

## Pantheon Report

Generated at 2018-09-05 02:48:37 (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.

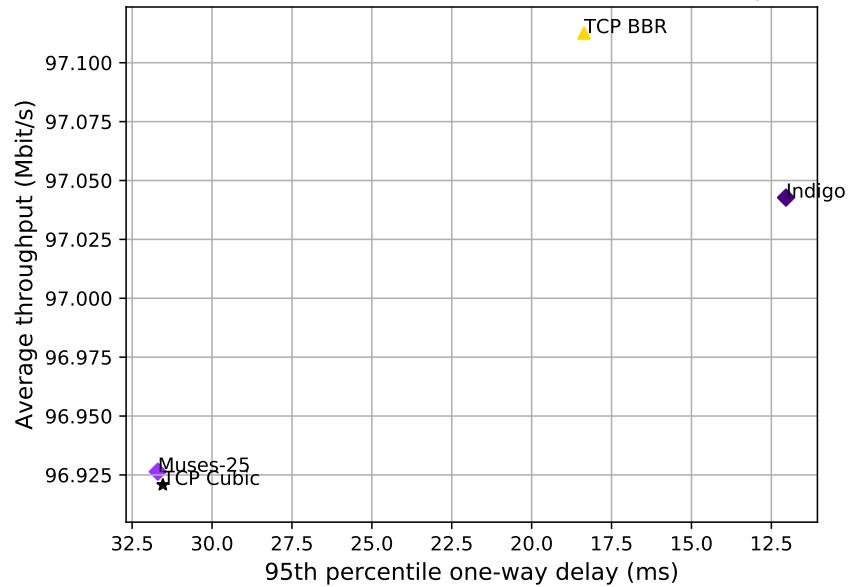
System info:

```
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
```

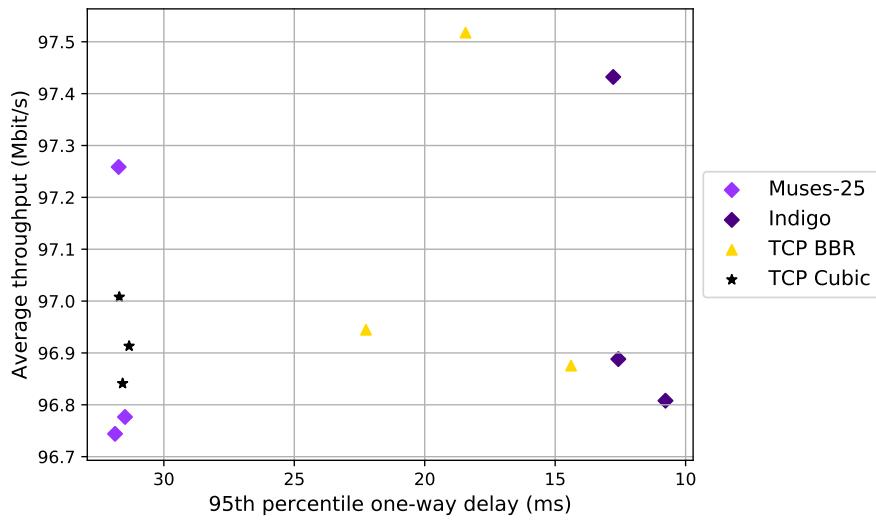
Git summary:

```
branch: muses @ 71e71e9a55b945431a7dea72180c1c9381097db9
third_party/fillp @ d47f4fa1b454a5e3c0537115c5a28436dbd4b834
third_party/fillp-sheep @ daed0c84f98531712514b2231f43ec6901114ffe
third_party/genericCC @ d0153f8e594aa89e93b032143cedbdf58e562f4
third_party/indigo @ 2601c92e4aa9d58d38dc4dfe0ecdbf90c077e64d
third_party/libutp @ b3465b942e2826f2b179eaab4a906ce6bb7cf3cf
third_party/muses @ 96fb95fb38373d71fb80c5a105e62e7636623b
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)



test from AWS Brazil 1 to Brazil, 3 runs of 30s each per scheme  
3 flows with 10s interval between flows



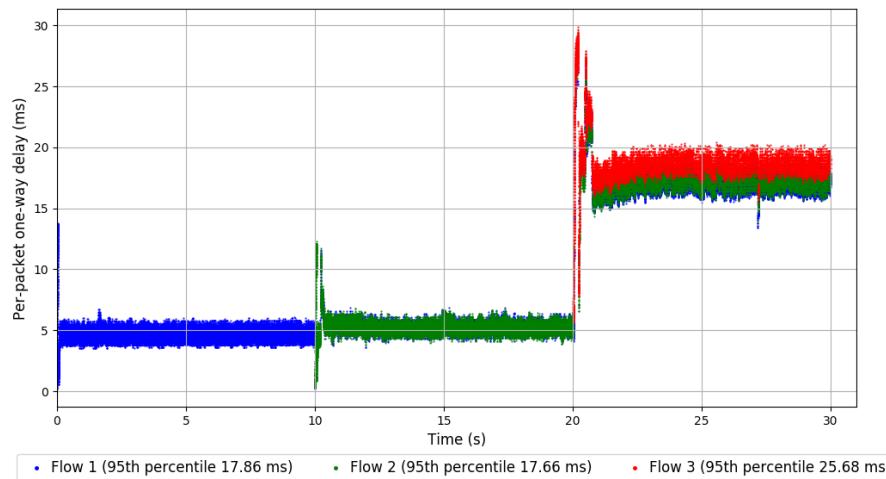
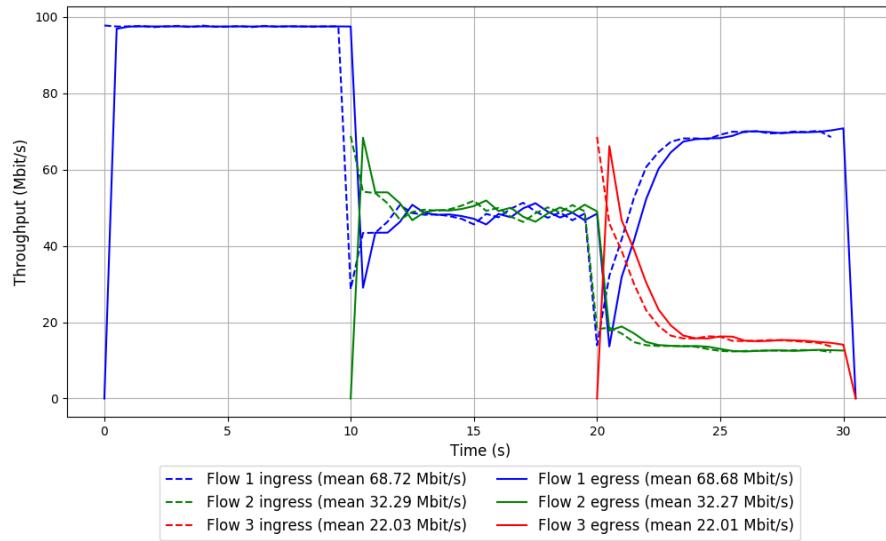
scheme	# runs	mean avg tput (Mbit/s)			mean 95th-%ile delay (ms)			mean loss rate (%)		
		flow 1	flow 2	flow 3	flow 1	flow 2	flow 3	flow 1	flow 2	flow 3
TCP BBR	3	65.45	40.25	14.53	17.96	18.22	21.26	0.00	0.00	0.00
TCP Cubic	3	63.41	34.15	32.43	31.14	31.77	31.91	0.05	0.06	0.07
Indigo	3	44.99	42.75	72.60	9.81	11.98	12.00	0.00	0.00	0.00
Muses-25	3	80.72	15.79	17.47	31.72	30.65	30.24	11.50	2.90	5.66

Run 1: Statistics of TCP BBR

