

High-speed Networks, Cybersecurity, and Software-defined Networking Workshop

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Lab 14: Router's bufferbloat

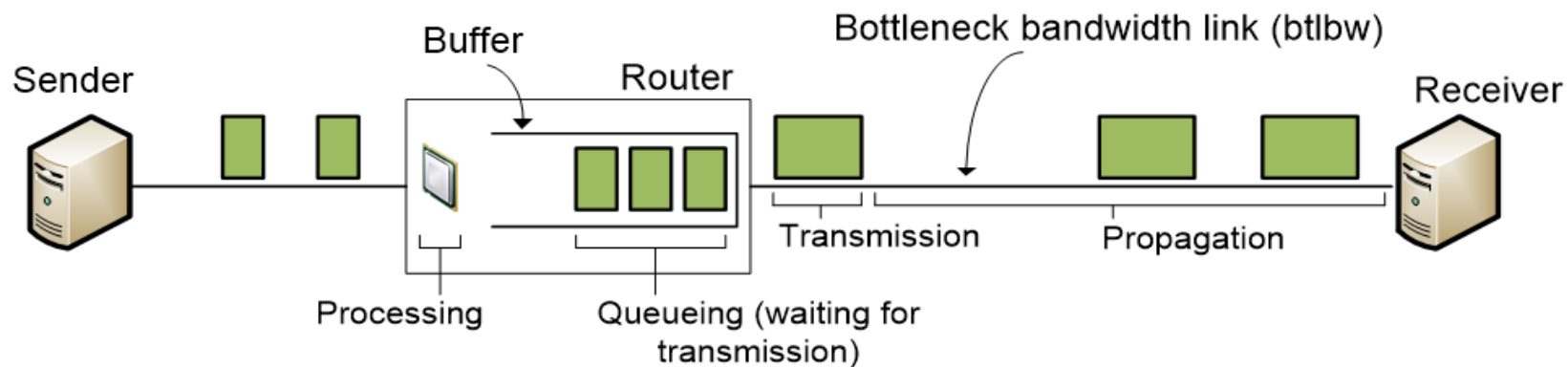
Content

- Introduction to bufferbloat
- Testing throughput on a network with a small buffer-size switch
- Testing throughput on a network with a $1 \cdot \text{BDP}$ buffer-size switch
- Testing throughput on a network with a large buffer-size switch

Section 1: Introduction to bufferbloat

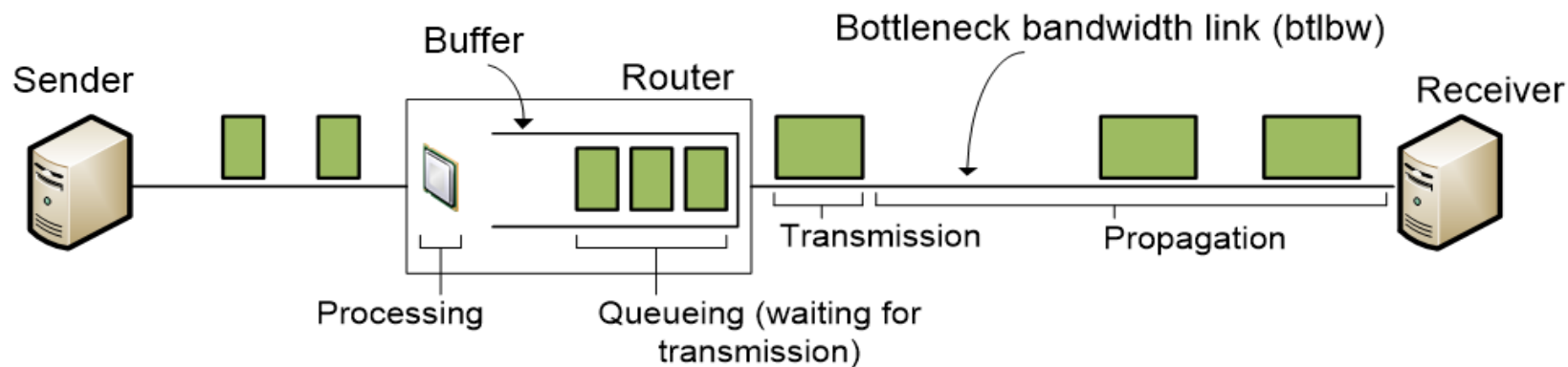
Packet delays

- As a packet travels from a sender to a receiver, it experiences several types of delays at each node (router / switch) along the path
- The most important of these delays are the processing delay, queuing delay, transmission delay, and propagation delay



