Pantheon Report

Generated at 2018-08-31 10:20:10 (UTC).

Data path: GCE London on **ens4** (*remote*) →GCE Tokyo on **ens4** (*local*).

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.
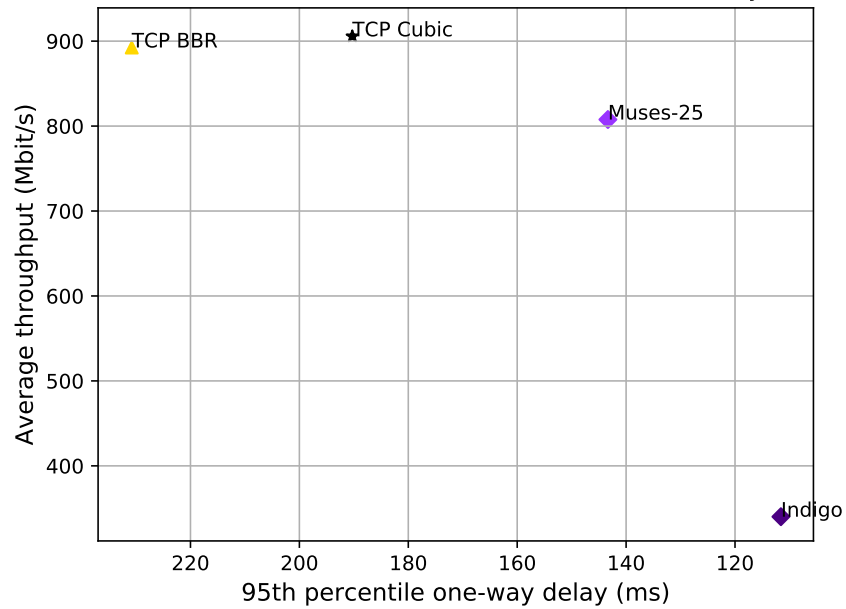
```
System info:
Linux 4.15.0-1018-gcp
net.core.default_qdisc = fq
net.core.rmem_default = 16777216
net.core.rmem_max = 536870912
net.core.wmem_default = 16777216
net.core.wmem_max = 536870912
net.ipv4.tcp_rmem = 4096 16777216 536870912
net.ipv4.tcp_wmem = 4096 16777216 536870912
net.ipv4.tcp_mem = 536870912 536870912 536870912
```
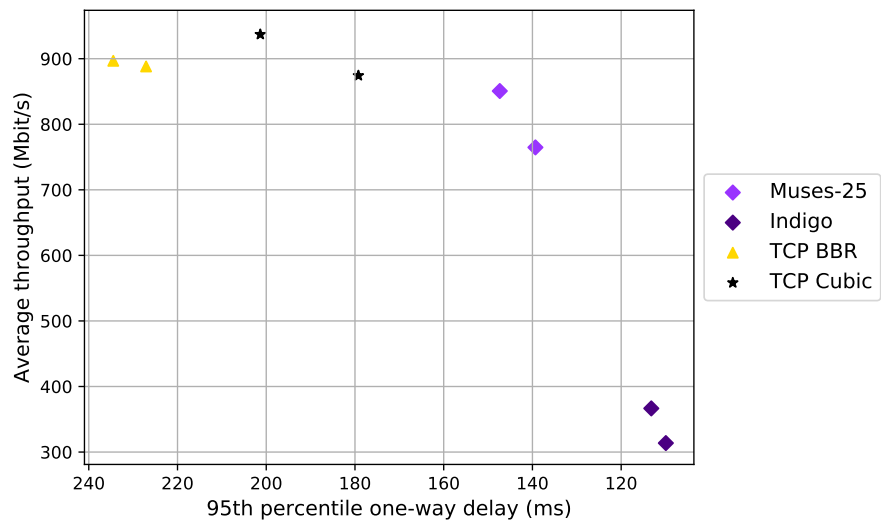
```
Git summary:
branch: muses @ e3c5aa19ca94c3066828fb83f16a8fb6b2731e7a
third_party/fillp @ d47f4fa1b454a5e3c0537115c5a28436dbd4b834
