

## Pantheon Report

Generated at 2018-09-03 10:17:48 (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.

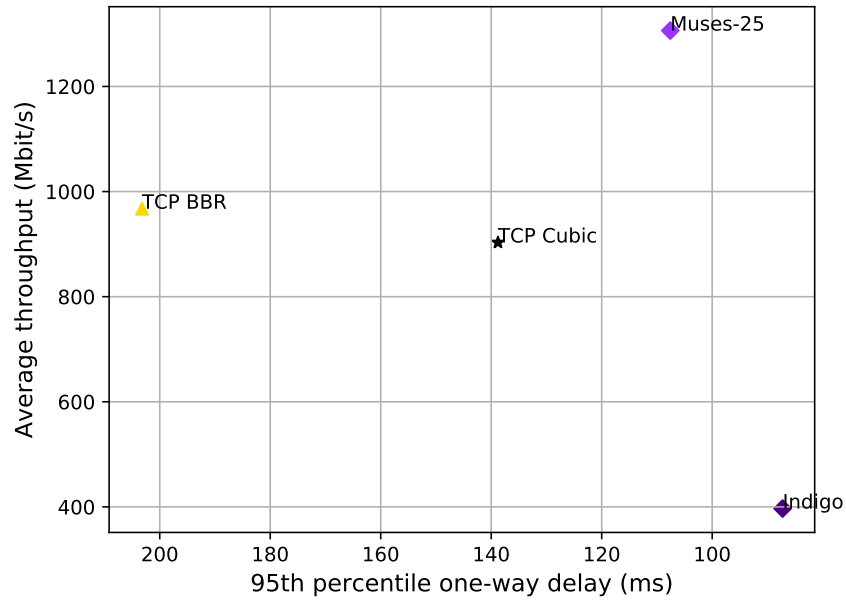
### System info:

```
Linux 4.15.0-1018-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
```

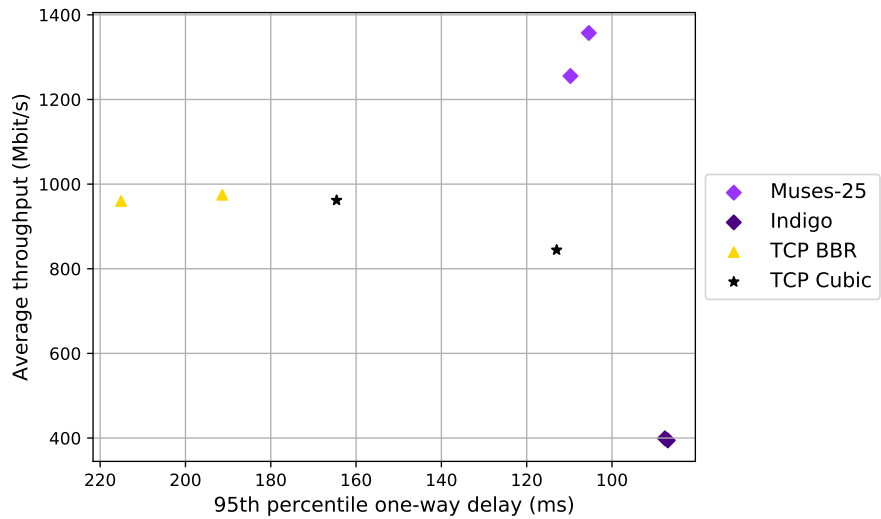
### Git summary:

```
branch: muses @ f309f5459e2c5237279a184e52ece7a2b47ef1c9
third_party/fillp @ d47f4fa1b454a5e3c0537115c5a28436dbd4b834
third_party/fillp-sheep @ daed0c84f98531712514b2231f43ec6901114ffe
third_party/genericCC @ d0153f8e594aa89e93b032143cedbdf58e562f4
third_party/indigo @ 2601c92e4aa9d58d38dc4dfe0ecdbf90c077e64d
third_party/libutp @ b3465b942e2826f2b179eaab4a906ce6bb7cf3cf
third_party/muses @ b8d5019b83a3a678804d830fcfe1da7b3a63421b
third_party/pantheon-tunnel @ cbfce6db5ff5740dafa1771f813cd646339e1952
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	523.16	468.83	404.02	197.02	194.36	213.08	2.11	2.28	4.88
TCP Cubic	2	476.69	441.78	404.62	131.32	131.19	143.91	0.66	1.03	2.52
