

Pantheon Report

Generated at 2018-08-31 06:06:47 (UTC).

Data path: Stanford on `eno1` (*remote*) → AWS California 1 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.

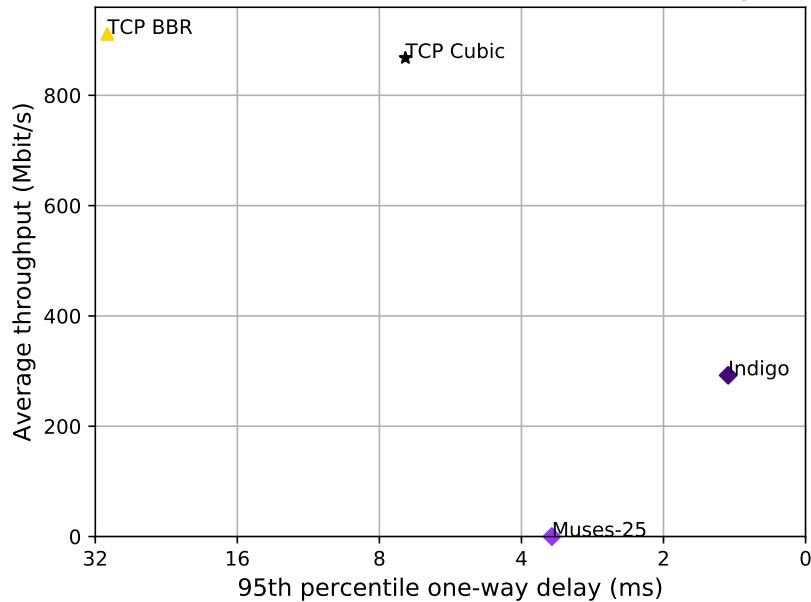
System info:

```
Linux 4.15.0-1020-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
```

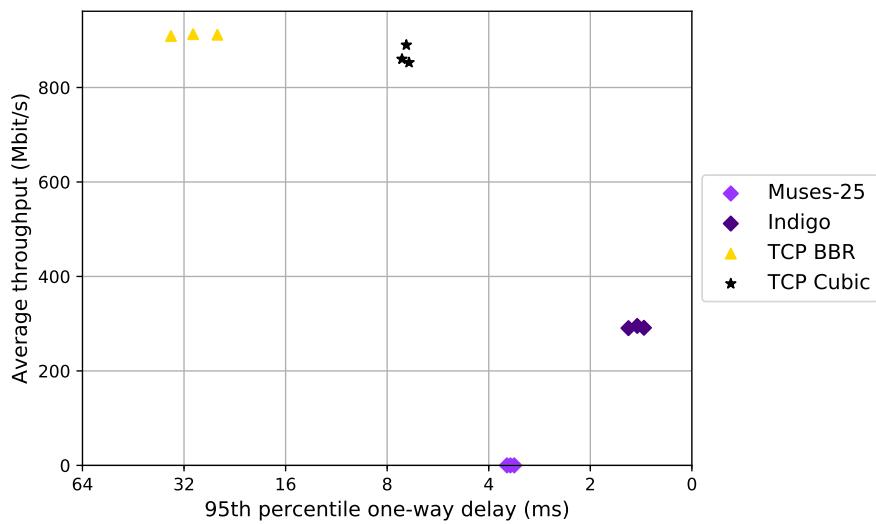
Git summary:

```
branch: muses @ 2de97ca91a065473c29a25ffffe63fb137c97a67c
third_party/fillp @ d47f4fa1b454a5e3c0537115c5a28436dbd4b834
third_party/fillp-sheep @ daed0c84f98531712514b2231f43ec6901114ffe
third_party/genericCC @ d0153f8e594aa89e93b032143cedbdf58e562f4
third_party/indigo @ 2601c92e4aa9d58d38dc4dfe0ecdbf90c077e64d
third_party/libutp @ b3465b942e2826f2b179eaab4a906ce6bb7cf3cf
third_party/muses @ b59e0d118c50af3579569c462d33045741c85981
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 Stanford to AWS California 1, 3 runs of 30s each per scheme
3 flows with 10s interval between flows (mean of all runs by scheme)



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



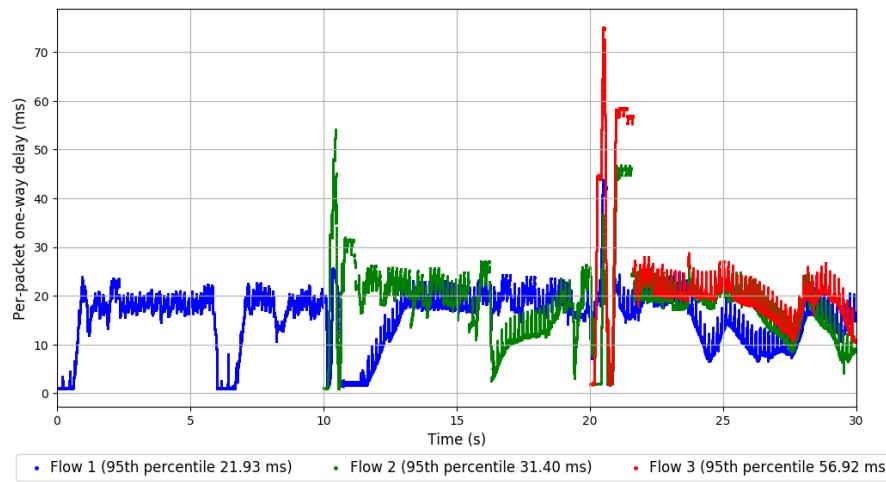
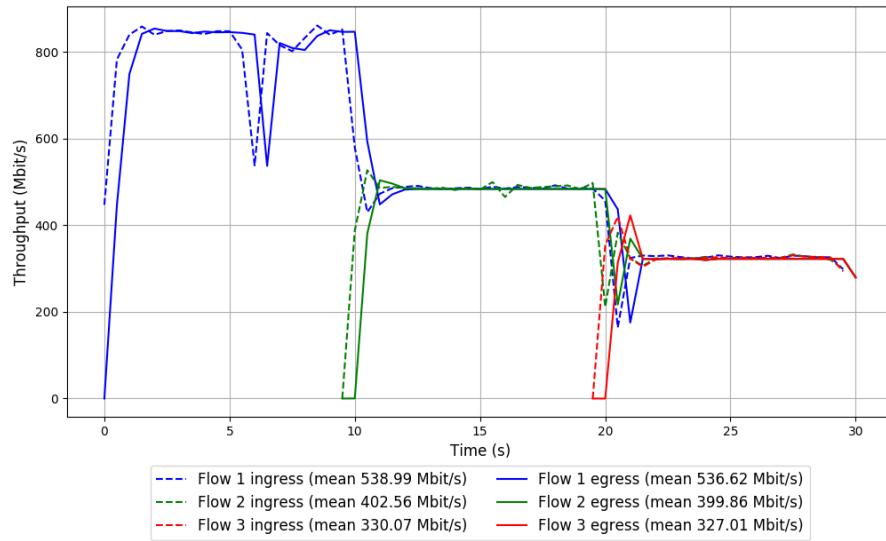
scheme	# runs	mean avg tput (Mbit/s)			mean 95th-%ile delay (ms)			mean loss rate (%)		
		flow 1	flow 2	flow 3	flow 1	flow 2	flow 3	flow 1	flow 2	flow 3
TCP BBR	3	536.45	400.88	324.89	24.32	41.40	47.57	0.41	0.78	1.09
TCP Cubic	3	509.48	389.44	297.50	7.05	7.16	6.75	0.05	0.09	0.26
Indigo	3	166.38	151.78	76.82	1.08	1.09	1.11	0.06	0.08	0.22
Muses-25	3	0.00	0.00	0.00	3.62	3.41	3.48	0.00	0.00	0.00

Run 1: Statistics of TCP BBR

