

## Pantheon Report

Generated at 2018-01-26 05:04:57 (UTC).

Data path: AWS California 1 Ethernet (*local*) → Stanford ppp0 (*remote*).

Repeated the test of 15 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).

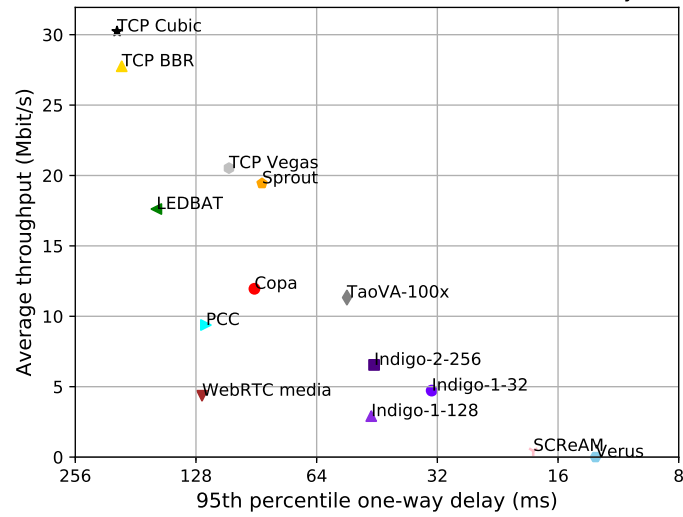
Tested BBR with qdisc of Fair Queuing (*fq*), and other schemes with the default Linux qdisc (*pfifo\_fast*).

NTP offsets were measured against `time.stanford.edu` and have been applied to correct the timestamps in logs.

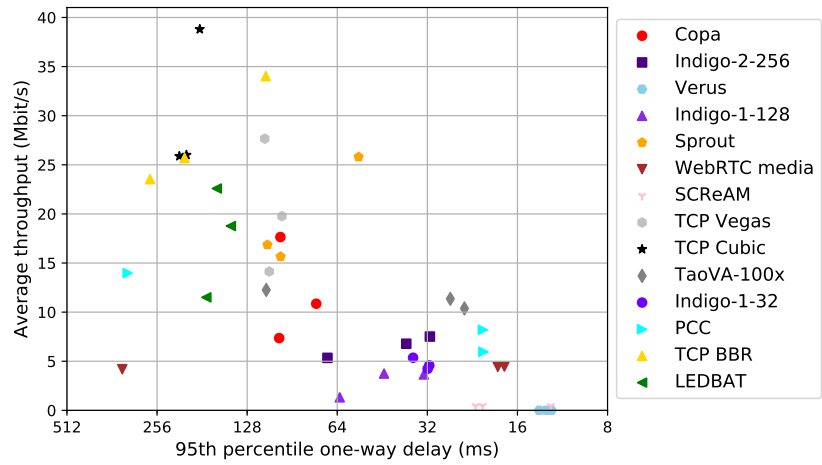
Git summary:

```
branch: master @ f23294ec38436c9f802847d477a41b7343ec76e6
third_party/calibrated_koho @ 3cb73c0d1c0322cdfae446ea37a522e53227db50
  M datagrump/sender.cc
third_party/fillp @ ec9585325218d5048c4d4152fa42240af54c6e67
third_party/genericCC @ 80b516c448f795fd6e9675f7177b69c622f07da8
third_party/indigo @ a9b2060d39e4da2e8987e893e3eca2a6c7cd0ab9
third_party/indigo-1-layer-128-unit @ 3ae9e4ef4230db7484501f82ce8b377695f2f66d
third_party/indigo-1-layer-32-unit @ 2601c92e4aa9d58d38dc4dfe0ecd9c077e64d
third_party/indigo-1-layer-32-unit-no-calib @ 1f3a7f75b41135ed5b540c0fd3505939528e2a5f
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 @ f1a14bffe749737437f61b1eae30b267cde681
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 AWS California 1 Ethernet to Stanford ppp0, 3 runs of 30s each per scheme  
 3 flows with 10s interval between flows (mean of all runs by scheme)



test from AWS California 1 Ethernet to Stanford ppp0, 3 runs of 30s each per scheme  
 3 flows with 10s interval between flows



scheme	# runs	mean avg tput (Mbit/s)			mean 95th-%ile delay (ms)			mean loss rate (%)		
		flow 1	flow 2	flow 3	flow 1	flow 2	flow 3	flow 1	flow 2	flow 3
TCP BBR	3	14.81	13.66	11.55	147.33	234.37	178.27	0.09	0.22	0.68
TCP Cubic	3	19.46	12.28	7.83	201.19	204.02	216.33	0.37	0.66	2.01
LEDBAT	3	12.14	6.45	3.60	150.66	179.92	179.06	0.14	0.44	1.23
PCC	3	2.78	3.56	12.74	100.80	110.33	125.69	1.45	2.19	4.88
QUIC Cubic	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SCReAM	3	0.22	0.22	0.22	18.33	18.79	17.32	0.00	0.00	0.00
WebRTC media	3	2.29	1.47	0.60	24.23	114.78	198.44	0.14	0.16	0.59
Sprout	3	10.75	9.21	7.67	82.37	89.71	97.08	0.07	0.02	0.46
TaoVA-100x	3	5.54	5.67	7.39	51.24	31.66	81.02	0.00	0.00	0.00
TCP Vegas	3	6.13	13.26	16.68	80.88	77.44	103.41	0.00	0.00	0.00
Verus	3	0.00	0.00	0.00	14.45	12.51	13.53	0.00	0.00	0.00
Copa	3	6.96	5.56	4.87	87.64	99.70	97.52	0.03	0.06	0.19
Indigo-2-256	3	2.26	3.82	5.45	41.88	44.16	51.47	0.00	0.00	0.00
Indigo-1-32	3	1.63	2.61	4.16	29.61	29.48	34.98	0.00	0.00	0.00
Indigo-1-128	3	0.83	1.98	2.36	29.54	55.91	73.21	0.00	0.00	0.00

Run 1: Statistics of TCP BBR

Start at: 2018-01-26 02:49:44

End at: 2018-01-26 02:50:14

Local clock offset: 2.709 ms

# Below is generated by plot.py at 2018-01-26 05:03:47

# Datalink statistics

-- Total of 3 flows:

Average throughput: 23.54 Mbit/s

95th percentile per-packet one-way delay: 270.183 ms

Loss rate: 0.18%

-- Flow 1:

Average throughput: 10.15 Mbit/s

95th percentile per-packet one-way delay: 171.203 ms

Loss rate: 0.11%

-- Flow 2:

Average throughput: 12.99 Mbit/s

95th percentile per-packet one-way delay: 343.087 ms

Loss rate: 0.20%

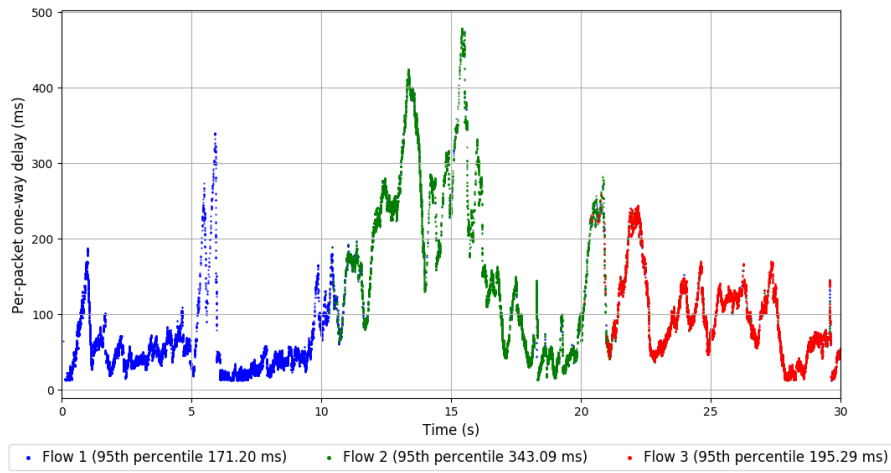
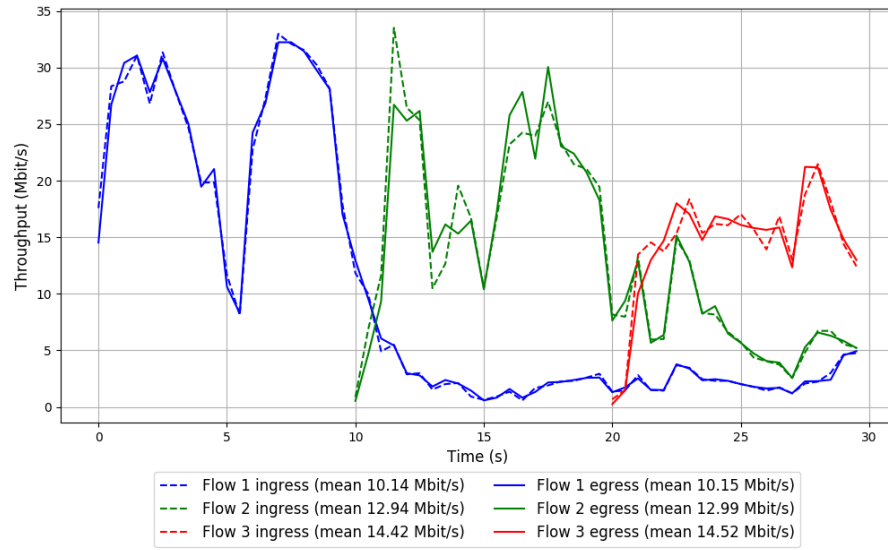
-- Flow 3:

Average throughput: 14.52 Mbit/s

95th percentile per-packet one-way delay: 195.295 ms

Loss rate: 0.32%

# Run 1: Report of TCP BBR — Data Link



Run 2: Statistics of TCP BBR

Start at: 2018-01-26 03:36:41

End at: 2018-01-26 03:37:11

Local clock offset: 2.463 ms

# Below is generated by plot.py at 2018-01-26 05:03:51

# Datalink statistics

-- Total of 3 flows:

Average throughput: 25.70 Mbit/s

95th percentile per-packet one-way delay: 207.128 ms

Loss rate: 0.30%

-- Flow 1:

Average throughput: 16.46 Mbit/s

95th percentile per-packet one-way delay: 174.035 ms

Loss rate: 0.14%

-- Flow 2:

Average throughput: 11.25 Mbit/s

95th percentile per-packet one-way delay: 252.507 ms

Loss rate: 0.40%

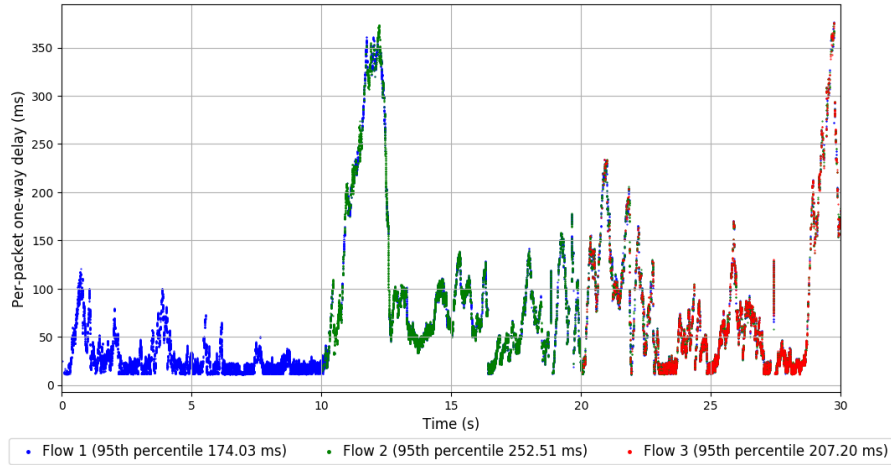
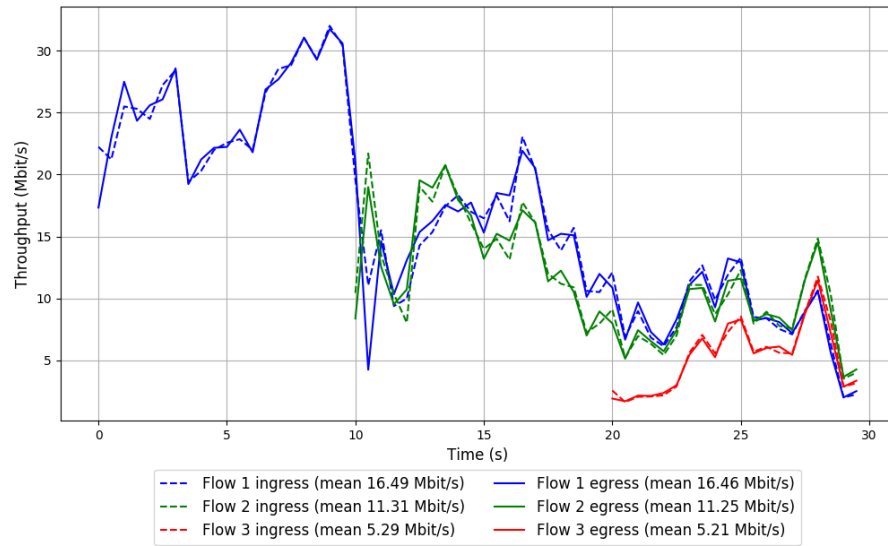
-- Flow 3:

Average throughput: 5.21 Mbit/s

95th percentile per-packet one-way delay: 207.198 ms

Loss rate: 1.41%

## Run 2: Report of TCP BBR — Data Link



Run 3: Statistics of TCP BBR

Start at: 2018-01-26 04:23:39

End at: 2018-01-26 04:24:09

Local clock offset: -4.099 ms

# Below is generated by plot.py at 2018-01-26 05:04:04

# Datalink statistics

-- Total of 3 flows:

Average throughput: 34.03 Mbit/s

95th percentile per-packet one-way delay: 110.880 ms

Loss rate: 0.08%

-- Flow 1:

Average throughput: 17.83 Mbit/s

95th percentile per-packet one-way delay: 96.745 ms

Loss rate: 0.03%

-- Flow 2:

Average throughput: 16.75 Mbit/s

95th percentile per-packet one-way delay: 107.523 ms

Loss rate: 0.06%

-- Flow 3:

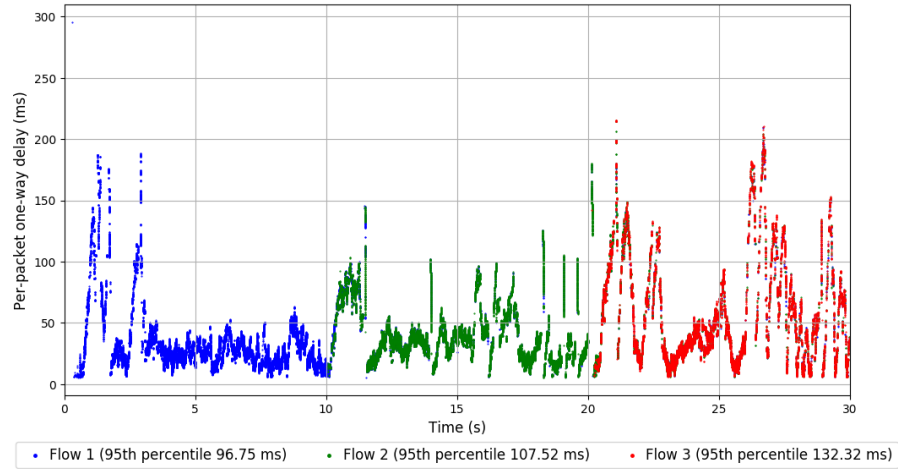
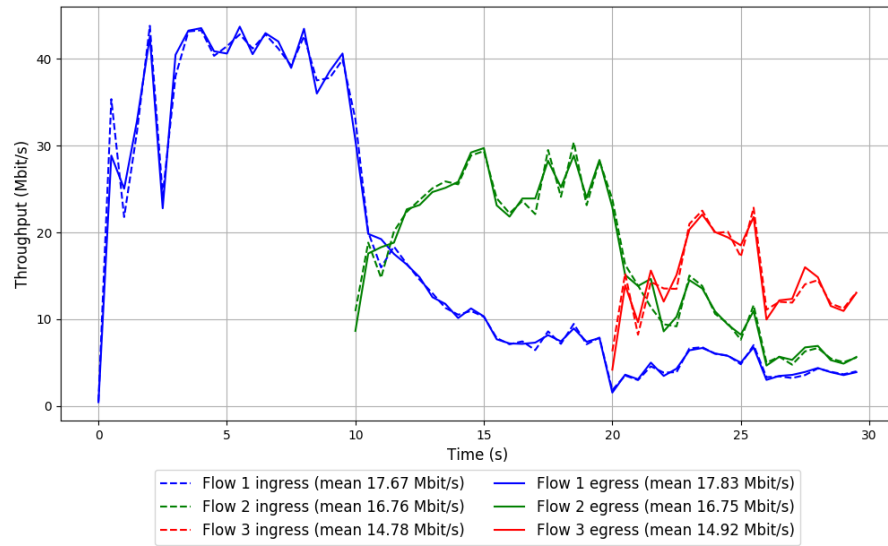
Average throughput: 14.92 Mbit/s

95th percentile per-packet one-way delay: 132.323 ms

Loss rate: 0.30%



### Run 3: Report of TCP BBR — Data Link



Run 1: Statistics of TCP Cubic

Start at: 2018-01-26 02:55:37

End at: 2018-01-26 02:56:07

Local clock offset: 2.634 ms

# Below is generated by plot.py at 2018-01-26 05:04:04

# Datalink statistics

-- Total of 3 flows:

Average throughput: 26.00 Mbit/s

95th percentile per-packet one-way delay: 204.230 ms

Loss rate: 0.60%

-- Flow 1:

Average throughput: 19.53 Mbit/s

95th percentile per-packet one-way delay: 201.819 ms

Loss rate: 0.38%

-- Flow 2:

Average throughput: 6.75 Mbit/s

95th percentile per-packet one-way delay: 208.289 ms

Loss rate: 0.82%

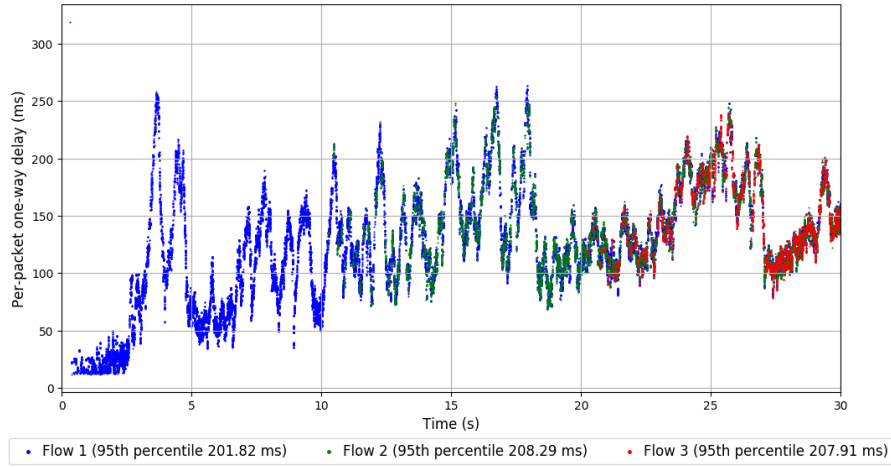
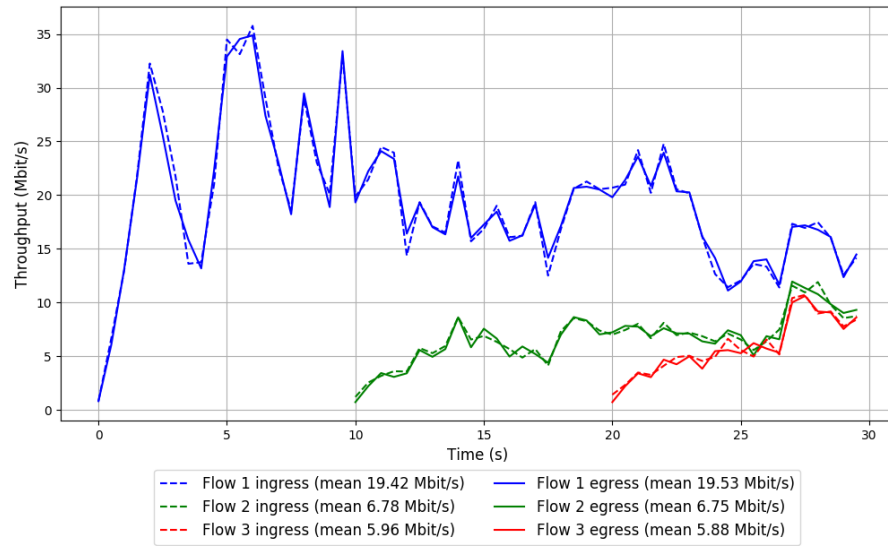
-- Flow 3:

Average throughput: 5.88 Mbit/s

95th percentile per-packet one-way delay: 207.907 ms

Loss rate: 2.23%

# Run 1: Report of TCP Cubic — Data Link



Run 2: Statistics of TCP Cubic

Start at: 2018-01-26 03:42:34

End at: 2018-01-26 03:43:04

Local clock offset: 0.132 ms

# Below is generated by plot.py at 2018-01-26 05:04:04

# Datalink statistics

-- Total of 3 flows:

Average throughput: 25.88 Mbit/s

95th percentile per-packet one-way delay: 215.623 ms

Loss rate: 0.43%

-- Flow 1:

Average throughput: 17.58 Mbit/s

95th percentile per-packet one-way delay: 208.914 ms

Loss rate: 0.30%

-- Flow 2:

Average throughput: 9.85 Mbit/s

95th percentile per-packet one-way delay: 233.043 ms

Loss rate: 0.38%

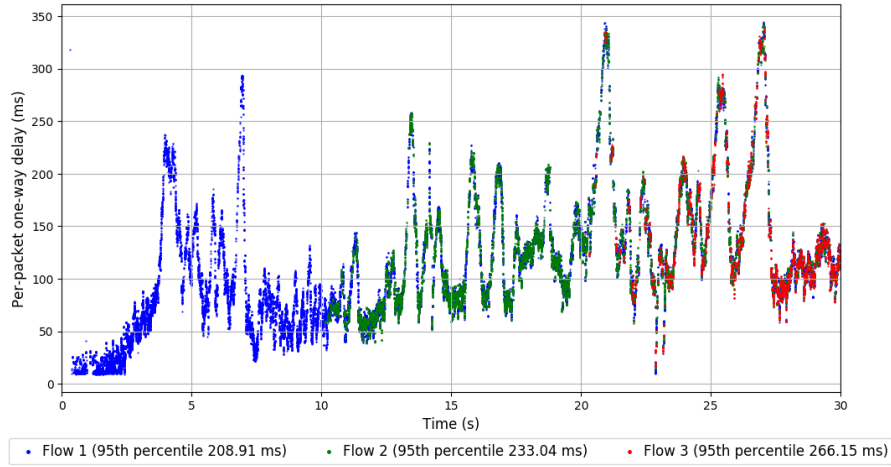
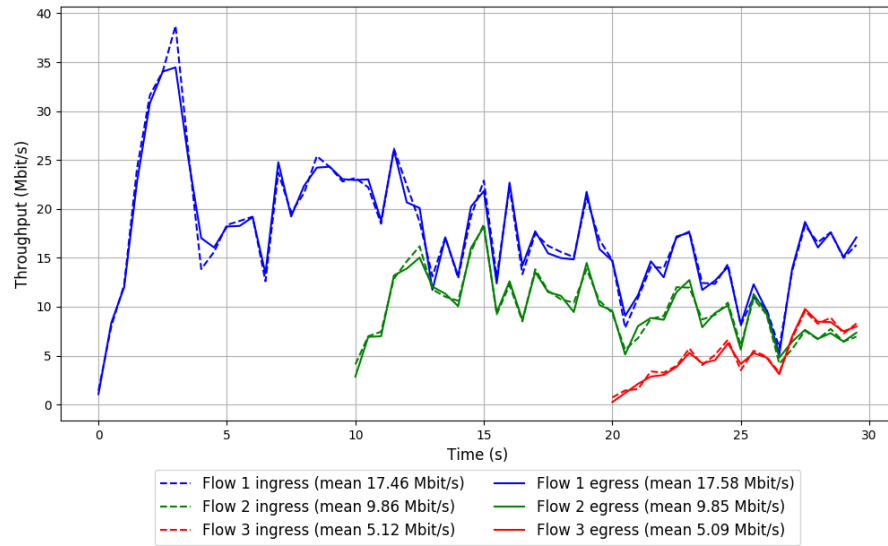
-- Flow 3:

Average throughput: 5.09 Mbit/s

95th percentile per-packet one-way delay: 266.152 ms

Loss rate: 2.00%

## Run 2: Report of TCP Cubic — Data Link



Run 3: Statistics of TCP Cubic

Start at: 2018-01-26 04:29:32

End at: 2018-01-26 04:30:02

Local clock offset: -4.28 ms

# Below is generated by plot.py at 2018-01-26 05:04:11

# Datalink statistics

-- Total of 3 flows:

Average throughput: 38.81 Mbit/s

95th percentile per-packet one-way delay: 184.343 ms

Loss rate: 0.69%

-- Flow 1:

Average throughput: 21.28 Mbit/s

95th percentile per-packet one-way delay: 192.843 ms

Loss rate: 0.42%

-- Flow 2:

Average throughput: 20.24 Mbit/s

95th percentile per-packet one-way delay: 170.721 ms

Loss rate: 0.77%

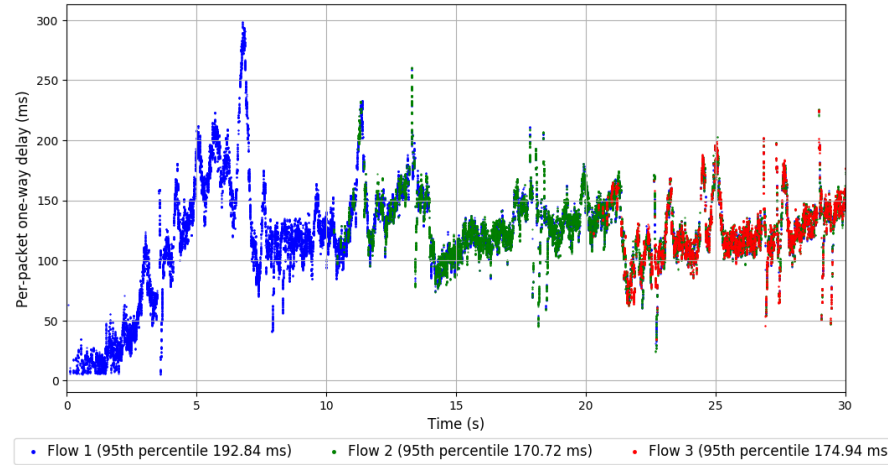
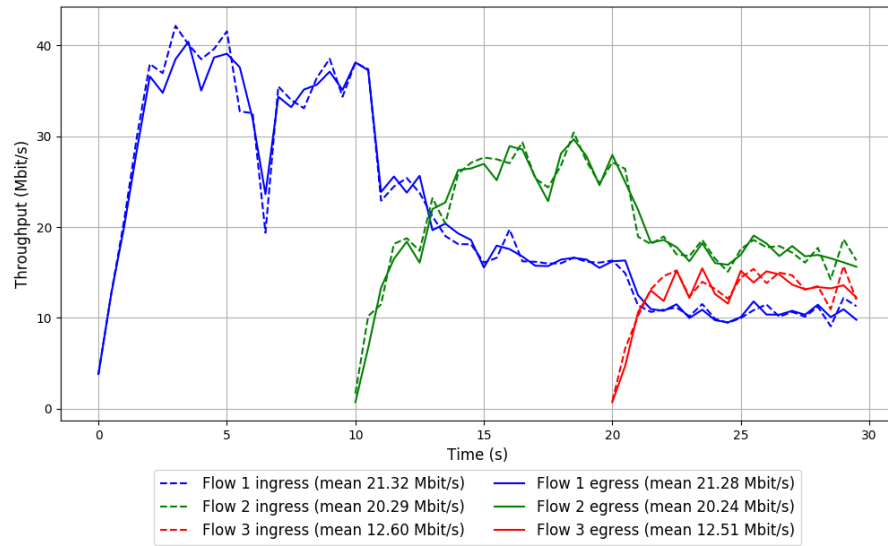
-- Flow 3:

Average throughput: 12.51 Mbit/s

95th percentile per-packet one-way delay: 174.945 ms

Loss rate: 1.81%

### Run 3: Report of TCP Cubic — Data Link



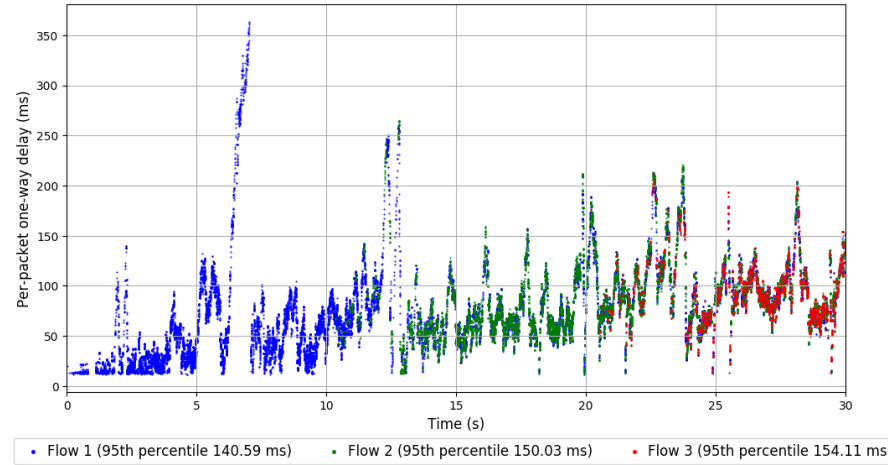
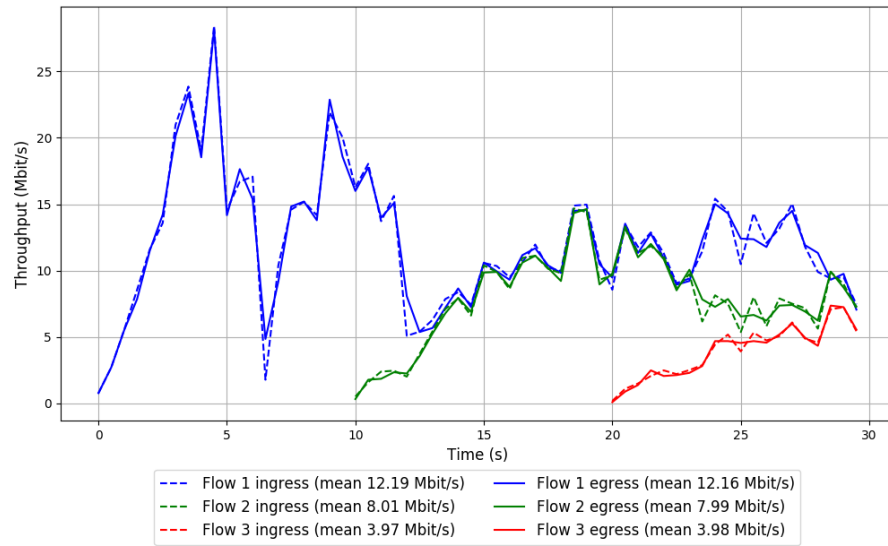
```
Run 1: Statistics of LEDBAT

