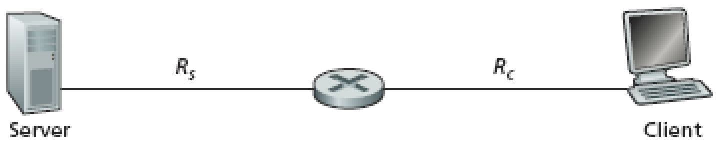
Dhirubhai Ambani Institute of Information & Communication Technology
Mid Semester Test-1, 1st Semester 2017- 18

Course Title	IT304 Computer Networks		**Max Marks**	15
Date	1 September 2017	**CLOSED BOOK**	**Time**	1 Hour

In protocol design problems,

- Assume that all the nodes run the required application components.
- Give a brief description of how your protocol functions.
- Provide the details of the message structure, message sequence, timer functions (if needed), and other actions performed by the nodes.
- Give brief justification for each component of your design.

1. Assume that the resolving name-server is running on DAIICT network and there is an *iterative* DNS server at each domain level. Draw the relevant DNS hierarchy and list the DNS messages sent and received and records processed in obtaining the IP address corresponding to "mail.cse.mit.edu". [4]



2. Assume that we know the bottleneck link along the path from the server to the client is the first link with rate R_s bits/sec. Suppose we send a pair of packets back to back from the server to the client, and there is no other traffic on this path. Assume each packet of size L bits, and both links have the same propagation delay d_{prop}.
   a. What is the packet inter-arrival time at the destination? That is, how much time elapses from when the last bit of the first packet arrives until the last bit of the second packet arrives?
   b. Now assume that the second link is the bottleneck link (i.e., $R_c < R_s$). Is it possible that the second packet queues at the input queue of the second link? Explain. Now suppose that the server sends the second packet T seconds after sending the first packet. How large must T be to ensure no queuing before the second link? Explain. [4]

3. On a LAN server, a ToD (time of day) application runs that periodically (at interval D) broadcasts the time to all the nodes connected on the LAN. A node, on booting, however, can ask for the ToD server to send the time immediately. ToD server responds with a single message, even if multiple requests come within time interval **d**. Design the protocol specifying the functionalities, message structure, actions, and syntax. [7]

Q 1.

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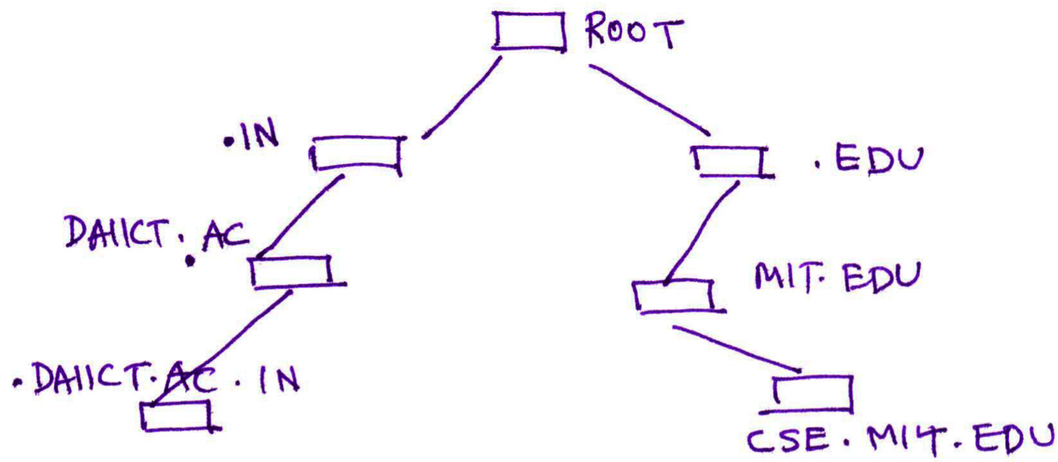
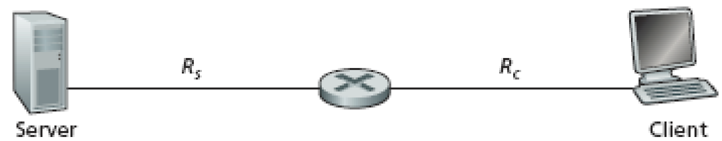


1 All servers are iterative ⇒ server resolves a query only to its immediate next level. Records will be either A type (final resolution) or NS type (intermediate resolution). The sequence

1 of messages from the local name server (LNS) sent and received would be :

	LNS → ROOT	query for mail.cse.mit.edu
	ROOT → LNS	$\boxed{\text{NS}}$ record with addr of .EDU.
	LNS → .EDU	query
1	.EDU → LNS	$\boxed{\text{NS}}$ record with addr of MIT.EDU
	LNS → .MIT.EDU	query
	MIT.EDU → LNS	$\boxed{\text{NS}}$ record
	LNS → CSE.MIT.EDU	query
	CSE.MIT.EDU → LNS	$\boxed{\text{A}}$ record for fully resolved addr. of mail.cse.mit.edu.



Assume that we know the bottleneck link along the path from the server to the client is the first link with rate R_s bits/sec. Suppose we send a pair of packets back to back from the server to the client, and there is no other traffic on this path. Assume each packet of size L bits, and both links have the same propagation delay d_{prop}.

a. What is the packet inter-arrival time at the destination? That is, how much time elapses from when the last bit of the first packet arrives until the last bit of the second packet arrives?
b. Now assume that the second link is the bottleneck link (i.e., $R_c < R_s$). Is it possible that the second packet queues at the input queue of the second link? Explain. Now suppose that the server sends the second packet T seconds after sending the first packet. How large must T be to ensure no queuing before the second link? Explain. [4]

Let's call the first packet A and call the second packet B.

a) If the bottleneck link is the first link, then packet B is queued at the first link waiting for the transmission of packet A. So the packet inter-arrival time at the destination is simply L/R_s.

b) If the second link is the bottleneck link and both packets are sent back to back, it must be true that the second packet arrives at the input queue of the second link before the second link finishes the transmission of the first packet. That is,

$$L/R_s + L/R_s + d_{prop} < L/R_s + d_{prop} + L/R_c$$

The left hand side of the above inequality represents the time needed by the second packet to *arrive at* the input queue of the second link (the second link has not started transmitting the second packet yet). The right hand side represents the time needed by the first packet to finish its transmission onto the second link.

If we send the second packet T seconds later, we will ensure that there is no queuing delay for the second packet at the second link if we have:

$$L/R_s + L/R_s + d_{prop} + T >= L/R_s + d_{prop} + L/R_c$$

Thus, the minimum value of T is $L/R_c - L/R_s$.

Q3

1. Broadcast ToD message at interval D.

   Message structure and size of each field (Logic behind that):……………………………… 1 + 1 Marks
   a. Src address : ToD server
   b. Dest. Address -**All**
   c. ToD – Counter from reference time/Systime
2. Timer – Set to D for broadcast……………………………………………………………………………. 1 Mark

3. When client boots up……………………………………………………………………………………… 1 Mark
   Request Message Structure:
   a. Src Address : client
   b. Dest. Address : TOD server
   c. flag to indicate TOD request – size of flag.

   Reply Message Structure: (same as in 1.)
   a. Src Address : ToD server
   b. Dest. Address : All
   c. ToD – Counter from reference time/Systime

4. Approach for timer d…………………………………………………………………………………… Max 2 Marks

   When server gets first request pkt, start Timer…………………………………………. 2 Mark
   wait till it times out d.
   Send reply pkt.

   (If you have sent the pkt first and then wait for time d, the protocoll may fail. Partial Marks -1)