

Pantheon Report

Generated at 2017-08-13 07:48:03 (UTC).

Data path: AWS California 2 Ethernet (*local*) →Mexico 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).

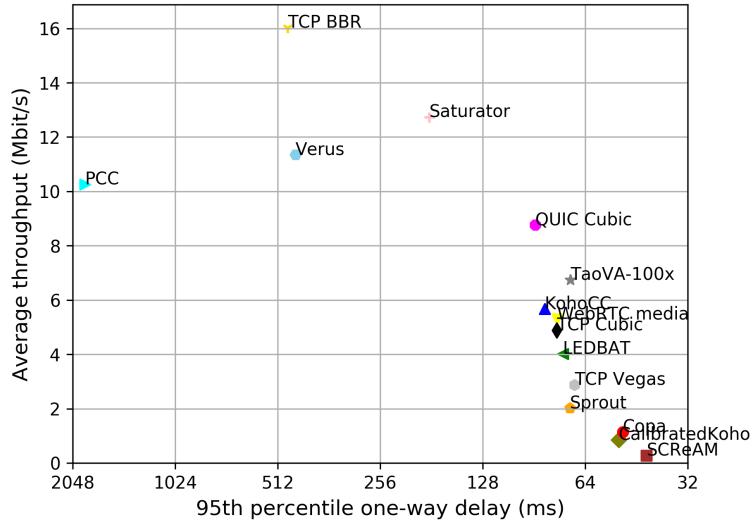
Tested BBR with qdisc of Fair Queuing (**fq**), and other schemes with the default Linux qdisc (**pfifo_fast**).

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

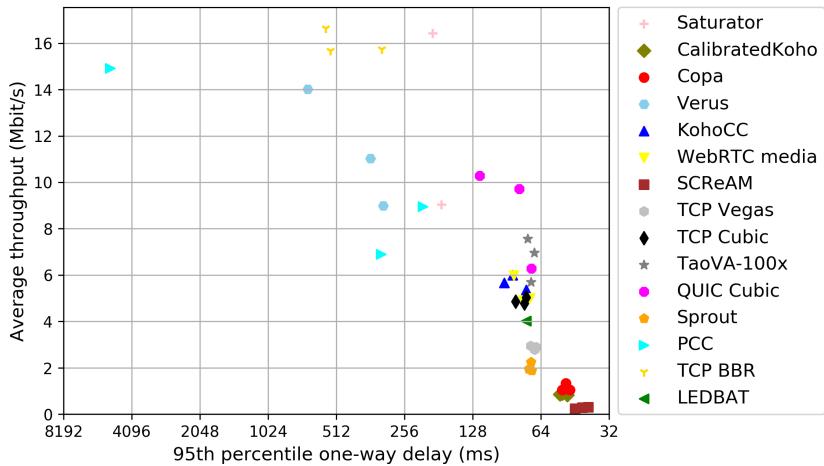
Git summary:

```
branch: master @ e43be7582298d552838afcfc6382342bf187fbbd6
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-quic @ 77961f1a82733a86b42f1bc8143ebc978f3cff42
third_party/scream @ c3370fd7bd17265a79aeb34e4016ad23f5965885
third_party/sourdough @ f1a14bffe749737437f61b1eaeeb30b267cde681
third_party/sprout @ 6f2efe6e088d91066a9f023df375eee2665089ce
  M src/examples/cellsim.cc
  M src/examples/sproutbt2.cc
  M src/network/sproutconn.cc
third_party/verus @ d4b447ea74c6c60a261149af2629562939f9a494
  M src/verus.hpp
  M tools/plot.py
third_party/webrtc @ a488197ddd041ace68a42849b2540ad834825f42
```

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



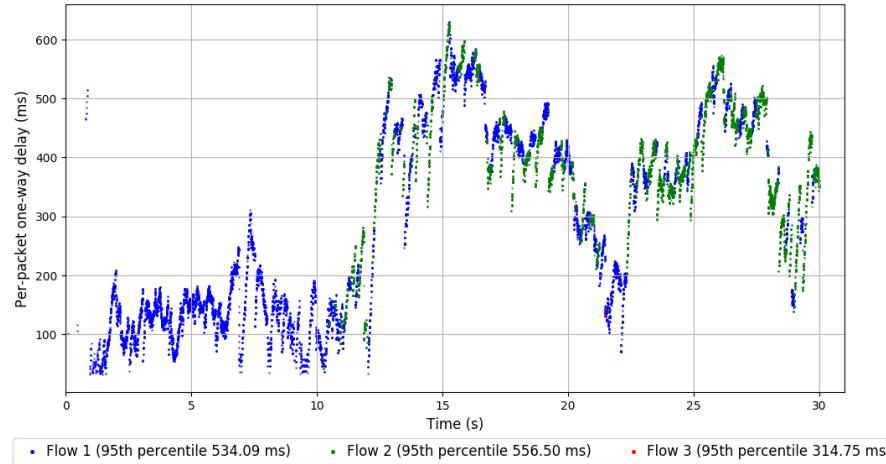
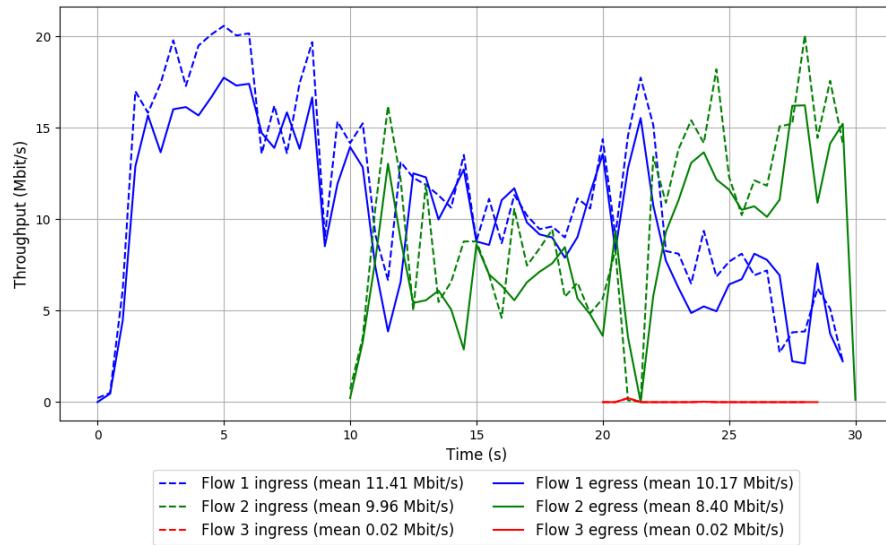
scheme	# runs	mean avg tput (Mbit/s)			mean 95th-%ile delay (ms)			mean loss rate (%)		
		flow 1	flow 2	flow 3	flow 1	flow 2	flow 3	flow 1	flow 2	flow 3
TCP BBR	3	10.27	7.65	2.27	470.53	491.83	413.95	12.31	16.86	9.34
CalibratedKoho	3	0.40	0.42	0.53	51.47	50.60	51.72	0.31	0.38	1.13
Copa	3	0.60	0.51	0.58	49.47	49.86	49.69	0.79	0.76	0.79
TCP Cubic	3	2.57	2.51	1.95	72.37	77.67	78.35	3.63	2.49	4.96
KohoCC	3	2.11	3.99	2.61	73.81	87.06	90.66	3.43	4.35	5.35
LEDBAT	2	2.38	1.65	1.67	74.27	72.11	74.58	2.92	3.62	3.66
PCC	3	6.76	4.09	2.51	2016.85	791.46	638.86	24.08	16.66	5.92
QUIC Cubic	3	4.53	4.59	3.70	82.24	74.06	77.16	4.65	6.57	6.69
Saturator	2	9.57	9.59	3.88	162.49	181.29	191.88	11.37	10.46	10.69
SCReAM	3	0.08	0.19	0.21	44.36	41.43	45.11	0.08	0.26	0.29
Sprout	3	1.15	0.87	0.89	71.45	72.17	67.96	1.13	1.83	2.32
TaoVA-100x	3	3.67	4.48	4.19	65.77	76.96	81.17	5.38	8.94	9.78
TCP Vegas	3	1.33	1.52	1.61	63.45	70.67	64.77	3.90	3.31	4.18
Verus	3	7.54	3.83	3.66	302.35	687.29	616.61	16.44	30.65	32.80
WebRTC media	3	3.45	1.40	0.45	76.13	77.39	82.55	3.46	4.59	5.45

Run 1: Statistics of TCP BBR

```
Start at: 2017-08-13 06:54:11
End at: 2017-08-13 06:54:41
Local clock offset: 0.534 ms
Remote clock offset: 1.342 ms

# Below is generated by plot.py at 2017-08-13 07:47:18
# Datalink statistics
-- Total of 3 flows:
Average throughput: 15.68 Mbit/s
95th percentile per-packet one-way delay: 542.636 ms
Loss rate: 13.06%
-- Flow 1:
Average throughput: 10.17 Mbit/s
95th percentile per-packet one-way delay: 534.091 ms
Loss rate: 11.44%
-- Flow 2:
Average throughput: 8.40 Mbit/s
95th percentile per-packet one-way delay: 556.496 ms
Loss rate: 15.83%
-- Flow 3:
Average throughput: 0.02 Mbit/s
95th percentile per-packet one-way delay: 314.753 ms
Loss rate: 0.00%
```

Run 1: Report of TCP BBR — Data Link

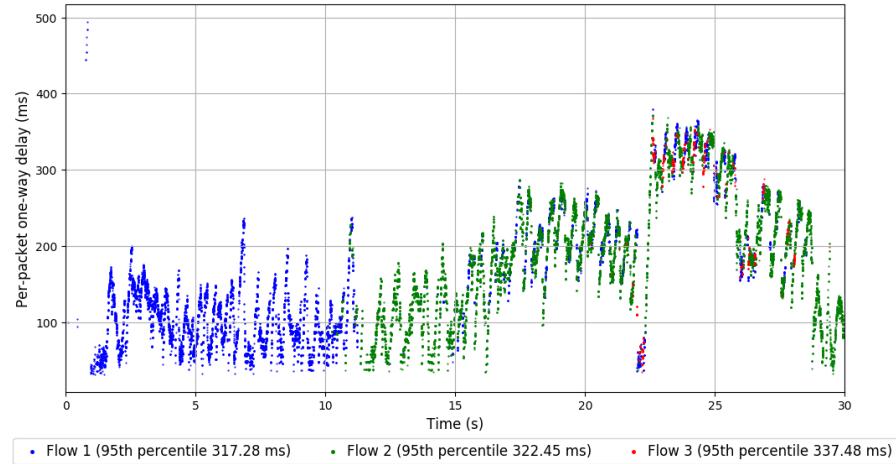
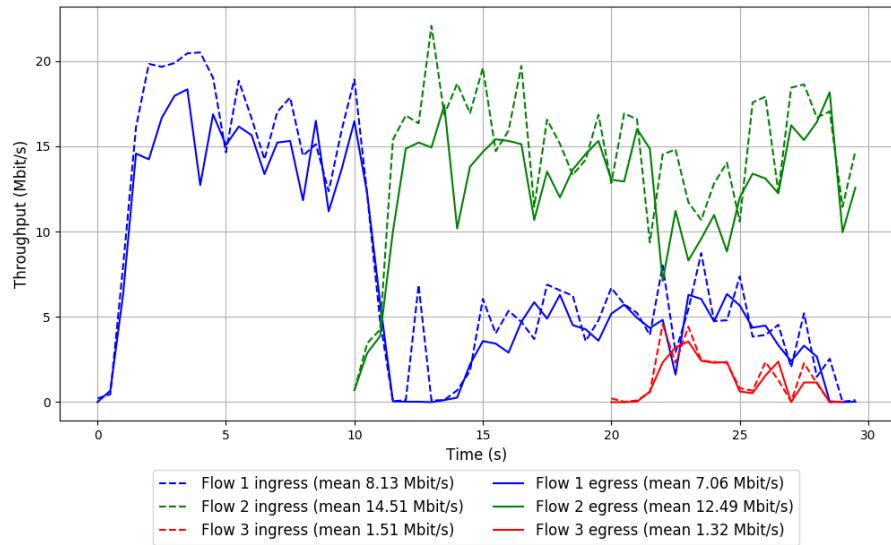


Run 2: Statistics of TCP BBR

```
Start at: 2017-08-13 07:14:23
End at: 2017-08-13 07:14:53
Local clock offset: 0.605 ms
Remote clock offset: 1.253 ms

# Below is generated by plot.py at 2017-08-13 07:47:19
# Datalink statistics
-- Total of 3 flows:
Average throughput: 15.74 Mbit/s
95th percentile per-packet one-way delay: 322.503 ms
Loss rate: 13.91%
-- Flow 1:
Average throughput: 7.06 Mbit/s
95th percentile per-packet one-way delay: 317.282 ms
Loss rate: 13.61%
-- Flow 2:
Average throughput: 12.49 Mbit/s
95th percentile per-packet one-way delay: 322.447 ms
Loss rate: 14.21%
-- Flow 3:
Average throughput: 1.32 Mbit/s
95th percentile per-packet one-way delay: 337.478 ms
Loss rate: 13.01%
```

Run 2: Report of TCP BBR — Data Link

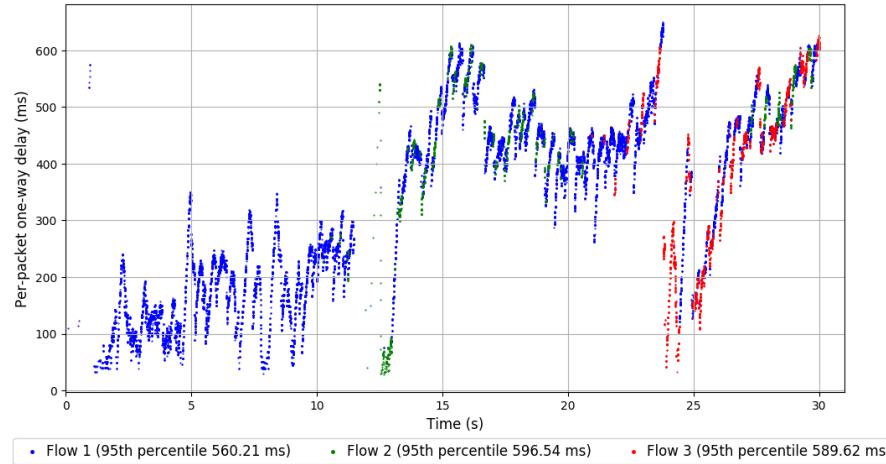
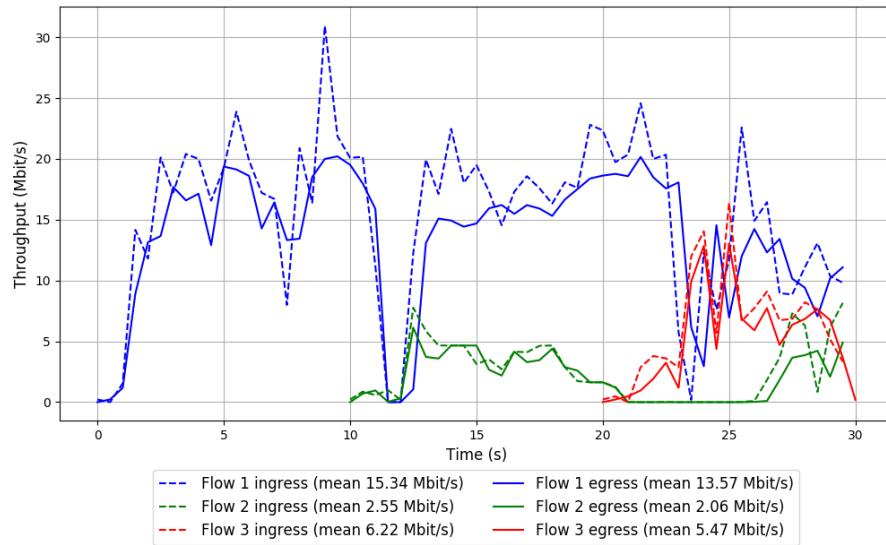


Run 3: Statistics of TCP BBR

```
Start at: 2017-08-13 07:34:31
End at: 2017-08-13 07:35:01
Local clock offset: 0.473 ms
Remote clock offset: 1.42 ms

# Below is generated by plot.py at 2017-08-13 07:47:23
# Datalink statistics
-- Total of 3 flows:
Average throughput: 16.64 Mbit/s
95th percentile per-packet one-way delay: 569.612 ms
Loss rate: 12.99%
-- Flow 1:
Average throughput: 13.57 Mbit/s
95th percentile per-packet one-way delay: 560.207 ms
Loss rate: 11.88%
-- Flow 2:
Average throughput: 2.06 Mbit/s
95th percentile per-packet one-way delay: 596.538 ms
Loss rate: 20.55%
-- Flow 3:
Average throughput: 5.47 Mbit/s
95th percentile per-packet one-way delay: 589.617 ms
Loss rate: 15.02%
```

Run 3: Report of TCP BBR — Data Link

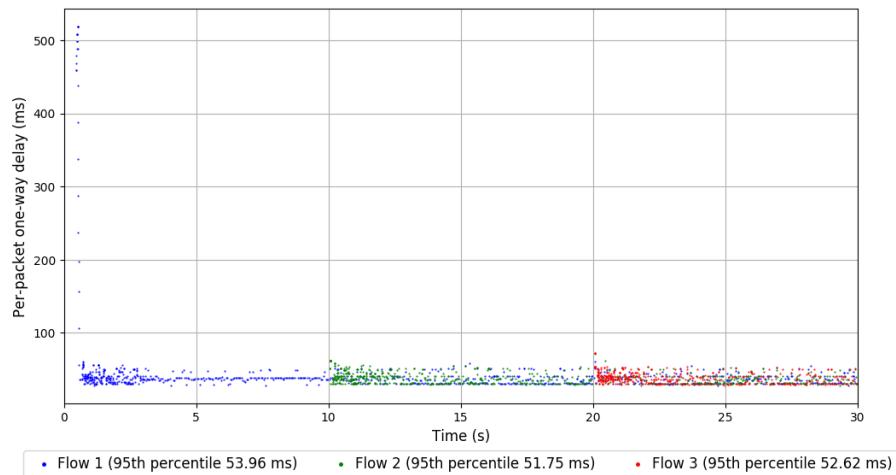
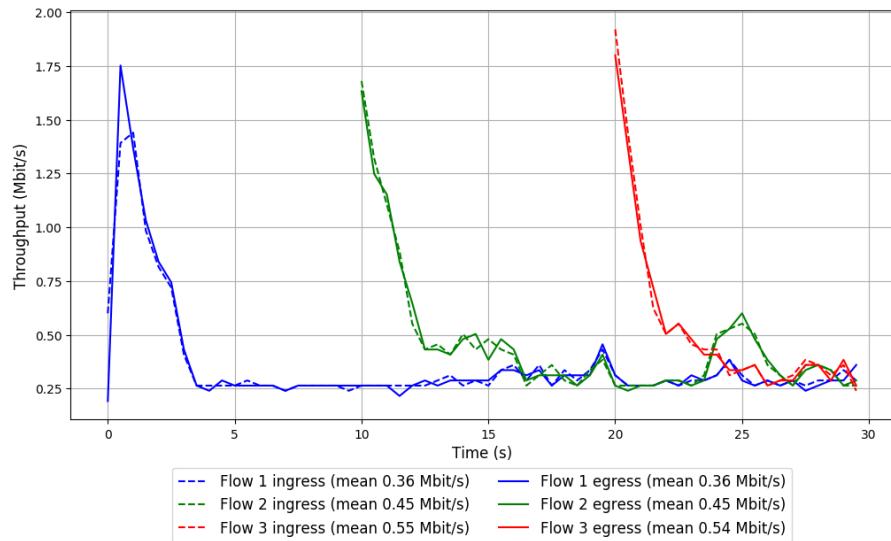


```
Run 1: Statistics of CalibratedKoho
```

```
Start at: 2017-08-13 07:04:58
End at: 2017-08-13 07:05:28
Local clock offset: 0.599 ms
Remote clock offset: 1.15 ms

# Below is generated by plot.py at 2017-08-13 07:47:23
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.85 Mbit/s
95th percentile per-packet one-way delay: 52.624 ms
Loss rate: 0.62%
-- Flow 1:
Average throughput: 0.36 Mbit/s
95th percentile per-packet one-way delay: 53.962 ms
Loss rate: 0.33%
-- Flow 2:
Average throughput: 0.45 Mbit/s
95th percentile per-packet one-way delay: 51.746 ms
Loss rate: 0.26%
-- Flow 3:
Average throughput: 0.54 Mbit/s
95th percentile per-packet one-way delay: 52.624 ms
Loss rate: 1.76%
```

