

Pantheon Report

Generated at 2018-08-28 09:32:36 (UTC).

Data path: AWS California 1 on `ens5` (*local*) → Stanford on `eno1` (*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 `time.stanford.edu` and have been applied to correct the timestamps in logs.

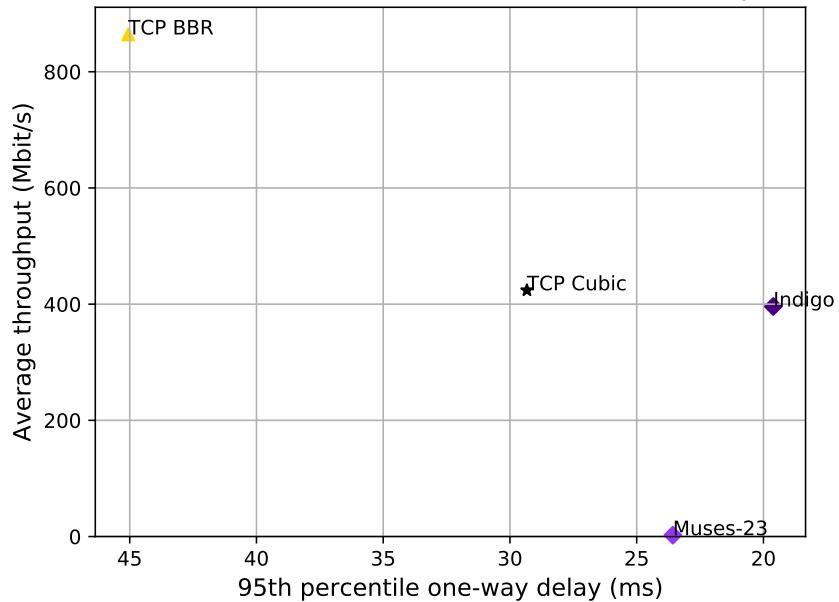
System info:

```
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
```

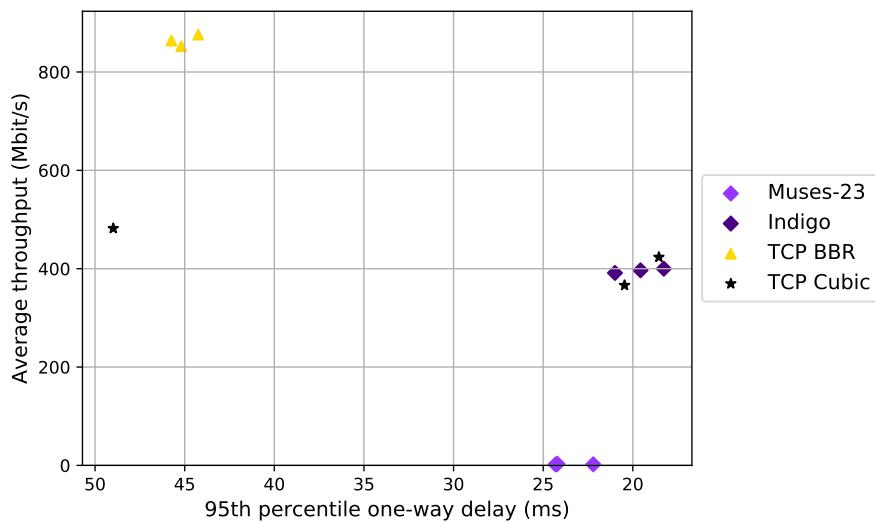
Git summary:

```
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 AWS California 1 to Stanford, 3 runs of 30s each per scheme
3 flows with 10s interval between flows (mean of all runs by scheme)



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



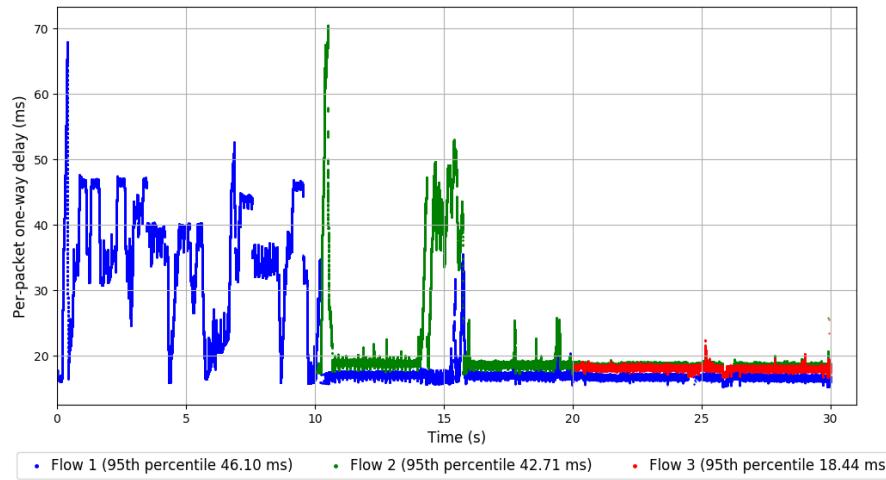
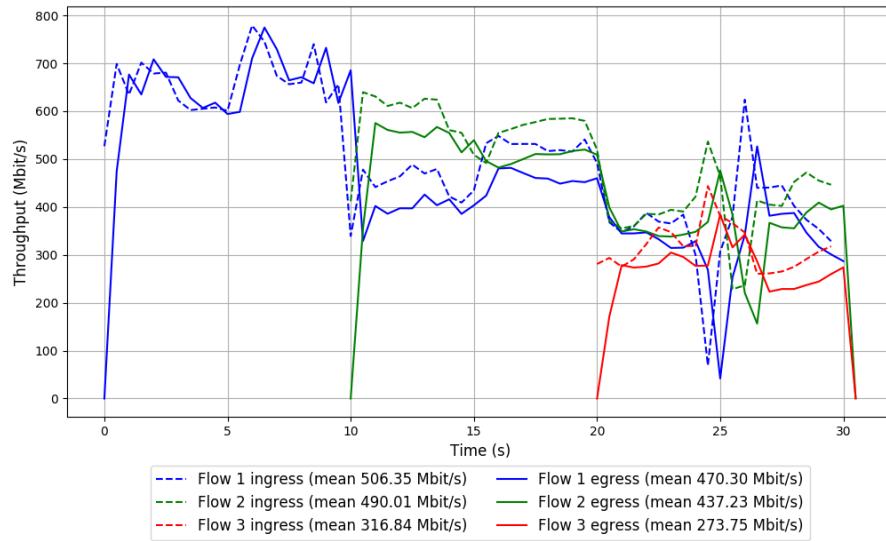
scheme	# runs	mean avg tput (Mbit/s)			mean 95th-%ile delay (ms)			mean loss rate (%)		
		flow 1	flow 2	flow 3	flow 1	flow 2	flow 3	flow 1	flow 2	flow 3
TCP BBR	3	486.08	417.58	300.74	46.41	34.04	19.36	6.78	10.99	12.69
TCP Cubic	3	231.84	170.03	236.88	33.42	18.81	20.56	0.07	0.03	0.08
Indigo	3	200.91	198.85	195.26	19.45	19.80	19.53	0.02	0.03	0.05
Muses-23	3	0.57	2.02	1.51	20.12	23.20	23.15	97.79	98.00	84.91

Run 1: Statistics of TCP BBR

