

## Pantheon Report

Generated at 2018-09-05 05:50:39 (UTC).  
Data path: GCE London on `ens4` (*remote*) → GCE Sydney 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.

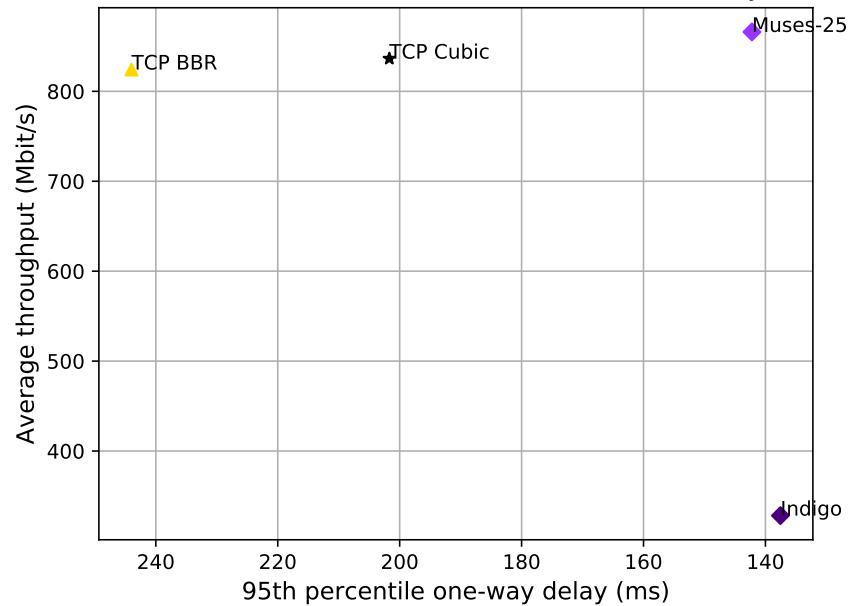
System info:

```
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
```

