

Homework 2 – Application-Level Protocols

Assigned: Tuesday, Sep 25, 2007

Due: Tuesday, Oct 2, 2007 *at the beginning of class*

Review Questions

1. What is the difference between a computer's hostname and its IP address?
2. What is a socket?
3. What Java function starts the TCP 3-way handshake?
4. Why do TCP servers typically use two sockets instead of just one socket?
5. What four pieces of information are needed to uniquely identify a TCP connection?
6. Does TCP preserve message boundaries? Explain your answer (include an example).
7. Consider the sample TCP and UDP client and server applications provided on Sep 13.
 - a. What happens if the TCP client is executed before the TCP server? Why?
 - b. What happens if the UDP client is executed before the UDP server? Why?
8. Is `2007 Tues 9/25 2:09pm EDT` in an acceptable date/time format for HTTP according to RFC 2616? If not, write the date/time in an acceptable format.
9. What is the default port used for HTTP servers?
10. Explain the difference between non-persistent HTTP connections, persistent HTTP connections, parallel HTTP connections, and persistent HTTP connections with pipelining.
11. Describe how Web caching can reduce the delay in receiving a requested object. Will Web caching reduce the delay for all objects requested by a user or for only some of the objects? Why?
12. Telnet into a web server and send a multi-line HTTP request message. Include in the request message the `If-modified-since:` header option line to force a response message with the `304 Not Modified` status code. Submit a printout of the telnet session.
13. What does it mean that FTP uses out-of-band control?
14. What is the difference between active FTP and passive FTP?
15. Is FTP secure (*i.e.*, by default, is information, including usernames and passwords, encrypted)?
16. Suppose Alice uses a webmail client (such as Gmail or Yahoo! Mail) to send an email message to her friend Bob who uses a traditional POP3 email client to read his mail (such as Eudora or Thunderbird). Discuss how the message gets from Alice's host to Bob's host. Be sure to list the series of application-layer protocols that are used to move the message between the two hosts.
17. Does DNS name resolution occur before the TCP handshake or after the TCP handshake? Why or why not?
18. What is the purpose of having a single hostname resolve to multiple IP addresses?

19. Explain the main difference between the operation of a client-server application and a peer-to-peer application.

Problems

1. You are in charge of developing your company's website. Your boss is concerned about the download times for the main company webpage, `www.imsmrt.com`. She wants to ensure that a typical user will be able to download the entire main webpage (including all objects) in less than 350 ms.

The current main webpage has a size of 1,250 bytes and includes the following embedded objects:

- | | |
|--|-------------|
| a. <code>http://www.imsmrt.com/ads/banner.jpg</code> | 500 bytes |
| b. <code>http://www.imsmrt.com/pics/boss.jpg</code> | 2,500 bytes |
| c. <code>http://www.fontmaster.com/img/smrt.jpg</code> | 1,500 bytes |

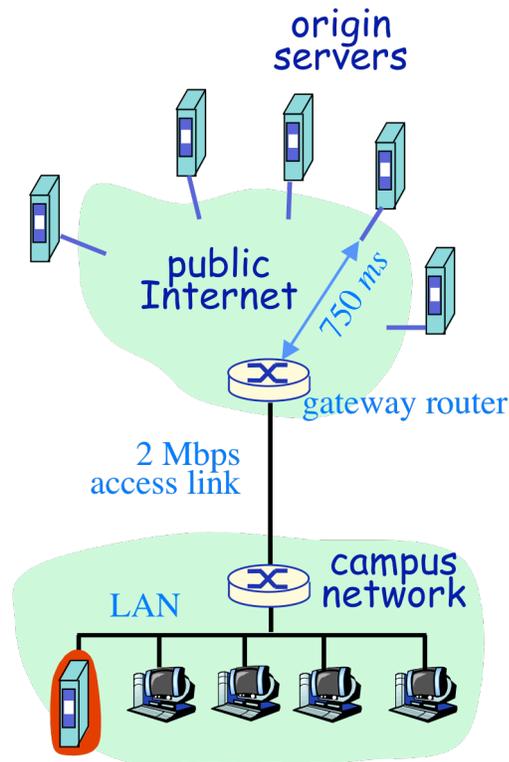
Your boss has specified the following parameters for a typical user:

- The round-trip time (RTT) from a typical user's machine to `www.imsmrt.com` is 60 ms (propagation delay only).
- The RTT from typical a user's machine to `www.fontmaster.com` is 45 ms (propagation delay only).
- The typical user has an access link of 1.5 Mbps.
- The access link to the servers at both `www.imsmrt.com` and `www.fontmaster.com` is 10 Mbps.
- The links in between the user's access link and the servers' access link are multiple Gbps, so transmission delays are negligible.
- For parallel connections, as soon as one of the parallel connections finishes, a new connection can be started.

Give the total download time and specify if your boss' requirements would be met if the user employs the following types of HTTP connections:

- a. non-persistent connections
- b. persistent connections (but no pipelining)
- c. 2 parallel non-persistent connections
- d. **555-only** persistent connections with pipelining

2. Consider the following network:



- On average there are 30 objects downloaded per second.
- The average object size is 55,000 bits.

What is the traffic intensity on the 2 Mbps access link?

3. Refer back to the network used in Problem 2. Add the following parameters:

- A proxy cache with a 40% hit ratio has been installed on the campus network.
- It takes on average 15 ms to send a request to the proxy cache, check the cache, and receive the response.
- On average, the RTT between the gateway router and any web server is 750 ms.

a. **What is the traffic intensity on the 2 Mbps access link?**

b. **What is the average response time for an object?**

4. For each object given below, **indicate the DNS servers that the local authoritative server contacts** in order to resolve the hostnames to IP addresses. **Also indicate what IP address the local authoritative server obtains from the DNS server it contacts.** Assume that the hostnames are resolved in the order given, and that caching is used.

- `http://sportsillustrated.cnn.com/football/ncaa`
- `http://i.a.cnn.net/si/element/js/3.0/main.js`
- `http://ad.doubleclick.net/ad/3475.si`
- `http://i.cnn.net/si/images/1.gif`