

Pantheon Report

Generated at 2018-09-03 10:01:10 (UTC).

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

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.

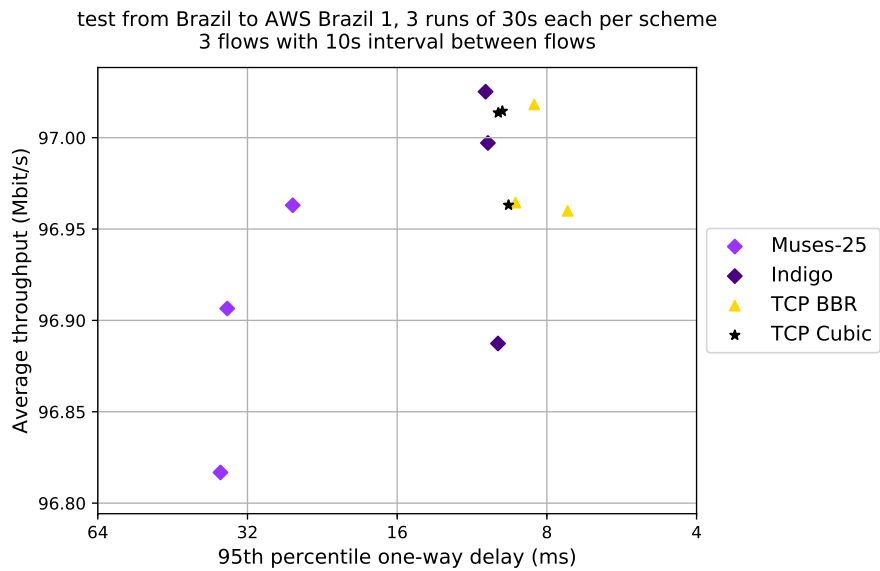
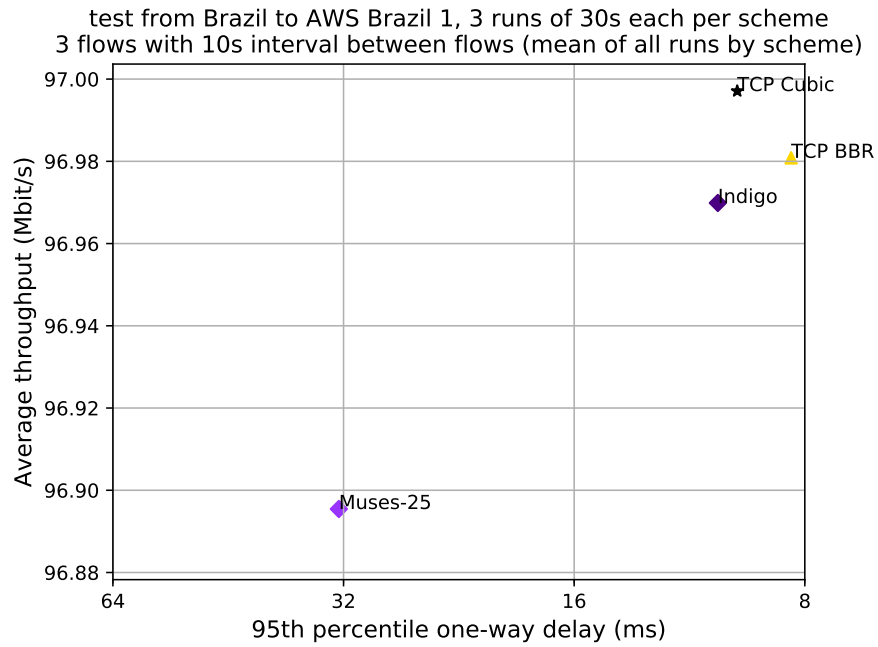
NTP offsets were measured against **gps.ntp.br** and have been applied to correct the timestamps in logs.

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 @ f309f5459e2c5237279a184e52ece7a2b47ef1c9
third_party/fillp @ d47f4fa1b454a5e3c0537115c5a28436dbd4b834
third_party/fillp-sheep @ daed0c84f98531712514b2231f43ec6901114ffe
third_party/genericCC @ d0153f8e594aa89e93b032143cedbdf58e562f4
third_party/indigo @ 2601c92e4aa9d58d38dc4dfe0ecdbf90c077e64d
third_party/libutp @ b3465b942e2826f2b179eaab4a906ce6bb7cf3cf
third_party/muses @ b8d5019b83a3a678804d830fcfe1da7b3a63421b
third_party/pantheon-tunnel @ cbfce6db5ff5740dafa1771f813cd646339e1952
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
```



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	59.00	40.71	32.73	8.28	7.91	8.86	0.15	0.09	0.31
TCP Cubic	3	59.31	40.45	32.34	9.91	9.62	9.98	0.09	0.16	0.26
Indigo	3	59.40	40.50	32.32	9.32	10.66	9.45	0.07	1.75	0.42
Muses-25	3	59.75	39.57	32.66	19.39	36.37	48.39	0.90	1.95	6.56

Run 1: Statistics of TCP BBR

Start at: 2018-09-03 09:46:06

End at: 2018-09-03 09:46:36

Local clock offset: 1.489 ms

