**CSCE 560 Homework / Wireshark Lab 2**

**Chapter 2 – Application Layer**

**Fall 18**

**Assigned: Monday, 15 Oct**

**Due: Wednesday, 24 Oct, 1400**

**Problem 1**. Chapter 2, R.1

List five nonproprietary Internet applications and the application-layer protocols that they use.

**Sol’n:**

Email – SMTP

File Transfer – FTP

Streaming/Web Access – HTTP

Remote terminal access – Telnet

Domain Name System - DNS

**Problem 2**. Chapter 2, R.3

For a communication session between a pair of processes, which process is the client and which is the server?

**Sol’n:**

Generally speaking, the orignal sending process of any request, i.e. the process that establishes the socket is the client and the process that is receiving the request is the server.

**Problem 3**. Chapter 2, R.5

What information is used by a process running on one host to identify a process running on another host?

**Sol’n:**

Processes use a Socket to identify a process on another host. A socket is a 4-tuple uniquely determined by (Soure IP, Source Port, Destination IP, Destination Port)

**Problem 4**. Chapter 2, R.10

What is meant by a handshaking protocol?

**Sol’n:**

A Handshaking protocol is a protocol in which some sort of special synchronization/acknowledgement must take place between the sender and receiver before the actual data or message is transmitted. One example of this is SMTP’s “hello” handshake or another is TCP’s Syn/Ack 3-way handshake.

**Problem 5**. Chapter 2, R.12

Consider an e-commerce site that wants to keep a purchase record for each of its customers. Describe how this can be done with cookies. [Describe how the cookies are created and exchanged between the computers. Discuss how and which headers are modified.]

**Sol’n:**

Assuming that the customer starts without a cookie, then the following steps show the process for using cookies.

1. Customer A accesses the e-commerce site’s website. At this step the HTTP request message does not contain a line for a cookie.
2. E-commerce site sees that customer A doesn’t have a cookie in the HTTP request message so it generates a cookie id (1234 for example) and in the HTTP Response message it appends set-cookie: 1234
3. Customer A’s computer reads the new cookie ID and stores it in a cookie file. All HTTP request messages for customer A to the e-commerce site will now contain the line: cookie: 1234
4. Every time that the Customer A sends the cookie to the e-commerce site, the e-commerce site is able to look up the cookie ID in their database and keep track of whatever items customer A has purchased.

**Problem 6**. Chapter 2, R.16

Suppose Alice with a Web-based e-mail account (such as Yahoo! mail or Hotmail) sends a message to Bob, who accesses his mail from his mail server using POP3. 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.

**Sol’n:**

1. Alice sends an email to Bob. On Alice’s end, her message leaves the host and gets delivered to the web server via SMTP.
2. The email is delivered via SMTP over TCP through all the intermediate web servers the message travels to until it reaches Bob’s mail server.
3. Bob accesses his mail server from his host and the message is delivered from the server to the host using POP3.

**Problem 7**. Chapter 2, R.18

From a user's perspective, what is the difference between the *download-and-delete mode* and the *download-and-keep mode* in POP3? [How do these modes affect the user?]

**Sol’n:**

In download-and-delete mode, client retrieves the messages in the inbox, reads them, and then once the mail server receives the “quit” line in the POP3 message, the messages are erased from the inbox on the mail server.

In download and keep mode, The messages are not deleted from the inbox on the mail server after the POP3 application is complete.

This makes a difference because in download and delete mode, you would not be able to access email from multiple devices because once the messages are deleted they would not be accessible from another device.

**Problem 8**. Chapter 2, P1

True or false?

*a.* A user requests a Web page that consists of some text and three images. For this page the client will send one request message and receive four response messages.

False. There is an HTTP request/response pair for each object.

*b.* Two distinct Web pages (for example, www.mit.edu/research.html and www.mit.edu/students.html) can be sent over the same persistent connection.

True. Assuming that the two web pages are hosted on the same server, then the two pages can be sent over the same persistent connection.

