

## Pantheon Report

Generated at 2018-08-28 14:07:13 (UTC).  
Data path: GCE Iowa 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.

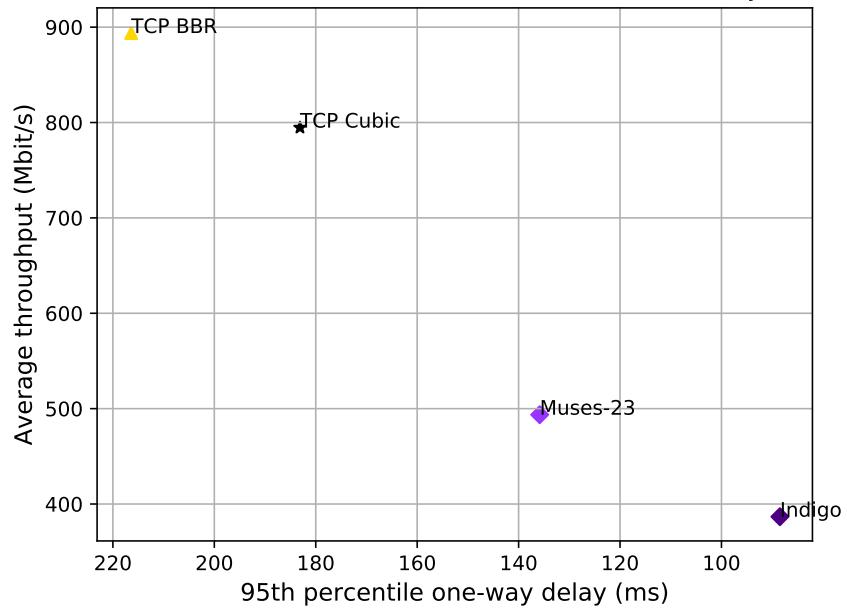
System info:

```
Linux 4.15.0-1015-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
```

