Pantheon Report

Generated at 2018-09-05 21:42:11 (UTC).

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

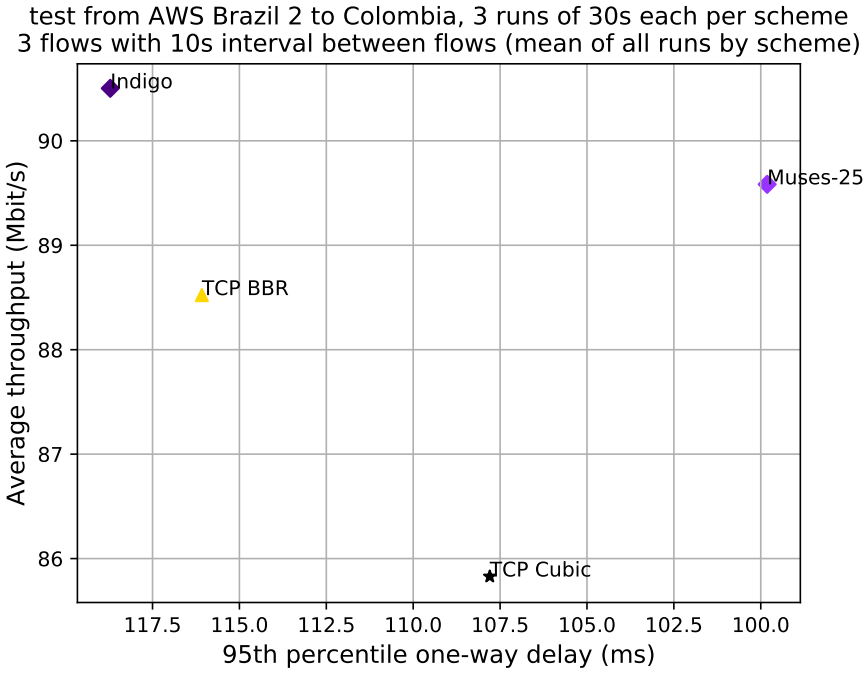
Repeated the test of 4 congestion control schemes 3 times.

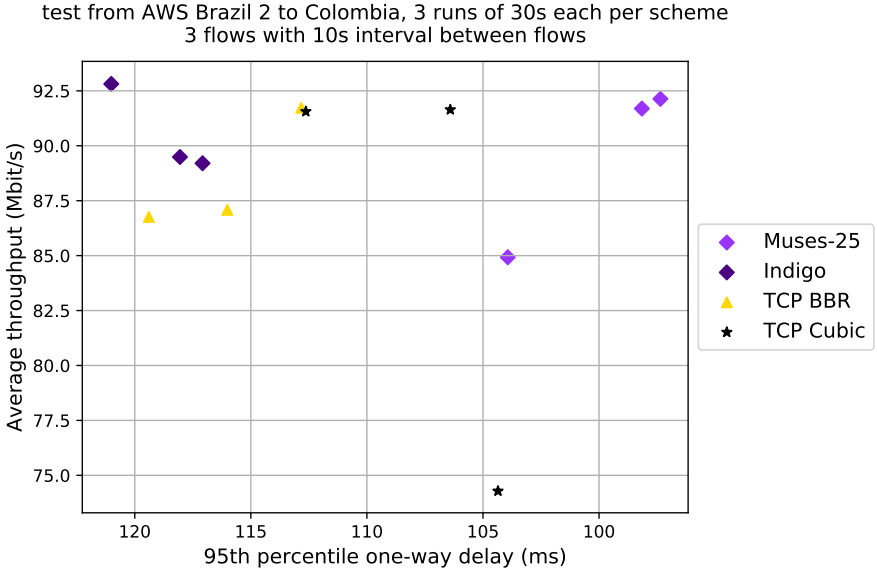
Each test lasted for 30 seconds running 3 flows with 10-second interval between two flows.

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 @ 18b9165265c8ba2915c862e8713fd9ad82c1ac21
third_party/fillp @ d47f4fa1b454a5e3c0537115c5a28436dbd4b834
third_party/fillp-sheep @ daed0c84f98531712514b2231f43ec6901114ffe
third_party/genericCC @ d0153f8e594aa89e93b032143cedbdfe58e562f4
third_party/indigo @ 2601c92e4aa9d58d38dc4dfe0ecdbf90c077e64d
third_party/libutp @ b3465b942e2826f2b179eaab4a906ce6bb7cf3cf
third_party/muses @ a28d20fb82a95a965a3da65fd1eb71b8994e9b84
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
Muses-25
TCP BBR
TCP Cubic
Average throughput (Mbit/s)
90
89
88
87
86
117.5
115.0
112.5
110.0
107.5
105.0
102.5
100.0
95th percentile one-way delay (ms)


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)
92.5
90.0
87.5
85.0
82.5
80.0
77.5
75.0
120
115
110
105
100
95th percentile one-way delay (ms)
Muses-25
Indigo
TCP BBR
TCP Cubic

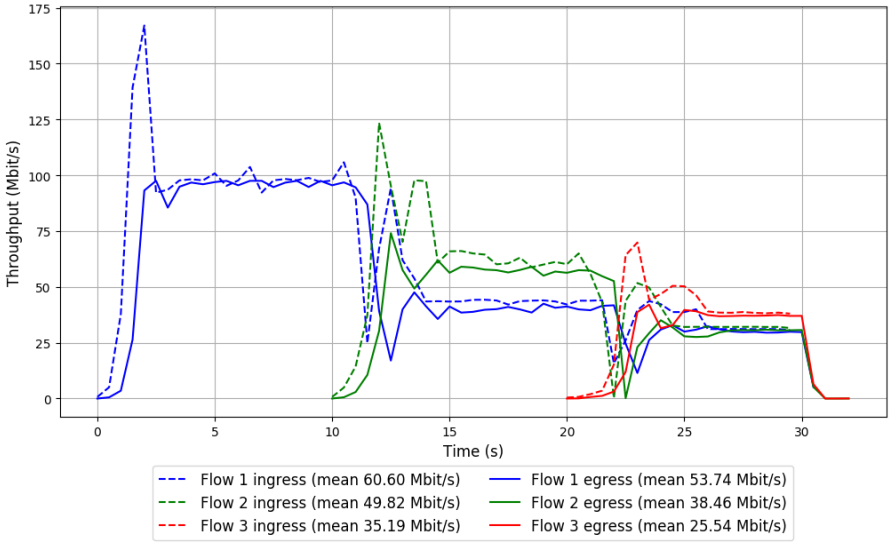
scheme	# runs	mean avg tput (Mbit/s)			mean 95th-%ile delay (ms)			mean loss rate (%)		
		flow 1	flow 2	flow 3	flow 1	flow 2	flow 3	flow 1	flow 2	flow 3
TCP BBR	3	60.63	26.16	32.56	115.93	114.00	113.87	11.39	18.14	24.30
TCP Cubic	3	69.12	11.56	27.08	106.13	110.94	108.02	0.97	0.28	0.47
Indigo	3	62.59	24.75	36.38	116.75	115.97	119.61	10.33	31.77	52.82
Muses-25	3	59.80	31.78	26.82	99.15	99.50	107.80	2.75	3.49	7.23

