Repeated the test of 4 congestion control schemes twice.
Each test lasted for 30 seconds running 3 flows with 10-second interval between two flows.
NTP offsets were measured against time.google.com and have been applied to correct the timestamps in logs.

System info:
Linux 4.15.0-1018-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
net.ipv4.tcp_mem = 536870912 536870912 536870912

Git summary:
branch: muses @ f309f5459e2c5237279a18452ee7a2b47ef1c9
third_party/fillp @ d47f4fa1b454a5e3c537115c5a28436dbd4b834
third_party/fillp-sheep @ daed0c84f98531712514b2231f43ec690111fffe
third_party/genericCC @ d0153f8e594aa89e93b032143cedbfe58e562f4
third_party/indigo @ 2601c92e4aa9d58d38cd4e0edbf90c077e64d
third_party/libutp @ b3465b942e8286f2b179eab4ba906ce6bb7c3f3cf
third_party/muses @ b8d5019b83a3a678804d830f1da7b3a63421b
third_party/pantheon-tunnel @ cbfcede6db5ff5740daef1771f843cd646339e1952
third_party/pcc @ 1afc958afa06d18b6230c91a55f6c872b4981e1
M receiver/src/buffer.h
M receiver/src/core.cpp
M sender/src/buffer.h
M sender/src/core.cpp
third_party/pcc-experimental @ cd43e34e3f5f5613e8ac08fab92c4eb24f974ab
third_party/proto-quic @ 77961f1a8273sa6b42f1bc8143ebc978f3ce42
third_party/scream-reproduce @ f099118d1421a3131bf11f1e964974e1da3bd7b2
M src/ScreamClient
M src/ScreamServer
third_party/sprout @ 366e35c6178b01e31d4a6ad8c74f9415f19a26
third_party/verus @ 4db447ea746c60a261149af2629562939f9a494
M src/verus.hpp
M tools/plot.py
third_party/vivace @ 2bad67211435ae071a32f96b7d53045876f57d7f4
third_party/webrtc @ 3f0cc2a9061a41b6ff9d4e735770d143a1fa2851
test from GCE Iowa to GCE London, 2 runs of 30s each per scheme
3 flows with 10s interval between flows (mean of all runs by scheme)

Average throughput (Mbit/s)

95th percentile one-way delay (ms)

Muses-25
Indigo
TCP BBR
TCP Cubic

Muses-25
Indigo
TCP BBR
TCP Cubic
<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 2</td>
<td>flow 3</td>
</tr>
<tr>
<td>TCP BBR</td>
<td>2</td>
<td>525.27</td>
<td>529.27</td>
<td>444.96</td>
</tr>
<tr>
<td>TCP Cubic</td>
<td>2</td>
<td>575.40</td>
<td>587.94</td>
<td>532.93</td>
</tr>
<tr>
<td>Indigo</td>
<td>2</td>
<td>220.53</td>
<td>208.07</td>
<td>181.34</td>
</tr>
<tr>
<td>Muses-25</td>
<td>2</td>
<td>700.28</td>
<td>627.20</td>
<td>590.36</td>
</tr>
</tbody>
</table>
Run 1: Statistics of TCP BBR

Start at: 2018-09-03 13:41:42
End at: 2018-09-03 13:42:12
Local clock offset: -0.971 ms
Remote clock offset: -0.077 ms

# Below is generated by plot.py at 2018-09-03 14:12:34
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1076.62 Mbit/s
95th percentile per-packet one-way delay: 166.678 ms
Loss rate: 1.60%
-- Flow 1:
Average throughput: 553.50 Mbit/s
95th percentile per-packet one-way delay: 166.181 ms
Loss rate: 1.53%
-- Flow 2:
Average throughput: 546.16 Mbit/s
95th percentile per-packet one-way delay: 174.838 ms
Loss rate: 2.03%
-- Flow 3:
Average throughput: 484.51 Mbit/s
95th percentile per-packet one-way delay: 70.585 ms
Loss rate: 0.89%
Run 1: Report of TCP BBR — Data Link

![Graph showing throughput and round-trip latency over time for different flows.]

