

Pantheon Report

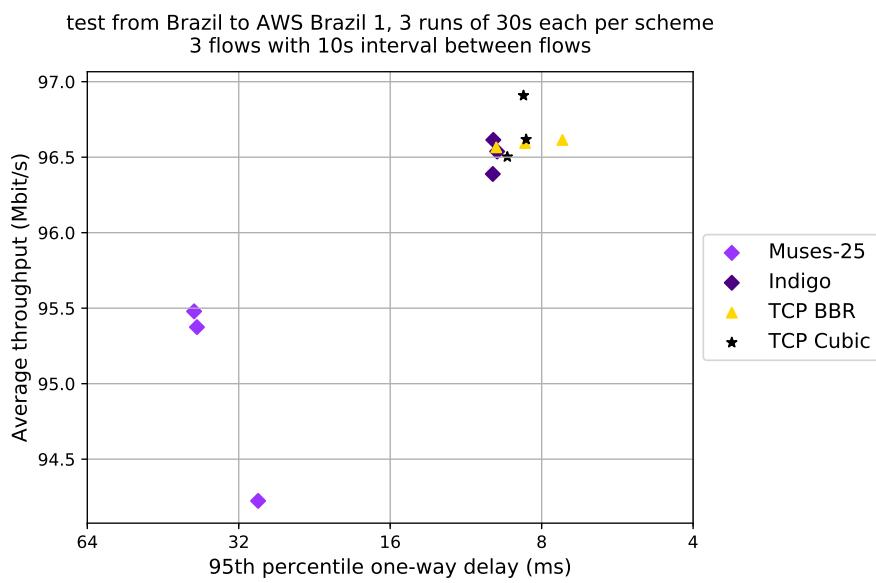
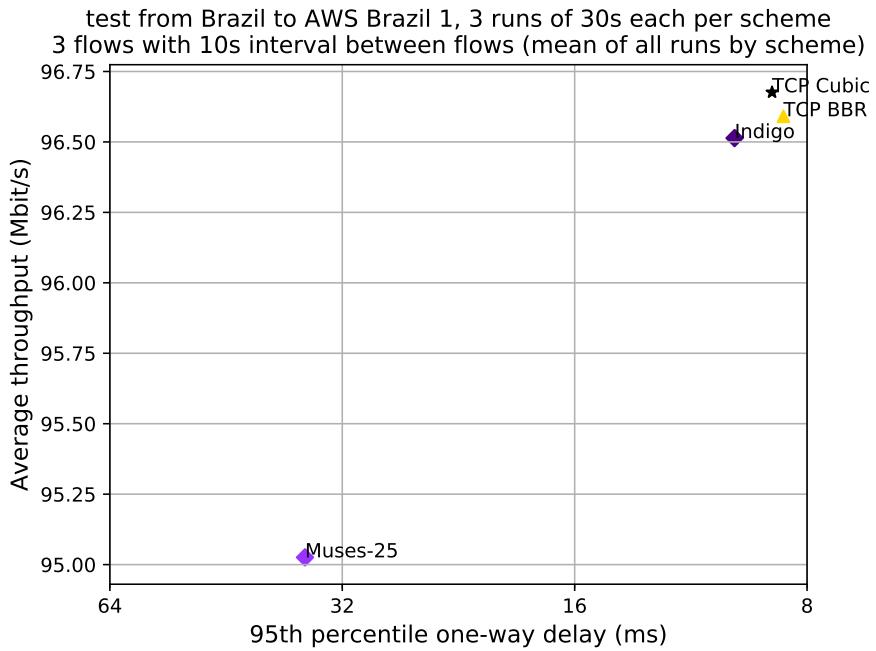
Generated at 2018-08-31 10:01:16 (UTC).
Data path: Brazil on p4p1 (*remote*) → AWS Brazil 1 on ens5 (*local*).
Repeated the test of 4 congestion control schemes 3 times.
Each test lasted for 30 seconds running 3 flows with 10-second interval between two flows.
NTP offsets were measured against gps.ntp.br 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 @ e3c5aa19ca94c3066828fb83f16a8fb6b2731e7a
third_party/fillp @ d47f4fa1b454a5e3c0537115c5a28436dbd4b834
third_party/fillp-sheep @ daed0c84f98531712514b2231f43ec6901114ffe
third_party/genericCC @ d0153f8e594aa89e93b032143cedbdf58e562f4
third_party/indigo @ 2601c92e4aa9d58d38dc4dfe0ecdbf90c077e64d
third_party/libutp @ b3465b942e2826f2b179eaab4a906ce6bb7cf3cf
third_party/muses @ b59e0d118c50af3579569c462d33045741c85981
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
```



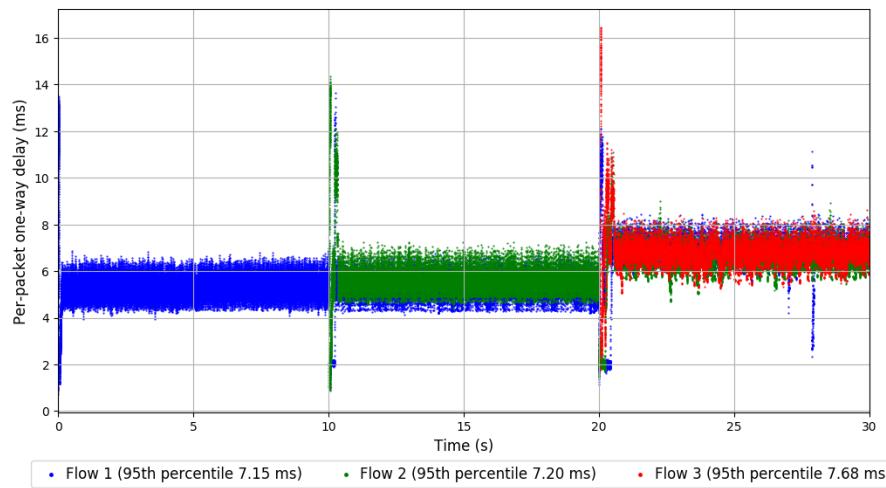
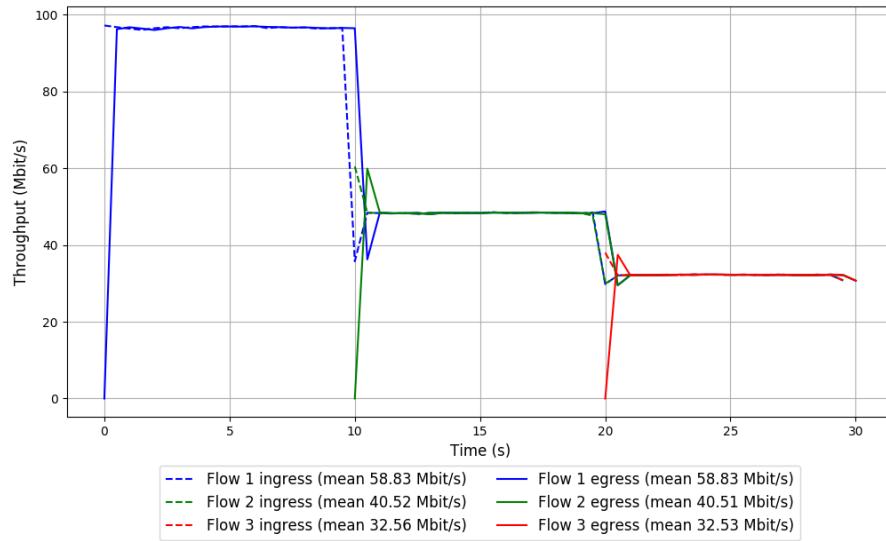
scheme	# runs	mean avg tput (Mbit/s)			mean 95th-%ile delay (ms)			mean loss rate (%)		
		flow 1	flow 2	flow 3	flow 1	flow 2	flow 3	flow 1	flow 2	flow 3
TCP BBR	3	58.77	40.54	32.59	8.52	8.44	8.48	0.20	0.19	0.37
TCP Cubic	3	59.15	40.28	32.21	9.08	8.62	8.90	0.10	0.16	0.26
Indigo	3	59.13	40.31	32.16	9.63	9.84	8.04	0.62	1.42	0.12
Muses-25	3	57.01	41.05	32.28	29.08	24.92	41.69	0.85	0.27	3.32

Run 1: Statistics of TCP BBR

