Pantheon Report

Generated at 2018-09-05 03:00:12 (UTC).

Data path: GCE Tokyo on `ens4` (*local*) →GCE London 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.
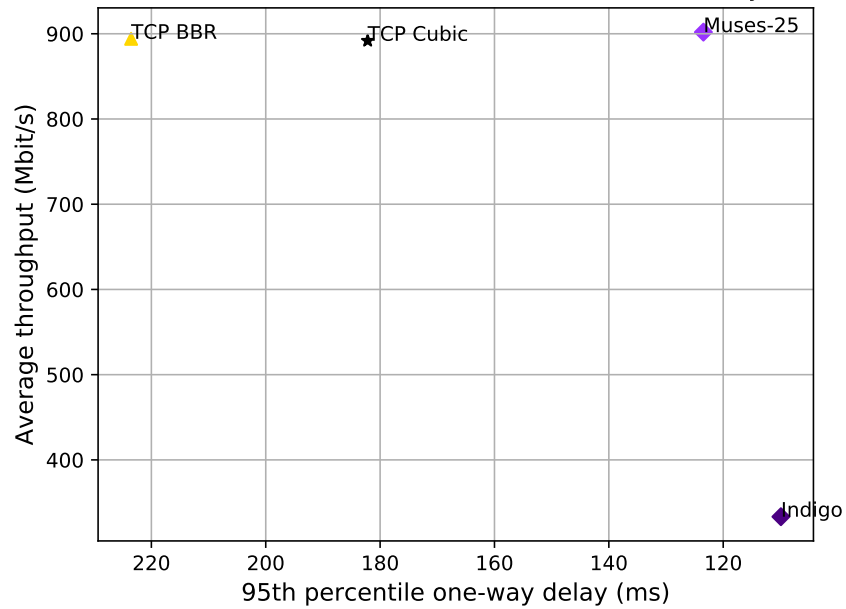
```
System info:
Linux 4.15.0-1018-gcp
net.core.default_qdisc = fq
net.core.rmem_default = 16777216
net.core.rmem_max = 536870912
net.core.wmem_default = 16777216
net.core.wmem_max = 536870912
net.ipv4.tcp_rmem = 4096 16777216 536870912
net.ipv4.tcp_wmem = 4096 16777216 536870912
net.ipv4.tcp_mem = 536870912 536870912 536870912
```
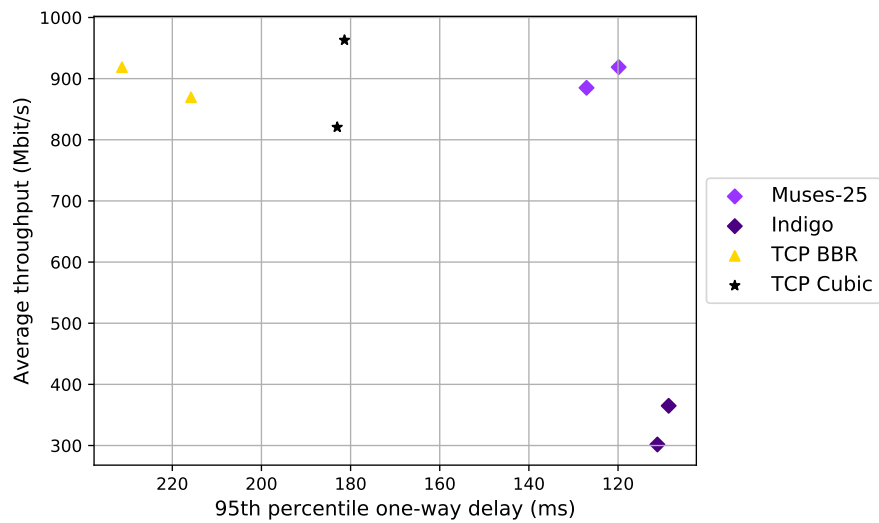
```
Git summary:
branch: muses @ 71e71e9a55b945431a7dea72180c1c9381097db9
third_party/fillp @ d47f4fa1b454a5e3c0537115c5a28436dbd4b834
third_party/fillp-sheep @ daed0c84f98531712514b2231f43ec6901114ffe
third_party/genericCC @ d0153f8e594aa89e93b032143cedbdfe58e562f4
third_party/indigo @ 2601c92e4aa9d58d38dc4dfe0ecdbf90c077e64d
third_party/libutp @ b3465b942e2826f2b179eaab4a906ce6bb7cf3cf
third_party/muses @ 96fbc95fb38373d71fbc80c5a105e62e7636623b
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 Tokyo 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 Tokyo 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	493.02	435.37	334.37	218.13	207.15	230.42	2.04	1.14	2.26
TCP Cubic	2	490.39	436.38	333.25	184.49	193.96	134.38	0.34	0.17	0.15
Indigo	2	190.66	150.14	134.17	109.86	109.74	110.03	0.00	0.00	0.00
Muses-25	2	488.87	472.49	308.56	121.63	125.03	124.34	0.01	0.00	0.00

