

## Pantheon Report

Generated at 2018-09-05 07:45:45 (UTC).  
Data path: GCE Iowa on `ens4` (*remote*) → GCE London on `ens4` (*local*).  
Repeated the test of 4 congestion control schemes twice.  
Each test lasted for 30 seconds running 3 flows with 10-second interval between two flows.

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

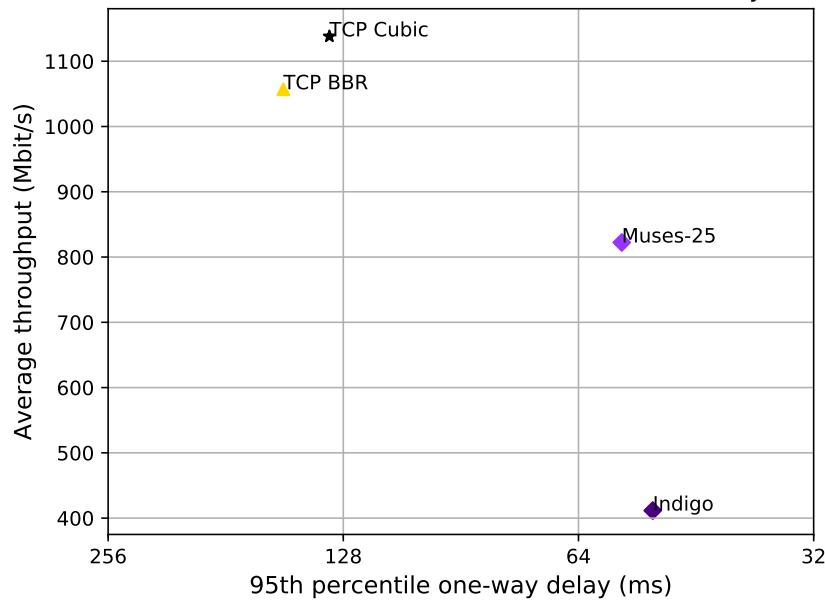
System info:

```
Linux 4.15.0-1018-gcp
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
```

