Pantheon Report

Generated at 2018-08-28 05:28:43 (UTC).

Data path: AWS California 2 on `ens5` (*local*) →Mexico on `em1` (*remote*).

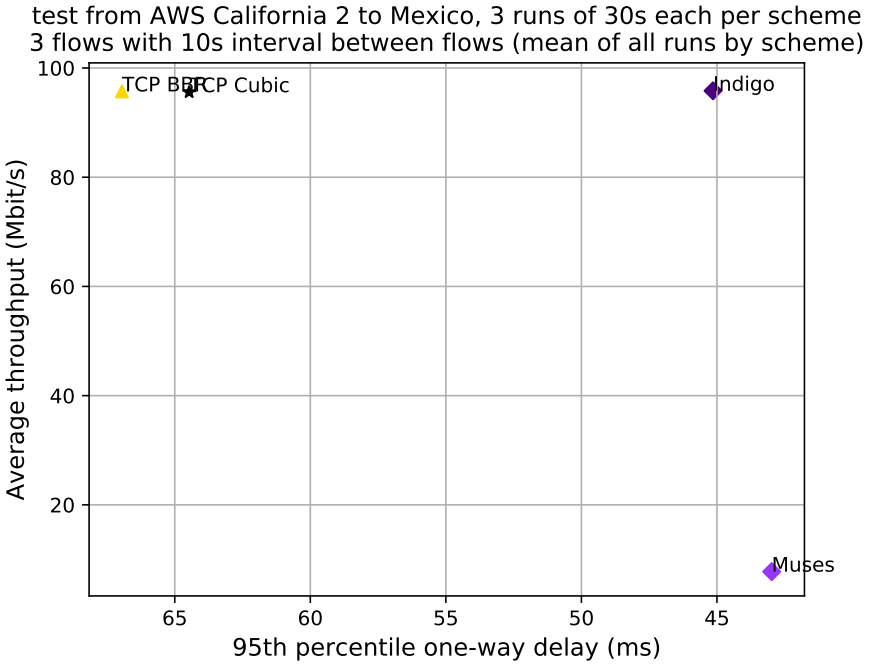
Repeated the test of 4 congestion control schemes 3 times.

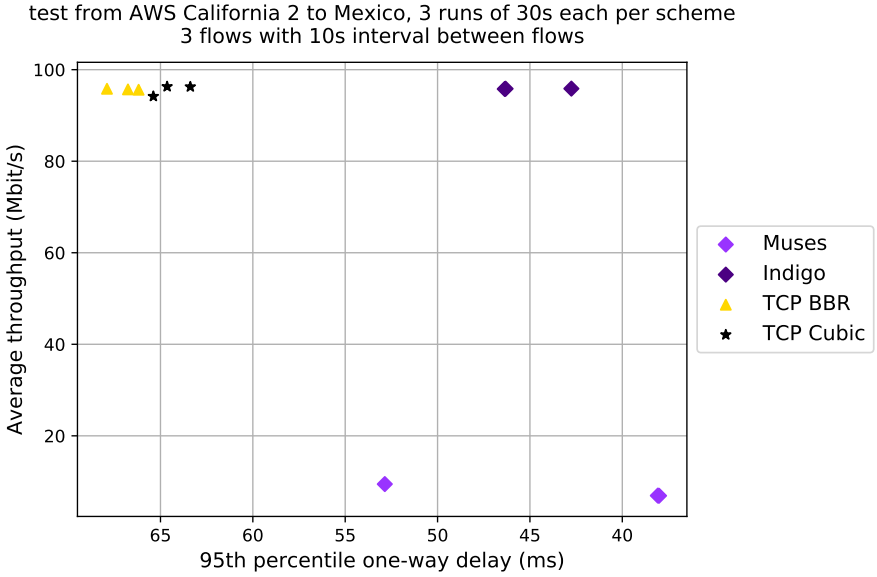
Each test lasted for 30 seconds running 3 flows with 10-second interval between two flows.

NTP offsets were measured against `time.stanford.edu` and have been applied to correct the timestamps in logs.

```
System info:
Linux 4.15.0-1019-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 @ d0153f8e594aa89e93b032143cedbdfe58e562f4
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 California 2 to Mexico, 3 runs of 30s each per scheme
3 flows with 10s interval between flows (mean of all runs by scheme)
TCP BBR
TCP Cubic
Indigo
Muses
Average throughput (Mbit/s)
95th percentile one-way delay (ms)
100
80
60
40
20
65
60
55
50
45


test from AWS California 2 to Mexico, 3 runs of 30s each per scheme
3 flows with 10s interval between flows
Average throughput (Mbit/s)
95th percentile one-way delay (ms)
Muses
Indigo
TCP BBR
TCP Cubic
100
80
60
40
20
65
60
55
50
45
40

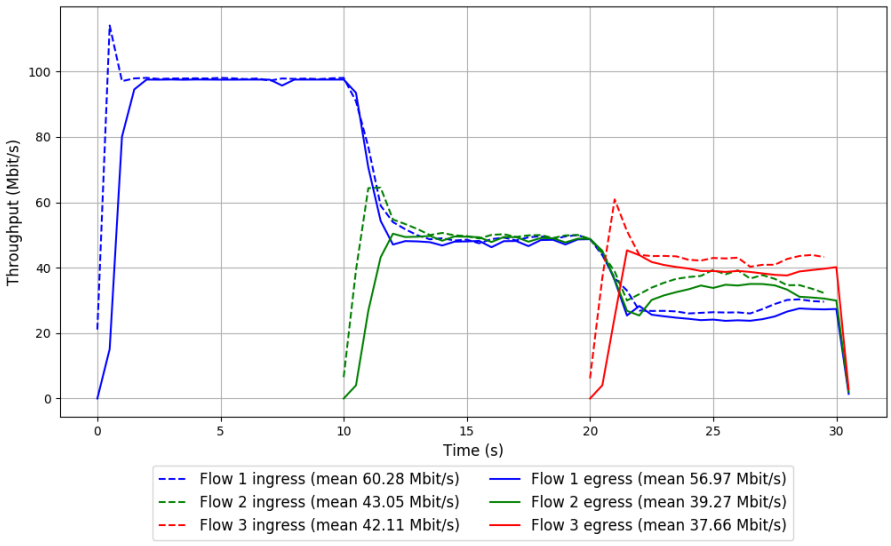
scheme	# runs	mean avg tput (Mbit/s)			mean 95th-%ile delay (ms)			mean loss rate (%)		
		flow 1	flow 2	flow 3	flow 1	flow 2	flow 3	flow 1	flow 2	flow 3
TCP BBR	3	57.59	37.41	39.81	65.48	67.83	68.52	6.18	10.39	12.16
TCP Cubic	3	74.22	14.87	34.39	64.45	66.15	62.65	0.98	0.52	0.61
Indigo	3	67.69	25.71	33.93	42.95	46.83	48.78	0.01	0.02	0.01
Muses	3	2.30	7.98	0.87	37.97	41.28	45.50	81.88	50.87	61.37

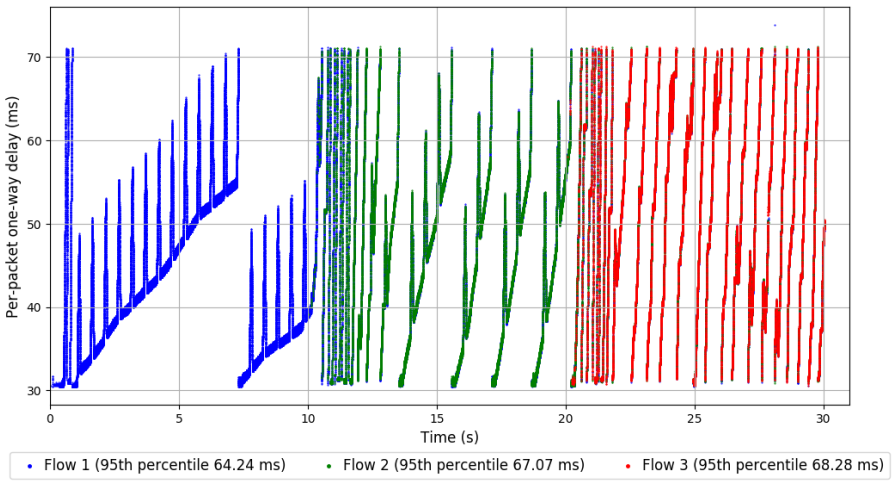
```
Run 1: Statistics of TCP BBR

