QCN: An Update of Benchmark Simulations

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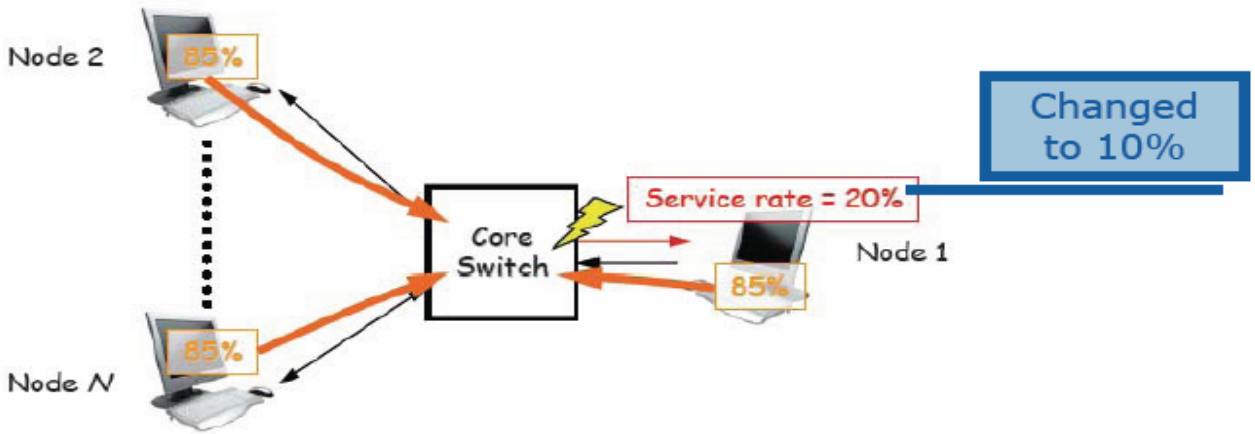
Simulation Parameters

- Traffic
  - i.i.d. Bernoulli arrivals
  - Uniform destination distribution (to all nodes except self)
  - Fixed frame size = 1500 B

- QCN
  - W = 2.0
  - Q_EQ = 33 KB
  - GD = 0.0078125
  - Base marking: once every 150 KB
  - Margin of randomness: 30%
  - R_{unit} = 1 Mb/s
  - MIN_RATE = 10 Mb/s
  - BC_LIMIT = 150 KB
  - TIMER_PERIOD = 15 ms
  - R_AI = 5 Mbps
  - R_HAI = 50Mbps
  - FAST_RECOVERY_TH = 5
  - Quantized_Fb: 6 bits

Baseline #1

1. Output Generated Hot Spot Single Hop



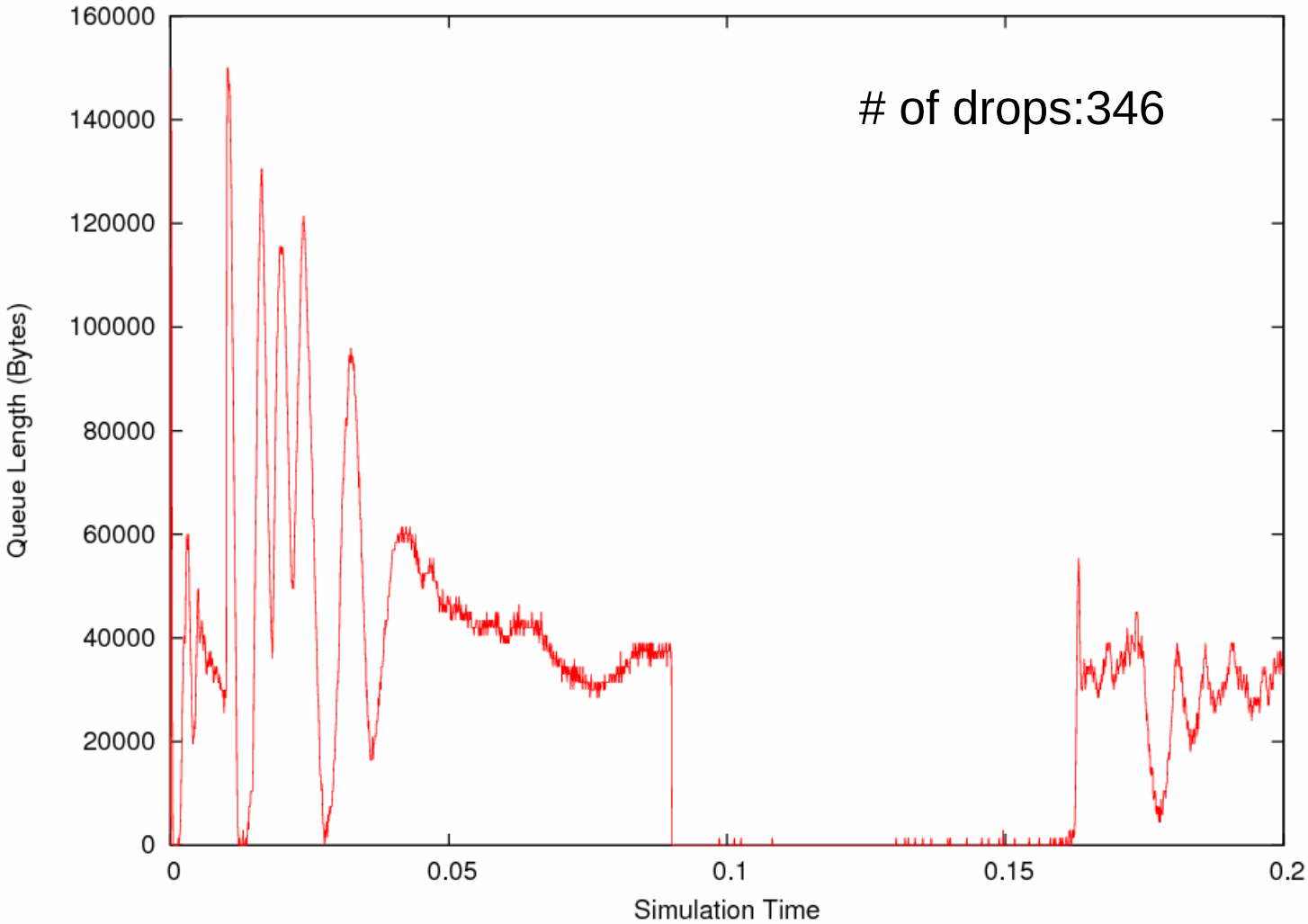
Workload:

- All Nodes (10) : Uniform Distribution, load = 8.5Gbps
- Node 1 Service Rate = 1Gbps
- One Congestion Point
  - Hotspot:
    - Degree: 9, Severity = 8.5:1,
    - Duration: 80 mS from ti=10 to 90 mS

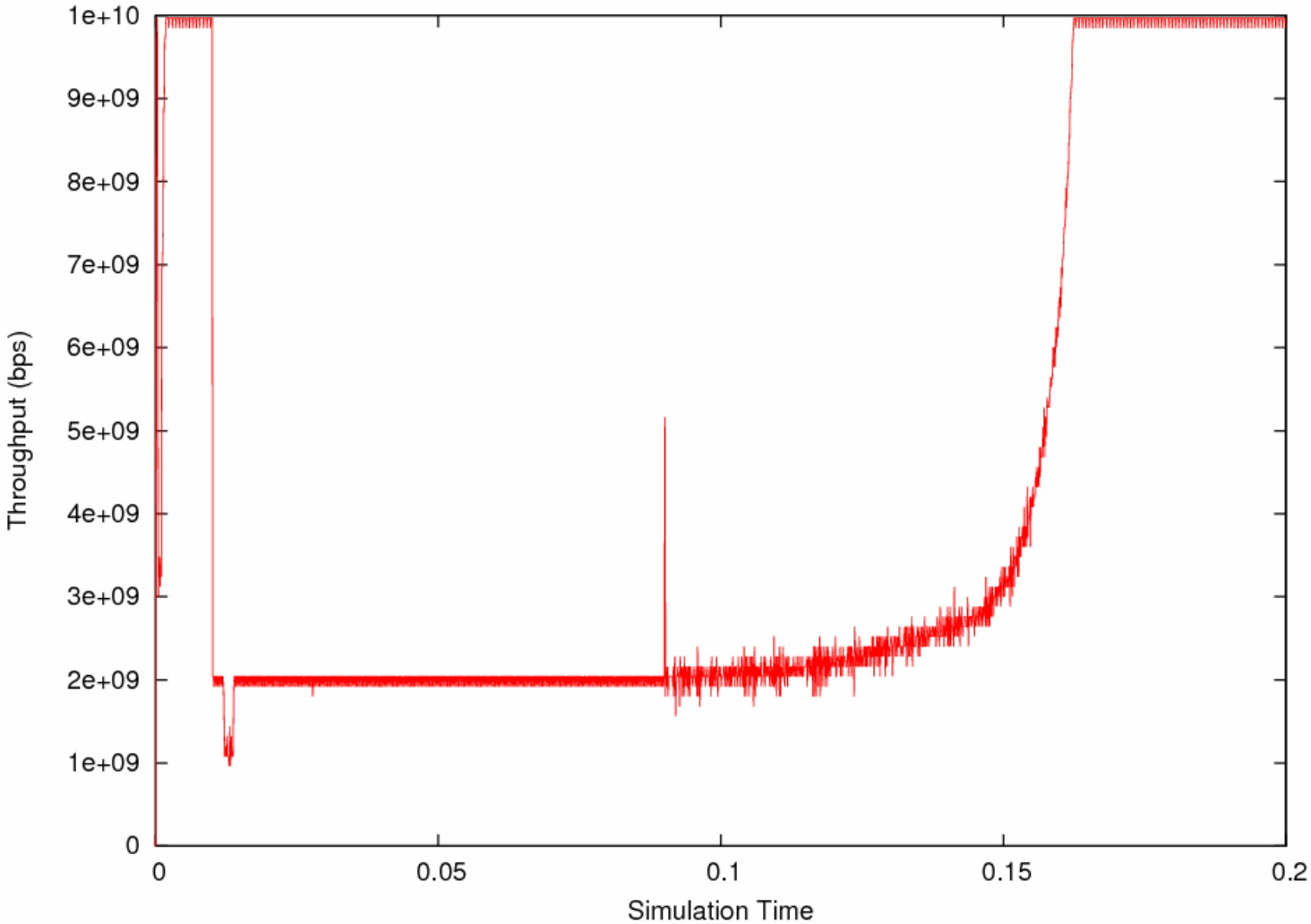
- Scenarios: 2Gbps, 1Gbps, 0.5Gbps OG service rates

