Pantheon Report

Generated at 2018-08-28 16:56:43 (UTC).

Data path: GCE Sydney on `ens4` (*local*) →GCE Tokyo on `ens4` (*remote*).

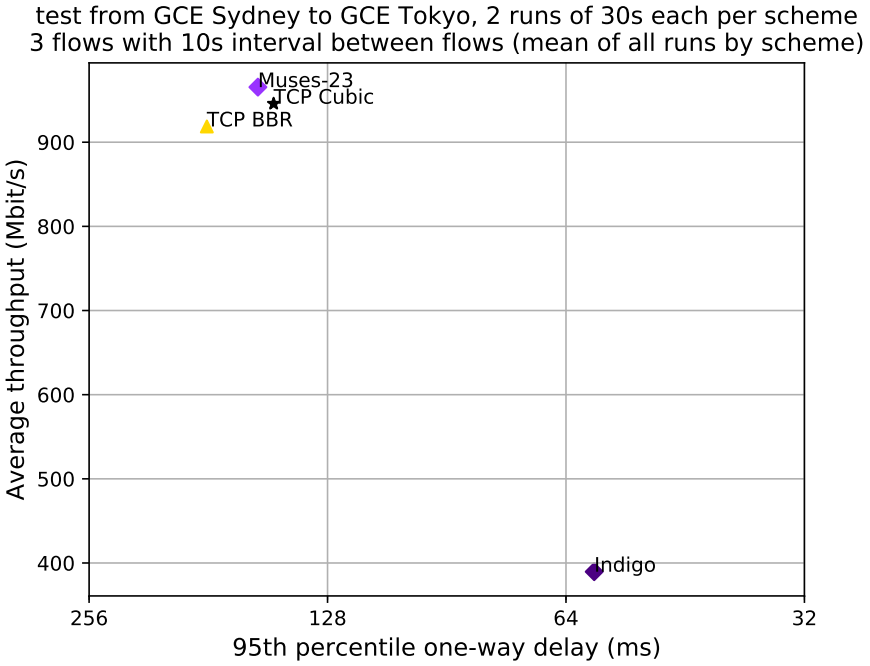
Repeated the test of 4 congestion control schemes twice.

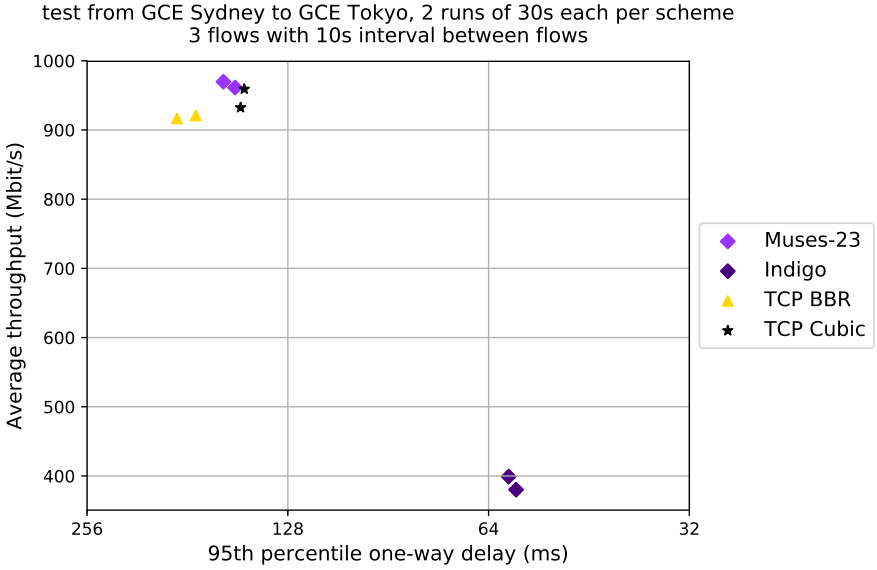
Each test lasted for 30 seconds running 3 flows with 10-second interval between two flows.