Remote clock offset: 0.378 ms

Below is generated by plot.py at 2018-09-03 10:00:32

Datalink statistics

-- Total of 3 flows:

Average throughput: 96.96 Mbit/s

95th percentile per-packet one-way delay: 9.255 ms

Loss rate: 0.16%

-- Flow 1:

Average throughput: 58.93 Mbit/s

95th percentile per-packet one-way delay: 9.417 ms

Loss rate: 0.23%

-- Flow 2:

Average throughput: 40.77 Mbit/s

95th percentile per-packet one-way delay: 8.372 ms

Loss rate: 0.03%

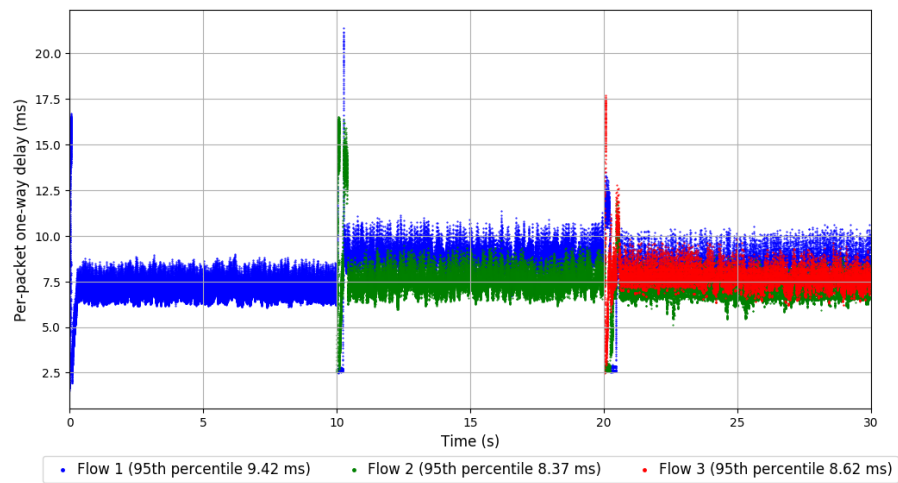
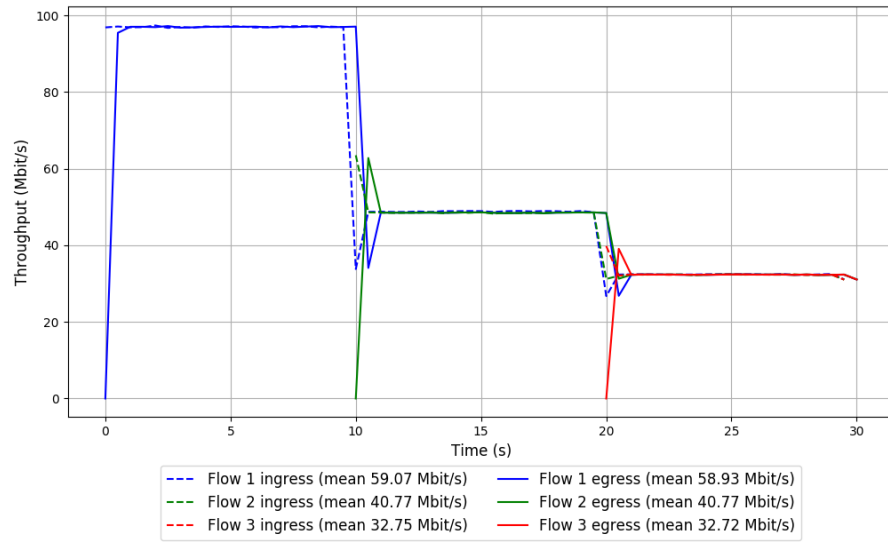
-- Flow 3:

Average throughput: 32.72 Mbit/s

95th percentile per-packet one-way delay: 8.624 ms

Loss rate: 0.08%

Run 1: Report of TCP BBR — Data Link



Run 2: Statistics of TCP BBR

Start at: 2018-09-03 09:50:36

End at: 2018-09-03 09:51:06

Local clock offset: 0.342 ms

Remote clock offset: 0.385 ms

Below is generated by plot.py at 2018-09-03 10:00:33

Datalink statistics

-- Total of 3 flows:

Average throughput: 96.96 Mbit/s

95th percentile per-packet one-way delay: 7.268 ms

Loss rate: 0.03%

-- Flow 1:

Average throughput: 59.05 Mbit/s

95th percentile per-packet one-way delay: 7.097 ms

Loss rate: 0.02%

-- Flow 2:

Average throughput: 40.65 Mbit/s

95th percentile per-packet one-way delay: 6.969 ms

Loss rate: 0.03%

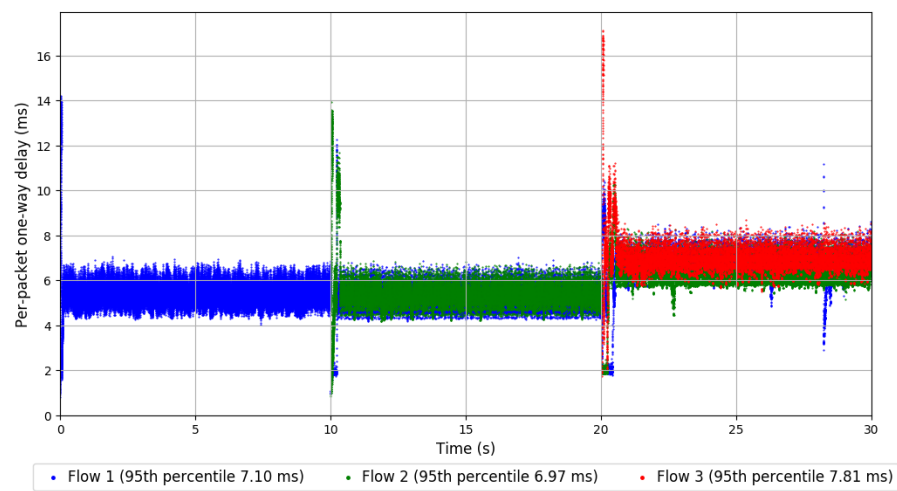
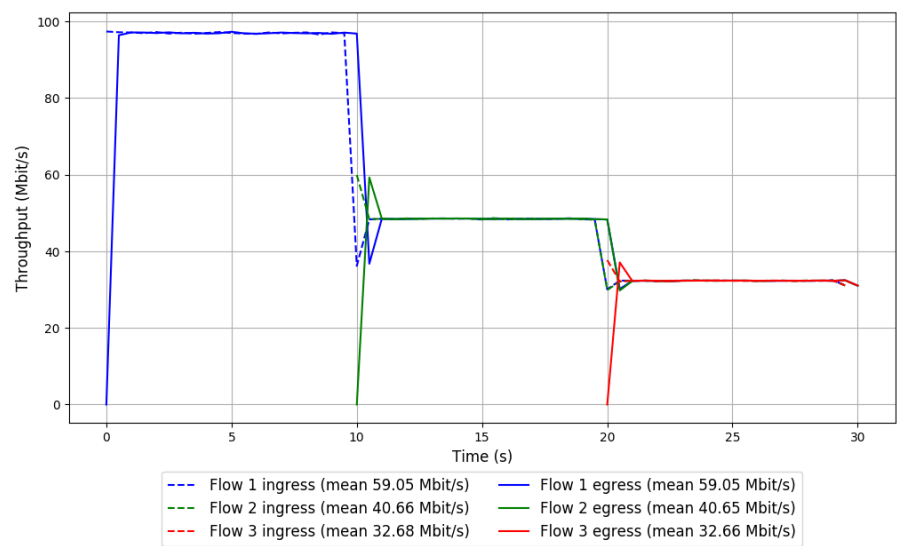
-- Flow 3:

Average throughput: 32.66 Mbit/s

95th percentile per-packet one-way delay: 7.814 ms

Loss rate: 0.07%

Run 2: Report of TCP BBR — Data Link



Run 3: Statistics of TCP BBR

Start at: 2018-09-03 09:55:06

End at: 2018-09-03 09:55:36

Local clock offset: 0.902 ms

Remote clock offset: 0.421 ms

Below is generated by plot.py at 2018-09-03 10:00:33

Datalink statistics

-- Total of 3 flows:

Average throughput: 97.02 Mbit/s

95th percentile per-packet one-way delay: 8.484 ms

Loss rate: 0.27%

-- Flow 1:

Average throughput: 59.02 Mbit/s

95th percentile per-packet one-way delay: 8.317 ms

Loss rate: 0.20%

-- Flow 2:

Average throughput: 40.70 Mbit/s

95th percentile per-packet one-way delay: 8.382 ms

Loss rate: 0.22%

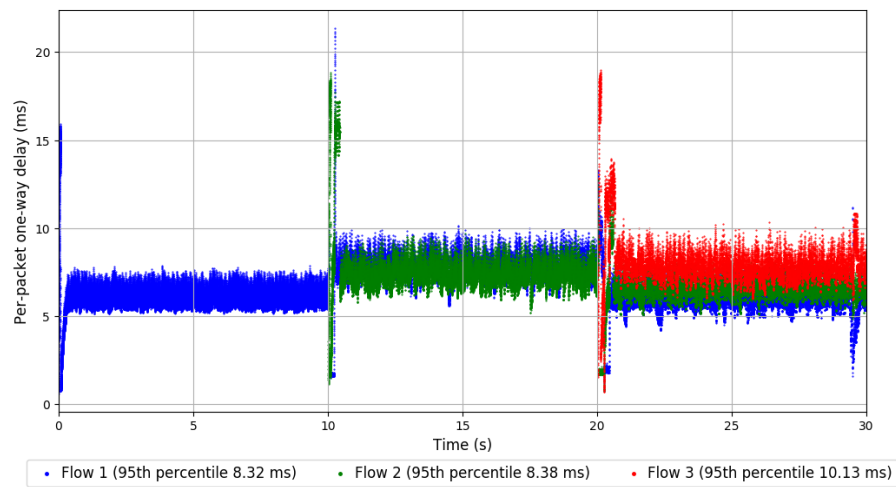
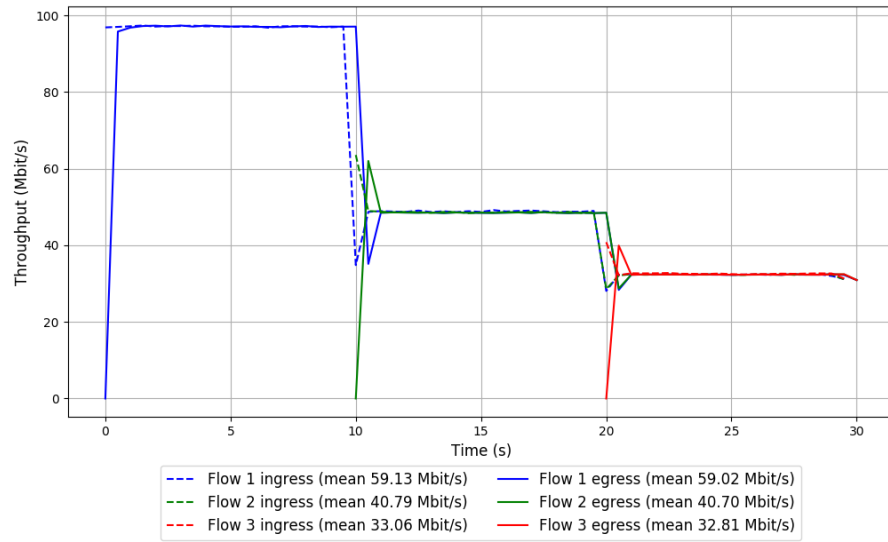
-- Flow 3:

Average throughput: 32.81 Mbit/s

95th percentile per-packet one-way delay: 10.129 ms

Loss rate: 0.78%

Run 3: Report of TCP BBR — Data Link



Run 1: Statistics of TCP Cubic

Start at: 2018-09-03 09:47:13

End at: 2018-09-03 09:47:43

Local clock offset: 0.642 ms

Remote clock offset: 0.309 ms

Below is generated by plot.py at 2018-09-03 10:00:33

Datalink statistics

-- Total of 3 flows:

Average throughput: 96.96 Mbit/s

95th percentile per-packet one-way delay: 9.555 ms

Loss rate: 0.12%

-- Flow 1:

Average throughput: 59.28 Mbit/s

95th percentile per-packet one-way delay: 10.134 ms

