Pantheon Report

Generated at 2018-09-05 21:42:49 (UTC).

Data path: AWS California 2 on `ens5` (*local*) →Mexico on `em1` (*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.

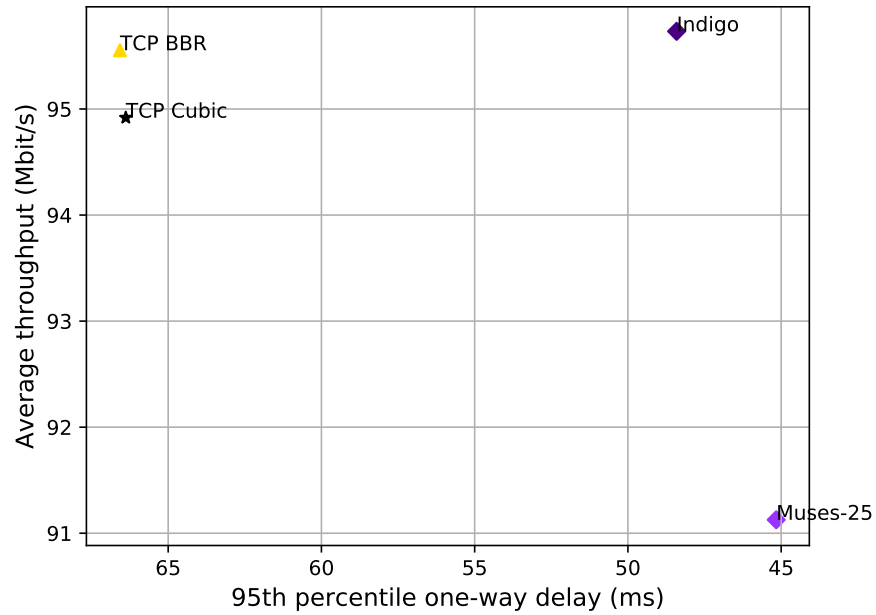NTP offsets were measured against `time.stanford.edu` and have been applied to correct the timestamps in logs.

```
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
```
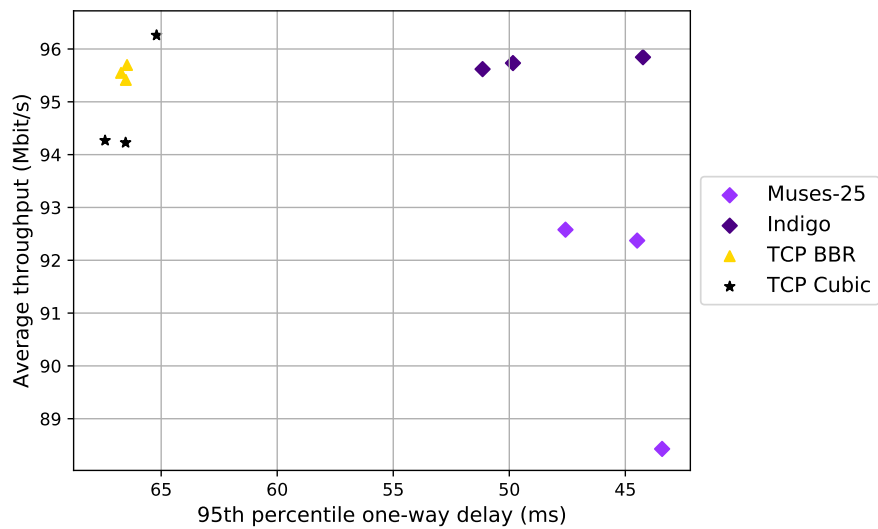
```
Git summary:
branch: muses @ 18b9165265c8ba2915c862e8713fd9ad82c1ac21
third_party/fillp @ d47f4fa1b454a5e3c0537115c5a28436dbd4b834
third_party/fillp-sheep @ daed0c84f98531712514b2231f43ec6901114ffe
third_party/genericCC @ d0153f8e594aa89e93b032143cedbdfe58e562f4
third_party/indigo @ 2601c92e4aa9d58d38dc4dfe0ecdbf90c077e64d
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 California 2 to Mexico, 3 runs of 30s each per scheme
3 flows with 10s interval between flows (mean of all runs by scheme)

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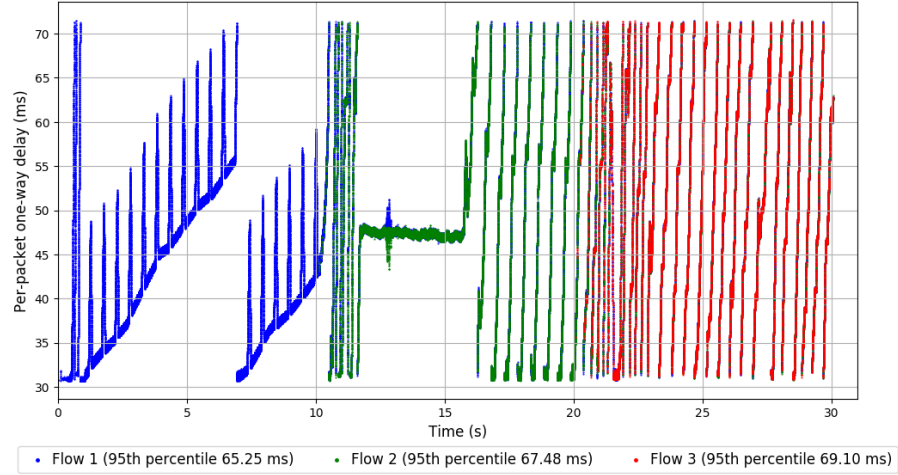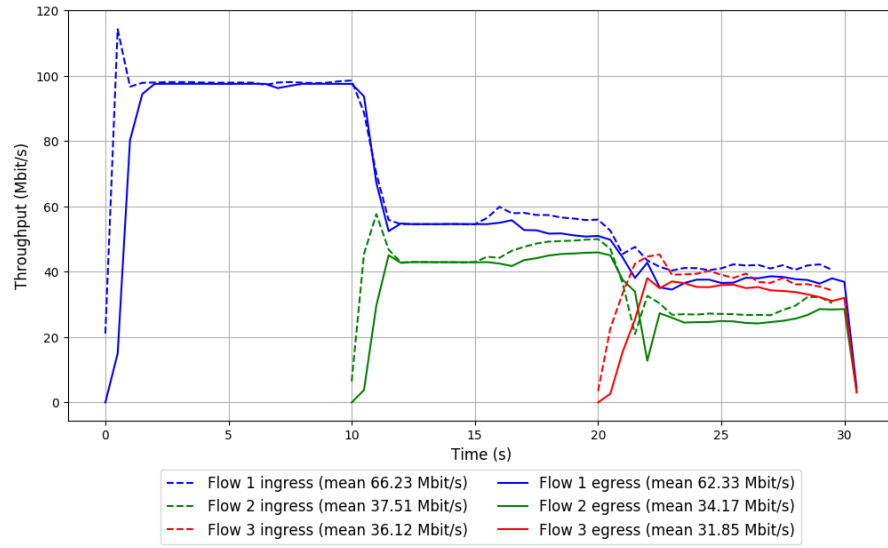3 flows with 10s interval between flows

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	60.90	35.89	32.33	65.28	67.67	68.02	5.65	9.14	10.17
TCP Cubic	3	68.53	29.79	19.65	65.59	67.02	68.05	0.75	0.38	0.44
Indigo	3	63.97	32.39	31.42	44.87	50.97	52.07	0.54	0.67	1.31
Muses-25	3	53.83	41.10	30.30	41.98	48.53	44.92	1.03	0.56	0.25

