# Pantheon Report

Generated at 2020-05-30 02:53:29 (UTC).

Tested in mahimahi: `mm-delay 40 mm-link 50mbps.trace 50mbps.trace --uplink-queue=droptail --uplink-queue-args=packets=300`

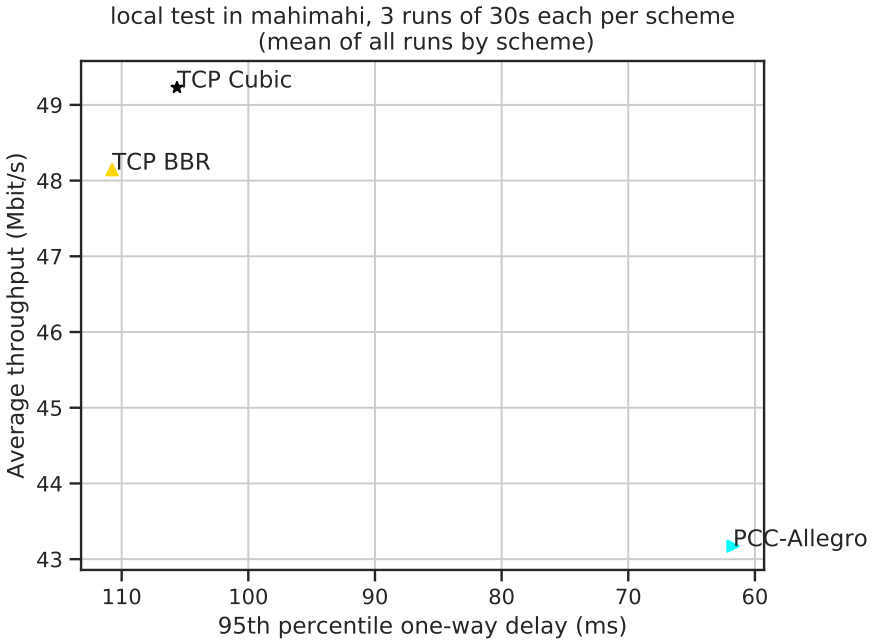
Repeated the test of 3 congestion control schemes 3 times.

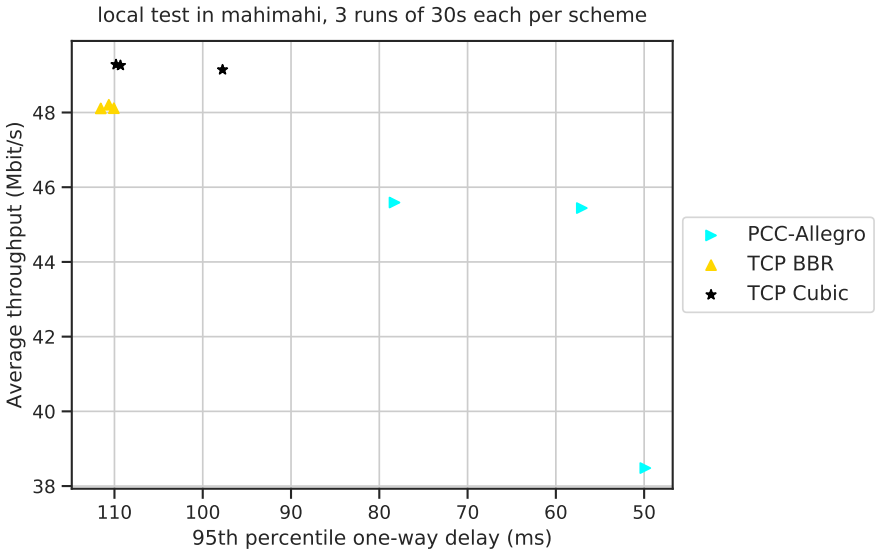
Each test lasted for 30 seconds running 1 flow.

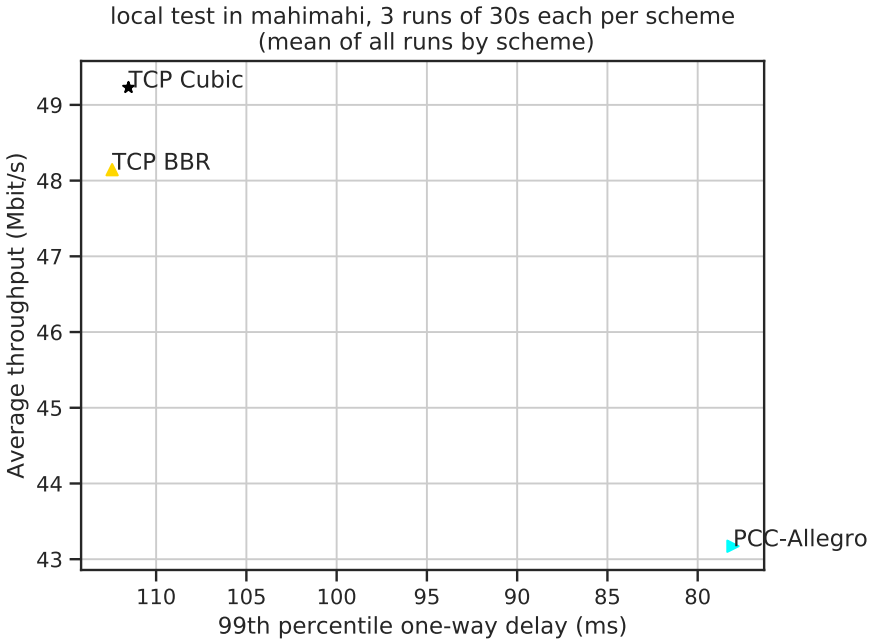
```
System info:
Linux 4.15.0-99-generic
net.core.default_qdisc = fq
net.core.rmem_default = 212992
net.core.rmem_max = 212992
net.core.wmem_default = 212992
net.core.wmem_max = 212992
net.ipv4.tcp_rmem = 4096 131072 6291456
net.ipv4.tcp_wmem = 4096 16384 4194304
```

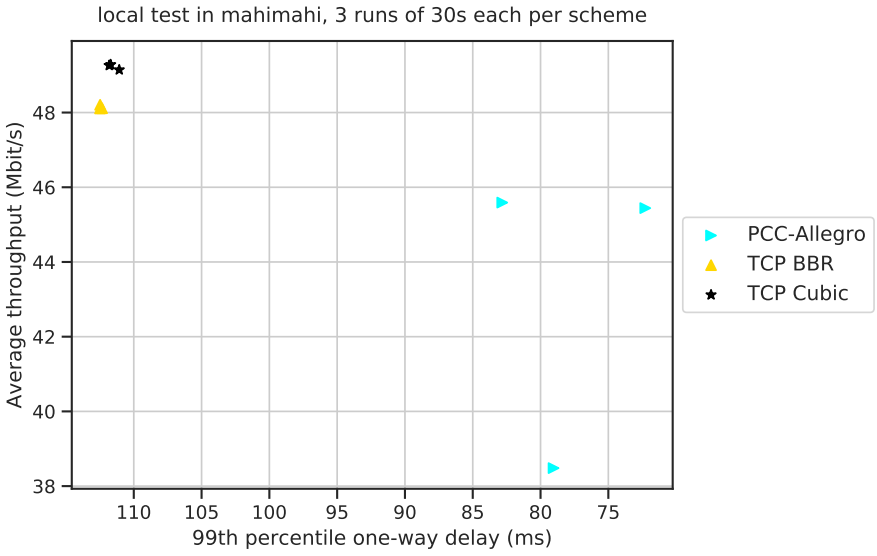
```
Git summary:
branch: master @ de3f76227a60e77b1f167c30c7e2d92e4c1e3850
third_party/aurora @ f3e943d61015b39960854ba6391797e0c7984d74
third_party/aurora-model @ e292c316c23fb837255c4e142e40590d154bbe95
third_party/eagle-plus @ f84a9431dfbfa1640fc82bb6d18e33f0ffe0661a
 M net-em/net-em/net_em/__pycache__/__init__.cpython-36.pyc
 M net-em/net-em/net_em/envs/__pycache__/__init__.cpython-36.pyc
 M net-em/net-em/net_em/envs/__pycache__/helpers.cpython-36.pyc
 M net-em/net-em/net_em/envs/__pycache__/project_root.cpython-36.pyc
 M net-em/net-em/net_em/envs/__pycache__/receiver.cpython-36.pyc
third_party/eagle-v1 @ c68d985e042be5c30704c0aee48c363861951a95
third_party/eagle-v2 @ c8a1737b3c84d7d49eada5b8785045d272a70120
third_party/eagle-v3 @ 50d676bd6e47e3e29a3ce914a6e50b2c6f15136b
third_party/fillp @ d6da1459332fcee56963885d7eba17e6a32d4519
third_party/fillp-sheep @ 0e5bb722943babcd2b090d2c64fcd45e12e923f9
third_party/genericCC @ d0153f8e594aa89e93b032143cedbdfe58e562f4
third_party/indigo @ 2601c92e4aa9d58d38dc4dfe0ecdbf90c077e64d
third_party/libutp @ b3465b942e2826f2b179eaab4a906ce6bb7cf3cf
third_party/pantheon-tunnel @ f866d3f58d27afd942717625ee3a354cc2e802bd
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/pcc-experimental @ cd43e34e3f5f5613e8acd08fab92c4eb24f974ab
third_party/proto-quic @ 77961f1a82733a86b42f1bc8143ebc978f3cff42
third_party/scream-reproduce @ f099118d1421aa3131bf11ff1964974e1da3bdb2
 M src/ScreamClient
```

