Pantheon Report

Generated at 2017-11-30 08:46:27 (UTC).

Data path: AWS Brazil 2 Ethernet (*local*) →Colombia ppp0 (*remote*).

Repeated the test of 14 congestion control schemes 3 times.

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

Increased UDP receive buffer to 16 MB (default) and 32 MB (max).

Tested BBR with qdisc of Fair Queuing (`fq`), and other schemes with the default Linux qdisc (`pfifo_fast`).

NTP offsets were measured against `gps.ntp.br` and have been applied to correct the timestamps in logs.

```
Git summary:
branch: indigos @ e3a57ad5ac5cfcaca0e3f983c8dd4cc3509e0262
third_party/calibrated_koho @ 3cb73c0d1c0322cdfae446ea37a522e53227db50
 M datagrump/sender.cc
third_party/genericCC @ b5b7c38e8391001927dc41c6cfa2627d03dde737
third_party/indigo @ b19f3730105f9aa95452552af924e3719b03cc55
third_party/indigo-cellular @ aee99e8eb842cb053f8c9a80e28cd256a930bbc2
third_party/indigo-no-calib @ 7224f2202e8a044d8306fa0b983ad84360c53d89
third_party/indigo-no-cwnd @ 3e58442c04028a11d7b02456e137604633ba2d6c
third_party/indigo-no-delivery-rate @ 57caa40858b964906edff4876d5a7e5bfff666c5
third_party/indigo-no-queuing-delay @ 03455460fd1a8ffbdad86fabb936fdca204b80db
third_party/indigo-no-send-rate @ b39dfa6b2c5f19cb7cd89626cb4f5bb81f9fecda
third_party/koho_cc @ f0f2e693303aee82ea808e6928eac4f1083a6681
 M datagrump/sender.cc
third_party/libutp @ b3465b942e2826f2b179eaab4a906ce6bb7cf3cf
third_party/pantheon-tunnel @ baf443516dea3eeddeccaf9b916cc313273ca4f4
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/proto-quic @ 77961f1a82733a86b42f1bc8143ebc978f3cff42
third_party/scream @ c3370fd7bd17265a79aeb34e4016ad23f5965885
third_party/sourdough @ f1a14bffe749737437f61b1eaeeb30b267cde681
third_party/sprout @ 6f2efe6e088d91066a9f023df375eee2665089ce
 M src/examples/cellsim.cc
 M src/examples/sproutbt2.cc
 M src/network/sproutconn.cc
third_party/verus @ d4b447ea74c6c60a261149af2629562939f9a494
 M src/verus.hpp
 M tools/plot.py
third_party/webrtc @ a488197ddd041ace68a42849b2540ad834825f42
```
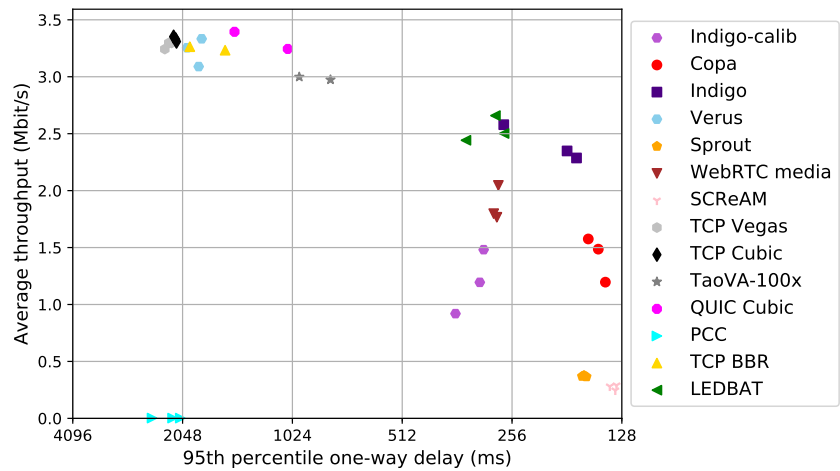
test from AWS Brazil 2 Ethernet to Colombia ppp0, 3 runs of 30s each per scheme
3 flows with 10s interval between flows (mean of all runs by scheme)
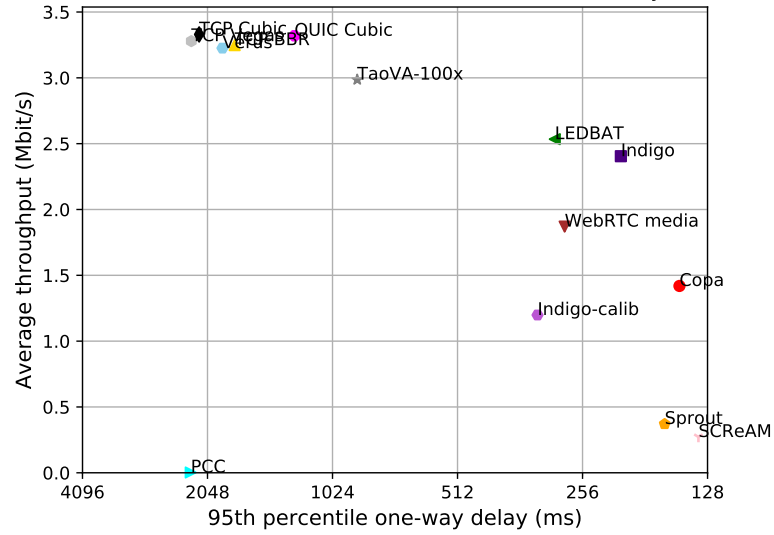
test from AWS Brazil 2 Ethernet to Colombia ppp0, 3 runs of 30s each per scheme
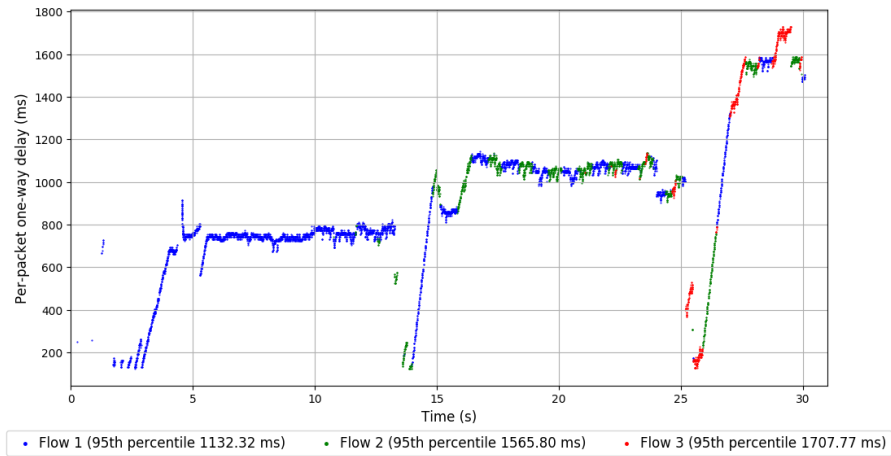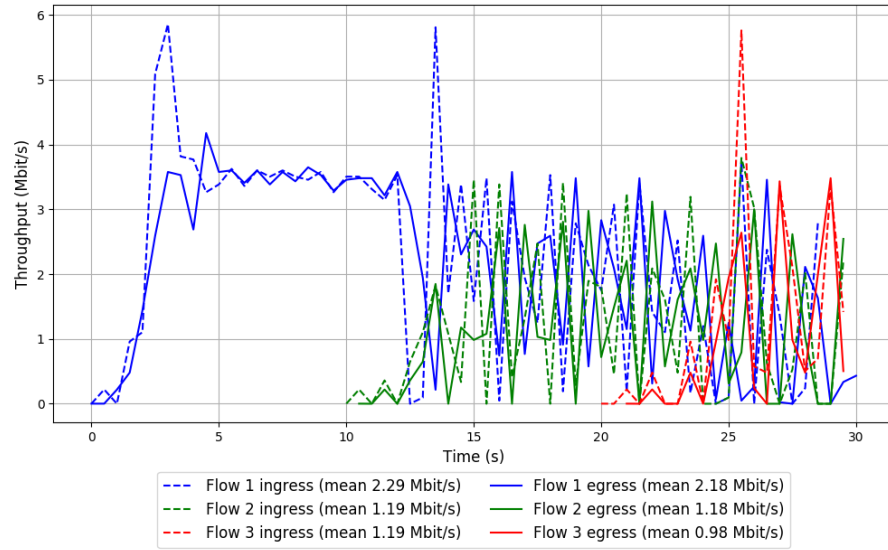3 flows with 10s interval between flows

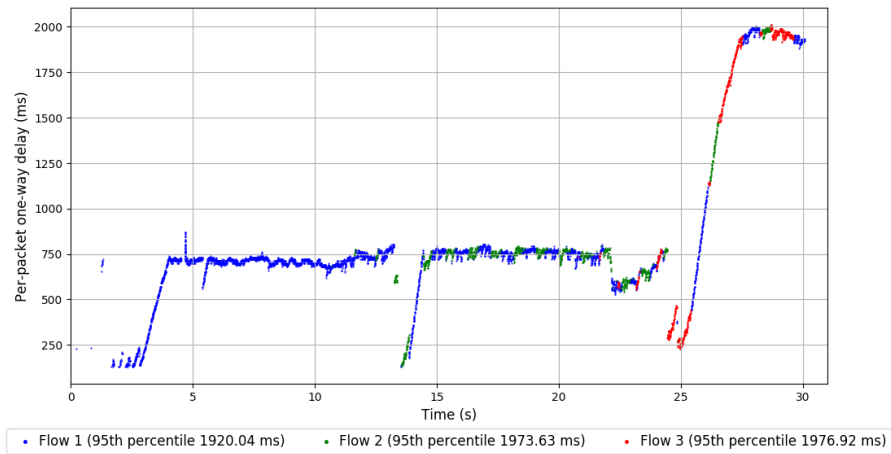| scheme	# runs	mean avg tput (Mbit/s)			mean 95th-%ile delay (ms)			mean loss rate (%)		
		flow 1	flow 2	flow 3	flow 1	flow 2	flow 3	flow 1	flow 2	flow 3
TCP BBR	2	2.24	1.06	1.17	1526.18	1769.72	1842.34	2.06	5.91	23.80
TCP Cubic	3	3.08	0.37	0.11	2142.07	2187.16	2039.83	9.30	17.68	50.65
LEDBAT	3	1.86	0.82	0.39	292.75	298.23	307.16	0.57	0.71	3.73
PCC	3	0.01	0.02	0.00	1369.74	2539.20	705.94	0.00	0.00	1.28
QUIC Cubic	2	2.65	0.82	0.36	1247.49	1285.69	1329.03	3.86	6.25	16.85
SCReAM	3	0.08	0.18	0.20	125.59	137.61	138.85	0.13	0.13	0.35
WebRTC media	3	1.15	0.61	0.13	264.81	301.99	318.10	0.16	0.32	1.17
Sprout	3	0.17	0.19	0.20	188.07	154.27	162.27	0.33	0.01	0.04
TaoVA-100x	2	1.59	1.45	1.29	587.07	1044.00	914.48	0.39	0.61	1.33
TCP Vegas	3	2.65	1.01	0.09	2240.52	2106.72	2079.97	12.59	20.40	57.50
Verus	3	3.21	0.01	0.01	1885.23	1868.37	1875.62	4.54	8.25	16.06
Copa	3	0.06	1.62	0.95	2837.77	149.59	148.90	0.00	0.23	1.08
Indigo	3	1.56	0.70	1.19	187.31	190.42	235.62	0.04	0.13	0.47
Indigo-calib	3	0.61	0.53	0.77	331.50	342.09	281.99	0.26	0.06	0.22

```
Run 1: Statistics of TCP BBR

Start at: 2017-11-30 08:01:50
End at: 2017-11-30 08:02:20
Local clock offset: 2.129 ms
Remote clock offset: -8.181 ms


# Below is generated by plot.py at 2017-11-30 08:45:57
# Datalink statistics
-- Total of 3 flows:
Average throughput: 3.23 Mbit/s
95th percentile per-packet one-way delay: 1565.919 ms
Loss rate: 4.90%
-- Flow 1:
Average throughput: 2.18 Mbit/s
95th percentile per-packet one-way delay: 1132.319 ms
Loss rate: 1.70%
-- Flow 2:
Average throughput: 1.18 Mbit/s
95th percentile per-packet one-way delay: 1565.798 ms
Loss rate: 4.66%
-- Flow 3:
Average throughput: 0.98 Mbit/s
95th percentile per-packet one-way delay: 1707.765 ms
Loss rate: 23.97%
```
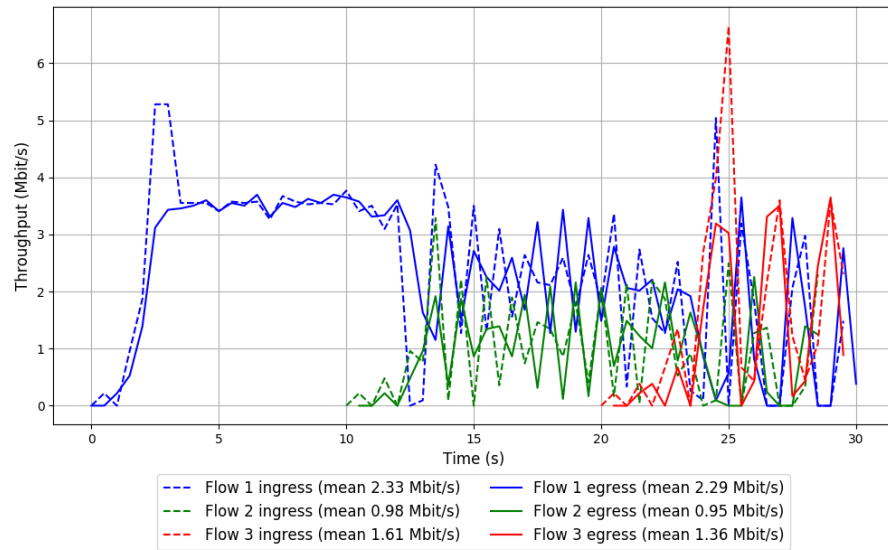
Run 1: Report of TCP BBR — Data Link

Legend:
- Flow 1 ingress (mean 2.29 Mbit/s)
- Flow 2 ingress (mean 1.19 Mbit/s)
- Flow 3 ingress (mean 1.19 Mbit/s)
- Flow 1 egress (mean 2.18 Mbit/s)
- Flow 2 egress (mean 1.18 Mbit/s)
- Flow 3 egress (mean 0.98 Mbit/s)

Legend:
- Flow 1 (95th percentile 1132.32 ms)
- Flow 2 (95th percentile 1565.80 ms)
- Flow 3 (95th percentile 1707.77 ms)

```
Run 2: Statistics of TCP BBR

Start at: 2017-11-30 08:19:21
End at: 2017-11-30 08:19:51
Local clock offset: 1.667 ms
Remote clock offset: -3.173 ms


# Below is generated by plot.py at 2017-11-30 08:45:58
# Datalink statistics
-- Total of 3 flows:
Average throughput: 3.26 Mbit/s
95th percentile per-packet one-way delay: 1956.917 ms
Loss rate: 6.47%
-- Flow 1:
Average throughput: 2.29 Mbit/s
95th percentile per-packet one-way delay: 1920.040 ms
Loss rate: 2.42%
-- Flow 2:
Average throughput: 0.95 Mbit/s
95th percentile per-packet one-way delay: 1973.635 ms
Loss rate: 7.15%
-- Flow 3:
Average throughput: 1.36 Mbit/s
95th percentile per-packet one-way delay: 1976.916 ms
Loss rate: 23.64%
```

Run 2: Report of TCP BBR — Data Link

Flow 1 ingress (mean 2.33 Mbit/s) — Flow 1 egress (mean 2.29 Mbit/s)
Flow 2 ingress (mean 0.98 Mbit/s) — Flow 2 egress (mean 0.95 Mbit/s)
Flow 3 ingress (mean 1.61 Mbit/s) — Flow 3 egress (mean 1.36 Mbit/s)

Flow 1 (95th percentile 1920.04 ms) • Flow 2 (95th percentile 1973.63 ms) • Flow 3 (95th percentile 1976.92 ms)

Run 3: Statistics of TCP BBR

/home/ubuntu/pantheon_data/2017-11-30T07-51-AWS-Brazil-2-to-Colombia-ppp0-3-runs-3-flows/bbr

Run 3: Report of TCP BBR — Data Link

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```
Run 1: Statistics of TCP Cubic

Start at: 2017-11-30 08:06:50
End at: 2017-11-30 08:07:20
Local clock offset: 2.105 ms
Remote clock offset: -3.963 ms

# Below is generated by plot.py at 2017-11-30 08:45:58
# Datalink statistics
-- Total of 3 flows:
Average throughput: 3.33 Mbit/s
95th percentile per-packet one-way delay: 2140.135 ms
Loss rate: 10.02%
-- Flow 1:
Average throughput: 3.12 Mbit/s
95th percentile per-packet one-way delay: 2140.117 ms
Loss rate: 8.85%
-- Flow 2:
Average throughput: 0.26 Mbit/s
95th percentile per-packet one-way delay: 2201.715 ms
Loss rate: 21.07%
-- Flow 3:
Average throughput: 0.18 Mbit/s
95th percentile per-packet one-way delay: 2000.038 ms
Loss rate: 34.96%
```

Run 1: Report of TCP Cubic — Data Link

Flow 1 ingress (mean 3.41 Mbit/s)   Flow 1 egress (mean 3.12 Mbit/s)
Flow 2 ingress (mean 0.31 Mbit/s)   Flow 2 egress (mean 0.26 Mbit/s)
Flow 3 ingress (mean 0.21 Mbit/s)   Flow 3 egress (mean 0.18 Mbit/s)

Flow 1 (95th percentile 2140.12 ms)   Flow 2 (95th percentile 2201.72 ms)   Flow 3 (95th percentile 2000.04 ms)

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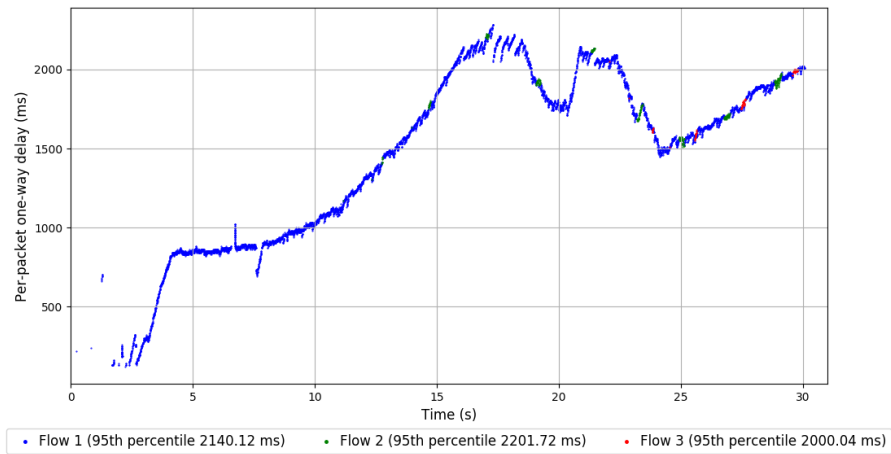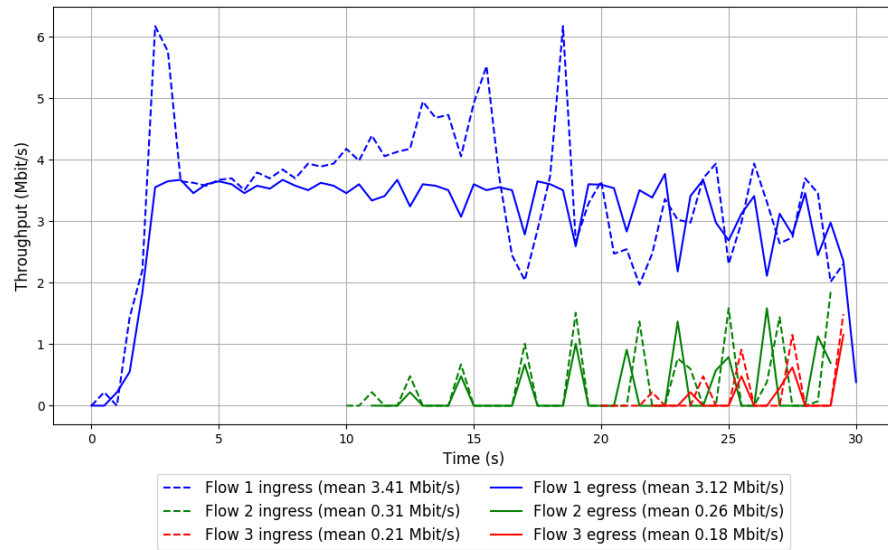
```
Run 2: Statistics of TCP Cubic

