

## Pantheon Report

Generated at 2018-08-31 14:19:27 (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.

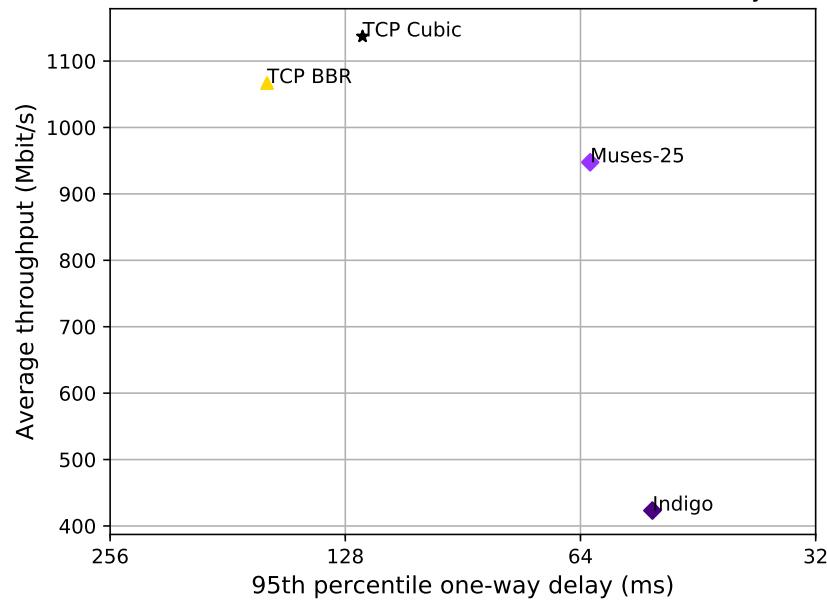
System info:

```
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
```