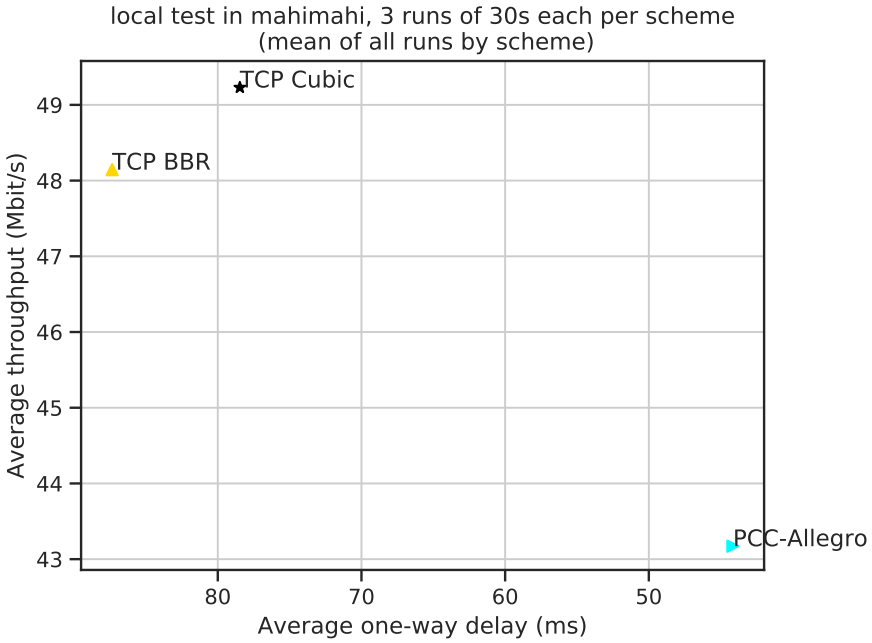
```
 M src/ScreamServer
third_party/sprout @ 366e35c6178b01e31d4a46ad18c74f9415f19a26
 M src/examples/cellsim.cc
 M src/examples/sproutbt2.cc
 M src/network/sproutconn.cc
third_party/verus @ d4b447ea74c6c60a261149af2629562939f9a494
 M src/verus.hpp
 M tools/plot.py
third_party/vivace @ 2baf86211435ae071a32f96b7d8c504587f5d7f4
third_party/webrtc @ 3f0cc2a9061a41b6f9dde4735770d143a1fa2851
```

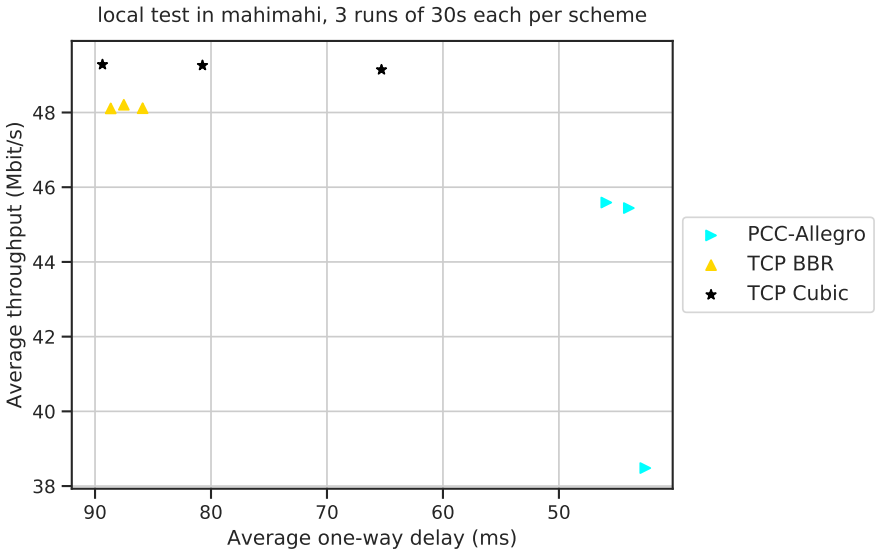

local test in mahimahi, 3 runs of 30s each per scheme
(mean of all runs by scheme)
TCP Cubic
TCP BBR
PCC-Allegro
Average throughput (Mbit/s)
49
48
47
46
45
44
43
110
100
90
80
70
60
95th percentile one-way delay (ms)


local test in mahimahi, 3 runs of 30s each per scheme
Average throughput (Mbit/s)
48
46
44
42
40
38
110
100
90
80
70
60
50
95th percentile one-way delay (ms)
PCC-Allegro
TCP BBR
TCP Cubic


local test in mahimahi, 3 runs of 30s each per scheme
(mean of all runs by scheme)
TCP Cubic
TCP BBR
PCC-Allegro
Average throughput (Mbit/s)
49
48
47
46
45
44
43
110
105
100
95
90
85
80
99th percentile one-way delay (ms)


local test in mahimahi, 3 runs of 30s each per scheme
Average throughput (Mbit/s)
48
46
44
42
40
38
110
105
100
95
90
85
80
75
99th percentile one-way delay (ms)
PCC-Allegro
TCP BBR
TCP Cubic

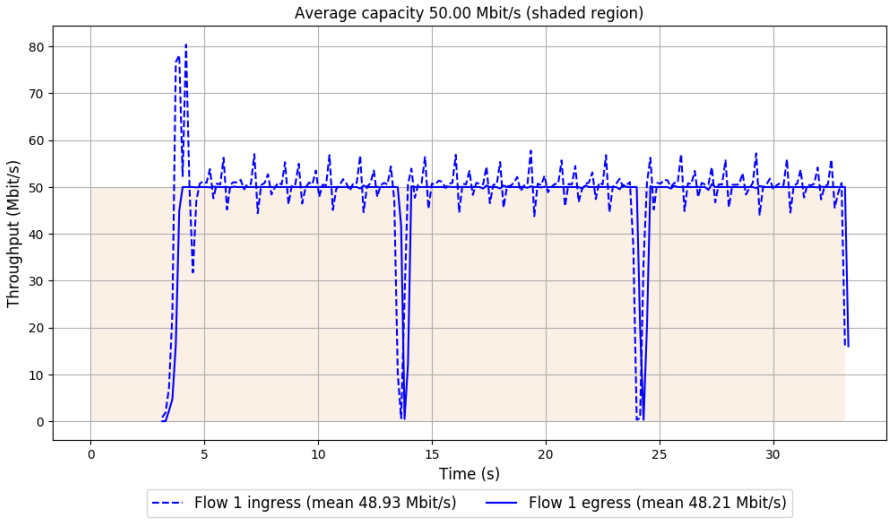

local test in mahimahi, 3 runs of 30s each per scheme
(mean of all runs by scheme)
TCP Cubic
TCP BBR
PCC-Allegro
Average throughput (Mbit/s)
Average one-way delay (ms)
49
48
47
46
45
44
43
80
70
60
50

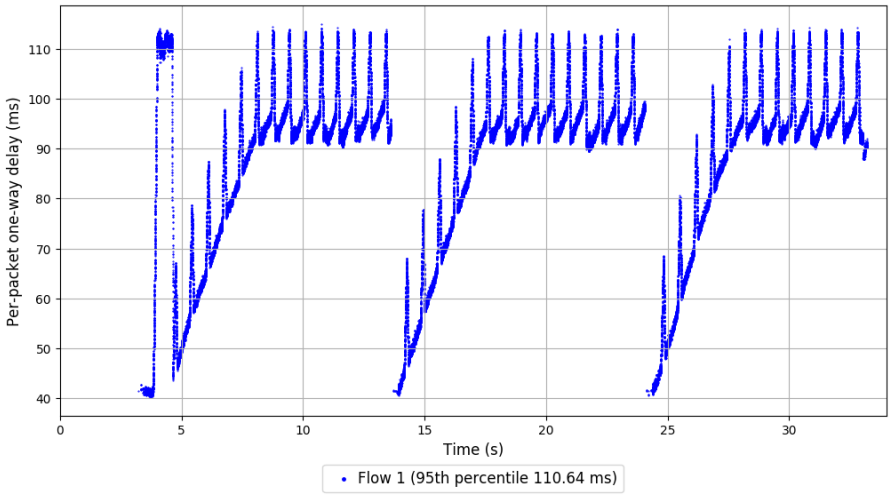

local test in mahimahi, 3 runs of 30s each per scheme
Average throughput (Mbit/s)
Average one-way delay (ms)
PCC-Allegro
TCP BBR
TCP Cubic
48
46
44
42
40
38
90
80
70
60
50