Loss rate: 0.08%

-- Flow 2:

Average throughput: 40.44 Mbit/s

95th percentile per-packet one-way delay: 9.210 ms

Loss rate: 0.15%

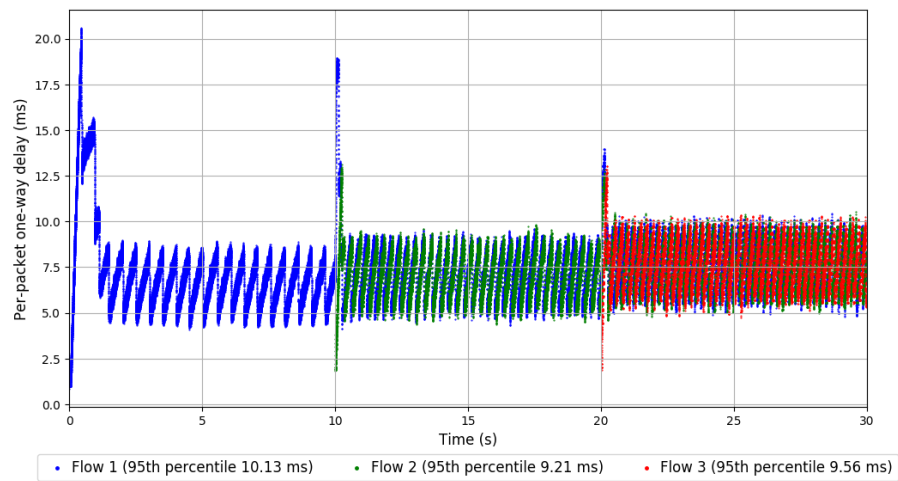
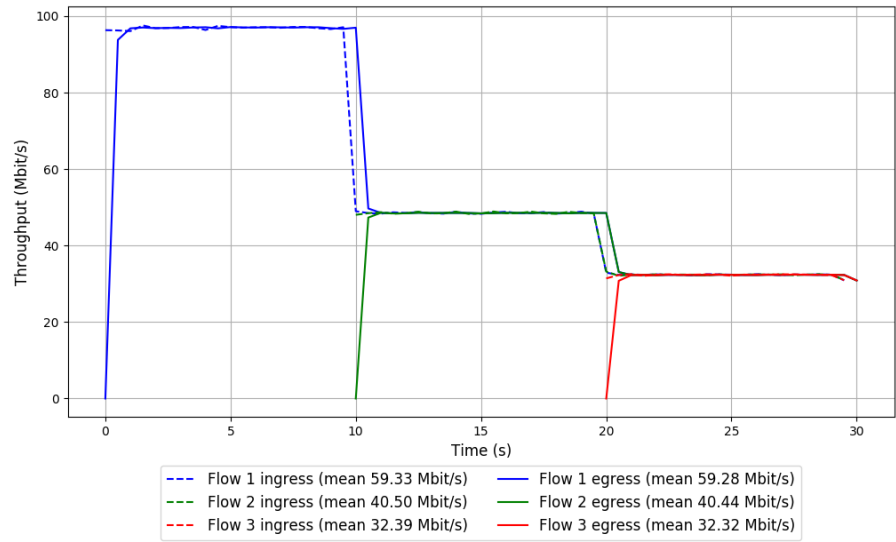
-- Flow 3:

Average throughput: 32.32 Mbit/s

95th percentile per-packet one-way delay: 9.558 ms

Loss rate: 0.22%

Run 1: Report of TCP Cubic — Data Link



Run 2: Statistics of TCP Cubic

Start at: 2018-09-03 09:51:43

End at: 2018-09-03 09:52:13

Local clock offset: 1.037 ms

Remote clock offset: 0.34 ms

Below is generated by plot.py at 2018-09-03 10:00:33

Datalink statistics

-- Total of 3 flows:

Average throughput: 97.01 Mbit/s

95th percentile per-packet one-way delay: 9.830 ms

Loss rate: 0.13%

-- Flow 1:

Average throughput: 59.33 Mbit/s

95th percentile per-packet one-way delay: 9.744 ms

Loss rate: 0.10%

-- Flow 2:

Average throughput: 40.44 Mbit/s

95th percentile per-packet one-way delay: 9.709 ms

Loss rate: 0.15%

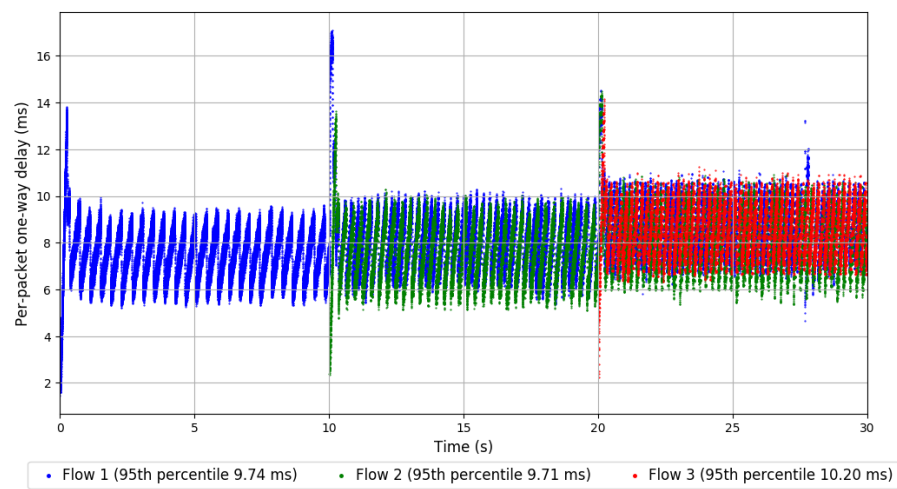
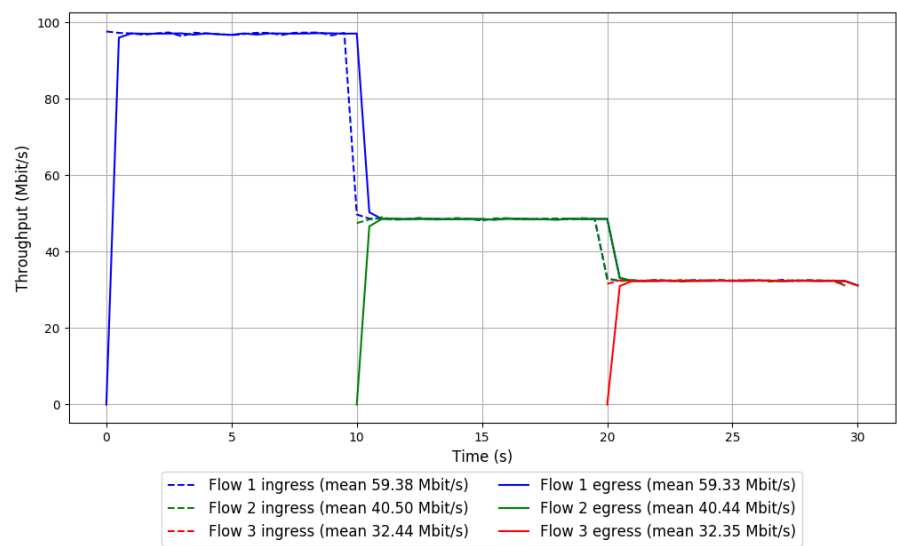
-- Flow 3:

Average throughput: 32.35 Mbit/s

95th percentile per-packet one-way delay: 10.200 ms

Loss rate: 0.27%

Run 2: Report of TCP Cubic — Data Link



Run 3: Statistics of TCP Cubic

Start at: 2018-09-03 09:56:14

End at: 2018-09-03 09:56:44

Local clock offset: 1.843 ms

Remote clock offset: 0.416 ms

