

Pantheon Report

Generated at 2018-09-05 04:02:54 (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.

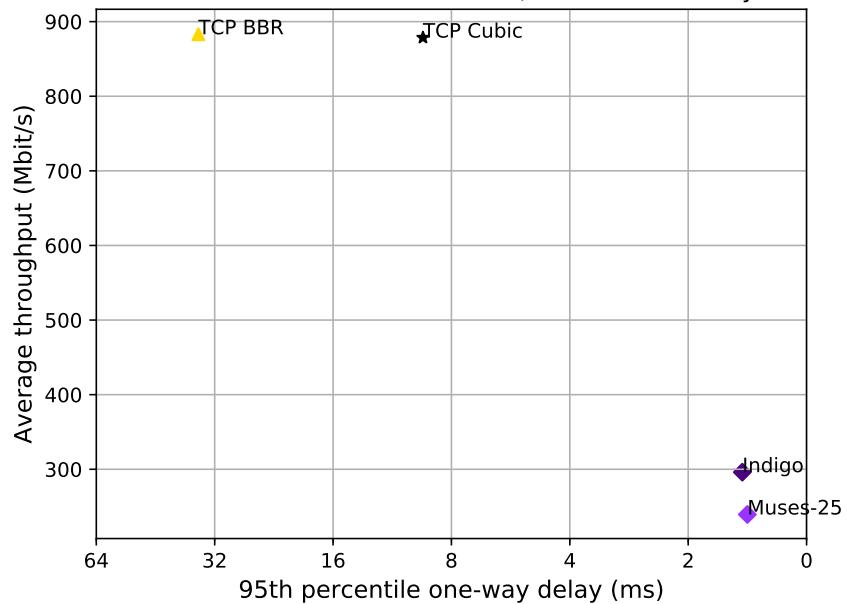
System info:

```
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
```

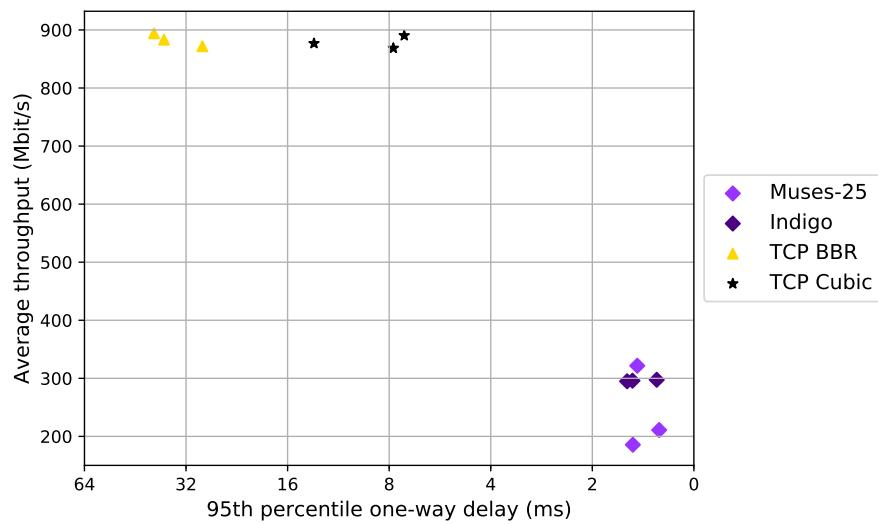
Git summary:

```
branch: muses @ 71e71e9a55b945431a7dea72180c1c9381097db9
third_party/fillp @ d47f4fa1b454a5e3c0537115c5a28436dbd4b834
third_party/fillp-sheep @ daed0c84f98531712514b2231f43ec6901114ffe
third_party/genericCC @ d0153f8e594aa89e93b032143cedbdf58e562f4
third_party/indigo @ 2601c92e4aa9d58d38dc4dfe0ecdbf90c077e64d
third_party/libutp @ b3465b942e2826f2b179eaab4a906ce6bb7cf3cf
third_party/muses @ 96fb95fb38373d71fb80c5a105e62e7636623b
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



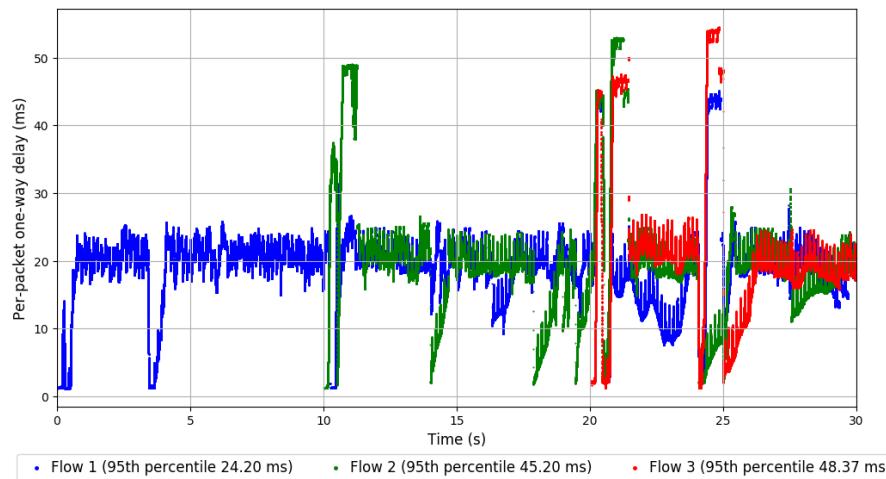
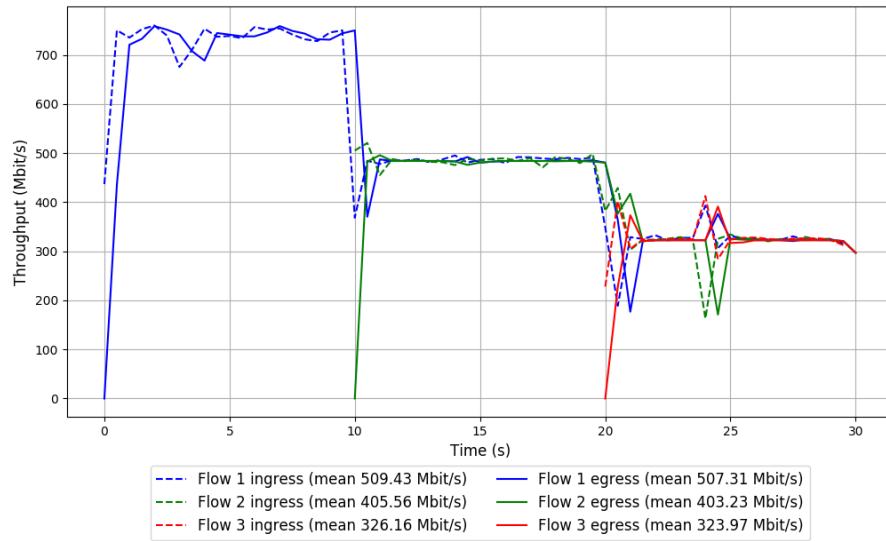
scheme	# runs	mean avg tput (Mbit/s)			mean 95th-%ile delay (ms)			mean loss rate (%)		
		flow 1	flow 2	flow 3	flow 1	flow 2	flow 3	flow 1	flow 2	flow 3
TCP BBR	3	508.23	401.62	323.83	23.35	41.36	47.17	0.48	0.78	1.00
TCP Cubic	3	521.52	385.49	302.32	9.94	7.16	7.01	0.05	0.10	0.28
Indigo	3	163.94	155.76	87.54	1.08	1.05	1.04	0.05	0.08	0.25
Muses-25	3	124.32	141.06	64.16	1.01	0.97	0.92	0.00	0.08	0.06

Run 1: Statistics of TCP BBR

