

## Pantheon Report

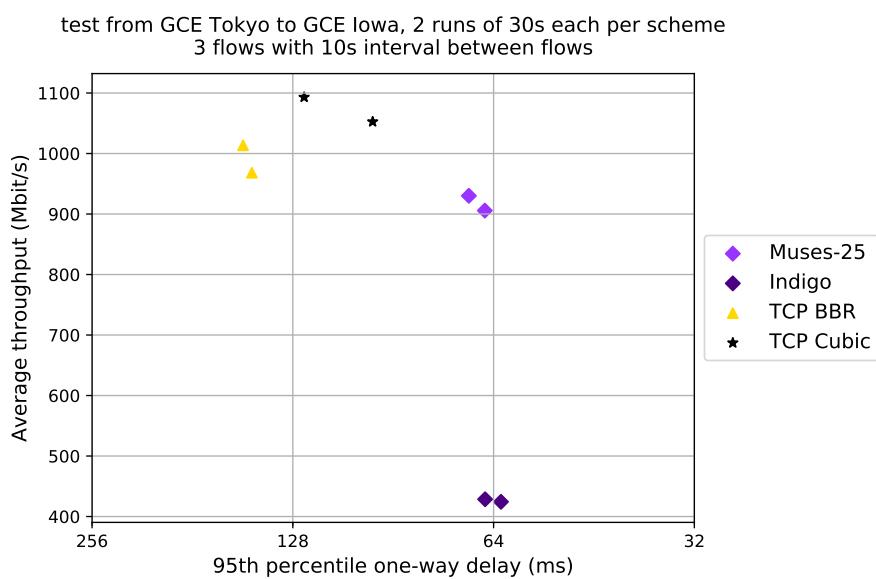
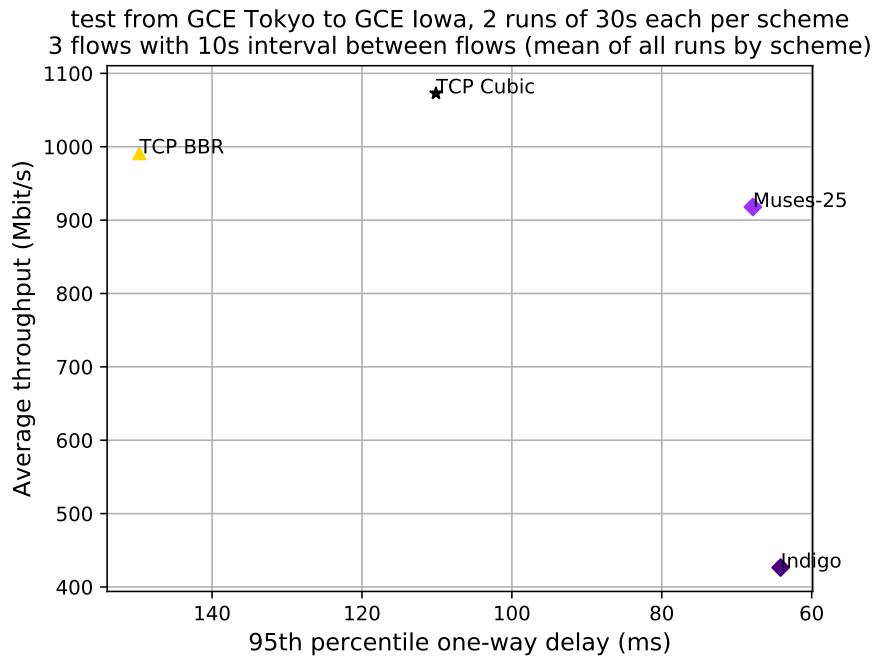
Generated at 2018-09-06 00:51:20 (UTC).  
Data path: GCE Tokyo on `ens4` (*remote*) → GCE Iowa on `ens4` (*local*).  
Repeated the test of 4 congestion control schemes twice.  
Each test lasted for 30 seconds running 3 flows with 10-second interval between two flows.  
NTP offsets were measured against `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 @ 18b9165265c8ba2915c862e8713fd9ad82c1ac21
third_party/fillp @ d47f4fa1b454a5e3c0537115c5a28436dbd4b834
third_party/fillp-sheep @ daed0c84f98531712514b2231f43ec6901114ffe
