Pantheon Report

Generated at 2018-08-28 14:06:11 (UTC).

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

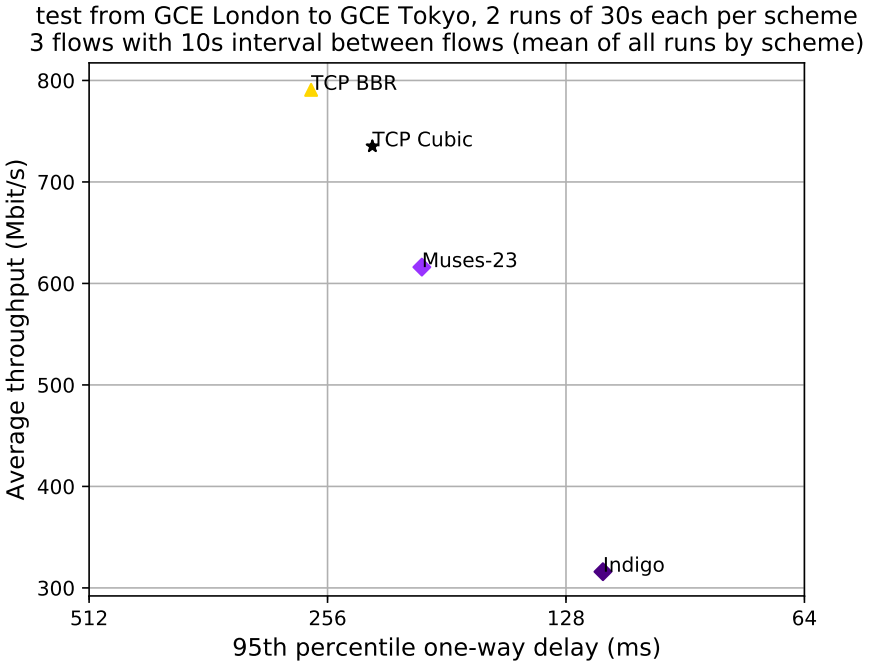
Repeated the test of 4 congestion control schemes twice.

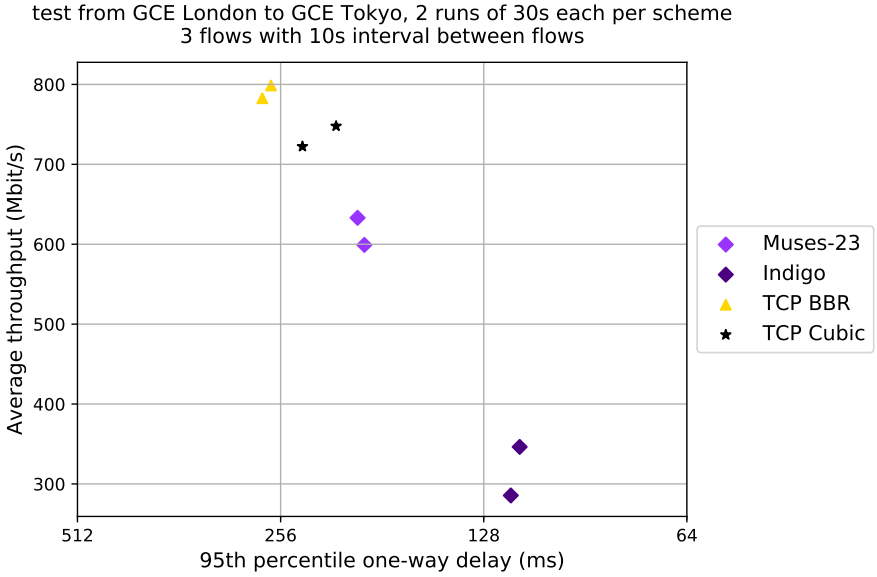
Each test lasted for 30 seconds running 3 flows with 10-second interval between two flows.

