

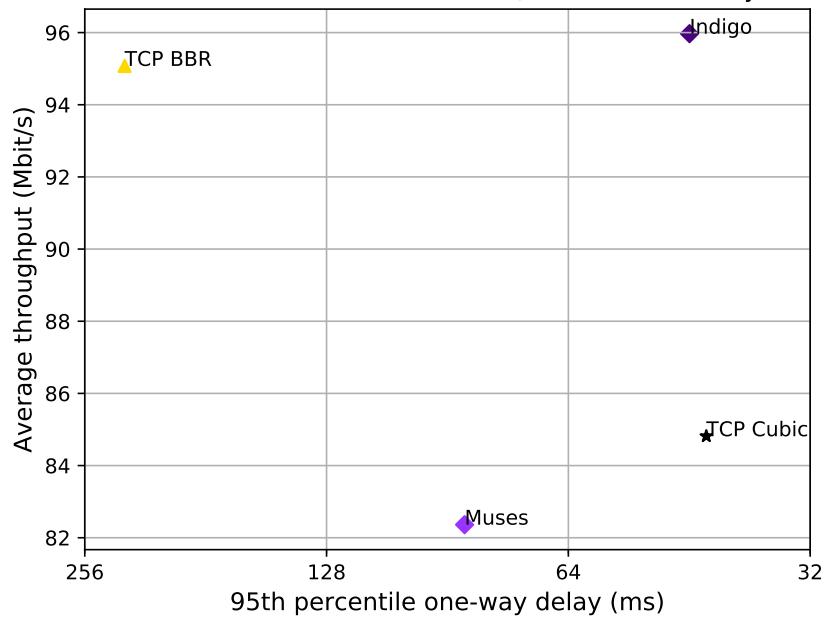
Pantheon Report

Generated at 2018-08-28 06:29:27 (UTC).
Data path: Mexico on `em1` (*remote*) → AWS California 2 on `ens5` (*local*).
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 `time.stanford.edu` and have been applied to correct the timestamps in logs.

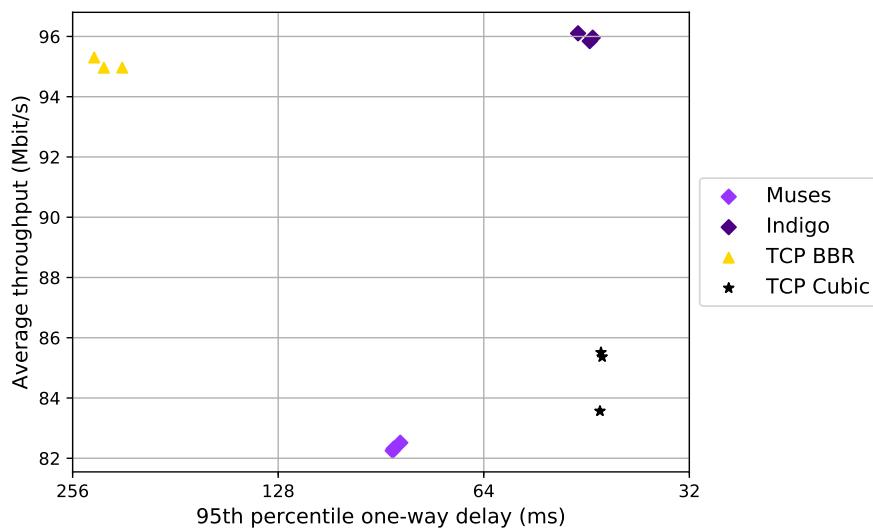
System info:
Linux 4.15.0-1019-aws
`net.core.default_qdisc = fq`
`net.core.rmem_default = 16777216`
`net.core.rmem_max = 536870912`
`net.core.wmem_default = 16777216`
`net.core.wmem_max = 536870912`
`net.ipv4.tcp_rmem = 4096 16777216 536870912`
`net.ipv4.tcp_wmem = 4096 16777216 536870912`

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 Mexico to AWS California 2, 3 runs of 30s each per scheme
3 flows with 10s interval between flows (mean of all runs by scheme)



test from Mexico to AWS California 2, 3 runs of 30s each per scheme
3 flows with 10s interval between flows



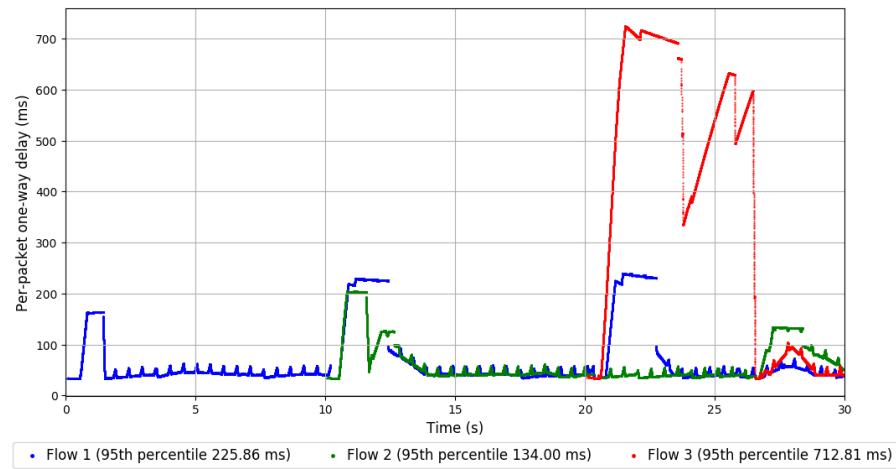
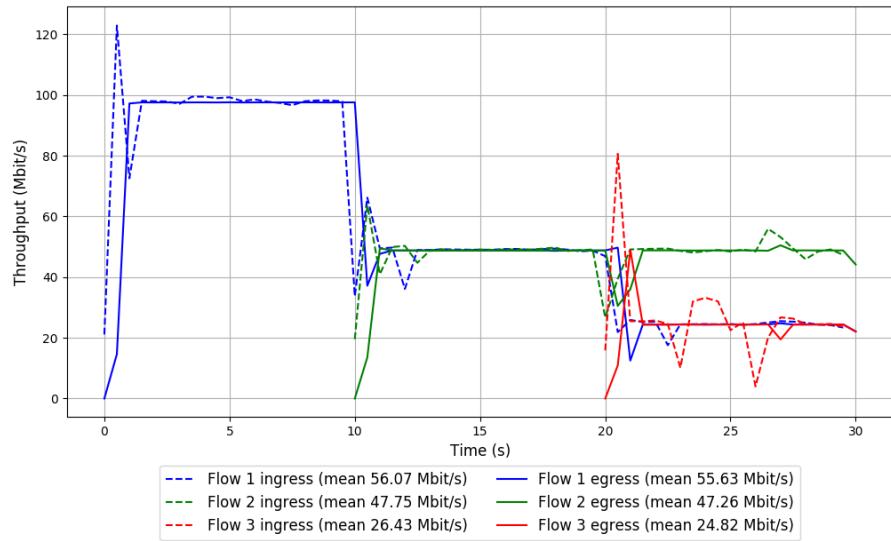
scheme	# runs	mean avg tput (Mbit/s)			mean 95th-%ile delay (ms)			mean loss rate (%)		
		flow 1	flow 2	flow 3	flow 1	flow 2	flow 3	flow 1	flow 2	flow 3
TCP BBR	3	58.80	40.95	27.24	184.13	171.72	584.99	0.80	1.21	4.87
TCP Cubic	3	48.18	38.82	32.65	48.04	42.06	51.05	0.17	0.36	0.72
Indigo	3	59.85	41.42	26.30	48.03	44.88	47.18	0.22	0.35	0.77
Muses	3	51.36	32.15	29.16	80.39	88.69	96.65	0.21	0.53	1.18

