Pantheon Report

Generated at 2018-08-31 09:04:01 (UTC).

Data path: AWS Brazil 1 on `ens5` (*local*) →Brazil on `p4p1` (*remote*).

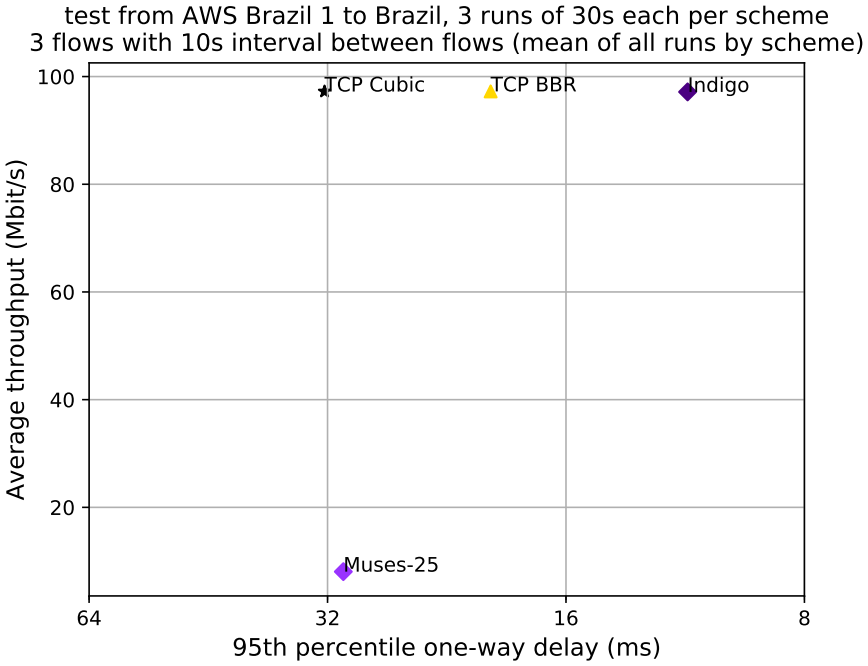
Repeated the test of 4 congestion control schemes 3 times.

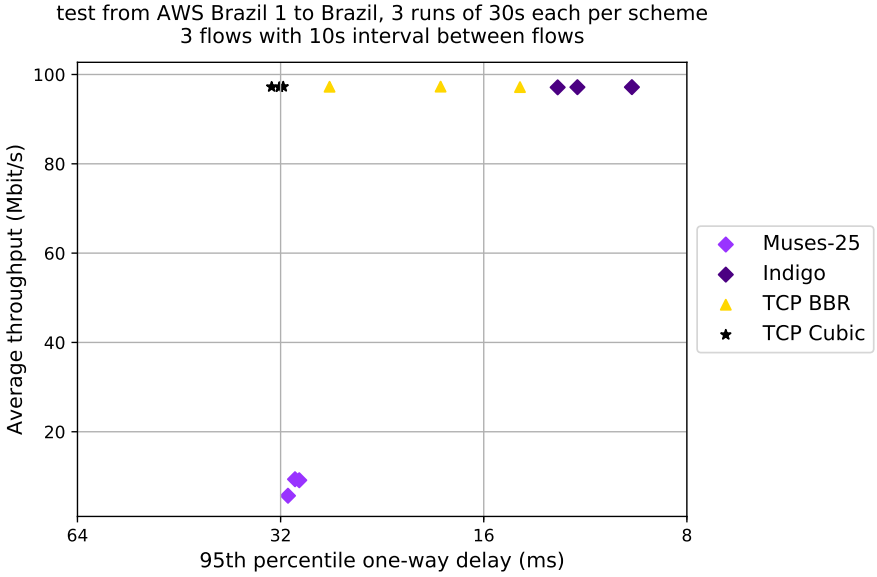
Each test lasted for 30 seconds running 3 flows with 10-second interval between two flows.

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 @ e3c5aa19ca94c3066828fb83f16a8fb6b2731e7a
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 1 to Brazil, 3 runs of 30s each per scheme
3 flows with 10s interval between flows (mean of all runs by scheme)
TCP Cubic
TCP BBR
Indigo
Muses-25
Average throughput (Mbit/s)
95th percentile one-way delay (ms)
100
80
60
40
20
64
32
16
8


test from AWS Brazil 1 to Brazil, 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)
100
80
60
40
20
64
32
16
8

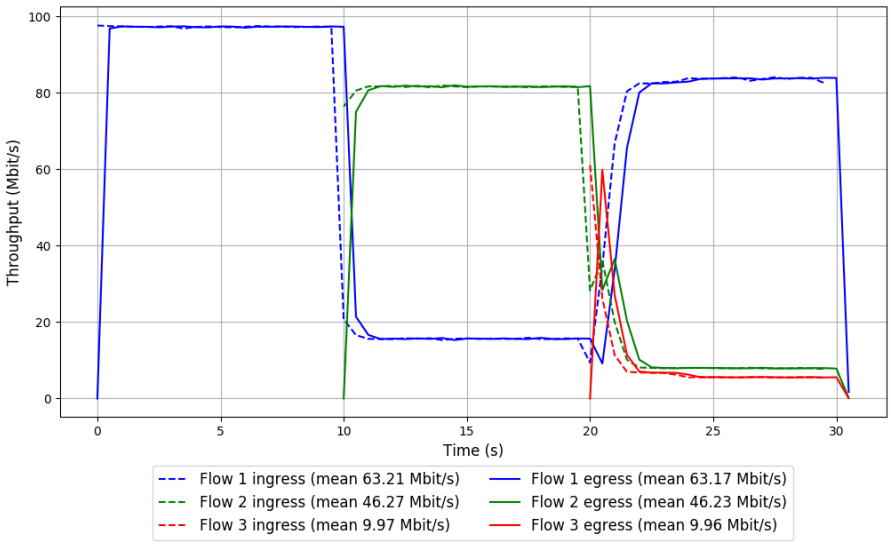
scheme	# runs	mean avg tput (Mbit/s)			mean 95th-%ile delay (ms)			mean loss rate (%)		
		flow 1	flow 2	flow 3	flow 1	flow 2	flow 3	flow 1	flow 2	flow 3
TCP BBR	3	64.83	42.26	12.78	19.77	19.17	21.30	0.00	0.00	0.01
TCP Cubic	3	64.05	35.23	29.27	32.04	32.60	31.69	0.04	0.04	0.06
Indigo	3	45.24	39.76	78.43	9.97	10.89	11.35	0.00	0.00	0.00
Muses-25	3	3.42	5.21	3.77	21.38	20.22	29.99	55.86	25.63	53.33

