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Networks Lab 4

1. What is the normal time required to download the webpage on h1 from h2?

```
mininet> h2 wget h1
--2021-10-30 16:48:56--  http://10.0.0.1/
Connecting to 10.0.0.1:80... connected.
HTTP request sent, awaiting response... 200 OK
Length: 177669 (174K) [text/html]
Saving to: 'index.html'

100%[======================================>] 177,669      178KB/s   in 1.0s

2021-10-30 16:48:57 (178 KB/s) - 'index.html' saved [177669/177669]
```

Start time = 16:48:56
End time = 16:48:57
Normal time taken = 1s

2. What was your initial expectation for the congestion window size over time?

The TCP cwnd should keep increasing and decreasing due to additive increase and multiplicative decrease. The cwnd should initially increase exponentially until the ssthreshold is reached then it will start to increase linearly, before reaching a loss where multiplicative decrease will then happen.

3. After starting iperf on h1, did you observe something interesting in the ping RTT?

```
--- 10.0.0.2 ping statistics ---
100 packets transmitted, 99 received, 1% packet loss, time 99004ms
rtt min/avg/max/mdev = 432.287/677.836/997.474/147.735 ms
```

The average RTT is 677.836, which is quite high as compared to without

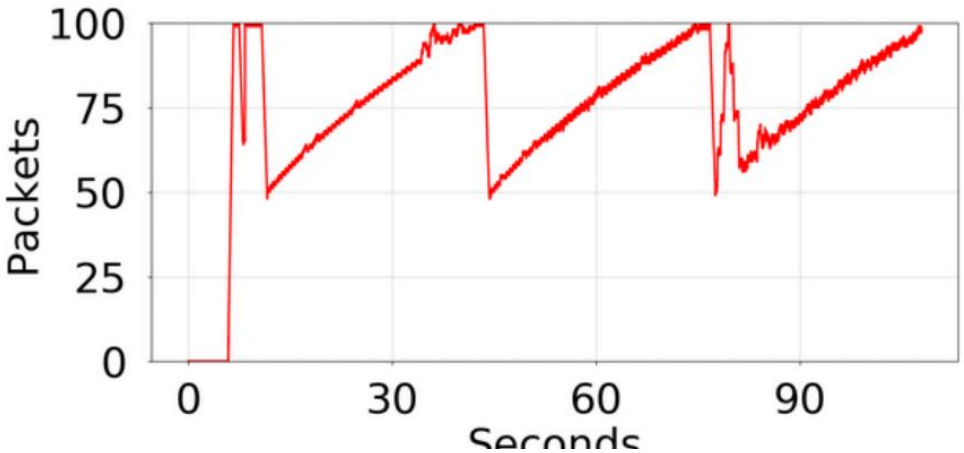
4. After starting iperf on h1, why does the web page take so much longer to download?

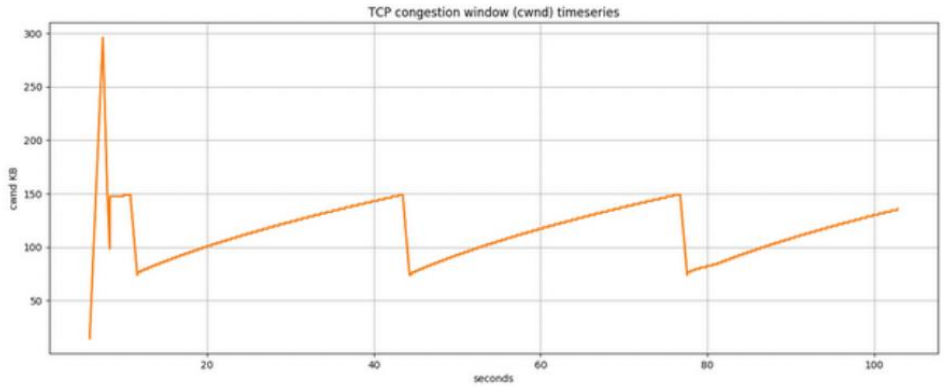
```
mininet> h2 wget h1
--2021-10-30 17:29:42--  http://10.0.0.1/
Connecting to 10.0.0.1:80... connected.
HTTP request sent, awaiting response... 200 OK
Length: 177669 (174K) [text/html]
Saving to: 'index.html'

100%[======================================>] 177,669     50.9KB/s   in 3.4s

2021-10-30 17:29:47 (50.9 KB/s) - 'index.html' saved [177669/177669]
```

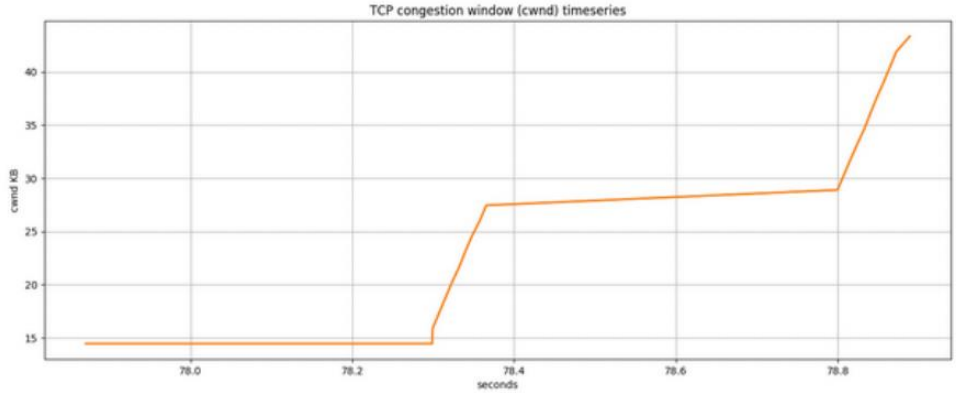
Start time = 17:29:42
End time = 17:29:47
Time taken = 5s

The TCP bandwidth is being shared between several data streams on iperf, resulting in a much lower download speed of 50.9KB/s on long flow than when running on short flow, so the web page takes a much longer time to download.