```
Start at: 2018-09-05 03:31:52
End at: 2018-09-05 03:32:22
Local clock offset: -4.768 ms
Remote clock offset: 3.473 ms

# Below is generated by plot.py at 2018-09-05 04:02:48
# Datalink statistics
-- Total of 3 flows:
Average throughput: 883.28 Mbit/s
95th percentile per-packet one-way delay: 37.189 ms
Loss rate: 0.59%
-- Flow 1:
Average throughput: 507.31 Mbit/s
95th percentile per-packet one-way delay: 24.195 ms
Loss rate: 0.48%
-- Flow 2:
Average throughput: 403.23 Mbit/s
95th percentile per-packet one-way delay: 45.197 ms
Loss rate: 0.67%
-- Flow 3:
Average throughput: 323.97 Mbit/s
95th percentile per-packet one-way delay: 48.373 ms
Loss rate: 0.87%
```

Run 1: Report of TCP BBR — Data Link

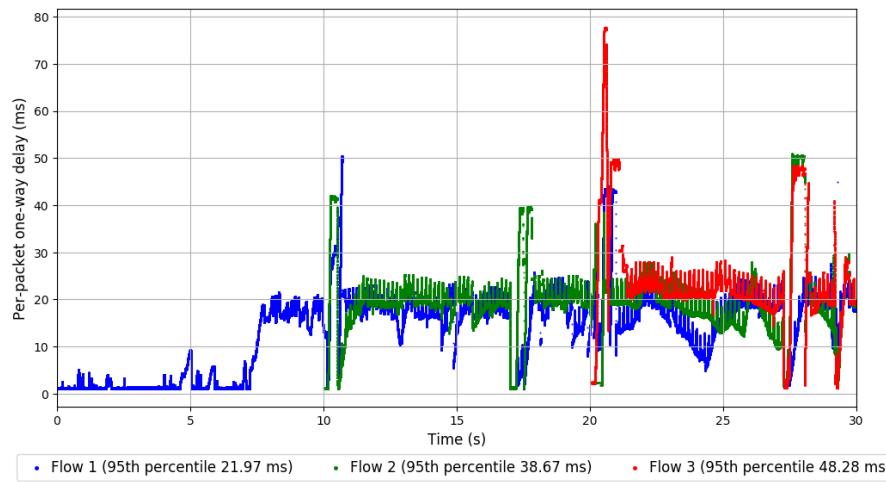
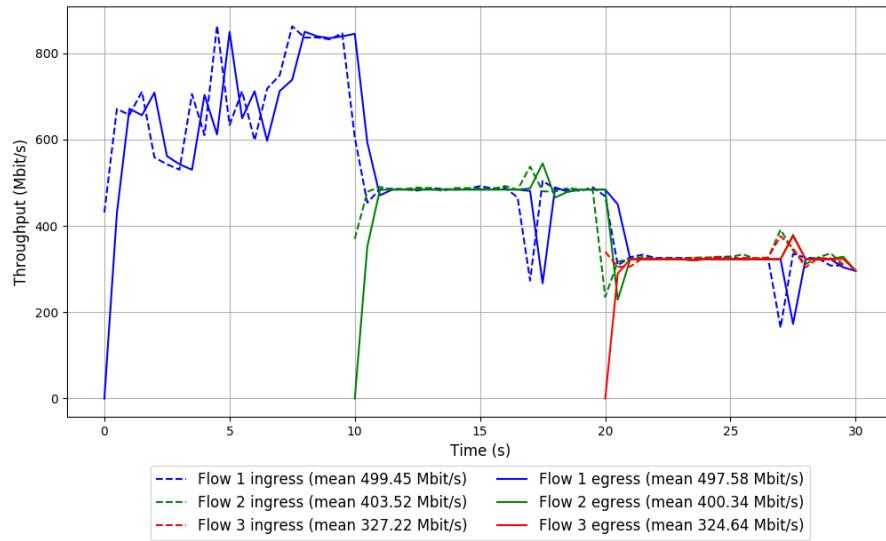


Run 2: Statistics of TCP BBR

```
Start at: 2018-09-05 03:38:41
End at: 2018-09-05 03:39:11
Local clock offset: -5.972 ms
Remote clock offset: 3.633 ms

