Pantheon Report

Data path: GCE Iowa on ens4 (remote) → GCE London on ens4 (local).
Repeated the test of 4 congestion control schemes twice.
Each test lasted for 30 seconds running 1 flow.
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 @ e3c5aa19ca94c3066828fb83f16a8fb6b2731e7a
third_party/fillp @ d47f4fa1b454a5e3c0537115c5a28436dbd4b834
third_party/fillp-sheep @ daed0c84f98531712514b2231f43ec6901114ffe
third_party/genericCC @ d0153f8e594aa89e93b032143cedbdf5e562f4
third_party/indigo @ 2601c92e4aa9d58d83d4dfe0edcbf90c077e6d4
third_party/libutp @ b3465b942e2826f2b179eaab4a906ce6bb7cf3cf
third_party/muses @ b59e0d118c50af3579569c462d33045741c85981
third_party/pantheon-tunnel @ cbf6e6db5ff5740dafe1771f813cd64339e1952
third_party/pcc @ 1af9958fa0d66d18b623c091a55f6c872b4981e1
M receiver/src/buffer.h
M receiver/src/core.cpp
M sender/src/buffer.h
M sender/src/core.cpp
third_party/pcc-experimental @ cd43e34e3f5f5613e8acd08fab92c4eb2df974ab
third_party/proto-quic @ 77961f1a82733a86b42f1bc8143ebc978f3cf42
third_party/scream-reproduce @ f099118d1421aa3131bf11ff1964974e1da3dbdb2
M src/ScreamClient
M src/ScreamServer
third_party/sprout @ 366a35c6178b01e31d4a46ad18c74f9415f19a26
third_party/verus @ d4b447ea74c6c60a261149af2629562939f9a94
M src/verus.hpp
M tools/plot.py
third_party/vivace @ 2baf86211435ae071a32f96b7d8c504587f5d7f4
third_party/webRTC @ 3f0cc2a9061a41b6f9ddee4735770d143a1fa2851
test from GCE Iowa to GCE London, 2 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>2</td>
<td>625.12</td>
<td>144.62</td>
<td>1.35</td>
</tr>
<tr>
<td>TCP Cubic</td>
<td>2</td>
<td>646.73</td>
<td>136.17</td>
<td>0.49</td>
</tr>
<tr>
<td>Indigo</td>
<td>2</td>
<td>238.06</td>
<td>50.63</td>
<td>0.33</td>
</tr>
<tr>
<td>Muses-25</td>
<td>2</td>
<td>657.87</td>
<td>59.98</td>
<td>0.35</td>
</tr>
</tbody>
</table>
Run 1: Statistics of TCP BBR

Start at: 2018-08-31 13:22:08
Local clock offset: -0.391 ms
Remote clock offset: -0.462 ms

# Below is generated by plot.py at 2018-08-31 13:42:17
# Datalink statistics
-- Total of 1 flow:
Average throughput: 624.58 Mbit/s
95th percentile per-packet one-way delay: 143.158 ms
Loss rate: 1.26%
-- Flow 1:
Average throughput: 624.58 Mbit/s
95th percentile per-packet one-way delay: 143.158 ms
Loss rate: 1.26%
Run 1: Report of TCP BBR — Data Link

![Graph showing throughput and packet delay over time]

- *Flow 1 ingress (mean 630.40 Mbit/s)***
- *Flow 1 egress (mean 624.58 Mbit/s)*

- *Flow 1 (95th percentile 143.16 ms)*
Run 2: Statistics of TCP BBR

End at: 2018-08-31 13:28:52
Local clock offset: -0.629 ms
Remote clock offset: -0.625 ms

# Below is generated by plot.py at 2018-08-31 13:42:19
# Datalink statistics
-- Total of 1 flow:
  Average throughput: 625.66 Mbit/s
  95th percentile per-packet one-way delay: 146.091 ms
  Loss rate: 1.44%
-- Flow 1:
  Average throughput: 625.66 Mbit/s
  95th percentile per-packet one-way delay: 146.091 ms
  Loss rate: 1.44%
Run 2: Report of TCP BBR — Data Link

![Graph 1: Throughput (Mbps) vs Time (s)](image1)

Graph 1: Throughput (Mbps) vs Time (s)
- Dashed line: Flow 1 ingress (mean 632.62 Mbps)
- Solid line: Flow 1 egress (mean 625.66 Mbps)

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

Graph 2: Per packet one-way delay (ms) vs Time (s)
- Dotted line: Flow 1 (95th percentile 146.09 ms)
Run 1: Statistics of TCP Cubic

Start at: 2018-08-31 13:20:32
End at: 2018-08-31 13:21:02
Local clock offset: -0.607 ms
Remote clock offset: -0.568 ms

