Pantheon Report

Generated at 2018-12-02 00:18:21 (UTC).

Data path: AWS India 2 on `ens5` (*local*) →Stanford 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 `time.stanford.edu` and have been applied to correct the timestamps in logs.
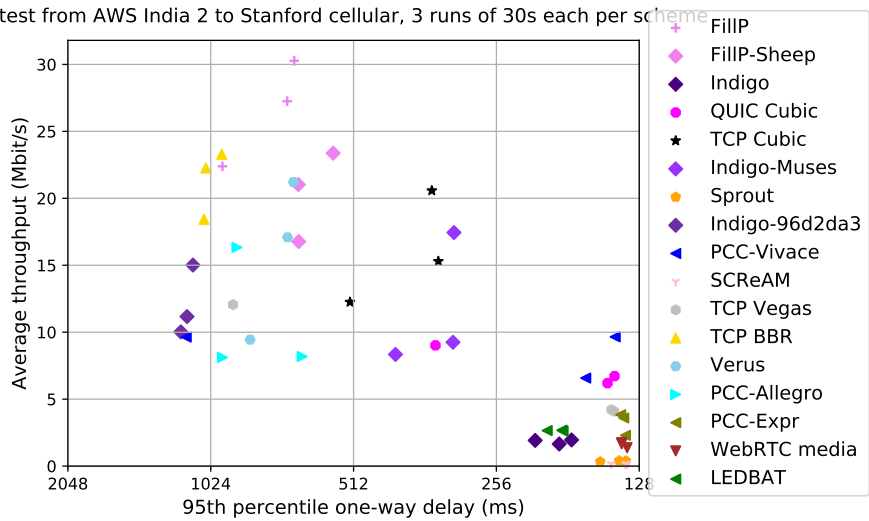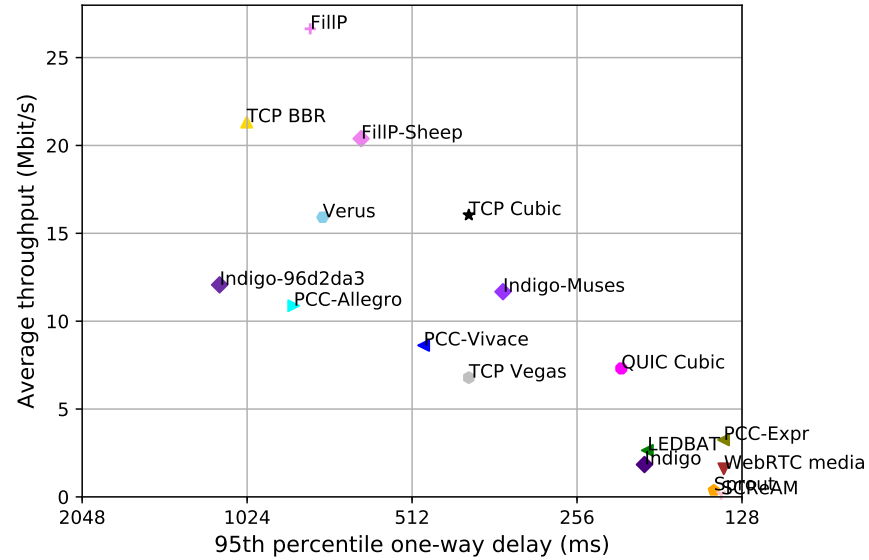
```
System info:
Linux 4.15.0-1027-aws
net.core.default_qdisc = fq
net.core.rmem_default = 16777216
net.core.rmem_max = 536870912
net.core.wmem_default = 16777216
net.core.wmem_max = 536870912
net.ipv4.tcp_rmem = 4096 16777216 536870912
net.ipv4.tcp_wmem = 4096 16777216 536870912

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 India 2 to Stanford cellular, 3 runs of 30s each per scheme
(mean of all runs by scheme)

test from AWS India 2 to Stanford cellular, 3 runs of 30s each per scheme

3

scheme	# runs	mean avg tput (Mbit/s) flow 1	mean 95th-%ile delay (ms) flow 1	mean loss rate (%) flow 1
TCP BBR	3	21.33	1025.75	1.80
Copa	0	N/A	N/A	N/A
TCP Cubic	3	16.04	403.44	0.10
FillP	3	26.64	785.54	4.45
FillP-Sheep	3	20.39	634.22	2.25
Indigo	3	1.84	192.85	0.01
Indigo-96d2da3	3	12.07	1149.56	69.08
LEDBAT	3	2.65	190.54	0.14
Indigo-Muses	3	11.68	349.43	0.06
PCC-Allegro	3	10.87	841.80	4.73
PCC-Expr	3	3.24	138.32	18.05
QUIC Cubic	3	7.31	212.55	0.07
SCReAM	3	0.15	139.73	0.00
Sprout	3	0.38	144.09	0.00
TaoVA-100x	0	N/A	N/A	N/A
TCP Vegas	3	6.79	403.42	0.09
Verus	3	15.91	745.49	1.01
PCC-Vivace	3	8.62	487.73	3.10
WebRTC media	3	1.60	138.16	0.00

```
Run 1: Statistics of TCP BBR

Start at: 2018-12-01 23:05:35
End at: 2018-12-01 23:06:05
Local clock offset: -6.259 ms
Remote clock offset: -3.689 ms


# Below is generated by plot.py at 2018-12-02 00:17:18
# Datalink statistics
-- Total of 1 flow:
Average throughput: 18.42 Mbit/s
95th percentile per-packet one-way delay: 1058.024 ms
Loss rate: 2.04%
-- Flow 1:
Average throughput: 18.42 Mbit/s
95th percentile per-packet one-way delay: 1058.024 ms
Loss rate: 2.04%
```
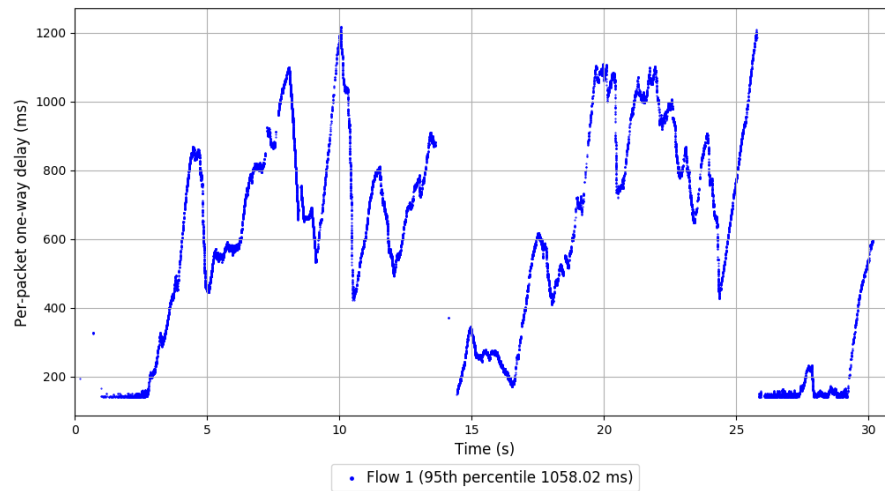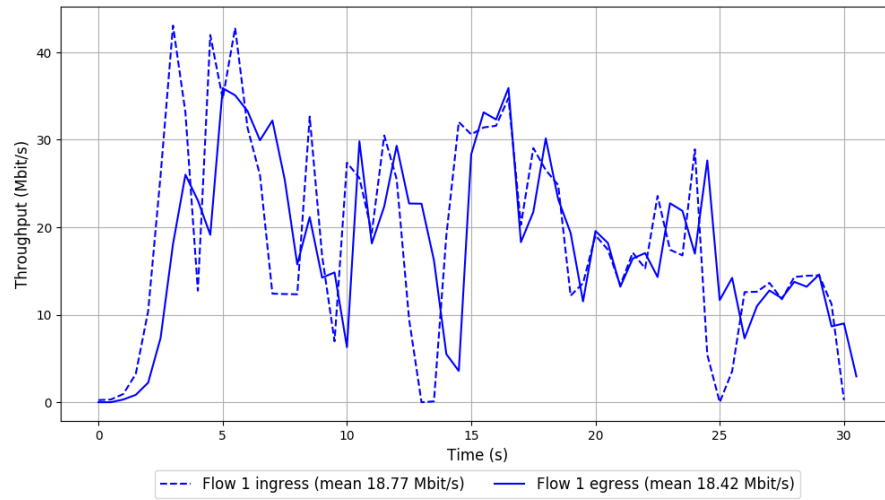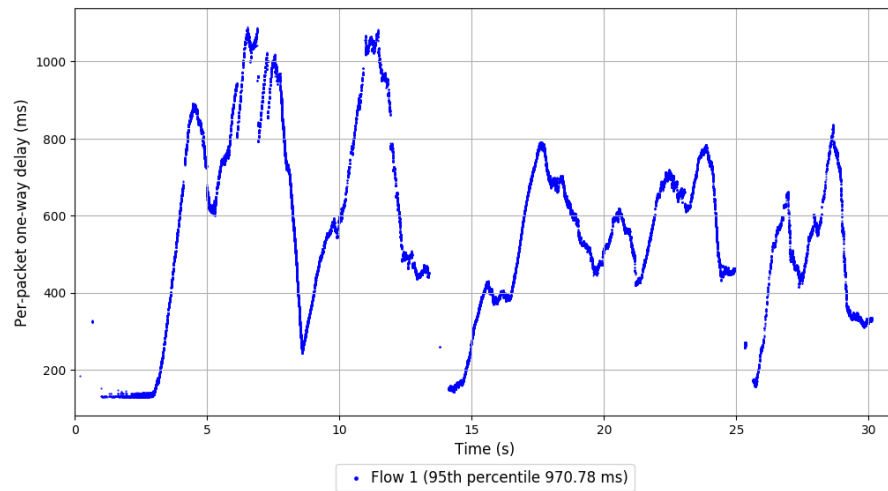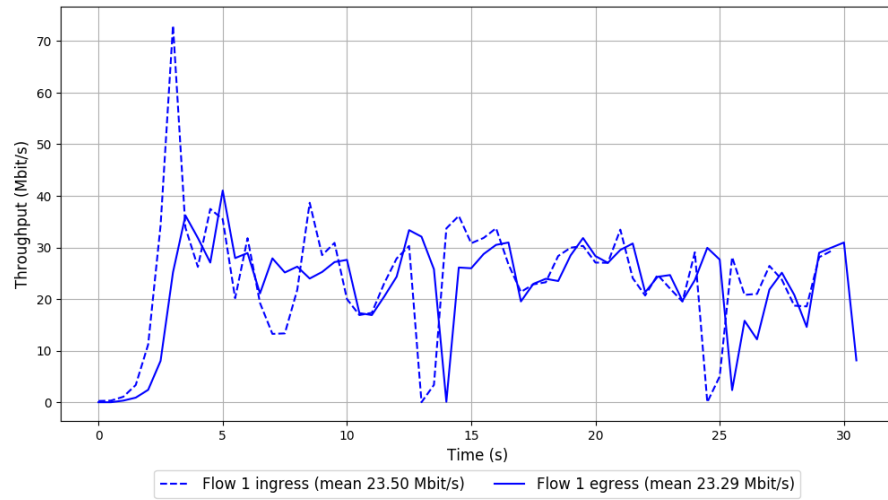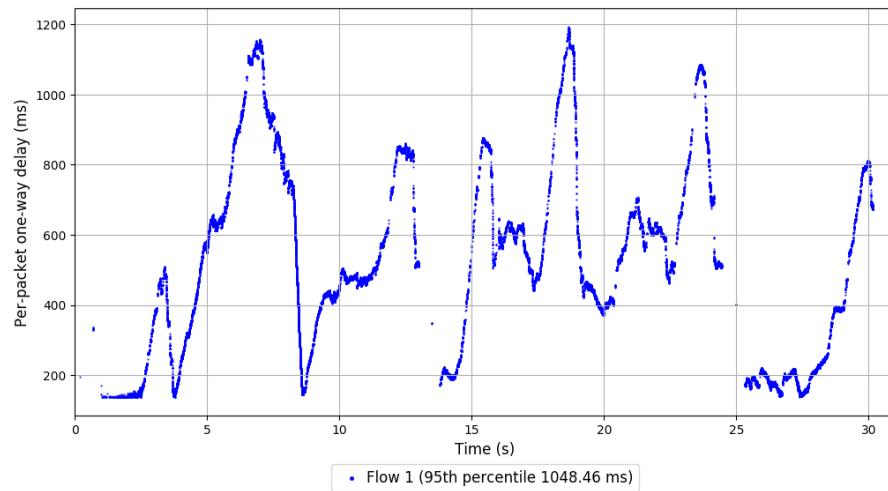
Run 1: Report of TCP BBR — Data Link

```
Run 2: Statistics of TCP BBR

Start at: 2018-12-01 23:30:53
End at: 2018-12-01 23:31:23
Local clock offset: 4.01 ms
Remote clock offset: 1.653 ms


# Below is generated by plot.py at 2018-12-02 00:17:22
# Datalink statistics
-- Total of 1 flow:
Average throughput: 23.29 Mbit/s
95th percentile per-packet one-way delay: 970.776 ms
Loss rate: 1.05%
-- Flow 1:
Average throughput: 23.29 Mbit/s
95th percentile per-packet one-way delay: 970.776 ms
Loss rate: 1.05%
```
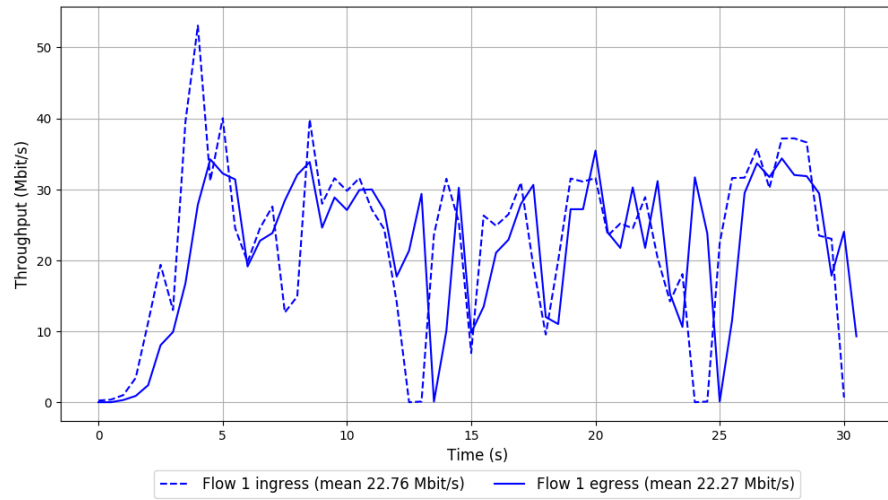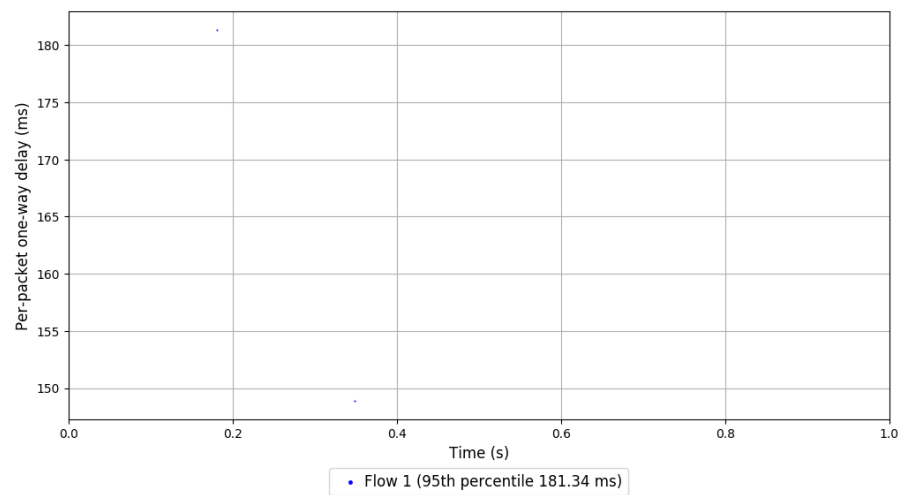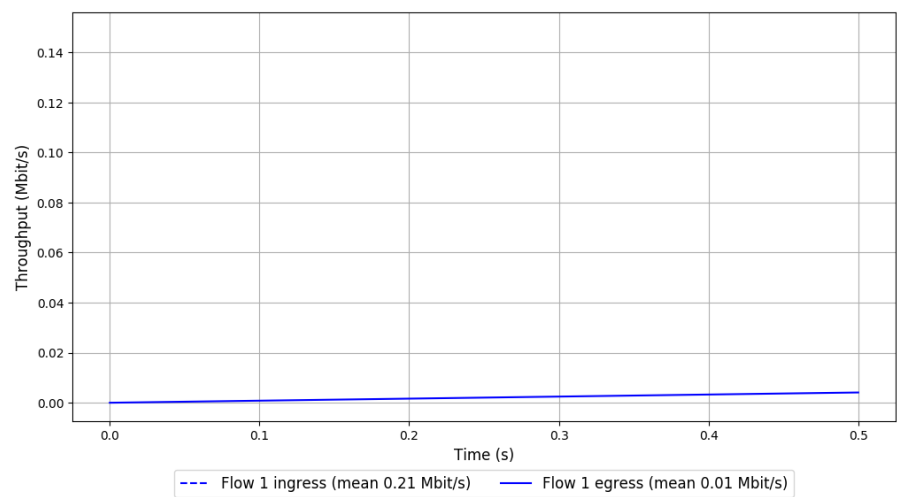
Run 2: Report of TCP BBR — Data Link

Flow 1 ingress (mean 23.50 Mbit/s) --- Flow 1 egress (mean 23.29 Mbit/s)

• Flow 1 (95th percentile 970.78 ms)

```
Run 3: Statistics of TCP BBR

Start at: 2018-12-01 23:56:16
End at: 2018-12-01 23:56:46
Local clock offset: -5.906 ms
Remote clock offset: 4.107 ms


# Below is generated by plot.py at 2018-12-02 00:17:22
# Datalink statistics
-- Total of 1 flow:
Average throughput: 22.27 Mbit/s
95th percentile per-packet one-way delay: 1048.457 ms
Loss rate: 2.32%
-- Flow 1:
Average throughput: 22.27 Mbit/s
95th percentile per-packet one-way delay: 1048.457 ms
Loss rate: 2.32%
```

Run 3: Report of TCP BBR — Data Link

Flow 1 ingress (mean 22.76 Mbit/s)   Flow 1 egress (mean 22.27 Mbit/s)

Flow 1 (95th percentile 1048.46 ms)

```
Run 1: Statistics of Copa

Start at: 2018-12-01 23:20:16
End at: 2018-12-01 23:20:46
Local clock offset: 3.694 ms
Remote clock offset: -3.849 ms
```

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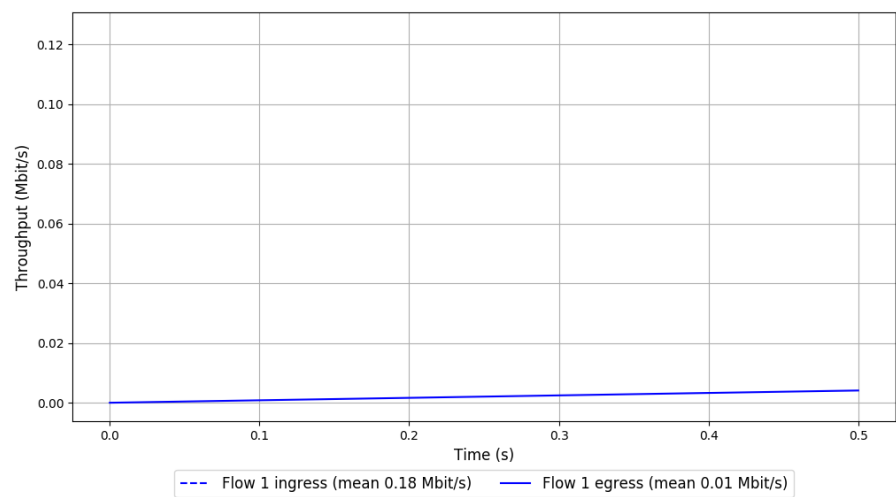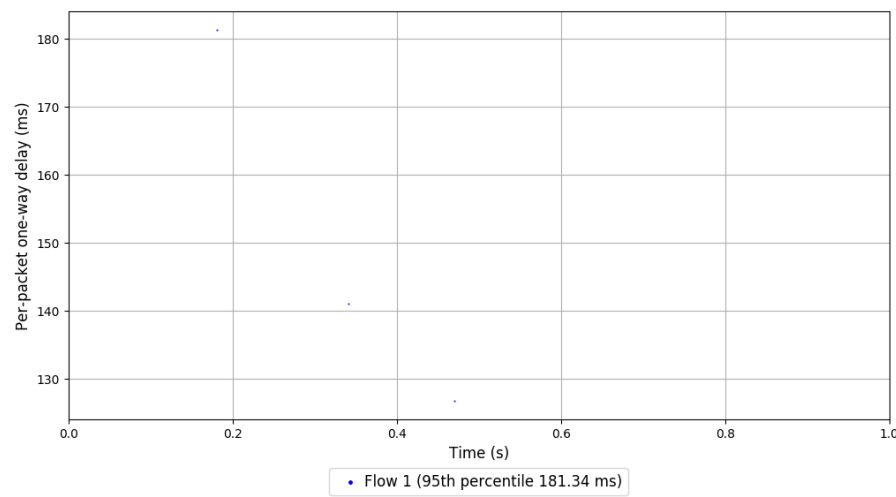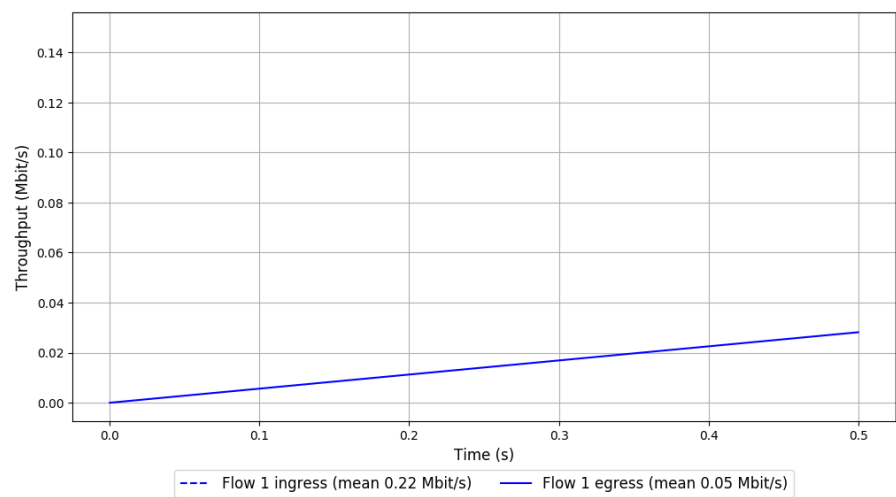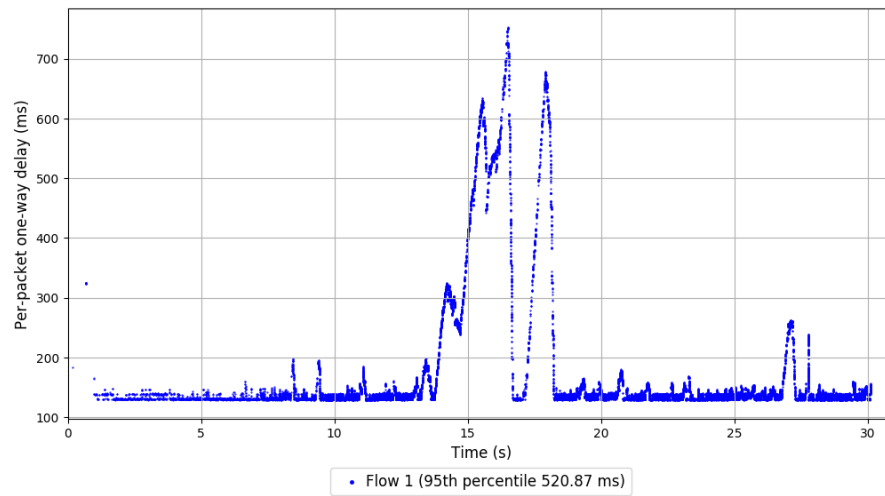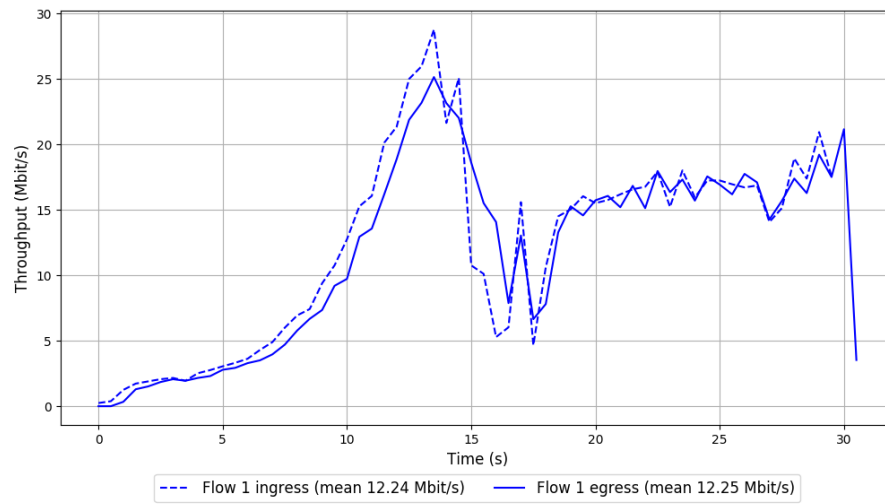
```
Run 2: Statistics of Copa