Start at: 2018-08-28 05:14:32
End at: 2018-08-28 05:15:02
Local clock offset: 0.243 ms
Remote clock offset: -1.117 ms

# Below is generated by plot.py at 2018-08-28 05:28:35
# Datalink statistics
-- Total of 3 flows:
Average throughput: 95.62 Mbit/s
95th percentile per-packet one-way delay: 66.183 ms
Loss rate: 7.05%
-- Flow 1:
Average throughput: 56.97 Mbit/s
95th percentile per-packet one-way delay: 64.240 ms
Loss rate: 5.43%
-- Flow 2:
Average throughput: 39.27 Mbit/s
95th percentile per-packet one-way delay: 67.067 ms
Loss rate: 8.72%
-- Flow 3:
Average throughput: 37.66 Mbit/s
95th percentile per-packet one-way delay: 68.283 ms
Loss rate: 10.63%
```

Run 1: Report of TCP BBR — Data Link



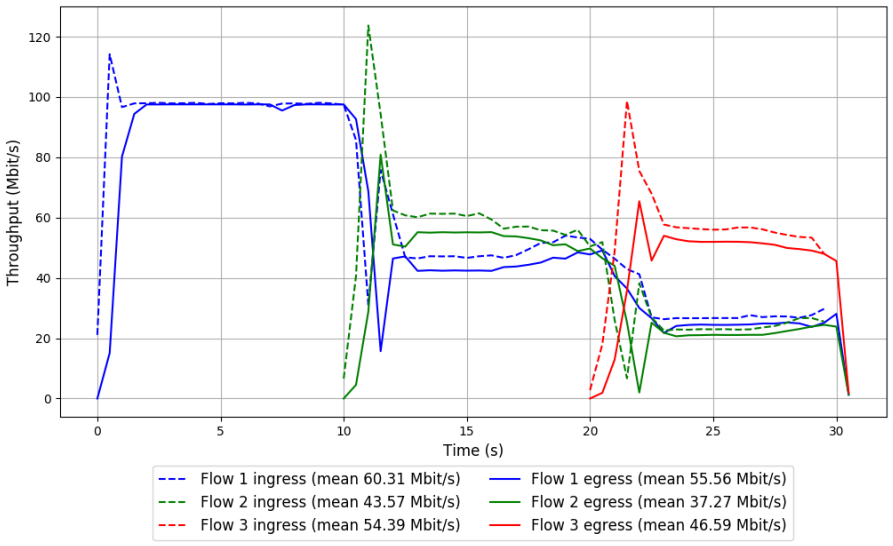


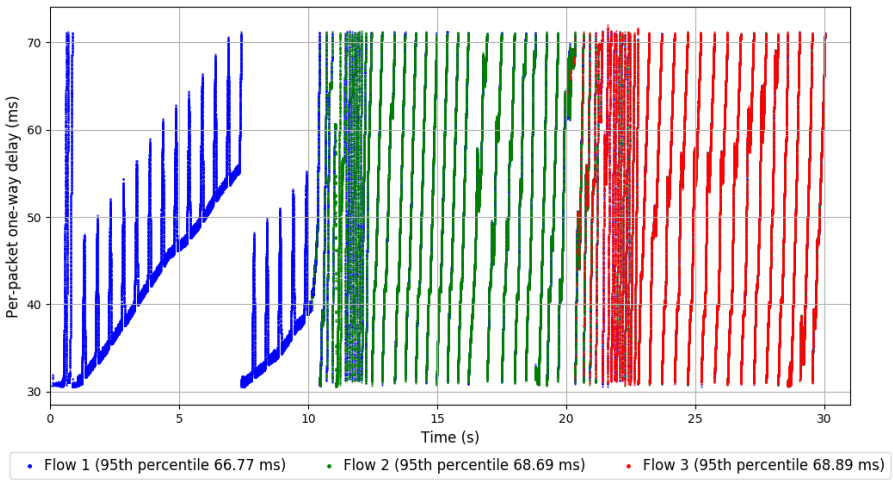
```
Run 2: Statistics of TCP BBR

