

## Pantheon Report

Generated at 2018-09-06 02:50:40 (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.

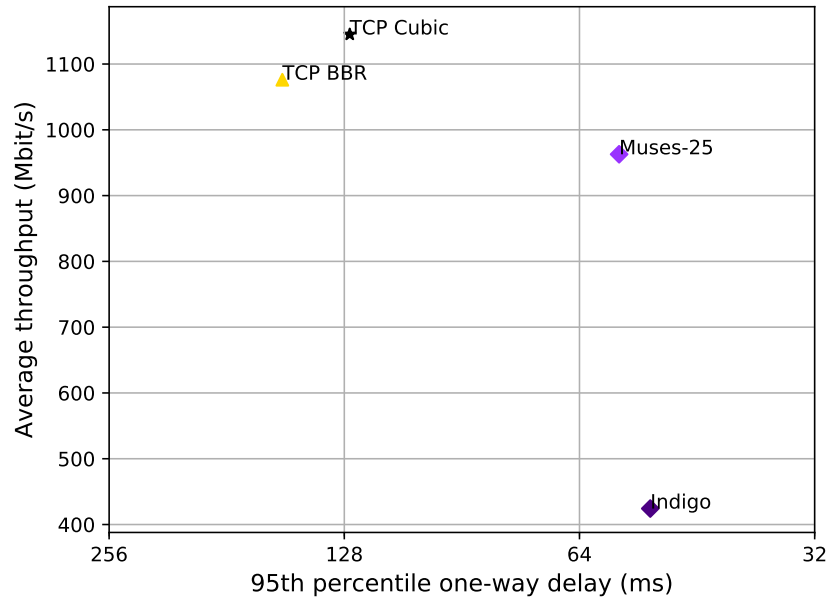
### System info:

```
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
```

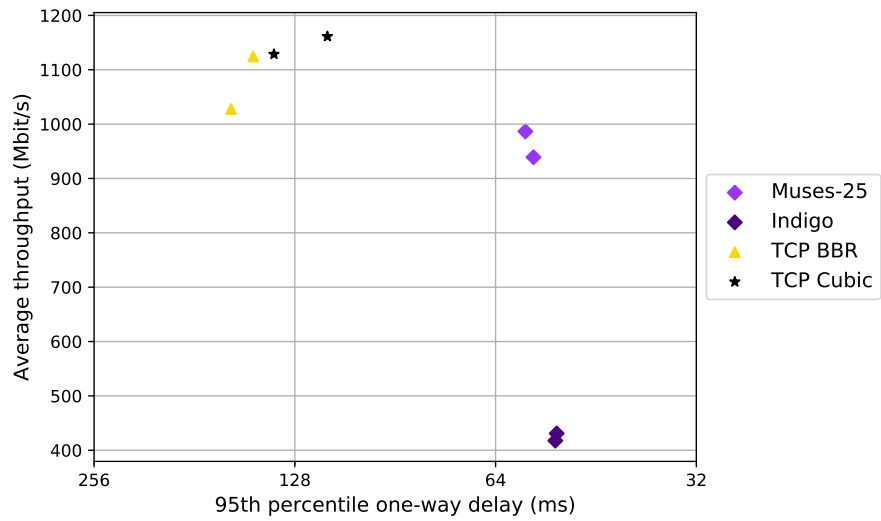
### Git summary:

```
branch: muses @ 18b9165265c8ba2915c862e8713fd9ad82c1ac21
third_party/fillp @ d47f4fa1b454a5e3c0537115c5a28436dbd4b834
third_party/fillp-sheep @ daed0c84f98531712514b2231f43ec6901114ffe
third_party/genericCC @ d0153f8e594aa89e93b032143cedbdf58e562f4
third_party/indigo @ 2601c92e4aa9d58d38dc4dfe0ecdbf90c077e64d
third_party/libutp @ b3465b942e2826f2b179eaab4a906ce6bb7cf3cf
third_party/muses @ a28d20fb82a95a965a3da65fd1eb71b8994e9b84
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-quick @ 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	571.35	554.57	411.75	129.96	139.49	153.07	0.68	1.59	4.21
TCP Cubic	2	602.13	577.96	480.17	129.48	114.50	79.01	0.50	0.76	1.32