Below is generated by plot.py at 2018-09-03 10:00:33

Datalink statistics

-- Total of 3 flows:

Average throughput: 97.01 Mbit/s

95th percentile per-packet one-way delay: 10.020 ms

Loss rate: 0.13%

-- Flow 1:

Average throughput: 59.32 Mbit/s

95th percentile per-packet one-way delay: 9.866 ms

Loss rate: 0.08%

-- Flow 2:

Average throughput: 40.46 Mbit/s

95th percentile per-packet one-way delay: 9.949 ms

Loss rate: 0.17%

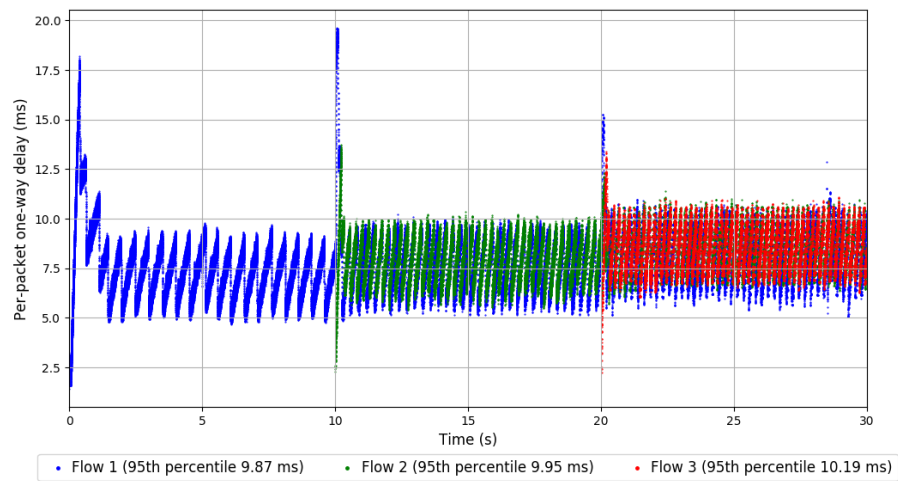
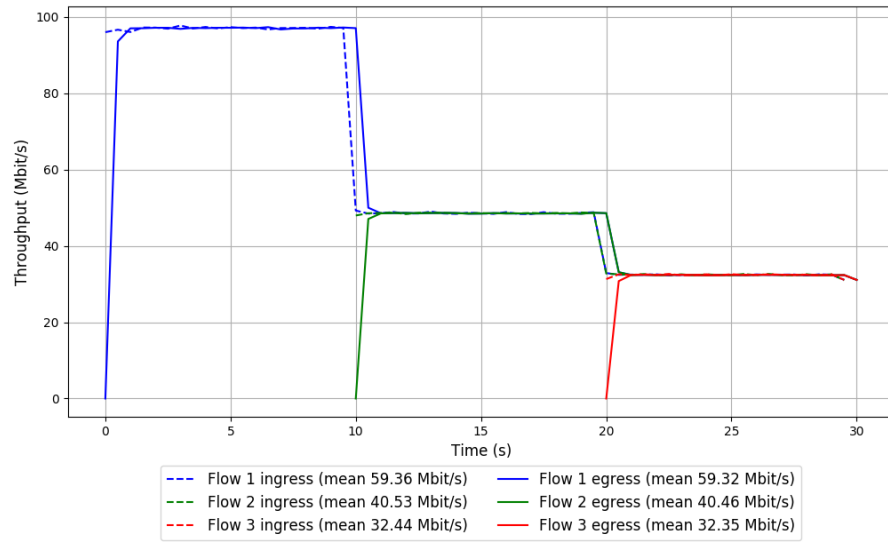
-- Flow 3:

Average throughput: 32.35 Mbit/s

95th percentile per-packet one-way delay: 10.186 ms

Loss rate: 0.28%

Run 3: Report of TCP Cubic — Data Link

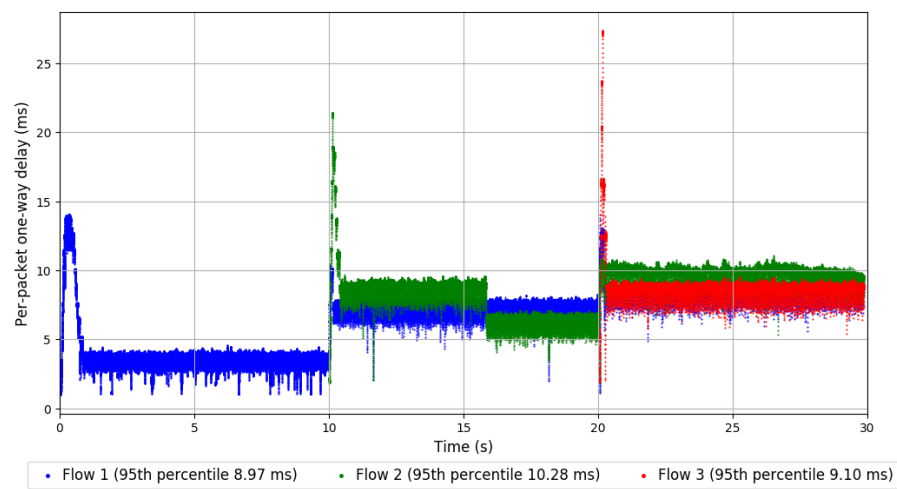
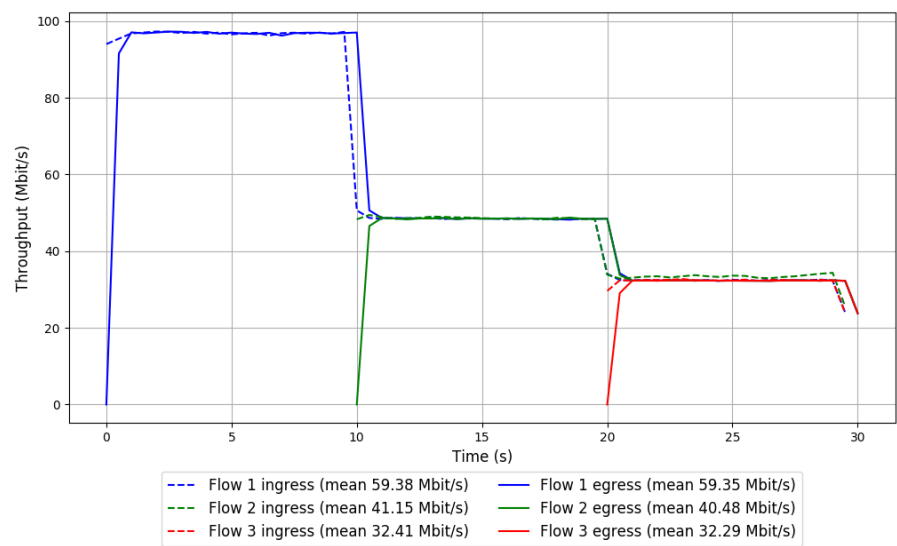


```
Run 1: Statistics of Indigo

Start at: 2018-09-03 09:49:27
End at: 2018-09-03 09:49:57
Local clock offset: 0.457 ms
Remote clock offset: 0.316 ms

# Below is generated by plot.py at 2018-09-03 10:00:33
# Datalink statistics
-- Total of 3 flows:
Average throughput: 96.89 Mbit/s
95th percentile per-packet one-way delay: 10.032 ms
Loss rate: 0.54%
-- Flow 1:
Average throughput: 59.35 Mbit/s
95th percentile per-packet one-way delay: 8.972 ms
Loss rate: 0.07%
-- Flow 2:
Average throughput: 40.48 Mbit/s
95th percentile per-packet one-way delay: 10.284 ms
Loss rate: 1.63%
-- Flow 3:
Average throughput: 32.29 Mbit/s
