Pantheon Report

Generated at 2018-08-31 14:19:56 (UTC).

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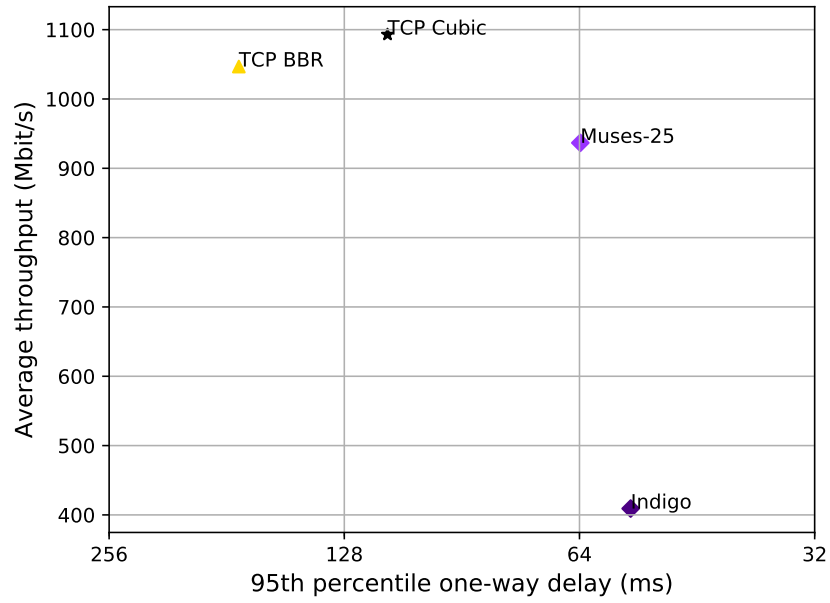
```
System info:
Linux 4.15.0-1018-gcp
net.core.default_qdisc = fq
net.core.rmem_default = 16777216
net.core.rmem_max = 536870912
net.core.wmem_default = 16777216
net.core.wmem_max = 536870912
net.ipv4.tcp_rmem = 4096 16777216 536870912
net.ipv4.tcp_wmem = 4096 16777216 536870912
net.ipv4.tcp_mem = 536870912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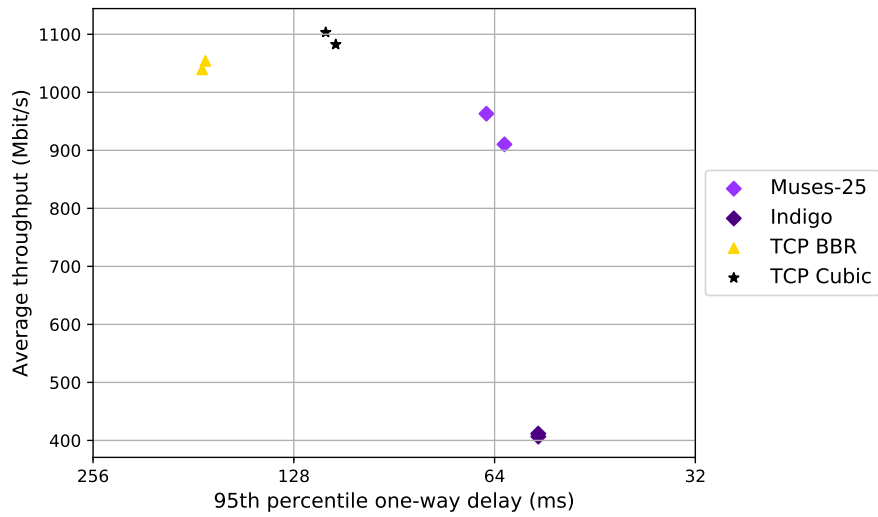
```
Git summary:
branch: muses @ e3c5aa19ca94c3066828fb83f16a8fb6b2731e7a
third_party/fillp @ d47f4fa1b454a5e3c0537115c5a28436dbd4b834
third_party/fillp-sheep @ daed0c84f98531712514b2231f43ec6901114ffe
third_party/genericCC @ d0153f8e594aa89e93b032143cedbdfe58e562f4
third_party/indigo @ 2601c92e4aa9d58d38dc4dfe0ecdbf90c077e64d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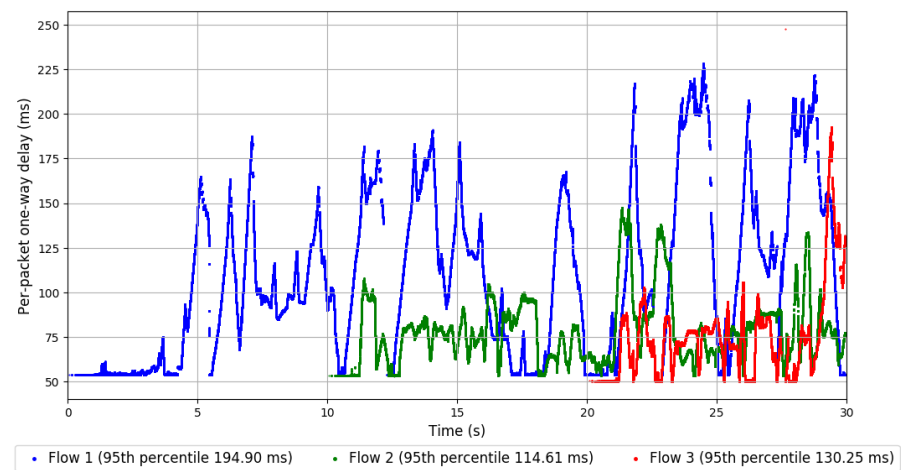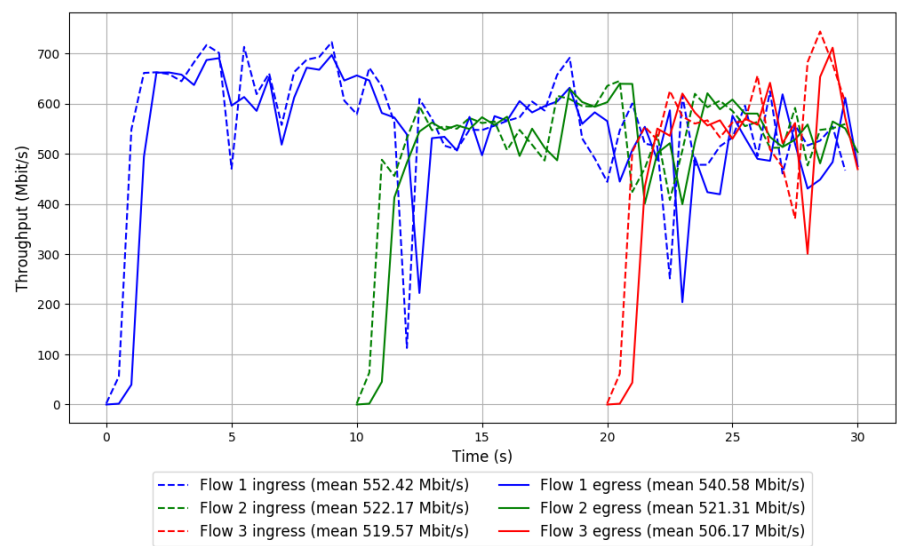### 3 flows with 10s interval between flows

