**Bufferbloat on Network Emulator (Mininet)**

1. The way the network manages congestion and the ensuing queuing delays is what causes the difference in webpage retrieve times with short and large router buffers. Larger buffer sizes cause routers to hold onto packets longer before passing them. As a result, packets spend more time waiting in the buffer before being transmitted, which increases latency and delay variation even if it can assist absorb traffic peaks. In a network with huge router buffers, fetching webpages can take longer than expected because of the excessive buffering. When network congestion occurs, this delay is frequently more noticeable, which increases the time it takes to fetch a webpage. On the other hand, shorter router buffers enable faster packet forwarding and hence less delay. In times of congestion, nevertheless, this may also lead to additional packet drops because the buffer's ability to store more packets is constrained. While low buffers can aid with latency reduction and real-time performance improvement, they might not be able to handle traffic bursts as well as bigger buffers.
2. The maximum time a packet might wait in the queue before it leaves the NIC is 0.12s.
3. Due to buffering and queuing delays, the Round-Trip Time (RTT) returned by the ping command can change with the size of the queue in a network. Following is a description of how the RTT and queue size relate:

* Small Queue Size: When network equipment (such as routers) have a small queue size, packets are routed more quickly, which reduces queuing delays. As a result, the RTT given by ping frequently reflects the actual network propagation delay and is quite consistent. Due to the queue's lower likelihood of causing large packet transmission delays, RTT values are stable and low.
* Large Queue Size: When there is a large queue, packets may have to wait longer before being transferred. Increased queue delays may result from this, especially when the network is busy. The RTT reported by ping may become increasingly erratic and prone to spikes while packets wait in the queue. Higher RTT values are a result of longer queuing delays since it takes more time for a packet to move through the queue and be sent.

1. Bufferbloat is a network issue caused by excessive buffering in network devices, which can increase latency and delay variation. In order to maintain good network performance and decrease latency, bufferbloat mitigation is crucial. Here are two strategies for reducing the bufferbloat issue:

* Policies for Quality of Service (QoS): In order to give crucial traffic preference over less important traffic, Quality of Service (QoS) methods prioritize and manage network traffic. By limiting the amount of buffer space allotted to certain types of traffic, QoS regulations can reduce bufferbloat. A few QoS tactics include the following: Traffic Shaping, Traffic Policing, Packet prioritization
* Algorithms for Active Queue Management (AQM): To avoid excessive waiting and buffer bloat, AQM algorithms try to dynamically regulate the size of network buffers. To maintain optimal network performance, these algorithms keep an eye on the queue length and modify the buffer size as necessary. A few well-known AQM algorithms are: Random Early Detection(RED), CoDel (Controlled Delay), FQ-CoDel(Fair Queueing Delay).

1. Because of the dynamic and changing character of networks, the outcomes of repeating network emulations or experiments can vary for a variety of reasons. The reasons why these changes take place can vary, affecting the results that are seen. The following details how and why repeating network emulations could lead to different outcomes:

* Network Conditions: Congestion
* Traffic Patterns: Different Traffic Mix.
* Randomness: Randomness in Packet Scheduling.
* Buffer Dynamics: Queue Size
* Background Traffic: Background processes
* External Factors: Network Interferences.
* Hardware and Virtualization: Resource Allocation.
* Measurement and Timing: Measurement Accuracy.
* Transient Effects: Transient Network Conditions
* Software and Updates: Software changes.