

Pantheon Report

Generated at 2018-09-03 10:15:55 (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.

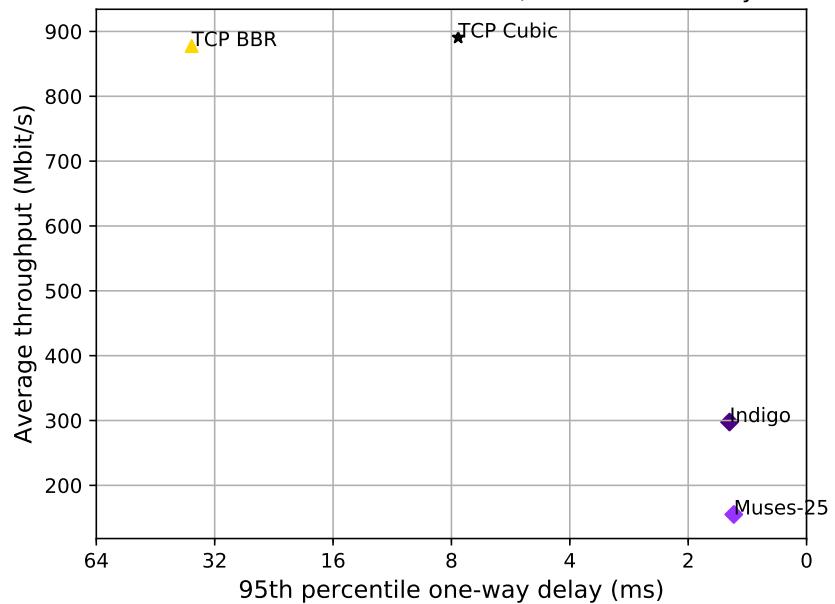
System info:

```
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
```

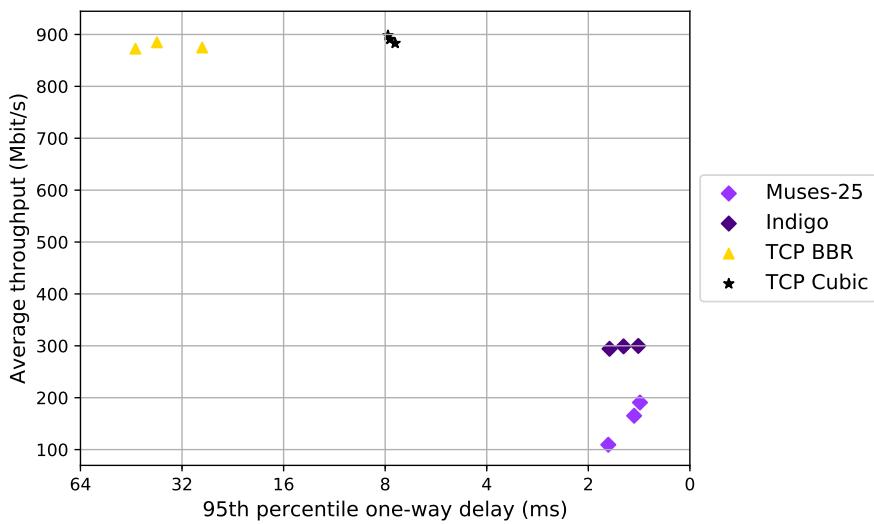
Git summary:

```
branch: muses @ 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 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



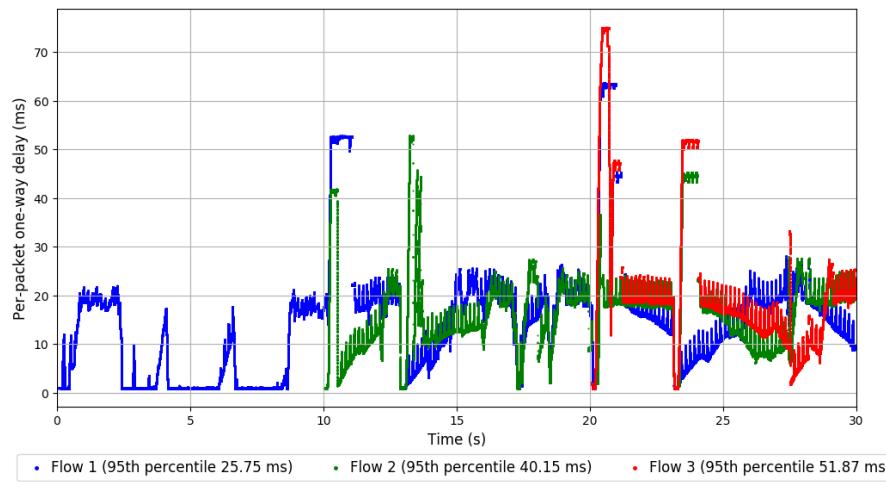
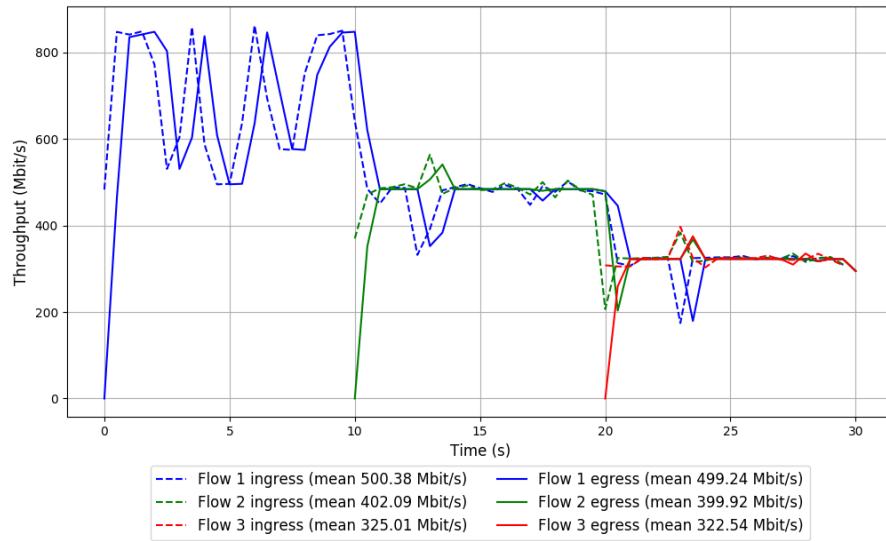
scheme	# runs	mean avg tput (Mbit/s)			mean 95th-%ile delay (ms)			mean loss rate (%)		
		flow 1	flow 2	flow 3	flow 1	flow 2	flow 3	flow 1	flow 2	flow 3
TCP BBR	3	502.28	401.56	324.49	24.37	43.95	52.83	0.37	0.70	1.06
TCP Cubic	3	539.10	390.02	275.83	7.96	7.28	5.88	0.05	0.10	0.25
Indigo	3	162.31	150.87	106.84	1.29	1.31	1.34	0.04	0.09	0.22
Muses-25	3	77.72	85.75	61.43	1.23	1.23	1.24	0.01	0.07	0.16

Run 1: Statistics of TCP BBR