```
Start at: 2018-08-31 09:49:28
End at: 2018-08-31 09:49:58
Local clock offset: -3.782 ms
Remote clock offset: 0.629 ms

# Below is generated by plot.py at 2018-08-31 10:00:30
# Datalink statistics
-- Total of 3 flows:
Average throughput: 96.61 Mbit/s
95th percentile per-packet one-way delay: 7.275 ms
Loss rate: 0.03%
-- Flow 1:
Average throughput: 58.83 Mbit/s
95th percentile per-packet one-way delay: 7.150 ms
Loss rate: 0.02%
-- Flow 2:
Average throughput: 40.51 Mbit/s
95th percentile per-packet one-way delay: 7.202 ms
Loss rate: 0.03%
-- Flow 3:
Average throughput: 32.53 Mbit/s
95th percentile per-packet one-way delay: 7.683 ms
Loss rate: 0.10%
```

Run 1: Report of TCP BBR — Data Link

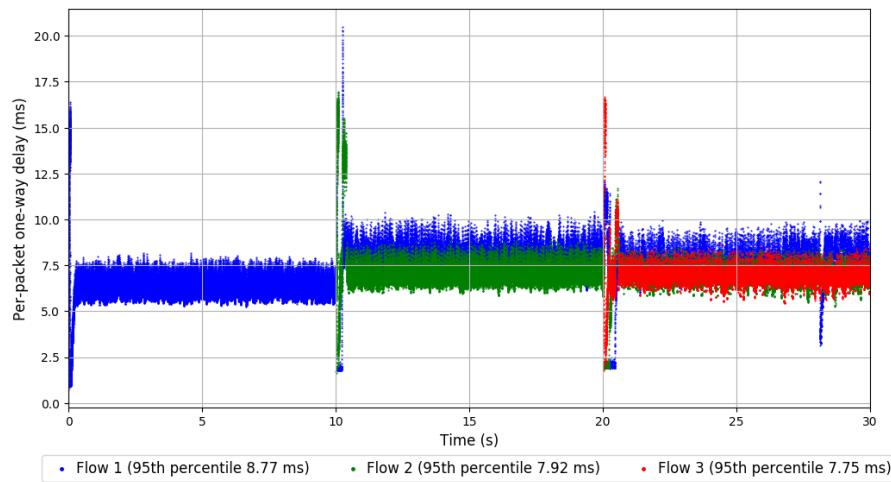
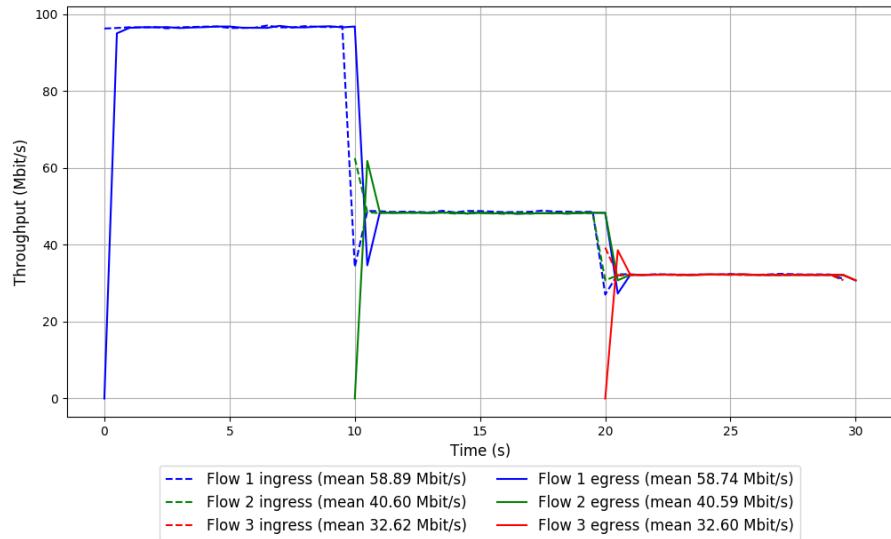


Run 2: Statistics of TCP BBR

```
Start at: 2018-08-31 09:53:59
End at: 2018-08-31 09:54:29
Local clock offset: -3.543 ms
Remote clock offset: 0.639 ms

