Home Page: http://www.public.asu.edu/~bhao2

Homework 2

Problems:

1, 6, 7, 8 and 9

Question: 1

True or false?

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.mit.edu/research.html and www.mit.edu/students.html) can be sent over the same persistent connection.

c. With nonpersistent 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.

Answer:

a. False
b. True – If the connection did not timeout, then it can be used to send another html request over the same port
c. False – One TCP segment can carry only one HTTP request message.
d. False – the time in the response message indicates when the request was generate.
e. True – not matter the response of the request is successes or not, at least the Status response should be returned.

Question: 6

Obtain the HTTP/1.1 specification (RFC 2616). Answer the following questions:

a. Explain the mechanism used for signaling between the client and server to indicate that a persistent connection is being closed. Can the client, the server, or both signal the close of a connection?

b. What encryption services are provided by HTTP?

c. Can a client open three or more simultaneous connections with a given server?

d. Either a server or a client may close a transport connection between them if either one detects the connection has been idle for some time. Is it possible that one side starts closing a connection while the other side is transmitting data via this connection? Explain.

Answer:

http://www.w3.org/Protocols/rfc2616/rfc2616.txt

a. In the page 44, 8.1.2 Overall Operation stated that for HTTP 1.1, persistent connections are the default behavior of any HTTP connection. That is, unless otherwise indicated, the client SHOULD assume that the server will maintain a persistent connection, even after error responses from the server.

   The closing of a connection can be initiated by either the client or the server using the connection header field. In order for the client to close the connection, the connection header must include the connection-token, “close” in the request. If the server wishes to close the connection, it must include the same “close” token in the connection header along with its response. This connection header is the last request for that connection. Both the client and server can close a connection.
b. There are no encryption services provided by HTTP.
c. Yes, a client can open three or more simultaneous connections with a given server, although the suggested number of concurrent persistent connections is two.
d. Closing the connection by one side is possible while the other side is transmitting. This is because HTTP is stateless and therefore neither party knows the others state.

Question: 7

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 (round-trip time) of RTT1, . . ., RTTn. 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?

Answer:

The total amount of time to get the IP address from the DNSs is

$$RTT_1 + RTT_2 + \ldots + RTT_n$$

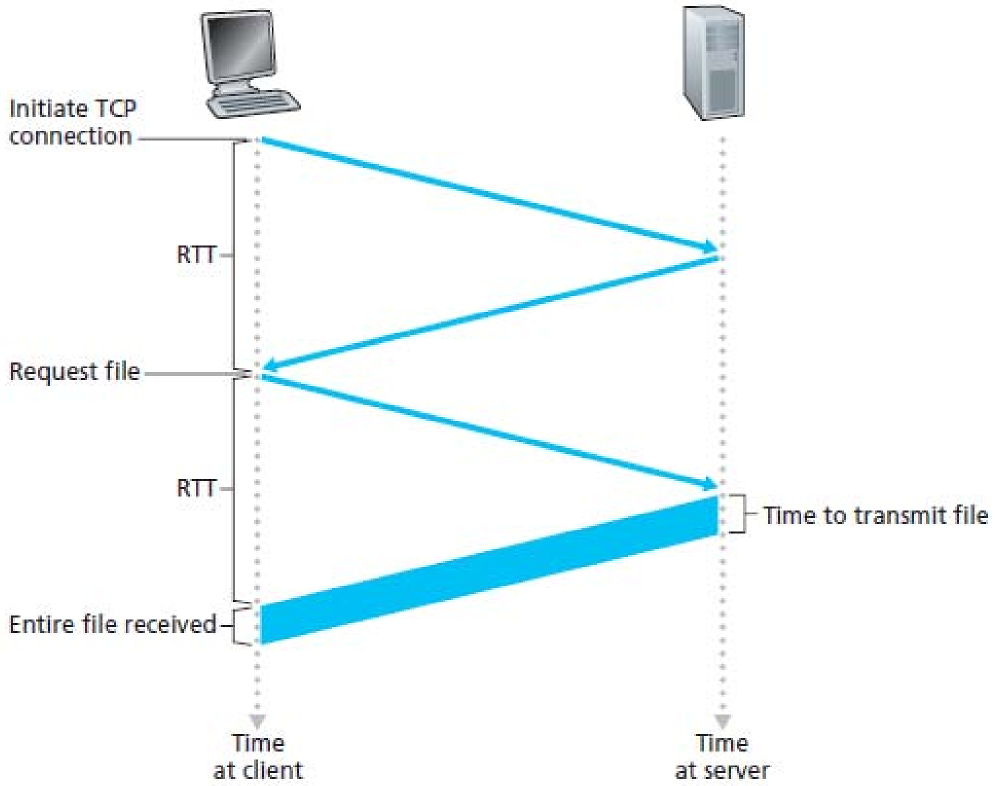

Figure 2.7 ♦ Back-of-the-envelope calculation for the time needed to request and receive an HTML file

After getting the IP address, two RTT_0 are needed to receive the file since one RTT_0 is used to set up the TCP connection and another RTT_0 is used to request and receive the file. This process is shown in Figure 2.7.