Run 1: Statistics of TCP BBR

```
Start at: 2018-08-28 06:13:14
End at: 2018-08-28 06:13:44
Local clock offset: 0.218 ms
Remote clock offset: 1.073 ms

# Below is generated by plot.py at 2018-08-28 06:28:49
# Datalink statistics
-- Total of 3 flows:
Average throughput: 95.30 Mbit/s
95th percentile per-packet one-way delay: 238.065 ms
Loss rate: 1.62%
-- Flow 1:
Average throughput: 55.63 Mbit/s
95th percentile per-packet one-way delay: 225.856 ms
Loss rate: 0.98%
-- Flow 2:
Average throughput: 47.26 Mbit/s
95th percentile per-packet one-way delay: 134.002 ms
Loss rate: 1.35%
-- Flow 3:
Average throughput: 24.82 Mbit/s
95th percentile per-packet one-way delay: 712.806 ms
Loss rate: 6.68%
```

Run 1: Report of TCP BBR — Data Link

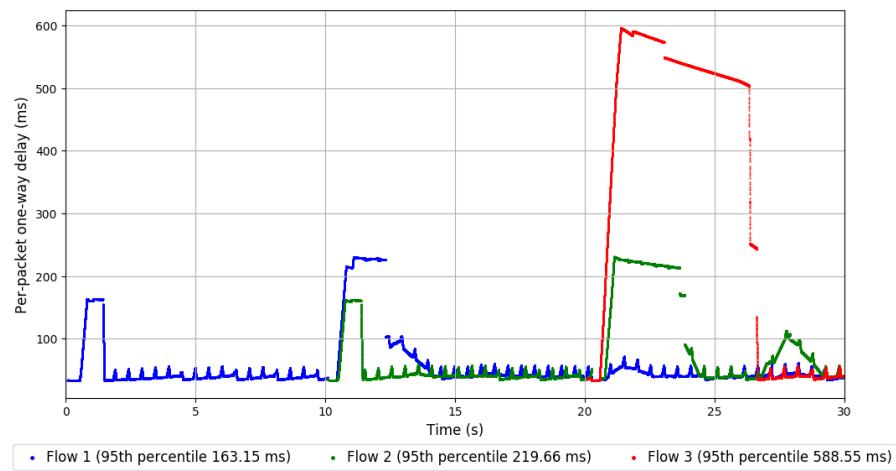
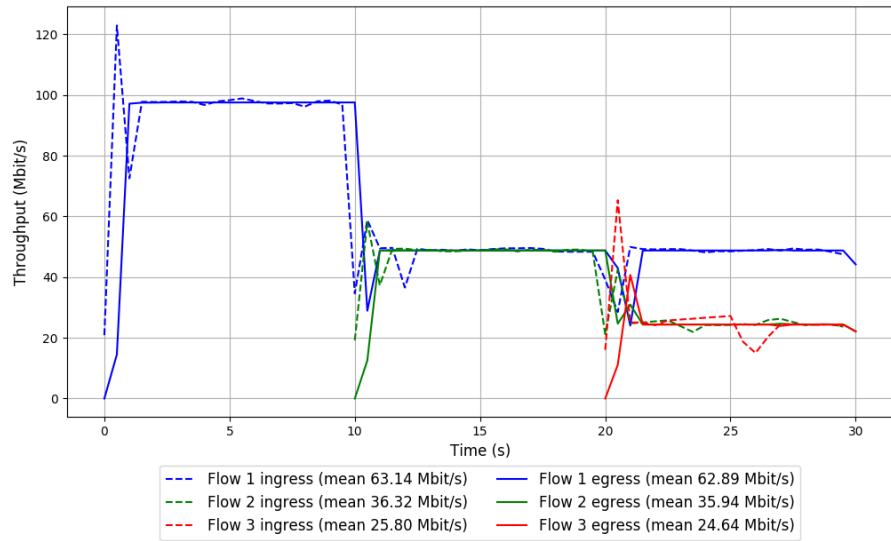


Run 2: Statistics of TCP BBR

```
Start at: 2018-08-28 06:18:40
End at: 2018-08-28 06:19:10
Local clock offset: 0.15 ms
Remote clock offset: 1.307 ms

# Below is generated by plot.py at 2018-08-28 06:28:49
# Datalink statistics
-- Total of 3 flows:
Average throughput: 94.96 Mbit/s
95th percentile per-packet one-way delay: 230.401 ms
Loss rate: 1.20%
-- Flow 1:
Average throughput: 62.89 Mbit/s
95th percentile per-packet one-way delay: 163.151 ms
Loss rate: 0.61%
-- Flow 2:
Average throughput: 35.94 Mbit/s
95th percentile per-packet one-way delay: 219.655 ms
Loss rate: 1.35%
-- Flow 3:
Average throughput: 24.64 Mbit/s
95th percentile per-packet one-way delay: 588.555 ms
Loss rate: 5.14%
```

