

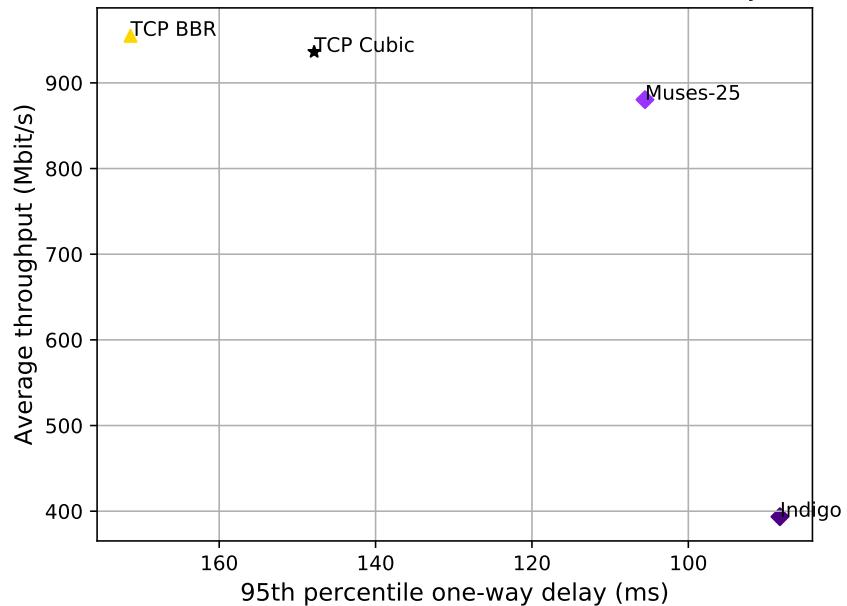
## Pantheon Report

Generated at 2018-08-31 09:24:14 (UTC).  
Data path: GCE Sydney on `ens4 (local)` → GCE Iowa on `ens4 (remote)`.  
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.

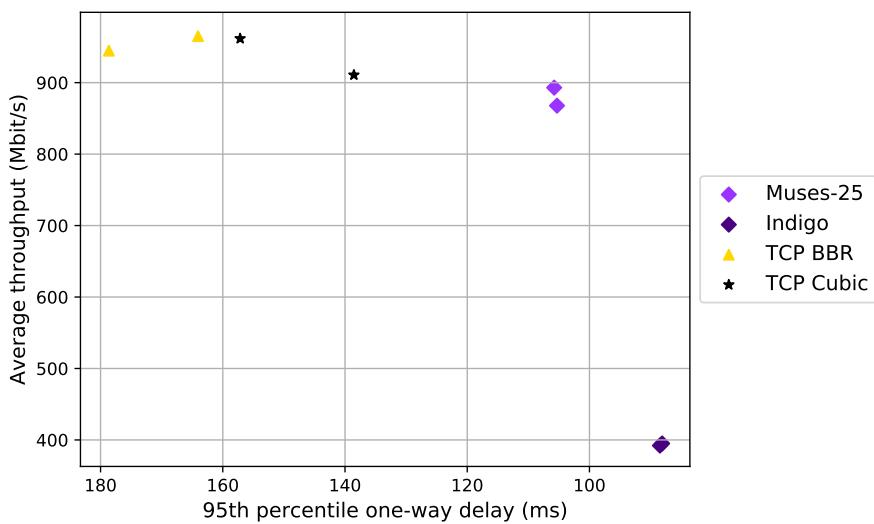
System info:  
Linux 4.15.0-1018-gcp  
net.core.default\_qdisc = fq  
net.core.rmem\_default = 16777216  
net.core.rmem\_max = 536870912  
net.core.wmem\_default = 16777216  
net.core.wmem\_max = 536870912  
net.ipv4.tcp\_rmem = 4096 16777216 536870912  
net.ipv4.tcp\_wmem = 4096 16777216 536870912  
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 Sydney to GCE Iowa, 2 runs of 30s each per scheme  
 3 flows with 10s interval between flows (mean of all runs by scheme)



