Pantheon Report

Generated at 2018-08-31 04:58:06 (UTC).

Data path: AWS Brazil 2 on `ens5` (*local*) →Colombia on `p4p1` (*remote*).

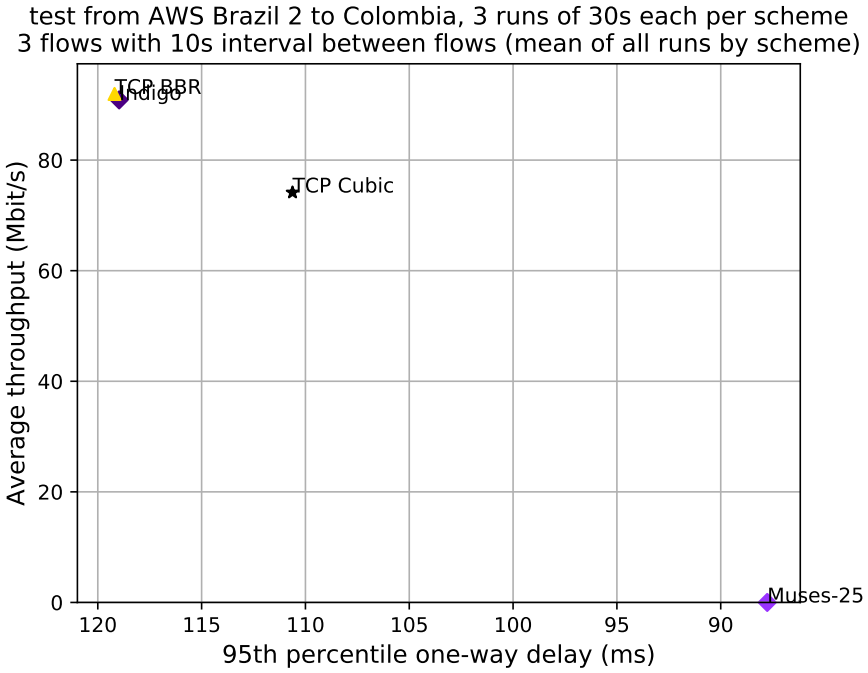
Repeated the test of 4 congestion control schemes 3 times.

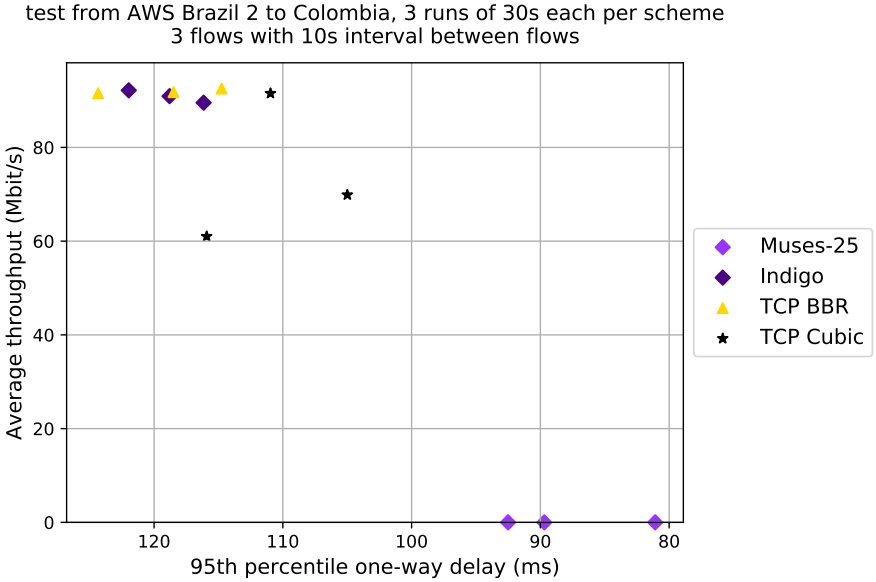
Each test lasted for 30 seconds running 3 flows with 10-second interval between two flows.

