

## Pantheon Report

Generated at 2017-08-13 07:38:43 (UTC).

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

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).

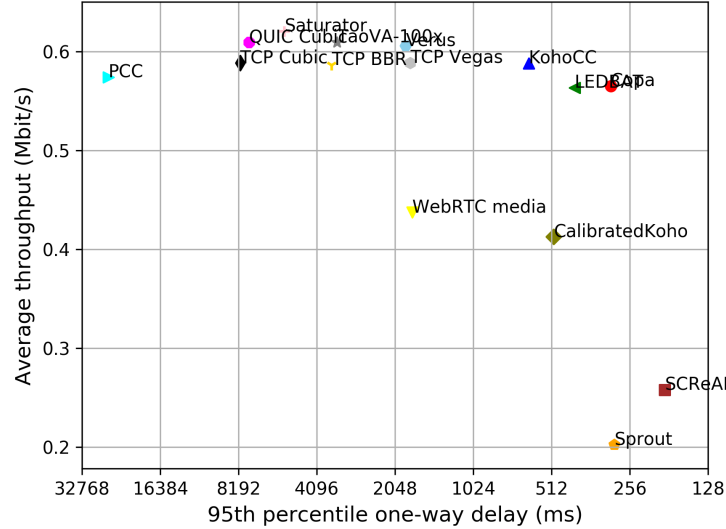
Tested BBR with qdisc of Fair Queuing (**fq**), and other schemes with the default Linux qdisc (**pfifo\_fast**).

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

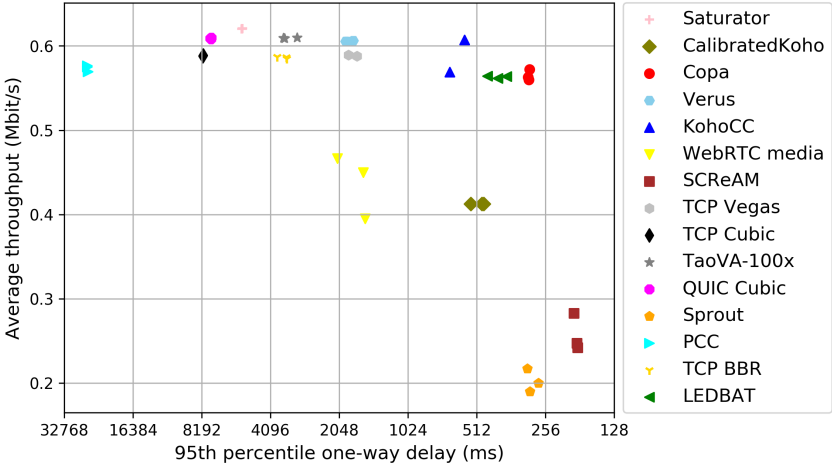
Git summary:

```
branch: master @ e43be7582298d552838afcf6382342bf187fbbd6
third_party/calibrated_koho @ 3cb73c0d1c0322cdfae446ea37a522e53227db50
  M datagrump/sender.cc
third_party/genericCC @ dae96123232f1bcb37725348fa2378691ce26725
third_party/koho_cc @ f0f2e693303aee82ea808e6928eac4f1083a6681
  M datagrump/sender.cc
third_party/libutp @ b3465b942e2826f2b179eaab4a906ce6bb7cf3cf
third_party/pantheon-stimuli @ fc73a85ca16c34366d1888dc8a0d0d88d4ebf2a7
third_party/pantheon-tunnel @ baf443516dea3eeddeccaf9b916cc313273ca4f4
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-quick @ 77961f1a82733a86b42f1bc8143ebc978f3cff42
third_party/scream @ c3370fd7bd17265a79aeb34e4016ad23f5965885
third_party/sourdough @ f1a14bffe749737437f61b1eaaeb30b267cde681
third_party/sprout @ 6f2efe6e088d91066a9f023df375eee2665089ce
  M src/examples/cellsim.cc
  M src/examples/sproutbt2.cc
  M src/network/sproutconn.cc
third_party/verus @ d4b447ea74c6c60a261149af2629562939f9a494
  M src/verus.hpp
  M tools/plot.py
third_party/webRTC @ a488197ddd041ace68a42849b2540ad834825f42
```

test from 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	0.38	0.31	0.03	3581.85	3624.61	3443.89	2.51	5.97	44.45
CalibratedKoho	3	0.20	0.20	0.22	1156.66	394.15	473.01	1.37	2.01	4.22
Copa	3	0.33	0.23	0.21	283.86	302.69	353.63	0.49	1.23	2.32
TCP Cubic	3	0.58	0.03	0.00	8100.09	6513.50	8451.30	30.82	53.61	74.06
KohoCC	2	0.32	0.27	0.30	743.60	582.52	618.24	3.16	2.33	4.26
LEDBAT	3	0.25	0.37	0.21	352.21	428.13	438.68	0.11	1.01	8.95
PCC	3	0.58	0.00	N/A	25979.77	N/A	N/A	98.58	N/A	N/A
QUIC Cubic	3	0.58	0.06	0.00	7455.52	7665.89	7620.48	28.81	34.12	33.33
Saturator	3	0.54	0.14	0.60	5047.32	5847.20	4944.45	13.87	52.63	72.40
SCReAM	3	0.08	0.17	0.17	168.78	188.59	203.13	0.70	1.09	1.87
Sprout	3	0.10	0.10	0.11	642.01	228.64	265.28	1.36	1.50	4.28
TaoVA-100x	3	0.37	0.26	0.22	2684.29	3324.34	4040.54	4.13	8.54	22.90
TCP Vegas	2	0.41	0.21	0.17	1731.94	1862.81	1847.02	3.21	6.07	21.58
Verus	3	0.59	0.01	0.01	1865.14	1874.25	1901.21	5.63	5.00	10.00
WebRTC media	3	0.24	0.15	0.05	1738.38	1732.47	1838.33	2.24	1.95	1.41

Run 1: Statistics of TCP BBR

Start at: 2017-08-13 05:47:02

End at: 2017-08-13 05:47:32

Local clock offset: 0.487 ms

Remote clock offset: 2.771 ms

# Below is generated by plot.py at 2017-08-13 07:38:11

# Datalink statistics

-- Total of 3 flows:

Average throughput: 0.58 Mbit/s

95th percentile per-packet one-way delay: 3479.775 ms

Loss rate: 4.64%

-- Flow 1:

Average throughput: 0.38 Mbit/s

95th percentile per-packet one-way delay: 3459.880 ms

Loss rate: 2.39%

-- Flow 2:

Average throughput: 0.30 Mbit/s

95th percentile per-packet one-way delay: 3498.022 ms

Loss rate: 6.95%

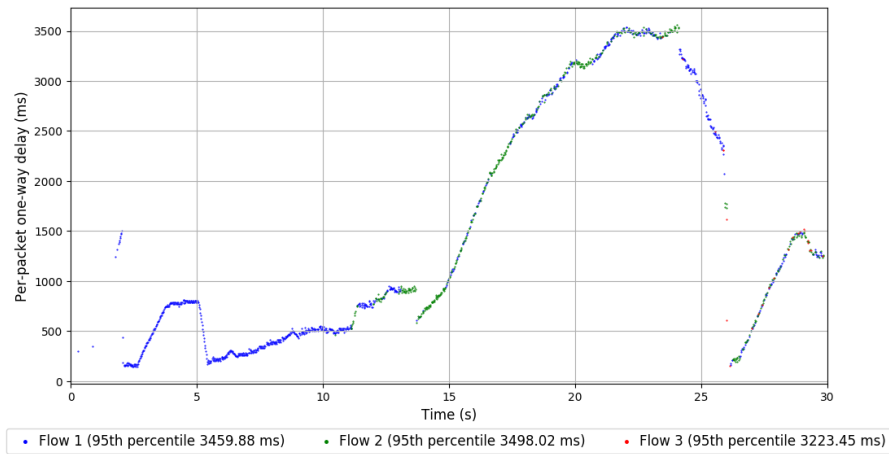
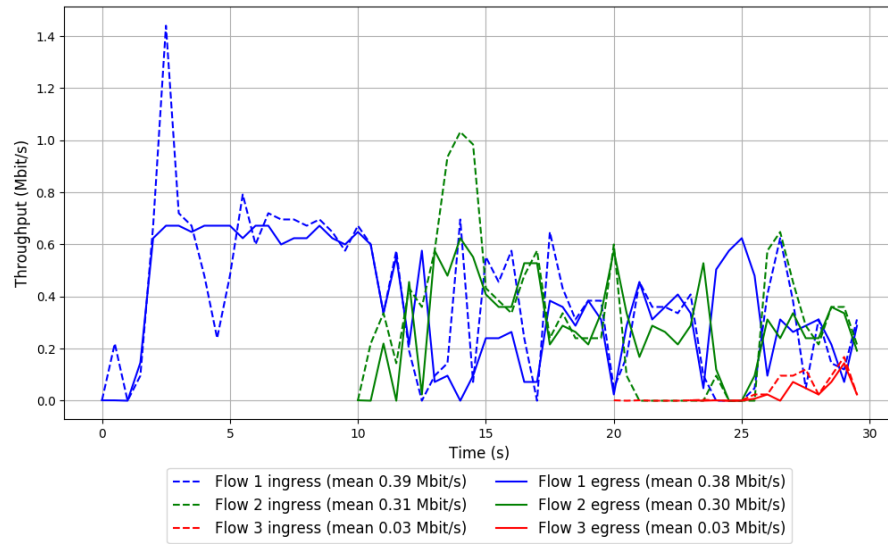
-- Flow 3:

Average throughput: 0.03 Mbit/s

95th percentile per-packet one-way delay: 3223.451 ms

Loss rate: 38.66%

# Run 1: Report of TCP BBR — Data Link

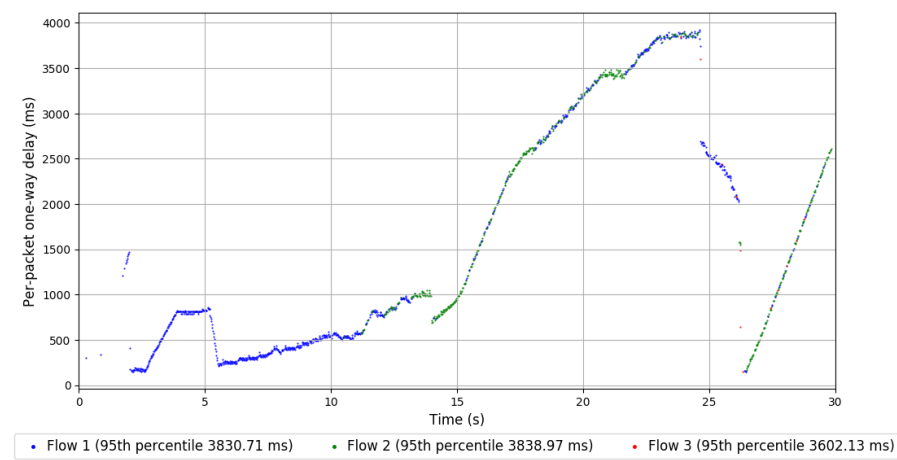
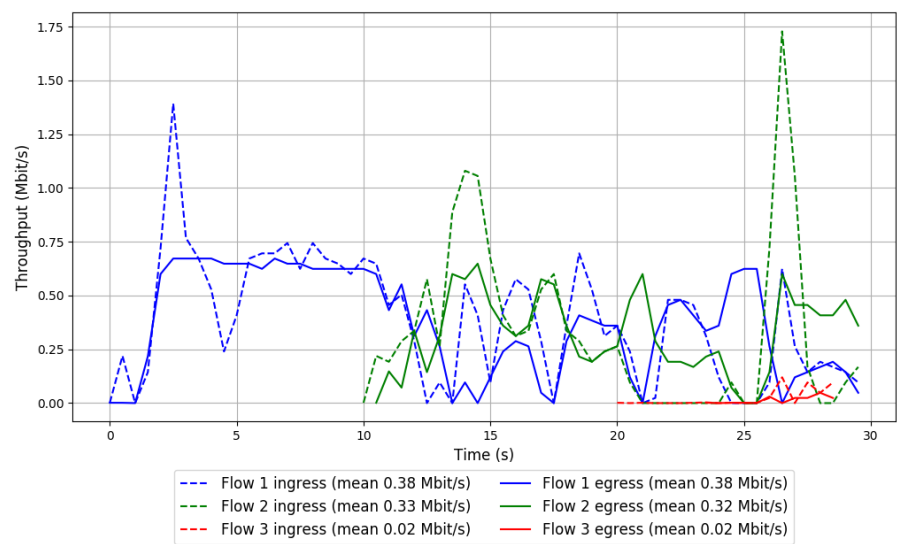


Run 2: Statistics of TCP BBR

Start at: 2017-08-13 06:05:46  
End at: 2017-08-13 06:06:16  
Local clock offset: 0.422 ms  
Remote clock offset: -2.039 ms

# Below is generated by plot.py at 2017-08-13 07:38:11  
# Datalink statistics  
-- Total of 3 flows:  
Average throughput: 0.59 Mbit/s  
95th percentile per-packet one-way delay: 3830.810 ms  
Loss rate: 4.88%  
-- Flow 1:  
Average throughput: 0.38 Mbit/s  
95th percentile per-packet one-way delay: 3830.710 ms  
Loss rate: 3.57%  
-- Flow 2:  
Average throughput: 0.32 Mbit/s  
95th percentile per-packet one-way delay: 3838.969 ms  
Loss rate: 5.45%  
-- Flow 3:  
Average throughput: 0.02 Mbit/s  
95th percentile per-packet one-way delay: 3602.134 ms  
Loss rate: 60.79%

Run 2: Report of TCP BBR — Data Link



Run 3: Statistics of TCP BBR

Start at: 2017-08-13 06:24:30

End at: 2017-08-13 06:25:00

Local clock offset: 0.463 ms

Remote clock offset: 2.043 ms

# Below is generated by plot.py at 2017-08-13 07:38:12

# Datalink statistics

-- Total of 3 flows:

Average throughput: 0.59 Mbit/s

95th percentile per-packet one-way delay: 3500.215 ms

Loss rate: 3.60%

-- Flow 1:

Average throughput: 0.38 Mbit/s

95th percentile per-packet one-way delay: 3454.954 ms

Loss rate: 1.56%

-- Flow 2:

Average throughput: 0.30 Mbit/s

95th percentile per-packet one-way delay: 3536.849 ms

Loss rate: 5.52%

-- Flow 3:

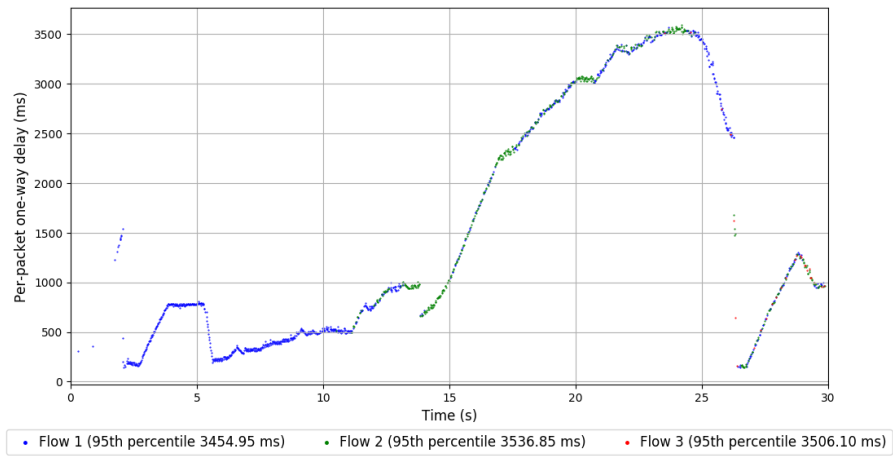
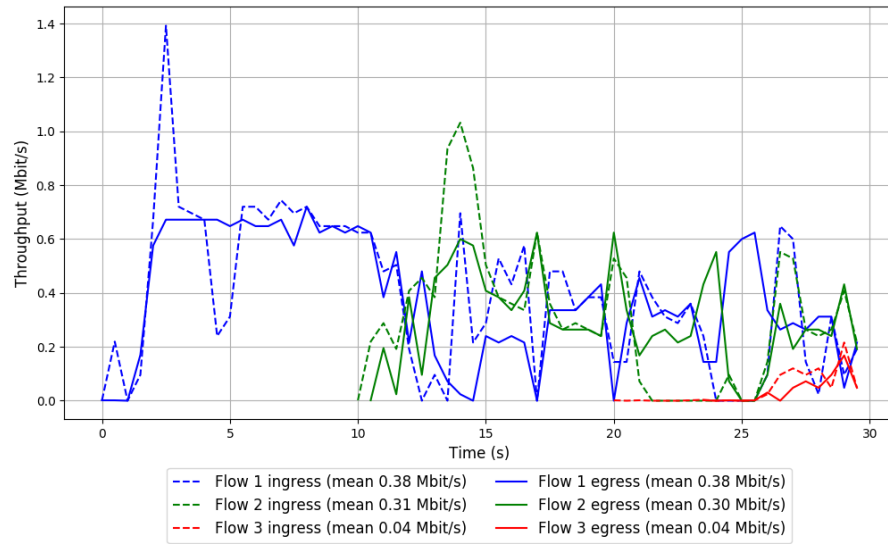
Average throughput: 0.04 Mbit/s

95th percentile per-packet one-way delay: 3506.096 ms

Loss rate: 33.90%



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



Run 1: Statistics of CalibratedKoho

Start at: 2017-08-13 05:50:46

End at: 2017-08-13 05:51:16

Local clock offset: 0.495 ms

Remote clock offset: 2.79 ms

# Below is generated by plot.py at 2017-08-13 07:38:13

# Datalink statistics

-- Total of 3 flows:

Average throughput: 0.41 Mbit/s

95th percentile per-packet one-way delay: 477.312 ms

Loss rate: 2.00%

-- Flow 1:

Average throughput: 0.21 Mbit/s

95th percentile per-packet one-way delay: 1157.048 ms

Loss rate: 1.22%

-- Flow 2:

Average throughput: 0.20 Mbit/s

95th percentile per-packet one-way delay: 416.709 ms

Loss rate: 2.15%

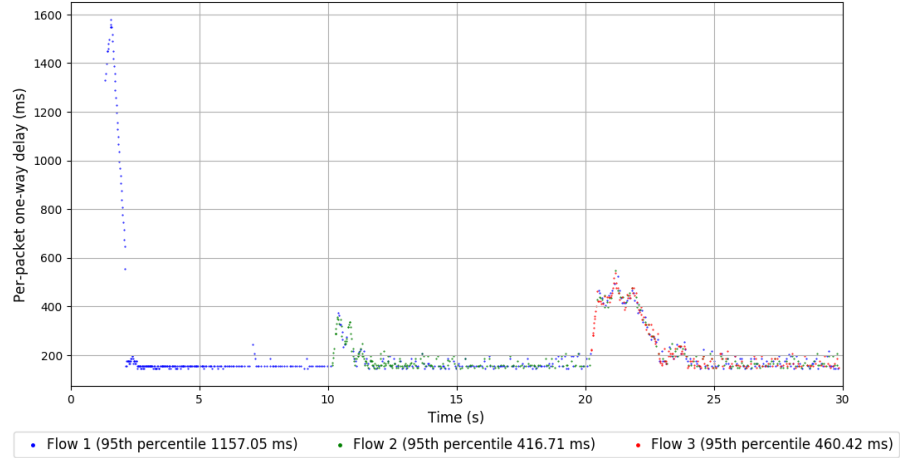
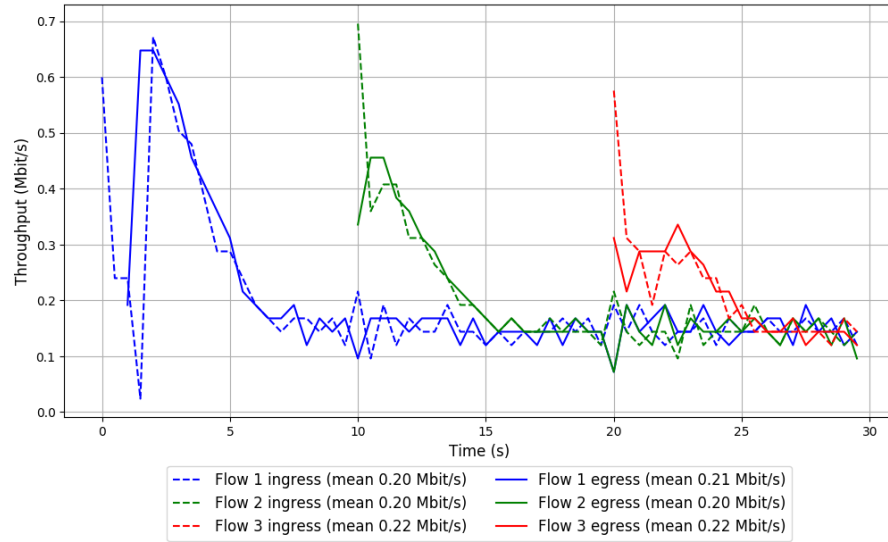
-- Flow 3:

