Pantheon Report

Generated at 2018-08-31 05:01:56 (UTC).

Data path: GCE Tokyo on `ens4` (*local*) →GCE London 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.
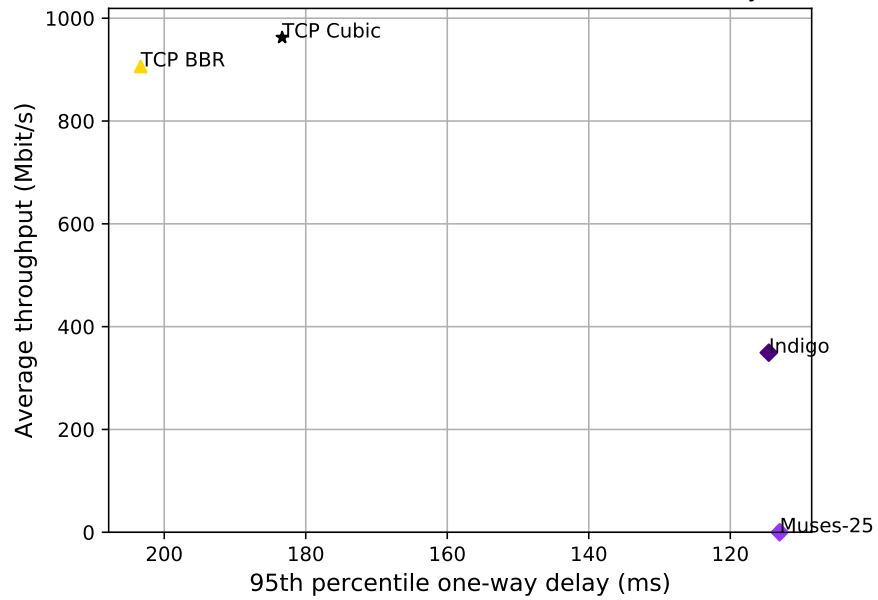
```
System info:
Linux 4.15.0-1018-gcp
net.core.default_qdisc = fq
net.core.rmem_default = 16777216
net.core.rmem_max = 536870912
net.core.wmem_default = 16777216
net.core.wmem_max = 536870912
net.ipv4.tcp_rmem = 4096 16777216 536870912
net.ipv4.tcp_wmem = 4096 16777216 536870912
net.ipv4.tcp_mem = 536870912 536870912 536870912
```
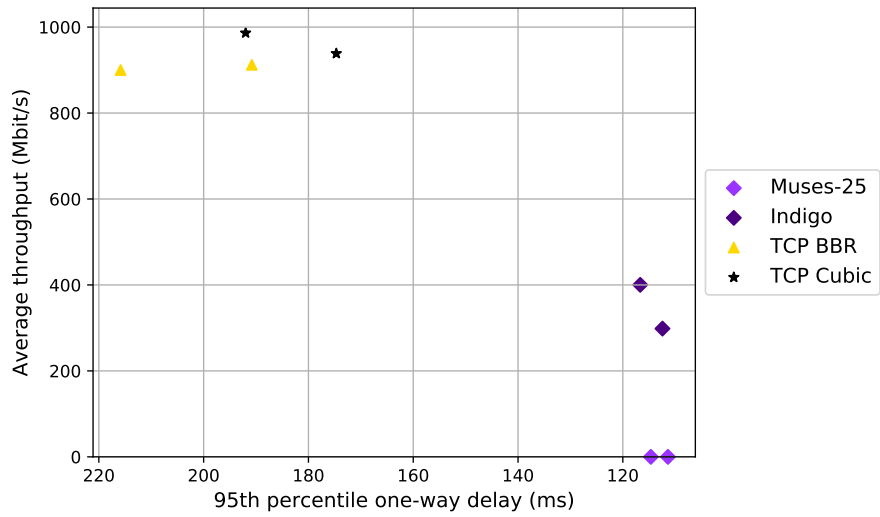
```
Git summary:
branch: muses @ 2de97ca91a065473c29a25fffe63fb137c97a67c
third_party/fillp @ d47f4fa1b454a5e3c0537115c5a28436dbd4b834
third_party/fillp-sheep @ daed0c84f98531712514b2231f43ec6901114ffe
third_party/genericCC @ d0153f8e594aa89e93b032143cedbdfe58e562f4
