Tutorial 1 (Week 5)

Note: Some questions are from past exams. Please note that mid-term test is MCQ. We are providing questions to prepare you for the final exam which will have mostly short questions. This will help prepare for finals throughout the session.

Section I - Multiple Choice, Fill-in Questions

Instructions: Circle the letter beside the choice that is the best answer for each question. For multiple choice, choose *only ONE answer unless specifically asked to do otherwise*. For Fill-in and Short Answer questions, provide *ONLY the number of answers requested* in the spaces indicated.

1. List the four different types of delays encountered in packet switched networks:

   a. Propagation delay (bits / propagation speed (light))

   b. Transmission delay (bits / transmission speed)

   c. Queueing delay

   d. Processing delay

2. Consider the operation of downloading a Web page consisting of an index page that references 3 JPEG objects located on the same server. Ignoring latency involved in transferring the objects themselves, fill in the blanks below with the correct values:

   a. Utilizing HTTP/1.0 with no parallel connection capability, the number of RTTs required to download the page is 8. 4 handshakes, 4 actual transmission

   b. Utilizing the default mode of HTTP/1.1, 5 RTTs are required to download the page. handshake, index, 3 Jpeg.

3. DNS responses have a TTL field. Why is this necessary?

   a. The TTL field is decremented at each DNS server that the response passes through on its way to the client, and servers drop responses with a TTL of 0, so the TTL field prevents responses from looping indefinitely.

   b. The TTL field allows DNS servers to prevent cache poisoning.

   c. The TTL field is necessary for scalability: if DNS servers could never time out entries, over time they would accumulate infinite state.

   d. The TTL field causes DNS servers to delete entries after some time, so that if the host moves and the underlying address changes, the server will eventually get the correct address.

(Similar kinds of questions in mid-term)

4. Transport layer may be able to provide reliability by using its own mechanisms, despite working over an unreliable network layer.

 a. True. TCP
 b. False.

5. UDP has which of the following characteristics:

 a. Three-way hand shake for connection establishment.
 b. Connection state at the server.
 c. Regulated send rate.
 d. None of the above.

All of them are TCP characteristics.

Section II – Problem Solving

Instructions: Calculate the values requested and provide a *numeric answer* for each question. You may use a calculator if desired, but problems have been developed in such a way that calculators should not be required. *Show your work* for each problem. Select the numeric result of your calculations from the choices provide, or fill in the blanks where requested.

1. Calculate the *end-to-end delay*, *dend-end*, between the source host and the destination host in a network with 4 routers between source and destination? Assume that the network is NOT congested (i.e. *dqueue* is insignificant), and that:
   i. all packets are 10,000 bits in length,
   ii. each link between source and destination is 5 kilometers long,
   iii. the processing time is 10msec at the source host and at each router,
   iv. the transmission rate from the source host and each router is 1Mbps,
   v. the propagation speed of each link is 2.5 x 10^8 meters/second.

CALCULATIONS:

$d_{end\text{-}end} = d_{prop} + d_{trans} + d_{proc}$

$= \frac{5\times10^3}{2.5\times10^8} + \frac{10000}{1\times10^6} + 10\text{ms}$

$= 0.02\text{ms} + 10\text{ms} + 10\text{ms} = 20.02\text{ms}$

$\therefore$ 5 hops: $5 \times 20.02 = 100.1\text{ms}$

ANSWER:

 a. 88 milliseconds
 b. 100.1 milliseconds
 c. 110 milliseconds
 d. 1.21 seconds

01010101
+01110000
11000101

11000101
+01001100
00010010

=) If there's an extra '1', leave it then add 1 at the back.

2. UDP and TCP use 1s complement for their checksums. Suppose you have the following three 8-bit bytes: 01010101, 01110000, 01001100. What is the 1's complement of the sum of these 8-bit bytes? (Note although TCP and UDP use 16-bit words in computing the checksum, for this problem we will only consider 8-bit summands). Show all work. Is it possible that a 1-bit error will go undetected by the checksum? How about a two-bit error? (If first bit turns into 0, and last bit turns into 1)

3. Answer these questions in a concise manner. A few sentences (2-3) should suffice.

Disadv: Verbose, waste bandwidth. Process quicker.

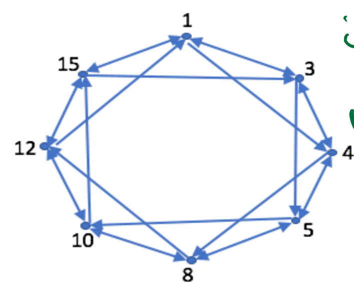
   a. List one advantage and one disadvantage of using a text-based header (as in HTTP) instead of a binary format (as in IP and TCP). Adv: Easy for human being, debugging. Extensible.
   b. Web caches and content distribution networks (CDNs) both reduce the time for a client to download Web pages by moving content closer to the users. Give two reasons why CDNs have been more widely deployed (and successful) than Web caching? Improves performance, reduces cost, prevent single point of failure.
   c. Why is BitTorrent vulnerable to incomplete downloads (i.e., instances where a few chunks may be missing from the file)? What steps are taken to minimize the possibility of this happening?

since users may leave after they finish downloading the file.
Rarest chunk first, Optimistic unchoke.