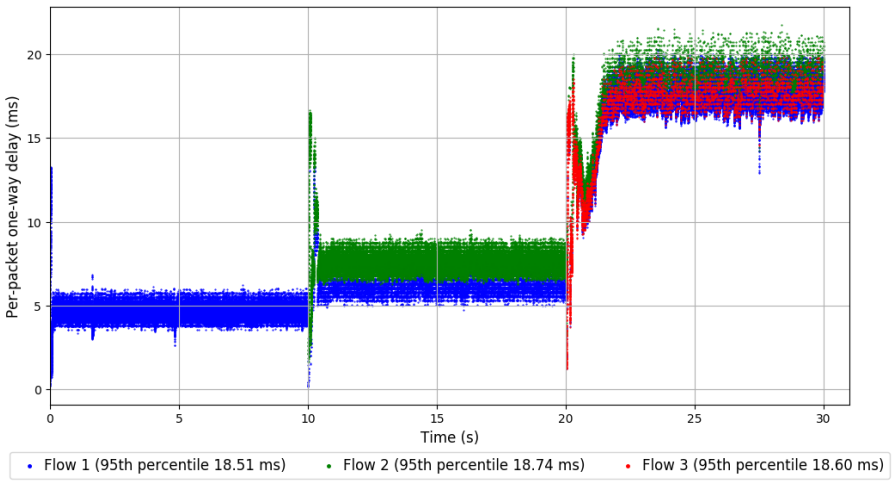
```
Run 1: Statistics of TCP BBR

Start at: 2018-08-31 08:53:01
End at: 2018-08-31 08:53:31
Local clock offset: -3.399 ms
Remote clock offset: 0.234 ms

# Below is generated by plot.py at 2018-08-31 09:03:51
# Datalink statistics
-- Total of 3 flows:
Average throughput: 97.29 Mbit/s
95th percentile per-packet one-way delay: 18.538 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 63.17 Mbit/s
95th percentile per-packet one-way delay: 18.512 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 46.23 Mbit/s
95th percentile per-packet one-way delay: 18.740 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 9.96 Mbit/s
95th percentile per-packet one-way delay: 18.599 ms
Loss rate: 0.00%
```

Run 1: Report of TCP BBR — Data Link



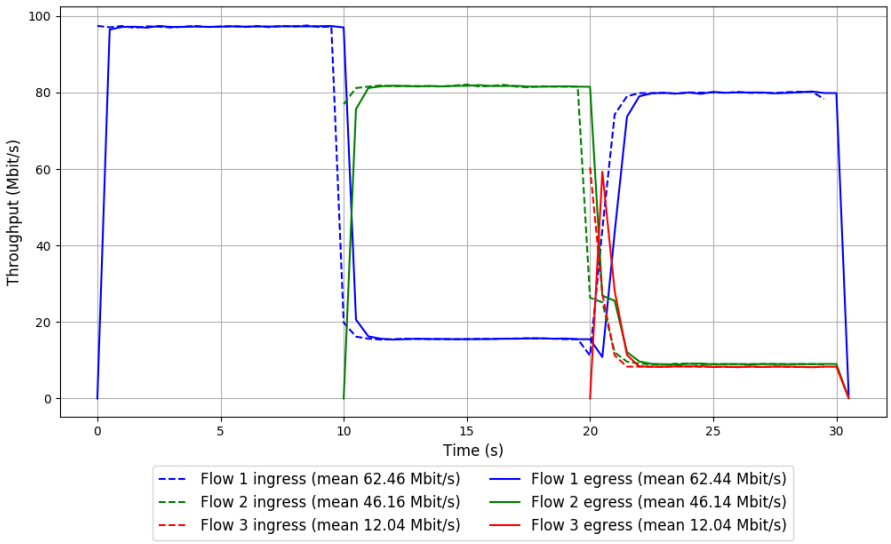


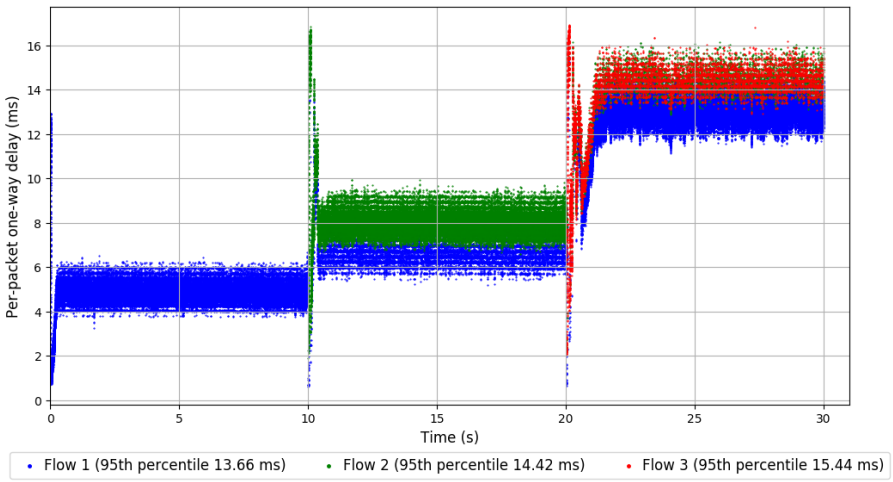
```
Run 2: Statistics of TCP BBR

Start at: 2018-08-31 08:57:28
End at: 2018-08-31 08:57:58
Local clock offset: -4.982 ms
Remote clock offset: 0.19 ms

# Below is generated by plot.py at 2018-08-31 09:03:51
# Datalink statistics
-- Total of 3 flows:
Average throughput: 97.18 Mbit/s
95th percentile per-packet one-way delay: 14.139 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 62.44 Mbit/s
95th percentile per-packet one-way delay: 13.656 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 46.14 Mbit/s
95th percentile per-packet one-way delay: 14.418 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 12.04 Mbit/s
95th percentile per-packet one-way delay: 15.443 ms
Loss rate: 0.00%
```

