

Pantheon Report

Generated at 2018-09-05 04:04:51 (UTC).
Data path: Saudi Arabia on `enp2s0` (*remote*) → AWS India 2 on `ens5` (*local*).
Repeated the test of 4 congestion control schemes 3 times.
Each test lasted for 30 seconds running 3 flows with 10-second interval between two flows.

NTP offsets were measured against `nets.org.sg` and have been applied to correct the timestamps in logs.

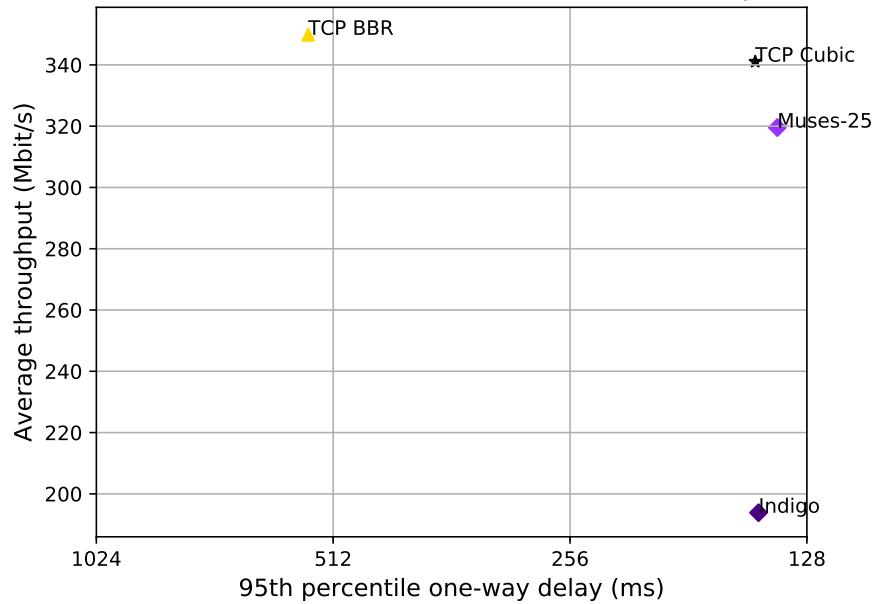
System info:

```
Linux 4.15.0-1020-aws
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
```

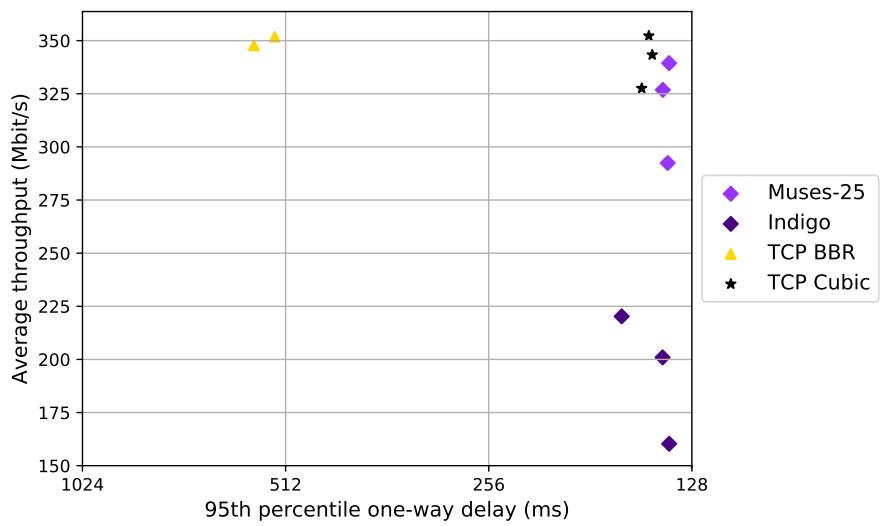
Git summary:

```
branch: muses @ 71e71e9a55b945431a7dea72180c1c9381097db9
third_party/fillp @ d47f4fa1b454a5e3c0537115c5a28436dbd4b834
third_party/fillp-sheep @ daed0c84f98531712514b2231f43ec6901114ffe
third_party/genericCC @ d0153f8e594aa89e93b032143cedbdf58e562f4
third_party/indigo @ 2601c92e4aa9d58d38dc4dfe0ecdbf90c077e64d
third_party/libutp @ b3465b942e2826f2b179eaab4a906ce6bb7cf3cf
third_party/muses @ 96fb95fb38373d71fb80c5a105e62e7636623b
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 Saudi Arabia to AWS India 2, 3 runs of 30s each per scheme
3 flows with 10s interval between flows (mean of all runs by scheme)



test from Saudi Arabia to AWS India 2, 3 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 | 277.74 | 68.81 | 97.72 | 552.47 | 383.86 | 358.91 | 2.36 | 4.20 | 6.78 |
| TCP Cubic | 3 | 237.51 | 112.31 | 88.15 | 143.53 | 160.81 | 176.96 | 0.40 | 2.19 | 3.19 |
| Indigo | 3 | 73.33 | 123.67 | 118.85 | 139.63 | 147.75 | 155.22 | 0.73 | 1.02 | 2.27 |
| Muses-25 | 3 | 236.85 | 94.29 | 61.82 | 139.53 | 139.20 | 139.90 | 0.48 | 1.30 | 2.12 |

Run 1: Statistics of TCP BBR

Start at: 2018-09-05 03:36:25

End at: 2018-09-05 03:36:55

Local clock offset: 1.75 ms

Remote clock offset: -33.708 ms

Run 1: Report of TCP BBR — Data Link

Figure is missing

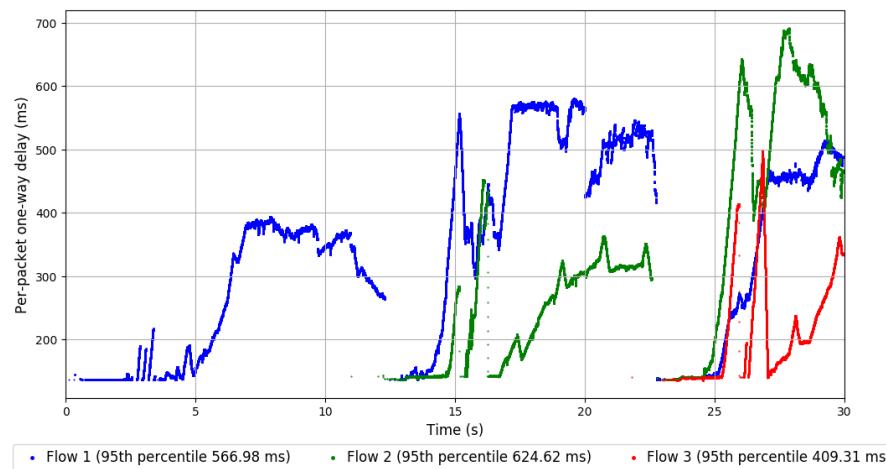
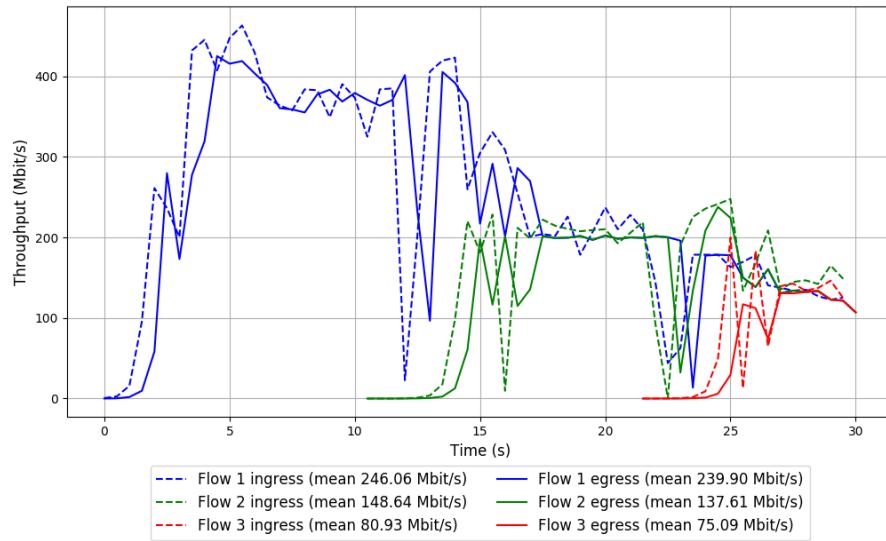
Figure is missing

Run 2: Statistics of TCP BBR