NTP offsets were measured against `gps.ntp.br` and have been applied to correct the timestamps in logs.

```
System info:
Linux 4.15.0-1020-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 @ 2de97ca91a065473c29a25fffe63fb137c97a67c
third_party/fillp @ d47f4fa1b454a5e3c0537115c5a28436dbd4b834
third_party/fillp-sheep @ daed0c84f98531712514b2231f43ec6901114ffe
third_party/genericCC @ d0153f8e594aa89e93b032143cedbdfe58e562f4
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 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)
TCP BBR
Indigo
TCP Cubic
Muses-25
Average throughput (Mbit/s)
95th percentile one-way delay (ms)
0
20
40
60
80
120
115
110
105
100
95
90


test from AWS Brazil 2 to Colombia, 3 runs of 30s each per scheme
3 flows with 10s interval between flows
Muses-25
Indigo
TCP BBR
TCP Cubic
Average throughput (Mbit/s)
95th percentile one-way delay (ms)
0
20
40
60
80
120
110
100
90
80

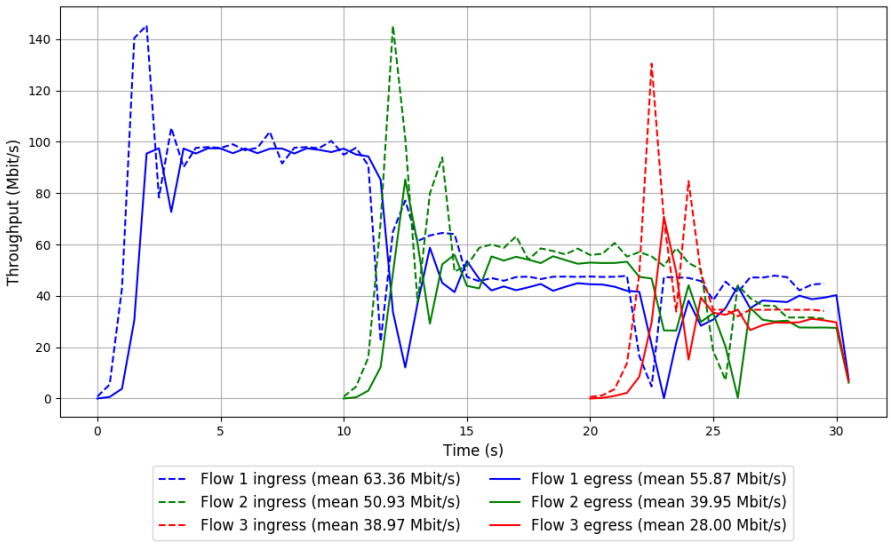
scheme	# runs	mean avg tput (Mbit/s)			mean 95th-%ile delay (ms)			mean loss rate (%)		
		flow 1	flow 2	flow 3	flow 1	flow 2	flow 3	flow 1	flow 2	flow 3
TCP BBR	3	56.79	37.16	31.36	115.08	117.66	116.37	12.13	19.21	24.11
TCP Cubic	3	47.32	32.33	15.89	108.70	111.91	112.62	0.75	0.76	1.98
Indigo	3	61.79	29.43	29.90	114.82	115.05	119.63	13.44	20.84	51.40
Muses-25	3	0.00	0.00	0.00	88.99	84.81	87.81	3.03	0.00	0.00

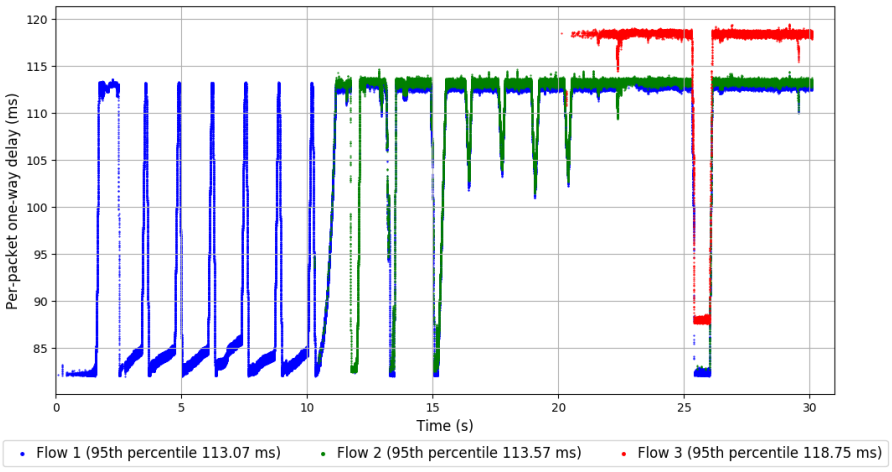
```
Run 1: Statistics of TCP BBR

Start at: 2018-08-31 04:41:44
End at: 2018-08-31 04:42:14
Local clock offset: -4.211 ms
Remote clock offset: -0.693 ms

# Below is generated by plot.py at 2018-08-31 04:58:01
# Datalink statistics
-- Total of 3 flows:
Average throughput: 91.79 Mbit/s
95th percentile per-packet one-way delay: 118.487 ms
Loss rate: 16.68%
-- Flow 1:
Average throughput: 55.87 Mbit/s
95th percentile per-packet one-way delay: 113.071 ms
Loss rate: 11.74%
-- Flow 2:
Average throughput: 39.95 Mbit/s
95th percentile per-packet one-way delay: 113.573 ms
Loss rate: 21.51%
-- Flow 3:
Average throughput: 28.00 Mbit/s
95th percentile per-packet one-way delay: 118.752 ms
Loss rate: 28.19%
```

Run 1: Report of TCP BBR — Data Link



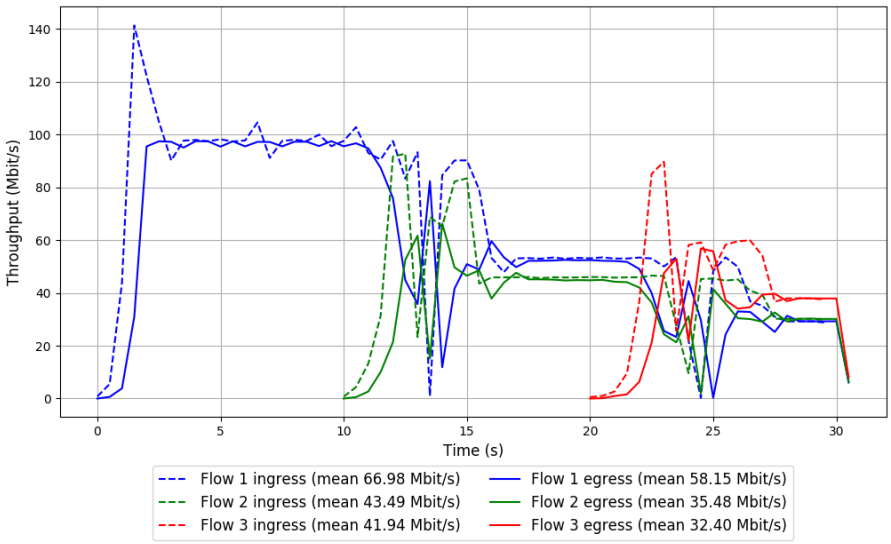


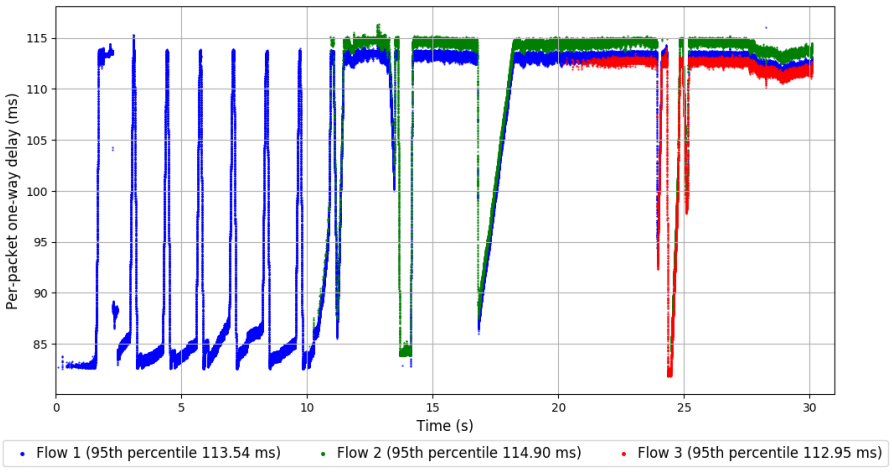
```
Run 2: Statistics of TCP BBR

