

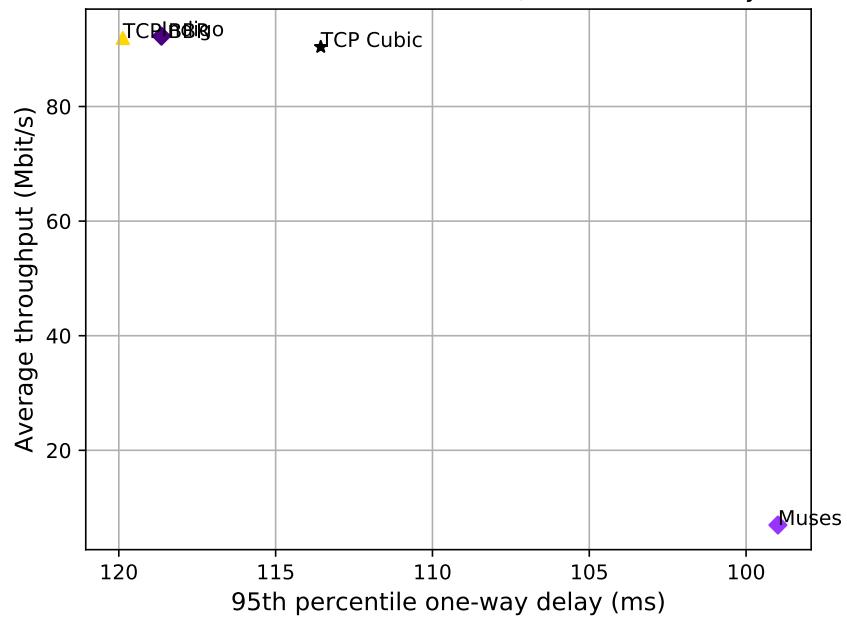
## Pantheon Report

Generated at 2018-08-28 05:27:32 (UTC).  
Data path: AWS Brazil 2 on `ens5` (*local*) → Colombia on `p4p1` (*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 `gps.ntp.br` and have been applied to correct the timestamps in logs.

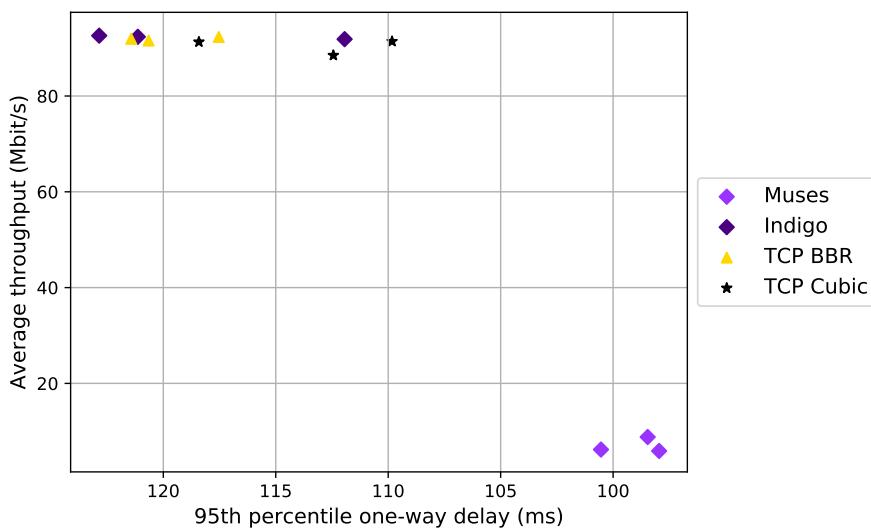
System info:  
Linux 4.15.0-1019-aws  
`net.core.default_qdisc = fq`  
`net.core.rmem_default = 16777216`  
`net.core.rmem_max = 536870912`  
`net.core.wmem_default = 16777216`  
`net.core.wmem_max = 536870912`  
`net.ipv4.tcp_rmem = 4096 16777216 536870912`  
`net.ipv4.tcp_wmem = 4096 16777216 536870912`

Git summary:  
branch: `muses` @ 86ef433b09b2f4ecae1186d6940af93bcf0969cd  
`third_party/fillp` @ d47f4fa1b454a5e3c0537115c5a28436dbd4b834  
`third_party/fillp-sheep` @ daed0c84f98531712514b2231f43ec6901114ffe  
`third_party/genericCC` @ d0153f8e594aa89e93b032143cedbfe58e562f4  
`third_party/indigo` @ 2601c92e4aa9d58d38dc4dfe0ecdbf90c077e64d  
`third_party/libutp` @ b3465b942e2826f2b179eaab4a906ce6bb7cf3cf  
`third_party/muses` @ b261c9e99c63be452bc16f94ce0caa99a4c9d39a  
`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 Brazil 2 to Colombia, 3 runs of 30s each per scheme  
3 flows with 10s interval between flows (mean of all runs by scheme)