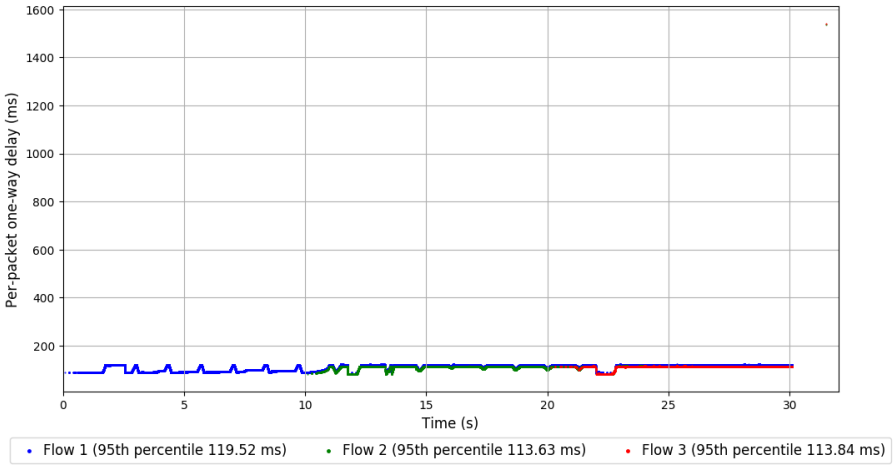
```
Run 1: Statistics of TCP BBR

Start at: 2018-09-05 21:28:47
End at: 2018-09-05 21:29:17
Local clock offset: 11.182 ms
Remote clock offset: -0.604 ms

# Below is generated by plot.py at 2018-09-05 21:41:37
# Datalink statistics
-- Total of 3 flows:
Average throughput: 86.76 Mbit/s
95th percentile per-packet one-way delay: 119.394 ms
Loss rate: 13.83%
-- Flow 1:
Average throughput: 53.74 Mbit/s
95th percentile per-packet one-way delay: 119.523 ms
Loss rate: 11.31%
-- Flow 2:
Average throughput: 38.46 Mbit/s
95th percentile per-packet one-way delay: 113.634 ms
Loss rate: 17.27%
-- Flow 3:
Average throughput: 25.54 Mbit/s
95th percentile per-packet one-way delay: 113.838 ms
Loss rate: 17.17%
```

Run 1: Report of TCP BBR — Data Link



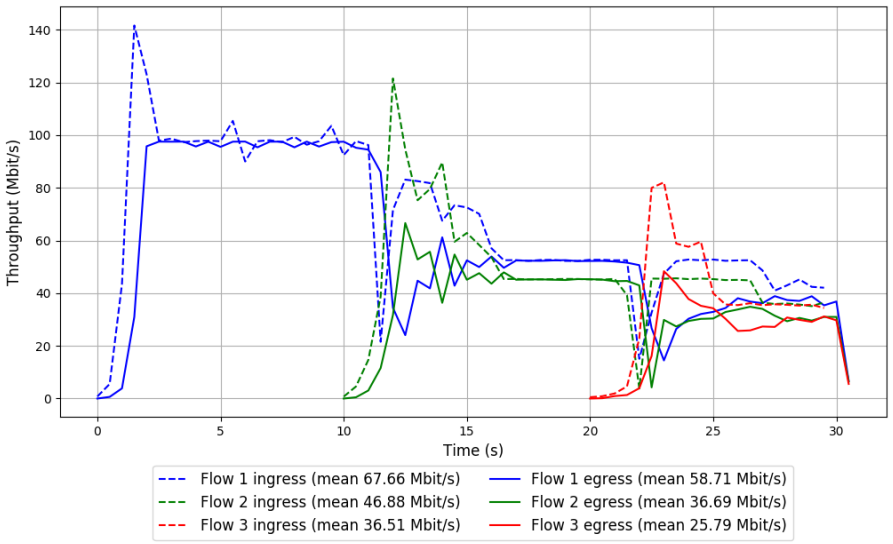


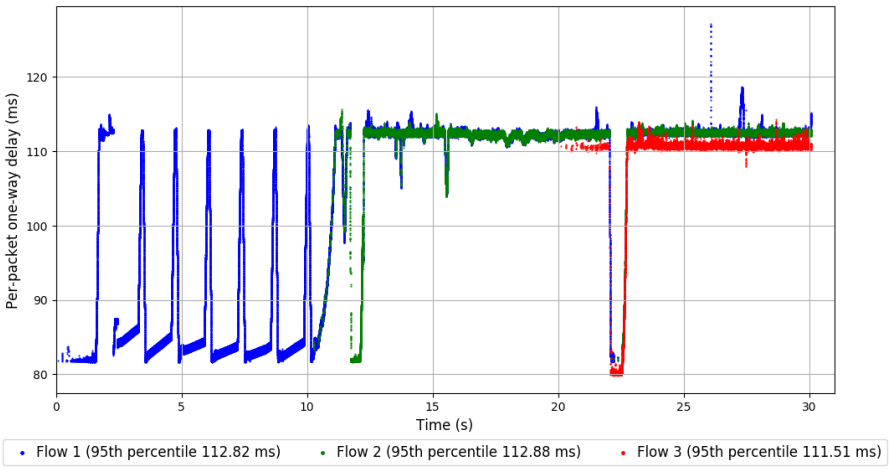
```
Run 2: Statistics of TCP BBR

Start at: 2018-09-05 21:34:05
End at: 2018-09-05 21:34:35
Local clock offset: 12.4 ms
Remote clock offset: -0.596 ms

# Below is generated by plot.py at 2018-09-05 21:41:38
# Datalink statistics
-- Total of 3 flows:
Average throughput: 91.73 Mbit/s
95th percentile per-packet one-way delay: 112.833 ms
Loss rate: 17.31%
-- Flow 1:
Average throughput: 58.71 Mbit/s
95th percentile per-packet one-way delay: 112.822 ms
Loss rate: 13.13%
-- Flow 2:
Average throughput: 36.69 Mbit/s
95th percentile per-packet one-way delay: 112.877 ms
Loss rate: 21.67%
-- Flow 3:
Average throughput: 25.79 Mbit/s
95th percentile per-packet one-way delay: 111.513 ms
Loss rate: 29.37%
```