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

```
System info:
Linux 4.15.0-1015-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 London to GCE Tokyo, 2 runs of 30s each per scheme
3 flows with 10s interval between flows (mean of all runs by scheme)
TCP BBR
TCP Cubic
Muses-23
Indigo
800
700
600
500
400
300
512
256
128
64
Average throughput (Mbit/s)
95th percentile one-way delay (ms)


test from GCE London to GCE Tokyo, 2 runs of 30s each per scheme
3 flows with 10s interval between flows
800
700
600
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400
300
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256
128
64
Average throughput (Mbit/s)
95th percentile one-way delay (ms)
Muses-23
Indigo
TCP BBR
TCP Cubic

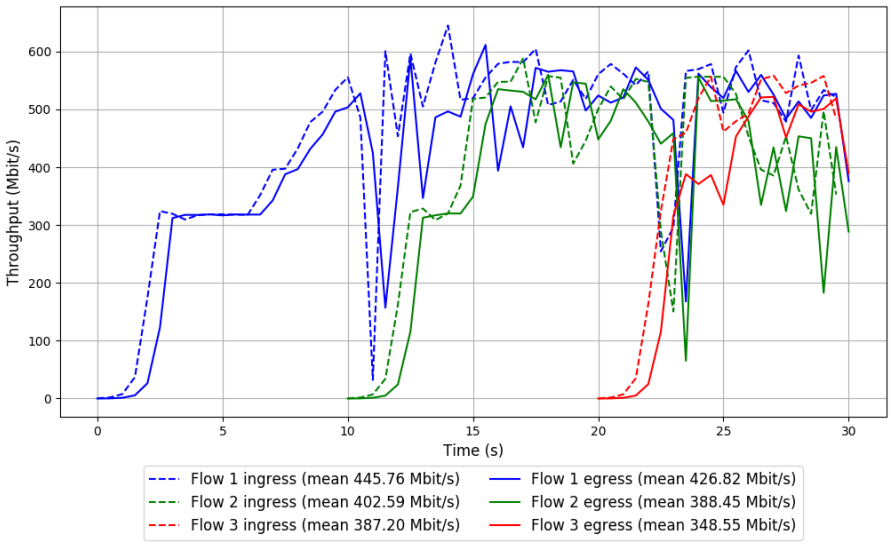
scheme	# runs	mean avg tput (Mbit/s)			mean 95th-%ile delay (ms)			mean loss rate (%)		
		flow 1	flow 2	flow 3	flow 1	flow 2	flow 3	flow 1	flow 2	flow 3
TCP BBR	2	423.04	390.80	331.16	247.89	270.01	315.15	4.48	4.18	15.02
TCP Cubic	2	433.76	323.29	265.11	222.41	184.54	205.45	0.86	1.42	6.09
Indigo	2	151.25	176.09	151.88	113.60	113.88	121.72	0.75	1.09	2.63
Muses-23	2	325.58	325.21	231.06	193.54	190.17	168.95	2.50	3.10	5.54

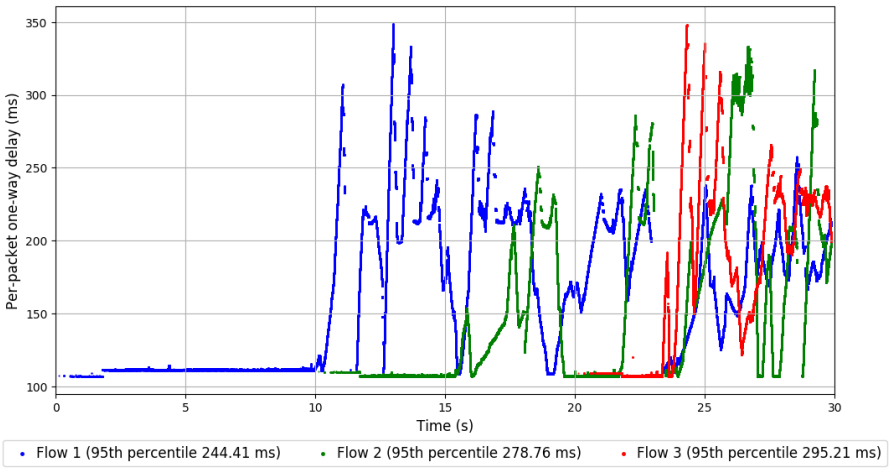
```
Run 1: Statistics of TCP BBR

Start at: 2018-08-28 13:40:34
End at: 2018-08-28 13:41:04
Local clock offset: -3.013 ms
Remote clock offset: -0.566 ms