Start at: 2018-01-26 03:27:52
End at: 2018-01-26 03:28:22
Local clock offset: 2.407 ms

# Below is generated by plot.py at 2018-01-26 05:04:11
# Datalink statistics
-- Total of 3 flows:
Average throughput: 18.77 Mbit/s
95th percentile per-packet one-way delay: 145.134 ms
Loss rate: 0.34%
-- Flow 1:
Average throughput: 12.16 Mbit/s
95th percentile per-packet one-way delay: 140.588 ms
Loss rate: 0.22%
-- Flow 2:
Average throughput: 7.99 Mbit/s
95th percentile per-packet one-way delay: 150.035 ms
Loss rate: 0.41%
-- Flow 3:
Average throughput: 3.98 Mbit/s
95th percentile per-packet one-way delay: 154.113 ms
Loss rate: 1.16%
```



## Run 1: Report of LEDBAT — Data Link



Run 2: Statistics of LEDBAT

Start at: 2018-01-26 04:14:49

End at: 2018-01-26 04:15:19

Local clock offset: -4.392 ms

# Below is generated by plot.py at 2018-01-26 05:04:11

# Datalink statistics

-- Total of 3 flows:

Average throughput: 11.50 Mbit/s

95th percentile per-packet one-way delay: 175.235 ms

Loss rate: 0.16%

-- Flow 1:

Average throughput: 9.94 Mbit/s

95th percentile per-packet one-way delay: 167.420 ms

Loss rate: 0.05%

-- Flow 2:

Average throughput: 1.66 Mbit/s

95th percentile per-packet one-way delay: 212.304 ms

Loss rate: 0.71%

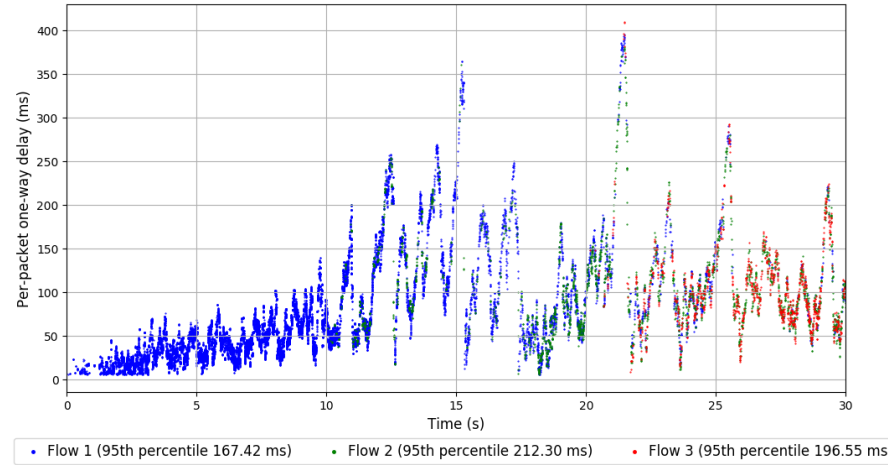
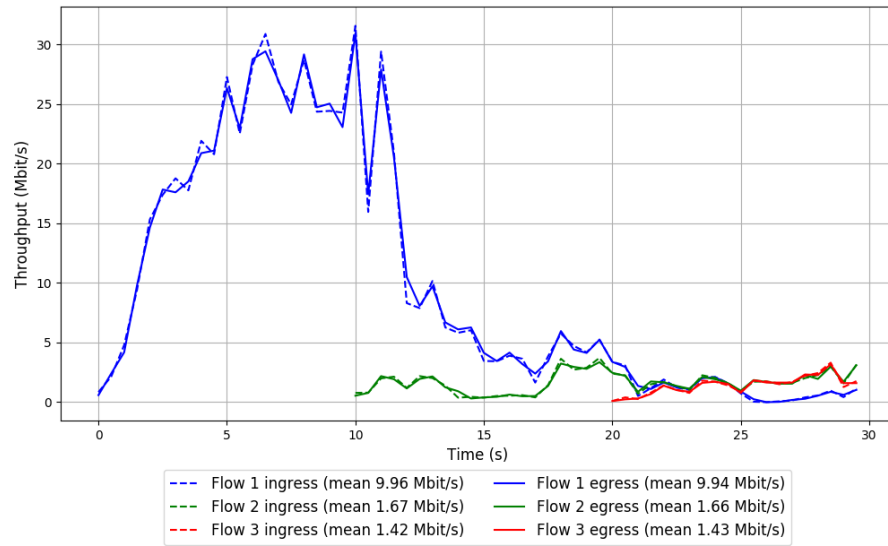
-- Flow 3:

Average throughput: 1.43 Mbit/s

95th percentile per-packet one-way delay: 196.548 ms

Loss rate: 1.24%

## Run 2: Report of LEDBAT — Data Link



Run 3: Statistics of LEDBAT

Start at: 2018-01-26 05:01:49

End at: 2018-01-26 05:02:19

Local clock offset: 2.203 ms

# Below is generated by plot.py at 2018-01-26 05:04:11

# Datalink statistics

-- Total of 3 flows:

Average throughput: 22.59 Mbit/s

95th percentile per-packet one-way delay: 161.673 ms

Loss rate: 0.25%

-- Flow 1:

Average throughput: 14.31 Mbit/s

95th percentile per-packet one-way delay: 143.979 ms

Loss rate: 0.14%

-- Flow 2:

Average throughput: 9.70 Mbit/s

95th percentile per-packet one-way delay: 177.432 ms

Loss rate: 0.19%

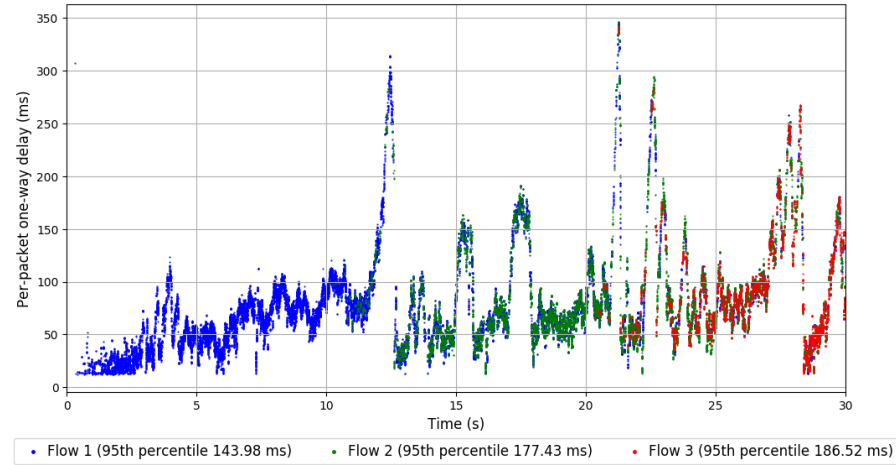
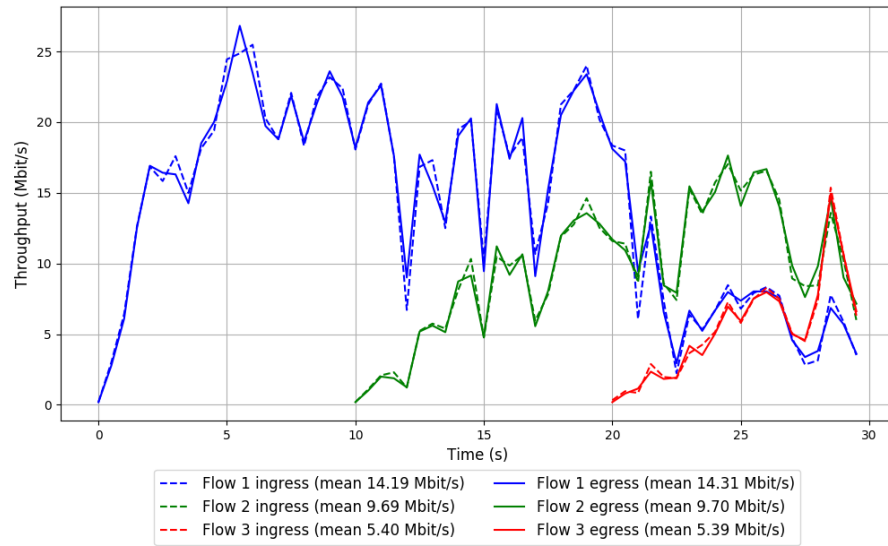
-- Flow 3:

Average throughput: 5.39 Mbit/s

95th percentile per-packet one-way delay: 186.520 ms

Loss rate: 1.29%

### Run 3: Report of LEDBAT — Data Link

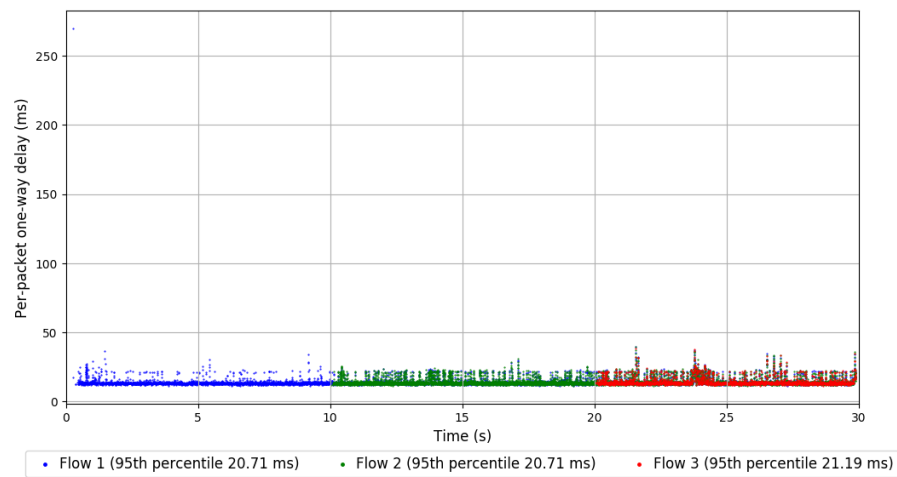
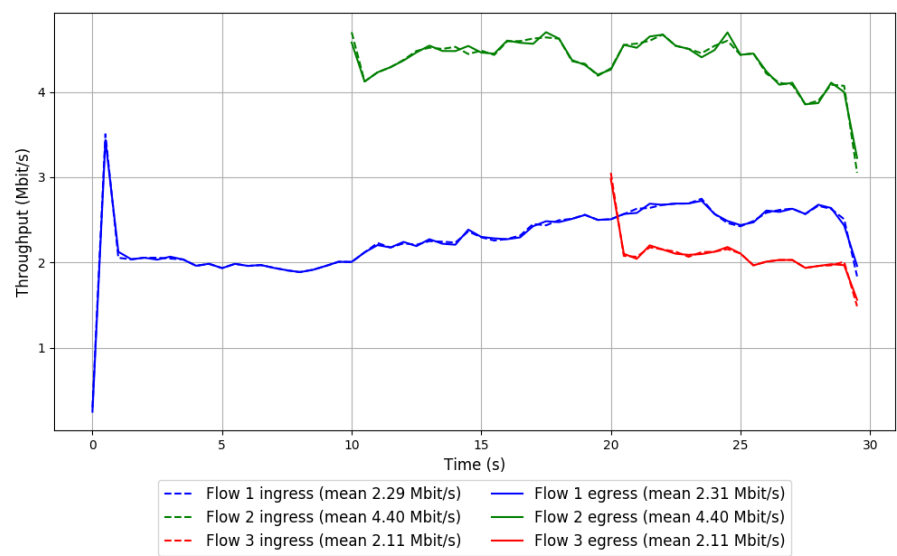


```
Run 1: Statistics of PCC

Start at: 2018-01-26 03:07:21
End at: 2018-01-26 03:07:51
Local clock offset: 2.59 ms

