Pantheon Report

Generated at 2019-10-22 20:23:42 (UTC).

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

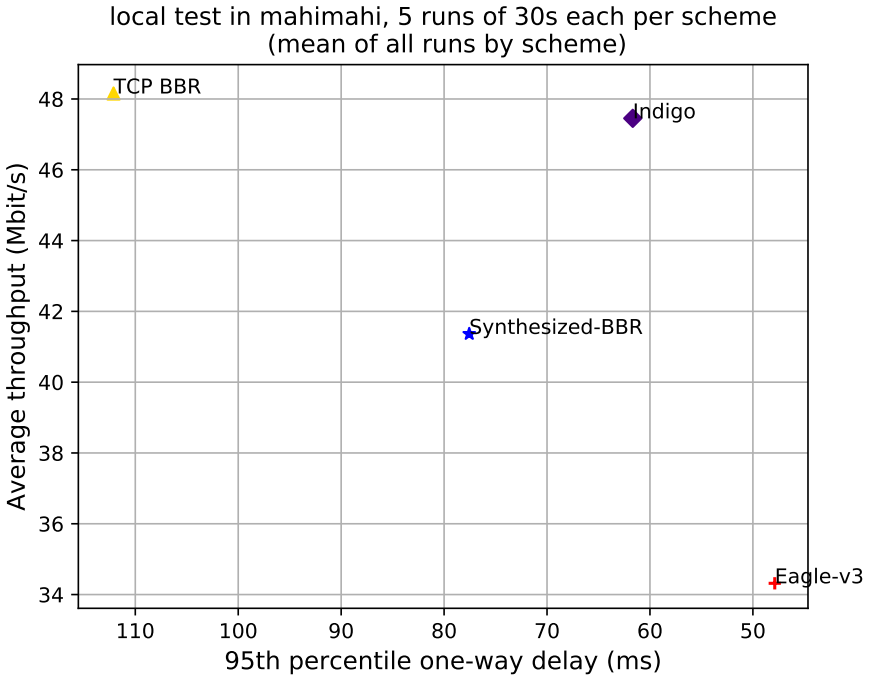
Repeated the test of 4 congestion control schemes 5 times.

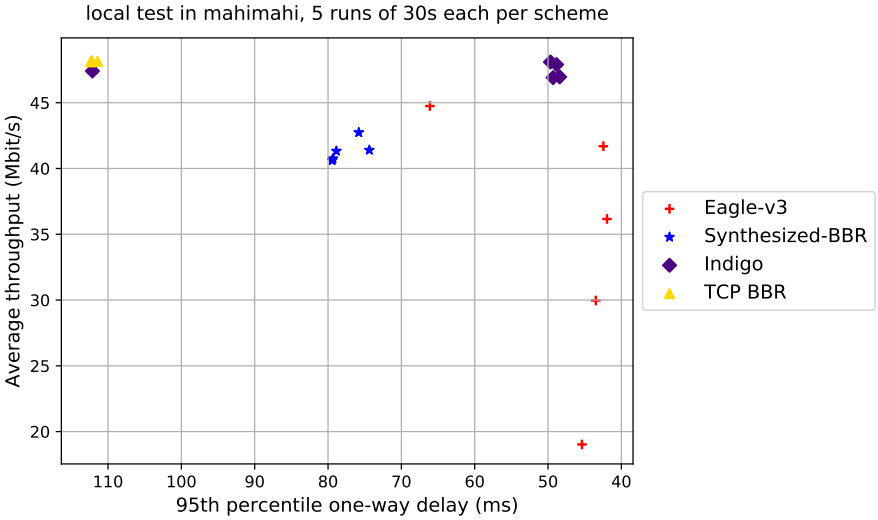
Each test lasted for 30 seconds running 1 flow.

```
System info:
Linux 4.15.0-65-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 87380 6291456
net.ipv4.tcp_wmem = 4096 16384 4194304
```

```
Git summary:
branch: master @ b54fc866b3140559c1fa1782d26fa636f7a43a8d
third_party/aurora @ f3e943d61015b39960854ba6391797e0c7984d74
third_party/aurora-model @ e292c316c23fb837255c4e142e40590d154bbe95
third_party/eagle-v1 @ c68d985e042be5c30704c0aee48c363861951a95
third_party/eagle-v2 @ c8a1737b3c84d7d49eada5b8785045d272a70120
third_party/eagle-v3 @ a63fea7809d9b57a6dbfc95c54181b54157c2b45
 M sender-receiver/sender-receiver/sender_receiver/envs/__pycache__/datagram_pb2.cpython-36.
 M sender-receiver/sender-receiver/sender_receiver/envs/__pycache__/helpers.cpython-36.pyc
 M sender-receiver/sender-receiver/sender_receiver/envs/__pycache__/mahimahi.cpython-36.pyc
 M sender-receiver/sender-receiver/sender_receiver/envs/__pycache__/project_root.cpython-36.
 M sender-receiver/sender-receiver/sender_receiver/envs/__pycache__/receiver.cpython-36.pyc
 M sender-receiver/sender-receiver/sender_receiver/envs/model-xentropy/model-xentropy.pt
 M sender-receiver/sender-receiver/sender_receiver/logs.txt
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/synthesizedBBR @ a63fea7809d9b57a6dbfc95c54181b54157c2b45
 M sender-receiver/sender-receiver/sender_receiver/__pycache__/__init__.cpython-36.pyc
 M sender-receiver/sender-receiver/sender_receiver/envs/__pycache__/__init__.cpython-36.pyc
 M sender-receiver/sender-receiver/sender_receiver/envs/__pycache__/datagram_pb2.cpython-36.
 M sender-receiver/sender-receiver/sender_receiver/envs/__pycache__/helpers.cpython-36.pyc
 M sender-receiver/sender-receiver/sender_receiver/envs/__pycache__/mahimahi.cpython-36.pyc
 M sender-receiver/sender-receiver/sender_receiver/envs/__pycache__/project_root.cpython-36.
 M sender-receiver/sender-receiver/sender_receiver/envs/__pycache__/receiver.cpython-36.pyc
 M sender-receiver/sender-receiver/sender_receiver/envs/__pycache__/sender_receiver_env.cpyt
 M sender-receiver/sender-receiver/sender_receiver/envs/model-xentropy/model-xentropy.pt
 M sender-receiver/sender-receiver/sender_receiver/envs/sender_receiver_env.py
 M sender-receiver/sender-receiver/sender_receiver/logs.txt
third_party/verus @ d4b447ea74c6c60a261149af2629562939f9a494
 M src/verus.hpp
 M tools/plot.py
third_party/vivace @ 2baf86211435ae071a32f96b7d8c504587f5d7f4
third_party/webrtc @ 3f0cc2a9061a41b6f9dde4735770d143a1fa2851
```