*c.* With nonpersistent connections between browser and origin server, it is possible for a single TCP segment to carry two distinct HTTP request messages.

False. In nonpersistent HTTP, A TCP connection is only used for one HTTP request/response pair.

*d.* The Date: header in the HTTP response message indicates when the object in the response was last modified.

False. The Last Modified: header indicates when the object was last modified.

**Problem 9**. Chapter 2, P7 **(this problem has been modified)**

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 that a DNS lookup is necessary to obtain the IP address. Suppose that *n* DNS servers are visited before your host receives the IP address from DNS; the successive visits incur an RTT of RTT1, ..., RTTn. Further suppose that the Web page associated with the link contains exactly one object, a small amount of HTML text. Let RTT0 denote the RTT between the local host and the server containing the object. Assuming a transmission time of t1 ­for the object, how much time elapses from when the client clicks on the link until the client receives the object?

**Sol’n:**

The total amount of time required for this lookup can be described by the following equation

Ttotal = tDNS + tHTTP + t1

TDNS = RTT1 + RTT2 + … + RTTn = RTTDNS

THTTP = 2\*RTT0 (3-way handshake to establish TCP connection)

So the total time is

Ttotal = RTT1 + RTT2 + … + RTTn + 2\*RTT0 + t1

**Problem 10**. Chapter 2, P9

Consider Figure 2.12, for which there is an institutional network connected to the Internet. Suppose that the average object size is 850,000 bits and that the average request rate from the institution’s browsers to the origin servers is 16 requests per second. Also suppose that the amount of time it takes from when the router on the Internet side of the access link forwards an HTTP request until it receives the response is three seconds on average (see Section 2.2.5). Model the total average response time as the sum of the average access delay (that is, the delay from Internet router to institution router), and the average Internet delay. For the average access delay, use /(1 – ), where  is the average time required to send an object over the access link and  is the arrival rate of objects to the access link. [You may assume the response time for a cache hit (i.e., LAN delay) is 0 seconds.]

**Sol’n:**

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request/16 sec = 1/16

850 Kbits/ 15Mbps = 850/15000 sec = 0.0567 sec

Avg. Access Delay = = = 0.0627 sec = 62.7 msec

*a.* Find the total average response time.

**Sol’n:**

We can model the total average response time as

Tresp = avg. internet delay + avg. access delay (see work at \* above)

We know our internet delay is 3 sec and we have our average access delay below so the total is

Total Average Response Time = 3 sec + 0.0627 sec = 3.0627 sec.

*b.* Now suppose a cache is installed in the institutional LAN. Suppose the **miss** rate is 0.4. Find the total response time.

**Sol’n:**

Total Time = Cache miss \* Internet Delay + Cache Hit \* Cache hit delay

We know that the cache hits can be satisfied instantly (0 sec) so the formula for total time is

Total Response Time = 0.4 \* Internet Delay = 0.4 \* 3.0627 sec = 1.21 sec

**Problem 11**. Chapter 2, Supplemental Question 1

What is the difference between persistent HTTP with pipelining and persistent HTTP without pipelining? [What event causes the requests to be sent?] Which of the two is used by HTTP/1.1?

**Sol’n:**

With pipelining, the HTTP request message is sent as each object reference is encountered. Without pipelining the HTTP request message is sent once the HTTP response is received (could be way after encountering the object reference).

HTTP 1.1 uses with pipelining by default.

**Problem 12**. Chapter 2, Supplemental Question 2

Why is it said that FTP sends control information “out-of-band”?

**Sol’n:**

This is because FTP maintains 2 TCP connections. One for control information and the other for data. Control information is sent over the control connection so it is “out of band” from the data connection.

**Wireshark Lab**

Complete the lab in 02 - Wireshark\_HTTP.pdf.

The last page of this lab instructs you to go to <http://www.motobit.com/util/base64-decoder-encoder.asp> in order to decode a string. Another good website is <http://www.opinionatedgeek.com/dotnet/tools/base64decode/> , paste the string in the box then click the Decode button.