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



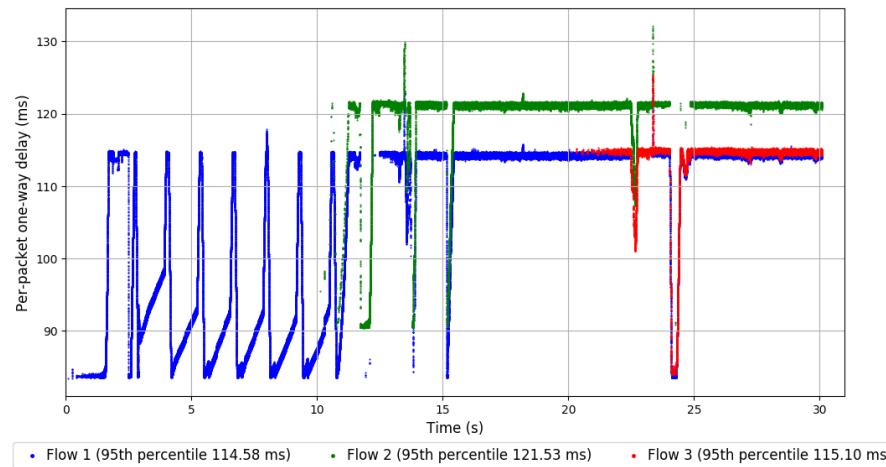
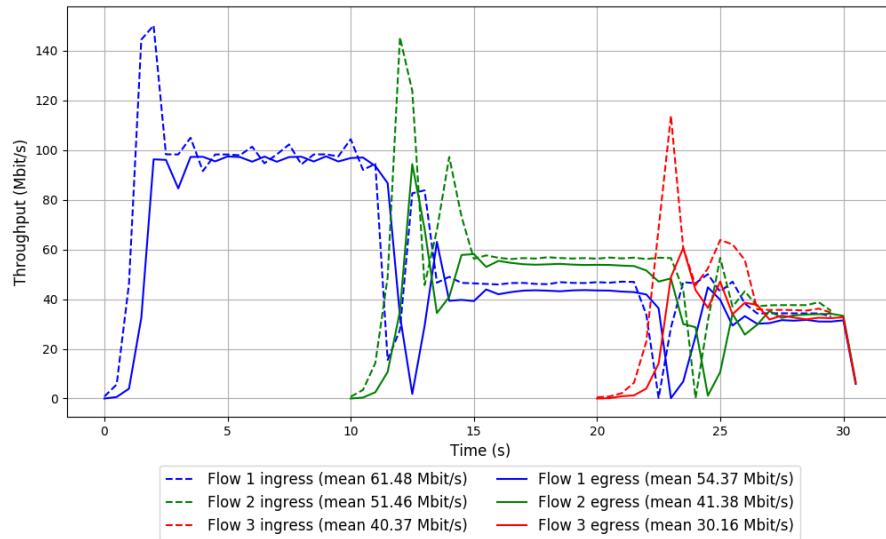
scheme	# runs	mean avg tput (Mbit/s)			mean 95th-%ile delay (ms)			mean loss rate (%)		
		flow 1	flow 2	flow 3	flow 1	flow 2	flow 3	flow 1	flow 2	flow 3
TCP BBR	3	55.45	39.40	30.87	116.45	117.31	116.75	12.04	20.28	28.21
TCP Cubic	3	74.56	16.01	15.58	113.94	114.64	103.99	0.66	0.21	0.21
Indigo	3	65.16	27.95	26.72	116.35	116.65	116.30	8.64	22.88	54.97
Muses	3	4.94	5.77	0.82	89.00	96.60	88.13	54.38	50.88	38.43

Run 1: Statistics of TCP BBR

```
Start at: 2018-08-28 05:15:23
End at: 2018-08-28 05:15:53
Local clock offset: 6.961 ms
Remote clock offset: 7.378 ms

# Below is generated by plot.py at 2018-08-28 05:27:23
# Datalink statistics
-- Total of 3 flows:
Average throughput: 91.94 Mbit/s
95th percentile per-packet one-way delay: 121.427 ms
Loss rate: 15.69%
-- Flow 1:
Average throughput: 54.37 Mbit/s
95th percentile per-packet one-way delay: 114.578 ms
Loss rate: 11.47%
-- Flow 2:
Average throughput: 41.38 Mbit/s
95th percentile per-packet one-way delay: 121.532 ms
Loss rate: 19.52%
-- Flow 3:
Average throughput: 30.16 Mbit/s
95th percentile per-packet one-way delay: 115.099 ms
Loss rate: 25.29%
```

## Run 1: Report of TCP BBR — Data Link

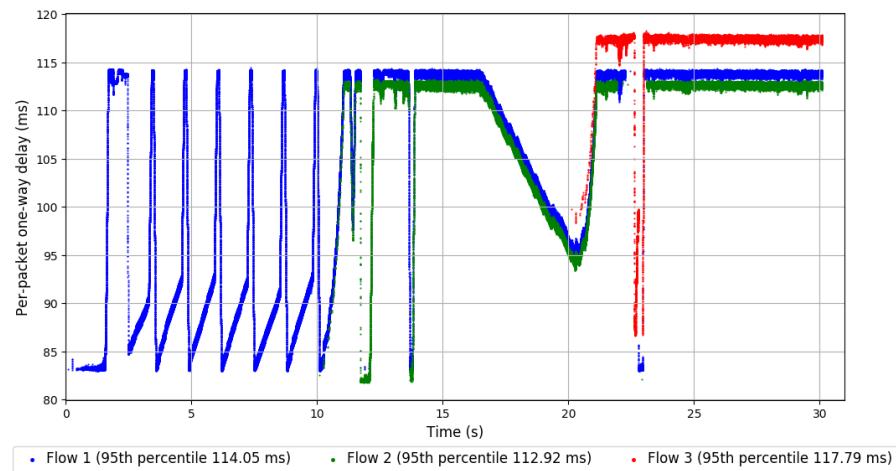
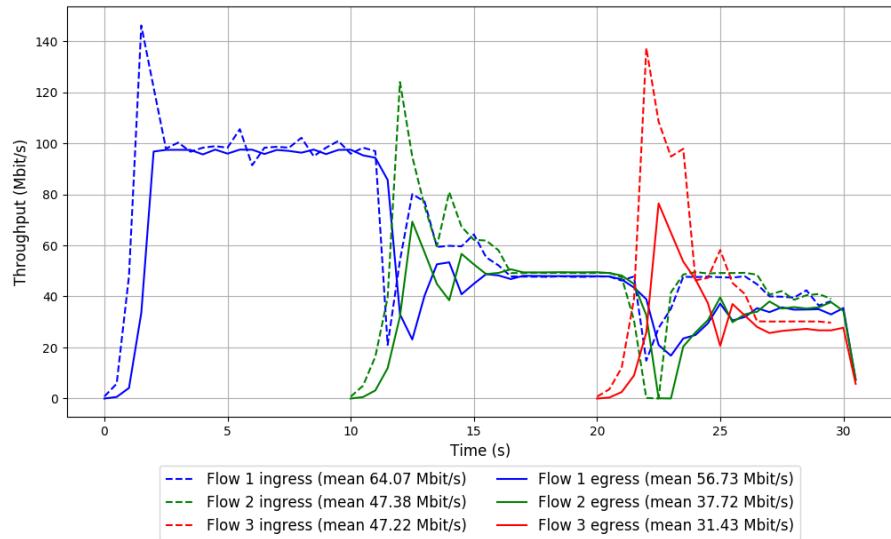