```
Start at: 2018-08-31 05:42:06
End at: 2018-08-31 05:42:36
Local clock offset: 2.43 ms
Remote clock offset: 0.269 ms

# Below is generated by plot.py at 2018-08-31 06:06:45
# Datalink statistics
-- Total of 3 flows:
Average throughput: 911.74 Mbit/s
95th percentile per-packet one-way delay: 25.487 ms
Loss rate: 0.66%
-- Flow 1:
Average throughput: 536.62 Mbit/s
95th percentile per-packet one-way delay: 21.934 ms
Loss rate: 0.51%
-- Flow 2:
Average throughput: 399.86 Mbit/s
95th percentile per-packet one-way delay: 31.401 ms
Loss rate: 0.77%
-- Flow 3:
Average throughput: 327.01 Mbit/s
95th percentile per-packet one-way delay: 56.920 ms
Loss rate: 1.13%
```

Run 1: Report of TCP BBR — Data Link

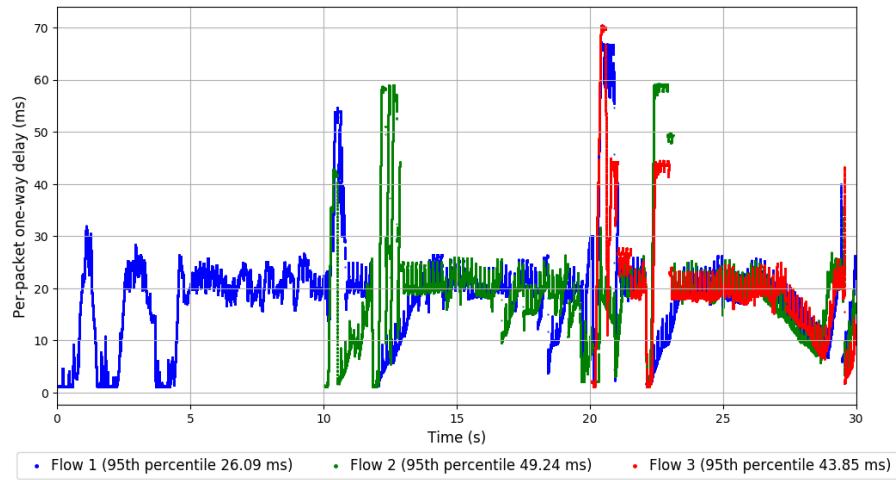
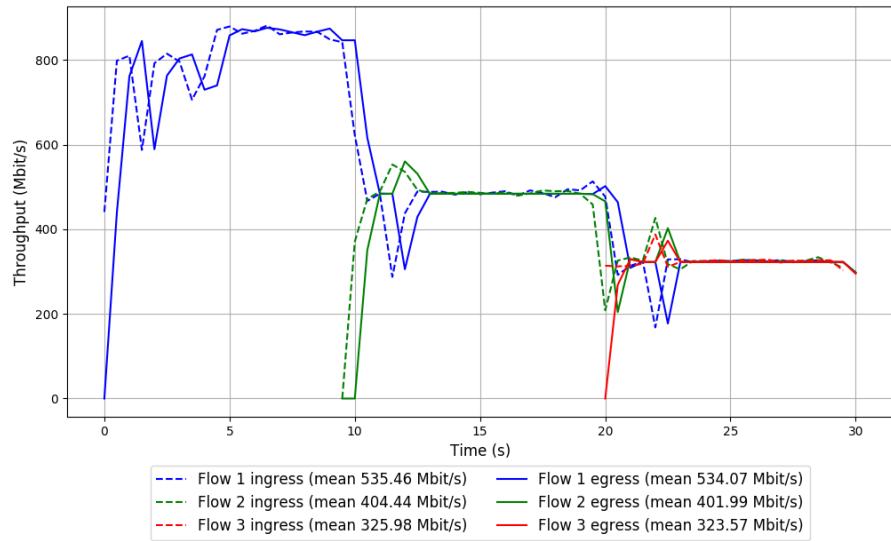


Run 2: Statistics of TCP BBR

```
Start at: 2018-08-31 05:48:36
End at: 2018-08-31 05:49:06
Local clock offset: 2.305 ms
Remote clock offset: -0.286 ms