Start at: 2017-11-30 08:24:21
End at: 2017-11-30 08:24:51
Local clock offset: 1.574 ms
Remote clock offset: -7.661 ms


# Below is generated by plot.py at 2017-11-30 08:45:59
# Datalink statistics
-- Total of 3 flows:
Average throughput: 3.35 Mbit/s
95th percentile per-packet one-way delay: 2167.406 ms
Loss rate: 10.40%
-- Flow 1:
Average throughput: 3.01 Mbit/s
95th percentile per-packet one-way delay: 2157.823 ms
Loss rate: 9.52%
-- Flow 2:
Average throughput: 0.58 Mbit/s
95th percentile per-packet one-way delay: 2223.654 ms
Loss rate: 16.44%
-- Flow 3:
Average throughput: 0.01 Mbit/s
95th percentile per-packet one-way delay: 2233.506 ms
Loss rate: 75.02%
```

Run 2: Report of TCP Cubic — Data Link
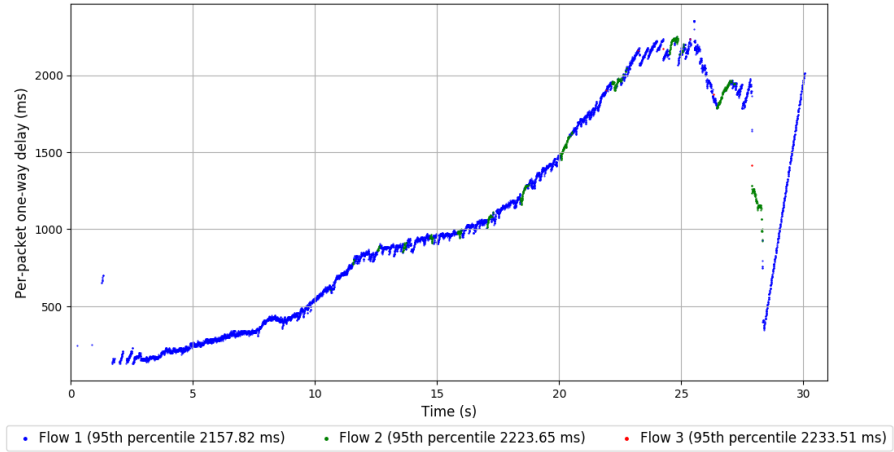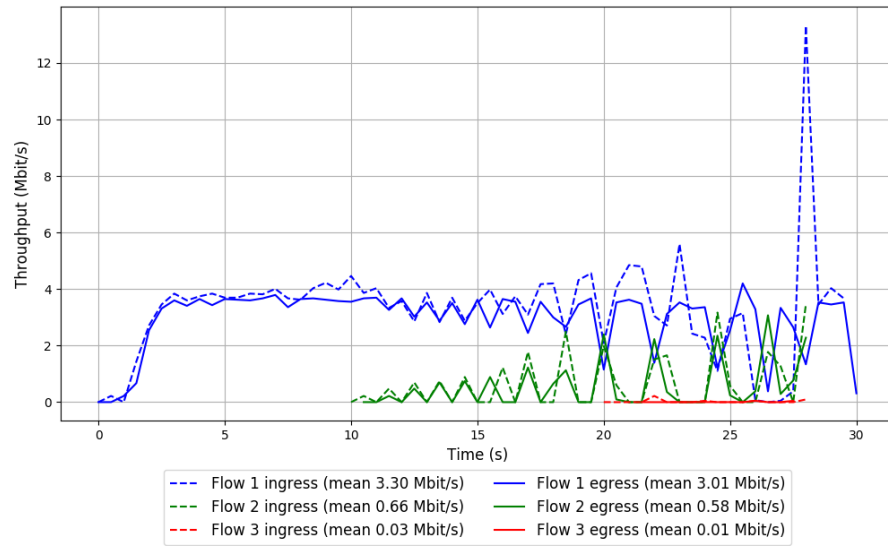
```
Run 3: Statistics of TCP Cubic

Start at: 2017-11-30 08:43:07
End at: 2017-11-30 08:43:37
Local clock offset: 1.283 ms
Remote clock offset: -3.393 ms


# Below is generated by plot.py at 2017-11-30 08:45:59
# Datalink statistics
-- Total of 3 flows:
Average throughput: 3.31 Mbit/s
95th percentile per-packet one-way delay: 2128.281 ms
Loss rate: 10.24%
-- Flow 1:
Average throughput: 3.12 Mbit/s
95th percentile per-packet one-way delay: 2128.281 ms
Loss rate: 9.52%
-- Flow 2:
Average throughput: 0.26 Mbit/s
95th percentile per-packet one-way delay: 2136.109 ms
Loss rate: 15.52%
-- Flow 3:
Average throughput: 0.13 Mbit/s
95th percentile per-packet one-way delay: 1885.948 ms
Loss rate: 41.98%
```

Run 3: Report of TCP Cubic — Data Link
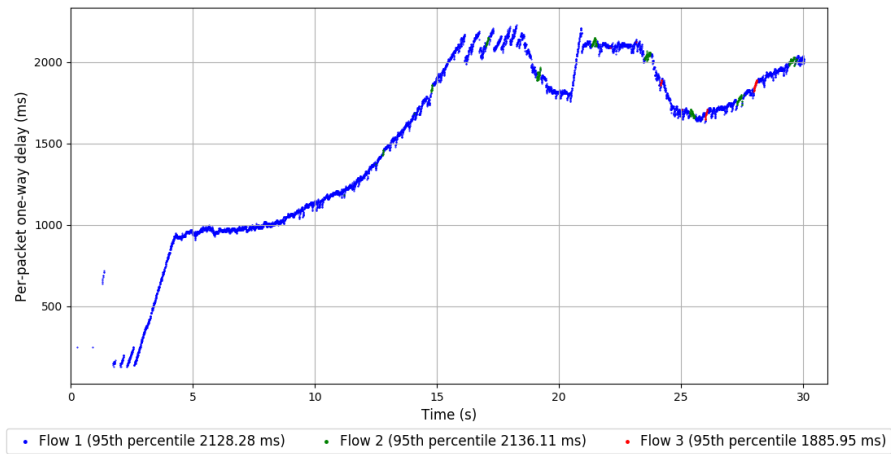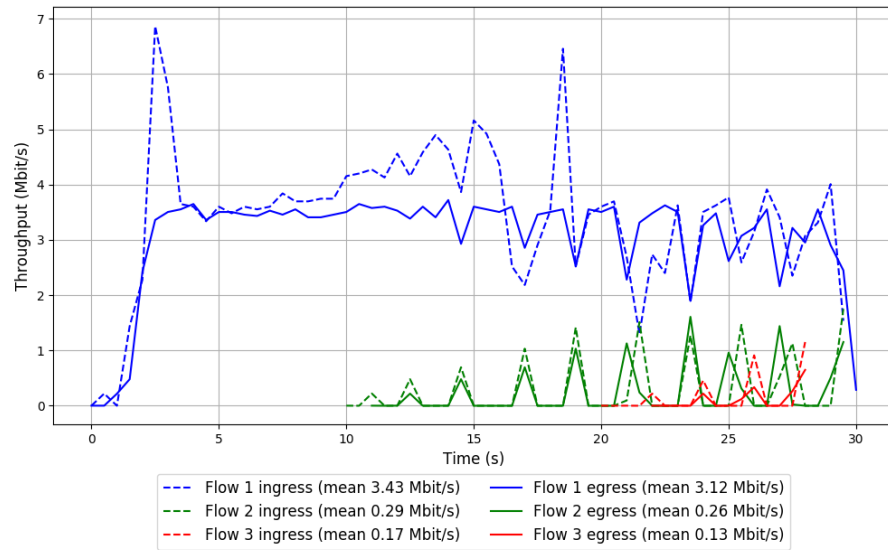
```
Run 1: Statistics of LEDBAT

Start at: 2017-11-30 07:54:21
End at: 2017-11-30 07:54:51
Local clock offset: 1.932 ms
Remote clock offset: -8.022 ms

# Below is generated by plot.py at 2017-11-30 08:45:59
# Datalink statistics
-- Total of 3 flows:
Average throughput: 2.50 Mbit/s
95th percentile per-packet one-way delay: 269.202 ms
Loss rate: 0.86%
-- Flow 1:
Average throughput: 1.65 Mbit/s
95th percentile per-packet one-way delay: 269.083 ms
Loss rate: 0.50%
-- Flow 2:
Average throughput: 1.06 Mbit/s
95th percentile per-packet one-way delay: 266.719 ms
Loss rate: 0.61%
-- Flow 3:
Average throughput: 0.45 Mbit/s
95th percentile per-packet one-way delay: 279.220 ms
Loss rate: 5.81%
```
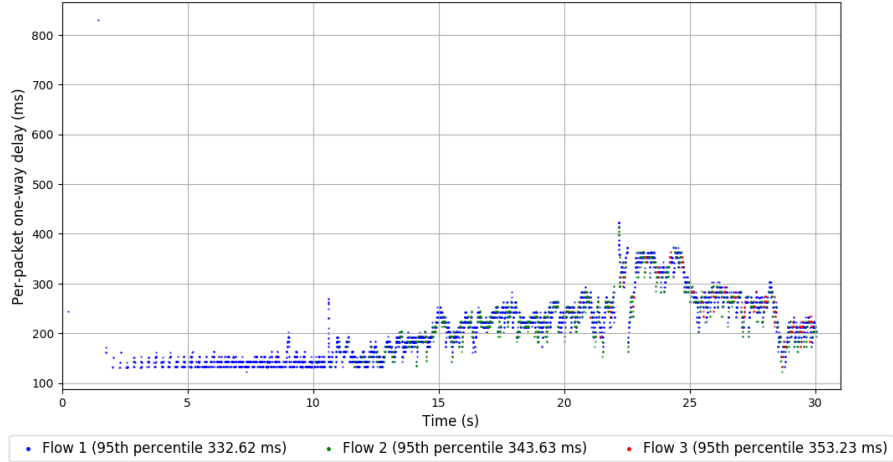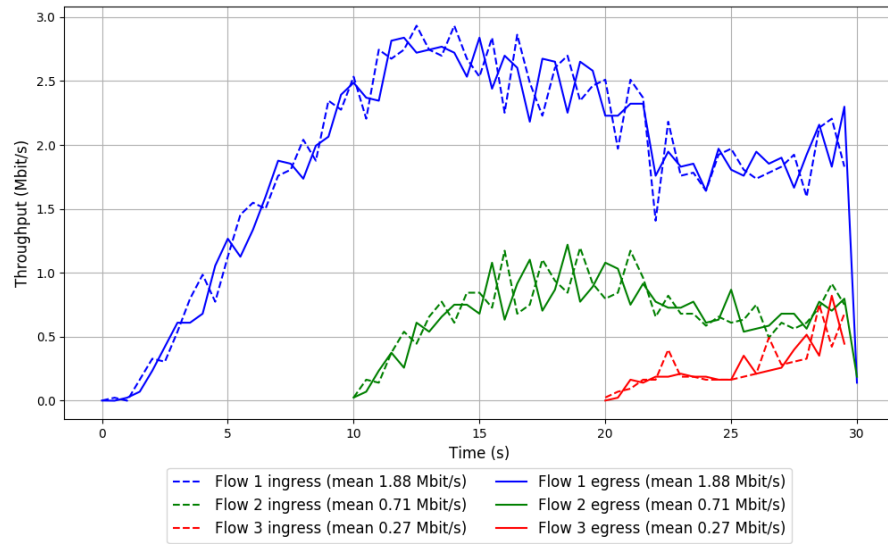
Run 1: Report of LEDBAT — Data Link
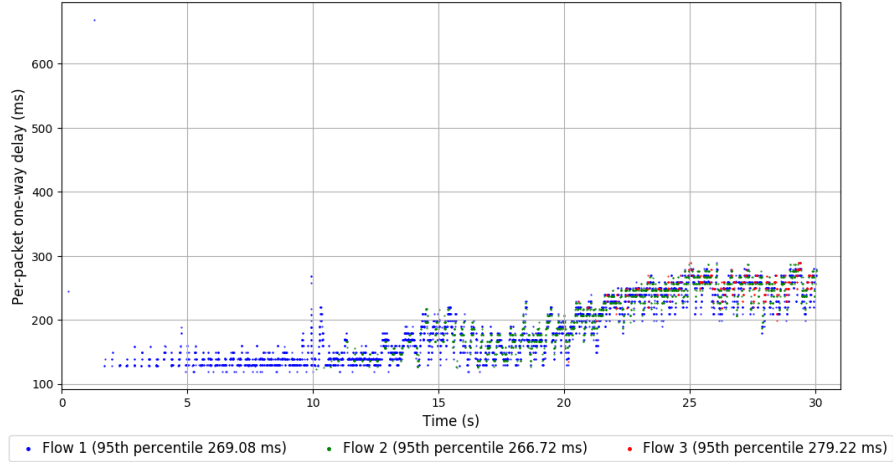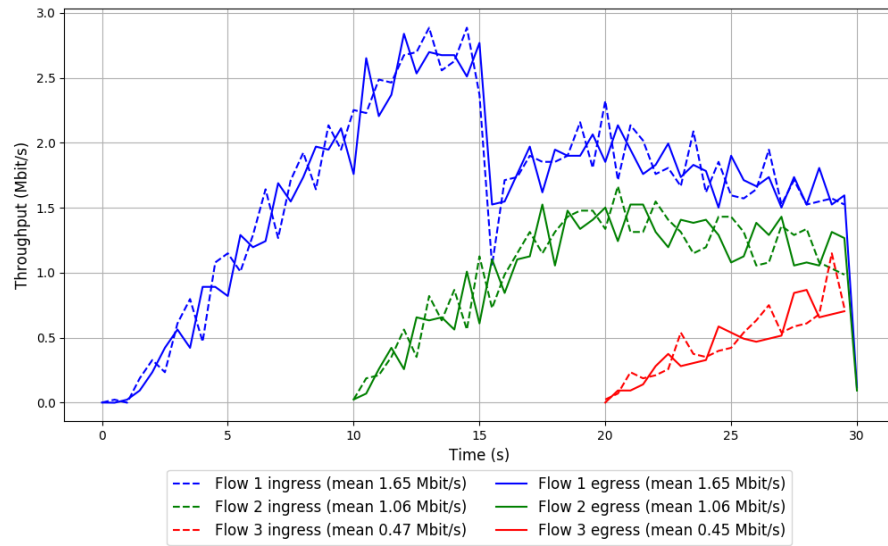
```
Run 2: Statistics of LEDBAT

Start at: 2017-11-30 08:11:52
End at: 2017-11-30 08:12:22
Local clock offset: 1.96 ms
Remote clock offset: -3.105 ms


# Below is generated by plot.py at 2017-11-30 08:45:59
# Datalink statistics
-- Total of 3 flows:
Average throughput: 2.66 Mbit/s
95th percentile per-packet one-way delay: 284.341 ms
Loss rate: 0.84%
-- Flow 1:
Average throughput: 2.06 Mbit/s
95th percentile per-packet one-way delay: 276.561 ms
Loss rate: 0.80%
-- Flow 2:
Average throughput: 0.69 Mbit/s
95th percentile per-packet one-way delay: 284.328 ms
Loss rate: 0.94%
-- Flow 3:
Average throughput: 0.44 Mbit/s
95th percentile per-packet one-way delay: 289.026 ms
Loss rate: 1.08%
```

Run 2: Report of LEDBAT — Data Link
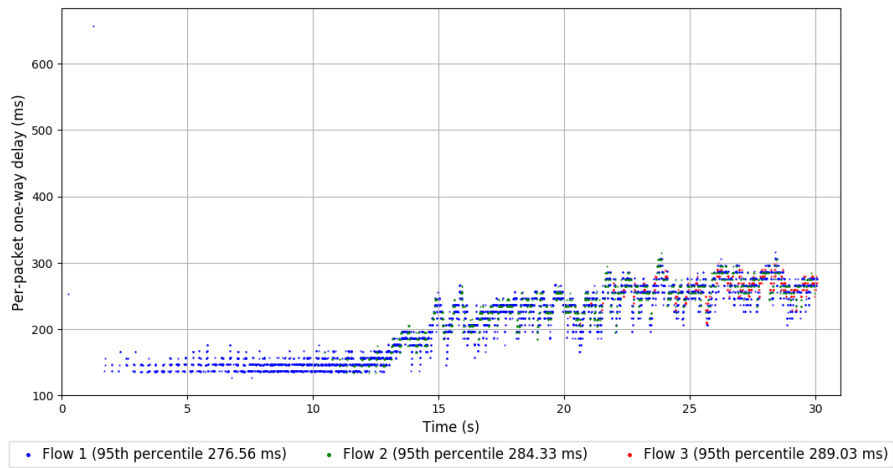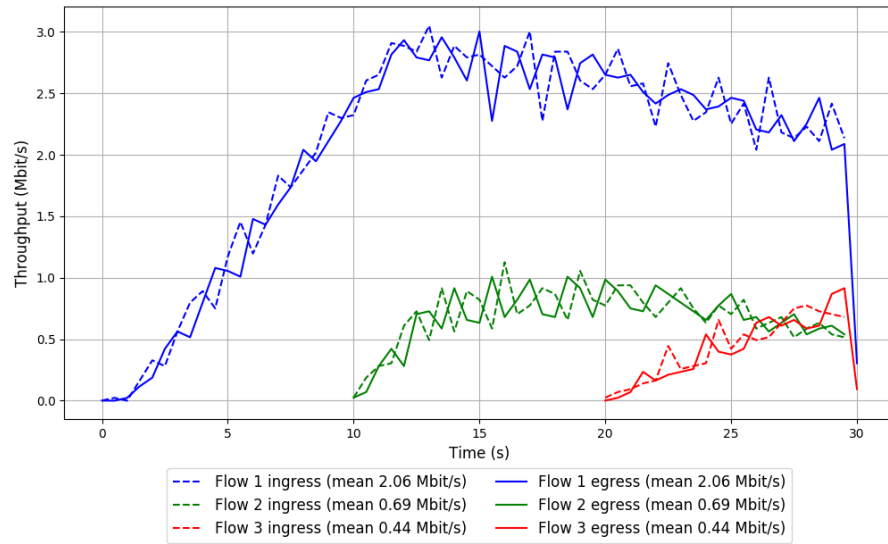
```
Run 3: Statistics of LEDBAT

Start at: 2017-11-30 08:29:59
End at: 2017-11-30 08:30:29
Local clock offset: 1.385 ms
Remote clock offset: -8.998 ms