Indigo	2	225.94	210.24	181.50	51.68	52.27	50.89	0.34	0.56	1.15
Muses-25	2	534.97	460.28	373.00	58.29	54.28	56.19	0.21	0.41	1.25

Run 1: Statistics of TCP BBR

Start at: 2018-09-06 02:18:56

End at: 2018-09-06 02:19:26

Local clock offset: 0.013 ms

Remote clock offset: -0.08 ms

# Below is generated by plot.py at 2018-09-06 02:50:27

# Datalink statistics

-- Total of 3 flows:

Average throughput: 1124.43 Mbit/s

95th percentile per-packet one-way delay: 147.742 ms

Loss rate: 1.32%

-- Flow 1:

Average throughput: 584.63 Mbit/s

95th percentile per-packet one-way delay: 120.993 ms

Loss rate: 0.63%

-- Flow 2:

Average throughput: 594.22 Mbit/s

95th percentile per-packet one-way delay: 95.414 ms

Loss rate: 0.60%

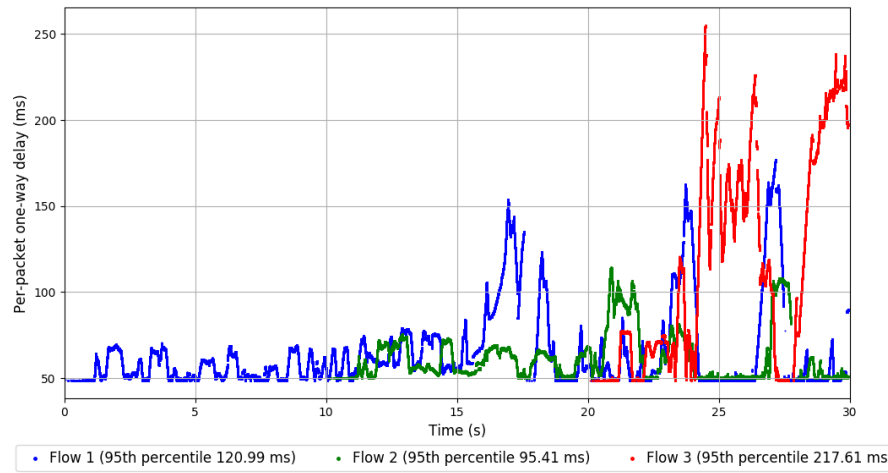
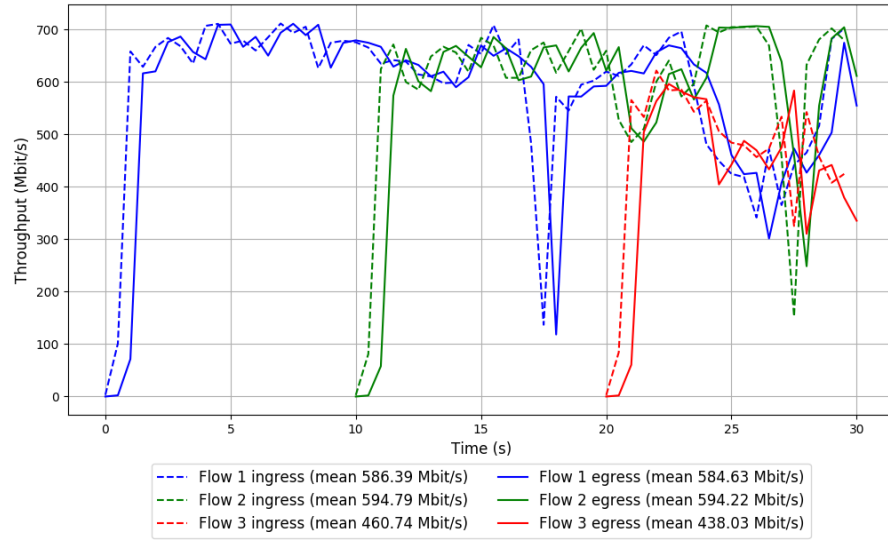
-- Flow 3:

Average throughput: 438.03 Mbit/s

95th percentile per-packet one-way delay: 217.614 ms

Loss rate: 5.82%

# Run 1: Report of TCP BBR — Data Link

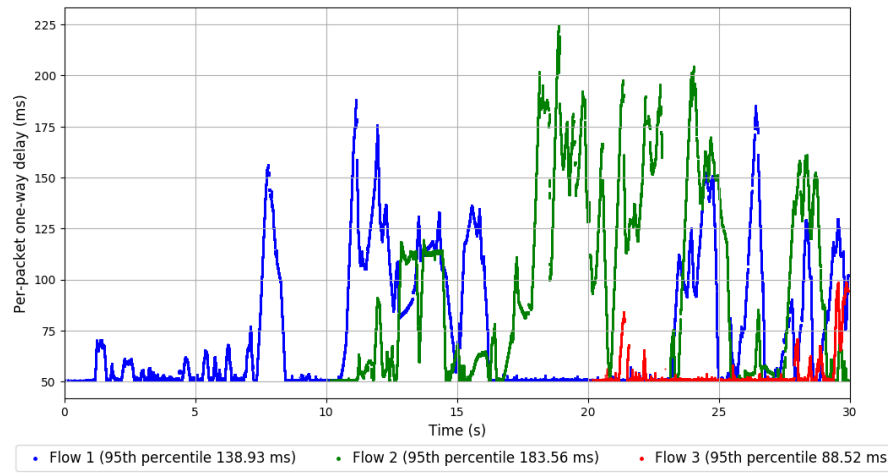