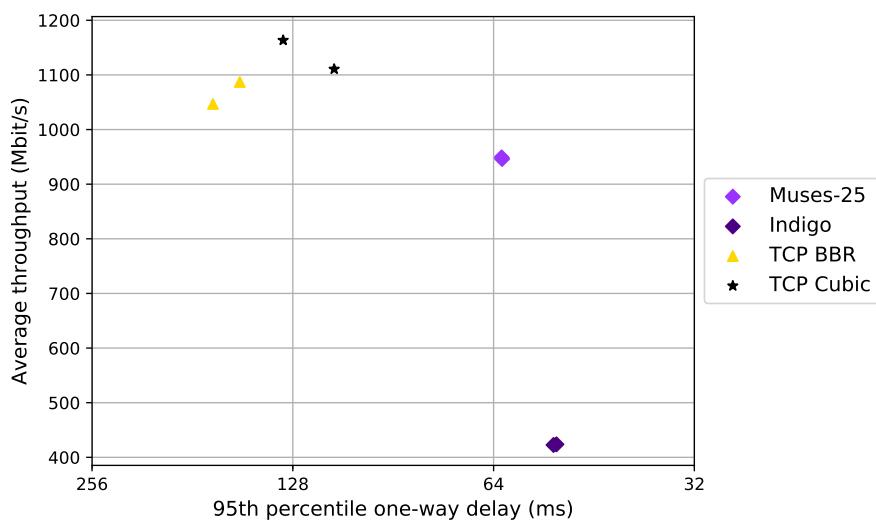
Git summary:

```
branch: muses @ e3c5aa19ca94c3066828fb83f16a8fb6b2731e7a
third_party/fillp @ d47f4fa1b454a5e3c0537115c5a28436dbd4b834
third_party/fillp-sheep @ daed0c84f98531712514b2231f43ec6901114ffe
third_party/genericCC @ d0153f8e594aa89e93b032143cedbdf58e562f4
third_party/indigo @ 2601c92e4aa9d58d38dc4dfe0ecdbf90c077e64d
third_party/libutp @ b3465b942e2826f2b179eaab4a906ce6bb7cf3cf
third_party/muses @ b59e0d118c50af3579569c462d33045741c85981
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



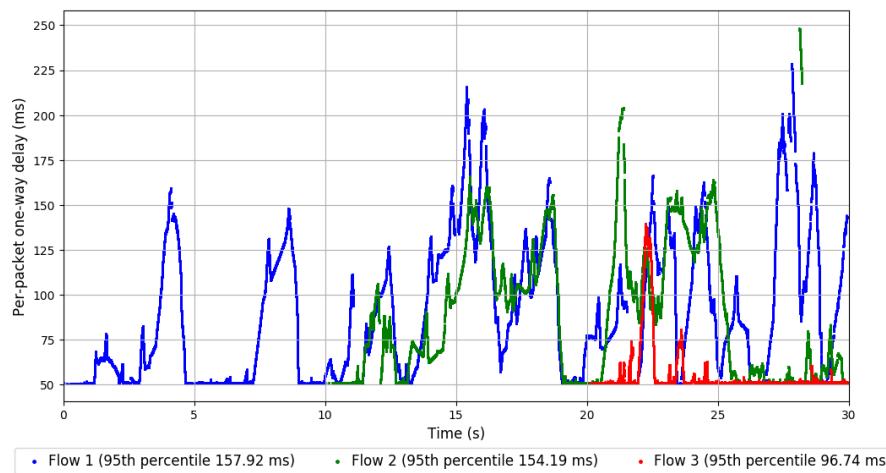
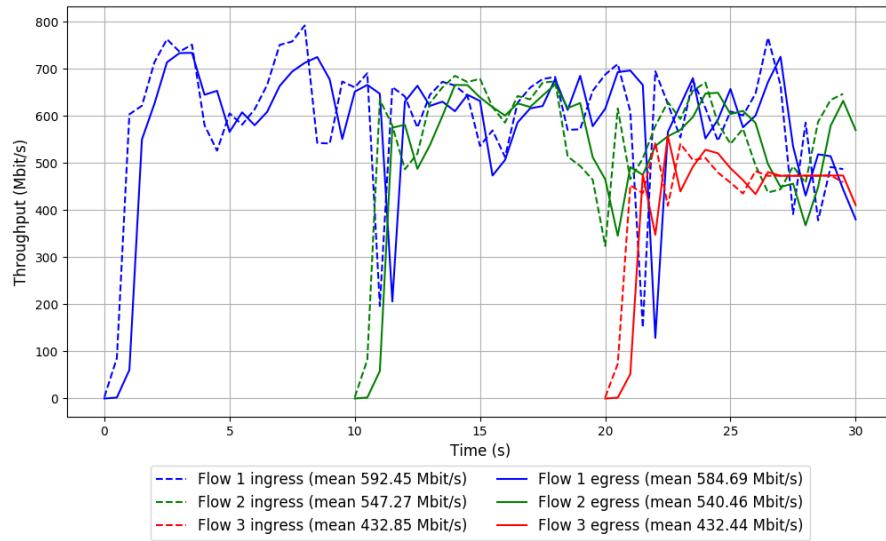
scheme	# runs	mean avg tput (Mbit/s)			mean 95th-%ile delay (ms)			mean loss rate (%)		
		flow 1	flow 2	flow 3	flow 1	flow 2	flow 3	flow 1	flow 2	flow 3
TCP BBR	2	564.28	522.98	470.87	154.91	177.20	127.53	1.25	2.54	1.63
TCP Cubic	2	616.10	525.78	518.61	121.50	108.64	79.87	0.48	0.75	1.24
Indigo	2	225.18	205.67	190.64	51.12	52.55	51.65	0.34	0.57	1.23
Muses-25	2	517.78	434.94	430.06	61.20	64.23	60.78	0.21	0.61	0.88

Run 1: Statistics of TCP BBR

```
Start at: 2018-08-31 13:44:57
End at: 2018-08-31 13:45:27
Local clock offset: -0.175 ms
Remote clock offset: -0.294 ms

