Pantheon Report

Tested in mahimahi: mm-delay 30 mm-link 12mbps.trace 12mbps.trace
--uplink-queue=droptail --uplink-queue-args=bytes=30000
Repeated the test of 21 congestion control schemes 3 times.
Each test lasted for 30 seconds running 1 flow.

System info:
Linux 4.15.0-1028-gcp
net.core.default_qdisc = fq
net.core.rmem_default = 16777216
net.core.rmem_max = 536870912
net.core.wmem_default = 16777216
net.core.wmem_max = 536870912
net.ipv4.tcp_rmem = 4096 16777216 536870912
net.ipv4.tcp_wmem = 4096 16777216 536870912

Git summary:
brANCH: muses @ 7a686f7c2ed0a333082c0bab1fa5c921ab47e6ee
third_party/fillp @ d6da459332fceed66963885d7eba17e6a32d4519
third_party/fillp-sheep @ 0e5bb722943babcd2b090d2c64fcd45e12e923f9
third_party/genericCC @ d0153f8e594aa9e93b032143cedbdfe58e562f4
third_party/indigo @ 2601c92e4aa9d58d38d4dfe0e8bdf90c07e64d
third_party/libutp @ b3465b942e2826f2b179eaaab4a906ce6bb7cf3cf
third_party/muses @ 5ce721187ad823da2095537730c746486ca4966
third_party/pantheon-tunnel @ f866d3f58d27af942717625ee3a354cc2e802bd
third_party/pcc @ 1afc955fa0d66d18b623c091a55feca872b4981e1
M receiver/src/buffer.h
M receiver/src/core.cpp
M sender/src/buffer.h
M sender/src/core.cpp
third_party/pcc-experimental @ cd43e34e3f5f5613e8acd08f8ab92c4ebf24f974ab
third_party/proto-quic @ 77961f1a45237a8642f1bc8143ebc978f3cf42
third_party/scream-reproduce @ 099118d1421aa3131bf11ff1964974e1da3b0d2
M src/ScreamClient
M src/ScreamServer
third_party/sprout @ 366e35c6178b01e31d4a46ad18c74f9415f91a26
M src/examples/sim.sim.cc
M src/examples/sproutbt2.cc
M src/network/sproutconn.cc
third_party/verus @ d4b447ea74c6c6a261149af2629562939f9a494
M src/verus.hpp
M tools/plot.py
third_party/vivace @ 2bf86211435ae071a32f96b7d8c504587f5d7f4
third_party/webrtc @ 3f0cc2a9061a41b6f9d9de4735770d143a1fa2851
local test in mahimahi, 3 runs of 30s each per scheme
(mean of all runs by scheme)
<table>
<thead>
<tr>
<th>scheme</th>
<th># runs</th>
<th>mean avg tput (Mbit/s)</th>
<th>mean 95th-%ile delay (ms)</th>
<th>mean loss rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>flow 1</td>
<td>flow 1</td>
<td>flow 1</td>
</tr>
<tr>
<td>TCP BBR</td>
<td>3</td>
<td>11.68</td>
<td>49.07</td>
<td>2.96</td>
</tr>
<tr>
<td>Copa</td>
<td>3</td>
<td>10.71</td>
<td>47.59</td>
<td>1.47</td>
</tr>
<tr>
<td>TCP Cubic</td>
<td>3</td>
<td>11.76</td>
<td>48.68</td>
<td>0.42</td>
</tr>
<tr>
<td>FillP</td>
<td>3</td>
<td>11.38</td>
<td>50.99</td>
<td>5.63</td>
</tr>
<tr>
<td>FillP-Sheep</td>
<td>3</td>
<td>10.75</td>
<td>49.47</td>
<td>1.52</td>
</tr>
<tr>
<td>Indigo</td>
<td>3</td>
<td>11.55</td>
<td>44.23</td>
<td>3.45</td>
</tr>
<tr>
<td>Indigo-MusesC3</td>
<td>3</td>
<td>11.63</td>
<td>43.67</td>
<td>0.87</td>
</tr>
<tr>
<td>Indigo-MusesC5</td>
<td>3</td>
<td>11.12</td>
<td>38.42</td>
<td>0.64</td>
</tr>
<tr>
<td>Indigo-MusesD</td>
<td>3</td>
<td>6.50</td>
<td>45.90</td>
<td>4.15</td>
</tr>
<tr>
<td>Indigo-MusesT</td>
<td>3</td>
<td>11.86</td>
<td>42.56</td>
<td>0.24</td>
</tr>
<tr>
<td>LEDBAT</td>
<td>3</td>
<td>8.76</td>
<td>49.50</td>
<td>1.11</td>
</tr>
<tr>
<td>PCC-Allegro</td>
<td>3</td>
<td>9.61</td>
<td>34.37</td>
<td>0.85</td>
</tr>
<tr>
<td>PCC-Expr</td>
<td>3</td>
<td>11.29</td>
<td>50.59</td>
<td>1.42</td>
</tr>
<tr>
<td>QUIC Cubic</td>
<td>3</td>
<td>11.64</td>
<td>49.92</td>
<td>0.38</td>
</tr>
<tr>
<td>SCReAM</td>
<td>3</td>
<td>0.21</td>
<td>31.76</td>
<td>0.00</td>
</tr>
<tr>
<td>Sprout</td>
<td>3</td>
<td>4.33</td>
<td>48.89</td>
<td>8.83</td>
</tr>
<tr>
<td>TaoVA-100x</td>
<td>3</td>
<td>11.12</td>
<td>33.14</td>
<td>0.58</td>
</tr>
<tr>
<td>TCP Vegas</td>
<td>3</td>
<td>11.76</td>
<td>37.19</td>
<td>0.31</td>
</tr>
<tr>
<td>Verus</td>
<td>3</td>
<td>6.58</td>
<td>51.68</td>
<td>86.37</td>
</tr>
<tr>
<td>PCC-Vivace</td>
<td>3</td>
<td>10.91</td>
<td>36.75</td>
<td>0.16</td>
</tr>
<tr>
<td>WebRTC media</td>
<td>3</td>
<td>0.05</td>
<td>41.69</td>
<td>0.00</td>
</tr>
</tbody>
</table>
Run 1: Statistics of TCP BBR

Start at: 2019-03-18 22:01:44
End at: 2019-03-18 22:02:14

# Below is generated by plot.py at 2019-03-18 22:37:58
# Datalink statistics
-- Total of 1 flow:
Average capacity: 12.00 Mbit/s
Average throughput: 11.68 Mbit/s (97.3% utilization)
95th percentile per-packet one-way delay: 49.156 ms
Loss rate: 2.85%
-- Flow 1:
Average throughput: 11.68 Mbit/s
95th percentile per-packet one-way delay: 49.156 ms
Loss rate: 2.85%
Run 1: Report of TCP BBR — Data Link

![Graph 1: Average capacity 12.00 Mbit/s (shaded region)]

**Throughput (Mbps)**

- **Flow 1 ingress** (mean 12.00 Mbit/s)
- **Flow 1 egress** (mean 11.68 Mbit/s)

![Graph 2: Per-packet one-way delay (ms)]

**Per-packet one-way delay (ms)**

- **Flow 1** (95th percentile 49.16 ms)
Run 2: Statistics of TCP BBR

Start at: 2019-03-18 22:14:12
End at: 2019-03-18 22:14:42

# Below is generated by plot.py at 2019-03-18 22:37:58
# Datalink statistics
   -- Total of 1 flow:
      Average capacity: 12.00 Mbit/s
      Average throughput: 11.68 Mbit/s (97.3% utilization)
      95th percentile per-packet one-way delay: 49.011 ms
      Loss rate: 3.13%
   -- Flow 1:
      Average throughput: 11.68 Mbit/s
      95th percentile per-packet one-way delay: 49.011 ms
      Loss rate: 3.13%
Run 2: Report of TCP BBR — Data Link
Run 3: Statistics of TCP BBR

