

Pantheon Report

Generated at 2018-08-31 10:17:08 (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.

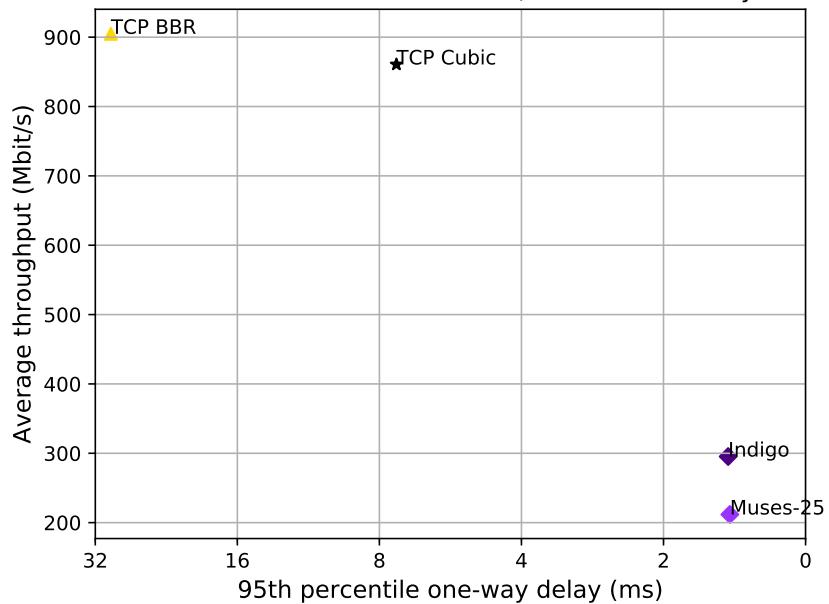
System info:

```
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
```

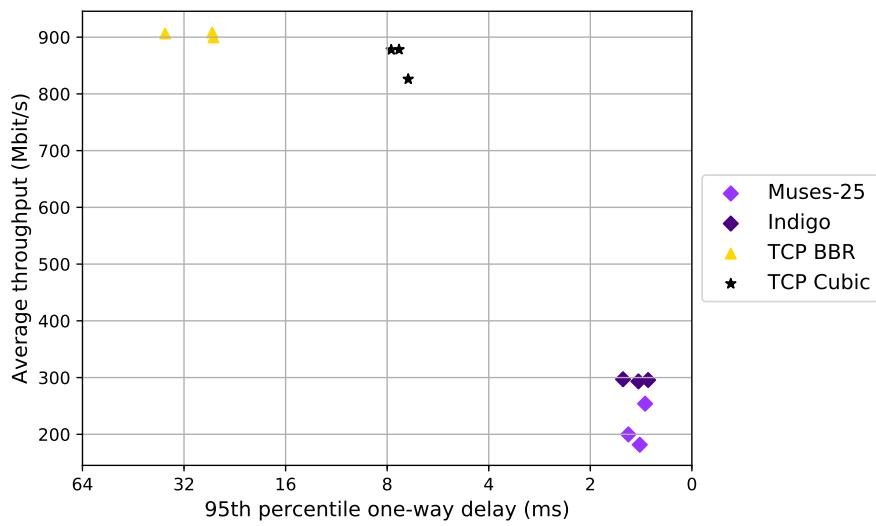
Git summary:

```
branch: muses @ e3c5aa19ca94c3066828fb83f16a8fb6b2731e7a
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



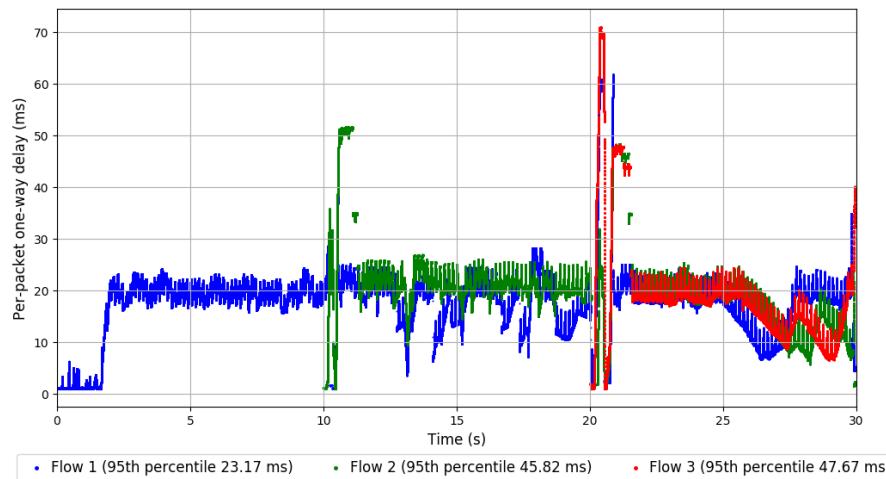
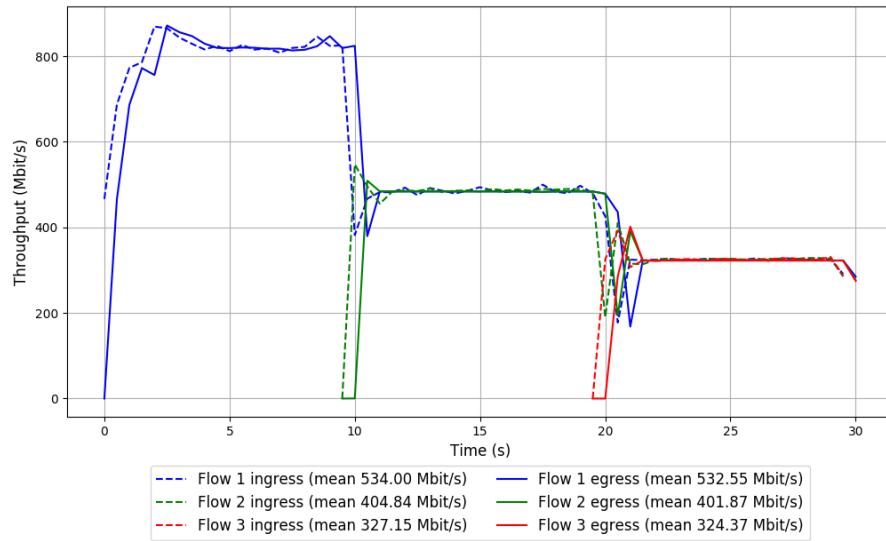
scheme	# runs	mean avg tput (Mbit/s)			mean 95th-%ile delay (ms)			mean loss rate (%)		
		flow 1	flow 2	flow 3	flow 1	flow 2	flow 3	flow 1	flow 2	flow 3
TCP BBR	3	528.90	403.25	322.89	24.44	45.45	48.23	0.36	0.69	1.09
TCP Cubic	3	505.42	384.29	299.27	8.51	6.84	6.84	0.06	0.11	0.26
Indigo	3	167.31	152.12	82.08	1.09	1.08	1.08	0.04	0.08	0.21
Muses-25	3	84.50	126.22	130.78	1.05	1.07	1.06	0.01	0.03	0.16

Run 1: Statistics of TCP BBR