local test in mahimahi, 5 runs of 30s each per scheme
(mean of all runs by scheme)
TCP BBR
Indigo
Synthesized-BBR
Eagle-v3
Average throughput (Mbit/s)
95th percentile one-way delay (ms)
48
46
44
42
40
38
36
34
110
100
90
80
70
60
50


local test in mahimahi, 5 runs of 30s each per scheme
Average throughput (Mbit/s)
95th percentile one-way delay (ms)
45
40
35
30
25
20
110
100
90
80
70
60
50
40
Eagle-v3
Synthesized-BBR
Indigo
TCP BBR

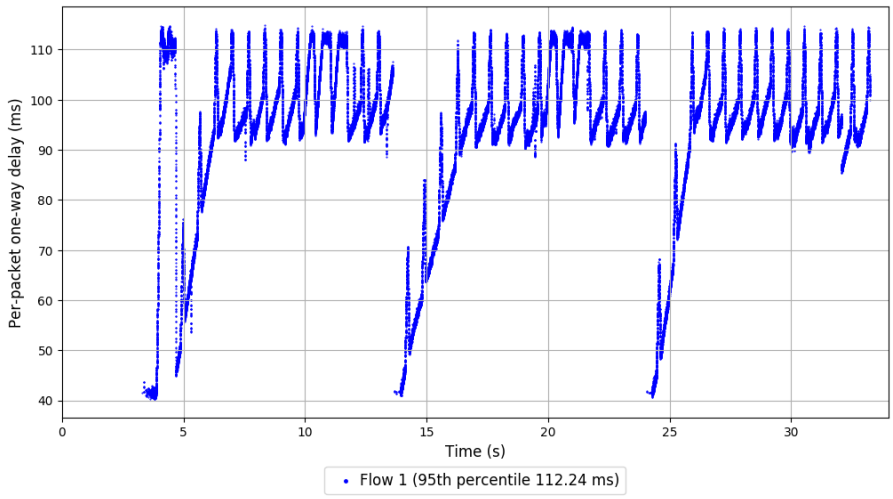
scheme	# runs	mean avg tput (Mbit/s) flow 1	mean 95th-%ile delay (ms) flow 1	mean loss rate (%) flow 1
TCP BBR	5	48.16	112.11	2.48
Eagle-v3	5	34.32	47.88	0.14
Indigo	5	47.45	61.67	2.39
Synthesized-BBR	5	41.37	77.56	0.15

```
Run 1: Statistics of TCP BBR

Start at: 2019-10-22 19:59:50
End at: 2019-10-22 20:00:20

# Below is generated by plot.py at 2019-10-22 20:21:45
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 48.19 Mbit/s (96.4% utilization)
95th percentile per-packet one-way delay: 112.244 ms
Loss rate: 2.38%
-- Flow 1:
Average throughput: 48.19 Mbit/s
95th percentile per-packet one-way delay: 112.244 ms
Loss rate: 2.38%
```