Start at: 2018-08-28 05:19:55
End at: 2018-08-28 05:20:25
Local clock offset: 0.334 ms
Remote clock offset: -0.903 ms

# Below is generated by plot.py at 2018-08-28 05:28:36
# Datalink statistics
-- Total of 3 flows:
Average throughput: 95.83 Mbit/s
95th percentile per-packet one-way delay: 67.896 ms
Loss rate: 10.76%
-- Flow 1:
Average throughput: 55.56 Mbit/s
95th percentile per-packet one-way delay: 66.768 ms
Loss rate: 7.84%
-- Flow 2:
Average throughput: 37.27 Mbit/s
95th percentile per-packet one-way delay: 68.685 ms
Loss rate: 14.46%
-- Flow 3:
Average throughput: 46.59 Mbit/s
95th percentile per-packet one-way delay: 68.892 ms
Loss rate: 14.55%
```

Run 2: Report of TCP BBR — Data Link



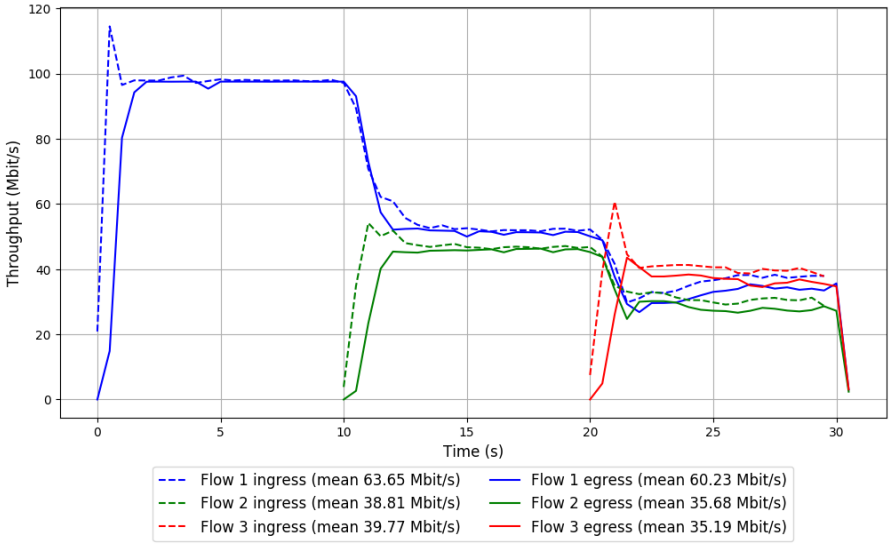


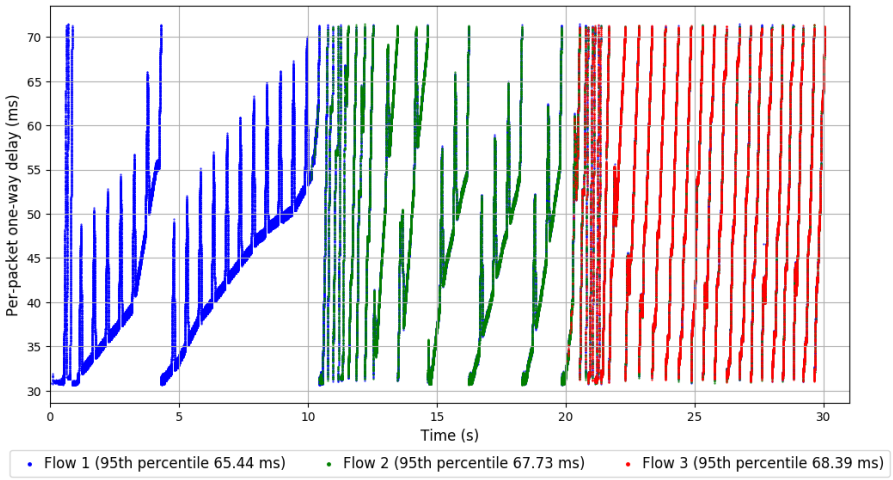
```
Run 3: Statistics of TCP BBR

Start at: 2018-08-28 05:25:18
End at: 2018-08-28 05:25:48
Local clock offset: 0.233 ms
Remote clock offset: -0.806 ms

# Below is generated by plot.py at 2018-08-28 05:28:36
# Datalink statistics
-- Total of 3 flows:
Average throughput: 95.70 Mbit/s
95th percentile per-packet one-way delay: 66.761 ms
Loss rate: 6.73%
-- Flow 1:
Average throughput: 60.23 Mbit/s
95th percentile per-packet one-way delay: 65.436 ms
Loss rate: 5.27%
-- Flow 2:
Average throughput: 35.68 Mbit/s
95th percentile per-packet one-way delay: 67.726 ms
Loss rate: 7.99%
-- Flow 3:
Average throughput: 35.19 Mbit/s
95th percentile per-packet one-way delay: 68.390 ms
Loss rate: 11.31%
```

Run 3: Report of TCP BBR — Data Link



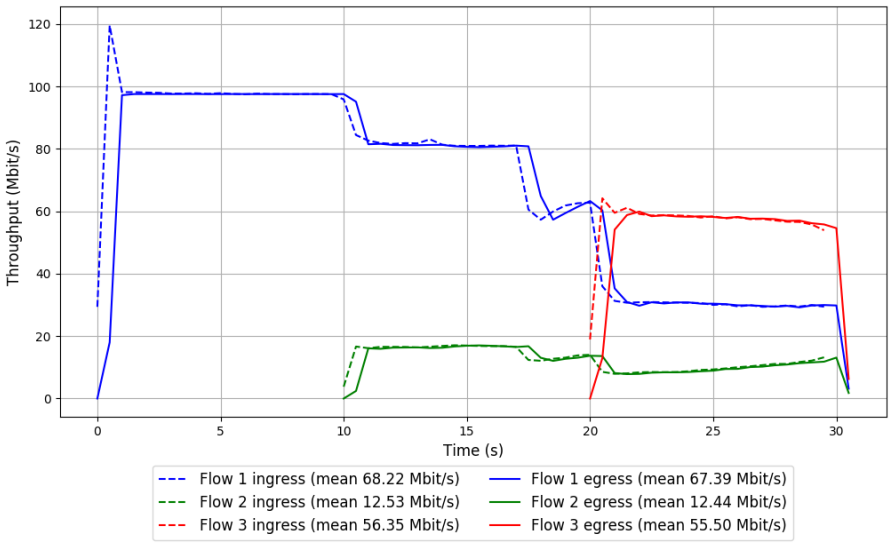


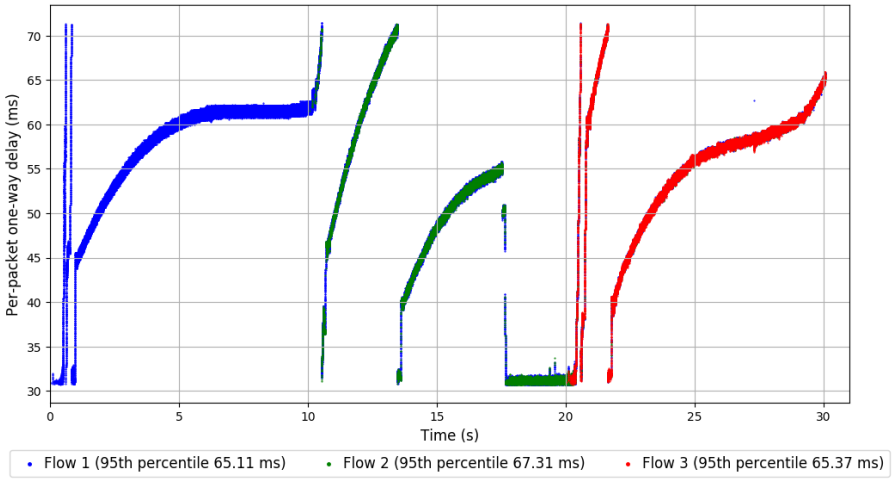
```
Run 1: Statistics of TCP Cubic

