

Pantheon Report

Generated at 2018-09-03 09:03:18 (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.

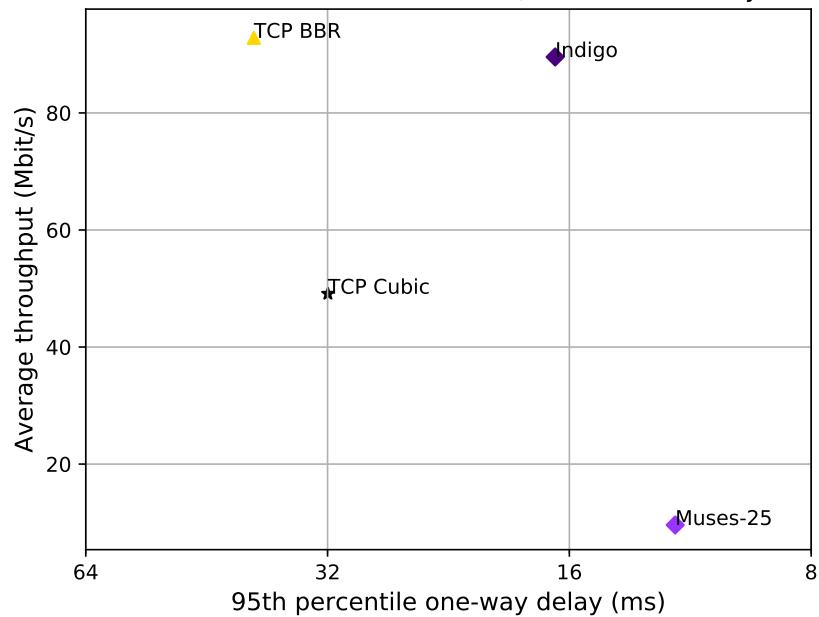
System info:

```
Linux 4.15.0-1020-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
net.ipv4.tcp_mem = 536870912 536870912 536870912
```

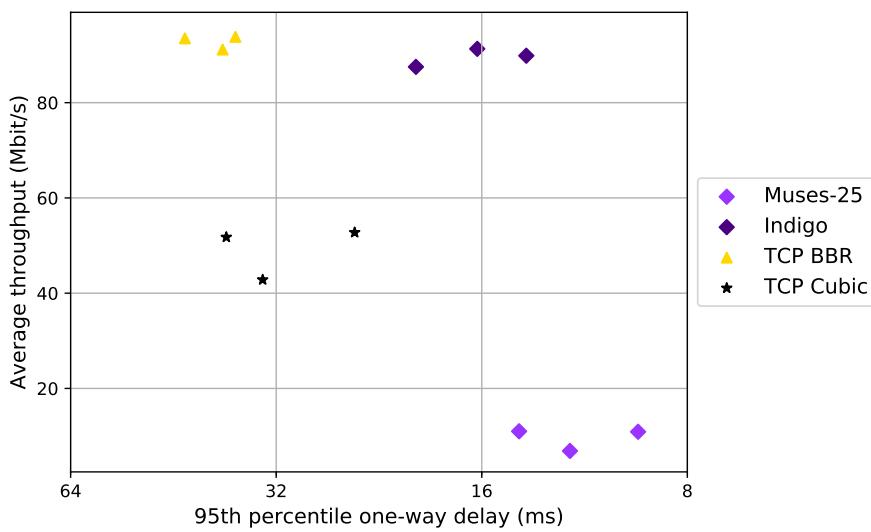
Git summary:

```
branch: muses @ f309f5459e2c5237279a184e52ece7a2b47ef1c9
third_party/fillp @ d47f4fa1b454a5e3c0537115c5a28436dbd4b834
third_party/fillp-sheep @ daed0c84f98531712514b2231f43ec6901114ffe
third_party/genericCC @ d0153f8e594aa89e93b032143cedbdf58e562f4
third_party/indigo @ 2601c92e4aa9d58d38dc4dfe0ecdbf90c077e64d
third_party/libutp @ b3465b942e2826f2b179eaab4a906ce6bb7cf3cf
third_party/muses @ b8d5019b83a3a678804d830fcfe1da7b3a63421b
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



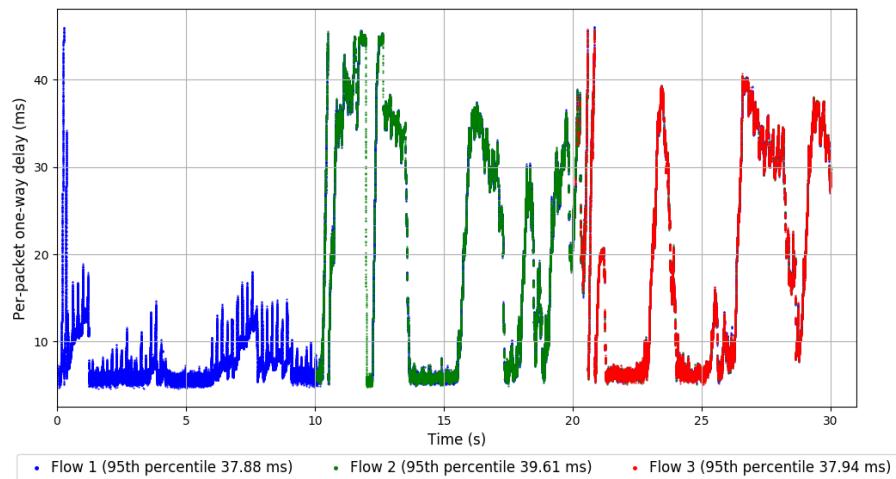
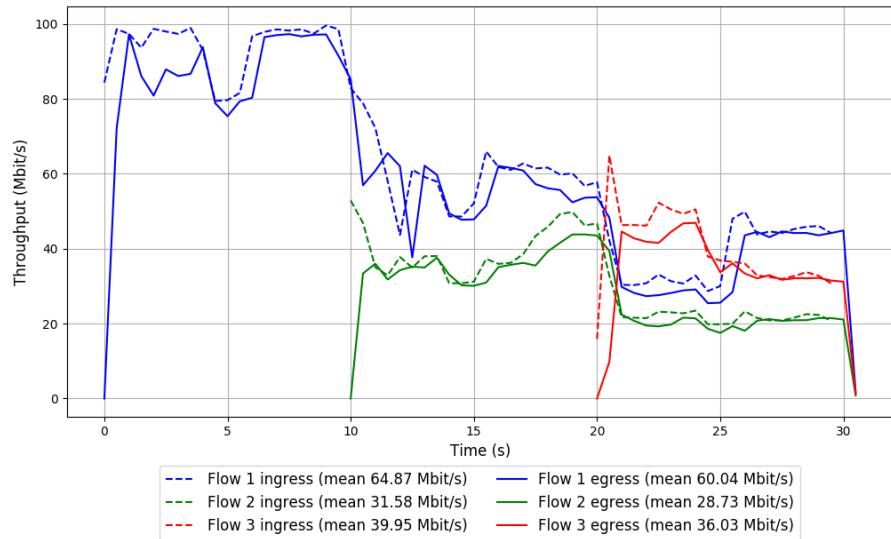
scheme	# runs	mean avg tput (Mbit/s)			mean 95th-%ile delay (ms)			mean loss rate (%)		
		flow 1	flow 2	flow 3	flow 1	flow 2	flow 3	flow 1	flow 2	flow 3
TCP BBR	3	58.69	29.73	43.38	37.12	39.09	42.47	6.00	7.08	9.57
TCP Cubic	3	28.52	20.51	20.80	33.14	20.57	30.10	0.36	0.20	0.21
Indigo	3	53.03	38.01	34.41	16.21	15.54	18.17	5.52	7.64	5.54
Muses-25	3	4.22	6.50	3.27	9.85	11.26	14.96	41.20	14.98	33.73

Run 1: Statistics of TCP BBR