- Flow 1 ingress (mean 560.18 Mbit/s)
- Flow 1 egress (mean 553.50 Mbit/s)
- Flow 2 ingress (mean 554.66 Mbit/s)
- Flow 2 egress (mean 546.16 Mbit/s)
- Flow 3 ingress (mean 483.86 Mbit/s)
- Flow 3 egress (mean 484.51 Mbit/s)

![Graph showing round-trip latency for different flows.]

- Flow 1 (95th percentile 166.18 ms)
- Flow 2 (95th percentile 174.84 ms)
- Flow 3 (95th percentile 70.58 ms)
Run 2: Statistics of TCP BBR

Start at: 2018-09-03 13:49:37
End at: 2018-09-03 13:50:07
Local clock offset: -0.064 ms
Remote clock offset: -0.023 ms

# Below is generated by plot.py at 2018-09-03 14:12:34
# Datalink statistics
-- Total of 3 flows:
Average throughput: 971.63 Mbit/s
95th percentile per-packet one-way delay: 161.014 ms
Loss rate: 1.71%
-- Flow 1:
Average throughput: 497.05 Mbit/s
95th percentile per-packet one-way delay: 163.707 ms
Loss rate: 1.93%
-- Flow 2:
Average throughput: 512.38 Mbit/s
95th percentile per-packet one-way delay: 165.830 ms
Loss rate: 1.69%
-- Flow 3:
Average throughput: 405.41 Mbit/s
95th percentile per-packet one-way delay: 86.928 ms
Loss rate: 0.95%
Run 2: Report of TCP BBR — Data Link

![Graph: Throughput vs Time (Mbps)]
- Flow 1 ingress (mean 505.12 Mbps)
- Flow 1 egress (mean 497.05 Mbps)
- Flow 2 ingress (mean 518.58 Mbps)
- Flow 2 egress (mean 512.38 Mbps)
- Flow 3 ingress (mean 405.13 Mbps)
- Flow 3 egress (mean 405.41 Mbps)

![Graph: Per-packet one way delay (ms)]
- Flow 1 (95th percentile 163.71 ms)
- Flow 2 (95th percentile 165.83 ms)
- Flow 3 (95th percentile 86.93 ms)
Run 1: Statistics of TCP Cubic

Start at: 2018-09-03 13:39:39
End at: 2018-09-03 13:40:09
Local clock offset: -0.316 ms
Remote clock offset: -0.057 ms

# Below is generated by plot.py at 2018-09-03 14:13:21
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1146.11 Mbit/s
95th percentile per-packet one-way delay: 141.096 ms
Loss rate: 0.62%
-- Flow 1:
Average throughput: 548.25 Mbit/s
95th percentile per-packet one-way delay: 68.799 ms
Loss rate: 0.35%
-- Flow 2:
Average throughput: 625.12 Mbit/s
95th percentile per-packet one-way delay: 150.144 ms
Loss rate: 0.83%
-- Flow 3:
Average throughput: 551.97 Mbit/s
95th percentile per-packet one-way delay: 140.886 ms
Loss rate: 0.98%
Run 1: Report of TCP Cubic — Data Link

Throughput (Mbit/s)

Time (s)

Flow 1 ingress (mean 548.33 Mbit/s)
Flow 1 egress (mean 548.25 Mbit/s)
Flow 2 ingress (mean 627.19 Mbit/s)
Flow 2 egress (mean 625.12 Mbit/s)
Flow 3 ingress (mean 551.87 Mbit/s)
Flow 3 egress (mean 551.97 Mbit/s)

Per-packet one-way delay (ms)

Time (s)

Flow 1 (95th percentile 68.80 ms)
Flow 2 (95th percentile 150.14 ms)
Flow 3 (95th percentile 140.89 ms)
Run 2: Statistics of TCP Cubic