# Below is generated by plot.py at 2018-08-31 10:00:32
# Datalink statistics
-- Total of 3 flows:
Average throughput: 96.59 Mbit/s
95th percentile per-packet one-way delay: 8.630 ms
Loss rate: 0.18%
-- Flow 1:
Average throughput: 58.74 Mbit/s
95th percentile per-packet one-way delay: 8.767 ms
Loss rate: 0.27%
-- Flow 2:
Average throughput: 40.59 Mbit/s
95th percentile per-packet one-way delay: 7.916 ms
Loss rate: 0.04%
-- Flow 3:
Average throughput: 32.60 Mbit/s
95th percentile per-packet one-way delay: 7.747 ms
Loss rate: 0.08%
```

Run 2: Report of TCP BBR — Data Link

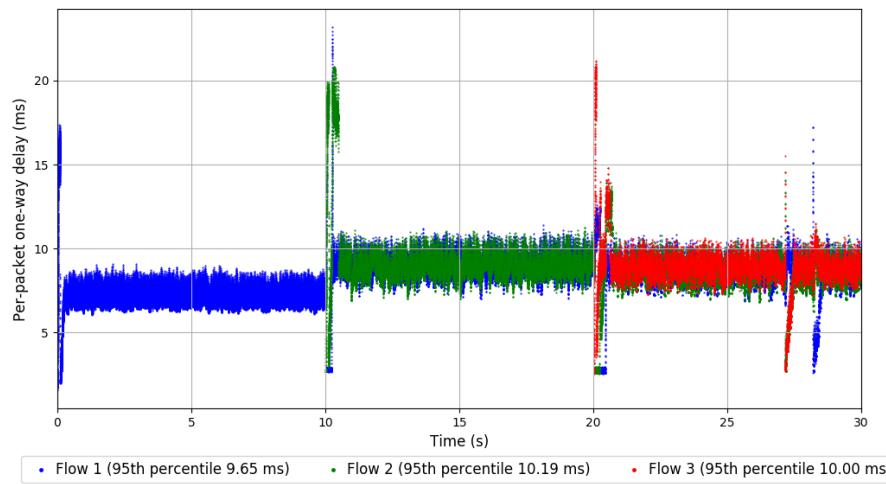
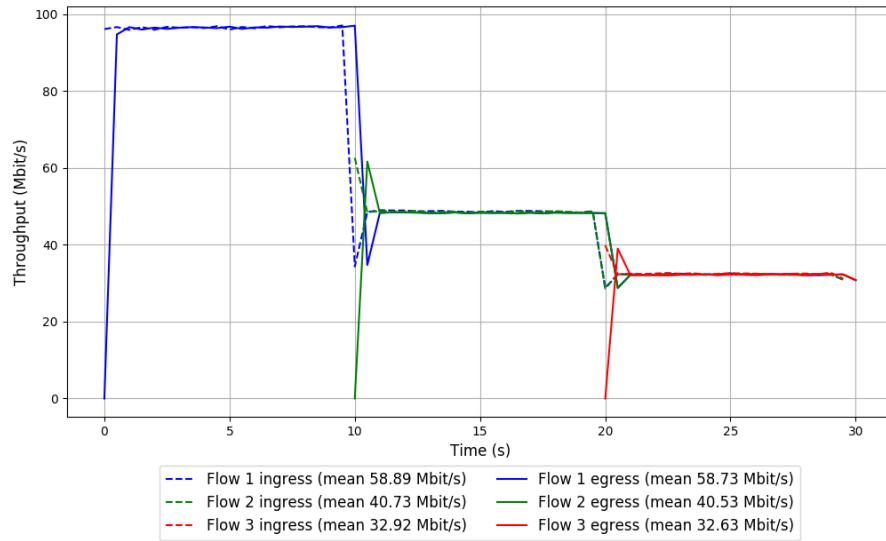


Run 3: Statistics of TCP BBR

```
Start at: 2018-08-31 09:58:30
End at: 2018-08-31 09:59:00
Local clock offset: -3.256 ms
Remote clock offset: 0.691 ms

# Below is generated by plot.py at 2018-08-31 10:00:32
# Datalink statistics
-- Total of 3 flows:
Average throughput: 96.57 Mbit/s
95th percentile per-packet one-way delay: 9.848 ms
Loss rate: 0.43%
-- Flow 1:
Average throughput: 58.73 Mbit/s
95th percentile per-packet one-way delay: 9.646 ms
Loss rate: 0.31%
-- Flow 2:
Average throughput: 40.53 Mbit/s
95th percentile per-packet one-way delay: 10.190 ms
Loss rate: 0.50%
-- Flow 3:
Average throughput: 32.63 Mbit/s
95th percentile per-packet one-way delay: 10.003 ms
Loss rate: 0.93%
```

Run 3: Report of TCP BBR — Data Link

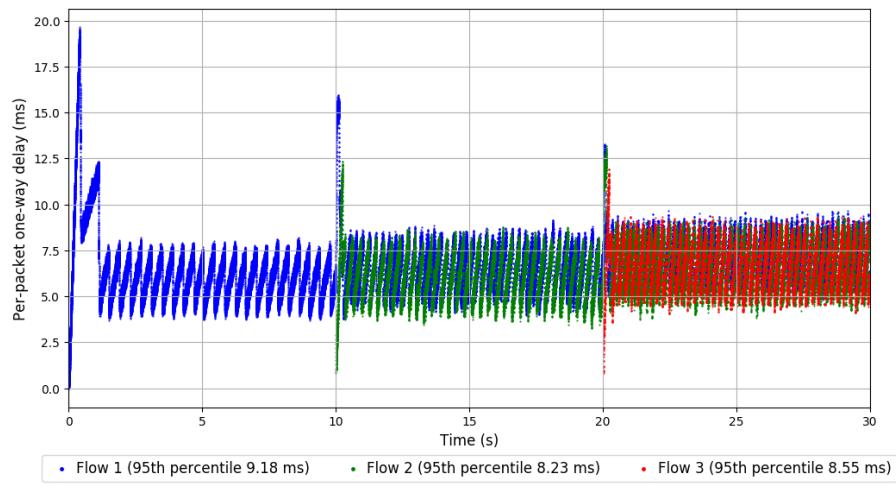
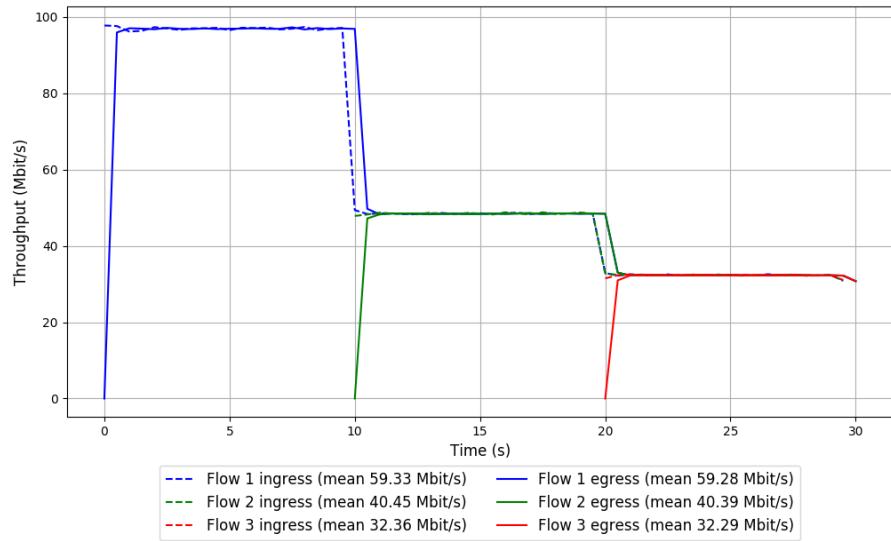


