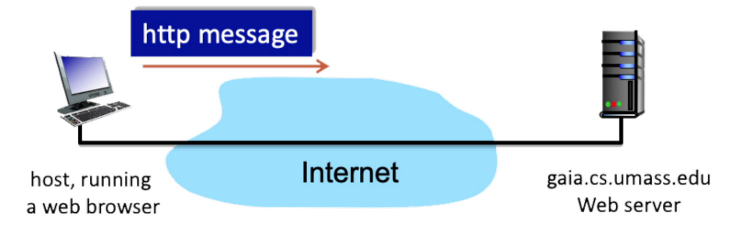
COMPUTER NETWORKS

Question Bank

Unit – 2
Application Layer

1) Consider the figure below, where a client is sending an HTTP GET message to a web server, gaia.cs.umass.edu



Suppose the client-to-server HTTP GET message is the following:

GET /kurose_ross_sandbox/interactive/quotation6.htm HTTP/1.0
Host: gaia.cs.umass.edu
If-Modified-Since: Mon, 20 Jul 2020 08:55:29 -0700

Questions

a) What is the name of the file that is being retrieved in this GET message?
b) What version of HTTP is the client running?
c) True or False: The client already has a cached copy of the file

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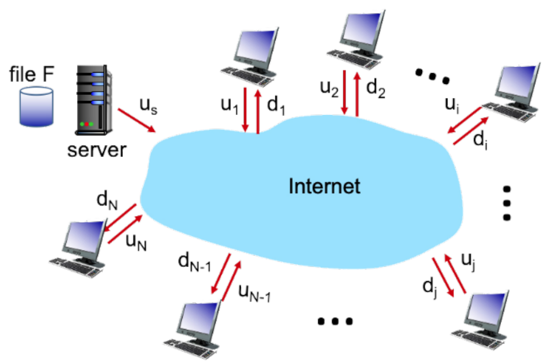
2) In this problem, you'll compare the time needed to distribute a file that is initially located at a server to clients via either client-server download or peer-to-peer download. Before beginning, you might want to first review Section 2.5 and the discussion surrounding Figure 2.22 in the text.



The problem is to distribute a file of size F = 4 Gbits to each of these 8 peers. Suppose the server has an upload rate of u = 50 Mbps.

The 8 peers have upload rates of: u1 = 30 Mbps, u2 = 15 Mbps, u3 = 29 Mbps, u4 = 26 Mbps, u5 = 20 Mbps, u6 = 28 Mbps, u7 = 16 Mbps, and u8 = 17 Mbps

The 8 peers have download rates of: d1 = 35 Mbps, d2 = 33 Mbps, d3 = 31 Mbps, d4 = 10 Mbps, d5 = 19 Mbps, d6 = 33 Mbps, d7 = 35 Mbps, and d8 = 24 Mbps

Questions

a) What is the minimum time needed to distribute this file from the central server to the 8 peers using the client-server model?
b) For the previous question, what is the root cause of this specific minimum time? Answer as 's' or 'ci' where 'i' is the client's number
c) What is the minimum time needed to distribute this file using peer-to-peer download?
d) For question 3, what is the root cause of this specific minimum time: the server (s), client (c), or the combined upload of the clients and the server (cu)

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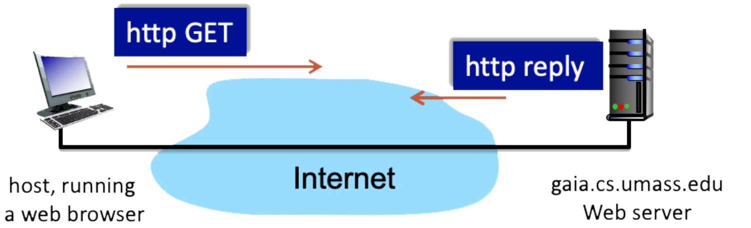
3) Consider the figure below, where the server is sending a HTTP RESPONSE message back the client.