# Below is generated by plot.py at 2017-11-30 08:45:59
# Datalink statistics
-- Total of 3 flows:
Average throughput: 2.44 Mbit/s
95th percentile per-packet one-way delay: 342.428 ms
Loss rate: 0.59%
-- Flow 1:
Average throughput: 1.88 Mbit/s
95th percentile per-packet one-way delay: 332.618 ms
Loss rate: 0.42%
-- Flow 2:
Average throughput: 0.71 Mbit/s
95th percentile per-packet one-way delay: 343.630 ms
Loss rate: 0.58%
-- Flow 3:
Average throughput: 0.27 Mbit/s
95th percentile per-packet one-way delay: 353.227 ms
Loss rate: 4.31%
```

Run 3: Report of LEDBAT — Data Link

Flow 1 ingress (mean 1.88 Mbit/s) • Flow 1 egress (mean 1.88 Mbit/s)
Flow 2 ingress (mean 0.71 Mbit/s) • Flow 2 egress (mean 0.71 Mbit/s)
Flow 3 ingress (mean 0.27 Mbit/s) • Flow 3 egress (mean 0.27 Mbit/s)

Flow 1 (95th percentile 332.62 ms) • Flow 2 (95th percentile 343.63 ms) • Flow 3 (95th percentile 353.23 ms)

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```
Run 1: Statistics of PCC

Start at: 2017-11-30 07:58:06
End at: 2017-11-30 07:58:36
Local clock offset: 2.105 ms
Remote clock offset: -8.97 ms


# Below is generated by plot.py at 2017-11-30 08:45:59
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 2078.141 ms
Loss rate: 1.64%
-- Flow 1:
Average throughput: 0.01 Mbit/s
95th percentile per-packet one-way delay: 1640.689 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 0.02 Mbit/s
95th percentile per-packet one-way delay: 2381.960 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 677.839 ms
Loss rate: 3.85%
```

Run 1: Report of PCC — Data Link

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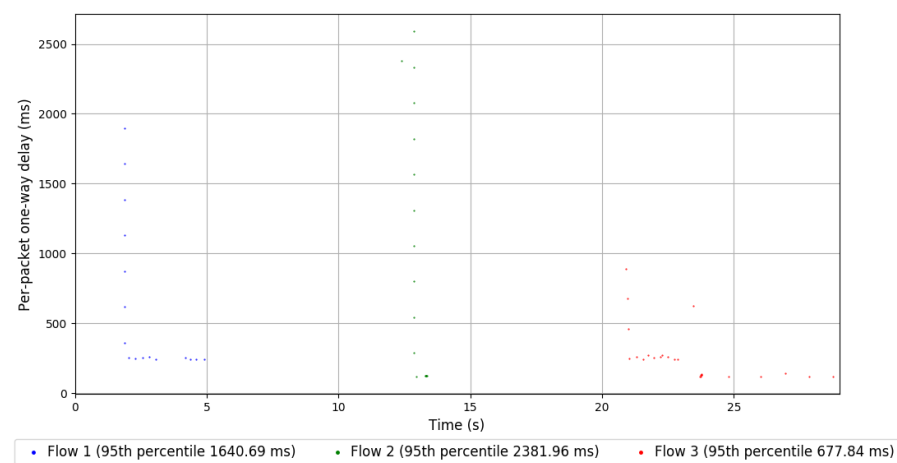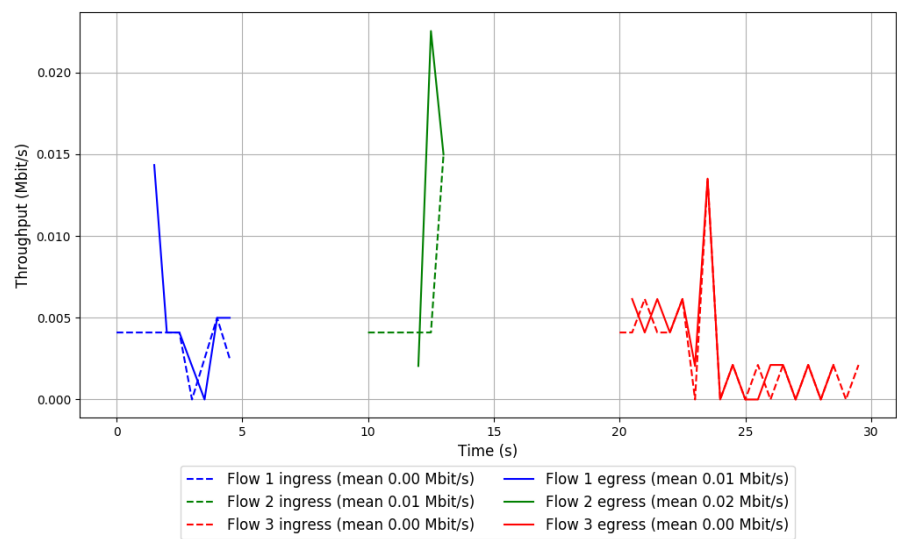
```
Run 2: Statistics of PCC

Start at: 2017-11-30 08:15:37
End at: 2017-11-30 08:16:07
Local clock offset: 1.861 ms
Remote clock offset: -3.713 ms


# Below is generated by plot.py at 2017-11-30 08:45:59
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 2483.203 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 0.01 Mbit/s
95th percentile per-packet one-way delay: 1302.180 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 0.02 Mbit/s
95th percentile per-packet one-way delay: 2767.831 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 703.063 ms
Loss rate: 0.00%
```
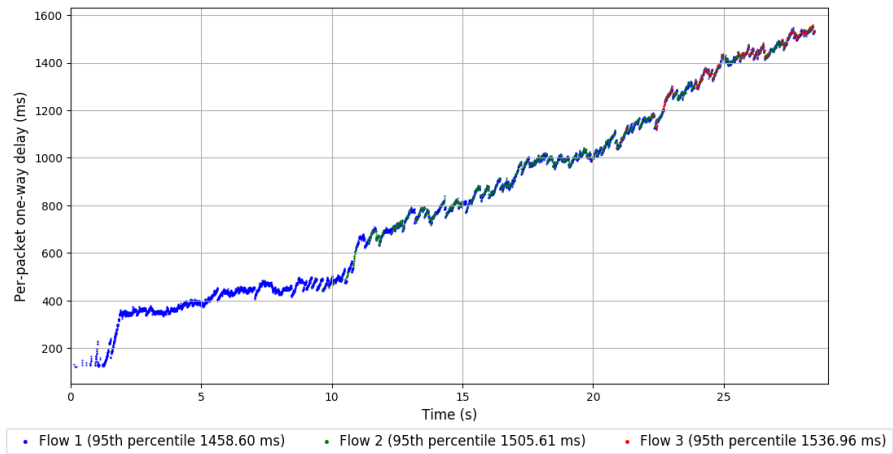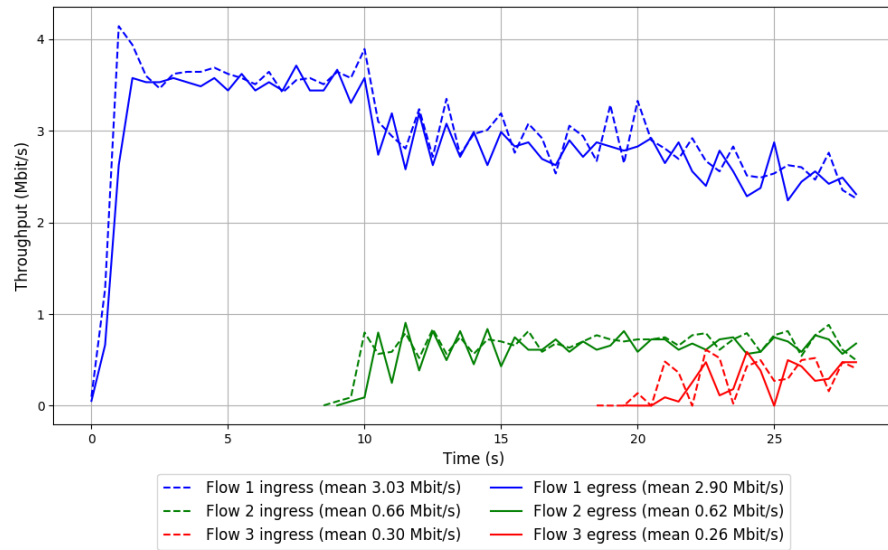
Run 2: Report of PCC — Data Link
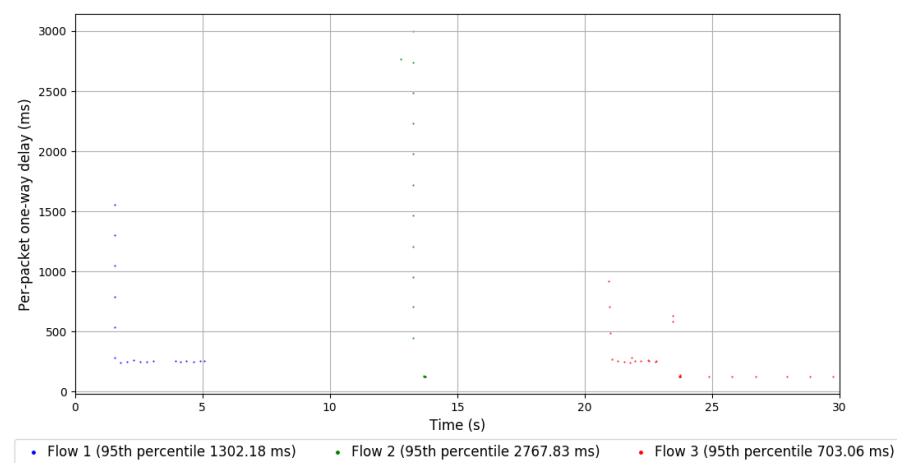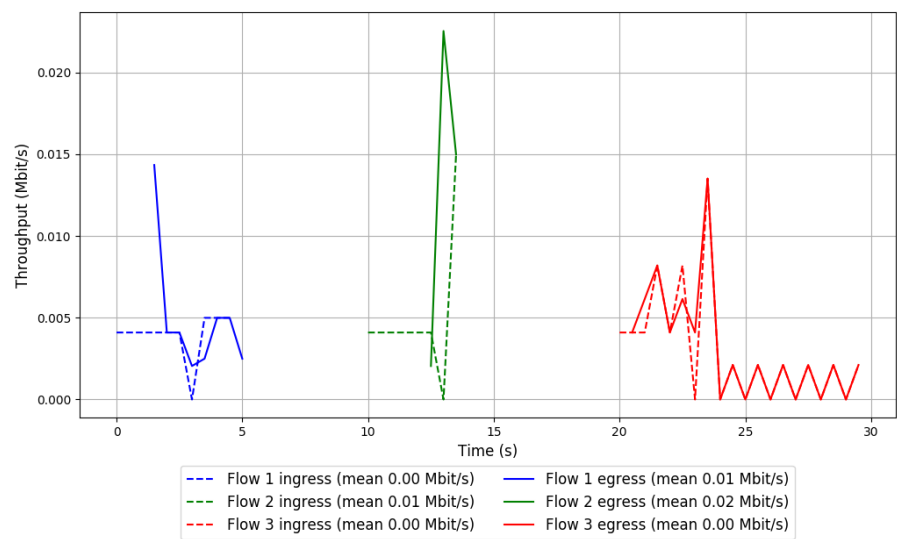
```
Run 3: Statistics of PCC

Start at: 2017-11-30 08:33:44
End at: 2017-11-30 08:34:14
Local clock offset: 1.41 ms
Remote clock offset: -8.112 ms


# Below is generated by plot.py at 2017-11-30 08:46:00
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 2181.190 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 0.01 Mbit/s
95th percentile per-packet one-way delay: 1166.364 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 0.02 Mbit/s
95th percentile per-packet one-way delay: 2467.815 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 736.924 ms
Loss rate: 0.00%
```
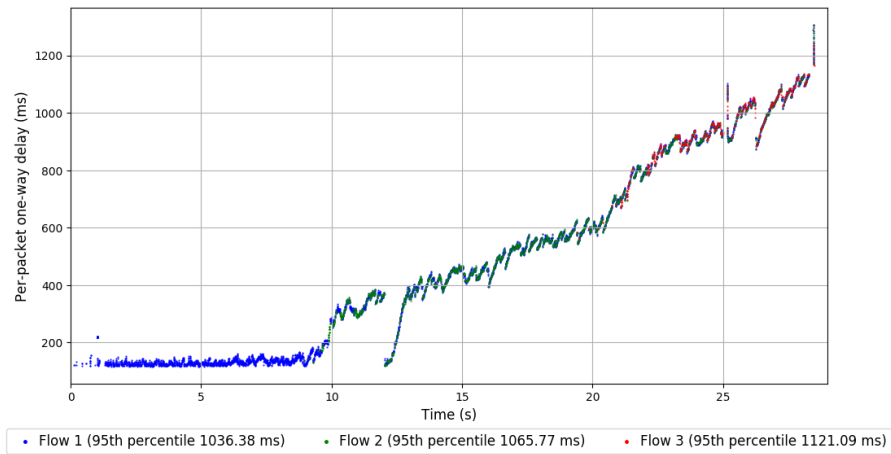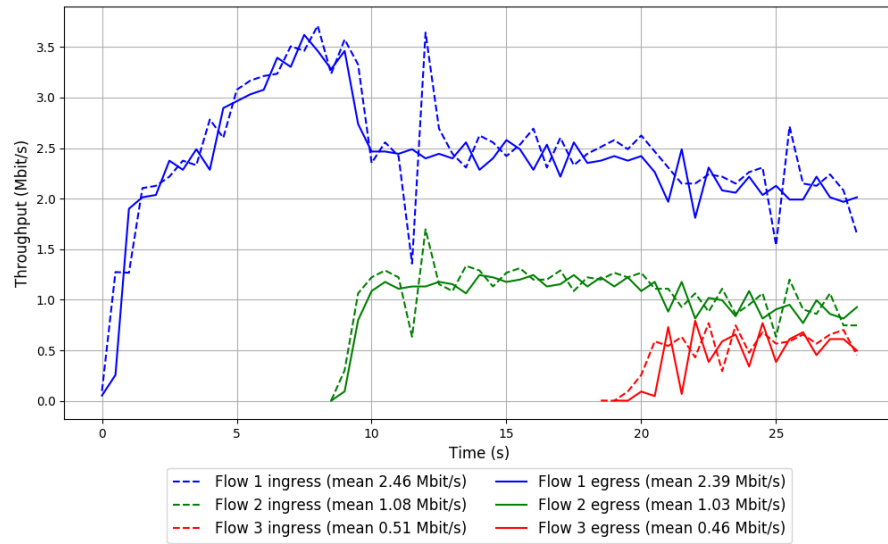
Run 3: Report of PCC — Data Link
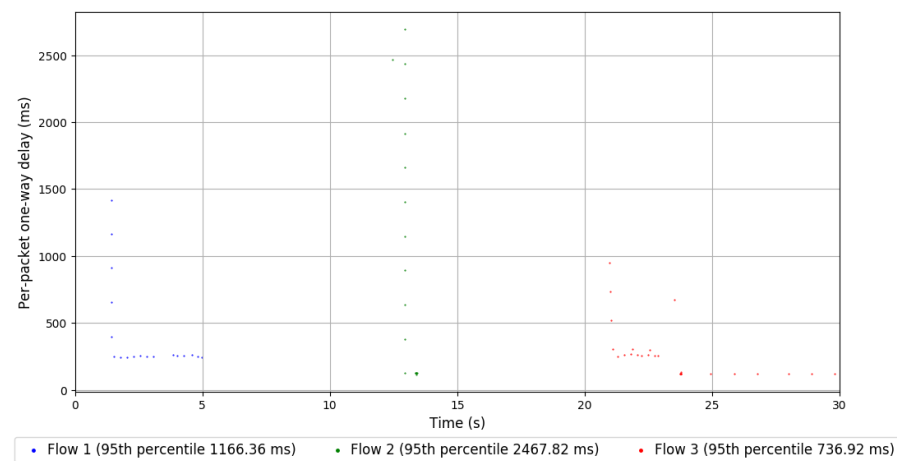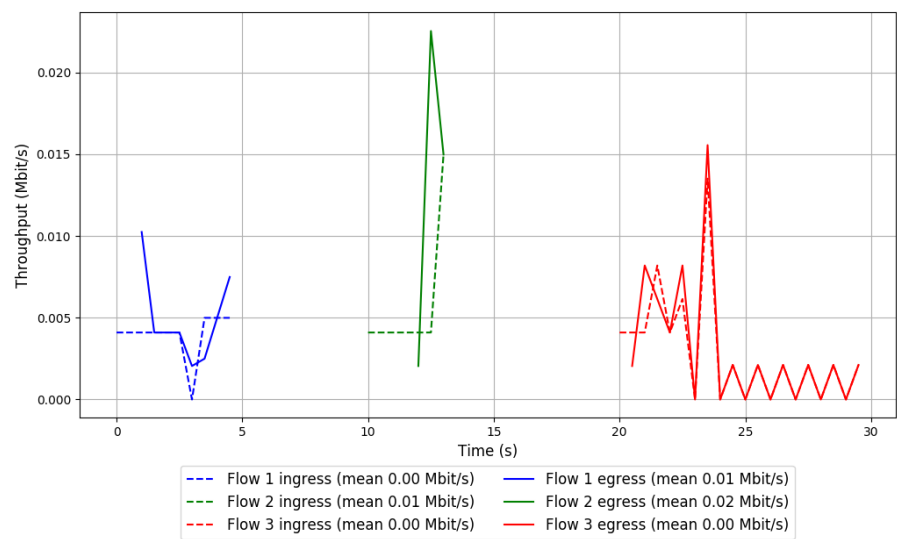
```
Run 1: Statistics of QUIC Cubic

Start at: 2017-11-30 08:03:05
End at: 2017-11-30 08:03:35
Local clock offset: 2.138 ms
Remote clock offset: -3.405 ms


# Below is generated by plot.py at 2017-11-30 08:46:06
# Datalink statistics
-- Total of 3 flows:
Average throughput: 3.39 Mbit/s
95th percentile per-packet one-way delay: 1475.733 ms
Loss rate: 5.37%
-- Flow 1:
Average throughput: 2.90 Mbit/s
95th percentile per-packet one-way delay: 1458.604 ms
Loss rate: 4.49%
-- Flow 2:
Average throughput: 0.62 Mbit/s
95th percentile per-packet one-way delay: 1505.607 ms
Loss rate: 8.15%
-- Flow 3:
Average throughput: 0.26 Mbit/s
95th percentile per-packet one-way delay: 1536.961 ms
Loss rate: 19.47%
```

Run 1: Report of QUIC Cubic — Data Link

Flow 1 ingress (mean 3.03 Mbit/s) --- Flow 1 egress (mean 2.90 Mbit/s)
Flow 2 ingress (mean 0.66 Mbit/s) --- Flow 2 egress (mean 0.62 Mbit/s)
Flow 3 ingress (mean 0.30 Mbit/s) --- Flow 3 egress (mean 0.26 Mbit/s)