# Below is generated by plot.py at 2018-08-31 14:18:11
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1087.03 Mbit/s
95th percentile per-packet one-way delay: 153.720 ms
Loss rate: 1.61%
-- Flow 1:
Average throughput: 584.69 Mbit/s
95th percentile per-packet one-way delay: 157.924 ms
Loss rate: 1.64%
-- Flow 2:
Average throughput: 540.46 Mbit/s
95th percentile per-packet one-way delay: 154.190 ms
Loss rate: 1.75%
-- Flow 3:
Average throughput: 432.44 Mbit/s
95th percentile per-packet one-way delay: 96.738 ms
Loss rate: 1.12%
```

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

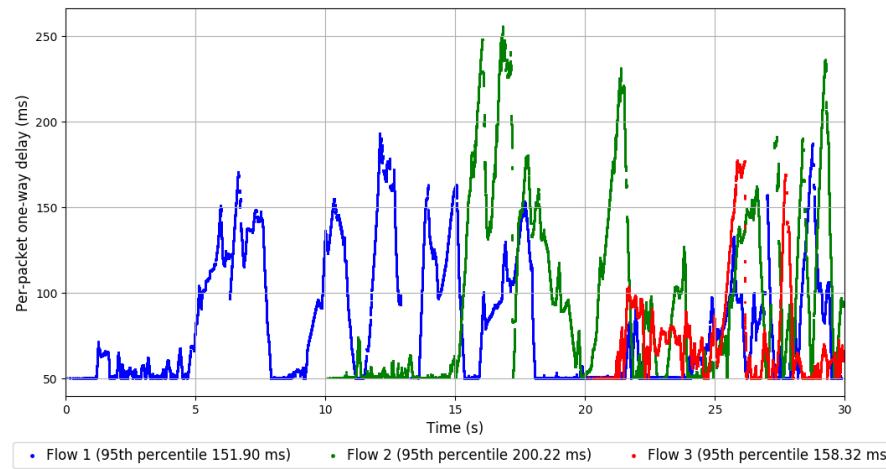
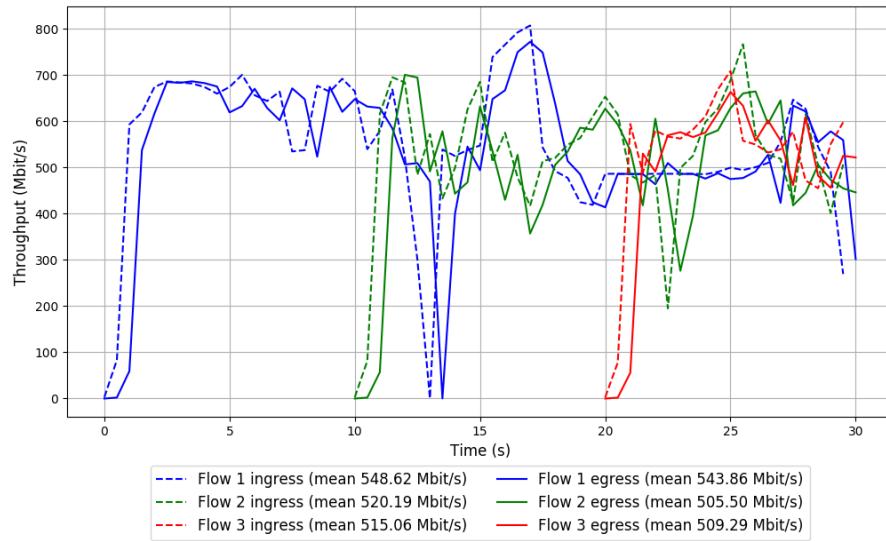


Run 2: Statistics of TCP BBR

```
Start at: 2018-08-31 13:52:51
End at: 2018-08-31 13:53:21
Local clock offset: -0.653 ms
Remote clock offset: -0.286 ms