```
Start at: 2018-09-05 03:42:36
End at: 2018-09-05 03:43:06
Local clock offset: 1.429 ms
Remote clock offset: -34.093 ms

# Below is generated by plot.py at 2018-09-05 04:04:04
# Datalink statistics
-- Total of 3 flows:
Average throughput: 347.79 Mbit/s
95th percentile per-packet one-way delay: 570.482 ms
Loss rate: 4.91%
-- Flow 1:
Average throughput: 239.90 Mbit/s
95th percentile per-packet one-way delay: 566.976 ms
Loss rate: 3.15%
-- Flow 2:
Average throughput: 137.61 Mbit/s
95th percentile per-packet one-way delay: 624.623 ms
Loss rate: 8.40%
-- Flow 3:
Average throughput: 75.09 Mbit/s
95th percentile per-packet one-way delay: 409.306 ms
Loss rate: 9.46%
```

Run 2: Report of TCP BBR — Data Link

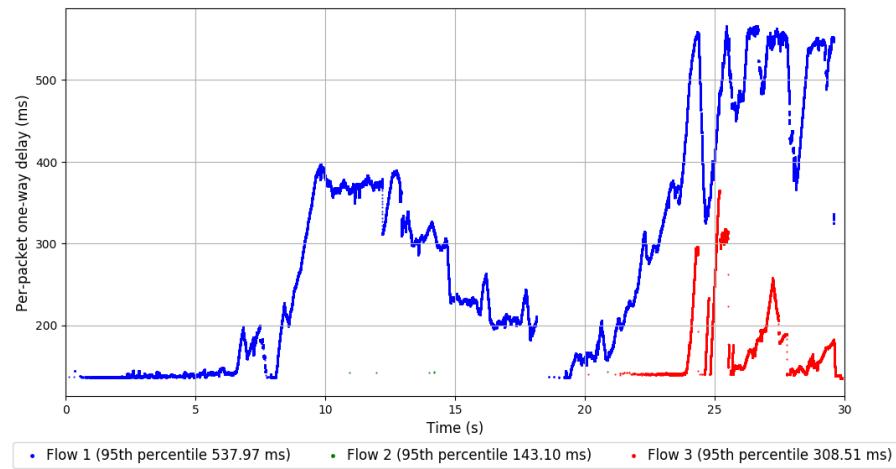
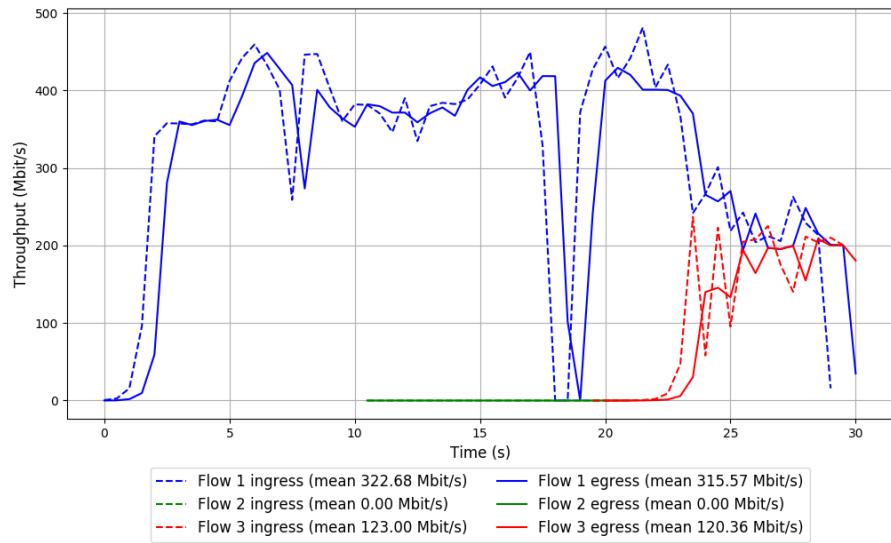


Run 3: Statistics of TCP BBR