Start at: 2019-03-18 22:26:40
End at: 2019-03-18 22:27:10

# Below is generated by plot.py at 2019-03-18 22:37:58
# Datalink statistics
-- Total of 1 flow:
  Average capacity: 12.00 Mbit/s
  Average throughput: 11.68 Mbit/s (97.3% utilization)
  95th percentile per-packet one-way delay: 49.039 ms
  Loss rate: 2.90%
-- Flow 1:
  Average throughput: 11.68 Mbit/s
  95th percentile per-packet one-way delay: 49.039 ms
  Loss rate: 2.90%
Run 3: Report of TCP BBR — Data Link

Average capacity 12.00 Mbit/s (shaded region)

Throughput (Mbit/s)

Time (s)

Flow 1 ingress (mean 12.01 Mbit/s)  Flow 1 egress (mean 11.68 Mbit/s)

Per-packet one-way delay (ms)

Time (s)

Flow 1 (95th percentile 49.04 ms)
Run 1: Statistics of Copa

Start at: 2019-03-18 22:01:08
End at: 2019-03-18 22:01:38

# Below is generated by plot.py at 2019-03-18 22:38:08
# Datalink statistics
-- Total of 1 flow:
  Average capacity: 12.00 Mbit/s
  Average throughput: 10.54 Mbit/s (87.8% utilization)
  95th percentile per-packet one-way delay: 47.345 ms
  Loss rate: 1.34%
-- Flow 1:
  Average throughput: 10.54 Mbit/s
  95th percentile per-packet one-way delay: 47.345 ms
  Loss rate: 1.34%
Run 1: Report of Copa — Data Link

Average capacity 12.00 Mbit/s (shaded region)

Throughput (Mbit/s)

Time (s)

Flow 1 ingress (mean 10.67 Mbit/s)  Flow 1 egress (mean 10.54 Mbit/s)

Per-packet one-way delay (ms)

Time (s)

Flow 1 (95th percentile 47.34 ms)
Run 2: Statistics of Copa

End at: 2019-03-18 22:14:06

# Below is generated by plot.py at 2019-03-18 22:38:08
# Datalink statistics
-- Total of 1 flow:
Average capacity: 12.00 Mbit/s
Average throughput: 10.40 Mbit/s (86.7% utilization)
95th percentile per-packet one-way delay: 49.585 ms
Loss rate: 2.12%
-- Flow 1:
Average throughput: 10.40 Mbit/s
95th percentile per-packet one-way delay: 49.585 ms
Loss rate: 2.12%
Run 2: Report of Copa — Data Link

Average capacity 12.00 Mbit/s (shaded region)

Flow 1 ingress (mean 10.62 Mbit/s)  Flow 1 egress (mean 10.40 Mbit/s)

Per-packet one-way delay (ms)

Flow 1 (95th percentile 49.59 ms)
Run 3: Statistics of Copa

Start at: 2019-03-18 22:26:04
End at: 2019-03-18 22:26:34

# Below is generated by plot.py at 2019-03-18 22:38:09
# Datalink statistics
-- Total of 1 flow:
Average capacity: 12.00 Mbit/s
Average throughput: 11.19 Mbit/s (93.2% utilization)
95th percentile per-packet one-way delay: 45.833 ms
Loss rate: 0.95%
-- Flow 1:
Average throughput: 11.19 Mbit/s
95th percentile per-packet one-way delay: 45.833 ms
Loss rate: 0.95%
Run 3: Report of Copa — Data Link

Average capacity 12.00 Mbit/s (shaded region)

Throughput (Mbit/s)

0 2 4 6 8 10 12 14
0 5 10 15 20 25 30 35
Time (s)

Flow 1 ingress (mean 11.29 Mbit/s)  Flow 1 egress (mean 11.19 Mbit/s)

Per packet one-way delay (ms)

0 5 10 15 20 25 30 35 40 45 50 55 60 65
0 5 10 15 20 25 30 35 40 45 50 55 60 65
Time (s)

Flow 1 (95th percentile 45.83 ms)
Run 1: Statistics of TCP Cubic

Start at: 2019-03-18 22:02:20
End at: 2019-03-18 22:02:50

# Below is generated by plot.py at 2019-03-18 22:38:09
# Datalink statistics
-- Total of 1 flow:
  Average capacity: 12.00 Mbit/s
  Average throughput: 11.76 Mbit/s (98.0% utilization)
  95th percentile per-packet one-way delay: 48.828 ms
  Loss rate: 0.42%
-- Flow 1:
  Average throughput: 11.76 Mbit/s
  95th percentile per-packet one-way delay: 48.828 ms
  Loss rate: 0.42%
Run 1: Report of TCP Cubic — Data Link

Average capacity 12.00 Mbit/s (shaded region)

Throughput (Mbps)

Time (s)

Flow 1 ingress (mean 11.80 Mbit/s)  Flow 1 egress (mean 11.76 Mbit/s)

Per-packet one-way delay (ms)

Time (s)

Flow 1 (95th percentile 48.53 ms)
Run 2: Statistics of TCP Cubic

End at: 2019-03-18 22:15:18

# Below is generated by plot.py at 2019-03-18 22:38:09
# Datalink statistics
-- Total of 1 flow:
Average capacity: 12.00 Mbit/s
Average throughput: 11.76 Mbit/s (98.0% utilization)
95th percentile per-packet one-way delay: 48.736 ms
Loss rate: 0.43%
-- Flow 1:
Average throughput: 11.76 Mbit/s
95th percentile per-packet one-way delay: 48.736 ms
Loss rate: 0.43%
Run 2: Report of TCP Cubic — Data Link

Average capacity 12.00 Mbit/s (shaded region)

Time (s)

Throughput (Mbps)

Flow 1 ingress (mean 11.80 Mbit/s) Flow 1 egress (mean 11.76 Mbit/s)

Per-packet one-way delay (ms)

Flow 1 (95th percentile 48.74 ms)
Run 3: Statistics of TCP Cubic

End at: 2019-03-18 22:27:46

# Below is generated by plot.py at 2019-03-18 22:38:19
# Datalink statistics
--- Total of 1 flow:
Average capacity: 12.00 Mbit/s
Average throughput: 11.76 Mbit/s (98.0% utilization)
95th percentile per-packet one-way delay: 48.467 ms
Loss rate: 0.42%
--- Flow 1:
Average throughput: 11.76 Mbit/s
95th percentile per-packet one-way delay: 48.467 ms
Loss rate: 0.42%
Run 3: Report of TCP Cubic — Data Link
Run 1: Statistics of FillP

End at: 2019-03-18 22:00:28

# Below is generated by plot.py at 2019-03-18 22:38:22
# Datalink statistics
-- Total of 1 flow:
  Average capacity: 12.00 Mbit/s
  Average throughput: 11.38 Mbit/s (94.8% utilization)
  95th percentile per-packet one-way delay: 51.015 ms
  Loss rate: 6.05%
-- Flow 1:
  Average throughput: 11.38 Mbit/s
  95th percentile per-packet one-way delay: 51.015 ms
  Loss rate: 6.05%
Run 1: Report of FillP — Data Link

**Average capacity 12.00 Mbit/s (shaded region)**

![Graph showing throughput over time with two lines representing Flow 1 ingress and egress with mean values]

- Flow 1 ingress (mean 12.11 Mbit/s)
- Flow 1 egress (mean 11.38 Mbit/s)

**Per packet delivery delay (ms)**

- Flow 1 (95th percentile 51.02 ms)
Run 2: Statistics of FillP

Start at: 2019-03-18 22:12:26
End at: 2019-03-18 22:12:56

# Below is generated by plot.py at 2019-03-18 22:38:23
# Datalink statistics
-- Total of 1 flow:
Average capacity: 12.00 Mbit/s
Average throughput: 11.36 Mbit/s (94.6% utilization)
95th percentile per-packet one-way delay: 50.878 ms
Loss rate: 5.45%
-- Flow 1:
Average throughput: 11.36 Mbit/s
95th percentile per-packet one-way delay: 50.878 ms
Loss rate: 5.45%
Run 2: Report of FillP — Data Link

Average capacity 12.00 Mbit/s (shaded region)

Flow 1 ingress (mean 12.00 Mbit/s)  Flow 1 egress (mean 11.36 Mbit/s)

Per-packet one-way delay (ms)