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



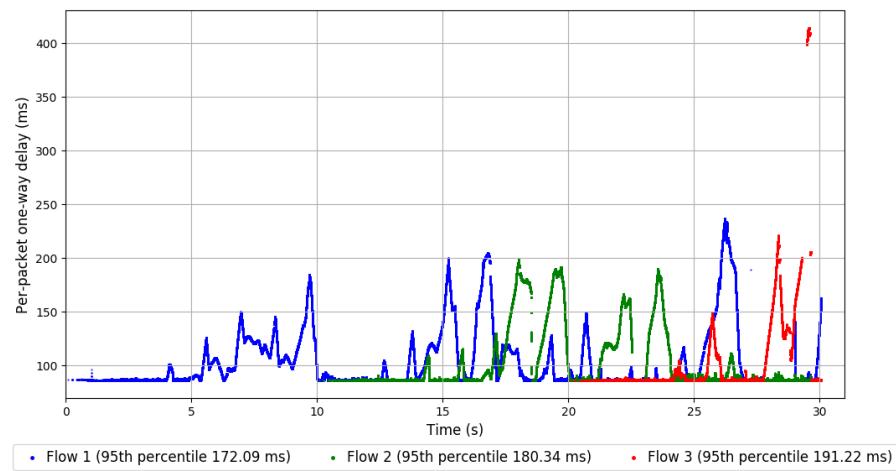
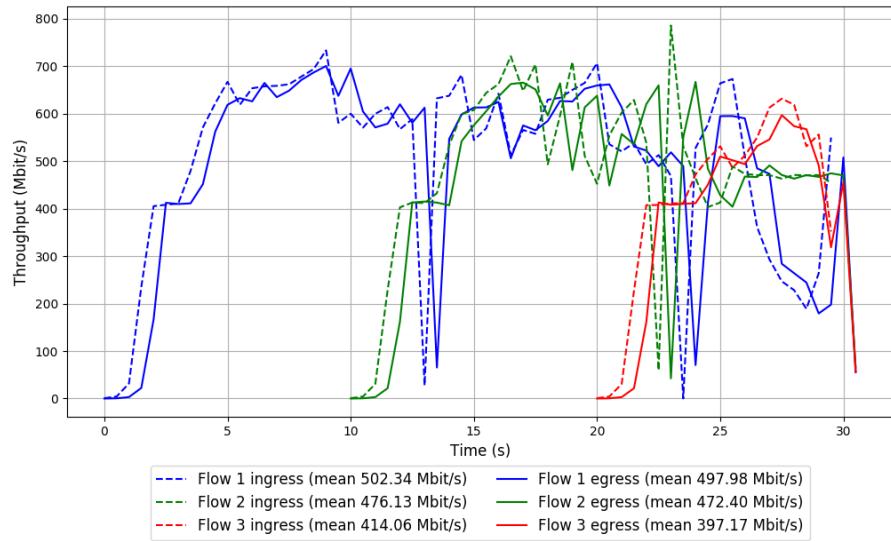
scheme	# runs	mean avg tput (Mbit/s)			mean 95th-%ile delay (ms)			mean loss rate (%)		
		flow 1	flow 2	flow 3	flow 1	flow 2	flow 3	flow 1	flow 2	flow 3
TCP BBR	2	510.84	463.32	407.42	171.14	150.08	181.30	0.74	0.39	2.10
TCP Cubic	2	513.86	430.41	408.07	129.17	111.09	198.64	0.12	0.00	0.77
Indigo	2	206.74	199.59	169.42	88.01	88.50	88.65	0.00	0.00	0.62
Muses-25	2	491.42	374.29	431.61	104.88	108.53	102.99	0.01	0.00	0.00

