

## Pantheon Report

Generated at 2018-08-28 17:58:21 (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.

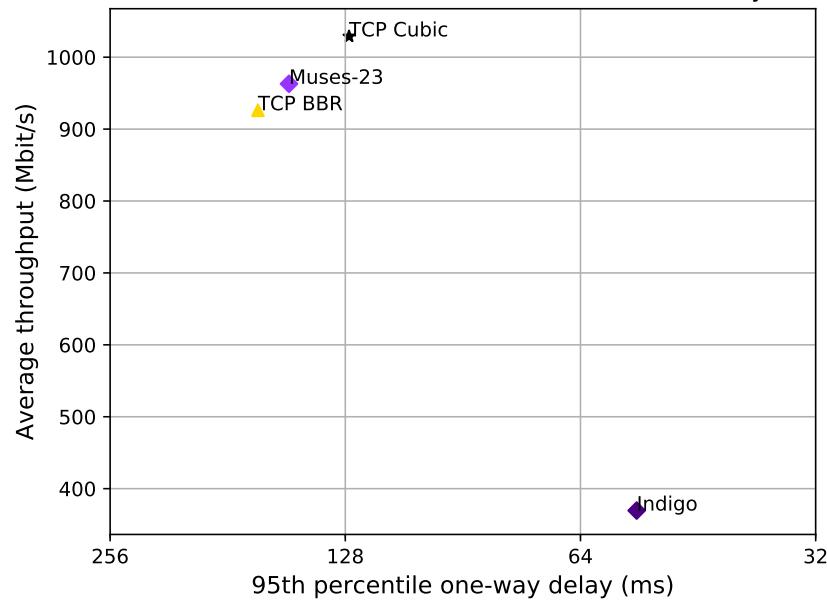
System info:

```
Linux 4.15.0-1015-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
```

