Effects of Pause and QCN on TCP Sources: Part 1 (Redo of simulation with slightly different topology)

Berk Atikoglu, Balaji Prabhakar

Analyze the Effects of Pause and QCN on TCP Sources: System Parameters

- **Congestion Management Schemes**
  - TCP Only
  - TCP + PAUSE
  - TCP + QCN + PAUSE

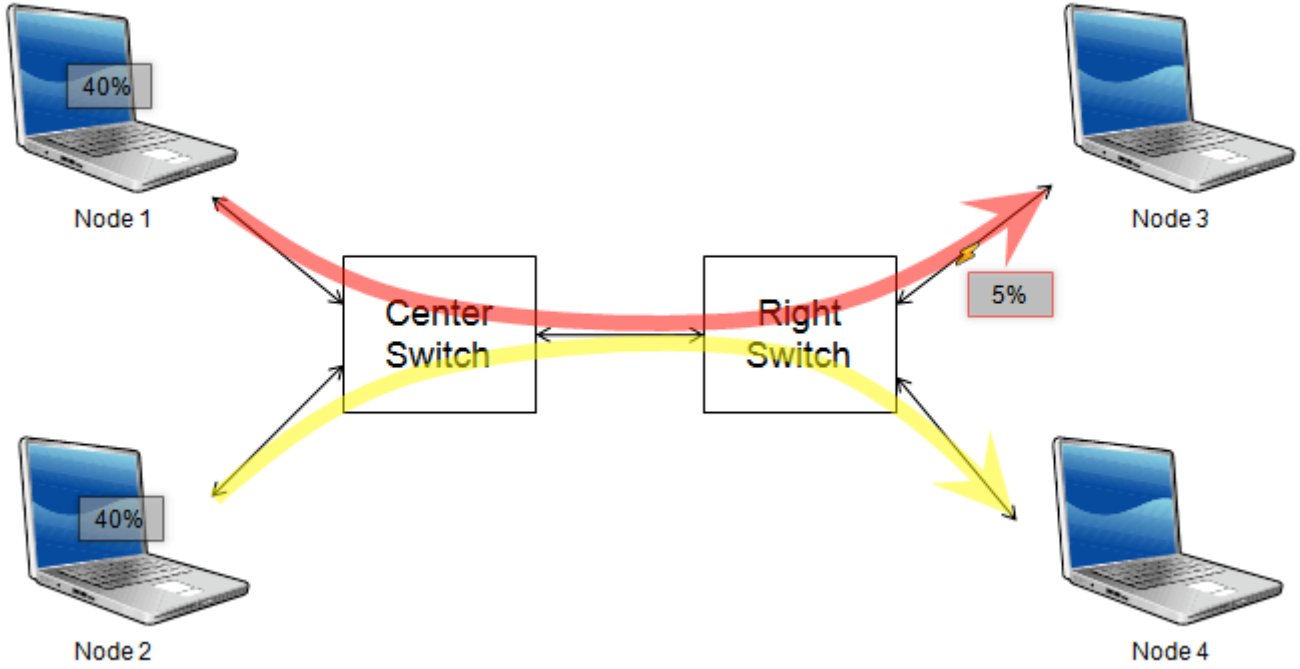
- **Switch Parameters**
  - PAUSE Disabled
    - Output queue limit of 150kbytes
  - PAUSE Enabled
  - No output queue limit
    - Applied on a per input basis based on watermarks
    - Watermark_hi = 130kbytes
    - Watermark_lo = 110kbytes

- **QCN Parameters**
  - W = 2.0
  - Q_EQ = 26kbytes
  - Gd = 1/128 = 0.0078125
  - Base marking: once every 150kbytes
  - Jitter on marking: 30%
  - Runit = 1Mb/s
  - MIN_RATE = 10Mb/s
  - BC_LIMIT = 150kbytes
  - TIMER_PERIOD = 15ms
  - R_AI = 5Mbps
  - R_HAI = 50Mbps
  - FAST_RECOVERY_TH = 5
  - Quantized_Fb: 6 bits
  - Jitter at RP: 30% (byte counter and timer)

