

Pantheon Report

Generated at 2018-09-03 13:14:08 (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 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.

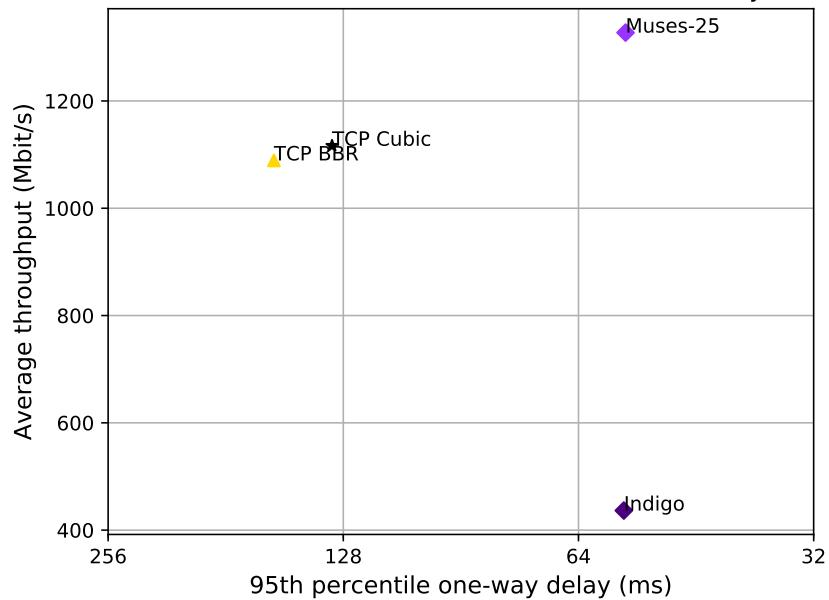
System info:

```
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
```

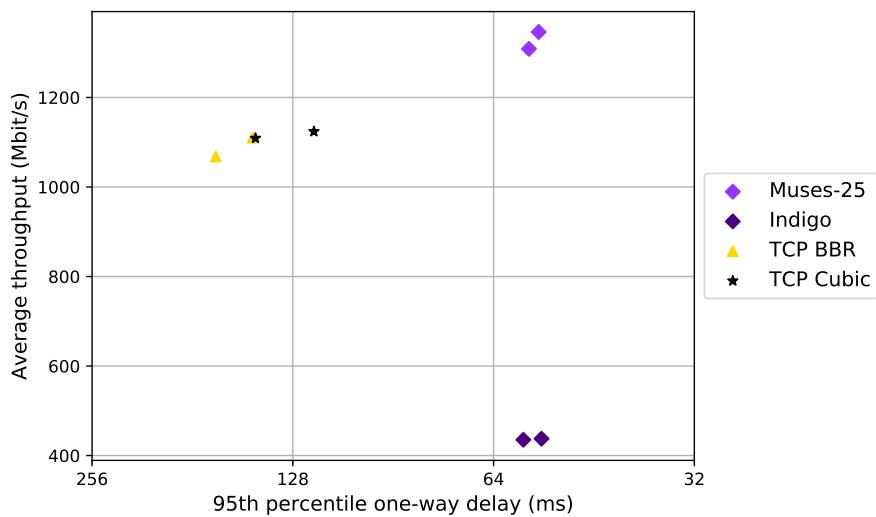
Git summary:

```
branch: muses @ f309f5459e2c5237279a184e52ece7a2b47ef1c9
third_party/fillp @ d47f4fa1b454a5e3c0537115c5a28436dbd4b834
third_party/fillp-sheep @ daed0c84f98531712514b2231f43ec6901114ffe
third_party/genericCC @ d0153f8e594aa89e93b032143cedbdf58e562f4
third_party/indigo @ 2601c92e4aa9d58d38dc4dfe0ecdbf90c077e64d
third_party/libutp @ b3465b942e2826f2b179eaab4a906ce6bb7cf3cf
third_party/muses @ b8d5019b83a3a678804d830fcfe1da7b3a63421b
third_party/pantheon-tunnel @ cbfce6db5ff5740dafe1771f813cd646339e1952
third_party/pcc @ 1afc958fa0d66d18b623c091a55fec872b4981e1
  M receiver/src/buffer.h
  M receiver/src/core.cpp
  M sender/src/buffer.h
  M sender/src/core.cpp
third_party/pcc-experimental @ cd43e34e3f5f5613e8acd08fab92c4eb24f974ab
third_party/proto-quic @ 77961f1a82733a86b42f1bc8143ebc978f3cff42
third_party/scream-reproduce @ f099118d1421aa3131bf11ff1964974e1da3bdb2
  M src/ScreamClient
  M src/ScreamServer
third_party/sprout @ 366e35c6178b01e31d4a46ad18c74f9415f19a26
third_party/verus @ d4b447ea74c6c60a261149af2629562939f9a494
  M src/verus.hpp
  M tools/plot.py
third_party/vivace @ 2baf86211435ae071a32f96b7d8c504587f5d7f4
third_party/webrtc @ 3f0cc2a9061a41b6f9dde4735770d143a1fa2851
```

