Pantheon Report

Generated at 2018-08-31 12:42:49 (UTC).
Data path: GCE Sydney on ens4 (local) → GCE Tokyo on ens4 (remote).
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 @ d47f4fa1b454a5e3c0537115c5a28436ddbd4b834
third_party/fillp-sheep @ daed0c84f98531712514b2231f43ec6901114ffe
third_party/genericCC @ d0153f8e594aa89e93b032143ced7f685e562f4
third_party/indigo @ 2601c92e4aa9d58d38dc44dfe0ecd6f90c07e0e6d
third_party/libutp @ b3465b942e2826f2b179e9ab4aa906ce6bb7cf3c3
third_party/muses @ b59e0d118c50af3579569c462d33045746c85981
third_party/pantheon-tunnel @ cbfc6db5ff5740dfe1771f813cd66339e1952
third_party/pcc @ 1af9c958fa0d66d18b23c091a556ec872b4981e1
  M receiver/src/buffer.h
  M receiver/src/core.cpp
  M sender/src/buffer.h
  M sender/src/core.cpp
third_party/pcc-experimental @ cd43e34e3f5f6513e8acd08fab92c4eb24f974ab
third_party/proto-quic @ 77961f1a82733a86b42f1bc8143beb978f3c7f42
third_party/scream-reproduce @ f099118d1421aa3131bf11ff1964974e1da3b1b2
  M src/ScreamClient
  M src/ScreamServer
third_party/sprout @ 366e35c6179b01e31d4a46ad18c74f9415f19a26
third_party/verus @ d4b447ea74c6c60a261149af2629562939f9a494
  M src/verus.hpp
  M tools/plot.py
third_party/vivace @ 2baf86211435ae071a32f96b7d8c504587f5d7f4
third_party/webRTC @ 3f0cc2a906141b6f9de4735770d143a1fa2851
test from GCE Sydney to GCE Tokyo, 2 runs of 30s each per scheme
(mean of all runs by scheme)

<table>
<thead>
<tr>
<th>95th percentile one-way delay (ms)</th>
<th>Average throughput (Mbit/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>250</td>
<td>Muses-25</td>
</tr>
<tr>
<td>300</td>
<td>Indigo</td>
</tr>
<tr>
<td>350</td>
<td>TCP BBR</td>
</tr>
<tr>
<td>400</td>
<td>TCP Cubic</td>
</tr>
<tr>
<td>450</td>
<td></td>
</tr>
<tr>
<td>500</td>
<td></td>
</tr>
<tr>
<td>550</td>
<td></td>
</tr>
<tr>
<td>600</td>
<td></td>
</tr>
</tbody>
</table>

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>TCP BBR</td>
<td>2</td>
<td>592.98</td>
<td>132.16</td>
<td>0.62</td>
</tr>
<tr>
<td>TCP Cubic</td>
<td>2</td>
<td>597.36</td>
<td>68.27</td>
<td>0.01</td>
</tr>
<tr>
<td>Indigo</td>
<td>2</td>
<td>228.19</td>
<td>49.33</td>
<td>0.00</td>
</tr>
<tr>
<td>Muses-25</td>
<td>2</td>
<td>623.55</td>
<td>55.39</td>
<td>0.00</td>
</tr>
</tbody>
</table>
Run 1: Statistics of TCP BBR

Start at: 2018-08-31 12:21:38
End at: 2018-08-31 12:22:08
Local clock offset: 0.386 ms
Remote clock offset: -2.456 ms

# Below is generated by plot.py at 2018-08-31 12:41:32
# Datalink statistics
-- Total of 1 flow:
  Average throughput: 598.28 Mbit/s
  95th percentile per-packet one-way delay: 135.337 ms
  Loss rate: 0.67%
-- Flow 1:
  Average throughput: 598.28 Mbit/s
  95th percentile per-packet one-way delay: 135.337 ms
  Loss rate: 0.67%
Run 1: Report of TCP BBR — Data Link

![Graph of Throughput vs Time](image1)

- **Flow 1 ingress (mean 602.32 Mbit/s)**
- **Flow 1 egress (mean 598.28 Mbit/s)**

![Graph of Per-packet one-way delay vs Time](image2)

- **Flow 1 (95th percentile 135.34 ms)**
Run 2: Statistics of TCP BBR

Start at: 2018-08-31 12:27:45
End at: 2018-08-31 12:28:15
Local clock offset: 0.317 ms
Remote clock offset: -2.399 ms

# Below is generated by plot.py at 2018-08-31 12:41:32
# Datalink statistics
-- Total of 1 flow:
Average throughput: 587.68 Mbit/s
95th percentile per-packet one-way delay: 128.988 ms
Loss rate: 0.58%
-- Flow 1:
Average throughput: 587.68 Mbit/s
95th percentile per-packet one-way delay: 128.988 ms
Loss rate: 0.58%
Run 2: Report of TCP BBR — Data Link
Run 1: Statistics of TCP Cubic