Run 1: Report of CalibratedKoho — Data Link

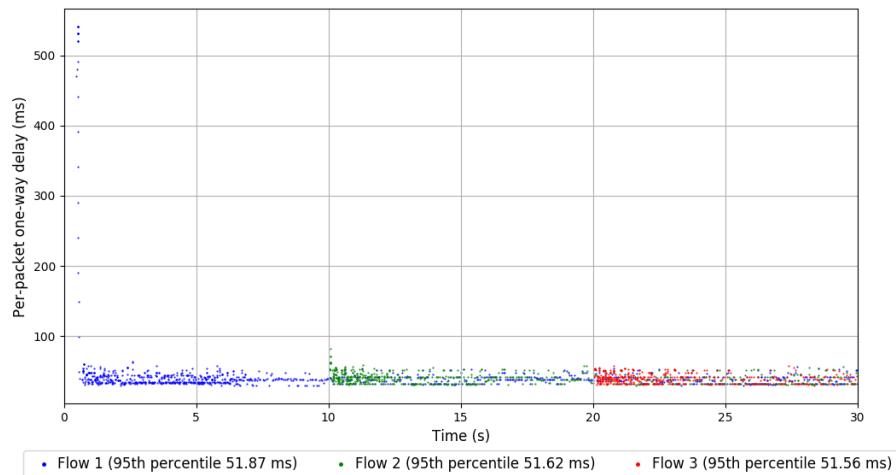
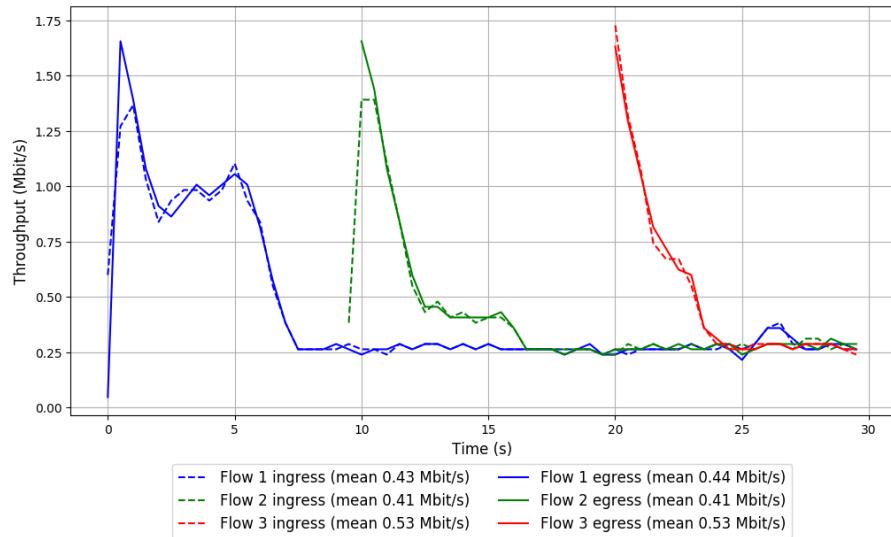


Run 2: Statistics of CalibratedKoho

```
Start at: 2017-08-13 07:25:07
End at: 2017-08-13 07:25:37
Local clock offset: 0.506 ms
Remote clock offset: 1.782 ms

# Below is generated by plot.py at 2017-08-13 07:47:23
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.89 Mbit/s
95th percentile per-packet one-way delay: 51.609 ms
Loss rate: 0.27%
-- Flow 1:
Average throughput: 0.44 Mbit/s
95th percentile per-packet one-way delay: 51.872 ms
Loss rate: 0.28%
-- Flow 2:
Average throughput: 0.41 Mbit/s
95th percentile per-packet one-way delay: 51.625 ms
Loss rate: 0.29%
-- Flow 3:
Average throughput: 0.53 Mbit/s
95th percentile per-packet one-way delay: 51.565 ms
Loss rate: 0.23%
```

Run 2: Report of CalibratedKoho — Data Link

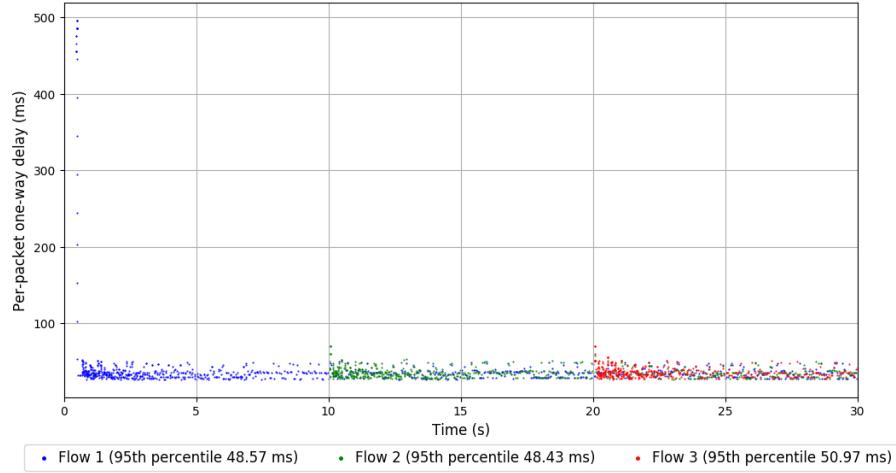
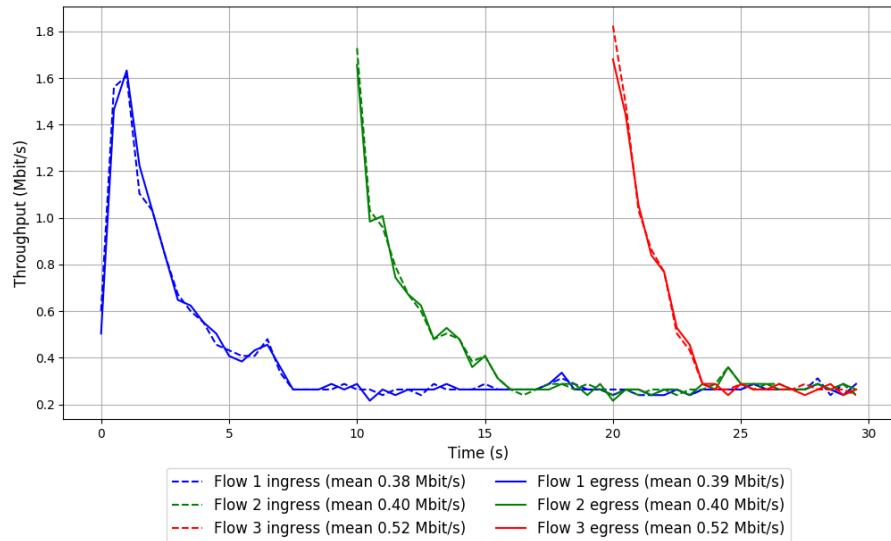


```
Run 3: Statistics of CalibratedKoho
```

```
Start at: 2017-08-13 07:45:14
End at: 2017-08-13 07:45:44
Local clock offset: 0.589 ms
Remote clock offset: -0.746 ms

# Below is generated by plot.py at 2017-08-13 07:47:23
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.83 Mbit/s
95th percentile per-packet one-way delay: 49.012 ms
Loss rate: 0.63%
-- Flow 1:
Average throughput: 0.39 Mbit/s
95th percentile per-packet one-way delay: 48.572 ms
Loss rate: 0.31%
-- Flow 2:
Average throughput: 0.40 Mbit/s
95th percentile per-packet one-way delay: 48.430 ms
Loss rate: 0.60%
-- Flow 3:
Average throughput: 0.52 Mbit/s
95th percentile per-packet one-way delay: 50.968 ms
Loss rate: 1.39%
```

Run 3: Report of CalibratedKoho — Data Link

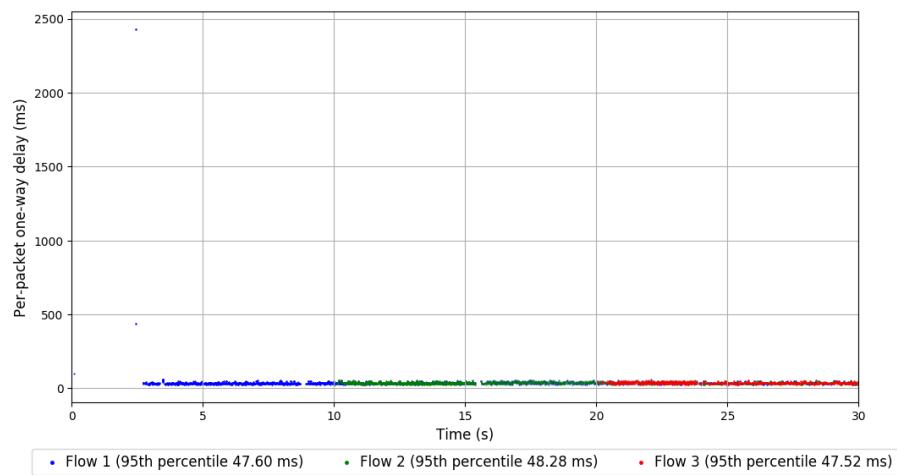
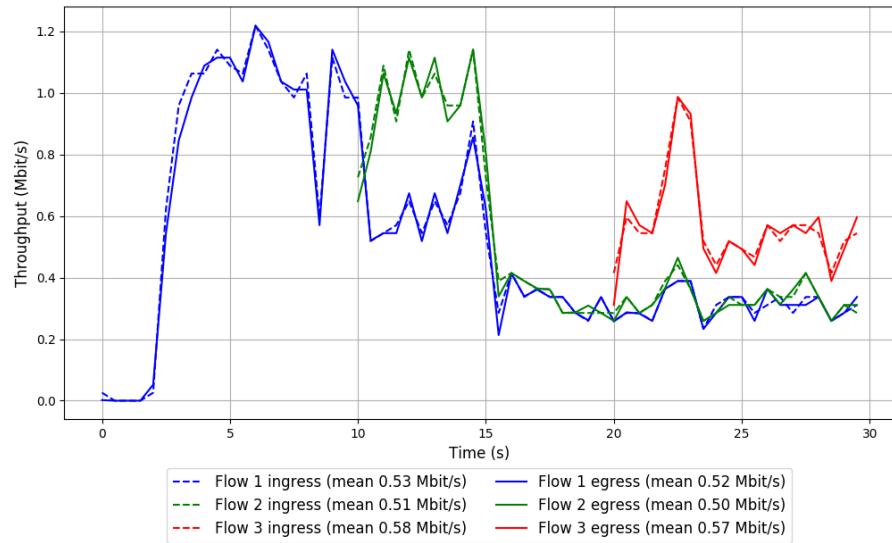


Run 1: Statistics of Copa

```
Start at: 2017-08-13 06:52:51
End at: 2017-08-13 06:53:21
Local clock offset: 0.596 ms
Remote clock offset: -1.318 ms

# Below is generated by plot.py at 2017-08-13 07:47:24
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1.05 Mbit/s
95th percentile per-packet one-way delay: 47.654 ms
Loss rate: 0.77%
-- Flow 1:
Average throughput: 0.52 Mbit/s
95th percentile per-packet one-way delay: 47.599 ms
Loss rate: 0.91%
-- Flow 2:
Average throughput: 0.50 Mbit/s
95th percentile per-packet one-way delay: 48.277 ms
Loss rate: 0.60%
-- Flow 3:
Average throughput: 0.57 Mbit/s
95th percentile per-packet one-way delay: 47.516 ms
Loss rate: 0.66%
```

Run 1: Report of Copa — Data Link

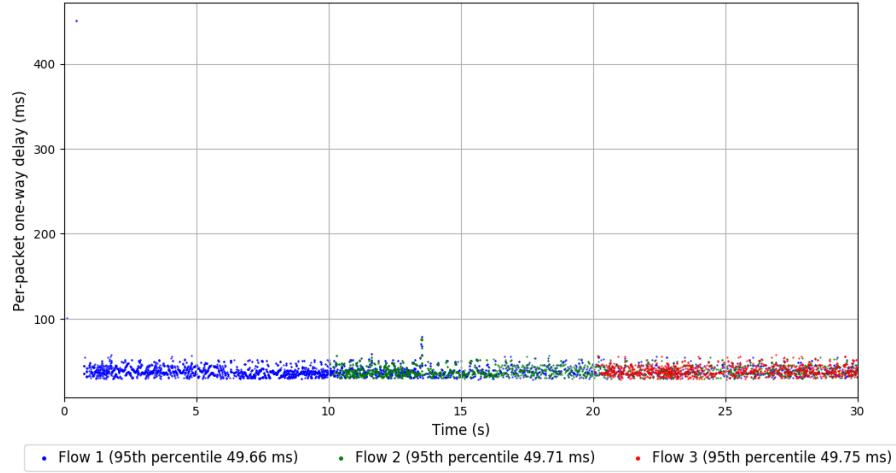
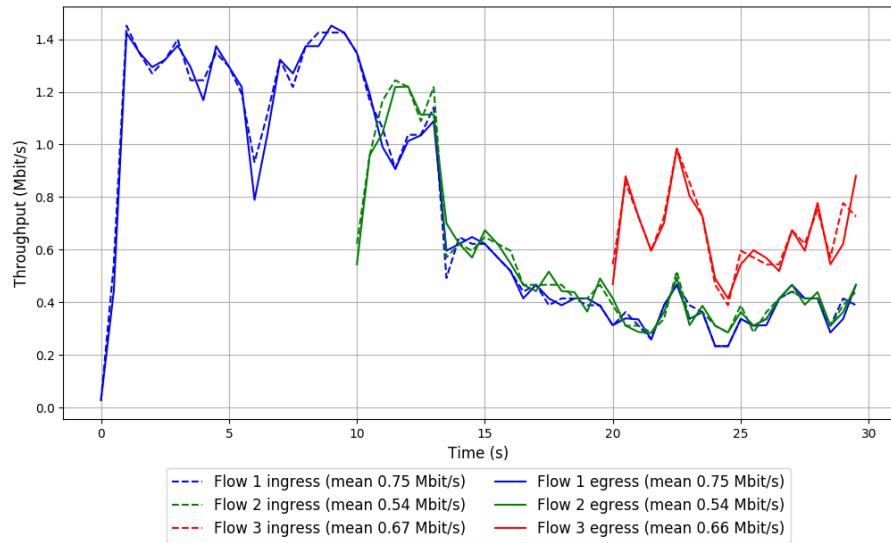


Run 2: Statistics of Copa

```
Start at: 2017-08-13 07:13:02
End at: 2017-08-13 07:13:32
Local clock offset: 0.588 ms
Remote clock offset: 1.858 ms

# Below is generated by plot.py at 2017-08-13 07:47:24
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1.33 Mbit/s
95th percentile per-packet one-way delay: 49.752 ms
Loss rate: 0.93%
-- Flow 1:
Average throughput: 0.75 Mbit/s
95th percentile per-packet one-way delay: 49.665 ms
Loss rate: 0.87%
-- Flow 2:
Average throughput: 0.54 Mbit/s
95th percentile per-packet one-way delay: 49.706 ms
Loss rate: 1.03%
-- Flow 3:
Average throughput: 0.66 Mbit/s
95th percentile per-packet one-way delay: 49.752 ms
Loss rate: 0.98%
```

Run 2: Report of Copa — Data Link

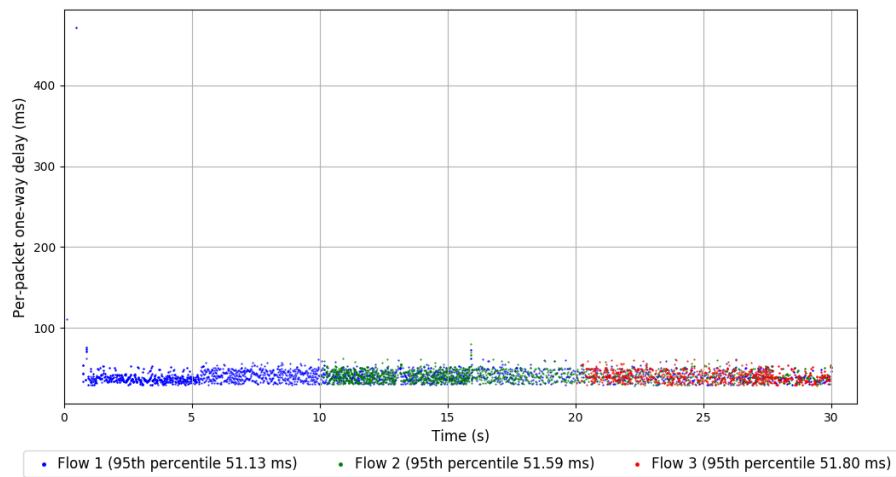
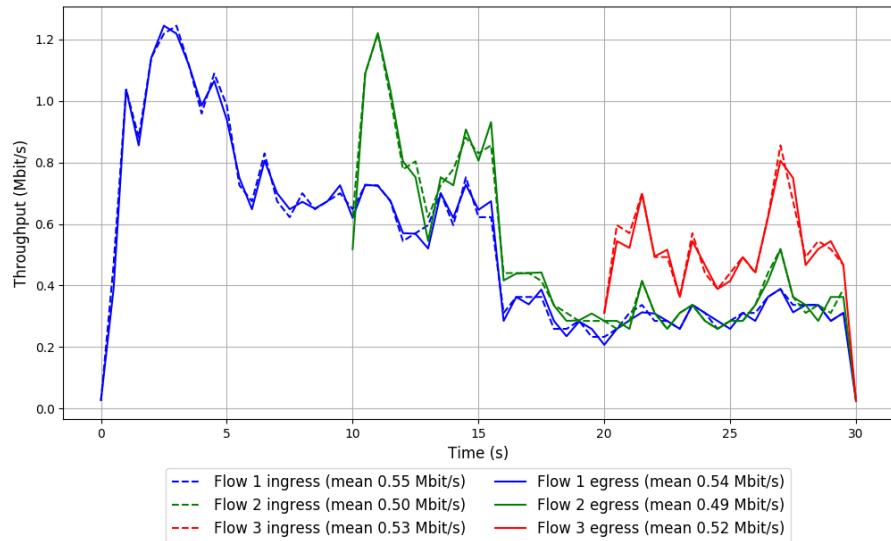


Run 3: Statistics of Copa

```
Start at: 2017-08-13 07:33:11
End at: 2017-08-13 07:33:41
Local clock offset: 0.594 ms
Remote clock offset: 1.829 ms

# Below is generated by plot.py at 2017-08-13 07:47:25
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1.05 Mbit/s
95th percentile per-packet one-way delay: 51.469 ms
Loss rate: 0.64%
-- Flow 1:
Average throughput: 0.54 Mbit/s
95th percentile per-packet one-way delay: 51.132 ms
Loss rate: 0.60%
-- Flow 2:
Average throughput: 0.49 Mbit/s
95th percentile per-packet one-way delay: 51.588 ms
Loss rate: 0.66%
-- Flow 3:
Average throughput: 0.52 Mbit/s
95th percentile per-packet one-way delay: 51.801 ms
Loss rate: 0.72%
```

Run 3: Report of Copa — Data Link

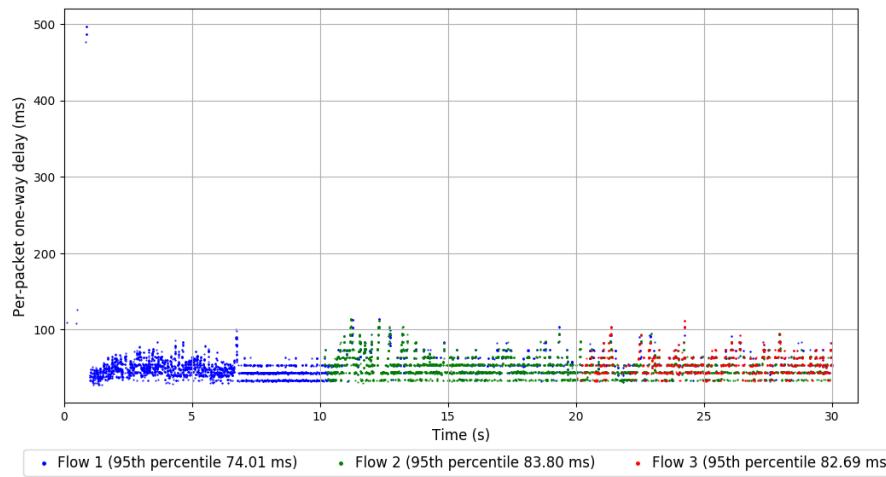
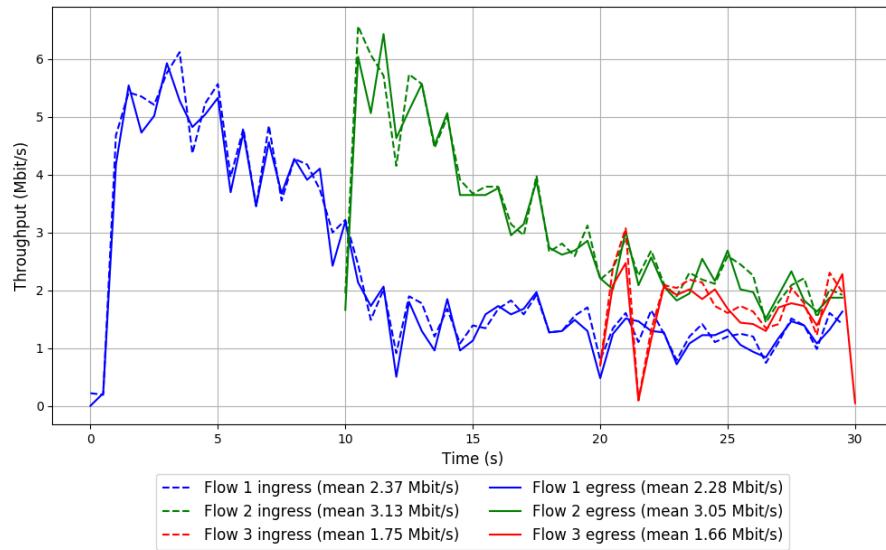


```
Run 1: Statistics of TCP Cubic
```

```
Start at: 2017-08-13 07:00:55
End at: 2017-08-13 07:01:25
Local clock offset: 0.507 ms
Remote clock offset: -1.143 ms

# Below is generated by plot.py at 2017-08-13 07:47:26
# Datalink statistics
-- Total of 3 flows:
Average throughput: 4.86 Mbit/s
95th percentile per-packet one-way delay: 82.654 ms
Loss rate: 3.57%
-- Flow 1:
Average throughput: 2.28 Mbit/s
95th percentile per-packet one-way delay: 74.012 ms
Loss rate: 4.04%
-- Flow 2:
Average throughput: 3.05 Mbit/s
95th percentile per-packet one-way delay: 83.797 ms
Loss rate: 2.57%
-- Flow 3:
Average throughput: 1.66 Mbit/s
95th percentile per-packet one-way delay: 82.691 ms
Loss rate: 5.24%
```