Start at: 2018-12-01 23:45:40
End at: 2018-12-01 23:46:10
Local clock offset: 1.922 ms
Remote clock offset: 4.329 ms
```

Run 2: Report of Copa — Data Link

Flow 1 ingress (mean 0.18 Mbit/s)   Flow 1 egress (mean 0.01 Mbit/s)

Flow 1 (95th percentile 181.53 ms)

```
Run 3: Statistics of Copa

Start at: 2018-12-02 00:11:00
End at: 2018-12-02 00:11:30
Local clock offset: 6.283 ms
Remote clock offset: 0.117 ms
```

Run 3: Report of Copa — Data Link

```
Run 1: Statistics of TCP Cubic

Start at: 2018-12-01 23:25:33
End at: 2018-12-01 23:26:03
Local clock offset: 4.162 ms
Remote clock offset: -0.462 ms


# Below is generated by plot.py at 2018-12-02 00:17:22
# Datalink statistics
-- Total of 1 flow:
Average throughput: 12.25 Mbit/s
95th percentile per-packet one-way delay: 520.871 ms
Loss rate: 0.04%
-- Flow 1:
Average throughput: 12.25 Mbit/s
95th percentile per-packet one-way delay: 520.871 ms
Loss rate: 0.04%
```
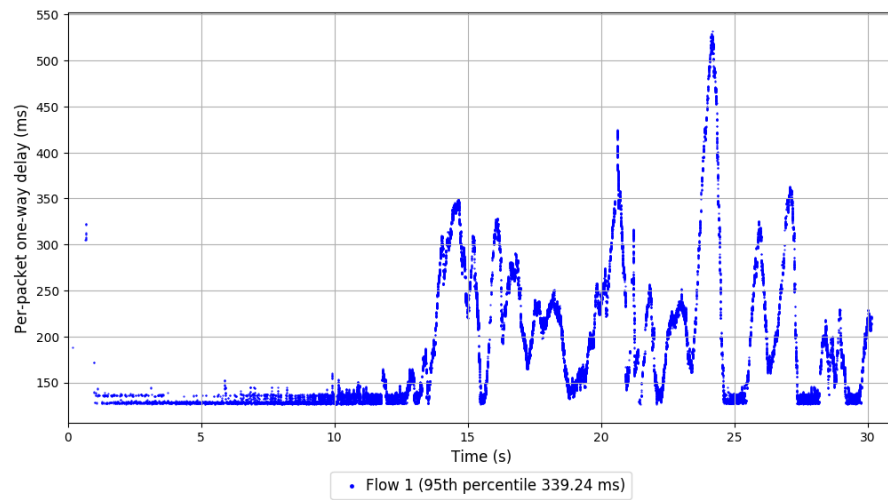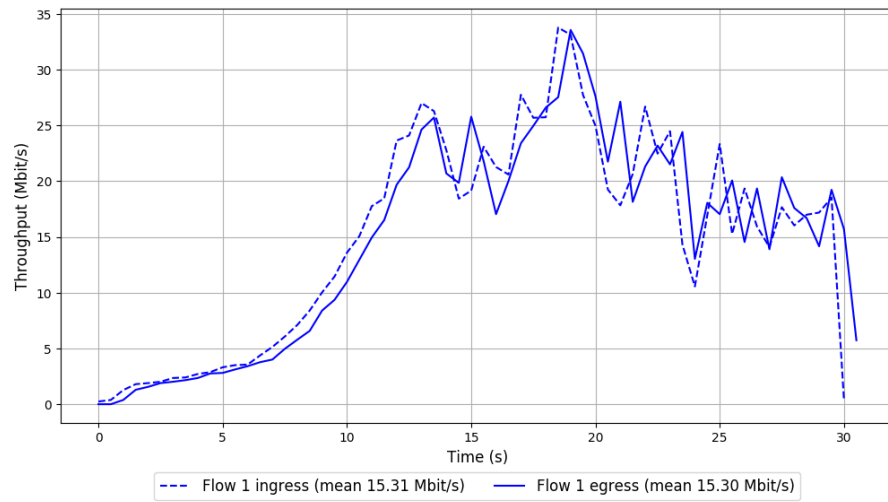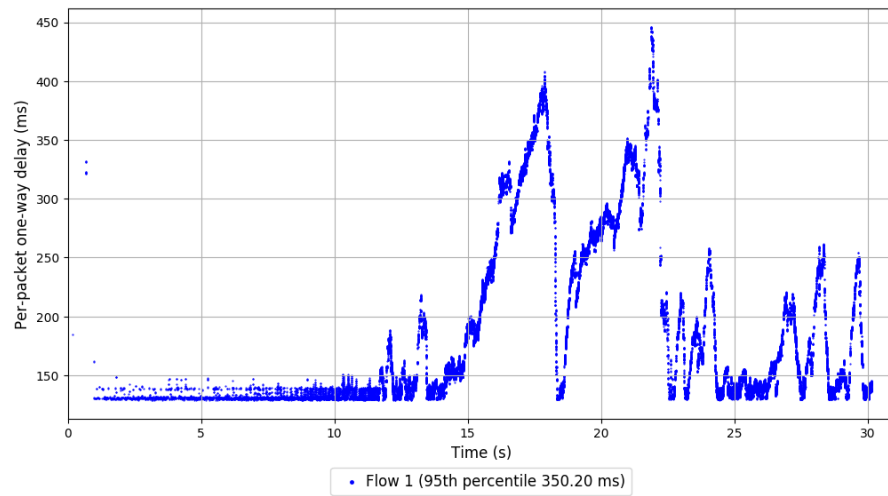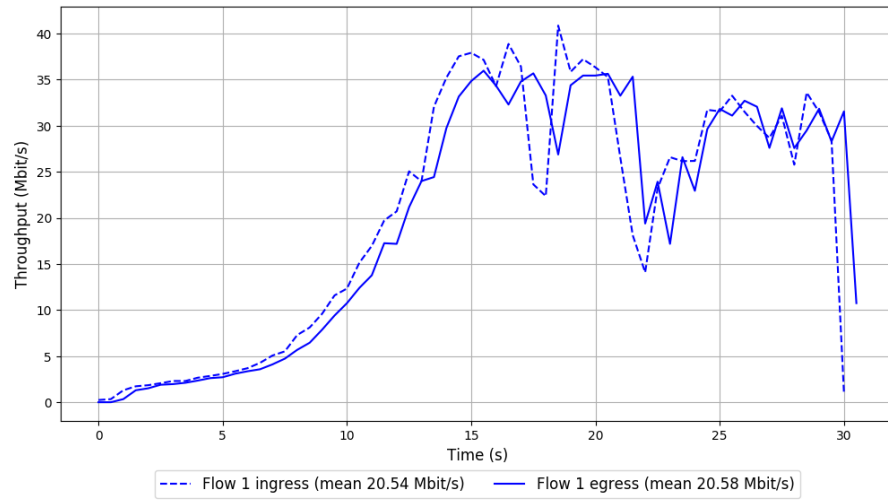
Run 1: Report of TCP Cubic — Data Link

Flow 1 ingress (mean 12.24 Mbit/s) — — —   Flow 1 egress (mean 12.25 Mbit/s) ———

• Flow 1 (95th percentile 520.87 ms)

```
Run 2: Statistics of TCP Cubic

Start at: 2018-12-01 23:50:56
End at: 2018-12-01 23:51:26
Local clock offset: 2.956 ms
Remote clock offset: 5.014 ms


# Below is generated by plot.py at 2018-12-02 00:17:22
# Datalink statistics
-- Total of 1 flow:
Average throughput: 15.30 Mbit/s
95th percentile per-packet one-way delay: 339.243 ms
Loss rate: 0.26%
-- Flow 1:
Average throughput: 15.30 Mbit/s
95th percentile per-packet one-way delay: 339.243 ms
Loss rate: 0.26%
```

Run 2: Report of TCP Cubic — Data Link

```
Run 3: Statistics of TCP Cubic

Start at: 2018-12-02 00:16:17
End at: 2018-12-02 00:16:47
Local clock offset: 4.567 ms
Remote clock offset: -0.335 ms


# Below is generated by plot.py at 2018-12-02 00:17:22
# Datalink statistics
-- Total of 1 flow:
Average throughput: 20.58 Mbit/s
95th percentile per-packet one-way delay: 350.198 ms
Loss rate: 0.01%
-- Flow 1:
Average throughput: 20.58 Mbit/s
95th percentile per-packet one-way delay: 350.198 ms
Loss rate: 0.01%
```

Run 3: Report of TCP Cubic — Data Link

```
Run 1: Statistics of FillP

Start at: 2018-12-01 23:18:55
End at: 2018-12-01 23:19:25
Local clock offset: 3.665 ms
Remote clock offset: -3.76 ms


# Below is generated by plot.py at 2018-12-02 00:17:28
# Datalink statistics
-- Total of 1 flow:
Average throughput: 22.39 Mbit/s
95th percentile per-packet one-way delay: 967.192 ms
Loss rate: 7.20%
-- Flow 1:
Average throughput: 22.39 Mbit/s
95th percentile per-packet one-way delay: 967.192 ms
Loss rate: 7.20%
```
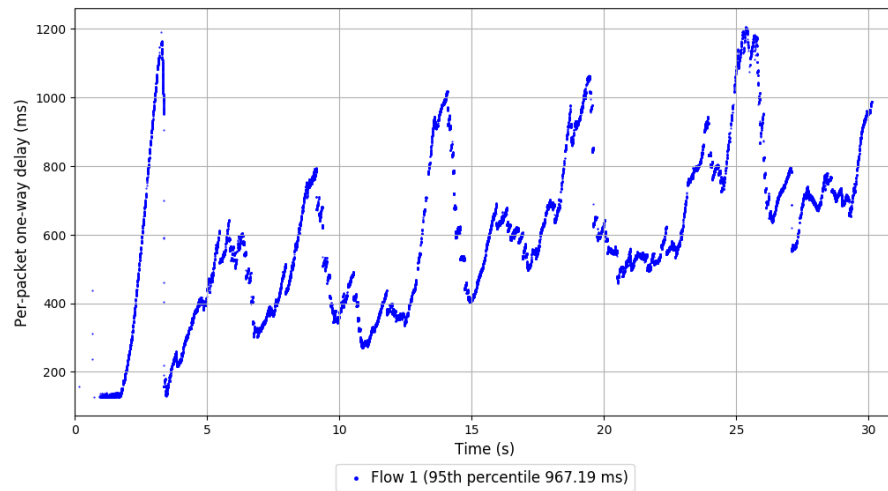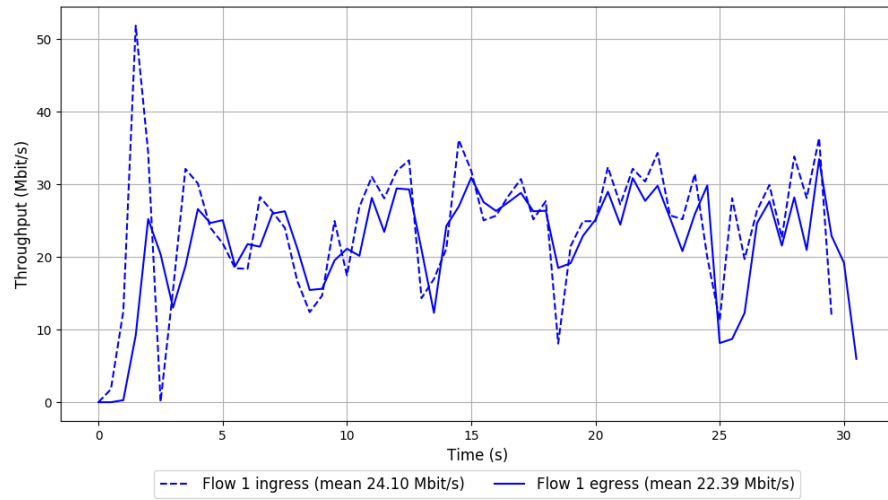
Run 1: Report of FillP — Data Link

```
Run 2: Statistics of FillP

Start at: 2018-12-01 23:44:19
End at: 2018-12-01 23:44:49
Local clock offset: 5.979 ms
Remote clock offset: 4.261 ms


# Below is generated by plot.py at 2018-12-02 00:17:35
# Datalink statistics
-- Total of 1 flow:
Average throughput: 30.27 Mbit/s
95th percentile per-packet one-way delay: 682.852 ms
Loss rate: 2.43%
-- Flow 1:
Average throughput: 30.27 Mbit/s
95th percentile per-packet one-way delay: 682.852 ms
Loss rate: 2.43%
```
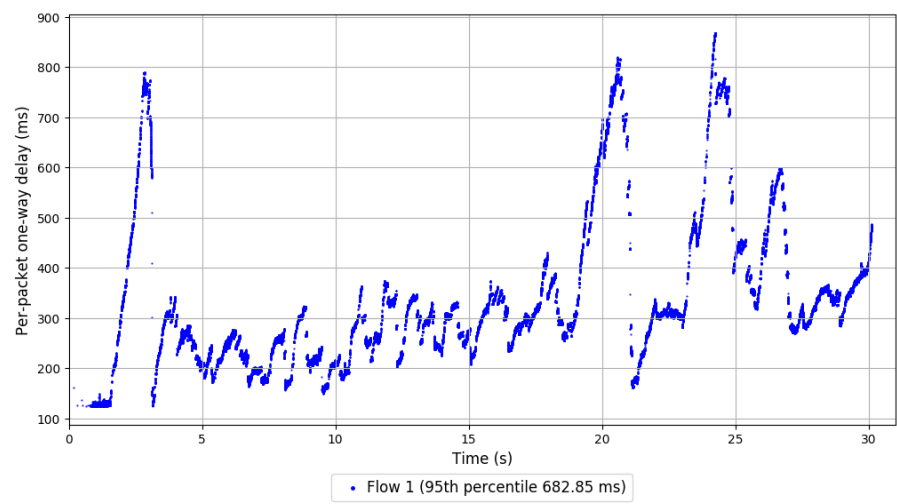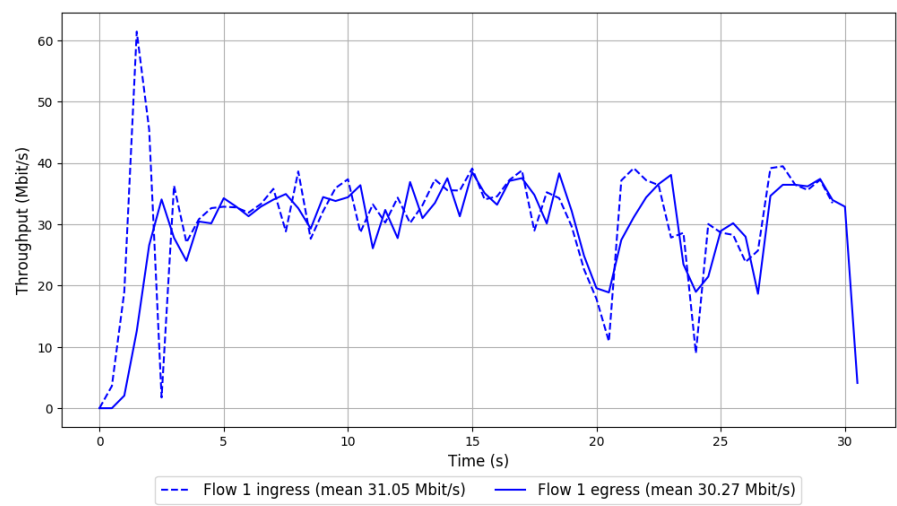
Run 2: Report of FillP — Data Link

```
Run 3: Statistics of FillP

Start at: 2018-12-02 00:09:39
End at: 2018-12-02 00:10:09
Local clock offset: 4.967 ms
Remote clock offset: 0.331 ms


# Below is generated by plot.py at 2018-12-02 00:17:43
# Datalink statistics
-- Total of 1 flow:
Average throughput: 27.25 Mbit/s
95th percentile per-packet one-way delay: 706.572 ms
Loss rate: 3.71%
-- Flow 1:
Average throughput: 27.25 Mbit/s
95th percentile per-packet one-way delay: 706.572 ms
Loss rate: 3.71%
```
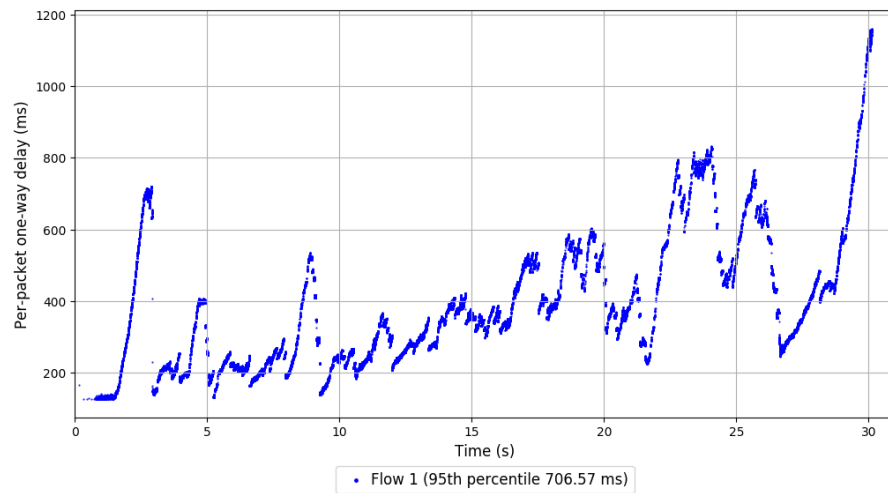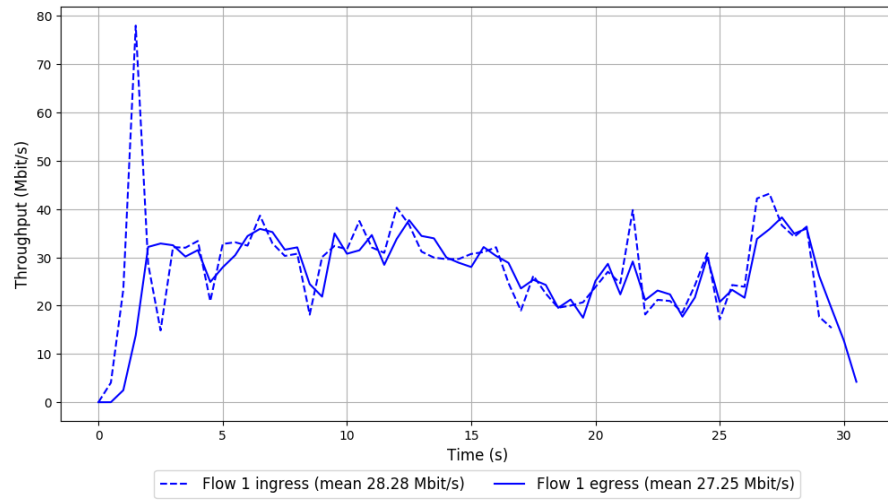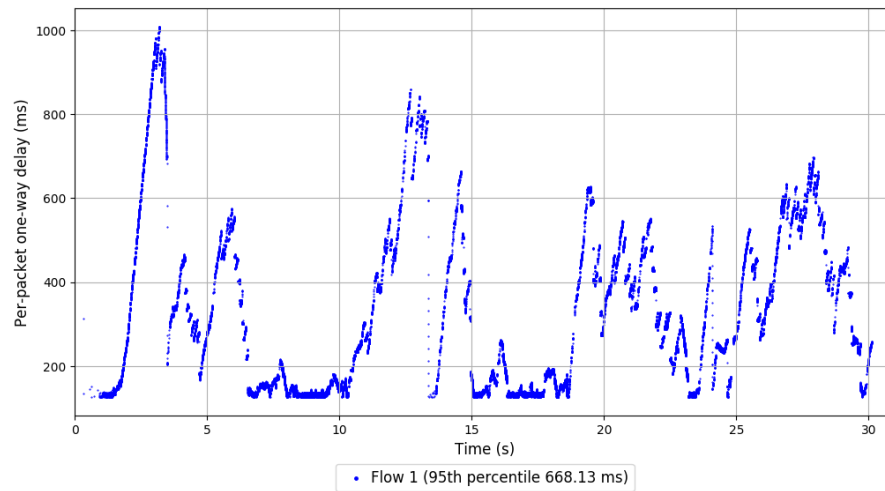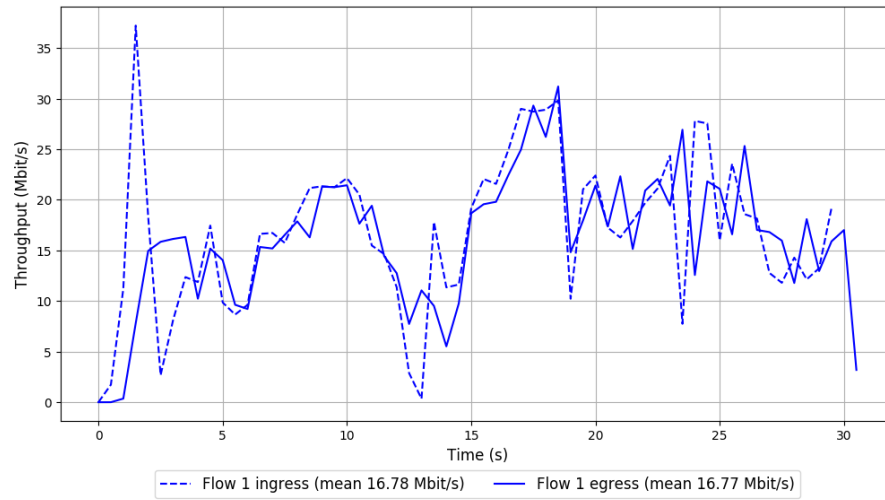
Run 3: Report of FillP — Data Link

Flow 1 ingress (mean 28.28 Mbit/s) --- Flow 1 egress (mean 27.25 Mbit/s)

Flow 1 (95th percentile 706.57 ms)

```
Run 1: Statistics of FillP-Sheep

Start at: 2018-12-01 23:06:56
End at: 2018-12-01 23:07:26
Local clock offset: 5.117 ms
Remote clock offset: -3.637 ms


# Below is generated by plot.py at 2018-12-02 00:17:43
# Datalink statistics
-- Total of 1 flow:
Average throughput: 16.77 Mbit/s
95th percentile per-packet one-way delay: 668.130 ms
Loss rate: 0.65%
-- Flow 1:
Average throughput: 16.77 Mbit/s
95th percentile per-packet one-way delay: 668.130 ms
Loss rate: 0.65%
```

Run 1: Report of FillP-Sheep — Data Link

```
Run 2: Statistics of FillP-Sheep

Start at: 2018-12-01 23:32:14
End at: 2018-12-01 23:32:44
Local clock offset: 4.034 ms
Remote clock offset: 2.087 ms


# Below is generated by plot.py at 2018-12-02 00:17:44
# Datalink statistics
-- Total of 1 flow:
Average throughput: 23.37 Mbit/s
95th percentile per-packet one-way delay: 565.160 ms
Loss rate: 2.30%
-- Flow 1:
Average throughput: 23.37 Mbit/s
95th percentile per-packet one-way delay: 565.160 ms
Loss rate: 2.30%
```
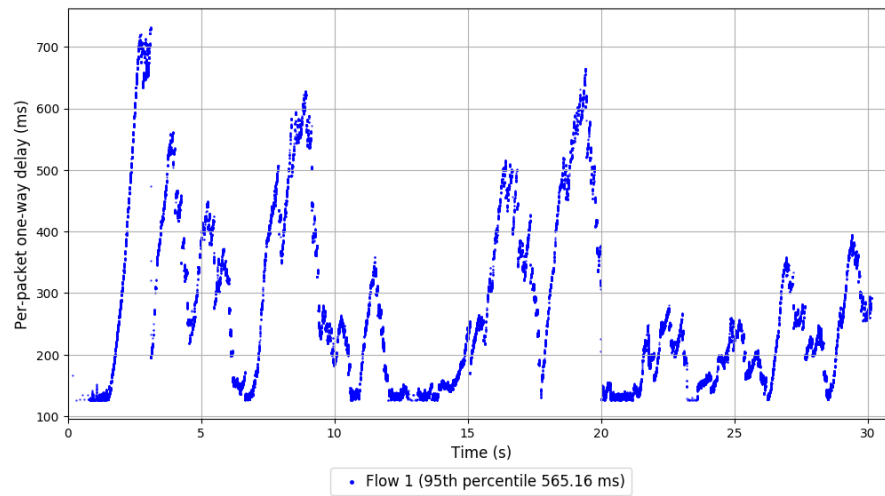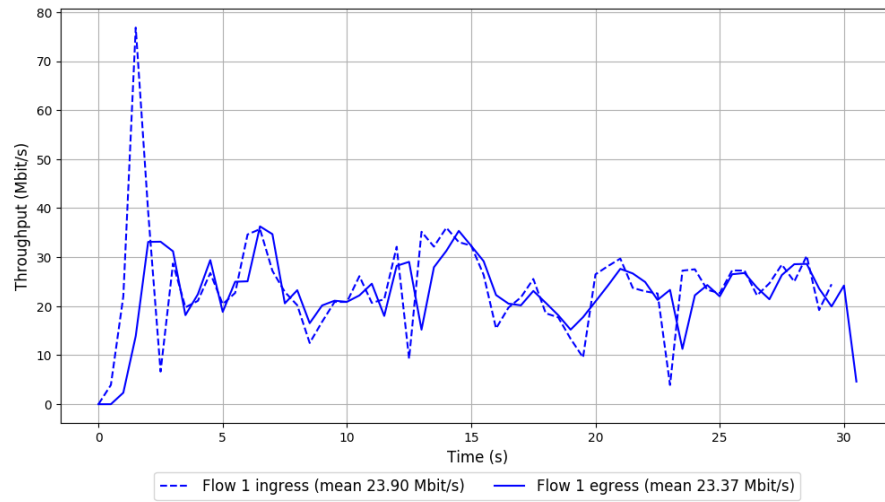
Run 2: Report of FillP-Sheep — Data Link