Flow 1 (95th percentile 1458.60 ms)   Flow 2 (95th percentile 1505.61 ms)   Flow 3 (95th percentile 1536.96 ms)
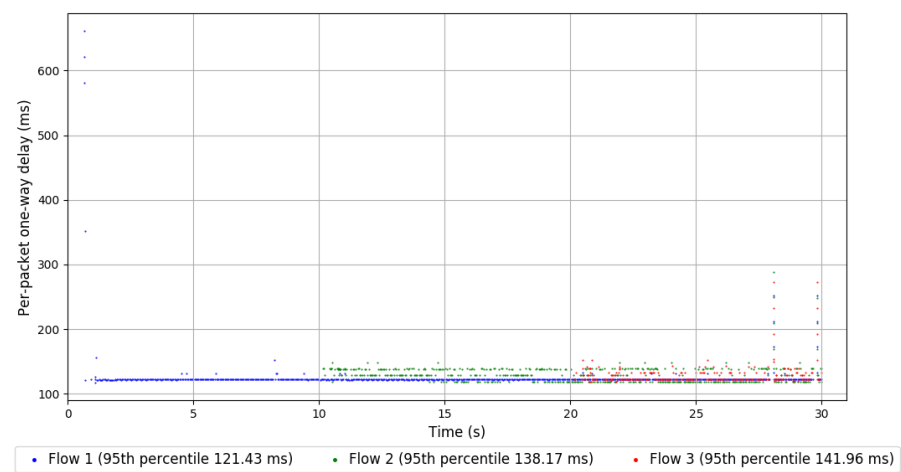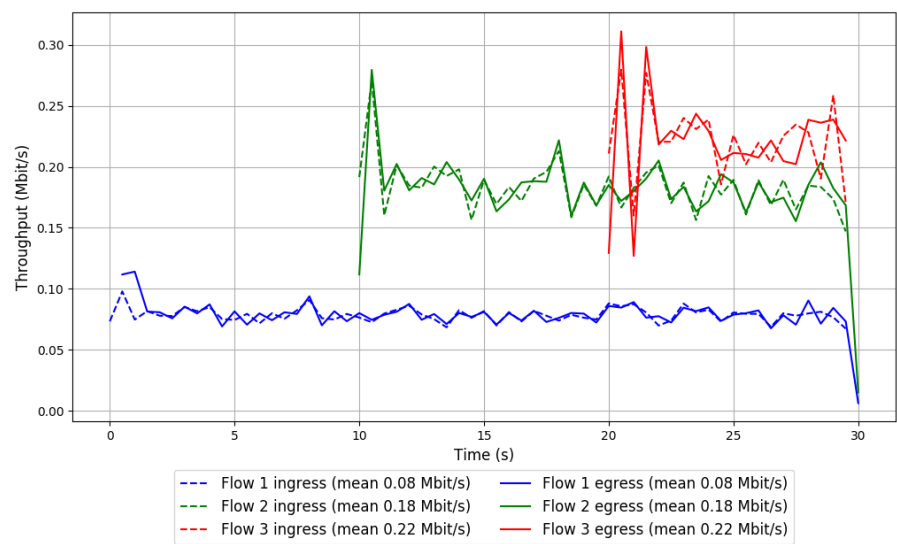
```
Run 2: Statistics of QUIC Cubic

Start at: 2017-11-30 08:20:36
End at: 2017-11-30 08:21:06
Local clock offset: 1.599 ms
Remote clock offset: -7.708 ms


# Below is generated by plot.py at 2017-11-30 08:46:09
# Datalink statistics
-- Total of 3 flows:
Average throughput: 3.24 Mbit/s
95th percentile per-packet one-way delay: 1054.078 ms
Loss rate: 4.02%
-- Flow 1:
Average throughput: 2.39 Mbit/s
95th percentile per-packet one-way delay: 1036.385 ms
Loss rate: 3.22%
-- Flow 2:
Average throughput: 1.03 Mbit/s
95th percentile per-packet one-way delay: 1065.766 ms
Loss rate: 4.34%
-- Flow 3:
Average throughput: 0.46 Mbit/s
95th percentile per-packet one-way delay: 1121.092 ms
Loss rate: 14.23%
```

Run 2: Report of QUIC Cubic — Data Link

Flow 1 ingress (mean 2.46 Mbit/s) — — — Flow 1 egress (mean 2.39 Mbit/s)
Flow 2 ingress (mean 1.08 Mbit/s) — — — Flow 2 egress (mean 1.03 Mbit/s)
Flow 3 ingress (mean 0.51 Mbit/s) — — — Flow 3 egress (mean 0.46 Mbit/s)

Flow 1 (95th percentile 1036.38 ms) Flow 2 (95th percentile 1065.77 ms) Flow 3 (95th percentile 1121.09 ms)

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Run 3: Statistics of QUIC Cubic

/home/ubuntu/pantheon_data/2017-11-30T07-51-AWS-Brazil-2-to-Colombia-ppp0-3-runs-3-flows/qui

Run 3: Report of QUIC Cubic — Data Link

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```
Run 1: Statistics of SCReAM

Start at: 2017-11-30 08:00:35
End at: 2017-11-30 08:01:05
Local clock offset: 2.092 ms
Remote clock offset: -8.666 ms

# Below is generated by plot.py at 2017-11-30 08:46:09
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.29 Mbit/s
95th percentile per-packet one-way delay: 132.408 ms
Loss rate: 0.21%
-- Flow 1:
Average throughput: 0.08 Mbit/s
95th percentile per-packet one-way delay: 132.288 ms
Loss rate: 0.13%
-- Flow 2:
Average throughput: 0.20 Mbit/s
95th percentile per-packet one-way delay: 132.454 ms
Loss rate: 0.19%
-- Flow 3:
Average throughput: 0.22 Mbit/s
95th percentile per-packet one-way delay: 132.520 ms
Loss rate: 0.35%
```

Run 1: Report of SCReAM — Data Link
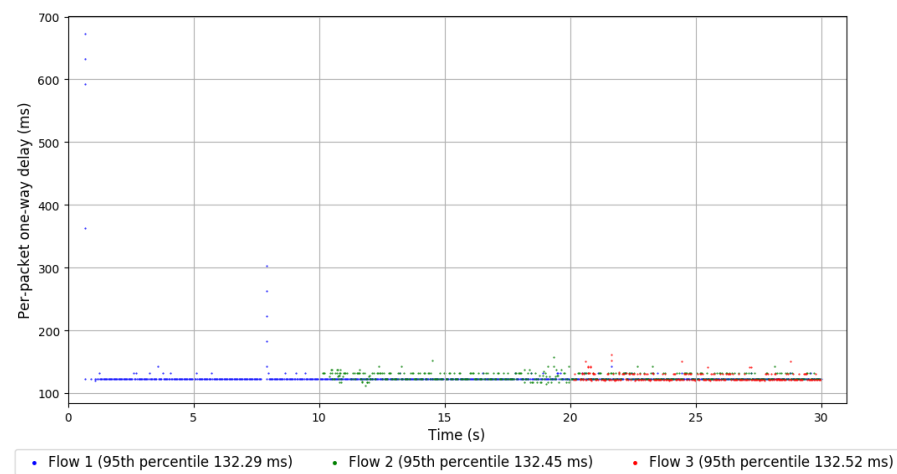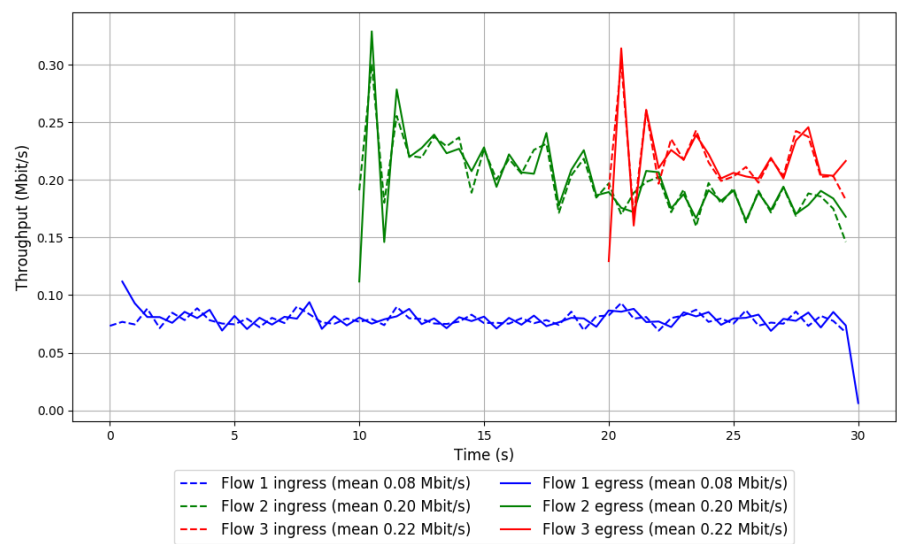
```
Run 2: Statistics of SCReAM

Start at: 2017-11-30 08:18:06
End at: 2017-11-30 08:18:36
Local clock offset: 1.79 ms
Remote clock offset: -8.905 ms


# Below is generated by plot.py at 2017-11-30 08:46:09
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.28 Mbit/s
95th percentile per-packet one-way delay: 138.112 ms
Loss rate: 0.13%
-- Flow 1:
Average throughput: 0.08 Mbit/s
95th percentile per-packet one-way delay: 121.426 ms
Loss rate: 0.13%
-- Flow 2:
Average throughput: 0.18 Mbit/s
95th percentile per-packet one-way delay: 138.168 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 0.22 Mbit/s
95th percentile per-packet one-way delay: 141.964 ms
Loss rate: 0.35%
```

Run 2: Report of SCReAM — Data Link

```
Run 3: Statistics of SCReAM

Start at: 2017-11-30 08:36:13
End at: 2017-11-30 08:36:43
Local clock offset: 1.375 ms
Remote clock offset: -8.239 ms


# Below is generated by plot.py at 2017-11-30 08:46:09
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.25 Mbit/s
95th percentile per-packet one-way delay: 133.413 ms
Loss rate: 0.21%
-- Flow 1:
Average throughput: 0.08 Mbit/s
95th percentile per-packet one-way delay: 123.070 ms
Loss rate: 0.13%
-- Flow 2:
Average throughput: 0.16 Mbit/s
95th percentile per-packet one-way delay: 142.217 ms
Loss rate: 0.20%
-- Flow 3:
Average throughput: 0.17 Mbit/s
95th percentile per-packet one-way delay: 142.054 ms
Loss rate: 0.34%
```

Run 3: Report of SCReAM — Data Link
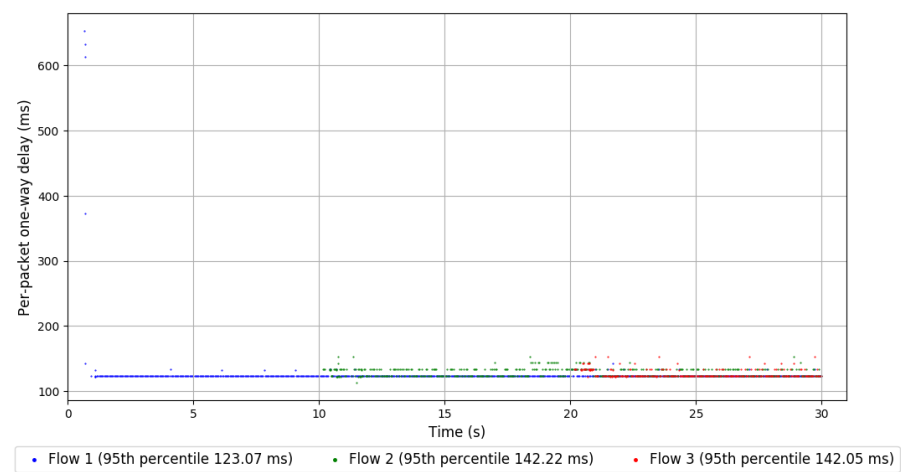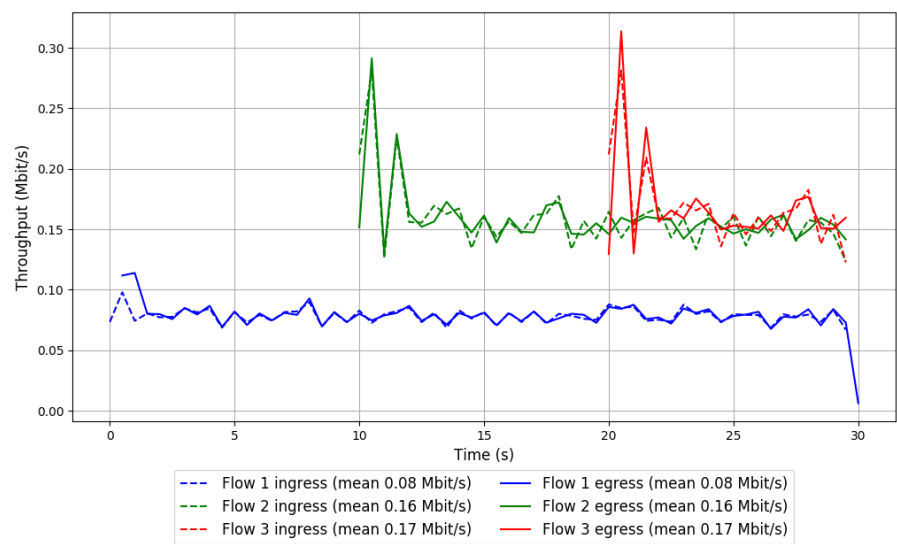
```
Run 1: Statistics of WebRTC media

Start at: 2017-11-30 08:04:20
End at: 2017-11-30 08:04:50
Local clock offset: 2.141 ms
Remote clock offset: -9.095 ms


# Below is generated by plot.py at 2017-11-30 08:46:09
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1.77 Mbit/s
95th percentile per-packet one-way delay: 281.736 ms
Loss rate: 0.23%
-- Flow 1:
Average throughput: 1.06 Mbit/s
95th percentile per-packet one-way delay: 238.641 ms
Loss rate: 0.23%
-- Flow 2:
Average throughput: 0.60 Mbit/s
95th percentile per-packet one-way delay: 333.866 ms
Loss rate: 0.20%
-- Flow 3:
Average throughput: 0.12 Mbit/s
95th percentile per-packet one-way delay: 359.307 ms
Loss rate: 0.29%
```
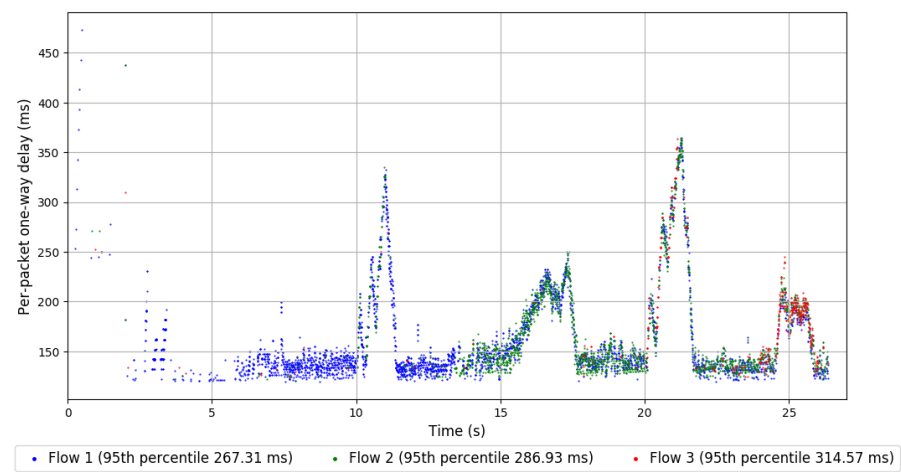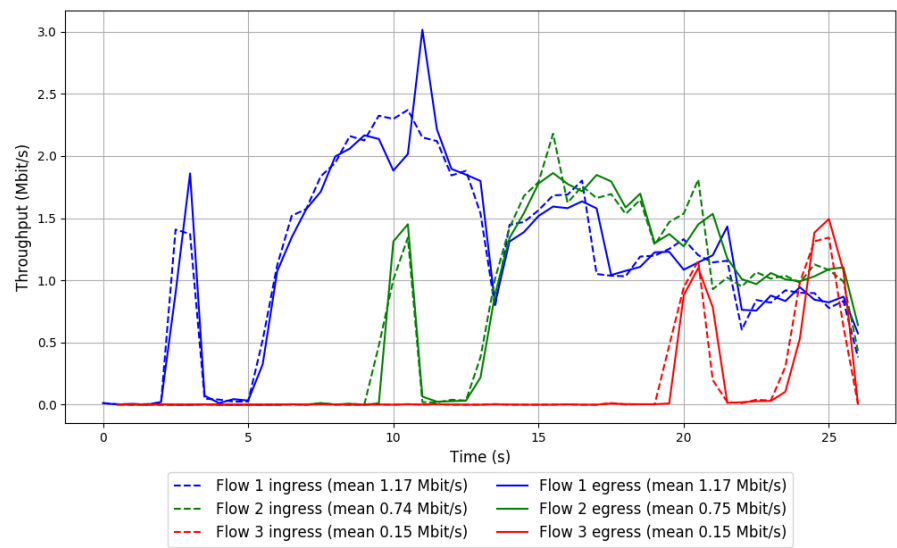
Run 1: Report of WebRTC media — Data Link
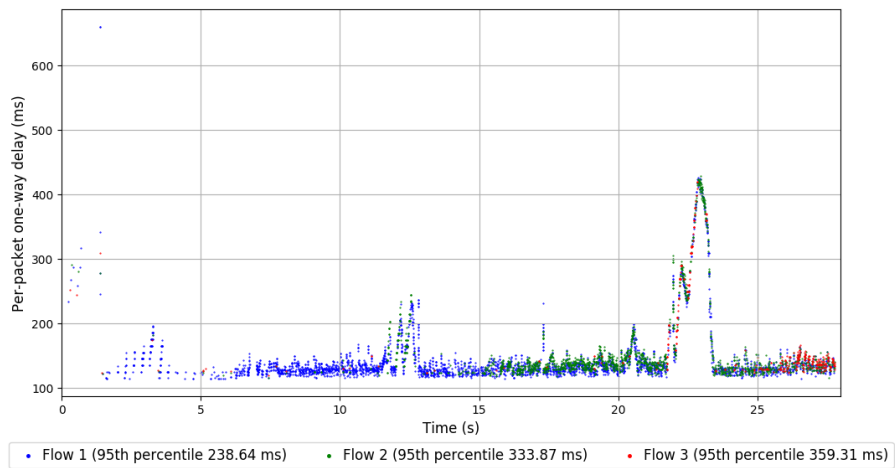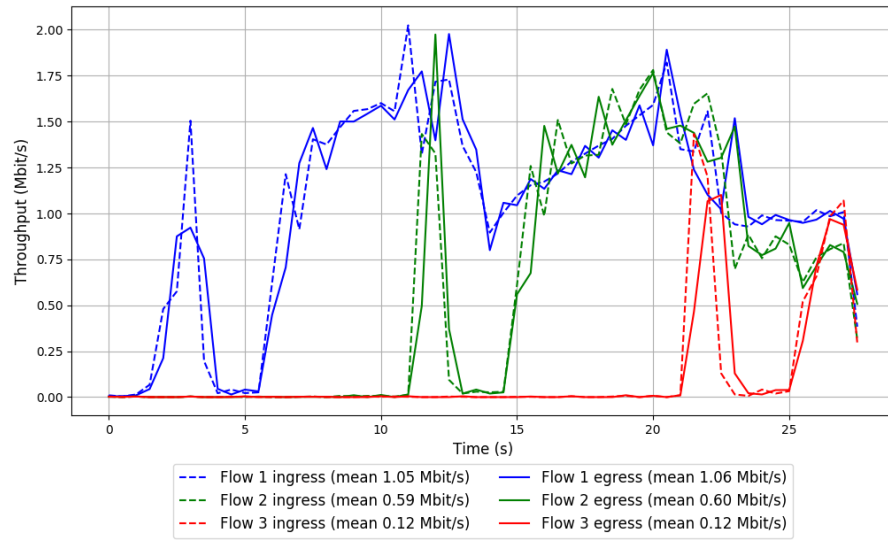
```
Run 2: Statistics of WebRTC media

Start at: 2017-11-30 08:21:51
End at: 2017-11-30 08:22:21
Local clock offset: 1.576 ms
Remote clock offset: -3.227 ms

# Below is generated by plot.py at 2017-11-30 08:46:09
# Datalink statistics
-- Total of 3 flows:
Average throughput: 2.05 Mbit/s
95th percentile per-packet one-way delay: 279.036 ms
Loss rate: 0.10%
-- Flow 1:
Average throughput: 1.17 Mbit/s
95th percentile per-packet one-way delay: 267.306 ms
Loss rate: 0.05%
-- Flow 2:
Average throughput: 0.75 Mbit/s
95th percentile per-packet one-way delay: 286.932 ms
Loss rate: 0.19%
-- Flow 3:
Average throughput: 0.15 Mbit/s
95th percentile per-packet one-way delay: 314.566 ms
Loss rate: 0.00%
```

Run 2: Report of WebRTC media — Data Link