Run 2: Report of TCP BBR — Data Link



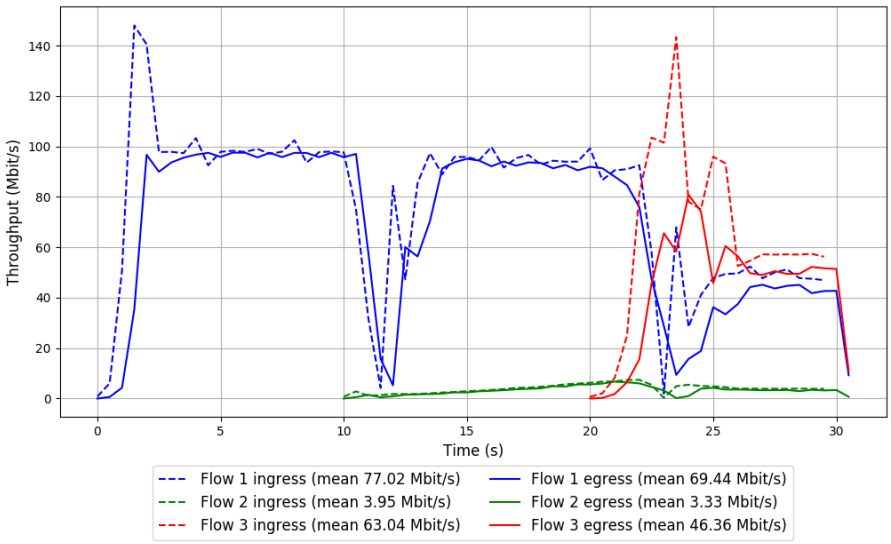


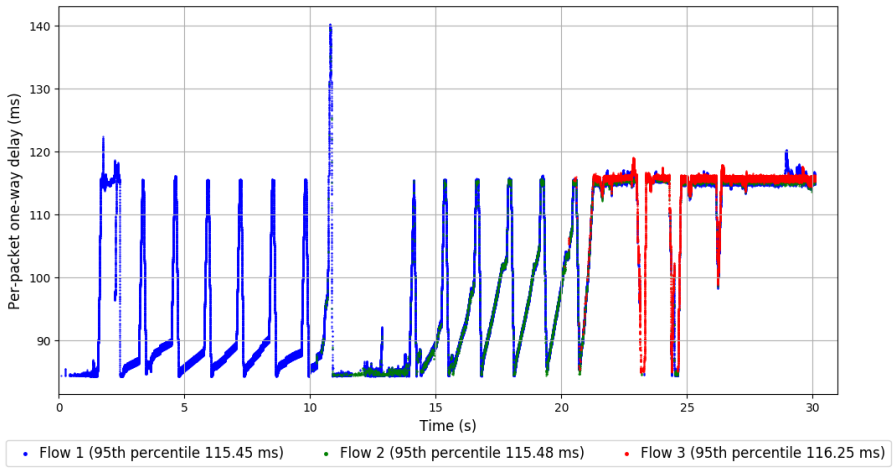
```
Run 3: Statistics of TCP BBR

Start at: 2018-09-05 21:39:29
End at: 2018-09-05 21:39:59
Local clock offset: 13.572 ms
Remote clock offset: 3.395 ms

# Below is generated by plot.py at 2018-09-05 21:41:38
# Datalink statistics
-- Total of 3 flows:
Average throughput: 87.08 Mbit/s
95th percentile per-packet one-way delay: 116.014 ms
Loss rate: 13.35%
-- Flow 1:
Average throughput: 69.44 Mbit/s
95th percentile per-packet one-way delay: 115.453 ms
Loss rate: 9.74%
-- Flow 2:
Average throughput: 3.33 Mbit/s
95th percentile per-packet one-way delay: 115.483 ms
Loss rate: 15.49%
-- Flow 3:
Average throughput: 46.36 Mbit/s
95th percentile per-packet one-way delay: 116.247 ms
Loss rate: 26.36%
```