```
Start at: 2018-09-05 02:33:12
End at: 2018-09-05 02:33:42
Local clock offset: 11.211 ms
Remote clock offset: -0.023 ms

# Below is generated by plot.py at 2018-09-05 02:48:01
# Datalink statistics
-- Total of 3 flows:
Average throughput: 97.52 Mbit/s
95th percentile per-packet one-way delay: 18.434 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 68.68 Mbit/s
95th percentile per-packet one-way delay: 17.859 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 32.27 Mbit/s
95th percentile per-packet one-way delay: 17.662 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 22.01 Mbit/s
95th percentile per-packet one-way delay: 25.678 ms
Loss rate: 0.00%
```

## Run 1: Report of TCP BBR — Data Link

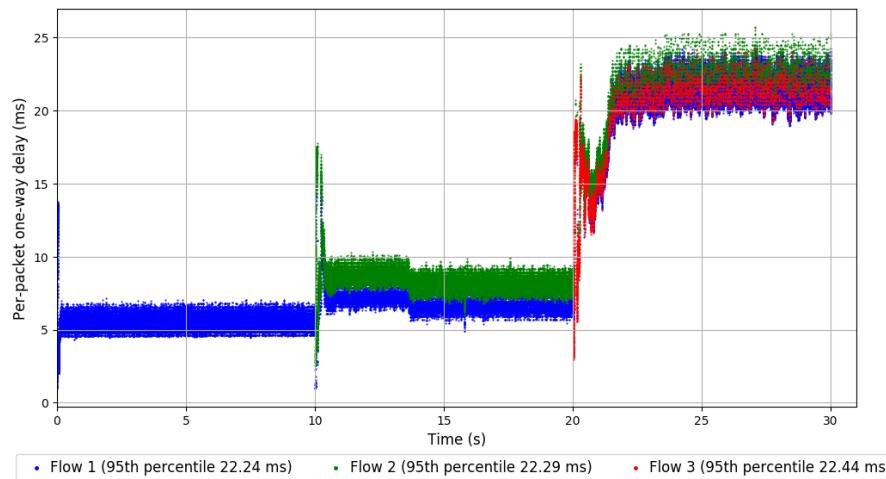
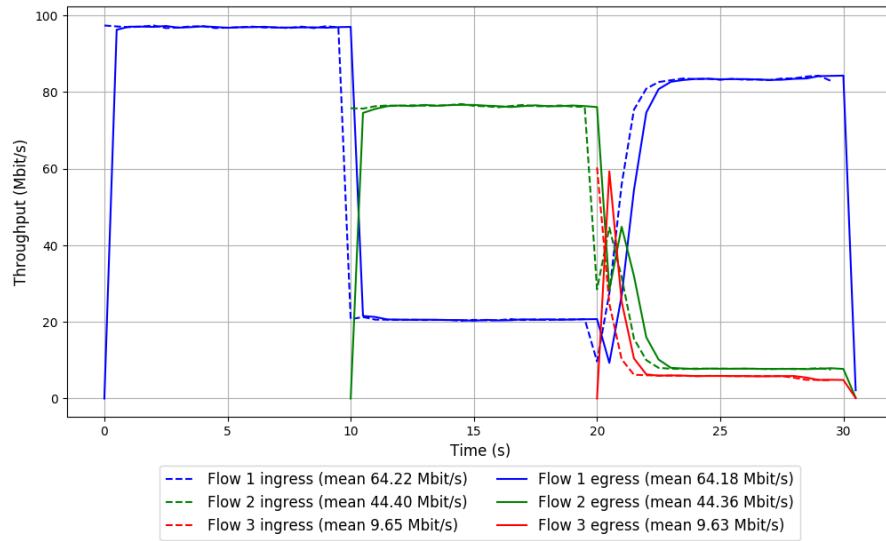


Run 2: Statistics of TCP BBR

```
Start at: 2018-09-05 02:37:50
End at: 2018-09-05 02:38:20
Local clock offset: 11.993 ms
Remote clock offset: 0.065 ms