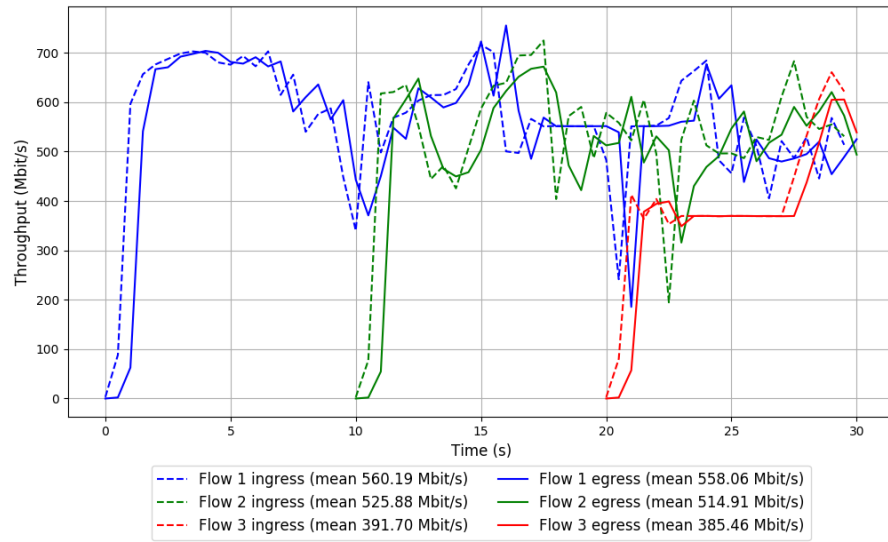


Run 2: Statistics of TCP BBR

Start at: 2018-09-06 02:26:58  
End at: 2018-09-06 02:27:28  
Local clock offset: 0.026 ms  
Remote clock offset: -0.087 ms

# Below is generated by plot.py at 2018-09-06 02:50:27  
# Datalink statistics  
-- Total of 3 flows:  
Average throughput: 1027.87 Mbit/s  
95th percentile per-packet one-way delay: 159.557 ms  
Loss rate: 1.58%  
-- Flow 1:  
Average throughput: 558.06 Mbit/s  
95th percentile per-packet one-way delay: 138.931 ms  
Loss rate: 0.72%  
-- Flow 2:  
Average throughput: 514.91 Mbit/s  
95th percentile per-packet one-way delay: 183.565 ms  
Loss rate: 2.58%  
-- Flow 3:  
Average throughput: 385.46 Mbit/s  
95th percentile per-packet one-way delay: 88.520 ms  
Loss rate: 2.60%

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



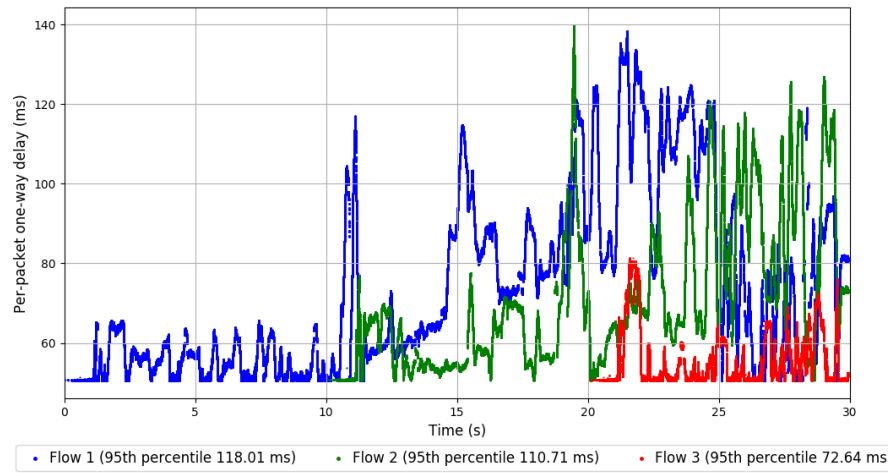
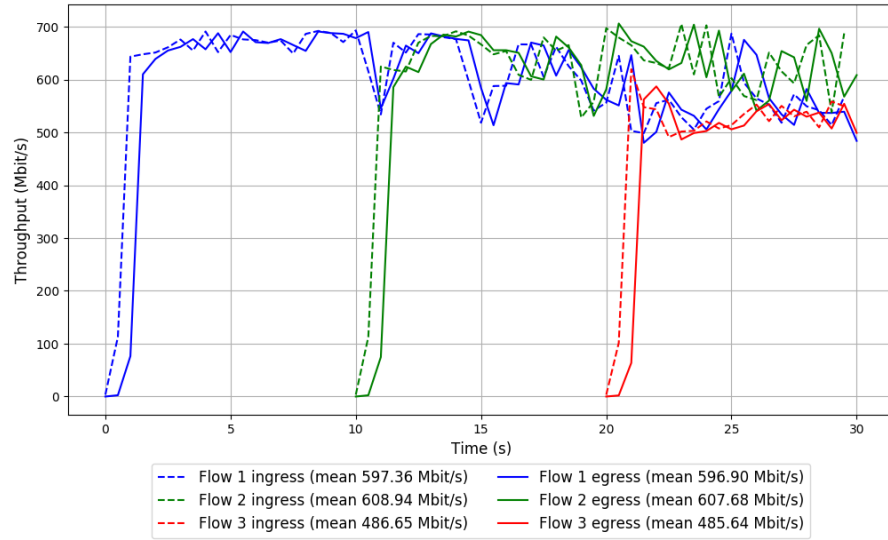
Run 1: Statistics of TCP Cubic

Start at: 2018-09-06 02:21:04  
