Pantheon Report

Generated at 2018-12-02 00:06:36 (UTC).

Data path: AWS Brazil 2 on `ens5` (*local*) →Colombia cellular on `ppp0` (*remote*).

Repeated the test of 19 congestion control schemes 3 times.

Each test lasted for 30 seconds running 1 flow.

NTP offsets were measured against `gps.ntp.br` and have been applied to correct the timestamps in logs.
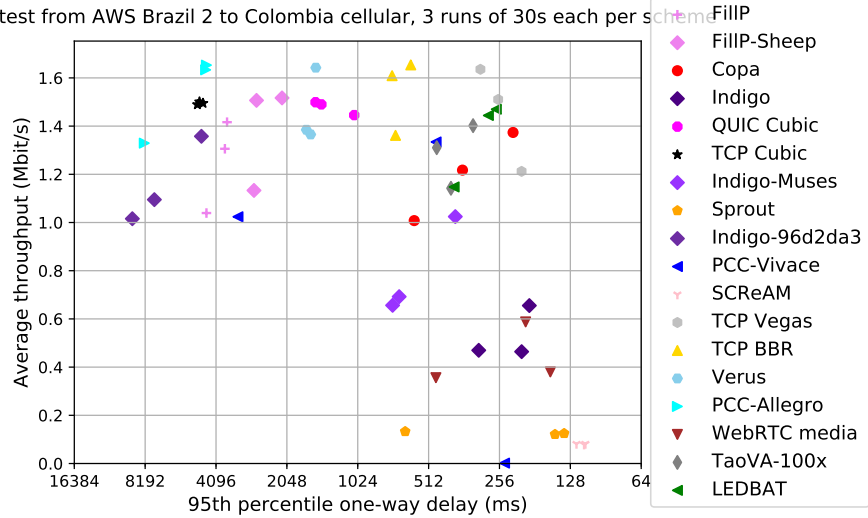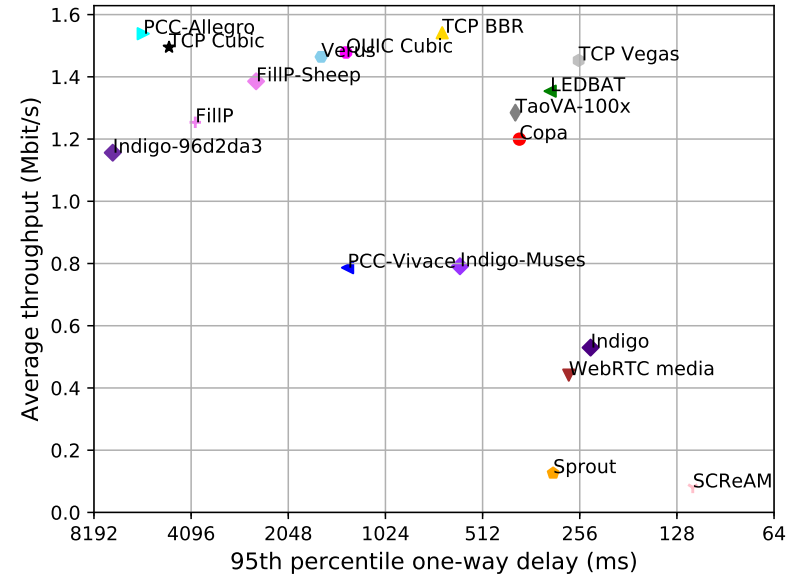
```
System info:
Linux 4.15.0-1027-aws
net.core.default_qdisc = fq
net.core.rmem_default = 16777216
net.core.rmem_max = 536870912
net.core.wmem_default = 16777216
net.core.wmem_max = 536870912
net.ipv4.tcp_rmem = 4096 16777216 536870912
net.ipv4.tcp_wmem = 4096 16777216 536870912

Git summary:
branch: muses @ 7b6dad87cde3ab65f7c4052140eb54098aa58e9d
third_party/fillp @ d6da1459332fcee56963885d7eba17e6a32d4519
third_party/fillp-sheep @ 0e5bb722943babcd2b090d2c64fcd45e12e923f9
third_party/genericCC @ d0153f8e594aa89e93b032143cedbdfe58e562f4
third_party/indigo @ 2601c92e4aa9d58d38dc4dfe0ecdbf90c077e64d
third_party/indigo-96d2da3 @ 8413272d46f8aa0bcb967ed7048b6a8f994abb95
third_party/libutp @ b3465b942e2826f2b179eaab4a906ce6bb7cf3cf
third_party/muses @ 65ac1b19bbefed0c6349ae986009b4fa8643c40a
third_party/pantheon-tunnel @ f866d3f58d27afd942717625ee3a354cc2e802bd
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
 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/vivace @ 2baf86211435ae071a32f96b7d8c504587f5d7f4
third_party/webrtc @ 3f0cc2a9061a41b6f9dde4735770d143a1fa2851
```

test from AWS Brazil 2 to Colombia cellular, 3 runs of 30s each per scheme
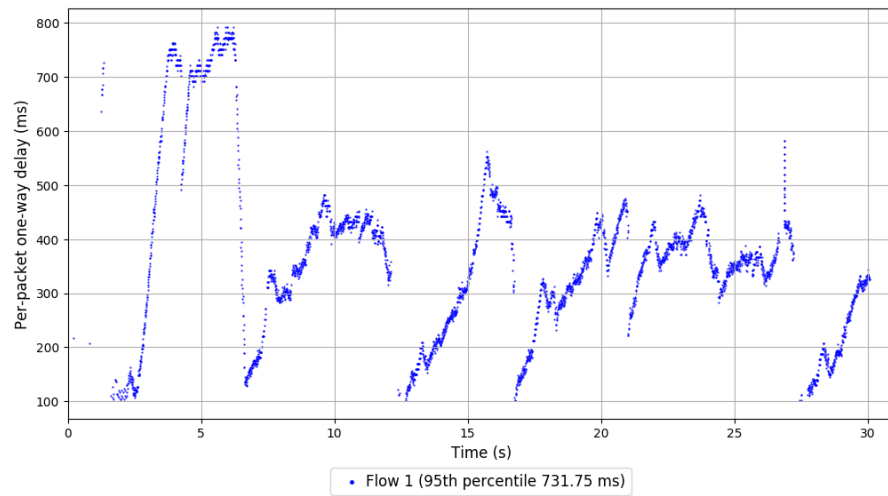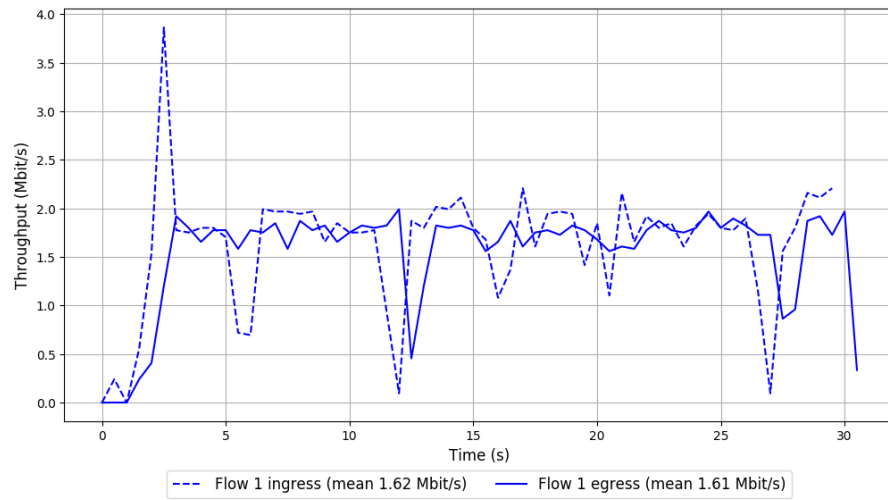(mean of all runs by scheme)

test from AWS Brazil 2 to Colombia cellular, 3 runs of 30s each per scheme

scheme	# runs	mean avg tput (Mbit/s) flow 1	mean 95th-%ile delay (ms) flow 1	mean loss rate (%) flow 1
TCP BBR	3	1.54	683.05	1.33
Copa	3	1.20	393.73	1.05
TCP Cubic	3	1.49	4794.74	18.89
FillP	3	1.26	3976.69	12.41
FillP-Sheep	3	1.39	2576.49	1.56
Indigo	3	0.53	236.95	0.06
Indigo-96d2da3	3	1.16	7165.80	88.89
LEDBAT	3	1.35	316.21	0.69
Indigo-Muses	3	0.79	601.77	0.62
PCC-Allegro	3	1.54	5764.33	73.00
PCC-Expr	0	N/A	N/A	N/A
QUIC Cubic	3	1.48	1356.28	4.69
SCReAM	3	0.08	114.30	0.13
Sprout	3	0.12	309.52	0.27
TaoVA-100x	3	1.28	405.29	0.64
TCP Vegas	3	1.45	258.00	0.34
Verus	3	1.46	1619.69	4.87
PCC-Vivace	3	0.78	1341.76	5.03
WebRTC media	3	0.44	276.86	0.08

```
Run 1: Statistics of TCP BBR

Start at: 2018-12-01 23:17:23
End at: 2018-12-01 23:17:53
Local clock offset: 2.587 ms
Remote clock offset: -13.122 ms

# Below is generated by plot.py at 2018-12-02 00:06:01
# Datalink statistics
-- Total of 1 flow:
Average throughput: 1.61 Mbit/s
95th percentile per-packet one-way delay: 731.750 ms
Loss rate: 1.14%
-- Flow 1:
Average throughput: 1.61 Mbit/s
95th percentile per-packet one-way delay: 731.750 ms
Loss rate: 1.14%
```
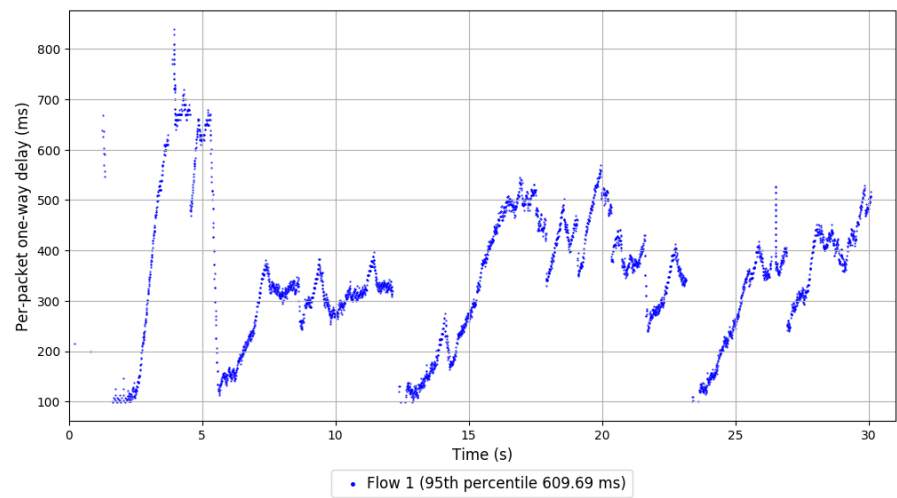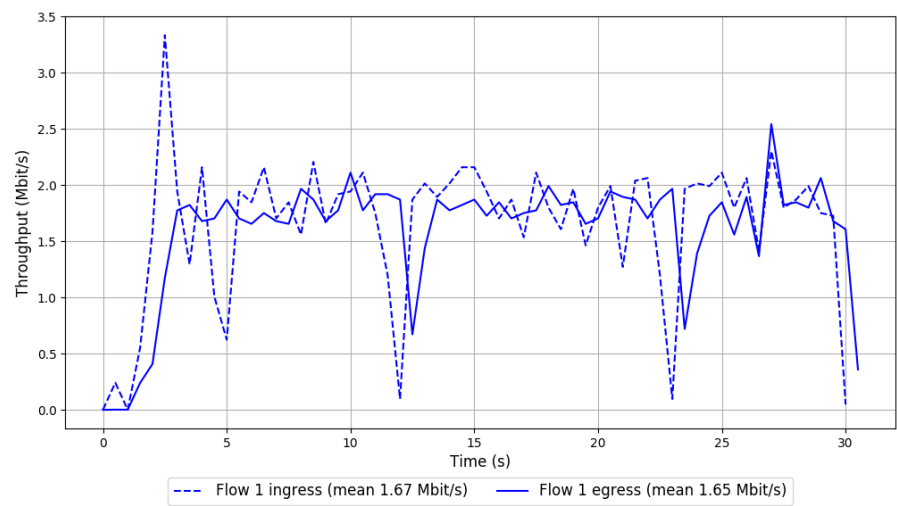
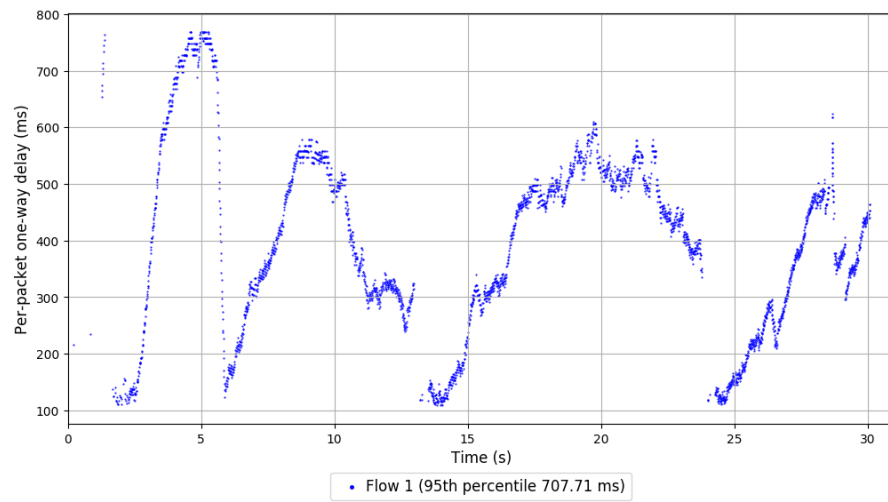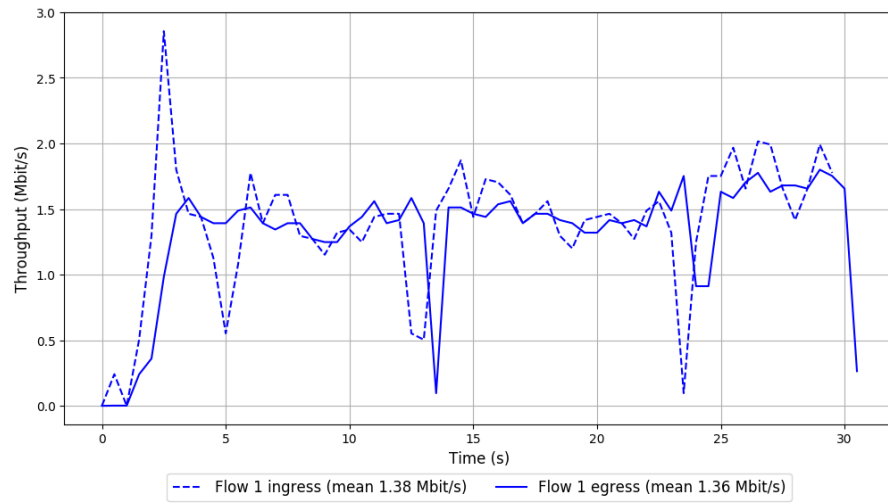Run 1: Report of TCP BBR — Data Link

Flow 1 ingress (mean 1.62 Mbit/s)   Flow 1 egress (mean 1.61 Mbit/s)

Flow 1 (95th percentile 731.75 ms)

```
Run 2: Statistics of TCP BBR

Start at: 2018-12-01 23:39:05
End at: 2018-12-01 23:39:35
Local clock offset: 6.399 ms
Remote clock offset: -13.797 ms


# Below is generated by plot.py at 2018-12-02 00:06:02
# Datalink statistics
-- Total of 1 flow:
Average throughput: 1.65 Mbit/s
95th percentile per-packet one-way delay: 609.693 ms
Loss rate: 1.34%
-- Flow 1:
Average throughput: 1.65 Mbit/s
95th percentile per-packet one-way delay: 609.693 ms
Loss rate: 1.34%
```
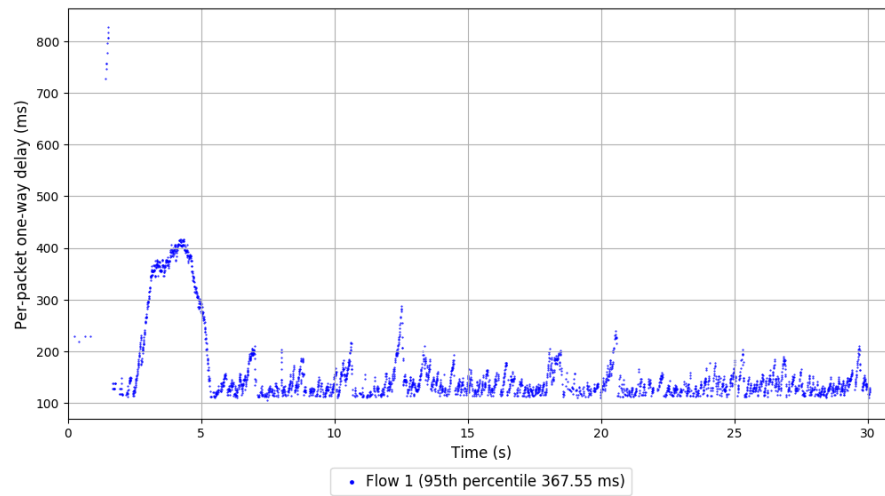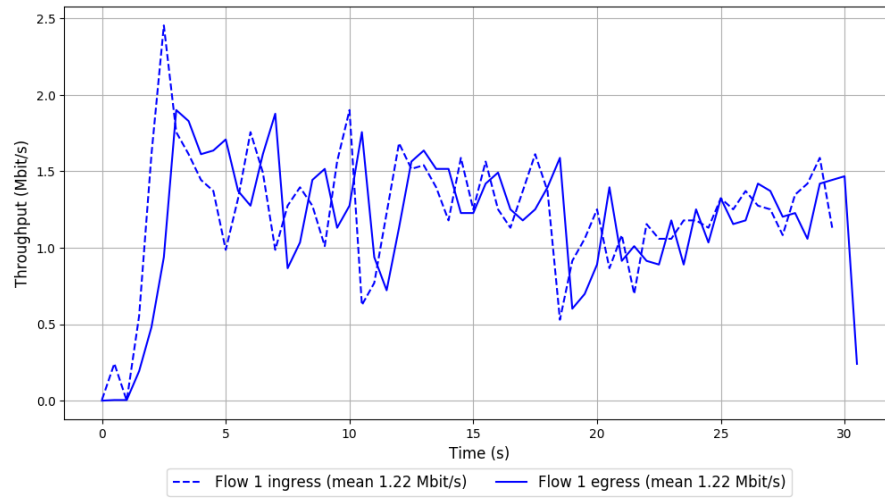
Run 2: Report of TCP BBR — Data Link

```
Run 3: Statistics of TCP BBR

Start at: 2018-12-02 00:00:45
End at: 2018-12-02 00:01:15
Local clock offset: -1.223 ms
Remote clock offset: -14.679 ms


# Below is generated by plot.py at 2018-12-02 00:06:02
# Datalink statistics
-- Total of 1 flow:
Average throughput: 1.36 Mbit/s
95th percentile per-packet one-way delay: 707.714 ms
Loss rate: 1.51%
-- Flow 1:
Average throughput: 1.36 Mbit/s
95th percentile per-packet one-way delay: 707.714 ms
Loss rate: 1.51%
```
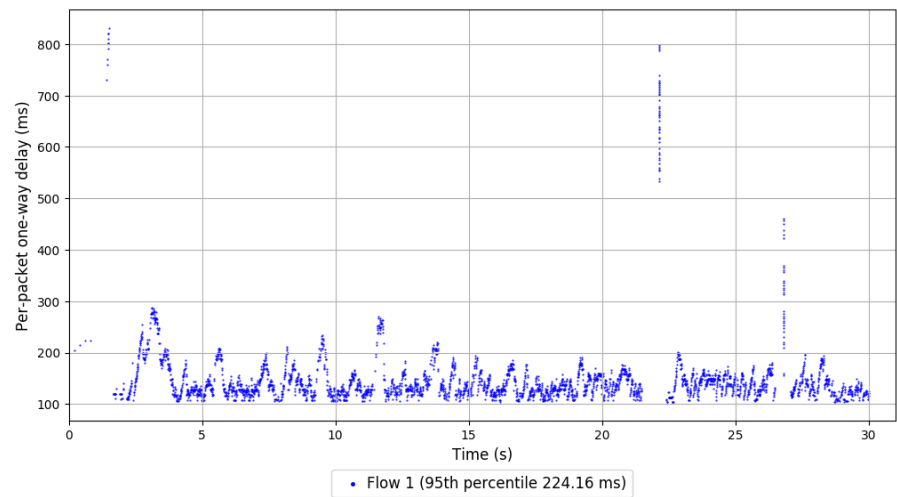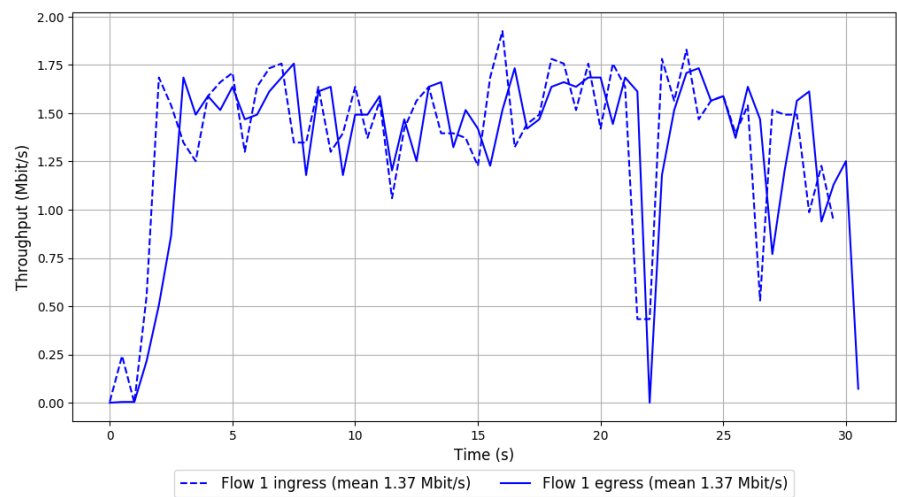
Run 3: Report of TCP BBR — Data Link

```
Run 1: Statistics of Copa

Start at: 2018-12-01 23:16:15
End at: 2018-12-01 23:16:45
Local clock offset: 3.06 ms
Remote clock offset: -7.687 ms


# Below is generated by plot.py at 2018-12-02 00:06:02
# Datalink statistics
-- Total of 1 flow:
Average throughput: 1.22 Mbit/s
95th percentile per-packet one-way delay: 367.548 ms
Loss rate: 0.82%
-- Flow 1:
Average throughput: 1.22 Mbit/s
95th percentile per-packet one-way delay: 367.548 ms
Loss rate: 0.82%
```
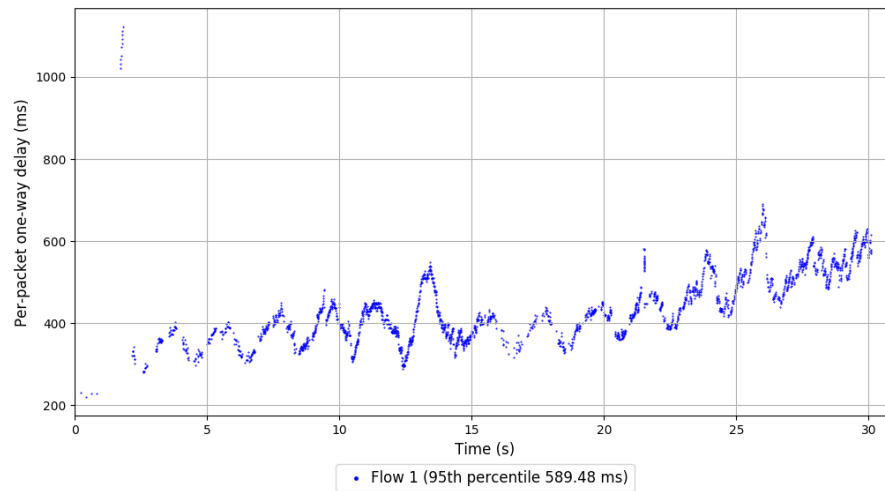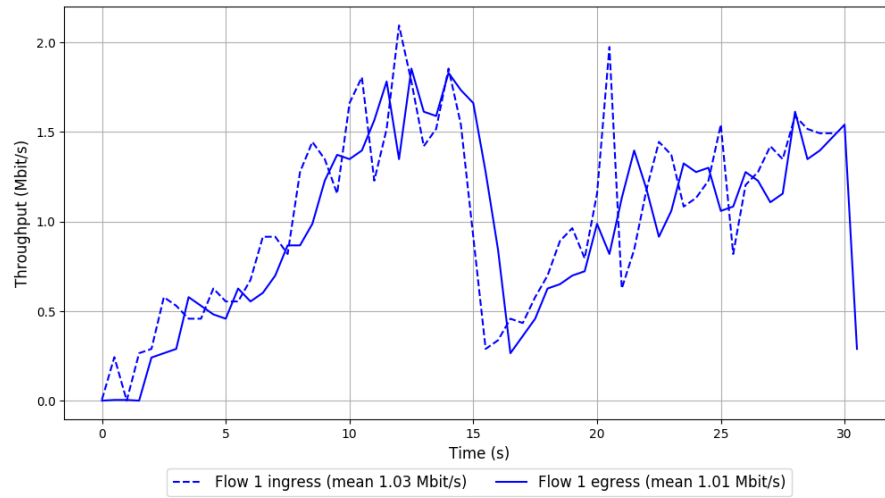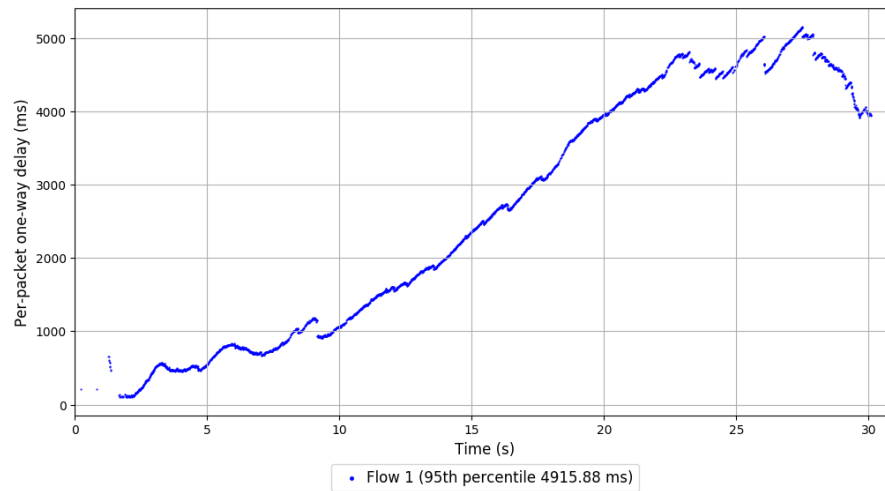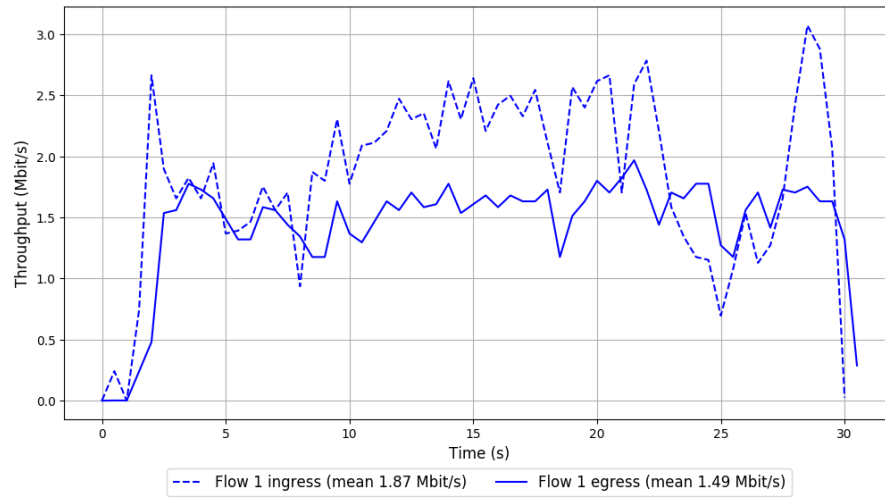
Run 1: Report of Copa — Data Link

```
Run 2: Statistics of Copa

Start at: 2018-12-01 23:37:57
End at: 2018-12-01 23:38:27
Local clock offset: 5.288 ms
Remote clock offset: -13.766 ms

# Below is generated by plot.py at 2018-12-02 00:06:02
# Datalink statistics
-- Total of 1 flow:
Average throughput: 1.37 Mbit/s
95th percentile per-packet one-way delay: 224.161 ms
Loss rate: 0.06%
-- Flow 1:
Average throughput: 1.37 Mbit/s
95th percentile per-packet one-way delay: 224.161 ms
Loss rate: 0.06%
```