```
Start at: 2018-09-03 08:52:09
End at: 2018-09-03 08:52:39
Local clock offset: -22.728 ms
Remote clock offset: -5.774 ms

# Below is generated by plot.py at 2018-09-03 09:03:14
# Datalink statistics
-- Total of 3 flows:
Average throughput: 91.15 Mbit/s
95th percentile per-packet one-way delay: 38.334 ms
Loss rate: 8.03%
-- Flow 1:
Average throughput: 60.04 Mbit/s
95th percentile per-packet one-way delay: 37.880 ms
Loss rate: 7.39%
-- Flow 2:
Average throughput: 28.73 Mbit/s
95th percentile per-packet one-way delay: 39.608 ms
Loss rate: 8.92%
-- Flow 3:
Average throughput: 36.03 Mbit/s
95th percentile per-packet one-way delay: 37.944 ms
Loss rate: 9.79%
```

Run 1: Report of TCP BBR — Data Link

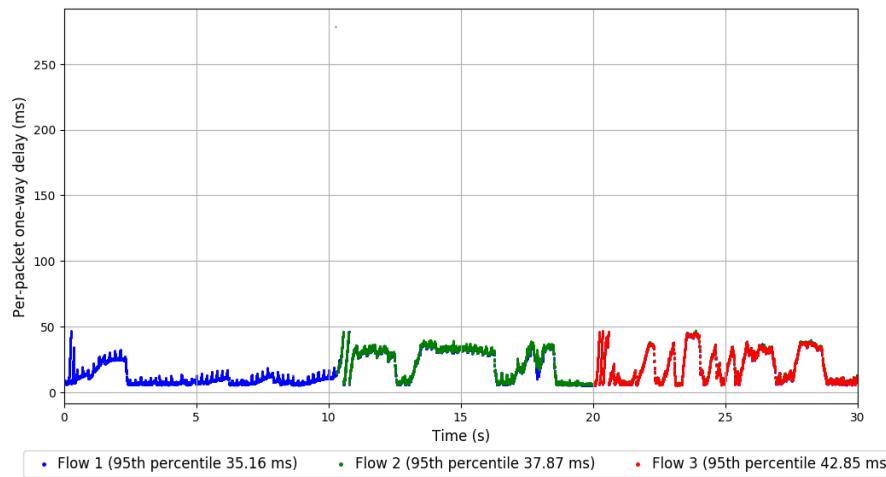
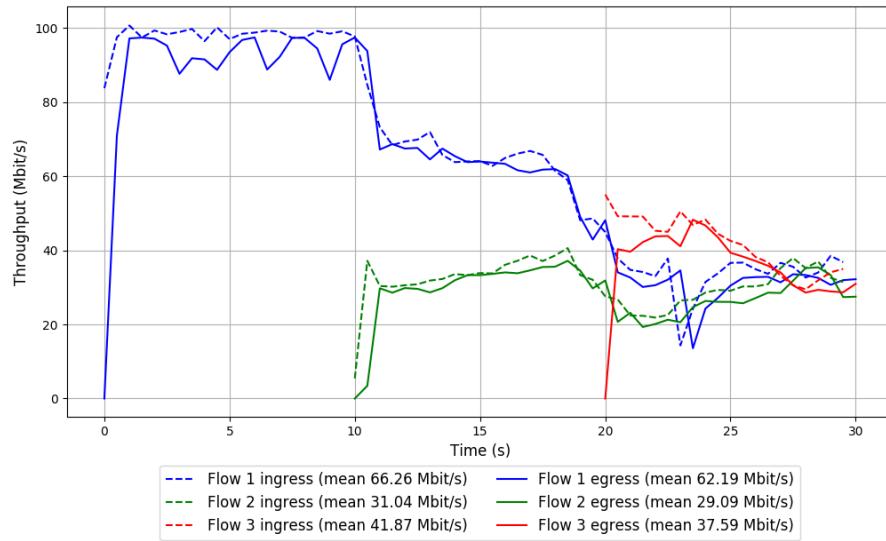


Run 2: Statistics of TCP BBR

```
Start at: 2018-09-03 08:56:46
End at: 2018-09-03 08:57:16
Local clock offset: -22.597 ms
Remote clock offset: -5.94 ms