Run 3: Report of TCP BBR — Data Link



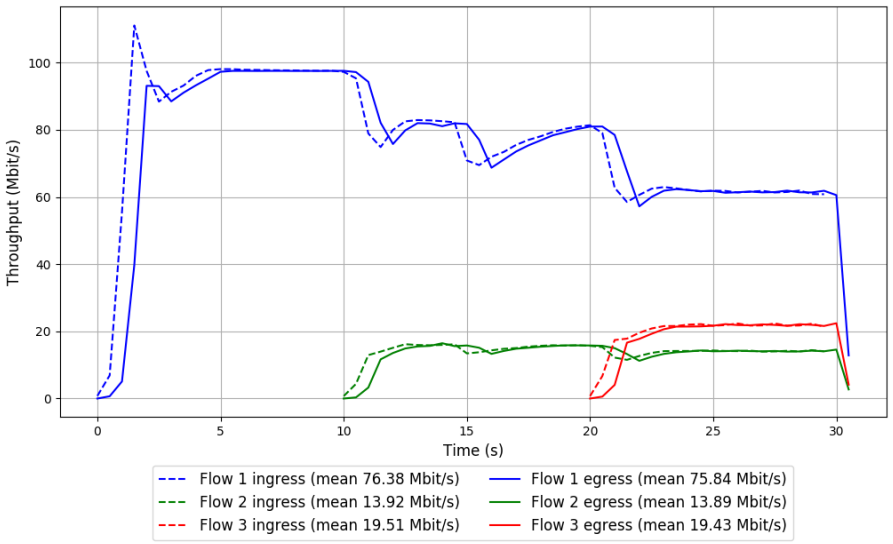


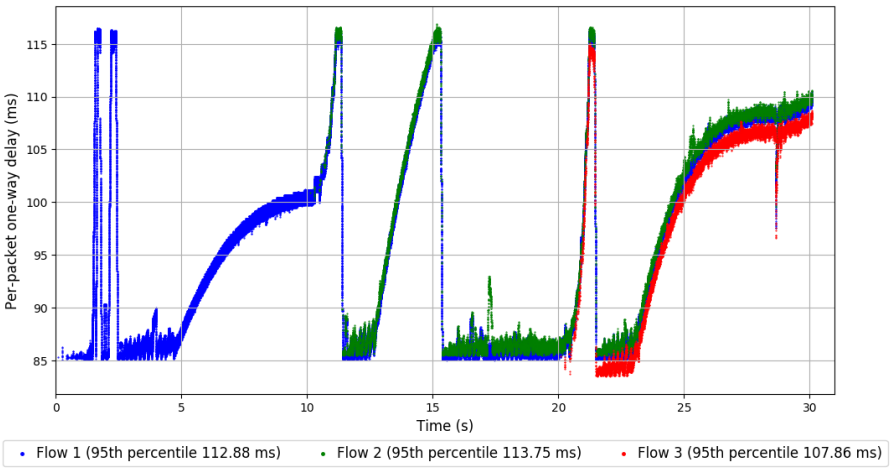
```
Run 1: Statistics of TCP Cubic

Start at: 2018-09-05 21:26:08
End at: 2018-09-05 21:26:38
Local clock offset: 11.102 ms
Remote clock offset: 2.222 ms

# Below is generated by plot.py at 2018-09-05 21:41:38
# Datalink statistics
-- Total of 3 flows:
Average throughput: 91.56 Mbit/s
95th percentile per-packet one-way delay: 112.631 ms
Loss rate: 0.56%
-- Flow 1:
Average throughput: 75.84 Mbit/s
95th percentile per-packet one-way delay: 112.882 ms
Loss rate: 0.63%
-- Flow 2:
Average throughput: 13.89 Mbit/s
95th percentile per-packet one-way delay: 113.745 ms
Loss rate: 0.21%
-- Flow 3:
Average throughput: 19.43 Mbit/s
95th percentile per-packet one-way delay: 107.864 ms
Loss rate: 0.18%
```

Run 1: Report of TCP Cubic — Data Link



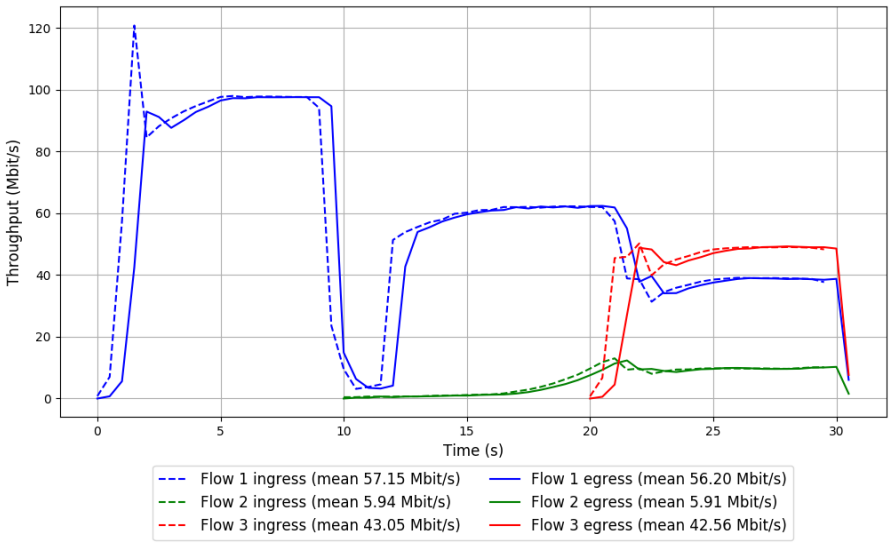


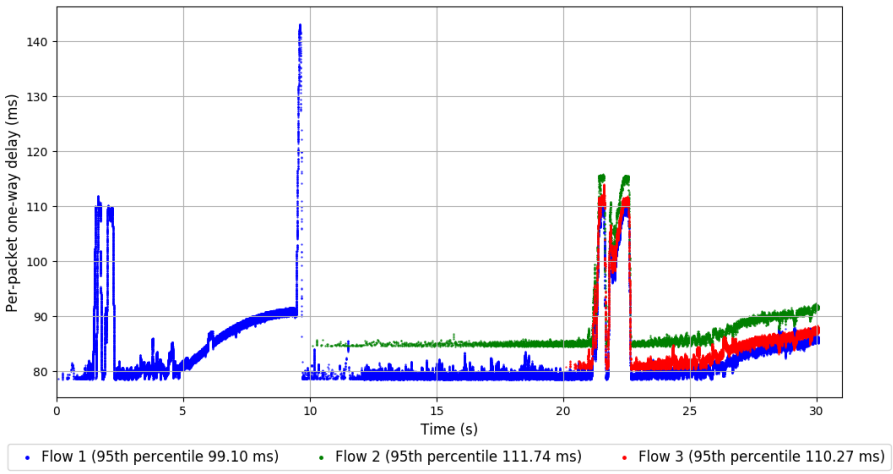
```
Run 2: Statistics of TCP Cubic

Start at: 2018-09-05 21:31:30
End at: 2018-09-05 21:32:00
Local clock offset: 12.505 ms
Remote clock offset: -1.74 ms

# Below is generated by plot.py at 2018-09-05 21:41:38
# Datalink statistics
-- Total of 3 flows:
Average throughput: 74.29 Mbit/s
95th percentile per-packet one-way delay: 104.354 ms
Loss rate: 1.48%
-- Flow 1:
Average throughput: 56.20 Mbit/s
95th percentile per-packet one-way delay: 99.097 ms
Loss rate: 1.65%
-- Flow 2:
Average throughput: 5.91 Mbit/s
95th percentile per-packet one-way delay: 111.740 ms
Loss rate: 0.48%
-- Flow 3:
Average throughput: 42.56 Mbit/s
95th percentile per-packet one-way delay: 110.271 ms
Loss rate: 1.07%
```