# Below is generated by plot.py at 2018-01-26 05:04:11
# Datalink statistics
-- Total of 3 flows:
Average throughput: 5.96 Mbit/s
95th percentile per-packet one-way delay: 20.787 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 2.31 Mbit/s
95th percentile per-packet one-way delay: 20.706 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 4.40 Mbit/s
95th percentile per-packet one-way delay: 20.710 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 2.11 Mbit/s
95th percentile per-packet one-way delay: 21.192 ms
Loss rate: 0.00%
```

Run 1: Report of PCC — Data Link



Run 2: Statistics of PCC

Start at: 2018-01-26 03:54:18

End at: 2018-01-26 03:54:48

Local clock offset: -2.764 ms

# Below is generated by plot.py at 2018-01-26 05:04:11

# Datalink statistics

-- Total of 3 flows:

Average throughput: 8.21 Mbit/s

95th percentile per-packet one-way delay: 20.877 ms

Loss rate: 0.00%

-- Flow 1:

Average throughput: 2.42 Mbit/s

95th percentile per-packet one-way delay: 17.466 ms

Loss rate: 0.00%

-- Flow 2:

Average throughput: 4.22 Mbit/s

95th percentile per-packet one-way delay: 20.662 ms

Loss rate: 0.00%

-- Flow 3:

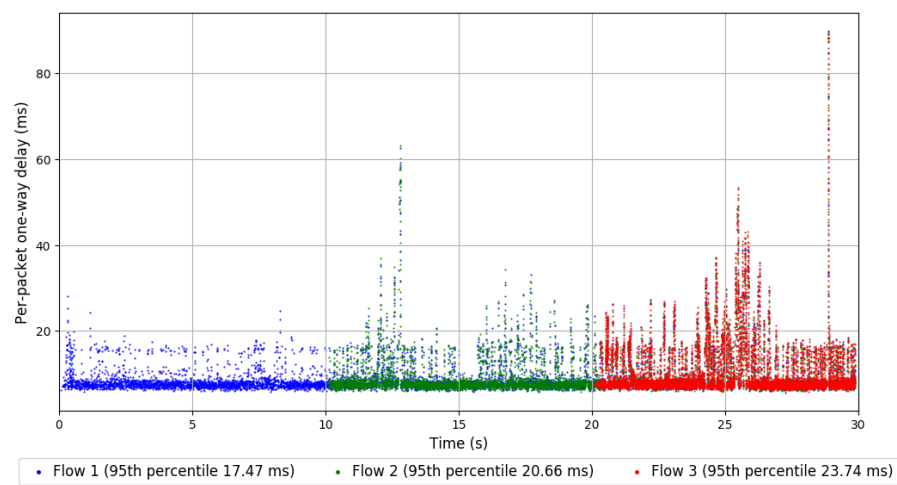
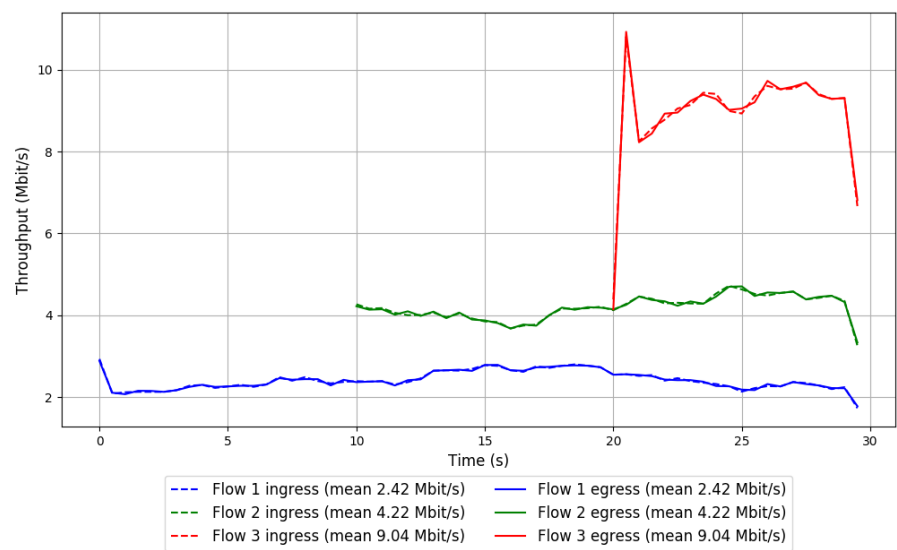
Average throughput: 9.04 Mbit/s

95th percentile per-packet one-way delay: 23.740 ms

Loss rate: 0.00%



Run 2: Report of PCC — Data Link



Run 3: Statistics of PCC

Start at: 2018-01-26 04:41:17

End at: 2018-01-26 04:41:47

Local clock offset: -4.625 ms

# Below is generated by plot.py at 2018-01-26 05:04:14

# Datalink statistics

-- Total of 3 flows:

Average throughput: 13.98 Mbit/s

95th percentile per-packet one-way delay: 320.983 ms

Loss rate: 11.44%

-- Flow 1:

Average throughput: 3.60 Mbit/s

95th percentile per-packet one-way delay: 264.216 ms

Loss rate: 4.36%

-- Flow 2:

Average throughput: 2.06 Mbit/s

95th percentile per-packet one-way delay: 289.610 ms

Loss rate: 6.56%

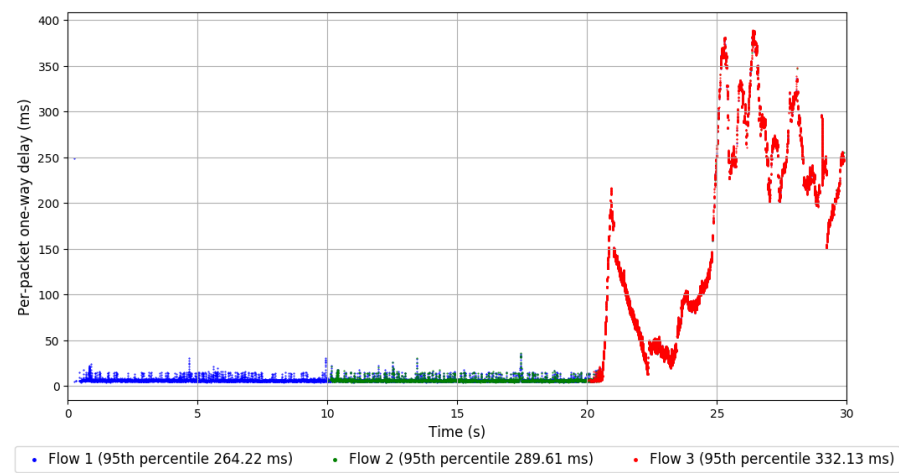
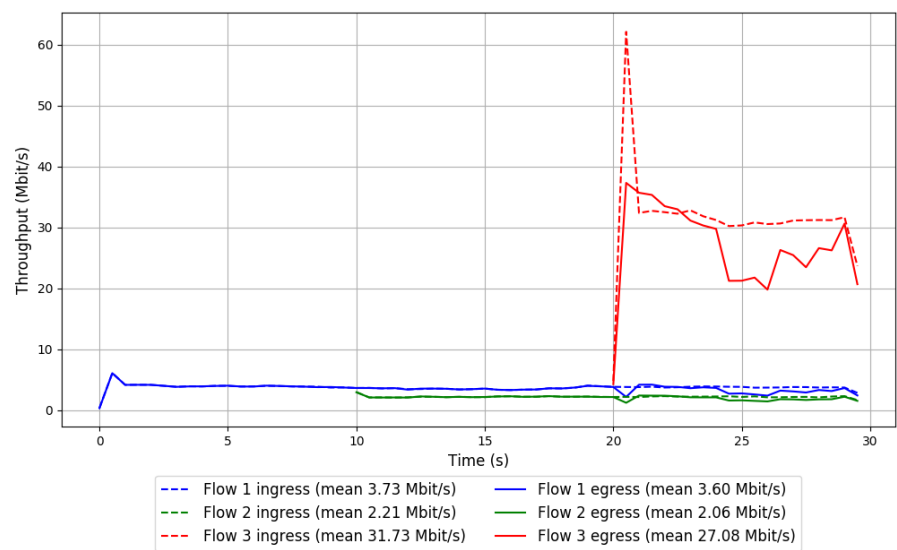
-- Flow 3:

Average throughput: 27.08 Mbit/s

95th percentile per-packet one-way delay: 332.128 ms

Loss rate: 14.65%

Run 3: Report of PCC — Data Link



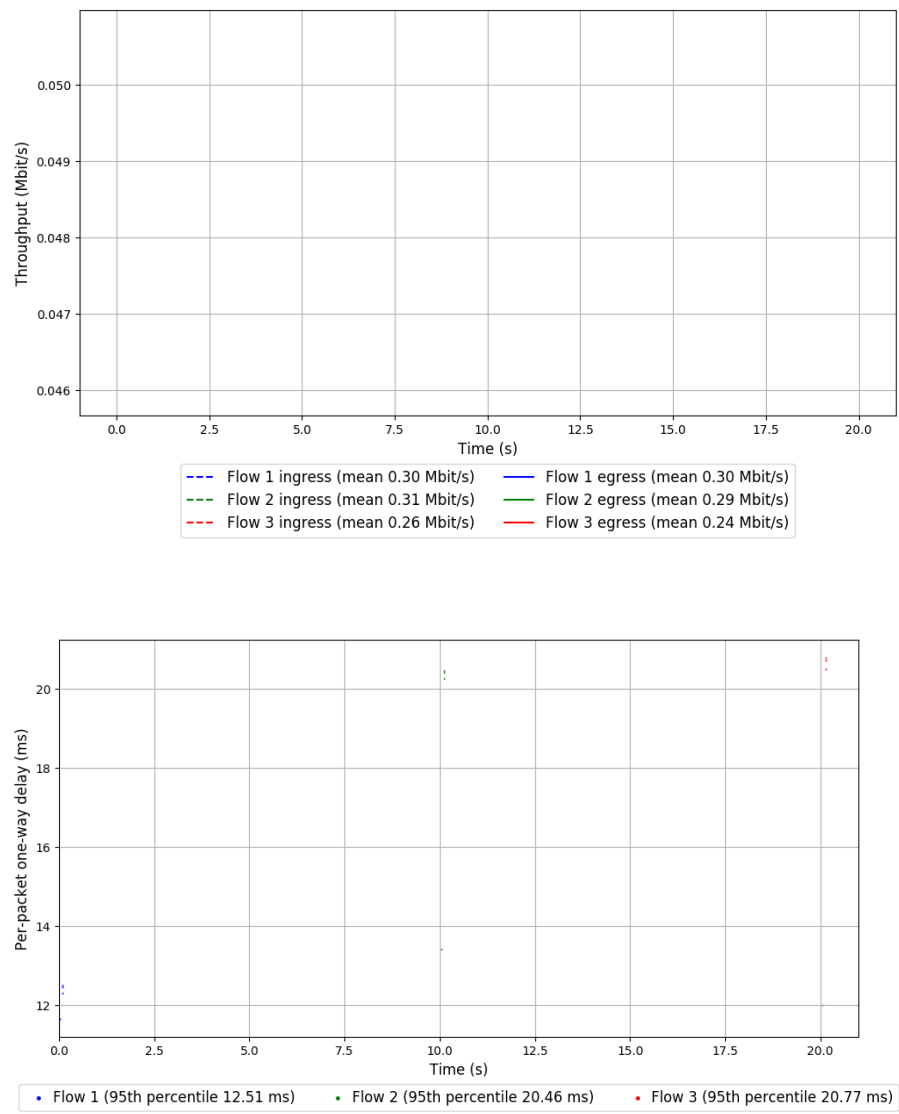
Run 1: Statistics of QUIC Cubic

Start at: 2018-01-26 03:24:57

End at: 2018-01-26 03:25:27

Local clock offset: 2.441 ms

Run 1: Report of QUIC Cubic — Data Link



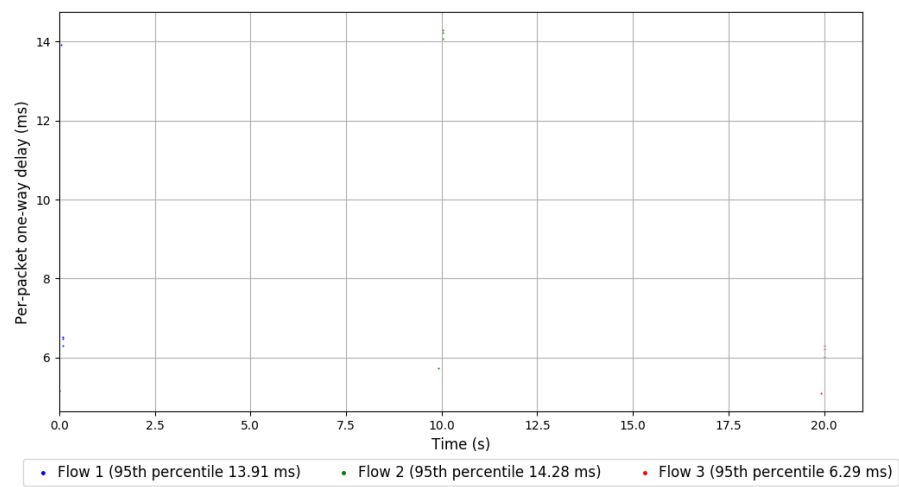
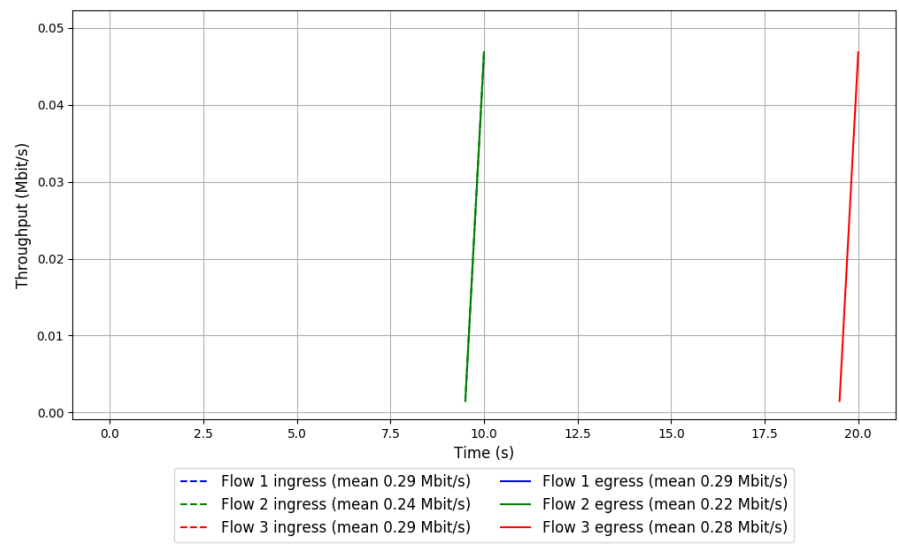
Run 2: Statistics of QUIC Cubic

Start at: 2018-01-26 04:11:54

End at: 2018-01-26 04:12:24

Local clock offset: -4.52 ms

Run 2: Report of QUIC Cubic — Data Link



Run 3: Statistics of QUIC Cubic

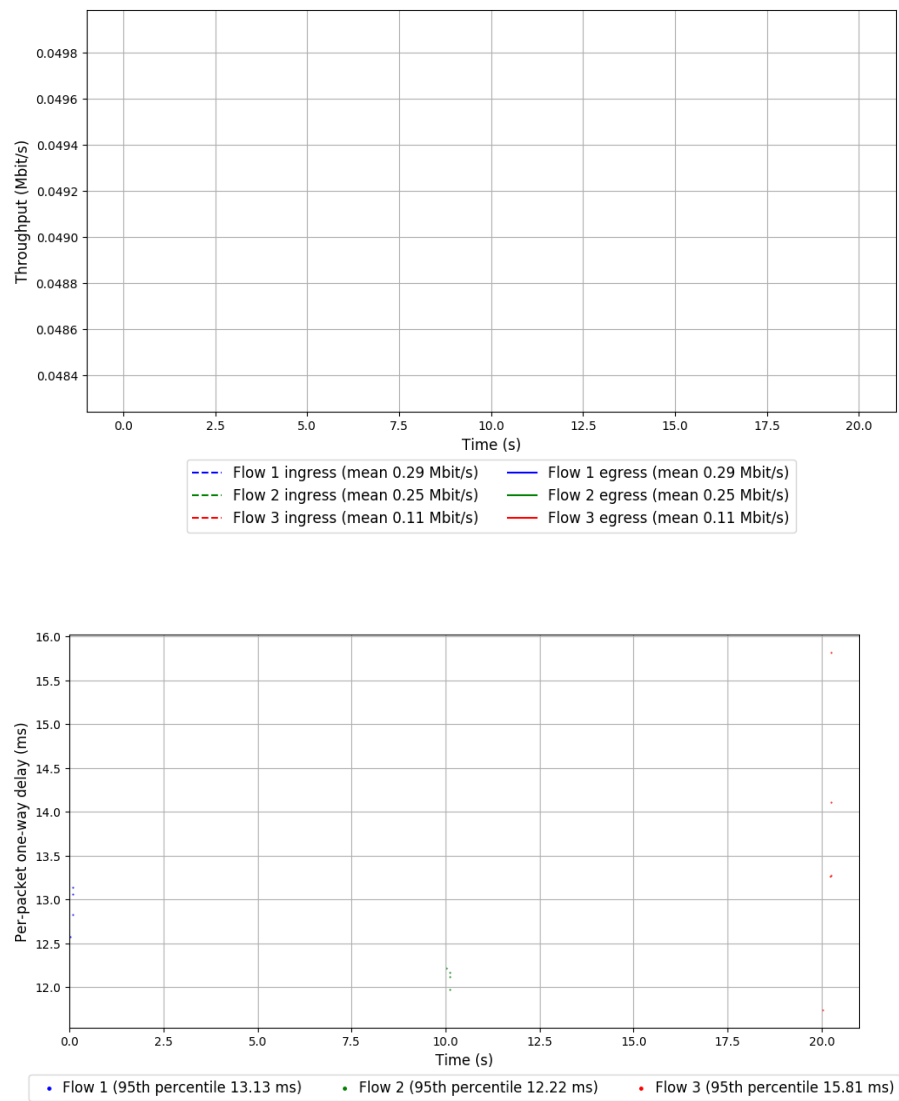
Start at: 2018-01-26 04:58:53

End at: 2018-01-26 04:59:23

Local clock offset: 1.539 ms



Run 3: Report of QUIC Cubic — Data Link

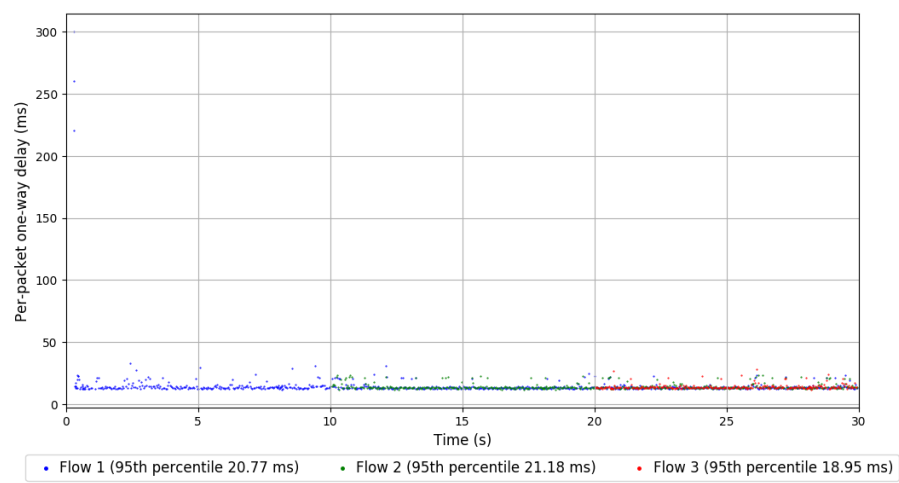
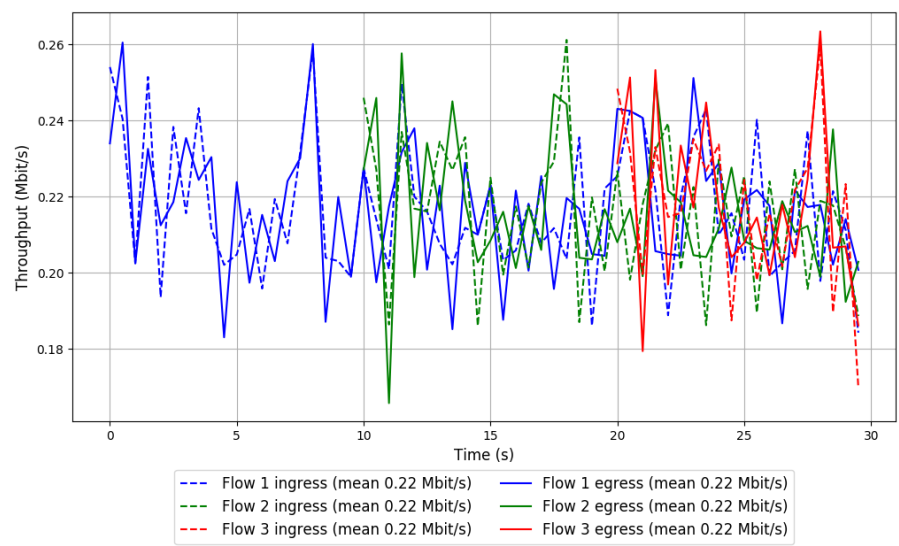


```
Run 1: Statistics of SReAM

Start at: 2018-01-26 02:43:53
End at: 2018-01-26 02:44:23
Local clock offset: 2.821 ms