4. Consider the circular DHT with shortcuts in Figure below, where each node in the DHT also keeps track of (i) its immediate predecessor, (ii) its immediate successor, and (iii) its second successor (i.e., the successor of the node's immediate successor).

a) The data will be stored in peer 10. Therefore will look for

1 → 4 → 8 → 10



   a. Suppose that peer 1 wants to learn where file with content ID 9 is stored. Write down the sequence of DHT protocol messages that the nodes exchange until peer 1 discovers the location of the file.
   b. Suppose that peer 3 learns that peer 5 has left. How does peer 3 update its successor state information?
   c. Now consider that the DHT nodes do not keep track of their second successor (the figure should look like lecture notes with a simple circular DHT). Suppose that a new peer 6 wants to join the DHT and peer 6 initially only knows the IP address of peer 15. What steps are taken?

b) 3 asks for 4 for its successors, 4 tells 3 it's 5 and 8. Then 3 will update its second successor as 8.

c) 6 will ask for 15. 15 will ask its successor Peer 1, so 15 knows 6 should not be its successor since 6 > 1. Then do the same thing until it reaches 5, where 5 < 6 < 8. Therefore 6 can be its successor.

5. Salil wants to watch a live stream of a UEFA soccer game using the VLC video player. He opens VLC and points it to vid1.streaming.uefa.com. The VLC player calls *gethostbyname()* with the given name to obtain the IP address of the server. As a result, of the *gethostbyname()* call, the local DNS client in Salil's machine contacts his local DNS server to translate the host name to an IP address. The local DNS server performs an **iterative lookup**. The table below contains the DNS entries with each row corresponding to a DNS record. The entries are grouped by the DNS server in which they are stored. For example, R1 and R2 are stored in the local DNS server (localdns.localdomain.com), R3 and R4 are stored in the E root server, and so on.

Record #	Name	TTL (sec)	IN	Type	Value
localdns.localdomain.com					
R1	.	262542	IN	NS	e.root-servers.net
R2	e.root-servers.net	348942	IN	A	192.203.230.10
e.root-servers.net					
R3	com.	172800	IN	NS	f.gtld-servers.net
R4	f.gtld-servers.net	172800	IN	A	192.35.51.30
f.gtld-servers.net					
R5	uefa.com.	172800	IN	NS	4klinsmann.uefa.com.
R6	4klinsmann.uefa.com.	172800	IN	A	205.153.37.175
4klinsmann.uefa.com.					
R7	streaming.uefa.com.	10	IN	NS	ns.streaming.uefa.com.
R8	ns.streaming.uefa.com.	10	IN	A	205.153.36.175
ns.streaming.uefa.com.					
R9	video.streaming.uefa.com.	10	IN	CNAME	vidl.streaming.uefa.com
R10	vidl.streaming.uefa.com.	10	IN	A	205.153.36.221

(a) Copy the figure below (Figure 1) to the answer booklet. Draw arrows to indicate the sequence of queries and responses exchanged among the different name servers. Label each arrow with a sequence number. Copy the table below to the answer booklet and fill in the table to indicate the following information:

- Sequence number indicating the ordering of the message exchanges.
- Message Type: use Q for query and R for response.
- Data: For queries use the value of the question data. For responses, specify the record ID(s) returned, if any, from the first column in the table above (e.g. R1, R2, ...).

Seq	Type	Data
1	Q	vidl.streaming.uefa.org (A)
		Add rows as necessary

Figure 1 already contains an arrow indicating the first message from the DNS client on Salil's machine to his local DNS server. The sequence number is 1 (first message), type = Q (query) and the data is the host name that the application wants to resolve (vid1.streaming.uefa.com). To make your sequence as simple as possible, assume that the server includes both the A and NS records when applicable.

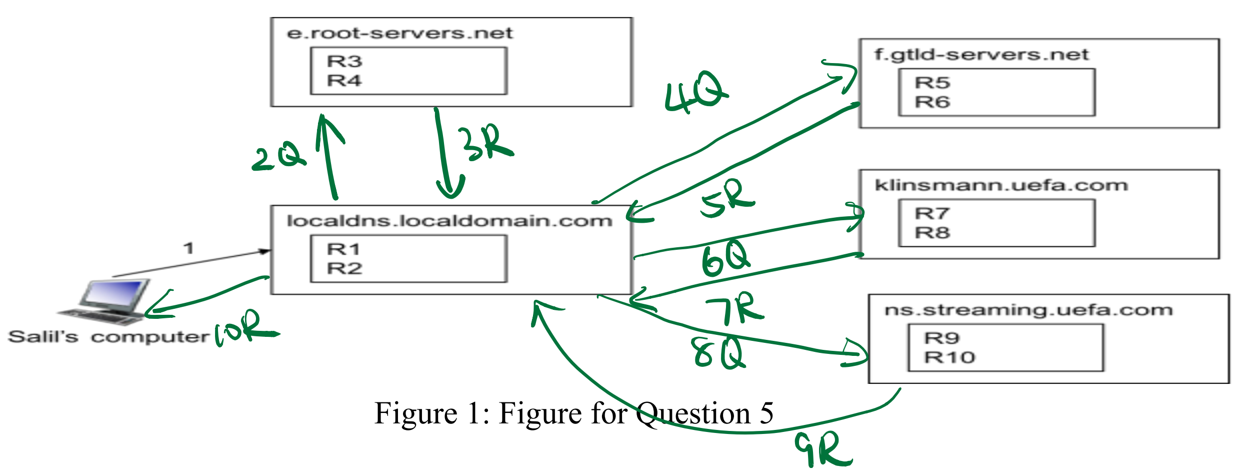


Figure 1: Figure for Question 5

(b) Salil repeats his query two minutes later. Show what happens for this subsequent query. Draw a new picture (Figure 1) showing the interactions between the various name servers and provide a new table showing the details of the DNS messages as in part (a).

b) It will directly ask for 4klinsmann.uefa.com, since the previous servers are cached. And the rest are same as the previous stuffs since those records are all expired.