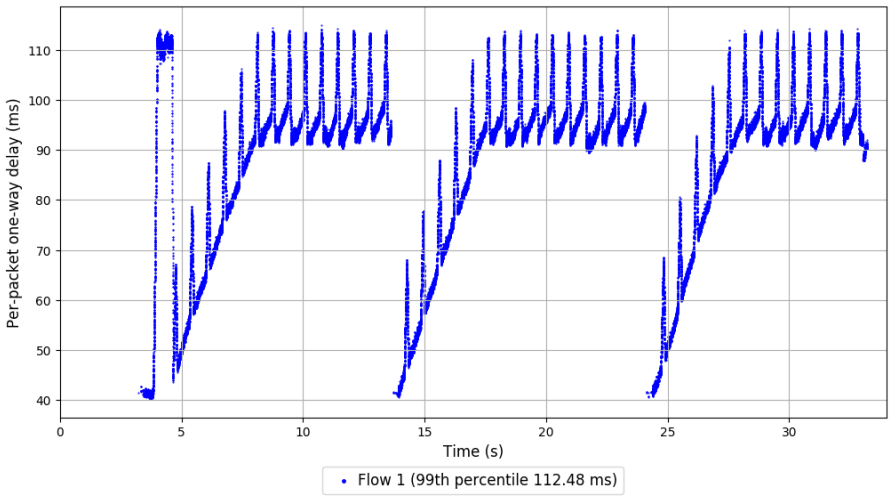
| scheme | # runs | mean avg tput (Mbit/s) flow 1 | mean 95th-%ile delay (ms) flow 1 | mean 99th-%ile delay (ms) flow 1 | mean avg delay (ms) flow 1 | mean loss rate (%) flow 1 |
|---|---|---|---|---|---|---|
| TCP BBR | 3 | 48.15 | 110.75 | 112.44 | 87.35 | 1.67 |
| TCP Cubic | 3 | 49.23 | 105.63 | 111.53 | 78.46 | 0.39 |
| PCC-Allegro | 3 | 43.17 | 61.73 | 78.04 | 44.14 | 0.86 |

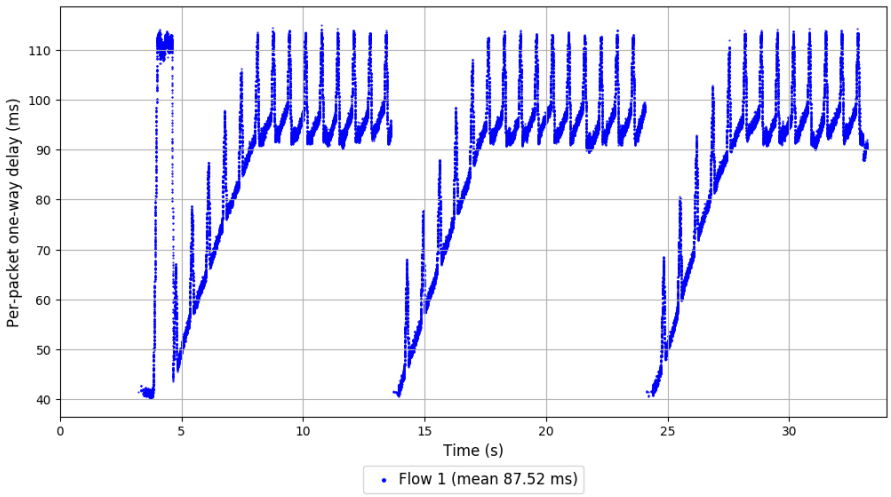
```
Run 1: Statistics of TCP BBR

Start at: 2020-05-29 23:15:29
End at: 2020-05-29 23:15:59

# Below is generated by plot.py at 2020-05-30 02:52:59
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 48.21 Mbit/s (96.4% utilization)
95th percentile per-packet one-way delay: 110.637 ms
99th percentile per-packet one-way delay: 112.484 ms
mean per-packet one-way delay: 87.517 ms
Loss rate: 1.62%
-- Flow 1:
Average throughput: 48.21 Mbit/s
95th percentile per-packet one-way delay: 110.637 ms
99th percentile per-packet one-way delay: 112.484 ms
Average per-packet one-way delay: 87.517 ms
Loss rate: 1.62%
```

Run 1: Report of TCP BBR — Data Link



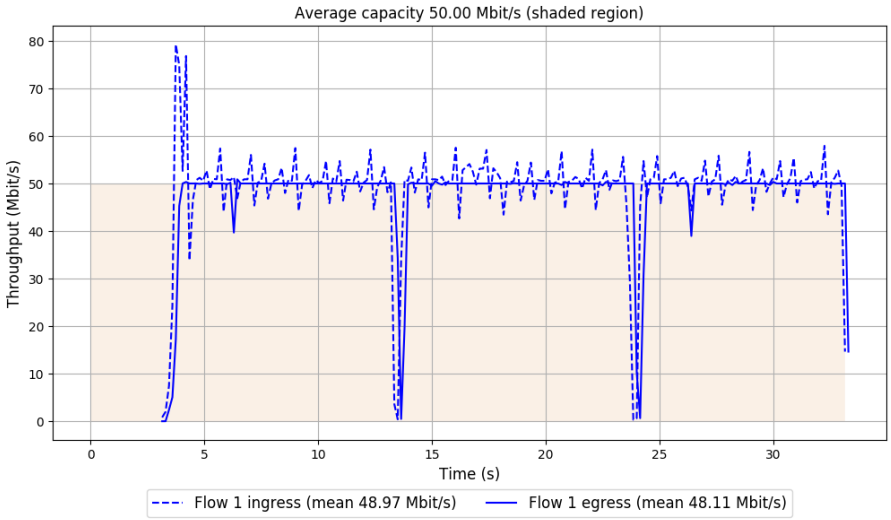



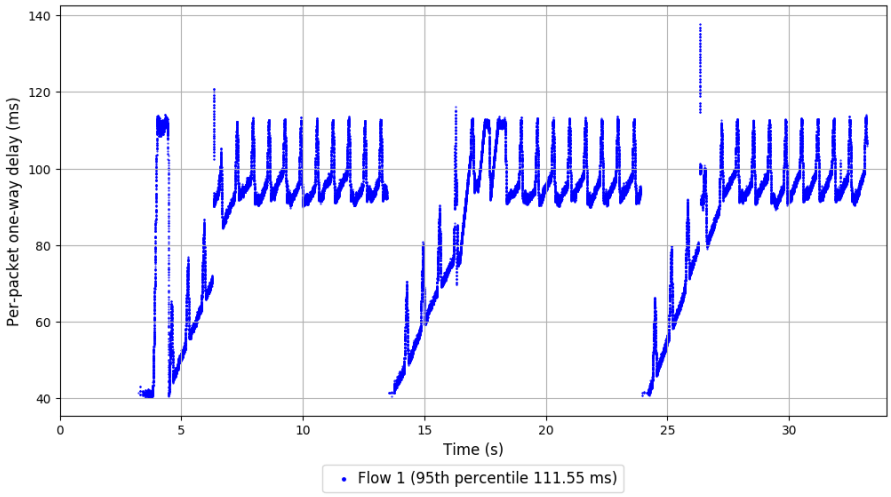

Per-packet one-way delay (ms)
Time (s)
Flow 1 (99th percentile 112.48 ms)

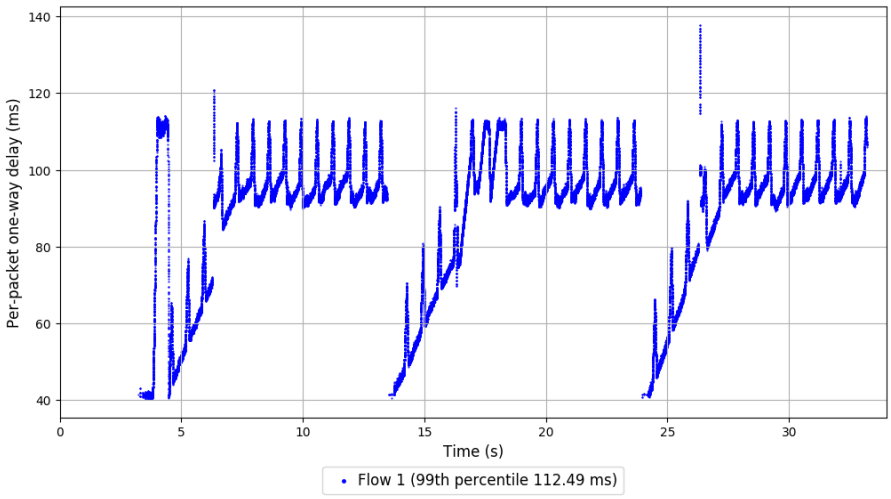

Per-packet one-way delay (ms)
Time (s)
Flow 1 (mean 87.52 ms)

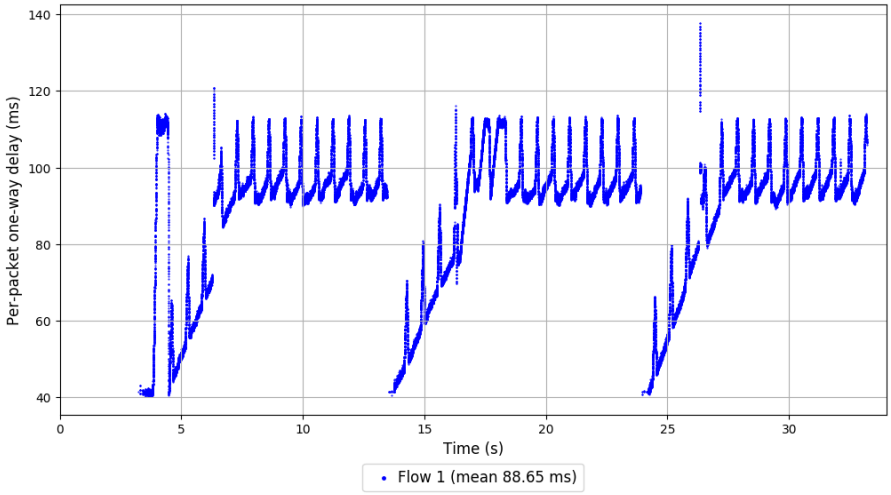
```
Run 2: Statistics of TCP BBR

Start at: 2020-05-29 23:17:17
End at: 2020-05-29 23:17:47

# Below is generated by plot.py at 2020-05-30 02:52:59
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 48.11 Mbit/s (96.2% utilization)
95th percentile per-packet one-way delay: 111.552 ms
99th percentile per-packet one-way delay: 112.488 ms
mean per-packet one-way delay: 88.648 ms
Loss rate: 1.89%
-- Flow 1:
Average throughput: 48.11 Mbit/s
95th percentile per-packet one-way delay: 111.552 ms
99th percentile per-packet one-way delay: 112.488 ms
Average per-packet one-way delay: 88.648 ms
Loss rate: 1.89%
```