```
Run 3: Statistics of WebRTC media

Start at: 2017-11-30 08:40:37
End at: 2017-11-30 08:41:07
Local clock offset: 1.294 ms
Remote clock offset: -3.15 ms

# Below is generated by plot.py at 2017-11-30 08:46:09
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1.80 Mbit/s
95th percentile per-packet one-way delay: 287.414 ms
Loss rate: 0.49%
-- Flow 1:
Average throughput: 1.21 Mbit/s
95th percentile per-packet one-way delay: 288.475 ms
Loss rate: 0.20%
-- Flow 2:
Average throughput: 0.49 Mbit/s
95th percentile per-packet one-way delay: 285.168 ms
Loss rate: 0.57%
-- Flow 3:
Average throughput: 0.11 Mbit/s
95th percentile per-packet one-way delay: 280.436 ms
Loss rate: 3.21%
```

Run 3: Report of WebRTC media — Data Link
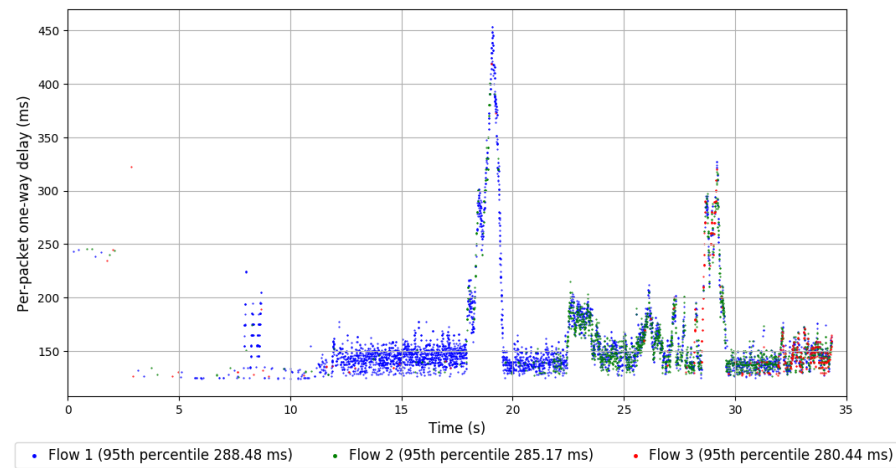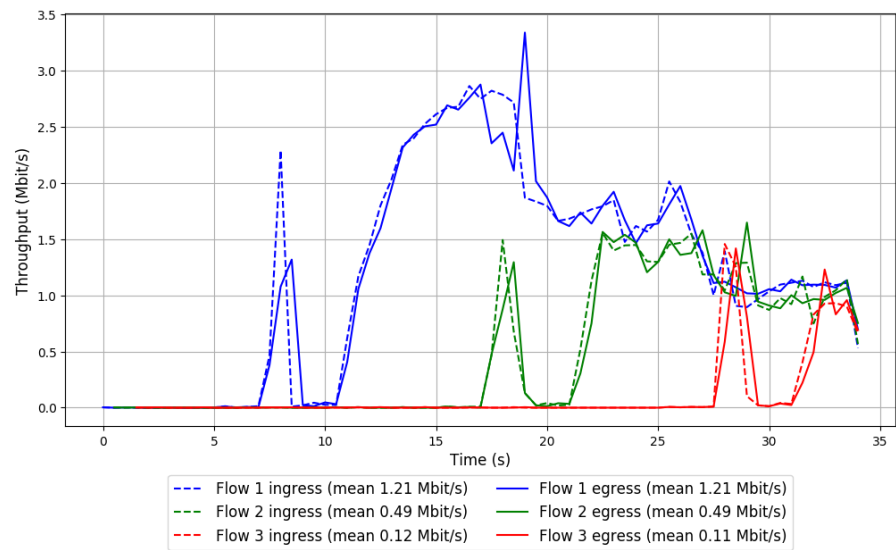
```
Run 1: Statistics of Sprout

Start at: 2017-11-30 07:59:20
End at: 2017-11-30 07:59:50
Local clock offset: 2.15 ms
Remote clock offset: -2.955 ms


# Below is generated by plot.py at 2017-11-30 08:46:09
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.37 Mbit/s
95th percentile per-packet one-way delay: 160.127 ms
Loss rate: 0.35%
-- Flow 1:
Average throughput: 0.19 Mbit/s
95th percentile per-packet one-way delay: 160.605 ms
Loss rate: 0.64%
-- Flow 2:
Average throughput: 0.17 Mbit/s
95th percentile per-packet one-way delay: 153.670 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 0.18 Mbit/s
95th percentile per-packet one-way delay: 161.533 ms
Loss rate: 0.04%
```

Run 1: Report of Sprout — Data Link
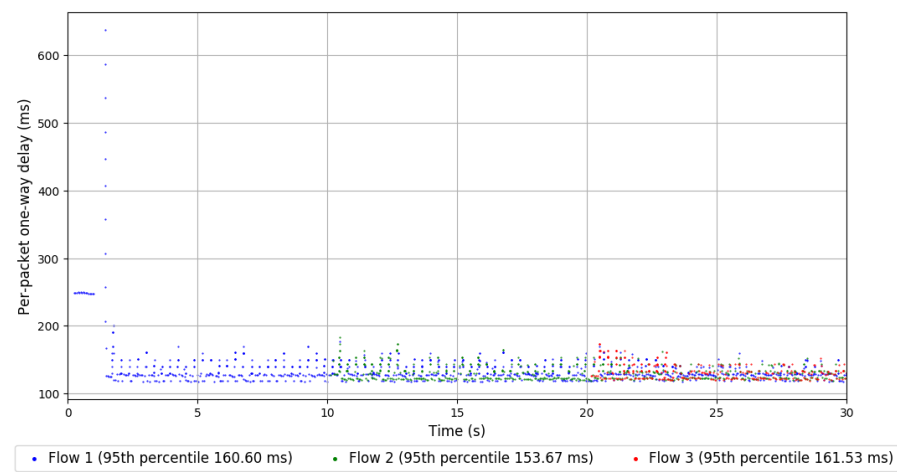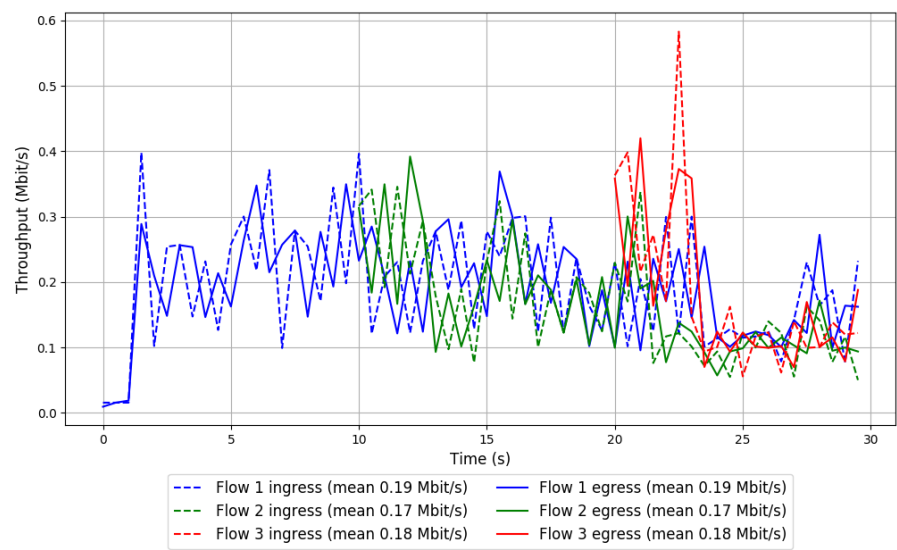
```
Run 2: Statistics of Sprout

Start at: 2017-11-30 08:16:51
End at: 2017-11-30 08:17:21
Local clock offset: 1.812 ms
Remote clock offset: -8.065 ms


# Below is generated by plot.py at 2017-11-30 08:46:09
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.37 Mbit/s
95th percentile per-packet one-way delay: 164.438 ms
Loss rate: 0.02%
-- Flow 1:
Average throughput: 0.17 Mbit/s
95th percentile per-packet one-way delay: 174.268 ms
Loss rate: 0.02%
-- Flow 2:
Average throughput: 0.18 Mbit/s
95th percentile per-packet one-way delay: 155.700 ms
Loss rate: 0.02%
-- Flow 3:
Average throughput: 0.24 Mbit/s
95th percentile per-packet one-way delay: 162.620 ms
Loss rate: 0.03%
```

Run 2: Report of Sprout — Data Link
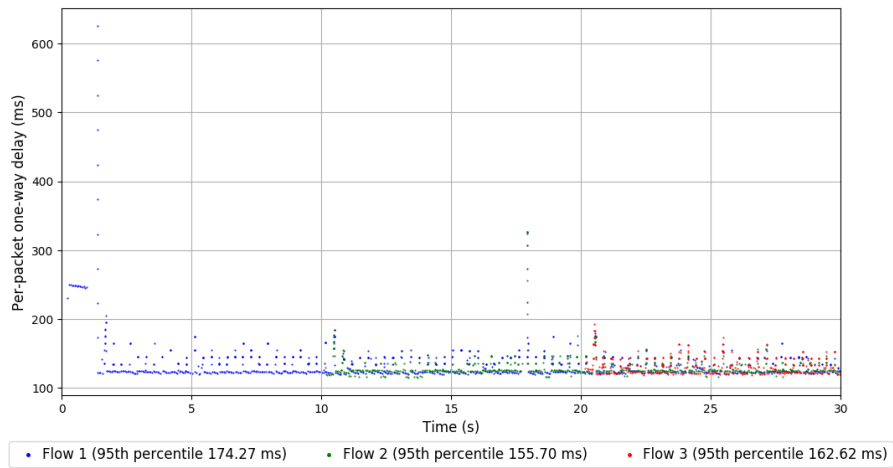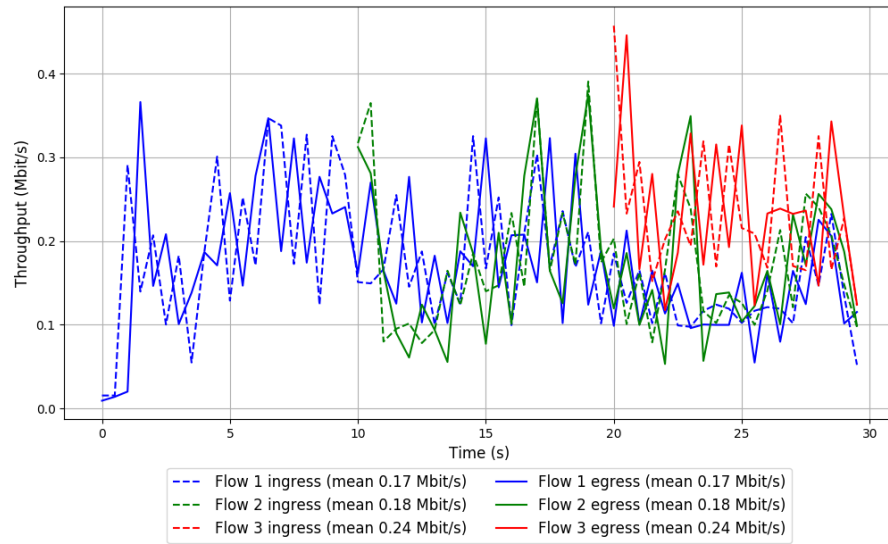
```
Run 3: Statistics of Sprout

Start at: 2017-11-30 08:34:59
End at: 2017-11-30 08:35:29
Local clock offset: 1.379 ms
Remote clock offset: -3.0 ms


# Below is generated by plot.py at 2017-11-30 08:46:09
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.38 Mbit/s
95th percentile per-packet one-way delay: 162.536 ms
Loss rate: 0.14%
-- Flow 1:
Average throughput: 0.14 Mbit/s
95th percentile per-packet one-way delay: 229.329 ms
Loss rate: 0.34%
-- Flow 2:
Average throughput: 0.22 Mbit/s
95th percentile per-packet one-way delay: 153.450 ms
Loss rate: 0.02%
-- Flow 3:
Average throughput: 0.19 Mbit/s
95th percentile per-packet one-way delay: 162.648 ms
Loss rate: 0.04%
```

Run 3: Report of Sprout — Data Link
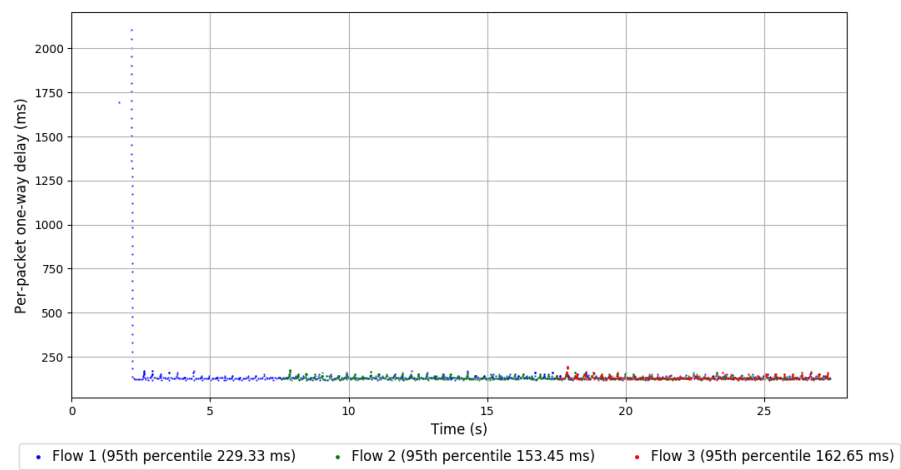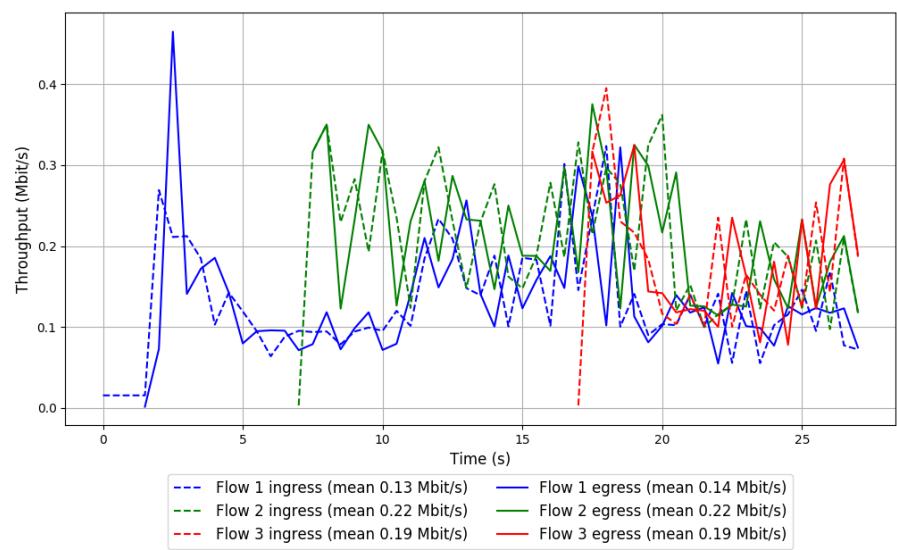
```
Run 1: Statistics of TaoVA-100x

Start at: 2017-11-30 08:08:06
End at: 2017-11-30 08:08:36
Local clock offset: 2.033 ms
Remote clock offset: -3.406 ms


# Below is generated by plot.py at 2017-11-30 08:46:17
# Datalink statistics
-- Total of 3 flows:
Average throughput: 3.00 Mbit/s
95th percentile per-packet one-way delay: 980.505 ms
Loss rate: 0.65%
-- Flow 1:
Average throughput: 1.59 Mbit/s
95th percentile per-packet one-way delay: 796.984 ms
Loss rate: 0.47%
-- Flow 2:
Average throughput: 1.47 Mbit/s
95th percentile per-packet one-way delay: 1285.527 ms
Loss rate: 0.78%
-- Flow 3:
Average throughput: 1.28 Mbit/s
95th percentile per-packet one-way delay: 865.825 ms
Loss rate: 1.01%
```

Run 1: Report of TaoVA-100x — Data Link
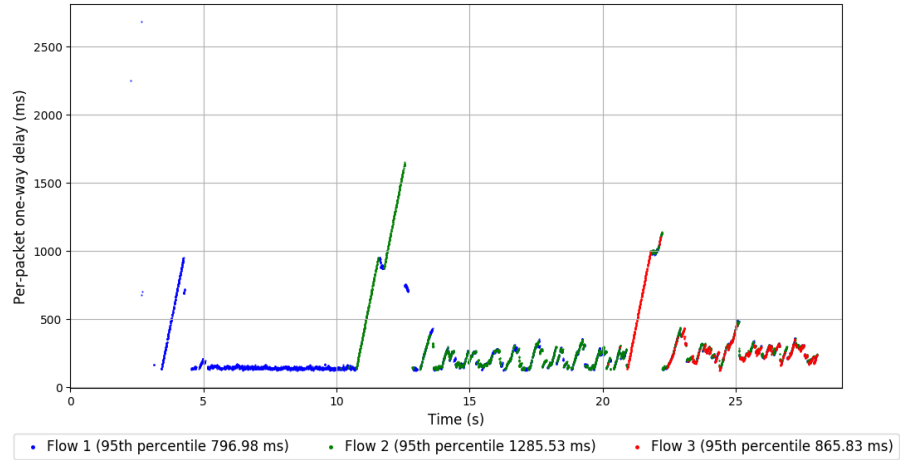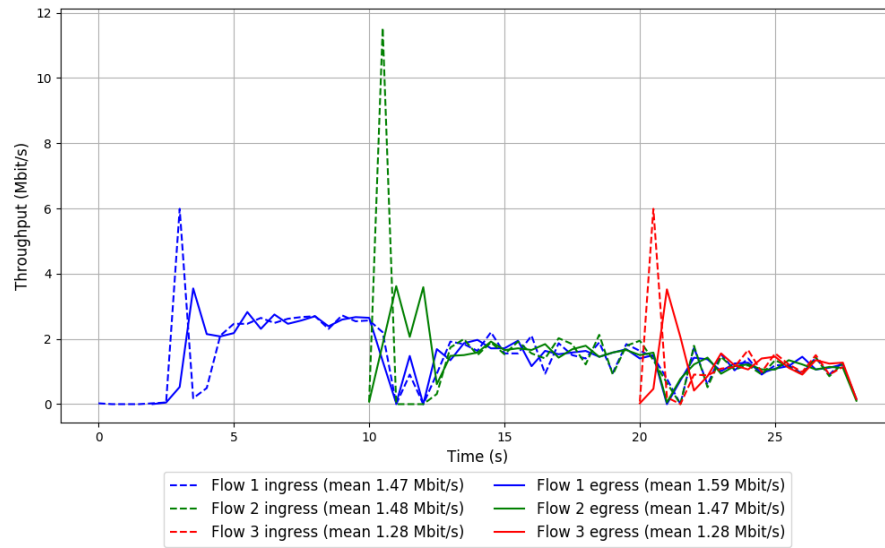
Run 2: Statistics of TaoVA-100x

/home/ubuntu/pantheon_data/2017-11-30T07-51-AWS-Brazil-2-to-Colombia-ppp0-3-runs-3-flows/ta

Run 2: Report of TaoVA-100x — Data Link

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```
Run 3: Statistics of TaoVA-100x

Start at: 2017-11-30 08:44:22
End at: 2017-11-30 08:44:52
Local clock offset: 1.258 ms
Remote clock offset: -9.225 ms

# Below is generated by plot.py at 2017-11-30 08:46:18
# Datalink statistics
-- Total of 3 flows:
Average throughput: 2.97 Mbit/s
95th percentile per-packet one-way delay: 805.185 ms
Loss rate: 0.54%
-- Flow 1:
Average throughput: 1.59 Mbit/s
95th percentile per-packet one-way delay: 377.155 ms
Loss rate: 0.31%
-- Flow 2:
Average throughput: 1.43 Mbit/s
95th percentile per-packet one-way delay: 802.466 ms
Loss rate: 0.45%
-- Flow 3:
Average throughput: 1.29 Mbit/s
95th percentile per-packet one-way delay: 963.133 ms
Loss rate: 1.65%
```