```
Run 3: Statistics of FillP-Sheep

Start at: 2018-12-01 23:57:37
End at: 2018-12-01 23:58:07
Local clock offset: 5.915 ms
Remote clock offset: 3.404 ms


# Below is generated by plot.py at 2018-12-02 00:17:44
# Datalink statistics
-- Total of 1 flow:
Average throughput: 21.03 Mbit/s
95th percentile per-packet one-way delay: 669.377 ms
Loss rate: 3.79%
-- Flow 1:
Average throughput: 21.03 Mbit/s
95th percentile per-packet one-way delay: 669.377 ms
Loss rate: 3.79%
```
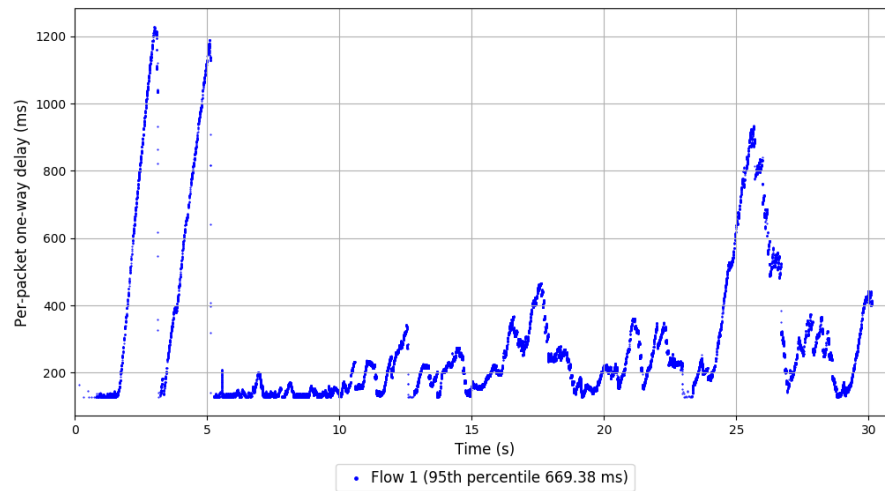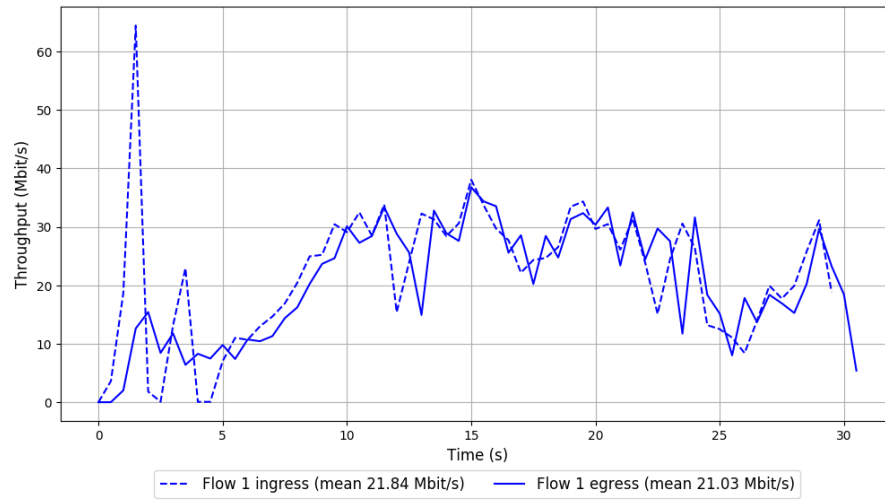
Run 3: Report of FillP-Sheep — Data Link

Flow 1 ingress (mean 21.84 Mbit/s)   Flow 1 egress (mean 21.03 Mbit/s)
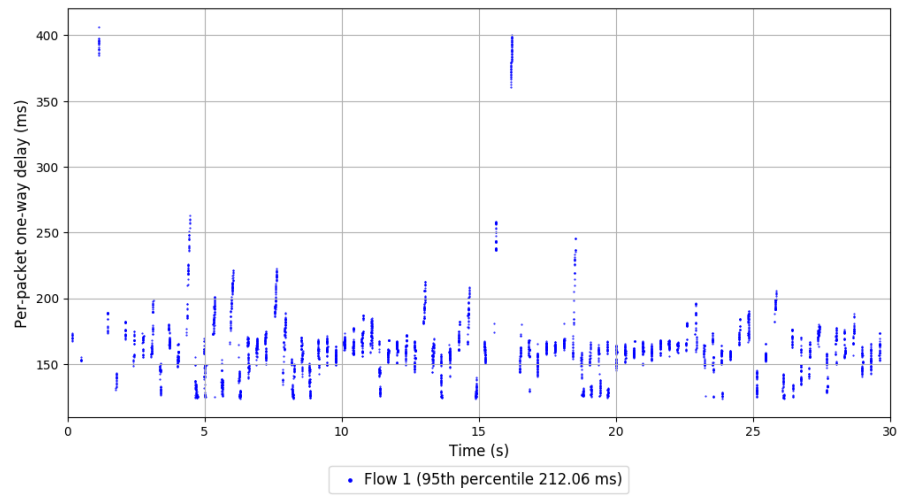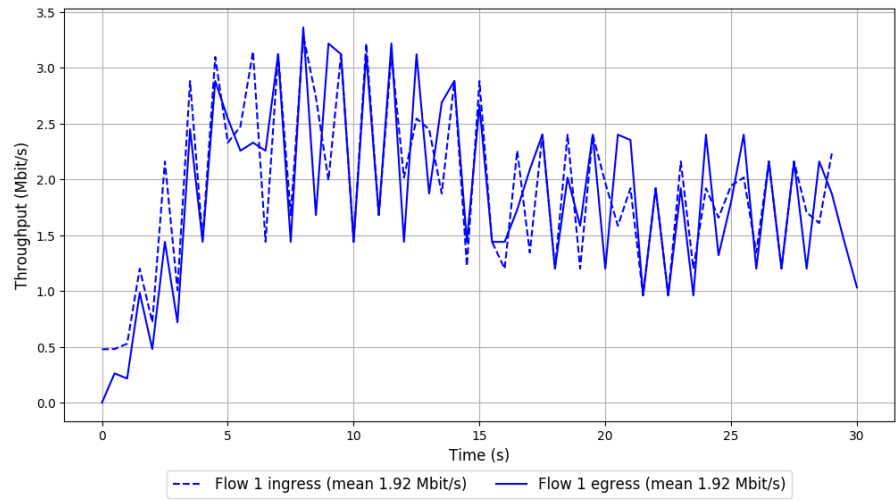

Flow 1 (95th percentile 669.38 ms)

```
Run 1: Statistics of Indigo

Start at: 2018-12-01 23:04:16
End at: 2018-12-01 23:04:46
Local clock offset: 9.88 ms
Remote clock offset: -3.687 ms

# Below is generated by plot.py at 2018-12-02 00:17:44
# Datalink statistics
-- Total of 1 flow:
Average throughput: 1.92 Mbit/s
95th percentile per-packet one-way delay: 212.059 ms
Loss rate: 0.04%
-- Flow 1:
Average throughput: 1.92 Mbit/s
95th percentile per-packet one-way delay: 212.059 ms
Loss rate: 0.04%
```
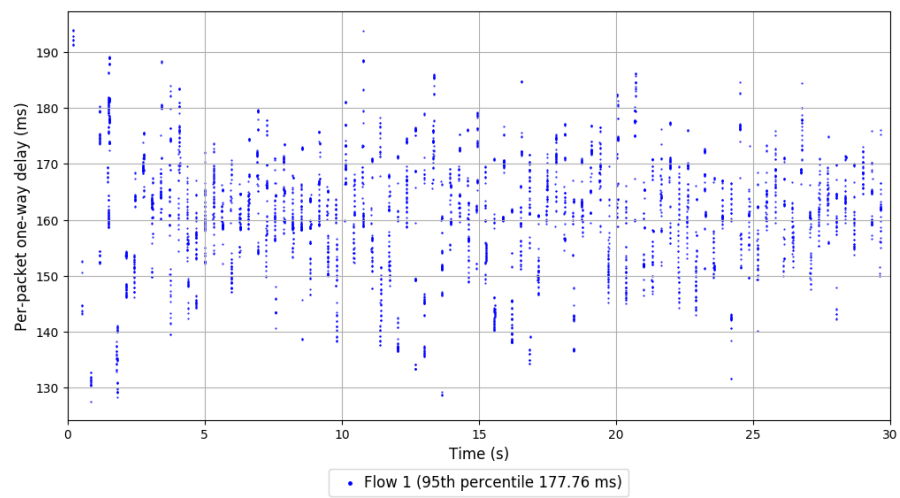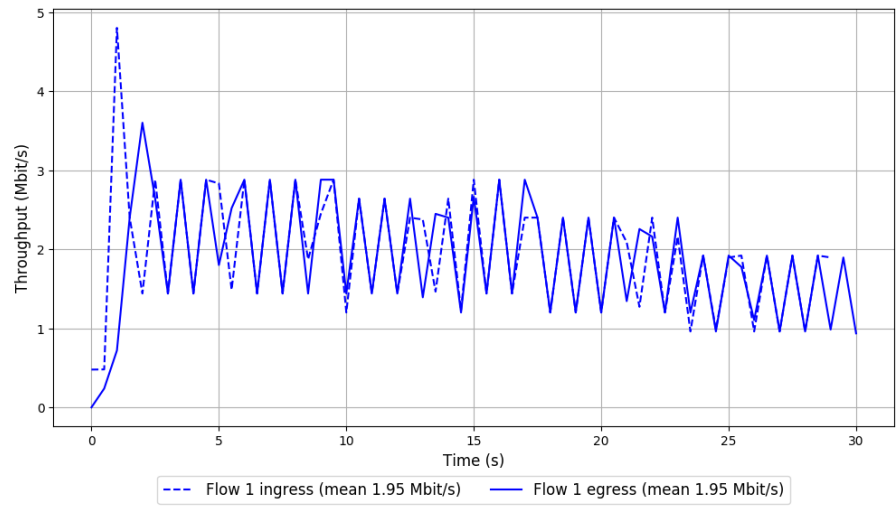
Run 1: Report of Indigo — Data Link

```
Run 2: Statistics of Indigo

Start at: 2018-12-01 23:29:33
End at: 2018-12-01 23:30:03
Local clock offset: 5.5 ms
Remote clock offset: 1.25 ms


# Below is generated by plot.py at 2018-12-02 00:17:44
# Datalink statistics
-- Total of 1 flow:
Average throughput: 1.95 Mbit/s
95th percentile per-packet one-way delay: 177.764 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 1.95 Mbit/s
95th percentile per-packet one-way delay: 177.764 ms
Loss rate: 0.00%
```
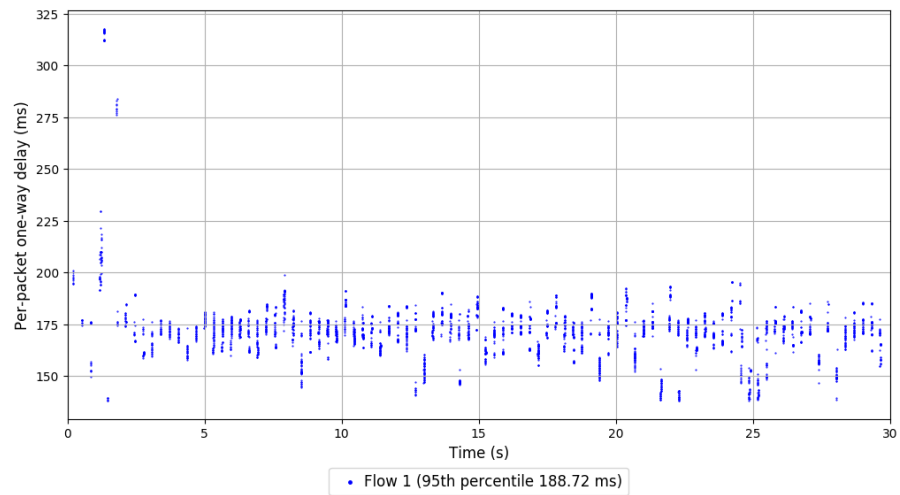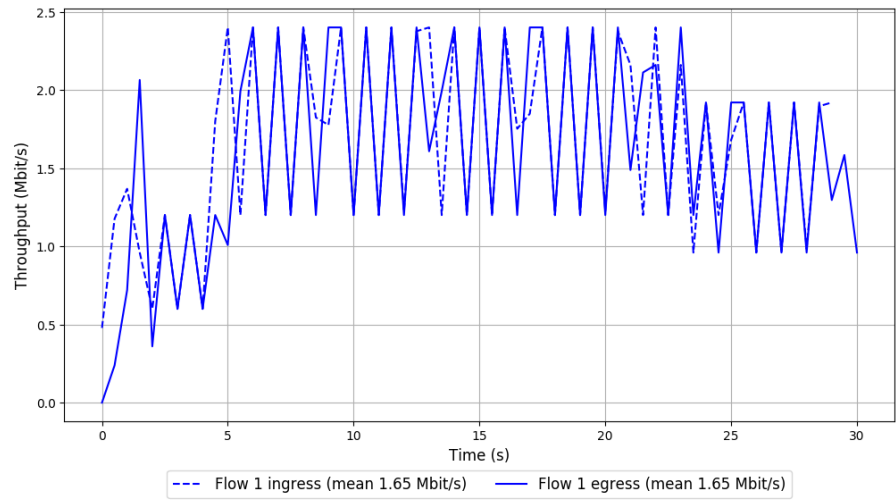
Run 2: Report of Indigo — Data Link

```
Run 3: Statistics of Indigo

Start at: 2018-12-01 23:54:57
End at: 2018-12-01 23:55:27
Local clock offset: -3.961 ms
Remote clock offset: 4.891 ms


# Below is generated by plot.py at 2018-12-02 00:17:44
# Datalink statistics
-- Total of 1 flow:
Average throughput: 1.65 Mbit/s
95th percentile per-packet one-way delay: 188.716 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 1.65 Mbit/s
95th percentile per-packet one-way delay: 188.716 ms
Loss rate: 0.00%
```

Run 3: Report of Indigo — Data Link

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

Start at: 2018-12-01 23:10:55
End at: 2018-12-01 23:11:25
Local clock offset: 4.637 ms
Remote clock offset: -3.696 ms


# Below is generated by plot.py at 2018-12-02 00:17:44
# Datalink statistics
-- Total of 1 flow:
Average throughput: 11.17 Mbit/s
95th percentile per-packet one-way delay: 1148.793 ms
Loss rate: 72.18%
-- Flow 1:
Average throughput: 11.17 Mbit/s
95th percentile per-packet one-way delay: 1148.793 ms
Loss rate: 72.18%
```
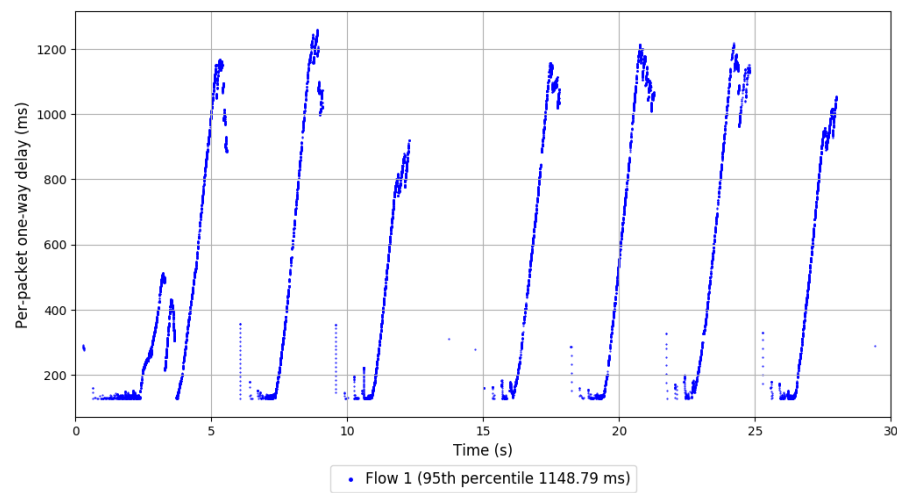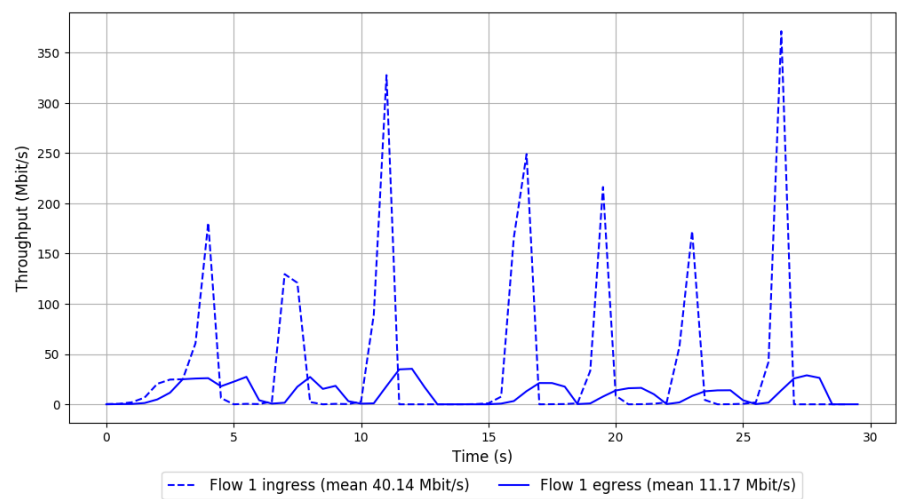
Run 1: Report of Indigo-96d2da3 — Data Link

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

Start at: 2018-12-01 23:36:14
End at: 2018-12-01 23:36:44
Local clock offset: 3.246 ms
Remote clock offset: 2.967 ms


# Below is generated by plot.py at 2018-12-02 00:17:44
# Datalink statistics
-- Total of 1 flow:
Average throughput: 10.02 Mbit/s
95th percentile per-packet one-way delay: 1183.707 ms
Loss rate: 74.70%
-- Flow 1:
Average throughput: 10.02 Mbit/s
95th percentile per-packet one-way delay: 1183.707 ms
Loss rate: 74.70%
```
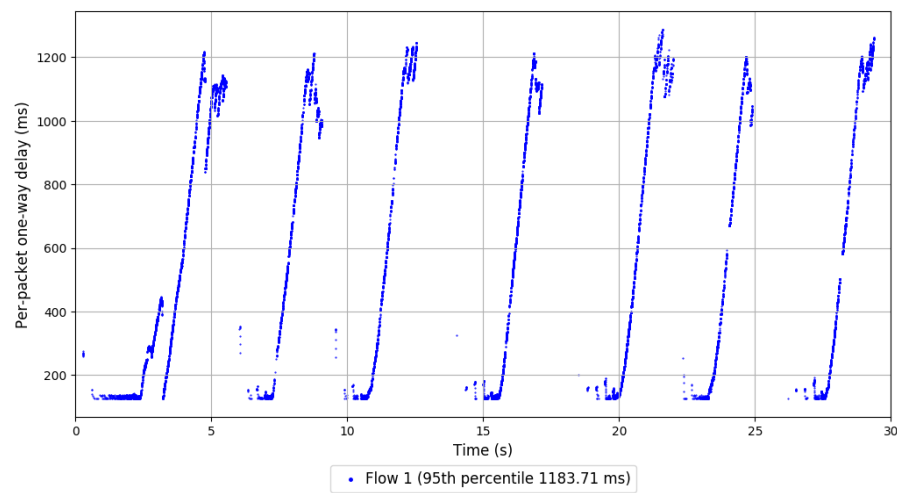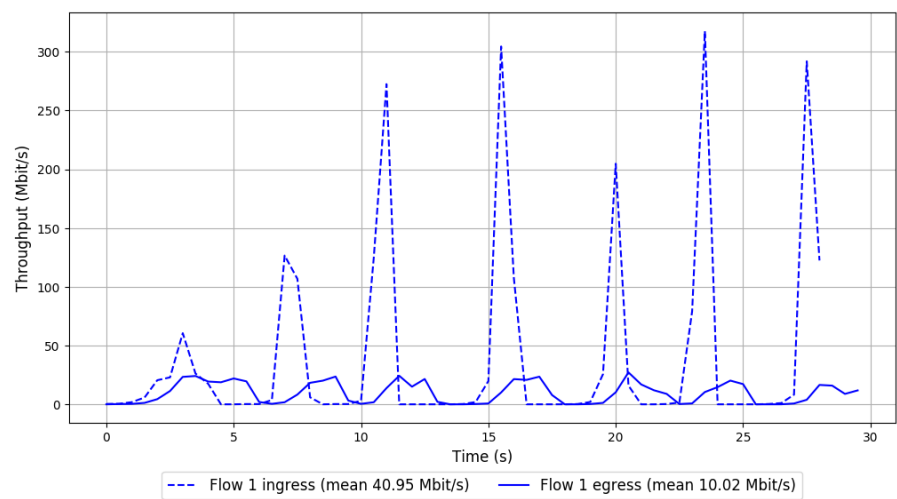
Run 2: Report of Indigo-96d2da3 — Data Link

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

Start at: 2018-12-02 00:01:38
End at: 2018-12-02 00:02:08
Local clock offset: 4.922 ms
Remote clock offset: 2.041 ms


# Below is generated by plot.py at 2018-12-02 00:17:50
# Datalink statistics
-- Total of 1 flow:
Average throughput: 15.01 Mbit/s
95th percentile per-packet one-way delay: 1116.182 ms
Loss rate: 60.35%
-- Flow 1:
Average throughput: 15.01 Mbit/s
95th percentile per-packet one-way delay: 1116.182 ms
Loss rate: 60.35%
```
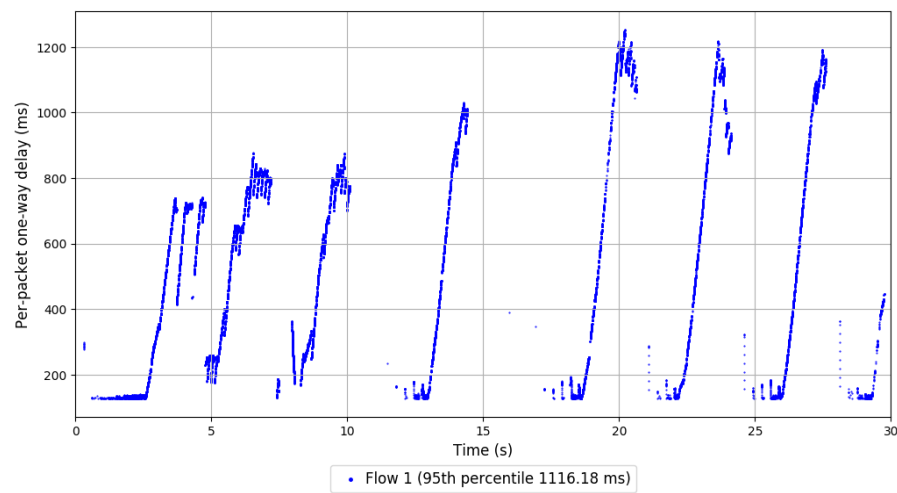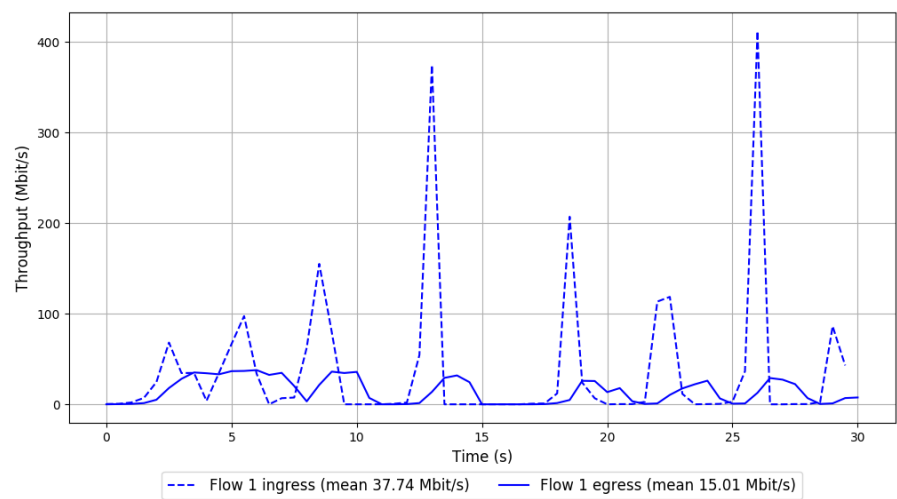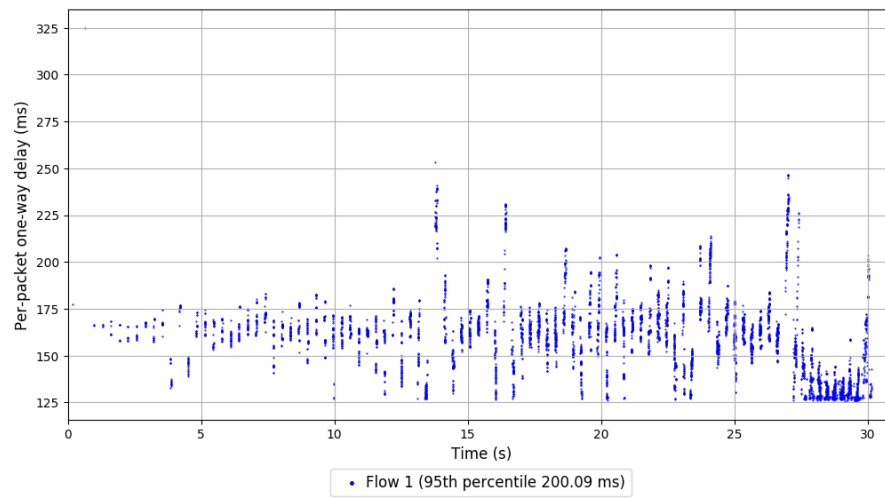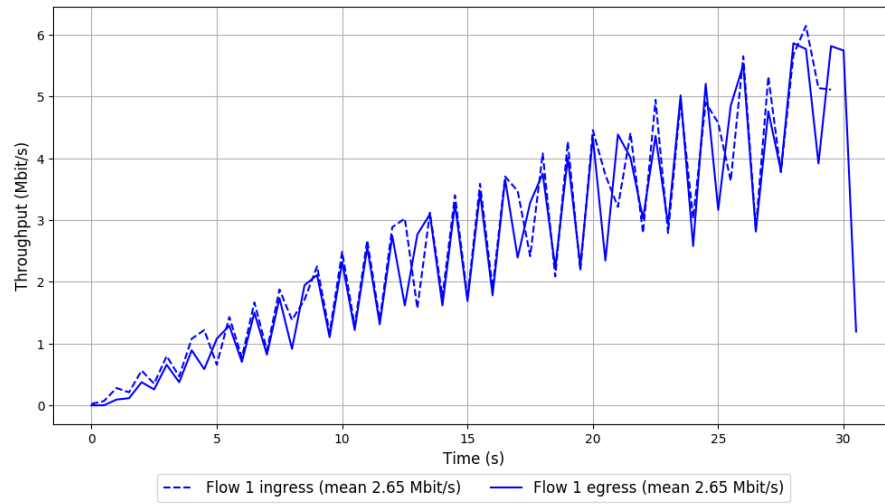
Run 3: Report of Indigo-96d2da3 — Data Link

```
Run 1: Statistics of LEDBAT

Start at: 2018-12-01 23:24:13
End at: 2018-12-01 23:24:43
Local clock offset: 4.465 ms
Remote clock offset: -1.129 ms


# Below is generated by plot.py at 2018-12-02 00:17:50
# Datalink statistics
-- Total of 1 flow:
Average throughput: 2.65 Mbit/s
95th percentile per-packet one-way delay: 200.095 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 2.65 Mbit/s
95th percentile per-packet one-way delay: 200.095 ms
Loss rate: 0.00%
```