```
Start at: 2018-09-05 03:48:54
End at: 2018-09-05 03:49:24
Local clock offset: 1.267 ms
Remote clock offset: -34.677 ms

# Below is generated by plot.py at 2018-09-05 04:04:05
# Datalink statistics
-- Total of 3 flows:
Average throughput: 351.83 Mbit/s
95th percentile per-packet one-way delay: 531.283 ms
Loss rate: 1.86%
-- Flow 1:
Average throughput: 315.57 Mbit/s
95th percentile per-packet one-way delay: 537.971 ms
Loss rate: 1.57%
-- Flow 2:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 143.097 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 120.36 Mbit/s
95th percentile per-packet one-way delay: 308.509 ms
Loss rate: 4.10%
```

Run 3: Report of TCP BBR — Data Link

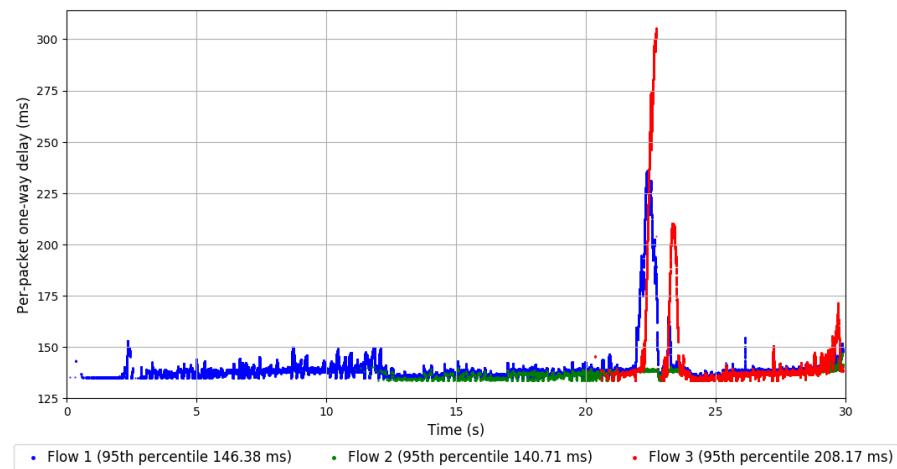
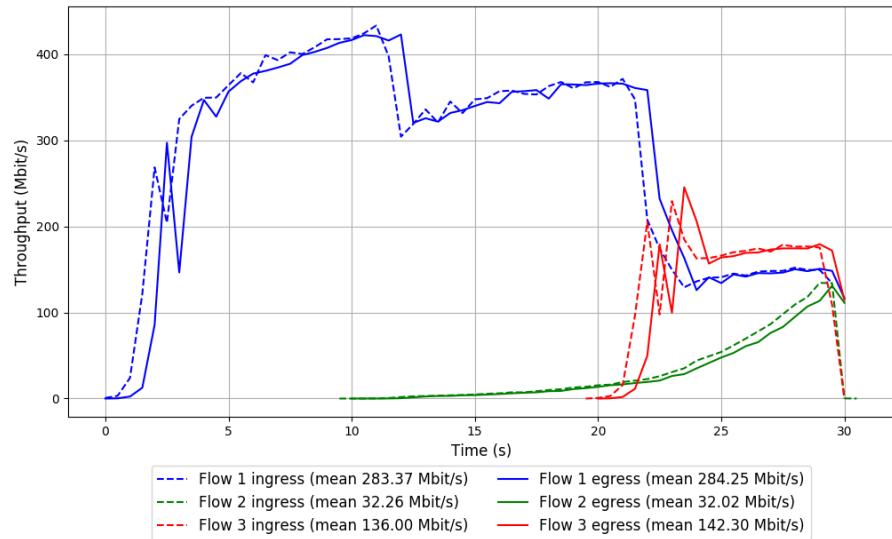


Run 1: Statistics of TCP Cubic

```
Start at: 2018-09-05 03:33:19
End at: 2018-09-05 03:33:49
Local clock offset: 0.475 ms
Remote clock offset: -33.175 ms