test from GCE Sydney to GCE Tokyo, 2 runs of 30s each per scheme
3 flows with 10s interval between flows (mean of all runs by scheme)



test from GCE Sydney to GCE Tokyo, 2 runs of 30s each per scheme
3 flows with 10s interval between flows



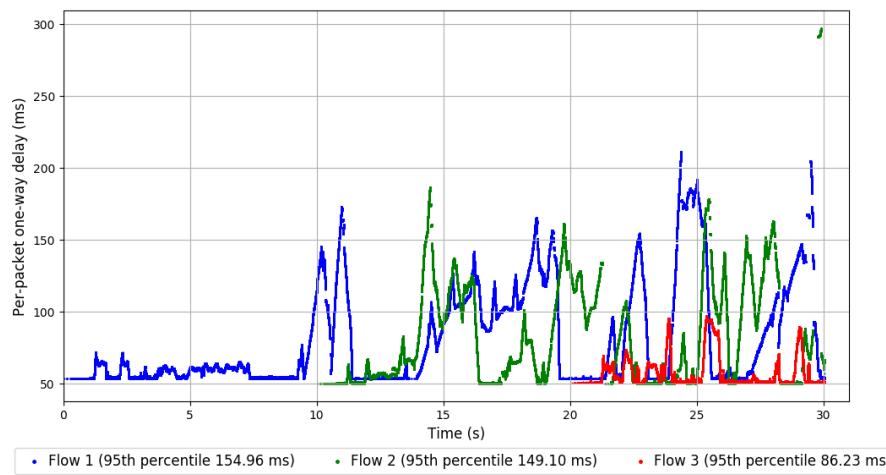
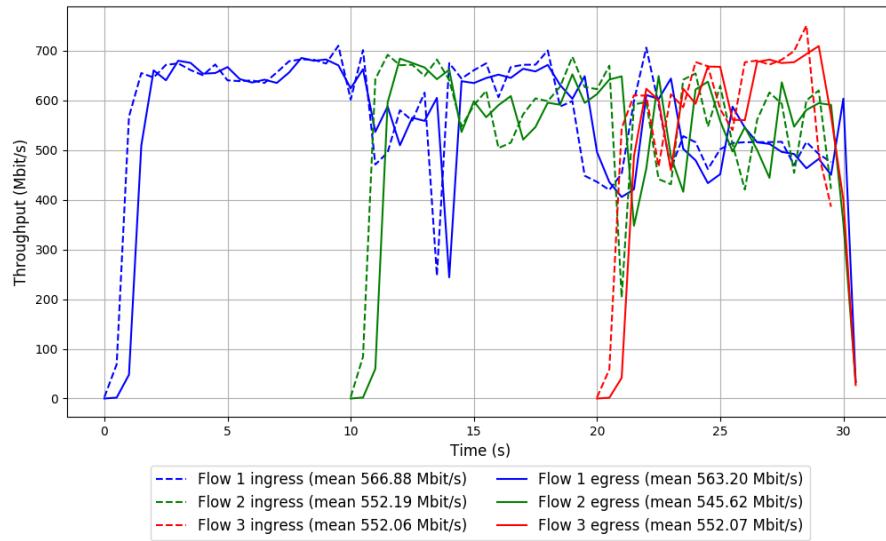
| scheme | # runs | mean avg tput (Mbit/s) | | | mean 95th-%ile delay (ms) | | | mean loss rate (%) | | |
|-----------|--------|------------------------|--------|--------|---------------------------|--------|--------|--------------------|--------|--------|
| | | flow 1 | flow 2 | flow 3 | flow 1 | flow 2 | flow 3 | flow 1 | flow 2 | flow 3 |
| TCP BBR | 2 | 548.40 | 529.52 | 570.67 | 164.95 | 140.44 | 114.33 | 1.08 | 0.73 | 0.69 |
| TCP Cubic | 2 | 582.37 | 552.30 | 500.20 | 133.09 | 94.15 | 109.62 | 0.10 | 0.11 | 0.09 |
| Indigo | 2 | 236.41 | 212.24 | 182.52 | 53.07 | 57.04 | 56.35 | 0.00 | 0.01 | 0.02 |
| Muses-25 | 2 | 715.41 | 637.05 | 578.28 | 55.75 | 55.62 | 55.17 | 0.00 | 0.01 | 0.03 |