# Below is generated by plot.py at 2018-01-26 05:04:14
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.44 Mbit/s
95th percentile per-packet one-way delay: 20.909 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 0.22 Mbit/s
95th percentile per-packet one-way delay: 20.774 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 0.22 Mbit/s
95th percentile per-packet one-way delay: 21.182 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 0.22 Mbit/s
95th percentile per-packet one-way delay: 18.945 ms
Loss rate: 0.00%
```

Run 1: Report of SReAM — Data Link



Run 2: Statistics of SReAM

Start at: 2018-01-26 03:30:49

End at: 2018-01-26 03:31:19

Local clock offset: 2.452 ms

# Below is generated by plot.py at 2018-01-26 05:04:14

# Datalink statistics

-- Total of 3 flows:

Average throughput: 0.44 Mbit/s

95th percentile per-packet one-way delay: 22.078 ms

Loss rate: 0.00%

-- Flow 1:

Average throughput: 0.22 Mbit/s

95th percentile per-packet one-way delay: 22.089 ms

Loss rate: 0.00%

-- Flow 2:

Average throughput: 0.22 Mbit/s

95th percentile per-packet one-way delay: 21.758 ms

Loss rate: 0.00%

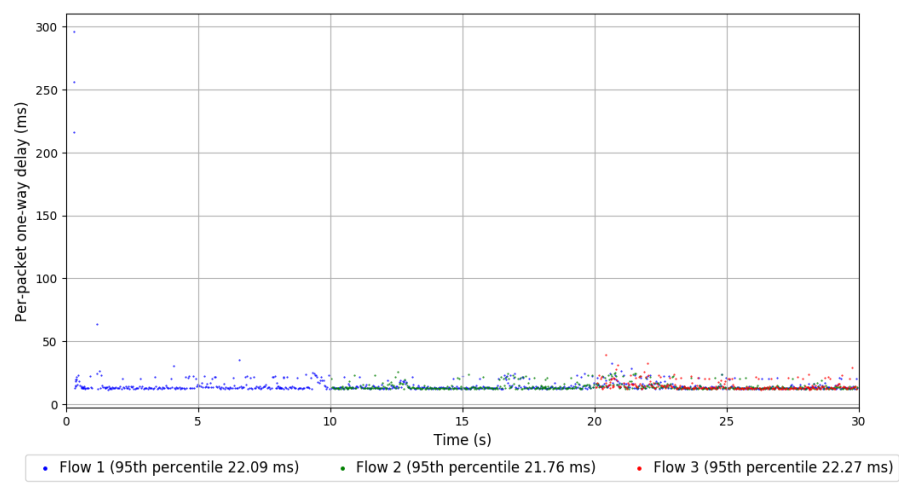
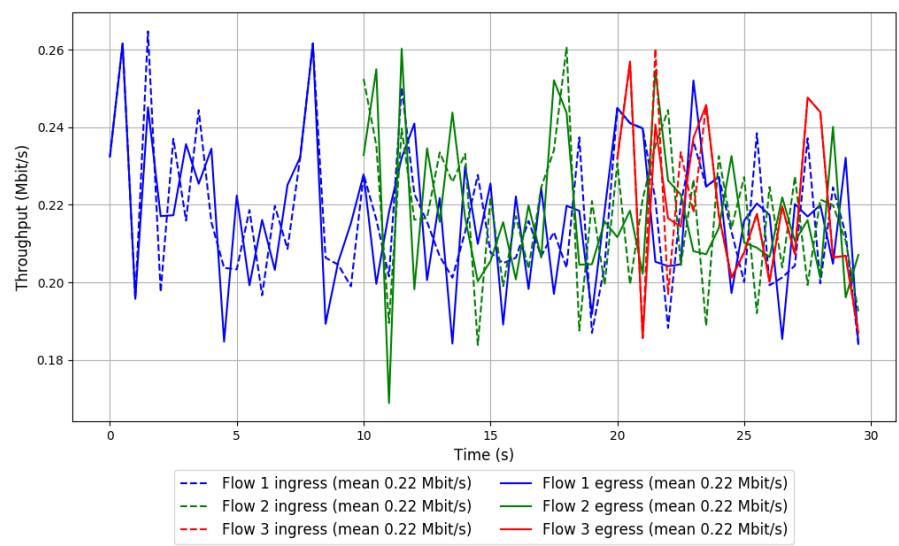
-- Flow 3:

Average throughput: 0.22 Mbit/s

95th percentile per-packet one-way delay: 22.275 ms

Loss rate: 0.00%

Run 2: Report of SReAM — Data Link



Run 3: Statistics of SReAM

Start at: 2018-01-26 04:17:46

End at: 2018-01-26 04:18:16

Local clock offset: -4.168 ms

# Below is generated by plot.py at 2018-01-26 05:04:14

# Datalink statistics

-- Total of 3 flows:

Average throughput: 0.44 Mbit/s

95th percentile per-packet one-way delay: 12.376 ms

Loss rate: 0.00%

-- Flow 1:

Average throughput: 0.22 Mbit/s

95th percentile per-packet one-way delay: 12.136 ms

Loss rate: 0.00%

-- Flow 2:

Average throughput: 0.22 Mbit/s

95th percentile per-packet one-way delay: 13.429 ms

Loss rate: 0.00%

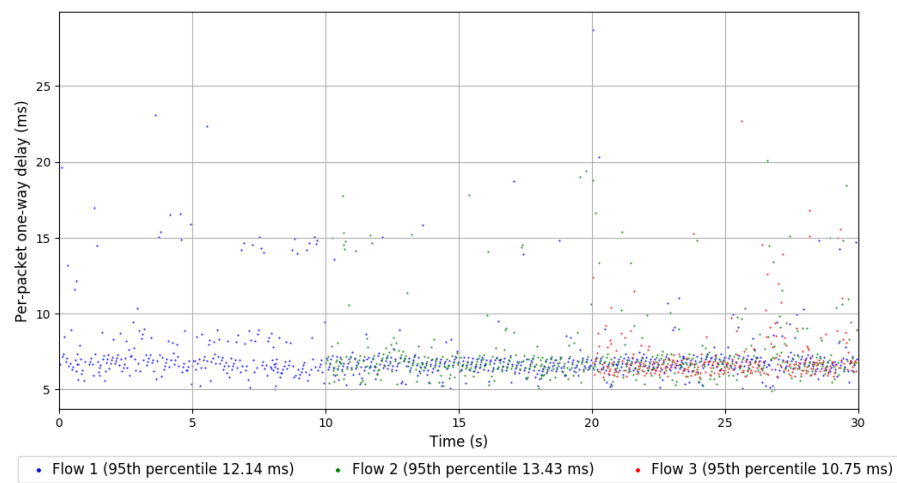
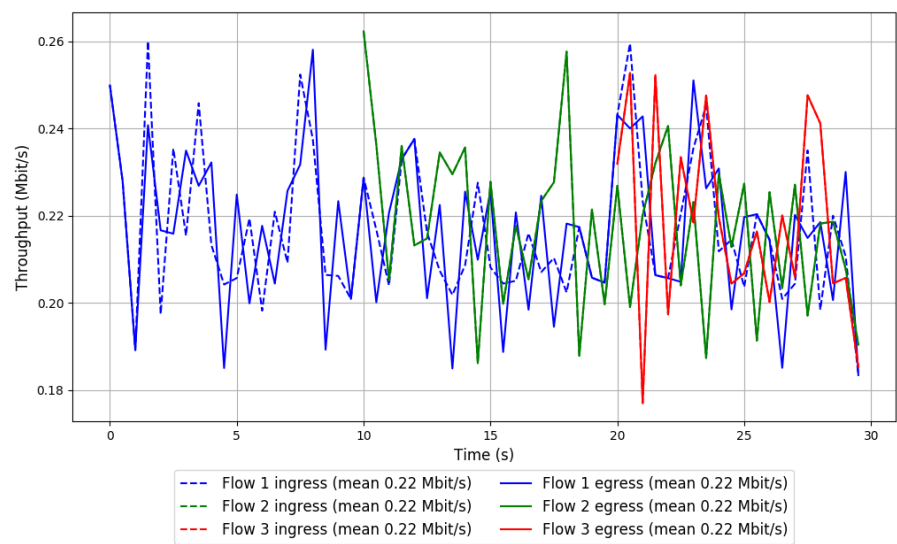
-- Flow 3:

Average throughput: 0.22 Mbit/s

95th percentile per-packet one-way delay: 10.753 ms

Loss rate: 0.00%

Run 3: Report of SReAM — Data Link



Run 1: Statistics of WebRTC media

Start at: 2018-01-26 03:13:14

End at: 2018-01-26 03:13:44

Local clock offset: 2.494 ms

# Below is generated by plot.py at 2018-01-26 05:04:14

# Datalink statistics

-- Total of 3 flows:

Average throughput: 4.19 Mbit/s

95th percentile per-packet one-way delay: 334.552 ms

Loss rate: 0.60%

-- Flow 1:

Average throughput: 2.26 Mbit/s

95th percentile per-packet one-way delay: 37.167 ms

Loss rate: 0.41%

-- Flow 2:

Average throughput: 1.43 Mbit/s

95th percentile per-packet one-way delay: 307.556 ms

Loss rate: 0.48%

-- Flow 3:

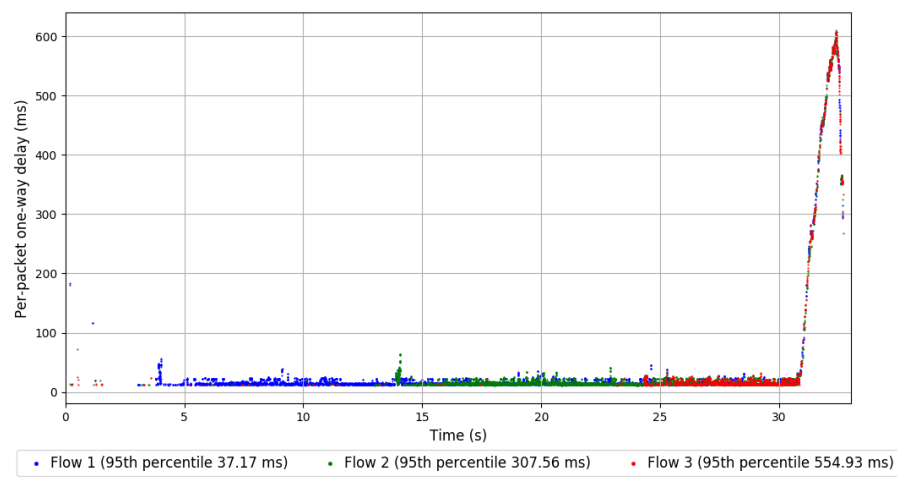
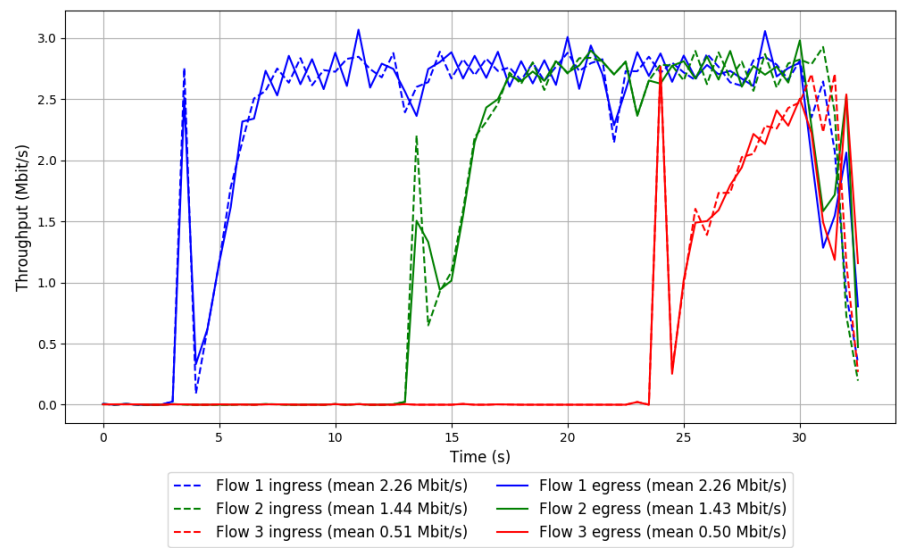
Average throughput: 0.50 Mbit/s

95th percentile per-packet one-way delay: 554.929 ms

Loss rate: 1.76%



Run 1: Report of WebRTC media — Data Link



Run 2: Statistics of WebRTC media

Start at: 2018-01-26 04:00:11

End at: 2018-01-26 04:00:41

Local clock offset: -3.449 ms

# Below is generated by plot.py at 2018-01-26 05:04:14

# Datalink statistics

-- Total of 3 flows:

Average throughput: 4.46 Mbit/s

95th percentile per-packet one-way delay: 17.692 ms

Loss rate: 0.00%

-- Flow 1:

Average throughput: 2.33 Mbit/s

95th percentile per-packet one-way delay: 16.982 ms

Loss rate: 0.00%

-- Flow 2:

Average throughput: 1.48 Mbit/s

95th percentile per-packet one-way delay: 18.665 ms

Loss rate: 0.00%

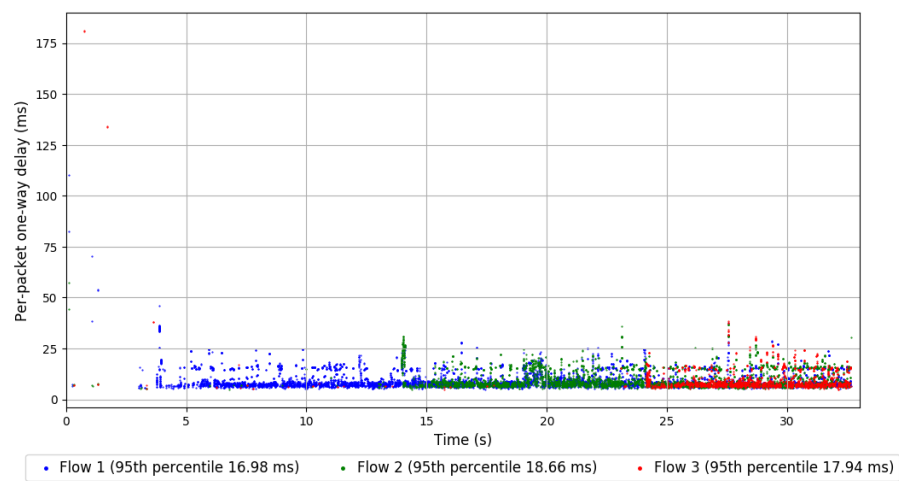
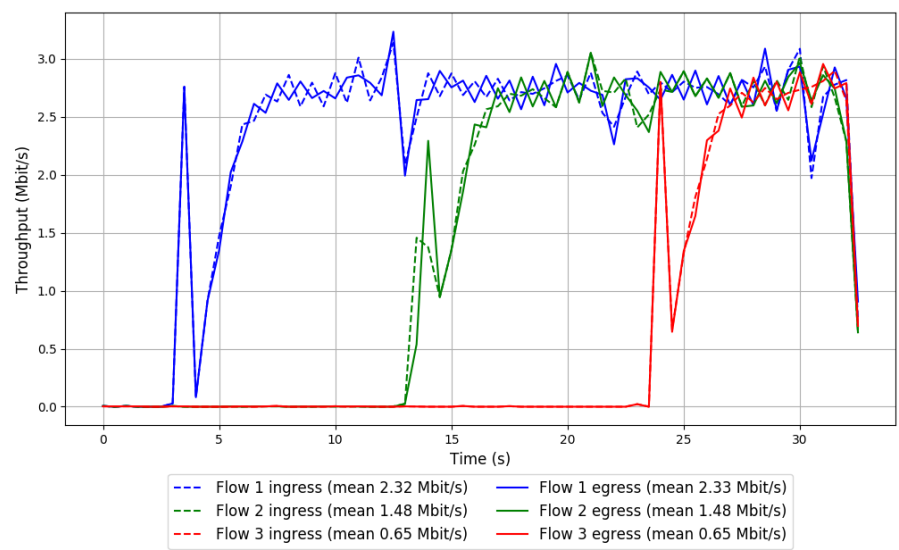
-- Flow 3:

Average throughput: 0.65 Mbit/s

95th percentile per-packet one-way delay: 17.942 ms

Loss rate: 0.00%

Run 2: Report of WebRTC media — Data Link



Run 3: Statistics of WebRTC media

Start at: 2018-01-26 04:47:10

End at: 2018-01-26 04:47:40

Local clock offset: -4.063 ms

# Below is generated by plot.py at 2018-01-26 05:04:14

# Datalink statistics

-- Total of 3 flows:

Average throughput: 4.43 Mbit/s

95th percentile per-packet one-way delay: 18.605 ms

Loss rate: 0.00%

-- Flow 1:

Average throughput: 2.29 Mbit/s

95th percentile per-packet one-way delay: 18.528 ms

Loss rate: 0.00%

-- Flow 2:

Average throughput: 1.50 Mbit/s

95th percentile per-packet one-way delay: 18.128 ms

Loss rate: 0.00%

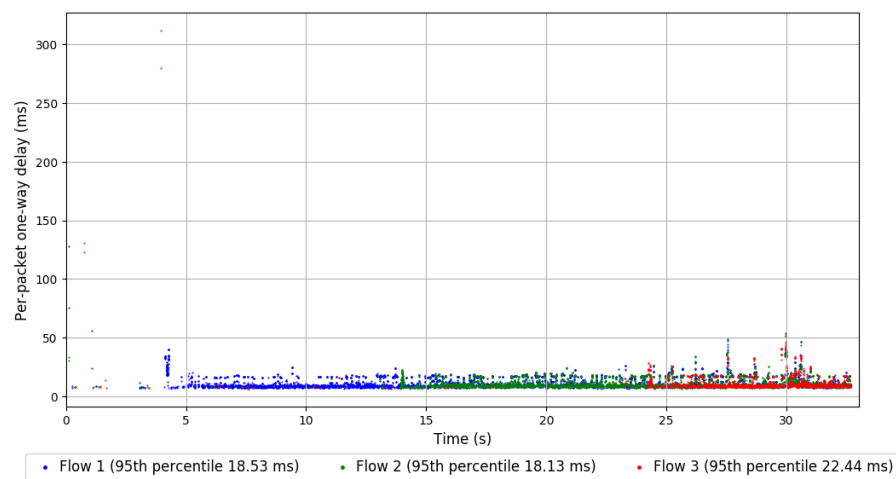
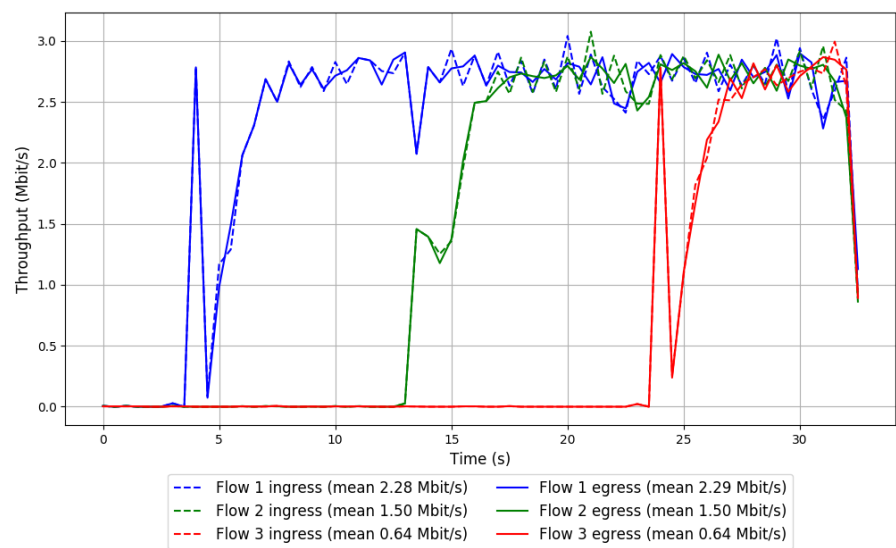
-- Flow 3:

Average throughput: 0.64 Mbit/s

95th percentile per-packet one-way delay: 22.437 ms

Loss rate: 0.00%

Run 3: Report of WebRTC media — Data Link

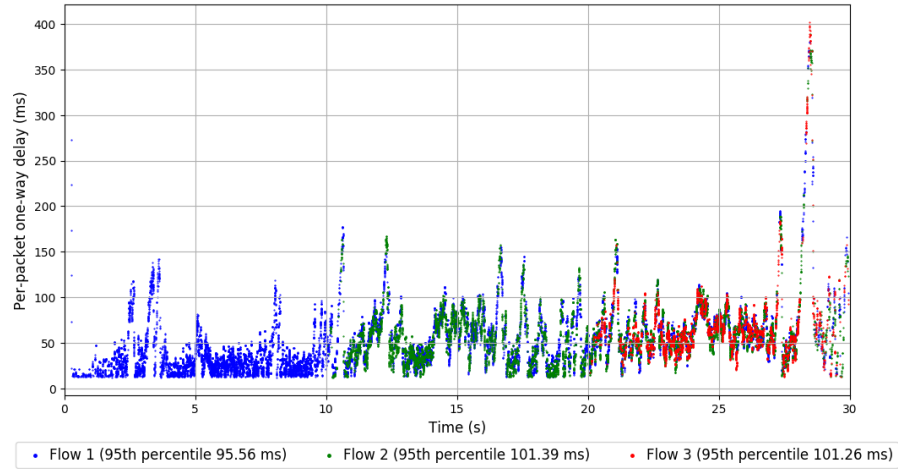
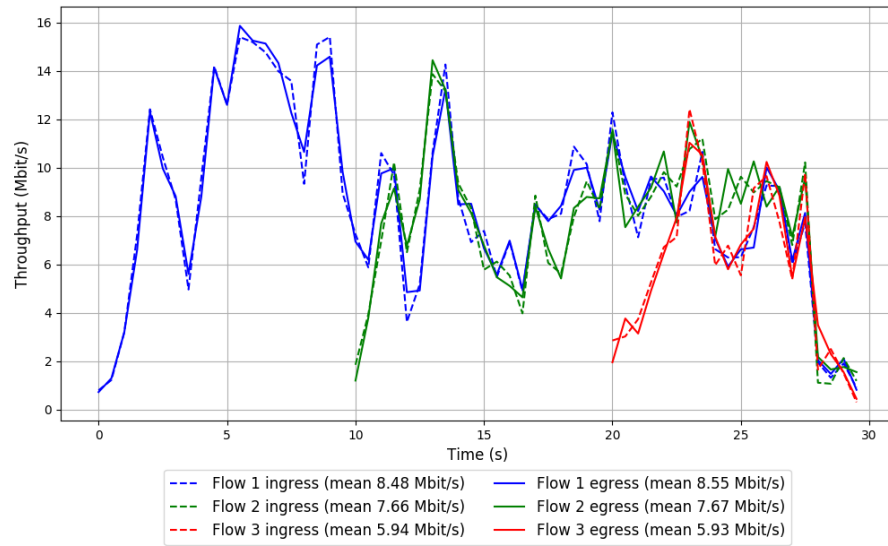