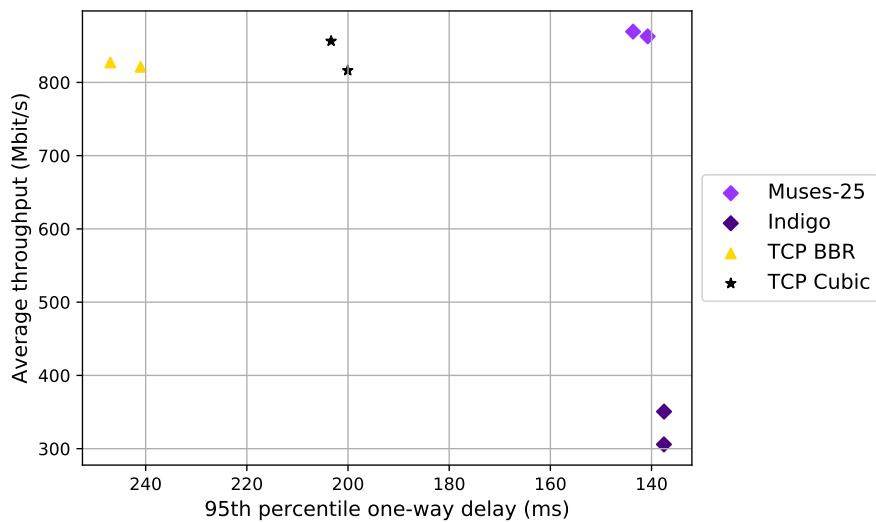
Git summary:

```
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 Sydney, 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 Sydney, 2 runs of 30s each per scheme  
3 flows with 10s interval between flows



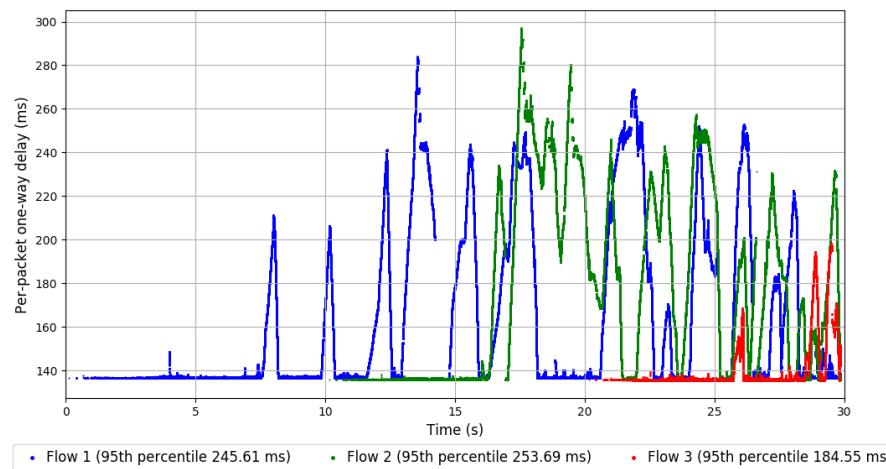
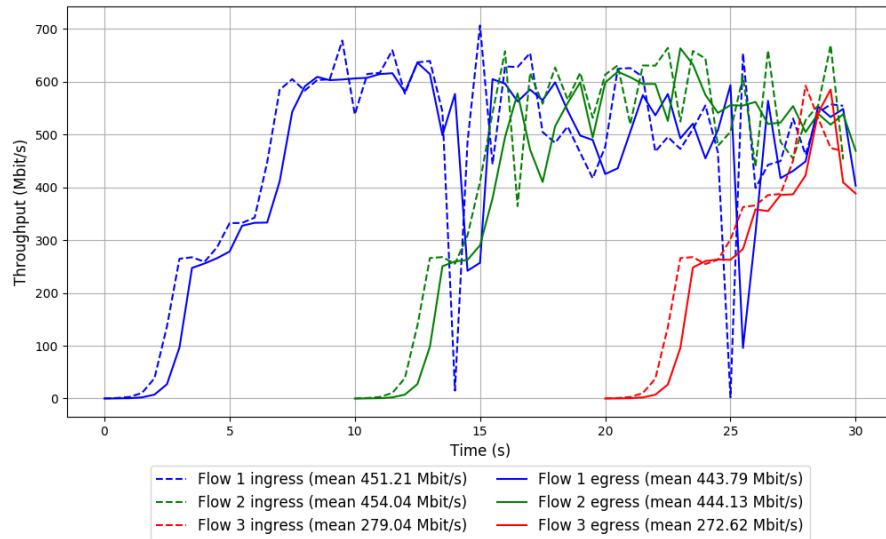
scheme	# runs	mean avg tput (Mbit/s)			mean 95th-%ile delay (ms)			mean loss rate (%)		
		flow 1	flow 2	flow 3	flow 1	flow 2	flow 3	flow 1	flow 2	flow 3
TCP BBR	2	446.73	417.39	308.69	236.96	246.82	225.41	2.27	3.49	6.62
TCP Cubic	2	481.70	386.50	301.31	189.11	223.22	190.23	1.16	1.87	4.72
Indigo	2	160.15	177.53	158.10	137.19	137.74	138.22	0.93	1.42	3.46
Muses-25	2	417.38	477.29	410.90	142.03	142.12	142.41	0.64	1.48	2.42

Run 1: Statistics of TCP BBR

```
Start at: 2018-09-05 05:21:13
End at: 2018-09-05 05:21:43
Local clock offset: 0.403 ms
Remote clock offset: -0.3 ms