Run 1: Statistics of TCP BBR

```
Start at: 2018-09-03 12:39:57
End at: 2018-09-03 12:40:27
Local clock offset: 0.39 ms
Remote clock offset: -0.08 ms

# Below is generated by plot.py at 2018-09-03 13:13:07
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1110.10 Mbit/s
95th percentile per-packet one-way delay: 147.056 ms
Loss rate: 0.72%
-- Flow 1:
Average throughput: 563.20 Mbit/s
95th percentile per-packet one-way delay: 154.961 ms
Loss rate: 0.65%
-- Flow 2:
Average throughput: 545.62 Mbit/s
95th percentile per-packet one-way delay: 149.104 ms
Loss rate: 1.19%
-- Flow 3:
Average throughput: 552.07 Mbit/s
95th percentile per-packet one-way delay: 86.234 ms
Loss rate: 0.00%
```

Run 1: Report of TCP BBR — Data Link

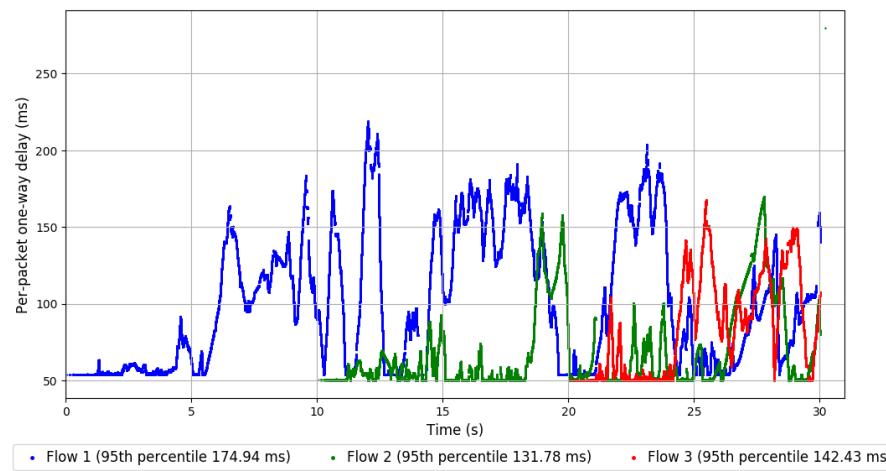
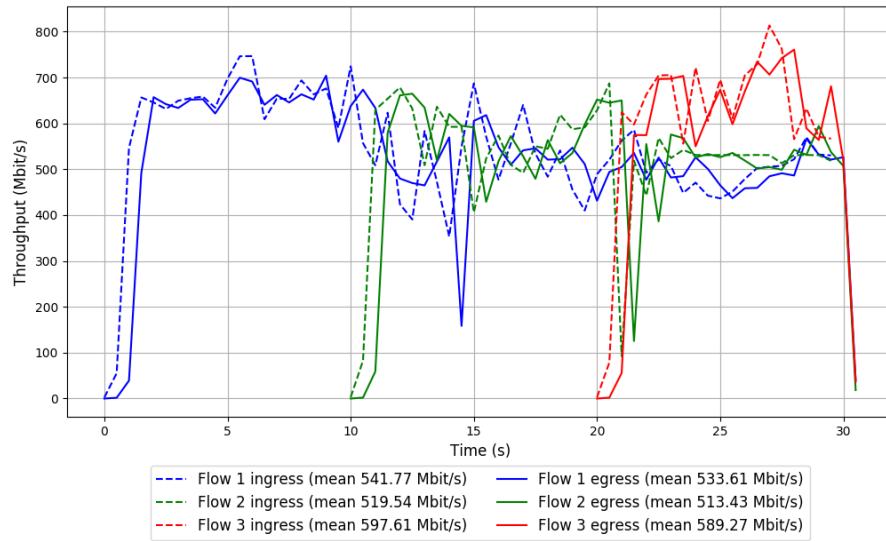


