Department of Computer Science and Engineering
Motilal Nehru National Institute of Technology
Midterm Exam, Computer Networks BTech (IT) V Semester
Time: 1.5 Hour, MM:20

Note: There are three questions. Attempt all.

1. (8 marks) Consider the networks shown in the figure below. There are two user machines m1.a.com and m2.a.com in the network a.com. Suppose the user at m1.a.com types in the URL www.b.com/bigfile.htm into a browser to retrieve a 1Gbit (1000 Mbit) file from www.b.com.

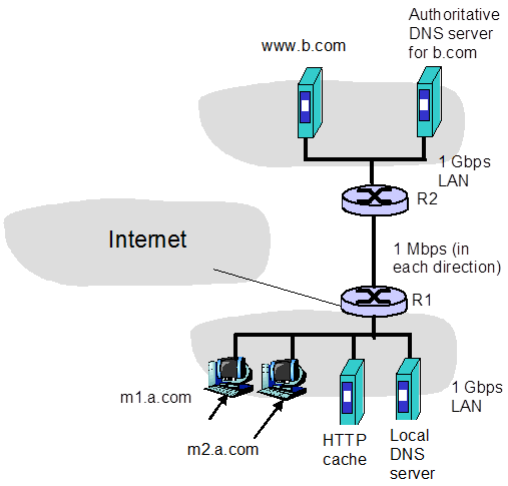

Figure 1: Figure for Question.1

(a) List the sequence of DNS and HTTP messages sent/received from/by m1.a.com as well as any other messages that leave/enter the a.com network that are not directly sent/received by m1.a.com from the point that the URL is entered into the browser until the file is completely received. Indicate the source and destination of each message. You can assume that every HTTP request by m1.a.com is first directed to the HTTP cache in a.com and that the cache is initially empty, and that all DNS requests are iterated queries.

(b) How much time does it take to accomplish the steps you outlined in your answer to 1(a)? Explain how you arrived at this answer. In answering this question, you can make the following assumptions:
- The packets containing any DNS commands and HTTP commands such as GET are very small compared to the size of the file, and thus their transmission times (but not their propagation times) can be neglected.
- Propagation delays within the LAN are small enough to be ignored. The propagation from router R1 to router R2 is 100 ms.
- The propagation delay from anywhere in a.com to any other site in the Internet (except b.com) is 500 ms.

(c) Now assume that machine m2.a.com makes a request to exactly the same URL that m1.a.com made. List the sequence of DNS and HTTP messages sent/received from/by m2.a.com as well as any other messages that leave/enter the a.com network that are not directly sent/received by m2.a.com from the point that the URL is entered into the browser until the file is completely received. Indicate the source and destination of each message.

(d) How much time does it take to accomplish the steps that you outlined in your answer to 1(c)?

(e) Now suppose there is no HTTP cache in network a.com. What is the maximum rate at which machines in a.com can make requests for the file www.b.com/bigfile.htm while keeping the time from when a request is made to when it is satisfied non-infinite in the long run?

2. (4 marks) Let us compare and contrast Go-Back-N (GBN) and Selective Repeat (SR) quantitatively. Let the window size be W.
   (a) How many timers are required at the sender side of GBN and how many timers at the sender side of SR?
   (b) How much buffer is required at the receiver side of GBN and how much at the receiver side of SR?
   (c) Suppose W is an even number. If packet $W/2$ is lost, what packet(s) will be retransmitted in GBN and what packet(s) will be retransmitted in SR?
   (d) Suppose W is an even number. If packet $W/2$ is lost, how much time does it take to have the first W packets arriving at the receiver in GBN and how much time in SR?
   (e) Let packet transmission time be T, timeout interval be TO, and round-trip time be RTT. Assume the path is symmetric where RTT equals twice the one-way delay. Assume also TO is greater than the time to send the whole window of packets WT plus the RTT. The transmission time of acknowledgement packets is negligible. Calculate the time to have all first W packets arriving at the receiver in terms of packet transmission time (T), timeout (TO), and round-trip time (RTT).
   (f) If memory is expensive and network bandwidth is abundant, which mechanism, GBN or SR, will you choose to transfer data? Why?
   (g) If your users care the most about download delay, which mechanism, GBN or SR, will you choose to transfer data?

3. (8 marks) Consider the network given in Figure.2 to answer this question. Suppose 192.168.10.0/24 is the network address assigned to the given network. Use fixed length subnetting to divide this network in to four equal sized subnets. Further, assign (a) host address ranges (b) subnet masks (c) default gateway address for all the four subnets. Assume currently the layer-2 switches have no entries in their MAC tables. Answer following questions.
   - Explain step by step procedure when two hosts of same subnet want to send request and reply data packets.
   - Explain step by step procedure when two hosts of different subnets want to send request and reply data packets.

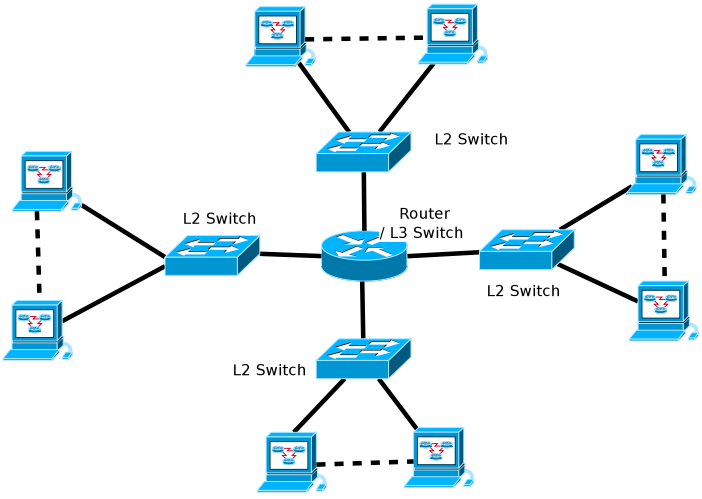

Figure 2: Figure for Question.3