```
Run 1: Statistics of TCP BBR

Start at: 2018-09-05 02:35:44
End at: 2018-09-05 02:36:14
Local clock offset: 10.787 ms
Remote clock offset: 2.426 ms


# Below is generated by plot.py at 2018-09-05 03:00:05
# Datalink statistics
-- Total of 3 flows:
Average throughput: 918.71 Mbit/s
95th percentile per-packet one-way delay: 231.286 ms
Loss rate: 2.10%
-- Flow 1:
Average throughput: 516.04 Mbit/s
95th percentile per-packet one-way delay: 237.894 ms
Loss rate: 3.18%
-- Flow 2:
Average throughput: 438.56 Mbit/s
95th percentile per-packet one-way delay: 191.095 ms
Loss rate: 0.66%
-- Flow 3:
Average throughput: 332.87 Mbit/s
95th percentile per-packet one-way delay: 212.560 ms
Loss rate: 0.75%
```
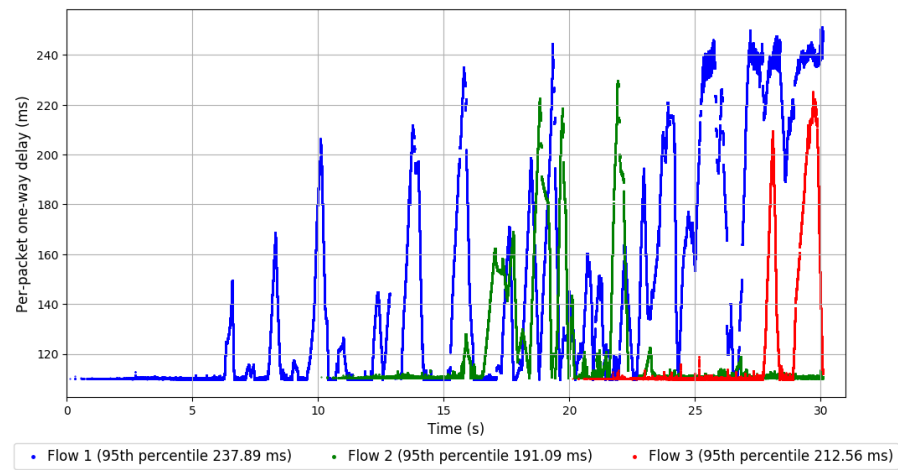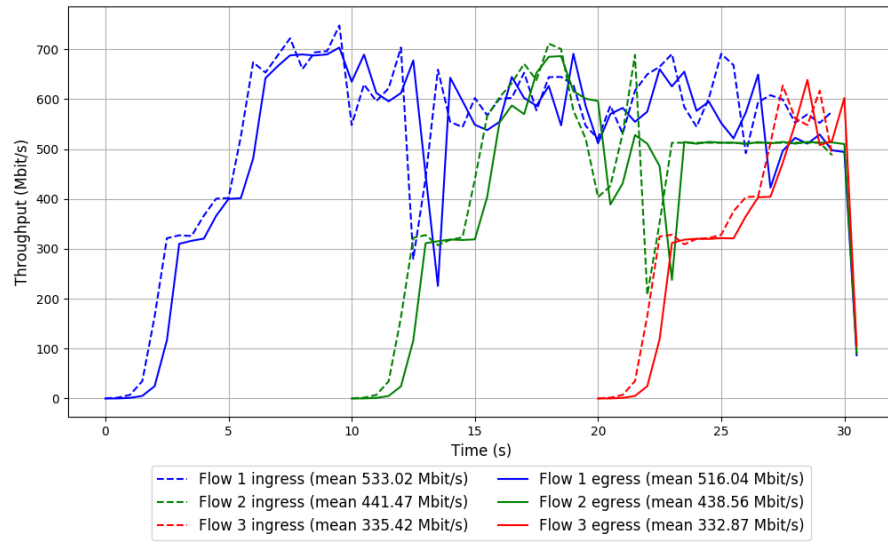
Run 1: Report of TCP BBR — Data Link

Flow 1 ingress (mean 533.02 Mbit/s) ----- Flow 1 egress (mean 516.04 Mbit/s)
Flow 2 ingress (mean 441.47 Mbit/s) ----- Flow 2 egress (mean 438.56 Mbit/s)
Flow 3 ingress (mean 335.42 Mbit/s) ----- Flow 3 egress (mean 332.87 Mbit/s)