```
Start at: 2018-08-31 09:46:17
End at: 2018-08-31 09:46:47
Local clock offset: 0.381 ms
Remote clock offset: -5.012 ms

# Below is generated by plot.py at 2018-08-31 10:17:04
# Datalink statistics
-- Total of 3 flows:
Average throughput: 908.22 Mbit/s
95th percentile per-packet one-way delay: 26.393 ms
Loss rate: 0.56%
-- Flow 1:
Average throughput: 532.55 Mbit/s
95th percentile per-packet one-way delay: 23.168 ms
Loss rate: 0.33%
-- Flow 2:
Average throughput: 401.87 Mbit/s
95th percentile per-packet one-way delay: 45.821 ms
Loss rate: 0.82%
-- Flow 3:
Average throughput: 324.37 Mbit/s
95th percentile per-packet one-way delay: 47.667 ms
Loss rate: 1.04%
```

Run 1: Report of TCP BBR — Data Link

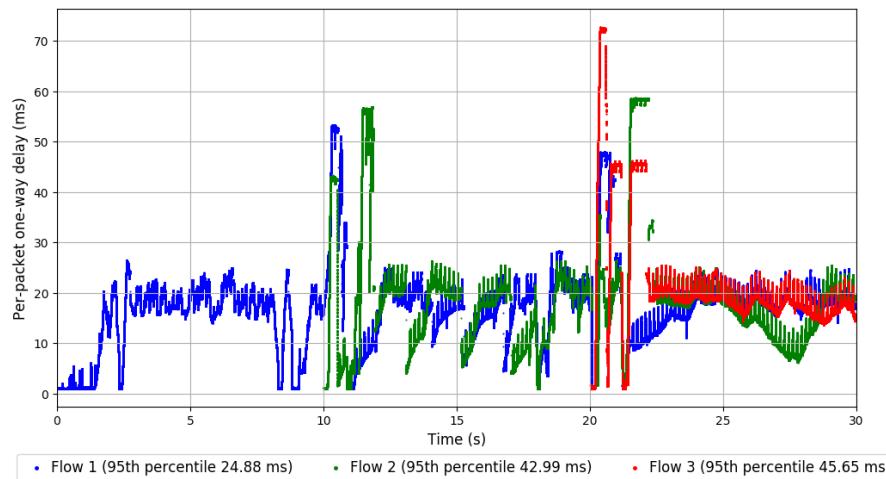
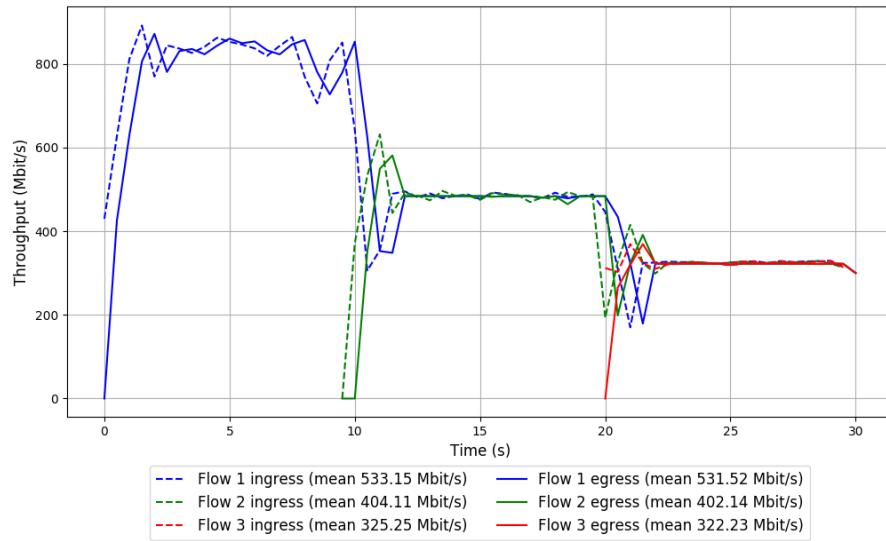


Run 2: Statistics of TCP BBR

```
Start at: 2018-08-31 09:52:54
End at: 2018-08-31 09:53:24
Local clock offset: 0.543 ms
Remote clock offset: -5.239 ms