Run 2: Report of TCP BBR — Data Link

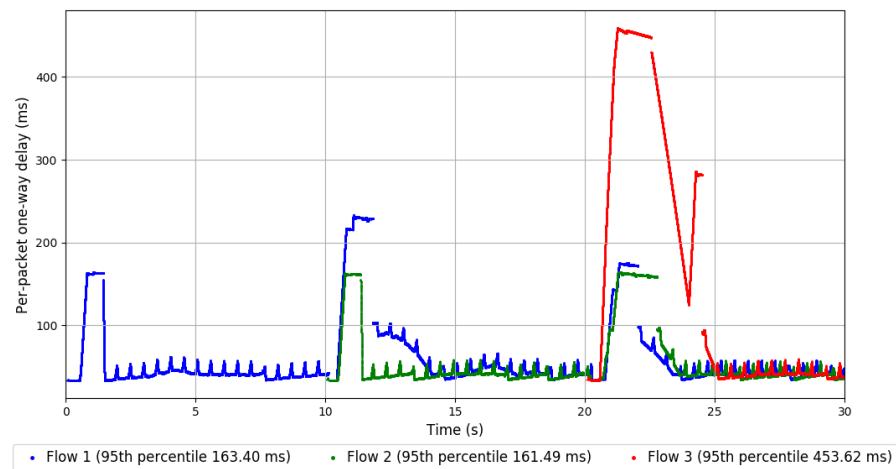
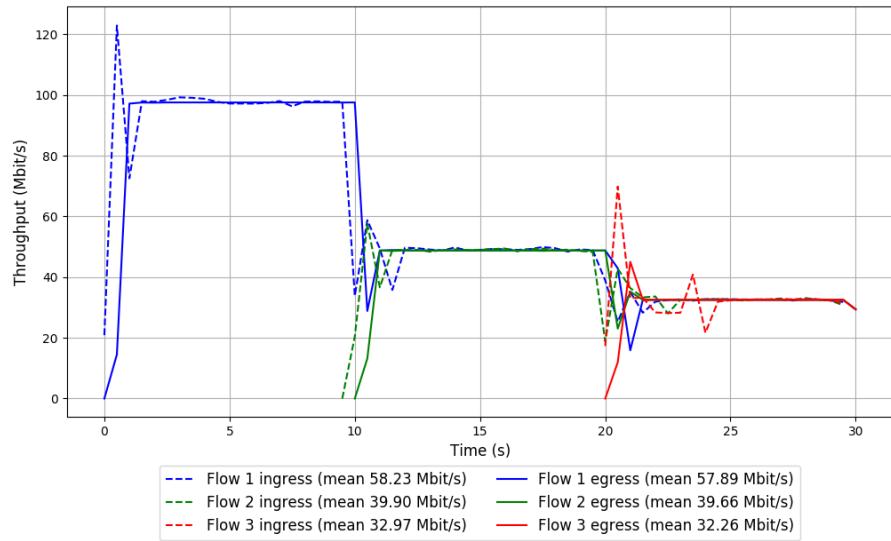


Run 3: Statistics of TCP BBR

```
Start at: 2018-08-28 06:24:04
End at: 2018-08-28 06:24:34
Local clock offset: 0.135 ms
Remote clock offset: 1.143 ms

# Below is generated by plot.py at 2018-08-28 06:28:49
# Datalink statistics
-- Total of 3 flows:
Average throughput: 94.97 Mbit/s
95th percentile per-packet one-way delay: 216.573 ms
Loss rate: 1.06%
-- Flow 1:
Average throughput: 57.89 Mbit/s
95th percentile per-packet one-way delay: 163.398 ms
Loss rate: 0.80%
-- Flow 2:
Average throughput: 39.66 Mbit/s
95th percentile per-packet one-way delay: 161.489 ms
Loss rate: 0.92%
-- Flow 3:
Average throughput: 32.26 Mbit/s
95th percentile per-packet one-way delay: 453.616 ms
Loss rate: 2.80%
```