# Below is generated by plot.py at 2018-09-05 04:04:05
# Datalink statistics
-- Total of 3 flows:
Average throughput: 352.24 Mbit/s
95th percentile per-packet one-way delay: 148.270 ms
Loss rate: 0.81%
-- Flow 1:
Average throughput: 284.25 Mbit/s
95th percentile per-packet one-way delay: 146.377 ms
Loss rate: 0.36%
-- Flow 2:
Average throughput: 32.02 Mbit/s
95th percentile per-packet one-way delay: 140.712 ms
Loss rate: 4.65%
-- Flow 3:
Average throughput: 142.30 Mbit/s
95th percentile per-packet one-way delay: 208.171 ms
Loss rate: 1.65%
```

Run 1: Report of TCP Cubic — Data Link

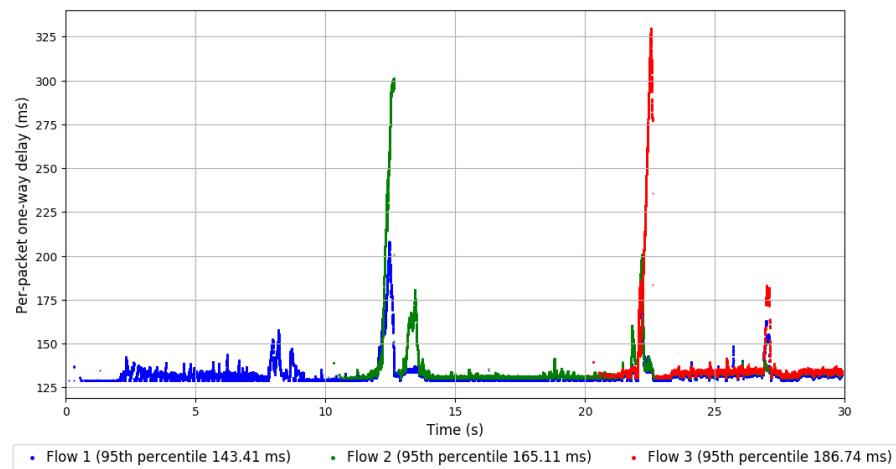
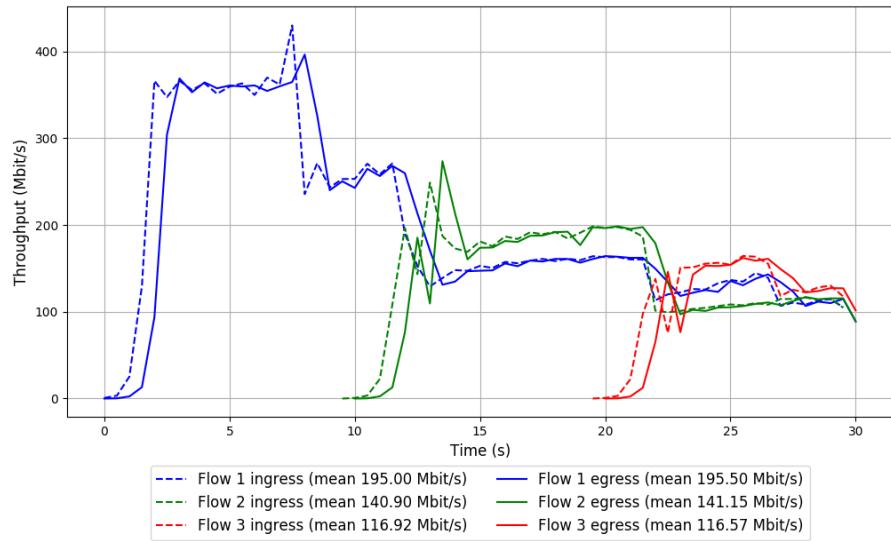


Run 2: Statistics of TCP Cubic

```
Start at: 2018-09-05 03:39:34
End at: 2018-09-05 03:40:04
Local clock offset: -1.205 ms
Remote clock offset: -30.214 ms

# Below is generated by plot.py at 2018-09-05 04:04:05
# Datalink statistics
-- Total of 3 flows:
Average throughput: 327.57 Mbit/s
95th percentile per-packet one-way delay: 151.913 ms
Loss rate: 0.74%
-- Flow 1:
Average throughput: 195.50 Mbit/s
95th percentile per-packet one-way delay: 143.411 ms
Loss rate: 0.40%
-- Flow 2:
Average throughput: 141.15 Mbit/s
95th percentile per-packet one-way delay: 165.114 ms
Loss rate: 0.81%
-- Flow 3:
Average throughput: 116.57 Mbit/s
95th percentile per-packet one-way delay: 186.743 ms
Loss rate: 2.28%
```

Run 2: Report of TCP Cubic — Data Link

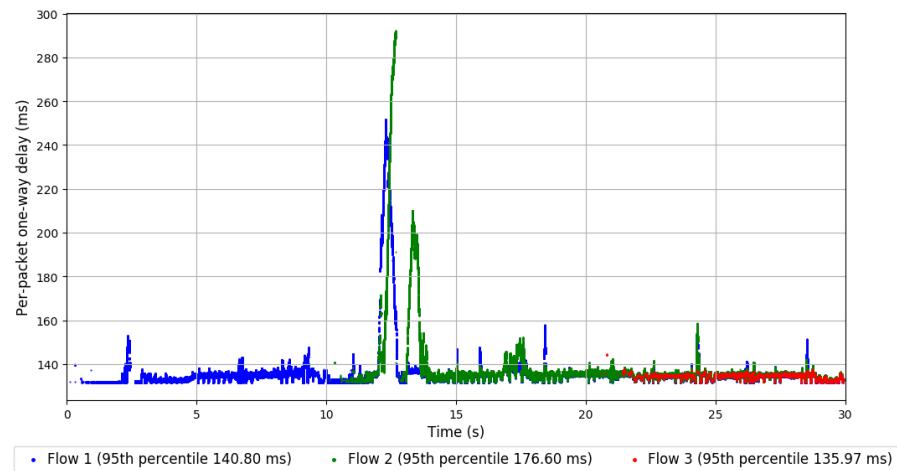
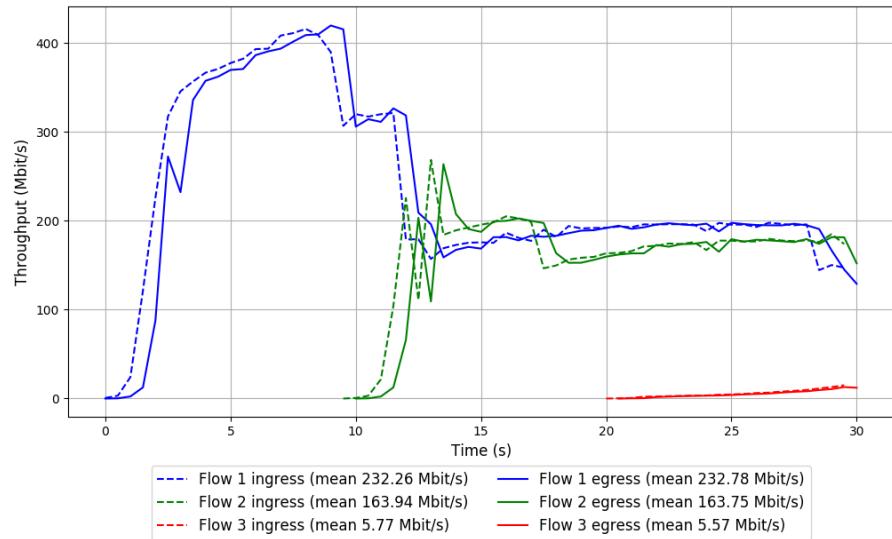


Run 3: Statistics of TCP Cubic