```
Run 1: Statistics of Sprout

Start at: 2018-01-26 03:01:29
End at: 2018-01-26 03:01:59
Local clock offset: 2.658 ms

# Below is generated by plot.py at 2018-01-26 05:04:21
# Datalink statistics
-- Total of 3 flows:
Average throughput: 15.66 Mbit/s
95th percentile per-packet one-way delay: 98.955 ms
Loss rate: 0.02%
-- Flow 1:
Average throughput: 8.55 Mbit/s
95th percentile per-packet one-way delay: 95.555 ms
Loss rate: 0.02%
-- Flow 2:
Average throughput: 7.67 Mbit/s
95th percentile per-packet one-way delay: 101.393 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 5.93 Mbit/s
95th percentile per-packet one-way delay: 101.260 ms
Loss rate: 0.09%
```

## Run 1: Report of Sprout — Data Link



Run 2: Statistics of Sprout

Start at: 2018-01-26 03:48:26

End at: 2018-01-26 03:48:56

Local clock offset: -1.637 ms

# Below is generated by plot.py at 2018-01-26 05:04:23

# Datalink statistics

-- Total of 3 flows:

Average throughput: 16.86 Mbit/s

95th percentile per-packet one-way delay: 109.536 ms

Loss rate: 0.23%

-- Flow 1:

Average throughput: 10.05 Mbit/s

95th percentile per-packet one-way delay: 100.546 ms

Loss rate: 0.14%

-- Flow 2:

Average throughput: 7.27 Mbit/s

95th percentile per-packet one-way delay: 112.597 ms

Loss rate: 0.05%

-- Flow 3:

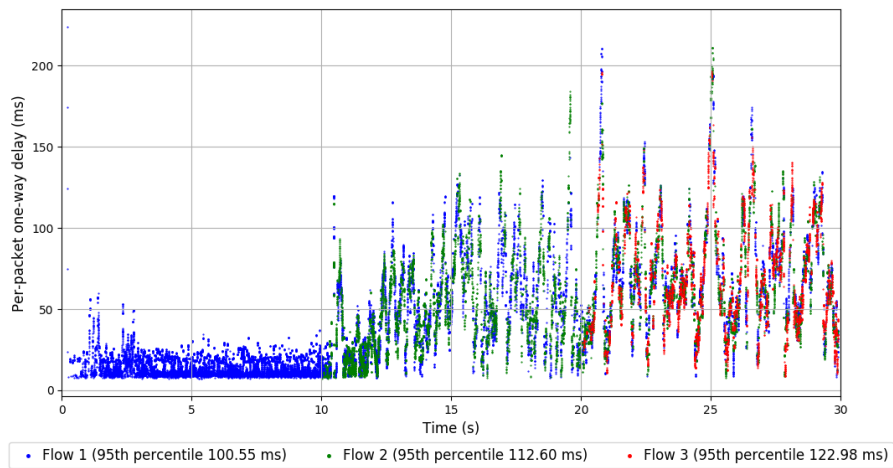
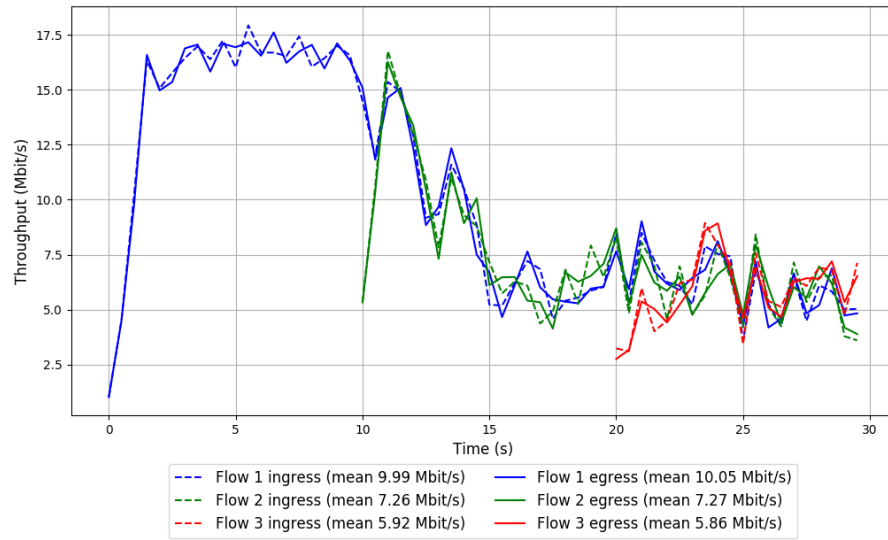
Average throughput: 5.86 Mbit/s

95th percentile per-packet one-way delay: 122.979 ms

Loss rate: 1.16%



## Run 2: Report of Sprout — Data Link



Run 3: Statistics of Sprout

Start at: 2018-01-26 04:35:25

End at: 2018-01-26 04:35:55

Local clock offset: -4.388 ms

# Below is generated by plot.py at 2018-01-26 05:04:38

# Datalink statistics

-- Total of 3 flows:

Average throughput: 25.80 Mbit/s

95th percentile per-packet one-way delay: 54.316 ms

Loss rate: 0.04%

-- Flow 1:

Average throughput: 13.66 Mbit/s

95th percentile per-packet one-way delay: 51.006 ms

Loss rate: 0.04%

-- Flow 2:

Average throughput: 12.68 Mbit/s

95th percentile per-packet one-way delay: 55.148 ms

Loss rate: 0.00%

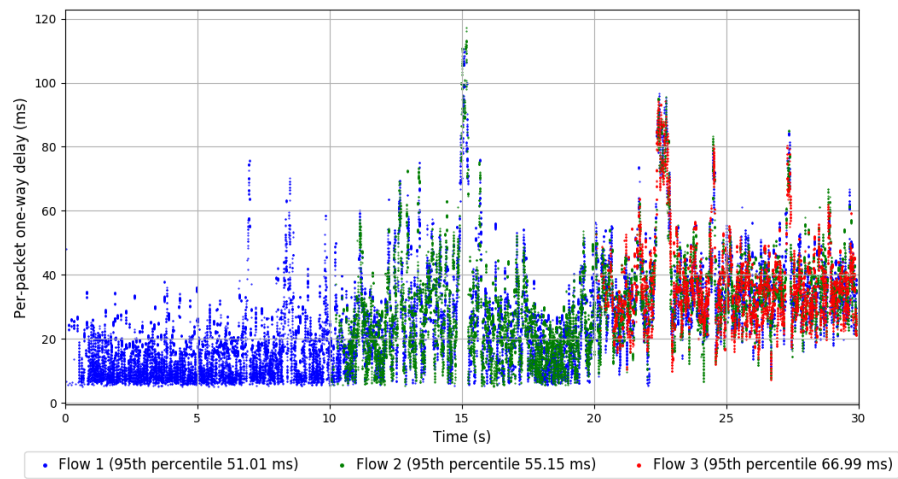
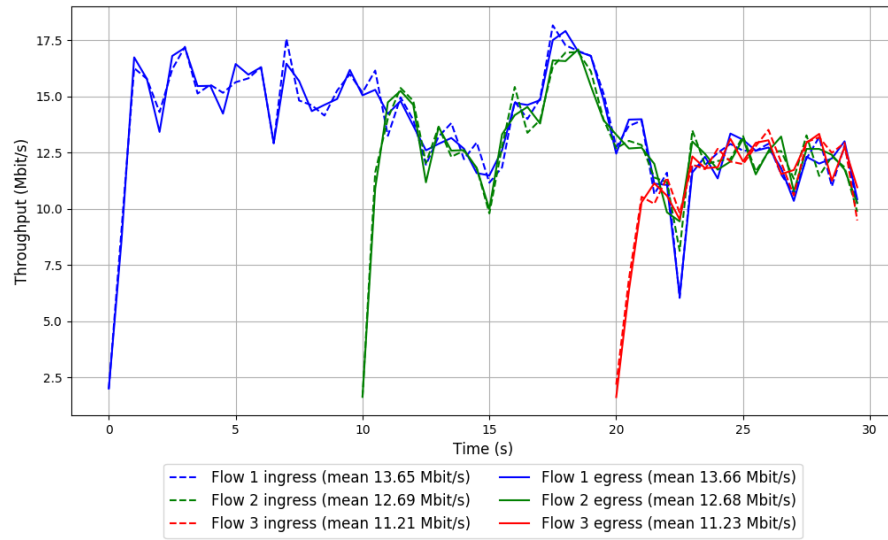
-- Flow 3:

Average throughput: 11.23 Mbit/s

95th percentile per-packet one-way delay: 66.988 ms

Loss rate: 0.14%

### Run 3: Report of Sprout — Data Link

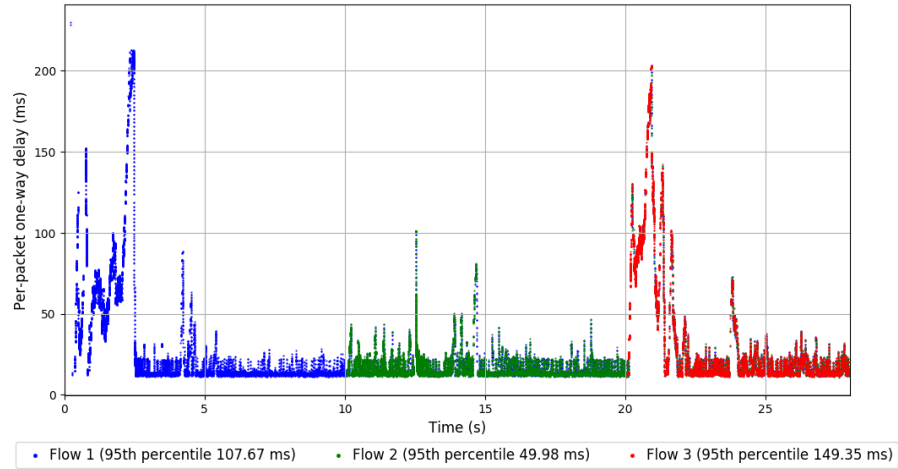
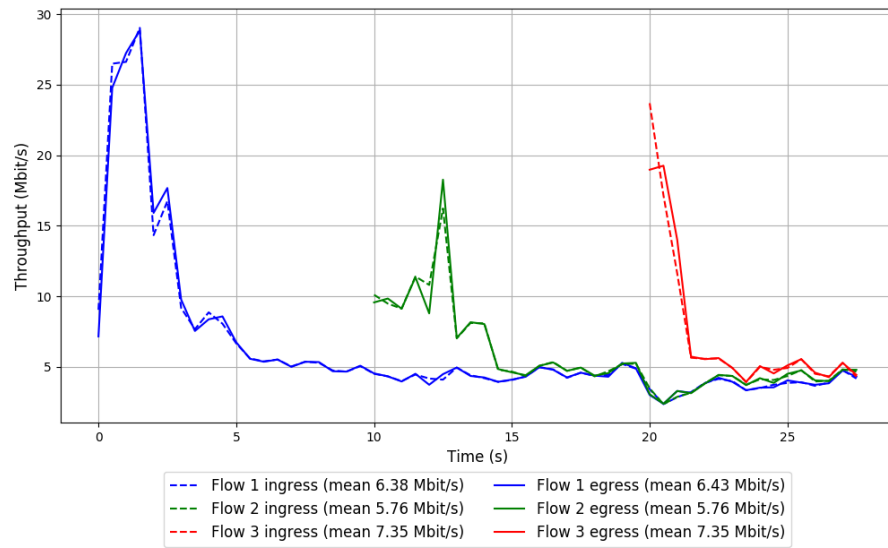


```
Run 1: Statistics of TaoVA-100x

Start at: 2018-01-26 03:19:05
End at: 2018-01-26 03:19:35
Local clock offset: 2.435 ms

# Below is generated by plot.py at 2018-01-26 05:04:38
# Datalink statistics
-- Total of 3 flows:
Average throughput: 12.26 Mbit/s
95th percentile per-packet one-way delay: 110.503 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 6.43 Mbit/s
95th percentile per-packet one-way delay: 107.671 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 5.76 Mbit/s
95th percentile per-packet one-way delay: 49.978 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 7.35 Mbit/s
95th percentile per-packet one-way delay: 149.348 ms
Loss rate: 0.00%
```

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

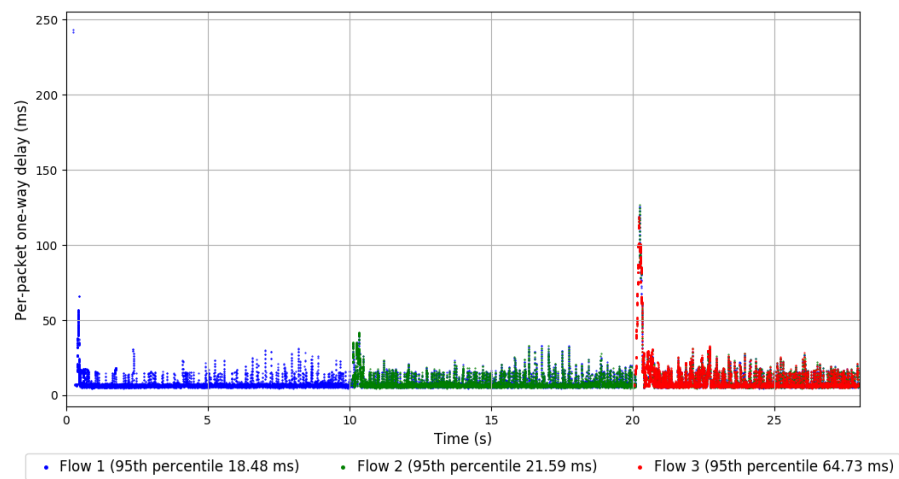
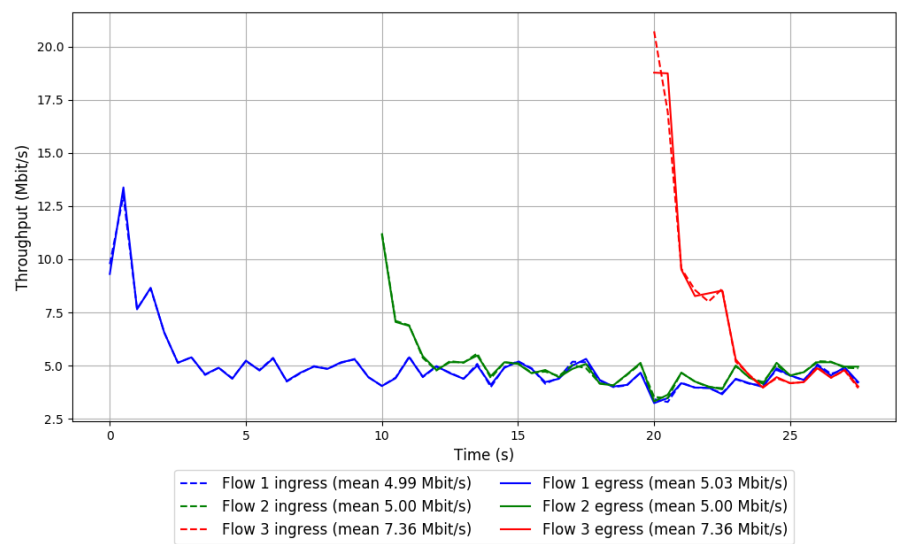


```
Run 2: Statistics of TaoVA-100x

Start at: 2018-01-26 04:06:02
End at: 2018-01-26 04:06:32
Local clock offset: -3.999 ms