Average throughput: 0.22 Mbit/s

95th percentile per-packet one-way delay: 460.417 ms

Loss rate: 3.87%

# Run 1: Report of CalibratedKoho — Data Link

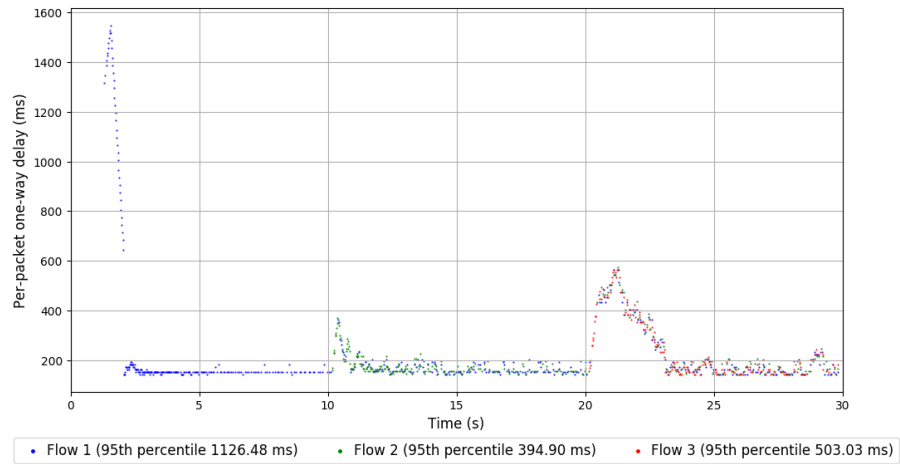
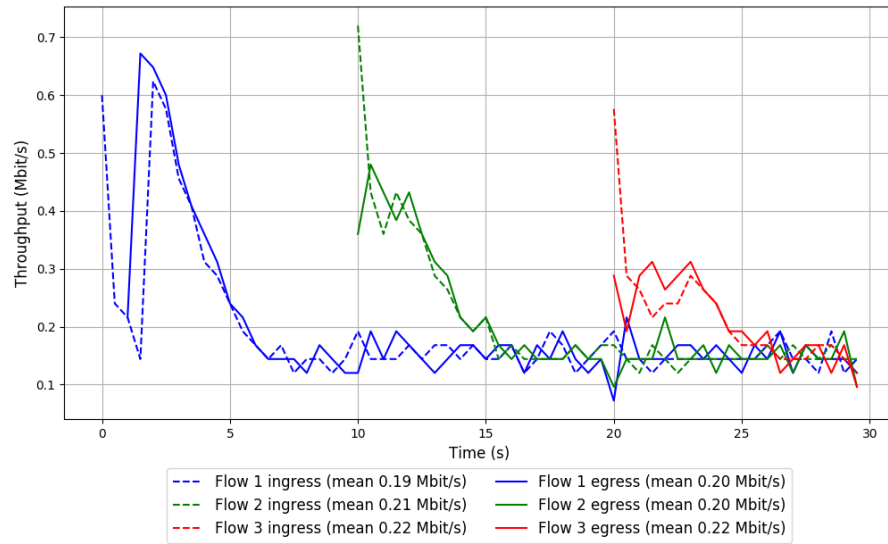


Run 2: Statistics of CalibratedKoho

Start at: 2017-08-13 06:09:30  
End at: 2017-08-13 06:10:00  
Local clock offset: 0.449 ms  
Remote clock offset: -1.963 ms

# Below is generated by plot.py at 2017-08-13 07:38:14  
# Datalink statistics  
-- Total of 3 flows:  
Average throughput: 0.41 Mbit/s  
95th percentile per-packet one-way delay: 544.321 ms  
Loss rate: 2.20%  
-- Flow 1:  
Average throughput: 0.20 Mbit/s  
95th percentile per-packet one-way delay: 1126.482 ms  
Loss rate: 1.46%  
-- Flow 2:  
Average throughput: 0.20 Mbit/s  
95th percentile per-packet one-way delay: 394.904 ms  
Loss rate: 2.35%  
-- Flow 3:  
Average throughput: 0.22 Mbit/s  
95th percentile per-packet one-way delay: 503.034 ms  
Loss rate: 3.87%

## Run 2: Report of CalibratedKoho — Data Link



Run 3: Statistics of CalibratedKoho

Start at: 2017-08-13 06:28:14

End at: 2017-08-13 06:28:44

Local clock offset: 0.363 ms

Remote clock offset: -1.84 ms

# Below is generated by plot.py at 2017-08-13 07:38:14

# Datalink statistics

-- Total of 3 flows:

Average throughput: 0.41 Mbit/s

95th percentile per-packet one-way delay: 485.725 ms

Loss rate: 2.10%

-- Flow 1:

Average throughput: 0.20 Mbit/s

95th percentile per-packet one-way delay: 1186.446 ms

Loss rate: 1.43%

-- Flow 2:

Average throughput: 0.20 Mbit/s

95th percentile per-packet one-way delay: 370.834 ms

Loss rate: 1.53%

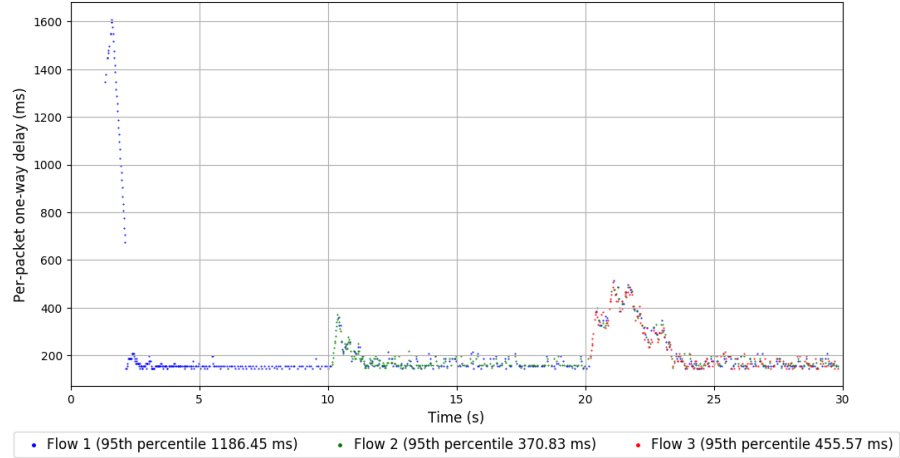
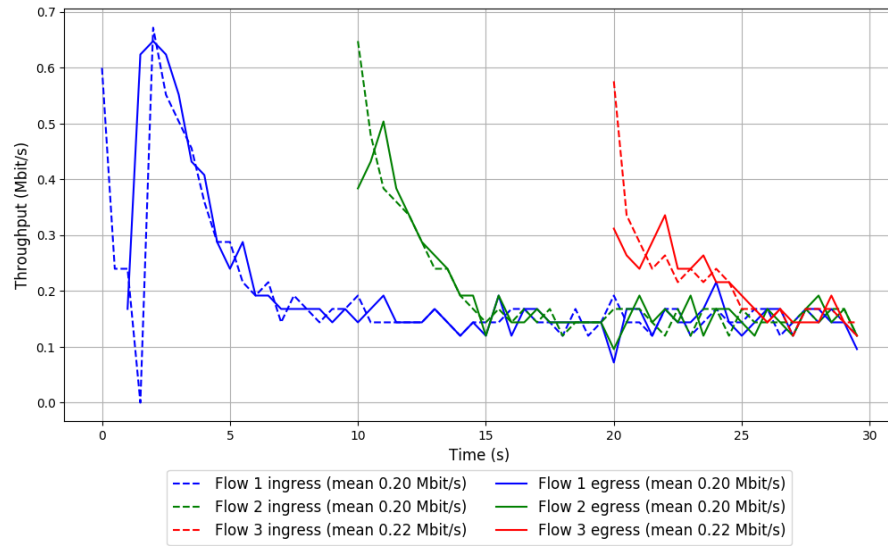
-- Flow 3:

Average throughput: 0.22 Mbit/s

95th percentile per-packet one-way delay: 455.575 ms

Loss rate: 4.92%

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



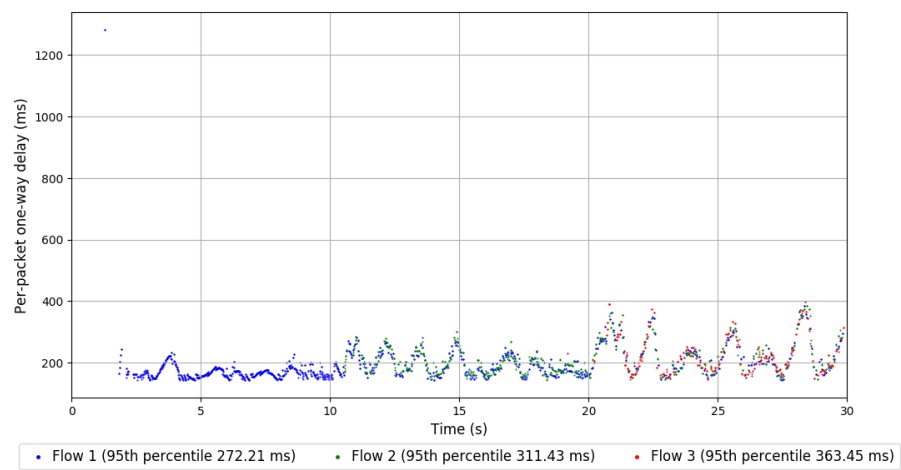
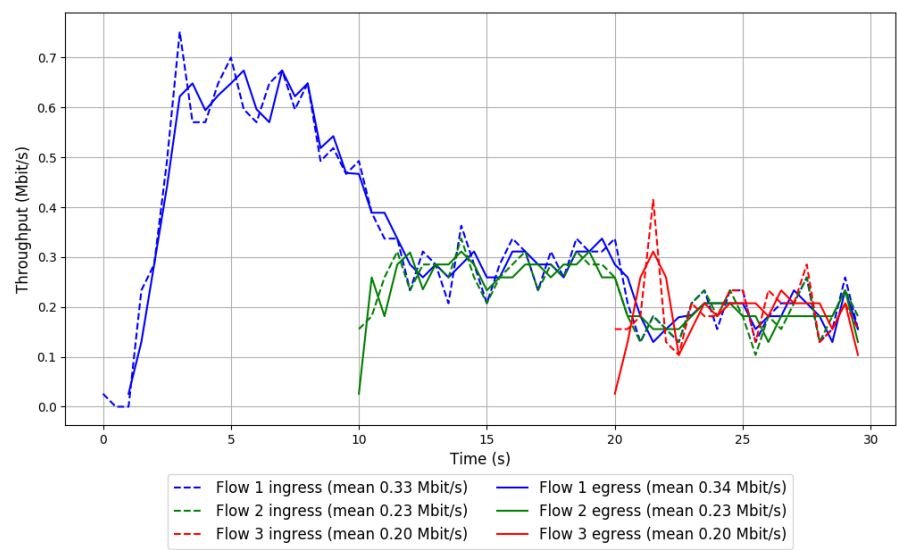
Run 1: Statistics of Copa

Start at: 2017-08-13 05:45:47  
End at: 2017-08-13 05:46:17  
Local clock offset: 0.494 ms  
Remote clock offset: -2.892 ms

# Below is generated by plot.py at 2017-08-13 07:38:15  
# Datalink statistics  
-- Total of 3 flows:  
Average throughput: 0.56 Mbit/s  
95th percentile per-packet one-way delay: 302.788 ms  
Loss rate: 1.28%  
-- Flow 1:  
Average throughput: 0.34 Mbit/s  
95th percentile per-packet one-way delay: 272.206 ms  
Loss rate: 0.66%  
-- Flow 2:  
Average throughput: 0.23 Mbit/s  
95th percentile per-packet one-way delay: 311.428 ms  
Loss rate: 1.73%  
-- Flow 3:  
Average throughput: 0.20 Mbit/s  
95th percentile per-packet one-way delay: 363.454 ms  
Loss rate: 3.33%



Run 1: Report of Copa — Data Link

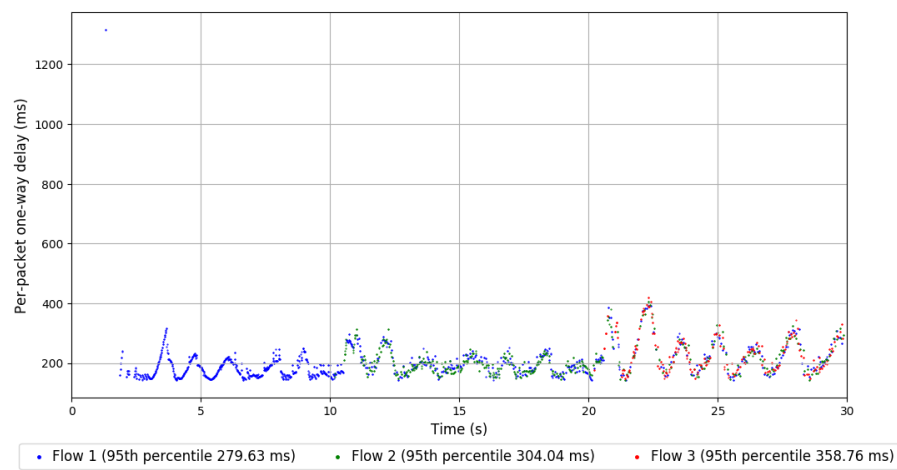
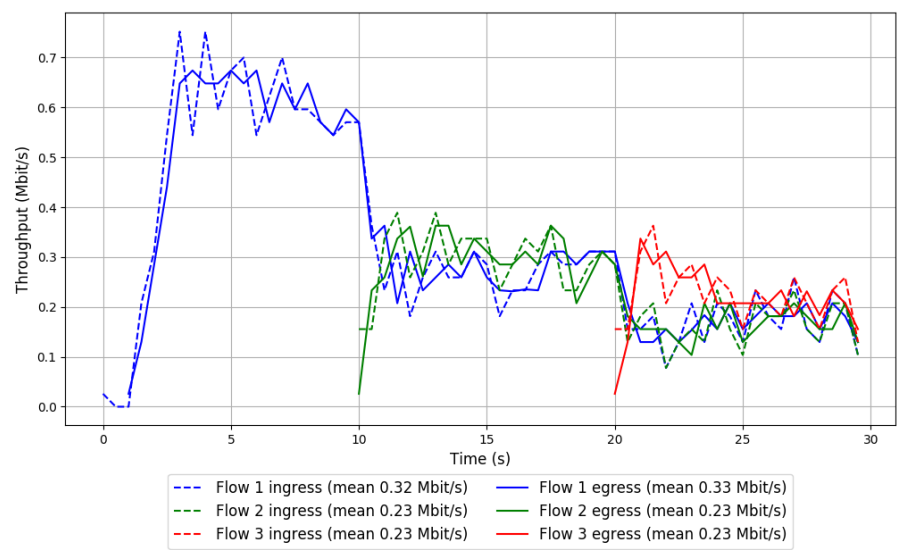


Run 2: Statistics of Copa

Start at: 2017-08-13 06:04:31  
End at: 2017-08-13 06:05:01  
Local clock offset: 0.352 ms  
Remote clock offset: -2.856 ms

# Below is generated by plot.py at 2017-08-13 07:38:16  
# Datalink statistics  
-- Total of 3 flows:  
Average throughput: 0.57 Mbit/s  
95th percentile per-packet one-way delay: 301.358 ms  
Loss rate: 0.79%  
-- Flow 1:  
Average throughput: 0.33 Mbit/s  
95th percentile per-packet one-way delay: 279.626 ms  
Loss rate: 0.41%  
-- Flow 2:  
Average throughput: 0.23 Mbit/s  
95th percentile per-packet one-way delay: 304.036 ms  
Loss rate: 0.84%  
-- Flow 3:  
Average throughput: 0.23 Mbit/s  
95th percentile per-packet one-way delay: 358.761 ms  
Loss rate: 2.33%

Run 2: Report of Copa — Data Link

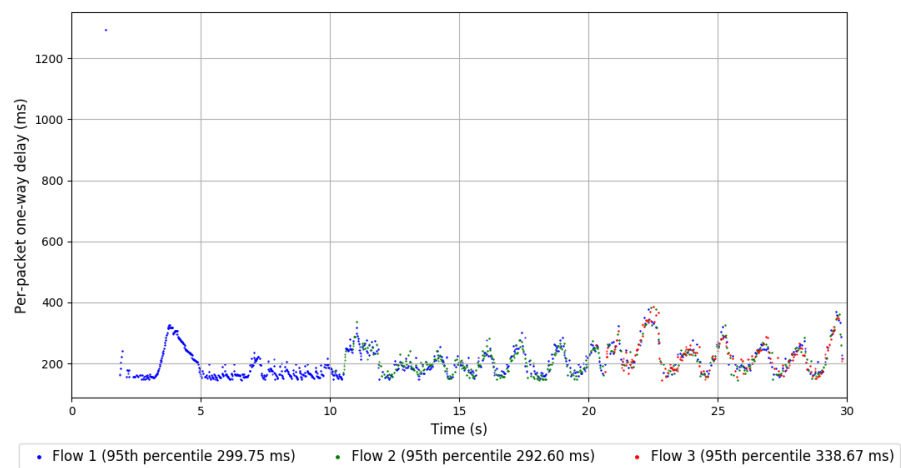
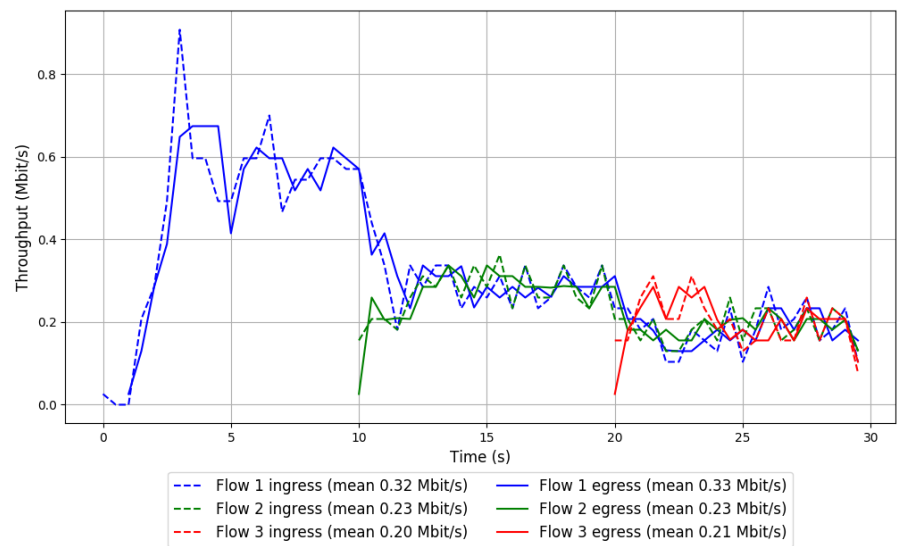


Run 3: Statistics of Copa

Start at: 2017-08-13 06:23:15  
End at: 2017-08-13 06:23:45  
Local clock offset: 0.419 ms  
Remote clock offset: -2.717 ms

# Below is generated by plot.py at 2017-08-13 07:38:16  
# Datalink statistics  
-- Total of 3 flows:  
Average throughput: 0.56 Mbit/s  
95th percentile per-packet one-way delay: 305.496 ms  
Loss rate: 0.72%  
-- Flow 1:  
Average throughput: 0.33 Mbit/s  
95th percentile per-packet one-way delay: 299.755 ms  
Loss rate: 0.41%  
-- Flow 2:  
Average throughput: 0.23 Mbit/s  
95th percentile per-packet one-way delay: 292.600 ms  
Loss rate: 1.13%  
-- Flow 3:  
Average throughput: 0.21 Mbit/s  
95th percentile per-packet one-way delay: 338.670 ms  
Loss rate: 1.30%

Run 3: Report of Copa — Data Link



Run 1: Statistics of TCP Cubic

Start at: 2017-08-13 05:54:30

End at: 2017-08-13 05:55:00

Local clock offset: 0.495 ms

Remote clock offset: 1.936 ms

# Below is generated by plot.py at 2017-08-13 07:38:17

# Datalink statistics

-- Total of 3 flows:

Average throughput: 0.59 Mbit/s

95th percentile per-packet one-way delay: 8068.322 ms

Loss rate: 31.49%

-- Flow 1:

Average throughput: 0.58 Mbit/s

95th percentile per-packet one-way delay: 8068.357 ms

Loss rate: 30.79%

-- Flow 2:

Average throughput: 0.03 Mbit/s

95th percentile per-packet one-way delay: 6536.637 ms

Loss rate: 53.59%

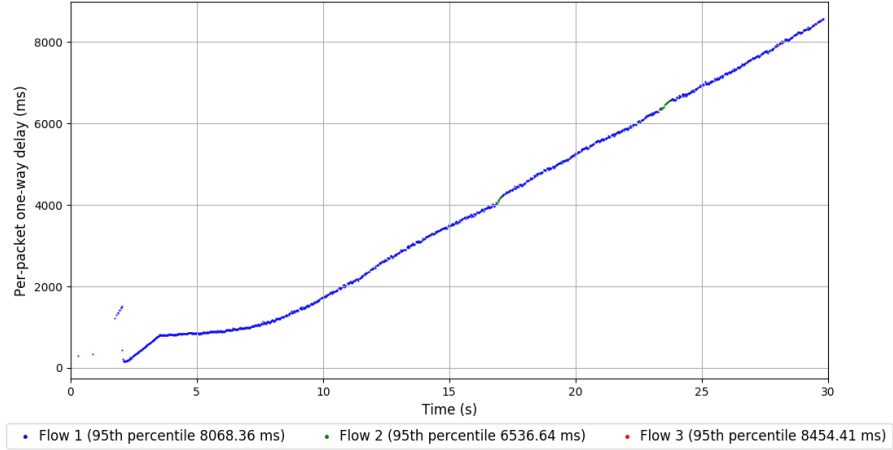
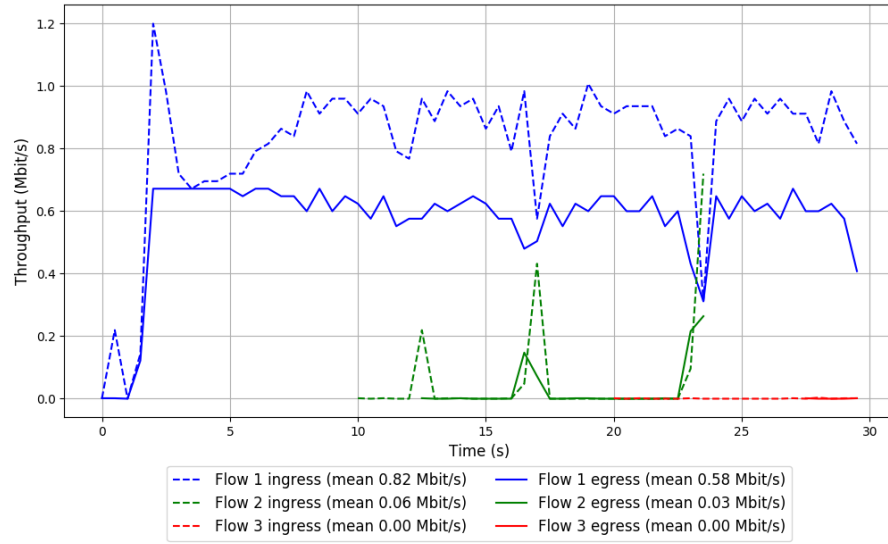
-- Flow 3:

Average throughput: 0.00 Mbit/s

95th percentile per-packet one-way delay: 8454.407 ms

Loss rate: 75.13%

# Run 1: Report of TCP Cubic — Data Link



Run 2: Statistics of TCP Cubic

Start at: 2017-08-13 06:13:14

End at: 2017-08-13 06:13:44

Local clock offset: 0.449 ms

Remote clock offset: 2.878 ms

# Below is generated by plot.py at 2017-08-13 07:38:18

# Datalink statistics

-- Total of 3 flows:

Average throughput: 0.59 Mbit/s

95th percentile per-packet one-way delay: 8107.677 ms

Loss rate: 31.57%

-- Flow 1:

Average throughput: 0.58 Mbit/s

95th percentile per-packet one-way delay: 8117.835 ms

Loss rate: 30.87%

-- Flow 2:

Average throughput: 0.03 Mbit/s

95th percentile per-packet one-way delay: 6529.576 ms

Loss rate: 53.64%

-- Flow 3:

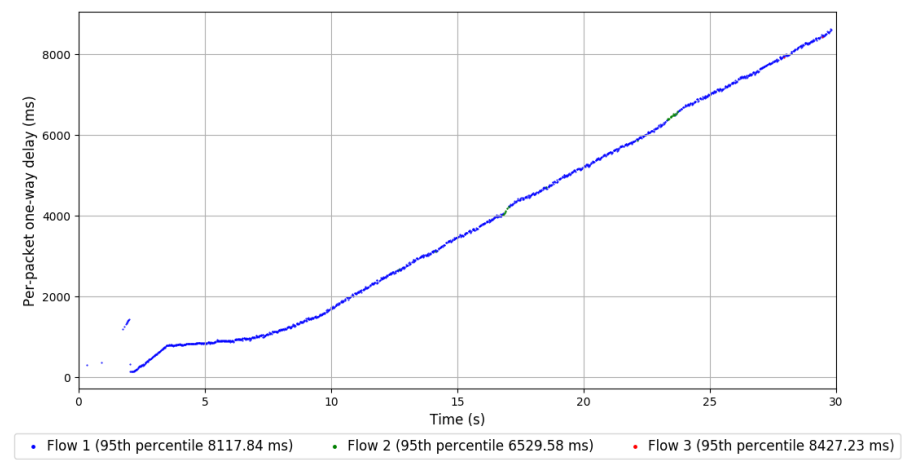
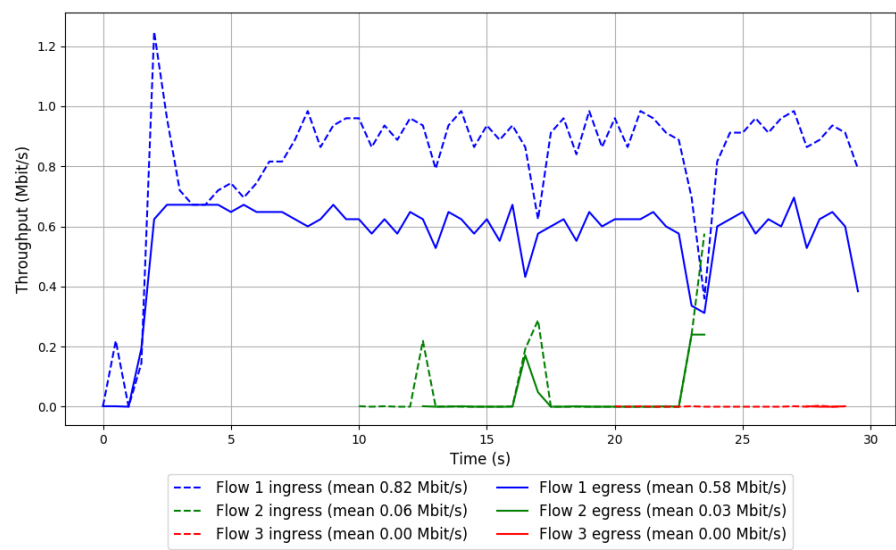
Average throughput: 0.00 Mbit/s

95th percentile per-packet one-way delay: 8427.225 ms

Loss rate: 71.93%



Run 2: Report of TCP Cubic — Data Link

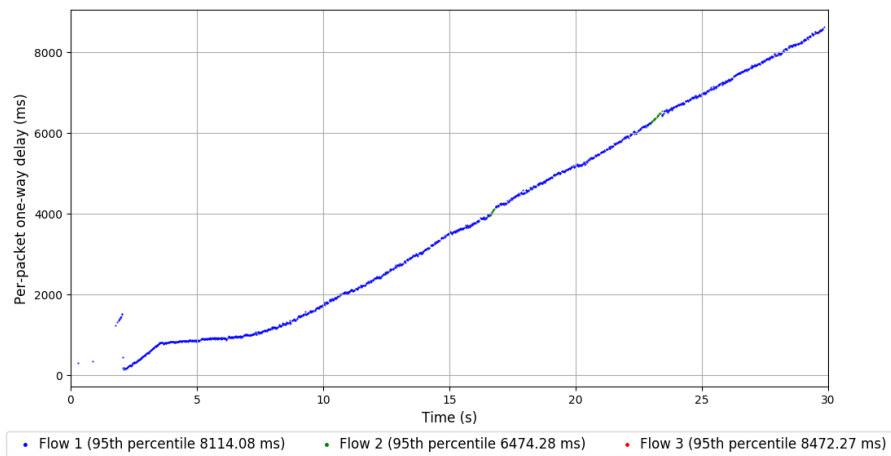
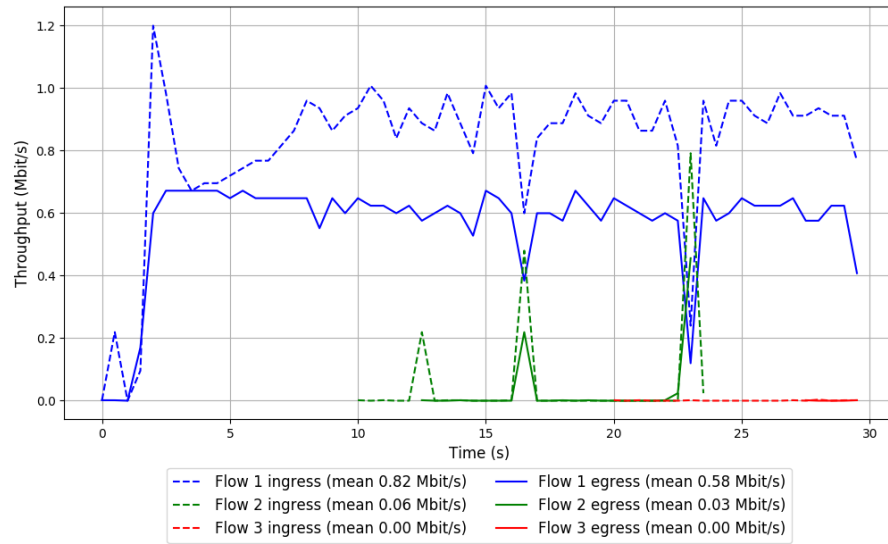


Run 3: Statistics of TCP Cubic

Start at: 2017-08-13 06:31:59  
End at: 2017-08-13 06:32:29  
Local clock offset: 0.435 ms  
Remote clock offset: -1.826 ms

# Below is generated by plot.py at 2017-08-13 07:38:18  
# Datalink statistics  
-- Total of 3 flows:  
Average throughput: 0.59 Mbit/s  
95th percentile per-packet one-way delay: 8104.416 ms  
Loss rate: 31.49%  
-- Flow 1:  
Average throughput: 0.58 Mbit/s  
95th percentile per-packet one-way delay: 8114.083 ms  
Loss rate: 30.79%  
-- Flow 2:  
Average throughput: 0.03 Mbit/s  
95th percentile per-packet one-way delay: 6474.285 ms  
Loss rate: 53.59%  
-- Flow 3:  
Average throughput: 0.00 Mbit/s  
95th percentile per-packet one-way delay: 8472.267 ms  
Loss rate: 75.13%

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



Run 1: Statistics of KohoCC

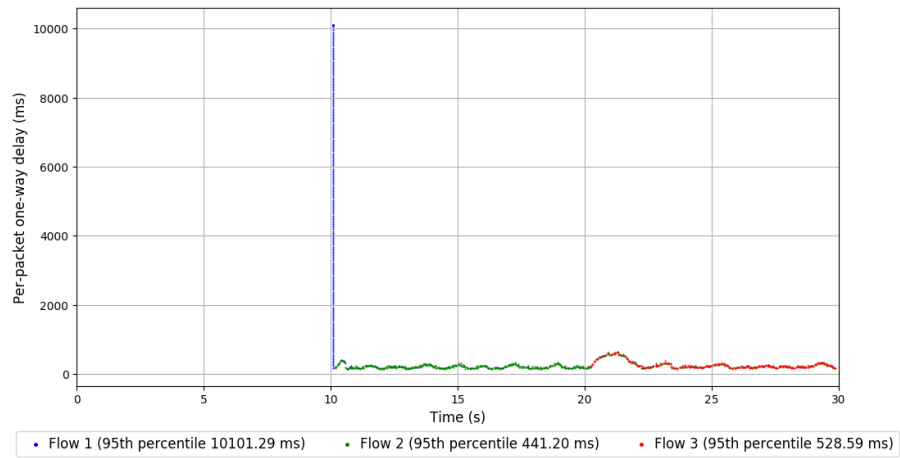
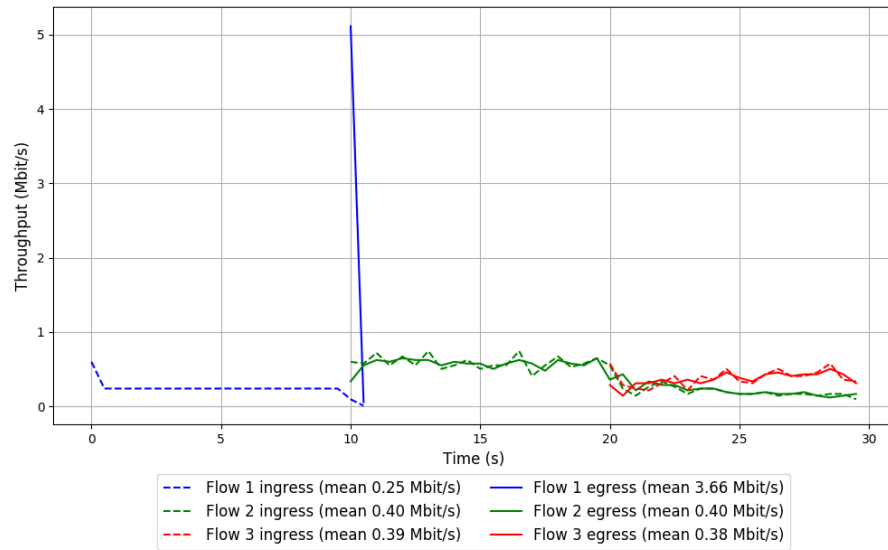
Start at: 2017-08-13 05:57:00

End at: 2017-08-13 05:57:30

Local clock offset: 0.438 ms

Remote clock offset: -2.054 ms

## Run 1: Report of KohoCC — Data Link



Run 2: Statistics of KohoCC

Start at: 2017-08-13 06:15:44

End at: 2017-08-13 06:16:14

Local clock offset: 0.417 ms

Remote clock offset: 1.111 ms

# Below is generated by plot.py at 2017-08-13 07:38:19

# Datalink statistics

-- Total of 3 flows:

Average throughput: 0.57 Mbit/s

95th percentile per-packet one-way delay: 674.089 ms

Loss rate: 4.24%

-- Flow 1:

Average throughput: 0.30 Mbit/s

95th percentile per-packet one-way delay: 866.439 ms

Loss rate: 5.23%

-- Flow 2:

Average throughput: 0.29 Mbit/s

95th percentile per-packet one-way delay: 626.274 ms

Loss rate: 2.14%

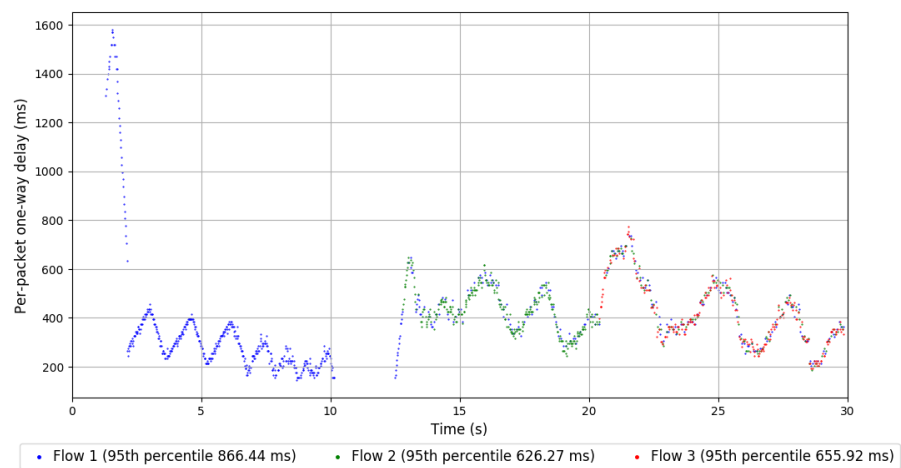
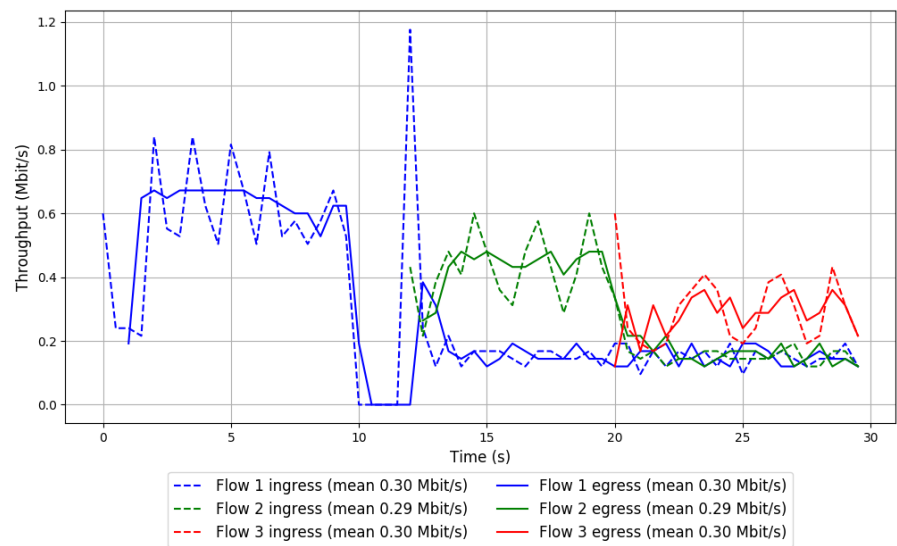
-- Flow 3:

Average throughput: 0.30 Mbit/s

95th percentile per-packet one-way delay: 655.924 ms

Loss rate: 4.84%

Run 2: Report of KohoCC — Data Link



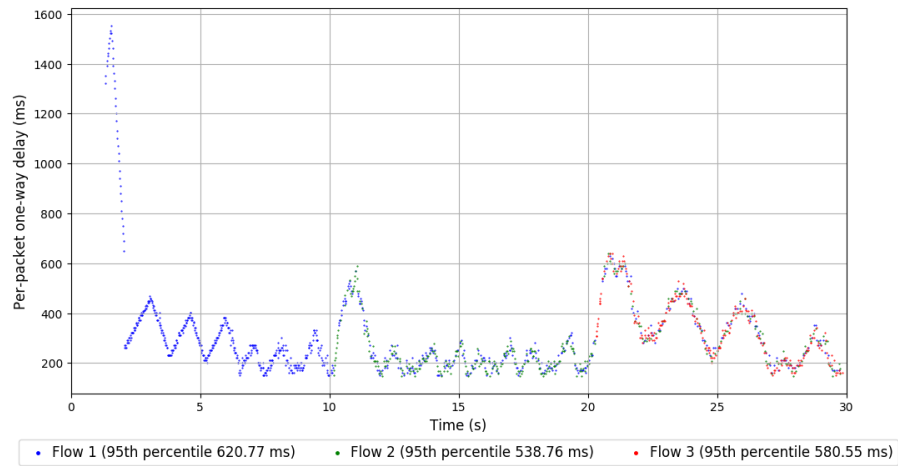
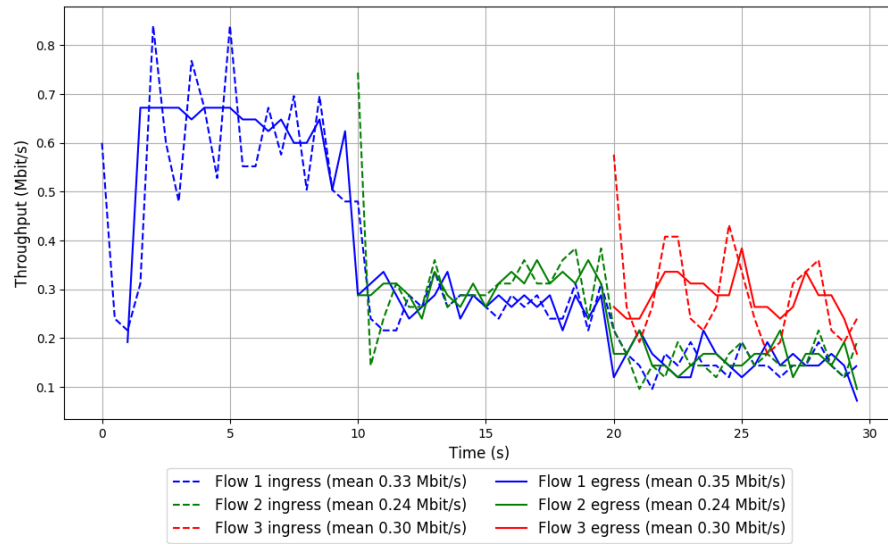
Run 3: Statistics of KohoCC

Start at: 2017-08-13 06:34:28  
End at: 2017-08-13 06:34:58  
Local clock offset: 0.476 ms  
Remote clock offset: -2.711 ms

# Below is generated by plot.py at 2017-08-13 07:38:20  
# Datalink statistics  
-- Total of 3 flows:  
Average throughput: 0.61 Mbit/s  
95th percentile per-packet one-way delay: 580.288 ms  
Loss rate: 1.90%  
-- Flow 1:  
Average throughput: 0.35 Mbit/s  
95th percentile per-packet one-way delay: 620.766 ms  
Loss rate: 1.09%  
-- Flow 2:  
Average throughput: 0.24 Mbit/s  
95th percentile per-packet one-way delay: 538.762 ms  
Loss rate: 2.51%  
-- Flow 3:  
Average throughput: 0.30 Mbit/s  
95th percentile per-packet one-way delay: 580.550 ms  
Loss rate: 3.69%



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

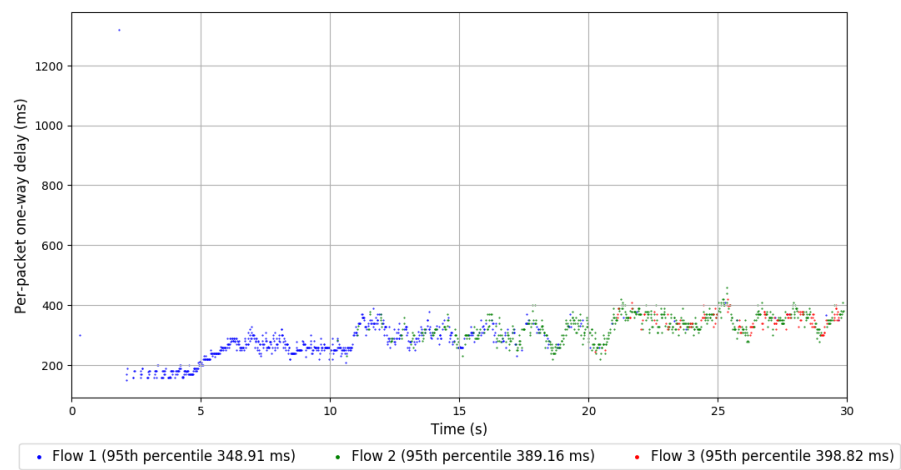
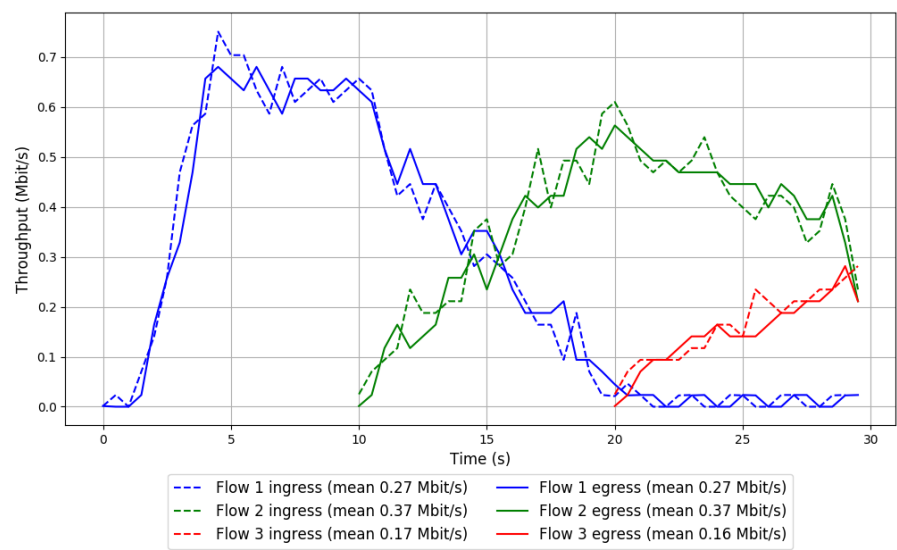


```
Run 1: Statistics of LEDBAT

Start at: 2017-08-13 05:53:16
End at: 2017-08-13 05:53:46
Local clock offset: 0.494 ms
Remote clock offset: -2.93 ms

# Below is generated by plot.py at 2017-08-13 07:38:21
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.56 Mbit/s
95th percentile per-packet one-way delay: 379.367 ms
Loss rate: 1.59%
-- Flow 1:
Average throughput: 0.27 Mbit/s
95th percentile per-packet one-way delay: 348.913 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 0.37 Mbit/s
95th percentile per-packet one-way delay: 389.159 ms
Loss rate: 1.75%
-- Flow 3:
Average throughput: 0.16 Mbit/s
95th percentile per-packet one-way delay: 398.823 ms
Loss rate: 8.69%
```