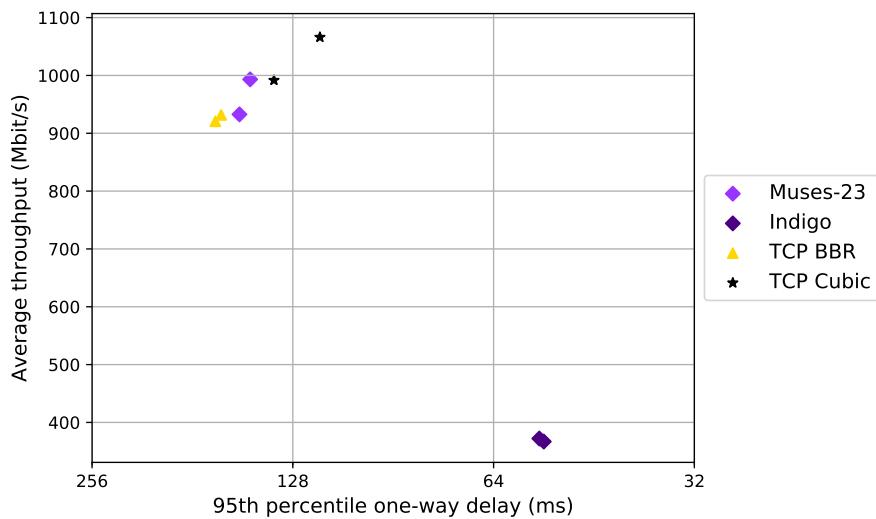
Git summary:

```
branch: muses-23 @ 88af05c5b0b7531637ca401951507a2fde628df6
third_party/fillp @ d47f4fa1b454a5e3c0537115c5a28436dbd4b834
third_party/fillp-sheep @ daed0c84f98531712514b2231f43ec6901114ffe
third_party/genericCC @ d0153f8e594aa89e93b032143cedbfe58e562f4
third_party/indigo @ 2601c92e4aa9d58d38dc4dfe0ecdbf90c077e64d
third_party/libutp @ b3465b942e2826f2b179eaab4a906ce6bb7cf3cf
third_party/muses @ b261c9e99c63be452bc16f94ce0caa99a4c9d39a
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



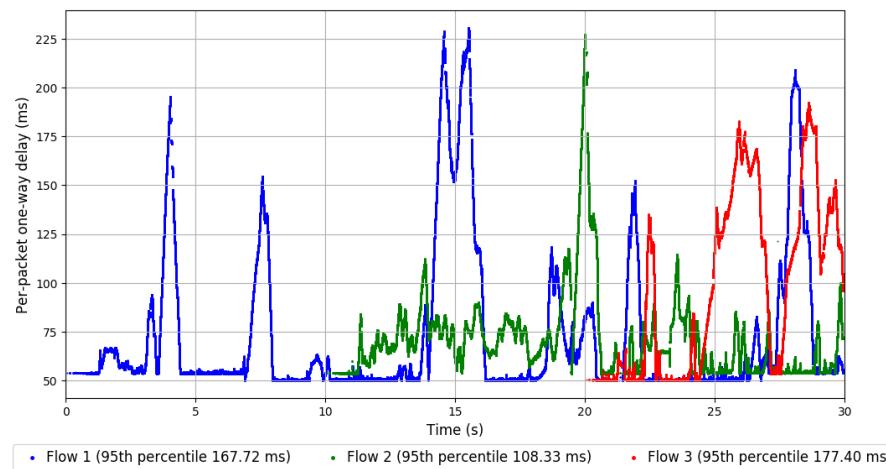
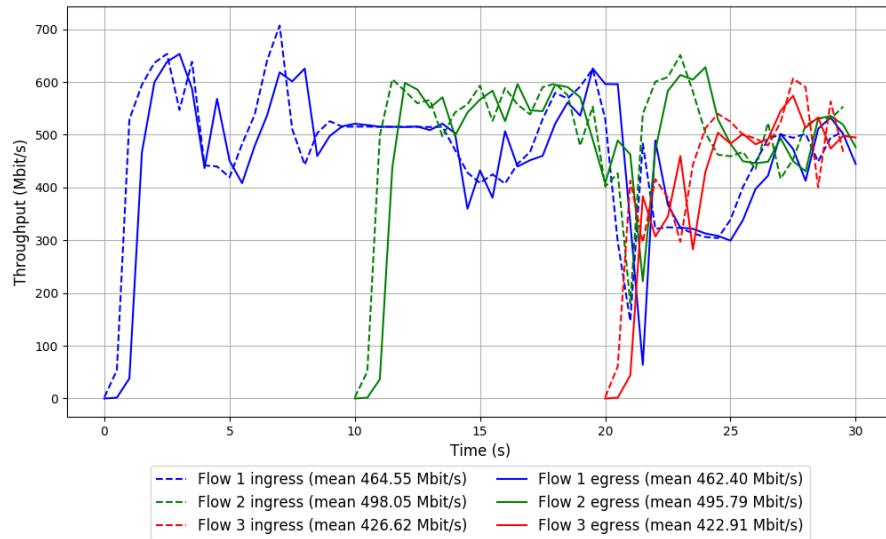
scheme	# runs	mean avg tput (Mbit/s)			mean 95th-%ile delay (ms)			mean loss rate (%)		
		flow 1	flow 2	flow 3	flow 1	flow 2	flow 3	flow 1	flow 2	flow 3
TCP BBR	2	473.73	463.78	436.54	156.69	143.94	175.56	0.95	1.10	2.72
TCP Cubic	2	558.97	487.21	444.88	127.22	119.00	121.31	0.32	0.75	0.79
Indigo	2	199.34	178.87	158.80	53.42	53.10	54.18	0.33	0.47	1.17
Muses-23	2	504.57	496.40	416.75	151.43	146.71	166.99	2.92	1.58	5.78

Run 1: Statistics of TCP BBR

```
Start at: 2018-08-28 17:29:40
End at: 2018-08-28 17:30:10
Local clock offset: -0.027 ms
Remote clock offset: -0.024 ms