Flow 1 (95th percentile 237.89 ms)   Flow 2 (95th percentile 191.09 ms)   Flow 3 (95th percentile 212.56 ms)

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```
Run 2: Statistics of TCP BBR

Start at: 2018-09-05 02:43:59
End at: 2018-09-05 02:44:29
Local clock offset: 8.116 ms
Remote clock offset: 3.954 ms


# Below is generated by plot.py at 2018-09-05 03:00:05
# Datalink statistics
-- Total of 3 flows:
Average throughput: 869.44 Mbit/s
95th percentile per-packet one-way delay: 215.797 ms
Loss rate: 1.51%
-- Flow 1:
Average throughput: 470.00 Mbit/s
95th percentile per-packet one-way delay: 198.376 ms
Loss rate: 0.89%
-- Flow 2:
Average throughput: 432.17 Mbit/s
95th percentile per-packet one-way delay: 223.197 ms
Loss rate: 1.61%
-- Flow 3:
Average throughput: 335.87 Mbit/s
95th percentile per-packet one-way delay: 248.284 ms
Loss rate: 3.77%
```
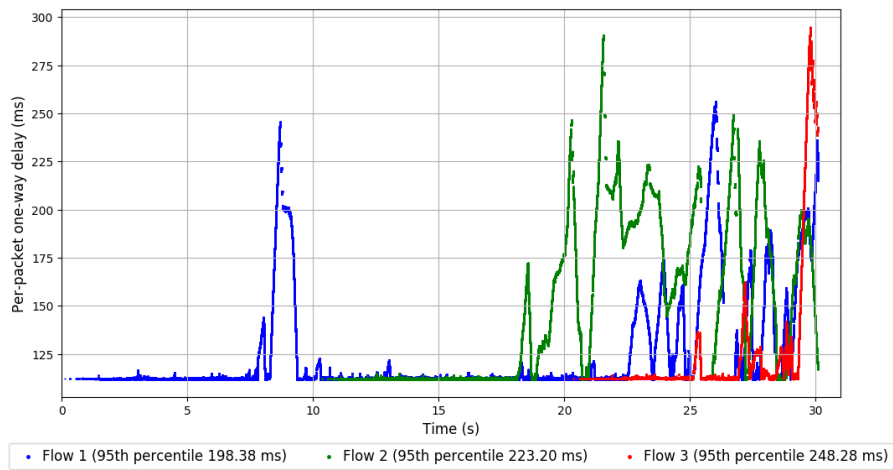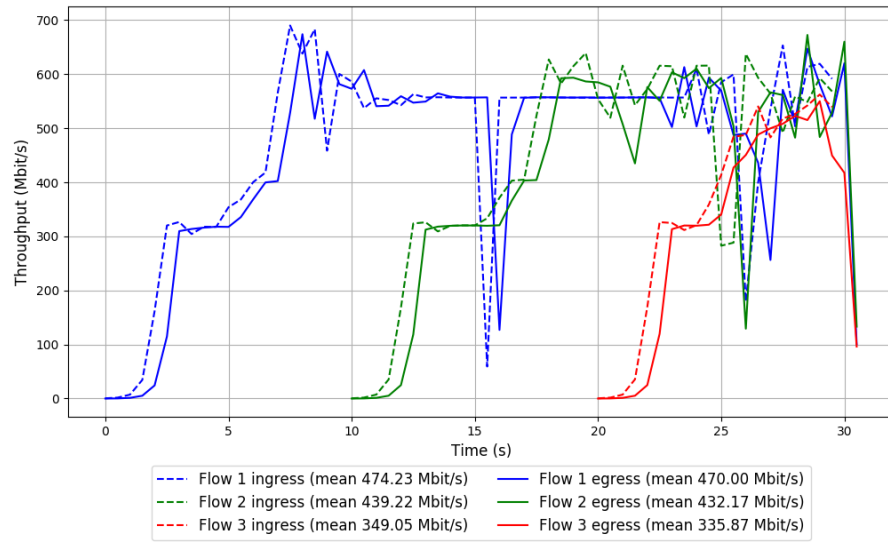
Run 2: Report of TCP BBR — Data Link