# Below is generated by plot.py at 2018-09-05 02:48:01
# Datalink statistics
-- Total of 3 flows:
Average throughput: 96.94 Mbit/s
95th percentile per-packet one-way delay: 22.251 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 64.18 Mbit/s
95th percentile per-packet one-way delay: 22.239 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 44.36 Mbit/s
95th percentile per-packet one-way delay: 22.290 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 9.63 Mbit/s
95th percentile per-packet one-way delay: 22.437 ms
Loss rate: 0.00%
```

## Run 2: Report of TCP BBR — Data Link

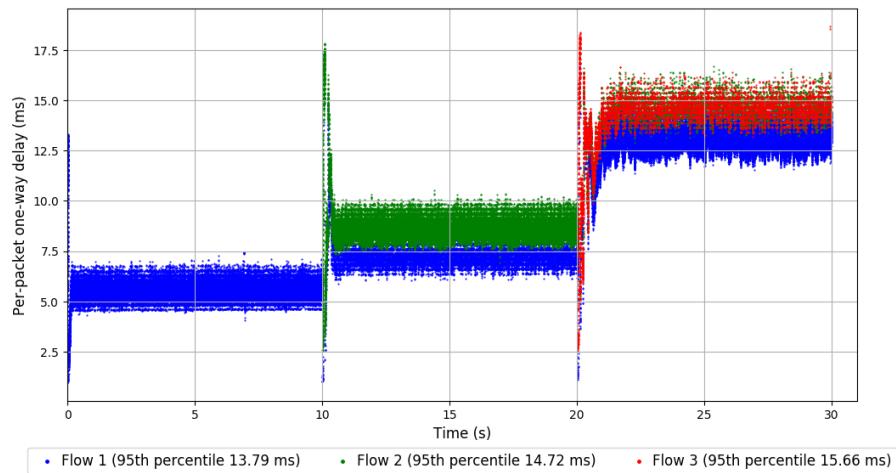
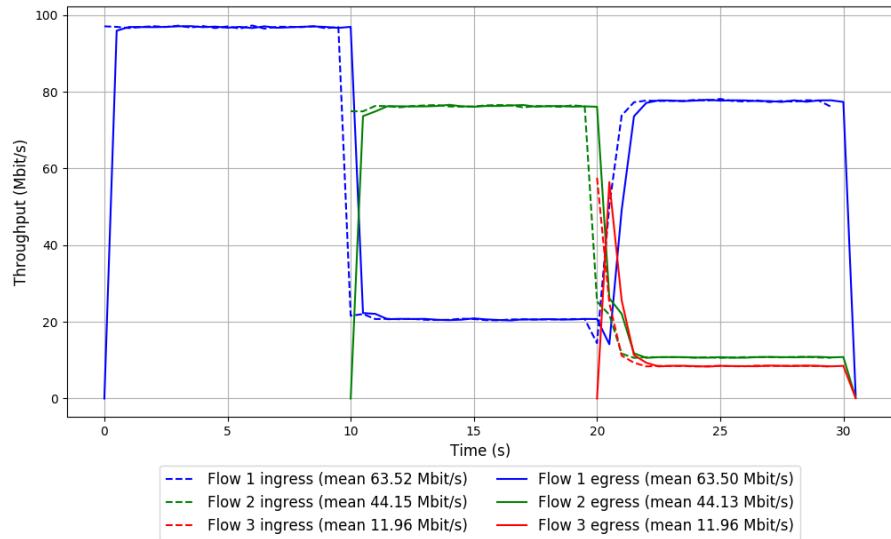


Run 3: Statistics of TCP BBR

```
Start at: 2018-09-05 02:42:28
End at: 2018-09-05 02:42:58
Local clock offset: 13.488 ms
Remote clock offset: 0.127 ms

# Below is generated by plot.py at 2018-09-05 02:48:01
# Datalink statistics
-- Total of 3 flows:
Average throughput: 96.88 Mbit/s
95th percentile per-packet one-way delay: 14.391 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 63.50 Mbit/s
95th percentile per-packet one-way delay: 13.794 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 44.13 Mbit/s
95th percentile per-packet one-way delay: 14.718 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 11.96 Mbit/s
95th percentile per-packet one-way delay: 15.656 ms
Loss rate: 0.00%
```

### Run 3: Report of TCP BBR — Data Link

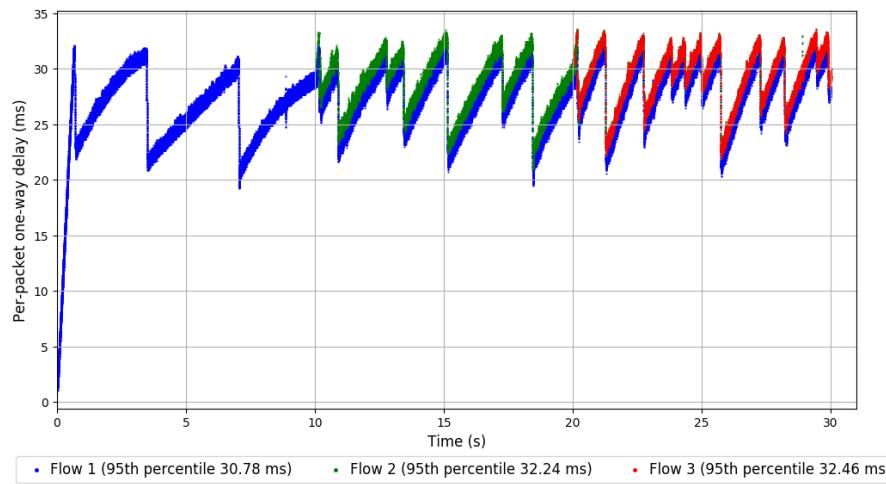
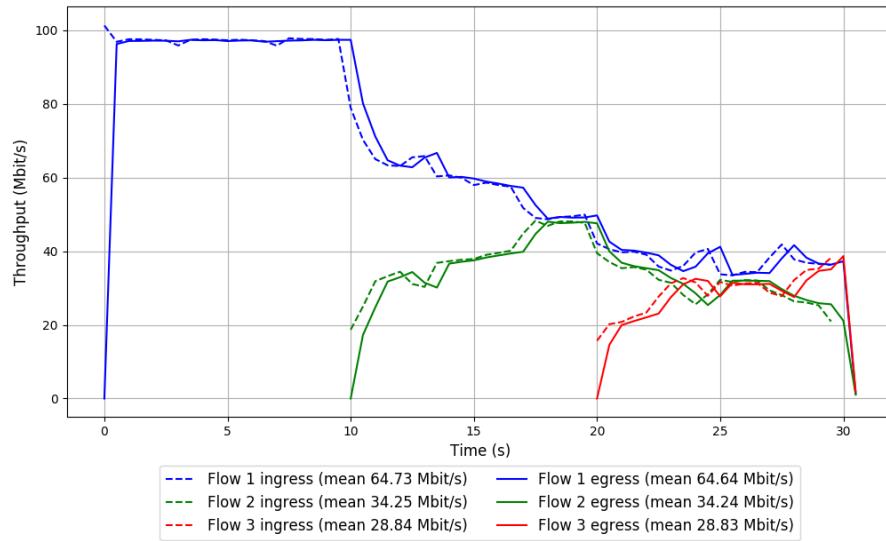