third_party/indigo @ 2601c92e4aa9d58d38dc4dfe0ecdbf90c077e64d
third_party/libutp @ b3465b942e2826f2b179eaab4a906ce6bb7cf3cf
third_party/muses @ b59e0d118c50af3579569c462d33045741c85981
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 Tokyo to GCE London, 2 runs of 30s each per scheme
3 flows with 10s interval between flows (mean of all runs by scheme)

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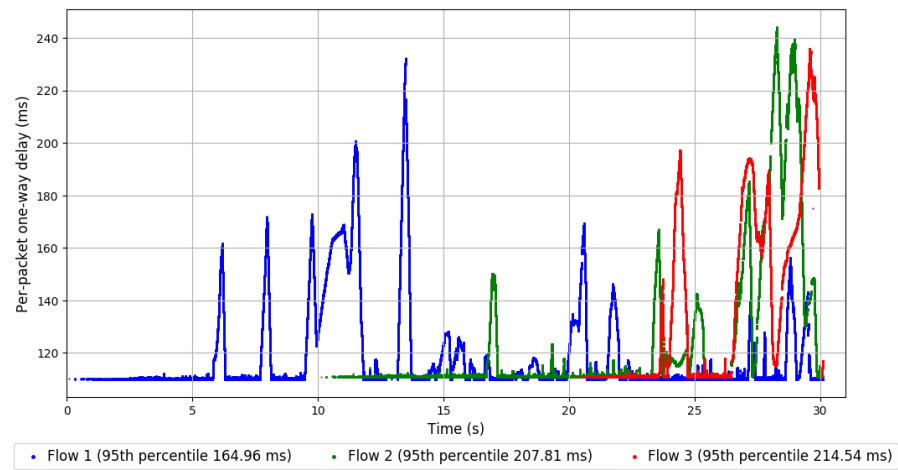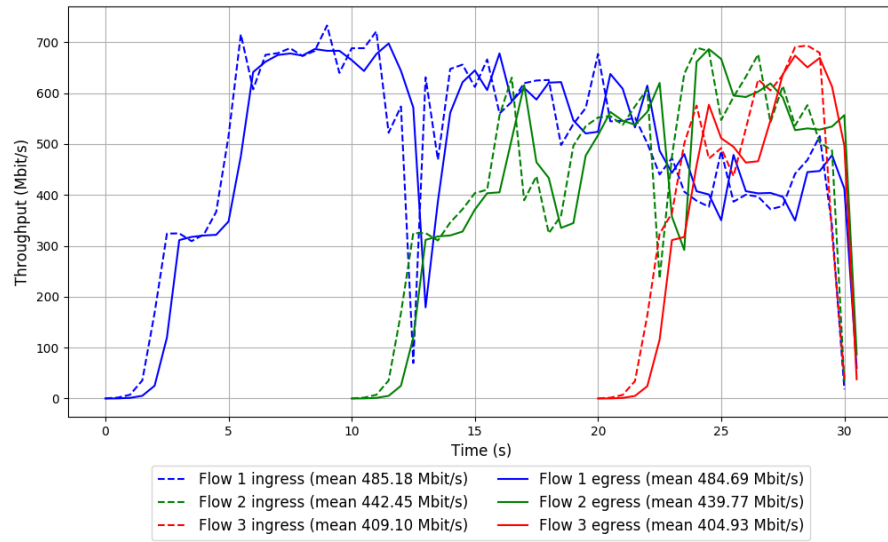3 flows with 10s interval between flows

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	480.32	469.00	341.24	191.68	211.90	166.33	0.66	1.35	0.77
TCP Cubic	2	543.46	465.06	328.40	189.91	158.44	161.13	0.33	0.01	0.41
Indigo	2	187.44	181.01	130.82	114.64	114.27	113.95	0.00	0.00	0.00
Muses-25	2	0.00	0.00	0.00	113.05	112.33	112.36	0.00	0.00	0.00

