

Pantheon Report

Generated at 2018-08-28 05:26:14 (UTC).
Data path: AWS India 1 on `ens5 (local)` → India on `em1 (remote)`.
Repeated the test of 4 congestion control schemes 3 times.
Each test lasted for 30 seconds running 3 flows with 10-second interval between two flows.
NTP offsets were measured against `nets.org.sg` and have been applied to correct the timestamps in logs.

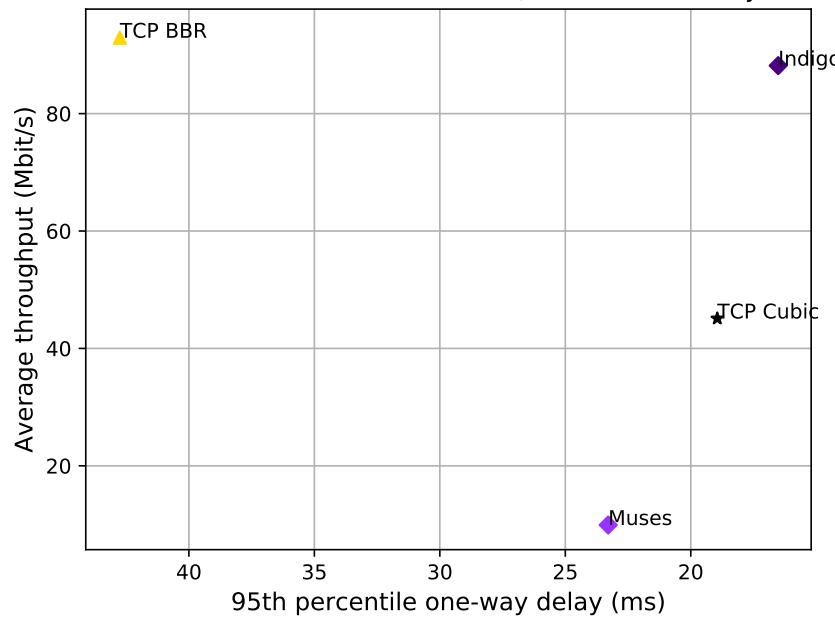
System info:

```
Linux 4.15.0-1019-aws
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
```

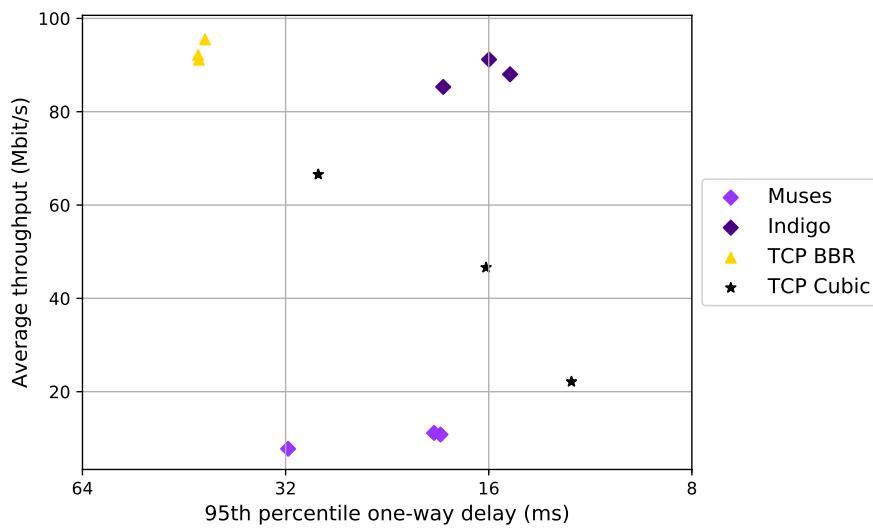
Git summary:

```
branch: muses @ 86ef433b09b2f4ecae1186d6940af93bcf0969cd
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 AWS India 1 to India, 3 runs of 30s each per scheme
 3 flows with 10s interval between flows (mean of all runs by scheme)



test from AWS India 1 to India, 3 runs of 30s each per scheme
 3 flows with 10s interval between flows



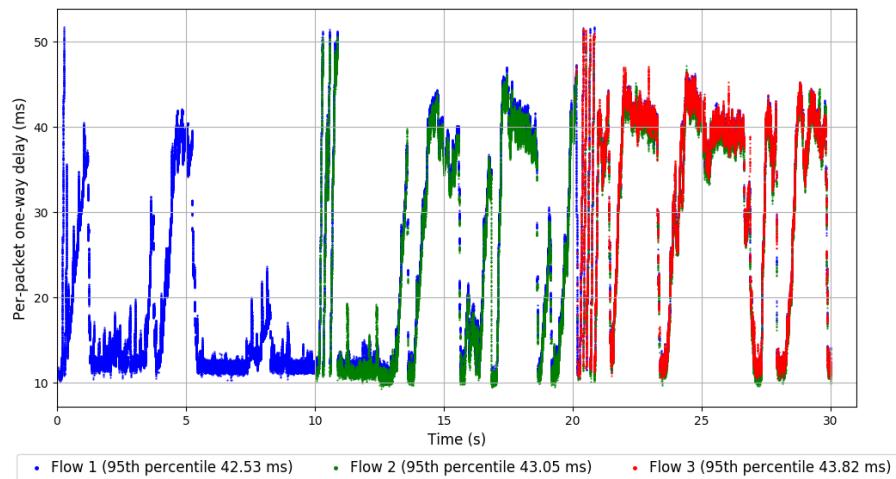
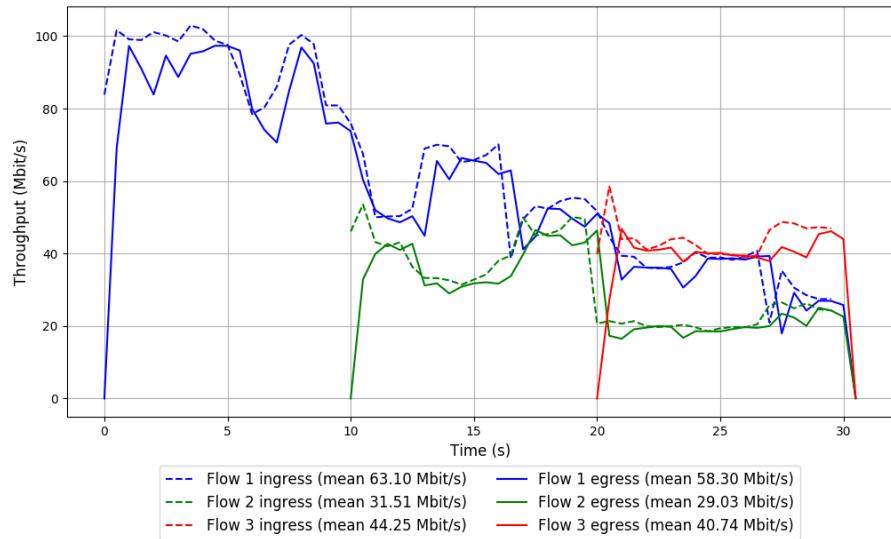
scheme	# runs	mean avg tput (Mbit/s)			mean 95th-%ile delay (ms)			mean loss rate (%)		
		flow 1	flow 2	flow 3	flow 1	flow 2	flow 3	flow 1	flow 2	flow 3
TCP BBR	3	55.53	38.19	35.98	42.34	42.91	43.18	6.38	6.84	6.85
TCP Cubic	3	27.17	18.39	17.09	25.31	18.18	17.04	0.48	0.25	0.38
Indigo	3	50.61	38.09	37.43	15.76	16.73	17.93	6.11	7.44	7.87
Muses	3	4.69	5.80	4.44	16.16	22.43	28.52	43.87	23.50	30.43