```
Run 1: Statistics of TCP Cubic
```

```
Start at: 2018-09-05 02:36:41
End at: 2018-09-05 02:37:11
Local clock offset: 11.563 ms
Remote clock offset: 0.065 ms

# Below is generated by plot.py at 2018-09-05 02:48:01
# Datalink statistics
-- Total of 3 flows:
Average throughput: 97.01 Mbit/s
95th percentile per-packet one-way delay: 31.706 ms
Loss rate: 0.04%
-- Flow 1:
Average throughput: 64.64 Mbit/s
95th percentile per-packet one-way delay: 30.778 ms
Loss rate: 0.04%
-- Flow 2:
Average throughput: 34.24 Mbit/s
95th percentile per-packet one-way delay: 32.243 ms
Loss rate: 0.05%
-- Flow 3:
Average throughput: 28.83 Mbit/s
95th percentile per-packet one-way delay: 32.457 ms
Loss rate: 0.05%
```

Run 1: Report of TCP Cubic — Data Link

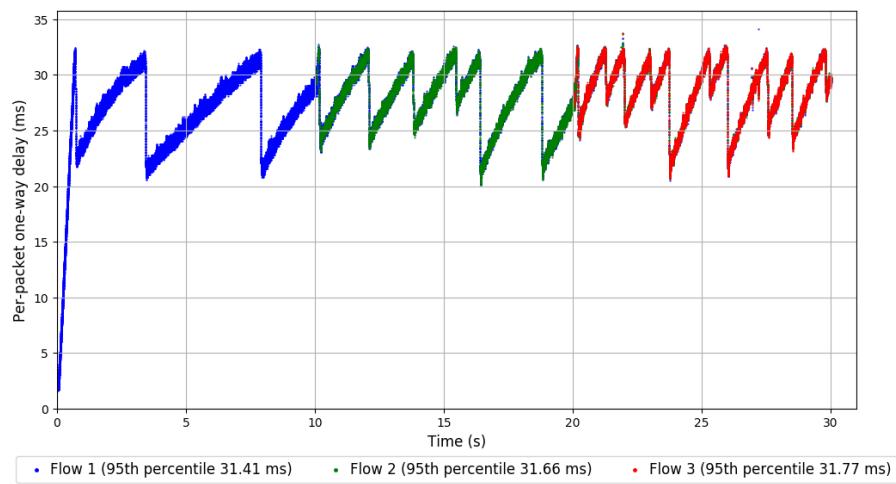
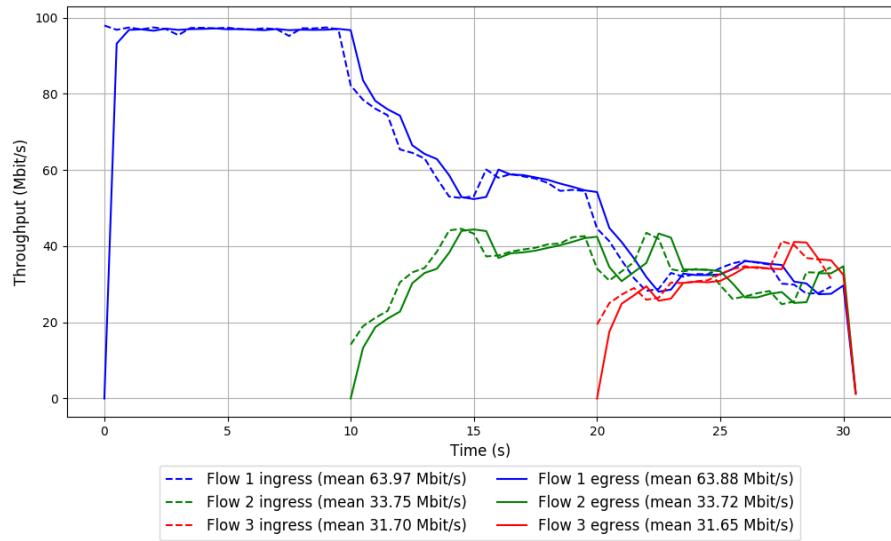


Run 2: Statistics of TCP Cubic

```
Start at: 2018-09-05 02:41:19
End at: 2018-09-05 02:41:49
Local clock offset: 13.809 ms
Remote clock offset: 0.051 ms