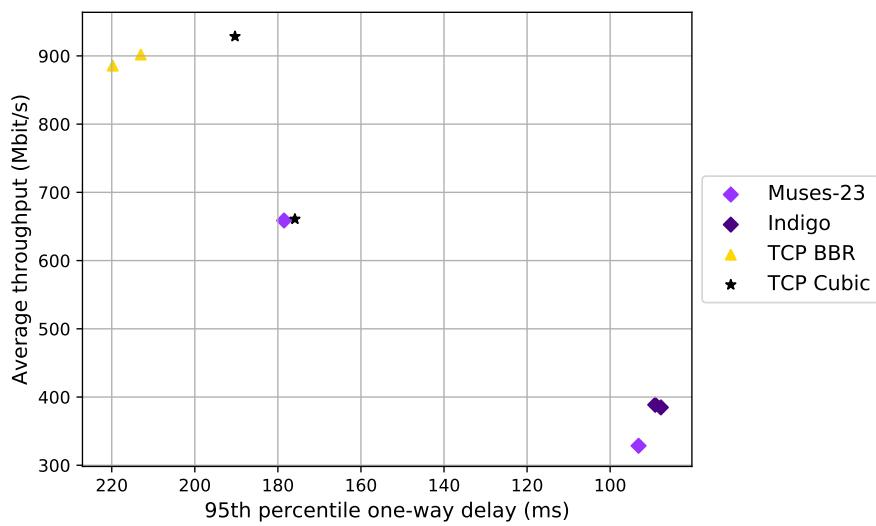
Git summary:

```
branch: muses-23 @ 88af05c5b0b7531637ca401951507a2fde628df6
third_party/fillp @ d47f4fa1b454a5e3c0537115c5a28436dbd4b834
third_party/fillp-sheep @ daed0c84f98531712514b2231f43ec6901114ffe
third_party/genericCC @ d0153f8e594aa89e93b032143cedbfe58e562f4
third_party/indigo @ 2601c92e4aa9d58d38dc4dfe0ecdbf90c077e64d
third_party/libutp @ b3465b942e2826f2b179eaab4a906ce6bb7cf3cf
third_party/muses @ b261c9e99c63be452bc16f94ce0caa99a4c9d39a
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 Sydney, 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 Sydney, 2 runs of 30s each per scheme  
3 flows with 10s interval between flows



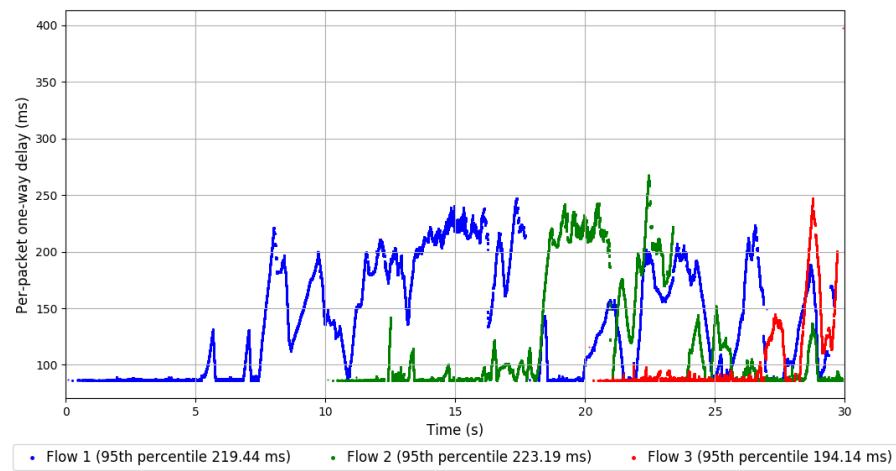
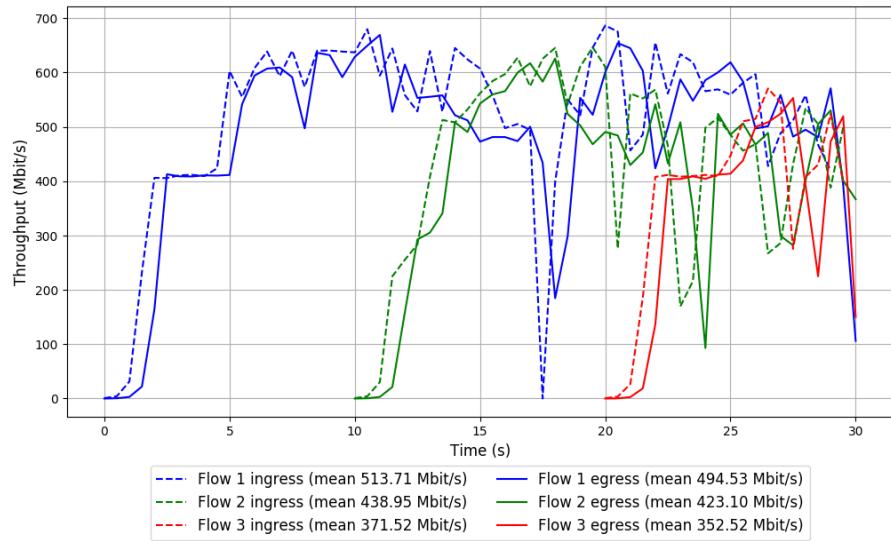
scheme	# runs	mean avg tput (Mbit/s)			mean 95th-%ile delay (ms)			mean loss rate (%)		
		flow 1	flow 2	flow 3	flow 1	flow 2	flow 3	flow 1	flow 2	flow 3
TCP BBR	2	485.76	436.00	369.12	212.82	228.73	188.28	3.35	4.48	4.54
TCP Cubic	2	350.44	492.38	356.96	149.95	187.86	148.16	0.45	1.28	2.45
Indigo	2	206.18	194.78	160.73	88.18	88.75	88.68	0.58	0.86	2.10
Muses-23	2	333.56	163.16	159.95	137.12	95.58	93.46	5.18	0.66	1.59

Run 1: Statistics of TCP BBR

```
Start at: 2018-08-28 13:40:12
End at: 2018-08-28 13:40:42
Local clock offset: -0.09 ms
Remote clock offset: -0.022 ms