# Below is generated by plot.py at 2018-08-31 06:06:45
# Datalink statistics
-- Total of 3 flows:
Average throughput: 909.17 Mbit/s
95th percentile per-packet one-way delay: 34.976 ms
Loss rate: 0.51%
-- Flow 1:
Average throughput: 534.07 Mbit/s
95th percentile per-packet one-way delay: 26.085 ms
Loss rate: 0.32%
-- Flow 2:
Average throughput: 401.99 Mbit/s
95th percentile per-packet one-way delay: 49.242 ms
Loss rate: 0.70%
-- Flow 3:
Average throughput: 323.57 Mbit/s
95th percentile per-packet one-way delay: 43.854 ms
Loss rate: 0.94%
```

Run 2: Report of TCP BBR — Data Link

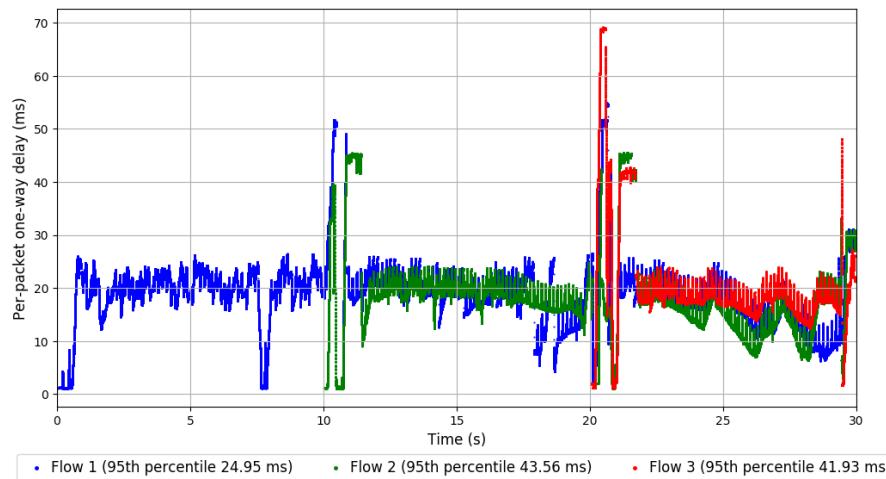
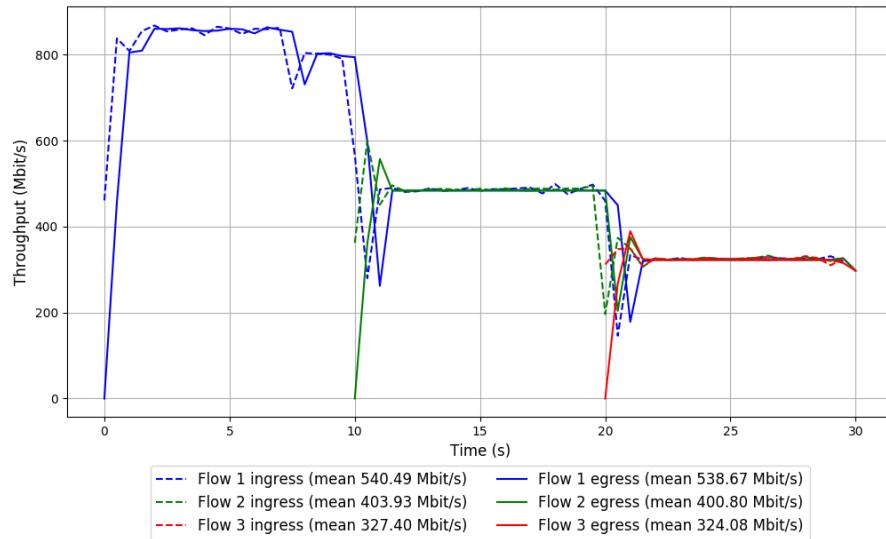


Run 3: Statistics of TCP BBR

```
Start at: 2018-08-31 05:55:05
End at: 2018-08-31 05:55:35
Local clock offset: 1.661 ms
Remote clock offset: -0.597 ms

# Below is generated by plot.py at 2018-08-31 06:06:45
# Datalink statistics
-- Total of 3 flows:
Average throughput: 913.01 Mbit/s
95th percentile per-packet one-way delay: 30.075 ms
Loss rate: 0.63%
-- Flow 1:
Average throughput: 538.67 Mbit/s
95th percentile per-packet one-way delay: 24.951 ms
Loss rate: 0.39%
-- Flow 2:
Average throughput: 400.80 Mbit/s
95th percentile per-packet one-way delay: 43.557 ms
Loss rate: 0.86%
-- Flow 3:
Average throughput: 324.08 Mbit/s
95th percentile per-packet one-way delay: 41.934 ms
Loss rate: 1.20%
```

Run 3: Report of TCP BBR — Data Link

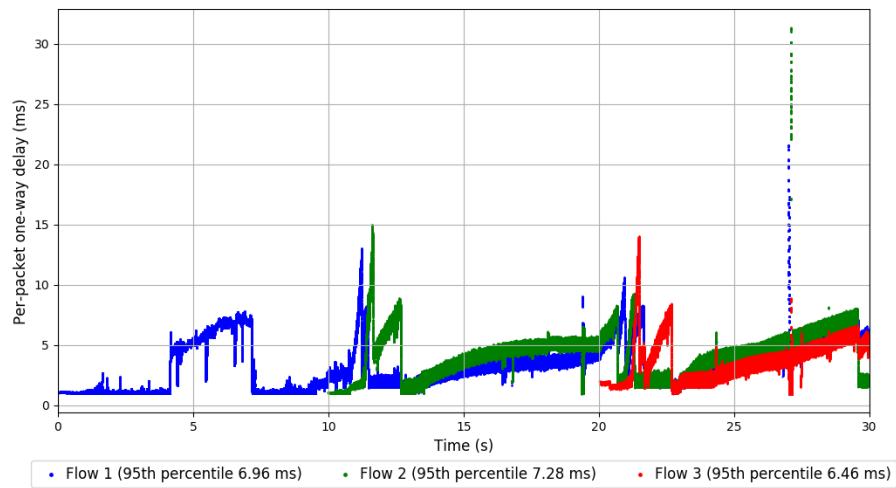
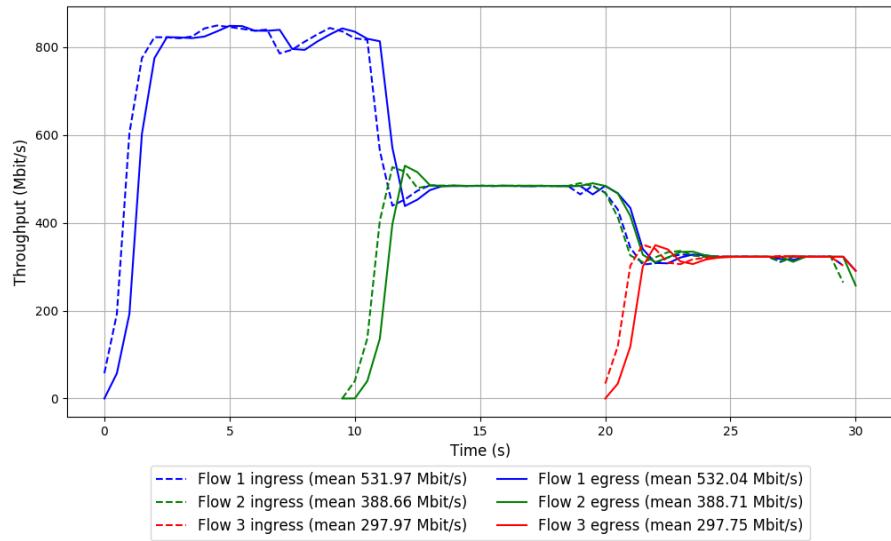