third_party/genericCC @ d0153f8e594aa89e93b032143cedbdf58e562f4
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
```



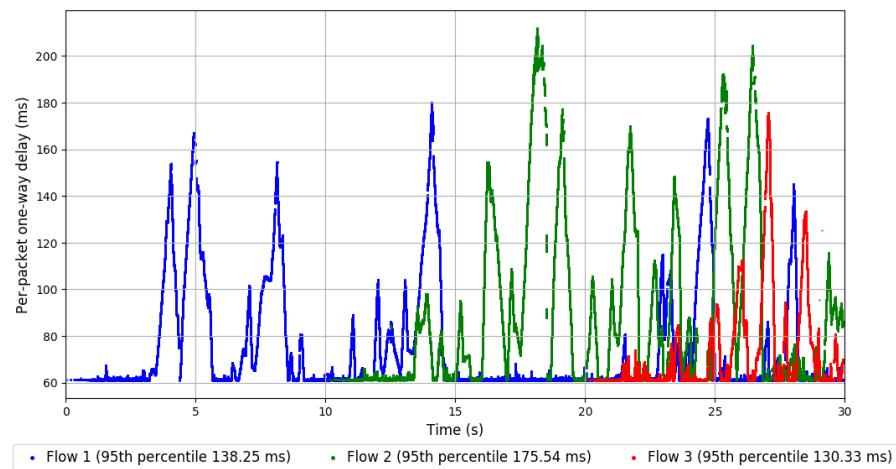
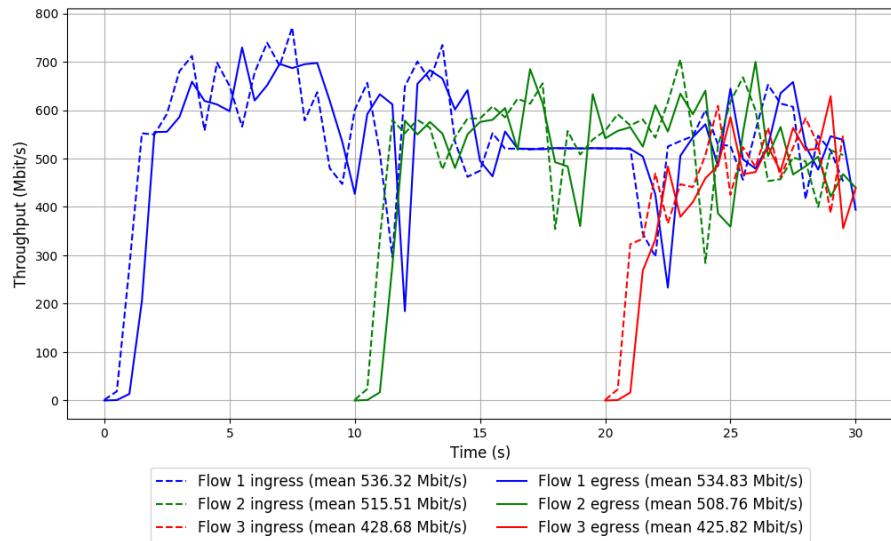
scheme	# runs	mean avg tput (Mbit/s)			mean 95th-%ile delay (ms)			mean loss rate (%)		
		flow 1	flow 2	flow 3	flow 1	flow 2	flow 3	flow 1	flow 2	flow 3
TCP BBR	2	514.37	498.09	440.95	149.30	138.81	130.79	1.10	1.30	2.17
TCP Cubic	2	564.57	529.05	474.93	99.17	105.24	104.27	0.47	0.69	1.75
Indigo	2	219.34	215.22	198.94	64.21	61.75	62.05	0.43	0.66	1.36
Muses-25	2	504.56	431.33	389.25	68.29	67.95	66.39	0.42	0.53	0.80

Run 1: Statistics of TCP BBR

