JAYPEE INSTITUTE OF INFORMATION TECHNOLOGY

COMPUTER NETWORKS (15B11CI511)

BTECH 5TH SEM 2019

TUTORIAL-3 (7th Aug-20th Aug, 2019)

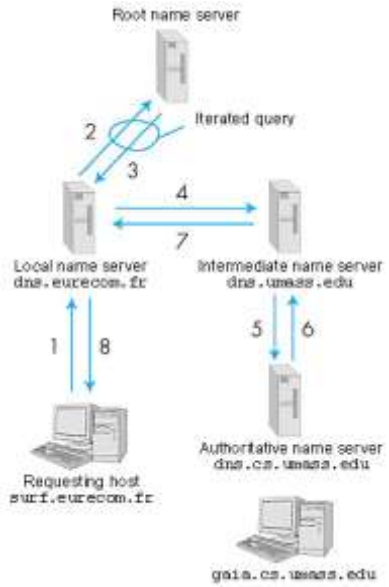
APPLICATION LAYER

Q1. True or false? (and brief reasoning)

a. A user requests a Web page that consists of some text and three images. For this page the client will send one request message and receive four response messages.
b. Two distinct Web pages (for example, www.duke.edu/research.html and www.duke.edu/students.html) can be sent over the same persistent connection.
c. With non-persistent connections between browser and origin server, it is possible for a single TCP segment to carry two distinct HTTP request messages.
d. The Date: header in the HTTP response message indicates when the object in the response was last modified.
e. HTTP response messages never have an empty message body

Q2. Suppose a web server has 10 ongoing TCP connections. How many server-side sockets are used? How many server-side port numbers are used? (Hint: remember the server implements fork())

Q3. In the following example execution of the DNS protocol, state which records are returned on 3, 6, 7 and 8. In your answers use IP(hostname) to denote the IP address of the host hostname. Recall that the 4 types of DNS records are A, NS, CNAME, and MX.



Q4. Assume that you have a base html file with 30 embedded images that is requested by a client. Assume that the base file and all of the images are small enough to fit within one TCP segment. How many round trips are required to retrieve the base file and the images under the following settings? Assume that the round trip times dominate all other times.

a. HTTP 1.0 with no parallel connections
b. HTTP 1.0 with up to 10 parallel connections
c. HTTP 1.1. with no pipelining
d. HTTP 1.1. with pipelining

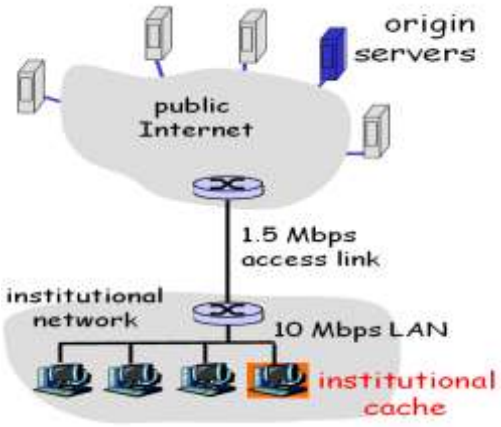
Q5. Suppose you open a startup company "avataar" and want to set up your company network. Your network has the following servers:

1. DNS server: "dns1.avataar.com" with IP as "172.119.12.40"
2. Web server: "avataar.com" with two IP as "172.119.12.55" and "172.119.12.56". The web server also has a name as "www.avataar.com".
3. Email server: "humonoid.avataar.com" with IP as "172.119.12.60"

Your company's email address is "username@avataar.com".

a. What resource records (RRs) do you need to provide to the upper-level ".com" Registrar?
b. What RRs do you need to put in your company's DNS server?

Q6. Consider the networks shown in the figure below. Assume computers in the institution send out 14 requests per second. Each object average size is 100,000 bits. Also assume the internet side delay of a request is 2 seconds. Using M/M/1 queue to model the access delay in the 1.5Mbps access link. The formula for the average response time is $E[T]=1/(\mu-\lambda)$, where λ is the arrival rate of objects to the access link and μ is the service rate of the access link.



a. Find the total average response time when no institutional cache is used. [Note: you should also use the M/M/1 queue formula to calculate the delay in internal Ethernet LAN.]
b. Now suppose the institutional cache is used. The hit rate for the cache is 0.75. Find the total average response time.

Q7. Using a Web browser, you visit the web site for www.hamburger.com. The base HTML page for the main page www.hamburger.com is 30,000 bits. Once the base HTML page is fetched, it contains URL references for the following embedded images:
http://www.hamburger.com/burger banner.jpg 15,000 bits
http://www.hamburger.com/lettuce.jpg 5,000 bits
http://www.hamburger.com/mmm bacon.jpg 10,000 bits
http://www.hamburger.com/veggie.jpg 10,000 bits
http://www.hamburger.com/disclaimer.txt 5,000 bits
http://www.hamburger.com/royale with cheese.jpg 35,000 bits
Your Web browser uses the HTTP protocol to download the base page and the embedded objects. Make the following assumptions:

- At most 10,000 bits of data fits into a single packet. You can ignore the overhead of any headers or framing.
- You must first download the entire base page before you can start fetching the embedded images.
- HTTP requests are 1,000 bits in size.
- Any new connection to a machine requires a connection-establishment handshake.

- For this problem, you do not need to worry about closing connections, and you can ignore the delay introduced in acknowledging the final data packet sent by the server to your browser.
- All senders use windows of 20,000 bits.
- No packets are lost.

a. For the initial transfer of the home page, how many RTTs are required, and what occurs during each of them?
b. How quickly (in terms of RTTs) can your browser download the base page for www.hamburger.com and all embedded objects if the browser uses:
   i. One connection per item, with up to 4 concurrent connections.
   ii. A single persistent, non-pipelined connection.
   iii. A single pipelined connection.

Q8. 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 RTT1, . . ., 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 RTT0 denote the RTT between the local host and the server containing the object. 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?

Q9. The text below shows the reply sent from the server in response to the HTTP GET message in the question above. Answer the following questions, indicating where in the message below you find the answer.

HTTP/1.1 200 OK<*cr*><*lf*>Date: Tue, 07 Mar 2008
12:39:45GMT<*cr*><*lf*>Server: Apache/2.0.52 (Fedora)
<cr><lf>Last-Modified: Sat, 10 Dec2005 18:27:46
GMT<*cr*><*lf*>ETag: “526c3-f22-a88a4c80”<*cr*><*lf*>Accept-
Ranges: bytes<*cr*><*lf*>Content-Length: 3874<*cr*><*lf*>
Keep-Alive: timeout=max=100<*cr*><*lf*>Connection:
Keep-Alive<*cr*><*lf*>Content-Type: text/html; charset=
ISO-8859-1<*cr*><*lf*><*cr*><*lf*><!doctype html public “-
//w3c//dtd html 4.0 transitional//en”><*lf*><html><*lf*>
<head><*lf*> <meta http-equiv=”Content-Type”
content=”text/html; charset=iso-8859-1”><*lf*> <meta
name=”GENERATOR” content=”Mozilla/4.79 [en] (Windows NT
5.0; U) Netscape]”><*lf*> <title>CMPSCI 453 / 591 /
NTU-ST550A Spring 2005 homepage</title><*lf*></head><*lf*>
<much more document text following here (not shown)>

a. Was the server able to successfully find the document or not? What time was the document reply provided?
b. When the document was last modified?
c. How many bytes are there in the document being returned?
d. What are the first 5 bytes of the document being returned? Did the server agree to a persistent connection?

Q10. Explain working of the following:
   a. SMTP
   b. FTP