# Run 3: Report of TaoVA-100x — Data Link

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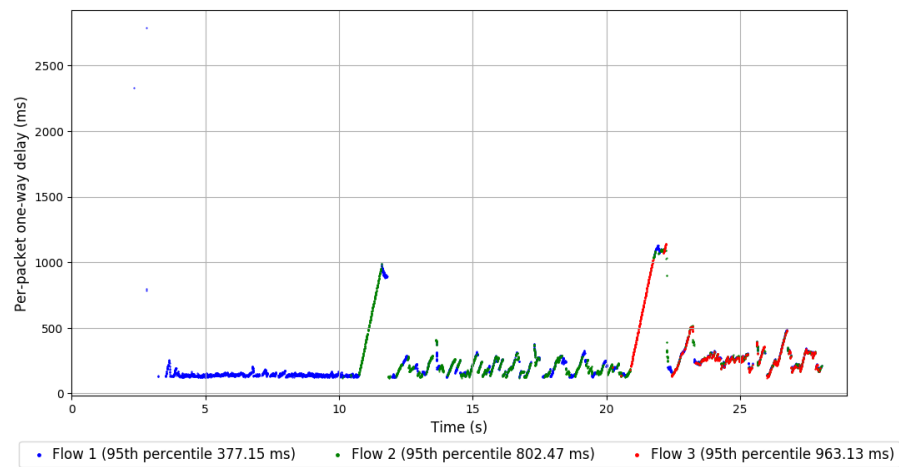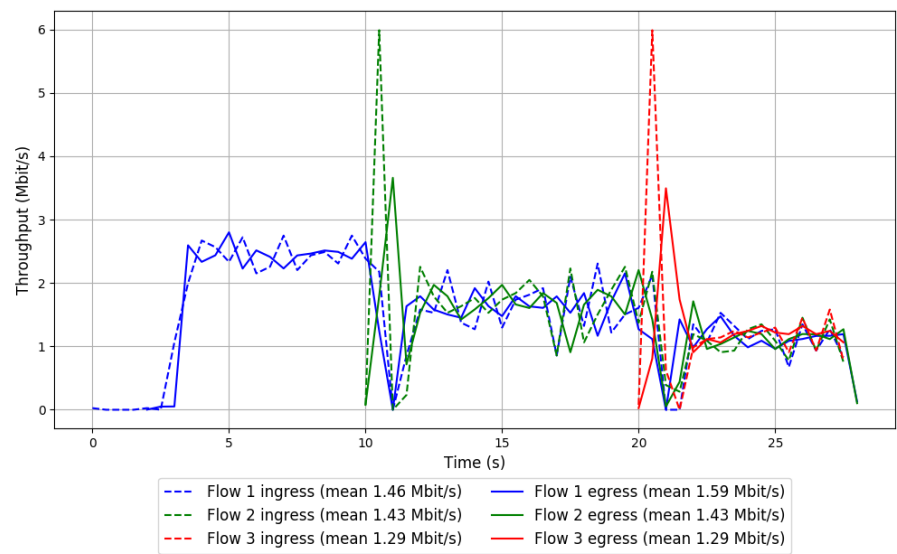
```
Run 1: Statistics of TCP Vegas

Start at: 2017-11-30 07:55:36
End at: 2017-11-30 07:56:06
Local clock offset: 2.032 ms
Remote clock offset: -4.089 ms


# Below is generated by plot.py at 2017-11-30 08:46:18
# Datalink statistics
-- Total of 3 flows:
Average throughput: 3.24 Mbit/s
95th percentile per-packet one-way delay: 2291.059 ms
Loss rate: 15.44%
-- Flow 1:
Average throughput: 2.54 Mbit/s
95th percentile per-packet one-way delay: 2271.382 ms
Loss rate: 12.27%
-- Flow 2:
Average throughput: 1.20 Mbit/s
95th percentile per-packet one-way delay: 2321.312 ms
Loss rate: 24.45%
-- Flow 3:
Average throughput: 0.01 Mbit/s
95th percentile per-packet one-way delay: 2265.260 ms
Loss rate: 62.70%
```

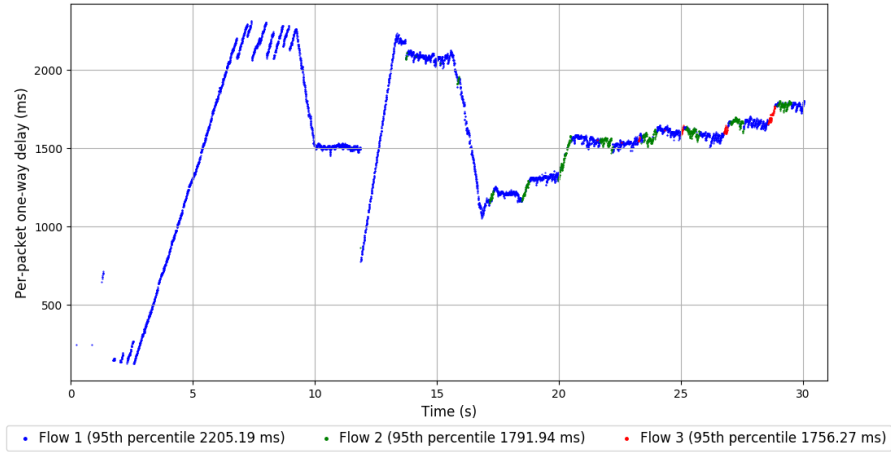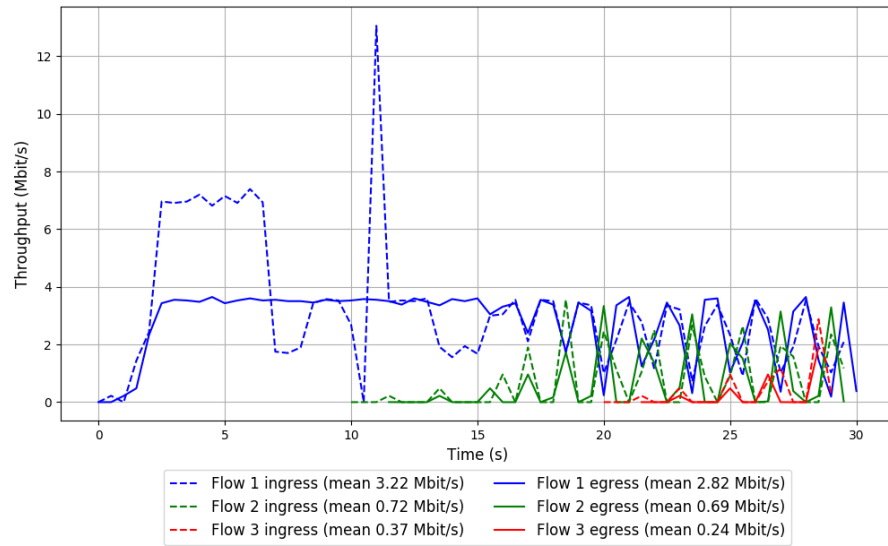Run 1: Report of TCP Vegas — Data Link
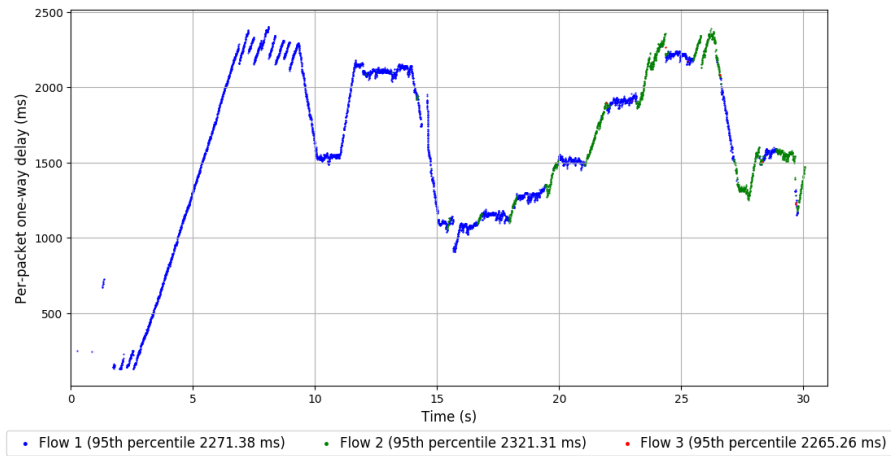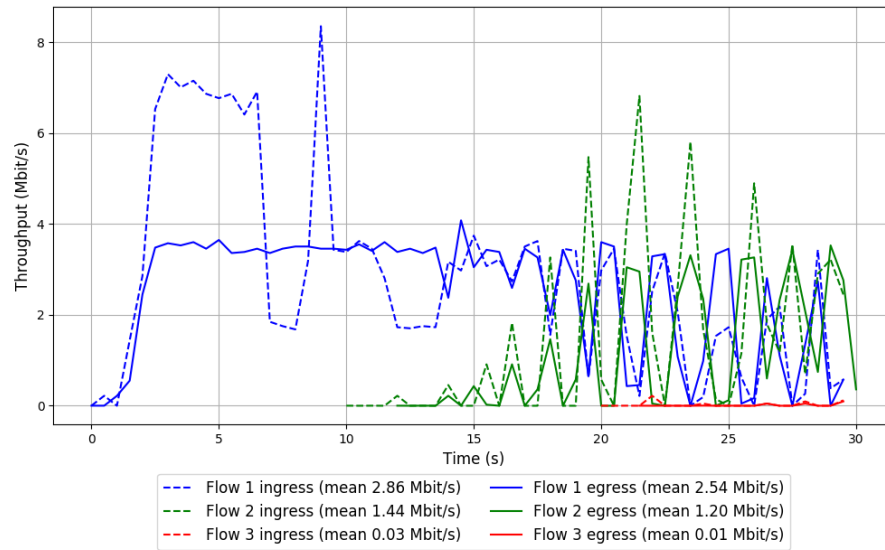
```
Run 2: Statistics of TCP Vegas

Start at: 2017-11-30 08:13:07
End at: 2017-11-30 08:13:37
Local clock offset: 1.898 ms
Remote clock offset: -8.478 ms


# Below is generated by plot.py at 2017-11-30 08:46:18
# Datalink statistics
-- Total of 3 flows:
Average throughput: 3.30 Mbit/s
95th percentile per-packet one-way delay: 2195.148 ms
Loss rate: 13.74%
-- Flow 1:
Average throughput: 2.82 Mbit/s
95th percentile per-packet one-way delay: 2205.188 ms
Loss rate: 12.77%
-- Flow 2:
Average throughput: 0.69 Mbit/s
95th percentile per-packet one-way delay: 1791.940 ms
Loss rate: 12.42%
-- Flow 3:
Average throughput: 0.24 Mbit/s
95th percentile per-packet one-way delay: 1756.269 ms
Loss rate: 47.09%
```

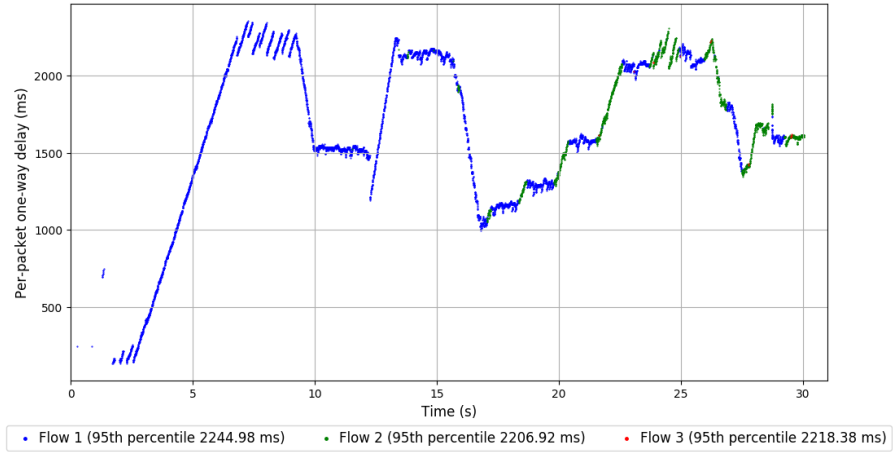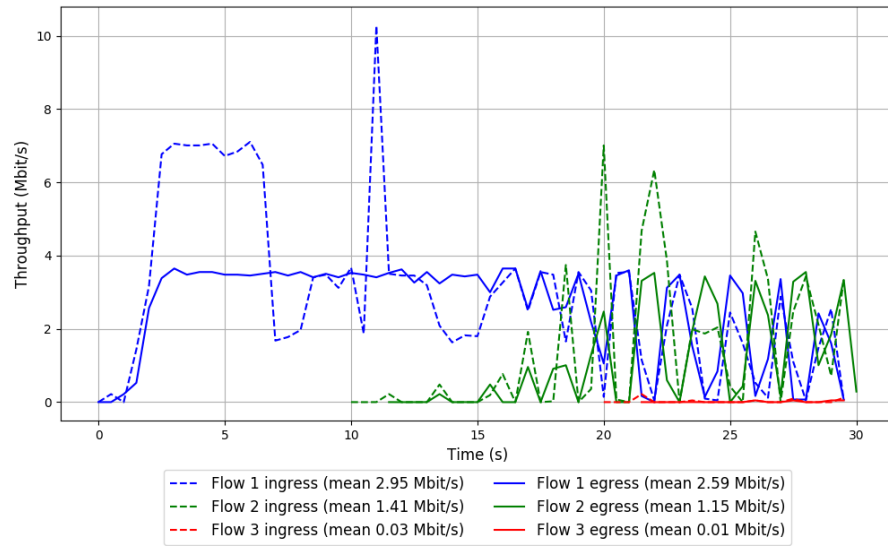Run 2: Report of TCP Vegas — Data Link

Flow 1 ingress (mean 3.22 Mbit/s)   Flow 1 egress (mean 2.82 Mbit/s)
Flow 2 ingress (mean 0.72 Mbit/s)   Flow 2 egress (mean 0.69 Mbit/s)
Flow 3 ingress (mean 0.37 Mbit/s)   Flow 3 egress (mean 0.24 Mbit/s)

Flow 1 (95th percentile 2205.19 ms)   Flow 2 (95th percentile 1791.94 ms)   Flow 3 (95th percentile 1756.27 ms)

```
Run 3: Statistics of TCP Vegas

Start at: 2017-11-30 08:31:14
End at: 2017-11-30 08:31:44
Local clock offset: 1.433 ms
Remote clock offset: -4.205 ms


# Below is generated by plot.py at 2017-11-30 08:46:18
# Datalink statistics
-- Total of 3 flows:
Average throughput: 3.30 Mbit/s
95th percentile per-packet one-way delay: 2234.633 ms
Loss rate: 15.64%
-- Flow 1:
Average throughput: 2.59 Mbit/s
95th percentile per-packet one-way delay: 2244.980 ms
Loss rate: 12.72%
-- Flow 2:
Average throughput: 1.15 Mbit/s
95th percentile per-packet one-way delay: 2206.919 ms
Loss rate: 24.33%
-- Flow 3:
Average throughput: 0.01 Mbit/s
95th percentile per-packet one-way delay: 2218.378 ms
Loss rate: 62.70%
```

# Run 3: Report of TCP Vegas — Data Link

Flow 1 ingress (mean 2.95 Mbit/s)   Flow 1 egress (mean 2.59 Mbit/s)
Flow 2 ingress (mean 1.41 Mbit/s)   Flow 2 egress (mean 1.15 Mbit/s)
Flow 3 ingress (mean 0.03 Mbit/s)   Flow 3 egress (mean 0.01 Mbit/s)

Flow 1 (95th percentile 2244.98 ms)   Flow 2 (95th percentile 2206.92 ms)   Flow 3 (95th percentile 2218.38 ms)

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```
Run 1: Statistics of Verus

Start at: 2017-11-30 07:51:51
End at: 2017-11-30 07:52:21
Local clock offset: 1.894 ms
Remote clock offset: -8.042 ms


# Below is generated by plot.py at 2017-11-30 08:46:18
# Datalink statistics
-- Total of 3 flows:
Average throughput: 3.09 Mbit/s
95th percentile per-packet one-way delay: 1850.069 ms
Loss rate: 5.40%
-- Flow 1:
Average throughput: 3.08 Mbit/s
95th percentile per-packet one-way delay: 1850.069 ms
Loss rate: 5.37%
-- Flow 2:
Average throughput: 0.01 Mbit/s
95th percentile per-packet one-way delay: 1822.932 ms
Loss rate: 10.00%
-- Flow 3:
Average throughput: 0.02 Mbit/s
95th percentile per-packet one-way delay: 1837.173 ms
Loss rate: 18.18%
```

Run 1: Report of Verus — Data Link
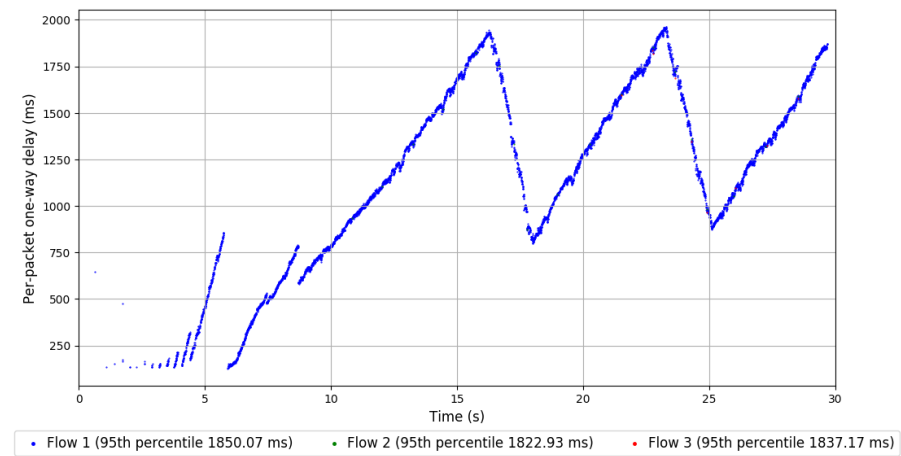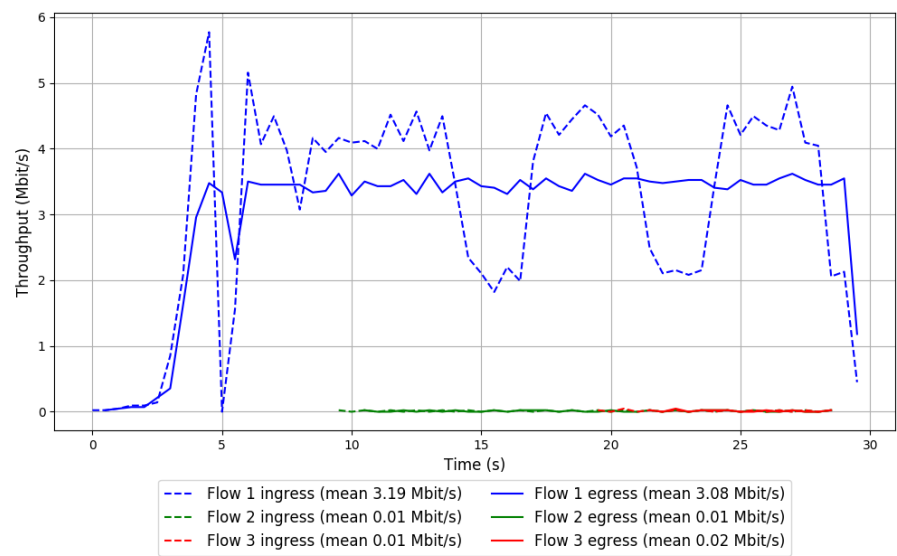
```
Run 2: Statistics of Verus

