Pantheon Report

Generated at 2018-08-28 13:13:56 (UTC).

Data path: GCE Sydney on `ens4` (*local*) →GCE Iowa 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.
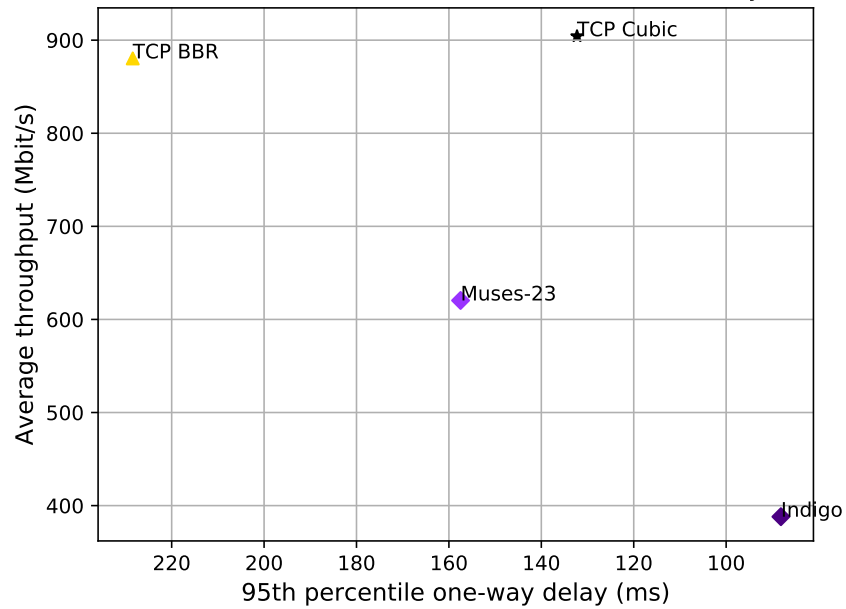
```
System info:
Linux 4.15.0-1015-gcp
net.core.default_qdisc = fq
net.core.rmem_default = 16777216
net.core.rmem_max = 536870912
net.core.wmem_default = 16777216
net.core.wmem_max = 536870912
net.ipv4.tcp_rmem = 4096 16777216 536870912
net.ipv4.tcp_wmem = 4096 16777216 536870912
```
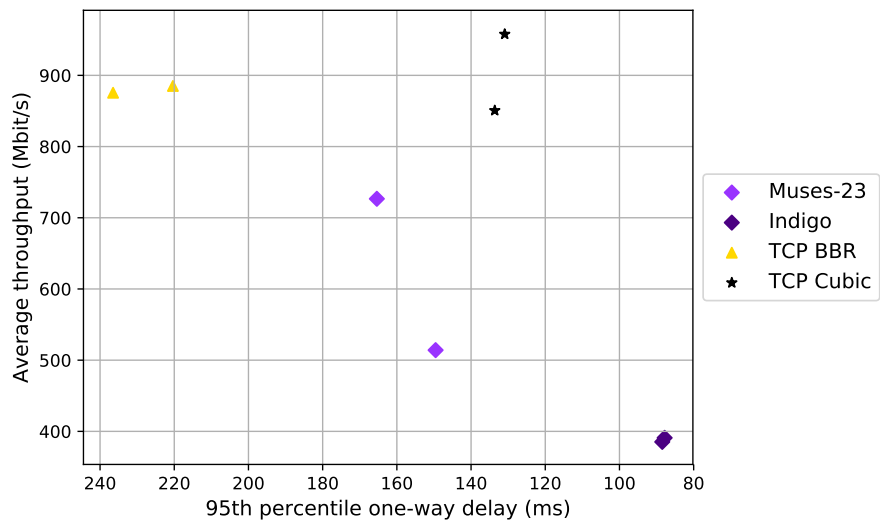
```
Git summary:
branch: muses-23 @ 88af05c5b0b7531637ca401951507a2fde628df6
third_party/fillp @ d47f4fa1b454a5e3c0537115c5a28436dbd4b834
third_party/fillp-sheep @ daed0c84f98531712514b2231f43ec6901114ffe
third_party/genericCC @ d0153f8e594aa89e93b032143cedbdfe58e562f4
third_party/indigo @ 2601c92e4aa9d58d38dc4dfe0ecdbf90c077e64d
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 Iowa, 2 runs of 30s each per scheme
3 flows with 10s interval between flows (mean of all runs by scheme)