Run 2: Report of TCP Cubic — Data Link



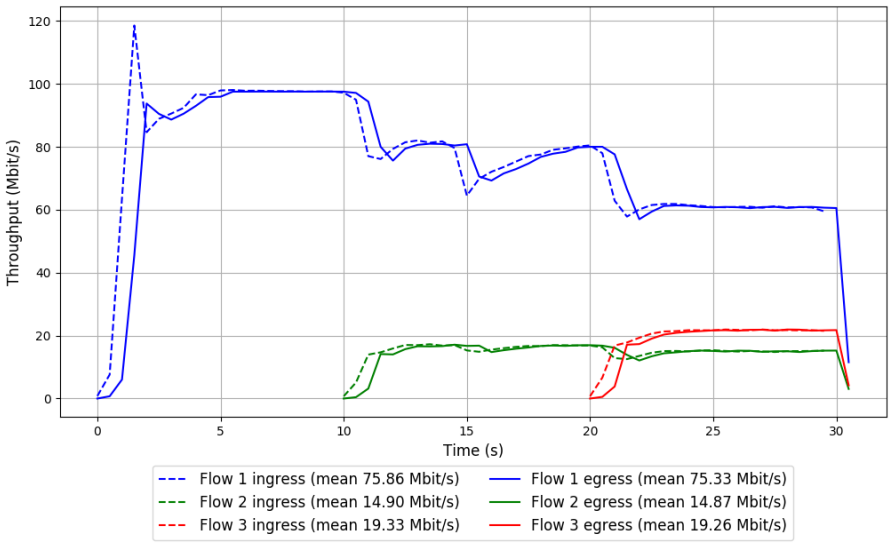


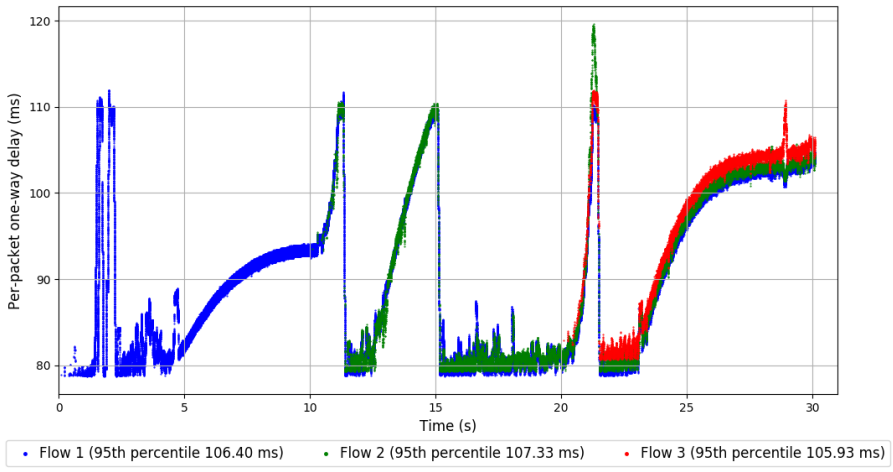
```
Run 3: Statistics of TCP Cubic

Start at: 2018-09-05 21:36:53
End at: 2018-09-05 21:37:23
Local clock offset: 12.878 ms
Remote clock offset: -1.692 ms

# Below is generated by plot.py at 2018-09-05 21:41:38
# Datalink statistics
-- Total of 3 flows:
Average throughput: 91.64 Mbit/s
95th percentile per-packet one-way delay: 106.408 ms
Loss rate: 0.54%
-- Flow 1:
Average throughput: 75.33 Mbit/s
95th percentile per-packet one-way delay: 106.400 ms
Loss rate: 0.62%
-- Flow 2:
Average throughput: 14.87 Mbit/s
95th percentile per-packet one-way delay: 107.335 ms
Loss rate: 0.15%
-- Flow 3:
Average throughput: 19.26 Mbit/s
95th percentile per-packet one-way delay: 105.929 ms
Loss rate: 0.16%
```