# Below is generated by plot.py at 2018-08-28 14:06:55
# Datalink statistics
-- Total of 3 flows:
Average throughput: 885.71 Mbit/s
95th percentile per-packet one-way delay: 219.776 ms
Loss rate: 4.10%
-- Flow 1:
Average throughput: 494.53 Mbit/s
95th percentile per-packet one-way delay: 219.435 ms
Loss rate: 3.52%
-- Flow 2:
Average throughput: 423.10 Mbit/s
95th percentile per-packet one-way delay: 223.189 ms
Loss rate: 4.46%
-- Flow 3:
Average throughput: 352.52 Mbit/s
95th percentile per-packet one-way delay: 194.143 ms
Loss rate: 5.63%
```

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

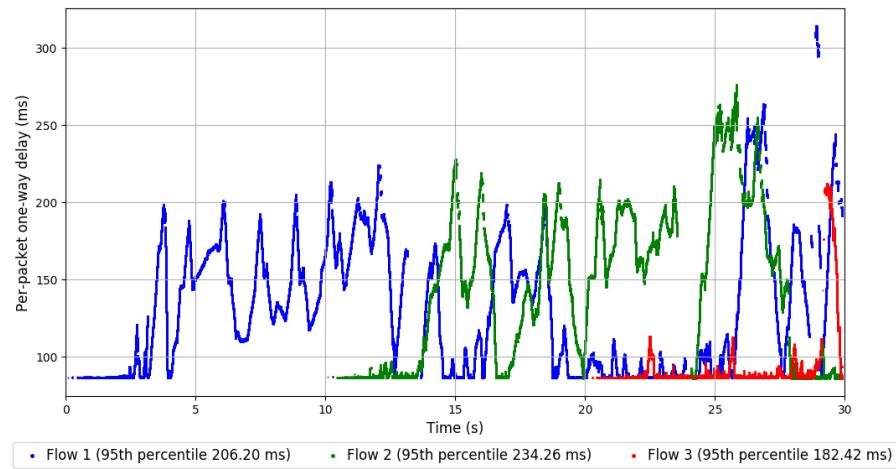
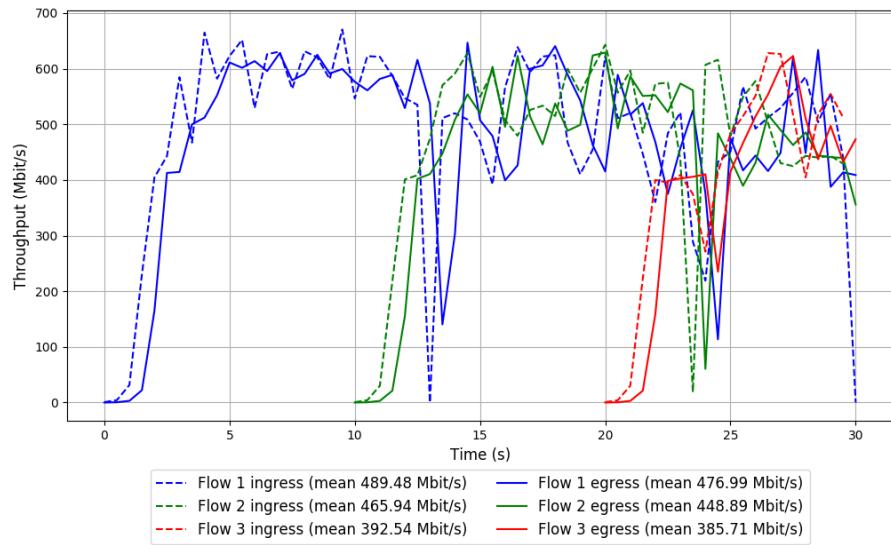


Run 2: Statistics of TCP BBR

```
Start at: 2018-08-28 13:48:04
End at: 2018-08-28 13:48:34
Local clock offset: -0.142 ms
Remote clock offset: -0.042 ms