Run 2: Statistics of TCP BBR

```
Start at: 2018-09-03 12:47:51
End at: 2018-09-03 12:48:21
Local clock offset: 0.591 ms
Remote clock offset: -0.232 ms

# Below is generated by plot.py at 2018-09-03 13:13:07
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1068.20 Mbit/s
95th percentile per-packet one-way delay: 167.034 ms
Loss rate: 1.10%
-- Flow 1:
Average throughput: 533.61 Mbit/s
95th percentile per-packet one-way delay: 174.938 ms
Loss rate: 1.52%
-- Flow 2:
Average throughput: 513.43 Mbit/s
95th percentile per-packet one-way delay: 131.780 ms
Loss rate: 0.28%
-- Flow 3:
Average throughput: 589.27 Mbit/s
95th percentile per-packet one-way delay: 142.431 ms
Loss rate: 1.39%
```

Run 2: Report of TCP BBR — Data Link

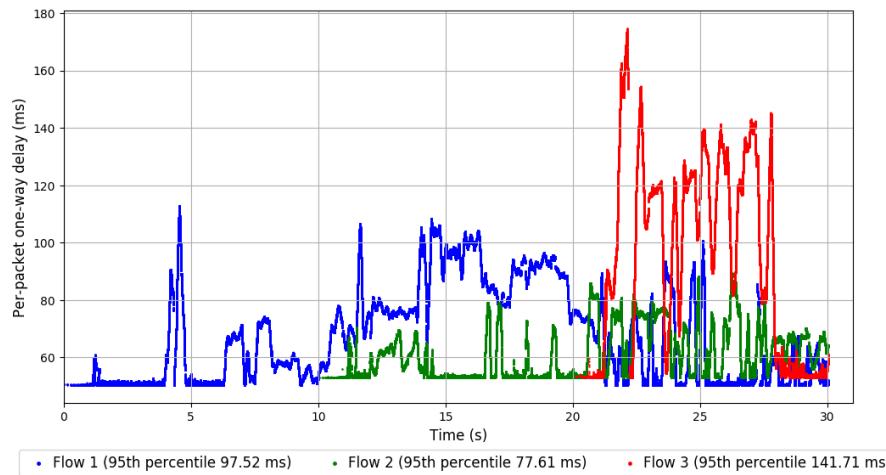
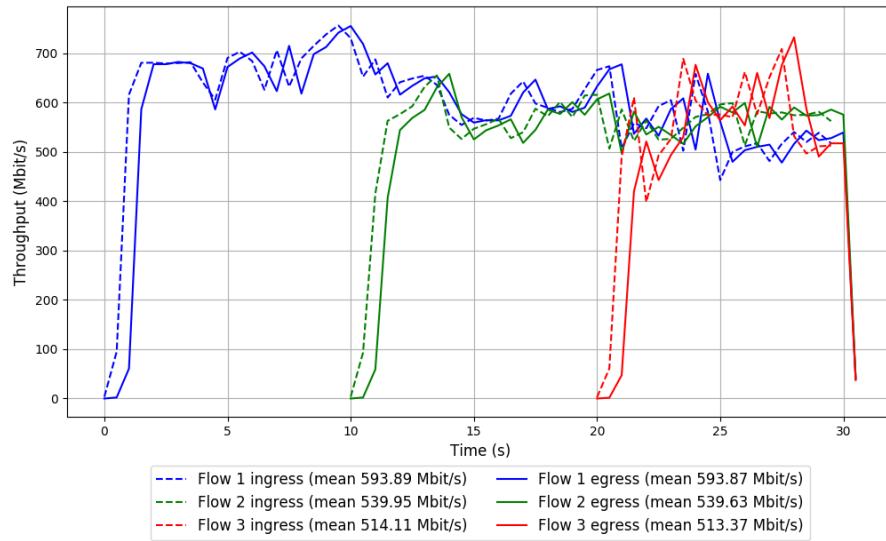