# Below is generated by plot.py at 2018-09-05 04:02:48
# Datalink statistics
-- Total of 3 flows:
Average throughput: 871.82 Mbit/s
95th percentile per-packet one-way delay: 28.616 ms
Loss rate: 0.65%
-- Flow 1:
Average throughput: 497.58 Mbit/s
95th percentile per-packet one-way delay: 21.969 ms
Loss rate: 0.44%
-- Flow 2:
Average throughput: 400.34 Mbit/s
95th percentile per-packet one-way delay: 38.674 ms
Loss rate: 0.89%
-- Flow 3:
Average throughput: 324.64 Mbit/s
95th percentile per-packet one-way delay: 48.281 ms
Loss rate: 1.00%
```

Run 2: Report of TCP BBR — Data Link

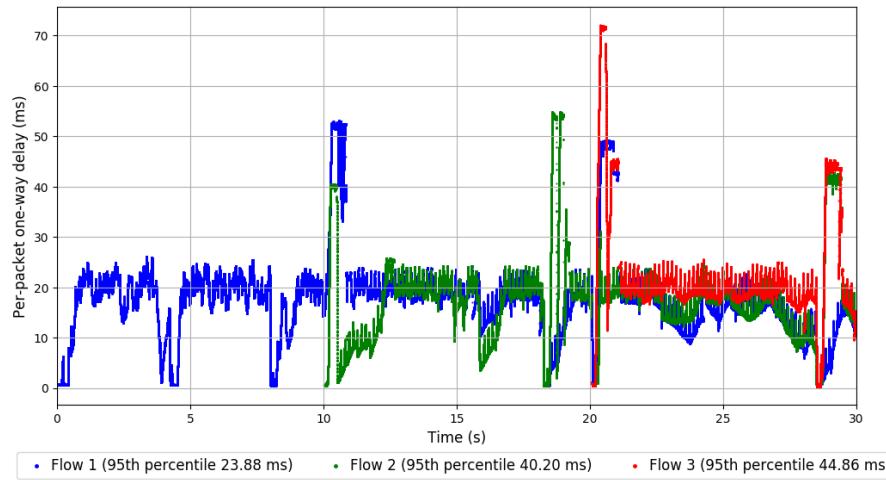
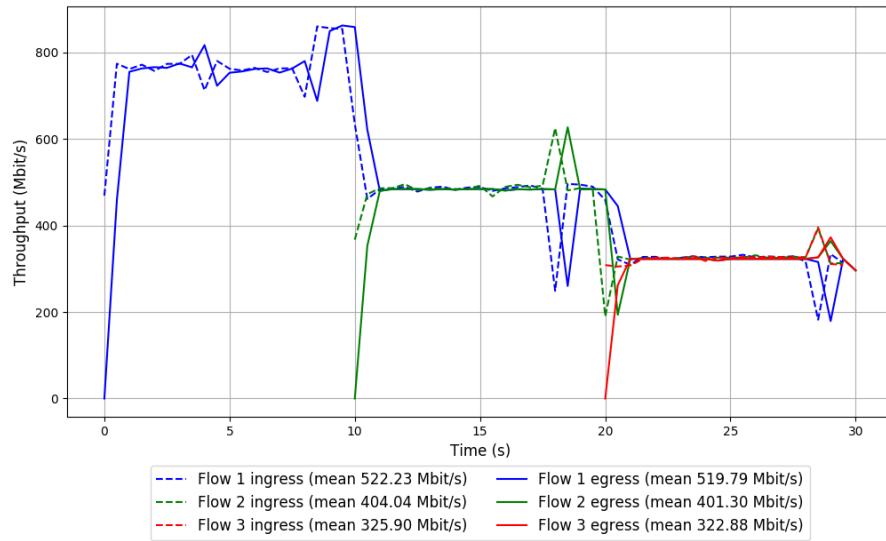


Run 3: Statistics of TCP BBR

```
Start at: 2018-09-05 03:45:27
End at: 2018-09-05 03:45:57
Local clock offset: -6.212 ms
Remote clock offset: 3.923 ms

# Below is generated by plot.py at 2018-09-05 04:02:52
# Datalink statistics
-- Total of 3 flows:
Average throughput: 894.14 Mbit/s
95th percentile per-packet one-way delay: 39.816 ms
Loss rate: 0.68%
-- Flow 1:
Average throughput: 519.79 Mbit/s
95th percentile per-packet one-way delay: 23.884 ms
Loss rate: 0.53%
-- Flow 2:
Average throughput: 401.30 Mbit/s
95th percentile per-packet one-way delay: 40.201 ms
Loss rate: 0.78%
-- Flow 3:
Average throughput: 322.88 Mbit/s
95th percentile per-packet one-way delay: 44.857 ms
Loss rate: 1.13%
```

Run 3: Report of TCP BBR — Data Link

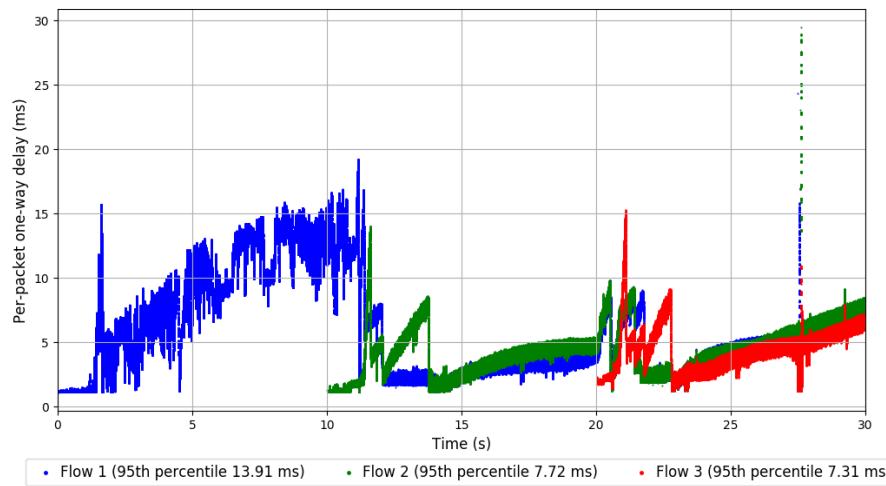
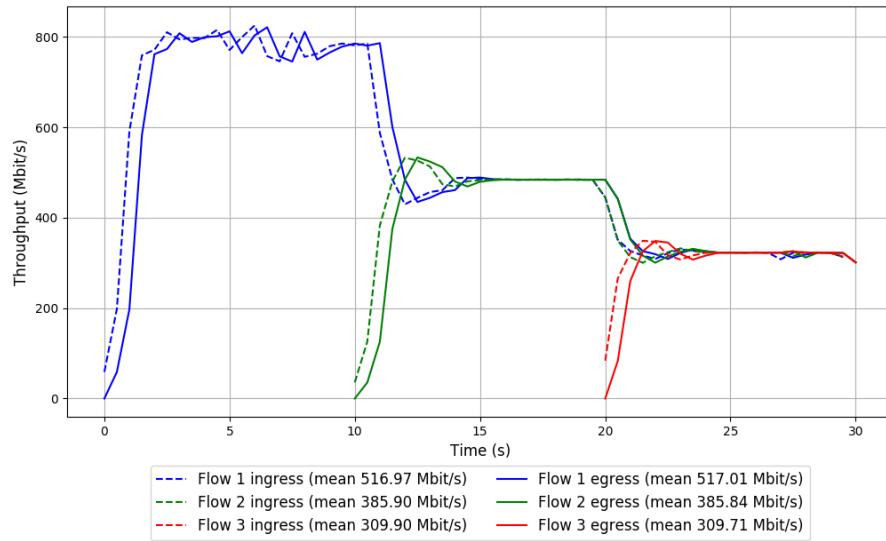