test from GCE Sydney to GCE Iowa, 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	488.79	417.08	344.38	202.13	247.64	110.04	1.68	4.44	0.55
TCP Cubic	2	448.72	493.76	381.15	115.59	134.59	141.94	0.00	0.12	0.17
Indigo	2	204.47	193.51	172.09	87.77	88.47	88.61	0.00	0.00	0.00
Muses-23	2	369.52	294.30	171.05	129.75	125.16	92.22	2.31	0.95	0.00

```
Run 1: Statistics of TCP BBR

Start at: 2018-08-28 12:46:19
End at: 2018-08-28 12:46:49
Local clock offset: 0.1 ms
Remote clock offset: 0.057 ms


# Below is generated by plot.py at 2018-08-28 13:13:29
# Datalink statistics
-- Total of 3 flows:
Average throughput: 875.60 Mbit/s
95th percentile per-packet one-way delay: 236.491 ms
Loss rate: 2.40%
-- Flow 1:
Average throughput: 493.68 Mbit/s
95th percentile per-packet one-way delay: 186.618 ms
Loss rate: 1.20%
-- Flow 2:
Average throughput: 406.14 Mbit/s
95th percentile per-packet one-way delay: 265.934 ms
Loss rate: 5.42%
-- Flow 3:
Average throughput: 338.76 Mbit/s
95th percentile per-packet one-way delay: 89.779 ms
Loss rate: 0.00%
```
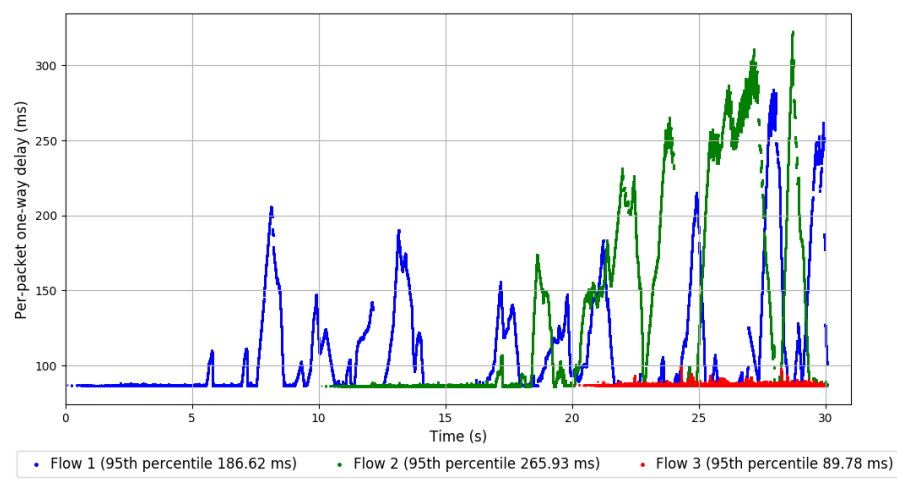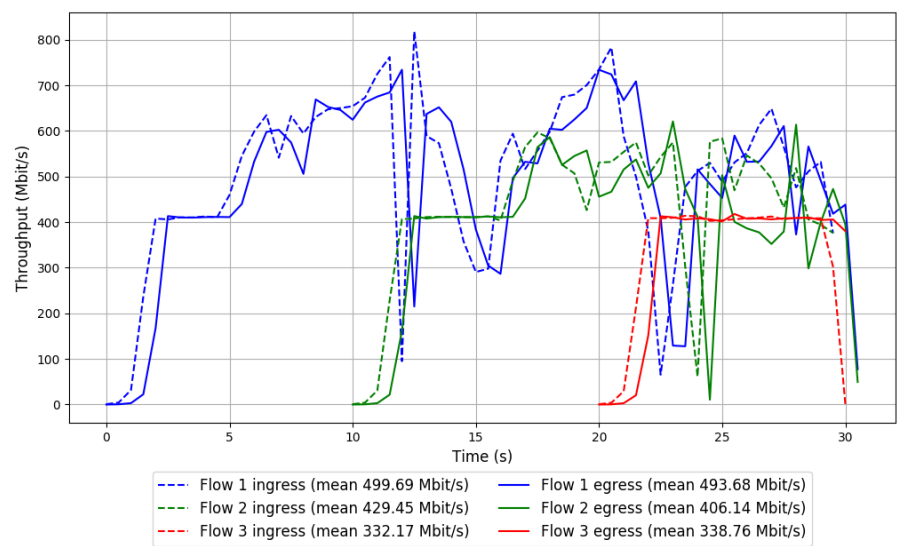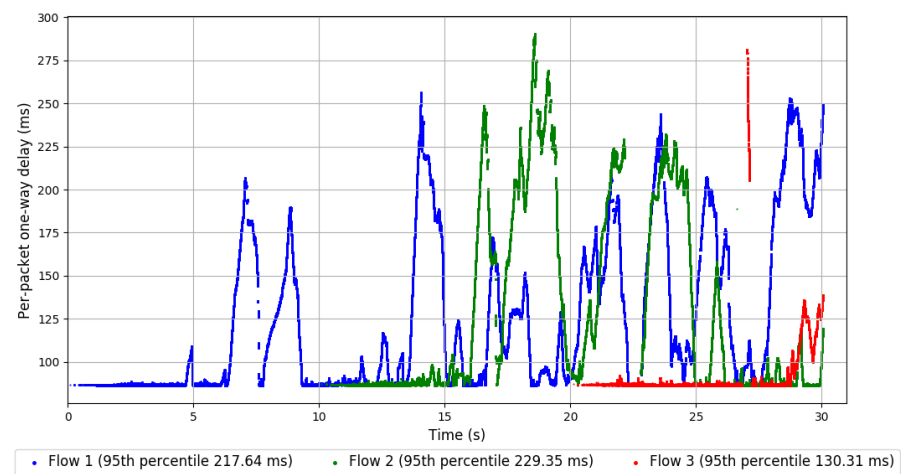
