Pantheon Report

Generated at 2018-01-16 02:16:35 (UTC).

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

Repeated the test of 14 congestion control schemes 3 times.

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

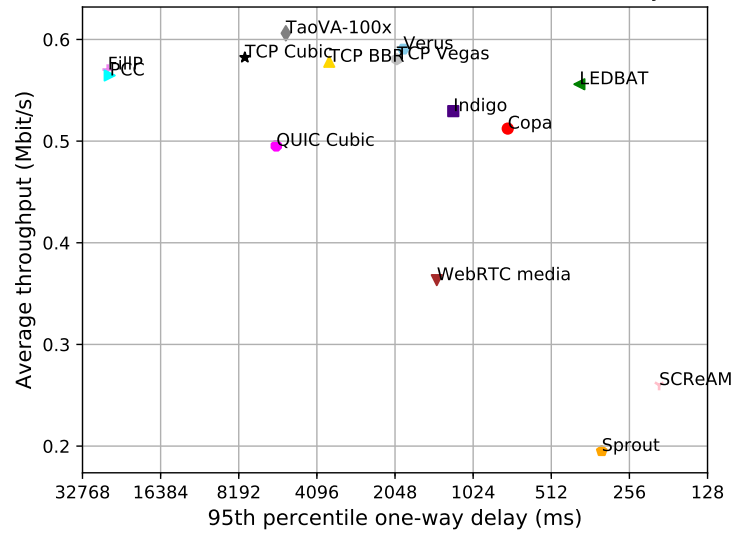Increased UDP receive buffer to 16 MB (default) and 32 MB (max).

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

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

```
Git summary:
branch: master @ af8abdfba95588b0c5f2aeca9e856a1656b0c598
third_party/calibrated_koho @ 3cb73c0d1c0322cdfae446ea37a522e53227db50
 M datagrump/sender.cc
third_party/fillp @ ec9585325218d5048c4d4152fa42240af54c6e67
third_party/genericCC @ 80b516c448f795fd6e9675f7177b69c622f07da8
third_party/indigo @ b19f3730105f9aa95452552af924e3719b03cc55
third_party/indigo-no-calib @ 7224f2202e8a044d8306fa0b983ad84360c53d89
third_party/koho_cc @ f0f2e693303aee82ea808e6928eac4f1083a6681
 M datagrump/sender.cc
third_party/libutp @ b3465b942e2826f2b179eaab4a906ce6bb7cf3cf
third_party/pantheon-tunnel @ fb1053193c2861da659ba9013db26744ccfcf993
third_party/pcc @ 1afc958fa0d66d18b623c091a55fec872b4981e1
 M receiver/src/buffer.h
 M receiver/src/core.cpp
 M sender/src/buffer.h
 M sender/src/core.cpp
third_party/proto-quic @ 77961f1a82733a86b42f1bc8143ebc978f3cff42
third_party/scream @ c3370fd7bd17265a79aeb34e4016ad23f5965885
third_party/sourdough @ f1a14bffe749737437f61b1eaeeb30b267cde681
third_party/sprout @ 6f2efe6e088d91066a9f023df375eee2665089ce
 M src/examples/cellsim.cc
 M src/examples/sproutbt2.cc
 M src/network/sproutconn.cc
third_party/verus @ d4b447ea74c6c60a261149af2629562939f9a494
 M src/verus.hpp
 M tools/plot.py
third_party/vivace @ 423cbca3e8ea1d599e7b5cf725835e8a2b6bfac6
third_party/webrtc @ a488197ddd041ace68a42849b2540ad834825f42
```
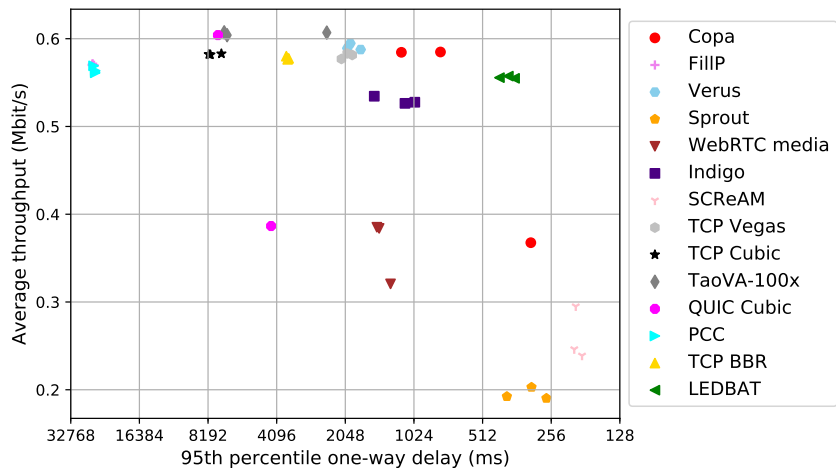
test from Colombia ppp0 to AWS Brazil 2 Ethernet, 3 runs of 30s each per scheme
3 flows with 10s interval between flows (mean of all runs by scheme)

test from Colombia ppp0 to AWS Brazil 2 Ethernet, 3 runs of 30s each per scheme
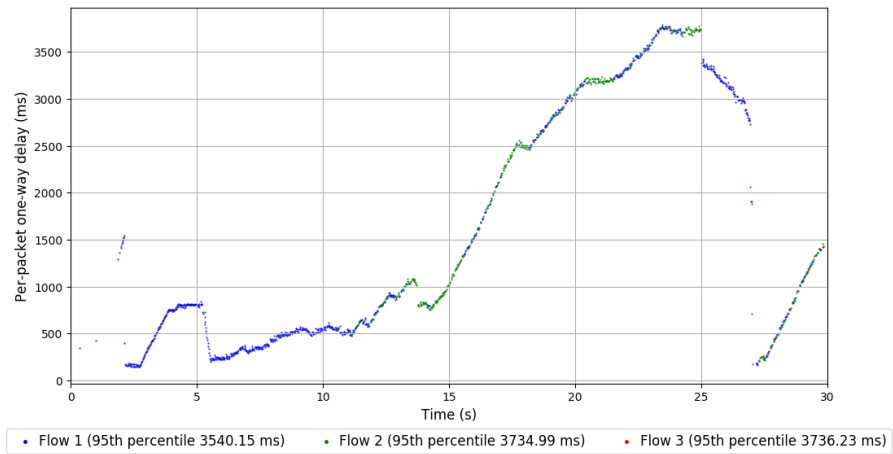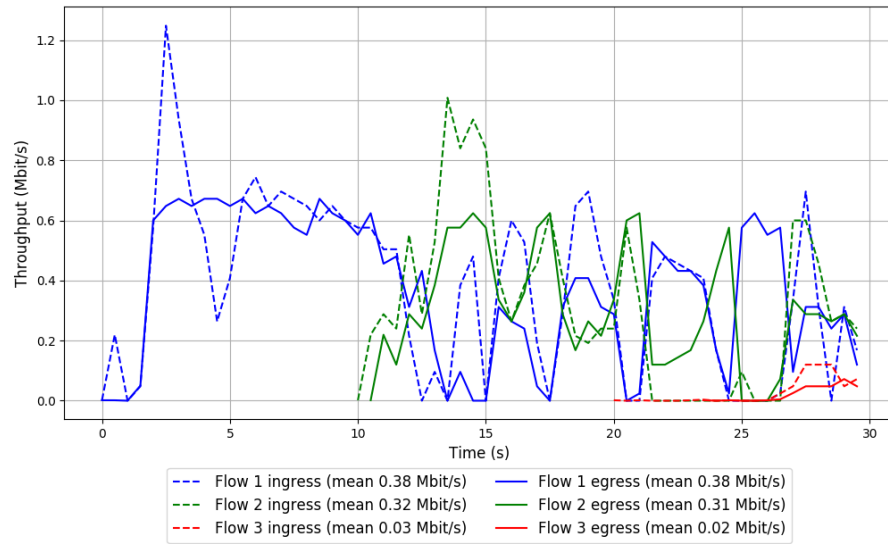3 flows with 10s interval between flows

scheme	# runs	mean avg tput (Mbit/s)			mean 95th-%ile delay (ms)			mean loss rate (%)		
		flow 1	flow 2	flow 3	flow 1	flow 2	flow 3	flow 1	flow 2	flow 3
TCP BBR	3	0.37	0.32	0.02	3625.52	3634.21	3566.21	3.23	5.86	55.06
TCP Cubic	3	0.57	0.03	0.00	7760.93	6700.20	7934.21	30.76	49.83	72.89
LEDBAT	3	0.27	0.31	0.26	341.46	410.84	432.18	0.20	1.13	6.66
PCC	3	0.56	0.00	N/A	25734.82	N/A	N/A	98.61	N/A	N/A
QUIC Cubic	2	0.32	0.31	0.03	3848.43	5870.41	6081.86	14.54	28.72	43.19
SCReAM	3	0.08	0.17	0.19	185.30	193.93	396.21	0.67	0.78	1.32
WebRTC media	3	0.13	0.21	0.08	1421.40	1293.27	1463.00	0.87	1.26	4.66
Sprout	3	0.09	0.10	0.11	696.34	238.94	254.64	1.22	1.75	3.93
TaoVA-100x	3	0.40	0.31	0.13	5489.88	4746.94	5358.89	21.89	38.40	69.10
TCP Vegas	3	0.41	0.21	0.16	1893.97	2039.03	2076.05	3.84	7.78	24.62
Verus	3	0.58	0.02	0.02	1900.93	1816.79	1920.60	4.86	4.63	9.14
Copa	3	0.27	0.30	0.16	1185.00	767.27	806.29	1.66	4.58	11.13
FillP	3	0.57	0.00	N/A	26200.91	N/A	N/A	98.15	N/A	N/A
Indigo	3	0.23	0.30	0.33	1273.27	1228.77	1168.63	6.30	6.98	9.83

```
Run 1: Statistics of TCP BBR

Start at: 2018-01-16 00:29:49
End at: 2018-01-16 00:30:19
Local clock offset: 2.019 ms
Remote clock offset: -3.645 ms


# Below is generated by plot.py at 2018-01-16 02:16:00
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.58 Mbit/s
95th percentile per-packet one-way delay: 3715.031 ms
Loss rate: 4.30%
-- Flow 1:
Average throughput: 0.38 Mbit/s
95th percentile per-packet one-way delay: 3540.147 ms
Loss rate: 2.13%
-- Flow 2:
Average throughput: 0.31 Mbit/s
95th percentile per-packet one-way delay: 3734.993 ms
Loss rate: 6.27%
-- Flow 3:
Average throughput: 0.02 Mbit/s
95th percentile per-packet one-way delay: 3736.229 ms
Loss rate: 46.91%
```
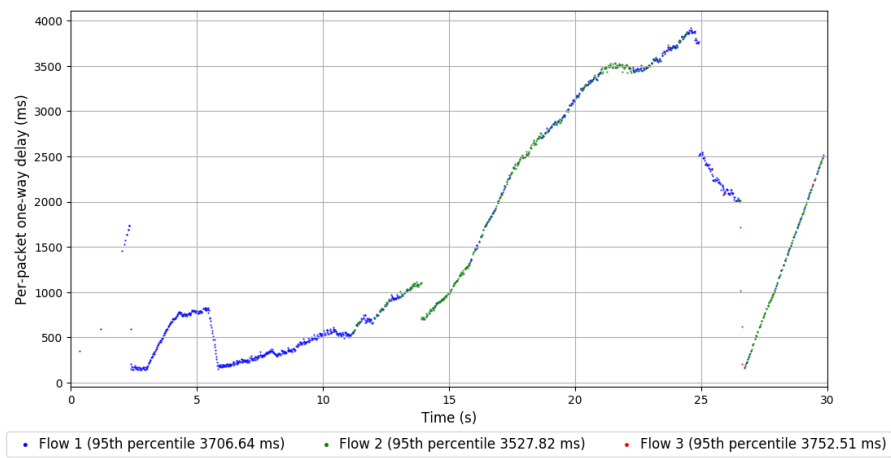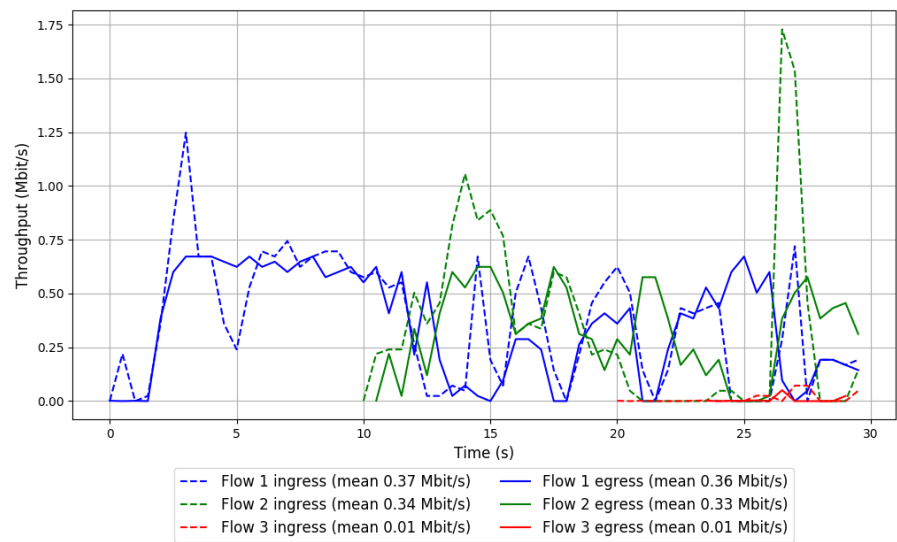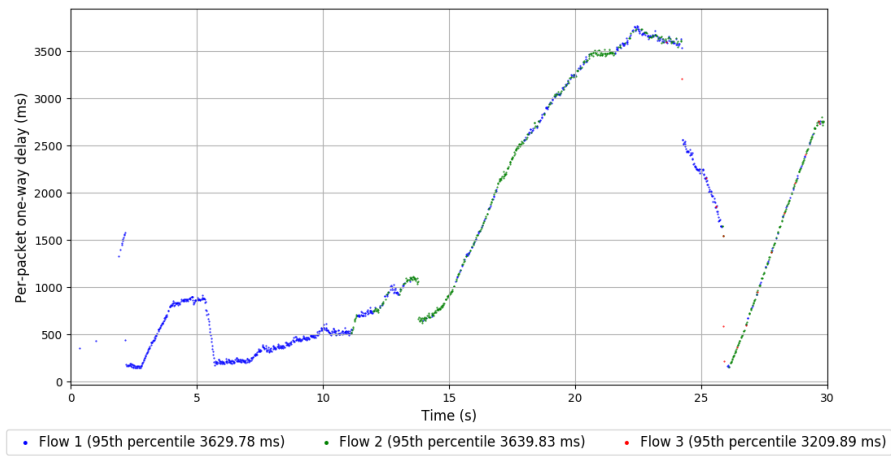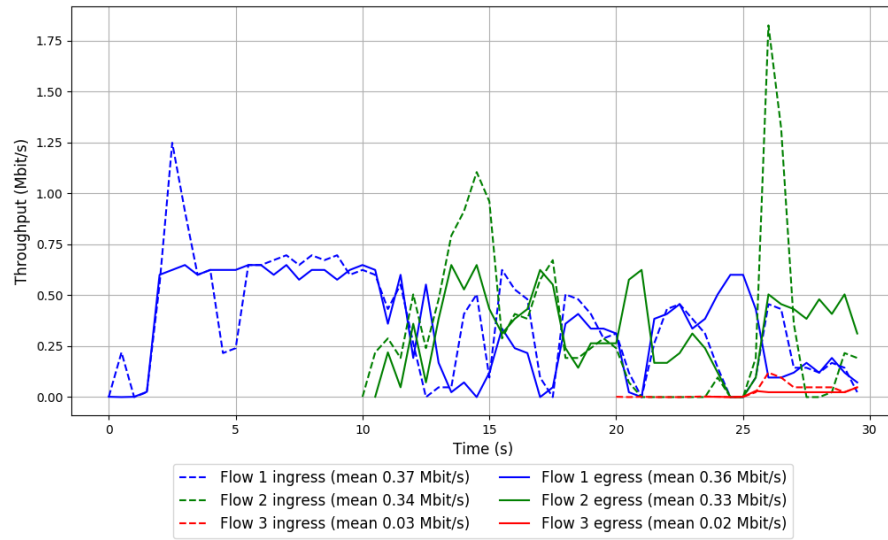
Run 1: Report of TCP BBR — Data Link

Flow 1 ingress (mean 0.38 Mbit/s)   Flow 1 egress (mean 0.38 Mbit/s)
Flow 2 ingress (mean 0.32 Mbit/s)   Flow 2 egress (mean 0.31 Mbit/s)
Flow 3 ingress (mean 0.03 Mbit/s)   Flow 3 egress (mean 0.02 Mbit/s)

Flow 1 (95th percentile 3540.15 ms)   Flow 2 (95th percentile 3734.99 ms)   Flow 3 (95th percentile 3736.23 ms)

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```
Run 2: Statistics of TCP BBR

Start at: 2018-01-16 00:48:36
End at: 2018-01-16 00:49:06
Local clock offset: 2.157 ms
Remote clock offset: -3.857 ms


# Below is generated by plot.py at 2018-01-16 02:16:00
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.58 Mbit/s
95th percentile per-packet one-way delay: 3665.841 ms
Loss rate: 5.47%
-- Flow 1:
Average throughput: 0.36 Mbit/s
95th percentile per-packet one-way delay: 3706.645 ms
Loss rate: 4.13%
-- Flow 2:
Average throughput: 0.33 Mbit/s
95th percentile per-packet one-way delay: 3527.820 ms
Loss rate: 6.50%
-- Flow 3:
Average throughput: 0.01 Mbit/s
95th percentile per-packet one-way delay: 3752.508 ms
Loss rate: 66.98%
```

Run 2: Report of TCP BBR — Data Link

```
Run 3: Statistics of TCP BBR

Start at: 2018-01-16 01:07:22
End at: 2018-01-16 01:07:52
Local clock offset: 1.791 ms
Remote clock offset: -3.784 ms


# Below is generated by plot.py at 2018-01-16 02:16:00
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.58 Mbit/s
95th percentile per-packet one-way delay: 3629.870 ms
Loss rate: 4.63%
-- Flow 1:
Average throughput: 0.36 Mbit/s
95th percentile per-packet one-way delay: 3629.776 ms
Loss rate: 3.42%
-- Flow 2:
Average throughput: 0.33 Mbit/s
95th percentile per-packet one-way delay: 3639.828 ms
Loss rate: 4.81%
-- Flow 3:
Average throughput: 0.02 Mbit/s
95th percentile per-packet one-way delay: 3209.885 ms
Loss rate: 51.28%
```
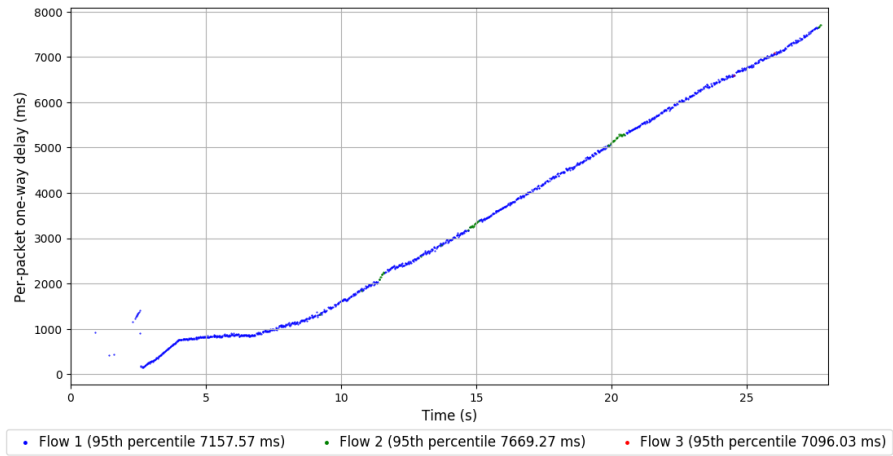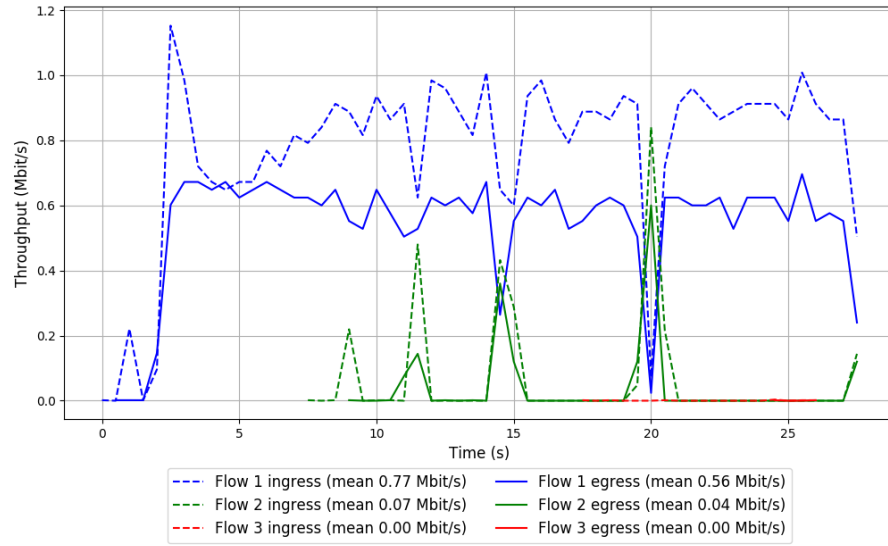
Run 3: Report of TCP BBR — Data Link