# Below is generated by plot.py at 2018-08-31 14:18:11
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1046.79 Mbit/s
95th percentile per-packet one-way delay: 168.645 ms
Loss rate: 1.87%
-- Flow 1:
Average throughput: 543.86 Mbit/s
95th percentile per-packet one-way delay: 151.898 ms
Loss rate: 0.87%
-- Flow 2:
Average throughput: 505.50 Mbit/s
95th percentile per-packet one-way delay: 200.219 ms
Loss rate: 3.32%
-- Flow 3:
Average throughput: 509.29 Mbit/s
95th percentile per-packet one-way delay: 158.323 ms
Loss rate: 2.14%
```

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

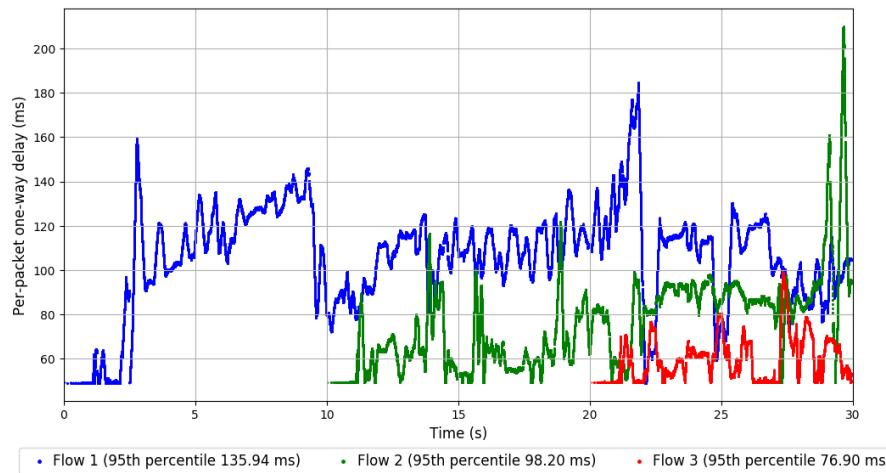
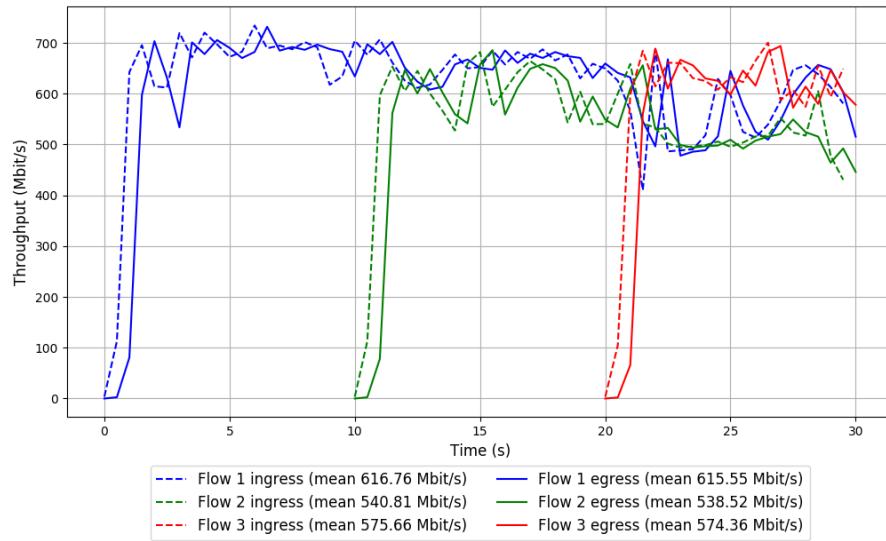


```
Run 1: Statistics of TCP Cubic
```

```
Start at: 2018-08-31 13:47:05
End at: 2018-08-31 13:47:35
Local clock offset: -1.546 ms
Remote clock offset: -0.288 ms