# Below is generated by plot.py at 2018-08-31 10:17:04
# Datalink statistics
-- Total of 3 flows:
Average throughput: 906.46 Mbit/s
95th percentile per-packet one-way delay: 36.395 ms
Loss rate: 0.52%
-- Flow 1:
Average throughput: 531.52 Mbit/s
95th percentile per-packet one-way delay: 24.879 ms
Loss rate: 0.37%
-- Flow 2:
Average throughput: 402.14 Mbit/s
95th percentile per-packet one-way delay: 42.987 ms
Loss rate: 0.58%
-- Flow 3:
Average throughput: 322.23 Mbit/s
95th percentile per-packet one-way delay: 45.653 ms
Loss rate: 1.11%
```

Run 2: Report of TCP BBR — Data Link

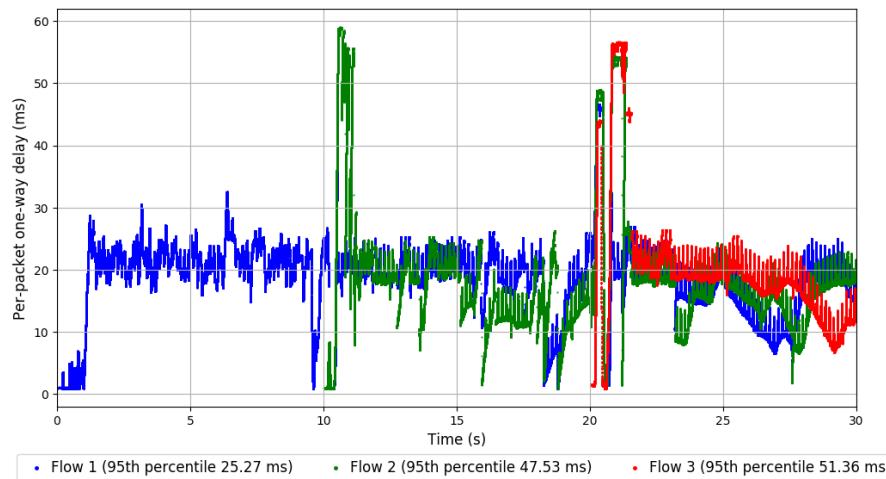
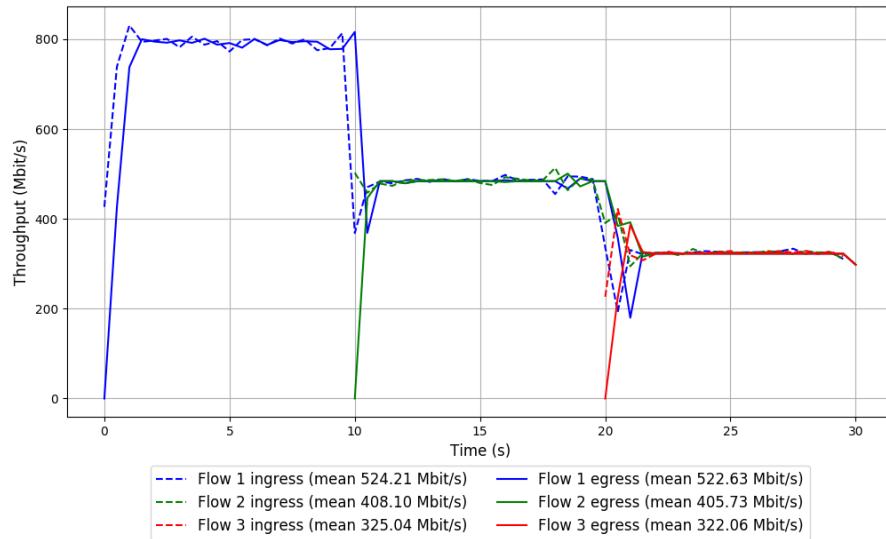


Run 3: Statistics of TCP BBR

```
Start at: 2018-08-31 09:59:32
End at: 2018-08-31 10:00:02
Local clock offset: 1.471 ms
Remote clock offset: -5.426 ms

# Below is generated by plot.py at 2018-08-31 10:17:04
# Datalink statistics
-- Total of 3 flows:
Average throughput: 899.64 Mbit/s
95th percentile per-packet one-way delay: 26.174 ms
Loss rate: 0.55%
-- Flow 1:
Average throughput: 522.63 Mbit/s
95th percentile per-packet one-way delay: 25.272 ms
Loss rate: 0.37%
-- Flow 2:
Average throughput: 405.73 Mbit/s
95th percentile per-packet one-way delay: 47.530 ms
Loss rate: 0.68%
-- Flow 3:
Average throughput: 322.06 Mbit/s
95th percentile per-packet one-way delay: 51.358 ms
Loss rate: 1.11%
```

Run 3: Report of TCP BBR — Data Link

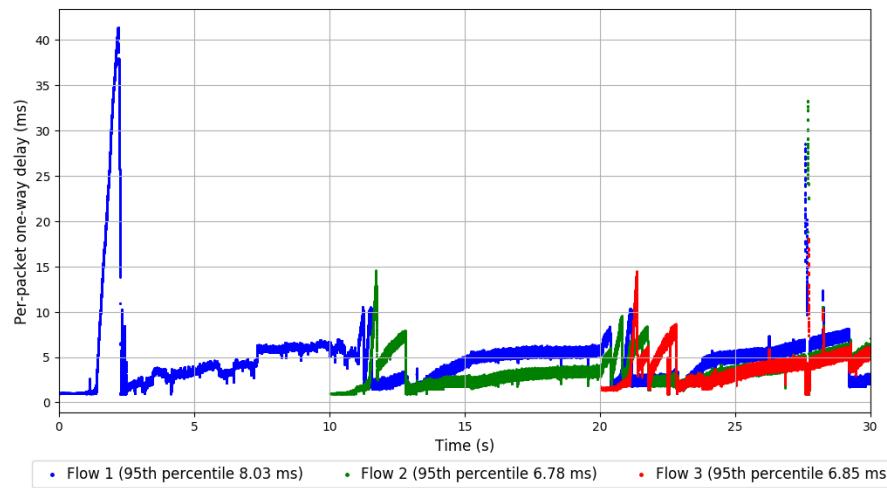
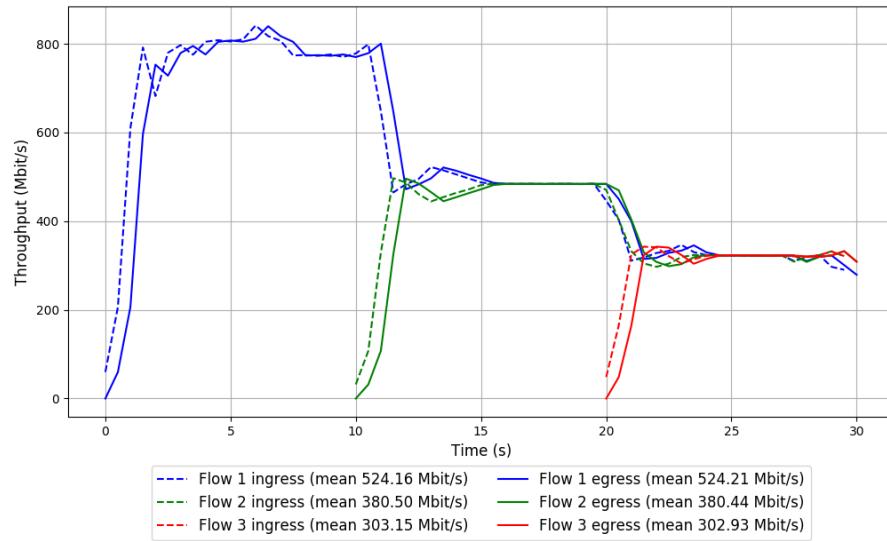


Run 1: Statistics of TCP Cubic

