

Pantheon Report

Generated at 2017-08-13 07:38:21 (UTC).

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

Repeated the test of 15 congestion control schemes 3 times.

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

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

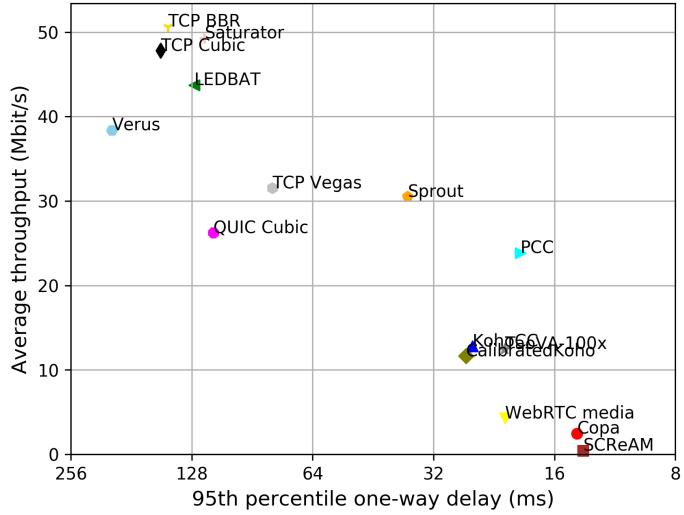
Tested BBR with qdisc of Fair Queuing (**fq**), and other schemes with the default Linux qdisc (**pfifo_fast**).

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

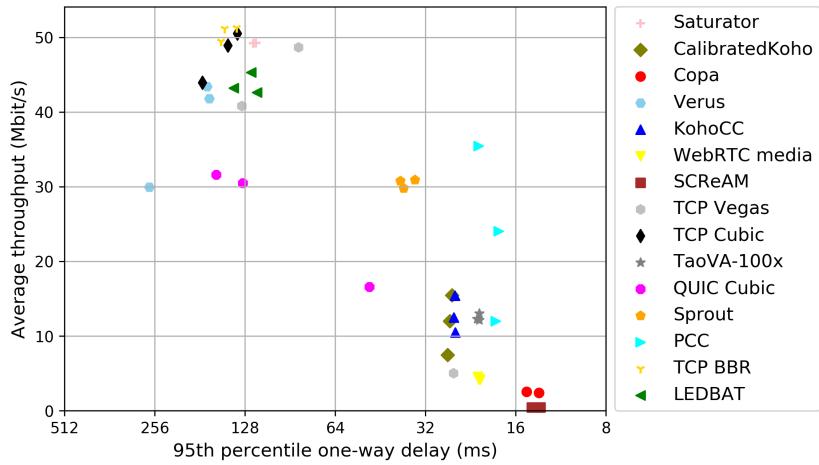
Git summary:

```
branch: master @ e43be7582298d552838afcfc6382342bf187fbdbd6
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
  M scripts/merge-tunnel-logs
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 @ f1a14bfe749737437f61b1eaeeb30b267cde681
third_party/sprout @ 6f2efef6e088d91066a9f023df375eee2665089ce
  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 1 Ethernet to Stanford ppp0, 3 runs of 30s each per scheme
 3 flows with 10s interval between flows (mean of all runs by scheme)



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



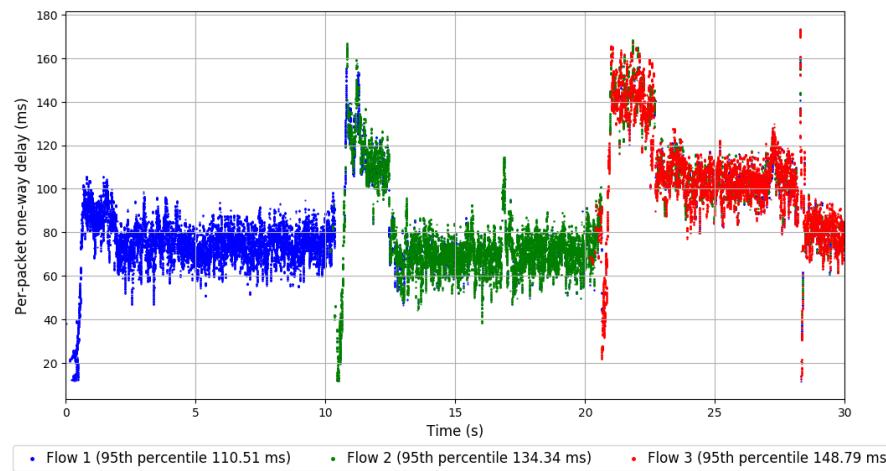
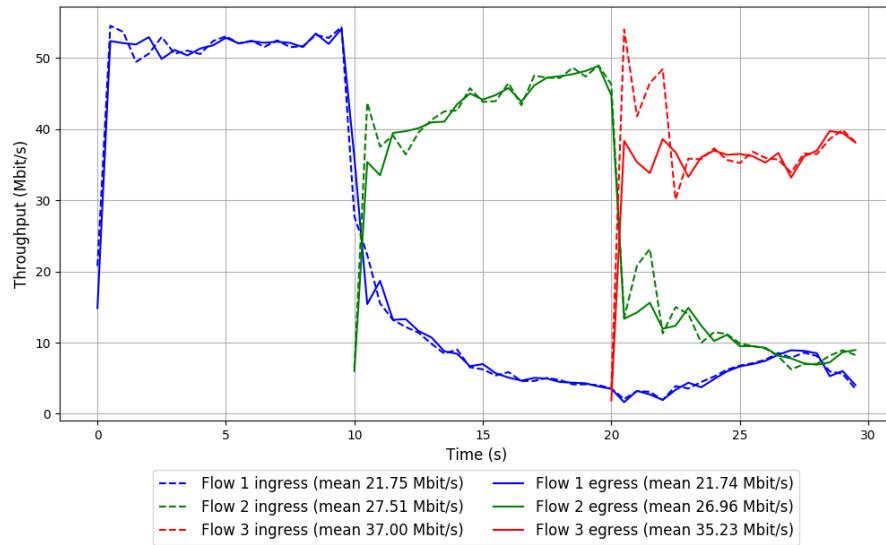
scheme	# runs	mean avg tput (Mbit/s)			mean 95th-%ile delay (ms)			mean loss rate (%)		
		flow 1	flow 2	flow 3	flow 1	flow 2	flow 3	flow 1	flow 2	flow 3
TCP BBR	3	23.29	30.27	21.46	129.77	147.62	169.66	1.00	4.07	10.05
CalibratedKoho	3	8.93	6.71	5.34	376.08	26.81	26.37	0.88	0.00	0.00
Copa	2	1.23	1.22	1.24	13.75	14.29	15.27	0.00	0.00	0.00
TCP Cubic	3	34.93	14.12	10.55	152.14	161.18	145.34	0.36	0.55	1.46
KohoCC	3	7.07	6.42	4.26	25.55	25.62	25.62	0.01	0.00	0.00
LEDBAT	3	34.73	10.74	5.41	121.93	130.83	134.13	0.23	0.66	1.42
PCC	3	16.57	8.89	3.96	18.39	19.59	19.50	0.03	0.00	0.00
QUIC Cubic	3	63.70	23.97	25.52	144.25	96.22	124.41	0.00	0.31	1.02
Saturator	2	29.36	21.27	17.06	116.14	119.61	121.94	0.15	0.36	0.85
SCReAM	3	0.22	0.22	0.22	13.61	13.47	13.52	0.00	0.00	0.00
Sprout	3	15.33	15.39	14.60	36.26	36.82	39.25	0.02	0.02	0.09
TaoVA-100x	3	5.72	5.98	7.27	19.72	22.62	25.04	0.00	0.00	0.00
TCP Vegas	3	18.01	16.76	6.74	69.76	76.10	75.86	0.03	0.14	0.32
Verus	3	28.95	9.97	9.21	196.83	211.74	211.39	12.05	21.61	34.14
WebRTC media	3	2.30	1.46	0.55	21.20	20.84	21.66	0.00	0.00	0.00

Run 1: Statistics of TCP BBR

```
Start at: 2017-08-13 06:52:46
End at: 2017-08-13 06:53:16
Local clock offset: 0.585 ms
Remote clock offset: -2.143 ms

# Below is generated by plot.py at 2017-08-13 07:36:47
# Datalink statistics
-- Total of 3 flows:
Average throughput: 51.27 Mbit/s
95th percentile per-packet one-way delay: 136.698 ms
Loss rate: 2.16%
-- Flow 1:
Average throughput: 21.74 Mbit/s
95th percentile per-packet one-way delay: 110.507 ms
Loss rate: 0.13%
-- Flow 2:
Average throughput: 26.96 Mbit/s
95th percentile per-packet one-way delay: 134.338 ms
Loss rate: 2.34%
-- Flow 3:
Average throughput: 35.23 Mbit/s
95th percentile per-packet one-way delay: 148.791 ms
Loss rate: 5.51%
```

Run 1: Report of TCP BBR — Data Link

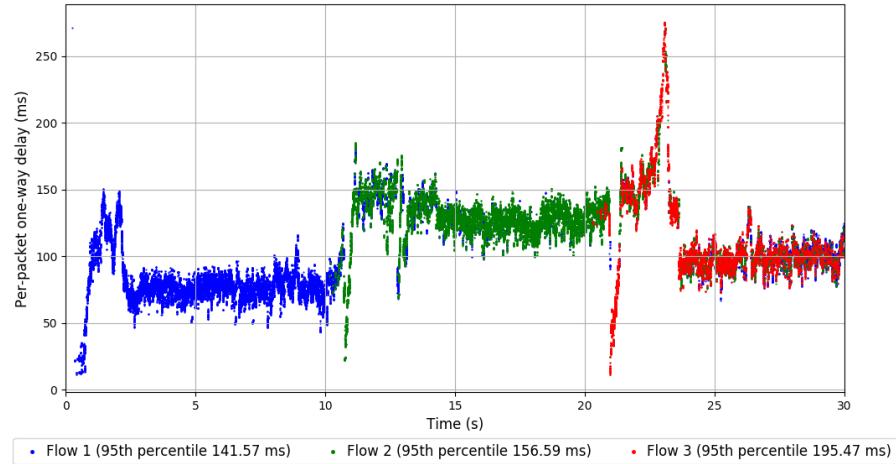
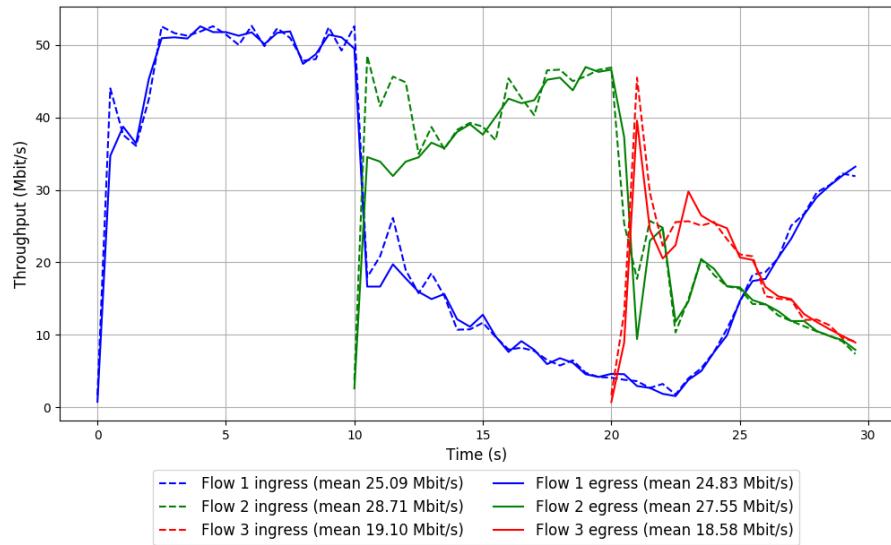


Run 2: Statistics of TCP BBR

```
Start at: 2017-08-13 07:10:55
End at: 2017-08-13 07:11:25
Local clock offset: 0.611 ms
Remote clock offset: -1.882 ms

# Below is generated by plot.py at 2017-08-13 07:36:47
# Datalink statistics
-- Total of 3 flows:
Average throughput: 49.43 Mbit/s
95th percentile per-packet one-way delay: 153.901 ms
Loss rate: 2.91%
-- Flow 1:
Average throughput: 24.83 Mbit/s
95th percentile per-packet one-way delay: 141.569 ms
Loss rate: 1.83%
-- Flow 2:
Average throughput: 27.55 Mbit/s
95th percentile per-packet one-way delay: 156.592 ms
Loss rate: 4.12%
-- Flow 3:
Average throughput: 18.58 Mbit/s
95th percentile per-packet one-way delay: 195.474 ms
Loss rate: 3.51%
```

Run 2: Report of TCP BBR — Data Link

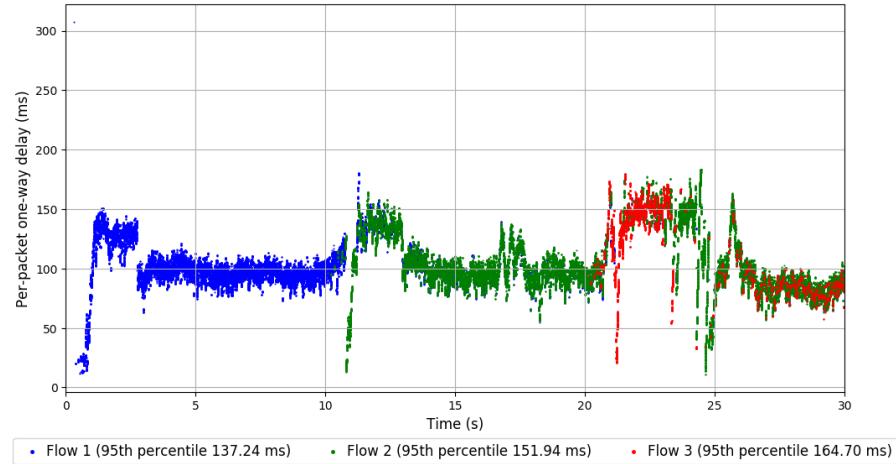
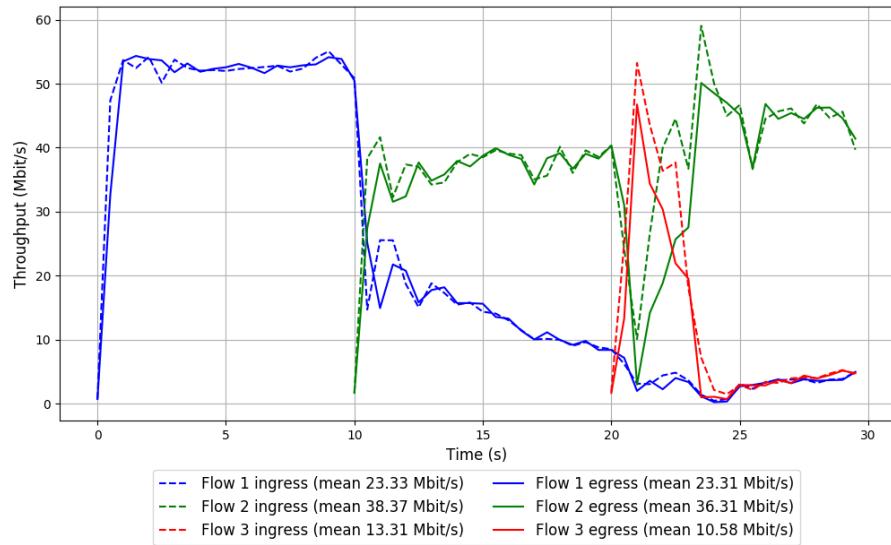


Run 3: Statistics of TCP BBR

```
Start at: 2017-08-13 07:28:58
End at: 2017-08-13 07:29:28
Local clock offset: 0.602 ms
Remote clock offset: -1.581 ms

# Below is generated by plot.py at 2017-08-13 07:36:57
# Datalink statistics
-- Total of 3 flows:
Average throughput: 51.15 Mbit/s
95th percentile per-packet one-way delay: 149.676 ms
Loss rate: 4.96%
-- Flow 1:
Average throughput: 23.31 Mbit/s
95th percentile per-packet one-way delay: 137.244 ms
Loss rate: 1.03%
-- Flow 2:
Average throughput: 36.31 Mbit/s
95th percentile per-packet one-way delay: 151.945 ms
Loss rate: 5.76%
-- Flow 3:
Average throughput: 10.58 Mbit/s
95th percentile per-packet one-way delay: 164.701 ms
Loss rate: 21.13%
```

Run 3: Report of TCP BBR — Data Link

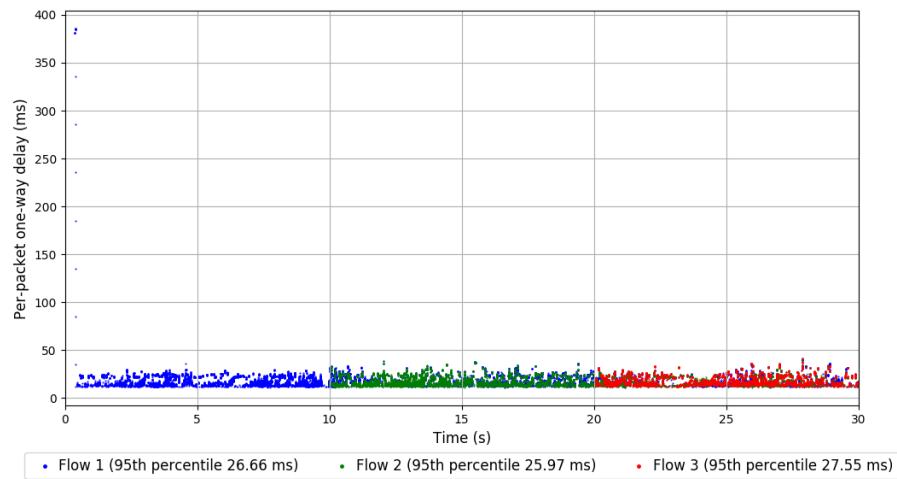
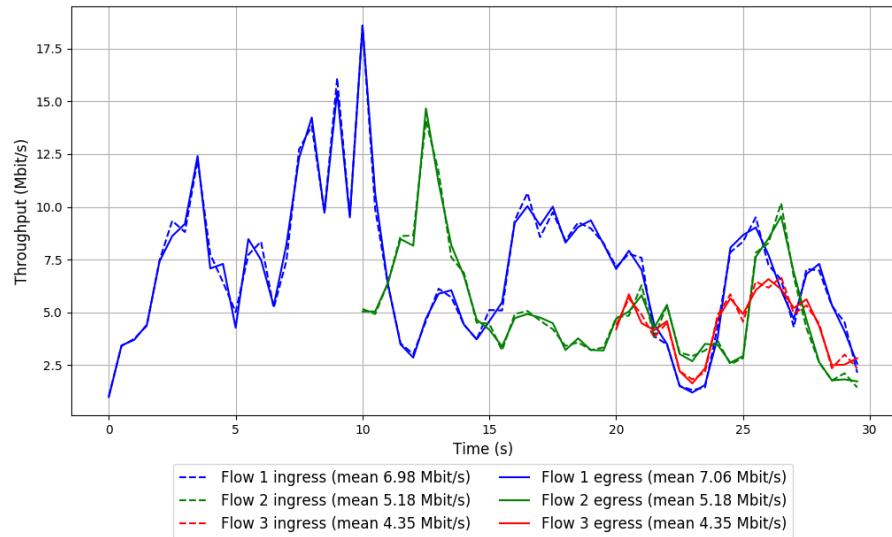


```
Run 1: Statistics of CalibratedKoho
```

```
Start at: 2017-08-13 06:50:23
End at: 2017-08-13 06:50:53
Local clock offset: 0.568 ms
Remote clock offset: -2.058 ms