# Below is generated by plot.py at 2018-09-05 05:50:25
# Datalink statistics
-- Total of 3 flows:
Average throughput: 827.20 Mbit/s
95th percentile per-packet one-way delay: 246.978 ms
Loss rate: 3.15%
-- Flow 1:
Average throughput: 443.79 Mbit/s
95th percentile per-packet one-way delay: 245.609 ms
Loss rate: 2.54%
-- Flow 2:
Average throughput: 444.13 Mbit/s
95th percentile per-packet one-way delay: 253.686 ms
Loss rate: 3.51%
-- Flow 3:
Average throughput: 272.62 Mbit/s
95th percentile per-packet one-way delay: 184.547 ms
Loss rate: 4.96%
```

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

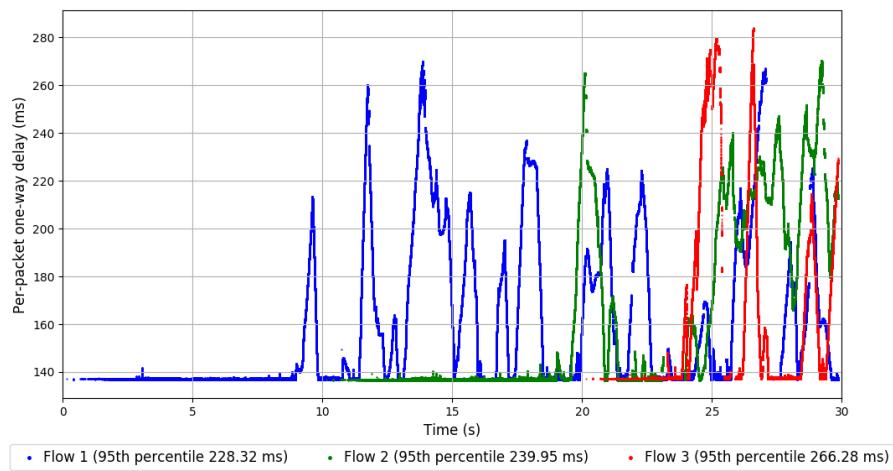
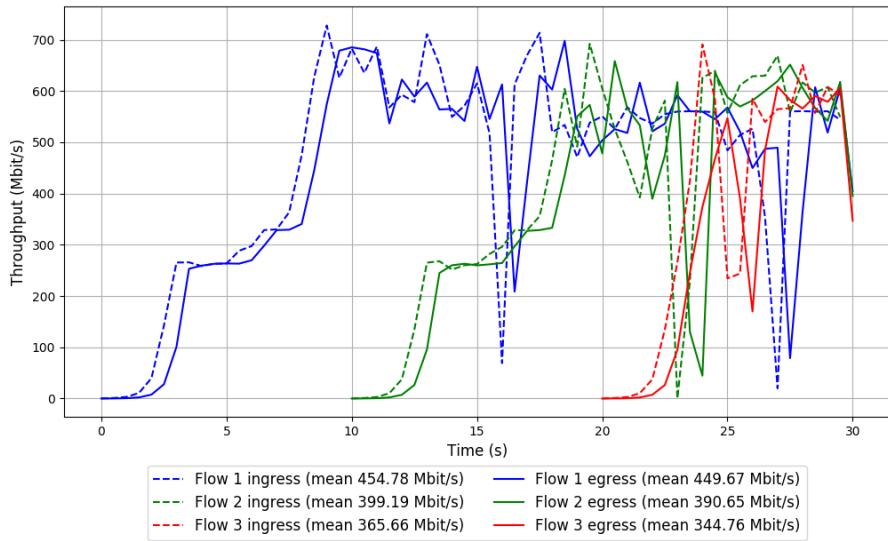


Run 2: Statistics of TCP BBR

```
Start at: 2018-09-05 05:29:43
End at: 2018-09-05 05:30:13
Local clock offset: 0.671 ms
Remote clock offset: -1.212 ms