```
Run 1: Statistics of TCP Cubic

Start at: 2018-01-16 00:32:20
End at: 2018-01-16 00:32:50
Local clock offset: 2.158 ms
Remote clock offset: 1.993 ms


# Below is generated by plot.py at 2018-01-16 02:16:00
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.58 Mbit/s
95th percentile per-packet one-way delay: 7157.669 ms
Loss rate: 31.27%
-- Flow 1:
Average throughput: 0.56 Mbit/s
95th percentile per-packet one-way delay: 7157.568 ms
Loss rate: 30.58%
-- Flow 2:
Average throughput: 0.04 Mbit/s
95th percentile per-packet one-way delay: 7669.272 ms
Loss rate: 42.20%
-- Flow 3:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 7096.029 ms
Loss rate: 71.60%
```
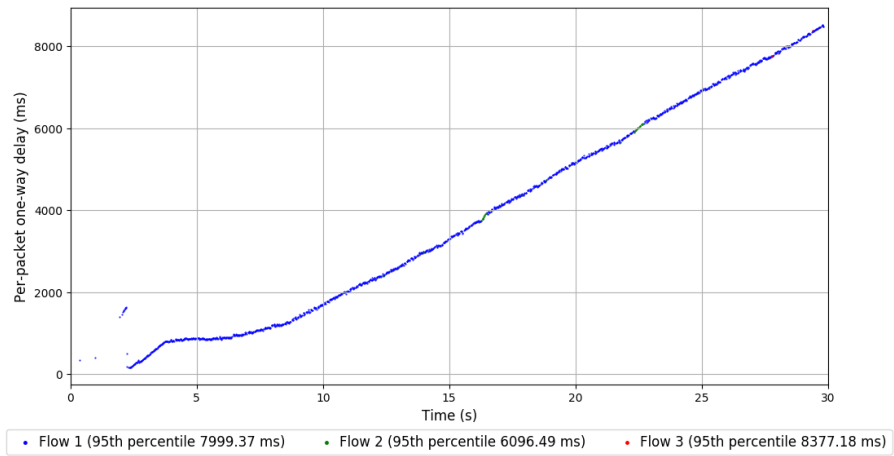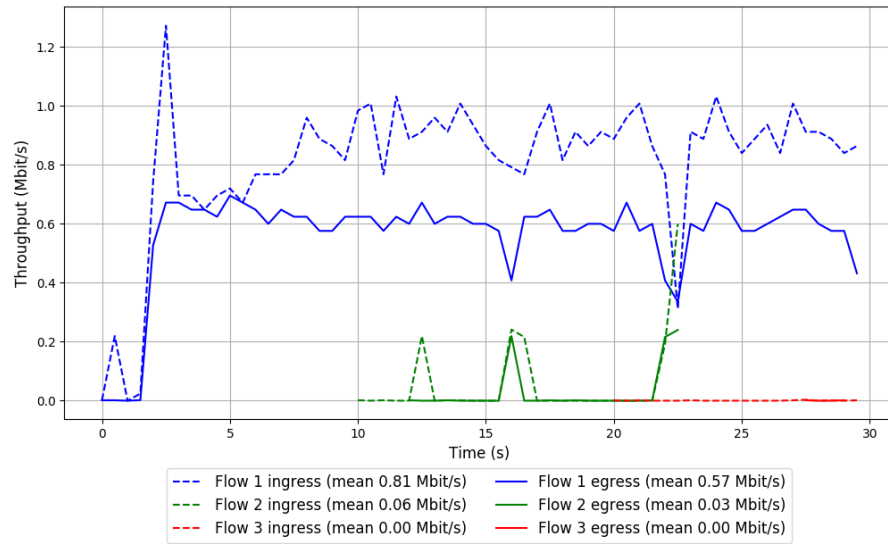
Run 1: Report of TCP Cubic — Data Link

```
Run 2: Statistics of TCP Cubic

Start at: 2018-01-16 00:51:07
End at: 2018-01-16 00:51:37
Local clock offset: 2.099 ms
Remote clock offset: 0.969 ms


# Below is generated by plot.py at 2018-01-16 02:16:01
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.58 Mbit/s
95th percentile per-packet one-way delay: 7999.323 ms
Loss rate: 31.51%
-- Flow 1:
Average throughput: 0.57 Mbit/s
95th percentile per-packet one-way delay: 7999.374 ms
Loss rate: 30.83%
-- Flow 2:
Average throughput: 0.03 Mbit/s
95th percentile per-packet one-way delay: 6096.489 ms
Loss rate: 53.71%
-- Flow 3:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 8377.179 ms
Loss rate: 75.13%
```
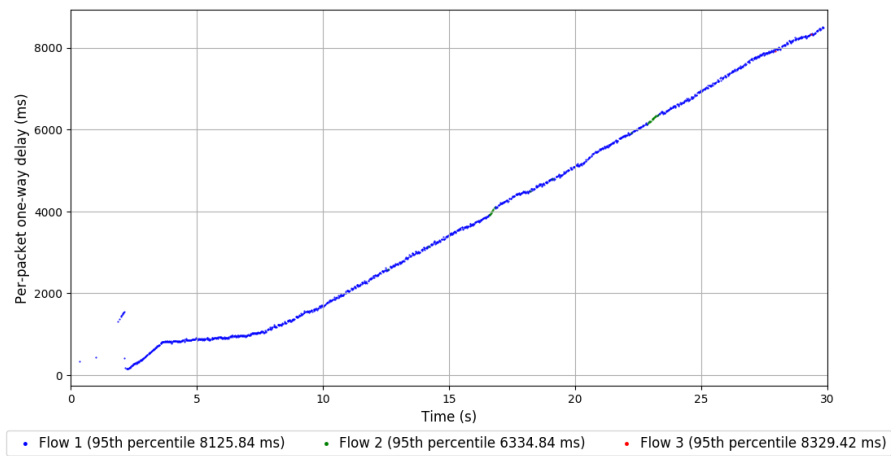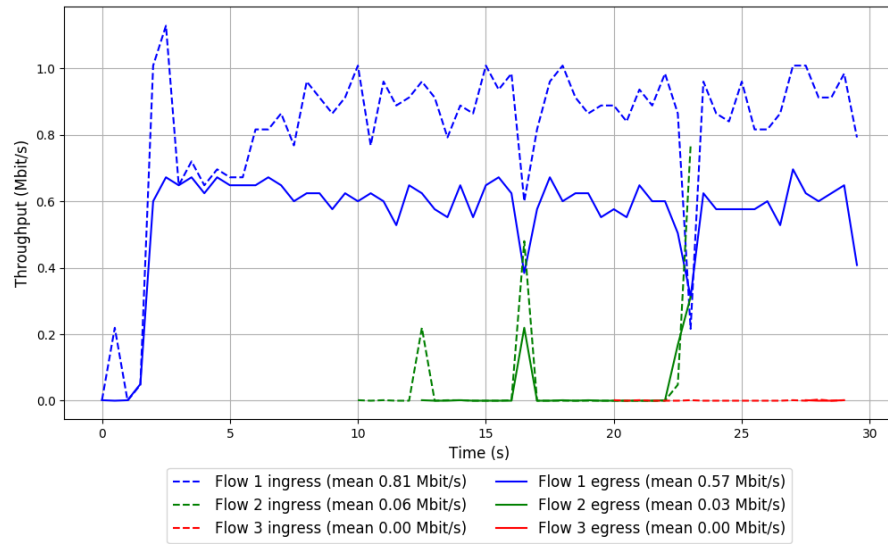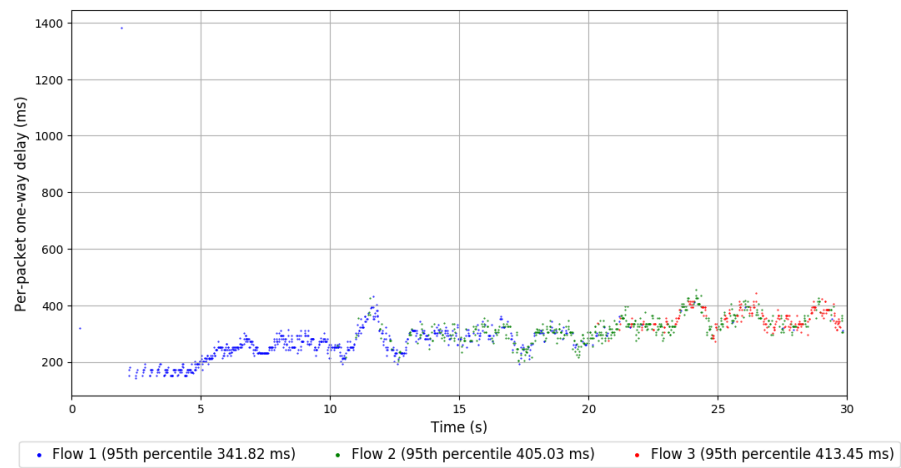
Run 2: Report of TCP Cubic — Data Link

- - - Flow 1 ingress (mean 0.81 Mbit/s) —— Flow 1 egress (mean 0.57 Mbit/s)
- - - Flow 2 ingress (mean 0.06 Mbit/s) —— Flow 2 egress (mean 0.03 Mbit/s)
- - - Flow 3 ingress (mean 0.00 Mbit/s) —— Flow 3 egress (mean 0.00 Mbit/s)

• Flow 1 (95th percentile 7999.37 ms)   • Flow 2 (95th percentile 6096.49 ms)   • Flow 3 (95th percentile 8377.18 ms)

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```
Run 3: Statistics of TCP Cubic

Start at: 2018-01-16 01:09:53
End at: 2018-01-16 01:10:23
Local clock offset: 1.814 ms
Remote clock offset: 1.155 ms


# Below is generated by plot.py at 2018-01-16 02:16:01
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.58 Mbit/s
95th percentile per-packet one-way delay: 8125.723 ms
Loss rate: 31.58%
-- Flow 1:
Average throughput: 0.57 Mbit/s
95th percentile per-packet one-way delay: 8125.841 ms
Loss rate: 30.88%
-- Flow 2:
Average throughput: 0.03 Mbit/s
95th percentile per-packet one-way delay: 6334.843 ms
Loss rate: 53.59%
-- Flow 3:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 8329.415 ms
Loss rate: 71.93%
```

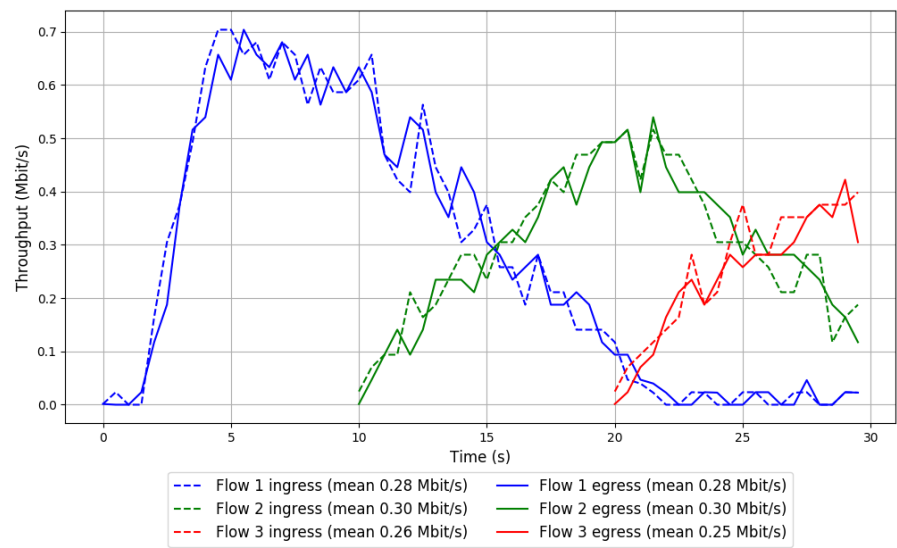Run 3: Report of TCP Cubic — Data Link

Flow 1 ingress (mean 0.81 Mbit/s) --- Flow 1 egress (mean 0.57 Mbit/s)
Flow 2 ingress (mean 0.06 Mbit/s) --- Flow 2 egress (mean 0.03 Mbit/s)
Flow 3 ingress (mean 0.00 Mbit/s) --- Flow 3 egress (mean 0.00 Mbit/s)

• Flow 1 (95th percentile 8125.84 ms)   • Flow 2 (95th percentile 6334.84 ms)   • Flow 3 (95th percentile 8329.42 ms)
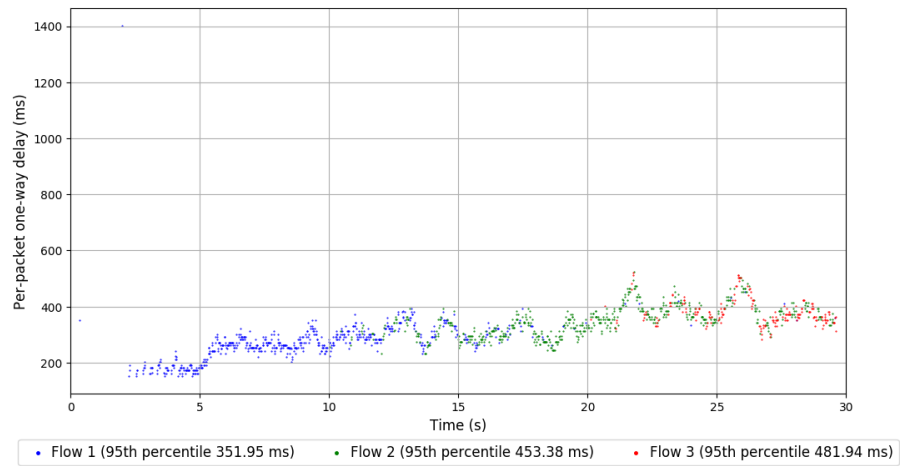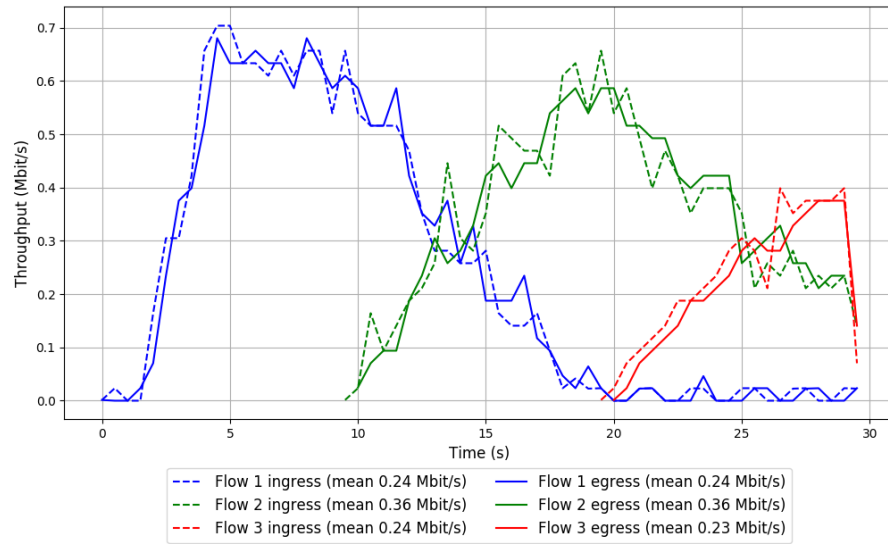
```
Run 1: Statistics of LEDBAT

Start at: 2018-01-16 00:26:04
End at: 2018-01-16 00:26:34
Local clock offset: 1.901 ms
Remote clock offset: 1.31 ms

# Below is generated by plot.py at 2018-01-16 02:16:01
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.56 Mbit/s
95th percentile per-packet one-way delay: 394.682 ms
Loss rate: 1.61%
-- Flow 1:
Average throughput: 0.28 Mbit/s
95th percentile per-packet one-way delay: 341.825 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 0.30 Mbit/s
95th percentile per-packet one-way delay: 405.031 ms
Loss rate: 1.17%
-- Flow 3:
Average throughput: 0.25 Mbit/s
95th percentile per-packet one-way delay: 413.450 ms
Loss rate: 7.80%
```

Run 1: Report of LEDBAT — Data Link

```
Run 2: Statistics of LEDBAT

Start at: 2018-01-16 00:44:51
End at: 2018-01-16 00:45:21
Local clock offset: 2.274 ms
Remote clock offset: -4.685 ms


# Below is generated by plot.py at 2018-01-16 02:16:01
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.56 Mbit/s
95th percentile per-packet one-way delay: 431.978 ms
Loss rate: 1.63%
-- Flow 1:
Average throughput: 0.24 Mbit/s
95th percentile per-packet one-way delay: 351.948 ms
Loss rate: 0.16%
-- Flow 2:
Average throughput: 0.36 Mbit/s
95th percentile per-packet one-way delay: 453.376 ms
Loss rate: 1.33%
-- Flow 3:
Average throughput: 0.23 Mbit/s
95th percentile per-packet one-way delay: 481.941 ms
Loss rate: 7.00%
```
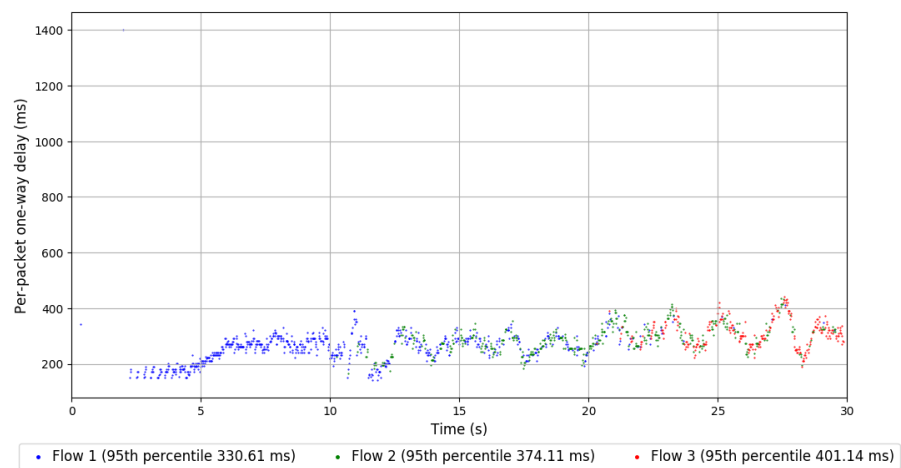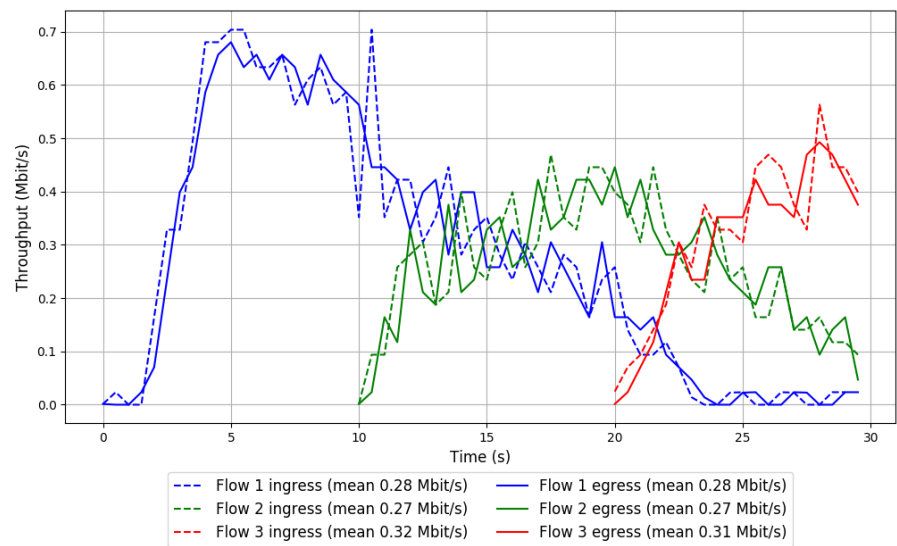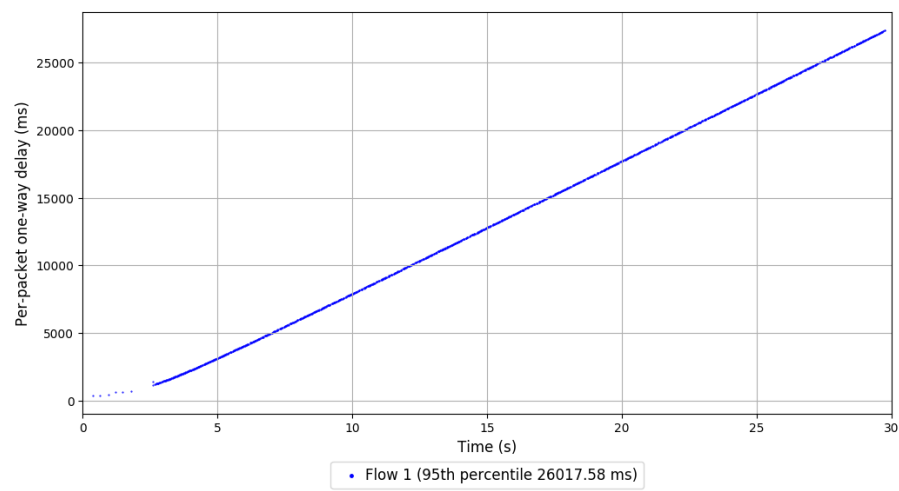
Run 2: Report of LEDBAT — Data Link

```
Run 3: Statistics of LEDBAT

Start at: 2018-01-16 01:03:37
End at: 2018-01-16 01:04:07
Local clock offset: 1.747 ms
Remote clock offset: 0.149 ms

# Below is generated by plot.py at 2018-01-16 02:16:04
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.55 Mbit/s
95th percentile per-packet one-way delay: 370.701 ms
Loss rate: 1.48%
-- Flow 1:
Average throughput: 0.28 Mbit/s
95th percentile per-packet one-way delay: 330.611 ms
Loss rate: 0.43%
-- Flow 2:
Average throughput: 0.27 Mbit/s
95th percentile per-packet one-way delay: 374.106 ms
Loss rate: 0.90%
-- Flow 3:
Average throughput: 0.31 Mbit/s
95th percentile per-packet one-way delay: 401.141 ms
Loss rate: 5.18%
```