```
Start at: 2018-09-05 03:45:49
End at: 2018-09-05 03:46:19
Local clock offset: -0.566 ms
Remote clock offset: -31.128 ms

# Below is generated by plot.py at 2018-09-05 04:04:05
# Datalink statistics
-- Total of 3 flows:
Average throughput: 343.30 Mbit/s
95th percentile per-packet one-way delay: 146.539 ms
Loss rate: 0.67%
-- Flow 1:
Average throughput: 232.78 Mbit/s
95th percentile per-packet one-way delay: 140.796 ms
Loss rate: 0.43%
-- Flow 2:
Average throughput: 163.75 Mbit/s
95th percentile per-packet one-way delay: 176.600 ms
Loss rate: 1.10%
-- Flow 3:
Average throughput: 5.57 Mbit/s
95th percentile per-packet one-way delay: 135.973 ms
Loss rate: 5.64%
```

Run 3: Report of TCP Cubic — Data Link

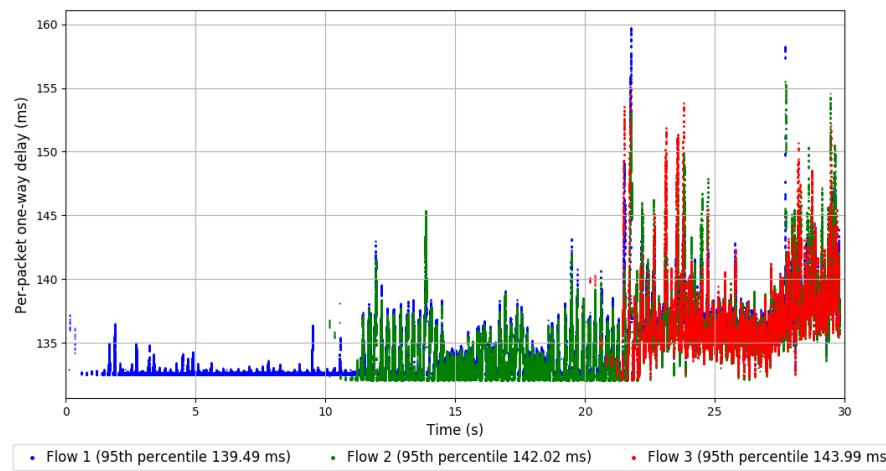
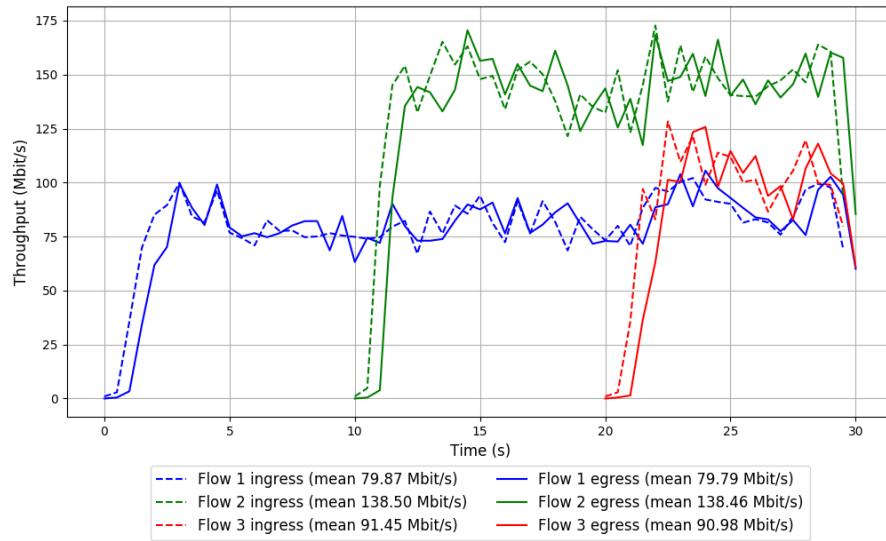


Run 1: Statistics of Indigo

```
Start at: 2018-09-05 03:34:55
End at: 2018-09-05 03:35:25
Local clock offset: 1.53 ms
Remote clock offset: -29.212 ms

