Pantheon Summary (Generated at Mon, 10 Jul 2017 22:22:28 +0000 with pantheon version `c3610718e2bbac84102e8ac47b889a75d4392d79`)

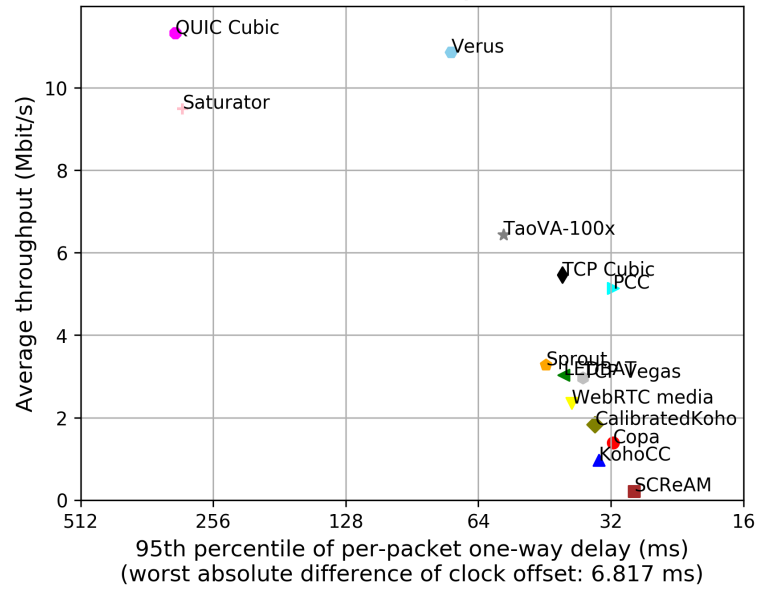Repeated the test of 15 congestion control schemes once.

Each test lasted for 30 seconds running 1 flow.

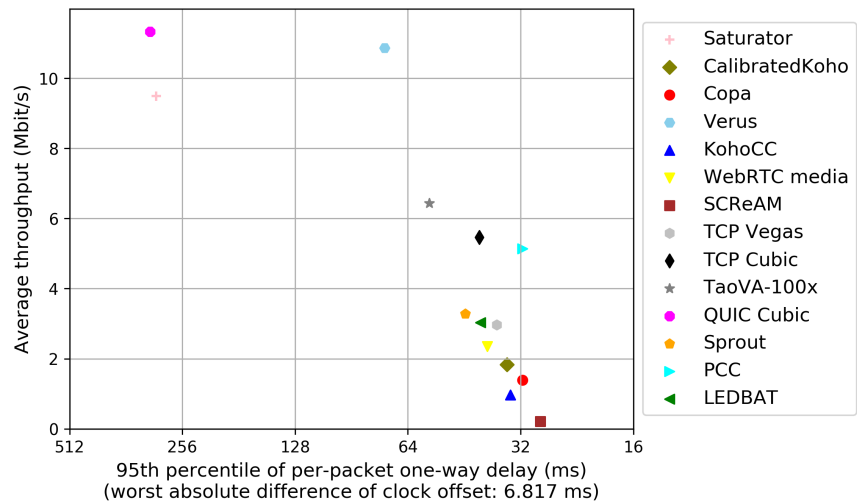Data path **from** Brazil ppp0 **to** AWS Brazil 1 Ethernet.

NTP offset measured against gps.ntp.br.

```
git branch: master @ c3610718e2bbac84102e8ac47b889a75d4392d79
third_party/calibrated_koho @ 3cb73c0d1c0322cdfae446ea37a522e53227db50
 M datagrump/sender.cc
third_party/genericCC @ dae96123232f1bcb37725348fa2378691ce26725
third_party/koho_cc @ f0f2e693303aee82ea808e6928eac4f1083a6681
 M datagrump/sender.cc
third_party/libutp @ b3465b942e2826f2b179eaab4a906ce6bb7cf3cf
third_party/pantheon-stimuli @ fc73a85ca16c34366d1888dc8a0d0d88d4ebf2a7
third_party/pantheon-tunnel @ c792f8e8e0704b1646a0e024766675d8e9a835f1
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 Brazil ppp0 to AWS Brazil 1 Ethernet, 1 run of 30s each per scheme
(mean of all runs by scheme)

Average throughput (Mbit/s)

QUIC Cubic
Verus
Saturator
TaoVA-100x
TCP Cubic
PCC
Sprout
LEDBAT Vegas
WebRTC media
CalibratedKoho
Copa
KohoCC
SCReAM

95th percentile of per-packet one-way delay (ms)
(worst absolute difference of clock offset: 6.817 ms)

test from Brazil ppp0 to AWS Brazil 1 Ethernet, 1 run of 30s each per scheme

Average throughput (Mbit/s)

Legend:
- Saturator
- CalibratedKoho
- Copa
- Verus
- KohoCC
- WebRTC media
- SCReAM
- TCP Vegas
- TCP Cubic
- TaoVA-100x
- QUIC Cubic
- Sprout
- PCC
- LEDBAT

95th percentile of per-packet one-way delay (ms)
(worst absolute difference of clock offset: 6.817 ms)

2

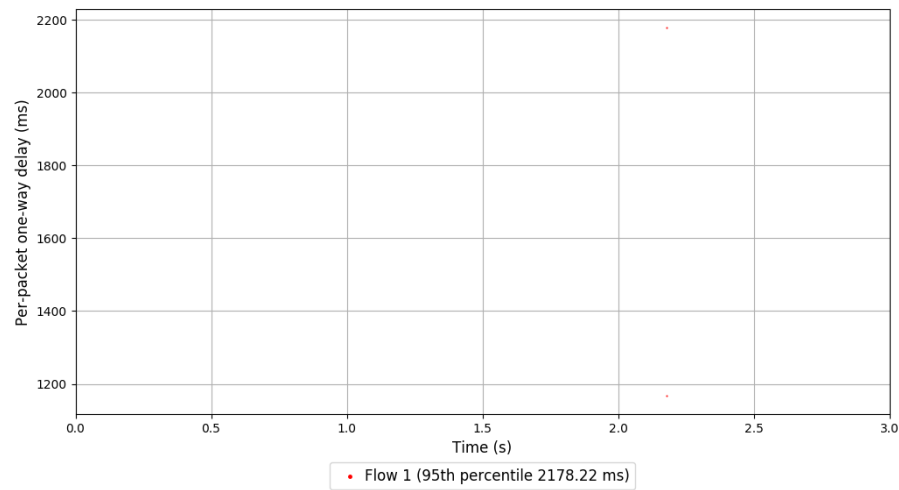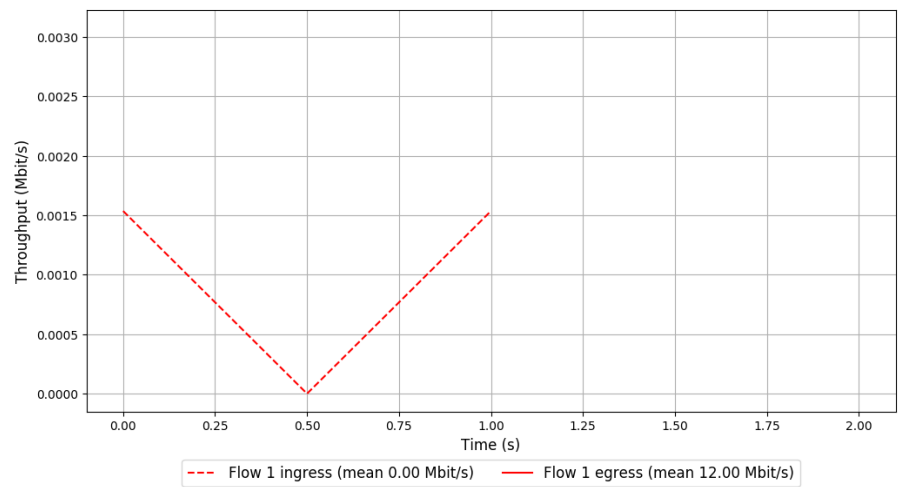| scheme	# runs	mean avg tput (Mbit/s) flow 1	mean 95th-%ile delay (ms) flow 1	mean loss rate (%) flow 1
TCP BBR	1	nan	nan	nan
CalibratedKoho	1	1.83	34.76	0.13
Copa	1	1.39	31.64	0.03
TCP Cubic	1	5.46	41.28	1.06
KohoCC	1	0.97	34.11	0.25
LEDBAT	1	3.04	40.95	1.80
PCC	1	5.14	31.60	0.18
QUIC Cubic	1	11.33	311.98	2.23
Saturator	1	9.50	300.65	6.17
SCReAM	1	0.21	28.36	0.00
Sprout	1	3.28	44.92	21.93
TaoVA-100x	1	6.44	56.15	0.36
TCP Vegas	1	2.97	37.03	0.19
Verus	1	10.87	73.77	8.22
WebRTC media	1	2.35	39.25	0.20

Run 1: Statistics of TCP BBR

Start at: Mon, 10 Jul 2017 22:14:21 +0000
End at: Mon, 10 Jul 2017 22:14:51 +0000
Local clock offset: -1.876 ms
Remote clock offset: -0.091 ms

Run 1: Report of TCP BBR — Data Link

Flow 1 ingress (mean 0.00 Mbit/s)   Flow 1 egress (mean 12.00 Mbit/s)

• Flow 1 (95th percentile 2178.22 ms)