```
Run 1: Statistics of TCP Cubic

Start at: 2018-08-31 09:46:04
End at: 2018-08-31 09:46:34
Local clock offset: -4.774 ms
Remote clock offset: 0.62 ms

# Below is generated by plot.py at 2018-08-31 10:00:32
# Datalink statistics
-- Total of 3 flows:
Average throughput: 96.91 Mbit/s
95th percentile per-packet one-way delay: 8.693 ms
Loss rate: 0.13%
-- Flow 1:
Average throughput: 59.28 Mbit/s
95th percentile per-packet one-way delay: 9.178 ms
Loss rate: 0.10%
-- Flow 2:
Average throughput: 40.39 Mbit/s
95th percentile per-packet one-way delay: 8.229 ms
Loss rate: 0.16%
-- Flow 3:
Average throughput: 32.29 Mbit/s
95th percentile per-packet one-way delay: 8.551 ms
Loss rate: 0.25%
```

Run 1: Report of TCP Cubic — Data Link

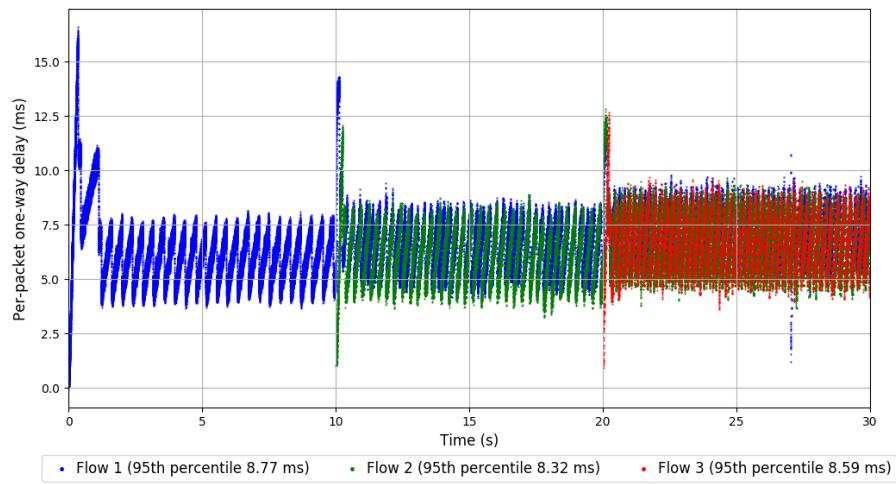
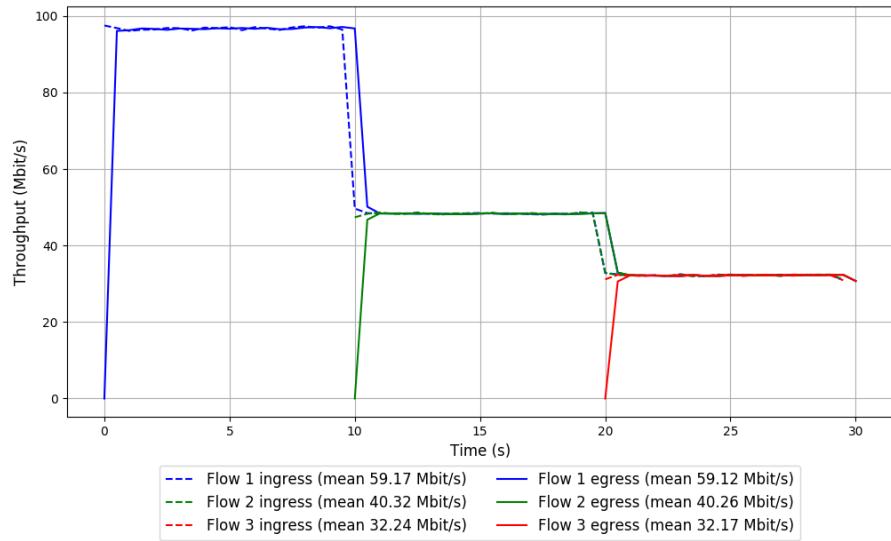


Run 2: Statistics of TCP Cubic

```
Start at: 2018-08-31 09:50:35
End at: 2018-08-31 09:51:05
Local clock offset: -4.5 ms
Remote clock offset: 0.641 ms