NTP offsets were measured against `time.google.com` and have been applied to correct the timestamps in logs.

```
System info:
Linux 4.15.0-1015-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 @ d0153f8e594aa89e93b032143cedbdfe58e562f4
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 Sydney to GCE Tokyo, 2 runs of 30s each per scheme
3 flows with 10s interval between flows (mean of all runs by scheme)
Muses-23
TCP Cubic
TCP BBR
Indigo
Average throughput (Mbit/s)
900
800
700
600
500
400
256
128
64
32
95th percentile one-way delay (ms)


test from GCE Sydney to GCE Tokyo, 2 runs of 30s each per scheme
3 flows with 10s interval between flows
Average throughput (Mbit/s)
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95th percentile one-way delay (ms)
Muses-23
Indigo
TCP BBR
TCP Cubic

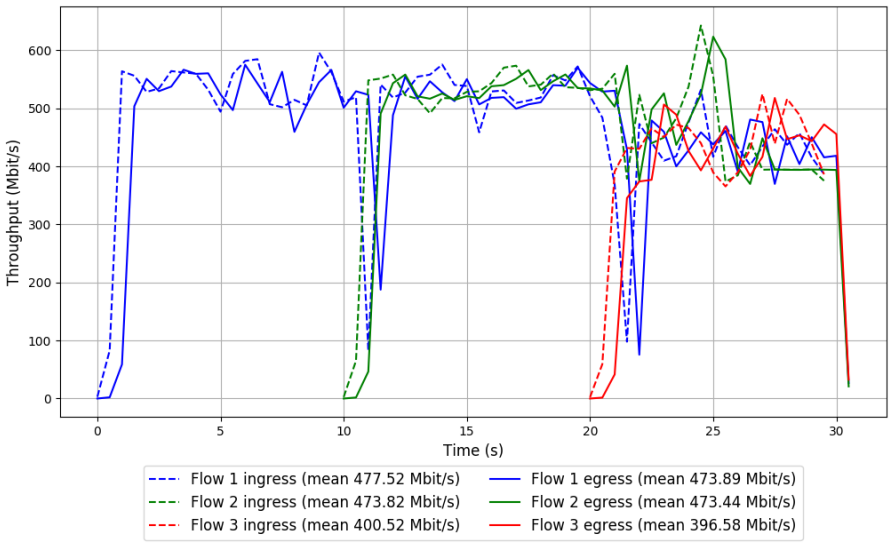
scheme	# runs	mean avg tput (Mbit/s)			mean 95th-%ile delay (ms)			mean loss rate (%)		
		flow 1	flow 2	flow 3	flow 1	flow 2	flow 3	flow 1	flow 2	flow 3
TCP BBR	2	468.71	470.28	411.80	182.14	134.84	211.09	0.91	0.47	1.73
TCP Cubic	2	516.60	447.17	394.98	133.82	152.34	157.69	0.16	0.33	0.69
Indigo	2	210.58	187.29	169.13	58.70	58.60	58.18	0.00	0.00	0.02
Muses-23	2	521.60	469.16	405.54	149.08	172.18	170.69	1.82	3.04	4.18

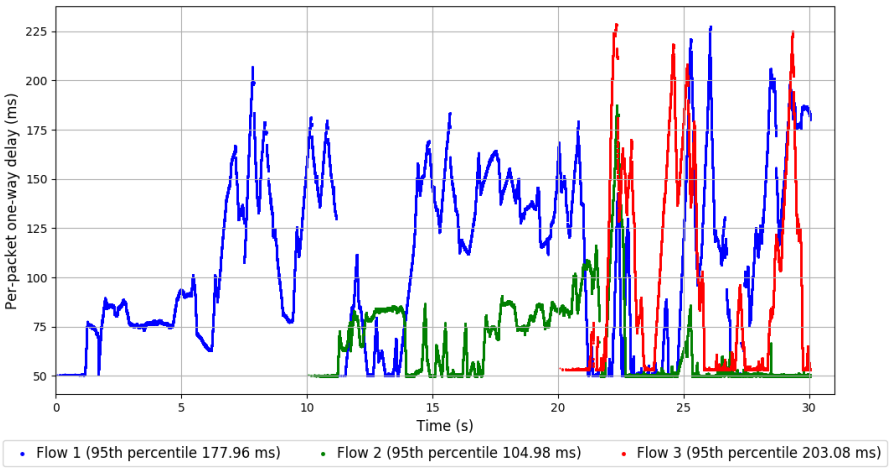
```
Run 1: Statistics of TCP BBR