Run 1: Statistics of TCP Cubic

```
Start at: 2018-09-03 12:45:49
End at: 2018-09-03 12:46:19
Local clock offset: 0.664 ms
Remote clock offset: -0.156 ms

# Below is generated by plot.py at 2018-09-03 13:13:11
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1123.88 Mbit/s
95th percentile per-packet one-way delay: 119.008 ms
Loss rate: 0.05%
-- Flow 1:
Average throughput: 593.87 Mbit/s
95th percentile per-packet one-way delay: 97.521 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 539.63 Mbit/s
95th percentile per-packet one-way delay: 77.605 ms
Loss rate: 0.07%
-- Flow 3:
Average throughput: 513.37 Mbit/s
95th percentile per-packet one-way delay: 141.705 ms
Loss rate: 0.16%
```

Run 1: Report of TCP Cubic — Data Link

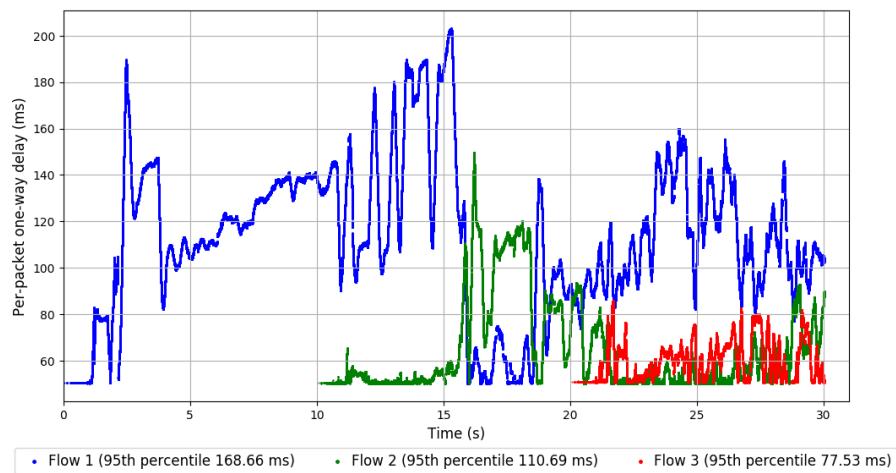
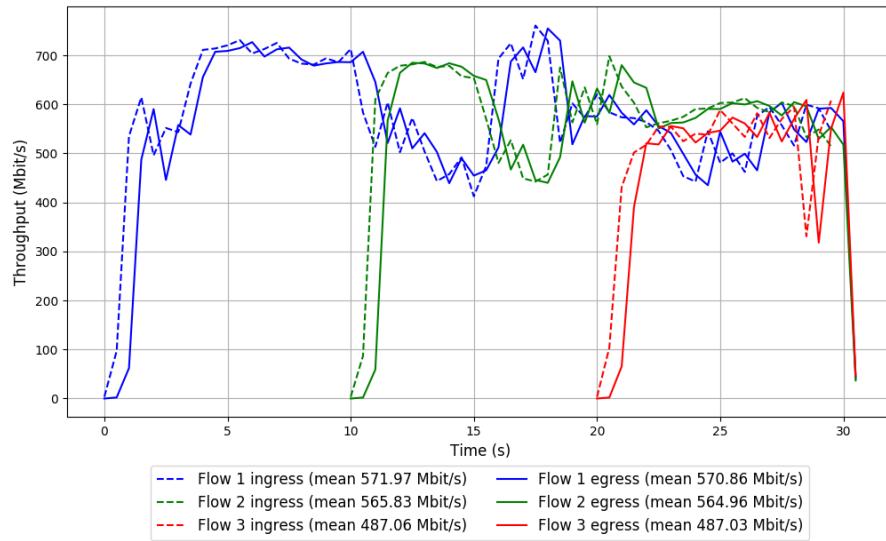


Run 2: Statistics of TCP Cubic

```
Start at: 2018-09-03 12:53:46
End at: 2018-09-03 12:54:16
Local clock offset: 0.718 ms
Remote clock offset: -0.087 ms

# Below is generated by plot.py at 2018-09-03 13:13:11
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1109.06 Mbit/s
95th percentile per-packet one-way delay: 145.616 ms
Loss rate: 0.15%
-- Flow 1:
Average throughput: 570.86 Mbit/s
95th percentile per-packet one-way delay: 168.656 ms
Loss rate: 0.19%
-- Flow 2:
Average throughput: 564.96 Mbit/s
95th percentile per-packet one-way delay: 110.688 ms
Loss rate: 0.15%
-- Flow 3:
Average throughput: 487.03 Mbit/s
95th percentile per-packet one-way delay: 77.535 ms
Loss rate: 0.01%
```

