(ASSIGNMENT 1)

BUFFERBLOAT

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QUESTION 1. Why do you see a difference in webpage fetch times with short and large router buffers ?

SOLUTION 1. When the queue size is large, TCP will continue to double the congestion window and transmit more and more packets, lengthening the fetch time because there will be a 6ms wait between each packet. Furthermore, to enable for speedier transmission of webpage fetch requests, TCP must cut its congestion window in half each time the time limit is reached while the queue size is small.

QUESTION 2. Bufferbloat can occur in other places such as your network interface card (NIC). Check the output of ifconfig eth0 on your VirtualBox VM. What is the (maximum) transmit queue length on the network interface reported by ifconfig? For this queue size, if you assume the queue drains at 100Mb/s, what is the maximum time a packet might wait in the queue before it leaves the NIC?

SOLUTION 2. My mininet's txqueuelen value is 1000, meaning 1000 packets can be buffered. Assuming each packet contains 1500 bytes, there will be a total of 1.5 * 10^6 bytes, and 100 Mbps is equivalent to 1.25 * 10^7 bytes per second, thus it will take roughly 0.12 seconds.

QUESTION 3. How does the RTT reported by ping vary with the queue size? Describe the relation between the two ?

SOLUTION 3. When the queue size is higher, RTT increases. RTT = queue size multiplied by propagation delay Since the propagation delay is fixed, it follows that the longer the RTT, the greater the queue_size.

QUESTION 4. Identify and describe two ways to mitigate the bufferbloat problem ?

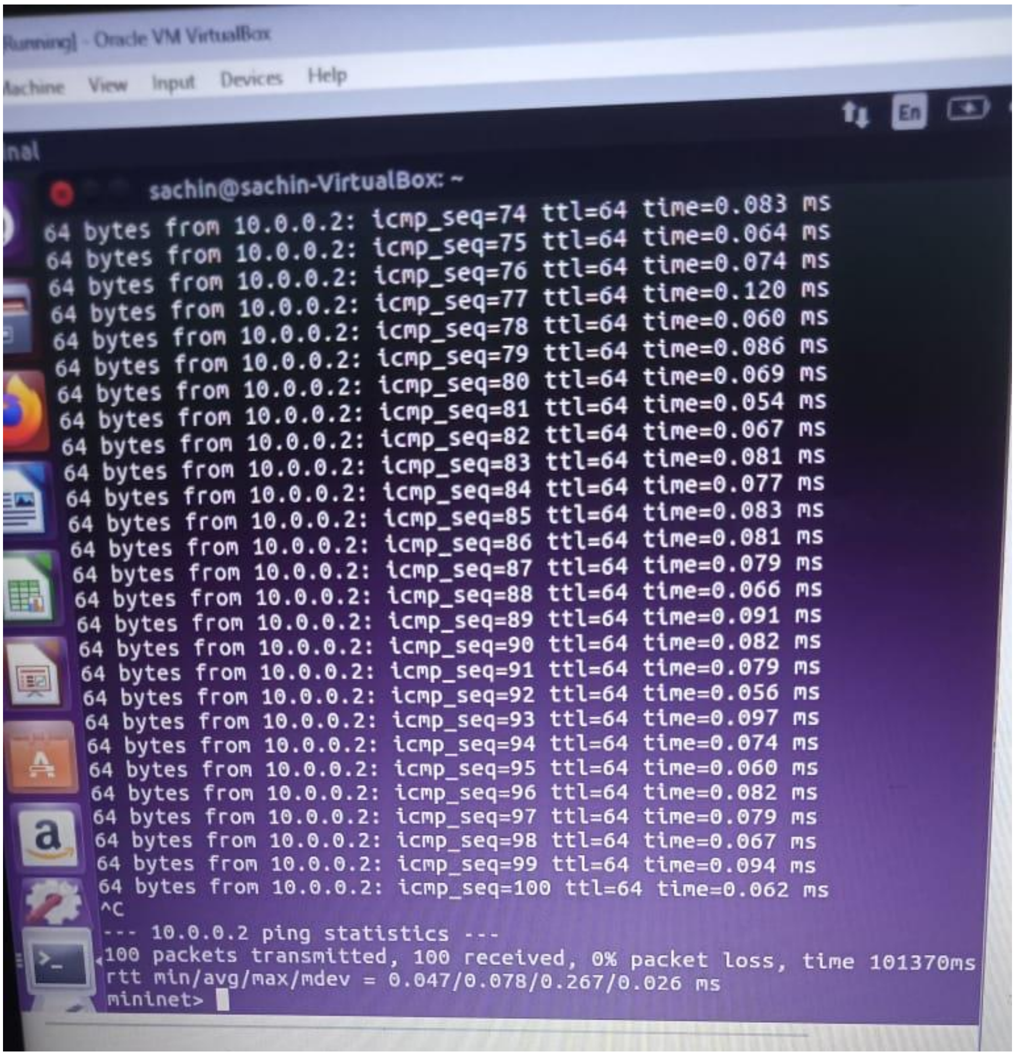
SOLUTION 4. The first method is to adjust the maximum queue size. In a network with constrained bandwidth, reducing the buffer size can decrease RTT. The second method is to delete packets at an early stage randomly and with a probability parameter using active queue management schemas like RED.