Run 2: Report of TCP BBR — Data Link



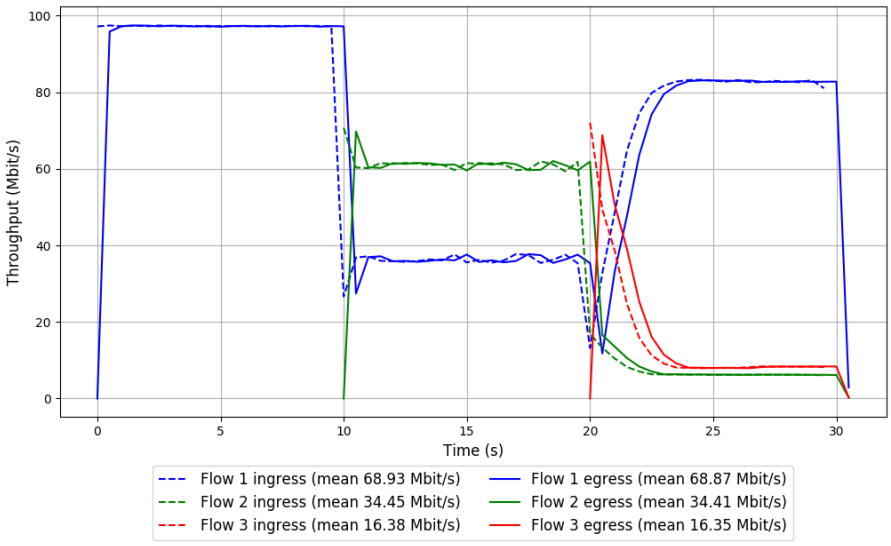


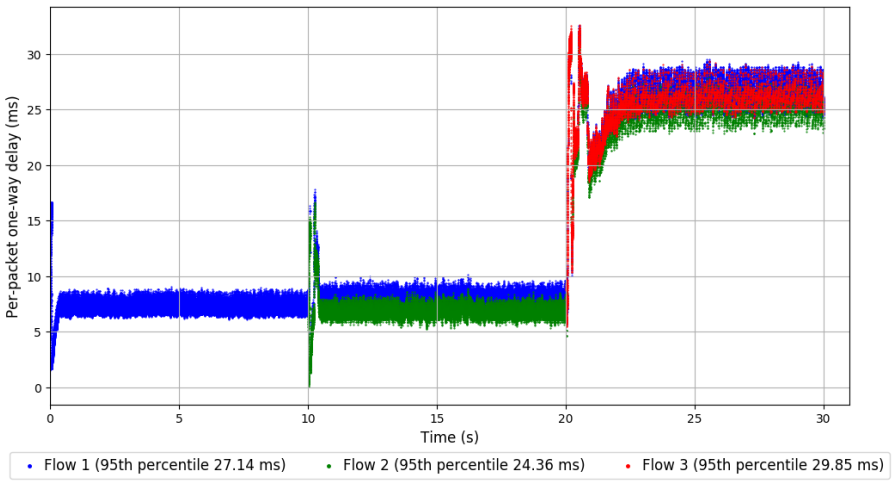
```
Run 3: Statistics of TCP BBR

Start at: 2018-08-31 09:01:56
End at: 2018-08-31 09:02:26
Local clock offset: -5.103 ms
Remote clock offset: 0.33 ms

# Below is generated by plot.py at 2018-08-31 09:03:52
# Datalink statistics
-- Total of 3 flows:
Average throughput: 97.26 Mbit/s
95th percentile per-packet one-way delay: 27.076 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 68.87 Mbit/s
95th percentile per-packet one-way delay: 27.141 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 34.41 Mbit/s
95th percentile per-packet one-way delay: 24.361 ms
Loss rate: 0.01%
-- Flow 3:
Average throughput: 16.35 Mbit/s
95th percentile per-packet one-way delay: 29.849 ms
Loss rate: 0.02%
```