# Below is generated by plot.py at 2018-08-28 14:05:59
# Datalink statistics
-- Total of 3 flows:
Average throughput: 798.74 Mbit/s
95th percentile per-packet one-way delay: 264.546 ms
Loss rate: 5.91%
-- Flow 1:
Average throughput: 426.82 Mbit/s
95th percentile per-packet one-way delay: 244.412 ms
Loss rate: 4.95%
-- Flow 2:
Average throughput: 388.45 Mbit/s
95th percentile per-packet one-way delay: 278.759 ms
Loss rate: 4.59%
-- Flow 3:
Average throughput: 348.55 Mbit/s
95th percentile per-packet one-way delay: 295.210 ms
Loss rate: 11.99%
```

Run 1: Report of TCP BBR — Data Link



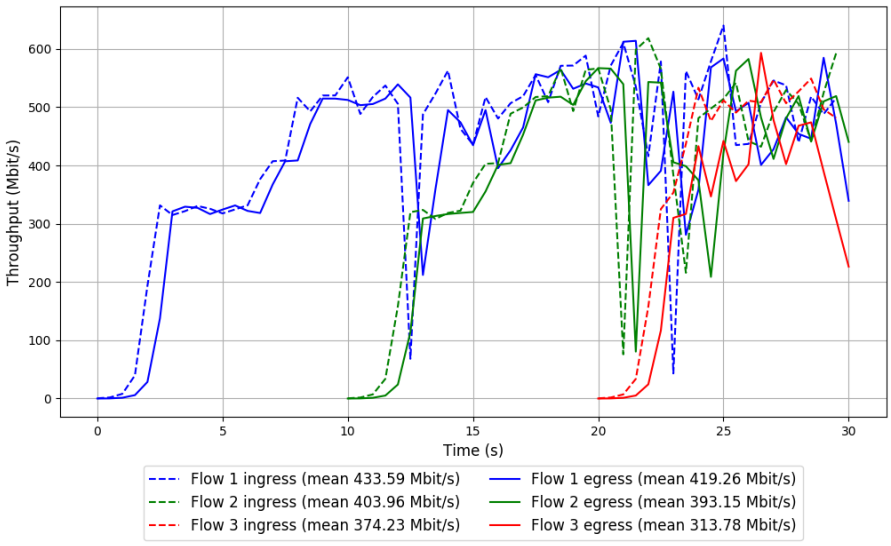


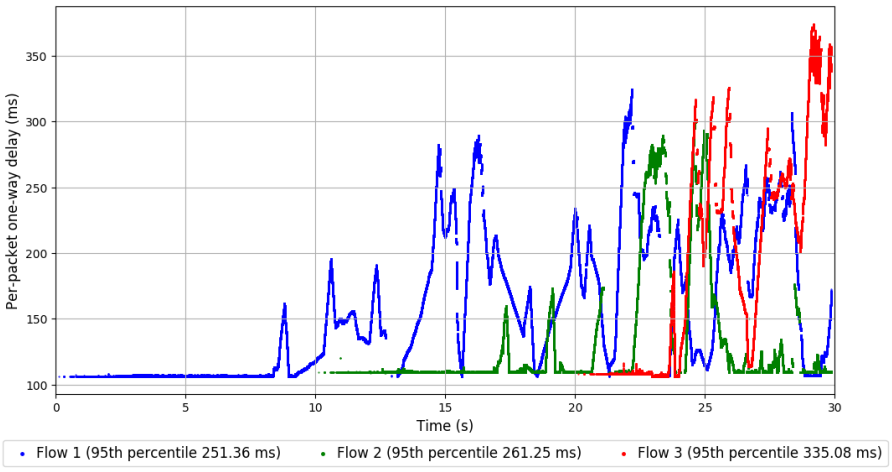
```
Run 2: Statistics of TCP BBR

Start at: 2018-08-28 13:48:13
End at: 2018-08-28 13:48:43
Local clock offset: -3.175 ms
Remote clock offset: -0.146 ms

