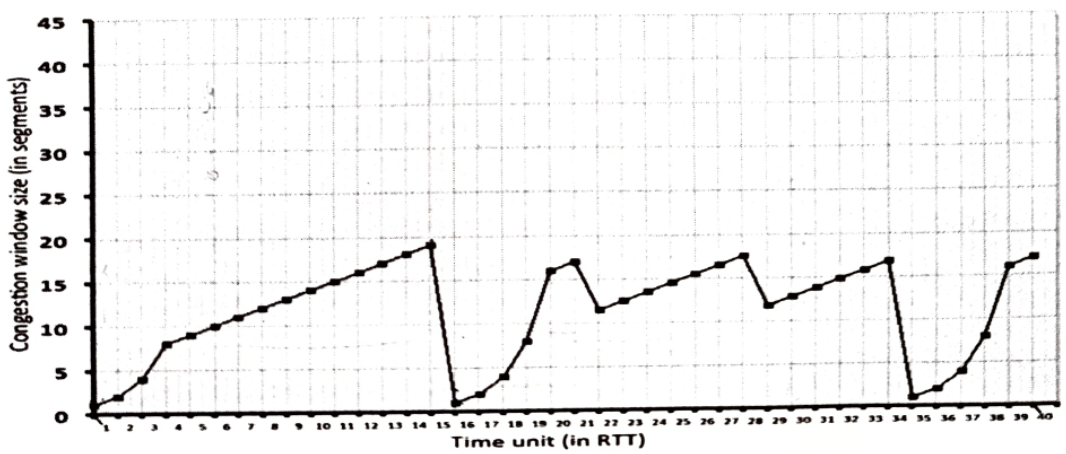
Systems and Networking II – Prof. Bartolini – July 4, 2024

Exercises

1. Given the following routing table entries:
   151.150.0.0/16 -> Next hop: Router A
   151.150.2.0/24 -> Next hop: Router B
   172.16.0.0/15-> Next hop: Router C
   Default route (0.0.0.0/0) -> Next hop: Router D
   Analyze the following IP addresses and determine the next hop router for each address using the longest prefix matching:
   a. IP Address 151.150.2.2
   b. IP Address 151.150.149.148
   c. IP address 172.18.2.0
   d. IP Address 172.17.10.20
   For each IP address, write down the most specific route (prefix) matched in the routing table and the corresponding next-hop router.
   Explain why each IP address matches a specific route based on the longest prefix match.

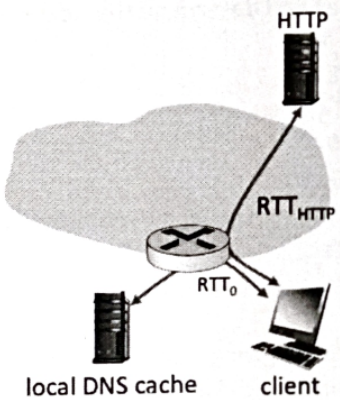
2. Explain how the CRC algorithm works, giving a general formula to derive the transmitted message, using knowledge of the generator G, and data payload D. Suppose that the 4-bit generator (G) is 1001, that the data payload (D) is 11011000. Provide the CRC padding for the given data payload using the polynomial division method. Show each step of the polynomial division process, including calculating the remainder. Finally, show the transmitted message.

3. Assuming that TCP Reno is being used and that the following figure reflects the behavior of the congestion window size *cwnd*.



   a) Reconstruct the sequence of events (ACKs, losses) that resulted in the evolution of TCP's *cwnd* shown above, between time 13 and 26.
   b) Give a table with the values of the slow start threshold (ssth) in the same interval.
   c) When is the 30th segment sent?

4. 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 the local DNS cache successfully responds with an with an RTT delay of RTT_0 = 5 msecs. Suppose the RTT between the local host and the Web server containing the object is RTT_{HTTP} = 80 msecs.



Suppose that the HTML object references 3 very small objects on the same server. Neglect transmission times. How much time (in msec) elapses from when the client clicks on the link until the base object and all 3 additional objects are received from web server at the client, assuming:

a) **non-persistent HTTP and no parallel TCP connections**
b) the client supports a maximum of 5 parallel TCP connections, with **non-persistent HTTP**.
c) the client supports a maximum of 5 parallel TCP connections, with **persistent HTTP**

5. A TCP server has just sent an ACK referring to sequence number 2001. Assume buffering at the server side. Explain the actions that the server will take following the given events, including buffering, interactions with the upper layer protocol, and messages being sent:

a) The server receives a 1000-byte segment with sequence number 5001.
b) Following the event in a) the server receives a 1000-byte segment with seq. number 2001.
c) Following the event in b) the server receives a 1000-byte segment with seq. number 4001.
d) Following the event in c) the server receives a 1000-byte segment with seq. number 3001.