2

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	544.27	507.92	499.26	187.72	148.89	141.74	1.89	1.16	2.81
TCP Cubic	2	584.36	534.01	464.42	109.76	114.52	98.28	0.47	0.69	1.22
Indigo	2	217.41	203.08	176.00	53.57	55.15	55.32	0.34	0.55	1.27
Muses-25	2	482.39	484.23	406.52	64.59	61.92	66.51	0.20	0.34	1.55

```
Run 1: Statistics of TCP BBR

Start at: 2018-08-31 13:46:42
End at: 2018-08-31 13:47:12
Local clock offset: 0.089 ms
Remote clock offset: -0.188 ms


# Below is generated by plot.py at 2018-08-31 14:18:42
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1054.14 Mbit/s
95th percentile per-packet one-way delay: 173.686 ms
Loss rate: 2.08%
-- Flow 1:
Average throughput: 540.58 Mbit/s
95th percentile per-packet one-way delay: 194.901 ms
Loss rate: 2.49%
-- Flow 2:
Average throughput: 521.31 Mbit/s
95th percentile per-packet one-way delay: 114.611 ms
Loss rate: 0.68%
-- Flow 3:
Average throughput: 506.17 Mbit/s
95th percentile per-packet one-way delay: 130.251 ms
Loss rate: 3.59%
```