Run 2: Report of Copa — Data Link

```
Run 3: Statistics of Copa

Start at: 2018-12-01 23:59:36
End at: 2018-12-02 00:00:06
Local clock offset: -0.858 ms
Remote clock offset: -8.233 ms

# Below is generated by plot.py at 2018-12-02 00:06:02
# Datalink statistics
-- Total of 1 flow:
Average throughput: 1.01 Mbit/s
95th percentile per-packet one-way delay: 589.482 ms
Loss rate: 2.27%
-- Flow 1:
Average throughput: 1.01 Mbit/s
95th percentile per-packet one-way delay: 589.482 ms
Loss rate: 2.27%
```

Run 3: Report of Copa — Data Link

Flow 1 ingress (mean 1.03 Mbit/s)   Flow 1 egress (mean 1.01 Mbit/s)
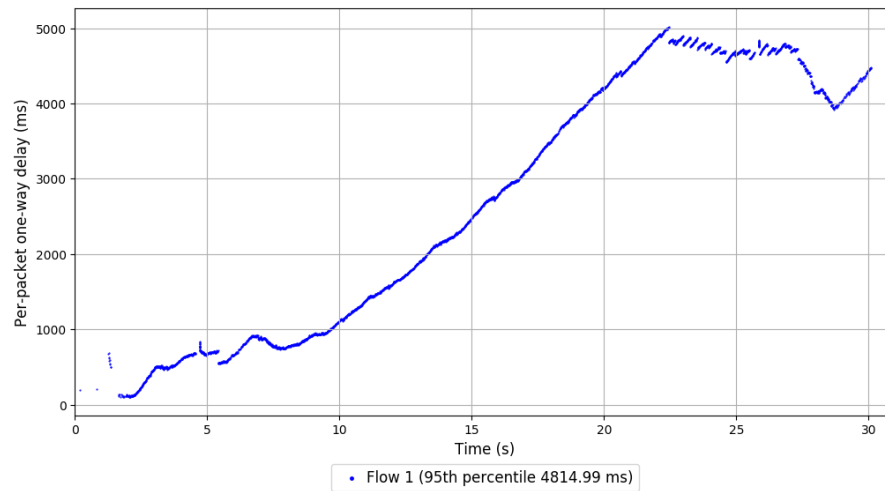

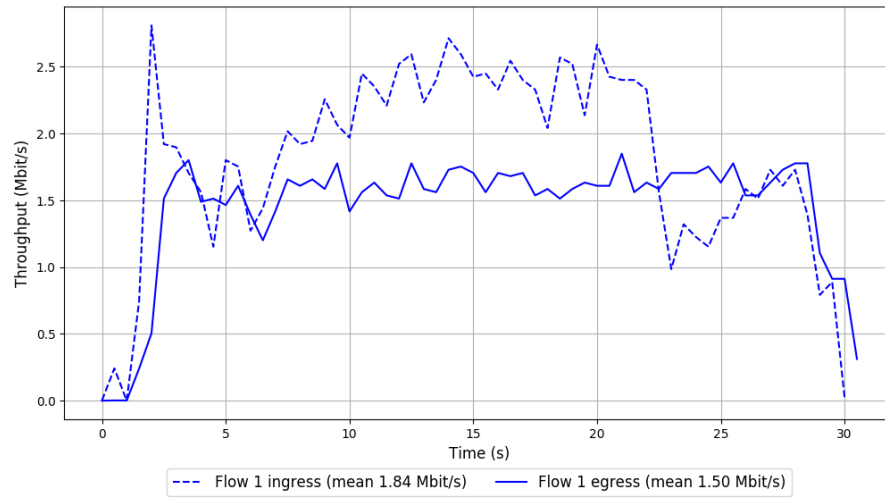Flow 1 (95th percentile 589.48 ms)

```
Run 1: Statistics of TCP Cubic

Start at: 2018-12-01 23:21:57
End at: 2018-12-01 23:22:27
Local clock offset: 2.214 ms
Remote clock offset: -12.107 ms


# Below is generated by plot.py at 2018-12-02 00:06:02
# Datalink statistics
-- Total of 1 flow:
Average throughput: 1.49 Mbit/s
95th percentile per-packet one-way delay: 4915.877 ms
Loss rate: 20.67%
-- Flow 1:
Average throughput: 1.49 Mbit/s
95th percentile per-packet one-way delay: 4915.877 ms
Loss rate: 20.67%
```
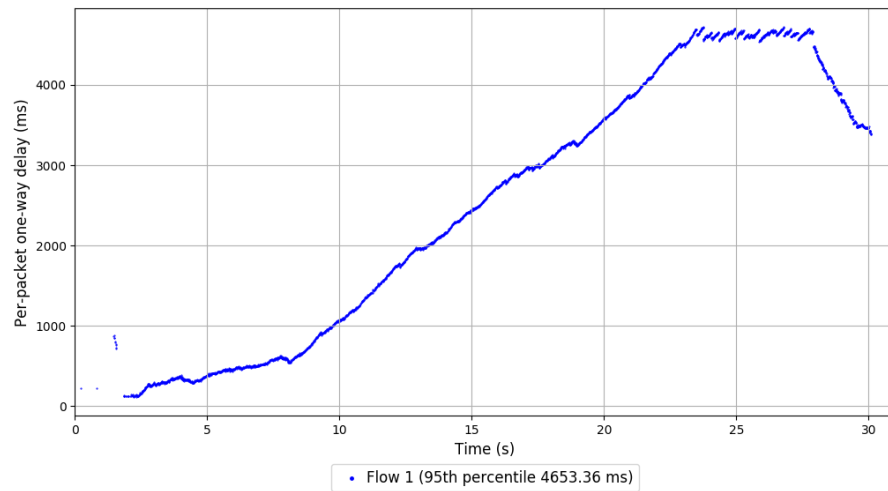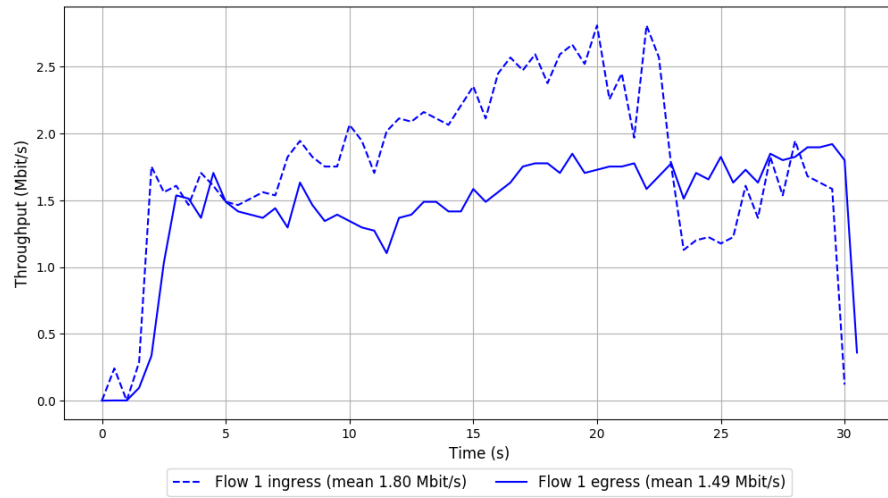
Run 1: Report of TCP Cubic — Data Link

```
Run 2: Statistics of TCP Cubic

Start at: 2018-12-01 23:43:38
End at: 2018-12-01 23:44:08
Local clock offset: 7.218 ms
Remote clock offset: -12.792 ms


# Below is generated by plot.py at 2018-12-02 00:06:02
# Datalink statistics
-- Total of 1 flow:
Average throughput: 1.50 Mbit/s
95th percentile per-packet one-way delay: 4814.990 ms
Loss rate: 18.77%
-- Flow 1:
Average throughput: 1.50 Mbit/s
95th percentile per-packet one-way delay: 4814.990 ms
Loss rate: 18.77%
```
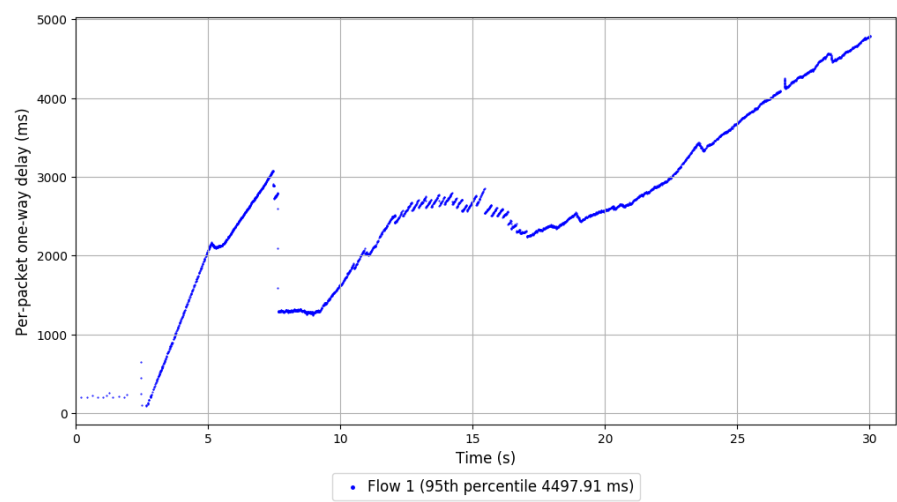
Run 2: Report of TCP Cubic — Data Link

```
Run 3: Statistics of TCP Cubic

Start at: 2018-12-02 00:05:20
End at: 2018-12-02 00:05:50
Local clock offset: -2.881 ms
Remote clock offset: -13.535 ms


# Below is generated by plot.py at 2018-12-02 00:06:05
# Datalink statistics
-- Total of 1 flow:
Average throughput: 1.49 Mbit/s
95th percentile per-packet one-way delay: 4653.362 ms
Loss rate: 17.24%
-- Flow 1:
Average throughput: 1.49 Mbit/s
95th percentile per-packet one-way delay: 4653.362 ms
Loss rate: 17.24%
```

Run 3: Report of TCP Cubic — Data Link

Flow 1 ingress (mean 1.80 Mbit/s)   Flow 1 egress (mean 1.49 Mbit/s)
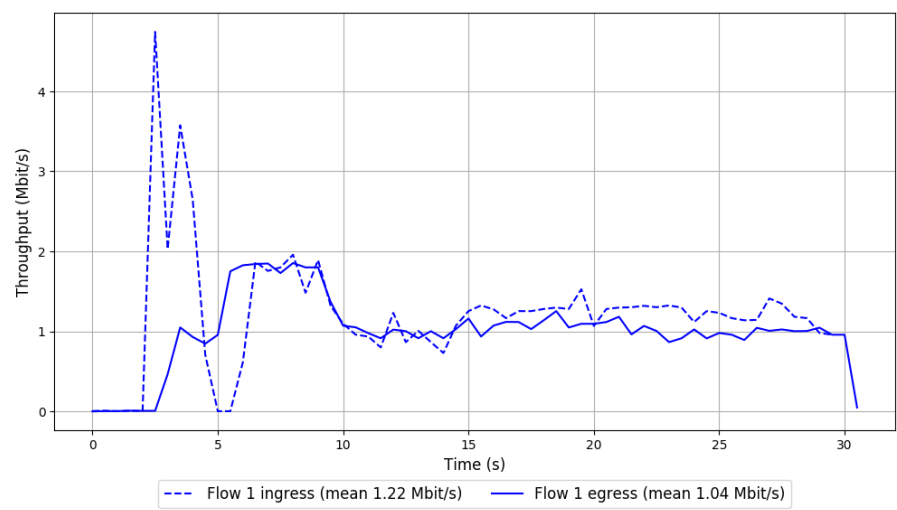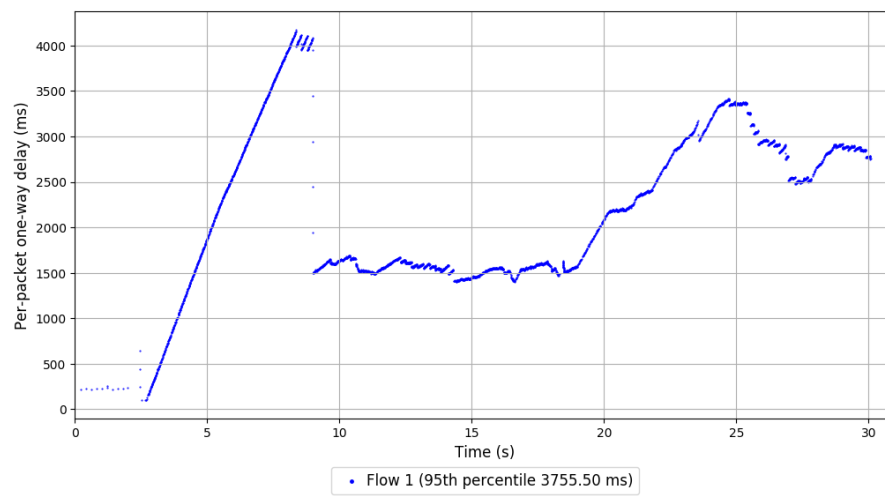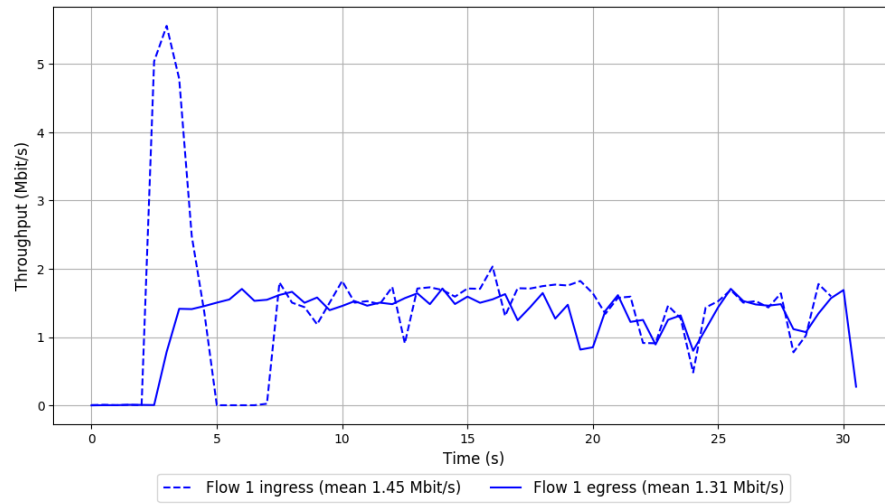

Flow 1 (95th percentile 4653.36 ms)

```
Run 1: Statistics of FillP

Start at: 2018-12-01 23:06:00
End at: 2018-12-01 23:06:30
Local clock offset: 7.023 ms
Remote clock offset: -12.782 ms

# Below is generated by plot.py at 2018-12-02 00:06:05
# Datalink statistics
-- Total of 1 flow:
Average throughput: 1.04 Mbit/s
95th percentile per-packet one-way delay: 4497.907 ms
Loss rate: 15.23%
-- Flow 1:
Average throughput: 1.04 Mbit/s
95th percentile per-packet one-way delay: 4497.907 ms
Loss rate: 15.23%
```
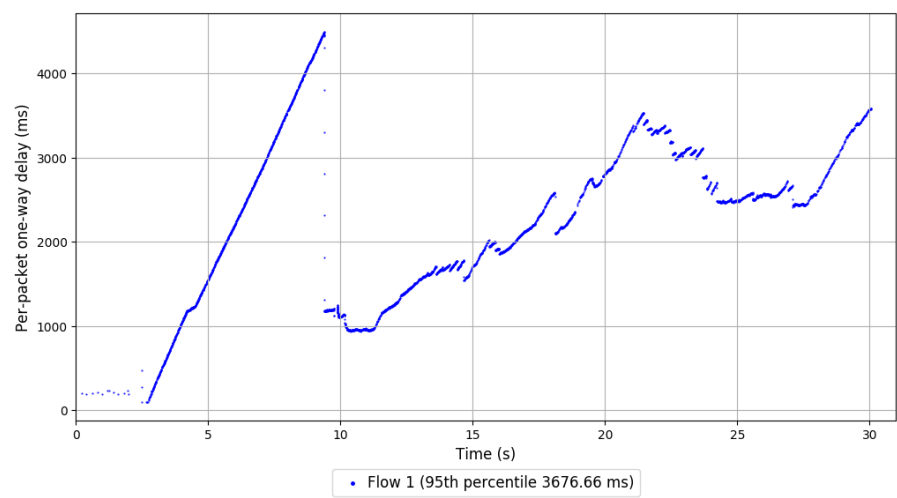
Run 1: Report of FillP — Data Link

```
Run 2: Statistics of FillP

Start at: 2018-12-01 23:27:40
End at: 2018-12-01 23:28:10
Local clock offset: 2.617 ms
Remote clock offset: -8.656 ms


# Below is generated by plot.py at 2018-12-02 00:06:06
# Datalink statistics
-- Total of 1 flow:
Average throughput: 1.31 Mbit/s
95th percentile per-packet one-way delay: 3755.503 ms
Loss rate: 10.12%
-- Flow 1:
Average throughput: 1.31 Mbit/s
95th percentile per-packet one-way delay: 3755.503 ms
Loss rate: 10.12%
```

Run 2: Report of FillP — Data Link

Flow 1 ingress (mean 1.45 Mbit/s)   Flow 1 egress (mean 1.31 Mbit/s)

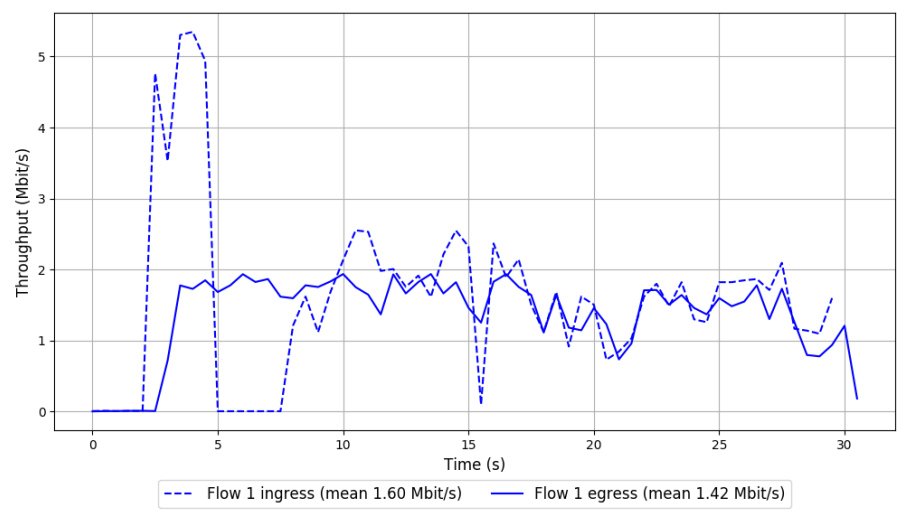Flow 1 (95th percentile 3755.50 ms)

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```
Run 3: Statistics of FillP

Start at: 2018-12-01 23:49:19
End at: 2018-12-01 23:49:50
Local clock offset: 7.756 ms
Remote clock offset: -14.031 ms


# Below is generated by plot.py at 2018-12-02 00:06:07
# Datalink statistics
-- Total of 1 flow:
Average throughput: 1.42 Mbit/s
95th percentile per-packet one-way delay: 3676.659 ms
Loss rate: 11.89%
-- Flow 1:
Average throughput: 1.42 Mbit/s
95th percentile per-packet one-way delay: 3676.659 ms
Loss rate: 11.89%
```
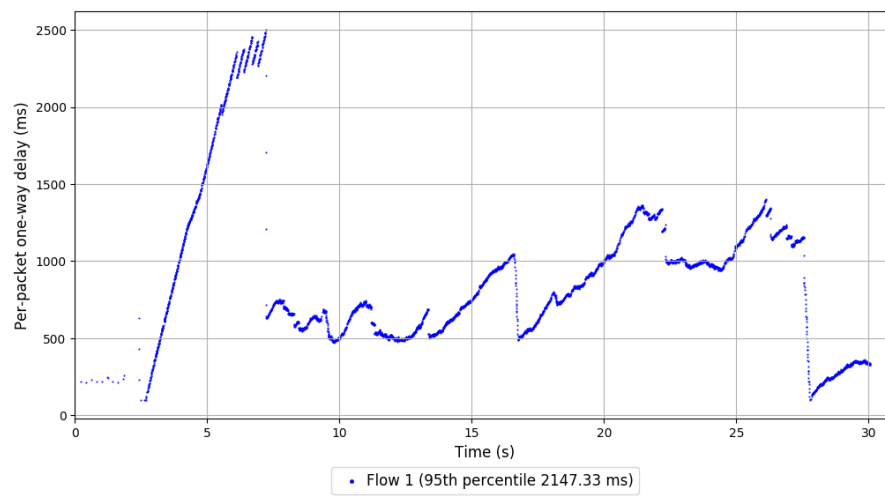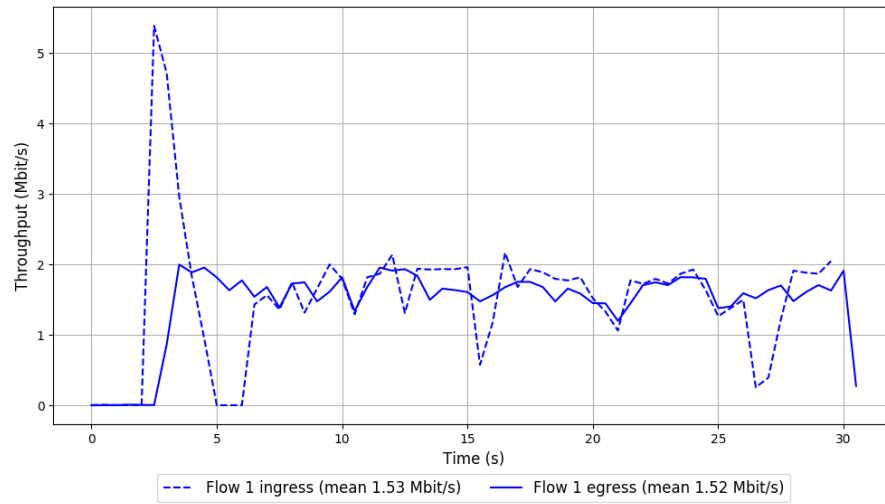
Run 3: Report of FillP — Data Link

Flow 1 ingress (mean 1.60 Mbit/s) ---- Flow 1 egress (mean 1.42 Mbit/s) ——

Flow 1 (95th percentile 3676.66 ms)