Run 3: Report of TCP BBR — Data Link

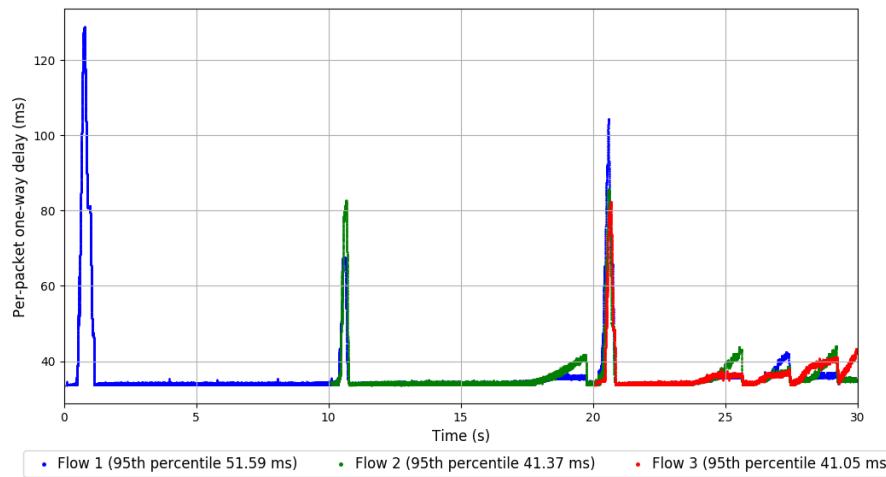
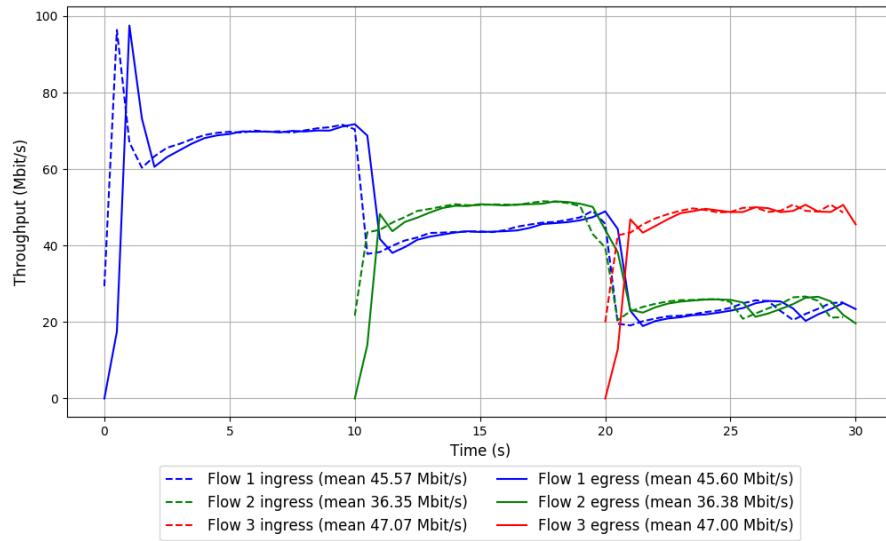


```
Run 1: Statistics of TCP Cubic

Start at: 2018-08-28 06:11:53
End at: 2018-08-28 06:12:23
Local clock offset: 0.163 ms
Remote clock offset: 0.828 ms

# Below is generated by plot.py at 2018-08-28 06:28:49
# Datalink statistics
-- Total of 3 flows:
Average throughput: 85.37 Mbit/s
95th percentile per-packet one-way delay: 42.936 ms
Loss rate: 0.28%
-- Flow 1:
Average throughput: 45.60 Mbit/s
95th percentile per-packet one-way delay: 51.595 ms
Loss rate: 0.15%
-- Flow 2:
Average throughput: 36.38 Mbit/s
95th percentile per-packet one-way delay: 41.371 ms
Loss rate: 0.22%
-- Flow 3:
Average throughput: 47.00 Mbit/s
95th percentile per-packet one-way delay: 41.045 ms
Loss rate: 0.77%
```

Run 1: Report of TCP Cubic — Data Link

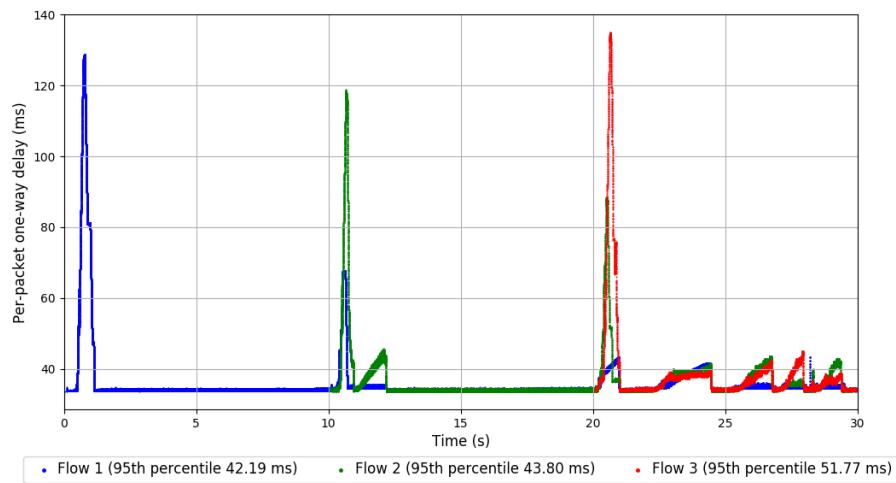
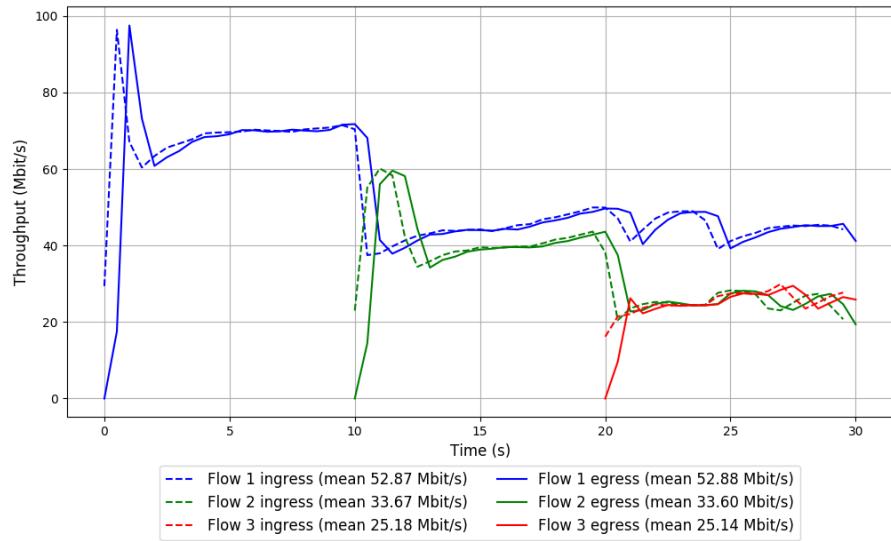


Run 2: Statistics of TCP Cubic

```
Start at: 2018-08-28 06:17:19
End at: 2018-08-28 06:17:49
Local clock offset: 0.233 ms
Remote clock offset: 1.116 ms

# Below is generated by plot.py at 2018-08-28 06:28:49
# Datalink statistics
-- Total of 3 flows:
Average throughput: 83.57 Mbit/s
95th percentile per-packet one-way delay: 43.255 ms
Loss rate: 0.35%
-- Flow 1:
Average throughput: 52.88 Mbit/s
95th percentile per-packet one-way delay: 42.193 ms
Loss rate: 0.20%
-- Flow 2:
Average throughput: 33.60 Mbit/s
95th percentile per-packet one-way delay: 43.803 ms
Loss rate: 0.52%
-- Flow 3:
Average throughput: 25.14 Mbit/s
95th percentile per-packet one-way delay: 51.766 ms
Loss rate: 0.81%
```

