Pantheon Report

Generated at 2018-08-28 09:21:08 (UTC).

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

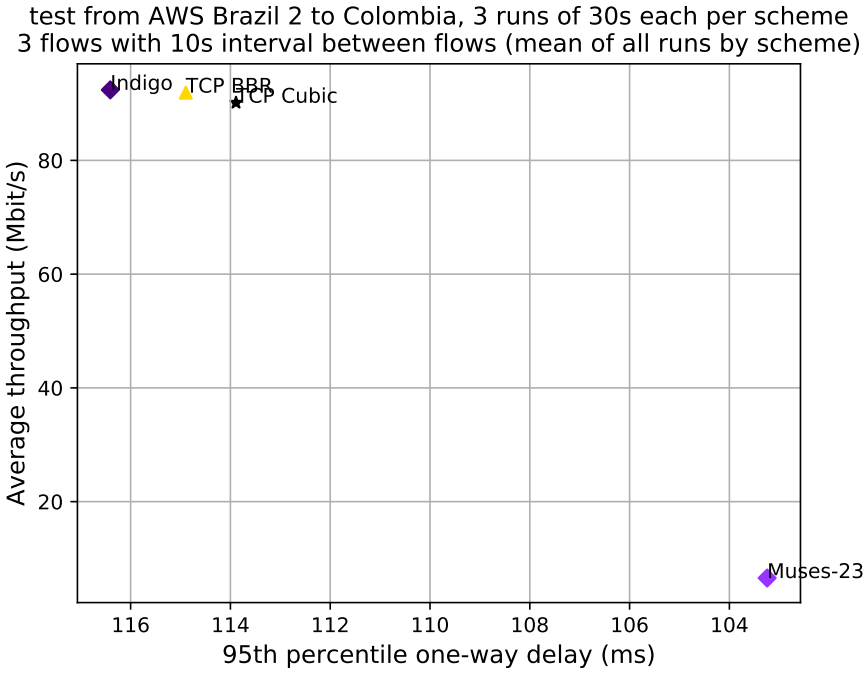
Repeated the test of 4 congestion control schemes 3 times.

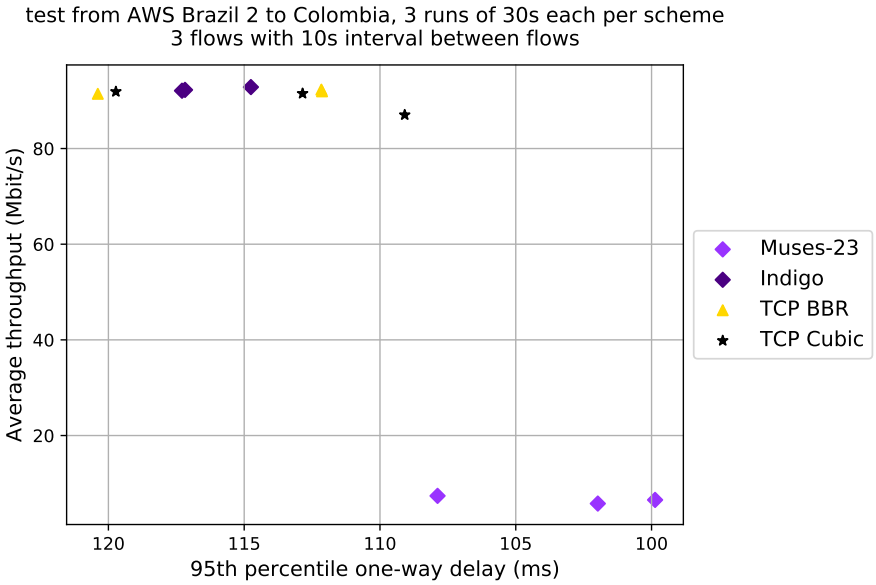
Each test lasted for 30 seconds running 3 flows with 10-second interval between two flows.

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

Git summary:
branch: muses-23 @ 88af05c5b0b7531637ca401951507a2fde628df6
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 Brazil 2 to Colombia, 3 runs of 30s each per scheme
3 flows with 10s interval between flows (mean of all runs by scheme)
Indigo
TCP BBR
TCP Cubic
Muses-23
Average throughput (Mbit/s)
95th percentile one-way delay (ms)
80
60
40
20
116
114
112
110
108
106
104


test from AWS Brazil 2 to Colombia, 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-23
Indigo
TCP BBR
TCP Cubic
80
60
40
20
120
115
110
105
100

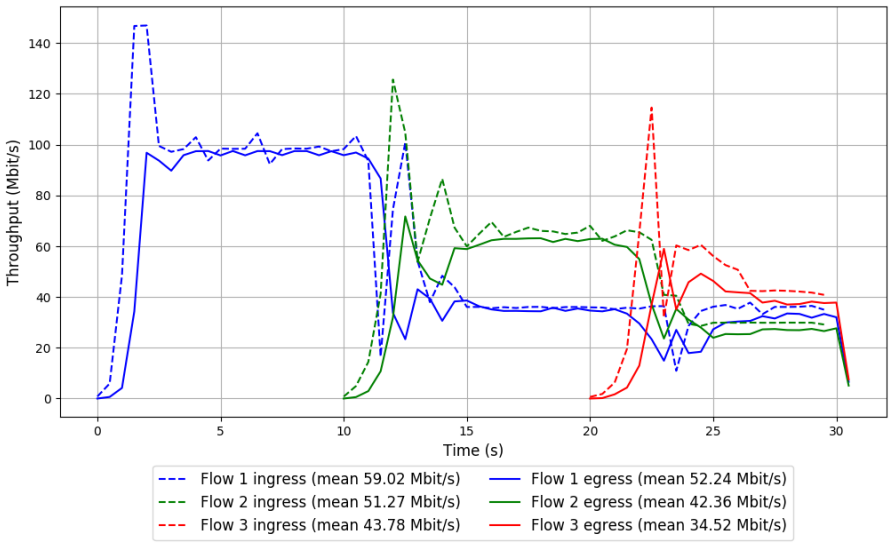
scheme	# runs	mean avg tput (Mbit/s)			mean 95th-%ile delay (ms)			mean loss rate (%)		
		flow 1	flow 2	flow 3	flow 1	flow 2	flow 3	flow 1	flow 2	flow 3
TCP BBR	3	54.74	39.12	33.37	113.55	114.31	112.32	11.40	16.78	21.84
TCP Cubic	3	70.79	17.53	23.07	113.10	113.79	113.89	0.70	0.18	0.30
Indigo	3	68.23	24.55	24.58	115.29	113.51	112.64	5.70	17.50	43.06
Muses-23	3	6.42	5.12	3.87	94.63	102.39	106.43	83.15	78.55	76.61