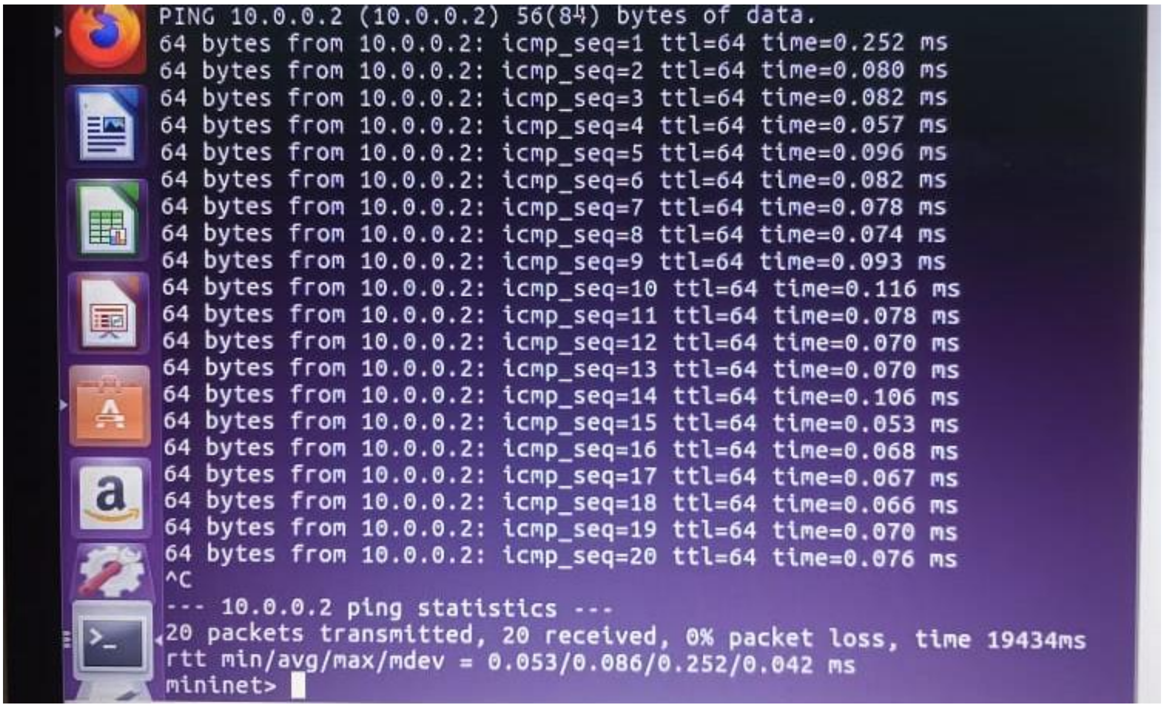
QUESTION 5. Describe how and why your results change when you re-run the emulation.?