```
Run 1: Statistics of TCP Cubic
```

```
Start at: 2018-09-05 03:33:48
End at: 2018-09-05 03:34:18
Local clock offset: -5.091 ms
Remote clock offset: 3.557 ms

# Below is generated by plot.py at 2018-09-05 04:02:52
# Datalink statistics
-- Total of 3 flows:
Average throughput: 876.77 Mbit/s
95th percentile per-packet one-way delay: 13.363 ms
Loss rate: 0.09%
-- Flow 1:
Average throughput: 517.01 Mbit/s
95th percentile per-packet one-way delay: 13.915 ms
Loss rate: 0.05%
-- Flow 2:
Average throughput: 385.84 Mbit/s
95th percentile per-packet one-way delay: 7.721 ms
Loss rate: 0.11%
-- Flow 3:
Average throughput: 309.71 Mbit/s
95th percentile per-packet one-way delay: 7.311 ms
Loss rate: 0.27%
```

Run 1: Report of TCP Cubic — Data Link

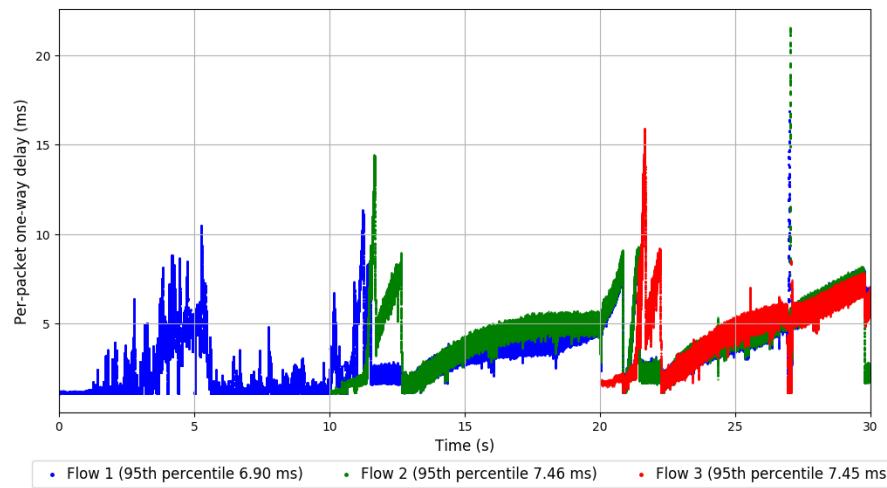
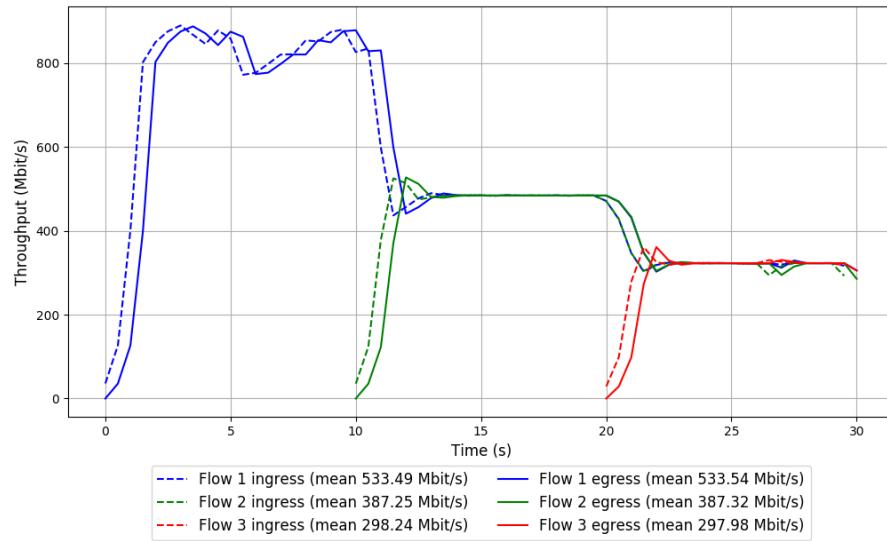


Run 2: Statistics of TCP Cubic

```
Start at: 2018-09-05 03:40:37
End at: 2018-09-05 03:41:07
Local clock offset: -6.161 ms
Remote clock offset: 3.786 ms

