

## Pantheon Report

Generated at 2018-09-05 03:58:13 (UTC).  
Data path: GCE London on `ens4` (*remote*) → GCE Tokyo 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.

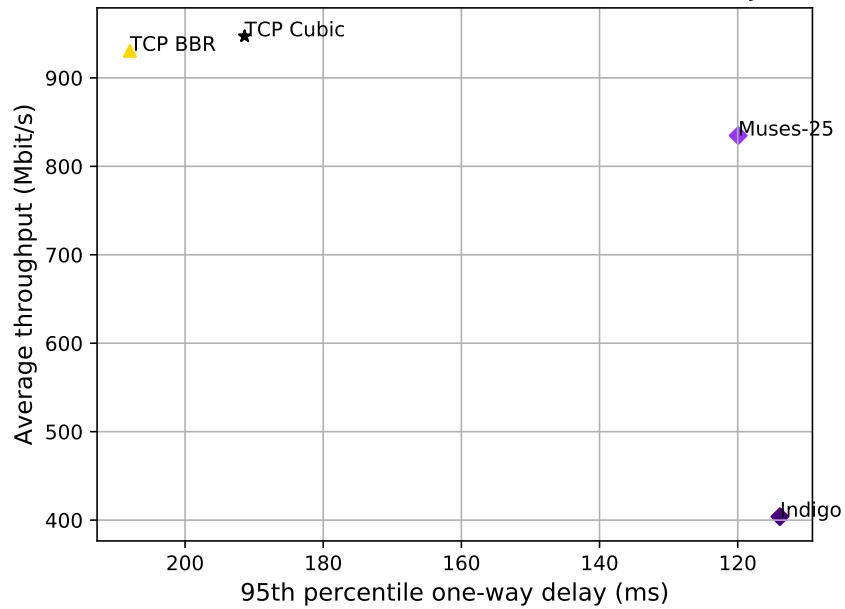
System info:

```
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
```

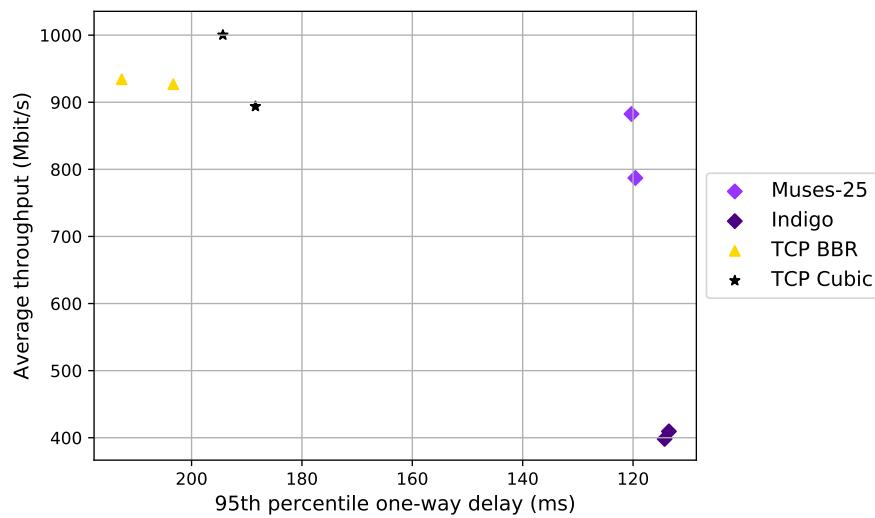
Git summary:

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



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



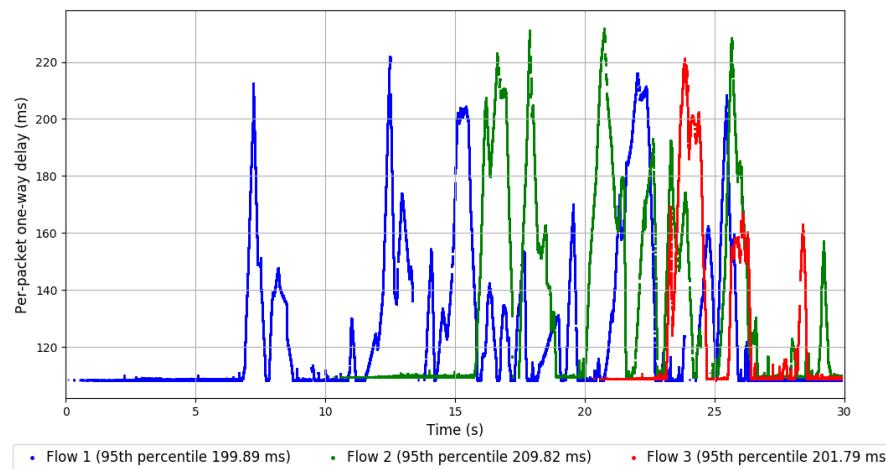
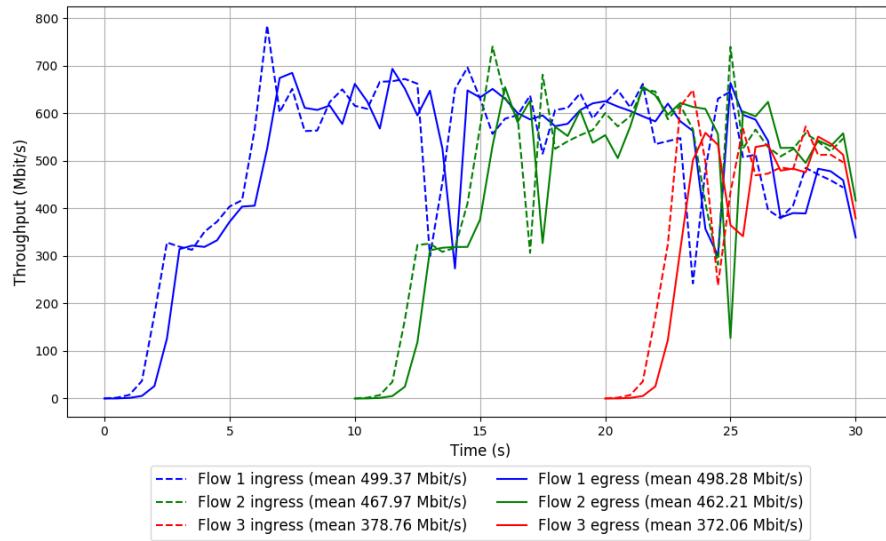
scheme	# runs	mean avg tput (Mbit/s)			mean 95th-%ile delay (ms)			mean loss rate (%)		
		flow 1	flow 2	flow 3	flow 1	flow 2	flow 3	flow 1	flow 2	flow 3
TCP BBR	2	500.93	473.11	353.06	213.33	209.21	177.75	1.77	2.48	3.88
TCP Cubic	2	538.11	457.95	320.67	176.15	200.14	153.78	0.88	1.55	4.56
Indigo	2	221.37	212.75	131.10	112.69	113.29	114.50	0.70	1.14	2.84
Muses-25	2	484.57	389.37	284.32	119.04	122.69	115.64	0.66	0.95	3.31

Run 1: Statistics of TCP BBR

```
Start at: 2018-09-05 03:32:04
End at: 2018-09-05 03:32:34
Local clock offset: 0.451 ms
Remote clock offset: 0.026 ms

# Below is generated by plot.py at 2018-09-05 03:58:02
# Datalink statistics
-- Total of 3 flows:
Average throughput: 926.89 Mbit/s
95th percentile per-packet one-way delay: 203.310 ms
Loss rate: 1.82%
-- Flow 1:
Average throughput: 498.28 Mbit/s
95th percentile per-packet one-way delay: 199.890 ms
Loss rate: 0.96%
-- Flow 2:
Average throughput: 462.21 Mbit/s
95th percentile per-packet one-way delay: 209.818 ms
Loss rate: 2.34%
-- Flow 3:
Average throughput: 372.06 Mbit/s
95th percentile per-packet one-way delay: 201.793 ms
Loss rate: 3.97%
```