Start at: 2018-08-31 04:46:42
End at: 2018-08-31 04:47:12
Local clock offset: -3.649 ms
Remote clock offset: 0.518 ms

# Below is generated by plot.py at 2018-08-31 04:58:01
# Datalink statistics
-- Total of 3 flows:
Average throughput: 92.56 Mbit/s
95th percentile per-packet one-way delay: 114.747 ms
Loss rate: 15.69%
-- Flow 1:
Average throughput: 58.15 Mbit/s
95th percentile per-packet one-way delay: 113.541 ms
Loss rate: 13.10%
-- Flow 2:
Average throughput: 35.48 Mbit/s
95th percentile per-packet one-way delay: 114.900 ms
Loss rate: 18.30%
-- Flow 3:
Average throughput: 32.40 Mbit/s
95th percentile per-packet one-way delay: 112.952 ms
Loss rate: 22.73%
```

Run 2: Report of TCP BBR — Data Link



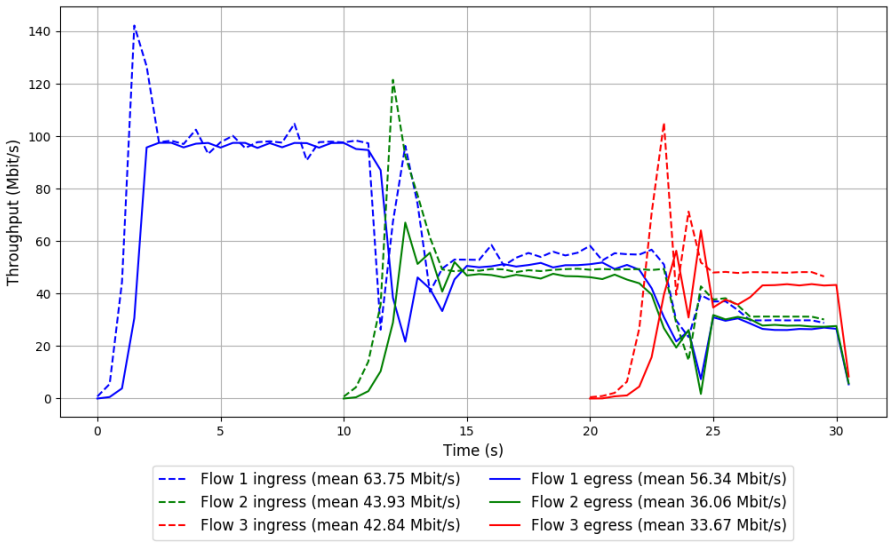


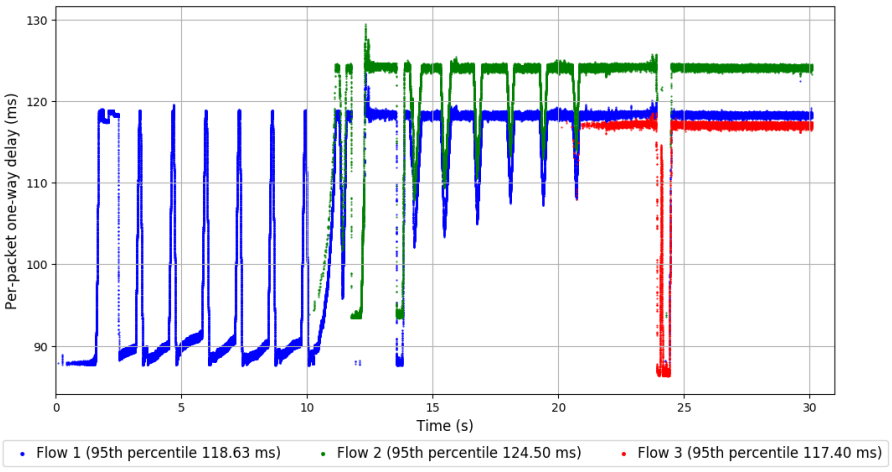
```
Run 3: Statistics of TCP BBR

Start at: 2018-08-31 04:52:03
End at: 2018-08-31 04:52:33
Local clock offset: -6.101 ms
Remote clock offset: 5.455 ms