Flow 1 (95th percentile 50.88 ms)
Run 3: Statistics of FillP

Start at: 2019-03-18 22:24:54
End at: 2019-03-18 22:25:24

# Below is generated by plot.py at 2019-03-18 22:38:23
# Datalink statistics
-- Total of 1 flow:
Average capacity: 12.00 Mbit/s
Average throughput: 11.39 Mbit/s (94.9% utilization)
95th percentile per-packet one-way delay: 51.068 ms
Loss rate: 5.39%
-- Flow 1:
Average throughput: 11.39 Mbit/s
95th percentile per-packet one-way delay: 51.068 ms
Loss rate: 5.39%
Run 3: Report of FillP — Data Link

Average capacity 12.00 Mbit/s (shaded region)

Throughput (Mbit/s)

Time (s)

Flow 1 ingress (mean 12.04 Mbit/s)  Flow 1 egress (mean 11.39 Mbit/s)

Per-packet one-way delay (ms)

Time (s)

Flow 1 (95th percentile 51.07 ms)
Run 1: Statistics of FillP-Sheep

Start at: 2019-03-18 22:05:54
End at: 2019-03-18 22:06:24

# Below is generated by plot.py at 2019-03-18 22:38:23
# Datalink statistics
-- Total of 1 flow:
  Average capacity: 12.00 Mbit/s
  Average throughput: 10.77 Mbit/s (89.7% utilization)
  95th percentile per-packet one-way delay: 49.725 ms
  Loss rate: 1.85%
-- Flow 1:
  Average throughput: 10.77 Mbit/s
  95th percentile per-packet one-way delay: 49.725 ms
  Loss rate: 1.85%
Run 1: Report of FillP-Sheep — Data Link

Average capacity 12.00 Mbit/s (shaded region)

Flow 1 ingress (mean 10.96 Mbit/s)  Flow 1 egress (mean 10.77 Mbit/s)

Per-packet one-way delay (ms)

Flow 1 (95th percentile 49.73 ms)
Run 2: Statistics of FillP-Sheep

End at: 2019-03-18 22:18:52

# Below is generated by plot.py at 2019-03-18 22:38:32
# Datalink statistics
-- Total of 1 flow:
  Average capacity: 12.00 Mbit/s
  Average throughput: 11.02 Mbit/s (91.8% utilization)
  95th percentile per-packet one-way delay: 49.407 ms
  Loss rate: 1.39%
-- Flow 1:
  Average throughput: 11.02 Mbit/s
  95th percentile per-packet one-way delay: 49.407 ms
  Loss rate: 1.39%
Run 2: Report of FillP-Sheep — Data Link

![Graphs showing network performance metrics including throughput and per-packet end-to-end delay over time.](image)
Run 3: Statistics of FillP-Sheep

Start at: 2019-03-18 22:30:50

# Below is generated by plot.py at 2019-03-18 22:38:32
# Datalink statistics
-- Total of 1 flow:
  Average capacity: 12.00 Mbit/s
  Average throughput: 10.47 Mbit/s (87.2% utilization)
  95th percentile per-packet one-way delay: 49.277 ms
  Loss rate: 1.32%
-- Flow 1:
  Average throughput: 10.47 Mbit/s
  95th percentile per-packet one-way delay: 49.277 ms
  Loss rate: 1.32%
Run 3: Report of FillP-Sheep — Data Link

Average capacity 12.00 Mbit/s (shaded region)

Throughput (Mbit/s)

Time (s)

Flow 1 ingress (mean 10.60 Mbit/s)  Flow 1 egress (mean 10.47 Mbit/s)

Per-packet one-way delay (ms)

Time (s)

Flow 1 (95th percentile 49.28 ms)
Run 1: Statistics of Indigo

Start at: 2019-03-18 22:10:39
End at: 2019-03-18 22:11:09

# Below is generated by plot.py at 2019-03-18 22:38:32
# Datalink statistics
-- Total of 1 flow:
Average capacity: 12.00 Mbit/s
Average throughput: 11.06 Mbit/s (92.2% utilization)
95th percentile per-packet one-way delay: 42.207 ms
Loss rate: 1.39%
-- Flow 1:
Average throughput: 11.06 Mbit/s
95th percentile per-packet one-way delay: 42.207 ms
Loss rate: 1.39%
Run 1: Report of Indigo — Data Link

![Graph 1: Average capacity 12.00 Mbit/s (shaded region)]

![Graph 2: Per-packet on-way delay (ms)]
Run 2: Statistics of Indigo

End at: 2019-03-18 22:23:37

# Below is generated by plot.py at 2019-03-18 22:38:41
# Datalink statistics
-- Total of 1 flow:
  Average capacity: 12.00 Mbit/s
  Average throughput: 11.79 Mbit/s (98.3% utilization)
  95th percentile per-packet one-way delay: 46.427 ms
  Loss rate: 4.92%
-- Flow 1:
  Average throughput: 11.79 Mbit/s
  95th percentile per-packet one-way delay: 46.427 ms
  Loss rate: 4.92%
Run 2: Report of Indigo — Data Link

Average capacity 12.00 Mbit/s (shaded region)

Throughput (Mbit/s)

Time (s)

Flow 1 ingress (mean 12.39 Mbit/s)  Flow 1 egress (mean 11.79 Mbit/s)

Per-packet one-way delay (ms)

Time (s)

Flow 1 (95th percentile 46.43 ms)
Run 3: Statistics of Indigo

Start at: 2019-03-18 22:35:36
End at: 2019-03-18 22:36:06

# Below is generated by plot.py at 2019-03-18 22:38:43
# Datalink statistics
-- Total of 1 flow:
  Average capacity: 12.00 Mbit/s
  Average throughput: 11.80 Mbit/s (98.3% utilization)
  95th percentile per-packet one-way delay: 44.064 ms
  Loss rate: 4.05%
-- Flow 1:
  Average throughput: 11.80 Mbit/s
  95th percentile per-packet one-way delay: 44.064 ms
  Loss rate: 4.05%
Run 3: Report of Indigo — Data Link

![Graph showing throughput and packet delay over time]

Average capacity 12.00 Mbit/s (shaded region)

- Flow 1 ingress (mean 12.29 Mbit/s)
- Flow 1 egress (mean 11.80 Mbit/s)

Per-packet on-way delay (ms)

- Flow 1 (95th percentile 44.06 ms)
Run 1: Statistics of Indigo-MusesC3

Start at: 2019-03-18 22:07:05
End at: 2019-03-18 22:07:35

# Below is generated by plot.py at 2019-03-18 22:38:43
# Datalink statistics
-- Total of 1 flow:
Average capacity: 12.00 Mbit/s
Average throughput: 11.44 Mbit/s (95.3% utilization)
95th percentile per-packet one-way delay: 42.792 ms
Loss rate: 1.13%
-- Flow 1:
Average throughput: 11.44 Mbit/s
95th percentile per-packet one-way delay: 42.792 ms
Loss rate: 1.13%
Run 1: Report of Indigo-MusesC3 — Data Link

Average capacity 12.00 Mbit/s (shaded region)

Throughput (Mbit/s)

Time (s)

Flow 1 ingress (mean 11.56 Mbit/s)  Flow 1 egress (mean 11.44 Mbit/s)

Per-packet one-way delay (ms)

Time (s)

Flow 1 (95th percentile 42.79 ms)
Run 2: Statistics of Indigo-MusesC3

End at: 2019-03-18 22:20:03

# Below is generated by plot.py at 2019-03-18 22:38:44
# Datalink statistics
  -- Total of 1 flow:
  Average capacity: 12.00 Mbit/s
  Average throughput: 11.73 Mbit/s (97.7% utilization)
  95th percentile per-packet one-way delay: 44.913 ms
  Loss rate: 0.82%
  -- Flow 1:
  Average throughput: 11.73 Mbit/s
  95th percentile per-packet one-way delay: 44.913 ms
  Loss rate: 0.82%
Run 2: Report of Indigo-MusesC3 — Data Link

Average capacity 12.00 Mbit/s (shaded region)

Time (s)

Throughput (Mbit/s)

Flow 1 ingress (mean 11.81 Mbit/s)  Flow 1 egress (mean 11.73 Mbit/s)