```
Run 1: Statistics of FillP-Sheep

Start at: 2018-12-01 23:01:27
End at: 2018-12-01 23:01:57
Local clock offset: 5.629 ms
Remote clock offset: -11.769 ms


# Below is generated by plot.py at 2018-12-02 00:06:08
# Datalink statistics
-- Total of 1 flow:
Average throughput: 1.52 Mbit/s
95th percentile per-packet one-way delay: 2147.330 ms
Loss rate: 1.28%
-- Flow 1:
Average throughput: 1.52 Mbit/s
95th percentile per-packet one-way delay: 2147.330 ms
Loss rate: 1.28%
```
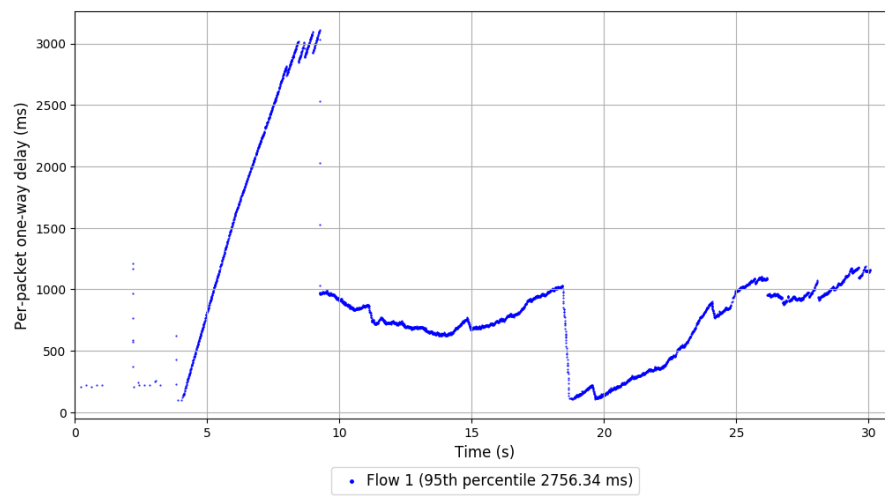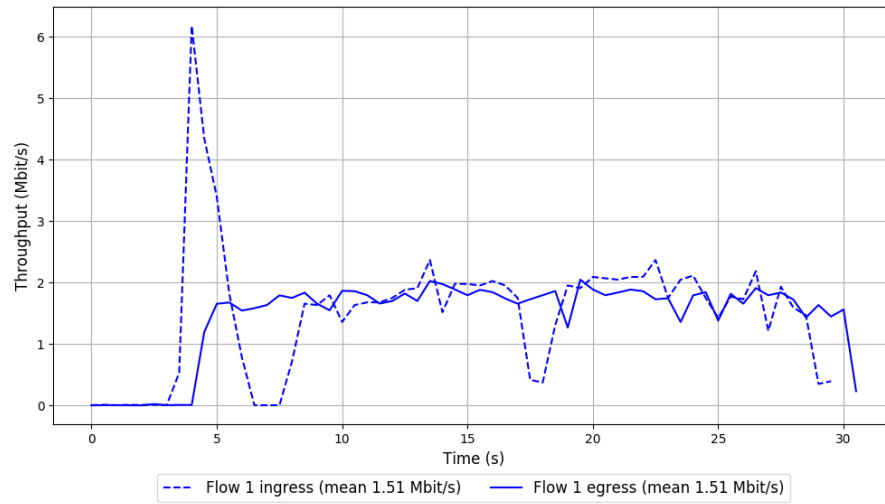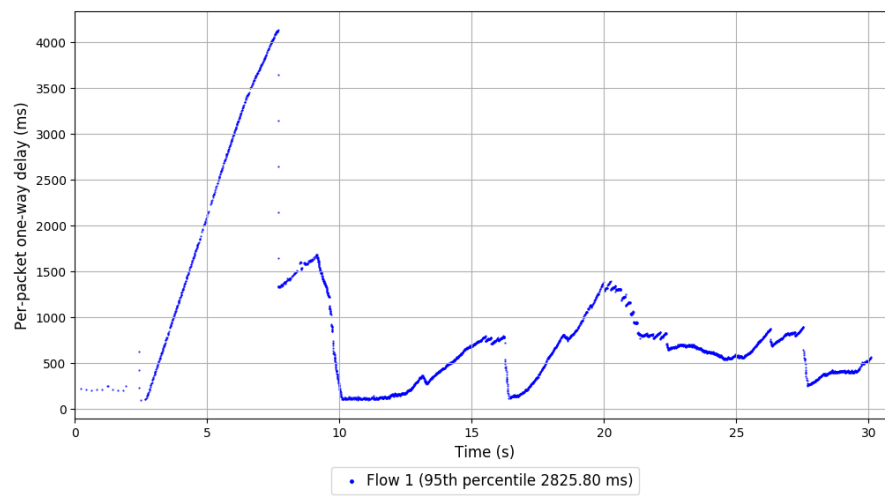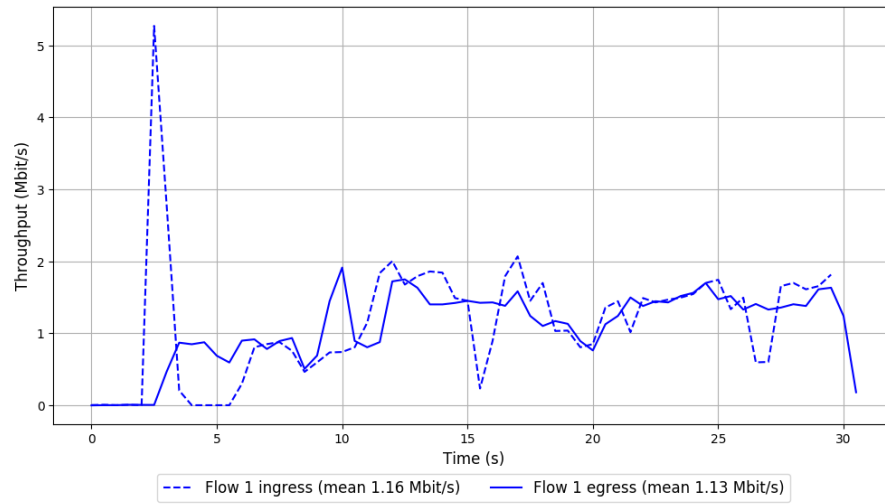
Run 1: Report of FillP-Sheep — Data Link

Flow 1 ingress (mean 1.53 Mbit/s)   Flow 1 egress (mean 1.52 Mbit/s)

Flow 1 (95th percentile 2147.33 ms)

```
Run 2: Statistics of FillP-Sheep

Start at: 2018-12-01 23:23:05
End at: 2018-12-01 23:23:35
Local clock offset: 2.954 ms
Remote clock offset: -12.304 ms


# Below is generated by plot.py at 2018-12-02 00:06:08
# Datalink statistics
-- Total of 1 flow:
Average throughput: 1.51 Mbit/s
95th percentile per-packet one-way delay: 2756.337 ms
Loss rate: 0.87%
-- Flow 1:
Average throughput: 1.51 Mbit/s
95th percentile per-packet one-way delay: 2756.337 ms
Loss rate: 0.87%
```
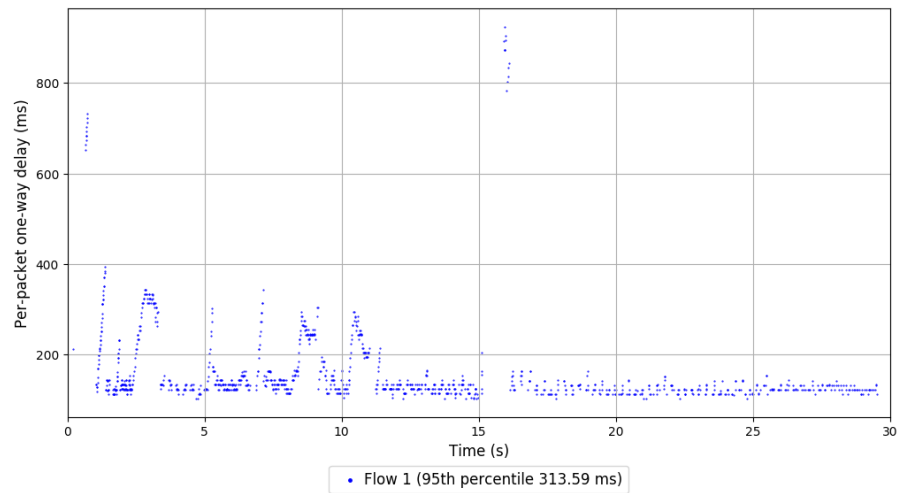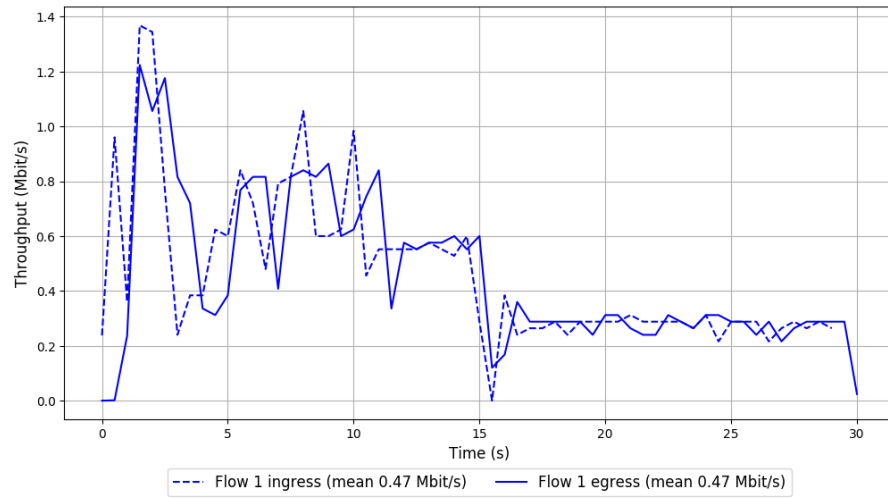
Run 2: Report of FillP-Sheep — Data Link

```
Run 3: Statistics of FillP-Sheep

Start at: 2018-12-01 23:44:47
End at: 2018-12-01 23:45:17
Local clock offset: 7.655 ms
Remote clock offset: -8.921 ms


# Below is generated by plot.py at 2018-12-02 00:06:08
# Datalink statistics
-- Total of 1 flow:
Average throughput: 1.13 Mbit/s
95th percentile per-packet one-way delay: 2825.798 ms
Loss rate: 2.52%
-- Flow 1:
Average throughput: 1.13 Mbit/s
95th percentile per-packet one-way delay: 2825.798 ms
Loss rate: 2.52%
```

Run 3: Report of FillP-Sheep — Data Link

Flow 1 ingress (mean 1.16 Mbit/s)   Flow 1 egress (mean 1.13 Mbit/s)
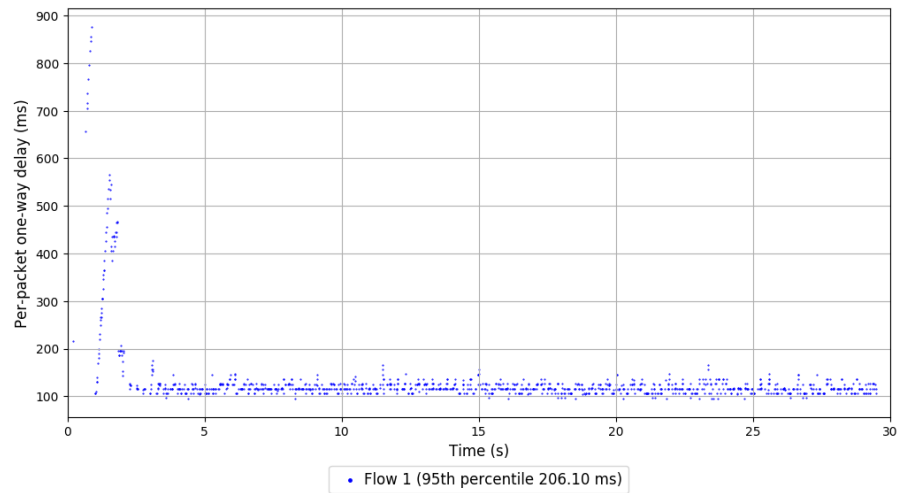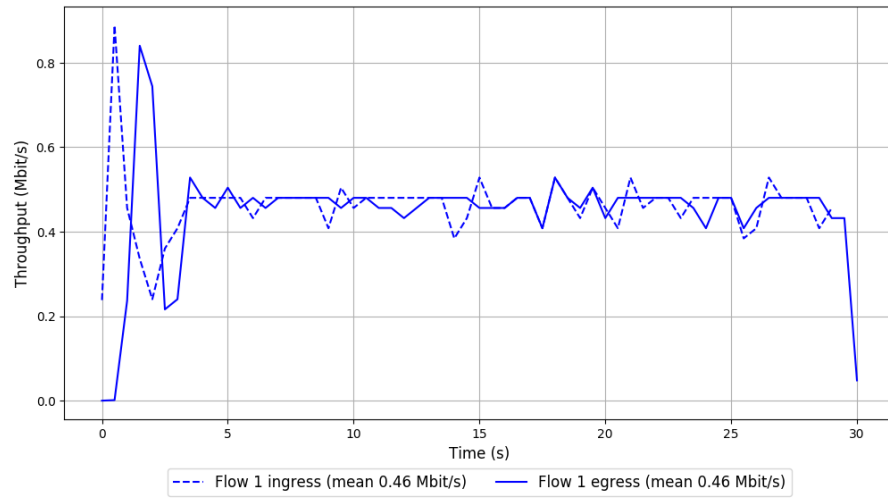

Flow 1 (95th percentile 2825.80 ms)

```
Run 1: Statistics of Indigo

Start at: 2018-12-01 23:07:08
End at: 2018-12-01 23:07:38
Local clock offset: 4.511 ms
Remote clock offset: -6.514 ms


# Below is generated by plot.py at 2018-12-02 00:06:08
# Datalink statistics
-- Total of 1 flow:
Average throughput: 0.47 Mbit/s
95th percentile per-packet one-way delay: 313.593 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 0.47 Mbit/s
95th percentile per-packet one-way delay: 313.593 ms
Loss rate: 0.00%
```

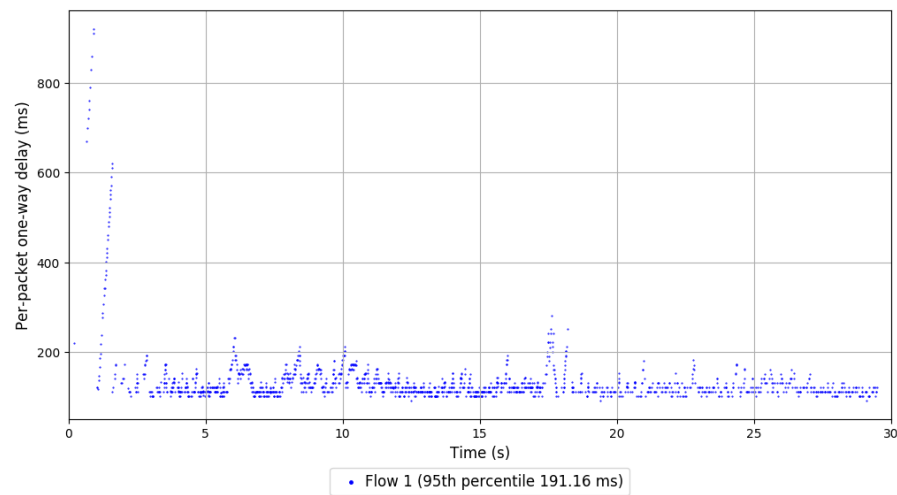Run 1: Report of Indigo — Data Link

```
Run 2: Statistics of Indigo

Start at: 2018-12-01 23:28:49
End at: 2018-12-01 23:29:19
Local clock offset: 3.571 ms
Remote clock offset: -13.53 ms


# Below is generated by plot.py at 2018-12-02 00:06:08
# Datalink statistics
-- Total of 1 flow:
Average throughput: 0.46 Mbit/s
95th percentile per-packet one-way delay: 206.105 ms
Loss rate: 0.18%
-- Flow 1:
Average throughput: 0.46 Mbit/s
95th percentile per-packet one-way delay: 206.105 ms
Loss rate: 0.18%
```

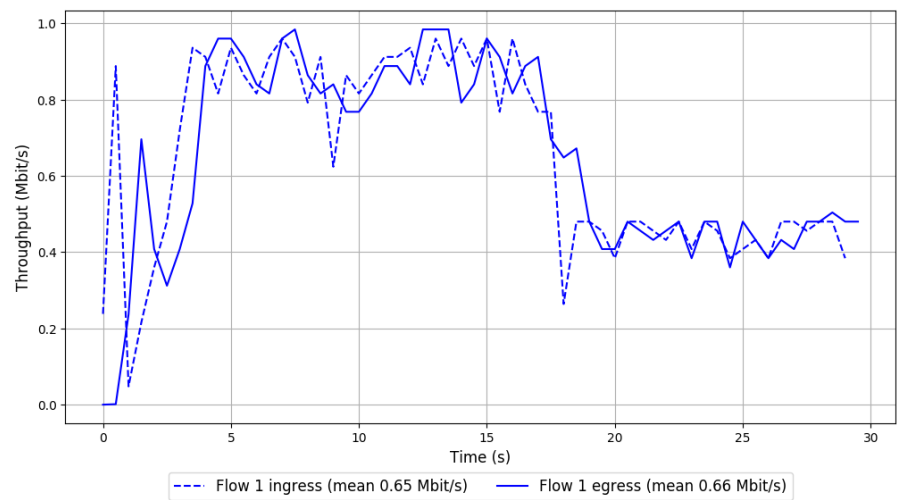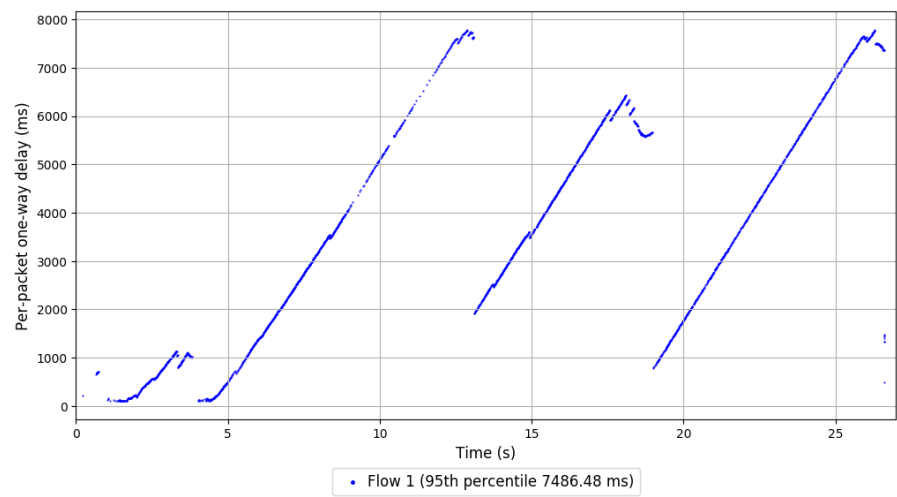Run 2: Report of Indigo — Data Link

```
Run 3: Statistics of Indigo

Start at: 2018-12-01 23:50:28
End at: 2018-12-01 23:50:58
Local clock offset: 5.467 ms
Remote clock offset: -14.103 ms


# Below is generated by plot.py at 2018-12-02 00:06:08
# Datalink statistics
-- Total of 1 flow:
Average throughput: 0.66 Mbit/s
95th percentile per-packet one-way delay: 191.162 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 0.66 Mbit/s
95th percentile per-packet one-way delay: 191.162 ms
Loss rate: 0.00%
```

Run 3: Report of Indigo — Data Link

Flow 1 ingress (mean 0.65 Mbit/s)   Flow 1 egress (mean 0.66 Mbit/s)
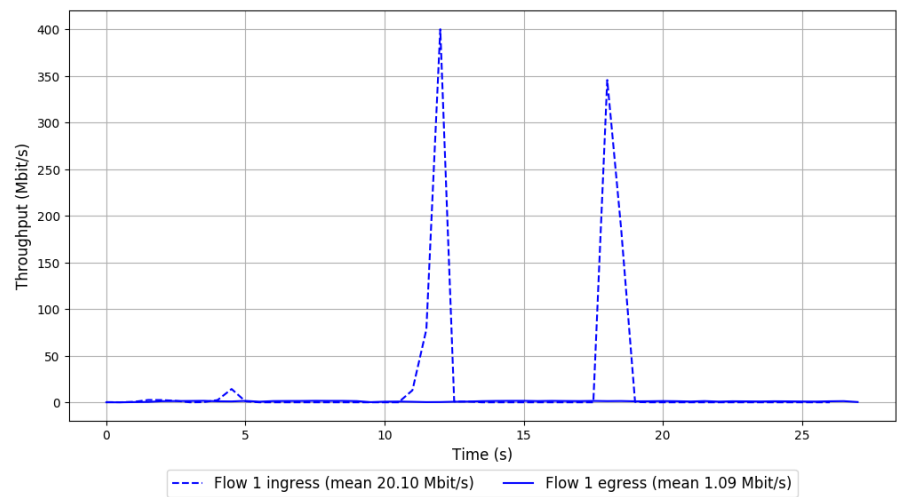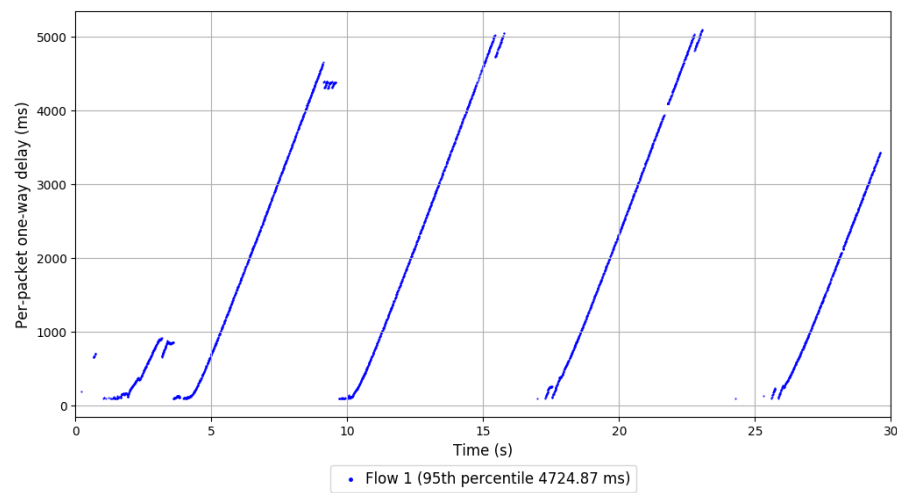

Flow 1 (95th percentile 191.16 ms)

```
Run 1: Statistics of Indigo-96d2da3

Start at: 2018-12-01 23:19:40
End at: 2018-12-01 23:20:10
Local clock offset: 3.216 ms
Remote clock offset: -9.202 ms