Run 1: Report of LEDBAT — Data Link



Run 2: Statistics of LEDBAT

Start at: 2017-08-13 06:12:00

End at: 2017-08-13 06:12:30

Local clock offset: 0.416 ms

Remote clock offset: 1.991 ms

# Below is generated by plot.py at 2017-08-13 07:38:22

# Datalink statistics

-- Total of 3 flows:

Average throughput: 0.56 Mbit/s

95th percentile per-packet one-way delay: 460.824 ms

Loss rate: 1.80%

-- Flow 1:

Average throughput: 0.24 Mbit/s

95th percentile per-packet one-way delay: 351.051 ms

Loss rate: 0.17%

-- Flow 2:

Average throughput: 0.38 Mbit/s

95th percentile per-packet one-way delay: 470.896 ms

Loss rate: 0.79%

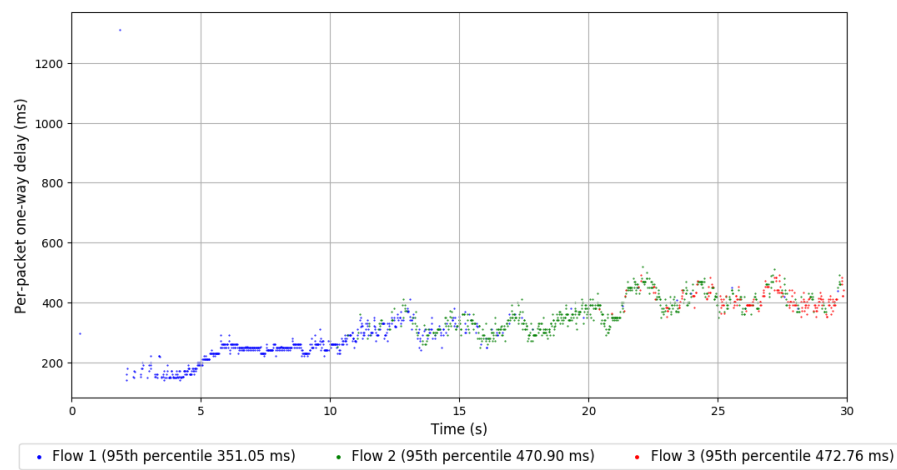
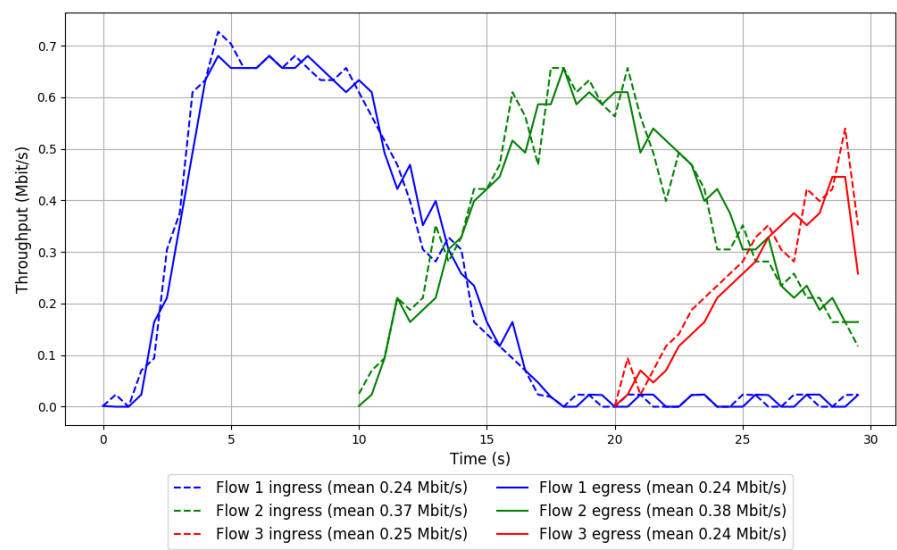
-- Flow 3:

Average throughput: 0.24 Mbit/s

95th percentile per-packet one-way delay: 472.764 ms

Loss rate: 9.34%

Run 2: Report of LEDBAT — Data Link



Run 3: Statistics of LEDBAT

Start at: 2017-08-13 06:30:44

End at: 2017-08-13 06:31:14

Local clock offset: 0.453 ms

Remote clock offset: 2.205 ms

# Below is generated by plot.py at 2017-08-13 07:38:22

# Datalink statistics

-- Total of 3 flows:

Average throughput: 0.56 Mbit/s

95th percentile per-packet one-way delay: 414.545 ms

Loss rate: 1.60%

-- Flow 1:

Average throughput: 0.25 Mbit/s

95th percentile per-packet one-way delay: 356.675 ms

Loss rate: 0.16%

-- Flow 2:

Average throughput: 0.36 Mbit/s

95th percentile per-packet one-way delay: 424.336 ms

Loss rate: 0.49%

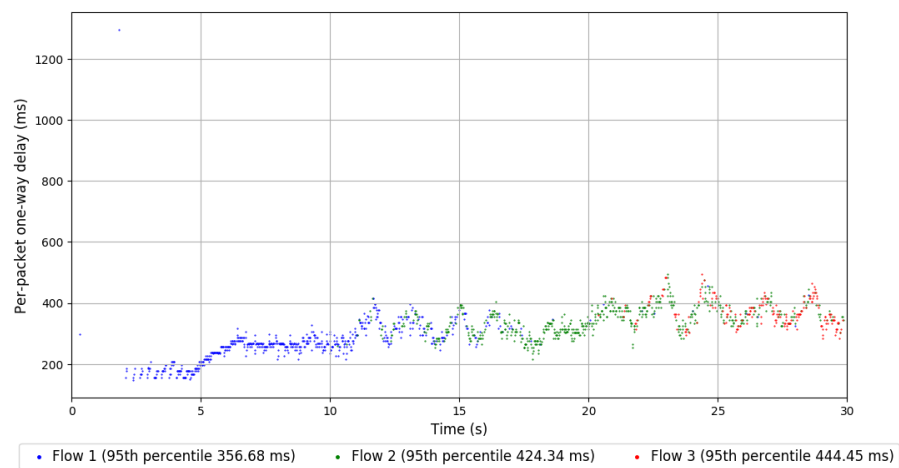
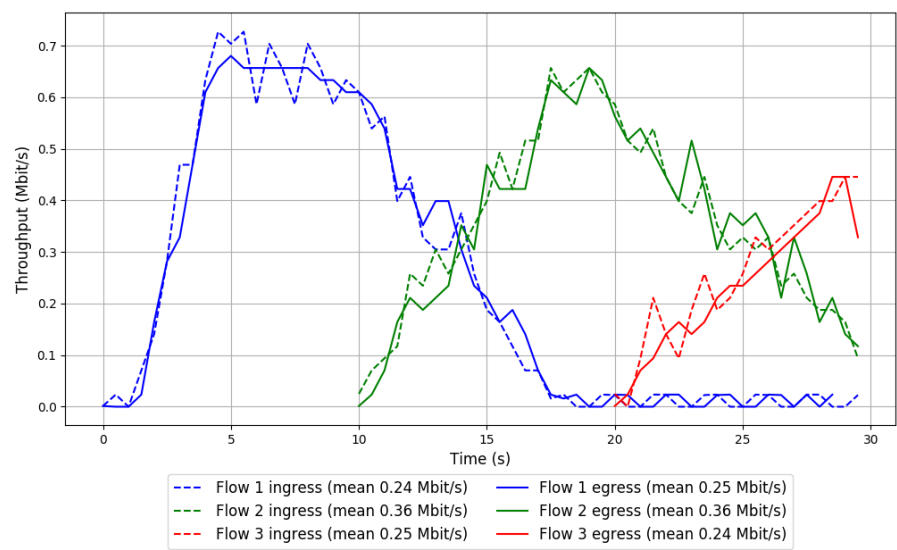
-- Flow 3:

Average throughput: 0.24 Mbit/s

95th percentile per-packet one-way delay: 444.449 ms

Loss rate: 8.83%

Run 3: Report of LEDBAT — Data Link



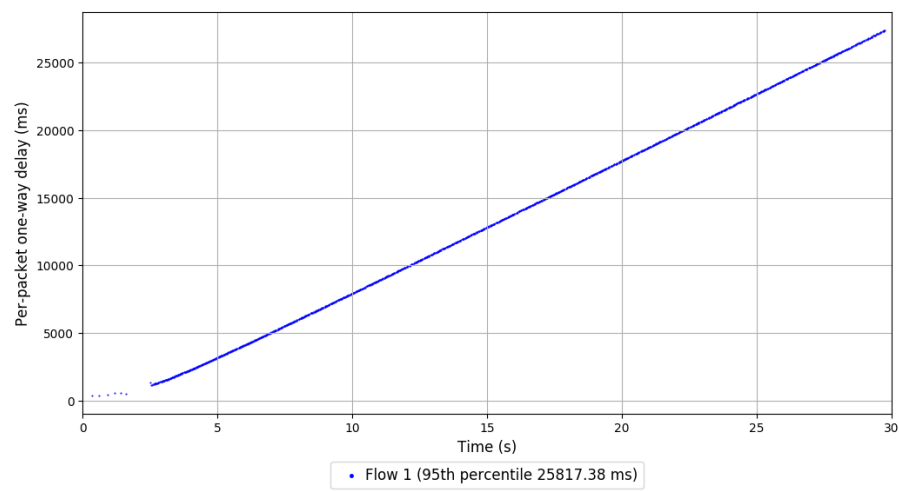
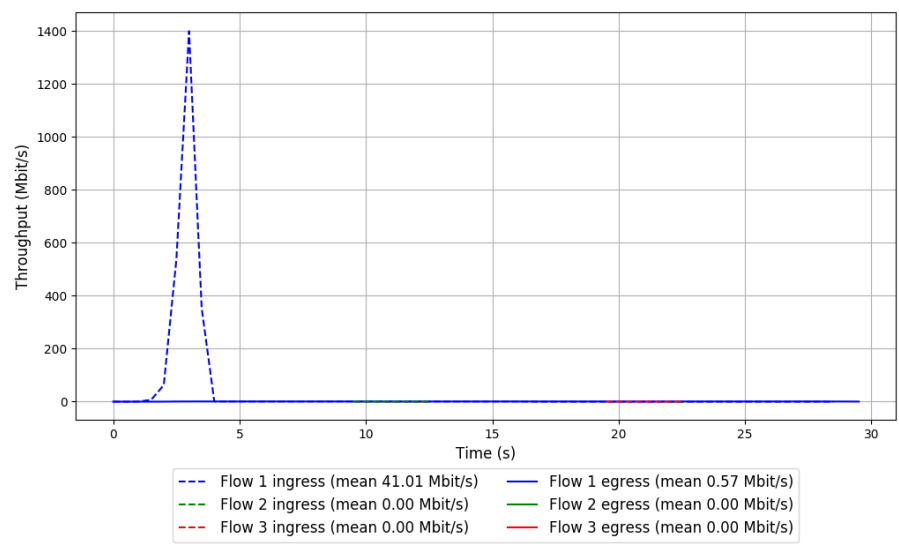
```
Run 1: Statistics of PCC

Start at: 2017-08-13 06:01:59
End at: 2017-08-13 06:02:29
Local clock offset: 0.434 ms
Remote clock offset: 2.832 ms

# Below is generated by plot.py at 2017-08-13 07:38:23
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.57 Mbit/s
95th percentile per-packet one-way delay: 25817.377 ms
Loss rate: 98.59%
-- Flow 1:
Average throughput: 0.57 Mbit/s
95th percentile per-packet one-way delay: 25817.377 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



Run 2: Statistics of PCC

Start at: 2017-08-13 06:20:43

End at: 2017-08-13 06:21:13

Local clock offset: 0.433 ms

Remote clock offset: 2.042 ms

# Below is generated by plot.py at 2017-08-13 07:38:24

# Datalink statistics

-- Total of 3 flows:

Average throughput: 0.58 Mbit/s

95th percentile per-packet one-way delay: 26052.066 ms

Loss rate: 98.57%

-- Flow 1:

Average throughput: 0.58 Mbit/s

95th percentile per-packet one-way delay: 26052.066 ms

Loss rate: 98.57%

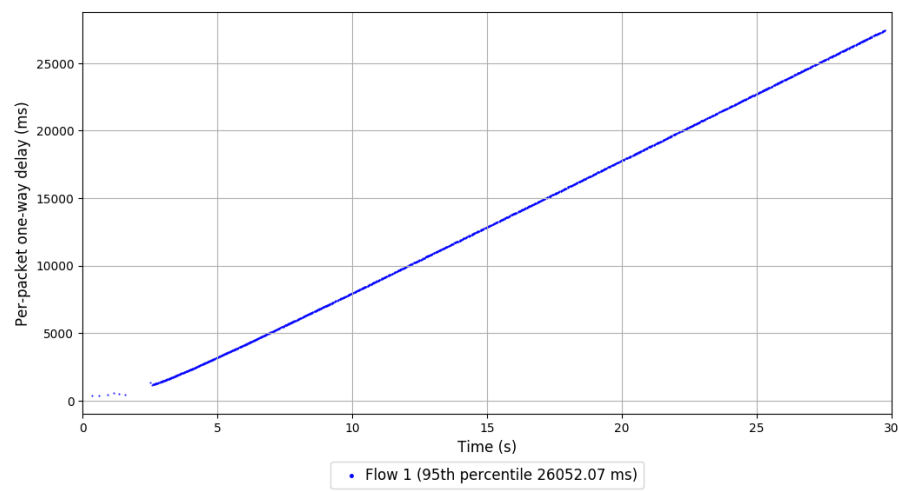
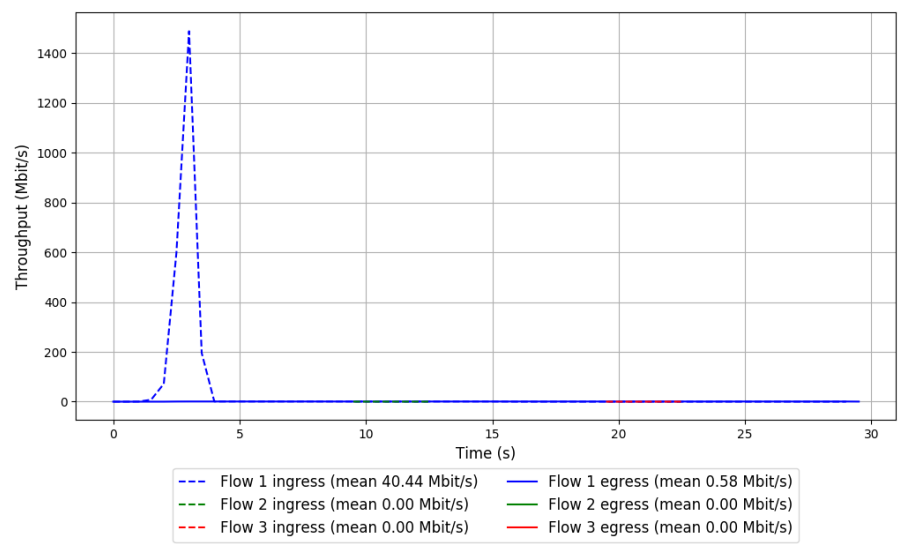
-- Flow 2:

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: 2017-08-13 06:39:27

End at: 2017-08-13 06:39:57

Local clock offset: 0.456 ms

Remote clock offset: 2.131 ms

# Below is generated by plot.py at 2017-08-13 07:38:27

# Datalink statistics

-- Total of 3 flows:

Average throughput: 0.58 Mbit/s

95th percentile per-packet one-way delay: 26069.879 ms

Loss rate: 98.58%

-- Flow 1:

Average throughput: 0.58 Mbit/s

95th percentile per-packet one-way delay: 26069.879 ms

Loss rate: 98.58%

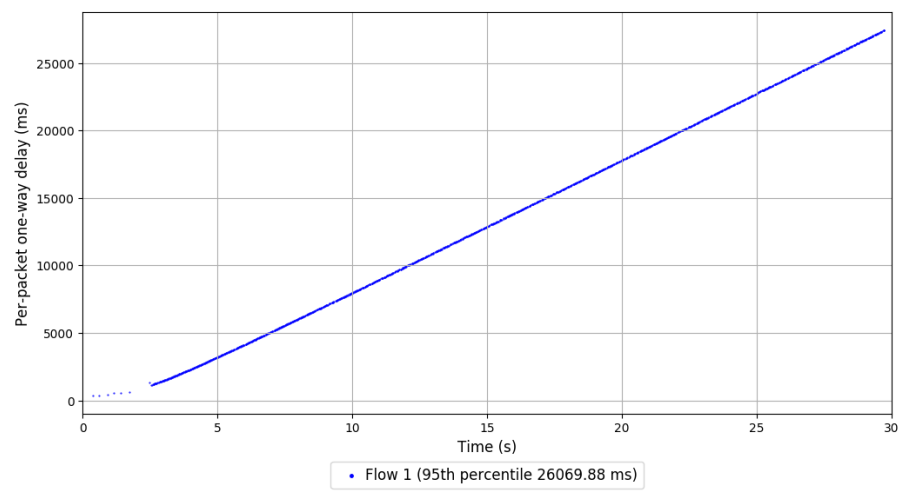
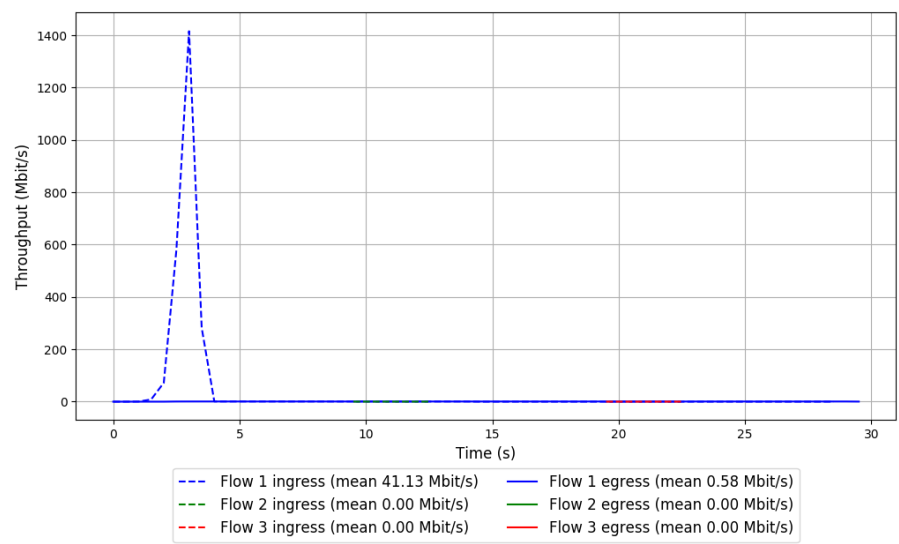
-- Flow 2:

Average throughput: 0.00 Mbit/s

-- Flow 3:

Average throughput: 0.00 Mbit/s

Run 3: Report of PCC — Data Link



Run 1: Statistics of QUIC Cubic

Start at: 2017-08-13 05:52:01

End at: 2017-08-13 05:52:31

Local clock offset: 0.457 ms

Remote clock offset: 1.854 ms

# Below is generated by plot.py at 2017-08-13 07:38:27

# Datalink statistics

-- Total of 3 flows:

Average throughput: 0.61 Mbit/s

95th percentile per-packet one-way delay: 7461.581 ms

Loss rate: 29.21%

-- Flow 1:

Average throughput: 0.57 Mbit/s

95th percentile per-packet one-way delay: 7433.946 ms

Loss rate: 28.85%

-- Flow 2:

Average throughput: 0.06 Mbit/s

95th percentile per-packet one-way delay: 7566.660 ms

Loss rate: 34.18%

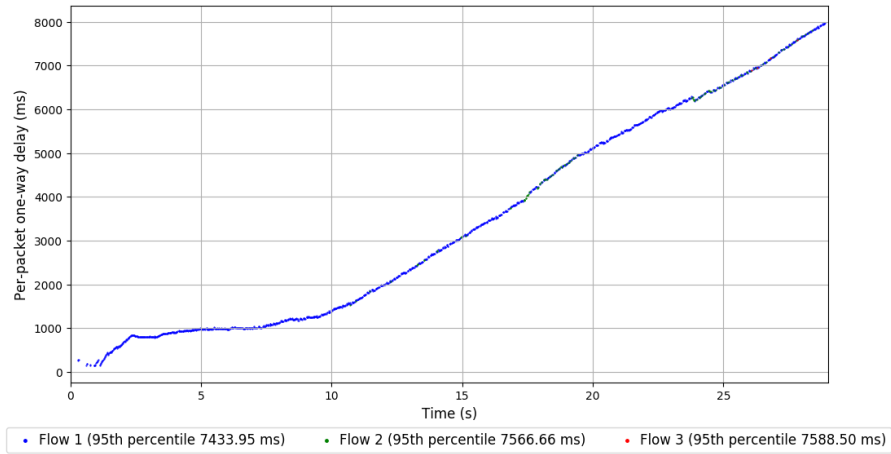
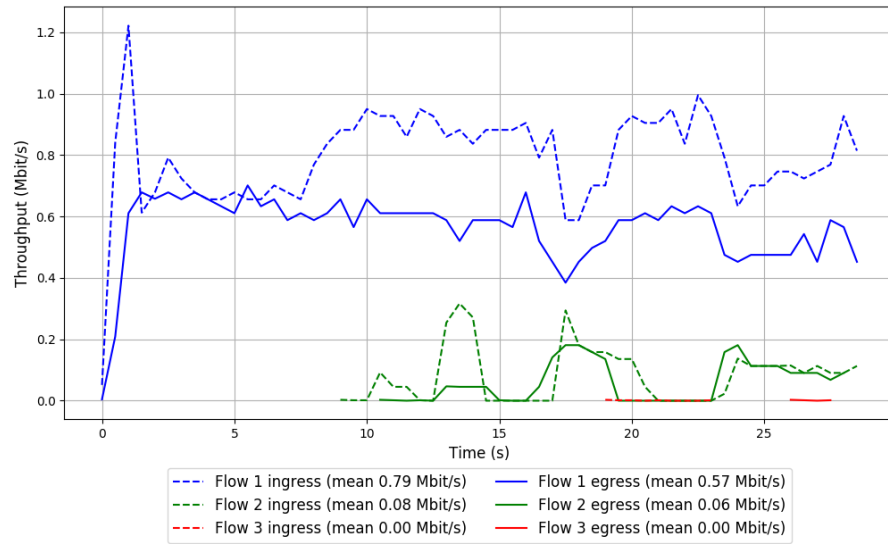
-- Flow 3:

Average throughput: 0.00 Mbit/s

95th percentile per-packet one-way delay: 7588.502 ms

Loss rate: 33.33%

## Run 1: Report of QUIC Cubic — Data Link



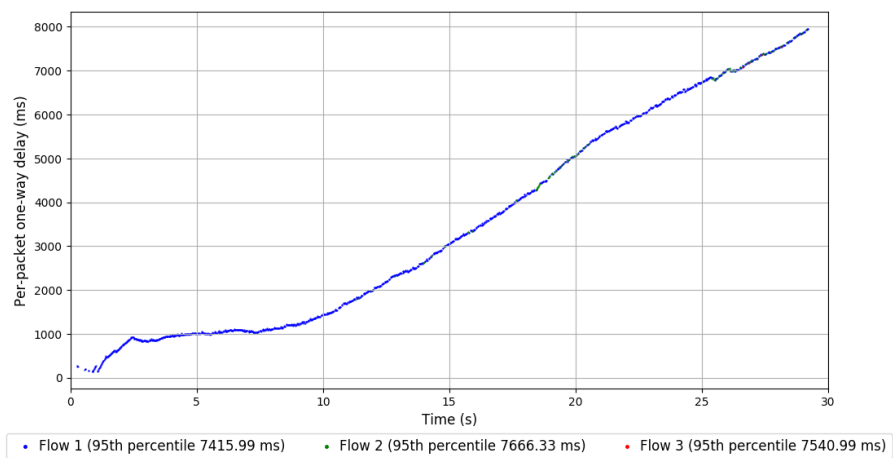
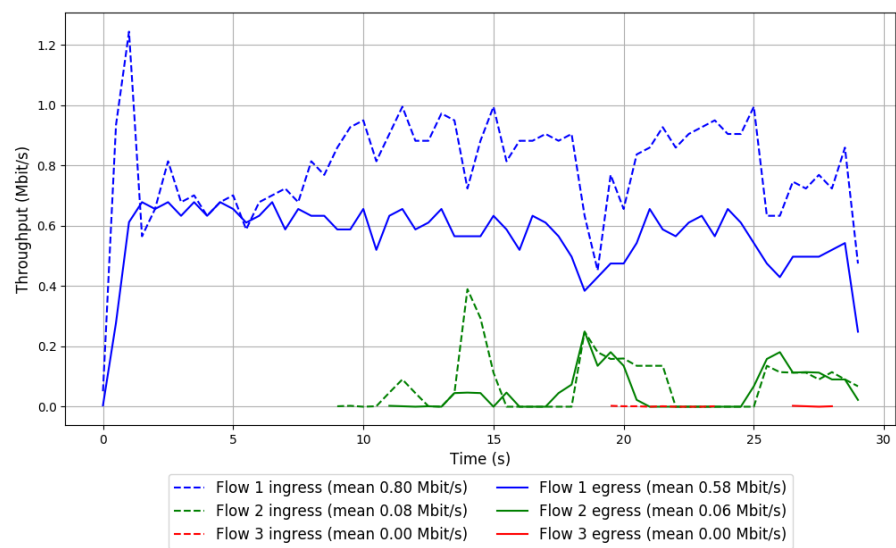
Run 2: Statistics of QUIC Cubic

Start at: 2017-08-13 06:10:45  
End at: 2017-08-13 06:11:15  
Local clock offset: 0.373 ms  
Remote clock offset: -2.817 ms

# Below is generated by plot.py at 2017-08-13 07:38:27  
# Datalink statistics  
-- Total of 3 flows:  
Average throughput: 0.61 Mbit/s  
95th percentile per-packet one-way delay: 7449.171 ms  
Loss rate: 29.12%  
-- Flow 1:  
Average throughput: 0.58 Mbit/s  
95th percentile per-packet one-way delay: 7415.990 ms  
Loss rate: 28.78%  
-- Flow 2:  
Average throughput: 0.06 Mbit/s  
95th percentile per-packet one-way delay: 7666.326 ms  
Loss rate: 34.47%  
-- Flow 3:  
Average throughput: 0.00 Mbit/s  
95th percentile per-packet one-way delay: 7540.990 ms  
Loss rate: 33.33%



Run 2: Report of QUIC Cubic — Data Link



Run 3: Statistics of QUIC Cubic

Start at: 2017-08-13 06:29:29

End at: 2017-08-13 06:29:59

Local clock offset: 0.437 ms

Remote clock offset: 3.001 ms

# Below is generated by plot.py at 2017-08-13 07:38:27

# Datalink statistics

-- Total of 3 flows:

Average throughput: 0.61 Mbit/s

95th percentile per-packet one-way delay: 7528.634 ms

Loss rate: 29.10%

-- Flow 1:

Average throughput: 0.58 Mbit/s

95th percentile per-packet one-way delay: 7516.637 ms

Loss rate: 28.81%

-- Flow 2:

Average throughput: 0.05 Mbit/s

95th percentile per-packet one-way delay: 7764.674 ms

Loss rate: 33.70%

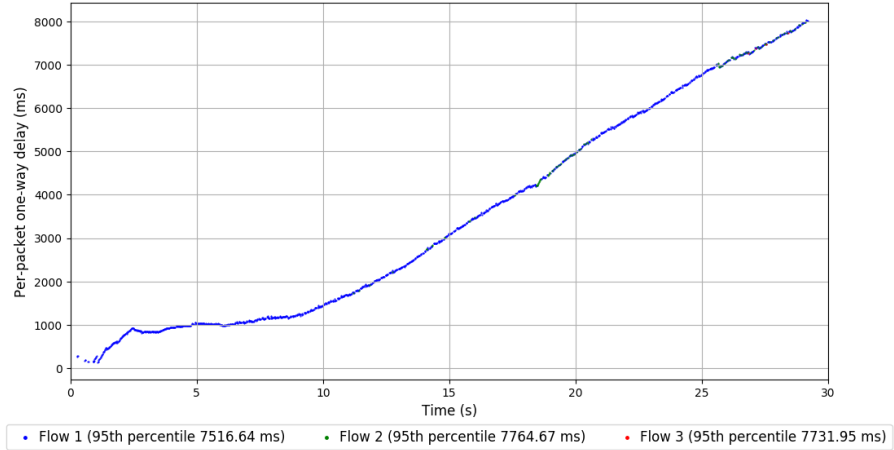
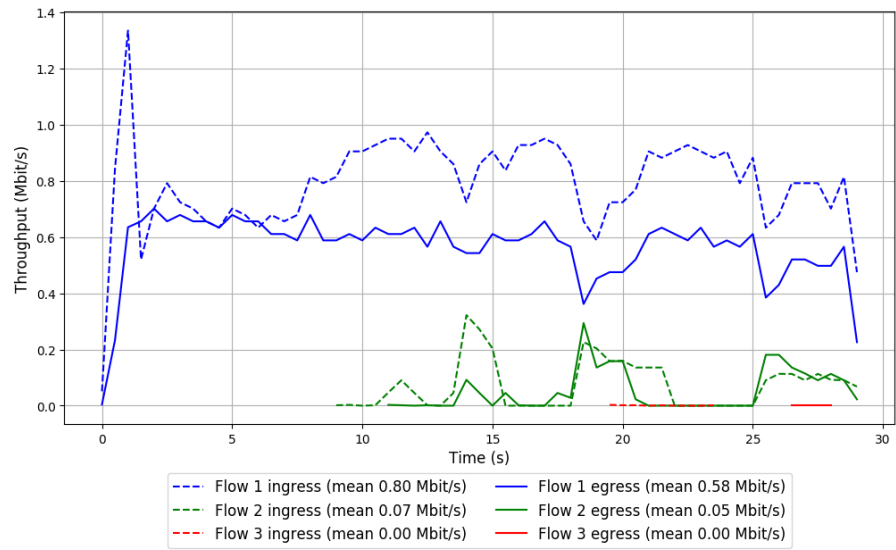
-- Flow 3:

Average throughput: 0.00 Mbit/s

95th percentile per-packet one-way delay: 7731.949 ms

Loss rate: 33.33%

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

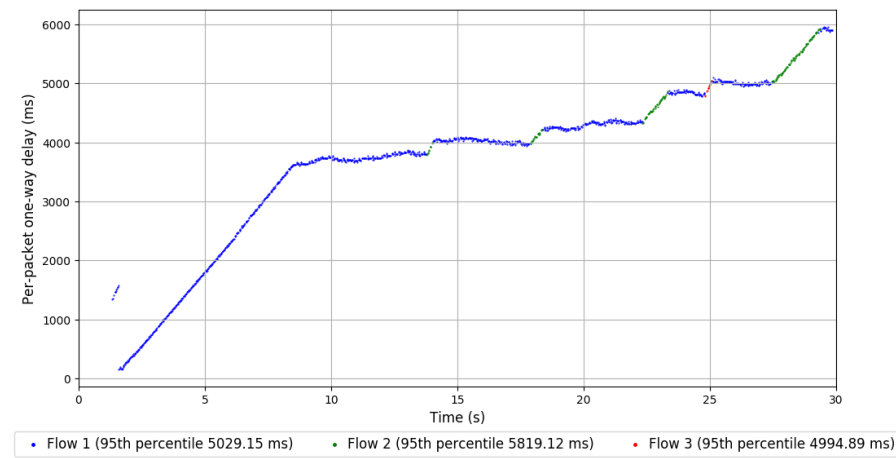
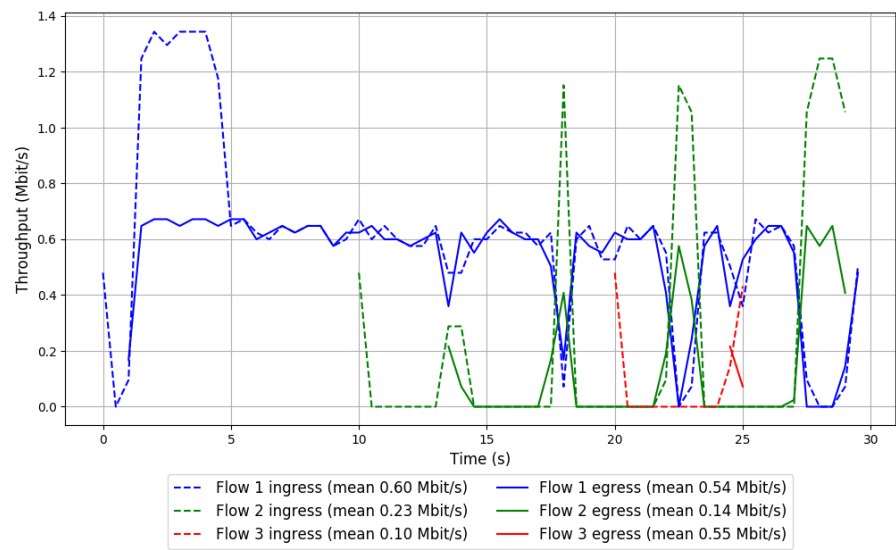


Run 1: Statistics of Saturator

Start at: 2017-08-13 05:58:15  
End at: 2017-08-13 05:58:45  
Local clock offset: 0.421 ms  
Remote clock offset: -2.035 ms

# Below is generated by plot.py at 2017-08-13 07:38:28  
# Datalink statistics  
-- Total of 3 flows:  
Average throughput: 0.62 Mbit/s  
95th percentile per-packet one-way delay: 5439.162 ms  
Loss rate: 22.90%  
-- Flow 1:  
Average throughput: 0.54 Mbit/s  
95th percentile per-packet one-way delay: 5029.154 ms  
Loss rate: 13.83%  
-- Flow 2:  
Average throughput: 0.14 Mbit/s  
95th percentile per-packet one-way delay: 5819.116 ms  
Loss rate: 52.63%  
-- Flow 3:  
Average throughput: 0.55 Mbit/s  
95th percentile per-packet one-way delay: 4994.885 ms  
Loss rate: 72.73%

Run 1: Report of Saturator — Data Link



Run 2: Statistics of Saturator

Start at: 2017-08-13 06:16:59

End at: 2017-08-13 06:17:29

Local clock offset: 0.413 ms

Remote clock offset: 1.992 ms

# Below is generated by plot.py at 2017-08-13 07:38:28

# Datalink statistics

-- Total of 3 flows:

Average throughput: 0.62 Mbit/s

95th percentile per-packet one-way delay: 5486.172 ms

Loss rate: 22.94%

