I. Reading Assignment

Required Reading: [JK] Chapter 2: Section 2.1, Section 2.2, Section 2.4, Section 2.5.

Further Reading:

- [JK] Chapter 2: Section 2.3, Section 2.6
- [http://www.w3.org/Protocols/rfc2616/rfc2616.html](http://www.w3.org/Protocols/rfc2616/rfc2616.html)

II. Homework Problems and Questions

1. (5 pts) List five application layer protocols that run on top of TCP. Explain why they are built over TCP instead of UDP.

2. (5 pts) Consider the following screenshot that was captured by Wireshark when the browser visits a website. Answer the following questions.

   - What is the IP address of the host on which the browser is running? What is the IP address of the web server?
   - What is the URL of the document requested by the browser?
   - What version of HTTP is the browser using?
   - What type of browser initiated this message? Why the browser type is needed in an HTTP request message?
   - Was the browser request a non-persistent or a persistent connection? Could you please compare these two types of connections?
3. (5 pts) Consider the following screenshot that was captured by Wireshark when the reply was sent from the server in response to the HTTP GET message in the question above. Answer the following questions.

- Was the server able to successfully find the document or not?
- What time was the document replied?
- When was the document last modified?
- Did the server agree to a persistent connection?
- How many bytes are in the document being returned?

4. (4 pts) The browser visits the same web page later. The following screenshots show the HTTP request and response that are captured by Wireshark. Answer the following questions.
What the “If-Modified-Since” field is used for in this request?

Did the web server deliver the page to the browser or not this time? If not, why?

5. (5 pts) Consider the following screenshot that was captured by Wireshark when the browser posts a message to a blog website. Answer the following questions.

What is the method used in this HTTP request? What is the purpose of this method in this request?

What is the name of the server side script that handles this HTTP request?

What is the URI that the browser visits before this request?


What is the method used in this HTTP request? What is the purpose of this method in this request?

What is the URI that the browser visits before this request?

(http://en.wikipedia.org/wiki/Uniform_Resource_Identifier)
- What is the purpose of the field of “Cookie”?
- Can you find the title and the body of this blog post? If so, where do you find it?

6. (10 pts) Suppose Alice accesses her Gmail account using a Web browser to send an email message to Bob. Bob retrieves his email from his mail server using Microsoft Outlook via POP3 protocol.

- Describe how the message gets from Alice’s computer to Bob’s computer. Feel free to use graphical illustrations. Be sure to list the hosts and the application-layer protocols that are used to move the messages from Alice to Bob.
- Alice sends out the email in the morning at 8am. Though Bob keeps checking his email from the server, he gets Alice’s email in the afternoon at 1pm, 5 hours after Alice’s email was sent. Could you please explain to Alice and Bob the possible cause(s) of such a delay?

7. (6 pts) Consider the following screenshots that were captured by Wireshark when the browser visits a website whose IP address is not available in the local cache. Answer the following questions.

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Frame 210: 82 bytes on wire (656 bits), 82 bytes captured (656 bits)
Ethernet II, Src: 00:1f:53:08:5b:78, Dst: 00:14:0f:9b:b1:68 (00:14:0f:9b:b1:68)
Internet Protocol, Src: 192.168.1.100 (192.168.1.100), Dst: 68.87.68.166 (68.87.68.166)
User Datagram Protocol, Src Port: 58037 (58037), Dst Port: domain (53)
Domain Name System (query)
  Transaction ID: 0x800F
  Flags: 0x0000 (Standard query)
  Questions: 1
  Answer RRs: 0
  Authority RRs: 0
  Additional RRs: 0
  Queries
  yuanxue00.blogspot.com: type A, class IN
    Name: yuanxue00.blogspot.com
    Type: A (Host address)
    Class: IN (0x0001)
```
What is the IP address of the (local) DNS server?

What is the hostname of the website in the DNS query?

How many question(s) are carried in the DNS query and reply? And how many answers?

Could you please explain the meaning of Type CNAME and Type A in the DNS messages?

From the DNS reply message, what is the canonical hostname of this website? What is its IP address?

What is the purpose of the “Time to Live” field?

8. (10 pts) Suppose you visit a website using the Web browser. 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 your local DNS server is ip-srv1.vanderbilt.edu and the round-trip time (RTT) from your host to this local DNS sever is denoted as RTT_dns_local. The local DNS server performs iterative queries to a Root DNS server, a TLD DNS server and an Authoritative DNS server. (Refer to Figure 2.21 of book [JK] for a graphical illustration of iterative query.) The round-trip time from the local DNS sever to these DNS servers are denoted as RTT_dns_root, RTT_dns_tld, and RTT_dns_auth, respectively. Suppose that the round-trip time from your local host to this website is RTT_web. Further suppose that the web page you visit is short, so that its transmission time of the page can be omitted. The web page references 8 small image objects hosted on the web site. Let’s assume zero transmission time for the image objects as well. How much time elapses from when you click on the link until the web page is fully displayed (with all image objects) on your browser? Consider the following scenarios and provide your solutions respectively.

- The browsing is using non-persistent HTTP with no parallel TCP connections
- The browsing is using non-persistent HTTP with parallel TCP connections
- The browsing is using persistent HTTP.