

Pantheon Report

Generated at 2018-09-03 10:03:49 (UTC).
Data path: Mexico on `em1` (*remote*) → AWS California 2 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 `time.stanford.edu` and have been applied to correct the timestamps in logs.

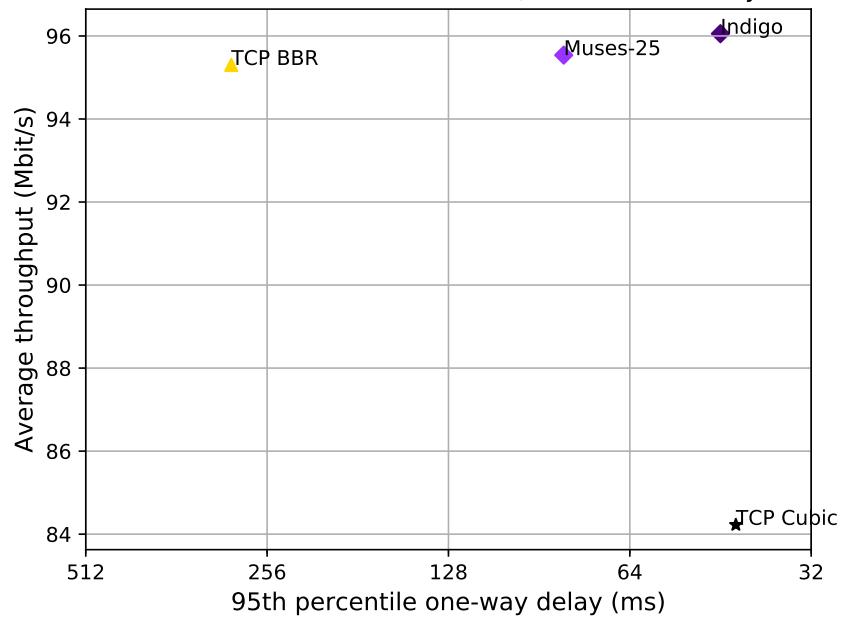
System info:

```
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
```

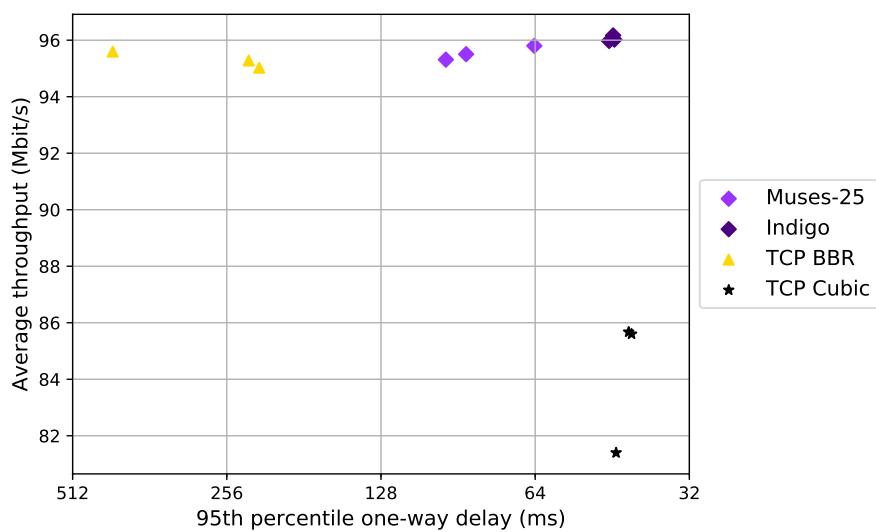
Git summary:

```
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 @ 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 Mexico to AWS California 2, 3 runs of 30s each per scheme
3 flows with 10s interval between flows (mean of all runs by scheme)



test from Mexico to AWS California 2, 3 runs of 30s each per scheme
3 flows with 10s interval between flows



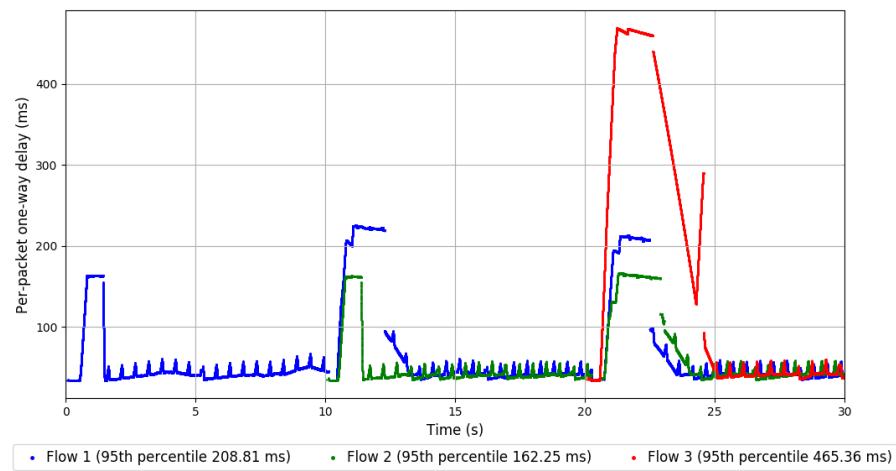
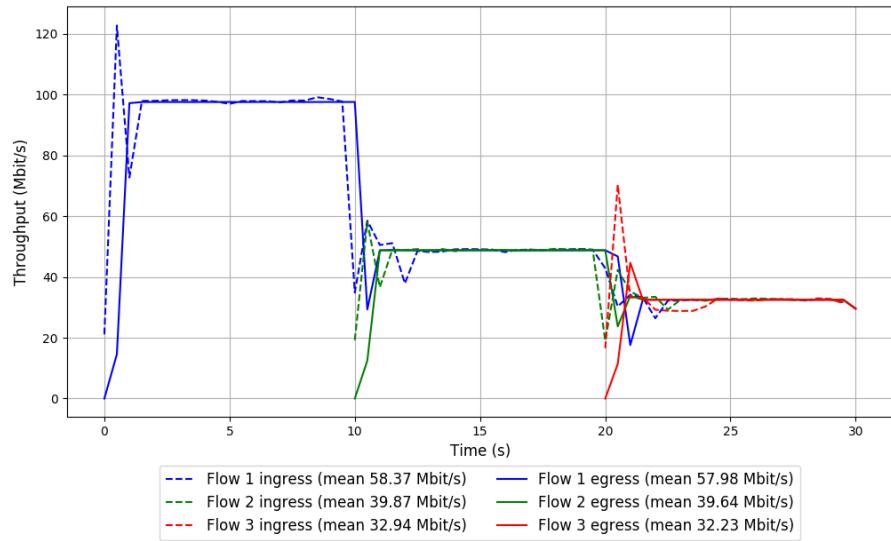
scheme	# runs	mean avg tput (Mbit/s)			mean 95th-%ile delay (ms)			mean loss rate (%)		
		flow 1	flow 2	flow 3	flow 1	flow 2	flow 3	flow 1	flow 2	flow 3
TCP BBR	3	58.84	40.97	27.80	178.13	233.60	634.96	0.80	1.14	4.96
TCP Cubic	3	47.64	41.61	26.85	46.02	41.02	46.49	0.18	0.30	0.72
Indigo	3	57.27	45.34	26.47	49.40	43.57	48.57	0.24	0.35	0.94
Muses-25	3	56.70	41.69	33.72	41.73	101.06	109.23	0.12	0.44	1.15

Run 1: Statistics of TCP BBR