Run 3: Report of TCP Cubic — Data Link



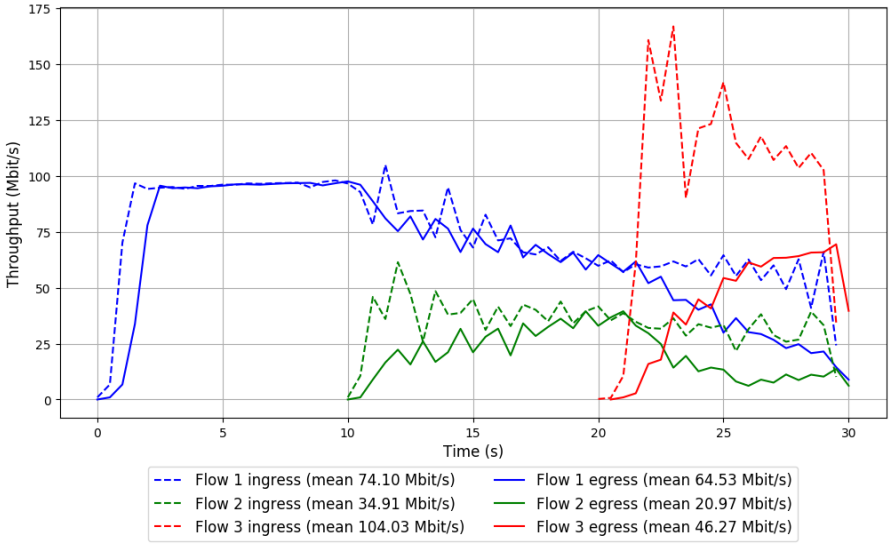


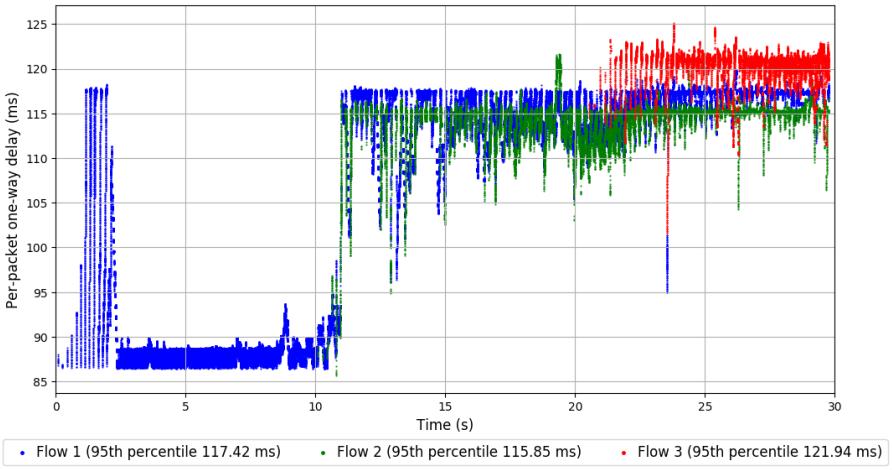
```
Run 1: Statistics of Indigo

Start at: 2018-09-05 21:24:49
End at: 2018-09-05 21:25:19
Local clock offset: 11.627 ms
Remote clock offset: 3.503 ms

# Below is generated by plot.py at 2018-09-05 21:41:41
# Datalink statistics
-- Total of 3 flows:
Average throughput: 92.82 Mbit/s
95th percentile per-packet one-way delay: 121.013 ms
Loss rate: 28.31%
-- Flow 1:
Average throughput: 64.53 Mbit/s
95th percentile per-packet one-way delay: 117.419 ms
Loss rate: 12.83%
-- Flow 2:
Average throughput: 20.97 Mbit/s
95th percentile per-packet one-way delay: 115.850 ms
Loss rate: 39.84%
-- Flow 3:
Average throughput: 46.27 Mbit/s
95th percentile per-packet one-way delay: 121.945 ms
Loss rate: 55.51%
```

Run 1: Report of Indigo — Data Link



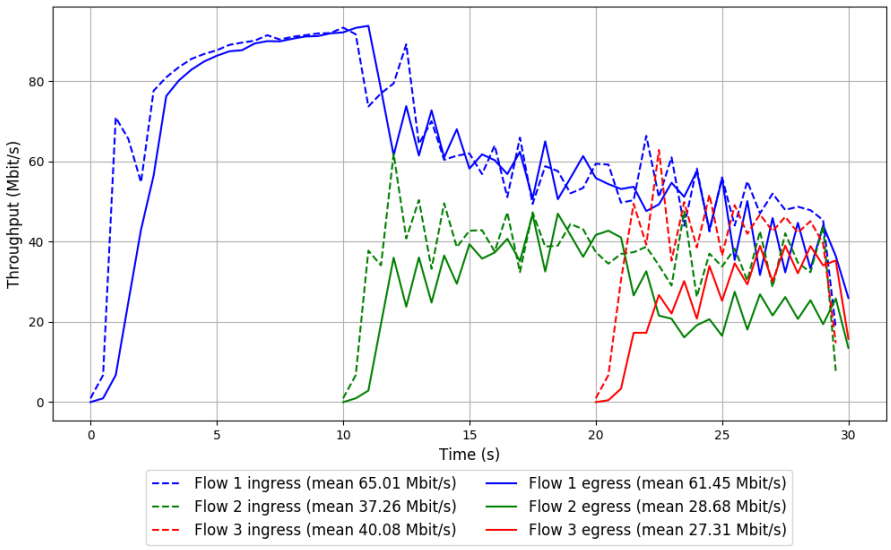


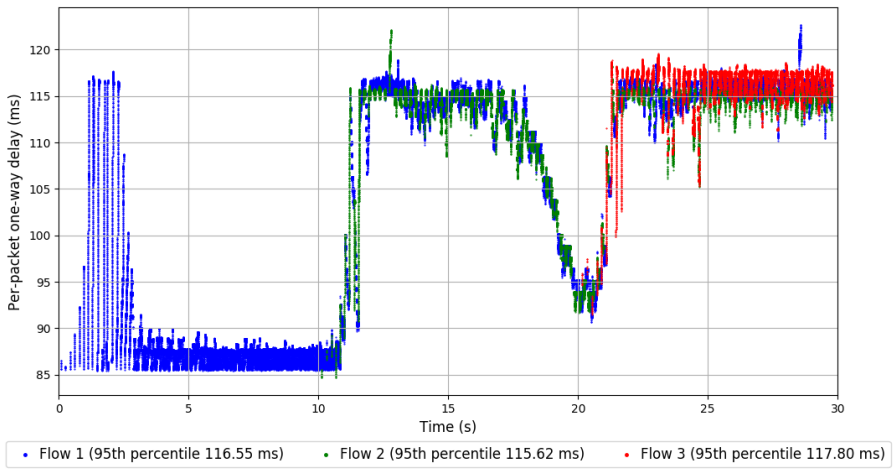
```
Run 2: Statistics of Indigo

Start at: 2018-09-05 21:30:07
End at: 2018-09-05 21:30:37
Local clock offset: 12.303 ms
Remote clock offset: 2.233 ms

# Below is generated by plot.py at 2018-09-05 21:41:41
# Datalink statistics
-- Total of 3 flows:
Average throughput: 89.20 Mbit/s
95th percentile per-packet one-way delay: 117.080 ms
Loss rate: 12.93%
-- Flow 1:
Average throughput: 61.45 Mbit/s
95th percentile per-packet one-way delay: 116.554 ms
Loss rate: 5.38%
-- Flow 2:
Average throughput: 28.68 Mbit/s
95th percentile per-packet one-way delay: 115.625 ms
Loss rate: 22.94%
-- Flow 3:
Average throughput: 27.31 Mbit/s
95th percentile per-packet one-way delay: 117.801 ms
Loss rate: 31.73%
```