# Below is generated by plot.py at 2018-08-31 14:18:46
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1163.46 Mbit/s
95th percentile per-packet one-way delay: 132.335 ms
Loss rate: 0.77%
-- Flow 1:
Average throughput: 615.55 Mbit/s
95th percentile per-packet one-way delay: 135.938 ms
Loss rate: 0.53%
-- Flow 2:
Average throughput: 538.52 Mbit/s
95th percentile per-packet one-way delay: 98.205 ms
Loss rate: 0.93%
-- Flow 3:
Average throughput: 574.36 Mbit/s
95th percentile per-packet one-way delay: 76.897 ms
Loss rate: 1.24%
```

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

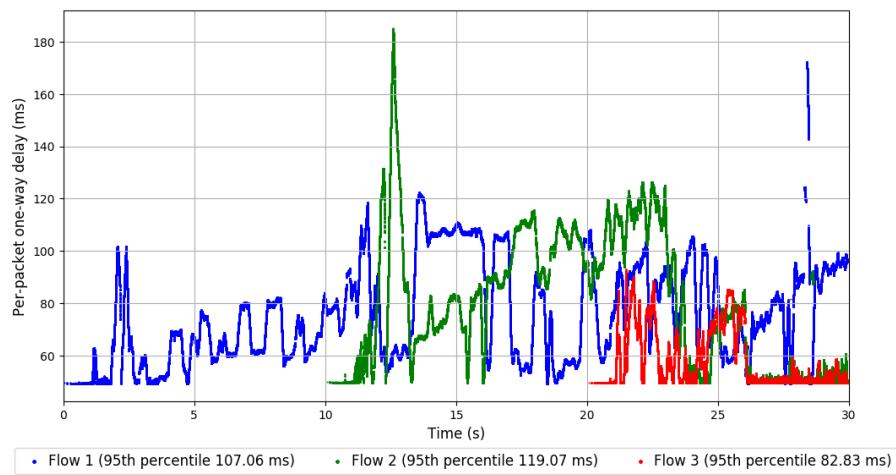
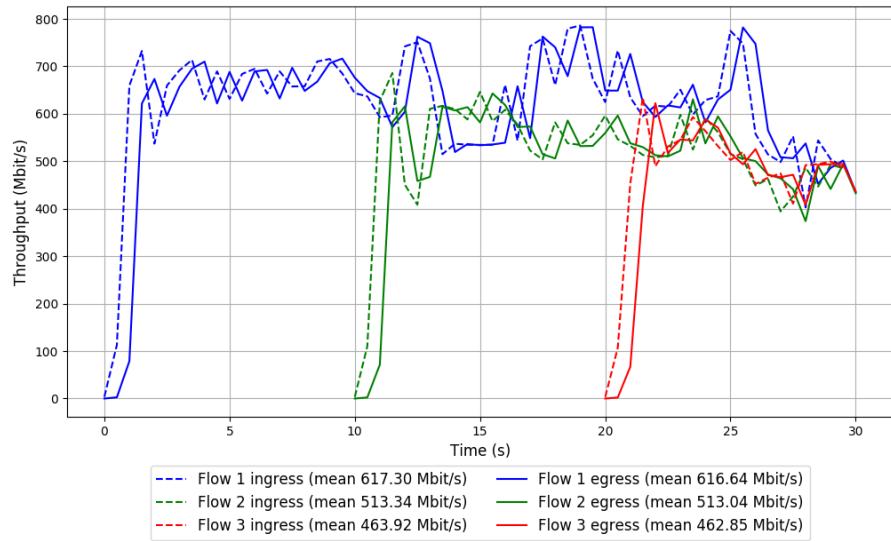


Run 2: Statistics of TCP Cubic

```
Start at: 2018-08-31 13:54:56
End at: 2018-08-31 13:55:26
Local clock offset: -1.237 ms
Remote clock offset: -0.241 ms