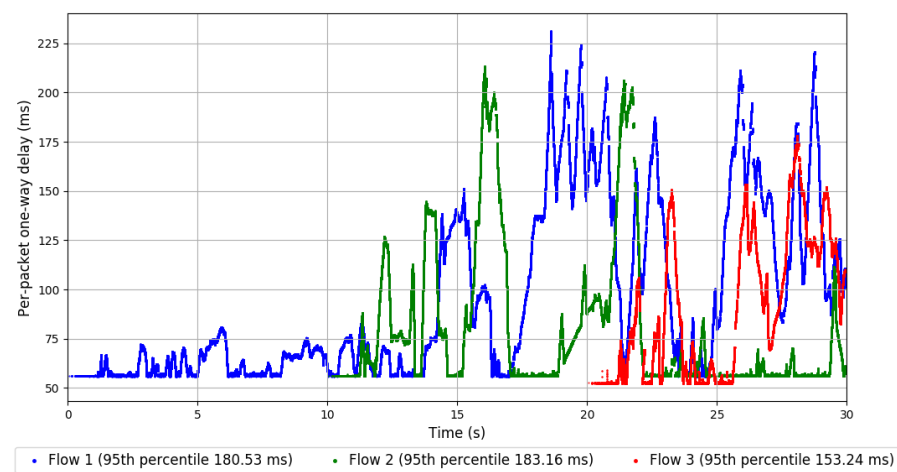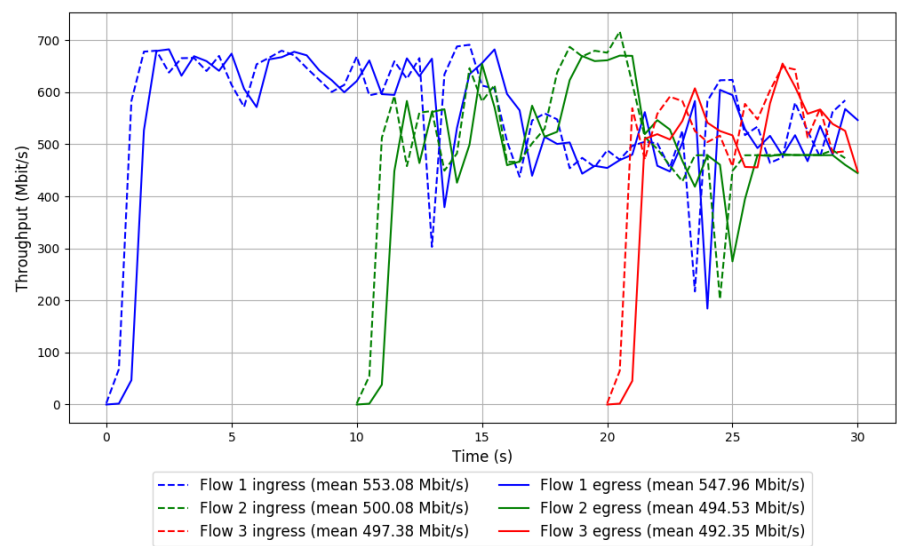Run 1: Report of TCP BBR — Data Link

```
Run 2: Statistics of TCP BBR

Start at: 2018-08-31 13:54:33
End at: 2018-08-31 13:55:03
Local clock offset: -0.27 ms
Remote clock offset: -2.833 ms


# Below is generated by plot.py at 2018-08-31 14:18:42
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1039.48 Mbit/s
95th percentile per-packet one-way delay: 175.639 ms
Loss rate: 1.51%
-- Flow 1:
Average throughput: 547.96 Mbit/s
95th percentile per-packet one-way delay: 180.534 ms
Loss rate: 1.28%
-- Flow 2:
Average throughput: 494.53 Mbit/s
95th percentile per-packet one-way delay: 183.164 ms
Loss rate: 1.64%
-- Flow 3:
Average throughput: 492.35 Mbit/s
95th percentile per-packet one-way delay: 153.238 ms
Loss rate: 2.04%
```