```
Run 1: Statistics of TCP BBR

Start at: 2018-09-05 21:26:20
End at: 2018-09-05 21:26:50
Local clock offset: 3.715 ms
Remote clock offset: -0.312 ms


# Below is generated by plot.py at 2018-09-05 21:42:16
# Datalink statistics
-- Total of 3 flows:
Average throughput: 95.70 Mbit/s
95th percentile per-packet one-way delay: 66.471 ms
Loss rate: 7.20%
-- Flow 1:
Average throughput: 62.33 Mbit/s
95th percentile per-packet one-way delay: 65.247 ms
Loss rate: 5.80%
-- Flow 2:
Average throughput: 34.17 Mbit/s
95th percentile per-packet one-way delay: 67.476 ms
Loss rate: 8.81%
-- Flow 3:
Average throughput: 31.85 Mbit/s
95th percentile per-packet one-way delay: 69.097 ms
Loss rate: 11.58%
```

Run 1: Report of TCP BBR — Data Link

```
Run 2: Statistics of TCP BBR

Start at: 2018-09-05 21:31:52
End at: 2018-09-05 21:32:22
Local clock offset: 4.696 ms
Remote clock offset: -0.271 ms


# Below is generated by plot.py at 2018-09-05 21:42:16
# Datalink statistics
-- Total of 3 flows:
Average throughput: 95.55 Mbit/s
95th percentile per-packet one-way delay: 66.729 ms
Loss rate: 9.01%
-- Flow 1:
Average throughput: 56.24 Mbit/s
95th percentile per-packet one-way delay: 65.168 ms
Loss rate: 6.69%
-- Flow 2:
Average throughput: 40.57 Mbit/s
95th percentile per-packet one-way delay: 68.097 ms
Loss rate: 12.06%
-- Flow 3:
Average throughput: 37.02 Mbit/s
95th percentile per-packet one-way delay: 67.275 ms
Loss rate: 12.29%
```
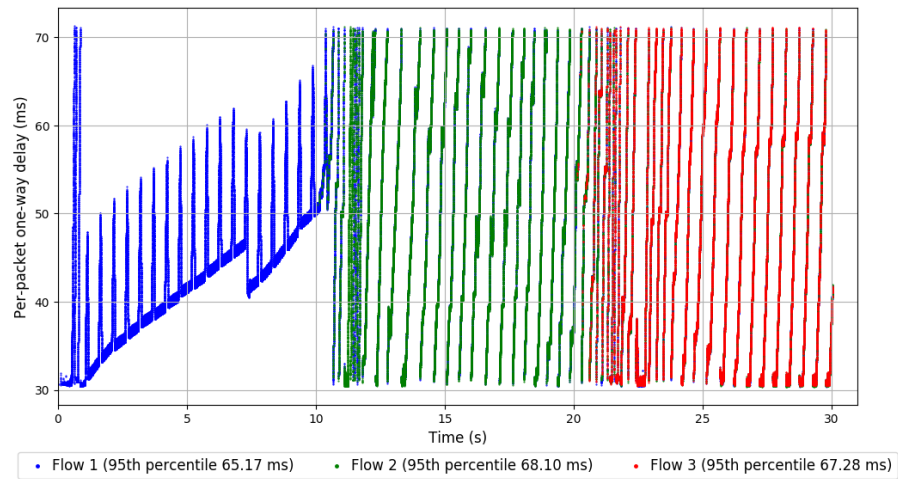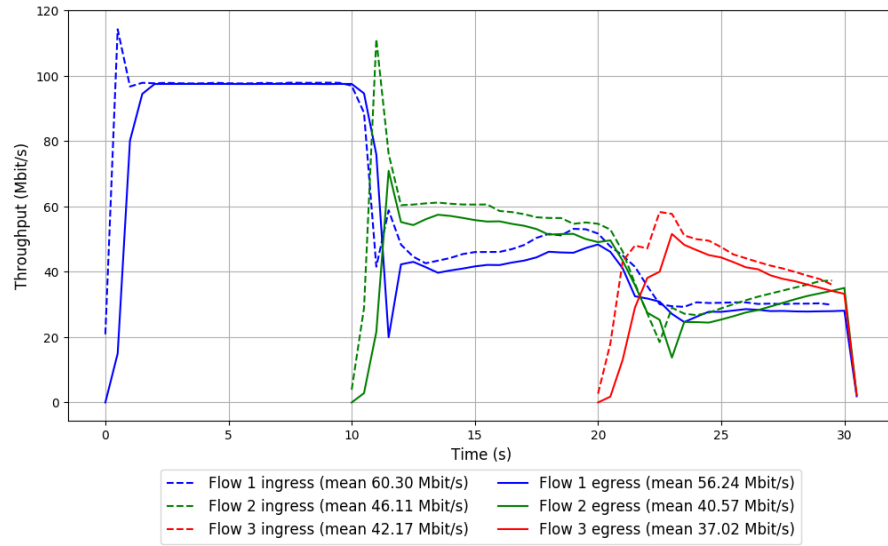
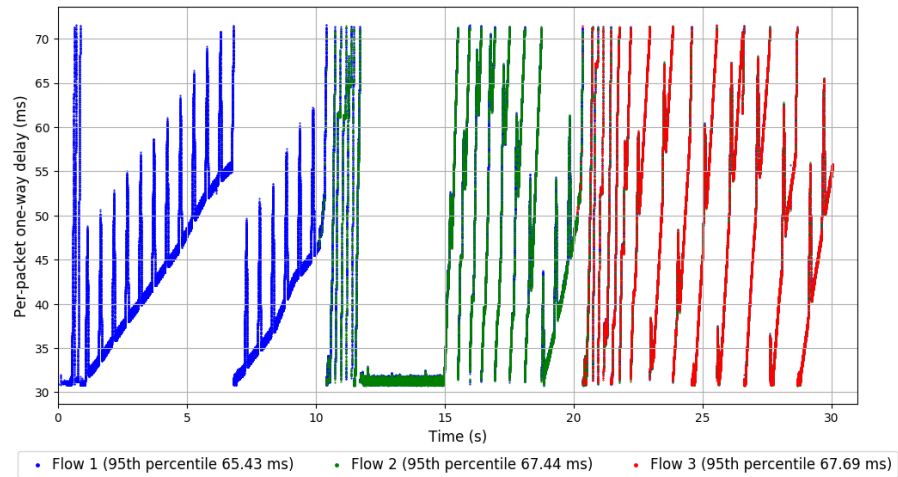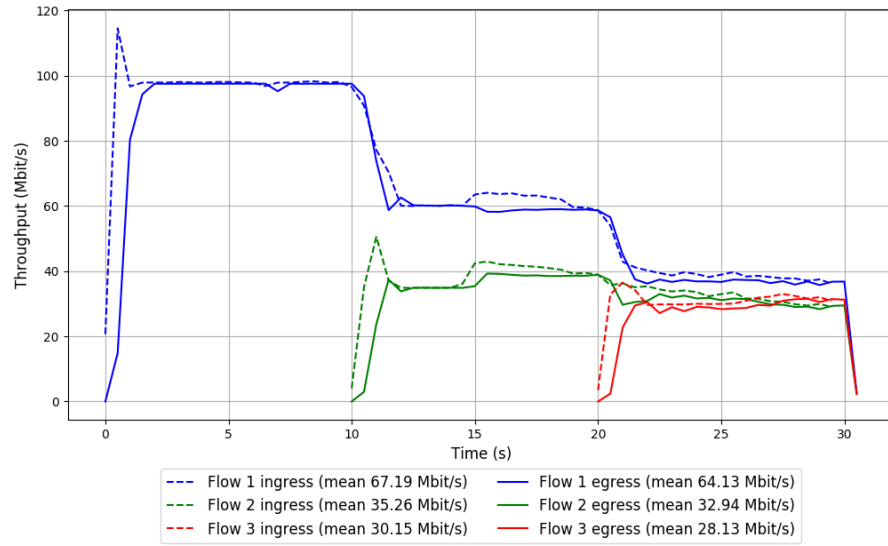Run 2: Report of TCP BBR — Data Link