```
Start at: 2018-09-03 09:46:19
End at: 2018-09-03 09:46:49
Local clock offset: 7.673 ms
Remote clock offset: -1.217 ms

# Below is generated by plot.py at 2018-09-03 10:15:42
# Datalink statistics
-- Total of 3 flows:
Average throughput: 872.58 Mbit/s
95th percentile per-packet one-way delay: 43.983 ms
Loss rate: 0.48%
-- Flow 1:
Average throughput: 499.24 Mbit/s
95th percentile per-packet one-way delay: 25.747 ms
Loss rate: 0.29%
-- Flow 2:
Average throughput: 399.92 Mbit/s
95th percentile per-packet one-way delay: 40.147 ms
Loss rate: 0.64%
-- Flow 3:
Average throughput: 322.54 Mbit/s
95th percentile per-packet one-way delay: 51.872 ms
Loss rate: 0.96%
```

Run 1: Report of TCP BBR — Data Link

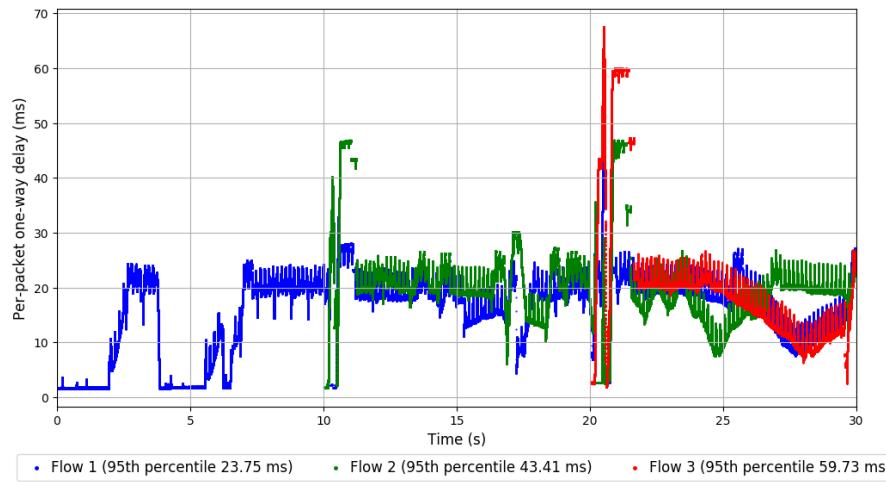
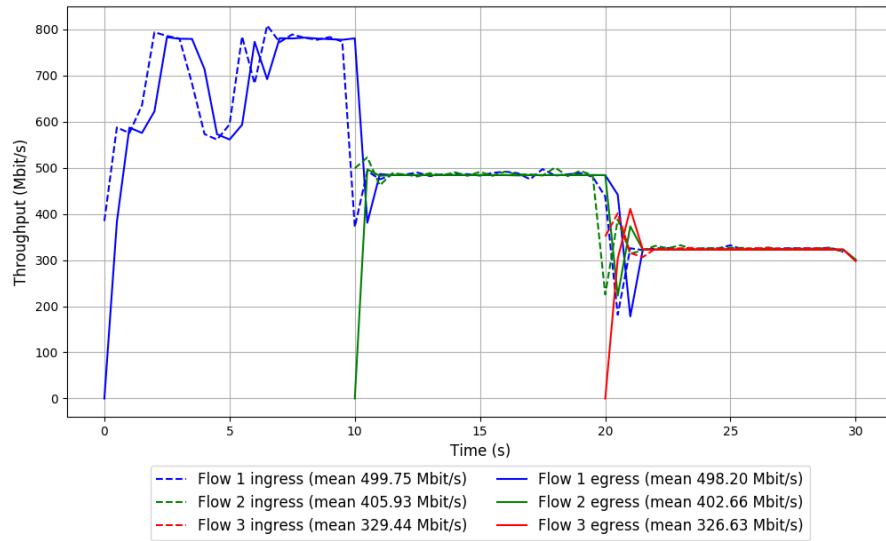


Run 2: Statistics of TCP BBR

```
Start at: 2018-09-03 09:52:52
End at: 2018-09-03 09:53:22
Local clock offset: 7.993 ms
Remote clock offset: -0.828 ms