```
Start at: 2018-09-03 09:49:00
End at: 2018-09-03 09:49:30
Local clock offset: -12.725 ms
Remote clock offset: 4.902 ms

# Below is generated by plot.py at 2018-09-03 10:03:13
# Datalink statistics
-- Total of 3 flows:
Average throughput: 95.03 Mbit/s
95th percentile per-packet one-way delay: 221.278 ms
Loss rate: 1.10%
-- Flow 1:
Average throughput: 57.98 Mbit/s
95th percentile per-packet one-way delay: 208.805 ms
Loss rate: 0.88%
-- Flow 2:
Average throughput: 39.64 Mbit/s
95th percentile per-packet one-way delay: 162.252 ms
Loss rate: 0.88%
-- Flow 3:
Average throughput: 32.23 Mbit/s
95th percentile per-packet one-way delay: 465.363 ms
Loss rate: 2.77%
```

Run 1: Report of TCP BBR — Data Link

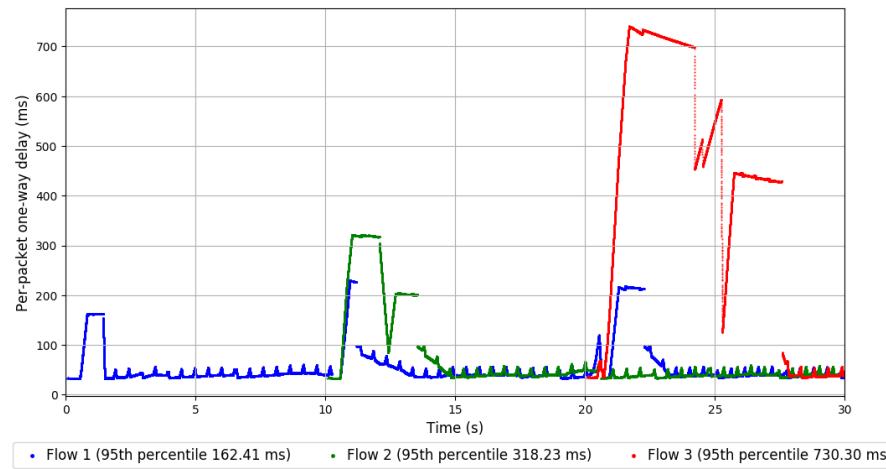
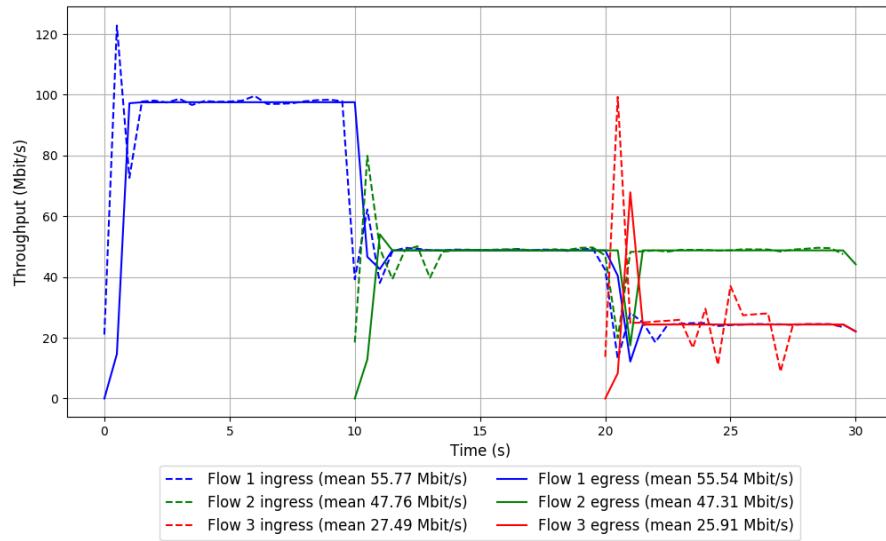


Run 2: Statistics of TCP BBR

```
Start at: 2018-09-03 09:54:28
End at: 2018-09-03 09:54:58
Local clock offset: -10.556 ms
Remote clock offset: 4.737 ms