95th percentile per-packet one-way delay: 9.102 ms
Loss rate: 0.40%
```


Run 1: Report of Indigo — Data Link



Run 2: Statistics of Indigo

Start at: 2018-09-03 09:53:58

End at: 2018-09-03 09:54:28

Local clock offset: 1.546 ms

Remote clock offset: 0.346 ms

Below is generated by plot.py at 2018-09-03 10:00:34

Datalink statistics

-- Total of 3 flows:

Average throughput: 97.00 Mbit/s

95th percentile per-packet one-way delay: 10.512 ms

Loss rate: 0.62%

-- Flow 1:

Average throughput: 59.43 Mbit/s

95th percentile per-packet one-way delay: 9.459 ms

Loss rate: 0.07%

-- Flow 2:

Average throughput: 40.51 Mbit/s

95th percentile per-packet one-way delay: 10.797 ms

Loss rate: 1.88%

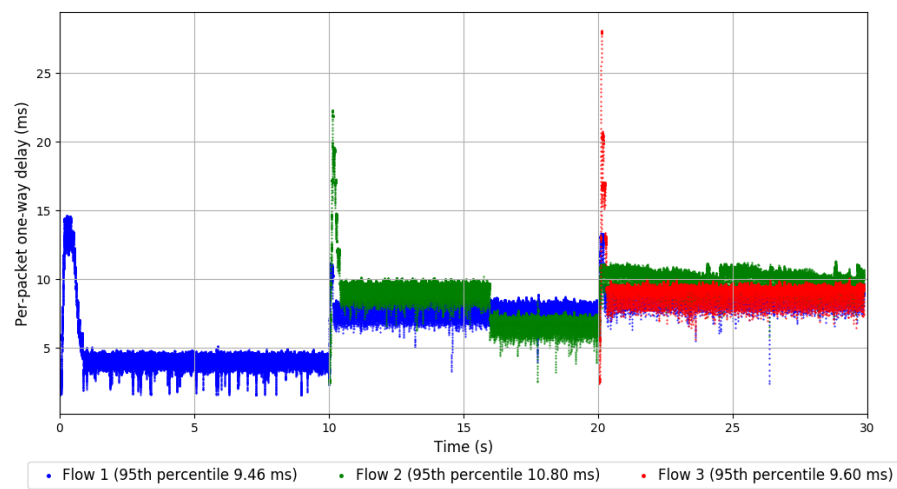
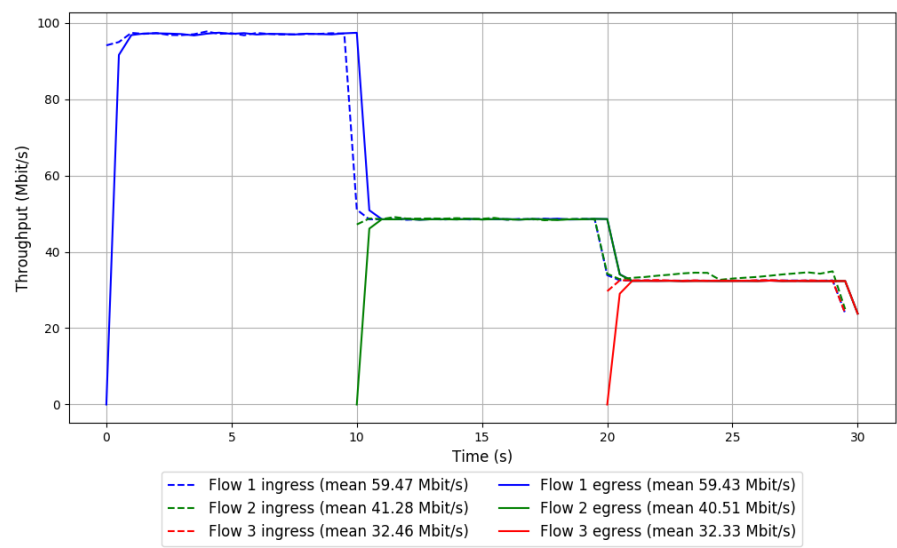
-- Flow 3:

Average throughput: 32.33 Mbit/s

95th percentile per-packet one-way delay: 9.602 ms

Loss rate: 0.44%

Run 2: Report of Indigo — Data Link



Run 3: Statistics of Indigo

Start at: 2018-09-03 09:58:28

End at: 2018-09-03 09:58:58

Local clock offset: 2.118 ms

Remote clock offset: 0.393 ms

Below is generated by plot.py at 2018-09-03 10:01:07

Datalink statistics

-- Total of 3 flows:

Average throughput: 97.03 Mbit/s

95th percentile per-packet one-way delay: 10.626 ms

Loss rate: 0.59%

-- Flow 1:

Average throughput: 59.41 Mbit/s

95th percentile per-packet one-way delay: 9.521 ms