- **TCP Version → NewReno**

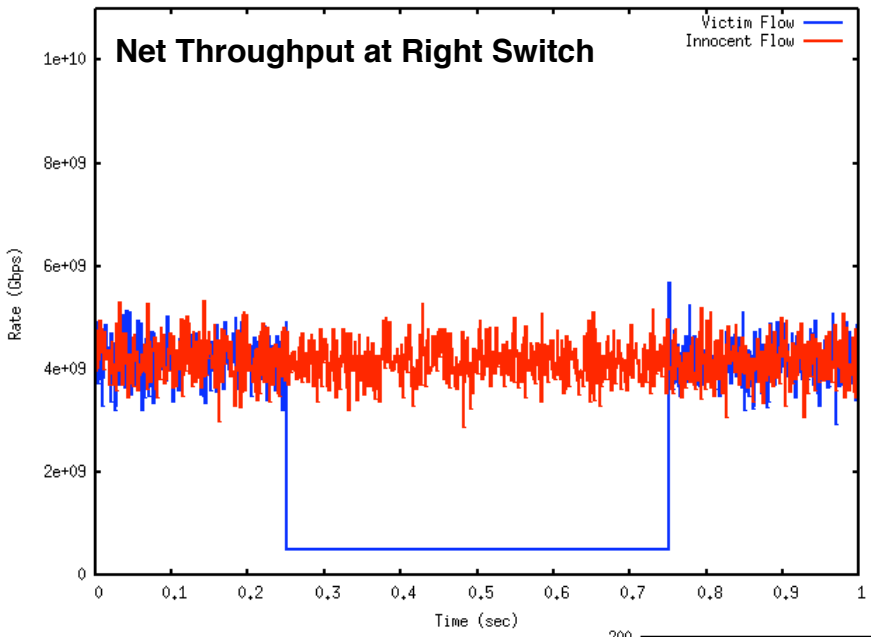
Data is taken form: http://www.ieee802.org/1/files/public/docs2008/au-sim-kwan-qcn-tcp-0308.pdf