# Below is generated by plot.py at 2018-12-02 00:06:20
# Datalink statistics
-- Total of 1 flow:
Average throughput: 1.09 Mbit/s
95th percentile per-packet one-way delay: 7486.475 ms
Loss rate: 94.50%
-- Flow 1:
Average throughput: 1.09 Mbit/s
95th percentile per-packet one-way delay: 7486.475 ms
Loss rate: 94.50%
```

Run 1: Report of Indigo-96d2da3 — Data Link

Flow 1 ingress (mean 20.10 Mbit/s)   Flow 1 egress (mean 1.09 Mbit/s)
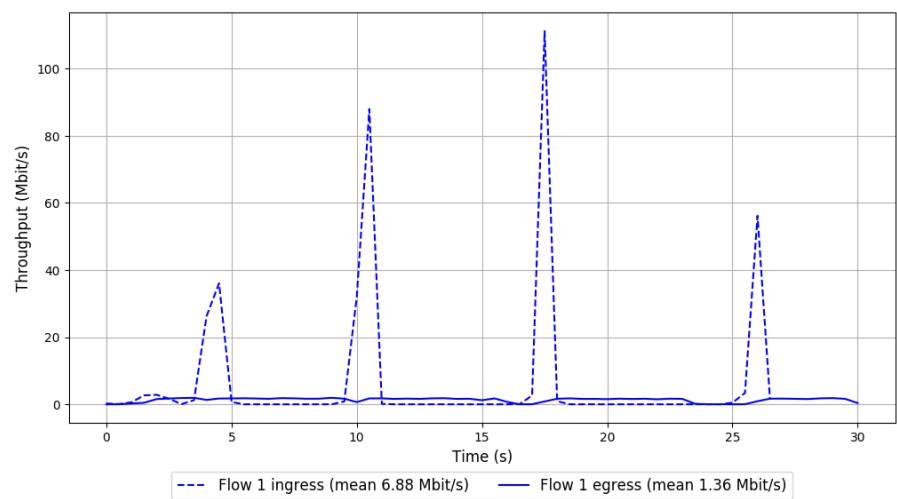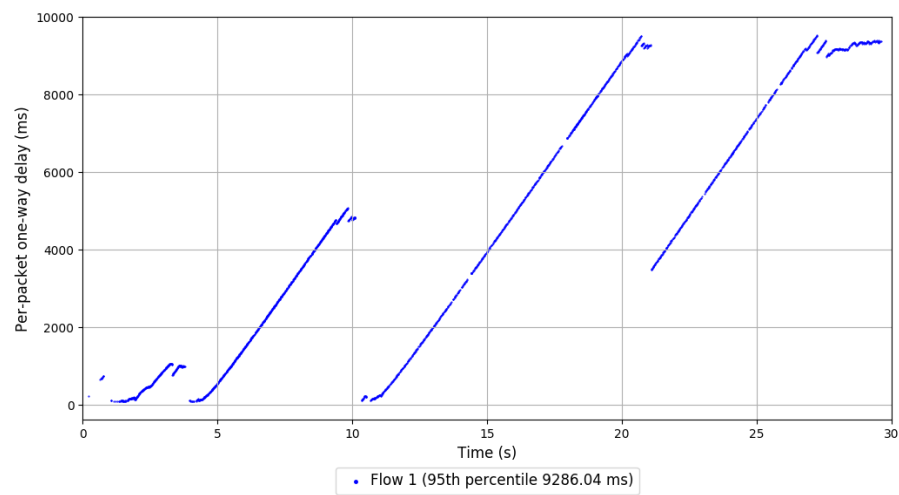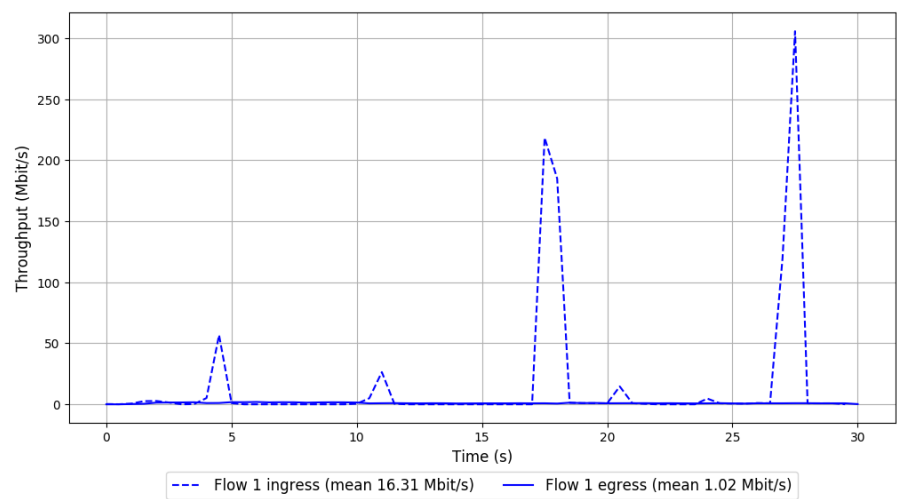

Flow 1 (95th percentile 7486.48 ms)

```
Run 2: Statistics of Indigo-96d2da3

Start at: 2018-12-01 23:41:22
End at: 2018-12-01 23:41:52
Local clock offset: 6.39 ms
Remote clock offset: -12.837 ms


# Below is generated by plot.py at 2018-12-02 00:06:20
# Datalink statistics
-- Total of 1 flow:
Average throughput: 1.36 Mbit/s
95th percentile per-packet one-way delay: 4724.871 ms
Loss rate: 78.38%
-- Flow 1:
Average throughput: 1.36 Mbit/s
95th percentile per-packet one-way delay: 4724.871 ms
Loss rate: 78.38%
```
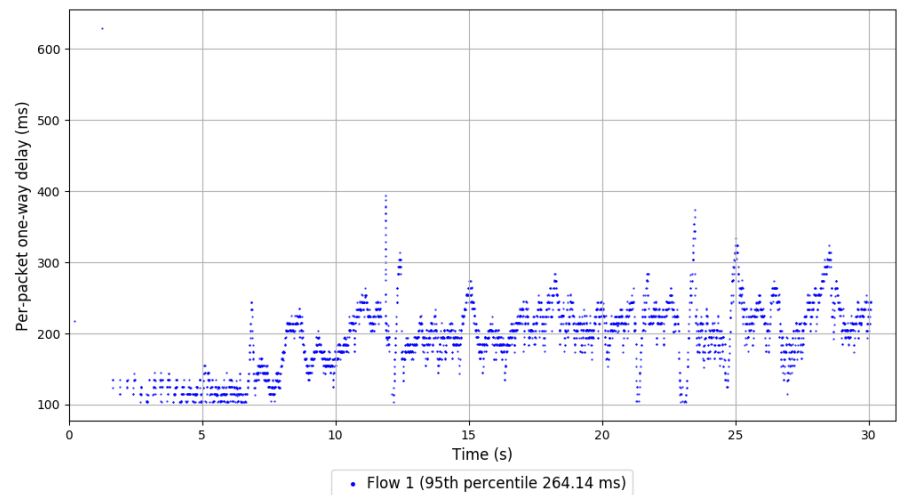
Run 2: Report of Indigo-96d2da3 — Data Link

```
Run 3: Statistics of Indigo-96d2da3

Start at: 2018-12-02 00:03:02
End at: 2018-12-02 00:03:32
Local clock offset: -1.868 ms
Remote clock offset: -10.695 ms


# Below is generated by plot.py at 2018-12-02 00:06:20
# Datalink statistics
-- Total of 1 flow:
Average throughput: 1.02 Mbit/s
95th percentile per-packet one-way delay: 9286.044 ms
Loss rate: 93.80%
-- Flow 1:
Average throughput: 1.02 Mbit/s
95th percentile per-packet one-way delay: 9286.044 ms
Loss rate: 93.80%
```

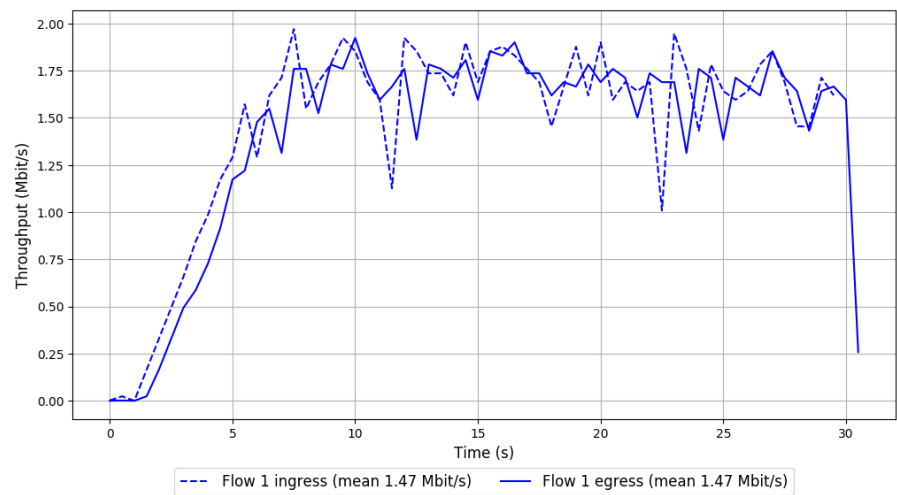# Run 3: Report of Indigo-96d2da3 — Data Link

```
Run 1: Statistics of LEDBAT

Start at: 2018-12-01 23:10:33
End at: 2018-12-01 23:11:03
Local clock offset: 2.153 ms
Remote clock offset: -13.013 ms


# Below is generated by plot.py at 2018-12-02 00:06:20
# Datalink statistics
-- Total of 1 flow:
Average throughput: 1.47 Mbit/s
95th percentile per-packet one-way delay: 264.144 ms
Loss rate: 0.53%
-- Flow 1:
Average throughput: 1.47 Mbit/s
95th percentile per-packet one-way delay: 264.144 ms
Loss rate: 0.53%
```
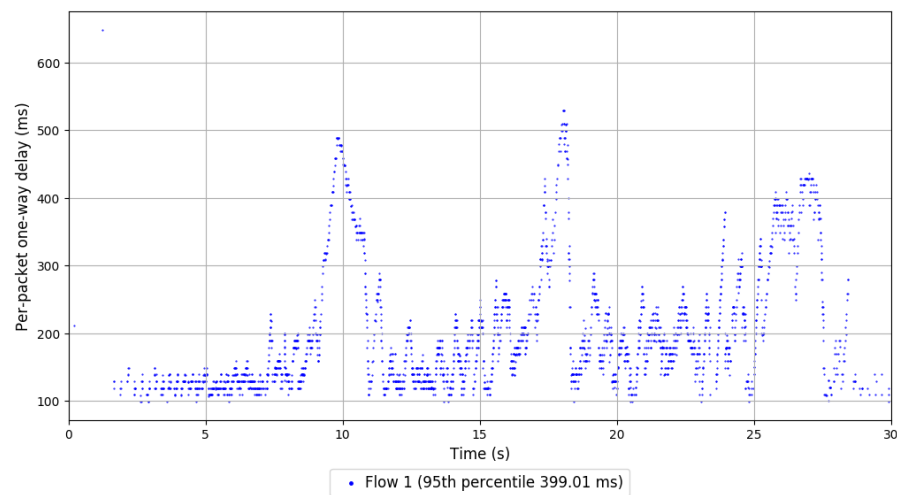
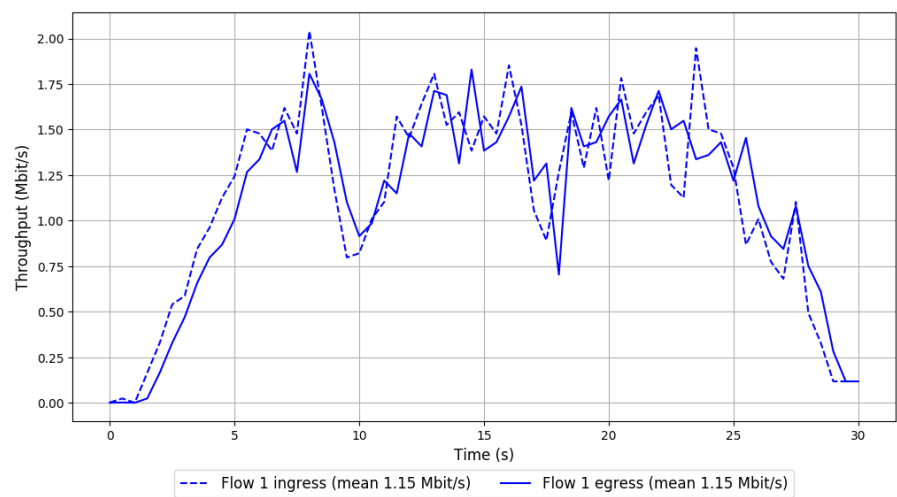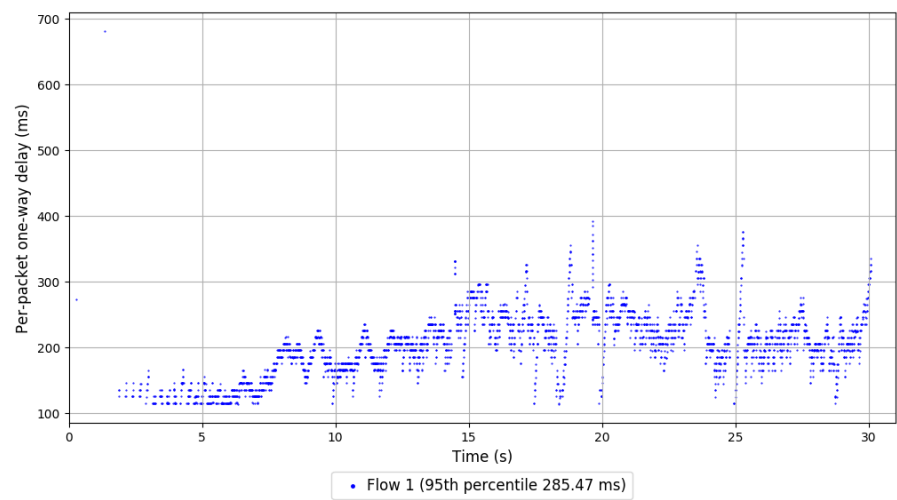Run 1: Report of LEDBAT — Data Link

Flow 1 ingress (mean 1.47 Mbit/s)   Flow 1 egress (mean 1.47 Mbit/s)

Flow 1 (95th percentile 264.14 ms)

48

```
Run 2: Statistics of LEDBAT

Start at: 2018-12-01 23:32:15
End at: 2018-12-01 23:32:45
Local clock offset: 3.581 ms
Remote clock offset: -9.658 ms

# Below is generated by plot.py at 2018-12-02 00:06:20
# Datalink statistics
-- Total of 1 flow:
Average throughput: 1.15 Mbit/s
95th percentile per-packet one-way delay: 399.012 ms
Loss rate: 0.82%
-- Flow 1:
Average throughput: 1.15 Mbit/s
95th percentile per-packet one-way delay: 399.012 ms
Loss rate: 0.82%
```

Run 2: Report of LEDBAT — Data Link

Flow 1 ingress (mean 1.15 Mbit/s) ----   Flow 1 egress (mean 1.15 Mbit/s) ——

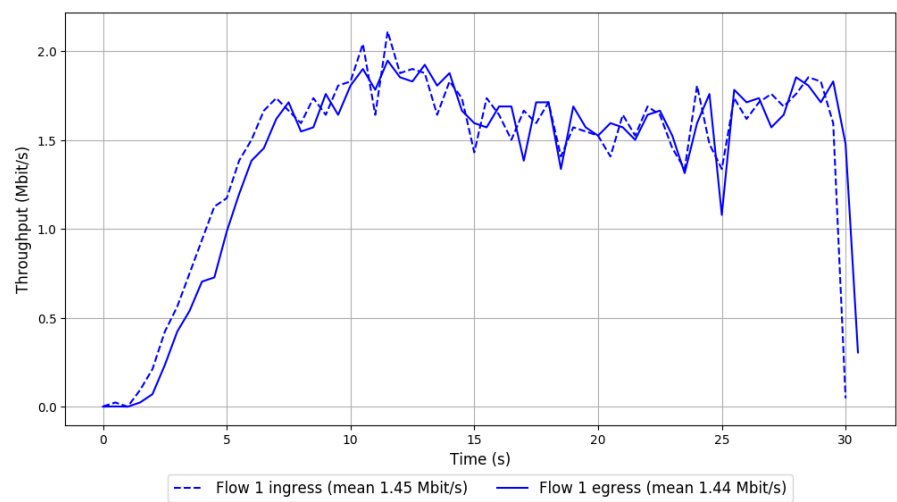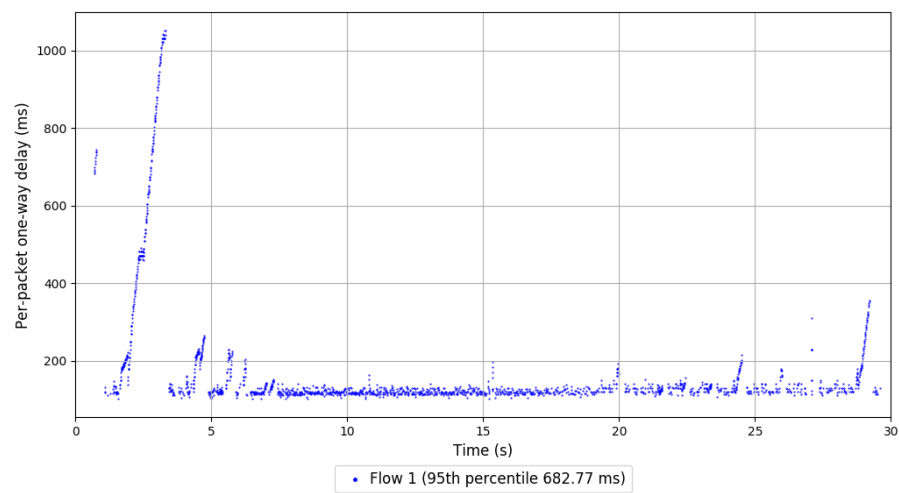Flow 1 (95th percentile 399.01 ms)

```
Run 3: Statistics of LEDBAT

Start at: 2018-12-01 23:53:55
End at: 2018-12-01 23:54:25
Local clock offset: 1.576 ms
Remote clock offset: -8.009 ms


# Below is generated by plot.py at 2018-12-02 00:06:20
# Datalink statistics
-- Total of 1 flow:
Average throughput: 1.44 Mbit/s
95th percentile per-packet one-way delay: 285.468 ms
Loss rate: 0.73%
-- Flow 1:
Average throughput: 1.44 Mbit/s
95th percentile per-packet one-way delay: 285.468 ms
Loss rate: 0.73%
```

Run 3: Report of LEDBAT — Data Link

Flow 1 ingress (mean 1.45 Mbit/s)   Flow 1 egress (mean 1.44 Mbit/s)

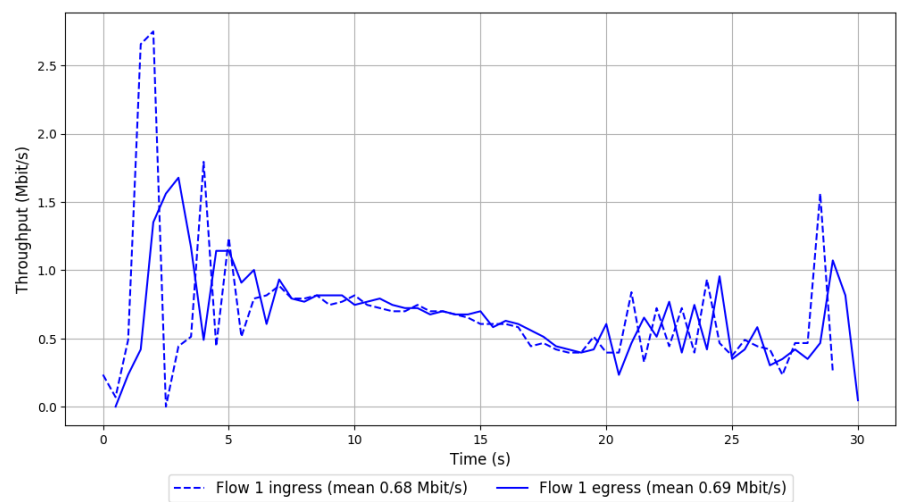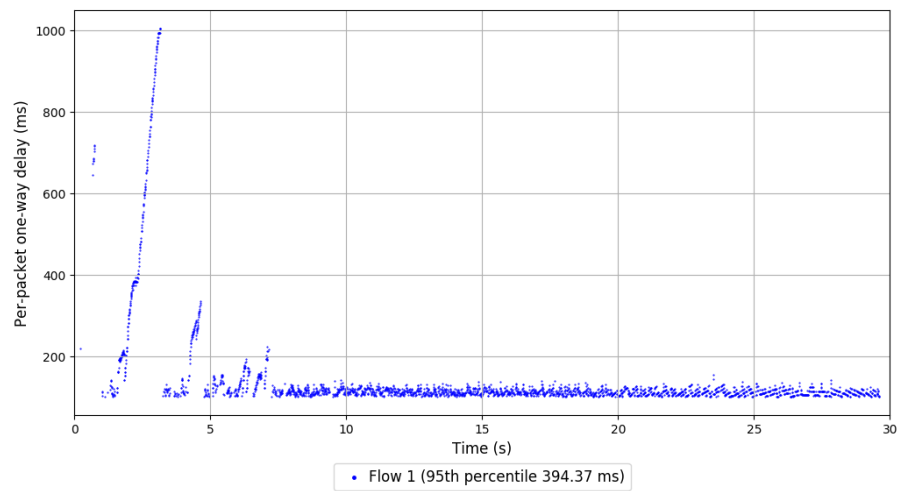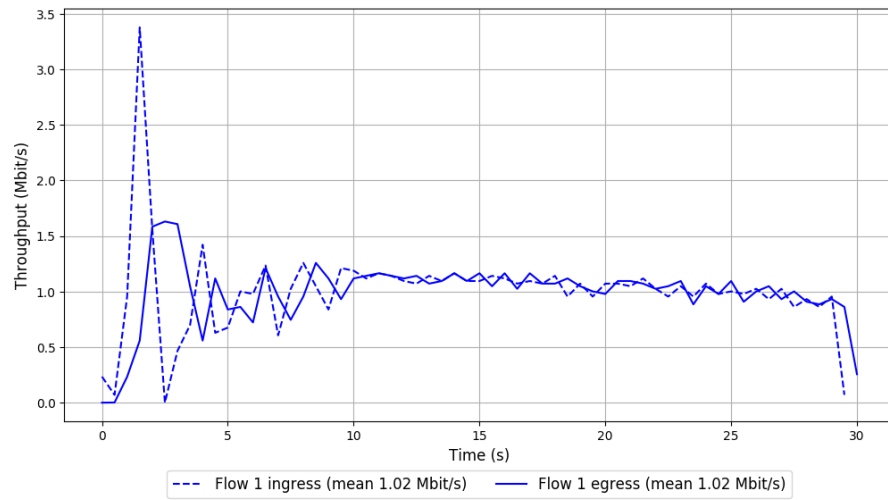Flow 1 (95th percentile 285.47 ms)

```
Run 1: Statistics of Indigo-Muses

Start at: 2018-12-01 23:18:32
End at: 2018-12-01 23:19:02
Local clock offset: 3.562 ms
Remote clock offset: -9.104 ms


# Below is generated by plot.py at 2018-12-02 00:06:20
# Datalink statistics
-- Total of 1 flow:
Average throughput: 0.69 Mbit/s
95th percentile per-packet one-way delay: 682.769 ms
Loss rate: 0.06%
-- Flow 1:
Average throughput: 0.69 Mbit/s
95th percentile per-packet one-way delay: 682.769 ms
Loss rate: 0.06%
```
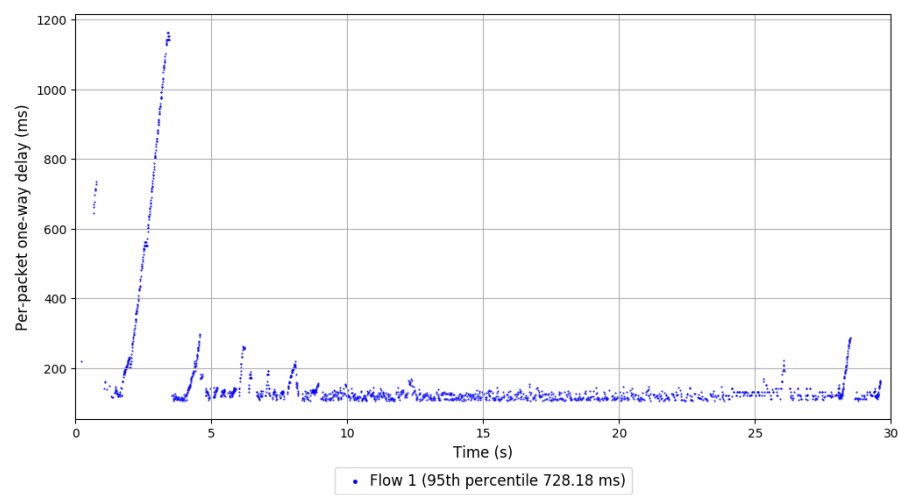
Run 1: Report of Indigo-Muses — Data Link

```
Run 2: Statistics of Indigo-Muses

Start at: 2018-12-01 23:40:14
End at: 2018-12-01 23:40:44
Local clock offset: 5.921 ms
Remote clock offset: -9.854 ms


# Below is generated by plot.py at 2018-12-02 00:06:20
# Datalink statistics
-- Total of 1 flow:
Average throughput: 1.02 Mbit/s
95th percentile per-packet one-way delay: 394.370 ms
Loss rate: 0.08%
-- Flow 1:
Average throughput: 1.02 Mbit/s
95th percentile per-packet one-way delay: 394.370 ms
Loss rate: 0.08%
```

Run 2: Report of Indigo-Muses — Data Link

Flow 1 ingress (mean 1.02 Mbit/s) — Flow 1 egress (mean 1.02 Mbit/s)

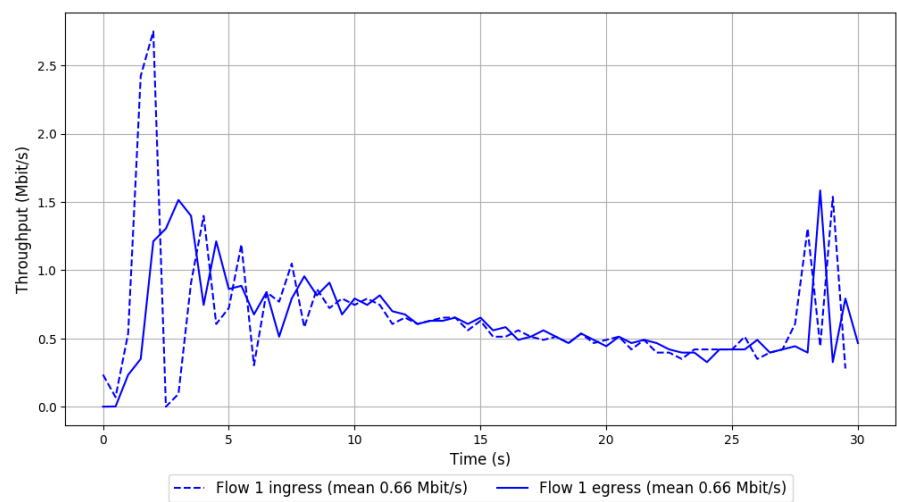

• Flow 1 (95th percentile 394.37 ms)

