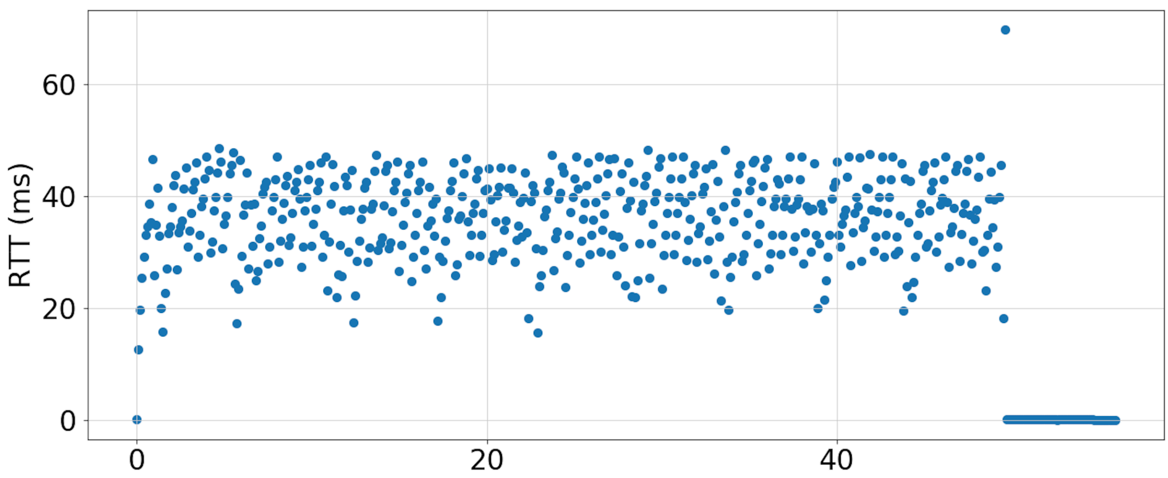
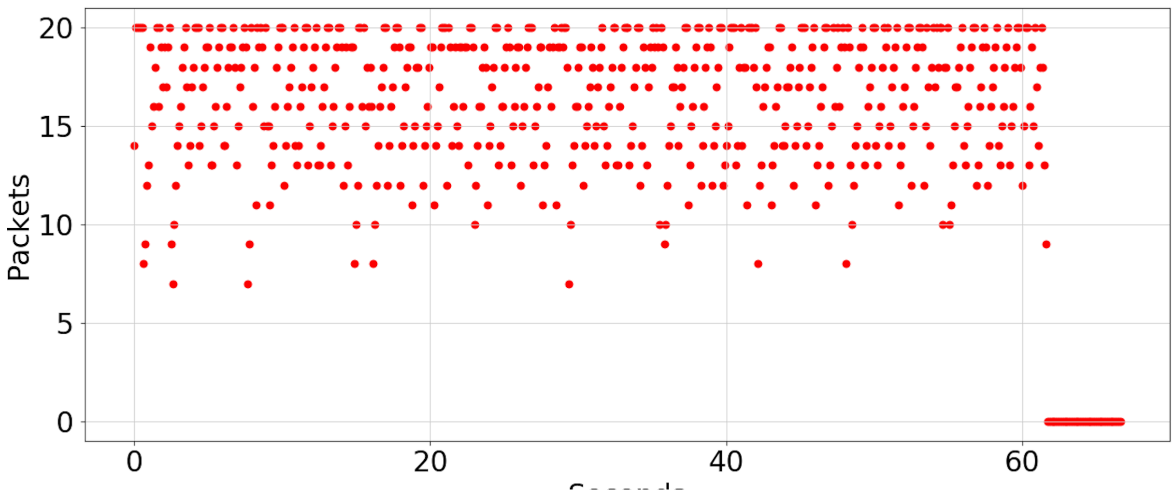
COL724 A1