Run 2: Report of Indigo — Data Link



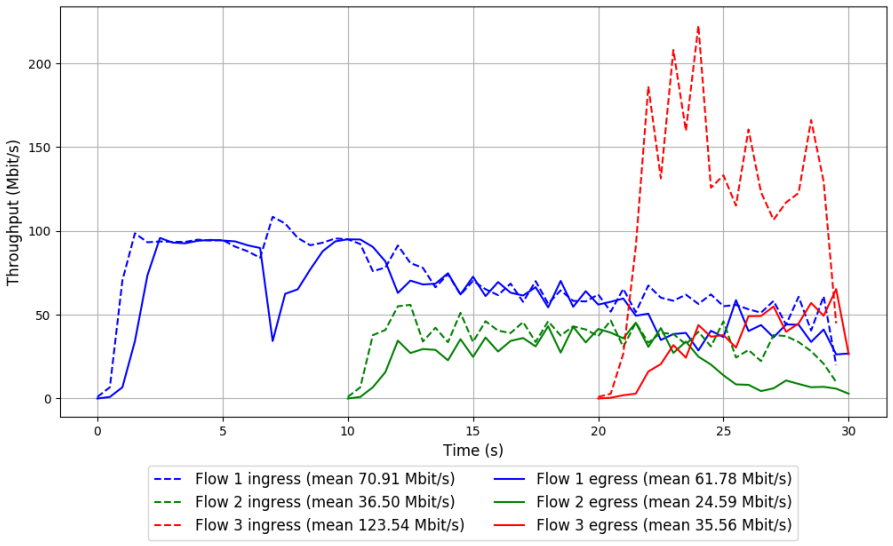


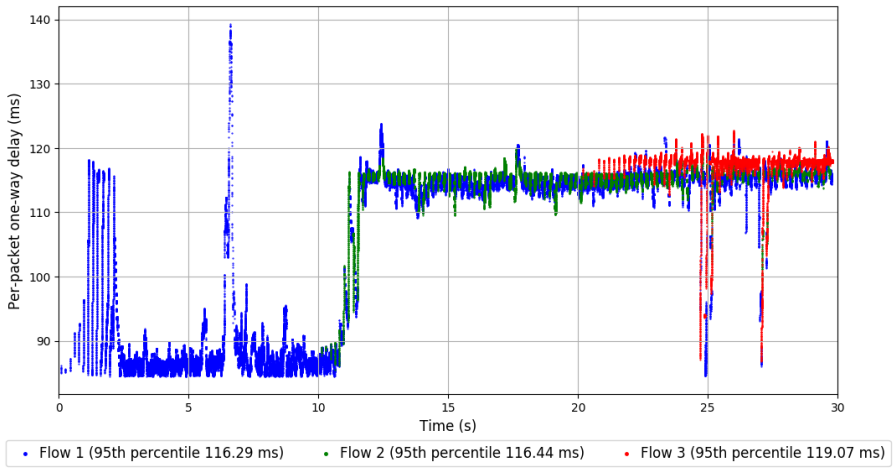
```
Run 3: Statistics of Indigo

Start at: 2018-09-05 21:35:33
End at: 2018-09-05 21:36:03
Local clock offset: 11.822 ms
Remote clock offset: 3.281 ms

# Below is generated by plot.py at 2018-09-05 21:42:08
# Datalink statistics
-- Total of 3 flows:
Average throughput: 89.49 Mbit/s
95th percentile per-packet one-way delay: 118.054 ms
Loss rate: 33.62%
-- Flow 1:
Average throughput: 61.78 Mbit/s
95th percentile per-packet one-way delay: 116.286 ms
Loss rate: 12.78%
-- Flow 2:
Average throughput: 24.59 Mbit/s
95th percentile per-packet one-way delay: 116.442 ms
Loss rate: 32.54%
-- Flow 3:
Average throughput: 35.56 Mbit/s
95th percentile per-packet one-way delay: 119.070 ms
Loss rate: 71.21%
```