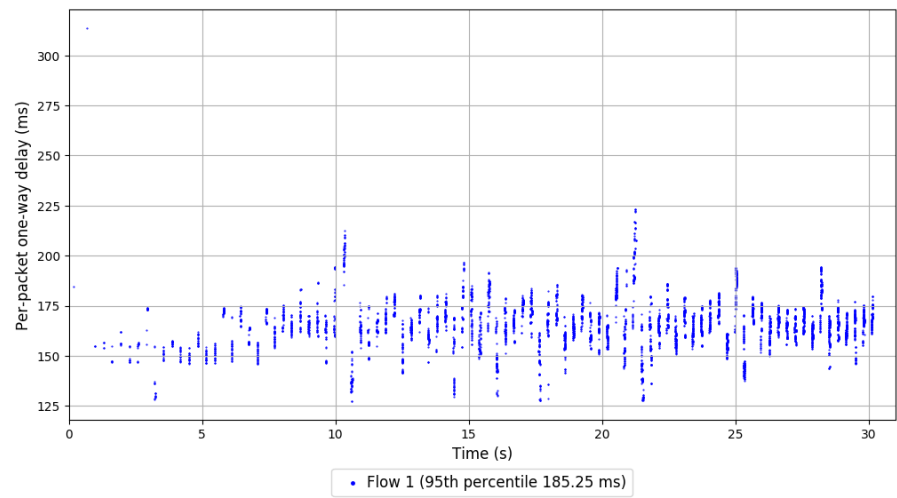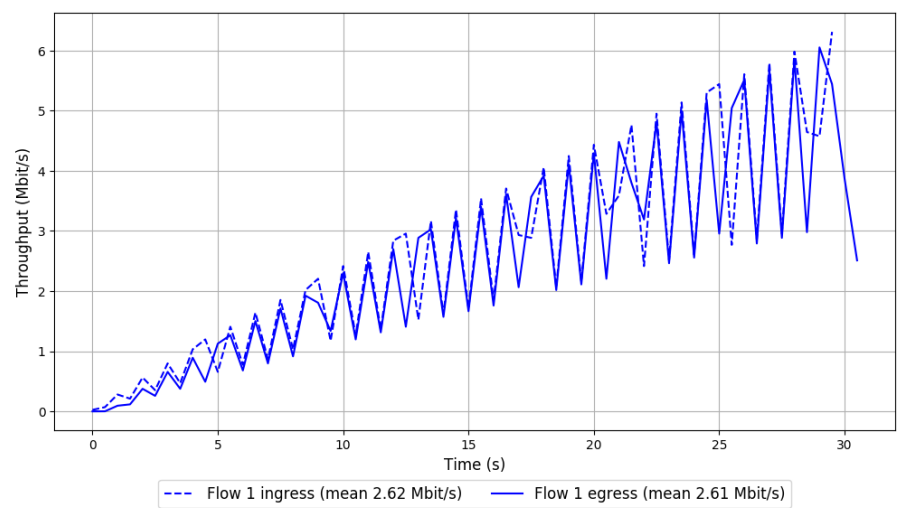Run 1: Report of LEDBAT — Data Link

```
Run 2: Statistics of LEDBAT

Start at: 2018-12-01 23:49:37
End at: 2018-12-01 23:50:07
Local clock offset: 1.895 ms
Remote clock offset: 4.785 ms


# Below is generated by plot.py at 2018-12-02 00:17:50
# Datalink statistics
-- Total of 1 flow:
Average throughput: 2.61 Mbit/s
95th percentile per-packet one-way delay: 185.253 ms
Loss rate: 0.42%
-- Flow 1:
Average throughput: 2.61 Mbit/s
95th percentile per-packet one-way delay: 185.253 ms
Loss rate: 0.42%
```

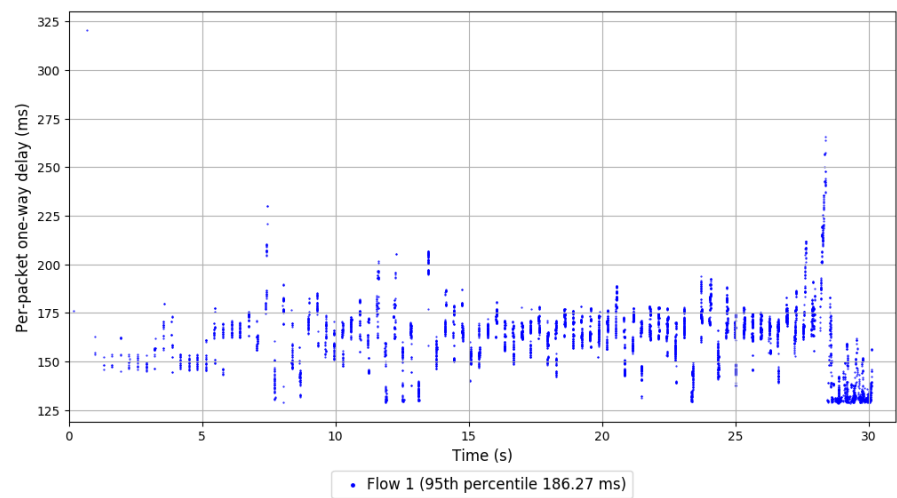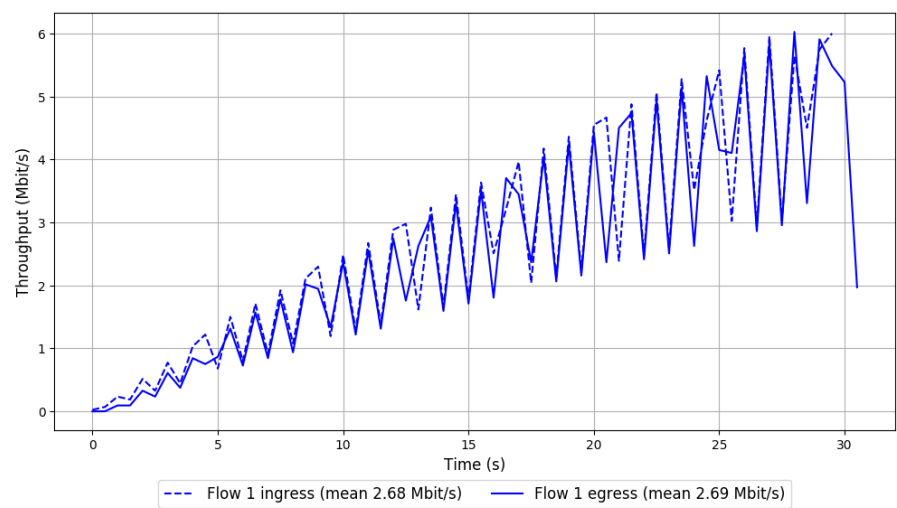# Run 2: Report of LEDBAT — Data Link

```
Run 3: Statistics of LEDBAT

Start at: 2018-12-02 00:14:57
End at: 2018-12-02 00:15:27
Local clock offset: 4.973 ms
Remote clock offset: -0.164 ms


# Below is generated by plot.py at 2018-12-02 00:17:50
# Datalink statistics
-- Total of 1 flow:
Average throughput: 2.69 Mbit/s
95th percentile per-packet one-way delay: 186.271 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 2.69 Mbit/s
95th percentile per-packet one-way delay: 186.271 ms
Loss rate: 0.00%
```

Run 3: Report of LEDBAT — Data Link

Flow 1 ingress (mean 2.68 Mbit/s) — — —   Flow 1 egress (mean 2.69 Mbit/s) ———

• Flow 1 (95th percentile 186.27 ms)

```
Run 1: Statistics of Indigo-Muses

Start at: 2018-12-01 23:22:53
End at: 2018-12-01 23:23:23
Local clock offset: 3.979 ms
Remote clock offset: -1.826 ms


# Below is generated by plot.py at 2018-12-02 00:17:50
# Datalink statistics
-- Total of 1 flow:
Average throughput: 8.34 Mbit/s
95th percentile per-packet one-way delay: 417.762 ms
Loss rate: 0.07%
-- Flow 1:
Average throughput: 8.34 Mbit/s
95th percentile per-packet one-way delay: 417.762 ms
Loss rate: 0.07%
```
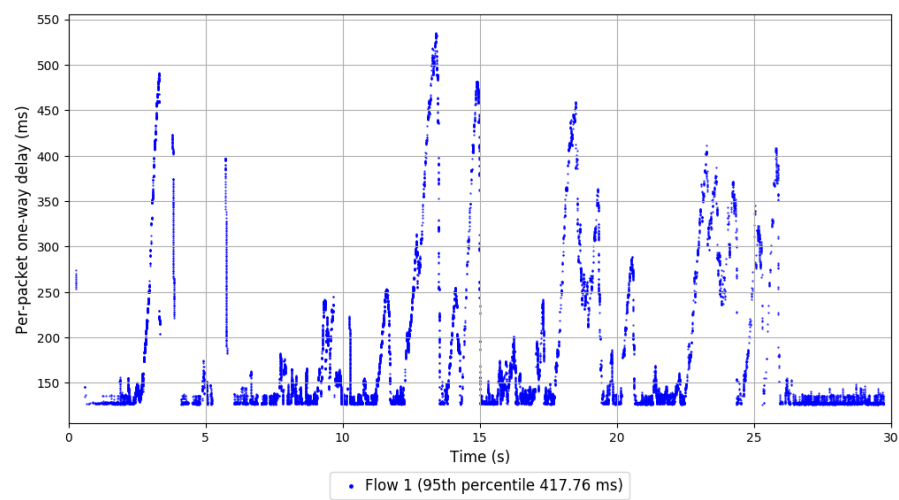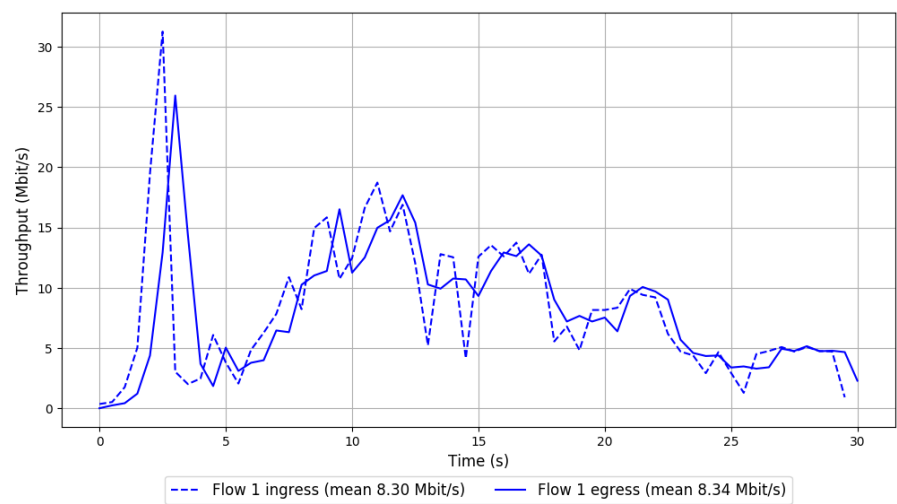
Run 1: Report of Indigo-Muses — Data Link

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```
Run 2: Statistics of Indigo-Muses

Start at: 2018-12-01 23:48:17
End at: 2018-12-01 23:48:47
Local clock offset: 2.487 ms
Remote clock offset: 4.617 ms


# Below is generated by plot.py at 2018-12-02 00:17:50
# Datalink statistics
-- Total of 1 flow:
Average throughput: 9.25 Mbit/s
95th percentile per-packet one-way delay: 316.019 ms
Loss rate: 0.09%
-- Flow 1:
Average throughput: 9.25 Mbit/s
95th percentile per-packet one-way delay: 316.019 ms
Loss rate: 0.09%
```
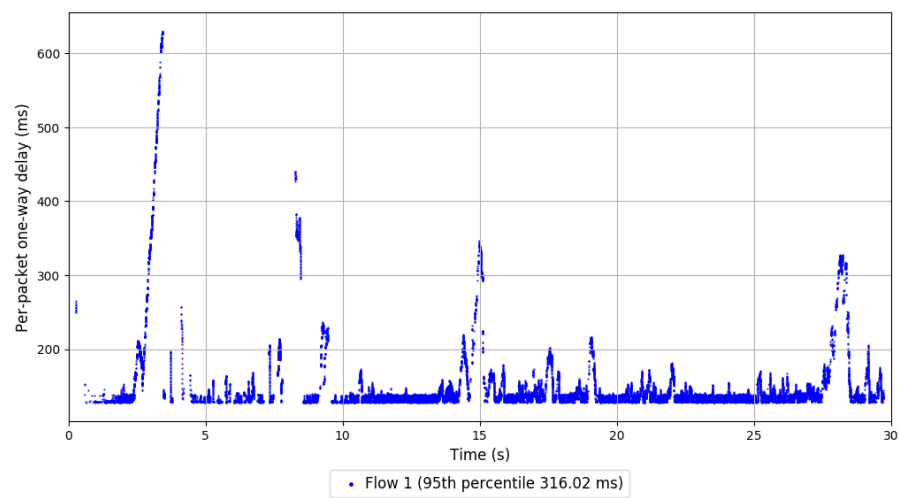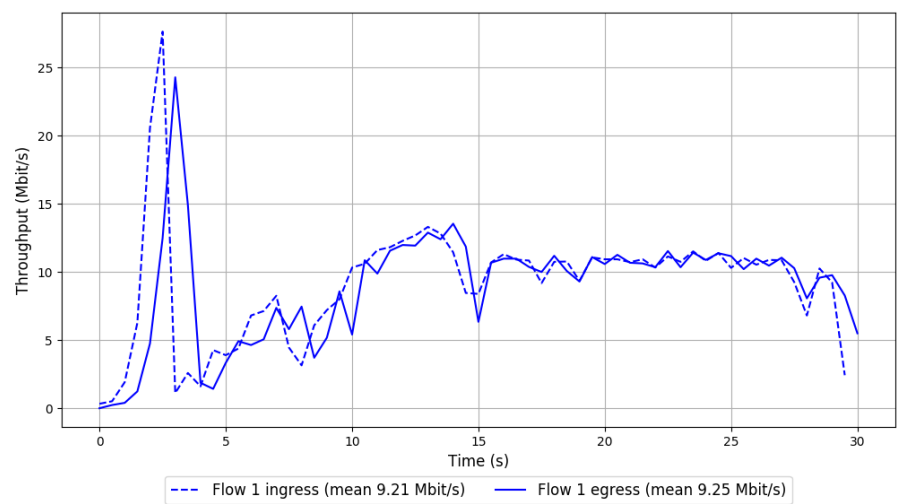
Run 2: Report of Indigo-Muses — Data Link

Flow 1 ingress (mean 9.21 Mbit/s) --- Flow 1 egress (mean 9.25 Mbit/s)
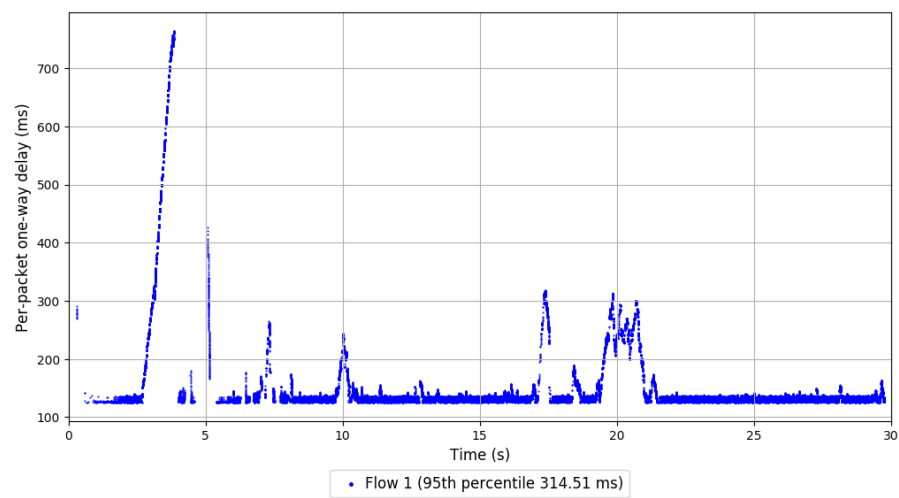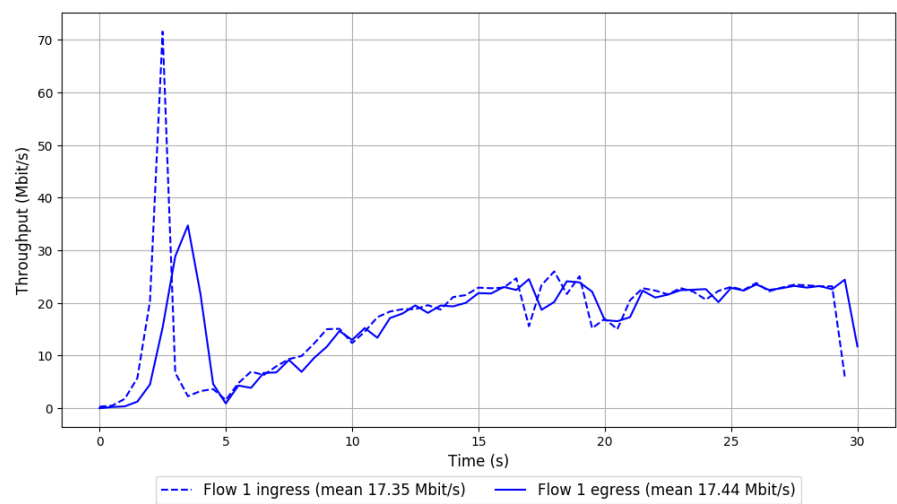

Flow 1 (95th percentile 316.02 ms)

```
Run 3: Statistics of Indigo-Muses

Start at: 2018-12-02 00:13:37
End at: 2018-12-02 00:14:07
Local clock offset: 6.148 ms
Remote clock offset: -0.124 ms


# Below is generated by plot.py at 2018-12-02 00:18:07
# Datalink statistics
-- Total of 1 flow:
Average throughput: 17.44 Mbit/s
95th percentile per-packet one-way delay: 314.506 ms
Loss rate: 0.01%
-- Flow 1:
Average throughput: 17.44 Mbit/s
95th percentile per-packet one-way delay: 314.506 ms
Loss rate: 0.01%
```

Run 3: Report of Indigo-Muses — Data Link

```
Run 1: Statistics of PCC-Allegro

Start at: 2018-12-01 23:09:35
End at: 2018-12-01 23:10:05
Local clock offset: 4.852 ms
Remote clock offset: -3.704 ms


# Below is generated by plot.py at 2018-12-02 00:18:07
# Datalink statistics
-- Total of 1 flow:
Average throughput: 8.11 Mbit/s
95th percentile per-packet one-way delay: 967.103 ms
Loss rate: 0.24%
-- Flow 1:
Average throughput: 8.11 Mbit/s
95th percentile per-packet one-way delay: 967.103 ms
Loss rate: 0.24%
```
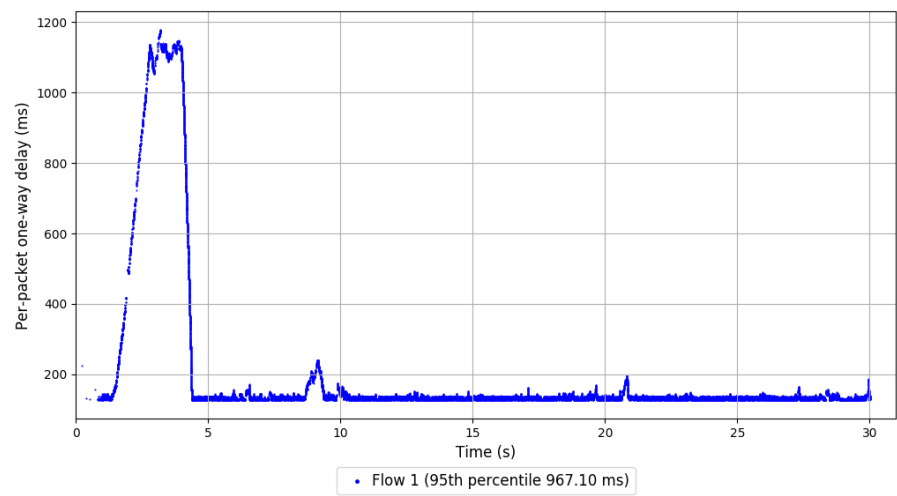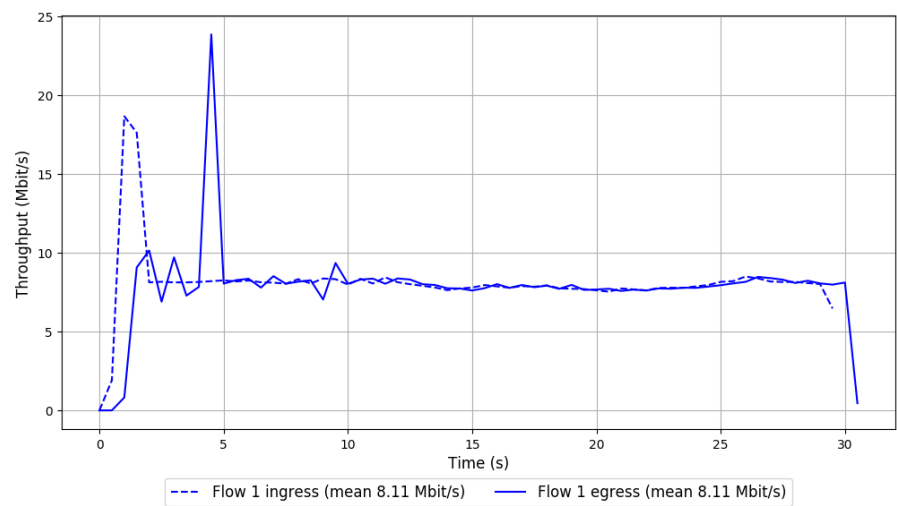
Run 1: Report of PCC-Allegro — Data Link