Per-packet one-way delay (ms)

Flow 1 (95th percentile 44.91 ms)
Run 3: Statistics of Indigo-MusesC3

Start at: 2019-03-18 22:32:01
End at: 2019-03-18 22:32:31

# Below is generated by plot.py at 2019-03-18 22:38:45
# Datalink statistics
-- Total of 1 flow:
Average capacity: 12.00 Mbit/s
Average throughput: 11.71 Mbit/s (97.6% utilization)
95th percentile per-packet one-way delay: 43.315 ms
Loss rate: 0.66%

-- Flow 1:
Average throughput: 11.71 Mbit/s
95th percentile per-packet one-way delay: 43.315 ms
Loss rate: 0.66%
Run 3: Report of Indigo-MusesC3 — Data Link

Average capacity 12.00 Mbit/s (shaded region)

Throughput (Mbit/s)

Time (s)

Flow 1 ingress (mean 11.77 Mbit/s)  
Flow 1 egress (mean 11.71 Mbit/s)

Per-packet one-way delay (ms)

Time (s)

Flow 1 (95th percentile 43.31 ms)
Run 1: Statistics of Indigo-MusesC5

Start at: 2019-03-18 22:05:19
End at: 2019-03-18 22:05:49

# Below is generated by plot.py at 2019-03-18 22:38:51
# Datalink statistics
-- Total of 1 flow:
Average capacity: 12.00 Mbit/s
Average throughput: 11.22 Mbit/s (93.5% utilization)
95th percentile per-packet one-way delay: 38.552 ms
Loss rate: 0.55%
-- Flow 1:
Average throughput: 11.22 Mbit/s
95th percentile per-packet one-way delay: 38.552 ms
Loss rate: 0.55%
Run 1: Report of Indigo-MusesC5 — Data Link

Average capacity 12.00 Mbit/s (shaded region)

Flow 1 ingress (mean 11.26 Mbit/s)  Flow 1 egress (mean 11.22 Mbit/s)

Per-packet end-to-end delay (ms)

Flow 1 (95th percentile 38.55 ms)
Run 2: Statistics of Indigo-MusesC5

Start at: 2019-03-18 22:17:46
End at: 2019-03-18 22:18:16

# Below is generated by plot.py at 2019-03-18 22:38:52
# Datalink statistics
-- Total of 1 flow:
  Average capacity: 12.00 Mbit/s
  Average throughput: 10.71 Mbit/s (89.3% utilization)
  95th percentile per-packet one-way delay: 37.924 ms
  Loss rate: 0.52%
-- Flow 1:
  Average throughput: 10.71 Mbit/s
  95th percentile per-packet one-way delay: 37.924 ms
  Loss rate: 0.52%
Run 2: Report of Indigo-MusesC5 — Data Link

![Graph showing data link performance](image1)

Average capacity 12.00 Mbps (shaded region)

- **Flow 1 ingress** (mean 10.76 Mbps)
- **Flow 1 egress** (mean 10.71 Mbps)

![Graph showing per-packet one-way delay](image2)

Per-packet one-way delay (ms)

- **Flow 1** (95th percentile 37.92 ms)
Run 3: Statistics of Indigo-MusesC5

Start at: 2019-03-18 22:30:15
End at: 2019-03-18 22:30:45

# Below is generated by plot.py at 2019-03-18 22:38:53
# Datalink statistics
-- Total of 1 flow:
  Average capacity: 12.00 Mbit/s
  Average throughput: 11.42 Mbit/s (95.2% utilization)
  95th percentile per-packet one-way delay: 38.781 ms
  Loss rate: 0.85%
-- Flow 1:
  Average throughput: 11.42 Mbit/s
  95th percentile per-packet one-way delay: 38.781 ms
  Loss rate: 0.85%
Run 3: Report of Indigo-MusesC5 — Data Link

Average capacity 12.00 Mbit/s (shaded region)

Throughput (Mbit/s)

Time (s)

Flow 1 ingress (mean 11.51 Mbit/s)  Flow 1 egress (mean 11.42 Mbit/s)

Per-packet end-to-end delay (ms)

Time (s)

Flow 1 (95th percentile 38.78 ms)
Run 1: Statistics of Indigo-MusesD

Start at: 2019-03-18 22:08:52
End at: 2019-03-18 22:09:22

# Below is generated by plot.py at 2019-03-18 22:38:54
# Datalink statistics
-- Total of 1 flow:
Average capacity: 12.00 Mbit/s
Average throughput: 4.75 Mbit/s (39.6% utilization)
95th percentile per-packet one-way delay: 48.271 ms
Loss rate: 4.93%
-- Flow 1:
Average throughput: 4.75 Mbit/s
95th percentile per-packet one-way delay: 48.271 ms
Loss rate: 4.93%
Run 1: Report of Indigo-MusesD — Data Link

Average capacity 12.00 Mbit/s (shaded region)

Flow 1 ingress (mean 4.99 Mbit/s)  Flow 1 egress (mean 4.75 Mbit/s)

Per-packet one-way delay (ms)

Flow 1 (95th percentile 48.27 ms)
Run 2: Statistics of Indigo-MusesD

End at: 2019-03-18 22:21:49

# Below is generated by plot.py at 2019-03-18 22:38:59
# Datalink statistics
-- Total of 1 flow:
  Average capacity: 12.00 Mbit/s
  Average throughput: 6.94 Mbit/s (57.9% utilization)
  95th percentile per-packet one-way delay: 45.012 ms
  Loss rate: 3.86%
-- Flow 1:
  Average throughput: 6.94 Mbit/s
  95th percentile per-packet one-way delay: 45.012 ms
  Loss rate: 3.86%
Run 2: Report of Indigo-MusesD — Data Link

![Graph showing throughput and per-packet one-way delay over time.]

**Average capacity 12.00 Mbit/s (shaded region)**

- Flow 1 ingress (mean 7.21 Mbit/s)
- Flow 1 egress (mean 6.94 Mbit/s)

**Per-packet one-way delay (ms)**

- Flow 1 (95th percentile 45.01 ms)
Run 3: Statistics of Indigo-MusesD

Start at: 2019-03-18 22:33:49
End at: 2019-03-18 22:34:19

# Below is generated by plot.py at 2019-03-18 22:39:00
# Datalink statistics
-- Total of 1 flow:
Average capacity: 12.00 Mbit/s
Average throughput: 7.81 Mbit/s (65.1% utilization)
95th percentile per-packet one-way delay: 44.426 ms
Loss rate: 3.67%
-- Flow 1:
Average throughput: 7.81 Mbit/s
95th percentile per-packet one-way delay: 44.426 ms
Loss rate: 3.67%
Run 3: Report of Indigo-MusesD — Data Link
Run 1: Statistics of Indigo-MusesT

Start at: 2019-03-18 22:10:03
End at: 2019-03-18 22:10:33

# Below is generated by plot.py at 2019-03-18 22:39:06
# Datalink statistics
-- Total of 1 flow:
Average capacity: 12.00 Mbit/s
Average throughput: 11.85 Mbit/s (98.8% utilization)
95th percentile per-packet one-way delay: 42.472 ms
Loss rate: 0.35%
-- Flow 1:
Average throughput: 11.85 Mbit/s
95th percentile per-packet one-way delay: 42.472 ms
Loss rate: 0.35%
Run 1: Report of Indigo-MusesT — Data Link

Average capacity 12.00 Mbit/s (shaded region)

Flow 1 ingress (mean 11.88 Mbit/s)  Flow 1 egress (mean 11.85 Mbit/s)

Per-packet one-way delay (ms)

Flow 1 (95th percentile 42.47 ms)
Run 2: Statistics of Indigo-MusesT

End at: 2019-03-18 22:23:01

# Below is generated by plot.py at 2019-03-18 22:39:06
# Datalink statistics
-- Total of 1 flow:
  Average capacity: 12.00 Mbit/s
  Average throughput: 11.86 Mbit/s (98.8% utilization)
  95th percentile per-packet one-way delay: 41.425 ms
  Loss rate: 0.16%
-- Flow 1:
  Average throughput: 11.86 Mbit/s
  95th percentile per-packet one-way delay: 41.425 ms
  Loss rate: 0.16%
Run 2: Report of Indigo-MusesT — Data Link