# Below is generated by plot.py at 2018-09-05 02:48:01
# Datalink statistics
-- Total of 3 flows:
Average throughput: 96.84 Mbit/s
95th percentile per-packet one-way delay: 31.581 ms
Loss rate: 0.06%
-- Flow 1:
Average throughput: 63.88 Mbit/s
95th percentile per-packet one-way delay: 31.413 ms
Loss rate: 0.05%
-- Flow 2:
Average throughput: 33.72 Mbit/s
95th percentile per-packet one-way delay: 31.657 ms
Loss rate: 0.06%
-- Flow 3:
Average throughput: 31.65 Mbit/s
95th percentile per-packet one-way delay: 31.766 ms
Loss rate: 0.11%
```

## Run 2: Report of TCP Cubic — Data Link

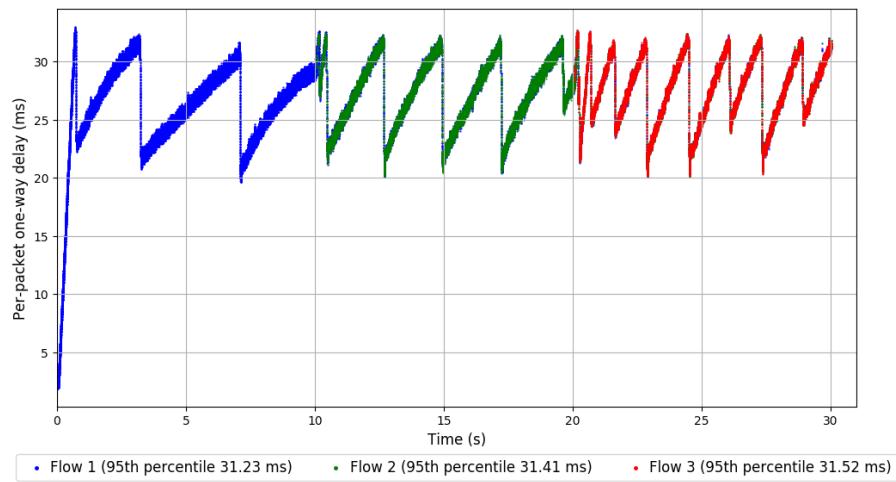
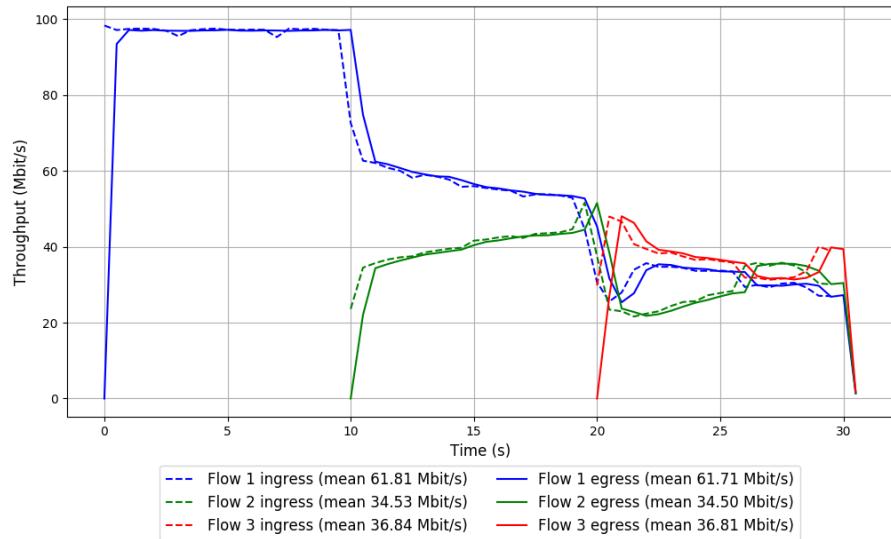


Run 3: Statistics of TCP Cubic

```
Start at: 2018-09-05 02:45:57
End at: 2018-09-05 02:46:27
Local clock offset: 12.871 ms
Remote clock offset: 0.122 ms

# Below is generated by plot.py at 2018-09-05 02:48:01
# Datalink statistics
-- Total of 3 flows:
Average throughput: 96.91 Mbit/s
95th percentile per-packet one-way delay: 31.331 ms
Loss rate: 0.05%
-- Flow 1:
Average throughput: 61.71 Mbit/s
95th percentile per-packet one-way delay: 31.234 ms
Loss rate: 0.05%
-- Flow 2:
Average throughput: 34.50 Mbit/s
95th percentile per-packet one-way delay: 31.412 ms
Loss rate: 0.06%
-- Flow 3:
Average throughput: 36.81 Mbit/s
95th percentile per-packet one-way delay: 31.516 ms
Loss rate: 0.04%
```

### Run 3: Report of TCP Cubic — Data Link

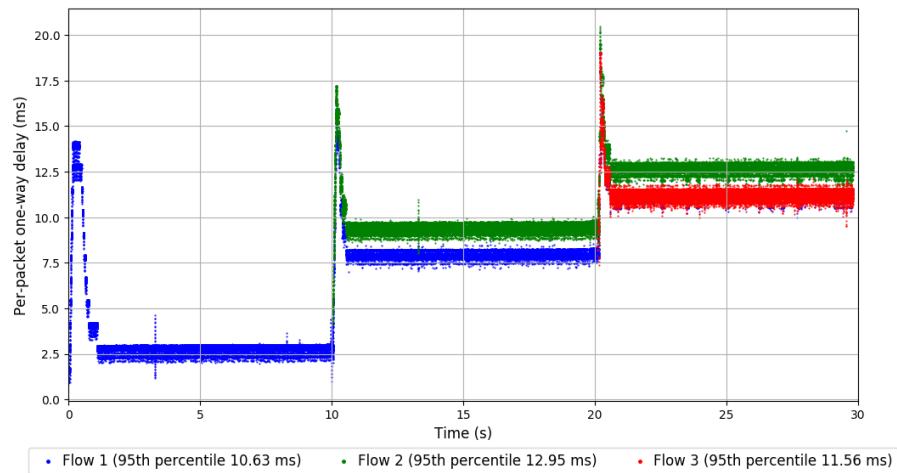
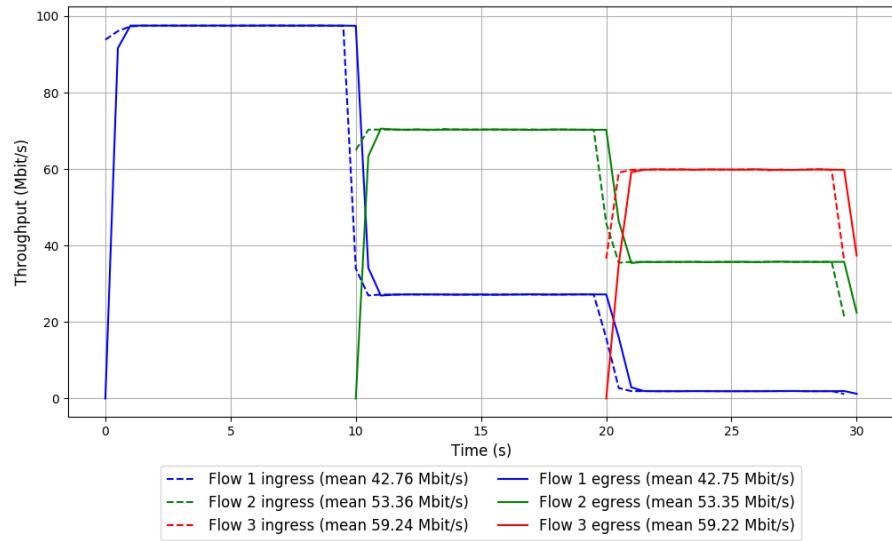


Run 1: Statistics of Indigo