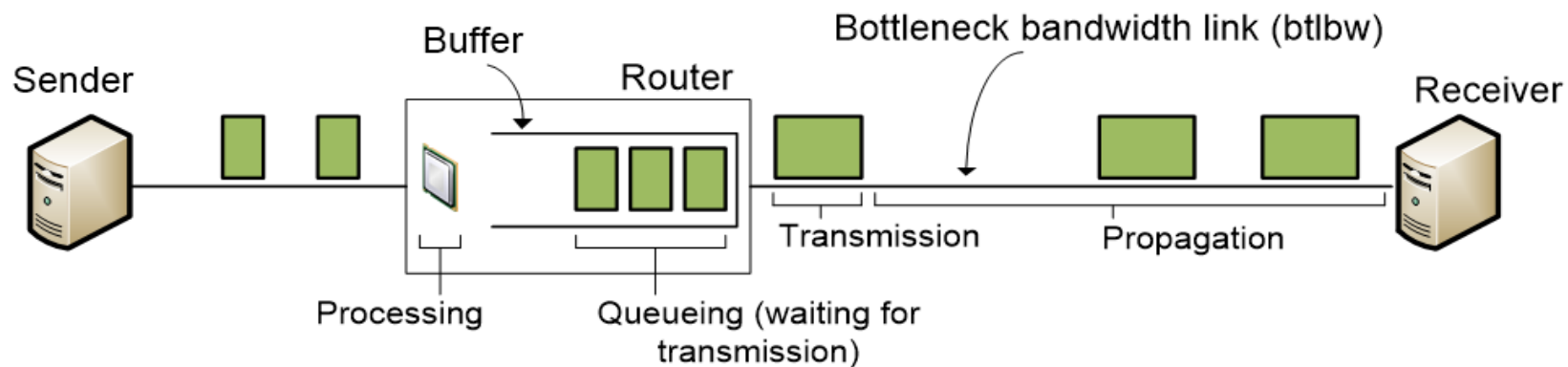
Bufferbloat

- In modern networks, the processing and transmission delays may be negligible
- The propagation delay can be considered as a constant
- The dynamics of the queues in routers results in varying queueing delays
- An important consideration that affects the queueing delay is the router's buffer size
- There is no consensus on how large the buffer should be
- Rule of thumb: buffer should be equal to the bandwidth-RTT product