```
Start at: 2018-08-28 09:07:05
End at: 2018-08-28 09:07:35
Local clock offset: -24.826 ms
Remote clock offset: 3.756 ms

# Below is generated by plot.py at 2018-08-28 09:32:33
# Datalink statistics
-- Total of 3 flows:
Average throughput: 852.54 Mbit/s
95th percentile per-packet one-way delay: 45.190 ms
Loss rate: 9.12%
-- Flow 1:
Average throughput: 470.30 Mbit/s
95th percentile per-packet one-way delay: 46.100 ms
Loss rate: 7.12%
-- Flow 2:
Average throughput: 437.23 Mbit/s
95th percentile per-packet one-way delay: 42.706 ms
Loss rate: 10.78%
-- Flow 3:
Average throughput: 273.75 Mbit/s
95th percentile per-packet one-way delay: 18.438 ms
Loss rate: 13.61%
```

Run 1: Report of TCP BBR — Data Link

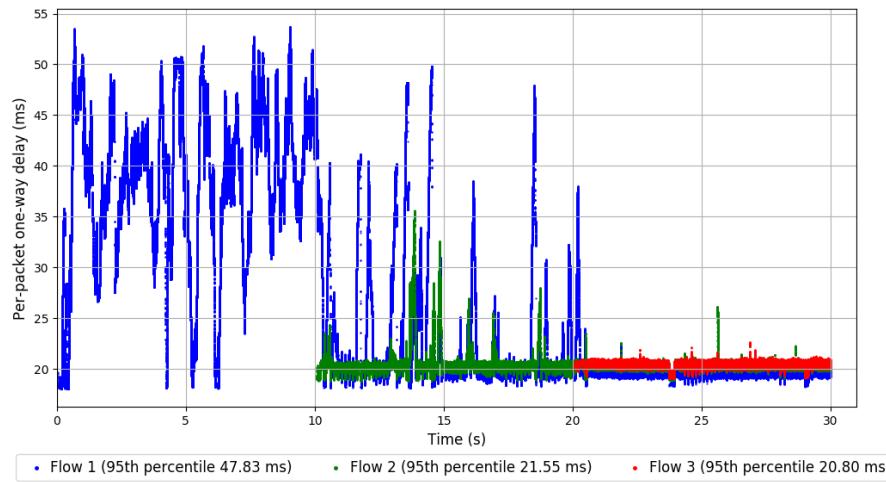
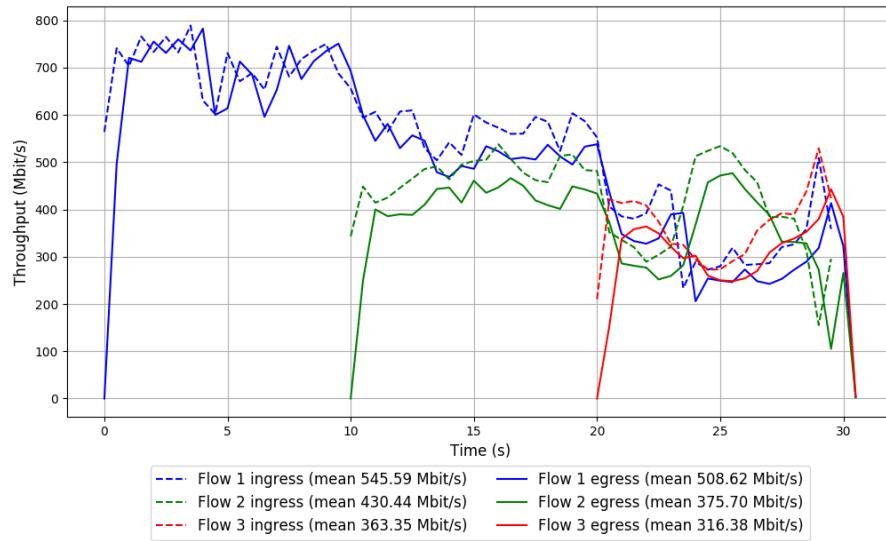


Run 2: Statistics of TCP BBR

```
Start at: 2018-08-28 09:13:23
End at: 2018-08-28 09:13:53
Local clock offset: -24.35 ms
Remote clock offset: 2.798 ms