# Below is generated by plot.py at 2018-08-28 17:55:32
# Datalink statistics
-- Total of 3 flows:
Average throughput: 931.76 Mbit/s
95th percentile per-packet one-way delay: 163.946 ms
Loss rate: 1.05%
-- Flow 1:
Average throughput: 462.40 Mbit/s
95th percentile per-packet one-way delay: 167.715 ms
Loss rate: 0.82%
-- Flow 2:
Average throughput: 495.79 Mbit/s
95th percentile per-packet one-way delay: 108.331 ms
Loss rate: 0.99%
-- Flow 3:
Average throughput: 422.91 Mbit/s
95th percentile per-packet one-way delay: 177.403 ms
Loss rate: 1.91%
```

## Run 1: Report of TCP BBR — Data Link

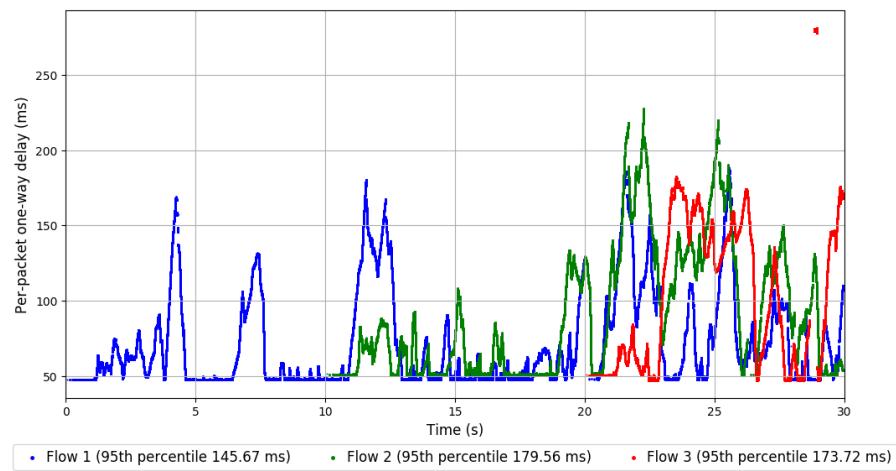
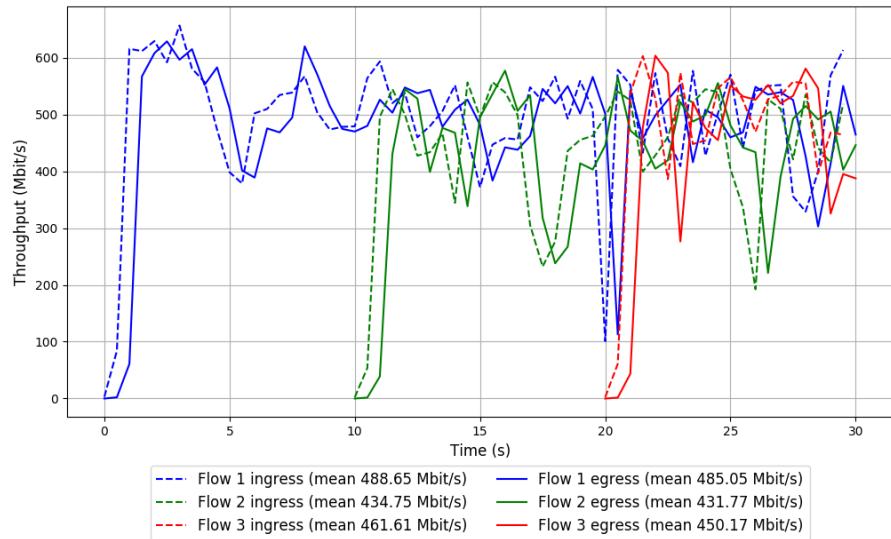


Run 2: Statistics of TCP BBR

```
Start at: 2018-08-28 17:37:24
End at: 2018-08-28 17:37:54
Local clock offset: 0.086 ms
Remote clock offset: 2.78 ms