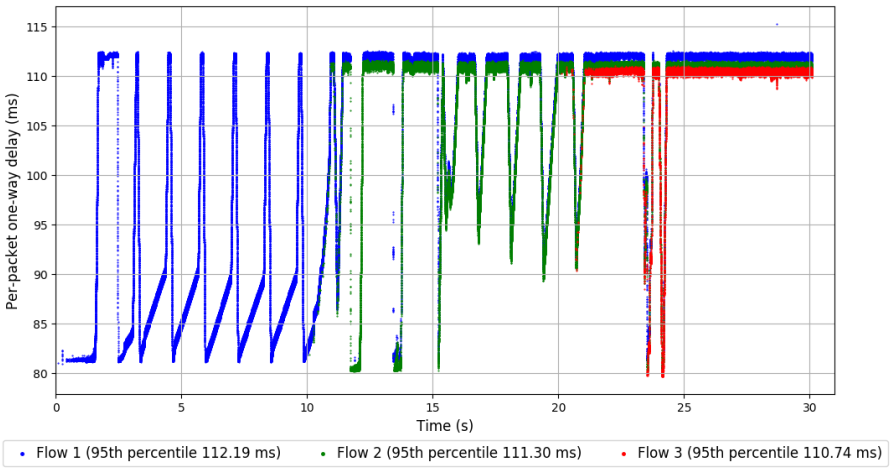
```
Run 1: Statistics of TCP BBR

Start at: 2018-08-28 09:09:00
End at: 2018-08-28 09:09:30
Local clock offset: 0.399 ms
Remote clock offset: -2.206 ms

# Below is generated by plot.py at 2018-08-28 09:21:00
# Datalink statistics
-- Total of 3 flows:
Average throughput: 91.95 Mbit/s
95th percentile per-packet one-way delay: 112.134 ms
Loss rate: 14.57%
-- Flow 1:
Average throughput: 52.24 Mbit/s
95th percentile per-packet one-way delay: 112.193 ms
Loss rate: 11.40%
-- Flow 2:
Average throughput: 42.36 Mbit/s
95th percentile per-packet one-way delay: 111.296 ms
Loss rate: 17.25%
-- Flow 3:
Average throughput: 34.52 Mbit/s
95th percentile per-packet one-way delay: 110.738 ms
Loss rate: 21.14%
```

Run 1: Report of TCP BBR — Data Link



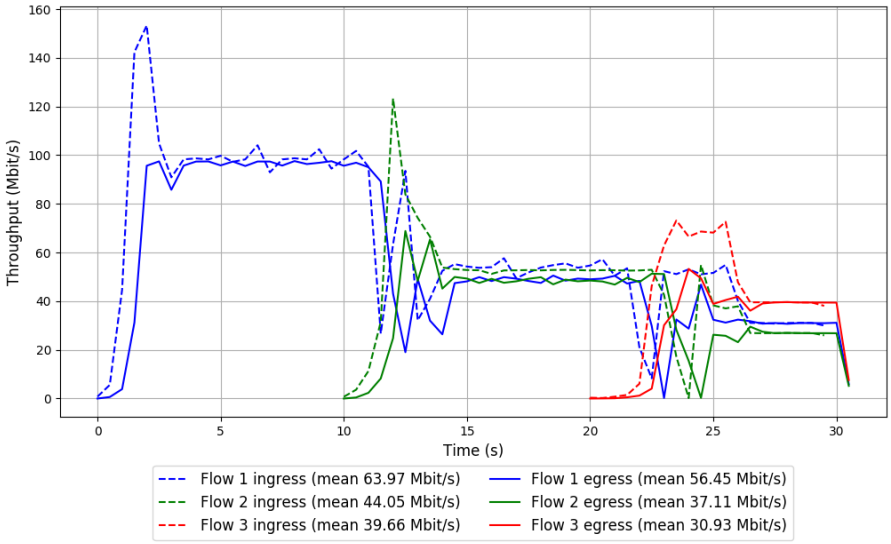


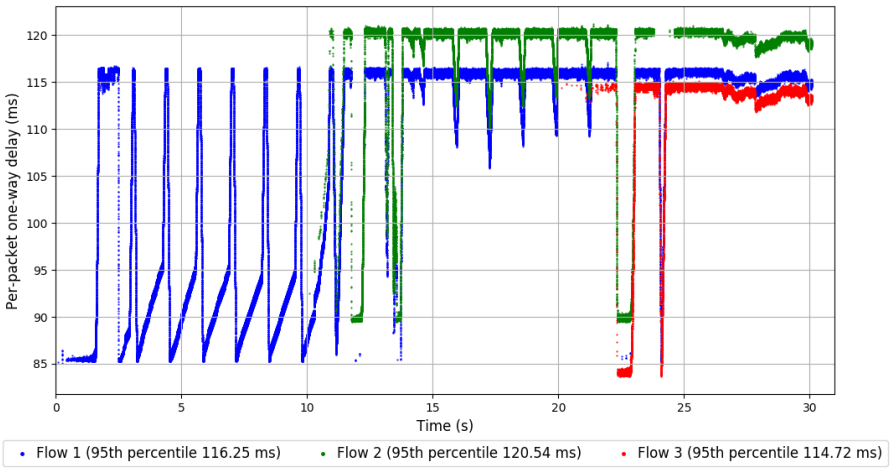
```
Run 2: Statistics of TCP BBR

Start at: 2018-08-28 09:14:00
End at: 2018-08-28 09:14:30
Local clock offset: 1.408 ms
Remote clock offset: 2.674 ms

# Below is generated by plot.py at 2018-08-28 09:21:00
# Datalink statistics
-- Total of 3 flows:
Average throughput: 91.44 Mbit/s
95th percentile per-packet one-way delay: 120.390 ms
Loss rate: 14.05%
-- Flow 1:
Average throughput: 56.45 Mbit/s
95th percentile per-packet one-way delay: 116.248 ms
Loss rate: 11.66%
-- Flow 2:
Average throughput: 37.11 Mbit/s
95th percentile per-packet one-way delay: 120.540 ms
Loss rate: 15.66%
-- Flow 3:
Average throughput: 30.93 Mbit/s
95th percentile per-packet one-way delay: 114.719 ms
Loss rate: 22.01%
```