Run 3: Report of TCP BBR — Data Link



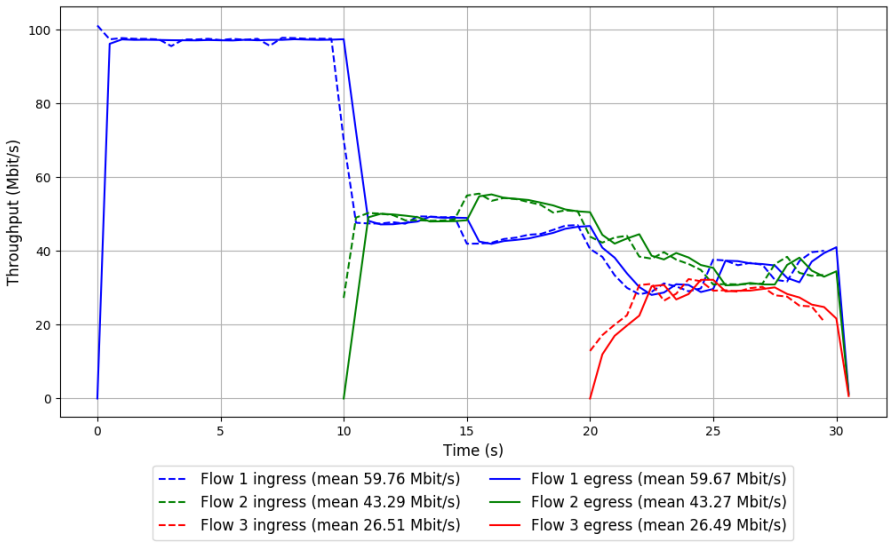


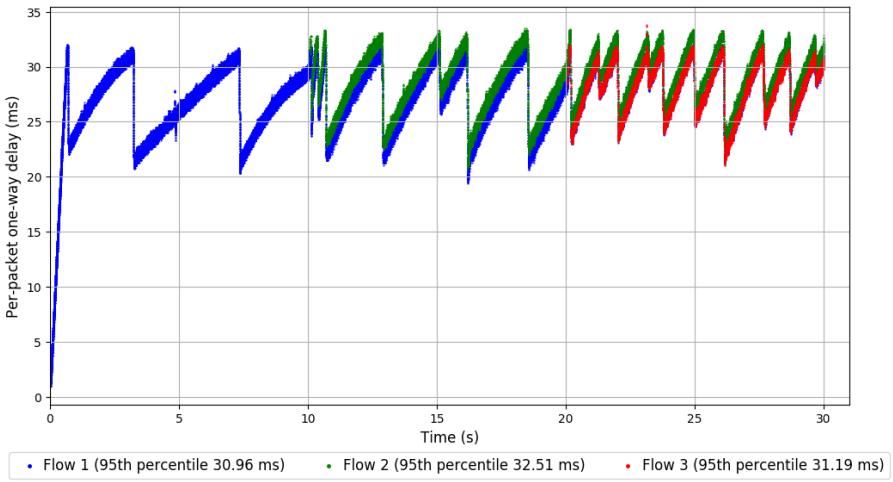
```
Run 1: Statistics of TCP Cubic

Start at: 2018-08-31 08:50:44
End at: 2018-08-31 08:51:14
Local clock offset: -4.397 ms
Remote clock offset: 0.196 ms

# Below is generated by plot.py at 2018-08-31 09:03:52
# Datalink statistics
-- Total of 3 flows:
Average throughput: 97.27 Mbit/s
95th percentile per-packet one-way delay: 31.714 ms
Loss rate: 0.05%
-- Flow 1:
Average throughput: 59.67 Mbit/s
95th percentile per-packet one-way delay: 30.962 ms
Loss rate: 0.05%
-- Flow 2:
Average throughput: 43.27 Mbit/s
95th percentile per-packet one-way delay: 32.506 ms
Loss rate: 0.04%
-- Flow 3:
Average throughput: 26.49 Mbit/s
95th percentile per-packet one-way delay: 31.189 ms
Loss rate: 0.06%
```

Run 1: Report of TCP Cubic — Data Link



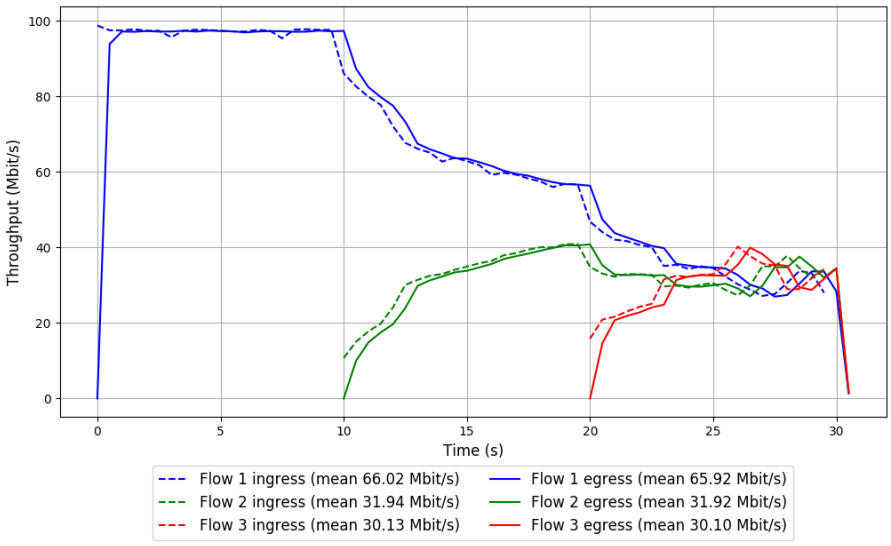


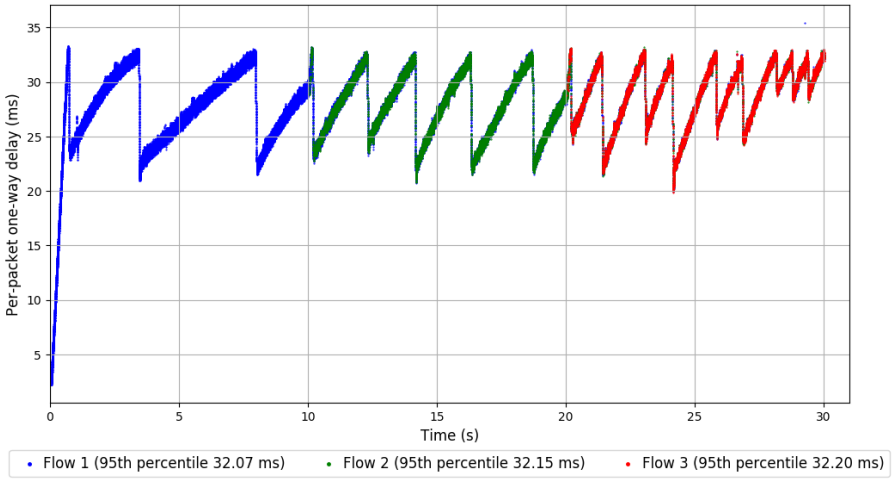
```
Run 2: Statistics of TCP Cubic

Start at: 2018-08-31 08:55:12
End at: 2018-08-31 08:55:42
Local clock offset: -4.307 ms
Remote clock offset: 0.256 ms

# Below is generated by plot.py at 2018-08-31 09:03:52
# Datalink statistics
-- Total of 3 flows:
Average throughput: 97.17 Mbit/s
95th percentile per-packet one-way delay: 32.132 ms
Loss rate: 0.05%
-- Flow 1:
Average throughput: 65.92 Mbit/s
95th percentile per-packet one-way delay: 32.069 ms
Loss rate: 0.04%
-- Flow 2:
Average throughput: 31.92 Mbit/s
95th percentile per-packet one-way delay: 32.148 ms
Loss rate: 0.05%
-- Flow 3:
Average throughput: 30.10 Mbit/s
95th percentile per-packet one-way delay: 32.205 ms
Loss rate: 0.06%
```

