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Homework 2
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1) What are the 'identifiers' required for a client (browser) to access a web server? (2 points)
   IP address, domain name

2) What is RFC (request for comments)? Find the RFC numbers for HTTP, SMTP,TCP, UDP, IPv4, and ICMP protocols. (4 pts)
   RFC is a formal document containing the specs for technology. HTTP: 1945; SMTP: 2821; UDP: 768; TCP: 793; IPv4: 791; ICMP: 792;

3) The design of TCP and UDP does not have the encryption/decryption mechanism. How to supplement it? (2 pts)
   Secure Sockets Layer (SSL) and Transport Layer Security (TLS) are used to secure UDP and TCP. After the TCP handshake, TLS uses a handshake to connect securely to the server. They use public-key cryptography to secure data.

4) When using HTTP or FTP protocols to download webpages/files, the underlying transport-layer protocol is TCP. Why don't we use UDP? (2 pts)
   We need a reliable protocol to download the entire file/webpage correctly and completely. UDP is not reliable, does not keep state, doesn't have handshakes. TCP guarantees the delivery of packets.

5) Given the web directory structure on find-me-if-you-can.bradley.edu, where all the web contents reside in the "www" directory. Provide the URI to access the image file "welcome.png". (2 pts)
   www.find-me-if-you-can.bradley.edu/images/welcome.png

6) Given an HTML page whose content contains 3 images, 1 CSS stylesheet, and 1JavaScript files. When using a web browser to download the full content of thisHTML page, how many RTTs does it take to complete the download if we use (1)non-persistent HTTP and (2) persistent HTTP? Here, we neglect the file transmission/download time. (4 pts)
   1) 10 RTT'S would be required for non-persistent HTTP.
   2) Persistent HTTP could use as little as 1 RTT for all referenced objects.

7) What does it mean if your browser receive a 404 response status code? What about the 301 code? (2 pts)
   A 404 code means that it could not be found but could be available later. A 301 code means that it's been permanently moved. Requests should be directed to a given URL.

8) Provide the URI to query "Bradley University" through Google Search. Note: "BradleyUniversity" is separated by a space. (2 pts)
   https://www.google.com/search?
source=hp&ei=8hmCX7XaEc7QtQaJr7zoDQ&q=bradley+university&oq=bradley+university&gs_lcp=CgZwc3ktYWIQAzILCC4QsQMQyQMQkwIyAggAMgIIADIICC4QxwEQrwEyAggAMgIIADICCAAyAggAMgIILjICCAA6DgguELEDEMcBEKMCEJMCOggILhCxAxCDAToLCC4QsQMQxwEQowI6DgguELEDEMcBEKMCEIsDOgsIABCxAxCDARCLAzoOCC4QsQMQxwEQrwEQkwI6CwgAELEDEIMBEMkDOgUIABCSAzoFCAAQsQM6CAguELEDEIsDOggIABCxAxCLAzoFCAAQiwM6CAgAELEDEIMBOhQILhCxAxCDARCLAxCYAxCaAxCoAzoLCC4QsQMQgwEQiwM6EQguELEDEIMBEIsDEJoDEKgDOgUILhCxAzoUCC4QsQMQgwEQiwMQmgMQmwMQqAM6EQguELEDEIMBEIsDEKgDEJoDOgsILhDHARCvARCLAzoFCC4QiwNQngdYIBdgsBhoAHAAeACAAWqIAfYLkgEEMTQuNJgBAKABAaoBB2d3cy13aXq4AQI&sclient=psy-ab&ved=0ahUKEwi1m6WD76rsAhVOaM0KHYkXD90Q4dUDCAg&uact=5

9) What are the characters required to separate the header field and message body of an HTTP message? (2 pts)
   CRLF \r\n

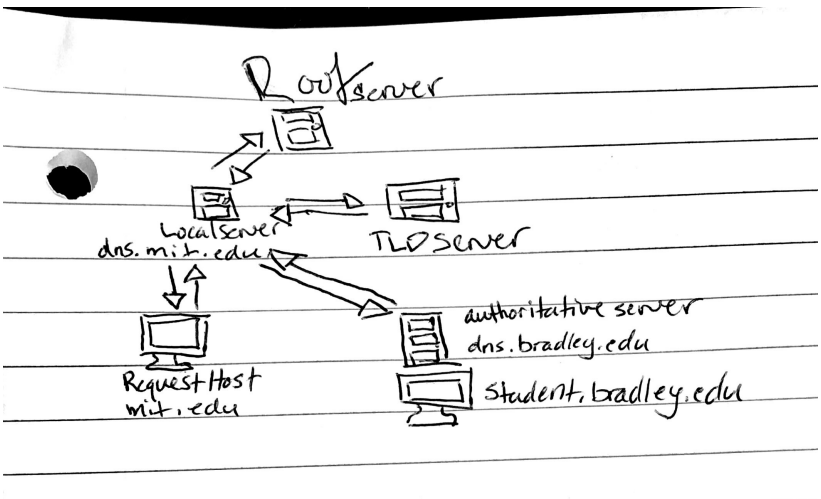
10) What are the purposes for the web sites to use cookies? What information is kept in a cookie? (2 pts)
   Cookies can be used for authorization, recommendations, user session state, etc. Information kept in a cookie can include a lot of things, for example, personal identifying information like email addresses, home address, name, phone number, and more unique information if you give it to the website.