# Below is generated by plot.py at 2018-09-05 04:02:52
# Datalink statistics
-- Total of 3 flows:
Average throughput: 890.29 Mbit/s
95th percentile per-packet one-way delay: 7.218 ms
Loss rate: 0.09%
-- Flow 1:
Average throughput: 533.54 Mbit/s
95th percentile per-packet one-way delay: 6.900 ms
Loss rate: 0.05%
-- Flow 2:
Average throughput: 387.32 Mbit/s
95th percentile per-packet one-way delay: 7.465 ms
Loss rate: 0.08%
-- Flow 3:
Average throughput: 297.98 Mbit/s
95th percentile per-packet one-way delay: 7.451 ms
Loss rate: 0.29%
```

Run 2: Report of TCP Cubic — Data Link

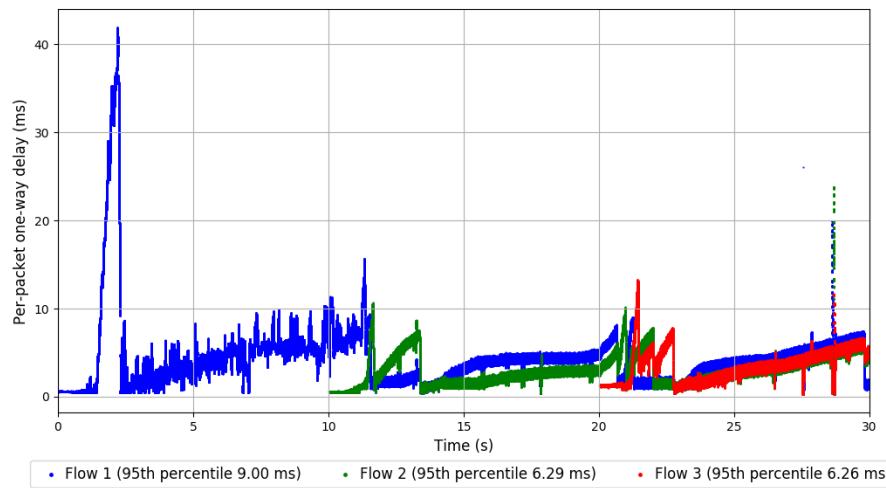
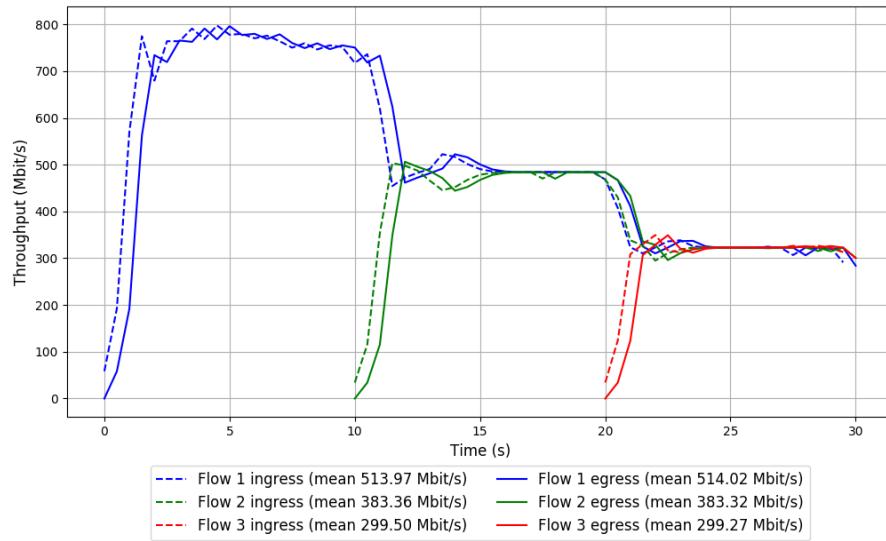


Run 3: Statistics of TCP Cubic

```
Start at: 2018-09-05 03:47:23
End at: 2018-09-05 03:47:53
Local clock offset: -5.082 ms
Remote clock offset: 4.051 ms

# Below is generated by plot.py at 2018-09-05 04:02:52
# Datalink statistics
-- Total of 3 flows:
Average throughput: 868.64 Mbit/s
95th percentile per-packet one-way delay: 7.774 ms
Loss rate: 0.09%
-- Flow 1:
Average throughput: 514.02 Mbit/s
95th percentile per-packet one-way delay: 9.004 ms
Loss rate: 0.06%
-- Flow 2:
Average throughput: 383.32 Mbit/s
95th percentile per-packet one-way delay: 6.294 ms
Loss rate: 0.10%
-- Flow 3:
Average throughput: 299.27 Mbit/s
95th percentile per-packet one-way delay: 6.265 ms
Loss rate: 0.27%
```

Run 3: Report of TCP Cubic — Data Link

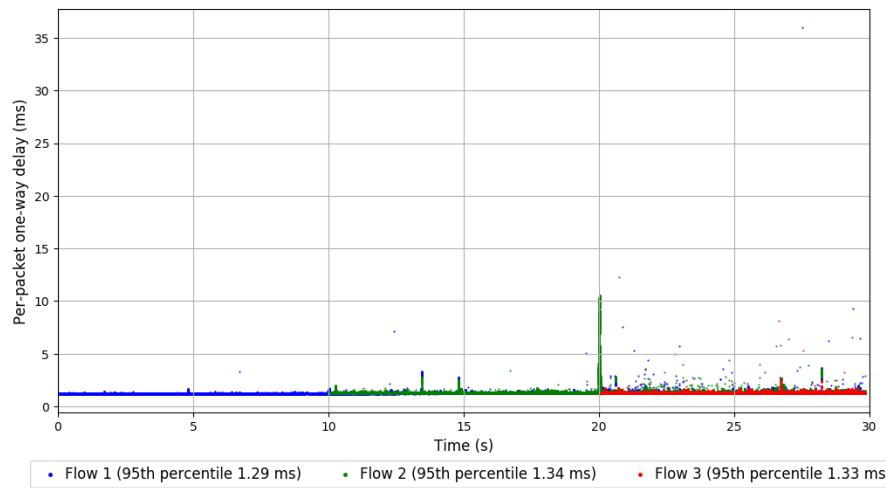
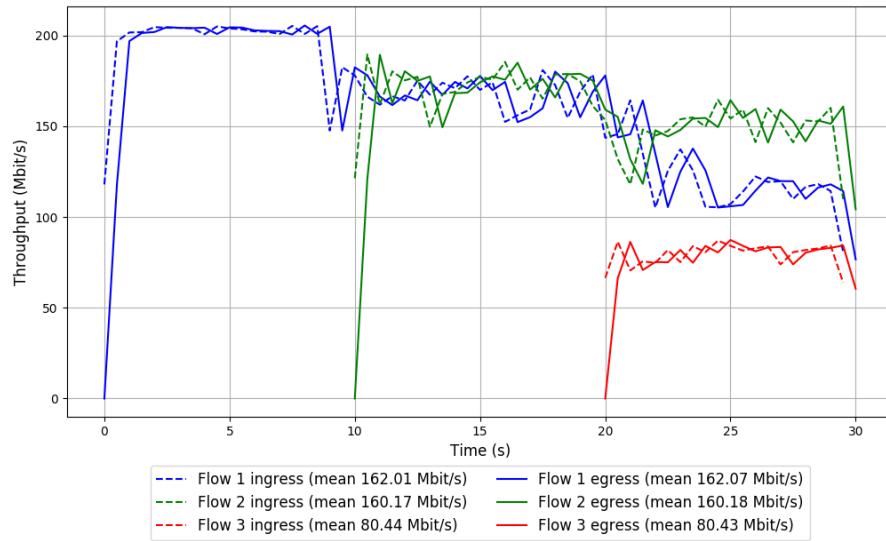


Run 1: Statistics of Indigo