Required

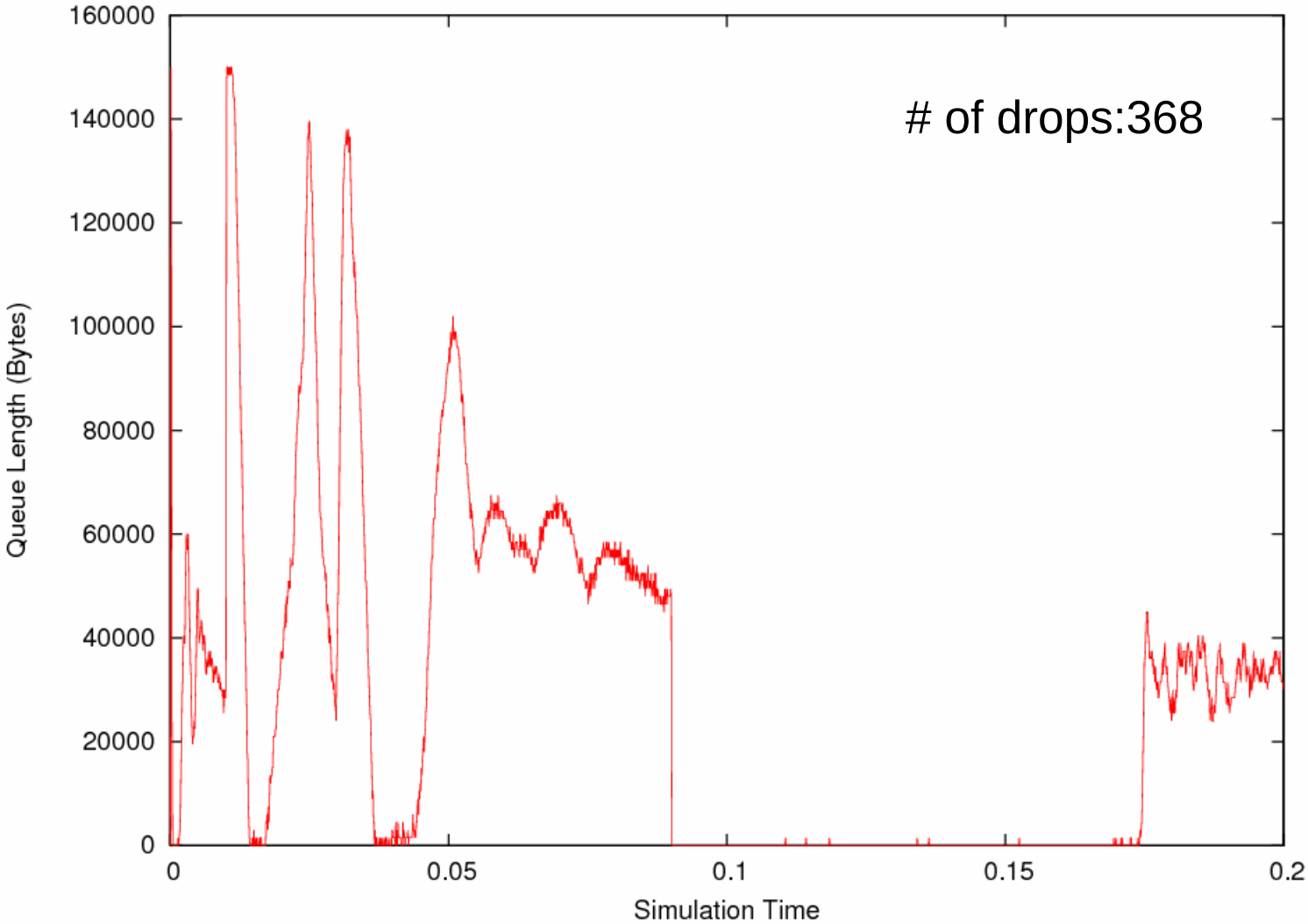
Service Rate: 2.0Gbps - Queue Size



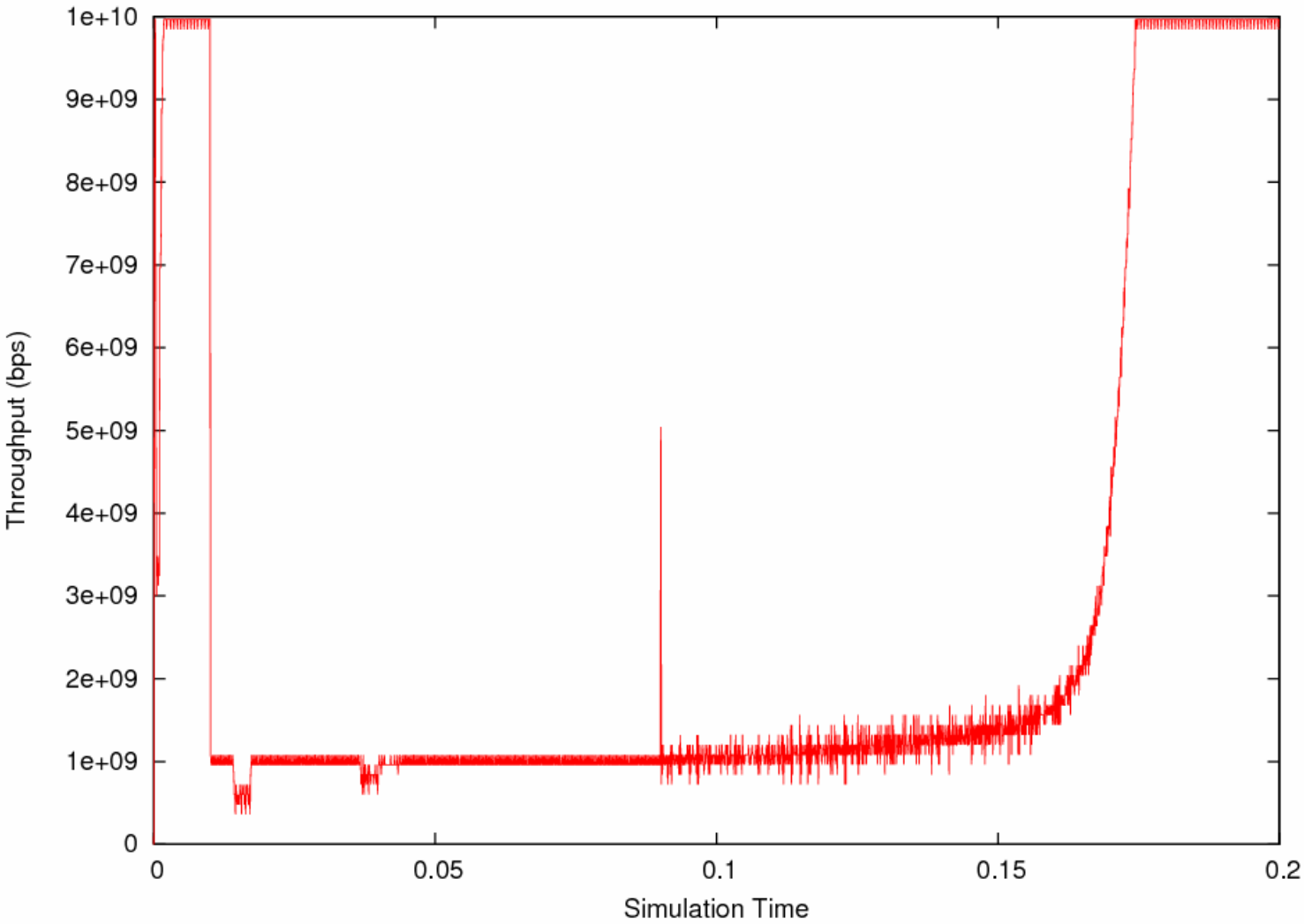
Service Rate: 2.0Gbps - Throughput



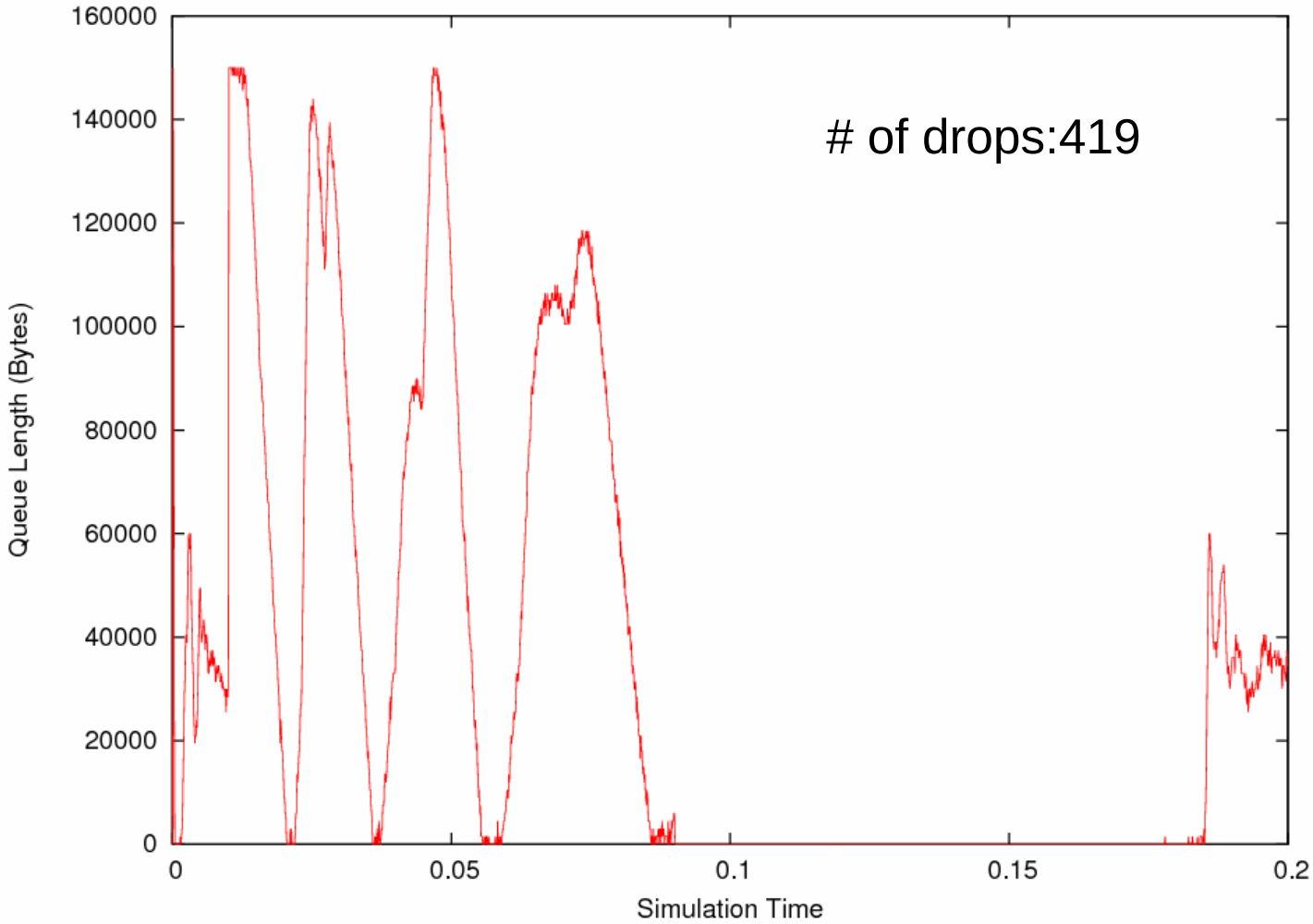
Service Rate: 1.0Gbps - Queue Size



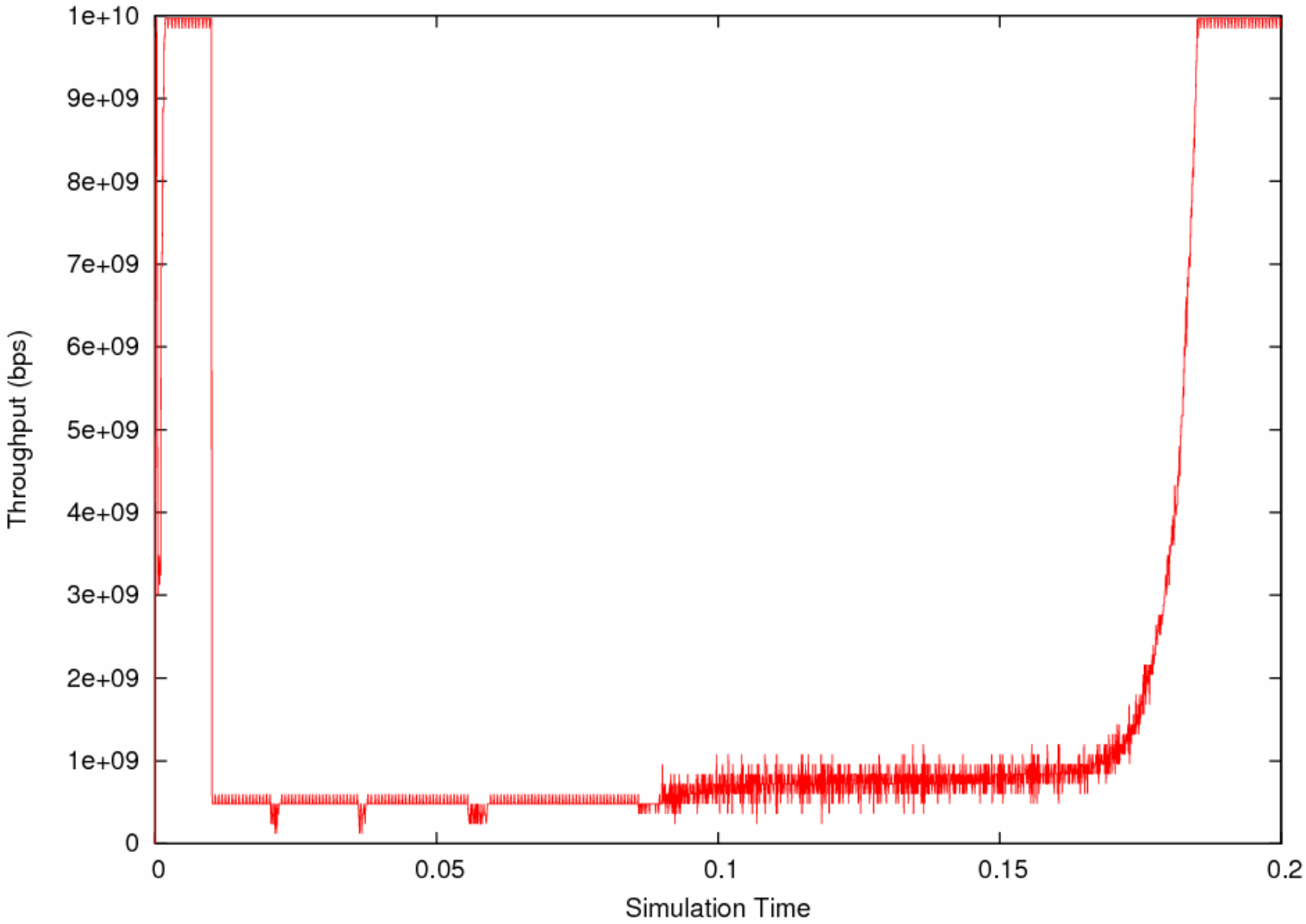
Service Rate: 1.0Gbps - Throughput



Service Rate: 0.5Gbps - Queue Size

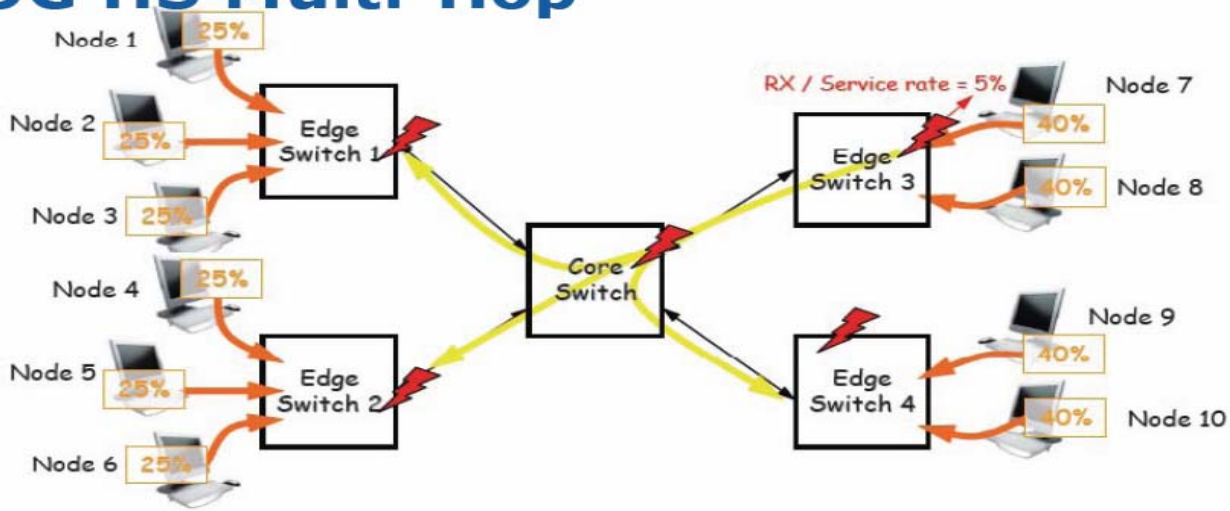


Service Rate: 0.5Gbps - Throughput



Baseline #2

2. OG HS Multi-Hop



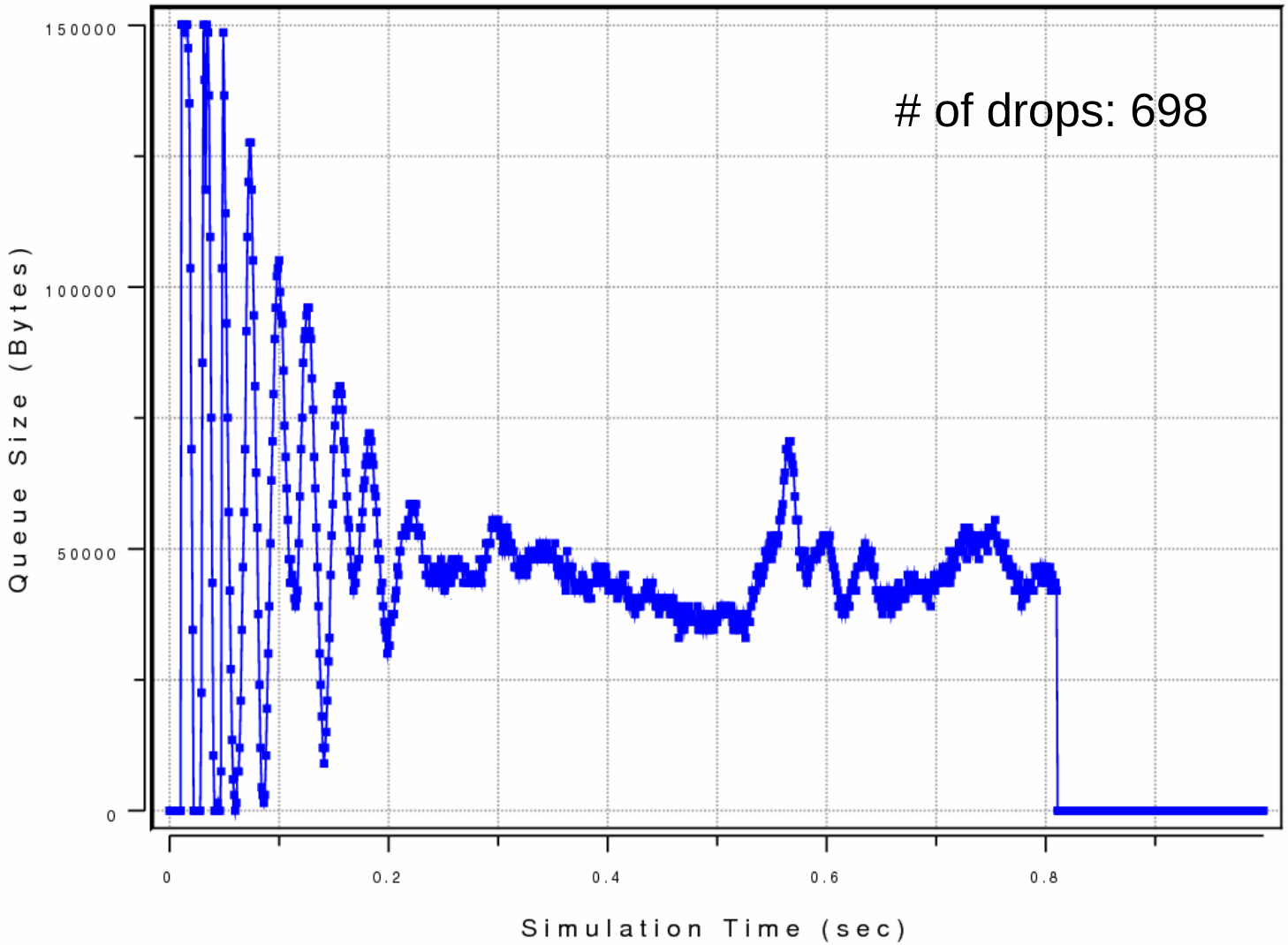
Workload:

- All: Uniform distribution traffic (background traffic)
- Nodes 1-6: 25% (2.5Gbps), Nodes 7-10: 40% (4 Gbps)
- Primary Hotspot:
  - Node 7 service rate = 5% (Rx only)
  - If saturation tree spreads => 5 congestion points total

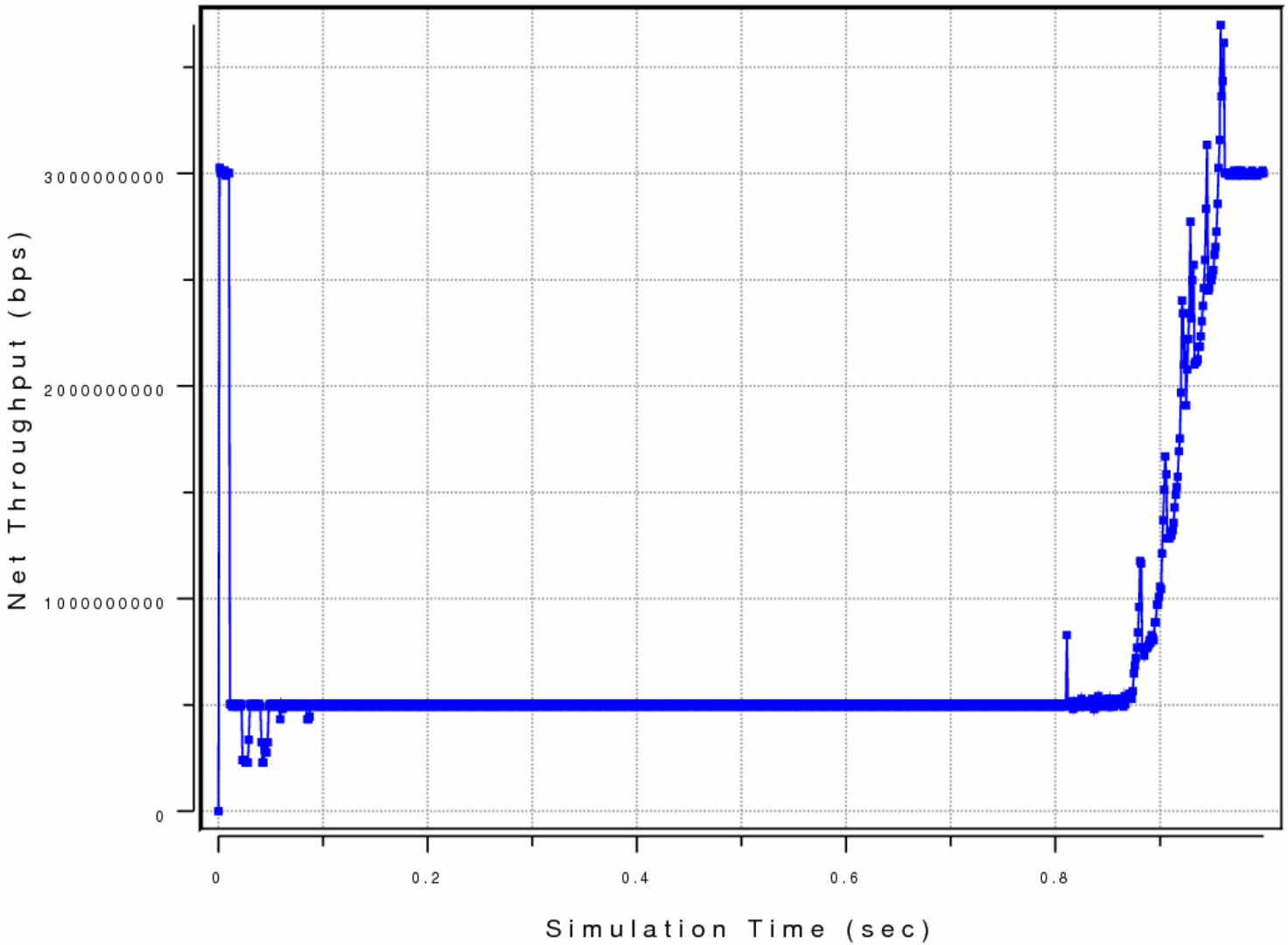
- Scenarios:
  - PAUSE: Enabled/Disabled

Required

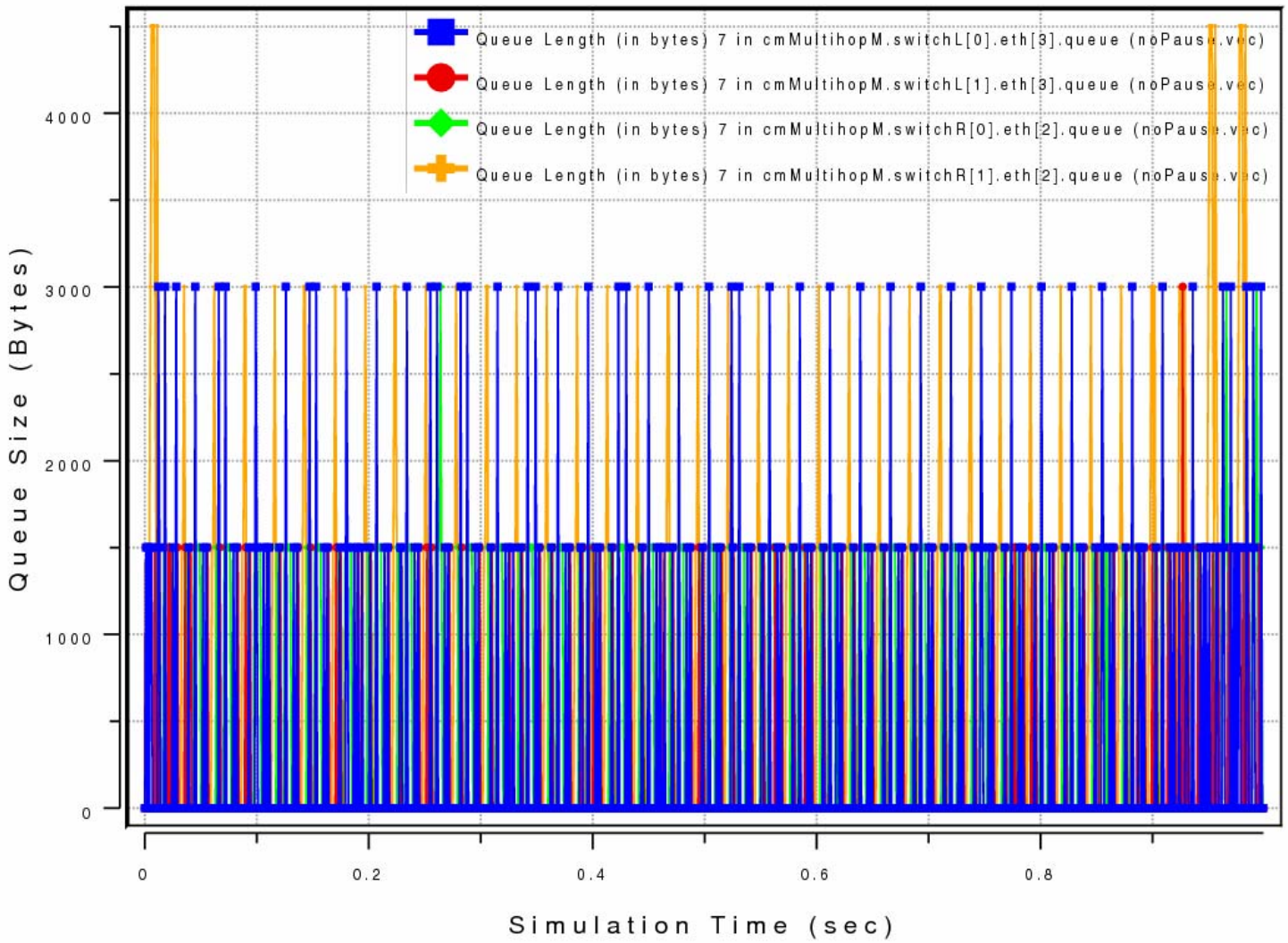
Without Pause
- Congested Queue Size (0.5Gbps)