# Below is generated by plot.py at 2018-08-31 14:18:46
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1110.68 Mbit/s
95th percentile per-packet one-way delay: 110.966 ms
Loss rate: 0.59%
-- Flow 1:
Average throughput: 616.64 Mbit/s
95th percentile per-packet one-way delay: 107.056 ms
Loss rate: 0.44%
-- Flow 2:
Average throughput: 513.04 Mbit/s
95th percentile per-packet one-way delay: 119.067 ms
Loss rate: 0.56%
-- Flow 3:
Average throughput: 462.85 Mbit/s
95th percentile per-packet one-way delay: 82.835 ms
Loss rate: 1.24%
```

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

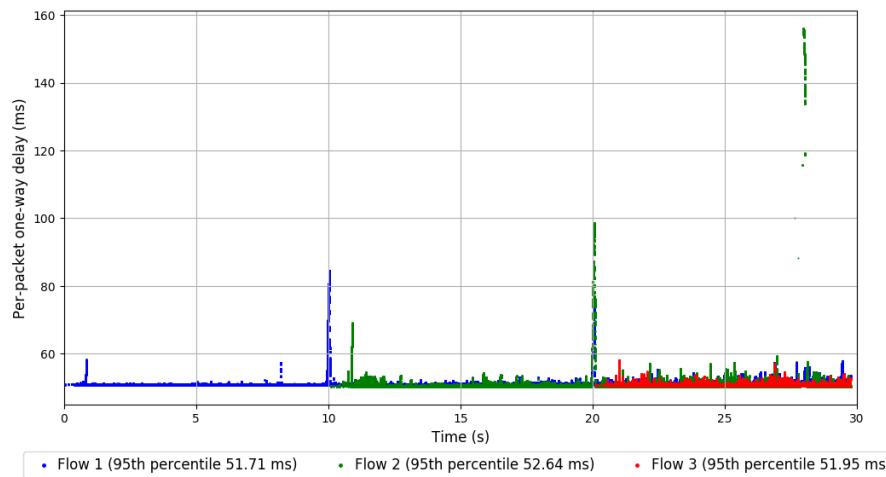
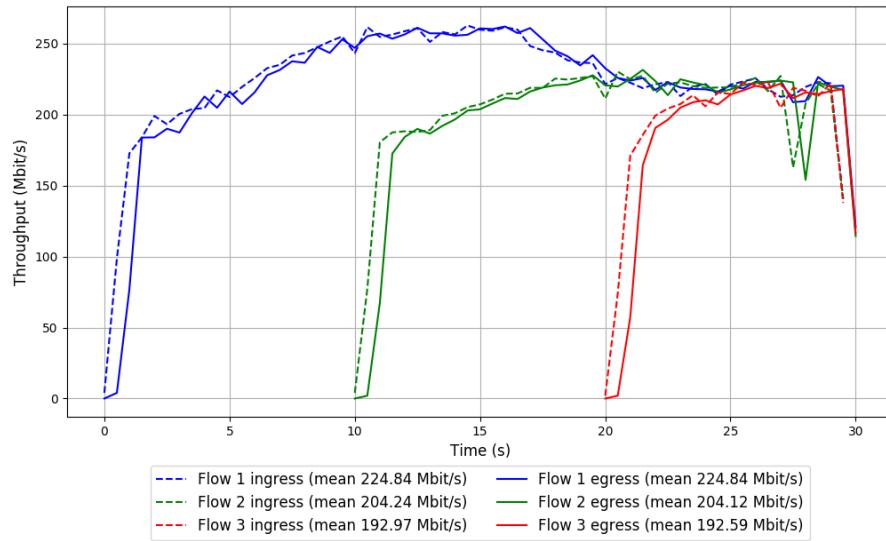


Run 1: Statistics of Indigo

```
Start at: 2018-08-31 13:51:06
End at: 2018-08-31 13:51:36
Local clock offset: -0.333 ms
Remote clock offset: -0.264 ms

