

## Pantheon Report

Generated at 2018-09-06 02:50:38 (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.

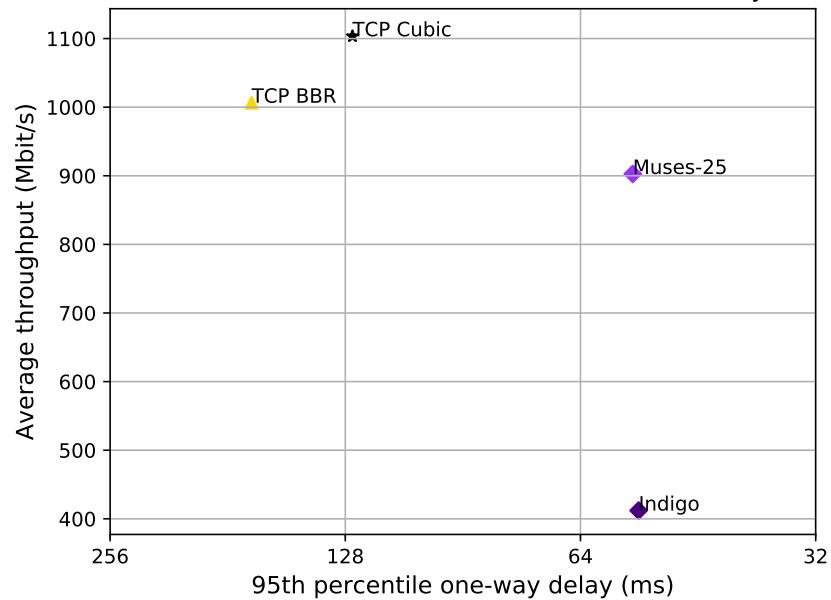
System info:

```
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
```