Run 2: Report of TCP Cubic — Data Link

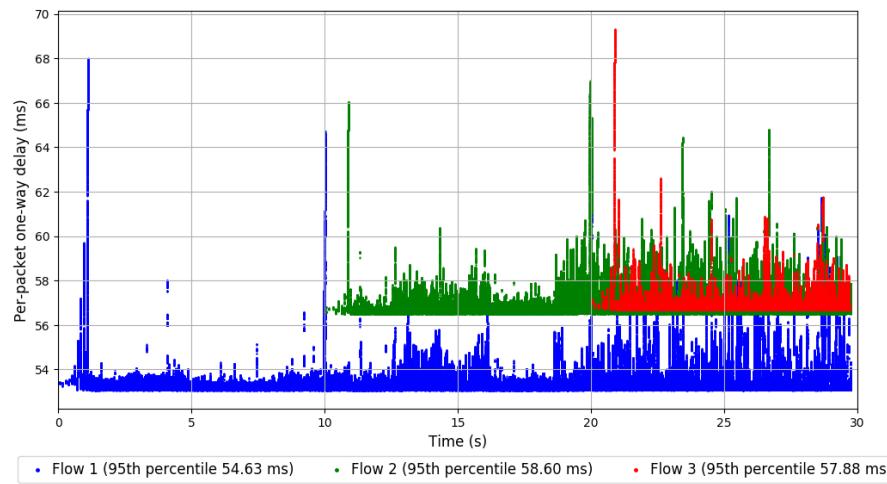
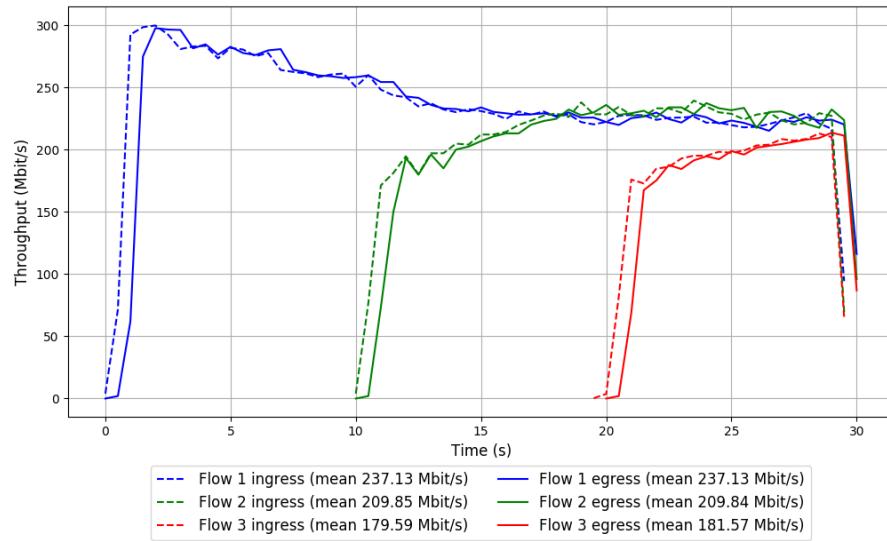


Run 1: Statistics of Indigo

```
Start at: 2018-09-03 12:44:02
End at: 2018-09-03 12:44:32
Local clock offset: 0.465 ms
Remote clock offset: 2.968 ms

# Below is generated by plot.py at 2018-09-03 13:13:11
# Datalink statistics
-- Total of 3 flows:
Average throughput: 435.26 Mbit/s
95th percentile per-packet one-way delay: 57.750 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 237.13 Mbit/s
95th percentile per-packet one-way delay: 54.633 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 209.84 Mbit/s
95th percentile per-packet one-way delay: 58.597 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 181.57 Mbit/s
95th percentile per-packet one-way delay: 57.878 ms
Loss rate: 0.00%
```