```
Run 1: Statistics of TCP BBR

Start at: 2018-08-31 04:40:09
End at: 2018-08-31 04:40:39
Local clock offset: 13.443 ms
Remote clock offset: 12.459 ms


# Below is generated by plot.py at 2018-08-31 05:01:42
# Datalink statistics
-- Total of 3 flows:
Average throughput: 912.20 Mbit/s
95th percentile per-packet one-way delay: 190.808 ms
Loss rate: 0.65%
-- Flow 1:
Average throughput: 484.69 Mbit/s
95th percentile per-packet one-way delay: 164.955 ms
Loss rate: 0.27%
-- Flow 2:
Average throughput: 439.77 Mbit/s
95th percentile per-packet one-way delay: 207.814 ms
Loss rate: 0.86%
-- Flow 3:
Average throughput: 404.93 Mbit/s
95th percentile per-packet one-way delay: 214.545 ms
Loss rate: 1.52%
```

Run 1: Report of TCP BBR — Data Link

Flow 1 ingress (mean 485.18 Mbit/s) --- Flow 1 egress (mean 484.69 Mbit/s)
Flow 2 ingress (mean 442.45 Mbit/s) --- Flow 2 egress (mean 439.77 Mbit/s)
Flow 3 ingress (mean 409.10 Mbit/s) --- Flow 3 egress (mean 404.93 Mbit/s)

Flow 1 (95th percentile 164.96 ms)   Flow 2 (95th percentile 207.81 ms)   Flow 3 (95th percentile 214.54 ms)
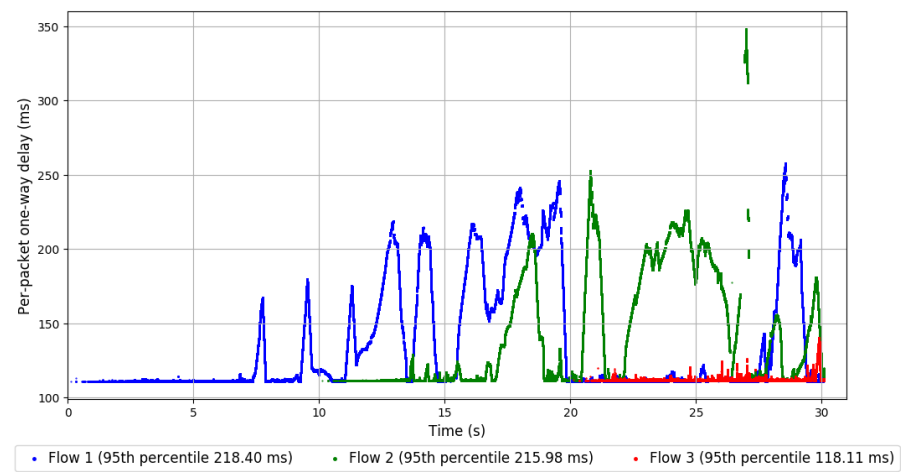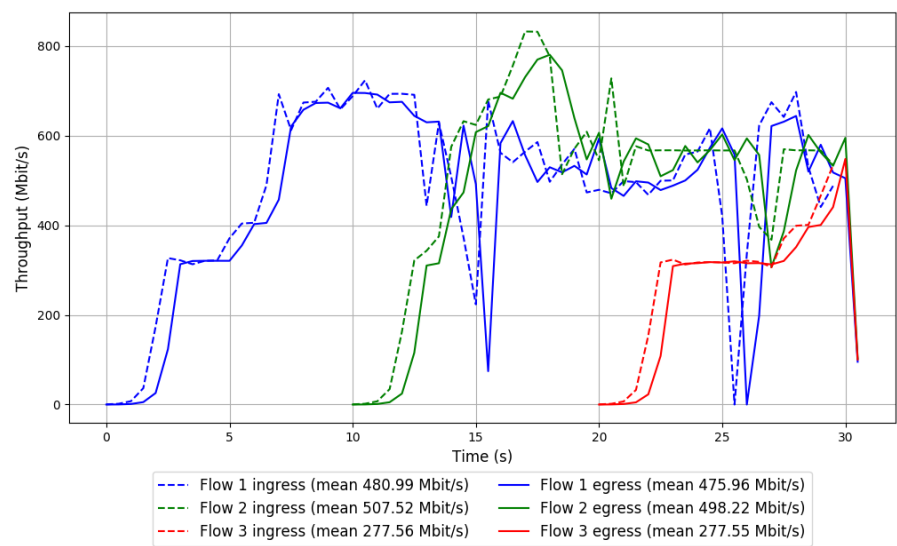
5

```
Run 2: Statistics of TCP BBR

Start at: 2018-08-31 04:47:35
End at: 2018-08-31 04:48:05
Local clock offset: 21.827 ms
Remote clock offset: 20.915 ms