Start at: 2017-11-30 08:09:21
End at: 2017-11-30 08:09:51
Local clock offset: 1.971 ms
Remote clock offset: -3.971 ms


# Below is generated by plot.py at 2017-11-30 08:46:18
# Datalink statistics
-- Total of 3 flows:
Average throughput: 3.25 Mbit/s
95th percentile per-packet one-way delay: 1990.418 ms
Loss rate: 4.14%
-- Flow 1:
Average throughput: 3.24 Mbit/s
95th percentile per-packet one-way delay: 1990.465 ms
Loss rate: 4.11%
-- Flow 2:
Average throughput: 0.01 Mbit/s
95th percentile per-packet one-way delay: 1890.060 ms
Loss rate: 10.00%
-- Flow 3:
Average throughput: 0.01 Mbit/s
95th percentile per-packet one-way delay: 1897.217 ms
Loss rate: 20.00%
```

## Run 2: Report of Verus — Data Link
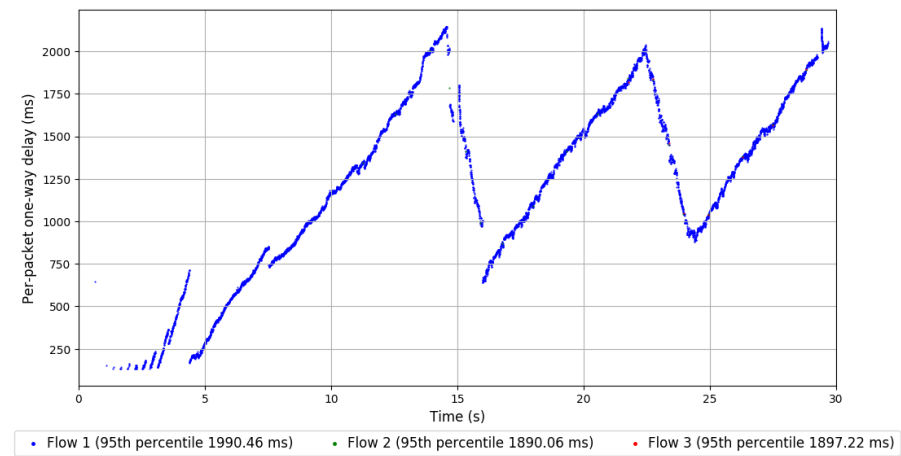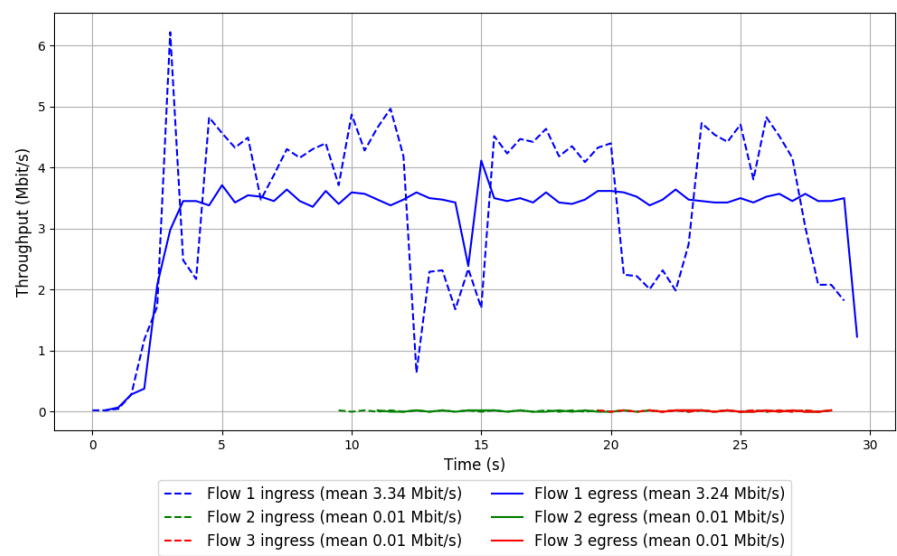
```
Run 3: Statistics of Verus

Start at: 2017-11-30 08:27:29
End at: 2017-11-30 08:27:59
Local clock offset: 1.51 ms
Remote clock offset: -4.144 ms


# Below is generated by plot.py at 2017-11-30 08:46:18
# Datalink statistics
-- Total of 3 flows:
Average throughput: 3.33 Mbit/s
95th percentile per-packet one-way delay: 1815.319 ms
Loss rate: 4.15%
-- Flow 1:
Average throughput: 3.32 Mbit/s
95th percentile per-packet one-way delay: 1815.157 ms
Loss rate: 4.14%
-- Flow 2:
Average throughput: 0.01 Mbit/s
95th percentile per-packet one-way delay: 1892.105 ms
Loss rate: 4.76%
-- Flow 3:
Average throughput: 0.01 Mbit/s
95th percentile per-packet one-way delay: 1892.460 ms
Loss rate: 10.00%
```

## Run 3: Report of Verus — Data Link
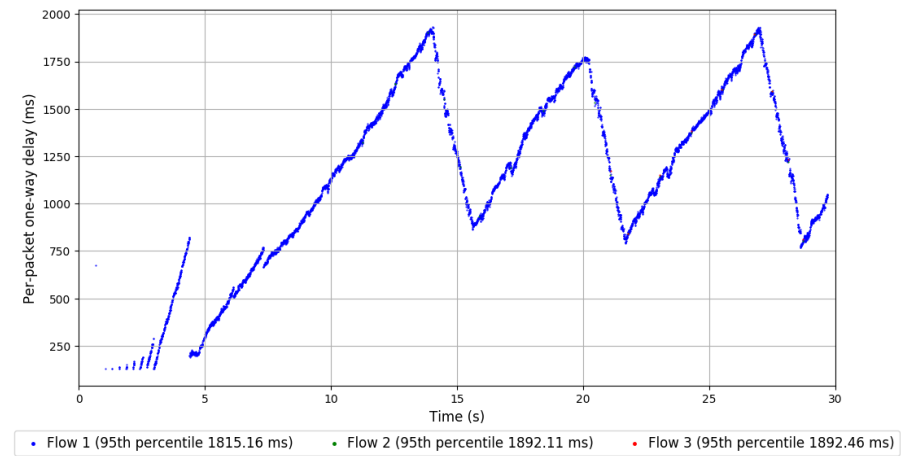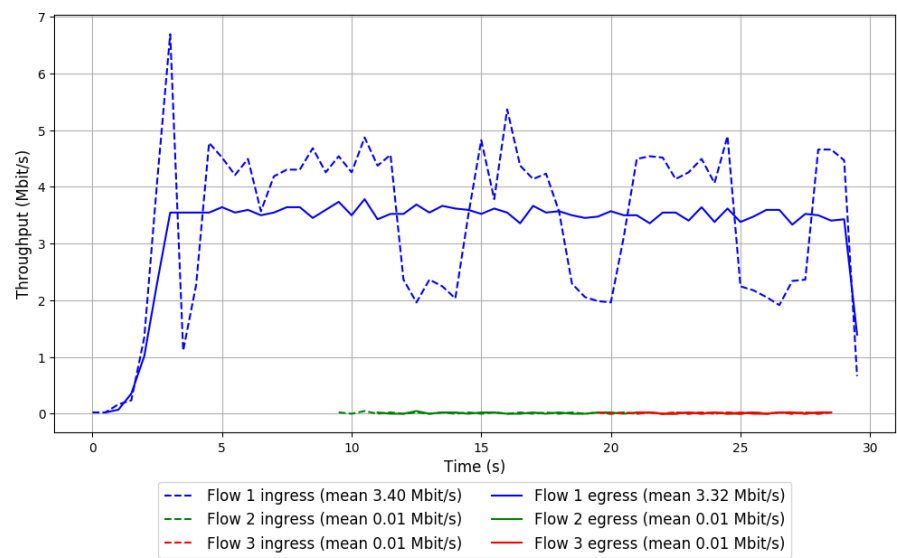
```
Run 1: Statistics of Copa

Start at: 2017-11-30 08:05:35
End at: 2017-11-30 08:06:05
Local clock offset: 2.117 ms
Remote clock offset: -3.433 ms


# Below is generated by plot.py at 2017-11-30 08:46:23
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1.49 Mbit/s
95th percentile per-packet one-way delay: 148.520 ms
Loss rate: 0.41%
-- Flow 1:
Average throughput: 0.06 Mbit/s
95th percentile per-packet one-way delay: 2823.923 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 1.68 Mbit/s
95th percentile per-packet one-way delay: 148.427 ms
Loss rate: 0.26%
-- Flow 3:
Average throughput: 1.04 Mbit/s
95th percentile per-packet one-way delay: 148.520 ms
Loss rate: 0.94%
```

Run 1: Report of Copa — Data Link
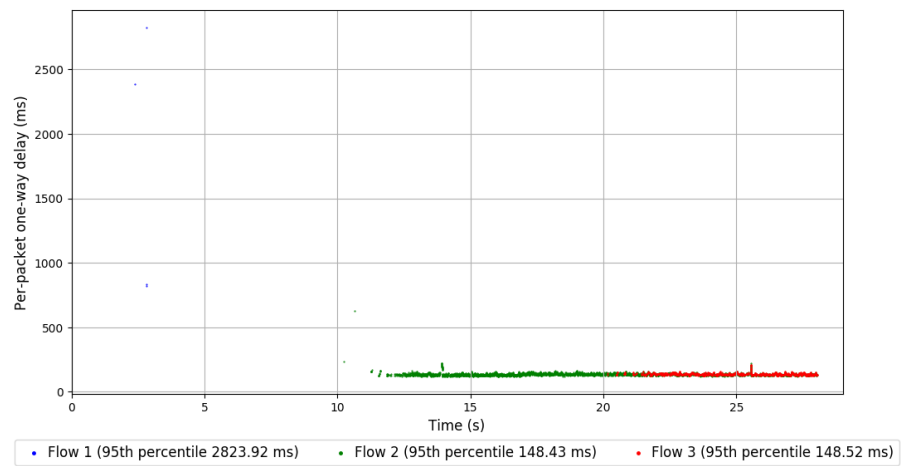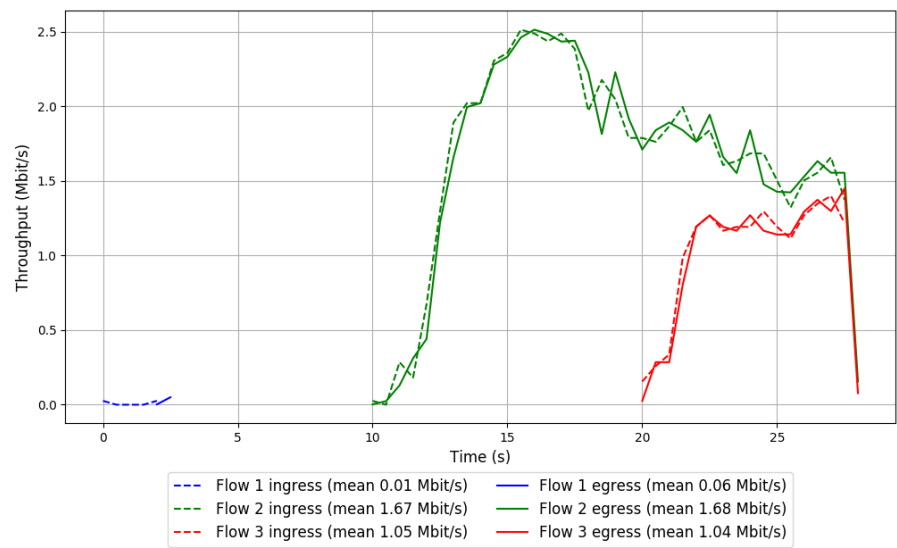
```
Run 2: Statistics of Copa

Start at: 2017-11-30 08:23:06
End at: 2017-11-30 08:23:36
Local clock offset: 1.624 ms
Remote clock offset: -4.128 ms

# Below is generated by plot.py at 2017-11-30 08:46:24
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1.58 Mbit/s
95th percentile per-packet one-way delay: 158.207 ms
Loss rate: 0.38%
-- Flow 1:
Average throughput: 0.06 Mbit/s
95th percentile per-packet one-way delay: 2929.528 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 1.80 Mbit/s
95th percentile per-packet one-way delay: 160.174 ms
Loss rate: 0.16%
-- Flow 3:
Average throughput: 1.04 Mbit/s
95th percentile per-packet one-way delay: 152.117 ms
Loss rate: 1.25%
```
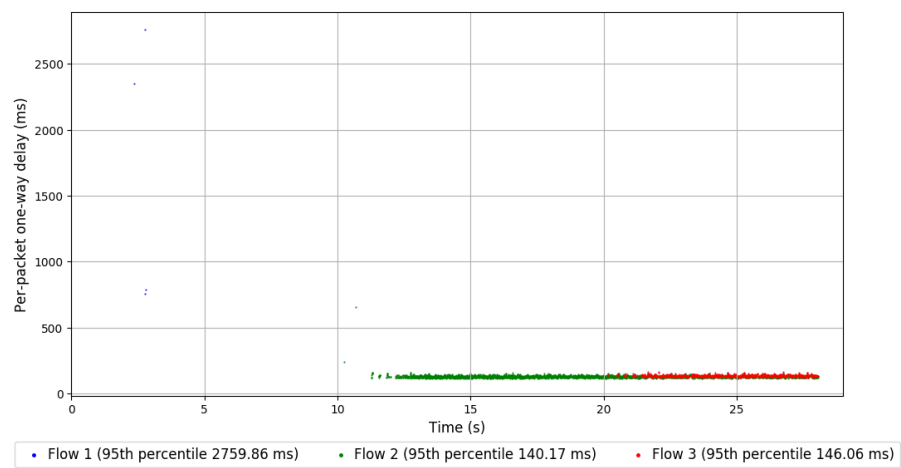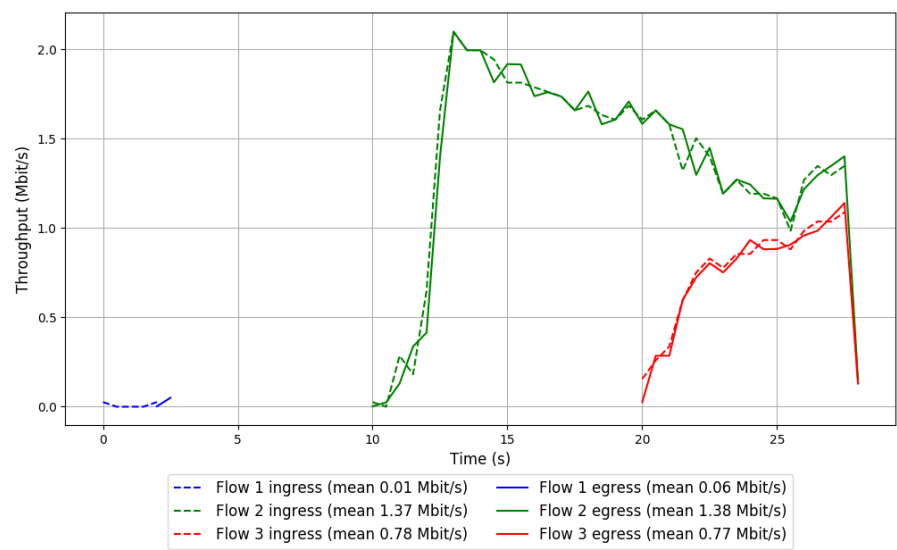
Run 2: Report of Copa — Data Link
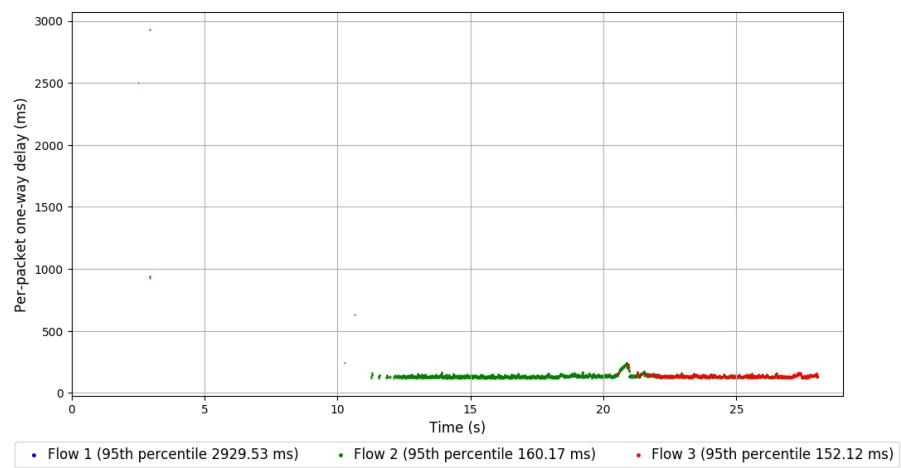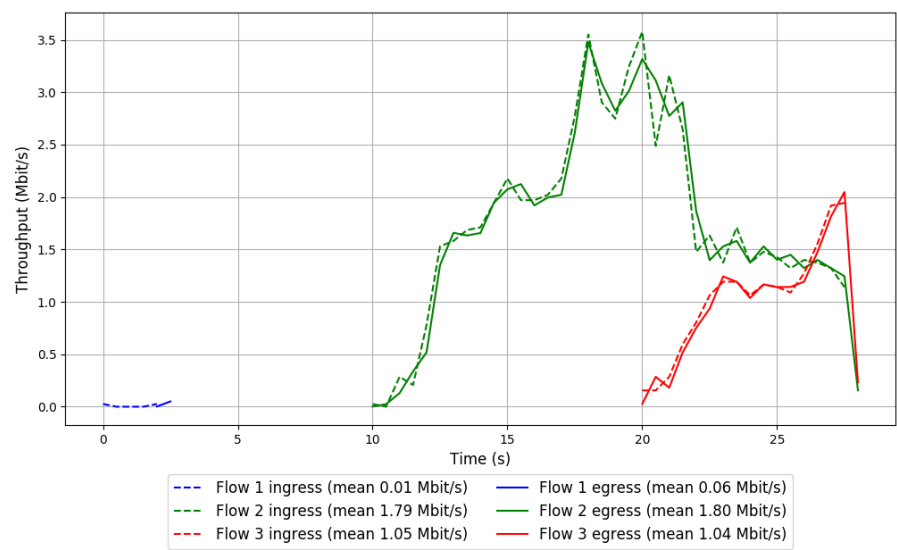
```
Run 3: Statistics of Copa

Start at: 2017-11-30 08:41:52
End at: 2017-11-30 08:42:22
Local clock offset: 1.254 ms
Remote clock offset: -7.985 ms