Run 1: Report of Indigo — Data Link

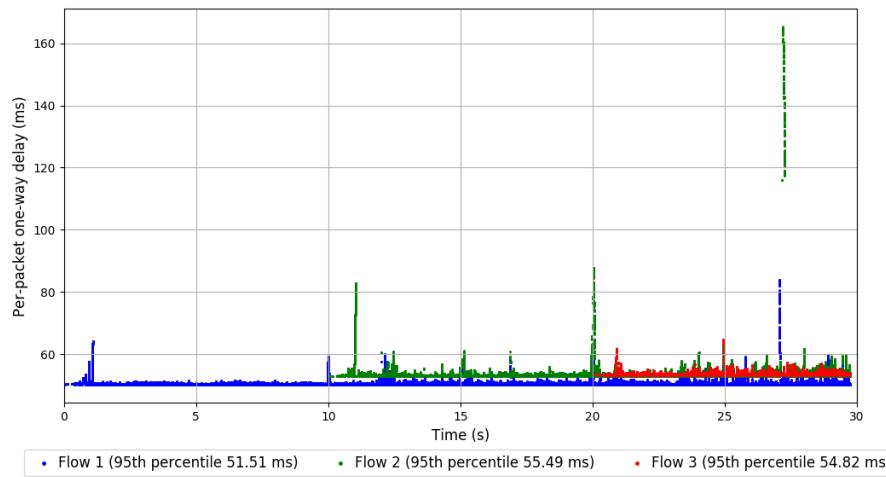
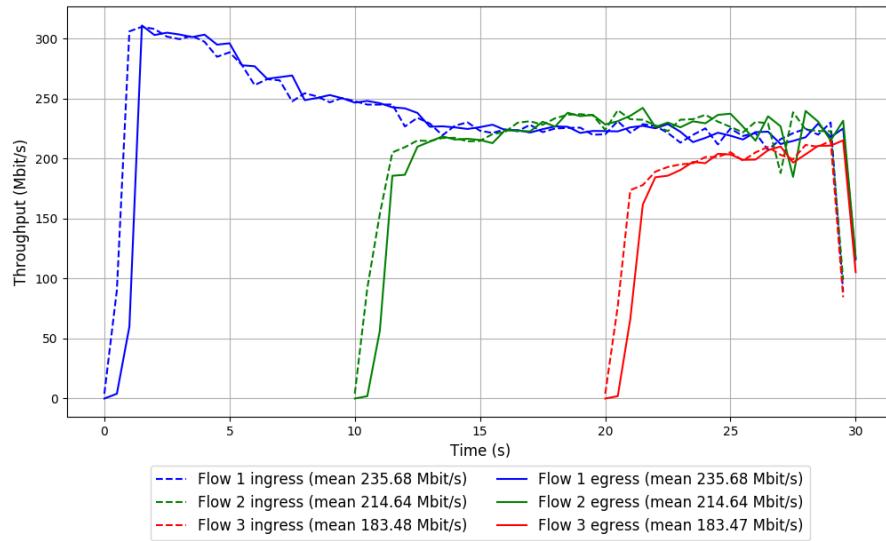


Run 2: Statistics of Indigo

```
Start at: 2018-09-03 12:51:59
End at: 2018-09-03 12:52:29
Local clock offset: 0.897 ms
Remote clock offset: -0.254 ms

# Below is generated by plot.py at 2018-09-03 13:13:11
# Datalink statistics
-- Total of 3 flows:
Average throughput: 437.68 Mbit/s
95th percentile per-packet one-way delay: 54.240 ms
Loss rate: 0.01%
-- Flow 1:
Average throughput: 235.68 Mbit/s
95th percentile per-packet one-way delay: 51.508 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 214.64 Mbit/s
95th percentile per-packet one-way delay: 55.492 ms
Loss rate: 0.01%
-- Flow 3:
Average throughput: 183.47 Mbit/s
95th percentile per-packet one-way delay: 54.819 ms
Loss rate: 0.04%
```

