

Pantheon Report

Generated at 2018-09-03 09:05:36 (UTC).
Data path: AWS California 2 on `ens5` (*local*) → Mexico on `em1` (*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.

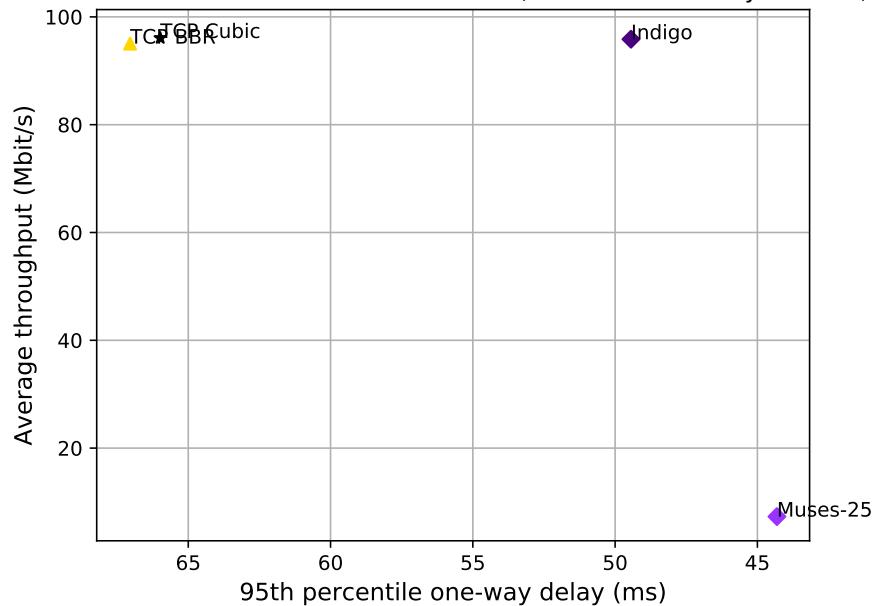
System info:

```
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
net.ipv4.tcp_mem = 536870912 536870912 536870912
```

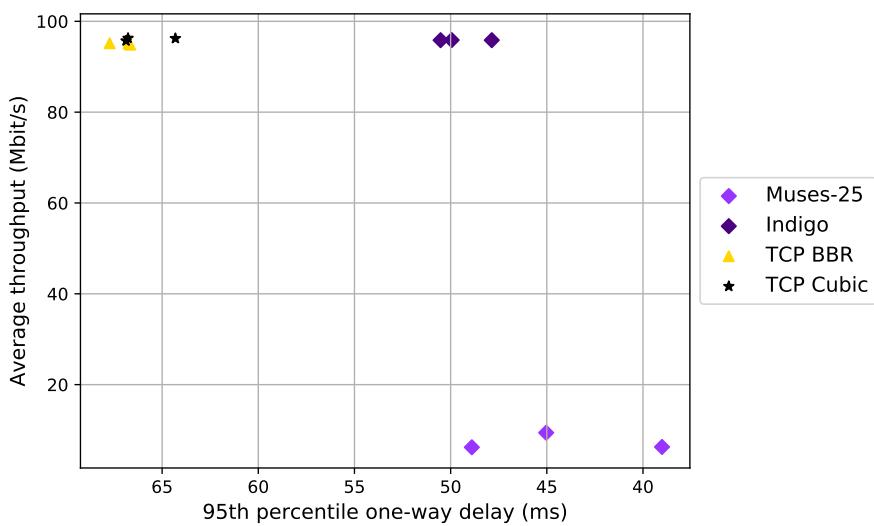
Git summary:

```
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 AWS California 2 to Mexico, 3 runs of 30s each per scheme
3 flows with 10s interval between flows (mean of all runs by scheme)



test from AWS California 2 to Mexico, 3 runs of 30s each per scheme
3 flows with 10s interval between flows



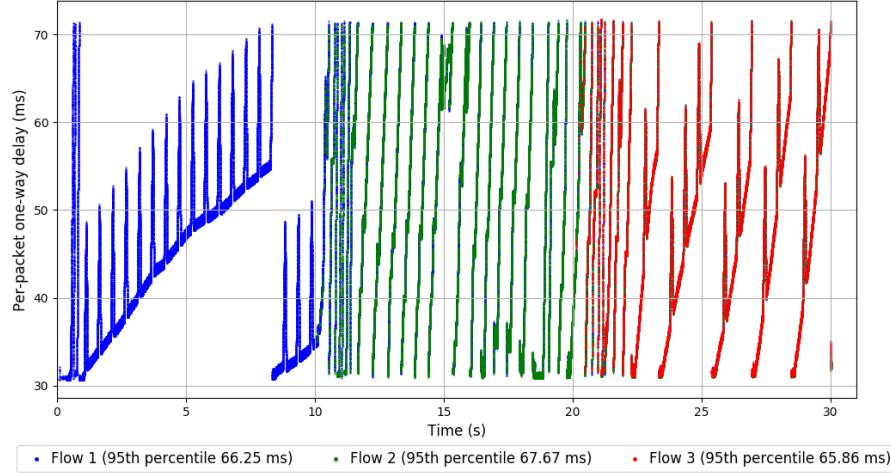
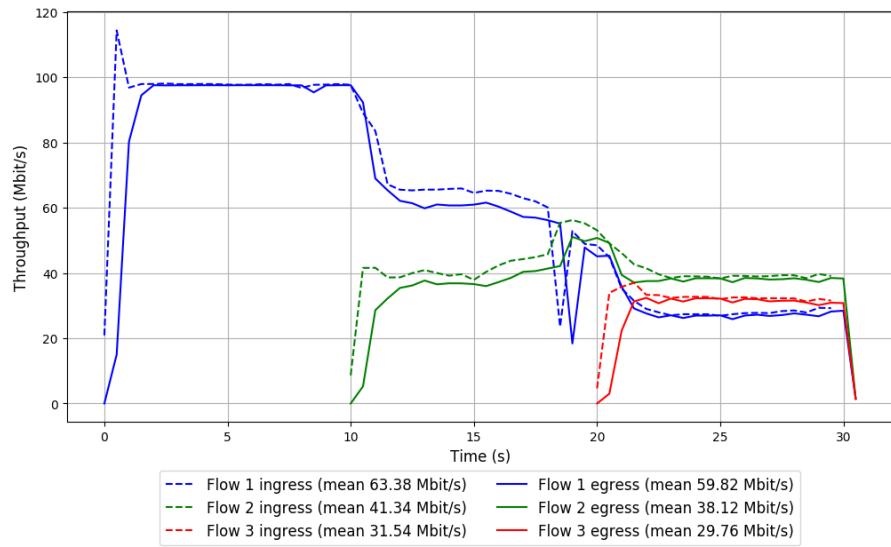
scheme	# runs	mean avg tput (Mbit/s)			mean 95th-%ile delay (ms)			mean loss rate (%)		
		flow 1	flow 2	flow 3	flow 1	flow 2	flow 3	flow 1	flow 2	flow 3
TCP BBR	3	60.99	37.38	27.52	66.17	68.00	67.35	6.59	10.63	9.34
TCP Cubic	3	73.10	22.99	23.10	65.89	66.83	62.40	0.93	0.65	0.63
Indigo	3	68.11	25.91	32.33	45.62	52.49	55.83	0.02	0.03	0.01
Muses-25	3	2.42	6.21	2.62	34.42	47.29	49.15	81.91	51.10	52.97

Run 1: Statistics of TCP BBR