```
Run 3: Statistics of TCP BBR

Start at: 2018-09-05 21:37:23
End at: 2018-09-05 21:37:53
Local clock offset: 4.041 ms
Remote clock offset: -0.209 ms


# Below is generated by plot.py at 2018-09-05 21:42:16
# Datalink statistics
-- Total of 3 flows:
Average throughput: 95.41 Mbit/s
95th percentile per-packet one-way delay: 66.522 ms
Loss rate: 5.17%
-- Flow 1:
Average throughput: 64.13 Mbit/s
95th percentile per-packet one-way delay: 65.430 ms
Loss rate: 4.47%
-- Flow 2:
Average throughput: 32.94 Mbit/s
95th percentile per-packet one-way delay: 67.440 ms
Loss rate: 6.54%
-- Flow 3:
Average throughput: 28.13 Mbit/s
95th percentile per-packet one-way delay: 67.688 ms
Loss rate: 6.64%
```

Run 3: Report of TCP BBR — Data Link

```
Run 1: Statistics of TCP Cubic

Start at: 2018-09-05 21:27:42
End at: 2018-09-05 21:28:12
Local clock offset: 3.914 ms
Remote clock offset: -0.271 ms


# Below is generated by plot.py at 2018-09-05 21:42:16
# Datalink statistics
-- Total of 3 flows:
Average throughput: 94.27 Mbit/s
95th percentile per-packet one-way delay: 67.417 ms
Loss rate: 0.48%
-- Flow 1:
Average throughput: 74.23 Mbit/s
95th percentile per-packet one-way delay: 67.302 ms
Loss rate: 0.54%
-- Flow 2:
Average throughput: 18.38 Mbit/s
95th percentile per-packet one-way delay: 67.113 ms
Loss rate: 0.33%
-- Flow 3:
Average throughput: 23.45 Mbit/s
95th percentile per-packet one-way delay: 68.388 ms
Loss rate: 0.13%
```
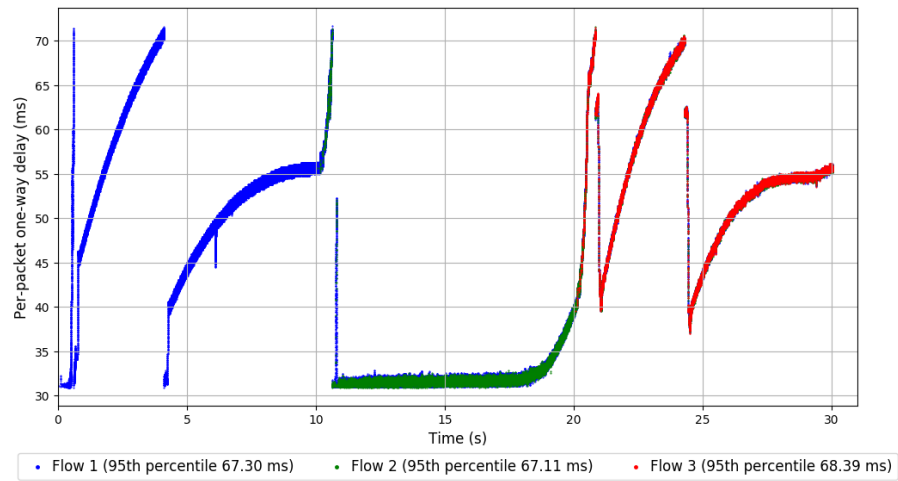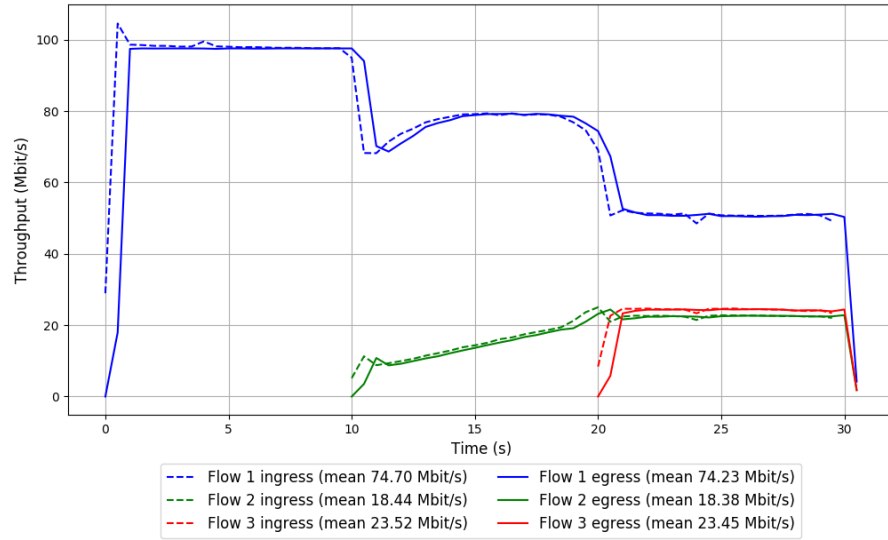
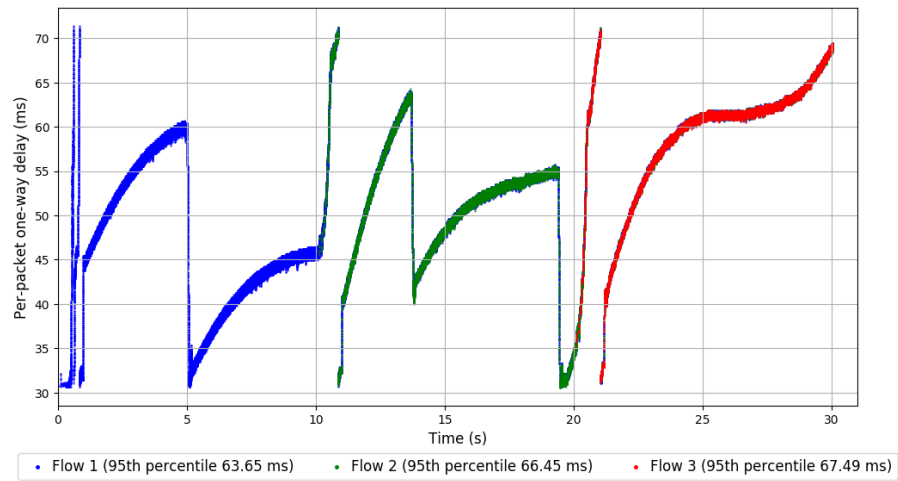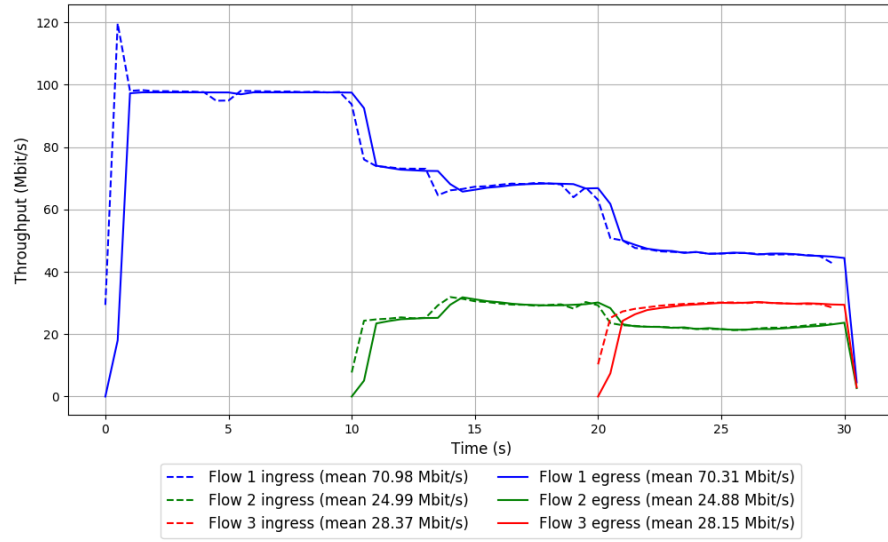Run 1: Report of TCP Cubic — Data Link

```
Run 2: Statistics of TCP Cubic

Start at: 2018-09-05 21:33:15
End at: 2018-09-05 21:33:45
Local clock offset: 4.329 ms
Remote clock offset: -0.276 ms