```
Start at: 2018-09-05 03:35:37
End at: 2018-09-05 03:36:07
Local clock offset: -5.391 ms
Remote clock offset: 3.557 ms

# Below is generated by plot.py at 2018-09-05 04:02:52
# Datalink statistics
-- Total of 3 flows:
Average throughput: 294.91 Mbit/s
95th percentile per-packet one-way delay: 1.315 ms
Loss rate: 0.08%
-- Flow 1:
Average throughput: 162.07 Mbit/s
95th percentile per-packet one-way delay: 1.292 ms
Loss rate: 0.05%
-- Flow 2:
Average throughput: 160.18 Mbit/s
95th percentile per-packet one-way delay: 1.340 ms
Loss rate: 0.10%
-- Flow 3:
Average throughput: 80.43 Mbit/s
95th percentile per-packet one-way delay: 1.326 ms
Loss rate: 0.21%
```

Run 1: Report of Indigo — Data Link

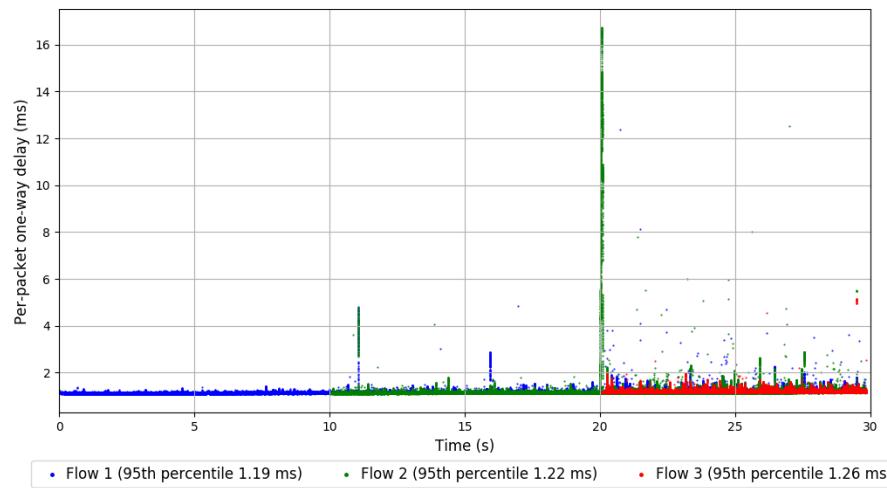
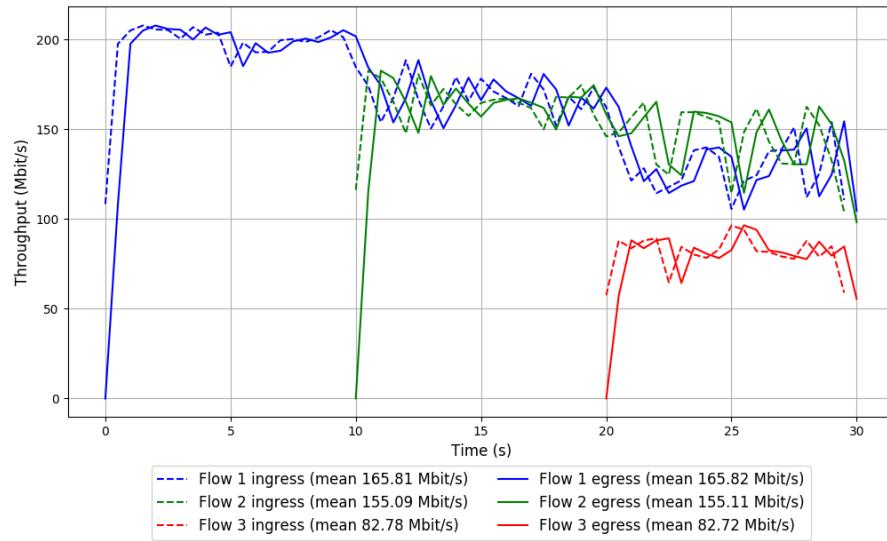


Run 2: Statistics of Indigo

```
Start at: 2018-09-05 03:42:27
End at: 2018-09-05 03:42:57
Local clock offset: -6.475 ms
Remote clock offset: 3.764 ms