```
Start at: 2018-09-03 08:51:26
End at: 2018-09-03 08:51:56
Local clock offset: -15.262 ms
Remote clock offset: 4.523 ms

# Below is generated by plot.py at 2018-09-03 09:05:27
# Datalink statistics
-- Total of 3 flows:
Average throughput: 95.10 Mbit/s
95th percentile per-packet one-way delay: 66.749 ms
Loss rate: 6.22%
-- Flow 1:
Average throughput: 59.82 Mbit/s
95th percentile per-packet one-way delay: 66.254 ms
Loss rate: 5.61%
-- Flow 2:
Average throughput: 38.12 Mbit/s
95th percentile per-packet one-way delay: 67.665 ms
Loss rate: 7.81%
-- Flow 3:
Average throughput: 29.76 Mbit/s
95th percentile per-packet one-way delay: 65.864 ms
Loss rate: 5.70%
```

Run 1: Report of TCP BBR — Data Link

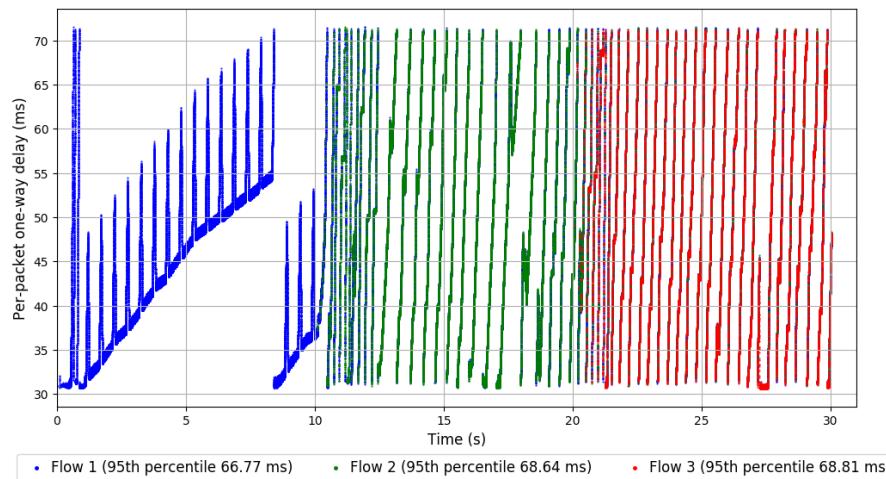
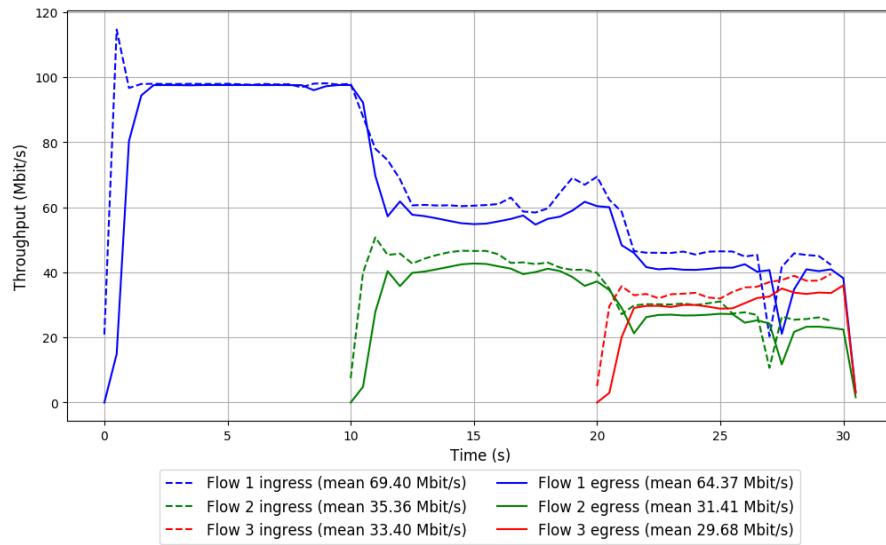


Run 2: Statistics of TCP BBR

```
Start at: 2018-09-03 08:56:48
End at: 2018-09-03 08:57:18
Local clock offset: -13.304 ms
Remote clock offset: 4.685 ms