Run 2: Statistics of TCP BBR

```
Start at: 2018-08-28 05:20:23
End at: 2018-08-28 05:20:53
Local clock offset: 4.845 ms
Remote clock offset: 3.302 ms

# Below is generated by plot.py at 2018-08-28 05:27:26
# Datalink statistics
-- Total of 3 flows:
Average throughput: 92.34 Mbit/s
95th percentile per-packet one-way delay: 117.534 ms
Loss rate: 16.99%
-- Flow 1:
Average throughput: 56.73 Mbit/s
95th percentile per-packet one-way delay: 114.052 ms
Loss rate: 11.36%
-- Flow 2:
Average throughput: 37.72 Mbit/s
95th percentile per-packet one-way delay: 112.925 ms
Loss rate: 20.27%
-- Flow 3:
Average throughput: 31.43 Mbit/s
95th percentile per-packet one-way delay: 117.787 ms
Loss rate: 33.35%
```

## Run 2: Report of TCP BBR — Data Link

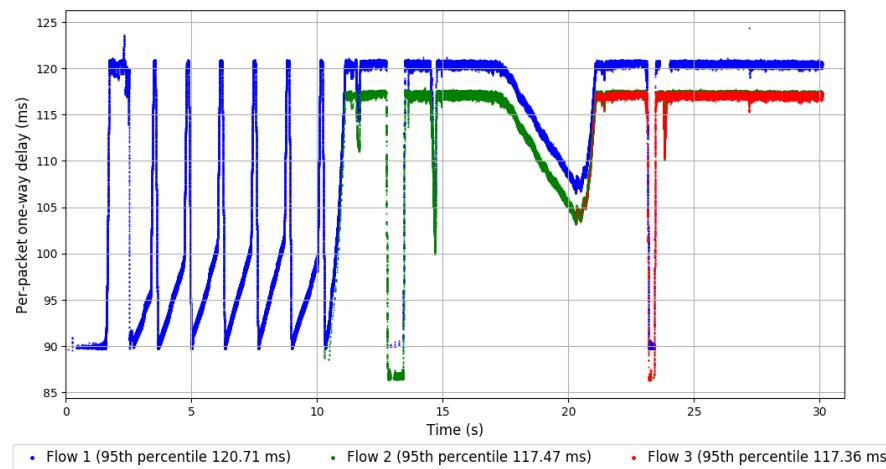
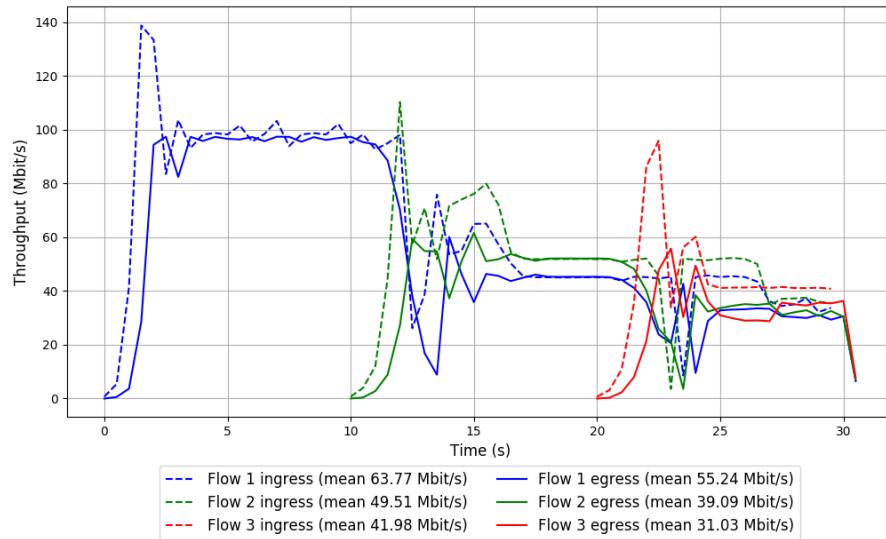


Run 3: Statistics of TCP BBR

```
Start at: 2018-08-28 05:25:22
End at: 2018-08-28 05:25:52
Local clock offset: 6.25 ms
Remote clock offset: 7.984 ms

# Below is generated by plot.py at 2018-08-28 05:27:26
# Datalink statistics
-- Total of 3 flows:
Average throughput: 91.58 Mbit/s
95th percentile per-packet one-way delay: 120.655 ms
Loss rate: 17.21%
-- Flow 1:
Average throughput: 55.24 Mbit/s
95th percentile per-packet one-way delay: 120.707 ms
Loss rate: 13.30%
-- Flow 2:
Average throughput: 39.09 Mbit/s
95th percentile per-packet one-way delay: 117.467 ms
Loss rate: 21.05%
-- Flow 3:
Average throughput: 31.03 Mbit/s
95th percentile per-packet one-way delay: 117.362 ms
Loss rate: 26.00%
```

