SOLUTION QUIZ 1 CMPT 371

1. A host X is making DNS queries to its local DNS server. Assume each of the following
   - The requests made by the local DNS server will be iterative
   - The cache of the local DNS server contained only the names and addresses of the root DNS servers when the first DNS query listed below was made. (this means that the DNS server was initialized immediately before making the first query listed below)
   - The following domains all contain authoritative DNS servers: .com. .orange.com. .fruit.orange.com. .carrot.vegetable.gov. .vegetable.gov. .gov. .sfu.ca. .ca.
   - breakfast, dinner and favoritedept are hosts within their respective domains

   Since the DNS server was initialized queries for addresses corresponding to the following domain names have been made

   i. **breakfast.fruit.orange.com**. (IP address is available only from authoritative DNS server for the domain fruit.orange.com., the address is not in any other DNS server's cache.)
   ii. **dinner.carrot.vegetable.gov**. (IP address is available only from authoritative DNS server for the domain carrot.vegetable.gov., the address is not in any other DNS server's cache)
   iii. **favoritedept.sfu.ca.** (IP address is available only from authoritative DNS server for the domain sfu.ca., the address is not in any other DNS server's cache)

   a) **[12 points]** Consider that the three DNS requests listed above (I, ii, iii) have been completed. List all domains for which the names of authoritative DNS servers will be recorded in the local DNS server's cache.

   .fruit.orange.com.
   .orange.com.
   .com.
   .carrot.vegetable.gov.
   .vegetable.gov.
   .gov.
   .sfu.ca.
   .ca.

b) [20 points] After the three requests listed in I, ii and iii are made another request is made. This additional request is for the IP address corresponding to the domain name **wserver.research.orange.com.**

- Give a step by step explanation of how the local DNS server would determine what the first query it should make would be.
- For each iterative query made by the local DNS server give
  I. The known domain name or known IP address in the query
  II. The domain name or IP address requested by the query
  III. The domain name of the server the request is made to
  IV. The domain name/s or IP addresse/s returned in response to the query
  V.

- ***The first domain queried will be orange.com.***
- ***This domain is chosen because this is the longest match for a domain name that can be found in the cache.***
- ***The step by step procedure to find the longest match is***
  - ***The local DNS server will attempt to find the IP for*** **wserver.research.orange.com.**
    In its DNS cache, the information is not in the DNS cache
  - ***The local DNS server will attempt to find the IP for*** **research.orange.com.**
    In its DNS cache, the information is not in the DNS cache
  - ***The local DNS server will attempt to find the IP for*** **orange.com.**
    In its DNS cache,
  - ***It will find the DNS name and IP address for the authoritative server in the domain orange.com. in the local DNS server's cache.***

If the student assumed that research.orange.com was an authoritative domain

- ***The first query***
  I. Know domain name orange.com.
  II. Query for the address of wserver.research.orange.com.
  III. The query is made to the authoritative server for the domain orange.com.
  IV. The answer returned from the first query will be the domain names of the authoritative servers for the research.orange.com. domain
    - ***IP addresses of these servers may be returned as well or an additional request for the IP address of one of the servers may need to be made.***
- ***The second query will be***
  I. Know domain name research.orange.com.
  II. Query for the address of wserver.research.orange.com.
  III. The query is made to the authoritative server for the domain research.orange.com.
  IV. The answer returned from the first query will be the IP address of wserver.research.orange.com.

If the student assumed that research.orange.com. was not an authoritative domain

- ***The first query***
  - ***I. Know domain name orange.com.***
  - ***II. Query for the address of wserver.research.orange.com.***
  - ***III. The query is made to the authoritative server for the domain orange.com.***
  - ***V. The answer returned from the first query will be the IP address of wserver.research.orange.com.***

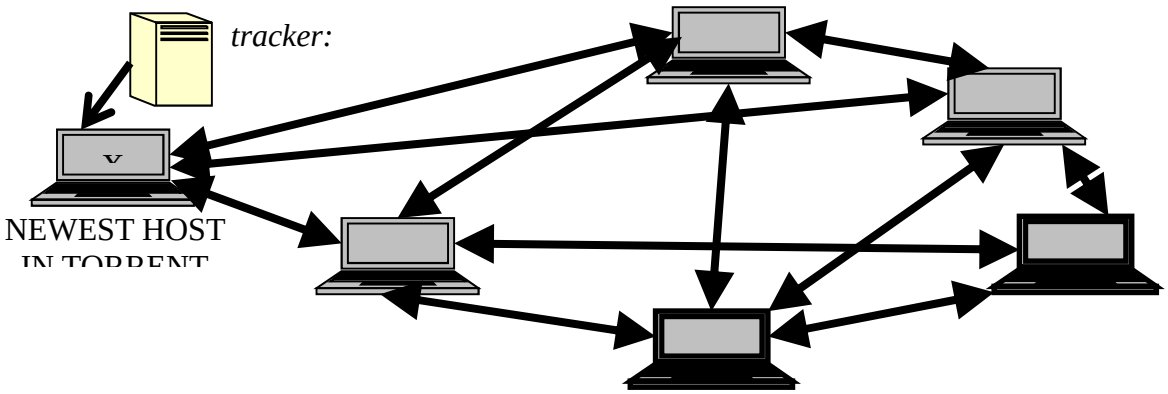
c) **[8 points]** What makes an authoritative response to a query authoritative? Is the final response in b) authoritative? Why? If a second DNS request for the IP address corresponding to the domain name **wserver.research.orange.com.** was made would the answer be authoritative? Why?

An authoritative response comes directly from the DNS server that is authoritative for the domain the host is in.

