Computer Networks Exercise 4: Transport (2/2)

Spring Semester 2019

Q1. Network unreliability: Selective acknowledgement enables a more fine-grained signal of which packets have arrived, and its major benefit is that it provides at least as much information as cumulative acknowledgement. Are there any benefits to cumulative acknowledgement over selective acknowledgement?

Q2. Fairness: Consider a network ecosystem in which there is a transport protocol A used by 50% of users, and transport protocol B by the other 50%. Why is it important that both transport protocols are equally aggressive in growing its window size $W$ (representing its rate)?

Q3. Sliding window: A sliding window is used in a transport protocol to enable high throughput. Part of such a transport protocol is to negotiate the sender window size and receiver window size. Why is it a desirable property that $\text{sender window} \leq \text{receiver window}$?

Q4. Window to rate: If Alice and Bob are connected via a 100 Mbps connection, which has a constant 5 ms RTT, what would be the ideal congestion window size $W$ in kilobytes?

Q5. Sliding window strategies: true or false?
   1. Go-Back-N acknowledges only the last in-order packet it has received.
   2. The amount of state kept at a Selective Repeat sender is more than in a Go-Back-N sender.
   3. Go-Back-N senders maintain a timer for each packet sent out.
   4. If a Selective Repeat receiver receives an out-of-order packet, it is possible to move the sliding receiver window along.
   5. If a Go-Back-N receiver receives an out-of-order packet, it is possible to move the sliding receiver window along.
Q6: Reliable transport (exam-style question).\textsuperscript{1}

Consider a Go-Back-N sender and receiver directly connected by a 10 Mbps link with a propagation delay of 100 milliseconds. The retransmission timer is set to 3 seconds. The retransmission timer restarts on every received ACK (including duplicate ones). The window has a length of 4 segments.

Draw a time-sequence diagram showing the transmission of 10 segments (each segment contains 10000 bits). An ACK is transmitted as soon as the last bit of the corresponding data segment is received and the size of the ACK is very small. (The number of an ACK is always RCV.NXT, i.e. +1 of the highest sequence number until it has received everything)

1. Draw the time-sequence diagram for the case where there are no losses. (fill in Fig. 1)

2. Draw the time-sequence diagram for the case where the 3rd and last segments are lost once. (fill in Fig. 2)

\textsuperscript{1}Adapted from exercises of Communication Networks (227-0120-00L).
Figure 1: Fill in solution 1
Figure 2: Fill in solution 2
Q7. **(Previous Exam Question**): Which of the following fields does an IP router typically modify before forwarding the packet to the next hop?

1. Destination MAC address
2. Destination IP address
3. Time-to-live (TTL) field
4. IP checksum

Q8. **(Previous Exam Question**): List three signals that warn about congestion in the network, and mention one advantage and one disadvantage of using each signal.

Q9: What is flow control and how does TCP implement it?

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2Operating Systems & Networks (252-0062-00L); Spring Semester 2016 (FS16). Question 5.5. [https://vis.ethz.ch/en/services/examcollection/Operating_Systems_and_Computer_Networks/](https://vis.ethz.ch/en/services/examcollection/Operating_Systems_and_Computer_Networks/)