# Below is generated by plot.py at 2018-09-03 09:05:29
# Datalink statistics
-- Total of 3 flows:
Average throughput: 95.16 Mbit/s
95th percentile per-packet one-way delay: 67.728 ms
Loss rate: 8.50%
-- Flow 1:
Average throughput: 64.37 Mbit/s
95th percentile per-packet one-way delay: 66.771 ms
Loss rate: 7.19%
-- Flow 2:
Average throughput: 31.41 Mbit/s
95th percentile per-packet one-way delay: 68.645 ms
Loss rate: 11.11%
-- Flow 3:
Average throughput: 29.68 Mbit/s
95th percentile per-packet one-way delay: 68.812 ms
Loss rate: 11.16%
```

Run 2: Report of TCP BBR — Data Link

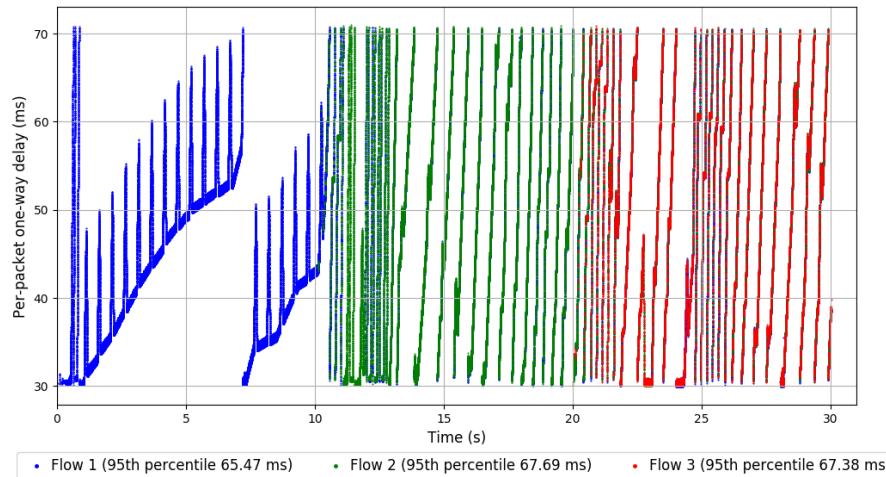
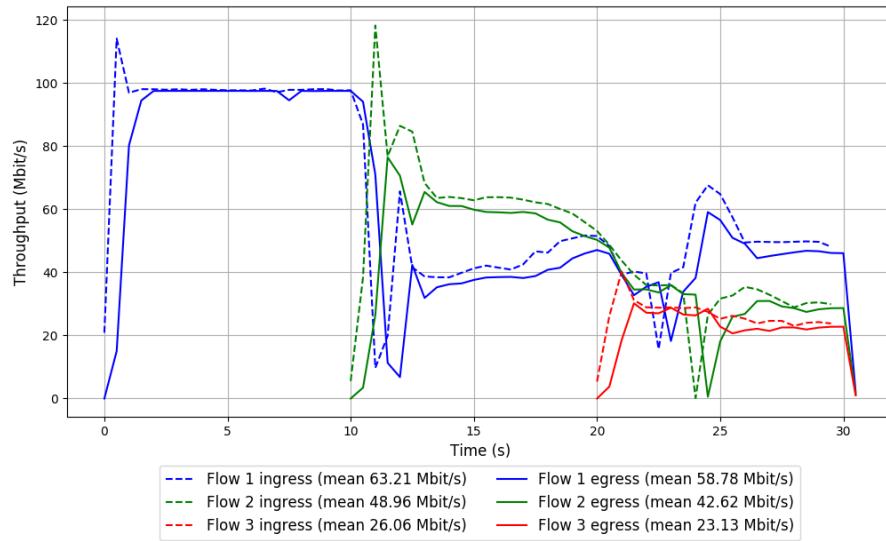


Run 3: Statistics of TCP BBR

```
Start at: 2018-09-03 09:02:09
End at: 2018-09-03 09:02:39
Local clock offset: -14.763 ms
Remote clock offset: 4.541 ms

# Below is generated by plot.py at 2018-09-03 09:05:29
# Datalink statistics
-- Total of 3 flows:
Average throughput: 94.85 Mbit/s
95th percentile per-packet one-way delay: 66.658 ms
Loss rate: 9.20%
-- Flow 1:
Average throughput: 58.78 Mbit/s
95th percentile per-packet one-way delay: 65.474 ms
Loss rate: 6.98%
-- Flow 2:
Average throughput: 42.62 Mbit/s
95th percentile per-packet one-way delay: 67.688 ms
Loss rate: 12.97%
-- Flow 3:
Average throughput: 23.13 Mbit/s
95th percentile per-packet one-way delay: 67.376 ms
Loss rate: 11.16%
```

Run 3: Report of TCP BBR — Data Link

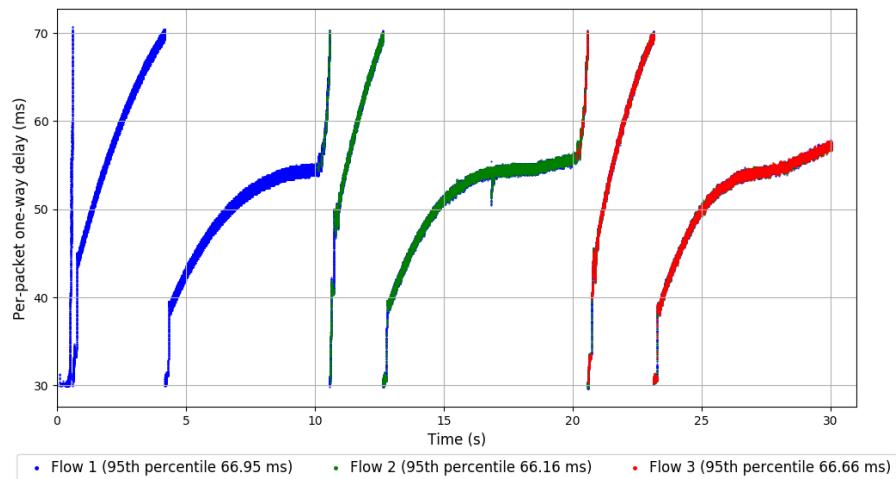
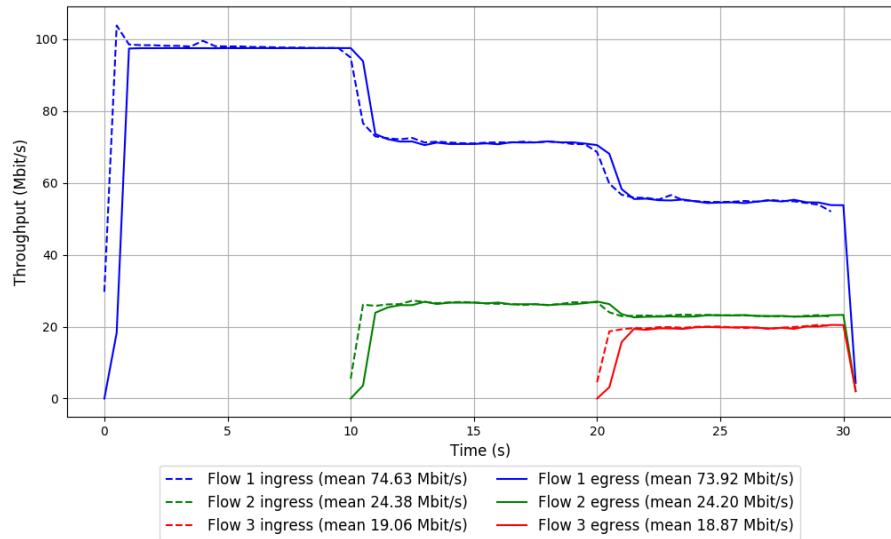