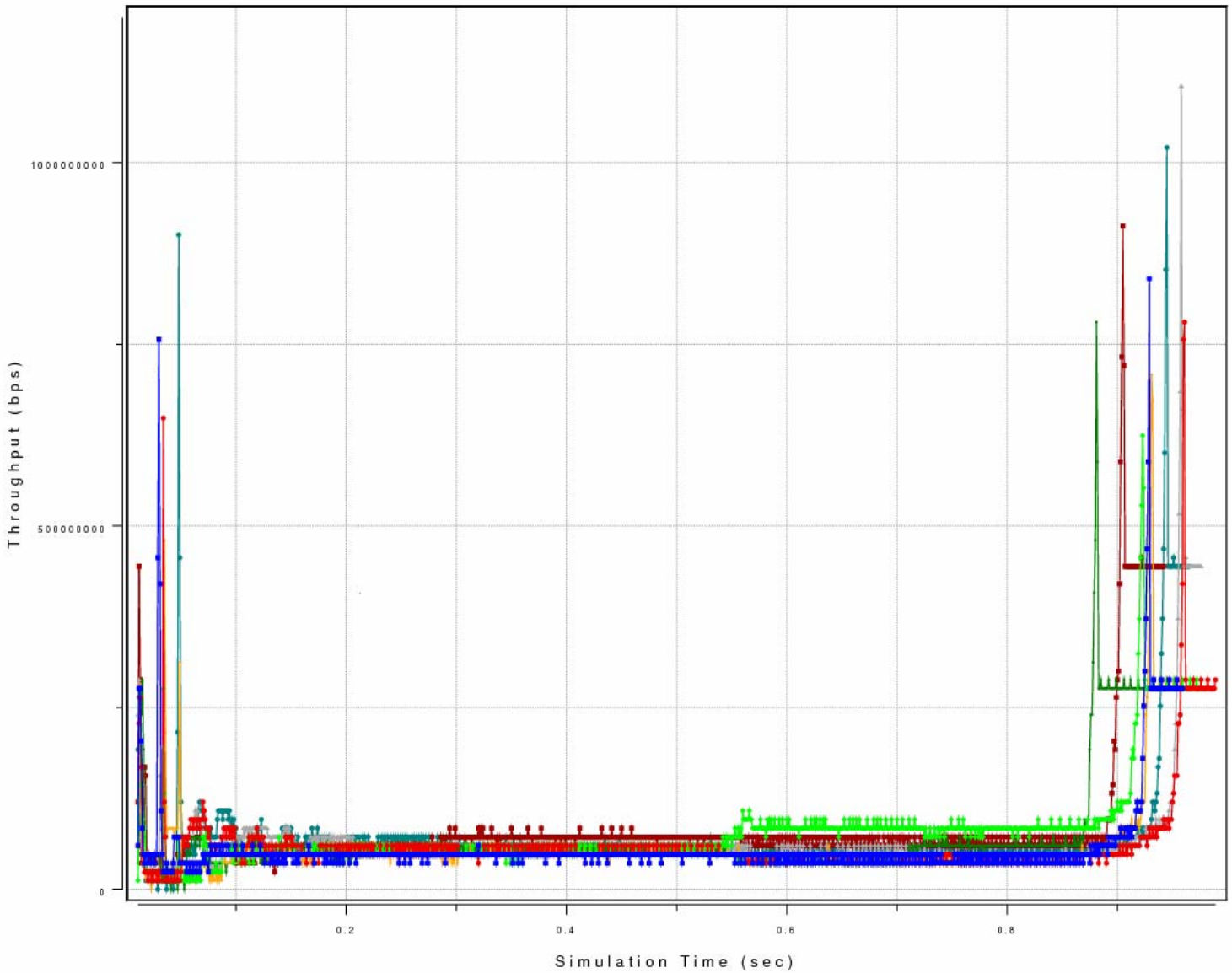
Benchmark 2 – Bottleneck Throughput



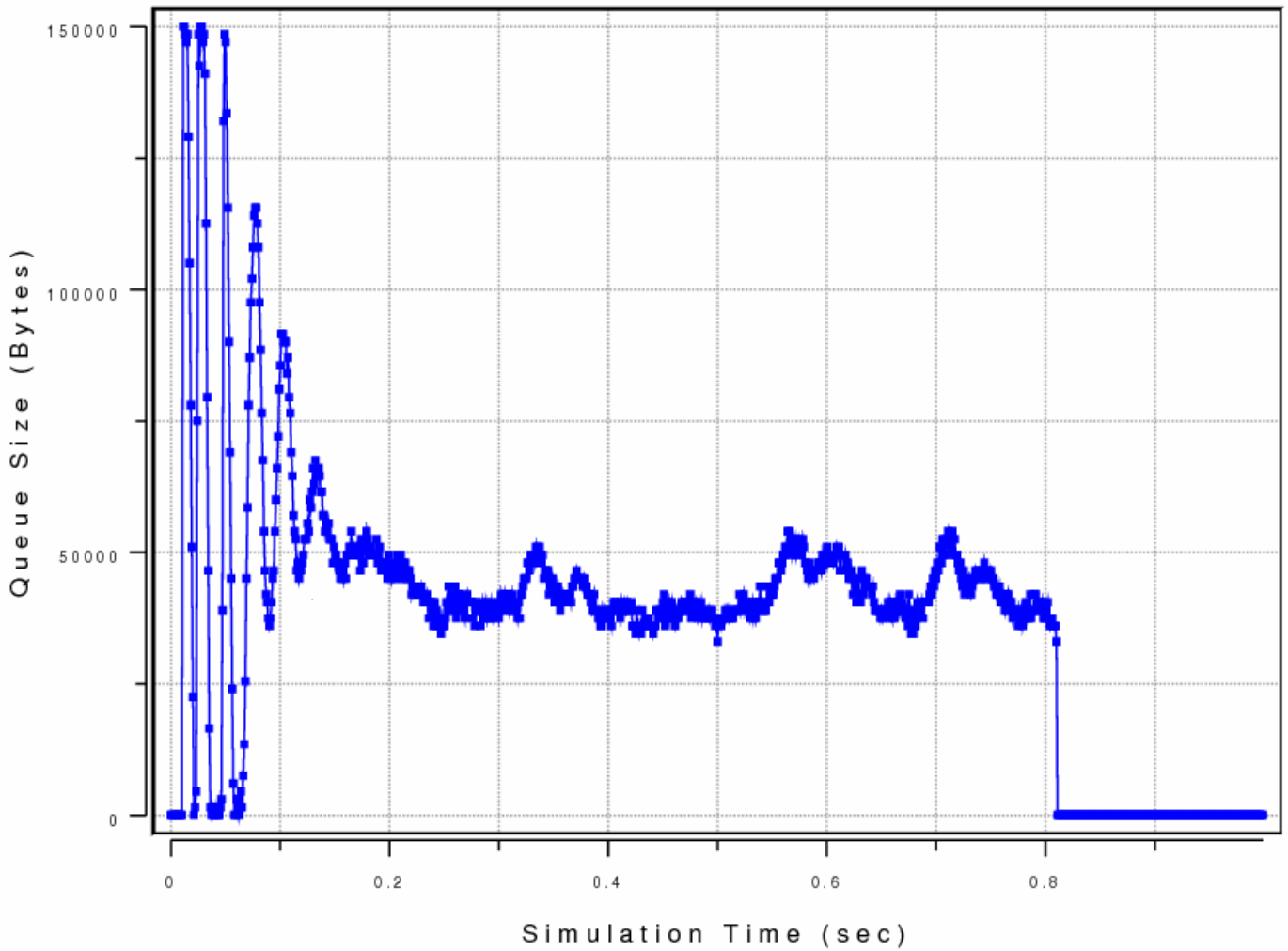
Without Pause
- Uncongested Queue Size (0.5Gbps)



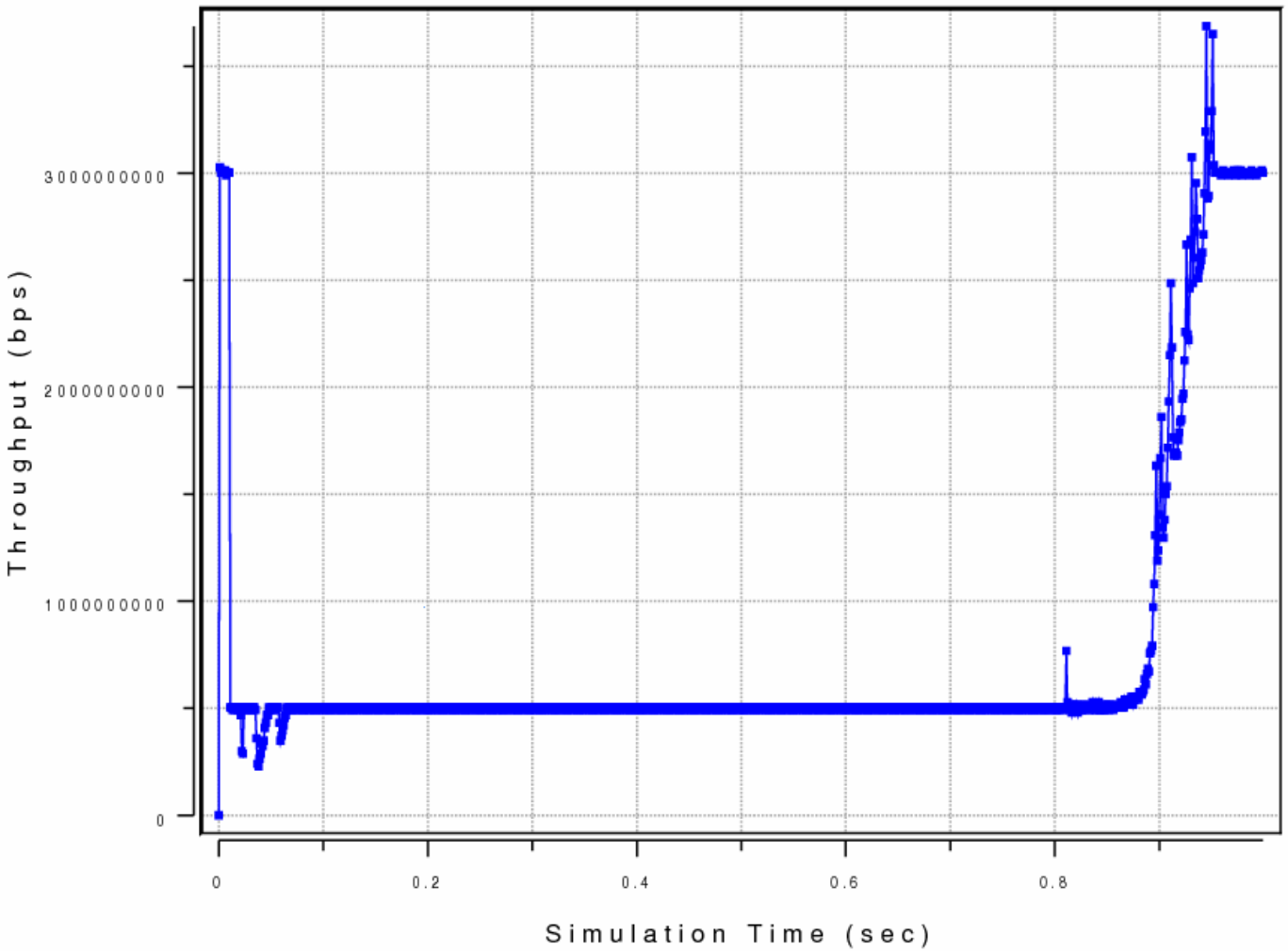
Benchmark 2 – Individual Flows' Throughput



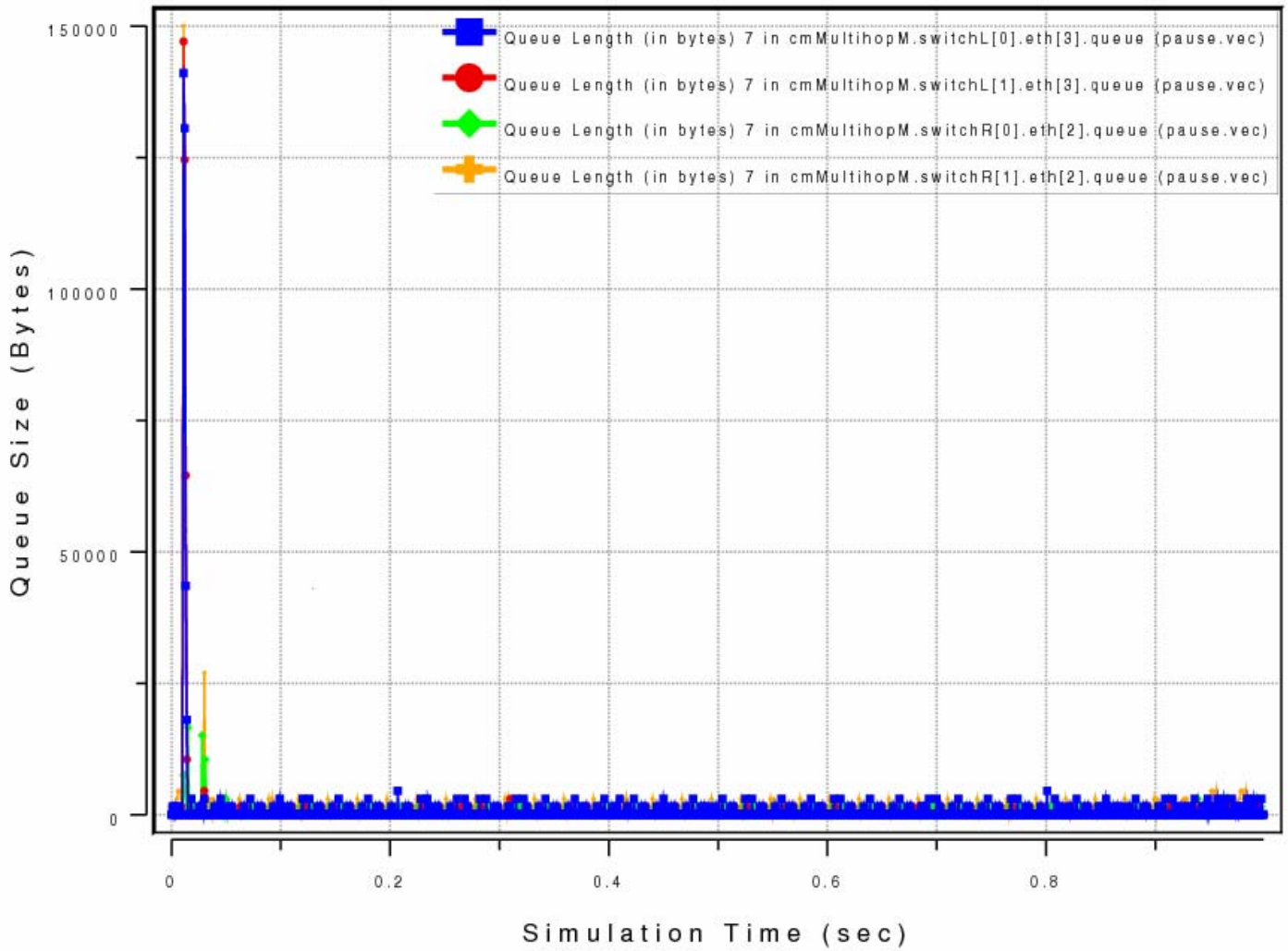
With Pause
- Bottleneck Queue Size



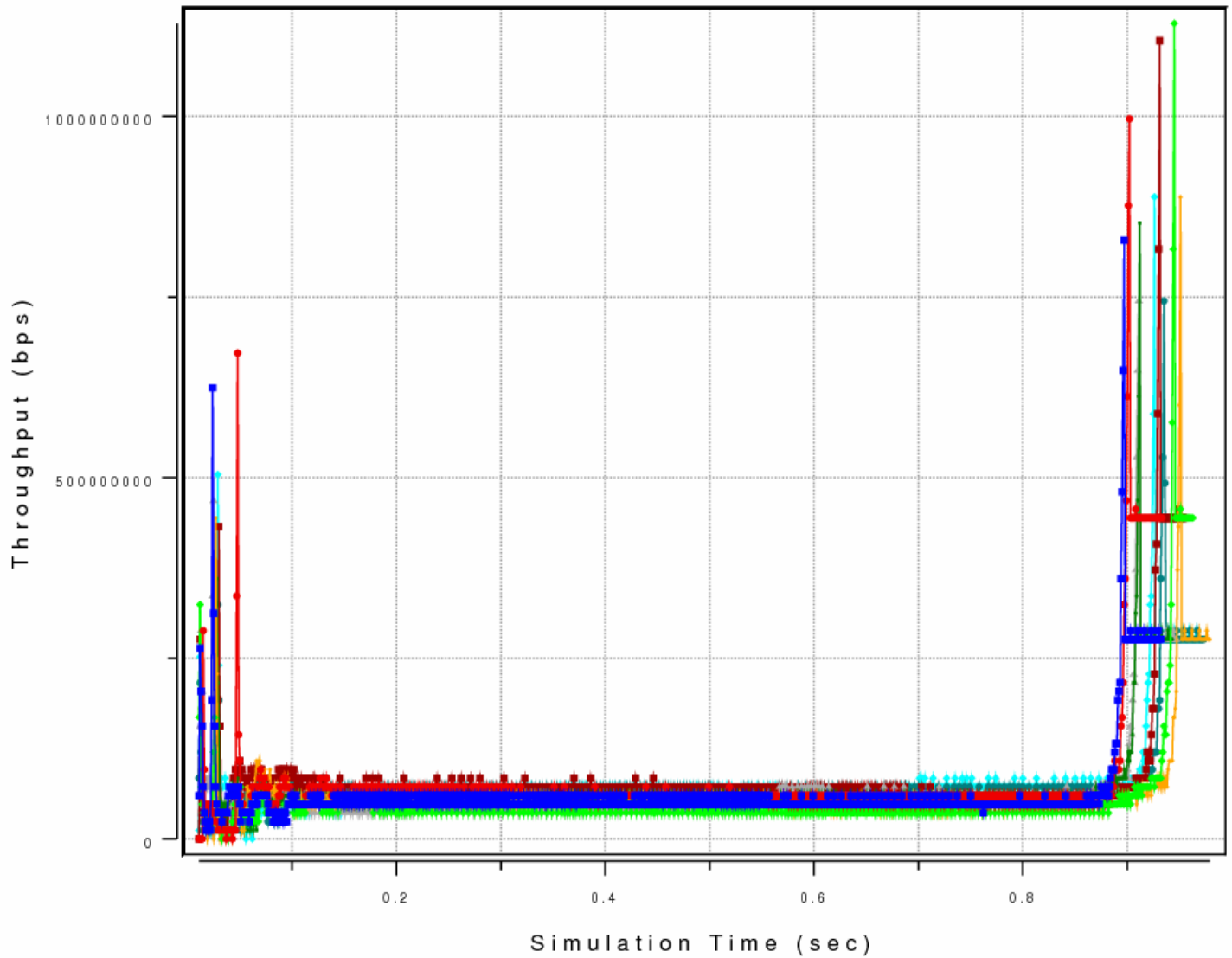
Benchmark 2 – With Pause
- Bottleneck Link Throughput (bps)