Run 2: Report of TCP Cubic — Data Link

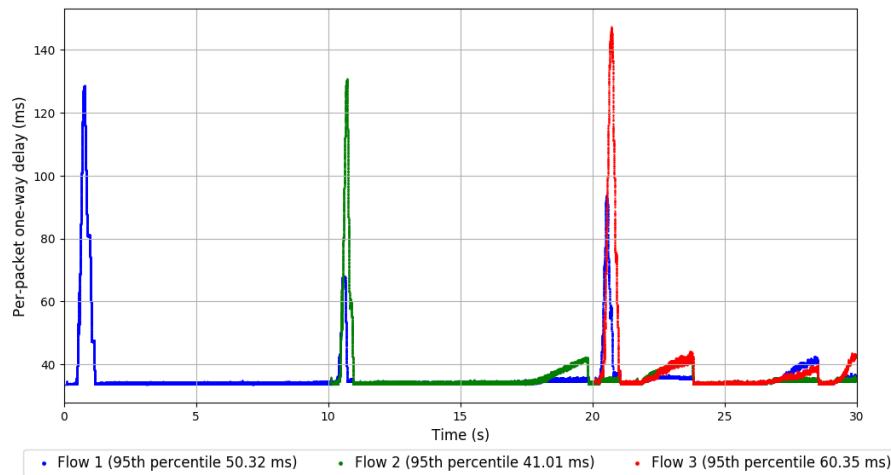
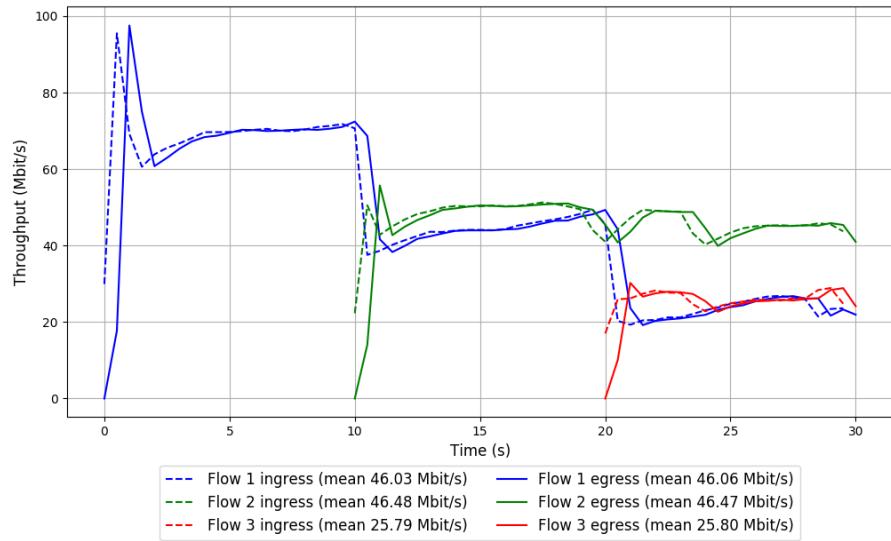


Run 3: Statistics of TCP Cubic

```
Start at: 2018-08-28 06:22:44
End at: 2018-08-28 06:23:14
Local clock offset: 0.223 ms
Remote clock offset: 1.127 ms

# Below is generated by plot.py at 2018-08-28 06:28:49
# Datalink statistics
-- Total of 3 flows:
Average throughput: 85.51 Mbit/s
95th percentile per-packet one-way delay: 43.105 ms
Loss rate: 0.26%
-- Flow 1:
Average throughput: 46.06 Mbit/s
95th percentile per-packet one-way delay: 50.319 ms
Loss rate: 0.15%
-- Flow 2:
Average throughput: 46.47 Mbit/s
95th percentile per-packet one-way delay: 41.008 ms
Loss rate: 0.34%
-- Flow 3:
Average throughput: 25.80 Mbit/s
95th percentile per-packet one-way delay: 60.347 ms
Loss rate: 0.58%
```

Run 3: Report of TCP Cubic — Data Link

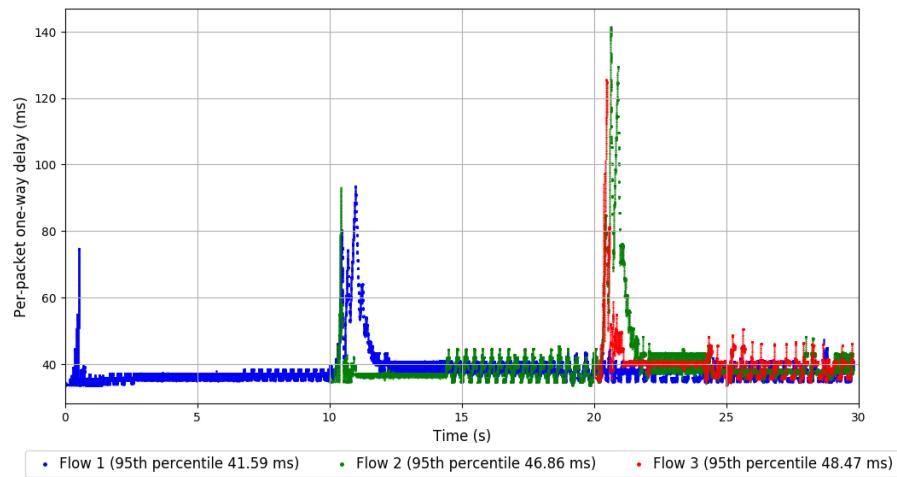
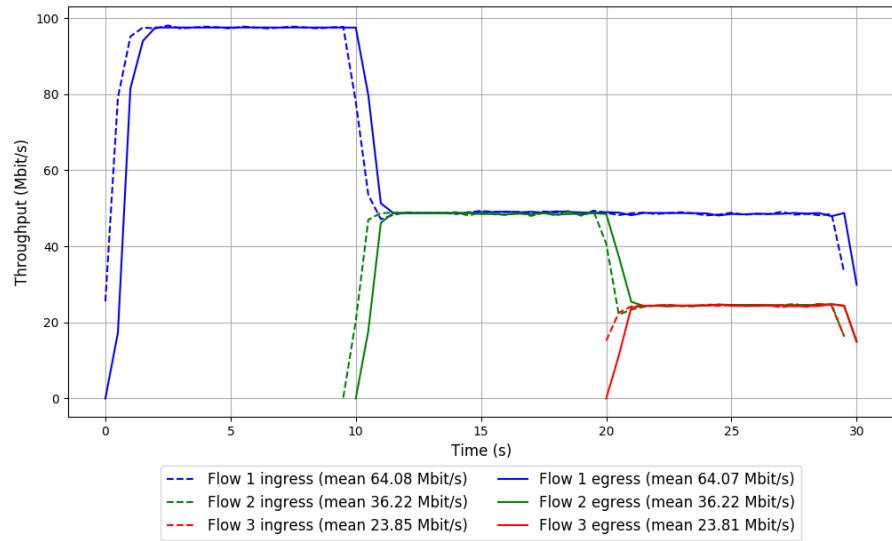


```
Run 1: Statistics of Indigo
```

```
Start at: 2018-08-28 06:15:57
End at: 2018-08-28 06:16:27
Local clock offset: 0.245 ms
Remote clock offset: 1.166 ms

# Below is generated by plot.py at 2018-08-28 06:28:50
# Datalink statistics
-- Total of 3 flows:
Average throughput: 95.96 Mbit/s
95th percentile per-packet one-way delay: 44.323 ms
Loss rate: 0.30%
-- Flow 1:
Average throughput: 64.07 Mbit/s
95th percentile per-packet one-way delay: 41.588 ms
Loss rate: 0.22%
-- Flow 2:
Average throughput: 36.22 Mbit/s
95th percentile per-packet one-way delay: 46.859 ms
Loss rate: 0.32%
-- Flow 3:
Average throughput: 23.81 Mbit/s
95th percentile per-packet one-way delay: 48.470 ms
Loss rate: 0.84%
```