```
Run 1: Statistics of TCP Cubic

Start at: 2018-09-03 08:50:05
End at: 2018-09-03 08:50:35
Local clock offset: -13.826 ms
Remote clock offset: 4.256 ms

# Below is generated by plot.py at 2018-09-03 09:05:29
# Datalink statistics
-- Total of 3 flows:
Average throughput: 96.30 Mbit/s
95th percentile per-packet one-way delay: 66.771 ms
Loss rate: 0.85%
-- Flow 1:
Average throughput: 73.92 Mbit/s
95th percentile per-packet one-way delay: 66.953 ms
Loss rate: 0.86%
-- Flow 2:
Average throughput: 24.20 Mbit/s
95th percentile per-packet one-way delay: 66.159 ms
Loss rate: 0.72%
-- Flow 3:
Average throughput: 18.87 Mbit/s
95th percentile per-packet one-way delay: 66.659 ms
Loss rate: 1.00%
```

Run 1: Report of TCP Cubic — Data Link

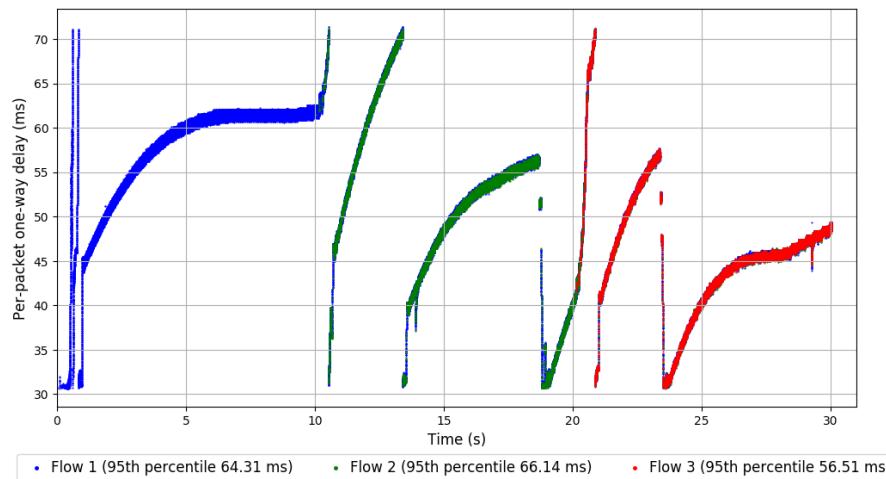
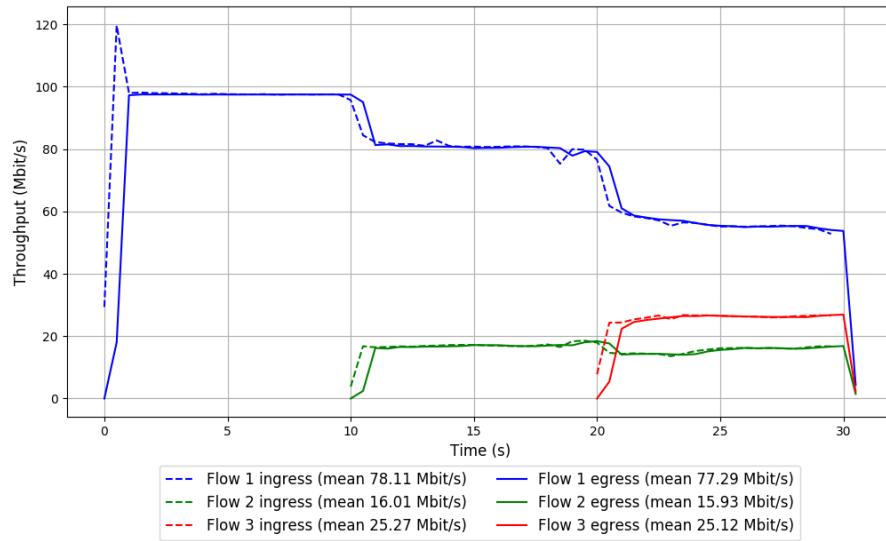


Run 2: Statistics of TCP Cubic

```
Start at: 2018-09-03 08:55:27
End at: 2018-09-03 08:55:57
Local clock offset: -13.458 ms
Remote clock offset: 4.425 ms