# Below is generated by plot.py at 2018-08-28 14:05:59
# Datalink statistics
-- Total of 3 flows:
Average throughput: 782.78 Mbit/s
95th percentile per-packet one-way delay: 272.487 ms
Loss rate: 6.05%
-- Flow 1:
Average throughput: 419.26 Mbit/s
95th percentile per-packet one-way delay: 251.362 ms
Loss rate: 4.02%
-- Flow 2:
Average throughput: 393.15 Mbit/s
95th percentile per-packet one-way delay: 261.253 ms
Loss rate: 3.78%
-- Flow 3:
Average throughput: 313.78 Mbit/s
95th percentile per-packet one-way delay: 335.085 ms
Loss rate: 18.04%
```

Run 2: Report of TCP BBR — Data Link



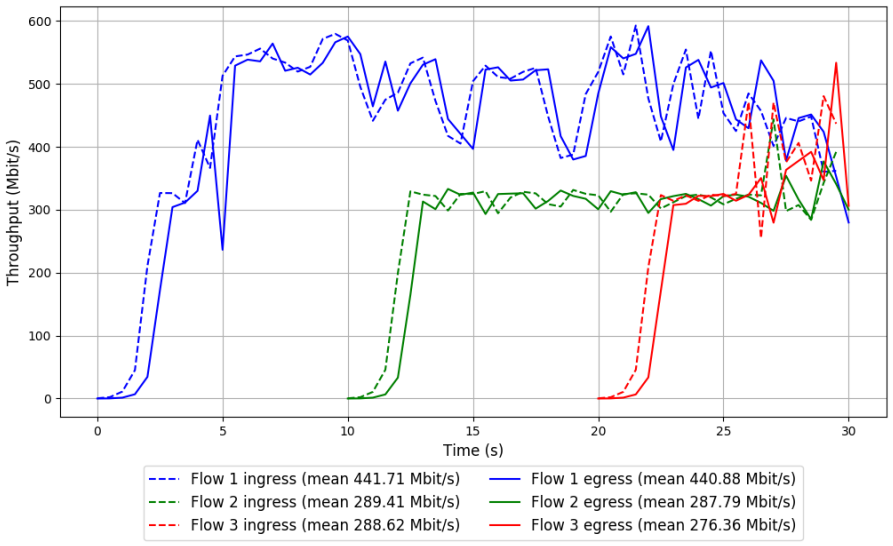


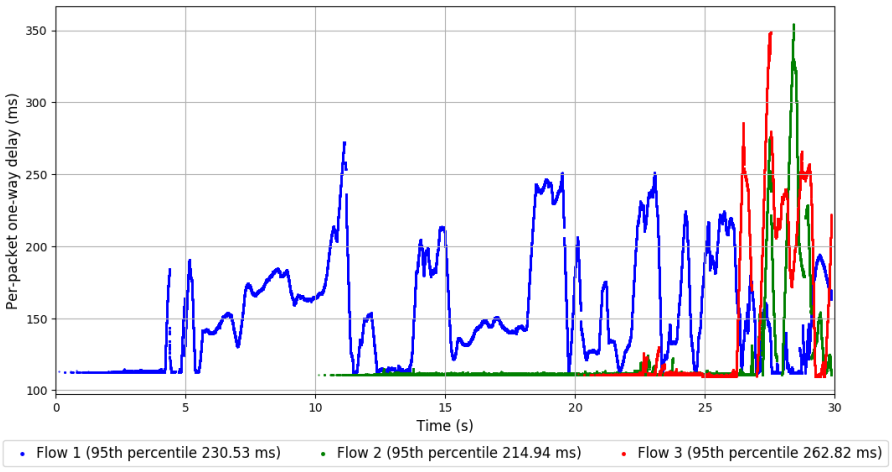
```
Run 1: Statistics of TCP Cubic

Start at: 2018-08-28 13:42:41
End at: 2018-08-28 13:43:11
Local clock offset: -0.24 ms
Remote clock offset: -0.577 ms