# Below is generated by plot.py at 2018-01-26 05:04:38
# Datalink statistics
-- Total of 3 flows:
Average throughput: 10.37 Mbit/s
95th percentile per-packet one-way delay: 24.058 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 5.03 Mbit/s
95th percentile per-packet one-way delay: 18.478 ms
Loss rate: 0.01%
-- Flow 2:
Average throughput: 5.00 Mbit/s
95th percentile per-packet one-way delay: 21.589 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 7.36 Mbit/s
95th percentile per-packet one-way delay: 64.732 ms
Loss rate: 0.00%
```

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



Run 3: Statistics of TaoVA-100x

Start at: 2018-01-26 04:53:02

End at: 2018-01-26 04:53:32

Local clock offset: -0.502 ms

# Below is generated by plot.py at 2018-01-26 05:04:38

# Datalink statistics

-- Total of 3 flows:

Average throughput: 11.35 Mbit/s

95th percentile per-packet one-way delay: 26.818 ms

Loss rate: 0.00%

-- Flow 1:

Average throughput: 5.17 Mbit/s

95th percentile per-packet one-way delay: 27.573 ms

Loss rate: 0.00%

-- Flow 2:

Average throughput: 6.25 Mbit/s

95th percentile per-packet one-way delay: 23.404 ms

Loss rate: 0.00%

-- Flow 3:

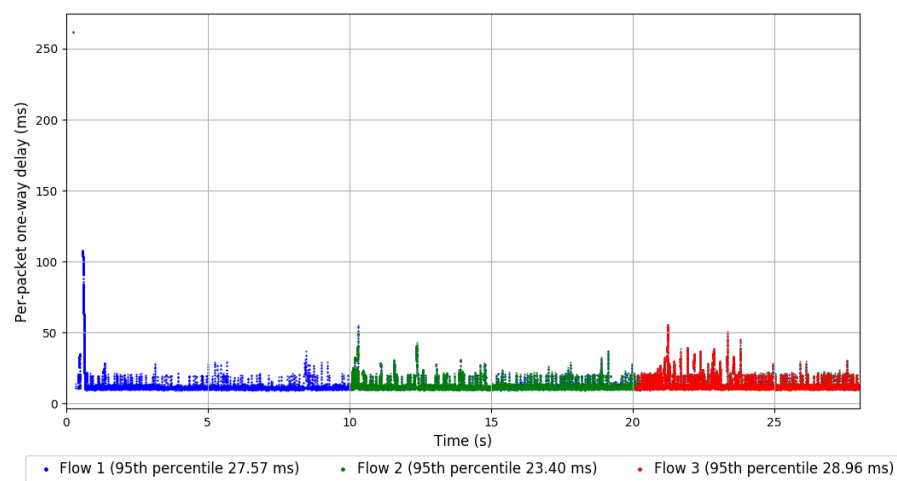
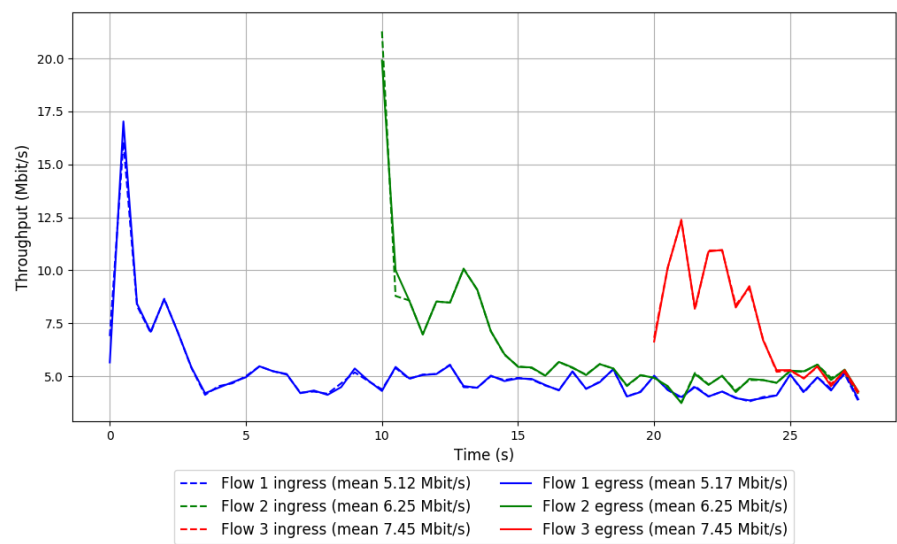
Average throughput: 7.45 Mbit/s

95th percentile per-packet one-way delay: 28.965 ms

Loss rate: 0.00%



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



Run 1: Statistics of TCP Vegas

Start at: 2018-01-26 03:10:17

End at: 2018-01-26 03:10:47

Local clock offset: 2.536 ms

# Below is generated by plot.py at 2018-01-26 05:04:38

# Datalink statistics

-- Total of 3 flows:

Average throughput: 19.77 Mbit/s

95th percentile per-packet one-way delay: 97.943 ms

Loss rate: 0.00%

-- Flow 1:

Average throughput: 4.89 Mbit/s

95th percentile per-packet one-way delay: 61.065 ms

Loss rate: 0.00%

-- Flow 2:

Average throughput: 19.67 Mbit/s

95th percentile per-packet one-way delay: 99.178 ms

Loss rate: 0.00%

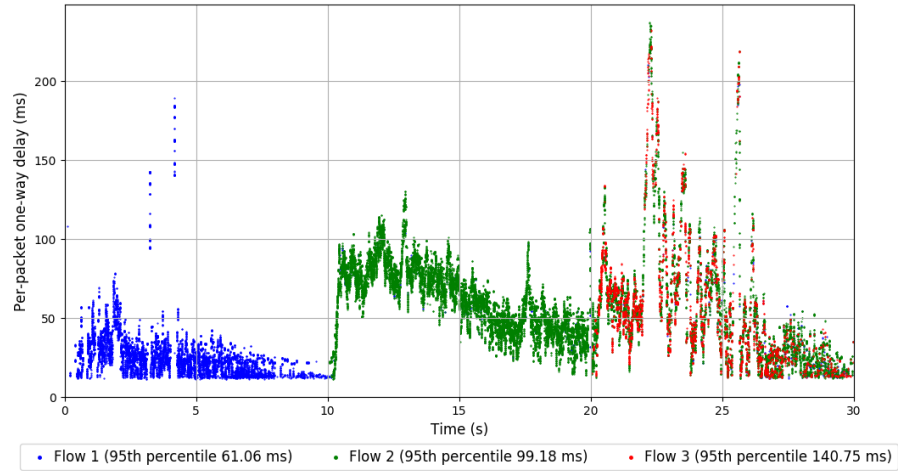
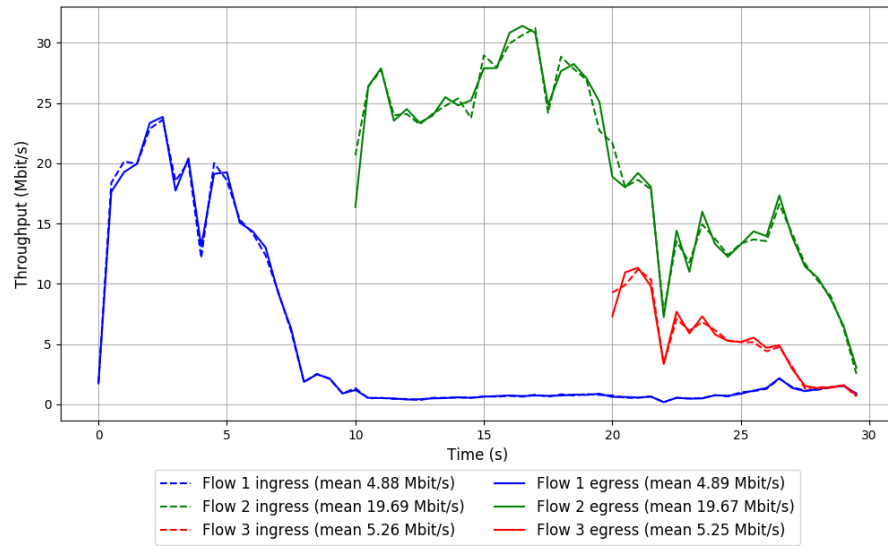
-- Flow 3:

Average throughput: 5.25 Mbit/s

95th percentile per-packet one-way delay: 140.748 ms

Loss rate: 0.00%

## Run 1: Report of TCP Vegas — Data Link



Run 2: Statistics of TCP Vegas

Start at: 2018-01-26 03:57:15

End at: 2018-01-26 03:57:45

Local clock offset: -3.194 ms

# Below is generated by plot.py at 2018-01-26 05:04:38

# Datalink statistics

-- Total of 3 flows:

Average throughput: 14.14 Mbit/s

95th percentile per-packet one-way delay: 108.005 ms

Loss rate: 0.00%

-- Flow 1:

Average throughput: 1.67 Mbit/s

95th percentile per-packet one-way delay: 39.160 ms

Loss rate: 0.00%

-- Flow 2:

Average throughput: 4.79 Mbit/s

95th percentile per-packet one-way delay: 36.740 ms

Loss rate: 0.00%

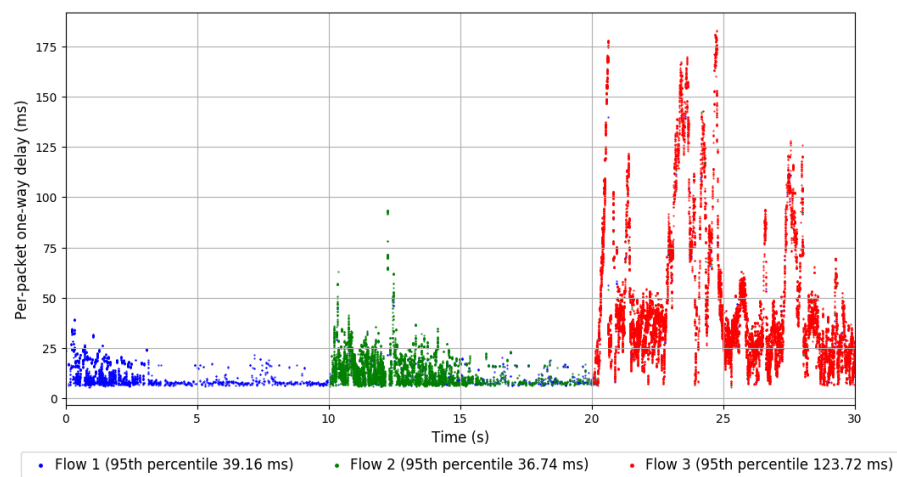
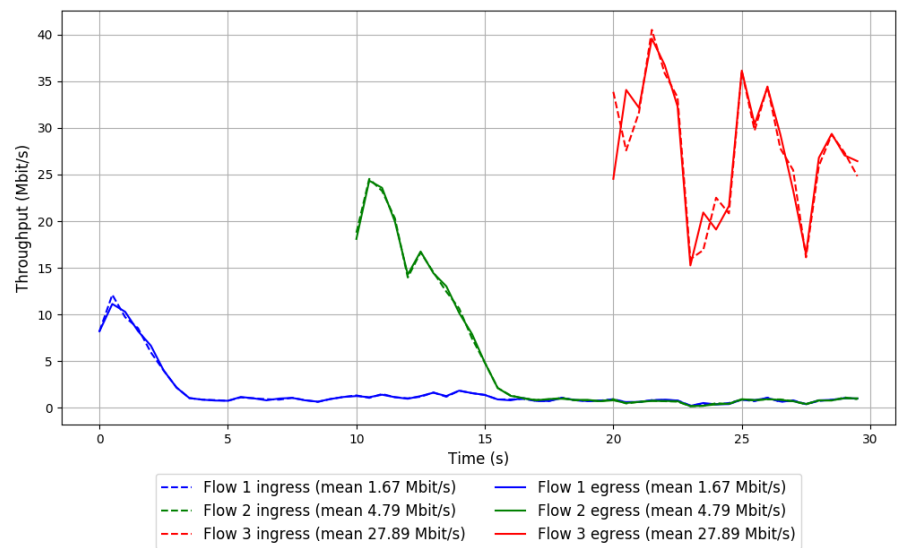
-- Flow 3:

Average throughput: 27.89 Mbit/s

95th percentile per-packet one-way delay: 123.715 ms

Loss rate: 0.00%

Run 2: Report of TCP Vegas — Data Link



Run 3: Statistics of TCP Vegas

Start at: 2018-01-26 04:44:13

End at: 2018-01-26 04:44:43

Local clock offset: -4.792 ms

# Below is generated by plot.py at 2018-01-26 05:04:54

# Datalink statistics

-- Total of 3 flows:

Average throughput: 27.66 Mbit/s

95th percentile per-packet one-way delay: 111.774 ms

Loss rate: 0.00%

-- Flow 1:

Average throughput: 11.83 Mbit/s

95th percentile per-packet one-way delay: 142.400 ms

Loss rate: 0.00%

-- Flow 2:

Average throughput: 15.31 Mbit/s

95th percentile per-packet one-way delay: 96.396 ms

Loss rate: 0.00%

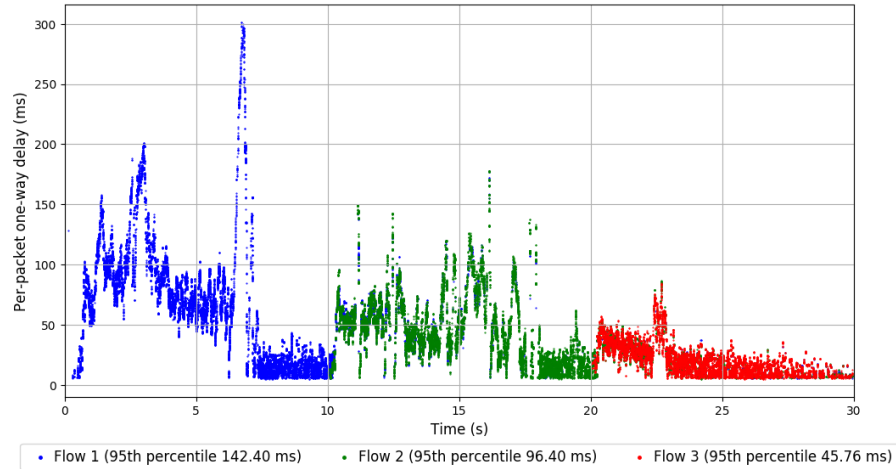
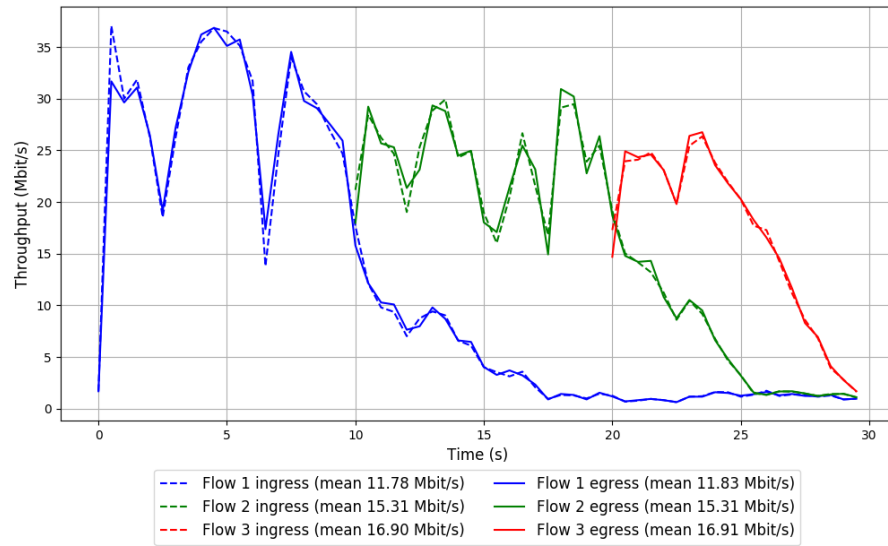
-- Flow 3:

Average throughput: 16.91 Mbit/s

95th percentile per-packet one-way delay: 45.762 ms

Loss rate: 0.00%

### Run 3: Report of TCP Vegas — Data Link



Run 1: Statistics of Verus

Start at: 2018-01-26 03:22:01

End at: 2018-01-26 03:22:31

Local clock offset: 2.446 ms

# Below is generated by plot.py at 2018-01-26 05:04:54

# Datalink statistics

-- Total of 3 flows:

Average throughput: 0.00 Mbit/s

95th percentile per-packet one-way delay: 13.553 ms

Loss rate: 0.00%

-- Flow 1:

Average throughput: 0.00 Mbit/s

95th percentile per-packet one-way delay: 13.784 ms

Loss rate: 0.00%

-- Flow 2:

Average throughput: 0.00 Mbit/s

95th percentile per-packet one-way delay: 12.942 ms

Loss rate: 0.00%

-- Flow 3:

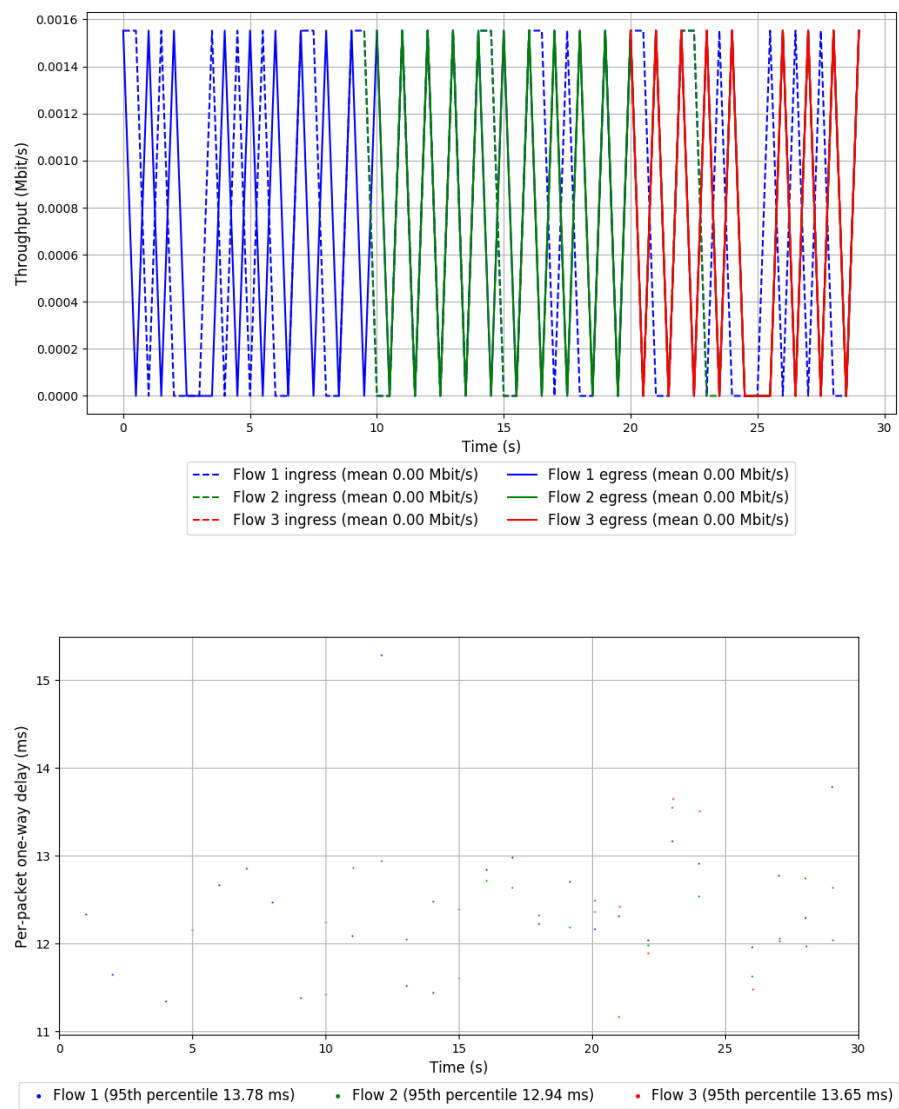
Average throughput: 0.00 Mbit/s

95th percentile per-packet one-way delay: 13.646 ms

Loss rate: 0.00%



Run 1: Report of Verus — Data Link



Run 2: Statistics of Verus

Start at: 2018-01-26 04:08:58

End at: 2018-01-26 04:09:28

Local clock offset: -4.272 ms

# Below is generated by plot.py at 2018-01-26 05:04:54

# Datalink statistics

-- Total of 3 flows:

Average throughput: 0.00 Mbit/s

95th percentile per-packet one-way delay: 12.303 ms

Loss rate: 0.00%

-- Flow 1:

Average throughput: 0.00 Mbit/s

95th percentile per-packet one-way delay: 9.694 ms

Loss rate: 0.00%

-- Flow 2:

Average throughput: 0.00 Mbit/s

95th percentile per-packet one-way delay: 12.303 ms

Loss rate: 0.00%

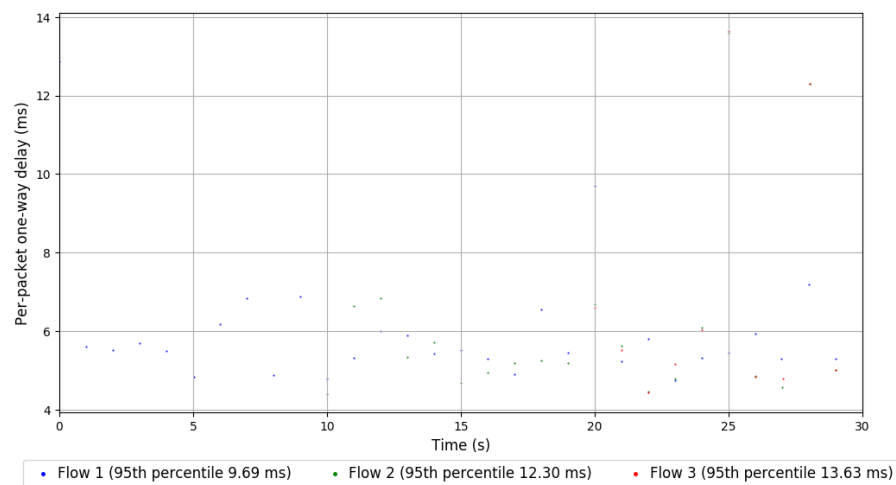
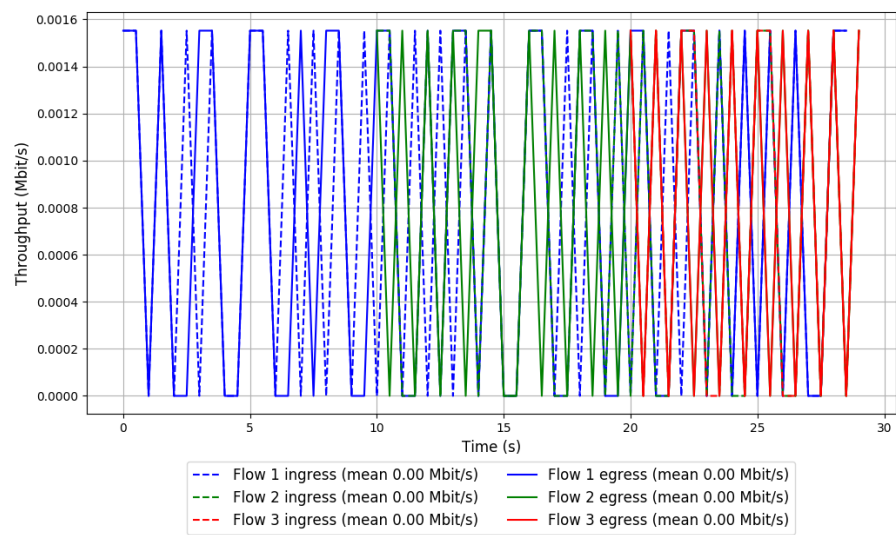
-- Flow 3:

Average throughput: 0.00 Mbit/s

95th percentile per-packet one-way delay: 13.633 ms

Loss rate: 0.00%

Run 2: Report of Verus — Data Link



Run 3: Statistics of Verus

Start at: 2018-01-26 04:55:58

End at: 2018-01-26 04:56:28

Local clock offset: 0.501 ms

# Below is generated by plot.py at 2018-01-26 05:04:54

# Datalink statistics

-- Total of 3 flows:

Average throughput: 0.00 Mbit/s

95th percentile per-packet one-way delay: 12.846 ms

Loss rate: 0.00%

-- Flow 1:

Average throughput: 0.00 Mbit/s

95th percentile per-packet one-way delay: 19.860 ms

Loss rate: 0.00%

-- Flow 2:

Average throughput: 0.00 Mbit/s

95th percentile per-packet one-way delay: 12.289 ms

Loss rate: 0.00%

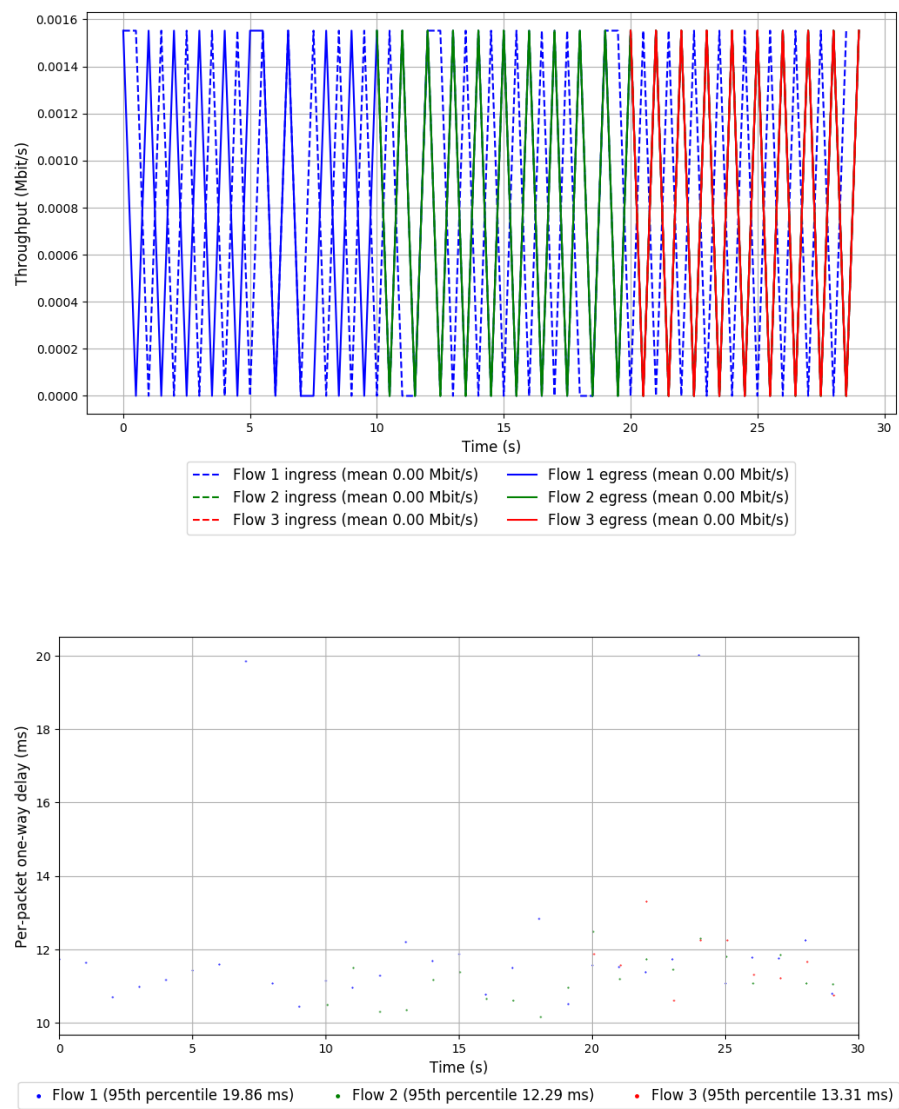
-- Flow 3:

Average throughput: 0.00 Mbit/s

95th percentile per-packet one-way delay: 13.313 ms

Loss rate: 0.00%

Run 3: Report of Verus — Data Link



Run 1: Statistics of Copa

Start at: 2018-01-26 02:46:48

End at: 2018-01-26 02:47:18

Local clock offset: 2.776 ms

# Below is generated by plot.py at 2018-01-26 05:04:54

# Datalink statistics

-- Total of 3 flows:

Average throughput: 7.36 Mbit/s

95th percentile per-packet one-way delay: 100.085 ms

Loss rate: 0.00%

-- Flow 1:

Average throughput: 4.75 Mbit/s

95th percentile per-packet one-way delay: 89.853 ms

Loss rate: 0.00%

-- Flow 2:

Average throughput: 3.06 Mbit/s

95th percentile per-packet one-way delay: 116.456 ms

Loss rate: 0.00%

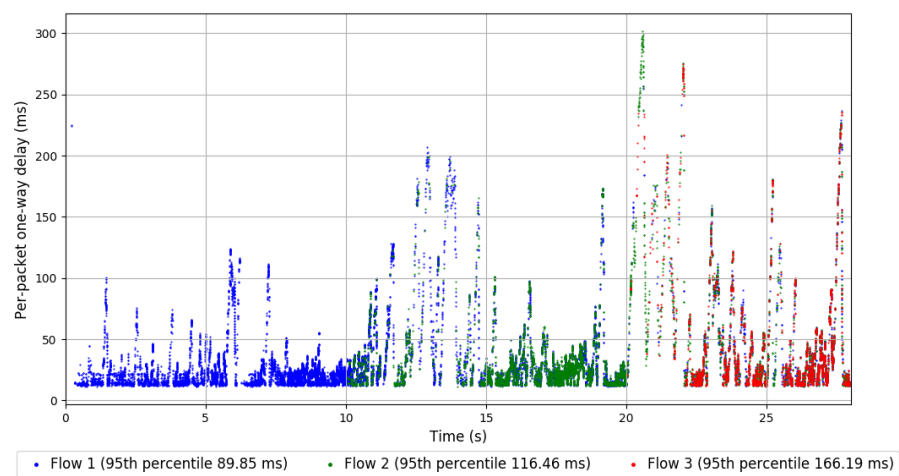
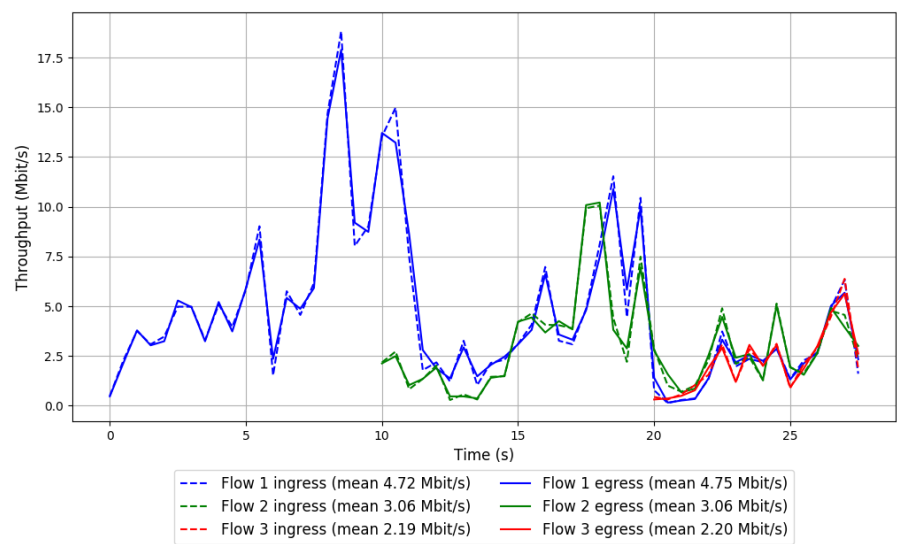
-- Flow 3:

Average throughput: 2.20 Mbit/s

95th percentile per-packet one-way delay: 166.185 ms

Loss rate: 0.01%

Run 1: Report of Copa — Data Link



Run 2: Statistics of Copa

Start at: 2018-01-26 03:33:45

End at: 2018-01-26 03:34:15

Local clock offset: 2.471 ms

# Below is generated by plot.py at 2018-01-26 05:04:54

# Datalink statistics

-- Total of 3 flows:

Average throughput: 10.86 Mbit/s

95th percentile per-packet one-way delay: 75.250 ms

Loss rate: 0.00%

-- Flow 1:

Average throughput: 5.99 Mbit/s

95th percentile per-packet one-way delay: 74.076 ms

Loss rate: 0.00%

-- Flow 2:

Average throughput: 5.26 Mbit/s

95th percentile per-packet one-way delay: 78.619 ms

Loss rate: 0.00%

-- Flow 3:

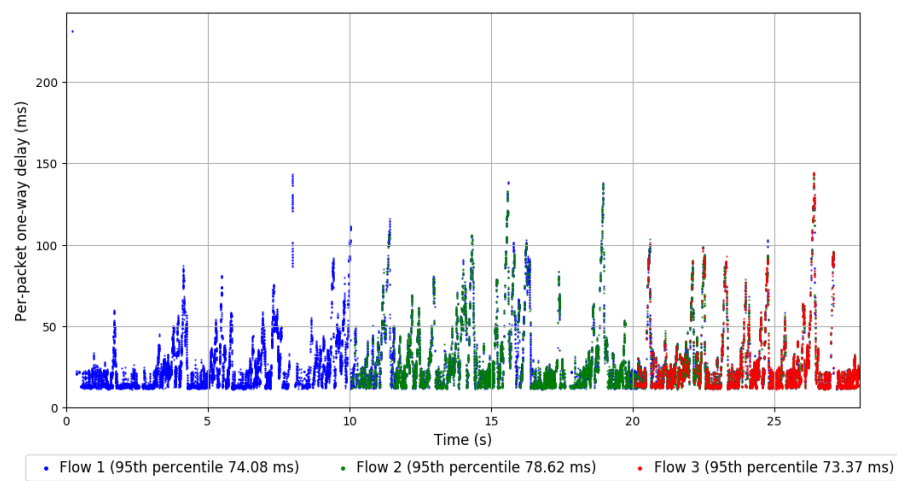
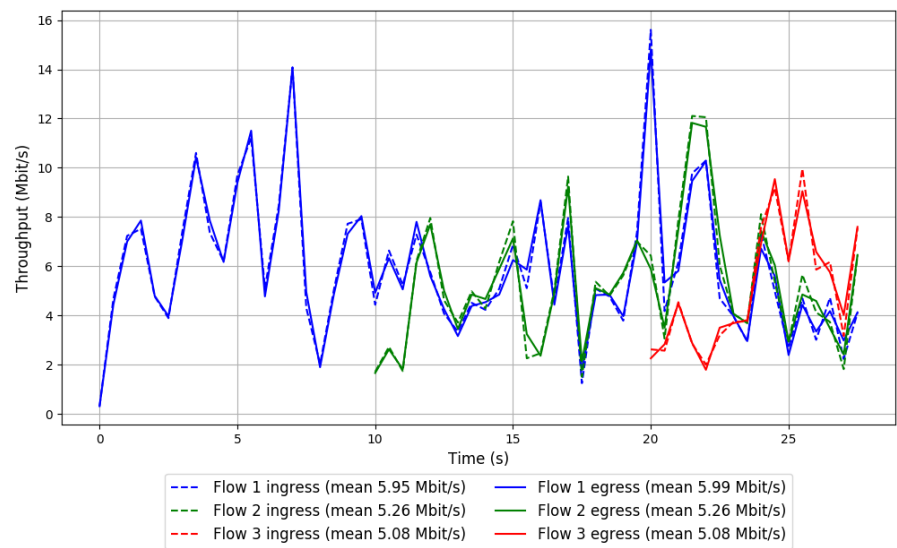
Average throughput: 5.08 Mbit/s

95th percentile per-packet one-way delay: 73.371 ms

Loss rate: 0.00%



Run 2: Report of Copa — Data Link



Run 3: Statistics of Copa

Start at: 2018-01-26 04:20:42

End at: 2018-01-26 04:21:12

Local clock offset: -4.182 ms

# Below is generated by plot.py at 2018-01-26 05:04:55

# Datalink statistics

-- Total of 3 flows:

Average throughput: 17.64 Mbit/s

95th percentile per-packet one-way delay: 99.123 ms

Loss rate: 0.18%

-- Flow 1:

Average throughput: 10.15 Mbit/s

95th percentile per-packet one-way delay: 98.988 ms

Loss rate: 0.10%

-- Flow 2:

Average throughput: 8.36 Mbit/s

95th percentile per-packet one-way delay: 104.023 ms

Loss rate: 0.18%

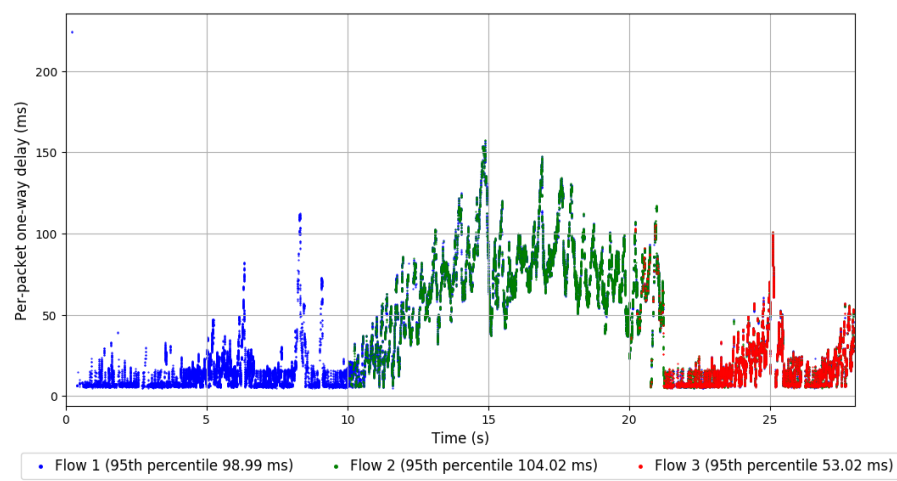
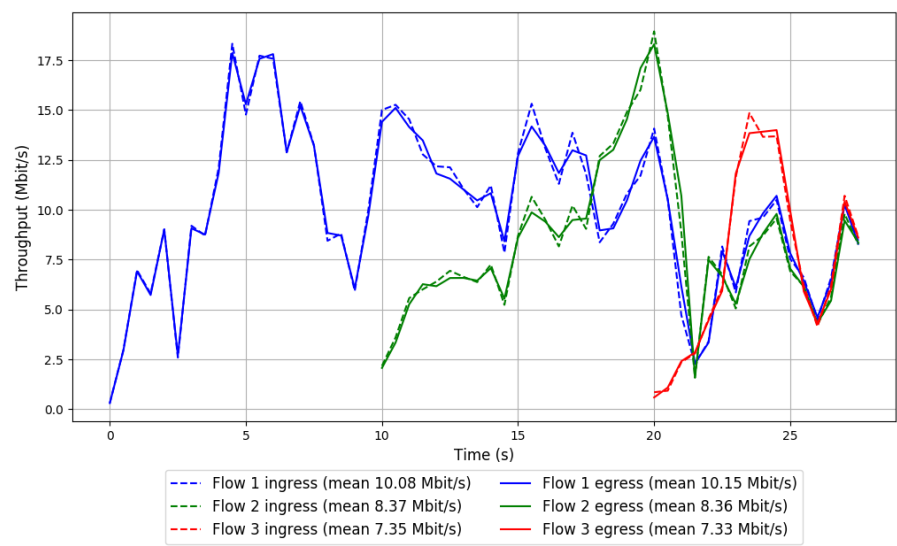
-- Flow 3:

Average throughput: 7.33 Mbit/s

95th percentile per-packet one-way delay: 53.015 ms

Loss rate: 0.55%

Run 3: Report of Copa — Data Link

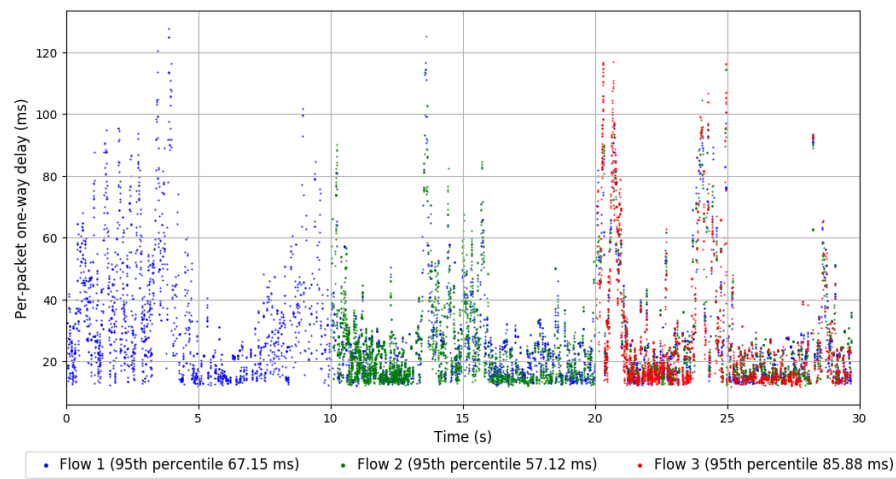
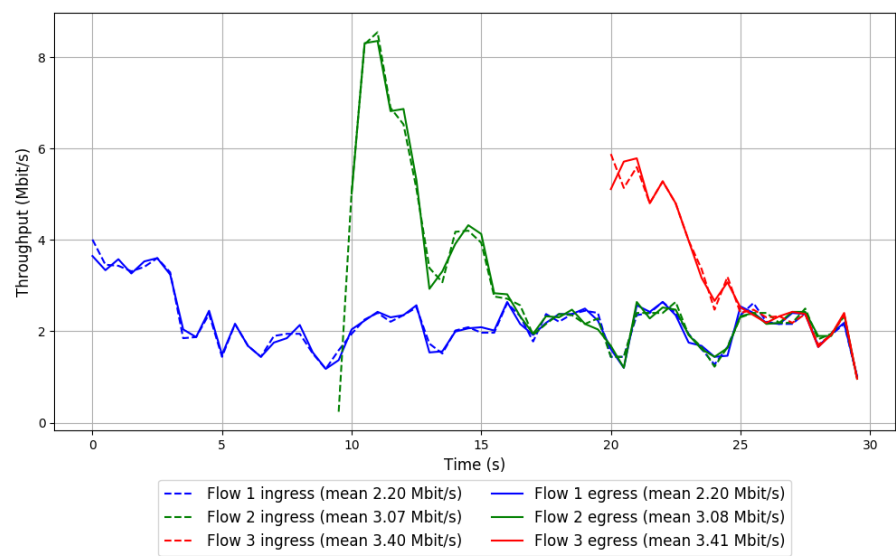