# Below is generated by plot.py at 2018-08-31 04:58:01
# Datalink statistics
-- Total of 3 flows:
Average throughput: 91.55 Mbit/s
95th percentile per-packet one-way delay: 124.342 ms
Loss rate: 14.56%
-- Flow 1:
Average throughput: 56.34 Mbit/s
95th percentile per-packet one-way delay: 118.632 ms
Loss rate: 11.54%
-- Flow 2:
Average throughput: 36.06 Mbit/s
95th percentile per-packet one-way delay: 124.495 ms
Loss rate: 17.83%
-- Flow 3:
Average throughput: 33.67 Mbit/s
95th percentile per-packet one-way delay: 117.401 ms
Loss rate: 21.42%
```

Run 3: Report of TCP BBR — Data Link



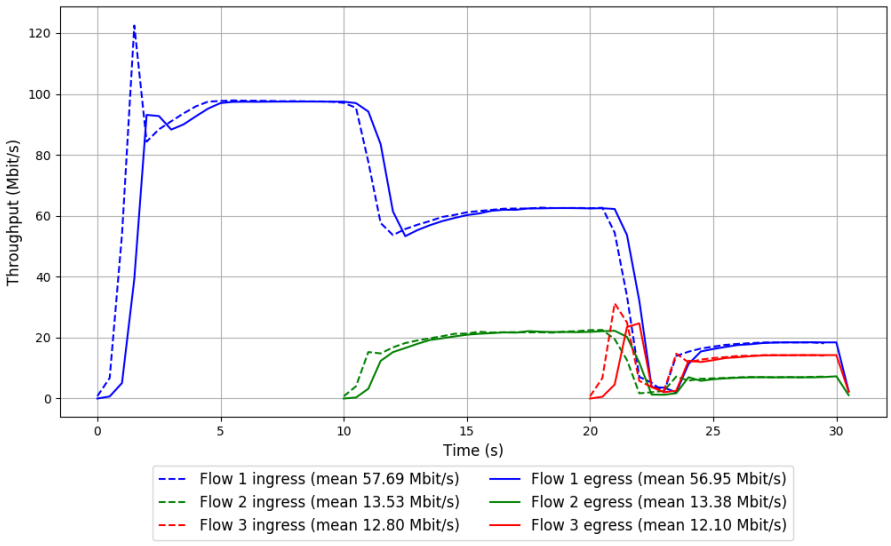


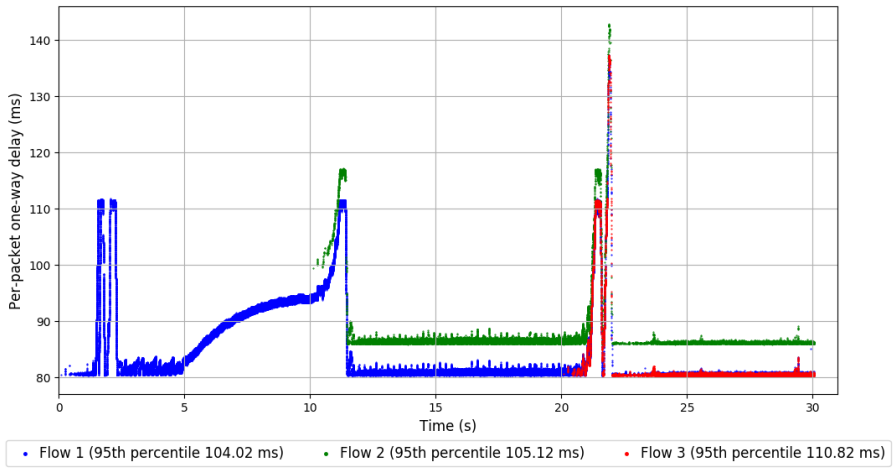
```
Run 1: Statistics of TCP Cubic

Start at: 2018-08-31 04:44:17
End at: 2018-08-31 04:44:47
Local clock offset: -2.669 ms
Remote clock offset: -0.768 ms

# Below is generated by plot.py at 2018-08-31 04:58:01
# Datalink statistics
-- Total of 3 flows:
Average throughput: 69.87 Mbit/s
95th percentile per-packet one-way delay: 104.991 ms
Loss rate: 1.53%
-- Flow 1:
Average throughput: 56.95 Mbit/s
95th percentile per-packet one-way delay: 104.022 ms
Loss rate: 1.29%
-- Flow 2:
Average throughput: 13.38 Mbit/s
95th percentile per-packet one-way delay: 105.125 ms
Loss rate: 1.24%
-- Flow 3:
Average throughput: 12.10 Mbit/s
95th percentile per-packet one-way delay: 110.824 ms
Loss rate: 5.52%
```

Run 1: Report of TCP Cubic — Data Link



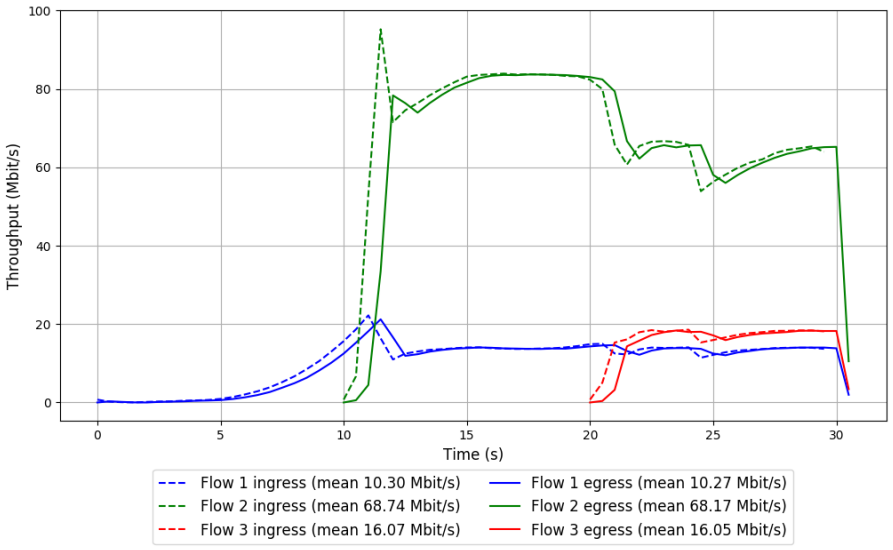


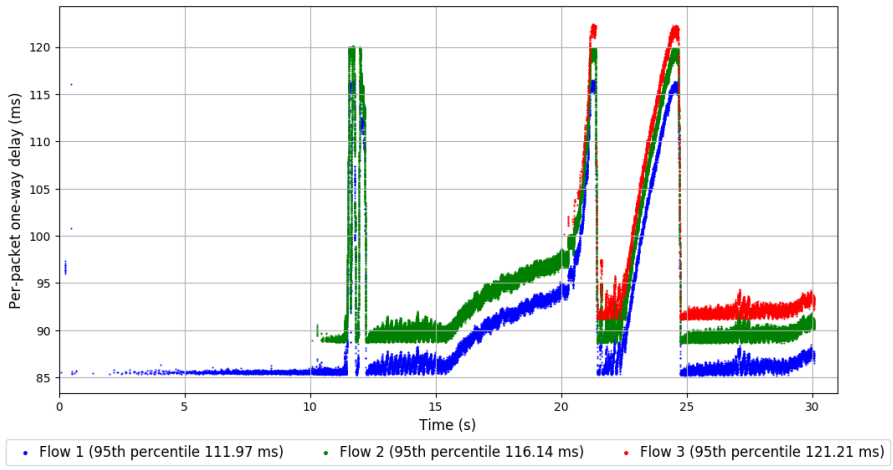
```
Run 2: Statistics of TCP Cubic