# Below is generated by plot.py at 2018-09-03 10:03:15
# Datalink statistics
-- Total of 3 flows:
Average throughput: 95.60 Mbit/s
95th percentile per-packet one-way delay: 427.515 ms
Loss rate: 1.38%
-- Flow 1:
Average throughput: 55.54 Mbit/s
95th percentile per-packet one-way delay: 162.412 ms
Loss rate: 0.63%
-- Flow 2:
Average throughput: 47.31 Mbit/s
95th percentile per-packet one-way delay: 318.226 ms
Loss rate: 1.27%
-- Flow 3:
Average throughput: 25.91 Mbit/s
95th percentile per-packet one-way delay: 730.300 ms
Loss rate: 6.37%
```

Run 2: Report of TCP BBR — Data Link

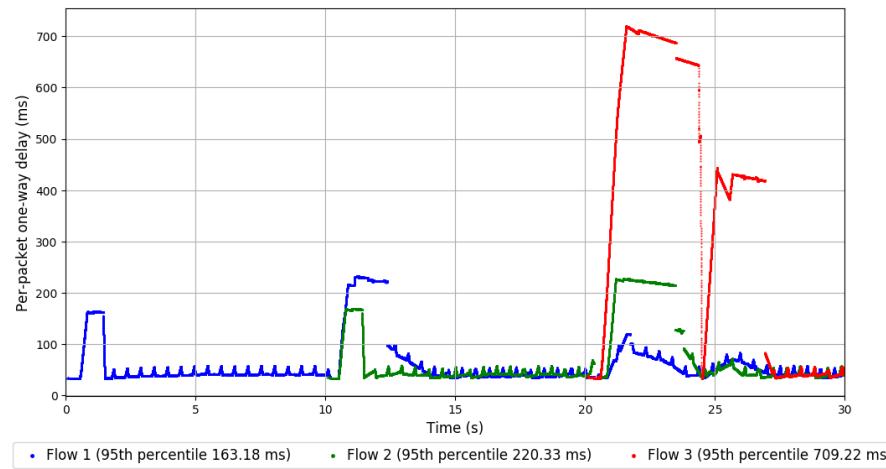
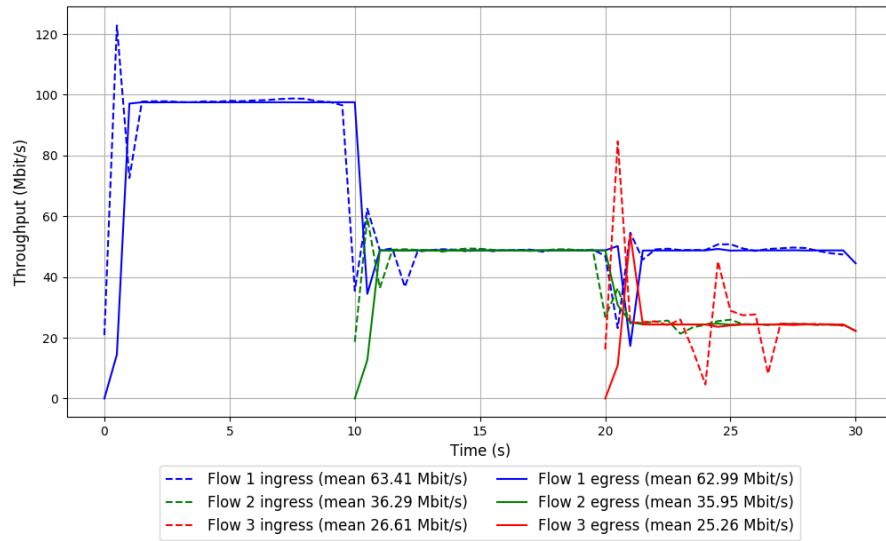


Run 3: Statistics of TCP BBR

```
Start at: 2018-09-03 09:59:51
End at: 2018-09-03 10:00:21
Local clock offset: -6.946 ms
Remote clock offset: 4.32 ms

# Below is generated by plot.py at 2018-09-03 10:03:15
# Datalink statistics
-- Total of 3 flows:
Average throughput: 95.28 Mbit/s
95th percentile per-packet one-way delay: 231.992 ms
Loss rate: 1.42%
-- Flow 1:
Average throughput: 62.99 Mbit/s
95th percentile per-packet one-way delay: 163.176 ms
Loss rate: 0.88%
-- Flow 2:
Average throughput: 35.95 Mbit/s
95th percentile per-packet one-way delay: 220.332 ms
Loss rate: 1.26%
-- Flow 3:
Average throughput: 25.26 Mbit/s
95th percentile per-packet one-way delay: 709.218 ms
Loss rate: 5.73%
```

Run 3: Report of TCP BBR — Data Link

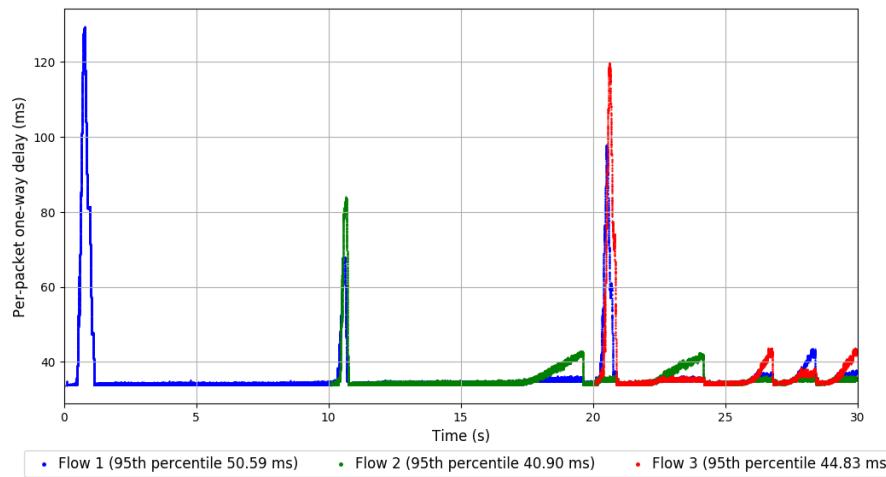
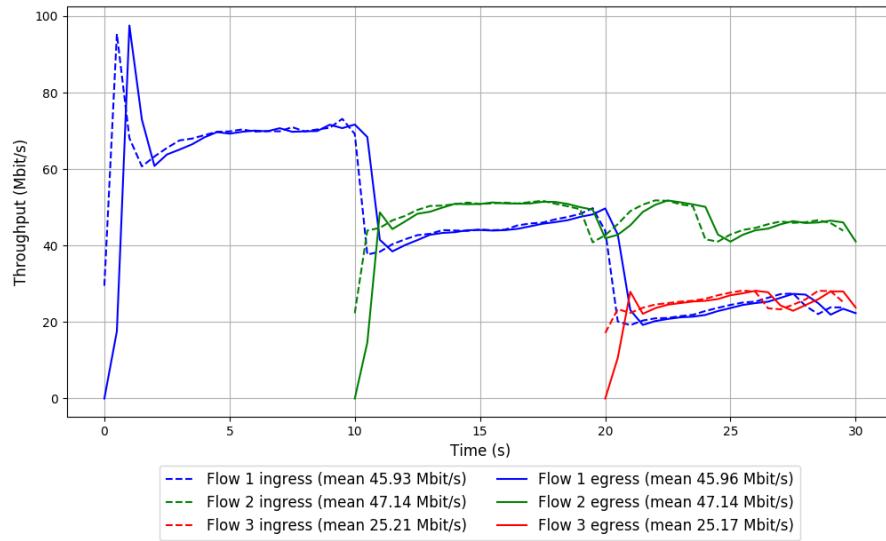