third_party/fillp-sheep @ daed0c84f98531712514b2231f43ec6901114ffe
third_party/genericCC @ d0153f8e594aa89e93b032143cedbdfe58e562f4
third_party/indigo @ 2601c92e4aa9d58d38dc4dfe0ecdbf90c077e64d
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 London 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 London to GCE Tokyo, 2 runs of 30s each per scheme
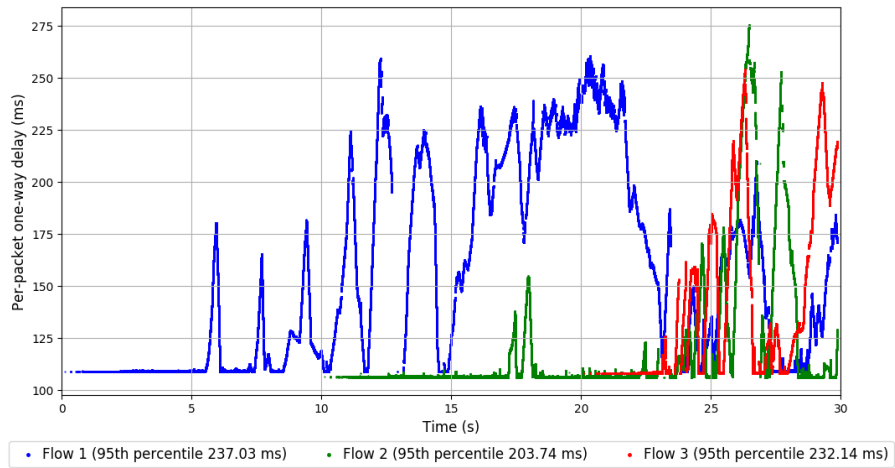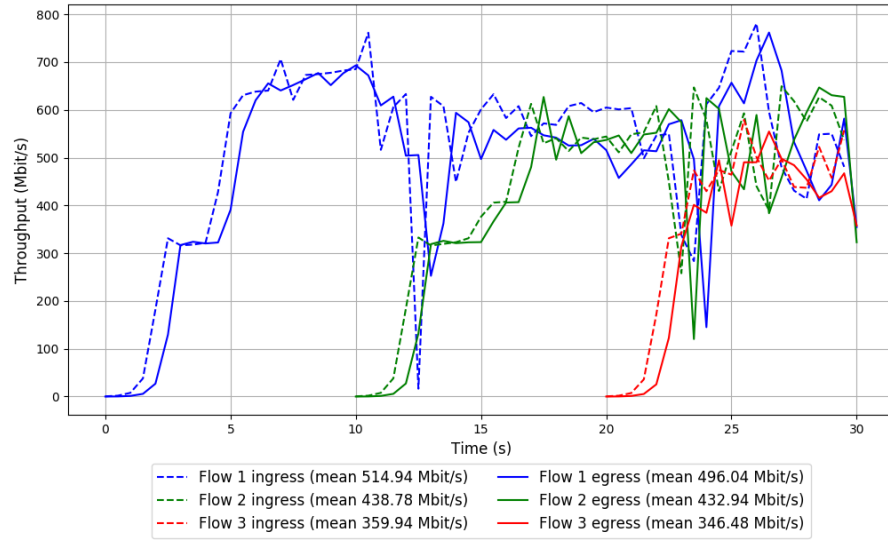### 3 flows with 10s interval between flows

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	490.68	433.02	349.56	225.83	229.03	231.83	3.28	3.23	4.69
TCP Cubic	2	495.50	450.13	340.43	184.89	202.64	149.31	0.98	1.60	3.76
Indigo	2	196.88	151.27	134.64	111.20	111.47	112.64	0.77	1.23	2.81
Muses-25	2	388.23	435.10	405.19	146.82	135.63	149.68	0.79	1.47	0.96