Run 2: Report of TCP BBR — Data Link



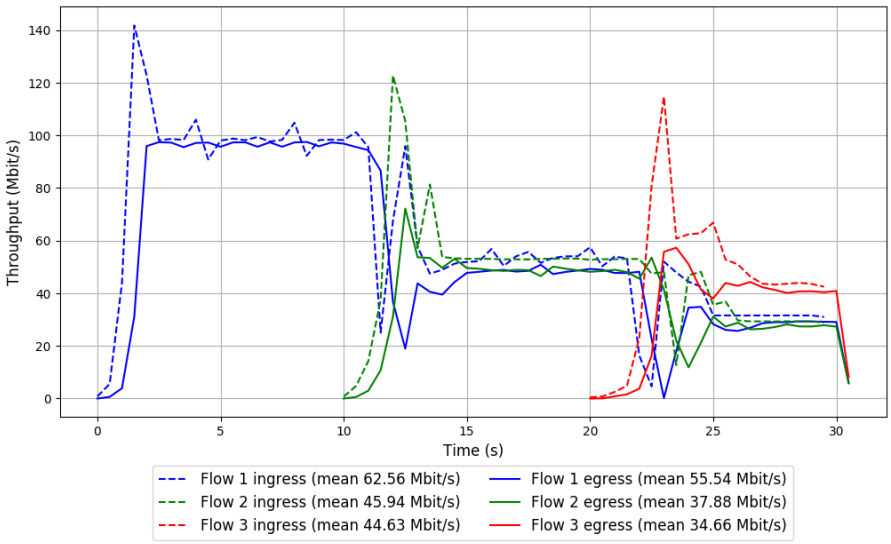


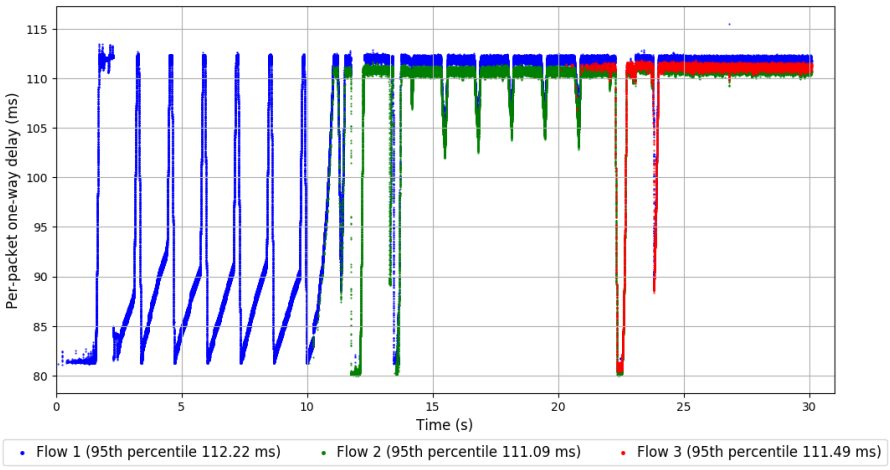
```
Run 3: Statistics of TCP BBR

Start at: 2018-08-28 09:18:58
End at: 2018-08-28 09:19:28
Local clock offset: 0.362 ms
Remote clock offset: -2.458 ms

# Below is generated by plot.py at 2018-08-28 09:21:02
# Datalink statistics
-- Total of 3 flows:
Average throughput: 92.33 Mbit/s
95th percentile per-packet one-way delay: 112.158 ms
Loss rate: 14.46%
-- Flow 1:
Average throughput: 55.54 Mbit/s
95th percentile per-packet one-way delay: 112.217 ms
Loss rate: 11.13%
-- Flow 2:
Average throughput: 37.88 Mbit/s
95th percentile per-packet one-way delay: 111.086 ms
Loss rate: 17.42%
-- Flow 3:
Average throughput: 34.66 Mbit/s
95th percentile per-packet one-way delay: 111.490 ms
Loss rate: 22.36%
```