```
Start at: 2018-09-06 00:24:10
End at: 2018-09-06 00:24:40
Local clock offset: 0.127 ms
Remote clock offset: 0.885 ms

# Below is generated by plot.py at 2018-09-06 00:51:06
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1013.53 Mbit/s
95th percentile per-packet one-way delay: 151.973 ms
Loss rate: 1.29%
-- Flow 1:
Average throughput: 534.83 Mbit/s
95th percentile per-packet one-way delay: 138.247 ms
Loss rate: 0.70%
-- Flow 2:
Average throughput: 508.76 Mbit/s
95th percentile per-packet one-way delay: 175.539 ms
Loss rate: 1.95%
-- Flow 3:
Average throughput: 425.82 Mbit/s
95th percentile per-packet one-way delay: 130.326 ms
Loss rate: 1.94%
```

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

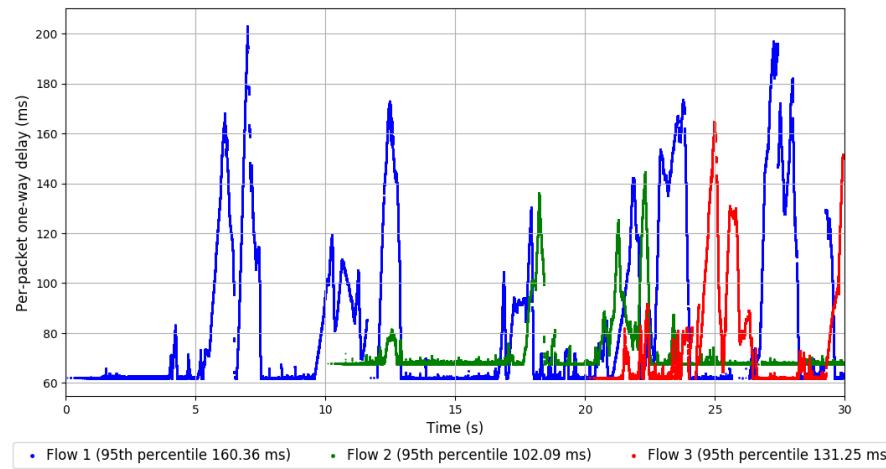
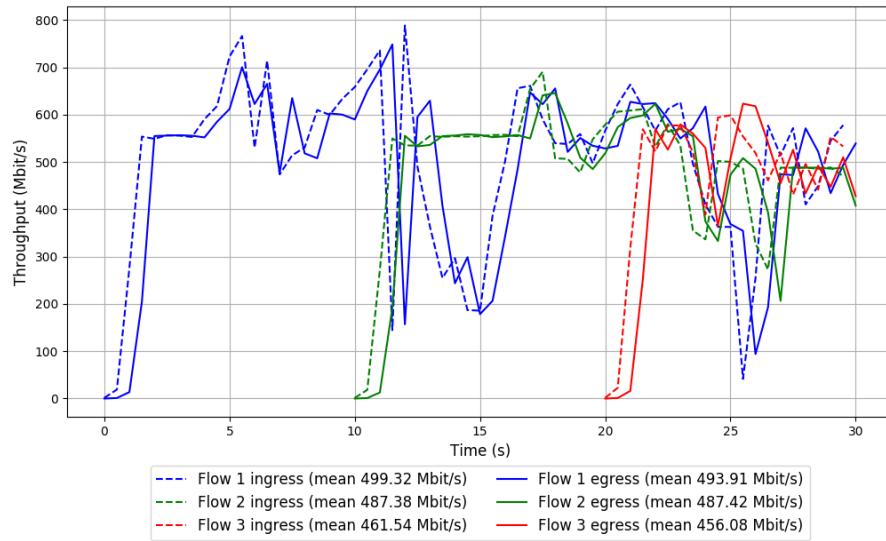


Run 2: Statistics of TCP BBR

```
Start at: 2018-09-06 00:32:12
End at: 2018-09-06 00:32:42
Local clock offset: 0.004 ms
Remote clock offset: -0.483 ms