Average capacity 12.00 Mbit/s (shaded region)

Throughput (Mbit/s)

Time (s)

Flow 1 ingress (mean 11.86 Mbit/s)  Flow 1 egress (mean 11.86 Mbit/s)

Per-packet one-way delay (ms)

Time (s)

Flow 1 (95th percentile 41.42 ms)
Run 3: Statistics of Indigo-MusesT

Start at: 2019-03-18 22:35:01
End at: 2019-03-18 22:35:31

# Below is generated by plot.py at 2019-03-18 22:39:14
# Datalink statistics
-- Total of 1 flow:
Average capacity: 12.00 Mbit/s
Average throughput: 11.87 Mbit/s (98.9% utilization)
95th percentile per-packet one-way delay: 43.785 ms
Loss rate: 0.21%
-- Flow 1:
Average throughput: 11.87 Mbit/s
95th percentile per-packet one-way delay: 43.785 ms
Loss rate: 0.21%
Run 3: Report of Indigo-MusesT — Data Link

Average capacity 12.00 Mbit/s (shaded region)

Throughput (Mbit/s)

Time (s)

Flow 1 ingress (mean 11.88 Mbit/s)  Flow 1 egress (mean 11.87 Mbit/s)

Per-packet one-way delay (ms)

Time (s)

Flow 1 (95th percentile 43.78 ms)
Run 1: Statistics of LEDBAT

Start at: 2019-03-18 22:06:30
End at: 2019-03-18 22:07:00

# Below is generated by plot.py at 2019-03-18 22:39:14
# Datalink statistics
-- Total of 1 flow:
Average capacity: 12.00 Mbit/s
Average throughput: 8.73 Mbit/s (72.8% utilization)
95th percentile per-packet one-way delay: 49.480 ms
Loss rate: 1.12%
-- Flow 1:
Average throughput: 8.73 Mbit/s
95th percentile per-packet one-way delay: 49.480 ms
Loss rate: 1.12%
Run 1: Report of LEDBAT — Data Link

Average capacity 12.00 Mbit/s (shaded region)

Throughput (Mbit/s)

Time (s)

Flow 1 ingress (mean 8.82 Mbit/s)  Flow 1 egress (mean 8.73 Mbit/s)

Per-packet e2e delays (ms)

Time (s)

Flow 1 (95th percentile 49.48 ms)
Run 2: Statistics of LEDBAT

Start at: 2019-03-18 22:18:57
End at: 2019-03-18 22:19:27

# Below is generated by plot.py at 2019-03-18 22:39:14
# Datalink statistics
-- Total of 1 flow:
  Average capacity: 12.00 Mbit/s
  Average throughput: 8.83 Mbit/s (73.6% utilization)
  95th percentile per-packet one-way delay: 49.467 ms
  Loss rate: 1.04%
-- Flow 1:
  Average throughput: 8.83 Mbit/s
  95th percentile per-packet one-way delay: 49.467 ms
  Loss rate: 1.04%
Run 2: Report of LEDBAT — Data Link

Average capacity 12.00 Mbit/s (shaded region)

Flow 1 ingress (mean 8.91 Mbit/s)  Flow 1 egress (mean 8.83 Mbit/s)

Per-packet one-way delay (ms)

Flow 1 (95th percentile 49.47 ms)
Run 3: Statistics of LEDBAT

Start at: 2019-03-18 22:31:26
End at: 2019-03-18 22:31:56

# Below is generated by plot.py at 2019-03-18 22:39:14
# Datalink statistics
-- Total of 1 flow:
Average capacity: 12.00 Mbit/s
Average throughput: 8.73 Mbit/s (72.7% utilization)
95th percentile per-packet one-way delay: 49.557 ms
Loss rate: 1.16%
-- Flow 1:
Average throughput: 8.73 Mbit/s
95th percentile per-packet one-way delay: 49.557 ms
Loss rate: 1.16\%
Run 3: Report of LEDBAT — Data Link

Average capacity 12.00 Mbit/s (shaded region)

Flow 1 ingress (mean 8.82 Mbit/s)   Flow 1 egress (mean 8.73 Mbit/s)

Per-packet end-to-end delay (ms)

Flow 1 (95th percentile 49.56 ms)
Run 1: Statistics of PCC-Allegro

Start at: 2019-03-18 22:11:50
End at: 2019-03-18 22:12:20

# Below is generated by plot.py at 2019-03-18 22:39:19
# Datalink statistics
-- Total of 1 flow:
  Average capacity: 12.00 Mbit/s
  Average throughput: 8.88 Mbit/s (74.0% utilization)
  95th percentile per-packet one-way delay: 32.694 ms
  Loss rate: 0.86%
-- Flow 1:
  Average throughput: 8.88 Mbit/s
  95th percentile per-packet one-way delay: 32.694 ms
  Loss rate: 0.86%
Run 1: Report of PCC-Allegro — Data Link
Run 2: Statistics of PCC-Allegro

Start at: 2019-03-18 22:24:18
End at: 2019-03-18 22:24:48

# Below is generated by plot.py at 2019-03-18 22:39:21
# Datalink statistics
-- Total of 1 flow:
  Average capacity: 12.00 Mbit/s
  Average throughput: 10.15 Mbit/s (84.6% utilization)
  95th percentile per-packet one-way delay: 34.698 ms
  Loss rate: 0.85%
-- Flow 1:
  Average throughput: 10.15 Mbit/s
  95th percentile per-packet one-way delay: 34.698 ms
  Loss rate: 0.85%
Run 2: Report of PCC-Allegro — Data Link

Average capacity 12.00 Mbit/s (shaded region)

Throughput (Mbit/s)

Time (s)

Flow 1 ingress (mean 10.22 Mbit/s)  Flow 1 egress (mean 10.15 Mbit/s)

Per-packet end-to-end delay (ms)

Time (s)

Flow 1 (95th percentile 34.70 ms)
Run 3: Statistics of PCC-Allegro

Start at: 2019-03-18 22:36:48
End at: 2019-03-18 22:37:18

# Below is generated by plot.py at 2019-03-18 22:39:25
# Datalink statistics
-- Total of 1 flow:
  Average capacity: 12.00 Mbit/s
  Average throughput: 9.81 Mbit/s (81.7% utilization)
  95th percentile per-packet one-way delay: 35.712 ms
  Loss rate: 0.83%
-- Flow 1:
  Average throughput: 9.81 Mbit/s
  95th percentile per-packet one-way delay: 35.712 ms
  Loss rate: 0.83%
Run 3: Report of PCC-Allegro — Data Link

Average capacity 12.00 Mbit/s (shaded region)

Flow 1 ingress (mean 9.88 Mbit/s)  Flow 1 egress (mean 9.81 Mbit/s)

Per-packet one-way delay (ms)

Flow 1 (95th percentile 35.71 ms)
Run 1: Statistics of PCC-Expr

Start at: 2019-03-18 22:04:07
End at: 2019-03-18 22:04:37

# Below is generated by plot.py at 2019-03-18 22:39:42
# Datalink statistics
-- Total of 1 flow:
  Average capacity: 12.00 Mbit/s
  Average throughput: 11.41 Mbit/s (95.1% utilization)
  95th percentile per-packet one-way delay: 50.477 ms
  Loss rate: 1.58%
-- Flow 1:
  Average throughput: 11.41 Mbit/s
  95th percentile per-packet one-way delay: 50.477 ms
  Loss rate: 1.58%
Run 1: Report of PCC-Expr — Data Link

![Graph of throughput and packet loss over time.]