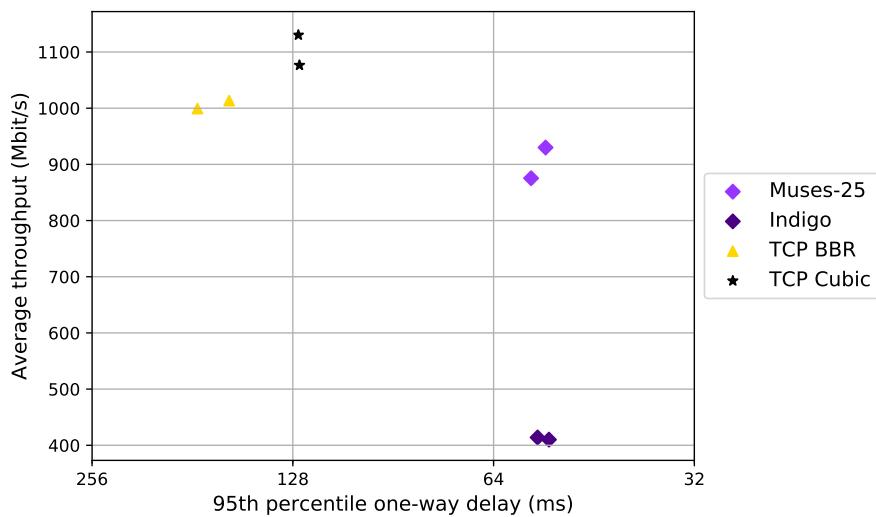
Git summary:

```
branch: muses @ 18b9165265c8ba2915c862e8713fd9ad82c1ac21
third_party/fillp @ d47f4fa1b454a5e3c0537115c5a28436dbd4b834
third_party/fillp-sheep @ daed0c84f98531712514b2231f43ec6901114ffe
third_party/genericCC @ d0153f8e594aa89e93b032143cedbdf58e562f4
third_party/indigo @ 2601c92e4aa9d58d38dc4dfe0ecdbf90c077e64d
third_party/libutp @ b3465b942e2826f2b179eaab4a906ce6bb7cf3cf
third_party/muses @ a28d20fb82a95a965a3da65fd1eb71b8994e9b84
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



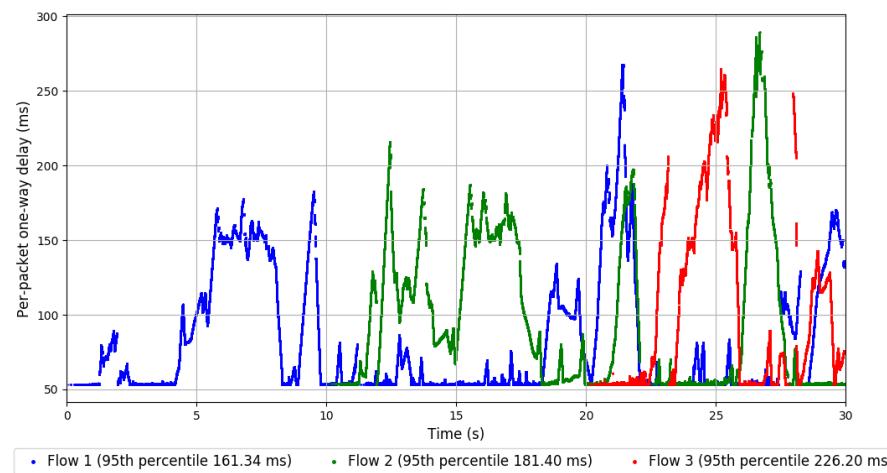
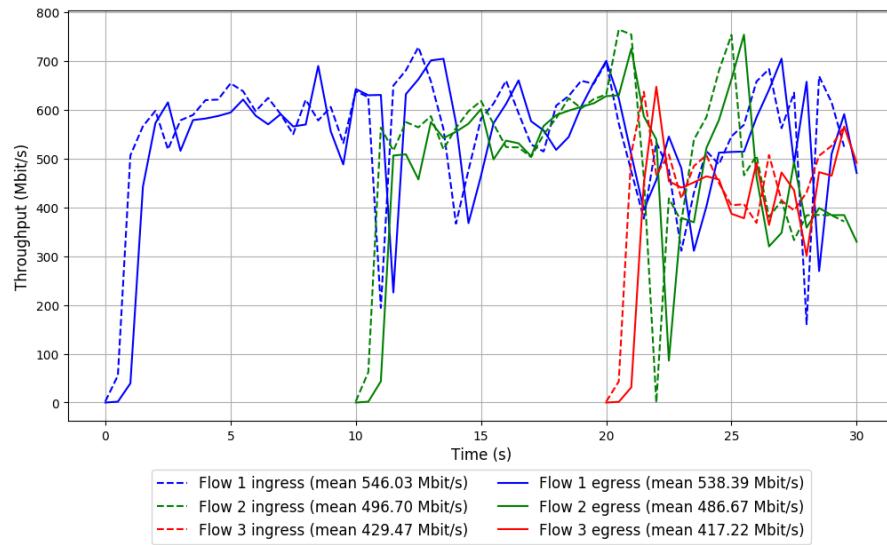
scheme	# runs	mean avg tput (Mbit/s)			mean 95th-%ile delay (ms)			mean loss rate (%)		
		flow 1	flow 2	flow 3	flow 1	flow 2	flow 3	flow 1	flow 2	flow 3
TCP BBR	2	528.50	509.15	422.73	161.87	172.51	162.84	1.54	2.38	2.60
TCP Cubic	2	598.51	524.63	472.52	122.51	118.58	105.93	0.38	0.64	1.46
Indigo	2	218.81	204.28	177.57	53.11	54.66	54.86	0.36	0.55	1.23
Muses-25	2	503.43	426.12	356.42	54.29	54.72	56.30	0.33	0.29	0.96

Run 1: Statistics of TCP BBR

```
Start at: 2018-09-06 02:17:01
End at: 2018-09-06 02:17:31
Local clock offset: -0.237 ms
Remote clock offset: 0.037 ms