# Below is generated by plot.py at 2018-09-03 10:15:44
# Datalink statistics
-- Total of 3 flows:
Average throughput: 874.80 Mbit/s
95th percentile per-packet one-way delay: 27.892 ms
Loss rate: 0.62%
-- Flow 1:
Average throughput: 498.20 Mbit/s
95th percentile per-packet one-way delay: 23.755 ms
Loss rate: 0.37%
-- Flow 2:
Average throughput: 402.66 Mbit/s
95th percentile per-packet one-way delay: 43.409 ms
Loss rate: 0.90%
-- Flow 3:
Average throughput: 326.63 Mbit/s
95th percentile per-packet one-way delay: 59.728 ms
Loss rate: 1.05%
```

Run 2: Report of TCP BBR — Data Link

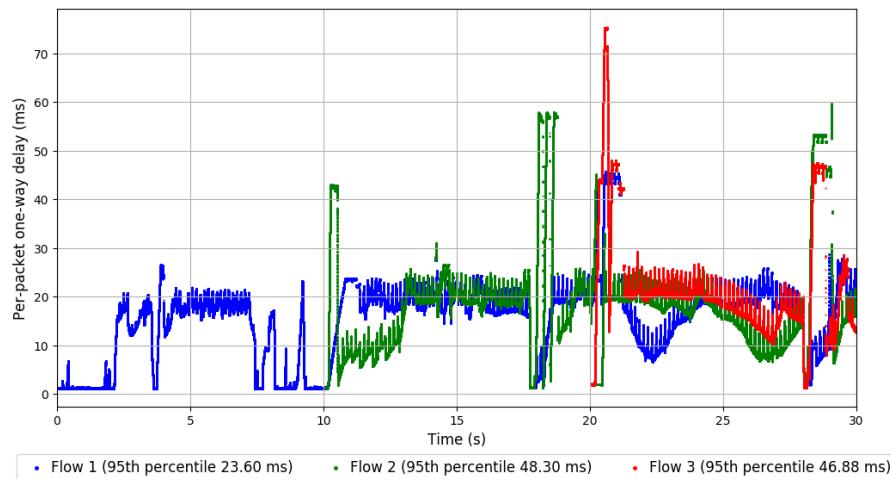
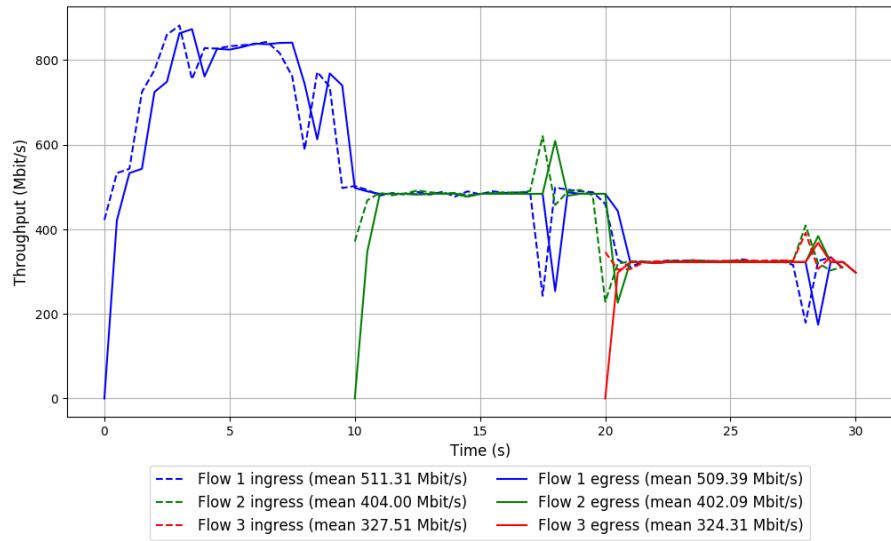


Run 3: Statistics of TCP BBR

```
Start at: 2018-09-03 09:59:24
End at: 2018-09-03 09:59:54
Local clock offset: 4.786 ms
Remote clock offset: -0.645 ms

# Below is generated by plot.py at 2018-09-03 10:15:51
# Datalink statistics
-- Total of 3 flows:
Average throughput: 884.78 Mbit/s
95th percentile per-packet one-way delay: 37.972 ms
Loss rate: 0.56%
-- Flow 1:
Average throughput: 509.39 Mbit/s
95th percentile per-packet one-way delay: 23.601 ms
Loss rate: 0.44%
-- Flow 2:
Average throughput: 402.09 Mbit/s
95th percentile per-packet one-way delay: 48.302 ms
Loss rate: 0.56%
-- Flow 3:
Average throughput: 324.31 Mbit/s
95th percentile per-packet one-way delay: 46.877 ms
Loss rate: 1.17%
```

Run 3: Report of TCP BBR — Data Link

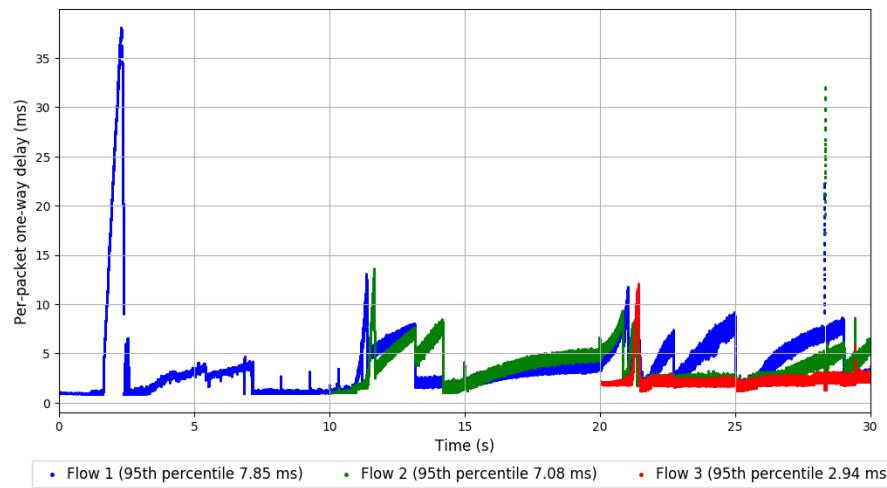
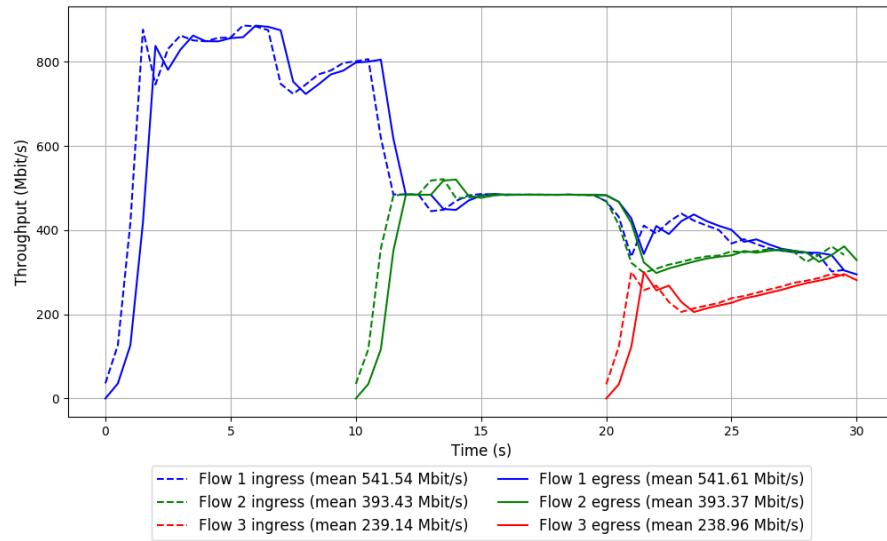