End at: 2018-09-06 02:21:34  
Local clock offset: 0.057 ms  
Remote clock offset: -0.085 ms

# Below is generated by plot.py at 2018-09-06 02:50:37  
# Datalink statistics  
-- Total of 3 flows:  
Average throughput: 1161.32 Mbit/s  
95th percentile per-packet one-way delay: 114.387 ms  
Loss rate: 0.63%  
-- Flow 1:  
Average throughput: 596.90 Mbit/s  
95th percentile per-packet one-way delay: 118.006 ms  
Loss rate: 0.41%  
-- Flow 2:  
Average throughput: 607.68 Mbit/s  
95th percentile per-packet one-way delay: 110.711 ms  
Loss rate: 0.71%  
-- Flow 3:  
Average throughput: 485.64 Mbit/s  
95th percentile per-packet one-way delay: 72.638 ms  
Loss rate: 1.22%



# Run 1: Report of TCP Cubic — Data Link

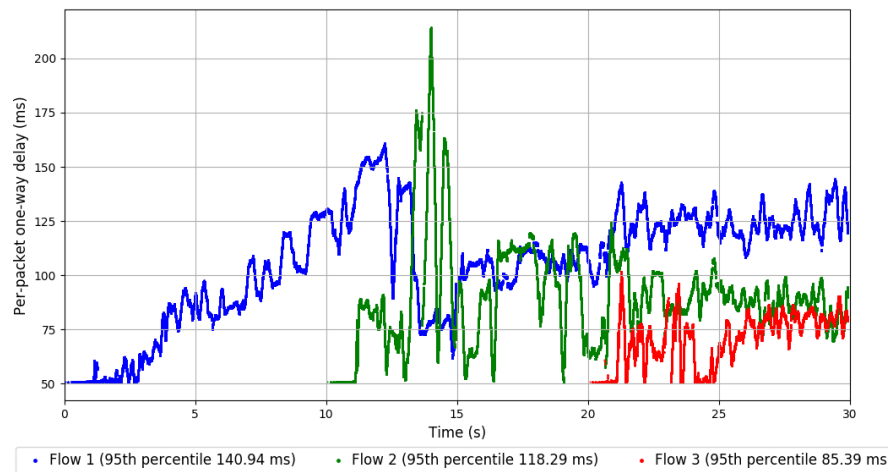
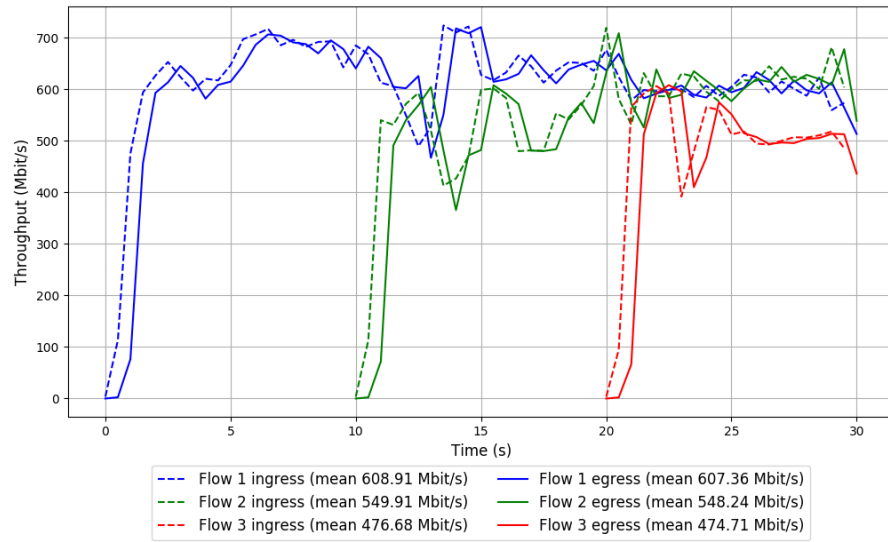


Run 2: Statistics of TCP Cubic

Start at: 2018-09-06 02:29:03  
End at: 2018-09-06 02:29:33  
Local clock offset: 0.055 ms  
Remote clock offset: -0.048 ms