# Below is generated by plot.py at 2018-09-03 09:03:14
# Datalink statistics
-- Total of 3 flows:
Average throughput: 93.83 Mbit/s
95th percentile per-packet one-way delay: 36.717 ms
Loss rate: 6.97%
-- Flow 1:
Average throughput: 62.19 Mbit/s
95th percentile per-packet one-way delay: 35.157 ms
Loss rate: 6.12%
-- Flow 2:
Average throughput: 29.09 Mbit/s
95th percentile per-packet one-way delay: 37.869 ms
Loss rate: 7.55%
-- Flow 3:
Average throughput: 37.59 Mbit/s
95th percentile per-packet one-way delay: 42.847 ms
Loss rate: 10.17%
```

Run 2: Report of TCP BBR — Data Link

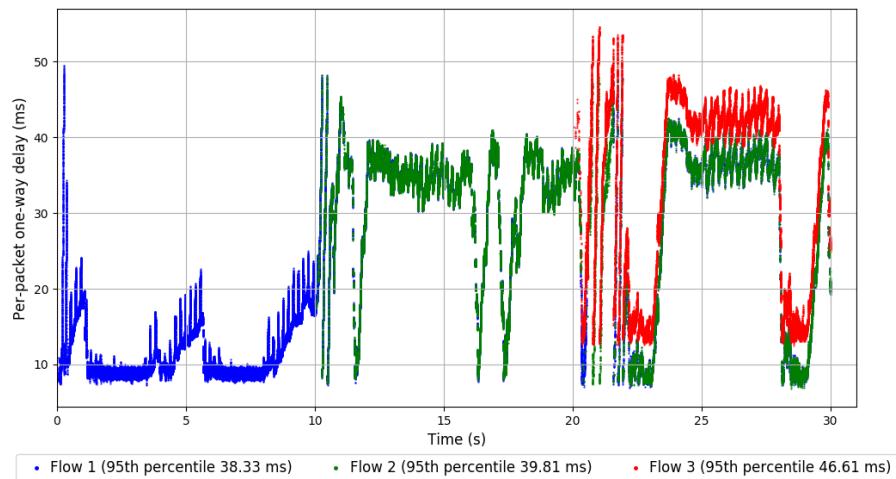
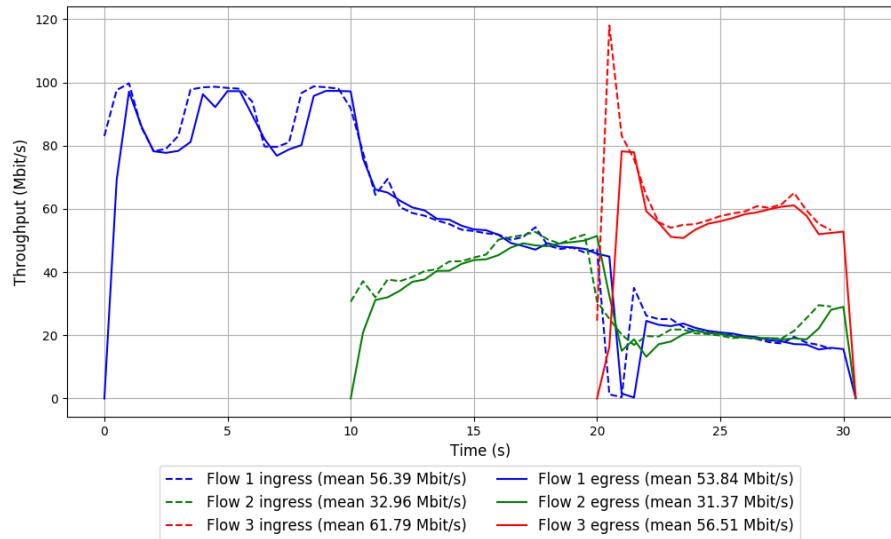


Run 3: Statistics of TCP BBR

```
Start at: 2018-09-03 09:01:20
End at: 2018-09-03 09:01:50
Local clock offset: -27.15 ms
Remote clock offset: -5.497 ms

# Below is generated by plot.py at 2018-09-03 09:03:14
# Datalink statistics
-- Total of 3 flows:
Average throughput: 93.51 Mbit/s
95th percentile per-packet one-way delay: 43.529 ms
Loss rate: 5.44%
-- Flow 1:
Average throughput: 53.84 Mbit/s
95th percentile per-packet one-way delay: 38.332 ms
Loss rate: 4.49%
-- Flow 2:
Average throughput: 31.37 Mbit/s
95th percentile per-packet one-way delay: 39.806 ms
Loss rate: 4.78%
-- Flow 3:
Average throughput: 56.51 Mbit/s
95th percentile per-packet one-way delay: 46.611 ms
Loss rate: 8.74%
```

Run 3: Report of TCP BBR — Data Link

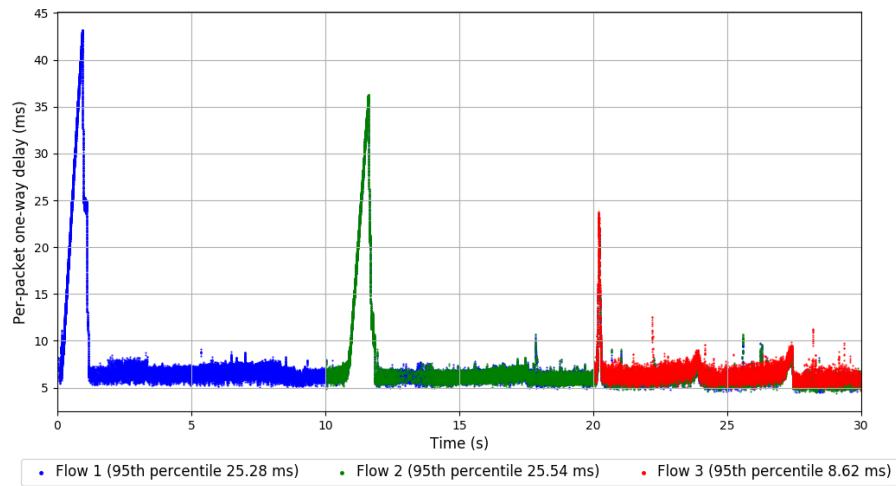
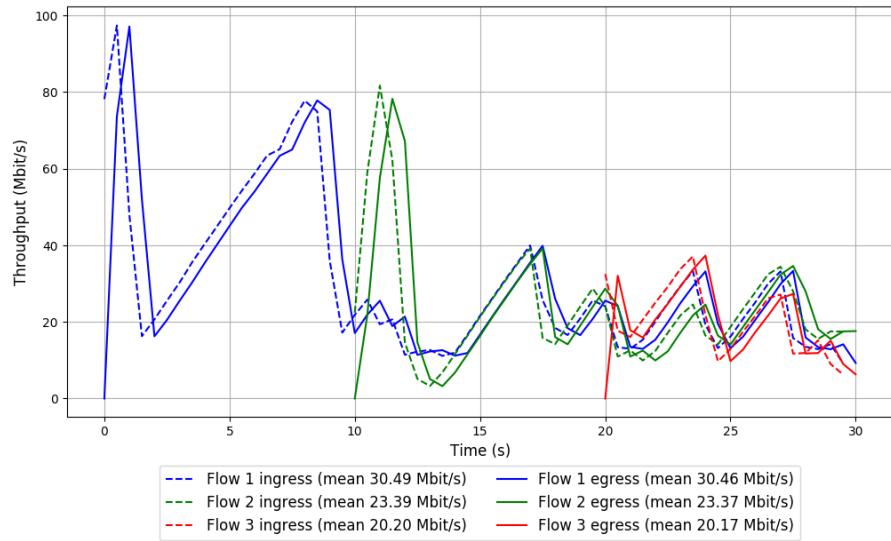