```
Run 1: Statistics of TCP Cubic
```

```
Start at: 2018-08-31 05:38:48
End at: 2018-08-31 05:39:18
Local clock offset: 2.313 ms
Remote clock offset: 0.699 ms

# Below is generated by plot.py at 2018-08-31 06:06:45
# Datalink statistics
-- Total of 3 flows:
Average throughput: 890.00 Mbit/s
95th percentile per-packet one-way delay: 7.018 ms
Loss rate: 0.08%
-- Flow 1:
Average throughput: 532.04 Mbit/s
95th percentile per-packet one-way delay: 6.955 ms
Loss rate: 0.05%
-- Flow 2:
Average throughput: 388.71 Mbit/s
95th percentile per-packet one-way delay: 7.276 ms
Loss rate: 0.08%
-- Flow 3:
Average throughput: 297.75 Mbit/s
95th percentile per-packet one-way delay: 6.464 ms
Loss rate: 0.26%
```

Run 1: Report of TCP Cubic — Data Link

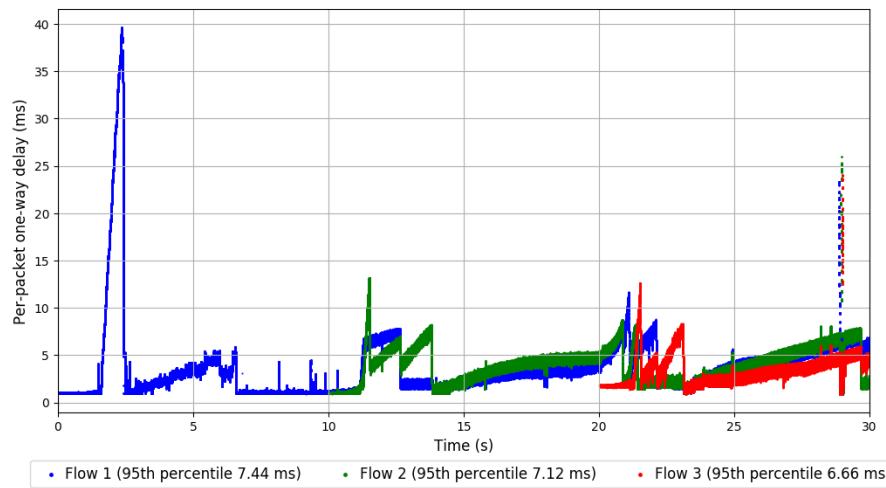
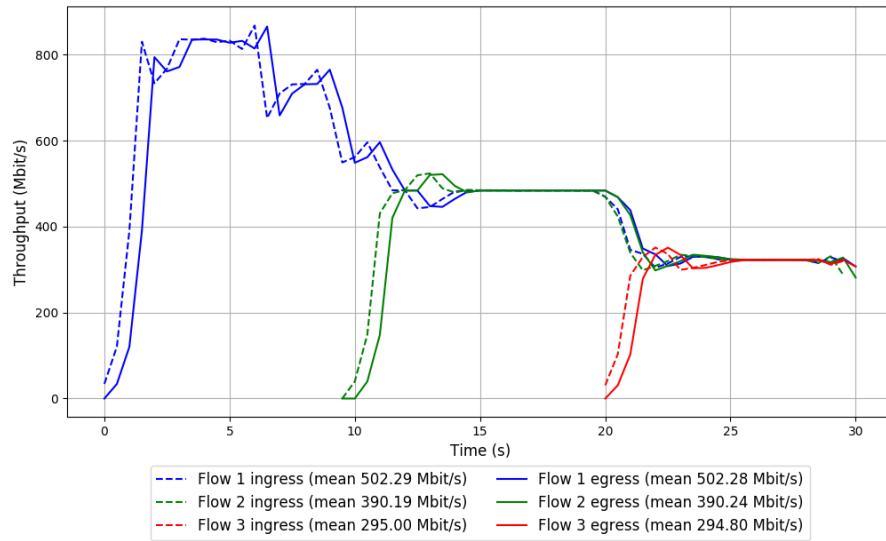


Run 2: Statistics of TCP Cubic

```
Start at: 2018-08-31 05:45:19
End at: 2018-08-31 05:45:49
Local clock offset: 2.564 ms
Remote clock offset: -0.013 ms