Flow 1 ingress (mean 474.23 Mbit/s) --- Flow 1 egress (mean 470.00 Mbit/s)
Flow 2 ingress (mean 439.22 Mbit/s) --- Flow 2 egress (mean 432.17 Mbit/s)
Flow 3 ingress (mean 349.05 Mbit/s) --- Flow 3 egress (mean 335.87 Mbit/s)

Flow 1 (95th percentile 198.38 ms)   Flow 2 (95th percentile 223.20 ms)   Flow 3 (95th percentile 248.28 ms)

```
Run 1: Statistics of TCP Cubic

Start at: 2018-09-05 02:33:34
End at: 2018-09-05 02:34:04
Local clock offset: 9.653 ms
Remote clock offset: 2.524 ms


# Below is generated by plot.py at 2018-09-05 03:00:11
# Datalink statistics
-- Total of 3 flows:
Average throughput: 962.96 Mbit/s
95th percentile per-packet one-way delay: 181.365 ms
Loss rate: 0.26%
-- Flow 1:
Average throughput: 555.74 Mbit/s
95th percentile per-packet one-way delay: 177.915 ms
Loss rate: 0.28%
-- Flow 2:
Average throughput: 429.52 Mbit/s
95th percentile per-packet one-way delay: 210.059 ms
Loss rate: 0.34%
-- Flow 3:
Average throughput: 364.62 Mbit/s
95th percentile per-packet one-way delay: 121.231 ms
Loss rate: 0.02%
```
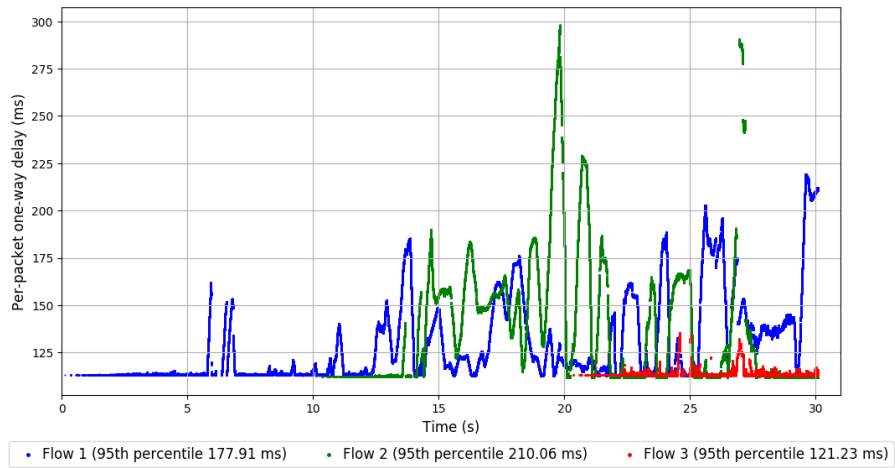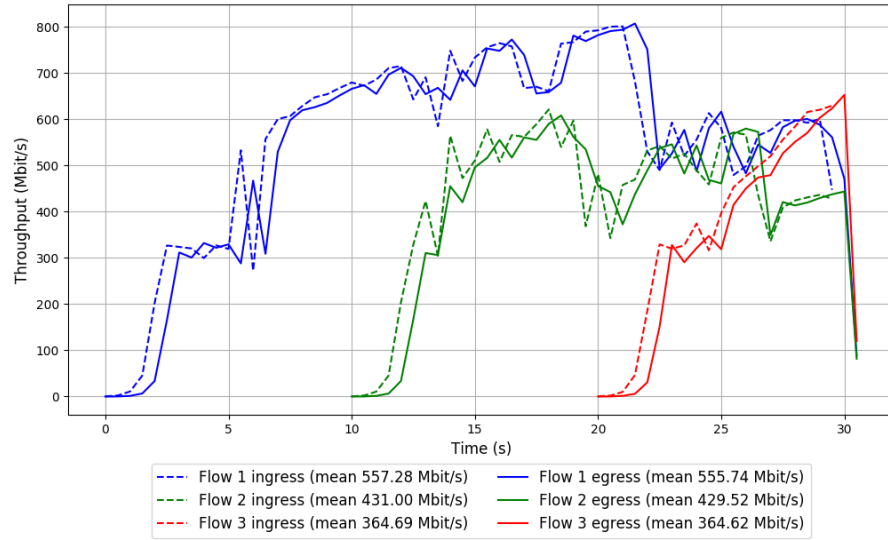