Start at: 2018-08-28 16:23:13
End at: 2018-08-28 16:23:43
Local clock offset: -0.218 ms
Remote clock offset: -0.062 ms

# Below is generated by plot.py at 2018-08-28 16:54:28
# Datalink statistics
-- Total of 3 flows:
Average throughput: 920.93 Mbit/s
95th percentile per-packet one-way delay: 175.904 ms
Loss rate: 0.56%
-- Flow 1:
Average throughput: 473.89 Mbit/s
95th percentile per-packet one-way delay: 177.957 ms
Loss rate: 0.75%
-- Flow 2:
Average throughput: 473.44 Mbit/s
95th percentile per-packet one-way delay: 104.984 ms
Loss rate: 0.08%
-- Flow 3:
Average throughput: 396.58 Mbit/s
95th percentile per-packet one-way delay: 203.077 ms
Loss rate: 0.99%
```

Run 1: Report of TCP BBR — Data Link



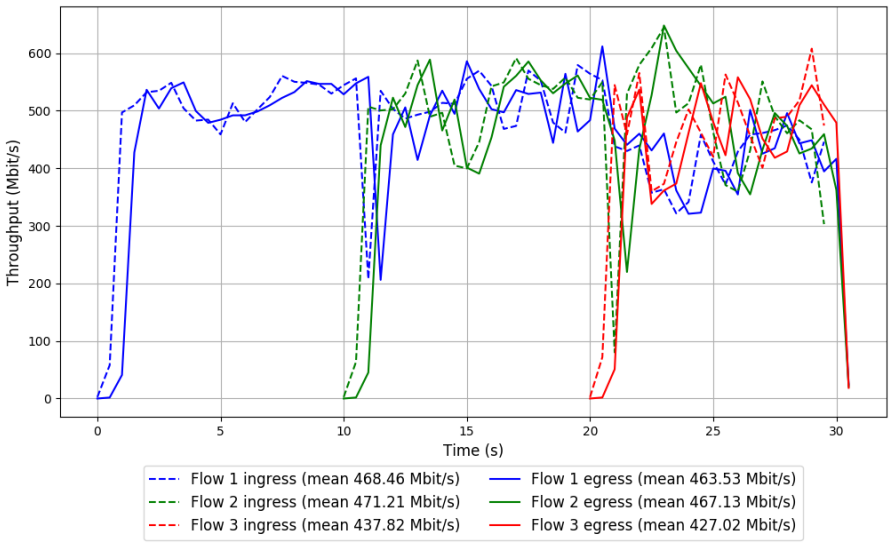


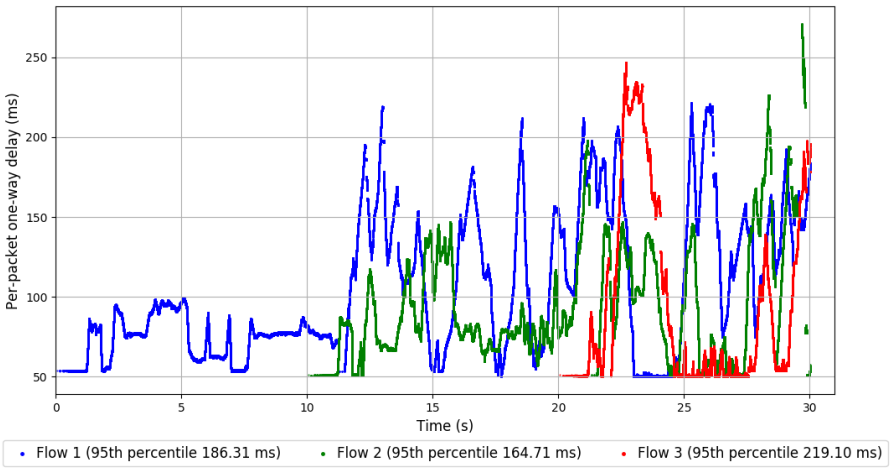
```
Run 2: Statistics of TCP BBR

Start at: 2018-08-28 16:30:50
End at: 2018-08-28 16:31:21
Local clock offset: -0.274 ms
Remote clock offset: -0.038 ms