```
Run 1: Statistics of TCP Cubic
```

```
Start at: 2018-09-03 09:51:06
End at: 2018-09-03 09:51:36
Local clock offset: 8.7 ms
Remote clock offset: -0.815 ms

# Below is generated by plot.py at 2018-09-03 10:15:51
# Datalink statistics
-- Total of 3 flows:
Average throughput: 883.01 Mbit/s
95th percentile per-packet one-way delay: 7.475 ms
Loss rate: 0.08%
-- Flow 1:
Average throughput: 541.61 Mbit/s
95th percentile per-packet one-way delay: 7.851 ms
Loss rate: 0.05%
-- Flow 2:
Average throughput: 393.37 Mbit/s
95th percentile per-packet one-way delay: 7.084 ms
Loss rate: 0.10%
-- Flow 3:
Average throughput: 238.96 Mbit/s
95th percentile per-packet one-way delay: 2.940 ms
Loss rate: 0.26%
```

Run 1: Report of TCP Cubic — Data Link

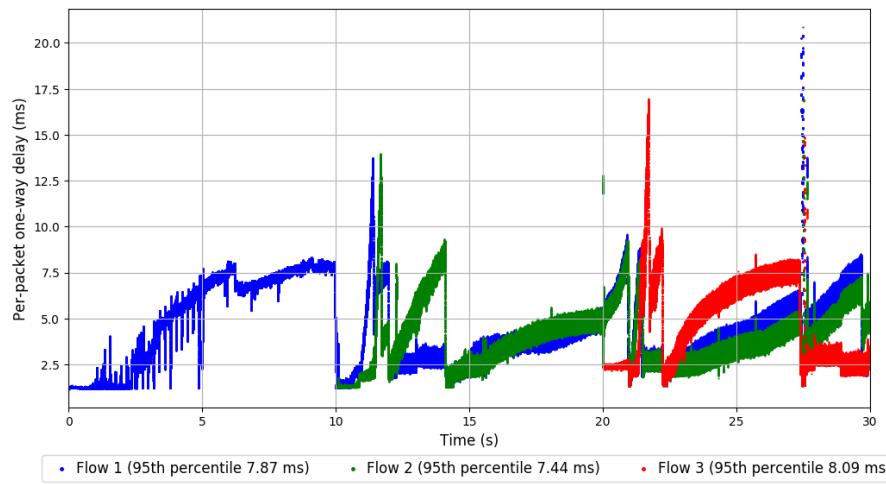
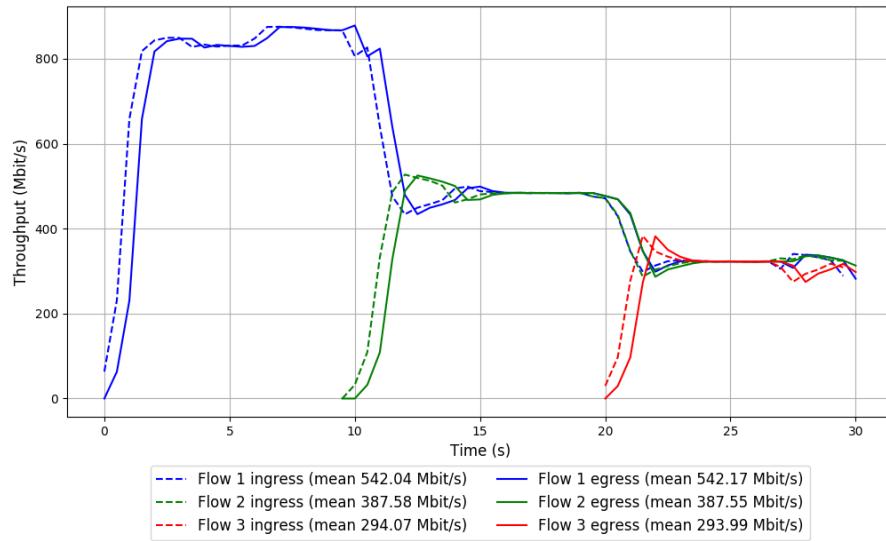


Run 2: Statistics of TCP Cubic

```
Start at: 2018-09-03 09:57:36
End at: 2018-09-03 09:58:06
Local clock offset: 5.406 ms
Remote clock offset: -0.602 ms