# Below is generated by plot.py at 2018-08-31 10:00:32
# Datalink statistics
-- Total of 3 flows:
Average throughput: 96.62 Mbit/s
95th percentile per-packet one-way delay: 8.587 ms
Loss rate: 0.13%
-- Flow 1:
Average throughput: 59.12 Mbit/s
95th percentile per-packet one-way delay: 8.765 ms
Loss rate: 0.10%
-- Flow 2:
Average throughput: 40.26 Mbit/s
95th percentile per-packet one-way delay: 8.323 ms
Loss rate: 0.16%
-- Flow 3:
Average throughput: 32.17 Mbit/s
95th percentile per-packet one-way delay: 8.589 ms
Loss rate: 0.24%
```

Run 2: Report of TCP Cubic — Data Link

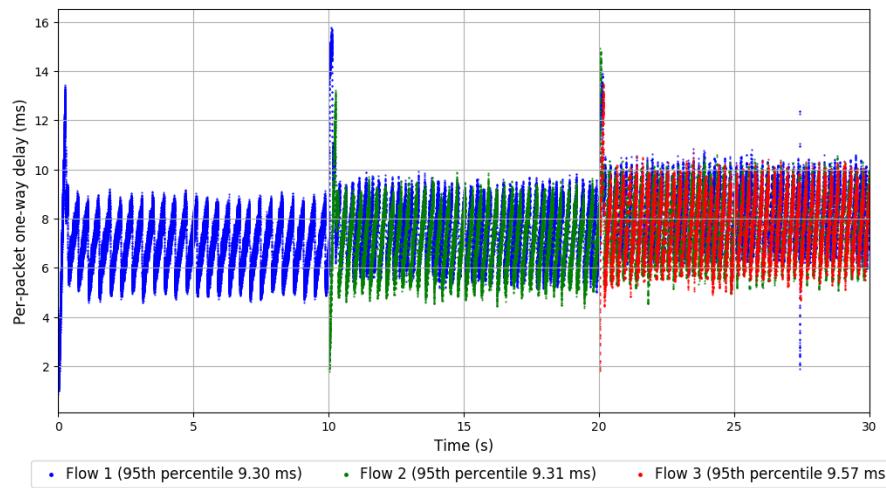
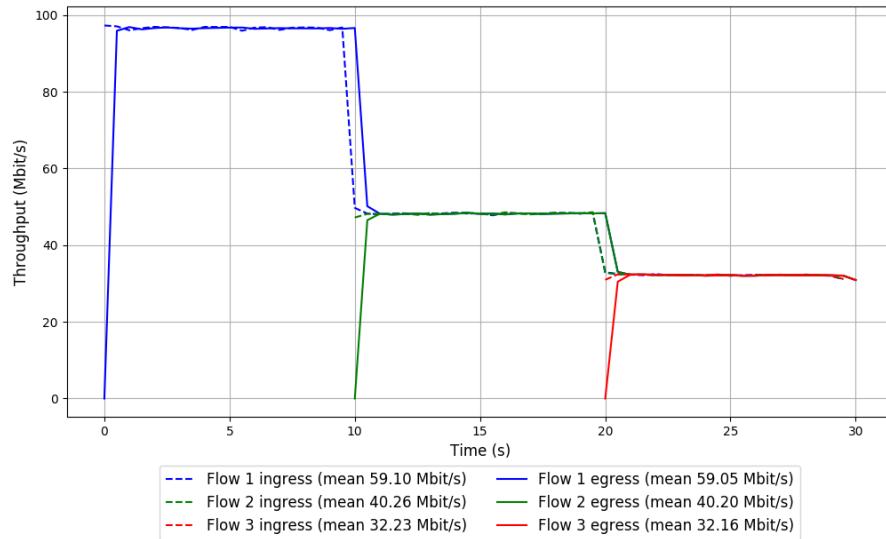


Run 3: Statistics of TCP Cubic

```
Start at: 2018-08-31 09:55:06
End at: 2018-08-31 09:55:36
Local clock offset: -3.643 ms
Remote clock offset: 0.589 ms

# Below is generated by plot.py at 2018-08-31 10:00:32
# Datalink statistics
-- Total of 3 flows:
Average throughput: 96.50 Mbit/s
95th percentile per-packet one-way delay: 9.360 ms
Loss rate: 0.14%
-- Flow 1:
Average throughput: 59.05 Mbit/s
95th percentile per-packet one-way delay: 9.299 ms
Loss rate: 0.10%
-- Flow 2:
Average throughput: 40.20 Mbit/s
95th percentile per-packet one-way delay: 9.315 ms
Loss rate: 0.16%
-- Flow 3:
Average throughput: 32.16 Mbit/s
95th percentile per-packet one-way delay: 9.566 ms
Loss rate: 0.28%
```

Run 3: Report of TCP Cubic — Data Link

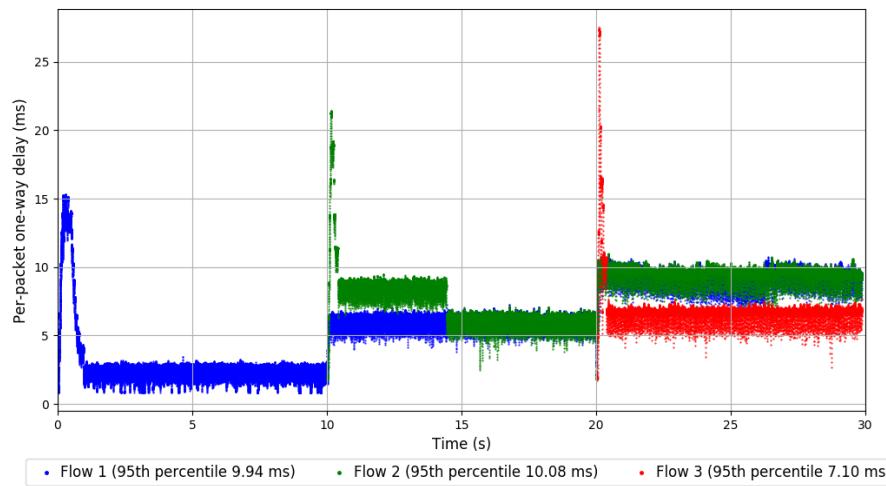
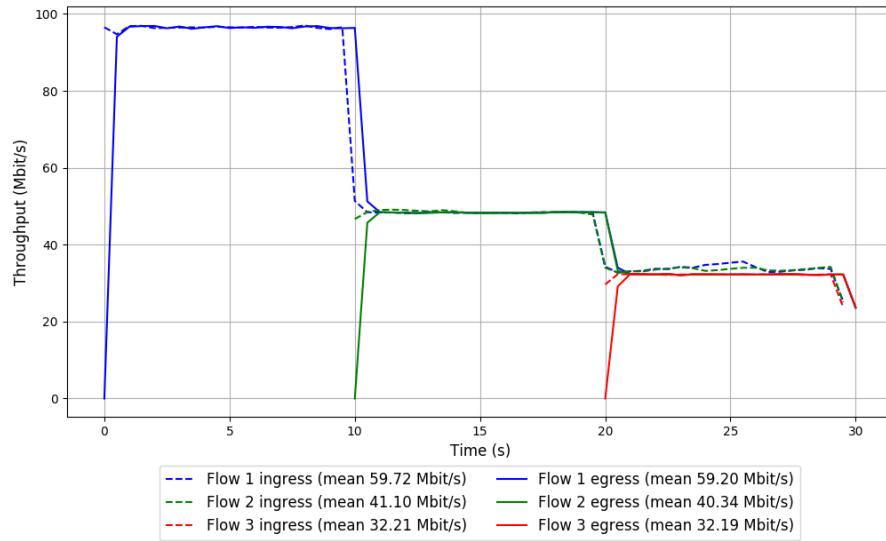


Run 1: Statistics of Indigo