# Below is generated by plot.py at 2017-08-13 07:36:57
# Datalink statistics
-- Total of 3 flows:
Average throughput: 12.02 Mbit/s
95th percentile per-packet one-way delay: 26.586 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 7.06 Mbit/s
95th percentile per-packet one-way delay: 26.662 ms
Loss rate: 0.01%
-- Flow 2:
Average throughput: 5.18 Mbit/s
95th percentile per-packet one-way delay: 25.974 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 4.35 Mbit/s
95th percentile per-packet one-way delay: 27.554 ms
Loss rate: 0.00%
```

Run 1: Report of CalibratedKoho — Data Link

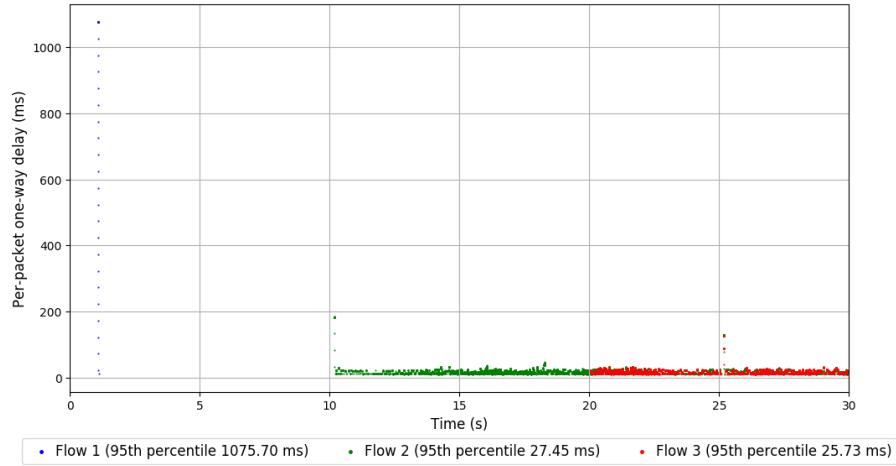
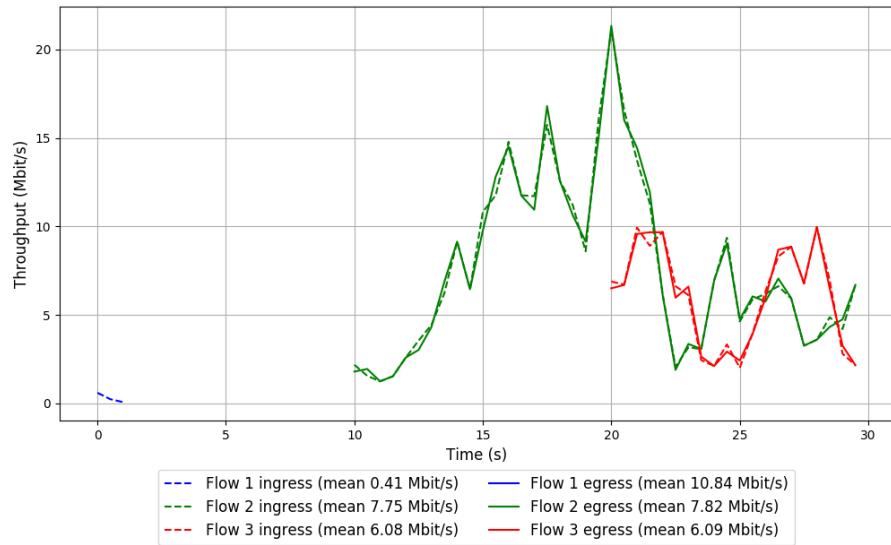


Run 2: Statistics of CalibratedKoho

```
Start at: 2017-08-13 07:08:32
End at: 2017-08-13 07:09:02
Local clock offset: 0.635 ms
Remote clock offset: -1.847 ms

# Below is generated by plot.py at 2017-08-13 07:36:57
# Datalink statistics
-- Total of 3 flows:
Average throughput: 7.46 Mbit/s
95th percentile per-packet one-way delay: 27.038 ms
Loss rate: 0.01%
-- Flow 1:
Average throughput: 10.84 Mbit/s
95th percentile per-packet one-way delay: 1075.696 ms
Loss rate: 2.63%
-- Flow 2:
Average throughput: 7.82 Mbit/s
95th percentile per-packet one-way delay: 27.447 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 6.09 Mbit/s
95th percentile per-packet one-way delay: 25.731 ms
Loss rate: 0.00%
```

Run 2: Report of CalibratedKoho — Data Link

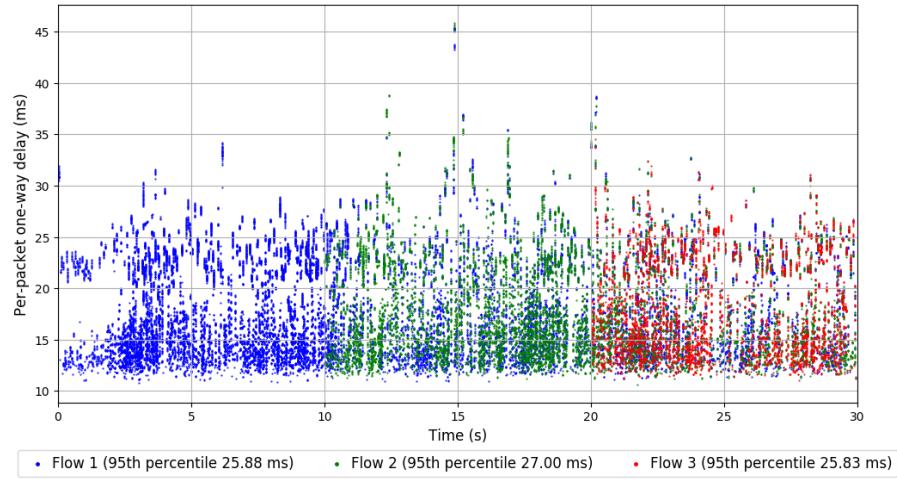
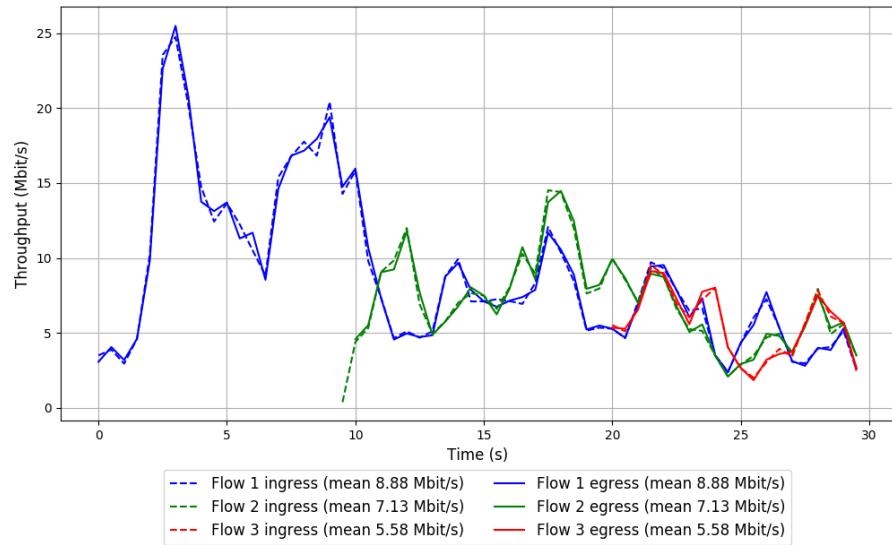


```
Run 3: Statistics of CalibratedKoho
```

```
Start at: 2017-08-13 07:26:34
End at: 2017-08-13 07:27:04
Local clock offset: 0.599 ms
Remote clock offset: -1.522 ms

# Below is generated by plot.py at 2017-08-13 07:36:57
# Datalink statistics
-- Total of 3 flows:
Average throughput: 15.49 Mbit/s
95th percentile per-packet one-way delay: 26.115 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 8.88 Mbit/s
95th percentile per-packet one-way delay: 25.883 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 7.13 Mbit/s
95th percentile per-packet one-way delay: 27.003 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 5.58 Mbit/s
95th percentile per-packet one-way delay: 25.827 ms
Loss rate: 0.00%
```

Run 3: Report of CalibratedKoho — Data Link

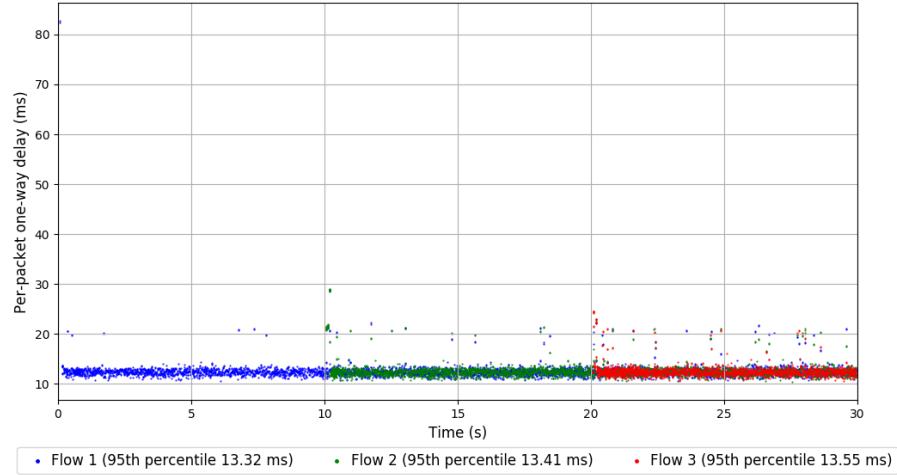
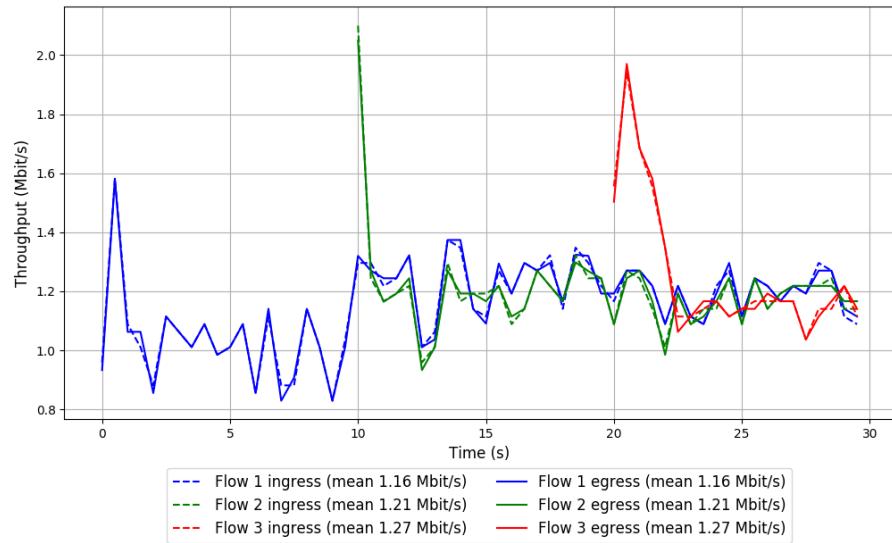


Run 1: Statistics of Copa

```
Start at: 2017-08-13 06:56:23
End at: 2017-08-13 06:56:53
Local clock offset: 0.647 ms
Remote clock offset: -2.127 ms

# Below is generated by plot.py at 2017-08-13 07:36:57
# Datalink statistics
-- Total of 3 flows:
Average throughput: 2.38 Mbit/s
95th percentile per-packet one-way delay: 13.378 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 1.16 Mbit/s
95th percentile per-packet one-way delay: 13.325 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 1.21 Mbit/s
95th percentile per-packet one-way delay: 13.406 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 1.27 Mbit/s
95th percentile per-packet one-way delay: 13.551 ms
Loss rate: 0.00%
```

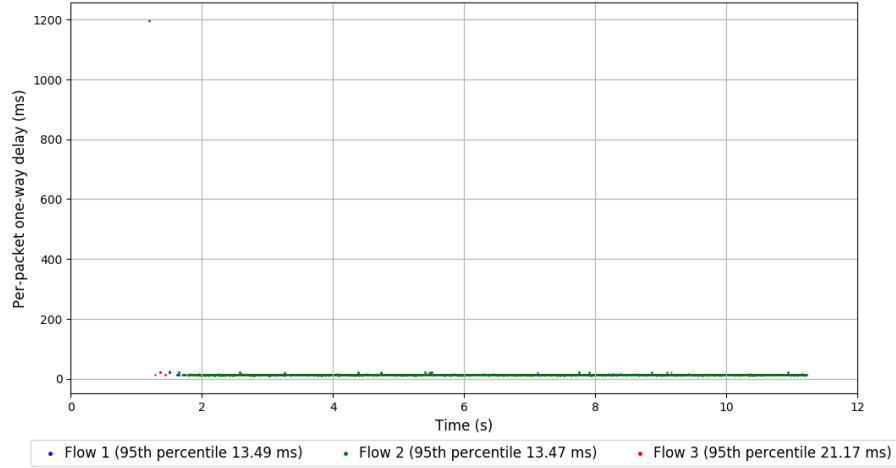
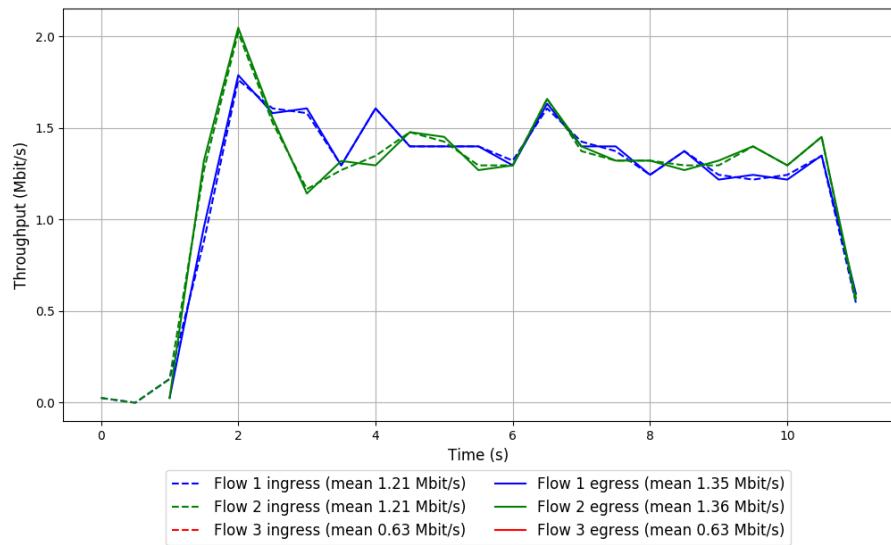
Run 1: Report of Copa — Data Link



Run 2: Statistics of Copa

Start at: 2017-08-13 07:14:32
End at: 2017-08-13 07:15:02
Local clock offset: 0.534 ms
Remote clock offset: -1.701 ms

Run 2: Report of Copa — Data Link

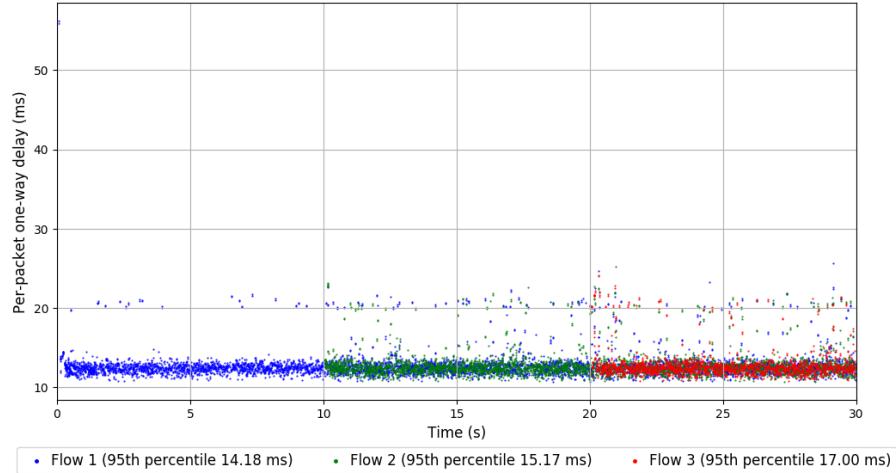
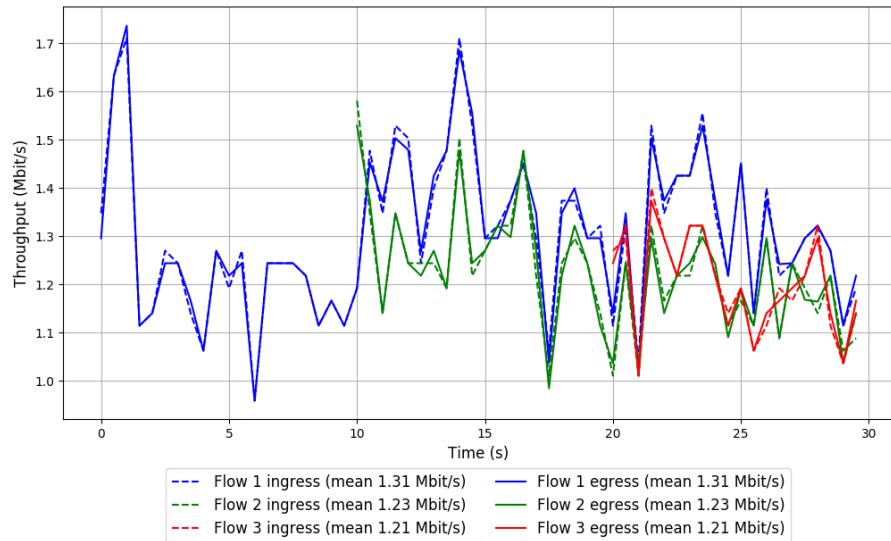


Run 3: Statistics of Copa

```
Start at: 2017-08-13 07:32:35
End at: 2017-08-13 07:33:05
Local clock offset: 0.486 ms
Remote clock offset: -1.59 ms

# Below is generated by plot.py at 2017-08-13 07:36:58
# Datalink statistics
-- Total of 3 flows:
Average throughput: 2.53 Mbit/s
95th percentile per-packet one-way delay: 14.744 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 1.31 Mbit/s
95th percentile per-packet one-way delay: 14.177 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 1.23 Mbit/s
95th percentile per-packet one-way delay: 15.168 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 1.21 Mbit/s
95th percentile per-packet one-way delay: 16.999 ms
Loss rate: 0.00%
```

Run 3: Report of Copa — Data Link

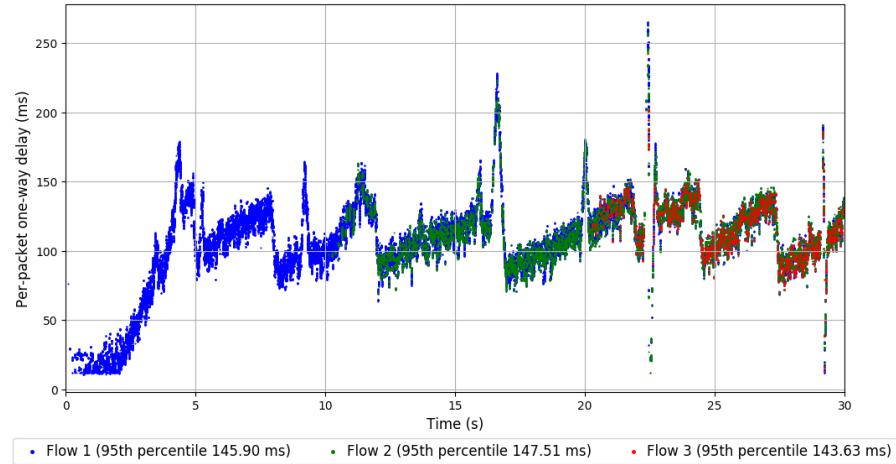
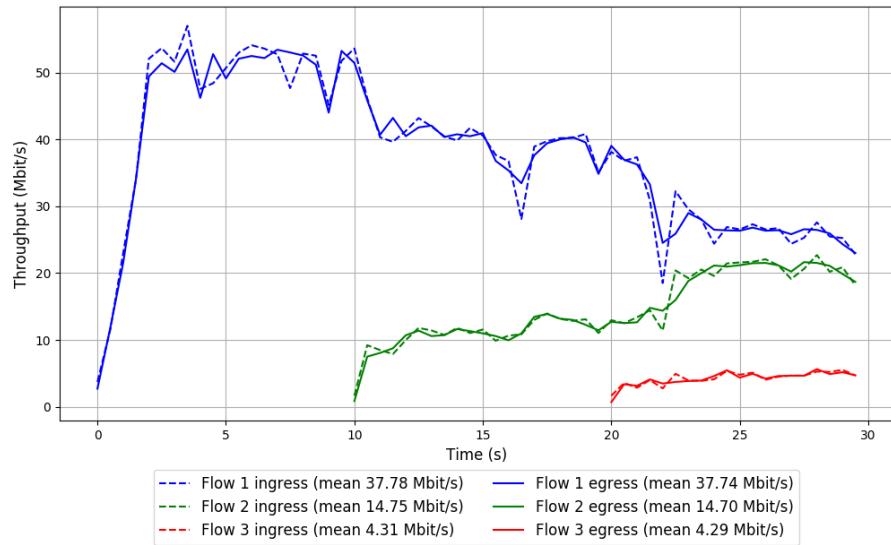


```
Run 1: Statistics of TCP Cubic
```

```
Start at: 2017-08-13 06:45:32
End at: 2017-08-13 06:46:02
Local clock offset: 0.648 ms
Remote clock offset: -2.089 ms