# Below is generated by plot.py at 2018-08-31 05:01:42
# Datalink statistics
-- Total of 3 flows:
Average throughput: 900.10 Mbit/s
95th percentile per-packet one-way delay: 215.844 ms
Loss rate: 1.23%
-- Flow 1:
Average throughput: 475.96 Mbit/s
95th percentile per-packet one-way delay: 218.404 ms
Loss rate: 1.04%
-- Flow 2:
Average throughput: 498.22 Mbit/s
95th percentile per-packet one-way delay: 215.978 ms
Loss rate: 1.84%
-- Flow 3:
Average throughput: 277.55 Mbit/s
95th percentile per-packet one-way delay: 118.111 ms
Loss rate: 0.02%
```

Run 2: Report of TCP BBR — Data Link

Flow 1 ingress (mean 480.99 Mbit/s)   Flow 1 egress (mean 475.96 Mbit/s)
Flow 2 ingress (mean 507.52 Mbit/s)   Flow 2 egress (mean 498.22 Mbit/s)
Flow 3 ingress (mean 277.56 Mbit/s)   Flow 3 egress (mean 277.55 Mbit/s)

Flow 1 (95th percentile 218.40 ms)   Flow 2 (95th percentile 215.98 ms)   Flow 3 (95th percentile 118.11 ms)
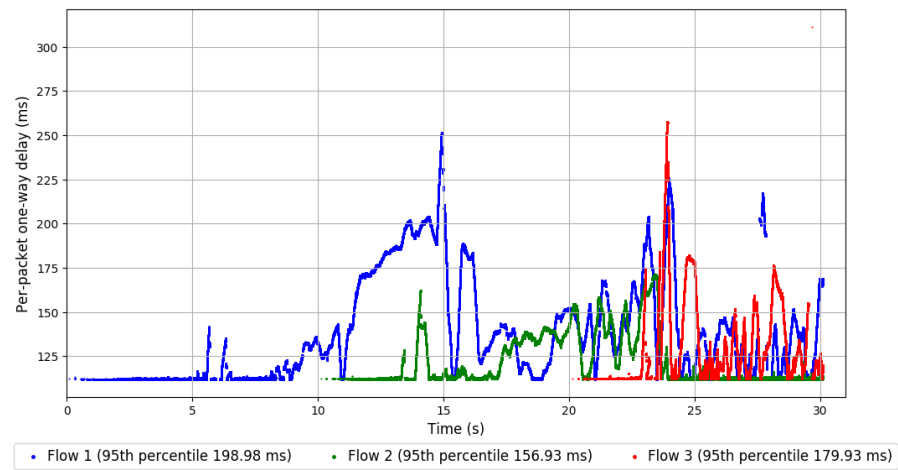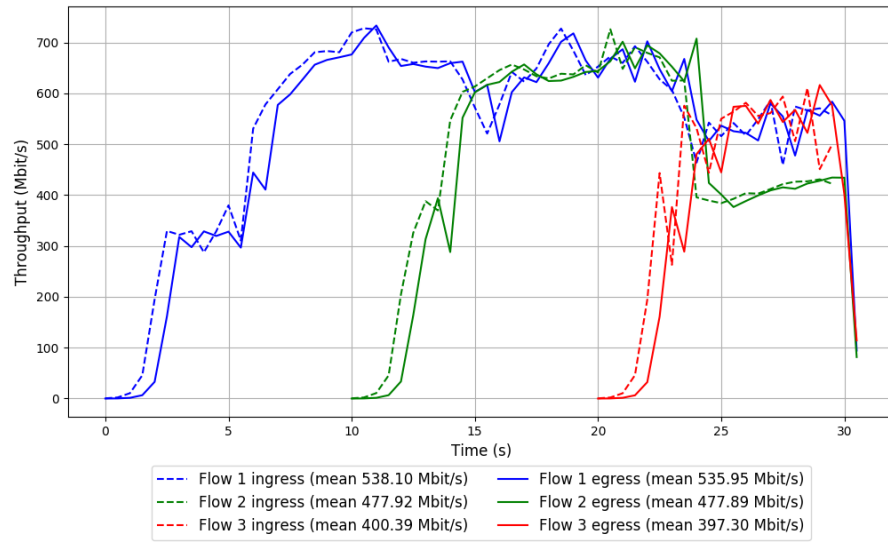
```
Run 1: Statistics of TCP Cubic

Start at: 2018-08-31 04:36:47
End at: 2018-08-31 04:37:17
Local clock offset: 12.529 ms
Remote clock offset: 12.676 ms