```
Start at: 2018-08-31 09:48:19
End at: 2018-08-31 09:48:49
Local clock offset: -3.873 ms
Remote clock offset: 0.624 ms

# Below is generated by plot.py at 2018-08-31 10:00:33
# Datalink statistics
-- Total of 3 flows:
Average throughput: 96.61 Mbit/s
95th percentile per-packet one-way delay: 9.981 ms
Loss rate: 1.07%
-- Flow 1:
Average throughput: 59.20 Mbit/s
95th percentile per-packet one-way delay: 9.944 ms
Loss rate: 0.89%
-- Flow 2:
Average throughput: 40.34 Mbit/s
95th percentile per-packet one-way delay: 10.076 ms
Loss rate: 1.85%
-- Flow 3:
Average throughput: 32.19 Mbit/s
95th percentile per-packet one-way delay: 7.104 ms
Loss rate: 0.10%
```

Run 1: Report of Indigo — Data Link

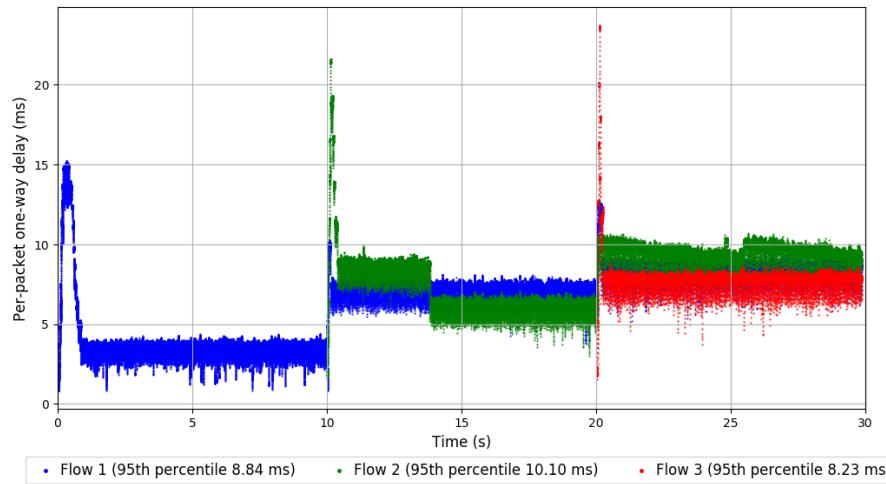
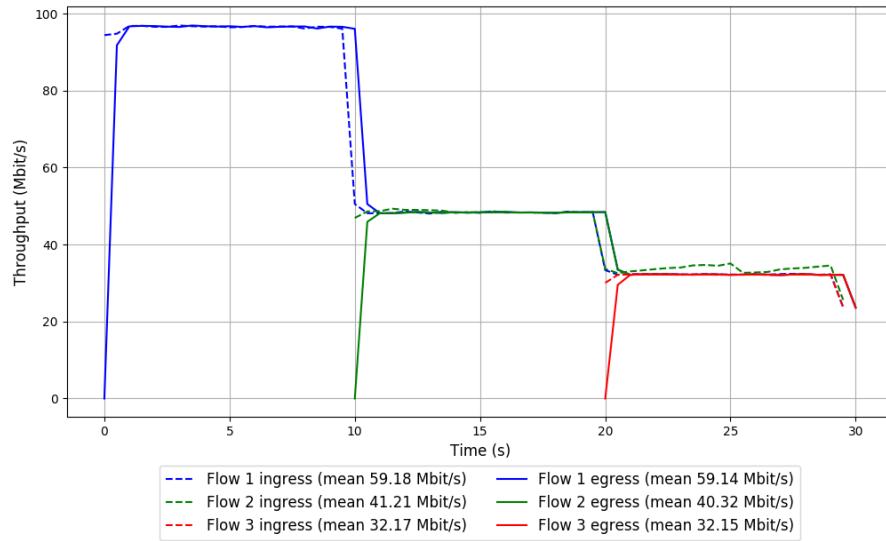


Run 2: Statistics of Indigo

```
Start at: 2018-08-31 09:52:50
End at: 2018-08-31 09:53:20
Local clock offset: -3.607 ms
Remote clock offset: 0.641 ms