Run 1: Report of TCP Cubic — Data Link

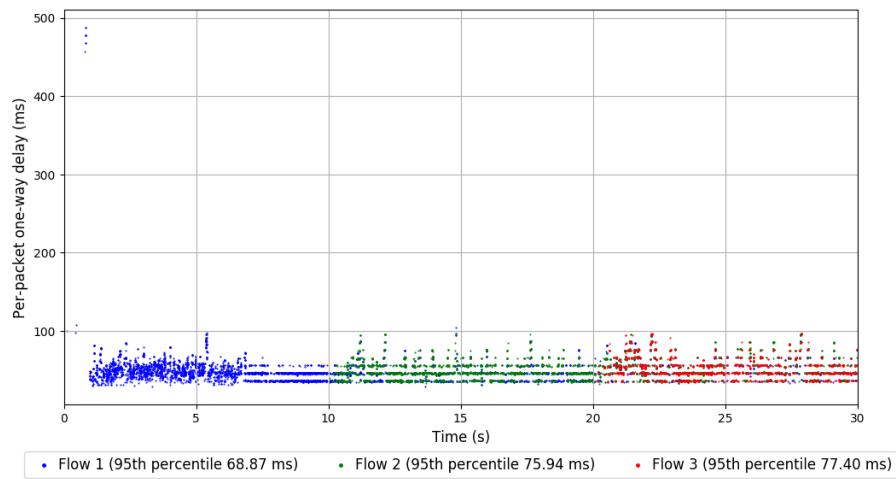
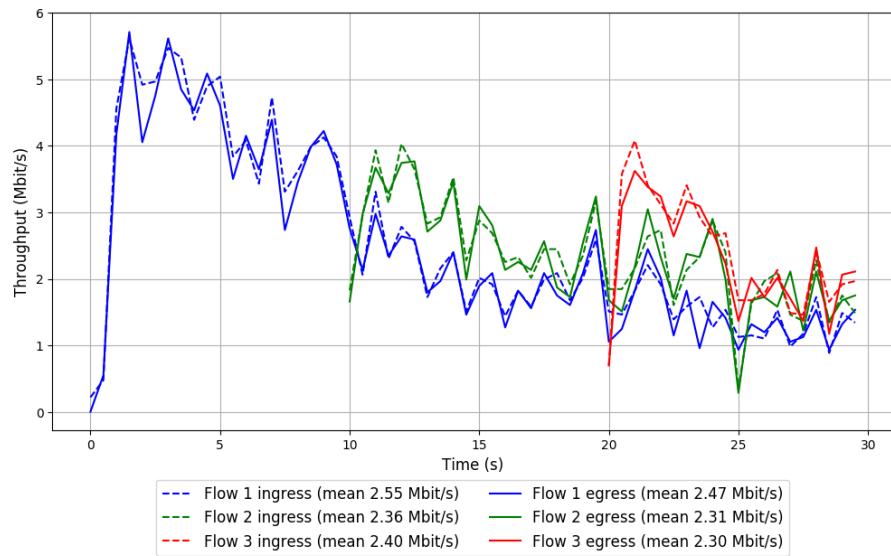


Run 2: Statistics of TCP Cubic

```
Start at: 2017-08-13 07:21:05
End at: 2017-08-13 07:21:35
Local clock offset: 0.507 ms
Remote clock offset: -0.622 ms

# Below is generated by plot.py at 2017-08-13 07:47:27
# Datalink statistics
-- Total of 3 flows:
Average throughput: 4.78 Mbit/s
95th percentile per-packet one-way delay: 75.626 ms
Loss rate: 2.87%
-- Flow 1:
Average throughput: 2.47 Mbit/s
95th percentile per-packet one-way delay: 68.868 ms
Loss rate: 3.27%
-- Flow 2:
Average throughput: 2.31 Mbit/s
95th percentile per-packet one-way delay: 75.940 ms
Loss rate: 1.92%
-- Flow 3:
Average throughput: 2.30 Mbit/s
95th percentile per-packet one-way delay: 77.402 ms
Loss rate: 3.48%
```

Run 2: Report of TCP Cubic — Data Link

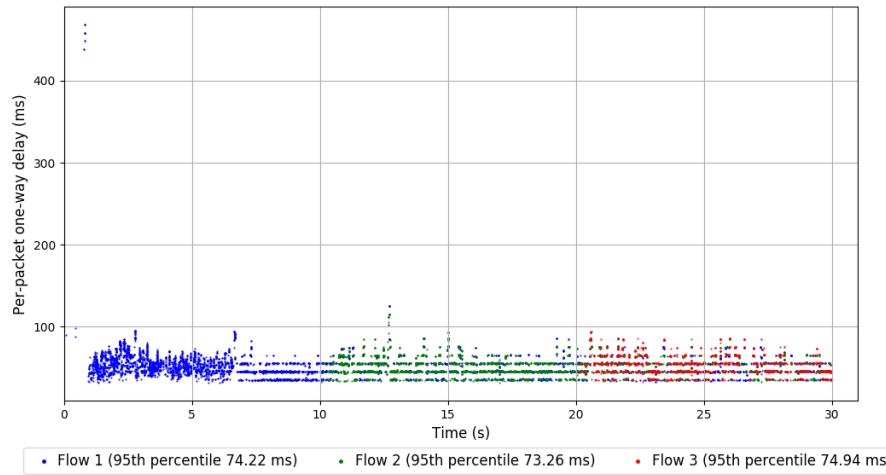
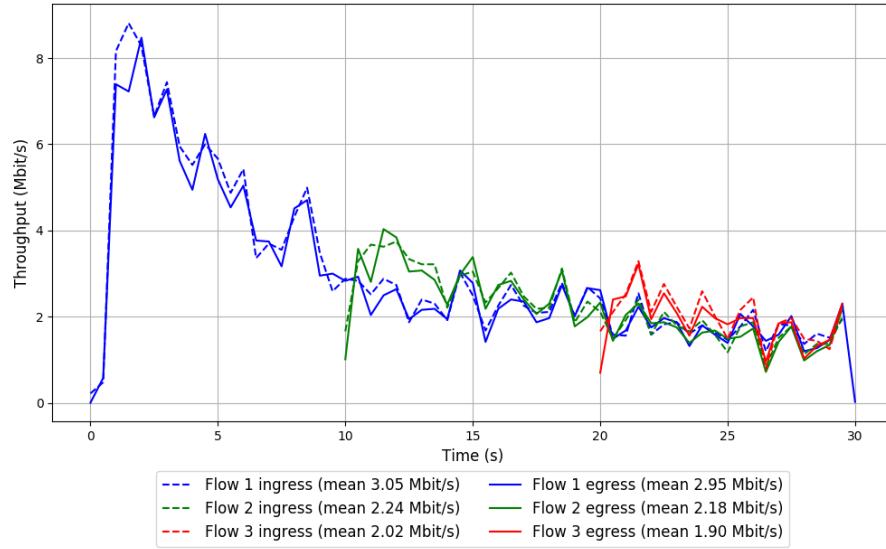


Run 3: Statistics of TCP Cubic

```
Start at: 2017-08-13 07:41:14
End at: 2017-08-13 07:41:44
Local clock offset: 0.472 ms
Remote clock offset: 1.479 ms

# Below is generated by plot.py at 2017-08-13 07:47:28
# Datalink statistics
-- Total of 3 flows:
Average throughput: 5.03 Mbit/s
95th percentile per-packet one-way delay: 74.228 ms
Loss rate: 3.74%
-- Flow 1:
Average throughput: 2.95 Mbit/s
95th percentile per-packet one-way delay: 74.223 ms
Loss rate: 3.59%
-- Flow 2:
Average throughput: 2.18 Mbit/s
95th percentile per-packet one-way delay: 73.258 ms
Loss rate: 2.97%
-- Flow 3:
Average throughput: 1.90 Mbit/s
95th percentile per-packet one-way delay: 74.942 ms
Loss rate: 6.16%
```

Run 3: Report of TCP Cubic — Data Link

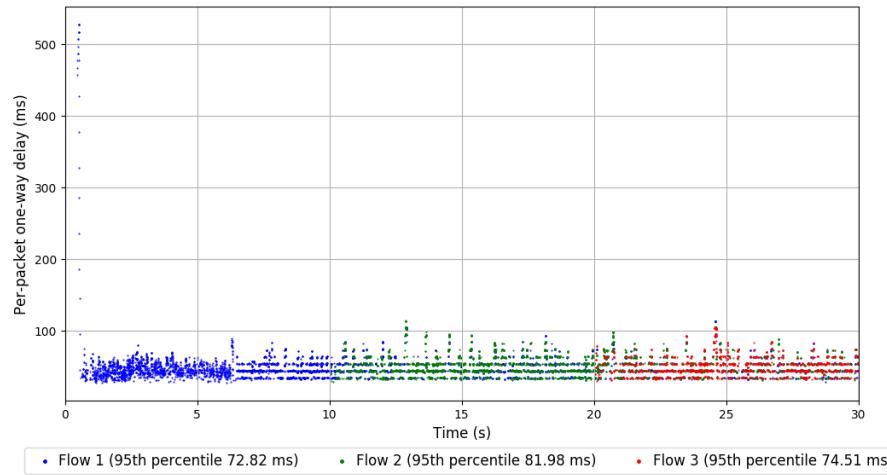
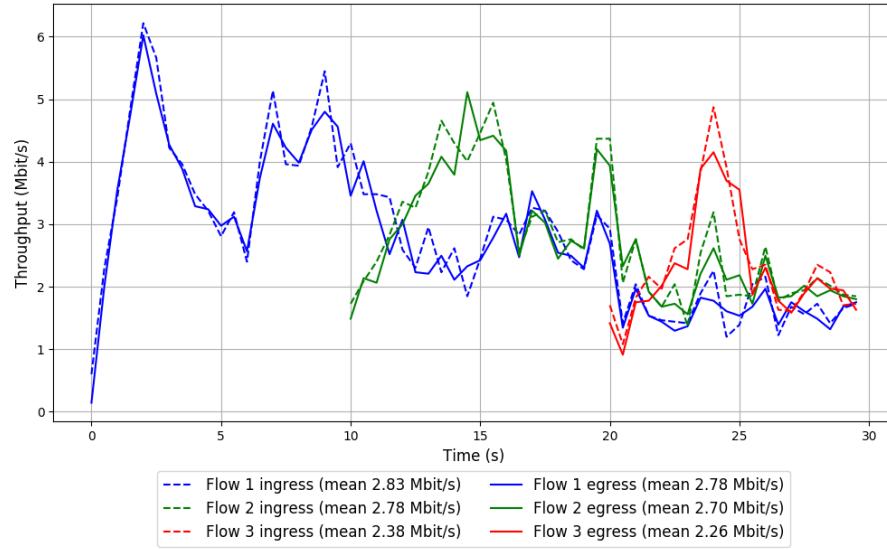


```
Run 1: Statistics of KohoCC
```

```
Start at: 2017-08-13 06:59:35
End at: 2017-08-13 07:00:05
Local clock offset: 0.515 ms
Remote clock offset: -1.099 ms

# Below is generated by plot.py at 2017-08-13 07:47:28
# Datalink statistics
-- Total of 3 flows:
Average throughput: 5.36 Mbit/s
95th percentile per-packet one-way delay: 74.306 ms
Loss rate: 3.36%
-- Flow 1:
Average throughput: 2.78 Mbit/s
95th percentile per-packet one-way delay: 72.820 ms
Loss rate: 3.16%
-- Flow 2:
Average throughput: 2.70 Mbit/s
95th percentile per-packet one-way delay: 81.979 ms
Loss rate: 2.97%
-- Flow 3:
Average throughput: 2.26 Mbit/s
95th percentile per-packet one-way delay: 74.506 ms
Loss rate: 5.02%
```

Run 1: Report of KohoCC — Data Link

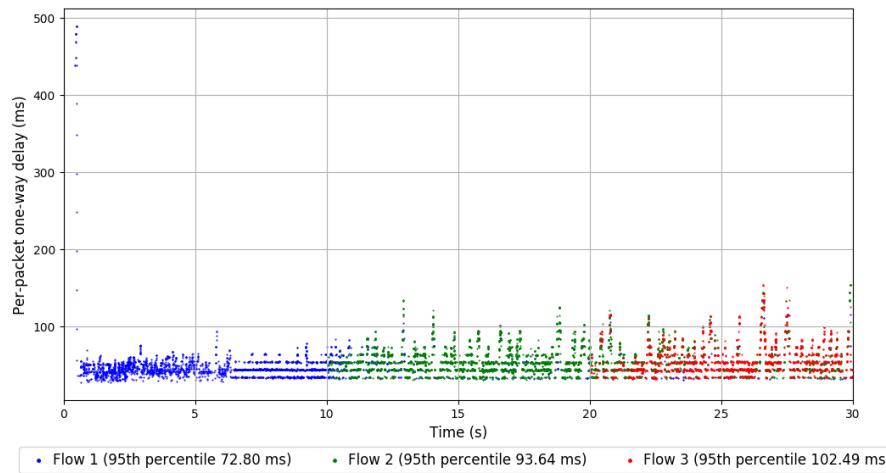
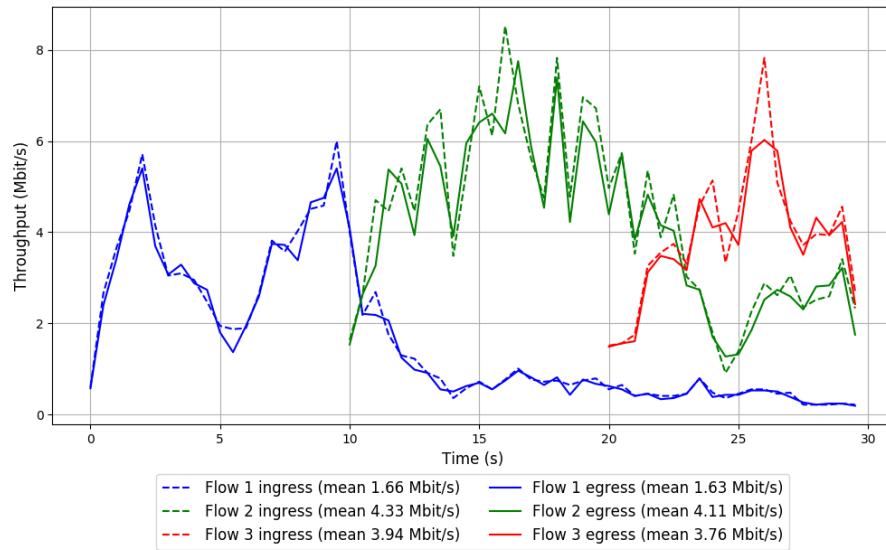


Run 2: Statistics of KohoCC

```
Start at: 2017-08-13 07:19:45
End at: 2017-08-13 07:20:15
Local clock offset: 0.584 ms
Remote clock offset: -0.706 ms

# Below is generated by plot.py at 2017-08-13 07:47:31
# Datalink statistics
-- Total of 3 flows:
Average throughput: 5.67 Mbit/s
95th percentile per-packet one-way delay: 92.800 ms
Loss rate: 4.43%
-- Flow 1:
Average throughput: 1.63 Mbit/s
95th percentile per-packet one-way delay: 72.802 ms
Loss rate: 3.30%
-- Flow 2:
Average throughput: 4.11 Mbit/s
95th percentile per-packet one-way delay: 93.643 ms
Loss rate: 5.02%
-- Flow 3:
Average throughput: 3.76 Mbit/s
95th percentile per-packet one-way delay: 102.487 ms
Loss rate: 4.57%
```

Run 2: Report of KohoCC — Data Link

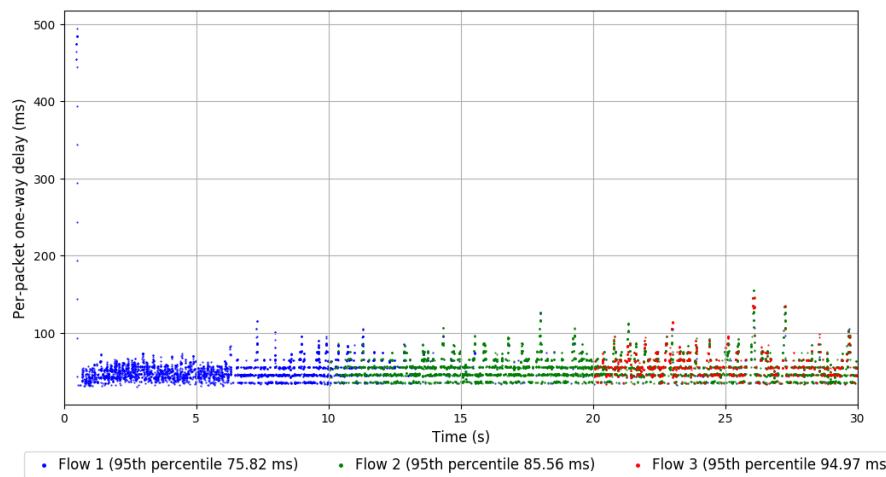
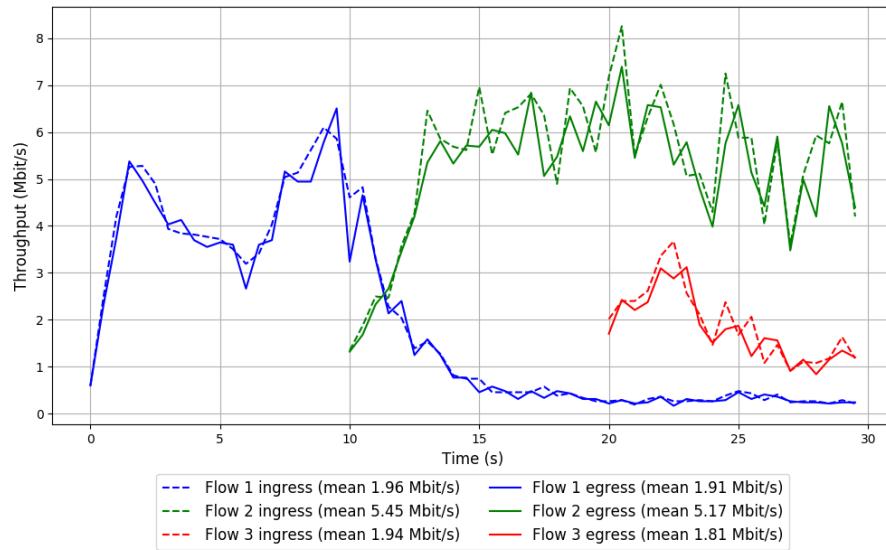


Run 3: Statistics of KohoCC

```
Start at: 2017-08-13 07:39:54
End at: 2017-08-13 07:40:24
Local clock offset: 0.577 ms
Remote clock offset: 1.881 ms

# Below is generated by plot.py at 2017-08-13 07:47:31
# Datalink statistics
-- Total of 3 flows:
Average throughput: 6.00 Mbit/s
95th percentile per-packet one-way delay: 85.181 ms
Loss rate: 4.82%
-- Flow 1:
Average throughput: 1.91 Mbit/s
95th percentile per-packet one-way delay: 75.819 ms
Loss rate: 3.84%
-- Flow 2:
Average throughput: 5.17 Mbit/s
95th percentile per-packet one-way delay: 85.561 ms
Loss rate: 5.06%
-- Flow 3:
Average throughput: 1.81 Mbit/s
95th percentile per-packet one-way delay: 94.973 ms
Loss rate: 6.45%
```

Run 3: Report of KohoCC — Data Link

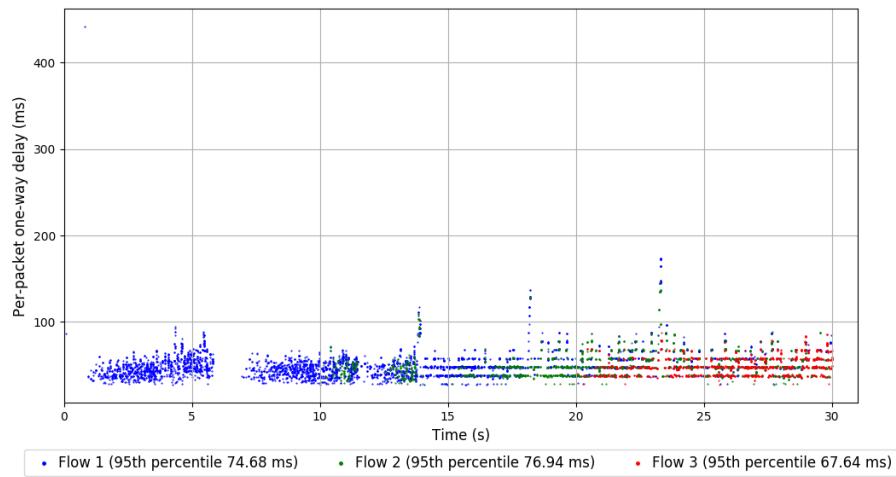
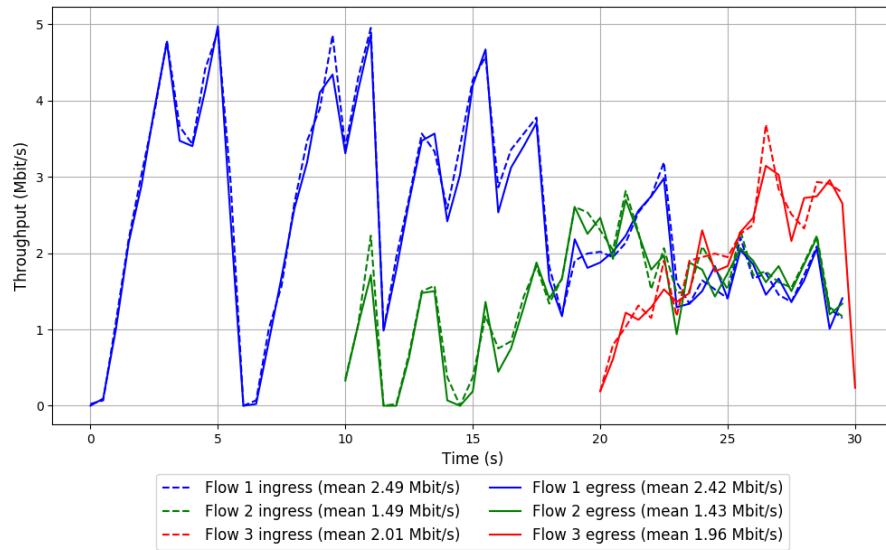


```
Run 1: Statistics of LEDBAT
```

```
Start at: 2017-08-13 06:48:48
End at: 2017-08-13 06:49:18
Local clock offset: 0.525 ms
Remote clock offset: -1.291 ms

# Below is generated by plot.py at 2017-08-13 07:47:32
# Datalink statistics
-- Total of 3 flows:
Average throughput: 4.03 Mbit/s
95th percentile per-packet one-way delay: 74.646 ms
Loss rate: 2.98%
-- Flow 1:
Average throughput: 2.42 Mbit/s
95th percentile per-packet one-way delay: 74.680 ms
Loss rate: 2.83%
-- Flow 2:
Average throughput: 1.43 Mbit/s
95th percentile per-packet one-way delay: 76.936 ms
Loss rate: 3.84%
-- Flow 3:
Average throughput: 1.96 Mbit/s
95th percentile per-packet one-way delay: 67.637 ms
Loss rate: 2.23%
```