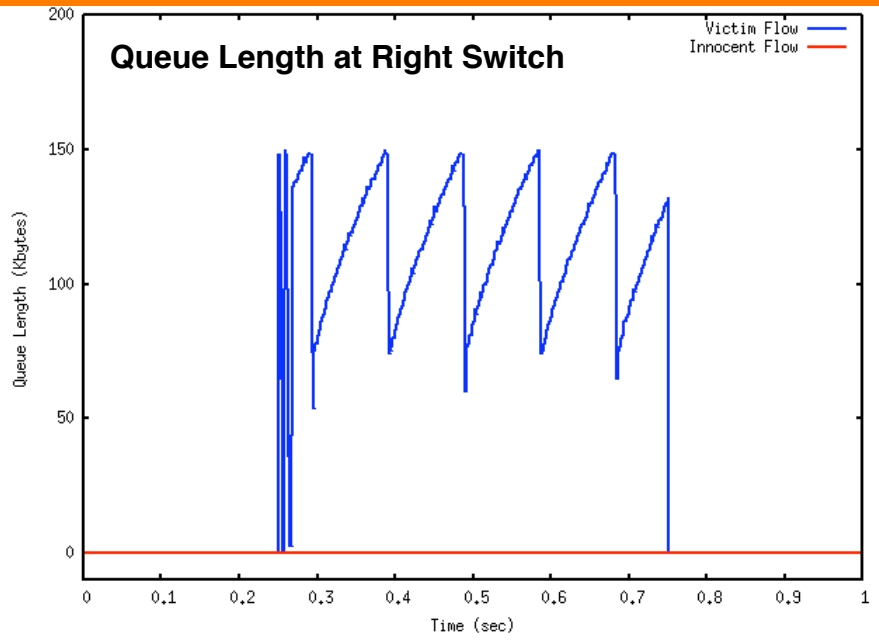
Topology and Workload

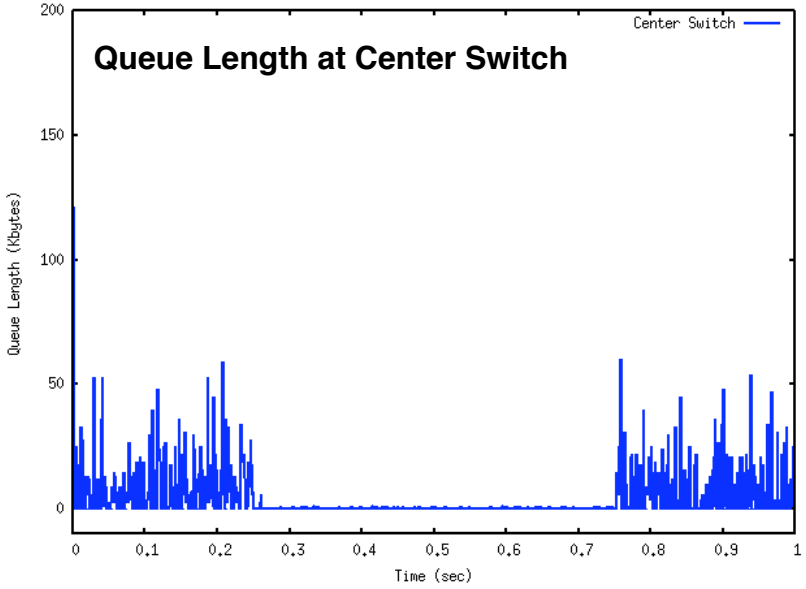


- Topology
  - Link Speed → 10Gbps for all links
  - Loop Latency → 18us
- Traffic Pattern
  - 9k byte transactions arriving with a Bernoulli distribution
  - Node 1 sends to Node 3 at 4Gbs (40%)
  - Node 2 sends data to Node 4 at 4Gbs (40%)
- Congestion Scenario
  - Node 3 temporarily reduces its service rate from 10Gbps to 500Mbps between [250-750ms]