Run 1: Statistics of TCP BBR

```
Start at: 2018-08-31 08:51:25
End at: 2018-08-31 08:51:55
Local clock offset: 15.311 ms
Remote clock offset: 18.795 ms

# Below is generated by plot.py at 2018-08-31 09:23:16
# Datalink statistics
-- Total of 3 flows:
Average throughput: 944.78 Mbit/s
95th percentile per-packet one-way delay: 178.640 ms
Loss rate: 1.30%
-- Flow 1:
Average throughput: 497.98 Mbit/s
95th percentile per-packet one-way delay: 172.093 ms
Loss rate: 0.87%
-- Flow 2:
Average throughput: 472.40 Mbit/s
95th percentile per-packet one-way delay: 180.341 ms
Loss rate: 0.78%
-- Flow 3:
Average throughput: 397.17 Mbit/s
95th percentile per-packet one-way delay: 191.219 ms
Loss rate: 4.08%
```

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

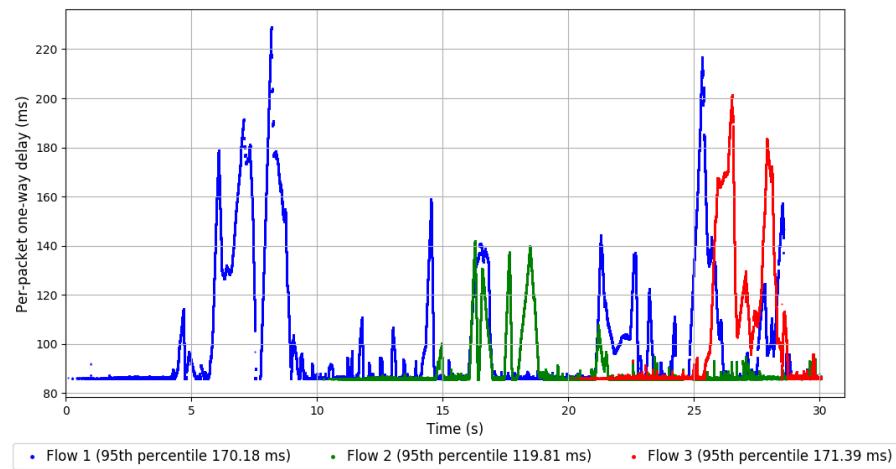
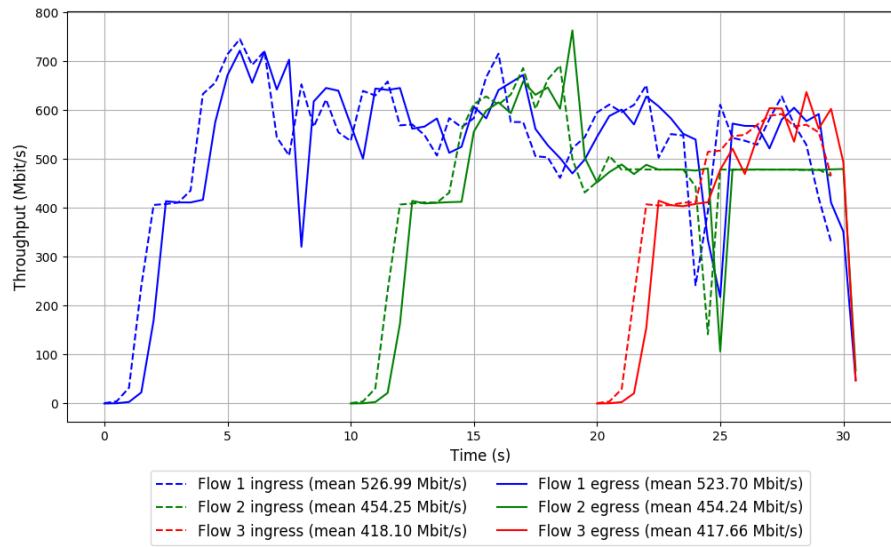


Run 2: Statistics of TCP BBR

```
Start at: 2018-08-31 08:59:24
End at: 2018-08-31 08:59:54
Local clock offset: 20.85 ms
Remote clock offset: 25.746 ms

# Below is generated by plot.py at 2018-08-31 09:23:21
# Datalink statistics
-- Total of 3 flows:
Average throughput: 965.06 Mbit/s
95th percentile per-packet one-way delay: 164.045 ms
Loss rate: 0.35%
-- Flow 1:
Average throughput: 523.70 Mbit/s
95th percentile per-packet one-way delay: 170.178 ms
Loss rate: 0.62%
-- Flow 2:
Average throughput: 454.24 Mbit/s
95th percentile per-packet one-way delay: 119.812 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 417.66 Mbit/s
95th percentile per-packet one-way delay: 171.386 ms
Loss rate: 0.11%
```