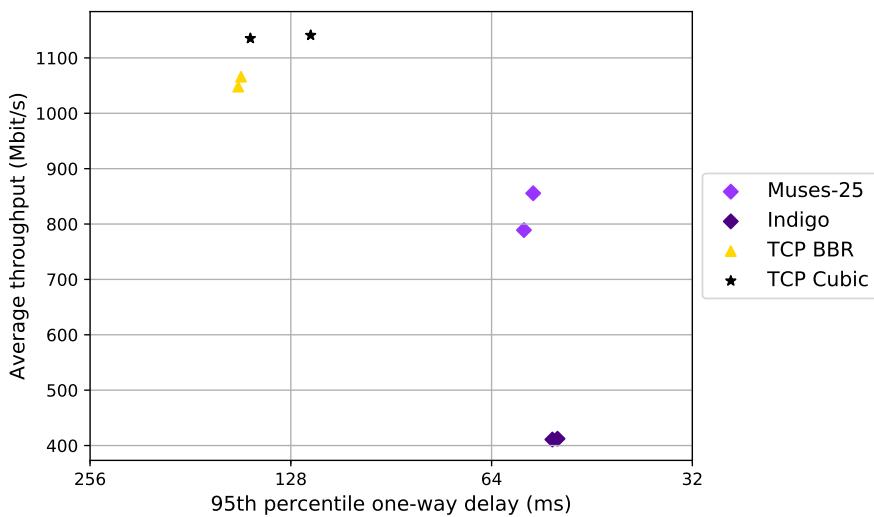
Git summary:

```
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 GCE Iowa to GCE London, 2 runs of 30s each per scheme  
3 flows with 10s interval between flows (mean of all runs by scheme)



test from GCE Iowa to GCE London, 2 runs of 30s each per scheme  
3 flows with 10s interval between flows



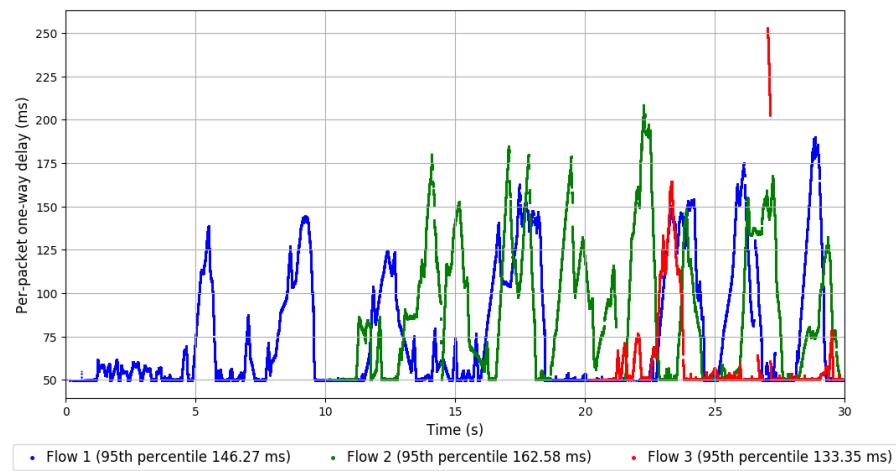
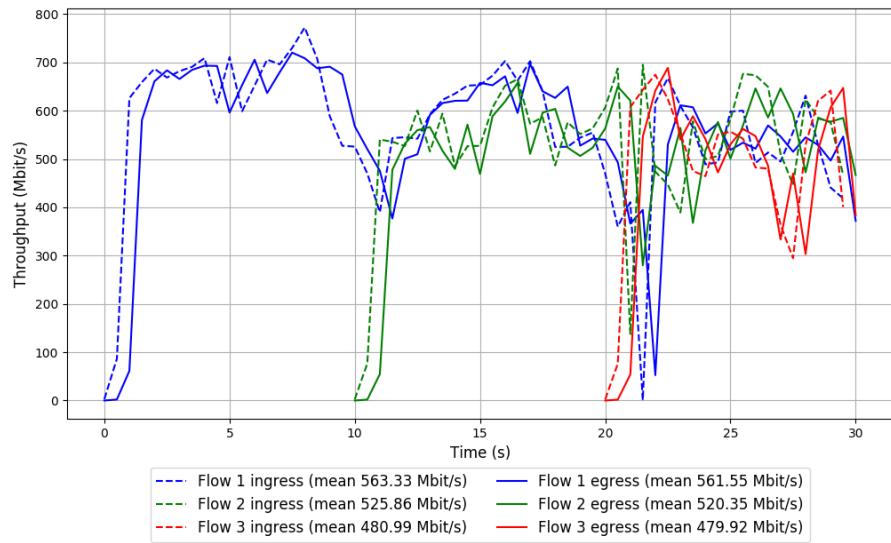
scheme	# runs	mean avg tput (Mbit/s)			mean 95th-%ile delay (ms)			mean loss rate (%)		
		flow 1	flow 2	flow 3	flow 1	flow 2	flow 3	flow 1	flow 2	flow 3
TCP BBR	2	555.67	519.44	472.49	151.42	155.51	136.05	0.96	1.31	1.61
TCP Cubic	2	598.43	562.95	499.93	130.21	135.50	85.26	0.42	0.64	1.26
Indigo	2	216.16	206.32	180.69	51.41	50.44	52.18	0.37	0.56	1.21
Muses-25	2	437.35	391.21	382.05	56.91	56.76	52.63	0.38	0.40	1.21

Run 1: Statistics of TCP BBR

```
Start at: 2018-09-05 07:13:15
End at: 2018-09-05 07:13:45
Local clock offset: -0.492 ms
Remote clock offset: -0.045 ms