Indigo	2	208.36	201.50	170.84	86.69	87.91	87.00	0.60	0.95	2.20
Muses-25	2	706.45	626.13	566.18	110.67	104.59	105.46	0.41	0.96	2.10

Run 1: Statistics of TCP BBR

Start at: 2018-09-03 09:48:45

End at: 2018-09-03 09:49:15

Local clock offset: 14.56 ms

Remote clock offset: 6.303 ms

# Below is generated by plot.py at 2018-09-03 10:16:28

# Datalink statistics

-- Total of 3 flows:

Average throughput: 959.96 Mbit/s

95th percentile per-packet one-way delay: 215.096 ms

Loss rate: 3.30%

-- Flow 1:

Average throughput: 517.16 Mbit/s

95th percentile per-packet one-way delay: 220.342 ms

Loss rate: 3.22%

-- Flow 2:

Average throughput: 460.06 Mbit/s

95th percentile per-packet one-way delay: 204.660 ms

Loss rate: 3.24%

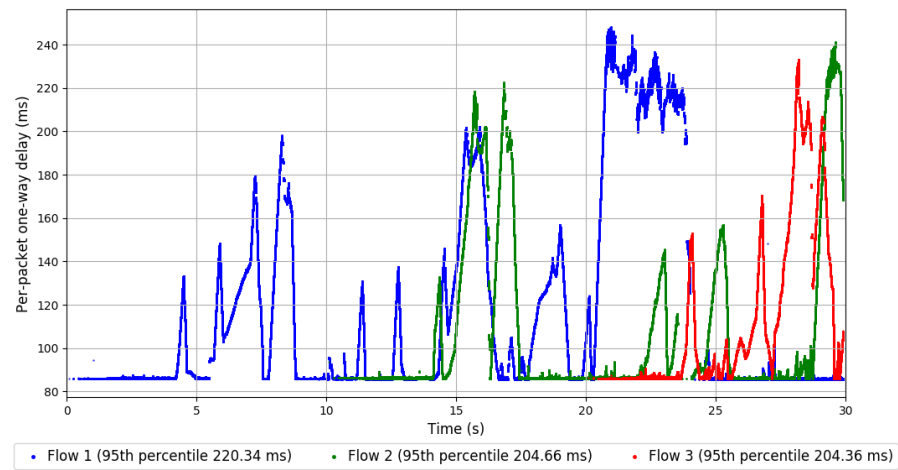
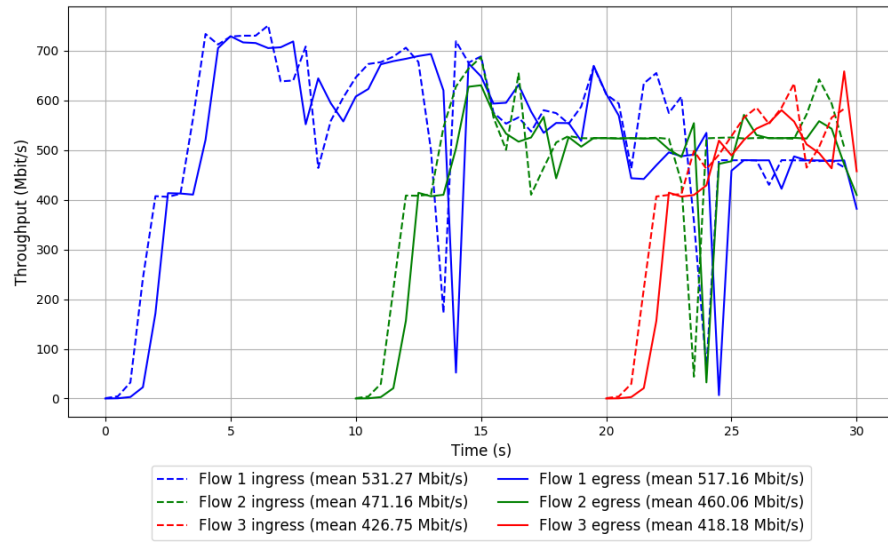
-- Flow 3:

Average throughput: 418.18 Mbit/s

95th percentile per-packet one-way delay: 204.360 ms

Loss rate: 3.71%