Run 3: Report of Indigo — Data Link



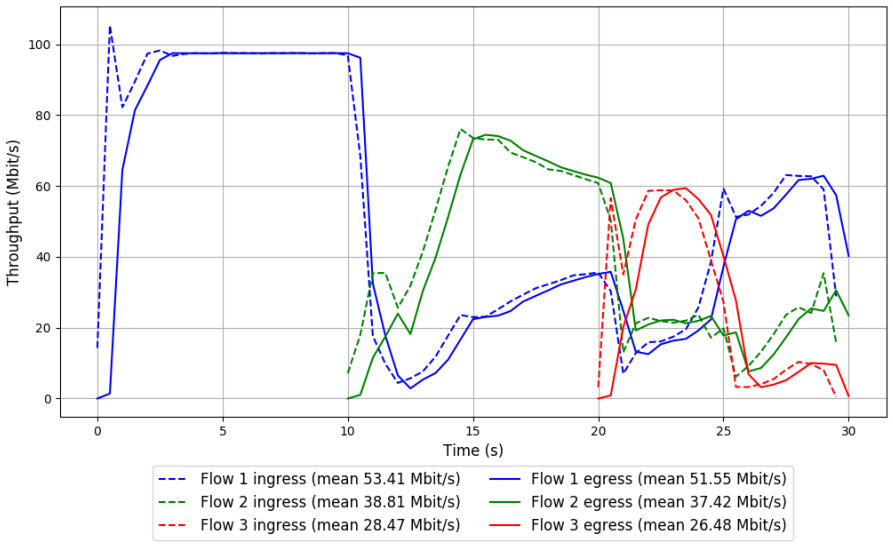


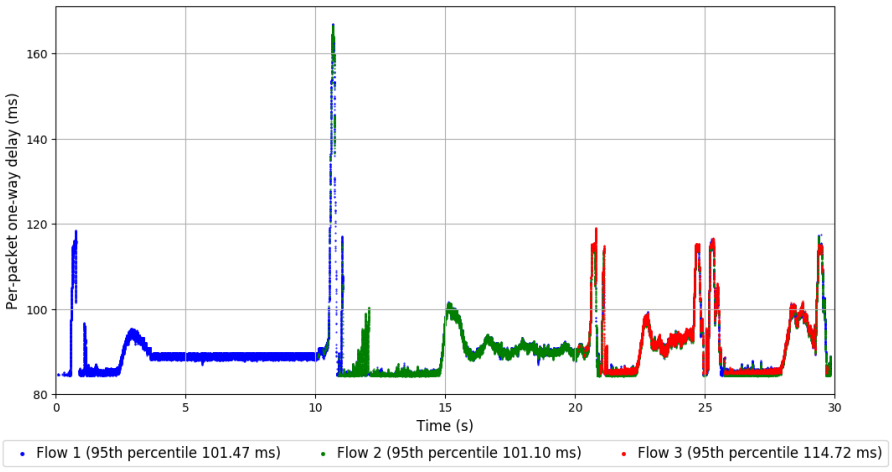
```
Run 1: Statistics of Muses-25

Start at: 2018-09-05 21:27:29
End at: 2018-09-05 21:27:59
Local clock offset: 11.758 ms
Remote clock offset: 2.212 ms

# Below is generated by plot.py at 2018-09-05 21:42:09
# Datalink statistics
-- Total of 3 flows:
Average throughput: 84.93 Mbit/s
95th percentile per-packet one-way delay: 103.932 ms
Loss rate: 3.89%
-- Flow 1:
Average throughput: 51.55 Mbit/s
95th percentile per-packet one-way delay: 101.468 ms
Loss rate: 3.48%
-- Flow 2:
Average throughput: 37.42 Mbit/s
95th percentile per-packet one-way delay: 101.098 ms
Loss rate: 3.61%
-- Flow 3:
Average throughput: 26.48 Mbit/s
95th percentile per-packet one-way delay: 114.723 ms
Loss rate: 7.03%
```

Run 1: Report of Muses-25 — Data Link



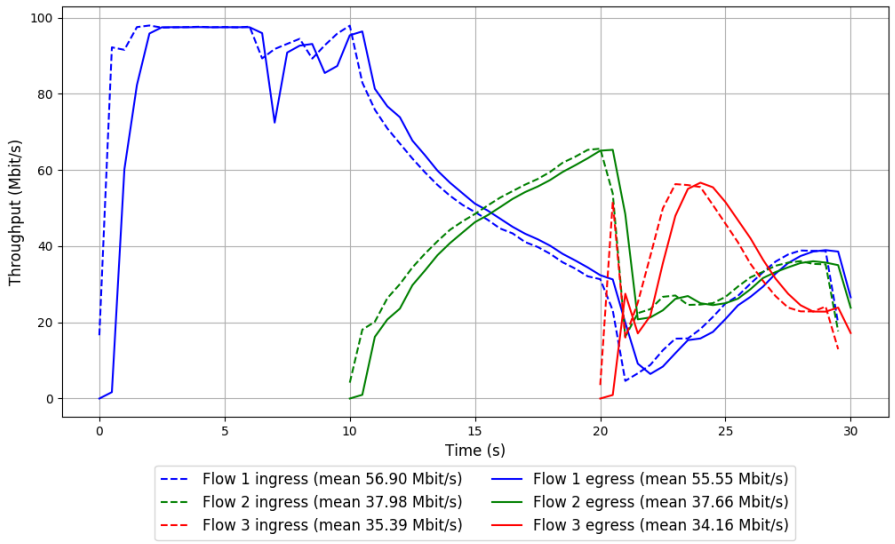


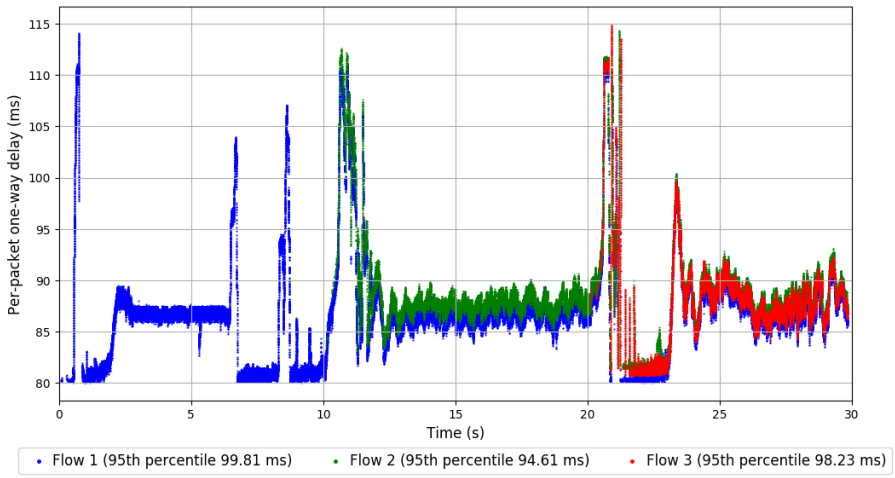
```
Run 2: Statistics of Muses-25

Start at: 2018-09-05 21:32:47
End at: 2018-09-05 21:33:17
Local clock offset: 12.355 ms
Remote clock offset: -0.588 ms

# Below is generated by plot.py at 2018-09-05 21:42:10
# Datalink statistics
-- Total of 3 flows:
Average throughput: 91.69 Mbit/s
95th percentile per-packet one-way delay: 98.156 ms
Loss rate: 2.08%
-- Flow 1:
Average throughput: 55.55 Mbit/s
95th percentile per-packet one-way delay: 99.808 ms
Loss rate: 2.35%
-- Flow 2:
Average throughput: 37.66 Mbit/s
95th percentile per-packet one-way delay: 94.610 ms
Loss rate: 0.81%
-- Flow 3:
Average throughput: 34.16 Mbit/s
95th percentile per-packet one-way delay: 98.235 ms
Loss rate: 3.50%
```

Run 2: Report of Muses-25 — Data Link





```
Run 3: Statistics of Muses-25

Start at: 2018-09-05 21:38:10
End at: 2018-09-05 21:38:40
Local clock offset: 12.424 ms
Remote clock offset: -1.661 ms

# Below is generated by plot.py at 2018-09-05 21:42:10
# Datalink statistics
-- Total of 3 flows:
Average throughput: 92.13 Mbit/s
95th percentile per-packet one-way delay: 97.358 ms
Loss rate: 3.63%
-- Flow 1:
Average throughput: 72.29 Mbit/s
95th percentile per-packet one-way delay: 96.175 ms
Loss rate: 2.43%
-- Flow 2:
Average throughput: 20.26 Mbit/s
95th percentile per-packet one-way delay: 102.789 ms
Loss rate: 6.06%
-- Flow 3:
Average throughput: 19.82 Mbit/s
95th percentile per-packet one-way delay: 110.452 ms
Loss rate: 11.17%
```

Run 3: Report of Muses-25 — Data Link