

Solutions for Homework Questions: Application Layer 2

Q1. Why is SMTP not used for transferring e-mail messages from the recipient's mail server to the recipient's personal computer?

A1. Whereas SMTP is a push protocol; the task of transferring e-mail messages from the recipient's mail server to the recipient's personal computer is a pull operation.

Q2. Why do you think DNS uses UDP, instead of TCP, for its query and response messages?

A2. TCP involves a connection establishment phase while UDP does not. Using TCP for DNS may end up involving several TCP connections to be established since several name servers may have to be contacted to translate a name into an IP address. This imposes a high overhead in delay that is acceptable for larger transfers but not acceptable for very short messages such as DNS queries and responses. In addition, UDP affords a smaller packet size and also imposes a smaller load on name servers due to its simplicity in comparison to TCP.

Q3. Suppose you are using sending an email from your Hotmail account to your friend, who reads his/her e-mail from his/her mail server using IMAP. Briefly describe how your email travels from your host to your friend's host. Also, what are the application-layer protocols involved?

A3. Message is sent from your host to your mail server over HTTP. Your mail server then sends the message to your friend's mail server over SMTP. Your friend then transfers the message from his/her mail server to his/her host over IMAP.

Q4. How can iterated DNS queries improve the overall performance?

A4. Iterated request can improve overall performance by offloading the processing of requests from root and TLD servers to local servers. In recursive queries, root servers can be tied up ensuring the completion of numerous requests, which can results in a substantial decrease in performance. Iterated requests move that burden to local servers, and distributed the load more evenly throughout the Internet. With less work at the root servers, they can perform much faster.

Q5. 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 look-up is necessary to obtain the IP address. Suppose that n DNS servers are visited before your host receives the IP address from DNS and that iterative queries are used. Let the successive visits to the DNS servers incur an RTT of RTT_1, \dots, RTT_n . Further suppose that the web page associated with the link contains only a small amount of HTML text. Let RTT_0 denote the RTT between the local host and the server containing the webpage. Assuming zero transmission time of the web page, how much time elapses from when the client clicks on the link until the client receives the web page?

A5. The total amount of time to get the IP address is

$$RTT_1 + RTT_2 + \dots + RTT_n.$$

Once the IP address is known, RTT_0 elapses to set up the TCP connection and another RTT_0 elapses to request and receive the small web page. The total response time is

$$2RTT_0 + RTT_1 + RTT_2 + \dots + RTT_n.$$

End of homework