```
Run 3: Statistics of Indigo-Muses

Start at: 2018-12-02 00:01:53
End at: 2018-12-02 00:02:23
Local clock offset: -2.351 ms
Remote clock offset: -9.513 ms


# Below is generated by plot.py at 2018-12-02 00:06:20
# Datalink statistics
-- Total of 1 flow:
Average throughput: 0.66 Mbit/s
95th percentile per-packet one-way delay: 728.180 ms
Loss rate: 1.72%
-- Flow 1:
Average throughput: 0.66 Mbit/s
95th percentile per-packet one-way delay: 728.180 ms
Loss rate: 1.72%
```

Run 3: Report of Indigo-Muses — Data Link

```
Run 1: Statistics of PCC-Allegro

Start at: 2018-12-01 23:09:24
End at: 2018-12-01 23:09:54
Local clock offset: 3.317 ms
Remote clock offset: -11.815 ms


# Below is generated by plot.py at 2018-12-02 00:06:20
# Datalink statistics
-- Total of 1 flow:
Average throughput: 1.63 Mbit/s
95th percentile per-packet one-way delay: 4533.188 ms
Loss rate: 63.96%
-- Flow 1:
Average throughput: 1.63 Mbit/s
95th percentile per-packet one-way delay: 4533.188 ms
Loss rate: 63.96%
```
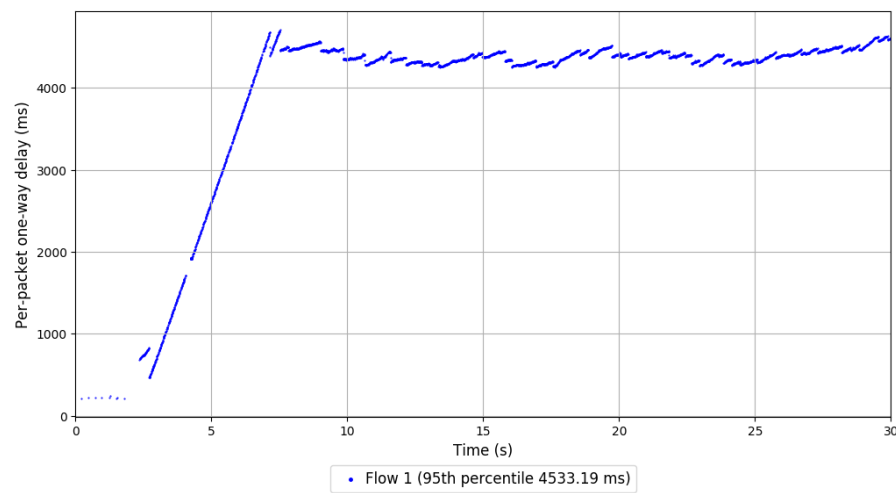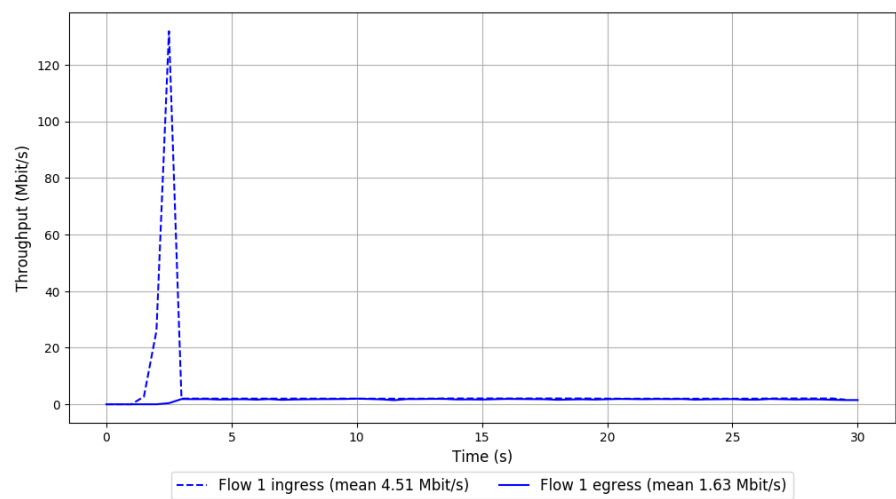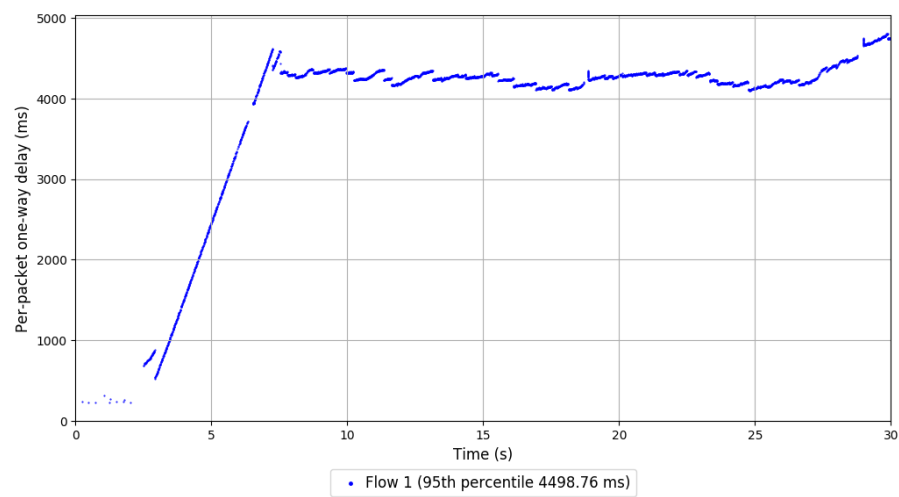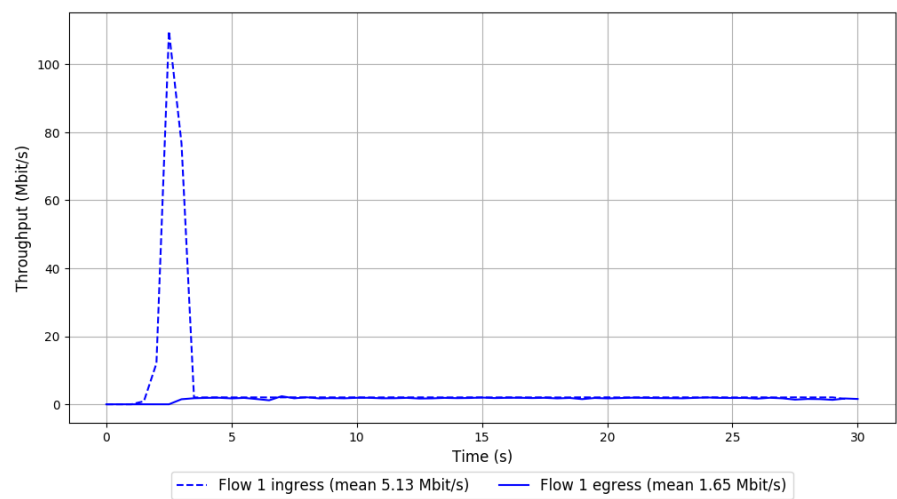
Run 1: Report of PCC-Allegro — Data Link

Flow 1 ingress (mean 4.51 Mbit/s)   Flow 1 egress (mean 1.63 Mbit/s)

Flow 1 (95th percentile 4533.19 ms)

```
Run 2: Statistics of PCC-Allegro

Start at: 2018-12-01 23:31:06
End at: 2018-12-01 23:31:36
Local clock offset: 3.282 ms
Remote clock offset: -8.402 ms


# Below is generated by plot.py at 2018-12-02 00:06:20
# Datalink statistics
-- Total of 1 flow:
Average throughput: 1.65 Mbit/s
95th percentile per-packet one-way delay: 4498.756 ms
Loss rate: 67.95%
-- Flow 1:
Average throughput: 1.65 Mbit/s
95th percentile per-packet one-way delay: 4498.756 ms
Loss rate: 67.95%
```
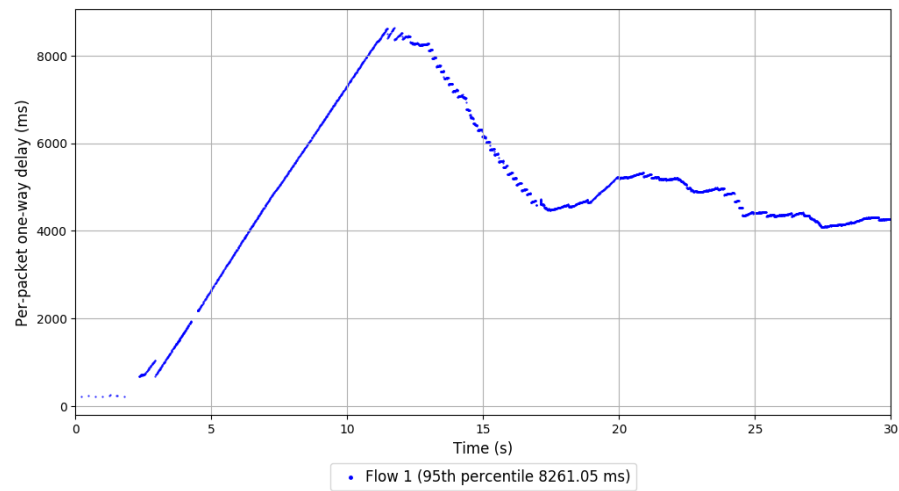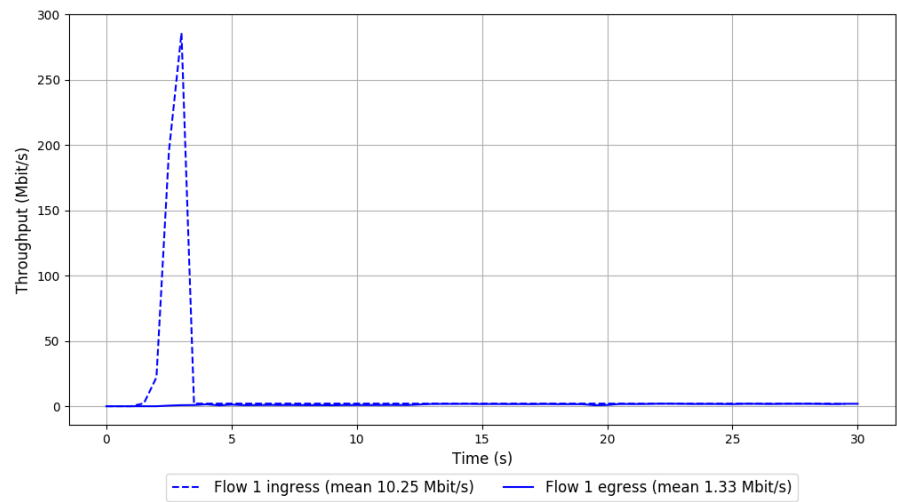
Run 2: Report of PCC-Allegro — Data Link

Flow 1 ingress (mean 5.13 Mbit/s) ----- Flow 1 egress (mean 1.65 Mbit/s) ——

• Flow 1 (95th percentile 4498.76 ms)
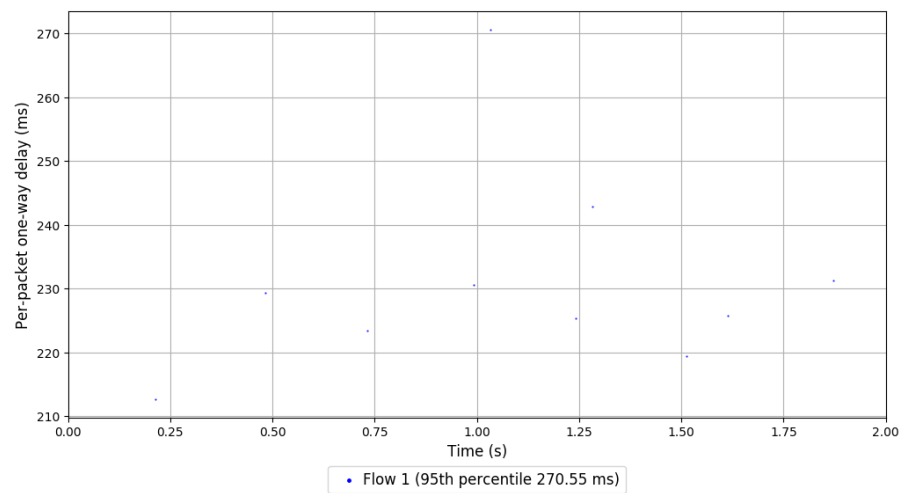
```
Run 3: Statistics of PCC-Allegro

Start at: 2018-12-01 23:52:47
End at: 2018-12-01 23:53:17
Local clock offset: 2.778 ms
Remote clock offset: -13.11 ms


# Below is generated by plot.py at 2018-12-02 00:06:23
# Datalink statistics
-- Total of 1 flow:
Average throughput: 1.33 Mbit/s
95th percentile per-packet one-way delay: 8261.052 ms
Loss rate: 87.09%
-- Flow 1:
Average throughput: 1.33 Mbit/s
95th percentile per-packet one-way delay: 8261.052 ms
Loss rate: 87.09%
```

Run 3: Report of PCC-Allegro — Data Link

```
Run 1: Statistics of PCC-Expr

Start at: 2018-12-01 23:12:49
End at: 2018-12-01 23:13:20
Local clock offset: 1.795 ms
Remote clock offset: -7.911 ms
```
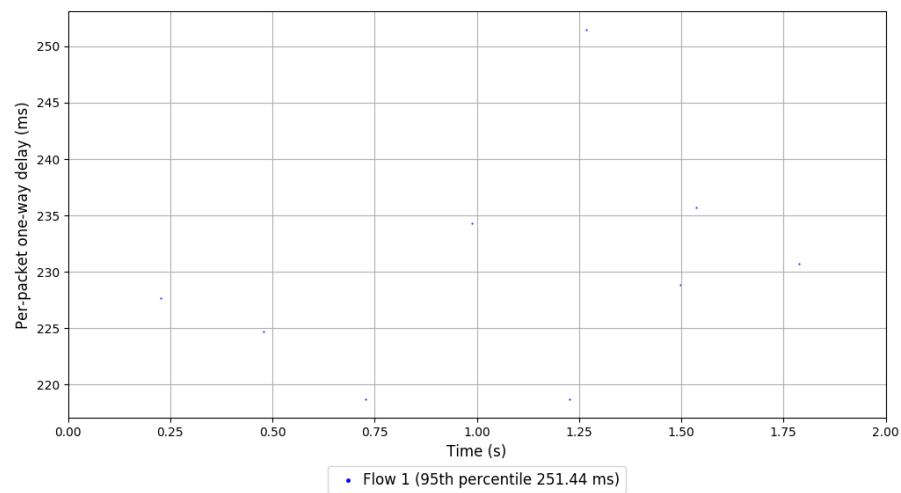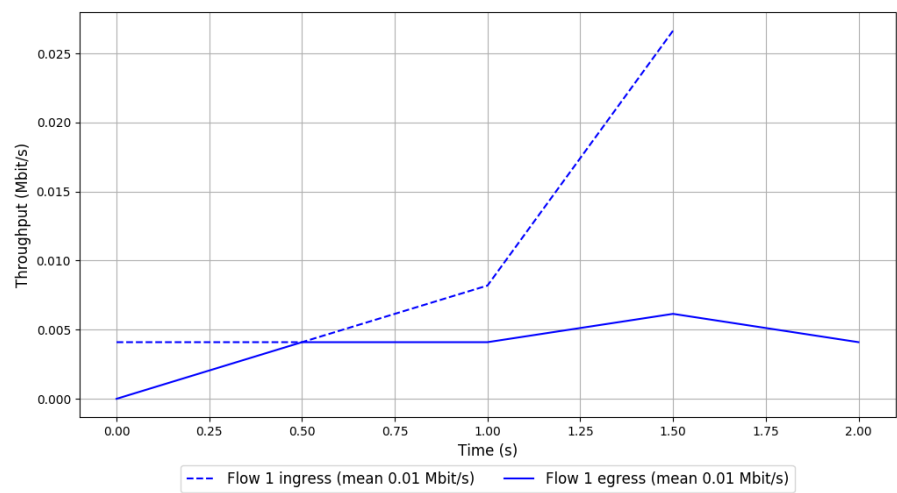
Run 1: Report of PCC-Expr — Data Link

Flow 1 ingress (mean 0.01 Mbit/s) --- Flow 1 egress (mean 0.01 Mbit/s) ——

• Flow 1 (95th percentile 270.55 ms)

```
Run 2: Statistics of PCC-Expr

Start at: 2018-12-01 23:34:32
End at: 2018-12-01 23:35:02
Local clock offset: 4.189 ms
Remote clock offset: -13.629 ms
```

Run 2: Report of PCC-Expr — Data Link
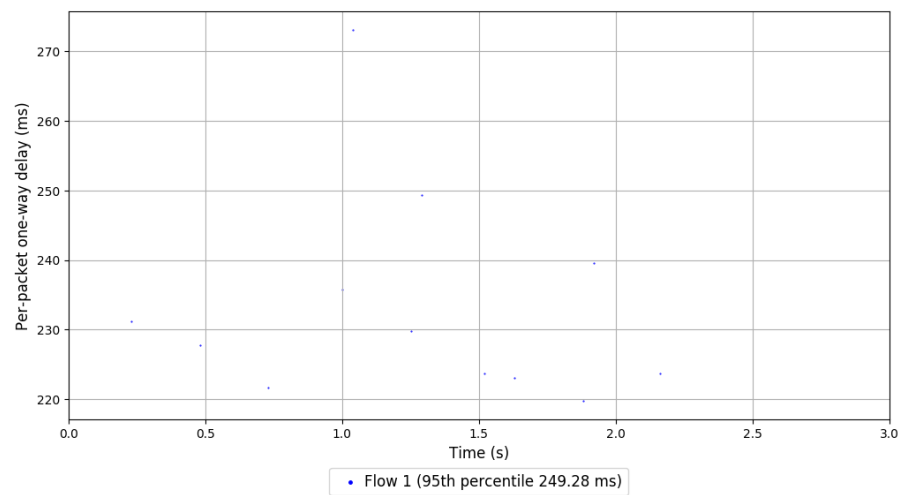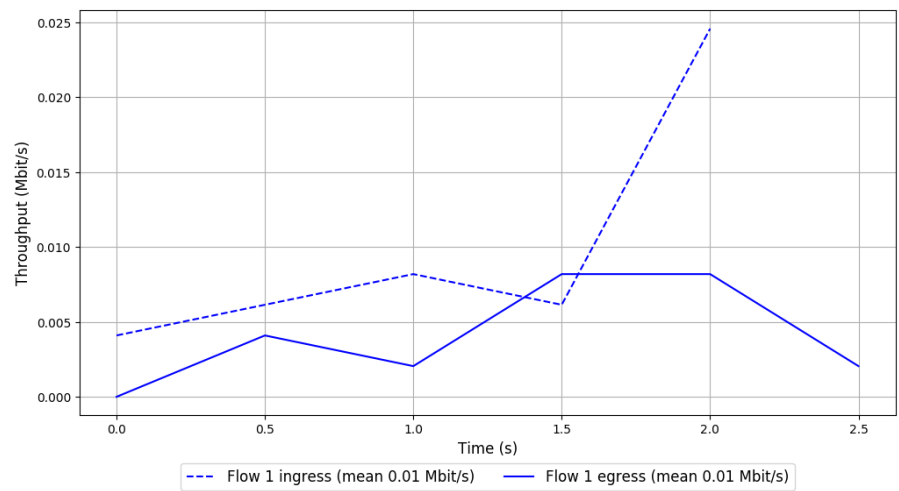
```
Run 3: Statistics of PCC-Expr

Start at: 2018-12-01 23:56:11
End at: 2018-12-01 23:56:41
Local clock offset: 0.003 ms
Remote clock offset: -10.281 ms
```

Run 3: Report of PCC-Expr — Data Link

```
Run 1: Statistics of QUIC Cubic

Start at: 2018-12-01 23:13:58
End at: 2018-12-01 23:14:28
Local clock offset: 1.864 ms
Remote clock offset: -11.8 ms

# Below is generated by plot.py at 2018-12-02 00:06:23
# Datalink statistics
-- Total of 1 flow:
Average throughput: 1.45 Mbit/s
95th percentile per-packet one-way delay: 1059.918 ms
Loss rate: 3.29%
-- Flow 1:
Average throughput: 1.45 Mbit/s
95th percentile per-packet one-way delay: 1059.918 ms
Loss rate: 3.29%
```
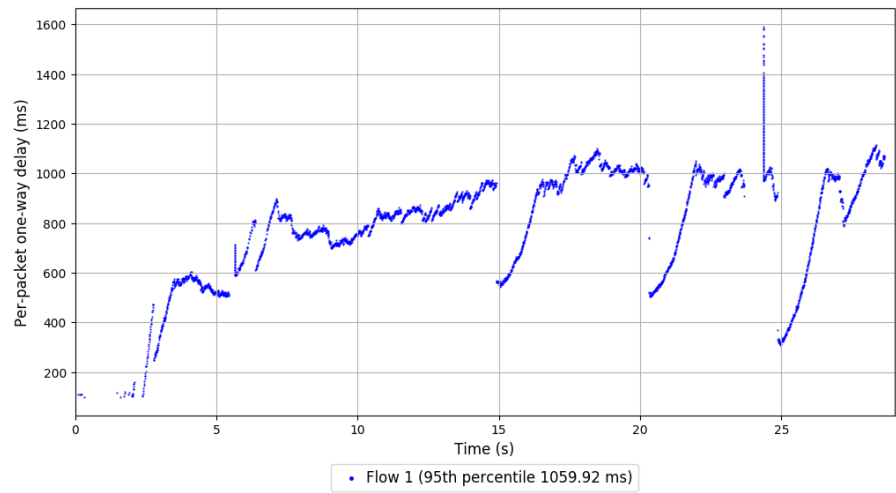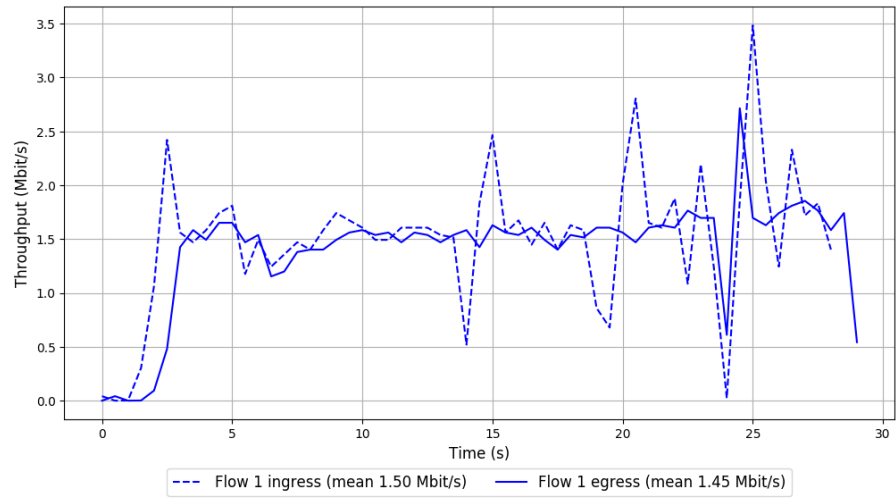
Run 1: Report of QUIC Cubic — Data Link

Flow 1 ingress (mean 1.50 Mbit/s) --- Flow 1 egress (mean 1.45 Mbit/s) ——
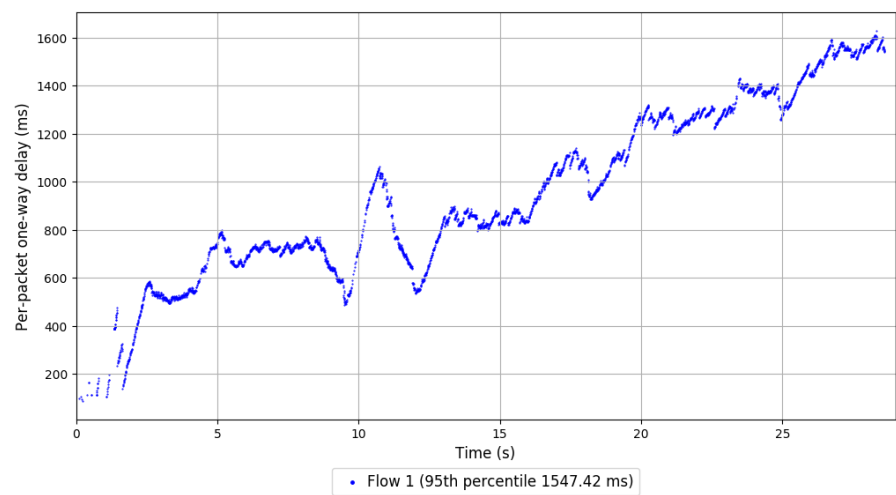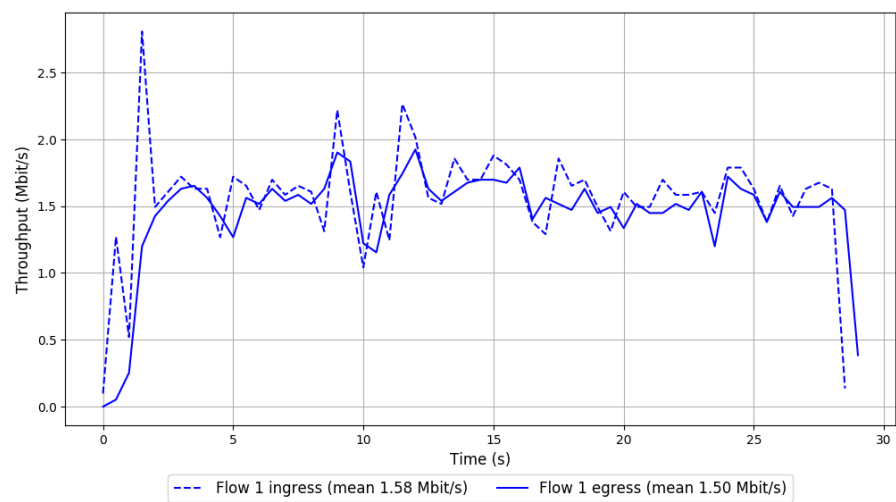

Flow 1 (95th percentile 1059.92 ms)