# Below is generated by plot.py at 2018-08-28 09:32:33
# Datalink statistics
-- Total of 3 flows:
Average throughput: 864.00 Mbit/s
95th percentile per-packet one-way delay: 45.738 ms
Loss rate: 9.34%
-- Flow 1:
Average throughput: 508.62 Mbit/s
95th percentile per-packet one-way delay: 47.829 ms
Loss rate: 6.77%
-- Flow 2:
Average throughput: 375.70 Mbit/s
95th percentile per-packet one-way delay: 21.552 ms
Loss rate: 12.71%
-- Flow 3:
Average throughput: 316.38 Mbit/s
95th percentile per-packet one-way delay: 20.803 ms
Loss rate: 12.93%
```

Run 2: Report of TCP BBR — Data Link

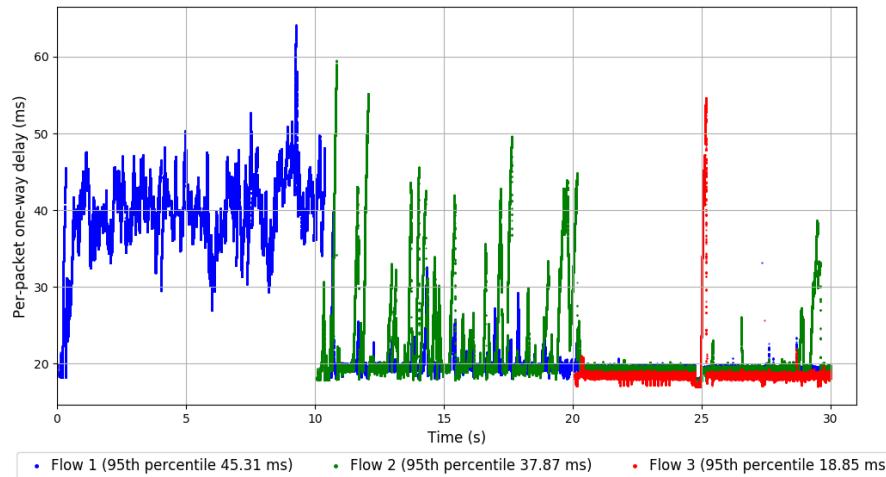
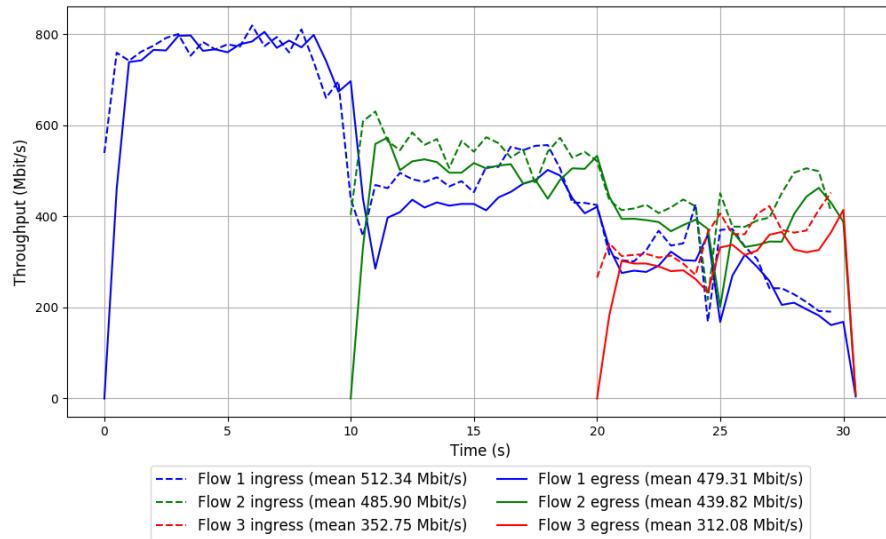


Run 3: Statistics of TCP BBR

```
Start at: 2018-08-28 09:19:46
End at: 2018-08-28 09:20:16
Local clock offset: -26.952 ms
Remote clock offset: 1.098 ms

# Below is generated by plot.py at 2018-08-28 09:32:35
# Datalink statistics
-- Total of 3 flows:
Average throughput: 876.07 Mbit/s
95th percentile per-packet one-way delay: 44.246 ms
Loss rate: 8.10%
-- Flow 1:
Average throughput: 479.31 Mbit/s
95th percentile per-packet one-way delay: 45.314 ms
Loss rate: 6.44%
-- Flow 2:
Average throughput: 439.82 Mbit/s
95th percentile per-packet one-way delay: 37.871 ms
Loss rate: 9.48%
-- Flow 3:
Average throughput: 312.08 Mbit/s
95th percentile per-packet one-way delay: 18.846 ms
Loss rate: 11.53%
```

Run 3: Report of TCP BBR — Data Link

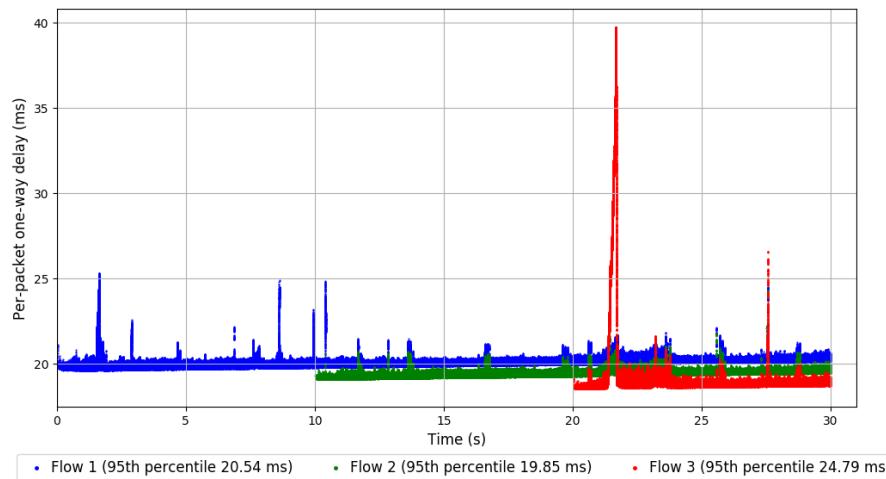
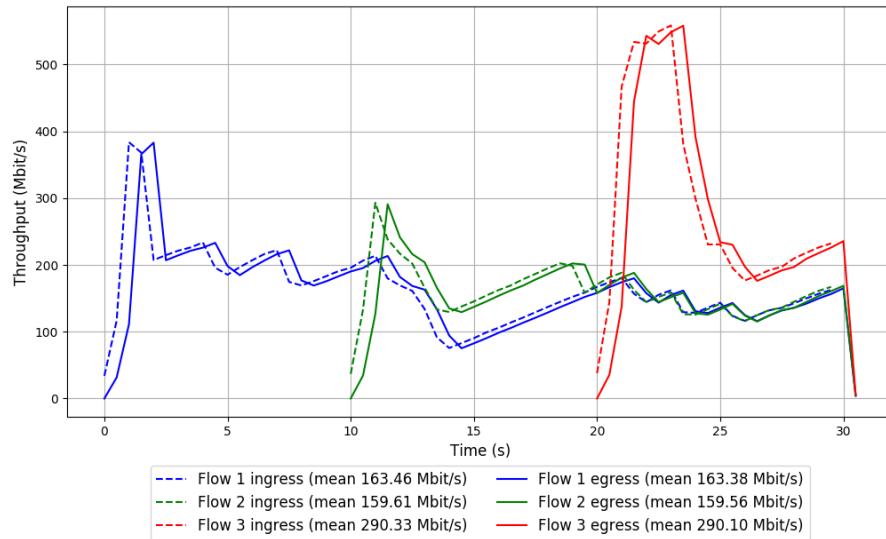