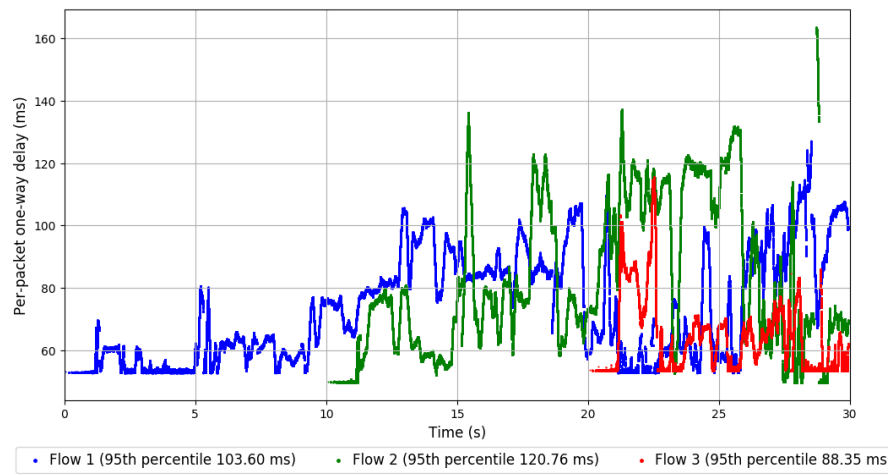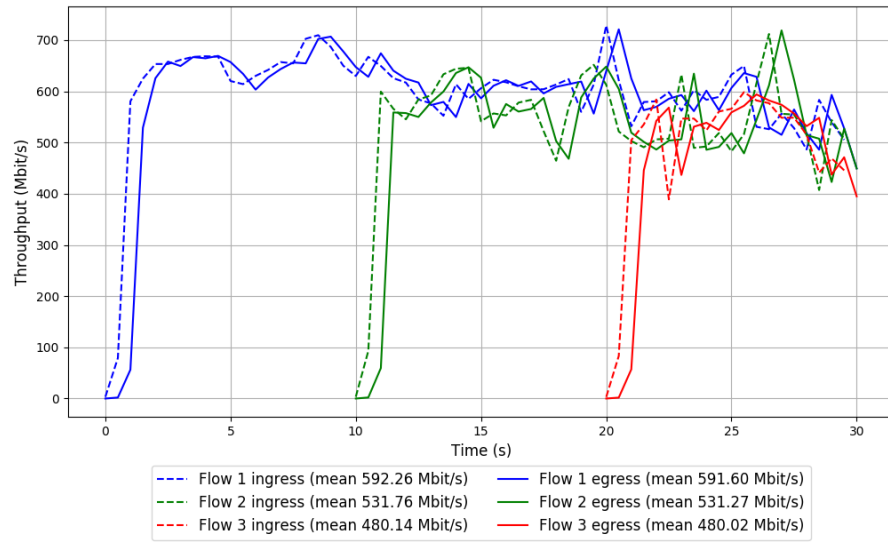Run 2: Report of TCP BBR — Data Link

```
Run 1: Statistics of TCP Cubic

Start at: 2018-08-31 13:50:44
End at: 2018-08-31 13:51:14
Local clock offset: -0.112 ms
Remote clock offset: -0.053 ms


# Below is generated by plot.py at 2018-08-31 14:18:57
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1103.34 Mbit/s
95th percentile per-packet one-way delay: 114.649 ms
Loss rate: 0.60%
-- Flow 1:
Average throughput: 591.60 Mbit/s
95th percentile per-packet one-way delay: 103.603 ms
Loss rate: 0.46%
-- Flow 2:
Average throughput: 531.27 Mbit/s
95th percentile per-packet one-way delay: 120.763 ms
Loss rate: 0.61%
-- Flow 3:
Average throughput: 480.02 Mbit/s
95th percentile per-packet one-way delay: 88.346 ms
Loss rate: 1.07%
```