```
Run 1: Statistics of TCP Cubic
```

```
Start at: 2018-09-03 08:48:38
End at: 2018-09-03 08:49:08
Local clock offset: -20.342 ms
Remote clock offset: -6.107 ms

# Below is generated by plot.py at 2018-09-03 09:03:14
# Datalink statistics
-- Total of 3 flows:
Average throughput: 52.74 Mbit/s
95th percentile per-packet one-way delay: 24.562 ms
Loss rate: 0.09%
-- Flow 1:
Average throughput: 30.46 Mbit/s
95th percentile per-packet one-way delay: 25.278 ms
Loss rate: 0.07%
-- Flow 2:
Average throughput: 23.37 Mbit/s
95th percentile per-packet one-way delay: 25.536 ms
Loss rate: 0.10%
-- Flow 3:
Average throughput: 20.17 Mbit/s
95th percentile per-packet one-way delay: 8.620 ms
Loss rate: 0.13%
```

Run 1: Report of TCP Cubic — Data Link

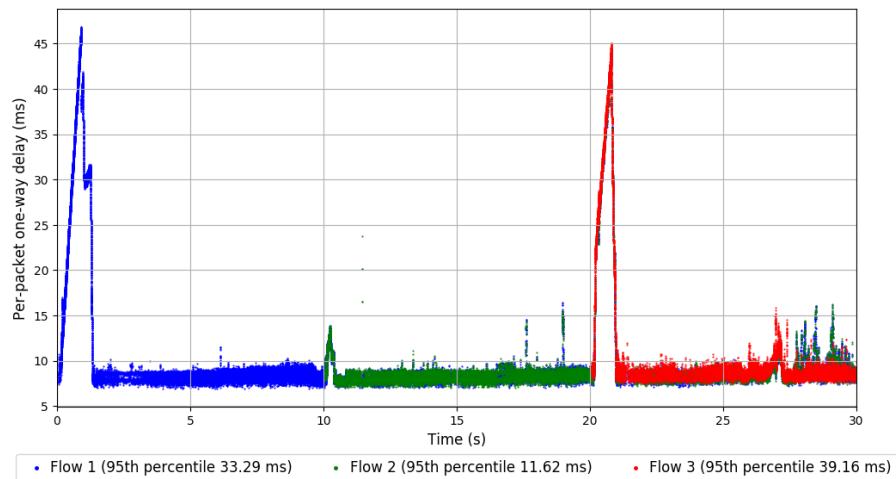
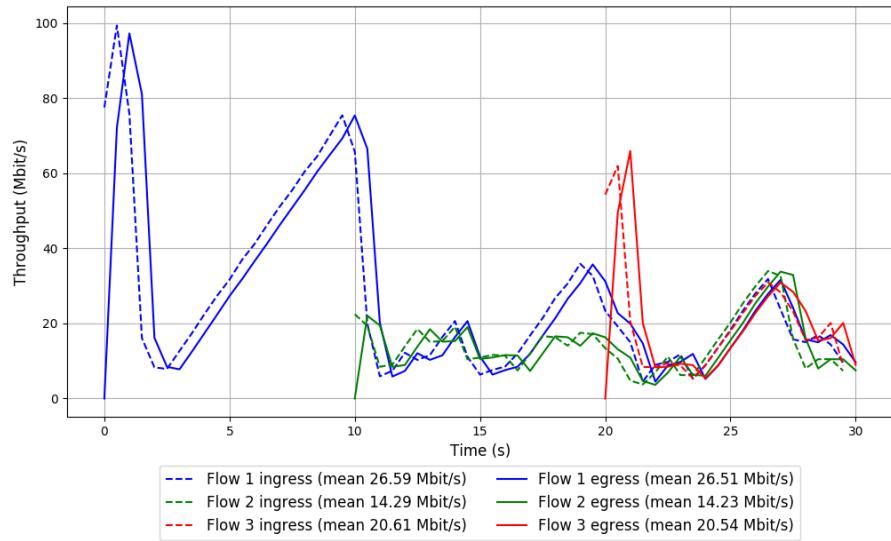


Run 2: Statistics of TCP Cubic

```
Start at: 2018-09-03 08:53:21
End at: 2018-09-03 08:53:51
Local clock offset: -23.918 ms
Remote clock offset: -5.408 ms