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

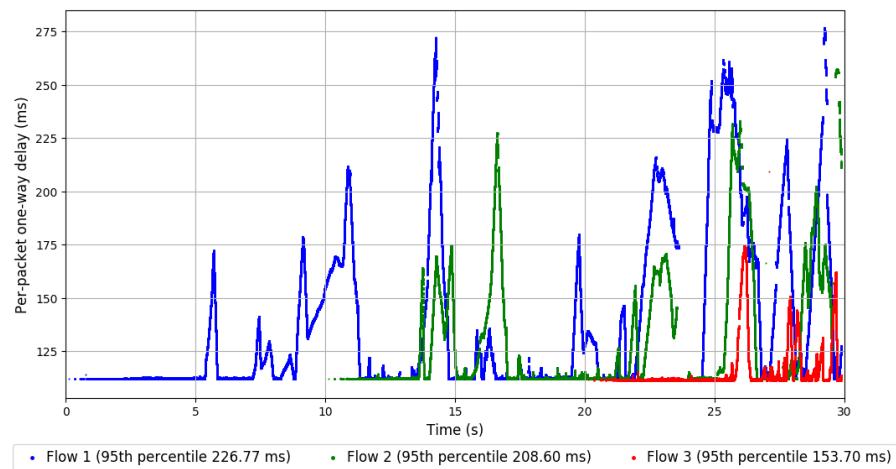
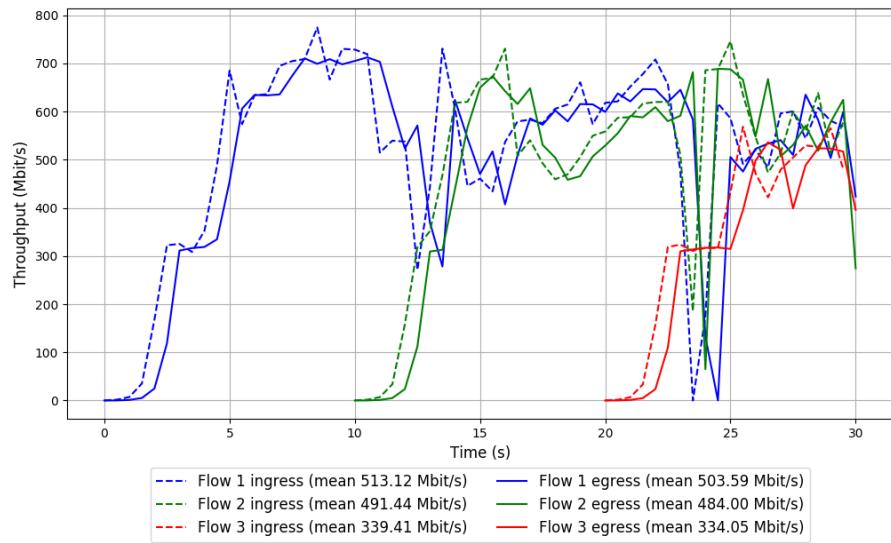


Run 2: Statistics of TCP BBR

```
Start at: 2018-09-05 03:40:36
End at: 2018-09-05 03:41:06
Local clock offset: 1.69 ms
Remote clock offset: 1.105 ms

# Below is generated by plot.py at 2018-09-05 03:58:05
# Datalink statistics
-- Total of 3 flows:
Average throughput: 934.25 Mbit/s
95th percentile per-packet one-way delay: 212.665 ms
Loss rate: 2.75%
-- Flow 1:
Average throughput: 503.59 Mbit/s
95th percentile per-packet one-way delay: 226.771 ms
Loss rate: 2.59%
-- Flow 2:
Average throughput: 484.00 Mbit/s
95th percentile per-packet one-way delay: 208.601 ms
Loss rate: 2.62%
-- Flow 3:
Average throughput: 334.05 Mbit/s
95th percentile per-packet one-way delay: 153.704 ms
Loss rate: 3.79%
```

