Department of Computer Science and Engineering
Motilal Nehru National Institute of Technology
End Semester Exam, Computer Networking(CS1503)
BTech (IT) V Semester
Time: 3 Hour, MM:60

Note: There are 5 questions. Attempt all.

1. Please refer to the Figure.1 to answer the questions. You can see that there are two subnets connected to left and right interfaces of router. Assume that third interface of router is connected to any other router. Switches shown in figure are all layer-2 switches. Further, MAC addresses in hexadecimal form are also given for some interfaces.

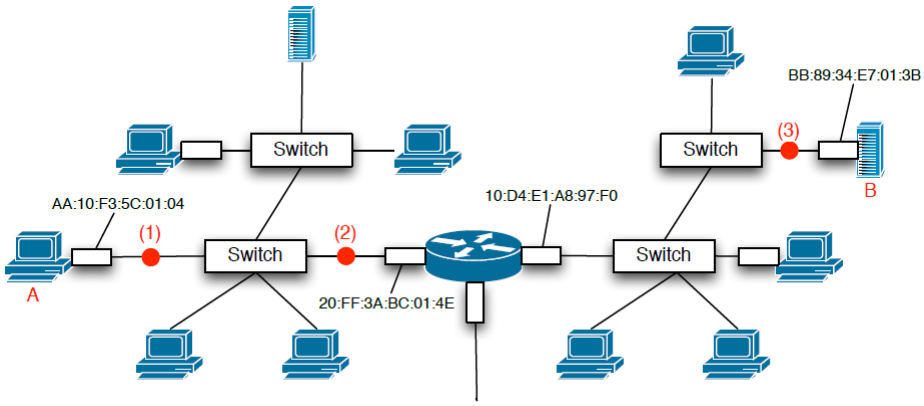

Figure 1: An Example LAN scenario

   (a) Assign IP address ranges (CIDR notation) to the subnets containing hosts A and B. The addressing scheme should use smallest amount of address space possible.

   (b) Provide IP address, Subnet mask and Default gateway for Host A and Host B. Also provide the routing tables at Host A, Host B and at the router.

   (c) What is the role of default gateway value set at Host A and B. Explain clearly.

   (d) Consider an IP packet being sent from Host A to Host B. What are the (i) Source MAC address and Destination MAC address and (ii) Source IP and Destination IP addresses of IP packet encapsulated in Ethernet frame at point (1), (2) and (3) in the Figure.1.

   (e) Suppose all the switches in given scenario are learning switches. Consider a packet being sent from A to B. Neither A or B have sent any packet in the networ before. How many of 11 hosts will receive the frame containing the packet sent by A. Explain briefly.

   (f) Suppose the server in upper part of left subnet sends a packet to A shortly after A to B packet is sent. How many of 11 hosts will receive the frame containing the packet sent by this server. Explain briefly.

2. Suppose you are using TCP to transfer a 4 MB file over a 1 Gbps network. The receiver advertises a receive window of 4 MB. Assume that the roundtrip time (RTT) is constant at 100 ms and that retransmission timers expire after 5 RTTs.

   (a) If TCP sends 4KB segments, how many RTTs does it take until the send window reaches 1MB, assuming that there are no segment losses?

   (b) How many RTTs does it take to send the file, assuming that there are no segment losses?

(c) Describe what happens if the first segment sent after the send window reaches 1MB is lost. Assume that the version of TCP you are using implements fast retransmit and fast recovery. How many RTTs does it take to send the file? How many RTTs are saved by the fact that your TCP implements fast retransmit/fast recovery?

(d) What is the effective throughput for the file transfer when no segments are lost? What is the effective throughput when one segment is lost as in (c)?

3. Assume you are administrating a private network 172.16.0.0/16, and public IP address 193.12.3.4 is assigned to you by your ISP. On your private network all hosts wish be able to access public hosts on the Internet. You therefore setup a NAT/PAT box. Assume now that two hosts 172.16.0.2 and 172.16.0.2 on your private network want to access the public web server 212.4.208.117, for example. The hosts issue an http request and the server replies with a corresponding http reply message. Which source and destination IP address and which TCP source and destination port numbers will the packets from two hosts have in the following locations: (a) When the http request is on the private network; (b) when the http request is on the Internet; (c) when the http reply from the server is on the Internet; and (d) when the http reply is on the private network.

4. (a) Compare GBN and SR in brief. Assume that the timeout values for both protocols are sufficiently long such that 5 consecutive data segments and their corresponding ACKs can be received by the receiving host (Host B) and the sending host (Host A) respectively. Suppose Host A sends 5 data segments to Host B, and the 2nd segment (sent from A) is lost. In the end, all 5 data segments have been correctly received by Host B. How many segments has Host A sent in total and how many ACKs has Host B sent in total? What are their sequence numbers? Answer this question for both protocols.

(b) Suppose that s bits are used to represent the sequence number. In class we said that the maximum window size W for Go-Back-N protocol is $W = N - 1$, where $N = 2^s$. The claim is that this is correct only when the packets cannot be re-ordered by the network during the retransmission, i.e., *a packet, P1, sent before another packet, P2, by the sender cannot show up at the receiver later than P2!* Use an example (say, use $s = 2$) to show why $W = N - 1$ will not work correctly if the network can indeed re-order the packets.

5. Consider the network shown in Figure.2.

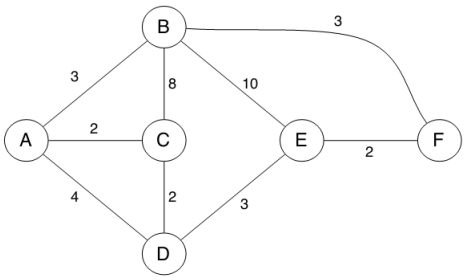

Figure 2:

- Show the operation of LinkState algorithm for computing the least cost path from E to all destinations.
- Show the least cost path from E to A, and briefly describe how you got that answer.
- What are distance vectors in node E,D and C ? In two or three sentences, explain how least cost path from E to A is determined by E based on these three distance vectors.
- Let us focus again on node E and distance vector routing. Suppose all distance vectors have been computed in all nodes and now suppose that link from E to B goes down. Approximately how many distance vector messages will be sent by node E as a result of this link going down? Explain