Run 1: Report of TCP BBR — Data Link

Flow 1 ingress (mean 499.69 Mbit/s) --- Flow 1 egress (mean 493.68 Mbit/s)
Flow 2 ingress (mean 429.45 Mbit/s) --- Flow 2 egress (mean 406.14 Mbit/s)
Flow 3 ingress (mean 332.17 Mbit/s) --- Flow 3 egress (mean 338.76 Mbit/s)

Flow 1 (95th percentile 186.62 ms)   Flow 2 (95th percentile 265.93 ms)   Flow 3 (95th percentile 89.78 ms)

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```
Run 2: Statistics of TCP BBR

Start at: 2018-08-28 12:53:55
End at: 2018-08-28 12:54:25
Local clock offset: -0.047 ms
Remote clock offset: 0.046 ms


# Below is generated by plot.py at 2018-08-28 13:13:36
# Datalink statistics
-- Total of 3 flows:
Average throughput: 885.17 Mbit/s
95th percentile per-packet one-way delay: 220.359 ms
Loss rate: 2.44%
-- Flow 1:
Average throughput: 483.90 Mbit/s
95th percentile per-packet one-way delay: 217.641 ms
Loss rate: 2.16%
-- Flow 2:
Average throughput: 428.02 Mbit/s
95th percentile per-packet one-way delay: 229.351 ms
Loss rate: 3.45%
-- Flow 3:
Average throughput: 349.99 Mbit/s