# Below is generated by plot.py at 2018-08-28 16:54:28
# Datalink statistics
-- Total of 3 flows:
Average throughput: 916.51 Mbit/s
95th percentile per-packet one-way delay: 187.687 ms
Loss rate: 1.21%
-- Flow 1:
Average throughput: 463.53 Mbit/s
95th percentile per-packet one-way delay: 186.314 ms
Loss rate: 1.06%
-- Flow 2:
Average throughput: 467.13 Mbit/s
95th percentile per-packet one-way delay: 164.705 ms
Loss rate: 0.86%
-- Flow 3:
Average throughput: 427.02 Mbit/s
95th percentile per-packet one-way delay: 219.101 ms
Loss rate: 2.46%
```

Run 2: Report of TCP BBR — Data Link



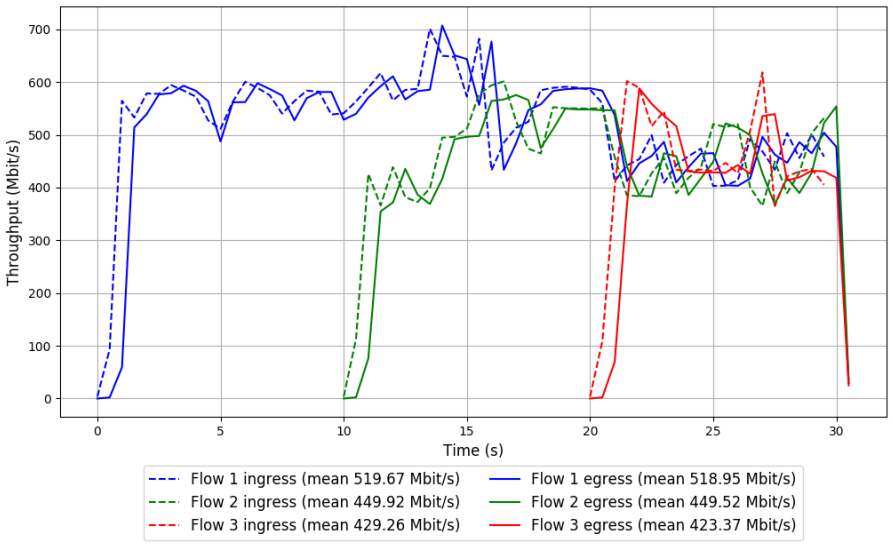


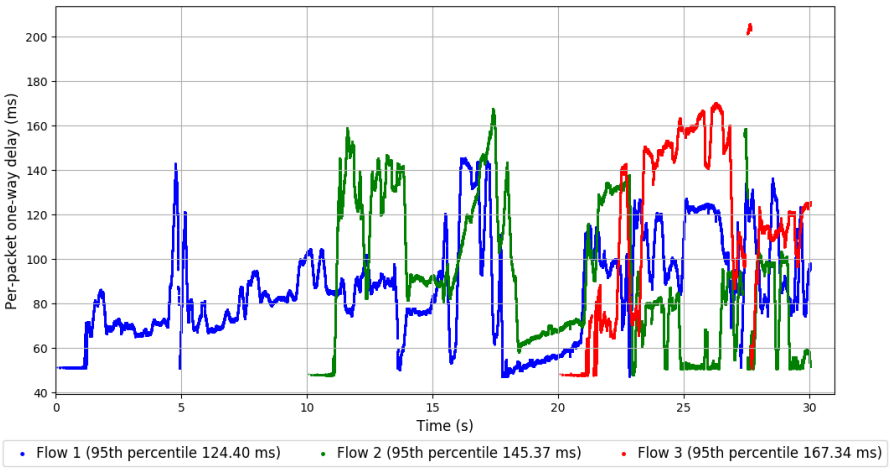
```
Run 1: Statistics of TCP Cubic

Start at: 2018-08-28 16:28:54
End at: 2018-08-28 16:29:24
Local clock offset: -0.449 ms
Remote clock offset: -2.828 ms