```
Run 1: Statistics of CalibratedKoho

Start at: Mon, 10 Jul 2017 22:10:05 +0000
End at: Mon, 10 Jul 2017 22:10:35 +0000
Local clock offset: -2.037 ms
Remote clock offset: -0.141 ms


# Below is generated by plot.py at Mon, 10 Jul 2017 22:22:14 +0000
# Datalink statistics
-- Total of 1 flow:
Average throughput: 1.83 Mbit/s
95th percentile per-packet one-way delay: 34.759 ms
Loss rate: 0.13%
-- Flow 1:
Average throughput: 1.83 Mbit/s
95th percentile per-packet one-way delay: 34.759 ms
Loss rate: 0.13%
```
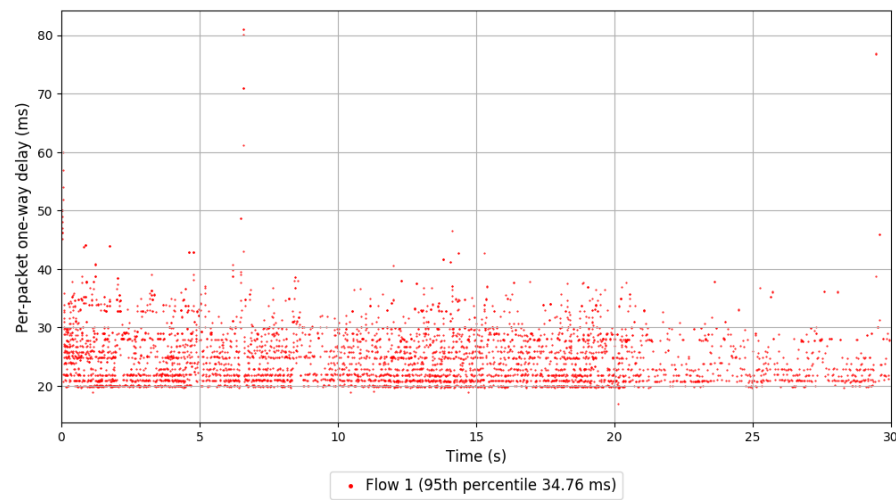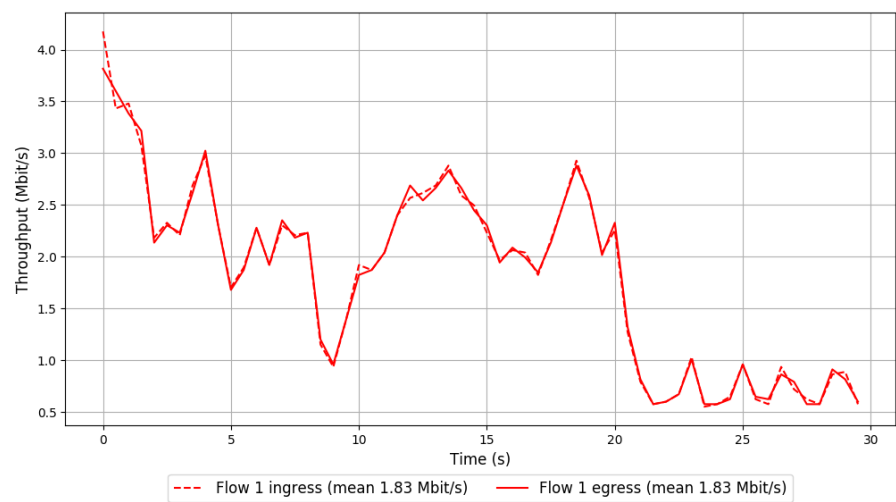
Run 1: Report of CalibratedKoho — Data Link

Flow 1 ingress (mean 1.83 Mbit/s) ---- Flow 1 egress (mean 1.83 Mbit/s)

• Flow 1 (95th percentile 34.76 ms)

```
Run 1: Statistics of Copa

Start at: Mon, 10 Jul 2017 22:19:41 +0000
End at: Mon, 10 Jul 2017 22:20:11 +0000
Local clock offset: -1.826 ms
Remote clock offset: -0.179 ms