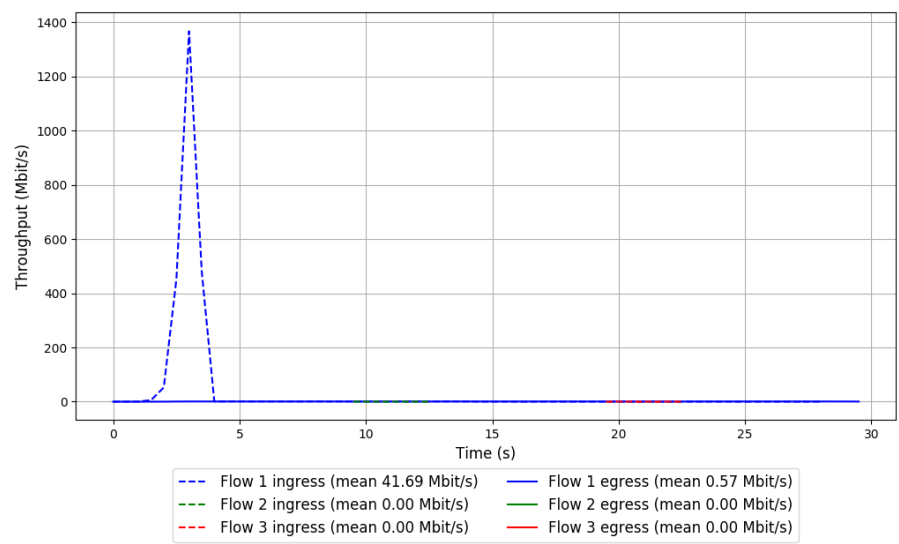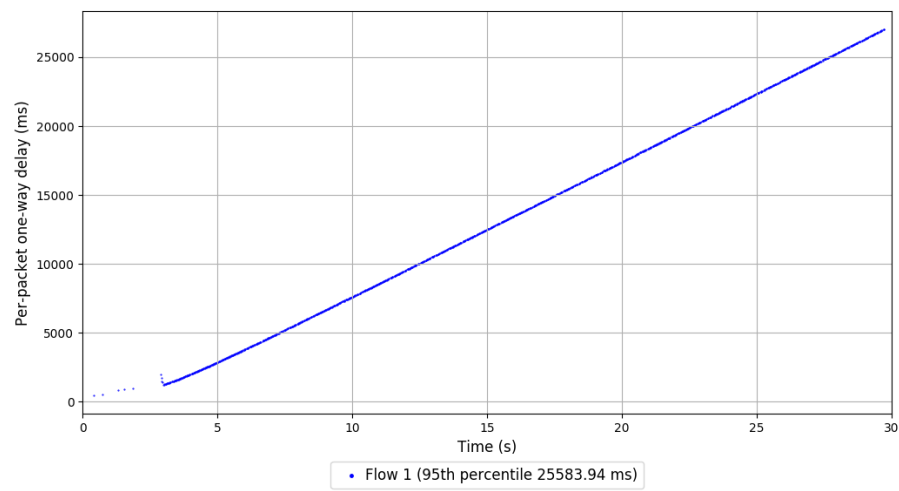# Run 3: Report of LEDBAT — Data Link

```
Run 1: Statistics of PCC

Start at: 2018-01-16 00:41:04
End at: 2018-01-16 00:41:34
Local clock offset: 2.424 ms
Remote clock offset: -4.563 ms


# Below is generated by plot.py at 2018-01-16 02:16:29
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.57 Mbit/s
95th percentile per-packet one-way delay: 26017.583 ms
Loss rate: 98.59%
-- Flow 1:
Average throughput: 0.57 Mbit/s
95th percentile per-packet one-way delay: 26017.583 ms
Loss rate: 98.59%
-- Flow 2:
Average throughput: 0.00 Mbit/s
-- Flow 3:
Average throughput: 0.00 Mbit/s
```

Run 1: Report of PCC — Data Link

Flow 1 ingress (mean 41.69 Mbit/s) — Flow 1 egress (mean 0.57 Mbit/s)
Flow 2 ingress (mean 0.00 Mbit/s) — Flow 2 egress (mean 0.00 Mbit/s)
Flow 3 ingress (mean 0.00 Mbit/s) — Flow 3 egress (mean 0.00 Mbit/s)
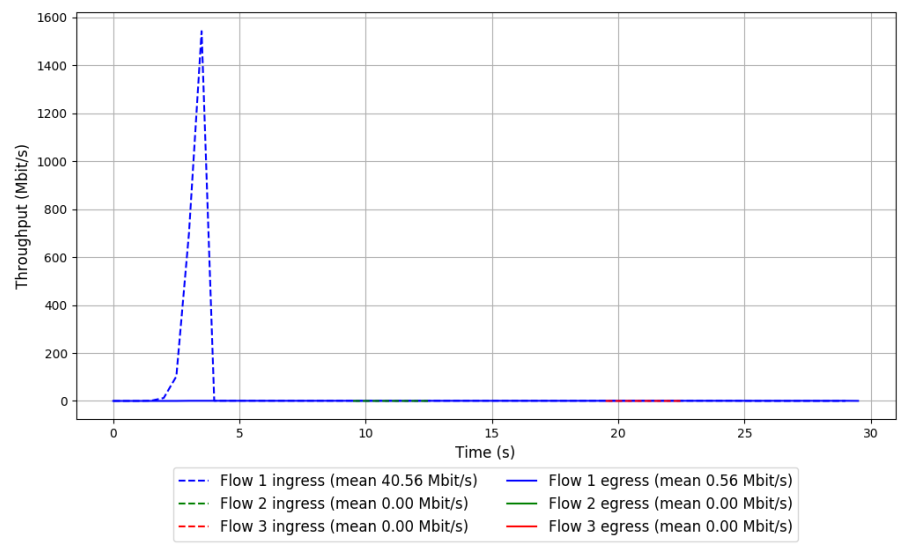

Flow 1 (95th percentile 26017.58 ms)

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```
Run 2: Statistics of PCC

Start at: 2018-01-16 00:59:50
End at: 2018-01-16 01:00:20
Local clock offset: 1.844 ms
Remote clock offset: -3.934 ms


# Below is generated by plot.py at 2018-01-16 02:16:30
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.56 Mbit/s
95th percentile per-packet one-way delay: 25583.935 ms
Loss rate: 98.62%
-- Flow 1:
Average throughput: 0.56 Mbit/s
95th percentile per-packet one-way delay: 25583.935 ms
Loss rate: 98.62%
-- Flow 2:
Average throughput: 0.00 Mbit/s
-- Flow 3:
Average throughput: 0.00 Mbit/s
```
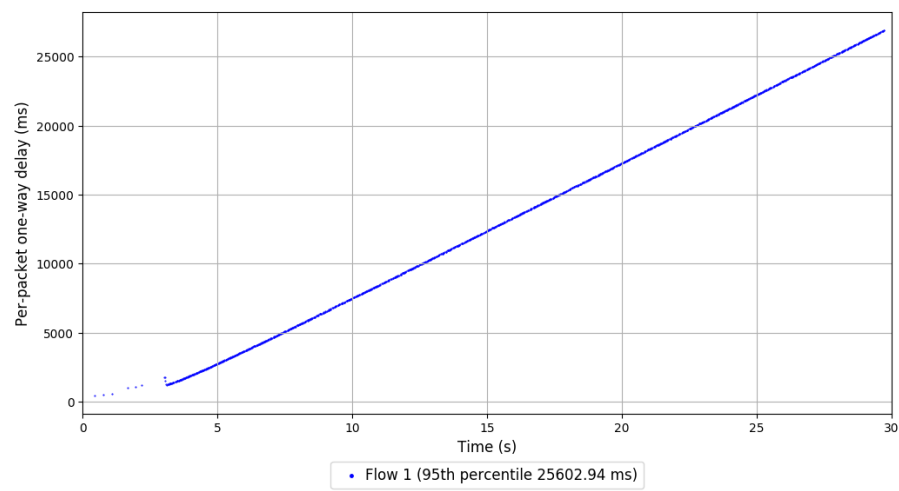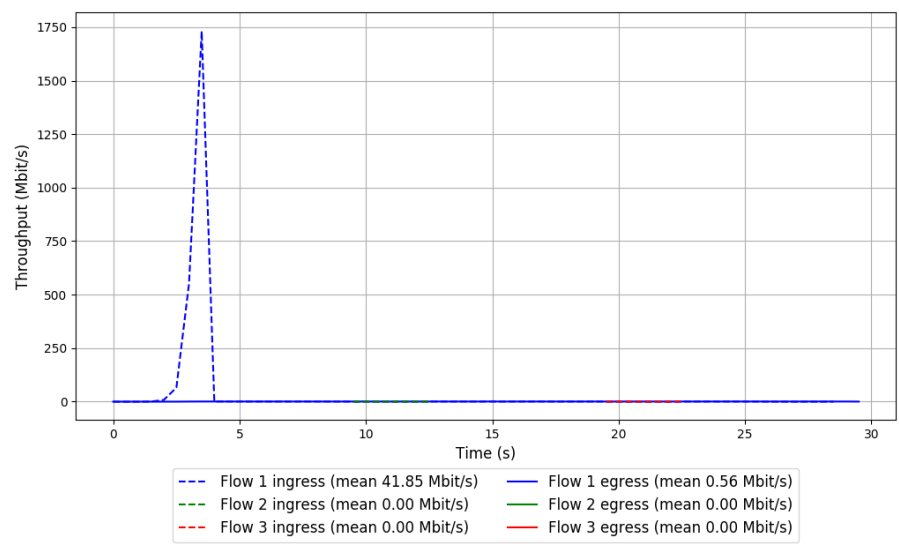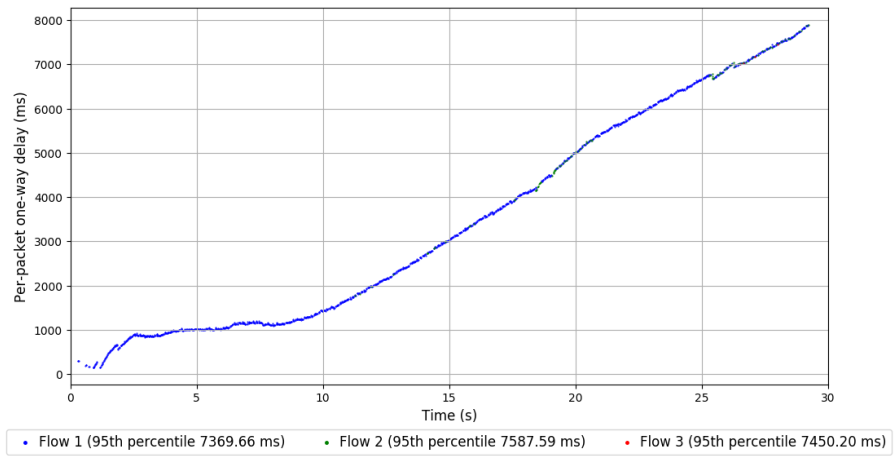
Run 2: Report of PCC — Data Link

```
Run 3: Statistics of PCC

Start at: 2018-01-16 01:18:37
End at: 2018-01-16 01:19:07
Local clock offset: 1.679 ms
Remote clock offset: 0.426 ms


# Below is generated by plot.py at 2018-01-16 02:16:30
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.56 Mbit/s
95th percentile per-packet one-way delay: 25602.936 ms
Loss rate: 98.62%
-- Flow 1:
Average throughput: 0.56 Mbit/s
95th percentile per-packet one-way delay: 25602.936 ms
Loss rate: 98.62%
-- Flow 2:
Average throughput: 0.00 Mbit/s
-- Flow 3:
Average throughput: 0.00 Mbit/s
```

Run 3: Report of PCC — Data Link

Flow 1 ingress (mean 41.85 Mbit/s)   Flow 1 egress (mean 0.56 Mbit/s)
Flow 2 ingress (mean 0.00 Mbit/s)   Flow 2 egress (mean 0.00 Mbit/s)
Flow 3 ingress (mean 0.00 Mbit/s)   Flow 3 egress (mean 0.00 Mbit/s)
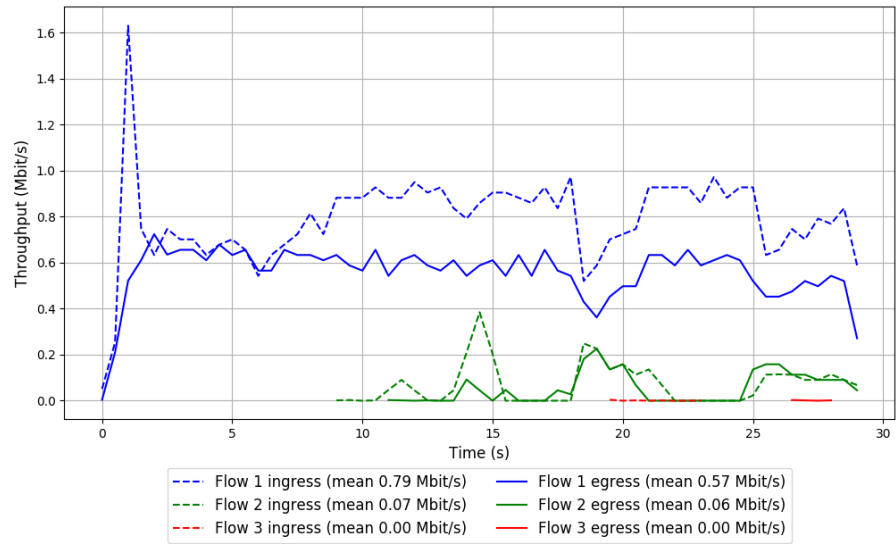

Flow 1 (95th percentile 25602.94 ms)

```
Run 1: Statistics of QUIC Cubic

Start at: 2018-01-16 00:23:34
End at: 2018-01-16 00:24:04
Local clock offset: 1.875 ms
Remote clock offset: -4.391 ms


# Below is generated by plot.py at 2018-01-16 02:16:30
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.60 Mbit/s
95th percentile per-packet one-way delay: 7410.273 ms
Loss rate: 29.19%
-- Flow 1:
Average throughput: 0.57 Mbit/s
95th percentile per-packet one-way delay: 7369.664 ms
Loss rate: 29.08%
-- Flow 2:
Average throughput: 0.06 Mbit/s
95th percentile per-packet one-way delay: 7587.588 ms
Loss rate: 30.93%
-- Flow 3:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 7450.204 ms
Loss rate: 33.33%
```
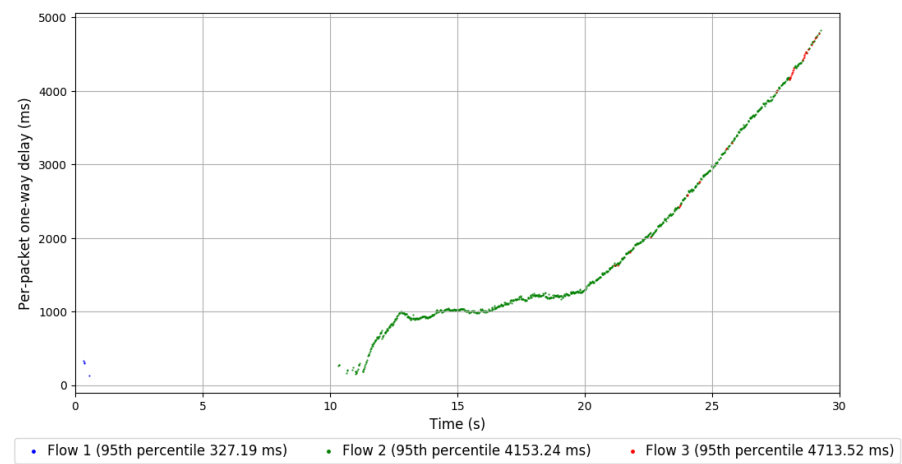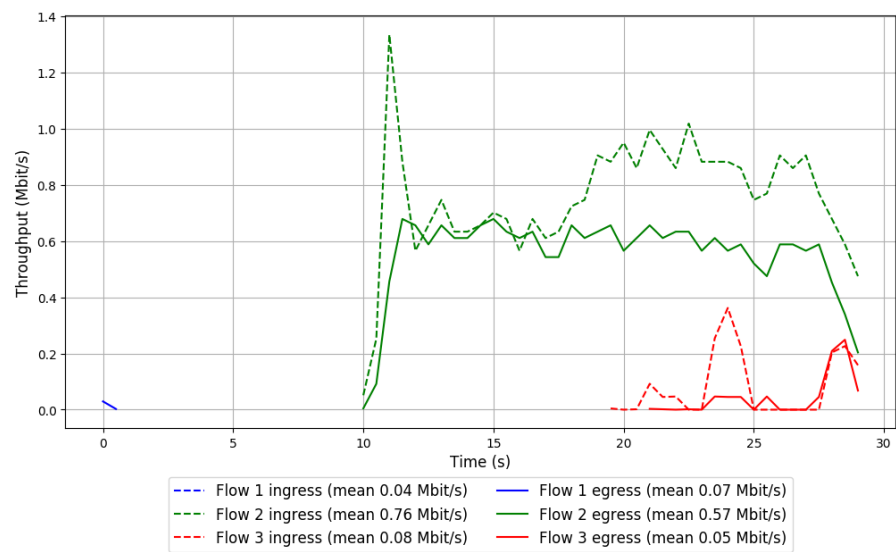
Run 1: Report of QUIC Cubic — Data Link
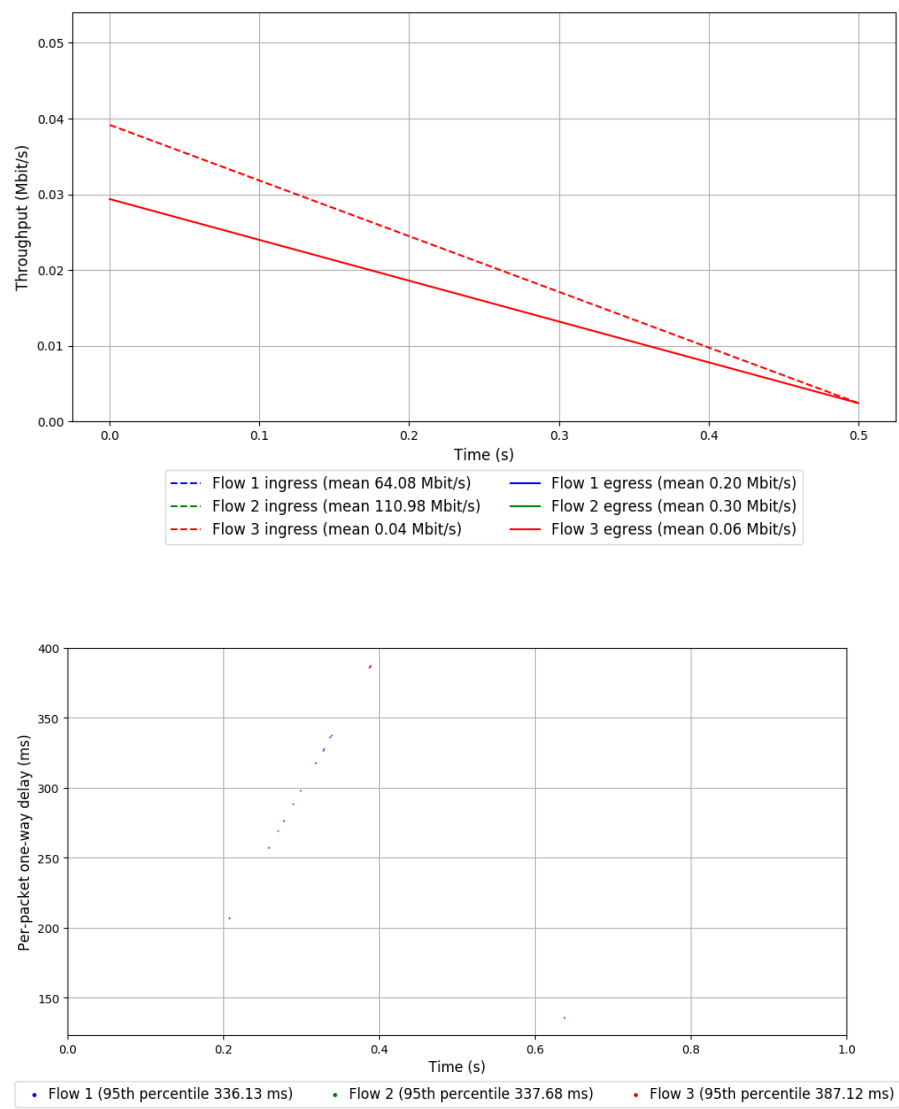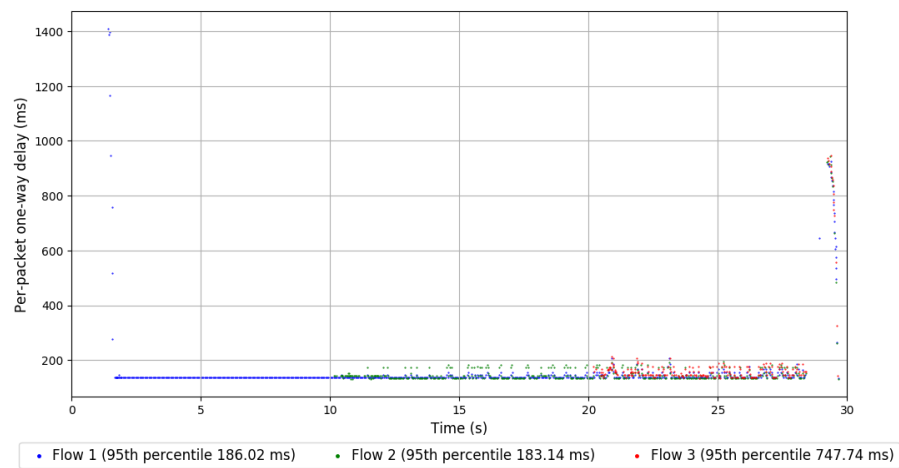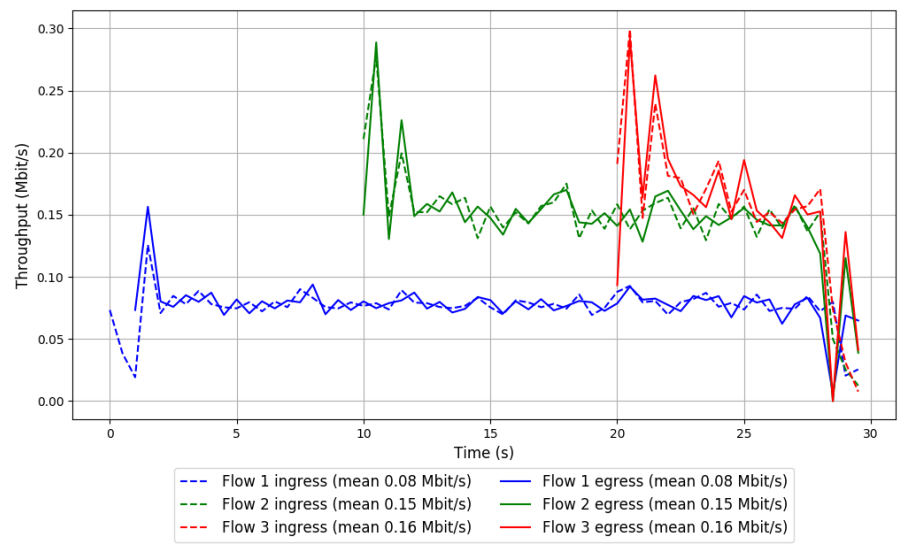
```
Run 2: Statistics of QUIC Cubic