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

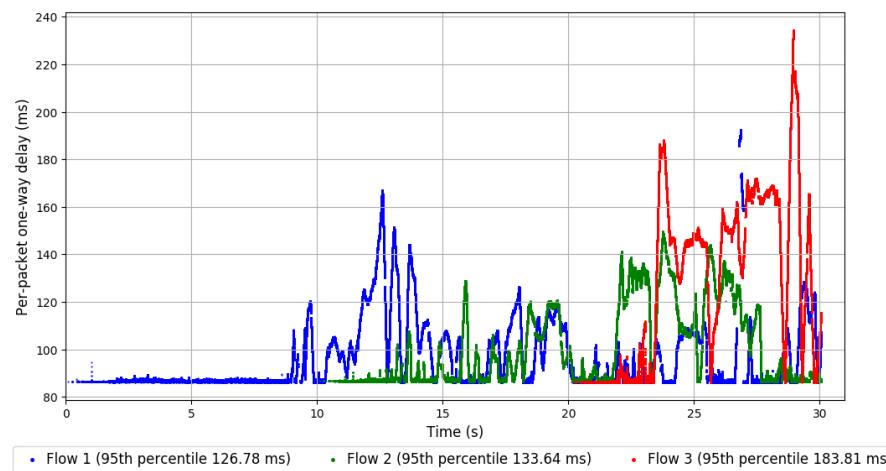
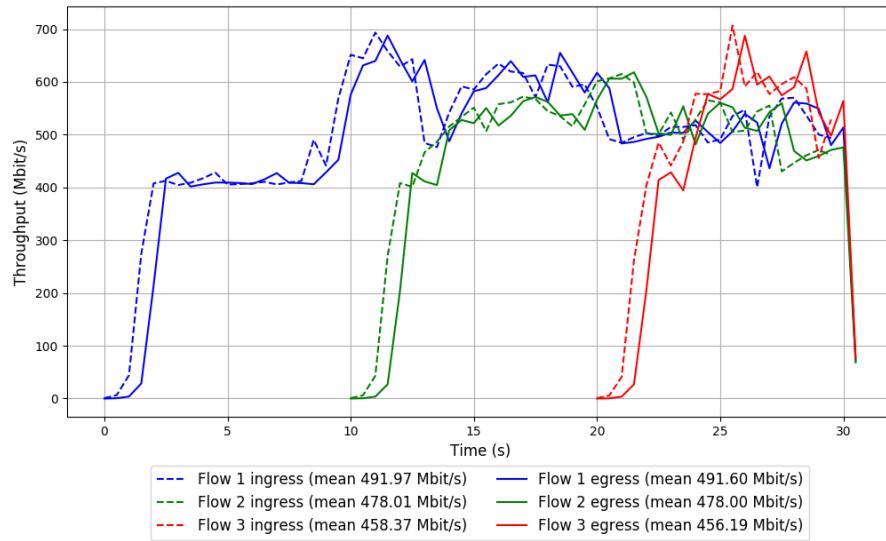


```
Run 1: Statistics of TCP Cubic
```

```
Start at: 2018-08-31 08:55:32
End at: 2018-08-31 08:56:02
Local clock offset: 19.812 ms
Remote clock offset: 24.61 ms

# Below is generated by plot.py at 2018-08-31 09:23:21
# Datalink statistics
-- Total of 3 flows:
Average throughput: 961.61 Mbit/s
95th percentile per-packet one-way delay: 157.161 ms
Loss rate: 0.11%
-- Flow 1:
Average throughput: 491.60 Mbit/s
95th percentile per-packet one-way delay: 126.783 ms
Loss rate: 0.07%
-- Flow 2:
Average throughput: 478.00 Mbit/s
95th percentile per-packet one-way delay: 133.638 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 456.19 Mbit/s
95th percentile per-packet one-way delay: 183.807 ms
Loss rate: 0.47%
```