# Below is generated by plot.py at 2018-09-06 02:50:37  
# Datalink statistics  
-- Total of 3 flows:  
Average throughput: 1128.58 Mbit/s  
95th percentile per-packet one-way delay: 137.547 ms  
Loss rate: 0.78%  
-- Flow 1:  
Average throughput: 607.36 Mbit/s  
95th percentile per-packet one-way delay: 140.945 ms  
Loss rate: 0.59%  
-- Flow 2:  
Average throughput: 548.24 Mbit/s  
95th percentile per-packet one-way delay: 118.292 ms  
Loss rate: 0.81%  
-- Flow 3:  
Average throughput: 474.71 Mbit/s  
95th percentile per-packet one-way delay: 85.385 ms  
Loss rate: 1.42%

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

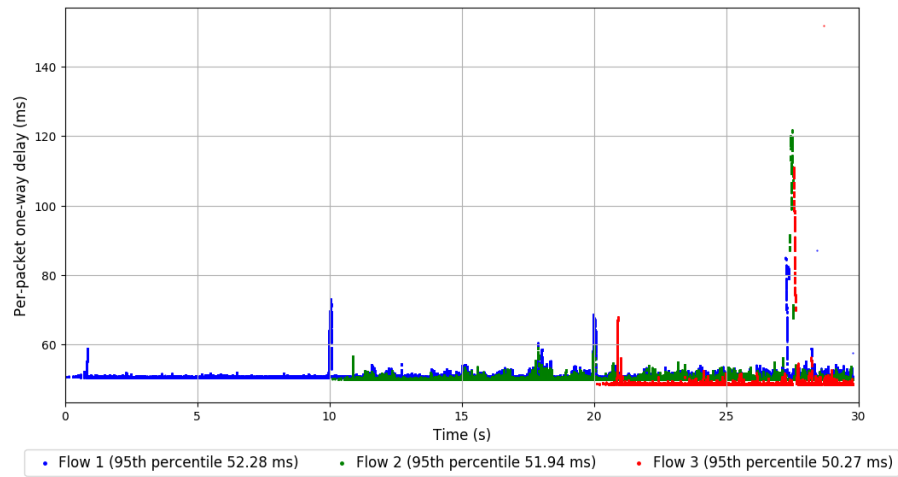
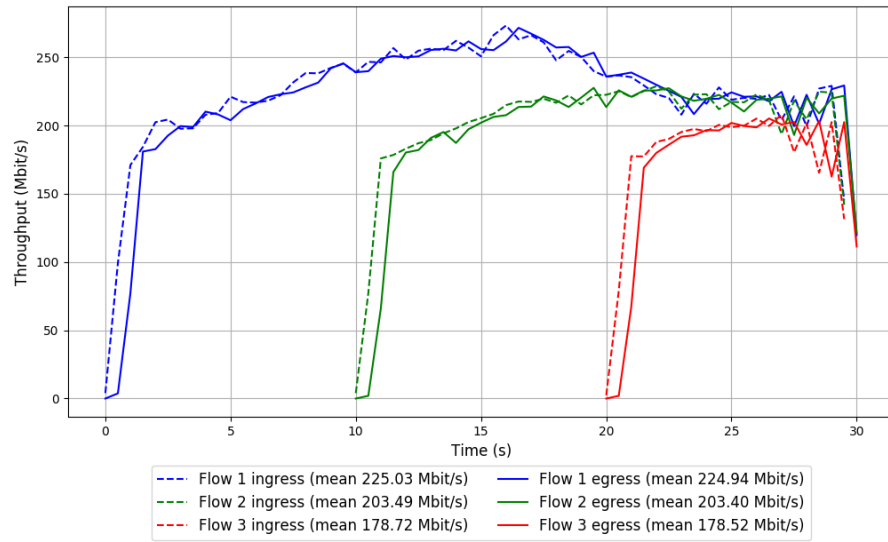


Run 1: Statistics of Indigo

Start at: 2018-09-06 02:23:11  
End at: 2018-09-06 02:23:41  
Local clock offset: 0.016 ms  
Remote clock offset: -0.075 ms

# Below is generated by plot.py at 2018-09-06 02:50:37  
# Datalink statistics  
-- Total of 3 flows:  
Average throughput: 417.63 Mbit/s  