# Below is generated by plot.py at 2017-08-13 07:37:03
# Datalink statistics
-- Total of 3 flows:
Average throughput: 48.91 Mbit/s
95th percentile per-packet one-way delay: 146.109 ms
Loss rate: 0.46%
-- Flow 1:
Average throughput: 37.74 Mbit/s
95th percentile per-packet one-way delay: 145.897 ms
Loss rate: 0.33%
-- Flow 2:
Average throughput: 14.70 Mbit/s
95th percentile per-packet one-way delay: 147.507 ms
Loss rate: 0.78%
-- Flow 3:
Average throughput: 4.29 Mbit/s
95th percentile per-packet one-way delay: 143.632 ms
Loss rate: 1.62%
```

Run 1: Report of TCP Cubic — Data Link

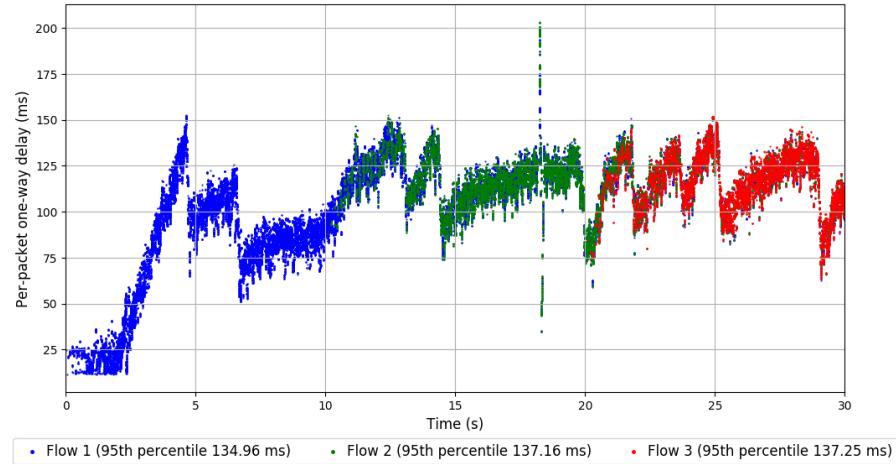
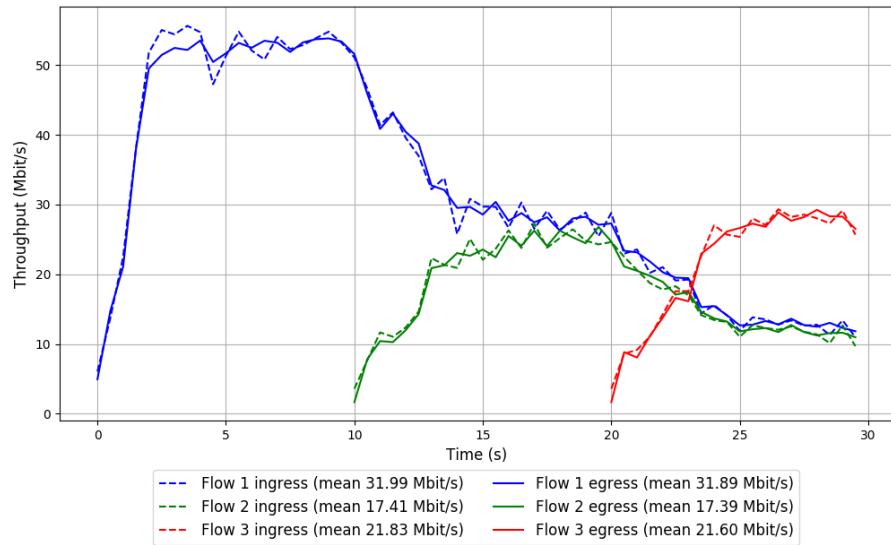


Run 2: Statistics of TCP Cubic

```
Start at: 2017-08-13 07:03:41
End at: 2017-08-13 07:04:11
Local clock offset: 0.648 ms
Remote clock offset: -2.071 ms

# Below is generated by plot.py at 2017-08-13 07:37:05
# Datalink statistics
-- Total of 3 flows:
Average throughput: 50.55 Mbit/s
95th percentile per-packet one-way delay: 135.851 ms
Loss rate: 0.49%
-- Flow 1:
Average throughput: 31.89 Mbit/s
95th percentile per-packet one-way delay: 134.961 ms
Loss rate: 0.29%
-- Flow 2:
Average throughput: 17.39 Mbit/s
95th percentile per-packet one-way delay: 137.161 ms
Loss rate: 0.43%
-- Flow 3:
Average throughput: 21.60 Mbit/s
95th percentile per-packet one-way delay: 137.247 ms
Loss rate: 1.47%
```

Run 2: Report of TCP Cubic — Data Link

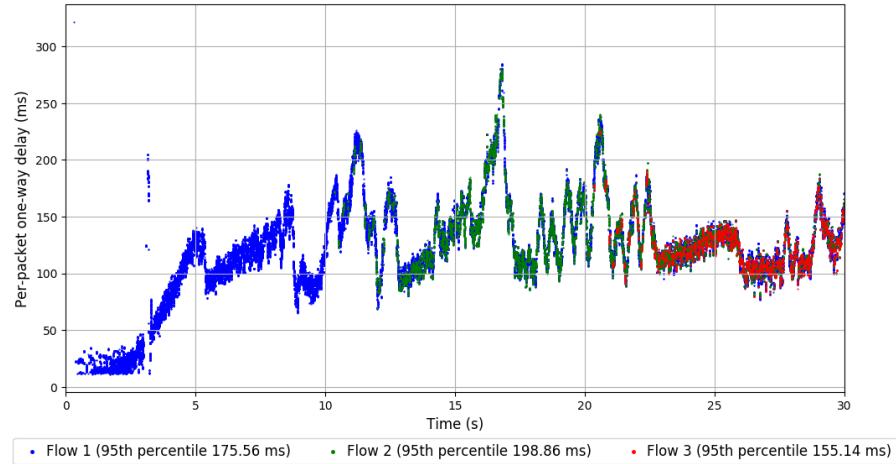
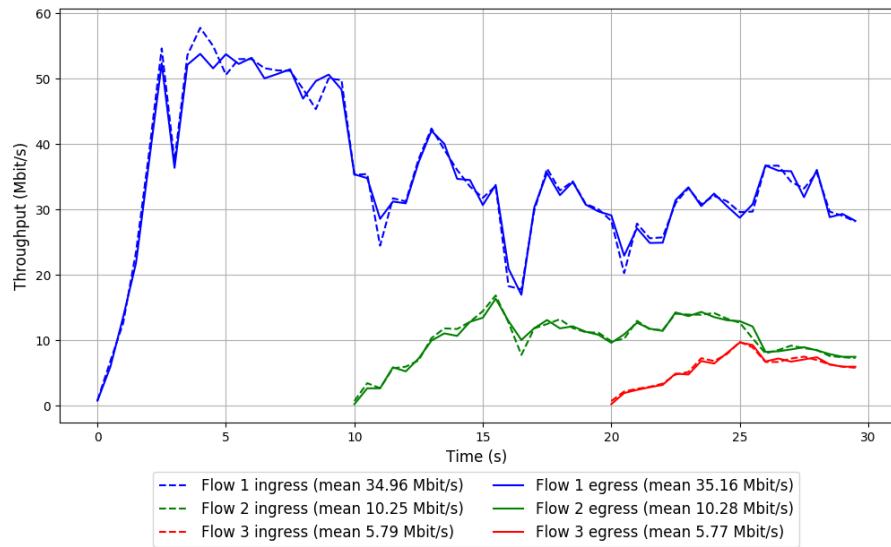


Run 3: Statistics of TCP Cubic

```
Start at: 2017-08-13 07:21:44
End at: 2017-08-13 07:22:14
Local clock offset: 0.501 ms
Remote clock offset: -1.66 ms

# Below is generated by plot.py at 2017-08-13 07:37:10
# Datalink statistics
-- Total of 3 flows:
Average throughput: 43.95 Mbit/s
95th percentile per-packet one-way delay: 177.688 ms
Loss rate: 0.49%
-- Flow 1:
Average throughput: 35.16 Mbit/s
95th percentile per-packet one-way delay: 175.563 ms
Loss rate: 0.46%
-- Flow 2:
Average throughput: 10.28 Mbit/s
95th percentile per-packet one-way delay: 198.863 ms
Loss rate: 0.43%
-- Flow 3:
Average throughput: 5.77 Mbit/s
95th percentile per-packet one-way delay: 155.144 ms
Loss rate: 1.29%
```

Run 3: Report of TCP Cubic — Data Link

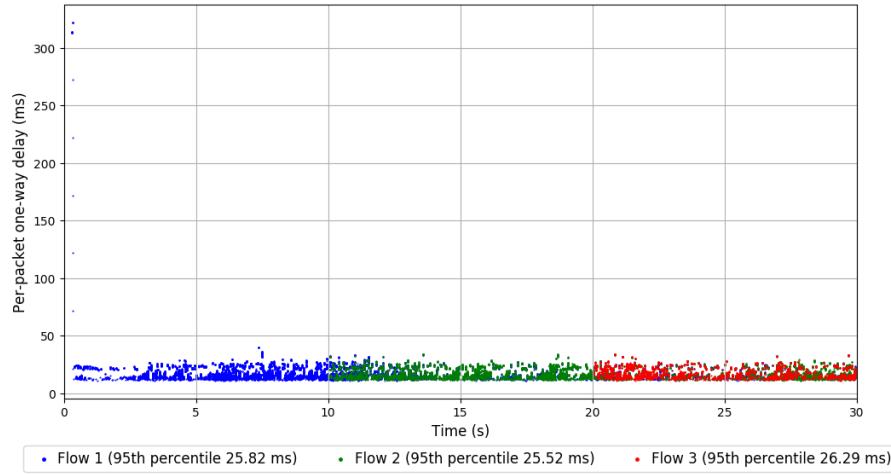
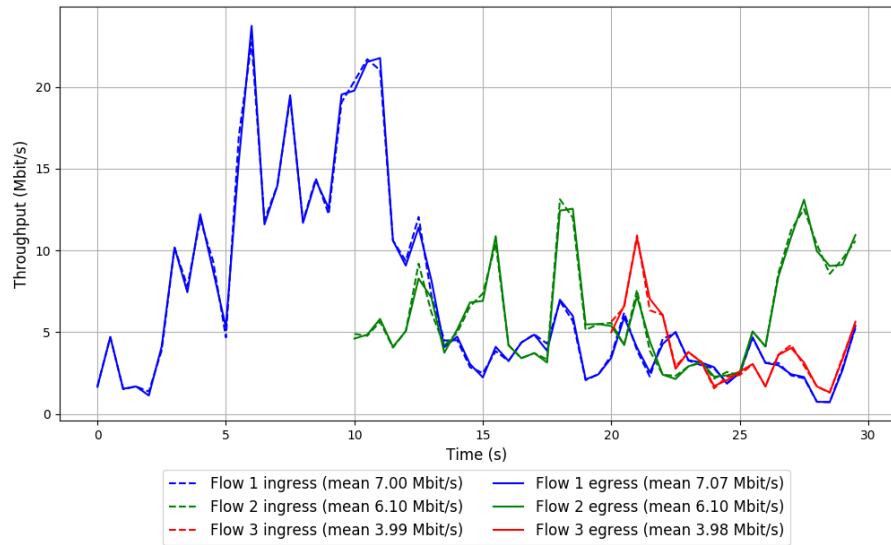


Run 1: Statistics of KohoCC

```
Start at: 2017-08-13 06:55:11
End at: 2017-08-13 06:55:41
Local clock offset: 0.532 ms
Remote clock offset: -2.086 ms

# Below is generated by plot.py at 2017-08-13 07:37:10
# Datalink statistics
-- Total of 3 flows:
Average throughput: 12.50 Mbit/s
95th percentile per-packet one-way delay: 25.779 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 7.07 Mbit/s
95th percentile per-packet one-way delay: 25.816 ms
Loss rate: 0.01%
-- Flow 2:
Average throughput: 6.10 Mbit/s
95th percentile per-packet one-way delay: 25.520 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 3.98 Mbit/s
95th percentile per-packet one-way delay: 26.285 ms
Loss rate: 0.00%
```

Run 1: Report of KohoCC — Data Link

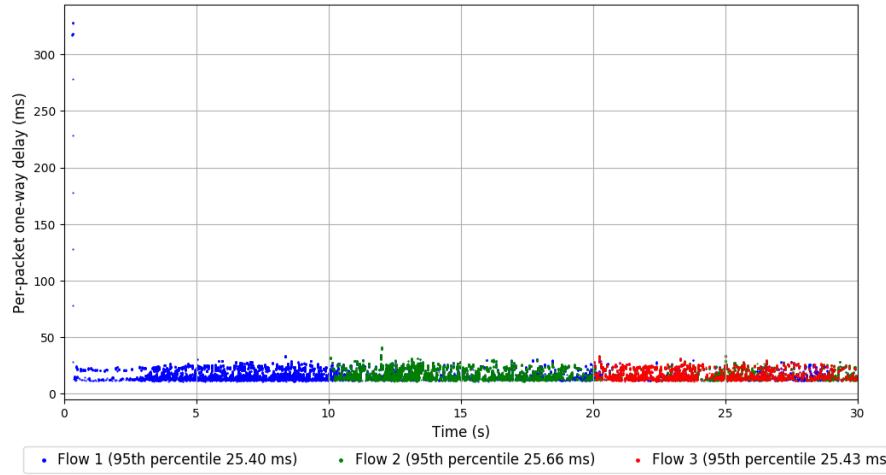
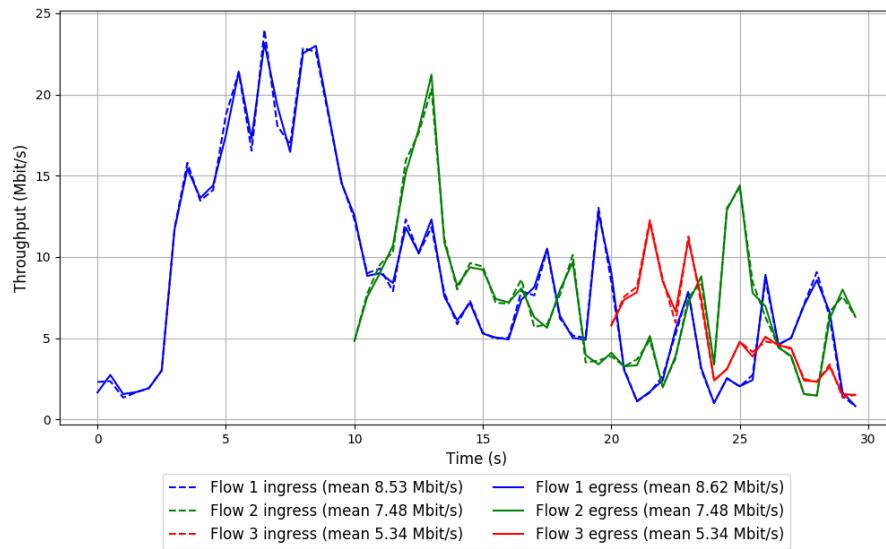


Run 2: Statistics of KohoCC

```
Start at: 2017-08-13 07:13:20
End at: 2017-08-13 07:13:50
Local clock offset: 0.615 ms
Remote clock offset: -1.828 ms

# Below is generated by plot.py at 2017-08-13 07:37:11
# Datalink statistics
-- Total of 3 flows:
Average throughput: 15.44 Mbit/s
95th percentile per-packet one-way delay: 25.502 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 8.62 Mbit/s
95th percentile per-packet one-way delay: 25.396 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 7.48 Mbit/s
95th percentile per-packet one-way delay: 25.656 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 5.34 Mbit/s
95th percentile per-packet one-way delay: 25.435 ms
Loss rate: 0.00%
```

Run 2: Report of KohoCC — Data Link

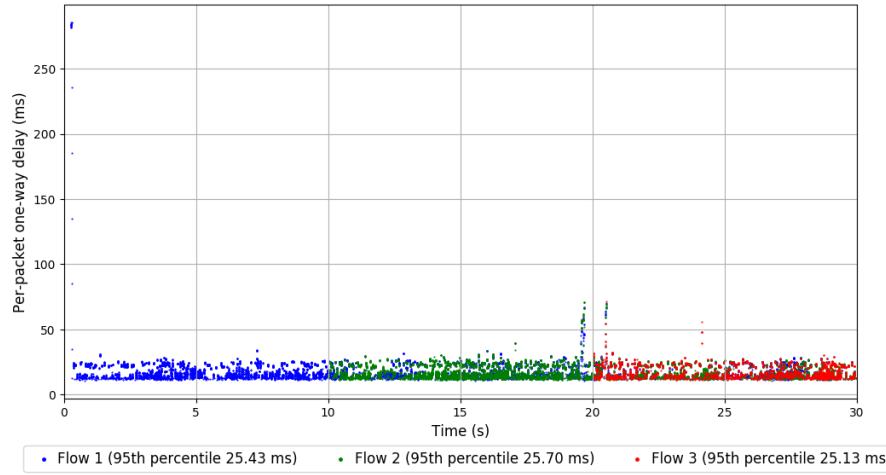
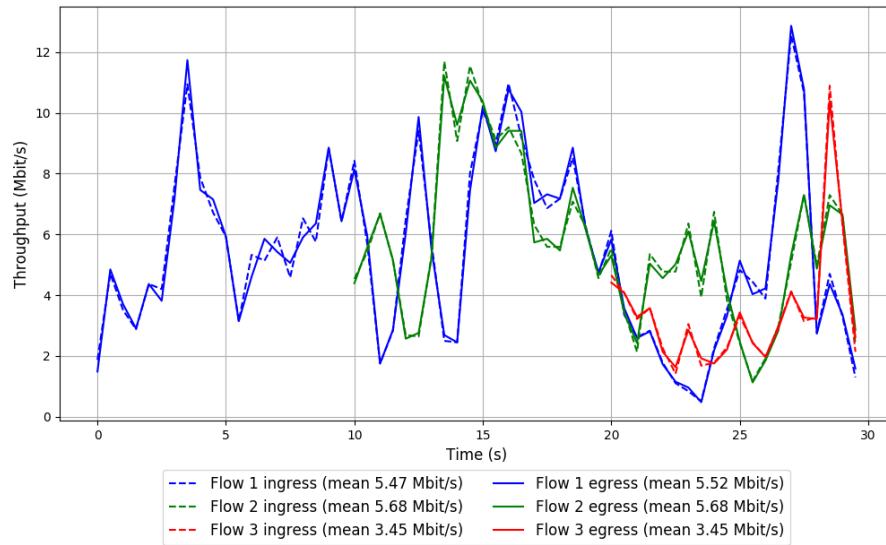


Run 3: Statistics of KohoCC

```
Start at: 2017-08-13 07:31:24
End at: 2017-08-13 07:31:54
Local clock offset: 0.57 ms
Remote clock offset: -1.57 ms

# Below is generated by plot.py at 2017-08-13 07:37:13
# Datalink statistics
-- Total of 3 flows:
Average throughput: 10.49 Mbit/s
95th percentile per-packet one-way delay: 25.458 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 5.52 Mbit/s
95th percentile per-packet one-way delay: 25.432 ms
Loss rate: 0.01%
-- Flow 2:
Average throughput: 5.68 Mbit/s
95th percentile per-packet one-way delay: 25.697 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 3.45 Mbit/s
95th percentile per-packet one-way delay: 25.130 ms
Loss rate: 0.00%
```

Run 3: Report of KohoCC — Data Link

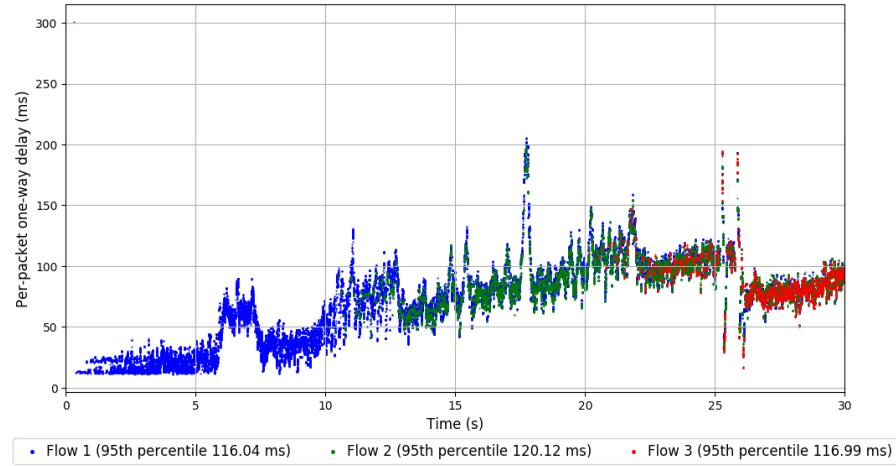
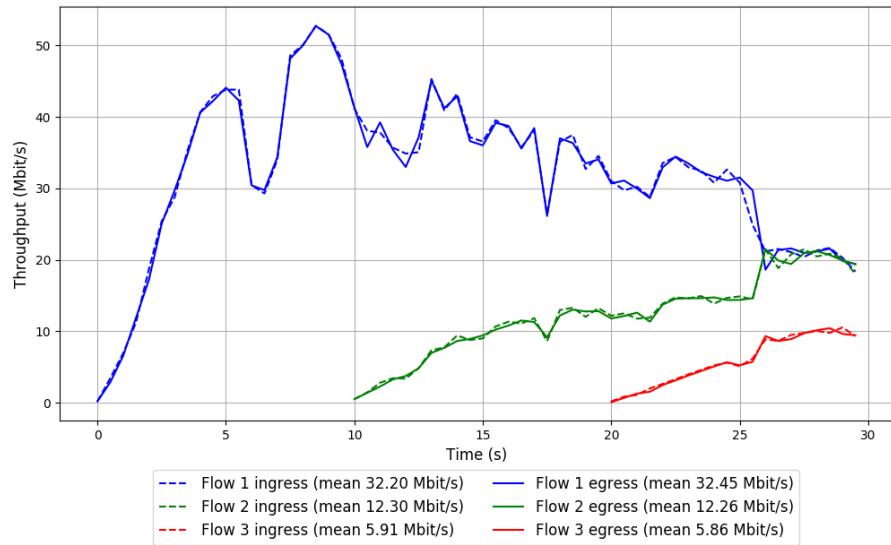