# Below is generated by plot.py at 2018-09-05 21:42:16
# Datalink statistics
-- Total of 3 flows:
Average throughput: 96.26 Mbit/s
95th percentile per-packet one-way delay: 65.199 ms
Loss rate: 0.70%
-- Flow 1:
Average throughput: 70.31 Mbit/s
95th percentile per-packet one-way delay: 63.652 ms
Loss rate: 0.82%
-- Flow 2:
Average throughput: 24.88 Mbit/s
95th percentile per-packet one-way delay: 66.454 ms
Loss rate: 0.34%
-- Flow 3:
Average throughput: 28.15 Mbit/s
95th percentile per-packet one-way delay: 67.492 ms
Loss rate: 0.43%
```

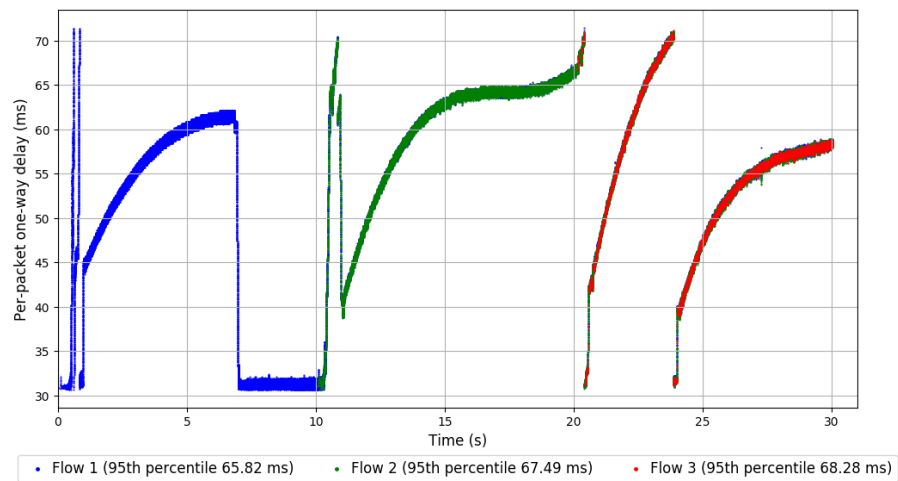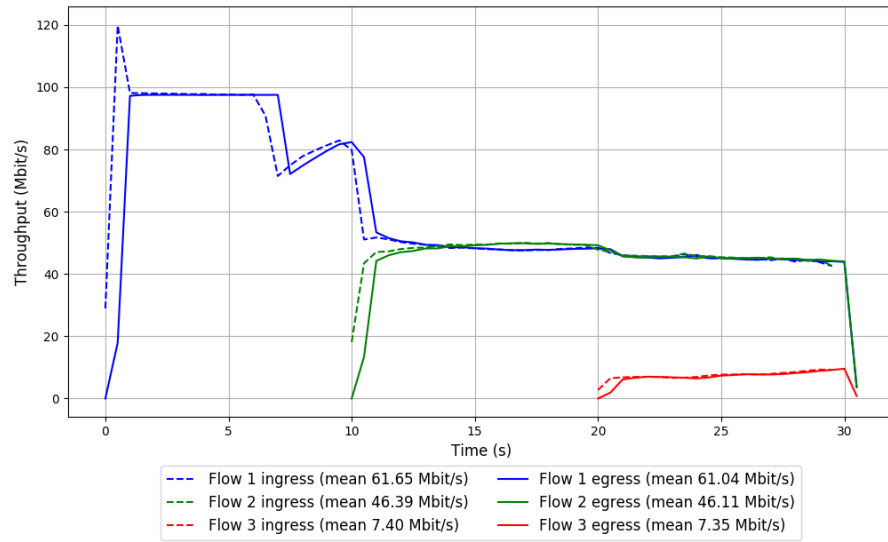Run 2: Report of TCP Cubic — Data Link

```
Run 3: Statistics of TCP Cubic

Start at: 2018-09-05 21:38:46
End at: 2018-09-05 21:39:16
Local clock offset: 4.181 ms
Remote clock offset: -0.207 ms


# Below is generated by plot.py at 2018-09-05 21:42:16
# Datalink statistics
-- Total of 3 flows:
Average throughput: 94.23 Mbit/s
95th percentile per-packet one-way delay: 66.533 ms
Loss rate: 0.75%
-- Flow 1:
Average throughput: 61.04 Mbit/s
95th percentile per-packet one-way delay: 65.820 ms
Loss rate: 0.89%
-- Flow 2:
Average throughput: 46.11 Mbit/s
95th percentile per-packet one-way delay: 67.494 ms
Loss rate: 0.46%
-- Flow 3:
Average throughput: 7.35 Mbit/s
95th percentile per-packet one-way delay: 68.276 ms
Loss rate: 0.75%
```

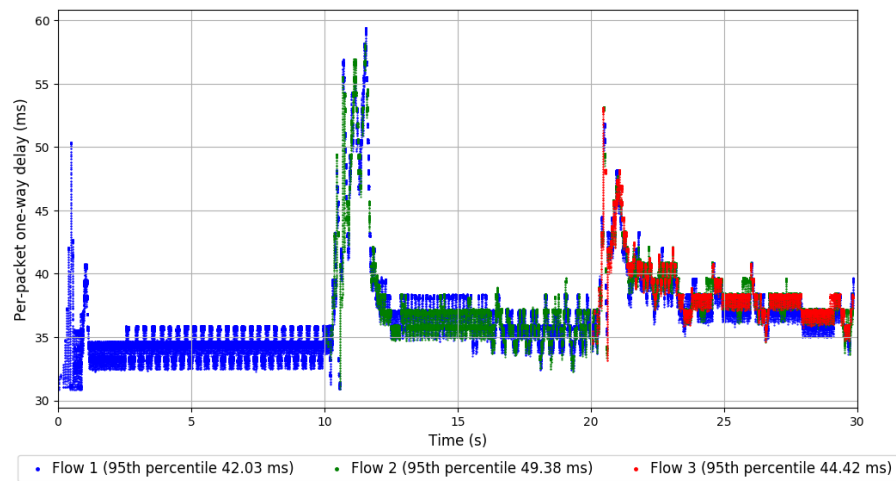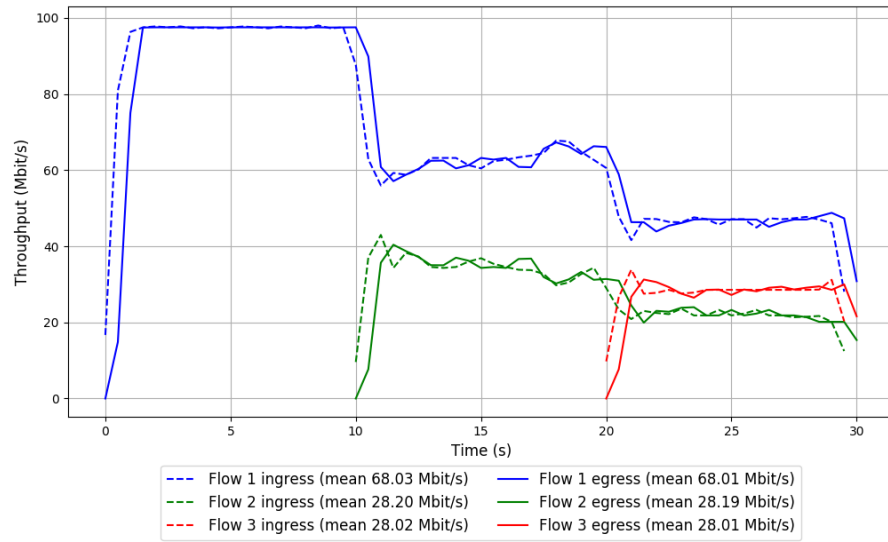Run 3: Report of TCP Cubic — Data Link