Start at: 2018-08-28 05:13:11
End at: 2018-08-28 05:13:41
Local clock offset: 0.255 ms
Remote clock offset: -0.916 ms

# Below is generated by plot.py at 2018-08-28 05:28:36
# Datalink statistics
-- Total of 3 flows:
Average throughput: 94.17 Mbit/s
95th percentile per-packet one-way delay: 65.385 ms
Loss rate: 1.09%
-- Flow 1:
Average throughput: 67.39 Mbit/s
95th percentile per-packet one-way delay: 65.106 ms
Loss rate: 1.11%
-- Flow 2:
Average throughput: 12.44 Mbit/s
95th percentile per-packet one-way delay: 67.311 ms
Loss rate: 0.71%
-- Flow 3:
Average throughput: 55.50 Mbit/s
95th percentile per-packet one-way delay: 65.370 ms
Loss rate: 1.16%
```

Run 1: Report of TCP Cubic — Data Link



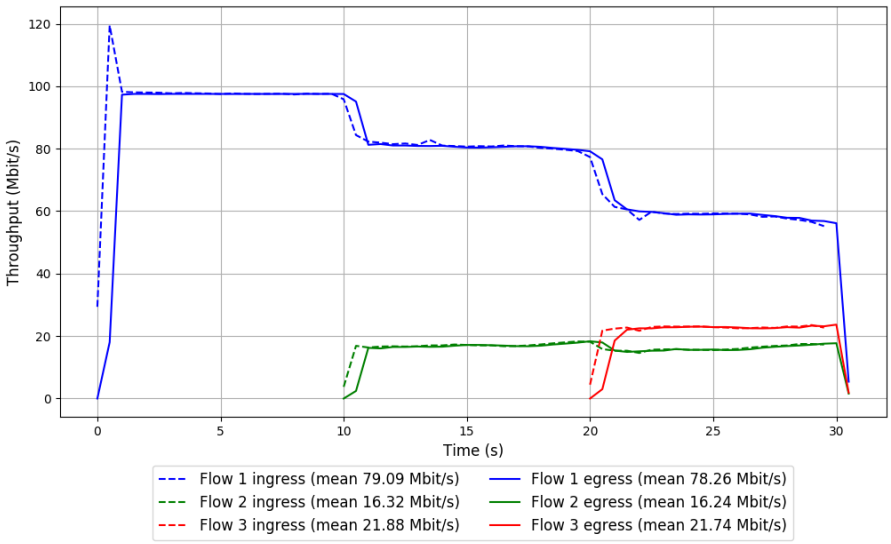


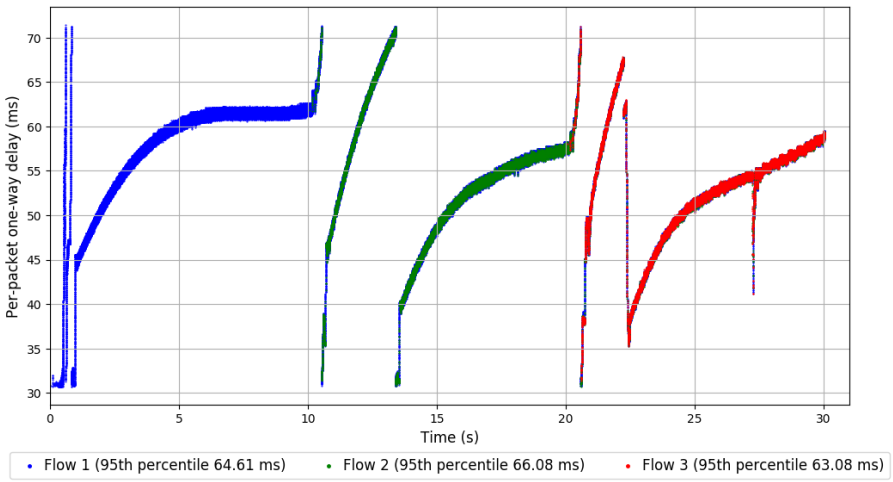
```
Run 2: Statistics of TCP Cubic

Start at: 2018-08-28 05:18:34
End at: 2018-08-28 05:19:04
Local clock offset: 0.24 ms
Remote clock offset: -0.87 ms