Run 1: Report of LEDBAT — Data Link

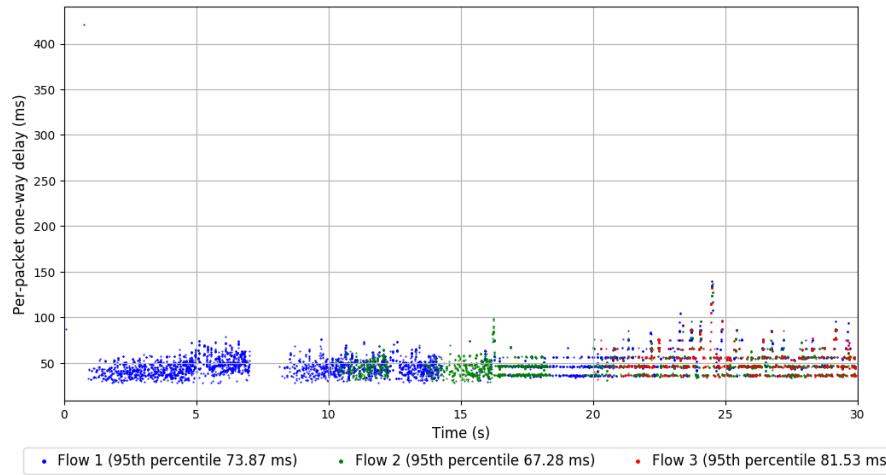
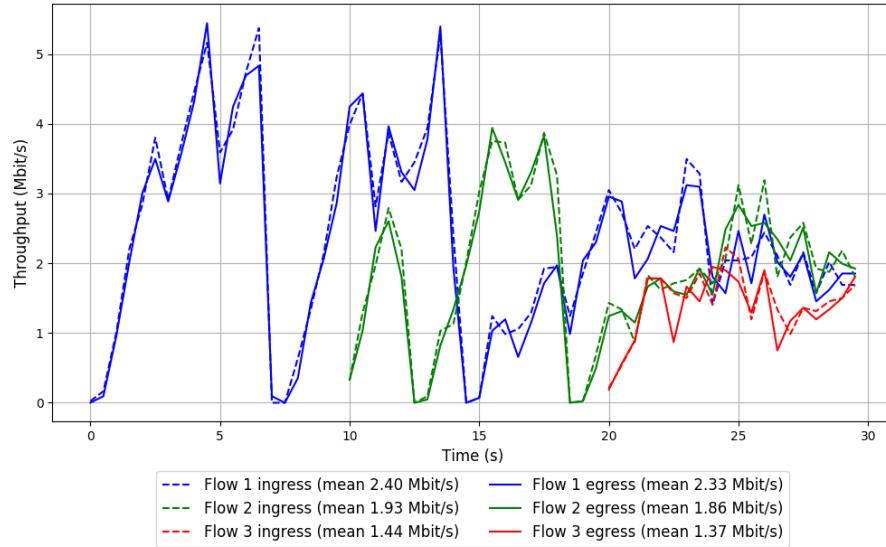


Run 2: Statistics of LEDBAT

```
Start at: 2017-08-13 07:09:00
End at: 2017-08-13 07:09:30
Local clock offset: 0.524 ms
Remote clock offset: -0.865 ms

# Below is generated by plot.py at 2017-08-13 07:47:32
# Datalink statistics
-- Total of 3 flows:
Average throughput: 4.02 Mbit/s
95th percentile per-packet one-way delay: 74.275 ms
Loss rate: 3.37%
-- Flow 1:
Average throughput: 2.33 Mbit/s
95th percentile per-packet one-way delay: 73.866 ms
Loss rate: 3.01%
-- Flow 2:
Average throughput: 1.86 Mbit/s
95th percentile per-packet one-way delay: 67.285 ms
Loss rate: 3.40%
-- Flow 3:
Average throughput: 1.37 Mbit/s
95th percentile per-packet one-way delay: 81.531 ms
Loss rate: 5.09%
```

Run 2: Report of LEDBAT — Data Link



Run 3: Statistics of LEDBAT

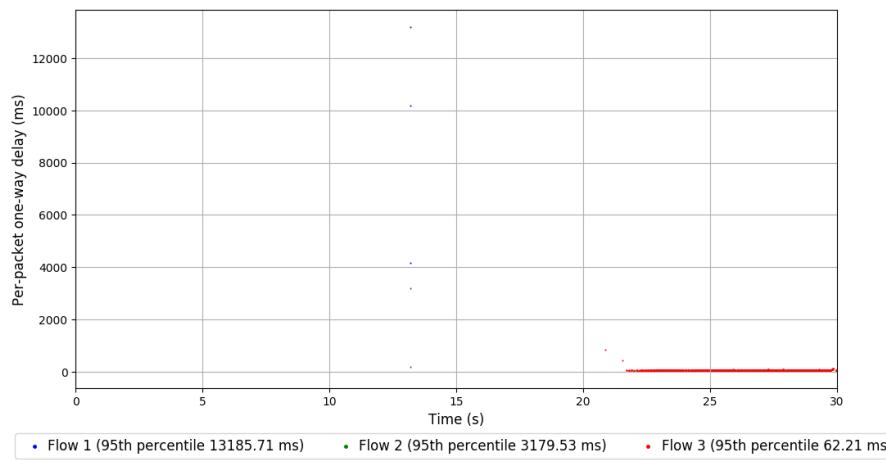
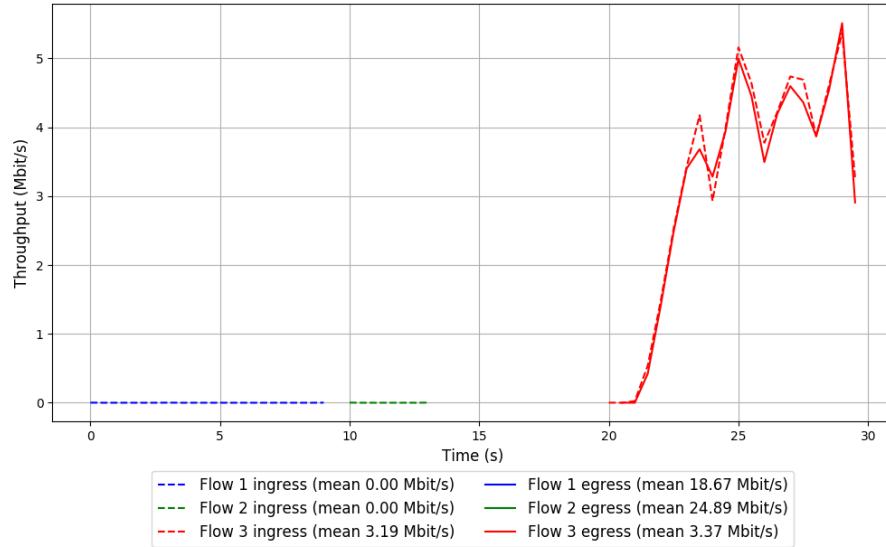
Start at: 2017-08-13 07:29:08

End at: 2017-08-13 07:29:38

Local clock offset: 0.597 ms

Remote clock offset: 1.39 ms

Run 3: Report of LEDBAT — Data Link

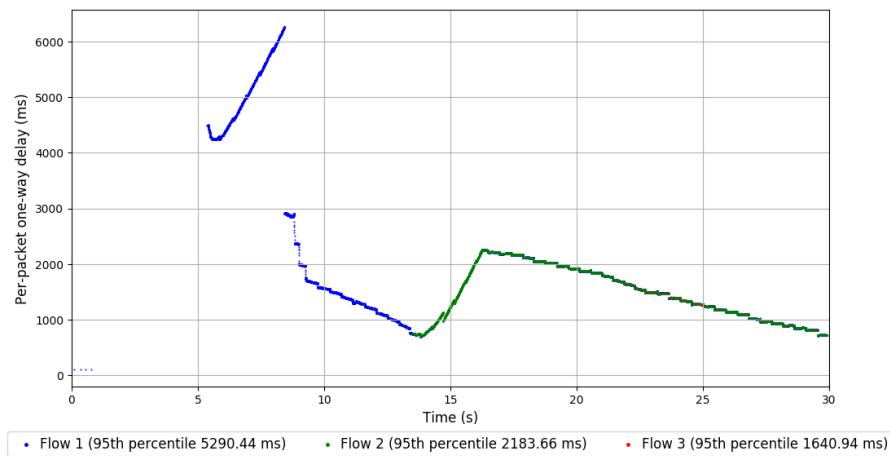
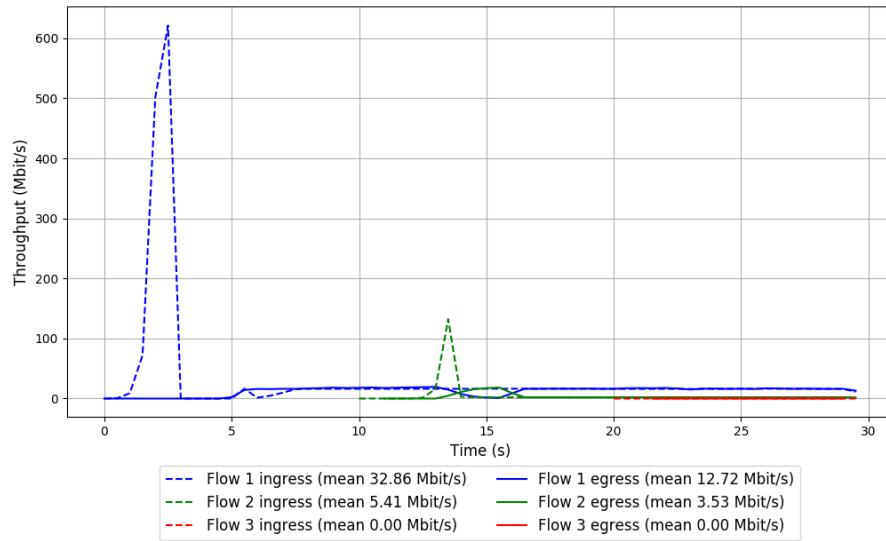


Run 1: Statistics of PCC

```
Start at: 2017-08-13 07:03:36
End at: 2017-08-13 07:04:06
Local clock offset: 0.599 ms
Remote clock offset: -1.007 ms

# Below is generated by plot.py at 2017-08-13 07:47:36
# Datalink statistics
-- Total of 3 flows:
Average throughput: 14.92 Mbit/s
95th percentile per-packet one-way delay: 5110.402 ms
Loss rate: 59.16%
-- Flow 1:
Average throughput: 12.72 Mbit/s
95th percentile per-packet one-way delay: 5290.435 ms
Loss rate: 61.38%
-- Flow 2:
Average throughput: 3.53 Mbit/s
95th percentile per-packet one-way delay: 2183.664 ms
Loss rate: 38.86%
-- Flow 3:
Average throughput: 0.00 Mbit/s
95th percentile per-packet one-way delay: 1640.940 ms
Loss rate: 3.58%
```

Run 1: Report of PCC — Data Link

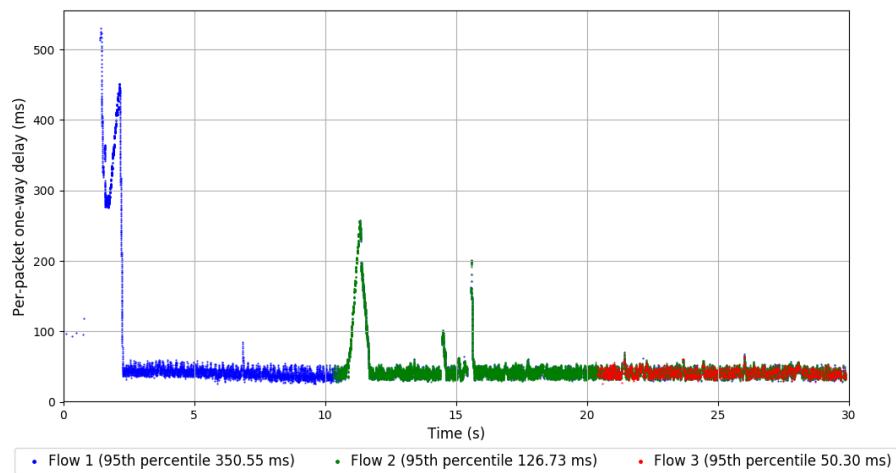
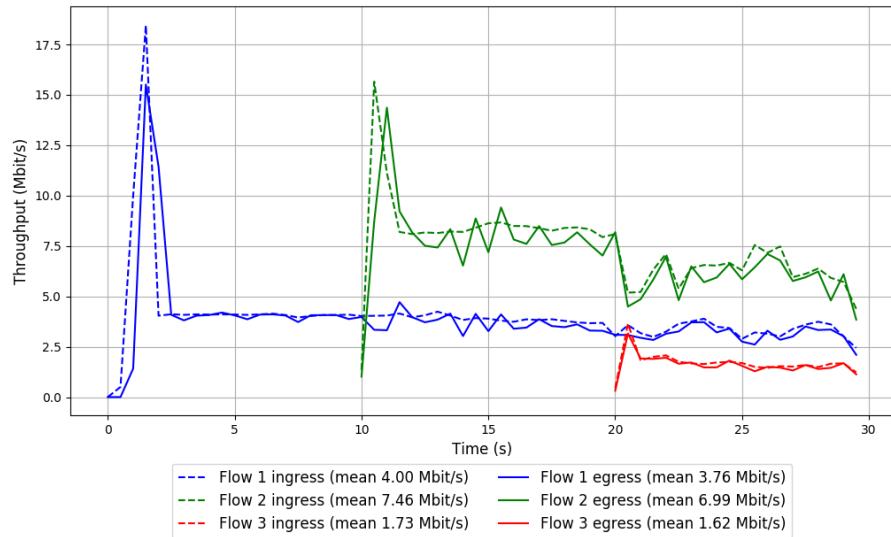


Run 2: Statistics of PCC

```
Start at: 2017-08-13 07:23:46
End at: 2017-08-13 07:24:16
Local clock offset: 0.596 ms
Remote clock offset: -0.714 ms

# Below is generated by plot.py at 2017-08-13 07:47:36
# Datalink statistics
-- Total of 3 flows:
Average throughput: 8.95 Mbit/s
95th percentile per-packet one-way delay: 212.397 ms
Loss rate: 6.16%
-- Flow 1:
Average throughput: 3.76 Mbit/s
95th percentile per-packet one-way delay: 350.550 ms
Loss rate: 6.02%
-- Flow 2:
Average throughput: 6.99 Mbit/s
95th percentile per-packet one-way delay: 126.726 ms
Loss rate: 6.27%
-- Flow 3:
Average throughput: 1.62 Mbit/s
95th percentile per-packet one-way delay: 50.305 ms
Loss rate: 6.20%
```

Run 2: Report of PCC — Data Link

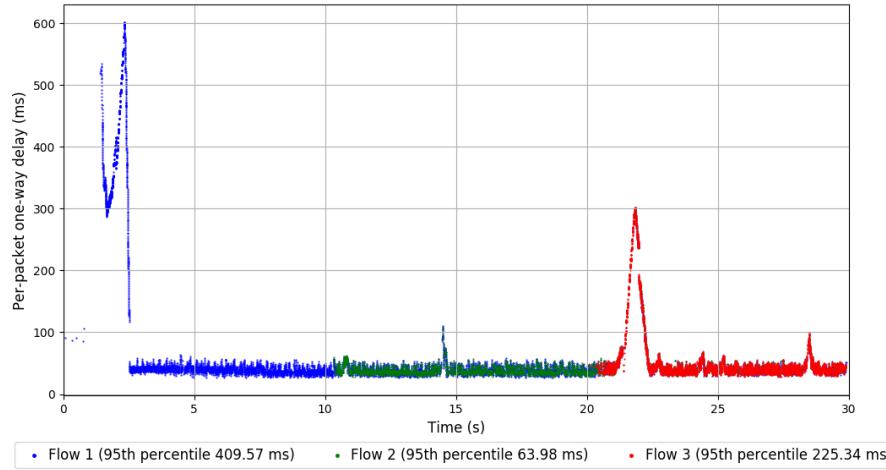
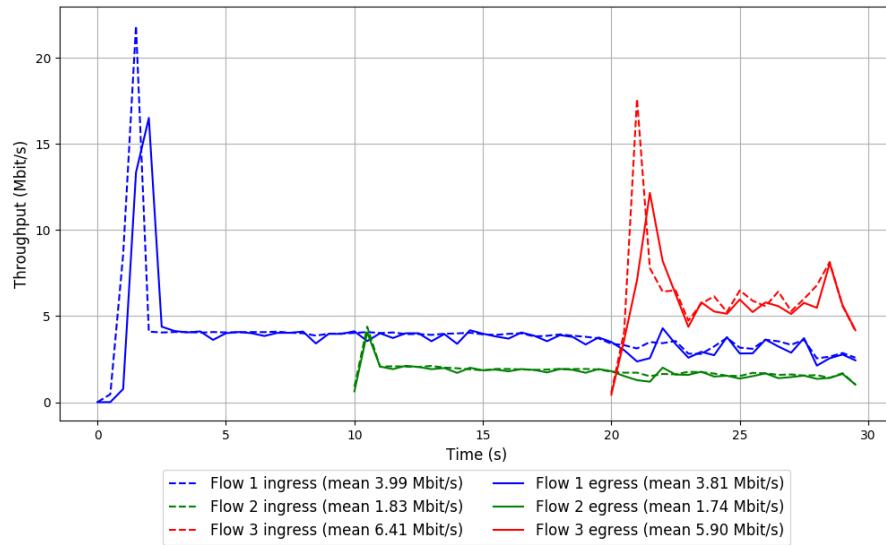


Run 3: Statistics of PCC

```
Start at: 2017-08-13 07:43:54
End at: 2017-08-13 07:44:24
Local clock offset: 0.561 ms
Remote clock offset: -0.719 ms

# Below is generated by plot.py at 2017-08-13 07:47:37
# Datalink statistics
-- Total of 3 flows:
Average throughput: 6.90 Mbit/s
95th percentile per-packet one-way delay: 325.192 ms
Loss rate: 5.74%
-- Flow 1:
Average throughput: 3.81 Mbit/s
95th percentile per-packet one-way delay: 409.568 ms
Loss rate: 4.84%
-- Flow 2:
Average throughput: 1.74 Mbit/s
95th percentile per-packet one-way delay: 63.981 ms
Loss rate: 4.86%
-- Flow 3:
Average throughput: 5.90 Mbit/s
95th percentile per-packet one-way delay: 225.344 ms
Loss rate: 7.97%
```