### Run 3: Report of TCP BBR — Data Link

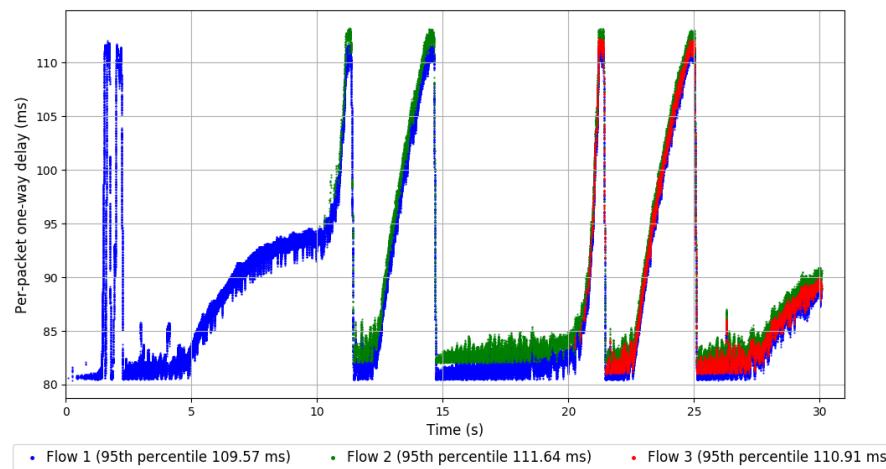
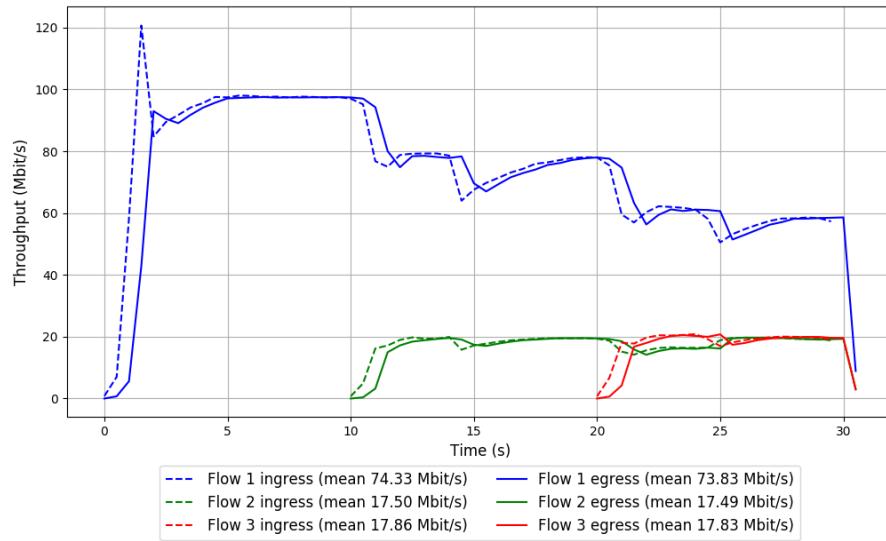


```
Run 1: Statistics of TCP Cubic

Start at: 2018-08-28 05:12:57
End at: 2018-08-28 05:13:27
Local clock offset: 6.657 ms
Remote clock offset: 3.812 ms

# Below is generated by plot.py at 2018-08-28 05:27:26
# Datalink statistics
-- Total of 3 flows:
Average throughput: 91.40 Mbit/s
95th percentile per-packet one-way delay: 109.829 ms
Loss rate: 0.55%
-- Flow 1:
Average throughput: 73.83 Mbit/s
95th percentile per-packet one-way delay: 109.567 ms
Loss rate: 0.65%
-- Flow 2:
Average throughput: 17.49 Mbit/s
95th percentile per-packet one-way delay: 111.643 ms
Loss rate: 0.14%
-- Flow 3:
Average throughput: 17.83 Mbit/s
95th percentile per-packet one-way delay: 110.905 ms
Loss rate: 0.15%
```

## Run 1: Report of TCP Cubic — Data Link

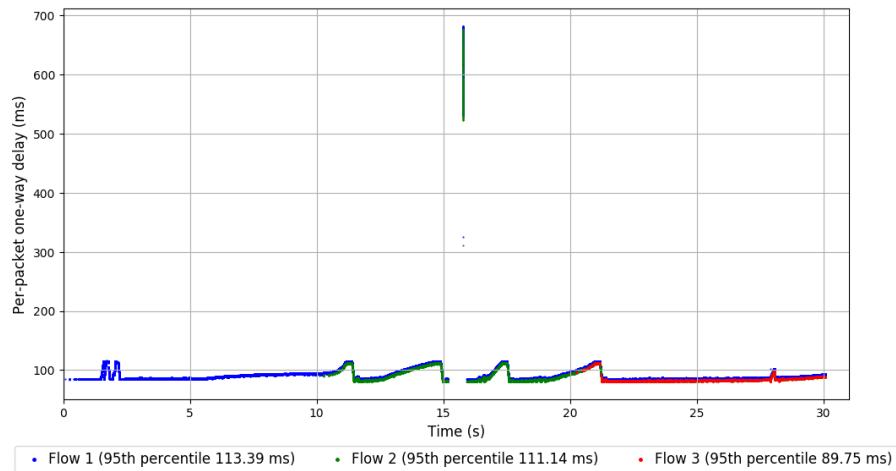
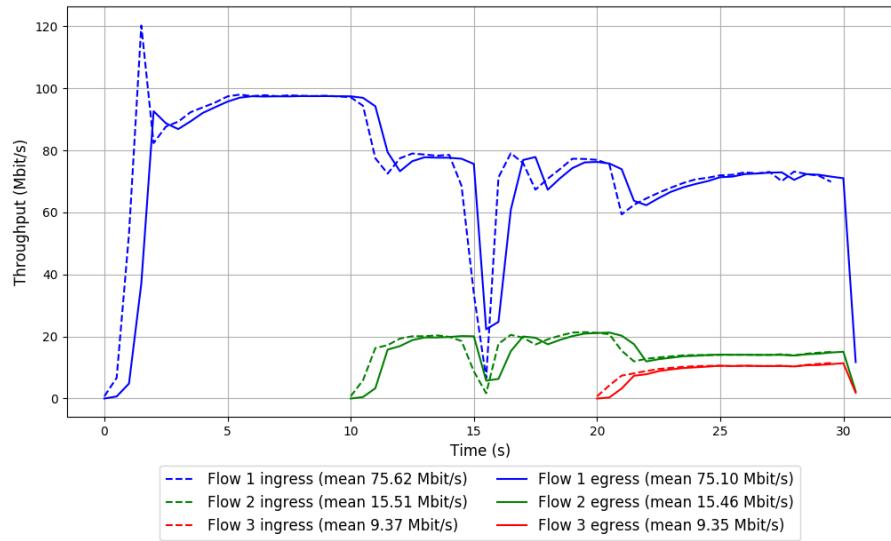


Run 2: Statistics of TCP Cubic

```
Start at: 2018-08-28 05:17:56
End at: 2018-08-28 05:18:26
Local clock offset: 5.868 ms
Remote clock offset: 2.184 ms

# Below is generated by plot.py at 2018-08-28 05:27:26
# Datalink statistics
-- Total of 3 flows:
Average throughput: 88.50 Mbit/s
95th percentile per-packet one-way delay: 112.438 ms
Loss rate: 0.61%
-- Flow 1:
Average throughput: 75.10 Mbit/s
95th percentile per-packet one-way delay: 113.394 ms
Loss rate: 0.67%
-- Flow 2:
Average throughput: 15.46 Mbit/s
95th percentile per-packet one-way delay: 111.142 ms
Loss rate: 0.31%
-- Flow 3:
Average throughput: 9.35 Mbit/s
95th percentile per-packet one-way delay: 89.749 ms
Loss rate: 0.27%
```