Run 2: Report of Indigo — Data Link

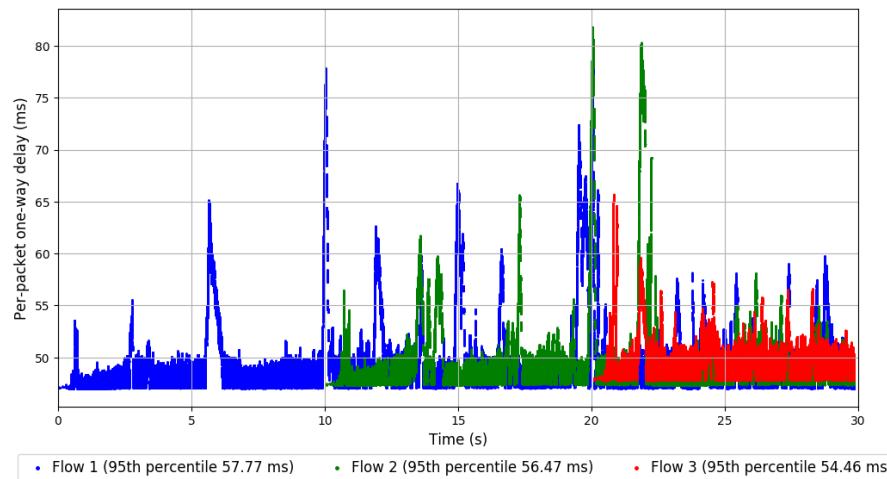
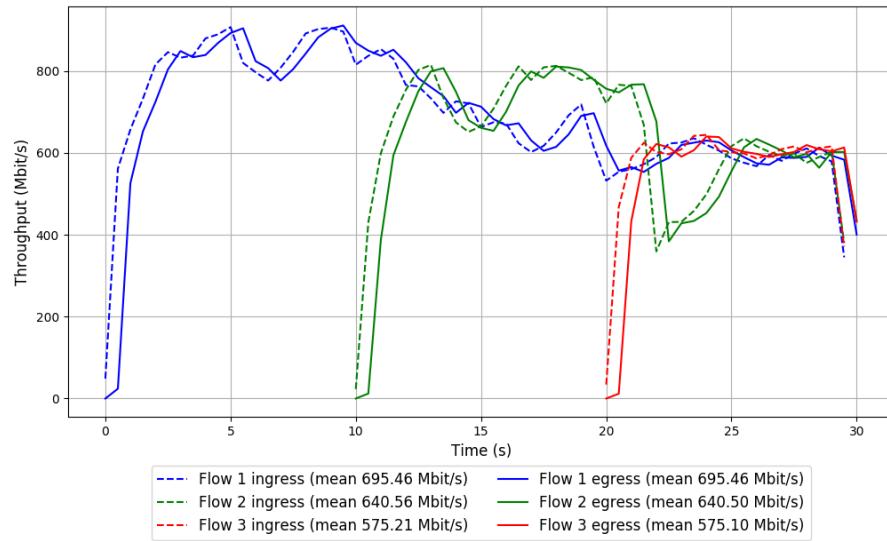


Run 1: Statistics of Muses-25

```
Start at: 2018-09-03 12:42:03
End at: 2018-09-03 12:42:33
Local clock offset: 0.535 ms
Remote clock offset: -2.959 ms

# Below is generated by plot.py at 2018-09-03 13:14:01
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1308.55 Mbit/s
95th percentile per-packet one-way delay: 56.640 ms
Loss rate: 0.01%
-- Flow 1:
Average throughput: 695.46 Mbit/s
95th percentile per-packet one-way delay: 57.774 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 640.50 Mbit/s
95th percentile per-packet one-way delay: 56.473 ms
Loss rate: 0.01%
-- Flow 3:
Average throughput: 575.10 Mbit/s
95th percentile per-packet one-way delay: 54.457 ms
Loss rate: 0.02%
```

Run 1: Report of Muses-25 — Data Link



Run 2: Statistics of Muses-25

```
Start at: 2018-09-03 12:49:57
End at: 2018-09-03 12:50:27
Local clock offset: 0.493 ms
Remote clock offset: -3.01 ms

# Below is generated by plot.py at 2018-09-03 13:14:05
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1346.30 Mbit/s
95th percentile per-packet one-way delay: 54.775 ms
Loss rate: 0.01%
-- Flow 1:
Average throughput: 735.37 Mbit/s
95th percentile per-packet one-way delay: 53.730 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 633.59 Mbit/s
95th percentile per-packet one-way delay: 54.763 ms
Loss rate: 0.01%
-- Flow 3:
Average throughput: 581.45 Mbit/s
95th percentile per-packet one-way delay: 55.879 ms
Loss rate: 0.03%
```

Run 2: Report of Muses-25 — Data Link