# Below is generated by plot.py at 2018-09-05 04:04:05
# Datalink statistics
-- Total of 3 flows:
Average throughput: 200.96 Mbit/s
95th percentile per-packet one-way delay: 141.454 ms
Loss rate: 1.15%
-- Flow 1:
Average throughput: 79.79 Mbit/s
95th percentile per-packet one-way delay: 139.490 ms
Loss rate: 0.76%
-- Flow 2:
Average throughput: 138.46 Mbit/s
95th percentile per-packet one-way delay: 142.020 ms
Loss rate: 1.02%
-- Flow 3:
Average throughput: 90.98 Mbit/s
95th percentile per-packet one-way delay: 143.994 ms
Loss rate: 2.56%
```

Run 1: Report of Indigo — Data Link

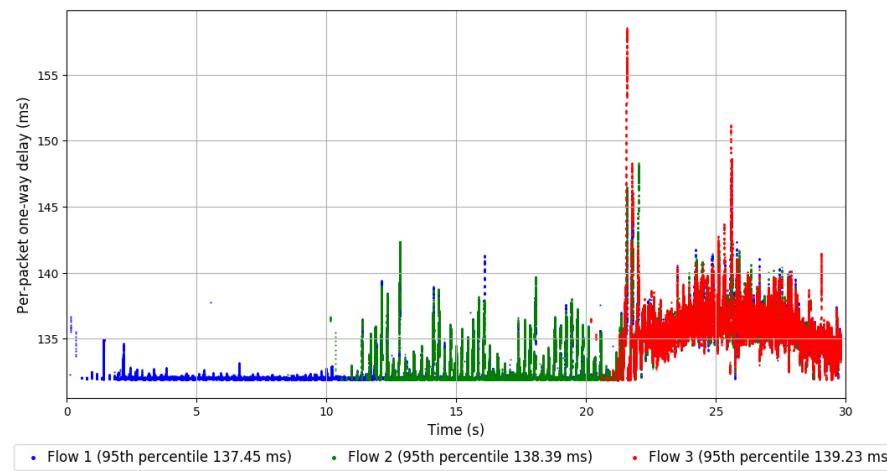
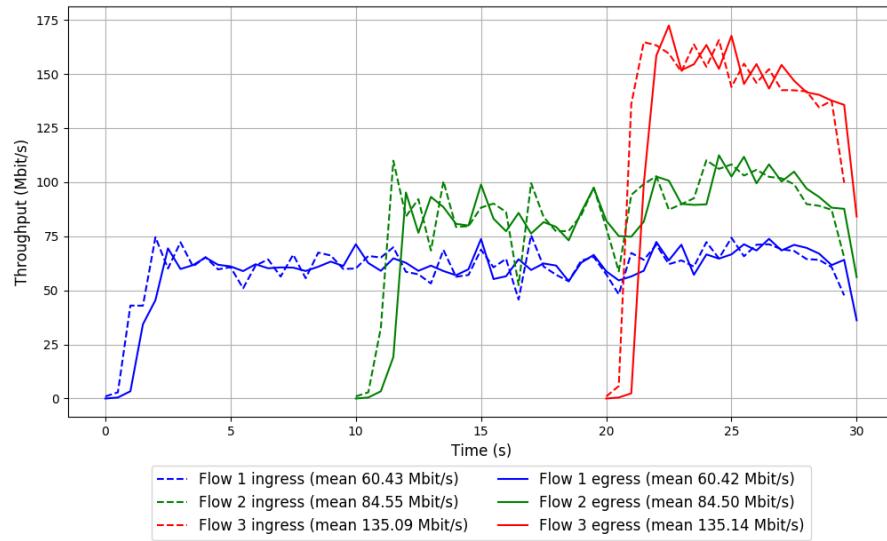


Run 2: Statistics of Indigo

```
Start at: 2018-09-05 03:41:08
End at: 2018-09-05 03:41:38
Local clock offset: -0.368 ms
Remote clock offset: -30.624 ms

# Below is generated by plot.py at 2018-09-05 04:04:05
# Datalink statistics
-- Total of 3 flows:
Average throughput: 160.31 Mbit/s
95th percentile per-packet one-way delay: 138.318 ms
Loss rate: 1.17%
-- Flow 1:
Average throughput: 60.42 Mbit/s
95th percentile per-packet one-way delay: 137.447 ms
Loss rate: 0.68%
-- Flow 2:
Average throughput: 84.50 Mbit/s
95th percentile per-packet one-way delay: 138.388 ms
Loss rate: 1.04%
-- Flow 3:
Average throughput: 135.14 Mbit/s
95th percentile per-packet one-way delay: 139.228 ms
Loss rate: 2.00%
```

Run 2: Report of Indigo — Data Link

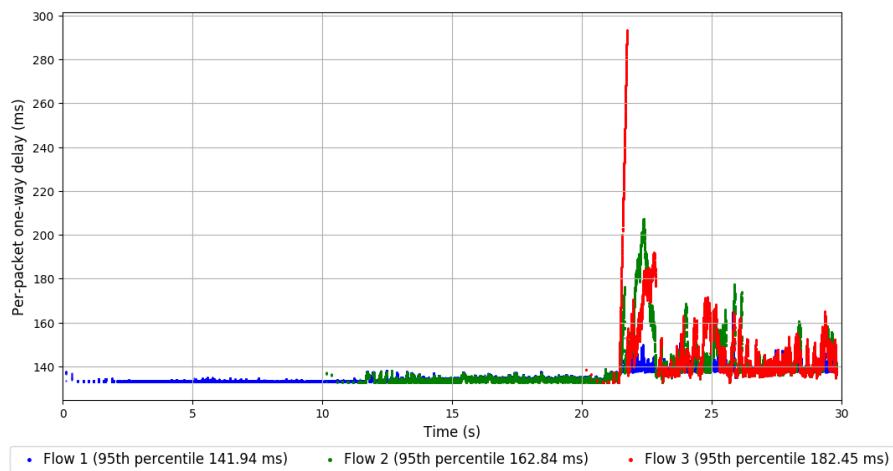
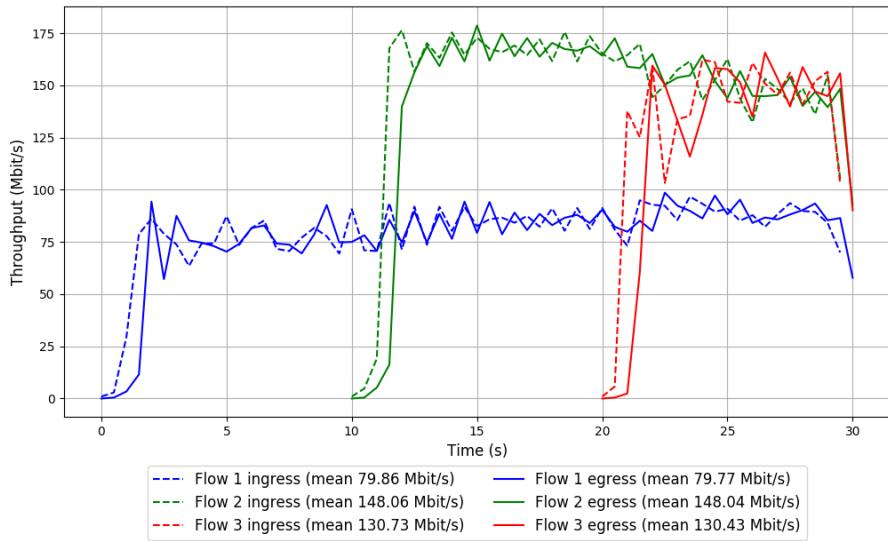


Run 3: Statistics of Indigo