Run 2: Report of TCP Cubic — Data Link



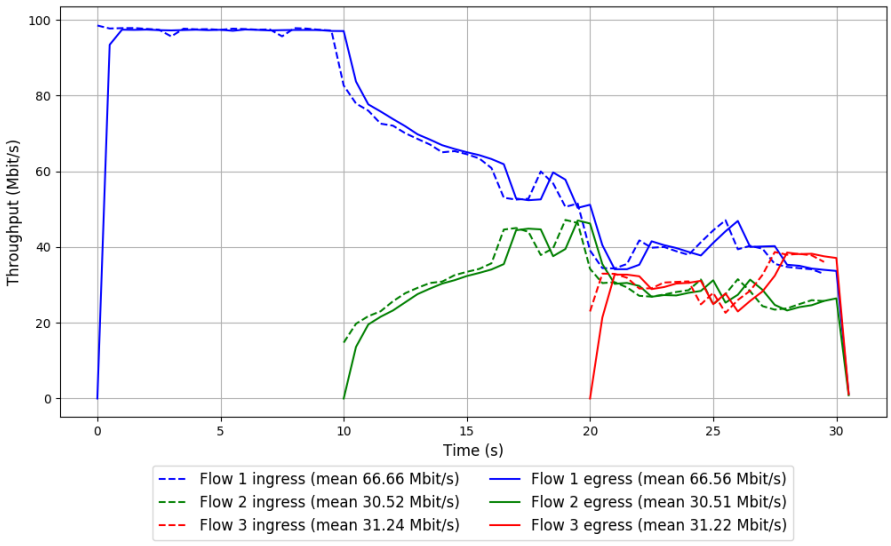


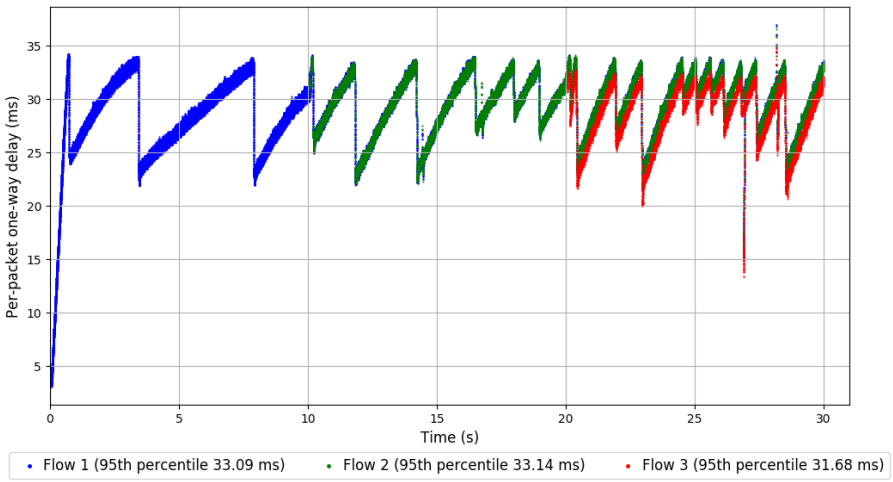
```
Run 3: Statistics of TCP Cubic

Start at: 2018-08-31 08:59:39
End at: 2018-08-31 09:00:09
Local clock offset: -6.332 ms
Remote clock offset: 0.293 ms

# Below is generated by plot.py at 2018-08-31 09:03:53
# Datalink statistics
-- Total of 3 flows:
Average throughput: 97.23 Mbit/s
95th percentile per-packet one-way delay: 32.993 ms
Loss rate: 0.04%
-- Flow 1:
Average throughput: 66.56 Mbit/s
95th percentile per-packet one-way delay: 33.091 ms
Loss rate: 0.04%
-- Flow 2:
Average throughput: 30.51 Mbit/s
95th percentile per-packet one-way delay: 33.139 ms
Loss rate: 0.04%
-- Flow 3:
Average throughput: 31.22 Mbit/s
95th percentile per-packet one-way delay: 31.680 ms
Loss rate: 0.05%
```