## Run 2: Report of TCP Cubic — Data Link

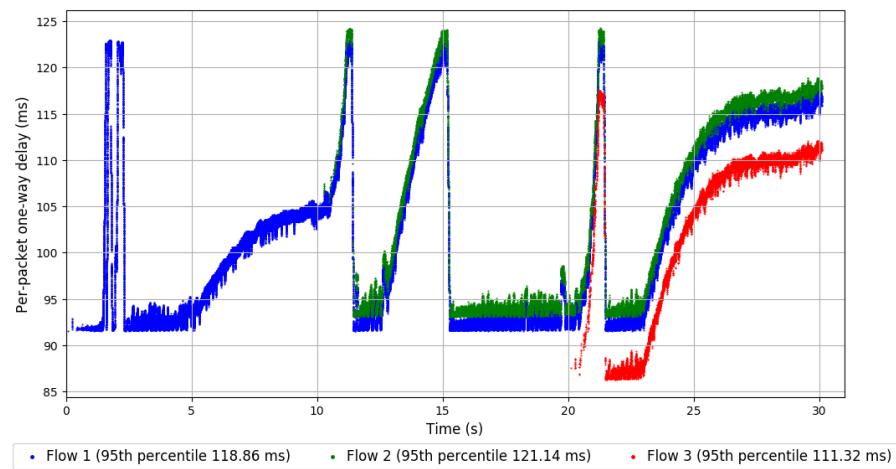
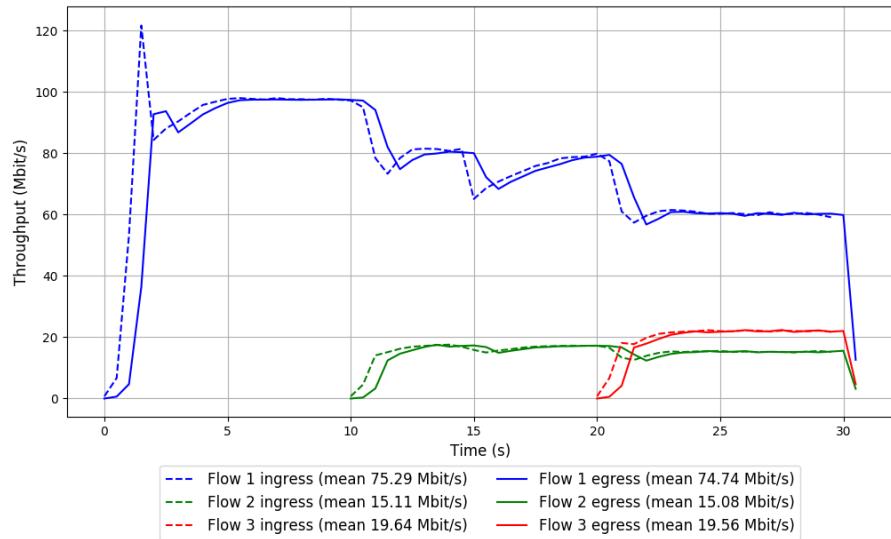


Run 3: Statistics of TCP Cubic

```
Start at: 2018-08-28 05:22:55
End at: 2018-08-28 05:23:25
Local clock offset: 4.783 ms
Remote clock offset: 8.045 ms

# Below is generated by plot.py at 2018-08-28 05:27:26
# Datalink statistics
-- Total of 3 flows:
Average throughput: 91.29 Mbit/s
95th percentile per-packet one-way delay: 118.417 ms
Loss rate: 0.57%
-- Flow 1:
Average throughput: 74.74 Mbit/s
95th percentile per-packet one-way delay: 118.857 ms
Loss rate: 0.65%
-- Flow 2:
Average throughput: 15.08 Mbit/s
95th percentile per-packet one-way delay: 121.138 ms
Loss rate: 0.17%
-- Flow 3:
Average throughput: 19.56 Mbit/s
95th percentile per-packet one-way delay: 111.317 ms
Loss rate: 0.20%
```