# Below is generated by plot.py at 2018-09-06 00:51:06
# Datalink statistics
-- Total of 3 flows:
Average throughput: 968.25 Mbit/s
95th percentile per-packet one-way delay: 147.428 ms
Loss rate: 1.37%
-- Flow 1:
Average throughput: 493.91 Mbit/s
95th percentile per-packet one-way delay: 160.358 ms
Loss rate: 1.51%
-- Flow 2:
Average throughput: 487.42 Mbit/s
95th percentile per-packet one-way delay: 102.086 ms
Loss rate: 0.66%
-- Flow 3:
Average throughput: 456.08 Mbit/s
95th percentile per-packet one-way delay: 131.247 ms
Loss rate: 2.40%
```

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

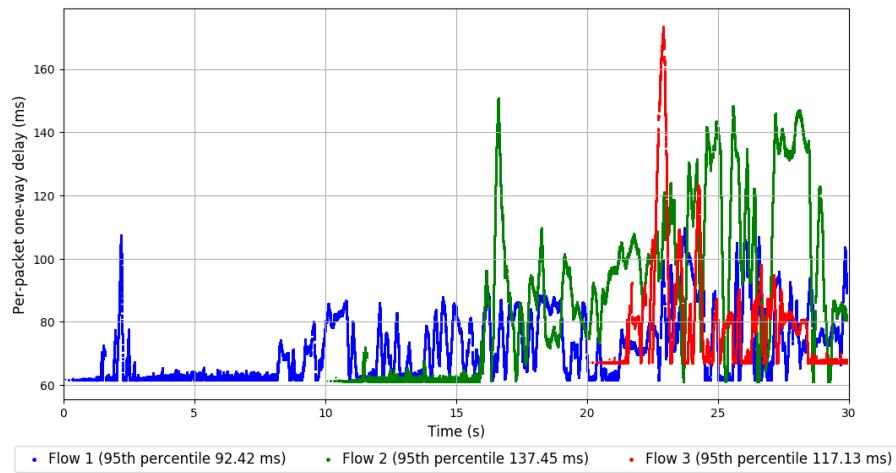
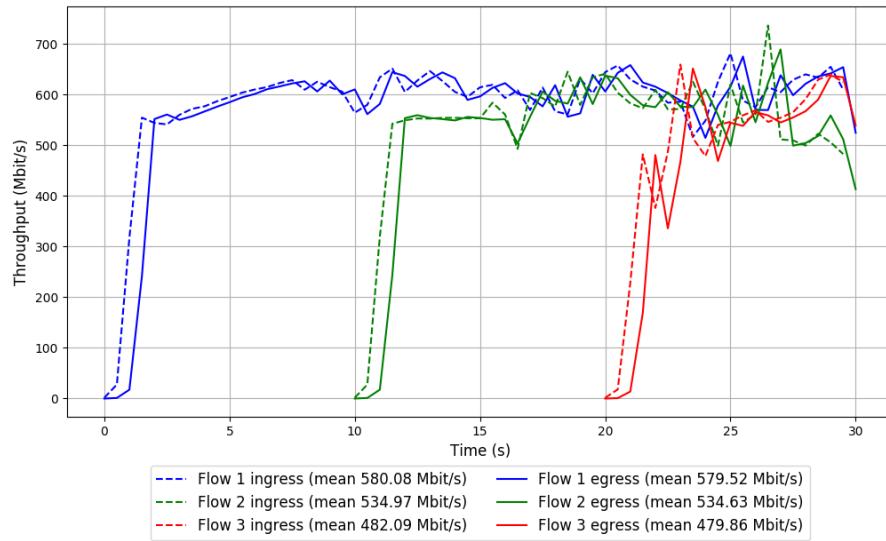


```
Run 1: Statistics of TCP Cubic
```

```
Start at: 2018-09-06 00:18:14
End at: 2018-09-06 00:18:44
Local clock offset: 0.357 ms
Remote clock offset: 0.698 ms