Run 1: Report of TCP Cubic — Data Link

```
Run 2: Statistics of TCP Cubic

Start at: 2018-09-05 02:41:56
End at: 2018-09-05 02:42:26
Local clock offset: 8.604 ms
Remote clock offset: 3.275 ms


# Below is generated by plot.py at 2018-09-05 03:00:11
# Datalink statistics
-- Total of 3 flows:
Average throughput: 820.57 Mbit/s
95th percentile per-packet one-way delay: 182.994 ms
Loss rate: 0.24%
-- Flow 1:
Average throughput: 425.05 Mbit/s
95th percentile per-packet one-way delay: 191.064 ms
Loss rate: 0.39%
-- Flow 2:
Average throughput: 443.24 Mbit/s
95th percentile per-packet one-way delay: 177.857 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 301.89 Mbit/s
95th percentile per-packet one-way delay: 147.524 ms
Loss rate: 0.28%
```
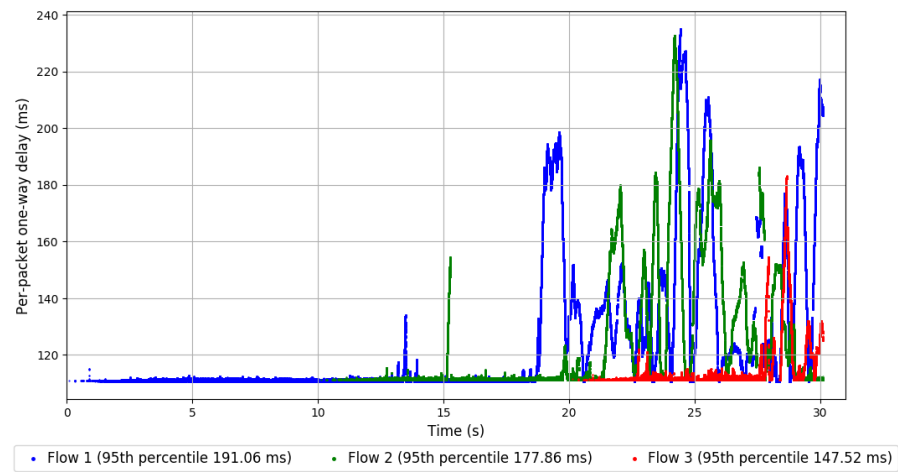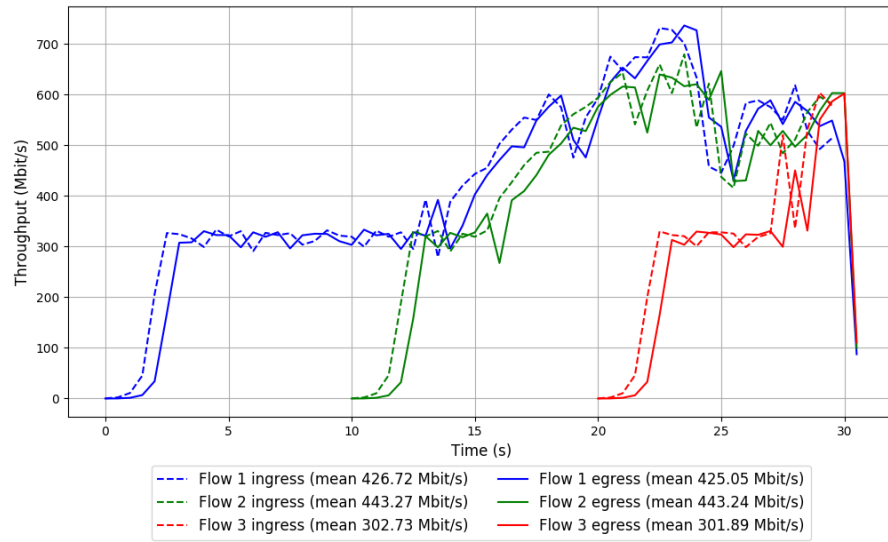
Run 2: Report of TCP Cubic — Data Link

Flow 1 ingress (mean 426.72 Mbit/s)   Flow 1 egress (mean 425.05 Mbit/s)
Flow 2 ingress (mean 443.27 Mbit/s)   Flow 2 egress (mean 443.24 Mbit/s)
Flow 3 ingress (mean 302.73 Mbit/s)   Flow 3 egress (mean 301.89 Mbit/s)