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

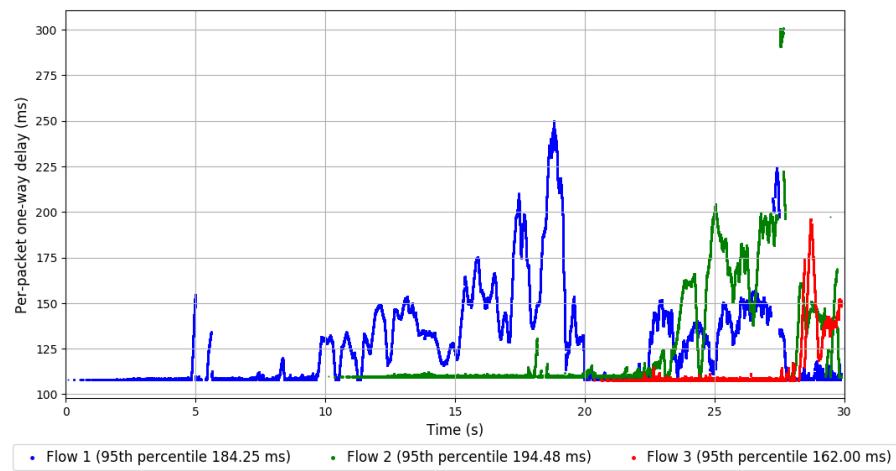
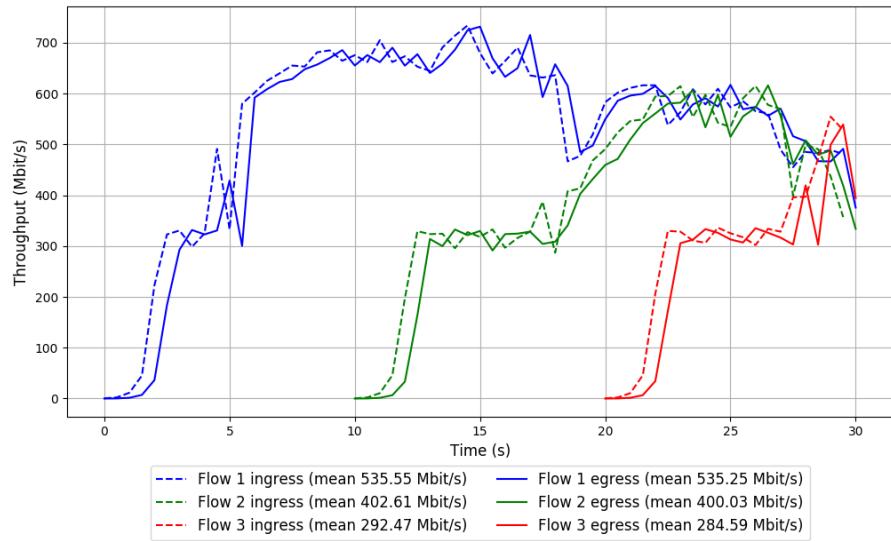


Run 1: Statistics of TCP Cubic

```
Start at: 2018-09-05 03:29:57
End at: 2018-09-05 03:30:27
Local clock offset: 1.009 ms
Remote clock offset: 0.576 ms

# Below is generated by plot.py at 2018-09-05 03:58:05
# Datalink statistics
-- Total of 3 flows:
Average throughput: 893.81 Mbit/s
95th percentile per-packet one-way delay: 188.429 ms
Loss rate: 1.52%
-- Flow 1:
Average throughput: 535.25 Mbit/s
95th percentile per-packet one-way delay: 184.247 ms
Loss rate: 0.80%
-- Flow 2:
Average throughput: 400.03 Mbit/s
95th percentile per-packet one-way delay: 194.477 ms
Loss rate: 1.75%
-- Flow 3:
Average throughput: 284.59 Mbit/s
95th percentile per-packet one-way delay: 161.995 ms
Loss rate: 4.85%
```