# Below is generated by plot.py at 2018-09-06 00:51:19
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1093.12 Mbit/s
95th percentile per-packet one-way delay: 123.102 ms
Loss rate: 0.77%
-- Flow 1:
Average throughput: 579.52 Mbit/s
95th percentile per-packet one-way delay: 92.417 ms
Loss rate: 0.53%
-- Flow 2:
Average throughput: 534.63 Mbit/s
95th percentile per-packet one-way delay: 137.454 ms
Loss rate: 0.70%
-- Flow 3:
Average throughput: 479.86 Mbit/s
95th percentile per-packet one-way delay: 117.133 ms
Loss rate: 1.80%
```

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

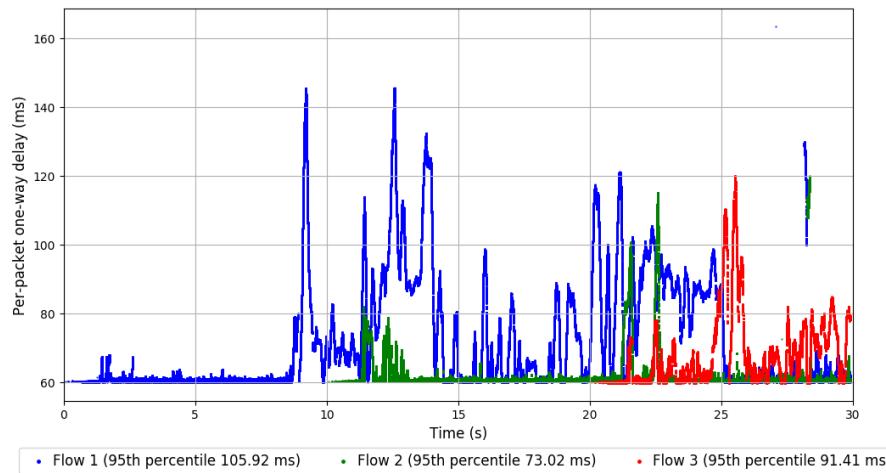
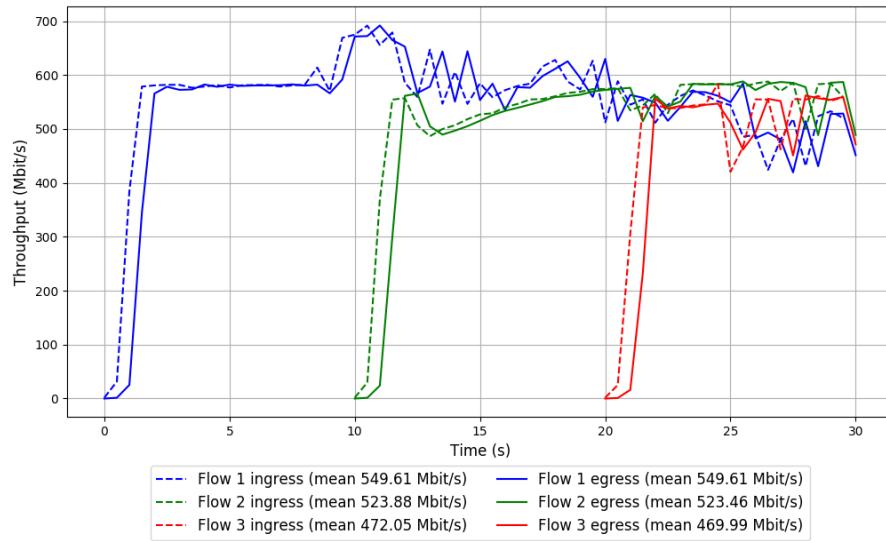


Run 2: Statistics of TCP Cubic

```
Start at: 2018-09-06 00:26:18
End at: 2018-09-06 00:26:48
Local clock offset: 0.066 ms
Remote clock offset: 1.672 ms