# Below is generated by plot.py at Mon, 10 Jul 2017 22:22:15 +0000
# Datalink statistics
-- Total of 1 flow:
Average throughput: 1.39 Mbit/s
95th percentile per-packet one-way delay: 31.640 ms
Loss rate: 0.03%
-- Flow 1:
Average throughput: 1.39 Mbit/s
95th percentile per-packet one-way delay: 31.640 ms
Loss rate: 0.03%
```
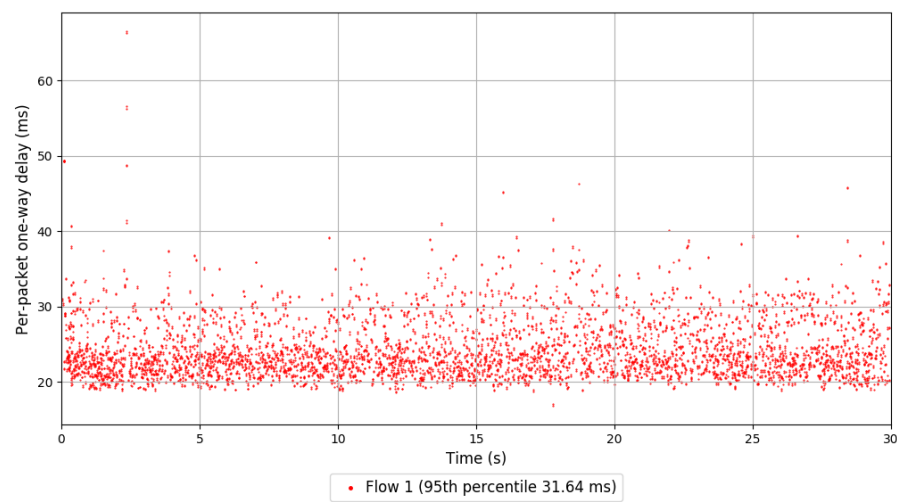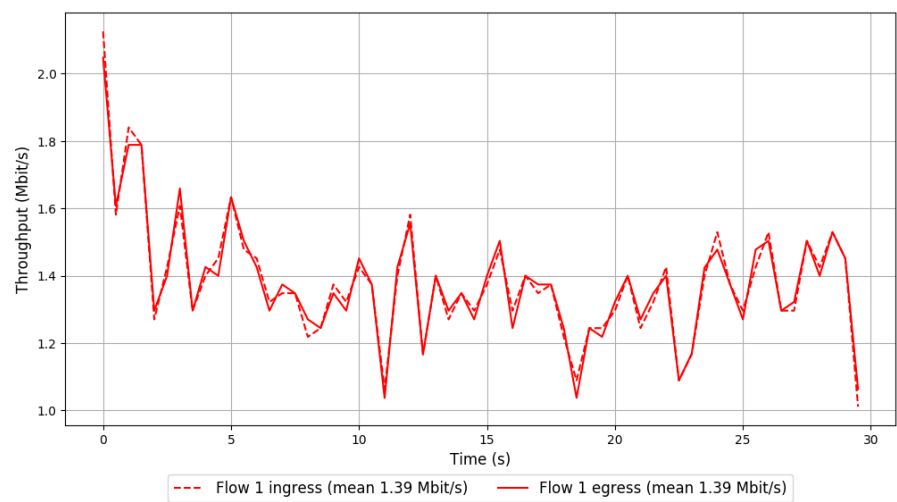
Run 1: Report of Copa — Data Link

Flow 1 ingress (mean 1.39 Mbit/s)   Flow 1 egress (mean 1.39 Mbit/s)

• Flow 1 (95th percentile 31.64 ms)

9

```
Run 1: Statistics of TCP Cubic

Start at: Mon, 10 Jul 2017 22:05:48 +0000
End at: Mon, 10 Jul 2017 22:06:18 +0000
Local clock offset: -1.98 ms
Remote clock offset: -0.174 ms


# Below is generated by plot.py at Mon, 10 Jul 2017 22:22:17 +0000
# Datalink statistics
-- Total of 1 flow:
Average throughput: 5.46 Mbit/s
95th percentile per-packet one-way delay: 41.279 ms
Loss rate: 1.06%
-- Flow 1:
Average throughput: 5.46 Mbit/s
95th percentile per-packet one-way delay: 41.279 ms
Loss rate: 1.06%
```
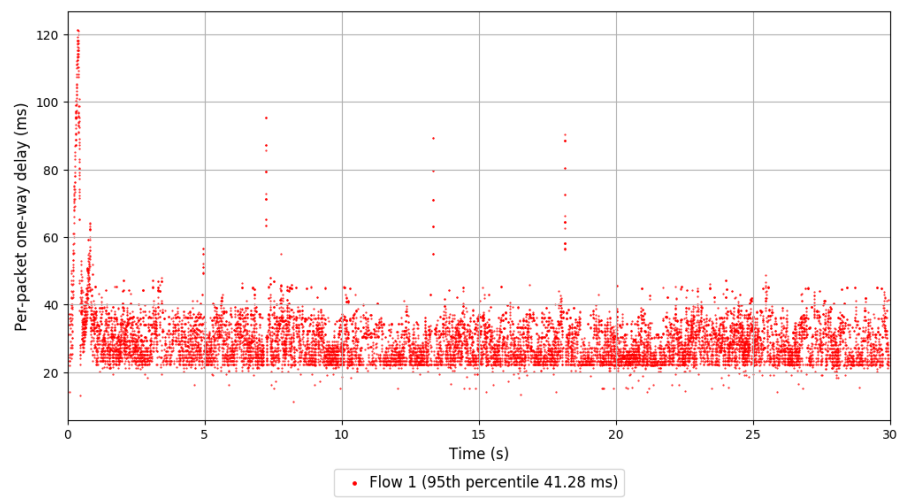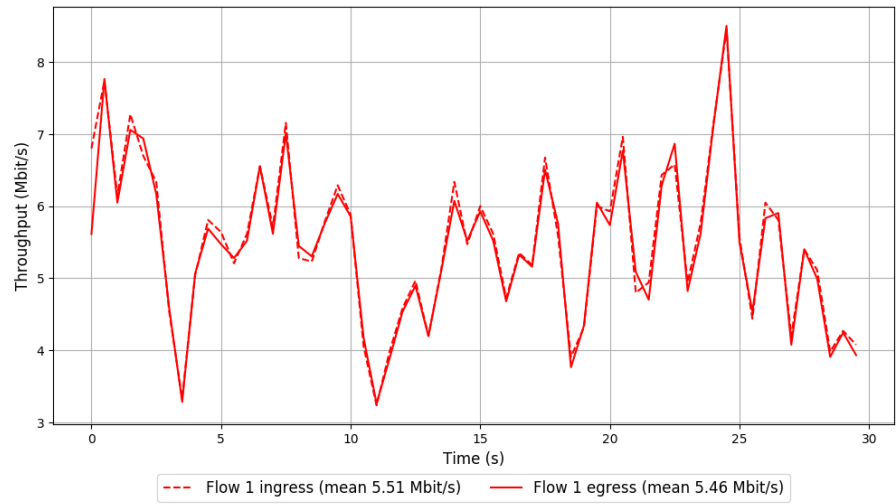
Run 1: Report of TCP Cubic — Data Link

```
Run 1: Statistics of KohoCC

Start at: Mon, 10 Jul 2017 22:12:13 +0000
End at: Mon, 10 Jul 2017 22:12:43 +0000
Local clock offset: -1.889 ms
Remote clock offset: -0.112 ms