### Run 3: Report of TCP Cubic — Data Link

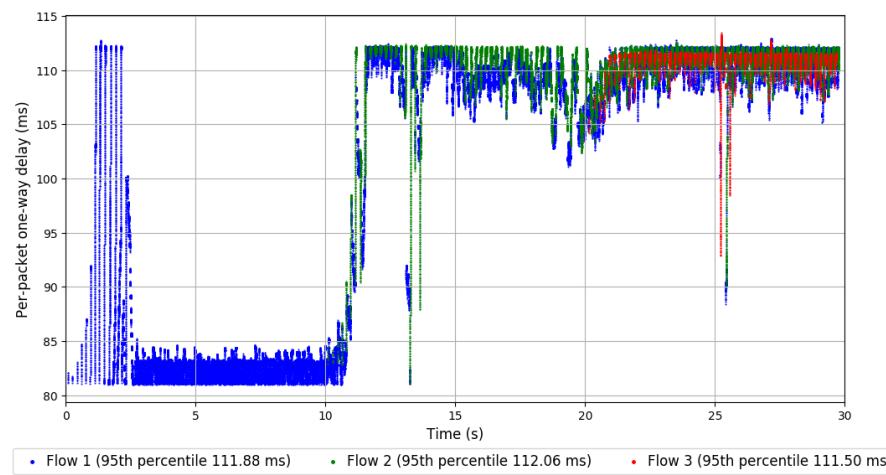
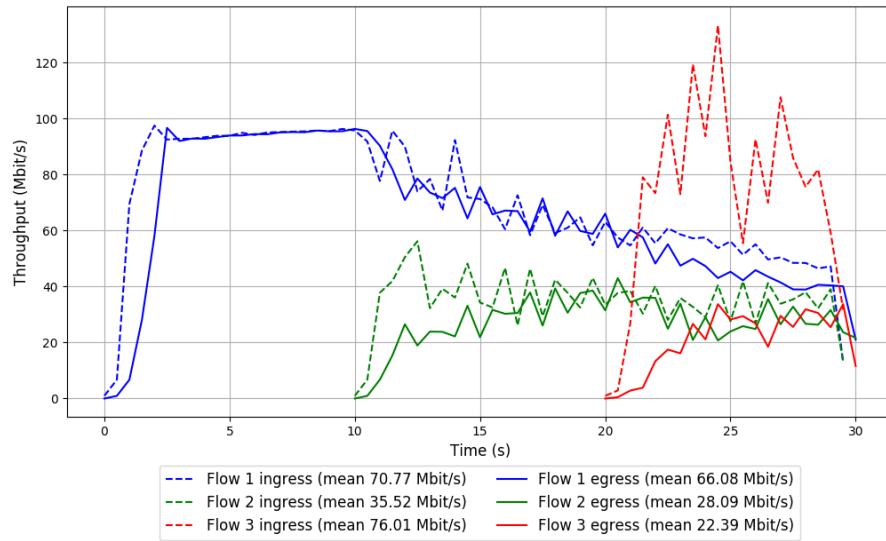


```
Run 1: Statistics of Indigo
```

```
Start at: 2018-08-28 05:11:40
End at: 2018-08-28 05:12:10
Local clock offset: 6.884 ms
Remote clock offset: 2.681 ms

# Below is generated by plot.py at 2018-08-28 05:27:27
# Datalink statistics
-- Total of 3 flows:
Average throughput: 91.87 Mbit/s
95th percentile per-packet one-way delay: 111.938 ms
Loss rate: 22.52%
-- Flow 1:
Average throughput: 66.08 Mbit/s
95th percentile per-packet one-way delay: 111.883 ms
Loss rate: 6.53%
-- Flow 2:
Average throughput: 28.09 Mbit/s
95th percentile per-packet one-way delay: 112.060 ms
Loss rate: 20.81%
-- Flow 3:
Average throughput: 22.39 Mbit/s
95th percentile per-packet one-way delay: 111.499 ms
Loss rate: 70.53%
```

Run 1: Report of Indigo — Data Link

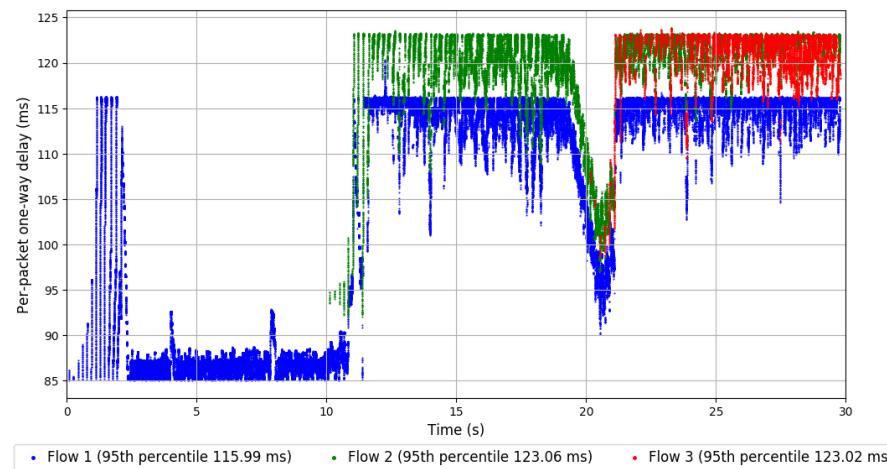
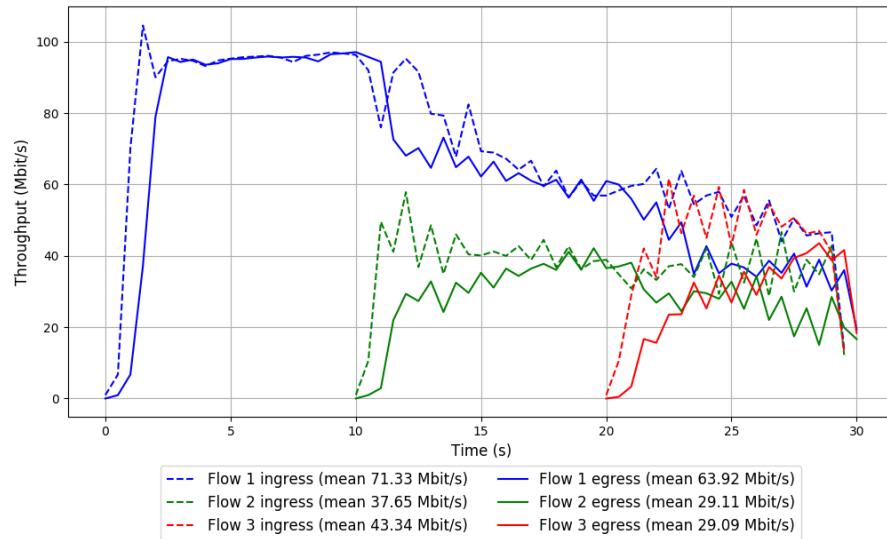


Run 2: Statistics of Indigo

```
Start at: 2018-08-28 05:16:39
End at: 2018-08-28 05:17:09
Local clock offset: 5.258 ms
Remote clock offset: 7.319 ms

# Below is generated by plot.py at 2018-08-28 05:27:27
# Datalink statistics
-- Total of 3 flows:
Average throughput: 92.60 Mbit/s
95th percentile per-packet one-way delay: 122.850 ms
Loss rate: 15.95%
-- Flow 1:
Average throughput: 63.92 Mbit/s
95th percentile per-packet one-way delay: 115.989 ms
Loss rate: 10.31%
-- Flow 2:
Average throughput: 29.11 Mbit/s
95th percentile per-packet one-way delay: 123.059 ms
Loss rate: 22.57%
-- Flow 3:
Average throughput: 29.09 Mbit/s
95th percentile per-packet one-way delay: 123.019 ms
Loss rate: 32.83%
```