Run 2: Report of TCP BBR — Data Link



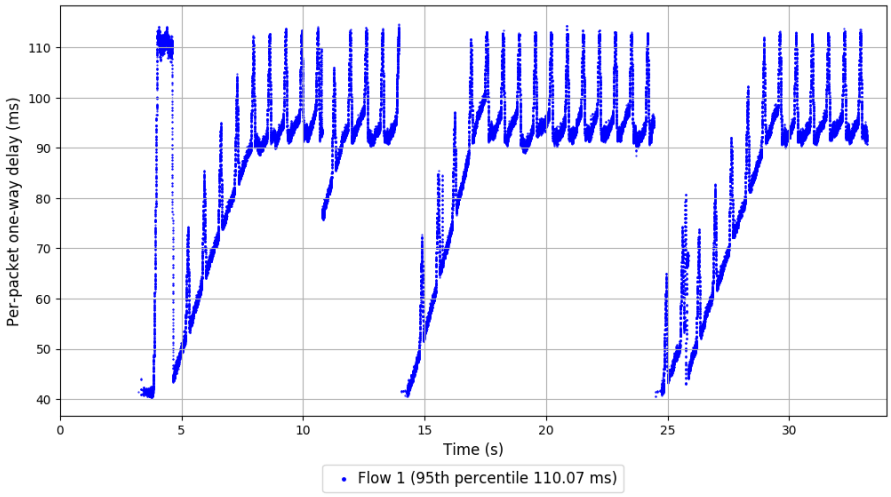



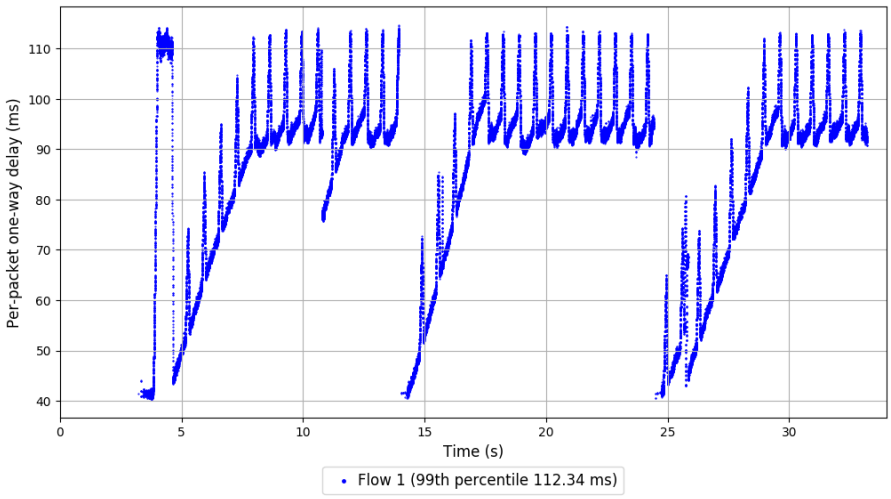

Per-packet one-way delay (ms)
Time (s)
Flow 1 (99th percentile 112.49 ms)

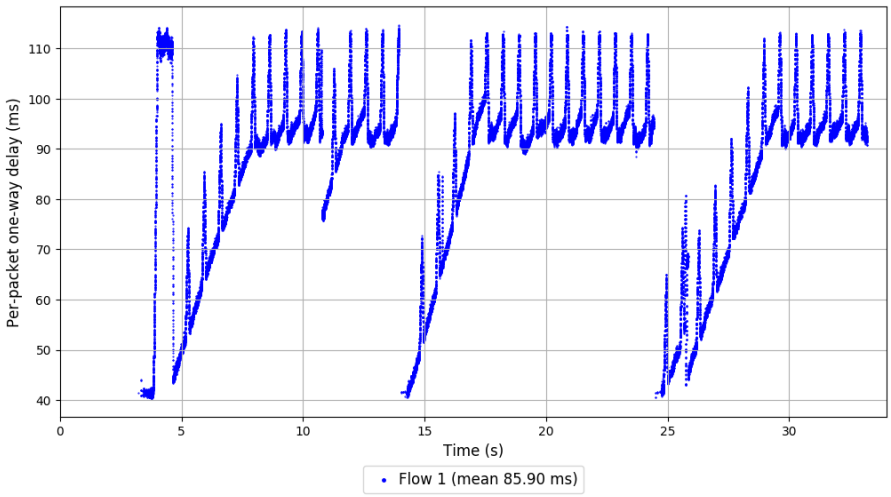

Per-packet one-way delay (ms)
Time (s)
Flow 1 (mean 88.65 ms)

```
Run 3: Statistics of TCP BBR

Start at: 2020-05-29 23:19:06
End at: 2020-05-29 23:19:36

# Below is generated by plot.py at 2020-05-30 02:52:59
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 48.12 Mbit/s (96.2% utilization)
95th percentile per-packet one-way delay: 110.069 ms
99th percentile per-packet one-way delay: 112.338 ms
mean per-packet one-way delay: 85.896 ms
Loss rate: 1.51%
-- Flow 1:
Average throughput: 48.12 Mbit/s
95th percentile per-packet one-way delay: 110.069 ms
99th percentile per-packet one-way delay: 112.338 ms
Average per-packet one-way delay: 85.896 ms
Loss rate: 1.51%
```

Run 3: Report of TCP BBR — Data Link

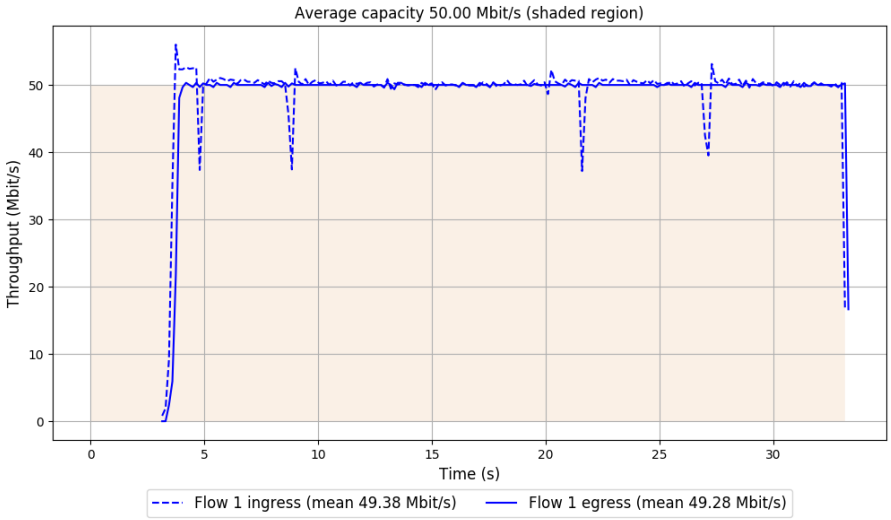


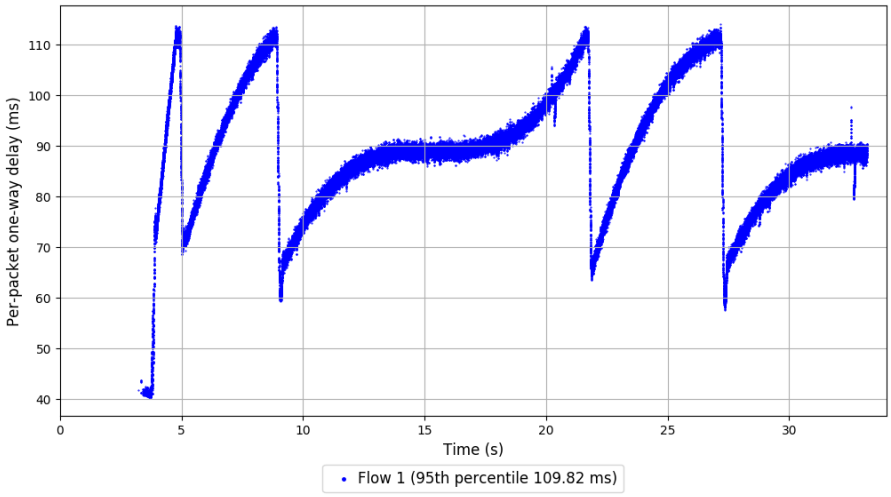

Per-packet one-way delay (ms)
Time (s)
Flow 1 (99th percentile 112.34 ms)