```
Run 1: Statistics of LEDBAT
```

```
Start at: 2017-08-13 06:40:39
End at: 2017-08-13 06:41:09
Local clock offset: 0.576 ms
Remote clock offset: -2.135 ms

# Below is generated by plot.py at 2017-08-13 07:37:16
# Datalink statistics
-- Total of 3 flows:
Average throughput: 42.62 Mbit/s
95th percentile per-packet one-way delay: 116.802 ms
Loss rate: 0.28%
-- Flow 1:
Average throughput: 32.45 Mbit/s
95th percentile per-packet one-way delay: 116.044 ms
Loss rate: 0.15%
-- Flow 2:
Average throughput: 12.26 Mbit/s
95th percentile per-packet one-way delay: 120.125 ms
Loss rate: 0.47%
-- Flow 3:
Average throughput: 5.86 Mbit/s
95th percentile per-packet one-way delay: 116.991 ms
Loss rate: 1.58%
```

Run 1: Report of LEDBAT — Data Link

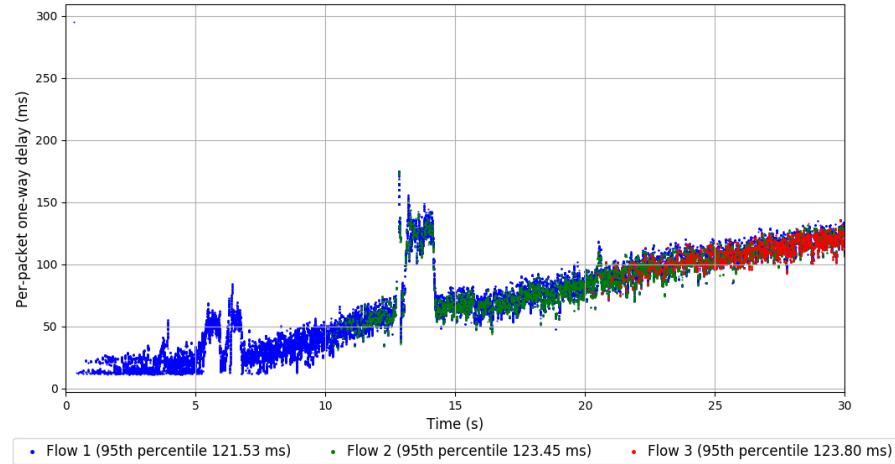
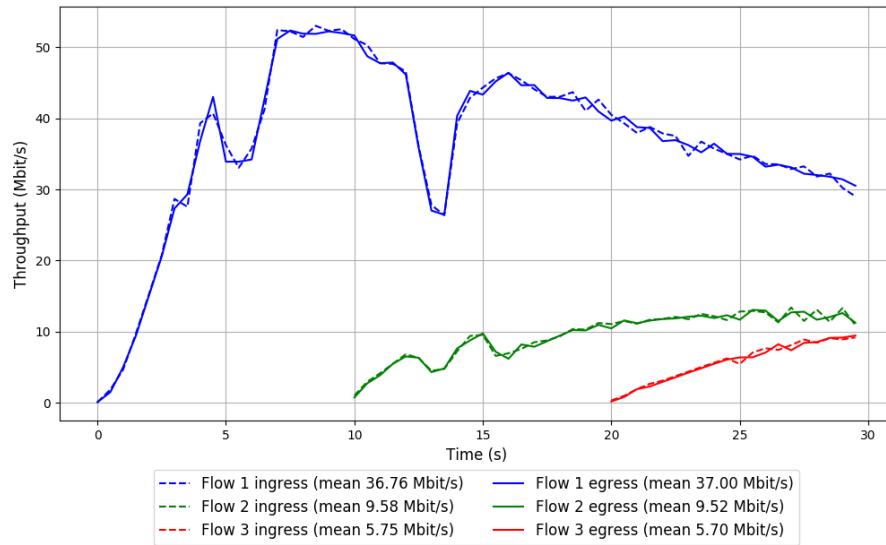


Run 2: Statistics of LEDBAT

```
Start at: 2017-08-13 06:58:48
End at: 2017-08-13 06:59:18
Local clock offset: 0.64 ms
Remote clock offset: -2.111 ms

# Below is generated by plot.py at 2017-08-13 07:37:19
# Datalink statistics
-- Total of 3 flows:
Average throughput: 45.29 Mbit/s
95th percentile per-packet one-way delay: 122.168 ms
Loss rate: 0.39%
-- Flow 1:
Average throughput: 37.00 Mbit/s
95th percentile per-packet one-way delay: 121.528 ms
Loss rate: 0.26%
-- Flow 2:
Average throughput: 9.52 Mbit/s
95th percentile per-packet one-way delay: 123.452 ms
Loss rate: 0.85%
-- Flow 3:
Average throughput: 5.70 Mbit/s
95th percentile per-packet one-way delay: 123.799 ms
Loss rate: 1.50%
```

Run 2: Report of LEDBAT — Data Link

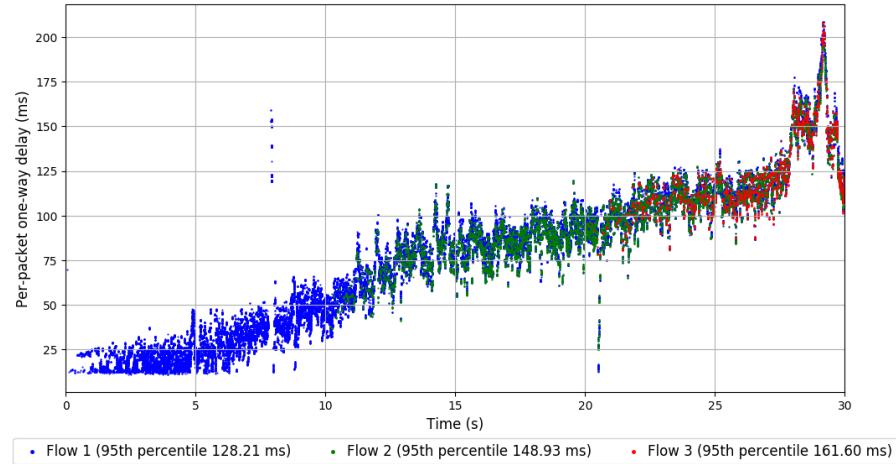
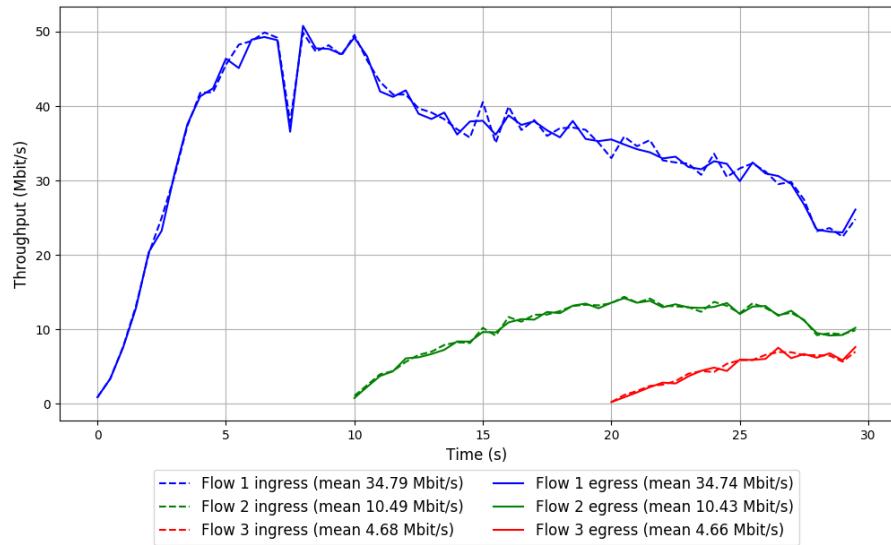


Run 3: Statistics of LEDBAT

```
Start at: 2017-08-13 07:16:55
End at: 2017-08-13 07:17:25
Local clock offset: 0.516 ms
Remote clock offset: -1.747 ms

# Below is generated by plot.py at 2017-08-13 07:37:25
# Datalink statistics
-- Total of 3 flows:
Average throughput: 43.23 Mbit/s
95th percentile per-packet one-way delay: 139.567 ms
Loss rate: 0.38%
-- Flow 1:
Average throughput: 34.74 Mbit/s
95th percentile per-packet one-way delay: 128.211 ms
Loss rate: 0.28%
-- Flow 2:
Average throughput: 10.43 Mbit/s
95th percentile per-packet one-way delay: 148.925 ms
Loss rate: 0.66%
-- Flow 3:
Average throughput: 4.66 Mbit/s
95th percentile per-packet one-way delay: 161.599 ms
Loss rate: 1.19%
```

Run 3: Report of LEDBAT — Data Link

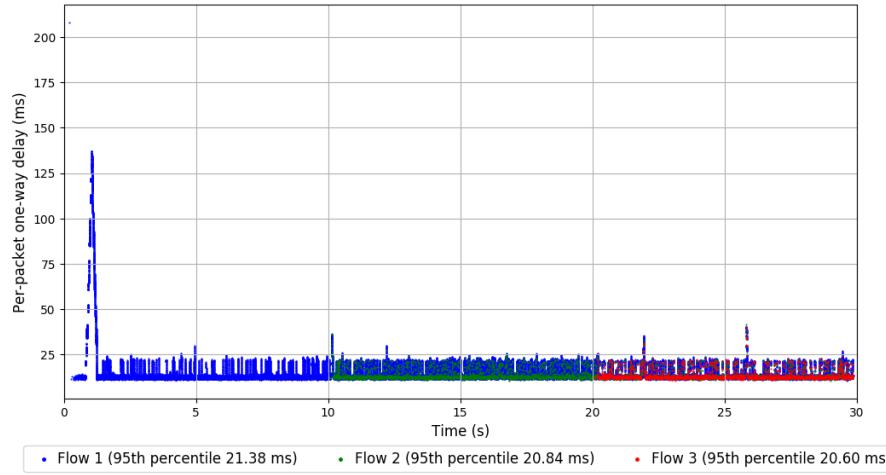
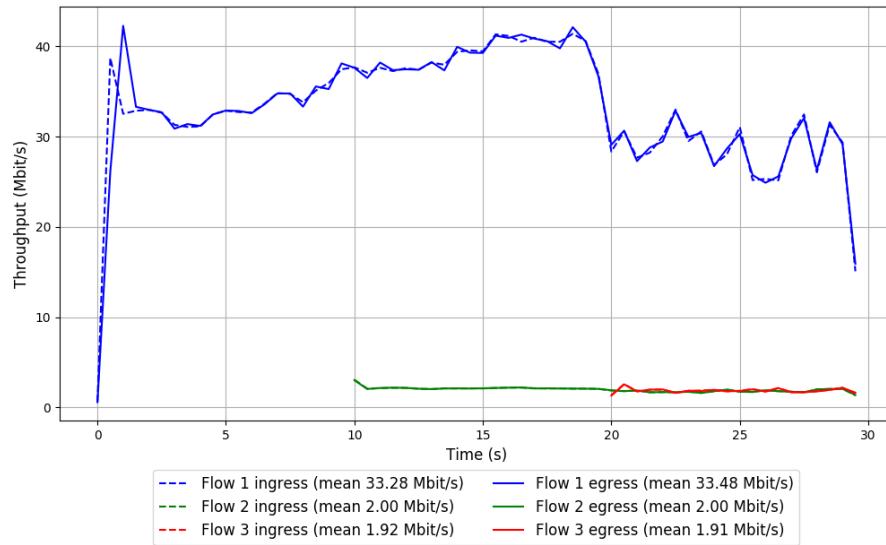


Run 1: Statistics of PCC

```
Start at: 2017-08-13 06:41:53
End at: 2017-08-13 06:42:23
Local clock offset: 0.66 ms
Remote clock offset: -2.088 ms

# Below is generated by plot.py at 2017-08-13 07:37:25
# Datalink statistics
-- Total of 3 flows:
Average throughput: 35.45 Mbit/s
95th percentile per-packet one-way delay: 21.321 ms
Loss rate: 0.08%
-- Flow 1:
Average throughput: 33.48 Mbit/s
95th percentile per-packet one-way delay: 21.378 ms
Loss rate: 0.08%
-- Flow 2:
Average throughput: 2.00 Mbit/s
95th percentile per-packet one-way delay: 20.843 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 1.91 Mbit/s
95th percentile per-packet one-way delay: 20.596 ms
Loss rate: 0.00%
```

Run 1: Report of PCC — Data Link

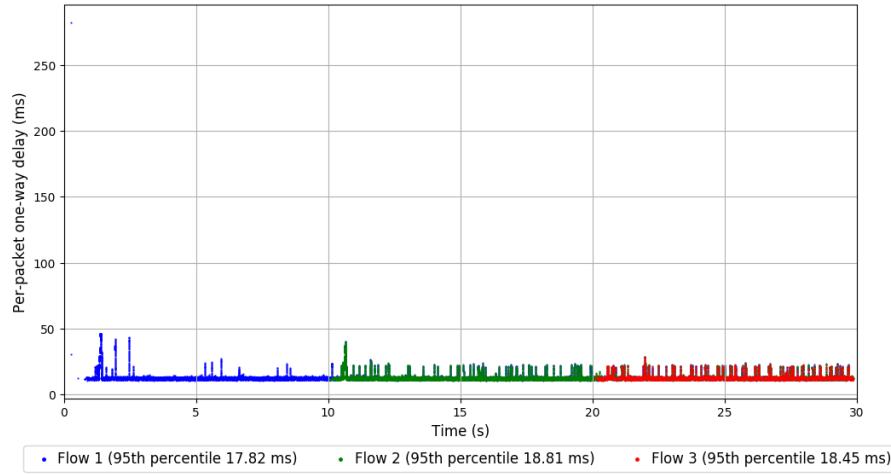
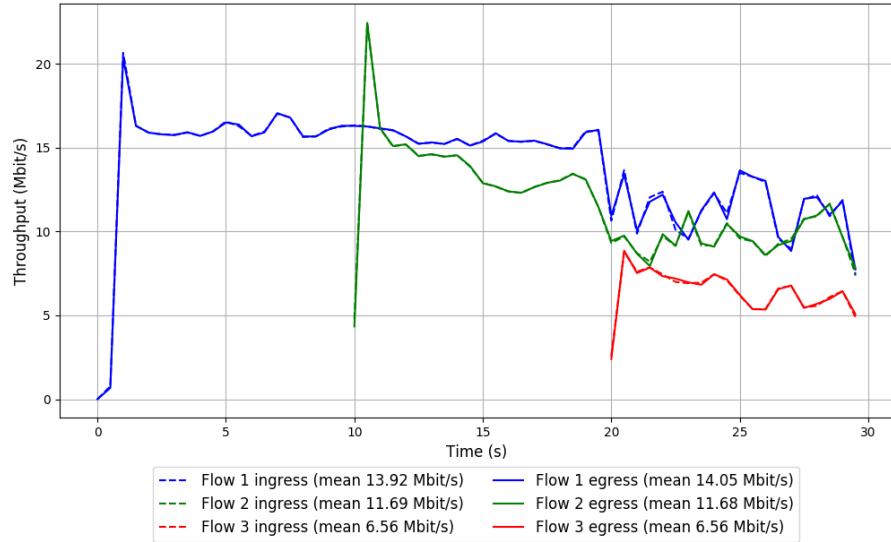


Run 2: Statistics of PCC

```
Start at: 2017-08-13 07:00:02
End at: 2017-08-13 07:00:32
Local clock offset: 0.555 ms
Remote clock offset: -2.039 ms

# Below is generated by plot.py at 2017-08-13 07:37:29
# Datalink statistics
-- Total of 3 flows:
Average throughput: 24.06 Mbit/s
95th percentile per-packet one-way delay: 18.282 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 14.05 Mbit/s
95th percentile per-packet one-way delay: 17.820 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 11.68 Mbit/s
95th percentile per-packet one-way delay: 18.808 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 6.56 Mbit/s
95th percentile per-packet one-way delay: 18.446 ms
Loss rate: 0.00%
```

Run 2: Report of PCC — Data Link

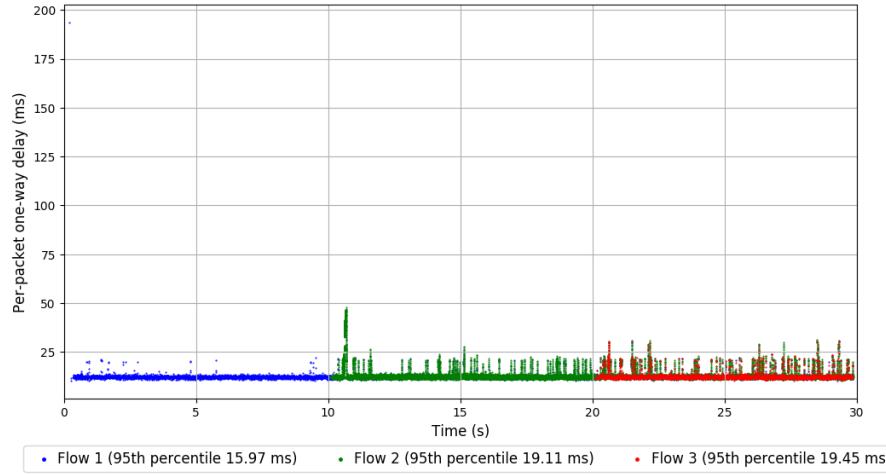
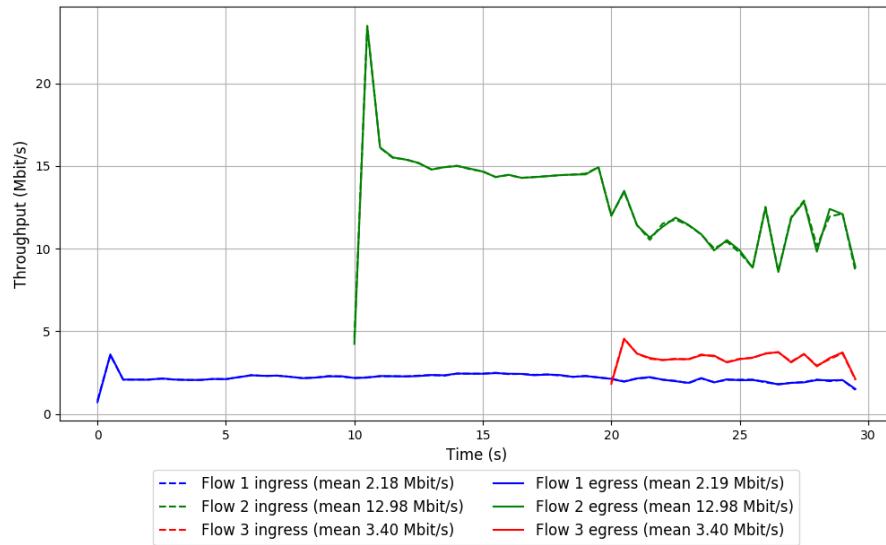


Run 3: Statistics of PCC

```
Start at: 2017-08-13 07:18:08
End at: 2017-08-13 07:18:38
Local clock offset: 0.606 ms
Remote clock offset: -1.72 ms

# Below is generated by plot.py at 2017-08-13 07:37:29
# Datalink statistics
-- Total of 3 flows:
Average throughput: 12.00 Mbit/s
95th percentile per-packet one-way delay: 18.696 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 2.19 Mbit/s
95th percentile per-packet one-way delay: 15.972 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 12.98 Mbit/s
95th percentile per-packet one-way delay: 19.111 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 3.40 Mbit/s
95th percentile per-packet one-way delay: 19.452 ms
Loss rate: 0.00%
```

Run 3: Report of PCC — Data Link

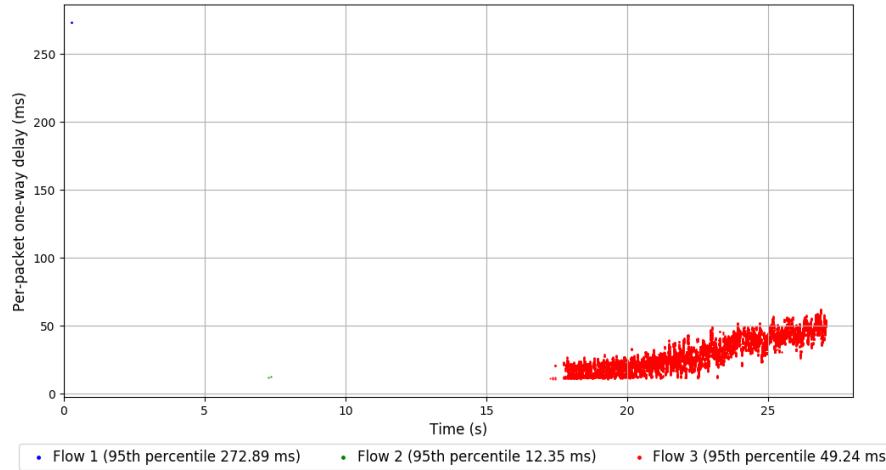
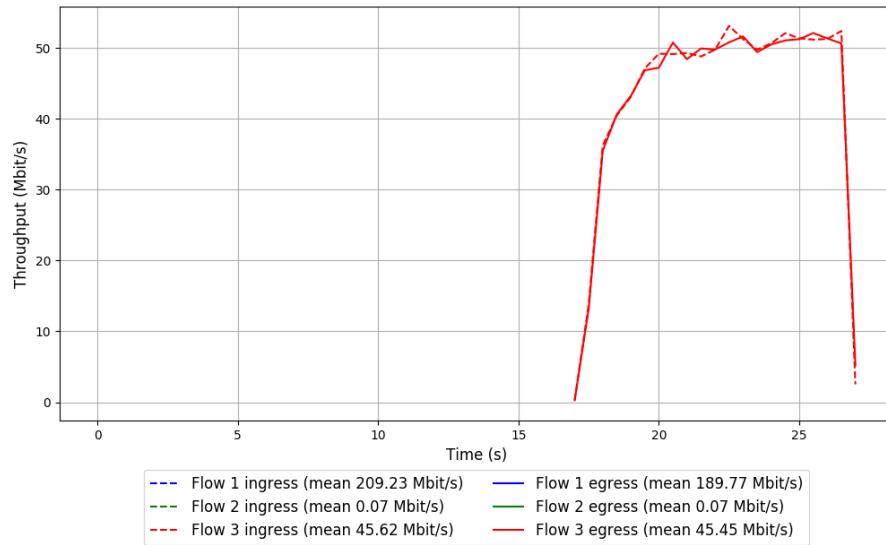