# Below is generated by plot.py at 2018-08-28 17:55:32
# Datalink statistics
-- Total of 3 flows:
Average throughput: 920.70 Mbit/s
95th percentile per-packet one-way delay: 167.241 ms
Loss rate: 1.53%
-- Flow 1:
Average throughput: 485.05 Mbit/s
95th percentile per-packet one-way delay: 145.667 ms
Loss rate: 1.08%
-- Flow 2:
Average throughput: 431.77 Mbit/s
95th percentile per-packet one-way delay: 179.555 ms
Loss rate: 1.22%
-- Flow 3:
Average throughput: 450.17 Mbit/s
95th percentile per-packet one-way delay: 173.724 ms
Loss rate: 3.53%
```

## Run 2: Report of TCP BBR — Data Link

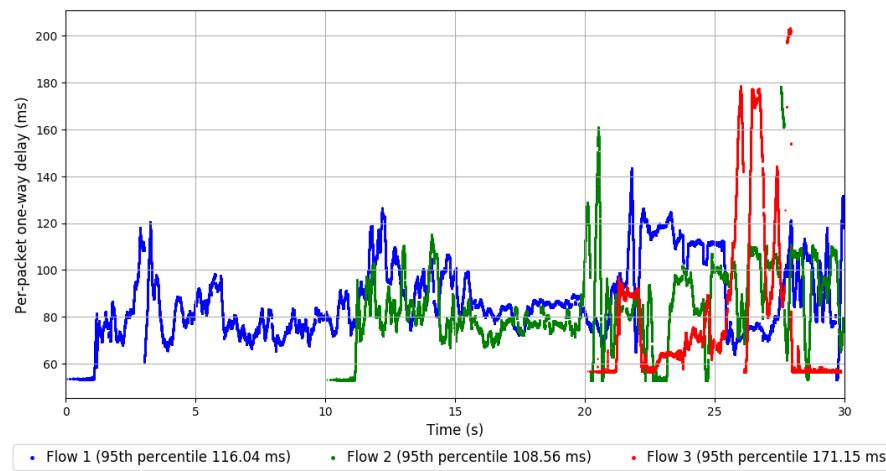
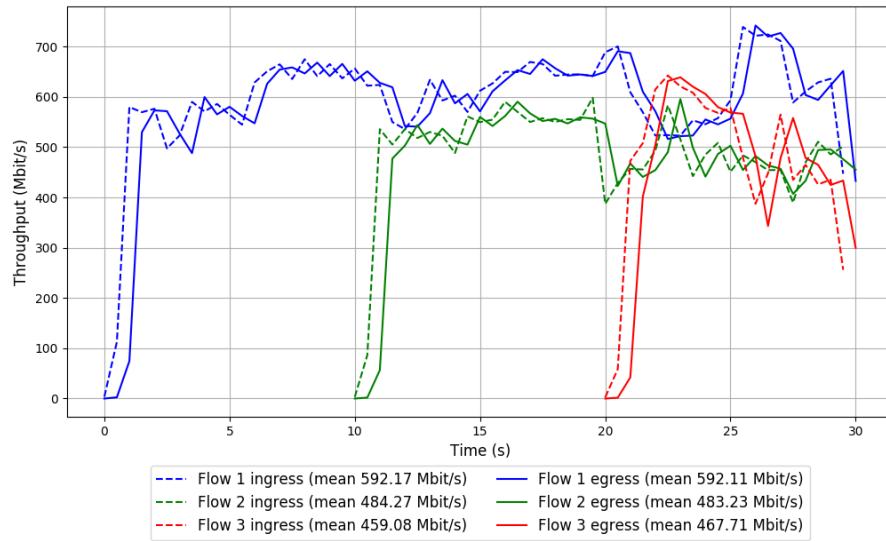


```
Run 1: Statistics of TCP Cubic
```

```
Start at: 2018-08-28 17:25:40
End at: 2018-08-28 17:26:10
Local clock offset: -0.054 ms
Remote clock offset: -2.863 ms