```
Run 1: Statistics of TCP Cubic
```

```
Start at: 2018-09-03 09:50:23
End at: 2018-09-03 09:50:53
Local clock offset: -13.343 ms
Remote clock offset: 4.855 ms

# Below is generated by plot.py at 2018-09-03 10:03:15
# Datalink statistics
-- Total of 3 flows:
Average throughput: 85.67 Mbit/s
95th percentile per-packet one-way delay: 42.041 ms
Loss rate: 0.28%
-- Flow 1:
Average throughput: 45.96 Mbit/s
95th percentile per-packet one-way delay: 50.587 ms
Loss rate: 0.14%
-- Flow 2:
Average throughput: 47.14 Mbit/s
95th percentile per-packet one-way delay: 40.902 ms
Loss rate: 0.33%
-- Flow 3:
Average throughput: 25.17 Mbit/s
95th percentile per-packet one-way delay: 44.830 ms
Loss rate: 0.82%
```

Run 1: Report of TCP Cubic — Data Link

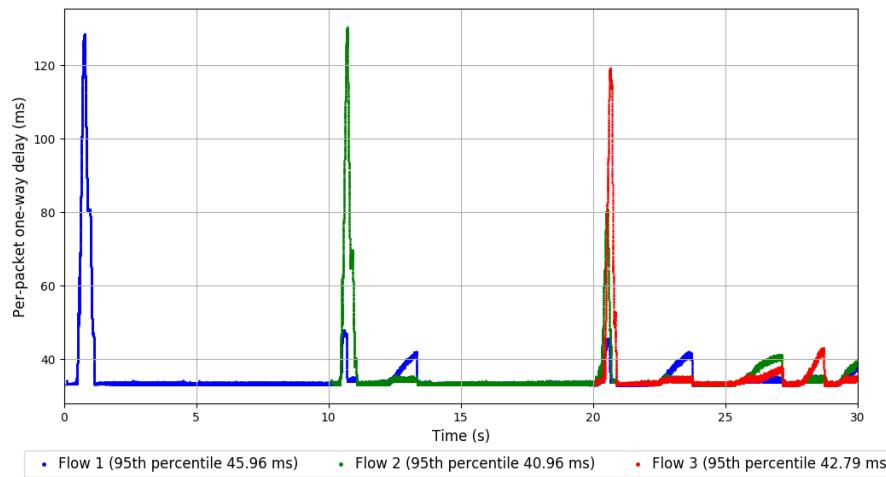
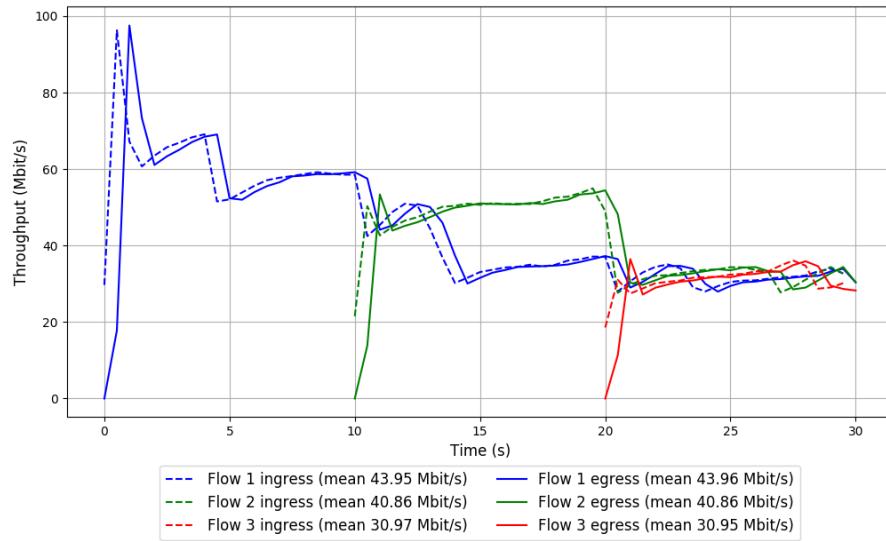


Run 2: Statistics of TCP Cubic

```
Start at: 2018-09-03 09:55:49
End at: 2018-09-03 09:56:19
Local clock offset: -9.152 ms
Remote clock offset: 4.701 ms