- **Average capacity**: 12.00 Mbit/s (shaded region)
- **Throughput (Mbps)**: 0.0 to 17.5
- **Time (s)**: 0 to 35

**Graph Details**:
- **Flow 1 ingress** (mean 11.58 Mbit/s)
- **Flow 1 egress** (mean 11.41 Mbit/s)

**Per-packet one-way delay (ms)**
- 0 to 60
- **Time (s)**: 0 to 30

**Flow 1** (95th percentile 50.48 ms)
Run 2: Statistics of PCC-Expr

Start at: 2019-03-18 22:16:35
End at: 2019-03-18 22:17:05

# Below is generated by plot.py at 2019-03-18 22:39:44
# Datalink statistics
-- Total of 1 flow:
  Average capacity: 12.00 Mbit/s
  Average throughput: 11.25 Mbit/s (93.7% utilization)
  95th percentile per-packet one-way delay: 50.768 ms
  Loss rate: 1.78%
-- Flow 1:
  Average throughput: 11.25 Mbit/s
  95th percentile per-packet one-way delay: 50.768 ms
  Loss rate: 1.78%
Run 2: Report of PCC-Expr — Data Link

Average capacity 12.00 Mbit/s (shaded region)

Flow 1 ingress (mean 11.44 Mbit/s)  Flow 1 egress (mean 11.25 Mbit/s)

Per-packet one-way delay (ms)

Flow 1 (95th percentile 50.77 ms)
Run 3: Statistics of PCC-Expr

Start at: 2019-03-18 22:29:03
End at: 2019-03-18 22:29:33

# Below is generated by plot.py at 2019-03-18 22:39:47
# Datalink statistics
-- Total of 1 flow:
Average capacity: 12.00 Mbit/s
Average throughput: 11.21 Mbit/s (93.4% utilization)
95th percentile per-packet one-way delay: 50.537 ms
Loss rate: 0.90%
-- Flow 1:
Average throughput: 11.21 Mbit/s
95th percentile per-packet one-way delay: 50.537 ms
Loss rate: 0.90%
Run 3: Report of PCC-Expr — Data Link

Average capacity 12.00 Mbit/s (shaded region)

Throughput (Mbit/s)

Time (s)

Flow 1 ingress (mean 11.30 Mbit/s)  Flow 1 egress (mean 11.21 Mbit/s)

Per-packet one-way delay (ms)

Time (s)

Flow 1 (95th percentile 50.54 ms)
Run 1: Statistics of QUIC Cubic

Start at: 2019-03-18 22:11:15
End at: 2019-03-18 22:11:45

# Below is generated by plot.py at 2019-03-18 22:39:47
# Datalink statistics
-- Total of 1 flow:
Average capacity: 12.00 Mbit/s
Average throughput: 11.66 Mbit/s (97.1% utilization)
95th percentile per-packet one-way delay: 49.976 ms
Loss rate: 0.38%
-- Flow 1:
Average throughput: 11.66 Mbit/s
95th percentile per-packet one-way delay: 49.976 ms
Loss rate: 0.38%
Run 1: Report of QUIC Cubic — Data Link
Run 2: Statistics of QUIC Cubic

End at: 2019-03-18 22:24:12

# Below is generated by plot.py at 2019-03-18 22:39:47
# Datalink statistics
-- Total of 1 flow:
Average capacity: 12.00 Mbit/s
Average throughput: 11.64 Mbit/s (97.0% utilization)
95th percentile per-packet one-way delay: 49.894 ms
Loss rate: 0.38%
-- Flow 1:
Average throughput: 11.64 Mbit/s
95th percentile per-packet one-way delay: 49.894 ms
Loss rate: 0.38%
Run 2: Report of QUIC Cubic — Data Link

Average capacity 12.00 Mbit/s (shaded region)

Throughput (Mbit/s)

Time (s)

Flow 1 ingress (mean 11.67 Mbit/s)  Flow 1 egress (mean 11.64 Mbit/s)

Per-packet one-way delay (ms)

Time (s)

Flow 1 (95th percentile 49.59 ms)
Run 3: Statistics of QUIC Cubic

Start at: 2019-03-18 22:36:12
End at: 2019-03-18 22:36:42

# Below is generated by plot.py at 2019-03-18 22:39:47
# Datalink statistics
-- Total of 1 flow:
Average capacity: 12.00 Mbit/s
Average throughput: 11.63 Mbit/s (96.9% utilization)
95th percentile per-packet one-way delay: 49.901 ms
Loss rate: 0.39%
-- Flow 1:
Average throughput: 11.63 Mbit/s
95th percentile per-packet one-way delay: 49.901 ms
Loss rate: 0.39%
Run 3: Report of QUIC Cubic — Data Link

Average capacity 12.00 Mbit/s (shaded region)

Throughput (Mbit/s)

Time (s)

Flow 1 ingress (mean 11.67 Mbit/s)  Flow 1 egress (mean 11.63 Mbit/s)

Per-packet one-way delay (ms)

Time (s)

Flow 1 (95th percentile 49.90 ms)
Run 1: Statistics of SCReAM

Start at: 2019-03-18 22:07:41
End at: 2019-03-18 22:08:11

# Below is generated by plot.py at 2019-03-18 22:39:47
# Datalink statistics
-- Total of 1 flow:
Average capacity: 12.00 Mbit/s
Average throughput: 0.21 Mbit/s (1.8% utilization)
95th percentile per-packet one-way delay: 31.724 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 0.21 Mbit/s
95th percentile per-packet one-way delay: 31.724 ms
Loss rate: 0.00%
Run 1: Report of SCReAM — Data Link

Average capacity 12.00 Mbit/s (shaded region)

Flow 1 ingress (mean 0.21 Mbit/s)  Flow 1 egress (mean 0.21 Mbit/s)

Flow 1 (95th percentile 31.72 ms)
Run 2: Statistics of SCReAM

Start at: 2019-03-18 22:20:08
End at: 2019-03-18 22:20:38

# Below is generated by plot.py at 2019-03-18 22:39:47
# Datalink statistics
-- Total of 1 flow:
  Average capacity: 12.00 Mbit/s
  Average throughput: 0.21 Mbit/s (1.8% utilization)
  95th percentile per-packet one-way delay: 31.879 ms
  Loss rate: 0.00%
-- Flow 1:
  Average throughput: 0.21 Mbit/s
  95th percentile per-packet one-way delay: 31.879 ms
  Loss rate: 0.00%
Run 2: Report of SCReAM — Data Link

Average capacity 12.00 Mbit/s (shaded region)

Flow 1 ingress (mean 0.21 Mbit/s)  Flow 1 egress (mean 0.21 Mbit/s)

Per packet one-way delay (ms)

Flow 1 (95th percentile 31.58 ms)

91
Run 3: Statistics of SCReAM

Start at: 2019-03-18 22:32:37
End at: 2019-03-18 22:33:07

# Below is generated by plot.py at 2019-03-18 22:39:47
# Datalink statistics
-- Total of 1 flow:
  Average capacity: 12.00 Mbit/s
  Average throughput: 0.21 Mbit/s (1.8% utilization)
  95th percentile per-packet one-way delay: 31.691 ms
  Loss rate: 0.00%
-- Flow 1:
  Average throughput: 0.21 Mbit/s
  95th percentile per-packet one-way delay: 31.691 ms
  Loss rate: 0.00%
Run 3: Report of SCReAM — Data Link

Average capacity 12.00 Mbit/s (shaded region)

Throughput (Mbit/s)

Time (s)

Flow 1 ingress (mean 0.21 Mbit/s) — Flow 1 egress (mean 0.21 Mbit/s)

Per packet one-way delay (ms)

Time (s)

Flow 1 (95th percentile 31.69 ms)
Run 1: Statistics of Sprout

Start at: 2019-03-18 22:02:56
End at: 2019-03-18 22:03:26

# Below is generated by plot.py at 2019-03-18 22:39:49
# Datalink statistics
-- Total of 1 flow:
Average capacity: 12.00 Mbit/s
Average throughput: 4.35 Mbit/s (36.2% utilization)
95th percentile per-packet one-way delay: 49.003 ms
Loss rate: 8.94%
-- Flow 1:
Average throughput: 4.35 Mbit/s
95th percentile per-packet one-way delay: 49.003 ms
Loss rate: 8.94%
Run 1: Report of Sprout — Data Link

Average capacity 12.00 Mbit/s (shaded region)

Throughput (Mbit/s)

Time (s)

Flow 1 ingress (mean 4.77 Mbit/s)  Flow 1 egress (mean 4.35 Mbit/s)

Per-packet one-way delay (ms)

Time (s)