```
Run 1: Statistics of TCP BBR
```

```
Start at: 2018-08-28 05:11:39
End at: 2018-08-28 05:12:09
Local clock offset: -0.836 ms
Remote clock offset: -1.333 ms

# Below is generated by plot.py at 2018-08-28 05:26:11
# Datalink statistics
-- Total of 3 flows:
Average throughput: 91.14 Mbit/s
95th percentile per-packet one-way delay: 43.009 ms
Loss rate: 7.77%
-- Flow 1:
Average throughput: 58.30 Mbit/s
95th percentile per-packet one-way delay: 42.526 ms
Loss rate: 7.61%
-- Flow 2:
Average throughput: 29.03 Mbit/s
95th percentile per-packet one-way delay: 43.048 ms
Loss rate: 7.91%
-- Flow 3:
Average throughput: 40.74 Mbit/s
95th percentile per-packet one-way delay: 43.823 ms
Loss rate: 8.22%
```

Run 1: Report of TCP BBR — Data Link

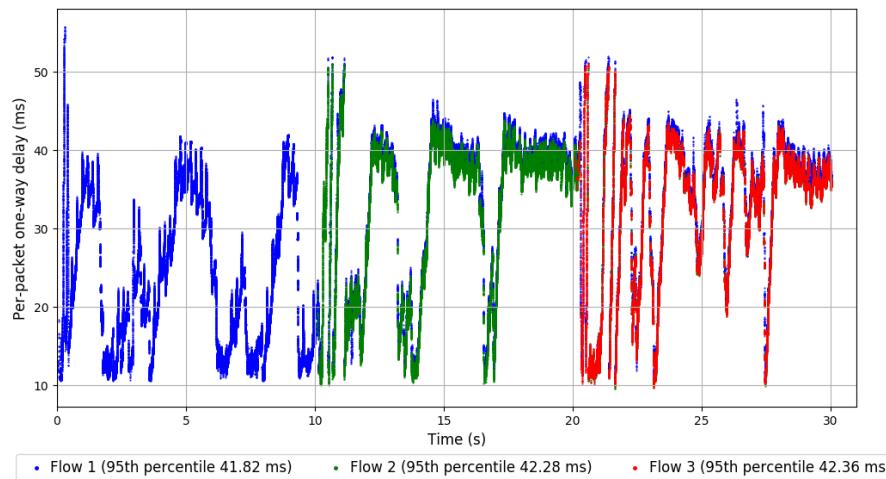
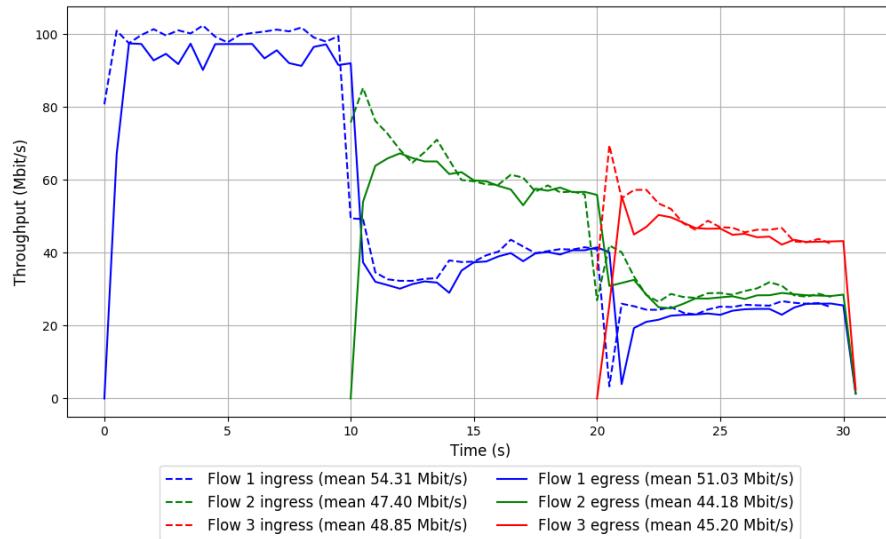


Run 2: Statistics of TCP BBR

```
Start at: 2018-08-28 05:16:15
End at: 2018-08-28 05:16:45
Local clock offset: -2.558 ms
Remote clock offset: -2.491 ms