95th percentile per-packet one-way delay: 130.306 ms
Loss rate: 1.10%
```
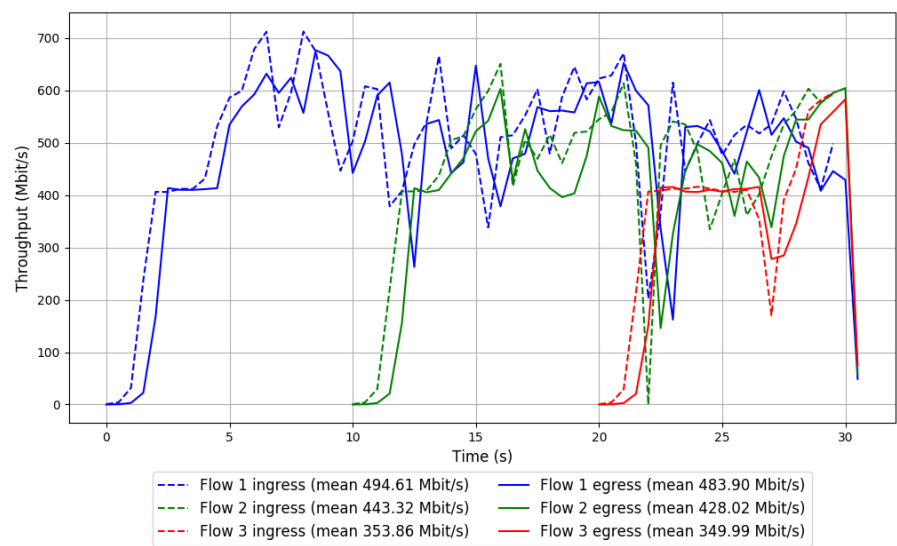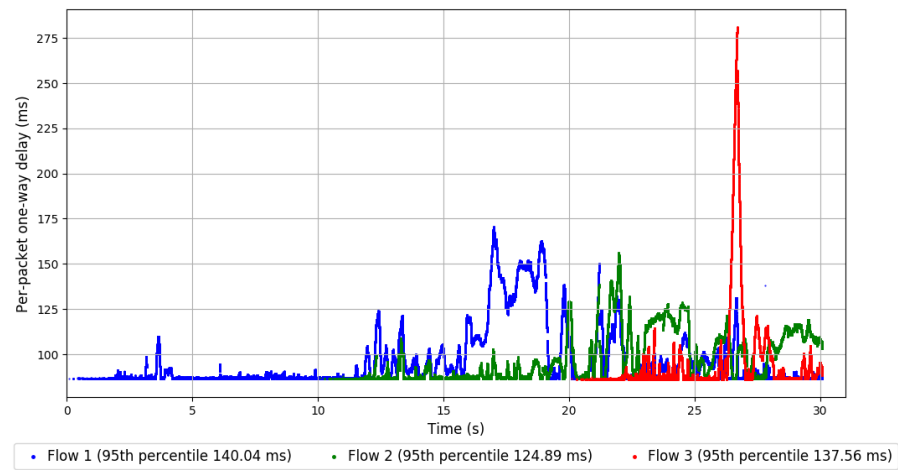
Run 2: Report of TCP BBR — Data Link

Flow 1 ingress (mean 494.61 Mbit/s) --- Flow 1 egress (mean 483.90 Mbit/s)
Flow 2 ingress (mean 443.32 Mbit/s) --- Flow 2 egress (mean 428.02 Mbit/s)
Flow 3 ingress (mean 353.86 Mbit/s) --- Flow 3 egress (mean 349.99 Mbit/s)

Flow 1 (95th percentile 217.64 ms)   Flow 2 (95th percentile 229.35 ms)   Flow 3 (95th percentile 130.31 ms)

```
Run 1: Statistics of TCP Cubic

Start at: 2018-08-28 12:48:21
End at: 2018-08-28 12:48:51
Local clock offset: -0.247 ms
Remote clock offset: 0.042 ms


# Below is generated by plot.py at 2018-08-28 13:13:47
# Datalink statistics
-- Total of 3 flows:
Average throughput: 957.86 Mbit/s
95th percentile per-packet one-way delay: 130.934 ms
Loss rate: 0.07%
-- Flow 1:
Average throughput: 499.39 Mbit/s
95th percentile per-packet one-way delay: 140.036 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 498.54 Mbit/s