Benchmark 2 – With Pause - Uncongested Queue Size

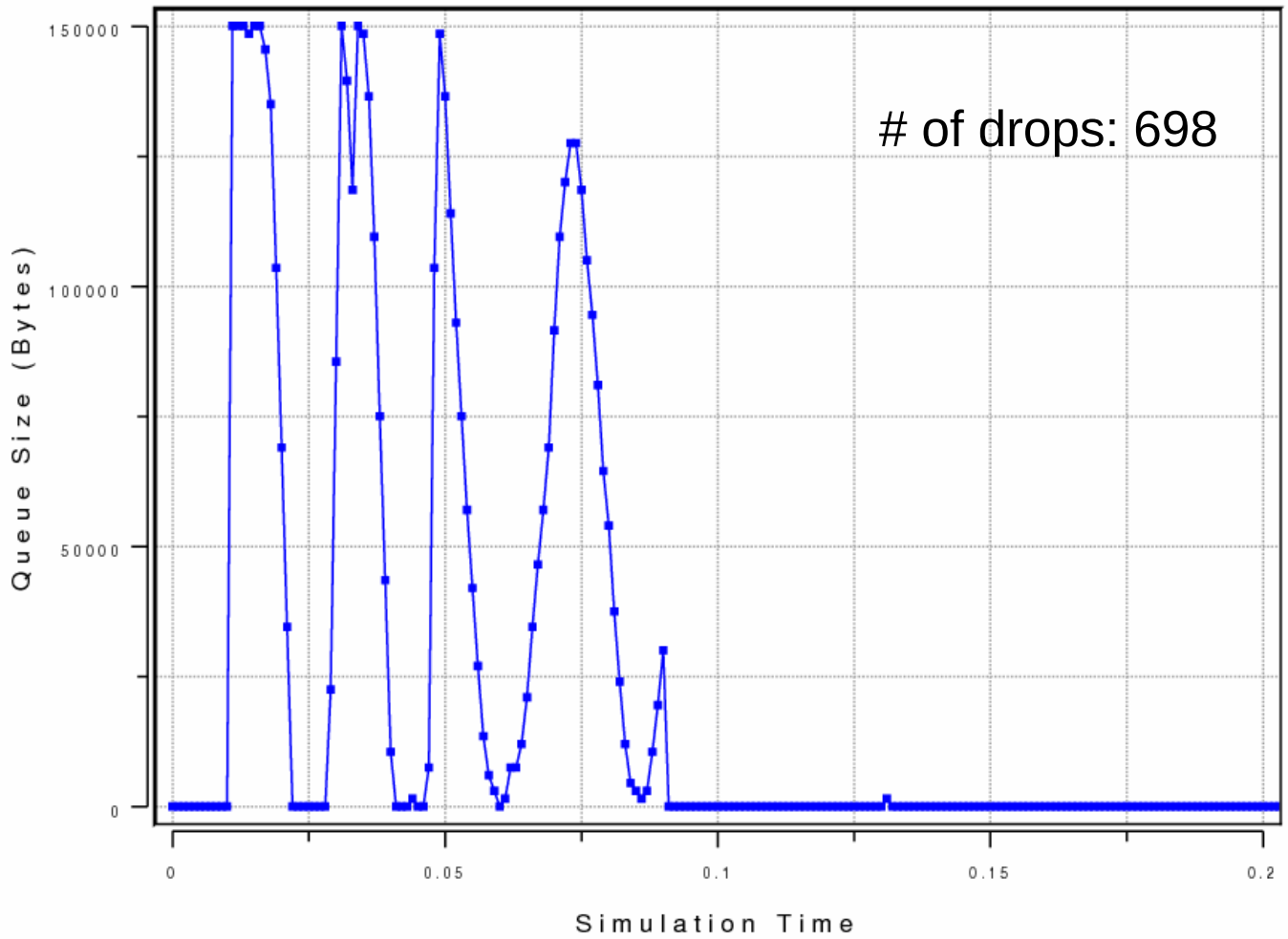


Benchmark 2 – With Pause
- Individual Flow Throughput (bps)

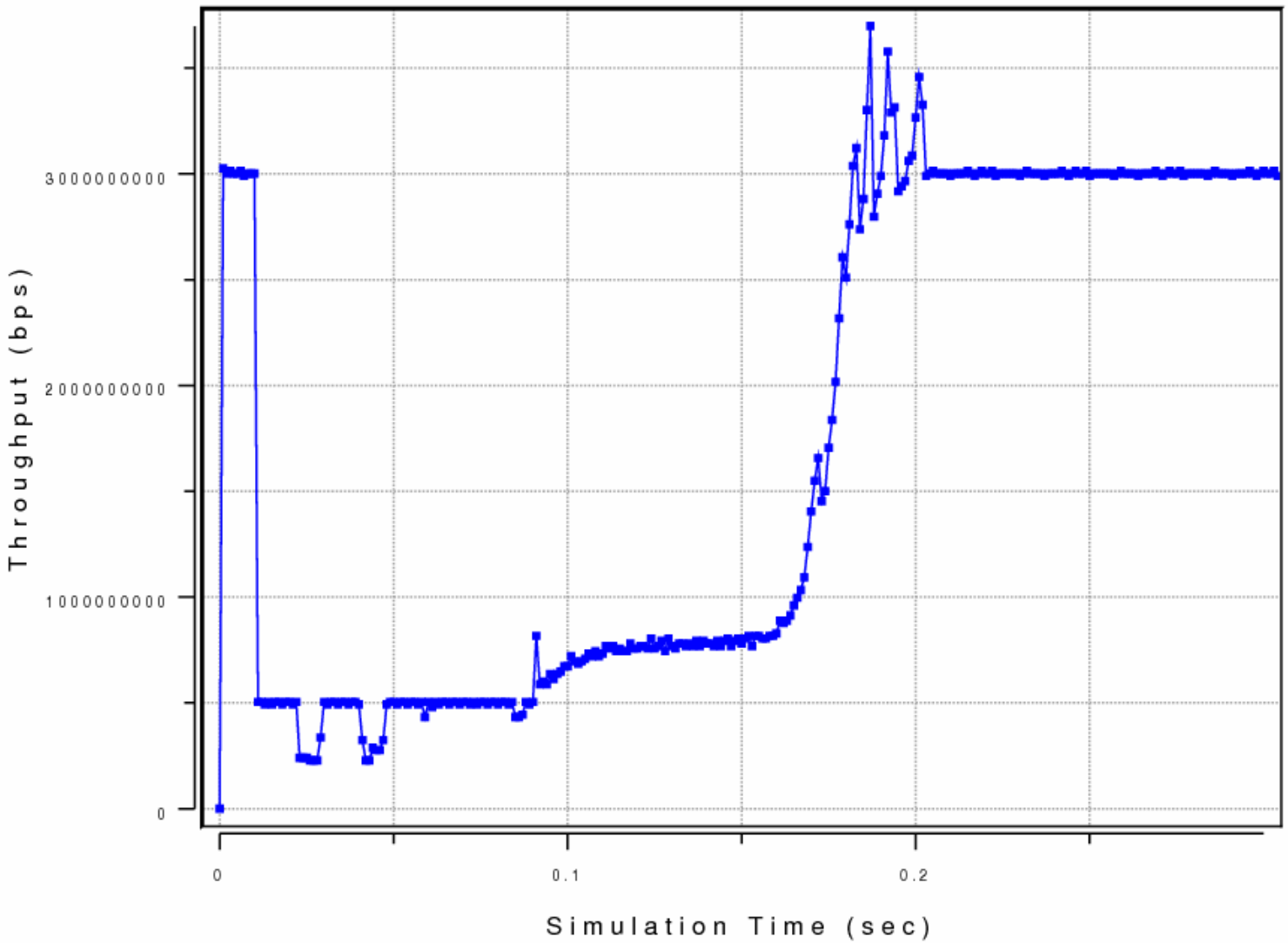


Scenario 2: 80ms Hot Spot Duration

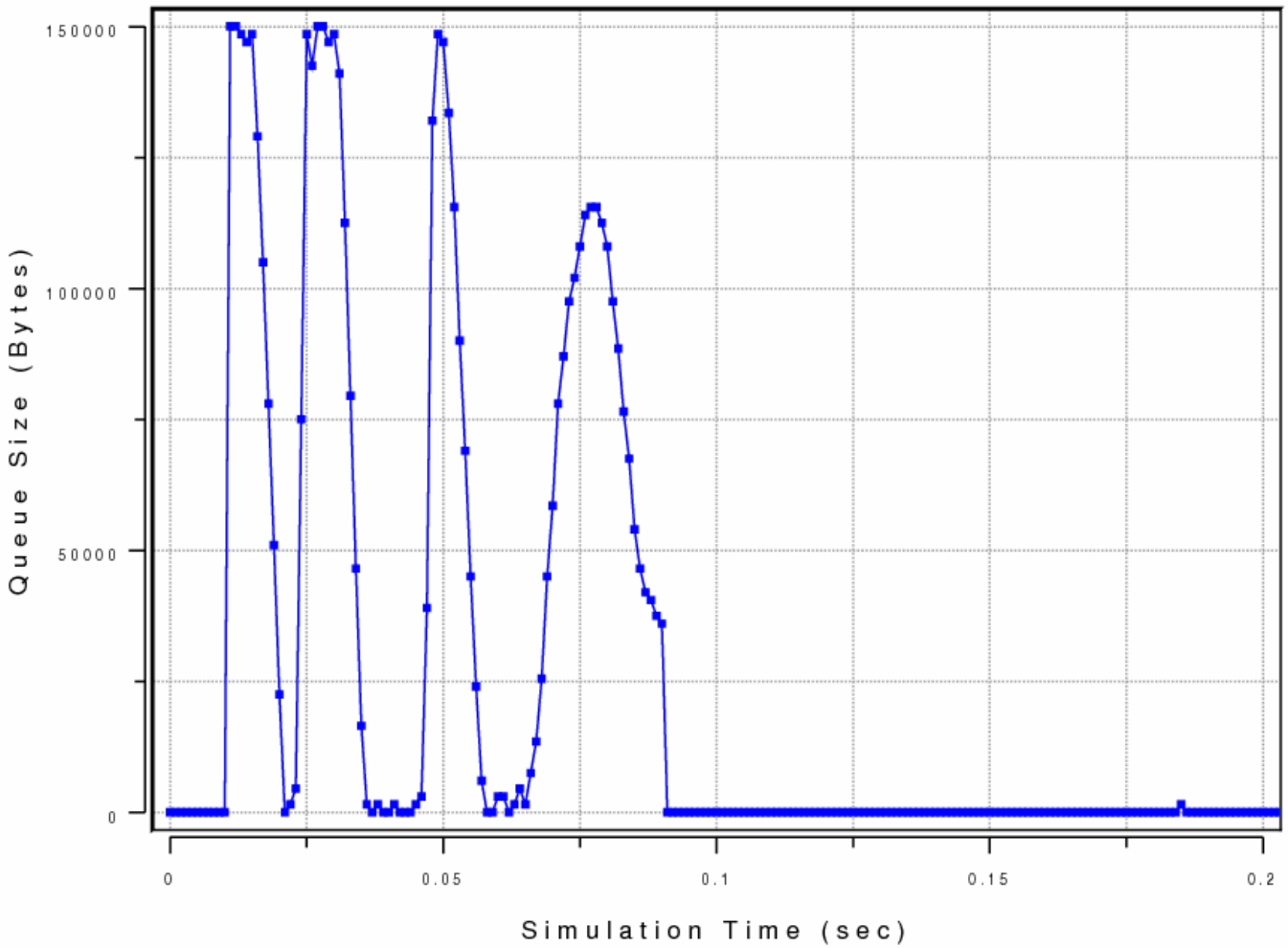
Without Pause
(80ms Hot Spot Duration)
- Congested Queue Size (0.5Gbps)



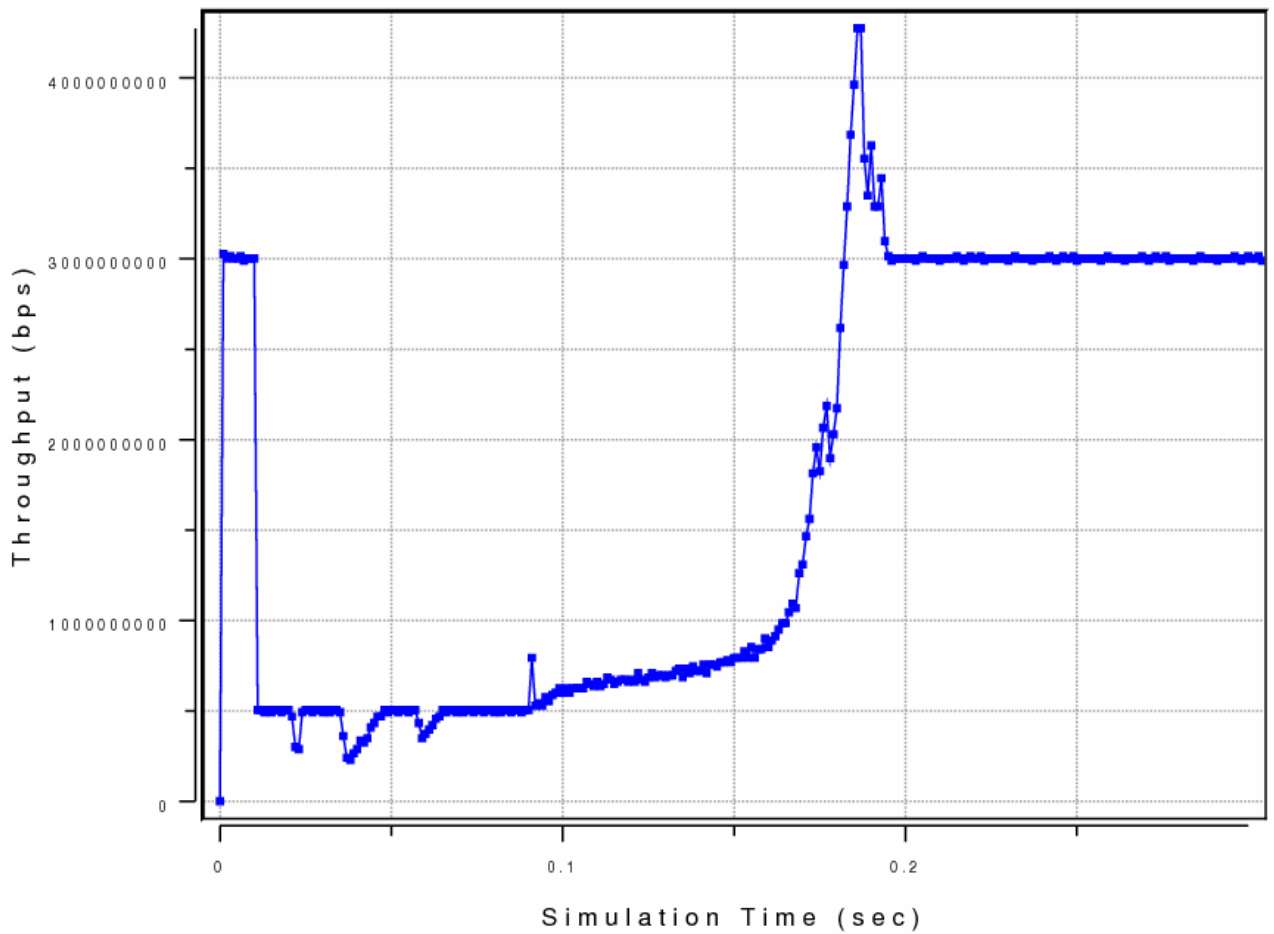
Benchmark 2 (80ms Hot Spot Duration) – Bottleneck Throughput