# Below is generated by plot.py at 2018-08-31 05:01:55
# Datalink statistics
-- Total of 3 flows:
Average throughput: 986.40 Mbit/s
95th percentile per-packet one-way delay: 191.989 ms
Loss rate: 0.33%
-- Flow 1:
Average throughput: 535.95 Mbit/s
95th percentile per-packet one-way delay: 198.981 ms
Loss rate: 0.40%
-- Flow 2:
Average throughput: 477.89 Mbit/s
95th percentile per-packet one-way delay: 156.932 ms
Loss rate: 0.01%
-- Flow 3:
Average throughput: 397.30 Mbit/s
95th percentile per-packet one-way delay: 179.930 ms
Loss rate: 0.78%
```

Run 1: Report of TCP Cubic — Data Link

Flow 1 ingress (mean 538.10 Mbit/s) --- Flow 1 egress (mean 535.95 Mbit/s)
Flow 2 ingress (mean 477.92 Mbit/s) --- Flow 2 egress (mean 477.89 Mbit/s)
Flow 3 ingress (mean 400.39 Mbit/s) --- Flow 3 egress (mean 397.30 Mbit/s)

Flow 1 (95th percentile 198.98 ms)   Flow 2 (95th percentile 156.93 ms)   Flow 3 (95th percentile 179.93 ms)
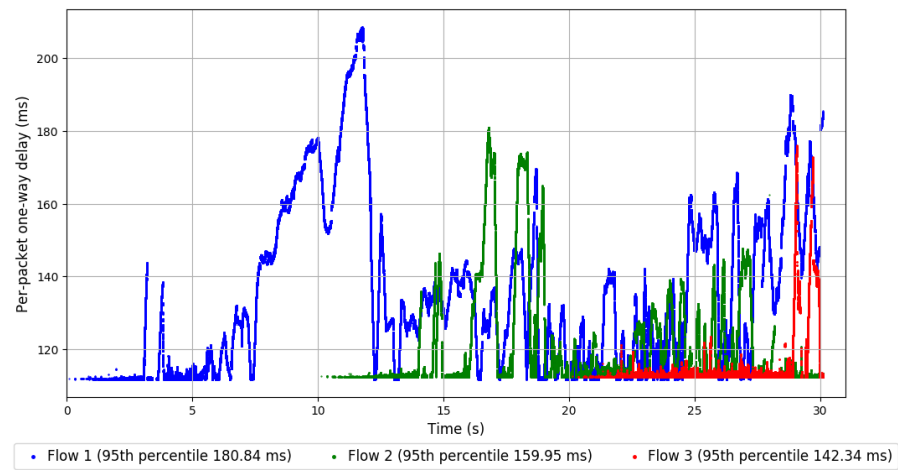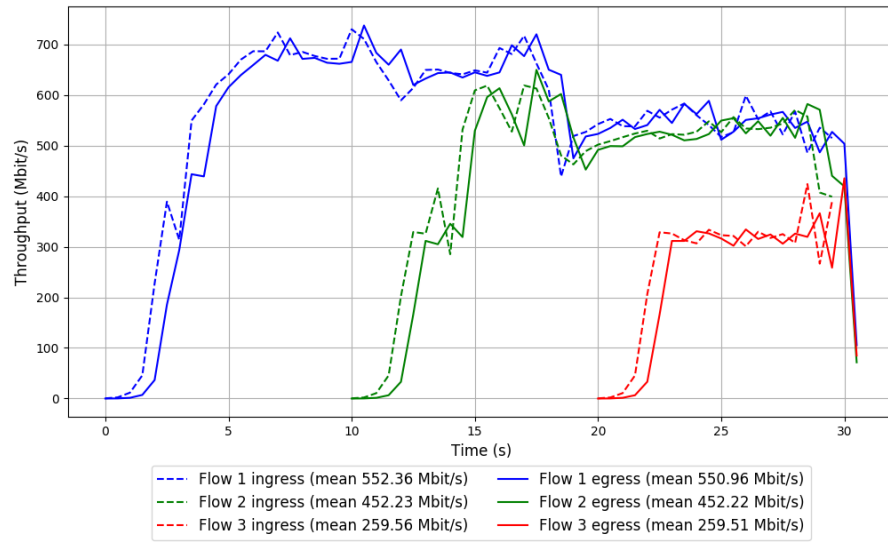
9

```
Run 2: Statistics of TCP Cubic

Start at: 2018-08-31 04:44:16
End at: 2018-08-31 04:44:46
Local clock offset: 17.507 ms
Remote clock offset: 17.682 ms