```
Start at: 2018-08-31 09:49:42
End at: 2018-08-31 09:50:12
Local clock offset: 0.457 ms
Remote clock offset: -5.145 ms

# Below is generated by plot.py at 2018-08-31 10:17:04
# Datalink statistics
-- Total of 3 flows:
Average throughput: 878.09 Mbit/s
95th percentile per-packet one-way delay: 7.377 ms
Loss rate: 0.09%
-- Flow 1:
Average throughput: 524.21 Mbit/s
95th percentile per-packet one-way delay: 8.028 ms
Loss rate: 0.05%
-- Flow 2:
Average throughput: 380.44 Mbit/s
95th percentile per-packet one-way delay: 6.778 ms
Loss rate: 0.10%
-- Flow 3:
Average throughput: 302.93 Mbit/s
95th percentile per-packet one-way delay: 6.850 ms
Loss rate: 0.26%
```

Run 1: Report of TCP Cubic — Data Link

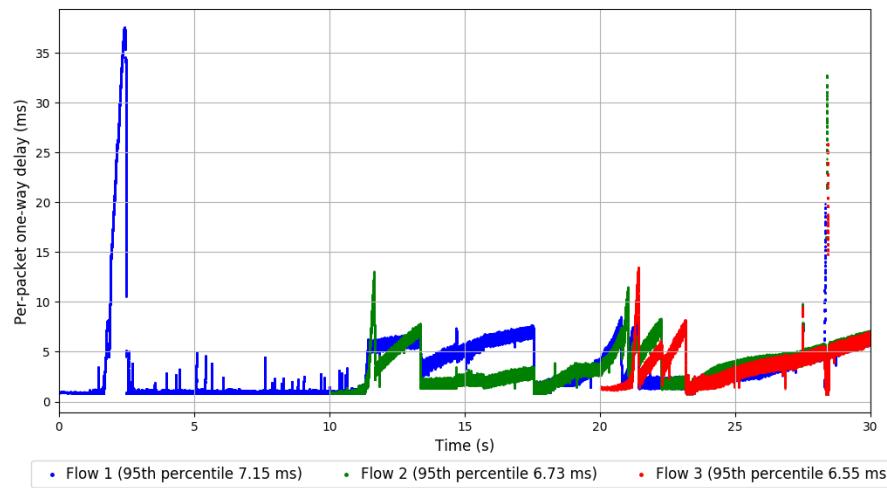
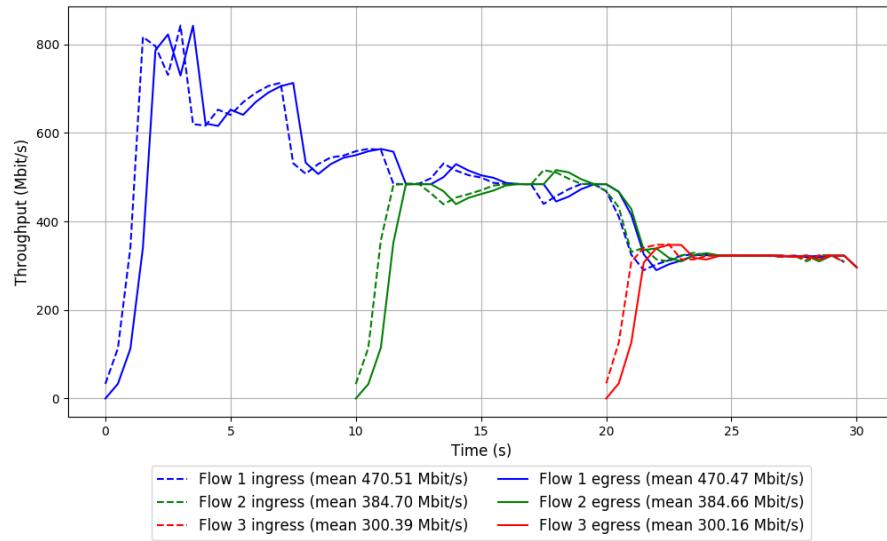


Run 2: Statistics of TCP Cubic

```
Start at: 2018-08-31 09:56:19
End at: 2018-08-31 09:56:49
Local clock offset: 0.843 ms
Remote clock offset: -5.377 ms