The final result in b) is authoritative because the result

A second request for wserver.research.orange.com. would produce an answer that was not authoritative because the answer would come from the local DNS server's cache not from the authoritative server

2. [20 points] Consider bit torrent as an example of a peer to peer application.



The host labeled X is has just joined the illustrated bit torrent. As indicated below the host it is the newest host in the torrent. Answer the following questions. Each answer should be no longer than three sentences.

a) How does host X obtain an initial list of potential peers?
X contacts the tracker. The tracker provides a list of potential peers chosen from its list of current peers (hosts currently part of the torrent)

b) What is the purpose of the tracker?
The tracker manages the torrent. The tracker keeps track of which peer has which block of data. The tracker provides each peer with a list of potential peers and periodically updates that list. The tracker tells each peer the blocks that each or its potential peers presently have.

c) How does a potential peer from X's list become an ~~actual~~ neighboring peer?
An neighboring peer is prepared to send data. That means to become an neigboring peer a TCP connection with the potential peer must be established. Before the connection is made no data can be sent and the peer is only a potential peer.
I missed a typo here, actual should be neighboring, so all students will receive the points for this part of the question. No definition for "actual" was discussed in class or in the text.

d) What does it mean to unchoke a peer?
X would choose to upload chunks of data to only the few (~4) neighboring peers that have sent it data most recently and most often.
A peer that has been chosen as the recipient of a data upload is a neighboring peer that has been unchoked.
The peers that have not been selected for data upload are choked (not receiving data uploads from X)

e) What does it mean for a peer to be optimistically unchoked?
X would normally choose to unchoke only the few (~4) actual peers that have sent it data most recently and most often. To find new peers to exchange with X would periodically randomly choose a peer and optimistically unchoke that randomly chosen peer. X is being optimistic hoping the the optimistically unchoked peer will send it data in return.

3. Consider the HTTP protocol
   a) [16 points] Answer each of the following questions. Each answer should be no more than four sentences in length.

I. What is the difference between an HTTP GET message and a conditional HTTP GET message?
II. What is the primary difference between a persistent HTTP connection and a non-persistent HTTP connection?
III. How does pipelining improve the efficiency of an HTTP connection?
IV. What does a HTTP POST message do that a HTTP GET message does not do?

b) [24 points] Consider an institutional network with a bandwidth of 50,000,000 bps. The institutional network is connected to the internet through a 12,000,000 bps network. The average number of HTTP queries from the network is 40 per second. Each query has an average size of 300,000 bits. Is the institutions internet connection overloaded? The institution is considering adding an HTTP proxy server with its own HTTP cache. If the cache will on average satisfy 70% of HTTP queries what will be the traffic intensity on the internet connection before and after the installation of the HTTP cache? Is the cache useful? Why?
HINT: Traffic intensity = number of queries per second * size of each query / data rate
Traffic intensity of 1 indicates network is 100% utilized.

SOLUTION

a) [16 points] Answer each of the following questions. Each answer should be no more than four sentences in length.

I. A conditional HTTP GET request includes an additional directive in the header section

If-Modified-Since: Sun, 12 Oct 1997 16:57:30 GMT\r\n

This directive instructs the HTTP server to send the object only if it has been updated since the data specified. This directive instructs the HTTP server to send only a HTTP NOT MODIFIED message (no object) if the object has not been modified since it was first placed in the cache

II. A persistent HTTP connection can transfer multiple HTTP objects during its lifetime a non-persistent HTTP connection transfers only a single object during its lifetime. A persistent HTTP connection improves the efficiency of sending multiple objects by avoiding the extra overhead of opening and closing a connection for every object, it only opens and closes one connection.

III. Pipelining allows a second request to be made before the response to the first request has been completely received. This means that multiple requests can be serviced at the same time
(given adequate bandwidth)
speeding up the delivery of the web page as a whole.

IV. An HTTP POST request carries information collected or generated by the agent (say data typed into a form) back to the server. The request message carries no date to the server only the request for a particular object and carries no data in its body.

b) Consider an institutional network with a bandwidth of 50,000,000 bps. The institutional network is connected to the internet through a 12,000,000 bps network. The average number

of HTTP queries from the network is 40 per second. Each query has an average size of 300,000 bits. Is the institutions internet connection overloaded? The institution is considering adding an HTTP proxy server with its own HTTP cache. If the cache will on average satisfy 70% of HTTP queries what will be the traffic intensity on the internet connection before and after the installation of the HTTP cache? Is the cache useful? Why?

HINT: Traffic intensity = number of queries per second * size of each query / data rate

Traffic intensity of 1 indicates network is 100% utilized.

SOLUTION

Bandwidth of institutional network 50Mbps

40 queries per second average

Average size of response to each query 300K

Traffic intensity of institutional network

300K * 40 / 50Mbps = 12000000/50000000=0.24

The institutional network is not overloaded by the volume of queries so congestion in the institutional network will not be a factor in determining the usefulness of the HTTP cache. If the institutional network were highly utilized (near 1) then the congestion inside the institutional network would not be alleviated by adding an HTTP cache

Bandwidth of internet connection 10Mbps

Traffic intensity of internet connection

300K * 40 / 12 Mbps = 100%

Since the traffic intensity is 100% the internet connection is clearly overloaded and will experience serious congestion and delays.

If the cache satisfies 70% of requests then the other 30% of requests still use the internet connection. Adding the cache will reduce the traffic intensity on the internet connection to

300K * (1-0.7)*40 /10 Mbps = 30%

An intensity of 30% will not significantly affect users.

Adding the cache has reduced the load on the internet connection so that users will no longer experience the serious delays due to congestion on the internet connection. Thus the cache is clearly useful.