Run 3: Report of TCP Cubic — Data Link



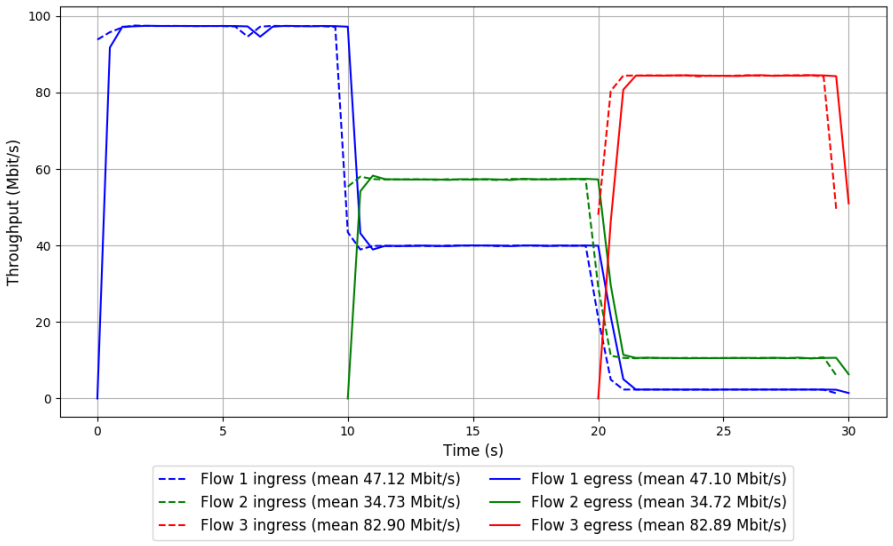


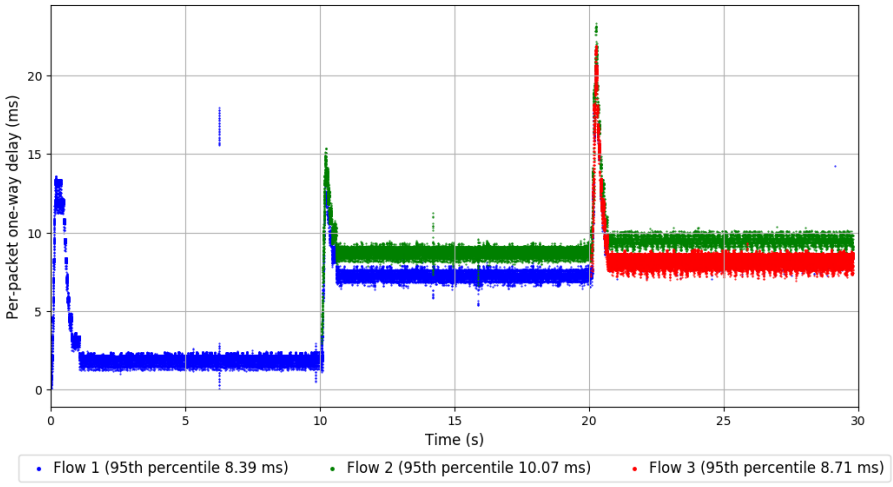
```
Run 1: Statistics of Indigo

Start at: 2018-08-31 08:51:52
End at: 2018-08-31 08:52:22
Local clock offset: -3.491 ms
Remote clock offset: 0.188 ms

# Below is generated by plot.py at 2018-08-31 09:03:53
# Datalink statistics
-- Total of 3 flows:
Average throughput: 97.17 Mbit/s
95th percentile per-packet one-way delay: 9.651 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 47.10 Mbit/s
95th percentile per-packet one-way delay: 8.389 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 34.72 Mbit/s
95th percentile per-packet one-way delay: 10.074 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 82.89 Mbit/s
95th percentile per-packet one-way delay: 8.711 ms
Loss rate: 0.00%
```

Run 1: Report of Indigo — Data Link



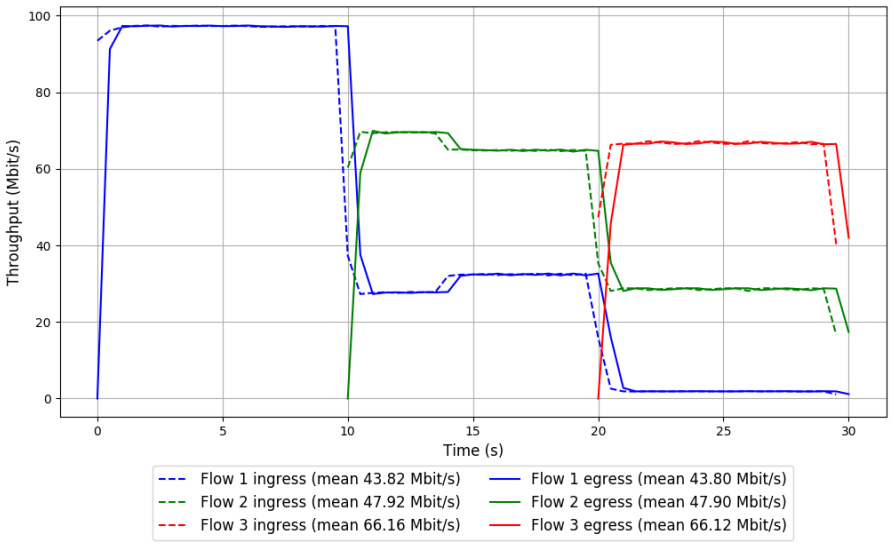


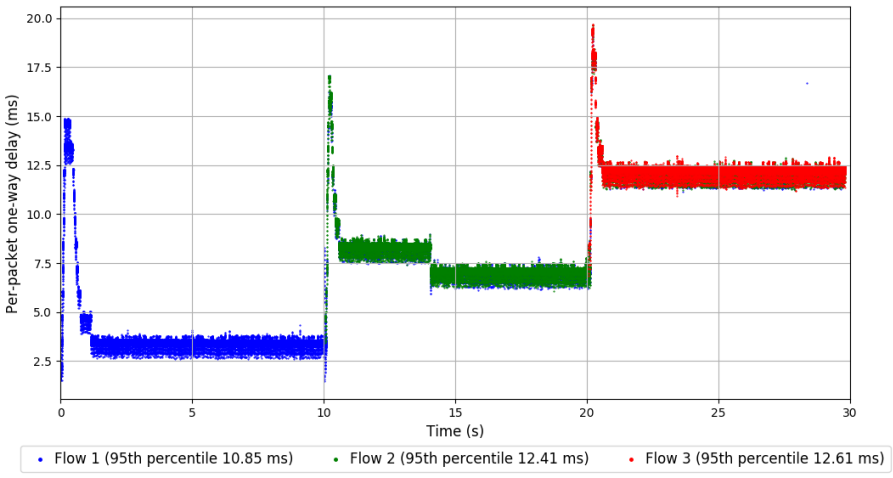
```
Run 2: Statistics of Indigo

Start at: 2018-08-31 08:56:19
End at: 2018-08-31 08:56:49
Local clock offset: -5.52 ms
Remote clock offset: 0.202 ms

# Below is generated by plot.py at 2018-08-31 09:03:53
# Datalink statistics
-- Total of 3 flows:
Average throughput: 97.12 Mbit/s
95th percentile per-packet one-way delay: 12.433 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 43.80 Mbit/s
95th percentile per-packet one-way delay: 10.852 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 47.90 Mbit/s
95th percentile per-packet one-way delay: 12.409 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 66.12 Mbit/s
95th percentile per-packet one-way delay: 12.609 ms
Loss rate: 0.00%
```