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

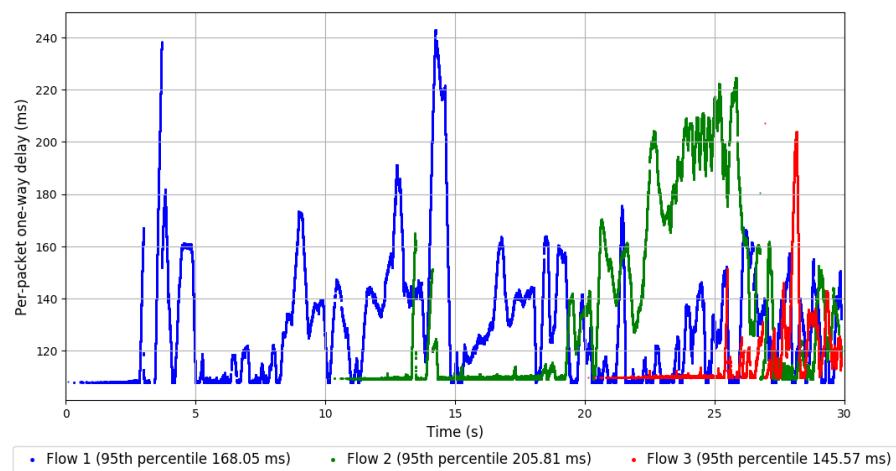
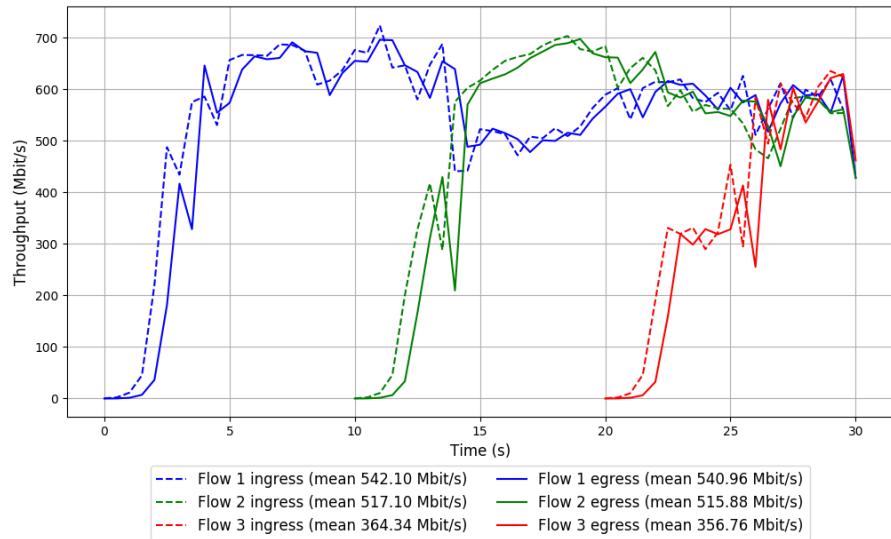


Run 2: Statistics of TCP Cubic

```
Start at: 2018-09-05 03:38:23
End at: 2018-09-05 03:38:53
Local clock offset: -0.821 ms
Remote clock offset: 0.609 ms

# Below is generated by plot.py at 2018-09-05 03:58:11
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1000.24 Mbit/s
95th percentile per-packet one-way delay: 194.332 ms
Loss rate: 1.49%
-- Flow 1:
Average throughput: 540.96 Mbit/s
95th percentile per-packet one-way delay: 168.048 ms
Loss rate: 0.95%
-- Flow 2:
Average throughput: 515.88 Mbit/s
95th percentile per-packet one-way delay: 205.812 ms
Loss rate: 1.35%
-- Flow 3:
Average throughput: 356.76 Mbit/s
95th percentile per-packet one-way delay: 145.566 ms
Loss rate: 4.28%
```

