Birla Institute of Technology & Science, Pilani
Department of Computer Science and Information Systems
First Semester 2022-23
Advanced Computer Networks (CS G525)
MID SEMESTER TEST (CLOSE BOOK)

Duration: 1.5 Hrs. **Date: 05-11-2022** **MM: 25**

Note: Answer sub-parts of a question (if any) at one place in the sequence.

Q.1 A chat group of four participants (A, B, C, and D) uses the ChronoSync protocol in NDN for synchronizing the namespace of the shared dataset (chat messages) among the participants. Assuming that the events in (a) to (e) occur in order. Answer the following questions. **[0.5+1.5+0.5+1.5+2=6M]**

a) What would be the Sync state of each node in the beginning when no chat message was generated?

b) Participant A generates the first chat message in the chat group. How would it be named? What message would be sent by A in the Sync group to update the shared state?

c) What reply would be sent by B on receiving the update message from A?

d) Assume A disconnected from the Sync group for some time. Meanwhile, two new chat messages were generated each by B and C. What would be the sequence of actions until a stable state is achieved? What is the value of state digest in the stable state condition?

e) What would be the sequence of actions to ensure a consistent state when A resume the connection to the sync group?

Q.2 How do the system design requirements become different for the following applications concerning the end-to-end argument? What are the appropriate endpoints for implementing reliability for both applications? **[4M]**

Application-1: A speech message system in which the voice packets get stored in a file for later listening by the recipient.
Application-2: A real-time voice communication system in which two entities transmit voice packets to each other.

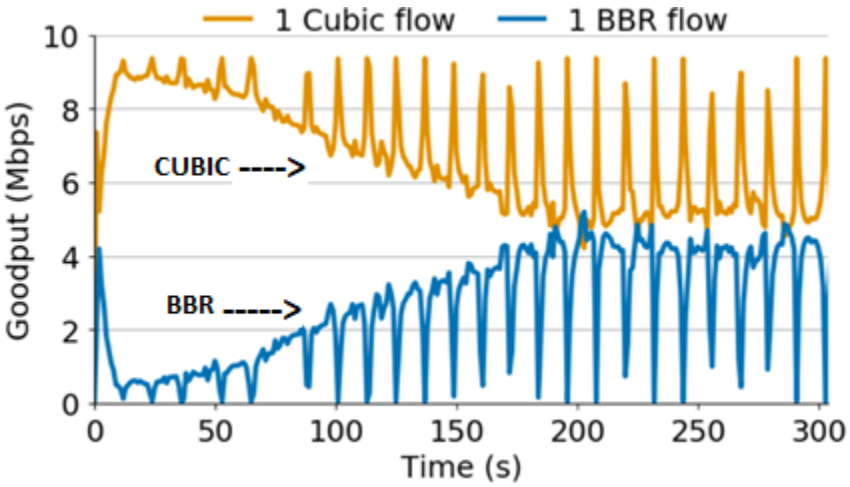
Q.3 Consider a modified TCP's AIMD algorithm in which the congestion window size is measured by the number of segments, not bytes. The additive increase factor is the same as standard TCP, whereas the multiplicative decrease factor is 0.25. If the result of multiplicative decrease is not an integer, then round down to the nearest integer. Suppose that two TCP connections, T1 and T2, share a bottleneck link of speed 50 segments/sec. Assume that both T1 and T2 always remain in the congestion avoidance phase. The RTT of T1 is 100 milli sec, and the RTT of T2 is 200 milli sec. When the data rate in the link exceeds the link's speed, i.e., 50 segments/sec, both TCP connections experience data segment loss. **[4+1=5M]**

a) If both T1 and T2 at time t_0 have a congestion window of 10 segments, what are their congestion window sizes after 1300 milli sec? Show your calculation steps in a tabular form for better clarity.

b) Will these two connections get an equal share of the bottleneck link bandwidth in the long run? Justify and explain your answer.

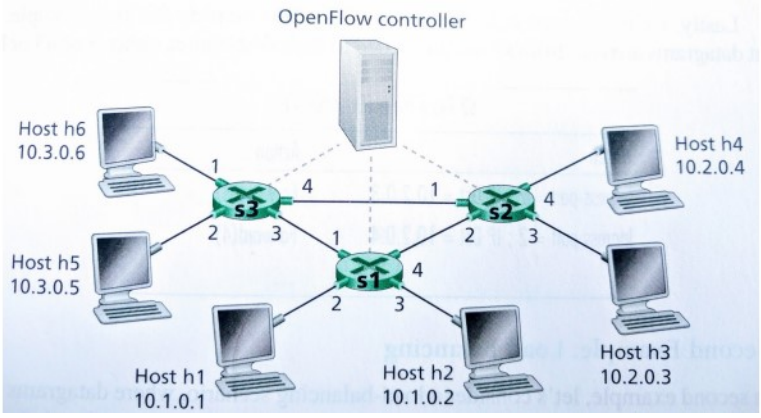
Q.4 When BBR flow is not sharing the bottleneck link with anyone, repeatedly probing for bandwidth allows BBR to both maximize throughput and minimize delay by figuring out exactly how much bandwidth is available. What happens when BBR competes with loss-based algorithms (e.g., Reno or CUBIC)? **[2.5M]**

b) The following plot shows BBR vs. CUBIC flows behavior over a 10 Mbps bottleneck link with a buffer size of 32 x BDP. Explain the behavior exhibited by the flows in the plot. Is the behavior on the expected line? Explain with appropriate justification. **[1.5M]**



Q.5 The network topology below comprises three open-flow switches (s1, s2, s3) and six hosts (h1 to h6). The numbers marked over the links represent the respective port numbers of the switches. What is the minimal number of flow table entries required to add into the switches s1 and s3 to implement the below-mentioned traffic rules in the topology? **[6M]**

1. h6 to h3 and h6 to h4 traffic should be routed through s1. Backward traffic (i.e., h3/h4 to h6) should follow the same path in reverse order.
2. h5 to h4 traffic should be routed through s1 but h4 to h5 traffic should not be routed through s1.
3. s1 should forward all traffic (except the traffic belonging to rules 1 and 2) for the destinations h4 and h3 to s3.
4. h1 should receive HTTP traffic only.
5. All other traffic flows (not covered by rules 1 to 2) should follow the shortest paths.



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