```
Run 2: Statistics of QUIC Cubic

Start at: 2018-12-01 23:35:40
End at: 2018-12-01 23:36:10
Local clock offset: 5.258 ms
Remote clock offset: -12.656 ms


# Below is generated by plot.py at 2018-12-02 00:06:23
# Datalink statistics
-- Total of 1 flow:
Average throughput: 1.50 Mbit/s
95th percentile per-packet one-way delay: 1547.418 ms
Loss rate: 5.36%
-- Flow 1:
Average throughput: 1.50 Mbit/s
95th percentile per-packet one-way delay: 1547.418 ms
Loss rate: 5.36%
```

Run 2: Report of QUIC Cubic — Data Link

Flow 1 ingress (mean 1.58 Mbit/s) --- Flow 1 egress (mean 1.50 Mbit/s)
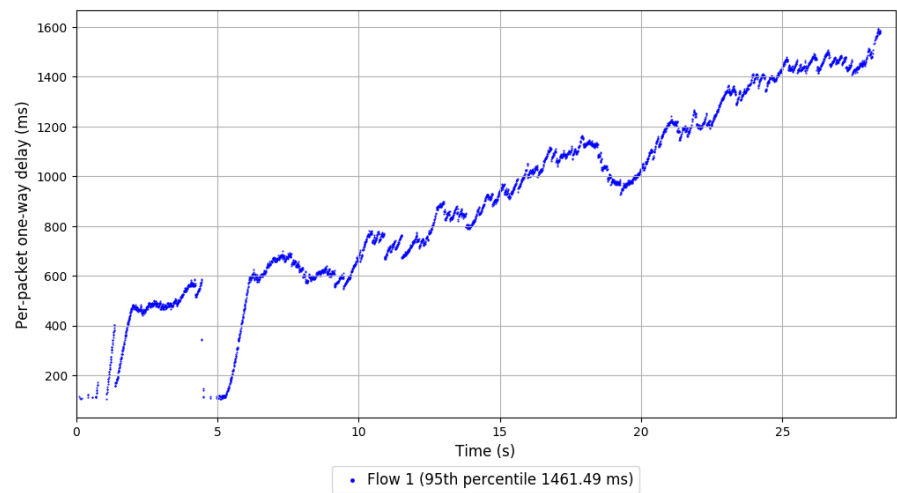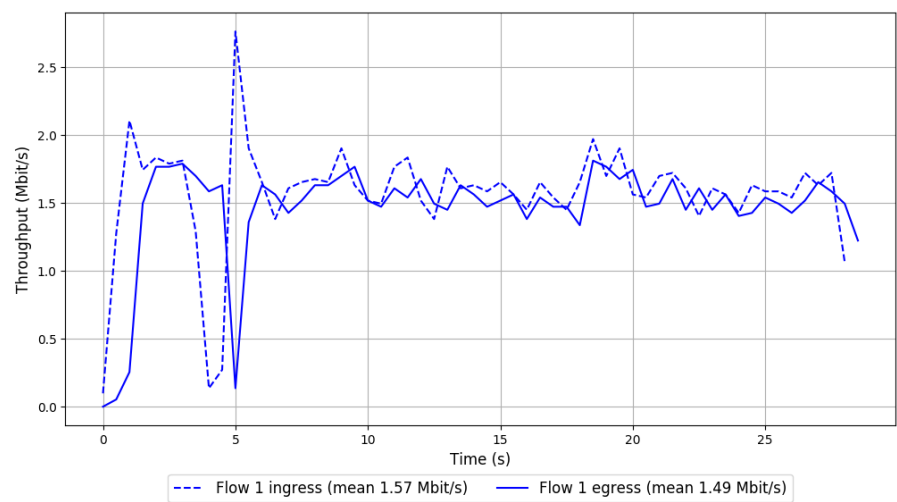

Flow 1 (95th percentile 1547.42 ms)

74

```
Run 3: Statistics of QUIC Cubic

Start at: 2018-12-01 23:57:19
End at: 2018-12-01 23:57:49
Local clock offset: -0.685 ms
Remote clock offset: -13.29 ms


# Below is generated by plot.py at 2018-12-02 00:06:23
# Datalink statistics
-- Total of 1 flow:
Average throughput: 1.49 Mbit/s
95th percentile per-packet one-way delay: 1461.493 ms
Loss rate: 5.42%
-- Flow 1:
Average throughput: 1.49 Mbit/s
95th percentile per-packet one-way delay: 1461.493 ms
Loss rate: 5.42%
```
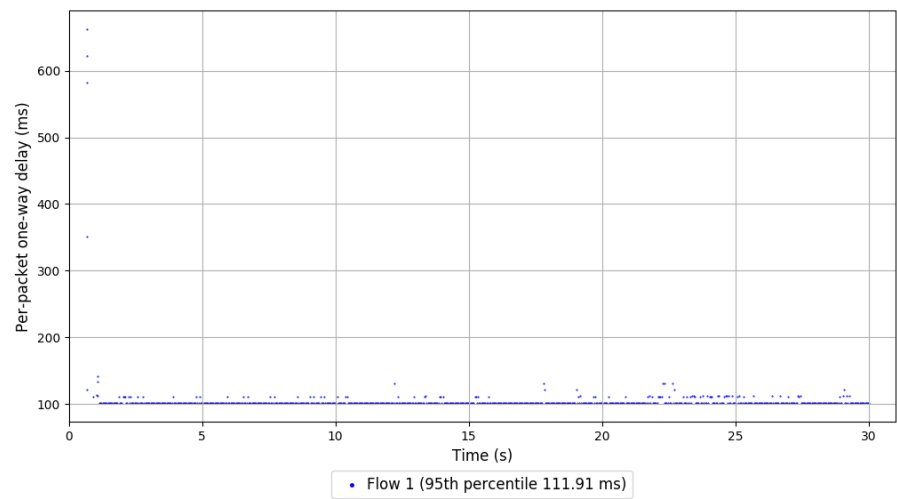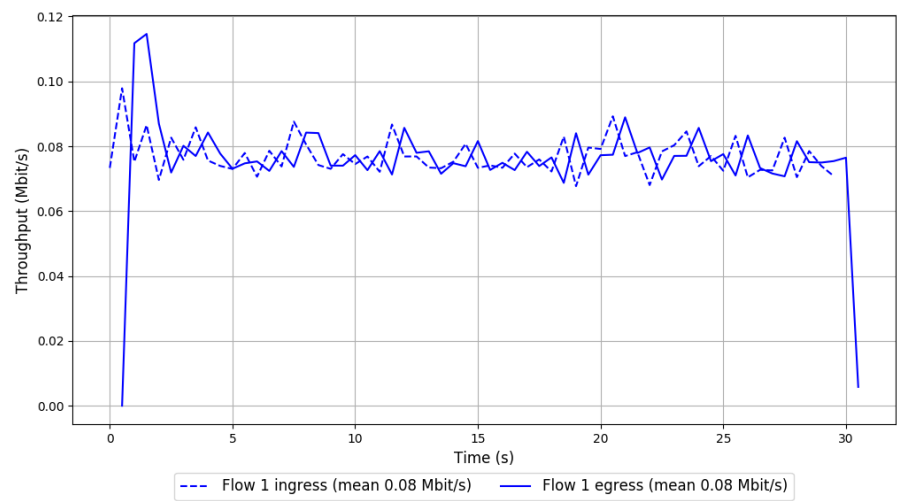
Run 3: Report of QUIC Cubic — Data Link

```
Run 1: Statistics of SCReAM

Start at: 2018-12-01 23:02:35
End at: 2018-12-01 23:03:05
Local clock offset: 5.571 ms
Remote clock offset: -7.799 ms


# Below is generated by plot.py at 2018-12-02 00:06:23
# Datalink statistics
-- Total of 1 flow:
Average throughput: 0.08 Mbit/s
95th percentile per-packet one-way delay: 111.913 ms
Loss rate: 0.13%
-- Flow 1:
Average throughput: 0.08 Mbit/s
95th percentile per-packet one-way delay: 111.913 ms
Loss rate: 0.13%
```

Run 1: Report of SCReAM — Data Link

Flow 1 ingress (mean 0.08 Mbit/s) —— Flow 1 egress (mean 0.08 Mbit/s)

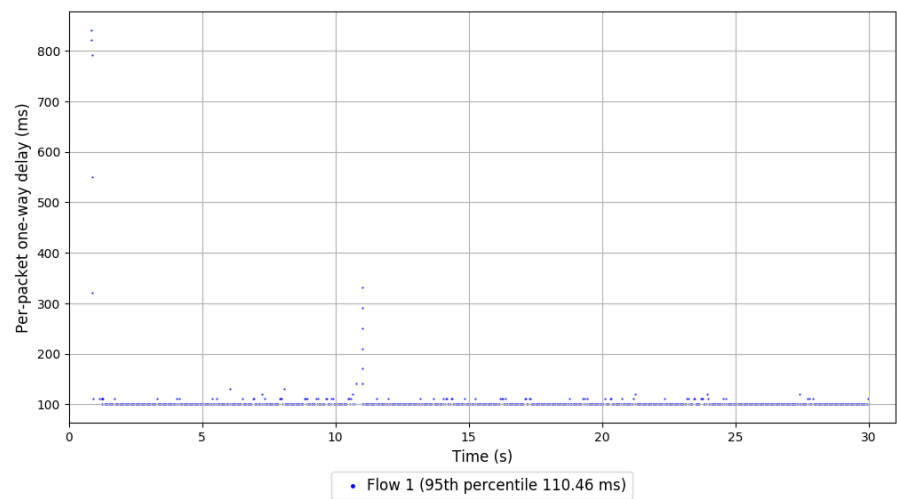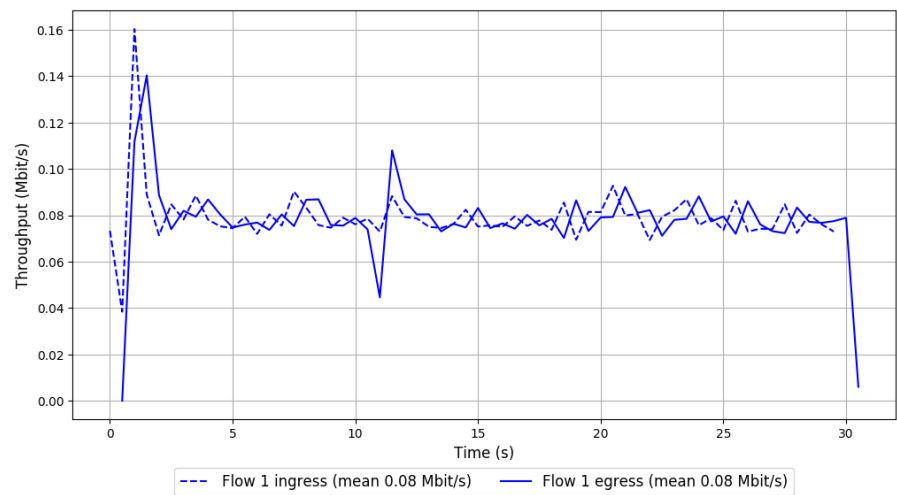• Flow 1 (95th percentile 111.91 ms)

```
Run 2: Statistics of SCReAM

Start at: 2018-12-01 23:24:15
End at: 2018-12-01 23:24:45
Local clock offset: 2.986 ms
Remote clock offset: -8.465 ms


# Below is generated by plot.py at 2018-12-02 00:06:24
# Datalink statistics
-- Total of 1 flow:
Average throughput: 0.08 Mbit/s
95th percentile per-packet one-way delay: 110.456 ms
Loss rate: 0.13%
-- Flow 1:
Average throughput: 0.08 Mbit/s
95th percentile per-packet one-way delay: 110.456 ms
Loss rate: 0.13%
```

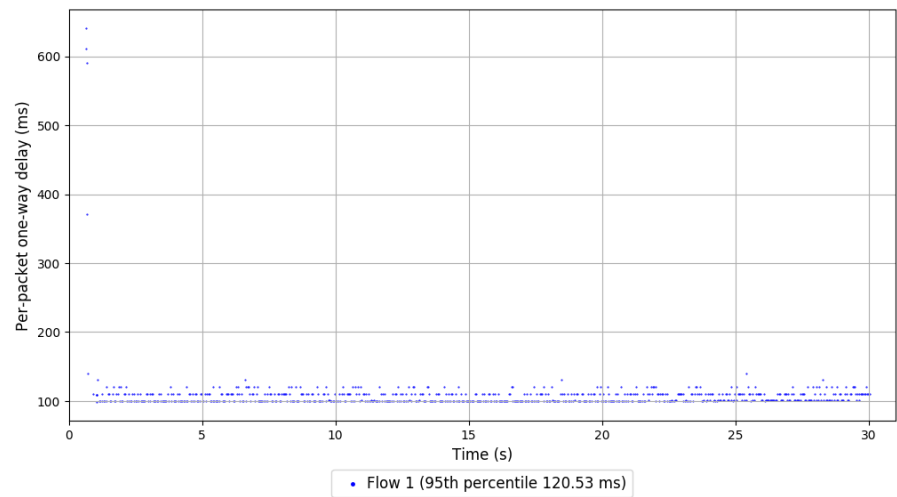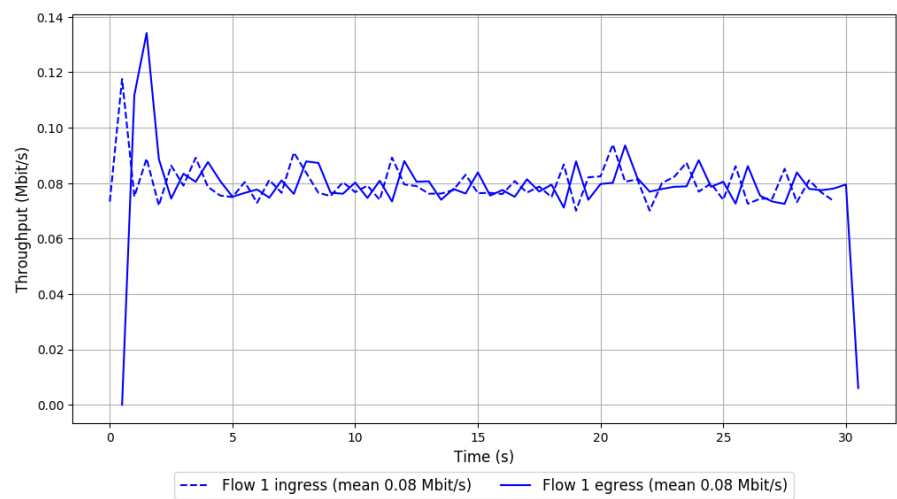Run 2: Report of SCReAM — Data Link

```
Run 3: Statistics of SCReAM

Start at: 2018-12-01 23:45:55
End at: 2018-12-01 23:46:25
Local clock offset: 8.121 ms
Remote clock offset: -10.089 ms


# Below is generated by plot.py at 2018-12-02 00:06:24
# Datalink statistics
-- Total of 1 flow:
Average throughput: 0.08 Mbit/s
95th percentile per-packet one-way delay: 120.535 ms
Loss rate: 0.13%
-- Flow 1:
Average throughput: 0.08 Mbit/s
95th percentile per-packet one-way delay: 120.535 ms
Loss rate: 0.13%
```

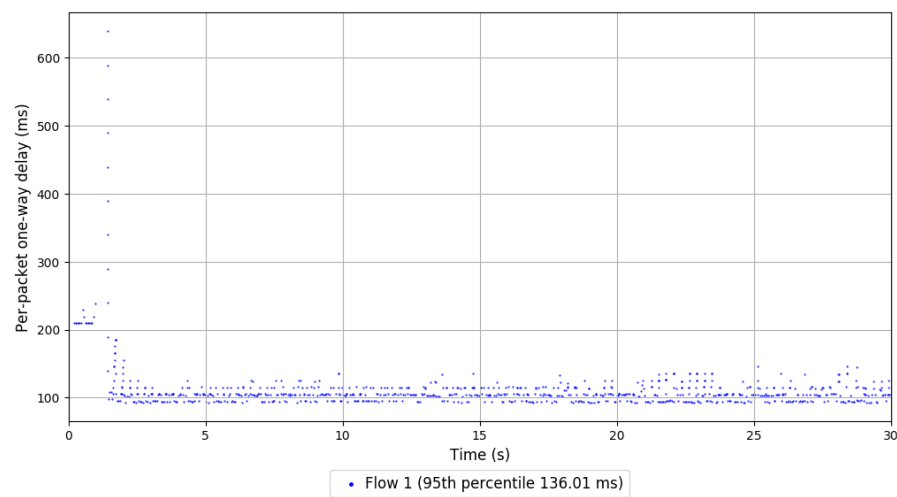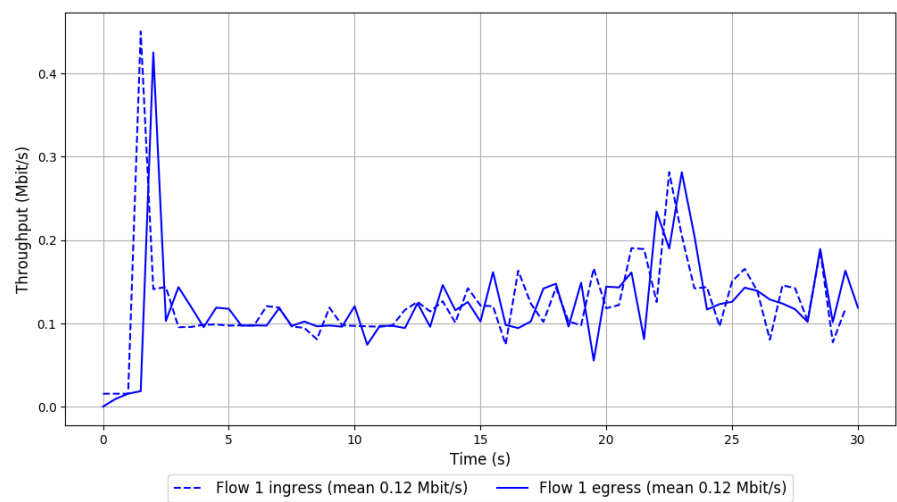Run 3: Report of SCReAM — Data Link

```
Run 1: Statistics of Sprout

Start at: 2018-12-01 23:08:16
End at: 2018-12-01 23:08:46
Local clock offset: 3.384 ms
Remote clock offset: -8.831 ms


# Below is generated by plot.py at 2018-12-02 00:06:24
# Datalink statistics
-- Total of 1 flow:
Average throughput: 0.12 Mbit/s
95th percentile per-packet one-way delay: 136.008 ms
Loss rate: 0.02%
-- Flow 1:
Average throughput: 0.12 Mbit/s
95th percentile per-packet one-way delay: 136.008 ms
Loss rate: 0.02%
```

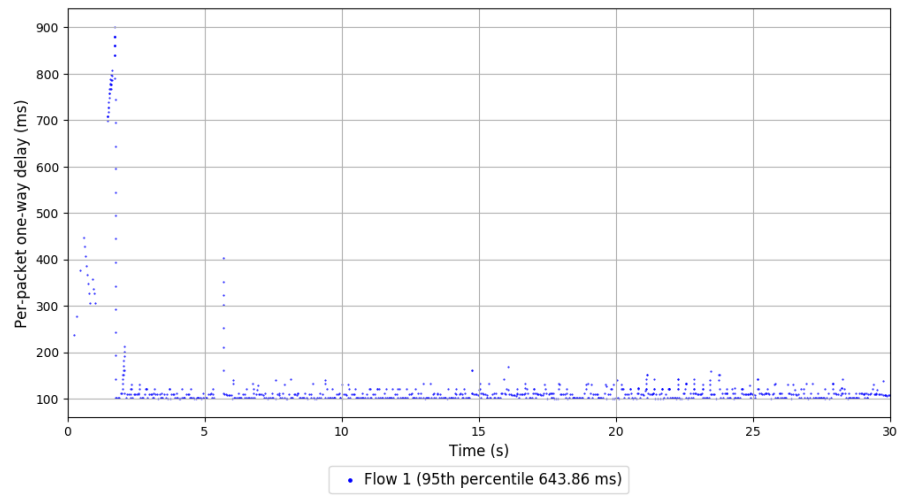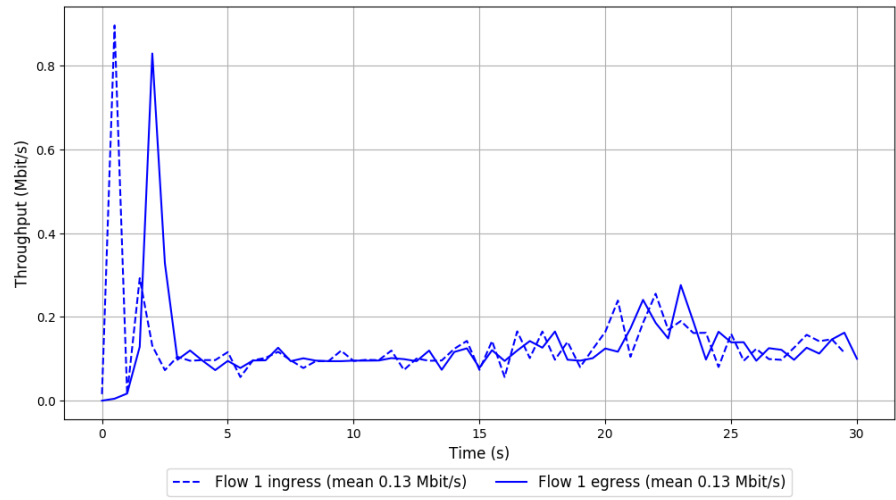Run 1: Report of Sprout — Data Link

```
Run 2: Statistics of Sprout

Start at: 2018-12-01 23:29:58
End at: 2018-12-01 23:30:28
Local clock offset: 3.033 ms
Remote clock offset: -8.406 ms


# Below is generated by plot.py at 2018-12-02 00:06:24
# Datalink statistics
-- Total of 1 flow:
Average throughput: 0.13 Mbit/s
95th percentile per-packet one-way delay: 643.859 ms
Loss rate: 0.54%
-- Flow 1:
Average throughput: 0.13 Mbit/s
95th percentile per-packet one-way delay: 643.859 ms
Loss rate: 0.54%
```

Run 2: Report of Sprout — Data Link

Flow 1 ingress (mean 0.13 Mbit/s)   Flow 1 egress (mean 0.13 Mbit/s)

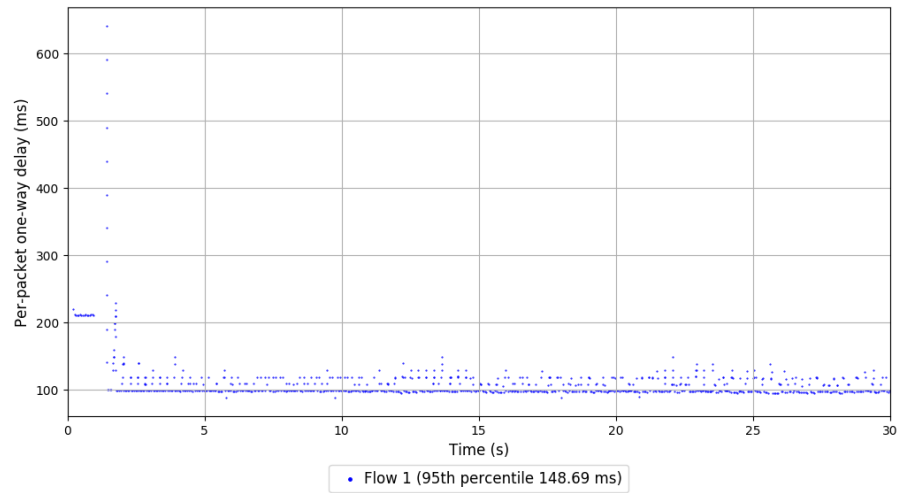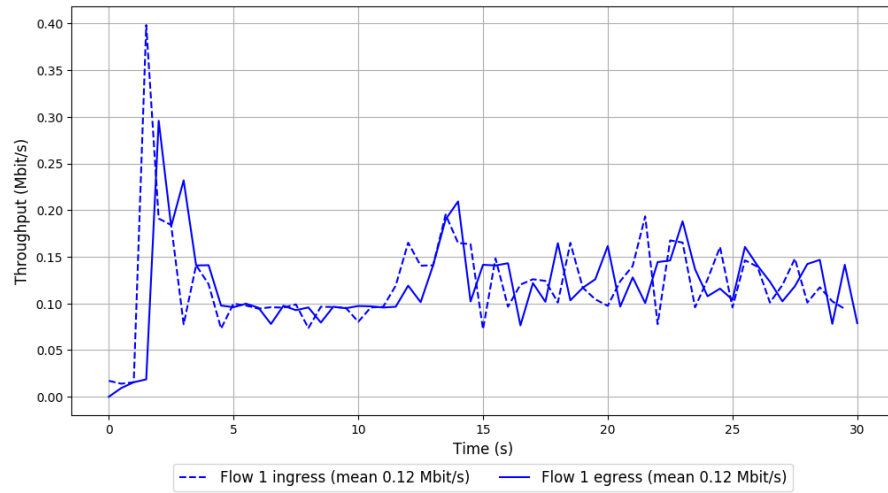Flow 1 (95th percentile 643.86 ms)