# Below is generated by plot.py at 2018-08-28 05:26:12
# Datalink statistics
-- Total of 3 flows:
Average throughput: 95.49 Mbit/s
95th percentile per-packet one-way delay: 42.122 ms
Loss rate: 6.44%
-- Flow 1:
Average throughput: 51.03 Mbit/s
95th percentile per-packet one-way delay: 41.817 ms
Loss rate: 5.97%
-- Flow 2:
Average throughput: 44.18 Mbit/s
95th percentile per-packet one-way delay: 42.285 ms
Loss rate: 6.71%
-- Flow 3:
Average throughput: 45.20 Mbit/s
95th percentile per-packet one-way delay: 42.364 ms
Loss rate: 7.51%
```

Run 2: Report of TCP BBR — Data Link

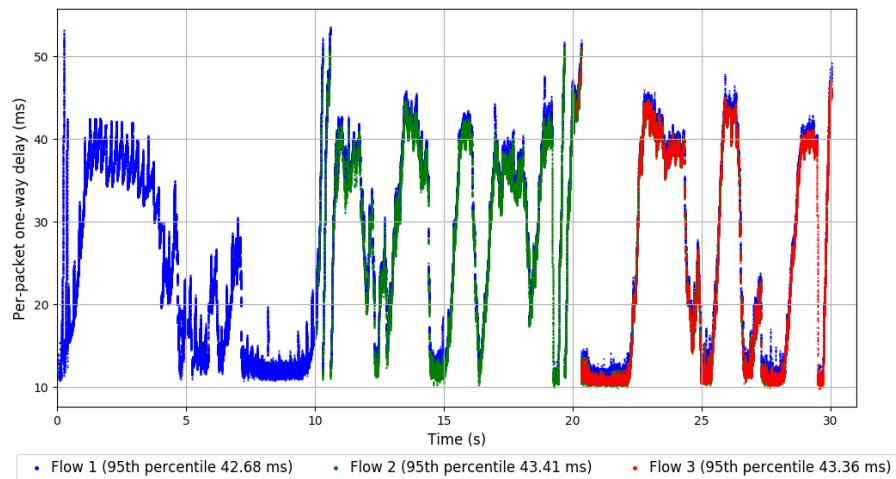
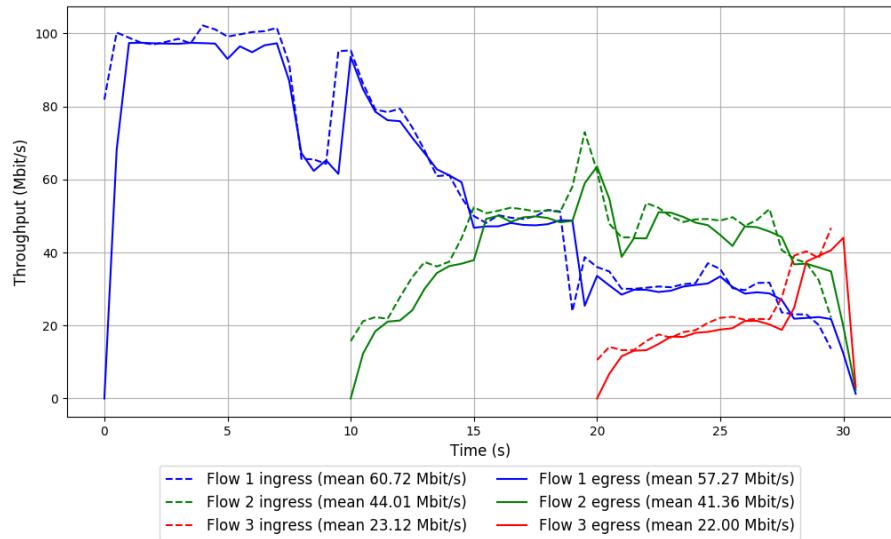


Run 3: Statistics of TCP BBR

```
Start at: 2018-08-28 05:20:53
End at: 2018-08-28 05:21:23
Local clock offset: -3.096 ms
Remote clock offset: -2.771 ms

# Below is generated by plot.py at 2018-08-28 05:26:12
# Datalink statistics
-- Total of 3 flows:
Average throughput: 92.14 Mbit/s
95th percentile per-packet one-way delay: 43.123 ms
Loss rate: 5.61%
-- Flow 1:
Average throughput: 57.27 Mbit/s
95th percentile per-packet one-way delay: 42.680 ms
Loss rate: 5.57%
-- Flow 2:
Average throughput: 41.36 Mbit/s
95th percentile per-packet one-way delay: 43.408 ms
Loss rate: 5.89%
-- Flow 3:
Average throughput: 22.00 Mbit/s
95th percentile per-packet one-way delay: 43.358 ms
Loss rate: 4.82%
```

Run 3: Report of TCP BBR — Data Link

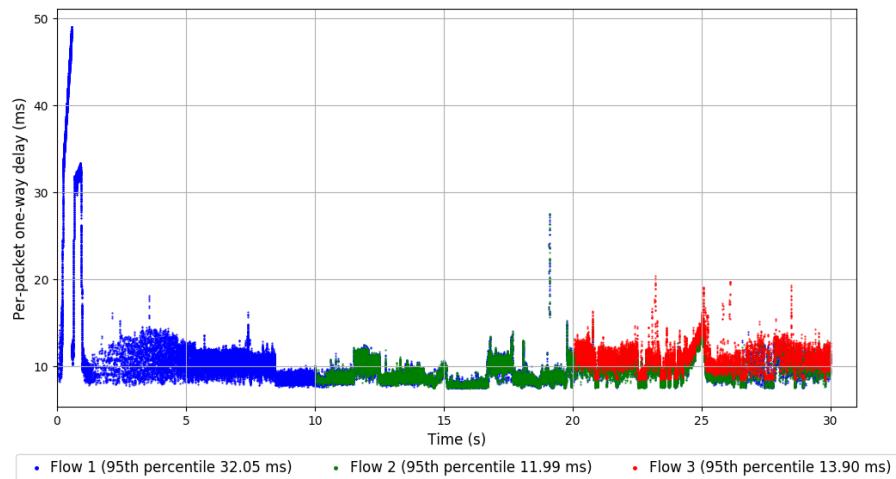
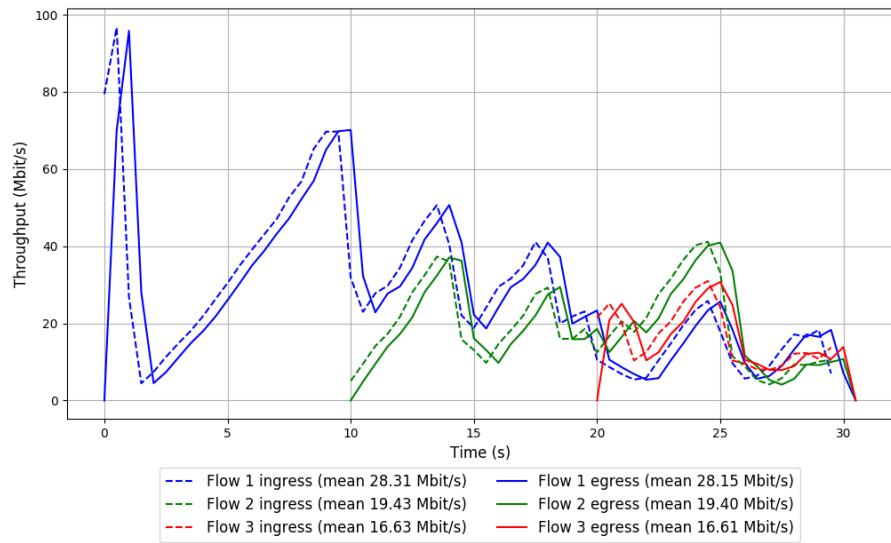