# Below is generated by plot.py at 2018-08-31 14:18:46
# Datalink statistics
-- Total of 3 flows:
Average throughput: 422.62 Mbit/s
95th percentile per-packet one-way delay: 52.036 ms
Loss rate: 0.55%
-- Flow 1:
Average throughput: 224.84 Mbit/s
95th percentile per-packet one-way delay: 51.711 ms
Loss rate: 0.34%
-- Flow 2:
Average throughput: 204.12 Mbit/s
95th percentile per-packet one-way delay: 52.639 ms
Loss rate: 0.57%
-- Flow 3:
Average throughput: 192.59 Mbit/s
95th percentile per-packet one-way delay: 51.953 ms
Loss rate: 1.23%
```

Run 1: Report of Indigo — Data Link

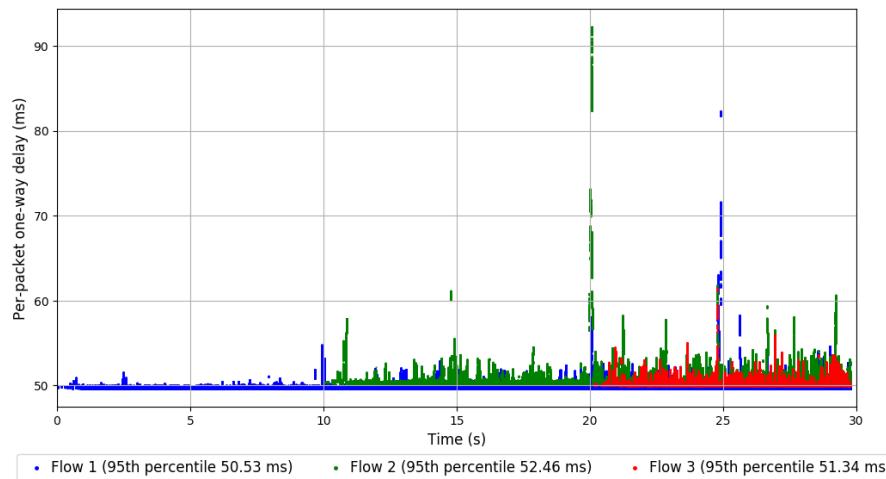
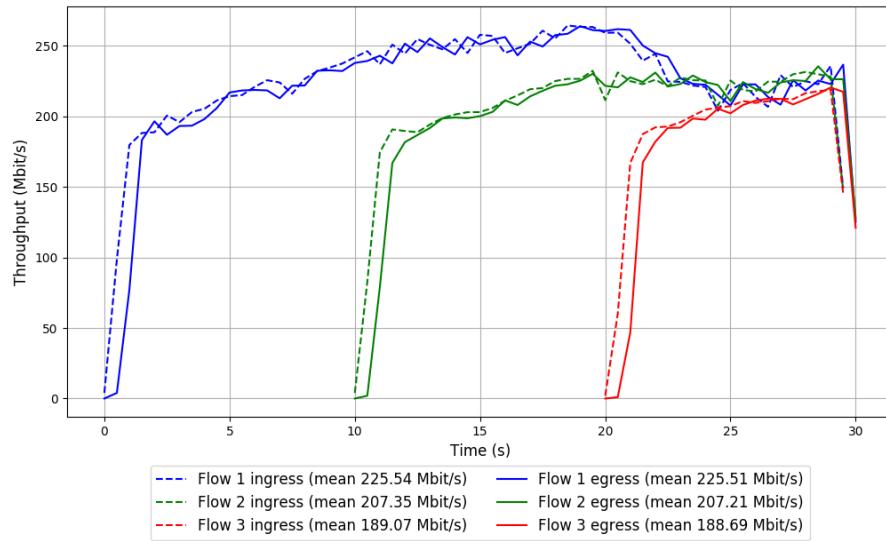


Run 2: Statistics of Indigo

```
Start at: 2018-08-31 13:58:56
End at: 2018-08-31 13:59:26
Local clock offset: -0.786 ms
Remote clock offset: -0.322 ms