Run 1: Report of Indigo — Data Link

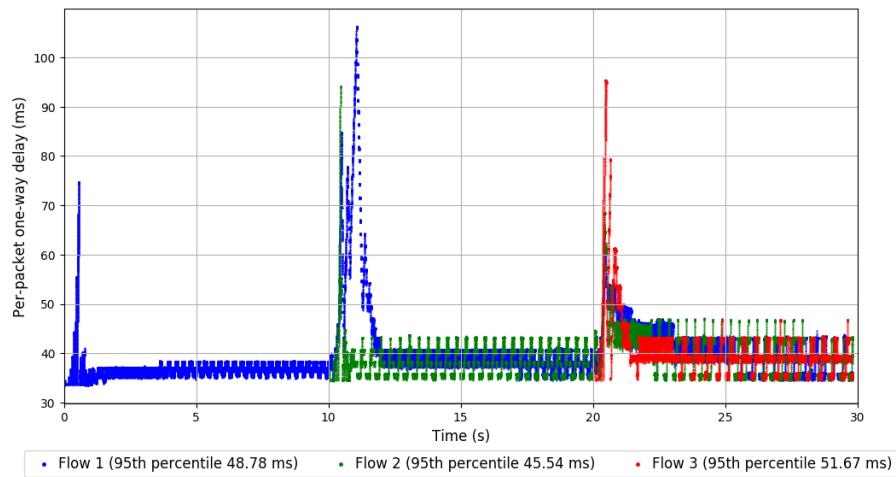
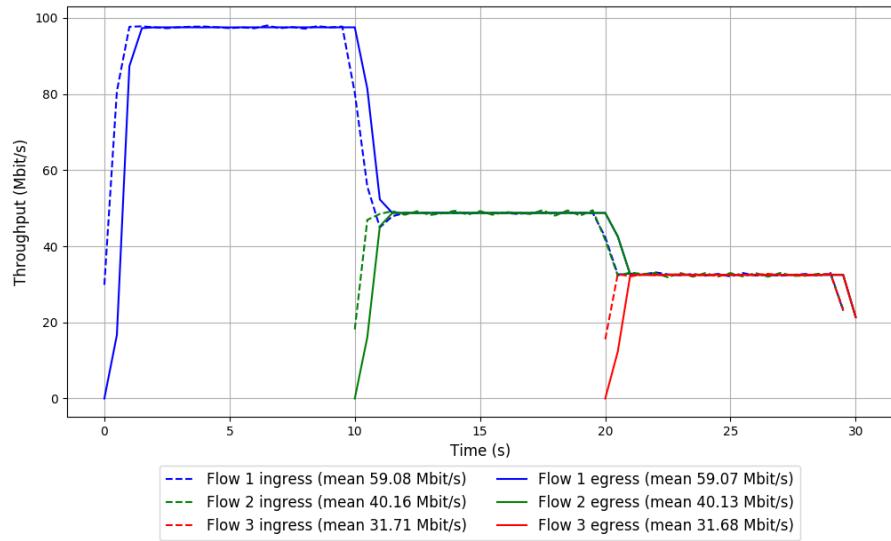


Run 2: Statistics of Indigo

```
Start at: 2018-08-28 06:21:22
End at: 2018-08-28 06:21:52
Local clock offset: 0.222 ms
Remote clock offset: 1.309 ms

# Below is generated by plot.py at 2018-08-28 06:28:50
# Datalink statistics
-- Total of 3 flows:
Average throughput: 96.10 Mbit/s
95th percentile per-packet one-way delay: 46.573 ms
Loss rate: 0.32%
-- Flow 1:
Average throughput: 59.07 Mbit/s
95th percentile per-packet one-way delay: 48.778 ms
Loss rate: 0.22%
-- Flow 2:
Average throughput: 40.13 Mbit/s
95th percentile per-packet one-way delay: 45.544 ms
Loss rate: 0.38%
-- Flow 3:
Average throughput: 31.68 Mbit/s
95th percentile per-packet one-way delay: 51.671 ms
Loss rate: 0.77%
```