Start at: 2018-08-31 04:49:39
End at: 2018-08-31 04:50:09
Local clock offset: -5.436 ms
Remote clock offset: 4.537 ms

# Below is generated by plot.py at 2018-08-31 04:58:01
# Datalink statistics
-- Total of 3 flows:
Average throughput: 61.01 Mbit/s
95th percentile per-packet one-way delay: 115.917 ms
Loss rate: 0.70%
-- Flow 1:
Average throughput: 10.27 Mbit/s
95th percentile per-packet one-way delay: 111.969 ms
Loss rate: 0.34%
-- Flow 2:
Average throughput: 68.17 Mbit/s
95th percentile per-packet one-way delay: 116.138 ms
Loss rate: 0.83%
-- Flow 3:
Average throughput: 16.05 Mbit/s
95th percentile per-packet one-way delay: 121.206 ms
Loss rate: 0.23%
```

Run 2: Report of TCP Cubic — Data Link



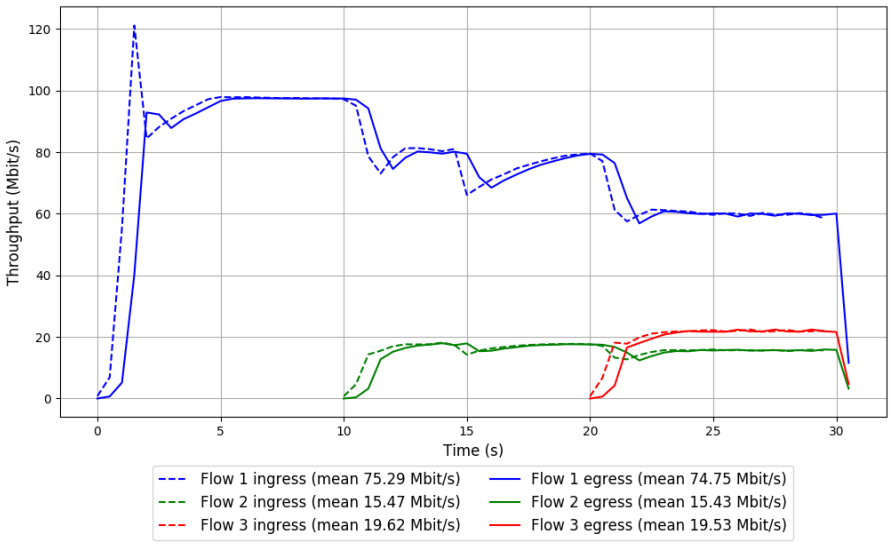


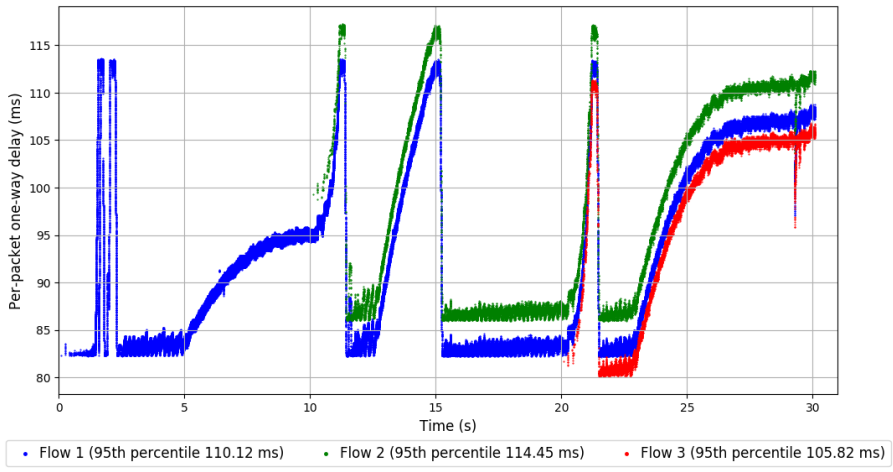
```
Run 3: Statistics of TCP Cubic

Start at: 2018-08-31 04:54:42
End at: 2018-08-31 04:55:12
Local clock offset: -6.002 ms
Remote clock offset: 0.37 ms