## Run 2: Report of Indigo — Data Link

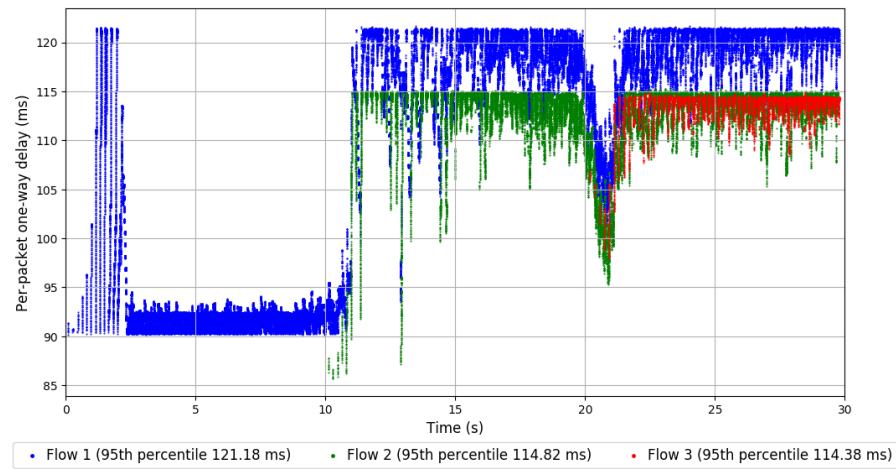
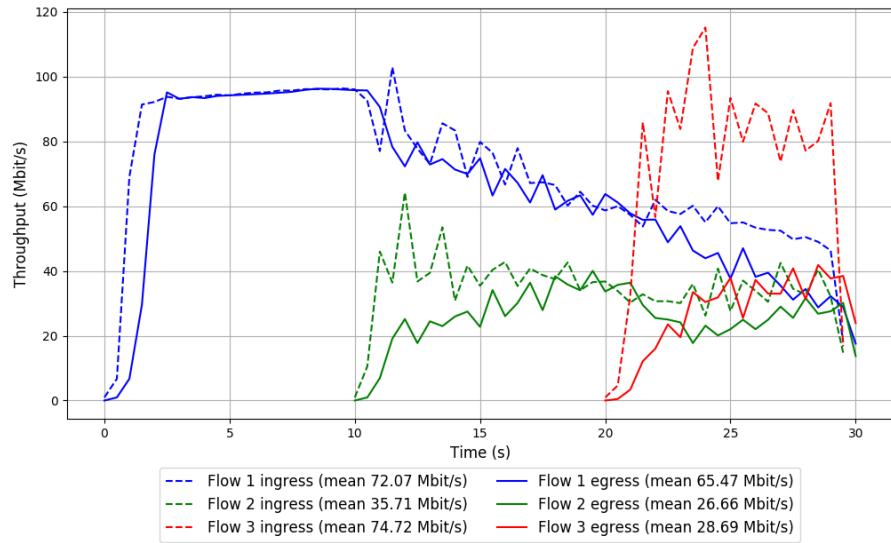


Run 3: Statistics of Indigo

```
Start at: 2018-08-28 05:21:39
End at: 2018-08-28 05:22:09
Local clock offset: 5.609 ms
Remote clock offset: 6.089 ms

# Below is generated by plot.py at 2018-08-28 05:27:31
# Datalink statistics
-- Total of 3 flows:
Average throughput: 92.36 Mbit/s
95th percentile per-packet one-way delay: 121.133 ms
Loss rate: 22.85%
-- Flow 1:
Average throughput: 65.47 Mbit/s
95th percentile per-packet one-way delay: 121.184 ms
Loss rate: 9.07%
-- Flow 2:
Average throughput: 26.66 Mbit/s
95th percentile per-packet one-way delay: 114.821 ms
Loss rate: 25.25%
-- Flow 3:
Average throughput: 28.69 Mbit/s
95th percentile per-packet one-way delay: 114.384 ms
Loss rate: 61.56%
```

### Run 3: Report of Indigo — Data Link

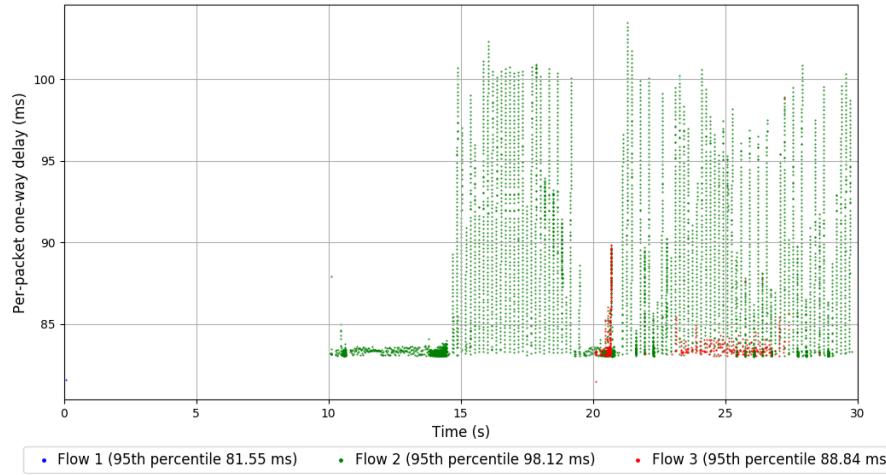
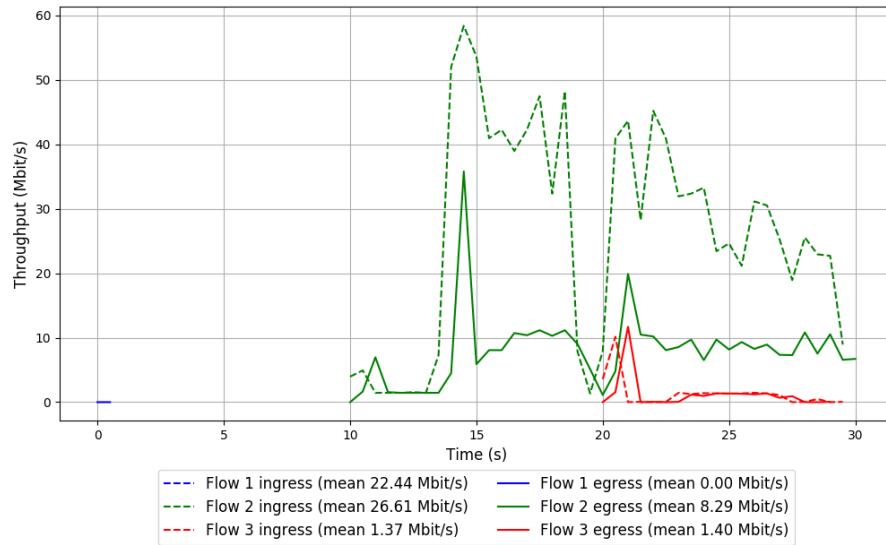


```
Run 1: Statistics of Muses
```

```
Start at: 2018-08-28 05:14:12
End at: 2018-08-28 05:14:42
Local clock offset: 5.558 ms
Remote clock offset: 3.61 ms

# Below is generated by plot.py at 2018-08-28 05:27:31
# Datalink statistics
-- Total of 3 flows:
Average throughput: 5.90 Mbit/s
95th percentile per-packet one-way delay: 97.954 ms
Loss rate: 67.43%
-- Flow 1:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 81.550 ms
Loss rate: 97.39%
-- Flow 2:
Average throughput: 8.29 Mbit/s
95th percentile per-packet one-way delay: 98.122 ms
Loss rate: 68.86%
-- Flow 3:
Average throughput: 1.40 Mbit/s
95th percentile per-packet one-way delay: 88.838 ms
Loss rate: 10.42%
```