Run 2: Report of Indigo — Data Link

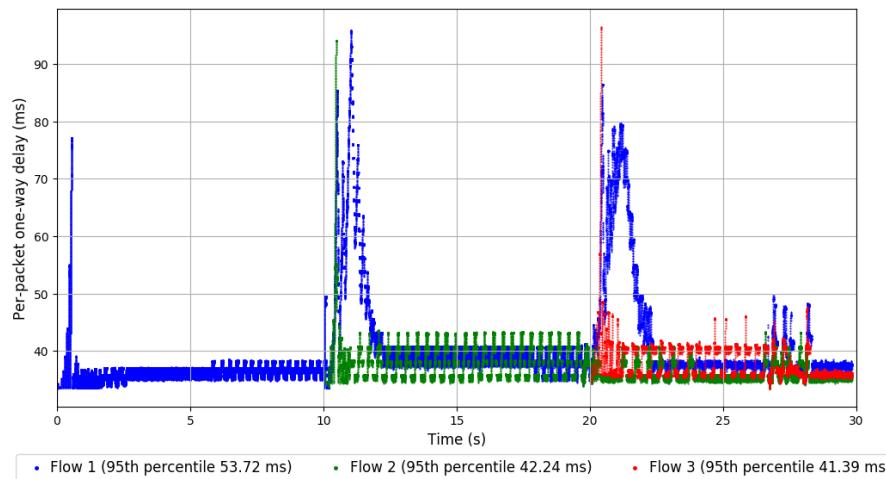
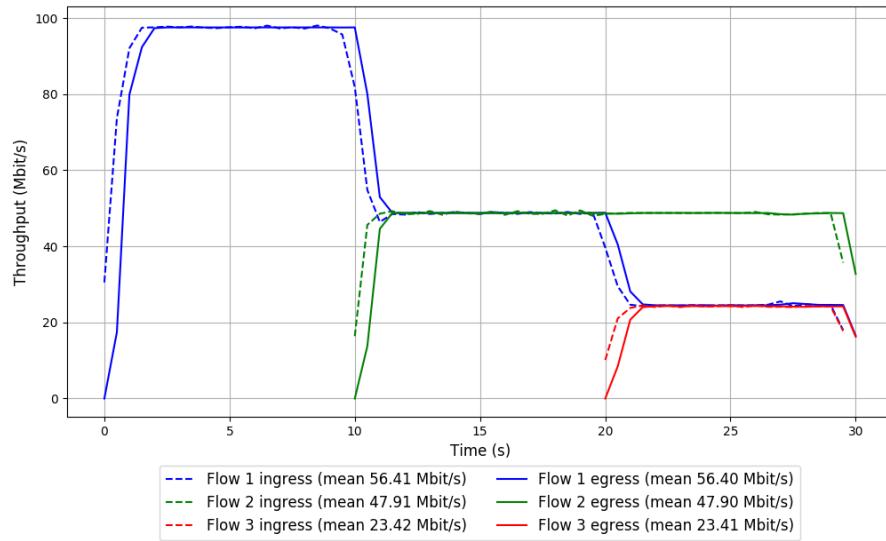


Run 3: Statistics of Indigo

```
Start at: 2018-08-28 06:26:46
End at: 2018-08-28 06:27:16
Local clock offset: 0.199 ms
Remote clock offset: 1.293 ms

# Below is generated by plot.py at 2018-08-28 06:29:19
# Datalink statistics
-- Total of 3 flows:
Average throughput: 95.85 Mbit/s
95th percentile per-packet one-way delay: 44.769 ms
Loss rate: 0.30%
-- Flow 1:
Average throughput: 56.40 Mbit/s
95th percentile per-packet one-way delay: 53.720 ms
Loss rate: 0.23%
-- Flow 2:
Average throughput: 47.90 Mbit/s
95th percentile per-packet one-way delay: 42.236 ms
Loss rate: 0.34%
-- Flow 3:
Average throughput: 23.41 Mbit/s
95th percentile per-packet one-way delay: 41.389 ms
Loss rate: 0.70%
```

Run 3: Report of Indigo — Data Link

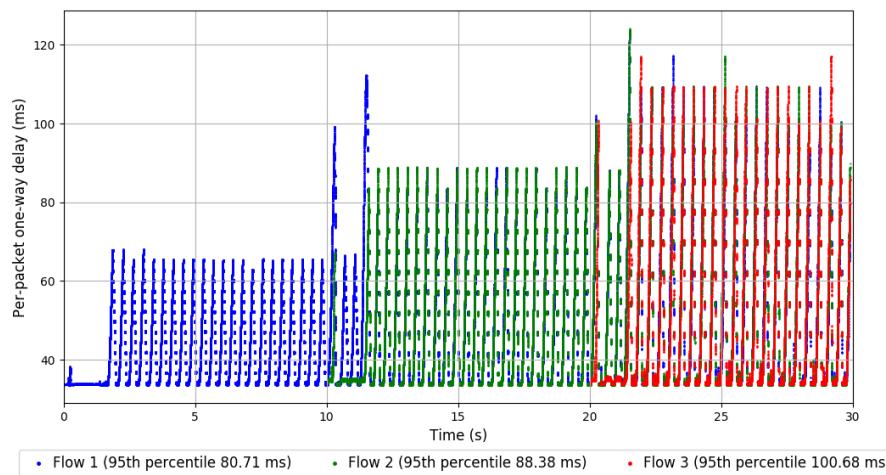
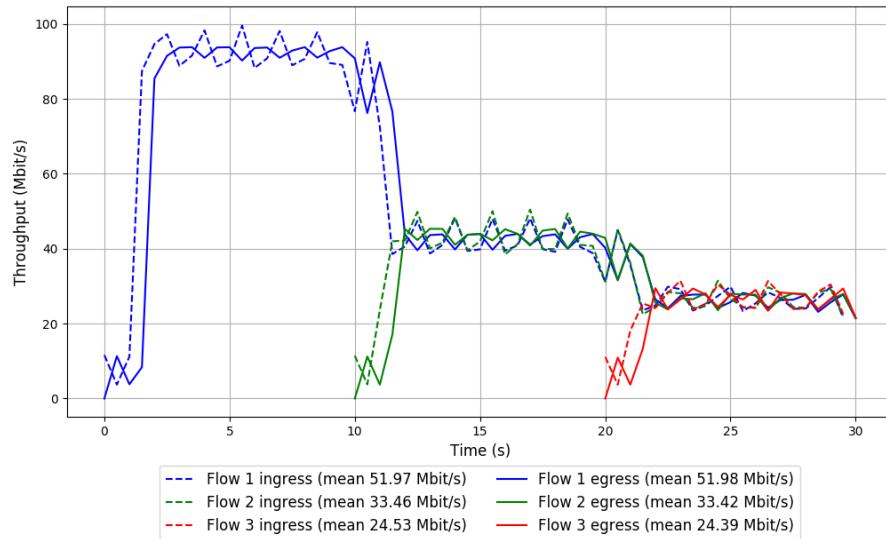


```
Run 1: Statistics of Muses
```

```
Start at: 2018-08-28 06:14:36
End at: 2018-08-28 06:15:06
Local clock offset: 0.248 ms
Remote clock offset: 1.124 ms

# Below is generated by plot.py at 2018-08-28 06:29:24
# Datalink statistics
-- Total of 3 flows:
Average throughput: 82.25 Mbit/s
95th percentile per-packet one-way delay: 87.002 ms
Loss rate: 0.36%
-- Flow 1:
Average throughput: 51.98 Mbit/s
95th percentile per-packet one-way delay: 80.707 ms
Loss rate: 0.20%
-- Flow 2:
Average throughput: 33.42 Mbit/s
95th percentile per-packet one-way delay: 88.376 ms
Loss rate: 0.44%
-- Flow 3:
Average throughput: 24.39 Mbit/s
95th percentile per-packet one-way delay: 100.683 ms
Loss rate: 1.18%
```