# Below is generated by plot.py at 2018-08-31 04:58:01
# Datalink statistics
-- Total of 3 flows:
Average throughput: 91.53 Mbit/s
95th percentile per-packet one-way delay: 110.960 ms
Loss rate: 0.55%
-- Flow 1:
Average throughput: 74.75 Mbit/s
95th percentile per-packet one-way delay: 110.116 ms
Loss rate: 0.63%
-- Flow 2:
Average throughput: 15.43 Mbit/s
95th percentile per-packet one-way delay: 114.452 ms
Loss rate: 0.21%
-- Flow 3:
Average throughput: 19.53 Mbit/s
95th percentile per-packet one-way delay: 105.819 ms
Loss rate: 0.20%
```

Run 3: Report of TCP Cubic — Data Link



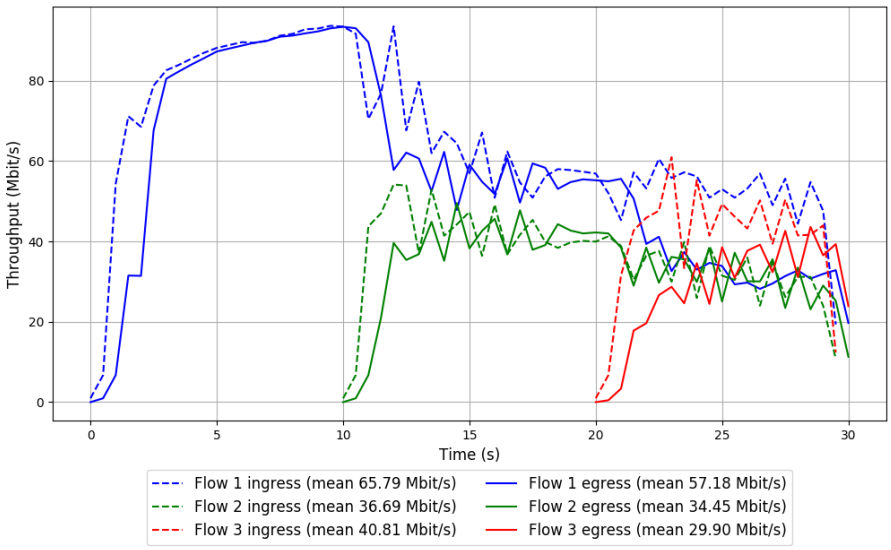


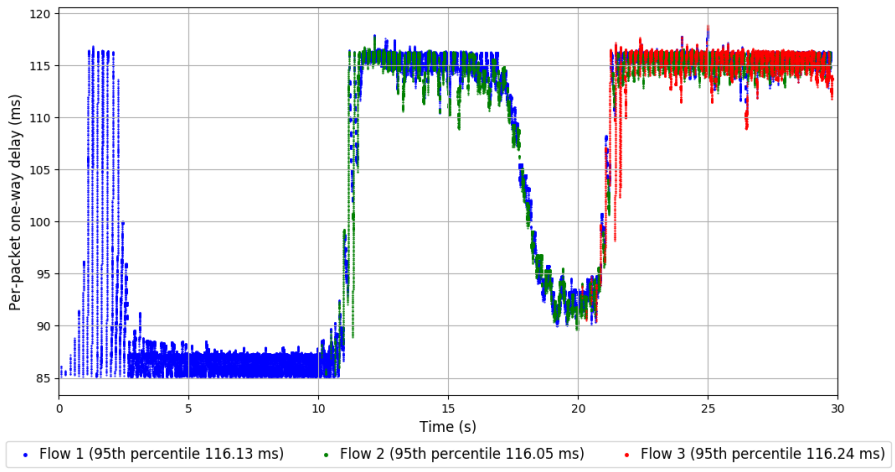
```
Run 1: Statistics of Indigo

Start at: 2018-08-31 04:43:00
End at: 2018-08-31 04:43:30
Local clock offset: -3.467 ms
Remote clock offset: 3.205 ms

# Below is generated by plot.py at 2018-08-31 04:58:01
# Datalink statistics
-- Total of 3 flows:
Average throughput: 89.54 Mbit/s
95th percentile per-packet one-way delay: 116.153 ms
Loss rate: 13.09%
-- Flow 1:
Average throughput: 57.18 Mbit/s
95th percentile per-packet one-way delay: 116.132 ms
Loss rate: 12.99%
-- Flow 2:
Average throughput: 34.45 Mbit/s
95th percentile per-packet one-way delay: 116.051 ms
Loss rate: 5.99%
-- Flow 3:
Average throughput: 29.90 Mbit/s
95th percentile per-packet one-way delay: 116.237 ms
Loss rate: 26.58%
```

Run 1: Report of Indigo — Data Link



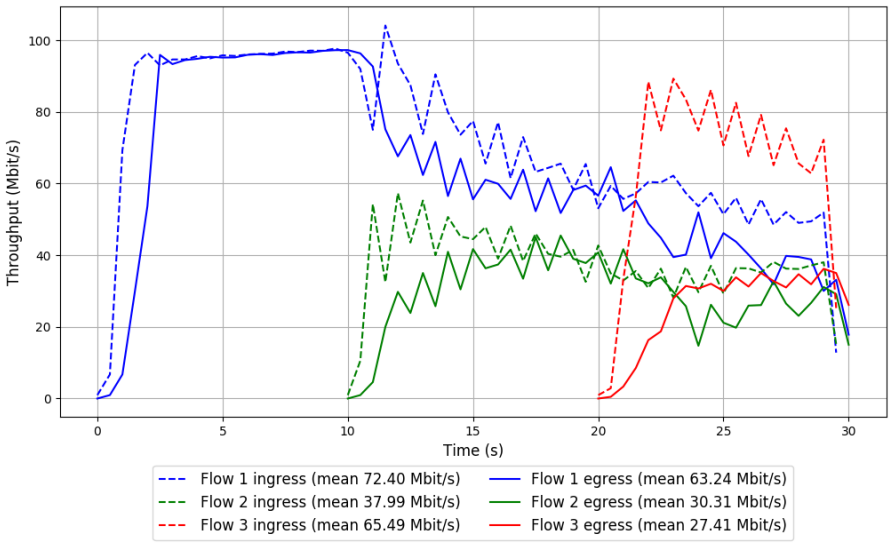


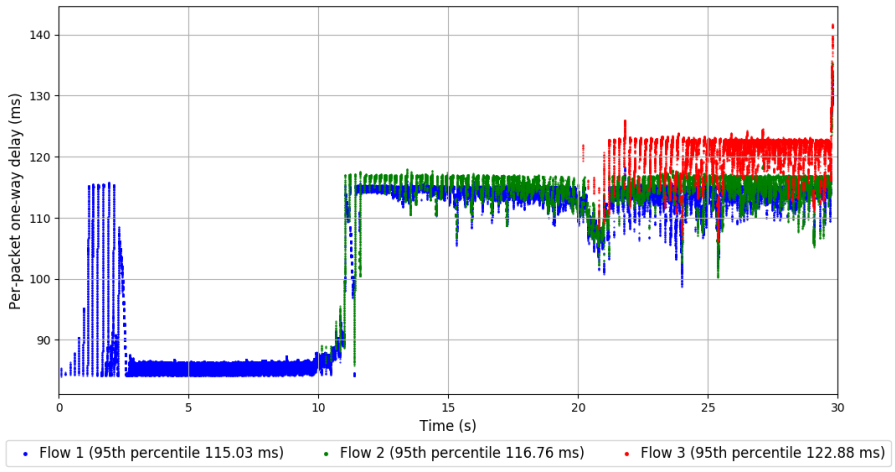
```
Run 2: Statistics of Indigo