```
Run 1: Statistics of QUIC Cubic
```

```
Start at: 2017-08-13 06:49:11
End at: 2017-08-13 06:49:41
Local clock offset: 0.642 ms
Remote clock offset: -2.088 ms

# Below is generated by plot.py at 2017-08-13 07:37:31
# Datalink statistics
-- Total of 3 flows:
Average throughput: 16.61 Mbit/s
95th percentile per-packet one-way delay: 49.255 ms
Loss rate: 0.34%
-- Flow 1:
Average throughput: 189.77 Mbit/s
95th percentile per-packet one-way delay: 272.886 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 0.07 Mbit/s
95th percentile per-packet one-way delay: 12.354 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 45.45 Mbit/s
95th percentile per-packet one-way delay: 49.245 ms
Loss rate: 0.34%
```

Run 1: Report of QUIC Cubic — Data Link

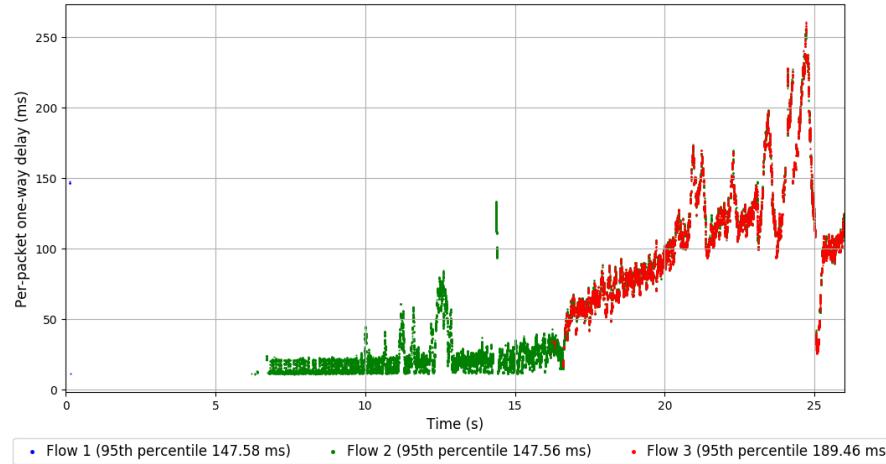
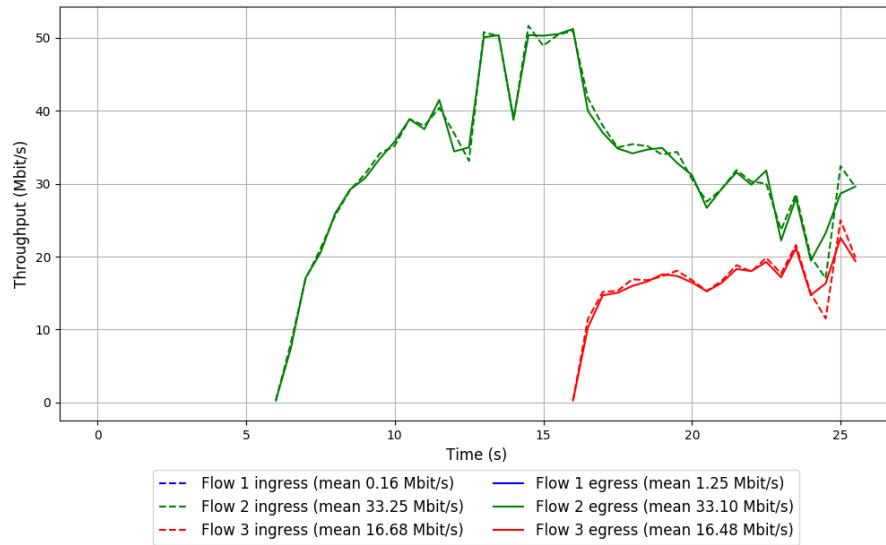


Run 2: Statistics of QUIC Cubic

```
Start at: 2017-08-13 07:07:19
End at: 2017-08-13 07:07:49
Local clock offset: 0.546 ms
Remote clock offset: -1.981 ms

# Below is generated by plot.py at 2017-08-13 07:37:34
# Datalink statistics
-- Total of 3 flows:
Average throughput: 31.60 Mbit/s
95th percentile per-packet one-way delay: 159.839 ms
Loss rate: 0.62%
-- Flow 1:
Average throughput: 1.25 Mbit/s
95th percentile per-packet one-way delay: 147.579 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 33.10 Mbit/s
95th percentile per-packet one-way delay: 147.562 ms
Loss rate: 0.45%
-- Flow 3:
Average throughput: 16.48 Mbit/s
95th percentile per-packet one-way delay: 189.461 ms
Loss rate: 1.33%
```

Run 2: Report of QUIC Cubic — Data Link

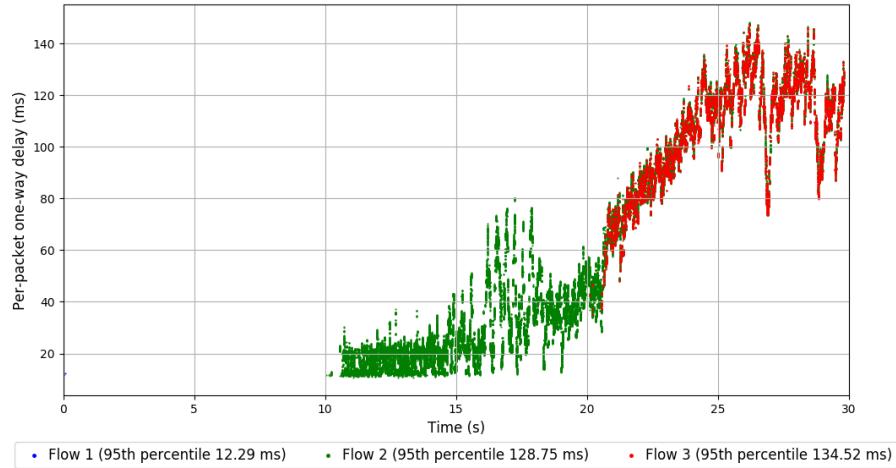
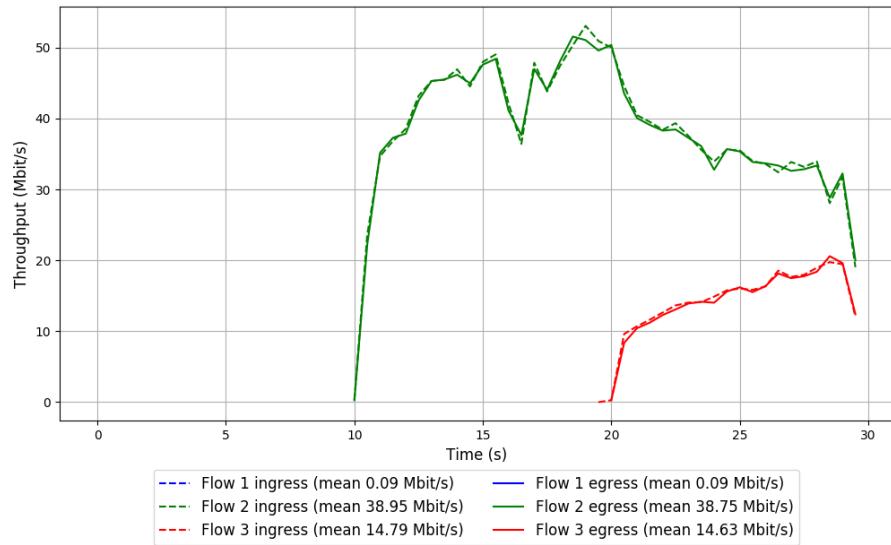


Run 3: Statistics of QUIC Cubic

```
Start at: 2017-08-13 07:25:22
End at: 2017-08-13 07:25:52
Local clock offset: 0.584 ms
Remote clock offset: -1.5 ms

# Below is generated by plot.py at 2017-08-13 07:37:35
# Datalink statistics
-- Total of 3 flows:
Average throughput: 30.49 Mbit/s
95th percentile per-packet one-way delay: 130.255 ms
Loss rate: 0.63%
-- Flow 1:
Average throughput: 0.09 Mbit/s
95th percentile per-packet one-way delay: 12.288 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 38.75 Mbit/s
95th percentile per-packet one-way delay: 128.748 ms
Loss rate: 0.49%
-- Flow 3:
Average throughput: 14.63 Mbit/s
95th percentile per-packet one-way delay: 134.522 ms
Loss rate: 1.40%
```

Run 3: Report of QUIC Cubic — Data Link

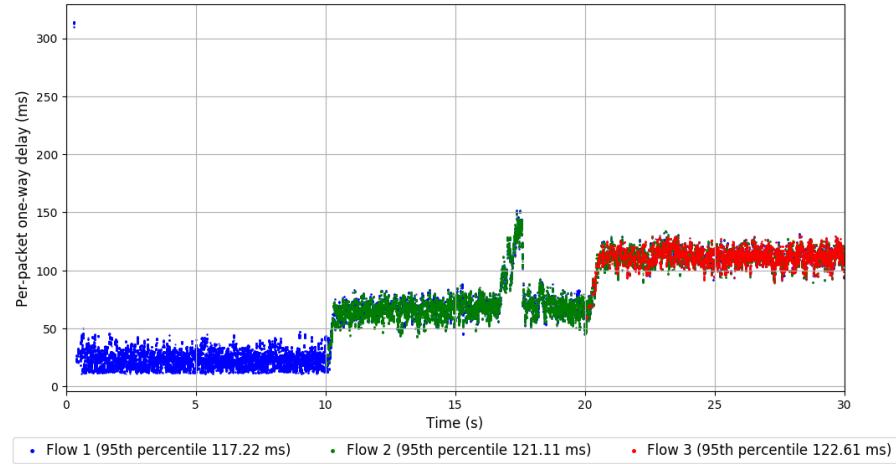
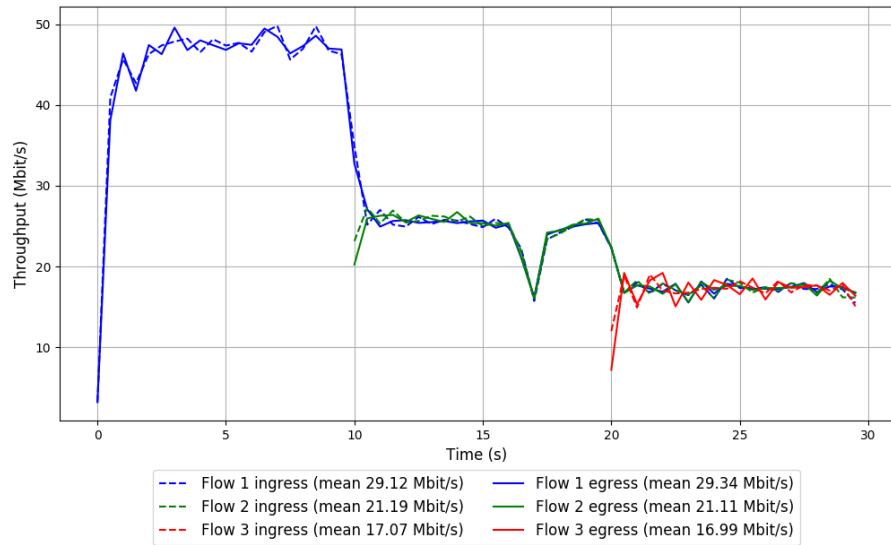


```
Run 1: Statistics of Saturator
```

```
Start at: 2017-08-13 06:44:18
End at: 2017-08-13 06:44:48
Local clock offset: 0.656 ms
Remote clock offset: -2.122 ms

# Below is generated by plot.py at 2017-08-13 07:37:40
# Datalink statistics
-- Total of 3 flows:
Average throughput: 49.21 Mbit/s
95th percentile per-packet one-way delay: 120.043 ms
Loss rate: 0.28%
-- Flow 1:
Average throughput: 29.34 Mbit/s
95th percentile per-packet one-way delay: 117.219 ms
Loss rate: 0.15%
-- Flow 2:
Average throughput: 21.11 Mbit/s
95th percentile per-packet one-way delay: 121.115 ms
Loss rate: 0.32%
-- Flow 3:
Average throughput: 16.99 Mbit/s
95th percentile per-packet one-way delay: 122.610 ms
Loss rate: 0.84%
```

Run 1: Report of Saturator — Data Link

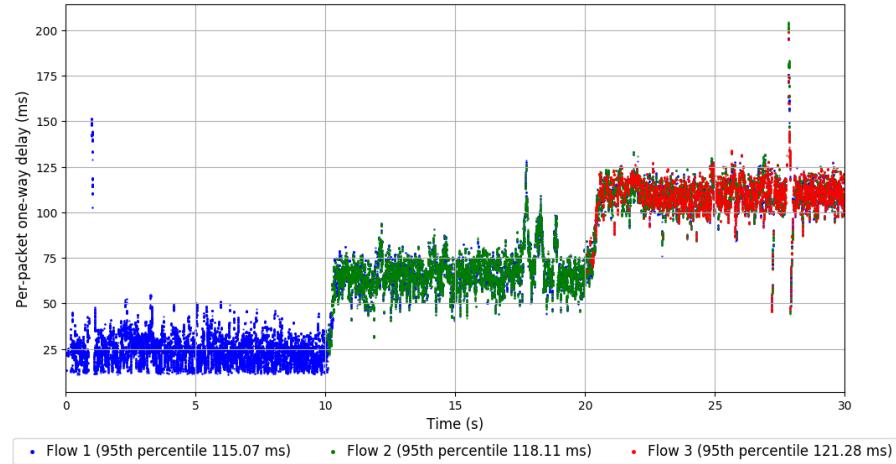
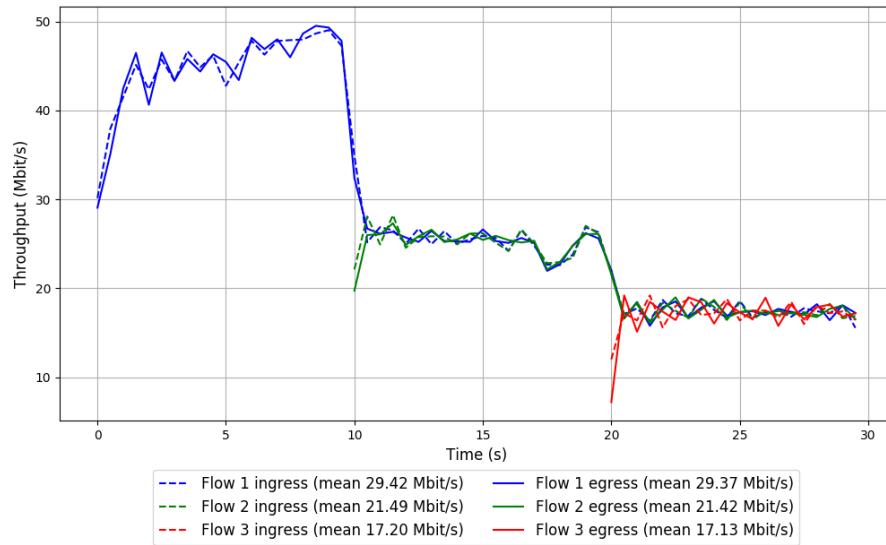


Run 2: Statistics of Saturator

```
Start at: 2017-08-13 07:02:26
End at: 2017-08-13 07:02:56
Local clock offset: 0.566 ms
Remote clock offset: -2.098 ms

# Below is generated by plot.py at 2017-08-13 07:37:43
# Datalink statistics
-- Total of 3 flows:
Average throughput: 49.28 Mbit/s
95th percentile per-packet one-way delay: 117.834 ms
Loss rate: 0.30%
-- Flow 1:
Average throughput: 29.37 Mbit/s
95th percentile per-packet one-way delay: 115.066 ms
Loss rate: 0.14%
-- Flow 2:
Average throughput: 21.42 Mbit/s
95th percentile per-packet one-way delay: 118.110 ms
Loss rate: 0.40%
-- Flow 3:
Average throughput: 17.13 Mbit/s
95th percentile per-packet one-way delay: 121.275 ms
Loss rate: 0.87%
```

Run 2: Report of Saturator — Data Link



Run 3: Statistics of Saturator

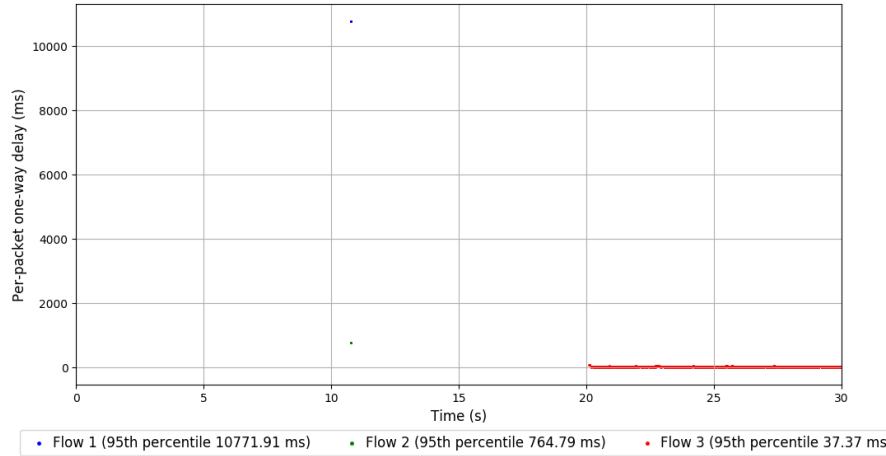
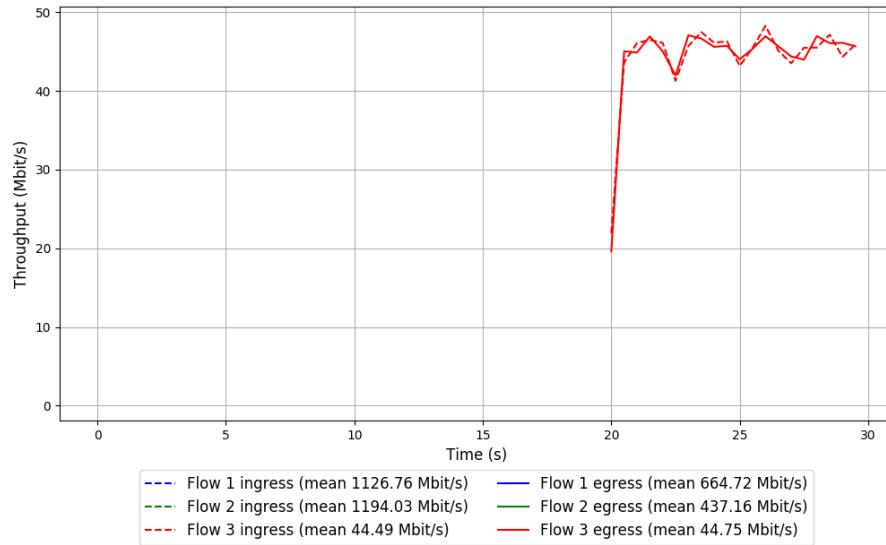
Start at: 2017-08-13 07:20:32

End at: 2017-08-13 07:21:02

Local clock offset: 0.613 ms

Remote clock offset: -1.565 ms

Run 3: Report of Saturator — Data Link

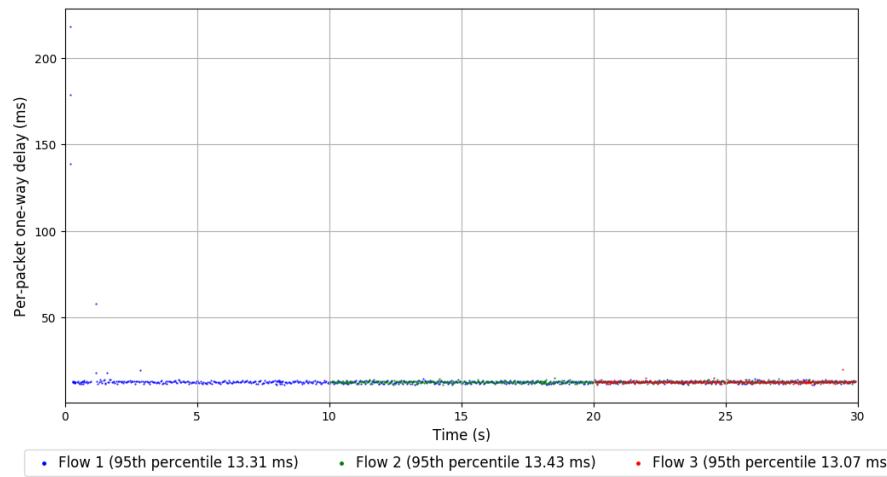
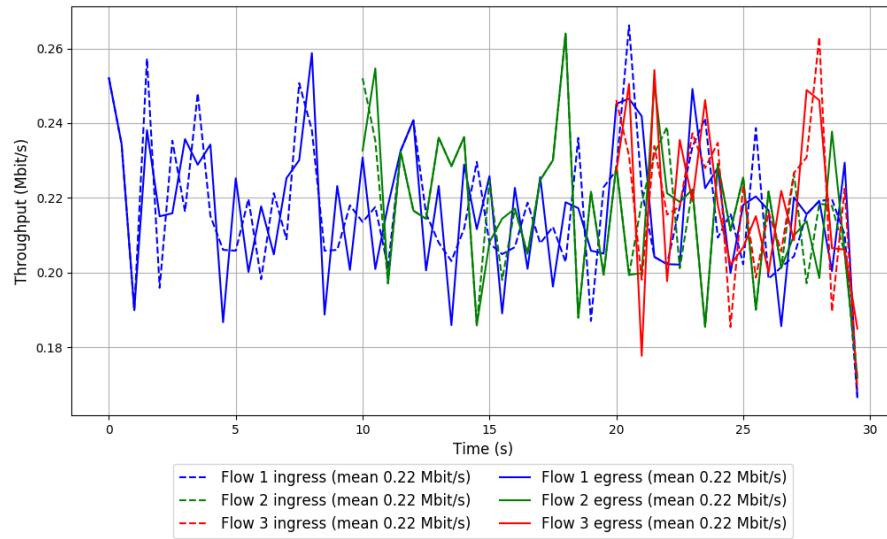