```
Run 2: Statistics of PCC-Allegro

Start at: 2018-12-01 23:34:54
End at: 2018-12-01 23:35:24
Local clock offset: 3.682 ms
Remote clock offset: 2.693 ms


# Below is generated by plot.py at 2018-12-02 00:18:07
# Datalink statistics
-- Total of 1 flow:
Average throughput: 8.18 Mbit/s
95th percentile per-packet one-way delay: 656.884 ms
Loss rate: 0.55%
-- Flow 1:
Average throughput: 8.18 Mbit/s
95th percentile per-packet one-way delay: 656.884 ms
Loss rate: 0.55%
```
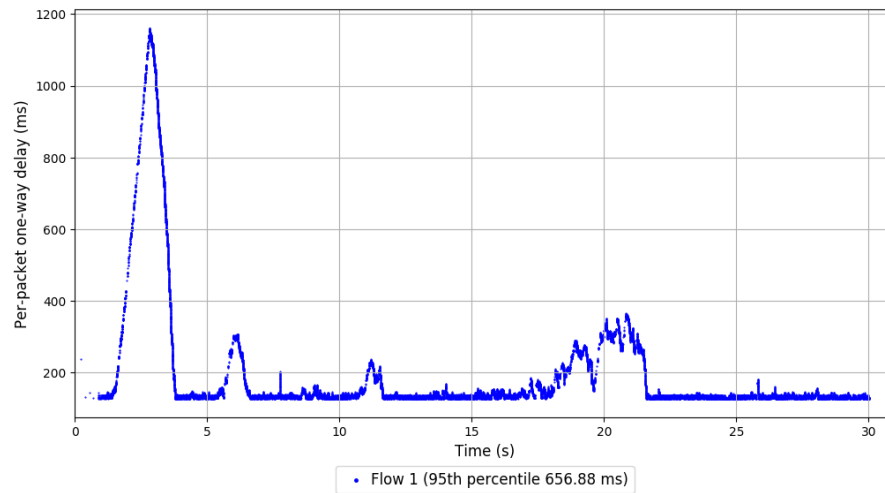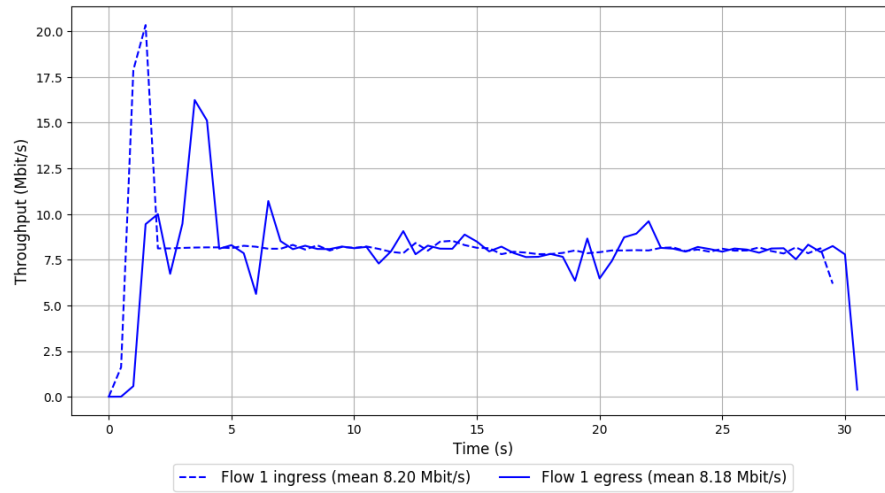
Run 2: Report of PCC-Allegro — Data Link

```
Run 3: Statistics of PCC-Allegro

Start at: 2018-12-02 00:00:17
End at: 2018-12-02 00:00:47
Local clock offset: 4.89 ms
Remote clock offset: 2.571 ms


# Below is generated by plot.py at 2018-12-02 00:18:08
# Datalink statistics
-- Total of 1 flow:
Average throughput: 16.33 Mbit/s
95th percentile per-packet one-way delay: 901.424 ms
Loss rate: 13.41%
-- Flow 1:
Average throughput: 16.33 Mbit/s
95th percentile per-packet one-way delay: 901.424 ms
Loss rate: 13.41%
```
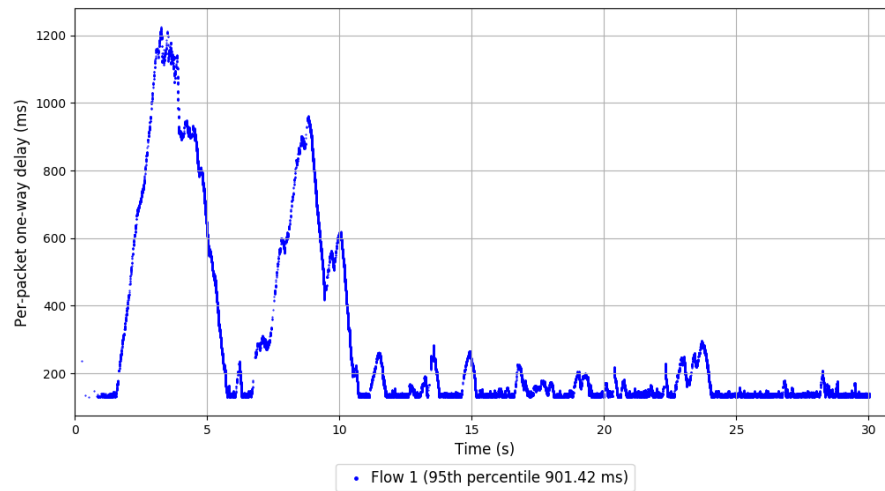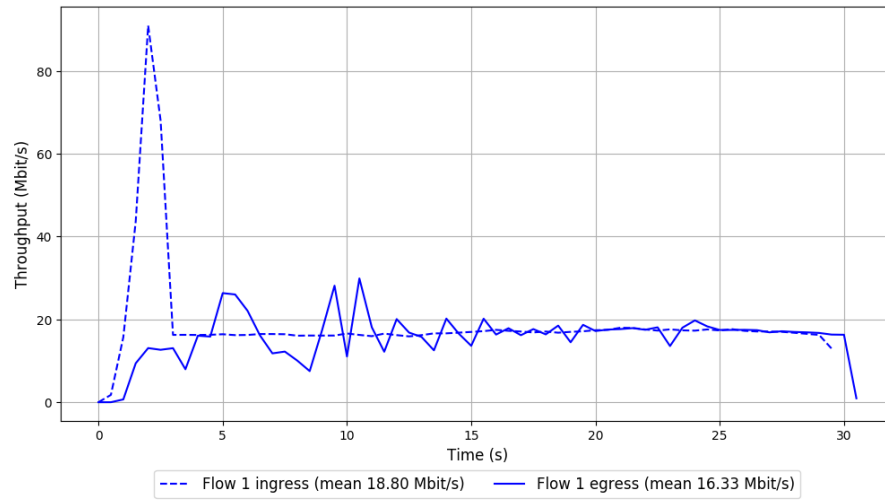
Run 3: Report of PCC-Allegro — Data Link

Flow 1 ingress (mean 18.80 Mbit/s) --- Flow 1 egress (mean 16.33 Mbit/s)
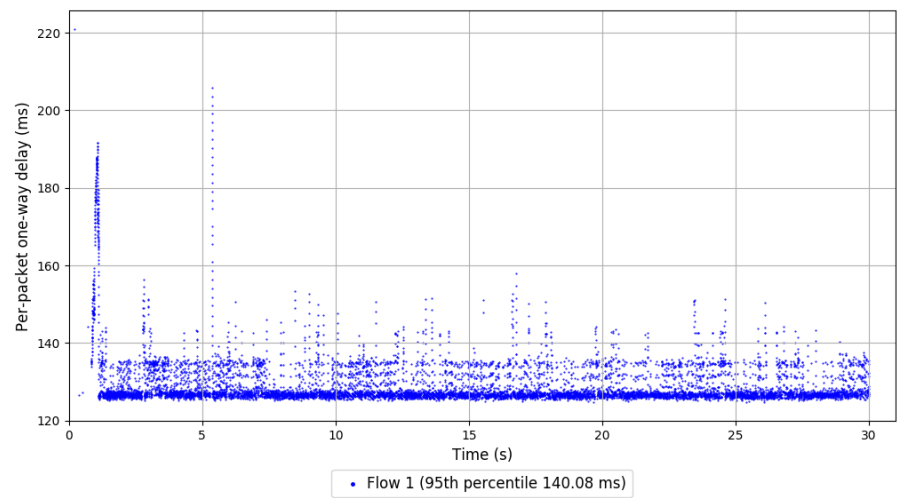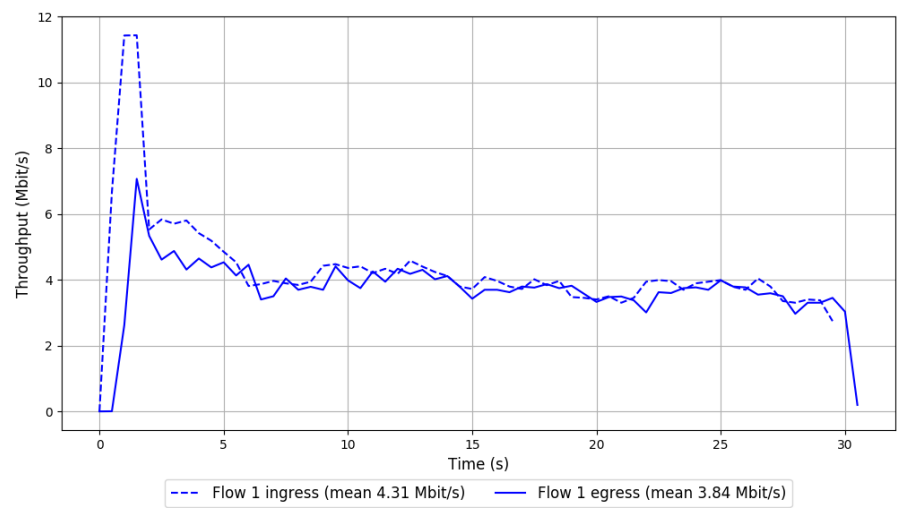

Flow 1 (95th percentile 901.42 ms)

```
Run 1: Statistics of PCC-Expr

Start at: 2018-12-01 23:14:54
End at: 2018-12-01 23:15:24
Local clock offset: 5.079 ms
Remote clock offset: -3.76 ms

# Below is generated by plot.py at 2018-12-02 00:18:08
# Datalink statistics
-- Total of 1 flow:
Average throughput: 3.84 Mbit/s
95th percentile per-packet one-way delay: 140.082 ms
Loss rate: 11.29%
-- Flow 1:
Average throughput: 3.84 Mbit/s
95th percentile per-packet one-way delay: 140.082 ms
Loss rate: 11.29%
```

Run 1: Report of PCC-Expr — Data Link

Flow 1 ingress (mean 4.31 Mbit/s) --- Flow 1 egress (mean 3.84 Mbit/s)

Flow 1 (95th percentile 140.08 ms)

```
Run 2: Statistics of PCC-Expr

Start at: 2018-12-01 23:40:13
End at: 2018-12-01 23:40:43
Local clock offset: 2.809 ms
Remote clock offset: 3.691 ms


# Below is generated by plot.py at 2018-12-02 00:18:08
# Datalink statistics
-- Total of 1 flow:
Average throughput: 2.30 Mbit/s
95th percentile per-packet one-way delay: 136.860 ms
Loss rate: 25.20%
-- Flow 1:
Average throughput: 2.30 Mbit/s
95th percentile per-packet one-way delay: 136.860 ms
Loss rate: 25.20%
```
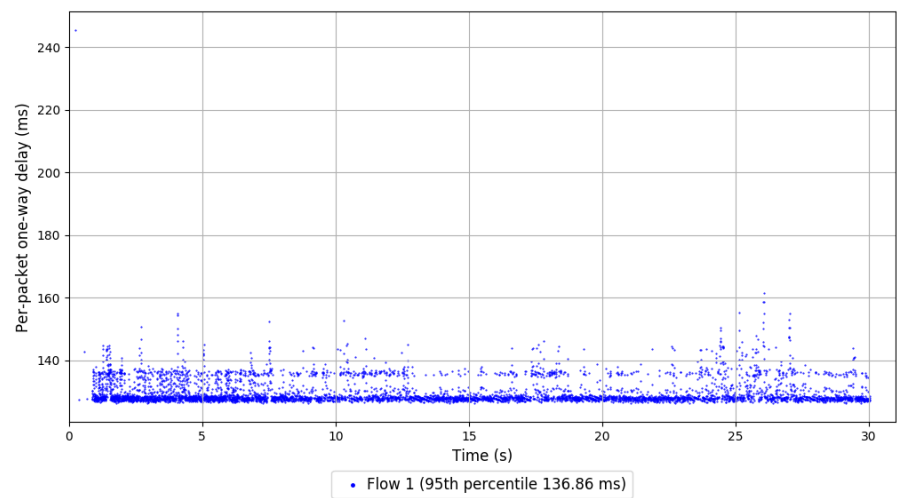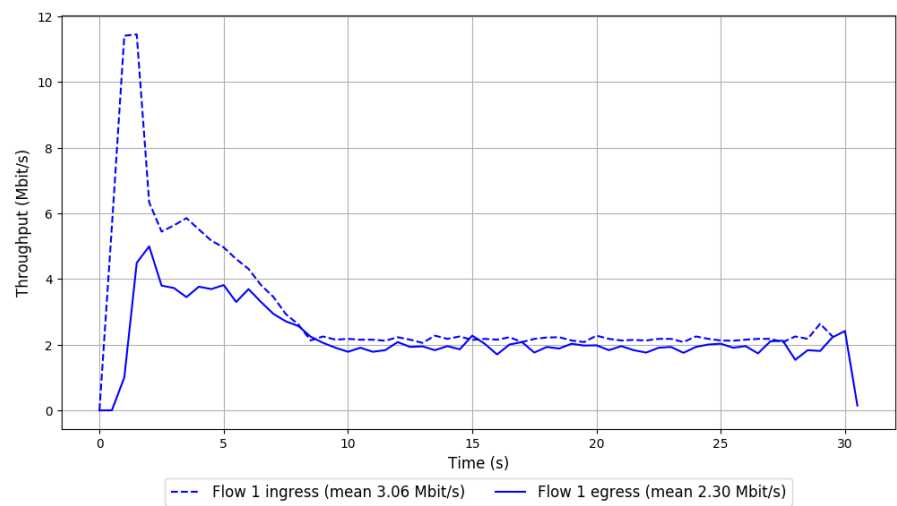
Run 2: Report of PCC-Expr — Data Link

```
Run 3: Statistics of PCC-Expr

Start at: 2018-12-02 00:05:37
End at: 2018-12-02 00:06:07
Local clock offset: 5.025 ms
Remote clock offset: 0.978 ms

# Below is generated by plot.py at 2018-12-02 00:18:08
# Datalink statistics
-- Total of 1 flow:
Average throughput: 3.59 Mbit/s
95th percentile per-packet one-way delay: 138.010 ms
Loss rate: 17.67%
-- Flow 1:
Average throughput: 3.59 Mbit/s
95th percentile per-packet one-way delay: 138.010 ms
Loss rate: 17.67%
```
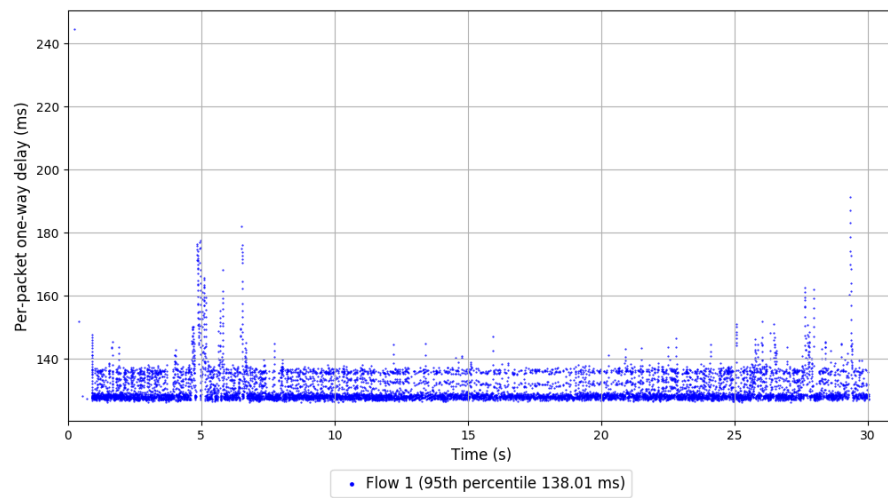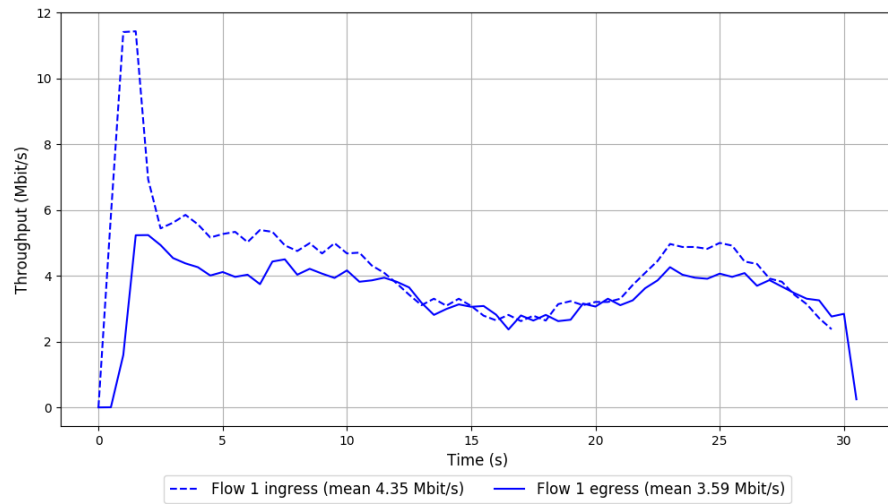
Run 3: Report of PCC-Expr — Data Link

Flow 1 ingress (mean 4.35 Mbit/s)   Flow 1 egress (mean 3.59 Mbit/s)

Flow 1 (95th percentile 138.01 ms)

```
Run 1: Statistics of QUIC Cubic

Start at: 2018-12-01 23:01:36
End at: 2018-12-01 23:02:06
Local clock offset: 6.0 ms
Remote clock offset: -3.713 ms


# Below is generated by plot.py at 2018-12-02 00:18:08
# Datalink statistics
-- Total of 1 flow:
Average throughput: 9.02 Mbit/s
95th percentile per-packet one-way delay: 344.062 ms
Loss rate: 0.12%
-- Flow 1:
Average throughput: 9.02 Mbit/s
95th percentile per-packet one-way delay: 344.062 ms
Loss rate: 0.12%
```
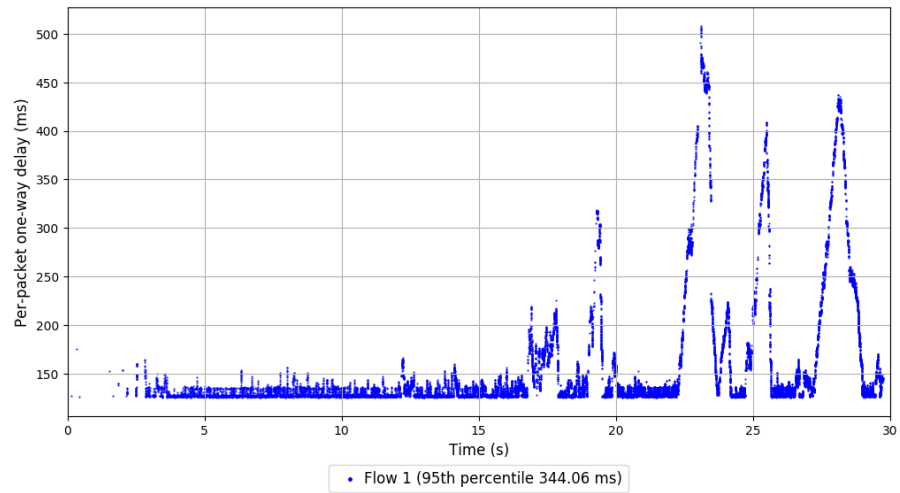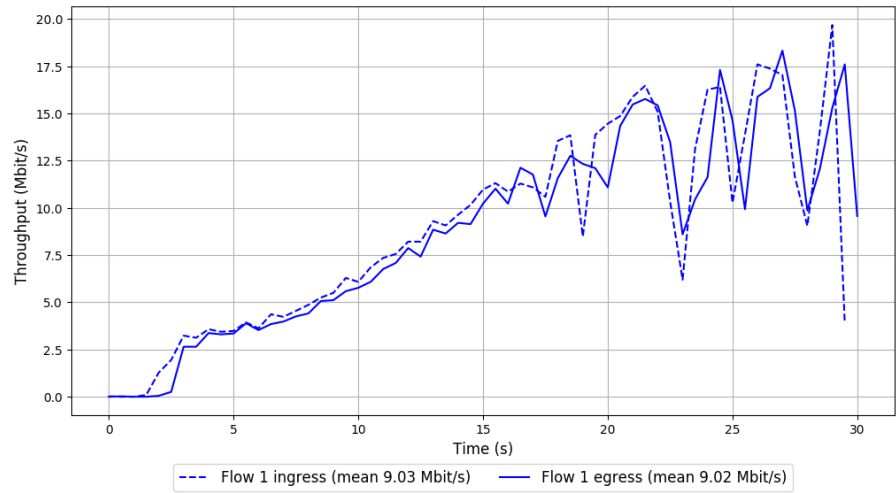
Run 1: Report of QUIC Cubic — Data Link

```
Run 2: Statistics of QUIC Cubic

Start at: 2018-12-01 23:26:53
End at: 2018-12-01 23:27:23
Local clock offset: 4.371 ms
Remote clock offset: 0.282 ms


# Below is generated by plot.py at 2018-12-02 00:18:08
# Datalink statistics
-- Total of 1 flow:
Average throughput: 6.72 Mbit/s
95th percentile per-packet one-way delay: 144.287 ms
Loss rate: 0.05%
-- Flow 1:
Average throughput: 6.72 Mbit/s
95th percentile per-packet one-way delay: 144.287 ms
Loss rate: 0.05%
```
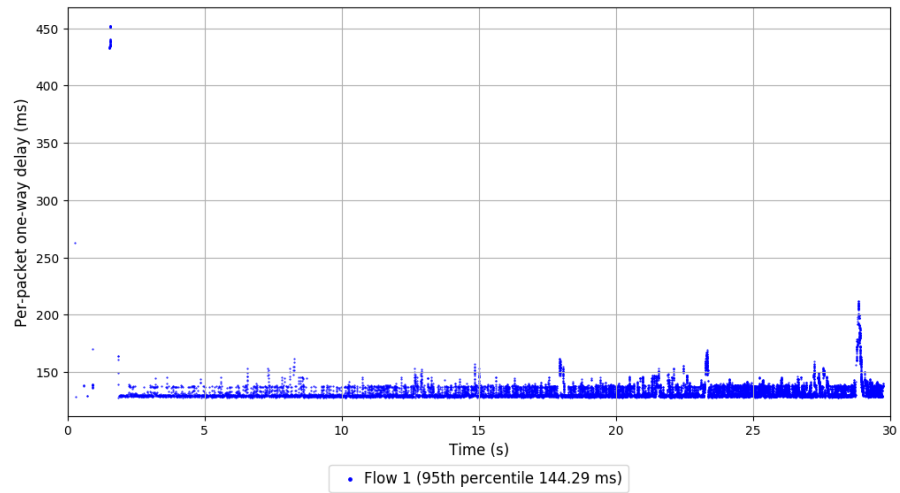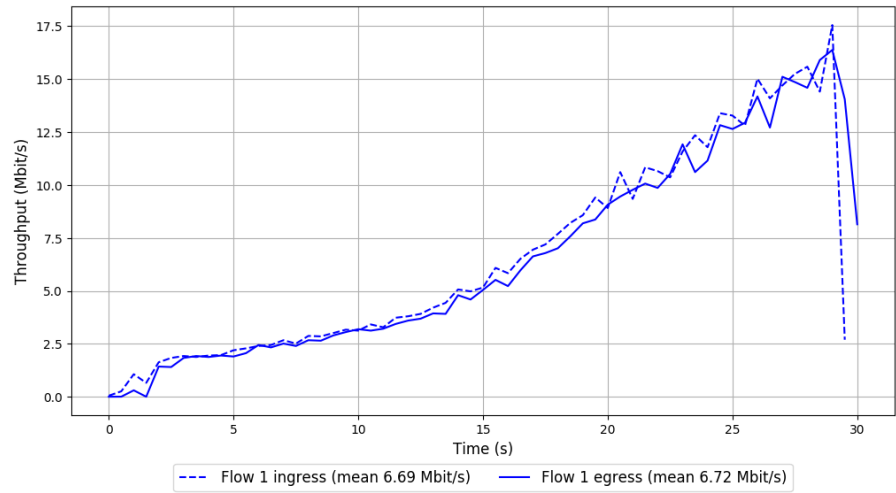
Run 2: Report of QUIC Cubic — Data Link