Run 2: Report of Indigo — Data Link



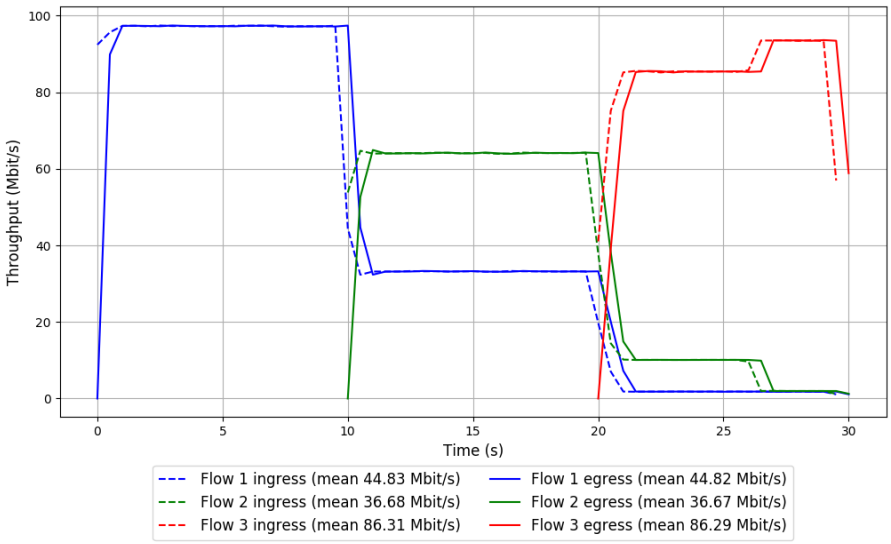


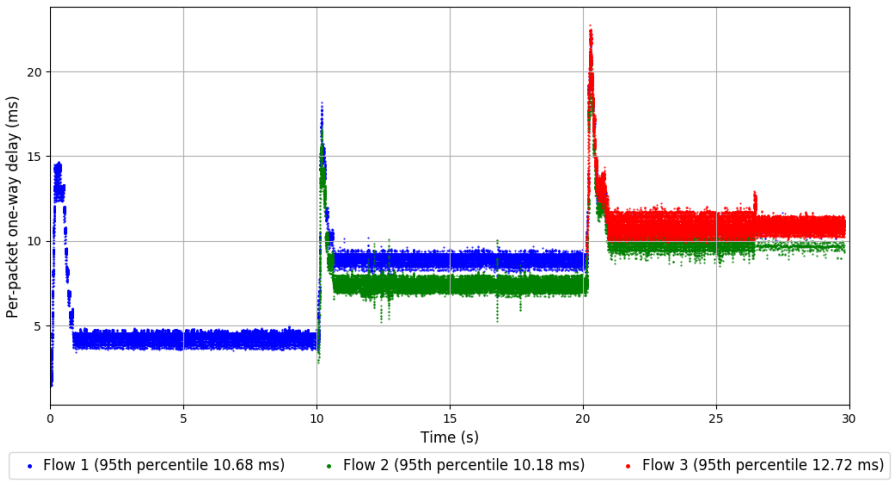
```
Run 3: Statistics of Indigo

Start at: 2018-08-31 09:00:47
End at: 2018-08-31 09:01:17
Local clock offset: -4.903 ms
Remote clock offset: 0.293 ms

# Below is generated by plot.py at 2018-08-31 09:04:00
# Datalink statistics
-- Total of 3 flows:
Average throughput: 97.16 Mbit/s
95th percentile per-packet one-way delay: 11.623 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 44.82 Mbit/s
95th percentile per-packet one-way delay: 10.681 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 36.67 Mbit/s
95th percentile per-packet one-way delay: 10.177 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 86.29 Mbit/s
95th percentile per-packet one-way delay: 12.716 ms
Loss rate: 0.00%
```

Run 3: Report of Indigo — Data Link



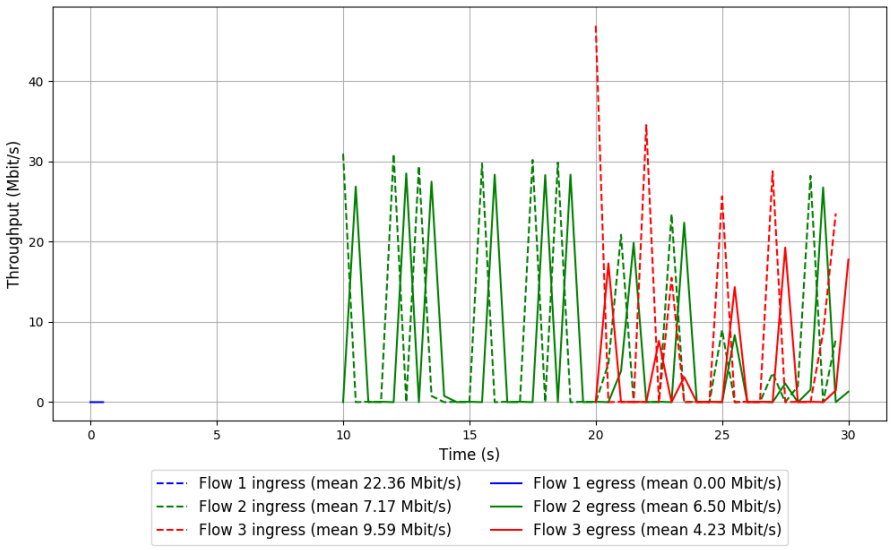


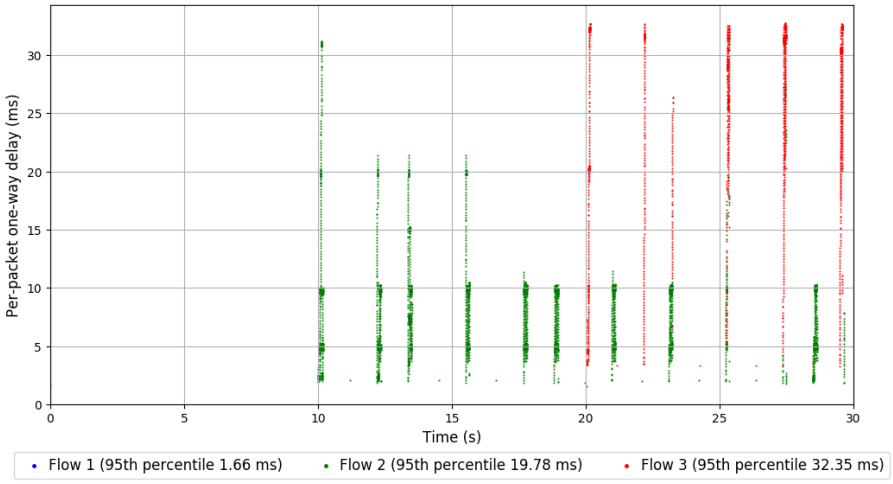
```
Run 1: Statistics of Muses-25

Start at: 2018-08-31 08:49:41
End at: 2018-08-31 08:50:11
Local clock offset: -5.295 ms
Remote clock offset: 0.174 ms

# Below is generated by plot.py at 2018-08-31 09:04:00
# Datalink statistics
-- Total of 3 flows:
Average throughput: 5.67 Mbit/s
95th percentile per-packet one-way delay: 31.205 ms
Loss rate: 27.76%
-- Flow 1:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 1.657 ms
Loss rate: 97.39%
-- Flow 2:
Average throughput: 6.50 Mbit/s
95th percentile per-packet one-way delay: 19.778 ms
Loss rate: 9.42%
-- Flow 3:
Average throughput: 4.23 Mbit/s
95th percentile per-packet one-way delay: 32.349 ms
Loss rate: 55.86%
```