```
Run 1: Statistics of SCReAM
```

```
Start at: 2017-08-13 06:48:00
End at: 2017-08-13 06:48:30
Local clock offset: 0.579 ms
Remote clock offset: -1.96 ms

# Below is generated by plot.py at 2017-08-13 07:37:45
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.44 Mbit/s
95th percentile per-packet one-way delay: 13.312 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 0.22 Mbit/s
95th percentile per-packet one-way delay: 13.312 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 0.22 Mbit/s
95th percentile per-packet one-way delay: 13.427 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 0.22 Mbit/s
95th percentile per-packet one-way delay: 13.068 ms
Loss rate: 0.00%
```

Run 1: Report of SCReAM — Data Link

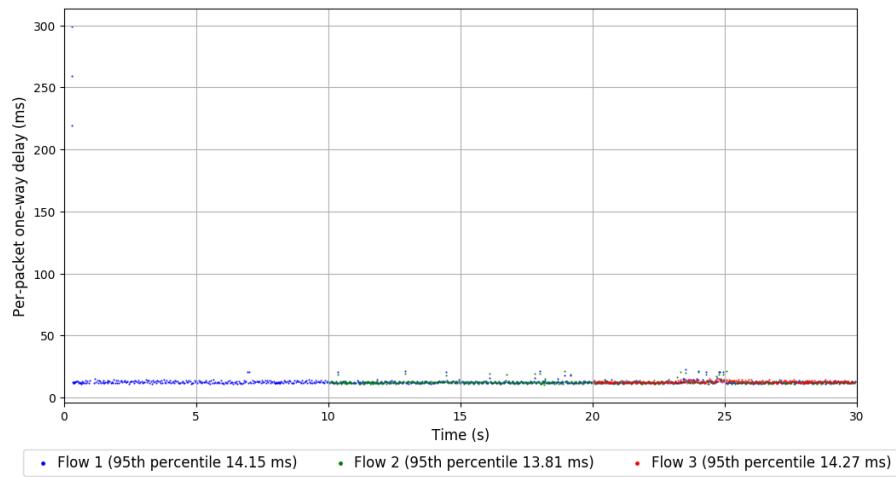
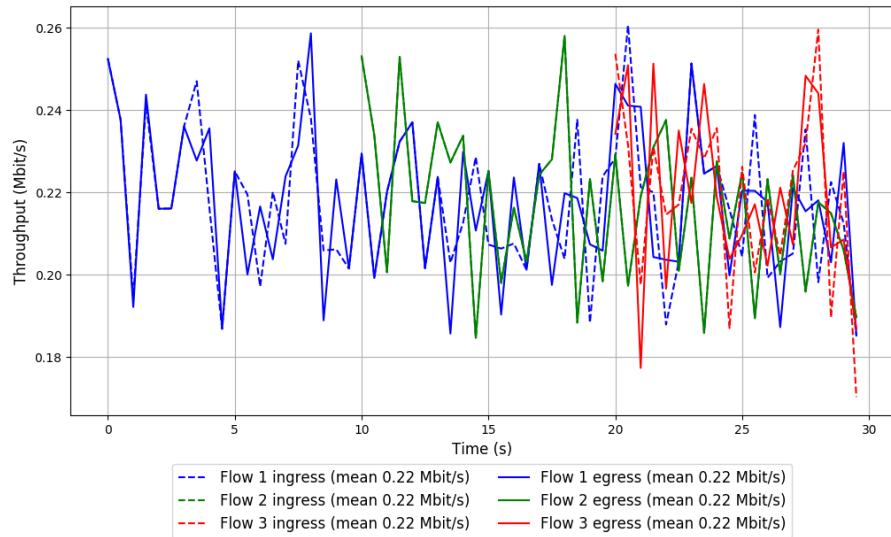


Run 2: Statistics of SCReAM

```
Start at: 2017-08-13 07:06:08
End at: 2017-08-13 07:06:38
Local clock offset: 0.604 ms
Remote clock offset: -2.003 ms

# Below is generated by plot.py at 2017-08-13 07:37:45
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.44 Mbit/s
95th percentile per-packet one-way delay: 14.161 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 0.22 Mbit/s
95th percentile per-packet one-way delay: 14.152 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 0.22 Mbit/s
95th percentile per-packet one-way delay: 13.811 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 0.22 Mbit/s
95th percentile per-packet one-way delay: 14.268 ms
Loss rate: 0.00%
```

Run 2: Report of SCReAM — Data Link

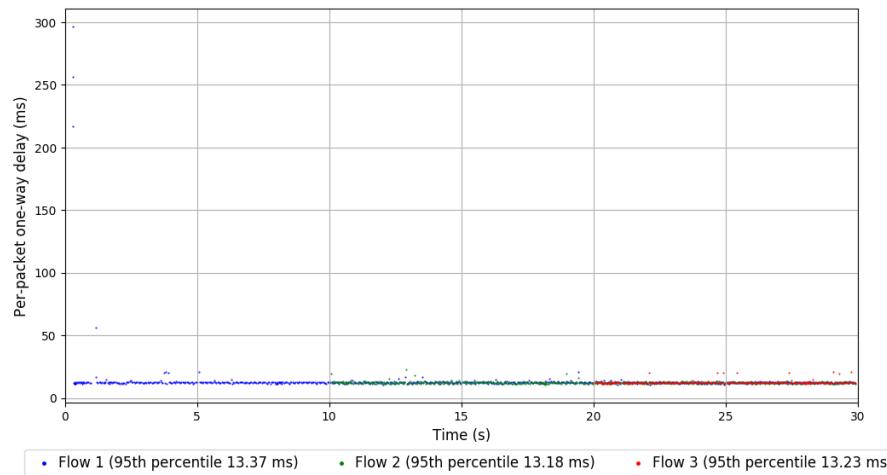
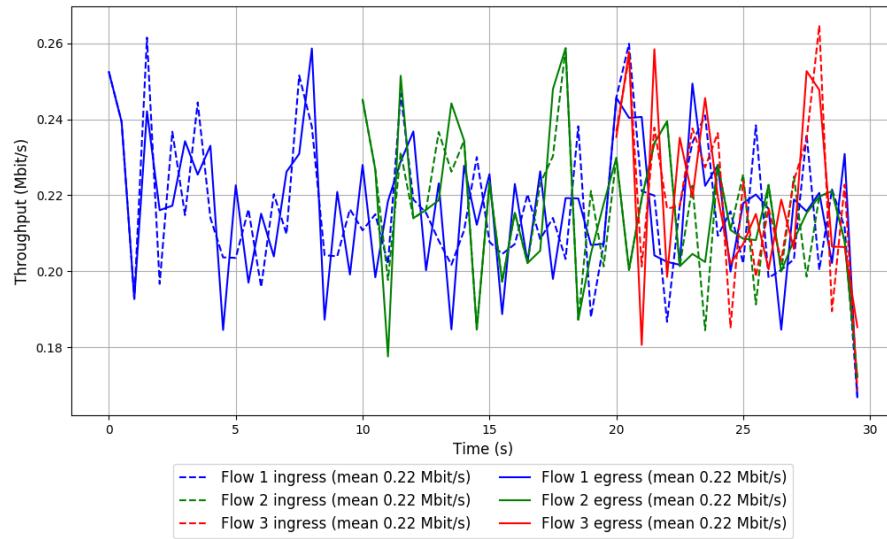


Run 3: Statistics of SCReAM

```
Start at: 2017-08-13 07:24:11
End at: 2017-08-13 07:24:41
Local clock offset: 0.602 ms
Remote clock offset: -1.551 ms

# Below is generated by plot.py at 2017-08-13 07:37:46
# Datalink statistics
-- Total of 3 flows:
Average throughput: 0.44 Mbit/s
95th percentile per-packet one-way delay: 13.238 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 0.22 Mbit/s
95th percentile per-packet one-way delay: 13.374 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 0.22 Mbit/s
95th percentile per-packet one-way delay: 13.178 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 0.22 Mbit/s
95th percentile per-packet one-way delay: 13.226 ms
Loss rate: 0.00%
```

Run 3: Report of SCReAM — Data Link

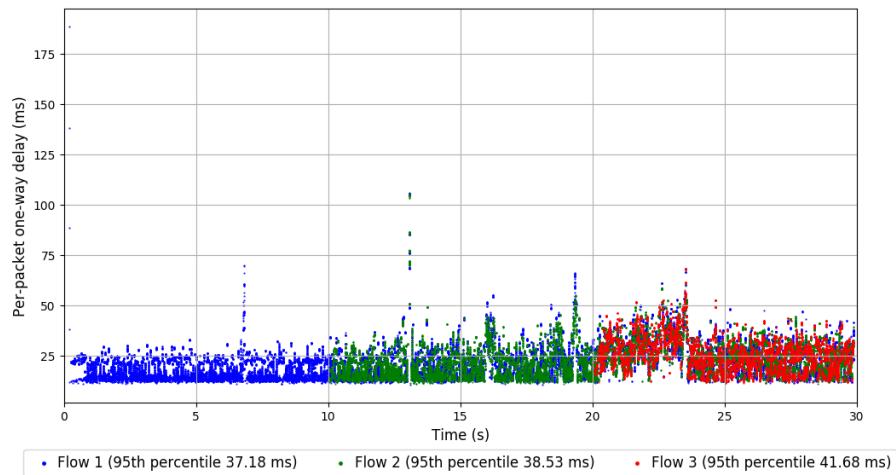
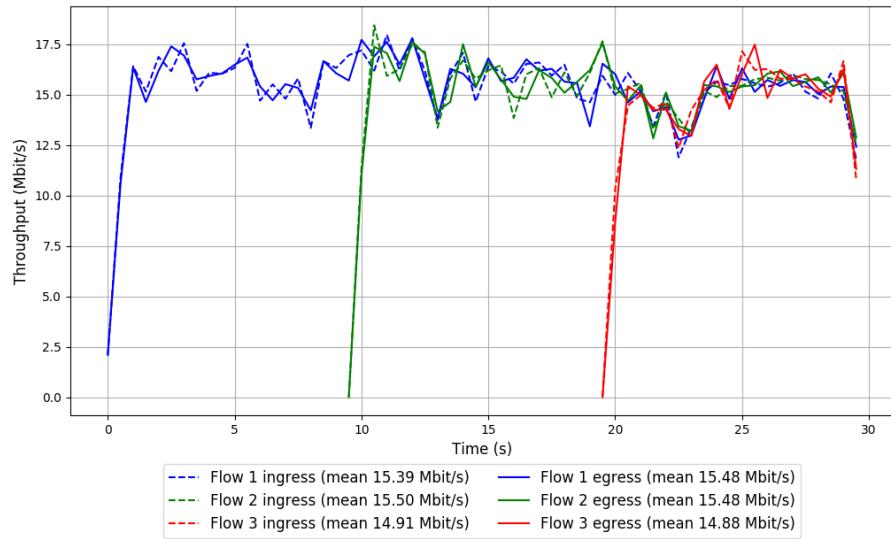


Run 1: Statistics of Sprout

```
Start at: 2017-08-13 06:53:59
End at: 2017-08-13 06:54:29
Local clock offset: 0.573 ms
Remote clock offset: -2.103 ms

# Below is generated by plot.py at 2017-08-13 07:37:50
# Datalink statistics
-- Total of 3 flows:
Average throughput: 30.80 Mbit/s
95th percentile per-packet one-way delay: 38.865 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 15.48 Mbit/s
95th percentile per-packet one-way delay: 37.179 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 15.48 Mbit/s
95th percentile per-packet one-way delay: 38.534 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 14.88 Mbit/s
95th percentile per-packet one-way delay: 41.679 ms
Loss rate: 0.00%
```

Run 1: Report of Sprout — Data Link

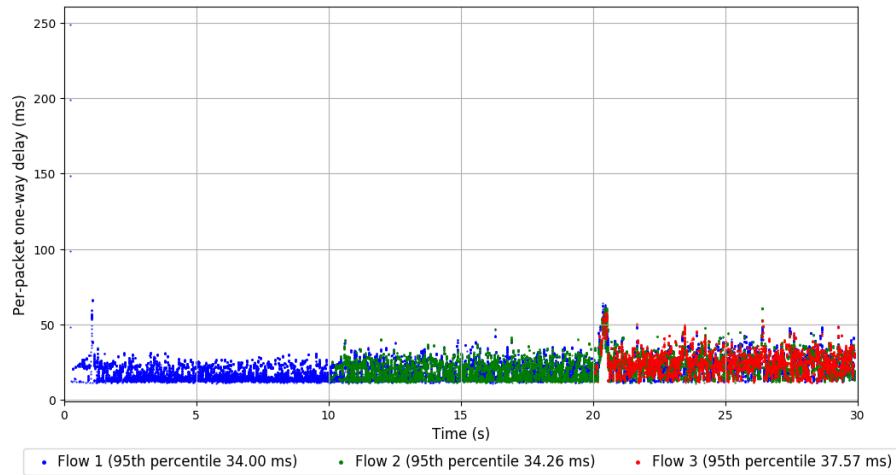
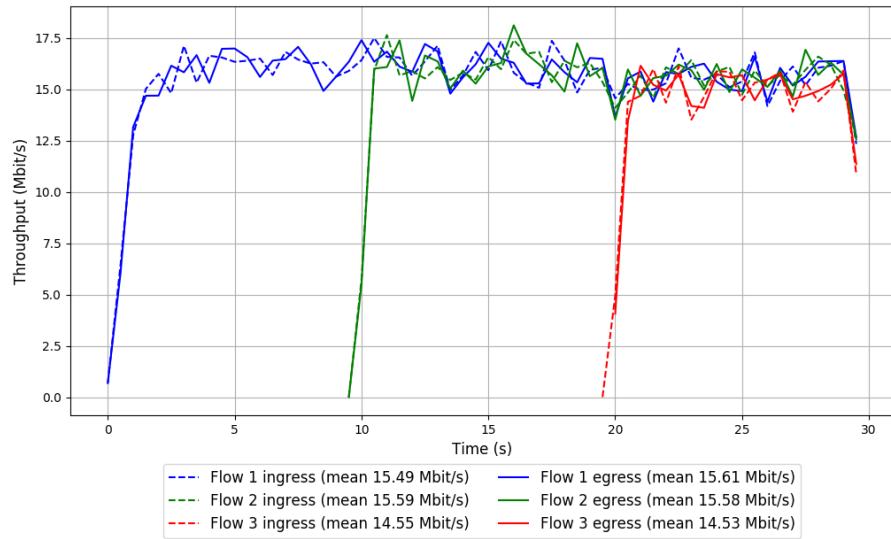


Run 2: Statistics of Sprout

```
Start at: 2017-08-13 07:12:08
End at: 2017-08-13 07:12:38
Local clock offset: 0.521 ms
Remote clock offset: -1.803 ms

# Below is generated by plot.py at 2017-08-13 07:37:51
# Datalink statistics
-- Total of 3 flows:
Average throughput: 30.91 Mbit/s
95th percentile per-packet one-way delay: 34.747 ms
Loss rate: 0.01%
-- Flow 1:
Average throughput: 15.61 Mbit/s
95th percentile per-packet one-way delay: 34.002 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 15.58 Mbit/s
95th percentile per-packet one-way delay: 34.262 ms
Loss rate: 0.03%
-- Flow 3:
Average throughput: 14.53 Mbit/s
95th percentile per-packet one-way delay: 37.567 ms
Loss rate: 0.00%
```

Run 2: Report of Sprout — Data Link

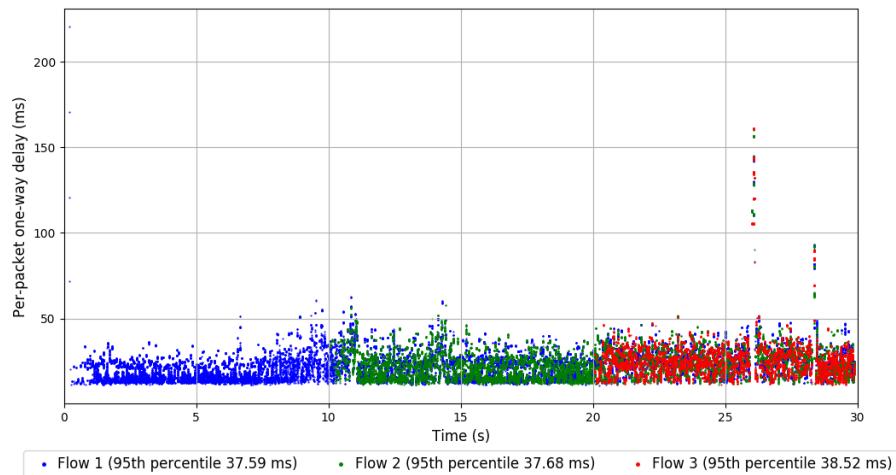
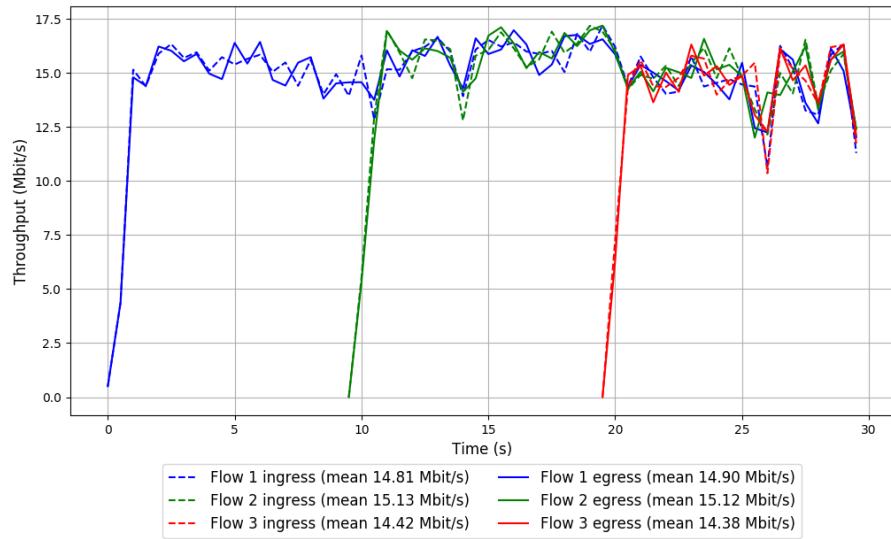


Run 3: Statistics of Sprout

```
Start at: 2017-08-13 07:30:12
End at: 2017-08-13 07:30:42
Local clock offset: 0.588 ms
Remote clock offset: -1.475 ms