95th percentile per-packet one-way delay: 124.894 ms
Loss rate: 0.09%
-- Flow 3:
Average throughput: 380.37 Mbit/s
95th percentile per-packet one-way delay: 137.564 ms
Loss rate: 0.27%
```
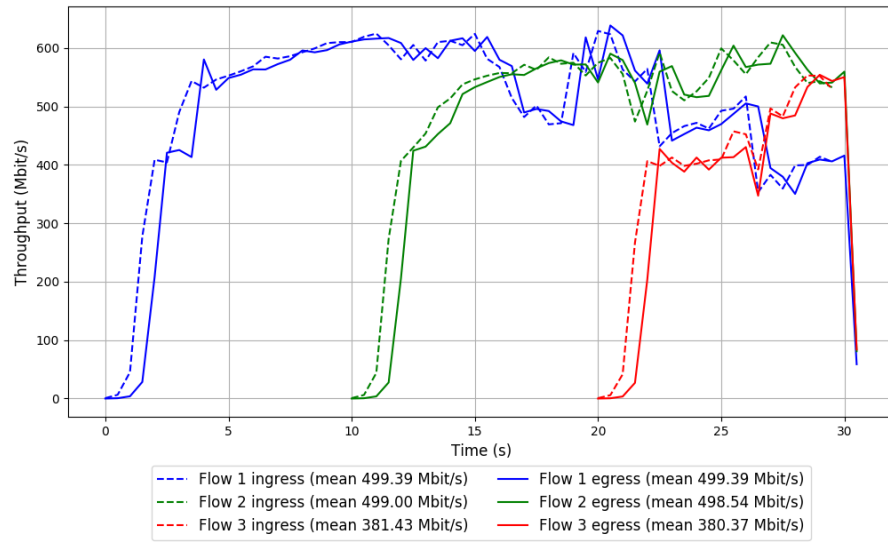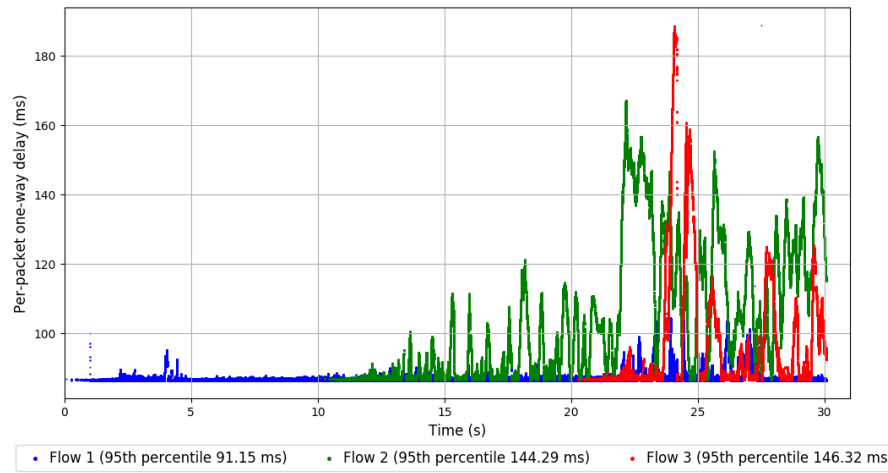
Run 1: Report of TCP Cubic — Data Link

```
Run 2: Statistics of TCP Cubic

Start at: 2018-08-28 12:55:59
End at: 2018-08-28 12:56:29
Local clock offset: 0.006 ms
Remote clock offset: 0.024 ms


# Below is generated by plot.py at 2018-08-28 13:13:47
# Datalink statistics
-- Total of 3 flows:
Average throughput: 850.60 Mbit/s
95th percentile per-packet one-way delay: 133.616 ms
Loss rate: 0.07%
-- Flow 1:
Average throughput: 398.05 Mbit/s
95th percentile per-packet one-way delay: 91.147 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 488.99 Mbit/s
95th percentile per-packet one-way delay: 144.295 ms
Loss rate: 0.16%
-- Flow 3:
Average throughput: 381.93 Mbit/s
95th percentile per-packet one-way delay: 146.319 ms
Loss rate: 0.06%
```
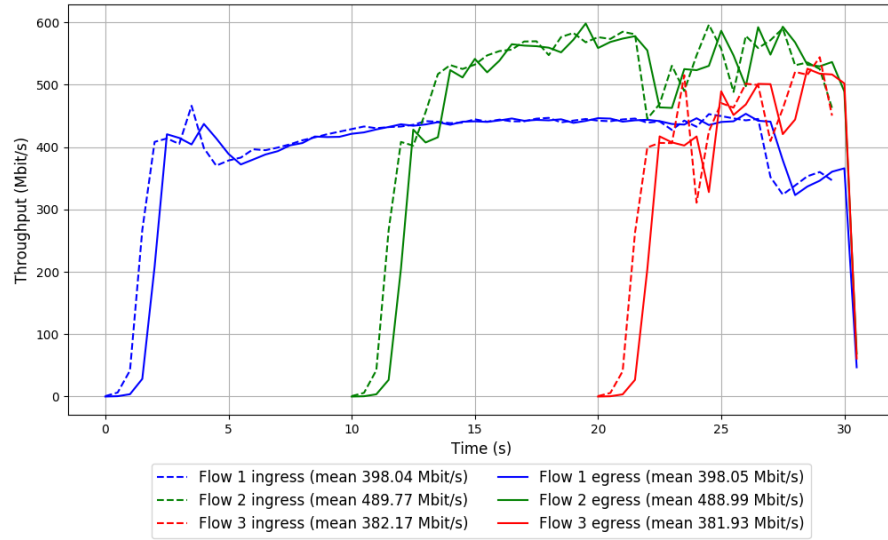
