

## Homework 2 – Application-Level Protocols

**Assigned:** Fri, Sep 29, 2006

**Due:** Fri, Oct 6, 2006 *at the beginning of class*

**Honor Policy for Written Homework:** You may talk about the written homework problems with other students, but each student must write up the solutions *in their own words*. **You must include the names of the students you worked with in your homework submission.** Since the exam questions will be similar in style to the written homework, it is your responsibility to make sure that you understand how to answer each question on your own. *This policy does not extend to programming assignments, which must be completed on your own.*

### Review Questions

1. What is the difference between a computer's hostname and its IP address?
2. What is a socket?
3. What does the C function `htons()` do and why do we need it in socket programs?
4. What C function starts the TCP 3-way handshake?
5. Why do TCP servers typically use two sockets instead of just one socket?
6. Does the `accept()` call in a socket program cause the program to block (*i.e.*, does the caller of the function wait for something before continuing execution of the program)? If so, what is it waiting for?
7. What four pieces of information are needed to uniquely identify a TCP connection?
8. Why are `recvfrom()` and `sendto()` used in UDP applications instead of `recv()` and `send()`? In what situation can `recv()` and `send()` be used in a UDP application?
9. Does TCP preserve message boundaries? Explain your answer (include an example).
10. Is `Thurs 9/25 2:09pm EST` in an acceptable date/time format for HTTP according to RFC 2616? If not, write the date/time in an acceptable format.
11. What is the default port used for HTTP servers?
12. Explain the difference between non-persistent HTTP connections, persistent HTTP connections, parallel HTTP connections, and persistent HTTP connections with pipelining.
13. 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.
14. What does it mean that FTP uses out-of-band control?
15. What is the difference between active FTP and passive FTP?
16. Is FTP secure (*i.e.*, by default, is information, including usernames and passwords, encrypted)?

17. Describe the process (including application-level protocols used) that occurs when Alice uses a webmail client (such as Gmail or Yahoo! Mail) to send an email message to her friend Bob who uses a traditional email client to read his mail (such as Eudora or Thunderbird).
18. Does DNS name resolution occur before the TCP handshake or after the TCP handshake? Why or why not?
19. What is the purpose of having a single hostname resolve to multiple IP addresses?
20. 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.imsprt.com`. She wants to ensure that a typical user will be able to download the entire main webpage (including all objects) in less than 500 ms.

The current main webpage has a size of 1,500 bytes and includes the following embedded objects:

- a. `http://www.imsprt.com/ads/banner.jpg` 5,000 bytes
- b. `http://www.imsprt.com/pics/boss.jpg` 3,000 bytes
- c. `http://www.fontmaster.com/img/sprt.jpg` 2,500 bytes

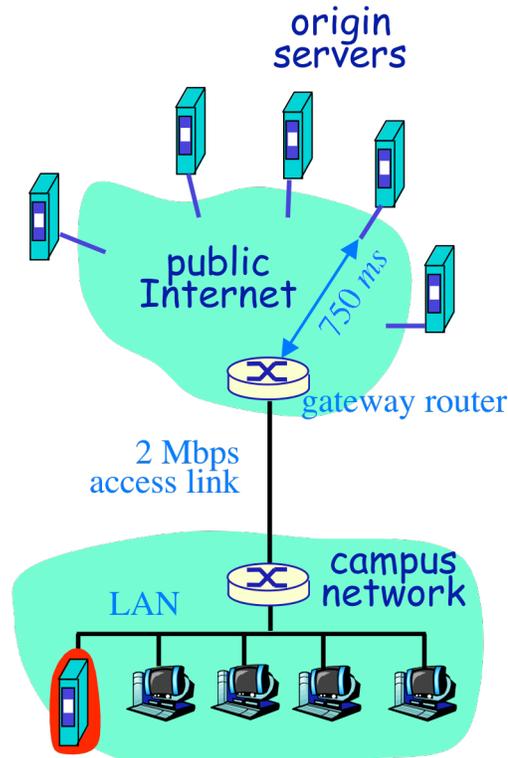
Your boss has specified the following parameters for a typical user:

- The maximum round-trip time (RTT) from a user's machine to `www.imsprt.com` is 50 ms.
- The maximum RTT from a user's machine to `www.fontmaster.com` is 30 ms.
- There is a maximum of 2 hops between the user and your server or `www.fontmaster.com`.
- The 2 links are both at least 1 Mbps.
- 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. persistent connections with pipelining
- d. 2 parallel non-persistent connections

2. Consider the following network:



- On average there are 25 objects downloaded per second.
- The average object size is 50,000 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 60% hit ratio has been installed on the campus network.
- It takes on average 25 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://sports.espn.com/ncf/index`
- `http://espn-ak.starwave.com/insertfiles/javascript/flash.js`
- `http://www.sports.net/swf/header2005/baseHeader_07.swf`
- `http://espn-aj.starwave.com/insertfiles/javascript/espncommand.js`