Suppose the server-to-client HTTP RESPONSE message is the following:

HTTP/1.0 404 Not Found
Date: Mon, 20 Jul 2020 16:24:09 +0000
Server: Apache/2.2.3 (CentOS)
Content-Length: 772
Connection: Close
Content-type: image/html

Questions

a) Is the response message using HTTP 1.0 or HTTP 1.1?
b) Was the server able to send the document successfully? Yes or No
c) How big is the document in bytes?
d) Is the connection persistent or nonpersistent?
e) What is the type of file being sent by the server in response?
f) What is the name of the server and its version? Write your answer as server/x.y.z
g) Will the ETag change if the resource content at this particular resource location changes? Yes or No

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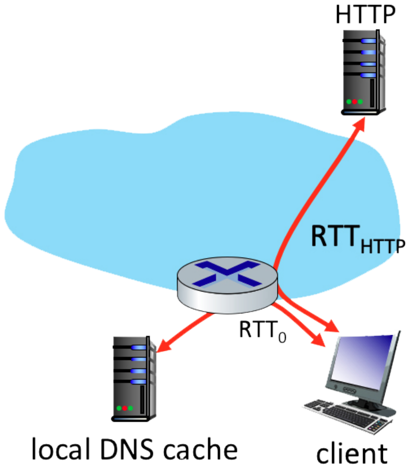
4) Before doing this question, you might want to review sections 2.2.1 and 2.2.2 on HTTP (in particular the text surrounding Figure 2.7) and the operation of the DNS (in particular the text surrounding Figure 2.19).

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 only one DNS server, the local DNS cache, is visited with an RTT delay of RTT_0 = 5 msecs. Initially, let's suppose that the Web page associated with the link contains exactly one object, consisting of a small amount of HTML text. Suppose the RTT between the local host and the Web server containing the object is RTT_{HTTP} = 43 msecs.



Questions

a) Assuming zero transmission time for the HTML object, how much time (in msec) elapses from when the client clicks on the link until the client receives the object?

b) Now suppose the HTML object references 8 very small objects on the same server. Neglecting transmission times, how much time (in msec) elapses from when the client clicks on the link until the base object and all 8 additional objects are received from web server at the client, assuming non-persistent HTTP and no parallel TCP connections?

c) Suppose the HTML object references 8 very small objects on the same server, but assume that the client is configured to support a maximum of 5 parallel TCP connections, with non-persistent HTTP.

d) Suppose the HTML object references 8 very small objects on the same server, but assume that the client is configured to support a maximum of 5 parallel TCP connections, with persistent HTTP.

e) What's the fastest method we've explored: Nonpersistent-serial, Nonpersistent-parallel, or Persistent-parallel?

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5) 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 <cr><lf> are carriage return and line-feed characters (that is, the italized character string <cr> 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.

GET /cs453/index.html HTTP/1.1<cr><lf>
Host: gaia.cs.umass.edu<cr><lf>
User-Agent: Mozilla/5.0 (Windows;U; Windows NT 5.1; en-US; rv:1.7.2) Gecko/20040804 Netscape/7.2 (ax) <cr><lf>
Accept: ext/xml, application/xml, application/xhtml+xml, text /html;q=0.9, text/plain;q=0.8,image/png,*/*;q=0.5<cr><lf>
Accept-Language: en-us,en;q=0.5<cr><lf>
Accept-Encoding: zip,deflate<cr><lf>
Accept-Charset: ISO-8859-1,utf-8;q=0.7,*;q=0.7<cr><lf>
Keep-Alive: 300<cr><lf>

Connection: keep-alive<cr><lf>
<cr><lf>

Questions

a) What is the URL of the document requested by the browser?
b) What version of HTTP is the browser running?
c) Does the browser request a non-persistent or a persistent connection?
d) What is the IP address of the host on which the browser is running?
e) What type of browser initiates this message? Why is the browser type needed in an HTTP request message?

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6) 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?

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7) Suppose that in UDPClient.py, after we create the socket, we add the line:

clientSocket.bind(('', 5432))

Will it become necessary to change UDPServer.py? What are the port numbers for the sockets in UDPClient and UDPServer? What were they before making this change?