```
Start at: 2018-09-05 03:47:23
End at: 2018-09-05 03:47:53
Local clock offset: -1.323 ms
Remote clock offset: -33.368 ms

# Below is generated by plot.py at 2018-09-05 04:04:05
# Datalink statistics
-- Total of 3 flows:
Average throughput: 220.26 Mbit/s
95th percentile per-packet one-way delay: 162.641 ms
Loss rate: 1.16%
-- Flow 1:
Average throughput: 79.77 Mbit/s
95th percentile per-packet one-way delay: 141.943 ms
Loss rate: 0.76%
-- Flow 2:
Average throughput: 148.04 Mbit/s
95th percentile per-packet one-way delay: 162.836 ms
Loss rate: 1.01%
-- Flow 3:
Average throughput: 130.43 Mbit/s
95th percentile per-packet one-way delay: 182.446 ms
Loss rate: 2.25%
```

Run 3: Report of Indigo — Data Link

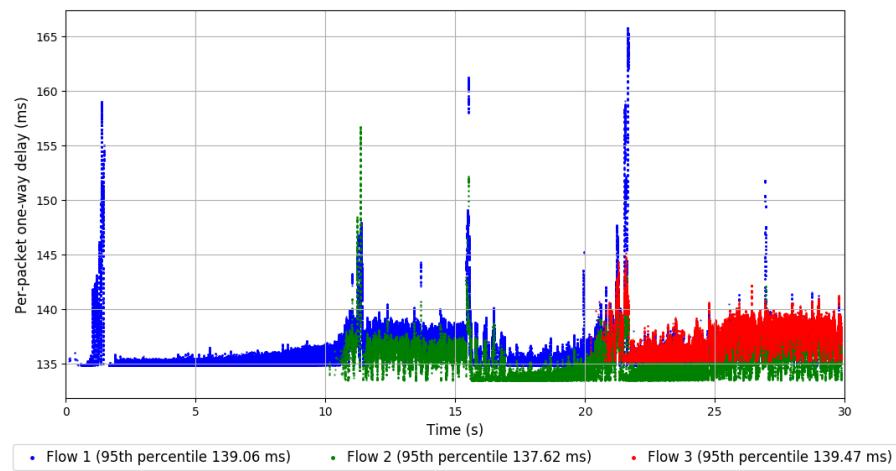
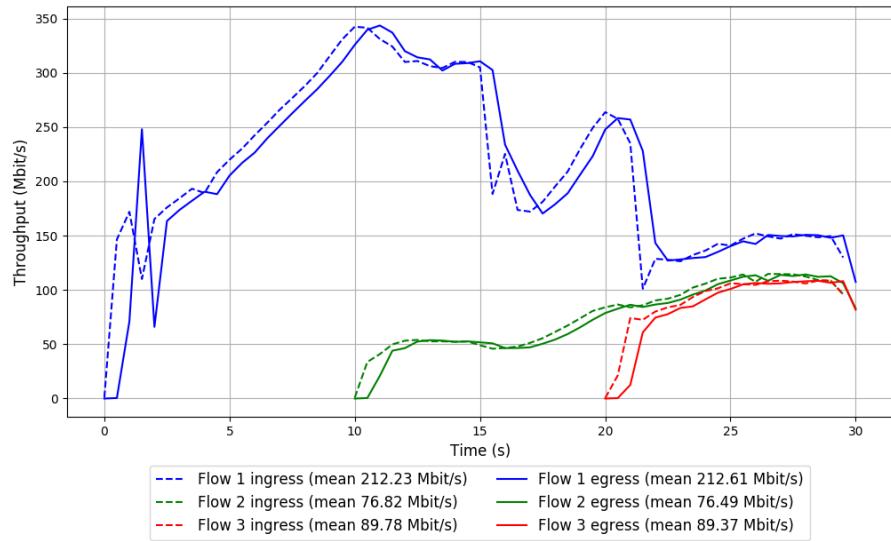


```
Run 1: Statistics of Muses-25
```

```
Start at: 2018-09-05 03:31:46
End at: 2018-09-05 03:32:16
Local clock offset: -0.642 ms
Remote clock offset: -34.071 ms