# Below is generated by plot.py at 2018-09-05 04:02:52
# Datalink statistics
-- Total of 3 flows:
Average throughput: 295.90 Mbit/s
95th percentile per-packet one-way delay: 1.209 ms
Loss rate: 0.09%
-- Flow 1:
Average throughput: 165.82 Mbit/s
95th percentile per-packet one-way delay: 1.193 ms
Loss rate: 0.06%
-- Flow 2:
Average throughput: 155.11 Mbit/s
95th percentile per-packet one-way delay: 1.219 ms
Loss rate: 0.09%
-- Flow 3:
Average throughput: 82.72 Mbit/s
95th percentile per-packet one-way delay: 1.257 ms
Loss rate: 0.24%
```

Run 2: Report of Indigo — Data Link

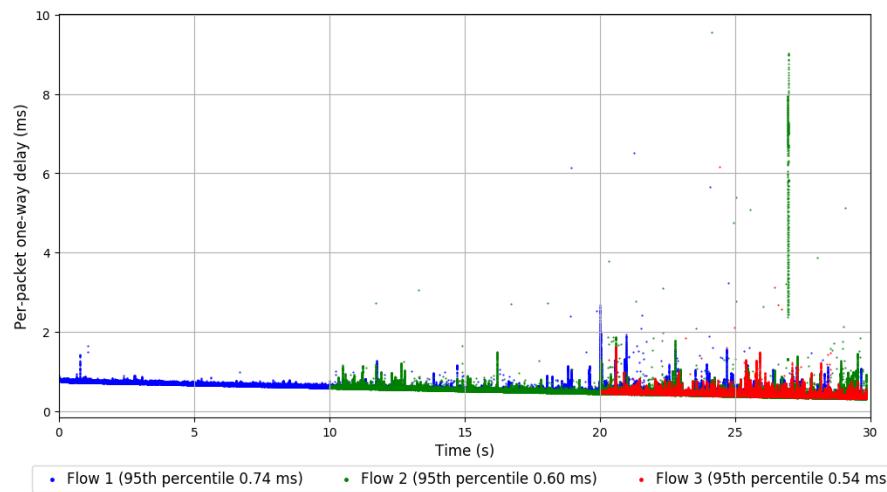
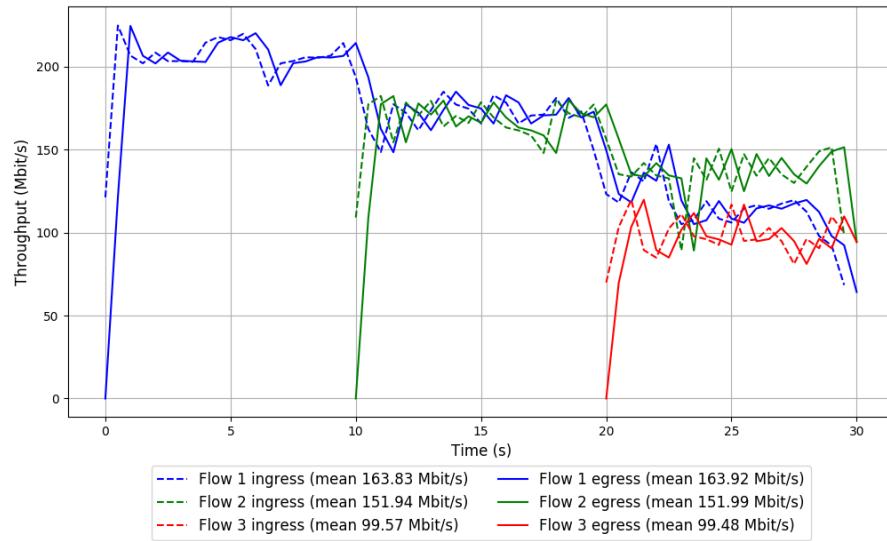


Run 3: Statistics of Indigo

```
Start at: 2018-09-05 03:49:13
End at: 2018-09-05 03:49:43
Local clock offset: -3.963 ms
Remote clock offset: 3.668 ms

# Below is generated by plot.py at 2018-09-05 04:02:52
# Datalink statistics
-- Total of 3 flows:
Average throughput: 297.48 Mbit/s
95th percentile per-packet one-way delay: 0.732 ms
Loss rate: 0.08%
-- Flow 1:
Average throughput: 163.92 Mbit/s
95th percentile per-packet one-way delay: 0.744 ms
Loss rate: 0.04%
-- Flow 2:
Average throughput: 151.99 Mbit/s
95th percentile per-packet one-way delay: 0.604 ms
Loss rate: 0.06%
-- Flow 3:
Average throughput: 99.48 Mbit/s
95th percentile per-packet one-way delay: 0.541 ms
Loss rate: 0.29%
```

Run 3: Report of Indigo — Data Link

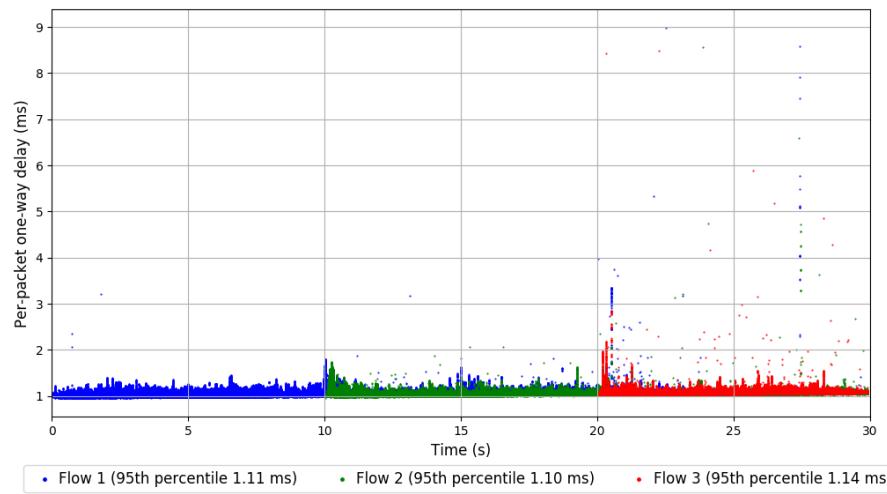
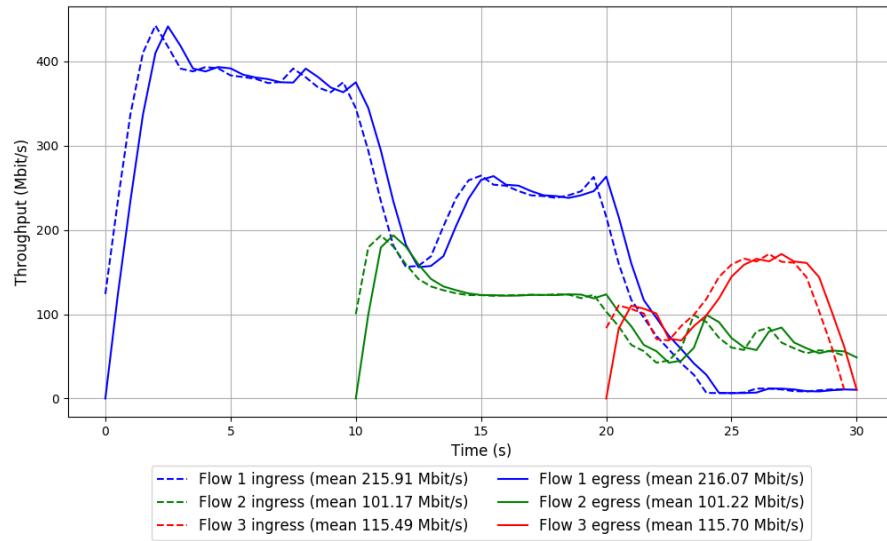


Run 1: Statistics of Muses-25