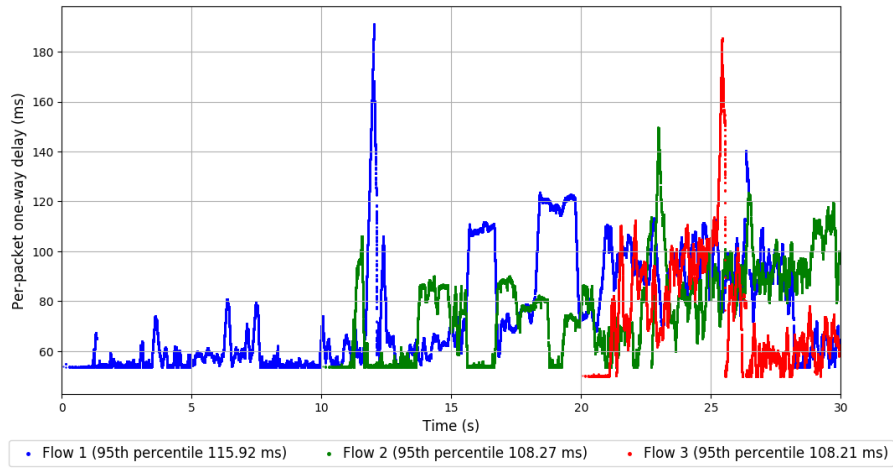
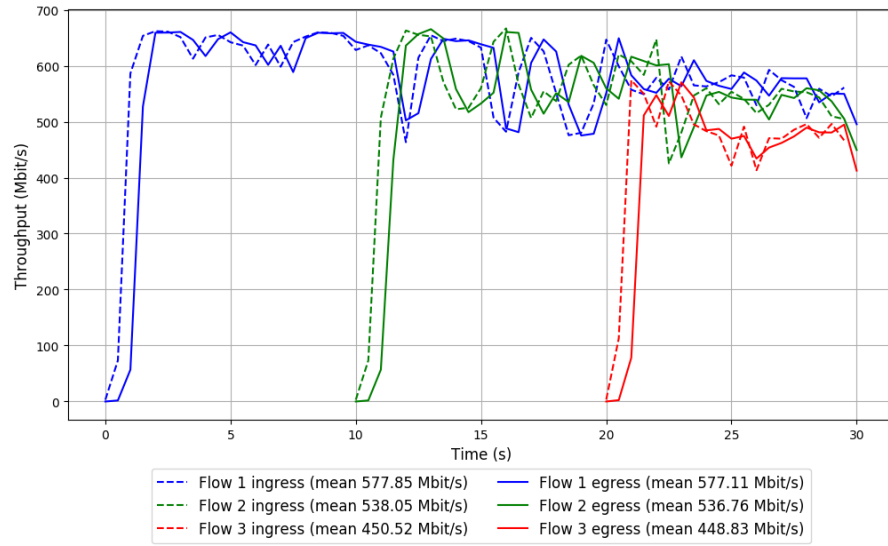Run 1: Report of TCP Cubic — Data Link

```
Run 2: Statistics of TCP Cubic

Start at: 2018-08-31 13:58:33
End at: 2018-08-31 13:59:03
Local clock offset: -0.08 ms
Remote clock offset: -0.219 ms


# Below is generated by plot.py at 2018-08-31 14:18:57
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1082.48 Mbit/s
95th percentile per-packet one-way delay: 110.743 ms
Loss rate: 0.70%
-- Flow 1:
Average throughput: 577.11 Mbit/s
95th percentile per-packet one-way delay: 115.918 ms
Loss rate: 0.48%
-- Flow 2:
Average throughput: 536.76 Mbit/s
95th percentile per-packet one-way delay: 108.268 ms
Loss rate: 0.77%
-- Flow 3:
Average throughput: 448.83 Mbit/s
95th percentile per-packet one-way delay: 108.210 ms
Loss rate: 1.37%
```