```
Run 1: Statistics of TCP BBR

Start at: 2018-08-31 09:52:11
End at: 2018-08-31 09:52:41
Local clock offset: 10.995 ms
Remote clock offset: 15.704 ms


# Below is generated by plot.py at 2018-08-31 10:19:11
# Datalink statistics
-- Total of 3 flows:
Average throughput: 896.83 Mbit/s
95th percentile per-packet one-way delay: 234.481 ms
Loss rate: 3.96%
-- Flow 1:
Average throughput: 496.04 Mbit/s
95th percentile per-packet one-way delay: 237.033 ms
Loss rate: 4.39%
-- Flow 2:
Average throughput: 432.94 Mbit/s
95th percentile per-packet one-way delay: 203.740 ms
Loss rate: 2.42%
-- Flow 3:
Average throughput: 346.48 Mbit/s
95th percentile per-packet one-way delay: 232.136 ms
Loss rate: 5.89%
```

Run 1: Report of TCP BBR — Data Link

Flow 1 ingress (mean 514.94 Mbit/s) — Flow 1 egress (mean 496.04 Mbit/s)
Flow 2 ingress (mean 438.78 Mbit/s) — Flow 2 egress (mean 432.94 Mbit/s)
Flow 3 ingress (mean 359.94 Mbit/s) — Flow 3 egress (mean 346.48 Mbit/s)

Flow 1 (95th percentile 237.03 ms) Flow 2 (95th percentile 203.74 ms) Flow 3 (95th percentile 232.14 ms)
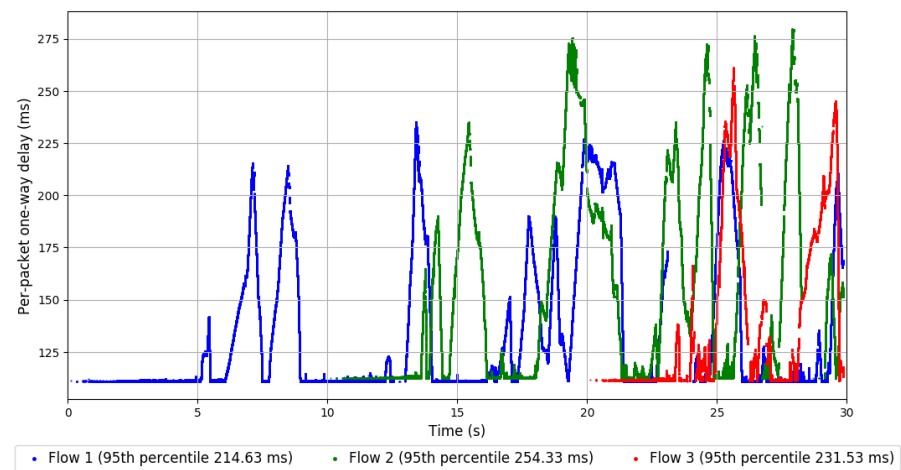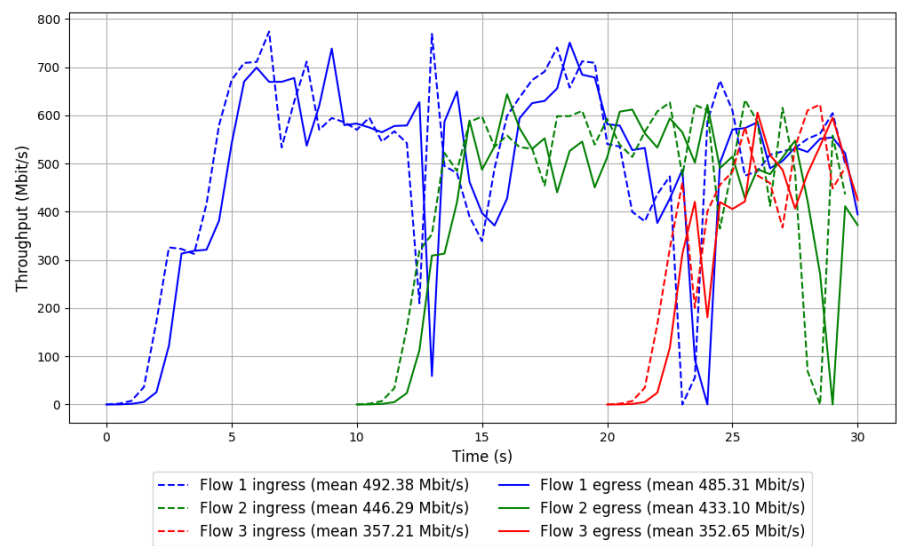
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```
Run 2: Statistics of TCP BBR

Start at: 2018-08-31 10:00:16
End at: 2018-08-31 10:00:46
Local clock offset: 15.594 ms
Remote clock offset: 17.859 ms


# Below is generated by plot.py at 2018-08-31 10:19:11
# Datalink statistics
-- Total of 3 flows:
Average throughput: 888.19 Mbit/s
95th percentile per-packet one-way delay: 227.085 ms
Loss rate: 2.96%
-- Flow 1:
Average throughput: 485.31 Mbit/s
95th percentile per-packet one-way delay: 214.630 ms
Loss rate: 2.17%
-- Flow 2:
Average throughput: 433.10 Mbit/s
95th percentile per-packet one-way delay: 254.327 ms
Loss rate: 4.05%
-- Flow 3:
Average throughput: 352.65 Mbit/s
95th percentile per-packet one-way delay: 231.531 ms
Loss rate: 3.49%
```