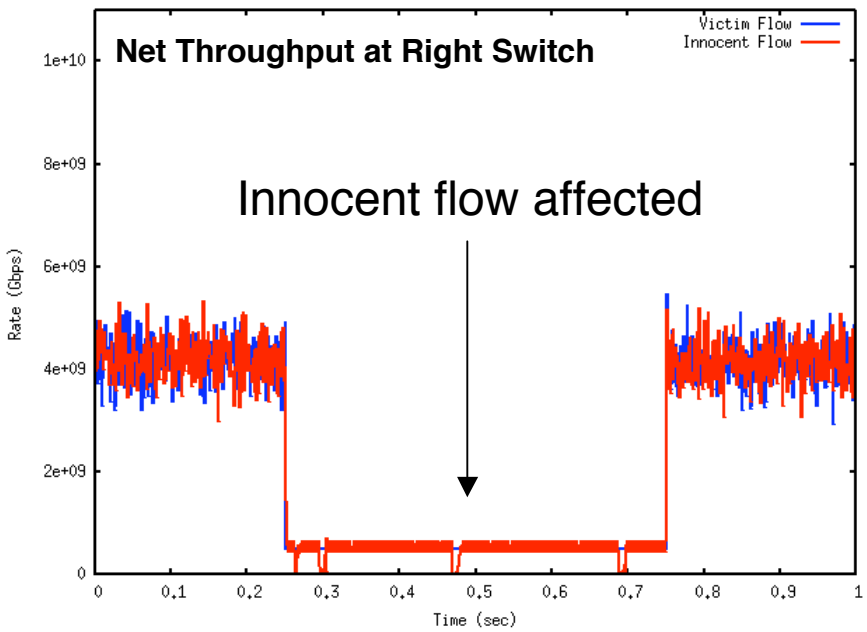
TCP Only

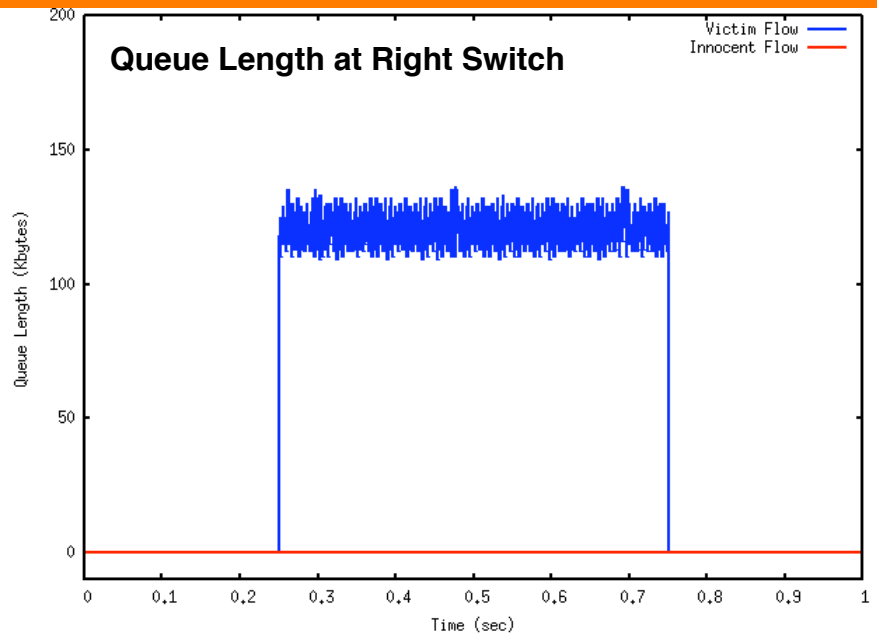

Net Throughput at Right Switch
Victim Flow
Innocent Flow
Rate (Gbps)
1e+10
8e+09
6e+09
4e+09
2e+09
0
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1
Time (sec)

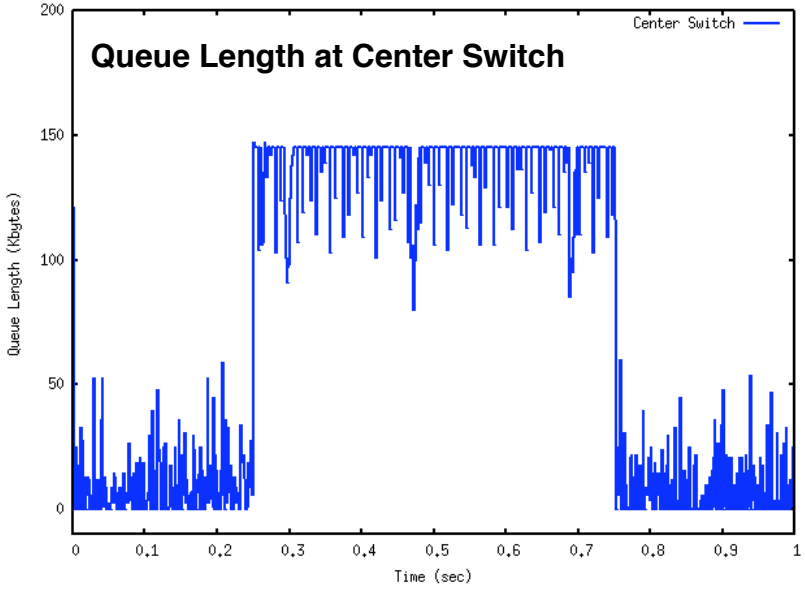

Queue Length at Right Switch
Victim Flow
Innocent Flow
Queue Length (Kbytes)
200
150
100
50
0
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1
Time (sec)


Queue Length at Center Switch
Center Switch
Queue Length (Kbytes)
200
150
100
50
0
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1
Time (sec)