Start at: 2018-01-16 00:42:21
End at: 2018-01-16 00:42:51
Local clock offset: 2.289 ms
Remote clock offset: 1.919 ms


# Below is generated by plot.py at 2018-01-16 02:16:30
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.39 Mbit/s
95th percentile per-packet one-way delay: 4332.769 ms
Loss rate: 27.87%
-- Flow 1:
Average throughput: 0.07 Mbit/s
95th percentile per-packet one-way delay: 327.191 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 0.57 Mbit/s
95th percentile per-packet one-way delay: 4153.239 ms
Loss rate: 26.51%
-- Flow 3:
Average throughput: 0.05 Mbit/s
95th percentile per-packet one-way delay: 4713.521 ms
Loss rate: 53.04%
```

Run 2: Report of QUIC Cubic — Data Link

Flow 1 ingress (mean 0.04 Mbit/s) — — — Flow 1 egress (mean 0.07 Mbit/s)
Flow 2 ingress (mean 0.76 Mbit/s) — — — Flow 2 egress (mean 0.57 Mbit/s)
Flow 3 ingress (mean 0.08 Mbit/s) — — — Flow 3 egress (mean 0.05 Mbit/s)

• Flow 1 (95th percentile 327.19 ms)   • Flow 2 (95th percentile 4153.24 ms)   • Flow 3 (95th percentile 4713.52 ms)

```
Run 3: Statistics of QUIC Cubic

Start at: 2018-01-16 01:01:07
End at: 2018-01-16 01:01:37
Local clock offset: 1.813 ms
Remote clock offset: -3.924 ms
```

Run 3: Report of QUIC Cubic — Data Link

Flow 1 ingress (mean 64.08 Mbit/s) — Flow 1 egress (mean 0.20 Mbit/s)
Flow 2 ingress (mean 110.98 Mbit/s) — Flow 2 egress (mean 0.30 Mbit/s)
Flow 3 ingress (mean 0.04 Mbit/s) — Flow 3 egress (mean 0.06 Mbit/s)

Flow 1 (95th percentile 336.13 ms)　　Flow 2 (95th percentile 337.68 ms)　　Flow 3 (95th percentile 387.12 ms)
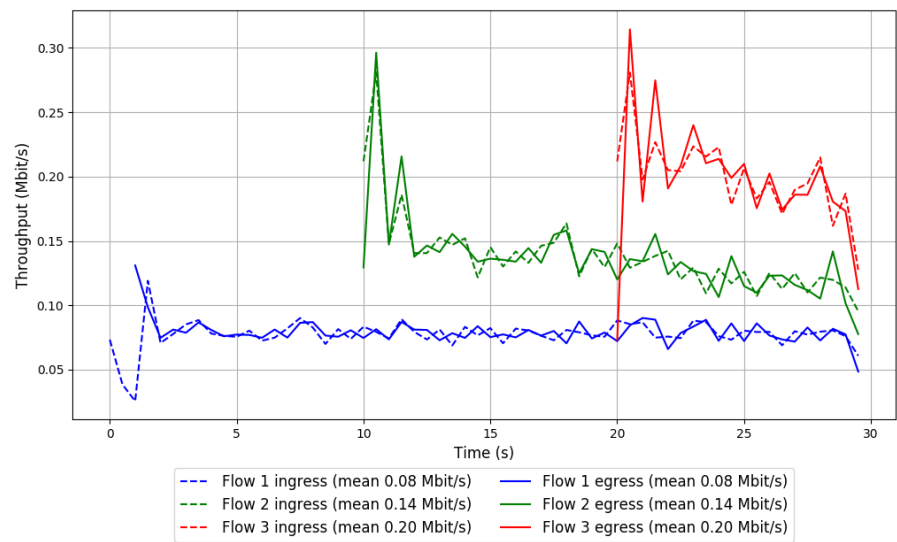
```
Run 1: Statistics of SCReAM

Start at: 2018-01-16 00:27:19
End at: 2018-01-16 00:27:49
Local clock offset: 1.942 ms
Remote clock offset: 0.39 ms


# Below is generated by plot.py at 2018-01-16 02:16:30
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.24 Mbit/s
95th percentile per-packet one-way delay: 187.543 ms
Loss rate: 0.28%
-- Flow 1:
Average throughput: 0.08 Mbit/s
95th percentile per-packet one-way delay: 186.016 ms
Loss rate: 0.42%
-- Flow 2:
Average throughput: 0.15 Mbit/s
95th percentile per-packet one-way delay: 183.139 ms
Loss rate: 0.19%
-- Flow 3:
Average throughput: 0.16 Mbit/s
95th percentile per-packet one-way delay: 747.740 ms
Loss rate: 0.24%
```

Run 1: Report of SCReAM — Data Link

```
Run 2: Statistics of SCReAM

Start at: 2018-01-16 00:46:06
End at: 2018-01-16 00:46:36
Local clock offset: 2.255 ms
Remote clock offset: -4.709 ms


# Below is generated by plot.py at 2018-01-16 02:16:30
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.25 Mbit/s
95th percentile per-packet one-way delay: 202.894 ms
Loss rate: 1.28%
-- Flow 1:
Average throughput: 0.08 Mbit/s
95th percentile per-packet one-way delay: 184.292 ms
Loss rate: 0.79%
-- Flow 2:
Average throughput: 0.14 Mbit/s
95th percentile per-packet one-way delay: 198.702 ms
Loss rate: 1.08%
-- Flow 3:
Average throughput: 0.20 Mbit/s
95th percentile per-packet one-way delay: 225.118 ms
Loss rate: 2.12%
```
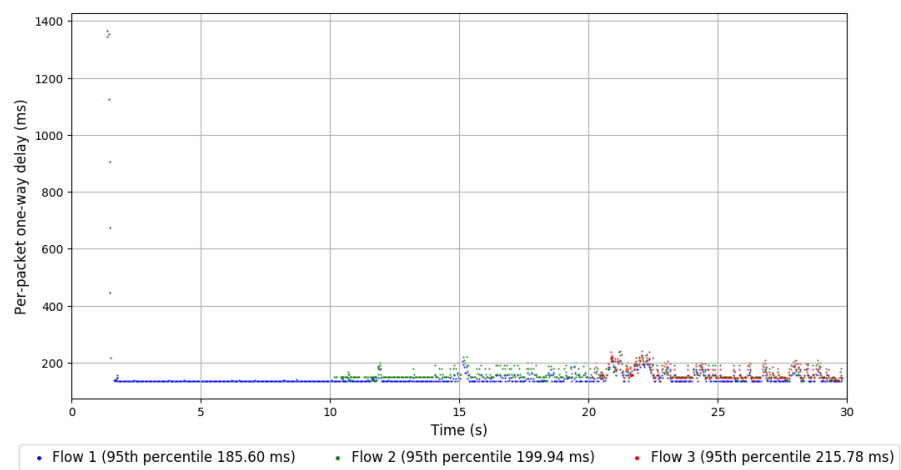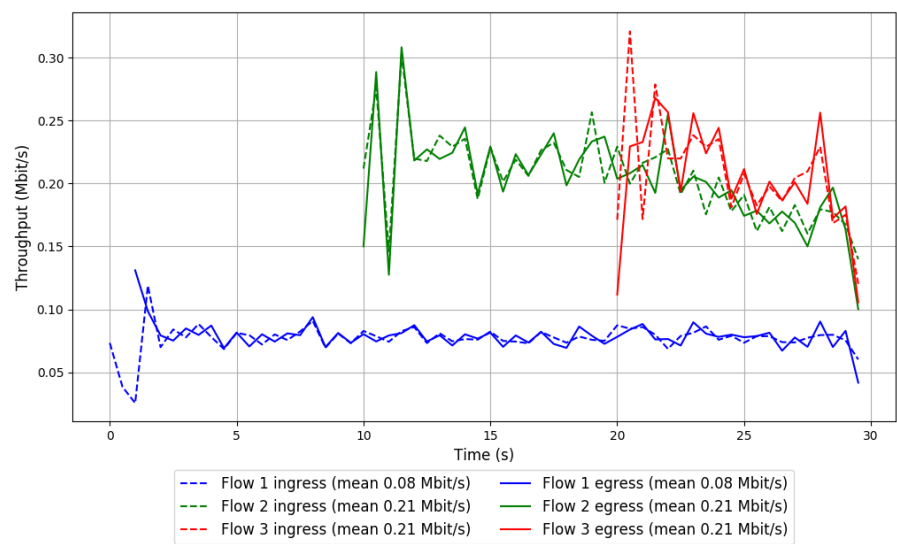
Run 2: Report of SCReAM — Data Link

```
Run 3: Statistics of SCReAM

Start at: 2018-01-16 01:04:52
End at: 2018-01-16 01:05:22
Local clock offset: 1.797 ms
Remote clock offset: 1.061 ms


# Below is generated by plot.py at 2018-01-16 02:16:30
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.30 Mbit/s
95th percentile per-packet one-way delay: 199.789 ms
Loss rate: 1.12%
-- Flow 1:
Average throughput: 0.08 Mbit/s
95th percentile per-packet one-way delay: 185.601 ms
Loss rate: 0.79%
-- Flow 2:
Average throughput: 0.21 Mbit/s
95th percentile per-packet one-way delay: 199.942 ms
Loss rate: 1.06%
-- Flow 3:
Average throughput: 0.21 Mbit/s
95th percentile per-packet one-way delay: 215.781 ms
Loss rate: 1.60%
```
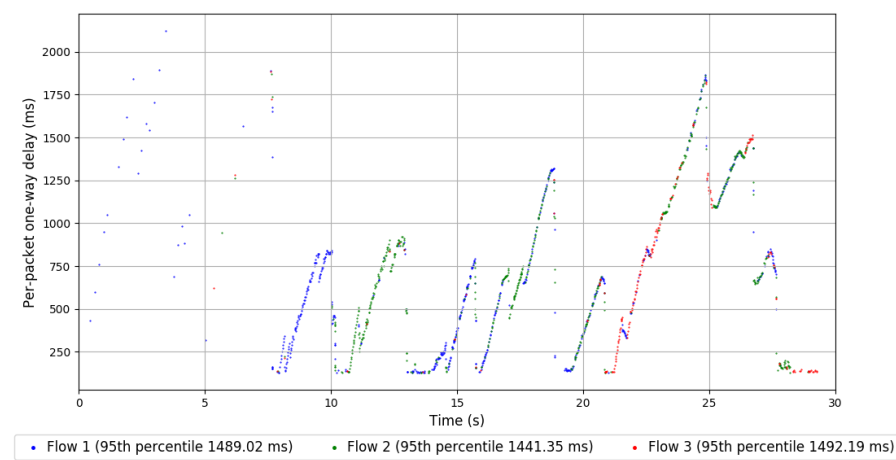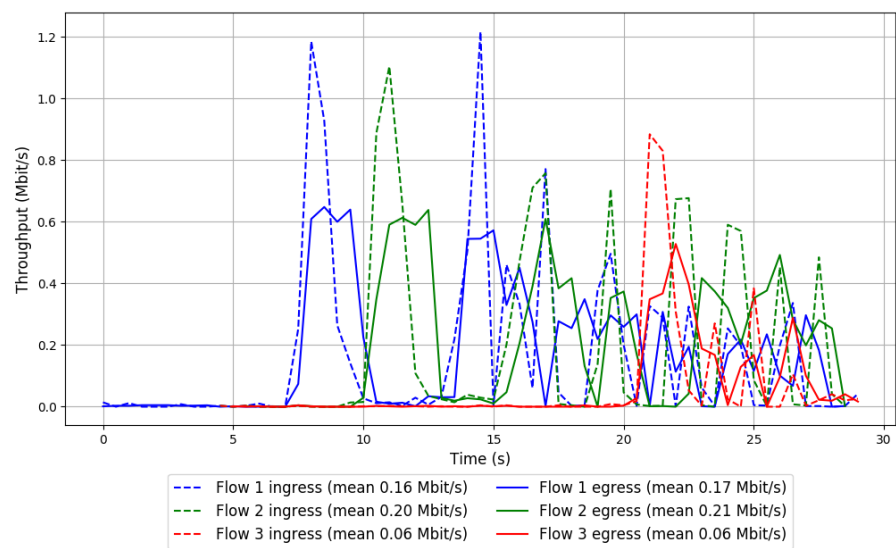
Run 3: Report of SCReAM — Data Link

```
Run 1: Statistics of WebRTC media

Start at: 2018-01-16 00:38:35
End at: 2018-01-16 00:39:05
Local clock offset: 2.41 ms
Remote clock offset: 1.096 ms


# Below is generated by plot.py at 2018-01-16 02:16:30
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.39 Mbit/s
95th percentile per-packet one-way delay: 1489.015 ms
Loss rate: 0.61%
-- Flow 1:
Average throughput: 0.17 Mbit/s
95th percentile per-packet one-way delay: 1489.015 ms
Loss rate: 0.45%
-- Flow 2:
Average throughput: 0.21 Mbit/s
95th percentile per-packet one-way delay: 1441.354 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 0.06 Mbit/s
95th percentile per-packet one-way delay: 1492.187 ms
Loss rate: 3.03%
```
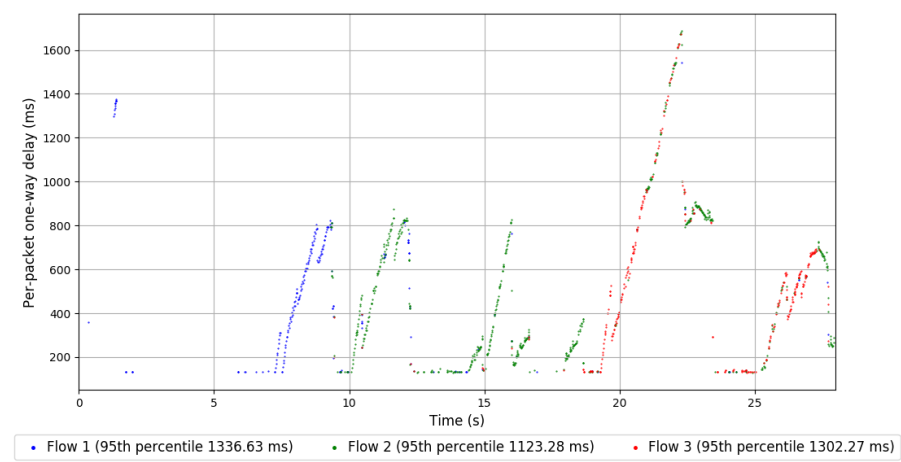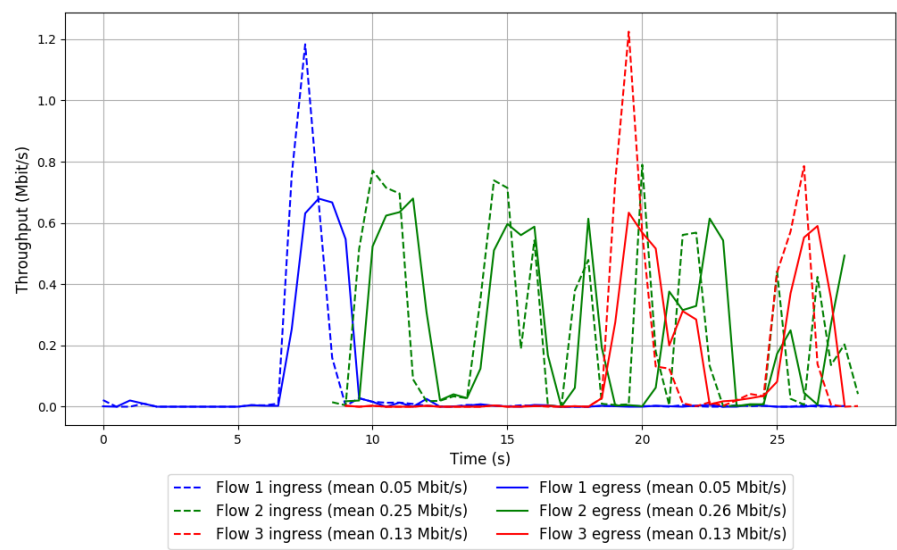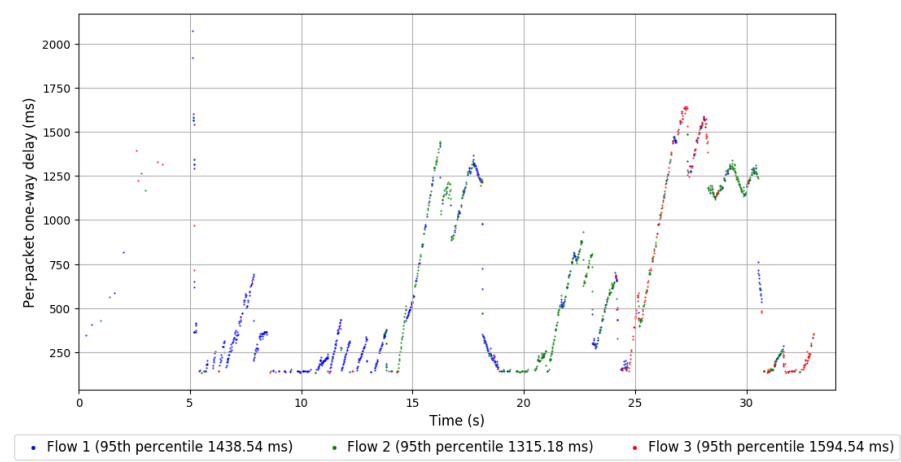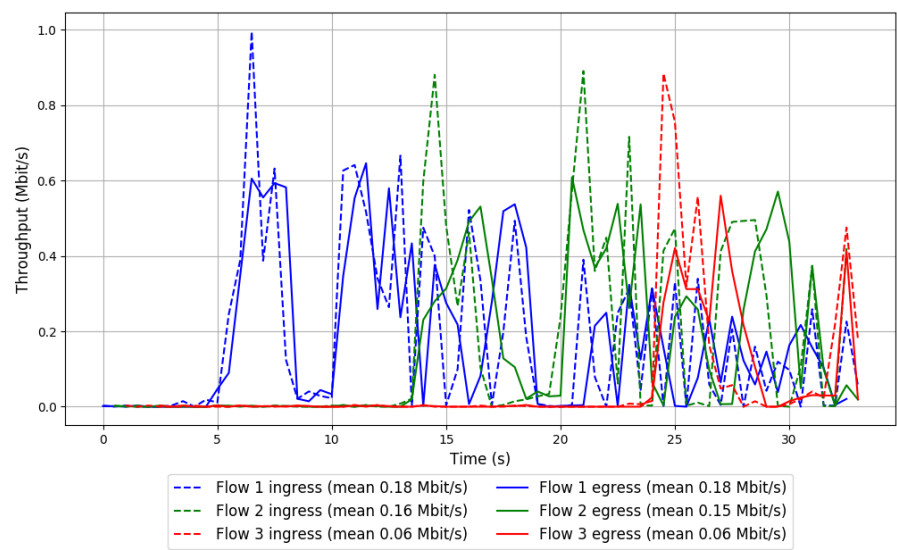
Run 1: Report of WebRTC media — Data Link

Flow 1 ingress (mean 0.16 Mbit/s)   Flow 1 egress (mean 0.17 Mbit/s)
Flow 2 ingress (mean 0.20 Mbit/s)   Flow 2 egress (mean 0.21 Mbit/s)
Flow 3 ingress (mean 0.06 Mbit/s)   Flow 3 egress (mean 0.06 Mbit/s)

Flow 1 (95th percentile 1489.02 ms)   Flow 2 (95th percentile 1441.35 ms)   Flow 3 (95th percentile 1492.19 ms)