# Below is generated by plot.py at 2018-08-31 10:17:04
# Datalink statistics
-- Total of 3 flows:
Average throughput: 826.09 Mbit/s
95th percentile per-packet one-way delay: 6.929 ms
Loss rate: 0.11%
-- Flow 1:
Average throughput: 470.47 Mbit/s
95th percentile per-packet one-way delay: 7.148 ms
Loss rate: 0.07%
-- Flow 2:
Average throughput: 384.66 Mbit/s
95th percentile per-packet one-way delay: 6.727 ms
Loss rate: 0.11%
-- Flow 3:
Average throughput: 300.16 Mbit/s
95th percentile per-packet one-way delay: 6.548 ms
Loss rate: 0.26%
```

Run 2: Report of TCP Cubic — Data Link

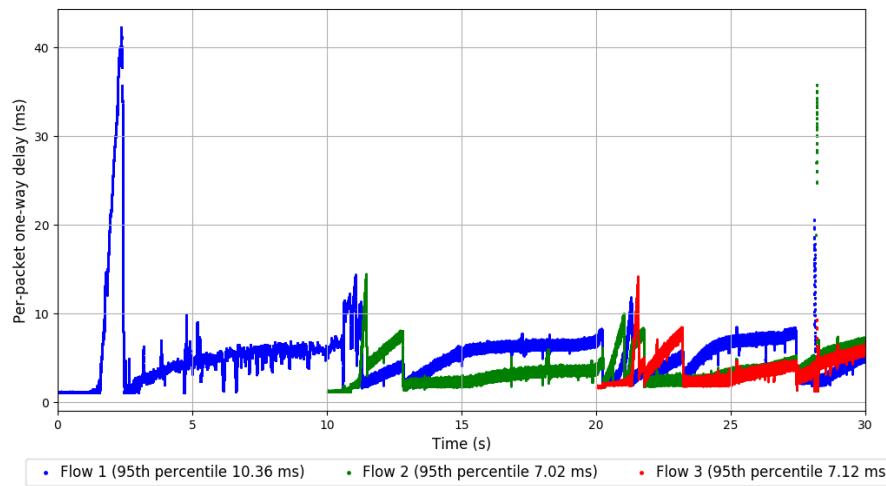
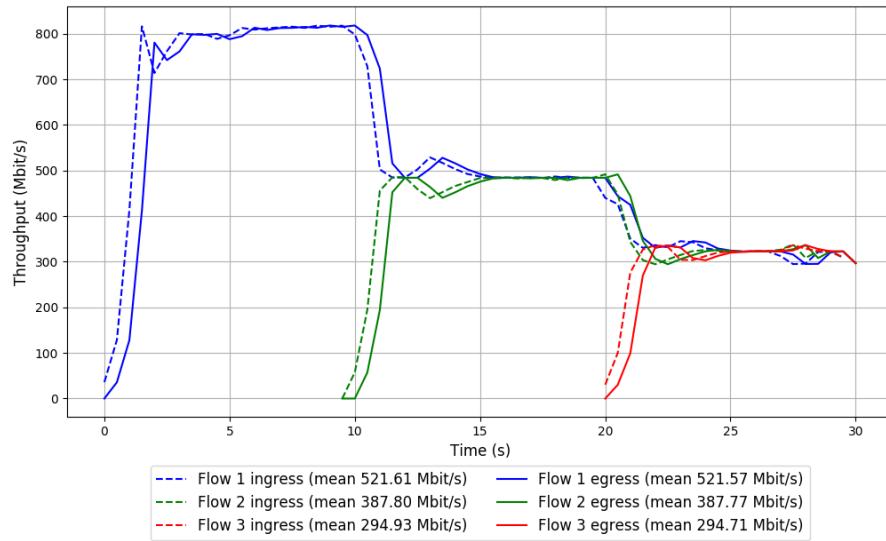


Run 3: Statistics of TCP Cubic

```
Start at: 2018-08-31 10:02:57
End at: 2018-08-31 10:03:27
Local clock offset: 1.828 ms
Remote clock offset: -4.168 ms

# Below is generated by plot.py at 2018-08-31 10:17:04
# Datalink statistics
-- Total of 3 flows:
Average throughput: 877.72 Mbit/s
95th percentile per-packet one-way delay: 7.782 ms
Loss rate: 0.10%
-- Flow 1:
Average throughput: 521.57 Mbit/s
95th percentile per-packet one-way delay: 10.355 ms
Loss rate: 0.07%
-- Flow 2:
Average throughput: 387.77 Mbit/s
95th percentile per-packet one-way delay: 7.016 ms
Loss rate: 0.11%
-- Flow 3:
Average throughput: 294.71 Mbit/s
95th percentile per-packet one-way delay: 7.116 ms
Loss rate: 0.27%
```

Run 3: Report of TCP Cubic — Data Link

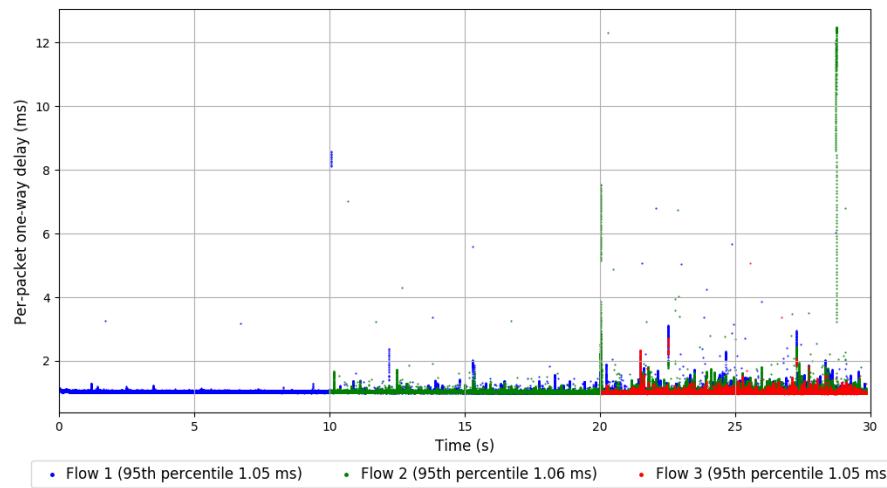
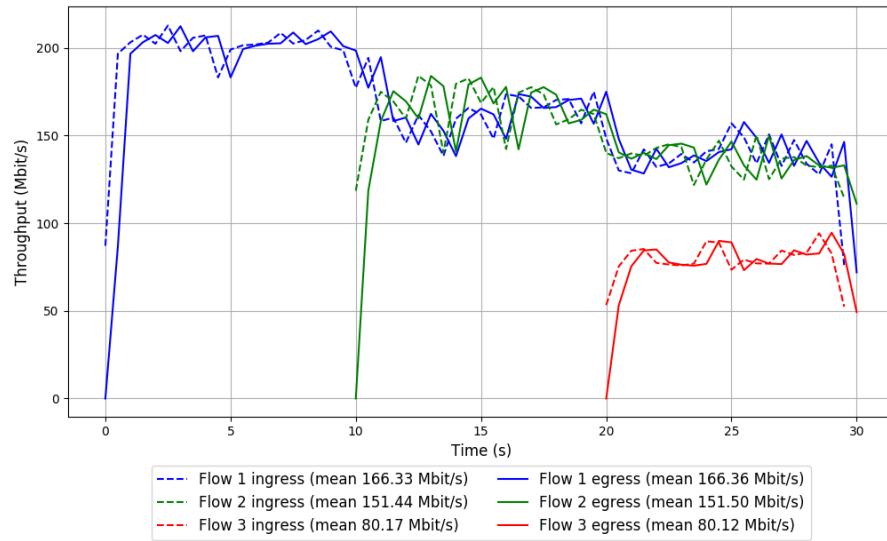


Run 1: Statistics of Indigo

