National University of Singapore
School of Computing
CS5229: Advanced Computer Networks
Semester I, 2021/2022

Lecture 3 Training
Buffer sizing and AQMs

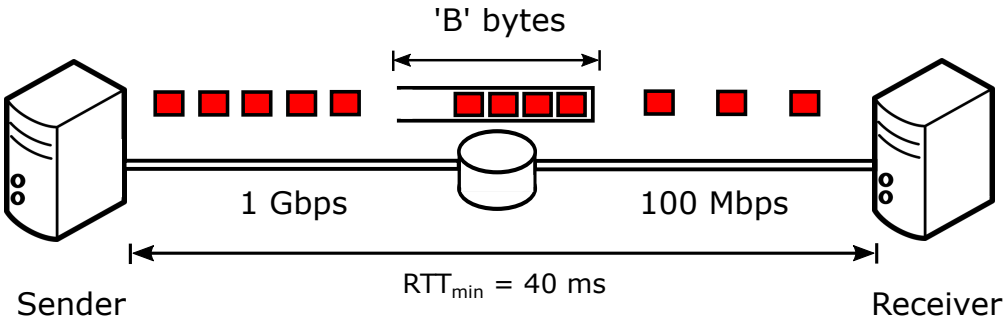

Figure 1: A simple network with a 100 Mbps bottleneck

In Lecture 3, you learnt how sizing the router buffer is crucial to ensuring link utilization with loss-based congestion control algorithms like Reno. In this training, we will explore the effects of buffer sizes on the throughput and RTT a little more.

Let's look at a simple network with 2 hosts with a 100 Mbps bottleneck link between them (Figure 1). Let the bottleneck buffer have a maximum capacity of B bytes and let RTT when the buffer is empty (RTT_{min}) be 40 ms. From the lecture, we know that if B is too small, we risk underutilizing the bottleneck. On the other hand if B is too large, there will be buffer bloat, which will increase the RTT of the connection (see Figure 2).

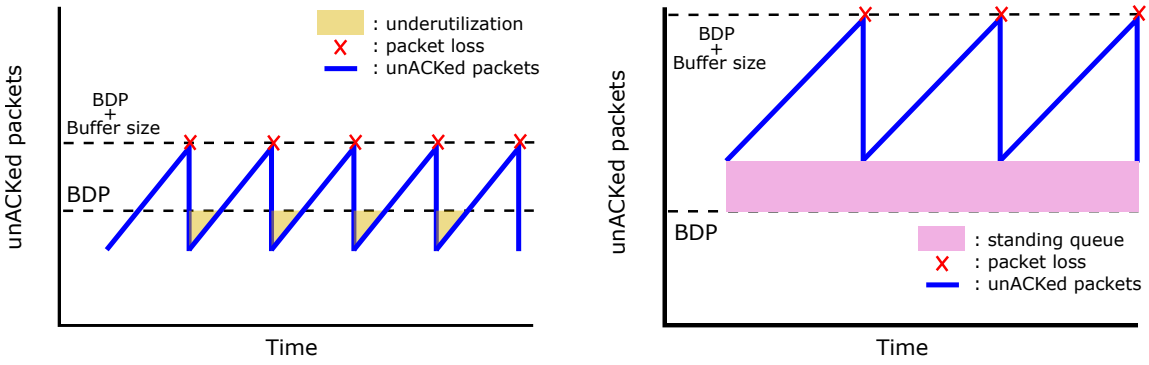

Figure 2: unACKed packets vs. time in different buffer sizes.

Assuming the sender starts a long flow (long enough for the slow start to be negligible) and uses Reno to do congestion control, answer the following questions. For simplicity sake, you can assume the time taken to drain the queue is negligible and the `cwnd` always matched the number of unACKed packets. Each packet is 1,000 bytes.

Questions

1. Calculate the average throughput and the minimum and maximum RTT when the bottleneck buffer is:
   (a) 100 Kilobytes
   (b) 500 Kilobytes
   (c) 1 Megabyte
2. In your opinion, which of the above mentioned buffer sizes is most suitable for this network, and why?