```
Run 3: Statistics of Sprout

Start at: 2018-12-01 23:51:38
End at: 2018-12-01 23:52:08
Local clock offset: 4.713 ms
Remote clock offset: -14.178 ms


# Below is generated by plot.py at 2018-12-02 00:06:25
# Datalink statistics
-- Total of 1 flow:
Average throughput: 0.12 Mbit/s
95th percentile per-packet one-way delay: 148.694 ms
Loss rate: 0.26%
-- Flow 1:
Average throughput: 0.12 Mbit/s
95th percentile per-packet one-way delay: 148.694 ms
Loss rate: 0.26%
```

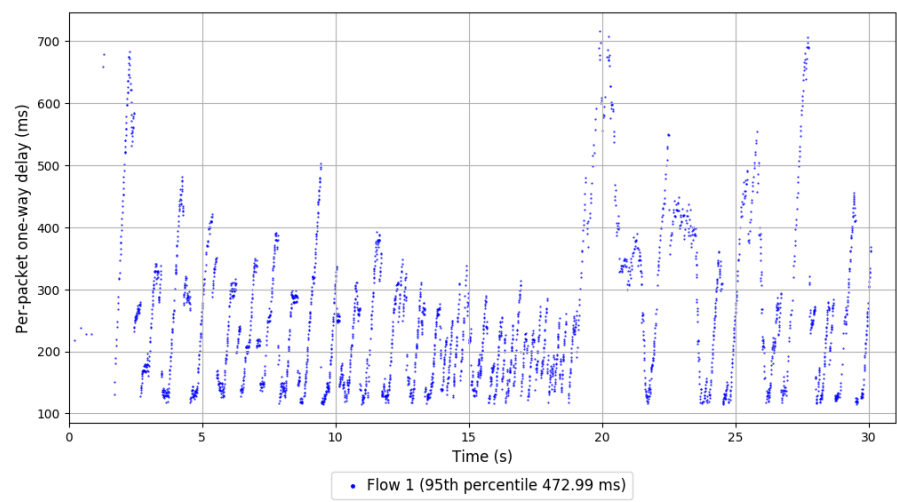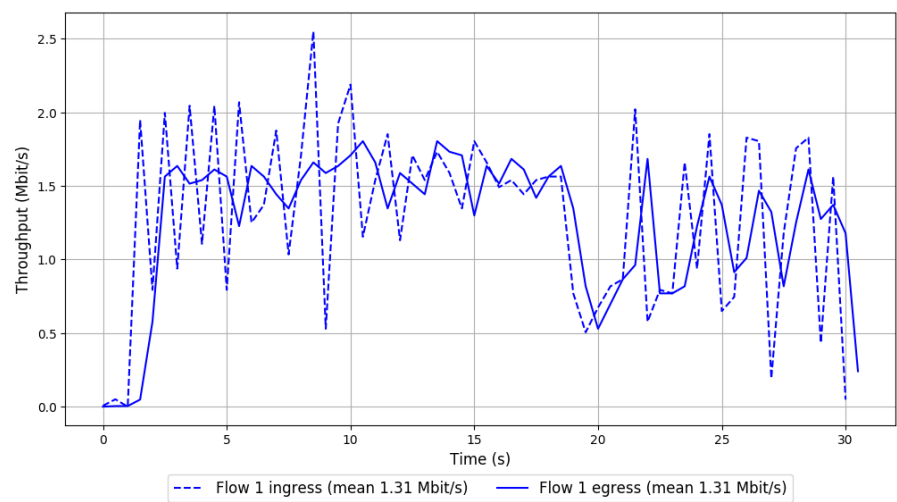Run 3: Report of Sprout — Data Link

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

Start at: 2018-12-01 23:15:06
End at: 2018-12-01 23:15:36
Local clock offset: 2.046 ms
Remote clock offset: -9.099 ms


# Below is generated by plot.py at 2018-12-02 00:06:26
# Datalink statistics
-- Total of 1 flow:
Average throughput: 1.31 Mbit/s
95th percentile per-packet one-way delay: 472.988 ms
Loss rate: 0.55%
-- Flow 1:
Average throughput: 1.31 Mbit/s
95th percentile per-packet one-way delay: 472.988 ms
Loss rate: 0.55%
```
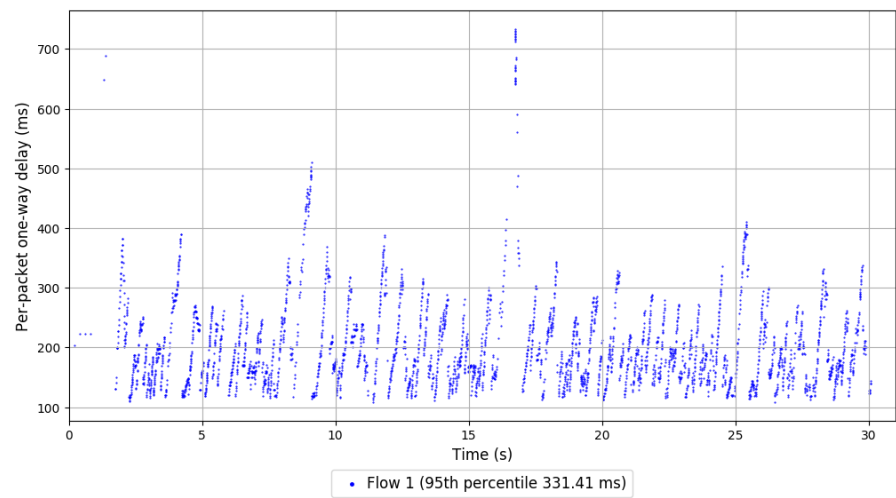
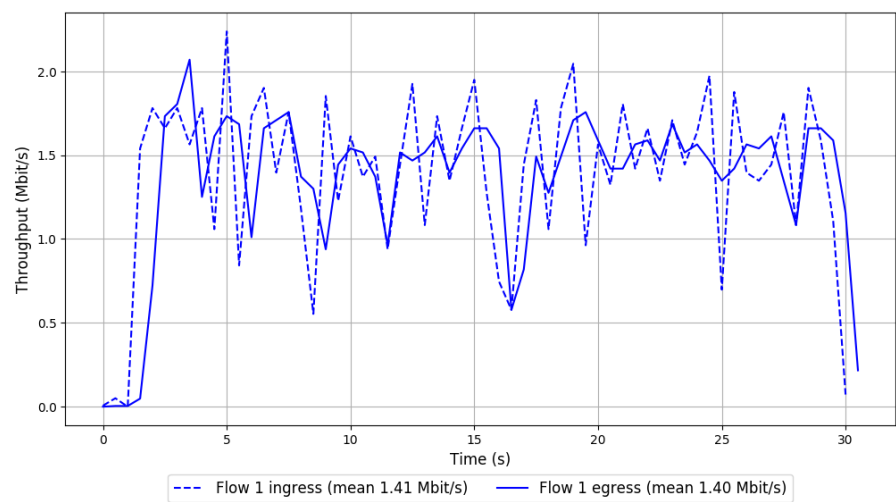Run 1: Report of TaoVA-100x — Data Link

```
Run 2: Statistics of TaoVA-100x

Start at: 2018-12-01 23:36:49
End at: 2018-12-01 23:37:19
Local clock offset: 5.609 ms
Remote clock offset: -13.597 ms


# Below is generated by plot.py at 2018-12-02 00:06:27
# Datalink statistics
-- Total of 1 flow:
Average throughput: 1.40 Mbit/s
95th percentile per-packet one-way delay: 331.407 ms
Loss rate: 0.68%
-- Flow 1:
Average throughput: 1.40 Mbit/s
95th percentile per-packet one-way delay: 331.407 ms
Loss rate: 0.68%
```

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

Flow 1 ingress (mean 1.41 Mbit/s) —— Flow 1 egress (mean 1.40 Mbit/s)
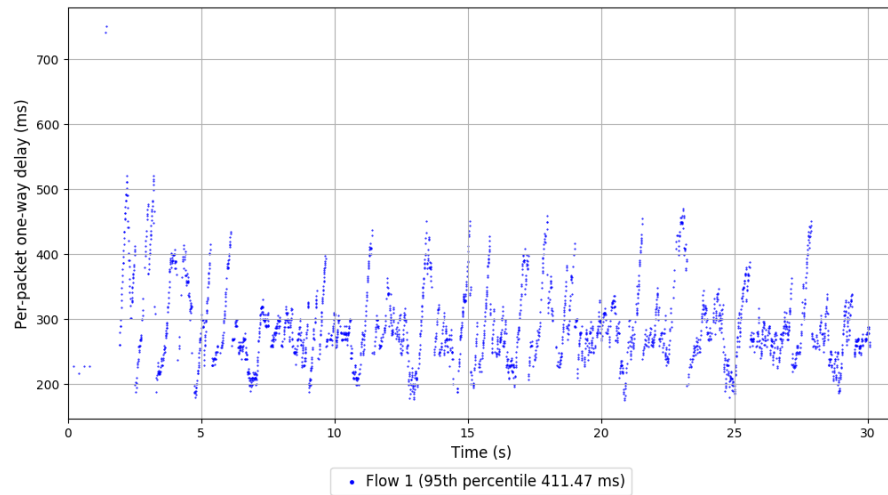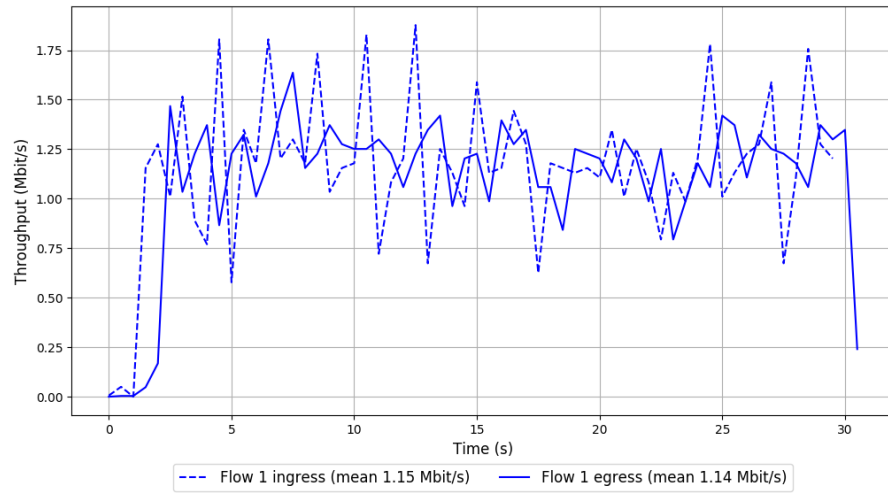

· Flow 1 (95th percentile 331.41 ms)

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

Start at: 2018-12-01 23:58:27
End at: 2018-12-01 23:58:57
Local clock offset: -0.407 ms
Remote clock offset: -10.281 ms


# Below is generated by plot.py at 2018-12-02 00:06:28
# Datalink statistics
-- Total of 1 flow:
Average throughput: 1.14 Mbit/s
95th percentile per-packet one-way delay: 411.473 ms
Loss rate: 0.70%
-- Flow 1:
Average throughput: 1.14 Mbit/s
95th percentile per-packet one-way delay: 411.473 ms
Loss rate: 0.70%
```

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

Flow 1 ingress (mean 1.15 Mbit/s) --- Flow 1 egress (mean 1.14 Mbit/s)
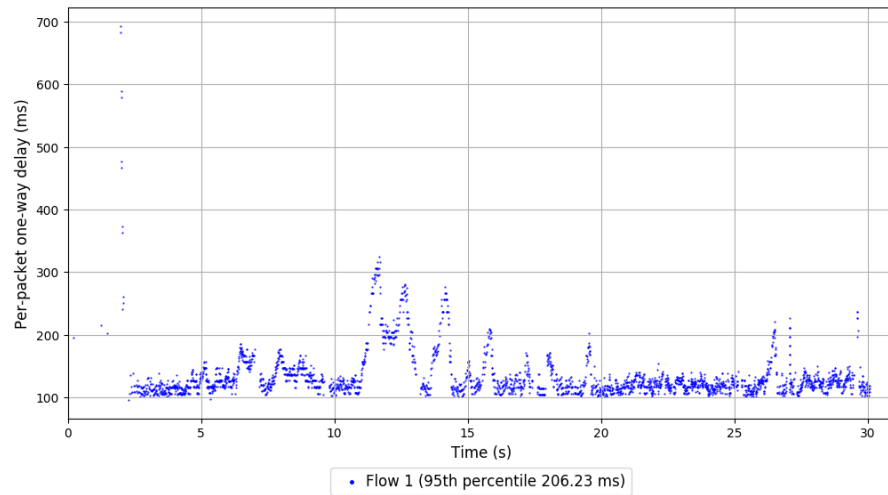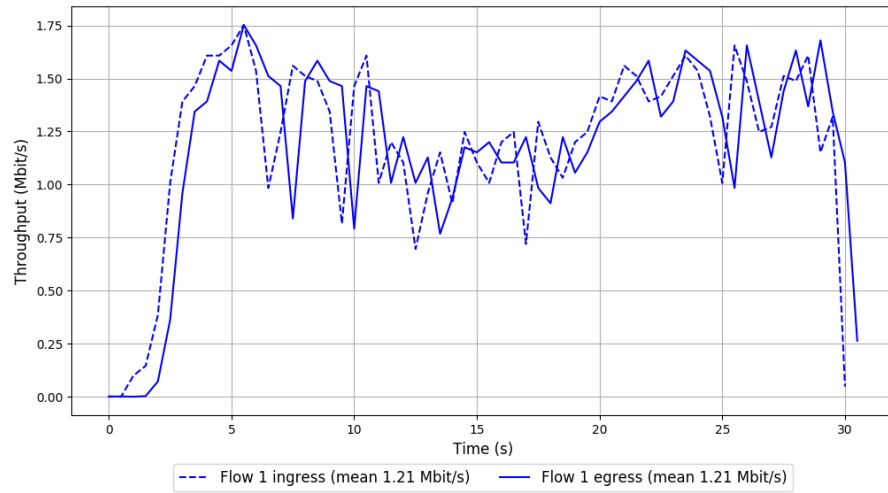

Flow 1 (95th percentile 411.47 ms)

```
Run 1: Statistics of TCP Vegas

Start at: 2018-12-01 23:20:48
End at: 2018-12-01 23:21:18
Local clock offset: 2.314 ms
Remote clock offset: -13.447 ms

# Below is generated by plot.py at 2018-12-02 00:06:28
# Datalink statistics
-- Total of 1 flow:
Average throughput: 1.21 Mbit/s
95th percentile per-packet one-way delay: 206.232 ms
Loss rate: 0.20%
-- Flow 1:
Average throughput: 1.21 Mbit/s
95th percentile per-packet one-way delay: 206.232 ms
Loss rate: 0.20%
```
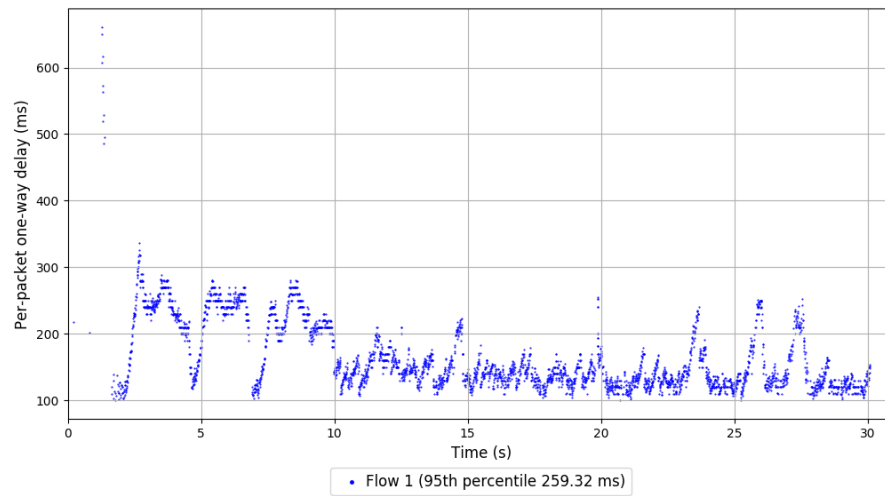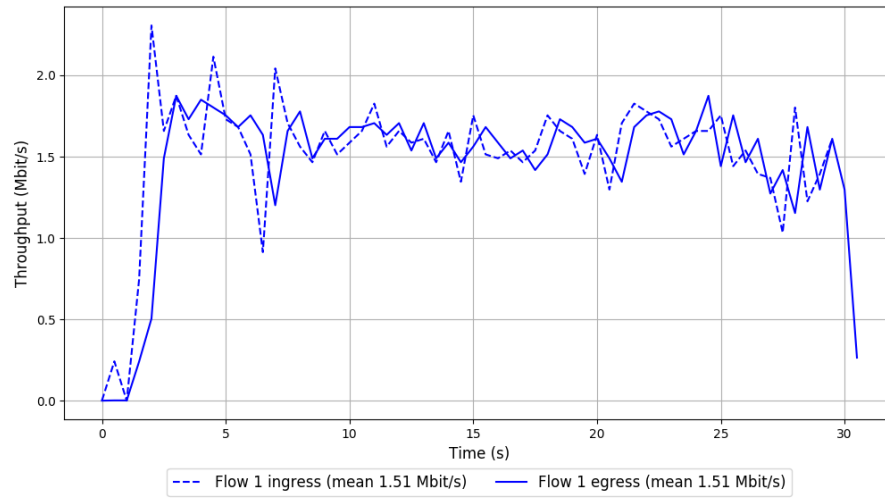
Run 1: Report of TCP Vegas — Data Link

```
Run 2: Statistics of TCP Vegas

Start at: 2018-12-01 23:42:30
End at: 2018-12-01 23:43:00
Local clock offset: 7.578 ms
Remote clock offset: -12.857 ms


# Below is generated by plot.py at 2018-12-02 00:06:30
# Datalink statistics
-- Total of 1 flow:
Average throughput: 1.51 Mbit/s
95th percentile per-packet one-way delay: 259.324 ms
Loss rate: 0.24%
-- Flow 1:
Average throughput: 1.51 Mbit/s
95th percentile per-packet one-way delay: 259.324 ms
Loss rate: 0.24%
```
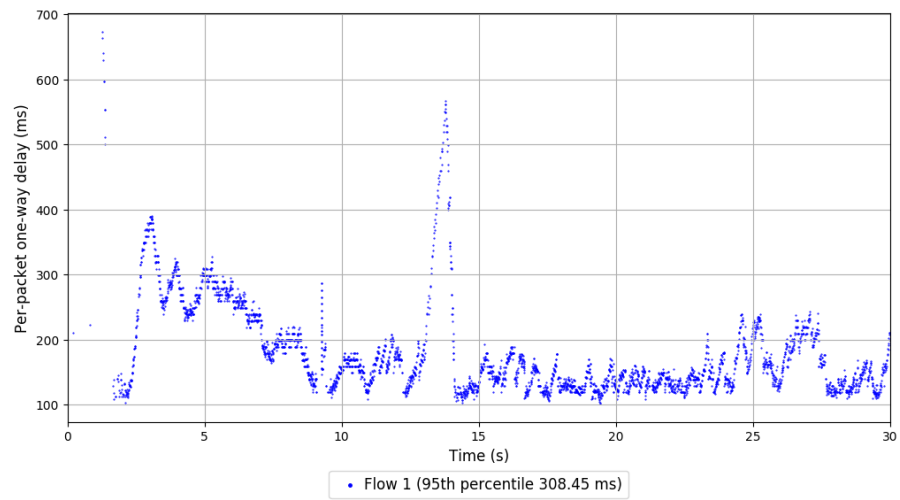
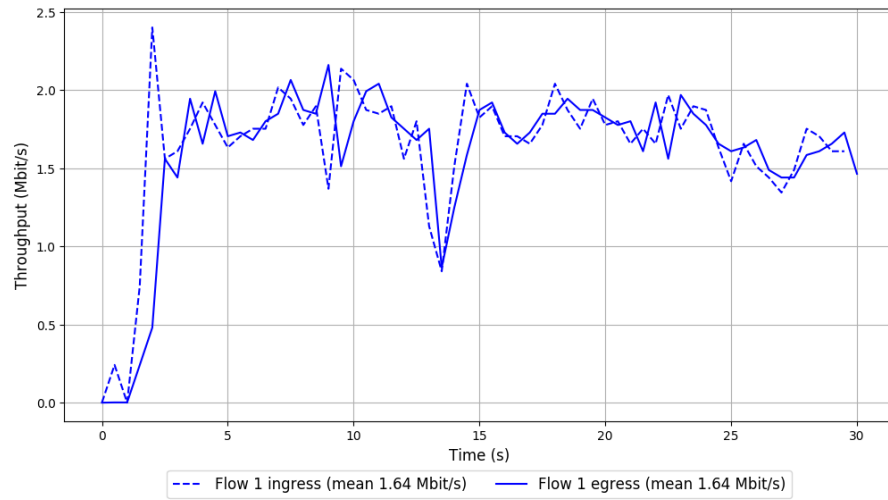Run 2: Report of TCP Vegas — Data Link

```
Run 3: Statistics of TCP Vegas

Start at: 2018-12-02 00:04:11
End at: 2018-12-02 00:04:41
Local clock offset: -2.044 ms
Remote clock offset: -9.609 ms


# Below is generated by plot.py at 2018-12-02 00:06:31
# Datalink statistics
-- Total of 1 flow:
Average throughput: 1.64 Mbit/s
95th percentile per-packet one-way delay: 308.450 ms
Loss rate: 0.59%
-- Flow 1:
Average throughput: 1.64 Mbit/s
95th percentile per-packet one-way delay: 308.450 ms
Loss rate: 0.59%
```

Run 3: Report of TCP Vegas — Data Link

Flow 1 ingress (mean 1.64 Mbit/s) --- Flow 1 egress (mean 1.64 Mbit/s)
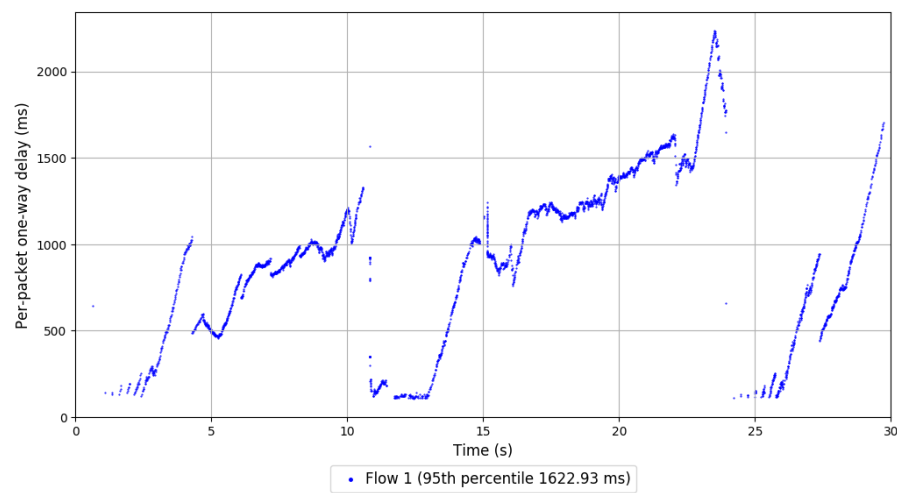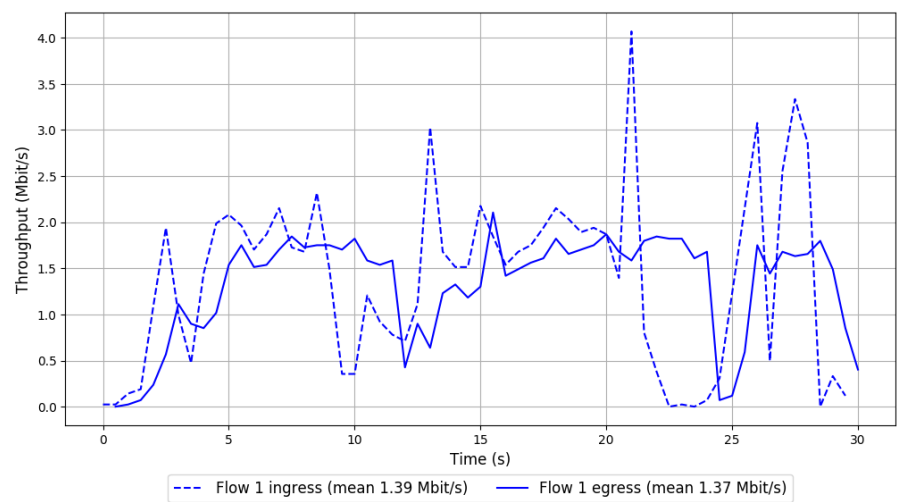
Flow 1 (95th percentile 308.45 ms)

```
Run 1: Statistics of Verus

Start at: 2018-12-01 23:03:43
End at: 2018-12-01 23:04:13
Local clock offset: 6.61 ms
Remote clock offset: -12.617 ms