```
Start at: 2018-08-31 09:48:11
End at: 2018-08-31 09:48:41
Local clock offset: 0.492 ms
Remote clock offset: -5.068 ms

# Below is generated by plot.py at 2018-08-31 10:17:04
# Datalink statistics
-- Total of 3 flows:
Average throughput: 293.26 Mbit/s
95th percentile per-packet one-way delay: 1.052 ms
Loss rate: 0.06%
-- Flow 1:
Average throughput: 166.36 Mbit/s
95th percentile per-packet one-way delay: 1.050 ms
Loss rate: 0.04%
-- Flow 2:
Average throughput: 151.50 Mbit/s
95th percentile per-packet one-way delay: 1.058 ms
Loss rate: 0.06%
-- Flow 3:
Average throughput: 80.12 Mbit/s
95th percentile per-packet one-way delay: 1.047 ms
Loss rate: 0.21%
```

Run 1: Report of Indigo — Data Link

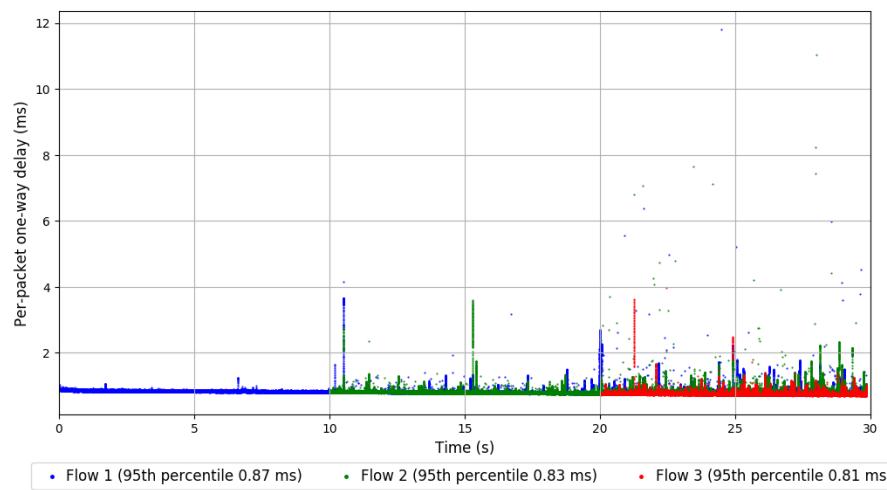
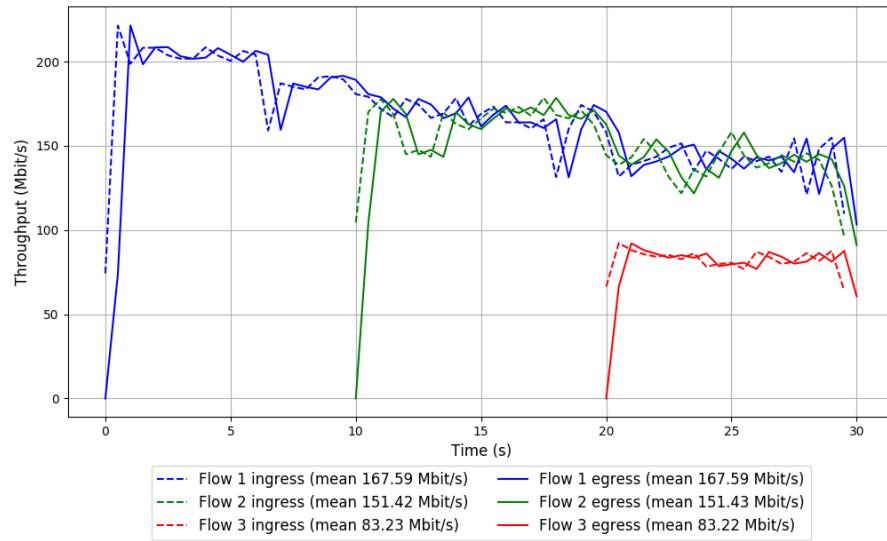


Run 2: Statistics of Indigo

```
Start at: 2018-08-31 09:54:48
End at: 2018-08-31 09:55:18
Local clock offset: 0.511 ms
Remote clock offset: -5.323 ms