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

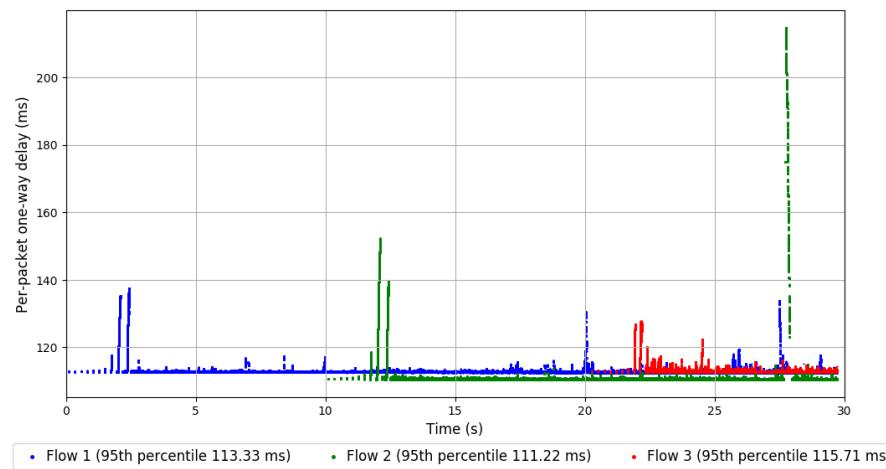
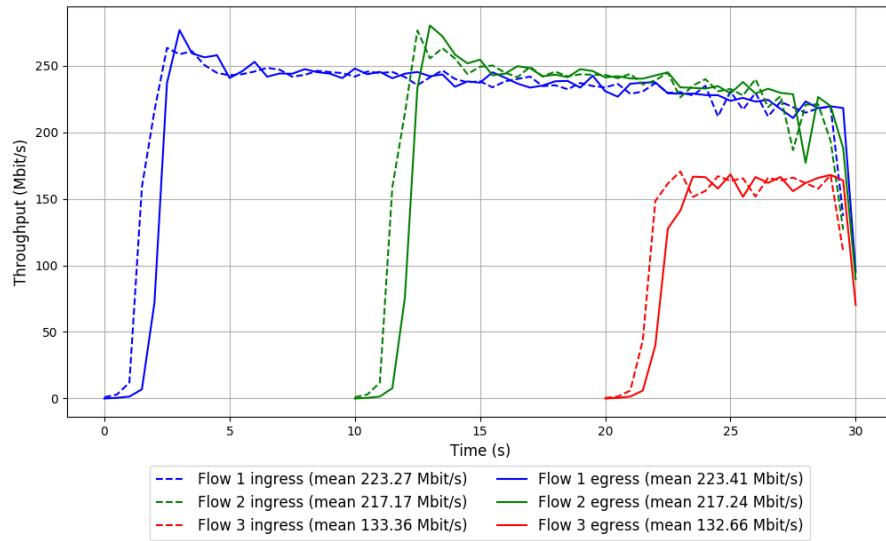


Run 1: Statistics of Indigo

```
Start at: 2018-09-05 03:27:57
End at: 2018-09-05 03:28:27
Local clock offset: 3.703 ms
Remote clock offset: 0.845 ms

# Below is generated by plot.py at 2018-09-05 03:58:11
# Datalink statistics
-- Total of 3 flows:
Average throughput: 409.49 Mbit/s
95th percentile per-packet one-way delay: 113.498 ms
Loss rate: 1.05%
-- Flow 1:
Average throughput: 223.41 Mbit/s
95th percentile per-packet one-way delay: 113.335 ms
Loss rate: 0.69%
-- Flow 2:
Average throughput: 217.24 Mbit/s
95th percentile per-packet one-way delay: 111.223 ms
Loss rate: 1.09%
-- Flow 3:
Average throughput: 132.66 Mbit/s
95th percentile per-packet one-way delay: 115.713 ms
Loss rate: 2.82%
```