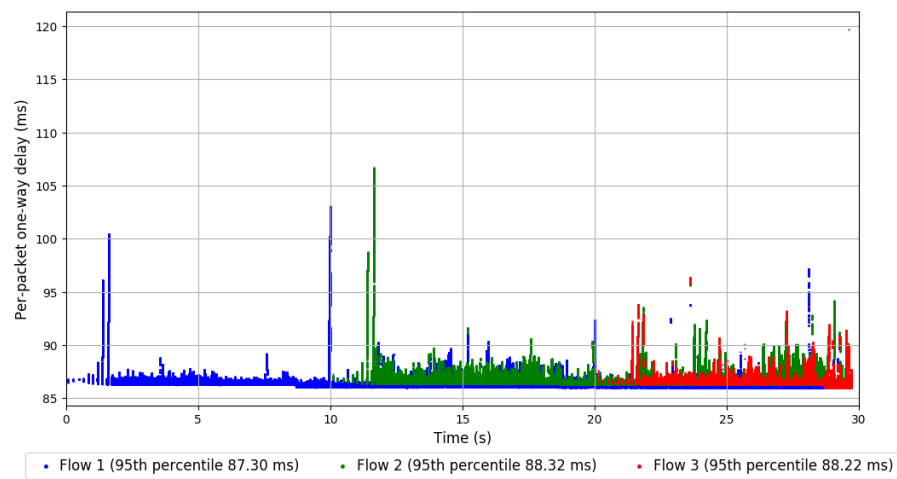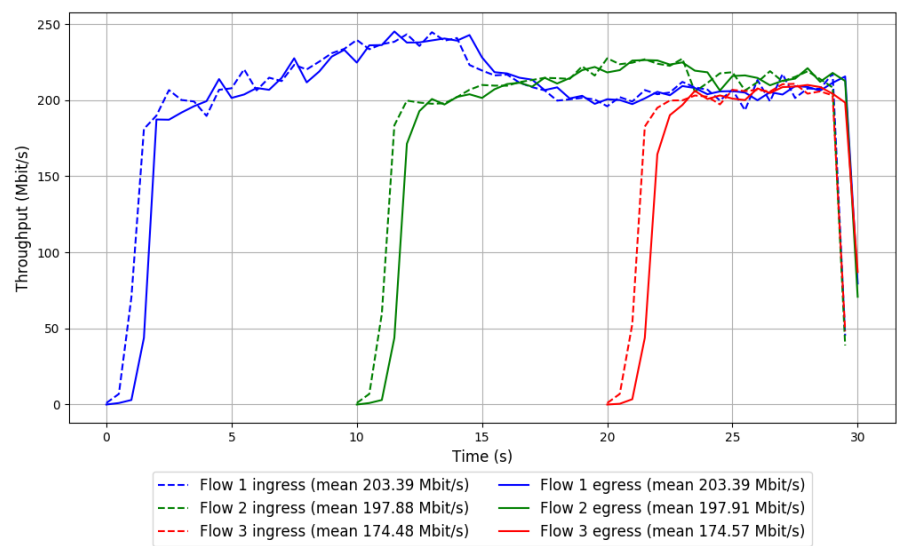Run 2: Report of TCP Cubic — Data Link

```
Run 1: Statistics of Indigo

Start at: 2018-08-28 12:44:29
End at: 2018-08-28 12:44:59
Local clock offset: -0.157 ms
Remote clock offset: 0.074 ms

# Below is generated by plot.py at 2018-08-28 13:13:47
# Datalink statistics
-- Total of 3 flows:
Average throughput: 390.92 Mbit/s
95th percentile per-packet one-way delay: 87.825 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 203.39 Mbit/s
95th percentile per-packet one-way delay: 87.299 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 197.91 Mbit/s
95th percentile per-packet one-way delay: 88.317 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 174.57 Mbit/s
95th percentile per-packet one-way delay: 88.224 ms
Loss rate: 0.00%
```

Run 1: Report of Indigo — Data Link

```
Run 2: Statistics of Indigo

Start at: 2018-08-28 12:52:05
End at: 2018-08-28 12:52:35
Local clock offset: -0.099 ms
Remote clock offset: 0.024 ms


# Below is generated by plot.py at 2018-08-28 13:13:47
# Datalink statistics
-- Total of 3 flows:
Average throughput: 385.24 Mbit/s
95th percentile per-packet one-way delay: 88.466 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 205.55 Mbit/s
95th percentile per-packet one-way delay: 88.246 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 189.11 Mbit/s
95th percentile per-packet one-way delay: 88.631 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 169.61 Mbit/s
95th percentile per-packet one-way delay: 88.993 ms
Loss rate: 0.00%
```
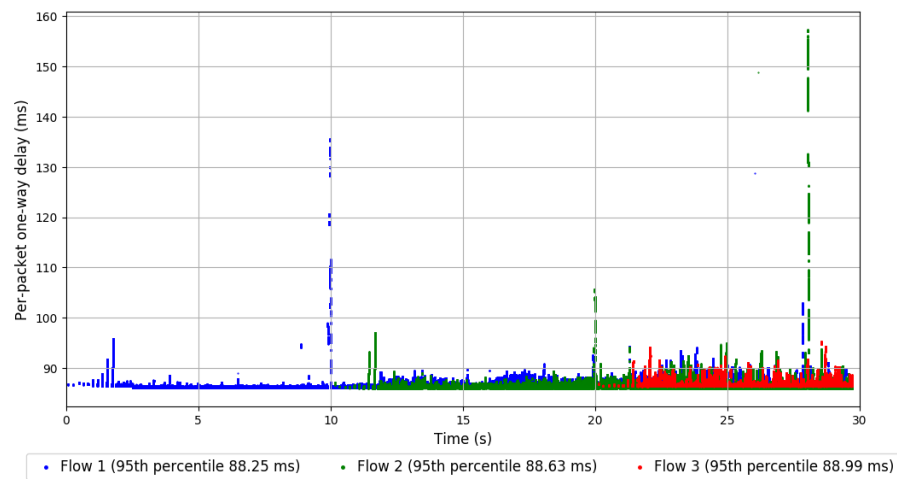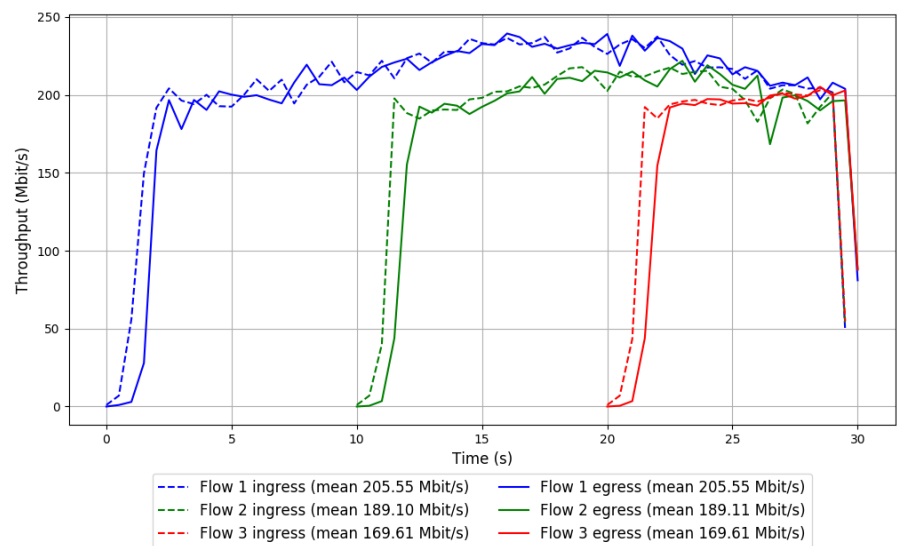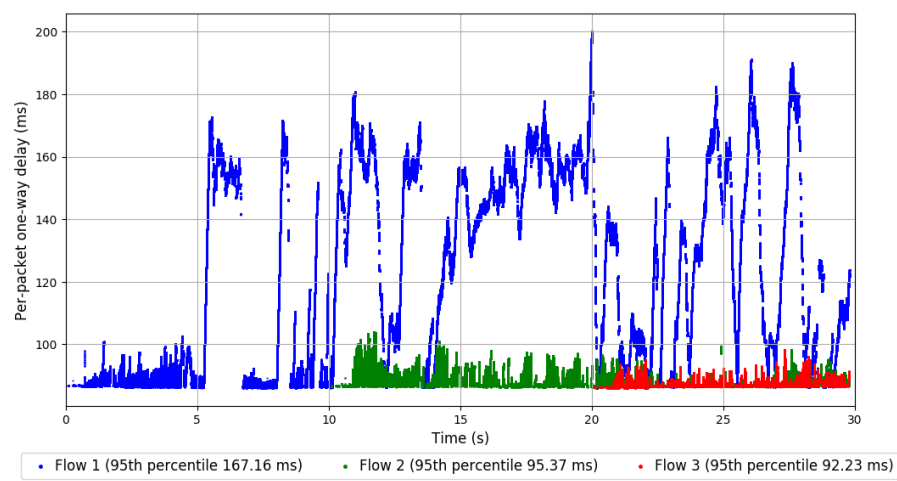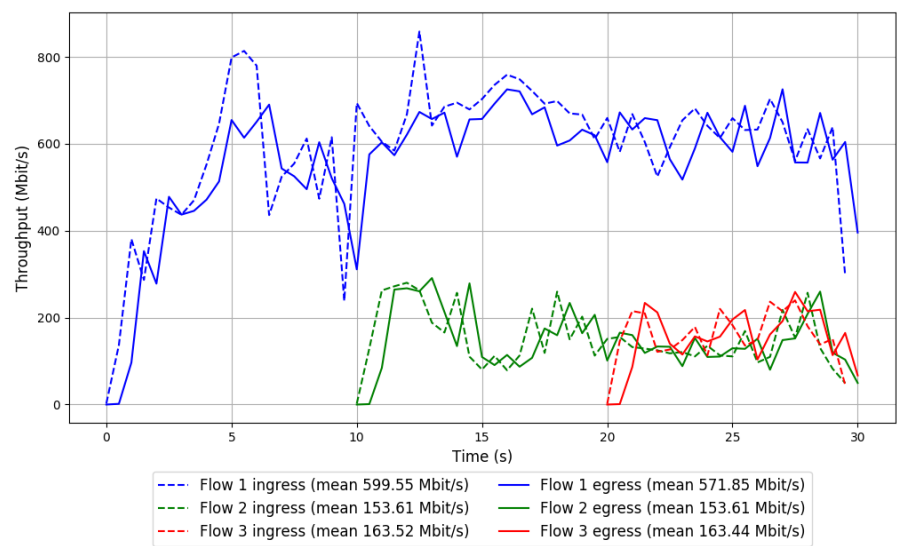
Run 2: Report of Indigo — Data Link

```
Run 1: Statistics of Muses-23

Start at: 2018-08-28 12:42:36
End at: 2018-08-28 12:43:06
Local clock offset: -0.112 ms
Remote clock offset: 0.124 ms


# Below is generated by plot.py at 2018-08-28 13:13:55
# Datalink statistics
-- Total of 3 flows:
Average throughput: 726.64 Mbit/s
95th percentile per-packet one-way delay: 165.397 ms
Loss rate: 3.67%
-- Flow 1:
Average throughput: 571.85 Mbit/s