```
Run 1: Statistics of Indigo

Start at: 2018-09-05 21:29:05
End at: 2018-09-05 21:29:35
Local clock offset: 4.371 ms
Remote clock offset: -0.215 ms


# Below is generated by plot.py at 2018-09-05 21:42:16
# Datalink statistics
-- Total of 3 flows:
Average throughput: 95.84 Mbit/s
95th percentile per-packet one-way delay: 44.240 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 68.01 Mbit/s
95th percentile per-packet one-way delay: 42.029 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 28.19 Mbit/s
95th percentile per-packet one-way delay: 49.380 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 28.01 Mbit/s
95th percentile per-packet one-way delay: 44.421 ms
Loss rate: 0.00%
```
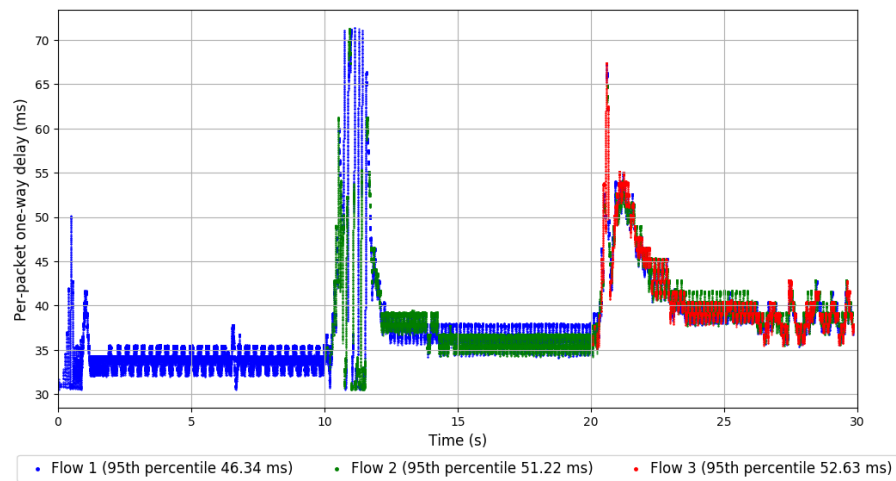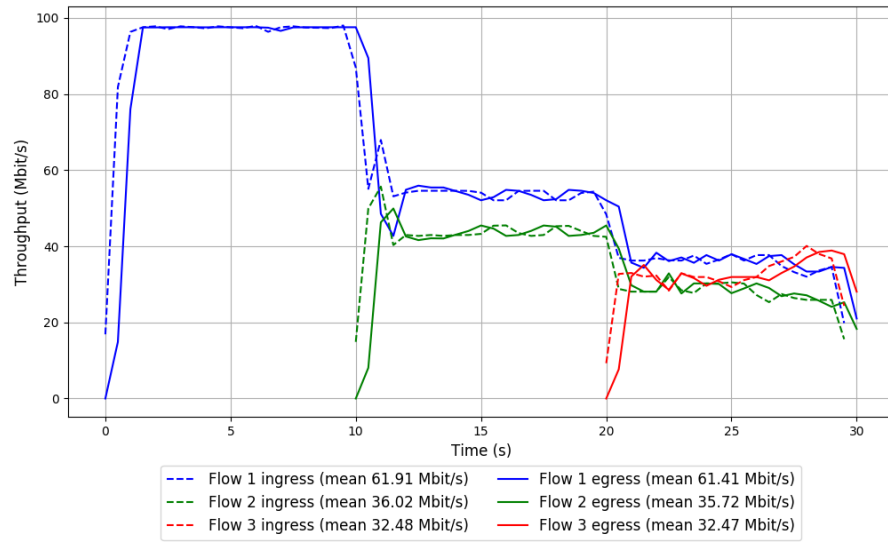
Run 1: Report of Indigo — Data Link

```
Run 2: Statistics of Indigo

Start at: 2018-09-05 21:34:37
End at: 2018-09-05 21:35:07
Local clock offset: 4.253 ms
Remote clock offset: -0.288 ms


