Pantheon Report

Data path: GCE Tokyo on ens4 (remote) → GCE Sydney 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 @ d47f4fa1b454a5e3c0537f115c5a28436dbd4b834
third_party/fillp-sheep @ daed0c8f898531712514b2231f43ec6901114ffe
third_party/genericCC @ d0153f8e594aa9e93b032143ceddbfe58e562f4
third_party/indigo @ 2601c92e4aa9d58d38dc4dfe0ecb5bf90c077e64d
third_party/libutp @ b3465b942e2826f2b179eaab4a906ce6bb7cf3c8f
third_party/muses @ b59e0d118c50af3579569c4623d3045741c85981
third_party/pantheon-tunnel @ cbfcede6b5ff5740dafe1771f813cd646339e1952
third_party/pcc @ 1af0958fa0d66d18b623c091a55f6c872b4981e1
M receiver/src/buffer.h
M receiver/src/core.cpp
M sender/src/buffer.h
M sender/src/core.cpp
third_party/pcc-experimental @ cd43e34e3f5f5613e8ac0d8f2ab92c4eb24f974ab
third_party/proto-quic @ 77961f1a82733a86b42f1bc8143ebc978f3cff42
third_party/scream-reproduce @ f09911b4d1e41aa3133bf11ff1964974e1da3b4bd2
M src/ScreamClient
M src/ScreamServer
third_party/sprout @ 366a35c6178b01e31d4a46ad18c74f9415f19a26
third_party/verus @ d4b447ea74c6c60a261149af2629562939f9a494
M src/verus.hpp
M tools/plot.py
third_party/vivace @ 2baf86211435ae071a32f96b7d8c504587f5d7f4
third_party/webrtc @ 3f0cc2a9061a41b6f9d4e735770d143a1fa2851
test from GCE Tokyo to GCE Sydney, 2 runs of 30s each per scheme
(mean of all runs by scheme)

Muses-25
Indigo
TCP BBR
TCP Cubic

95th percentile one-way delay (ms)

Average throughput (Mbit/s)

2
<table>
<thead>
<tr>
<th>scheme</th>
<th># runs</th>
<th>mean avg tput (Mbit/s) flow 1</th>
<th>mean 95th-%ile delay (ms) flow 1</th>
<th>mean loss rate (%) flow 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>TCP BBR</td>
<td>2</td>
<td>589.81</td>
<td>132.71</td>
<td>0.76</td>
</tr>
<tr>
<td>TCP Cubic</td>
<td>2</td>
<td>585.05</td>
<td>75.72</td>
<td>0.42</td>
</tr>
<tr>
<td>Indigo</td>
<td>2</td>
<td>228.00</td>
<td>55.40</td>
<td>0.34</td>
</tr>
<tr>
<td>Muses-25</td>
<td>2</td>
<td>643.19</td>
<td>59.78</td>
<td>0.35</td>
</tr>
</tbody>
</table>
Run 1: Statistics of TCP BBR

Start at: 2018-08-31 13:20:33
End at: 2018-08-31 13:21:03
Local clock offset: -0.198 ms
Remote clock offset: -2.965 ms

# Below is generated by plot.py at 2018-08-31 13:42:09
# Datalink statistics
-- Total of 1 flow:
Average throughput: 587.91 Mbit/s
95th percentile per-packet one-way delay: 133.578 ms
Loss rate: 0.81%
-- Flow 1:
Average throughput: 587.91 Mbit/s
95th percentile per-packet one-way delay: 133.578 ms
Loss rate: 0.81%
Run 1: Report of TCP BBR — Data Link

![Graph 1](image1.png)

- Flow 1 ingress (mean 590.57 Mbit/s)
- Flow 1 egress (mean 587.91 Mbit/s)

![Graph 2](image2.png)

- Flow 1 (95th percentile 133.58 ms)
Run 2: Statistics of TCP BBR

Start at: 2018-08-31 13:26:41
End at: 2018-08-31 13:27:11
Local clock offset: -0.169 ms
Remote clock offset: -0.191 ms

# Below is generated by plot.py at 2018-08-31 13:42:13
# Datalink statistics
-- Total of 1 flow:
Average throughput: 591.71 Mbit/s
95th percentile per-packet one-way delay: 131.836 ms
Loss rate: 0.70%
-- Flow 1:
Average throughput: 591.71 Mbit/s
95th percentile per-packet one-way delay: 131.836 ms
Loss rate: 0.70%
Run 2: Report of TCP BBR — Data Link

![Graph of Throughput vs Time](image)

- Flow 1 ingress (mean 593.83 Mbit/s)
- Flow 1 egress (mean 591.71 Mbit/s)

![Graph of Packet Delay vs Time](image)