95th percentile per-packet one-way delay: 167.163 ms
Loss rate: 4.62%
-- Flow 2:
Average throughput: 153.61 Mbit/s
95th percentile per-packet one-way delay: 95.373 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 163.44 Mbit/s
95th percentile per-packet one-way delay: 92.234 ms
Loss rate: 0.00%
```

Run 1: Report of Muses-23 — Data Link

```
Run 2: Statistics of Muses-23

Start at: 2018-08-28 12:50:23
End at: 2018-08-28 12:50:53
Local clock offset: -0.064 ms
Remote clock offset: 0.002 ms

# Below is generated by plot.py at 2018-08-28 13:13:55
# Datalink statistics
-- Total of 3 flows:
Average throughput: 514.09 Mbit/s
95th percentile per-packet one-way delay: 149.556 ms
Loss rate: 1.08%
-- Flow 1:
Average throughput: 167.20 Mbit/s
95th percentile per-packet one-way delay: 92.330 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 434.98 Mbit/s
95th percentile per-packet one-way delay: 154.950 ms
Loss rate: 1.91%
-- Flow 3:
Average throughput: 178.65 Mbit/s
95th percentile per-packet one-way delay: 92.202 ms
Loss rate: 0.00%
```

Run 2: Report of Muses-23 — Data Link