```
Run 3: Statistics of QUIC Cubic

Start at: 2018-12-01 23:52:17
End at: 2018-12-01 23:52:47
Local clock offset: 3.156 ms
Remote clock offset: 5.095 ms


# Below is generated by plot.py at 2018-12-02 00:18:08
# Datalink statistics
-- Total of 1 flow:
Average throughput: 6.20 Mbit/s
95th percentile per-packet one-way delay: 149.300 ms
Loss rate: 0.04%
-- Flow 1:
Average throughput: 6.20 Mbit/s
95th percentile per-packet one-way delay: 149.300 ms
Loss rate: 0.04%
```
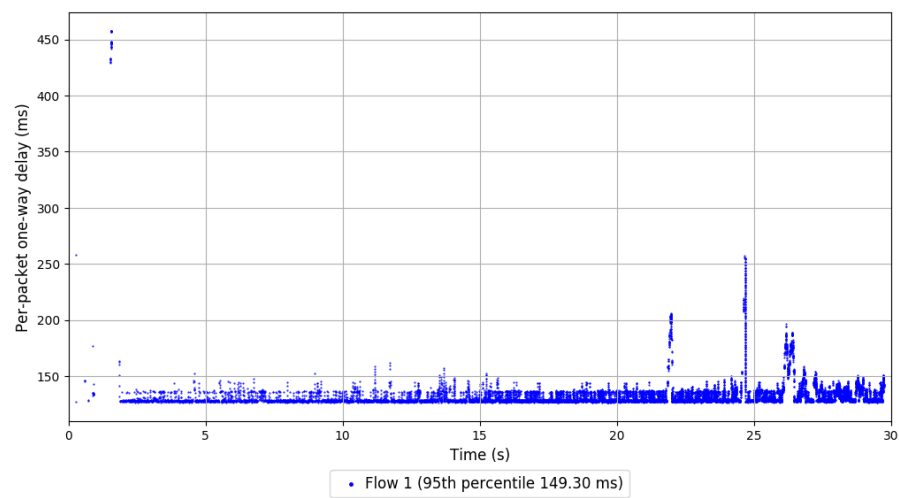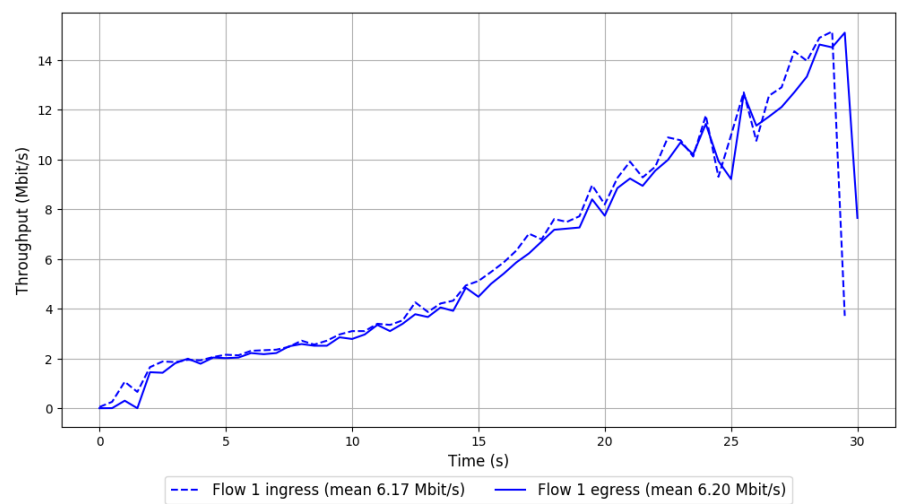
Run 3: Report of QUIC Cubic — Data Link

Flow 1 ingress (mean 6.17 Mbit/s)   Flow 1 egress (mean 6.20 Mbit/s)

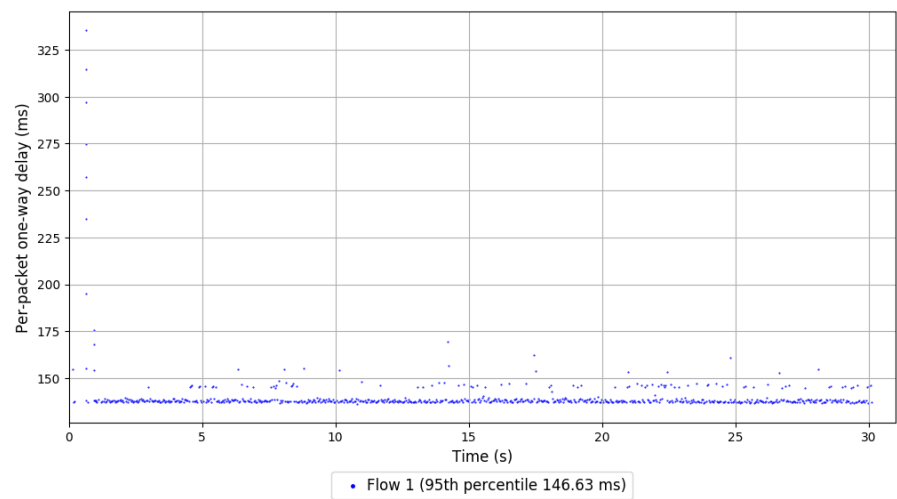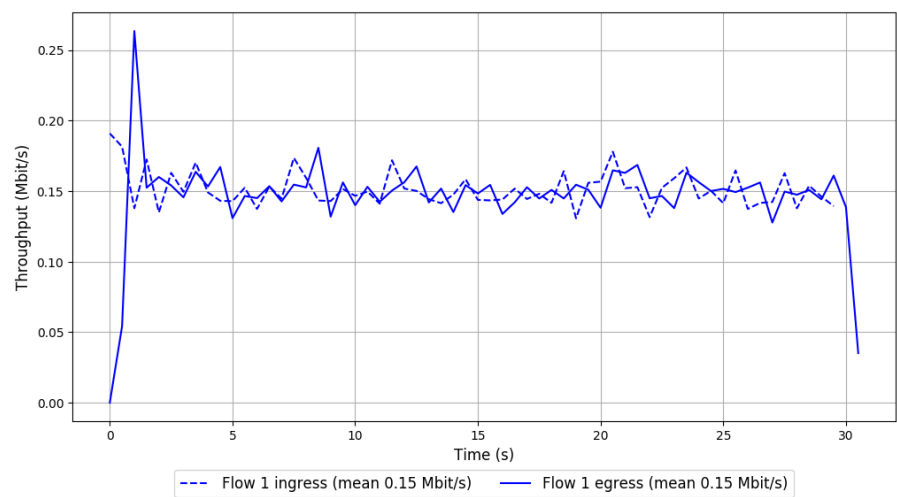Flow 1 (95th percentile 149.30 ms)

```
Run 1: Statistics of SCReAM

Start at: 2018-12-01 23:21:35
End at: 2018-12-01 23:22:05
Local clock offset: -6.412 ms
Remote clock offset: -2.808 ms

# Below is generated by plot.py at 2018-12-02 00:18:08
# Datalink statistics
-- Total of 1 flow:
Average throughput: 0.15 Mbit/s
95th percentile per-packet one-way delay: 146.631 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 0.15 Mbit/s
95th percentile per-packet one-way delay: 146.631 ms
Loss rate: 0.00%
```

Run 1: Report of SCReAM — Data Link

```
Run 2: Statistics of SCReAM

Start at: 2018-12-01 23:46:58
End at: 2018-12-01 23:47:28
Local clock offset: 1.661 ms
Remote clock offset: 4.567 ms


# Below is generated by plot.py at 2018-12-02 00:18:08
# Datalink statistics
-- Total of 1 flow:
Average throughput: 0.15 Mbit/s
95th percentile per-packet one-way delay: 135.736 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 0.15 Mbit/s
95th percentile per-packet one-way delay: 135.736 ms
Loss rate: 0.00%
```
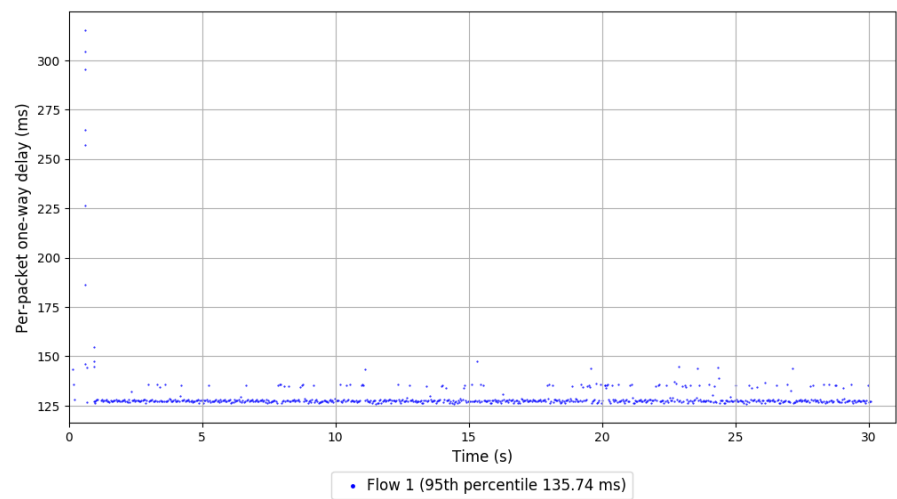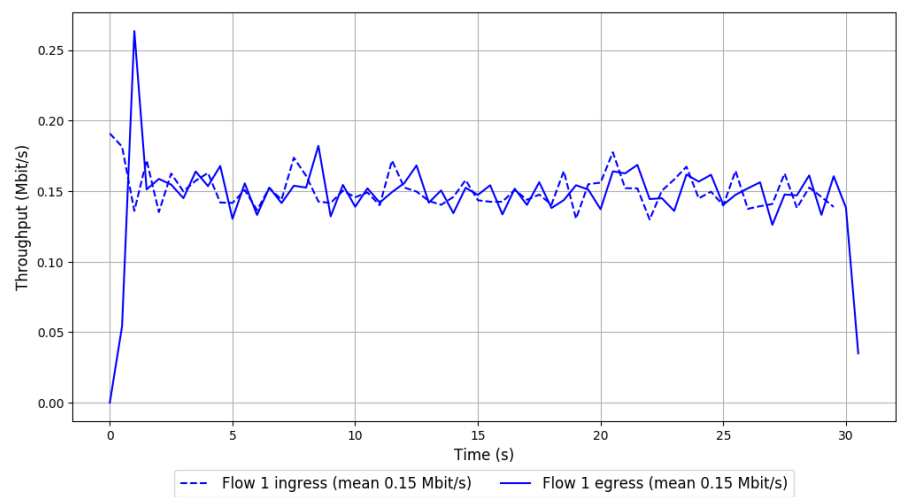
Run 2: Report of SCReAM — Data Link

Flow 1 ingress (mean 0.15 Mbit/s) --- Flow 1 egress (mean 0.15 Mbit/s)

Flow 1 (95th percentile 135.74 ms)

```
Run 3: Statistics of SCReAM

Start at: 2018-12-02 00:12:18
End at: 2018-12-02 00:12:48
Local clock offset: 4.775 ms
Remote clock offset: 0.024 ms


# Below is generated by plot.py at 2018-12-02 00:18:08
# Datalink statistics
-- Total of 1 flow:
Average throughput: 0.15 Mbit/s
95th percentile per-packet one-way delay: 136.835 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 0.15 Mbit/s
95th percentile per-packet one-way delay: 136.835 ms
Loss rate: 0.00%
```
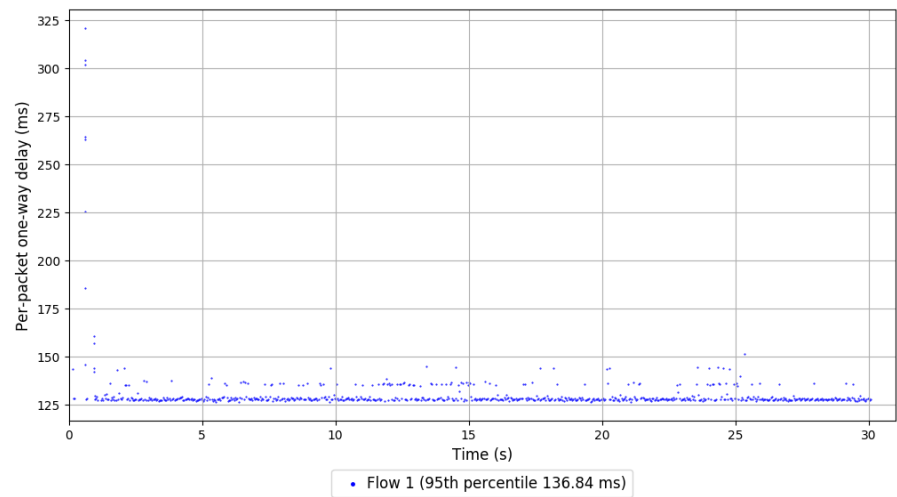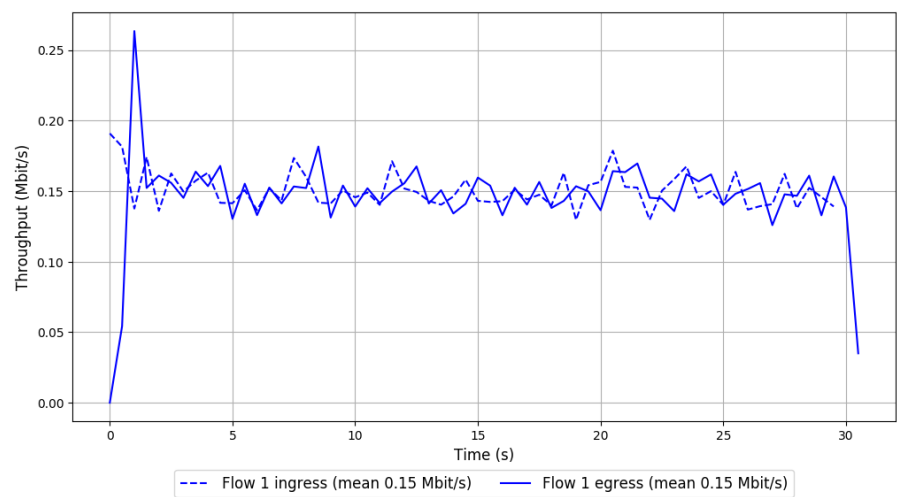
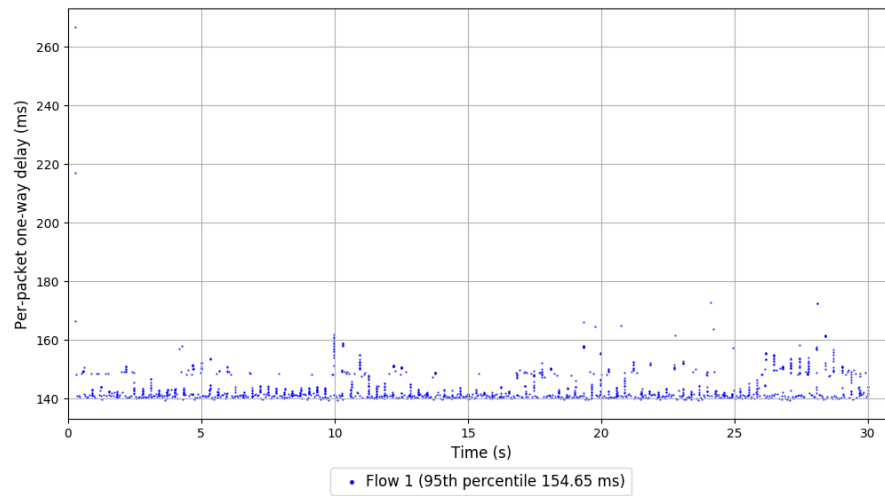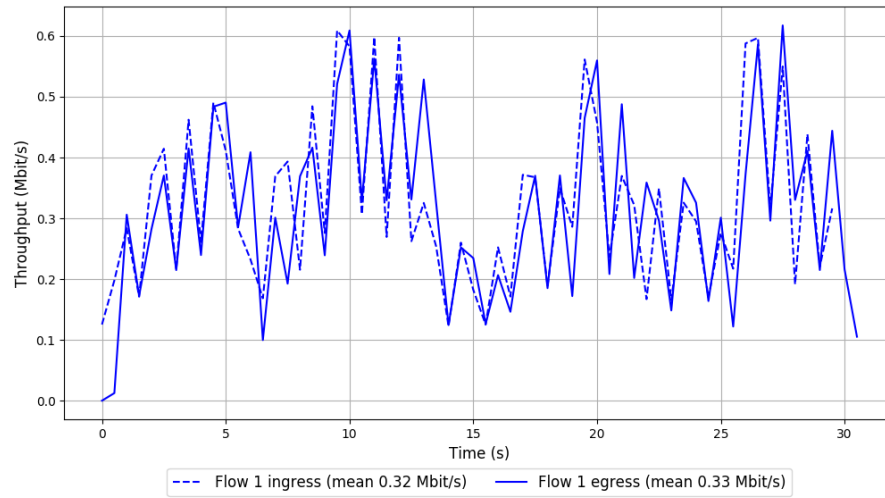Run 3: Report of SCReAM — Data Link

```
Run 1: Statistics of Sprout

Start at: 2018-12-01 23:13:36
End at: 2018-12-01 23:14:06
Local clock offset: -6.933 ms
Remote clock offset: -3.742 ms


# Below is generated by plot.py at 2018-12-02 00:18:08
# Datalink statistics
-- Total of 1 flow:
Average throughput: 0.33 Mbit/s
95th percentile per-packet one-way delay: 154.646 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 0.33 Mbit/s
95th percentile per-packet one-way delay: 154.646 ms
Loss rate: 0.00%
```

Run 1: Report of Sprout — Data Link

```
Run 2: Statistics of Sprout

Start at: 2018-12-01 23:38:54
End at: 2018-12-01 23:39:24
Local clock offset: 2.876 ms
Remote clock offset: 3.425 ms


# Below is generated by plot.py at 2018-12-02 00:18:08
# Datalink statistics
-- Total of 1 flow:
Average throughput: 0.41 Mbit/s
95th percentile per-packet one-way delay: 141.070 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 0.41 Mbit/s
95th percentile per-packet one-way delay: 141.070 ms
Loss rate: 0.00%
```
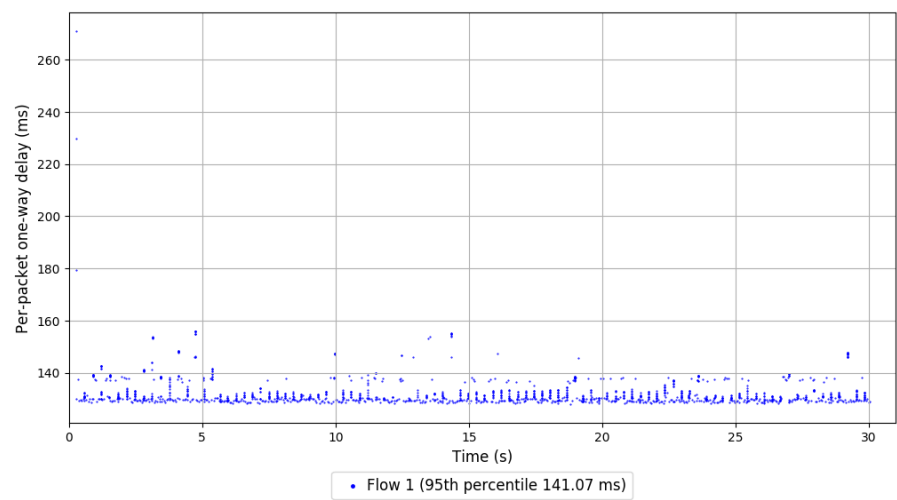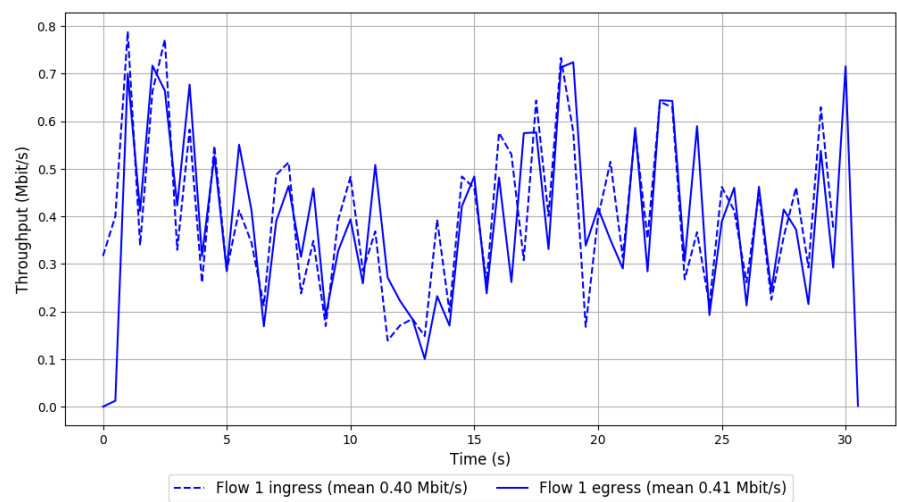
Run 2: Report of Sprout — Data Link

```
Run 3: Statistics of Sprout

Start at: 2018-12-02 00:04:18
End at: 2018-12-02 00:04:48
Local clock offset: 6.207 ms
Remote clock offset: 1.304 ms