```
Run 1: Statistics of TCP Cubic

Start at: 2018-08-28 05:15:08
End at: 2018-08-28 05:15:38
Local clock offset: -0.733 ms
Remote clock offset: -2.766 ms

# Below is generated by plot.py at 2018-08-28 05:26:12
# Datalink statistics
-- Total of 3 flows:
Average throughput: 46.60 Mbit/s
95th percentile per-packet one-way delay: 16.148 ms
Loss rate: 0.39%
-- Flow 1:
Average throughput: 28.15 Mbit/s
95th percentile per-packet one-way delay: 32.050 ms
Loss rate: 0.57%
-- Flow 2:
Average throughput: 19.40 Mbit/s
95th percentile per-packet one-way delay: 11.993 ms
Loss rate: 0.11%
-- Flow 3:
Average throughput: 16.61 Mbit/s
95th percentile per-packet one-way delay: 13.899 ms
Loss rate: 0.16%
```

Run 1: Report of TCP Cubic — Data Link

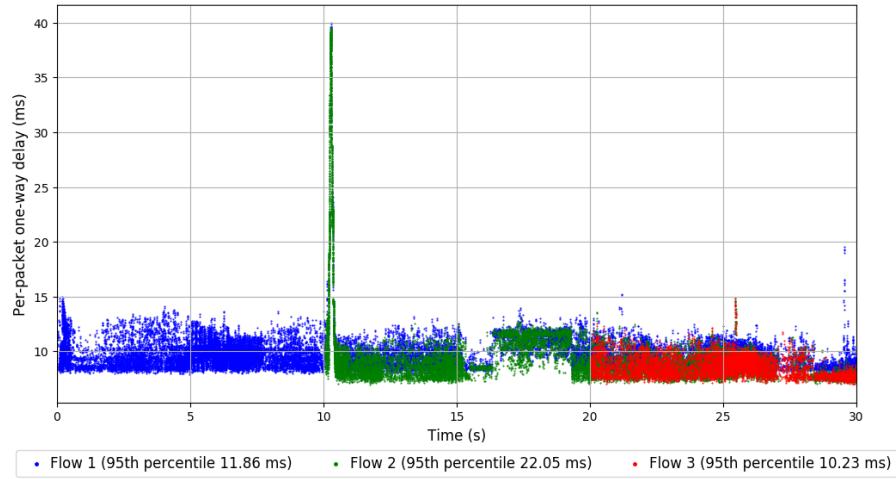
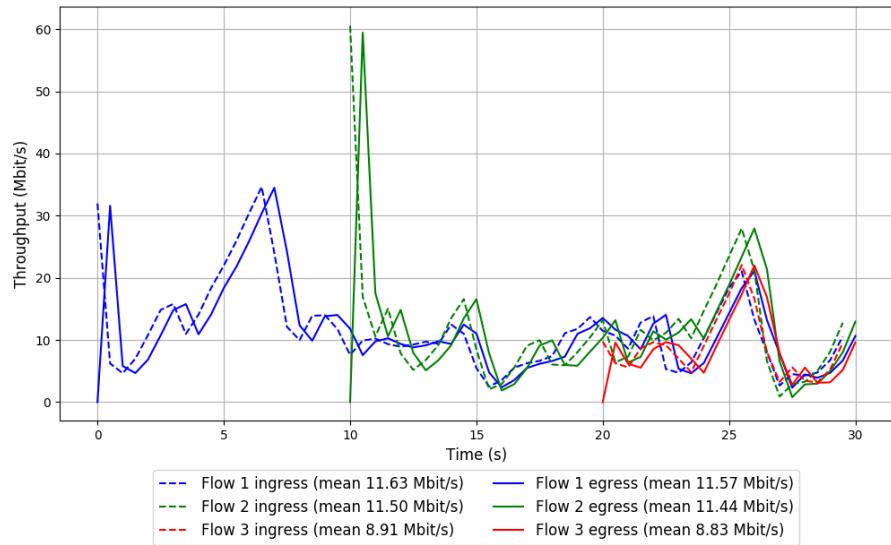


Run 2: Statistics of TCP Cubic

```
Start at: 2018-08-28 05:19:47
End at: 2018-08-28 05:20:17
Local clock offset: -0.468 ms
Remote clock offset: -2.983 ms