Run 3: Report of TCP BBR — Data Link



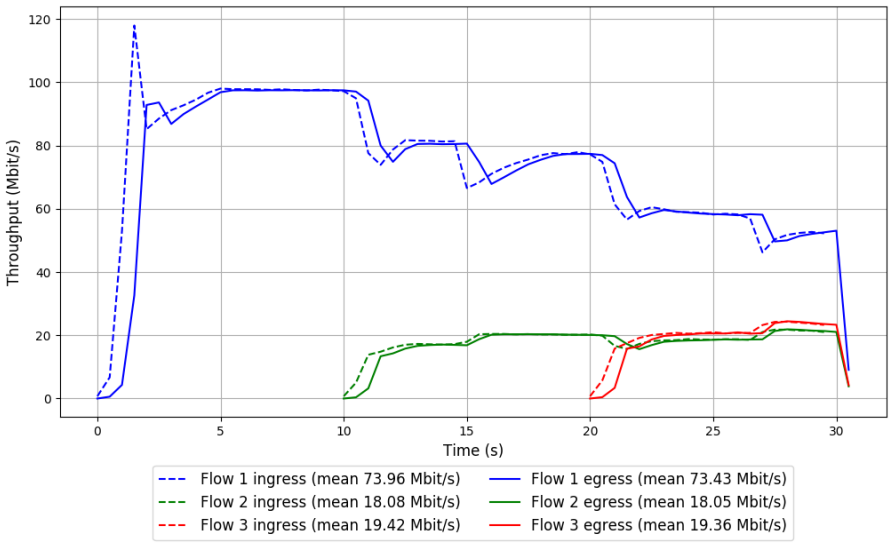


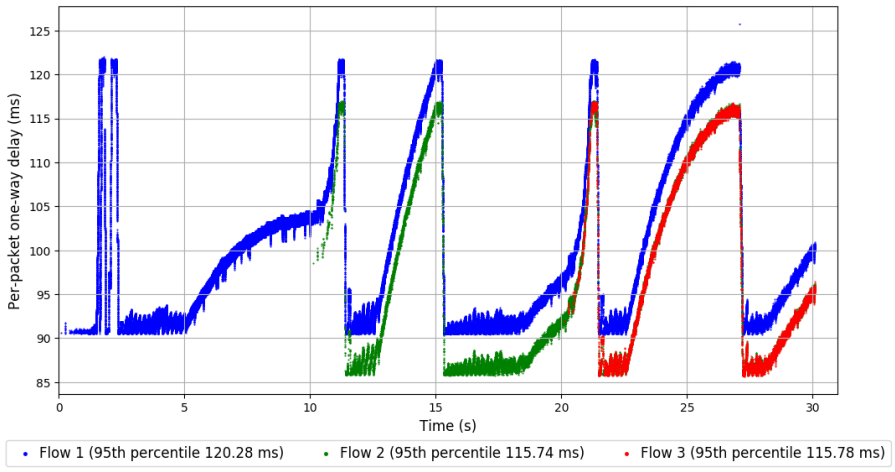
```
Run 1: Statistics of TCP Cubic

Start at: 2018-08-28 09:07:45
End at: 2018-08-28 09:08:15
Local clock offset: -0.314 ms
Remote clock offset: 2.965 ms

# Below is generated by plot.py at 2018-08-28 09:21:02
# Datalink statistics
-- Total of 3 flows:
Average throughput: 91.89 Mbit/s
95th percentile per-packet one-way delay: 119.725 ms
Loss rate: 0.60%
-- Flow 1:
Average throughput: 73.43 Mbit/s
95th percentile per-packet one-way delay: 120.280 ms
Loss rate: 0.70%
-- Flow 2:
Average throughput: 18.05 Mbit/s
95th percentile per-packet one-way delay: 115.738 ms
Loss rate: 0.19%
-- Flow 3:
Average throughput: 19.36 Mbit/s
95th percentile per-packet one-way delay: 115.778 ms
Loss rate: 0.24%
```

Run 1: Report of TCP Cubic — Data Link



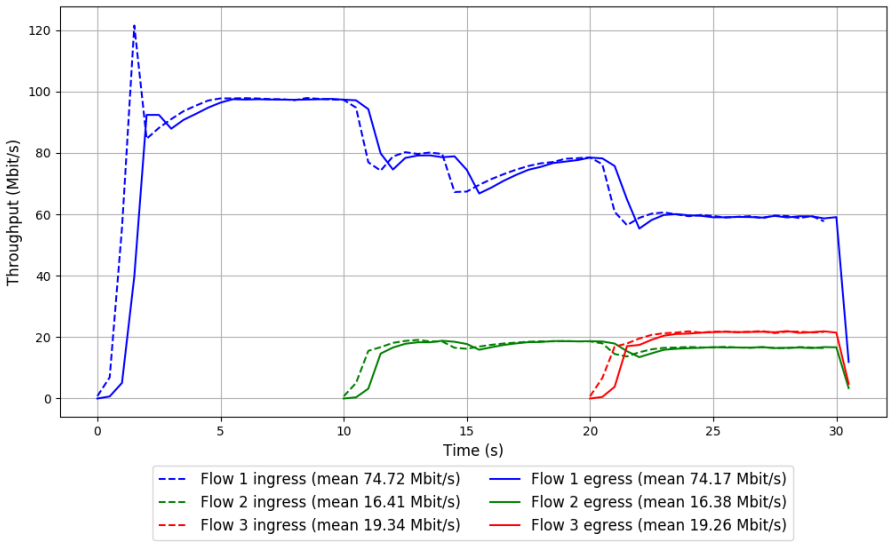


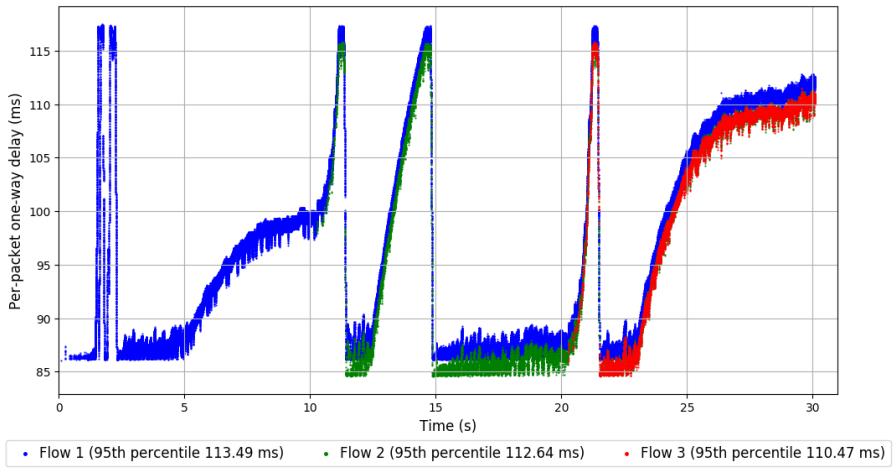
```
Run 2: Statistics of TCP Cubic

Start at: 2018-08-28 09:12:45
End at: 2018-08-28 09:13:15
Local clock offset: 0.571 ms
Remote clock offset: 2.651 ms

# Below is generated by plot.py at 2018-08-28 09:21:02
# Datalink statistics
-- Total of 3 flows:
Average throughput: 91.50 Mbit/s
95th percentile per-packet one-way delay: 112.850 ms
Loss rate: 0.55%
-- Flow 1:
Average throughput: 74.17 Mbit/s
95th percentile per-packet one-way delay: 113.491 ms
Loss rate: 0.65%
-- Flow 2:
Average throughput: 16.38 Mbit/s
95th percentile per-packet one-way delay: 112.640 ms
Loss rate: 0.15%
-- Flow 3:
Average throughput: 19.26 Mbit/s
95th percentile per-packet one-way delay: 110.472 ms
Loss rate: 0.14%
```