Run 2: Report of TCP BBR — Data Link

Flow 1 ingress (mean 492.38 Mbit/s)   Flow 1 egress (mean 485.31 Mbit/s)
Flow 2 ingress (mean 446.29 Mbit/s)   Flow 2 egress (mean 433.10 Mbit/s)
Flow 3 ingress (mean 357.21 Mbit/s)   Flow 3 egress (mean 352.65 Mbit/s)

Flow 1 (95th percentile 214.63 ms)   Flow 2 (95th percentile 254.33 ms)   Flow 3 (95th percentile 231.53 ms)
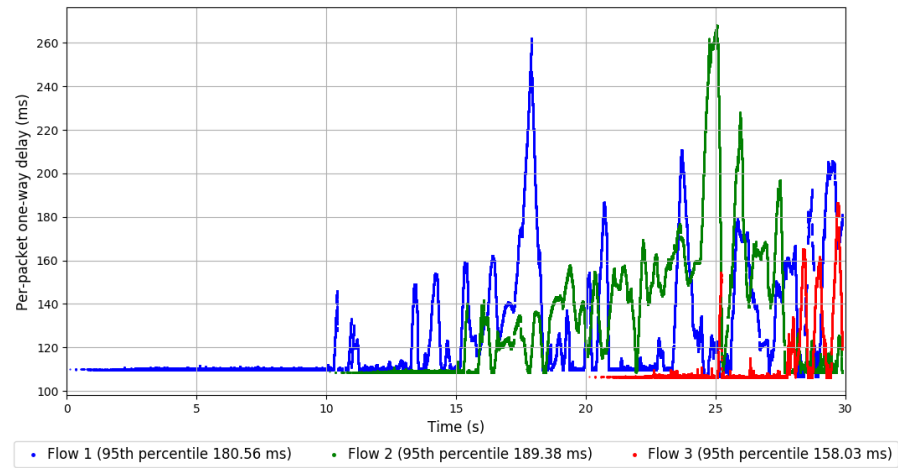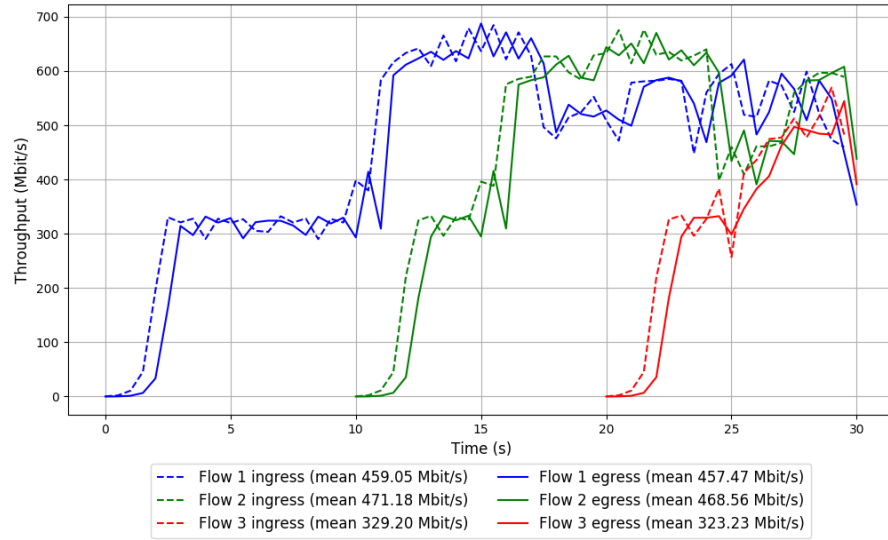
```
Run 1: Statistics of TCP Cubic

Start at: 2018-08-31 09:48:14
End at: 2018-08-31 09:48:44
Local clock offset: 10.746 ms
Remote clock offset: 15.567 ms


# Below is generated by plot.py at 2018-08-31 10:19:11
# Datalink statistics
-- Total of 3 flows:
Average throughput: 874.21 Mbit/s
95th percentile per-packet one-way delay: 179.225 ms
Loss rate: 1.65%
-- Flow 1:
Average throughput: 457.47 Mbit/s
95th percentile per-packet one-way delay: 180.556 ms
Loss rate: 1.09%
-- Flow 2:
Average throughput: 468.56 Mbit/s
95th percentile per-packet one-way delay: 189.382 ms
Loss rate: 1.66%
-- Flow 3:
Average throughput: 323.23 Mbit/s
95th percentile per-packet one-way delay: 158.031 ms
Loss rate: 3.99%
```