Flow 1 (95th percentile 191.06 ms)   Flow 2 (95th percentile 177.86 ms)   Flow 3 (95th percentile 147.52 ms)

```
Run 1: Statistics of Indigo

Start at: 2018-09-05 02:31:46
End at: 2018-09-05 02:32:16
Local clock offset: 14.26 ms
Remote clock offset: 2.79 ms


# Below is generated by plot.py at 2018-09-05 03:00:11
# Datalink statistics
-- Total of 3 flows:
Average throughput: 301.70 Mbit/s
95th percentile per-packet one-way delay: 111.173 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 159.27 Mbit/s
95th percentile per-packet one-way delay: 111.413 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 149.70 Mbit/s
95th percentile per-packet one-way delay: 110.923 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 134.42 Mbit/s
95th percentile per-packet one-way delay: 110.071 ms
Loss rate: 0.00%
```
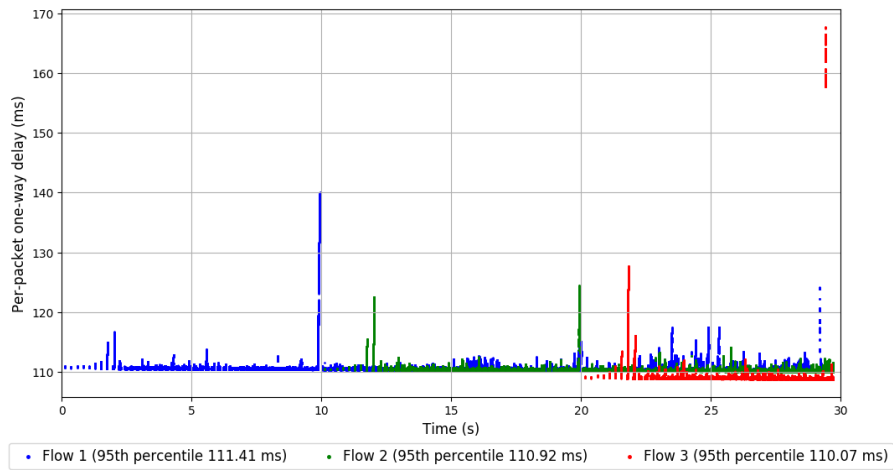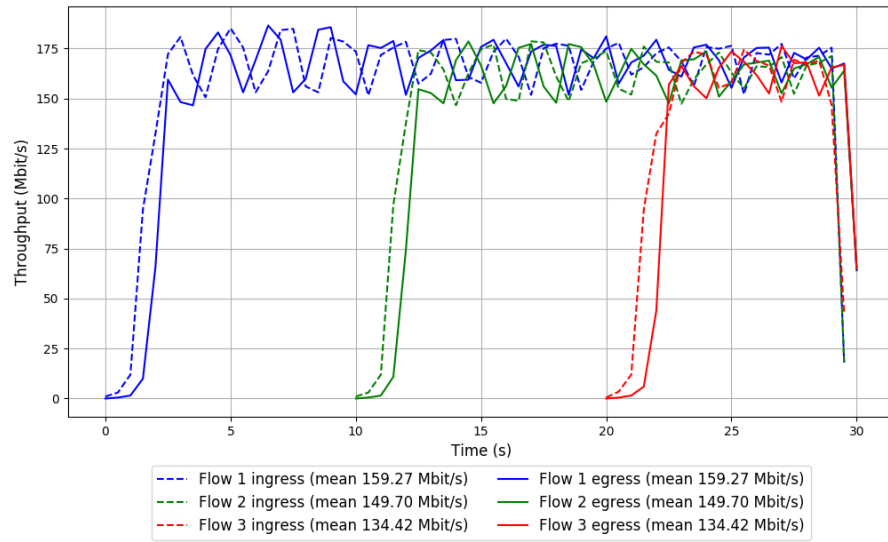