# Below is generated by plot.py at 2018-08-31 10:17:04
# Datalink statistics
-- Total of 3 flows:
Average throughput: 295.62 Mbit/s
95th percentile per-packet one-way delay: 0.862 ms
Loss rate: 0.09%
-- Flow 1:
Average throughput: 167.59 Mbit/s
95th percentile per-packet one-way delay: 0.866 ms
Loss rate: 0.06%
-- Flow 2:
Average throughput: 151.43 Mbit/s
95th percentile per-packet one-way delay: 0.835 ms
Loss rate: 0.09%
-- Flow 3:
Average throughput: 83.22 Mbit/s
95th percentile per-packet one-way delay: 0.809 ms
Loss rate: 0.25%
```

Run 2: Report of Indigo — Data Link

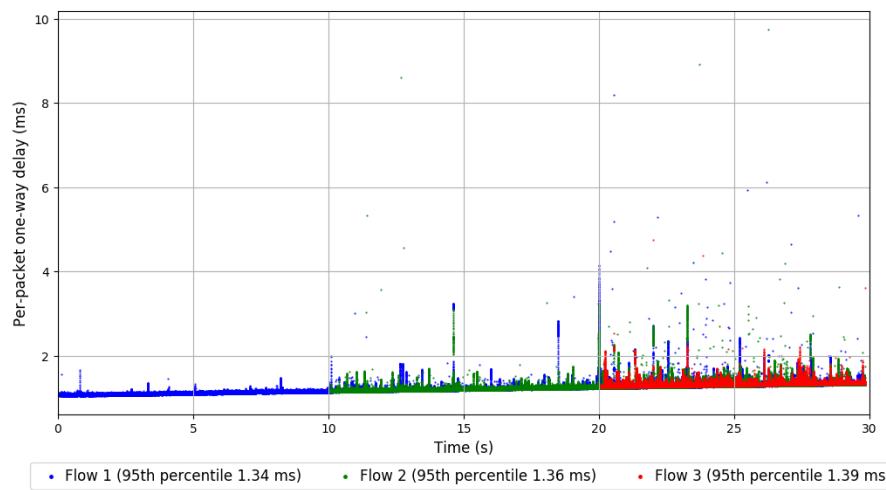
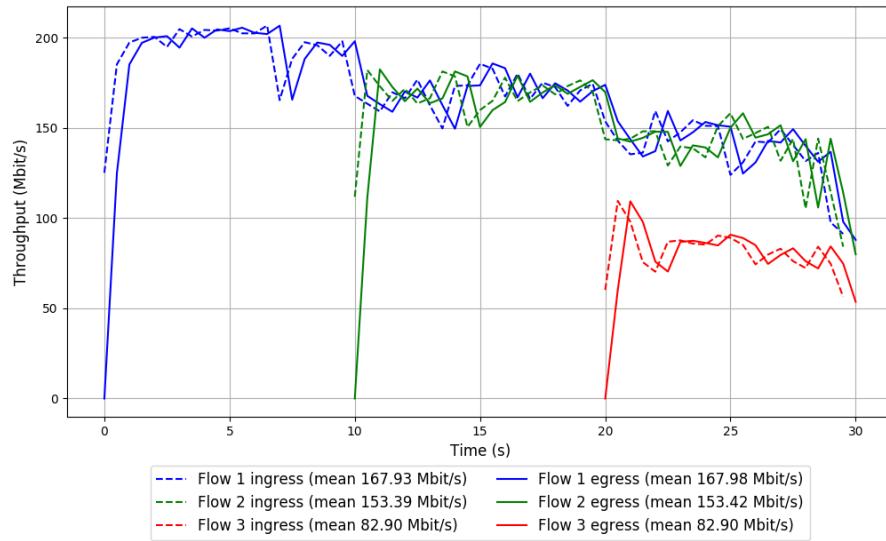


Run 3: Statistics of Indigo

```
Start at: 2018-08-31 10:01:26
End at: 2018-08-31 10:01:56
Local clock offset: 1.678 ms
Remote clock offset: -5.119 ms

# Below is generated by plot.py at 2018-08-31 10:17:04
# Datalink statistics
-- Total of 3 flows:
Average throughput: 297.04 Mbit/s
95th percentile per-packet one-way delay: 1.356 ms
Loss rate: 0.06%
-- Flow 1:
Average throughput: 167.98 Mbit/s
95th percentile per-packet one-way delay: 1.342 ms
Loss rate: 0.03%
-- Flow 2:
Average throughput: 153.42 Mbit/s
95th percentile per-packet one-way delay: 1.356 ms
Loss rate: 0.08%
-- Flow 3:
Average throughput: 82.90 Mbit/s
95th percentile per-packet one-way delay: 1.394 ms
Loss rate: 0.17%
```

Run 3: Report of Indigo — Data Link

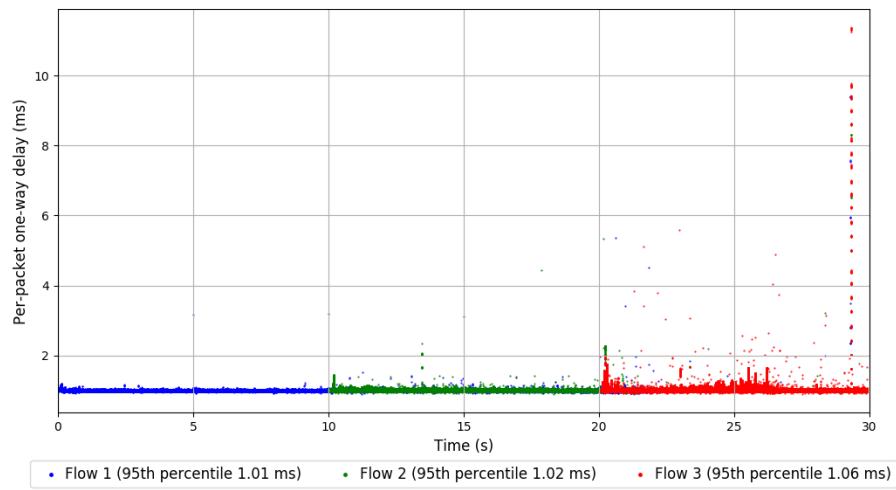
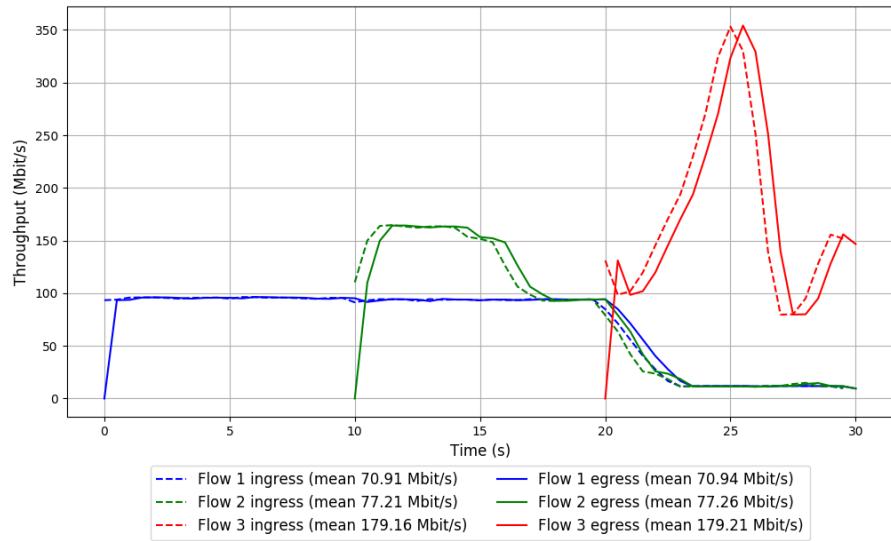


Run 1: Statistics of Muses-25