# Below is generated by plot.py at 2018-08-28 14:05:59
# Datalink statistics
-- Total of 3 flows:
Average throughput: 722.33 Mbit/s
95th percentile per-packet one-way delay: 237.608 ms
Loss rate: 1.84%
-- Flow 1:
Average throughput: 440.88 Mbit/s
95th percentile per-packet one-way delay: 230.528 ms
Loss rate: 0.93%
-- Flow 2:
Average throughput: 287.79 Mbit/s
95th percentile per-packet one-way delay: 214.941 ms
Loss rate: 1.67%
-- Flow 3:
Average throughput: 276.36 Mbit/s
95th percentile per-packet one-way delay: 262.824 ms
Loss rate: 6.39%
```

Run 1: Report of TCP Cubic — Data Link



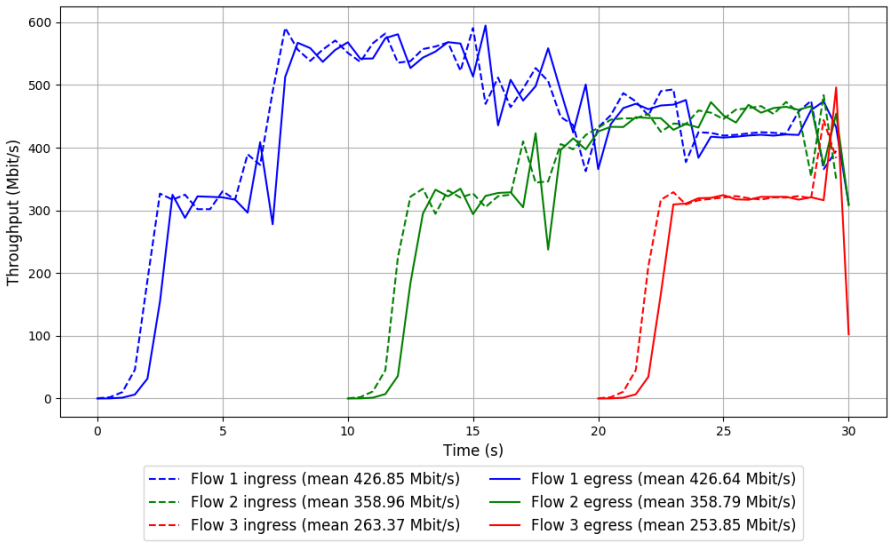


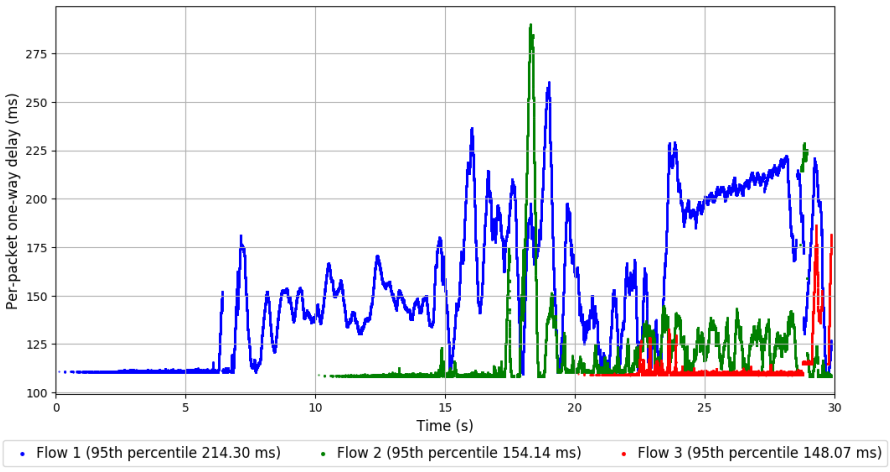
```
Run 2: Statistics of TCP Cubic

Start at: 2018-08-28 13:50:17
End at: 2018-08-28 13:50:47
Local clock offset: -3.006 ms
Remote clock offset: -1.028 ms