Run 1: Report of Indigo — Data Link

```
Run 2: Statistics of Indigo

Start at: 2018-09-05 02:40:02
End at: 2018-09-05 02:40:32
Local clock offset: 11.617 ms
Remote clock offset: 2.595 ms

# Below is generated by plot.py at 2018-09-05 03:00:11
# Datalink statistics
-- Total of 3 flows:
Average throughput: 364.98 Mbit/s
95th percentile per-packet one-way delay: 108.642 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 222.04 Mbit/s
95th percentile per-packet one-way delay: 108.317 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 150.58 Mbit/s
95th percentile per-packet one-way delay: 108.554 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 133.92 Mbit/s
95th percentile per-packet one-way delay: 109.981 ms
Loss rate: 0.00%
```
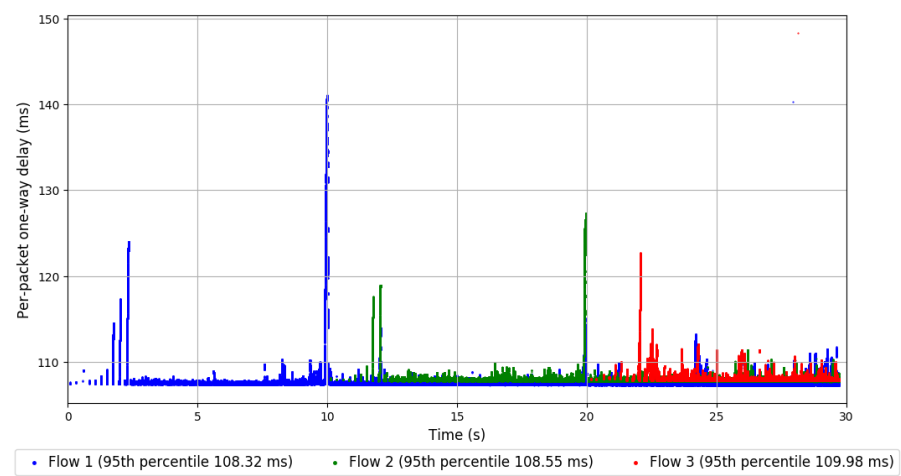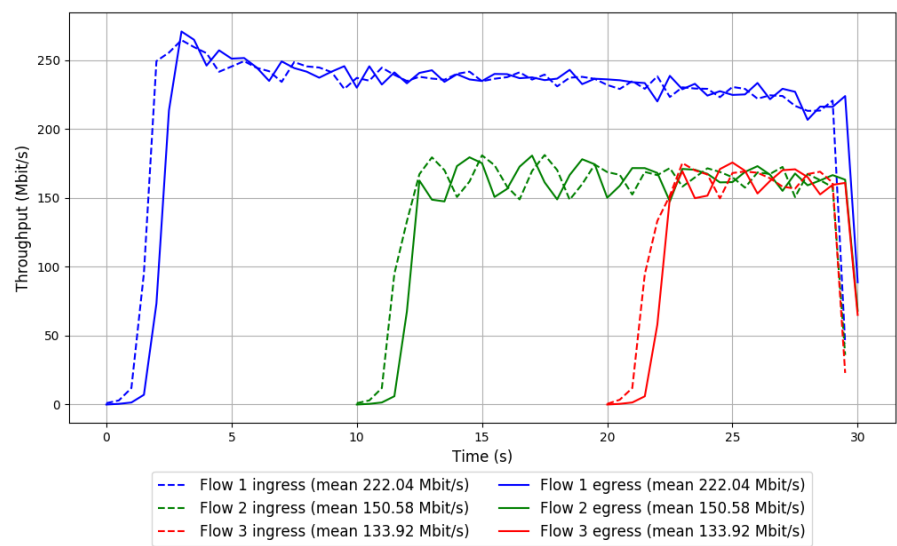
Run 2: Report of Indigo — Data Link