Start at: 2018-09-03 13:47:34
End at: 2018-09-03 13:48:04
Local clock offset: -0.432 ms
Remote clock offset: 0.021 ms

# Below is generated by plot.py at 2018-09-03 14:13:21
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1138.49 Mbit/s
95th percentile per-packet one-way delay: 126.894 ms
Loss rate: 0.38%
-- Flow 1:
Average throughput: 602.56 Mbit/s
95th percentile per-packet one-way delay: 120.468 ms
Loss rate: 0.35%
-- Flow 2:
Average throughput: 550.77 Mbit/s
95th percentile per-packet one-way delay: 133.269 ms
Loss rate: 0.06%
-- Flow 3:
Average throughput: 513.90 Mbit/s
95th percentile per-packet one-way delay: 101.785 ms
Loss rate: 1.19%
Run 2: Report of TCP Cubic — Data Link

![Graph 1: Throughput (Mbps)](image1)

- Flow 1 ingress (mean 602.69 Mbps)
- Flow 1 egress (mean 602.56 Mbps)
- Flow 2 ingress (mean 543.69 Mbps)
- Flow 2 egress (mean 550.77 Mbps)
- Flow 3 ingress (mean 514.88 Mbps)
- Flow 3 egress (mean 513.90 Mbps)

![Graph 2: Per-packet one-way delay (ms)](image2)

- Flow 1 (95th percentile 120.47 ms)
- Flow 2 (95th percentile 133.27 ms)
- Flow 3 (95th percentile 101.78 ms)
Run 1: Statistics of Indigo

Start at: 2018-09-03 13:43:47
End at: 2018-09-03 13:44:17
Local clock offset: -0.314 ms
Remote clock offset: -0.041 ms

# Below is generated by plot.py at 2018-09-03 14:13:21
# Datalink statistics
-- Total of 3 flows:
  Average throughput: 406.60 Mbit/s
  95th percentile per-packet one-way delay: 51.887 ms
  Loss rate: 0.52%
-- Flow 1:
  Average throughput: 218.30 Mbit/s
  95th percentile per-packet one-way delay: 51.568 ms
  Loss rate: 0.35%
-- Flow 2:
  Average throughput: 199.02 Mbit/s
  95th percentile per-packet one-way delay: 52.310 ms
  Loss rate: 0.52%
-- Flow 3:
  Average throughput: 173.15 Mbit/s
  95th percentile per-packet one-way delay: 51.482 ms
  Loss rate: 1.19%
Run 1: Report of Indigo — Data Link

![Graph showing throughput and latency over time for different flows.](image-url)

**Graph Details:**
- **Throughput Graph:**
  - X-axis: Time (s)
  - Y-axis: Throughput (Mbps)
  - Legend:
    - Blue dashed line: Flow 1 ingress (mean 218.32 Mbps)
    - Blue solid line: Flow 1 egress (mean 218.30 Mbps)
    - Green dashed line: Flow 2 ingress (mean 199.04 Mbps)
    - Green solid line: Flow 2 egress (mean 199.02 Mbps)
    - Red dashed line: Flow 3 ingress (mean 173.45 Mbps)
    - Red solid line: Flow 3 egress (mean 173.15 Mbps)

- **Latency Graph:**
  - X-axis: Time (s)
  - Y-axis: Per-packet one way delay (ms)
  - Legend:
    - Blue dot: Flow 1 (95th percentile 51.57 ms)
    - Green dot: Flow 2 (95th percentile 52.31 ms)
    - Red dot: Flow 3 (95th percentile 51.48 ms)
Run 2: Statistics of Indigo

Start at: 2018-09-03 13:51:37
End at: 2018-09-03 13:52:07
Local clock offset: 0.15 ms
Remote clock offset: 0.031 ms