# Below is generated by plot.py at Mon, 10 Jul 2017 22:22:17 +0000
# Datalink statistics
-- Total of 1 flow:
Average throughput: 0.97 Mbit/s
95th percentile per-packet one-way delay: 34.107 ms
Loss rate: 0.25%
-- Flow 1:
Average throughput: 0.97 Mbit/s
95th percentile per-packet one-way delay: 34.107 ms
Loss rate: 0.25%
```
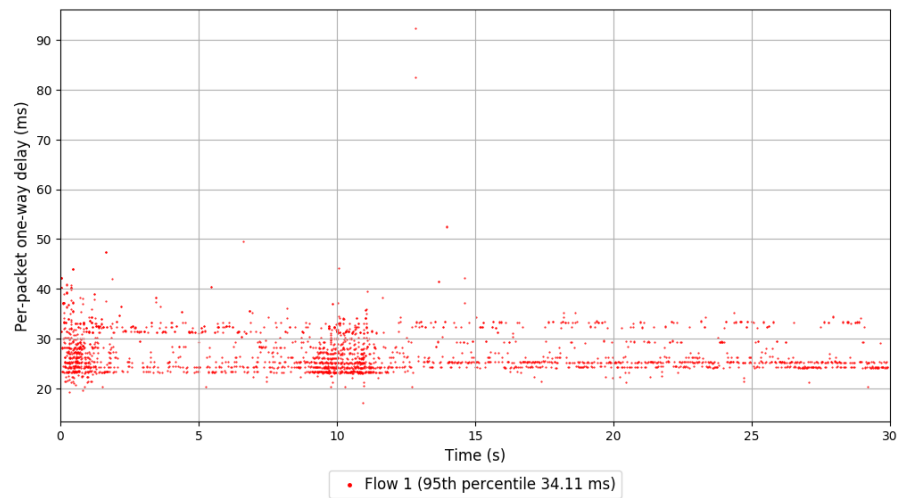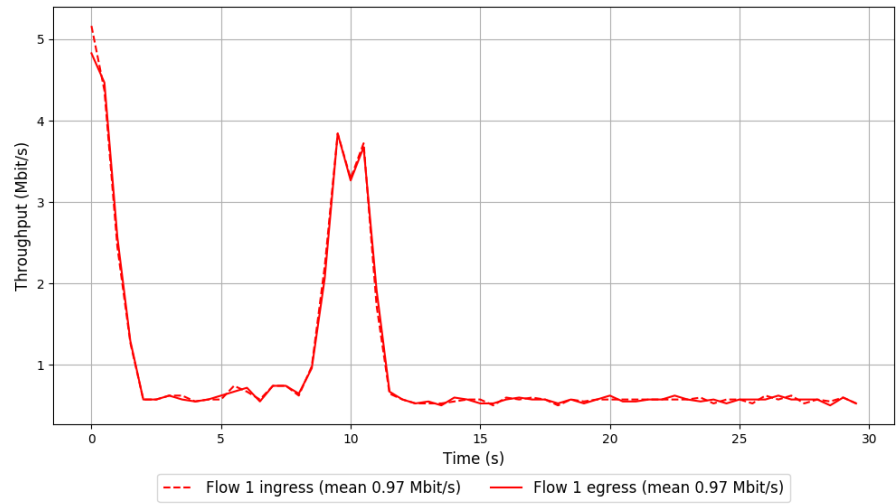
Run 1: Report of KohoCC — Data Link

```
Run 1: Statistics of LEDBAT

Start at: Mon, 10 Jul 2017 22:18:37 +0000
End at: Mon, 10 Jul 2017 22:19:07 +0000
Local clock offset: -1.828 ms
Remote clock offset: -0.064 ms


# Below is generated by plot.py at Mon, 10 Jul 2017 22:22:17 +0000
# Datalink statistics
-- Total of 1 flow:
Average throughput: 3.04 Mbit/s
95th percentile per-packet one-way delay: 40.948 ms
Loss rate: 1.80%
-- Flow 1:
Average throughput: 3.04 Mbit/s
95th percentile per-packet one-way delay: 40.948 ms
Loss rate: 1.80%
```
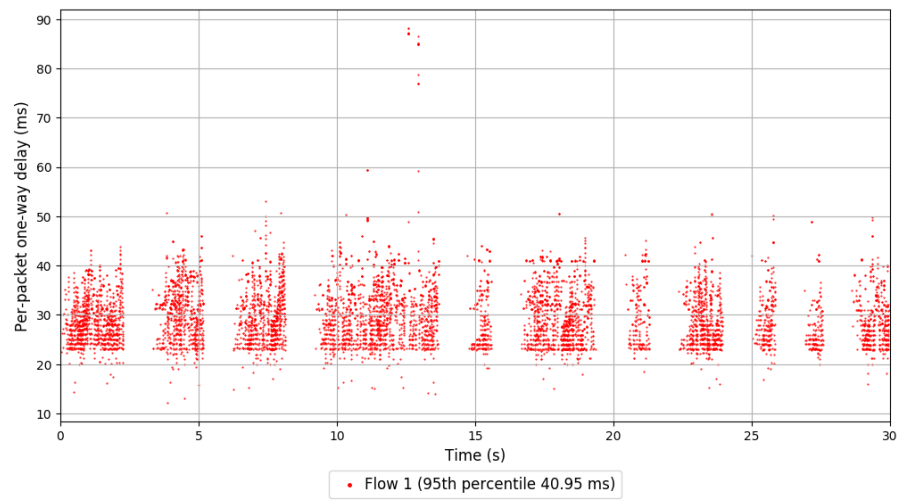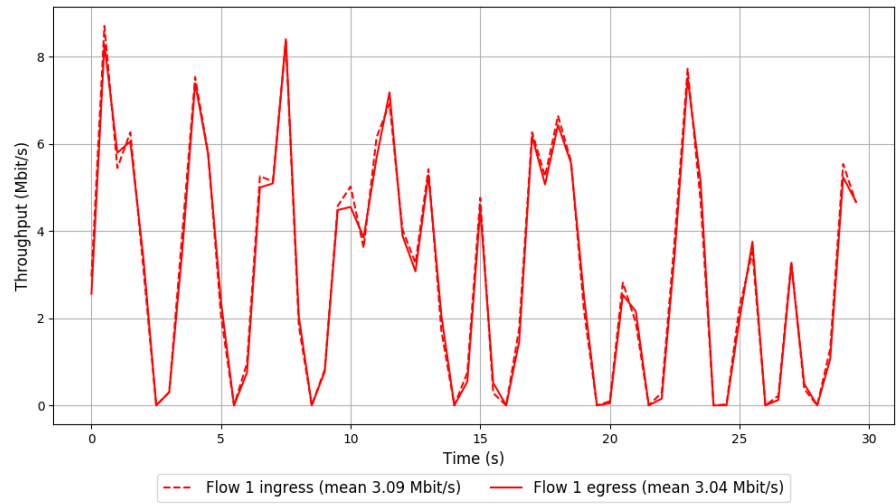
Run 1: Report of LEDBAT — Data Link

```
Run 1: Statistics of PCC

Start at: Mon, 10 Jul 2017 22:15:25 +0000
End at: Mon, 10 Jul 2017 22:15:55 +0000
Local clock offset: -1.868 ms
Remote clock offset: -0.096 ms