# Below is generated by plot.py at 2018-09-03 10:15:53
# Datalink statistics
-- Total of 3 flows:
Average throughput: 898.02 Mbit/s
95th percentile per-packet one-way delay: 7.849 ms
Loss rate: 0.08%
-- Flow 1:
Average throughput: 542.17 Mbit/s
95th percentile per-packet one-way delay: 7.865 ms
Loss rate: 0.04%
-- Flow 2:
Average throughput: 387.55 Mbit/s
95th percentile per-packet one-way delay: 7.443 ms
Loss rate: 0.10%
-- Flow 3:
Average throughput: 293.99 Mbit/s
95th percentile per-packet one-way delay: 8.092 ms
Loss rate: 0.22%
```

Run 2: Report of TCP Cubic — Data Link

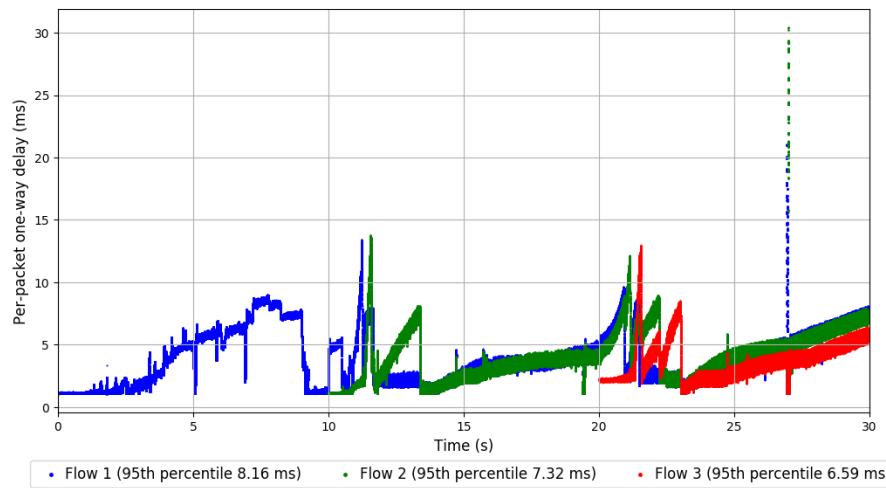
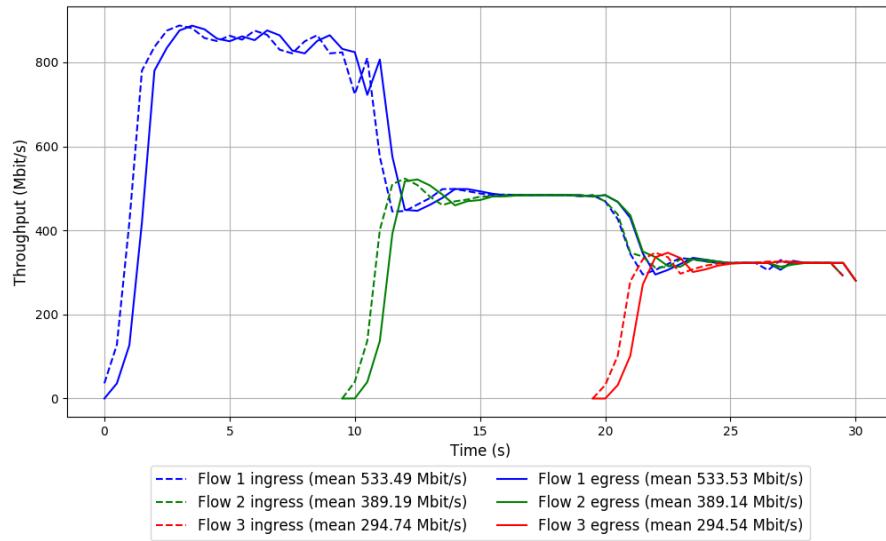


Run 3: Statistics of TCP Cubic

```
Start at: 2018-09-03 10:04:10
End at: 2018-09-03 10:04:40
Local clock offset: 4.074 ms
Remote clock offset: -0.605 ms

# Below is generated by plot.py at 2018-09-03 10:15:53
# Datalink statistics
-- Total of 3 flows:
Average throughput: 890.79 Mbit/s
95th percentile per-packet one-way delay: 7.746 ms
Loss rate: 0.09%
-- Flow 1:
Average throughput: 533.53 Mbit/s
95th percentile per-packet one-way delay: 8.165 ms
Loss rate: 0.05%
-- Flow 2:
Average throughput: 389.14 Mbit/s
95th percentile per-packet one-way delay: 7.320 ms
Loss rate: 0.10%
-- Flow 3:
Average throughput: 294.54 Mbit/s
95th percentile per-packet one-way delay: 6.594 ms
Loss rate: 0.26%
```

Run 3: Report of TCP Cubic — Data Link

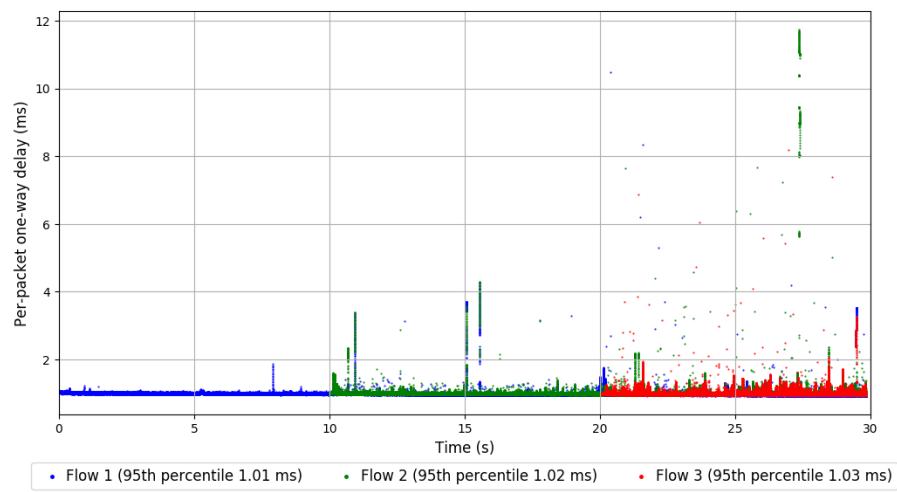
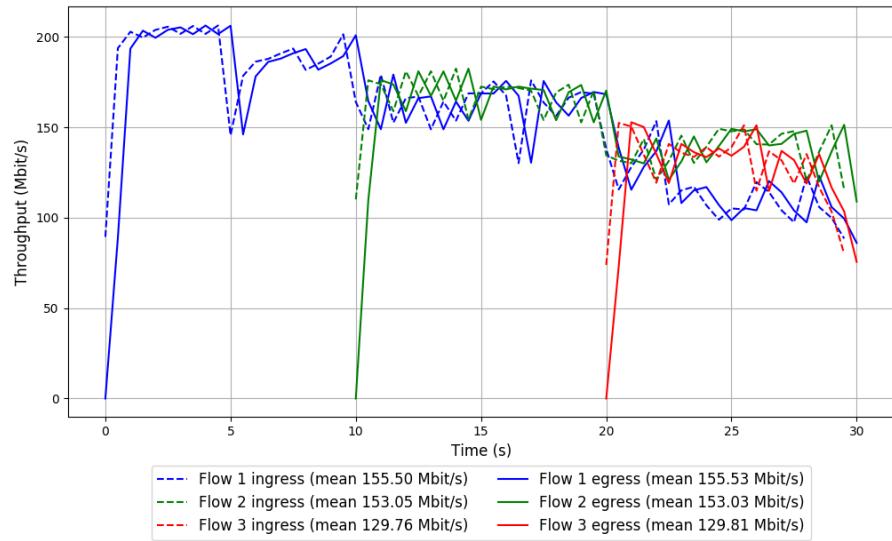


Run 1: Statistics of Indigo