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



Run 2: Statistics of TCP BBR

Start at: 2018-09-03 09:56:51

End at: 2018-09-03 09:57:21

Local clock offset: 16.432 ms

Remote clock offset: 3.202 ms

# Below is generated by plot.py at 2018-09-03 10:16:32

# Datalink statistics

-- Total of 3 flows:

Average throughput: 974.71 Mbit/s

95th percentile per-packet one-way delay: 191.351 ms

Loss rate: 1.79%

-- Flow 1:

Average throughput: 529.17 Mbit/s

95th percentile per-packet one-way delay: 173.696 ms

Loss rate: 1.00%

-- Flow 2:

Average throughput: 477.60 Mbit/s

95th percentile per-packet one-way delay: 184.052 ms

Loss rate: 1.31%

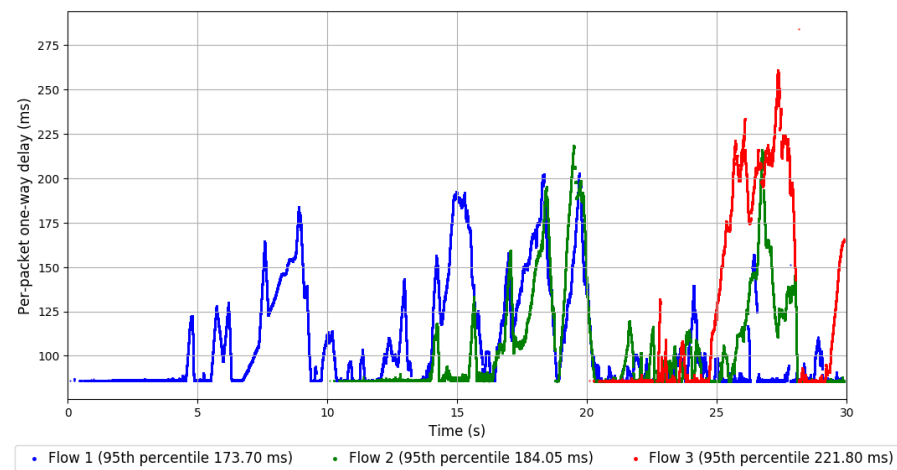
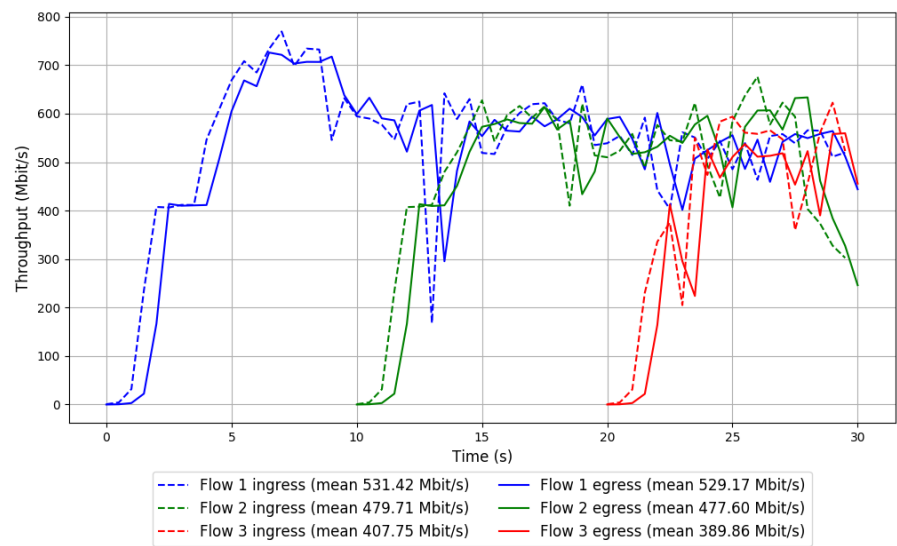
-- Flow 3:

Average throughput: 389.86 Mbit/s

95th percentile per-packet one-way delay: 221.798 ms

Loss rate: 6.04%

Run 2: Report of TCP BBR — Data Link



Run 1: Statistics of TCP Cubic

Start at: 2018-09-03 09:45:00

End at: 2018-09-03 09:45:30