# Below is generated by plot.py at 2018-08-28 14:07:03
# Datalink statistics
-- Total of 3 flows:
Average throughput: 901.96 Mbit/s
95th percentile per-packet one-way delay: 213.000 ms
Loss rate: 3.67%
-- Flow 1:
Average throughput: 476.99 Mbit/s
95th percentile per-packet one-way delay: 206.204 ms
Loss rate: 3.19%
-- Flow 2:
Average throughput: 448.89 Mbit/s
95th percentile per-packet one-way delay: 234.263 ms
Loss rate: 4.50%
-- Flow 3:
Average throughput: 385.71 Mbit/s
95th percentile per-packet one-way delay: 182.421 ms
Loss rate: 3.45%
```

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

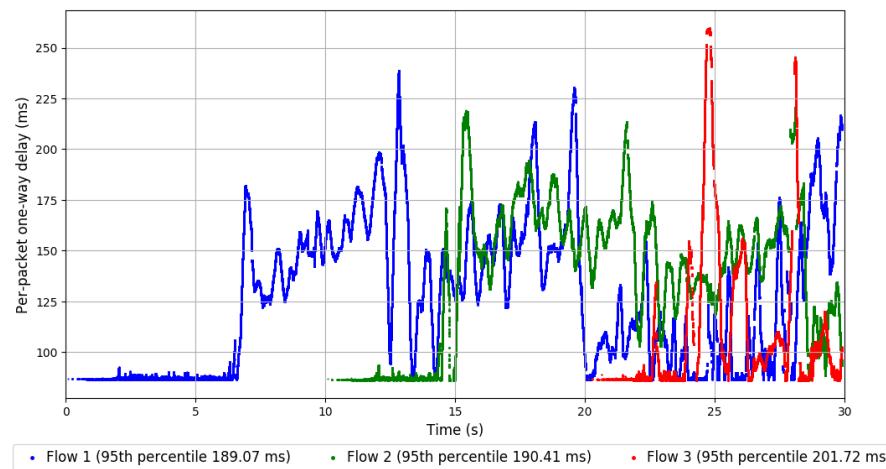
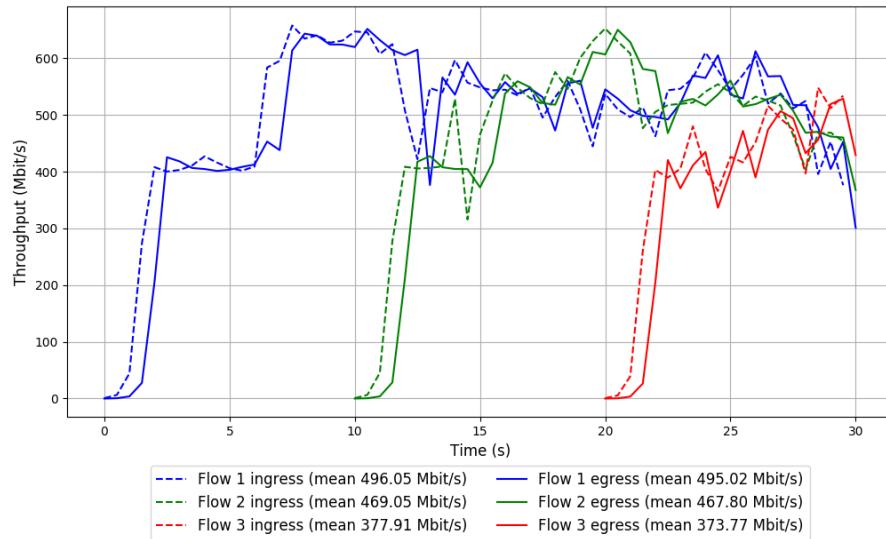


Run 1: Statistics of TCP Cubic

```
Start at: 2018-08-28 13:42:20
End at: 2018-08-28 13:42:50
Local clock offset: -0.014 ms
Remote clock offset: -0.043 ms

