SOLUTION ASSIGNMENT-02 6A

PART-01

REVIEW QUESTIONS

R4. No. In a P2P file-sharing application, the peer that is receiving a file is typically the client and the peer that is sending the file is typically the server.

R5. The IP address of the destination host and the port number of the socket in the destination process.

R6. You would use UDP. With UDP, the transaction can be completed in one roundtrip time (RTT) - the client sends the transaction request into a UDP socket, and the server sends the reply back to the client's UDP socket. With TCP, a minimum of two RTTs are needed - one to set-up the TCP connection, and another for the client to send the request, and for the server to send back the reply.

R11. The applications associated with those protocols require that all application data be received in the correct order and without gaps. TCP provides this service whereas UDP does not.

R13. Web caching can bring the desired content "closer" to the user, possibly to the same LAN to which the user's host is connected. Web caching can reduce the delay for all objects, even objects that are not cached, since caching reduces the traffic on links.

R19. Yes an organization's mail server and Web server can have the same alias for a host name. The MX record is used to map the mail server's host name to its IP address.

PROBLEMS

P3. Application layer protocols: DNS and HTTP Transport layer protocols: UDP for DNS; TCP for HTTP

P7.

The total amount of time to get the IP address is
$RTT_1 + RTT_2 + \cdots + RTT_n$.

Once the IP address is known, RTT_O elapses to set up the TCP connection and another RTT_O elapses to request and receive the small object. The total response time is

$2RTT_o + RTT_1 + RTT_2 + \cdots + RTT_n$

P8.

a)

$$RTT_1 + \cdots + RTT_n + 2RTT_o + 8 \cdot 2RTT_o$$
$$= 18RTT_o + RTT_1 + \cdots + RTT_n.$$

b)

$$RTT_1 + \cdots + RTT_n + 2RTT_o + 2 \cdot 2RTT_o$$
$$= 6RTT_o + RTT_1 + \cdots + RTT_n$$

c) Persistent connection with pipelining. This is the default mode of HTTP.

$$RTT_1 + \cdots + RTT_n + 2RTT_o + RTT_o$$
$$= 3RTT_o + RTT_1 + \cdots + RTT_n.$$

Persistent connection without pipelining, without parallel connections.

$$RTT_1 + \cdots + RTT_n + 2RTT_o + 8RTT_o$$
$$= 10RTT_o + RTT_1 + \cdots + RTT_n.$$

P13.

a) 2015

2000 frames of video clip
3 frames of image1
3 frames of image2
3 frames of image3
3 frames of image4
3 frames of image5

b) 18

1st frame of video
1st frame of image1
1st frame of image2
1st frame of image3
1st frame of image4
1st frame of image5
Repeat for the second the third frames for all the objects

PART-02

Question 1

a) RTT = 2* one-way propagation delay = 2* 20ms = 40ms

Time to download the Webpage with non-persistent HTTP = 8 RTT + time transmission of the base file (25 Kbytes) + time transmission of the 3 images (200 Kbytes each)

= (8*40ms) + (8*25*10^3) / (2*10^6) + (3*8*200*10^3) / (2*10^6) = 2.82 secs

b) RTT = 2* one-way propagation delay = 2* 20ms = 40ms

Time to download the Webpage with persistent HTTP without pipelining = 5 RTT + time transmission of the base file (25 Kbytes) + time transmission of the 3 images (200 Kbytes each)

= (5*40ms) + (8*25*10^3) / (2*10^6) + (3*8*200*10^3) / (2*10^6) = 2.7 secs

Question 2

a) The time to transmit an object of size L over a link or rate R is L/R. The average time is the average size of the object divided by R:

   Δ = (850,000 bits)/(15,000,000 bits/sec) = .0567 sec

   The traffic intensity on the link is given by $\beta\Delta$=(16 requests/sec)(.0567 sec/request) = 0.907. Thus, the average access delay is (.0567 sec)/(1 - .907) ≈ .6 seconds. The total average response time is therefore .6 sec + 3 sec = 3.6 sec.

b) The traffic intensity on the access link is reduced by 60% since the 60% of the requests are satisfied within the institutional network. Thus the average access delay is (.0567 sec)/[1 – (.4)(.907)] = .089 seconds. The response time is approximately zero if the request is satisfied by the cache (which happens with probability .6); the average response time is .089 sec + 3 sec = 3.089 sec for cache misses (which happens 40% of the time). So the average response time is (.6)(0 sec) + (.4)(3.089 sec) = 1.24 seconds. Thus the average response time is reduced from 3.6 sec to 1.24 sec.