# Below is generated by plot.py at 2018-08-31 05:01:55
# Datalink statistics
-- Total of 3 flows:
Average throughput: 938.50 Mbit/s
95th percentile per-packet one-way delay: 174.680 ms
Loss rate: 0.15%
-- Flow 1:
Average throughput: 550.96 Mbit/s
95th percentile per-packet one-way delay: 180.845 ms
Loss rate: 0.25%
-- Flow 2:
Average throughput: 452.22 Mbit/s
95th percentile per-packet one-way delay: 159.947 ms
Loss rate: 0.01%
-- Flow 3:
Average throughput: 259.51 Mbit/s
95th percentile per-packet one-way delay: 142.339 ms
Loss rate: 0.03%
```

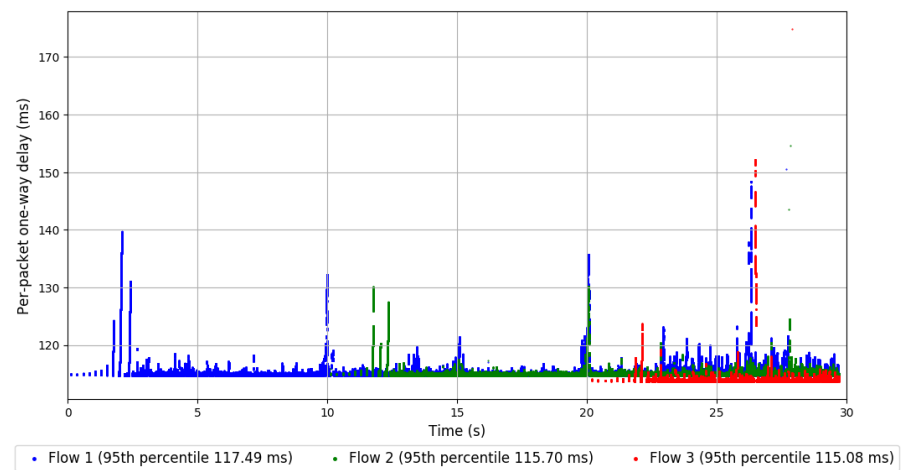Run 2: Report of TCP Cubic — Data Link

Flow 1 ingress (mean 552.36 Mbit/s) — — — Flow 1 egress (mean 550.96 Mbit/s)
Flow 2 ingress (mean 452.23 Mbit/s) — — — Flow 2 egress (mean 452.22 Mbit/s)
Flow 3 ingress (mean 259.56 Mbit/s) — — — Flow 3 egress (mean 259.51 Mbit/s)

Flow 1 (95th percentile 180.84 ms)   Flow 2 (95th percentile 159.95 ms)   Flow 3 (95th percentile 142.34 ms)
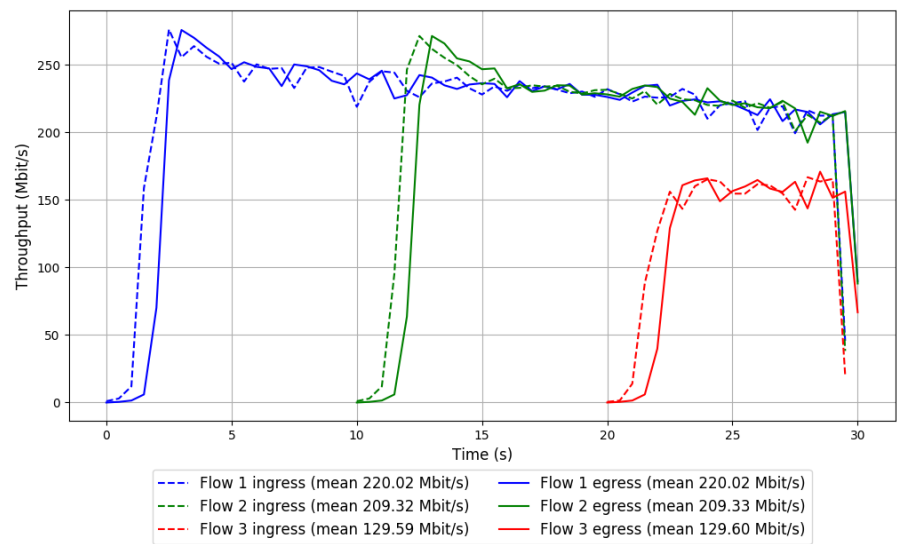
11