Run 2: Report of TCP Cubic — Data Link



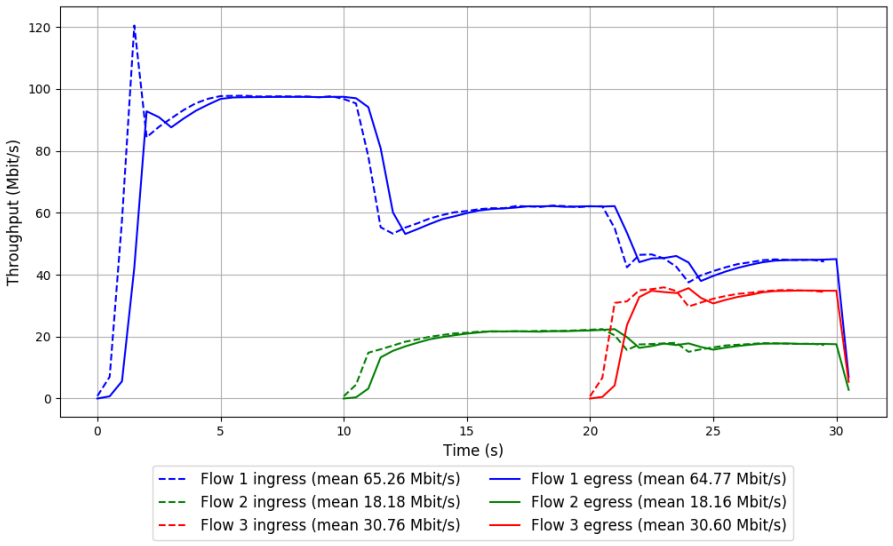


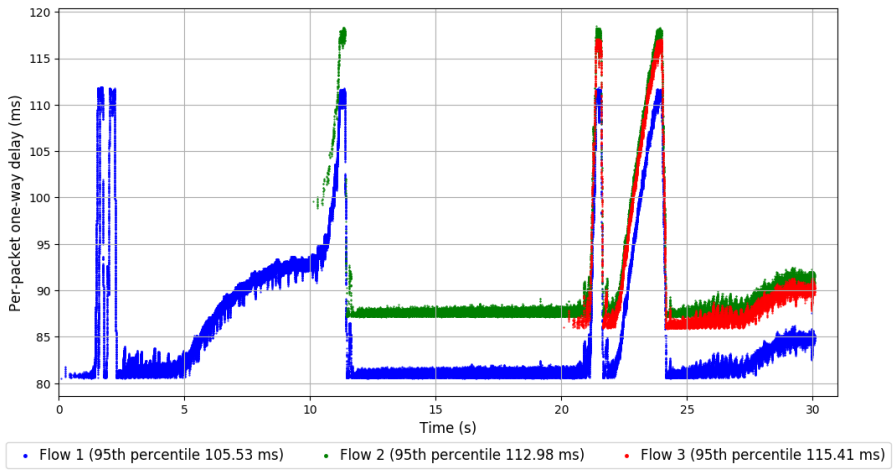
```
Run 3: Statistics of TCP Cubic

Start at: 2018-08-28 09:17:43
End at: 2018-08-28 09:18:13
Local clock offset: 0.517 ms
Remote clock offset: -1.352 ms

# Below is generated by plot.py at 2018-08-28 09:21:02
# Datalink statistics
-- Total of 3 flows:
Average throughput: 87.03 Mbit/s
95th percentile per-packet one-way delay: 109.089 ms
Loss rate: 0.64%
-- Flow 1:
Average throughput: 64.77 Mbit/s
95th percentile per-packet one-way delay: 105.526 ms
Loss rate: 0.74%
-- Flow 2:
Average throughput: 18.16 Mbit/s
95th percentile per-packet one-way delay: 112.977 ms
Loss rate: 0.20%
-- Flow 3:
Average throughput: 30.60 Mbit/s
95th percentile per-packet one-way delay: 115.412 ms
Loss rate: 0.51%
```