# Below is generated by plot.py at 2018-12-02 00:18:08
# Datalink statistics
-- Total of 1 flow:
Average throughput: 0.40 Mbit/s
95th percentile per-packet one-way delay: 136.552 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 0.40 Mbit/s
95th percentile per-packet one-way delay: 136.552 ms
Loss rate: 0.00%
```
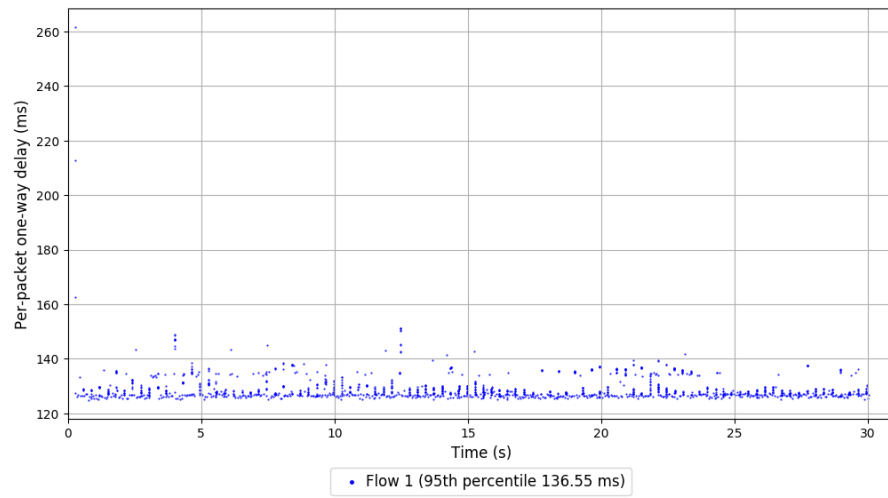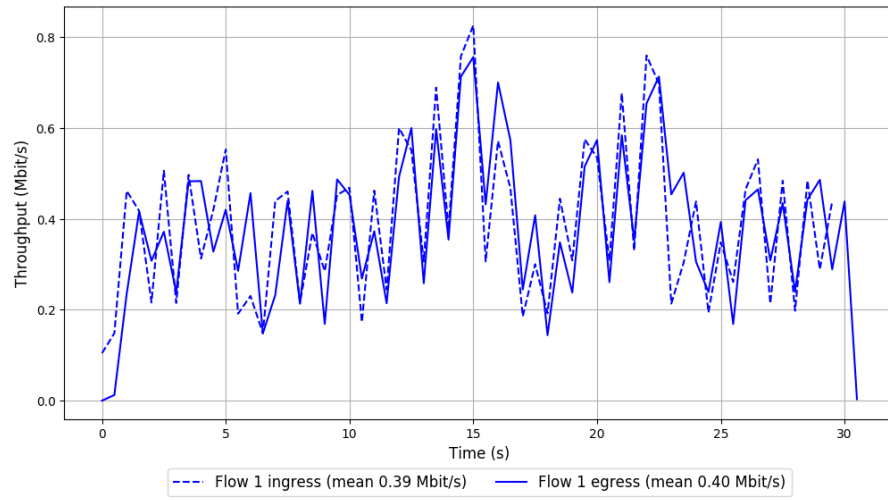
Run 3: Report of Sprout — Data Link
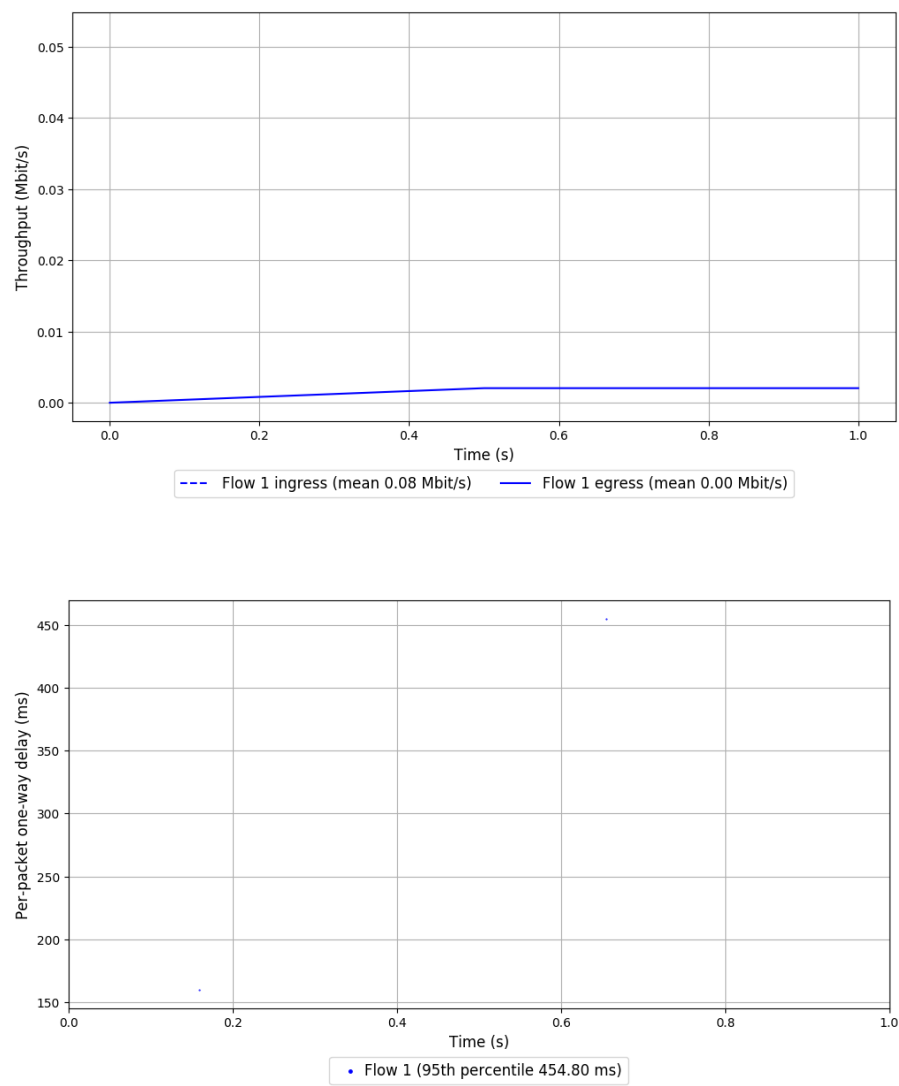
```
Run 1: Statistics of TaoVA-100x

Start at: 2018-12-01 23:08:16
End at: 2018-12-01 23:08:46
Local clock offset: 5.103 ms
Remote clock offset: -3.702 ms
```

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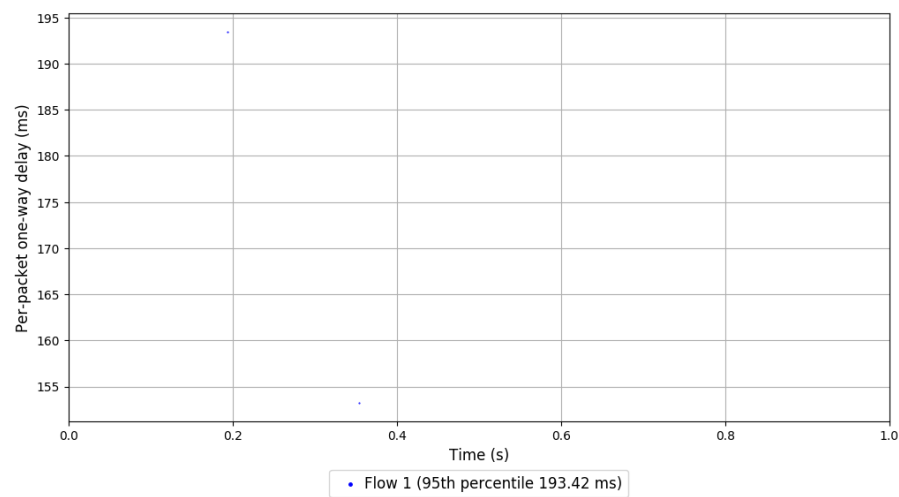
```
Run 2: Statistics of TaoVA-100x

Start at: 2018-12-01 23:33:35
End at: 2018-12-01 23:34:05
Local clock offset: -7.736 ms
Remote clock offset: 2.344 ms
```
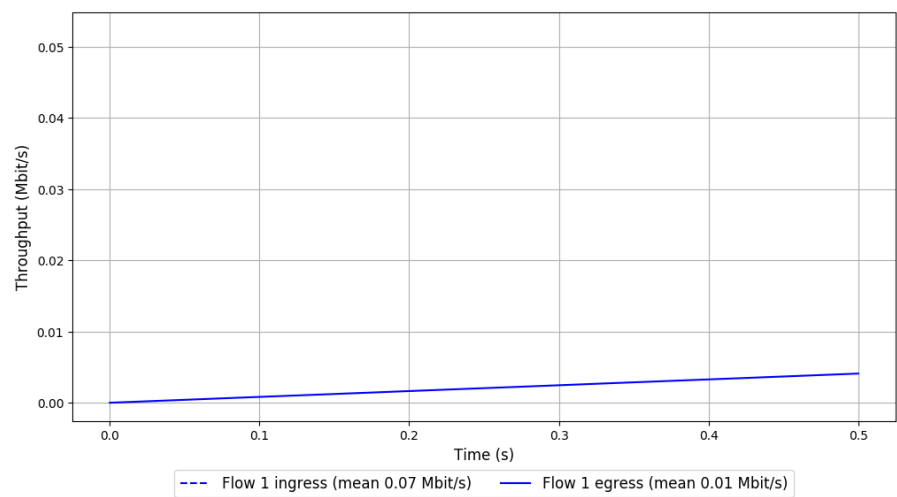
Run 2: Report of TaoVA-100x — Data Link

Flow 1 ingress (mean 0.07 Mbit/s) --- Flow 1 egress (mean 0.01 Mbit/s)

• Flow 1 (95th percentile 193.42 ms)
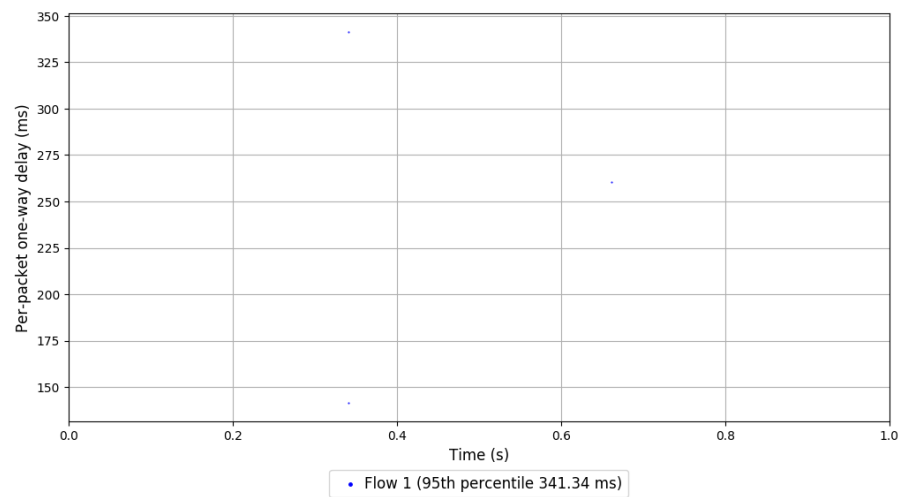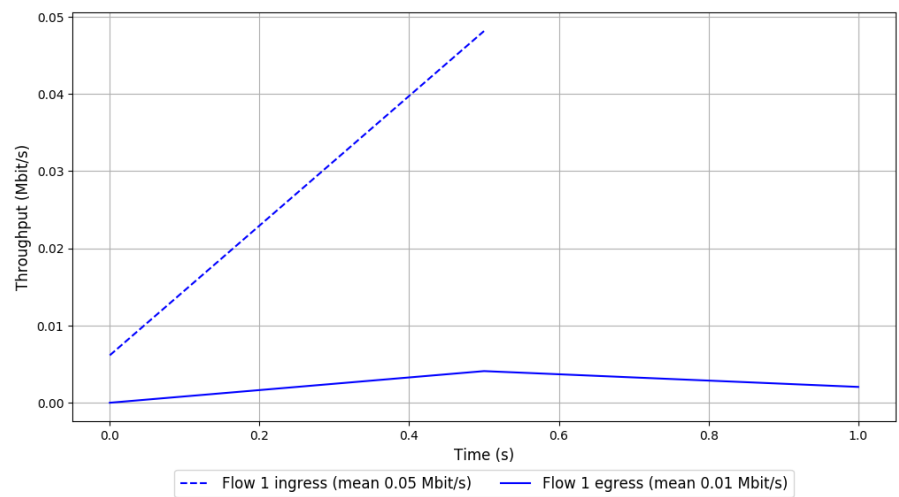
Run 3: Statistics of TaoVA-100x

Start at: 2018-12-01 23:58:58
End at: 2018-12-01 23:59:28
Local clock offset: 4.814 ms
Remote clock offset: 2.877 ms

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

Flow 1 ingress (mean 0.05 Mbit/s) --- Flow 1 egress (mean 0.01 Mbit/s)
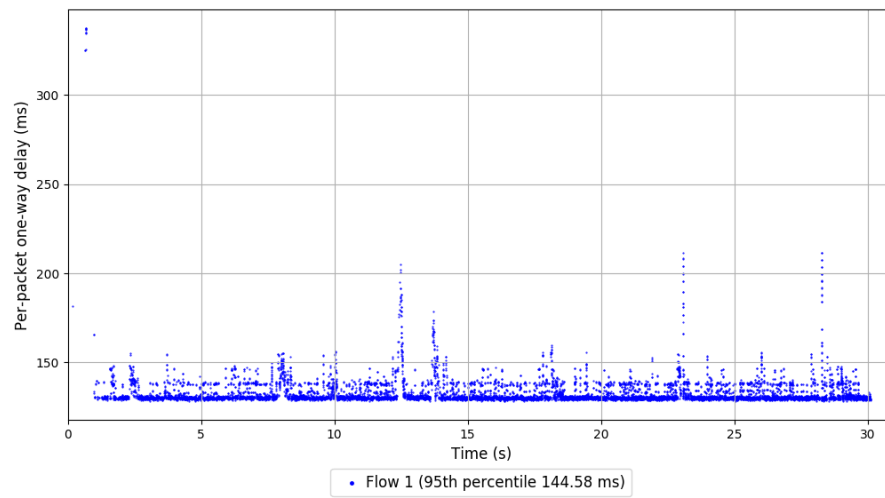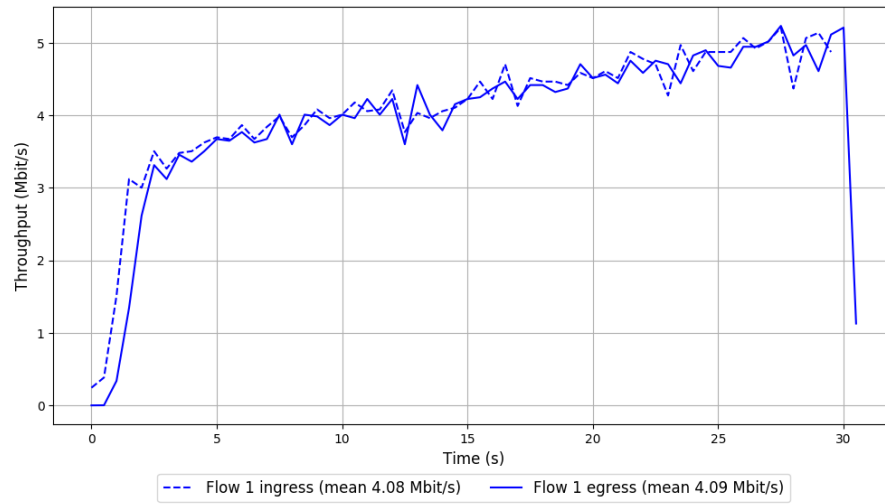

Flow 1 (95th percentile 341.34 ms)

```
Run 1: Statistics of TCP Vegas

Start at: 2018-12-01 23:02:56
End at: 2018-12-01 23:03:26
Local clock offset: 5.546 ms
Remote clock offset: -3.629 ms


# Below is generated by plot.py at 2018-12-02 00:18:08
# Datalink statistics
-- Total of 1 flow:
Average throughput: 4.09 Mbit/s
95th percentile per-packet one-way delay: 144.578 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 4.09 Mbit/s
95th percentile per-packet one-way delay: 144.578 ms
Loss rate: 0.00%
```

Run 1: Report of TCP Vegas — Data Link

Flow 1 ingress (mean 4.08 Mbit/s) --- Flow 1 egress (mean 4.09 Mbit/s)

Flow 1 (95th percentile 144.58 ms)

```
Run 2: Statistics of TCP Vegas

Start at: 2018-12-01 23:28:13
End at: 2018-12-01 23:28:43
Local clock offset: 4.174 ms
Remote clock offset: 0.702 ms


# Below is generated by plot.py at 2018-12-02 00:18:15
# Datalink statistics
-- Total of 1 flow:
Average throughput: 12.06 Mbit/s
95th percentile per-packet one-way delay: 919.157 ms
Loss rate: 0.26%
-- Flow 1:
Average throughput: 12.06 Mbit/s
95th percentile per-packet one-way delay: 919.157 ms
Loss rate: 0.26%
```
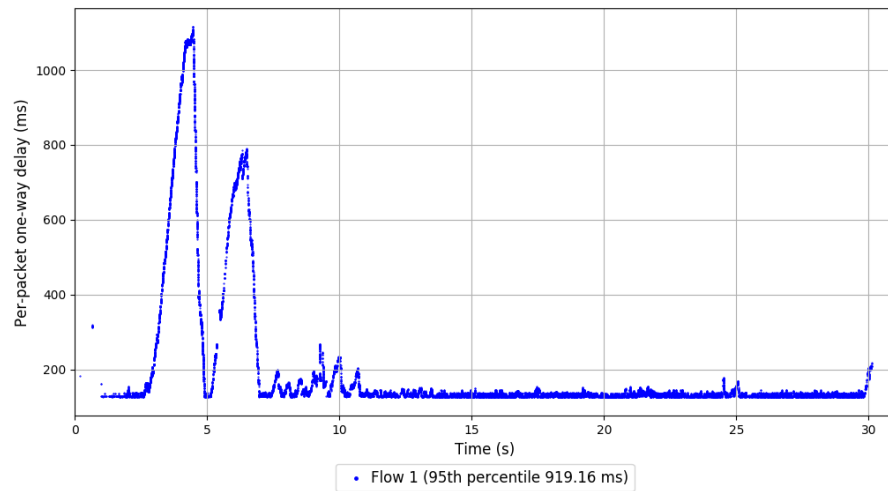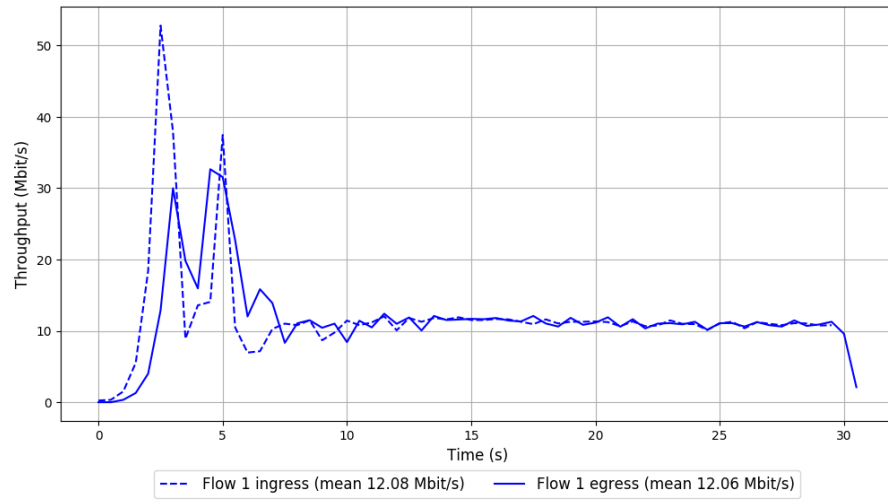
Run 2: Report of TCP Vegas — Data Link

Flow 1 ingress (mean 12.08 Mbit/s) ----   Flow 1 egress (mean 12.06 Mbit/s) ——

Flow 1 (95th percentile 919.16 ms)

```
Run 3: Statistics of TCP Vegas

Start at: 2018-12-01 23:53:37
End at: 2018-12-01 23:54:07
Local clock offset: -3.349 ms
Remote clock offset: 5.162 ms


# Below is generated by plot.py at 2018-12-02 00:18:15
# Datalink statistics
-- Total of 1 flow:
Average throughput: 4.21 Mbit/s
95th percentile per-packet one-way delay: 146.510 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 4.21 Mbit/s
95th percentile per-packet one-way delay: 146.510 ms
Loss rate: 0.00%
```
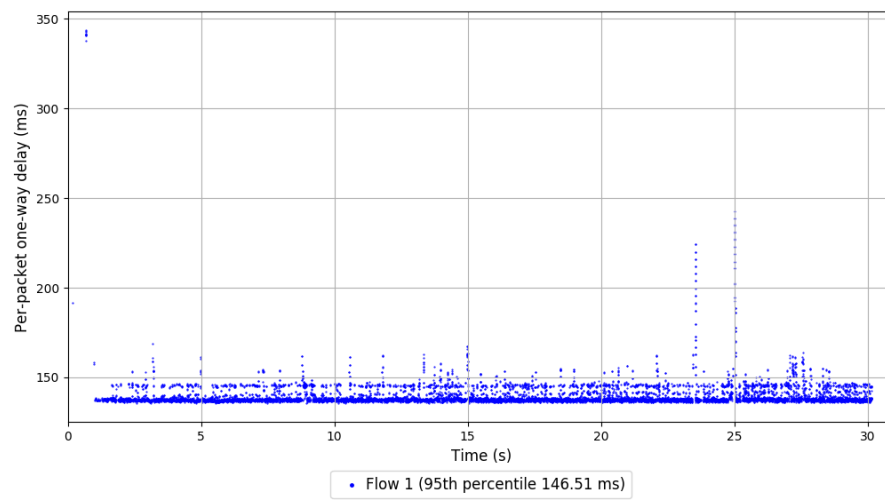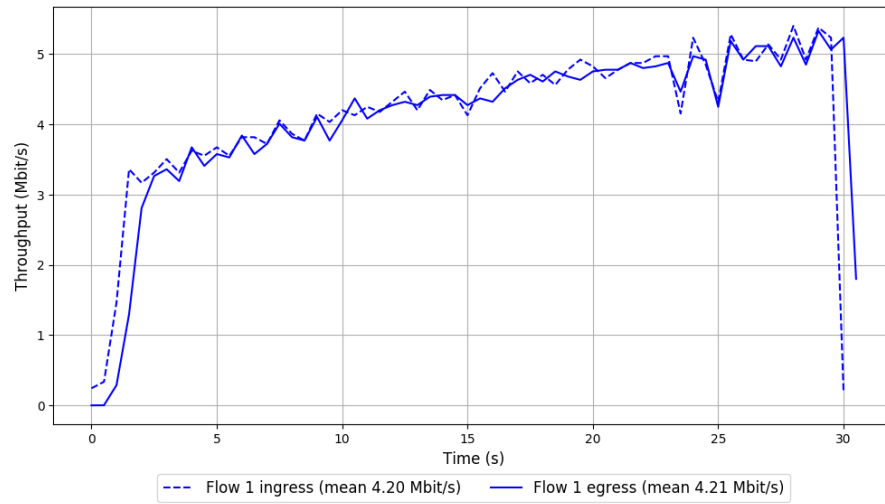
Run 3: Report of TCP Vegas — Data Link

Flow 1 ingress (mean 4.20 Mbit/s) Flow 1 egress (mean 4.21 Mbit/s)

Flow 1 (95th percentile 146.51 ms)

```
Run 1: Statistics of Verus

Start at: 2018-12-01 23:16:14
End at: 2018-12-01 23:16:44
Local clock offset: 3.734 ms
Remote clock offset: -3.77 ms


# Below is generated by plot.py at 2018-12-02 00:18:15
# Datalink statistics
-- Total of 1 flow:
Average throughput: 9.44 Mbit/s
95th percentile per-packet one-way delay: 845.664 ms
Loss rate: 2.04%
-- Flow 1:
Average throughput: 9.44 Mbit/s
95th percentile per-packet one-way delay: 845.664 ms
Loss rate: 2.04%
```
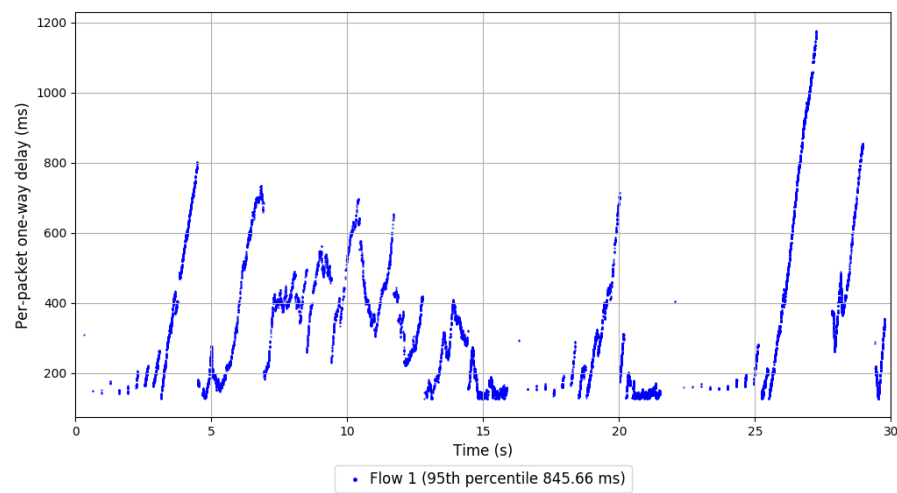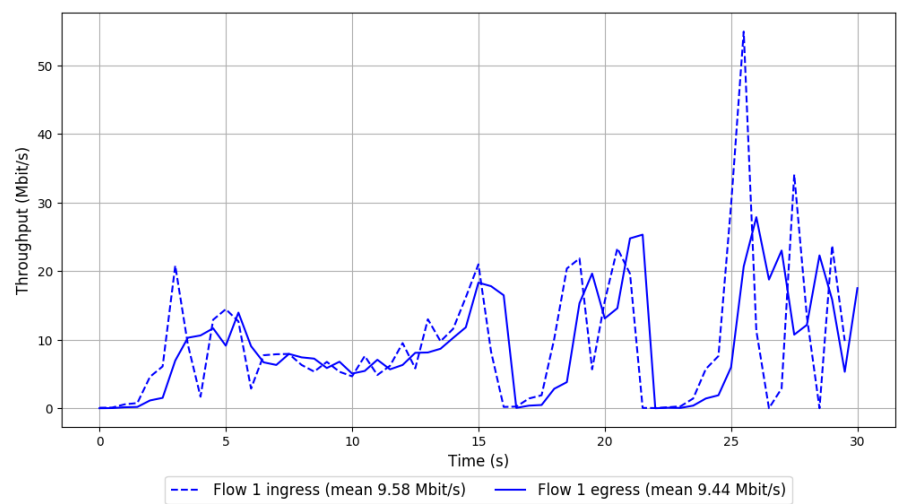
Run 1: Report of Verus — Data Link