# Below is generated by plot.py at 2018-08-28 16:54:36
# Datalink statistics
-- Total of 3 flows:
Average throughput: 959.15 Mbit/s
95th percentile per-packet one-way delay: 148.757 ms
Loss rate: 0.29%
-- Flow 1:
Average throughput: 518.95 Mbit/s
95th percentile per-packet one-way delay: 124.400 ms
Loss rate: 0.14%
-- Flow 2:
Average throughput: 449.52 Mbit/s
95th percentile per-packet one-way delay: 145.371 ms
Loss rate: 0.07%
-- Flow 3:
Average throughput: 423.37 Mbit/s
95th percentile per-packet one-way delay: 167.345 ms
Loss rate: 1.33%
```

Run 1: Report of TCP Cubic — Data Link



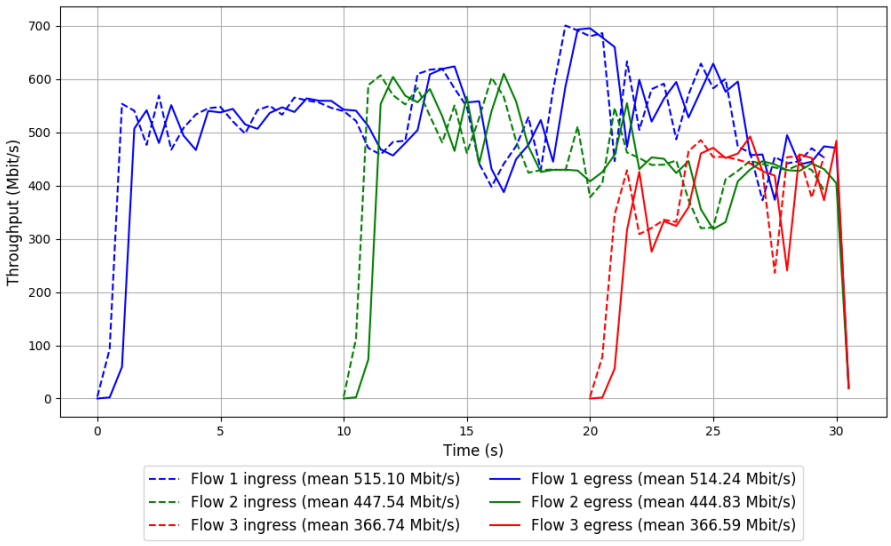


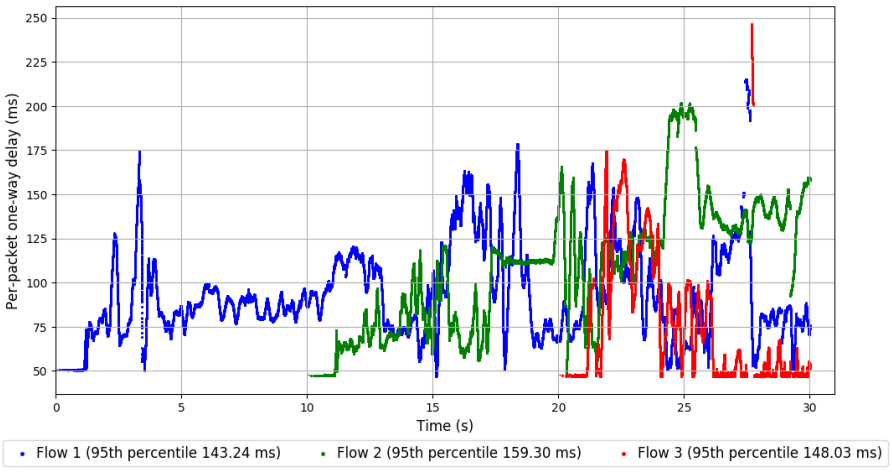
```
Run 2: Statistics of TCP Cubic

Start at: 2018-08-28 16:36:30
End at: 2018-08-28 16:37:00
Local clock offset: -0.081 ms
Remote clock offset: -2.947 ms