Run 1: Report of Indigo — Data Link

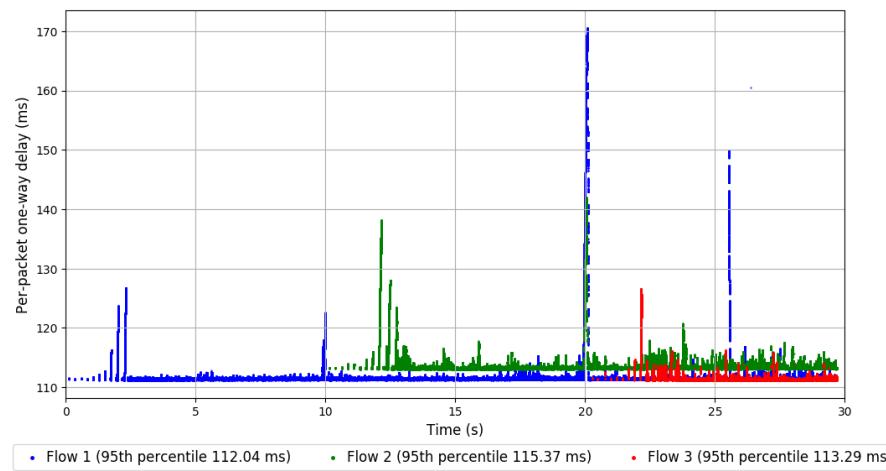
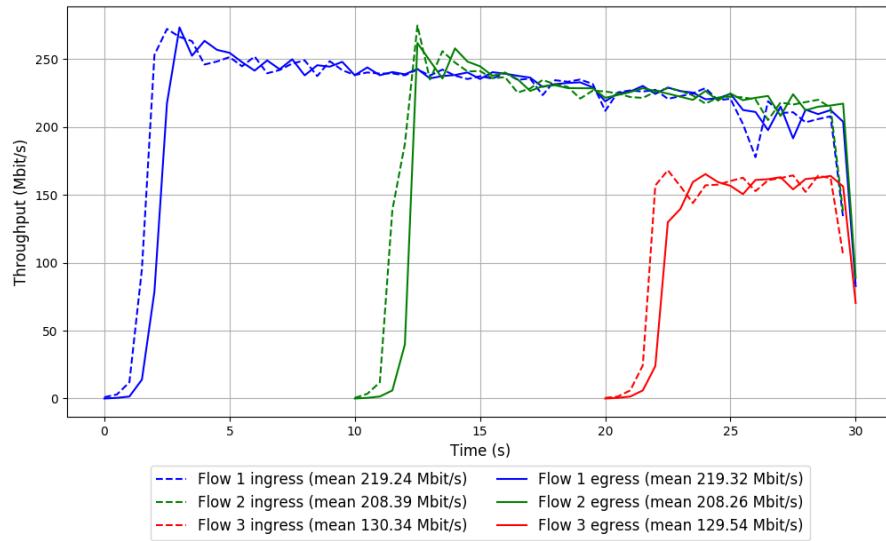


Run 2: Statistics of Indigo

```
Start at: 2018-09-05 03:36:25
End at: 2018-09-05 03:36:55
Local clock offset: 2.327 ms
Remote clock offset: 0.159 ms

# Below is generated by plot.py at 2018-09-05 03:58:11
# Datalink statistics
-- Total of 3 flows:
Average throughput: 398.21 Mbit/s
95th percentile per-packet one-way delay: 114.279 ms
Loss rate: 1.10%
-- Flow 1:
Average throughput: 219.32 Mbit/s
95th percentile per-packet one-way delay: 112.041 ms
Loss rate: 0.71%
-- Flow 2:
Average throughput: 208.26 Mbit/s
95th percentile per-packet one-way delay: 115.366 ms
Loss rate: 1.19%
-- Flow 3:
Average throughput: 129.54 Mbit/s
95th percentile per-packet one-way delay: 113.290 ms
Loss rate: 2.87%
```