Start at: 2018-08-31 12:20:02
End at: 2018-08-31 12:20:32
Local clock offset: 0.31 ms
Remote clock offset: 3.343 ms

# Below is generated by plot.py at 2018-08-31 12:42:03
# Datalink statistics
-- Total of 1 flow:
Average throughput: 633.07 Mbit/s
95th percentile per-packet one-way delay: 69.533 ms
Loss rate: 0.02%
-- Flow 1:
Average throughput: 633.07 Mbit/s
95th percentile per-packet one-way delay: 69.533 ms
Loss rate: 0.02%
Run 1: Report of TCP Cubic — Data Link
Run 2: Statistics of TCP Cubic

Start at: 2018-08-31 12:26:14
End at: 2018-08-31 12:26:44
Local clock offset: 0.422 ms
Remote clock offset: 0.372 ms

# Below is generated by plot.py at 2018-08-31 12:42:03
# Datalink statistics
-- Total of 1 flow:
Average throughput: 561.65 Mbit/s
95th percentile per-packet one-way delay: 67.002 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 561.65 Mbit/s
95th percentile per-packet one-way delay: 67.002 ms
Loss rate: 0.00%
Run 2: Report of TCP Cubic — Data Link

[Graphs showing throughput and packet delay]
Run 1: Statistics of Indigo

Start at: 2018-08-31 12:24:48
End at: 2018-08-31 12:25:19
Local clock offset: 0.427 ms
Remote clock offset: 0.256 ms

# Below is generated by plot.py at 2018-08-31 12:42:03
# Datalink statistics
-- Total of 1 flow:
Average throughput: 231.08 Mbit/s
95th percentile per-packet one-way delay: 50.679 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 231.08 Mbit/s
95th percentile per-packet one-way delay: 50.679 ms
Loss rate: 0.00%
Run 1: Report of Indigo — Data Link

![Graph 1: Throughput over Time]

![Graph 2: Per-packet one-way delay over Time]

13
Run 2: Statistics of Indigo

Start at: 2018-08-31 12:30:59
End at: 2018-08-31 12:31:29
Local clock offset: 0.529 ms
Remote clock offset: -2.274 ms

# Below is generated by plot.py at 2018-08-31 12:42:03
# Datalink statistics
-- Total of 1 flow:
Average throughput: 225.29 Mbit/s
95th percentile per-packet one-way delay: 47.976 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 225.29 Mbit/s
95th percentile per-packet one-way delay: 47.976 ms
Loss rate: 0.00%
Run 2: Report of Indigo — Data Link

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**Throughput (Mbit/s)**

- Flow 1 ingress (mean 225.28 Mbit/s)
- Flow 1 egress (mean 225.29 Mbit/s)

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

- Flow 1 (95th percentile 47.98 ms)
Run 1: Statistics of Muses-25

End at: 2018-08-31 12:23:43
Local clock offset: 0.573 ms
Remote clock offset: -2.388 ms

# Below is generated by plot.py at 2018-08-31 12:42:44
# Datalink statistics
-- Total of 1 flow:
Average throughput: 611.19 Mbit/s
95th percentile per-packet one-way delay: 52.949 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 611.19 Mbit/s
95th percentile per-packet one-way delay: 52.949 ms
Loss rate: 0.00%
Run 1: Report of Muses-25 — Data Link

Graph 1: Throughput vs. Time (s)

- Flow 1 ingress (mean 611.19 Mbit/s)
- Flow 1 egress (mean 611.19 Mbit/s)

Graph 2: Packet Drop vs. Time (s)

- Flow 1 (95th percentile 52.95 ms)
Run 2: Statistics of Muses-25

Start at: 2018-08-31 12:29:21  
End at: 2018-08-31 12:29:51  
Local clock offset: 0.519 ms  
Remote clock offset: 0.622 ms

# Below is generated by plot.py at 2018-08-31 12:42:47  
# Datalink statistics  
-- Total of 1 flow:  
Average throughput: 635.91 Mbit/s  
95th percentile per-packet one-way delay: 57.829 ms  
Loss rate: 0.00%  
-- Flow 1:  
Average throughput: 635.91 Mbit/s  
95th percentile per-packet one-way delay: 57.829 ms  
Loss rate: 0.00%
Run 2: Report of Muses-25 — Data Link

Throughput (bit/s)

Time (s)

Flow 1 ingress (mean 635.97 Mbit/s)  Flow 1 egress (mean 635.91 Mbit/s)

Throughput (bit/s)

Time (s)

Flow 1 (95th percentile 57.83 ms)