Run 2: Report of TCP Cubic — Data Link

- - - Flow 1 ingress (mean 577.85 Mbit/s) —— Flow 1 egress (mean 577.11 Mbit/s)
- - - Flow 2 ingress (mean 538.05 Mbit/s) —— Flow 2 egress (mean 536.76 Mbit/s)
- - - Flow 3 ingress (mean 450.52 Mbit/s) —— Flow 3 egress (mean 448.83 Mbit/s)

· Flow 1 (95th percentile 115.92 ms)   · Flow 2 (95th percentile 108.27 ms)   · Flow 3 (95th percentile 108.21 ms)
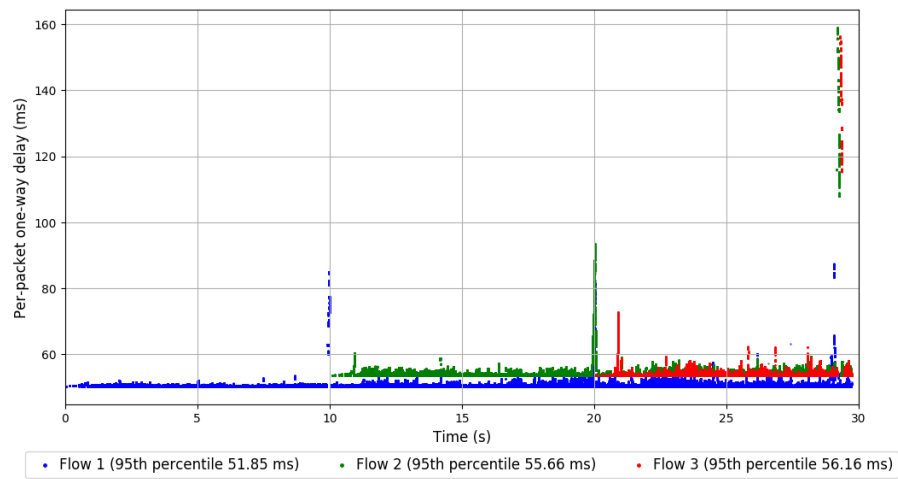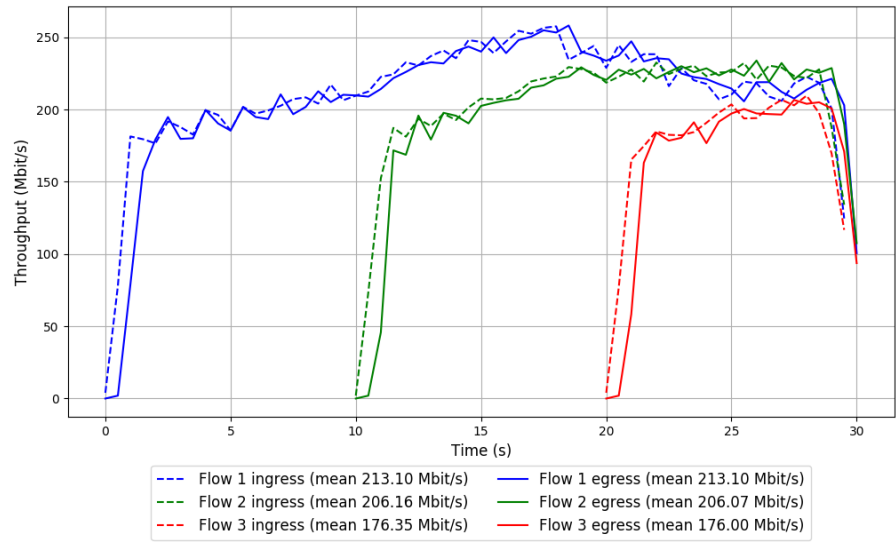
```
Run 1: Statistics of Indigo

Start at: 2018-08-31 13:44:57
End at: 2018-08-31 13:45:27
Local clock offset: 0.031 ms
Remote clock offset: -0.146 ms


# Below is generated by plot.py at 2018-08-31 14:18:57
# Datalink statistics
-- Total of 3 flows:
Average throughput: 406.59 Mbit/s
95th percentile per-packet one-way delay: 55.032 ms
Loss rate: 0.56%
-- Flow 1:
Average throughput: 213.10 Mbit/s
95th percentile per-packet one-way delay: 51.854 ms
Loss rate: 0.35%
-- Flow 2:
Average throughput: 206.07 Mbit/s
95th percentile per-packet one-way delay: 55.657 ms
Loss rate: 0.59%
-- Flow 3:
Average throughput: 176.00 Mbit/s
95th percentile per-packet one-way delay: 56.156 ms
Loss rate: 1.28%
```