# Below is generated by plot.py at 2018-09-05 07:45:22
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1065.97 Mbit/s
95th percentile per-packet one-way delay: 151.989 ms
Loss rate: 1.04%
-- Flow 1:
Average throughput: 561.55 Mbit/s
95th percentile per-packet one-way delay: 146.273 ms
Loss rate: 0.65%
-- Flow 2:
Average throughput: 520.35 Mbit/s
95th percentile per-packet one-way delay: 162.578 ms
Loss rate: 1.55%
-- Flow 3:
Average throughput: 479.92 Mbit/s
95th percentile per-packet one-way delay: 133.346 ms
Loss rate: 1.25%
```

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

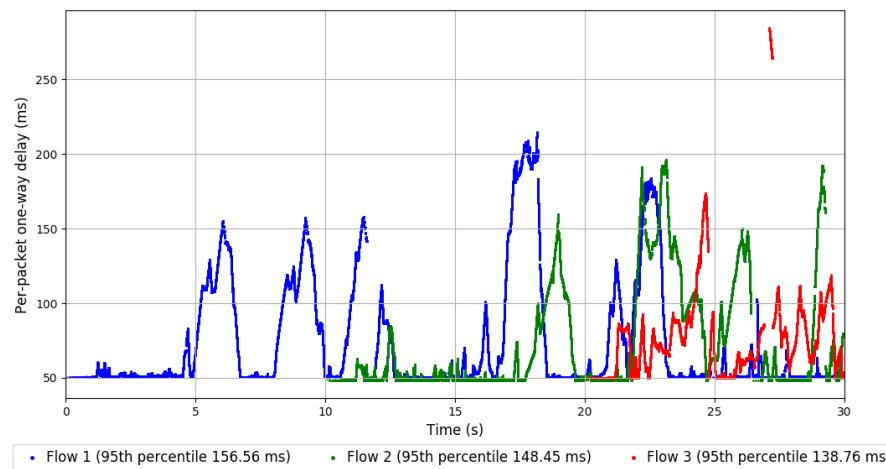
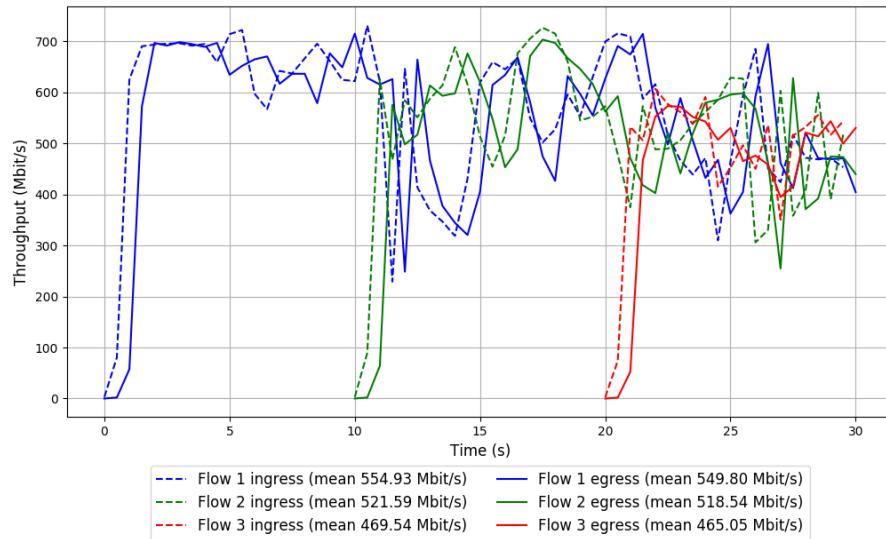


Run 2: Statistics of TCP BBR

```
Start at: 2018-09-05 07:21:07
End at: 2018-09-05 07:21:37
Local clock offset: -0.596 ms
Remote clock offset: -0.019 ms