```
Run 1: Statistics of Indigo-2-256

Start at: 2018-01-26 02:58:33
End at: 2018-01-26 02:59:03
Local clock offset: 2.723 ms

# Below is generated by plot.py at 2018-01-26 05:04:55
# Datalink statistics
-- Total of 3 flows:
Average throughput: 5.34 Mbit/s
95th percentile per-packet one-way delay: 69.023 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 2.20 Mbit/s
95th percentile per-packet one-way delay: 67.151 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 3.08 Mbit/s
95th percentile per-packet one-way delay: 57.124 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 3.41 Mbit/s
95th percentile per-packet one-way delay: 85.875 ms
Loss rate: 0.00%
```

Run 1: Report of Indigo-2-256 — Data Link



Run 2: Statistics of Indigo-2-256

Start at: 2018-01-26 03:45:31

End at: 2018-01-26 03:46:01

Local clock offset: -1.028 ms

# Below is generated by plot.py at 2018-01-26 05:04:55

# Datalink statistics

-- Total of 3 flows:

Average throughput: 7.51 Mbit/s

95th percentile per-packet one-way delay: 31.385 ms

Loss rate: 0.00%

-- Flow 1:

Average throughput: 2.64 Mbit/s

95th percentile per-packet one-way delay: 28.372 ms

Loss rate: 0.00%

-- Flow 2:

Average throughput: 4.87 Mbit/s

95th percentile per-packet one-way delay: 32.476 ms

Loss rate: 0.00%

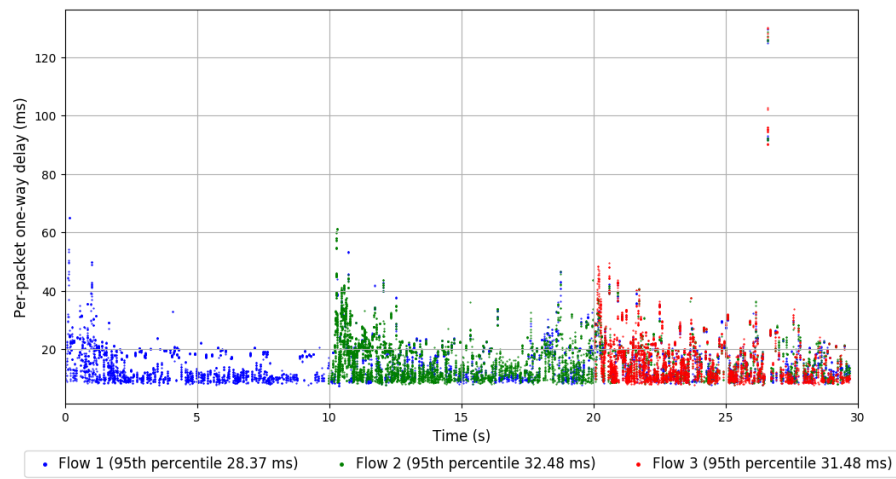
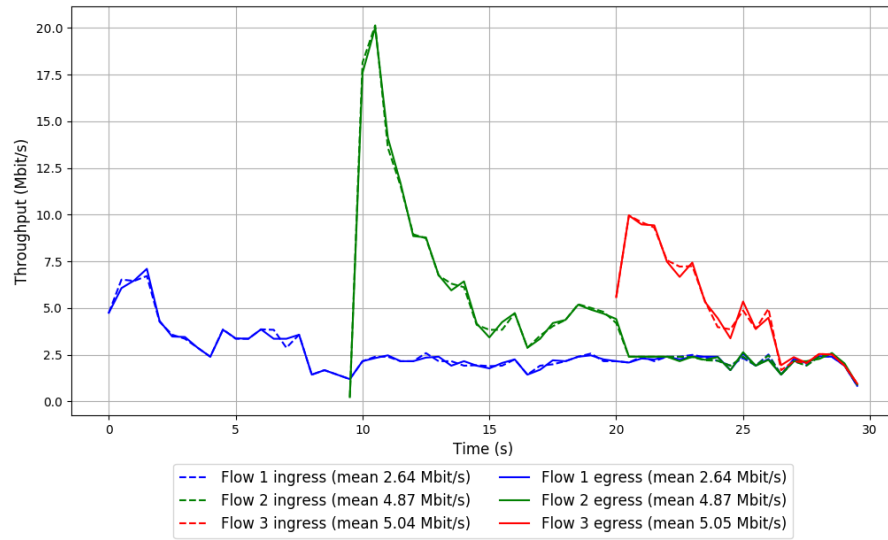
-- Flow 3:

Average throughput: 5.05 Mbit/s

95th percentile per-packet one-way delay: 31.479 ms

Loss rate: 0.00%

## Run 2: Report of Indigo-2-256 — Data Link



Run 3: Statistics of Indigo-2-256

Start at: 2018-01-26 04:32:29

End at: 2018-01-26 04:32:59

Local clock offset: -4.345 ms

# Below is generated by plot.py at 2018-01-26 05:04:55

# Datalink statistics

-- Total of 3 flows:

Average throughput: 6.78 Mbit/s

95th percentile per-packet one-way delay: 37.642 ms

Loss rate: 0.00%

-- Flow 1:

Average throughput: 1.94 Mbit/s

95th percentile per-packet one-way delay: 30.117 ms

Loss rate: 0.00%

-- Flow 2:

Average throughput: 3.51 Mbit/s

95th percentile per-packet one-way delay: 42.892 ms

Loss rate: 0.00%

-- Flow 3:

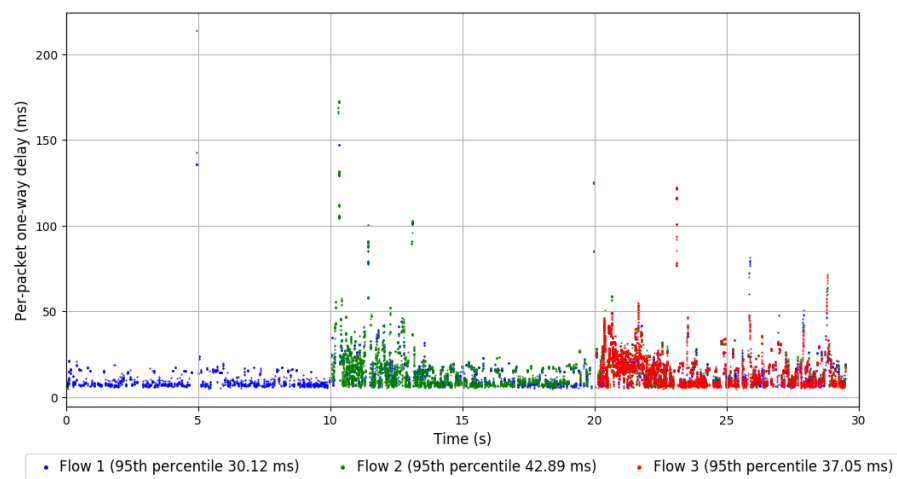
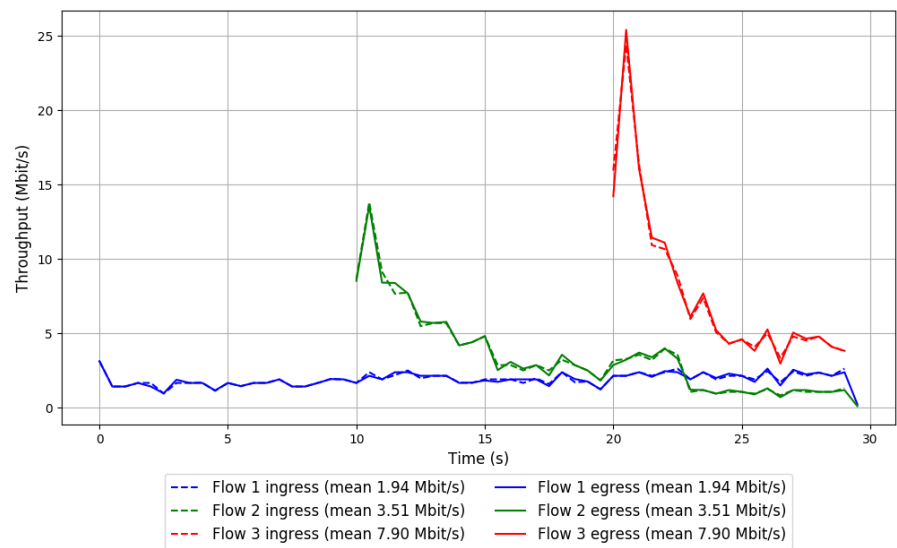
Average throughput: 7.90 Mbit/s

95th percentile per-packet one-way delay: 37.047 ms

Loss rate: 0.00%



Run 3: Report of Indigo-2-256 — Data Link

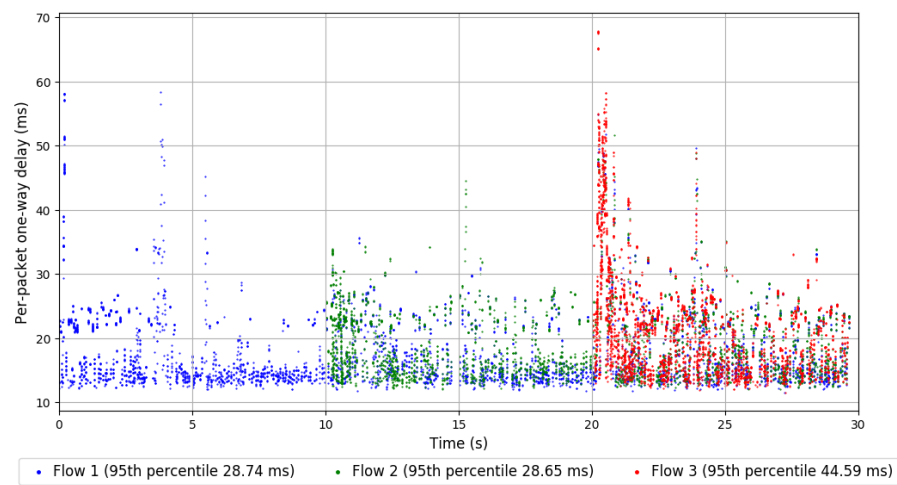
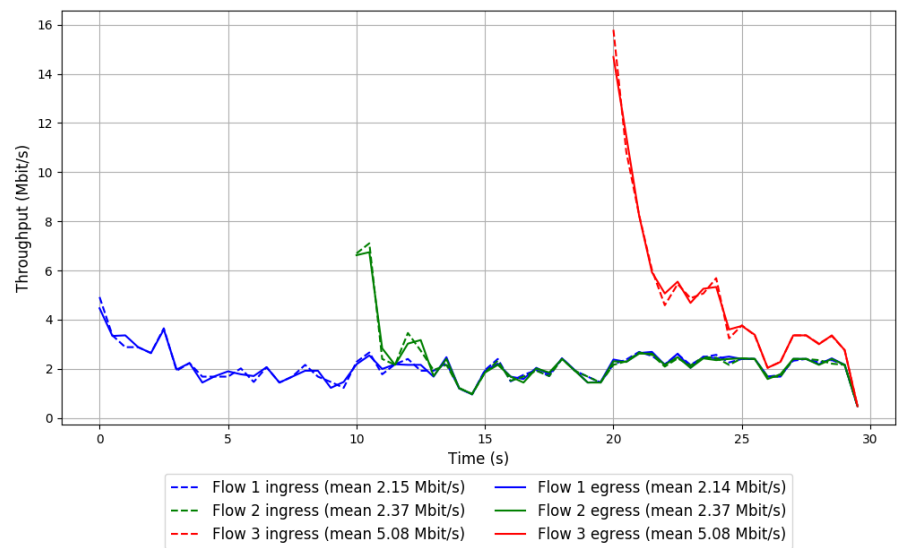