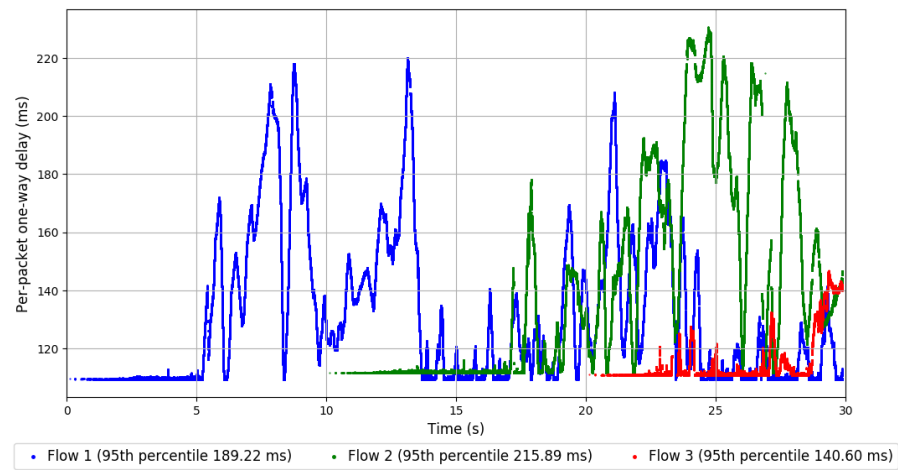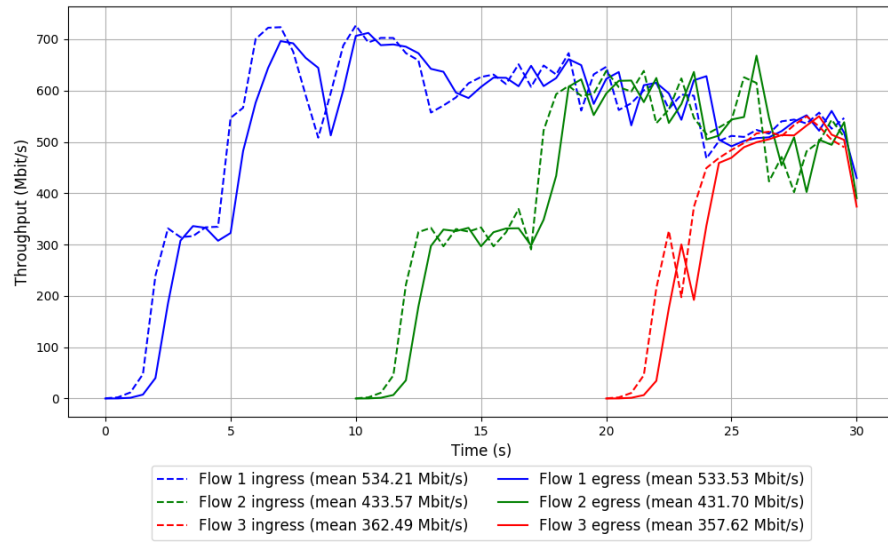Run 1: Report of TCP Cubic — Data Link

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```
Run 2: Statistics of TCP Cubic

Start at: 2018-08-31 09:56:22
End at: 2018-08-31 09:56:52
Local clock offset: 14.45 ms
Remote clock offset: 16.635 ms