# Below is generated by plot.py at 2018-09-03 10:03:15
# Datalink statistics
-- Total of 3 flows:
Average throughput: 81.40 Mbit/s
95th percentile per-packet one-way delay: 44.482 ms
Loss rate: 0.29%
-- Flow 1:
Average throughput: 43.96 Mbit/s
95th percentile per-packet one-way delay: 45.962 ms
Loss rate: 0.19%
-- Flow 2:
Average throughput: 40.86 Mbit/s
95th percentile per-packet one-way delay: 40.959 ms
Loss rate: 0.30%
-- Flow 3:
Average throughput: 30.95 Mbit/s
95th percentile per-packet one-way delay: 42.791 ms
Loss rate: 0.70%
```

Run 2: Report of TCP Cubic — Data Link

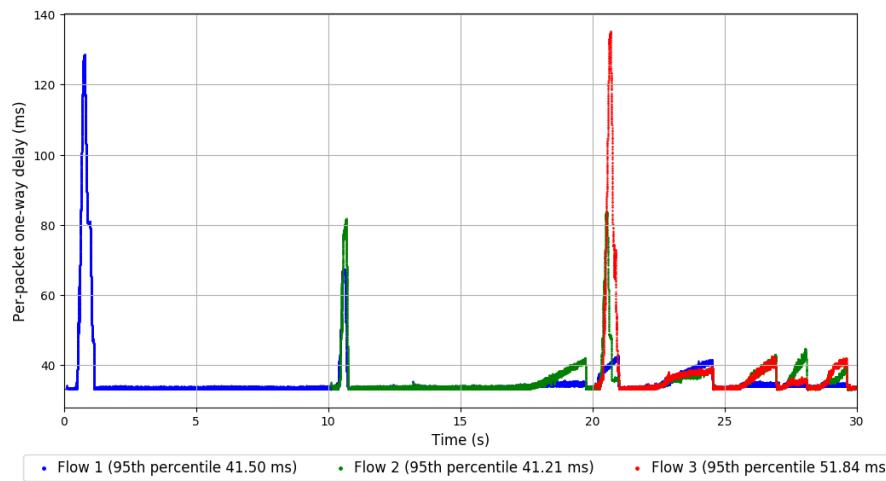
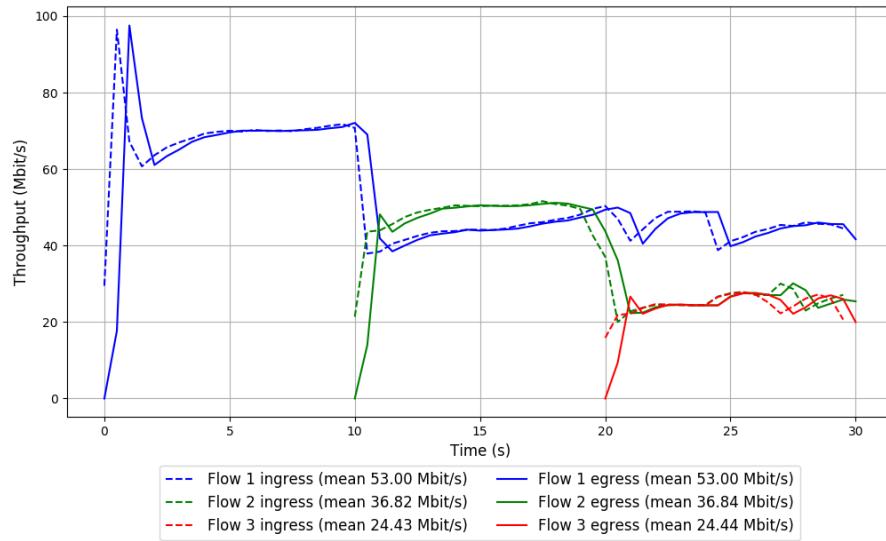


Run 3: Statistics of TCP Cubic

```
Start at: 2018-09-03 10:01:13
End at: 2018-09-03 10:01:43
Local clock offset: -6.468 ms
Remote clock offset: 4.209 ms

# Below is generated by plot.py at 2018-09-03 10:03:15
# Datalink statistics
-- Total of 3 flows:
Average throughput: 85.60 Mbit/s
95th percentile per-packet one-way delay: 41.494 ms
Loss rate: 0.26%
-- Flow 1:
Average throughput: 53.00 Mbit/s
95th percentile per-packet one-way delay: 41.503 ms
Loss rate: 0.20%
-- Flow 2:
Average throughput: 36.84 Mbit/s
95th percentile per-packet one-way delay: 41.208 ms
Loss rate: 0.27%
-- Flow 3:
Average throughput: 24.44 Mbit/s
95th percentile per-packet one-way delay: 51.843 ms
Loss rate: 0.63%
```

Run 3: Report of TCP Cubic — Data Link

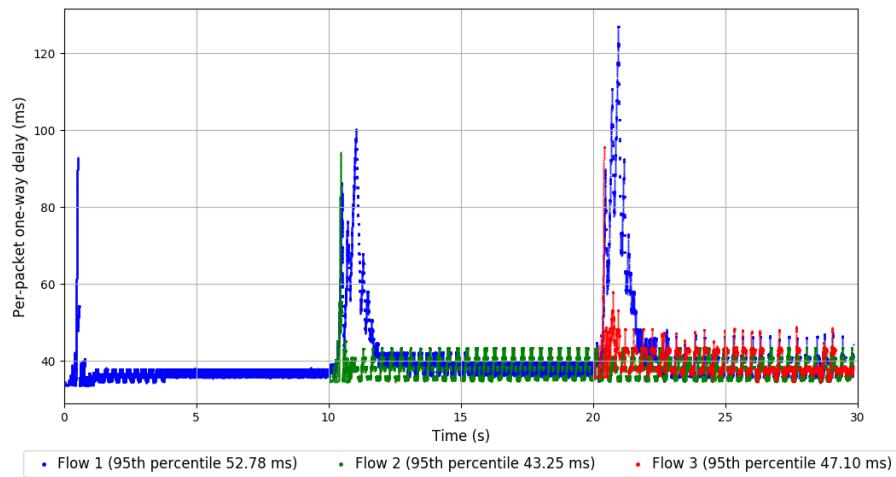
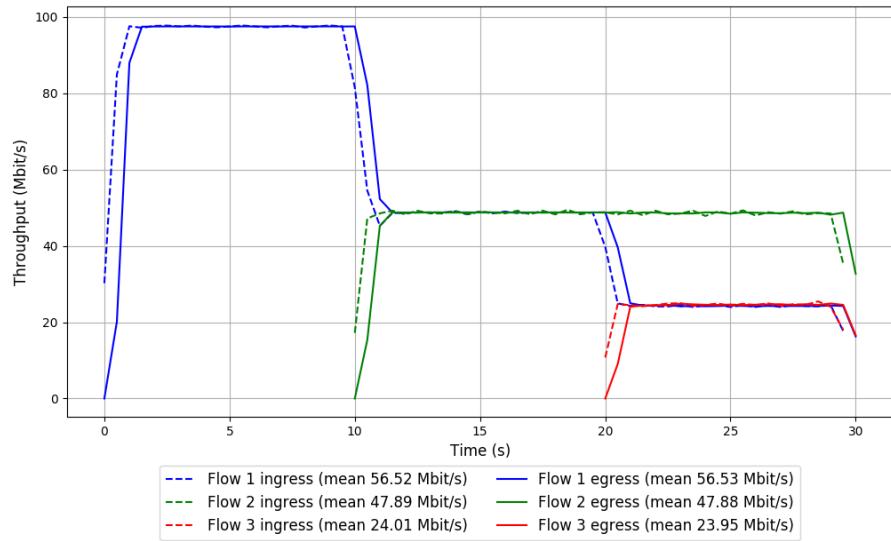


Run 1: Statistics of Indigo