Local clock offset: 14.69 ms

Remote clock offset: 9.491 ms

# Below is generated by plot.py at 2018-09-03 10:16:32

# Datalink statistics

-- Total of 3 flows:

Average throughput: 844.36 Mbit/s

95th percentile per-packet one-way delay: 112.982 ms

Loss rate: 1.11%

-- Flow 1:

Average throughput: 429.12 Mbit/s

95th percentile per-packet one-way delay: 89.162 ms

Loss rate: 0.66%

-- Flow 2:

Average throughput: 413.43 Mbit/s

95th percentile per-packet one-way delay: 116.556 ms

Loss rate: 1.10%

-- Flow 3:

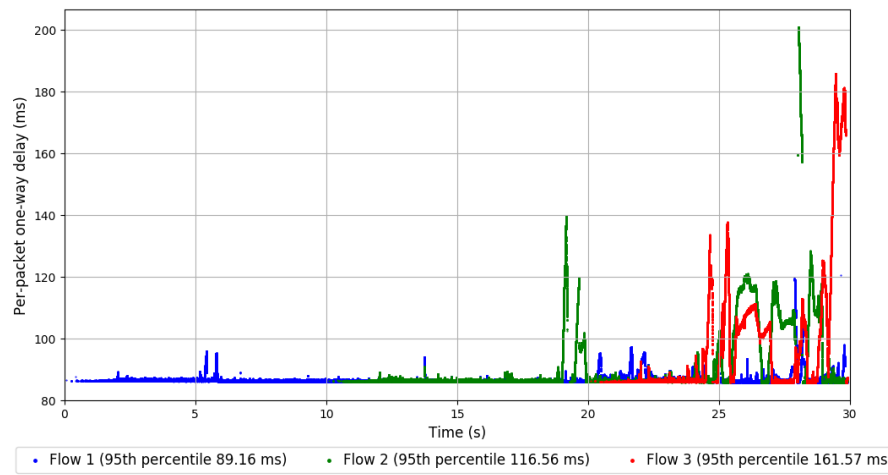
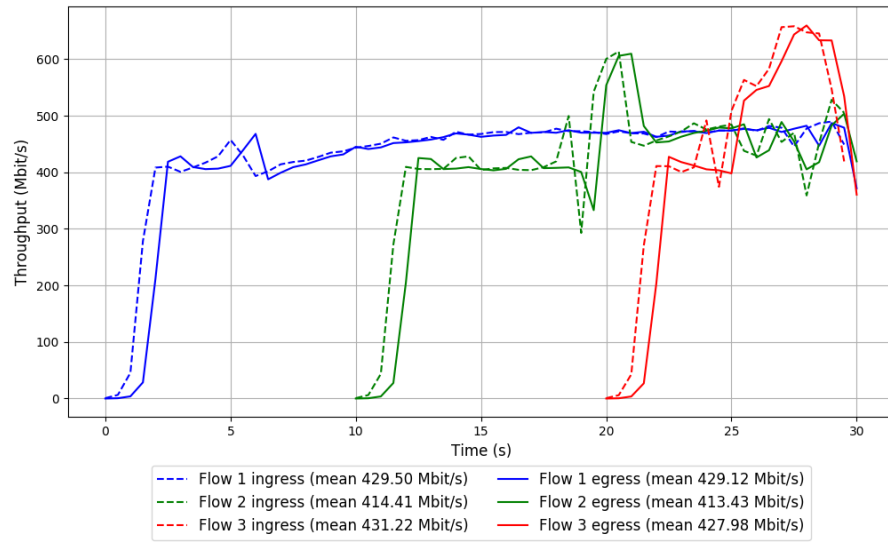
Average throughput: 427.98 Mbit/s

95th percentile per-packet one-way delay: 161.567 ms

Loss rate: 2.48%



# Run 1: Report of TCP Cubic — Data Link



Run 2: Statistics of TCP Cubic

Start at: 2018-09-03 09:52:58

End at: 2018-09-03 09:53:28

Local clock offset: 15.231 ms

Remote clock offset: 4.296 ms

# Below is generated by plot.py at 2018-09-03 10:16:32

# Datalink statistics

-- Total of 3 flows:

Average throughput: 961.84 Mbit/s

95th percentile per-packet one-way delay: 164.571 ms

Loss rate: 1.01%

-- Flow 1:

Average throughput: 524.27 Mbit/s

95th percentile per-packet one-way delay: 173.478 ms

Loss rate: 0.66%

-- Flow 2:

Average throughput: 470.13 Mbit/s

95th percentile per-packet one-way delay: 145.831 ms

Loss rate: 0.96%

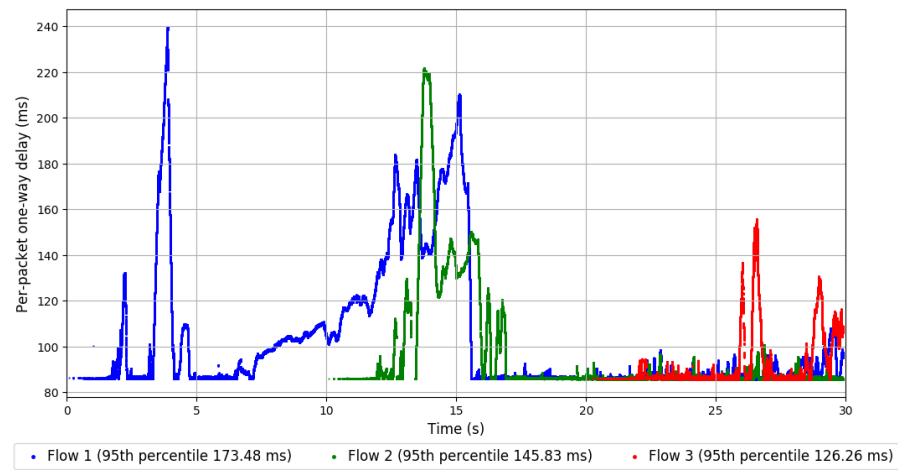
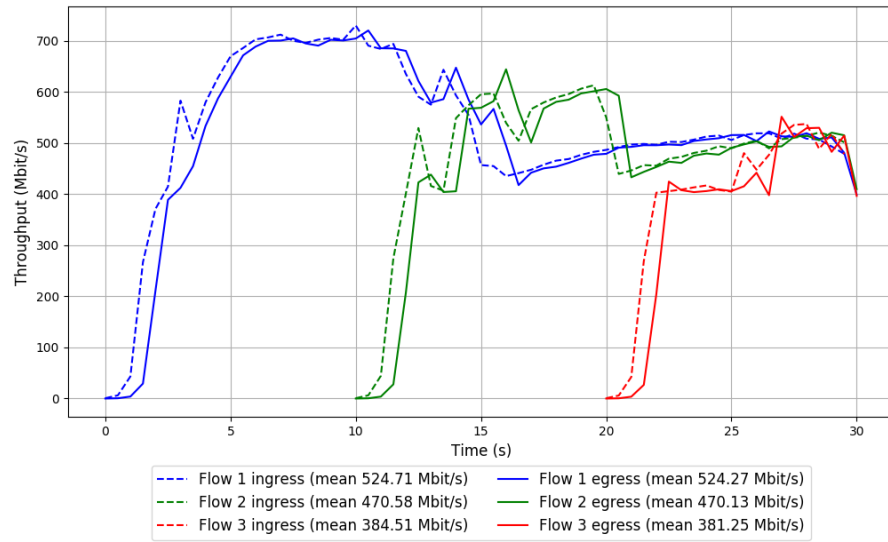
-- Flow 3:

Average throughput: 381.25 Mbit/s

95th percentile per-packet one-way delay: 126.258 ms

Loss rate: 2.56%

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



Run 1: Statistics of Indigo

Start at: 2018-09-03 09:46:56

End at: 2018-09-03 09:47:26

Local clock offset: 14.565 ms

Remote clock offset: 7.613 ms

# Below is generated by plot.py at 2018-09-03 10:16:32

# Datalink statistics

-- Total of 3 flows:

Average throughput: 394.31 Mbit/s

95th percentile per-packet one-way delay: 86.917 ms