### Run 1: Report of Muses — Data Link

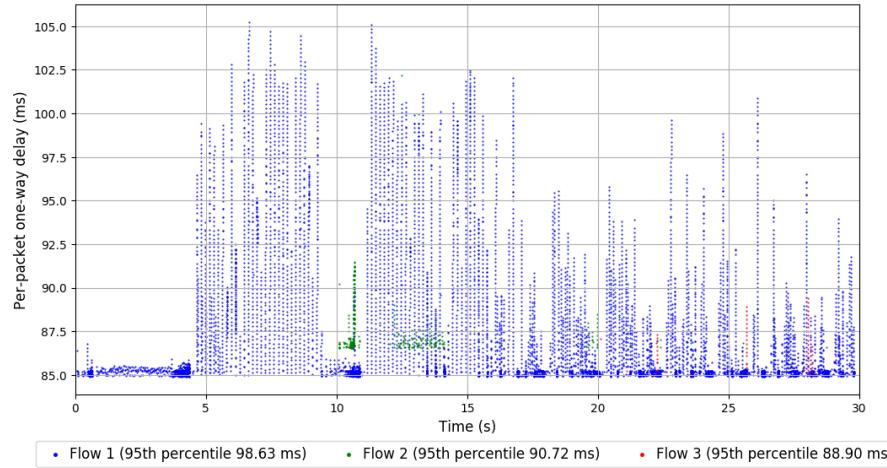
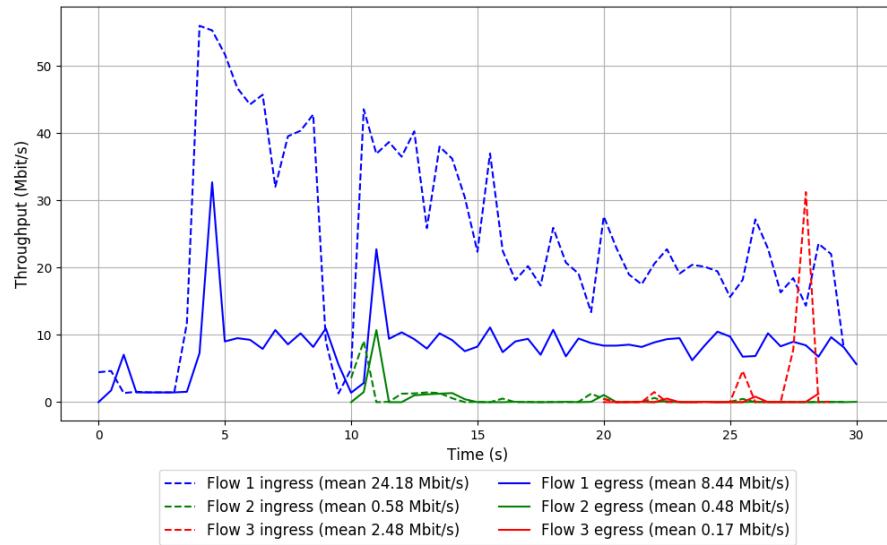


Run 2: Statistics of Muses

```
Start at: 2018-08-28 05:19:11
End at: 2018-08-28 05:19:41
Local clock offset: 6.539 ms
Remote clock offset: 8.403 ms

# Below is generated by plot.py at 2018-08-28 05:27:31
# Datalink statistics
-- Total of 3 flows:
Average throughput: 8.81 Mbit/s
95th percentile per-packet one-way delay: 98.462 ms
Loss rate: 65.24%
-- Flow 1:
Average throughput: 8.44 Mbit/s
95th percentile per-packet one-way delay: 98.630 ms
Loss rate: 65.10%
-- Flow 2:
Average throughput: 0.48 Mbit/s
95th percentile per-packet one-way delay: 90.719 ms
Loss rate: 15.81%
-- Flow 3:
Average throughput: 0.17 Mbit/s
95th percentile per-packet one-way delay: 88.898 ms
Loss rate: 93.90%
```

## Run 2: Report of Muses — Data Link



Run 3: Statistics of Muses

```
Start at: 2018-08-28 05:24:11
End at: 2018-08-28 05:24:41
Local clock offset: 4.729 ms
Remote clock offset: 7.08 ms

# Below is generated by plot.py at 2018-08-28 05:27:31
# Datalink statistics
-- Total of 3 flows:
Average throughput: 6.19 Mbit/s
95th percentile per-packet one-way delay: 100.539 ms
Loss rate: 66.13%
-- Flow 1:
Average throughput: 6.37 Mbit/s
95th percentile per-packet one-way delay: 86.828 ms
Loss rate: 0.66%
-- Flow 2:
Average throughput: 8.55 Mbit/s
95th percentile per-packet one-way delay: 100.961 ms
Loss rate: 67.98%
-- Flow 3:
Average throughput: 0.90 Mbit/s
95th percentile per-packet one-way delay: 86.662 ms
Loss rate: 10.96%
```

### Run 3: Report of Muses — Data Link