Run 3: Report of PCC — Data Link

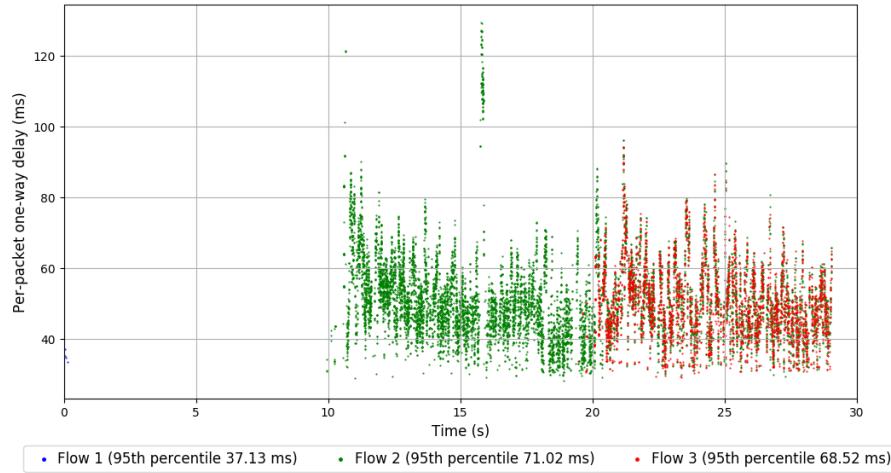
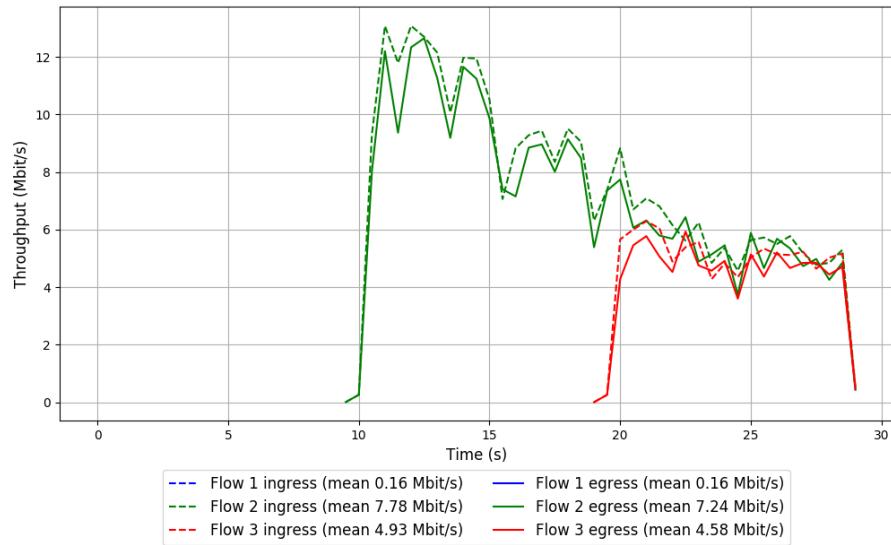


```
Run 1: Statistics of QUIC Cubic
```

```
Start at: 2017-08-13 06:47:27
End at: 2017-08-13 06:47:57
Local clock offset: 0.63 ms
Remote clock offset: -1.316 ms

# Below is generated by plot.py at 2017-08-13 07:47:38
# Datalink statistics
-- Total of 3 flows:
Average throughput: 6.28 Mbit/s
95th percentile per-packet one-way delay: 70.417 ms
Loss rate: 7.04%
-- Flow 1:
Average throughput: 0.16 Mbit/s
95th percentile per-packet one-way delay: 37.127 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 7.24 Mbit/s
95th percentile per-packet one-way delay: 71.015 ms
Loss rate: 6.95%
-- Flow 3:
Average throughput: 4.58 Mbit/s
95th percentile per-packet one-way delay: 68.524 ms
Loss rate: 7.33%
```

Run 1: Report of QUIC Cubic — Data Link

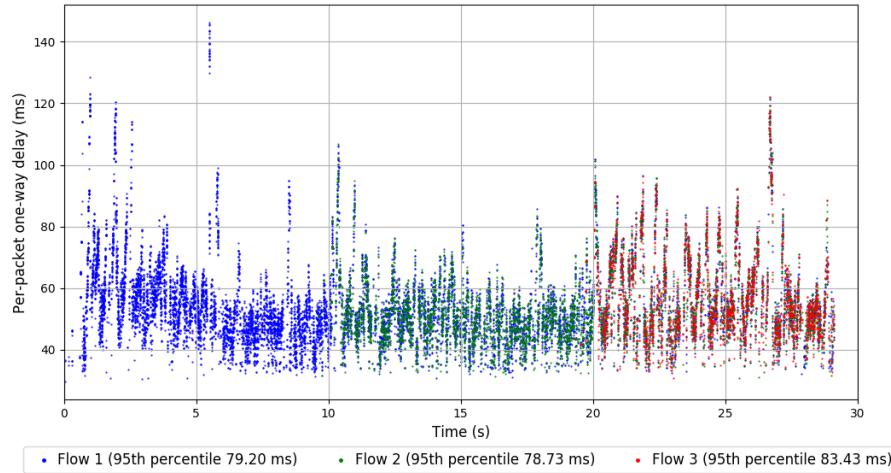
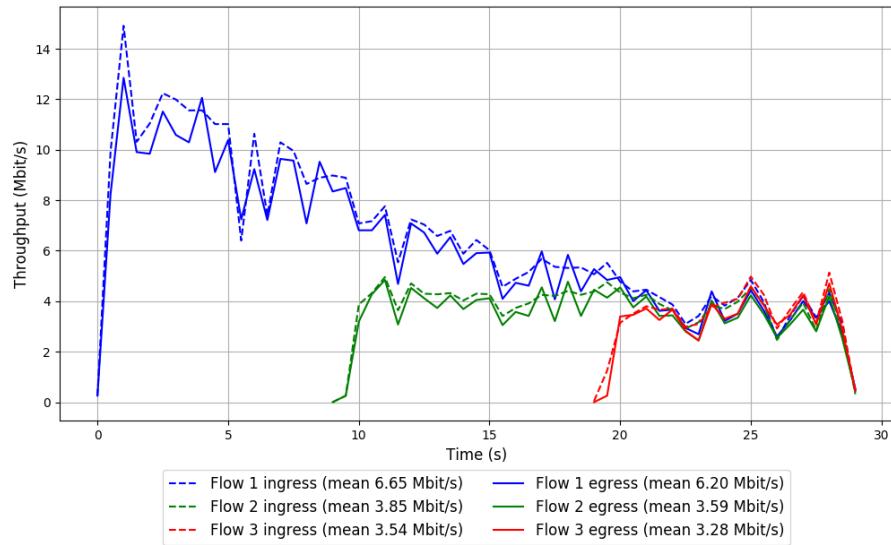


```
Run 2: Statistics of QUIC Cubic
```

```
Start at: 2017-08-13 07:07:39
End at: 2017-08-13 07:08:09
Local clock offset: 0.573 ms
Remote clock offset: 1.152 ms

# Below is generated by plot.py at 2017-08-13 07:47:40
# Datalink statistics
-- Total of 3 flows:
Average throughput: 9.72 Mbit/s
95th percentile per-packet one-way delay: 79.874 ms
Loss rate: 6.84%
-- Flow 1:
Average throughput: 6.20 Mbit/s
95th percentile per-packet one-way delay: 79.196 ms
Loss rate: 6.81%
-- Flow 2:
Average throughput: 3.59 Mbit/s
95th percentile per-packet one-way delay: 78.728 ms
Loss rate: 6.73%
-- Flow 3:
Average throughput: 3.28 Mbit/s
95th percentile per-packet one-way delay: 83.430 ms
Loss rate: 7.24%
```

Run 2: Report of QUIC Cubic — Data Link

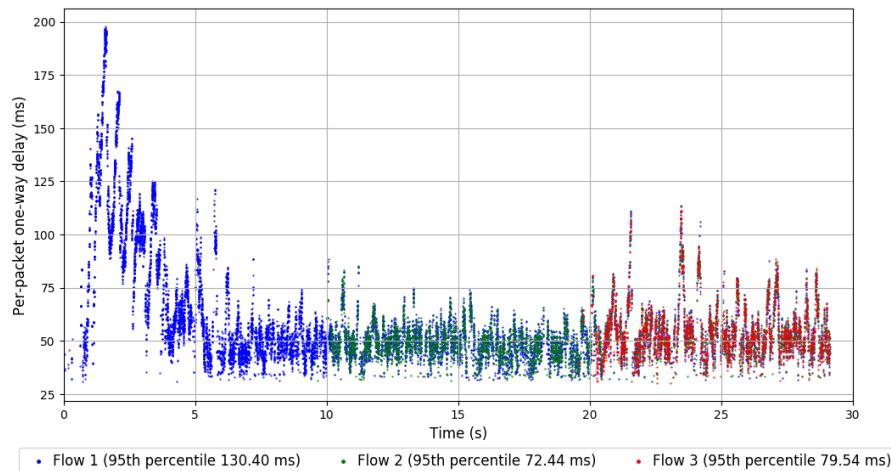
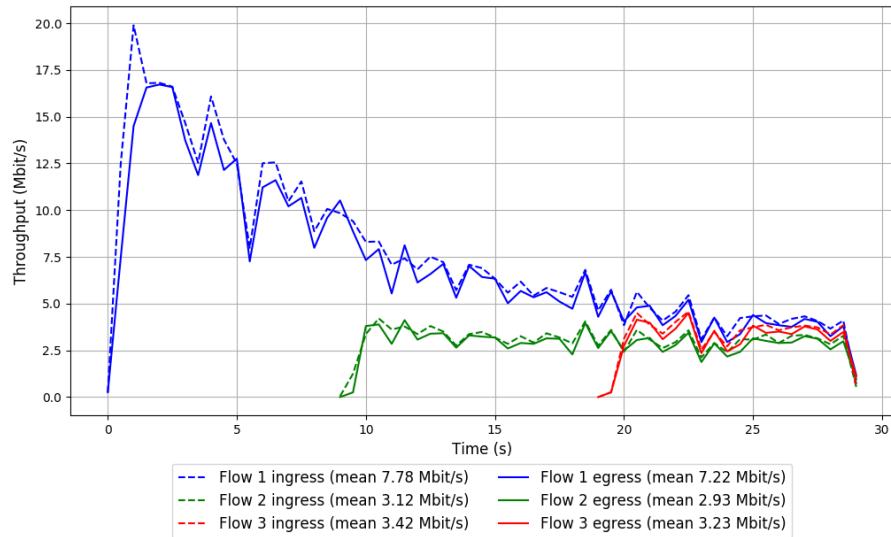


Run 3: Statistics of QUIC Cubic

```
Start at: 2017-08-13 07:27:47
End at: 2017-08-13 07:28:17
Local clock offset: 0.588 ms
Remote clock offset: 1.269 ms

# Below is generated by plot.py at 2017-08-13 07:47:41
# Datalink statistics
-- Total of 3 flows:
Average throughput: 10.28 Mbit/s
95th percentile per-packet one-way delay: 119.153 ms
Loss rate: 6.75%
-- Flow 1:
Average throughput: 7.22 Mbit/s
95th percentile per-packet one-way delay: 130.397 ms
Loss rate: 7.13%
-- Flow 2:
Average throughput: 2.93 Mbit/s
95th percentile per-packet one-way delay: 72.441 ms
Loss rate: 6.03%
-- Flow 3:
Average throughput: 3.23 Mbit/s
95th percentile per-packet one-way delay: 79.540 ms
Loss rate: 5.49%
```

Run 3: Report of QUIC Cubic — Data Link

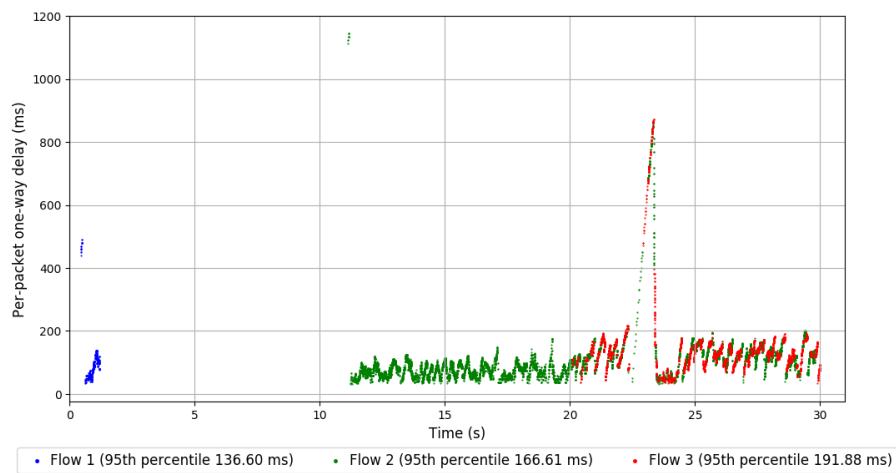
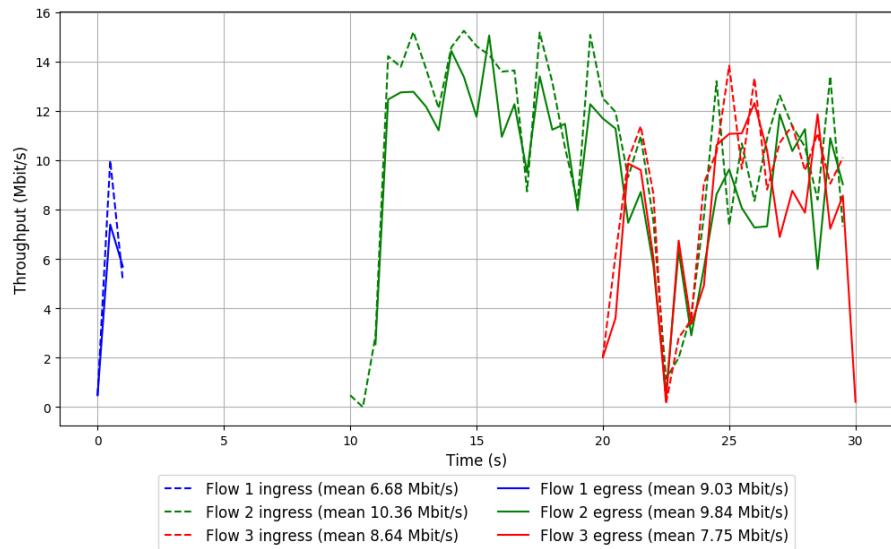


```
Run 1: Statistics of Saturator
```

```
Start at: 2017-08-13 06:56:53
End at: 2017-08-13 06:57:23
Local clock offset: 0.506 ms
Remote clock offset: 0.868 ms

# Below is generated by plot.py at 2017-08-13 07:47:42
# Datalink statistics
-- Total of 3 flows:
Average throughput: 9.04 Mbit/s
95th percentile per-packet one-way delay: 175.370 ms
Loss rate: 10.52%
-- Flow 1:
Average throughput: 9.03 Mbit/s
95th percentile per-packet one-way delay: 136.604 ms
Loss rate: 13.08%
-- Flow 2:
Average throughput: 9.84 Mbit/s
95th percentile per-packet one-way delay: 166.606 ms
Loss rate: 10.36%
-- Flow 3:
Average throughput: 7.75 Mbit/s
95th percentile per-packet one-way delay: 191.884 ms
Loss rate: 10.69%
```

Run 1: Report of Saturator — Data Link



Run 2: Statistics of Saturator

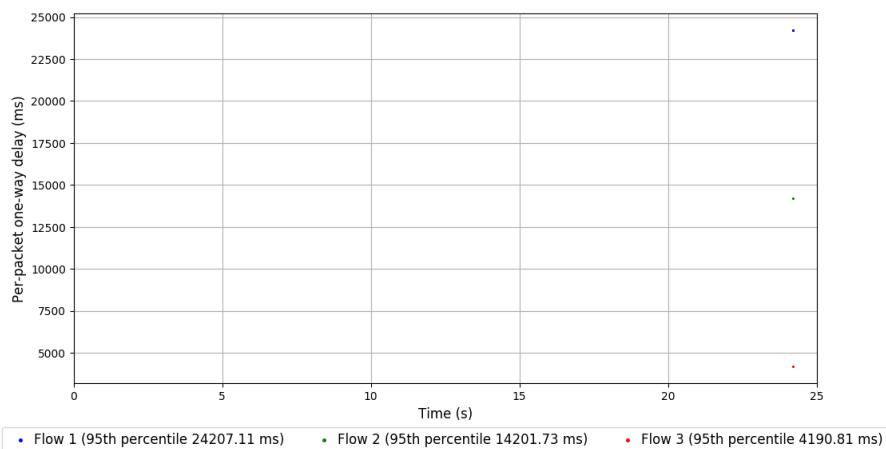
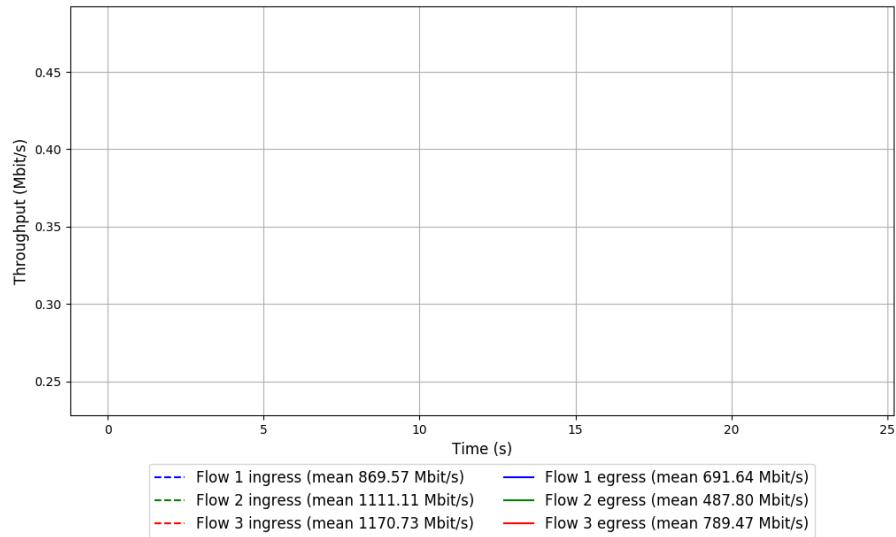
Start at: 2017-08-13 07:17:05

End at: 2017-08-13 07:17:35

Local clock offset: 0.499 ms

Remote clock offset: -0.65 ms

Run 2: Report of Saturator — Data Link

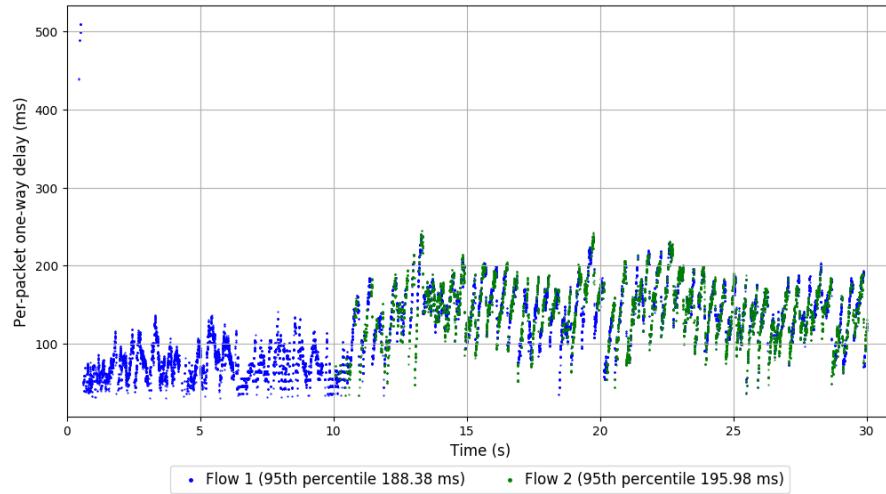
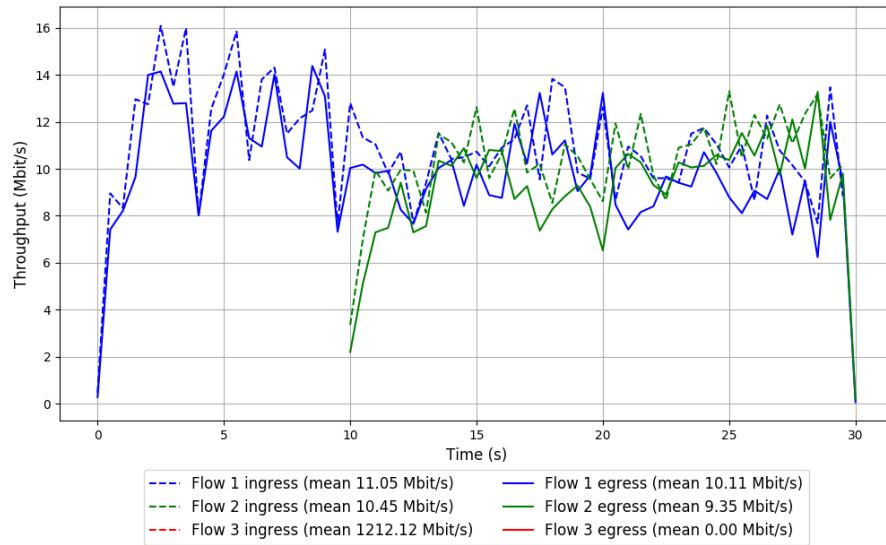


Run 3: Statistics of Saturator

```
Start at: 2017-08-13 07:37:13
End at: 2017-08-13 07:37:43
Local clock offset: 0.489 ms
Remote clock offset: 1.398 ms

# Below is generated by plot.py at 2017-08-13 07:47:47
# Datalink statistics
-- Total of 3 flows:
Average throughput: 16.42 Mbit/s
95th percentile per-packet one-way delay: 192.229 ms
Loss rate: 10.04%
-- Flow 1:
Average throughput: 10.11 Mbit/s
95th percentile per-packet one-way delay: 188.380 ms
Loss rate: 9.65%
-- Flow 2:
Average throughput: 9.35 Mbit/s
95th percentile per-packet one-way delay: 195.982 ms
Loss rate: 10.57%
-- Flow 3:
Average throughput: 0.00 Mbit/s
```