# Below is generated by plot.py at 2018-08-31 13:42:27
# Datalink statistics
-- Total of 1 flow:
Average throughput: 647.80 Mbit/s
95th percentile per-packet one-way delay: 133.499 ms
Loss rate: 0.55%
-- Flow 1:
Average throughput: 647.80 Mbit/s
95th percentile per-packet one-way delay: 133.499 ms
Loss rate: 0.55%
Run 1: Report of TCP Cubic — Data Link
Run 2: Statistics of TCP Cubic

Start at: 2018-08-31 13:26:47  
End at: 2018-08-31 13:27:17  
Local clock offset: -0.921 ms  
Remote clock offset: -0.615 ms

# Below is generated by plot.py at 2018-08-31 13:42:27  
# Datalink statistics  
-- Total of 1 flow:  
Average throughput: 645.66 Mbit/s  
95th percentile per-packet one-way delay: 138.840 ms  
Loss rate: 0.44%  
-- Flow 1:  
Average throughput: 645.66 Mbit/s  
95th percentile per-packet one-way delay: 138.840 ms  
Loss rate: 0.44%
Run 2: Report of TCP Cubic — Data Link
Run 1: Statistics of Indigo

End at: 2018-08-31 13:24:14
Local clock offset: -0.414 ms
Remote clock offset: -0.594 ms

# Below is generated by plot.py at 2018-08-31 13:42:27
# Datalink statistics
-- Total of 1 flow:
Average throughput: 237.19 Mbit/s
95th percentile per-packet one-way delay: 50.769 ms
Loss rate: 0.33%
-- Flow 1:
Average throughput: 237.19 Mbit/s
95th percentile per-packet one-way delay: 50.769 ms
Loss rate: 0.33%
Run 1: Report of Indigo — Data Link

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**Throughput (Mbps)**

- Flow 1 ingress (mean 237.17 Mbit/s)
- Flow 1 egress (mean 237.19 Mbit/s)

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

- Flow 1 (95th percentile 50.77 ms)
Run 2: Statistics of Indigo

Start at: 2018-08-31 13:29:58
End at: 2018-08-31 13:30:28
Local clock offset: -0.716 ms
Remote clock offset: -0.651 ms

# Below is generated by plot.py at 2018-08-31 13:42:27
# Datalink statistics
-- Total of 1 flow:
Average throughput: 238.92 Mbit/s
95th percentile per-packet one-way delay: 50.489 ms
Loss rate: 0.32%
-- Flow 1:
Average throughput: 238.92 Mbit/s
95th percentile per-packet one-way delay: 50.489 ms
Loss rate: 0.32%
Run 2: Report of Indigo — Data Link

![Graph showing throughput versus time for Flow 1 ingress and egress.]

![Graph showing per-packet one-way delay versus time for Flow 1, with a 95th percentile of 50.49 ms.]

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Run 1: Statistics of Muses-25

Start at: 2018-08-31 13:25:10
End at: 2018-08-31 13:25:40
Local clock offset: -0.771 ms
Remote clock offset: -0.598 ms

# Below is generated by plot.py at 2018-08-31 13:43:40
# Datalink statistics
-- Total of 1 flow:
Average throughput: 631.62 Mbit/s
95th percentile per-packet one-way delay: 59.912 ms
Loss rate: 0.35%
-- Flow 1:
Average throughput: 631.62 Mbit/s
95th percentile per-packet one-way delay: 59.912 ms
Loss rate: 0.35%
Run 1: Report of Muses-25 — Data Link

![Graph showing throughput over time for different flows and packet one-way delay](image-url)

- **Flow 1 ingress (mean 631.69 Mbit/s)
- **Flow 1 egress (mean 631.62 Mbit/s)
- **Flow 1 (95th percentile 59.91 ms)
Run 2: Statistics of Muses-25

Start at: 2018-08-31 13:31:25
End at: 2018-08-31 13:31:55
Local clock offset: -0.234 ms
Remote clock offset: -0.658 ms

# Below is generated by plot.py at 2018-08-31 13:43:44
# Datalink statistics
-- Total of 1 flow:
Average throughput: 684.11 Mbit/s
95th percentile per-packet one-way delay: 60.048 ms
Loss rate: 0.36%
-- Flow 1:
Average throughput: 684.11 Mbit/s
95th percentile per-packet one-way delay: 60.048 ms
Loss rate: 0.36%
Run 2: Report of Muses-25 — Data Link

Graph 1: Throughput (Mbps)
- Flow 1 ingress (mean 684.26 Mbps)
- Flow 1 egress (mean 684.11 Mbps)

Graph 2: Per-packet one-way delay (ms)
- Flow 1 (99th percentile 60.05 ms)