# Below is generated by plot.py at 2017-08-13 07:37:55
# Datalink statistics
-- Total of 3 flows:
Average throughput: 29.83 Mbit/s
95th percentile per-packet one-way delay: 37.829 ms
Loss rate: 0.09%
-- Flow 1:
Average throughput: 14.90 Mbit/s
95th percentile per-packet one-way delay: 37.594 ms
Loss rate: 0.07%
-- Flow 2:
Average throughput: 15.12 Mbit/s
95th percentile per-packet one-way delay: 37.678 ms
Loss rate: 0.04%
-- Flow 3:
Average throughput: 14.38 Mbit/s
95th percentile per-packet one-way delay: 38.516 ms
Loss rate: 0.28%
```

Run 3: Report of Sprout — Data Link

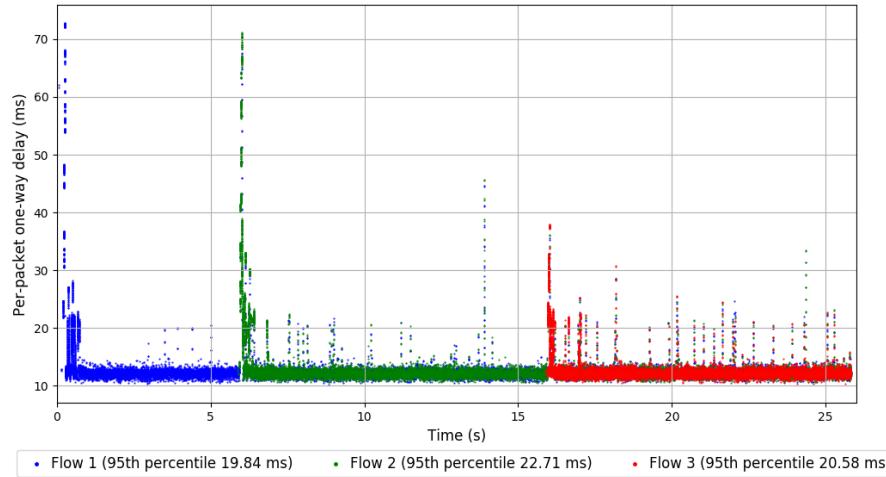
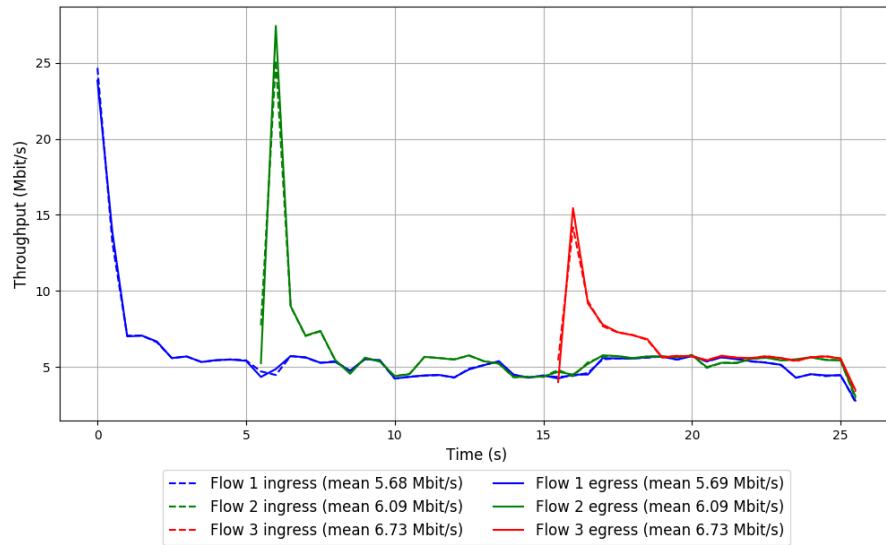


Run 1: Statistics of TaoVA-100x

```
Start at: 2017-08-13 06:43:06
End at: 2017-08-13 06:43:36
Local clock offset: 0.587 ms
Remote clock offset: -2.129 ms

# Below is generated by plot.py at 2017-08-13 07:37:55
# Datalink statistics
-- Total of 3 flows:
Average throughput: 13.01 Mbit/s
95th percentile per-packet one-way delay: 21.163 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 5.69 Mbit/s
95th percentile per-packet one-way delay: 19.843 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 6.09 Mbit/s
95th percentile per-packet one-way delay: 22.706 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 6.73 Mbit/s
95th percentile per-packet one-way delay: 20.582 ms
Loss rate: 0.00%
```

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

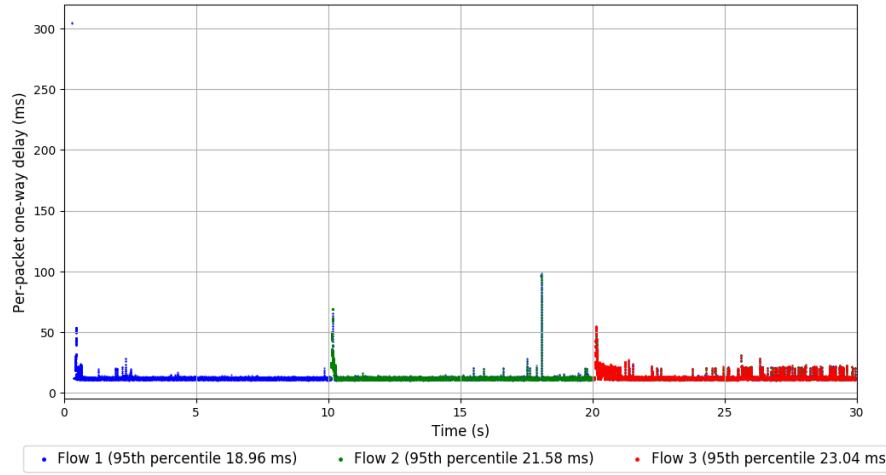
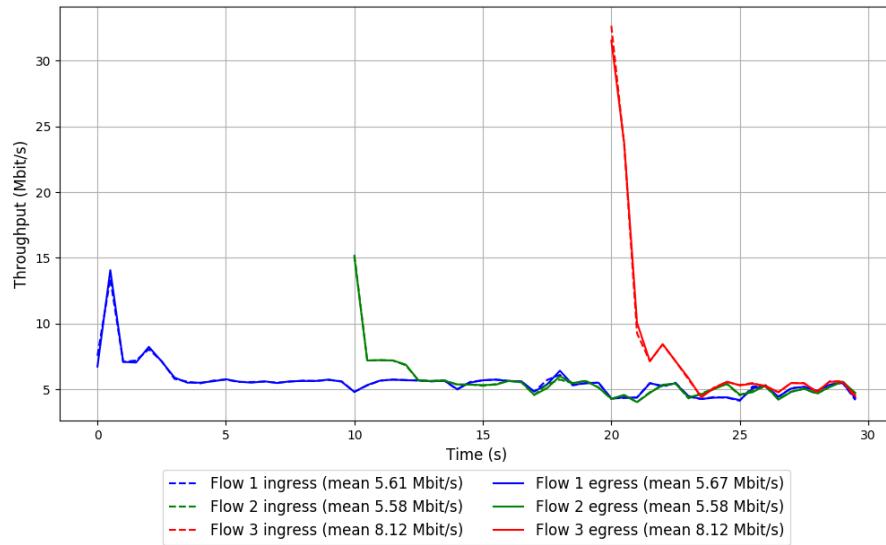


Run 2: Statistics of TaoVA-100x

```
Start at: 2017-08-13 07:01:14
End at: 2017-08-13 07:01:44
Local clock offset: 0.665 ms
Remote clock offset: -2.122 ms

# Below is generated by plot.py at 2017-08-13 07:37:59
# Datalink statistics
-- Total of 3 flows:
Average throughput: 12.14 Mbit/s
95th percentile per-packet one-way delay: 21.155 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 5.67 Mbit/s
95th percentile per-packet one-way delay: 18.959 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 5.58 Mbit/s
95th percentile per-packet one-way delay: 21.584 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 8.12 Mbit/s
95th percentile per-packet one-way delay: 23.042 ms
Loss rate: 0.00%
```

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

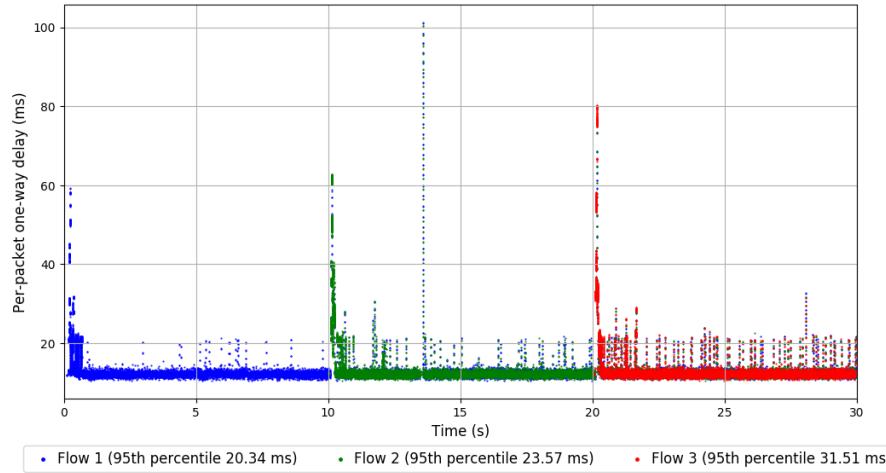
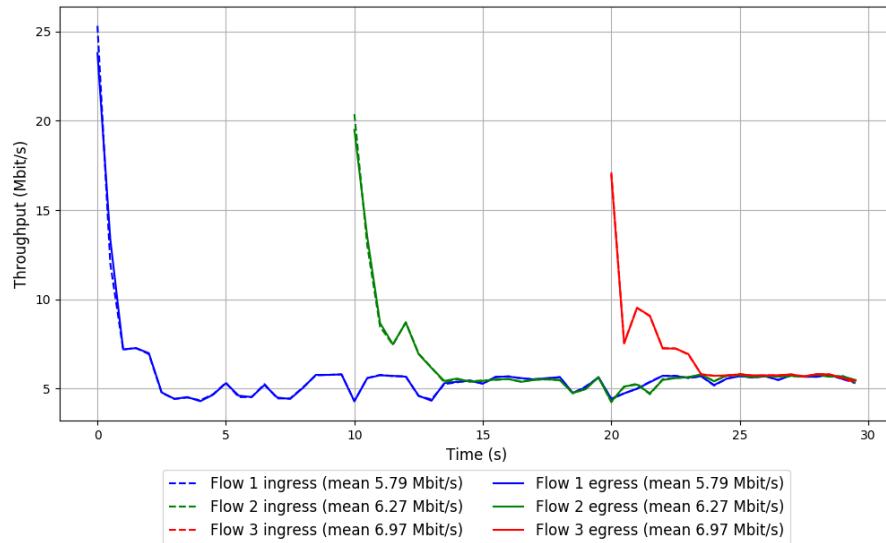


Run 3: Statistics of TaoVA-100x

```
Start at: 2017-08-13 07:19:20
End at: 2017-08-13 07:19:50
Local clock offset: 0.525 ms
Remote clock offset: -1.595 ms

# Below is generated by plot.py at 2017-08-13 07:37:59
# Datalink statistics
-- Total of 3 flows:
Average throughput: 12.29 Mbit/s
95th percentile per-packet one-way delay: 21.507 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 5.79 Mbit/s
95th percentile per-packet one-way delay: 20.344 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 6.27 Mbit/s
95th percentile per-packet one-way delay: 23.569 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 6.97 Mbit/s
95th percentile per-packet one-way delay: 31.510 ms
Loss rate: 0.00%
```

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

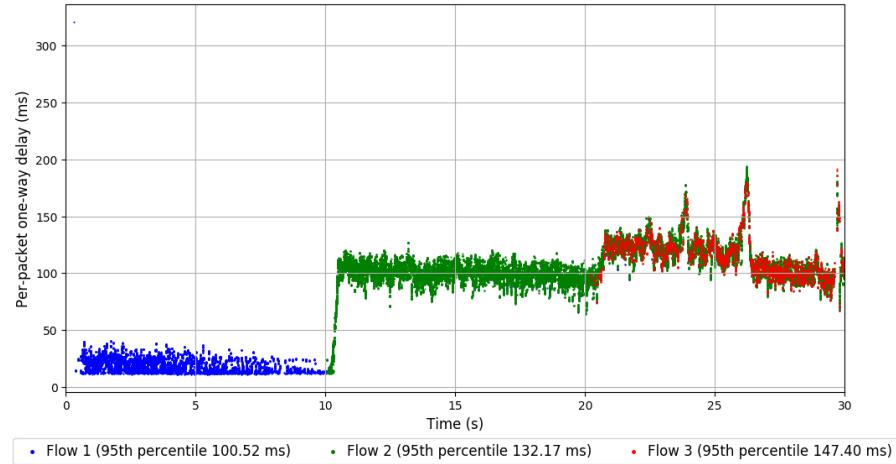
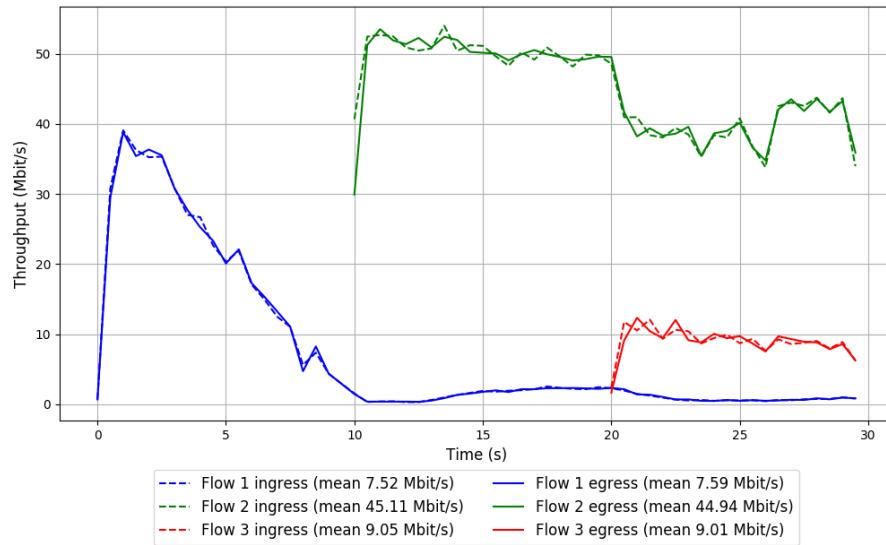


Run 1: Statistics of TCP Vegas

```
Start at: 2017-08-13 06:39:27
End at: 2017-08-13 06:39:57
Local clock offset: 0.656 ms
Remote clock offset: -2.09 ms

# Below is generated by plot.py at 2017-08-13 07:38:03
# Datalink statistics
-- Total of 3 flows:
Average throughput: 40.83 Mbit/s
95th percentile per-packet one-way delay: 131.466 ms
Loss rate: 0.38%
-- Flow 1:
Average throughput: 7.59 Mbit/s
95th percentile per-packet one-way delay: 100.520 ms
Loss rate: 0.03%
-- Flow 2:
Average throughput: 44.94 Mbit/s
95th percentile per-packet one-way delay: 132.172 ms
Loss rate: 0.41%
-- Flow 3:
Average throughput: 9.01 Mbit/s
95th percentile per-packet one-way delay: 147.399 ms
Loss rate: 0.95%
```

Run 1: Report of TCP Vegas — Data Link

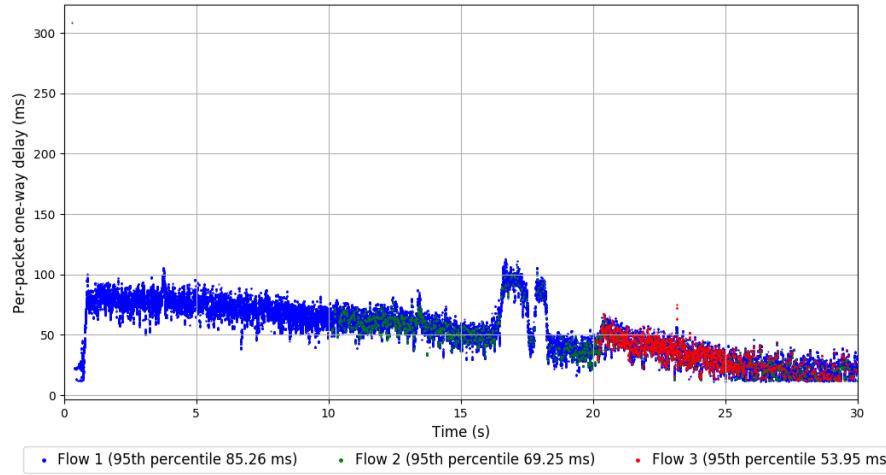
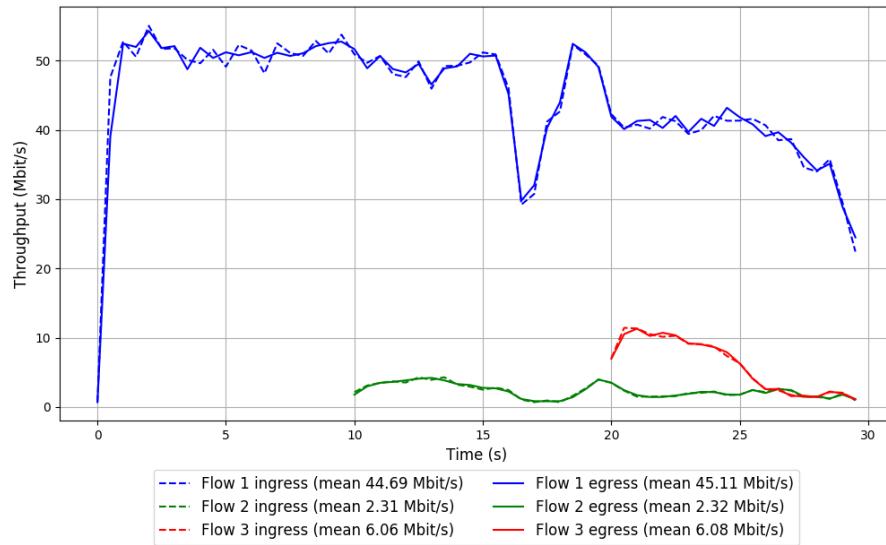


Run 2: Statistics of TCP Vegas

```
Start at: 2017-08-13 06:57:35
End at: 2017-08-13 06:58:05
Local clock offset: 0.566 ms
Remote clock offset: -2.183 ms

# Below is generated by plot.py at 2017-08-13 07:38:07
# Datalink statistics
-- Total of 3 flows:
Average throughput: 48.69 Mbit/s
95th percentile per-packet one-way delay: 84.831 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 45.11 Mbit/s
95th percentile per-packet one-way delay: 85.259 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 2.32 Mbit/s
95th percentile per-packet one-way delay: 69.249 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 6.08 Mbit/s
95th percentile per-packet one-way delay: 53.948 ms
Loss rate: 0.00%
```

Run 2: Report of TCP Vegas — Data Link

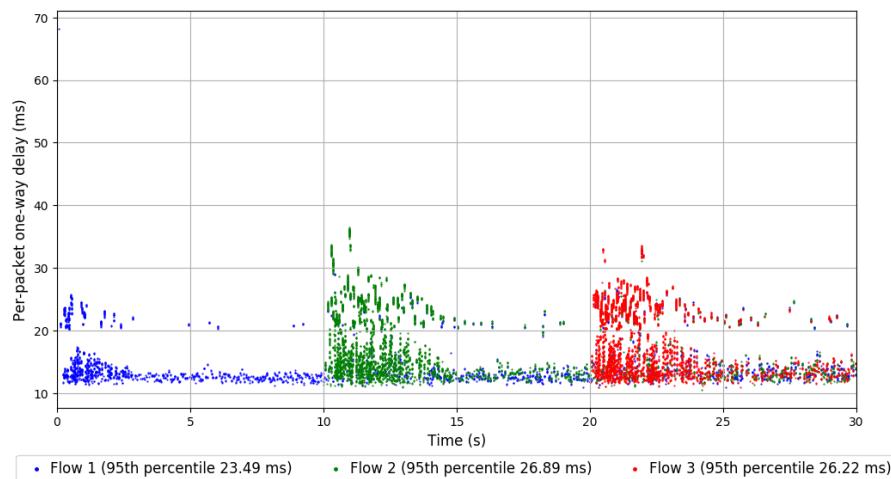
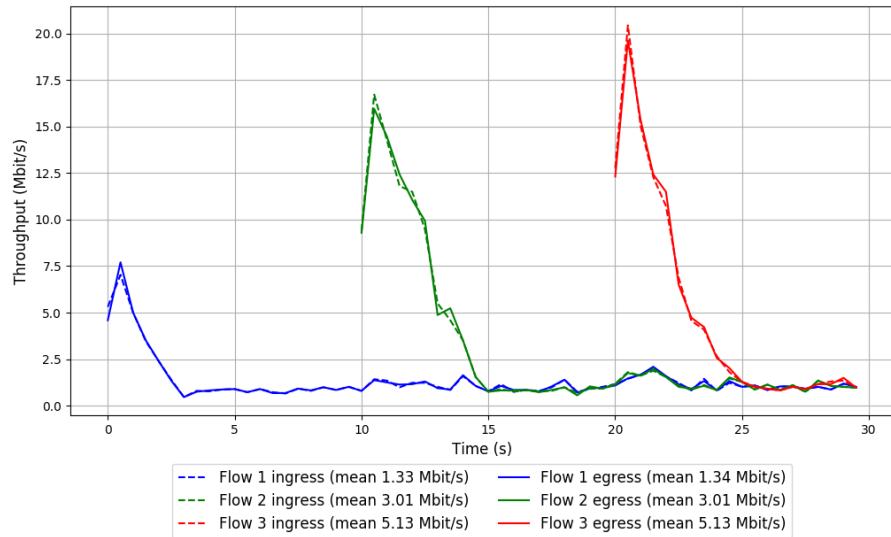


Run 3: Statistics of TCP Vegas