Run 3: Report of Saturator — Data Link

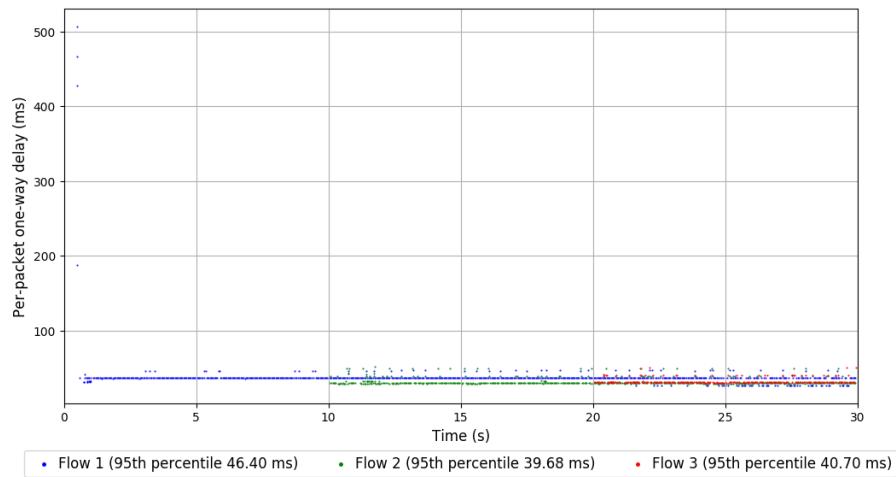
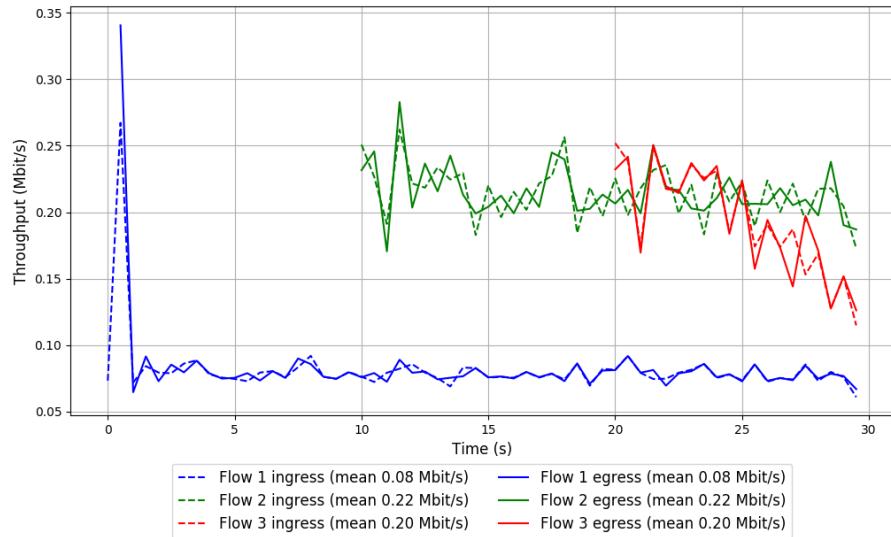


```
Run 1: Statistics of SCReAM

Start at: 2017-08-13 07:02:16
End at: 2017-08-13 07:02:46
Local clock offset: 0.622 ms
Remote clock offset: -1.076 ms

# Below is generated by plot.py at 2017-08-13 07:47:47
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.29 Mbit/s
95th percentile per-packet one-way delay: 42.035 ms
Loss rate: 0.09%
-- Flow 1:
Average throughput: 0.08 Mbit/s
95th percentile per-packet one-way delay: 46.397 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 0.22 Mbit/s
95th percentile per-packet one-way delay: 39.676 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 0.20 Mbit/s
95th percentile per-packet one-way delay: 40.705 ms
Loss rate: 0.40%
```

Run 1: Report of SCReAM — Data Link

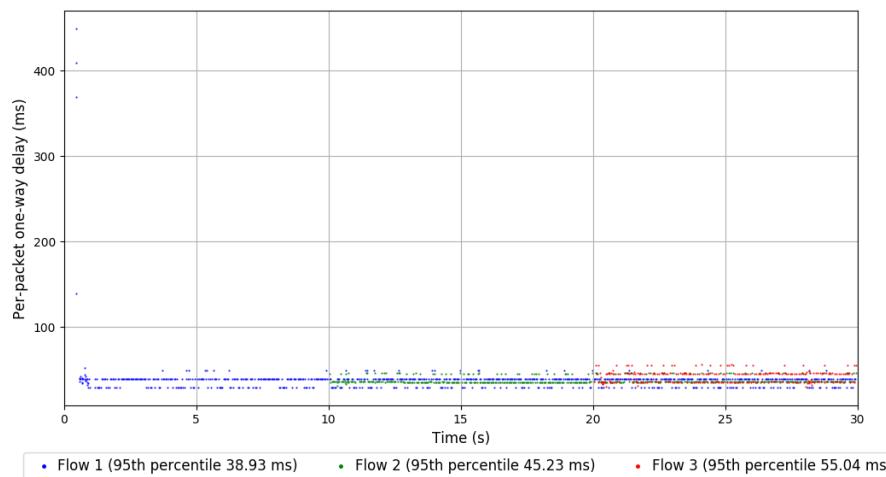
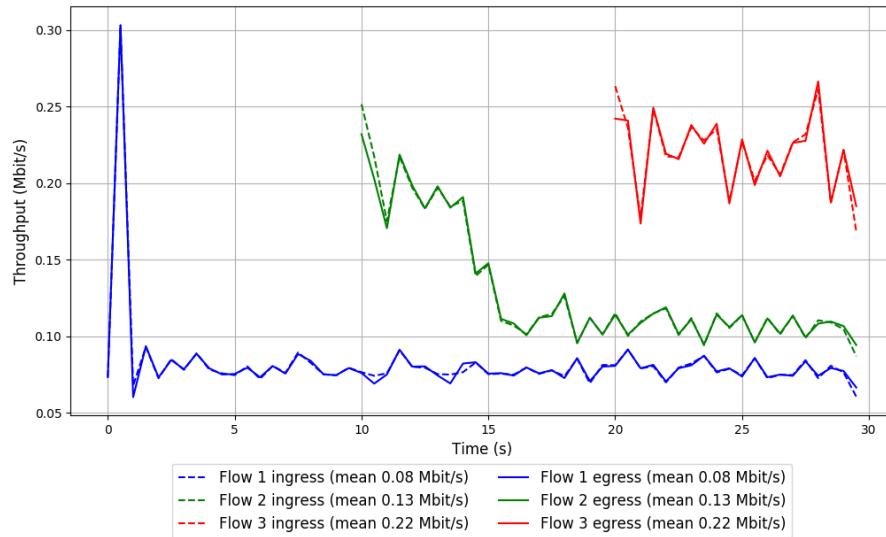


Run 2: Statistics of SCReAM

```
Start at: 2017-08-13 07:22:26
End at: 2017-08-13 07:22:56
Local clock offset: 0.503 ms
Remote clock offset: 1.894 ms

# Below is generated by plot.py at 2017-08-13 07:47:47
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.25 Mbit/s
95th percentile per-packet one-way delay: 45.284 ms
Loss rate: 0.17%
-- Flow 1:
Average throughput: 0.08 Mbit/s
95th percentile per-packet one-way delay: 38.926 ms
Loss rate: 0.12%
-- Flow 2:
Average throughput: 0.13 Mbit/s
95th percentile per-packet one-way delay: 45.225 ms
Loss rate: 0.38%
-- Flow 3:
Average throughput: 0.22 Mbit/s
95th percentile per-packet one-way delay: 55.037 ms
Loss rate: 0.00%
```

Run 2: Report of SCReAM — Data Link

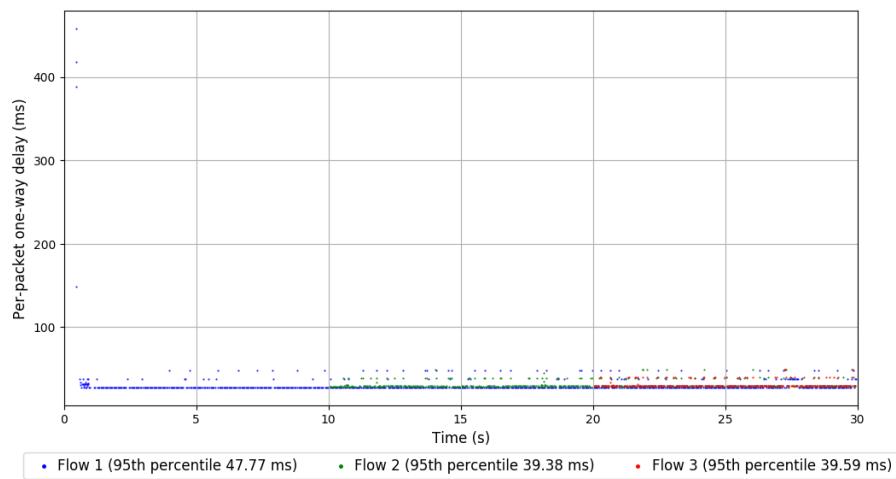
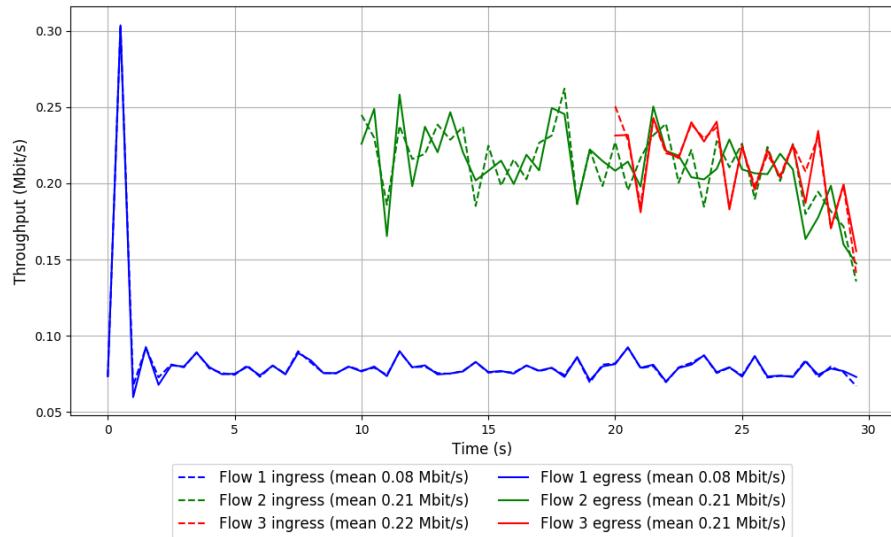


Run 3: Statistics of SCReAM

```
Start at: 2017-08-13 07:42:35
End at: 2017-08-13 07:43:05
Local clock offset: 0.473 ms
Remote clock offset: -0.705 ms

# Below is generated by plot.py at 2017-08-13 07:47:47
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.30 Mbit/s
95th percentile per-packet one-way delay: 39.525 ms
Loss rate: 0.33%
-- Flow 1:
Average throughput: 0.08 Mbit/s
95th percentile per-packet one-way delay: 47.769 ms
Loss rate: 0.11%
-- Flow 2:
Average throughput: 0.21 Mbit/s
95th percentile per-packet one-way delay: 39.384 ms
Loss rate: 0.39%
-- Flow 3:
Average throughput: 0.21 Mbit/s
95th percentile per-packet one-way delay: 39.590 ms
Loss rate: 0.47%
```

Run 3: Report of SCReAM — Data Link

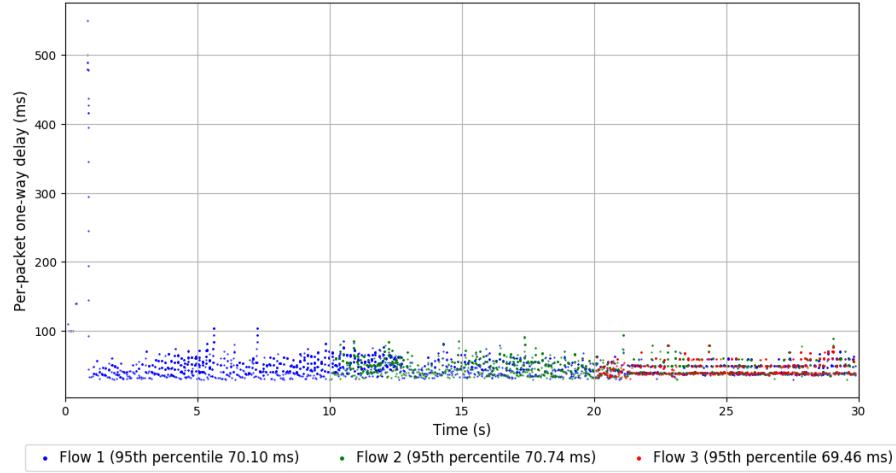
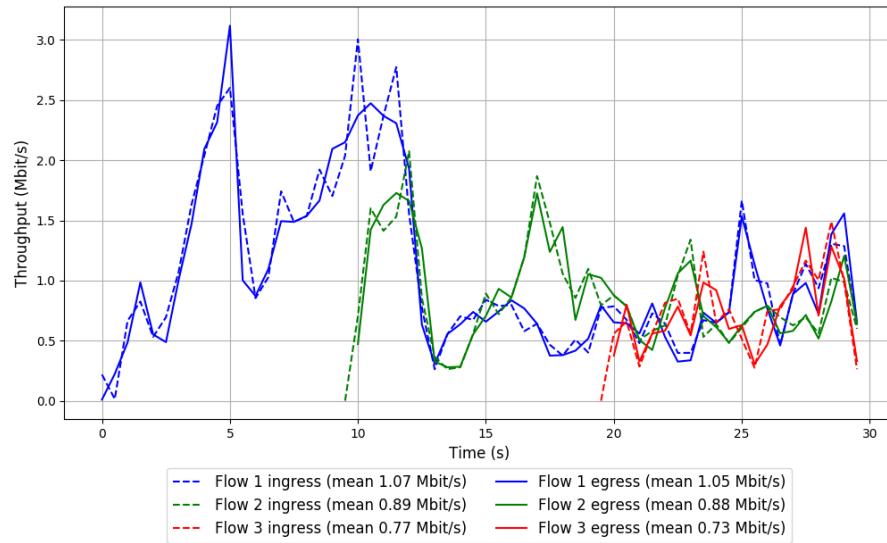


Run 1: Statistics of Sprout

```
Start at: 2017-08-13 06:55:33
End at: 2017-08-13 06:56:03
Local clock offset: 0.61 ms
Remote clock offset: 1.497 ms

# Below is generated by plot.py at 2017-08-13 07:47:47
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1.88 Mbit/s
95th percentile per-packet one-way delay: 70.113 ms
Loss rate: 1.77%
-- Flow 1:
Average throughput: 1.05 Mbit/s
95th percentile per-packet one-way delay: 70.099 ms
Loss rate: 1.80%
-- Flow 2:
Average throughput: 0.88 Mbit/s
95th percentile per-packet one-way delay: 70.744 ms
Loss rate: 0.39%
-- Flow 3:
Average throughput: 0.73 Mbit/s
95th percentile per-packet one-way delay: 69.458 ms
Loss rate: 4.80%
```

Run 1: Report of Sprout — Data Link

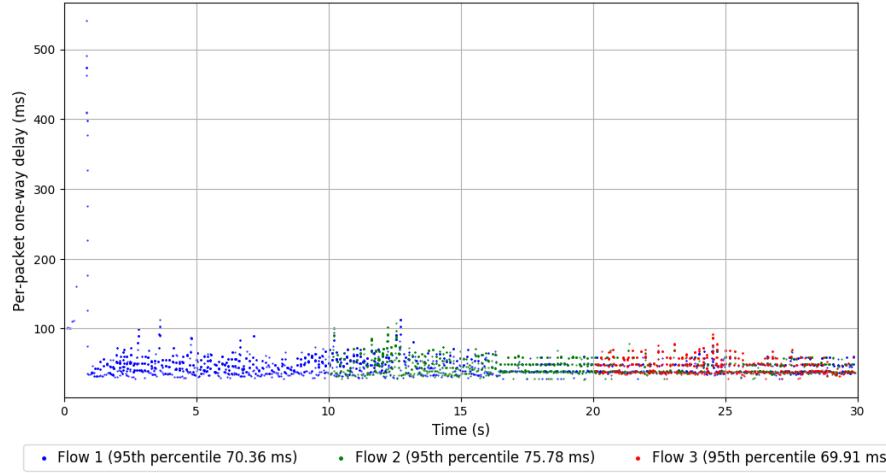
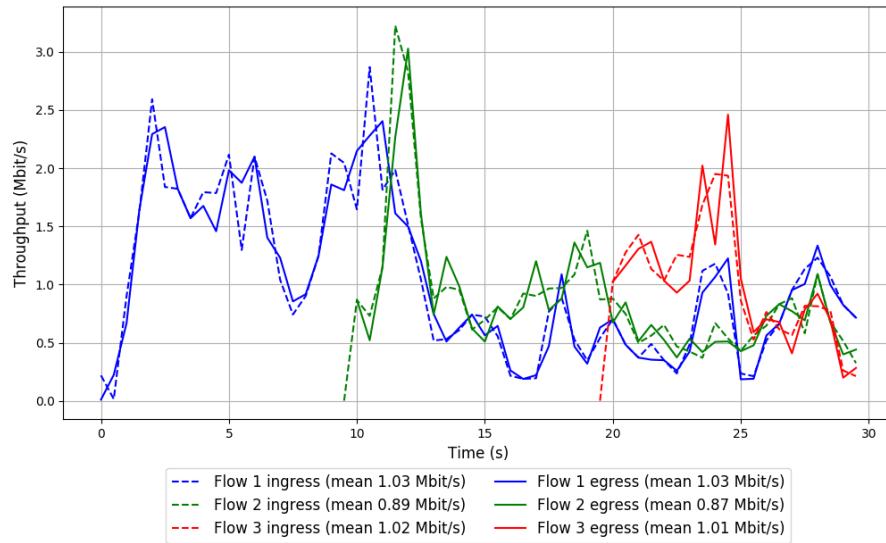


Run 2: Statistics of Sprout

```
Start at: 2017-08-13 07:15:44
End at: 2017-08-13 07:16:14
Local clock offset: 0.601 ms
Remote clock offset: 1.236 ms

# Below is generated by plot.py at 2017-08-13 07:47:47
# Datalink statistics
-- Total of 3 flows:
Average throughput: 1.94 Mbit/s
95th percentile per-packet one-way delay: 72.238 ms
Loss rate: 1.35%
-- Flow 1:
Average throughput: 1.03 Mbit/s
95th percentile per-packet one-way delay: 70.360 ms
Loss rate: 0.64%
-- Flow 2:
Average throughput: 0.87 Mbit/s
95th percentile per-packet one-way delay: 75.777 ms
Loss rate: 2.86%
-- Flow 3:
Average throughput: 1.01 Mbit/s
95th percentile per-packet one-way delay: 69.914 ms
Loss rate: 0.84%
```

Run 2: Report of Sprout — Data Link

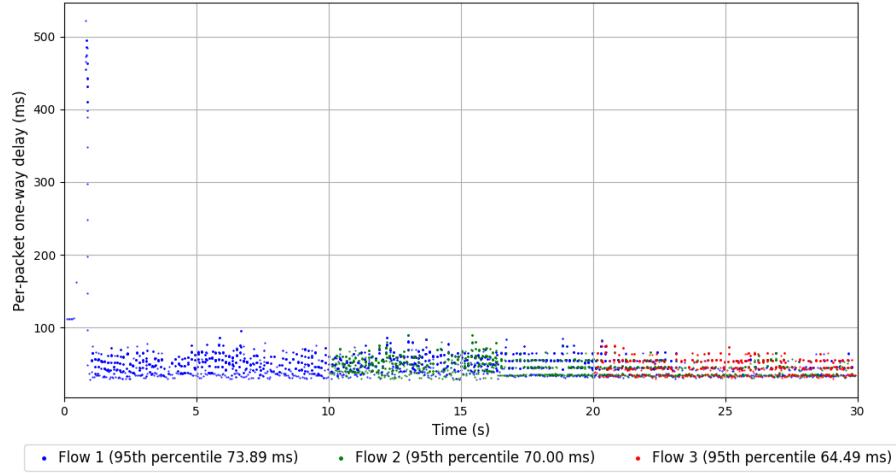
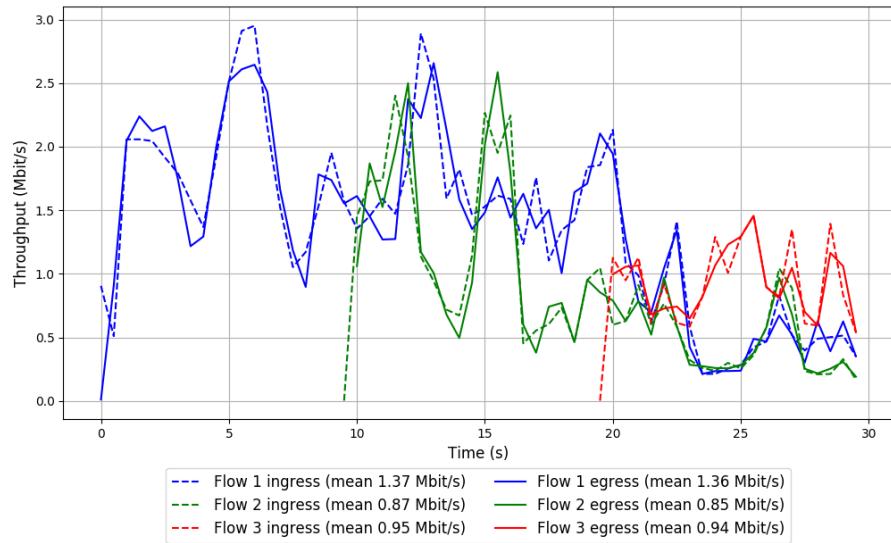


Run 3: Statistics of Sprout

```
Start at: 2017-08-13 07:35:52
End at: 2017-08-13 07:36:22
Local clock offset: 0.491 ms
Remote clock offset: 1.825 ms

# Below is generated by plot.py at 2017-08-13 07:47:48
# Datalink statistics
-- Total of 3 flows:
Average throughput: 2.24 Mbit/s
95th percentile per-packet one-way delay: 70.745 ms
Loss rate: 1.34%
-- Flow 1:
Average throughput: 1.36 Mbit/s
95th percentile per-packet one-way delay: 73.891 ms
Loss rate: 0.96%
-- Flow 2:
Average throughput: 0.85 Mbit/s
95th percentile per-packet one-way delay: 70.000 ms
Loss rate: 2.23%
-- Flow 3:
Average throughput: 0.94 Mbit/s
95th percentile per-packet one-way delay: 64.494 ms
Loss rate: 1.32%
```