# Below is generated by plot.py at 2018-09-03 09:05:29
# Datalink statistics
-- Total of 3 flows:
Average throughput: 96.24 Mbit/s
95th percentile per-packet one-way delay: 64.310 ms
Loss rate: 0.90%
-- Flow 1:
Average throughput: 77.29 Mbit/s
95th percentile per-packet one-way delay: 64.313 ms
Loss rate: 0.99%
-- Flow 2:
Average throughput: 15.93 Mbit/s
95th percentile per-packet one-way delay: 66.145 ms
Loss rate: 0.55%
-- Flow 3:
Average throughput: 25.12 Mbit/s
95th percentile per-packet one-way delay: 56.506 ms
Loss rate: 0.53%
```

Run 2: Report of TCP Cubic — Data Link

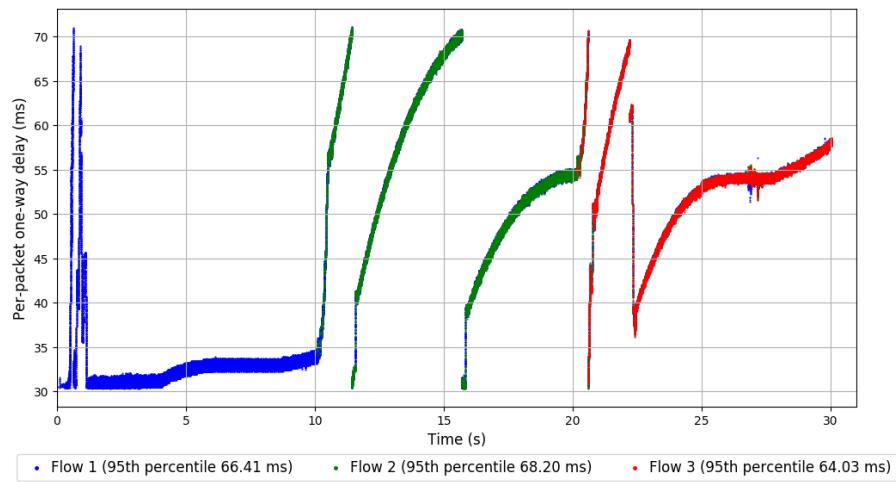
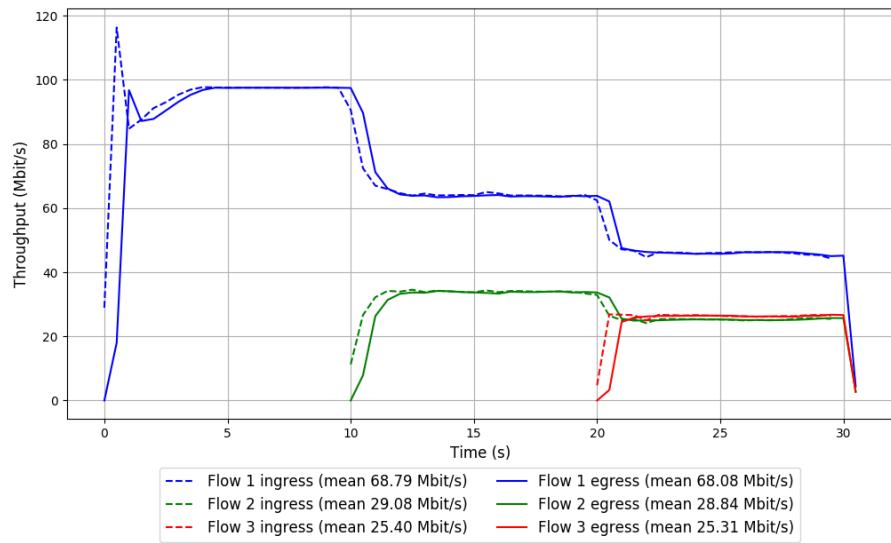


Run 3: Statistics of TCP Cubic

```
Start at: 2018-09-03 09:00:48
End at: 2018-09-03 09:01:18
Local clock offset: -14.101 ms
Remote clock offset: 4.641 ms

# Below is generated by plot.py at 2018-09-03 09:05:29
# Datalink statistics
-- Total of 3 flows:
Average throughput: 95.71 Mbit/s
95th percentile per-packet one-way delay: 66.875 ms
Loss rate: 0.83%
-- Flow 1:
Average throughput: 68.08 Mbit/s
95th percentile per-packet one-way delay: 66.414 ms
Loss rate: 0.94%
-- Flow 2:
Average throughput: 28.84 Mbit/s
95th percentile per-packet one-way delay: 68.197 ms
Loss rate: 0.69%
-- Flow 3:
Average throughput: 25.31 Mbit/s
95th percentile per-packet one-way delay: 64.030 ms
Loss rate: 0.35%
```

Run 3: Report of TCP Cubic — Data Link

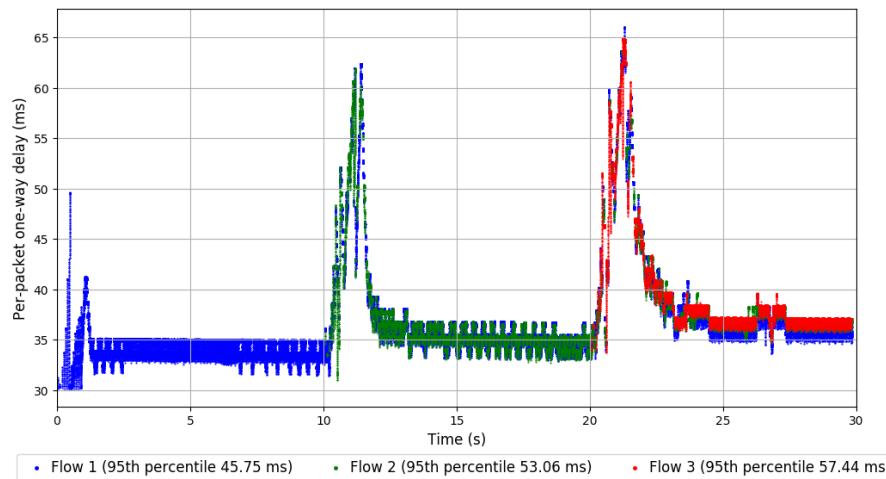
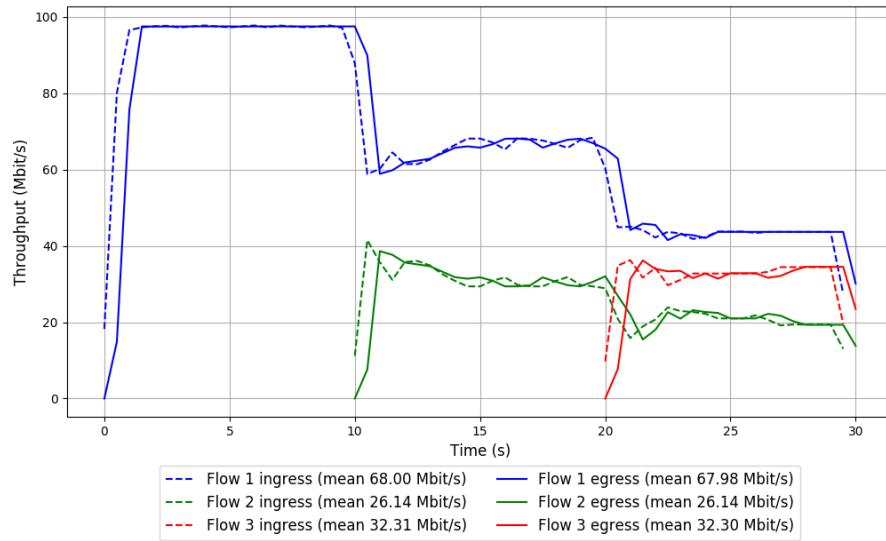


