**Comp 2322 Computer Networking**

**Tutorial Two**

**Questions:**

1. Consider an HTTP client that wants to retrieve a Web document at a given URL. The IP address of the HTTP server is initially unknown. What transport and application-layer protocols besides HTTP are needed in this scenario?
2. Suppose within your Web browser you click on a link to obtain a Web page. The IP address for the link’s 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, RTT2, ..., 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 the RTT 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?
3. Referring to Question 2, suppose the HTML file references eight very small objects on the same server. Neglecting transmission times, how much time elapses with
4. Non-persistent HTTP with no parallel TCP connections?
5. Non-persistent HTTP with the browser configured for 5 parallel connections?
6. Persistent HTTP?
7. Consider a short, 10-meter link, over which a sender can transmit at a rate of 150 bits/sec in both directions. Suppose that packets containing data are 100,000 bits long, and packets containing only control (e.g., ACK or handshaking) are 200 bits long. Assume that N parallel connections each get 1/N of the link bandwidth. Now consider the HTTP protocol, and suppose that each downloaded object is 100 Kbits long, and that the initial downloaded object contains 10 referenced objects from the same sender. Would parallel downloads via parallel instances of non-persistent HTTP make sense in this case? How about persistent HTTP? Do you expect significant gains over the non-persistent case? Justify and explain your answer.
8. Consider the scenario introduced in Question 4. Now suppose that the link is shared by Bob with four other users. Bob uses parallel instances of non-persistent HTTP, and the other four users use non-persistent HTTP without parallel downloads.
9. Do Bob’s parallel connections help him get Web pages more quickly? Justify your answer.
10. If all five users open five parallel instances of non-persistent HTTP, then would Bob’s parallel connections still be beneficial? Justify your answer.