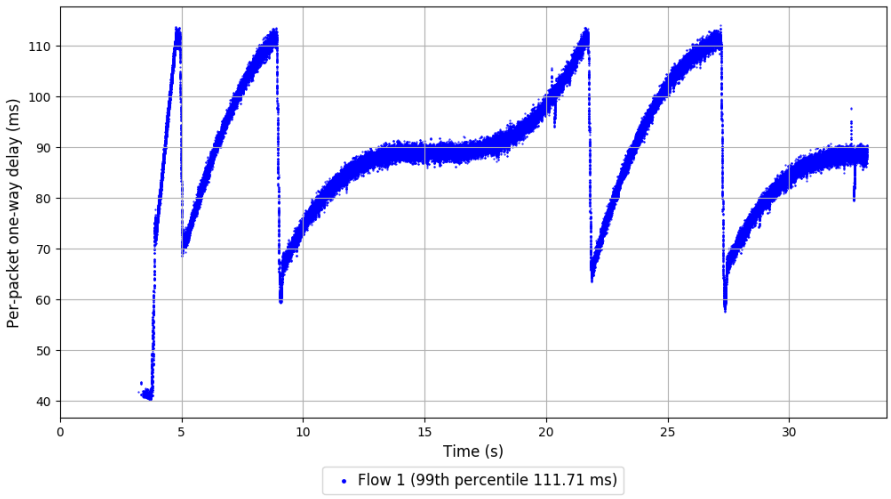

Per-packet one-way delay (ms)
Time (s)
Flow 1 (mean 85.90 ms)

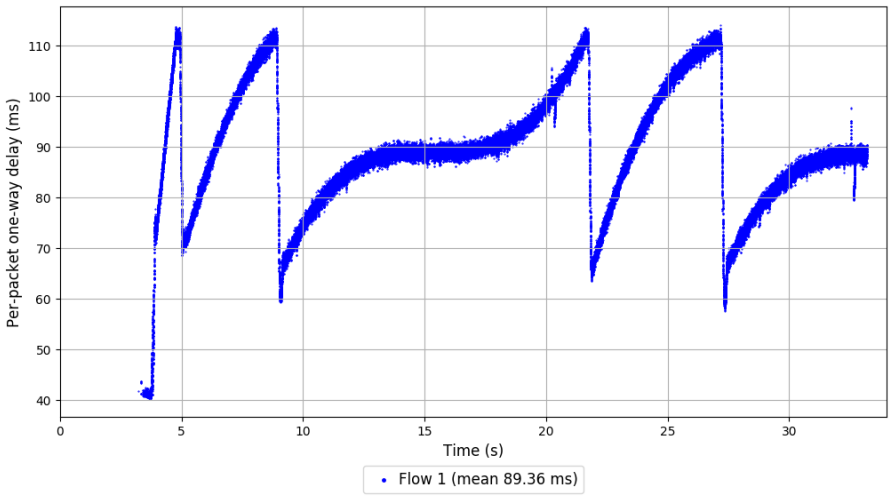
```
Run 1: Statistics of TCP Cubic

Start at: 2020-05-29 23:16:05
End at: 2020-05-29 23:16:35

# Below is generated by plot.py at 2020-05-30 02:53:14
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 49.28 Mbit/s (98.6% utilization)
95th percentile per-packet one-way delay: 109.820 ms
99th percentile per-packet one-way delay: 111.707 ms
mean per-packet one-way delay: 89.358 ms
Loss rate: 0.33%
-- Flow 1:
Average throughput: 49.28 Mbit/s
95th percentile per-packet one-way delay: 109.820 ms
99th percentile per-packet one-way delay: 111.707 ms
Average per-packet one-way delay: 89.358 ms
Loss rate: 0.33%
```

Run 1: Report of TCP Cubic — Data Link



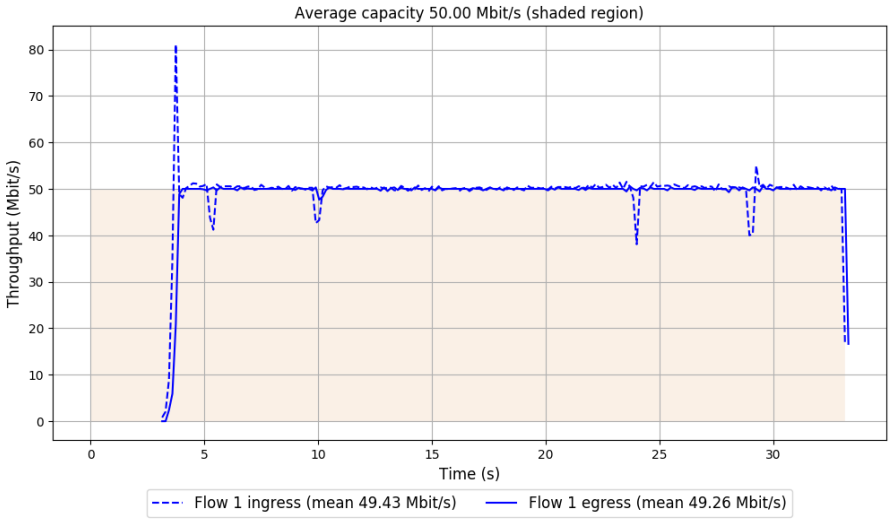



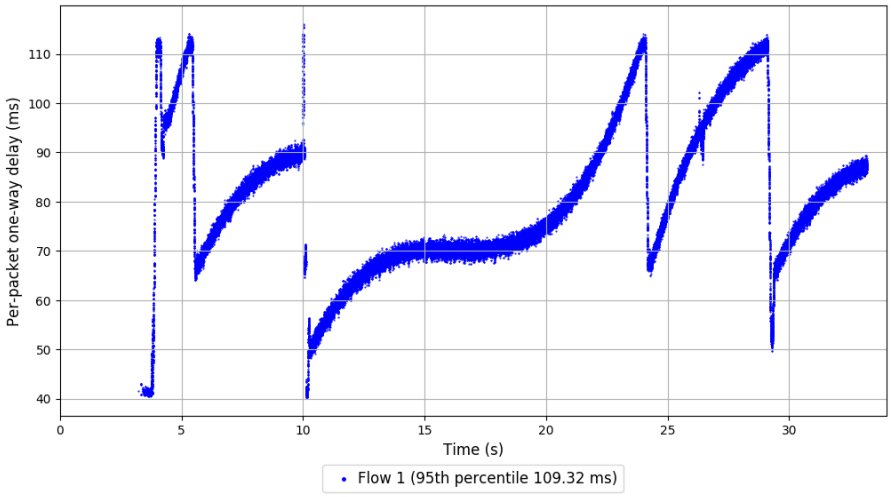

Per-packet one-way delay (ms)
Time (s)
Flow 1 (99th percentile 111.71 ms)

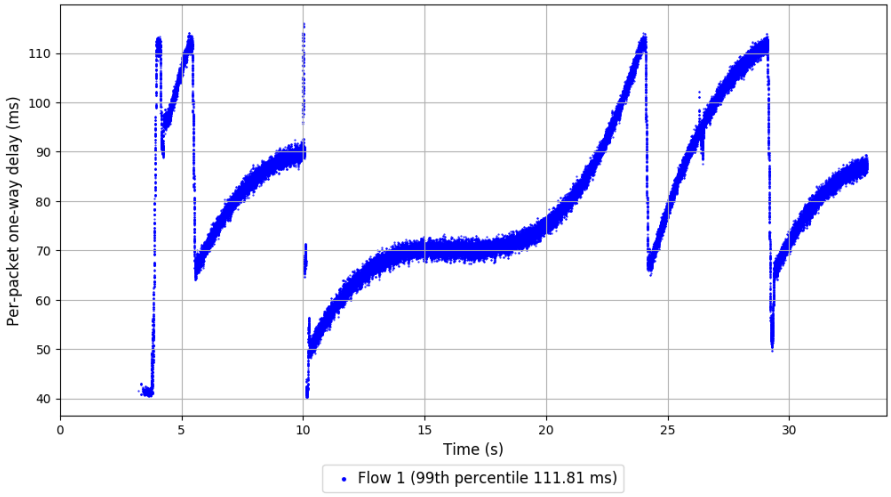

Per-packet one-way delay (ms)
Time (s)
Flow 1 (mean 89.36 ms)

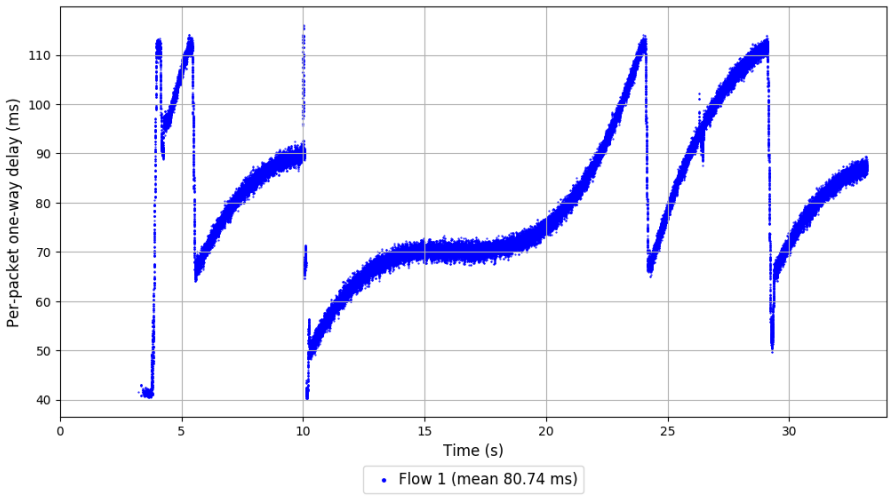
```
Run 2: Statistics of TCP Cubic

Start at: 2020-05-29 23:17:54
End at: 2020-05-29 23:18:24

# Below is generated by plot.py at 2020-05-30 02:53:19
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 49.26 Mbit/s (98.5% utilization)
95th percentile per-packet one-way delay: 109.322 ms
99th percentile per-packet one-way delay: 111.814 ms
mean per-packet one-way delay: 80.735 ms
Loss rate: 0.48%
-- Flow 1:
Average throughput: 49.26 Mbit/s
95th percentile per-packet one-way delay: 109.322 ms
99th percentile per-packet one-way delay: 111.814 ms
Average per-packet one-way delay: 80.735 ms
Loss rate: 0.48%
```