With Pause
(80ms Hot Spot Duration)
- Congested Queue Size (0.5Gbps)

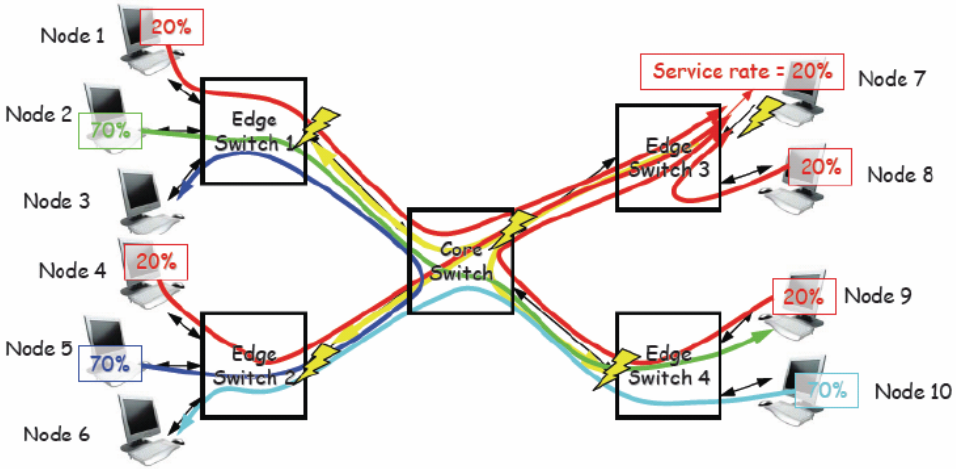


Benchmark 2 (80ms Hot Spot Duration) – Bottleneck Throughput



Benchmark 3

3. OG HS Multi-Hop: Selected Victims

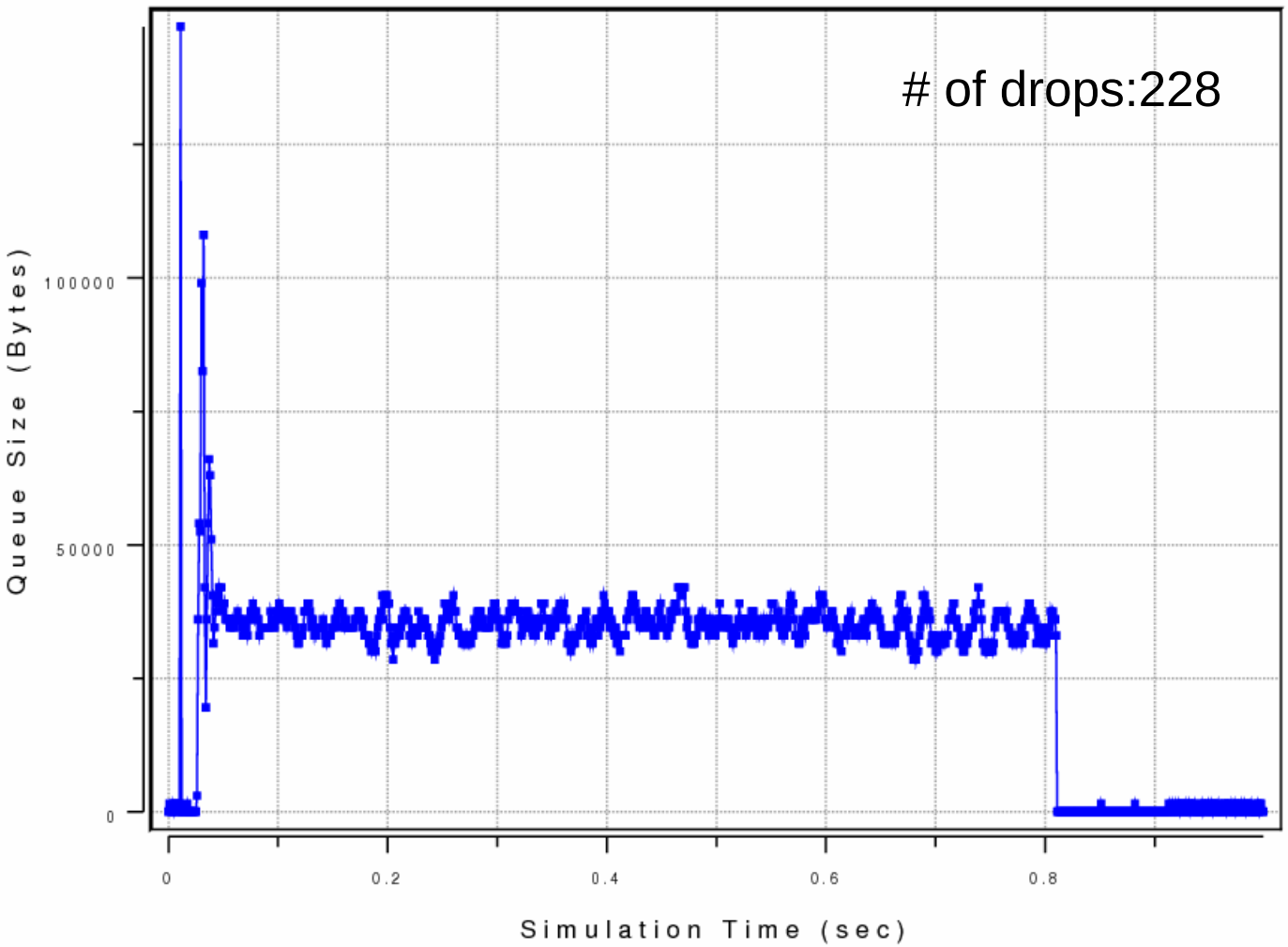


Workload:

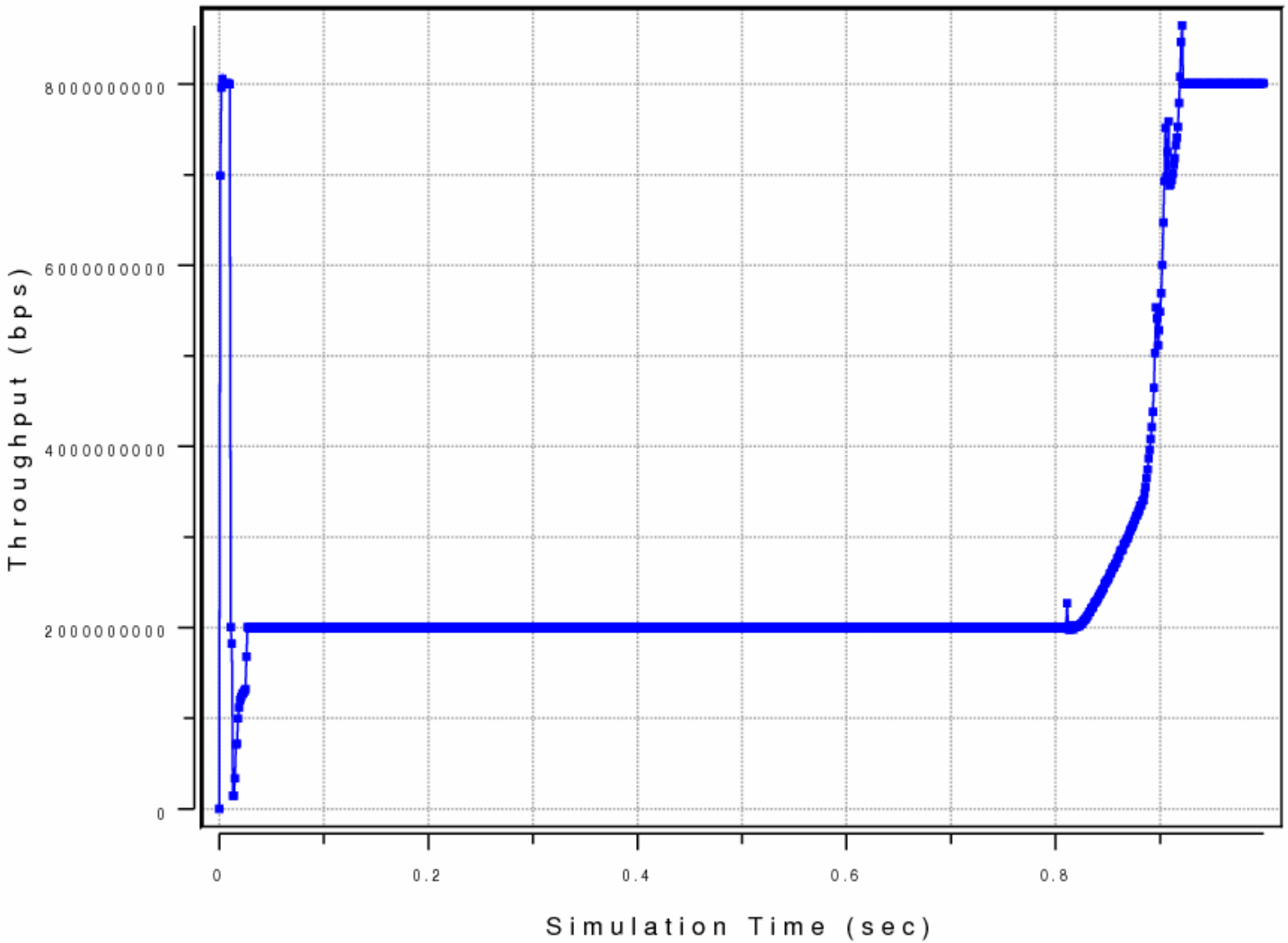
- Four culprit flows of 2 Gb/s each from nodes 1, 4, 8, 9 to node 7 (hotspot)
- Three victim flows of 7 Gb/s each: node 2 to 9, node 5 to 3, node 10 to 6
- Node 7 service rate = 20%
- Five congestion points, All switches and all flows affected
- Fair allocation provides 0.5 Gb/s to all culprits and 7 Gb/s to all victim

Required

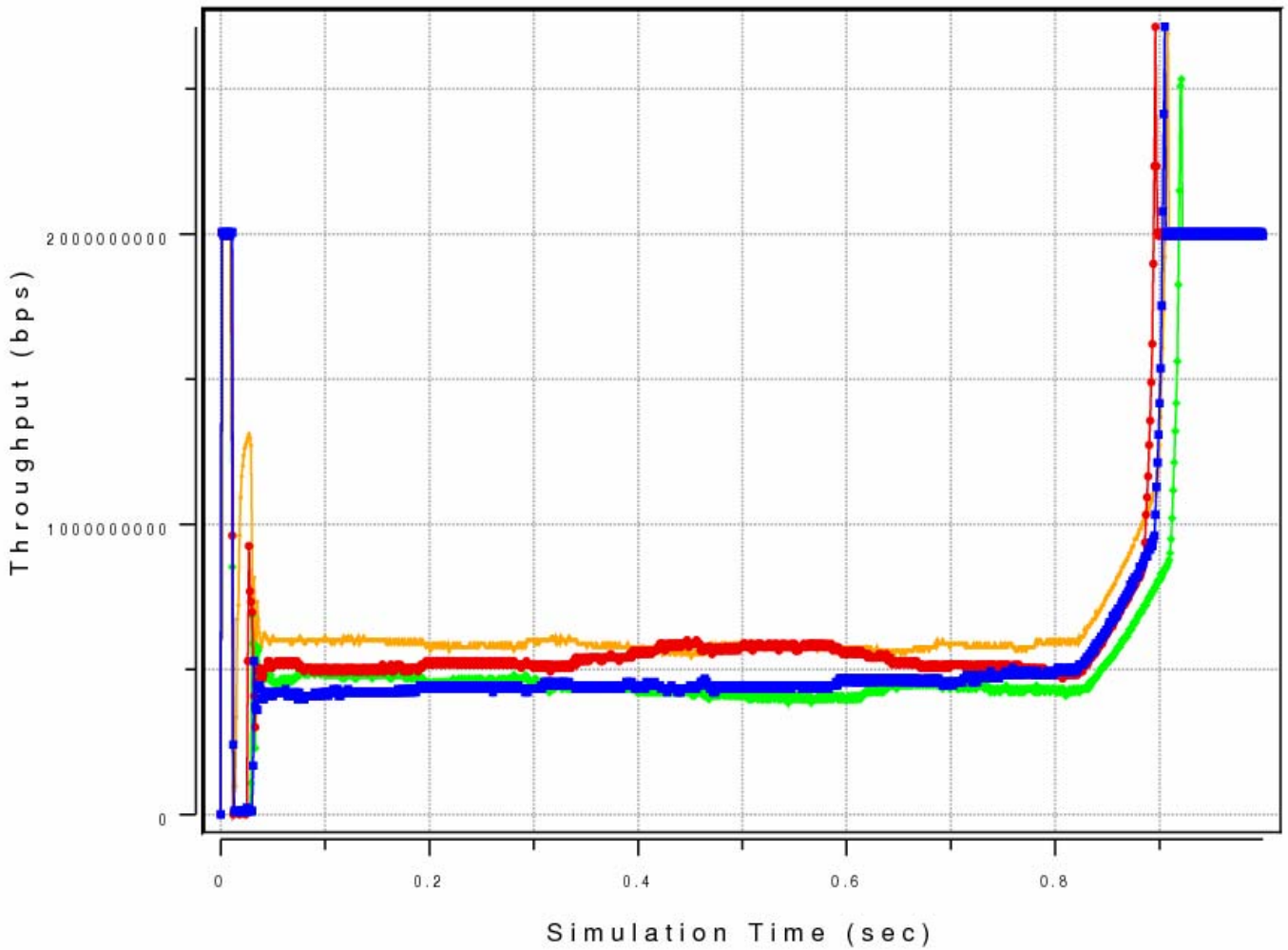
Without Pause
- Bottleneck Queue Size (2Gbps)