```
Start at: 2018-09-03 09:48:11
End at: 2018-09-03 09:48:41
Local clock offset: 8.089 ms
Remote clock offset: -1.067 ms

# Below is generated by plot.py at 2018-09-03 10:15:53
# Datalink statistics
-- Total of 3 flows:
Average throughput: 299.73 Mbit/s
95th percentile per-packet one-way delay: 1.016 ms
Loss rate: 0.08%
-- Flow 1:
Average throughput: 155.53 Mbit/s
95th percentile per-packet one-way delay: 1.015 ms
Loss rate: 0.03%
-- Flow 2:
Average throughput: 153.03 Mbit/s
95th percentile per-packet one-way delay: 1.018 ms
Loss rate: 0.11%
-- Flow 3:
Average throughput: 129.81 Mbit/s
95th percentile per-packet one-way delay: 1.031 ms
Loss rate: 0.18%
```

Run 1: Report of Indigo — Data Link

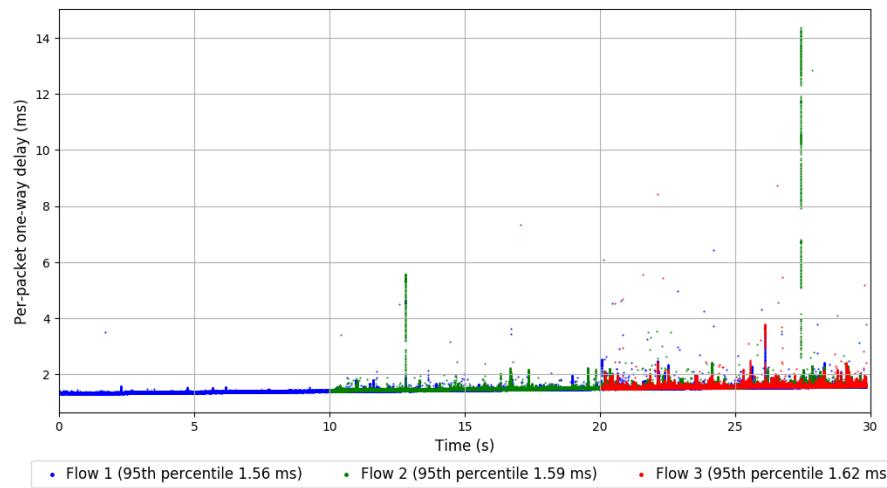
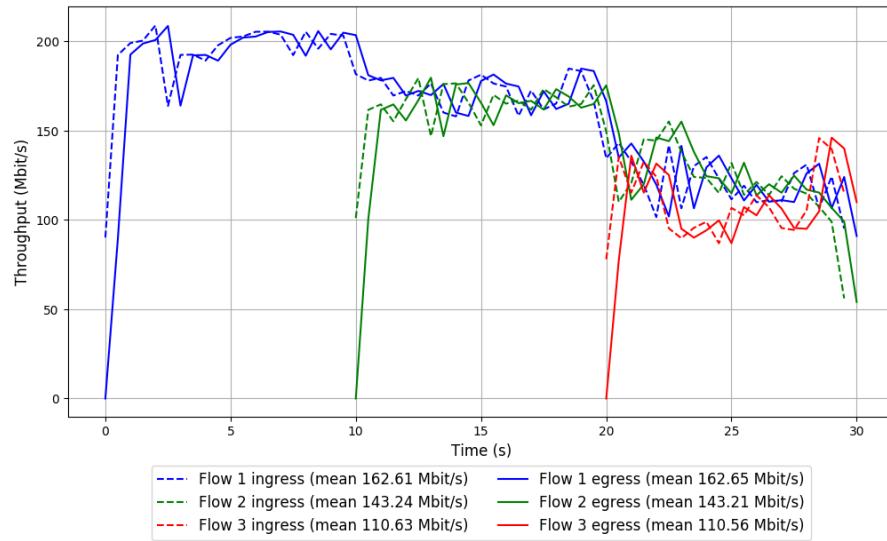


Run 2: Statistics of Indigo

```
Start at: 2018-09-03 09:54:45
End at: 2018-09-03 09:55:15
Local clock offset: 6.67 ms
Remote clock offset: -0.668 ms