# Below is generated by plot.py at Mon, 10 Jul 2017 22:22:19 +0000
# Datalink statistics
-- Total of 1 flow:
Average throughput: 5.14 Mbit/s
95th percentile per-packet one-way delay: 31.598 ms
Loss rate: 0.18%
-- Flow 1:
Average throughput: 5.14 Mbit/s
95th percentile per-packet one-way delay: 31.598 ms
Loss rate: 0.18%
```
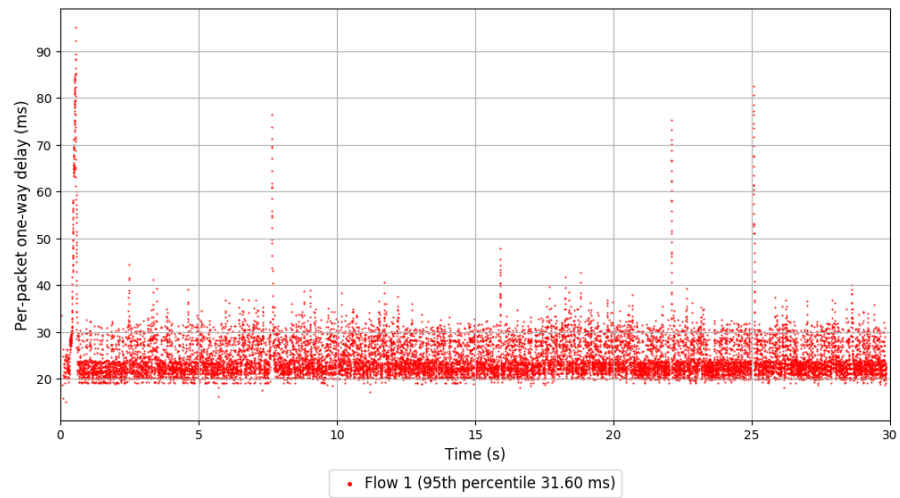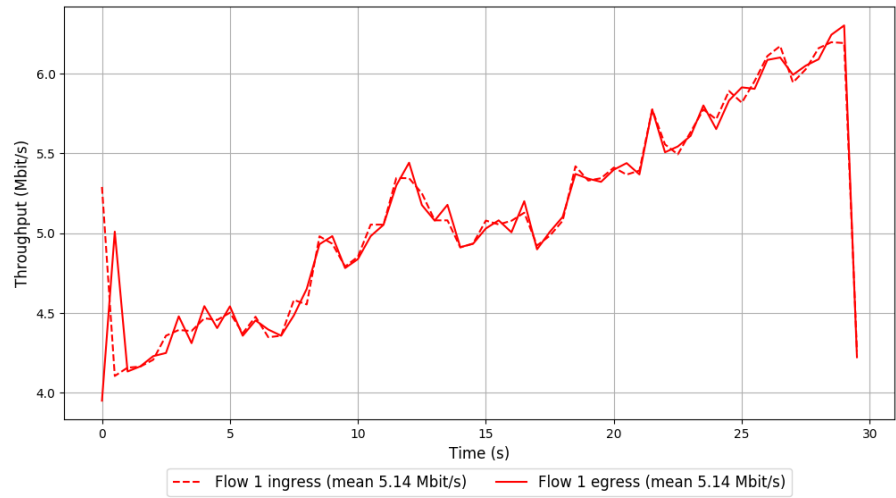
Run 1: Report of PCC — Data Link

```
Run 1: Statistics of QUIC Cubic

Start at: Mon, 10 Jul 2017 22:07:57 +0000
End at: Mon, 10 Jul 2017 22:08:27 +0000
Local clock offset: -2.047 ms
Remote clock offset: -8.864 ms


# Below is generated by plot.py at Mon, 10 Jul 2017 22:22:20 +0000
# Datalink statistics
-- Total of 1 flow:
Average throughput: 11.33 Mbit/s
95th percentile per-packet one-way delay: 311.982 ms
Loss rate: 2.23%
-- Flow 1:
Average throughput: 11.33 Mbit/s
95th percentile per-packet one-way delay: 311.982 ms
Loss rate: 2.23%
```
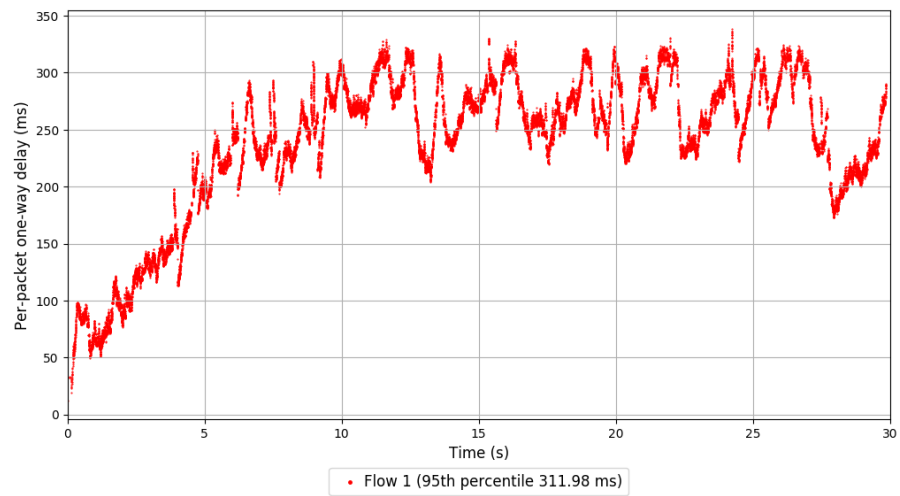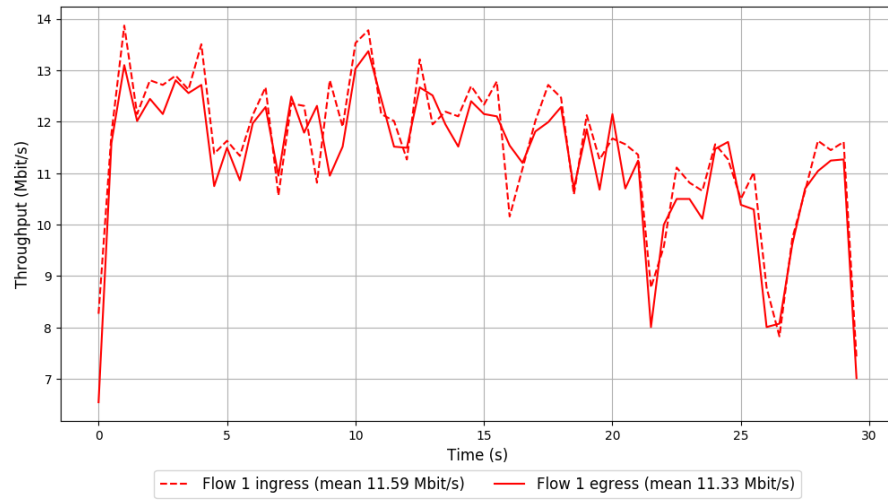
Run 1: Report of QUIC Cubic — Data Link

- - - Flow 1 ingress (mean 11.59 Mbit/s) —— Flow 1 egress (mean 11.33 Mbit/s)

· Flow 1 (95th percentile 311.98 ms)

```
Run 1: Statistics of Saturator

Start at: Mon, 10 Jul 2017 22:06:52 +0000
End at: Mon, 10 Jul 2017 22:07:22 +0000
Local clock offset: -2.063 ms
Remote clock offset: -0.181 ms