# Below is generated by plot.py at 2018-09-06 02:50:12
# Datalink statistics
-- Total of 3 flows:
Average throughput: 999.39 Mbit/s
95th percentile per-packet one-way delay: 177.908 ms
Loss rate: 2.31%
-- Flow 1:
Average throughput: 538.39 Mbit/s
95th percentile per-packet one-way delay: 161.344 ms
Loss rate: 1.75%
-- Flow 2:
Average throughput: 486.67 Mbit/s
95th percentile per-packet one-way delay: 181.396 ms
Loss rate: 2.54%
-- Flow 3:
Average throughput: 417.22 Mbit/s
95th percentile per-packet one-way delay: 226.196 ms
Loss rate: 3.90%
```

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

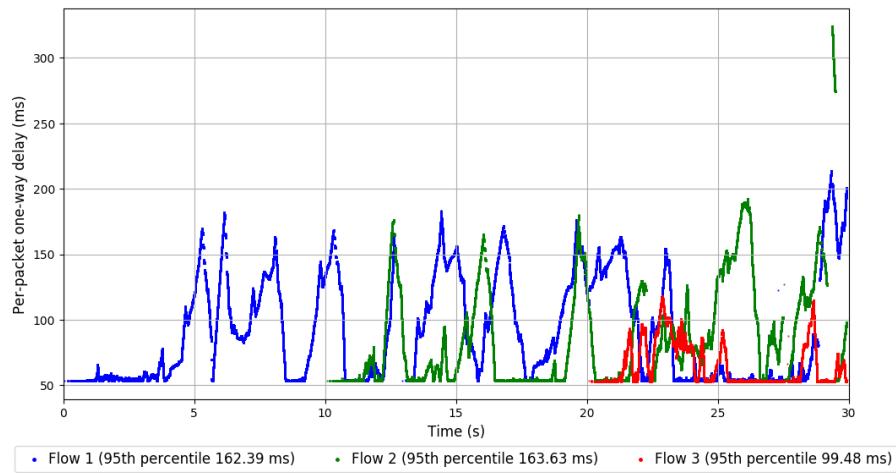
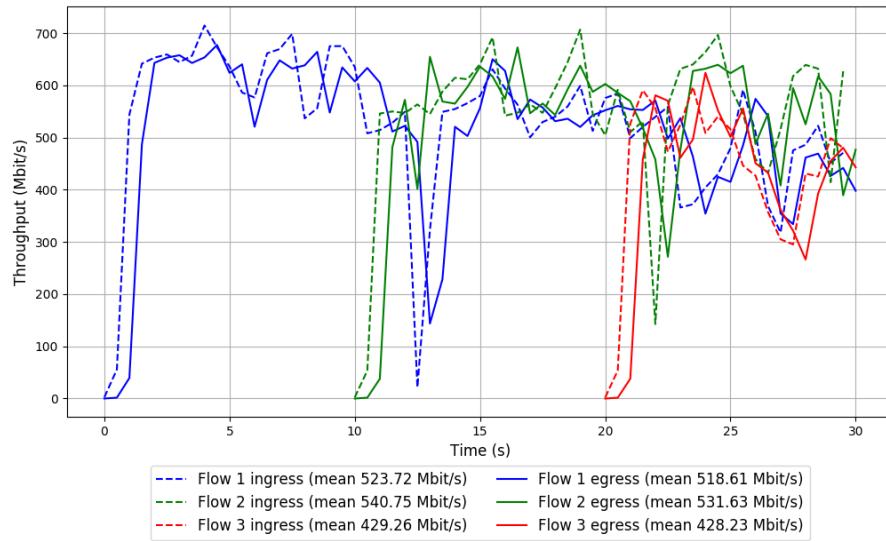


Run 2: Statistics of TCP BBR

```
Start at: 2018-09-06 02:24:56
End at: 2018-09-06 02:25:26
Local clock offset: -0.015 ms
Remote clock offset: -0.007 ms