Run 3: Report of TCP Cubic — Data Link



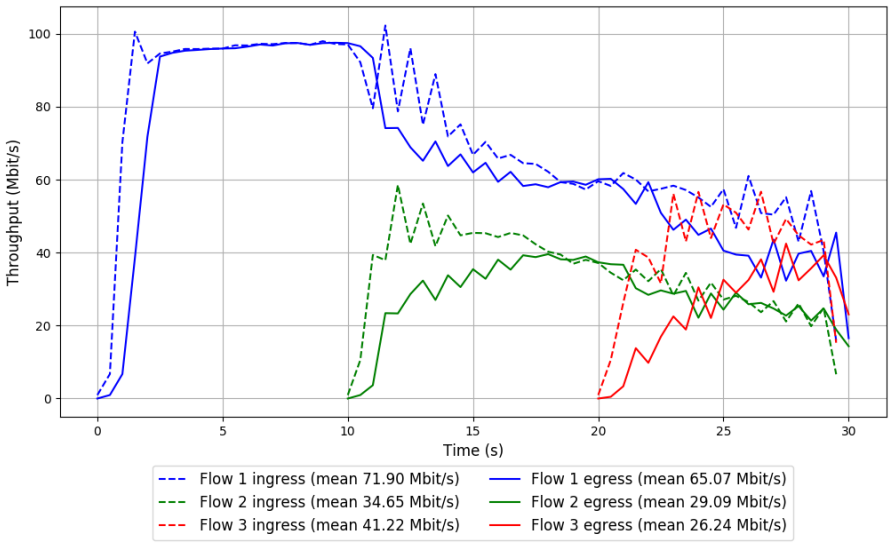


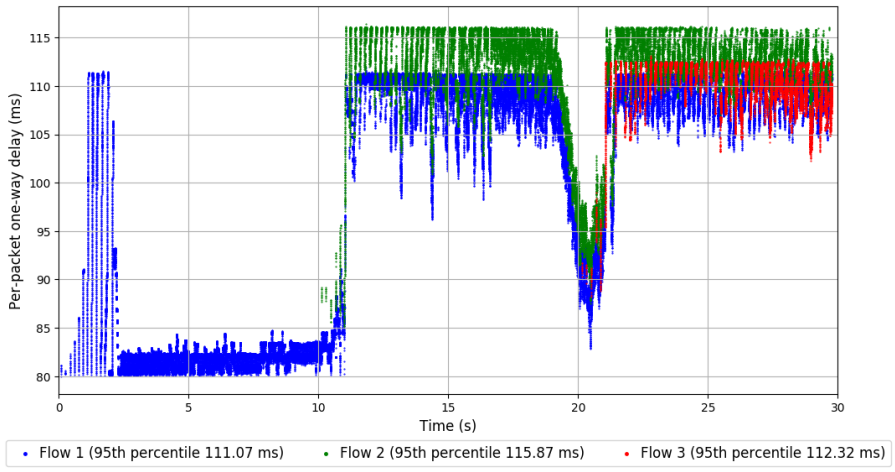
```
Run 1: Statistics of Indigo

Start at: 2018-08-28 09:05:18
End at: 2018-08-28 09:05:48
Local clock offset: 1.671 ms
Remote clock offset: -0.958 ms

# Below is generated by plot.py at 2018-08-28 09:21:02
# Datalink statistics
-- Total of 3 flows:
Average throughput: 92.85 Mbit/s
95th percentile per-packet one-way delay: 114.753 ms
Loss rate: 14.10%
-- Flow 1:
Average throughput: 65.07 Mbit/s
95th percentile per-packet one-way delay: 111.066 ms
Loss rate: 9.40%
-- Flow 2:
Average throughput: 29.09 Mbit/s
95th percentile per-packet one-way delay: 115.866 ms
Loss rate: 15.95%
-- Flow 3:
Average throughput: 26.24 Mbit/s
95th percentile per-packet one-way delay: 112.320 ms
Loss rate: 36.22%
```

Run 1: Report of Indigo — Data Link



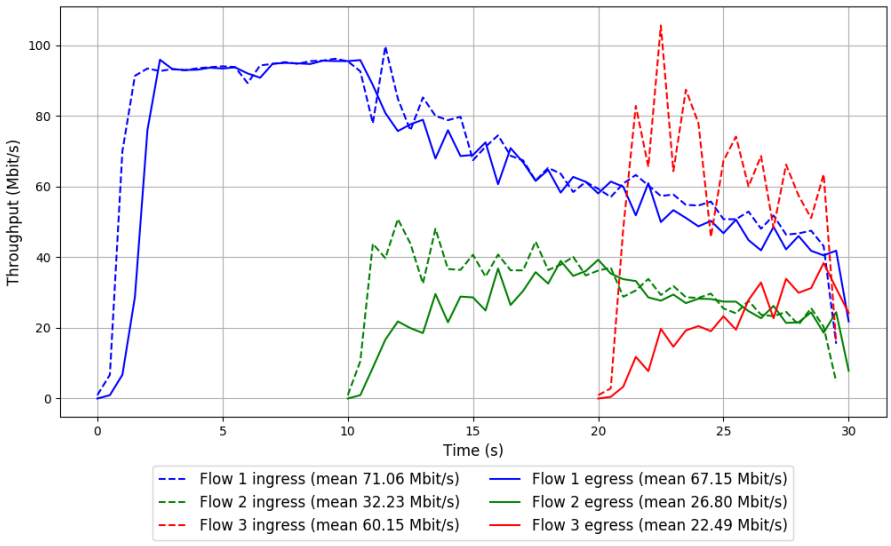


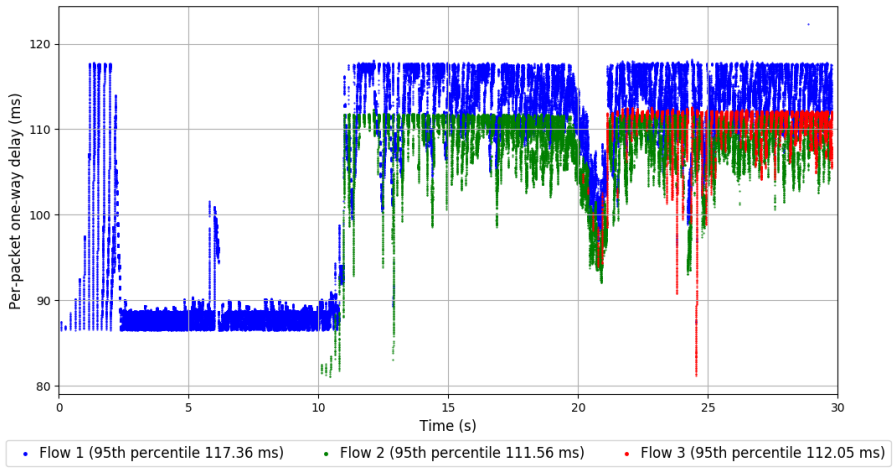
```
Run 2: Statistics of Indigo

Start at: 2018-08-28 09:10:17
End at: 2018-08-28 09:10:47
Local clock offset: 0.49 ms
Remote clock offset: -1.01 ms

# Below is generated by plot.py at 2018-08-28 09:21:02
# Datalink statistics
-- Total of 3 flows:
Average throughput: 92.09 Mbit/s
95th percentile per-packet one-way delay: 117.290 ms
Loss rate: 17.51%
-- Flow 1:
Average throughput: 67.15 Mbit/s
95th percentile per-packet one-way delay: 117.357 ms
Loss rate: 5.41%
-- Flow 2:
Average throughput: 26.80 Mbit/s
95th percentile per-packet one-way delay: 111.562 ms
Loss rate: 16.72%
-- Flow 3:
Average throughput: 22.49 Mbit/s
95th percentile per-packet one-way delay: 112.046 ms
Loss rate: 62.59%
```