# Below is generated by plot.py at 2018-08-28 14:07:09
# Datalink statistics
-- Total of 3 flows:
Average throughput: 928.49 Mbit/s
95th percentile per-packet one-way delay: 190.326 ms
Loss rate: 1.17%
-- Flow 1:
Average throughput: 495.02 Mbit/s
95th percentile per-packet one-way delay: 189.068 ms
Loss rate: 0.79%
-- Flow 2:
Average throughput: 467.80 Mbit/s
95th percentile per-packet one-way delay: 190.413 ms
Loss rate: 1.13%
-- Flow 3:
Average throughput: 373.77 Mbit/s
95th percentile per-packet one-way delay: 201.717 ms
Loss rate: 2.82%
```

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

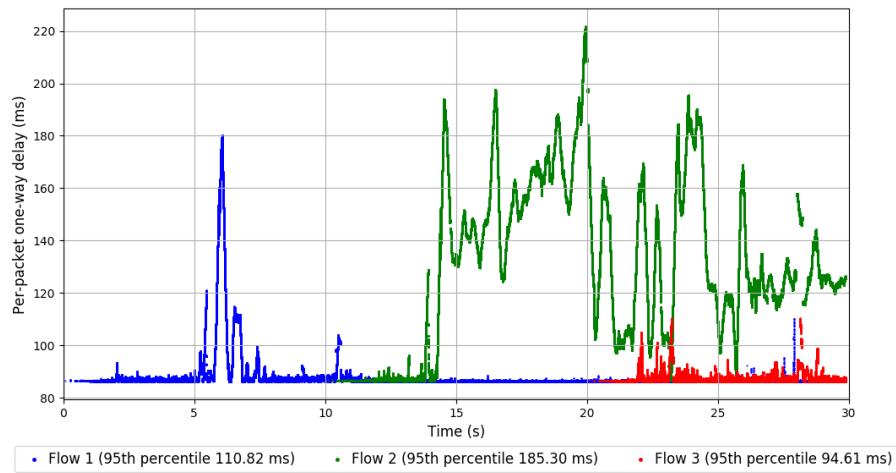
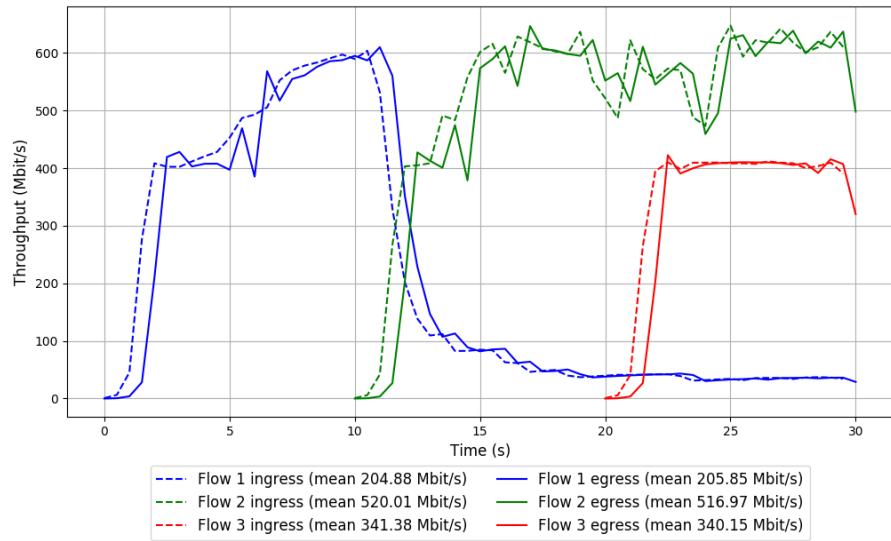


Run 2: Statistics of TCP Cubic

```
Start at: 2018-08-28 13:50:11
End at: 2018-08-28 13:50:41
Local clock offset: -0.157 ms
Remote clock offset: 0.009 ms