# Below is generated by plot.py at 2018-08-31 10:19:29
# Datalink statistics
-- Total of 3 flows:
Average throughput: 937.08 Mbit/s
95th percentile per-packet one-way delay: 201.337 ms
Loss rate: 1.41%
-- Flow 1:
Average throughput: 533.53 Mbit/s
95th percentile per-packet one-way delay: 189.216 ms
Loss rate: 0.86%
-- Flow 2:
Average throughput: 431.70 Mbit/s
95th percentile per-packet one-way delay: 215.889 ms
Loss rate: 1.54%
-- Flow 3:
Average throughput: 357.62 Mbit/s
95th percentile per-packet one-way delay: 140.598 ms
Loss rate: 3.53%
```

Run 2: Report of TCP Cubic — Data Link

- - - Flow 1 ingress (mean 534.21 Mbit/s) —— Flow 1 egress (mean 533.53 Mbit/s)
- - - Flow 2 ingress (mean 433.57 Mbit/s) —— Flow 2 egress (mean 431.70 Mbit/s)
- - - Flow 3 ingress (mean 362.49 Mbit/s) —— Flow 3 egress (mean 357.62 Mbit/s)

• Flow 1 (95th percentile 189.22 ms)   • Flow 2 (95th percentile 215.89 ms)   • Flow 3 (95th percentile 140.60 ms)

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```
Run 1: Statistics of Indigo

Start at: 2018-08-31 09:50:19
End at: 2018-08-31 09:50:49
Local clock offset: 13.454 ms
Remote clock offset: 15.236 ms


# Below is generated by plot.py at 2018-08-31 10:19:29
# Datalink statistics
-- Total of 3 flows:
Average throughput: 366.60 Mbit/s
95th percentile per-packet one-way delay: 113.210 ms
Loss rate: 1.13%
-- Flow 1:
Average throughput: 223.06 Mbit/s
95th percentile per-packet one-way delay: 112.584 ms
Loss rate: 0.74%
-- Flow 2:
Average throughput: 149.26 Mbit/s
95th percentile per-packet one-way delay: 113.607 ms
Loss rate: 1.24%
-- Flow 3:
Average throughput: 139.34 Mbit/s
95th percentile per-packet one-way delay: 113.439 ms
Loss rate: 2.81%
```
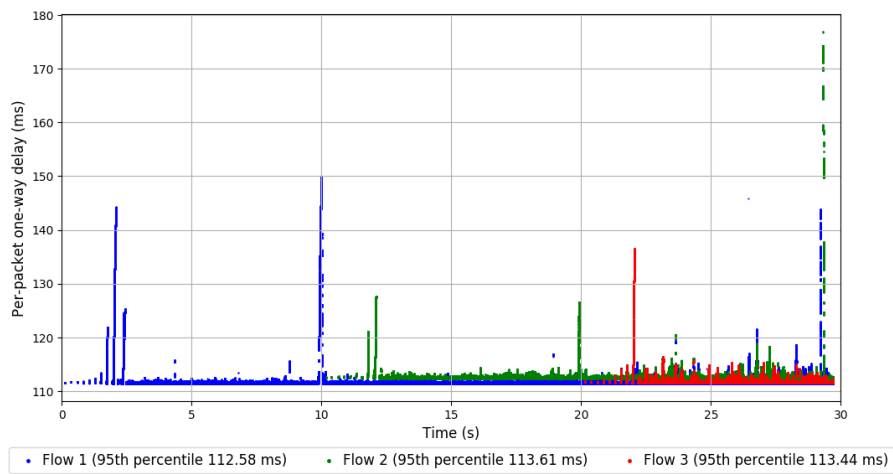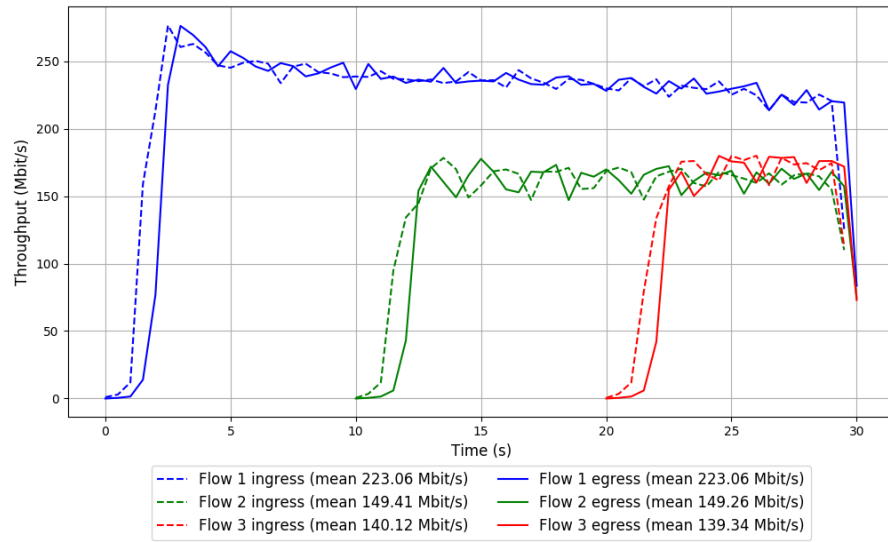
Run 1: Report of Indigo — Data Link

Flow 1 ingress (mean 223.06 Mbit/s) --- Flow 1 egress (mean 223.06 Mbit/s)
Flow 2 ingress (mean 149.41 Mbit/s) --- Flow 2 egress (mean 149.26 Mbit/s)
Flow 3 ingress (mean 140.12 Mbit/s) --- Flow 3 egress (mean 139.34 Mbit/s)