Run 2: Report of Indigo — Data Link



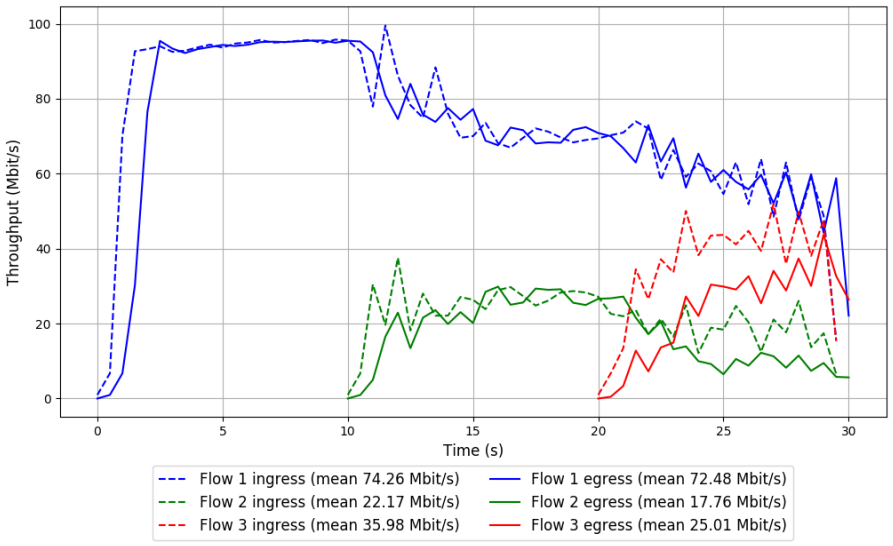


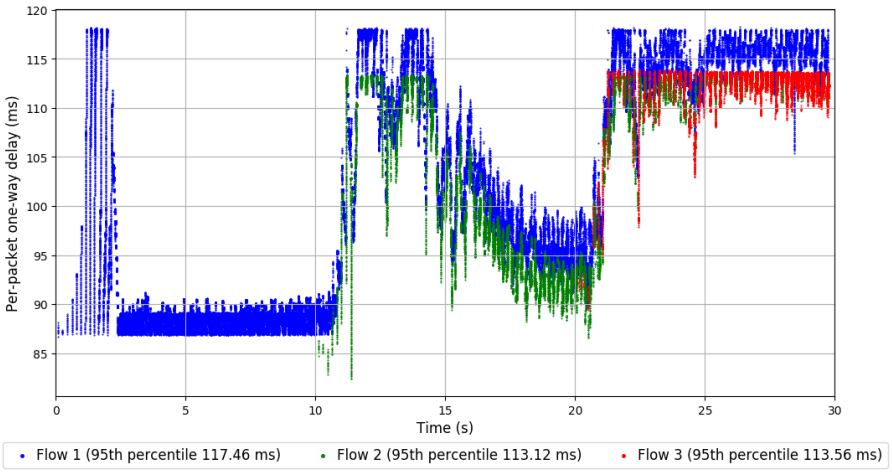
```
Run 3: Statistics of Indigo

Start at: 2018-08-28 09:15:16
End at: 2018-08-28 09:15:46
Local clock offset: -0.208 ms
Remote clock offset: -2.27 ms

# Below is generated by plot.py at 2018-08-28 09:21:07
# Datalink statistics
-- Total of 3 flows:
Average throughput: 92.26 Mbit/s
95th percentile per-packet one-way delay: 117.179 ms
Loss rate: 8.11%
-- Flow 1:
Average throughput: 72.48 Mbit/s
95th percentile per-packet one-way delay: 117.460 ms
Loss rate: 2.29%
-- Flow 2:
Average throughput: 17.76 Mbit/s
95th percentile per-packet one-way delay: 113.116 ms
Loss rate: 19.82%
-- Flow 3:
Average throughput: 25.01 Mbit/s
95th percentile per-packet one-way delay: 113.555 ms
Loss rate: 30.36%
```