Run 1: Report of Muses-25 — Data Link



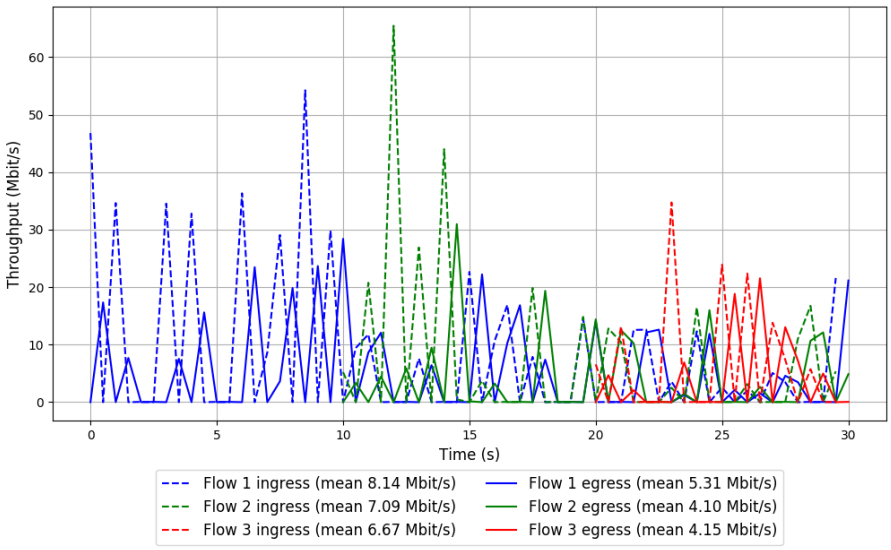


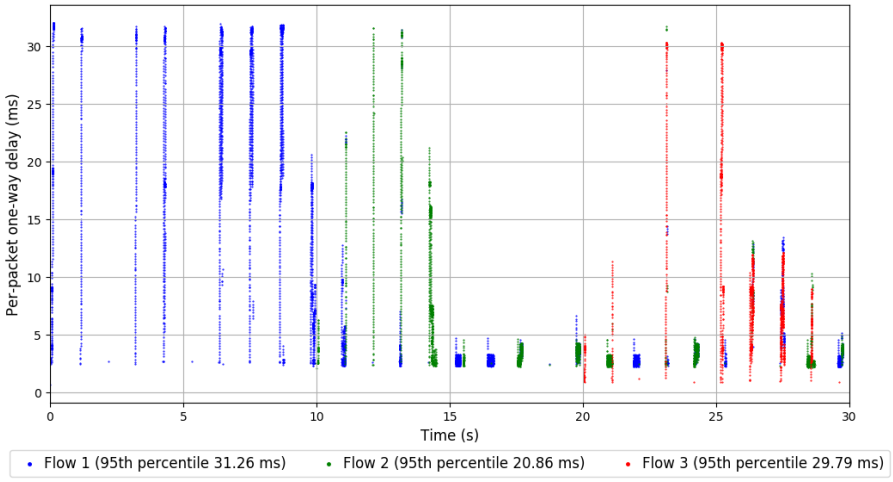
```
Run 2: Statistics of Muses-25

Start at: 2018-08-31 08:54:08
End at: 2018-08-31 08:54:38
Local clock offset: -4.048 ms
Remote clock offset: 0.24 ms

# Below is generated by plot.py at 2018-08-31 09:04:00
# Datalink statistics
-- Total of 3 flows:
Average throughput: 9.37 Mbit/s
95th percentile per-packet one-way delay: 30.463 ms
Loss rate: 37.49%
-- Flow 1:
Average throughput: 5.31 Mbit/s
95th percentile per-packet one-way delay: 31.260 ms
Loss rate: 34.72%
-- Flow 2:
Average throughput: 4.10 Mbit/s
95th percentile per-packet one-way delay: 20.859 ms
Loss rate: 42.13%
-- Flow 3:
Average throughput: 4.15 Mbit/s
95th percentile per-packet one-way delay: 29.787 ms
Loss rate: 37.83%
```

Run 2: Report of Muses-25 — Data Link





```
Run 3: Statistics of Muses-25

Start at: 2018-08-31 08:58:36
End at: 2018-08-31 08:59:06
Local clock offset: -5.266 ms
Remote clock offset: 0.216 ms

# Below is generated by plot.py at 2018-08-31 09:04:00
# Datalink statistics
-- Total of 3 flows:
Average throughput: 9.14 Mbit/s
95th percentile per-packet one-way delay: 30.026 ms
Loss rate: 38.28%
-- Flow 1:
Average throughput: 4.95 Mbit/s
95th percentile per-packet one-way delay: 31.219 ms
Loss rate: 35.47%
-- Flow 2:
Average throughput: 5.02 Mbit/s
95th percentile per-packet one-way delay: 20.028 ms
Loss rate: 25.33%
-- Flow 3:
Average throughput: 2.94 Mbit/s
95th percentile per-packet one-way delay: 27.827 ms
Loss rate: 66.29%
```

Run 3: Report of Muses-25 — Data Link