# Below is generated by plot.py at 2018-09-05 05:50:25
# Datalink statistics
-- Total of 3 flows:
Average throughput: 821.30 Mbit/s
95th percentile per-packet one-way delay: 240.997 ms
Loss rate: 3.38%
-- Flow 1:
Average throughput: 449.67 Mbit/s
95th percentile per-packet one-way delay: 228.318 ms
Loss rate: 2.01%
-- Flow 2:
Average throughput: 390.65 Mbit/s
95th percentile per-packet one-way delay: 239.947 ms
Loss rate: 3.47%
-- Flow 3:
Average throughput: 344.76 Mbit/s
95th percentile per-packet one-way delay: 266.278 ms
Loss rate: 8.28%
```

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

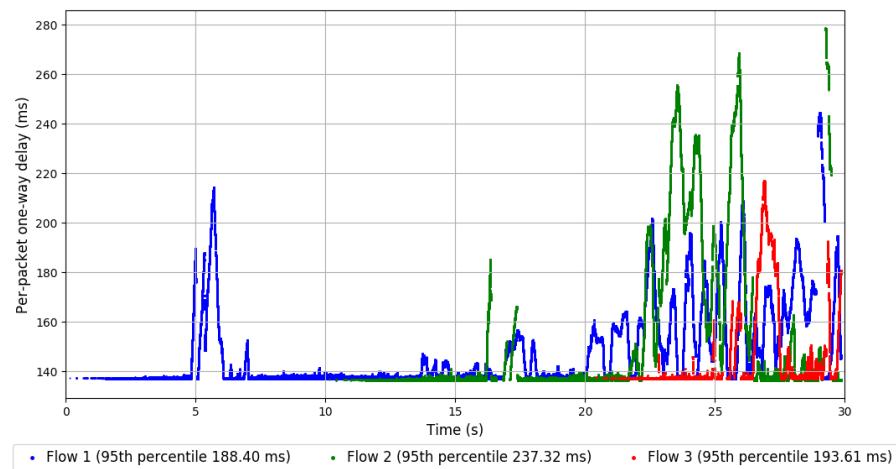
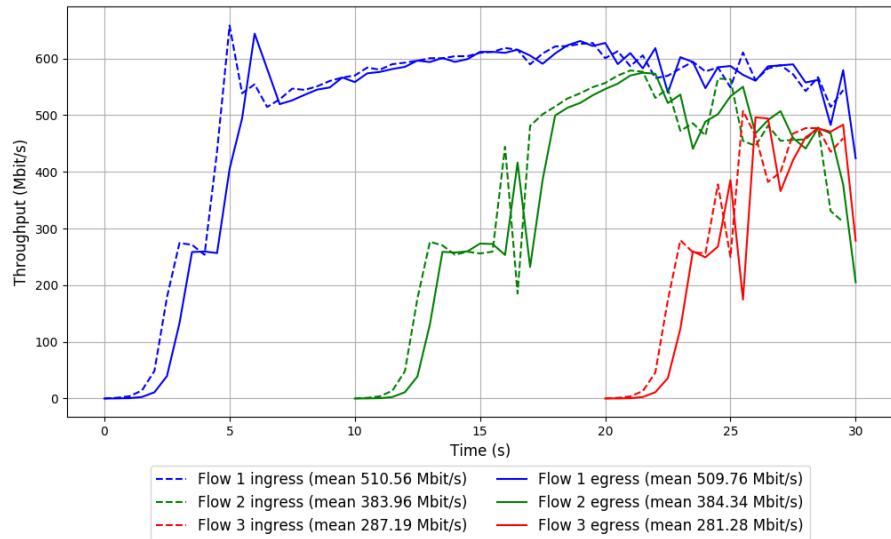


Run 1: Statistics of TCP Cubic

```
Start at: 2018-09-05 05:23:29
End at: 2018-09-05 05:23:59
Local clock offset: 0.423 ms
Remote clock offset: -0.918 ms