# Below is generated by plot.py at 2018-09-06 02:50:17
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1013.50 Mbit/s
95th percentile per-packet one-way delay: 159.457 ms
Loss rate: 1.64%
-- Flow 1:
Average throughput: 518.61 Mbit/s
95th percentile per-packet one-way delay: 162.387 ms
Loss rate: 1.33%
-- Flow 2:
Average throughput: 531.63 Mbit/s
95th percentile per-packet one-way delay: 163.633 ms
Loss rate: 2.21%
-- Flow 3:
Average throughput: 428.23 Mbit/s
95th percentile per-packet one-way delay: 99.483 ms
Loss rate: 1.30%
```

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

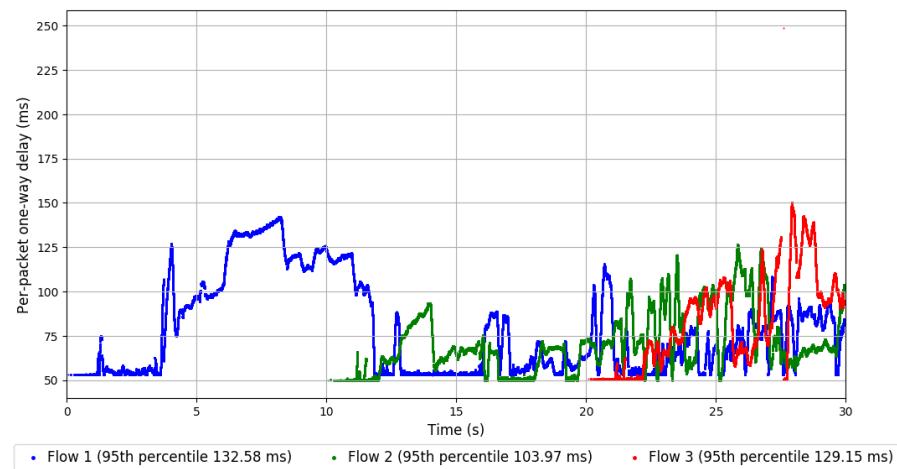
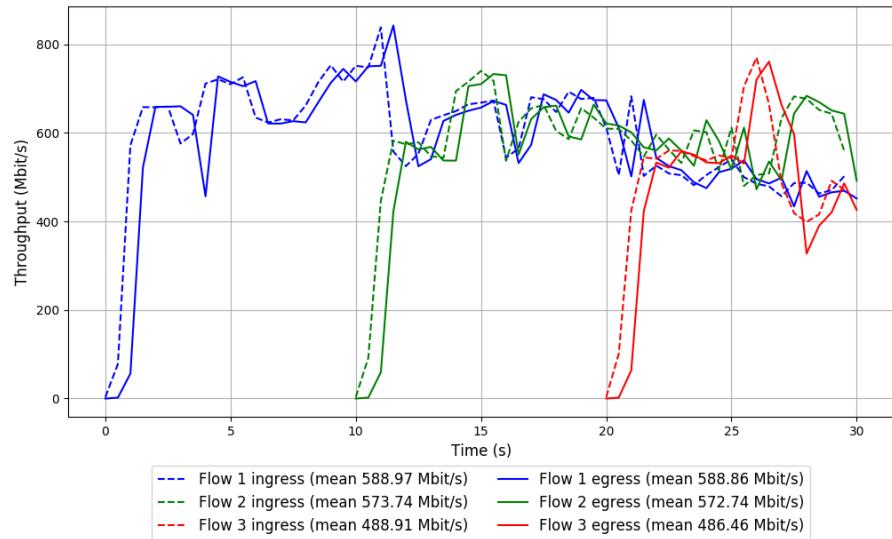


```
Run 1: Statistics of TCP Cubic
```

```
Start at: 2018-09-06 02:19:08
End at: 2018-09-06 02:19:38
Local clock offset: -0.064 ms
Remote clock offset: -0.118 ms