# Below is generated by plot.py at 2018-09-05 21:42:16
# Datalink statistics
-- Total of 3 flows:
Average throughput: 95.73 Mbit/s
95th percentile per-packet one-way delay: 49.842 ms
Loss rate: 0.70%
-- Flow 1:
Average throughput: 61.41 Mbit/s
95th percentile per-packet one-way delay: 46.339 ms
Loss rate: 0.79%
-- Flow 2:
Average throughput: 35.72 Mbit/s
95th percentile per-packet one-way delay: 51.216 ms
Loss rate: 0.79%
-- Flow 3:
Average throughput: 32.47 Mbit/s
95th percentile per-packet one-way delay: 52.628 ms
Loss rate: 0.00%
```
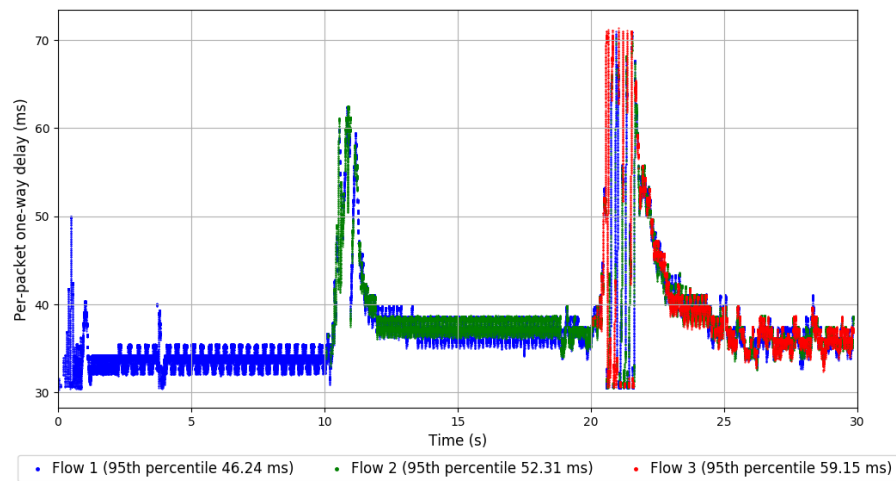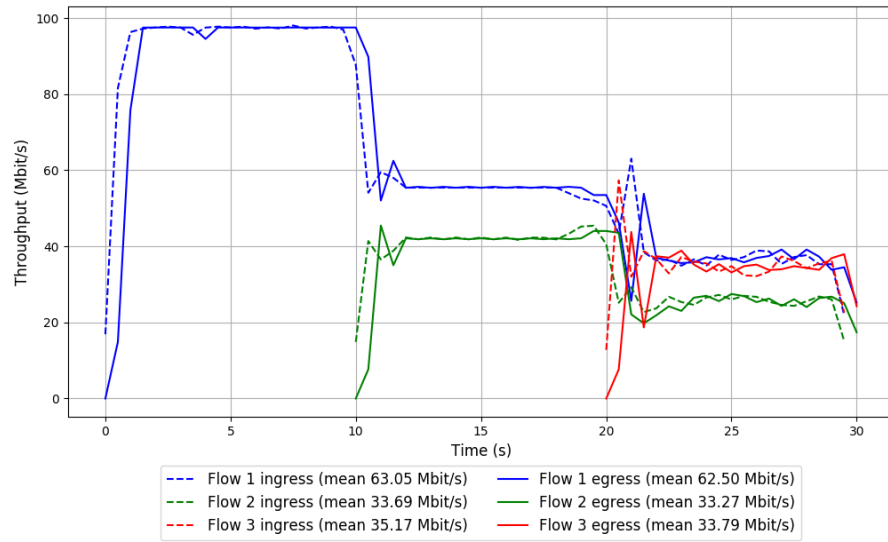
Run 2: Report of Indigo — Data Link

```
Run 3: Statistics of Indigo

Start at: 2018-09-05 21:40:09
End at: 2018-09-05 21:40:39
Local clock offset: 4.264 ms
Remote clock offset: -0.424 ms


# Below is generated by plot.py at 2018-09-05 21:42:47
# Datalink statistics
-- Total of 3 flows:
Average throughput: 95.62 Mbit/s
95th percentile per-packet one-way delay: 51.151 ms
Loss rate: 1.30%
-- Flow 1:
Average throughput: 62.50 Mbit/s
95th percentile per-packet one-way delay: 46.238 ms
Loss rate: 0.84%
-- Flow 2:
Average throughput: 33.27 Mbit/s
95th percentile per-packet one-way delay: 52.312 ms
Loss rate: 1.22%
-- Flow 3:
Average throughput: 33.79 Mbit/s
95th percentile per-packet one-way delay: 59.151 ms
Loss rate: 3.92%
```

Run 3: Report of Indigo — Data Link

Flow 1 ingress (mean 63.05 Mbit/s)   Flow 1 egress (mean 62.50 Mbit/s)
Flow 2 ingress (mean 33.69 Mbit/s)   Flow 2 egress (mean 33.27 Mbit/s)
Flow 3 ingress (mean 35.17 Mbit/s)   Flow 3 egress (mean 33.79 Mbit/s)

Flow 1 (95th percentile 46.24 ms)   Flow 2 (95th percentile 52.31 ms)   Flow 3 (95th percentile 59.15 ms)
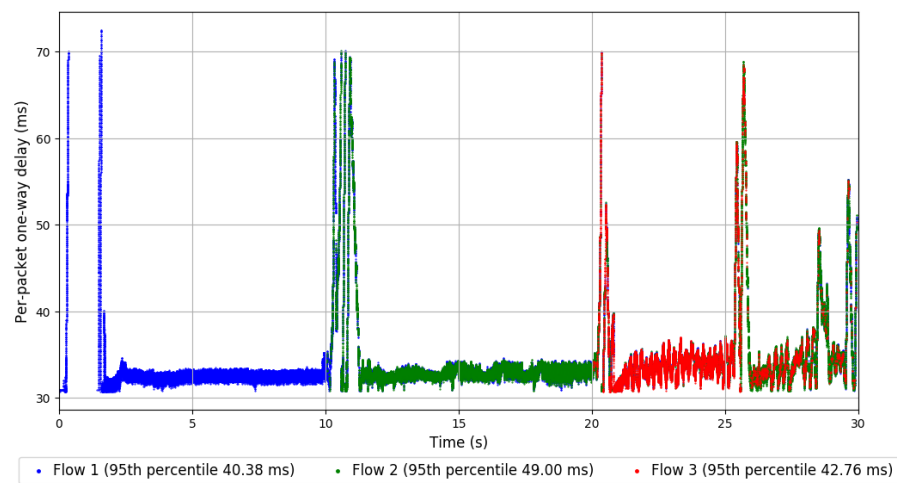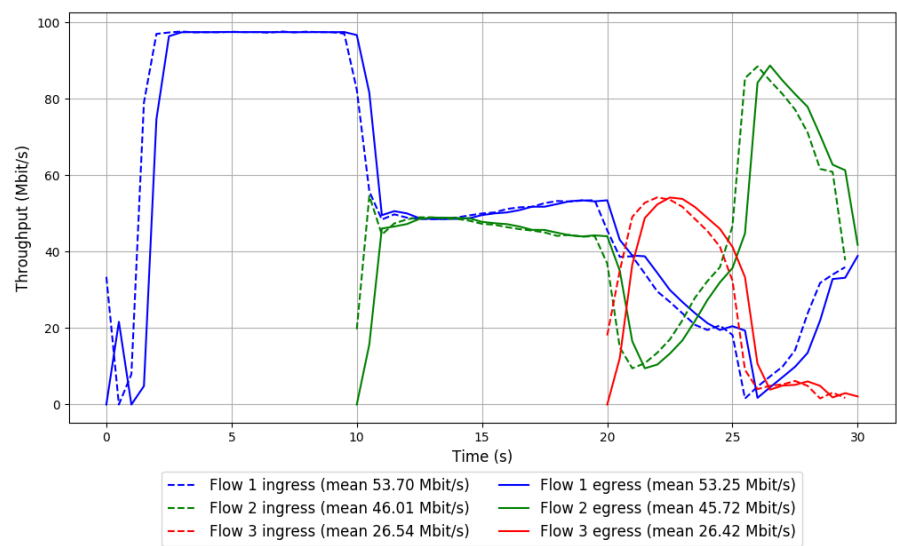
```
Run 1: Statistics of Muses-25