Flow 1 (95th percentile 112.58 ms)   Flow 2 (95th percentile 113.61 ms)   Flow 3 (95th percentile 113.44 ms)
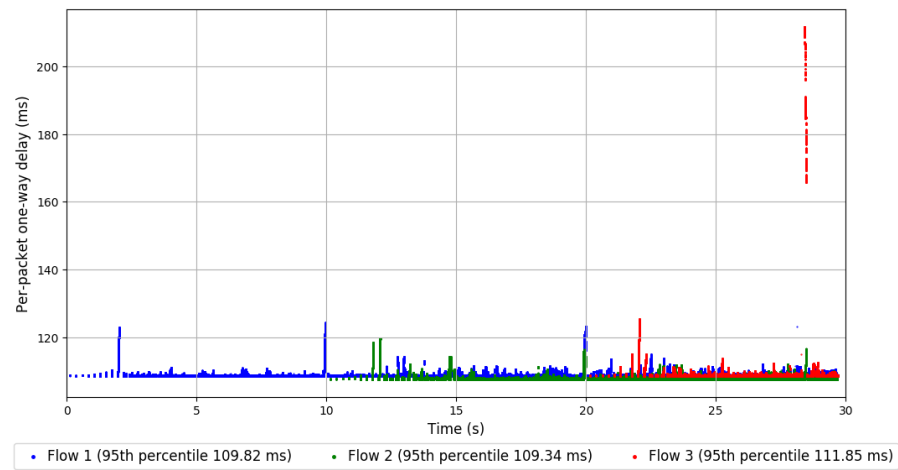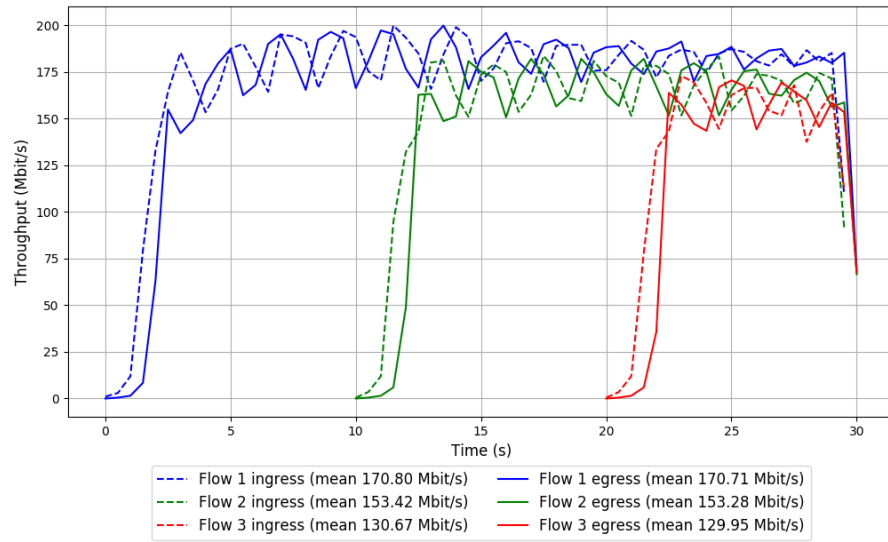
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```
Run 2: Statistics of Indigo

Start at: 2018-08-31 09:58:29
End at: 2018-08-31 09:58:59
Local clock offset: 12.316 ms
Remote clock offset: 17.361 ms