# Below is generated by plot.py at 2018-09-05 07:45:22
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1048.14 Mbit/s
95th percentile per-packet one-way delay: 153.489 ms
Loss rate: 1.31%
-- Flow 1:
Average throughput: 549.80 Mbit/s
95th percentile per-packet one-way delay: 156.560 ms
Loss rate: 1.26%
-- Flow 2:
Average throughput: 518.54 Mbit/s
95th percentile per-packet one-way delay: 148.446 ms
Loss rate: 1.08%
-- Flow 3:
Average throughput: 465.05 Mbit/s
95th percentile per-packet one-way delay: 138.758 ms
Loss rate: 1.97%
```

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

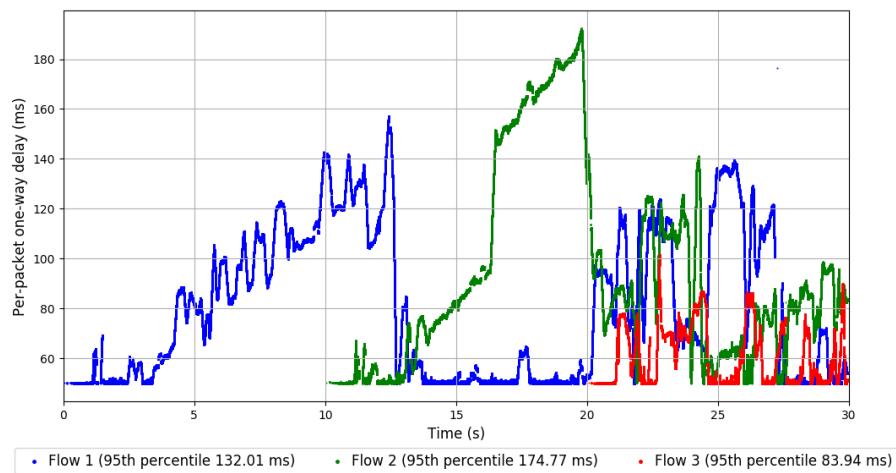
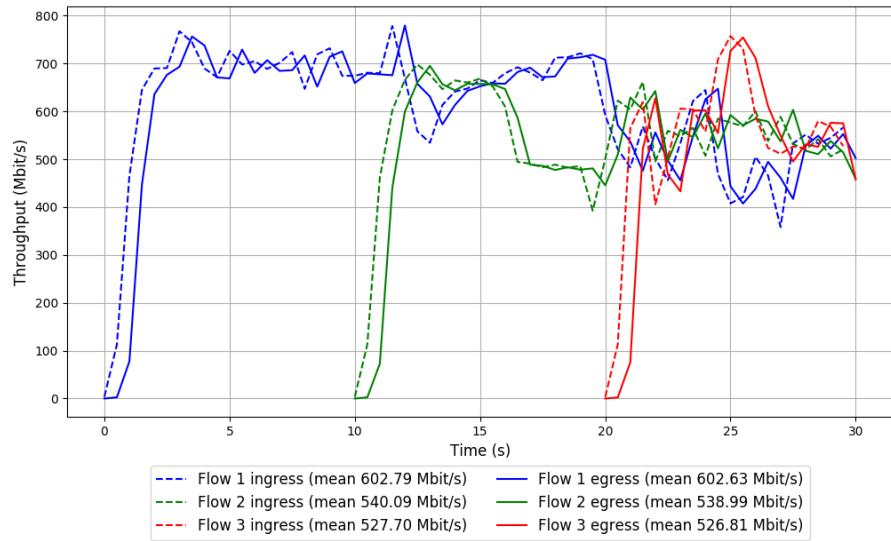


```
Run 1: Statistics of TCP Cubic
```

```
Start at: 2018-09-05 07:17:12
End at: 2018-09-05 07:17:42
Local clock offset: -0.983 ms
Remote clock offset: -0.024 ms