# Below is generated by plot.py at 2018-09-05 05:50:32
# Datalink statistics
-- Total of 3 flows:
Average throughput: 856.44 Mbit/s
95th percentile per-packet one-way delay: 203.340 ms
Loss rate: 1.53%
-- Flow 1:
Average throughput: 509.76 Mbit/s
95th percentile per-packet one-way delay: 188.398 ms
Loss rate: 1.06%
-- Flow 2:
Average throughput: 384.34 Mbit/s
95th percentile per-packet one-way delay: 237.322 ms
Loss rate: 1.26%
-- Flow 3:
Average throughput: 281.28 Mbit/s
95th percentile per-packet one-way delay: 193.612 ms
Loss rate: 4.72%
```

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

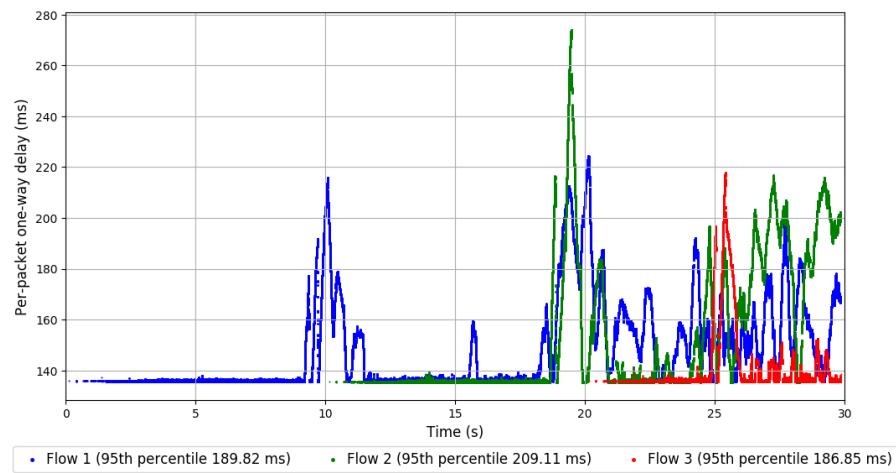
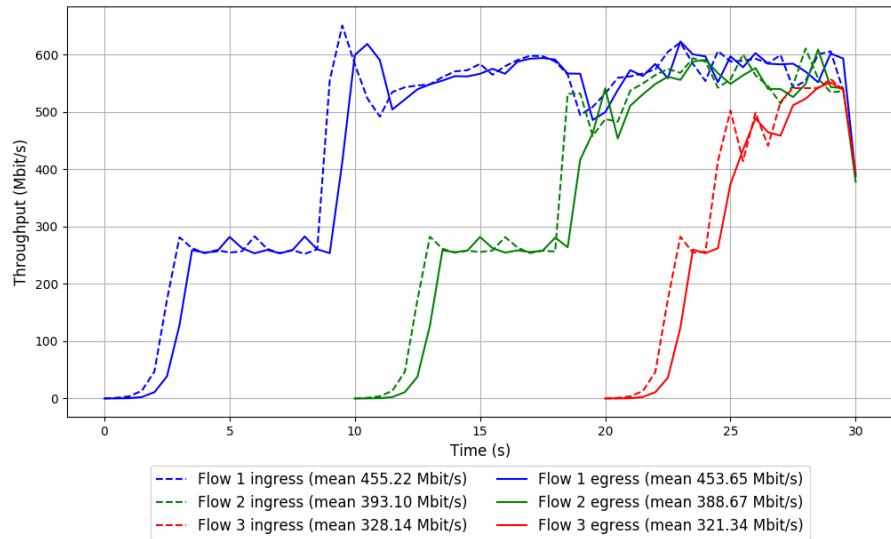


Run 2: Statistics of TCP Cubic

```
Start at: 2018-09-05 05:31:56
End at: 2018-09-05 05:32:26
Local clock offset: 0.502 ms
Remote clock offset: -0.278 ms