Start at: 2018-09-05 21:24:57
End at: 2018-09-05 21:25:27
Local clock offset: 3.423 ms
Remote clock offset: -0.329 ms


# Below is generated by plot.py at 2018-09-05 21:42:47
# Datalink statistics
-- Total of 3 flows:
Average throughput: 92.37 Mbit/s
95th percentile per-packet one-way delay: 44.490 ms
Loss rate: 0.66%
-- Flow 1:
Average throughput: 53.25 Mbit/s
95th percentile per-packet one-way delay: 40.375 ms
Loss rate: 0.78%
-- Flow 2:
Average throughput: 45.72 Mbit/s
95th percentile per-packet one-way delay: 49.002 ms
Loss rate: 0.55%
-- Flow 3:
Average throughput: 26.42 Mbit/s
95th percentile per-packet one-way delay: 42.764 ms
Loss rate: 0.27%
```

Run 1: Report of Muses-25 — Data Link

```
Run 2: Statistics of Muses-25

Start at: 2018-09-05 21:30:29
End at: 2018-09-05 21:30:59
Local clock offset: 4.688 ms
Remote clock offset: -0.44 ms


# Below is generated by plot.py at 2018-09-05 21:42:48
# Datalink statistics
-- Total of 3 flows:
Average throughput: 92.58 Mbit/s
95th percentile per-packet one-way delay: 47.579 ms
Loss rate: 0.71%
-- Flow 1:
Average throughput: 57.77 Mbit/s
95th percentile per-packet one-way delay: 43.922 ms
Loss rate: 1.07%
-- Flow 2:
Average throughput: 33.09 Mbit/s
95th percentile per-packet one-way delay: 50.666 ms
Loss rate: 0.15%
-- Flow 3:
Average throughput: 38.99 Mbit/s
95th percentile per-packet one-way delay: 51.435 ms
Loss rate: 0.00%
```
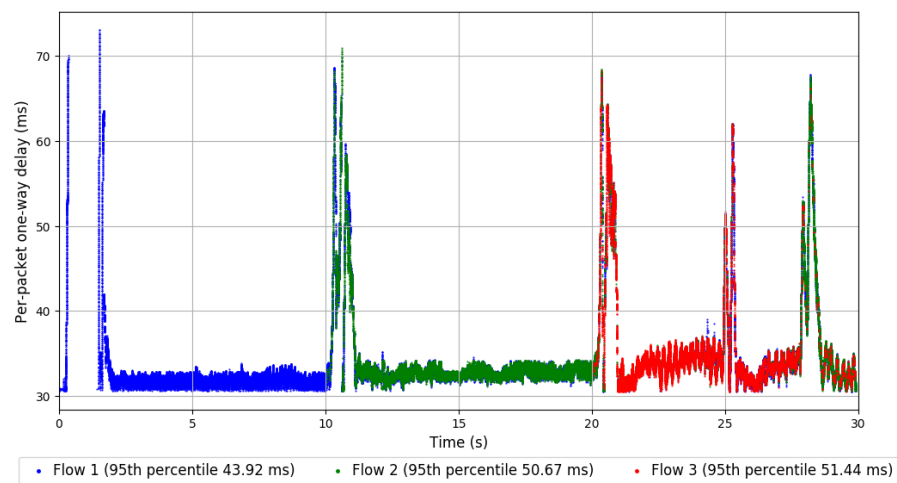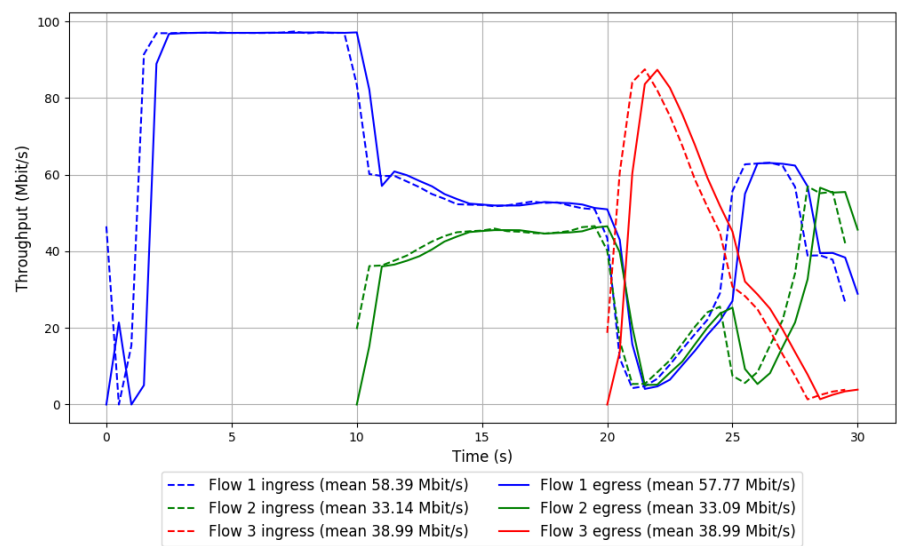
Run 2: Report of Muses-25 — Data Link

```
Run 3: Statistics of Muses-25

Start at: 2018-09-05 21:36:01
End at: 2018-09-05 21:36:31
Local clock offset: 4.161 ms
Remote clock offset: -0.162 ms

# Below is generated by plot.py at 2018-09-05 21:42:48
# Datalink statistics
-- Total of 3 flows:
Average throughput: 88.43 Mbit/s
95th percentile per-packet one-way delay: 43.415 ms
Loss rate: 1.08%
-- Flow 1:
Average throughput: 50.46 Mbit/s
95th percentile per-packet one-way delay: 41.649 ms
Loss rate: 1.24%
-- Flow 2:
Average throughput: 44.49 Mbit/s
95th percentile per-packet one-way delay: 45.926 ms
Loss rate: 0.98%
-- Flow 3:
Average throughput: 25.49 Mbit/s
95th percentile per-packet one-way delay: 40.567 ms
Loss rate: 0.47%
```

Run 3: Report of Muses-25 — Data Link