# Below is generated by plot.py at 2018-09-06 00:51:19
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1052.50 Mbit/s
95th percentile per-packet one-way delay: 97.162 ms
Loss rate: 0.70%
-- Flow 1:
Average throughput: 549.61 Mbit/s
95th percentile per-packet one-way delay: 105.919 ms
Loss rate: 0.41%
-- Flow 2:
Average throughput: 523.46 Mbit/s
95th percentile per-packet one-way delay: 73.017 ms
Loss rate: 0.69%
-- Flow 3:
Average throughput: 469.99 Mbit/s
95th percentile per-packet one-way delay: 91.409 ms
Loss rate: 1.71%
```

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

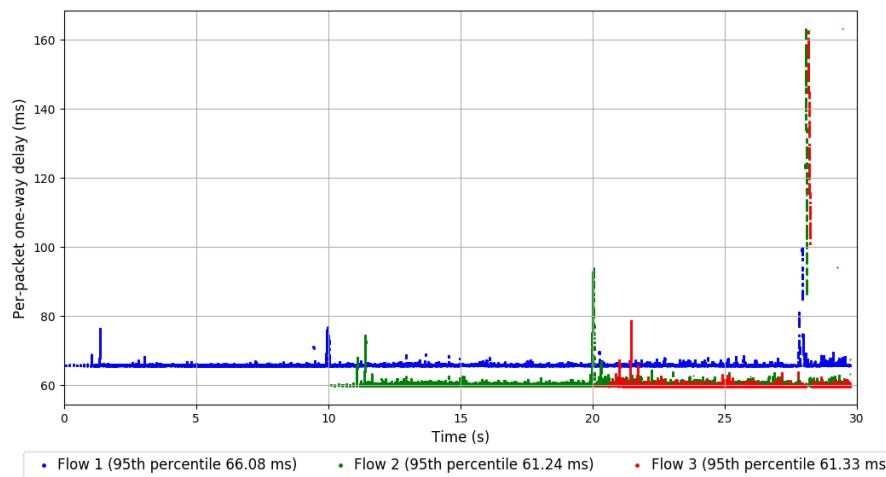
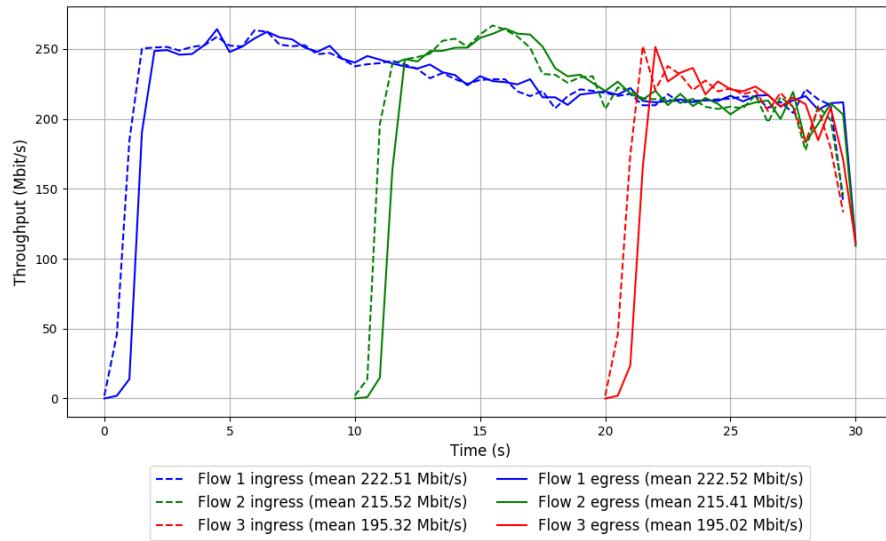


Run 1: Statistics of Indigo

```
Start at: 2018-09-06 00:22:17
End at: 2018-09-06 00:22:47
Local clock offset: 0.156 ms
Remote clock offset: 2.133 ms

