

Homework 2 assignment for ECE374

Posted: 02/20/15

Due: 02/27/15

Note: *In all written assignments, please show as much of your work as you can. Even if you get a wrong answer, you can get partial credit if you show your work. If you make a mistake, it will also help the grader show you where you made a mistake.*

Problem 1: (10 Points)

Suppose within your Web browser you click on a link to obtain a web page. The IP address for the associated URL is not cached in your local host, so a DNS lookup is necessary to obtain the IP address. Suppose that n DNS servers are visited before your host receives the IP address from DNS; the successive visits incur an RTT of RTT_1, \dots, RTT_n . Further suppose that the web page associated with the link contains exactly one object, consisting of a small amount of HTML text. Let RTT_0 denote the RTT between the local host and the server containing the object.

- a. Assuming zero transmission time of the object, how much time elapses from when the client clicks on the link until the client receives the object?

Now assume the HTML file references seven very small objects on the same server.

Neglecting transmission times, how much time elapses with

- b. Non-persistent HTTP with no parallel TCP connections?
- c. Non-persistent HTTP with the browser configured for 5 parallel connections?
- d. Persistent HTTP?

Problem 2: (20 Points)

Consider the scenario shown in Figure 1 in which a server is connected to a router by a 100Mbps link with a 50ms propagation delay. Initially this router is also connected to two routers, each over a 25Mbps link with a 200ms propagation delay. A 1Gbps link connects a host and a cache (if present) to each of these routers and we assume that this link has 0 propagation delay. All packets in the network are 20,000 bits long.

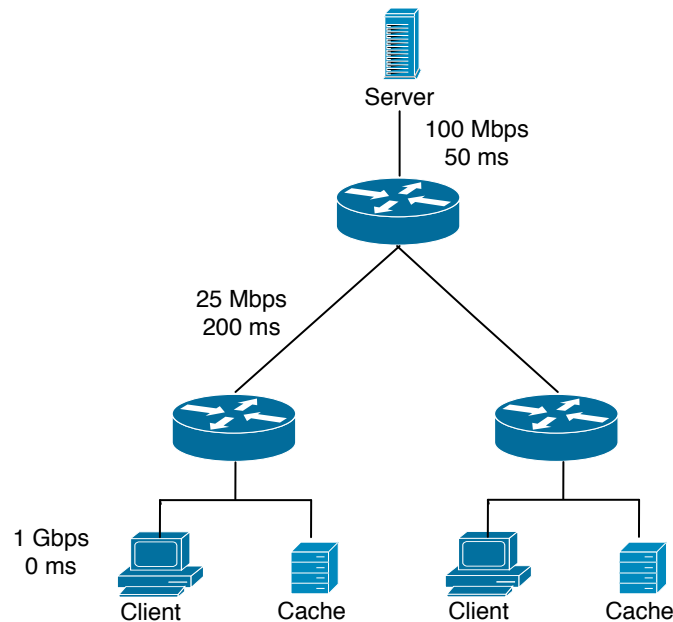


Figure 1

- What is the end-to-end delay from when a packet is transmitted by the server to when it is received by the client? In this case, we assume there are no caches, there's no queuing delay at the routers, and the packet processing delays at routers and nodes are all 0.
- Here we assume that client hosts send requests for files directly to the server (caches are not used or off in this case). What is the maximum rate at which the server can deliver data to a single client if we assume no other clients are making requests?
- Again we assume only one active client but in this case the caches are on and behave like HTTP caches. A client's HTTP GET is always first directed to its local cache. 60% of the requests can be satisfied by the local cache. What is the average rate at which the client can receive data in this case?
- What is the average end-to-end delay for the case that 60% of the requests can be satisfied by the local cache?

Problem 3: (15 Points)

In this problem, we use the useful `dig` tool available on Unix and Linux hosts to explore the hierarchy of DNS servers. Recall that in slide 67 in Chapter 2, a DNS server higher in the DNS hierarchy delegates a DNS query to a DNS server lower in the hierarchy, by sending back to the DNS client the name of that lower-level DNS server. First read the man page for `dig` (e.g., <http://linux.die.net/man/1/dig>), and then answer the following questions.

- Starting with a root DNS server (from one of the root servers [a-m].root-servers.net], initiate a sequence of queries for the IP address for your department's Web server (www.ecs.umass.edu) by using `dig`. Show the list of the names of DNS servers in the delegation chain in answering your query.
- Repeat part a) for several popular Web sites, such as google.com, yahoo.com, or amazon.com.

Back up your answers with screen shots that show the results of your `dig` queries.

Problem 4: (25 Points)

Consider distributing a file of $F = 25$ Gbits to N peers. The server has an upload rate of $u_s = 30$ Mbps, and each peer has a download rate of $d_i = 2$ Mbps and an upload rate of u .

- For $N = 10, 100,$ and $1,000$ and $u = 300$ Kbps, 700 Kbps, and 2 Mbps, prepare a chart giving the minimum distribution time for each of the combination of N and u for both client-server distribution and P2P distribution.

Client Server:

		N		
		10	100	1000
u	300 Kbps			
	700 Kbps			
	2 Mbps			

Peer-to-Peer:

		N		
		10	100	1000
u	300 Kbps			
	700 Kbps			
	2 Mbps			

- Assuming you could provide as many servers as you like, what would be the maximum number of servers you would need to reduce the client-server distribution time to its minimum for the cases of $N = 10, 100,$ and $1,000$?

What would the minimum distribution times be in this case?

N		
10	100	1000

Problem 5: (10 Points)

- Suppose that Alice wants to send an email message to Bob. This will involve four entities: Alice's mail client (for email composition and sending), Alice's outgoing mail server, Bob's incoming mail server, and Bob's mail client (for email retrieval and viewing). Between which of these four entities does the SMTP protocol operate? What about the IMAP protocol?
- How does SMTP mark the end of a message body? How about HTTP? Can HTTP use the same method as SMTP to mark the end of a message body? Explain.

Problem 6 (20 Points): Sliding Window Protocols

- Consider the sliding window protocol in Figure 2 to the right. Does this figure indicate that Go-Back-N is being used, Selective Repeat is being used, or there is not enough information to tell? Explain your answer briefly.

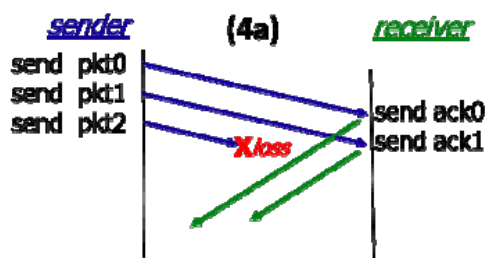


Figure 2

- Consider the sliding window protocol in Figure 3. Does this figure indicate that Go-Back-N is being used, Selective Repeat is being used, or there is not enough information to tell? Explain your answer briefly.

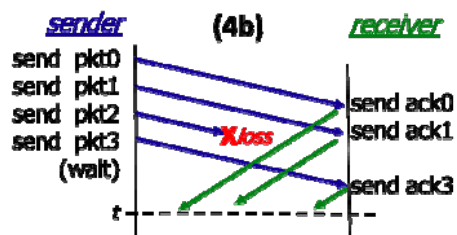


Figure 3

- Consider Figure 3 again. Suppose the sender and receiver windows are of size $N = 5$ and suppose the sequence number space goes from 0 to 15. Show the position of the sender and receiver windows over this sequence number space at time t (the horizontal dashed line).

- d. Suppose that it takes 1 ms to send a packet, with a 10 ms one-way propagation delay between the sender and receiver. The sliding windows size is again $N = 4$. What is the channel/link utilization?