```
Run 1: Statistics of TCP Cubic
```

```
Start at: 2018-08-28 09:08:58
End at: 2018-08-28 09:09:28
Local clock offset: -27.778 ms
Remote clock offset: 3.819 ms

# Below is generated by plot.py at 2018-08-28 09:32:35
# Datalink statistics
-- Total of 3 flows:
Average throughput: 366.28 Mbit/s
95th percentile per-packet one-way delay: 20.462 ms
Loss rate: 0.05%
-- Flow 1:
Average throughput: 163.38 Mbit/s
95th percentile per-packet one-way delay: 20.544 ms
Loss rate: 0.05%
-- Flow 2:
Average throughput: 159.56 Mbit/s
95th percentile per-packet one-way delay: 19.852 ms
Loss rate: 0.03%
-- Flow 3:
Average throughput: 290.10 Mbit/s
95th percentile per-packet one-way delay: 24.792 ms
Loss rate: 0.07%
```

Run 1: Report of TCP Cubic — Data Link

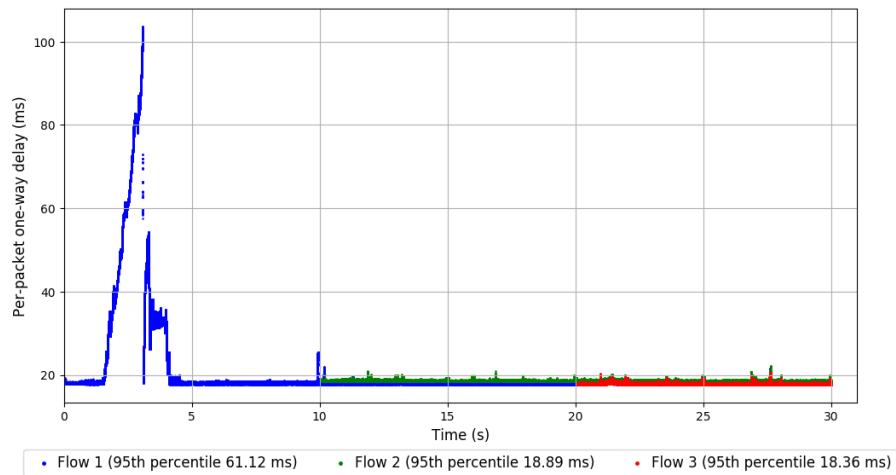
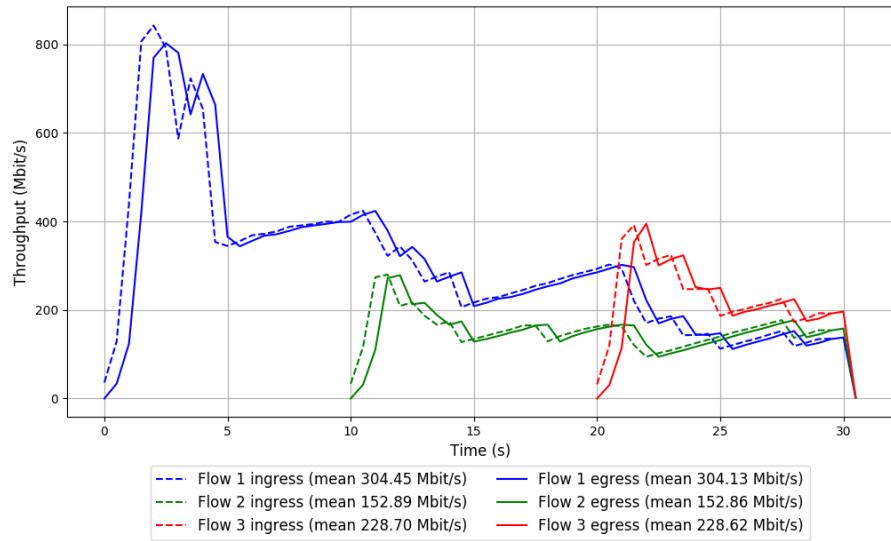


Run 2: Statistics of TCP Cubic

```
Start at: 2018-08-28 09:15:17
End at: 2018-08-28 09:15:47
Local clock offset: -24.445 ms
Remote clock offset: 2.125 ms