Run 2: Report of TCP Cubic — Data Link



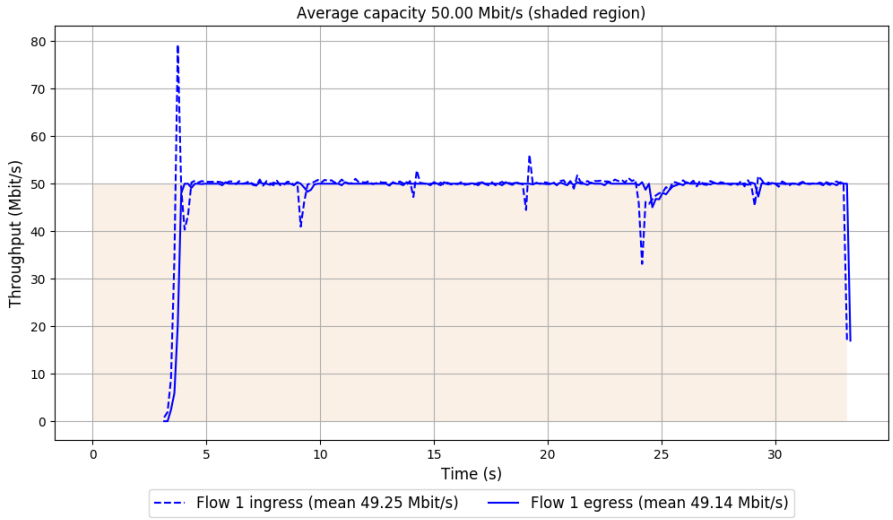



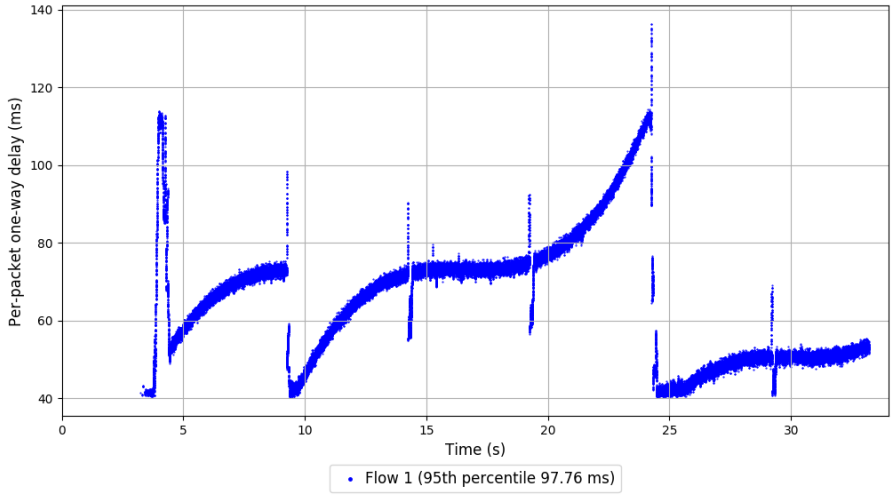

Per-packet one-way delay (ms)
Time (s)
Flow 1 (99th percentile 111.81 ms)

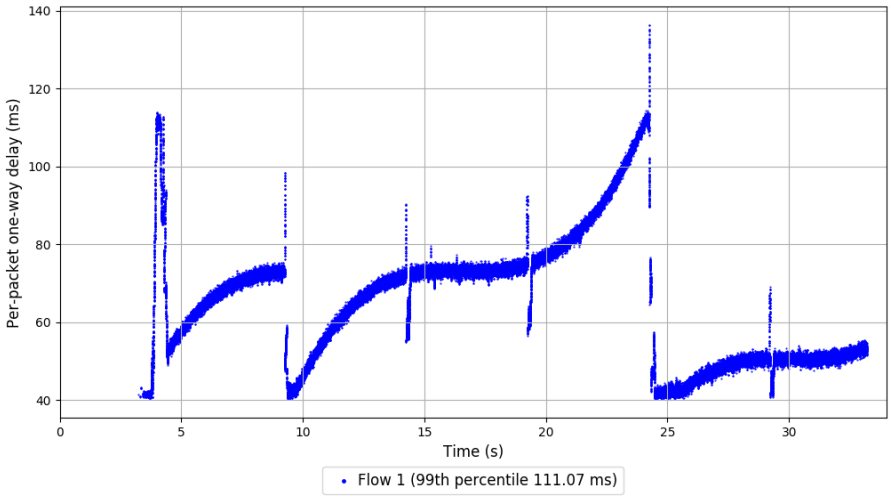

Per-packet one-way delay (ms)
Time (s)
Flow 1 (mean 80.74 ms)

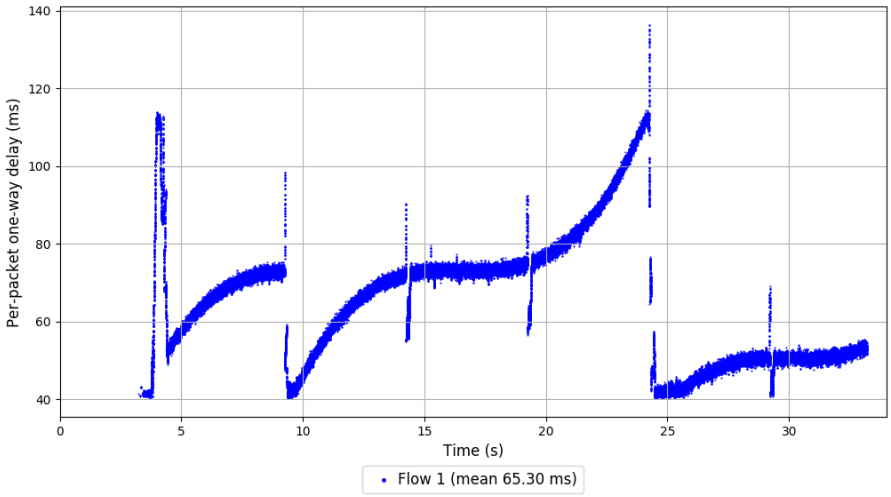
```
Run 3: Statistics of TCP Cubic

Start at: 2020-05-29 23:19:43
End at: 2020-05-29 23:20:13

# Below is generated by plot.py at 2020-05-30 02:53:19
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 49.14 Mbit/s (98.3% utilization)
95th percentile per-packet one-way delay: 97.756 ms
99th percentile per-packet one-way delay: 111.072 ms
mean per-packet one-way delay: 65.299 ms
Loss rate: 0.36%
-- Flow 1:
Average throughput: 49.14 Mbit/s
95th percentile per-packet one-way delay: 97.756 ms
99th percentile per-packet one-way delay: 111.072 ms
Average per-packet one-way delay: 65.299 ms
Loss rate: 0.36%
```

Run 3: Report of TCP Cubic — Data Link



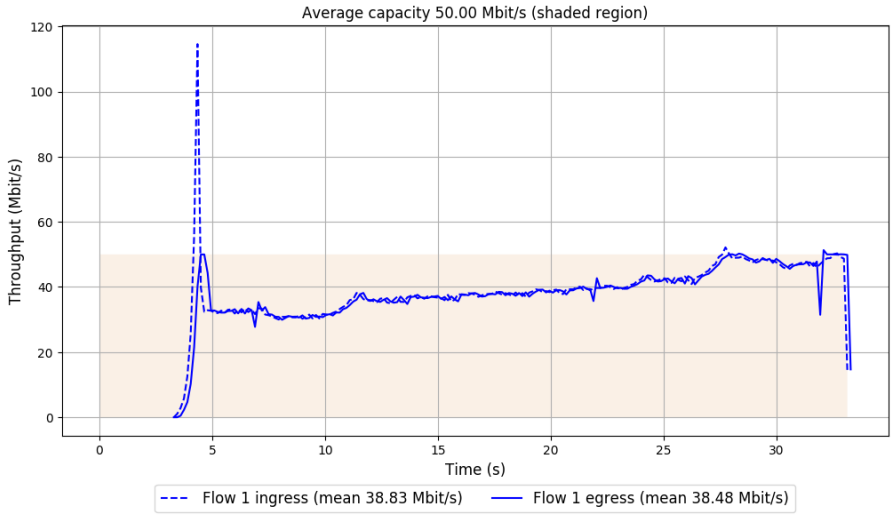



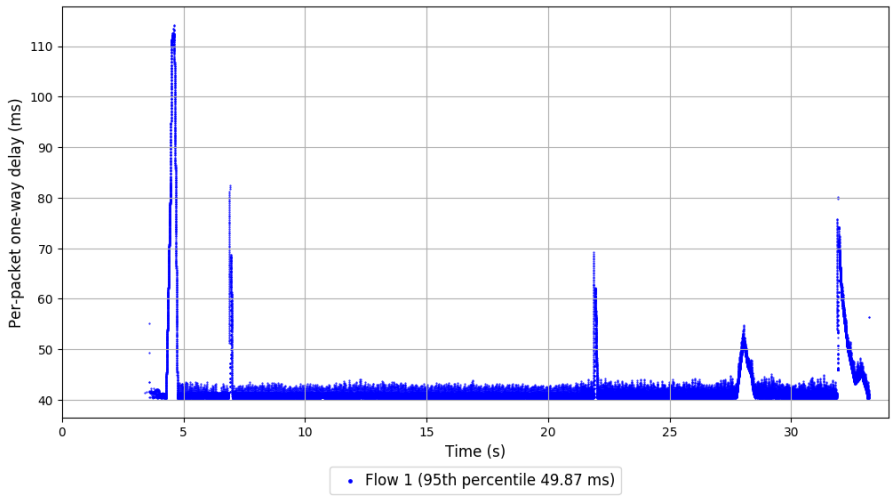

Per-packet one-way delay (ms)
Time (s)
Flow 1 (99th percentile 111.07 ms)