# Below is generated by plot.py at 2018-08-28 16:54:36
# Datalink statistics
-- Total of 3 flows:
Average throughput: 932.32 Mbit/s
95th percentile per-packet one-way delay: 150.681 ms
Loss rate: 0.30%
-- Flow 1:
Average throughput: 514.24 Mbit/s
95th percentile per-packet one-way delay: 143.238 ms
Loss rate: 0.18%
-- Flow 2:
Average throughput: 444.83 Mbit/s
95th percentile per-packet one-way delay: 159.302 ms
Loss rate: 0.60%
-- Flow 3:
Average throughput: 366.59 Mbit/s
95th percentile per-packet one-way delay: 148.027 ms
Loss rate: 0.05%
```

Run 2: Report of TCP Cubic — Data Link



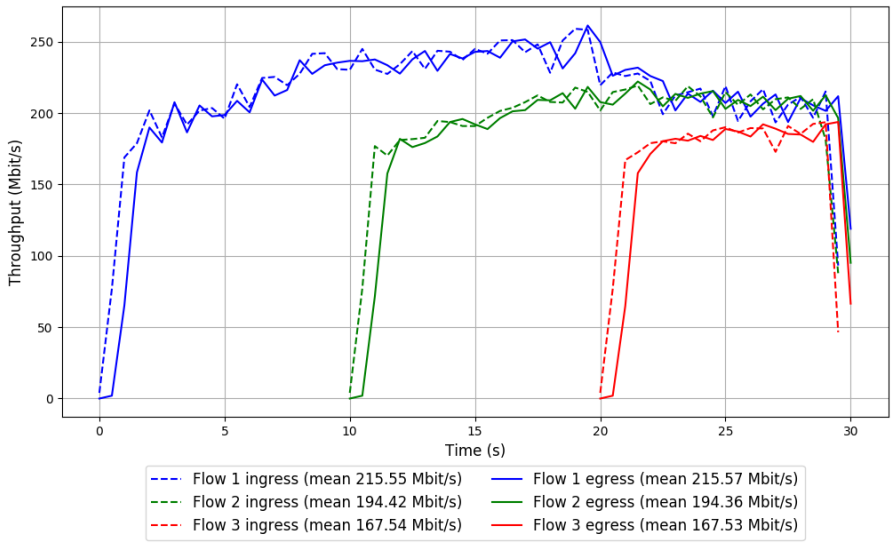


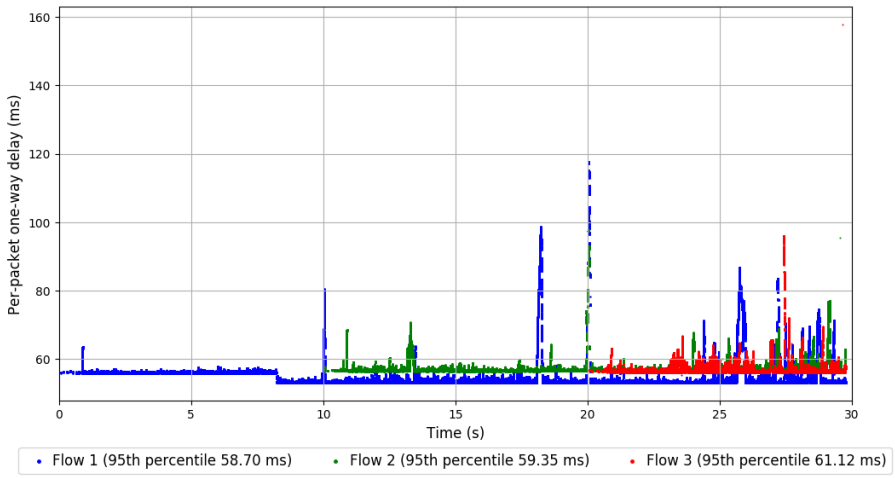
```
Run 1: Statistics of Indigo

Start at: 2018-08-28 16:25:10
End at: 2018-08-28 16:25:40
Local clock offset: -0.443 ms
Remote clock offset: 2.832 ms