```
Run 1: Statistics of Indigo
```

```
Start at: 2018-09-03 08:48:42
End at: 2018-09-03 08:49:12
Local clock offset: -12.364 ms
Remote clock offset: 4.43 ms

# Below is generated by plot.py at 2018-09-03 09:05:29
# Datalink statistics
-- Total of 3 flows:
Average throughput: 95.87 Mbit/s
95th percentile per-packet one-way delay: 49.945 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 67.98 Mbit/s
95th percentile per-packet one-way delay: 45.746 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 26.14 Mbit/s
95th percentile per-packet one-way delay: 53.056 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 32.30 Mbit/s
95th percentile per-packet one-way delay: 57.438 ms
Loss rate: 0.00%
```

Run 1: Report of Indigo — Data Link

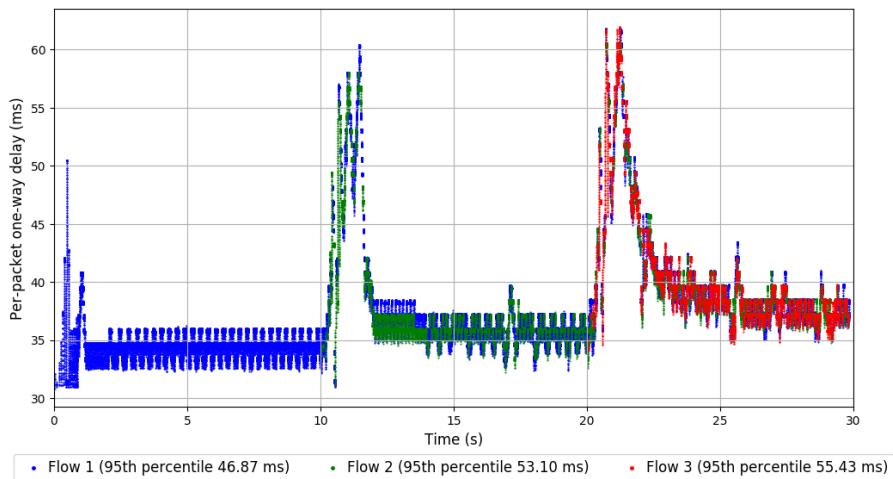
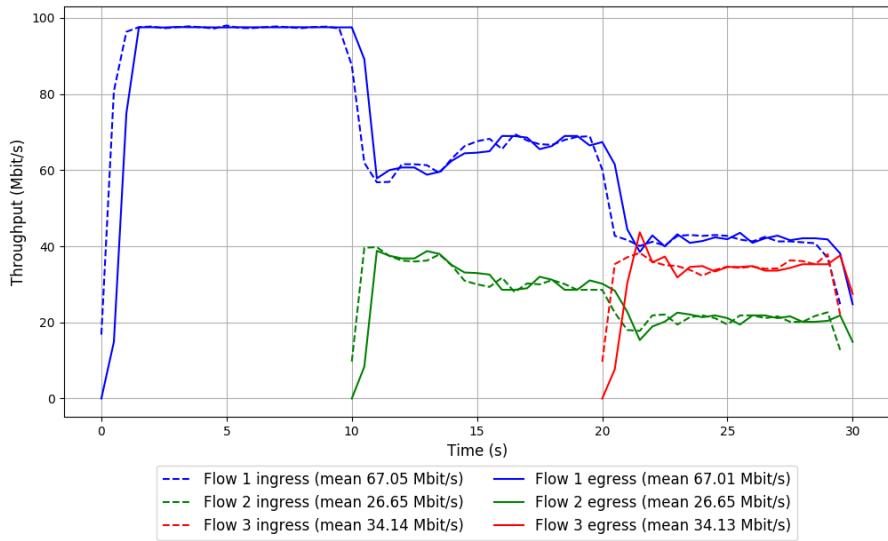


Run 2: Statistics of Indigo

```
Start at: 2018-09-03 08:54:04
End at: 2018-09-03 08:54:34
Local clock offset: -13.935 ms
Remote clock offset: 4.623 ms