# Below is generated by plot.py at 2017-11-30 08:46:24
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1.20 Mbit/s
95th percentile per-packet one-way delay: 142.021 ms
Loss rate: 0.42%
-- Flow 1:
Average throughput: 0.06 Mbit/s
95th percentile per-packet one-way delay: 2759.858 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 1.38 Mbit/s
95th percentile per-packet one-way delay: 140.167 ms
Loss rate: 0.26%
-- Flow 3:
Average throughput: 0.77 Mbit/s
95th percentile per-packet one-way delay: 146.063 ms
Loss rate: 1.05%
```

Run 3: Report of Copa — Data Link

- - - Flow 1 ingress (mean 0.01 Mbit/s) ——— Flow 1 egress (mean 0.06 Mbit/s)
- - - Flow 2 ingress (mean 1.37 Mbit/s) ——— Flow 2 egress (mean 1.38 Mbit/s)
- - - Flow 3 ingress (mean 0.78 Mbit/s) ——— Flow 3 egress (mean 0.77 Mbit/s)

• Flow 1 (95th percentile 2759.86 ms)   • Flow 2 (95th percentile 140.17 ms)   • Flow 3 (95th percentile 146.06 ms)
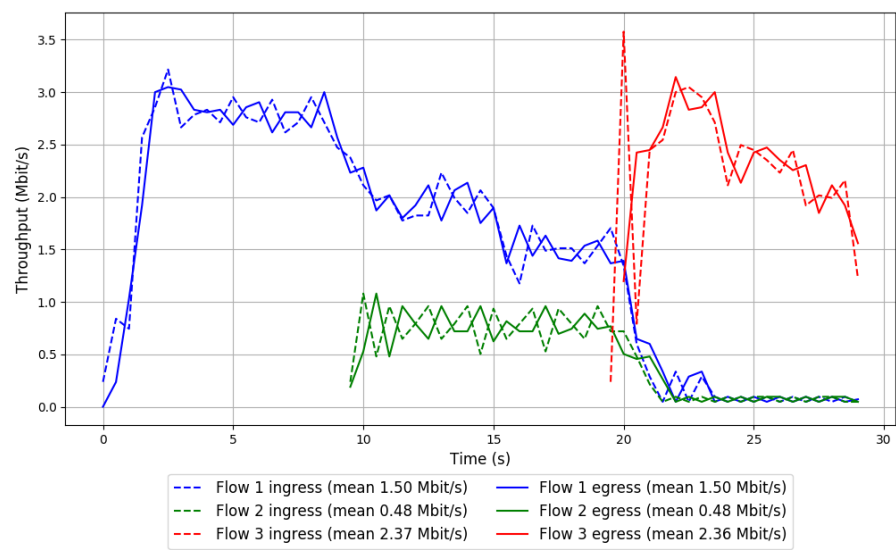
```
Run 1: Statistics of Indigo

Start at: 2017-11-30 07:53:06
End at: 2017-11-30 07:53:36
Local clock offset: 1.867 ms
Remote clock offset: -2.426 ms

# Below is generated by plot.py at 2017-11-30 08:46:24
# Datalink statistics
-- Total of 3 flows:
Average throughput: 2.58 Mbit/s
95th percentile per-packet one-way delay: 269.730 ms
Loss rate: 0.24%
-- Flow 1:
Average throughput: 1.50 Mbit/s
95th percentile per-packet one-way delay: 204.619 ms
Loss rate: 0.03%
-- Flow 2:
Average throughput: 0.48 Mbit/s
95th percentile per-packet one-way delay: 228.398 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 2.36 Mbit/s
95th percentile per-packet one-way delay: 349.460 ms
Loss rate: 0.75%
```

Run 1: Report of Indigo — Data Link
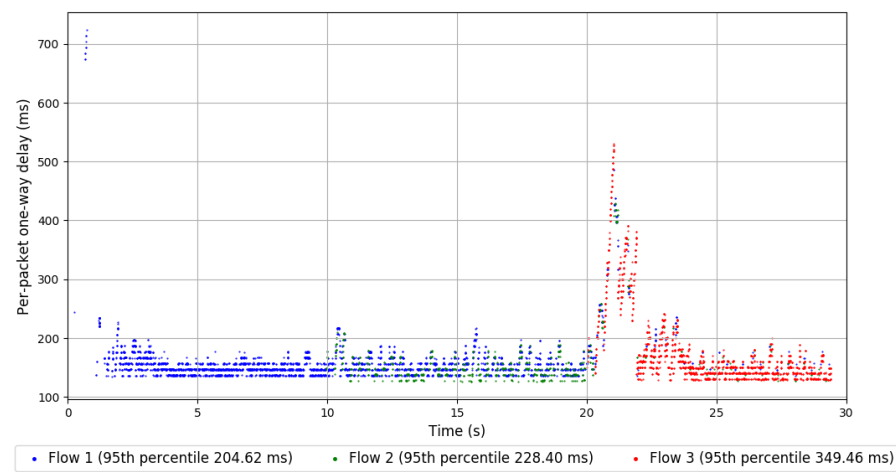
```
Run 2: Statistics of Indigo

Start at: 2017-11-30 08:10:37
End at: 2017-11-30 08:11:07
Local clock offset: 2.008 ms
Remote clock offset: -3.166 ms

# Below is generated by plot.py at 2017-11-30 08:46:24
# Datalink statistics
-- Total of 3 flows:
Average throughput: 2.35 Mbit/s
95th percentile per-packet one-way delay: 180.865 ms
Loss rate: 0.21%
-- Flow 1:
Average throughput: 1.58 Mbit/s
95th percentile per-packet one-way delay: 186.760 ms
Loss rate: 0.08%
-- Flow 2:
Average throughput: 0.79 Mbit/s
95th percentile per-packet one-way delay: 173.856 ms
Loss rate: 0.39%
-- Flow 3:
Average throughput: 0.76 Mbit/s
95th percentile per-packet one-way delay: 178.478 ms
Loss rate: 0.66%
```

# Run 2: Report of Indigo — Data Link
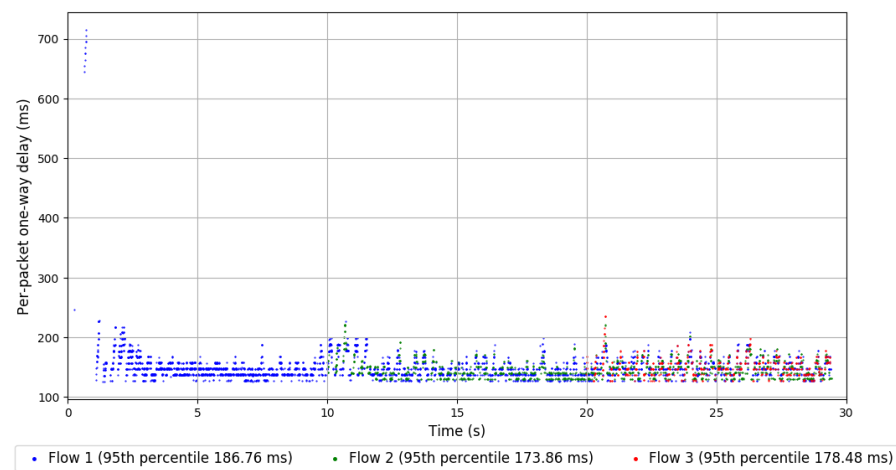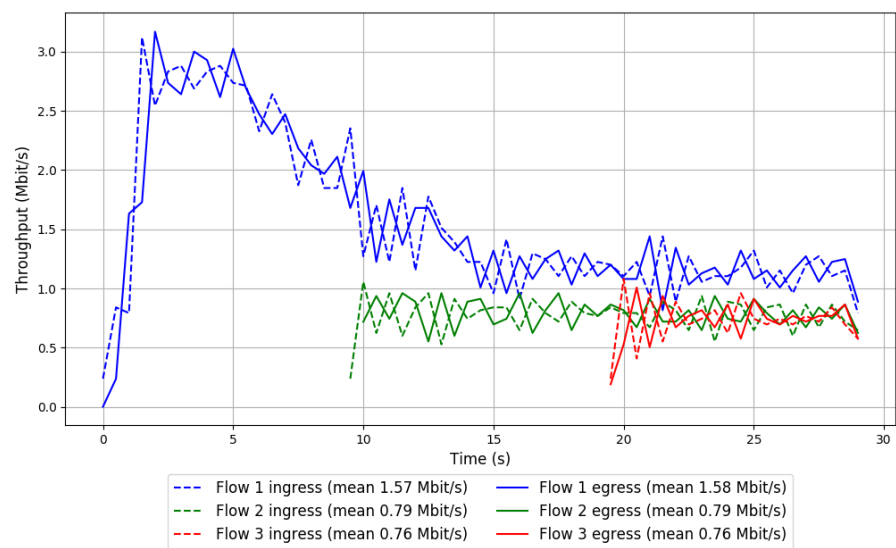
```
Run 3: Statistics of Indigo

Start at: 2017-11-30 08:28:44
End at: 2017-11-30 08:29:14
Local clock offset: 1.473 ms
Remote clock offset: -8.917 ms


# Below is generated by plot.py at 2017-11-30 08:46:25
# Datalink statistics
-- Total of 3 flows:
Average throughput: 2.29 Mbit/s
95th percentile per-packet one-way delay: 170.413 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 1.59 Mbit/s
95th percentile per-packet one-way delay: 170.543 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 0.82 Mbit/s
95th percentile per-packet one-way delay: 169.005 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 0.44 Mbit/s
95th percentile per-packet one-way delay: 178.910 ms
Loss rate: 0.00%
```

Run 3: Report of Indigo — Data Link
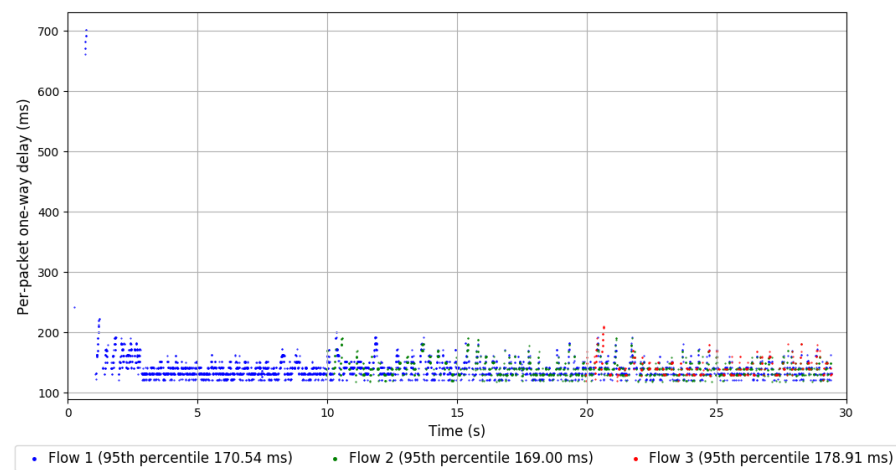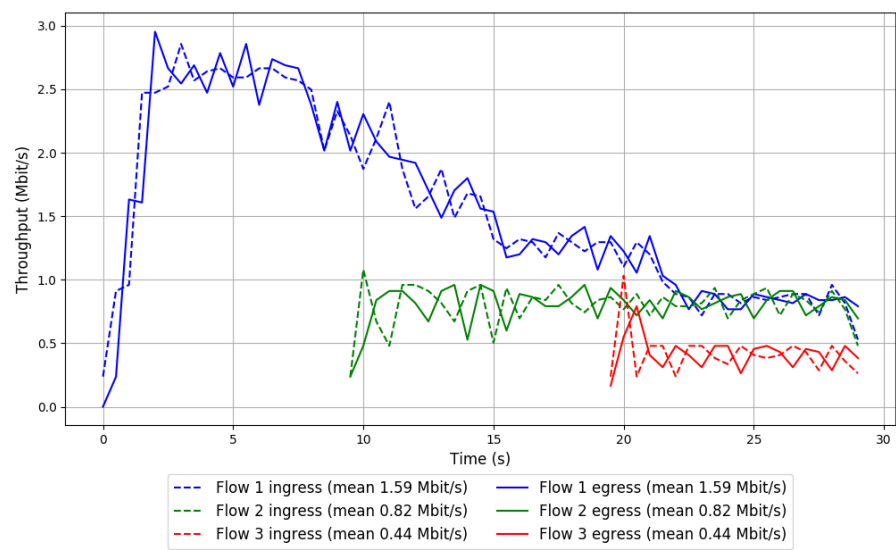
```
Run 1: Statistics of Indigo-calib

Start at: 2017-11-30 07:56:51
End at: 2017-11-30 07:57:21
Local clock offset: 2.06 ms
Remote clock offset: -2.408 ms


# Below is generated by plot.py at 2017-11-30 08:46:25
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1.19 Mbit/s
95th percentile per-packet one-way delay: 313.768 ms
Loss rate: 0.41%
-- Flow 1:
Average throughput: 0.56 Mbit/s
95th percentile per-packet one-way delay: 323.493 ms
Loss rate: 0.51%
-- Flow 2:
Average throughput: 0.68 Mbit/s
95th percentile per-packet one-way delay: 334.385 ms
Loss rate: 0.18%
-- Flow 3:
Average throughput: 0.61 Mbit/s
95th percentile per-packet one-way delay: 214.093 ms
Loss rate: 0.66%
```

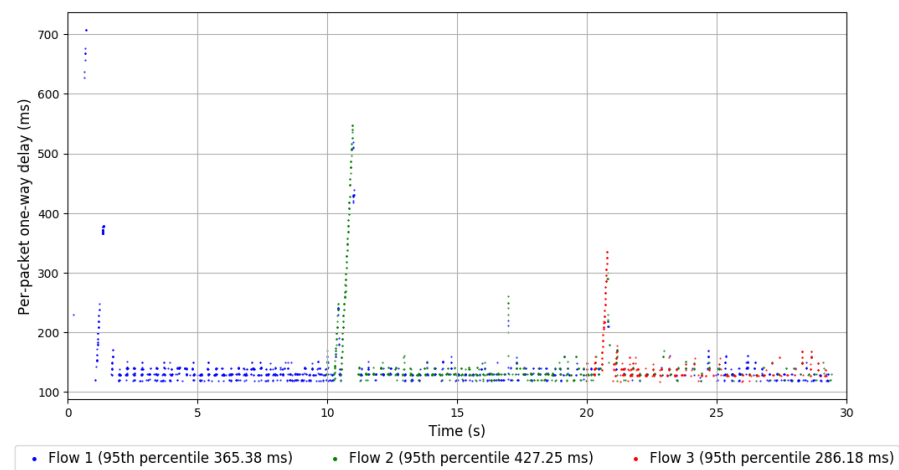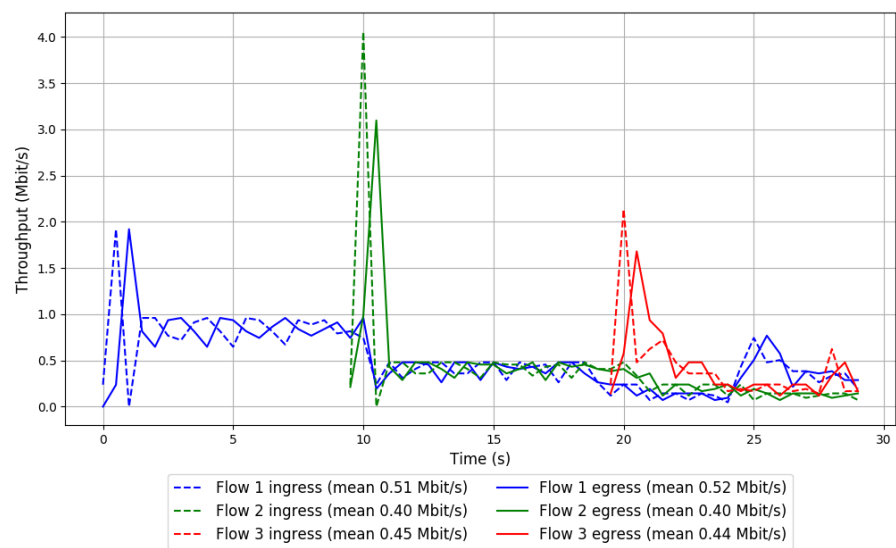Run 1: Report of Indigo-calib — Data Link
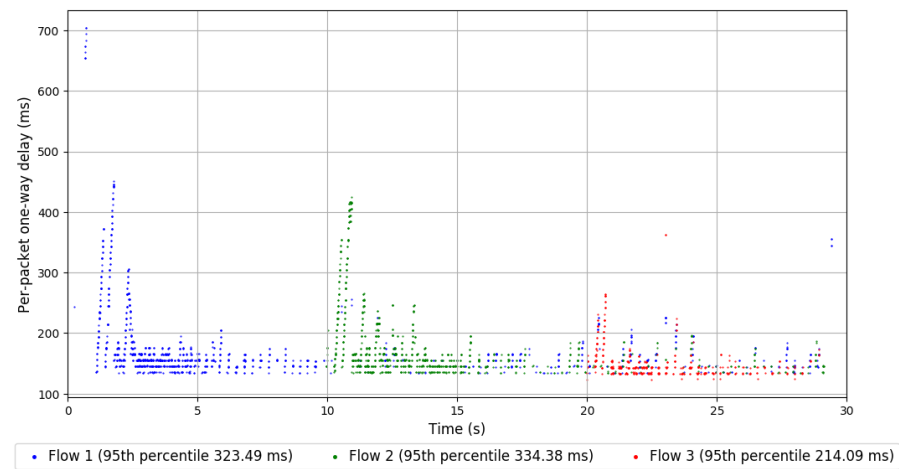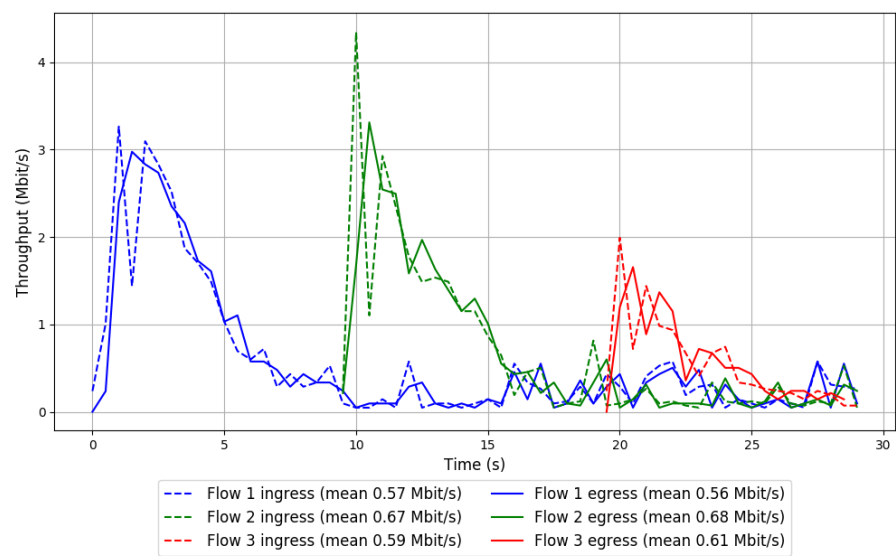
```
Run 2: Statistics of Indigo-calib

Start at: 2017-11-30 08:14:22
End at: 2017-11-30 08:14:52
Local clock offset: 1.869 ms
Remote clock offset: -7.601 ms

# Below is generated by plot.py at 2017-11-30 08:46:25
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.92 Mbit/s
95th percentile per-packet one-way delay: 365.801 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 0.52 Mbit/s
95th percentile per-packet one-way delay: 365.382 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 0.40 Mbit/s
95th percentile per-packet one-way delay: 427.253 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 0.44 Mbit/s
95th percentile per-packet one-way delay: 286.182 ms
Loss rate: 0.00%
```

Run 2: Report of Indigo-calib — Data Link

```
Run 3: Statistics of Indigo-calib

Start at: 2017-11-30 08:32:29
End at: 2017-11-30 08:32:59
Local clock offset: 1.411 ms
Remote clock offset: -8.149 ms


# Below is generated by plot.py at 2017-11-30 08:46:25
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1.48 Mbit/s
95th percentile per-packet one-way delay: 306.219 ms
Loss rate: 0.14%
-- Flow 1:
Average throughput: 0.74 Mbit/s
95th percentile per-packet one-way delay: 305.623 ms
Loss rate: 0.28%
-- Flow 2:
Average throughput: 0.52 Mbit/s
95th percentile per-packet one-way delay: 264.625 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 1.25 Mbit/s
95th percentile per-packet one-way delay: 345.686 ms
Loss rate: 0.00%
```

Run 3: Report of Indigo-calib — Data Link