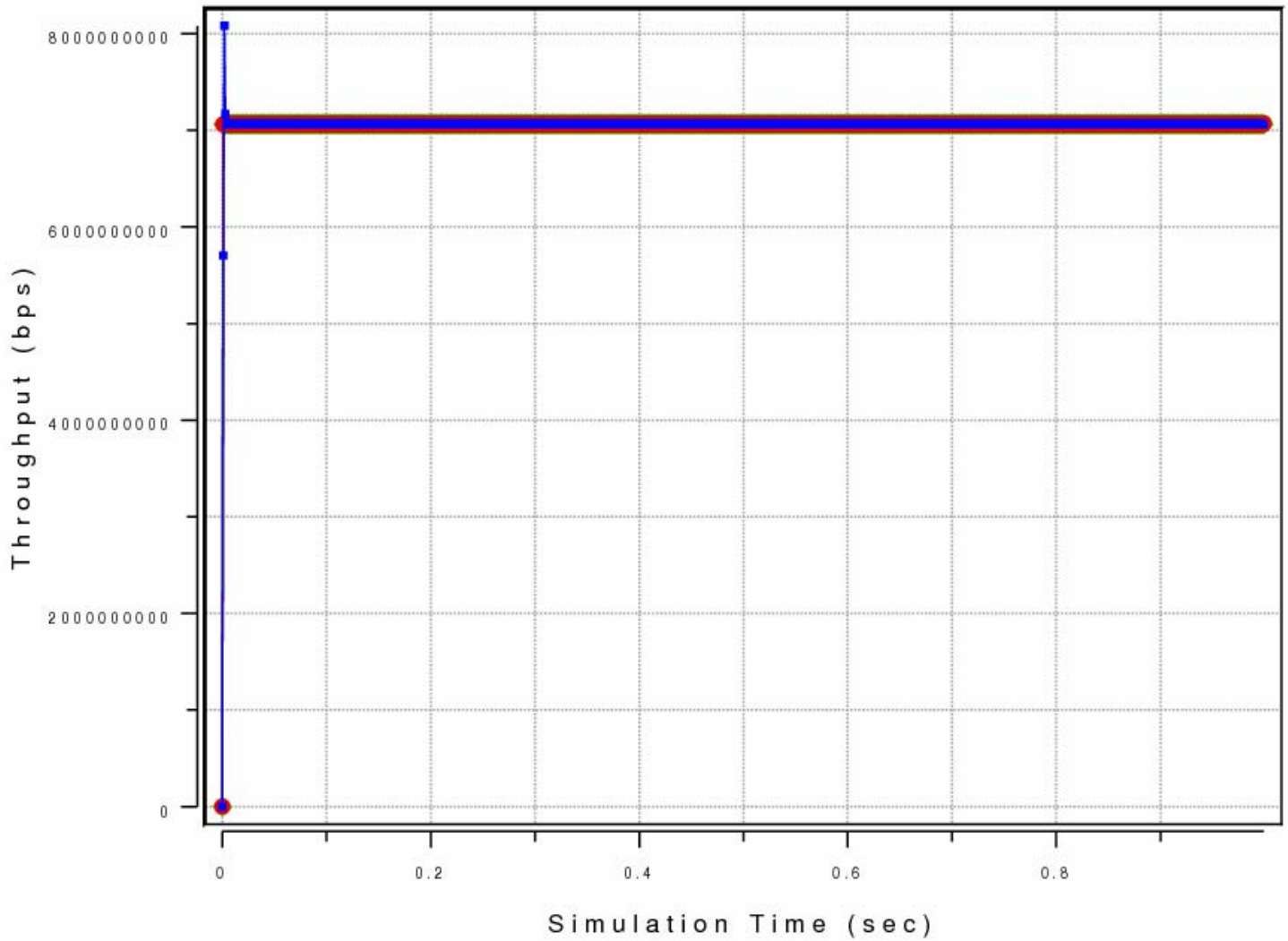
Without Pause
- Bottleneck Throughput



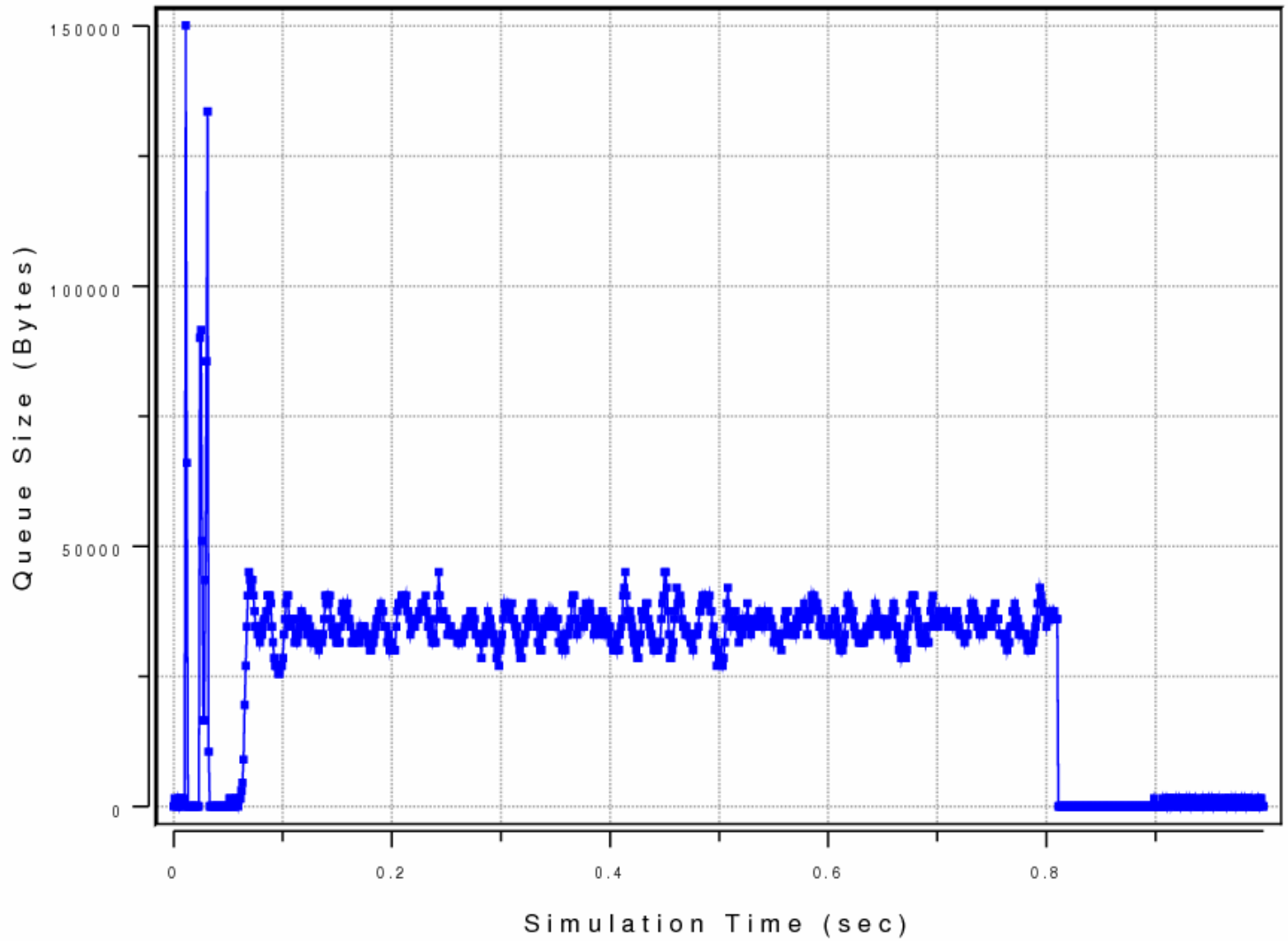
Culpit Flows - Throughput (0.5Gbps)



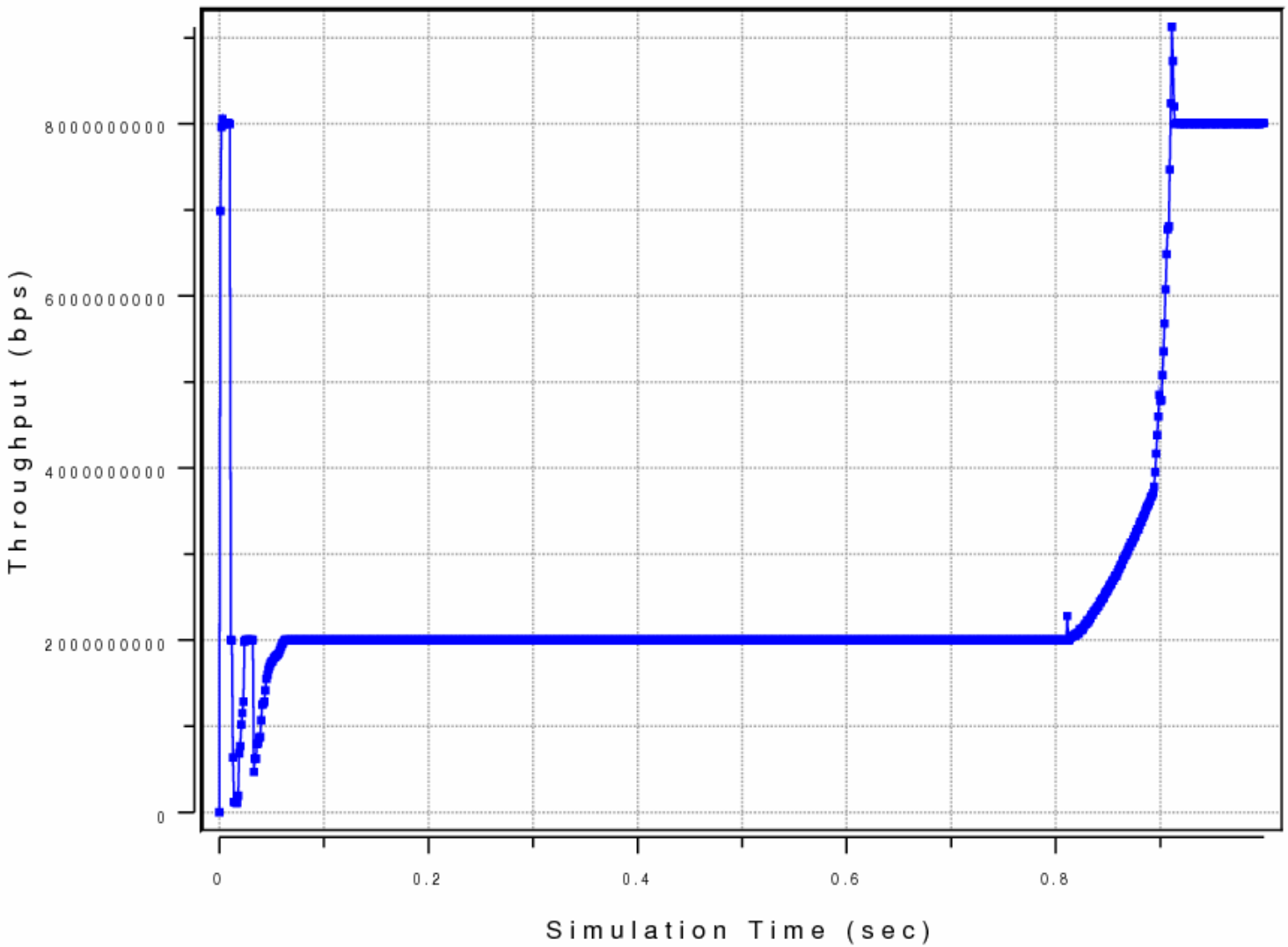
Victim Flows - Throughput (7Gbps)



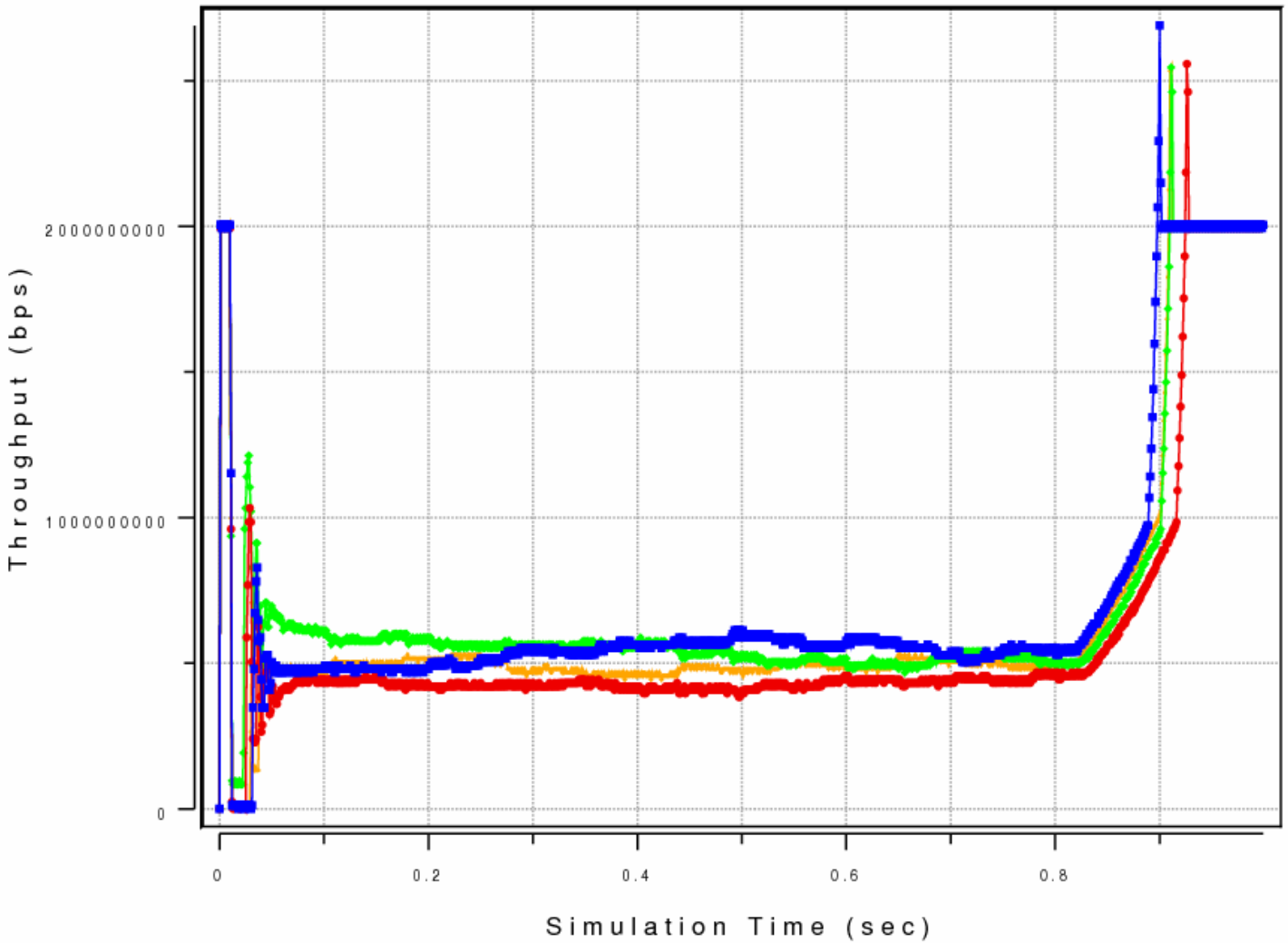
Wit Pause
- Bottleneck Queue Size (2Gbps)