# Below is generated by plot.py at 2018-08-31 06:06:45
# Datalink statistics
-- Total of 3 flows:
Average throughput: 860.21 Mbit/s
95th percentile per-packet one-way delay: 7.231 ms
Loss rate: 0.09%
-- Flow 1:
Average throughput: 502.28 Mbit/s
95th percentile per-packet one-way delay: 7.440 ms
Loss rate: 0.07%
-- Flow 2:
Average throughput: 390.24 Mbit/s
95th percentile per-packet one-way delay: 7.116 ms
Loss rate: 0.08%
-- Flow 3:
Average throughput: 294.80 Mbit/s
95th percentile per-packet one-way delay: 6.659 ms
Loss rate: 0.27%
```

Run 2: Report of TCP Cubic — Data Link

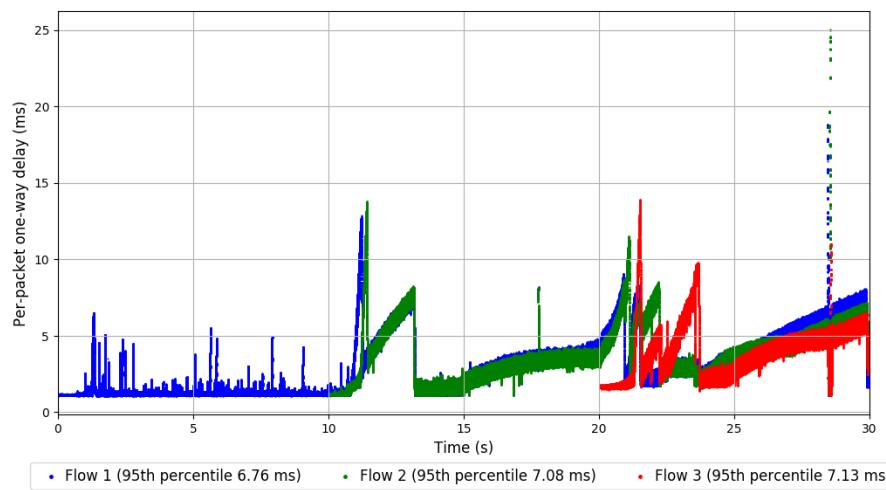
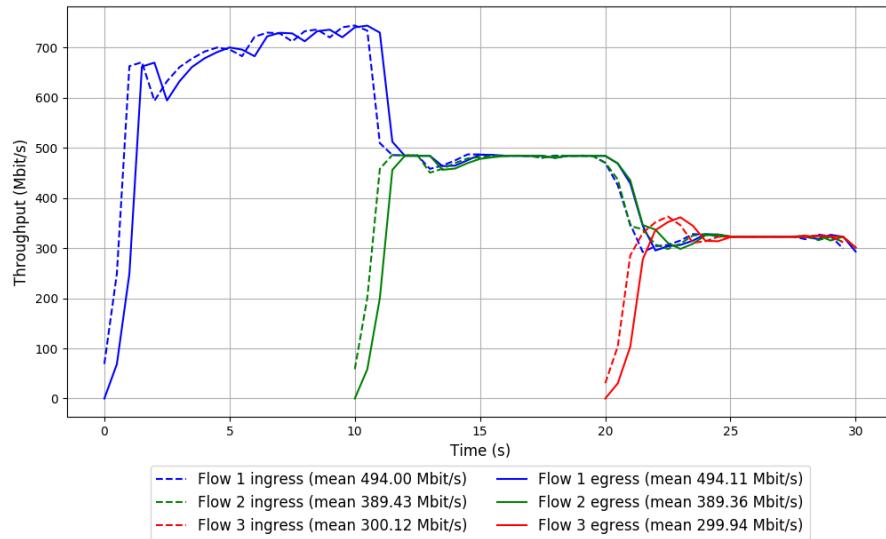


Run 3: Statistics of TCP Cubic

```
Start at: 2018-08-31 05:51:48
End at: 2018-08-31 05:52:18
Local clock offset: 1.89 ms
Remote clock offset: -0.428 ms

# Below is generated by plot.py at 2018-08-31 06:06:45
# Datalink statistics
-- Total of 3 flows:
Average throughput: 852.93 Mbit/s
95th percentile per-packet one-way delay: 6.891 ms
Loss rate: 0.08%
-- Flow 1:
Average throughput: 494.11 Mbit/s
95th percentile per-packet one-way delay: 6.758 ms
Loss rate: 0.04%
-- Flow 2:
Average throughput: 389.36 Mbit/s
95th percentile per-packet one-way delay: 7.081 ms
Loss rate: 0.10%
-- Flow 3:
Average throughput: 299.94 Mbit/s
95th percentile per-packet one-way delay: 7.133 ms
Loss rate: 0.24%
```

Run 3: Report of TCP Cubic — Data Link

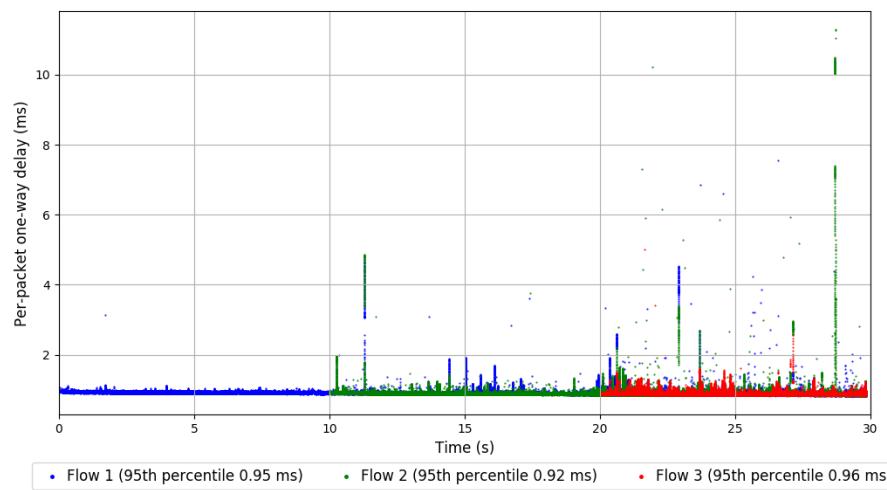
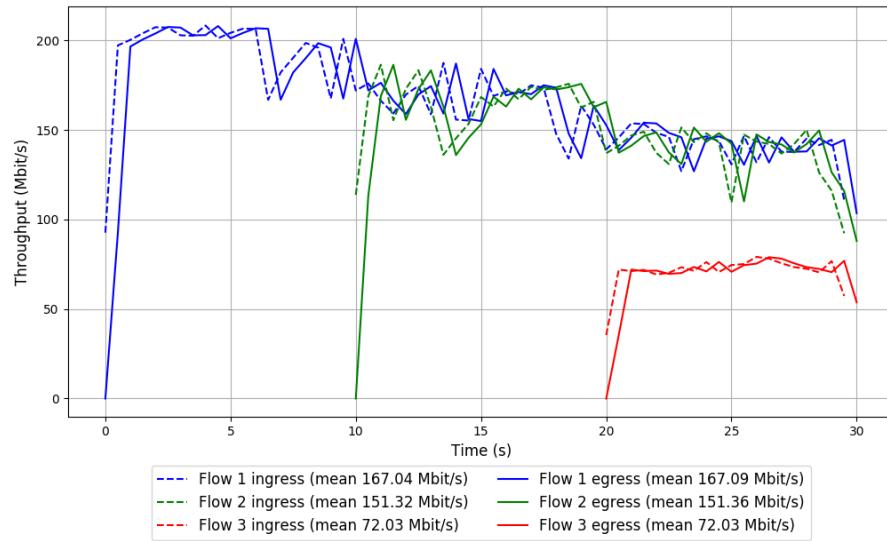


Run 1: Statistics of Indigo