Flow 1 (95th percentile 49.00 ms)
Run 2: Statistics of Sprout

Start at: 2019-03-18 22:15:24
End at: 2019-03-18 22:15:54

# Below is generated by plot.py at 2019-03-18 22:39:49
# Datalink statistics
-- Total of 1 flow:
Average capacity: 12.00 Mbit/s
Average throughput: 4.30 Mbit/s (35.9% utilization)
95th percentile per-packet one-way delay: 48.834 ms
Loss rate: 9.13%
-- Flow 1:
Average throughput: 4.30 Mbit/s
95th percentile per-packet one-way delay: 48.834 ms
Loss rate: 9.13%
Run 2: Report of Sprout — Data Link

**Average capacity 12.00 Mbit/s (shaded region)**

**Flow 1 ingress (mean 4.73 Mbit/s)**

**Flow 1 egress (mean 4.30 Mbit/s)**

**Per-packet one-way delay (ms)**

**Flow 1 (95th percentile 48.53 ms)**
Run 3: Statistics of Sprout


# Below is generated by plot.py at 2019-03-18 22:39:50
# Datalink statistics
-- Total of 1 flow:
 Average capacity: 12.00 Mbit/s
 Average throughput: 4.33 Mbit/s (36.1% utilization)
 95th percentile per-packet one-way delay: 48.841 ms
 Loss rate: 8.42%
-- Flow 1:
 Average throughput: 4.33 Mbit/s
 95th percentile per-packet one-way delay: 48.841 ms
 Loss rate: 8.42%
Run 3: Report of Sprout — Data Link

Average capacity 12.00 Mbit/s (shaded region)

Throughput (Mbit/s)

0 2 4 6 8 10 12

0 5 10 15 20 25 30 35

Time (s)

Flow 1 ingress (mean 4.73 Mbit/s)  Flow 1 egress (mean 4.33 Mbit/s)

Per-packet end-to-end delay (ms)

30 35 40 45 50

0 5 10 15 20 25 30 35 40 45 50

Time (s)

Flow 1 (95th percentile 48.54 ms)
Run 1: Statistics of TaoVA-100x

Start at: 2019-03-18 22:09:27
End at: 2019-03-18 22:09:57

# Below is generated by plot.py at 2019-03-18 22:40:10
# Datalink statistics
-- Total of 1 flow:
  Average capacity: 12.00 Mbit/s
  Average throughput: 11.10 Mbit/s (92.5% utilization)
  95th percentile per-packet one-way delay: 33.134 ms
  Loss rate: 0.73%
-- Flow 1:
  Average throughput: 11.10 Mbit/s
  95th percentile per-packet one-way delay: 33.134 ms
  Loss rate: 0.73%
Run 1: Report of TaoVA-100x — Data Link

Average capacity 12.00 Mbit/s (shaded region)

Flow 1 ingress (mean 11.17 Mbit/s)  Flow 1 egress (mean 11.10 Mbit/s)

Per-packet one-way delay (ms)

Flow 1 (95th percentile 33.13 ms)
Run 2: Statistics of TaoVA-100x


# Below is generated by plot.py at 2019-03-18 22:40:15
# Datalink statistics
-- Total of 1 flow:
  Average capacity: 12.00 Mbit/s
  Average throughput: 11.15 Mbit/s (92.9% utilization)
  95th percentile per-packet one-way delay: 33.184 ms
  Loss rate: 0.28%
-- Flow 1:
  Average throughput: 11.15 Mbit/s
  95th percentile per-packet one-way delay: 33.184 ms
  Loss rate: 0.28%
Run 2: Report of TaoVA-100x — Data Link

Average capacity 12.00 Mbit/s (shaded region)

Flow 1 ingress (mean 11.17 Mbit/s)  Flow 1 egress (mean 11.15 Mbit/s)

Per-packet one-way delay (ms)

Flow 1 (95th percentile 33.18 ms)
Run 3: Statistics of TaoVA-100x

Start at: 2019-03-18 22:34:24
End at: 2019-03-18 22:34:54

# Below is generated by plot.py at 2019-03-18 22:40:15
# Datalink statistics
-- Total of 1 flow:
 Average capacity: 12.00 Mbit/s
 Average throughput: 11.12 Mbit/s (92.6% utilization)
 95th percentile per-packet one-way delay: 33.089 ms
 Loss rate: 0.72%
-- Flow 1:
 Average throughput: 11.12 Mbit/s
 95th percentile per-packet one-way delay: 33.089 ms
 Loss rate: 0.72%
Run 3: Report of TaoVA-100x — Data Link

Average capacity 12.00 Mbit/s (shaded region)

Throughput (Mbit/s)

Time (s)

Flow 1 ingress (mean 11.19 Mbit/s)  Flow 1 egress (mean 11.12 Mbit/s)

Per-packet end-to-end delay (ms)

Time (s)

Flow 1 (95th percentile 33.09 ms)
Run 1: Statistics of TCP Vegas

Start at: 2019-03-18 22:04:43
End at: 2019-03-18 22:05:13

# Below is generated by plot.py at 2019-03-18 22:40:15
# Datalink statistics
-- Total of 1 flow:
  Average capacity: 12.00 Mbit/s
  Average throughput: 11.89 Mbit/s (99.1% utilization)
  95th percentile per-packet one-way delay: 37.562 ms
  Loss rate: 0.29%
-- Flow 1:
  Average throughput: 11.89 Mbit/s
  95th percentile per-packet one-way delay: 37.562 ms
  Loss rate: 0.29%
Run 1: Report of TCP Vegas — Data Link

Average capacity 12.00 Mbit/s (shaded region)

Throughput (Mbit/s)

Time (s)

Flow 1 ingress (mean 11.91 Mbit/s)  Flow 1 egress (mean 11.89 Mbit/s)

Per-packet one-way delay (ms)

Time (s)

Flow 1 (95th percentile 37.56 ms)
Run 2: Statistics of TCP Vegas

Start at: 2019-03-18 22:17:11
End at: 2019-03-18 22:17:41

# Below is generated by plot.py at 2019-03-18 22:40:15
# Datalink statistics
-- Total of 1 flow:
  Average capacity: 12.00 Mbit/s
  Average throughput: 11.70 Mbit/s (97.5% utilization)
  95th percentile per-packet one-way delay: 37.698 ms
  Loss rate: 0.32%
-- Flow 1:
  Average throughput: 11.70 Mbit/s
  95th percentile per-packet one-way delay: 37.698 ms
  Loss rate: 0.32%
Run 2: Report of TCP Vegas — Data Link

Average capacity 12.00 Mbit/s (shaded region)

Throughput (Mbit/s)

Time (s)

Flow 1 ingress (mean 11.73 Mbit/s)  Flow 1 egress (mean 11.70 Mbit/s)

Per-packet on-way delay (ms)

Time (s)

Flow 1 (95th percentile 37.70 ms)
Run 3: Statistics of TCP Vegas

End at: 2019-03-18 22:30:09

# Below is generated by plot.py at 2019-03-18 22:40:15
# Datalink statistics
-- Total of 1 flow:
  Average capacity: 12.00 Mbit/s
  Average throughput: 11.69 Mbit/s (97.4% utilization)
  95th percentile per-packet one-way delay: 36.315 ms
  Loss rate: 0.31%
-- Flow 1:
  Average throughput: 11.69 Mbit/s
  95th percentile per-packet one-way delay: 36.315 ms
  Loss rate: 0.31%
Run 3: Report of TCP Vegas — Data Link

![Graph showing average capacity and throughput over time, with shaded region indicating 12.00 Mbit/s average capacity.]