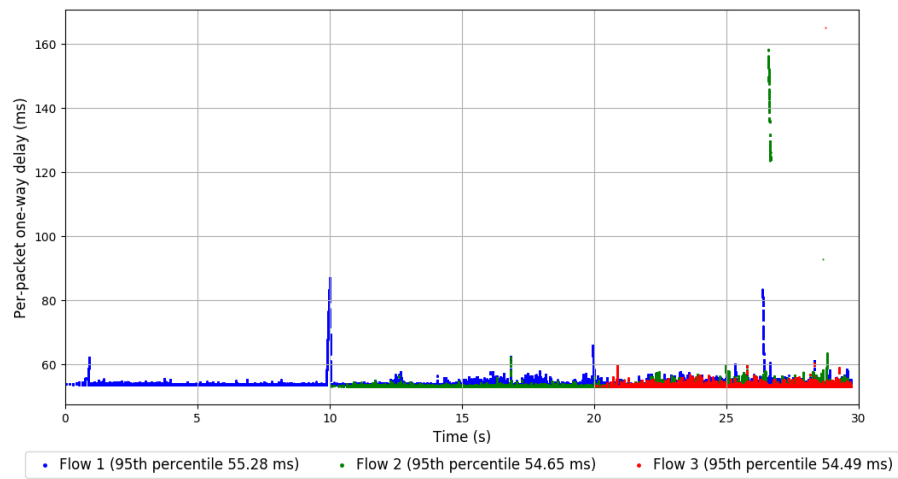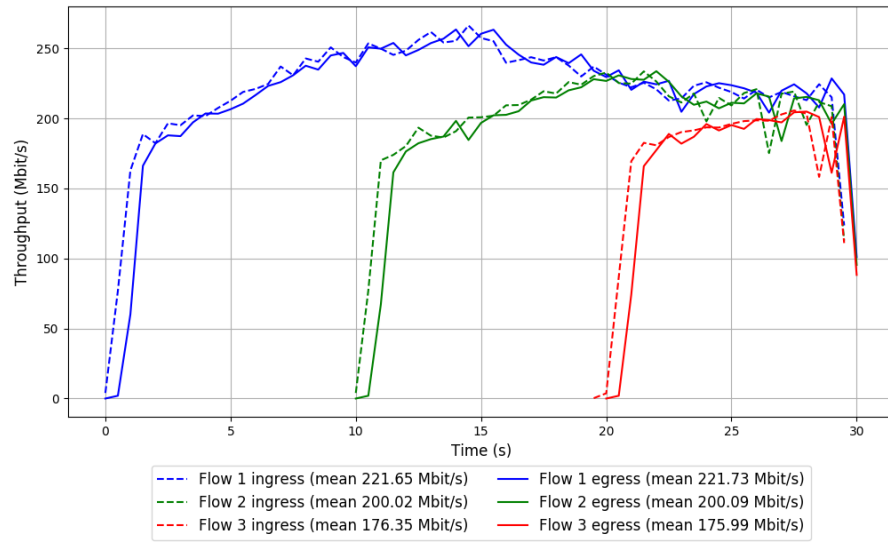Run 1: Report of Indigo — Data Link

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```
Run 2: Statistics of Indigo

Start at: 2018-08-31 13:52:46
End at: 2018-08-31 13:53:16
Local clock offset: 0.129 ms
Remote clock offset: -0.146 ms