# Below is generated by plot.py at 2018-09-03 10:15:53
# Datalink statistics
-- Total of 3 flows:
Average throughput: 294.23 Mbit/s
95th percentile per-packet one-way delay: 1.582 ms
Loss rate: 0.07%
-- Flow 1:
Average throughput: 162.65 Mbit/s
95th percentile per-packet one-way delay: 1.556 ms
Loss rate: 0.05%
-- Flow 2:
Average throughput: 143.21 Mbit/s
95th percentile per-packet one-way delay: 1.589 ms
Loss rate: 0.05%
-- Flow 3:
Average throughput: 110.56 Mbit/s
95th percentile per-packet one-way delay: 1.622 ms
Loss rate: 0.24%
```

Run 2: Report of Indigo — Data Link

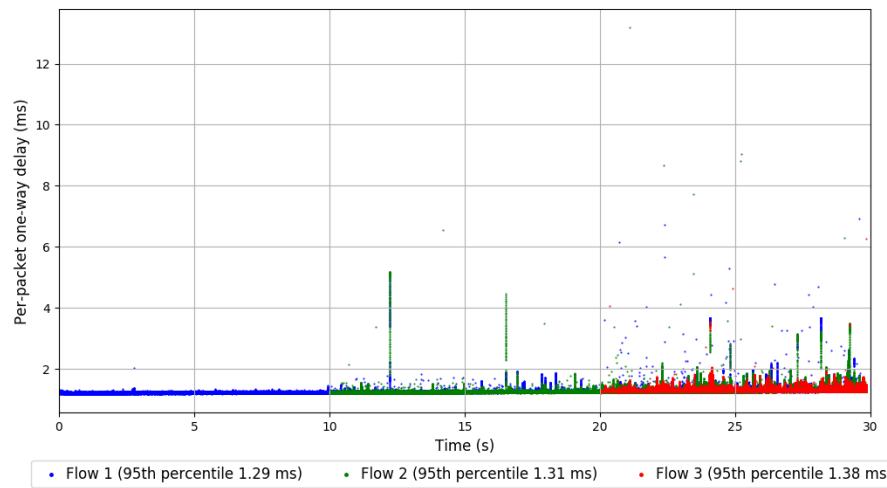
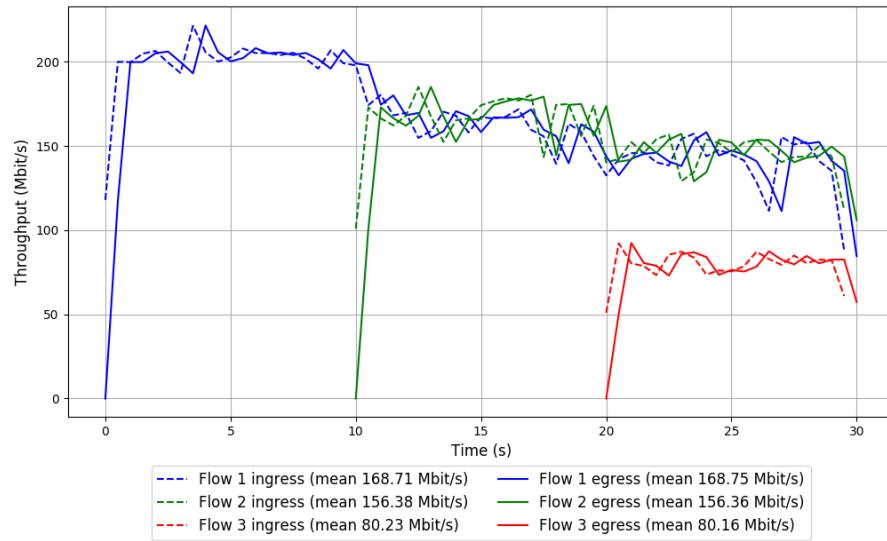


Run 3: Statistics of Indigo

```
Start at: 2018-09-03 10:01:17
End at: 2018-09-03 10:01:47
Local clock offset: 4.461 ms
Remote clock offset: -0.632 ms

# Below is generated by plot.py at 2018-09-03 10:15:53
# Datalink statistics
-- Total of 3 flows:
Average throughput: 298.97 Mbit/s
95th percentile per-packet one-way delay: 1.306 ms
Loss rate: 0.08%
-- Flow 1:
Average throughput: 168.75 Mbit/s
95th percentile per-packet one-way delay: 1.291 ms
Loss rate: 0.03%
-- Flow 2:
Average throughput: 156.36 Mbit/s
95th percentile per-packet one-way delay: 1.310 ms
Loss rate: 0.11%
-- Flow 3:
Average throughput: 80.16 Mbit/s
95th percentile per-packet one-way delay: 1.380 ms
Loss rate: 0.23%
```

Run 3: Report of Indigo — Data Link

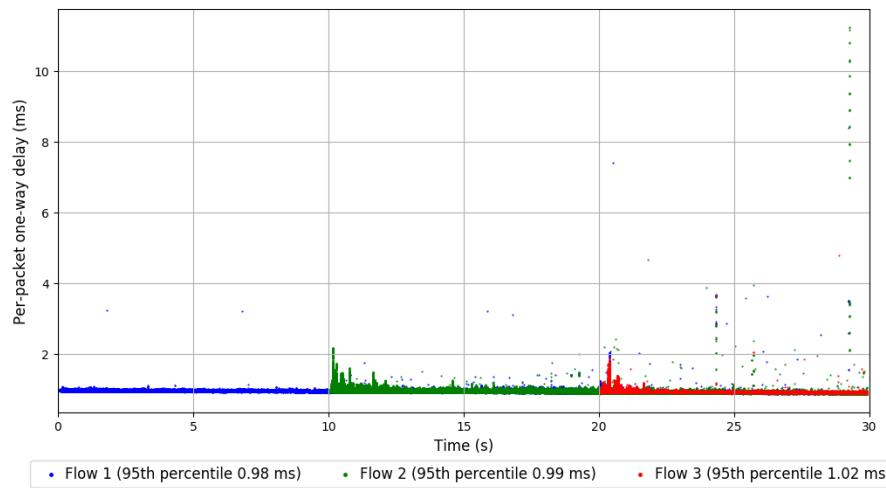
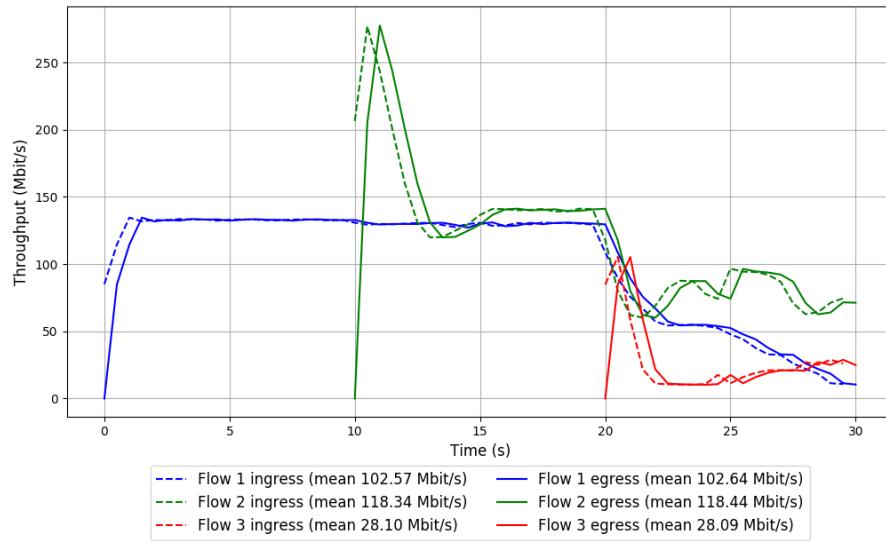


Run 1: Statistics of Muses-25