5. Please provide the figures for the first experiment (with qlen 100). Please comment on what you can see in the figures.



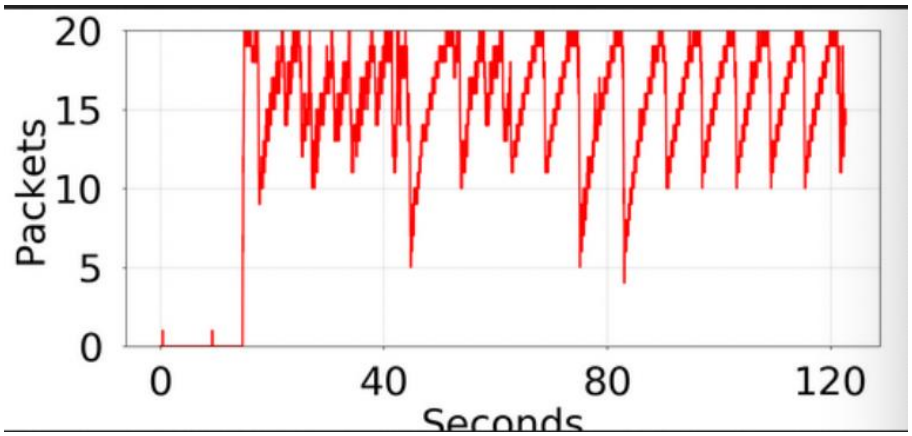


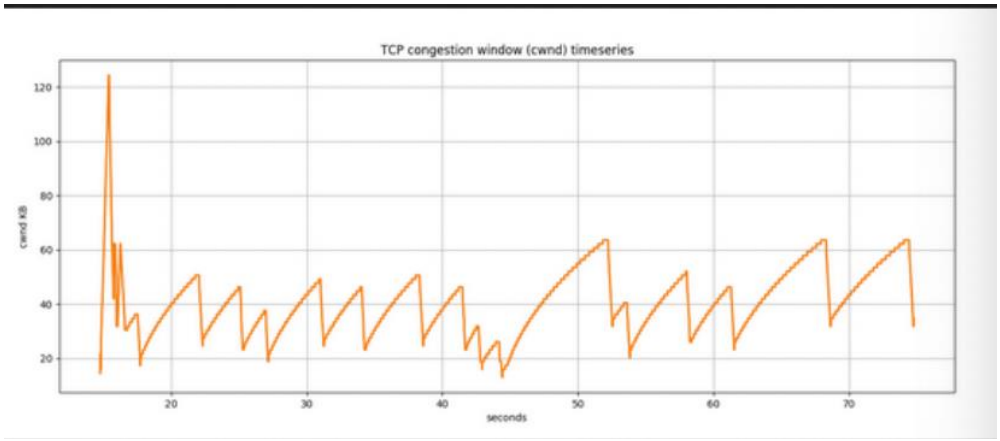


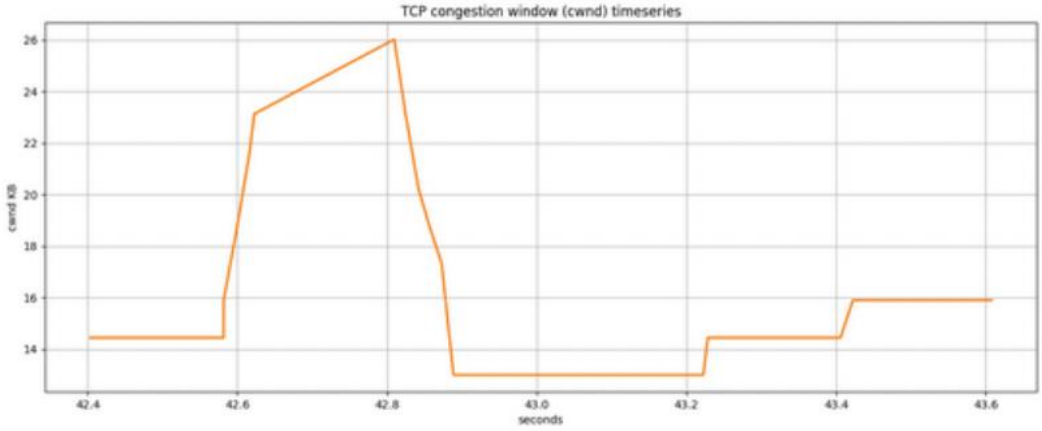
It takes about 60s to reach the max queue occupancy of 100 packets before loss happens and causes multiplicative decrease in cwnd, where cwnd is halved, and hence causes a decrease in queue occupancy where queue occupancy is also halved. Once multiplicative decrease happens, additive increase will take place and the queue occupancy will start

increasing again until 100 and 150 before multiplicative decrease occurs again. This pattern repeatedly continues.

6. Please provide the figures for the second experiment (with qlen 20). Please comment on what you can see in the figures and what is different from the previous experiment. Explain the reason behind the difference.







This experiment takes much lesser time to reach the max occupancy of 20 packets and it happens much more frequently than the previous experiment as the queue length is shorter.

The download time is reduced as there are more cycles of additive increase and multiplicative decrease in this experiment, which means that TCP fairness can be achieved faster to reach the optimum transmission bandwidth for the packets.