# Below is generated by plot.py at 2018-09-05 07:45:43
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1135.24 Mbit/s
95th percentile per-packet one-way delay: 147.185 ms
Loss rate: 0.60%
-- Flow 1:
Average throughput: 602.63 Mbit/s
95th percentile per-packet one-way delay: 132.009 ms
Loss rate: 0.37%
-- Flow 2:
Average throughput: 538.99 Mbit/s
95th percentile per-packet one-way delay: 174.768 ms
Loss rate: 0.71%
-- Flow 3:
Average throughput: 526.81 Mbit/s
95th percentile per-packet one-way delay: 83.939 ms
Loss rate: 1.17%
```

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

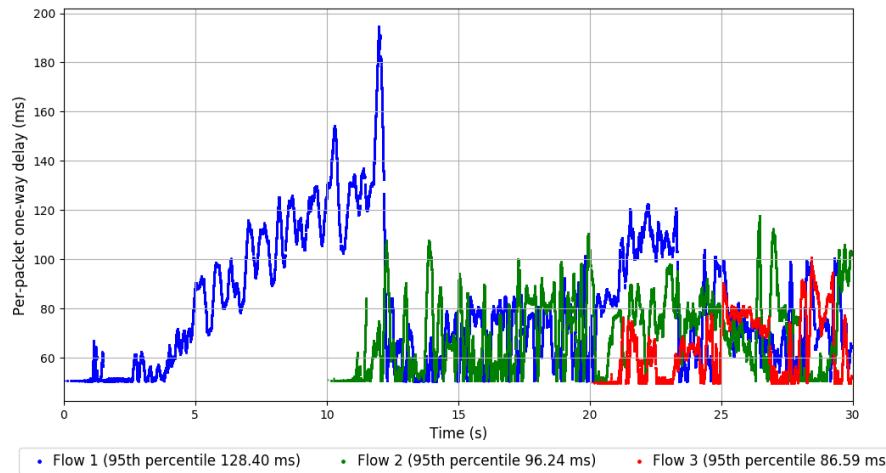
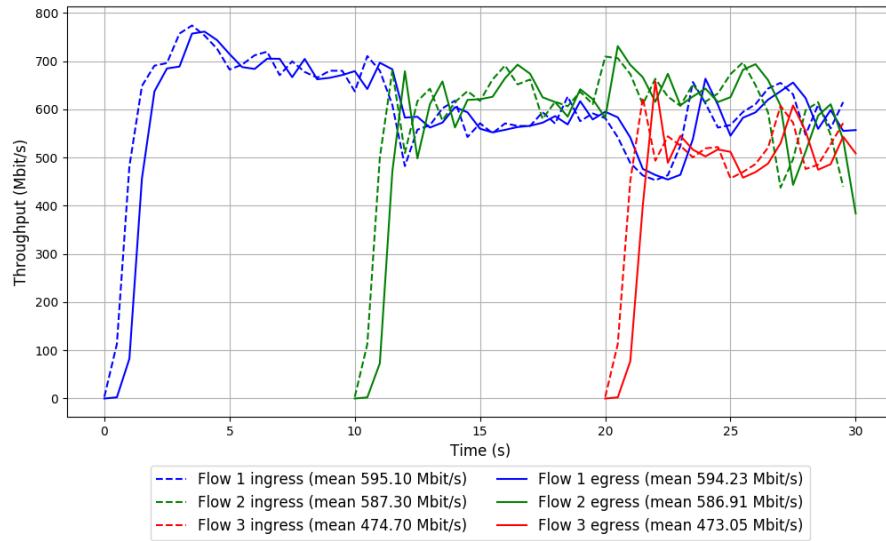


Run 2: Statistics of TCP Cubic

```
Start at: 2018-09-05 07:25:04
End at: 2018-09-05 07:25:34
Local clock offset: -0.249 ms
Remote clock offset: -0.014 ms