# Below is generated by plot.py at 2018-08-28 05:26:12
# Datalink statistics
-- Total of 3 flows:
Average throughput: 22.13 Mbit/s
95th percentile per-packet one-way delay: 12.065 ms
Loss rate: 0.59%
-- Flow 1:
Average throughput: 11.57 Mbit/s
95th percentile per-packet one-way delay: 11.864 ms
Loss rate: 0.53%
-- Flow 2:
Average throughput: 11.44 Mbit/s
95th percentile per-packet one-way delay: 22.055 ms
Loss rate: 0.58%
-- Flow 3:
Average throughput: 8.83 Mbit/s
95th percentile per-packet one-way delay: 10.226 ms
Loss rate: 0.88%
```

Run 2: Report of TCP Cubic — Data Link

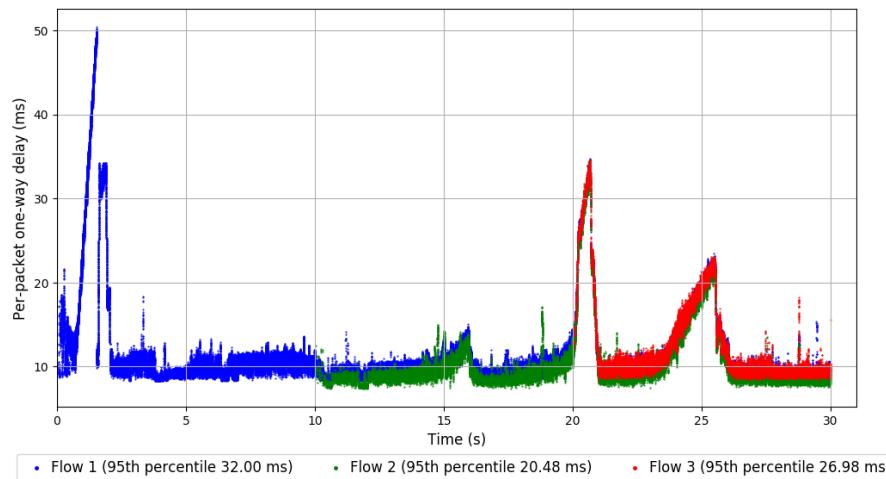
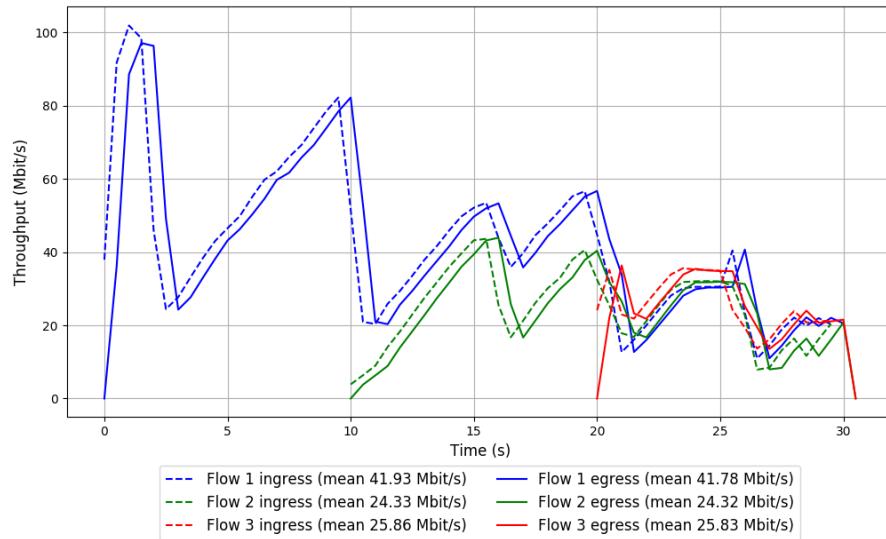


Run 3: Statistics of TCP Cubic

```
Start at: 2018-08-28 05:24:21
End at: 2018-08-28 05:24:51
Local clock offset: -2.241 ms
Remote clock offset: -4.219 ms

# Below is generated by plot.py at 2018-08-28 05:26:12
# Datalink statistics
-- Total of 3 flows:
Average throughput: 66.56 Mbit/s
95th percentile per-packet one-way delay: 28.621 ms
Loss rate: 0.25%
-- Flow 1:
Average throughput: 41.78 Mbit/s
95th percentile per-packet one-way delay: 32.002 ms
Loss rate: 0.35%
-- Flow 2:
Average throughput: 24.32 Mbit/s
95th percentile per-packet one-way delay: 20.482 ms
Loss rate: 0.06%
-- Flow 3:
Average throughput: 25.83 Mbit/s
95th percentile per-packet one-way delay: 26.982 ms
Loss rate: 0.10%
```

Run 3: Report of TCP Cubic — Data Link

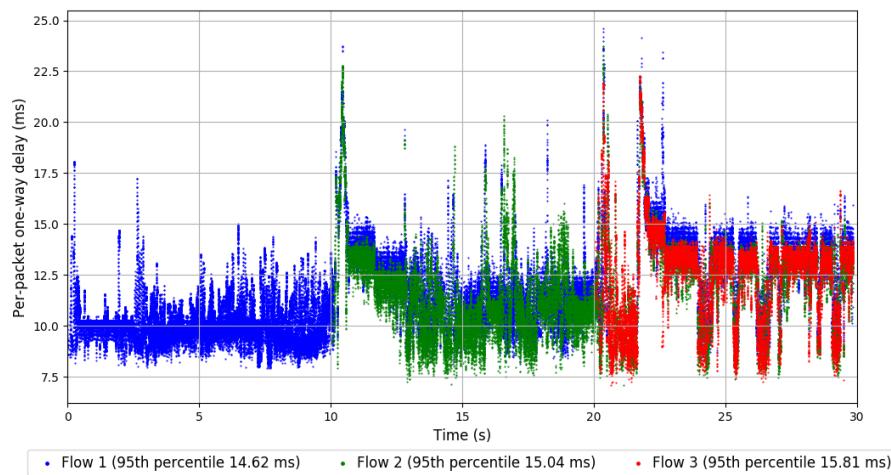
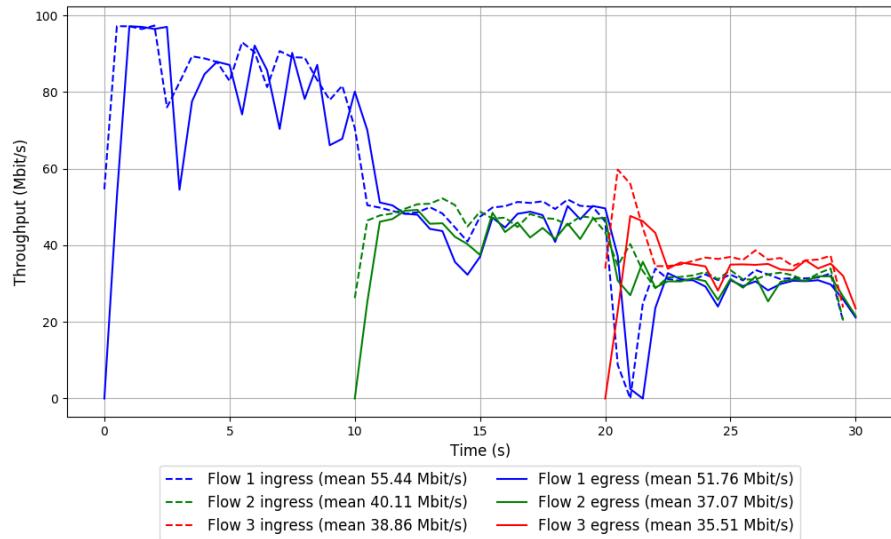