# Below is generated by plot.py at 2018-08-28 14:07:09
# Datalink statistics
-- Total of 3 flows:
Average throughput: 660.83 Mbit/s
95th percentile per-packet one-way delay: 175.905 ms
Loss rate: 1.14%
-- Flow 1:
Average throughput: 205.85 Mbit/s
95th percentile per-packet one-way delay: 110.823 ms
Loss rate: 0.11%
-- Flow 2:
Average throughput: 516.97 Mbit/s
95th percentile per-packet one-way delay: 185.304 ms
Loss rate: 1.44%
-- Flow 3:
Average throughput: 340.15 Mbit/s
95th percentile per-packet one-way delay: 94.612 ms
Loss rate: 2.08%
```

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

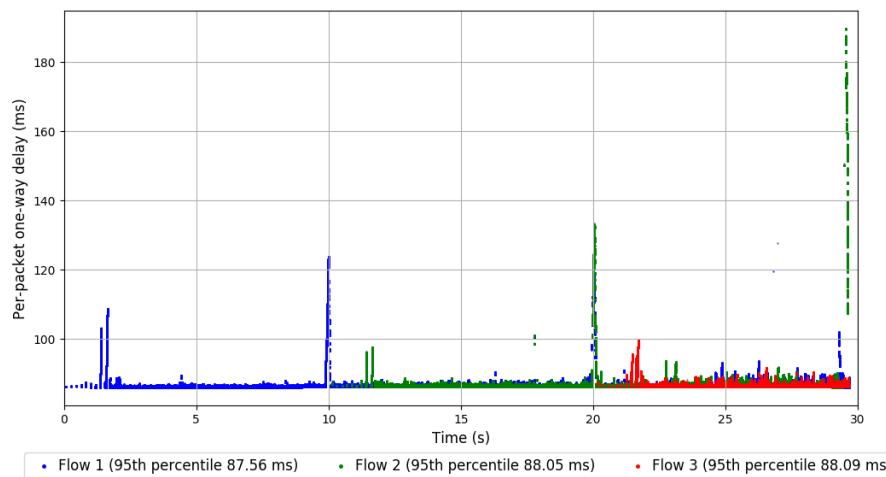
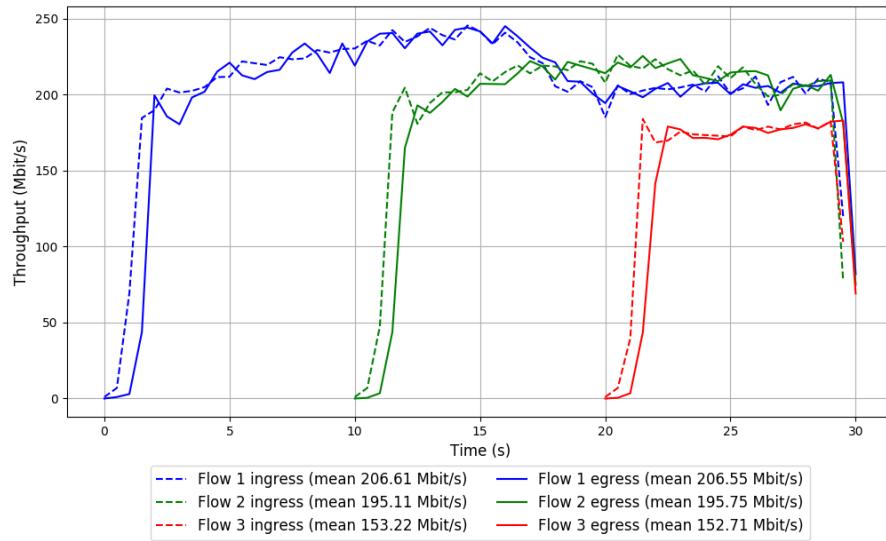


Run 1: Statistics of Indigo

```
Start at: 2018-08-28 13:38:23
End at: 2018-08-28 13:38:53
Local clock offset: -0.163 ms
Remote clock offset: -0.004 ms