SOLUTION 5. 1.The randomness of imitation : There may be random or probabilistic processes involved in some aspects of network emulation, such as packet delays and queueing.These procedures could provide various results each time you run the simulation, resulting in changes to the observed latency, queue lengths, and other metrics.

2. network circumstances : Numerous factors may alter the outcomes, even in a simulated network.

External factors may have an impact on network circumstances including bandwidth utilization, packet loss, and latency, which could result in differing outcomes across different runs.




PING 10.0.0.2 (10.0.0.2) 56(84) bytes of data.
64 bytes from 10.0.0.2: icmp_seq=1 ttl=64 time=0.252 ms
64 bytes from 10.0.0.2: icmp_seq=2 ttl=64 time=0.080 ms
64 bytes from 10.0.0.2: icmp_seq=3 ttl=64 time=0.082 ms
64 bytes from 10.0.0.2: icmp_seq=4 ttl=64 time=0.057 ms
64 bytes from 10.0.0.2: icmp_seq=5 ttl=64 time=0.096 ms
64 bytes from 10.0.0.2: icmp_seq=6 ttl=64 time=0.082 ms
64 bytes from 10.0.0.2: icmp_seq=7 ttl=64 time=0.078 ms
64 bytes from 10.0.0.2: icmp_seq=8 ttl=64 time=0.074 ms
64 bytes from 10.0.0.2: icmp_seq=9 ttl=64 time=0.093 ms
64 bytes from 10.0.0.2: icmp_seq=10 ttl=64 time=0.116 ms
64 bytes from 10.0.0.2: icmp_seq=11 ttl=64 time=0.078 ms
64 bytes from 10.0.0.2: icmp_seq=12 ttl=64 time=0.070 ms
64 bytes from 10.0.0.2: icmp_seq=13 ttl=64 time=0.070 ms
64 bytes from 10.0.0.2: icmp_seq=14 ttl=64 time=0.106 ms
64 bytes from 10.0.0.2: icmp_seq=15 ttl=64 time=0.053 ms
64 bytes from 10.0.0.2: icmp_seq=16 ttl=64 time=0.068 ms
64 bytes from 10.0.0.2: icmp_seq=17 ttl=64 time=0.067 ms
64 bytes from 10.0.0.2: icmp_seq=18 ttl=64 time=0.066 ms
64 bytes from 10.0.0.2: icmp_seq=19 ttl=64 time=0.070 ms
64 bytes from 10.0.0.2: icmp_seq=20 ttl=64 time=0.076 ms
^C
--- 10.0.0.2 ping statistics ---
20 packets transmitted, 20 received, 0% packet loss, time 19434ms
rtt min/avg/max/mdev = 0.053/0.086/0.252/0.042 ms
mininet>