```
Run 1: Statistics of Indigo

Start at: 2018-08-31 04:42:22
End at: 2018-08-31 04:42:52
Local clock offset: 12.567 ms
Remote clock offset: 15.313 ms


# Below is generated by plot.py at 2018-08-31 05:01:55
# Datalink statistics
-- Total of 3 flows:
Average throughput: 400.23 Mbit/s
95th percentile per-packet one-way delay: 116.680 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 220.02 Mbit/s
95th percentile per-packet one-way delay: 117.492 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 209.33 Mbit/s
95th percentile per-packet one-way delay: 115.699 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 129.60 Mbit/s
95th percentile per-packet one-way delay: 115.077 ms
Loss rate: 0.00%
```
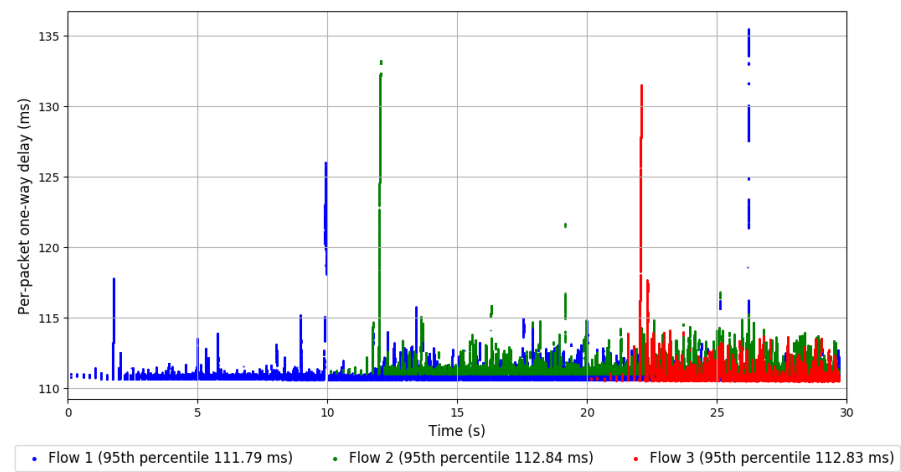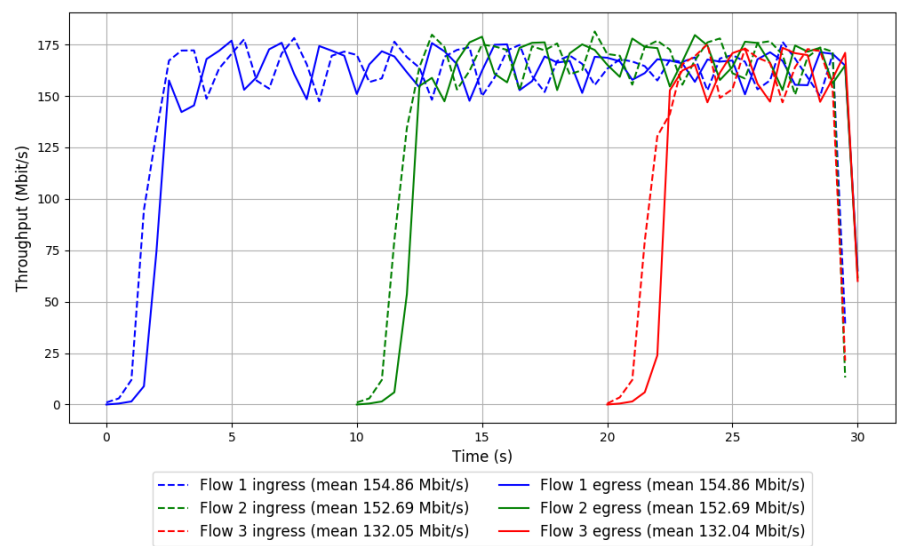
Run 1: Report of Indigo — Data Link

```
Run 2: Statistics of Indigo

Start at: 2018-08-31 04:49:43
End at: 2018-08-31 04:50:13
Local clock offset: 24.933 ms
Remote clock offset: 23.742 ms


