Homework 2 Solutions

Problem 1

a) F  
b) T  
c) F  
d) F  
e) F

Problem 4

a) The document request was http://gaia.cs.umass.edu/cs453/index.html. The Host: field indicates the server's name and /cs453/index.html indicates the file name.

b) The browser is running HTTP version 1.1, as indicated just before the first <cr><lf> pair.

c) The browser is requesting a persistent connection, as indicated by the Connection: keep-alive.

d) This is a trick question. This information is not contained in an HTTP message anywhere. So there is no way to tell this from looking at the exchange of HTTP messages alone. One would need information from the IP datagrams (that carried the TCP segment that carried the HTTP GET request) to answer this question.

e) Mozilla/5.0. The browser type information is needed by the server to send different versions of the same object to different types of browsers.

Problem 9

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 $R$:

$$\Delta = \frac{850,000 \text{ bits}}{15,000,000 \text{ bits/sec}} = 0.0567 \text{ sec}$$

The traffic intensity on the link is given by $\beta \Delta = (16 \text{ requests/sec})(0.0567 \text{ sec/request}) = 0.907$. Thus, the average access delay is $(0.0567 \text{ sec})/(1 - 0.907) \approx 0.6 \text{ seconds}$. The total average response time is therefore $.6 \text{ sec} + 3 \text{ sec} = 3.6 \text{ sec}.$
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 

\[
\frac{.0567 \text{ sec}}{[1 - (.4)(.907)]} = .089 \text{ seconds.}
\]

The response time is approximately zero if the request is satisfied by the cache (which happens with probability .6); the average response time is 

\[
.089 \text{ sec} + 3 \text{ sec} = 3.089 \text{ sec}
\]

for cache misses (which happens 40% of the time). So the average response time is 

\[
(.6)(0 \text{ sec}) + (.4)(3.089 \text{ sec}) = 1.24 \text{ seconds.}
\]

Thus the average response time is reduced from 3.6 sec to 1.24 sec.

**Problem 10**

Note that each downloaded object can be completely put into one data packet. Let \( T_p \) denote the one-way propagation delay between the client and the server.

First consider parallel downloads using non-persistent connections. Parallel downloads would allow 10 connections to share the 150 bits/sec bandwidth, giving each just 15 bits/sec. Thus, the total time needed to receive all objects is given by:

\[
(\frac{200}{150} + T_p + 200/150 + T_p + 200/150 + T_p + 100,000/150 + T_p ) + (\frac{200}{150/10} + T_p + 200/(150/10) + T_p + 200/(150/10) + T_p + 100,000/(150/10) + T_p ) = 7377 + 8*T_p \text{ (seconds)}
\]

Now consider a persistent HTTP connection. The total time needed is given by:

\[
(\frac{200}{150} + T_p + 200/150 + T_p + 200/150 + T_p + 100,000/150 + T_p ) + 10(\frac{200}{150} + T_p + 100,000/150 + T_p ) = 7351 + 24*T_p \text{ (seconds)}
\]

Assuming the speed of light is \(300*10^6\) m/sec, then \( T_p=10/(300*10^6)=0.03 \) microsec. \( T_p \) is therefore negligible compared with transmission delay.

Thus, we see that persistent HTTP is not significantly faster (less than 1 percent) than the non-persistent case with parallel download.

**Problem 18**

a) For a given input of domain name (such as ccn.com), IP address or network administrator name, the *whois* database can be used to locate the corresponding registrar, whois server, DNS server, and so on.

b) NS4.YAHOO.COM from www.register.com; NS1.MSFT.NET from www.register.com

c) **Local Domain: www.mindspring.com**

Web servers : www.mindspring.com
d) The yahoo web server has multiple IP addresses
www.yahoo.com (216.109.112.135, 66.94.234.13)
e) The address range for Polytechnic University: 128.238.0.0 – 128.238.255.255

f) An attacker can use the *whois* database and nslookup tool to determine the IP address ranges, DNS server addresses, etc., for the target institution.

g) By analyzing the source address of attack packets, the victim can use whois to obtain information about domain from which the attack is coming and possibly inform the administrators of the origin domain.

**Problem 22**

For calculating the minimum distribution time for client-server distribution, we use the following formula:

\[ D_{cs} = \max \left\{ \frac{NF}{u_s}, \frac{F}{d_{\text{min}}} \right\} \]

Similarly, for calculating the minimum distribution time for P2P distribution, we use the following formula:

\[ D_{\text{P2P}} = \max \left\{ \frac{F}{u_s}, \frac{F}{d_{\text{min}}, \frac{NF}{\sum_{i=1}^{N} u_i}} \right\} \]

Where, \( F = 15 \text{ Gbits} = 15 \times 1024 \text{ Mbits} \)
\( u_s = 30 \text{ Mbps} \)
\( d_{\text{min}} - d_i = 2 \text{ Mbps} \)

*Note, 300Kbps = 300/1024 Mbps.*

**Client Server**

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<th>N</th>
<th>10</th>
<th>100</th>
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**Peer to Peer**

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Similarly, for calculating the minimum distribution time for P2P distribution, we use the following formula:

\[ D_{p2p} = \max \{F/u_s, F/d_{min}, NF/(u_s + \sum_{i=1}^{N} u_i)\} \]

Where, \( F = 15 \) Gbits = 15 * 1024 Mbits
\( u_s = 30 \) Mbps
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