```
Start at: 2018-09-05 03:37:10
End at: 2018-09-05 03:37:40
Local clock offset: -5.746 ms
Remote clock offset: 3.701 ms

# Below is generated by plot.py at 2018-09-05 04:02:52
# Datalink statistics
-- Total of 3 flows:
Average throughput: 321.66 Mbit/s
95th percentile per-packet one-way delay: 1.115 ms
Loss rate: 0.02%
-- Flow 1:
Average throughput: 216.07 Mbit/s
95th percentile per-packet one-way delay: 1.111 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 101.22 Mbit/s
95th percentile per-packet one-way delay: 1.103 ms
Loss rate: 0.06%
-- Flow 3:
Average throughput: 115.70 Mbit/s
95th percentile per-packet one-way delay: 1.143 ms
Loss rate: 0.02%
```

Run 1: Report of Muses-25 — Data Link

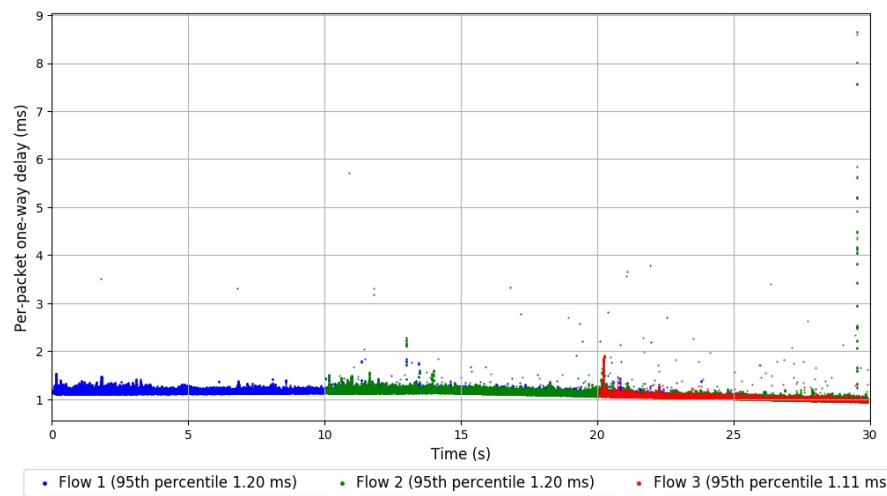
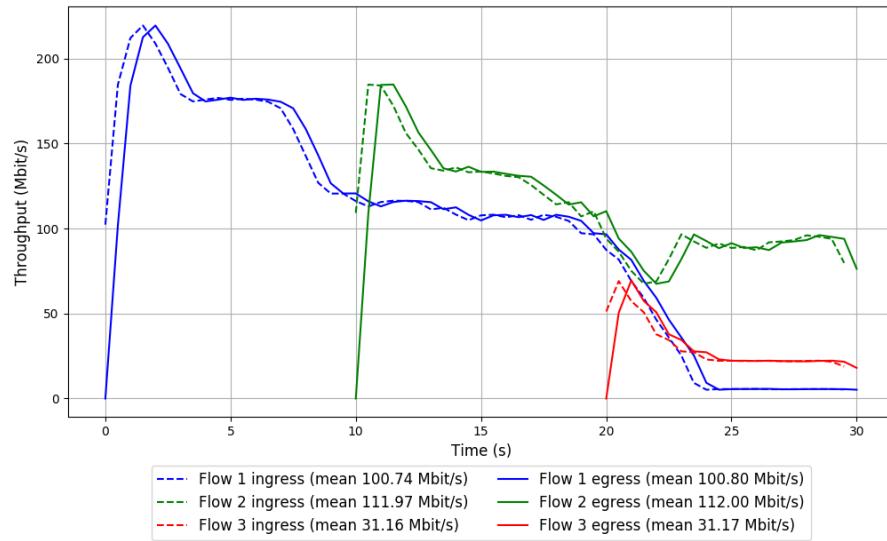


Run 2: Statistics of Muses-25

```
Start at: 2018-09-05 03:44:00
End at: 2018-09-05 03:44:30
Local clock offset: -6.575 ms
Remote clock offset: 3.852 ms

# Below is generated by plot.py at 2018-09-05 04:02:52
# Datalink statistics
-- Total of 3 flows:
Average throughput: 185.62 Mbit/s
95th percentile per-packet one-way delay: 1.202 ms
Loss rate: 0.04%
-- Flow 1:
Average throughput: 100.80 Mbit/s
95th percentile per-packet one-way delay: 1.204 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 112.00 Mbit/s
95th percentile per-packet one-way delay: 1.202 ms
Loss rate: 0.08%
-- Flow 3:
Average throughput: 31.17 Mbit/s
95th percentile per-packet one-way delay: 1.112 ms
Loss rate: 0.15%
```

Run 2: Report of Muses-25 — Data Link



Run 3: Statistics of Muses-25

```
Start at: 2018-09-05 03:50:46
End at: 2018-09-05 03:51:16
Local clock offset: -3.333 ms
Remote clock offset: 3.132 ms

# Below is generated by plot.py at 2018-09-05 04:02:52
# Datalink statistics
-- Total of 3 flows:
Average throughput: 210.93 Mbit/s
95th percentile per-packet one-way delay: 0.684 ms
Loss rate: 0.06%
-- Flow 1:
Average throughput: 56.10 Mbit/s
95th percentile per-packet one-way delay: 0.707 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 209.96 Mbit/s
95th percentile per-packet one-way delay: 0.606 ms
Loss rate: 0.09%
-- Flow 3:
Average throughput: 45.61 Mbit/s
95th percentile per-packet one-way delay: 0.503 ms
Loss rate: 0.02%
```

Run 3: Report of Muses-25 — Data Link