# Below is generated by plot.py at 2018-09-03 09:05:29
# Datalink statistics
-- Total of 3 flows:
Average throughput: 95.85 Mbit/s
95th percentile per-packet one-way delay: 50.522 ms
Loss rate: 0.03%
-- Flow 1:
Average throughput: 67.01 Mbit/s
95th percentile per-packet one-way delay: 46.871 ms
Loss rate: 0.05%
-- Flow 2:
Average throughput: 26.65 Mbit/s
95th percentile per-packet one-way delay: 53.100 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 34.13 Mbit/s
95th percentile per-packet one-way delay: 55.427 ms
Loss rate: 0.00%
```

Run 2: Report of Indigo — Data Link

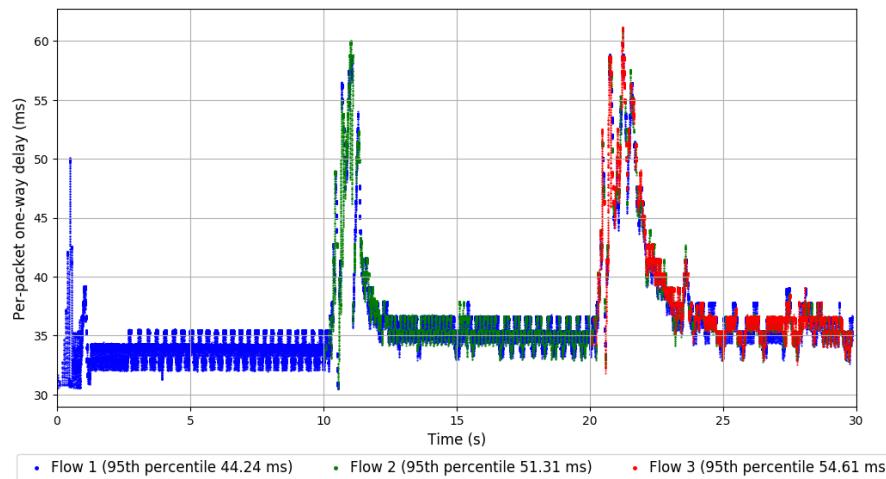
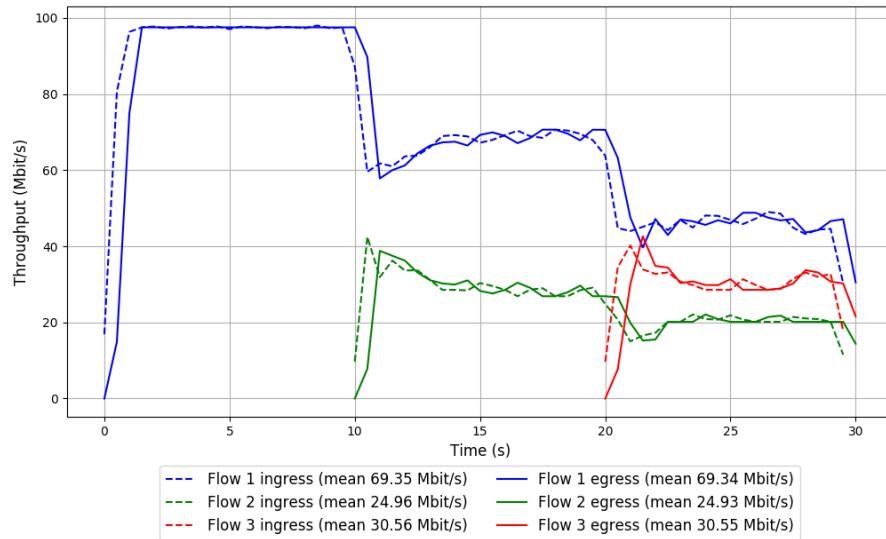


Run 3: Statistics of Indigo

```
Start at: 2018-09-03 08:59:26
End at: 2018-09-03 08:59:56
Local clock offset: -13.723 ms
Remote clock offset: 4.658 ms

# Below is generated by plot.py at 2018-09-03 09:05:35
# Datalink statistics
-- Total of 3 flows:
Average throughput: 95.85 Mbit/s
95th percentile per-packet one-way delay: 47.861 ms
Loss rate: 0.02%
-- Flow 1:
Average throughput: 69.34 Mbit/s
95th percentile per-packet one-way delay: 44.244 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 24.93 Mbit/s
95th percentile per-packet one-way delay: 51.313 ms
Loss rate: 0.09%
-- Flow 3:
Average throughput: 30.55 Mbit/s
95th percentile per-packet one-way delay: 54.611 ms
Loss rate: 0.03%
```

Run 3: Report of Indigo — Data Link

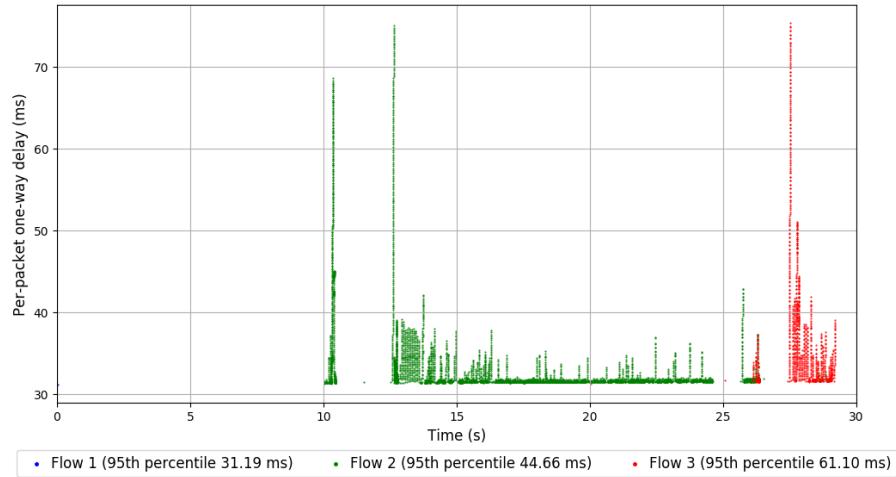
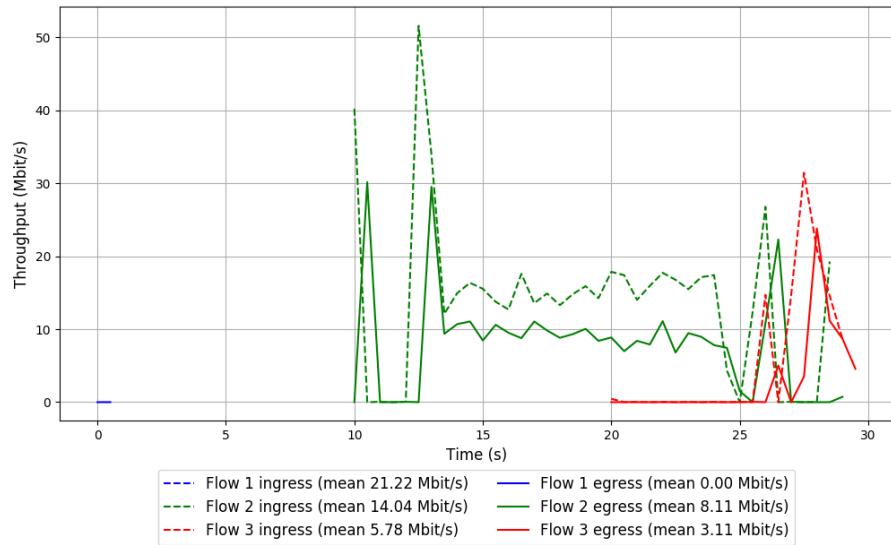


Run 1: Statistics of Muses-25