Start at: 2018-08-31 04:48:09
End at: 2018-08-31 04:48:39
Local clock offset: -4.152 ms
Remote clock offset: 4.417 ms

# Below is generated by plot.py at 2018-08-31 04:58:02
# Datalink statistics
-- Total of 3 flows:
Average throughput: 92.18 Mbit/s
95th percentile per-packet one-way delay: 121.966 ms
Loss rate: 22.23%
-- Flow 1:
Average throughput: 63.24 Mbit/s
95th percentile per-packet one-way delay: 115.032 ms
Loss rate: 12.51%
-- Flow 2:
Average throughput: 30.31 Mbit/s
95th percentile per-packet one-way delay: 116.760 ms
Loss rate: 20.02%
-- Flow 3:
Average throughput: 27.41 Mbit/s
95th percentile per-packet one-way delay: 122.878 ms
Loss rate: 58.04%
```

Run 2: Report of Indigo — Data Link



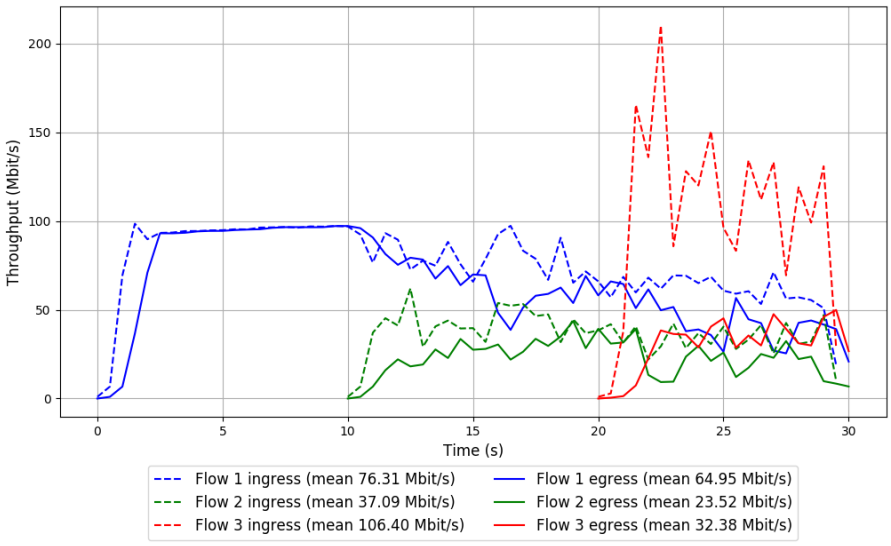


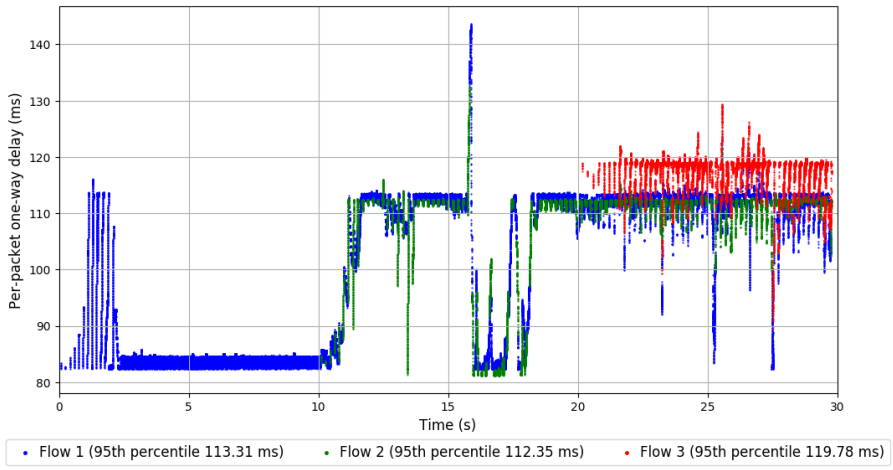
```
Run 3: Statistics of Indigo

Start at: 2018-08-31 04:53:23
End at: 2018-08-31 04:53:53
Local clock offset: -5.758 ms
Remote clock offset: 0.575 ms

# Below is generated by plot.py at 2018-08-31 04:58:05
# Datalink statistics
-- Total of 3 flows:
Average throughput: 90.94 Mbit/s
95th percentile per-packet one-way delay: 118.794 ms
Loss rate: 32.70%
-- Flow 1:
Average throughput: 64.95 Mbit/s
95th percentile per-packet one-way delay: 113.309 ms
Loss rate: 14.82%
-- Flow 2:
Average throughput: 23.52 Mbit/s
95th percentile per-packet one-way delay: 112.351 ms
Loss rate: 36.50%
-- Flow 3:
Average throughput: 32.38 Mbit/s
95th percentile per-packet one-way delay: 119.775 ms
Loss rate: 69.58%
```

Run 3: Report of Indigo — Data Link



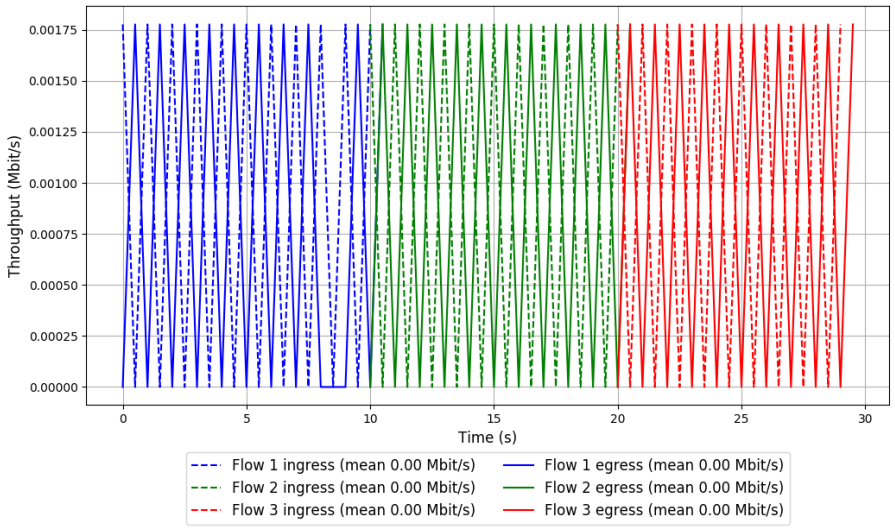


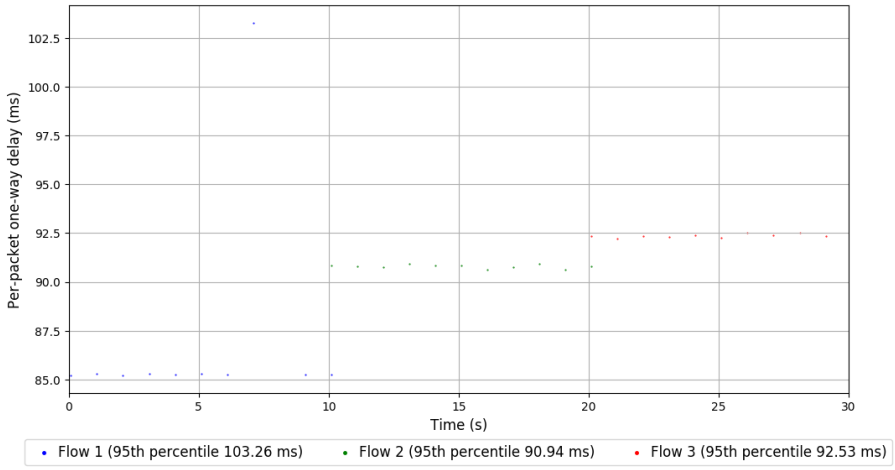
```
Run 1: Statistics of Muses-25