# Below is generated by plot.py at Mon, 10 Jul 2017 22:22:21 +0000
# Datalink statistics
-- Total of 1 flow:
Average throughput: 9.50 Mbit/s
95th percentile per-packet one-way delay: 300.646 ms
Loss rate: 6.17%
-- Flow 1:
Average throughput: 9.50 Mbit/s
95th percentile per-packet one-way delay: 300.646 ms
Loss rate: 6.17%
```
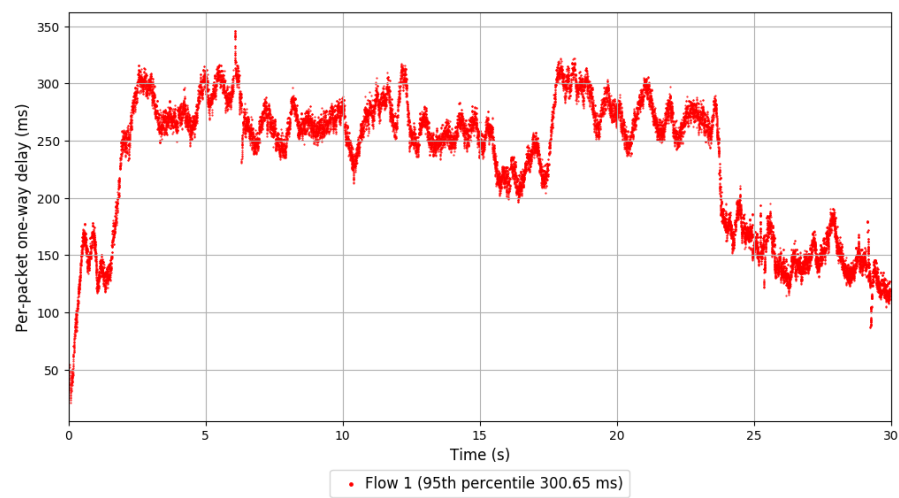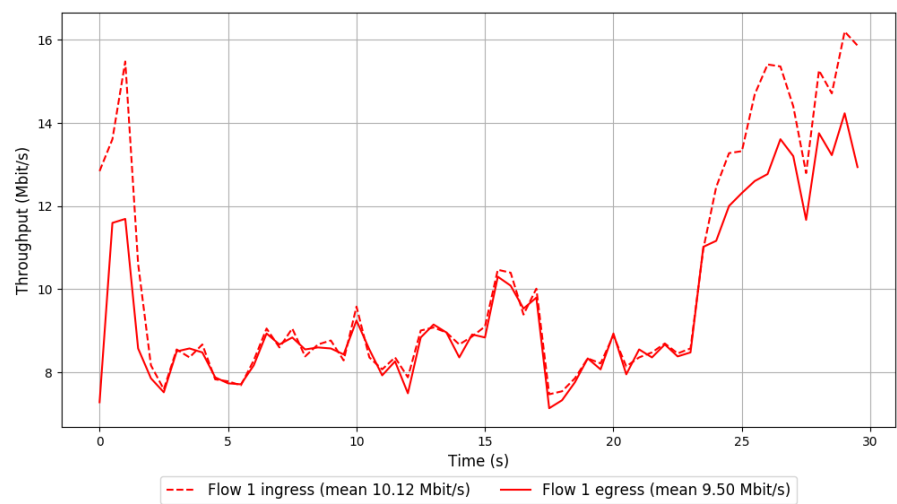
Run 1: Report of Saturator — Data Link

Flow 1 ingress (mean 10.12 Mbit/s) — — —   Flow 1 egress (mean 9.50 Mbit/s) ———

• Flow 1 (95th percentile 300.65 ms)

```
Run 1: Statistics of SCReAM

Start at: Mon, 10 Jul 2017 22:11:09 +0000
End at: Mon, 10 Jul 2017 22:11:39 +0000
Local clock offset: -1.931 ms
Remote clock offset: -0.119 ms


# Below is generated by plot.py at Mon, 10 Jul 2017 22:22:21 +0000
# Datalink statistics
-- Total of 1 flow:
Average throughput: 0.21 Mbit/s
95th percentile per-packet one-way delay: 28.355 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 0.21 Mbit/s
95th percentile per-packet one-way delay: 28.355 ms
Loss rate: 0.00%
```
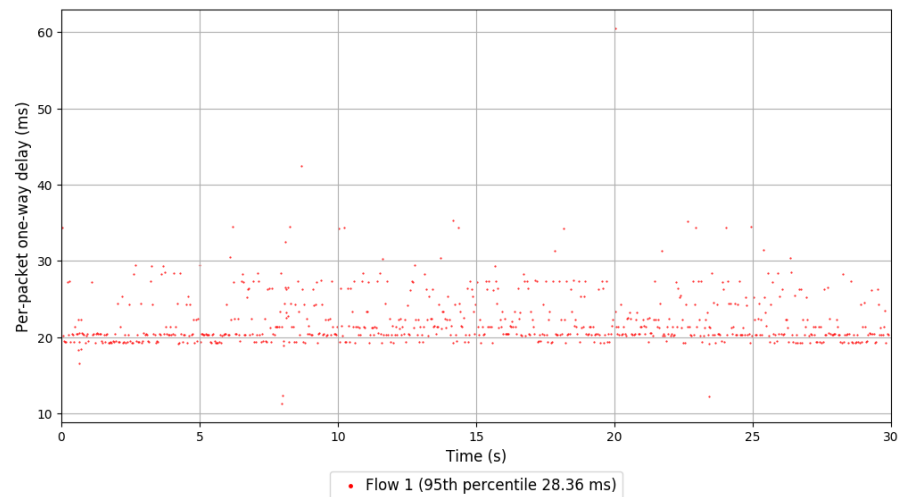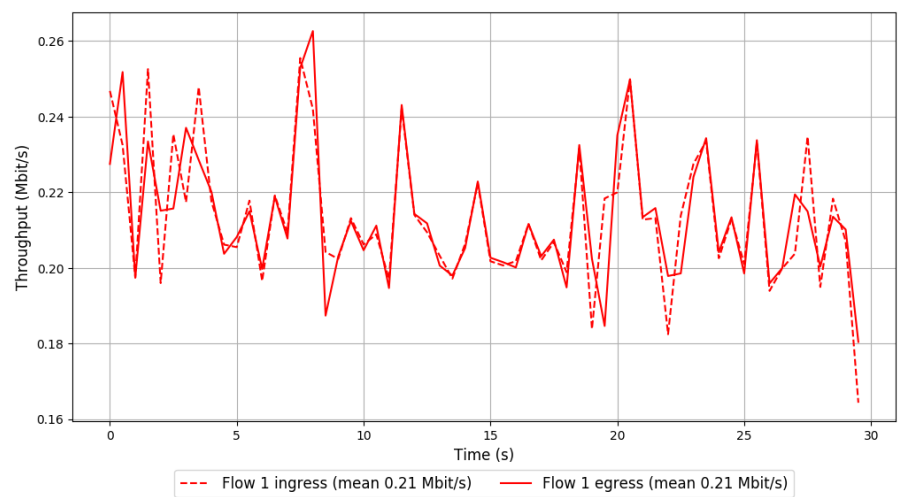
Run 1: Report of SCReAM — Data Link

```
Run 1: Statistics of Sprout

Start at: Mon, 10 Jul 2017 22:13:17 +0000
End at: Mon, 10 Jul 2017 22:13:47 +0000
Local clock offset: -1.911 ms
Remote clock offset: -0.104 ms