Loss rate: 0.96%

-- Flow 1:

Average throughput: 205.69 Mbit/s

95th percentile per-packet one-way delay: 87.008 ms

Loss rate: 0.61%

-- Flow 2:

Average throughput: 199.06 Mbit/s

95th percentile per-packet one-way delay: 86.830 ms

Loss rate: 0.96%

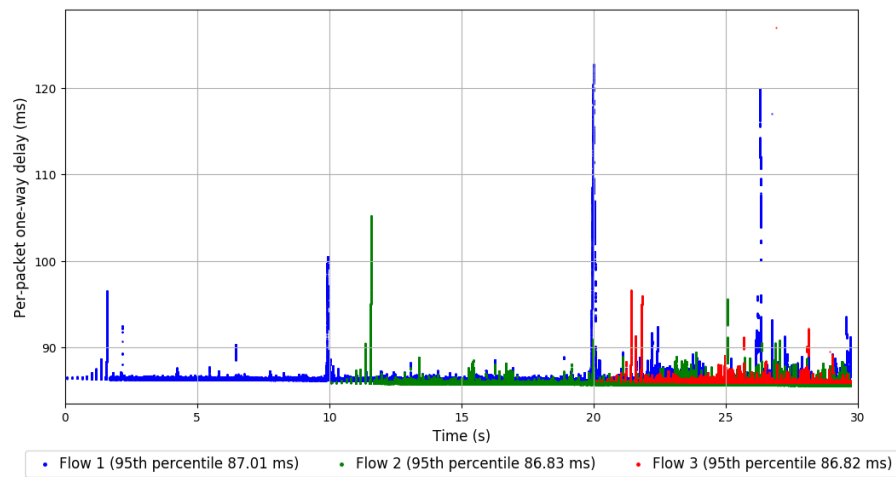
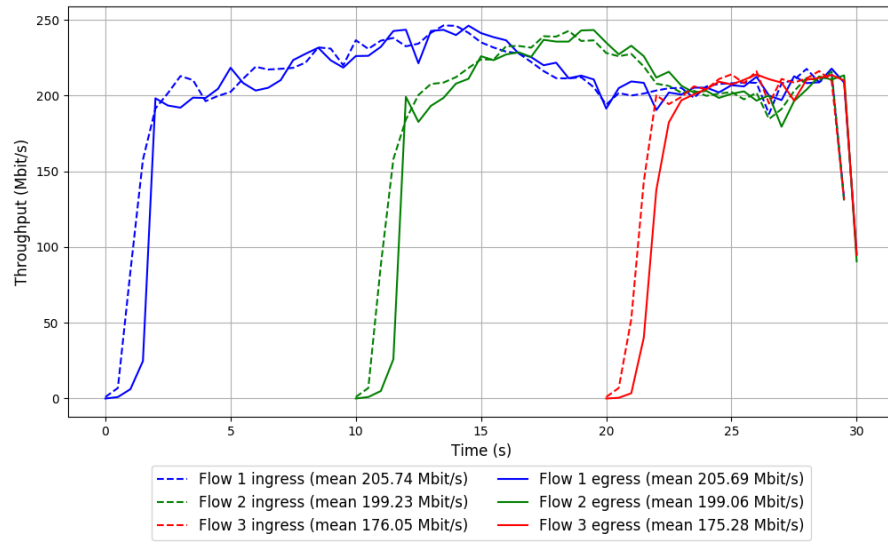
-- Flow 3:

Average throughput: 175.28 Mbit/s

95th percentile per-packet one-way delay: 86.816 ms

Loss rate: 2.21%

## Run 1: Report of Indigo — Data Link



Run 2: Statistics of Indigo

Start at: 2018-09-03 09:55:00

End at: 2018-09-03 09:55:30

Local clock offset: 15.734 ms

Remote clock offset: 3.6 ms

# Below is generated by plot.py at 2018-09-03 10:16:32

# Datalink statistics

-- Total of 3 flows:

Average throughput: 399.35 Mbit/s

95th percentile per-packet one-way delay: 87.589 ms

Loss rate: 0.93%

-- Flow 1:

Average throughput: 211.03 Mbit/s

95th percentile per-packet one-way delay: 86.363 ms

Loss rate: 0.60%

-- Flow 2:

Average throughput: 203.95 Mbit/s

95th percentile per-packet one-way delay: 88.999 ms

Loss rate: 0.94%

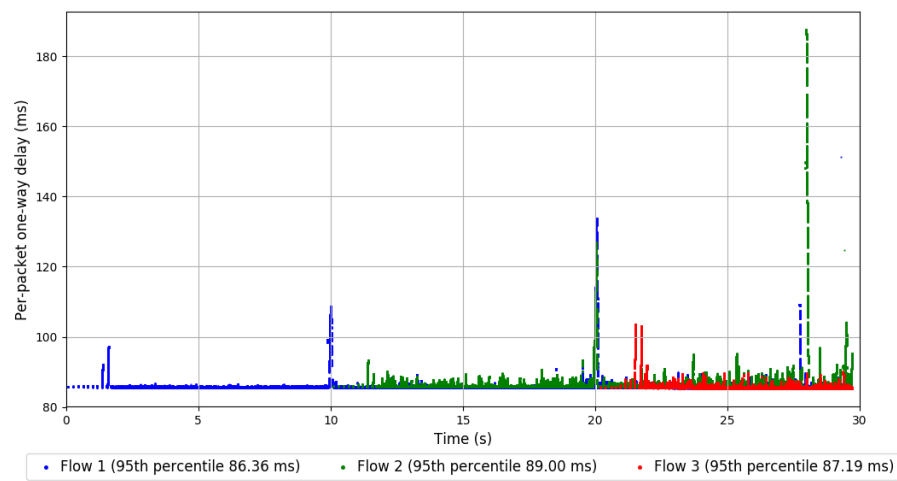
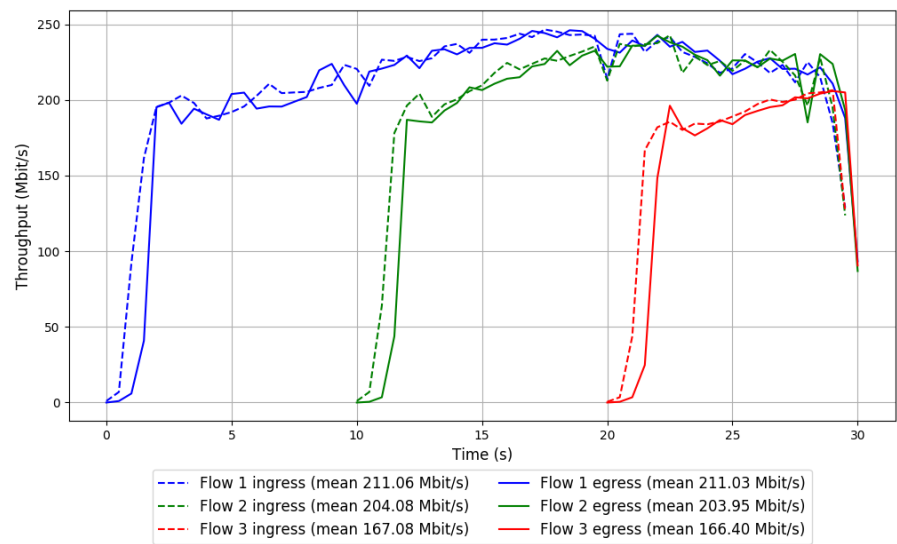
-- Flow 3:

Average throughput: 166.40 Mbit/s

95th percentile per-packet one-way delay: 87.192 ms

Loss rate: 2.18%

Run 2: Report of Indigo — Data Link



Run 1: Statistics of Muses-25

Start at: 2018-09-03 09:50:52

End at: 2018-09-03 09:51:22

Local clock offset: 14.973 ms

Remote clock offset: 5.177 ms

# Below is generated by plot.py at 2018-09-03 10:17:28

# Datalink statistics

-- Total of 3 flows:

Average throughput: 1255.43 Mbit/s

95th percentile per-packet one-way delay: 109.749 ms

Loss rate: 0.92%

-- Flow 1:

Average throughput: 664.07 Mbit/s

95th percentile per-packet one-way delay: 114.995 ms

Loss rate: 0.57%

-- Flow 2:

Average throughput: 640.31 Mbit/s

95th percentile per-packet one-way delay: 103.888 ms

Loss rate: 0.95%

-- Flow 3:

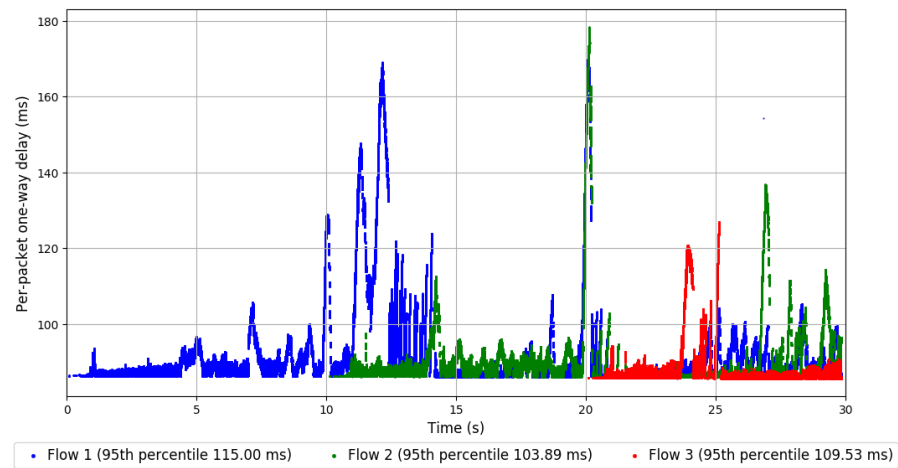
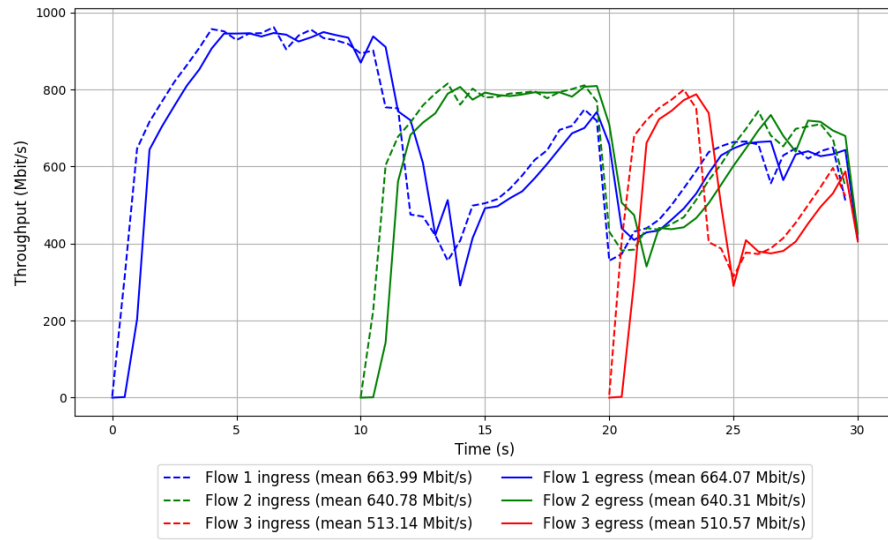
Average throughput: 510.57 Mbit/s

95th percentile per-packet one-way delay: 109.525 ms

Loss rate: 2.23%



## Run 1: Report of Muses-25 — Data Link



Run 2: Statistics of Muses-25

Start at: 2018-09-03 09:59:00

End at: 2018-09-03 09:59:30

Local clock offset: 17.373 ms

Remote clock offset: 2.787 ms

# Below is generated by plot.py at 2018-09-03 10:17:47

# Datalink statistics

-- Total of 3 flows:

Average throughput: 1357.13 Mbit/s

95th percentile per-packet one-way delay: 105.431 ms

Loss rate: 0.73%

-- Flow 1:

Average throughput: 748.83 Mbit/s

95th percentile per-packet one-way delay: 106.349 ms

Loss rate: 0.25%

-- Flow 2:

Average throughput: 611.96 Mbit/s

95th percentile per-packet one-way delay: 105.293 ms

Loss rate: 0.98%

-- Flow 3:

Average throughput: 621.79 Mbit/s

95th percentile per-packet one-way delay: 101.394 ms

Loss rate: 1.97%

## Run 2: Report of Muses-25 — Data Link