# Below is generated by plot.py at 2018-08-28 09:32:35
# Datalink statistics
-- Total of 3 flows:
Average throughput: 481.96 Mbit/s
95th percentile per-packet one-way delay: 48.983 ms
Loss rate: 0.08%
-- Flow 1:
Average throughput: 304.13 Mbit/s
95th percentile per-packet one-way delay: 61.121 ms
Loss rate: 0.11%
-- Flow 2:
Average throughput: 152.86 Mbit/s
95th percentile per-packet one-way delay: 18.887 ms
Loss rate: 0.02%
-- Flow 3:
Average throughput: 228.62 Mbit/s
95th percentile per-packet one-way delay: 18.361 ms
Loss rate: 0.04%
```

Run 2: Report of TCP Cubic — Data Link

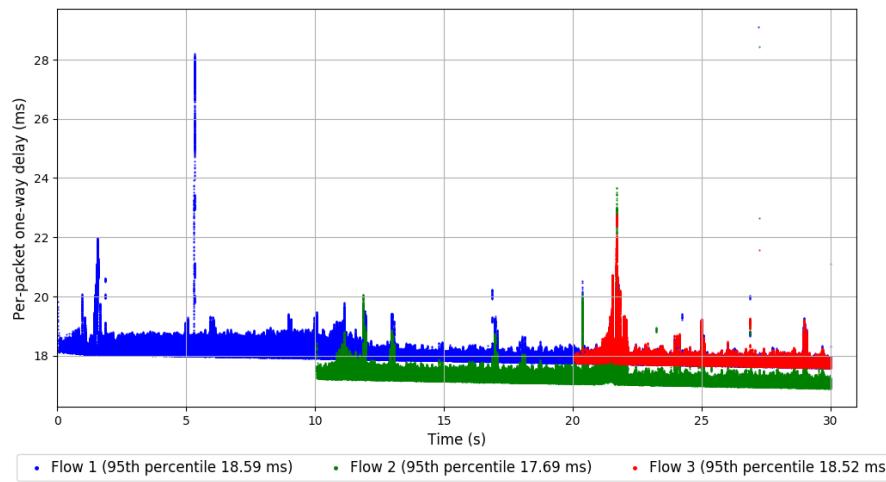
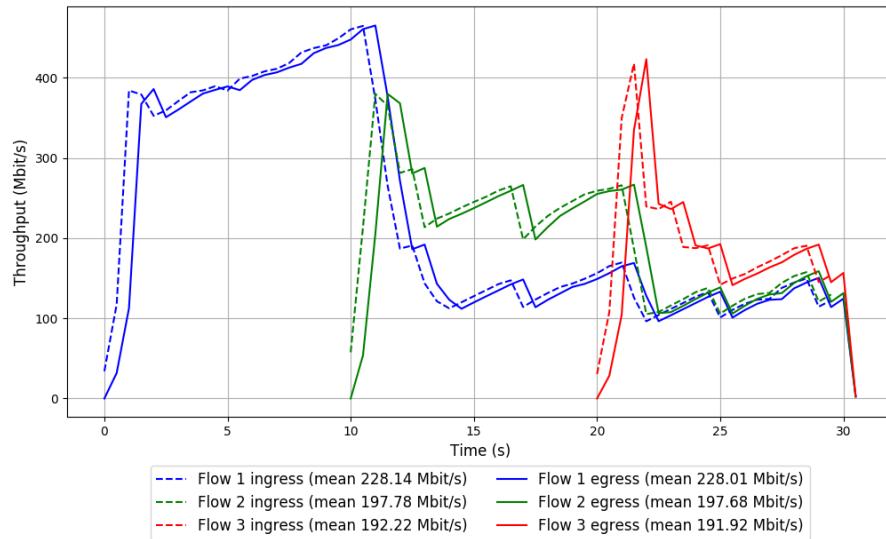


Run 3: Statistics of TCP Cubic

```
Start at: 2018-08-28 09:21:40
End at: 2018-08-28 09:22:10
Local clock offset: -28.911 ms
Remote clock offset: 0.8 ms

# Below is generated by plot.py at 2018-08-28 09:32:35
# Datalink statistics
-- Total of 3 flows:
Average throughput: 423.48 Mbit/s
95th percentile per-packet one-way delay: 18.548 ms
Loss rate: 0.06%
-- Flow 1:
Average throughput: 228.01 Mbit/s
95th percentile per-packet one-way delay: 18.595 ms
Loss rate: 0.06%
-- Flow 2:
Average throughput: 197.68 Mbit/s
95th percentile per-packet one-way delay: 17.687 ms
Loss rate: 0.05%
-- Flow 3:
Average throughput: 191.92 Mbit/s
95th percentile per-packet one-way delay: 18.521 ms
Loss rate: 0.13%
```

Run 3: Report of TCP Cubic — Data Link

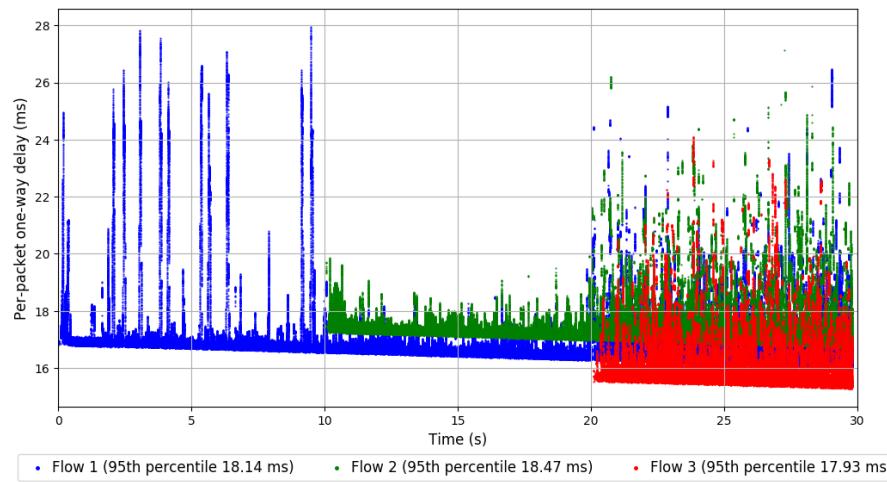
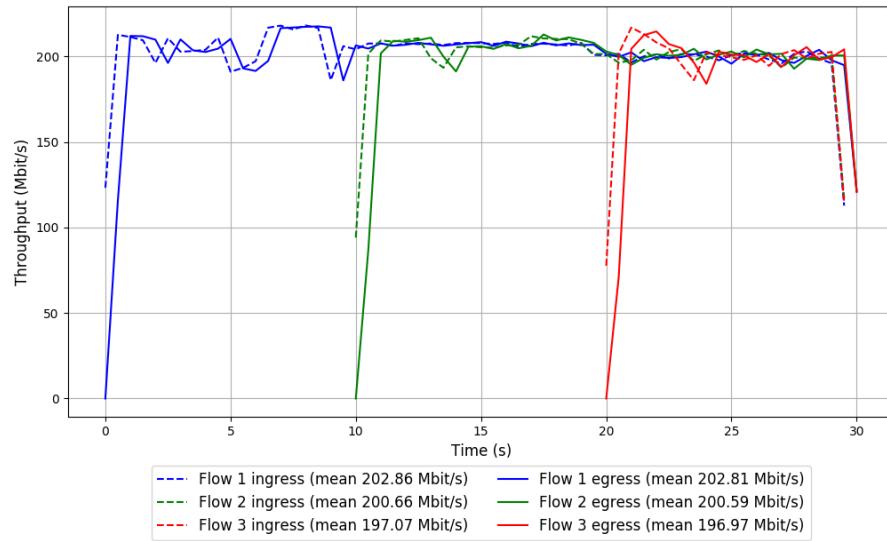


Run 1: Statistics of Indigo