Run 3: Report of Sprout — Data Link

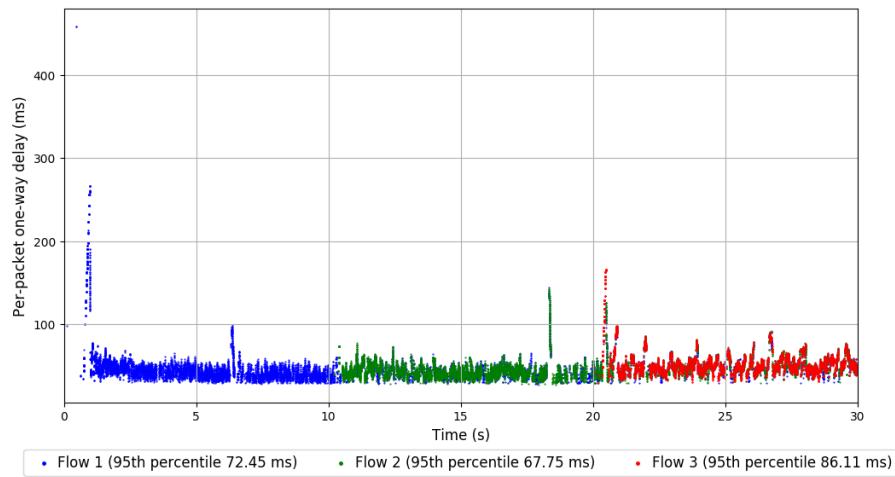
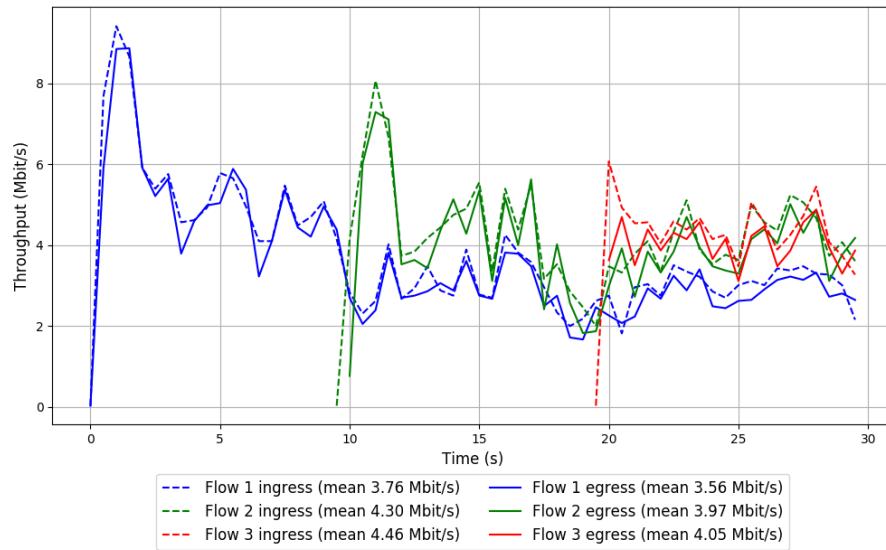


Run 1: Statistics of TaoVA-100x

```
Start at: 2017-08-13 06:51:29
End at: 2017-08-13 06:51:59
Local clock offset: 0.578 ms
Remote clock offset: 0.778 ms

# Below is generated by plot.py at 2017-08-13 07:47:50
# Datalink statistics
-- Total of 3 flows:
Average throughput: 7.56 Mbit/s
95th percentile per-packet one-way delay: 73.139 ms
Loss rate: 6.85%
-- Flow 1:
Average throughput: 3.56 Mbit/s
95th percentile per-packet one-way delay: 72.449 ms
Loss rate: 5.41%
-- Flow 2:
Average throughput: 3.97 Mbit/s
95th percentile per-packet one-way delay: 67.750 ms
Loss rate: 7.57%
-- Flow 3:
Average throughput: 4.05 Mbit/s
95th percentile per-packet one-way delay: 86.114 ms
Loss rate: 9.13%
```

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

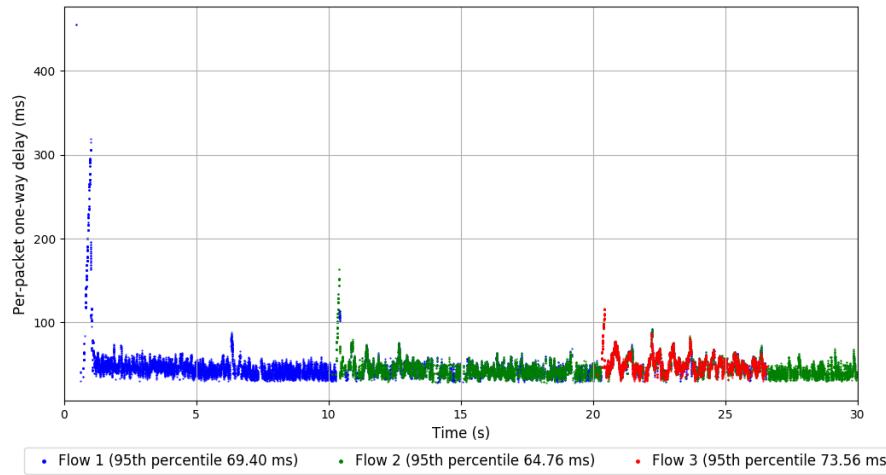
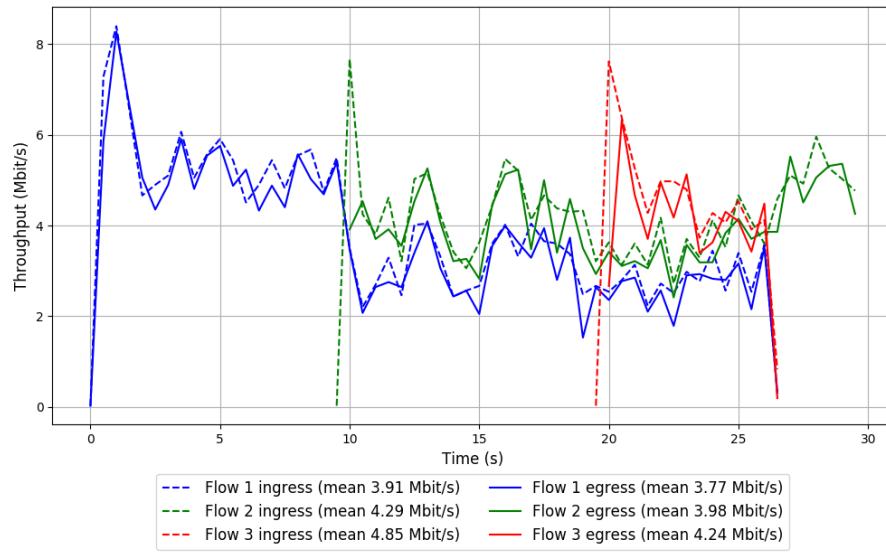


Run 2: Statistics of TaoVA-100x

```
Start at: 2017-08-13 07:11:41
End at: 2017-08-13 07:12:11
Local clock offset: 0.608 ms
Remote clock offset: 1.661 ms

# Below is generated by plot.py at 2017-08-13 07:47:51
# Datalink statistics
-- Total of 3 flows:
Average throughput: 6.96 Mbit/s
95th percentile per-packet one-way delay: 68.548 ms
Loss rate: 7.17%
-- Flow 1:
Average throughput: 3.77 Mbit/s
95th percentile per-packet one-way delay: 69.401 ms
Loss rate: 5.13%
-- Flow 2:
Average throughput: 3.98 Mbit/s
95th percentile per-packet one-way delay: 64.760 ms
Loss rate: 7.27%
-- Flow 3:
Average throughput: 4.24 Mbit/s
95th percentile per-packet one-way delay: 73.565 ms
Loss rate: 13.53%
```

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

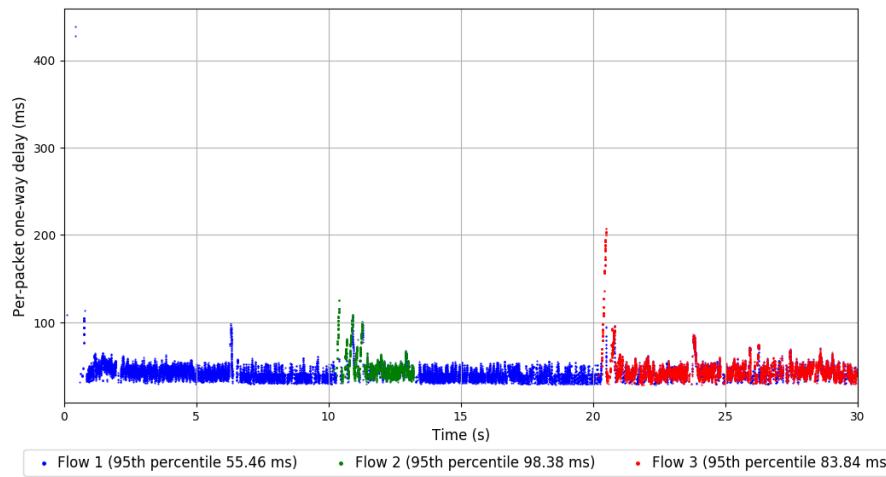
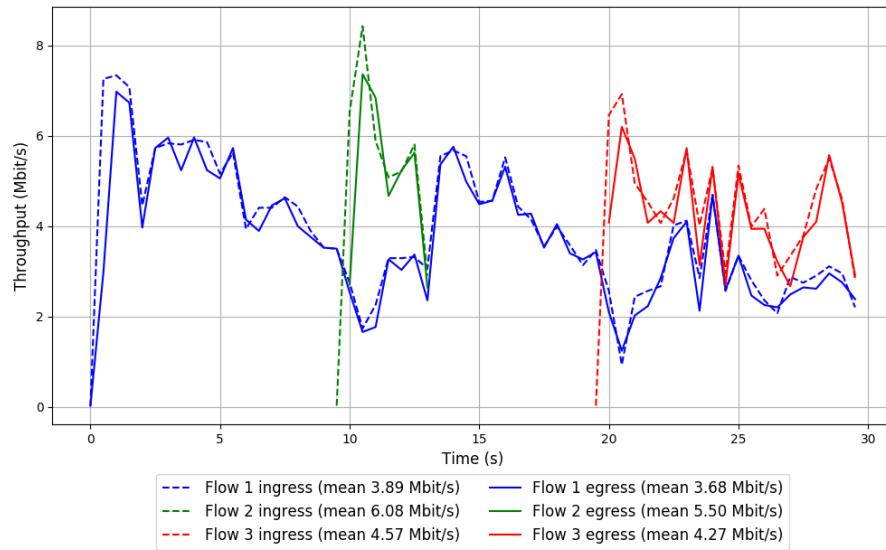


Run 3: Statistics of TaoVA-100x

```
Start at: 2017-08-13 07:31:50
End at: 2017-08-13 07:32:20
Local clock offset: 0.522 ms
Remote clock offset: 1.382 ms

# Below is generated by plot.py at 2017-08-13 07:47:53
# Datalink statistics
-- Total of 3 flows:
Average throughput: 5.69 Mbit/s
95th percentile per-packet one-way delay: 70.835 ms
Loss rate: 6.58%
-- Flow 1:
Average throughput: 3.68 Mbit/s
95th percentile per-packet one-way delay: 55.463 ms
Loss rate: 5.61%
-- Flow 2:
Average throughput: 5.50 Mbit/s
95th percentile per-packet one-way delay: 98.382 ms
Loss rate: 11.99%
-- Flow 3:
Average throughput: 4.27 Mbit/s
95th percentile per-packet one-way delay: 83.845 ms
Loss rate: 6.69%
```

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

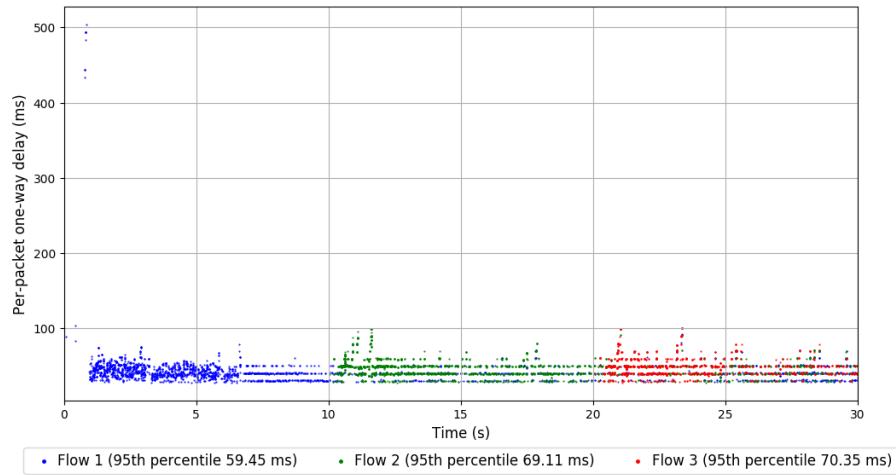
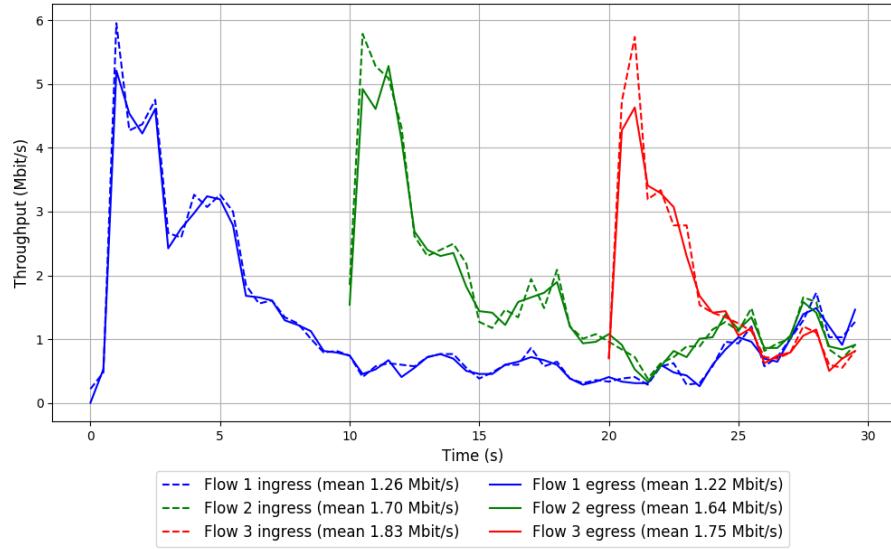


Run 1: Statistics of TCP Vegas

```
Start at: 2017-08-13 06:46:07
End at: 2017-08-13 06:46:37
Local clock offset: 0.652 ms
Remote clock offset: -1.382 ms

# Below is generated by plot.py at 2017-08-13 07:47:53
# Datalink statistics
-- Total of 3 flows:
Average throughput: 2.90 Mbit/s
95th percentile per-packet one-way delay: 67.072 ms
Loss rate: 3.37%
-- Flow 1:
Average throughput: 1.22 Mbit/s
95th percentile per-packet one-way delay: 59.451 ms
Loss rate: 2.61%
-- Flow 2:
Average throughput: 1.64 Mbit/s
95th percentile per-packet one-way delay: 69.108 ms
Loss rate: 3.68%
-- Flow 3:
Average throughput: 1.75 Mbit/s
95th percentile per-packet one-way delay: 70.353 ms
Loss rate: 4.35%
```

Run 1: Report of TCP Vegas — Data Link

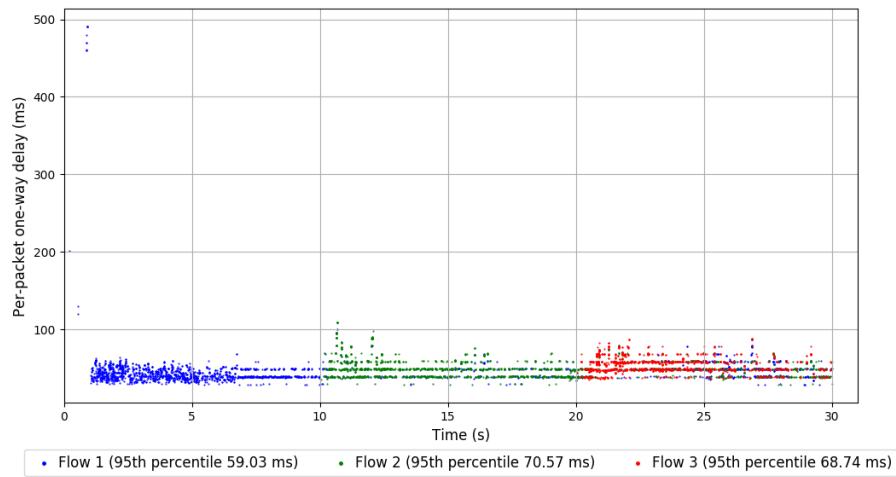
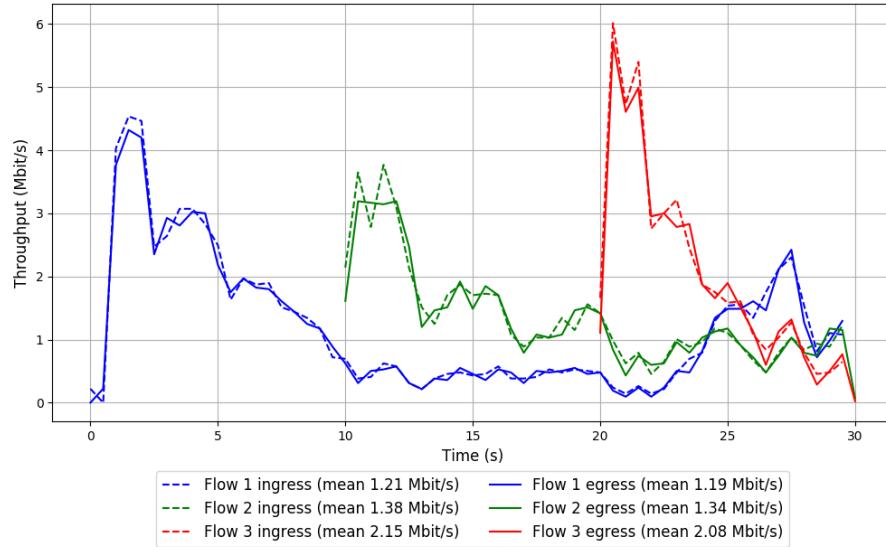


Run 2: Statistics of TCP Vegas

```
Start at: 2017-08-13 07:06:18
End at: 2017-08-13 07:06:48
Local clock offset: 0.614 ms
Remote clock offset: 1.079 ms

# Below is generated by plot.py at 2017-08-13 07:47:54
# Datalink statistics
-- Total of 3 flows:
Average throughput: 2.78 Mbit/s
95th percentile per-packet one-way delay: 68.173 ms
Loss rate: 2.48%
-- Flow 1:
Average throughput: 1.19 Mbit/s
95th percentile per-packet one-way delay: 59.028 ms
Loss rate: 2.28%
-- Flow 2:
Average throughput: 1.34 Mbit/s
95th percentile per-packet one-way delay: 70.574 ms
Loss rate: 2.45%
-- Flow 3:
Average throughput: 2.08 Mbit/s
95th percentile per-packet one-way delay: 68.743 ms
Loss rate: 2.87%
```

Run 2: Report of TCP Vegas — Data Link

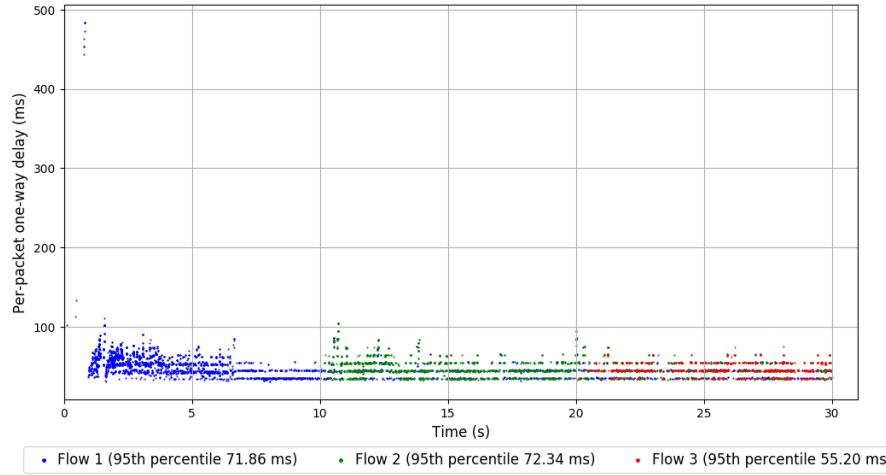
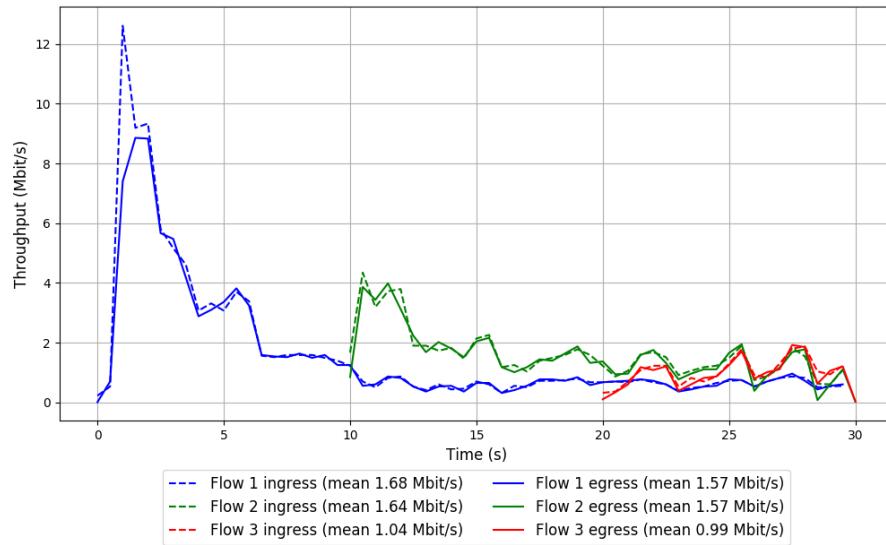