# Below is generated by plot.py at 2018-08-28 14:05:59
# Datalink statistics
-- Total of 3 flows:
Average throughput: 747.88 Mbit/s
95th percentile per-packet one-way delay: 211.832 ms
Loss rate: 1.49%
-- Flow 1:
Average throughput: 426.64 Mbit/s
95th percentile per-packet one-way delay: 214.302 ms
Loss rate: 0.79%
-- Flow 2:
Average throughput: 358.79 Mbit/s
95th percentile per-packet one-way delay: 154.137 ms
Loss rate: 1.16%
-- Flow 3:
Average throughput: 253.85 Mbit/s
95th percentile per-packet one-way delay: 148.071 ms
Loss rate: 5.80%
```

Run 2: Report of TCP Cubic — Data Link



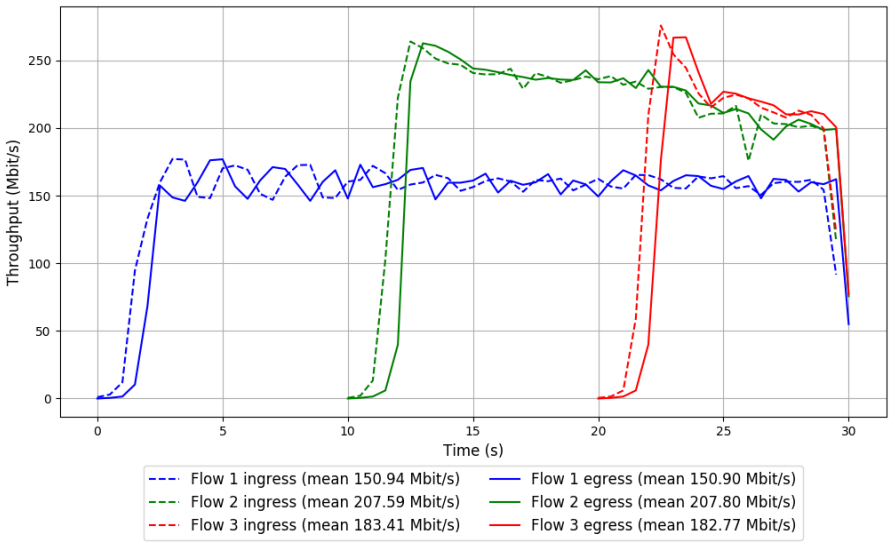


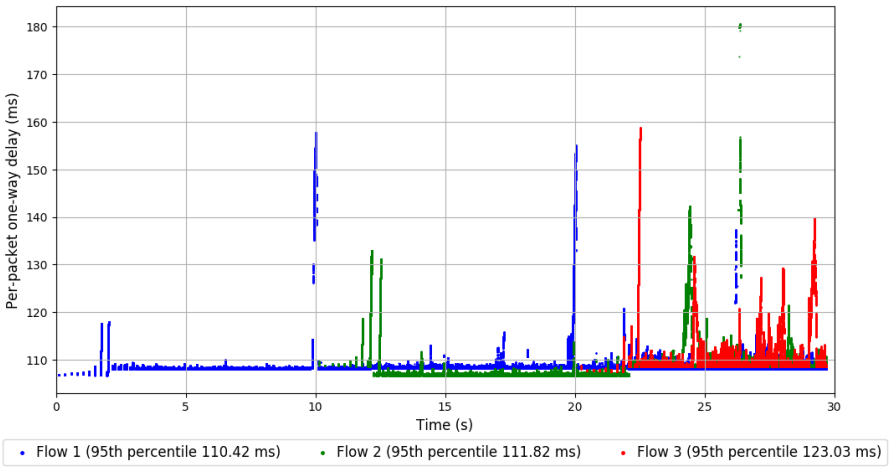
```
Run 1: Statistics of Indigo

Start at: 2018-08-28 13:38:44
End at: 2018-08-28 13:39:14
Local clock offset: -3.133 ms
Remote clock offset: -0.514 ms