# Below is generated by plot.py at 2018-08-28 05:28:36
# Datalink statistics
-- Total of 3 flows:
Average throughput: 96.30 Mbit/s
95th percentile per-packet one-way delay: 64.640 ms
Loss rate: 0.87%
-- Flow 1:
Average throughput: 78.26 Mbit/s
95th percentile per-packet one-way delay: 64.610 ms
Loss rate: 0.95%
-- Flow 2:
Average throughput: 16.24 Mbit/s
95th percentile per-packet one-way delay: 66.078 ms
Loss rate: 0.49%
-- Flow 3:
Average throughput: 21.74 Mbit/s
95th percentile per-packet one-way delay: 63.076 ms
Loss rate: 0.62%
```

Run 2: Report of TCP Cubic — Data Link



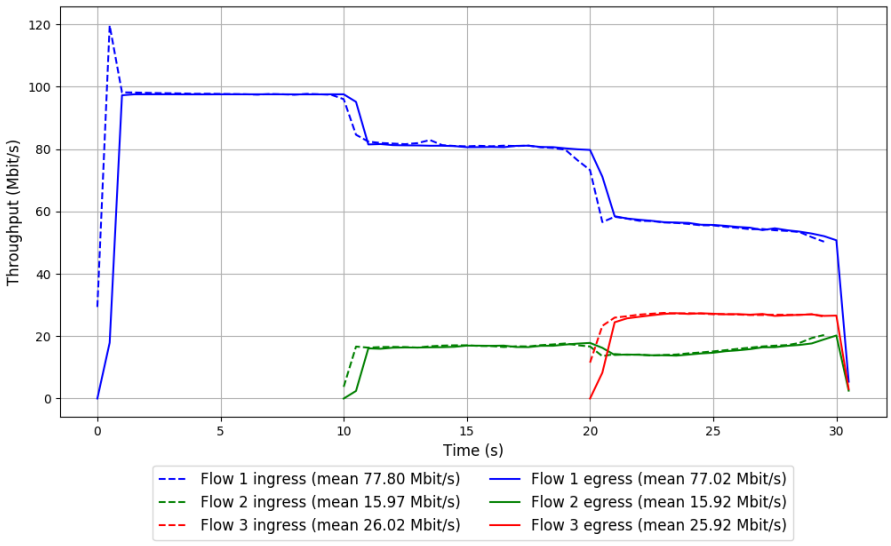


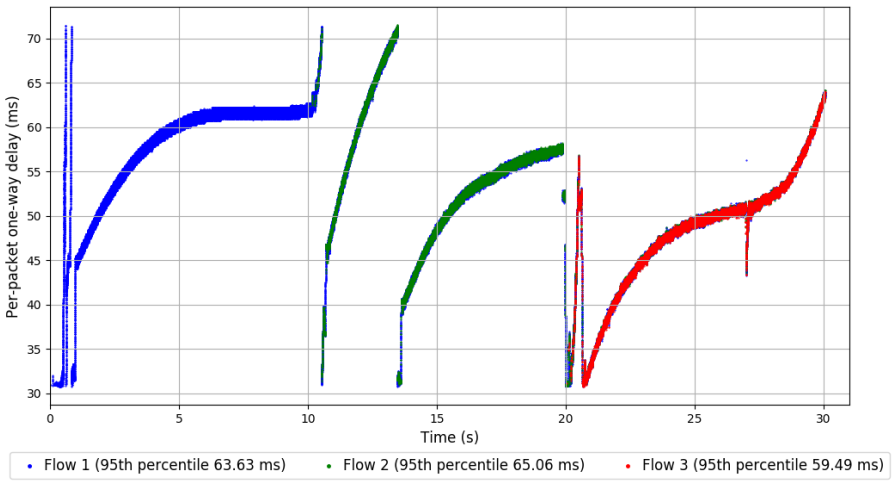
```
Run 3: Statistics of TCP Cubic

Start at: 2018-08-28 05:23:57
End at: 2018-08-28 05:24:27
Local clock offset: 0.239 ms
Remote clock offset: -0.784 ms

# Below is generated by plot.py at 2018-08-28 05:28:36
# Datalink statistics
-- Total of 3 flows:
Average throughput: 96.26 Mbit/s
95th percentile per-packet one-way delay: 63.384 ms
Loss rate: 0.75%
-- Flow 1:
Average throughput: 77.02 Mbit/s
95th percentile per-packet one-way delay: 63.628 ms
Loss rate: 0.88%
-- Flow 2:
Average throughput: 15.92 Mbit/s
95th percentile per-packet one-way delay: 65.057 ms
Loss rate: 0.35%
-- Flow 3:
Average throughput: 25.92 Mbit/s
95th percentile per-packet one-way delay: 59.493 ms
Loss rate: 0.06%
```

Run 3: Report of TCP Cubic — Data Link



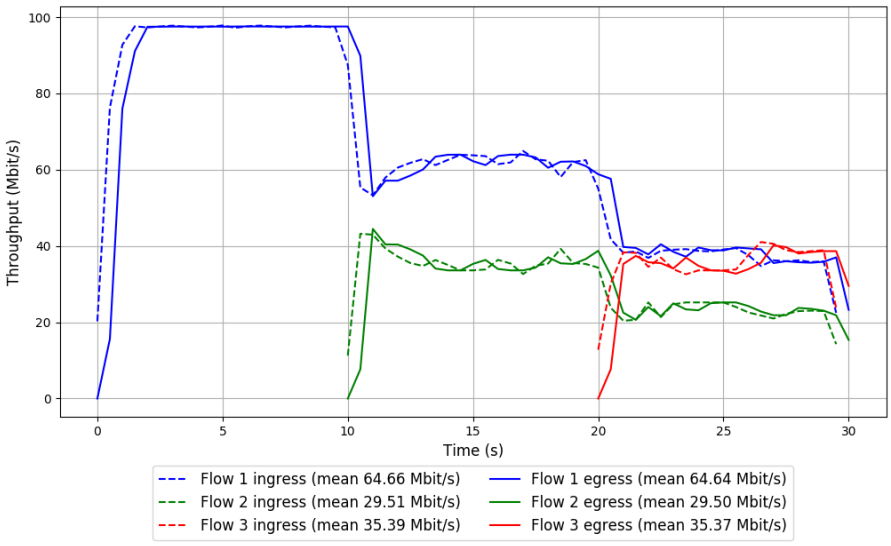


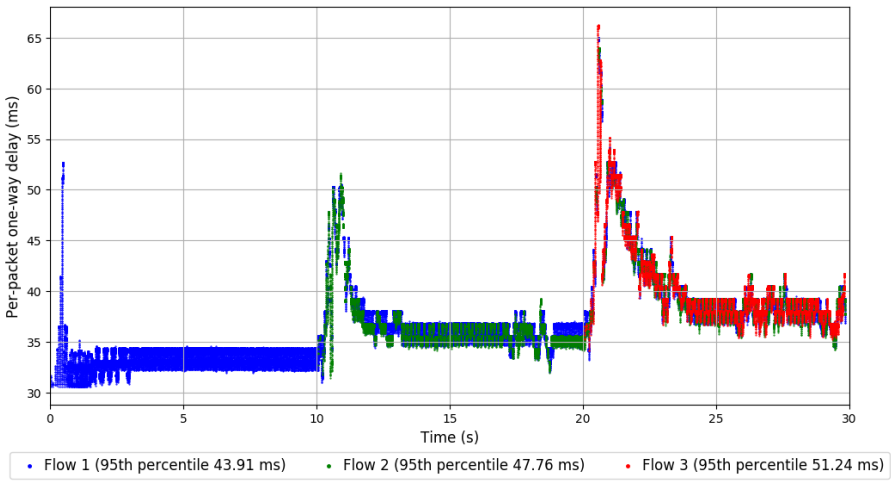
```
Run 1: Statistics of Indigo