# Below is generated by plot.py at 2018-09-06 02:50:36
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1130.23 Mbit/s
95th percentile per-packet one-way delay: 125.562 ms
Loss rate: 0.64%
-- Flow 1:
Average throughput: 588.86 Mbit/s
95th percentile per-packet one-way delay: 132.576 ms
Loss rate: 0.37%
-- Flow 2:
Average throughput: 572.74 Mbit/s
95th percentile per-packet one-way delay: 103.970 ms
Loss rate: 0.69%
-- Flow 3:
Average throughput: 486.46 Mbit/s
95th percentile per-packet one-way delay: 129.150 ms
Loss rate: 1.51%
```

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

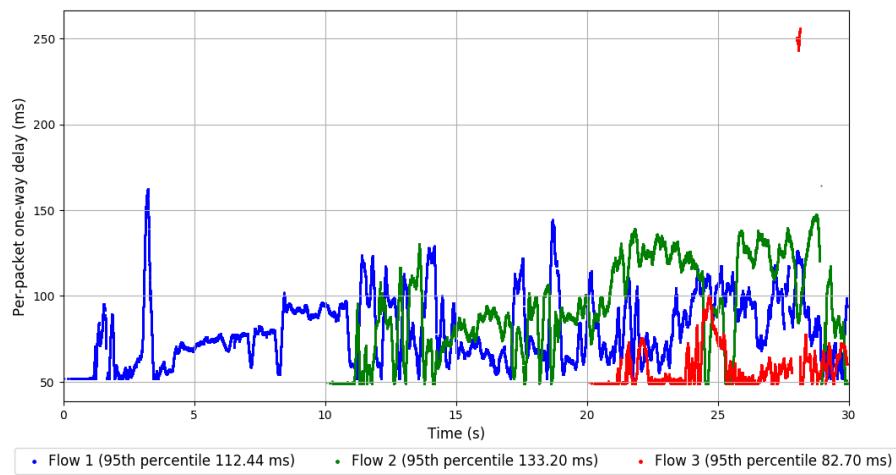
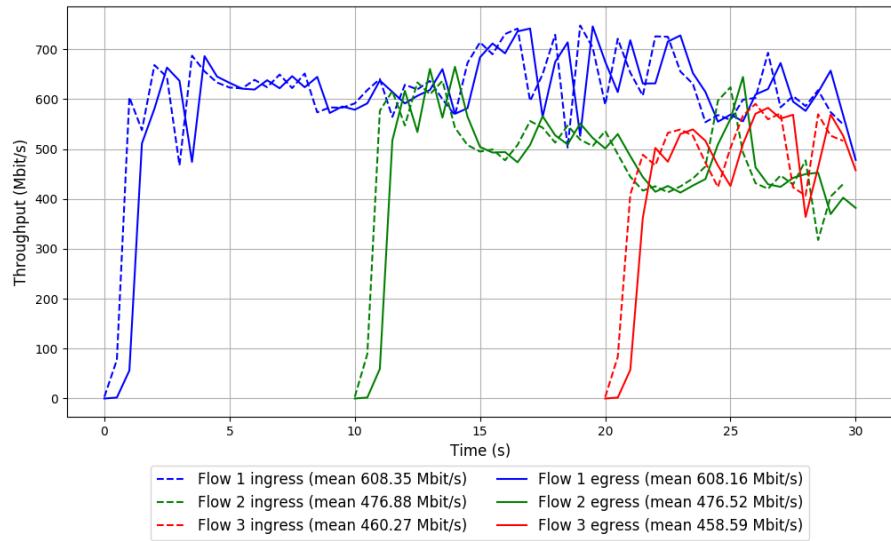


Run 2: Statistics of TCP Cubic

```
Start at: 2018-09-06 02:27:03
End at: 2018-09-06 02:27:33
Local clock offset: -0.137 ms
Remote clock offset: 1.159 ms