Start at: 2018-08-31 04:45:32
End at: 2018-08-31 04:46:02
Local clock offset: -2.742 ms
Remote clock offset: 5.515 ms

# Below is generated by plot.py at 2018-08-31 04:58:05
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 92.507 ms
Loss rate: 3.12%
-- Flow 1:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 103.263 ms
Loss rate: 9.09%
-- Flow 2:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 90.935 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 92.527 ms
Loss rate: 0.00%
```

Run 1: Report of Muses-25 — Data Link



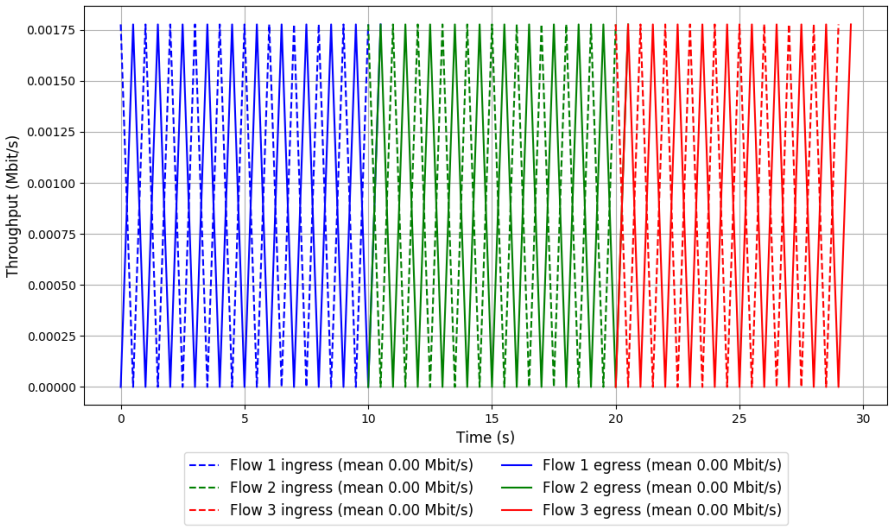


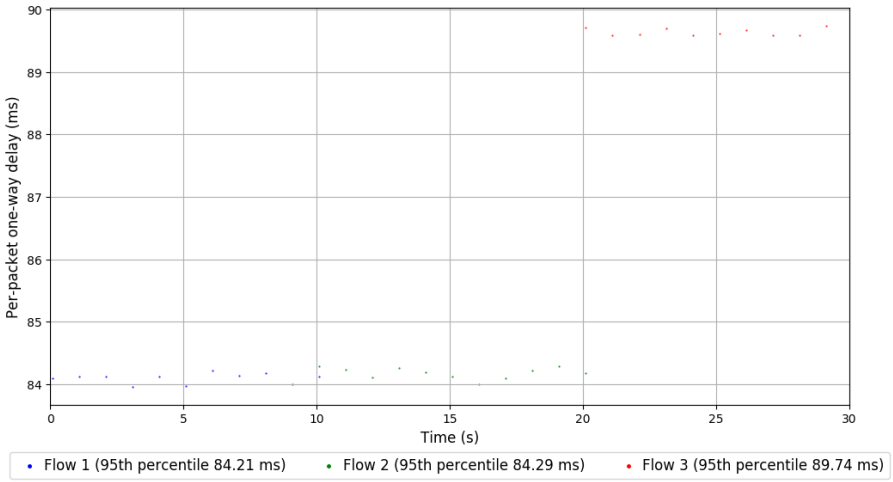
```
Run 2: Statistics of Muses-25

Start at: 2018-08-31 04:50:53
End at: 2018-08-31 04:51:23
Local clock offset: -5.733 ms
Remote clock offset: 3.338 ms

# Below is generated by plot.py at 2018-08-31 04:58:05
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 89.692 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 84.212 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 84.289 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 89.738 ms
Loss rate: 0.00%
```

Run 2: Report of Muses-25 — Data Link





```
Run 3: Statistics of Muses-25

Start at: 2018-08-31 04:56:04
End at: 2018-08-31 04:56:34
Local clock offset: -6.363 ms
Remote clock offset: -0.748 ms

# Below is generated by plot.py at 2018-08-31 04:58:05
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 81.081 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 79.488 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 79.211 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 81.163 ms
Loss rate: 0.00%
```

Run 3: Report of Muses-25 — Data Link