Start at: 2018-08-28 05:11:49
End at: 2018-08-28 05:12:19
Local clock offset: 0.239 ms
Remote clock offset: -1.05 ms

# Below is generated by plot.py at 2018-08-28 05:28:36
# Datalink statistics
-- Total of 3 flows:
Average throughput: 95.78 Mbit/s
95th percentile per-packet one-way delay: 46.363 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 64.64 Mbit/s
95th percentile per-packet one-way delay: 43.908 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 29.50 Mbit/s
95th percentile per-packet one-way delay: 47.763 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 35.37 Mbit/s
95th percentile per-packet one-way delay: 51.237 ms
Loss rate: 0.00%
```

Run 1: Report of Indigo — Data Link



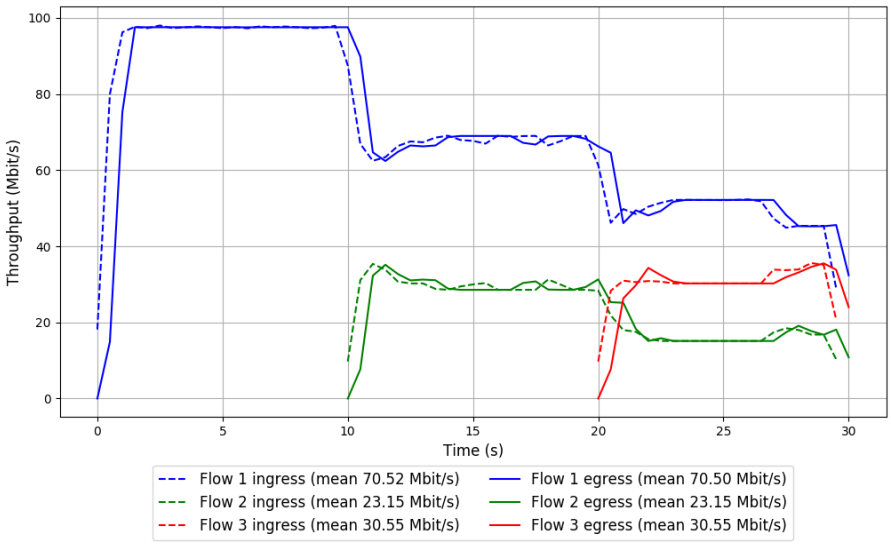


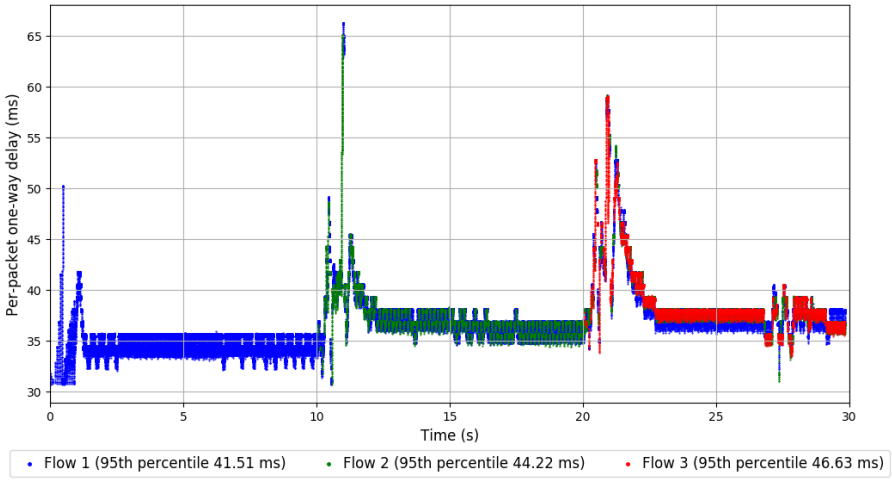
```
Run 2: Statistics of Indigo

Start at: 2018-08-28 05:17:11
End at: 2018-08-28 05:17:41
Local clock offset: 0.226 ms
Remote clock offset: -0.939 ms