Therefore, the total response time is:

$$2RTT_0 + RTT_1 + RTT_2 + ... + RTT_n$$

Question: 8

Referring to Problem P7, suppose the HTML file references eight very small objects on the same server. Neglecting transmission times, how much time elapses with

a. Non-persistent HTTP with no parallel TCP connections?

b. Non-persistent HTTP with the browser configured for 5 parallel connections?

c. Persistent HTTP?

Answer:

a. $RTT_1 + RTT_2 + ... + RTT_n + 2RTT_0 + 8*2RTT_0 = 18RTT_0 + RTT_1 + RTT_2 + ... + RTT_n$

Note: Query the DNS once +setup connection once+ request 8 files

b. $RTT_1 + RTT_2 + ... + RTT_n + 2RTT_0 + 2*2RTT_0 = 6RTT_0 + RTT_1 + RTT_2 + ... + RTT_n$

Note: Query the DNS once +setup connection once+ request 5 files concurrently +request 3 files concurrently

c. $RTT_1 + RTT_2 + ... + RTT_n + 2RTT_0 + RTT_0 = 3RTT_0 + RTT_1 + RTT_2 + ... + RTT_n$

Note: Query the DNS once +setup connection once+ receive 8 files without additional request

Question: 9

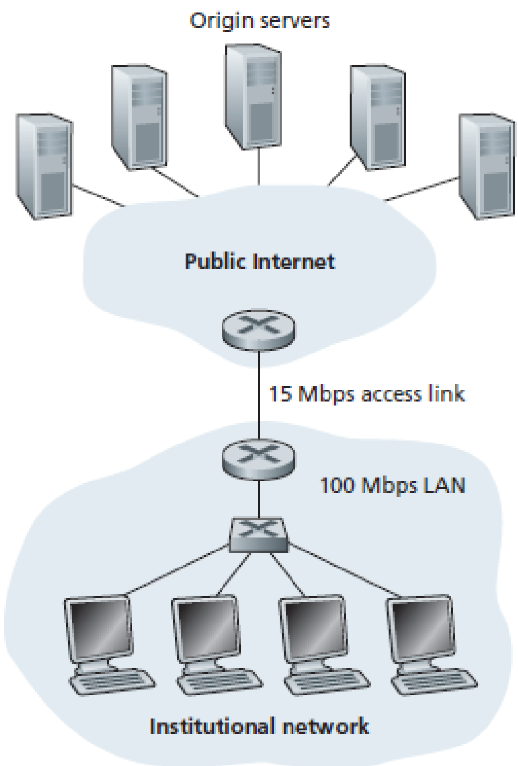

Figure 2.12 ♦ Bottleneck between an institutional network and the Internet

Consider Figure 2.12, for which there is an institutional network connected to the Internet. Suppose that the average object size is 850,000 bits and that the average request rate from the institution's browsers to the origin servers is 16 requests per second. Also suppose that the amount of time it takes from when the router on the Internet side of the access link forwards an HTTP request until it receives the response is three seconds on average (see Section 2.2.5).

Model the total average response time as the sum of the average access delay (that is, the delay from Internet router to institution router) and the average Internet delay. For the average access delay, use $\Delta/(1 - \Delta\beta)$, where Δ is the average time required to send an object over the access link and β is the arrival rate of objects to the access link.

a. Find the total average response time. (Chapter 2 Problem 9a modification: Average object size is 500,000 bits, request rate is 2 per second, and uses an access link of 1 Mbps.)

b. Now suppose a cache is installed in the institutional LAN. Suppose the miss rate is 0.4. Find the total response time.

Answer:

a. The time to transmit an object of size L over a link on rate R is L/R. The average time is the average size of the object divided by R: Δ= (500,000 bits)/(1,000,000 bits/sec)=0.5 sec.
   The traffic intensity on the link is given by $\Delta\beta$ =(2 requests/sec)(0.5 sec/request) = 1
   According to the book, page 113. As the traffic intensity approaches 1 (as is the case of the access link in Figure 2.12), the delay on a link becomes very large and grows without bound. Thus, the average response time to satisfy requests is going to be on the order of minutes, if not more, which is unacceptable for the institution's users.
b. The traffic intensity on the access link is reduced by 60% since the 60% of the requests are satisfied by cache. Thus the average access delay is (0.5 sec)/(1-0.4*1)=0.83333 sec. Suppose the response time is zero if the request is satisfied by the cache (60% of the time). The average response time is 0.833 sec + 3 sec = 3.833 sec for cache misses (40% of the time).
   Finally, the total response time is 0.6*0 + 0.4*3.833 = 1.533 sec