# Below is generated by plot.py at 2018-08-28 14:07:09
# Datalink statistics
-- Total of 3 flows:
Average throughput: 384.78 Mbit/s
95th percentile per-packet one-way delay: 87.793 ms
Loss rate: 0.89%
-- Flow 1:
Average throughput: 206.55 Mbit/s
95th percentile per-packet one-way delay: 87.561 ms
Loss rate: 0.61%
-- Flow 2:
Average throughput: 195.75 Mbit/s
95th percentile per-packet one-way delay: 88.049 ms
Loss rate: 0.86%
-- Flow 3:
Average throughput: 152.71 Mbit/s
95th percentile per-packet one-way delay: 88.091 ms
Loss rate: 2.12%
```

## Run 1: Report of Indigo — Data Link

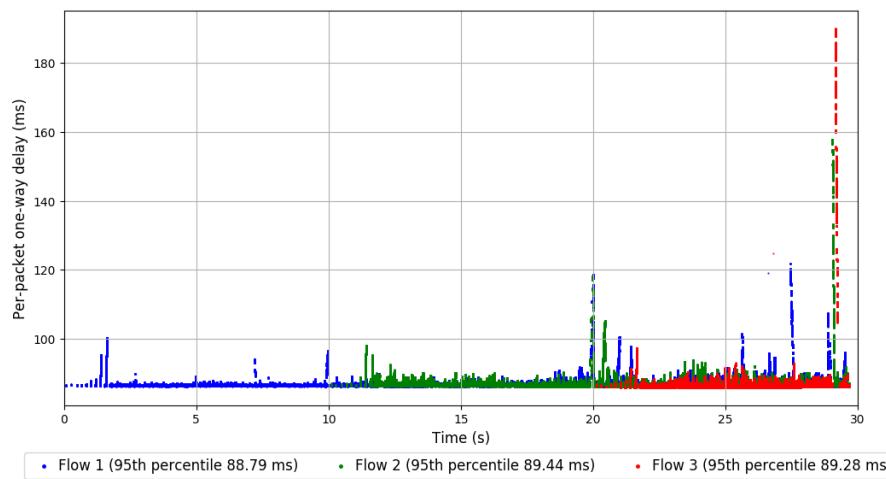
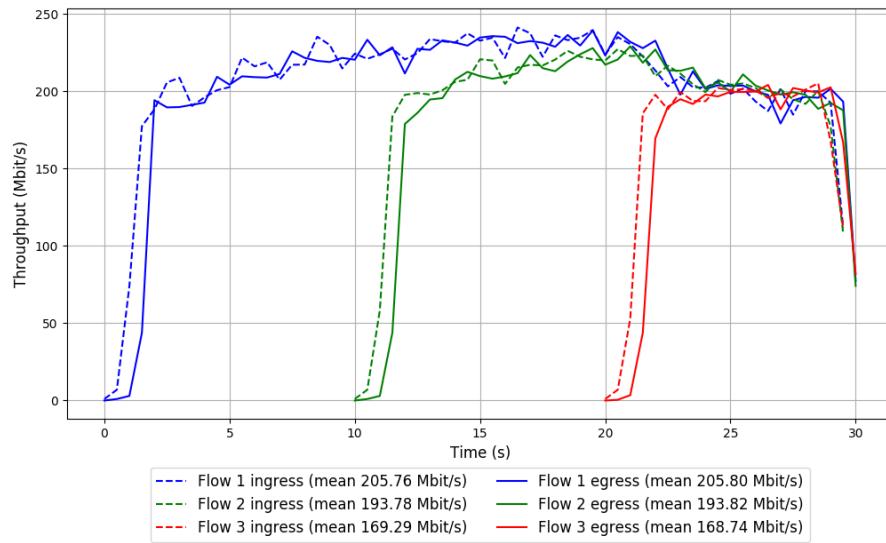


Run 2: Statistics of Indigo

```
Start at: 2018-08-28 13:46:14
End at: 2018-08-28 13:46:44
Local clock offset: -0.334 ms
Remote clock offset: -0.077 ms