```
Start at: 2018-09-05 02:34:21
End at: 2018-09-05 02:34:51
Local clock offset: 10.859 ms
Remote clock offset: -0.023 ms

# Below is generated by plot.py at 2018-09-05 02:48:01
# Datalink statistics
-- Total of 3 flows:
Average throughput: 97.43 Mbit/s
95th percentile per-packet one-way delay: 12.775 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 42.75 Mbit/s
95th percentile per-packet one-way delay: 10.631 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 53.35 Mbit/s
95th percentile per-packet one-way delay: 12.946 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 59.22 Mbit/s
95th percentile per-packet one-way delay: 11.560 ms
Loss rate: 0.00%
```

## Run 1: Report of Indigo — Data Link

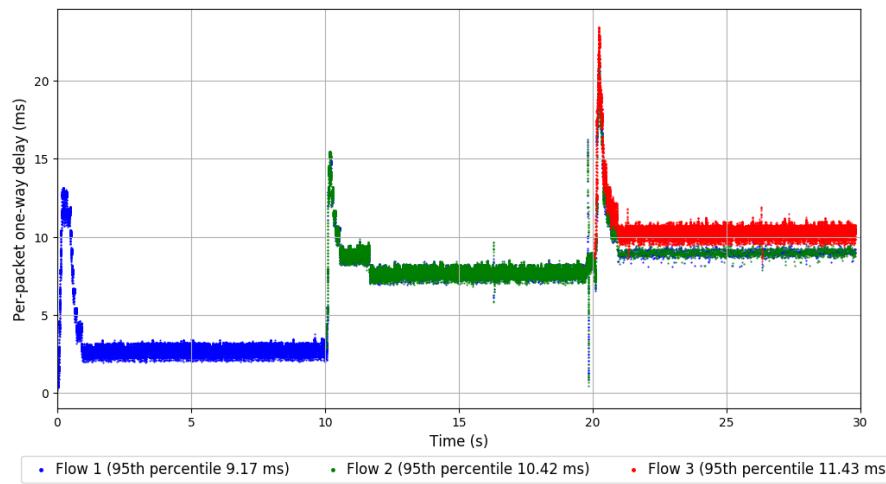
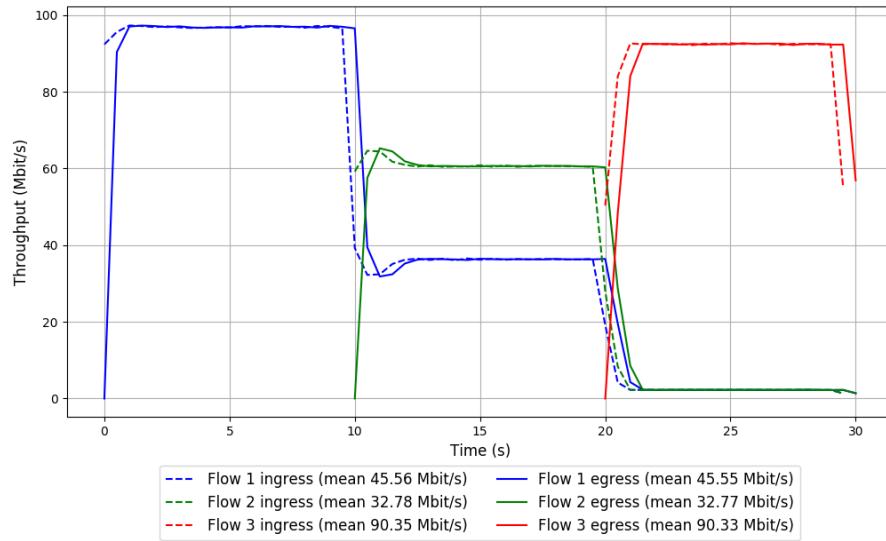


Run 2: Statistics of Indigo

```
Start at: 2018-09-05 02:38:59
End at: 2018-09-05 02:39:29
Local clock offset: 12.973 ms
Remote clock offset: 0.088 ms