```
Start at: 2018-09-03 09:49:42
End at: 2018-09-03 09:50:12
Local clock offset: 8.416 ms
Remote clock offset: -0.913 ms

# Below is generated by plot.py at 2018-09-03 10:15:53
# Datalink statistics
-- Total of 3 flows:
Average throughput: 190.73 Mbit/s
95th percentile per-packet one-way delay: 0.983 ms
Loss rate: 0.04%
-- Flow 1:
Average throughput: 102.64 Mbit/s
95th percentile per-packet one-way delay: 0.980 ms
Loss rate: 0.01%
-- Flow 2:
Average throughput: 118.44 Mbit/s
95th percentile per-packet one-way delay: 0.991 ms
Loss rate: 0.07%
-- Flow 3:
Average throughput: 28.09 Mbit/s
95th percentile per-packet one-way delay: 1.016 ms
Loss rate: 0.22%
```

Run 1: Report of Muses-25 — Data Link

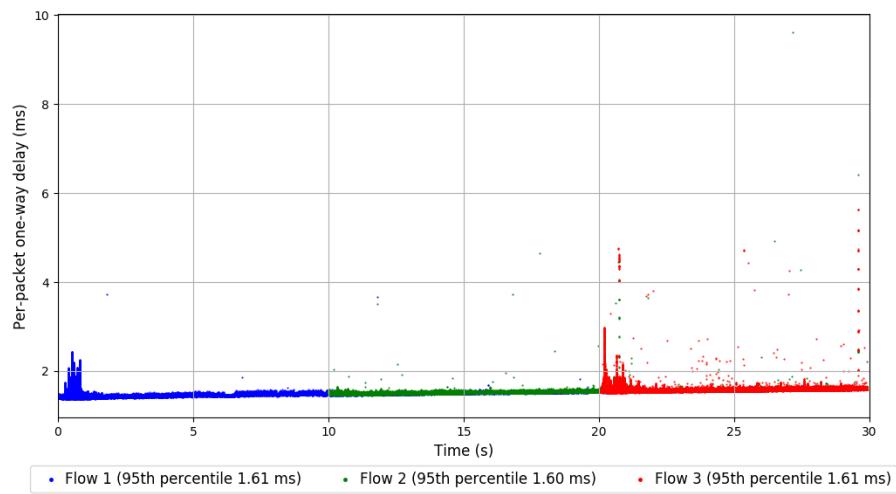
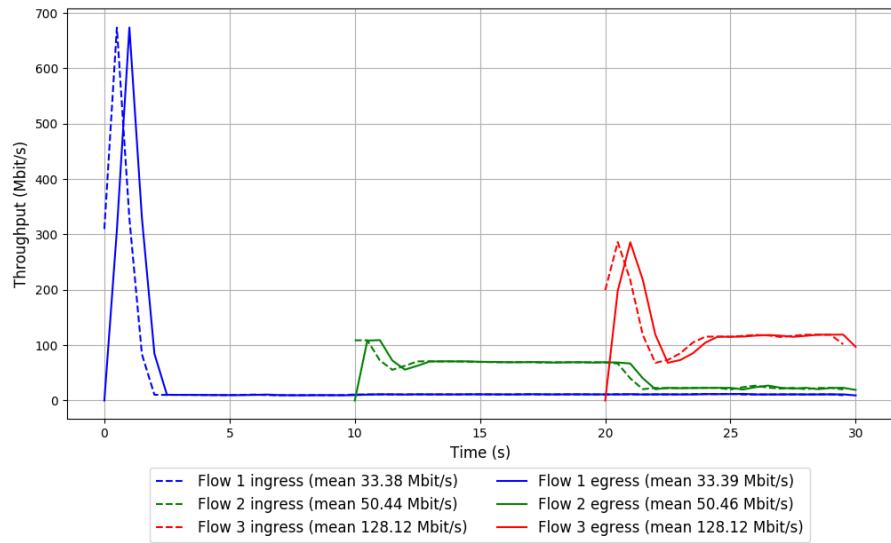


Run 2: Statistics of Muses-25

```
Start at: 2018-09-03 09:56:15
End at: 2018-09-03 09:56:45
Local clock offset: 5.991 ms
Remote clock offset: -0.708 ms

# Below is generated by plot.py at 2018-09-03 10:15:53
# Datalink statistics
-- Total of 3 flows:
Average throughput: 109.36 Mbit/s
95th percentile per-packet one-way delay: 1.607 ms
Loss rate: 0.09%
-- Flow 1:
Average throughput: 33.39 Mbit/s
95th percentile per-packet one-way delay: 1.611 ms
Loss rate: 0.02%
-- Flow 2:
Average throughput: 50.46 Mbit/s
95th percentile per-packet one-way delay: 1.601 ms
Loss rate: 0.04%
-- Flow 3:
Average throughput: 128.12 Mbit/s
95th percentile per-packet one-way delay: 1.613 ms
Loss rate: 0.19%
```

Run 2: Report of Muses-25 — Data Link



Run 3: Statistics of Muses-25

```
Start at: 2018-09-03 10:02:47
End at: 2018-09-03 10:03:17
Local clock offset: 4.135 ms
Remote clock offset: -0.56 ms

# Below is generated by plot.py at 2018-09-03 10:15:53
# Datalink statistics
-- Total of 3 flows:
Average throughput: 165.20 Mbit/s
95th percentile per-packet one-way delay: 1.098 ms
Loss rate: 0.04%
-- Flow 1:
Average throughput: 97.13 Mbit/s
95th percentile per-packet one-way delay: 1.089 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 88.34 Mbit/s
95th percentile per-packet one-way delay: 1.111 ms
Loss rate: 0.09%
-- Flow 3:
Average throughput: 28.09 Mbit/s
95th percentile per-packet one-way delay: 1.104 ms
Loss rate: 0.07%
```

Run 3: Report of Muses-25 — Data Link