# Below is generated by plot.py at 2018-09-03 09:03:14
# Datalink statistics
-- Total of 3 flows:
Average throughput: 42.82 Mbit/s
95th percentile per-packet one-way delay: 33.493 ms
Loss rate: 0.34%
-- Flow 1:
Average throughput: 26.51 Mbit/s
95th percentile per-packet one-way delay: 33.286 ms
Loss rate: 0.32%
-- Flow 2:
Average throughput: 14.23 Mbit/s
95th percentile per-packet one-way delay: 11.619 ms
Loss rate: 0.40%
-- Flow 3:
Average throughput: 20.54 Mbit/s
95th percentile per-packet one-way delay: 39.156 ms
Loss rate: 0.35%
```

Run 2: Report of TCP Cubic — Data Link

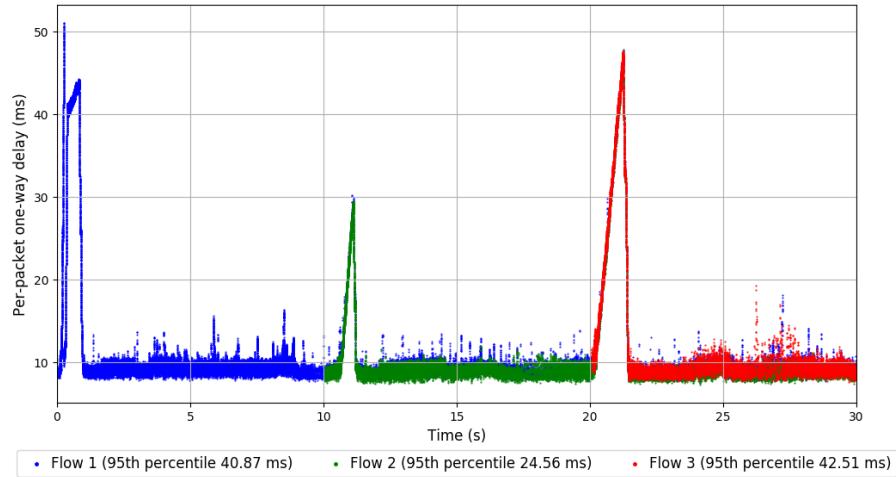
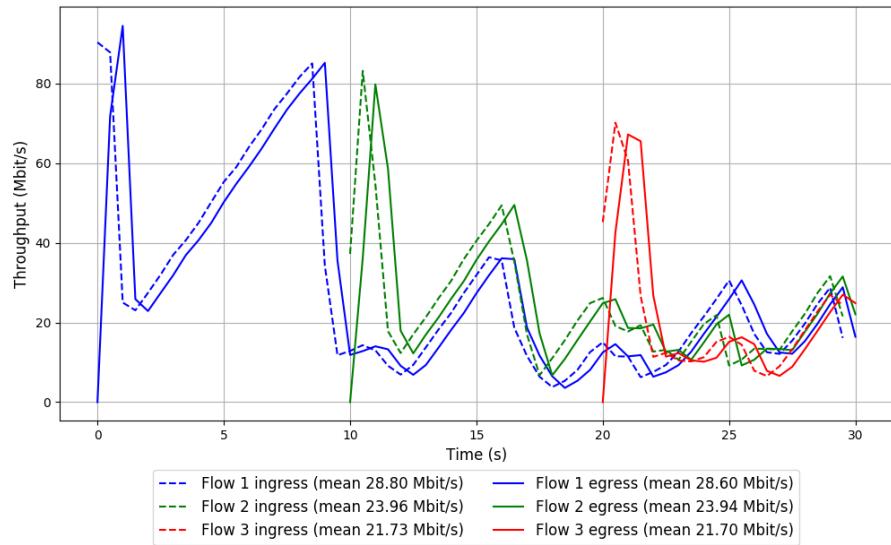


Run 3: Statistics of TCP Cubic

```
Start at: 2018-09-03 08:57:57
End at: 2018-09-03 08:58:27
Local clock offset: -24.904 ms
Remote clock offset: -5.449 ms

# Below is generated by plot.py at 2018-09-03 09:03:14
# Datalink statistics
-- Total of 3 flows:
Average throughput: 51.77 Mbit/s
95th percentile per-packet one-way delay: 37.858 ms
Loss rate: 0.43%
-- Flow 1:
Average throughput: 28.60 Mbit/s
95th percentile per-packet one-way delay: 40.867 ms
Loss rate: 0.69%
-- Flow 2:
Average throughput: 23.94 Mbit/s
95th percentile per-packet one-way delay: 24.560 ms
Loss rate: 0.10%
-- Flow 3:
Average throughput: 21.70 Mbit/s
95th percentile per-packet one-way delay: 42.514 ms
Loss rate: 0.15%
```

Run 3: Report of TCP Cubic — Data Link

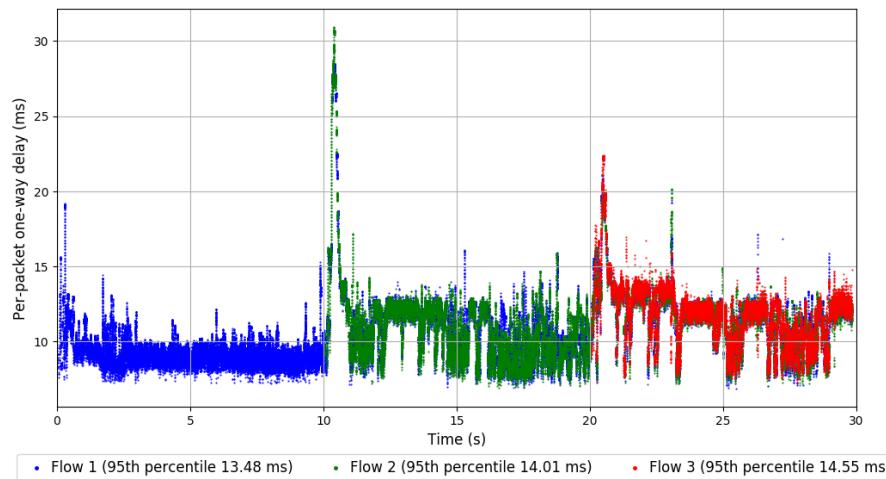
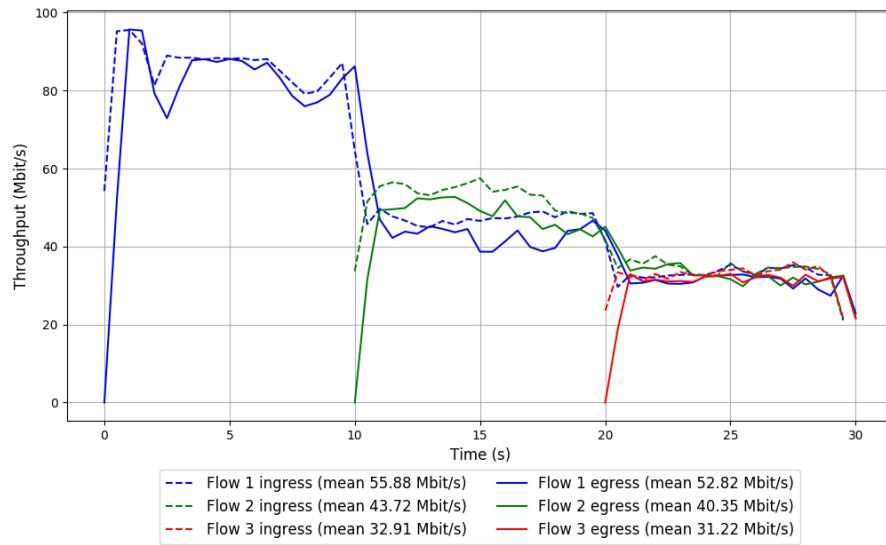


Run 1: Statistics of Indigo