```
Start at: 2018-08-28 09:05:29
End at: 2018-08-28 09:05:59
Local clock offset: -22.356 ms
Remote clock offset: 3.65 ms

# Below is generated by plot.py at 2018-08-28 09:32:35
# Datalink statistics
-- Total of 3 flows:
Average throughput: 399.99 Mbit/s
95th percentile per-packet one-way delay: 18.270 ms
Loss rate: 0.04%
-- Flow 1:
Average throughput: 202.81 Mbit/s
95th percentile per-packet one-way delay: 18.141 ms
Loss rate: 0.03%
-- Flow 2:
Average throughput: 200.59 Mbit/s
95th percentile per-packet one-way delay: 18.474 ms
Loss rate: 0.04%
-- Flow 3:
Average throughput: 196.97 Mbit/s
95th percentile per-packet one-way delay: 17.933 ms
Loss rate: 0.06%
```

Run 1: Report of Indigo — Data Link

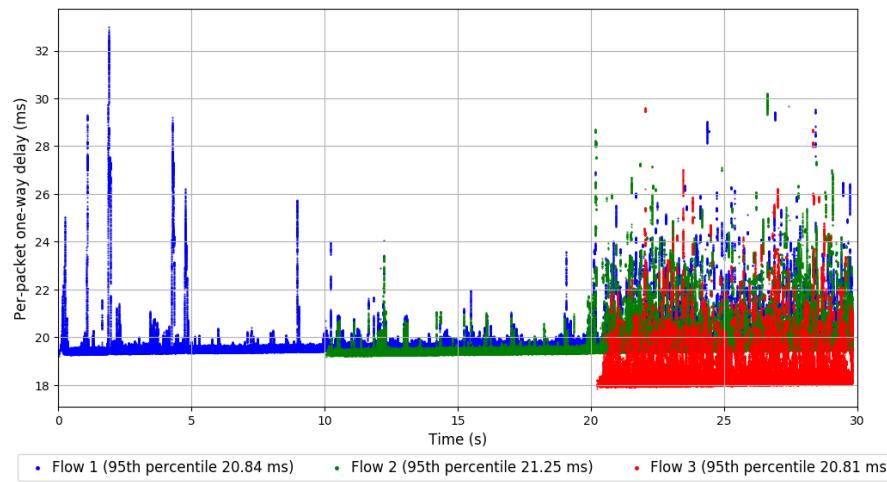
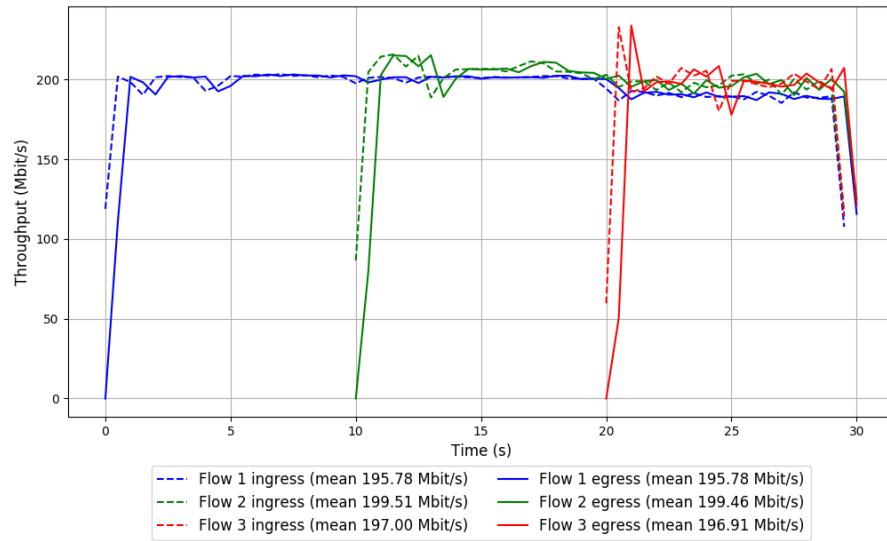


Run 2: Statistics of Indigo

```
Start at: 2018-08-28 09:11:47
End at: 2018-08-28 09:12:17
Local clock offset: -24.953 ms
Remote clock offset: 3.462 ms