# Below is generated by plot.py at 2018-09-05 05:50:32
# Datalink statistics
-- Total of 3 flows:
Average throughput: 816.27 Mbit/s
95th percentile per-packet one-way delay: 200.056 ms
Loss rate: 2.09%
-- Flow 1:
Average throughput: 453.65 Mbit/s
95th percentile per-packet one-way delay: 189.825 ms
Loss rate: 1.25%
-- Flow 2:
Average throughput: 388.67 Mbit/s
95th percentile per-packet one-way delay: 209.110 ms
Loss rate: 2.47%
-- Flow 3:
Average throughput: 321.34 Mbit/s
95th percentile per-packet one-way delay: 186.849 ms
Loss rate: 4.73%
```

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

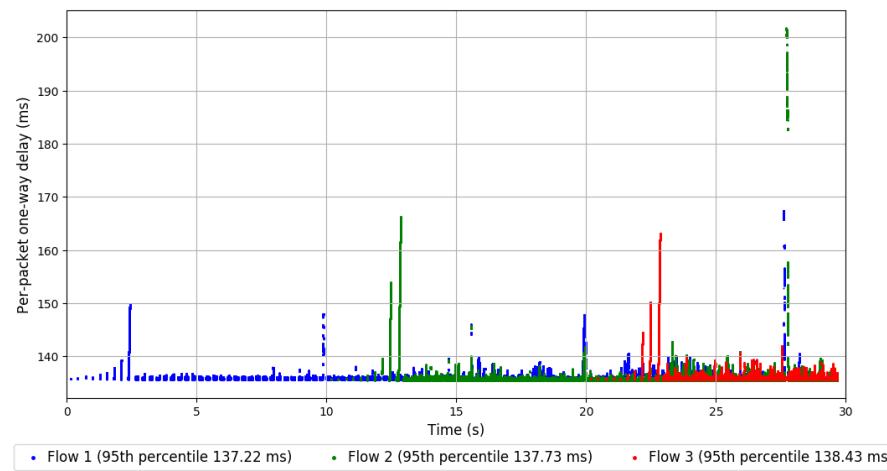
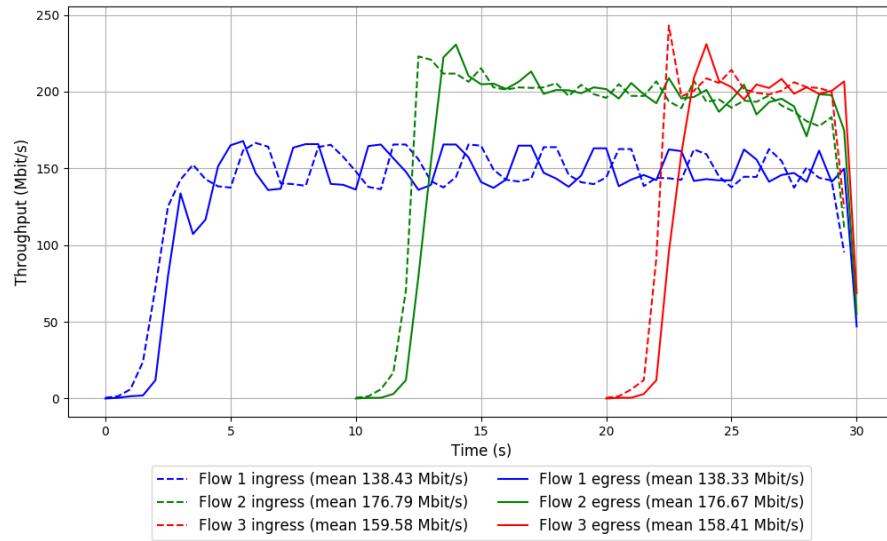


Run 1: Statistics of Indigo

```
Start at: 2018-09-05 05:25:40
End at: 2018-09-05 05:26:10
Local clock offset: 0.506 ms
Remote clock offset: -0.072 ms