# Below is generated by plot.py at 2018-09-05 04:04:27
# Datalink statistics
-- Total of 3 flows:
Average throughput: 292.40 Mbit/s
95th percentile per-packet one-way delay: 138.996 ms
Loss rate: 0.86%
-- Flow 1:
Average throughput: 212.61 Mbit/s
95th percentile per-packet one-way delay: 139.060 ms
Loss rate: 0.49%
-- Flow 2:
Average throughput: 76.49 Mbit/s
95th percentile per-packet one-way delay: 137.619 ms
Loss rate: 1.44%
-- Flow 3:
Average throughput: 89.37 Mbit/s
95th percentile per-packet one-way delay: 139.466 ms
Loss rate: 2.52%
```

Run 1: Report of Muses-25 — Data Link

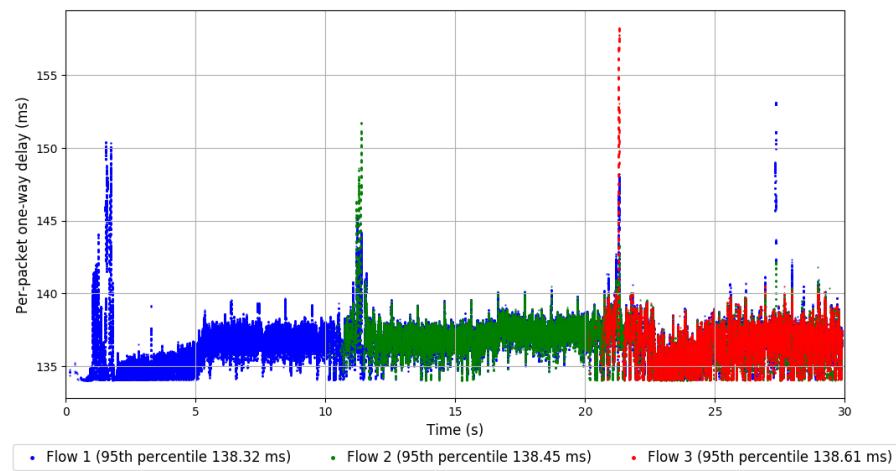
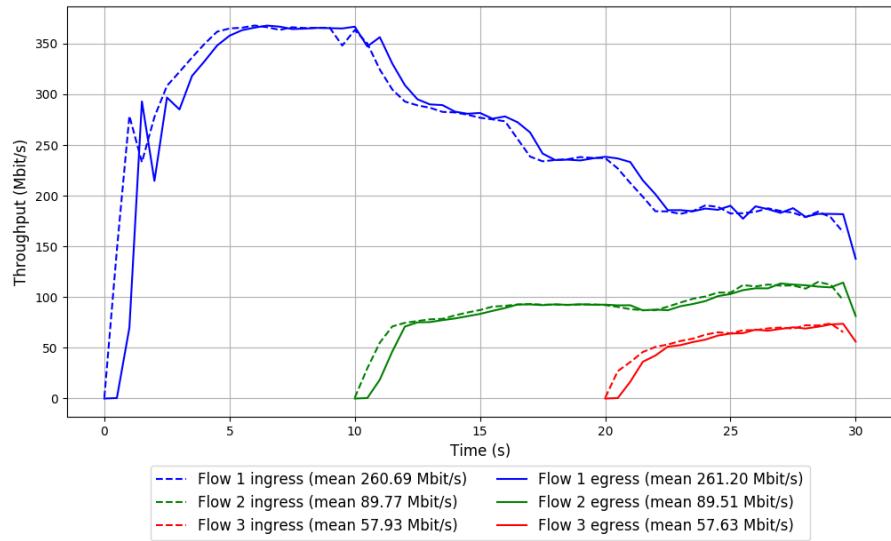


Run 2: Statistics of Muses-25

```
Start at: 2018-09-05 03:38:00
End at: 2018-09-05 03:38:30
Local clock offset: -0.701 ms
Remote clock offset: -33.468 ms

# Below is generated by plot.py at 2018-09-05 04:04:48
# Datalink statistics
-- Total of 3 flows:
Average throughput: 339.40 Mbit/s
95th percentile per-packet one-way delay: 138.365 ms
Loss rate: 0.73%
-- Flow 1:
Average throughput: 261.20 Mbit/s
95th percentile per-packet one-way delay: 138.323 ms
Loss rate: 0.47%
-- Flow 2:
Average throughput: 89.51 Mbit/s
95th percentile per-packet one-way delay: 138.449 ms
Loss rate: 1.29%
-- Flow 3:
Average throughput: 57.63 Mbit/s
95th percentile per-packet one-way delay: 138.612 ms
Loss rate: 2.51%
```

Run 2: Report of Muses-25 — Data Link



Run 3: Statistics of Muses-25

```
Start at: 2018-09-05 03:44:13
End at: 2018-09-05 03:44:43
Local clock offset: 1.46 ms
Remote clock offset: -33.88 ms

# Below is generated by plot.py at 2018-09-05 04:04:50
# Datalink statistics
-- Total of 3 flows:
Average throughput: 326.83 Mbit/s
95th percentile per-packet one-way delay: 141.348 ms
Loss rate: 0.67%
-- Flow 1:
Average throughput: 236.74 Mbit/s
95th percentile per-packet one-way delay: 141.213 ms
Loss rate: 0.47%
-- Flow 2:
Average throughput: 116.88 Mbit/s
95th percentile per-packet one-way delay: 141.544 ms
Loss rate: 1.17%
-- Flow 3:
Average throughput: 38.46 Mbit/s
95th percentile per-packet one-way delay: 141.622 ms
Loss rate: 1.32%
```

Run 3: Report of Muses-25 — Data Link

