded through interface 4?

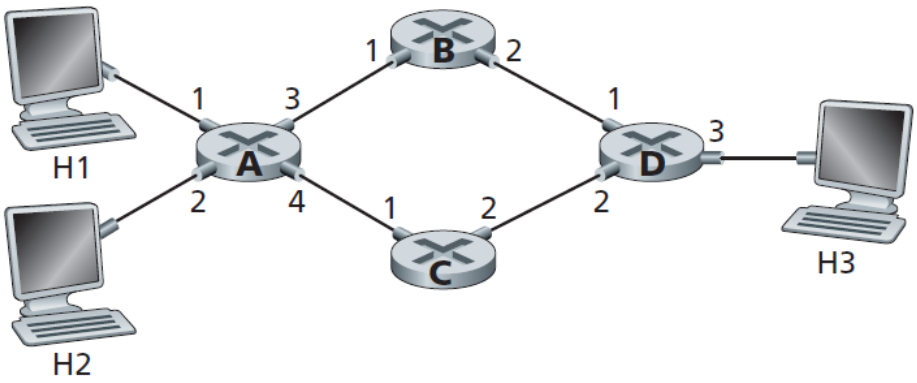

Figure 1: Network model

5. Consider a datagram network using 32-bit host addresses as in Figure 2. Suppose a router has four links, numbered 0 through 3, and packets are to be forwarded to the link interfaces as follows:

   (a) Provide a forwarding table that has five entries, uses longest prefix matching, and forwards packets to the correct link interfaces

   (b) Describe how your forwarding table determines the appropriate link interface for datagrams with destination addresses:

      i. 11001000 10010001 01010001 01010101
      ii. 11100001 01000000 11000011 00111100
      iii. 11100001 10000000 00010001 01110111

6. Consider a subnet with prefix 128.119.40.128/26. Give an example of one IP address (of form xxx.xxx.xxx.xxx) that can be assigned to this network. Suppose an ISP owns the block of addresses of the form

Destination Address Range	Link Interface
11100000 00000000 00000000 00000000 through 11100000 00111111 11111111 11111111	0
11100000 01000000 00000000 00000000 through 11100000 01000000 11111111 11111111	1
11100000 01000001 00000000 00000000 through 11100001 01111111 11111111 11111111	2
otherwise	3

Figure 2: Network interface table

128.119.40.64/26. Suppose it wants to create four subnets from this block, with each block having the same number of IP addresses. What are the prefixes (of form $a.b.c.d/x$) for the four subnets?

7. Consider the network setup in Figure 3. Suppose that the ISP instead assigns the router the address 24.34.112.235 and that the network address of the home network is 192.168.1/24.

   (a) Assign addresses to all interfaces in the home network.

   (b) Suppose each host has two ongoing TCP connections, all to port 80 at host 128.119.40.86. Provide the six corresponding entries in the NAT translation table.

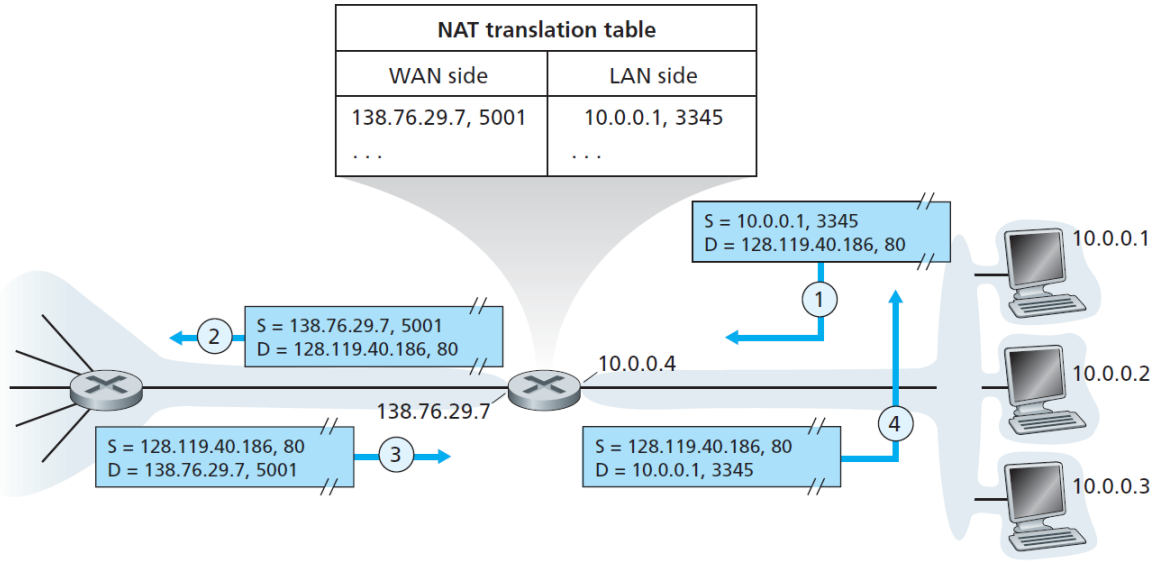

Figure 3: Network Address Translation (NAT)

8. ***Programming Assignment:***

Based on the content covered in the class, you are required to implement a simplified network store-forward simulating program. You can conduct the homework by yourself or work with another student as a group. You are required to set up your system with computers to emulate the sender, receiver and routers, which are connected as shown in Figure 4.

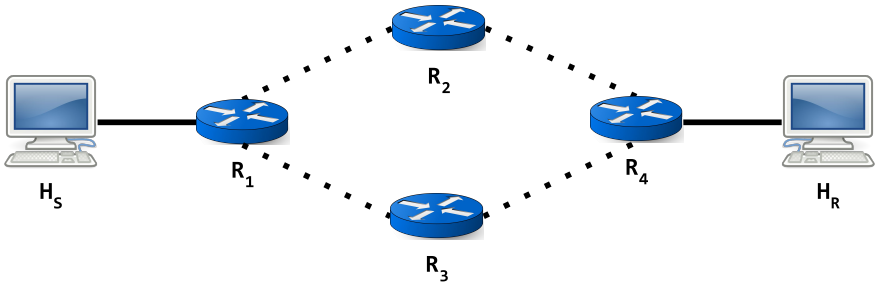

Figure 4: Network Transmission Model (Topology)

The sender H_S will send Y packets (changing Y from $10, 20, 40, 60, 80, 100$) via the routers to the receiver H_R. The routers (R_2 or R_3) in the middle will randomly drop a packet with a probability (10+X) %, where X is the last digit of your panther ID+ your partners last digit of the

Panther ID. We further assume that the routers (R_2 or R_3) can randomly drop data or acknowledge packets while the routers R_1 and R_4 randomly select the path by using R_2 or R_3. In other words, routers R_1 and R_4 can have two options to forward the data and acknowledge packets.

You have to:

(a) Implement programs (with your preferred programming language) running on the ***sender***, ***routers***, and the ***receiver*** by using of TCP transmission protocol (sample code blocks in iCollege)

(b) Submit all your code blocks into the iCollege

(c) Demonstrate your program to the TA during the TAs office hour