# Below is generated by plot.py at 2018-08-28 17:57:15
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1066.09 Mbit/s
95th percentile per-packet one-way delay: 116.572 ms
Loss rate: 0.46%
-- Flow 1:
Average throughput: 592.11 Mbit/s
95th percentile per-packet one-way delay: 116.042 ms
Loss rate: 0.36%
-- Flow 2:
Average throughput: 483.23 Mbit/s
95th percentile per-packet one-way delay: 108.563 ms
Loss rate: 0.73%
-- Flow 3:
Average throughput: 467.71 Mbit/s
95th percentile per-packet one-way delay: 171.149 ms
Loss rate: 0.27%
```

## Run 1: Report of TCP Cubic — Data Link

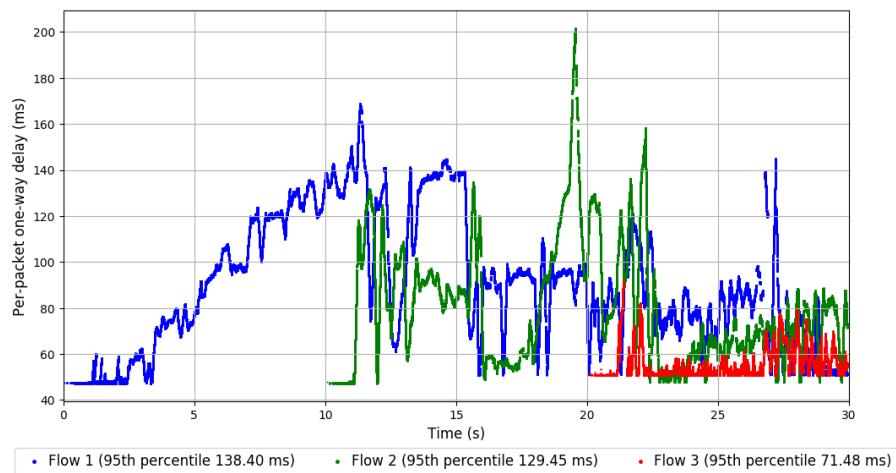
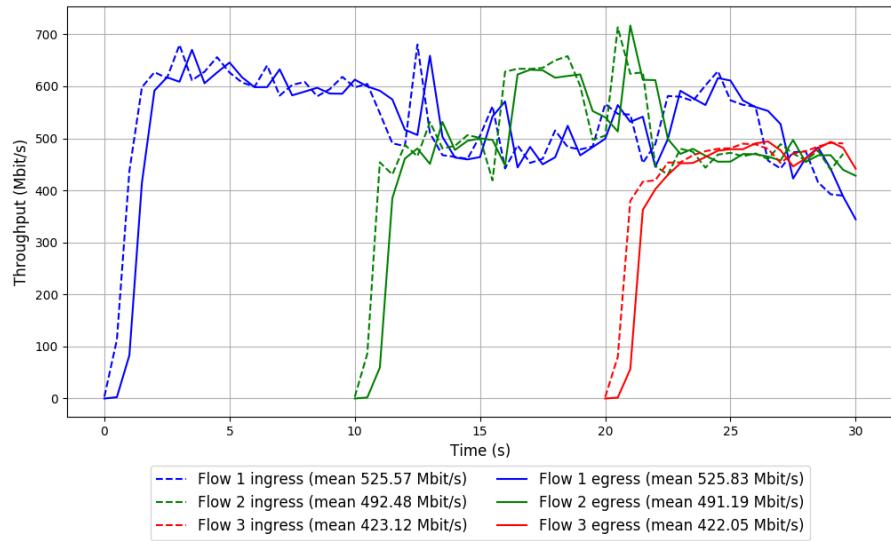


Run 2: Statistics of TCP Cubic

```
Start at: 2018-08-28 17:33:23
End at: 2018-08-28 17:33:53
Local clock offset: 0.06 ms
Remote clock offset: 2.744 ms