# Below is generated by plot.py at 2018-12-02 00:06:31
# Datalink statistics
-- Total of 1 flow:
Average throughput: 1.37 Mbit/s
95th percentile per-packet one-way delay: 1622.929 ms
Loss rate: 3.70%
-- Flow 1:
Average throughput: 1.37 Mbit/s
95th percentile per-packet one-way delay: 1622.929 ms
Loss rate: 3.70%
```

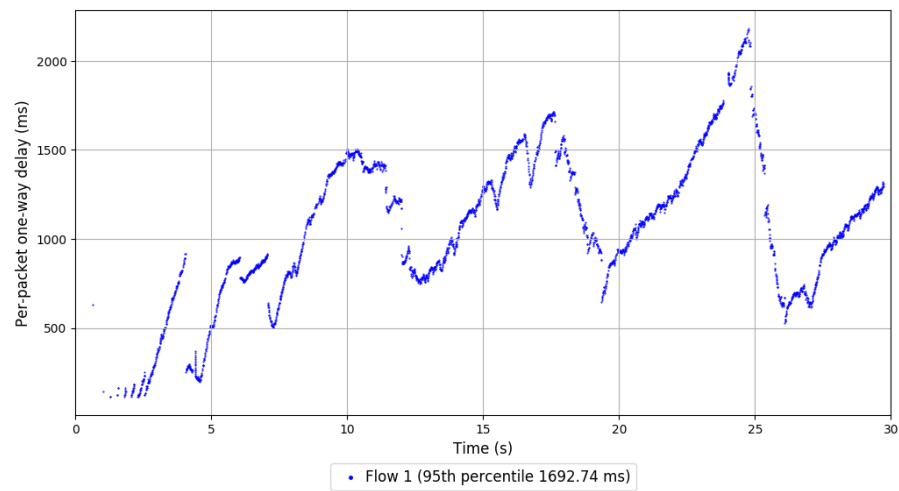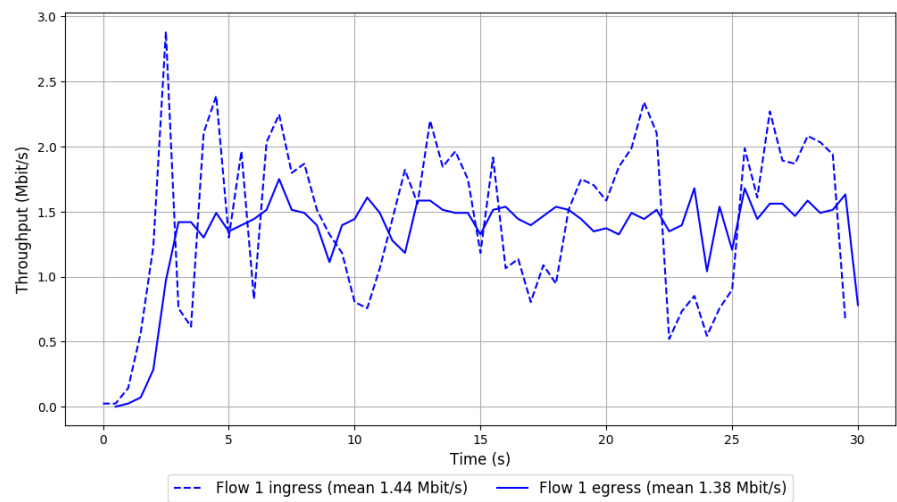Run 1: Report of Verus — Data Link

```
Run 2: Statistics of Verus

Start at: 2018-12-01 23:25:24
End at: 2018-12-01 23:25:54
Local clock offset: 3.081 ms
Remote clock offset: -12.491 ms


# Below is generated by plot.py at 2018-12-02 00:06:31
# Datalink statistics
-- Total of 1 flow:
Average throughput: 1.38 Mbit/s
95th percentile per-packet one-way delay: 1692.737 ms
Loss rate: 5.88%
-- Flow 1:
Average throughput: 1.38 Mbit/s
95th percentile per-packet one-way delay: 1692.737 ms
Loss rate: 5.88%
```
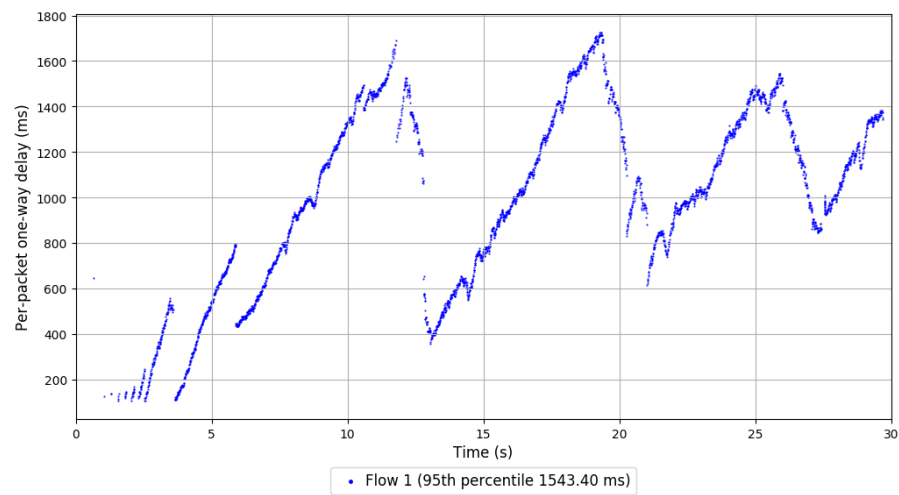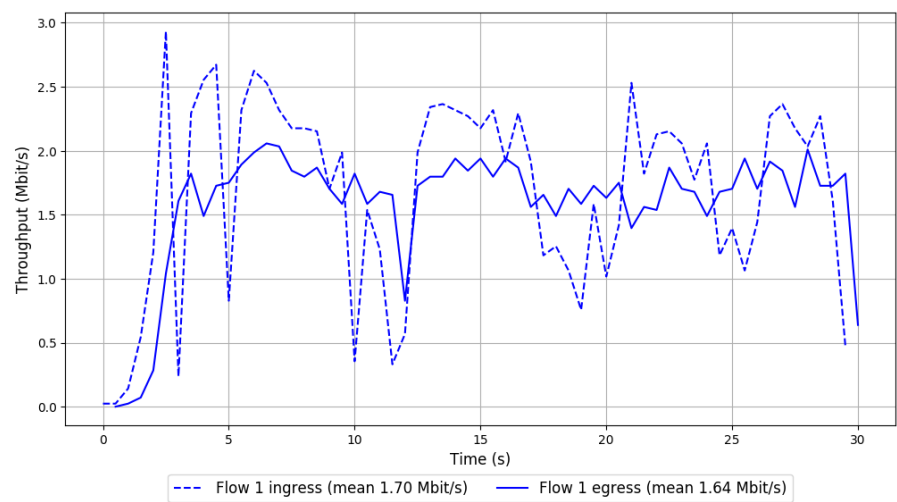
Run 2: Report of Verus — Data Link

```
Run 3: Statistics of Verus

Start at: 2018-12-01 23:47:03
End at: 2018-12-01 23:47:33
Local clock offset: 9.252 ms
Remote clock offset: -13.12 ms


# Below is generated by plot.py at 2018-12-02 00:06:32
# Datalink statistics
-- Total of 1 flow:
Average throughput: 1.64 Mbit/s
95th percentile per-packet one-way delay: 1543.401 ms
Loss rate: 5.02%
-- Flow 1:
Average throughput: 1.64 Mbit/s
95th percentile per-packet one-way delay: 1543.401 ms
Loss rate: 5.02%
```
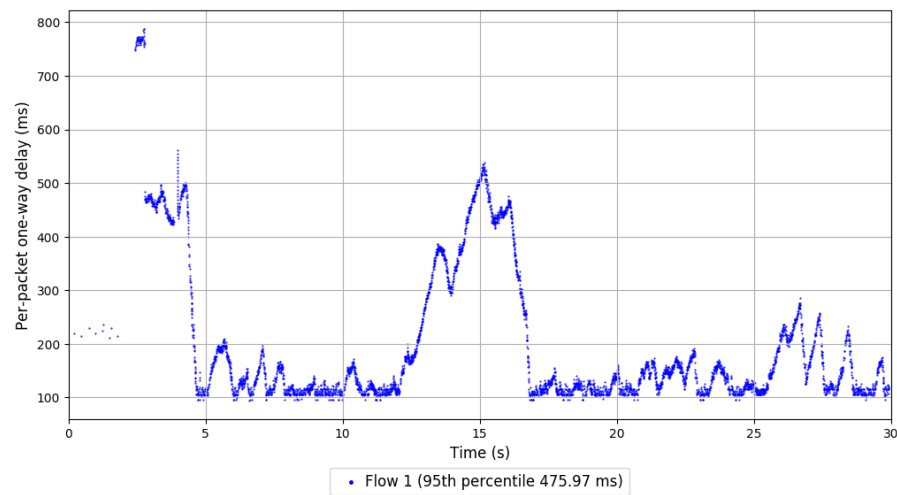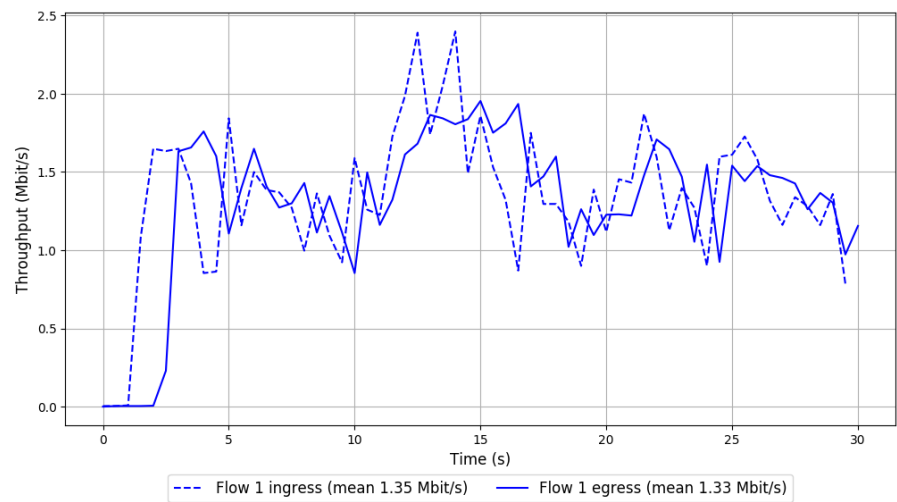
Run 3: Report of Verus — Data Link

```
Run 1: Statistics of PCC-Vivace

Start at: 2018-12-01 23:11:41
End at: 2018-12-01 23:12:11
Local clock offset: 2.639 ms
Remote clock offset: -13.049 ms

# Below is generated by plot.py at 2018-12-02 00:06:33
# Datalink statistics
-- Total of 1 flow:
Average throughput: 1.33 Mbit/s
95th percentile per-packet one-way delay: 475.967 ms
Loss rate: 1.42%
-- Flow 1:
Average throughput: 1.33 Mbit/s
95th percentile per-packet one-way delay: 475.967 ms
Loss rate: 1.42%
```

Run 1: Report of PCC-Vivace — Data Link

```
Run 2: Statistics of PCC-Vivace

Start at: 2018-12-01 23:33:24
End at: 2018-12-01 23:33:54
Local clock offset: 4.674 ms
Remote clock offset: -12.41 ms


# Below is generated by plot.py at 2018-12-02 00:06:33
# Datalink statistics
-- Total of 1 flow:
Average throughput: 1.02 Mbit/s
95th percentile per-packet one-way delay: 3305.650 ms
Loss rate: 13.68%
-- Flow 1:
Average throughput: 1.02 Mbit/s
95th percentile per-packet one-way delay: 3305.650 ms
Loss rate: 13.68%
```
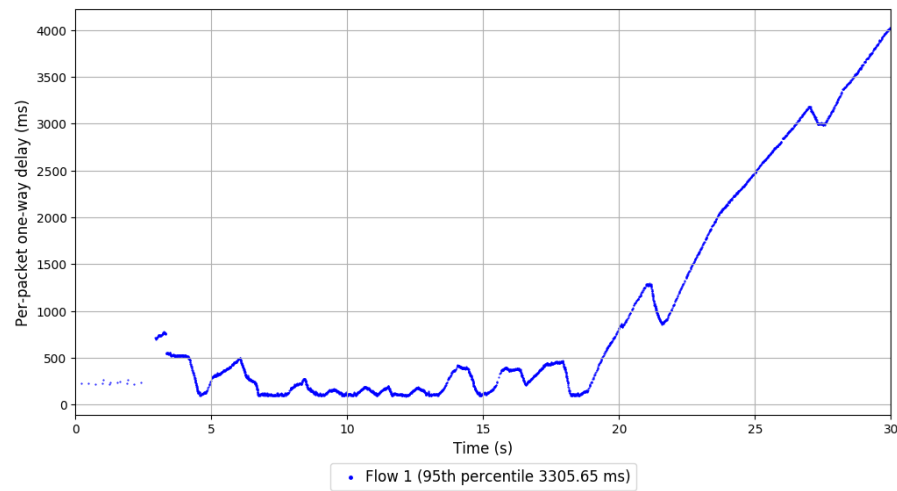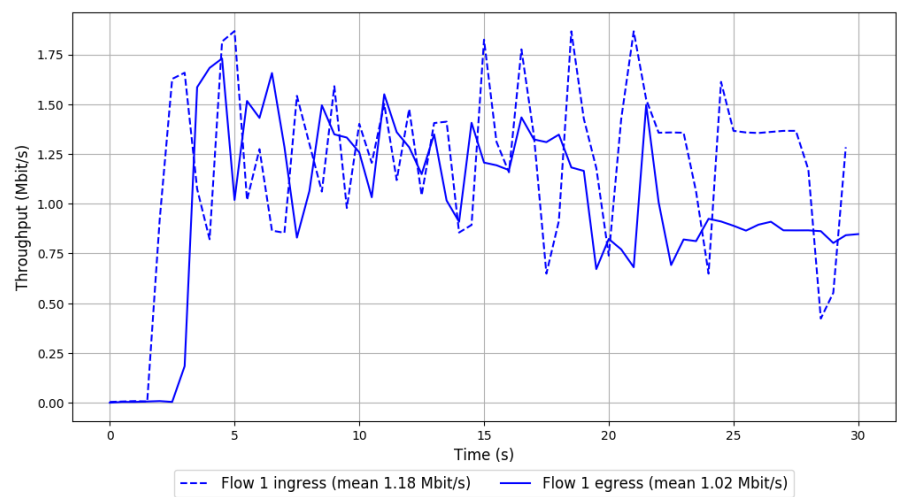
Run 2: Report of PCC-Vivace — Data Link

Flow 1 ingress (mean 1.18 Mbit/s) --- Flow 1 egress (mean 1.02 Mbit/s)

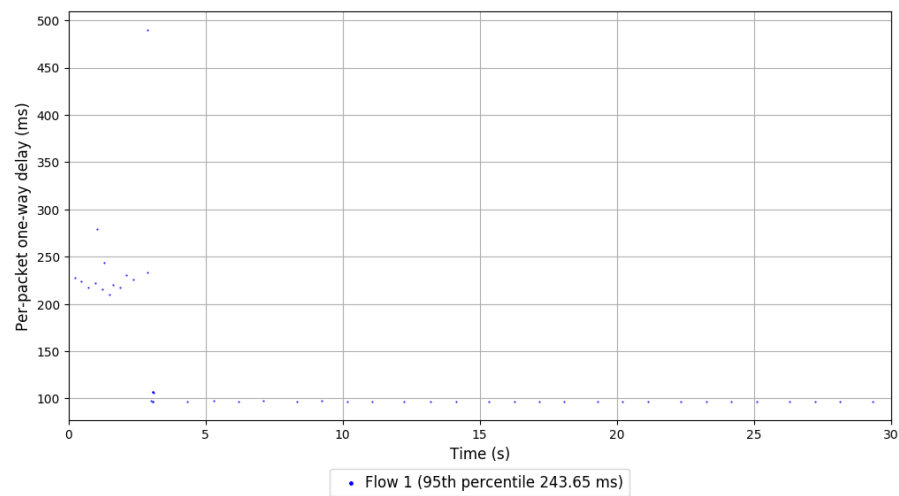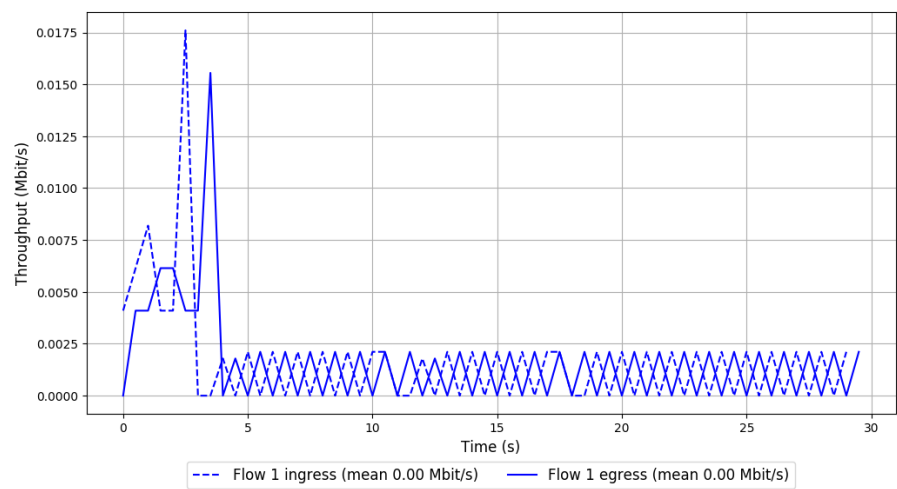• Flow 1 (95th percentile 3305.65 ms)

```
Run 3: Statistics of PCC-Vivace

Start at: 2018-12-01 23:55:03
End at: 2018-12-01 23:55:33
Local clock offset: 0.776 ms
Remote clock offset: -13.179 ms


# Below is generated by plot.py at 2018-12-02 00:06:33
# Datalink statistics
-- Total of 1 flow:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 243.650 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 243.650 ms
Loss rate: 0.00%
```

Run 3: Report of PCC-Vivace — Data Link

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

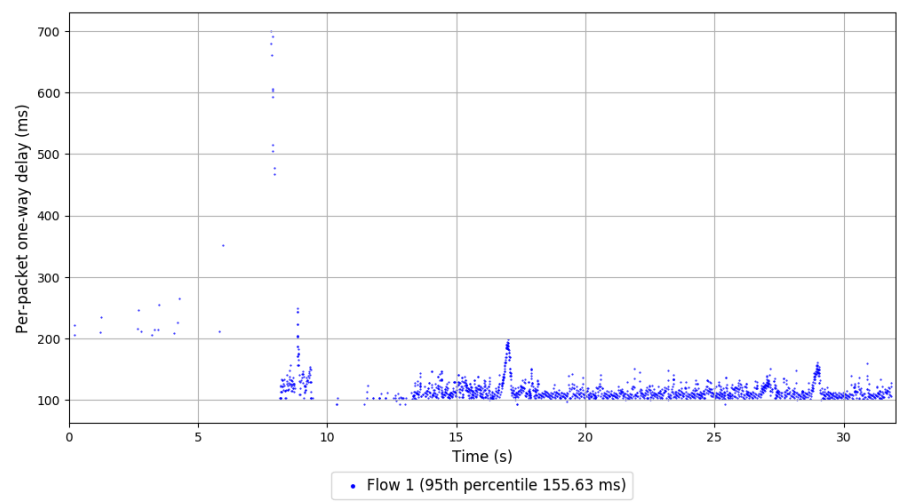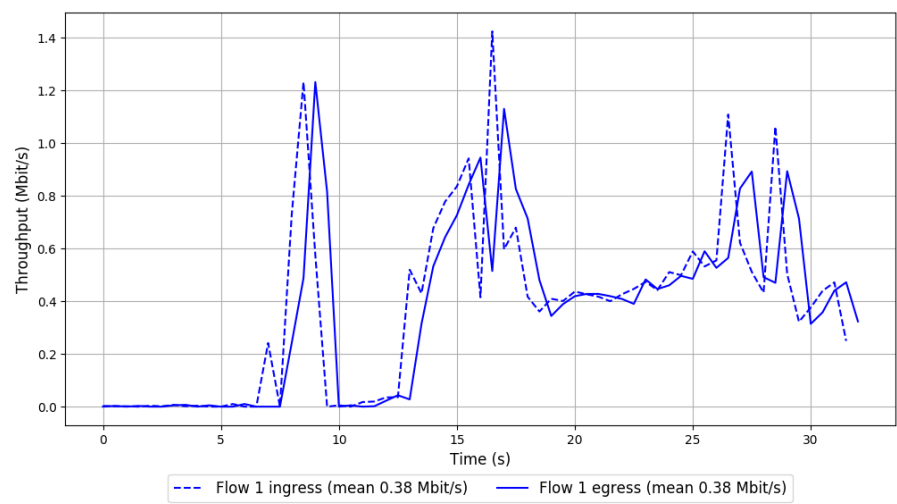
• Flow 1 (95th percentile 243.65 ms)

```
Run 1: Statistics of WebRTC media

Start at: 2018-12-01 23:04:52
End at: 2018-12-01 23:05:22
Local clock offset: 7.584 ms
Remote clock offset: -7.442 ms


# Below is generated by plot.py at 2018-12-02 00:06:33
# Datalink statistics
-- Total of 1 flow:
Average throughput: 0.38 Mbit/s
95th percentile per-packet one-way delay: 155.626 ms
Loss rate: 0.05%
-- Flow 1:
Average throughput: 0.38 Mbit/s
95th percentile per-packet one-way delay: 155.626 ms
Loss rate: 0.05%
```

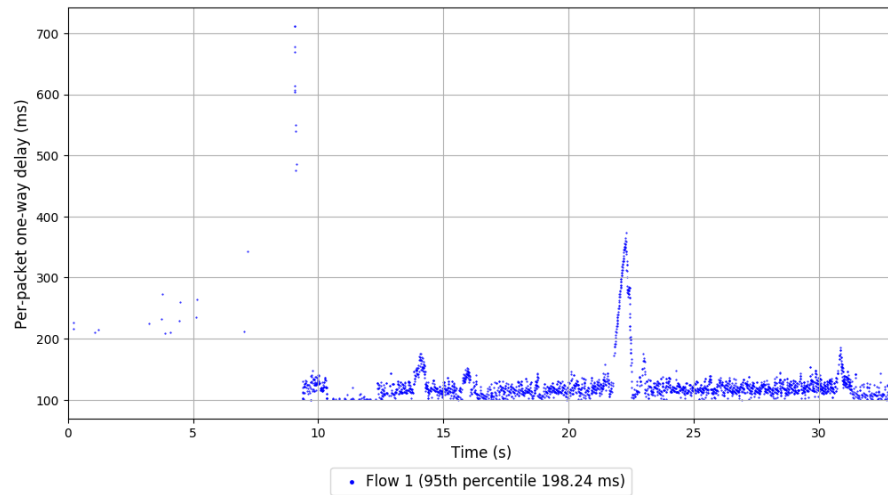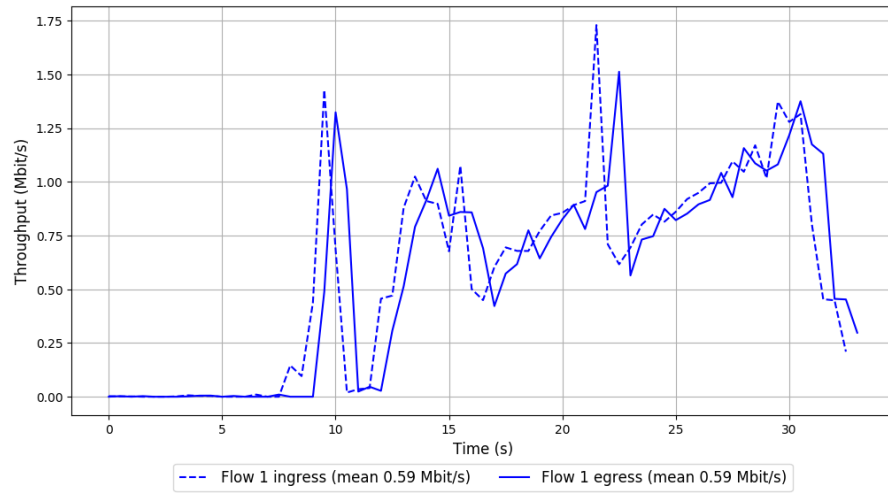Run 1: Report of WebRTC media — Data Link

```
Run 2: Statistics of WebRTC media

Start at: 2018-12-01 23:26:32
End at: 2018-12-01 23:27:02
Local clock offset: 2.398 ms
Remote clock offset: -7.039 ms


# Below is generated by plot.py at 2018-12-02 00:06:34
# Datalink statistics
-- Total of 1 flow:
Average throughput: 0.59 Mbit/s
95th percentile per-packet one-way delay: 198.238 ms
Loss rate: 0.04%
-- Flow 1:
Average throughput: 0.59 Mbit/s
95th percentile per-packet one-way delay: 198.238 ms
Loss rate: 0.04%
```

Run 2: Report of WebRTC media — Data Link

```
Run 3: Statistics of WebRTC media

Start at: 2018-12-01 23:48:11
End at: 2018-12-01 23:48:41
Local clock offset: 9.574 ms
Remote clock offset: -7.981 ms


# Below is generated by plot.py at 2018-12-02 00:06:34
# Datalink statistics
-- Total of 1 flow:
Average throughput: 0.36 Mbit/s
95th percentile per-packet one-way delay: 476.725 ms
Loss rate: 0.15%
-- Flow 1:
Average throughput: 0.36 Mbit/s
95th percentile per-packet one-way delay: 476.725 ms
Loss rate: 0.15%
```

Run 3: Report of WebRTC media — Data Link