Run 2: Report of Indigo — Data Link

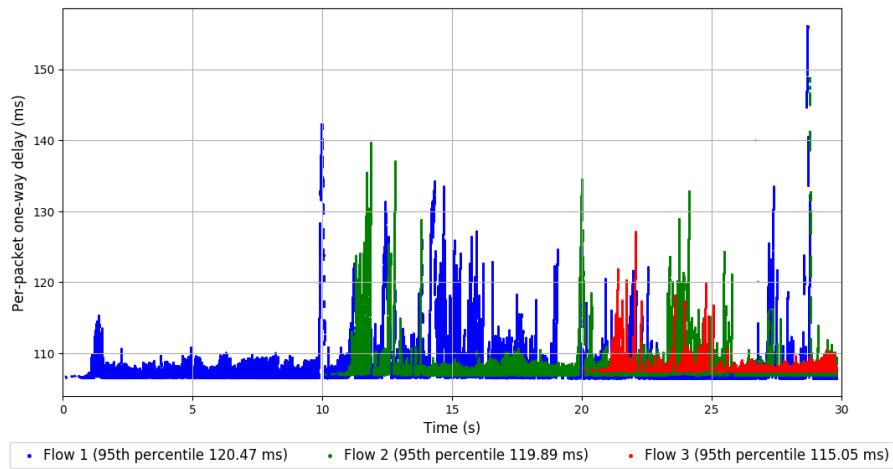
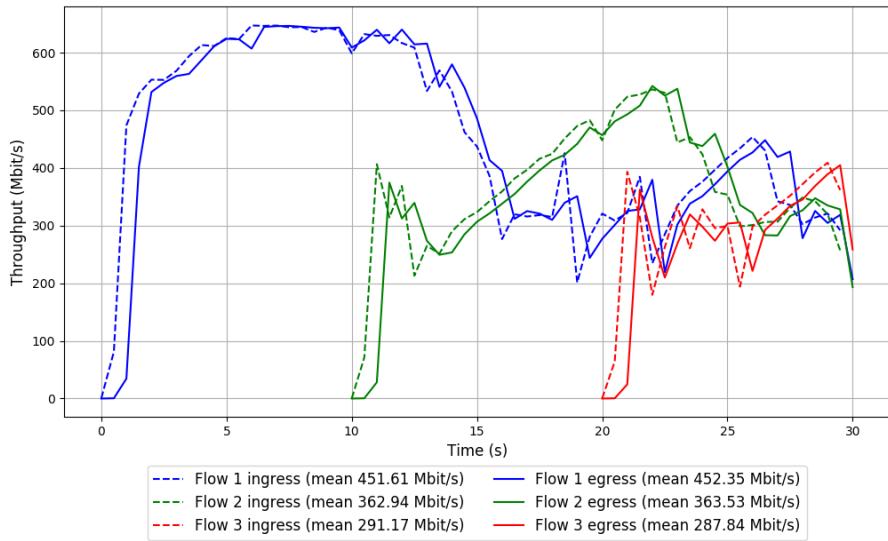


```
Run 1: Statistics of Muses-25
```

```
Start at: 2018-09-05 03:25:57
End at: 2018-09-05 03:26:27
Local clock offset: 0.737 ms
Remote clock offset: 2.275 ms

# Below is generated by plot.py at 2018-09-05 03:58:11
# Datalink statistics
-- Total of 3 flows:
Average throughput: 787.12 Mbit/s
95th percentile per-packet one-way delay: 119.582 ms
Loss rate: 1.04%
-- Flow 1:
Average throughput: 452.35 Mbit/s
95th percentile per-packet one-way delay: 120.470 ms
Loss rate: 0.58%
-- Flow 2:
Average throughput: 363.53 Mbit/s
95th percentile per-packet one-way delay: 119.894 ms
Loss rate: 0.96%
-- Flow 3:
Average throughput: 287.84 Mbit/s
95th percentile per-packet one-way delay: 115.049 ms
Loss rate: 3.36%
```

Run 1: Report of Muses-25 — Data Link



Run 2: Statistics of Muses-25

```
Start at: 2018-09-05 03:34:19
End at: 2018-09-05 03:34:49
Local clock offset: -0.088 ms
Remote clock offset: -0.484 ms

# Below is generated by plot.py at 2018-09-05 03:58:11
# Datalink statistics
-- Total of 3 flows:
Average throughput: 882.45 Mbit/s
95th percentile per-packet one-way delay: 120.278 ms
Loss rate: 1.07%
-- Flow 1:
Average throughput: 516.79 Mbit/s
95th percentile per-packet one-way delay: 117.601 ms
Loss rate: 0.73%
-- Flow 2:
Average throughput: 415.20 Mbit/s
95th percentile per-packet one-way delay: 125.476 ms
Loss rate: 0.94%
-- Flow 3:
Average throughput: 280.80 Mbit/s
95th percentile per-packet one-way delay: 116.238 ms
Loss rate: 3.27%
```

Run 2: Report of Muses-25 — Data Link