Run 3: Report of Indigo — Data Link



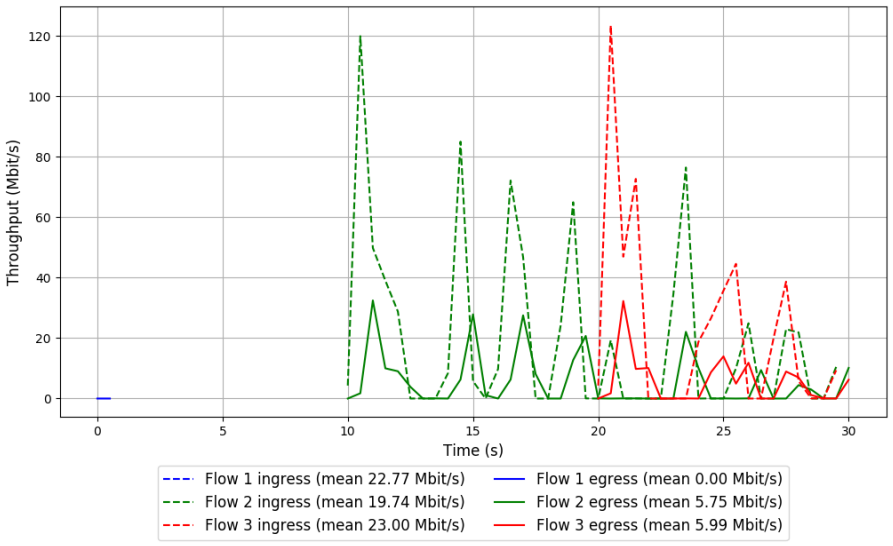


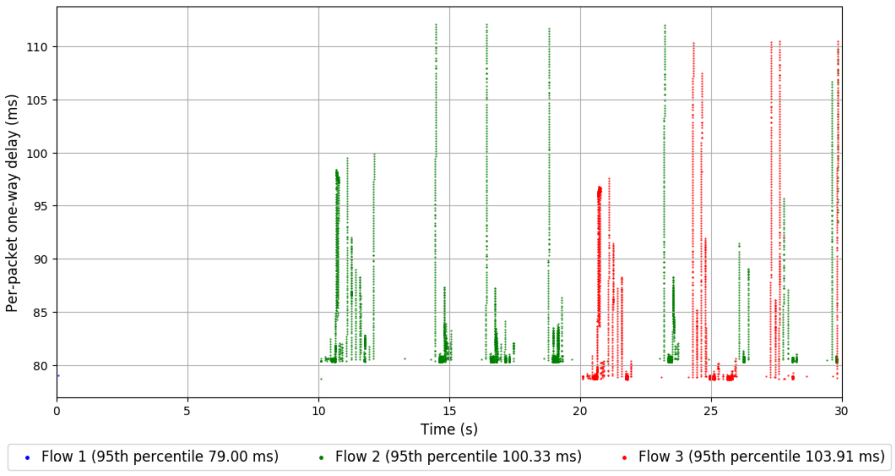
```
Run 1: Statistics of Muses-23

Start at: 2018-08-28 09:06:34
End at: 2018-08-28 09:07:04
Local clock offset: 1.465 ms
Remote clock offset: -2.105 ms

# Below is generated by plot.py at 2018-08-28 09:21:07
# Datalink statistics
-- Total of 3 flows:
Average throughput: 5.78 Mbit/s
95th percentile per-packet one-way delay: 101.979 ms
Loss rate: 71.96%
-- Flow 1:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 78.999 ms
Loss rate: 97.39%
-- Flow 2:
Average throughput: 5.75 Mbit/s
95th percentile per-packet one-way delay: 100.328 ms
Loss rate: 70.85%
-- Flow 3:
Average throughput: 5.99 Mbit/s
95th percentile per-packet one-way delay: 103.909 ms
Loss rate: 73.89%
```

Run 1: Report of Muses-23 — Data Link



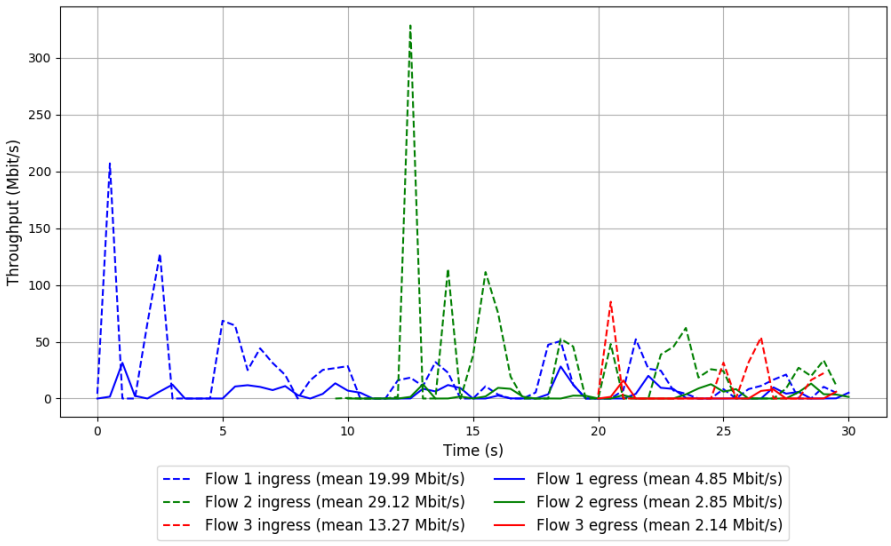


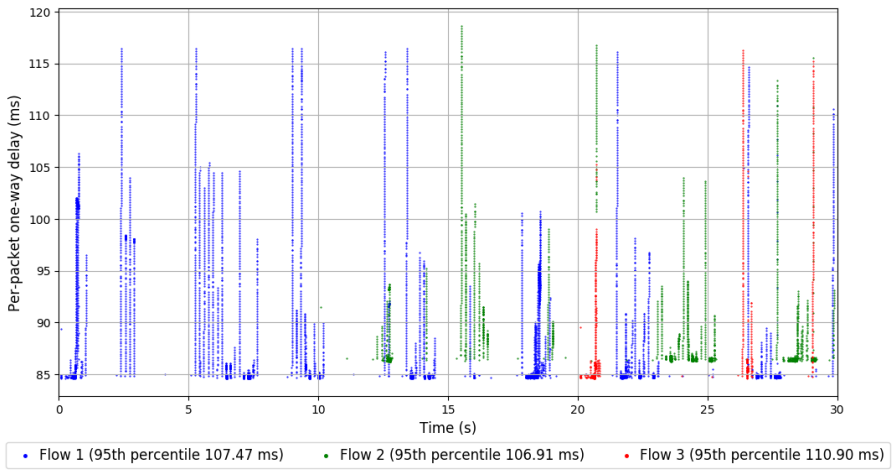
```
Run 2: Statistics of Muses-23

Start at: 2018-08-28 09:11:33
End at: 2018-08-28 09:12:03
Local clock offset: 0.614 ms
Remote clock offset: 2.75 ms

# Below is generated by plot.py at 2018-08-28 09:21:07
# Datalink statistics
-- Total of 3 flows:
Average throughput: 7.39 Mbit/s
95th percentile per-packet one-way delay: 107.880 ms
Loss rate: 82.98%
-- Flow 1:
Average throughput: 4.85 Mbit/s
95th percentile per-packet one-way delay: 107.472 ms
Loss rate: 75.69%
-- Flow 2:
Average throughput: 2.85 Mbit/s
95th percentile per-packet one-way delay: 106.907 ms
Loss rate: 90.22%
-- Flow 3:
Average throughput: 2.14 Mbit/s
95th percentile per-packet one-way delay: 110.901 ms
Loss rate: 84.35%
```

Run 2: Report of Muses-23 — Data Link





```
Run 3: Statistics of Muses-23

Start at: 2018-08-28 09:16:32
End at: 2018-08-28 09:17:02
Local clock offset: 0.581 ms
Remote clock offset: -2.397 ms

# Below is generated by plot.py at 2018-08-28 09:21:07
# Datalink statistics
-- Total of 3 flows:
Average throughput: 6.54 Mbit/s
95th percentile per-packet one-way delay: 99.870 ms
Loss rate: 74.39%
-- Flow 1:
Average throughput: 14.41 Mbit/s
95th percentile per-packet one-way delay: 97.431 ms
Loss rate: 76.38%
-- Flow 2:
Average throughput: 6.75 Mbit/s
95th percentile per-packet one-way delay: 99.947 ms
Loss rate: 74.57%
-- Flow 3:
Average throughput: 3.48 Mbit/s
95th percentile per-packet one-way delay: 104.467 ms
Loss rate: 71.58%
```

Run 3: Report of Muses-23 — Data Link