# Below is generated by plot.py at 2018-08-31 14:18:57
# Datalink statistics
-- Total of 3 flows:
Average throughput: 411.73 Mbit/s
95th percentile per-packet one-way delay: 55.050 ms
Loss rate: 0.52%
-- Flow 1:
Average throughput: 221.73 Mbit/s
95th percentile per-packet one-way delay: 55.278 ms
Loss rate: 0.33%
-- Flow 2:
Average throughput: 200.09 Mbit/s
95th percentile per-packet one-way delay: 54.650 ms
Loss rate: 0.51%
-- Flow 3:
Average throughput: 175.99 Mbit/s
95th percentile per-packet one-way delay: 54.492 ms
Loss rate: 1.26%
```
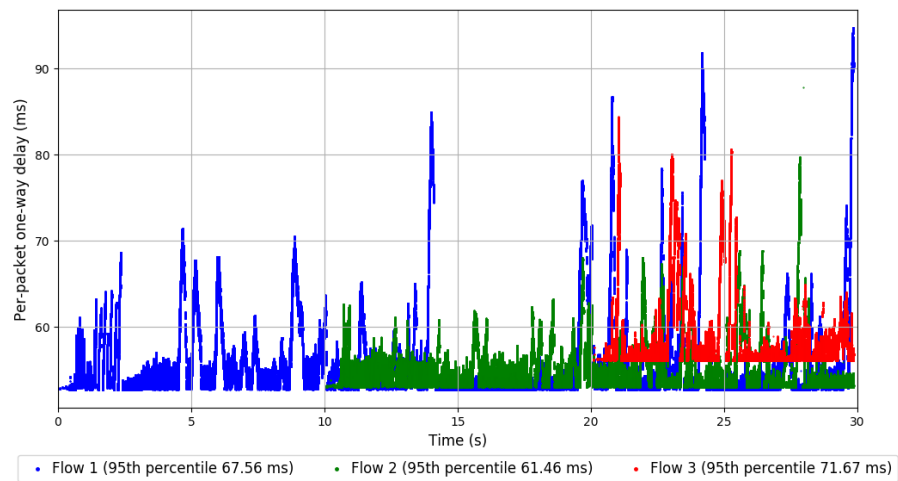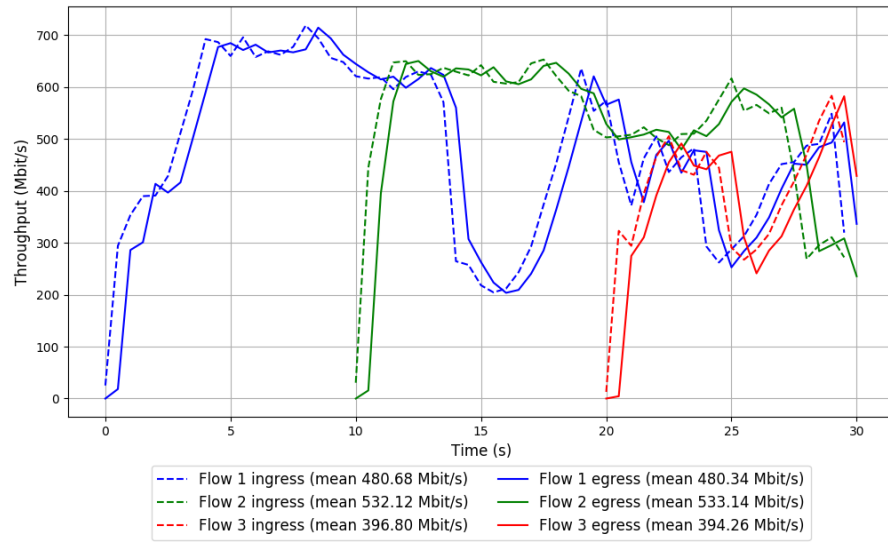
Run 2: Report of Indigo — Data Link

```
Run 1: Statistics of Muses-25

Start at: 2018-08-31 13:48:45
End at: 2018-08-31 13:49:15
Local clock offset: -0.106 ms
Remote clock offset: -3.116 ms

# Below is generated by plot.py at 2018-08-31 14:19:53
# Datalink statistics
-- Total of 3 flows:
Average throughput: 963.11 Mbit/s
95th percentile per-packet one-way delay: 65.831 ms
Loss rate: 0.45%
-- Flow 1:
Average throughput: 480.34 Mbit/s
95th percentile per-packet one-way delay: 67.555 ms
Loss rate: 0.19%
-- Flow 2:
Average throughput: 533.14 Mbit/s
95th percentile per-packet one-way delay: 61.460 ms
Loss rate: 0.34%
-- Flow 3:
Average throughput: 394.26 Mbit/s
95th percentile per-packet one-way delay: 71.669 ms
Loss rate: 1.72%
```

Run 1: Report of Muses-25 — Data Link

```
Run 2: Statistics of Muses-25

Start at: 2018-08-31 13:56:36
End at: 2018-08-31 13:57:06
Local clock offset: -0.317 ms
Remote clock offset: -0.117 ms


# Below is generated by plot.py at 2018-08-31 14:19:53
# Datalink statistics
-- Total of 3 flows:
Average throughput: 910.32 Mbit/s
95th percentile per-packet one-way delay: 61.857 ms
Loss rate: 0.42%
-- Flow 1:
Average throughput: 484.45 Mbit/s
95th percentile per-packet one-way delay: 61.635 ms
Loss rate: 0.20%
-- Flow 2:
Average throughput: 435.31 Mbit/s
95th percentile per-packet one-way delay: 62.372 ms
Loss rate: 0.33%
-- Flow 3:
Average throughput: 418.79 Mbit/s
95th percentile per-packet one-way delay: 61.358 ms
Loss rate: 1.39%
```

Run 2: Report of Muses-25 — Data Link