# Below is generated by plot.py at Mon, 10 Jul 2017 22:22:23 +0000
# Datalink statistics
-- Total of 1 flow:
Average throughput: 3.28 Mbit/s
95th percentile per-packet one-way delay: 44.921 ms
Loss rate: 21.93%
-- Flow 1:
Average throughput: 3.28 Mbit/s
95th percentile per-packet one-way delay: 44.921 ms
Loss rate: 21.93%
```
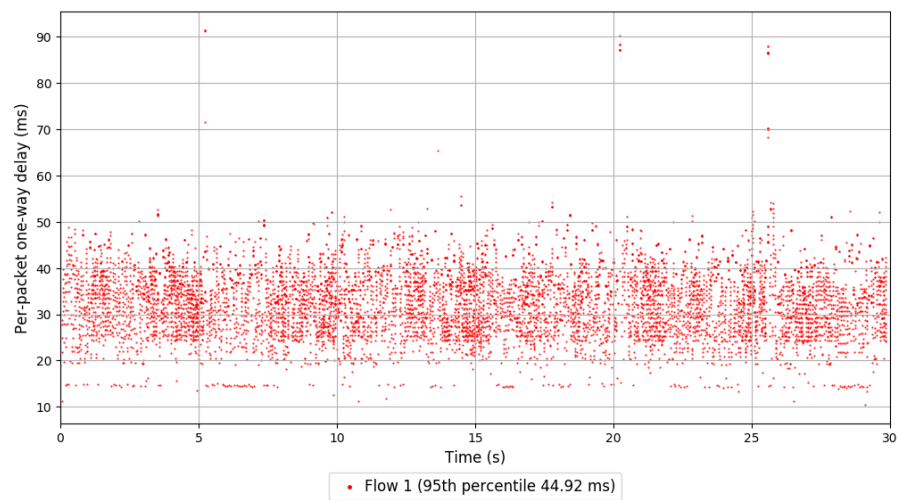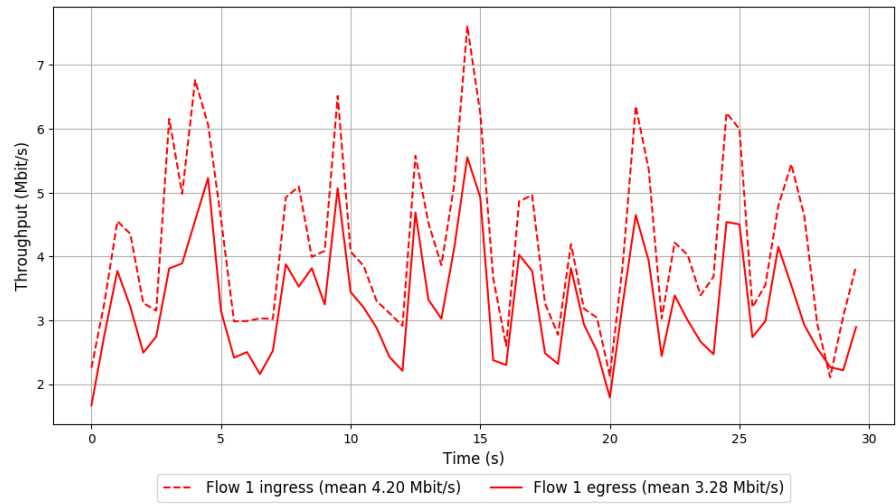
Run 1: Report of Sprout — Data Link

Flow 1 ingress (mean 4.20 Mbit/s) --- Flow 1 egress (mean 3.28 Mbit/s)

• Flow 1 (95th percentile 44.92 ms)

```
Run 1: Statistics of TaoVA-100x

Start at: Mon, 10 Jul 2017 22:20:45 +0000
End at: Mon, 10 Jul 2017 22:21:15 +0000
Local clock offset: -1.81 ms
Remote clock offset: -0.072 ms


# Below is generated by plot.py at Mon, 10 Jul 2017 22:22:24 +0000
# Datalink statistics
-- Total of 1 flow:
Average throughput: 6.44 Mbit/s
95th percentile per-packet one-way delay: 56.147 ms
Loss rate: 0.36%
-- Flow 1:
Average throughput: 6.44 Mbit/s
95th percentile per-packet one-way delay: 56.147 ms
Loss rate: 0.36%
```
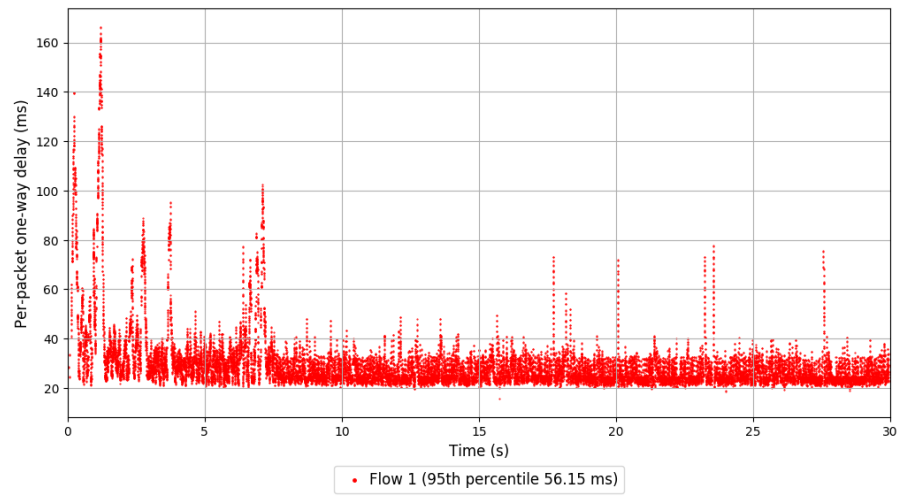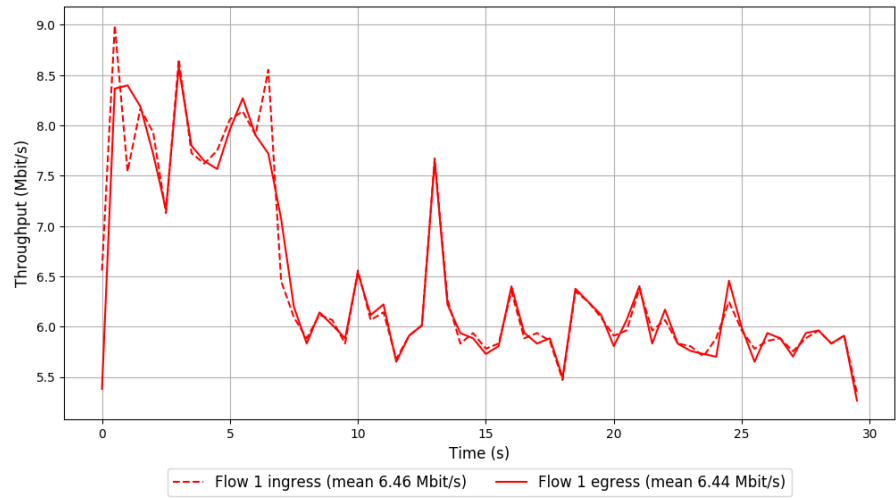
Run 1: Report of TaoVA-100x — Data Link

```
Run 1: Statistics of TCP Vegas

Start at: Mon, 10 Jul 2017 22:09:01 +0000
End at: Mon, 10 Jul 2017 22:09:31 +0000
Local clock offset: -2.007 ms
Remote clock offset: -0.193 ms