# Below is generated by plot.py at 2018-08-28 05:28:36
# Datalink statistics
-- Total of 3 flows:
Average throughput: 95.86 Mbit/s
95th percentile per-packet one-way delay: 42.756 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 70.50 Mbit/s
95th percentile per-packet one-way delay: 41.511 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 23.15 Mbit/s
95th percentile per-packet one-way delay: 44.219 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 30.55 Mbit/s
95th percentile per-packet one-way delay: 46.626 ms
Loss rate: 0.00%
```

Run 2: Report of Indigo — Data Link



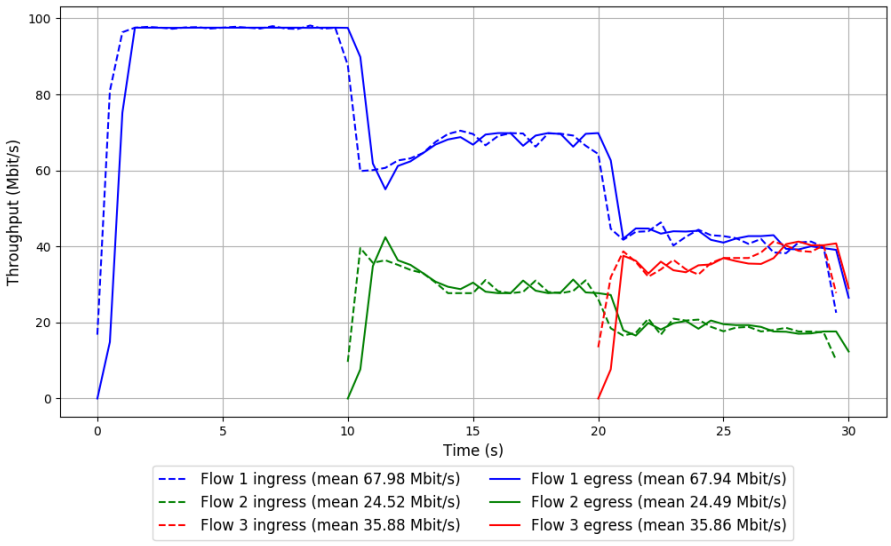


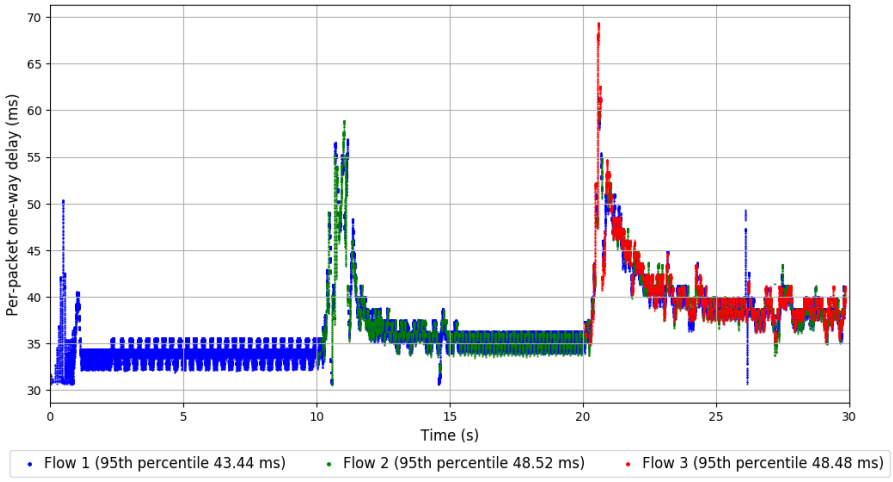
```
Run 3: Statistics of Indigo

Start at: 2018-08-28 05:22:34
End at: 2018-08-28 05:23:04
Local clock offset: 0.337 ms
Remote clock offset: -0.847 ms

# Below is generated by plot.py at 2018-08-28 05:28:42
# Datalink statistics
-- Total of 3 flows:
Average throughput: 95.84 Mbit/s
95th percentile per-packet one-way delay: 46.317 ms
Loss rate: 0.03%
-- Flow 1:
Average throughput: 67.94 Mbit/s
95th percentile per-packet one-way delay: 43.439 ms
Loss rate: 0.03%
-- Flow 2:
Average throughput: 24.49 Mbit/s
95th percentile per-packet one-way delay: 48.515 ms
Loss rate: 0.06%
-- Flow 3:
Average throughput: 35.86 Mbit/s
95th percentile per-packet one-way delay: 48.476 ms
Loss rate: 0.02%
```

Run 3: Report of Indigo — Data Link



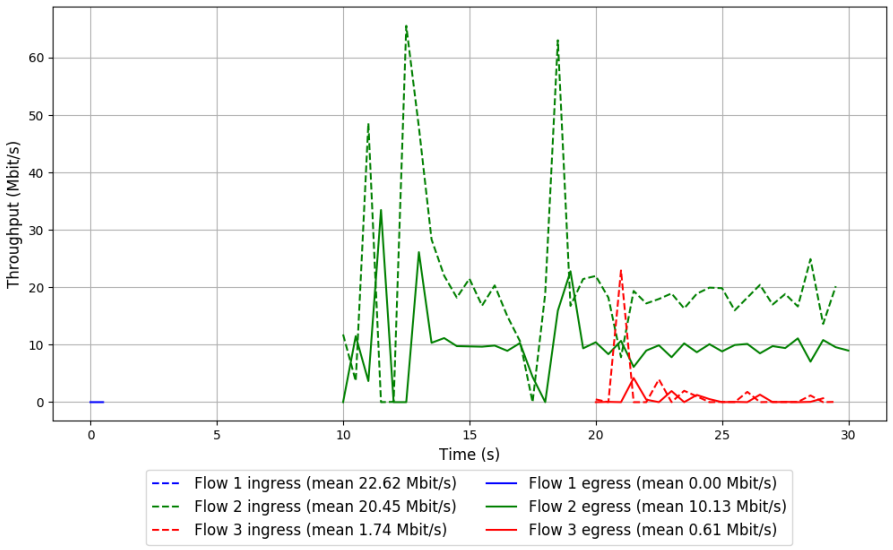


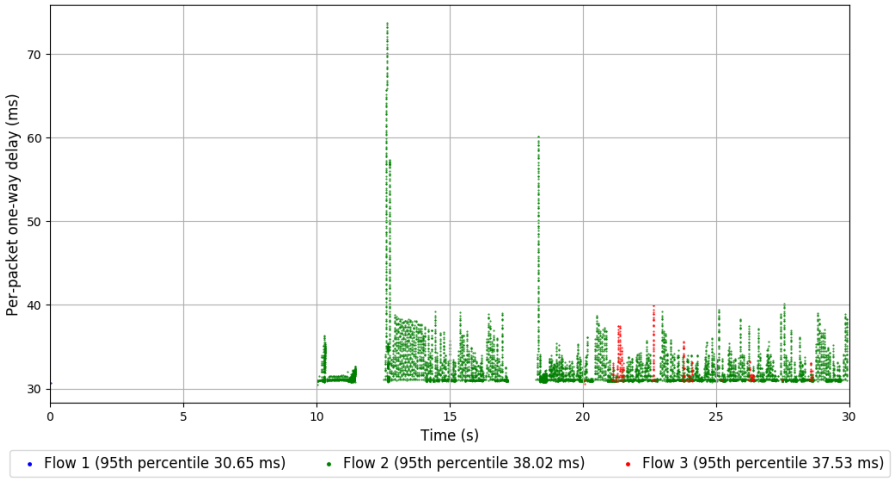
```
Run 1: Statistics of Muses