Run 1: Report of Muses — Data Link

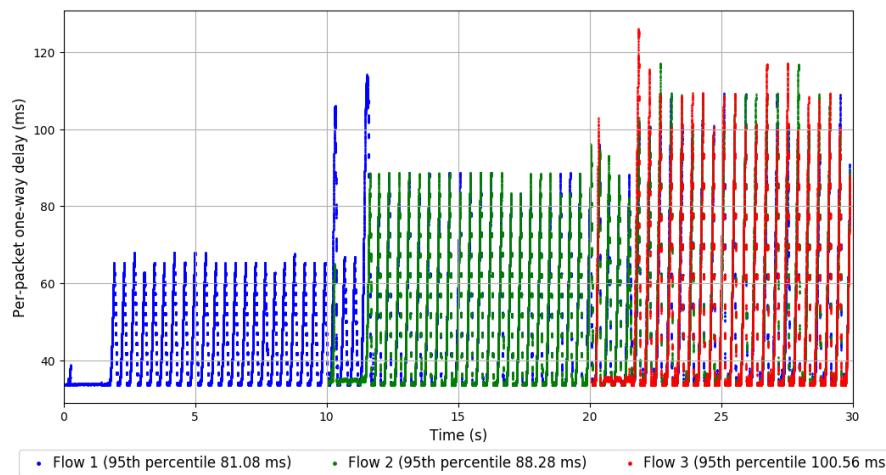
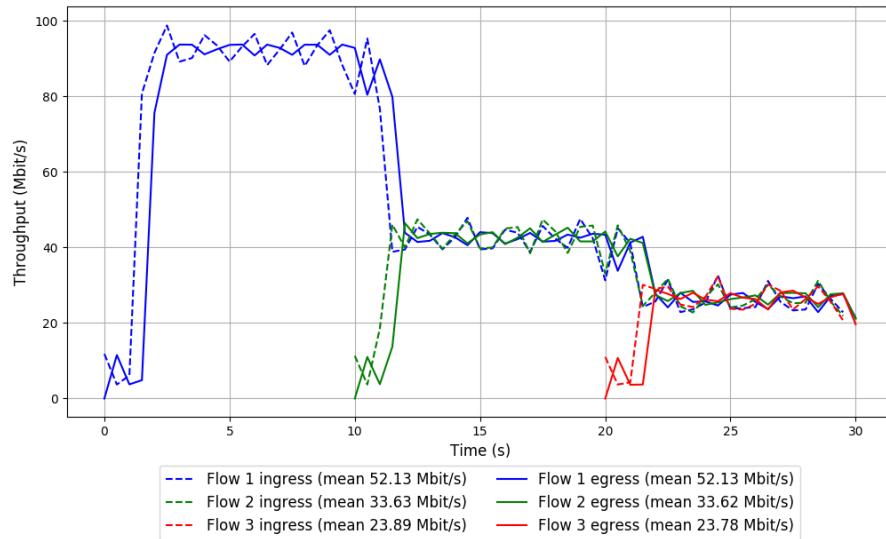


Run 2: Statistics of Muses

```
Start at: 2018-08-28 06:20:01
End at: 2018-08-28 06:20:31
Local clock offset: 0.229 ms
Remote clock offset: 1.325 ms

# Below is generated by plot.py at 2018-08-28 06:29:25
# Datalink statistics
-- Total of 3 flows:
Average throughput: 82.32 Mbit/s
95th percentile per-packet one-way delay: 86.706 ms
Loss rate: 0.33%
-- Flow 1:
Average throughput: 52.13 Mbit/s
95th percentile per-packet one-way delay: 81.082 ms
Loss rate: 0.21%
-- Flow 2:
Average throughput: 33.62 Mbit/s
95th percentile per-packet one-way delay: 88.279 ms
Loss rate: 0.36%
-- Flow 3:
Average throughput: 23.78 Mbit/s
95th percentile per-packet one-way delay: 100.556 ms
Loss rate: 1.05%
```

Run 2: Report of Muses — Data Link



Run 3: Statistics of Muses

```
Start at: 2018-08-28 06:25:26
End at: 2018-08-28 06:25:56
Local clock offset: 0.222 ms
Remote clock offset: 1.119 ms

# Below is generated by plot.py at 2018-08-28 06:29:26
# Datalink statistics
-- Total of 3 flows:
Average throughput: 82.52 Mbit/s
95th percentile per-packet one-way delay: 84.806 ms
Loss rate: 0.52%
-- Flow 1:
Average throughput: 49.98 Mbit/s
95th percentile per-packet one-way delay: 79.375 ms
Loss rate: 0.21%
-- Flow 2:
Average throughput: 29.41 Mbit/s
95th percentile per-packet one-way delay: 89.401 ms
Loss rate: 0.80%
-- Flow 3:
Average throughput: 39.32 Mbit/s
95th percentile per-packet one-way delay: 88.697 ms
Loss rate: 1.31%
```

Run 3: Report of Muses — Data Link