95th percentile per-packet one-way delay: 52.072 ms  
Loss rate: 0.53%  
-- Flow 1:  
Average throughput: 224.94 Mbit/s  
95th percentile per-packet one-way delay: 52.276 ms  
Loss rate: 0.35%  
-- Flow 2:  
Average throughput: 203.40 Mbit/s  
95th percentile per-packet one-way delay: 51.938 ms  
Loss rate: 0.56%  
-- Flow 3:  
Average throughput: 178.52 Mbit/s  
95th percentile per-packet one-way delay: 50.271 ms  
Loss rate: 1.15%

# Run 1: Report of Indigo — Data Link

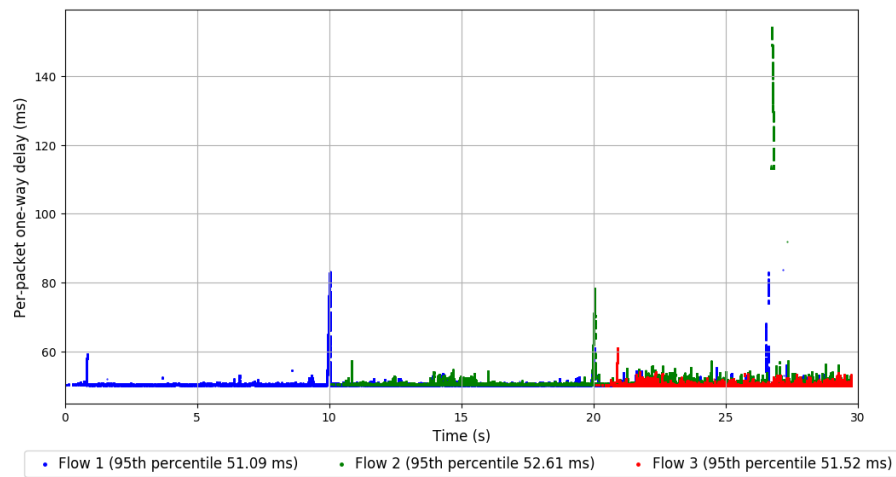
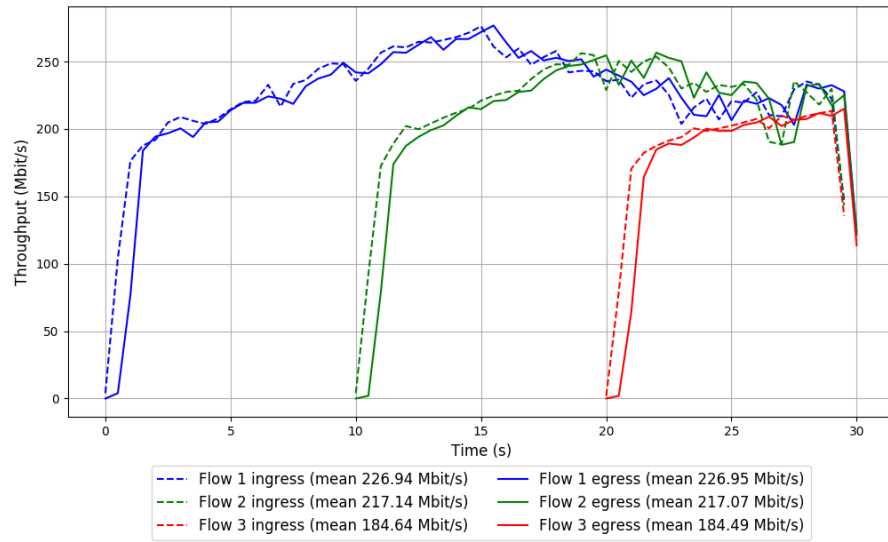


Run 2: Statistics of Indigo

Start at: 2018-09-06 02:31:09  
End at: 2018-09-06 02:31:39  
Local clock offset: -0.308 ms  
Remote clock offset: -0.053 ms

# Below is generated by plot.py at 2018-09-06 02:50:37  
# Datalink statistics  
-- Total of 3 flows:  
Average throughput: 430.91 Mbit/s  
95th percentile per-packet one-way delay: 51.827 ms  
Loss rate: 0.52%  
-- Flow 1:  
Average throughput: 226.95 Mbit/s  