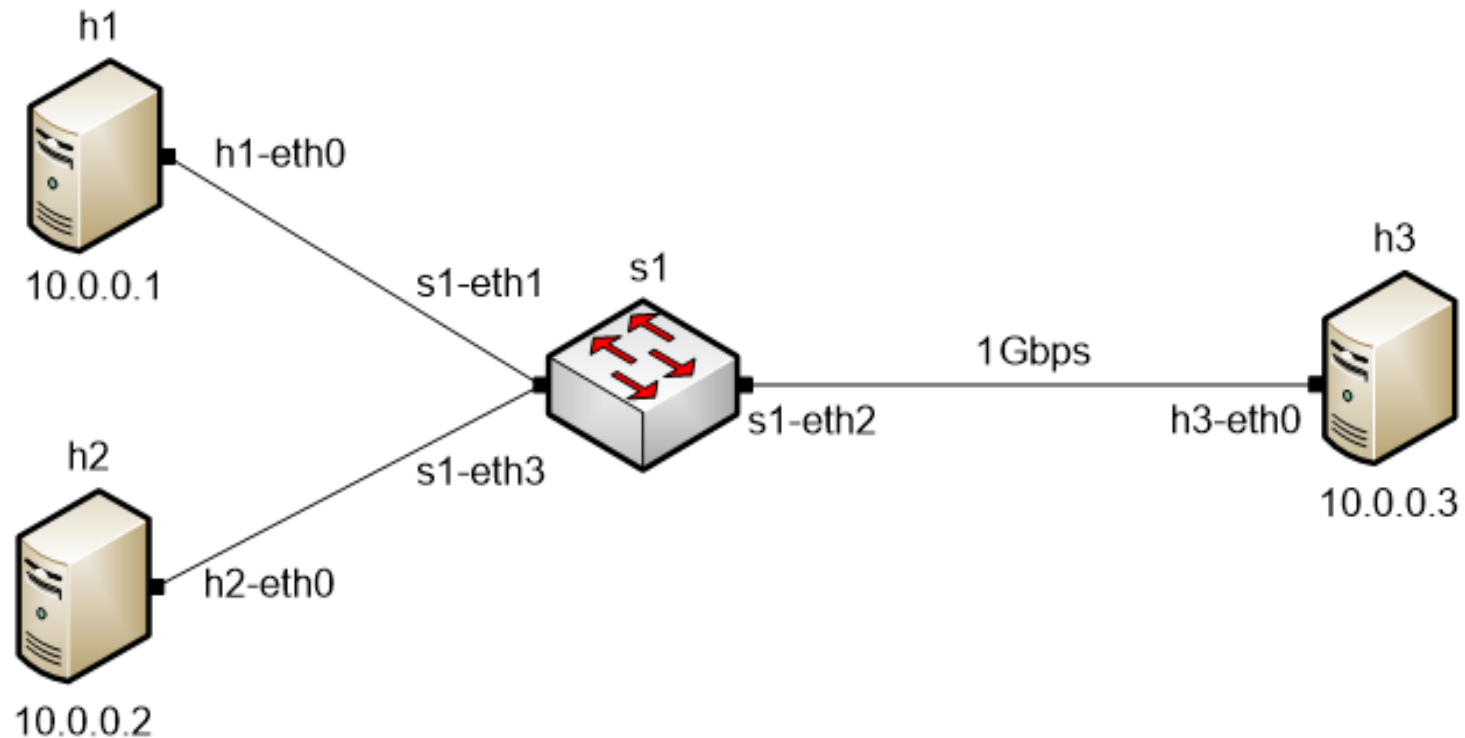
Bufferbloat

- A large-enough router's buffer size is essential to absorb transitory packet bursts and prevents losses
- However, if a buffer size is excessively large, queues may be formed and substantial queueing delay may be observed
- The bufferbloat problem is caused by routers with large buffer size



Emulating a wide area network

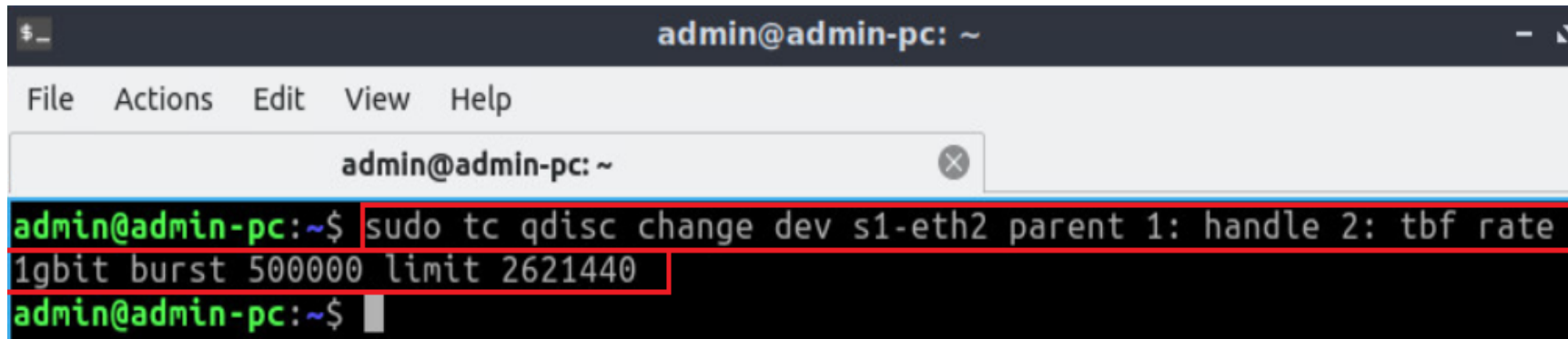
- The figure below shows the topology and the devices' interfaces