```
Start at: 2018-09-03 09:47:37
End at: 2018-09-03 09:48:07
Local clock offset: -12.272 ms
Remote clock offset: 4.996 ms

# Below is generated by plot.py at 2018-09-03 10:03:15
# Datalink statistics
-- Total of 3 flows:
Average throughput: 96.17 Mbit/s
95th percentile per-packet one-way delay: 45.073 ms
Loss rate: 0.30%
-- Flow 1:
Average throughput: 56.53 Mbit/s
95th percentile per-packet one-way delay: 52.782 ms
Loss rate: 0.19%
-- Flow 2:
Average throughput: 47.88 Mbit/s
95th percentile per-packet one-way delay: 43.253 ms
Loss rate: 0.34%
-- Flow 3:
Average throughput: 23.95 Mbit/s
95th percentile per-packet one-way delay: 47.101 ms
Loss rate: 0.88%
```

Run 1: Report of Indigo — Data Link

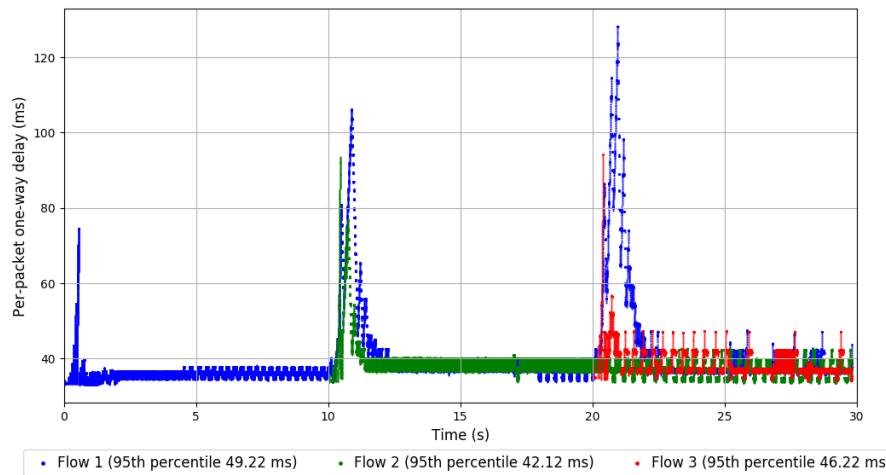
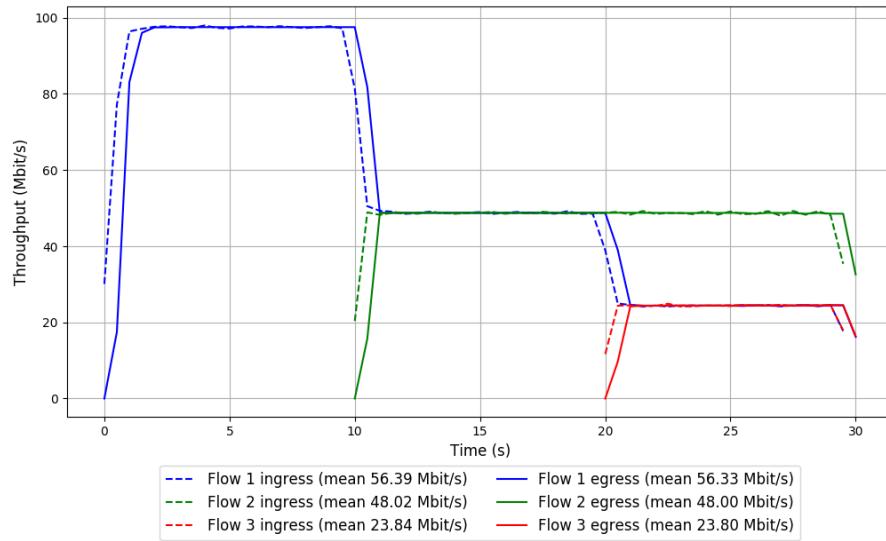


Run 2: Statistics of Indigo

```
Start at: 2018-09-03 09:53:05
End at: 2018-09-03 09:53:35
Local clock offset: -11.964 ms
Remote clock offset: 4.641 ms