-- Flow 1:

Average throughput: 0.54 Mbit/s

95th percentile per-packet one-way delay: 5066.356 ms

Loss rate: 13.89%

-- Flow 2:

Average throughput: 0.14 Mbit/s

95th percentile per-packet one-way delay: 5856.064 ms

Loss rate: 52.63%

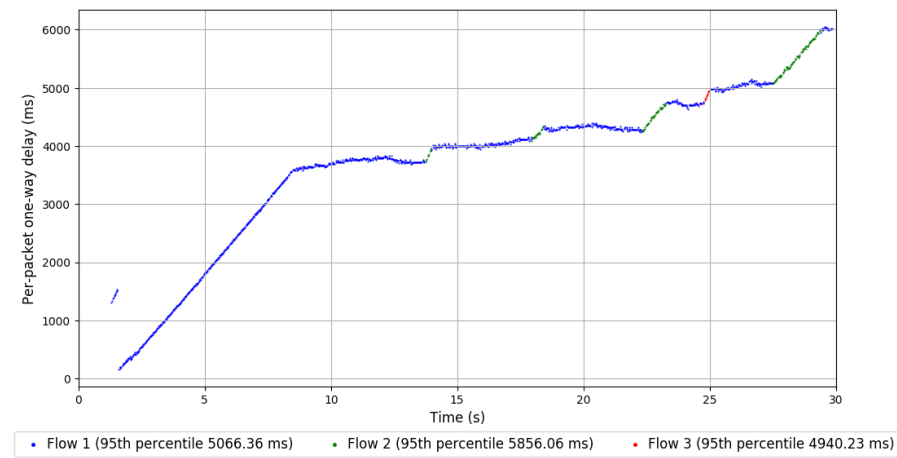
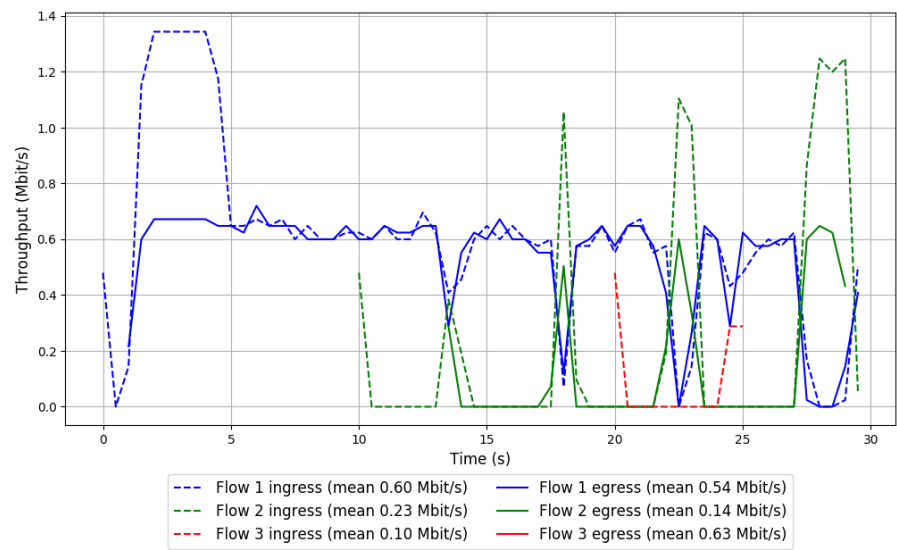
-- Flow 3:

Average throughput: 0.63 Mbit/s

95th percentile per-packet one-way delay: 4940.234 ms

Loss rate: 72.73%

Run 2: Report of Saturator — Data Link



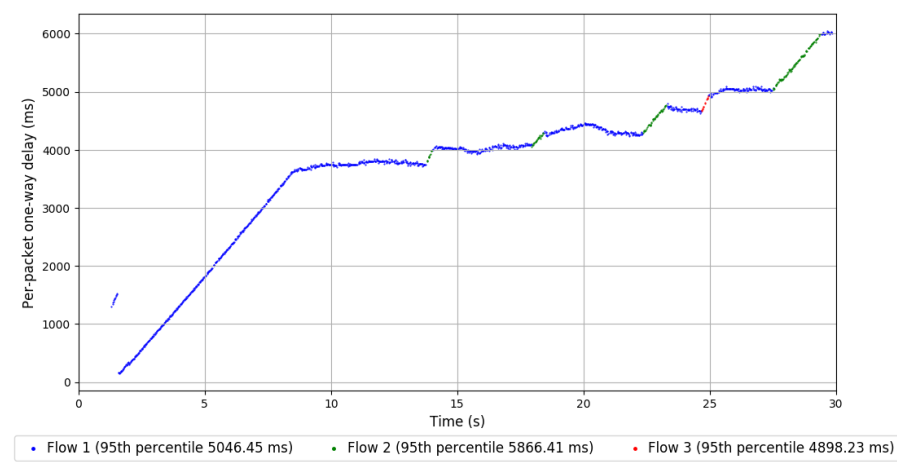
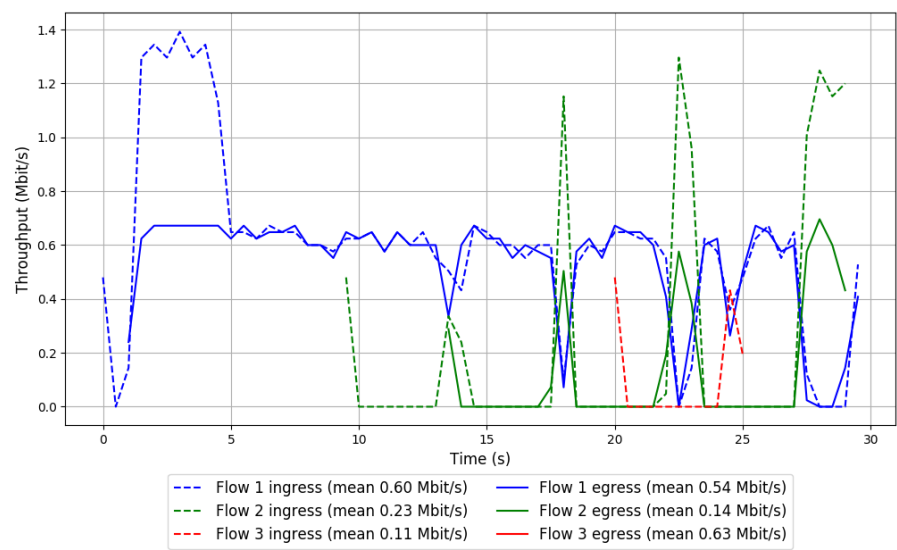
Run 3: Statistics of Saturator

Start at: 2017-08-13 06:35:43  
End at: 2017-08-13 06:36:13  
Local clock offset: 0.473 ms  
Remote clock offset: -1.739 ms

# Below is generated by plot.py at 2017-08-13 07:38:29  
# Datalink statistics  
-- Total of 3 flows:  
Average throughput: 0.62 Mbit/s  
95th percentile per-packet one-way delay: 5456.379 ms  
Loss rate: 22.98%  
-- Flow 1:  
Average throughput: 0.54 Mbit/s  
95th percentile per-packet one-way delay: 5046.452 ms  
Loss rate: 13.90%  
-- Flow 2:  
Average throughput: 0.14 Mbit/s  
95th percentile per-packet one-way delay: 5866.409 ms  
Loss rate: 52.63%  
-- Flow 3:  
Average throughput: 0.63 Mbit/s  
95th percentile per-packet one-way delay: 4898.225 ms  
Loss rate: 71.74%



Run 3: Report of Saturator — Data Link

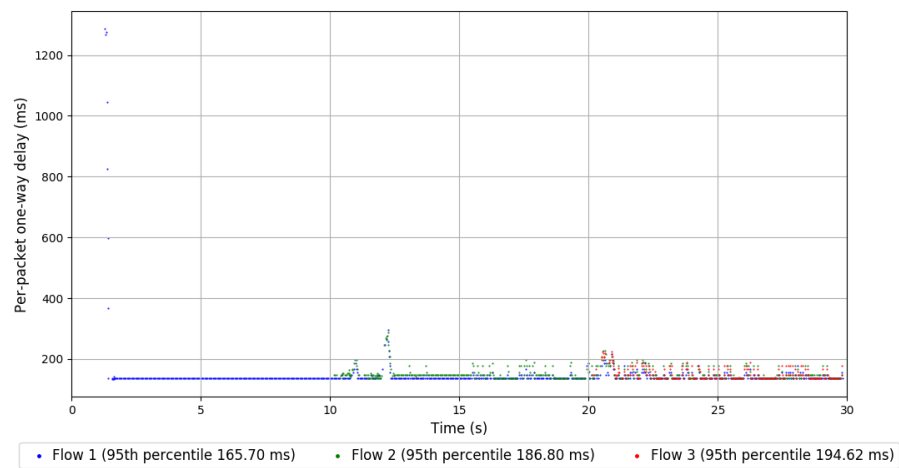
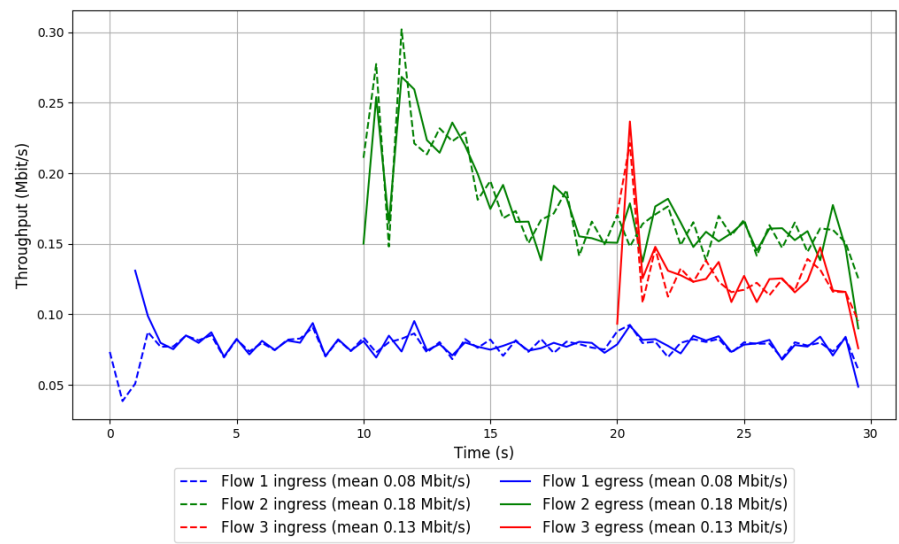


Run 1: Statistics of SCReAM

Start at: 2017-08-13 05:48:16  
End at: 2017-08-13 05:48:46  
Local clock offset: 0.368 ms  
Remote clock offset: -2.995 ms

# Below is generated by plot.py at 2017-08-13 07:38:30  
# Datalink statistics  
-- Total of 3 flows:  
Average throughput: 0.25 Mbit/s  
95th percentile per-packet one-way delay: 186.396 ms  
Loss rate: 1.10%  
-- Flow 1:  
Average throughput: 0.08 Mbit/s  
95th percentile per-packet one-way delay: 165.704 ms  
Loss rate: 0.66%  
-- Flow 2:  
Average throughput: 0.18 Mbit/s  
95th percentile per-packet one-way delay: 186.799 ms  
Loss rate: 1.12%  
-- Flow 3:  
Average throughput: 0.13 Mbit/s  
95th percentile per-packet one-way delay: 194.622 ms  
Loss rate: 1.84%

Run 1: Report of SReAM — Data Link

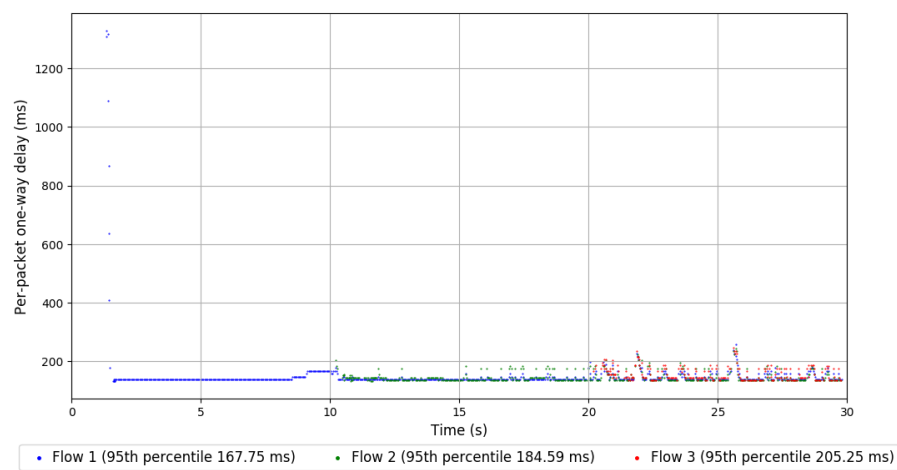
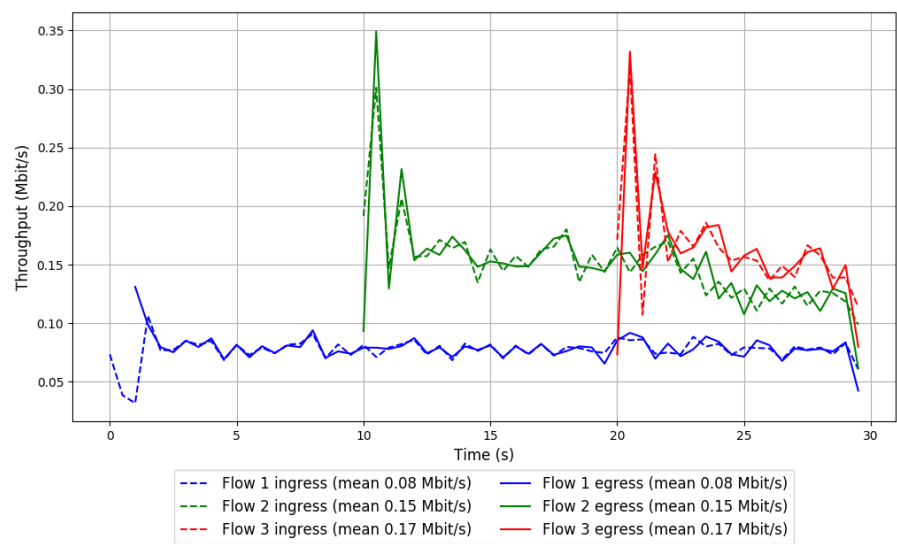


Run 2: Statistics of SCReAM

Start at: 2017-08-13 06:07:01  
End at: 2017-08-13 06:07:31  
Local clock offset: 0.414 ms  
Remote clock offset: -2.011 ms

# Below is generated by plot.py at 2017-08-13 07:38:31  
# Datalink statistics  
-- Total of 3 flows:  
Average throughput: 0.24 Mbit/s  
95th percentile per-packet one-way delay: 185.360 ms  
Loss rate: 1.25%  
-- Flow 1:  
Average throughput: 0.08 Mbit/s  
95th percentile per-packet one-way delay: 167.755 ms  
Loss rate: 0.79%  
-- Flow 2:  
Average throughput: 0.15 Mbit/s  
95th percentile per-packet one-way delay: 184.586 ms  
Loss rate: 1.17%  
-- Flow 3:  
Average throughput: 0.17 Mbit/s  
95th percentile per-packet one-way delay: 205.255 ms  
Loss rate: 2.05%

Run 2: Report of SReAM — Data Link



Run 3: Statistics of SCReAM

Start at: 2017-08-13 06:25:45

End at: 2017-08-13 06:26:15

Local clock offset: 0.368 ms

Remote clock offset: 3.004 ms

# Below is generated by plot.py at 2017-08-13 07:38:31

# Datalink statistics

-- Total of 3 flows:

Average throughput: 0.28 Mbit/s

95th percentile per-packet one-way delay: 192.556 ms

Loss rate: 1.07%

-- Flow 1:

Average throughput: 0.08 Mbit/s

95th percentile per-packet one-way delay: 172.871 ms

Loss rate: 0.66%

-- Flow 2:

Average throughput: 0.19 Mbit/s

95th percentile per-packet one-way delay: 194.397 ms

Loss rate: 0.97%

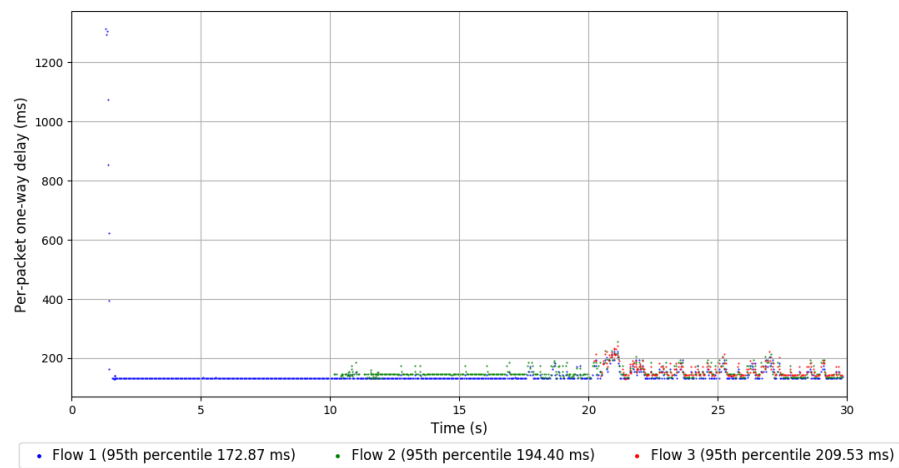
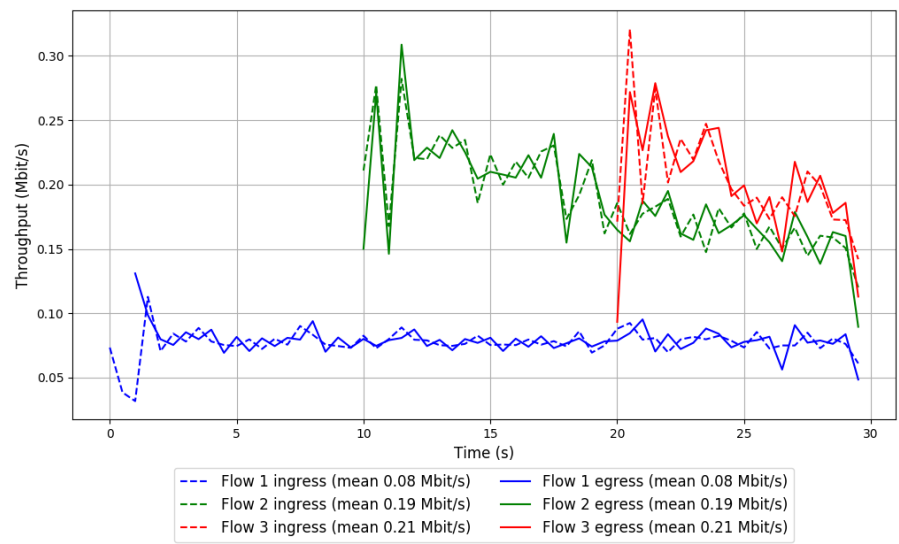
-- Flow 3:

Average throughput: 0.21 Mbit/s

95th percentile per-packet one-way delay: 209.525 ms

Loss rate: 1.73%

Run 3: Report of SCRaM — Data Link



Run 1: Statistics of Sprout

Start at: 2017-08-13 05:49:31

End at: 2017-08-13 05:50:01

Local clock offset: 0.484 ms

Remote clock offset: 2.837 ms

# Below is generated by plot.py at 2017-08-13 07:38:32

# Datalink statistics

-- Total of 3 flows:

Average throughput: 0.22 Mbit/s

95th percentile per-packet one-way delay: 308.108 ms

Loss rate: 1.61%

-- Flow 1:

Average throughput: 0.10 Mbit/s

95th percentile per-packet one-way delay: 899.447 ms

Loss rate: 1.12%

-- Flow 2:

Average throughput: 0.10 Mbit/s

95th percentile per-packet one-way delay: 221.586 ms

Loss rate: 1.43%

-- Flow 3:

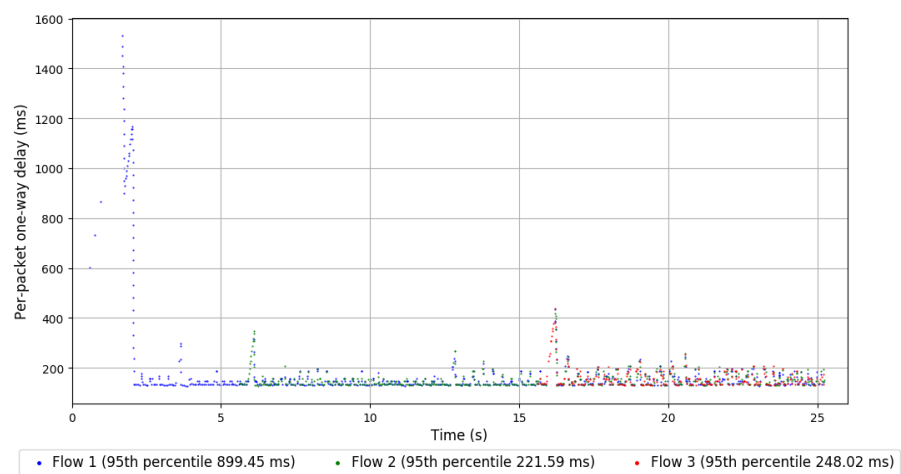
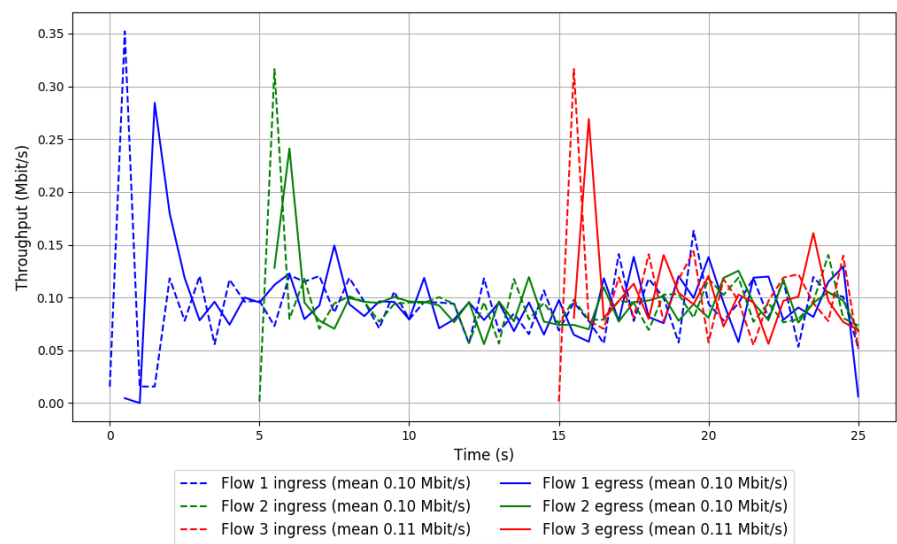
Average throughput: 0.11 Mbit/s

95th percentile per-packet one-way delay: 248.019 ms

Loss rate: 3.03%



Run 1: Report of Sprout — Data Link

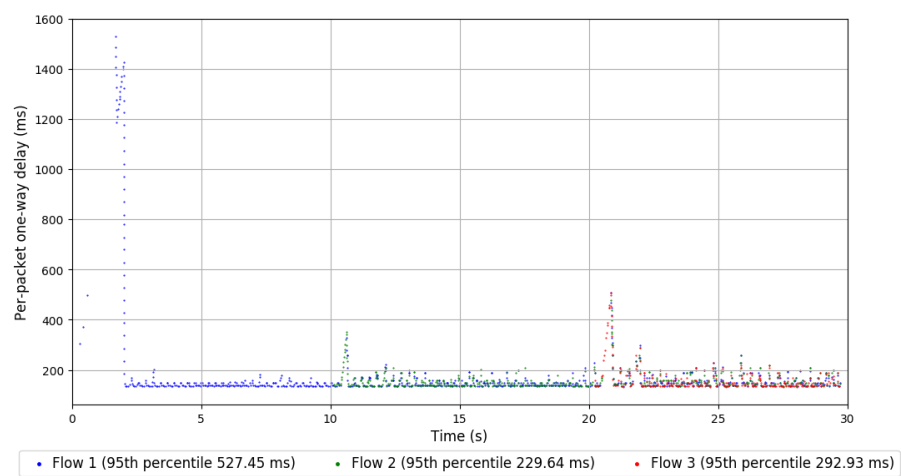
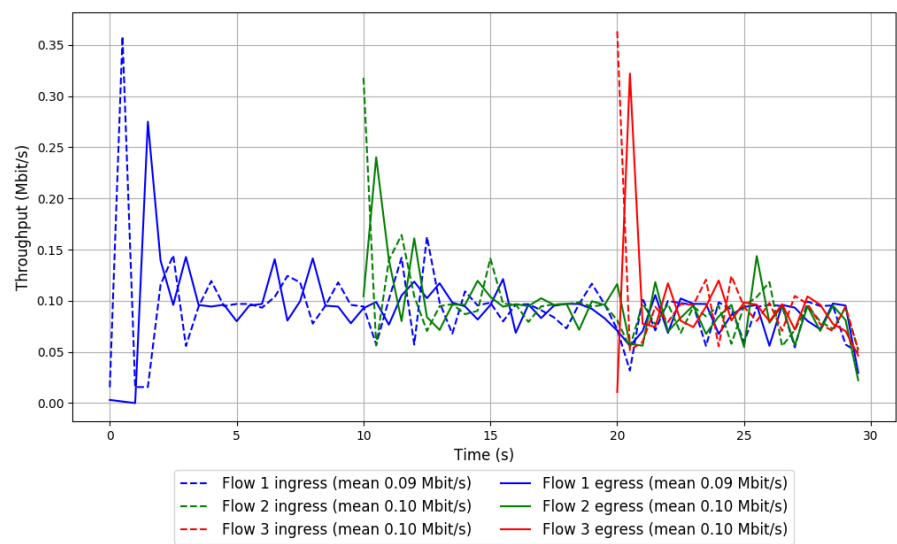


Run 2: Statistics of Sprout

Start at: 2017-08-13 06:08:15  
End at: 2017-08-13 06:08:45  
Local clock offset: 0.432 ms  
Remote clock offset: -2.854 ms

# Below is generated by plot.py at 2017-08-13 07:38:32  
# Datalink statistics  
-- Total of 3 flows:  
Average throughput: 0.19 Mbit/s  
95th percentile per-packet one-way delay: 299.477 ms  
Loss rate: 2.15%  
-- Flow 1:  
Average throughput: 0.09 Mbit/s  
95th percentile per-packet one-way delay: 527.452 ms  
Loss rate: 1.50%  
-- Flow 2:  
Average throughput: 0.10 Mbit/s  
95th percentile per-packet one-way delay: 229.637 ms  
Loss rate: 1.87%  
-- Flow 3:  
Average throughput: 0.10 Mbit/s  
95th percentile per-packet one-way delay: 292.926 ms  
Loss rate: 4.53%

Run 2: Report of Sprout — Data Link

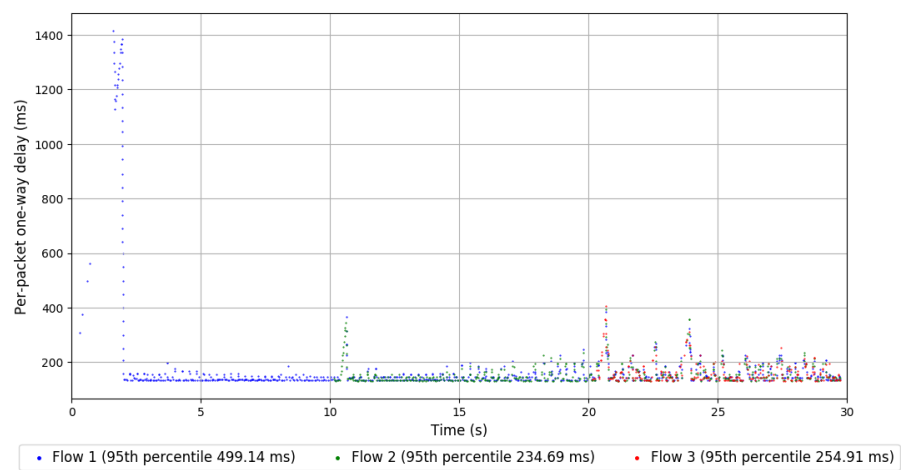
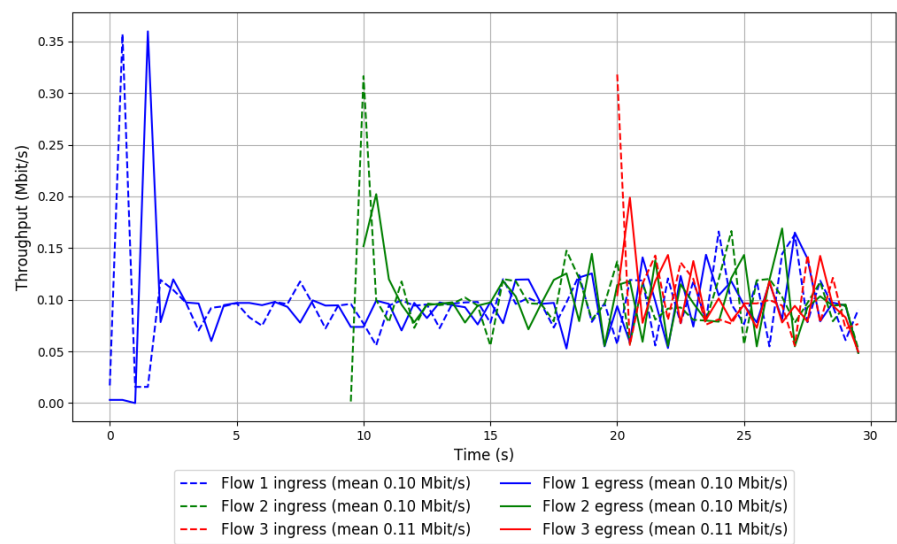


### Run 3: Statistics of Sprout

Start at: 2017-08-13 06:27:00  
End at: 2017-08-13 06:27:30  
Local clock offset: 0.438 ms  
Remote clock offset: -1.815 ms