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8) Install and compile the Python programs TCPClient and UDPClient on one host and TCPServer and UDPServer on another host.

a) Suppose you run TCPClient before you run TCPServer. What happens? Why?
b) Suppose you run UDPClient before you run UDPServer. What happens? Why?
c) What happens if you use different port numbers for the client and server sides?

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9) The text below shows the reply sent from the server in response to the HTTP GET message in the question above. Answer the following questions, indicating where in the message below you find the answer.

HTTP/1.1 200 OK<cr><lf>Date: Tue, 07 Mar 2008 12:39:45GMT<cr><lf>
Server: Apache/2.0.52 (Fedora)<cr><lf>
Last-Modified: Sat, 10 Dec2005 18:27:46 GMT<cr><lf>
ETag: "526c3-f22-a88a4c80"<cr><lf>
Accept-Ranges: bytes<cr><lf>Content-Length: 3874<cr><lf>
Keep-Alive: timeout=max=100<cr><lf>
Connection: Keep-Alive<cr><lf>
Content-Type: text/html; charset=ISO-8859-1<cr><lf>
<cr><lf>
<!doctype html public "-//w3c//dtd html
4.0transitional//en"><lf><html><lf>
<head><lf> <meta http-equiv="Content-Type" content="text/html;
charset=iso-8859-1"><lf> <meta name="GENERATOR"
content="Mozilla/4.79 [en] (Windows NT
5.0; U) Netscape]"><lf> <title>CMPSCI 453 / 591 /NTU-ST550ASpring 2005
homepage</title><lf></head><lf>
<much more document text following here (not shown)>

a) Was the server able to successfully find the document or not? What time was the document reply provided?
b) When was the document last modified?
c) How many bytes are there in the document being returned?
d) What are the first 5 bytes of the document being returned? Did the server agree to a persistent connection?

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10) Obtain the HTTP/1.1 specification (RFC 2616). Answer the following questions: 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?
a) What encryption services are provided by HTTP?
b) Can a client open three or more simultaneous connections with a given server?
c) 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.

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11)

a) What is a whois database?
b) Use various whois databases on the Internet to obtain the names of two DNS servers. Indicate which whois databases you used.
c) Use nslookup on your local host to send DNS queries to three DNS servers: your local DNS server and the two DNS servers you found in part (b). Try querying for Type A, NS, and MX reports. Summarize your findings.
d) Use nslookup to find a Web server that has multiple IP addresses. Does the Web server of your institution (school or company) have multiple IP addresses?
e) Use the ARIN whois database to determine the IP address range used by your university.
f) Describe how an attacker can use whois databases and the nslookup tool to perform reconnaissance on an institution before launching an attack.
g) Discuss why whois databases should be publicly available.

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12) Suppose Bob joins a BitTorrent torrent, but he does not want to upload any data to any other peers (so called free-riding).
a) Bob claims that he can receive a complete copy of the file that is shared by the swarm. Is Bob's claim possible? Why or why not?
b) Bob further claims that he can further make his "free-riding" more efficient by using a collection of multiple computers (with distinct IP addresses) in the computer lab in his department. How can he do that?

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13) We have seen that Internet TCP sockets treat the data being sent as a byte stream but UDP sockets recognize message boundaries. What are one advantage and one disadvantage of byte-oriented API versus having the API explicitly recognize and preserve application-defined message boundaries?

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14) Suppose that your department has a local DNS server for all computers in the department. You are an ordinary user (i.e., not a network/system administrator).

Can you determine if an external Web site was likely accessed from a computer in your department a couple of seconds ago? Explain.

15) In this problem, we use the useful dig tool available on Unix and Linux hosts to explore the hierarchy of DNS servers. Recall that in Figure 2.19, a DNS server in the DNS hierarchy delegates a DNS query to a DNS server lower in the hierarchy, by sending back to the DNS client the name of that lower-level DNS server. First read the man page for dig, and then answer the following questions.
    a) Starting with a root DNS server (from one of the root servers [a-m].root-servers.net), initiate a sequence of queries for the IP address for your department's Web server by using dig. Show the list of the names of DNS servers in the delegation chain in answering your query.
    b) Repeat part (a) for several popular Web sites, such as google.com, yahoo.com, or amazon.com.