# Below is generated by plot.py at 2018-08-28 17:57:15
# Datalink statistics
-- Total of 3 flows:
Average throughput: 991.69 Mbit/s
95th percentile per-packet one-way delay: 136.618 ms
Loss rate: 0.59%
-- Flow 1:
Average throughput: 525.83 Mbit/s
95th percentile per-packet one-way delay: 138.402 ms
Loss rate: 0.29%
-- Flow 2:
Average throughput: 491.19 Mbit/s
95th percentile per-packet one-way delay: 129.446 ms
Loss rate: 0.77%
-- Flow 3:
Average throughput: 422.05 Mbit/s
95th percentile per-packet one-way delay: 71.477 ms
Loss rate: 1.30%
```

## Run 2: Report of TCP Cubic — Data Link

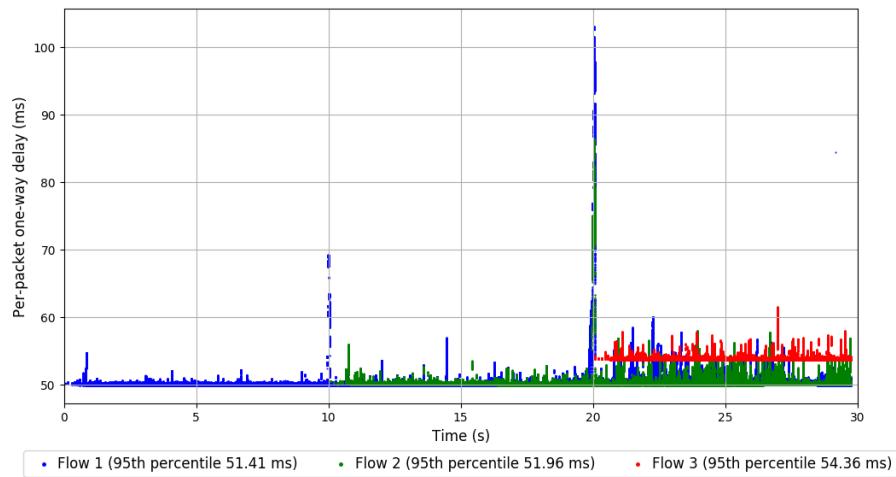
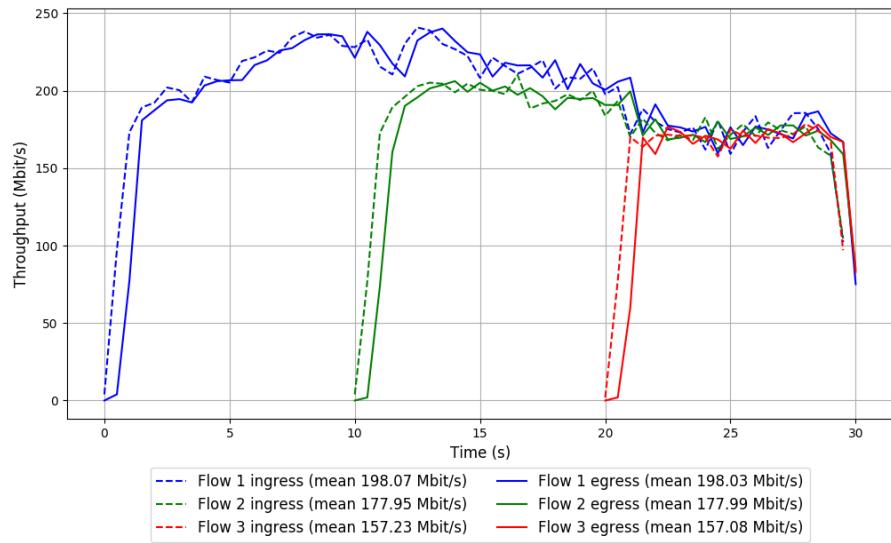


Run 1: Statistics of Indigo

```
Start at: 2018-08-28 17:23:58
End at: 2018-08-28 17:24:28
Local clock offset: -0.105 ms
Remote clock offset: -0.113 ms