```
# Below is generated by plot.py at 2017-08-13 07:38:33
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.20 Mbit/s
95th percentile per-packet one-way delay: 274.676 ms
Loss rate: 2.05%
-- Flow 1:
Average throughput: 0.10 Mbit/s
95th percentile per-packet one-way delay: 499.136 ms
Loss rate: 1.45%
-- Flow 2:
Average throughput: 0.10 Mbit/s
95th percentile per-packet one-way delay: 234.691 ms
Loss rate: 1.21%
-- Flow 3:
Average throughput: 0.11 Mbit/s
95th percentile per-packet one-way delay: 254.905 ms
Loss rate: 5.28%
```

Run 3: Report of Sprout — Data Link



Run 1: Statistics of TaoVA-100x

Start at: 2017-08-13 05:59:30

End at: 2017-08-13 06:00:00

Local clock offset: 0.426 ms

Remote clock offset: 1.905 ms

# Below is generated by plot.py at 2017-08-13 07:38:34

# Datalink statistics

-- Total of 3 flows:

Average throughput: 0.61 Mbit/s

95th percentile per-packet one-way delay: 3553.854 ms

Loss rate: 7.40%

-- Flow 1:

Average throughput: 0.37 Mbit/s

95th percentile per-packet one-way delay: 2832.262 ms

Loss rate: 4.07%

-- Flow 2:

Average throughput: 0.25 Mbit/s

95th percentile per-packet one-way delay: 3662.607 ms

Loss rate: 8.74%

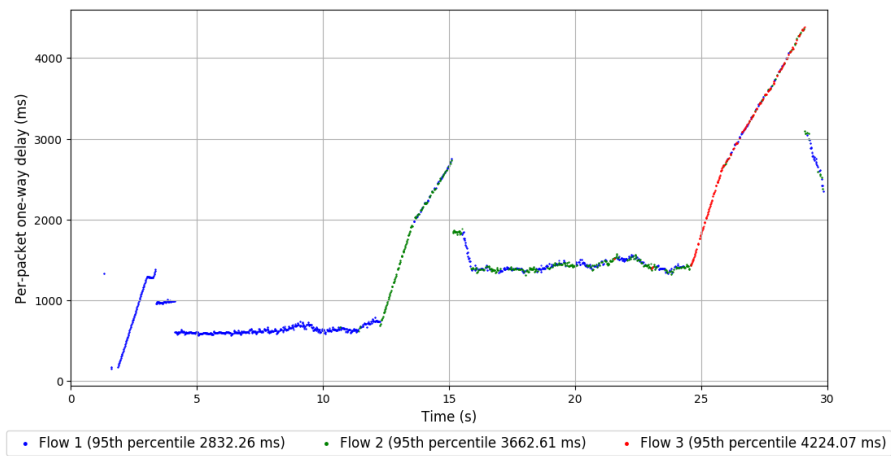
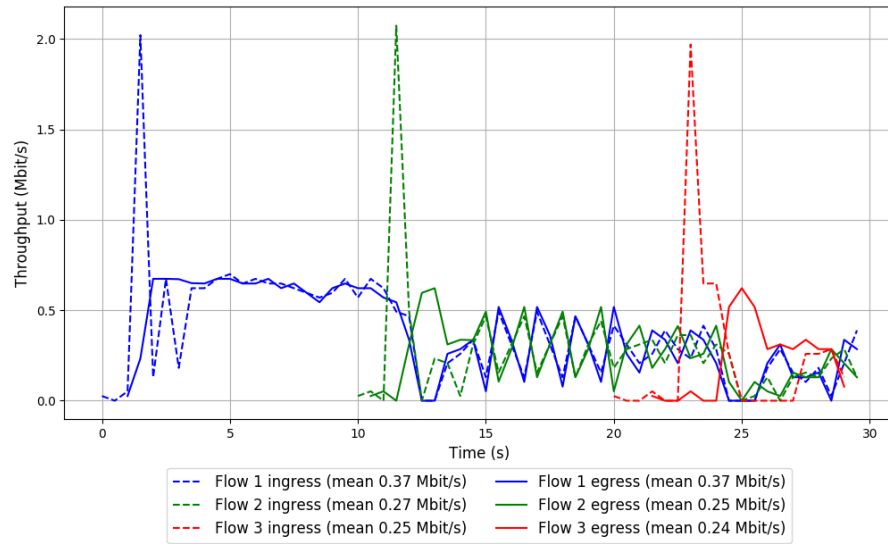
-- Flow 3:

Average throughput: 0.24 Mbit/s

95th percentile per-packet one-way delay: 4224.067 ms

Loss rate: 20.57%

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



Run 2: Statistics of TaoVA-100x

Start at: 2017-08-13 06:18:14

End at: 2017-08-13 06:18:44

Local clock offset: 0.412 ms

Remote clock offset: 2.022 ms

# Below is generated by plot.py at 2017-08-13 07:38:35

# Datalink statistics

-- Total of 3 flows:

Average throughput: 0.61 Mbit/s

95th percentile per-packet one-way delay: 3598.925 ms

Loss rate: 7.81%

-- Flow 1:

Average throughput: 0.36 Mbit/s

95th percentile per-packet one-way delay: 2579.014 ms

Loss rate: 4.28%

-- Flow 2:

Average throughput: 0.27 Mbit/s

95th percentile per-packet one-way delay: 3168.635 ms

Loss rate: 8.28%

-- Flow 3:

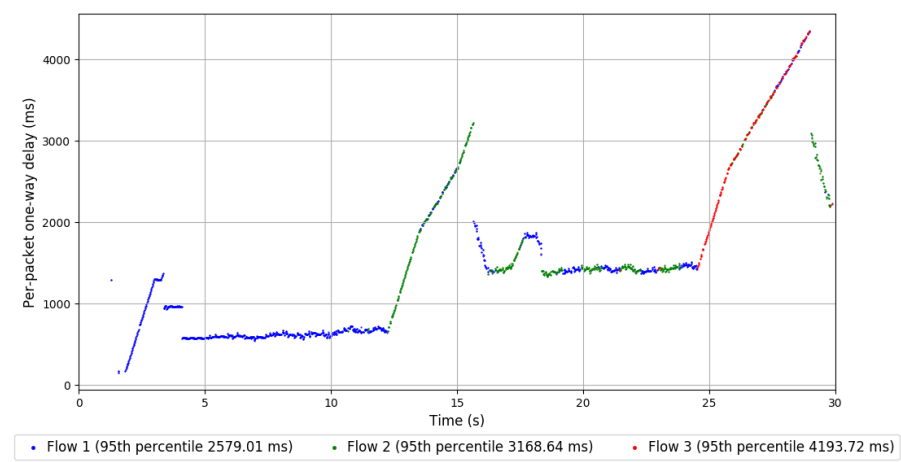
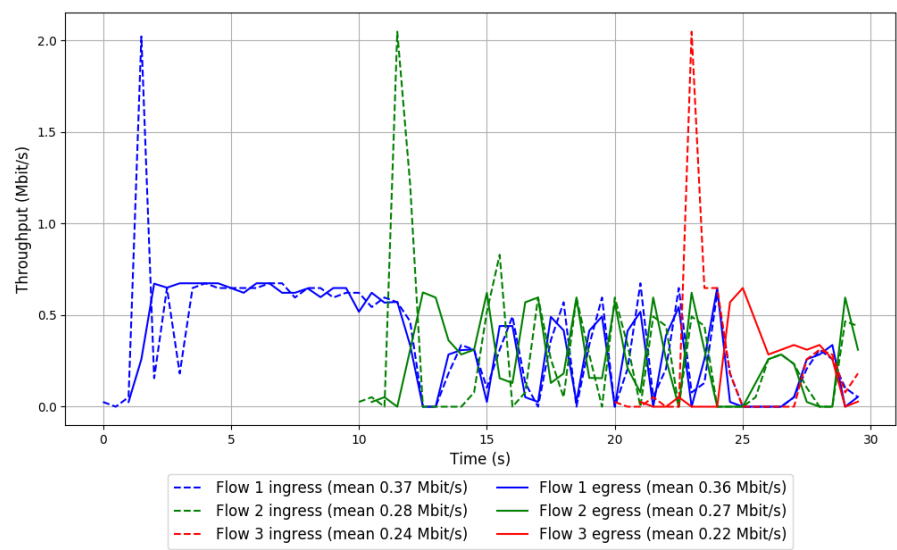
Average throughput: 0.22 Mbit/s

95th percentile per-packet one-way delay: 4193.723 ms

Loss rate: 23.03%



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

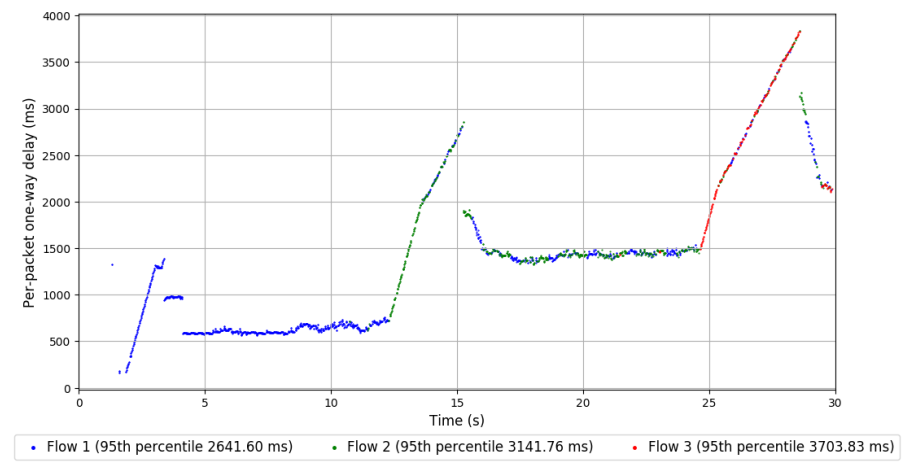
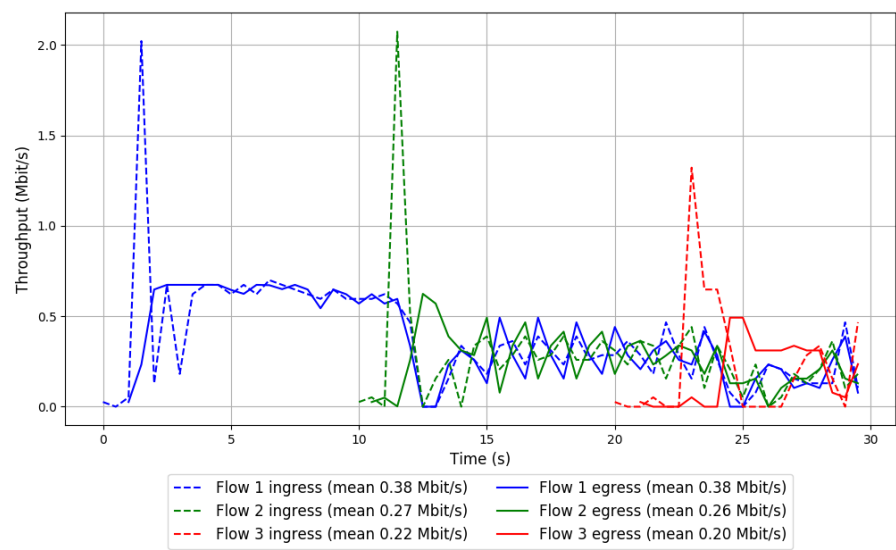


Run 3: Statistics of TaoVA-100x

Start at: 2017-08-13 06:36:58  
End at: 2017-08-13 06:37:28  
Local clock offset: 0.385 ms  
Remote clock offset: -2.727 ms

# Below is generated by plot.py at 2017-08-13 07:38:35  
# Datalink statistics  
-- Total of 3 flows:  
Average throughput: 0.61 Mbit/s  
95th percentile per-packet one-way delay: 3131.981 ms  
Loss rate: 7.82%  
-- Flow 1:  
Average throughput: 0.38 Mbit/s  
95th percentile per-packet one-way delay: 2641.596 ms  
Loss rate: 4.04%  
-- Flow 2:  
Average throughput: 0.26 Mbit/s  
95th percentile per-packet one-way delay: 3141.763 ms  
Loss rate: 8.61%  
-- Flow 3:  
Average throughput: 0.20 Mbit/s  
95th percentile per-packet one-way delay: 3703.834 ms  
Loss rate: 25.10%

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

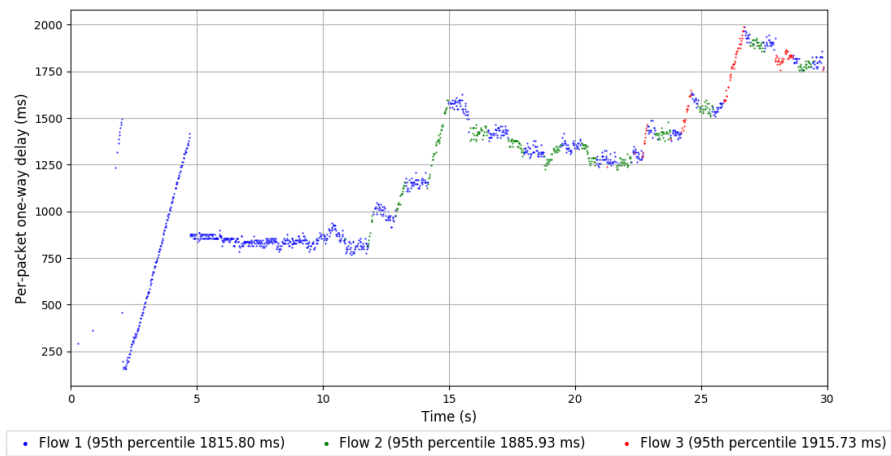
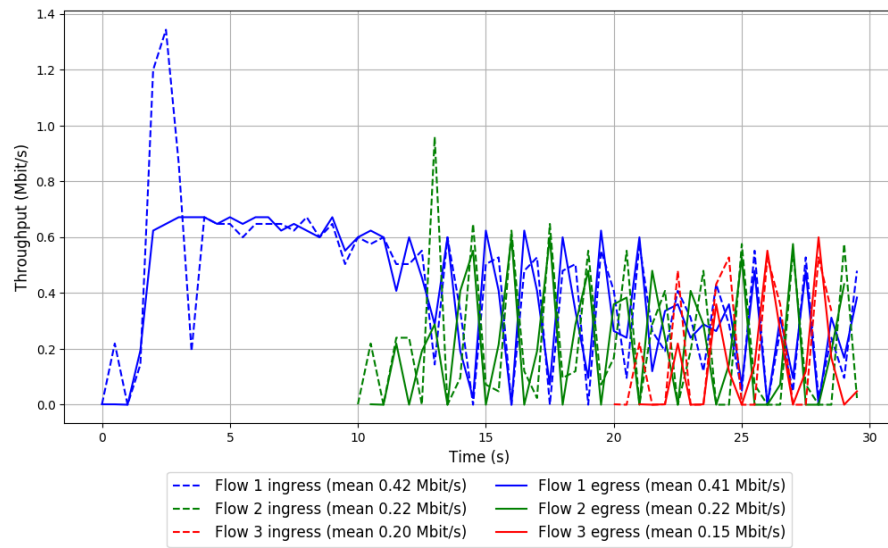


Run 1: Statistics of TCP Vegas

Start at: 2017-08-13 06:00:45  
End at: 2017-08-13 06:01:15  
Local clock offset: 0.433 ms  
Remote clock offset: -1.982 ms

# Below is generated by plot.py at 2017-08-13 07:38:36  
# Datalink statistics  
-- Total of 3 flows:  
Average throughput: 0.59 Mbit/s  
95th percentile per-packet one-way delay: 1866.199 ms  
Loss rate: 6.02%  
-- Flow 1:  
Average throughput: 0.41 Mbit/s  
95th percentile per-packet one-way delay: 1815.797 ms  
Loss rate: 3.28%  
-- Flow 2:  
Average throughput: 0.22 Mbit/s  
95th percentile per-packet one-way delay: 1885.930 ms  
Loss rate: 6.86%  
-- Flow 3:  
Average throughput: 0.15 Mbit/s  
95th percentile per-packet one-way delay: 1915.730 ms  
Loss rate: 23.89%

# Run 1: Report of TCP Vegas — Data Link



Run 2: Statistics of TCP Vegas

Start at: 2017-08-13 06:19:29

End at: 2017-08-13 06:19:59

Local clock offset: 0.323 ms

Remote clock offset: 2.057 ms

# Below is generated by plot.py at 2017-08-13 07:38:36

# Datalink statistics

-- Total of 3 flows:

Average throughput: 0.59 Mbit/s

95th percentile per-packet one-way delay: 1717.990 ms

Loss rate: 5.42%

-- Flow 1:

Average throughput: 0.41 Mbit/s

95th percentile per-packet one-way delay: 1648.086 ms

Loss rate: 3.14%

-- Flow 2:

Average throughput: 0.20 Mbit/s

95th percentile per-packet one-way delay: 1839.686 ms

Loss rate: 5.28%

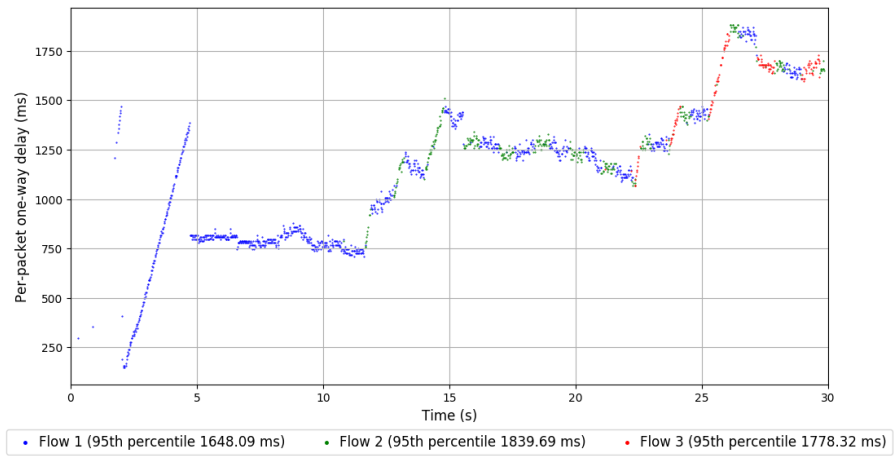
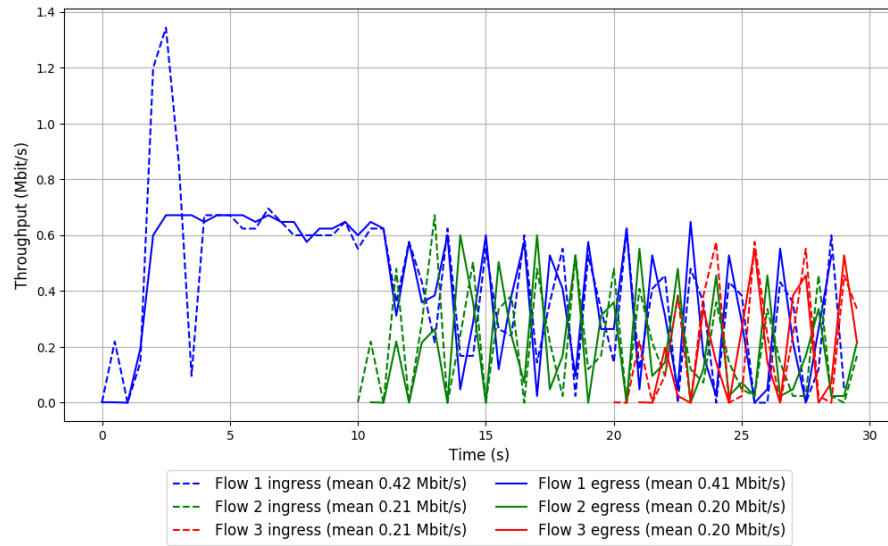
-- Flow 3:

Average throughput: 0.20 Mbit/s

95th percentile per-packet one-way delay: 1778.315 ms

Loss rate: 19.26%

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



Run 3: Statistics of TCP Vegas

Start at: 2017-08-13 06:38:13

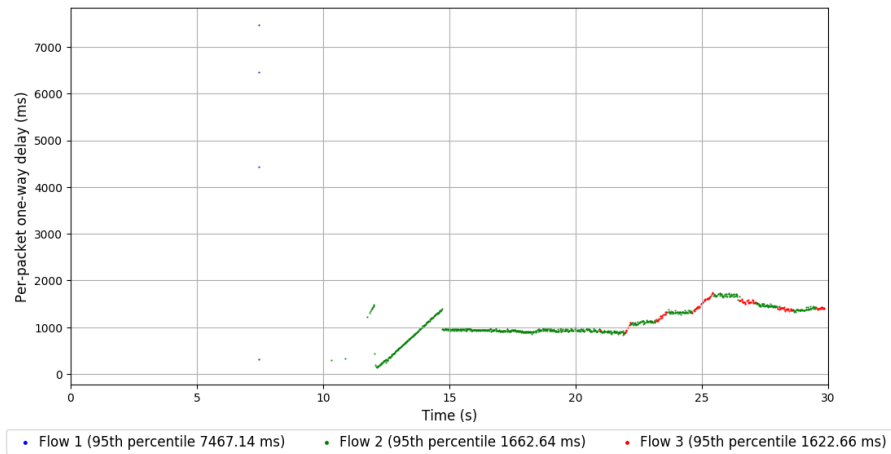
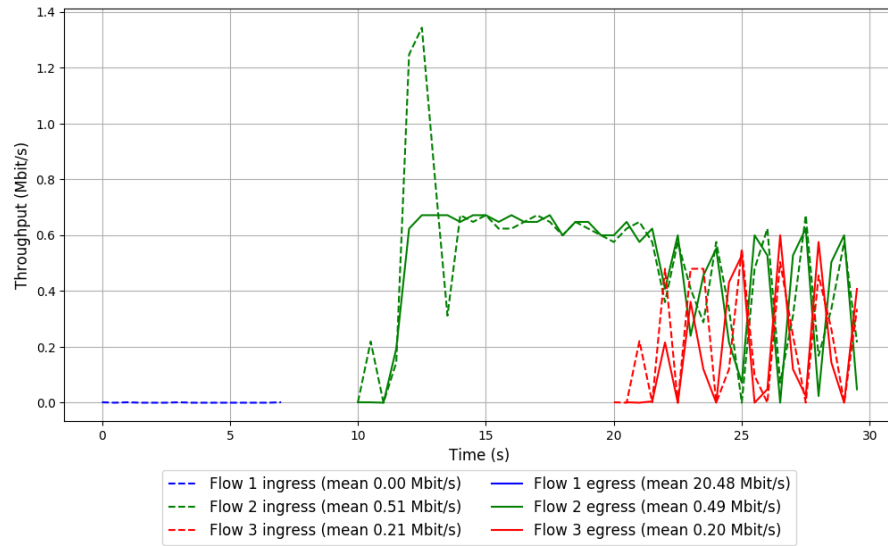
End at: 2017-08-13 06:38:43

Local clock offset: 0.454 ms