```
Start at: 2018-08-31 05:40:35
End at: 2018-08-31 05:41:05
Local clock offset: 2.276 ms
Remote clock offset: 0.431 ms

# Below is generated by plot.py at 2018-08-31 06:06:45
# Datalink statistics
-- Total of 3 flows:
Average throughput: 291.29 Mbit/s
95th percentile per-packet one-way delay: 0.944 ms
Loss rate: 0.09%
-- Flow 1:
Average throughput: 167.09 Mbit/s
95th percentile per-packet one-way delay: 0.947 ms
Loss rate: 0.08%
-- Flow 2:
Average throughput: 151.36 Mbit/s
95th percentile per-packet one-way delay: 0.924 ms
Loss rate: 0.08%
-- Flow 3:
Average throughput: 72.03 Mbit/s
95th percentile per-packet one-way delay: 0.957 ms
Loss rate: 0.25%
```

Run 1: Report of Indigo — Data Link

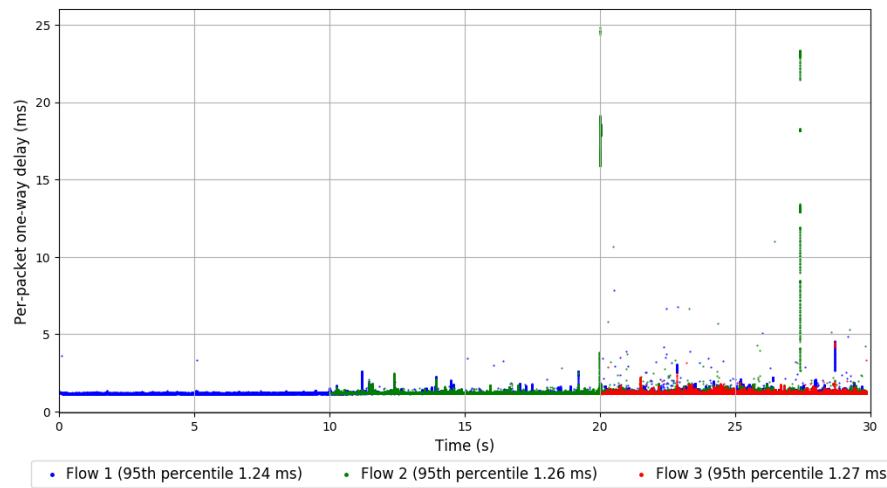
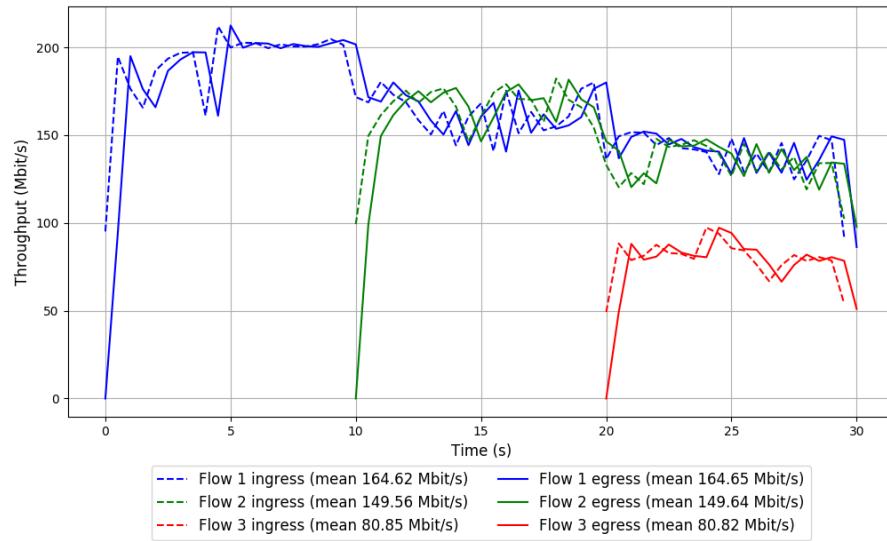


Run 2: Statistics of Indigo

```
Start at: 2018-08-31 05:47:05
End at: 2018-08-31 05:47:35
Local clock offset: 2.572 ms
Remote clock offset: -0.164 ms