# Below is generated by plot.py at 2018-09-05 02:48:01
# Datalink statistics
-- Total of 3 flows:
Average throughput: 96.81 Mbit/s
95th percentile per-packet one-way delay: 10.772 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 45.55 Mbit/s
95th percentile per-packet one-way delay: 9.166 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 32.77 Mbit/s
95th percentile per-packet one-way delay: 10.422 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 90.33 Mbit/s
95th percentile per-packet one-way delay: 11.429 ms
Loss rate: 0.00%
```

## Run 2: Report of Indigo — Data Link

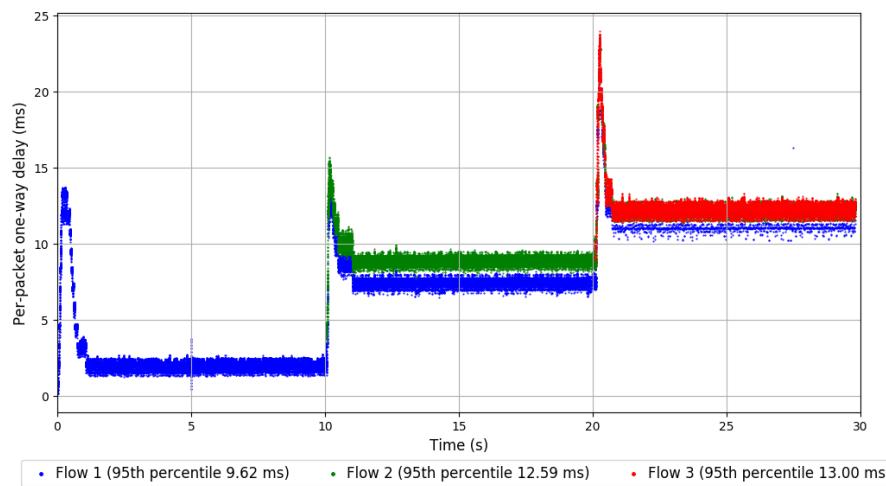
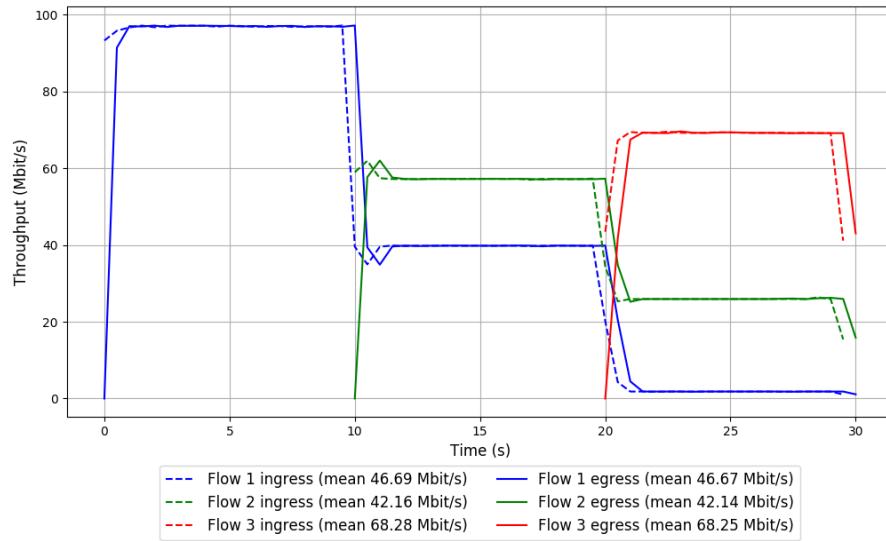


Run 3: Statistics of Indigo

```
Start at: 2018-09-05 02:43:37
End at: 2018-09-05 02:44:07
Local clock offset: 14.622 ms
Remote clock offset: 0.132 ms

# Below is generated by plot.py at 2018-09-05 02:48:33
# Datalink statistics
-- Total of 3 flows:
Average throughput: 96.89 Mbit/s
95th percentile per-packet one-way delay: 12.579 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 46.67 Mbit/s
95th percentile per-packet one-way delay: 9.621 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 42.14 Mbit/s
95th percentile per-packet one-way delay: 12.586 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 68.25 Mbit/s
95th percentile per-packet one-way delay: 13.004 ms
Loss rate: 0.00%
```

### Run 3: Report of Indigo — Data Link

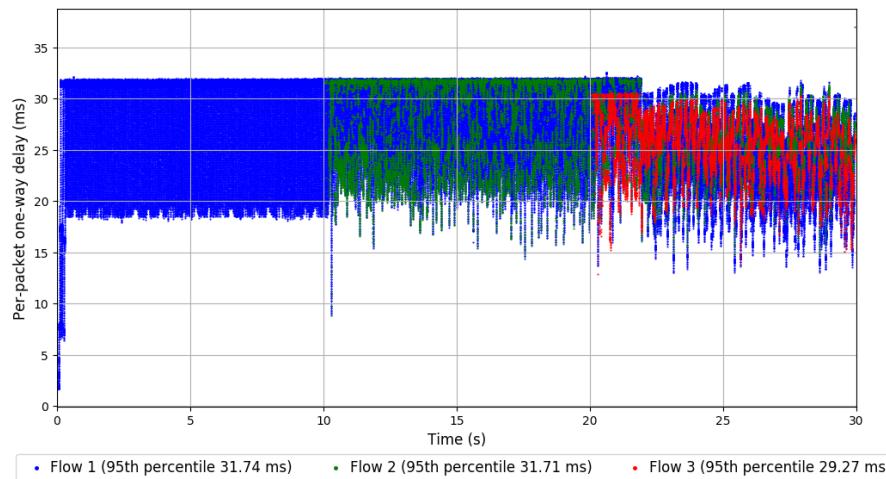
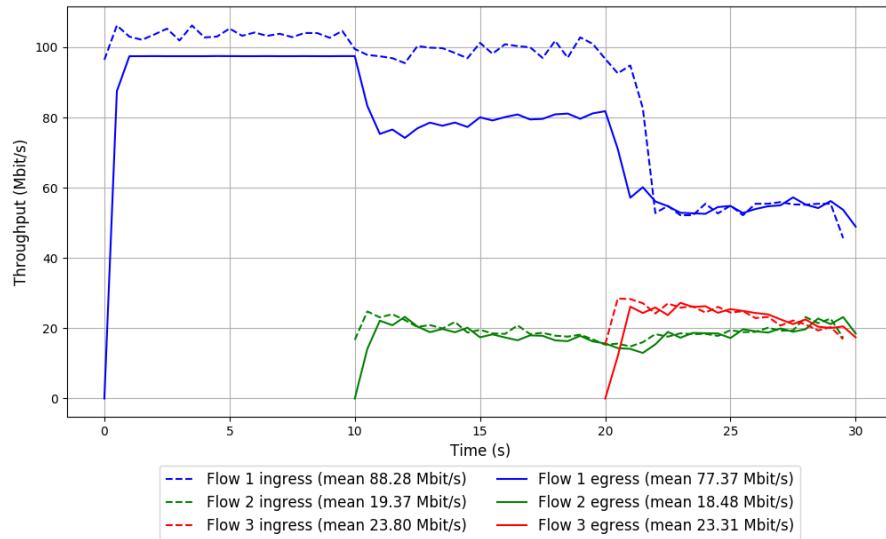