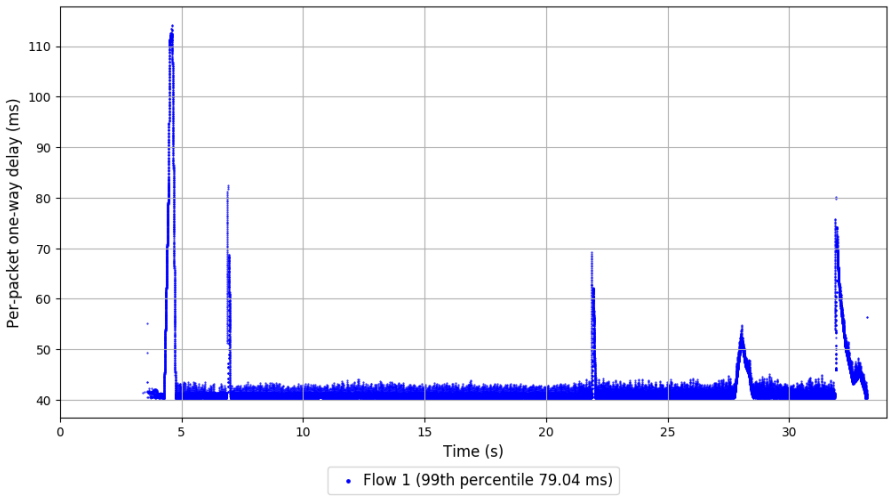

Per-packet one-way delay (ms)
Time (s)
Flow 1 (mean 65.30 ms)

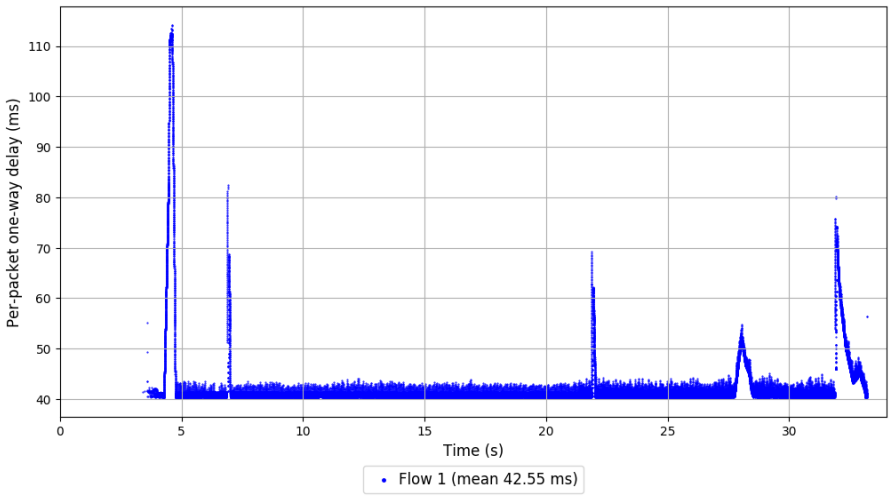
```
Run 1: Statistics of PCC-Allegro

Start at: 2020-05-29 23:16:42
End at: 2020-05-29 23:17:12

# Below is generated by plot.py at 2020-05-30 02:53:19
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 38.48 Mbit/s (77.0% utilization)
95th percentile per-packet one-way delay: 49.866 ms
99th percentile per-packet one-way delay: 79.038 ms
mean per-packet one-way delay: 42.551 ms
Loss rate: 0.99%
-- Flow 1:
Average throughput: 38.48 Mbit/s
95th percentile per-packet one-way delay: 49.866 ms
99th percentile per-packet one-way delay: 79.038 ms
Average per-packet one-way delay: 42.551 ms
Loss rate: 0.99%
```

Run 1: Report of PCC-Allegro — Data Link



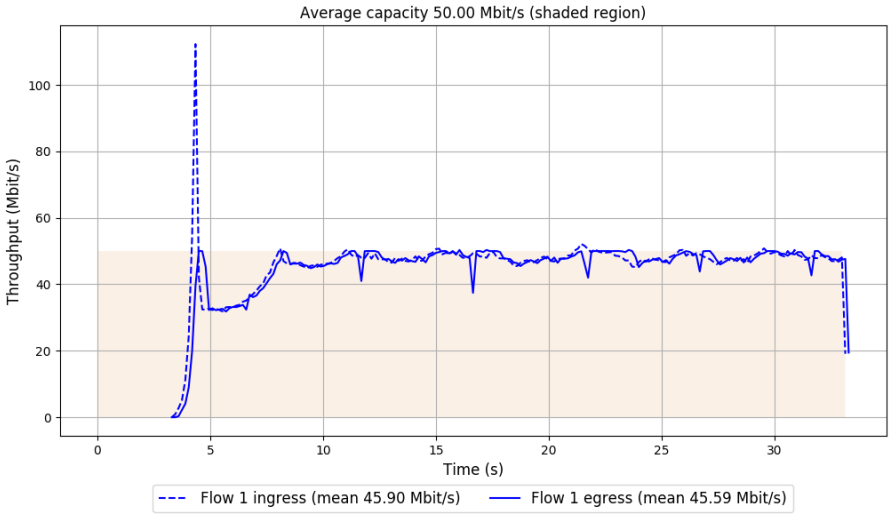



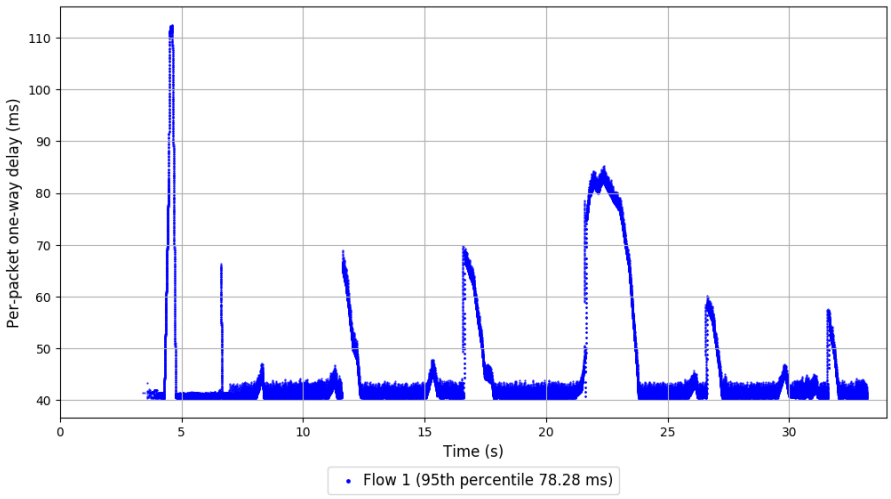

Per-packet one-way delay (ms)
110
100
90
80
70
60
50
40
0
5
10
15
20
25
30
Time (s)
Flow 1 (99th percentile 79.04 ms)

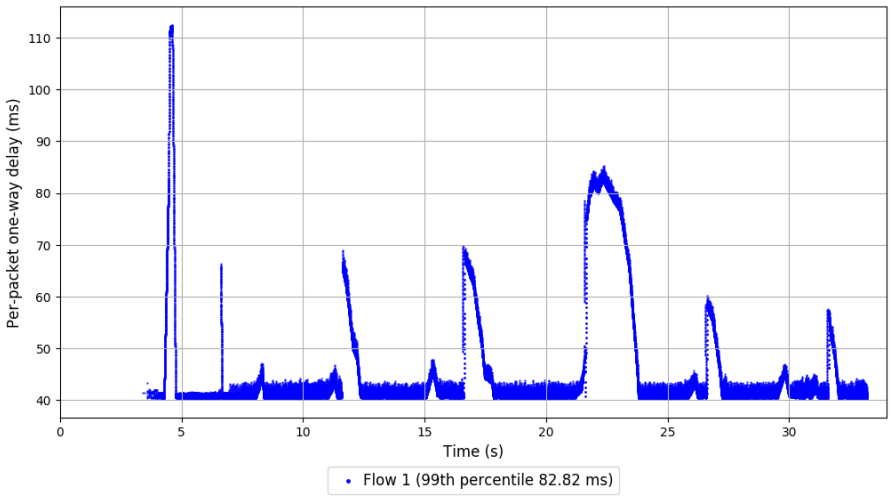

Per-packet one-way delay (ms)
110
100
90
80
70
60
50
40
0
5
10
15
20
25
30
Time (s)
Flow 1 (mean 42.55 ms)