```
Run 2: Statistics of WebRTC media

Start at: 2018-01-16 00:57:21
End at: 2018-01-16 00:57:51
Local clock offset: 1.899 ms
Remote clock offset: 1.721 ms


# Below is generated by plot.py at 2018-01-16 02:16:30
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.32 Mbit/s
95th percentile per-packet one-way delay: 1297.106 ms
Loss rate: 0.25%
-- Flow 1:
Average throughput: 0.05 Mbit/s
95th percentile per-packet one-way delay: 1336.630 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 0.26 Mbit/s
95th percentile per-packet one-way delay: 1123.278 ms
Loss rate: 0.42%
-- Flow 3:
Average throughput: 0.13 Mbit/s
95th percentile per-packet one-way delay: 1302.269 ms
Loss rate: 0.04%
```

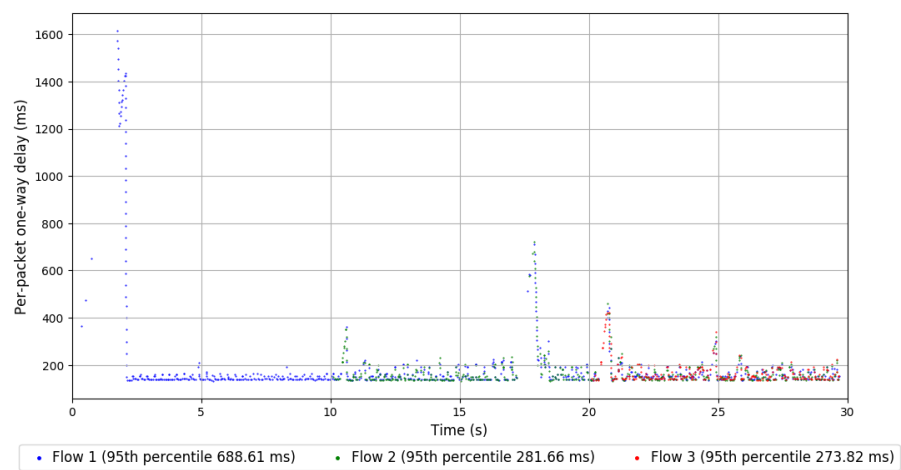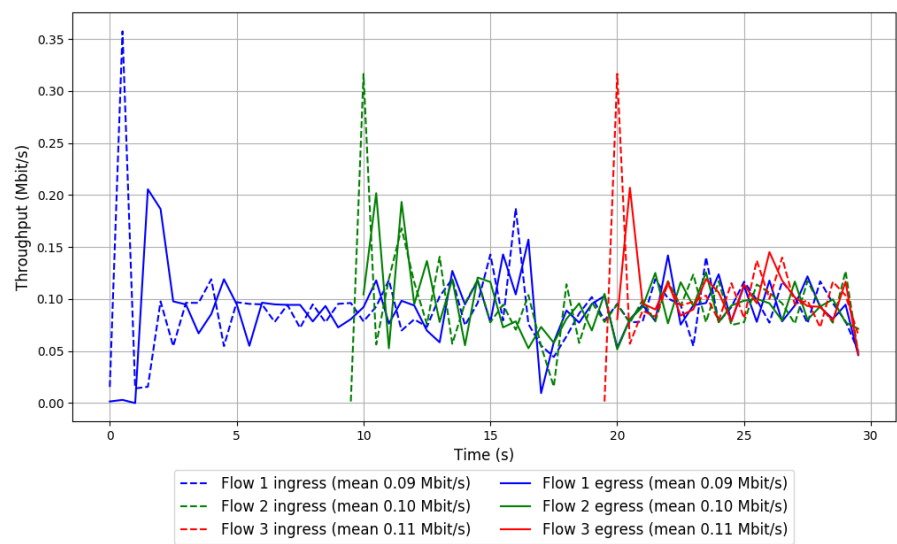Run 2: Report of WebRTC media — Data Link

```
Run 3: Statistics of WebRTC media

Start at: 2018-01-16 01:16:07
End at: 2018-01-16 01:16:37
Local clock offset: 1.77 ms
Remote clock offset: -4.468 ms


# Below is generated by plot.py at 2018-01-16 02:16:30
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.38 Mbit/s
95th percentile per-packet one-way delay: 1455.297 ms
Loss rate: 3.92%
-- Flow 1:
Average throughput: 0.18 Mbit/s
95th percentile per-packet one-way delay: 1438.543 ms
Loss rate: 2.17%
-- Flow 2:
Average throughput: 0.15 Mbit/s
95th percentile per-packet one-way delay: 1315.184 ms
Loss rate: 3.36%
-- Flow 3:
Average throughput: 0.06 Mbit/s
95th percentile per-packet one-way delay: 1594.536 ms
Loss rate: 10.91%
```

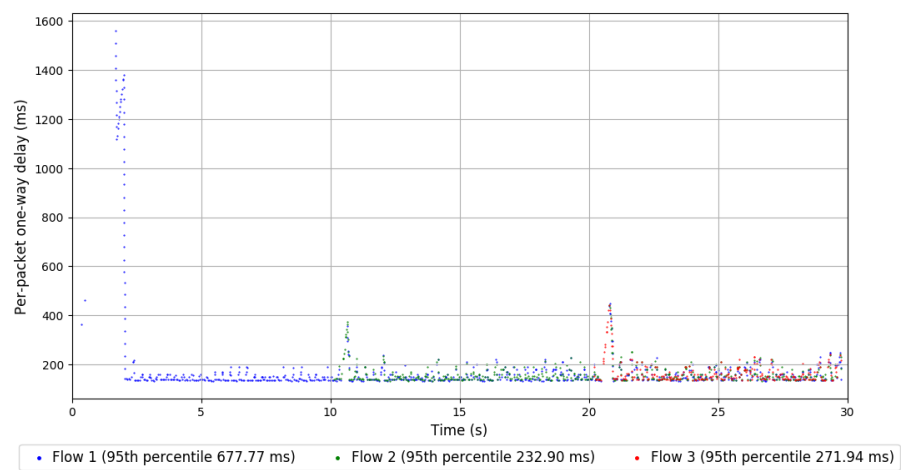Run 3: Report of WebRTC media — Data Link

```
Run 1: Statistics of Sprout

Start at: 2018-01-16 00:33:35
End at: 2018-01-16 00:34:05
Local clock offset: 2.189 ms
Remote clock offset: -4.434 ms


# Below is generated by plot.py at 2018-01-16 02:16:30
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.19 Mbit/s
95th percentile per-packet one-way delay: 400.592 ms
Loss rate: 2.52%
-- Flow 1:
Average throughput: 0.09 Mbit/s
95th percentile per-packet one-way delay: 688.605 ms
Loss rate: 1.64%
-- Flow 2:
Average throughput: 0.10 Mbit/s
95th percentile per-packet one-way delay: 281.663 ms
Loss rate: 2.84%
-- Flow 3:
Average throughput: 0.11 Mbit/s
95th percentile per-packet one-way delay: 273.824 ms
Loss rate: 4.16%
```

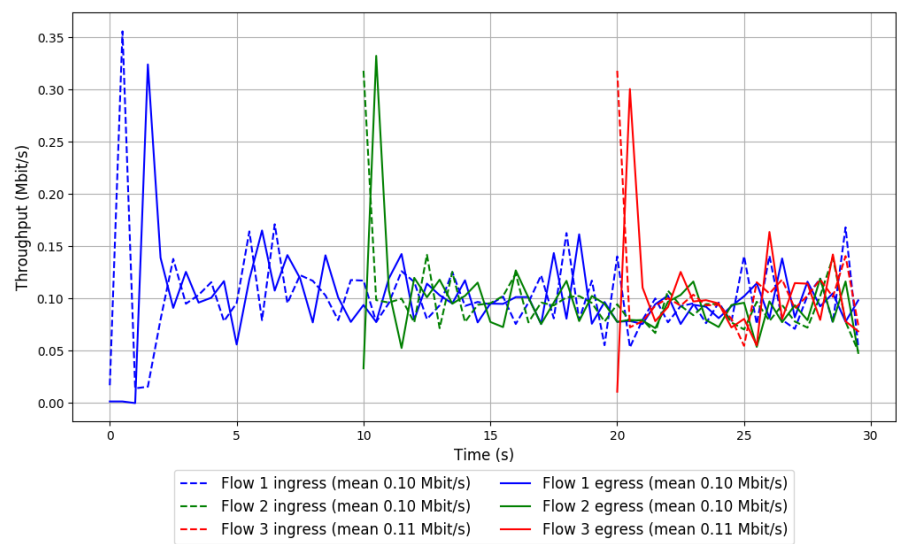Run 1: Report of Sprout — Data Link

```
Run 2: Statistics of Sprout

Start at: 2018-01-16 00:52:22
End at: 2018-01-16 00:52:52
Local clock offset: 2.047 ms
Remote clock offset: -3.869 ms


# Below is generated by plot.py at 2018-01-16 02:16:30
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.20 Mbit/s
95th percentile per-packet one-way delay: 312.396 ms
Loss rate: 1.63%
-- Flow 1:
Average throughput: 0.10 Mbit/s
95th percentile per-packet one-way delay: 677.766 ms
Loss rate: 0.99%
-- Flow 2:
Average throughput: 0.10 Mbit/s
95th percentile per-packet one-way delay: 232.904 ms
Loss rate: 1.21%
-- Flow 3:
Average throughput: 0.11 Mbit/s
95th percentile per-packet one-way delay: 271.937 ms
Loss rate: 4.21%
```
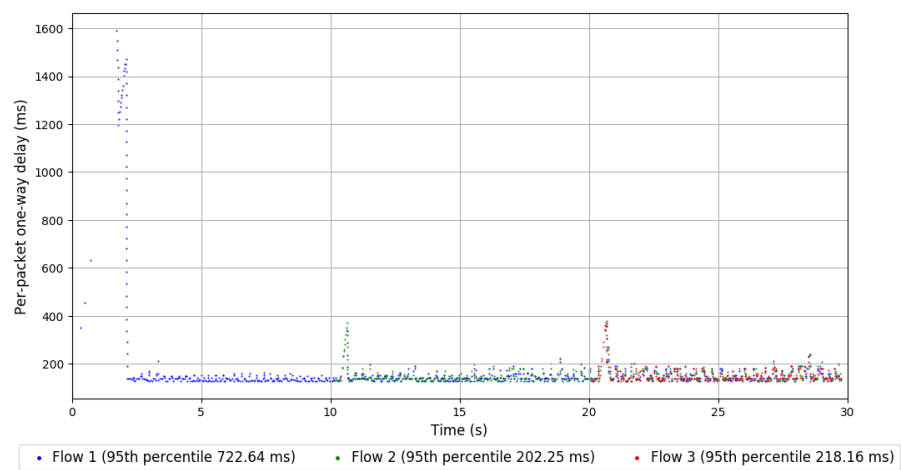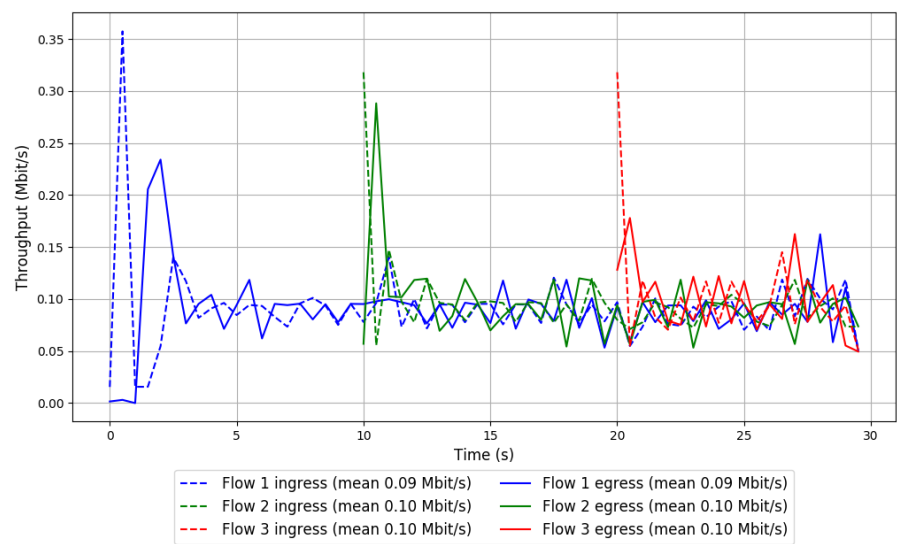
Run 2: Report of Sprout — Data Link

```
Run 3: Statistics of Sprout

Start at: 2018-01-16 01:11:08
End at: 2018-01-16 01:11:38
Local clock offset: 1.82 ms
Remote clock offset: 1.043 ms


# Below is generated by plot.py at 2018-01-16 02:16:30
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.19 Mbit/s
95th percentile per-packet one-way delay: 268.746 ms
Loss rate: 1.53%
-- Flow 1:
Average throughput: 0.09 Mbit/s
95th percentile per-packet one-way delay: 722.640 ms
Loss rate: 1.04%
-- Flow 2:
Average throughput: 0.10 Mbit/s
95th percentile per-packet one-way delay: 202.246 ms
Loss rate: 1.21%
-- Flow 3:
Average throughput: 0.10 Mbit/s
95th percentile per-packet one-way delay: 218.159 ms
Loss rate: 3.41%
```
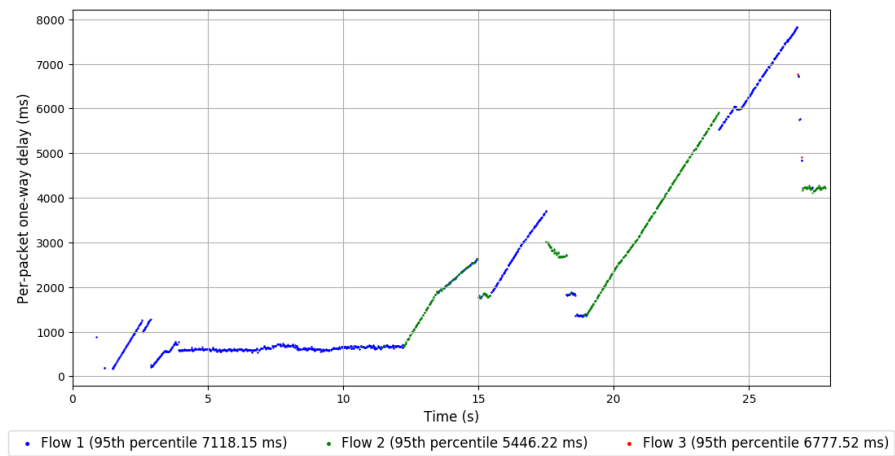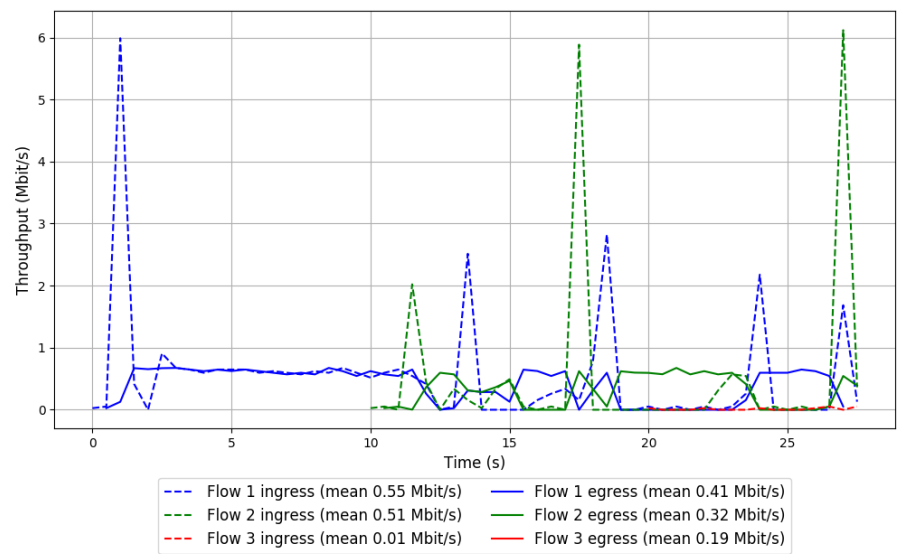
Run 3: Report of Sprout — Data Link

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

Start at: 2018-01-16 00:28:33
End at: 2018-01-16 00:29:03
Local clock offset: 2.049 ms
Remote clock offset: 0.414 ms


# Below is generated by plot.py at 2018-01-16 02:16:30
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.60 Mbit/s
95th percentile per-packet one-way delay: 6756.505 ms
Loss rate: 32.91%
-- Flow 1:
Average throughput: 0.41 Mbit/s
95th percentile per-packet one-way delay: 7118.152 ms
Loss rate: 28.77%
-- Flow 2:
Average throughput: 0.32 Mbit/s
95th percentile per-packet one-way delay: 5446.224 ms
Loss rate: 39.45%
-- Flow 3:
Average throughput: 0.19 Mbit/s
95th percentile per-packet one-way delay: 6777.515 ms
Loss rate: 75.00%
```
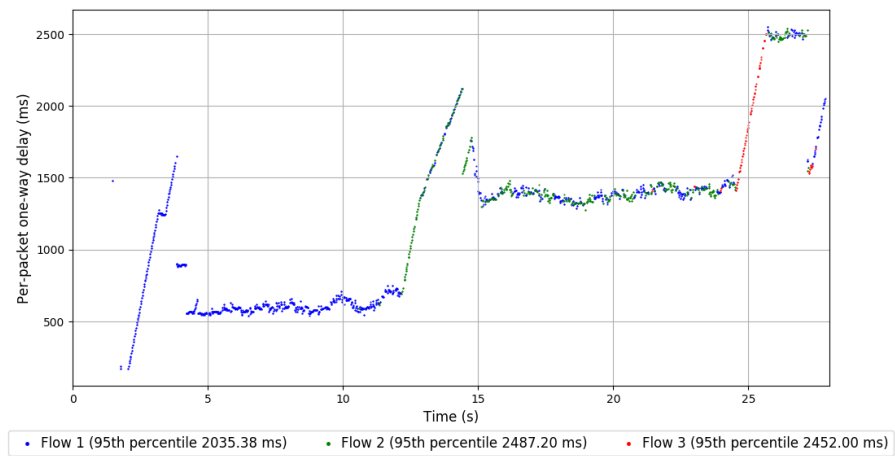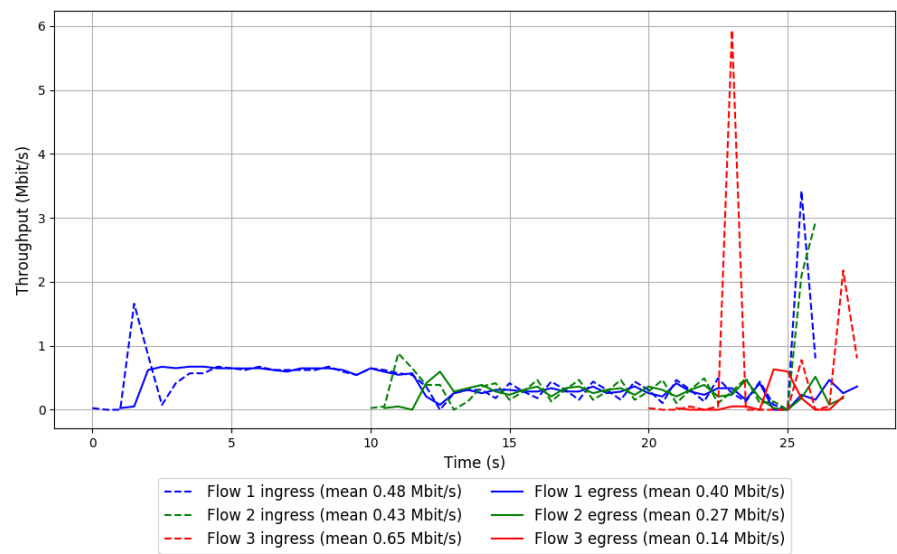
Run 1: Report of TaoVA-100x — Data Link