# Below is generated by plot.py at 2018-09-06 00:51:19
# Datalink statistics
-- Total of 3 flows:
Average throughput: 428.55 Mbit/s
95th percentile per-packet one-way delay: 65.900 ms
Loss rate: 0.66%
-- Flow 1:
Average throughput: 222.52 Mbit/s
95th percentile per-packet one-way delay: 66.075 ms
Loss rate: 0.43%
-- Flow 2:
Average throughput: 215.41 Mbit/s
95th percentile per-packet one-way delay: 61.238 ms
Loss rate: 0.67%
-- Flow 3:
Average throughput: 195.02 Mbit/s
95th percentile per-packet one-way delay: 61.328 ms
Loss rate: 1.42%
```

Run 1: Report of Indigo — Data Link

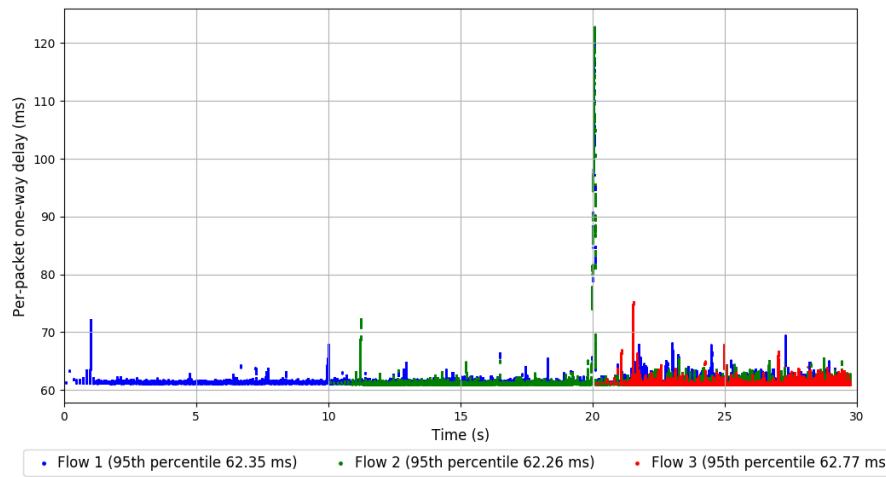
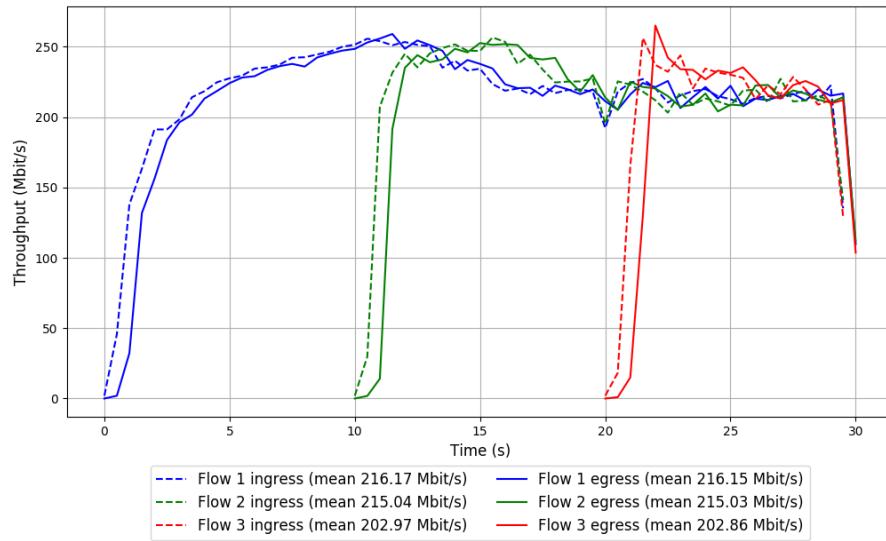


Run 2: Statistics of Indigo

```
Start at: 2018-09-06 00:30:21
End at: 2018-09-06 00:30:51
Local clock offset: 0.018 ms
Remote clock offset: 0.402 ms