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

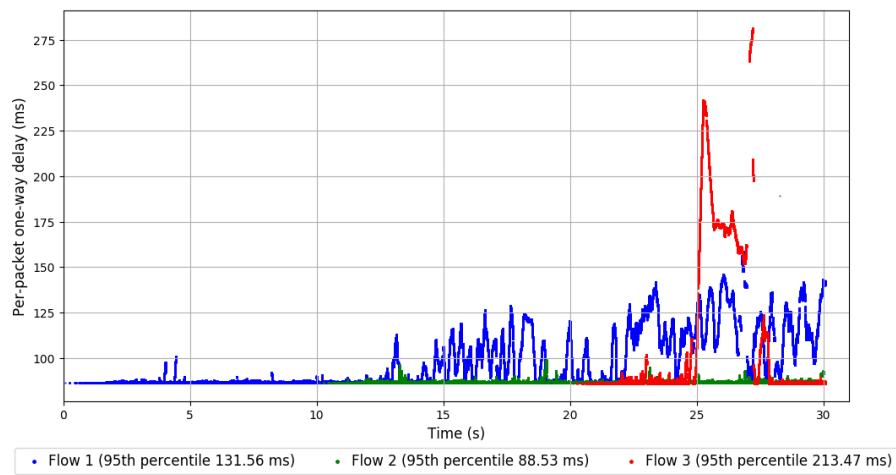
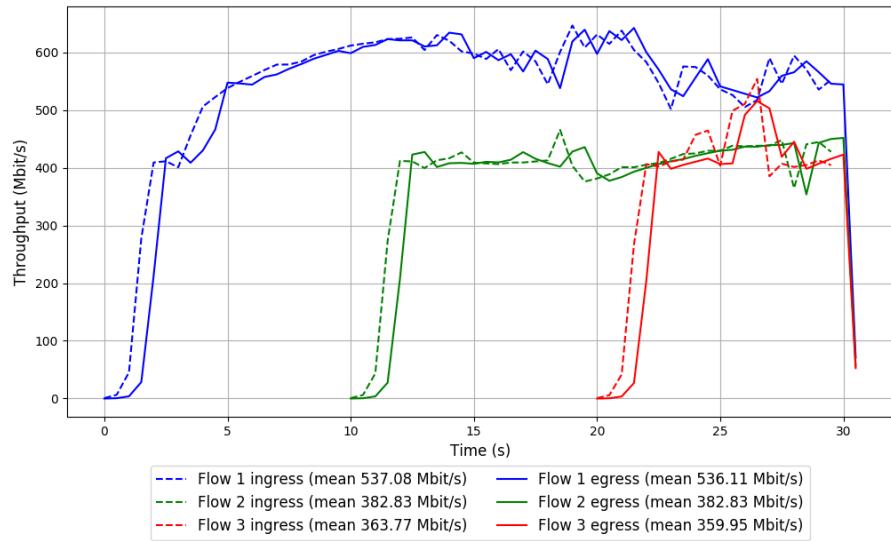


Run 2: Statistics of TCP Cubic

```
Start at: 2018-08-31 09:03:31
End at: 2018-08-31 09:04:01
Local clock offset: 17.343 ms
Remote clock offset: 21.712 ms

# Below is generated by plot.py at 2018-08-31 09:23:21
# Datalink statistics
-- Total of 3 flows:
Average throughput: 910.75 Mbit/s
95th percentile per-packet one-way delay: 138.547 ms
Loss rate: 0.25%
-- Flow 1:
Average throughput: 536.11 Mbit/s
95th percentile per-packet one-way delay: 131.561 ms
Loss rate: 0.18%
-- Flow 2:
Average throughput: 382.83 Mbit/s
95th percentile per-packet one-way delay: 88.532 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 359.95 Mbit/s
95th percentile per-packet one-way delay: 213.465 ms
Loss rate: 1.06%
```