# Below is generated by plot.py at 2018-08-28 09:32:35
# Datalink statistics
-- Total of 3 flows:
Average throughput: 391.36 Mbit/s
95th percentile per-packet one-way delay: 20.996 ms
Loss rate: 0.02%
-- Flow 1:
Average throughput: 195.78 Mbit/s
95th percentile per-packet one-way delay: 20.838 ms
Loss rate: 0.02%
-- Flow 2:
Average throughput: 199.46 Mbit/s
95th percentile per-packet one-way delay: 21.249 ms
Loss rate: 0.02%
-- Flow 3:
Average throughput: 196.91 Mbit/s
95th percentile per-packet one-way delay: 20.808 ms
Loss rate: 0.04%
```

Run 2: Report of Indigo — Data Link

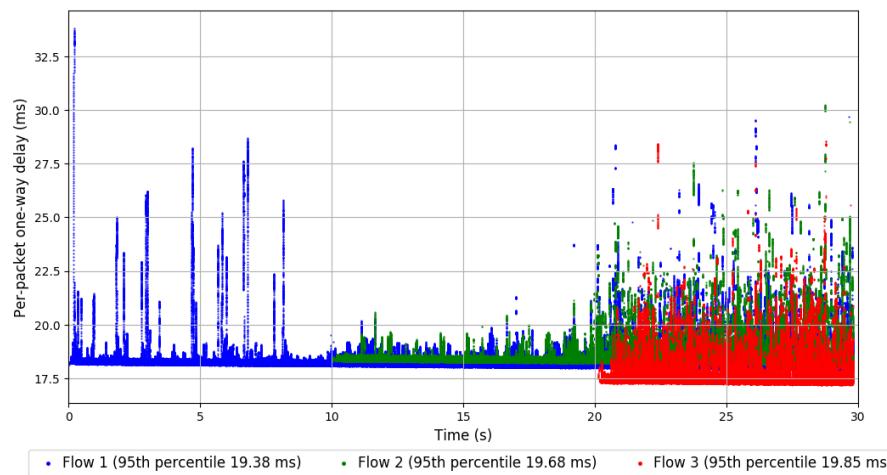
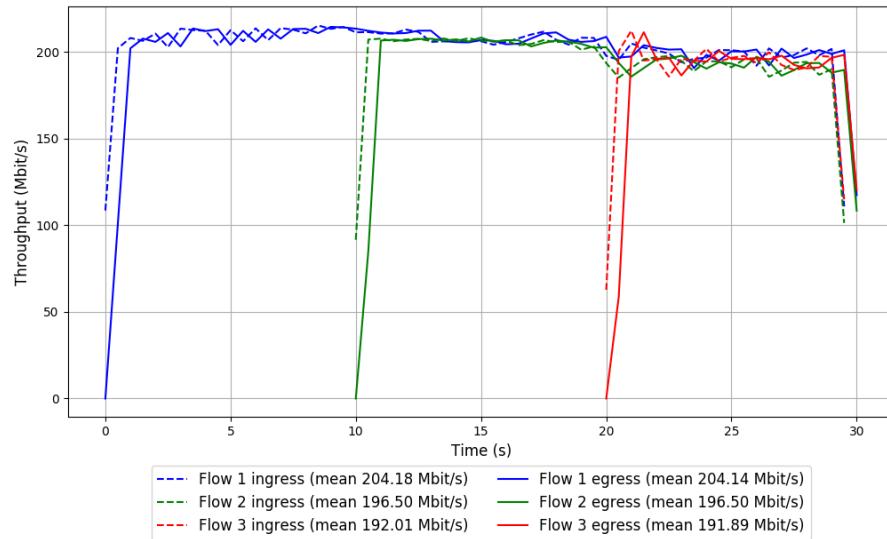


Run 3: Statistics of Indigo

```
Start at: 2018-08-28 09:18:11
End at: 2018-08-28 09:18:41
Local clock offset: -25.74 ms
Remote clock offset: 1.428 ms

# Below is generated by plot.py at 2018-08-28 09:32:35
# Datalink statistics
-- Total of 3 flows:
Average throughput: 396.72 Mbit/s
95th percentile per-packet one-way delay: 19.571 ms
Loss rate: 0.03%
-- Flow 1:
Average throughput: 204.14 Mbit/s
95th percentile per-packet one-way delay: 19.383 ms
Loss rate: 0.02%
-- Flow 2:
Average throughput: 196.50 Mbit/s
95th percentile per-packet one-way delay: 19.679 ms
Loss rate: 0.02%
-- Flow 3:
Average throughput: 191.89 Mbit/s
95th percentile per-packet one-way delay: 19.849 ms
Loss rate: 0.06%
```

Run 3: Report of Indigo — Data Link

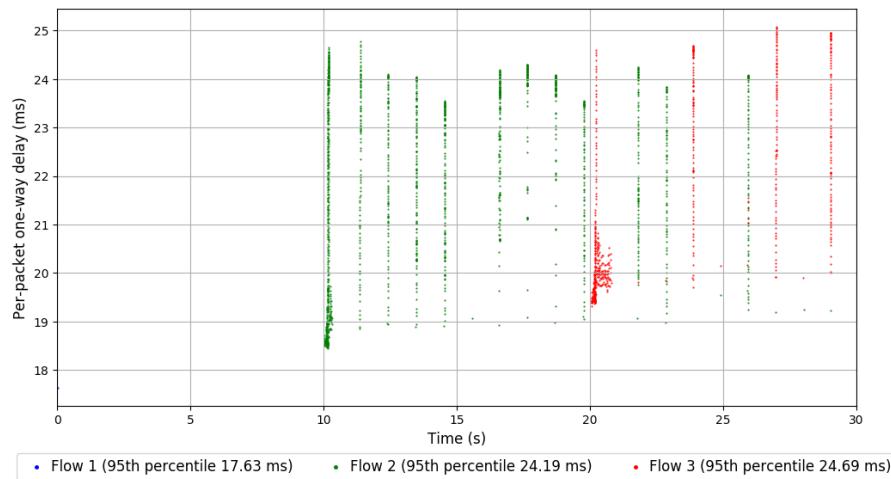
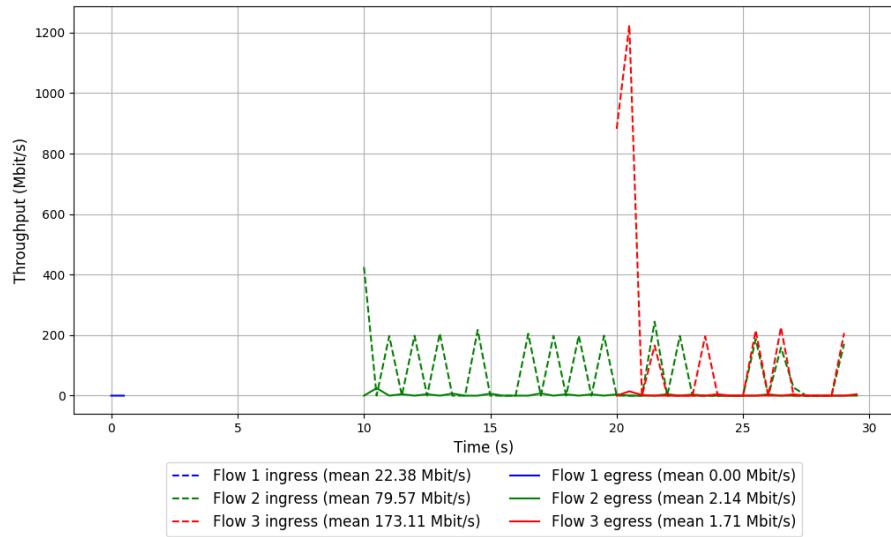


Run 1: Statistics of Muses-23