# Below is generated by plot.py at 2018-09-03 14:13:21
# Datalink statistics

-- Total of 3 flows:
Average throughput: 428.36 Mbit/s
95th percentile per-packet one-way delay: 51.853 ms
Loss rate: 0.52%

-- Flow 1:
Average throughput: 222.76 Mbit/s
95th percentile per-packet one-way delay: 51.125 ms
Loss rate: 0.35%

-- Flow 2:
Average throughput: 217.12 Mbit/s
95th percentile per-packet one-way delay: 52.308 ms
Loss rate: 0.49%

-- Flow 3:
Average throughput: 189.52 Mbit/s
95th percentile per-packet one-way delay: 52.306 ms
Loss rate: 1.16%
Run 2: Report of Indigo — Data Link
Run 1: Statistics of Muses-25

Start at: 2018-09-03 13:45:33
End at: 2018-09-03 13:46:03
Local clock offset: -0.97 ms
Remote clock offset: -0.029 ms

# Below is generated by plot.py at 2018-09-03 14:14:04
# Datalink statistics
-- Total of 3 flows:
  Average throughput: 1321.90 Mbit/s
  95th percentile per-packet one-way delay: 65.400 ms
  Loss rate: 0.47%
-- Flow 1:
  Average throughput: 711.80 Mbit/s
  95th percentile per-packet one-way delay: 65.693 ms
  Loss rate: 0.31%
-- Flow 2:
  Average throughput: 632.16 Mbit/s
  95th percentile per-packet one-way delay: 66.683 ms
  Loss rate: 0.41%
-- Flow 3:
  Average throughput: 584.90 Mbit/s
  95th percentile per-packet one-way delay: 58.737 ms
  Loss rate: 1.19%
Run 1: Report of Muses-25 — Data Link

Throughput (Mb/s)

Time (s)

Flow 1 ingress (mean 711.51 Mb/s)  Flow 1 egress (mean 711.80 Mb/s)
Flow 2 ingress (mean 630.45 Mb/s)  Flow 2 egress (mean 632.16 Mb/s)
Flow 3 ingress (mean 585.99 Mb/s)  Flow 3 egress (mean 584.90 Mb/s)

Per-packet one-way delay (ms)

Time (s)

Flow 1 (95th percentile 65.69 ms)  Flow 2 (95th percentile 66.68 ms)  Flow 3 (95th percentile 58.74 ms)
Run 2: Statistics of Muses-25

Start at: 2018-09-03 13:53:23
End at: 2018-09-03 13:53:53
Local clock offset: -0.549 ms
Remote clock offset: 0.028 ms

# Below is generated by plot.py at 2018-09-03 14:14:04
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1296.68 Mbit/s
95th percentile per-packet one-way delay: 61.863 ms
Loss rate: 0.54%
-- Flow 1:
Average throughput: 688.76 Mbit/s
95th percentile per-packet one-way delay: 61.765 ms
Loss rate: 0.34%
-- Flow 2:
Average throughput: 622.25 Mbit/s
95th percentile per-packet one-way delay: 66.250 ms
Loss rate: 0.55%
-- Flow 3:
Average throughput: 595.82 Mbit/s
95th percentile per-packet one-way delay: 56.221 ms
Loss rate: 1.19%
Run 2: Report of Muses-25 — Data Link

![Graph 1: Throughput (Mbps)]

- Flow 1 Ingress (mean 690.43 Mbps)
- Flow 1 Egress (mean 688.76 Mbps)
- Flow 2 Ingress (mean 624.68 Mbps)
- Flow 2 Egress (mean 622.25 Mbps)
- Flow 3 Ingress (mean 601.11 Mbps)
- Flow 3 Egress (mean 595.82 Mbps)

![Graph 2: Per-packet end-to-end delay (ms)]

- Flow 1 (95th percentile 61.77 ms)
- Flow 2 (95th percentile 66.25 ms)
- Flow 3 (95th percentile 56.22 ms)