# Below is generated by plot.py at 2018-08-31 06:06:45
# Datalink statistics
-- Total of 3 flows:
Average throughput: 290.57 Mbit/s
95th percentile per-packet one-way delay: 1.249 ms
Loss rate: 0.08%
-- Flow 1:
Average throughput: 164.65 Mbit/s
95th percentile per-packet one-way delay: 1.241 ms
Loss rate: 0.06%
-- Flow 2:
Average throughput: 149.64 Mbit/s
95th percentile per-packet one-way delay: 1.258 ms
Loss rate: 0.09%
-- Flow 3:
Average throughput: 80.82 Mbit/s
95th percentile per-packet one-way delay: 1.267 ms
Loss rate: 0.20%
```

Run 2: Report of Indigo — Data Link

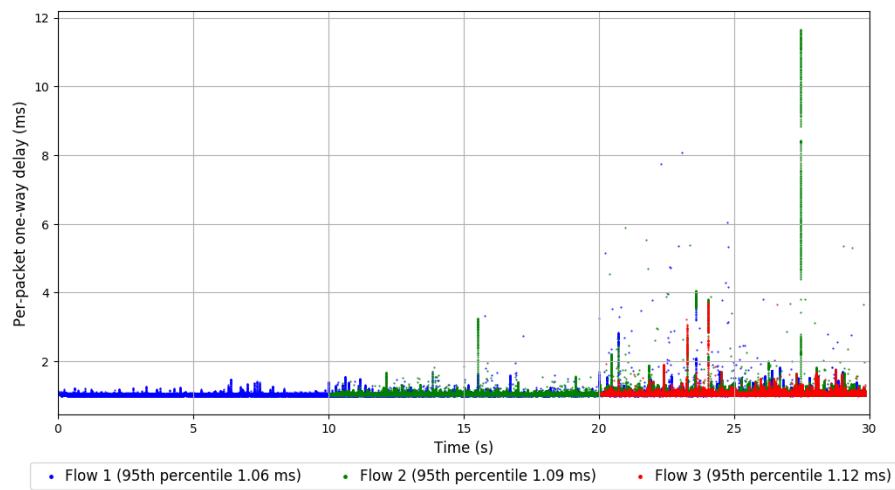
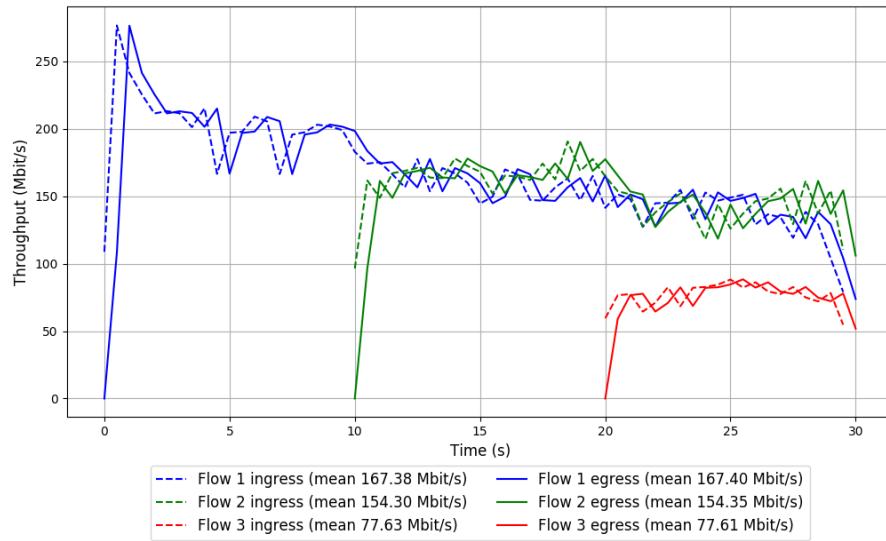


Run 3: Statistics of Indigo

```
Start at: 2018-08-31 05:53:34
End at: 2018-08-31 05:54:04
Local clock offset: 1.674 ms
Remote clock offset: -0.512 ms

# Below is generated by plot.py at 2018-08-31 06:06:45
# Datalink statistics
-- Total of 3 flows:
Average throughput: 295.25 Mbit/s
95th percentile per-packet one-way delay: 1.077 ms
Loss rate: 0.08%
-- Flow 1:
Average throughput: 167.40 Mbit/s
95th percentile per-packet one-way delay: 1.060 ms
Loss rate: 0.05%
-- Flow 2:
Average throughput: 154.35 Mbit/s
95th percentile per-packet one-way delay: 1.087 ms
Loss rate: 0.08%
-- Flow 3:
Average throughput: 77.61 Mbit/s
95th percentile per-packet one-way delay: 1.116 ms
Loss rate: 0.22%
```

Run 3: Report of Indigo — Data Link

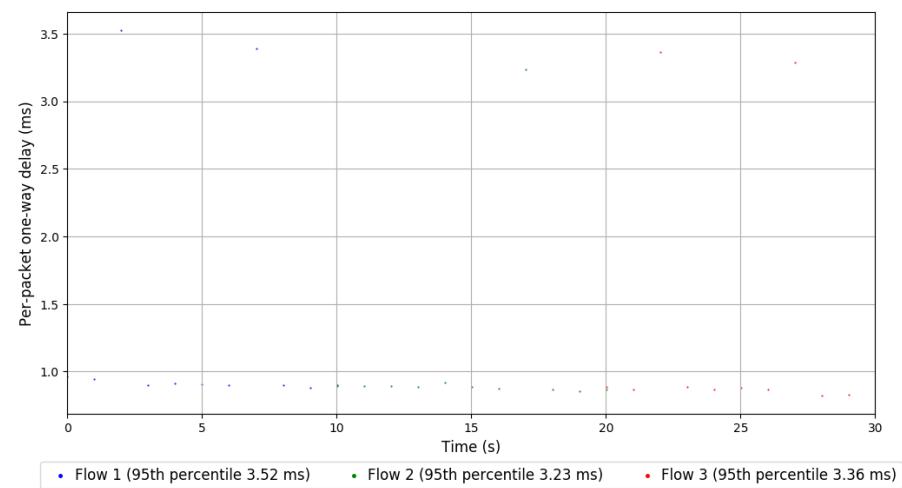
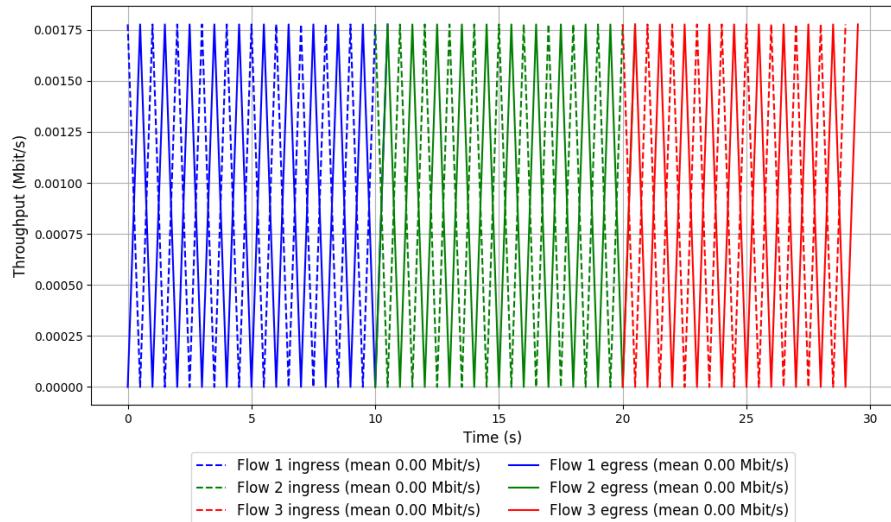