# Below is generated by plot.py at 2018-08-31 14:18:46
# Datalink statistics
-- Total of 3 flows:
Average throughput: 423.78 Mbit/s
95th percentile per-packet one-way delay: 51.514 ms
Loss rate: 0.55%
-- Flow 1:
Average throughput: 225.51 Mbit/s
95th percentile per-packet one-way delay: 50.529 ms
Loss rate: 0.35%
-- Flow 2:
Average throughput: 207.21 Mbit/s
95th percentile per-packet one-way delay: 52.461 ms
Loss rate: 0.58%
-- Flow 3:
Average throughput: 188.69 Mbit/s
95th percentile per-packet one-way delay: 51.338 ms
Loss rate: 1.24%
```

## Run 2: Report of Indigo — Data Link

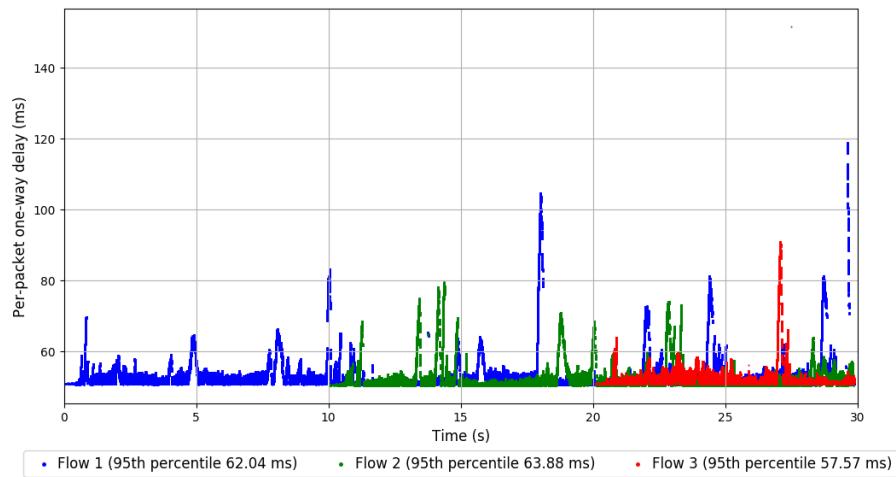
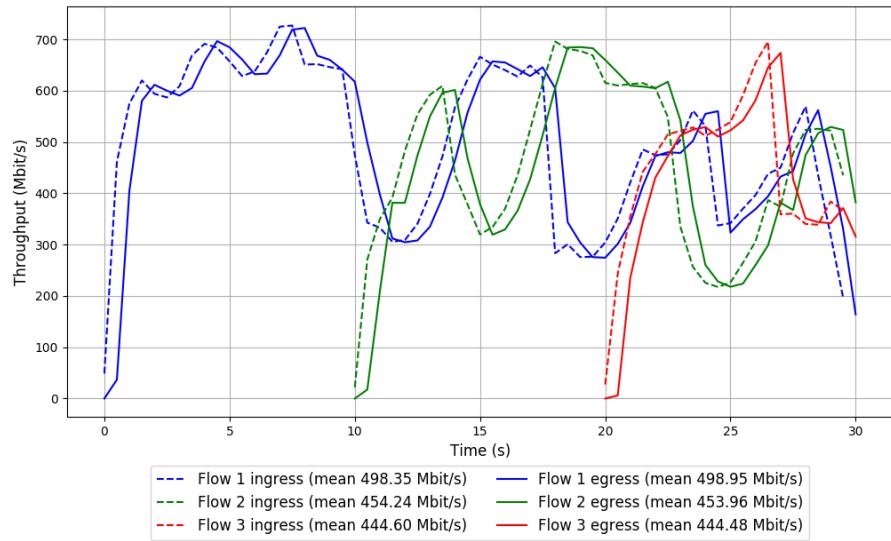


Run 1: Statistics of Muses-25

```
Start at: 2018-08-31 13:49:08
End at: 2018-08-31 13:49:38
Local clock offset: -0.243 ms
Remote clock offset: -0.227 ms

# Below is generated by plot.py at 2018-08-31 14:19:20
# Datalink statistics
-- Total of 3 flows:
Average throughput: 946.12 Mbit/s
95th percentile per-packet one-way delay: 62.146 ms
Loss rate: 0.47%
-- Flow 1:
Average throughput: 498.95 Mbit/s
95th percentile per-packet one-way delay: 62.042 ms
Loss rate: 0.22%
-- Flow 2:
Average throughput: 453.96 Mbit/s
95th percentile per-packet one-way delay: 63.879 ms
Loss rate: 0.58%
-- Flow 3:
Average throughput: 444.48 Mbit/s
95th percentile per-packet one-way delay: 57.571 ms
Loss rate: 1.07%
```

Run 1: Report of Muses-25 — Data Link



Run 2: Statistics of Muses-25

```
Start at: 2018-08-31 13:56:58
End at: 2018-08-31 13:57:28
Local clock offset: -1.274 ms
Remote clock offset: -0.277 ms

# Below is generated by plot.py at 2018-08-31 14:19:25
# Datalink statistics
-- Total of 3 flows:
Average throughput: 949.06 Mbit/s
95th percentile per-packet one-way delay: 62.252 ms
Loss rate: 0.41%
-- Flow 1:
Average throughput: 536.62 Mbit/s
95th percentile per-packet one-way delay: 60.348 ms
Loss rate: 0.21%
-- Flow 2:
Average throughput: 415.92 Mbit/s
95th percentile per-packet one-way delay: 64.572 ms
Loss rate: 0.65%
-- Flow 3:
Average throughput: 415.65 Mbit/s
95th percentile per-packet one-way delay: 63.987 ms
Loss rate: 0.69%
```

Run 2: Report of Muses-25 — Data Link

