DATA COMMUNICATION AND NETWORKS (CS-328)

Assignment# 02

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ROLL NO: 2019-CS-026

SECTION: A

TASK - 1

Study IPv4 and compare it with IPv6 with respect to requirements and services of IPv6. Prepare for an oral quiz.

TASK-2

Solve minimum 2 problems of the following topics. Following the book entitled "Computer networking a Top-Down-Approach".

HTTP PROBLEMS:

P3. Consider an HTTP client that wants to retrieve a Web document at a given URL. The IP address of the HTTP server is initially unknown. What transport and application-layer protocols besides HTTP are needed in this scenario?

Answer:

TRANSPORT LAYER PROTOCOLS:

- TCP for HTTP
- UDP for DNS;

APPLICATION LAYER PROTOCOLS:

- DNS · HTTP **P4.** Consider the following string of ASCII characters that were captured by Wireshark when the browser sent an HTTP GET message (i.e., this is the actual content of an HTTP GET message). The characters are carriage return and line-feed characters (that is, the italized character string in the text below represents the single carriage-return character that was contained at that point in the HTTP header). Answer the following questions, indicating where in the HTTP GET message below you find the answer.

a) What is the URL of the document requested by the browser?

Answer: 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) What version of HTTP is the browser running?

Answer: The browser is running HTTP version 1.1, as indicated just before the first pair.

c) Does the browser request a non-persistent or a persistent connection?

Answer: The browser is requesting a persistent connection, as indicated by the Connection: keepalive.

d) What is the IP address of the host on which the browser is running?

Answer: 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) What type of browser initiates this message? Why is the browser type needed in an HTTP request message?

Answer: 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.

WEB CACHE PROBLEMS:

P9. 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 $\Delta/(1 - \Delta)$, where Δ is the average time required to send an object over the access link and is the arrival rate of objects to the access link.

a) Find the total average response time.

Answer: 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:

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

The traffic intensity on the link is given by = (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 secs = **3.6 sec.**

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

Answer: 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 secs = **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.**

P20. Suppose you can access the caches in the local DNS servers of your department. Can you propose a way to roughly determine the Web servers (outside your department) that are most popular among the users in your department? Explain.

Answer: We can periodically take a snapshot of the DNS caches in the local DNS servers. The Web server that appears most frequently in the DNS caches is the most popular server. This is because if more users are interested in a Web server, then DNS requests for that server are more frequently sent by users. Thus, that Web server will appear in the DNS caches more frequently.

ROUND TRIP TIME (RTT) PROBLEMS:

P7. 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, . . ., 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:

Consider the IP address of total amount of time:

$$RTT_1 + RTT_2 + \ldots + RTT_N$$

Time elapses from when the client clicks on the link until the client receives the object:

$$\mathbf{2RTT_0 + RTT_1 + RTT_2 + \ldots + RTT_n}$$

P8. 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?

Answer: Non-persistent HTTP with no parallel TCP connections as follows:

$$RTT_1 + \ldots + RTT_N + 2RTT_0 + 3.2RTT_0 = 8RTT_0 + RTT_1 + \ldots + RTT_N$$

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

Answer: Non-persistent HTTP with the browser configured for 5 parallel connections as follows:

$$RTT_1 + \ldots + RTT_N + 2RTT_0 + 2RTT_0 = 4RTT_0 + RTT_1 + \ldots + RTT_N$$

c) Persistent HTTP?

Answer: Persistent HTTP as follows:

$$RTT_1 + \ldots + RTT_N + 2RTT_0 + RTT_0$$