# Below is generated by plot.py at 2018-08-28 14:05:59
# Datalink statistics
-- Total of 3 flows:
Average throughput: 346.35 Mbit/s
95th percentile per-packet one-way delay: 113.223 ms
Loss rate: 1.18%
-- Flow 1:
Average throughput: 150.90 Mbit/s
95th percentile per-packet one-way delay: 110.424 ms
Loss rate: 0.76%
-- Flow 2:
Average throughput: 207.80 Mbit/s
95th percentile per-packet one-way delay: 111.822 ms
Loss rate: 1.03%
-- Flow 3:
Average throughput: 182.77 Mbit/s
95th percentile per-packet one-way delay: 123.026 ms
Loss rate: 2.61%
```

Run 1: Report of Indigo — Data Link



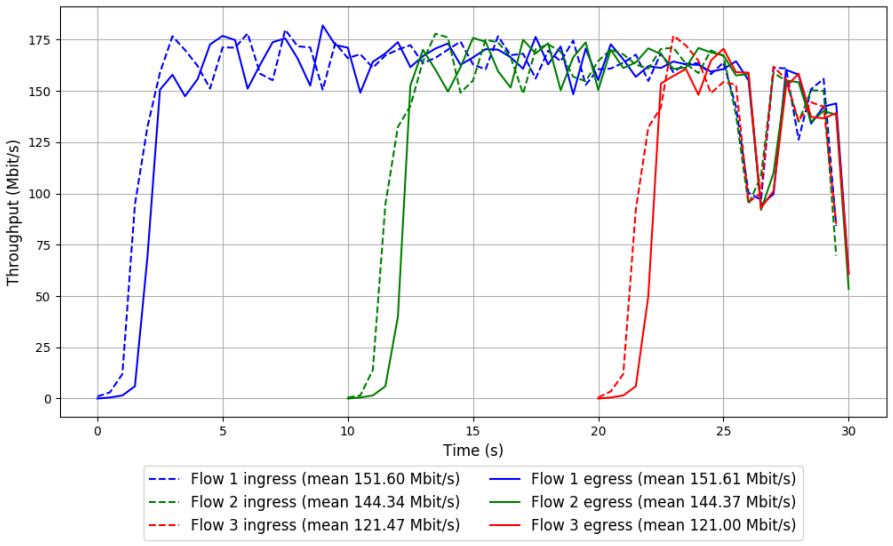


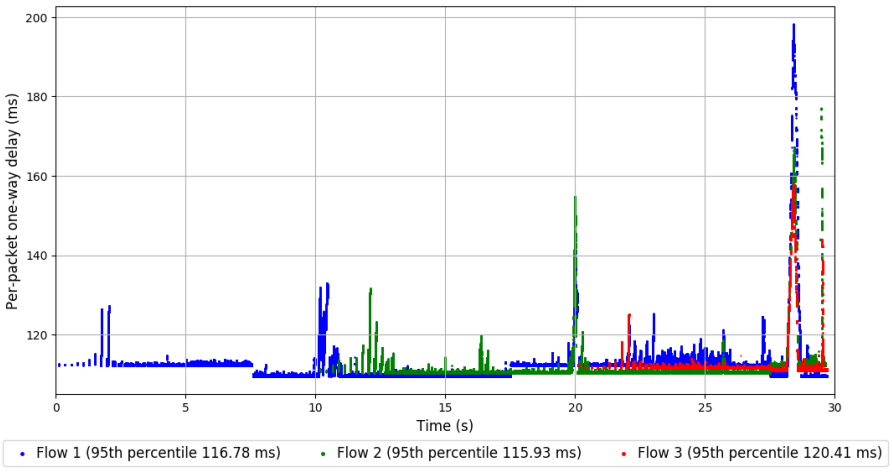
```
Run 2: Statistics of Indigo

Start at: 2018-08-28 13:46:28
End at: 2018-08-28 13:46:58
Local clock offset: -0.184 ms
Remote clock offset: -0.295 ms

