Assignment 2 - Solution

Covered Topics:-
Application Layer Protocol: HTTP

HTTP (Hypertext Transfer Protocol)

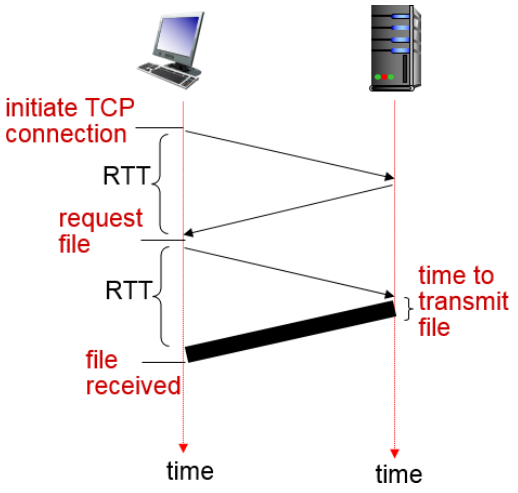
- It is Application layer protocol
- Client: A browser that requests, receives, (using HTTTP protocol) and displays Web Objects. E.g. PC, iPhone.
- Server: Web server sends (using HTTP protocol) objects in response to request.
- A client initiates TCP connection to server using port 80. A server accepts TCP connection from client. HTTP messages exchanged between browser (HTTP client) and Web server (HTTP server).
- HTTP connection types are:
  - Non-Persistent HTTP: one object sent per TCP connection then closed. Downloading multiple objects required multiple connections.

    *Non-Persistent HTTP response time = 2 *n*RTT+ file transmission time*

    Where: RTT (Round-Trip Time): time for a small packet to travel from client to server and back
  - Persistent HTTP: multiple objects can be sent over single TCP connection between client and server.

    Persistent HTTP response time = (n+1) RTT+ file transmission time

    Where: n: Number of Objects to be transmitted.



Problem 1

A client is trying to retrieve a webpage which consists of a base file and 4 JPEG images from server S1. The propagation delay is 100ms. Calculate the total delay in case of:

a) HTTP Persistent Connection
b) HTTP Non- Persistent Connection

Note: The base HTML file is an object that references the other objects in the page with the objects' URLs

Solution

Number of Objects: 1 (Base File) + 4 (JPEG Images) = 5 objects.

$D_{prop} = 100*10^{-3}$ sec

Total delay =?

Persistent HTTP Connection:-

RTT = $2*D_{prop} = 2*100*10^{-3} = 200*10^{-3}$ sec

Transmission time = 0 sec

Response Time = [(n+1)*RTT] + Transmission Time

= $[(5+1)*200*10^{-3}] + 0 = 1200*10^{-3}$ = 1200msec.

Non-Persistent HTTP Connection:-

Response Time = [2*n*RTT] + Transmission Time

= $(2*5*200*10^{-3}) = 2000*10^{-3}$ = 2000msec.

Problem 2

Consider a network path between a browser and server. If the propagation delay between the client and the server is 150msec, and assume the response time in case non-persistent HTTP connections is 6.01 sec. solve the following

a) Find number of objects in the requested file
b) Assume Persistent HTTP connections, what is the response time?

Solution

$D_{prop} = 150*10^{-3}$sec.

Response Time (Non-Persistent) = 6.001sec.

a. n =?

   RTT = 2* D_{prop}= $2*150*10^{-3}$ = 0.3sec

   Respone Time = 2*n*RTT

   6.001 = 2*0.3*n

   n = 10 Objects.

b. Response Time (persistent) = (n+1)*RTT = (10+1)*0.3 = 3.3sec

Problem 3

Consider end user A requesting a web page consists of a base file and 10 objects from server S that is on a different network. If 4 of the 10 objects reside on server K that is on another network, the total network delay between A and S is 100msec, the total network delay between A and K is 200msec. Calculate the total response time in case of persistent connection.

Solution

Total Number of Objects = 1 (Base File) + 10 (Objects) = 11 Objects

Connection from PC-> Server S

Number of Objects = 1 (Base file) + 6 Objects = 7 Objects

$D_{prop\ (PC \rightarrow Server\ S)} = 100*10^{-3}$ sec

RTT = 2* = $2*100*10^{-3}$ = 0.2sec

Total Response Time $_{(PC \rightarrow Server\ S)}$ = (n+1)*RTT = (7+1)*0.2 = 1.6sec

Connection from PC-> Server K

Number of Objects = 4 Objects

$D_{prop\ (PC \rightarrow Server\ S)} = 200*10^{-3}$ sec

RTT = 2* = $2*200*10^{-3}$ = 0.4sec

Total Response Time $_{(PC \rightarrow Server\ S)}$ = (n+1)*RTT = (4+1)*0.4 = 2sec

Total Response Time:-

Total Response Time = Response Time $_{(PC \rightarrow Server\ S)}$ + Response Time $_{(PC \rightarrow Server\ K)}$ = 1.6 + 2 = 3.6sec

Problem 4

End user A is requesting a web page consists of 3 objects from Server S. The propagation delay is 400ms and the transmission delay of each object is 100ms. (The transmission delay of the http request and response is neglected) Calculate the total response time of Server?

Solution

n = 3 Objects.

$D_{prop} = 400*10^{-3} = 0.4sec$

$D_{trans} = 100*10^{-3} = 0.1sec$

$RTT = 2* D_{prop} = 2*0.4 = 0.8sec$

Total Response = $(n+1)*RTT + n* D_{trans} = (3+1)*0.8 + 3*0.1 = 3.2 + 0.3 = 3.5sec$

Problem 5

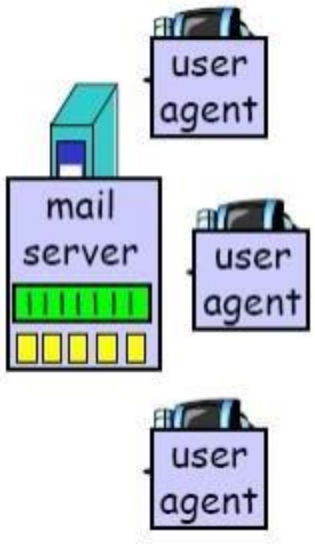
The figure shows a mail server with three user agents. Answer the following questions

a) The user agent can be a program that can be installed on the computer, or a web based interface that can be accessed using a normal web browser. What is the difference between the two?

User agent based solutions:

Access solutions installed and run on the user's computer. This includes:

- Access features built into the operating systems or browsers (platforms).
- Downloadable add-ons to platforms.
- And commercial assistive technologies that are installed on a computer.



This model takes advantage of the client computer's processing power in order to create faster response than server-based solutions. Additionally, these types of projects are currently the easiest to develop and deploy (especially the browser add-ons), since they require no added server side infrastructure. However, they require that users have permission to install and modify programs on every computer on which they may need access.

Web-based user agents

Include web-based access technologies that can be used anywhere, from any internet-enabled device. Web anywhere is an example of this approach.

b) What is the protocol name that the user agent uses to retrieve messages from the mail server?

Protocols that the user agent uses for retrieving mail include POP3 and IMAP4.

c) What is the protocol name that the mail server uses to send the messages to the other mail servers?

The name of the protocol that the mail server uses to send messages is the SMTP protocol.