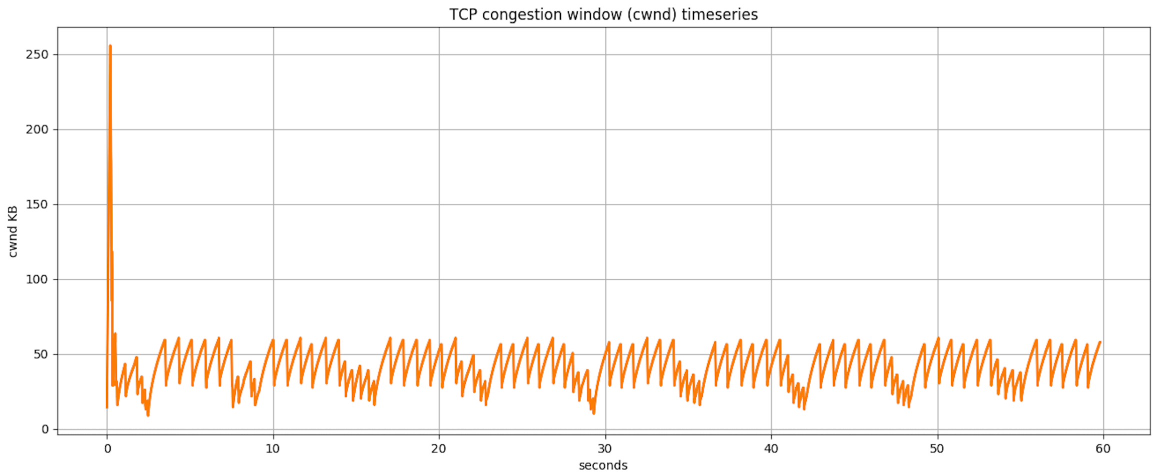
Questions

1. Variances in webpage fetch times between routers with short and large buffers stem from the buffer size itself. The data shows that shorter buffers yield quicker fetch times (avg. 0.50s) with less variation (std dev 0.162), compared to larger buffers (avg. 1.189s, std dev 0.52). Larger buffers delay congestion detection, elongating fetch times as they fill. Smaller buffers enhance TCP congestion control, promptly addressing packet loss and ensuring swifter fetch times.
2. Bufferbloat can also occur in places like your network interface card (NIC). The 'ifconfig eth0' output shows a transmit queue length of 1000 and MTU of 1500. Assuming the queue drains at 100 Mb/s, a packet could wait up to 0.12 seconds in the queue before leaving the NIC. This illustrates the possible delay due to bufferbloat.
3. The ping-reported round-trip time (RTT) varies with queue size. The relation can be symbolized as: RTT = Queue_Size * Packet_Delay (where 0.5s < Packet_Delay < 1.0s). In simple terms, larger queues lead to higher RTT due to accommodating more packets, directly increasing the total RTT per packet delay.
4.
    a. **Reducing Buffer Size**: Lowering the maximum buffer size reduces waiting times, addressing bufferbloat. For instance, 'q20' with smaller buffers had an average fetch time of 0.50s (std dev 0.162), while 'q100' with larger buffers had an average of 1.188s (std dev 0.520).
    b. **Active Queue Management (AQM)**: AQM drops packets probabilistically, mitigating problems of drop tail queues like bursty flows and flow synchronization, effectively combating bufferbloat.
5. Emulation results change due to random network behavior, varying conditions, resource fluctuations, settings, and model accuracy.