- Flow 1 (95th percentile 131.84 ms)
Run 1: Statistics of TCP Cubic

Local clock offset: -0.207 ms
Remote clock offset: -0.129 ms

# Below is generated by plot.py at 2018-08-31 13:42:13
# Datalink statistics
-- Total of 1 flow:
Average throughput: 543.07 Mbit/s
95th percentile per-packet one-way delay: 57.043 ms
Loss rate: 0.44%
-- Flow 1:
Average throughput: 543.07 Mbit/s
95th percentile per-packet one-way delay: 57.043 ms
Loss rate: 0.44%
Run 1: Report of TCP Cubic — Data Link

![Graph of Throughput (Mbps) over time](image1)

- **Flow 1 ingress (mean 543.54 Mbps)**
- **Flow 1 egress (mean 543.07 Mbps)**

![Graph of Per-packet delay (ms) over time](image2)

- **Flow 1 (95th percentile 57.04 ms)**
Run 2: Statistics of TCP Cubic

Start at: 2018-08-31 13:28:17  
End at: 2018-08-31 13:28:47  
Local clock offset: -0.129 ms  
Remote clock offset: -0.263 ms

# Below is generated by plot.py at 2018-08-31 13:42:18
# Datalink statistics
-- Total of 1 flow:
Average throughput: 627.03 Mbit/s  
95th percentile per-packet one-way delay: 94.393 ms  
Loss rate: 0.39%
-- Flow 1:
Average throughput: 627.03 Mbit/s  
95th percentile per-packet one-way delay: 94.393 ms  
Loss rate: 0.39%
Run 2: Report of TCP Cubic — Data Link

![Graph showing throughput and packet delay over time.]

- Flow 1 ingress (mean 627.27 Mbit/s)
- Flow 1 egress (mean 627.03 Mbit/s)

![Graph showing packet delay over time.]

- Flow 1 (95th percentile 94.39 ms)
Run 1: Statistics of Indigo

End at: 2018-08-31 13:24:09
Local clock offset: -0.121 ms
Remote clock offset: -2.799 ms

# Below is generated by plot.py at 2018-08-31 13:42:18
# Datalink statistics
-- Total of 1 flow:
Average throughput: 228.33 Mbit/s
95th percentile per-packet one-way delay: 56.761 ms
Loss rate: 0.34%
-- Flow 1:
Average throughput: 228.33 Mbit/s
95th percentile per-packet one-way delay: 56.761 ms
Loss rate: 0.34%
Run 1: Report of Indigo — Data Link

![Graph showing throughput and packet delay over time.](image-url)
Run 2: Statistics of Indigo

Start at: 2018-08-31 13:29:52
End at: 2018-08-31 13:30:22
Local clock offset: -0.17 ms
Remote clock offset: -0.237 ms

# Below is generated by plot.py at 2018-08-31 13:42:18
# Datalink statistics
-- Total of 1 flow:
Average throughput: 227.68 Mbit/s
95th percentile per-packet one-way delay: 54.038 ms
Loss rate: 0.35%
-- Flow 1:
Average throughput: 227.68 Mbit/s
95th percentile per-packet one-way delay: 54.038 ms
Loss rate: 0.35%
Run 2: Report of Indigo — Data Link

![Graph of Throughput](image)

Legend:
- Flow 1 ingress (mean 227.66 Mbit/s)
- Flow 1 egress (mean 227.68 Mbit/s)

![Graph of Packet Delay](image)

Legend:
- Flow 1 (95th percentile 54.04 ms)
Run 1: Statistics of Muses-25

Start at: 2018-08-31 13:25:04
End at: 2018-08-31 13:25:34
Local clock offset: -0.104 ms
Remote clock offset: -0.061 ms

# Below is generated by plot.py at 2018-08-31 13:43:34
# Datalink statistics
-- Total of 1 flow:
Average throughput: 622.40 Mbit/s
95th percentile per-packet one-way delay: 58.330 ms
Loss rate: 0.37%
-- Flow 1:
Average throughput: 622.40 Mbit/s
95th percentile per-packet one-way delay: 58.330 ms
Loss rate: 0.37%
Run 1: Report of Muses-25 — Data Link

![Graph 1: Throughput (kbps)]

- Flow 1 ingress (mean 623.39 Mbit/s)
- Flow 1 egress (mean 622.40 Mbit/s)

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

- Flow 1 (95th percentile 58.33 ms)
Run 2: Statistics of Muses-25

Start at: 2018-08-31 13:31:17
End at: 2018-08-31 13:31:47
Local clock offset: -0.011 ms
Remote clock offset: -0.105 ms

# Below is generated by plot.py at 2018-08-31 13:43:37
# Datalink statistics
-- Total of 1 flow:
Average throughput: 663.99 Mbit/s
95th percentile per-packet one-way delay: 61.230 ms
Loss rate: 0.34%
-- Flow 1:
Average throughput: 663.99 Mbit/s
95th percentile per-packet one-way delay: 61.230 ms
Loss rate: 0.34%
Run 2: Report of Muses-25 — Data Link

![Throughput Graph](image)

- Flow 1 ingress (mean 664.00 Mbit/s)
- Flow 1 egress (mean 663.99 Mbit/s)

![Packet Delay Graph](image)

- Flow 1 (95th percentile 61.23 ms)