```
Run 1: Statistics of Indigo
```

```
Start at: 2018-08-28 05:12:50
End at: 2018-08-28 05:13:20
Local clock offset: 0.655 ms
Remote clock offset: -1.975 ms

# Below is generated by plot.py at 2018-08-28 05:26:12
# Datalink statistics
-- Total of 3 flows:
Average throughput: 88.02 Mbit/s
95th percentile per-packet one-way delay: 14.876 ms
Loss rate: 7.15%
-- Flow 1:
Average throughput: 51.76 Mbit/s
95th percentile per-packet one-way delay: 14.620 ms
Loss rate: 6.61%
-- Flow 2:
Average throughput: 37.07 Mbit/s
95th percentile per-packet one-way delay: 15.042 ms
Loss rate: 7.56%
-- Flow 3:
Average throughput: 35.51 Mbit/s
95th percentile per-packet one-way delay: 15.808 ms
Loss rate: 8.59%
```

Run 1: Report of Indigo — Data Link

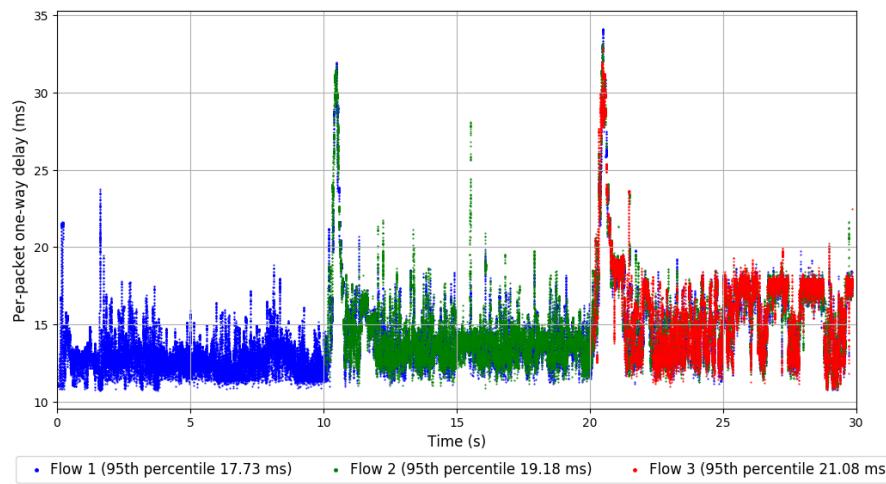
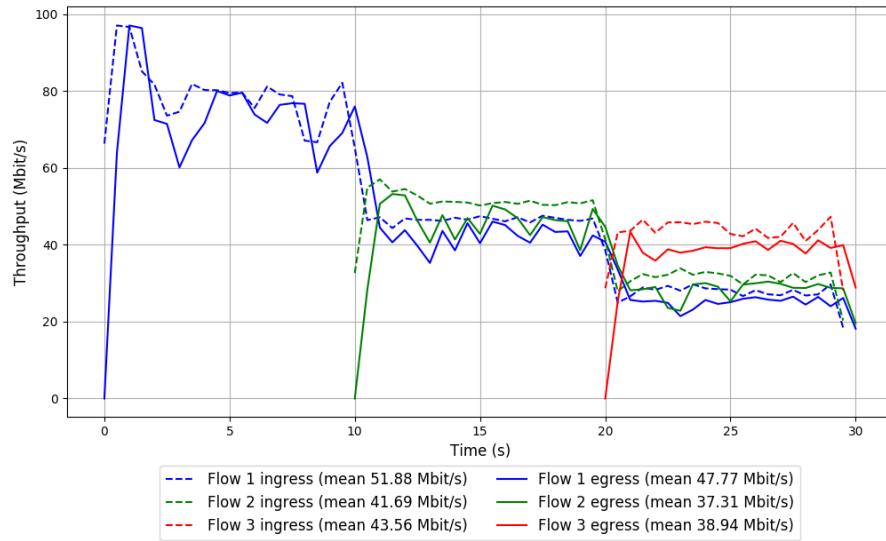


Run 2: Statistics of Indigo

```
Start at: 2018-08-28 05:17:28
End at: 2018-08-28 05:17:58
Local clock offset: -2.362 ms
Remote clock offset: -1.998 ms