# Below is generated by plot.py at 2018-09-06 02:50:36
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1076.49 Mbit/s
95th percentile per-packet one-way delay: 125.095 ms
Loss rate: 0.59%
-- Flow 1:
Average throughput: 608.16 Mbit/s
95th percentile per-packet one-way delay: 112.441 ms
Loss rate: 0.39%
-- Flow 2:
Average throughput: 476.52 Mbit/s
95th percentile per-packet one-way delay: 133.199 ms
Loss rate: 0.59%
-- Flow 3:
Average throughput: 458.59 Mbit/s
95th percentile per-packet one-way delay: 82.700 ms
Loss rate: 1.40%
```

Run 2: Report of TCP Cubic — Data Link

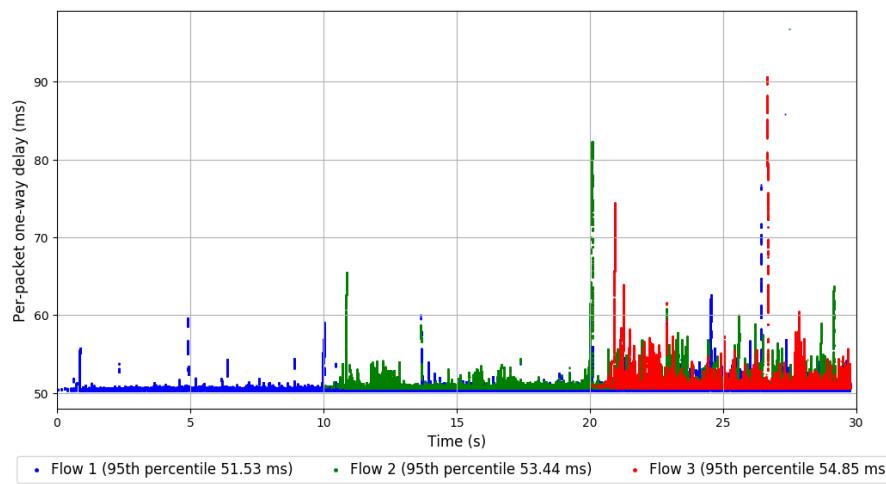
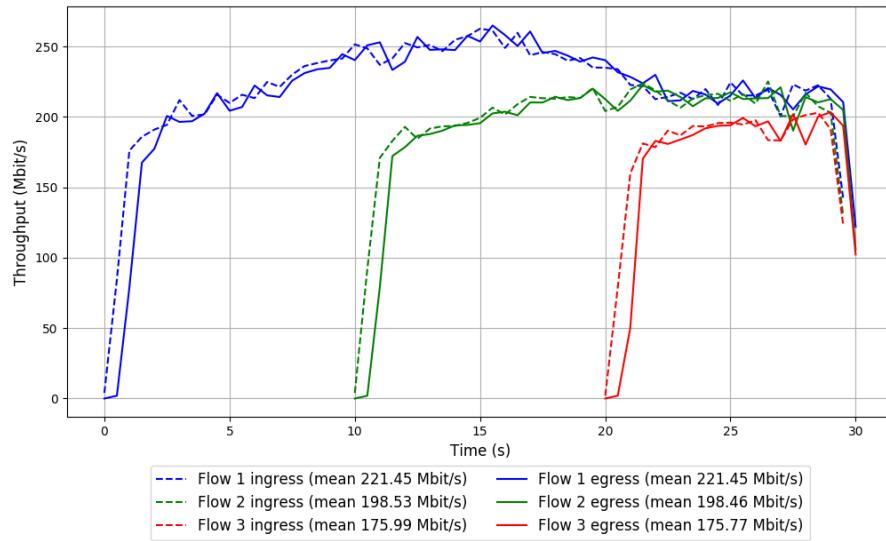


Run 1: Statistics of Indigo

```
Start at: 2018-09-06 02:21:14
End at: 2018-09-06 02:21:44
Local clock offset: -0.174 ms
Remote clock offset: -0.406 ms