# Below is generated by plot.py at 2018-08-28 17:57:15
# Datalink statistics
-- Total of 3 flows:
Average throughput: 366.93 Mbit/s
95th percentile per-packet one-way delay: 53.819 ms
Loss rate: 0.51%
-- Flow 1:
Average throughput: 198.03 Mbit/s
95th percentile per-packet one-way delay: 51.405 ms
Loss rate: 0.35%
-- Flow 2:
Average throughput: 177.99 Mbit/s
95th percentile per-packet one-way delay: 51.958 ms
Loss rate: 0.48%
-- Flow 3:
Average throughput: 157.08 Mbit/s
95th percentile per-packet one-way delay: 54.358 ms
Loss rate: 1.17%
```

## Run 1: Report of Indigo — Data Link

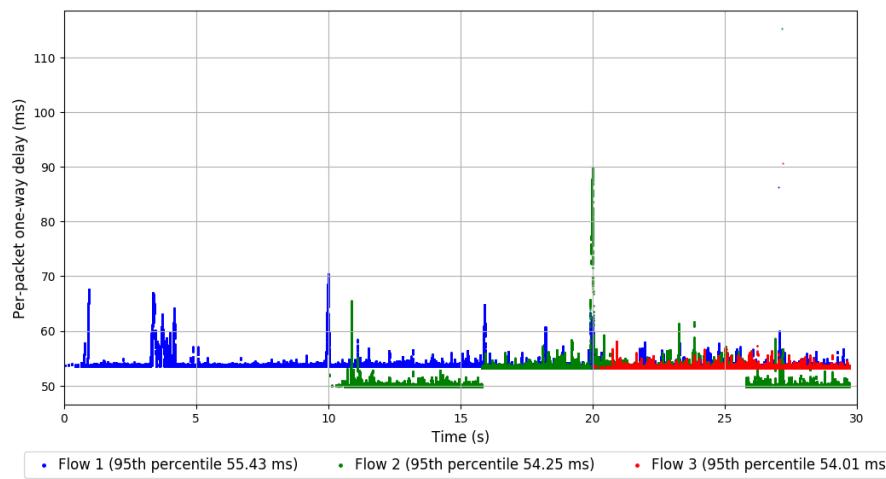
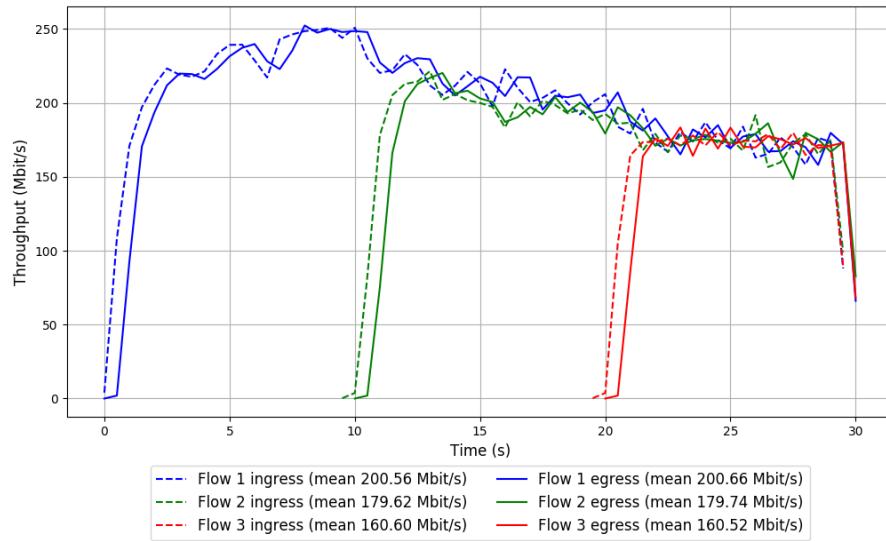


Run 2: Statistics of Indigo

```
Start at: 2018-08-28 17:31:40
End at: 2018-08-28 17:32:10
Local clock offset: -0.195 ms
Remote clock offset: 0.023 ms