![Graph showing packet delay with 95th percentile at 36.31 ms.]
Run 1: Statistics of Verus

Start at: 2019-03-18 22:08:16
End at: 2019-03-18 22:08:46

# Below is generated by plot.py at 2019-03-18 22:40:17
# Datalink statistics
-- Total of 1 flow:
Average capacity: 12.00 Mbit/s
Average throughput: 6.83 Mbit/s (56.9% utilization)
95th percentile per-packet one-way delay: 51.586 ms
Loss rate: 84.65%
-- Flow 1:
Average throughput: 6.83 Mbit/s
95th percentile per-packet one-way delay: 51.586 ms
Loss rate: 84.65%
Run 1: Report of Verus — Data Link

Average capacity 12.00 Mbit/s (shaded region)

Throughput (Mbit/s)

<table>
<thead>
<tr>
<th>Time (s)</th>
<th>0</th>
<th>5</th>
<th>10</th>
<th>15</th>
<th>20</th>
<th>25</th>
<th>30</th>
<th>35</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow 1 ingress (mean 44.34 Mbit/s)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flow 1 egress (mean 6.83 Mbit/s)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Per-packet one-way delay (ms)

<table>
<thead>
<tr>
<th>Time (s)</th>
<th>0</th>
<th>5</th>
<th>10</th>
<th>15</th>
<th>20</th>
<th>25</th>
<th>30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow 1 (95th percentile 51.59 ms)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Run 2: Statistics of Verus

Start at: 2019-03-18 22:20:43

# Below is generated by plot.py at 2019-03-18 22:40:17
# Datalink statistics
-- Total of 1 flow:
Average capacity: 12.00 Mbit/s
Average throughput: 6.64 Mbit/s (55.3% utilization)
95th percentile per-packet one-way delay: 51.553 ms
Loss rate: 80.84%
-- Flow 1:
Average throughput: 6.64 Mbit/s
95th percentile per-packet one-way delay: 51.553 ms
Loss rate: 80.84%
Run 2: Report of Verus — Data Link

Average capacity 12.00 Mbit/s (shaded region)

- Flow 1 ingress (mean 34.61 Mbit/s)
- Flow 1 egress (mean 6.64 Mbit/s)

Per packet one-way delay (ms)

- Flow 1 (95th percentile 51.55 ms)
Run 3: Statistics of Verus

Start at: 2019-03-18 22:33:12
End at: 2019-03-18 22:33:42

# Below is generated by plot.py at 2019-03-18 22:40:27
# Datalink statistics
-- Total of 1 flow:
  Average capacity: 12.00 Mbit/s
  Average throughput: 6.28 Mbit/s (52.3% utilization)
  95th percentile per-packet one-way delay: 51.886 ms
  Loss rate: 93.61%
-- Flow 1:
  Average throughput: 6.28 Mbit/s
  95th percentile per-packet one-way delay: 51.886 ms
  Loss rate: 93.61%
Run 3: Report of Verus — Data Link

Average capacity 12.00 Mbit/s (shaded region)

Throughput (Mbit/s)

- Flow 1 ingress (mean 98.37 Mbit/s)
- Flow 1 egress (mean 6.28 Mbit/s)

Per-packet one-way delay (ms)

- Flow 1 (95th percentile 51.89 ms)
Run 1: Statistics of PCC-Vivace

Start at: 2019-03-18 22:03:31
End at: 2019-03-18 22:04:01

# Below is generated by plot.py at 2019-03-18 22:40:27
# Datalink statistics
-- Total of 1 flow:
  Average capacity: 12.00 Mbit/s
  Average throughput: 10.95 Mbit/s (91.2% utilization)
  95th percentile per-packet one-way delay: 35.090 ms
  Loss rate: 0.10%
-- Flow 1:
  Average throughput: 10.95 Mbit/s
  95th percentile per-packet one-way delay: 35.090 ms
  Loss rate: 0.10%
Run 1: Report of PCC-Vivace — Data Link

Average capacity 12.00 Mbit/s (shaded region)

Throughput (Mbit/s)

Time (s)

Flow 1 ingress (mean 10.95 Mbit/s)  Flow 1 egress (mean 10.95 Mbit/s)

Packet drop delay (ms)

Time (s)

Flow 1 (95th percentile 35.09 ms)
Run 2: Statistics of PCC-Vivace

Start at: 2019-03-18 22:15:59
End at: 2019-03-18 22:16:29

# Below is generated by plot.py at 2019-03-18 22:40:27
# Datalink statistics
-- Total of 1 flow:
Average capacity: 12.00 Mbit/s
Average throughput: 10.86 Mbit/s (90.5% utilization)
95th percentile per-packet one-way delay: 36.075 ms
Loss rate: 0.20%
-- Flow 1:
Average throughput: 10.86 Mbit/s
95th percentile per-packet one-way delay: 36.075 ms
Loss rate: 0.20%
Run 2: Report of PCC-Vivace — Data Link

Average capacity 12.00 Mbit/s (shaded region)

Flow 1 ingress (mean 10.87 Mbit/s)  Flow 1 egress (mean 10.86 Mbit/s)

Per-packet end-to-end delay (ms)

Flow 1 (95th percentile 36.08 ms)
Run 3: Statistics of PCC-Vivace


# Below is generated by plot.py at 2019-03-18 22:40:27
# Datalink statistics
-- Total of 1 flow:
Average capacity: 12.00 Mbit/s
Average throughput: 10.92 Mbit/s (91.0% utilization)
95th percentile per-packet one-way delay: 39.073 ms
Loss rate: 0.17%
-- Flow 1:
Average throughput: 10.92 Mbit/s
95th percentile per-packet one-way delay: 39.073 ms
Loss rate: 0.17%
Run 3: Report of PCC-Vivace — Data Link

![Graph 1: Average capacity 12.00 Mbit/s (shaded region)]

![Graph 2: Per-packet round-trip delay (ms)]

Flow 1 ingress (mean 10.93 Mbit/s)  Flow 1 egress (mean 10.92 Mbit/s)

Flow 1 (95th percentile 39.07 ms)
Run 1: Statistics of WebRTC media

Start at: 2019-03-18 22:00:33
End at: 2019-03-18 22:01:03

# Below is generated by plot.py at 2019-03-18 22:40:27
# Datalink statistics
-- Total of 1 flow:
Average capacity: 12.00 Mbit/s
Average throughput: 0.05 Mbit/s (0.4% utilization)
95th percentile per-packet one-way delay: 41.254 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 0.05 Mbit/s
95th percentile per-packet one-way delay: 41.254 ms
Loss rate: 0.00%
Run 1: Report of WebRTC media — Data Link

![Graph showing throughput and packet delay](image)

- Average capacity: 12.00 Mbit/s (shaded region)
- Flow 1 ingress (mean 0.05 Mbit/s)
- Flow 1 egress (mean 0.05 Mbit/s)

![Graph showing packet delay](image)

- Flow 1 95th percentile delay: 41.25 ms
Run 2: Statistics of WebRTC media

Start at: 2019-03-18 22:13:01

# Below is generated by plot.py at 2019-03-18 22:40:27
# Datalink statistics
-- Total of 1 flow:
Average capacity: 12.00 Mbit/s
Average throughput: 0.05 Mbit/s (0.4% utilization)
95th percentile per-packet one-way delay: 41.822 ms
Loss rate: 0.00%

-- Flow 1:
Average throughput: 0.05 Mbit/s
95th percentile per-packet one-way delay: 41.822 ms
Loss rate: 0.00%
Run 2: Report of WebRTC media — Data Link

![Network throughput chart](image1)

- Average capacity 12.00 Mbit/s (shaded region)
- Flow 1 ingress (mean 0.05 Mbit/s)
- Flow 1 egress (mean 0.05 Mbit/s)

![Packet delay chart](image2)

- Flow 1 (95th percentile 41.82 ms)
Run 3: Statistics of WebRTC media

End at: 2019-03-18 22:25:59

# Below is generated by plot.py at 2019-03-18 22:40:27
# Datalink statistics
-- Total of 1 flow:
  Average capacity: 12.00 Mbit/s
  Average throughput: 0.05 Mbit/s (0.4% utilization)
  95th percentile per-packet one-way delay: 41.998 ms
  Loss rate: 0.00%
-- Flow 1:
  Average throughput: 0.05 Mbit/s
  95th percentile per-packet one-way delay: 41.998 ms
  Loss rate: 0.00%
Run 3: Report of WebRTC media — Data Link

Average capacity 12.00 Mbit/s (shaded region)

- Flow 1 ingress (mean 0.05 Mbit/s)
- Flow 1 egress (mean 0.05 Mbit/s)

Per packet one-way delay (ms)

Flow 1 (95th percentile 42.00 ms)