# Below is generated by plot.py at 2018-09-06 02:50:36
# Datalink statistics
-- Total of 3 flows:
Average throughput: 410.13 Mbit/s
95th percentile per-packet one-way delay: 52.867 ms
Loss rate: 0.53%
-- Flow 1:
Average throughput: 221.45 Mbit/s
95th percentile per-packet one-way delay: 51.530 ms
Loss rate: 0.35%
-- Flow 2:
Average throughput: 198.46 Mbit/s
95th percentile per-packet one-way delay: 53.441 ms
Loss rate: 0.56%
-- Flow 3:
Average throughput: 175.77 Mbit/s
95th percentile per-packet one-way delay: 54.852 ms
Loss rate: 1.19%
```

Run 1: Report of Indigo — Data Link

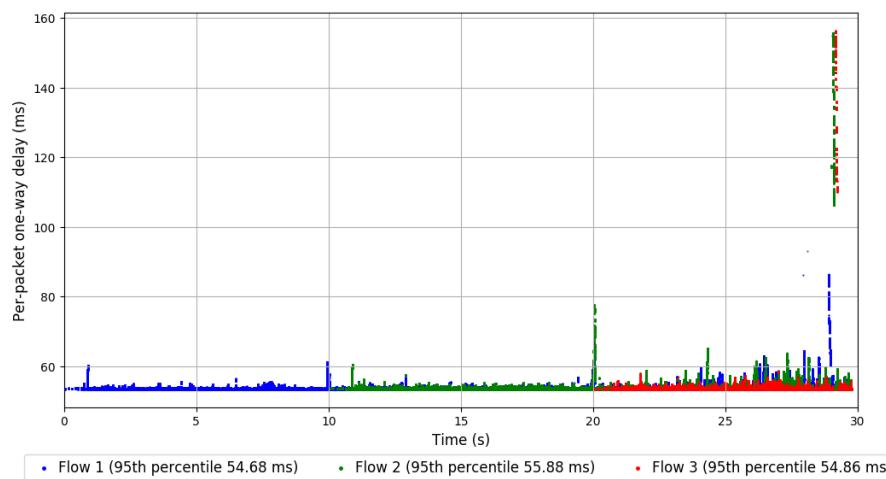
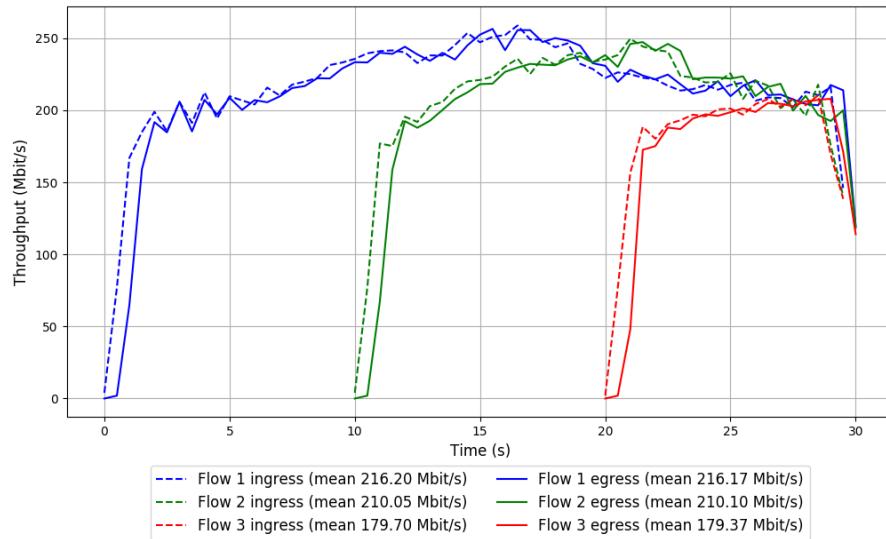


Run 2: Statistics of Indigo

```
Start at: 2018-09-06 02:29:07
End at: 2018-09-06 02:29:37
Local clock offset: -0.162 ms
Remote clock offset: -0.062 ms