```
Start at: 2018-08-31 09:51:29
End at: 2018-08-31 09:51:59
Local clock offset: 0.557 ms
Remote clock offset: -5.134 ms

# Below is generated by plot.py at 2018-08-31 10:17:04
# Datalink statistics
-- Total of 3 flows:
Average throughput: 181.60 Mbit/s
95th percentile per-packet one-way delay: 1.026 ms
Loss rate: 0.06%
-- Flow 1:
Average throughput: 70.94 Mbit/s
95th percentile per-packet one-way delay: 1.011 ms
Loss rate: 0.01%
-- Flow 2:
Average throughput: 77.26 Mbit/s
95th percentile per-packet one-way delay: 1.025 ms
Loss rate: 0.01%
-- Flow 3:
Average throughput: 179.21 Mbit/s
95th percentile per-packet one-way delay: 1.058 ms
Loss rate: 0.15%
```

Run 1: Report of Muses-25 — Data Link

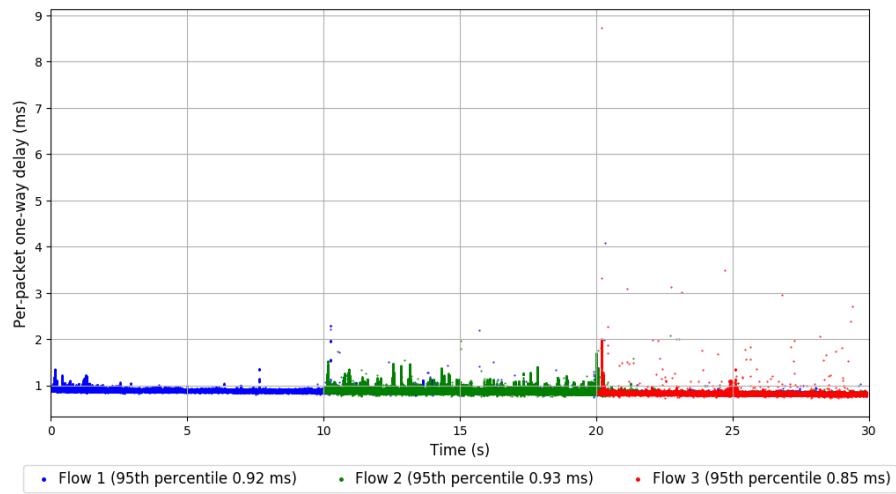
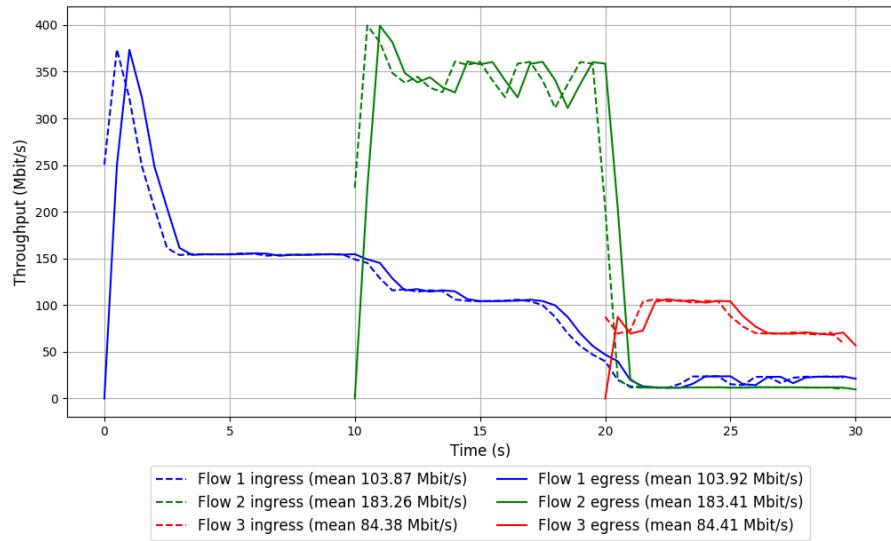


Run 2: Statistics of Muses-25

```
Start at: 2018-08-31 09:58:04
End at: 2018-08-31 09:58:34
Local clock offset: 1.155 ms
Remote clock offset: -5.428 ms

# Below is generated by plot.py at 2018-08-31 10:17:06
# Datalink statistics
-- Total of 3 flows:
Average throughput: 253.90 Mbit/s
95th percentile per-packet one-way delay: 0.921 ms
Loss rate: 0.03%
-- Flow 1:
Average throughput: 103.92 Mbit/s
95th percentile per-packet one-way delay: 0.922 ms
Loss rate: 0.02%
-- Flow 2:
Average throughput: 183.41 Mbit/s
95th percentile per-packet one-way delay: 0.926 ms
Loss rate: 0.01%
-- Flow 3:
Average throughput: 84.41 Mbit/s
95th percentile per-packet one-way delay: 0.851 ms
Loss rate: 0.18%
```

Run 2: Report of Muses-25 — Data Link



Run 3: Statistics of Muses-25

```
Start at: 2018-08-31 10:04:44
End at: 2018-08-31 10:05:14
Local clock offset: 1.846 ms
Remote clock offset: -3.331 ms

# Below is generated by plot.py at 2018-08-31 10:17:06
# Datalink statistics
-- Total of 3 flows:
Average throughput: 199.79 Mbit/s
95th percentile per-packet one-way delay: 1.251 ms
Loss rate: 0.07%
-- Flow 1:
Average throughput: 78.63 Mbit/s
95th percentile per-packet one-way delay: 1.206 ms
Loss rate: 0.01%
-- Flow 2:
Average throughput: 118.00 Mbit/s
95th percentile per-packet one-way delay: 1.255 ms
Loss rate: 0.08%
-- Flow 3:
Average throughput: 128.73 Mbit/s
95th percentile per-packet one-way delay: 1.263 ms
Loss rate: 0.15%
```

Run 3: Report of Muses-25 — Data Link