```
Start at: 2018-08-28 09:10:29
End at: 2018-08-28 09:10:59
Local clock offset: -25.805 ms
Remote clock offset: 3.794 ms

# Below is generated by plot.py at 2018-08-28 09:32:35
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1.93 Mbit/s
95th percentile per-packet one-way delay: 24.305 ms
Loss rate: 98.18%
-- Flow 1:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 17.629 ms
Loss rate: 97.39%
-- Flow 2:
Average throughput: 2.14 Mbit/s
95th percentile per-packet one-way delay: 24.190 ms
Loss rate: 97.31%
-- Flow 3:
Average throughput: 1.71 Mbit/s
95th percentile per-packet one-way delay: 24.686 ms
Loss rate: 99.01%
```

Run 1: Report of Muses-23 — Data Link

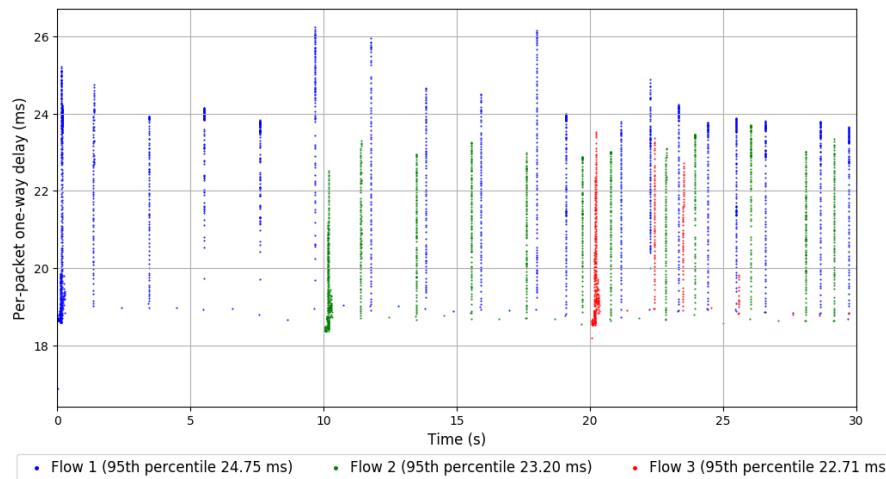
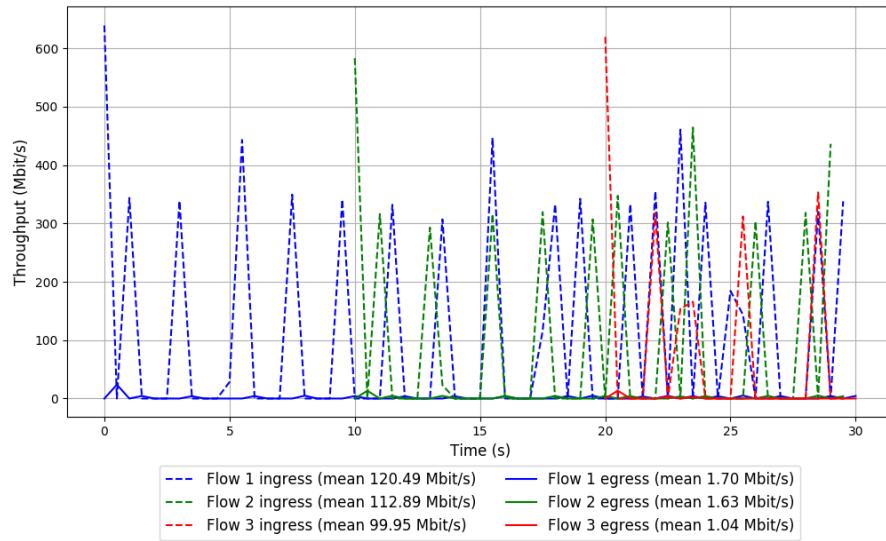


Run 2: Statistics of Muses-23

```
Start at: 2018-08-28 09:16:51
End at: 2018-08-28 09:17:21
Local clock offset: -25.028 ms
Remote clock offset: 1.758 ms

# Below is generated by plot.py at 2018-08-28 09:32:35
# Datalink statistics
-- Total of 3 flows:
Average throughput: 3.09 Mbit/s
95th percentile per-packet one-way delay: 24.210 ms
Loss rate: 98.63%
-- Flow 1:
Average throughput: 1.70 Mbit/s
95th percentile per-packet one-way delay: 24.751 ms
Loss rate: 98.59%
-- Flow 2:
Average throughput: 1.63 Mbit/s
95th percentile per-packet one-way delay: 23.204 ms
Loss rate: 98.56%
-- Flow 3:
Average throughput: 1.04 Mbit/s
95th percentile per-packet one-way delay: 22.711 ms
Loss rate: 98.96%
```

Run 2: Report of Muses-23 — Data Link



Run 3: Statistics of Muses-23

```
Start at: 2018-08-28 09:23:12
End at: 2018-08-28 09:23:42
Local clock offset: -30.594 ms
Remote clock offset: 0.599 ms

# Below is generated by plot.py at 2018-08-28 09:32:35
# Datalink statistics
-- Total of 3 flows:
Average throughput: 2.08 Mbit/s
95th percentile per-packet one-way delay: 22.206 ms
Loss rate: 97.47%
-- Flow 1:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 17.977 ms
Loss rate: 97.39%
-- Flow 2:
Average throughput: 2.30 Mbit/s
95th percentile per-packet one-way delay: 22.219 ms
Loss rate: 98.14%
-- Flow 3:
Average throughput: 1.79 Mbit/s
95th percentile per-packet one-way delay: 22.065 ms
Loss rate: 56.75%
```

Run 3: Report of Muses-23 — Data Link