# Below is generated by plot.py at 2018-09-06 02:50:36
# Datalink statistics
-- Total of 3 flows:
Average throughput: 413.94 Mbit/s
95th percentile per-packet one-way delay: 54.984 ms
Loss rate: 0.56%
-- Flow 1:
Average throughput: 216.17 Mbit/s
95th percentile per-packet one-way delay: 54.683 ms
Loss rate: 0.38%
-- Flow 2:
Average throughput: 210.10 Mbit/s
95th percentile per-packet one-way delay: 55.879 ms
Loss rate: 0.54%
-- Flow 3:
Average throughput: 179.37 Mbit/s
95th percentile per-packet one-way delay: 54.863 ms
Loss rate: 1.28%
```

## Run 2: Report of Indigo — Data Link

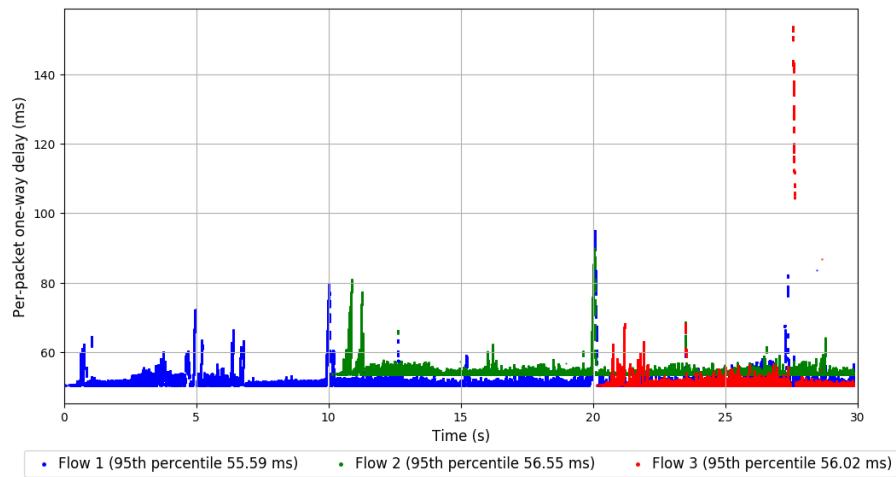
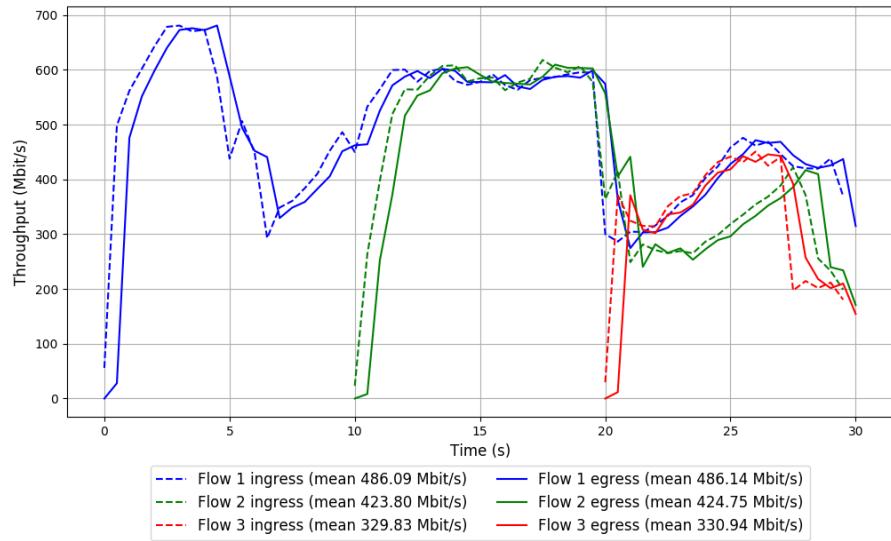


```
Run 1: Statistics of Muses-25
```

```
Start at: 2018-09-06 02:23:02
End at: 2018-09-06 02:23:32
Local clock offset: 0.047 ms
Remote clock offset: -0.227 ms

# Below is generated by plot.py at 2018-09-06 02:50:36
# Datalink statistics
-- Total of 3 flows:
Average throughput: 875.40 Mbit/s
95th percentile per-packet one-way delay: 56.226 ms
Loss rate: 0.38%
-- Flow 1:
Average throughput: 486.14 Mbit/s
95th percentile per-packet one-way delay: 55.595 ms
Loss rate: 0.34%
-- Flow 2:
Average throughput: 424.75 Mbit/s
95th percentile per-packet one-way delay: 56.552 ms
Loss rate: 0.32%
-- Flow 3:
Average throughput: 330.94 Mbit/s
95th percentile per-packet one-way delay: 56.017 ms
Loss rate: 0.73%
```

Run 1: Report of Muses-25 — Data Link



Run 2: Statistics of Muses-25

```
Start at: 2018-09-06 02:30:56
End at: 2018-09-06 02:31:26
Local clock offset: -0.416 ms
Remote clock offset: 0.053 ms

# Below is generated by plot.py at 2018-09-06 02:50:36
# Datalink statistics
-- Total of 3 flows:
Average throughput: 929.98 Mbit/s
95th percentile per-packet one-way delay: 53.486 ms
Loss rate: 0.42%
-- Flow 1:
Average throughput: 520.72 Mbit/s
95th percentile per-packet one-way delay: 52.991 ms
Loss rate: 0.32%
-- Flow 2:
Average throughput: 427.49 Mbit/s
95th percentile per-packet one-way delay: 52.882 ms
Loss rate: 0.25%
-- Flow 3:
Average throughput: 381.90 Mbit/s
95th percentile per-packet one-way delay: 56.583 ms
Loss rate: 1.20%
```

Run 2: Report of Muses-25 — Data Link