- - - Flow 1 ingress (mean 0.55 Mbit/s) ── Flow 1 egress (mean 0.41 Mbit/s)
- - - Flow 2 ingress (mean 0.51 Mbit/s) ── Flow 2 egress (mean 0.32 Mbit/s)
- - - Flow 3 ingress (mean 0.01 Mbit/s) ── Flow 3 egress (mean 0.19 Mbit/s)

• Flow 1 (95th percentile 7118.15 ms)   • Flow 2 (95th percentile 5446.22 ms)   • Flow 3 (95th percentile 6777.52 ms)

53

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

Start at: 2018-01-16 00:47:21
End at: 2018-01-16 00:47:51
Local clock offset: 2.239 ms
Remote clock offset: 0.983 ms

# Below is generated by plot.py at 2018-01-16 02:16:30
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.61 Mbit/s
95th percentile per-packet one-way delay: 2469.423 ms
Loss rate: 34.48%
-- Flow 1:
Average throughput: 0.40 Mbit/s
95th percentile per-packet one-way delay: 2035.384 ms
Loss rate: 14.94%
-- Flow 2:
Average throughput: 0.27 Mbit/s
95th percentile per-packet one-way delay: 2487.205 ms
Loss rate: 35.62%
-- Flow 3:
Average throughput: 0.14 Mbit/s
95th percentile per-packet one-way delay: 2452.002 ms
Loss rate: 82.31%
```
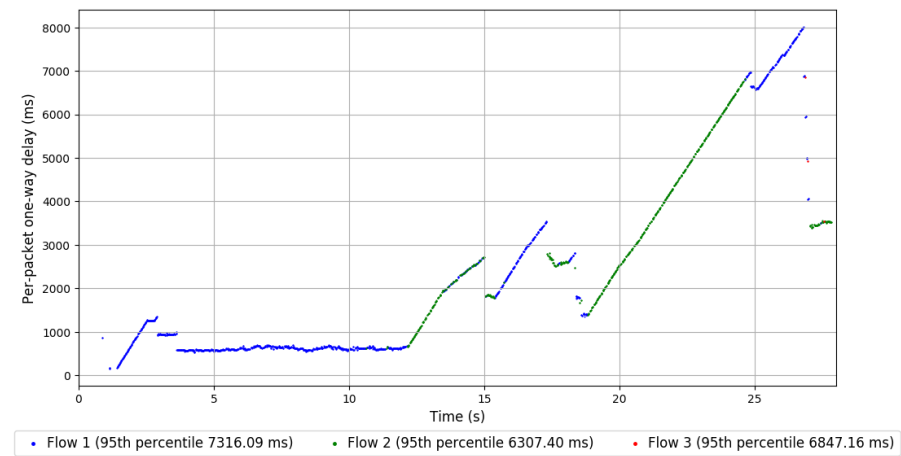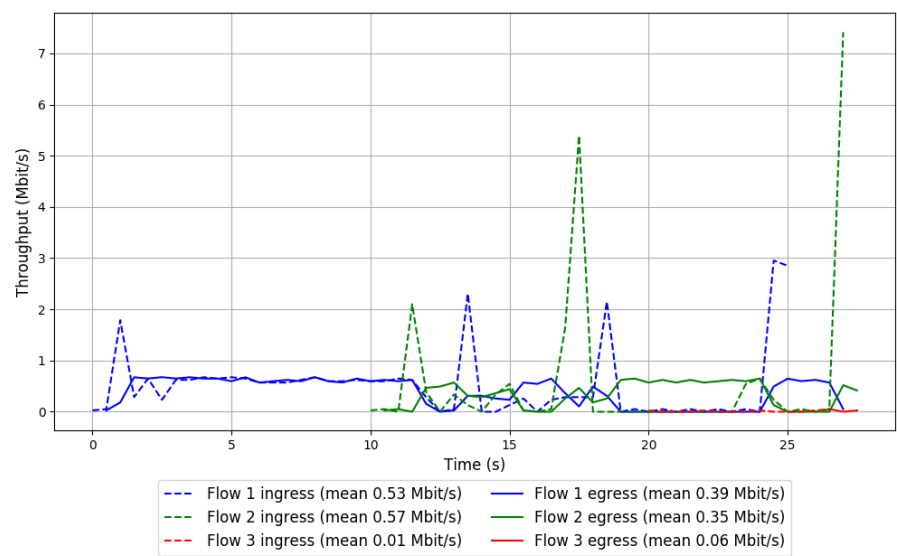
Run 2: Report of TaoVA-100x — Data Link

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

Start at: 2018-01-16 01:06:07
End at: 2018-01-16 01:06:37
Local clock offset: 1.782 ms
Remote clock offset: 0.984 ms


# Below is generated by plot.py at 2018-01-16 02:16:30
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.61 Mbit/s
95th percentile per-packet one-way delay: 6958.331 ms
Loss rate: 29.83%
-- Flow 1:
Average throughput: 0.39 Mbit/s
95th percentile per-packet one-way delay: 7316.092 ms
Loss rate: 21.97%
-- Flow 2:
Average throughput: 0.35 Mbit/s
95th percentile per-packet one-way delay: 6307.399 ms
Loss rate: 40.13%
-- Flow 3:
Average throughput: 0.06 Mbit/s
95th percentile per-packet one-way delay: 6847.160 ms
Loss rate: 50.00%
```

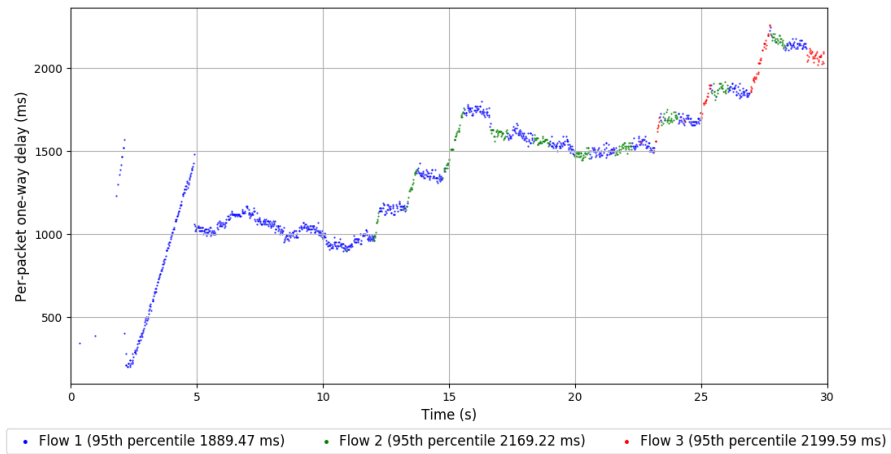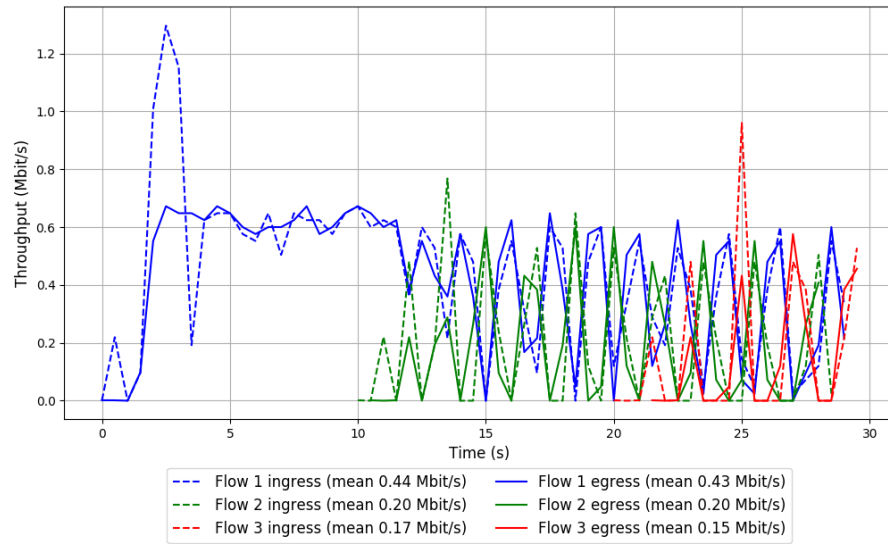Run 3: Report of TaoVA-100x — Data Link

```
Run 1: Statistics of TCP Vegas

Start at: 2018-01-16 00:36:04
End at: 2018-01-16 00:36:34
Local clock offset: 2.298 ms
Remote clock offset: -3.682 ms


# Below is generated by plot.py at 2018-01-16 02:16:30
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.58 Mbit/s
95th percentile per-packet one-way delay: 2129.648 ms
Loss rate: 6.83%
-- Flow 1:
Average throughput: 0.43 Mbit/s
95th percentile per-packet one-way delay: 1889.472 ms
Loss rate: 4.19%
-- Flow 2:
Average throughput: 0.20 Mbit/s
95th percentile per-packet one-way delay: 2169.216 ms
Loss rate: 8.62%
-- Flow 3:
Average throughput: 0.15 Mbit/s
95th percentile per-packet one-way delay: 2199.594 ms
Loss rate: 23.47%
```

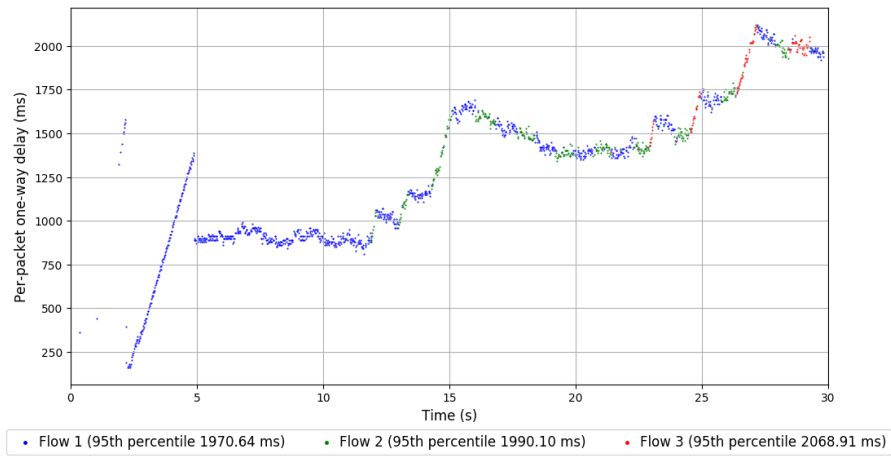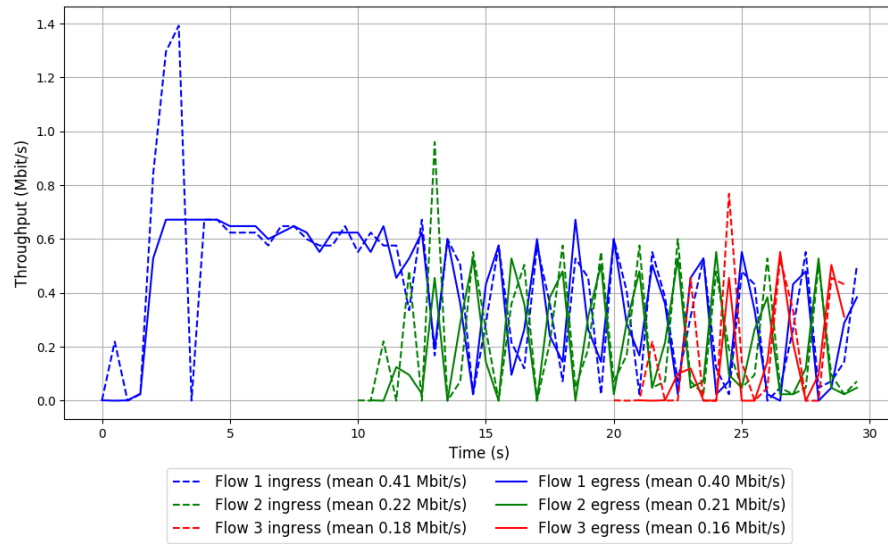Run 1: Report of TCP Vegas — Data Link

```
Run 2: Statistics of TCP Vegas

Start at: 2018-01-16 00:54:52
End at: 2018-01-16 00:55:22
Local clock offset: 1.961 ms
Remote clock offset: -4.796 ms


# Below is generated by plot.py at 2018-01-16 02:16:30
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.58 Mbit/s
95th percentile per-packet one-way delay: 2010.455 ms
Loss rate: 6.77%
-- Flow 1:
Average throughput: 0.40 Mbit/s
95th percentile per-packet one-way delay: 1970.639 ms
Loss rate: 3.70%
-- Flow 2:
Average throughput: 0.21 Mbit/s
95th percentile per-packet one-way delay: 1990.103 ms
Loss rate: 7.92%
-- Flow 3:
Average throughput: 0.16 Mbit/s
95th percentile per-packet one-way delay: 2068.914 ms
Loss rate: 26.18%
```

Run 2: Report of TCP Vegas — Data Link

```
Run 3: Statistics of TCP Vegas

Start at: 2018-01-16 01:13:37
End at: 2018-01-16 01:14:07
Local clock offset: 1.724 ms
Remote clock offset: 0.243 ms


# Below is generated by plot.py at 2018-01-16 02:16:30
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.58 Mbit/s
95th percentile per-packet one-way delay: 1909.492 ms
Loss rate: 6.23%
-- Flow 1:
Average throughput: 0.40 Mbit/s
95th percentile per-packet one-way delay: 1821.803 ms
Loss rate: 3.63%
-- Flow 2:
Average throughput: 0.22 Mbit/s
95th percentile per-packet one-way delay: 1957.777 ms
Loss rate: 6.81%
-- Flow 3:
Average throughput: 0.17 Mbit/s
95th percentile per-packet one-way delay: 1959.644 ms
Loss rate: 24.21%
```
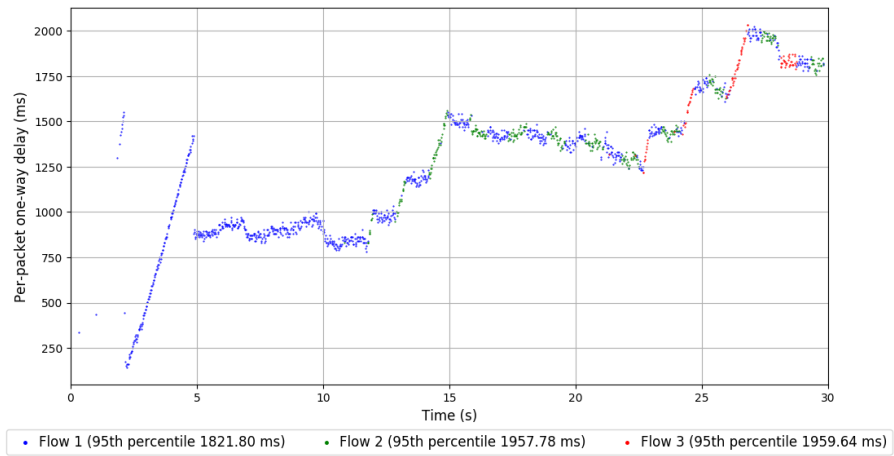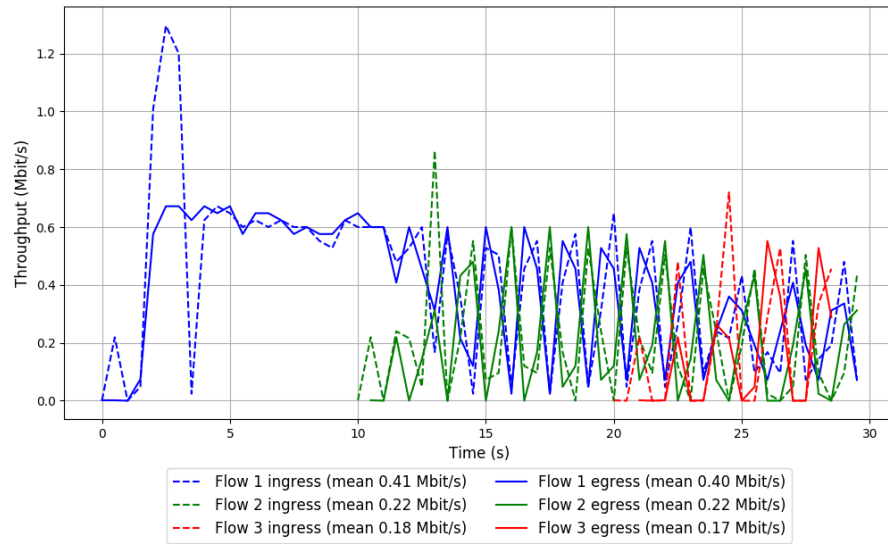
Run 3: Report of TCP Vegas — Data Link

Flow 1 ingress (mean 0.41 Mbit/s)   Flow 1 egress (mean 0.40 Mbit/s)
Flow 2 ingress (mean 0.22 Mbit/s)   Flow 2 egress (mean 0.22 Mbit/s)
Flow 3 ingress (mean 0.18 Mbit/s)   Flow 3 egress (mean 0.17 Mbit/s)