# Below is generated by plot.py at Mon, 10 Jul 2017 22:22:24 +0000
# Datalink statistics
-- Total of 1 flow:
Average throughput: 2.97 Mbit/s
95th percentile per-packet one-way delay: 37.031 ms
Loss rate: 0.19%
-- Flow 1:
Average throughput: 2.97 Mbit/s
95th percentile per-packet one-way delay: 37.031 ms
Loss rate: 0.19%
```
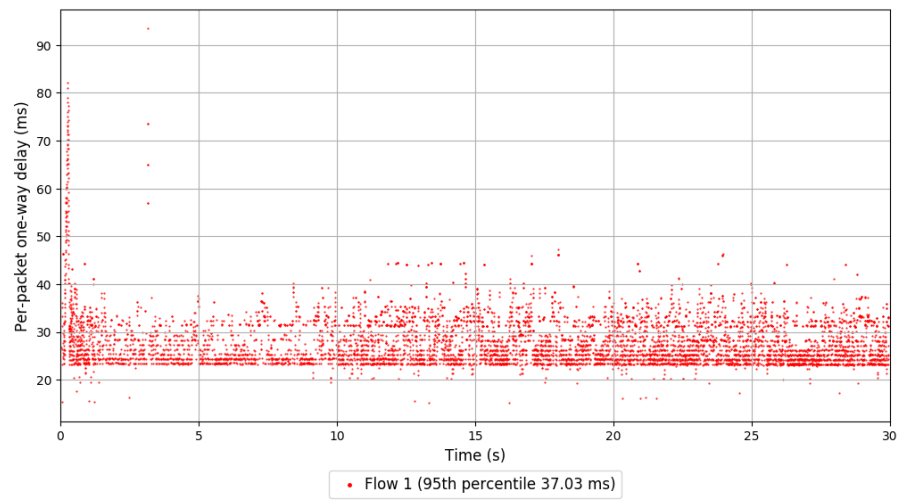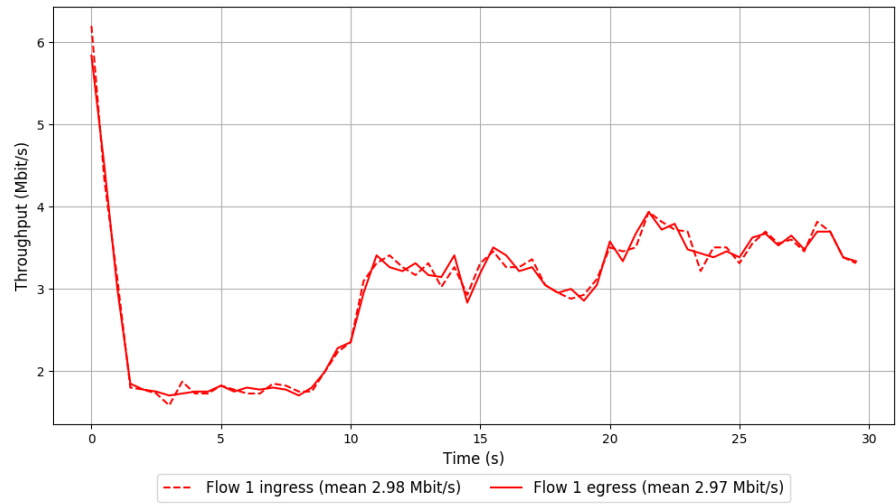
Run 1: Report of TCP Vegas — Data Link

Flow 1 ingress (mean 2.98 Mbit/s) ----   Flow 1 egress (mean 2.97 Mbit/s) ——

• Flow 1 (95th percentile 37.03 ms)

```
Run 1: Statistics of Verus

Start at: Mon, 10 Jul 2017 22:16:29 +0000
End at: Mon, 10 Jul 2017 22:16:59 +0000
Local clock offset: -1.847 ms
Remote clock offset: -0.158 ms


# Below is generated by plot.py at Mon, 10 Jul 2017 22:22:26 +0000
# Datalink statistics
-- Total of 1 flow:
Average throughput: 10.87 Mbit/s
95th percentile per-packet one-way delay: 73.774 ms
Loss rate: 8.22%
-- Flow 1:
Average throughput: 10.87 Mbit/s
95th percentile per-packet one-way delay: 73.774 ms
Loss rate: 8.22%
```
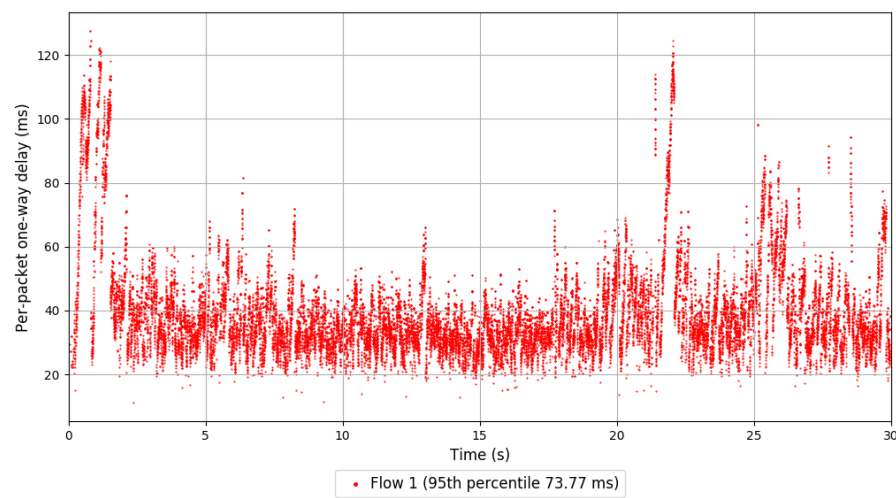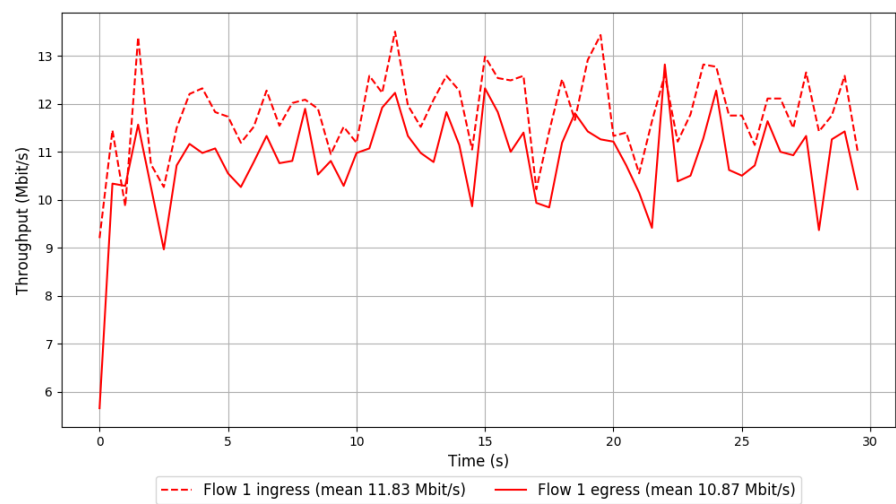
Run 1: Report of Verus — Data Link

Flow 1 ingress (mean 11.83 Mbit/s)   Flow 1 egress (mean 10.87 Mbit/s)

Flow 1 (95th percentile 73.77 ms)

```
Run 1: Statistics of WebRTC media

Start at: Mon, 10 Jul 2017 22:17:33 +0000
End at: Mon, 10 Jul 2017 22:18:03 +0000
Local clock offset: -1.836 ms
Remote clock offset: -0.099 ms


# Below is generated by plot.py at Mon, 10 Jul 2017 22:22:26 +0000
# Datalink statistics
-- Total of 1 flow:
Average throughput: 2.35 Mbit/s
95th percentile per-packet one-way delay: 39.249 ms
Loss rate: 0.20%
-- Flow 1:
Average throughput: 2.35 Mbit/s
95th percentile per-packet one-way delay: 39.249 ms
Loss rate: 0.20%
```

Run 1: Report of WebRTC media — Data Link