# Below is generated by plot.py at 2018-09-05 07:45:43
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1140.92 Mbit/s
95th percentile per-packet one-way delay: 119.531 ms
Loss rate: 0.63%
-- Flow 1:
Average throughput: 594.23 Mbit/s
95th percentile per-packet one-way delay: 128.404 ms
Loss rate: 0.48%
-- Flow 2:
Average throughput: 586.91 Mbit/s
95th percentile per-packet one-way delay: 96.242 ms
Loss rate: 0.57%
-- Flow 3:
Average throughput: 473.05 Mbit/s
95th percentile per-packet one-way delay: 86.586 ms
Loss rate: 1.35%
```

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

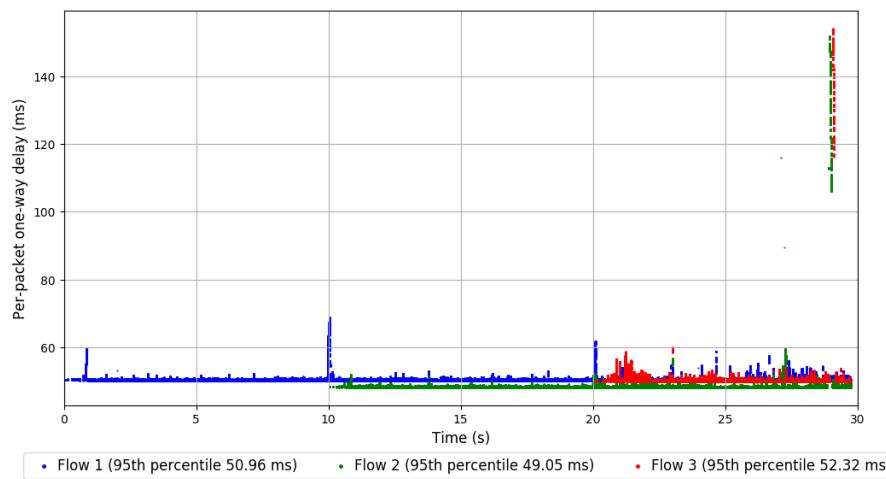
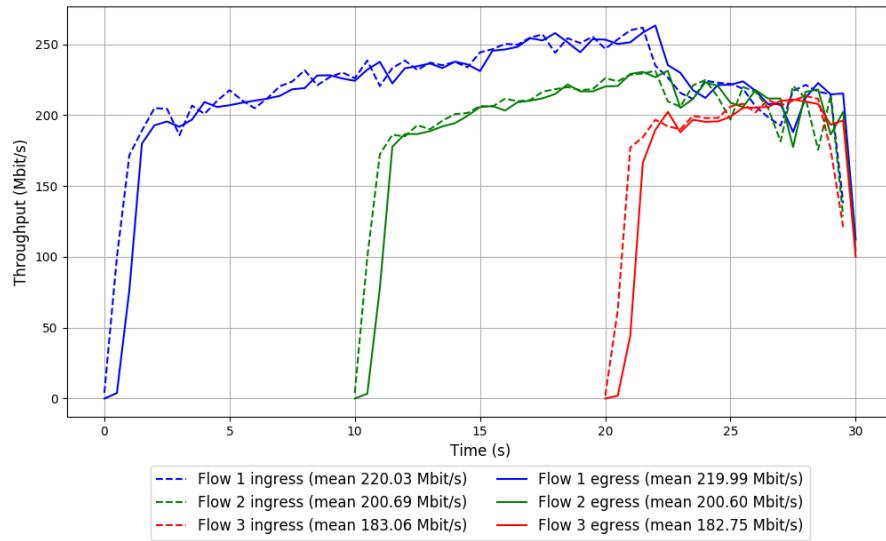


Run 1: Statistics of Indigo

```
Start at: 2018-09-05 07:15:24
End at: 2018-09-05 07:15:54
Local clock offset: -0.556 ms
Remote clock offset: -0.049 ms