# Below is generated by plot.py at 2018-08-28 05:26:12
# Datalink statistics
-- Total of 3 flows:
Average throughput: 85.31 Mbit/s
95th percentile per-packet one-way delay: 18.690 ms
Loss rate: 9.07%
-- Flow 1:
Average throughput: 47.77 Mbit/s
95th percentile per-packet one-way delay: 17.727 ms
Loss rate: 7.90%
-- Flow 2:
Average throughput: 37.31 Mbit/s
95th percentile per-packet one-way delay: 19.178 ms
Loss rate: 10.49%
-- Flow 3:
Average throughput: 38.94 Mbit/s
95th percentile per-packet one-way delay: 21.078 ms
Loss rate: 10.54%
```

Run 2: Report of Indigo — Data Link

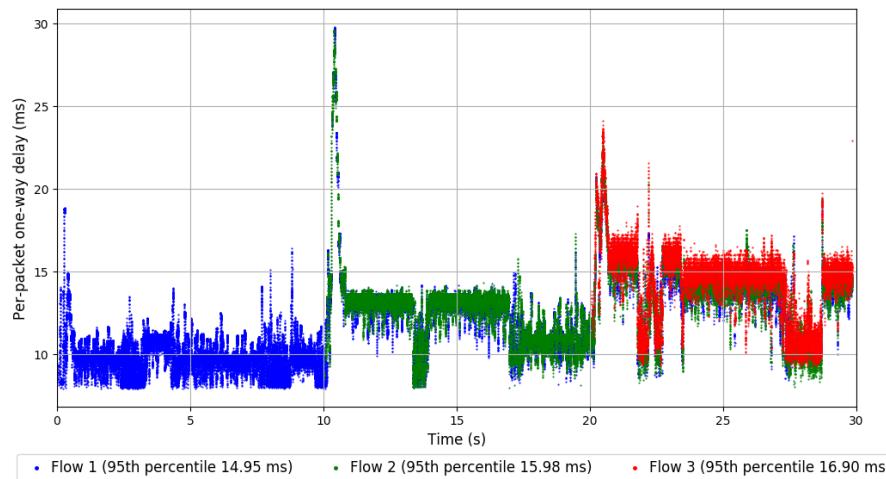
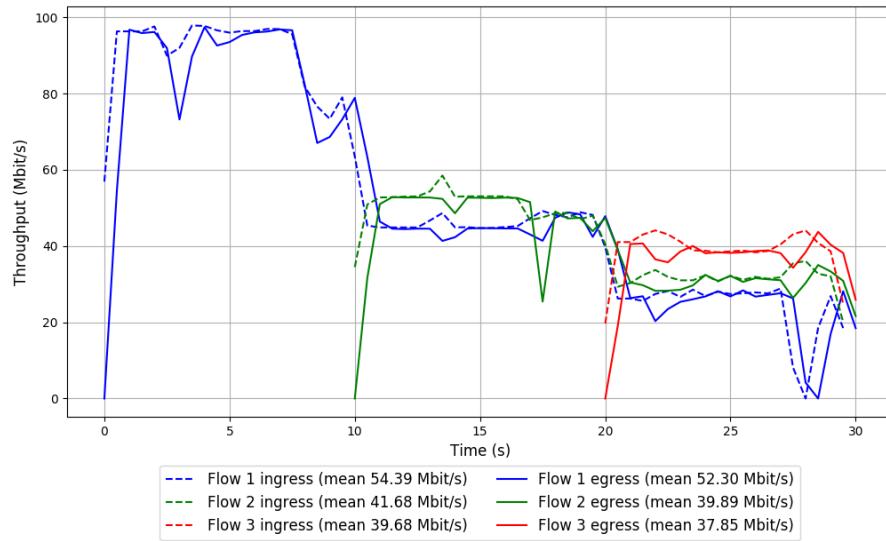


Run 3: Statistics of Indigo

```
Start at: 2018-08-28 05:22:05
End at: 2018-08-28 05:22:35
Local clock offset: -1.469 ms
Remote clock offset: -2.955 ms

# Below is generated by plot.py at 2018-08-28 05:26:13
# Datalink statistics
-- Total of 3 flows:
Average throughput: 91.19 Mbit/s
95th percentile per-packet one-way delay: 15.984 ms
Loss rate: 4.04%
-- Flow 1:
Average throughput: 52.30 Mbit/s
95th percentile per-packet one-way delay: 14.945 ms
Loss rate: 3.81%
-- Flow 2:
Average throughput: 39.89 Mbit/s
95th percentile per-packet one-way delay: 15.983 ms
Loss rate: 4.28%
-- Flow 3:
Average throughput: 37.85 Mbit/s
95th percentile per-packet one-way delay: 16.901 ms
Loss rate: 4.49%
```

Run 3: Report of Indigo — Data Link

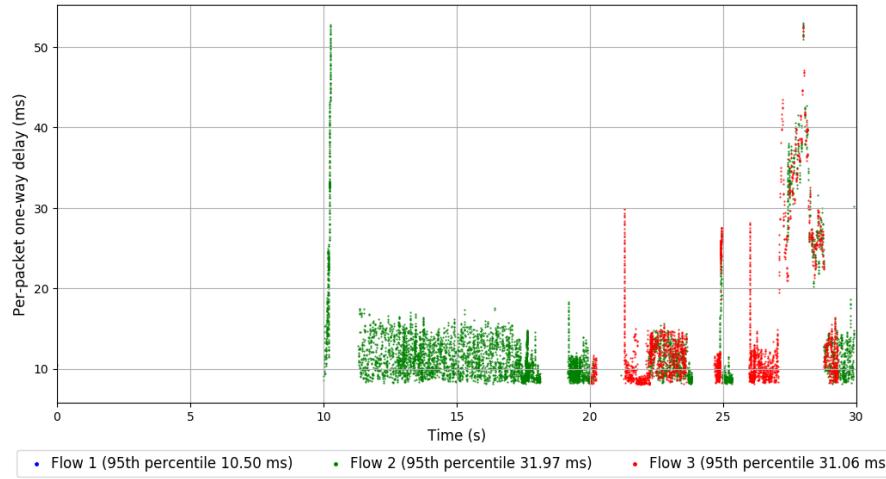
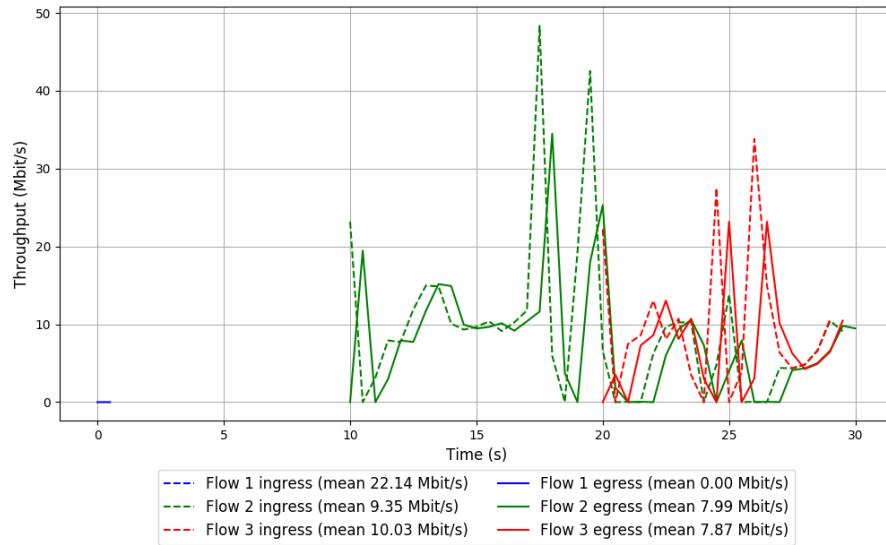