Flow 1 (95th percentile 1821.80 ms)   Flow 2 (95th percentile 1957.78 ms)   Flow 3 (95th percentile 1959.64 ms)

```
Run 1: Statistics of Verus

Start at: 2018-01-16 00:34:50
End at: 2018-01-16 00:35:20
Local clock offset: 2.261 ms
Remote clock offset: 2.034 ms


# Below is generated by plot.py at 2018-01-16 02:16:30
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.59 Mbit/s
95th percentile per-packet one-way delay: 2007.298 ms
Loss rate: 4.33%
-- Flow 1:
Average throughput: 0.58 Mbit/s
95th percentile per-packet one-way delay: 2007.298 ms
Loss rate: 4.30%
-- Flow 2:
Average throughput: 0.01 Mbit/s
95th percentile per-packet one-way delay: 2018.462 ms
Loss rate: 4.35%
-- Flow 3:
Average throughput: 0.02 Mbit/s
95th percentile per-packet one-way delay: 2006.932 ms
Loss rate: 8.33%
```
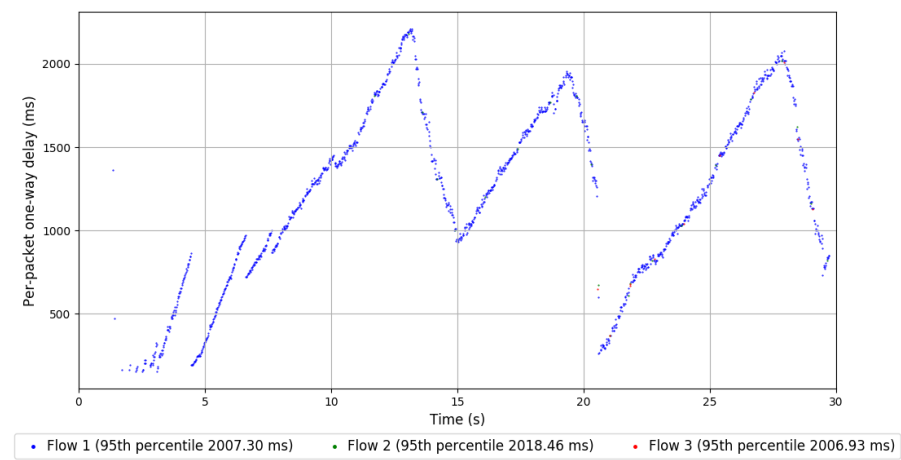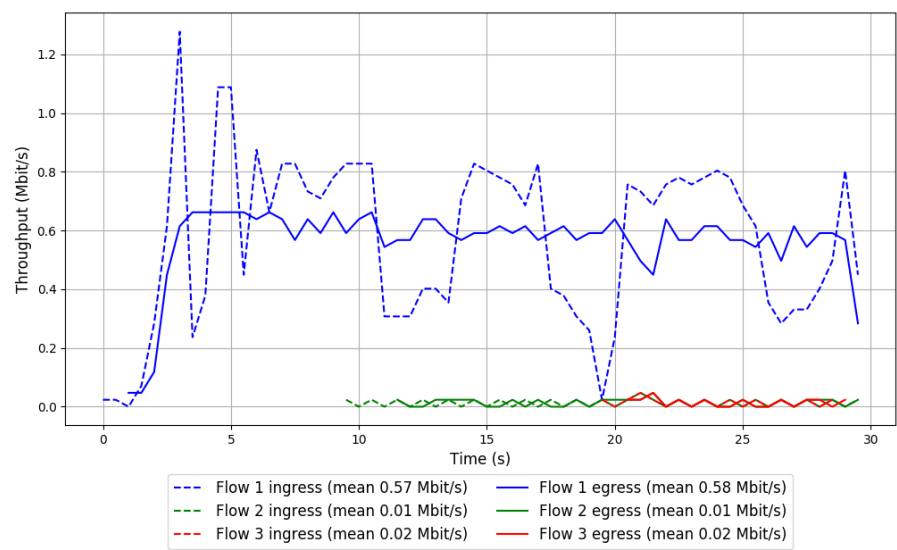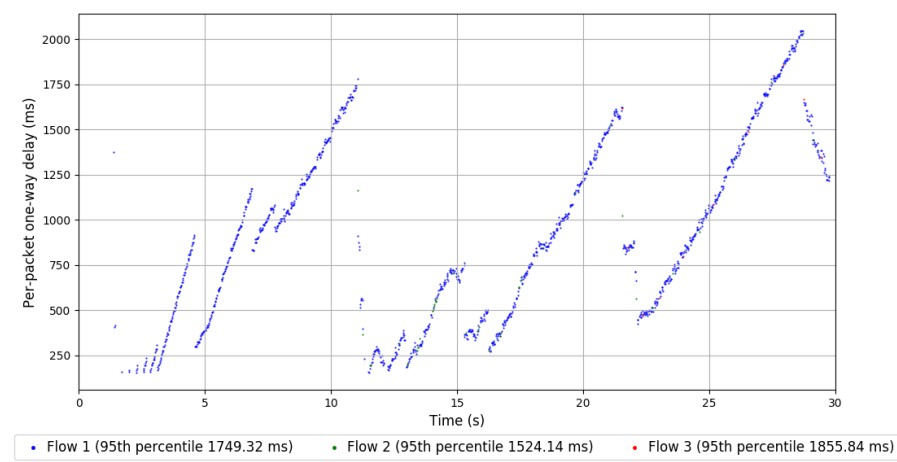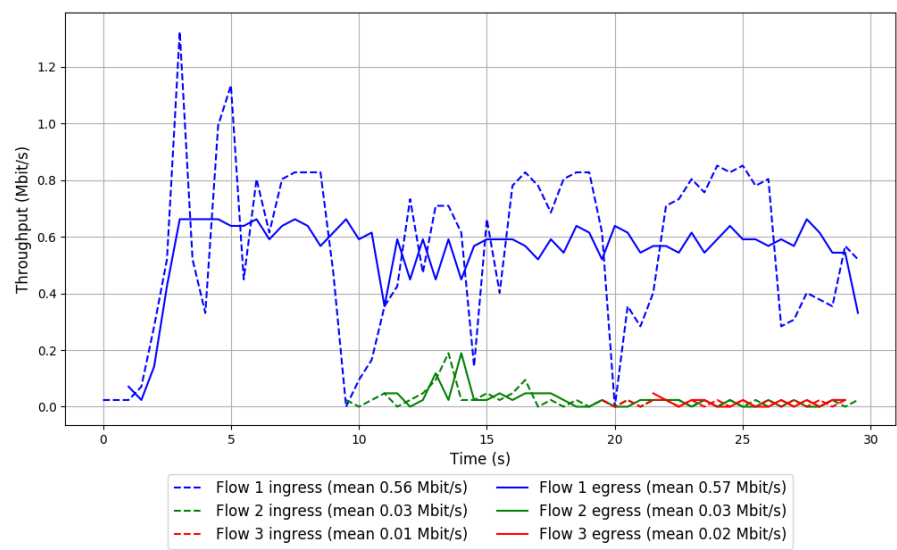
Run 1: Report of Verus — Data Link

Flow 1 ingress (mean 0.57 Mbit/s) Flow 1 egress (mean 0.58 Mbit/s)
Flow 2 ingress (mean 0.01 Mbit/s) Flow 2 egress (mean 0.01 Mbit/s)
Flow 3 ingress (mean 0.02 Mbit/s) Flow 3 egress (mean 0.02 Mbit/s)

• Flow 1 (95th percentile 2007.30 ms)   • Flow 2 (95th percentile 2018.46 ms)   • Flow 3 (95th percentile 2006.93 ms)

65

```
Run 2: Statistics of Verus

Start at: 2018-01-16 00:53:37
End at: 2018-01-16 00:54:07
Local clock offset: 2.013 ms
Remote clock offset: 0.91 ms


# Below is generated by plot.py at 2018-01-16 02:16:30
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.59 Mbit/s
95th percentile per-packet one-way delay: 1753.793 ms
Loss rate: 4.15%
-- Flow 1:
Average throughput: 0.57 Mbit/s
95th percentile per-packet one-way delay: 1749.317 ms
Loss rate: 4.10%
-- Flow 2:
Average throughput: 0.03 Mbit/s
95th percentile per-packet one-way delay: 1524.138 ms
Loss rate: 4.55%
-- Flow 3:
Average throughput: 0.02 Mbit/s
95th percentile per-packet one-way delay: 1855.844 ms
Loss rate: 9.09%
```
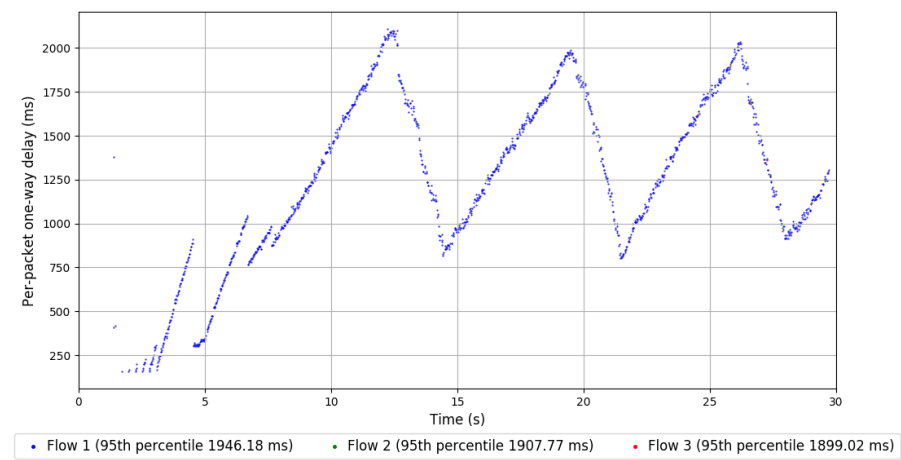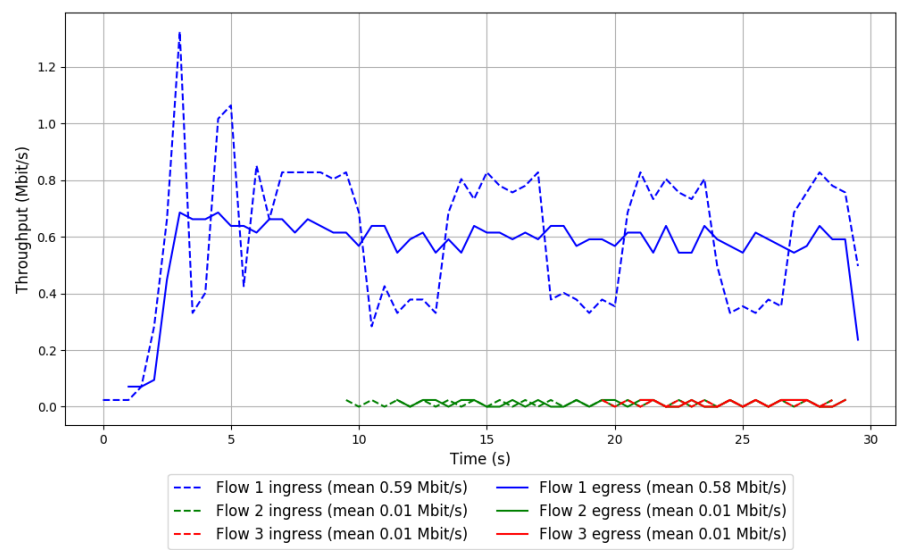
Run 2: Report of Verus — Data Link

```
Run 3: Statistics of Verus

Start at: 2018-01-16 01:12:23
End at: 2018-01-16 01:12:53
Local clock offset: 1.778 ms
Remote clock offset: 1.095 ms


# Below is generated by plot.py at 2018-01-16 02:16:30
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.59 Mbit/s
95th percentile per-packet one-way delay: 1946.179 ms
Loss rate: 6.18%
-- Flow 1:
Average throughput: 0.58 Mbit/s
95th percentile per-packet one-way delay: 1946.179 ms
Loss rate: 6.17%
-- Flow 2:
Average throughput: 0.01 Mbit/s
95th percentile per-packet one-way delay: 1907.770 ms
Loss rate: 5.00%
-- Flow 3:
Average throughput: 0.01 Mbit/s
95th percentile per-packet one-way delay: 1899.021 ms
Loss rate: 10.00%
```
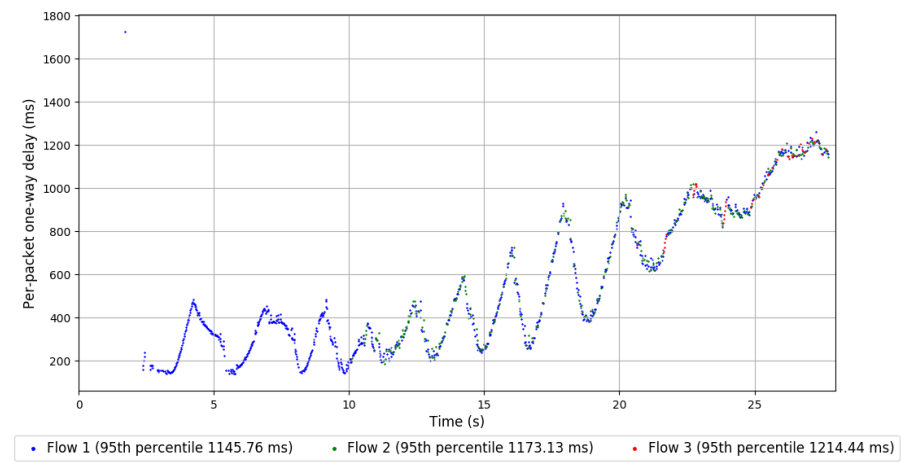
Run 3: Report of Verus — Data Link

```
Run 1: Statistics of Copa

Start at: 2018-01-16 00:24:49
End at: 2018-01-16 00:25:19
Local clock offset: 1.982 ms
Remote clock offset: 2.144 ms


# Below is generated by plot.py at 2018-01-16 02:16:30
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.58 Mbit/s
95th percentile per-packet one-way delay: 1162.335 ms
Loss rate: 4.71%
-- Flow 1:
Average throughput: 0.42 Mbit/s
95th percentile per-packet one-way delay: 1145.760 ms
Loss rate: 3.09%
-- Flow 2:
Average throughput: 0.21 Mbit/s
95th percentile per-packet one-way delay: 1173.131 ms
Loss rate: 6.58%
-- Flow 3:
Average throughput: 0.08 Mbit/s
95th percentile per-packet one-way delay: 1214.438 ms
Loss rate: 21.15%
```
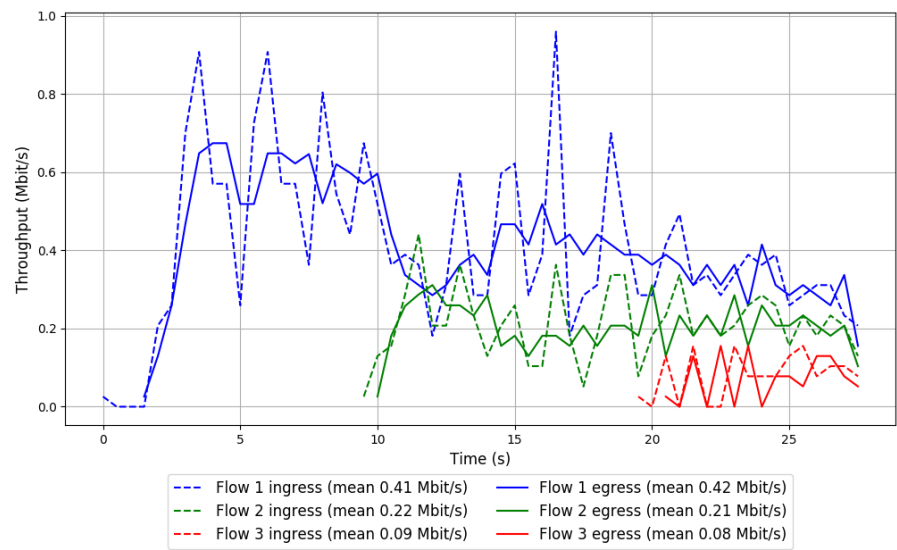
Run 1: Report of Copa — Data Link

```
Run 2: Statistics of Copa

Start at: 2018-01-16 00:43:36
End at: 2018-01-16 00:44:06
Local clock offset: 2.3 ms
Remote clock offset: 0.995 ms

# Below is generated by plot.py at 2018-01-16 02:16:30
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.37 Mbit/s
95th percentile per-packet one-way delay: 314.567 ms
Loss rate: 1.99%
-- Flow 1:
Average throughput: 0.01 Mbit/s
95th percentile per-packet one-way delay: 1734.097 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 0.44 Mbit/s
95th percentile per-packet one-way delay: 314.636 ms
Loss rate: 1.33%
-- Flow 3:
Average throughput: 0.24 Mbit/s
95th percentile per-packet one-way delay: 310.520 ms
Loss rate: 4.79%
```
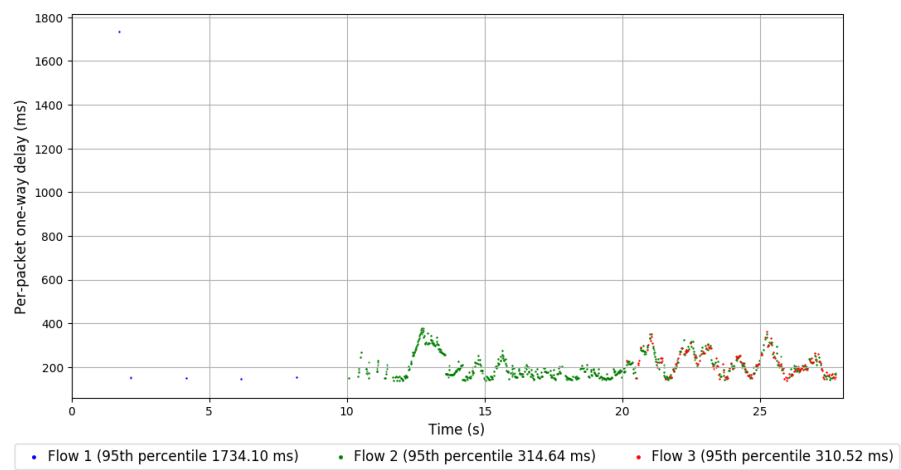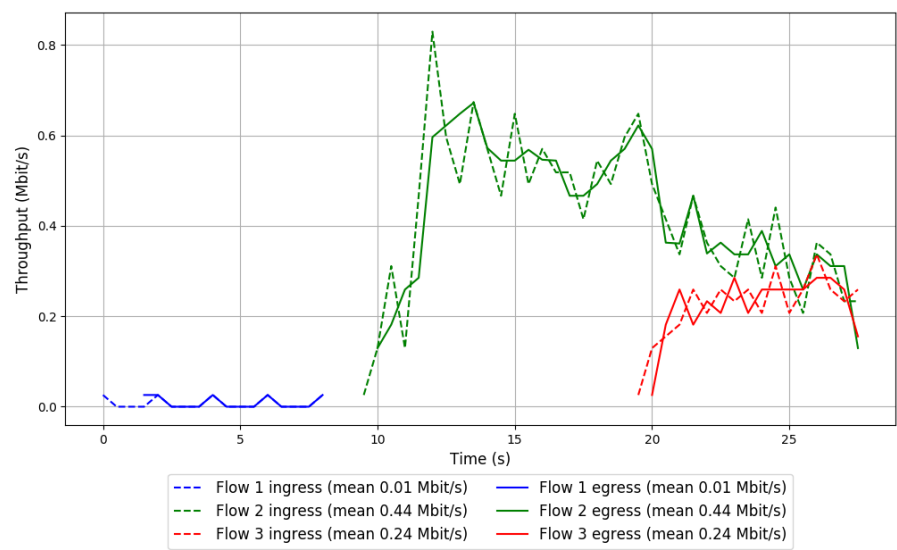
Run 2: Report of Copa — Data Link

```
Run 3: Statistics of Copa

Start at: 2018-01-16 01:02:22
End at: 2018-01-16 01:02:52
Local clock offset: 1.754 ms
Remote clock offset: 0.931 ms

# Below is generated by plot.py at 2018-01-16 02:16:30
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.58 Mbit/s
95th percentile per-packet one-way delay: 783.338 ms
Loss rate: 3.49%
-- Flow 1:
Average throughput: 0.37 Mbit/s
95th percentile per-packet one-way delay: 675.155 ms
Loss rate: 1.90%
-- Flow 2:
Average throughput: 0.26 Mbit/s
95th percentile per-packet one-way delay: 814.048 ms
Loss rate: 5.84%
-- Flow 3:
Average throughput: 0.15 Mbit/s
95th percentile per-packet one-way delay: 893.902 ms
Loss rate: 7.45%
```
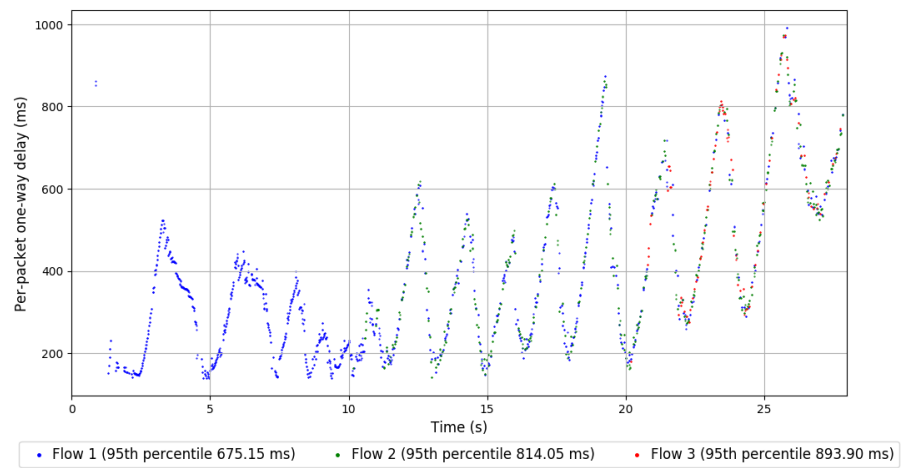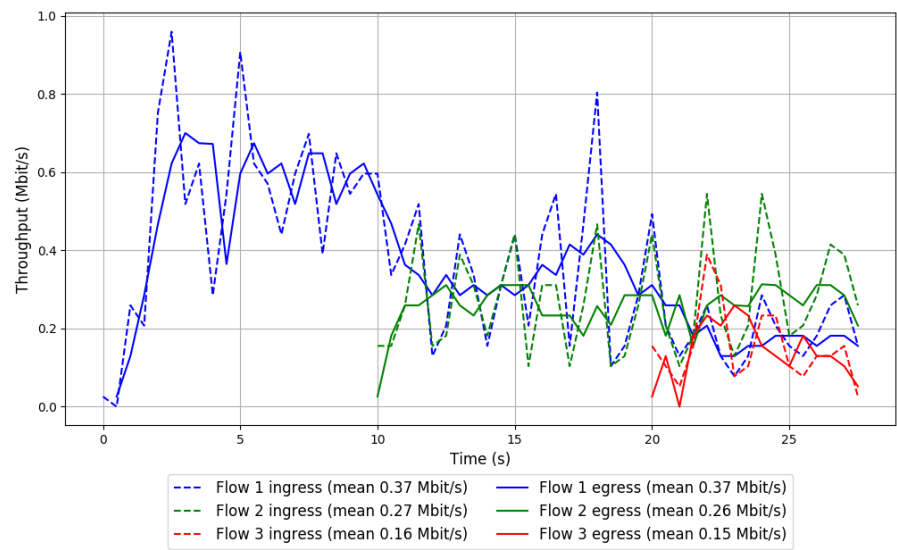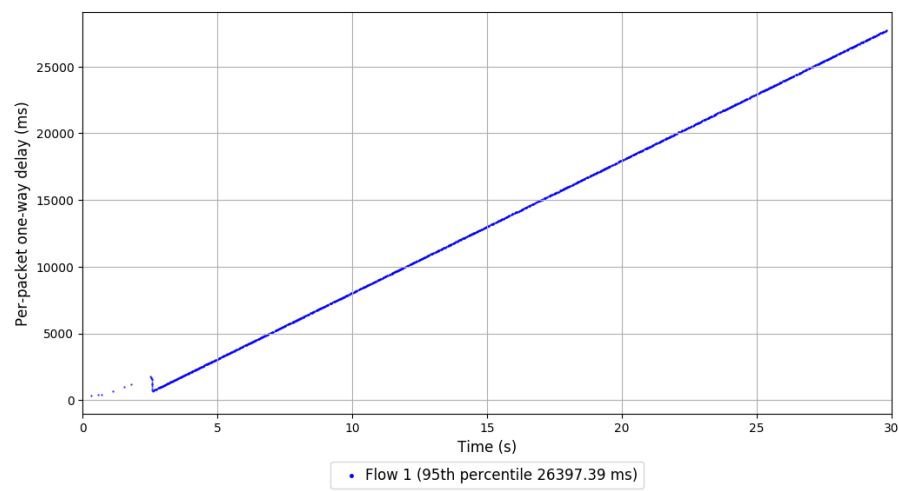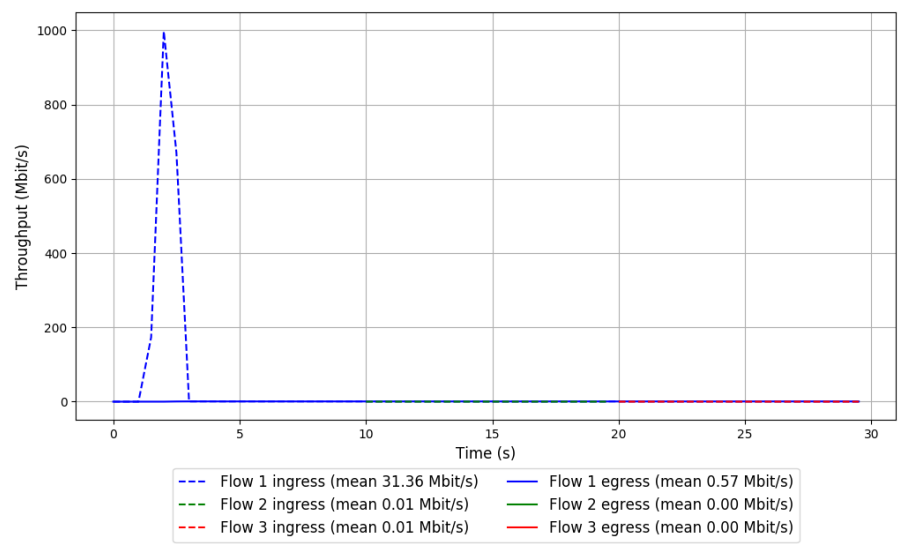
Run 3: Report of Copa — Data Link

```
Run 1: Statistics of FillP

Start at: 2018-01-16 00:31:03
End at: 2018-01-16 00:31:33
Local clock offset: 2.046 ms
Remote clock offset: -3.615 ms


# Below is generated by plot.py at 2018-01-16 02:16:31
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.57 Mbit/s
95th percentile per-packet one-way delay: 26397.392 ms
Loss rate: 98.21%
-- Flow 1:
Average throughput: 0.57 Mbit/s
95th percentile per-packet one-way delay: 26397.392 ms
Loss rate: 98.21%
-- Flow 2:
Average throughput: 0.00 Mbit/s
-- Flow 3:
Average throughput: 0.00 Mbit/s
```