```
Run 1: Statistics of Indigo-1-32

Start at: 2018-01-26 03:04:25
End at: 2018-01-26 03:04:55
Local clock offset: 2.725 ms

# Below is generated by plot.py at 2018-01-26 05:04:55
# Datalink statistics
-- Total of 3 flows:
Average throughput: 5.36 Mbit/s
95th percentile per-packet one-way delay: 35.718 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 2.14 Mbit/s
95th percentile per-packet one-way delay: 28.736 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 2.37 Mbit/s
95th percentile per-packet one-way delay: 28.652 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 5.08 Mbit/s
95th percentile per-packet one-way delay: 44.594 ms
Loss rate: 0.00%
```

Run 1: Report of Indigo-1-32 — Data Link



Run 2: Statistics of Indigo-1-32

Start at: 2018-01-26 03:51:23

End at: 2018-01-26 03:51:53

Local clock offset: -2.299 ms

# Below is generated by plot.py at 2018-01-26 05:04:55

# Datalink statistics

-- Total of 3 flows:

Average throughput: 4.58 Mbit/s

95th percentile per-packet one-way delay: 31.534 ms

Loss rate: 0.00%

-- Flow 1:

Average throughput: 1.68 Mbit/s

95th percentile per-packet one-way delay: 34.016 ms

Loss rate: 0.00%

-- Flow 2:

Average throughput: 2.17 Mbit/s

95th percentile per-packet one-way delay: 22.799 ms

Loss rate: 0.00%

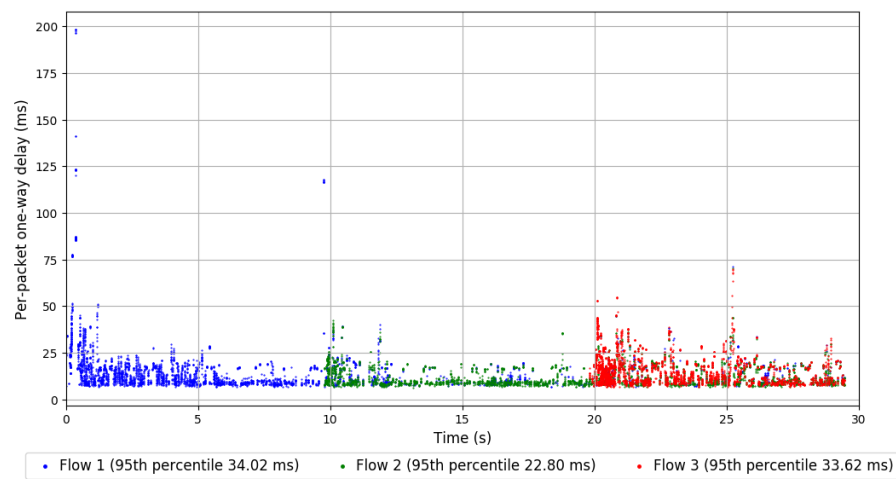
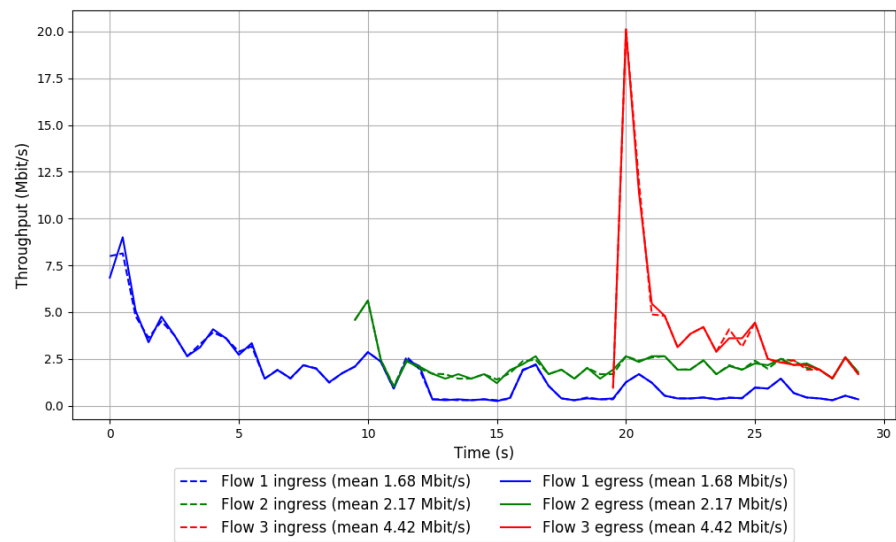
-- Flow 3:

Average throughput: 4.42 Mbit/s

95th percentile per-packet one-way delay: 33.619 ms

Loss rate: 0.00%

Run 2: Report of Indigo-1-32 — Data Link



Run 3: Statistics of Indigo-1-32

Start at: 2018-01-26 04:38:21

End at: 2018-01-26 04:38:51

Local clock offset: -4.547 ms

# Below is generated by plot.py at 2018-01-26 05:04:55

# Datalink statistics

-- Total of 3 flows:

Average throughput: 4.23 Mbit/s

95th percentile per-packet one-way delay: 31.919 ms

Loss rate: 0.00%

-- Flow 1:

Average throughput: 1.08 Mbit/s

95th percentile per-packet one-way delay: 26.076 ms

Loss rate: 0.00%

-- Flow 2:

Average throughput: 3.30 Mbit/s

95th percentile per-packet one-way delay: 36.983 ms

Loss rate: 0.00%

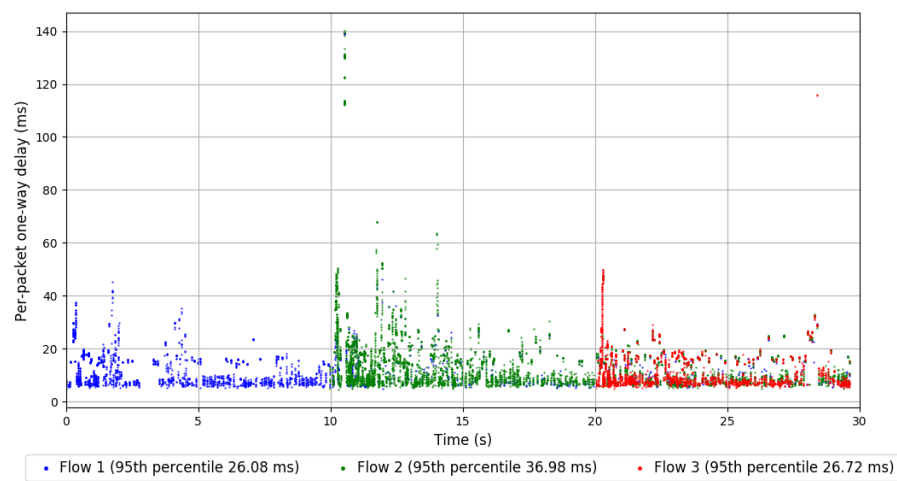
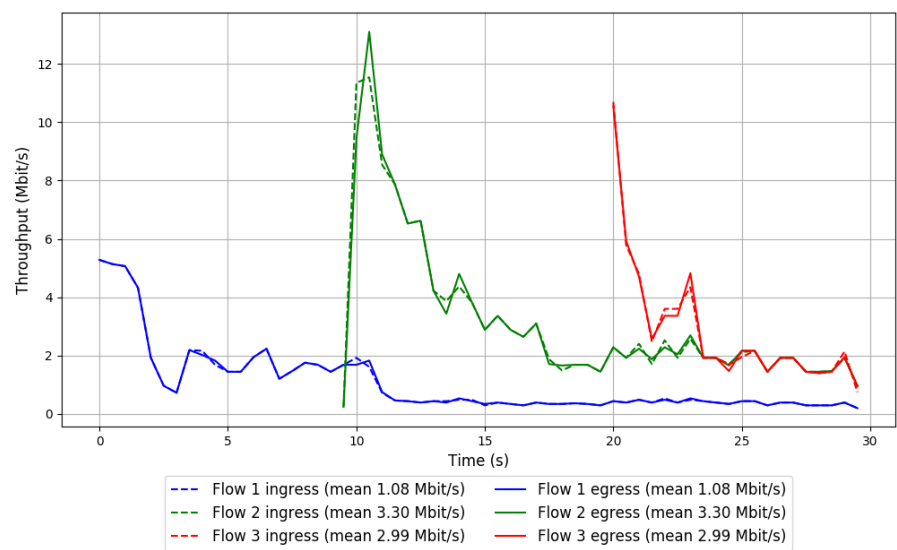
-- Flow 3:

Average throughput: 2.99 Mbit/s

95th percentile per-packet one-way delay: 26.724 ms

Loss rate: 0.00%

Run 3: Report of Indigo-1-32 — Data Link



Run 1: Statistics of Indigo-1-128

Start at: 2018-01-26 03:16:09

End at: 2018-01-26 03:16:39

Local clock offset: 2.384 ms

# Below is generated by plot.py at 2018-01-26 05:04:55

# Datalink statistics

-- Total of 3 flows:

Average throughput: 1.33 Mbit/s

95th percentile per-packet one-way delay: 62.789 ms

Loss rate: 0.00%

-- Flow 1:

Average throughput: 0.49 Mbit/s

95th percentile per-packet one-way delay: 39.117 ms

Loss rate: 0.00%

-- Flow 2:

Average throughput: 0.63 Mbit/s

95th percentile per-packet one-way delay: 78.438 ms

Loss rate: 0.00%

-- Flow 3:

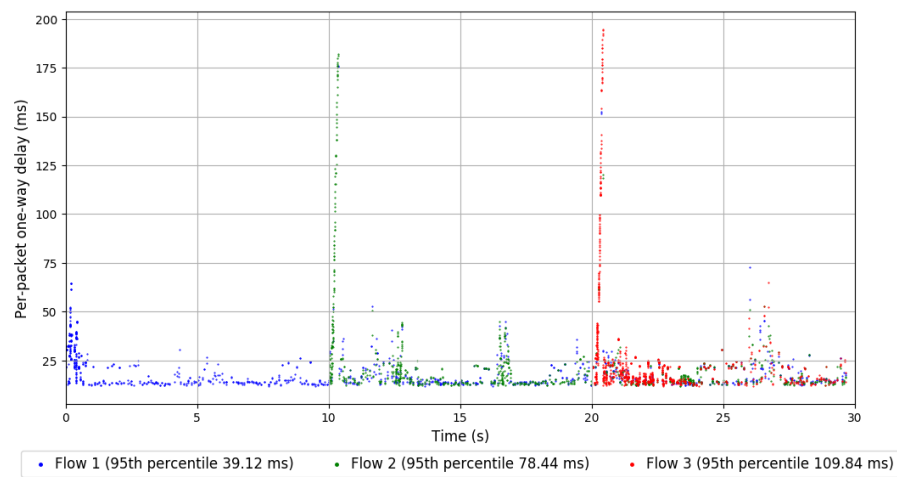
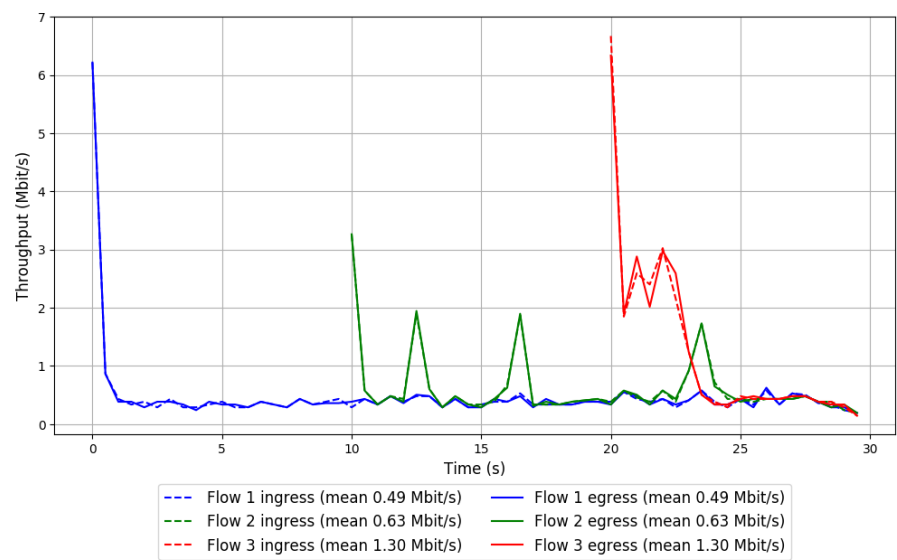
Average throughput: 1.30 Mbit/s

95th percentile per-packet one-way delay: 109.845 ms

Loss rate: 0.00%



Run 1: Report of Indigo-1-128 — Data Link



Run 2: Statistics of Indigo-1-128

Start at: 2018-01-26 04:03:06

End at: 2018-01-26 04:03:36

Local clock offset: -3.843 ms

# Below is generated by plot.py at 2018-01-26 05:04:55

# Datalink statistics

-- Total of 3 flows:

Average throughput: 3.75 Mbit/s

95th percentile per-packet one-way delay: 44.662 ms

Loss rate: 0.00%

-- Flow 1:

Average throughput: 1.42 Mbit/s

95th percentile per-packet one-way delay: 24.584 ms

Loss rate: 0.00%

-- Flow 2:

Average throughput: 3.18 Mbit/s

95th percentile per-packet one-way delay: 52.116 ms

Loss rate: 0.00%

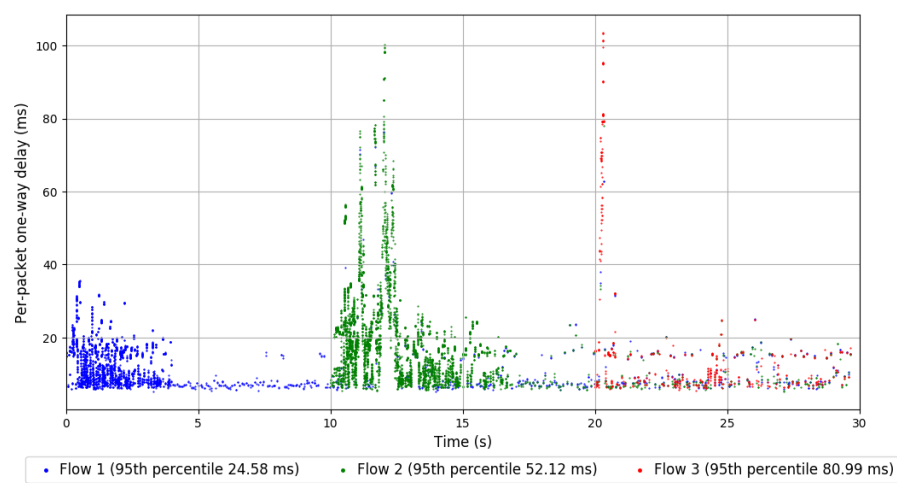
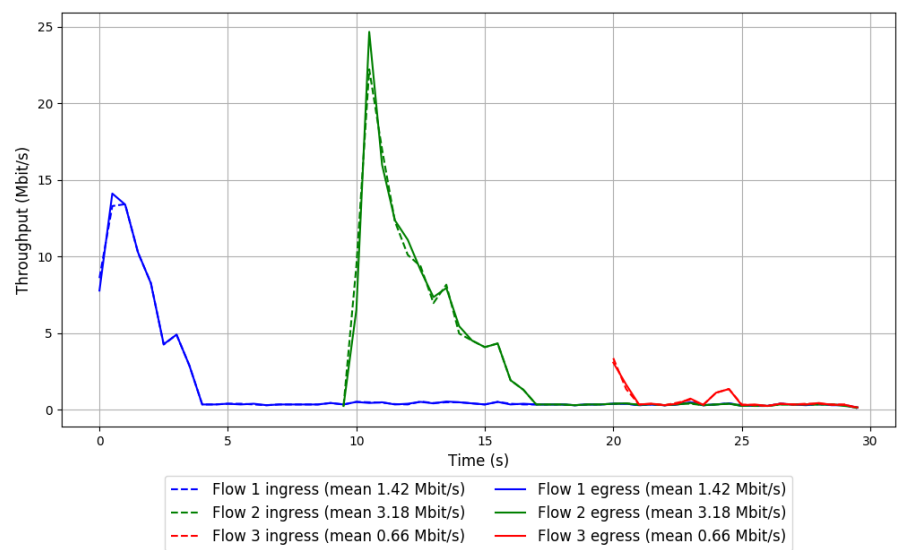
-- Flow 3:

Average throughput: 0.66 Mbit/s

95th percentile per-packet one-way delay: 80.990 ms

Loss rate: 0.00%

Run 2: Report of Indigo-1-128 — Data Link



Run 3: Statistics of Indigo-1-128

Start at: 2018-01-26 04:50:06

End at: 2018-01-26 04:50:36

Local clock offset: -1.981 ms

# Below is generated by plot.py at 2018-01-26 05:04:55

# Datalink statistics

-- Total of 3 flows:

Average throughput: 3.66 Mbit/s

95th percentile per-packet one-way delay: 32.876 ms

Loss rate: 0.00%

-- Flow 1:

Average throughput: 0.58 Mbit/s

95th percentile per-packet one-way delay: 24.923 ms

Loss rate: 0.00%

-- Flow 2:

Average throughput: 2.13 Mbit/s

95th percentile per-packet one-way delay: 37.184 ms

Loss rate: 0.00%

-- Flow 3:

Average throughput: 5.12 Mbit/s

95th percentile per-packet one-way delay: 28.784 ms

Loss rate: 0.00%

Run 3: Report of Indigo-1-128 — Data Link