# Below is generated by plot.py at 2018-08-28 14:05:59
# Datalink statistics
-- Total of 3 flows:
Average throughput: 285.59 Mbit/s
95th percentile per-packet one-way delay: 116.706 ms
Loss rate: 1.14%
-- Flow 1:
Average throughput: 151.61 Mbit/s
95th percentile per-packet one-way delay: 116.781 ms
Loss rate: 0.74%
-- Flow 2:
Average throughput: 144.37 Mbit/s
95th percentile per-packet one-way delay: 115.933 ms
Loss rate: 1.15%
-- Flow 3:
Average throughput: 121.00 Mbit/s
95th percentile per-packet one-way delay: 120.411 ms
Loss rate: 2.66%
```

Run 2: Report of Indigo — Data Link



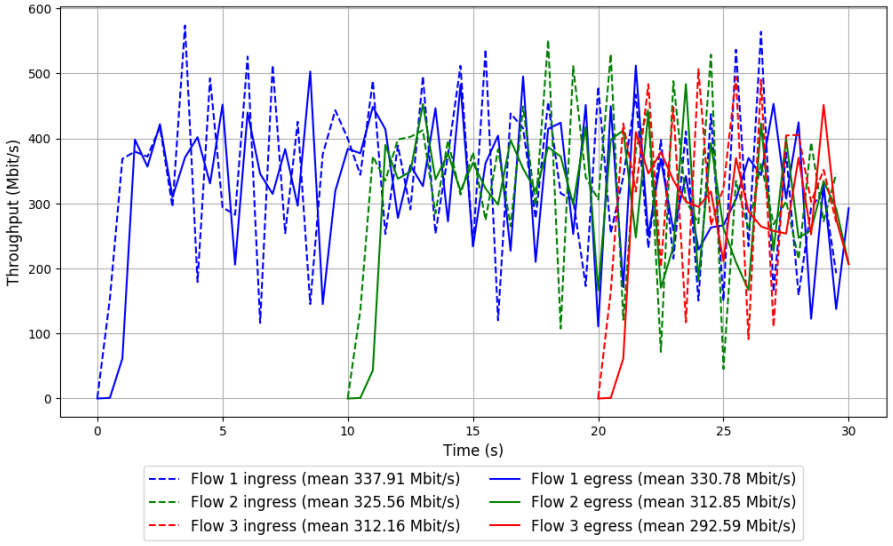


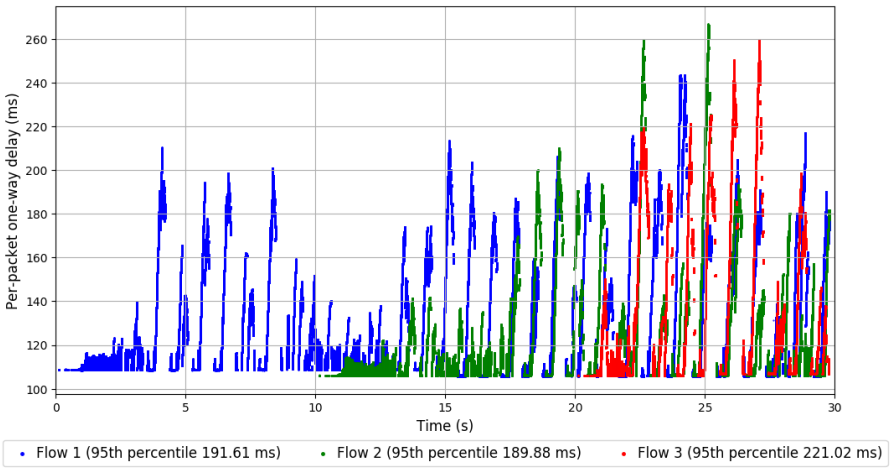
```
Run 1: Statistics of Muses-23

Start at: 2018-08-28 13:36:51
End at: 2018-08-28 13:37:21
Local clock offset: -3.008 ms
Remote clock offset: 0.556 ms

# Below is generated by plot.py at 2018-08-28 14:06:09
# Datalink statistics
-- Total of 3 flows:
Average throughput: 633.05 Mbit/s
95th percentile per-packet one-way delay: 196.874 ms
Loss rate: 3.89%
-- Flow 1:
Average throughput: 330.78 Mbit/s
95th percentile per-packet one-way delay: 191.610 ms
Loss rate: 2.13%
-- Flow 2:
Average throughput: 312.85 Mbit/s
95th percentile per-packet one-way delay: 189.884 ms
Loss rate: 4.40%
-- Flow 3:
Average throughput: 292.59 Mbit/s
95th percentile per-packet one-way delay: 221.022 ms
Loss rate: 8.51%
```

Run 1: Report of Muses-23 — Data Link





```
Run 2: Statistics of Muses-23

Start at: 2018-08-28 13:44:38
End at: 2018-08-28 13:45:08
Local clock offset: -0.135 ms
Remote clock offset: -0.235 ms

# Below is generated by plot.py at 2018-08-28 14:06:09
# Datalink statistics
-- Total of 3 flows:
Average throughput: 599.11 Mbit/s
95th percentile per-packet one-way delay: 192.343 ms
Loss rate: 2.44%
-- Flow 1:
Average throughput: 320.39 Mbit/s
95th percentile per-packet one-way delay: 195.468 ms
Loss rate: 2.86%
-- Flow 2:
Average throughput: 337.56 Mbit/s
95th percentile per-packet one-way delay: 190.451 ms
Loss rate: 1.80%
-- Flow 3:
Average throughput: 169.53 Mbit/s
95th percentile per-packet one-way delay: 116.885 ms
Loss rate: 2.57%
```

Run 2: Report of Muses-23 — Data Link