```
Run 1: Statistics of Muses
```

```
Start at: 2018-08-28 05:14:03
End at: 2018-08-28 05:14:33
Local clock offset: 0.141 ms
Remote clock offset: -2.603 ms

# Below is generated by plot.py at 2018-08-28 05:26:13
# Datalink statistics
-- Total of 3 flows:
Average throughput: 7.77 Mbit/s
95th percentile per-packet one-way delay: 31.726 ms
Loss rate: 16.81%
-- Flow 1:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 10.499 ms
Loss rate: 97.39%
-- Flow 2:
Average throughput: 7.99 Mbit/s
95th percentile per-packet one-way delay: 31.970 ms
Loss rate: 14.39%
-- Flow 3:
Average throughput: 7.87 Mbit/s
95th percentile per-packet one-way delay: 31.058 ms
Loss rate: 21.61%
```

Run 1: Report of Muses — Data Link

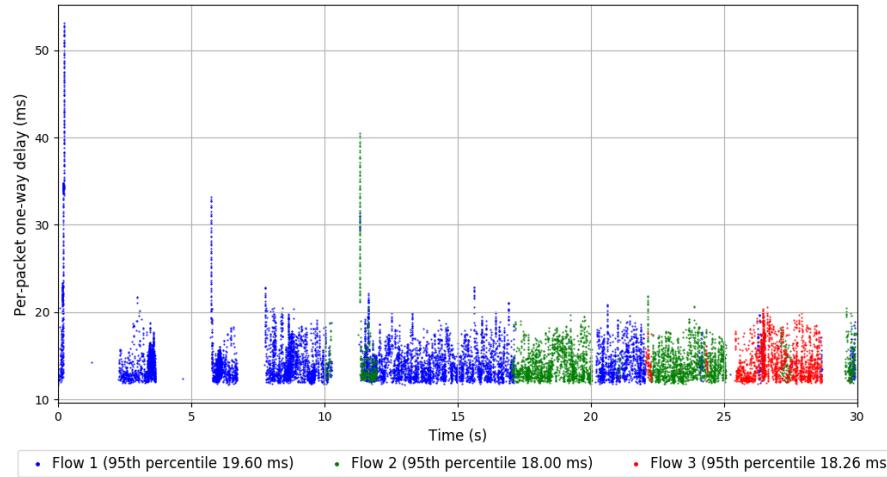
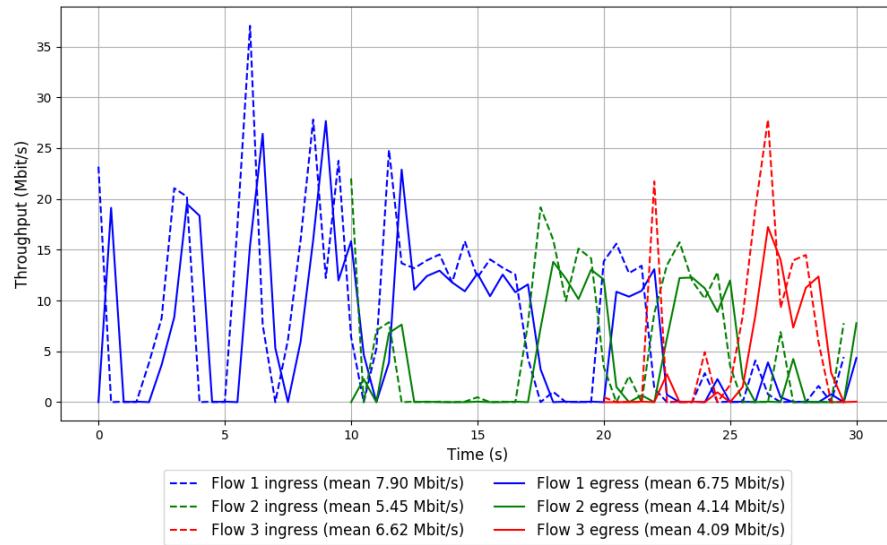


Run 2: Statistics of Muses

```
Start at: 2018-08-28 05:18:42
End at: 2018-08-28 05:19:12
Local clock offset: -4.223 ms
Remote clock offset: -3.222 ms

# Below is generated by plot.py at 2018-08-28 05:26:13
# Datalink statistics
-- Total of 3 flows:
Average throughput: 10.82 Mbit/s
95th percentile per-packet one-way delay: 18.863 ms
Loss rate: 20.79%
-- Flow 1:
Average throughput: 6.75 Mbit/s
95th percentile per-packet one-way delay: 19.601 ms
Loss rate: 14.56%
-- Flow 2:
Average throughput: 4.14 Mbit/s
95th percentile per-packet one-way delay: 18.003 ms
Loss rate: 24.06%
-- Flow 3:
Average throughput: 4.09 Mbit/s
95th percentile per-packet one-way delay: 18.259 ms
Loss rate: 38.28%
```

Run 2: Report of Muses — Data Link



Run 3: Statistics of Muses

```
Start at: 2018-08-28 05:23:16
End at: 2018-08-28 05:23:46
Local clock offset: -3.038 ms
Remote clock offset: -3.075 ms

# Below is generated by plot.py at 2018-08-28 05:26:13
# Datalink statistics
-- Total of 3 flows:
Average throughput: 11.16 Mbit/s
95th percentile per-packet one-way delay: 19.283 ms
Loss rate: 24.36%
-- Flow 1:
Average throughput: 7.32 Mbit/s
95th percentile per-packet one-way delay: 18.371 ms
Loss rate: 19.65%
-- Flow 2:
Average throughput: 5.26 Mbit/s
95th percentile per-packet one-way delay: 17.309 ms
Loss rate: 32.04%
-- Flow 3:
Average throughput: 1.37 Mbit/s
95th percentile per-packet one-way delay: 36.252 ms
Loss rate: 31.39%
```

Run 3: Report of Muses — Data Link