```
Run 1: Statistics of Muses-25
```

```
Start at: 2018-08-31 05:37:30
End at: 2018-08-31 05:38:00
Local clock offset: 2.243 ms
Remote clock offset: 0.991 ms

# Below is generated by plot.py at 2018-08-31 06:06:45
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 3.361 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 3.523 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 3.235 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 3.361 ms
Loss rate: 0.00%
```

Run 1: Report of Muses-25 — Data Link

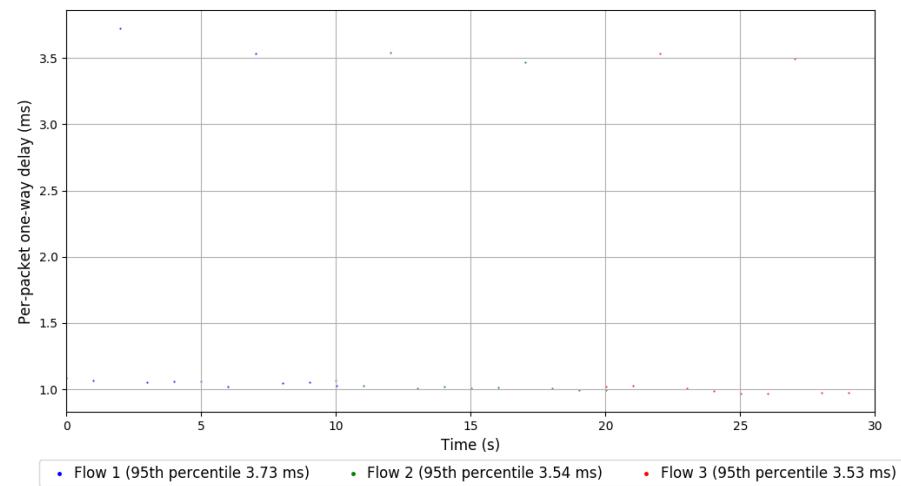
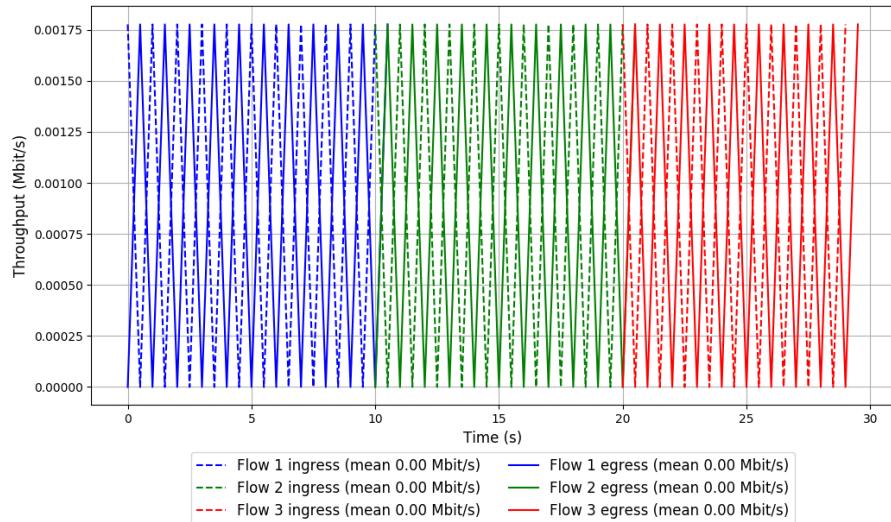


Run 2: Statistics of Muses-25

```
Start at: 2018-08-31 05:44:01
End at: 2018-08-31 05:44:31
Local clock offset: 2.544 ms
Remote clock offset: 0.068 ms

# Below is generated by plot.py at 2018-08-31 06:06:45
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 3.533 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 3.725 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 3.545 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 3.533 ms
Loss rate: 0.00%
```

Run 2: Report of Muses-25 — Data Link



Run 3: Statistics of Muses-25

```
Start at: 2018-08-31 05:50:30
End at: 2018-08-31 05:51:00
Local clock offset: 2.039 ms
Remote clock offset: -0.356 ms

# Below is generated by plot.py at 2018-08-31 06:06:45
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 3.450 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 3.607 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 3.450 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 3.558 ms
Loss rate: 0.00%
```

Run 3: Report of Muses-25 — Data Link