```
Run 2: Statistics of Verus

Start at: 2018-12-01 23:41:32
End at: 2018-12-01 23:42:02
Local clock offset: -4.481 ms
Remote clock offset: 3.893 ms


# Below is generated by plot.py at 2018-12-02 00:18:19
# Datalink statistics
-- Total of 1 flow:
Average throughput: 17.09 Mbit/s
95th percentile per-packet one-way delay: 705.438 ms
Loss rate: 0.79%
-- Flow 1:
Average throughput: 17.09 Mbit/s
95th percentile per-packet one-way delay: 705.438 ms
Loss rate: 0.79%
```
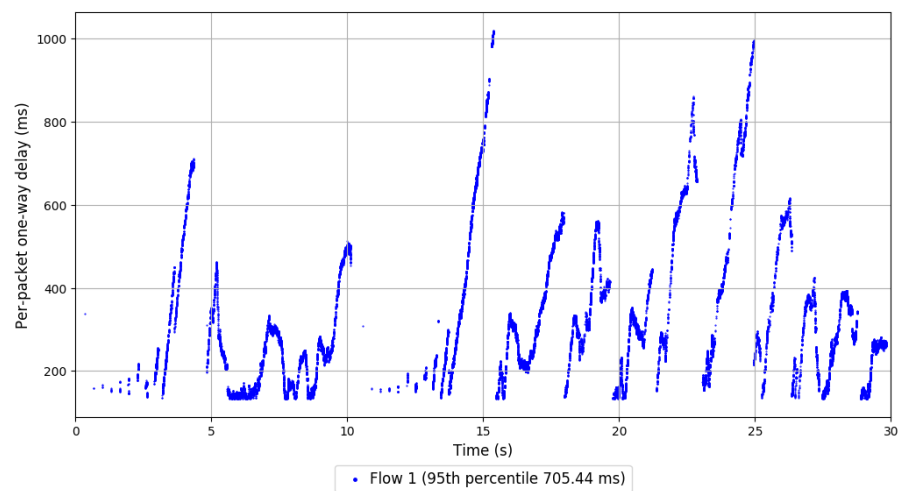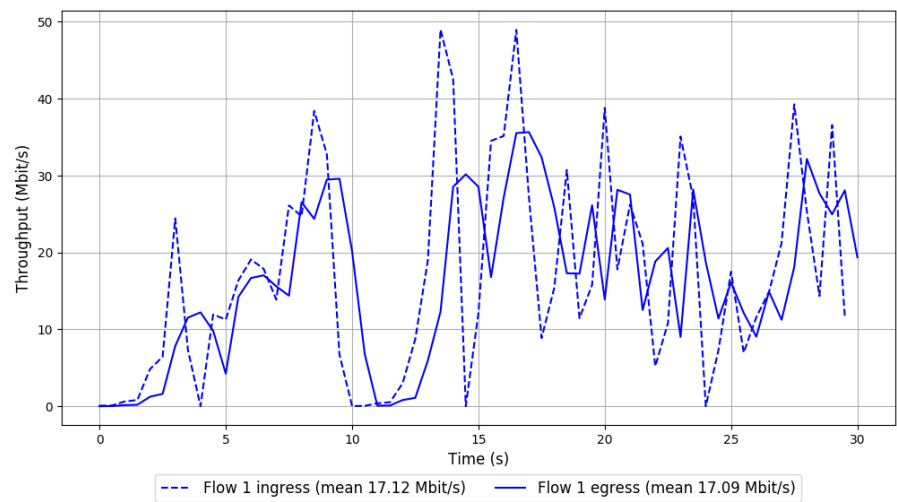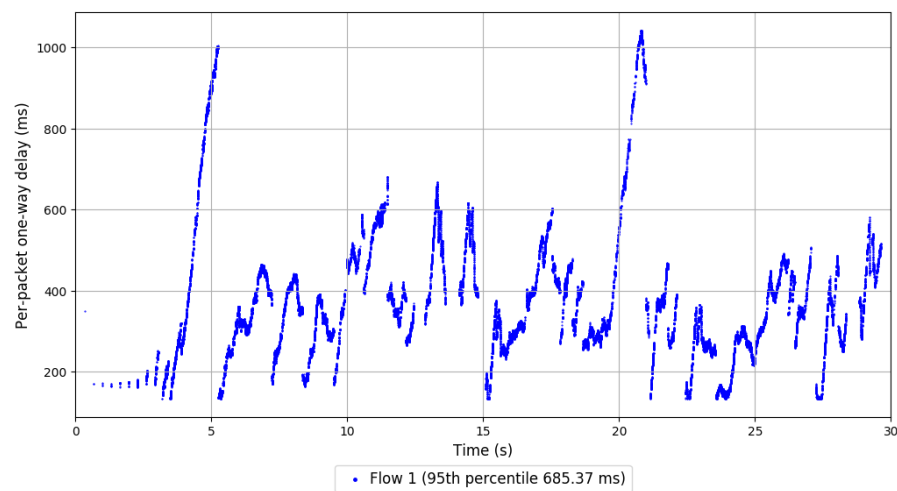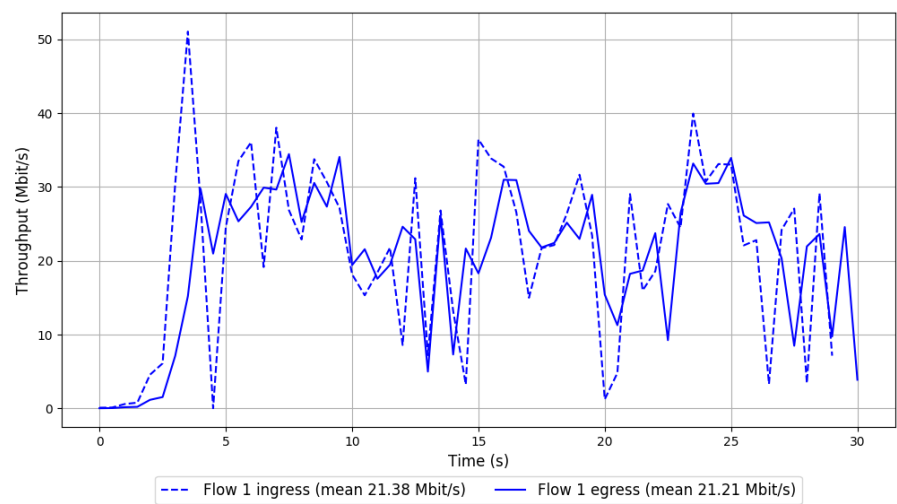
Run 2: Report of Verus — Data Link

```
Run 3: Statistics of Verus

Start at: 2018-12-02 00:06:56
End at: 2018-12-02 00:07:26
Local clock offset: -2.106 ms
Remote clock offset: 0.82 ms


# Below is generated by plot.py at 2018-12-02 00:18:19
# Datalink statistics
-- Total of 1 flow:
Average throughput: 21.21 Mbit/s
95th percentile per-packet one-way delay: 685.368 ms
Loss rate: 0.21%
-- Flow 1:
Average throughput: 21.21 Mbit/s
95th percentile per-packet one-way delay: 685.368 ms
Loss rate: 0.21%
```

Run 3: Report of Verus — Data Link

```
Run 1: Statistics of PCC-Vivace

Start at: 2018-12-01 23:17:35
End at: 2018-12-01 23:18:05
Local clock offset: 3.309 ms
Remote clock offset: -3.8 ms


# Below is generated by plot.py at 2018-12-02 00:18:19
# Datalink statistics
-- Total of 1 flow:
Average throughput: 9.64 Mbit/s
95th percentile per-packet one-way delay: 1153.376 ms
Loss rate: 9.31%
-- Flow 1:
Average throughput: 9.64 Mbit/s
95th percentile per-packet one-way delay: 1153.376 ms
Loss rate: 9.31%
```
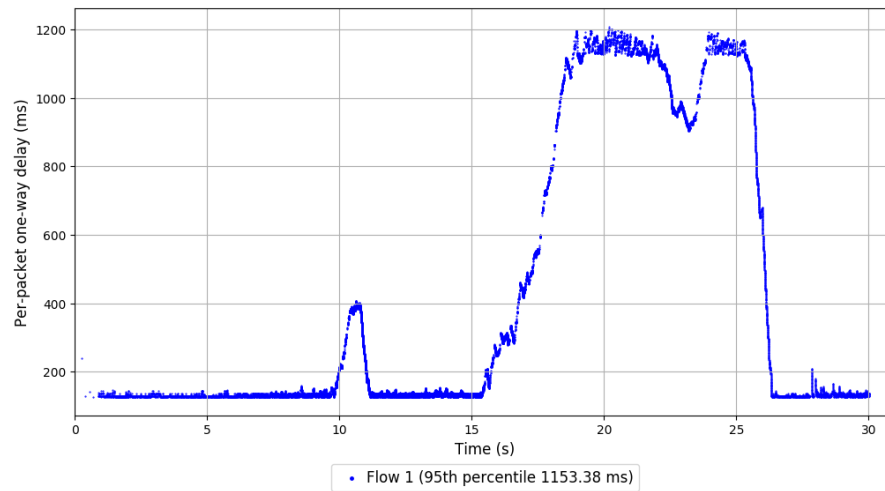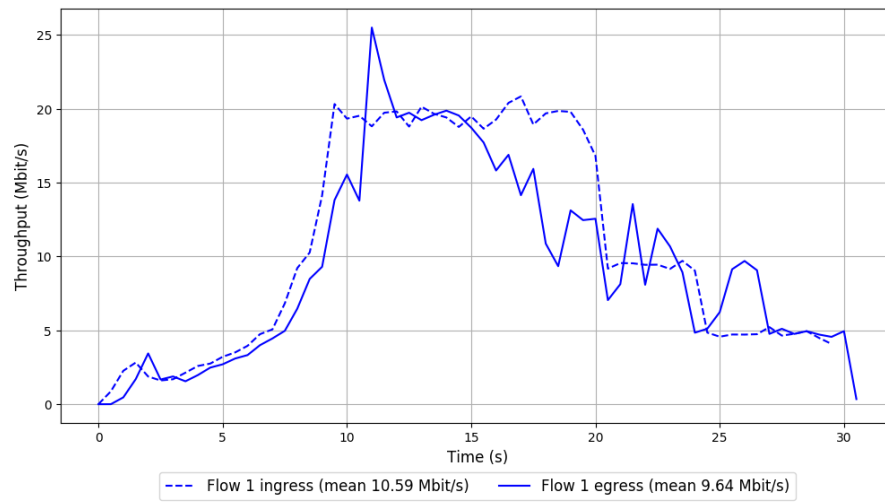
Run 1: Report of PCC-Vivace — Data Link

Flow 1 ingress (mean 10.59 Mbit/s)   Flow 1 egress (mean 9.64 Mbit/s)

Flow 1 (95th percentile 1153.38 ms)

```
Run 2: Statistics of PCC-Vivace

Start at: 2018-12-01 23:42:54
End at: 2018-12-01 23:43:24
Local clock offset: -4.844 ms
Remote clock offset: 4.12 ms


# Below is generated by plot.py at 2018-12-02 00:18:19
# Datalink statistics
-- Total of 1 flow:
Average throughput: 6.58 Mbit/s
95th percentile per-packet one-way delay: 165.976 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 6.58 Mbit/s
95th percentile per-packet one-way delay: 165.976 ms
Loss rate: 0.00%
```
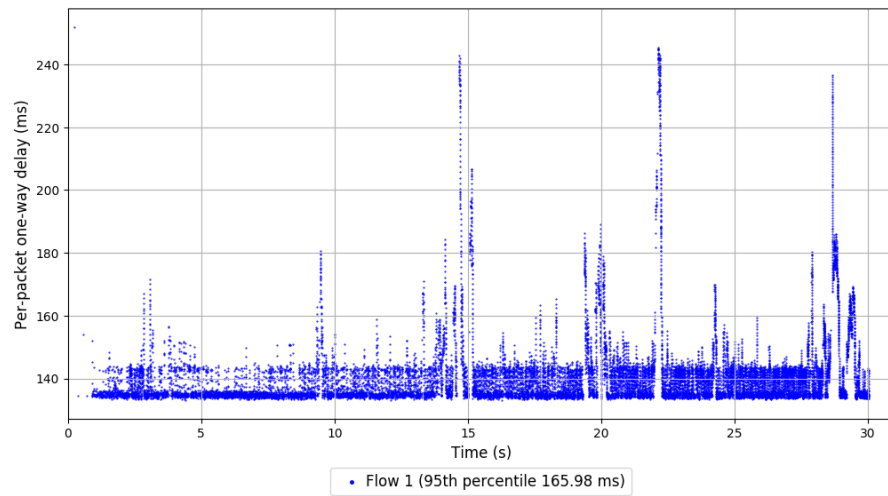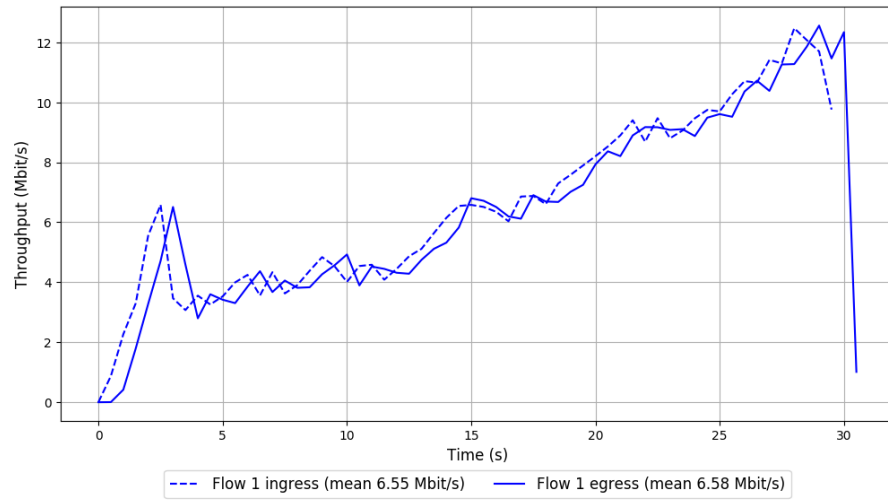
Run 2: Report of PCC-Vivace — Data Link

```
Run 3: Statistics of PCC-Vivace

Start at: 2018-12-02 00:08:18
End at: 2018-12-02 00:08:48
Local clock offset: 5.123 ms
Remote clock offset: 0.483 ms


# Below is generated by plot.py at 2018-12-02 00:18:19
# Datalink statistics
-- Total of 1 flow:
Average throughput: 9.65 Mbit/s
95th percentile per-packet one-way delay: 143.844 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 9.65 Mbit/s
95th percentile per-packet one-way delay: 143.844 ms
Loss rate: 0.00%
```
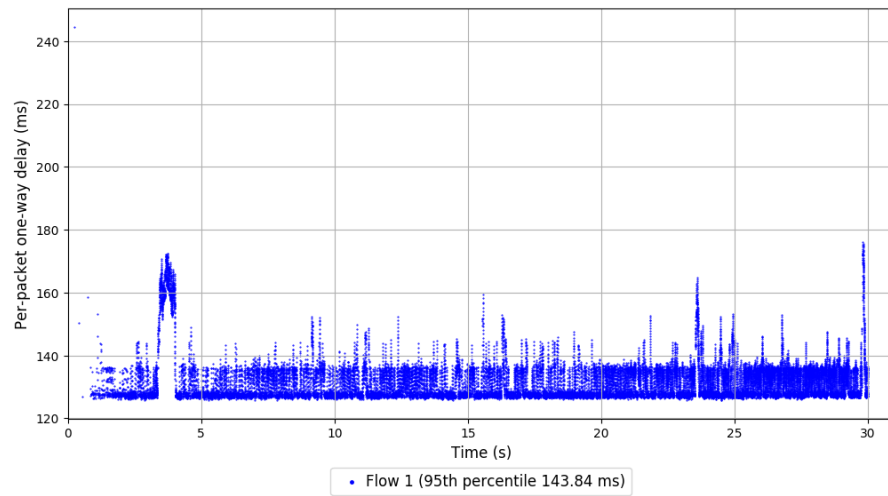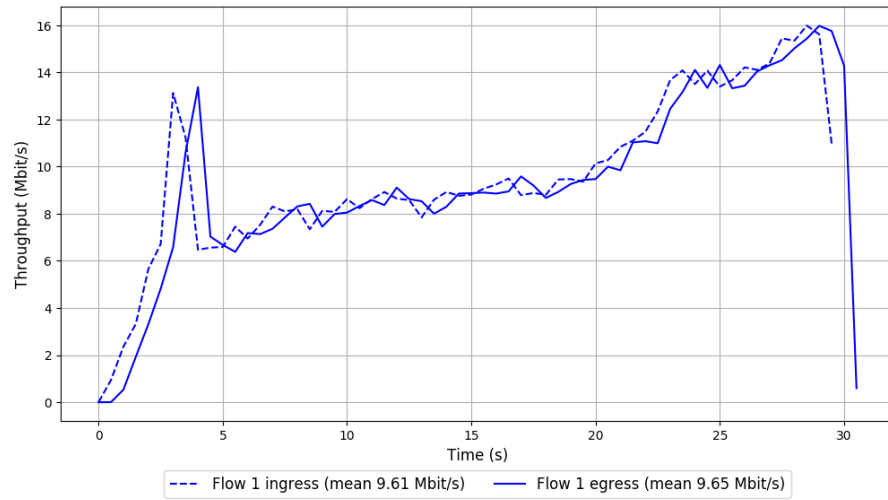
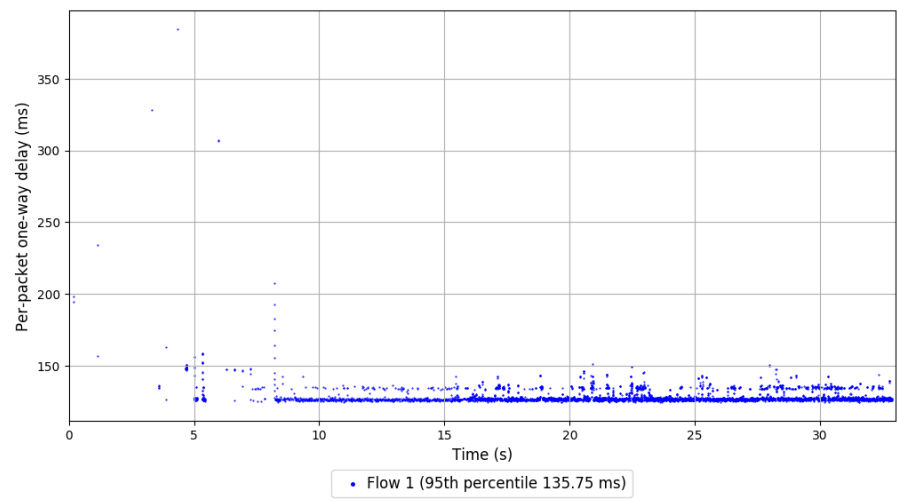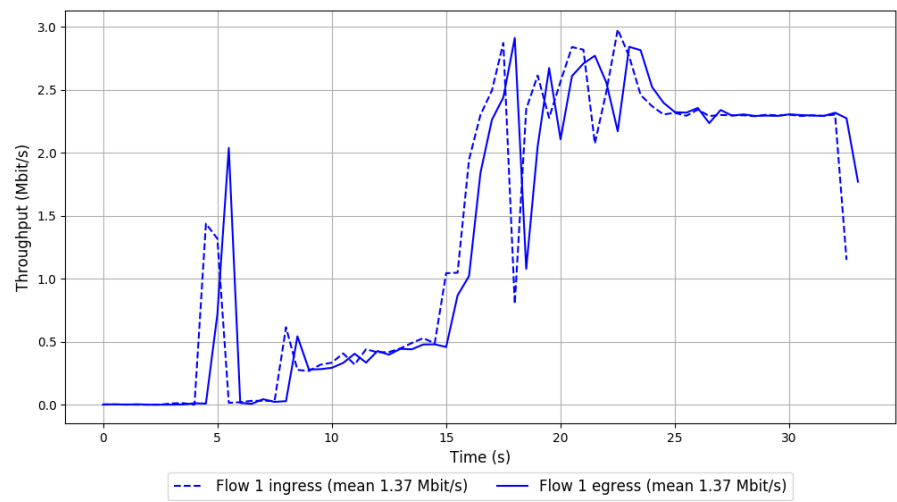## Run 3: Report of PCC-Vivace — Data Link

```
Run 1: Statistics of WebRTC media

Start at: 2018-12-01 23:12:16
End at: 2018-12-01 23:12:46
Local clock offset: 5.559 ms
Remote clock offset: -3.745 ms


# Below is generated by plot.py at 2018-12-02 00:18:19
# Datalink statistics
-- Total of 1 flow:
Average throughput: 1.37 Mbit/s
95th percentile per-packet one-way delay: 135.751 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 1.37 Mbit/s
95th percentile per-packet one-way delay: 135.751 ms
Loss rate: 0.00%
```

Run 1: Report of WebRTC media — Data Link

```
Run 2: Statistics of WebRTC media

Start at: 2018-12-01 23:37:35
End at: 2018-12-01 23:38:05
Local clock offset: 3.118 ms
Remote clock offset: 3.203 ms


# Below is generated by plot.py at 2018-12-02 00:18:19
# Datalink statistics
-- Total of 1 flow:
Average throughput: 1.67 Mbit/s
95th percentile per-packet one-way delay: 139.332 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 1.67 Mbit/s
95th percentile per-packet one-way delay: 139.332 ms
Loss rate: 0.00%
```
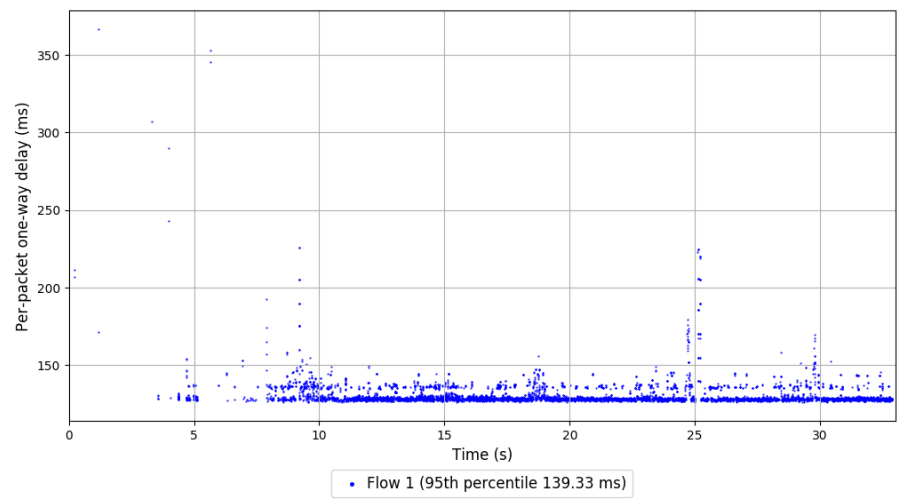
Run 2: Report of WebRTC media — Data Link

```
Run 3: Statistics of WebRTC media

Start at: 2018-12-02 00:02:59
End at: 2018-12-02 00:03:29
Local clock offset: 5.413 ms
Remote clock offset: 1.703 ms


# Below is generated by plot.py at 2018-12-02 00:18:19
# Datalink statistics
-- Total of 1 flow:
Average throughput: 1.75 Mbit/s
95th percentile per-packet one-way delay: 139.401 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 1.75 Mbit/s
95th percentile per-packet one-way delay: 139.401 ms
Loss rate: 0.00%
```
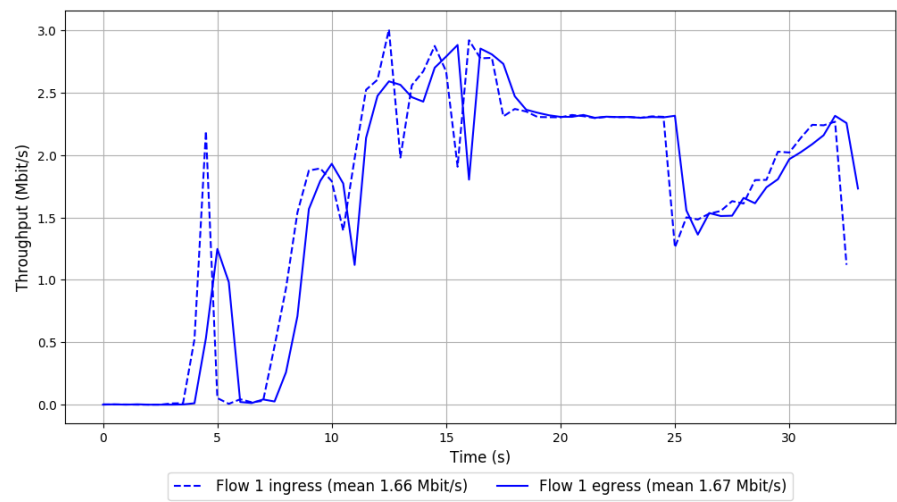
Run 3: Report of WebRTC media — Data Link

Flow 1 ingress (mean 1.75 Mbit/s) --- Flow 1 egress (mean 1.75 Mbit/s)

Flow 1 (95th percentile 139.40 ms)