Flow 1 ingress (mean 222.04 Mbit/s) --- Flow 1 egress (mean 222.04 Mbit/s)
Flow 2 ingress (mean 150.58 Mbit/s) --- Flow 2 egress (mean 150.58 Mbit/s)
Flow 3 ingress (mean 133.92 Mbit/s) --- Flow 3 egress (mean 133.92 Mbit/s)

Flow 1 (95th percentile 108.32 ms) Flow 2 (95th percentile 108.55 ms) Flow 3 (95th percentile 109.98 ms)
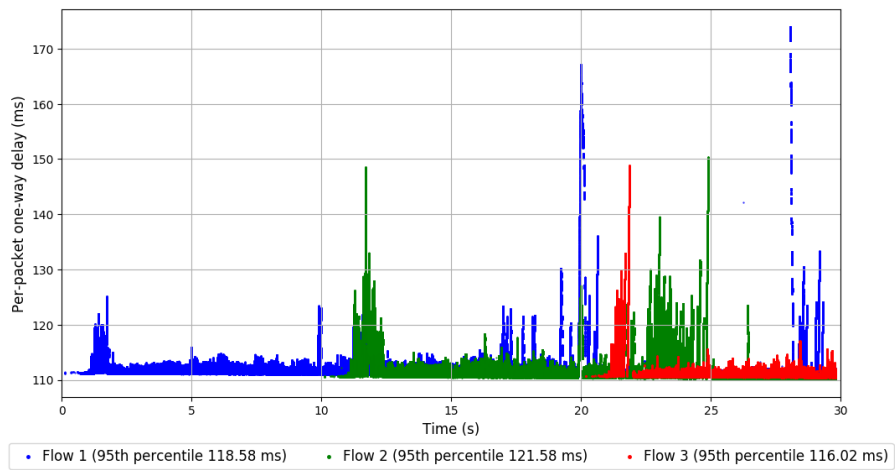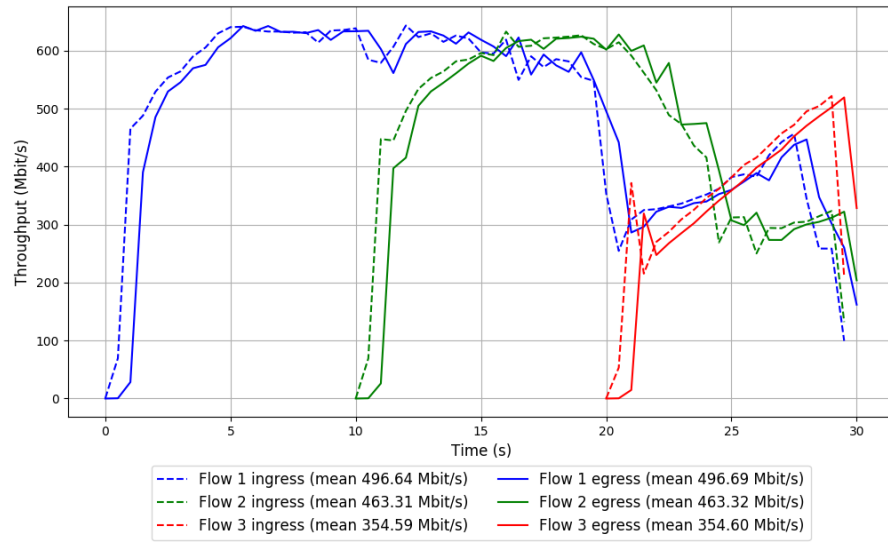
```
Run 1: Statistics of Muses-25

Start at: 2018-09-05 02:29:39
End at: 2018-09-05 02:30:09
Local clock offset: 16.802 ms
Remote clock offset: 3.338 ms

# Below is generated by plot.py at 2018-09-05 03:00:11
# Datalink statistics
-- Total of 3 flows:
Average throughput: 918.84 Mbit/s
95th percentile per-packet one-way delay: 119.856 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 496.69 Mbit/s
95th percentile per-packet one-way delay: 118.575 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 463.32 Mbit/s
95th percentile per-packet one-way delay: 121.575 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 354.60 Mbit/s
95th percentile per-packet one-way delay: 116.021 ms
Loss rate: 0.00%
```

Run 1: Report of Muses-25 — Data Link

```
Run 2: Statistics of Muses-25

Start at: 2018-09-05 02:37:57
End at: 2018-09-05 02:38:27
Local clock offset: 9.575 ms
Remote clock offset: 3.607 ms


# Below is generated by plot.py at 2018-09-05 03:00:11
# Datalink statistics
-- Total of 3 flows:
Average throughput: 885.01 Mbit/s
95th percentile per-packet one-way delay: 127.069 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 481.04 Mbit/s
95th percentile per-packet one-way delay: 124.686 ms
Loss rate: 0.01%
-- Flow 2:
Average throughput: 481.66 Mbit/s
95th percentile per-packet one-way delay: 128.479 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 262.53 Mbit/s
95th percentile per-packet one-way delay: 132.660 ms
Loss rate: 0.00%
```

Run 2: Report of Muses-25 — Data Link

Flow 1 ingress (mean 481.07 Mbit/s)   Flow 1 egress (mean 481.04 Mbit/s)
Flow 2 ingress (mean 481.66 Mbit/s)   Flow 2 egress (mean 481.66 Mbit/s)
Flow 3 ingress (mean 262.53 Mbit/s)   Flow 3 egress (mean 262.53 Mbit/s)

Flow 1 (95th percentile 124.69 ms)   Flow 2 (95th percentile 128.48 ms)   Flow 3 (95th percentile 132.66 ms)

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