95th percentile per-packet one-way delay: 51.090 ms  
Loss rate: 0.33%  
-- Flow 2:  
Average throughput: 217.07 Mbit/s  
95th percentile per-packet one-way delay: 52.609 ms  
Loss rate: 0.55%  
-- Flow 3:  
Average throughput: 184.49 Mbit/s  
95th percentile per-packet one-way delay: 51.515 ms  
Loss rate: 1.14%

## Run 2: Report of Indigo — Data Link



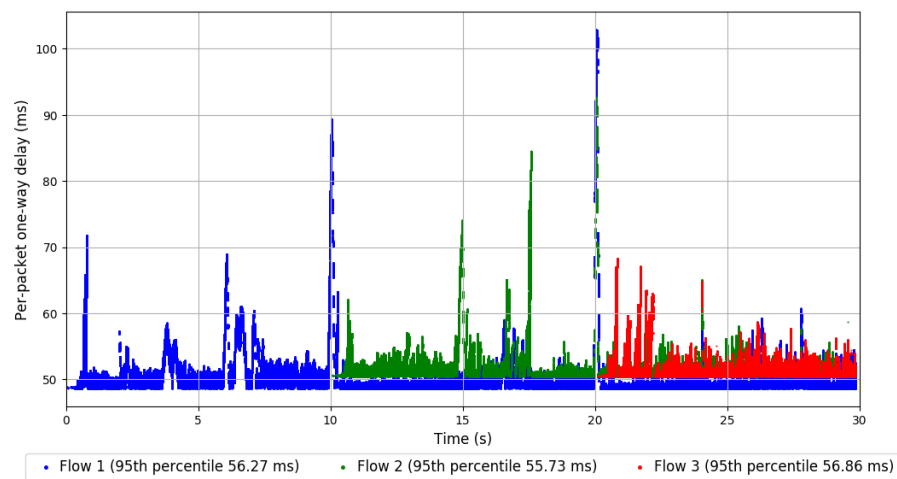
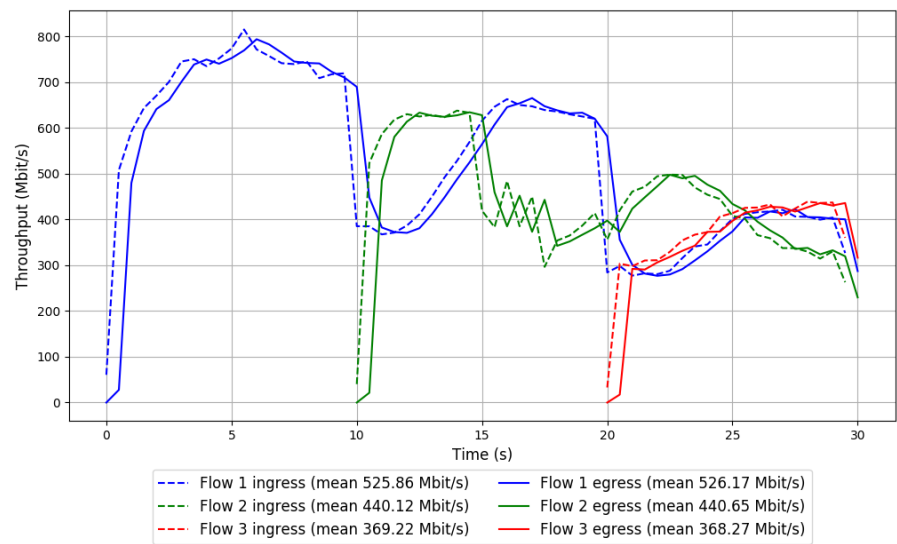
Run 1: Statistics of Muses-25

Start at: 2018-09-06 02:17:01  
End at: 2018-09-06 02:17:31  
Local clock offset: -0.007 ms  
Remote clock offset: -0.103 ms

# Below is generated by plot.py at 2018-09-06 02:50:37  
# Datalink statistics  
-- Total of 3 flows:  
Average throughput: 939.11 Mbit/s  
95th percentile per-packet one-way delay: 56.145 ms  
Loss rate: 0.43%  
-- Flow 1:  
Average throughput: 526.17 Mbit/s  
95th percentile per-packet one-way delay: 56.266 ms  
Loss rate: 0.27%  
-- Flow 2:  
Average throughput: 440.65 Mbit/s  
95th percentile per-packet one-way delay: 55.732 ms  
Loss rate: 0.38%  
-- Flow 3:  
Average throughput: 368.27 Mbit/s  
95th percentile per-packet one-way delay: 56.863 ms  
Loss rate: 1.27%



Run 1: Report of Muses-25 — Data Link



Run 2: Statistics of Muses-25

Start at: 2018-09-06 02:25:00  
End at: 2018-09-06 02:25:30  
Local clock offset: 0.102 ms  
Remote clock offset: -0.079 ms

# Below is generated by plot.py at 2018-09-06 02:50:37  
# Datalink statistics  
-- Total of 3 flows:  
Average throughput: 986.52 Mbit/s  
95th percentile per-packet one-way delay: 57.746 ms  
Loss rate: 0.38%  
-- Flow 1:  
Average throughput: 543.77 Mbit/s  
95th percentile per-packet one-way delay: 60.307 ms  
Loss rate: 0.15%  
-- Flow 2:  
Average throughput: 479.92 Mbit/s  
95th percentile per-packet one-way delay: 52.838 ms  
Loss rate: 0.43%  
-- Flow 3:  
Average throughput: 377.72 Mbit/s  
95th percentile per-packet one-way delay: 55.517 ms  
Loss rate: 1.24%

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