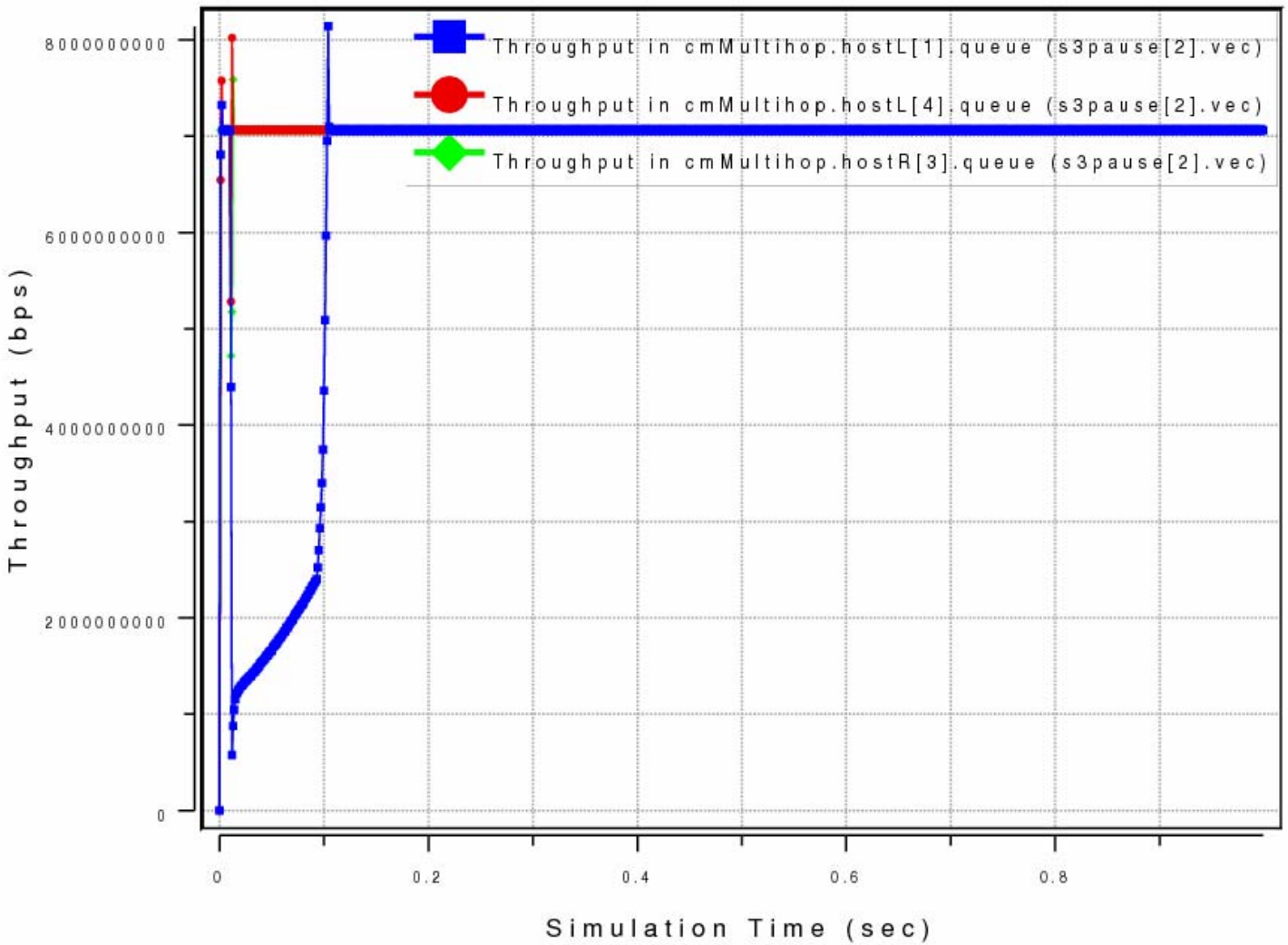
Wit Pause
- Bottleneck Throughput



Culpit Flows - Throughput (0.5Gbps)

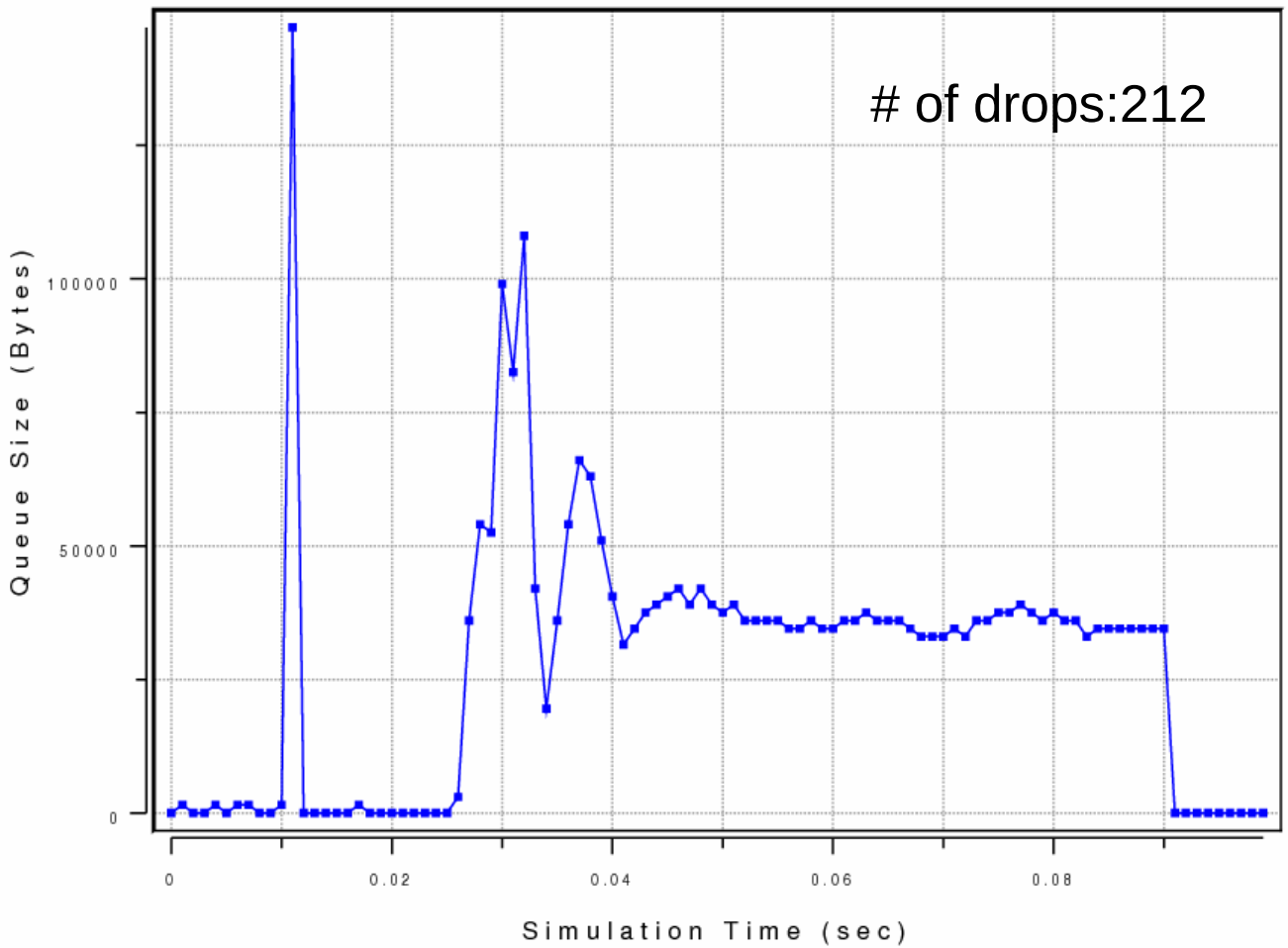


Victim Flows - Throughput (7Gbps)

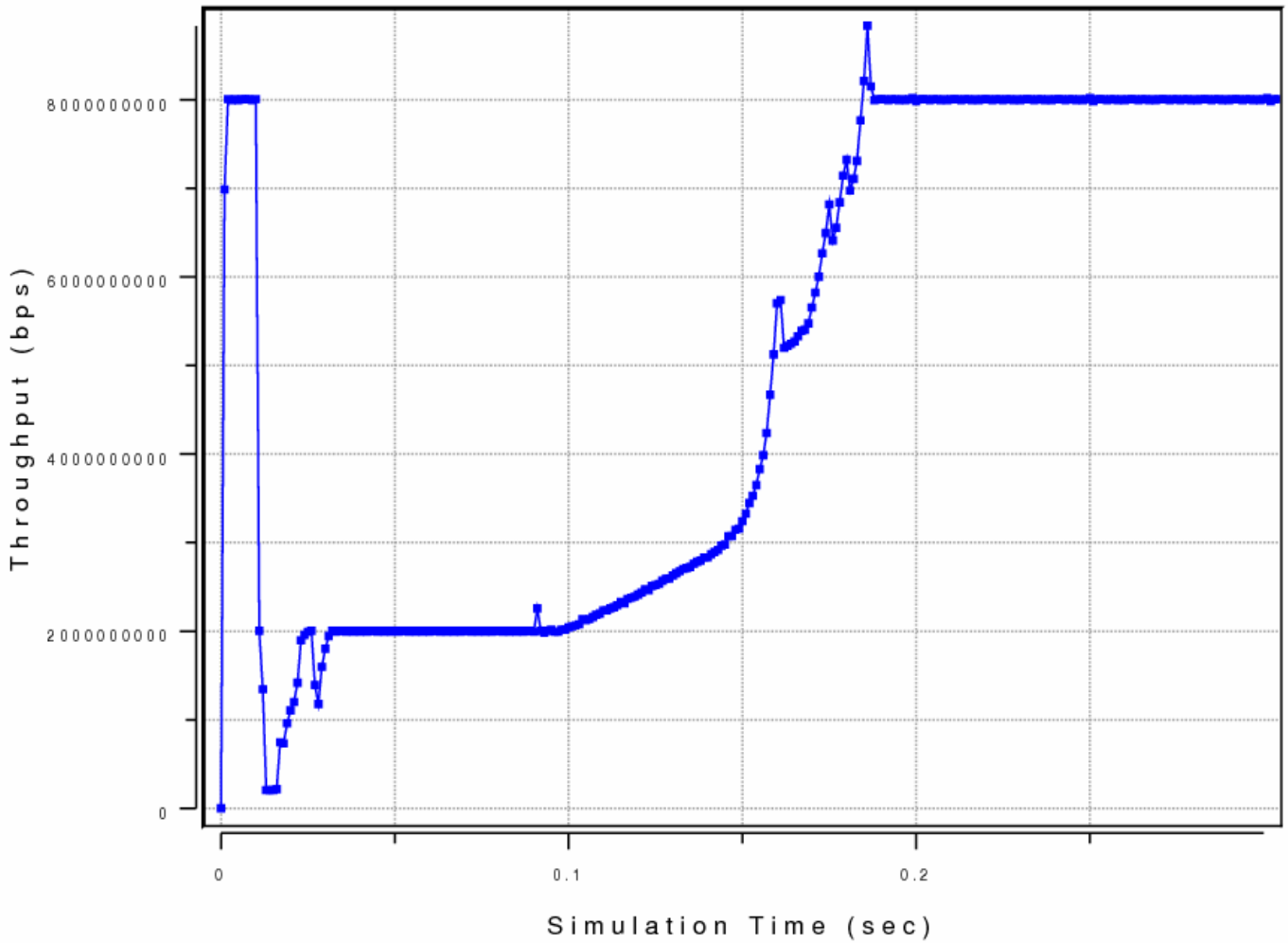


Scenario 3: 80ms Hot Spot Duration

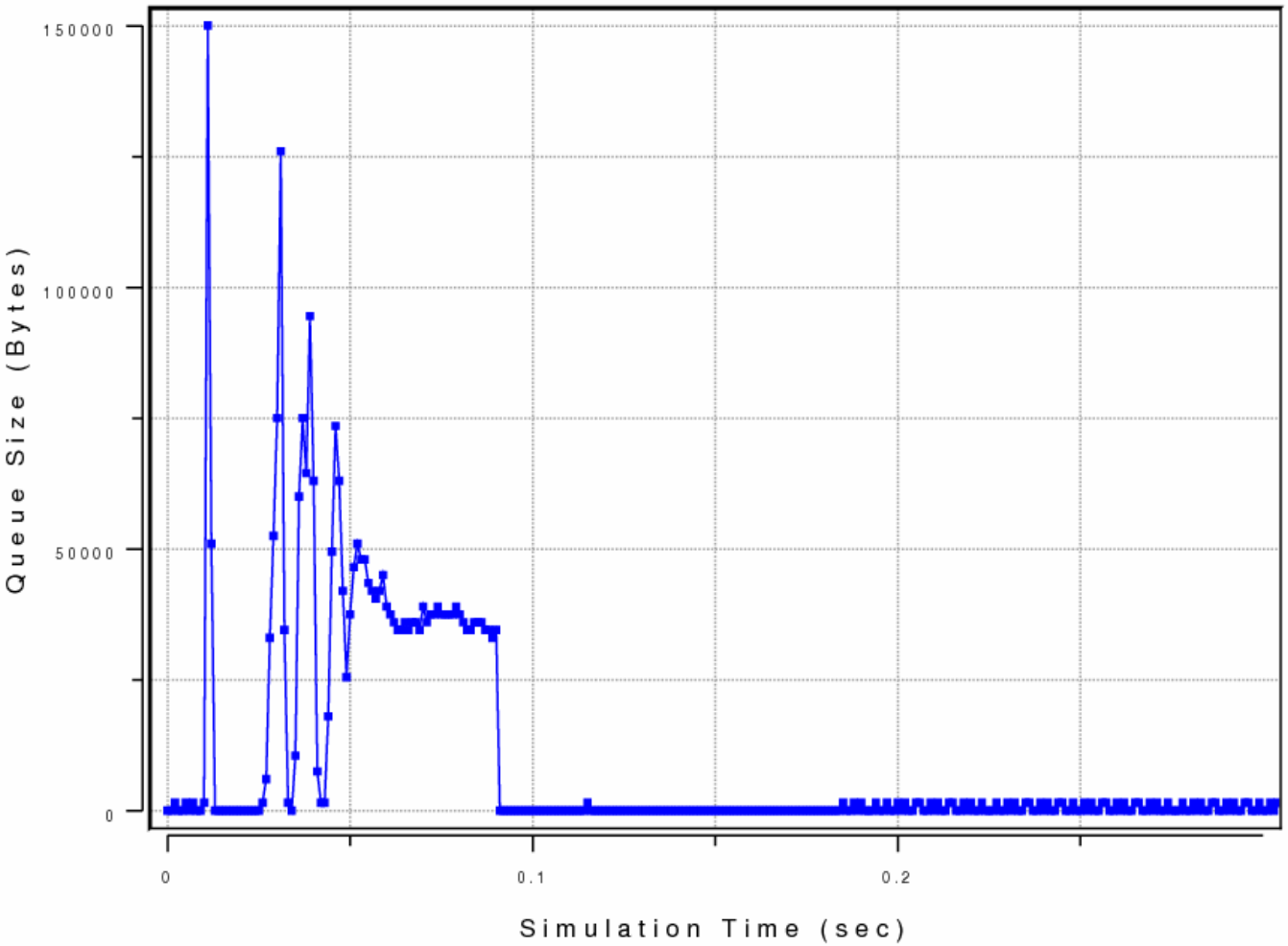
Without Pause
(80ms Hot Spot Duration)
- Congested Queue Size (2Gbps)



Benchmark 3 (80ms Hot Spot Duration) – Bottleneck Throughput



With Pause
(80ms Hot Spot Duration)
- Congested Queue Size (2 Gbps)



Benchmark 3 (80ms Hot Spot Duration) – Bottleneck Throughput