# Below is generated by plot.py at 2018-09-05 05:50:32
# Datalink statistics
-- Total of 3 flows:
Average throughput: 305.84 Mbit/s
95th percentile per-packet one-way delay: 137.553 ms
Loss rate: 1.57%
-- Flow 1:
Average throughput: 138.33 Mbit/s
95th percentile per-packet one-way delay: 137.223 ms
Loss rate: 0.98%
-- Flow 2:
Average throughput: 176.67 Mbit/s
95th percentile per-packet one-way delay: 137.734 ms
Loss rate: 1.42%
-- Flow 3:
Average throughput: 158.41 Mbit/s
95th percentile per-packet one-way delay: 138.434 ms
Loss rate: 3.47%
```

Run 1: Report of Indigo — Data Link

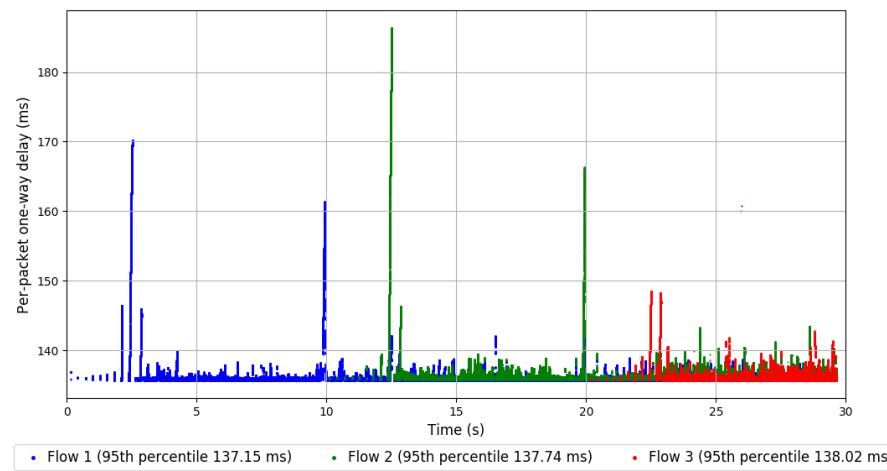
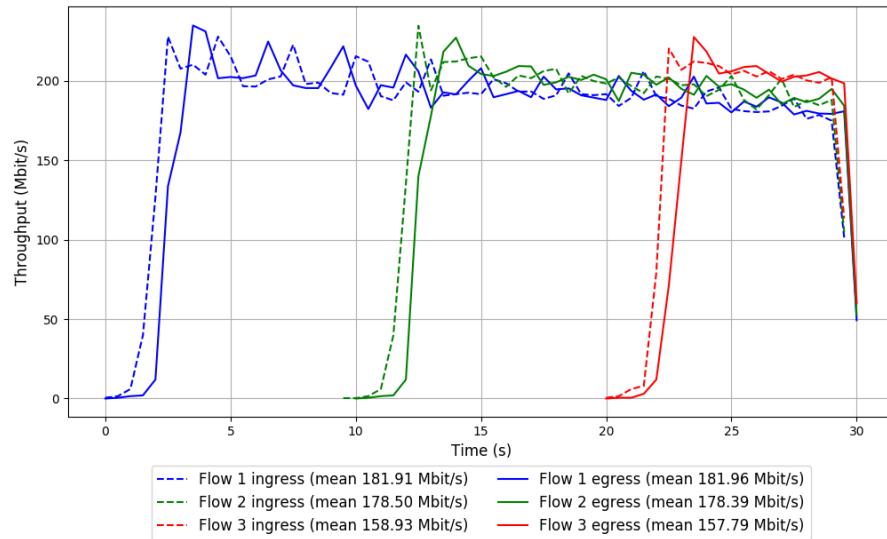


Run 2: Statistics of Indigo

```
Start at: 2018-09-05 05:34:05
End at: 2018-09-05 05:34:35
Local clock offset: 0.551 ms
Remote clock offset: -0.279 ms