Section 3: Testing throughput on a network with a 1BDP buffer-size switch

Setting switch s1's buffer size to 1BDP

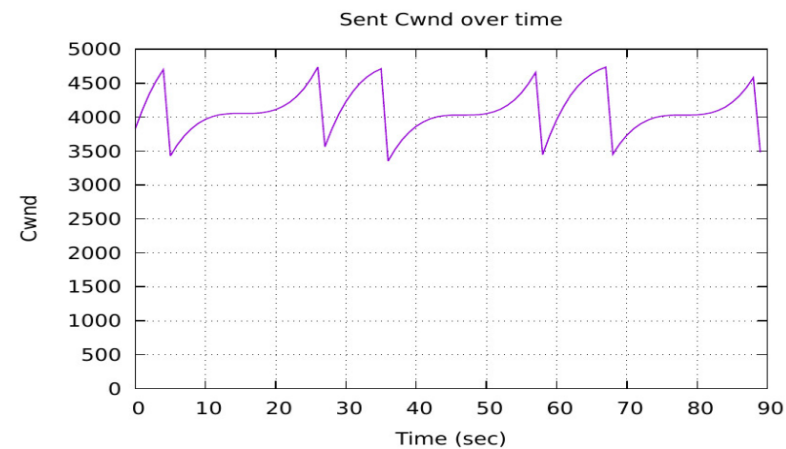
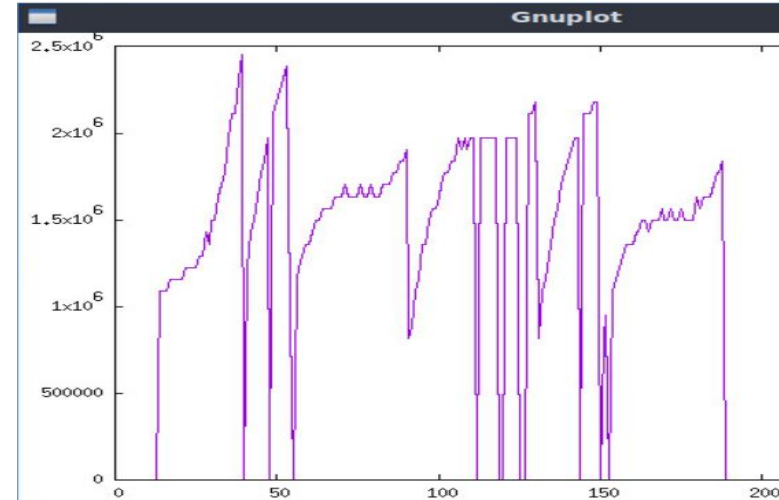
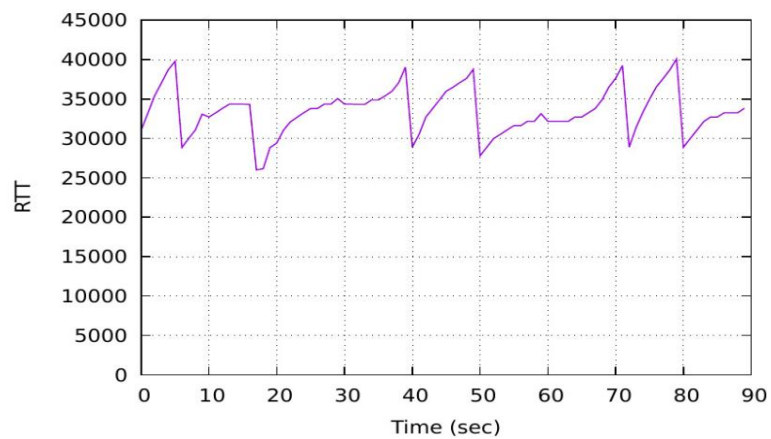
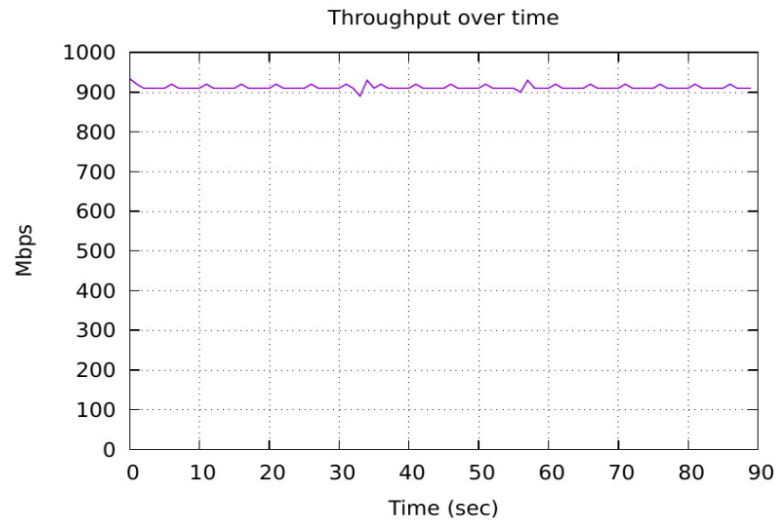
- The following command configures a buffer size of 2,621,440 bytes (1BDP) to switch s1



```
admin@admin-pc: ~  
File Actions Edit View Help  
admin@admin-pc: ~  
admin@admin-pc:~$ sudo tc qdisc change dev s1-eth2 parent 1: handle 2: tbf rate  
1gbit burst 500000 limit 2621440  
admin@admin-pc:~$
```