# Below is generated by plot.py at 2018-08-31 10:00:34
# Datalink statistics
-- Total of 3 flows:
Average throughput: 96.54 Mbit/s
95th percentile per-packet one-way delay: 9.806 ms
Loss rate: 0.67%
-- Flow 1:
Average throughput: 59.14 Mbit/s
95th percentile per-packet one-way delay: 8.839 ms
Loss rate: 0.06%
-- Flow 2:
Average throughput: 40.32 Mbit/s
95th percentile per-packet one-way delay: 10.098 ms
Loss rate: 2.19%
-- Flow 3:
Average throughput: 32.15 Mbit/s
95th percentile per-packet one-way delay: 8.226 ms
Loss rate: 0.10%
```

Run 2: Report of Indigo — Data Link

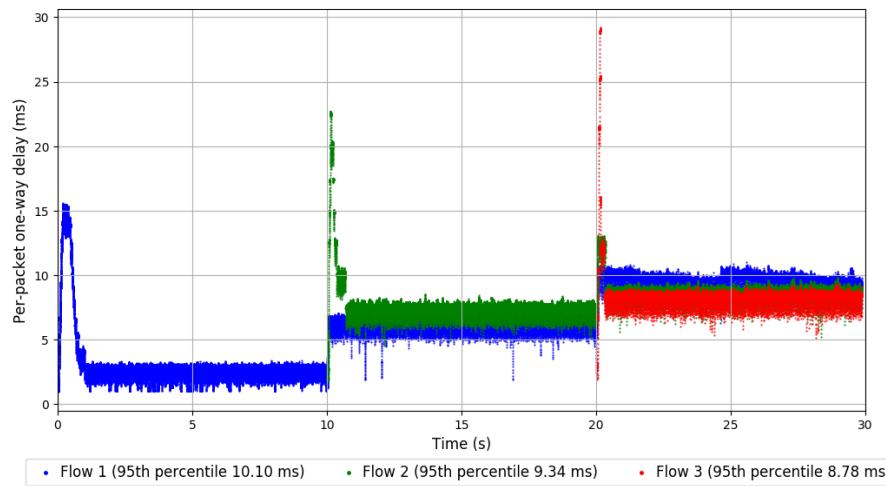
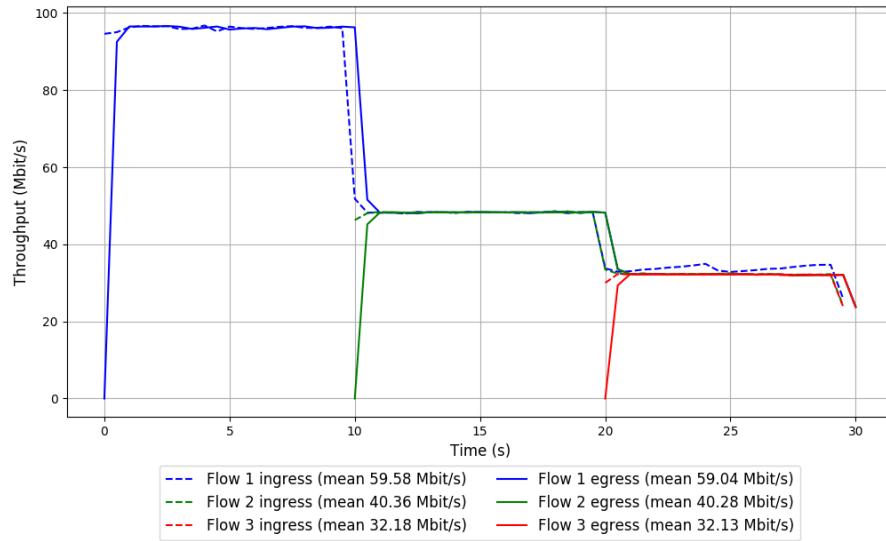


Run 3: Statistics of Indigo

```
Start at: 2018-08-31 09:57:22
End at: 2018-08-31 09:57:52
Local clock offset: -3.909 ms
Remote clock offset: 0.62 ms

# Below is generated by plot.py at 2018-08-31 10:00:58
# Datalink statistics
-- Total of 3 flows:
Average throughput: 96.39 Mbit/s
95th percentile per-packet one-way delay: 10.004 ms
Loss rate: 0.64%
-- Flow 1:
Average throughput: 59.04 Mbit/s
95th percentile per-packet one-way delay: 10.102 ms
Loss rate: 0.91%
-- Flow 2:
Average throughput: 40.28 Mbit/s
95th percentile per-packet one-way delay: 9.344 ms
Loss rate: 0.22%
-- Flow 3:
Average throughput: 32.13 Mbit/s
95th percentile per-packet one-way delay: 8.781 ms
Loss rate: 0.16%
```

Run 3: Report of Indigo — Data Link

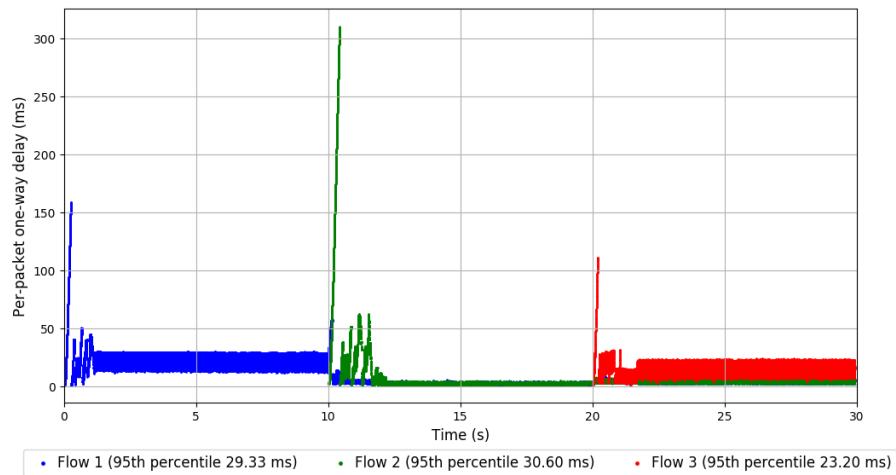
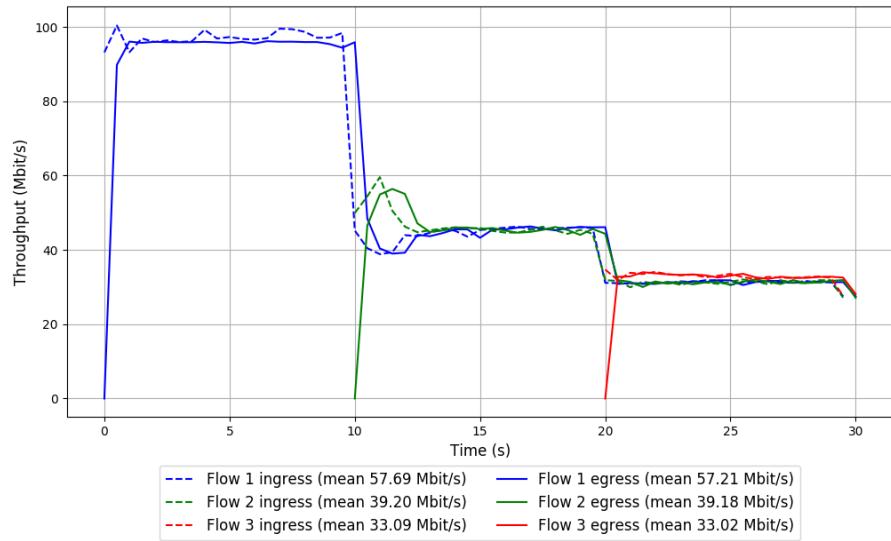


Run 1: Statistics of Muses-25