Remote clock offset: -1.785 ms



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



Run 1: Statistics of Verus

Start at: 2017-08-13 05:55:45

End at: 2017-08-13 05:56:15

Local clock offset: 0.452 ms

Remote clock offset: 1.016 ms

# Below is generated by plot.py at 2017-08-13 07:38:38

# Datalink statistics

-- Total of 3 flows:

Average throughput: 0.61 Mbit/s

95th percentile per-packet one-way delay: 1923.024 ms

Loss rate: 5.52%

-- Flow 1:

Average throughput: 0.59 Mbit/s

95th percentile per-packet one-way delay: 1922.318 ms

Loss rate: 5.49%

-- Flow 2:

Average throughput: 0.01 Mbit/s

95th percentile per-packet one-way delay: 1956.022 ms

Loss rate: 5.00%

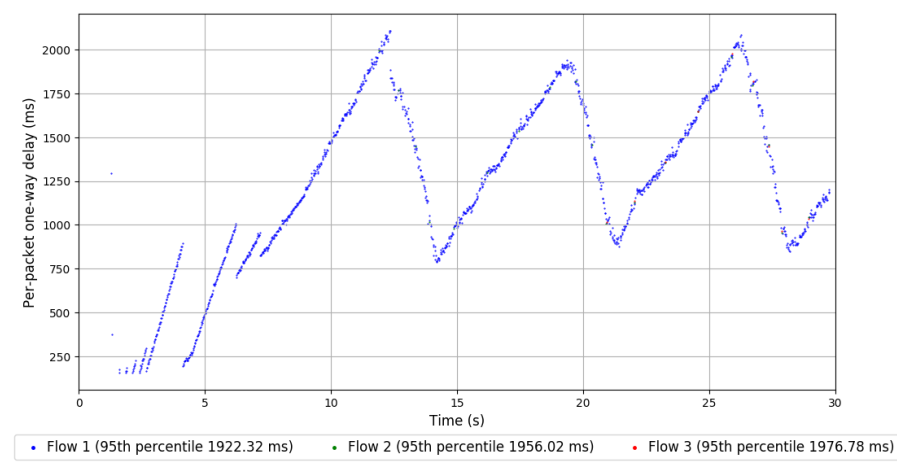
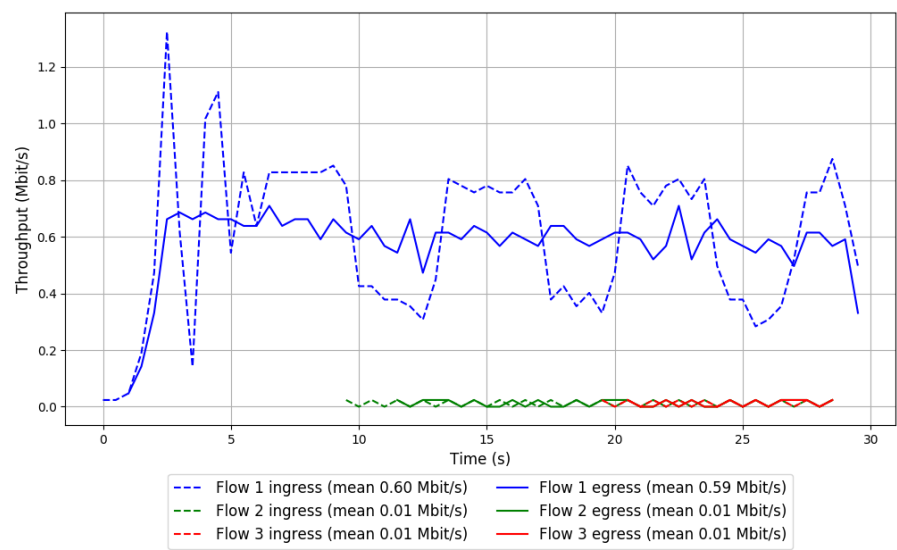
-- Flow 3:

Average throughput: 0.01 Mbit/s

95th percentile per-packet one-way delay: 1976.778 ms

Loss rate: 10.00%

Run 1: Report of Verus — Data Link



Run 2: Statistics of Verus

Start at: 2017-08-13 06:14:29

End at: 2017-08-13 06:14:59

Local clock offset: 0.437 ms

Remote clock offset: 2.972 ms

# Below is generated by plot.py at 2017-08-13 07:38:39

# Datalink statistics

-- Total of 3 flows:

Average throughput: 0.61 Mbit/s

95th percentile per-packet one-way delay: 1895.154 ms

Loss rate: 6.68%

-- Flow 1:

Average throughput: 0.59 Mbit/s

95th percentile per-packet one-way delay: 1895.154 ms

Loss rate: 6.68%

-- Flow 2:

Average throughput: 0.01 Mbit/s

95th percentile per-packet one-way delay: 1876.764 ms

Loss rate: 5.00%

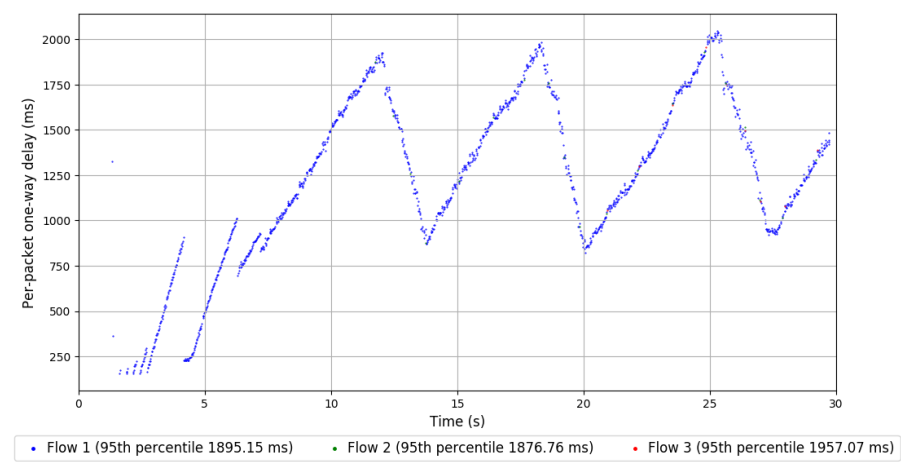
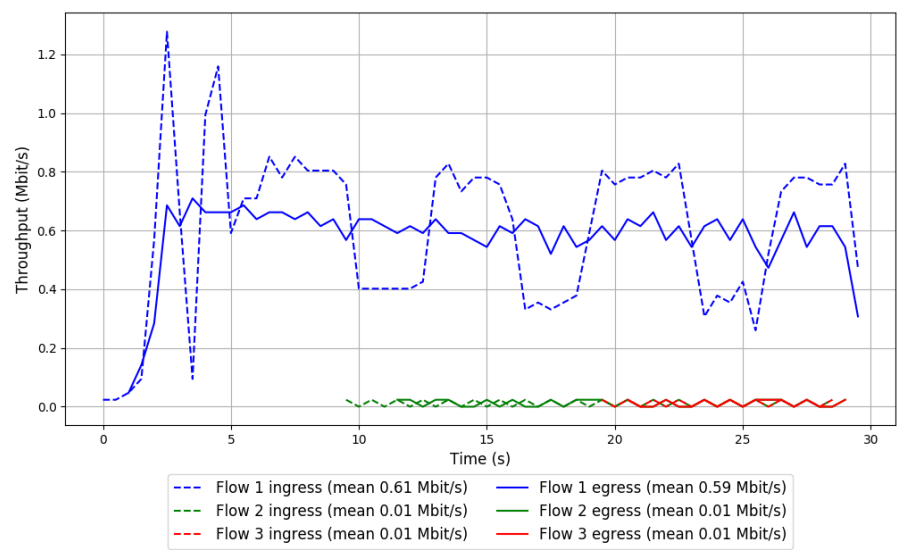
-- Flow 3:

Average throughput: 0.01 Mbit/s

95th percentile per-packet one-way delay: 1957.068 ms

Loss rate: 10.00%

Run 2: Report of Verus — Data Link

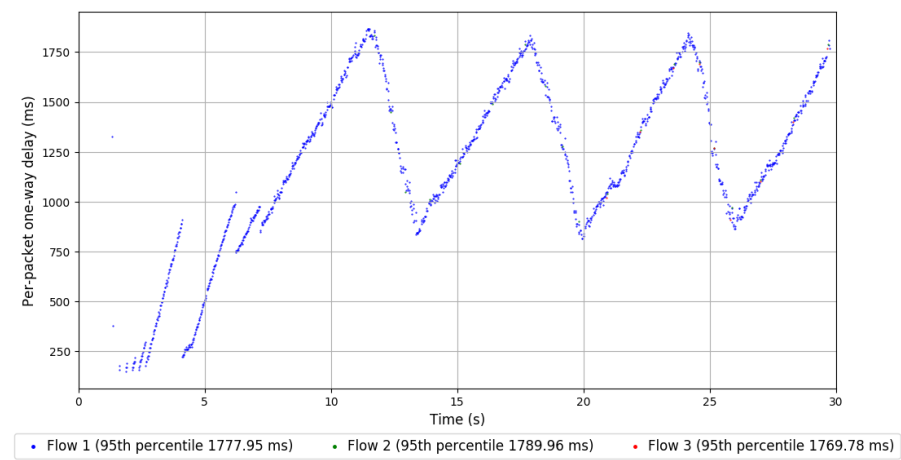
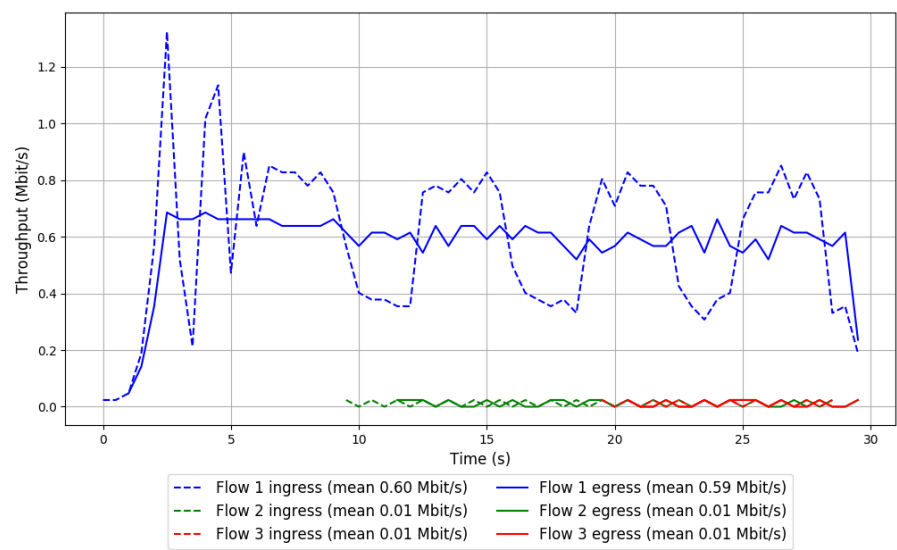


Run 3: Statistics of Verus

Start at: 2017-08-13 06:33:13  
End at: 2017-08-13 06:33:43  
Local clock offset: 0.413 ms  
Remote clock offset: -2.714 ms

# Below is generated by plot.py at 2017-08-13 07:38:39  
# Datalink statistics  
-- Total of 3 flows:  
Average throughput: 0.61 Mbit/s  
95th percentile per-packet one-way delay: 1778.092 ms  
Loss rate: 4.77%  
-- Flow 1:  
Average throughput: 0.59 Mbit/s  
95th percentile per-packet one-way delay: 1777.949 ms  
Loss rate: 4.73%  
-- Flow 2:  
Average throughput: 0.01 Mbit/s  
95th percentile per-packet one-way delay: 1789.956 ms  
Loss rate: 5.00%  
-- Flow 3:  
Average throughput: 0.01 Mbit/s  
95th percentile per-packet one-way delay: 1769.783 ms  
Loss rate: 10.00%

Run 3: Report of Verus — Data Link



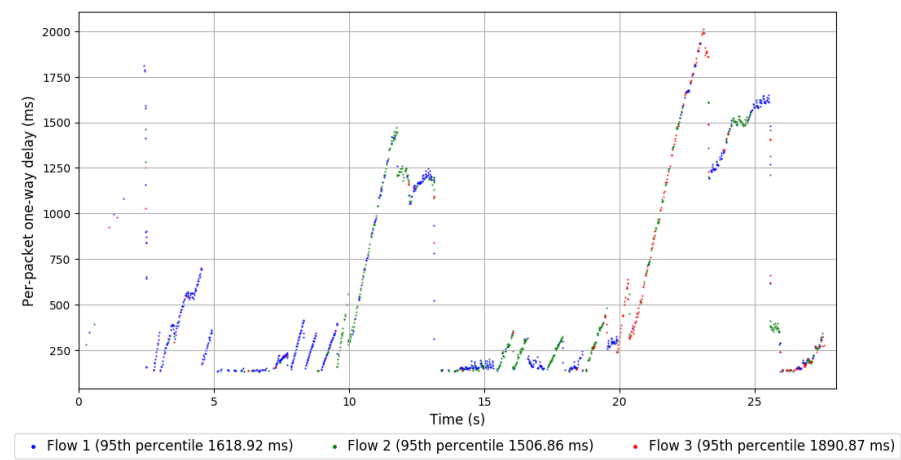
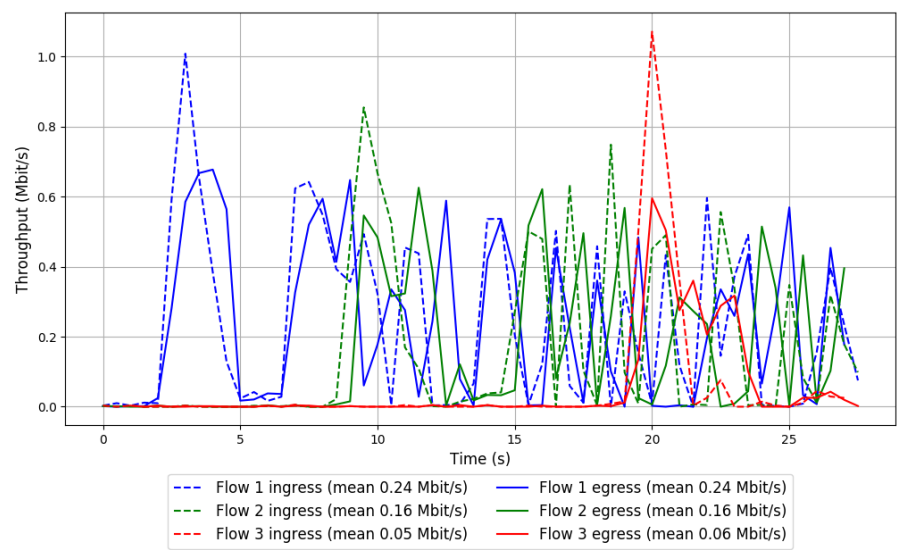
Run 1: Statistics of WebRTC media

Start at: 2017-08-13 06:03:16  
End at: 2017-08-13 06:03:46  
Local clock offset: 0.44 ms  
Remote clock offset: -2.004 ms

# Below is generated by plot.py at 2017-08-13 07:38:40  
# Datalink statistics  
-- Total of 3 flows:  
Average throughput: 0.45 Mbit/s  
95th percentile per-packet one-way delay: 1609.918 ms  
Loss rate: 1.36%  
-- Flow 1:  
Average throughput: 0.24 Mbit/s  
95th percentile per-packet one-way delay: 1618.921 ms  
Loss rate: 1.71%  
-- Flow 2:  
Average throughput: 0.16 Mbit/s  
95th percentile per-packet one-way delay: 1506.856 ms  
Loss rate: 1.13%  
-- Flow 3:  
Average throughput: 0.06 Mbit/s  
95th percentile per-packet one-way delay: 1890.866 ms  
Loss rate: 0.44%



Run 1: Report of WebRTC media — Data Link



Run 2: Statistics of WebRTC media

Start at: 2017-08-13 06:22:00

End at: 2017-08-13 06:22:30

Local clock offset: 0.453 ms

Remote clock offset: 2.101 ms

# Below is generated by plot.py at 2017-08-13 07:38:41

# Datalink statistics

-- Total of 3 flows:

Average throughput: 0.47 Mbit/s

95th percentile per-packet one-way delay: 2090.808 ms

Loss rate: 3.67%

-- Flow 1:

Average throughput: 0.27 Mbit/s

95th percentile per-packet one-way delay: 2053.974 ms

Loss rate: 3.29%

-- Flow 2:

Average throughput: 0.15 Mbit/s

95th percentile per-packet one-way delay: 2108.080 ms

Loss rate: 4.69%

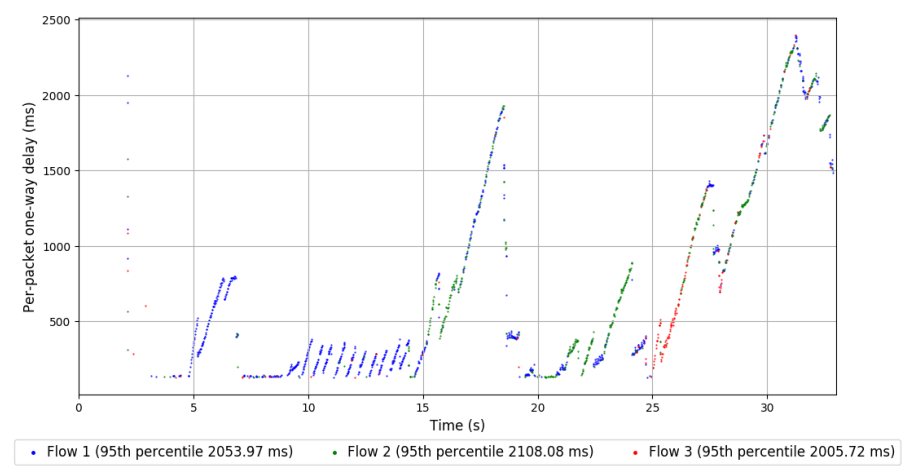
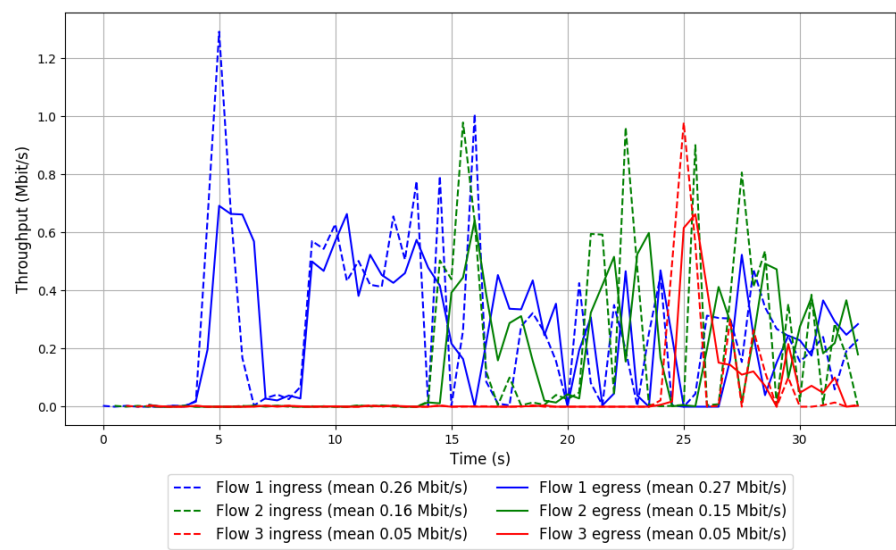
-- Flow 3:

Average throughput: 0.05 Mbit/s

95th percentile per-packet one-way delay: 2005.717 ms

Loss rate: 2.41%

Run 2: Report of WebRTC media — Data Link



Run 3: Statistics of WebRTC media

Start at: 2017-08-13 06:40:44  
End at: 2017-08-13 06:41:14  
Local clock offset: 0.41 ms  
Remote clock offset: -2.664 ms

# Below is generated by plot.py at 2017-08-13 07:38:41  
# Datalink statistics  
-- Total of 3 flows:  
Average throughput: 0.39 Mbit/s  
95th percentile per-packet one-way delay: 1578.688 ms  
Loss rate: 1.13%  
-- Flow 1:  
Average throughput: 0.22 Mbit/s  
95th percentile per-packet one-way delay: 1542.232 ms  
Loss rate: 1.73%  
-- Flow 2:  
Average throughput: 0.14 Mbit/s  
95th percentile per-packet one-way delay: 1582.477 ms  
Loss rate: 0.03%  
-- Flow 3:  
Average throughput: 0.05 Mbit/s  
95th percentile per-packet one-way delay: 1618.407 ms  
Loss rate: 1.37%

### Run 3: Report of WebRTC media — Data Link