```
Run 1: Statistics of Muses-25

Start at: 2018-09-05 02:35:32
End at: 2018-09-05 02:36:02
Local clock offset: 11.918 ms
Remote clock offset: -0.035 ms

# Below is generated by plot.py at 2018-09-05 02:48:36
# Datalink statistics
-- Total of 3 flows:
Average throughput: 97.26 Mbit/s
95th percentile per-packet one-way delay: 31.732 ms
Loss rate: 10.63%
-- Flow 1:
Average throughput: 77.37 Mbit/s
95th percentile per-packet one-way delay: 31.744 ms
Loss rate: 12.29%
-- Flow 2:
Average throughput: 18.48 Mbit/s
95th percentile per-packet one-way delay: 31.707 ms
Loss rate: 4.49%
-- Flow 3:
Average throughput: 23.31 Mbit/s
95th percentile per-packet one-way delay: 29.270 ms
Loss rate: 2.10%
```

Run 1: Report of Muses-25 — Data Link

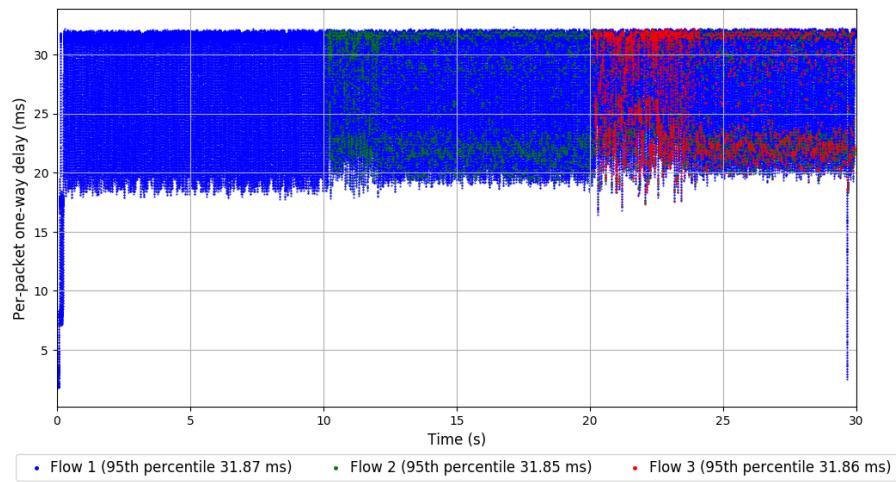
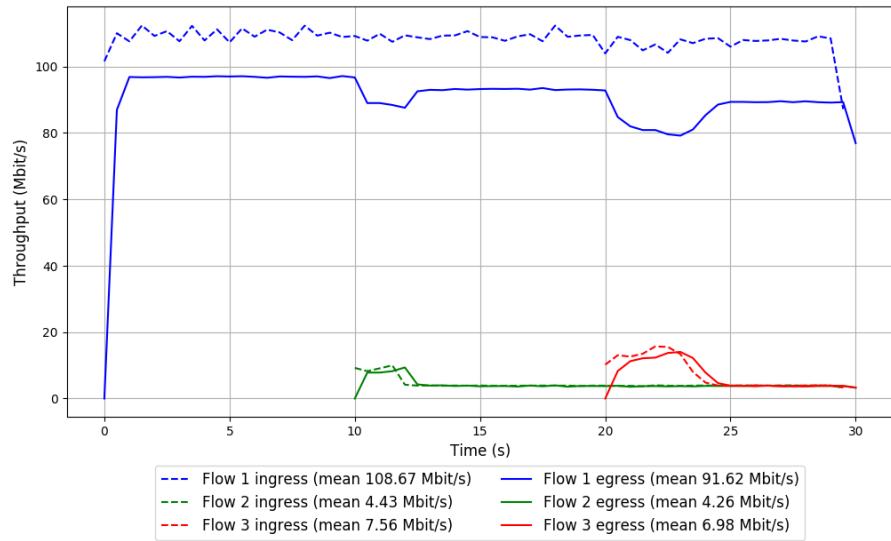


Run 2: Statistics of Muses-25

```
Start at: 2018-09-05 02:40:10
End at: 2018-09-05 02:40:40
Local clock offset: 13.358 ms
Remote clock offset: 0.127 ms

# Below is generated by plot.py at 2018-09-05 02:48:36
# Datalink statistics
-- Total of 3 flows:
Average throughput: 96.74 Mbit/s
95th percentile per-packet one-way delay: 31.870 ms
Loss rate: 15.13%
-- Flow 1:
Average throughput: 91.62 Mbit/s
95th percentile per-packet one-way delay: 31.871 ms
Loss rate: 15.60%
-- Flow 2:
Average throughput: 4.26 Mbit/s
95th percentile per-packet one-way delay: 31.847 ms
Loss rate: 3.86%
-- Flow 3:
Average throughput: 6.98 Mbit/s
95th percentile per-packet one-way delay: 31.860 ms
Loss rate: 7.82%
```

Run 2: Report of Muses-25 — Data Link



Run 3: Statistics of Muses-25

```
Start at: 2018-09-05 02:44:47
End at: 2018-09-05 02:45:17
Local clock offset: 14.16 ms
Remote clock offset: 0.184 ms

# Below is generated by plot.py at 2018-09-05 02:48:36
# Datalink statistics
-- Total of 3 flows:
Average throughput: 96.78 Mbit/s
95th percentile per-packet one-way delay: 31.489 ms
Loss rate: 5.64%
-- Flow 1:
Average throughput: 73.18 Mbit/s
95th percentile per-packet one-way delay: 31.551 ms
Loss rate: 6.60%
-- Flow 2:
Average throughput: 24.62 Mbit/s
95th percentile per-packet one-way delay: 28.403 ms
Loss rate: 0.36%
-- Flow 3:
Average throughput: 22.13 Mbit/s
95th percentile per-packet one-way delay: 29.592 ms
Loss rate: 7.06%
```

Run 3: Report of Muses-25 — Data Link