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

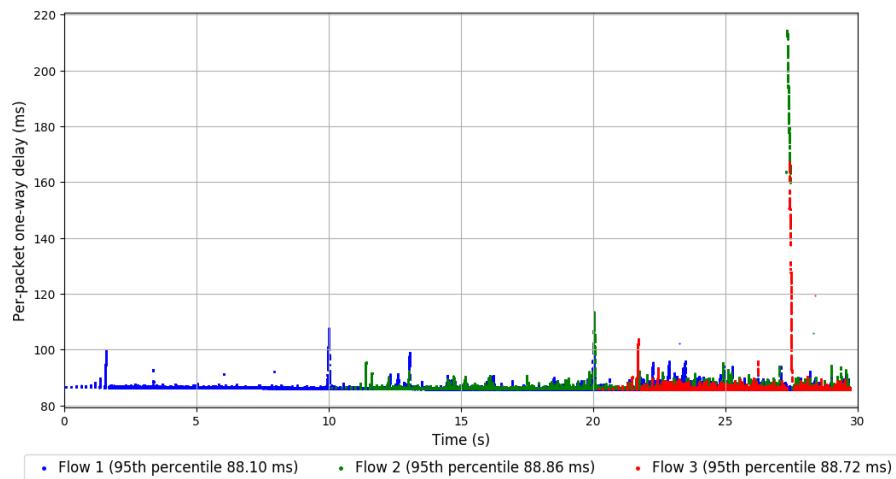
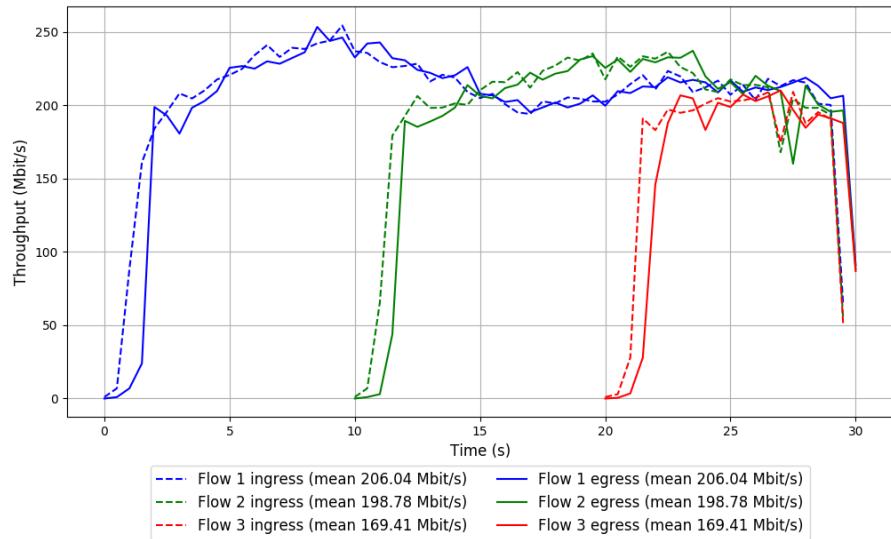


Run 1: Statistics of Indigo

```
Start at: 2018-08-31 08:57:35
End at: 2018-08-31 08:58:05
Local clock offset: 22.086 ms
Remote clock offset: 27.737 ms

# Below is generated by plot.py at 2018-08-31 09:23:21
# Datalink statistics
-- Total of 3 flows:
Average throughput: 392.13 Mbit/s
95th percentile per-packet one-way delay: 88.469 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 206.04 Mbit/s
95th percentile per-packet one-way delay: 88.098 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 198.78 Mbit/s
95th percentile per-packet one-way delay: 88.857 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 169.41 Mbit/s
95th percentile per-packet one-way delay: 88.722 ms
Loss rate: 0.00%
```