# Below is generated by plot.py at 2018-08-31 05:01:55
# Datalink statistics
-- Total of 3 flows:
Average throughput: 298.43 Mbit/s
95th percentile per-packet one-way delay: 112.434 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 154.86 Mbit/s
95th percentile per-packet one-way delay: 111.788 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 152.69 Mbit/s
95th percentile per-packet one-way delay: 112.845 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 132.04 Mbit/s
95th percentile per-packet one-way delay: 112.829 ms
Loss rate: 0.00%
```

Run 2: Report of Indigo — Data Link

Flow 1 ingress (mean 154.86 Mbit/s)   Flow 1 egress (mean 154.86 Mbit/s)
Flow 2 ingress (mean 152.69 Mbit/s)   Flow 2 egress (mean 152.69 Mbit/s)
Flow 3 ingress (mean 132.05 Mbit/s)   Flow 3 egress (mean 132.04 Mbit/s)

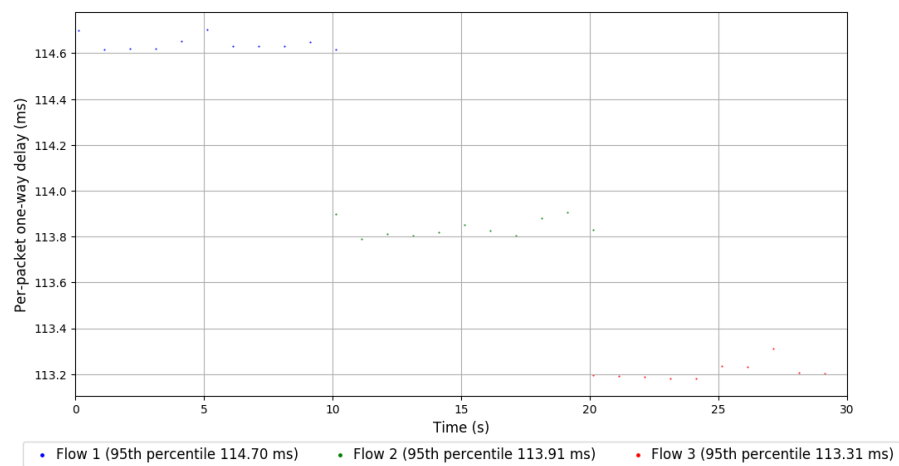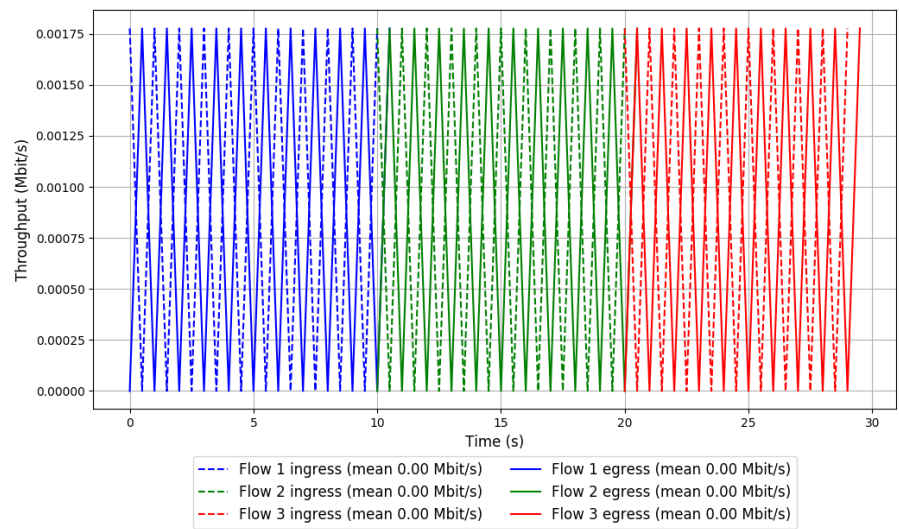Flow 1 (95th percentile 111.79 ms)   Flow 2 (95th percentile 112.84 ms)   Flow 3 (95th percentile 112.83 ms)

```
Run 1: Statistics of Muses-25

Start at: 2018-08-31 04:38:56
End at: 2018-08-31 04:39:26
Local clock offset: 9.961 ms
Remote clock offset: 12.733 ms

# Below is generated by plot.py at 2018-08-31 05:01:55
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 114.653 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 114.702 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 113.905 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 113.310 ms
Loss rate: 0.00%
```

Run 1: Report of Muses-25 — Data Link

```
Run 2: Statistics of Muses-25

Start at: 2018-08-31 04:46:22
End at: 2018-08-31 04:46:52
Local clock offset: 20.32 ms
Remote clock offset: 19.257 ms


# Below is generated by plot.py at 2018-08-31 05:01:55
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 111.393 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 111.401 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 110.750 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 111.415 ms
Loss rate: 0.00%
```

Run 2: Report of Muses-25 — Data Link