```
Start at: 2018-09-03 08:50:51
End at: 2018-09-03 08:51:21
Local clock offset: -24.715 ms
Remote clock offset: -4.631 ms

# Below is generated by plot.py at 2018-09-03 09:03:14
# Datalink statistics
-- Total of 3 flows:
Average throughput: 89.86 Mbit/s
95th percentile per-packet one-way delay: 13.770 ms
Loss rate: 6.10%
-- Flow 1:
Average throughput: 52.82 Mbit/s
95th percentile per-packet one-way delay: 13.482 ms
Loss rate: 5.47%
-- Flow 2:
Average throughput: 40.35 Mbit/s
95th percentile per-packet one-way delay: 14.005 ms
Loss rate: 7.69%
-- Flow 3:
Average throughput: 31.22 Mbit/s
95th percentile per-packet one-way delay: 14.549 ms
Loss rate: 5.10%
```

Run 1: Report of Indigo — Data Link

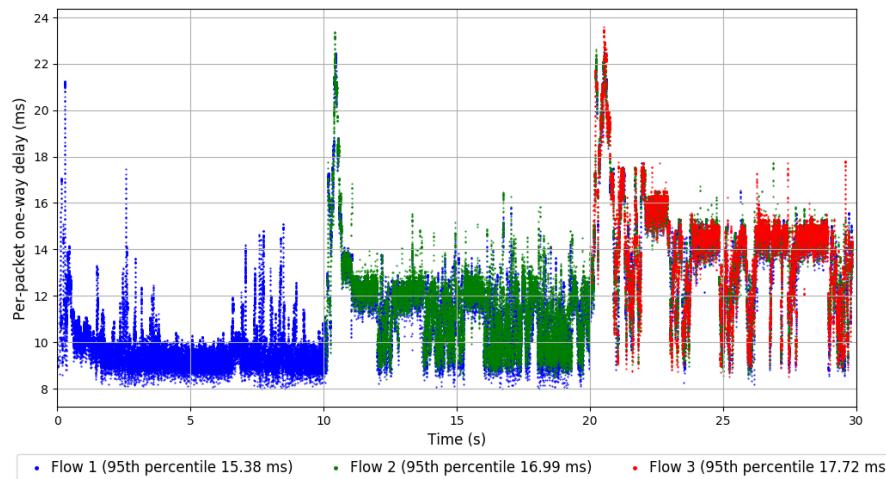
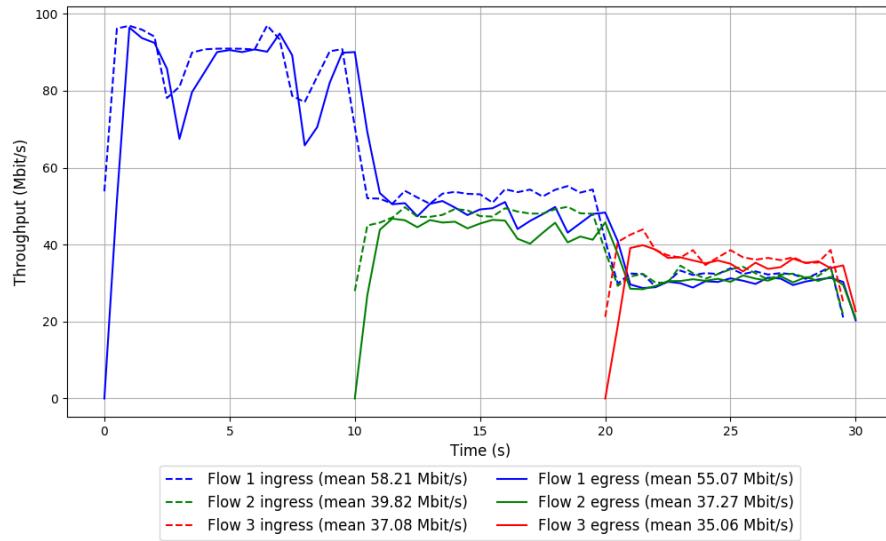


Run 2: Statistics of Indigo

```
Start at: 2018-09-03 08:55:33
End at: 2018-09-03 08:56:03
Local clock offset: -23.893 ms
Remote clock offset: -4.641 ms