Run 1: Report of Indigo — Data Link

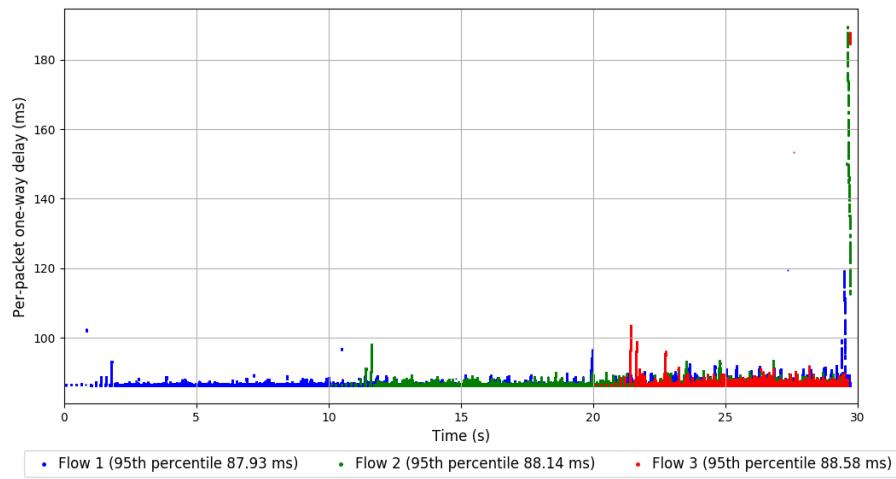
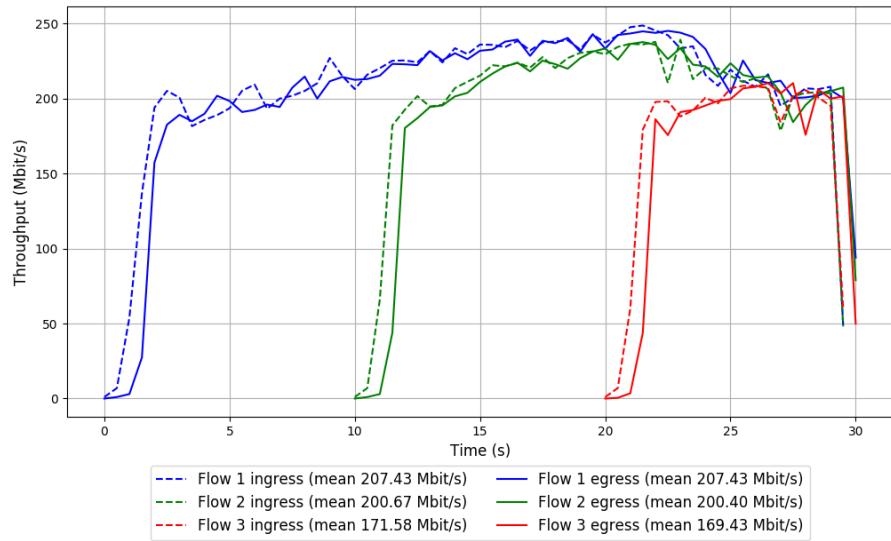


Run 2: Statistics of Indigo

```
Start at: 2018-08-31 09:05:31
End at: 2018-08-31 09:06:01
Local clock offset: 17.05 ms
Remote clock offset: 21.074 ms

# Below is generated by plot.py at 2018-08-31 09:23:21
# Datalink statistics
-- Total of 3 flows:
Average throughput: 395.03 Mbit/s
95th percentile per-packet one-way delay: 88.103 ms
Loss rate: 0.17%
-- Flow 1:
Average throughput: 207.43 Mbit/s
95th percentile per-packet one-way delay: 87.929 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 200.40 Mbit/s
95th percentile per-packet one-way delay: 88.141 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 169.43 Mbit/s
95th percentile per-packet one-way delay: 88.582 ms
Loss rate: 1.24%
```