Run 3: Statistics of TCP Vegas

```
Start at: 2017-08-13 07:26:27
End at: 2017-08-13 07:26:57
Local clock offset: 0.513 ms
Remote clock offset: 1.733 ms

# Below is generated by plot.py at 2017-08-13 07:47:54
# Datalink statistics
-- Total of 3 flows:
Average throughput: 2.94 Mbit/s
95th percentile per-packet one-way delay: 71.059 ms
Loss rate: 5.58%
-- Flow 1:
Average throughput: 1.57 Mbit/s
95th percentile per-packet one-way delay: 71.864 ms
Loss rate: 6.81%
-- Flow 2:
Average throughput: 1.57 Mbit/s
95th percentile per-packet one-way delay: 72.336 ms
Loss rate: 3.79%
-- Flow 3:
Average throughput: 0.99 Mbit/s
95th percentile per-packet one-way delay: 55.204 ms
Loss rate: 5.31%
```

Run 3: Report of TCP Vegas — Data Link

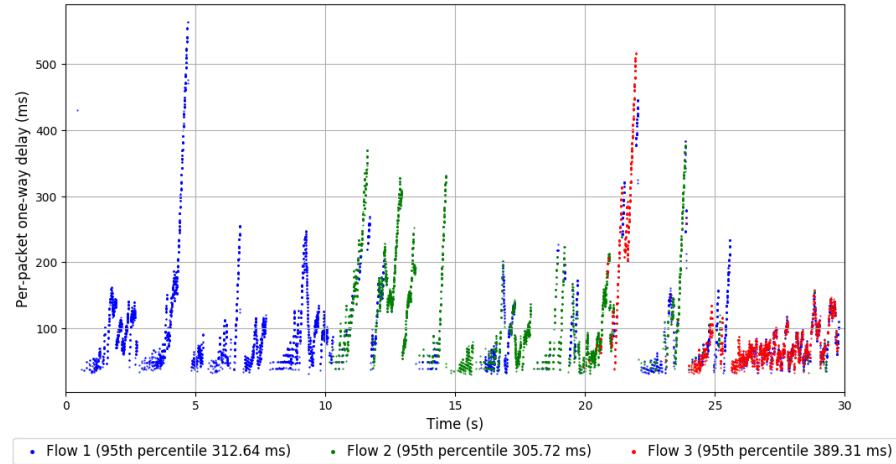
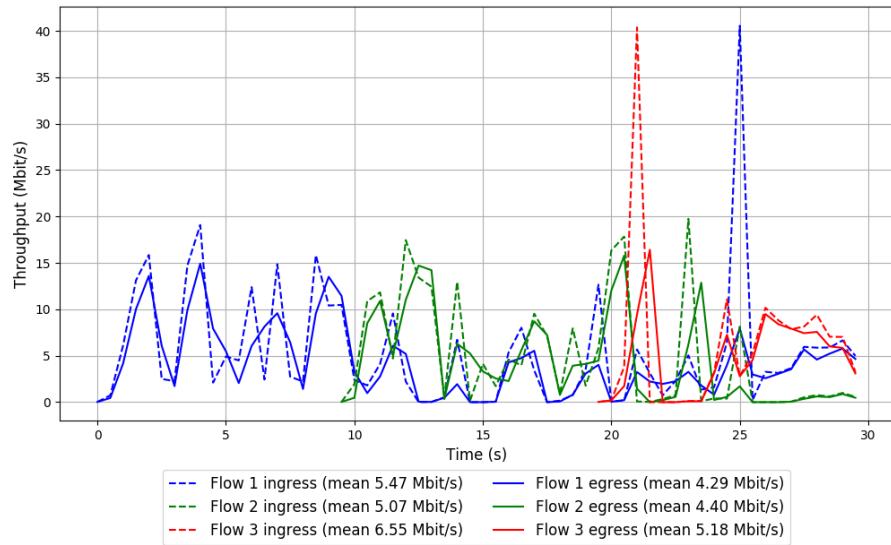


Run 1: Statistics of Verus

```
Start at: 2017-08-13 06:50:08
End at: 2017-08-13 06:50:38
Local clock offset: 0.646 ms
Remote clock offset: 0.84 ms

# Below is generated by plot.py at 2017-08-13 07:47:56
# Datalink statistics
-- Total of 3 flows:
Average throughput: 8.99 Mbit/s
95th percentile per-packet one-way delay: 317.630 ms
Loss rate: 19.52%
-- Flow 1:
Average throughput: 4.29 Mbit/s
95th percentile per-packet one-way delay: 312.637 ms
Loss rate: 22.62%
-- Flow 2:
Average throughput: 4.40 Mbit/s
95th percentile per-packet one-way delay: 305.721 ms
Loss rate: 13.46%
-- Flow 3:
Average throughput: 5.18 Mbit/s
95th percentile per-packet one-way delay: 389.306 ms
Loss rate: 21.17%
```

Run 1: Report of Verus — Data Link

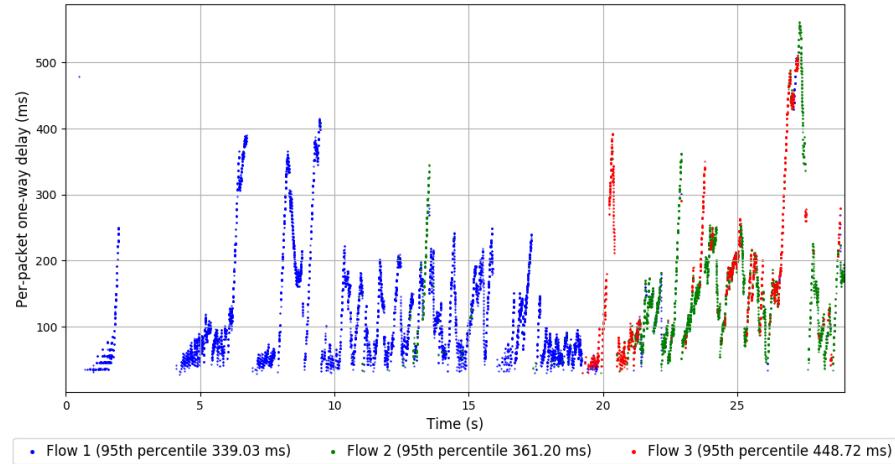
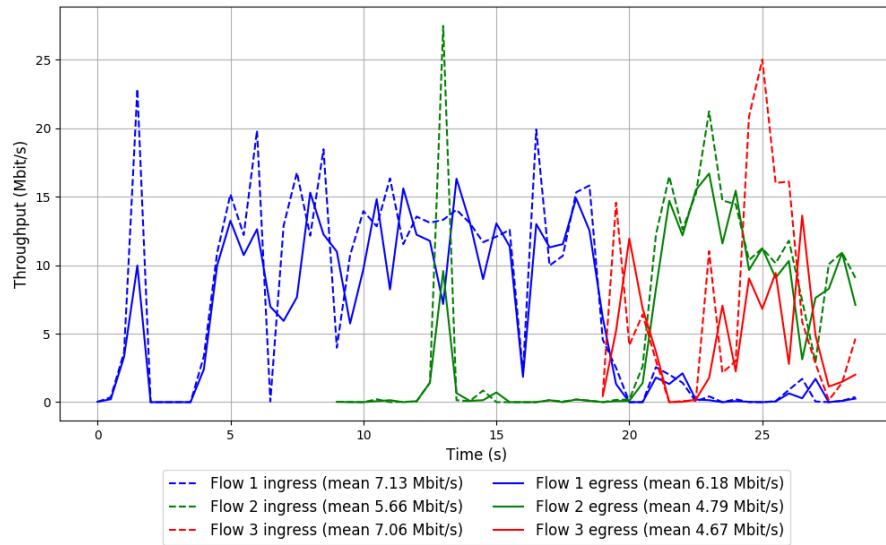


Run 2: Statistics of Verus

```
Start at: 2017-08-13 07:10:20
End at: 2017-08-13 07:10:50
Local clock offset: 0.551 ms
Remote clock offset: 1.58 ms

# Below is generated by plot.py at 2017-08-13 07:47:57
# Datalink statistics
-- Total of 3 flows:
Average throughput: 11.03 Mbit/s
95th percentile per-packet one-way delay: 361.669 ms
Loss rate: 18.93%
-- Flow 1:
Average throughput: 6.18 Mbit/s
95th percentile per-packet one-way delay: 339.031 ms
Loss rate: 14.85%
-- Flow 2:
Average throughput: 4.79 Mbit/s
95th percentile per-packet one-way delay: 361.196 ms
Loss rate: 16.96%
-- Flow 3:
Average throughput: 4.67 Mbit/s
95th percentile per-packet one-way delay: 448.719 ms
Loss rate: 34.33%
```

Run 2: Report of Verus — Data Link

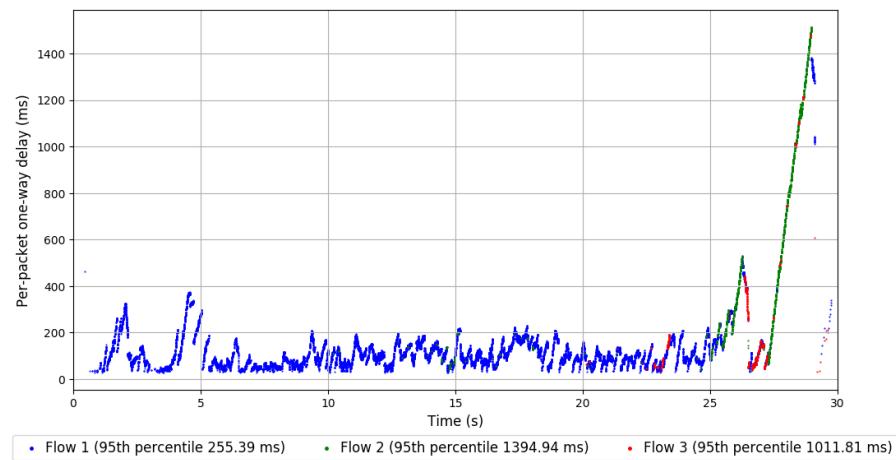
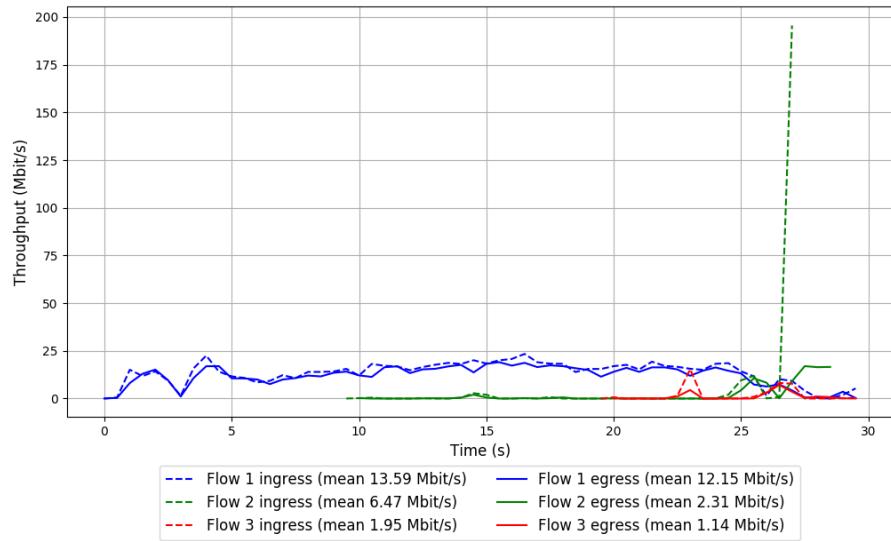


Run 3: Statistics of Verus

```
Start at: 2017-08-13 07:30:29
End at: 2017-08-13 07:30:59
Local clock offset: 0.487 ms
Remote clock offset: -0.608 ms

# Below is generated by plot.py at 2017-08-13 07:47:58
# Datalink statistics
-- Total of 3 flows:
Average throughput: 14.02 Mbit/s
95th percentile per-packet one-way delay: 684.340 ms
Loss rate: 23.48%
-- Flow 1:
Average throughput: 12.15 Mbit/s
95th percentile per-packet one-way delay: 255.390 ms
Loss rate: 11.85%
-- Flow 2:
Average throughput: 2.31 Mbit/s
95th percentile per-packet one-way delay: 1394.942 ms
Loss rate: 61.52%
-- Flow 3:
Average throughput: 1.14 Mbit/s
95th percentile per-packet one-way delay: 1011.813 ms
Loss rate: 42.90%
```

Run 3: Report of Verus — Data Link

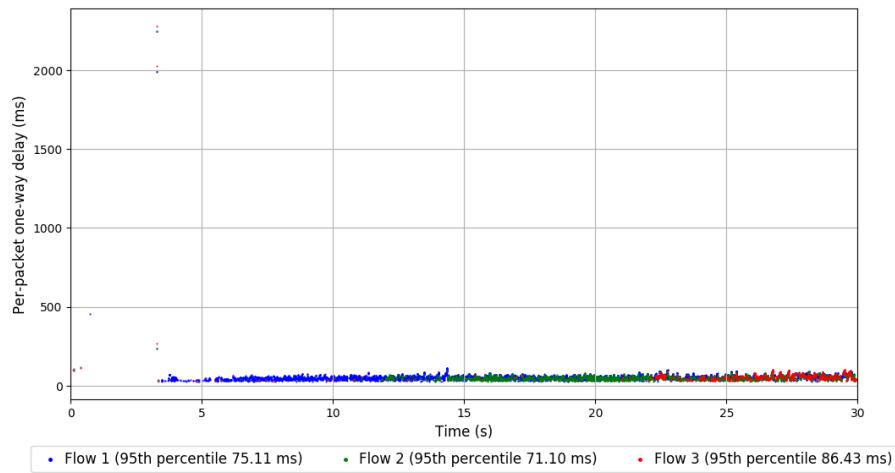
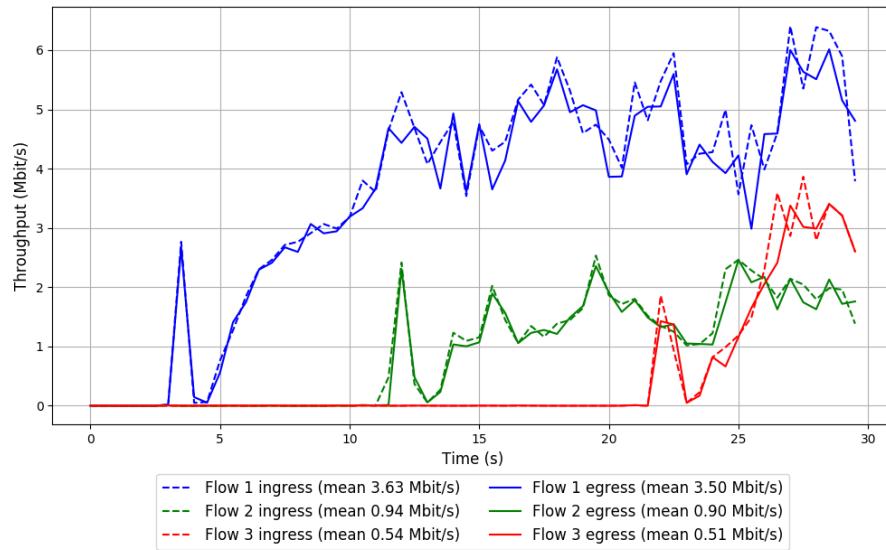


```
Run 1: Statistics of WebRTC media

Start at: 2017-08-13 06:58:14
End at: 2017-08-13 06:58:44
Local clock offset: 0.605 ms
Remote clock offset: -1.212 ms

# Below is generated by plot.py at 2017-08-13 07:48:00
# Datalink statistics
-- Total of 3 flows:
Average throughput: 4.91 Mbit/s
95th percentile per-packet one-way delay: 76.486 ms
Loss rate: 4.01%
-- Flow 1:
Average throughput: 3.50 Mbit/s
95th percentile per-packet one-way delay: 75.113 ms
Loss rate: 3.69%
-- Flow 2:
Average throughput: 0.90 Mbit/s
95th percentile per-packet one-way delay: 71.098 ms
Loss rate: 4.34%
-- Flow 3:
Average throughput: 0.51 Mbit/s
95th percentile per-packet one-way delay: 86.432 ms
Loss rate: 5.60%
```

Run 1: Report of WebRTC media — Data Link

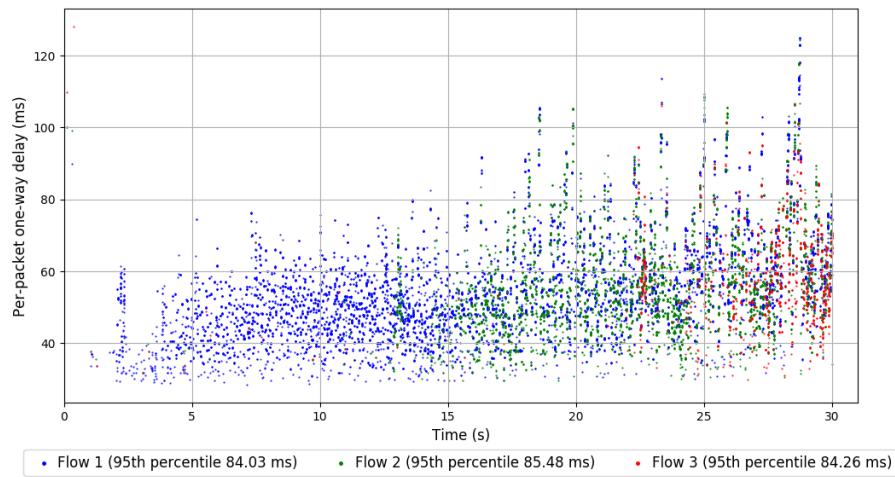
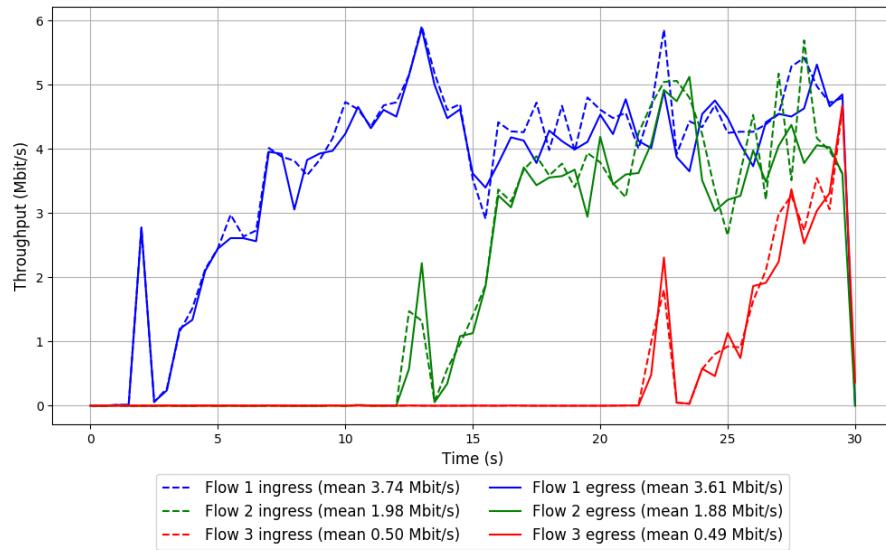


Run 2: Statistics of WebRTC media

```
Start at: 2017-08-13 07:18:25
End at: 2017-08-13 07:18:55
Local clock offset: 0.494 ms
Remote clock offset: 1.361 ms

# Below is generated by plot.py at 2017-08-13 07:48:00
# Datalink statistics
-- Total of 3 flows:
Average throughput: 5.98 Mbit/s
95th percentile per-packet one-way delay: 84.425 ms
Loss rate: 4.13%
-- Flow 1:
Average throughput: 3.61 Mbit/s
95th percentile per-packet one-way delay: 84.028 ms
Loss rate: 3.81%
-- Flow 2:
Average throughput: 1.88 Mbit/s
95th percentile per-packet one-way delay: 85.483 ms
Loss rate: 4.99%
-- Flow 3:
Average throughput: 0.49 Mbit/s
95th percentile per-packet one-way delay: 84.256 ms
Loss rate: 3.20%
```

Run 2: Report of WebRTC media — Data Link



Run 3: Statistics of WebRTC media

```
Start at: 2017-08-13 07:38:34
End at: 2017-08-13 07:39:04
Local clock offset: 0.597 ms
Remote clock offset: 1.4 ms

# Below is generated by plot.py at 2017-08-13 07:48:01
# Datalink statistics
-- Total of 3 flows:
Average throughput: 5.00 Mbit/s
95th percentile per-packet one-way delay: 71.498 ms
Loss rate: 3.68%
-- Flow 1:
Average throughput: 3.24 Mbit/s
95th percentile per-packet one-way delay: 69.259 ms
Loss rate: 2.89%
-- Flow 2:
Average throughput: 1.41 Mbit/s
95th percentile per-packet one-way delay: 75.584 ms
Loss rate: 4.43%
-- Flow 3:
Average throughput: 0.36 Mbit/s
95th percentile per-packet one-way delay: 76.961 ms
Loss rate: 7.56%
```

Run 3: Report of WebRTC media — Data Link