# Below is generated by plot.py at 2018-08-31 10:19:29
# Datalink statistics
-- Total of 3 flows:
Average throughput: 313.69 Mbit/s
95th percentile per-packet one-way delay: 109.929 ms
Loss rate: 1.21%
-- Flow 1:
Average throughput: 170.71 Mbit/s
95th percentile per-packet one-way delay: 109.823 ms
Loss rate: 0.80%
-- Flow 2:
Average throughput: 153.28 Mbit/s
95th percentile per-packet one-way delay: 109.342 ms
Loss rate: 1.23%
-- Flow 3:
Average throughput: 129.95 Mbit/s
95th percentile per-packet one-way delay: 111.848 ms
Loss rate: 2.82%
```

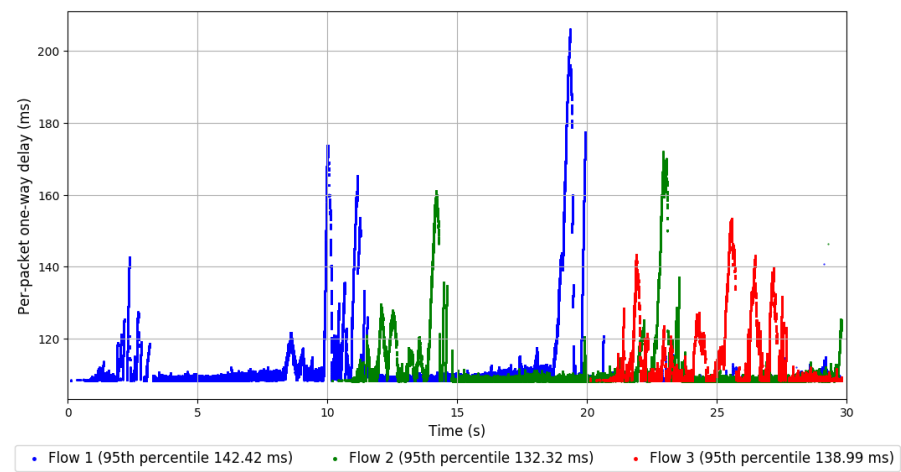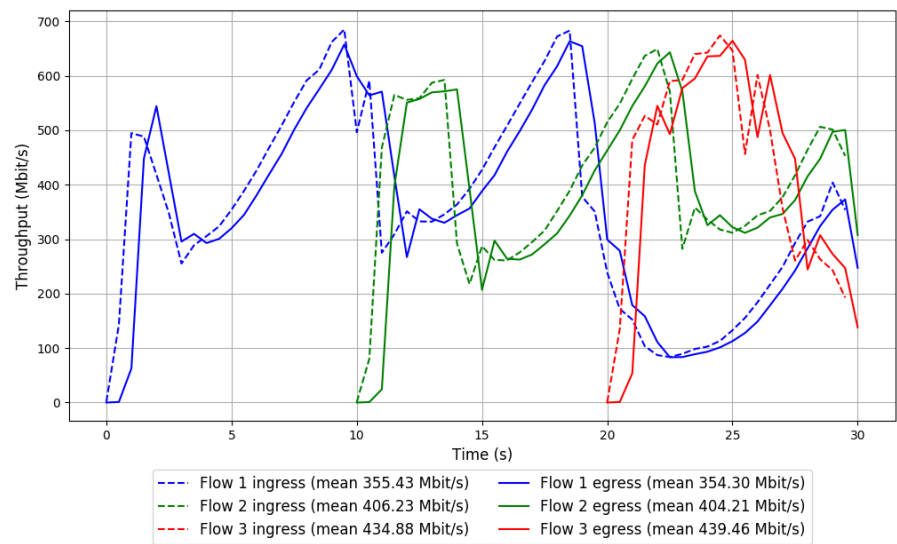Run 2: Report of Indigo — Data Link

```
Run 1: Statistics of Muses-25

Start at: 2018-08-31 09:54:22
End at: 2018-08-31 09:54:52
Local clock offset: 11.131 ms
Remote clock offset: 16.299 ms


# Below is generated by plot.py at 2018-08-31 10:19:59
# Datalink statistics
-- Total of 3 flows:
Average throughput: 764.71 Mbit/s
95th percentile per-packet one-way delay: 139.328 ms
Loss rate: 1.29%
-- Flow 1:
Average throughput: 354.30 Mbit/s
95th percentile per-packet one-way delay: 142.420 ms
Loss rate: 1.07%
-- Flow 2:
Average throughput: 404.21 Mbit/s
95th percentile per-packet one-way delay: 132.321 ms
Loss rate: 1.62%
-- Flow 3:
Average throughput: 439.46 Mbit/s
95th percentile per-packet one-way delay: 138.986 ms
Loss rate: 1.23%
```

Run 1: Report of Muses-25 — Data Link

```
Run 2: Statistics of Muses-25

Start at: 2018-08-31 10:02:28
End at: 2018-08-31 10:02:58
Local clock offset: 19.37 ms
Remote clock offset: 18.738 ms


# Below is generated by plot.py at 2018-08-31 10:20:08
# Datalink statistics
-- Total of 3 flows:
Average throughput: 850.70 Mbit/s
95th percentile per-packet one-way delay: 147.359 ms
Loss rate: 0.83%
-- Flow 1:
Average throughput: 422.15 Mbit/s
95th percentile per-packet one-way delay: 151.227 ms
Loss rate: 0.51%
-- Flow 2:
Average throughput: 465.99 Mbit/s
95th percentile per-packet one-way delay: 138.940 ms
Loss rate: 1.32%
-- Flow 3:
Average throughput: 370.93 Mbit/s
95th percentile per-packet one-way delay: 160.364 ms
Loss rate: 0.68%
```

Run 2: Report of Muses-25 — Data Link