# Below is generated by plot.py at 2018-09-03 10:03:16
# Datalink statistics
-- Total of 3 flows:
Average throughput: 96.02 Mbit/s
95th percentile per-packet one-way delay: 44.818 ms
Loss rate: 0.37%
-- Flow 1:
Average throughput: 56.33 Mbit/s
95th percentile per-packet one-way delay: 49.224 ms
Loss rate: 0.31%
-- Flow 2:
Average throughput: 48.00 Mbit/s
95th percentile per-packet one-way delay: 42.118 ms
Loss rate: 0.35%
-- Flow 3:
Average throughput: 23.80 Mbit/s
95th percentile per-packet one-way delay: 46.215 ms
Loss rate: 0.82%
```

Run 2: Report of Indigo — Data Link

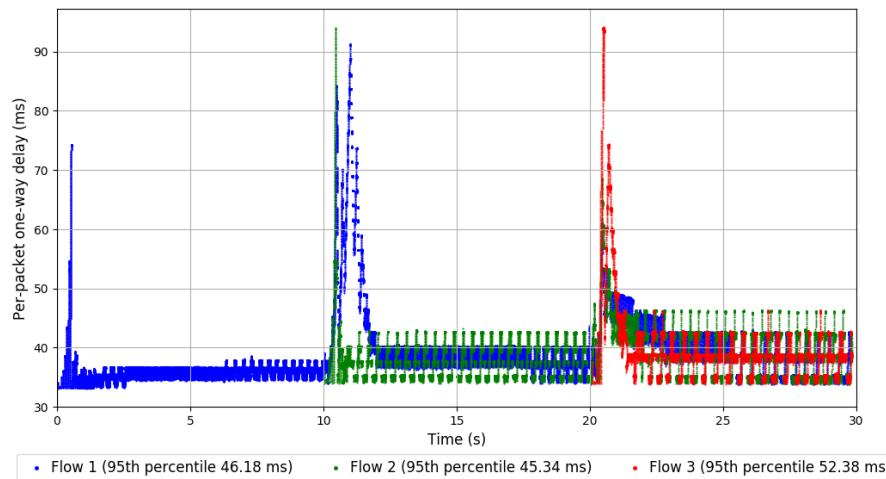
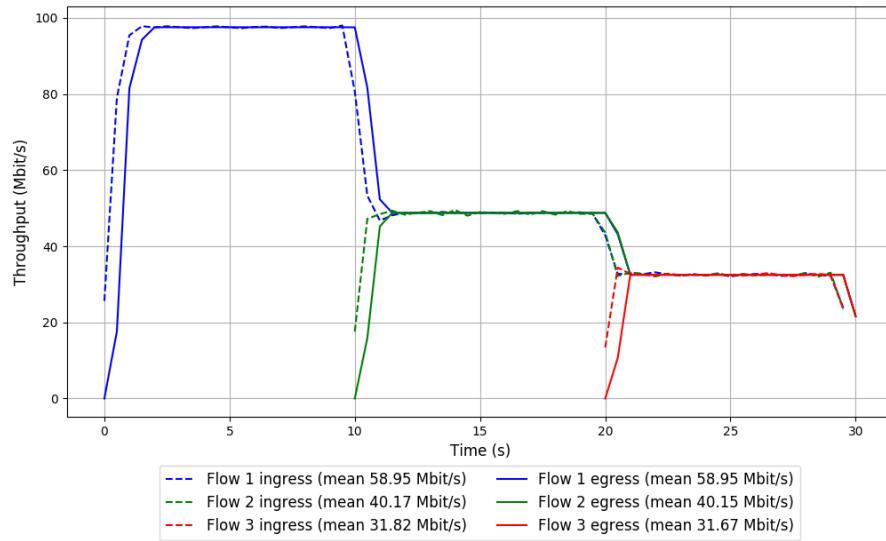


Run 3: Statistics of Indigo

```
Start at: 2018-09-03 09:58:29
End at: 2018-09-03 09:58:59
Local clock offset: -7.572 ms
Remote clock offset: 4.502 ms

# Below is generated by plot.py at 2018-09-03 10:03:44
# Datalink statistics
-- Total of 3 flows:
Average throughput: 95.97 Mbit/s
95th percentile per-packet one-way delay: 45.903 ms
Loss rate: 0.35%
-- Flow 1:
Average throughput: 58.95 Mbit/s
95th percentile per-packet one-way delay: 46.183 ms
Loss rate: 0.21%
-- Flow 2:
Average throughput: 40.15 Mbit/s
95th percentile per-packet one-way delay: 45.345 ms
Loss rate: 0.36%
-- Flow 3:
Average throughput: 31.67 Mbit/s
95th percentile per-packet one-way delay: 52.385 ms
Loss rate: 1.11%
```

Run 3: Report of Indigo — Data Link

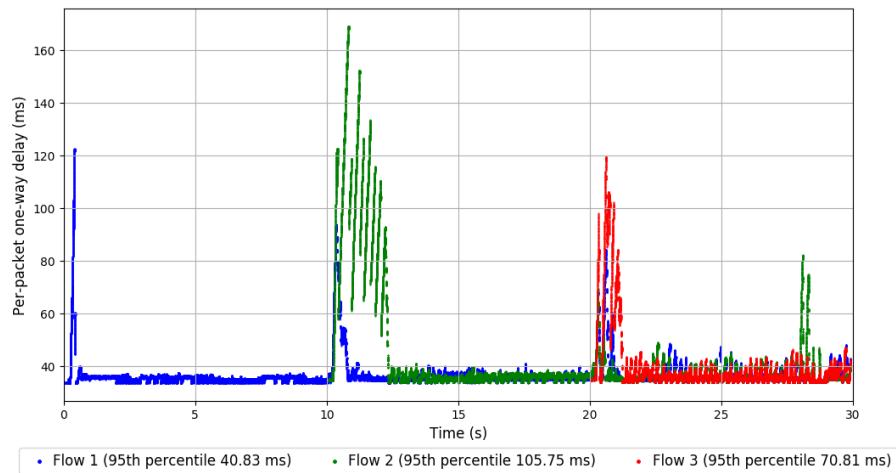
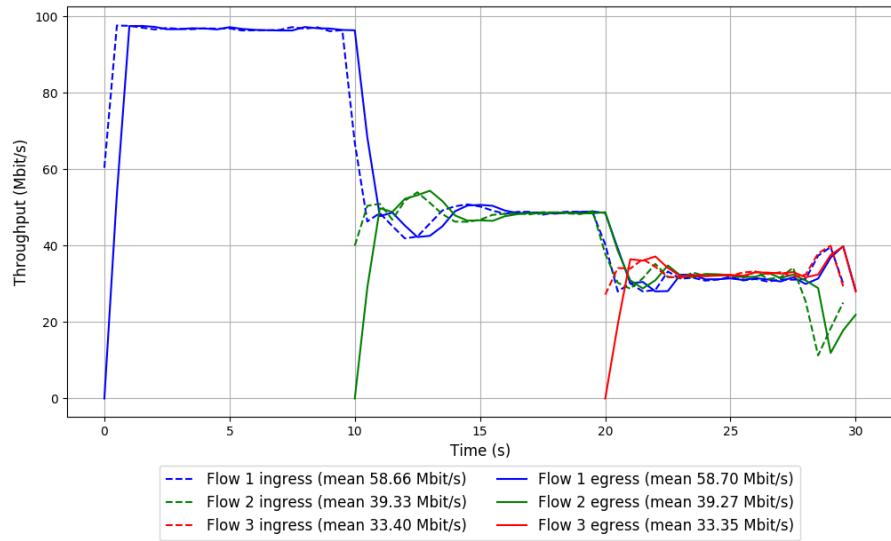


Run 1: Statistics of Muses-25