# Below is generated by plot.py at 2018-09-03 09:03:14
# Datalink statistics
-- Total of 3 flows:
Average throughput: 91.30 Mbit/s
95th percentile per-packet one-way delay: 16.246 ms
Loss rate: 5.66%
-- Flow 1:
Average throughput: 55.07 Mbit/s
95th percentile per-packet one-way delay: 15.379 ms
Loss rate: 5.37%
-- Flow 2:
Average throughput: 37.27 Mbit/s
95th percentile per-packet one-way delay: 16.990 ms
Loss rate: 6.39%
-- Flow 3:
Average throughput: 35.06 Mbit/s
95th percentile per-packet one-way delay: 17.720 ms
Loss rate: 5.43%
```

Run 2: Report of Indigo — Data Link

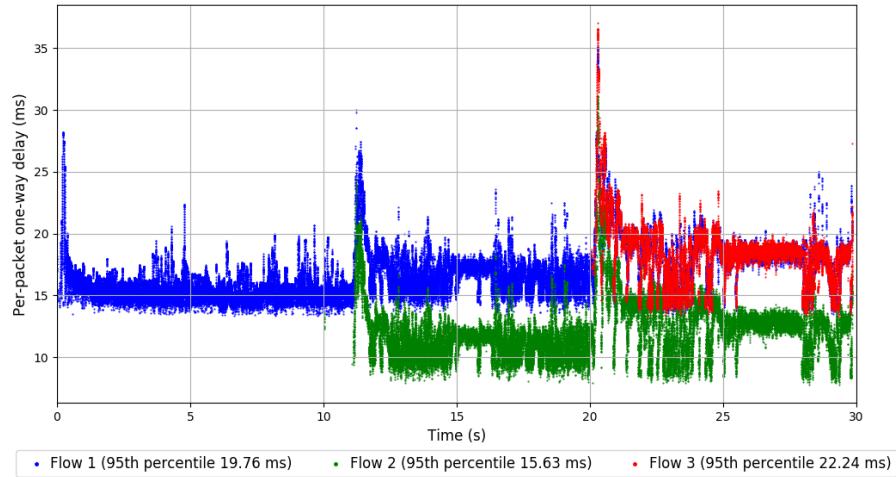
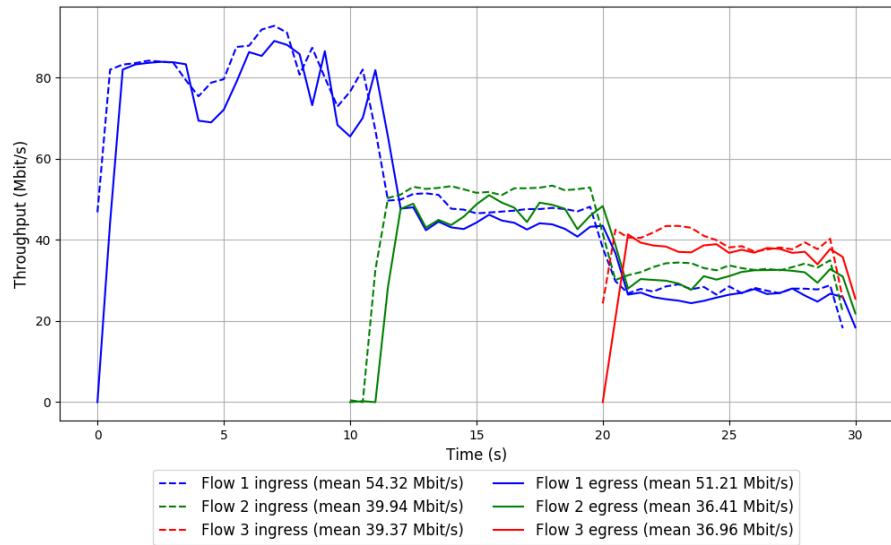


Run 3: Statistics of Indigo

```
Start at: 2018-09-03 09:00:10
End at: 2018-09-03 09:00:40
Local clock offset: -26.295 ms
Remote clock offset: -4.903 ms

# Below is generated by plot.py at 2018-09-03 09:03:17
# Datalink statistics
-- Total of 3 flows:
Average throughput: 87.52 Mbit/s
95th percentile per-packet one-way delay: 19.977 ms
Loss rate: 6.65%
-- Flow 1:
Average throughput: 51.21 Mbit/s
95th percentile per-packet one-way delay: 19.764 ms
Loss rate: 5.71%
-- Flow 2:
Average throughput: 36.41 Mbit/s
95th percentile per-packet one-way delay: 15.633 ms
Loss rate: 8.83%
-- Flow 3:
Average throughput: 36.96 Mbit/s
95th percentile per-packet one-way delay: 22.239 ms
Loss rate: 6.08%
```

Run 3: Report of Indigo — Data Link

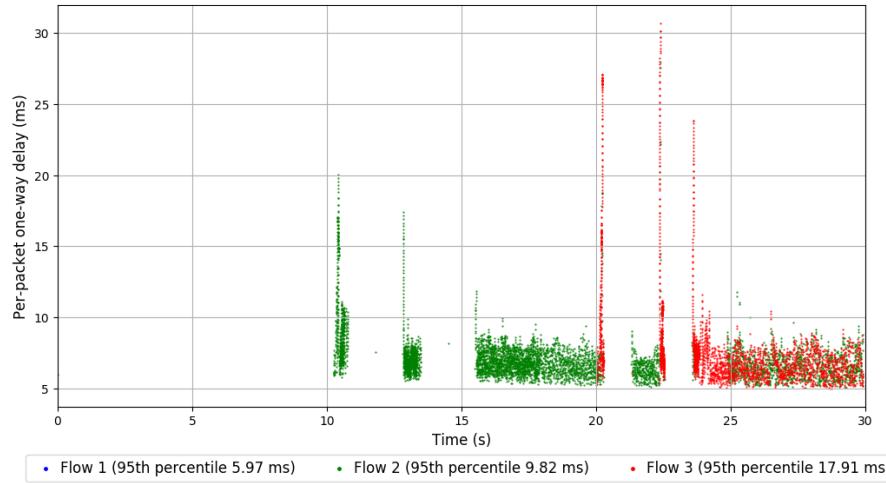
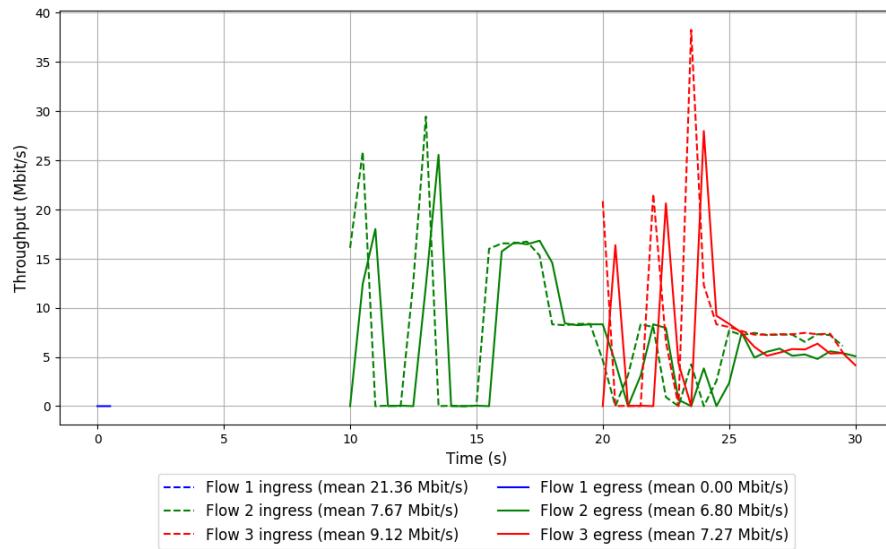


Run 1: Statistics of Muses-25