```
Start at: 2018-09-03 08:52:47
End at: 2018-09-03 08:53:17
Local clock offset: -14.756 ms
Remote clock offset: 4.59 ms

# Below is generated by plot.py at 2018-09-03 09:05:35
# Datalink statistics
-- Total of 3 flows:
Average throughput: 6.20 Mbit/s
95th percentile per-packet one-way delay: 48.897 ms
Loss rate: 42.95%
-- Flow 1:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 31.189 ms
Loss rate: 97.24%
-- Flow 2:
Average throughput: 8.11 Mbit/s
95th percentile per-packet one-way delay: 44.660 ms
Loss rate: 42.28%
-- Flow 3:
Average throughput: 3.11 Mbit/s
95th percentile per-packet one-way delay: 61.105 ms
Loss rate: 46.24%
```

Run 1: Report of Muses-25 — Data Link

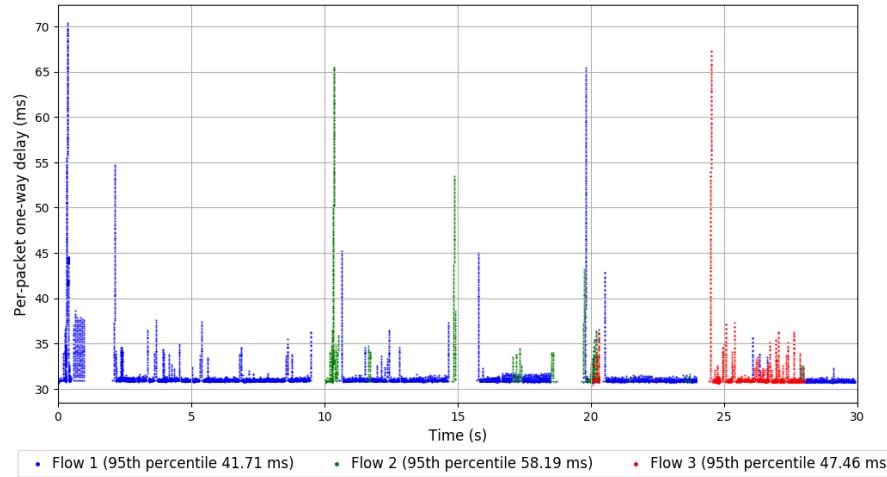
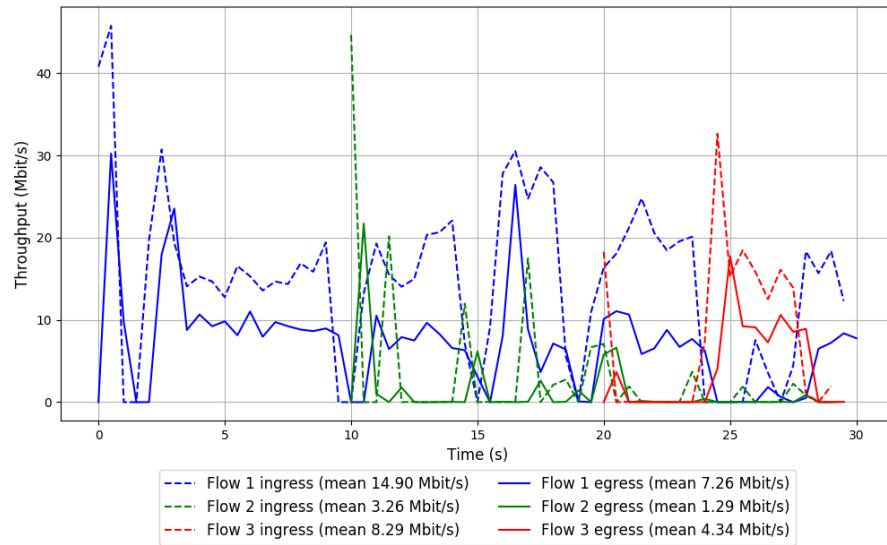


Run 2: Statistics of Muses-25

```
Start at: 2018-09-03 08:58:09
End at: 2018-09-03 08:58:39
Local clock offset: -13.438 ms
Remote clock offset: 4.689 ms

# Below is generated by plot.py at 2018-09-03 09:05:35
# Datalink statistics
-- Total of 3 flows:
Average throughput: 9.41 Mbit/s
95th percentile per-packet one-way delay: 45.033 ms
Loss rate: 51.86%
-- Flow 1:
Average throughput: 7.26 Mbit/s
95th percentile per-packet one-way delay: 41.708 ms
Loss rate: 51.26%
-- Flow 2:
Average throughput: 1.29 Mbit/s
95th percentile per-packet one-way delay: 58.190 ms
Loss rate: 60.46%
-- Flow 3:
Average throughput: 4.34 Mbit/s
95th percentile per-packet one-way delay: 47.458 ms
Loss rate: 48.38%
```

Run 2: Report of Muses-25 — Data Link



Run 3: Statistics of Muses-25

```
Start at: 2018-09-03 09:03:30
End at: 2018-09-03 09:04:00
Local clock offset: -15.482 ms
Remote clock offset: 4.73 ms

# Below is generated by plot.py at 2018-09-03 09:05:35
# Datalink statistics
-- Total of 3 flows:
Average throughput: 6.27 Mbit/s
95th percentile per-packet one-way delay: 39.010 ms
Loss rate: 50.95%
-- Flow 1:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 30.354 ms
Loss rate: 97.24%
-- Flow 2:
Average throughput: 9.24 Mbit/s
95th percentile per-packet one-way delay: 39.010 ms
Loss rate: 50.56%
-- Flow 3:
Average throughput: 0.41 Mbit/s
95th percentile per-packet one-way delay: 38.894 ms
Loss rate: 64.30%
```

Run 3: Report of Muses-25 — Data Link