# Below is generated by plot.py at 2018-08-28 17:57:15
# Datalink statistics
-- Total of 3 flows:
Average throughput: 372.17 Mbit/s
95th percentile per-packet one-way delay: 54.653 ms
Loss rate: 0.48%
-- Flow 1:
Average throughput: 200.66 Mbit/s
95th percentile per-packet one-way delay: 55.434 ms
Loss rate: 0.31%
-- Flow 2:
Average throughput: 179.74 Mbit/s
95th percentile per-packet one-way delay: 54.249 ms
Loss rate: 0.47%
-- Flow 3:
Average throughput: 160.52 Mbit/s
95th percentile per-packet one-way delay: 54.010 ms
Loss rate: 1.16%
```

## Run 2: Report of Indigo — Data Link

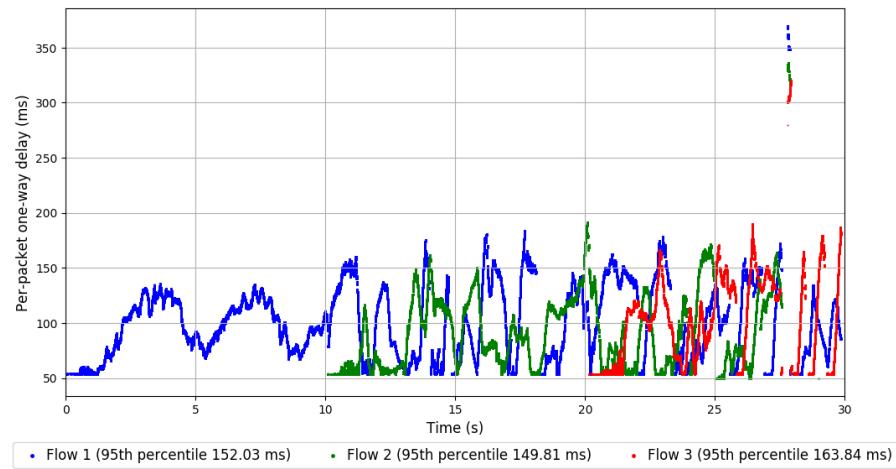
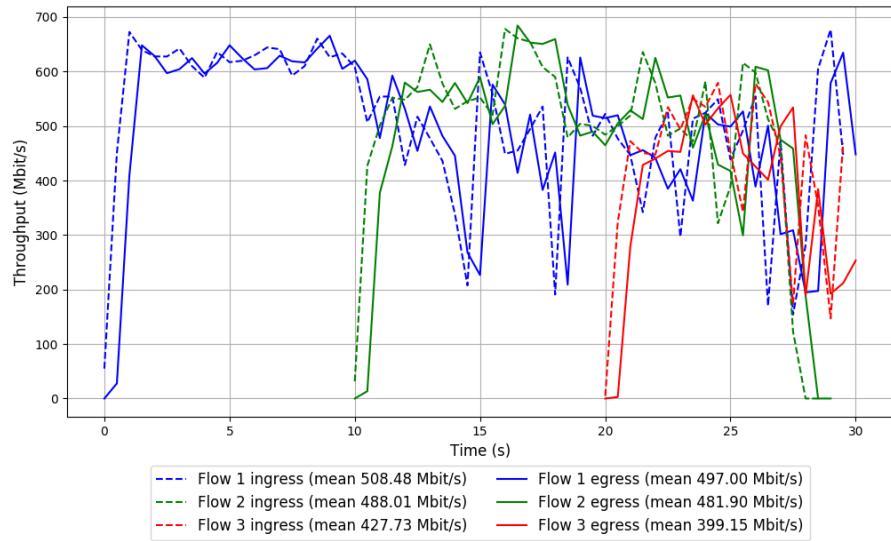


Run 1: Statistics of Muses-23

```
Start at: 2018-08-28 17:27:41
End at: 2018-08-28 17:28:11
Local clock offset: -0.12 ms
Remote clock offset: -0.008 ms

# Below is generated by plot.py at 2018-08-28 17:58:09
# Datalink statistics
-- Total of 3 flows:
Average throughput: 932.71 Mbit/s
95th percentile per-packet one-way delay: 153.886 ms
Loss rate: 2.90%
-- Flow 1:
Average throughput: 497.00 Mbit/s
95th percentile per-packet one-way delay: 152.033 ms
Loss rate: 2.61%
-- Flow 2:
Average throughput: 481.90 Mbit/s
95th percentile per-packet one-way delay: 149.807 ms
Loss rate: 1.27%
-- Flow 3:
Average throughput: 399.15 Mbit/s
95th percentile per-packet one-way delay: 163.837 ms
Loss rate: 7.54%
```

Run 1: Report of Muses-23 — Data Link



Run 2: Statistics of Muses-23

```
Start at: 2018-08-28 17:35:21
End at: 2018-08-28 17:35:51
Local clock offset: -0.111 ms
Remote clock offset: -0.006 ms

# Below is generated by plot.py at 2018-08-28 17:58:18
# Datalink statistics
-- Total of 3 flows:
Average throughput: 993.22 Mbit/s
95th percentile per-packet one-way delay: 148.317 ms
Loss rate: 2.89%
-- Flow 1:
Average throughput: 512.14 Mbit/s
95th percentile per-packet one-way delay: 150.821 ms
Loss rate: 3.23%
-- Flow 2:
Average throughput: 510.90 Mbit/s
95th percentile per-packet one-way delay: 143.621 ms
Loss rate: 1.89%
-- Flow 3:
Average throughput: 434.36 Mbit/s
95th percentile per-packet one-way delay: 170.152 ms
Loss rate: 4.02%
```

Run 2: Report of Muses-23 — Data Link