```
Start at: 2018-08-31 09:47:11
End at: 2018-08-31 09:47:41
Local clock offset: -3.156 ms
Remote clock offset: 0.606 ms

# Below is generated by plot.py at 2018-08-31 10:01:13
# Datalink statistics
-- Total of 3 flows:
Average throughput: 94.22 Mbit/s
95th percentile per-packet one-way delay: 29.287 ms
Loss rate: 0.54%
-- Flow 1:
Average throughput: 57.21 Mbit/s
95th percentile per-packet one-way delay: 29.330 ms
Loss rate: 0.84%
-- Flow 2:
Average throughput: 39.18 Mbit/s
95th percentile per-packet one-way delay: 30.599 ms
Loss rate: 0.04%
-- Flow 3:
Average throughput: 33.02 Mbit/s
95th percentile per-packet one-way delay: 23.204 ms
Loss rate: 0.15%
```

Run 1: Report of Muses-25 — Data Link

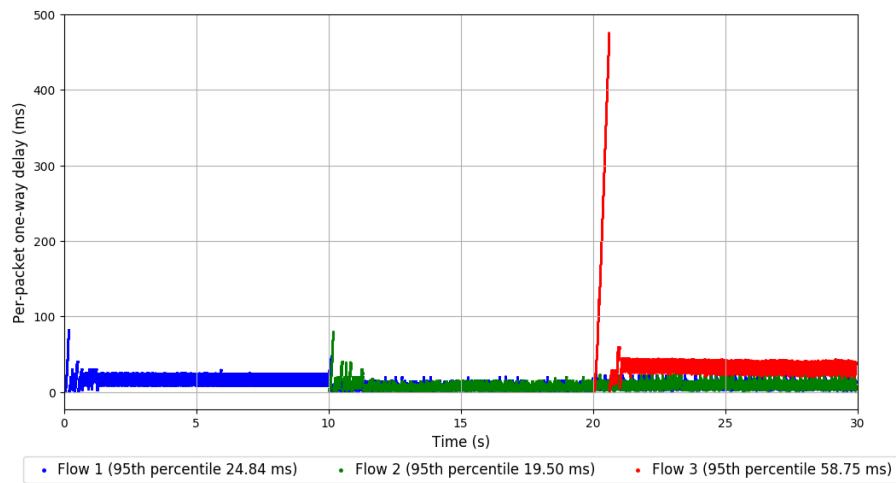
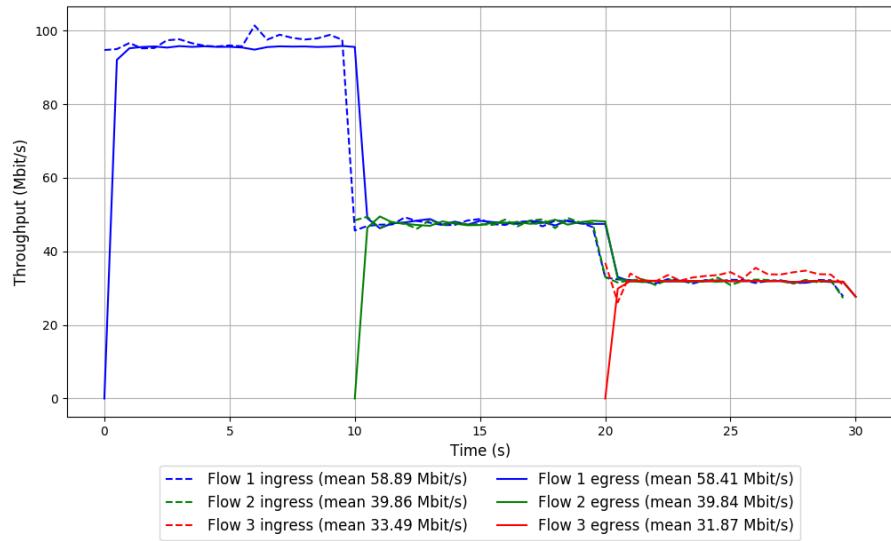


Run 2: Statistics of Muses-25

```
Start at: 2018-08-31 09:51:42
End at: 2018-08-31 09:52:12
Local clock offset: -3.748 ms
Remote clock offset: 0.562 ms

# Below is generated by plot.py at 2018-08-31 10:01:15
# Datalink statistics
-- Total of 3 flows:
Average throughput: 95.48 Mbit/s
95th percentile per-packet one-way delay: 39.254 ms
Loss rate: 1.07%
-- Flow 1:
Average throughput: 58.41 Mbit/s
95th percentile per-packet one-way delay: 24.837 ms
Loss rate: 0.82%
-- Flow 2:
Average throughput: 39.84 Mbit/s
95th percentile per-packet one-way delay: 19.497 ms
Loss rate: 0.07%
-- Flow 3:
Average throughput: 31.87 Mbit/s
95th percentile per-packet one-way delay: 58.752 ms
Loss rate: 4.79%
```

Run 2: Report of Muses-25 — Data Link



Run 3: Statistics of Muses-25

```
Start at: 2018-08-31 09:56:14
End at: 2018-08-31 09:56:44
Local clock offset: -4.607 ms
Remote clock offset: 0.611 ms

# Below is generated by plot.py at 2018-08-31 10:01:15
# Datalink statistics
-- Total of 3 flows:
Average throughput: 95.37 Mbit/s
95th percentile per-packet one-way delay: 38.744 ms
Loss rate: 1.31%
-- Flow 1:
Average throughput: 55.42 Mbit/s
95th percentile per-packet one-way delay: 33.077 ms
Loss rate: 0.88%
-- Flow 2:
Average throughput: 44.13 Mbit/s
95th percentile per-packet one-way delay: 24.674 ms
Loss rate: 0.71%
-- Flow 3:
Average throughput: 31.96 Mbit/s
95th percentile per-packet one-way delay: 43.099 ms
Loss rate: 5.01%
```

Run 3: Report of Muses-25 — Data Link