# Below is generated by plot.py at 2018-08-28 14:07:09
# Datalink statistics
-- Total of 3 flows:
Average throughput: 388.63 Mbit/s
95th percentile per-packet one-way delay: 89.156 ms
Loss rate: 0.88%
-- Flow 1:
Average throughput: 205.80 Mbit/s
95th percentile per-packet one-way delay: 88.793 ms
Loss rate: 0.56%
-- Flow 2:
Average throughput: 193.82 Mbit/s
95th percentile per-packet one-way delay: 89.443 ms
Loss rate: 0.87%
-- Flow 3:
Average throughput: 168.74 Mbit/s
95th percentile per-packet one-way delay: 89.275 ms
Loss rate: 2.08%
```

## Run 2: Report of Indigo — Data Link

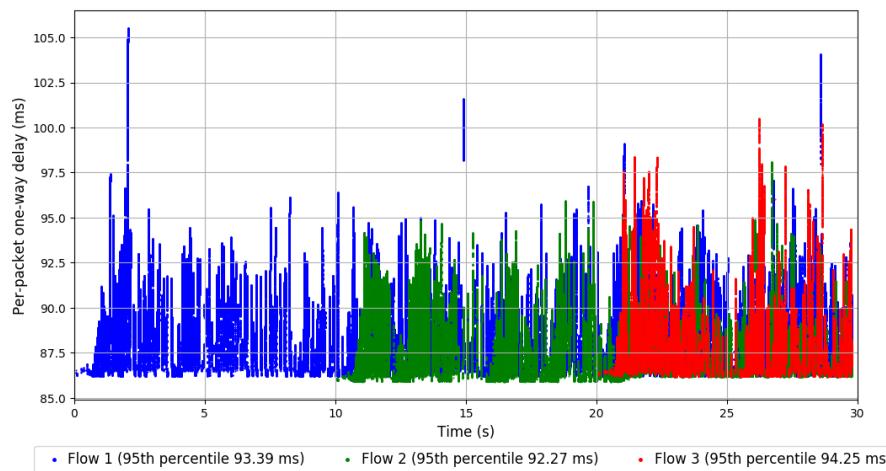
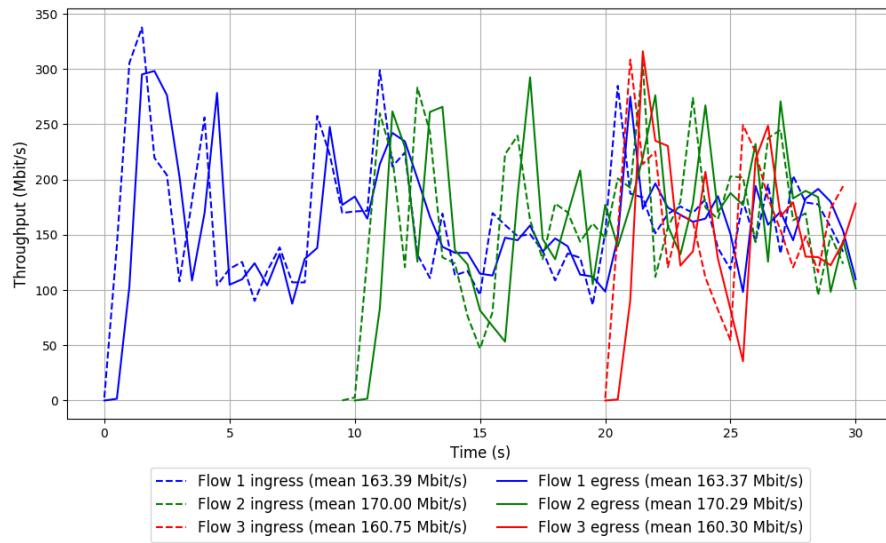


```
Run 1: Statistics of Muses-23
```

```
Start at: 2018-08-28 13:36:51
End at: 2018-08-28 13:37:21
Local clock offset: -0.223 ms
Remote clock offset: -0.032 ms

# Below is generated by plot.py at 2018-08-28 14:07:09
# Datalink statistics
-- Total of 3 flows:
Average throughput: 328.53 Mbit/s
95th percentile per-packet one-way delay: 93.163 ms
Loss rate: 0.88%
-- Flow 1:
Average throughput: 163.37 Mbit/s
95th percentile per-packet one-way delay: 93.389 ms
Loss rate: 0.60%
-- Flow 2:
Average throughput: 170.29 Mbit/s
95th percentile per-packet one-way delay: 92.274 ms
Loss rate: 0.70%
-- Flow 3:
Average throughput: 160.30 Mbit/s
95th percentile per-packet one-way delay: 94.254 ms
Loss rate: 2.12%
```

Run 1: Report of Muses-23 — Data Link



Run 2: Statistics of Muses-23

```
Start at: 2018-08-28 13:44:23
End at: 2018-08-28 13:44:53
Local clock offset: 0.075 ms
Remote clock offset: -0.024 ms

# Below is generated by plot.py at 2018-08-28 14:07:12
# Datalink statistics
-- Total of 3 flows:
Average throughput: 658.73 Mbit/s
95th percentile per-packet one-way delay: 178.515 ms
Loss rate: 7.80%
-- Flow 1:
Average throughput: 503.74 Mbit/s
95th percentile per-packet one-way delay: 180.860 ms
Loss rate: 9.77%
-- Flow 2:
Average throughput: 156.02 Mbit/s
95th percentile per-packet one-way delay: 98.889 ms
Loss rate: 0.62%
-- Flow 3:
Average throughput: 159.60 Mbit/s
95th percentile per-packet one-way delay: 92.674 ms
Loss rate: 1.06%
```

Run 2: Report of Muses-23 — Data Link