# Below is generated by plot.py at 2018-08-28 16:54:36
# Datalink statistics
-- Total of 3 flows:
Average throughput: 399.08 Mbit/s
95th percentile per-packet one-way delay: 59.720 ms
Loss rate: 0.01%
-- Flow 1:
Average throughput: 215.57 Mbit/s
95th percentile per-packet one-way delay: 58.698 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 194.36 Mbit/s
95th percentile per-packet one-way delay: 59.352 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 167.53 Mbit/s
95th percentile per-packet one-way delay: 61.115 ms
Loss rate: 0.04%
```

Run 1: Report of Indigo — Data Link



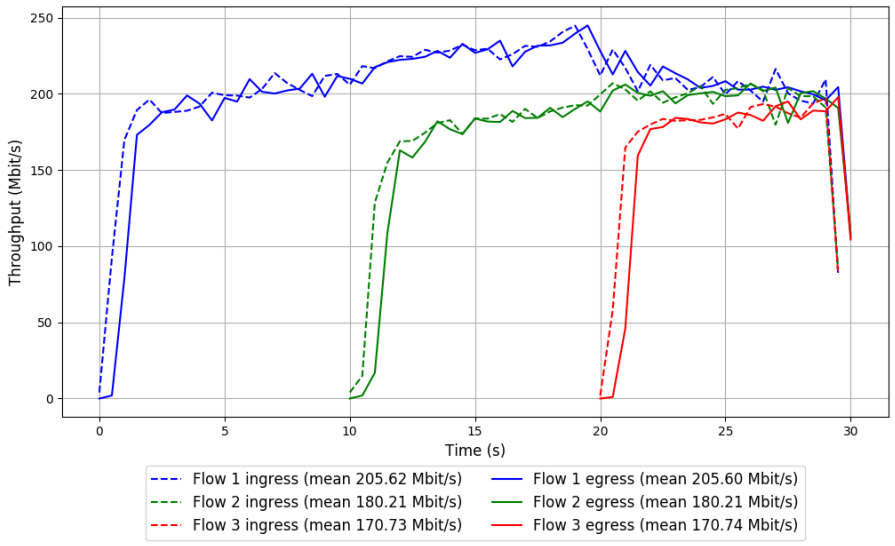


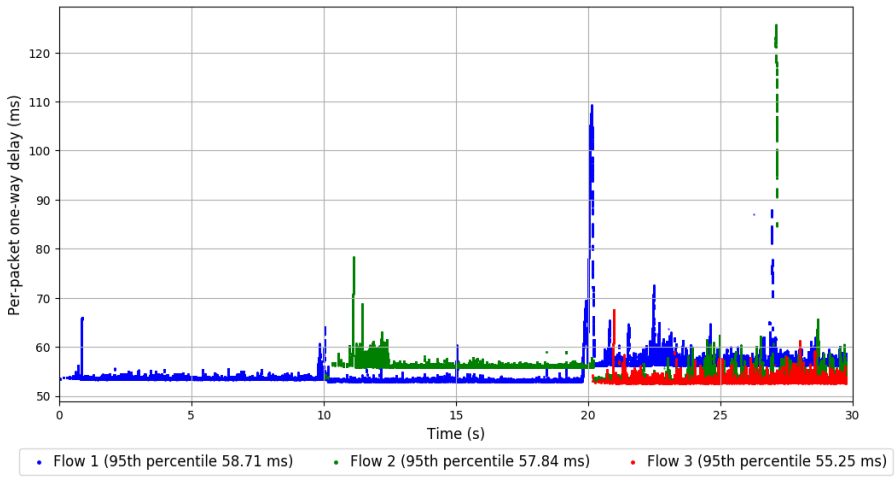
```
Run 2: Statistics of Indigo

Start at: 2018-08-28 16:32:48
End at: 2018-08-28 16:33:18
Local clock offset: -0.242 ms
Remote clock offset: 2.735 ms