```
Start at: 2018-09-03 08:49:46
End at: 2018-09-03 08:50:16
Local clock offset: -22.183 ms
Remote clock offset: -6.096 ms

# Below is generated by plot.py at 2018-09-03 09:03:17
# Datalink statistics
-- Total of 3 flows:
Average throughput: 6.87 Mbit/s
95th percentile per-packet one-way delay: 11.884 ms
Loss rate: 14.71%
-- Flow 1:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 5.975 ms
Loss rate: 97.24%
-- Flow 2:
Average throughput: 6.80 Mbit/s
95th percentile per-packet one-way delay: 9.817 ms
Loss rate: 11.36%
-- Flow 3:
Average throughput: 7.27 Mbit/s
95th percentile per-packet one-way delay: 17.910 ms
Loss rate: 20.28%
```

Run 1: Report of Muses-25 — Data Link

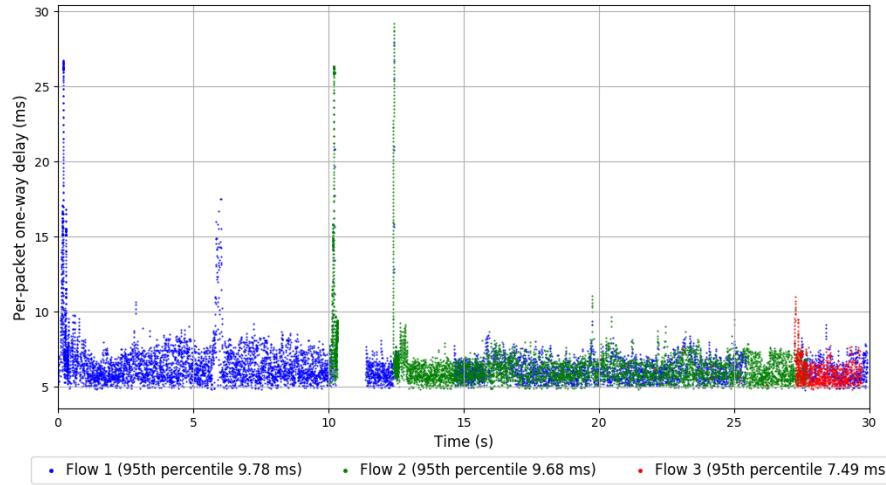
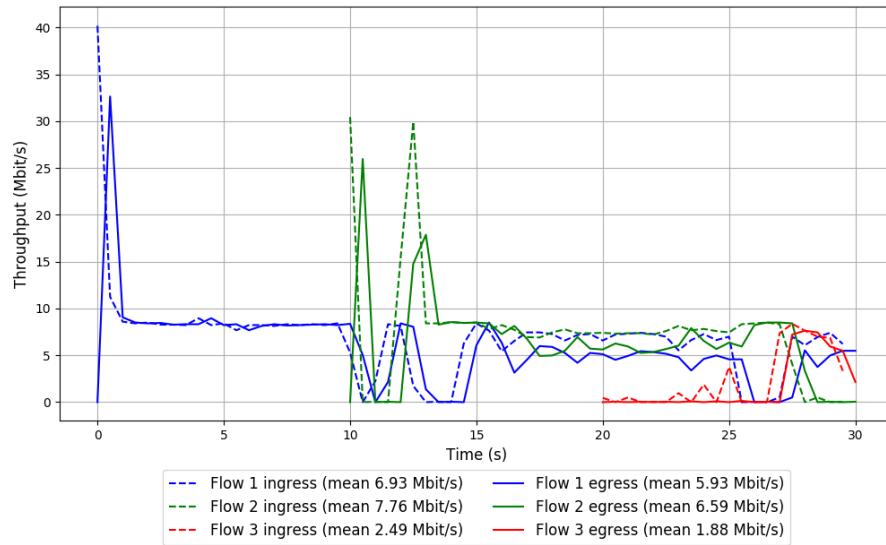


Run 2: Statistics of Muses-25

```
Start at: 2018-09-03 08:54:28
End at: 2018-09-03 08:54:58
Local clock offset: -21.063 ms
Remote clock offset: -5.538 ms

# Below is generated by plot.py at 2018-09-03 09:03:17
# Datalink statistics
-- Total of 3 flows:
Average throughput: 10.90 Mbit/s
95th percentile per-packet one-way delay: 9.446 ms
Loss rate: 15.28%
-- Flow 1:
Average throughput: 5.93 Mbit/s
95th percentile per-packet one-way delay: 9.784 ms
Loss rate: 14.40%
-- Flow 2:
Average throughput: 6.59 Mbit/s
95th percentile per-packet one-way delay: 9.677 ms
Loss rate: 15.03%
-- Flow 3:
Average throughput: 1.88 Mbit/s
95th percentile per-packet one-way delay: 7.485 ms
Loss rate: 24.48%
```

Run 2: Report of Muses-25 — Data Link



Run 3: Statistics of Muses-25

```
Start at: 2018-09-03 08:59:05
End at: 2018-09-03 08:59:35
Local clock offset: -23.984 ms
Remote clock offset: -5.479 ms

# Below is generated by plot.py at 2018-09-03 09:03:17
# Datalink statistics
-- Total of 3 flows:
Average throughput: 11.00 Mbit/s
95th percentile per-packet one-way delay: 14.108 ms
Loss rate: 16.09%
-- Flow 1:
Average throughput: 6.73 Mbit/s
95th percentile per-packet one-way delay: 13.797 ms
Loss rate: 11.95%
-- Flow 2:
Average throughput: 6.10 Mbit/s
95th percentile per-packet one-way delay: 14.293 ms
Loss rate: 18.55%
-- Flow 3:
Average throughput: 0.65 Mbit/s
95th percentile per-packet one-way delay: 19.488 ms
Loss rate: 56.42%
```

Run 3: Report of Muses-25 — Data Link