Run 1: Report of FillP — Data Link

```
Run 2: Statistics of FillP

Start at: 2018-01-16 00:49:51
End at: 2018-01-16 00:50:21
Local clock offset: 2.092 ms
Remote clock offset: 0.966 ms


# Below is generated by plot.py at 2018-01-16 02:16:32
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.57 Mbit/s
95th percentile per-packet one-way delay: 25912.321 ms
Loss rate: 98.04%
-- Flow 1:
Average throughput: 0.57 Mbit/s
95th percentile per-packet one-way delay: 25912.321 ms
Loss rate: 98.04%
-- Flow 2:
Average throughput: 0.00 Mbit/s
-- Flow 3:
Average throughput: 0.00 Mbit/s
```
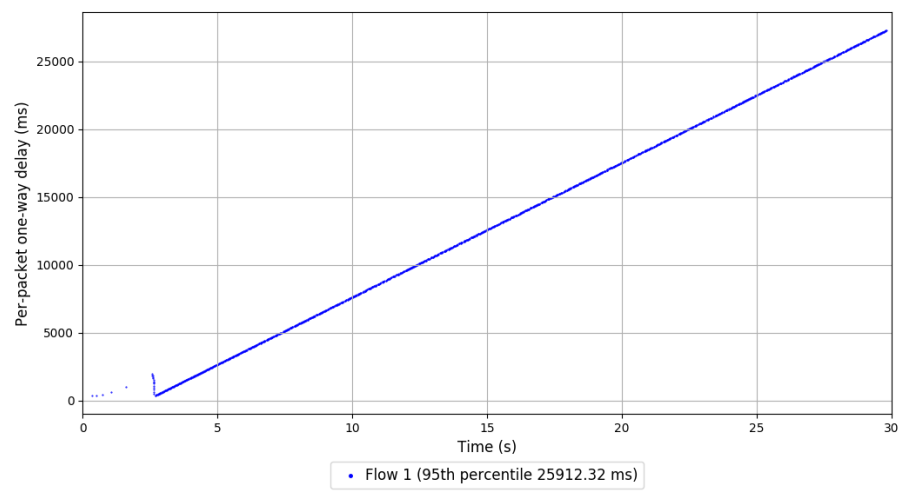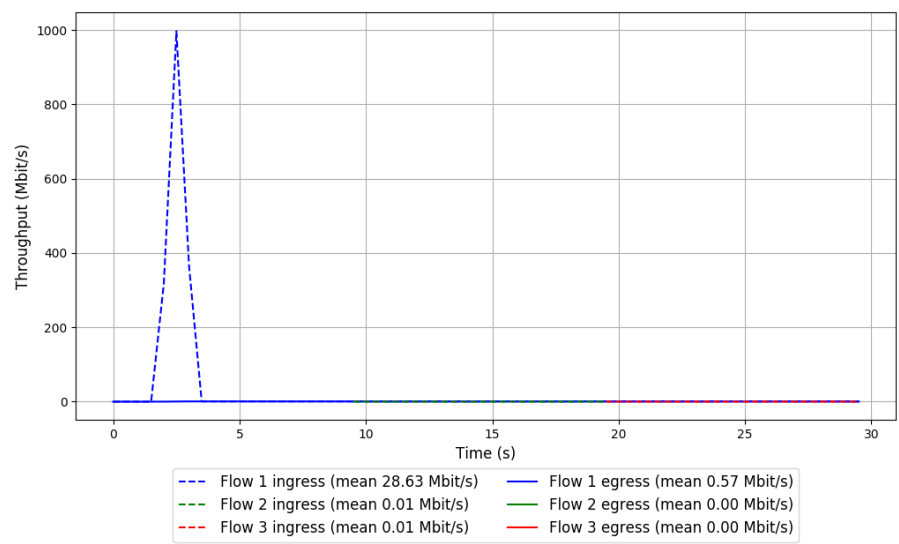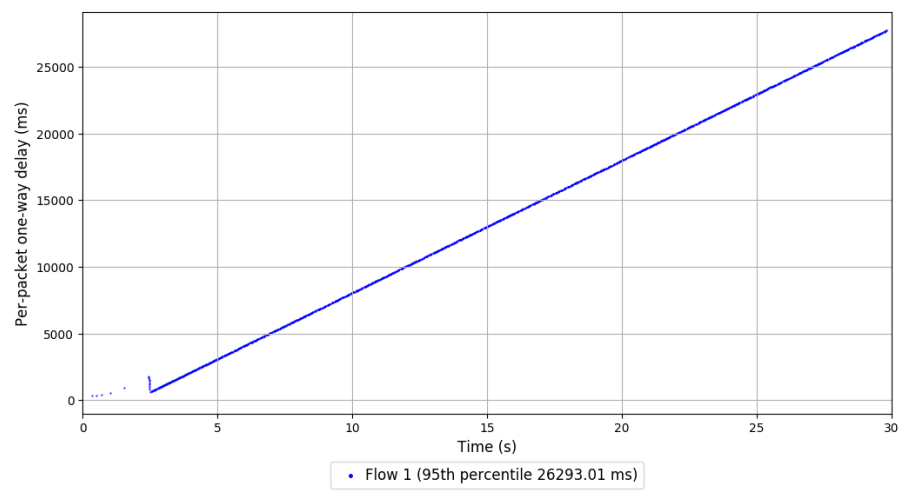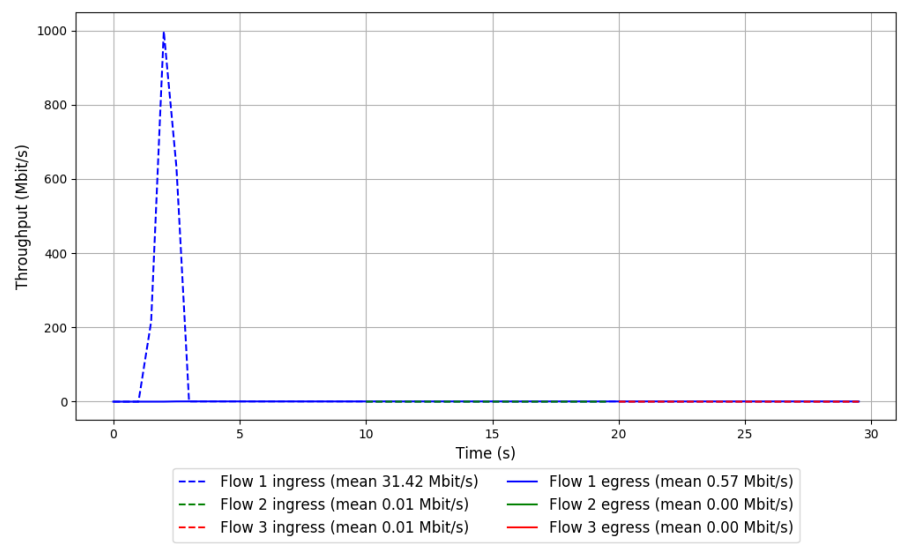
Run 2: Report of FillP — Data Link

```
Run 3: Statistics of FillP

Start at: 2018-01-16 01:08:37
End at: 2018-01-16 01:09:07
Local clock offset: 1.805 ms
Remote clock offset: -3.812 ms


# Below is generated by plot.py at 2018-01-16 02:16:32
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.57 Mbit/s
95th percentile per-packet one-way delay: 26293.006 ms
Loss rate: 98.21%
-- Flow 1:
Average throughput: 0.57 Mbit/s
95th percentile per-packet one-way delay: 26293.006 ms
Loss rate: 98.21%
-- Flow 2:
Average throughput: 0.00 Mbit/s
-- Flow 3:
Average throughput: 0.00 Mbit/s
```

Run 3: Report of FillP — Data Link

Flow 1 ingress (mean 31.42 Mbit/s)   Flow 1 egress (mean 0.57 Mbit/s)
Flow 2 ingress (mean 0.01 Mbit/s)   Flow 2 egress (mean 0.00 Mbit/s)
Flow 3 ingress (mean 0.01 Mbit/s)   Flow 3 egress (mean 0.00 Mbit/s)

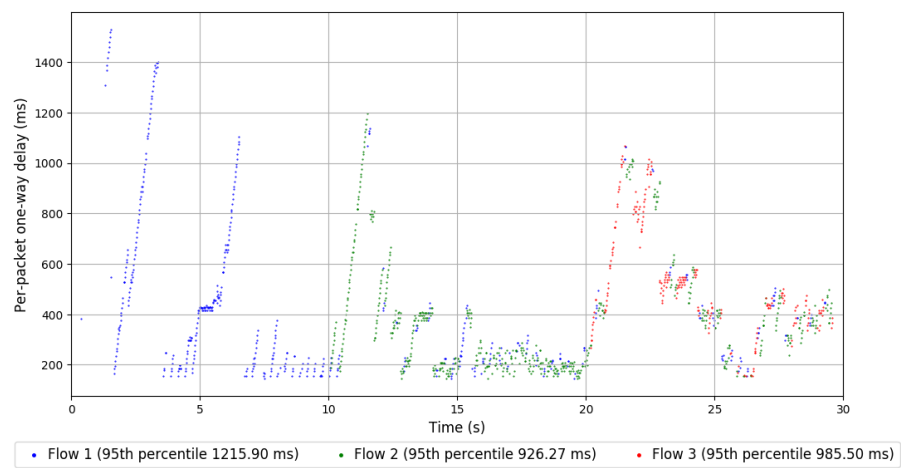
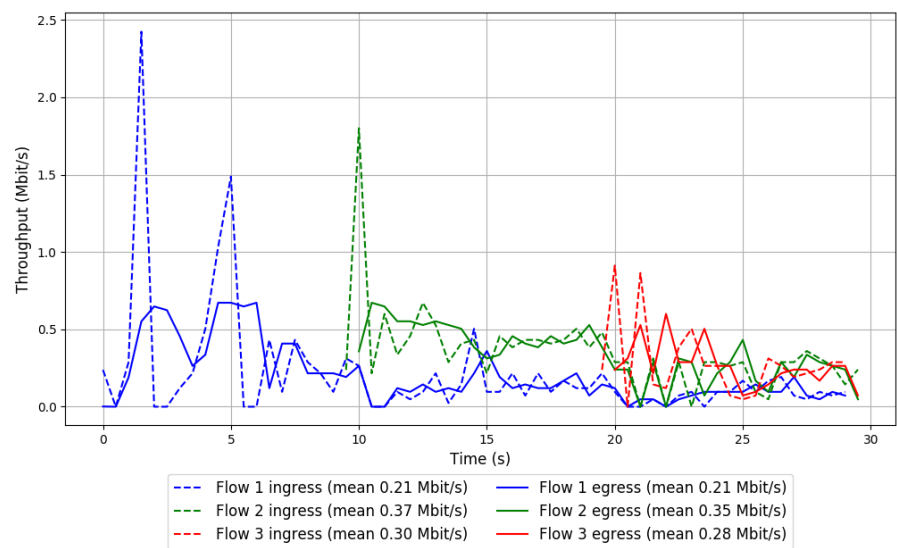
Flow 1 (95th percentile 26293.01 ms)

```
Run 1: Statistics of Indigo

Start at: 2018-01-16 00:39:49
End at: 2018-01-16 00:40:19
Local clock offset: 2.37 ms
Remote clock offset: -3.865 ms


# Below is generated by plot.py at 2018-01-16 02:16:32
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.53 Mbit/s
95th percentile per-packet one-way delay: 1015.165 ms
Loss rate: 5.59%
-- Flow 1:
Average throughput: 0.21 Mbit/s
95th percentile per-packet one-way delay: 1215.898 ms
Loss rate: 5.18%
-- Flow 2:
Average throughput: 0.35 Mbit/s
95th percentile per-packet one-way delay: 926.269 ms
Loss rate: 5.32%
-- Flow 3:
Average throughput: 0.28 Mbit/s
95th percentile per-packet one-way delay: 985.505 ms
Loss rate: 7.18%
```

Run 1: Report of Indigo — Data Link

```
Run 2: Statistics of Indigo

Start at: 2018-01-16 00:58:36
End at: 2018-01-16 00:59:06
Local clock offset: 1.79 ms
Remote clock offset: 0.867 ms


# Below is generated by plot.py at 2018-01-16 02:16:32
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.53 Mbit/s
95th percentile per-packet one-way delay: 1121.006 ms
Loss rate: 6.37%
-- Flow 1:
Average throughput: 0.21 Mbit/s
95th percentile per-packet one-way delay: 1014.195 ms
Loss rate: 2.08%
-- Flow 2:
Average throughput: 0.31 Mbit/s
95th percentile per-packet one-way delay: 1142.343 ms
Loss rate: 8.26%
-- Flow 3:
Average throughput: 0.32 Mbit/s
95th percentile per-packet one-way delay: 1142.781 ms
Loss rate: 10.76%
```
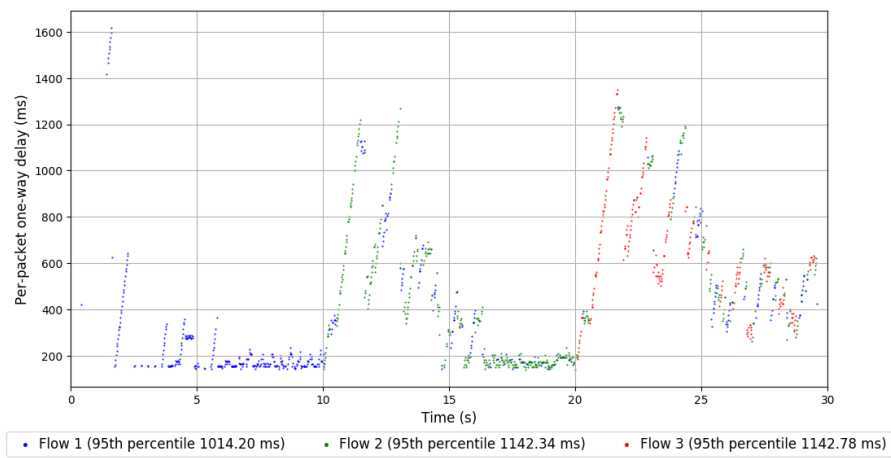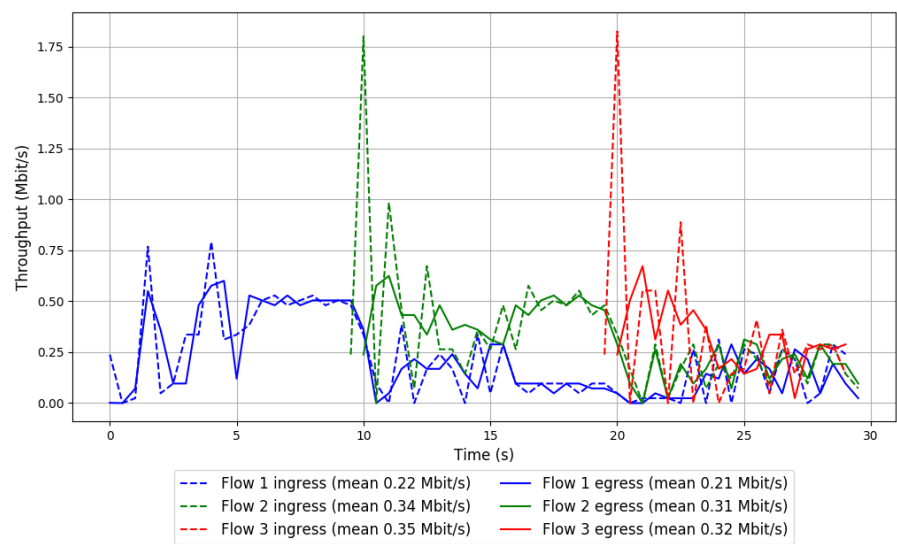
Run 2: Report of Indigo — Data Link

```
Run 3: Statistics of Indigo

Start at: 2018-01-16 01:17:22
End at: 2018-01-16 01:17:52
Local clock offset: 1.758 ms
Remote clock offset: -4.414 ms


# Below is generated by plot.py at 2018-01-16 02:16:32
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.53 Mbit/s
95th percentile per-packet one-way delay: 1528.656 ms
Loss rate: 10.42%
-- Flow 1:
Average throughput: 0.26 Mbit/s
95th percentile per-packet one-way delay: 1589.710 ms
Loss rate: 11.63%
-- Flow 2:
Average throughput: 0.24 Mbit/s
95th percentile per-packet one-way delay: 1617.689 ms
Loss rate: 7.37%
-- Flow 3:
Average throughput: 0.38 Mbit/s
95th percentile per-packet one-way delay: 1377.619 ms
Loss rate: 11.54%
```

Run 3: Report of Indigo — Data Link