```
Start at: 2018-09-03 09:46:17
End at: 2018-09-03 09:46:47
Local clock offset: -11.69 ms
Remote clock offset: 4.994 ms

# Below is generated by plot.py at 2018-09-03 10:03:47
# Datalink statistics
-- Total of 3 flows:
Average throughput: 95.80 Mbit/s
95th percentile per-packet one-way delay: 64.248 ms
Loss rate: 0.30%
-- Flow 1:
Average throughput: 58.70 Mbit/s
95th percentile per-packet one-way delay: 40.828 ms
Loss rate: 0.14%
-- Flow 2:
Average throughput: 39.27 Mbit/s
95th percentile per-packet one-way delay: 105.745 ms
Loss rate: 0.47%
-- Flow 3:
Average throughput: 33.35 Mbit/s
95th percentile per-packet one-way delay: 70.808 ms
Loss rate: 0.74%
```

Run 1: Report of Muses-25 — Data Link

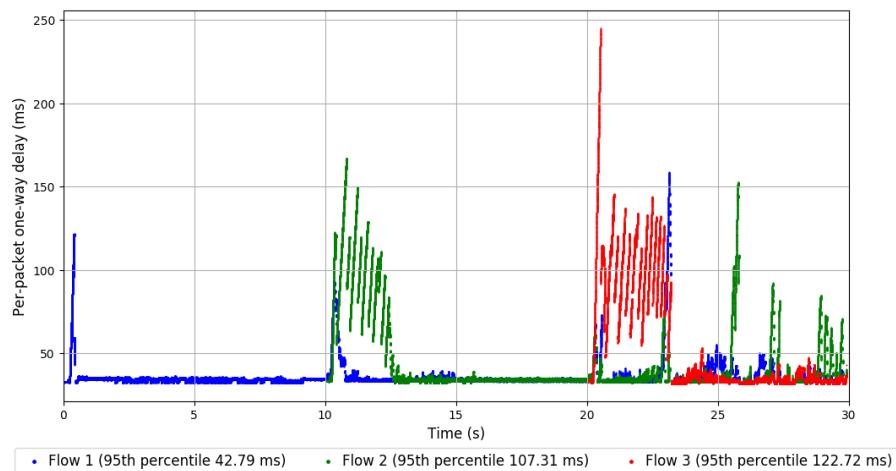
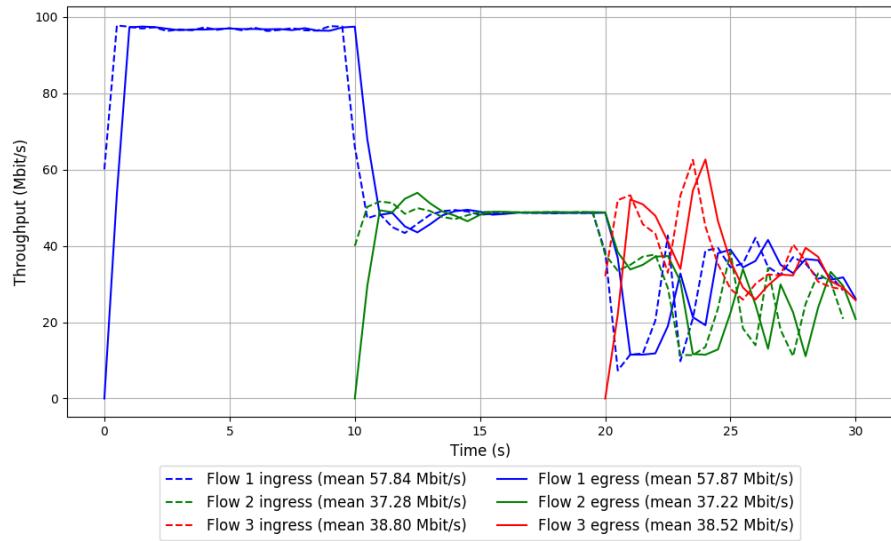


Run 2: Statistics of Muses-25

```
Start at: 2018-09-03 09:51:44
End at: 2018-09-03 09:52:14
Local clock offset: -13.953 ms
Remote clock offset: 4.861 ms

# Below is generated by plot.py at 2018-09-03 10:03:47
# Datalink statistics
-- Total of 3 flows:
Average throughput: 95.31 Mbit/s
95th percentile per-packet one-way delay: 95.618 ms
Loss rate: 0.37%
-- Flow 1:
Average throughput: 57.87 Mbit/s
95th percentile per-packet one-way delay: 42.791 ms
Loss rate: 0.15%
-- Flow 2:
Average throughput: 37.22 Mbit/s
95th percentile per-packet one-way delay: 107.305 ms
Loss rate: 0.42%
-- Flow 3:
Average throughput: 38.52 Mbit/s
95th percentile per-packet one-way delay: 122.718 ms
Loss rate: 1.32%
```

Run 2: Report of Muses-25 — Data Link



Run 3: Statistics of Muses-25

```
Start at: 2018-09-03 09:57:09
End at: 2018-09-03 09:57:39
Local clock offset: -8.256 ms
Remote clock offset: 4.485 ms

# Below is generated by plot.py at 2018-09-03 10:03:48
# Datalink statistics
-- Total of 3 flows:
Average throughput: 95.50 Mbit/s
95th percentile per-packet one-way delay: 87.294 ms
Loss rate: 0.32%
-- Flow 1:
Average throughput: 53.53 Mbit/s
95th percentile per-packet one-way delay: 41.566 ms
Loss rate: 0.06%
-- Flow 2:
Average throughput: 48.59 Mbit/s
95th percentile per-packet one-way delay: 90.124 ms
Loss rate: 0.43%
-- Flow 3:
Average throughput: 29.30 Mbit/s
95th percentile per-packet one-way delay: 134.160 ms
Loss rate: 1.39%
```

Run 3: Report of Muses-25 — Data Link