## Run 2: Report of Indigo — Data Link

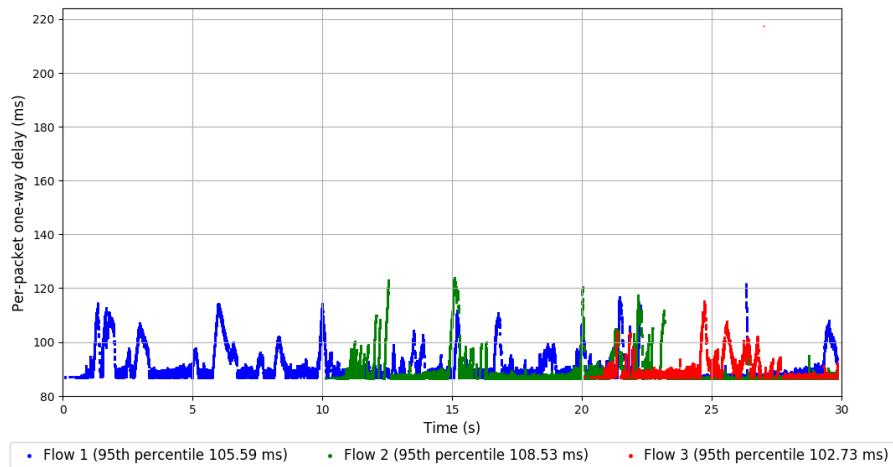
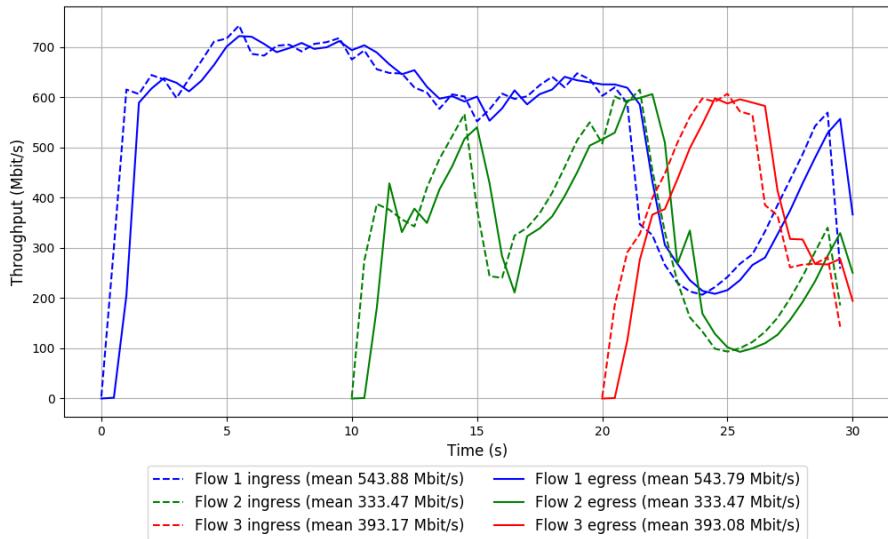


Run 1: Statistics of Muses-25

```
Start at: 2018-08-31 08:53:31
End at: 2018-08-31 08:54:01
Local clock offset: 17.1 ms
Remote clock offset: 21.869 ms

# Below is generated by plot.py at 2018-08-31 09:24:13
# Datalink statistics
-- Total of 3 flows:
Average throughput: 893.01 Mbit/s
95th percentile per-packet one-way delay: 105.773 ms
Loss rate: 0.01%
-- Flow 1:
Average throughput: 543.79 Mbit/s
95th percentile per-packet one-way delay: 105.592 ms
Loss rate: 0.02%
-- Flow 2:
Average throughput: 333.47 Mbit/s
95th percentile per-packet one-way delay: 108.529 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 393.08 Mbit/s
95th percentile per-packet one-way delay: 102.734 ms
Loss rate: 0.00%
```

Run 1: Report of Muses-25 — Data Link



Run 2: Statistics of Muses-25

```
Start at: 2018-08-31 09:01:31
End at: 2018-08-31 09:02:01
Local clock offset: 18.354 ms
Remote clock offset: 23.299 ms

# Below is generated by plot.py at 2018-08-31 09:24:13
# Datalink statistics
-- Total of 3 flows:
Average throughput: 867.79 Mbit/s
95th percentile per-packet one-way delay: 105.310 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 439.05 Mbit/s
95th percentile per-packet one-way delay: 104.167 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 415.11 Mbit/s
95th percentile per-packet one-way delay: 108.529 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 470.14 Mbit/s
95th percentile per-packet one-way delay: 103.239 ms
Loss rate: 0.00%
```

Run 2: Report of Muses-25 — Data Link