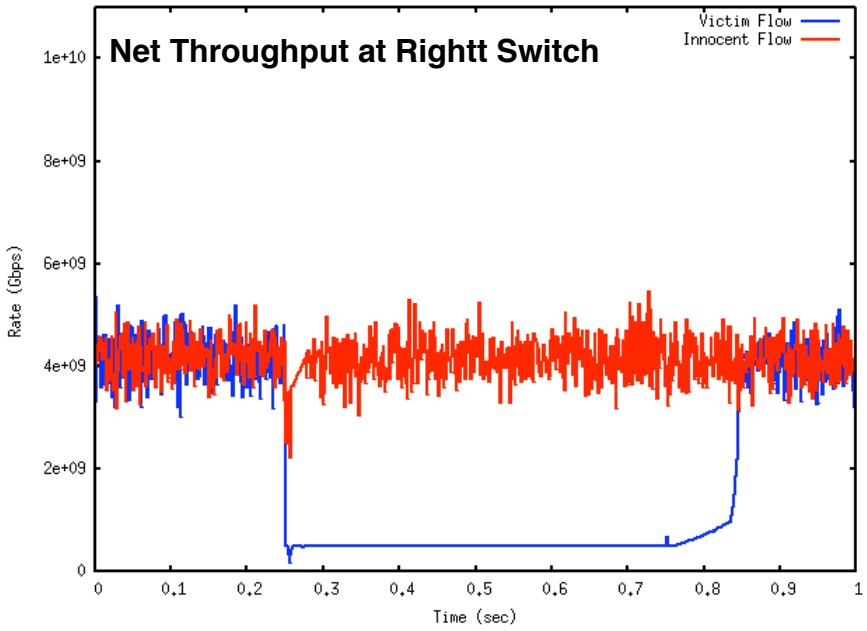
TCP and PAUSE

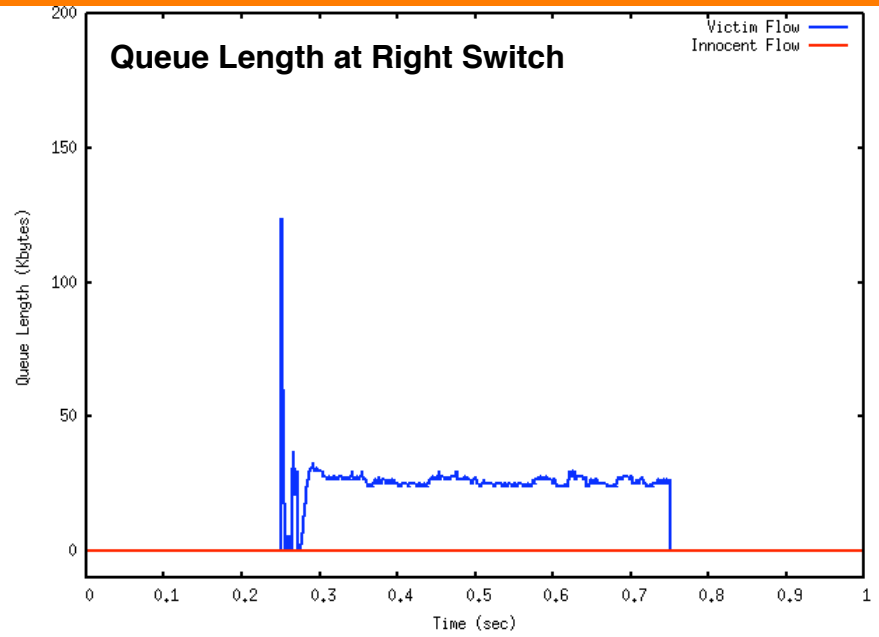


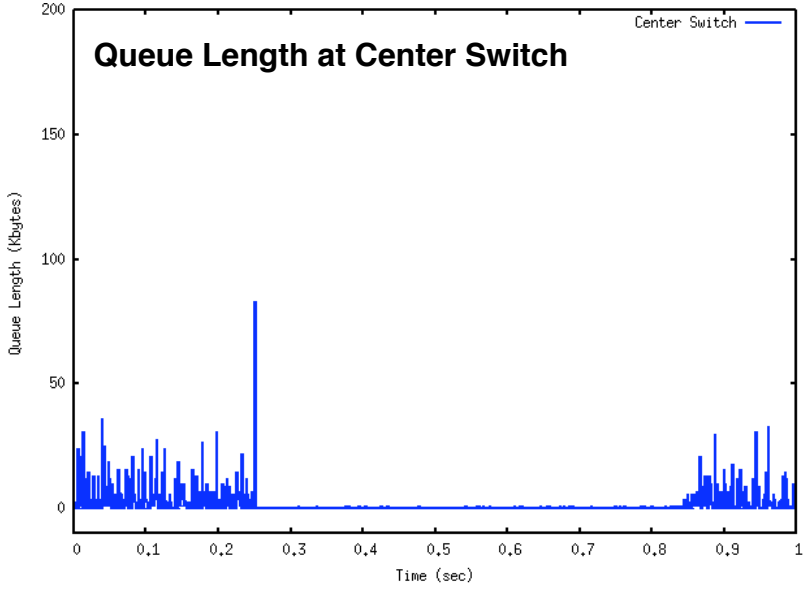




TCP, QCN and PAUSE







Interaction of QCN and TCP
Part 2

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Overview

- In Part 1 we saw how QCN helps TCP discover the correct bottleneck bandwidth
  - In this case each TCP flow had its own RL
- In Part 2 (this presentation) we consider the case where RLs are shared among TCP flows
- Potential problem with the shared rate limiters
  - When there is a multipath scenario, a shared RL causes an innocent flow to lose throughput
- Proposed solution to the problem
  - A TCP flow can adjust its sending rate if it is aware of the congestion at Layer 2
  - This can be conveyed to it via a flowid
- Simulation results