# Below is generated by plot.py at 2018-09-06 00:51:19
# Datalink statistics
-- Total of 3 flows:
Average throughput: 424.34 Mbit/s
95th percentile per-packet one-way delay: 62.387 ms
Loss rate: 0.64%
-- Flow 1:
Average throughput: 216.15 Mbit/s
95th percentile per-packet one-way delay: 62.354 ms
Loss rate: 0.43%
-- Flow 2:
Average throughput: 215.03 Mbit/s
95th percentile per-packet one-way delay: 62.261 ms
Loss rate: 0.65%
-- Flow 3:
Average throughput: 202.86 Mbit/s
95th percentile per-packet one-way delay: 62.765 ms
Loss rate: 1.31%
```

## Run 2: Report of Indigo — Data Link

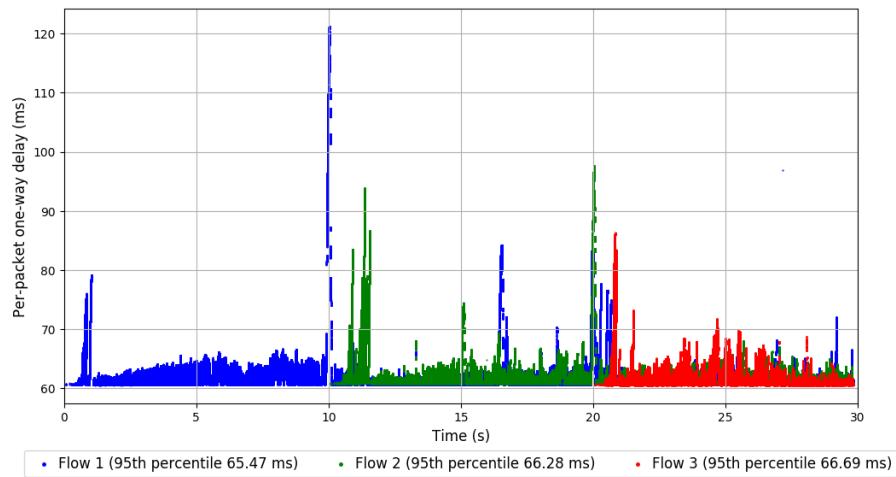
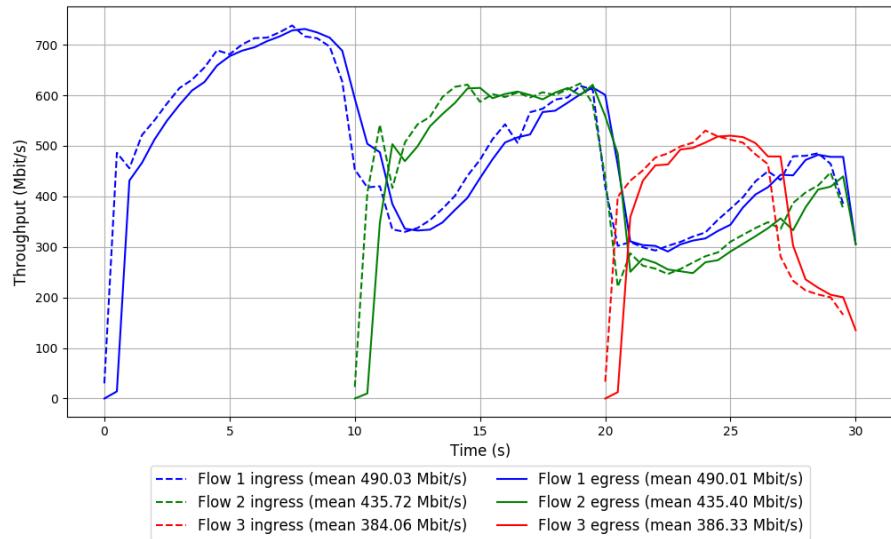


```
Run 1: Statistics of Muses-25
```

```
Start at: 2018-09-06 00:20:21
End at: 2018-09-06 00:20:51
Local clock offset: 0.272 ms
Remote clock offset: 1.333 ms

# Below is generated by plot.py at 2018-09-06 00:51:19
# Datalink statistics
-- Total of 3 flows:
Average throughput: 905.69 Mbit/s
95th percentile per-packet one-way delay: 65.969 ms
Loss rate: 0.57%
-- Flow 1:
Average throughput: 490.01 Mbit/s
95th percentile per-packet one-way delay: 65.468 ms
Loss rate: 0.43%
-- Flow 2:
Average throughput: 435.40 Mbit/s
95th percentile per-packet one-way delay: 66.284 ms
Loss rate: 0.72%
-- Flow 3:
Average throughput: 386.33 Mbit/s
95th percentile per-packet one-way delay: 66.694 ms
Loss rate: 0.73%
```

Run 1: Report of Muses-25 — Data Link



Run 2: Statistics of Muses-25

```
Start at: 2018-09-06 00:28:23
End at: 2018-09-06 00:28:53
Local clock offset: 0.051 ms
Remote clock offset: 0.561 ms

# Below is generated by plot.py at 2018-09-06 00:51:19
# Datalink statistics
-- Total of 3 flows:
Average throughput: 930.13 Mbit/s
95th percentile per-packet one-way delay: 69.706 ms
Loss rate: 0.46%
-- Flow 1:
Average throughput: 519.10 Mbit/s
95th percentile per-packet one-way delay: 71.115 ms
Loss rate: 0.42%
-- Flow 2:
Average throughput: 427.26 Mbit/s
95th percentile per-packet one-way delay: 69.610 ms
Loss rate: 0.34%
-- Flow 3:
Average throughput: 392.16 Mbit/s
95th percentile per-packet one-way delay: 66.086 ms
Loss rate: 0.87%
```

Run 2: Report of Muses-25 — Data Link