Start at: 2018-08-28 05:15:54
End at: 2018-08-28 05:16:24
Local clock offset: 0.312 ms
Remote clock offset: -0.91 ms

# Below is generated by plot.py at 2018-08-28 05:28:42
# Datalink statistics
-- Total of 3 flows:
Average throughput: 6.91 Mbit/s
95th percentile per-packet one-way delay: 38.011 ms
Loss rate: 51.21%
-- Flow 1:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 30.653 ms
Loss rate: 97.39%
-- Flow 2:
Average throughput: 10.13 Mbit/s
95th percentile per-packet one-way delay: 38.017 ms
Loss rate: 50.49%
-- Flow 3:
Average throughput: 0.61 Mbit/s
95th percentile per-packet one-way delay: 37.528 ms
Loss rate: 68.59%
```

Run 1: Report of Muses — Data Link



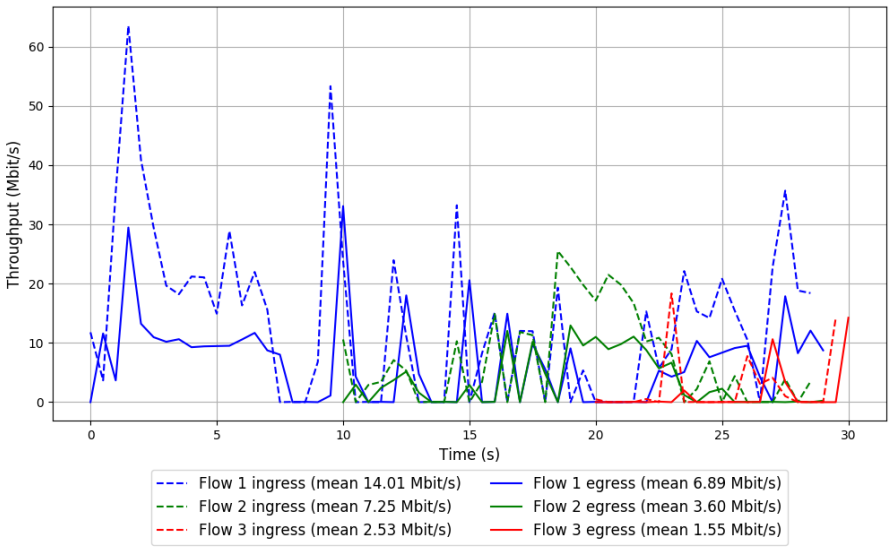


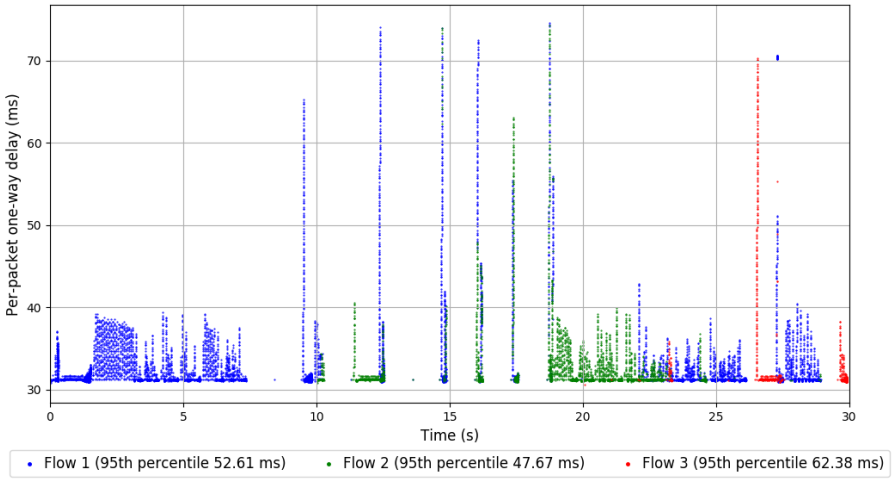
```
Run 2: Statistics of Muses

Start at: 2018-08-28 05:21:17
End at: 2018-08-28 05:21:47
Local clock offset: 0.239 ms
Remote clock offset: -0.8 ms

# Below is generated by plot.py at 2018-08-28 05:28:42
# Datalink statistics
-- Total of 3 flows:
Average throughput: 9.46 Mbit/s
95th percentile per-packet one-way delay: 52.856 ms
Loss rate: 50.24%
-- Flow 1:
Average throughput: 6.89 Mbit/s
95th percentile per-packet one-way delay: 52.611 ms
Loss rate: 50.86%
-- Flow 2:
Average throughput: 3.60 Mbit/s
95th percentile per-packet one-way delay: 47.669 ms
Loss rate: 50.49%
-- Flow 3:
Average throughput: 1.55 Mbit/s
95th percentile per-packet one-way delay: 62.384 ms
Loss rate: 38.70%
```

Run 2: Report of Muses — Data Link





```
Run 3: Statistics of Muses

Start at: 2018-08-28 05:26:39
End at: 2018-08-28 05:27:09
Local clock offset: 0.322 ms
Remote clock offset: -0.837 ms

# Below is generated by plot.py at 2018-08-28 05:28:42
# Datalink statistics
-- Total of 3 flows:
Average throughput: 6.94 Mbit/s
95th percentile per-packet one-way delay: 38.076 ms
Loss rate: 52.69%
-- Flow 1:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 30.649 ms
Loss rate: 97.39%
-- Flow 2:
Average throughput: 10.22 Mbit/s
95th percentile per-packet one-way delay: 38.142 ms
Loss rate: 51.62%
-- Flow 3:
Average throughput: 0.45 Mbit/s
95th percentile per-packet one-way delay: 36.594 ms
Loss rate: 76.83%
```

Run 3: Report of Muses — Data Link