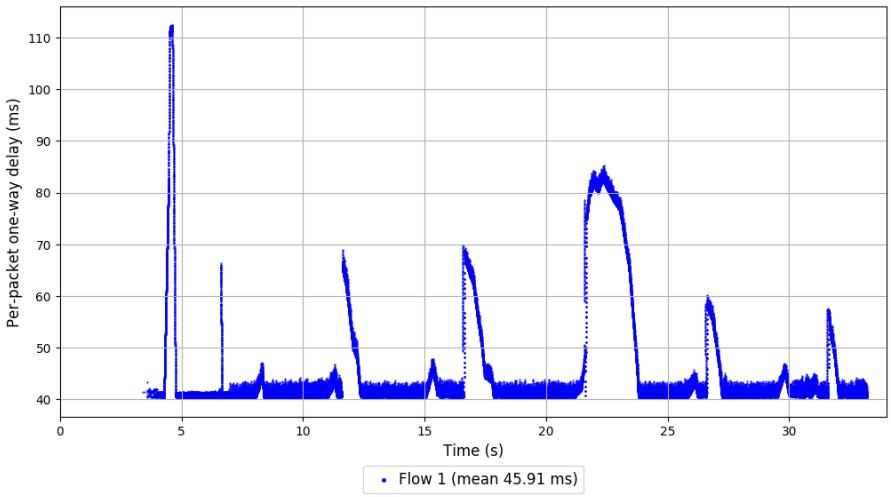
```
Run 2: Statistics of PCC-Allegro

Start at: 2020-05-29 23:18:31
End at: 2020-05-29 23:19:01

# Below is generated by plot.py at 2020-05-30 02:53:19
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 45.59 Mbit/s (91.2% utilization)
95th percentile per-packet one-way delay: 78.275 ms
99th percentile per-packet one-way delay: 82.822 ms
mean per-packet one-way delay: 45.912 ms
Loss rate: 0.82%
-- Flow 1:
Average throughput: 45.59 Mbit/s
95th percentile per-packet one-way delay: 78.275 ms
99th percentile per-packet one-way delay: 82.822 ms
Average per-packet one-way delay: 45.912 ms
Loss rate: 0.82%
```

Run 2: Report of PCC-Allegro — Data Link



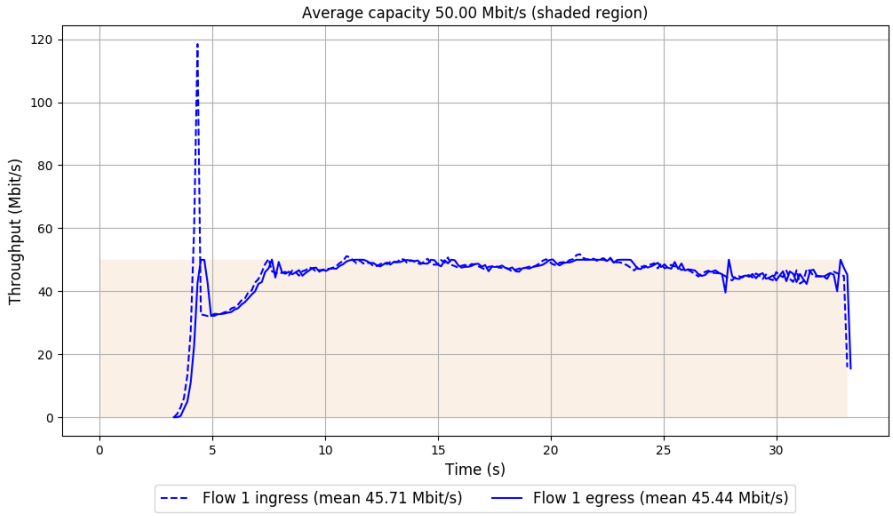



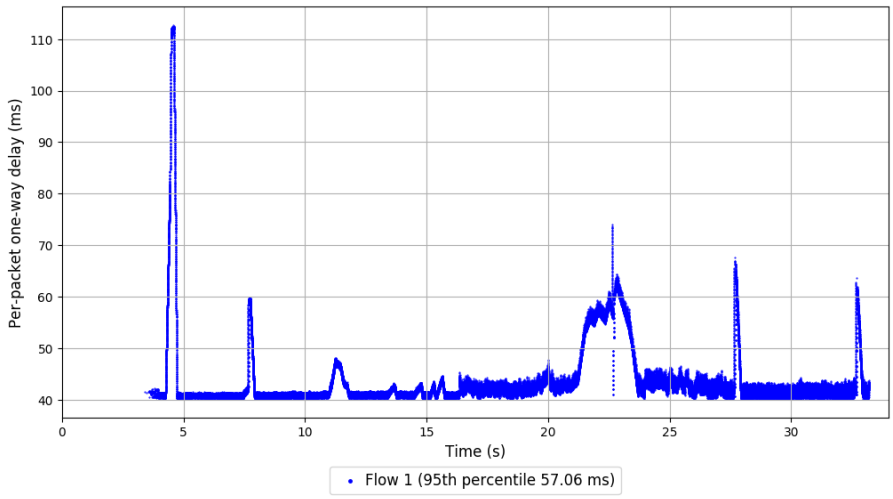

Per-packet one-way delay (ms)
110
100
90
80
70
60
50
40
0
5
10
15
20
25
30
Time (s)
Flow 1 (99th percentile 82.82 ms)

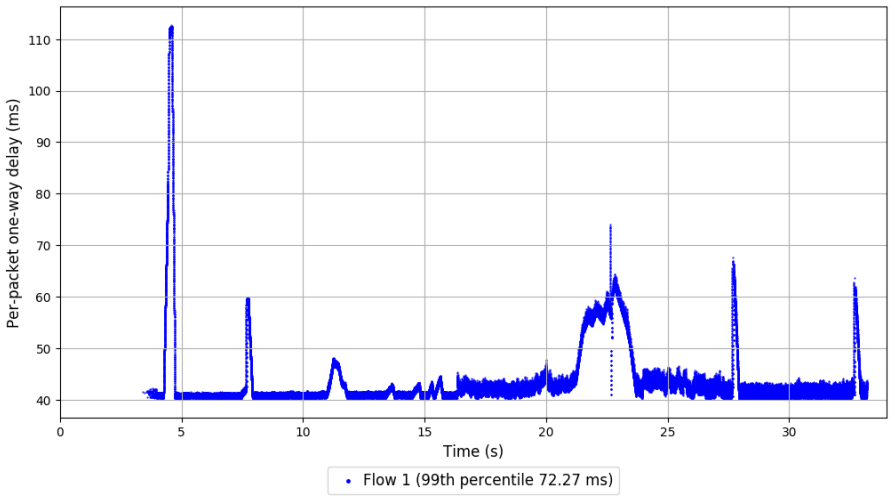

Per-packet one-way delay (ms)
110
100
90
80
70
60
50
40
0
5
10
15
20
25
30
Time (s)
Flow 1 (mean 45.91 ms)

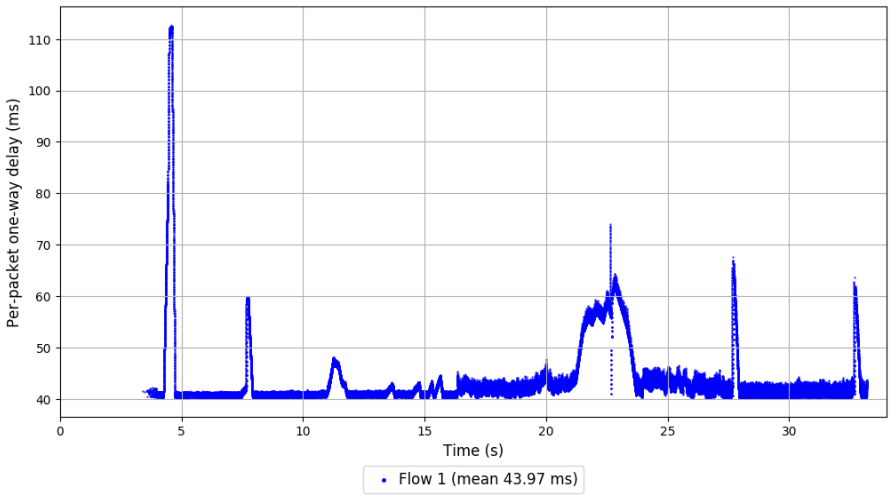
```
Run 3: Statistics of PCC-Allegro

Start at: 2020-05-29 23:20:19
End at: 2020-05-29 23:20:49

# Below is generated by plot.py at 2020-05-30 02:53:21
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 45.44 Mbit/s (90.9% utilization)
95th percentile per-packet one-way delay: 57.058 ms
99th percentile per-packet one-way delay: 72.274 ms
mean per-packet one-way delay: 43.968 ms
Loss rate: 0.78%
-- Flow 1:
Average throughput: 45.44 Mbit/s
95th percentile per-packet one-way delay: 57.058 ms
99th percentile per-packet one-way delay: 72.274 ms
Average per-packet one-way delay: 43.968 ms
Loss rate: 0.78%
```

Run 3: Report of PCC-Allegro — Data Link




Per-packet one-way delay (ms)
110
100
90
80
70
60
50
40
0
5
10
15
20
25
30
Time (s)
Flow 1 (99th percentile 72.27 ms)


Per-packet one-way delay (ms)
110
100
90
80
70
60
50
40
0
5
10
15
20
25
30
Time (s)
Flow 1 (mean 43.97 ms)