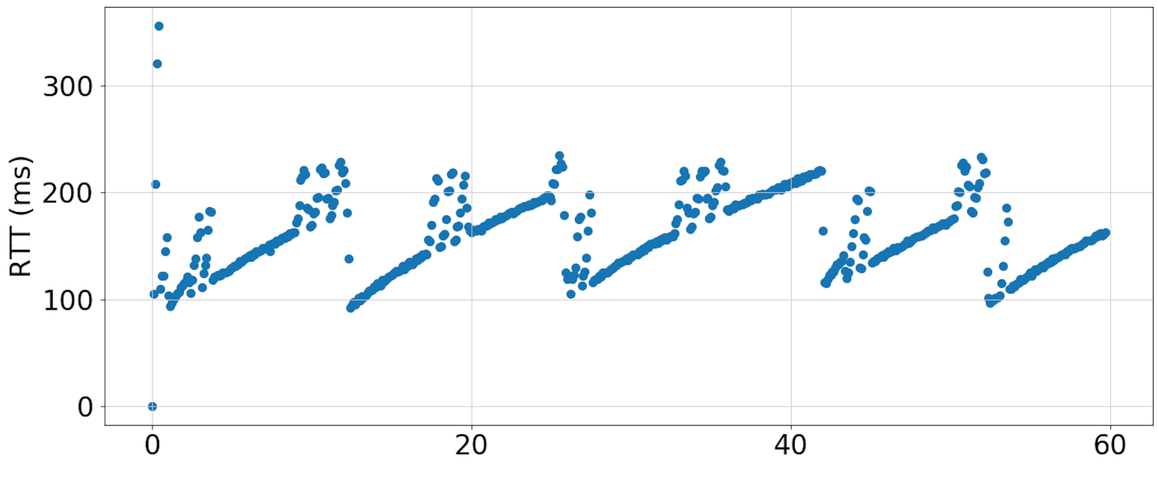
BB-q20

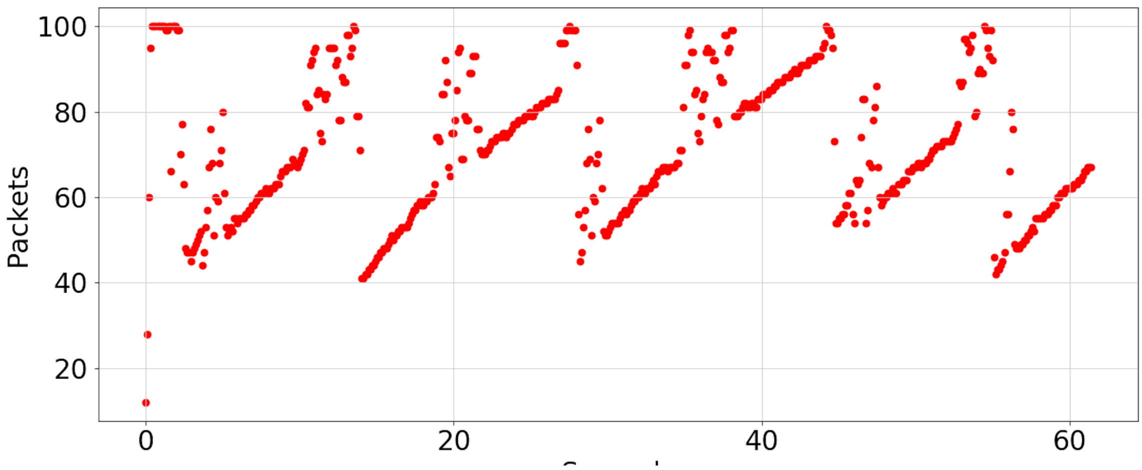


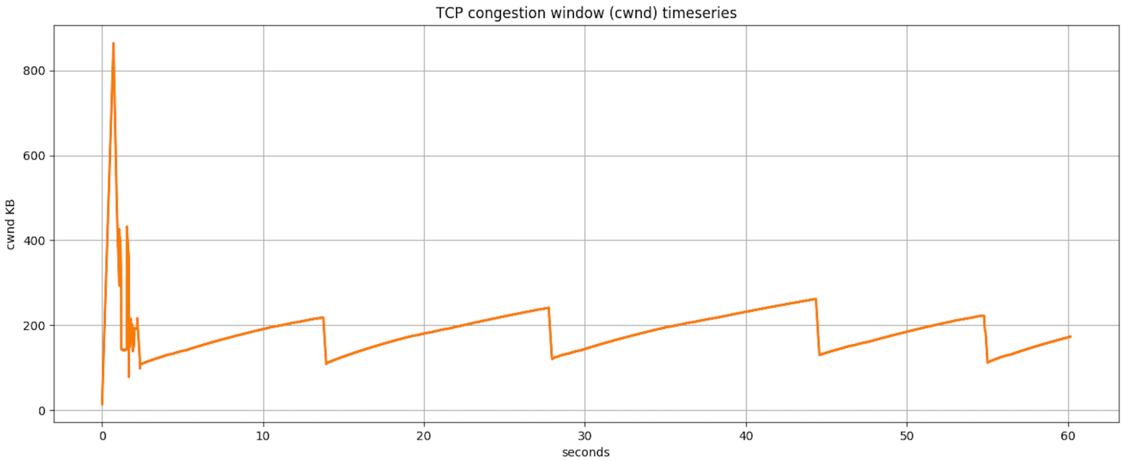

Packets
0
5
10
15
20
0
20
40
60


TCP congestion window (cwnd) timeseries
cwnd KB
seconds
0
50
100
150
200
250
0
10
20
30
40
50
60

BB-q100


RTT (ms)
0
100
200
300
0
20
40
60


Packets
100
80
60
40
20
0
20
40
60


TCP congestion window (cwnd) timeseries
cwnd KB
800
600
400
200
0
0
10
20
30
40
50
60
seconds