Loss rate: 0.08%

-- Flow 2:

Average throughput: 40.51 Mbit/s

95th percentile per-packet one-way delay: 10.895 ms

Loss rate: 1.75%

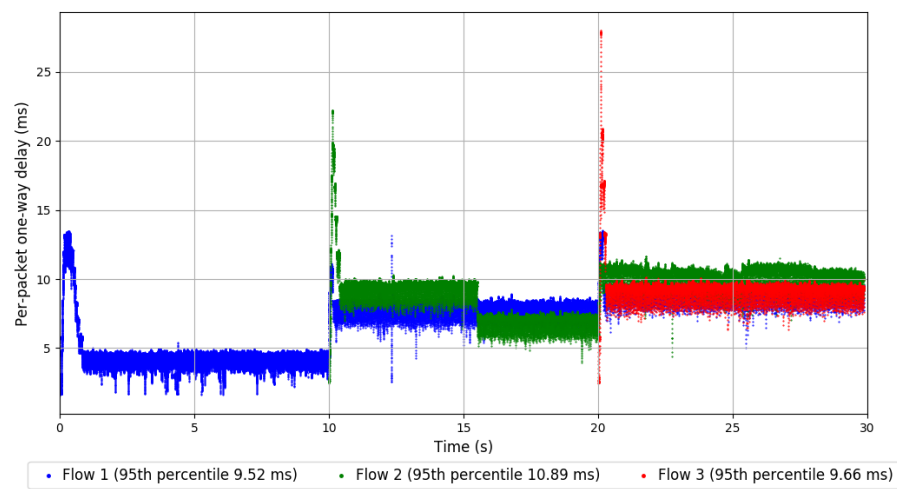
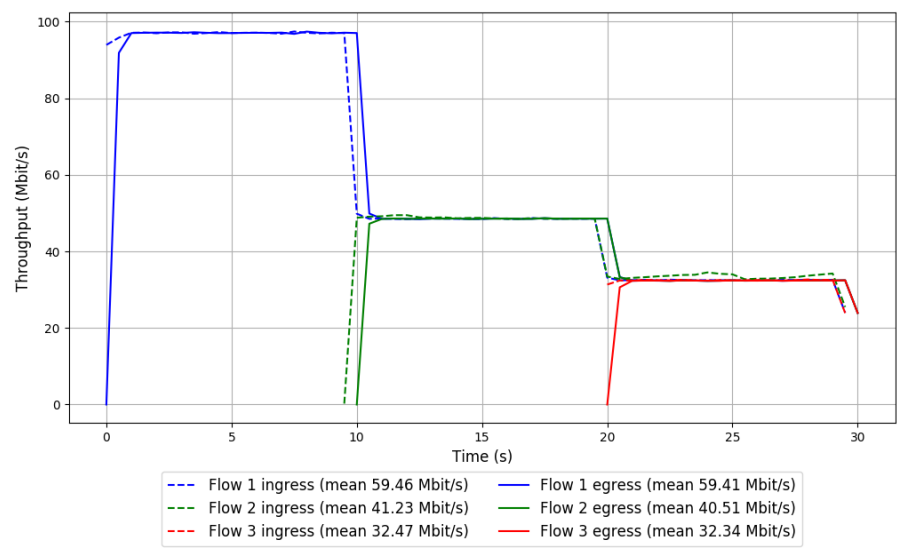
-- Flow 3:

Average throughput: 32.34 Mbit/s

95th percentile per-packet one-way delay: 9.659 ms

Loss rate: 0.42%

Run 3: Report of Indigo — Data Link



Run 1: Statistics of Muses-25

Start at: 2018-09-03 09:48:21

End at: 2018-09-03 09:48:51

Local clock offset: 0.473 ms

Remote clock offset: 0.37 ms

Below is generated by plot.py at 2018-09-03 10:01:09

Datalink statistics

-- Total of 3 flows:

Average throughput: 96.91 Mbit/s

95th percentile per-packet one-way delay: 35.147 ms

Loss rate: 1.84%

-- Flow 1:

Average throughput: 58.59 Mbit/s

95th percentile per-packet one-way delay: 12.664 ms

Loss rate: 0.01%

-- Flow 2:

Average throughput: 41.50 Mbit/s

95th percentile per-packet one-way delay: 33.834 ms

Loss rate: 3.21%

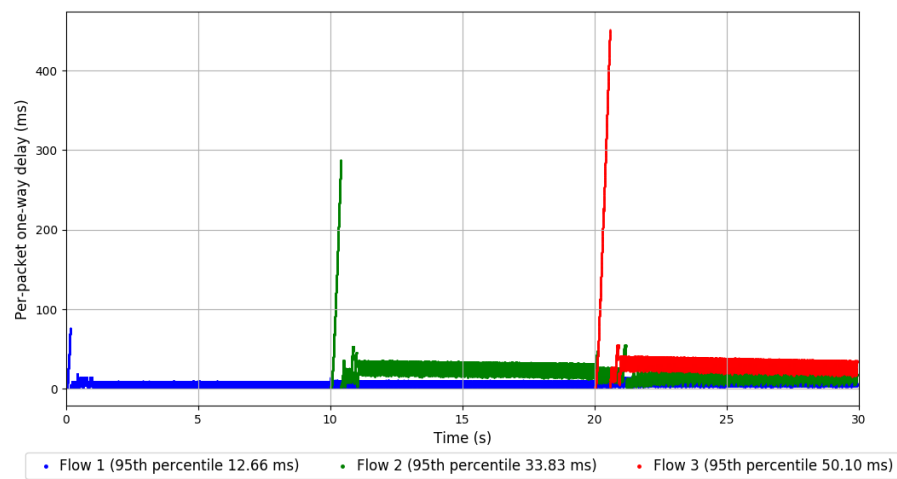
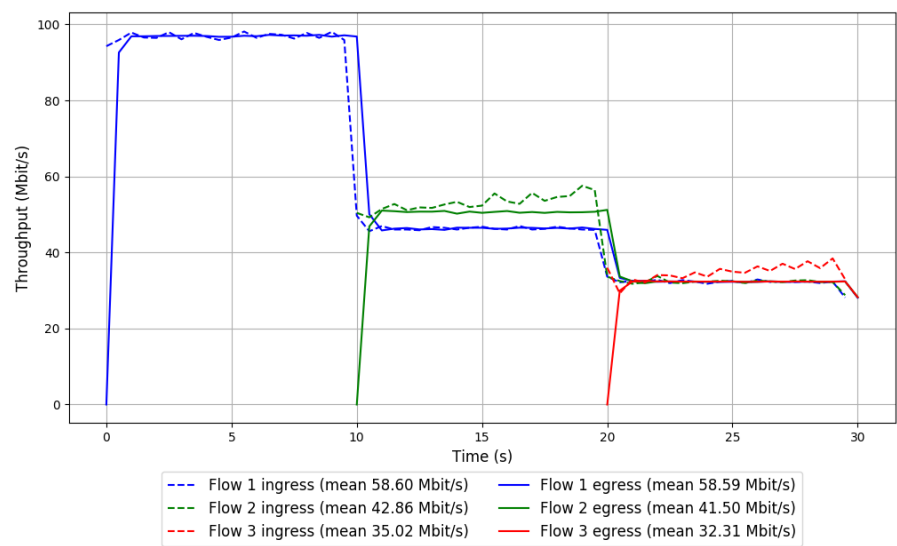
-- Flow 3:

Average throughput: 32.31 Mbit/s

95th percentile per-packet one-way delay: 50.103 ms

Loss rate: 7.75%

Run 1: Report of Muses-25 — Data Link



Run 2: Statistics of Muses-25

Start at: 2018-09-03 09:52:51

End at: 2018-09-03 09:53:21

Local clock offset: 1.281 ms

Remote clock offset: 0.374 ms

Below is generated by plot.py at 2018-09-03 10:01:09