# Below is generated by plot.py at 2018-09-05 07:45:43
# Datalink statistics
-- Total of 3 flows:
Average throughput: 412.30 Mbit/s
95th percentile per-packet one-way delay: 50.969 ms
Loss rate: 0.54%
-- Flow 1:
Average throughput: 219.99 Mbit/s
95th percentile per-packet one-way delay: 50.964 ms
Loss rate: 0.36%
-- Flow 2:
Average throughput: 200.60 Mbit/s
95th percentile per-packet one-way delay: 49.054 ms
Loss rate: 0.55%
-- Flow 3:
Average throughput: 182.75 Mbit/s
95th percentile per-packet one-way delay: 52.321 ms
Loss rate: 1.20%
```

## Run 1: Report of Indigo — Data Link

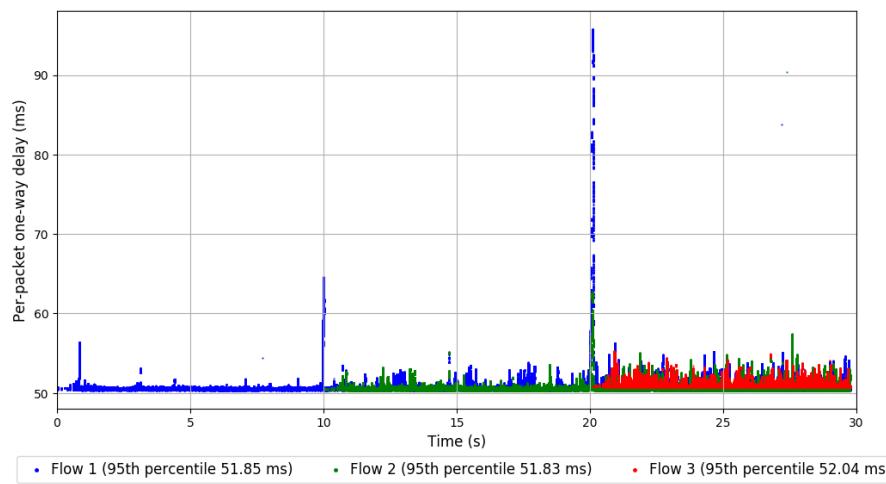
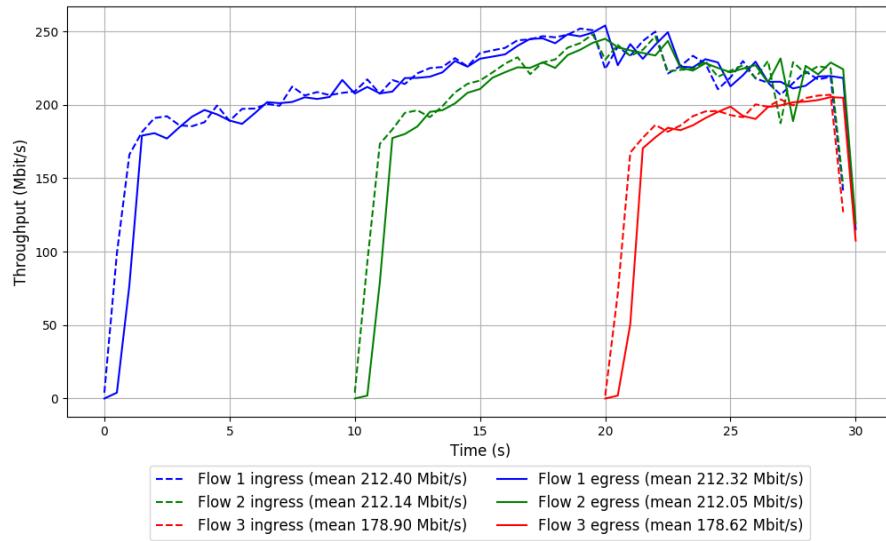


Run 2: Statistics of Indigo

```
Start at: 2018-09-05 07:23:16
End at: 2018-09-05 07:23:46
Local clock offset: -0.093 ms
Remote clock offset: -0.015 ms

