Assignment #2 – Application Layer

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***This assignment is to be done individually. Please use complete sentences for any questions that ask for explanations. The due date is posted in BB.***

1. **(9 points) A Rowan student types in** [**www.ed.ac.uk**](http://www.ed.ac.uk/) **to learn more about the University of Edinburgh. The IP address of the web server used by the University of Edinburgh is initially unknown.**

**What application and transport layer protocols beside HTTP are required in this web session?**

To get the IP for [www.ed.ac.uk](http://www.ed.ac.uk/) (23.185.0.1), the client must first make a request to a Domain name system (DNS) server. This server will return the IP address to a given URL.

1. **(6 points) Use the SMTP RFC 5321 posted online (search this via Google) to assist you with this question.**

**Distinguish below between MAIL FROM: in SMTP and From: in an actual mail message itself?**

MAIL FROM is an SMTP command containing the E-Mail address of the sender. From is a header field containing the name and E-Mail address of the sender.

1. **(9 points) Concerning electronic mail.**
   1. **List (3) mail access protocols**

SMTP  
IMAP  
POP3

* 1. **What mail access protocol is better suited for a smartphone?**IMAP
  2. **Explain your answer to b. and include one specific reason for the protocol you chose?**

IMAP is good for smartphones because email clients do not directly store the emails.

1. **(6 points) HTTP using TCP does not provide encryption services. Note that TCP can be enhanced with SSL to provide process-to-process encryption. Does SSL operate at the transport layer or the application layer?**

**If an application developer needs TCP to be enhanced with SSL, what does the developer need to do?**

SSL operates at the transport layer. To use SSL a developer must first generate an SSL certificate.

1. **(5 points) During a virtual technical event, a Rowan student located in NJ is introduced to another student at a small, unknown college in Switzerland. The Rowan student decides to learn more about the college in Switzerland by going to their website from their laptop. Since this website is rarely visited the DNS query to locate it’s IP address generates an iterative query across the Internet. List the sequence of queries that were involved with providing the students laptop the IP address of the college’s website below. Make sure you correctly identify the server that initiates a query to another server and keep in mind that the order you list any sequence of queries is important. For example: “the student’s laptop queries the local dns server”.**The student’s laptop first queries the local DNS server. Since the local DNS server likely does not have the Swiss website cached, it queries a regional DNS server. Then, depending on whether or not the regional DNS server has the Swiss website cached, it will query the root DNS server. At this point, the root DNS server will fulfill the regional server’s request, followed by the regional server fulfilling the local server’s request, and finally the local server fulfills the student’s laptop’s request.
2. **(6 points) 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?**

**Explain why?**

Web caching can easily reduce request delay because it allows commonly accessed information to be stored closer to the clients that commonly access it.

1. **(7 points) RFC 959 for the FTP protocol (Search via Google).** 
   1. **Use RFC 959 to find and list all of the FTP service commands.**
   2. **What are the commands to make and remove a directory?**
2. **(6 points) Suppose you can access the caches in the local DNS servers of your department.** 
   1. **Can you propose a way to roughly determine the web servers (outside your department) that are most popular among the users in your department?**Make a request to a lot of web servers and measure the response time. The web servers associated with the shortest response times are likely the most commonly accessed.
   2. **Explain**

Since these servers are cached, they are stored in a more easily accessible location. Since they are easily accessible, response times will be shorter. The more web servers that are requested, the more we can be sure that the list we have is accurate.

1. **(8 points) Describe what is meant by a protocol that sends information:**
   1. **out-of-band**

Control signals and data are sent in different frequency bands

* 1. **in-band**

Control information and data are sent in the same frequency bands

* 1. **name a protocol that uses out-of-band**

Signaling System No. 7

* 1. **name a protocol that uses in-band**

Dual tone multi-frequency signaling

1. (6 points) Use the HTTP RFC (2616) (search via Google) for this question.
   1. What mechanism is used to signal that a persistent connection is being closed?
   2. Can the client, or server, or both use that signal?
2. **(3 points) What’s the difference between DNS resource record types A and AAAA?**

A records are for domains with IPv4 addresses and AAAA records are for domains with IPv6 addresses.

1. **(6 points) What command in SMTP is used to see if an email address is valid?**

VRFY

1. **(6 points) 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 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, consisting of a small amount of HTML text. Let RTT0 denote theRTT between the local host and the server containing the object. Assuming zero transmission time of the object, how much time elapses from when the client clicks on the link until the client receives the object?**
2. **(6 points) Research the SNMP protocol.**
   1. **What does the acronym SNMP stand for?**Simple Network Management Protocol
   2. **What is this protocol used for?**The SNMP protocol is used for keeping track and changing the behavior of managed devices on an IP network.
   3. **What layer in the model does this protocol operate?**The SNMP protocol operates in the application OSI layer.