# Below is generated by plot.py at 2018-09-05 05:50:32
# Datalink statistics
-- Total of 3 flows:
Average throughput: 350.58 Mbit/s
95th percentile per-packet one-way delay: 137.529 ms
Loss rate: 1.45%
-- Flow 1:
Average throughput: 181.96 Mbit/s
95th percentile per-packet one-way delay: 137.154 ms
Loss rate: 0.88%
-- Flow 2:
Average throughput: 178.39 Mbit/s
95th percentile per-packet one-way delay: 137.744 ms
Loss rate: 1.43%
-- Flow 3:
Average throughput: 157.79 Mbit/s
95th percentile per-packet one-way delay: 138.016 ms
Loss rate: 3.46%
```

## Run 2: Report of Indigo — Data Link

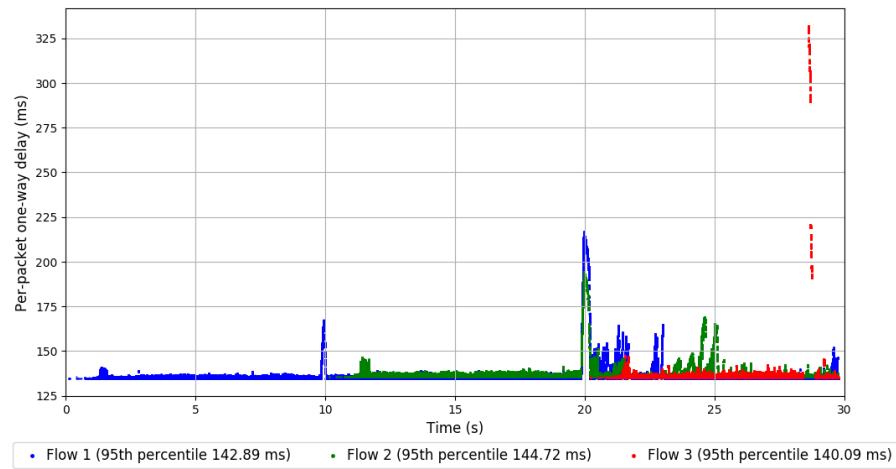
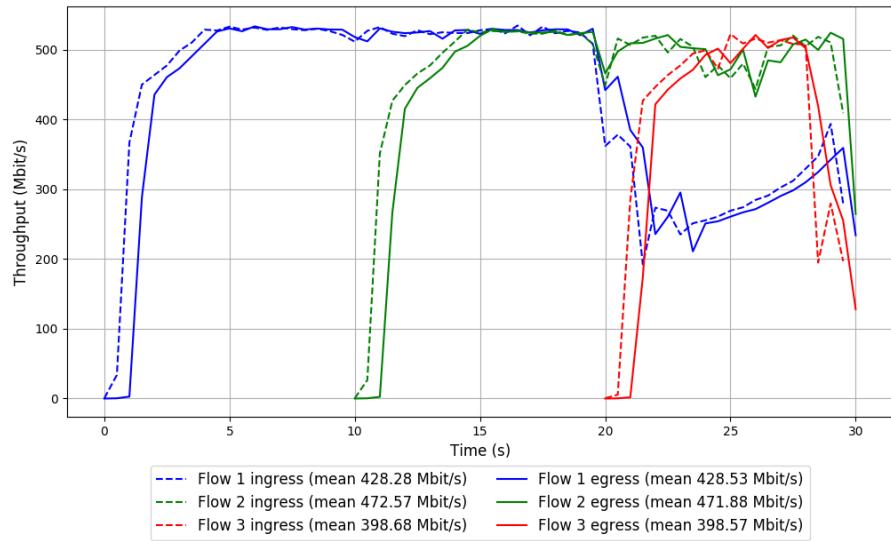


```
Run 1: Statistics of Muses-25
```

```
Start at: 2018-09-05 05:19:04
End at: 2018-09-05 05:19:34
Local clock offset: 0.196 ms
Remote clock offset: -0.24 ms

# Below is generated by plot.py at 2018-09-05 05:50:37
# Datalink statistics
-- Total of 3 flows:
Average throughput: 869.33 Mbit/s
95th percentile per-packet one-way delay: 143.654 ms
Loss rate: 1.30%
-- Flow 1:
Average throughput: 428.53 Mbit/s
95th percentile per-packet one-way delay: 142.887 ms
Loss rate: 0.69%
-- Flow 2:
Average throughput: 471.88 Mbit/s
95th percentile per-packet one-way delay: 144.724 ms
Loss rate: 1.51%
-- Flow 3:
Average throughput: 398.57 Mbit/s
95th percentile per-packet one-way delay: 140.086 ms
Loss rate: 2.79%
```

Run 1: Report of Muses-25 — Data Link



Run 2: Statistics of Muses-25

```
Start at: 2018-09-05 05:27:33
End at: 2018-09-05 05:28:03
Local clock offset: 0.525 ms
Remote clock offset: -0.311 ms

# Below is generated by plot.py at 2018-09-05 05:50:37
# Datalink statistics
-- Total of 3 flows:
Average throughput: 862.83 Mbit/s
95th percentile per-packet one-way delay: 140.763 ms
Loss rate: 1.14%
-- Flow 1:
Average throughput: 406.22 Mbit/s
95th percentile per-packet one-way delay: 141.183 ms
Loss rate: 0.58%
-- Flow 2:
Average throughput: 482.71 Mbit/s
95th percentile per-packet one-way delay: 139.508 ms
Loss rate: 1.45%
-- Flow 3:
Average throughput: 423.24 Mbit/s
95th percentile per-packet one-way delay: 144.726 ms
Loss rate: 2.06%
```

Run 2: Report of Muses-25 — Data Link