Running a throughput test

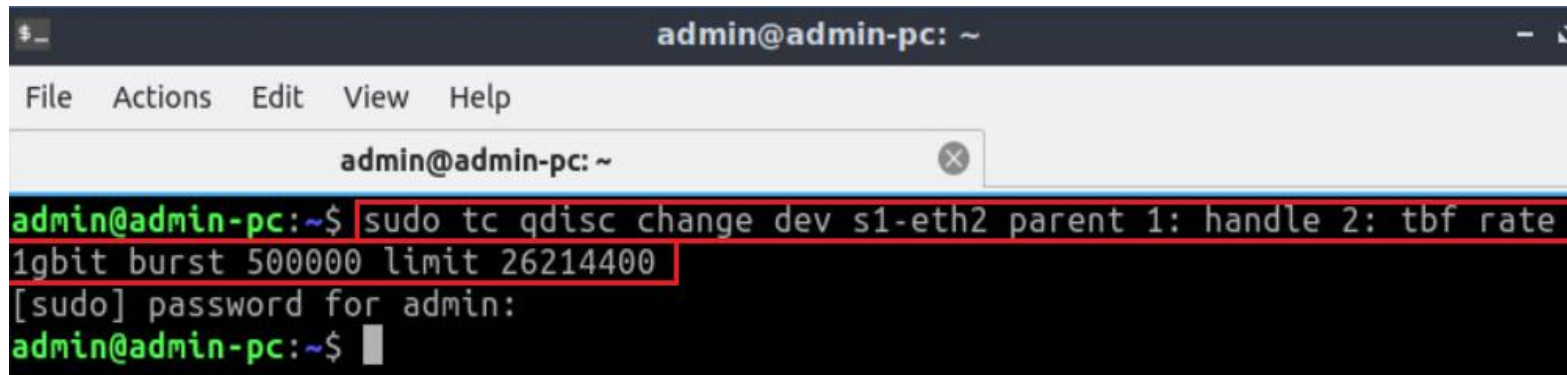
- The user performs a throughput test using iperf3 tool



Section 4: Testing throughput on a network with a 100BDP buffer-size switch

Setting switch s1's buffer size to 100BDP

- The following command configures a buffer size of 26,214,400 bytes (100BDP) to switch s1

A terminal window titled 'admin@admin-pc: ~' with a menu bar (File, Actions, Edit, View, Help) and a tab labeled 'admin@admin-pc: ~'. The terminal shows the command 'sudo tc qdisc change dev s1-eth2 parent 1: handle 2: tbf rate 1gbit burst 500000 limit 26214400' being entered and executed. The prompt changes to '[sudo] password for admin:' and then back to 'admin@admin-pc:~\$' after the password is entered.

```
admin@admin-pc:~$ sudo tc qdisc change dev s1-eth2 parent 1: handle 2: tbf rate
1gbit burst 500000 limit 26214400
[sudo] password for admin:
admin@admin-pc:~$
```

Running a throughput test

- The user performs a throughput test using iperf3 tool