11) Web caching: given the following assumptions –
   (1) the clients on average send out 3 requests per second
   (2) one average each request would download 5 Mbits of data
   (3) the round-trip-time from the access router to one of the servers is 1 seconds
   (4) the access link rate is 15 Mbps
   (5) the LAN has link rate 100 Mbps.
   1) What is the LAN utilization? (2 pts)
      5%
   2) What is the access link utilization? (2 pts)
      33%
   3) What is the total response time for the client to complete the web requests? (2pts)
      Total = 1sec + 20ms + 20ms = 1,040ms

12) Following the same setting above, after adding a proxy server in the LAN, 60% of the original requests are now fulfilled by the proxy server. We also know that it takes 20 ms for clients to access the content on the proxy server.
   1) What is the access link utilization? (2 pts)
      60%
   2) What is the total response time for the client to complete the web requests? (2pts)
      ((0.6 (1.02)) + (0.4 (0.02))) = .612 + 0.008 = .62 seconds

13) (1) Provide some examples of the top-level domains. (2 pts) (2) What are the authoritative DNS servers at Bradley University? What are the commands you use to get the authoritative DNS servers? (4 pts)
   com, org, net, edu, uk, fr, ca are all top level domains. Bradley's authoritative DNS servers are dns.bradley.edu and dns3.bradley.edu. I got the information by entering "nslookup" in Terminal >> "set query=ns" >> "bradley.edu" or "52.2.159.182."
   The following is the non-authoritative answer I received from the same command.
   182.159.2.52.in-addr.arpa  name = ec2-52-2-159-182.compute-1.amazonaws.com.

14) Illustrate the iterated query and recursive query when you send out a DNS query from your machine (student.bradley.edu) to the site www.mit.edu. (4 pts)



15) Why the root domain name servers are not often visited by end systems? (2 pts)

DNS is a hierarchical naming system and root domain is at the top. There are only 13 of these type of servers. The root zone file tells top-level domains where the authoritative servers are and how they can reach them.

16) When you create a non-profit organization ABC, you would like to get a domainnameabc.org, set up your own web site/serverwww.abc.org, and run a mailserversmtp.abc.org. You would also makedns.abc.org the authoritative DNS server. (1) What resource records (RRs) should be added to the .org TLD? (2)What RRs should be added to your authoritative DNS server? (4 pts) (Note: we assume that your network has IP addresses in 136.176.0.0/16, so you can assign the IP addresses within the range of 136.176.0.1 – 136.176.255.254 to all the servers. Each service/server uses a unique IP addresses.)

maidens.abc.org, you would add the NS and a type A resource record. For the authoritative DNS server, NS would be used and CNAME is optional (unless the name is very long).

17) P2P vs. Client/Server: how much time does it take to distribute a 1 Gigabits file to 5 different clients? Assume that the server's upload capacity is 50 Mbps, each client has upload capacity of 5 Mbps and download capacity of 10 Mbps.(a) Client-Server (2 pts) (b) Peer-to-Peer (2 pts) (c) If the number of clients is changed from 5 to 50. What will be the time for client-server and peer-to-peer structures? (2 pts)

(1000mb / 50mbps = 20 * 5 = 100)  (1000mb / 10mbps = 100)

a) Distribution for client-server = max( 100, 100 )

(1000mb / 50mbps = 20) (1000mb / 10mpbs = 100) (1000 / (50mbps + 25))

b) Distribution for P2P = max(20, 100, 13.33)

(1000mb / 50 mbps = 20 * 50 = 1,000) (1000mb / 10mbps = 100)

(1000mb / 50 mbps = 20) (1000mb / 10mbps = 100) (1000mb / (50mbps + 250)

c) Distribution for P2P = max (1,000, 100)

Distribution for C-S = max (20, 100, 3.33)