Datalink statistics

-- Total of 3 flows:

Average throughput: 96.82 Mbit/s

95th percentile per-packet one-way delay: 36.265 ms

Loss rate: 1.59%

-- Flow 1:

Average throughput: 61.54 Mbit/s

95th percentile per-packet one-way delay: 23.098 ms

Loss rate: 1.35%

-- Flow 2:

Average throughput: 36.42 Mbit/s

95th percentile per-packet one-way delay: 48.610 ms

Loss rate: 0.08%

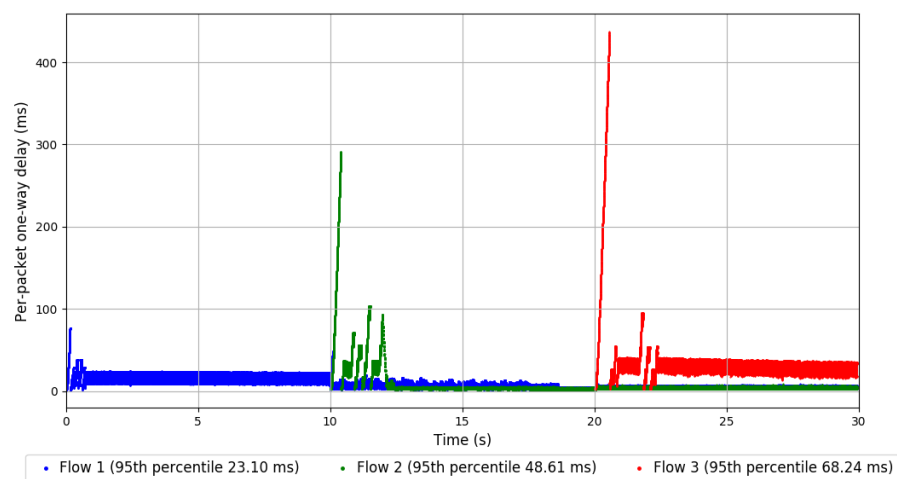
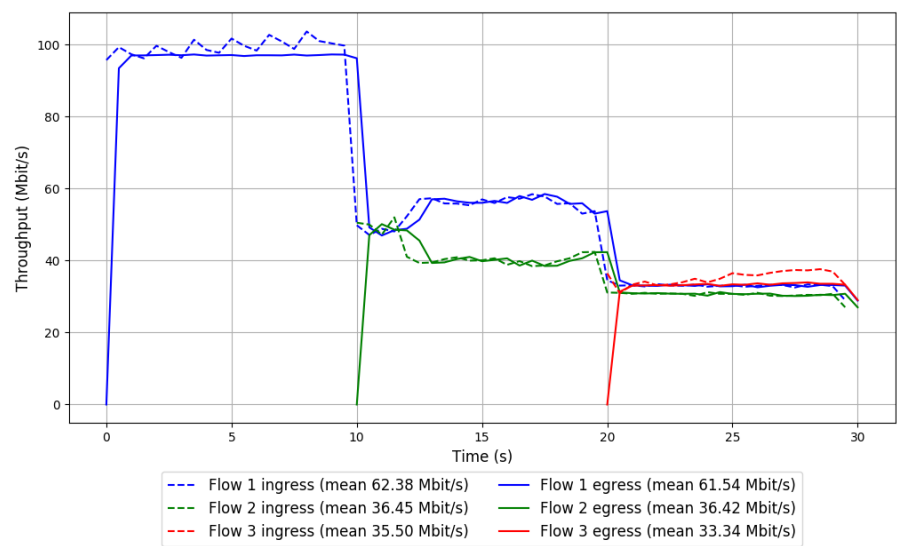
-- Flow 3:

Average throughput: 33.34 Mbit/s

95th percentile per-packet one-way delay: 68.242 ms

Loss rate: 6.04%

Run 2: Report of Muses-25 — Data Link



Run 3: Statistics of Muses-25

Start at: 2018-09-03 09:57:21

End at: 2018-09-03 09:57:51

Local clock offset: 1.189 ms

Remote clock offset: 0.443 ms

Below is generated by plot.py at 2018-09-03 10:01:09

Datalink statistics

-- Total of 3 flows:

Average throughput: 96.96 Mbit/s

95th percentile per-packet one-way delay: 25.951 ms

Loss rate: 2.20%

-- Flow 1:

Average throughput: 59.12 Mbit/s

95th percentile per-packet one-way delay: 22.396 ms

Loss rate: 1.33%

-- Flow 2:

Average throughput: 40.79 Mbit/s

95th percentile per-packet one-way delay: 26.680 ms

Loss rate: 2.56%

-- Flow 3:

Average throughput: 32.32 Mbit/s

95th percentile per-packet one-way delay: 26.834 ms

Loss rate: 5.88%

Run 3: Report of Muses-25 — Data Link