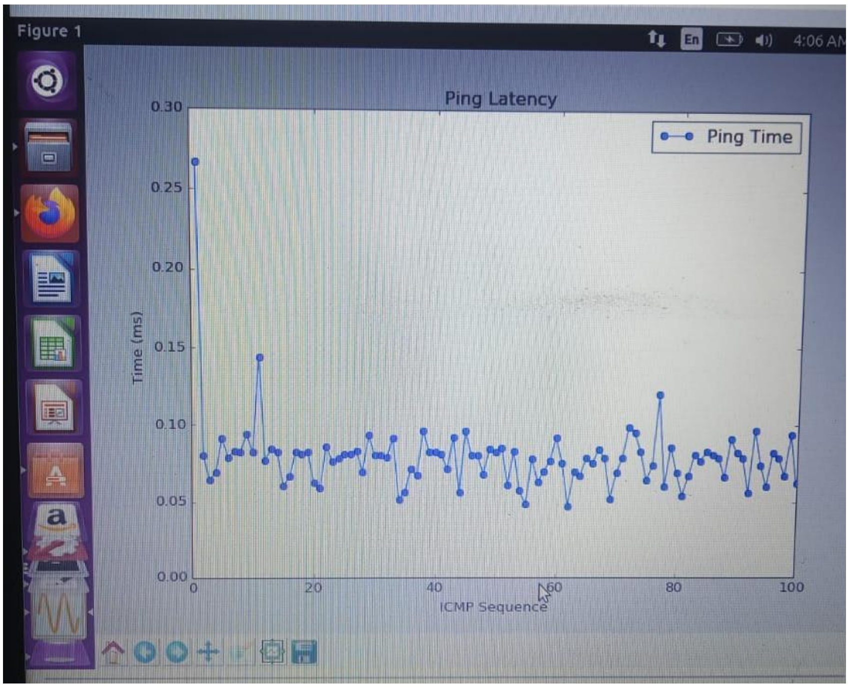
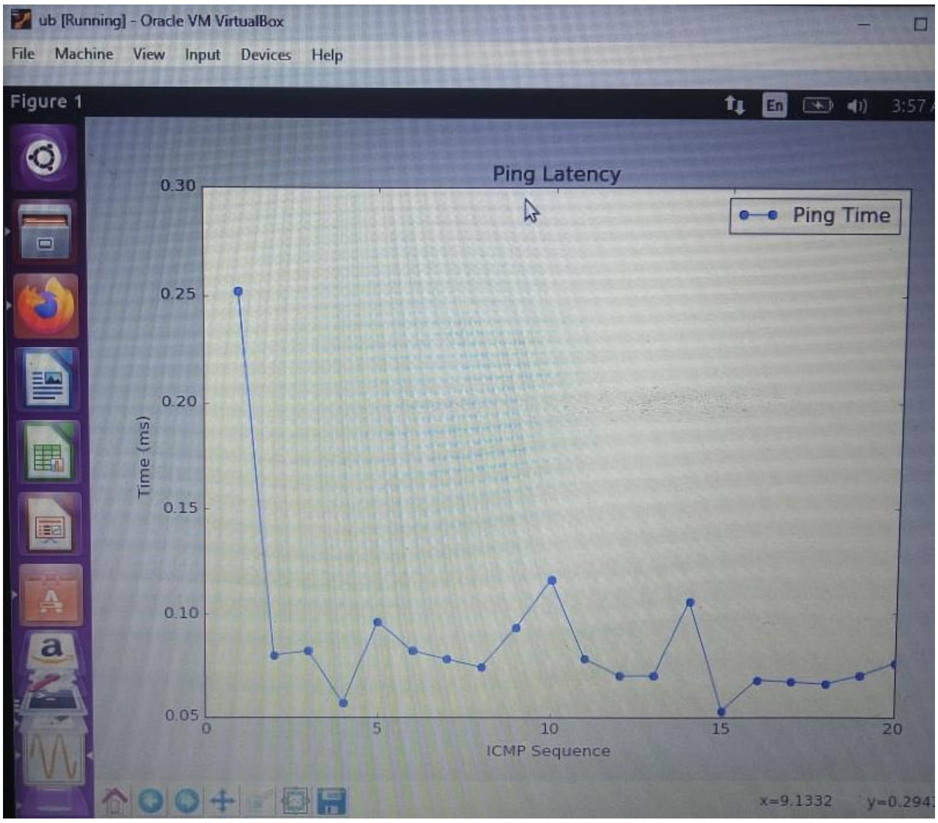


Figure 1
4:06 AM
Ping Latency
Ping Time
Time (ms)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0
20
40
60
80
100
ICMP Sequence


ub [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Figure 1
En
3:57
Ping Latency
Ping Time
Time (ms)
0.30
0.25
0.20
0.15
0.10
0.05
0
5
10
15
20
ICMP Sequence
x=9.1332