QCN parameters

- W = 2.0
- Q_EQ = 26 Kbytes
- Gd = 1/128 = 0.0078125
- Base marking: once every 150kbytes
- Jitter on marking: 30%
- MIN_RATE = 10Mb/s
- BC_LIMIT = 150kbytes
- TIMER_PERIOD = 15ms
- R_AI = 5Mbps
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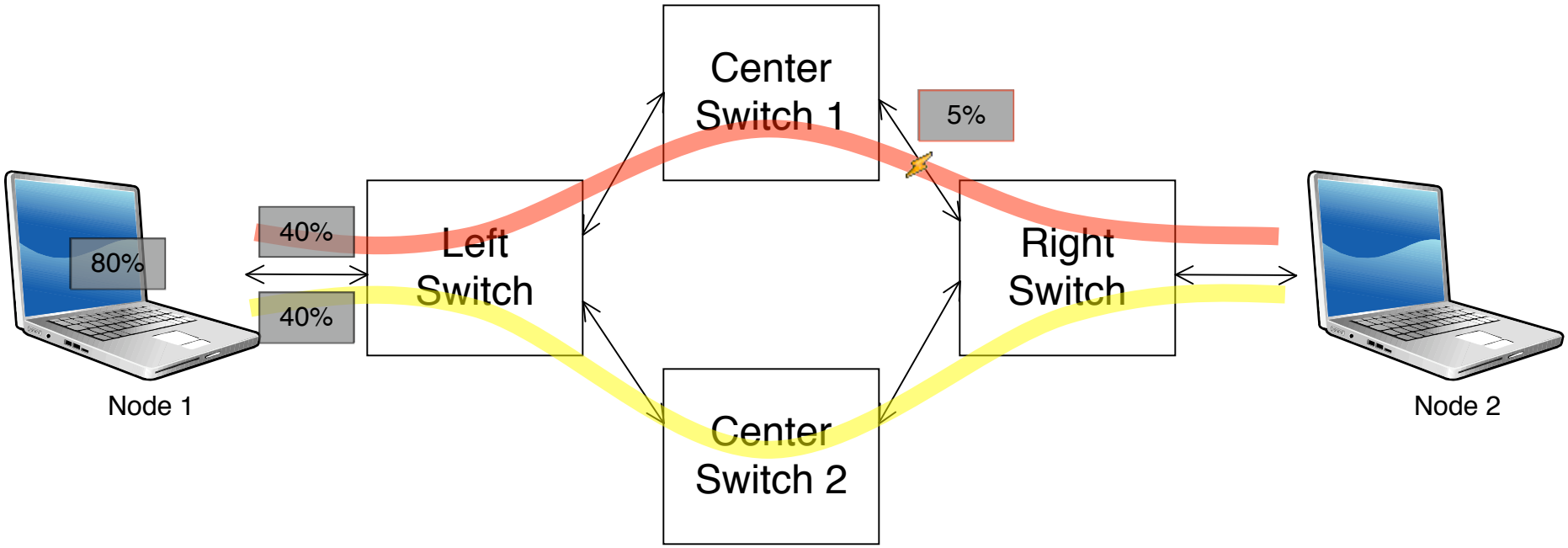
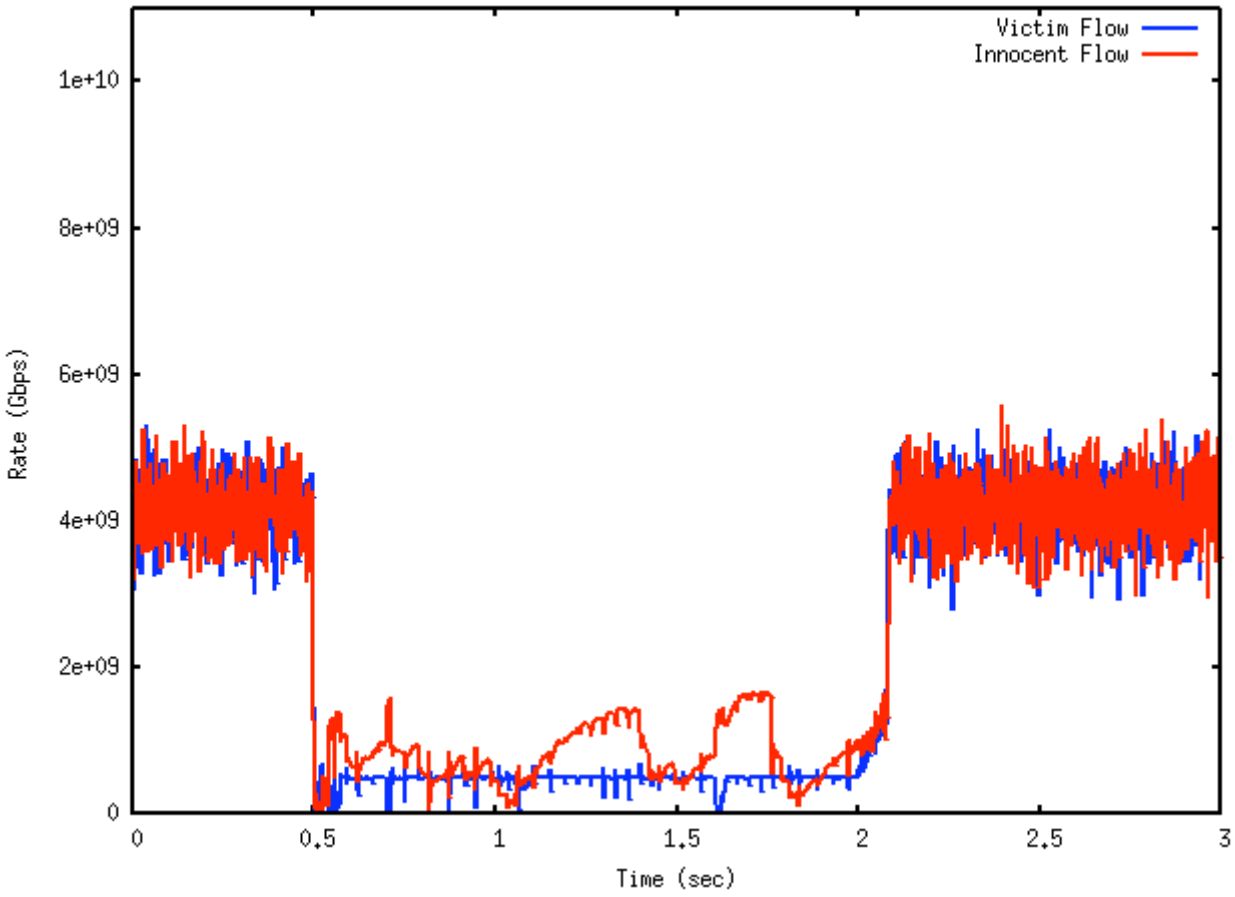
Topology and Workload



- Topology
  - Link Speed → 10Gbps for all links
  - Loop Latency → 200us
- Traffic Pattern
  - 9k byte transactions arriving with a Bernoulli distribution
  - Two TCP flows at Node 1 generate a total traffic of 8Gbps (80%)
  - Flow 1 sends data to Node 2 at 4Gbs (40%) using the path LS -> CS1 -> RS
  - Flow 2 sends data to Node 2 at 4Gbs (40%) using the path LS -> CS2 -> RS
- Congestion Scenario
  - CS1 temporarily reduces its service rate from 10Gbps to 500Mbps between [500ms-2s]

Throughput of the Flows (QCN and TCP)



Problem

- Ideally victim flow should get 500Mbps and innocent flow should get 4Gbps
- Shared RL causes innocent flow to also get around 500Mbps

Proposed solution

- If victim TCP flow was aware of the congestion, it could adjust its rate and innocent flow need not be affected
- RL is aware of the congestion
- RL can notify victim TCP flow
  - Drop a packet of the victim flow or,
  - Set the ECN bit of a packet of the victim flow
- In our scheme, we drop a packet of the victim flow

Simulation Results