```
Start at: 2017-08-13 07:15:43
End at: 2017-08-13 07:16:13
Local clock offset: 0.626 ms
Remote clock offset: -1.779 ms

# Below is generated by plot.py at 2017-08-13 07:38:07
# Datalink statistics
-- Total of 3 flows:
Average throughput: 5.05 Mbit/s
95th percentile per-packet one-way delay: 25.816 ms
Loss rate: 0.02%
-- Flow 1:
Average throughput: 1.34 Mbit/s
95th percentile per-packet one-way delay: 23.494 ms
Loss rate: 0.06%
-- Flow 2:
Average throughput: 3.01 Mbit/s
95th percentile per-packet one-way delay: 26.891 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 5.13 Mbit/s
95th percentile per-packet one-way delay: 26.221 ms
Loss rate: 0.00%
```

Run 3: Report of TCP Vegas — Data Link

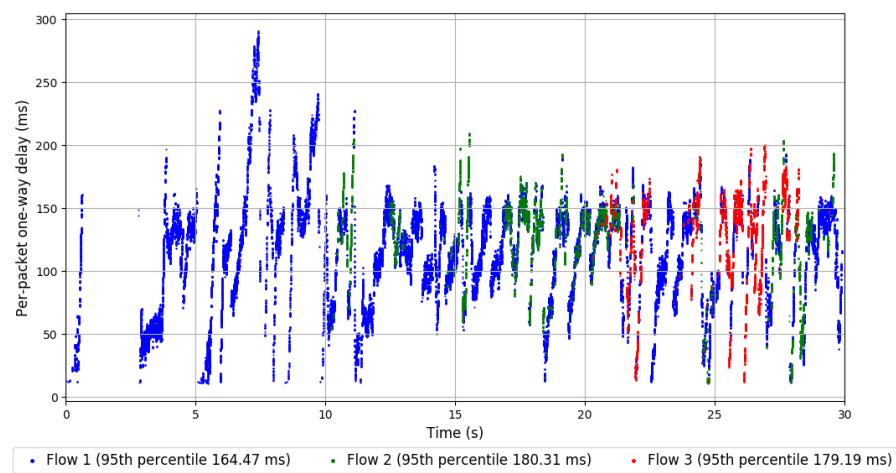
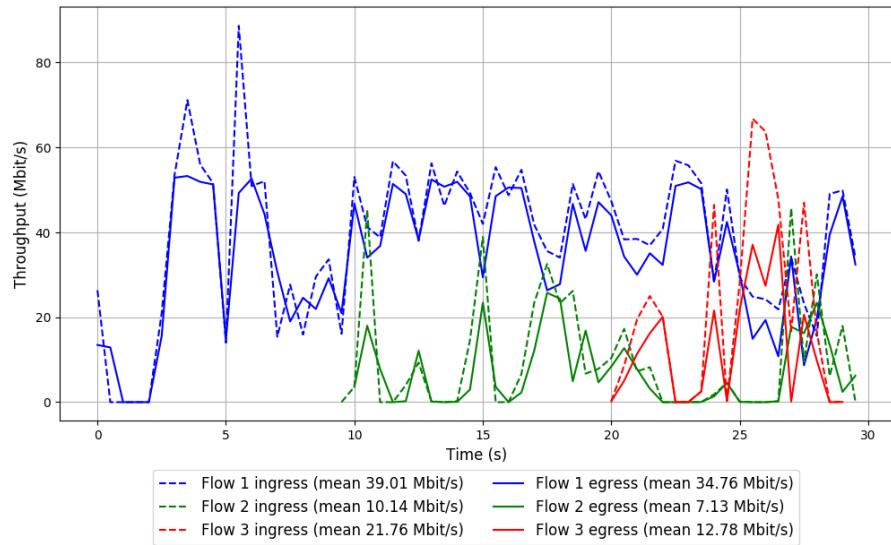


Run 1: Statistics of Verus

```
Start at: 2017-08-13 06:46:45
End at: 2017-08-13 06:47:15
Local clock offset: 0.671 ms
Remote clock offset: -2.08 ms

# Below is generated by plot.py at 2017-08-13 07:38:11
# Datalink statistics
-- Total of 3 flows:
Average throughput: 43.41 Mbit/s
95th percentile per-packet one-way delay: 171.549 ms
Loss rate: 17.25%
-- Flow 1:
Average throughput: 34.76 Mbit/s
95th percentile per-packet one-way delay: 164.472 ms
Loss rate: 10.59%
-- Flow 2:
Average throughput: 7.13 Mbit/s
95th percentile per-packet one-way delay: 180.309 ms
Loss rate: 30.18%
-- Flow 3:
Average throughput: 12.78 Mbit/s
95th percentile per-packet one-way delay: 179.189 ms
Loss rate: 42.34%
```

Run 1: Report of Verus — Data Link

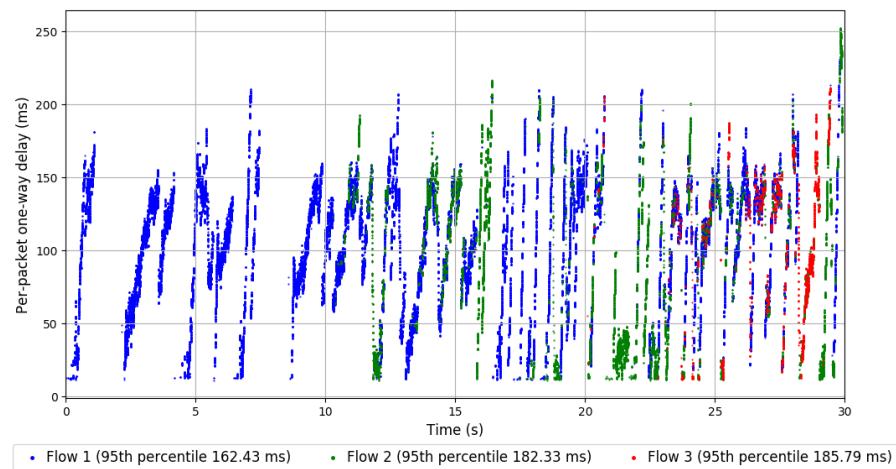
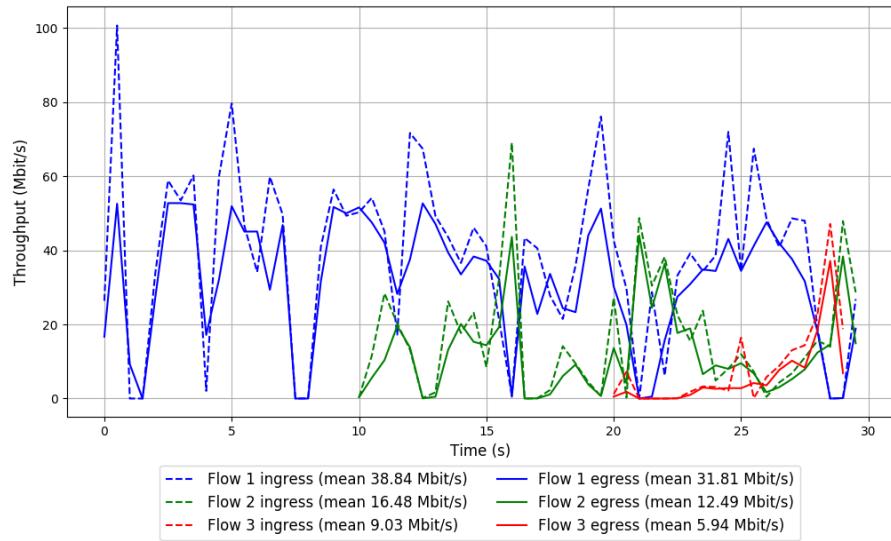


Run 2: Statistics of Verus

```
Start at: 2017-08-13 07:04:54
End at: 2017-08-13 07:05:24
Local clock offset: 0.538 ms
Remote clock offset: -2.038 ms

# Below is generated by plot.py at 2017-08-13 07:38:14
# Datalink statistics
-- Total of 3 flows:
Average throughput: 41.82 Mbit/s
95th percentile per-packet one-way delay: 168.398 ms
Loss rate: 20.18%
-- Flow 1:
Average throughput: 31.81 Mbit/s
95th percentile per-packet one-way delay: 162.432 ms
Loss rate: 18.14%
-- Flow 2:
Average throughput: 12.49 Mbit/s
95th percentile per-packet one-way delay: 182.330 ms
Loss rate: 24.09%
-- Flow 3:
Average throughput: 5.94 Mbit/s
95th percentile per-packet one-way delay: 185.789 ms
Loss rate: 33.14%
```

Run 2: Report of Verus — Data Link

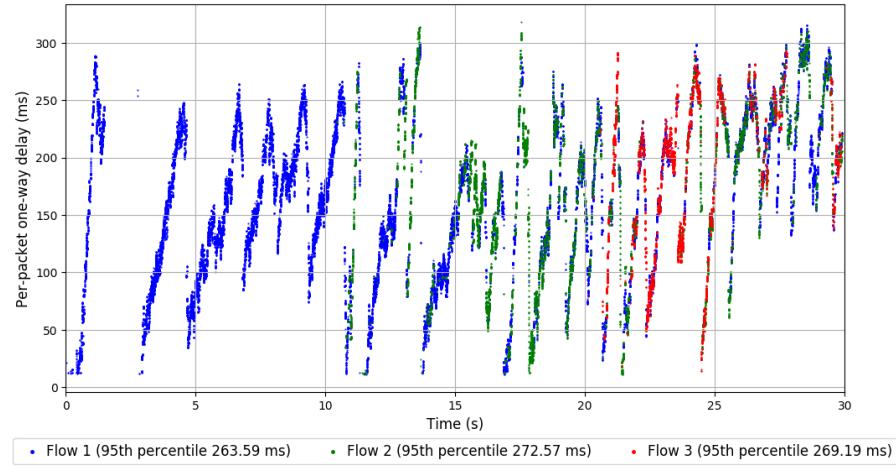
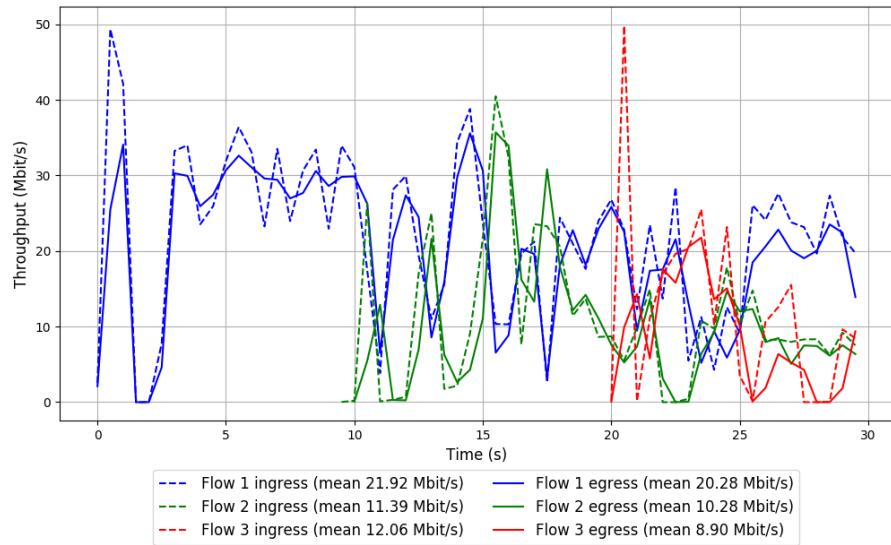


Run 3: Statistics of Verus

```
Start at: 2017-08-13 07:22:57
End at: 2017-08-13 07:23:27
Local clock offset: 0.6 ms
Remote clock offset: -1.595 ms

# Below is generated by plot.py at 2017-08-13 07:38:19
# Datalink statistics
-- Total of 3 flows:
Average throughput: 29.96 Mbit/s
95th percentile per-packet one-way delay: 266.992 ms
Loss rate: 10.46%
-- Flow 1:
Average throughput: 20.28 Mbit/s
95th percentile per-packet one-way delay: 263.587 ms
Loss rate: 7.43%
-- Flow 2:
Average throughput: 10.28 Mbit/s
95th percentile per-packet one-way delay: 272.575 ms
Loss rate: 10.56%
-- Flow 3:
Average throughput: 8.90 Mbit/s
95th percentile per-packet one-way delay: 269.187 ms
Loss rate: 26.95%
```

Run 3: Report of Verus — Data Link

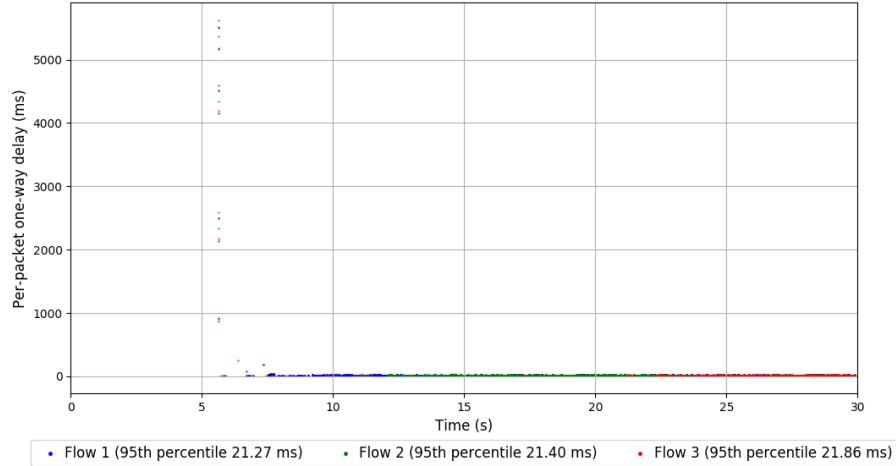
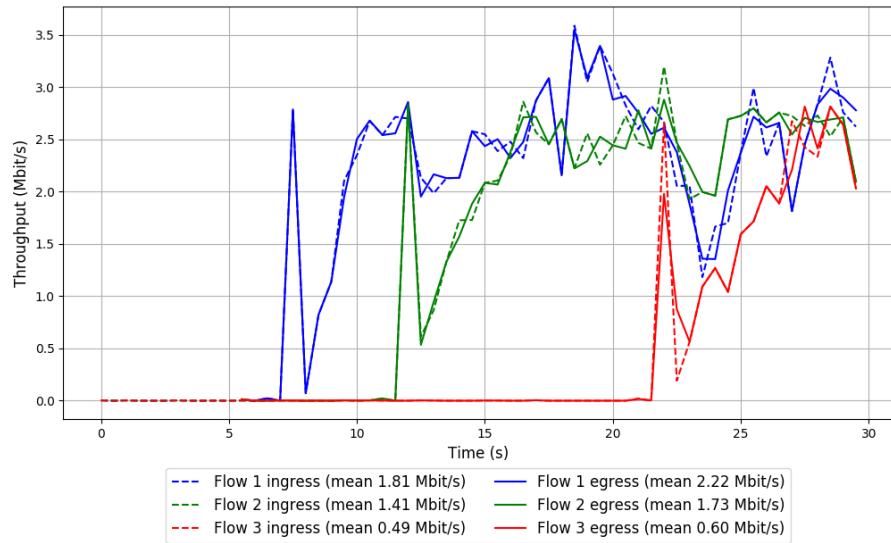


```
Run 1: Statistics of WebRTC media

Start at: 2017-08-13 06:51:34
End at: 2017-08-13 06:52:04
Local clock offset: 0.566 ms
Remote clock offset: -2.13 ms

# Below is generated by plot.py at 2017-08-13 07:38:19
# Datalink statistics
-- Total of 3 flows:
Average throughput: 4.54 Mbit/s
95th percentile per-packet one-way delay: 21.424 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 2.22 Mbit/s
95th percentile per-packet one-way delay: 21.265 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 1.73 Mbit/s
95th percentile per-packet one-way delay: 21.399 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 0.60 Mbit/s
95th percentile per-packet one-way delay: 21.862 ms
Loss rate: 0.00%
```

Run 1: Report of WebRTC media — Data Link

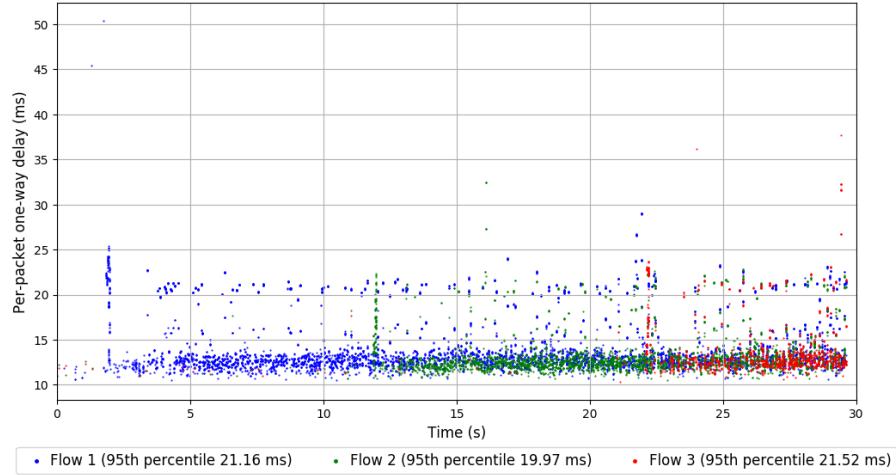
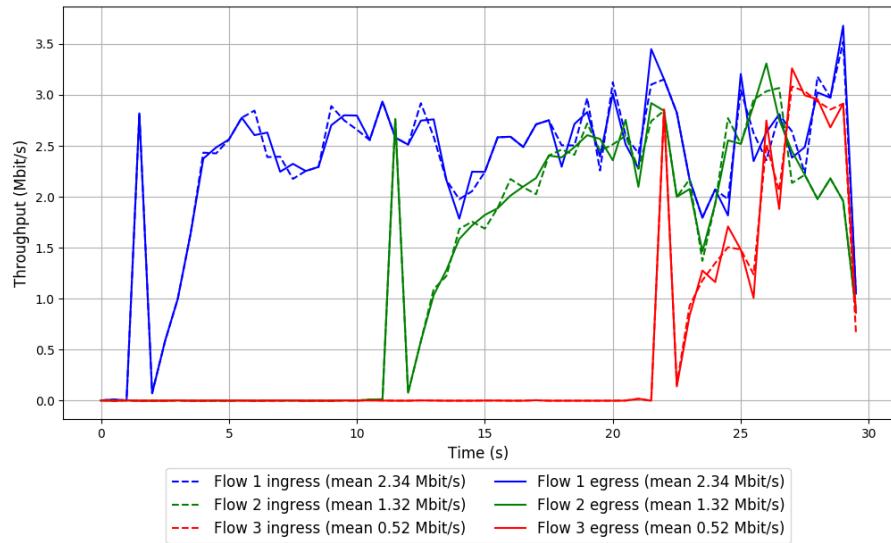


Run 2: Statistics of WebRTC media

```
Start at: 2017-08-13 07:09:43
End at: 2017-08-13 07:10:13
Local clock offset: 0.525 ms
Remote clock offset: -1.924 ms

# Below is generated by plot.py at 2017-08-13 07:38:19
# Datalink statistics
-- Total of 3 flows:
Average throughput: 4.17 Mbit/s
95th percentile per-packet one-way delay: 21.064 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 2.34 Mbit/s
95th percentile per-packet one-way delay: 21.158 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 1.32 Mbit/s
95th percentile per-packet one-way delay: 19.969 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 0.52 Mbit/s
95th percentile per-packet one-way delay: 21.522 ms
Loss rate: 0.00%
```

Run 2: Report of WebRTC media — Data Link



Run 3: Statistics of WebRTC media

```
Start at: 2017-08-13 07:27:46
End at: 2017-08-13 07:28:16
Local clock offset: 0.506 ms
Remote clock offset: -1.566 ms

# Below is generated by plot.py at 2017-08-13 07:38:19
# Datalink statistics
-- Total of 3 flows:
Average throughput: 4.18 Mbit/s
95th percentile per-packet one-way delay: 21.212 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 2.33 Mbit/s
95th percentile per-packet one-way delay: 21.172 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 1.33 Mbit/s
95th percentile per-packet one-way delay: 21.158 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 0.53 Mbit/s
95th percentile per-packet one-way delay: 21.586 ms
Loss rate: 0.00%
```

Run 3: Report of WebRTC media — Data Link