# Below is generated by plot.py at 2018-08-28 16:54:36
# Datalink statistics
-- Total of 3 flows:
Average throughput: 380.20 Mbit/s
95th percentile per-packet one-way delay: 58.203 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 205.60 Mbit/s
95th percentile per-packet one-way delay: 58.709 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 180.21 Mbit/s
95th percentile per-packet one-way delay: 57.841 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 170.74 Mbit/s
95th percentile per-packet one-way delay: 55.250 ms
Loss rate: 0.00%
```

Run 2: Report of Indigo — Data Link



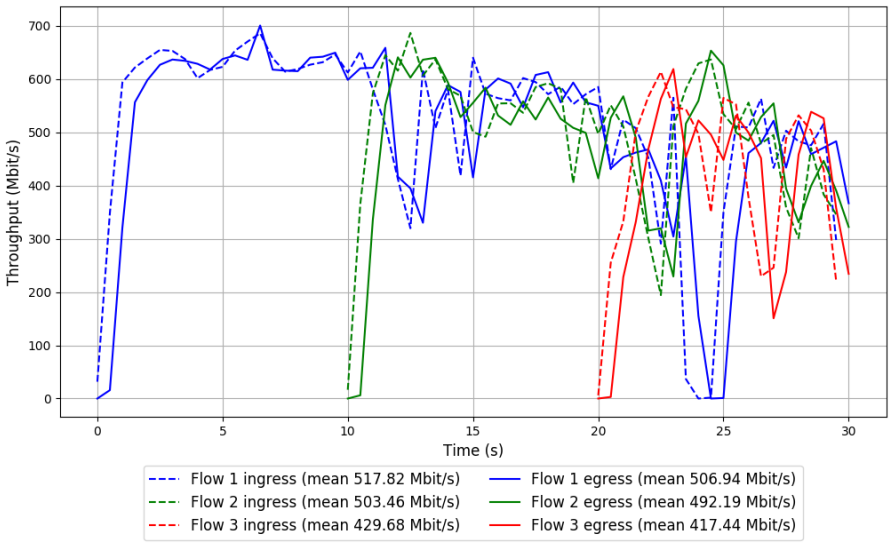


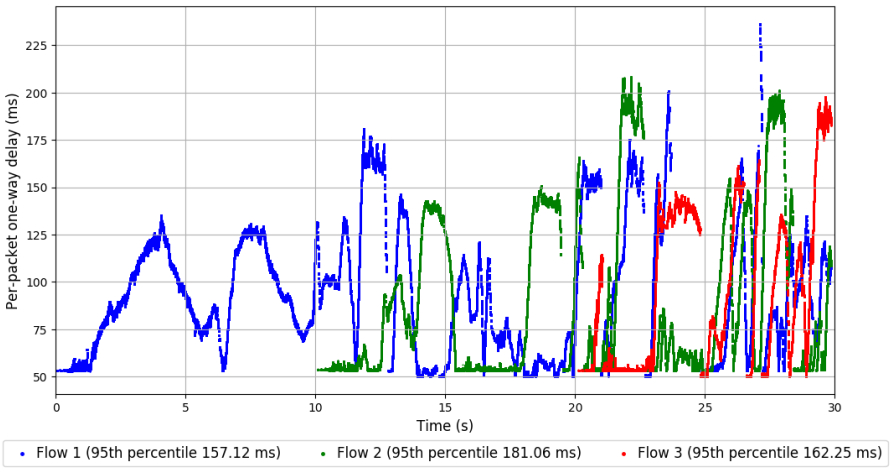
```
Run 1: Statistics of Muses-23

Start at: 2018-08-28 16:26:54
End at: 2018-08-28 16:27:24
Local clock offset: -0.114 ms
Remote clock offset: 0.014 ms

# Below is generated by plot.py at 2018-08-28 16:56:41
# Datalink statistics
-- Total of 3 flows:
Average throughput: 969.67 Mbit/s
95th percentile per-packet one-way delay: 159.854 ms
Loss rate: 2.26%
-- Flow 1:
Average throughput: 506.94 Mbit/s
95th percentile per-packet one-way delay: 157.123 ms
Loss rate: 2.11%
-- Flow 2:
Average throughput: 492.19 Mbit/s
95th percentile per-packet one-way delay: 181.064 ms
Loss rate: 2.25%
-- Flow 3:
Average throughput: 417.44 Mbit/s
95th percentile per-packet one-way delay: 162.250 ms
Loss rate: 2.86%
```

Run 1: Report of Muses-23 — Data Link





```
Run 2: Statistics of Muses-23

Start at: 2018-08-28 16:34:31
End at: 2018-08-28 16:35:01
Local clock offset: -0.407 ms
Remote clock offset: -0.069 ms

# Below is generated by plot.py at 2018-08-28 16:56:41
# Datalink statistics
-- Total of 3 flows:
Average throughput: 961.25 Mbit/s
95th percentile per-packet one-way delay: 153.592 ms
Loss rate: 2.79%
-- Flow 1:
Average throughput: 536.26 Mbit/s
95th percentile per-packet one-way delay: 141.041 ms
Loss rate: 1.53%
-- Flow 2:
Average throughput: 446.14 Mbit/s
95th percentile per-packet one-way delay: 163.300 ms
Loss rate: 3.82%
-- Flow 3:
Average throughput: 393.65 Mbit/s
95th percentile per-packet one-way delay: 179.130 ms
Loss rate: 5.50%
```

Run 2: Report of Muses-23 — Data Link