# Below is generated by plot.py at 2018-09-05 07:45:43
# Datalink statistics
-- Total of 3 flows:
Average throughput: 410.87 Mbit/s
95th percentile per-packet one-way delay: 51.881 ms
Loss rate: 0.56%
-- Flow 1:
Average throughput: 212.32 Mbit/s
95th percentile per-packet one-way delay: 51.848 ms
Loss rate: 0.38%
-- Flow 2:
Average throughput: 212.05 Mbit/s
95th percentile per-packet one-way delay: 51.833 ms
Loss rate: 0.57%
-- Flow 3:
Average throughput: 178.62 Mbit/s
95th percentile per-packet one-way delay: 52.038 ms
Loss rate: 1.23%
```

Run 2: Report of Indigo — Data Link

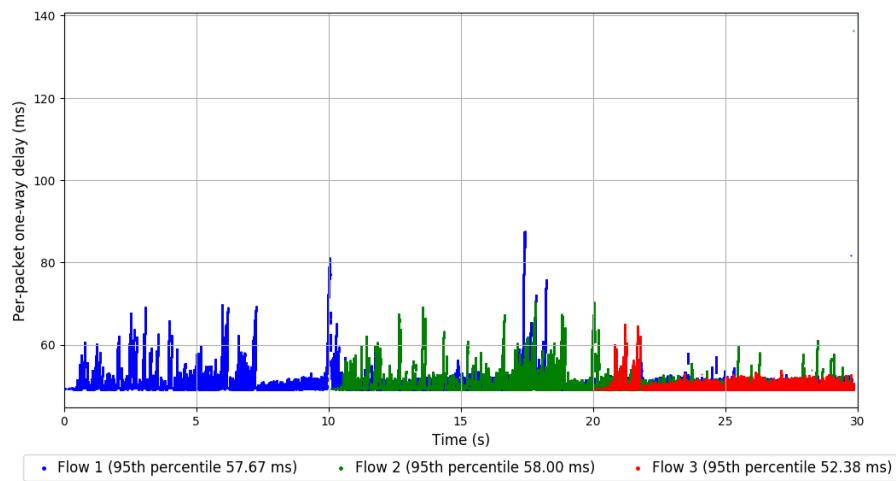
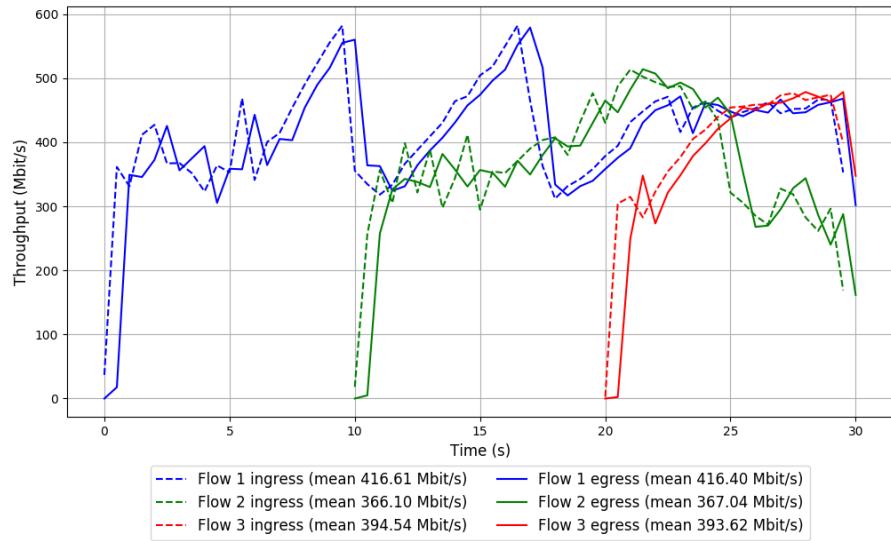


```
Run 1: Statistics of Muses-25
```

```
Start at: 2018-09-05 07:19:18
End at: 2018-09-05 07:19:48
Local clock offset: -0.688 ms
Remote clock offset: -0.065 ms

# Below is generated by plot.py at 2018-09-05 07:45:43
# Datalink statistics
-- Total of 3 flows:
Average throughput: 789.05 Mbit/s
95th percentile per-packet one-way delay: 57.238 ms
Loss rate: 0.49%
-- Flow 1:
Average throughput: 416.40 Mbit/s
95th percentile per-packet one-way delay: 57.671 ms
Loss rate: 0.39%
-- Flow 2:
Average throughput: 367.04 Mbit/s
95th percentile per-packet one-way delay: 58.001 ms
Loss rate: 0.26%
-- Flow 3:
Average throughput: 393.62 Mbit/s
95th percentile per-packet one-way delay: 52.382 ms
Loss rate: 1.25%
```

Run 1: Report of Muses-25 — Data Link



Run 2: Statistics of Muses-25

```
Start at: 2018-09-05 07:27:10
End at: 2018-09-05 07:27:40
Local clock offset: -0.642 ms
Remote clock offset: -0.024 ms

# Below is generated by plot.py at 2018-09-05 07:45:43
# Datalink statistics
-- Total of 3 flows:
Average throughput: 855.55 Mbit/s
95th percentile per-packet one-way delay: 55.436 ms
Loss rate: 0.53%
-- Flow 1:
Average throughput: 458.30 Mbit/s
95th percentile per-packet one-way delay: 56.156 ms
Loss rate: 0.36%
-- Flow 2:
Average throughput: 415.37 Mbit/s
95th percentile per-packet one-way delay: 55.512 ms
Loss rate: 0.53%
-- Flow 3:
Average throughput: 370.48 Mbit/s
95th percentile per-packet one-way delay: 52.882 ms
Loss rate: 1.17%
```

## Run 2: Report of Muses-25 — Data Link