Run 1: Report of TCP BBR — Data Link

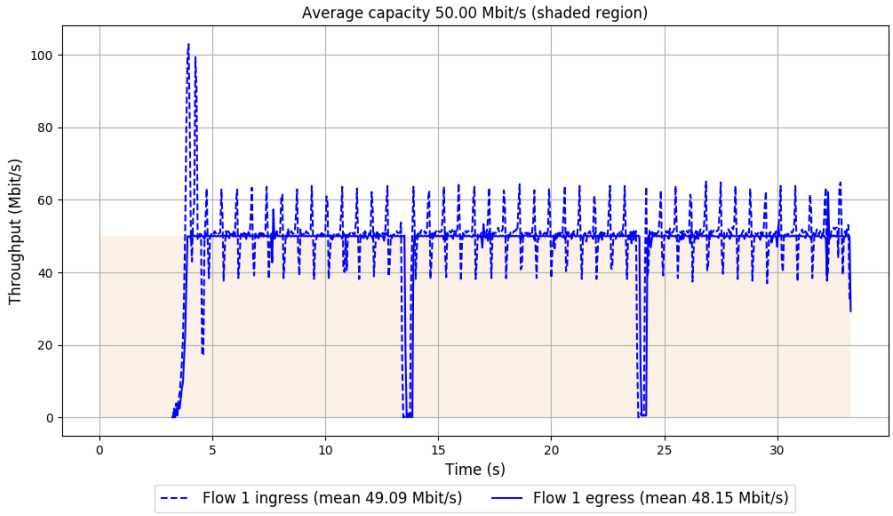


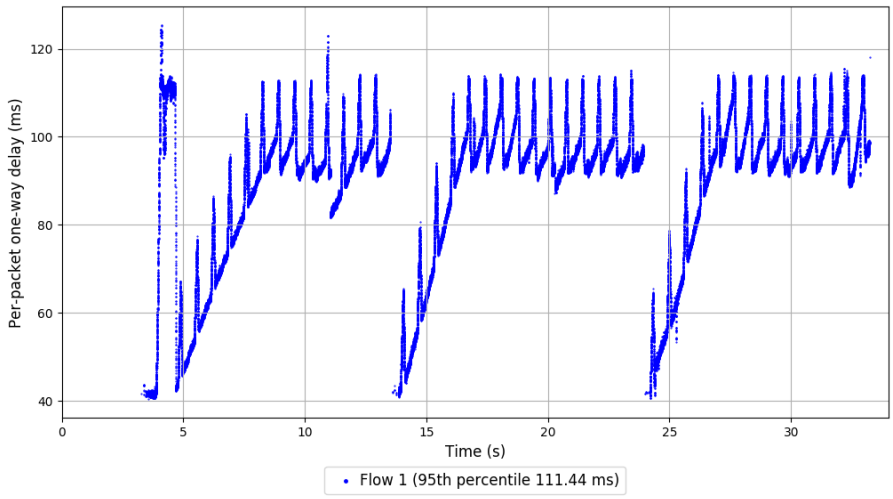
```
Run 2: Statistics of TCP BBR

Start at: 2019-10-22 20:02:15
End at: 2019-10-22 20:02:45

# Below is generated by plot.py at 2019-10-22 20:21:45
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 48.15 Mbit/s (96.3% utilization)
95th percentile per-packet one-way delay: 111.436 ms
Loss rate: 1.99%
-- Flow 1:
Average throughput: 48.15 Mbit/s
95th percentile per-packet one-way delay: 111.436 ms
Loss rate: 1.99%
```

Run 2: Report of TCP BBR — Data Link



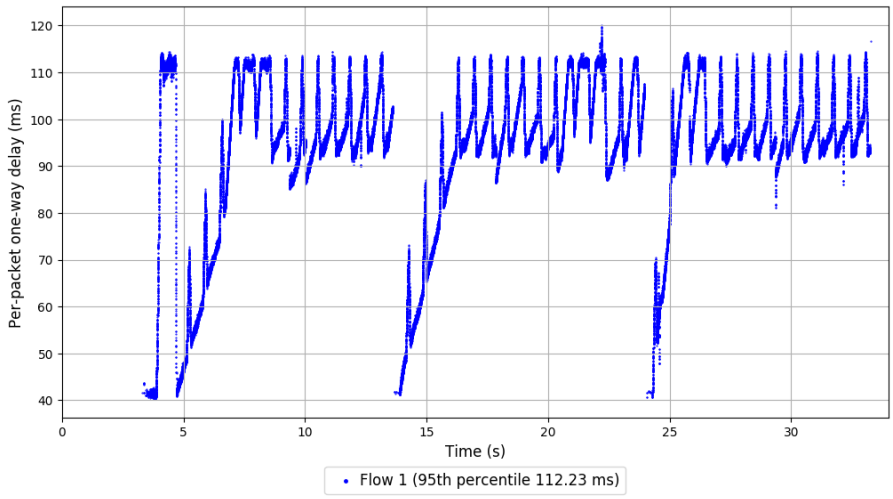


```
Run 3: Statistics of TCP BBR

Start at: 2019-10-22 20:04:41
End at: 2019-10-22 20:05:11

# Below is generated by plot.py at 2019-10-22 20:21:55
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 48.16 Mbit/s (96.3% utilization)
95th percentile per-packet one-way delay: 112.229 ms
Loss rate: 2.76%
-- Flow 1:
Average throughput: 48.16 Mbit/s
95th percentile per-packet one-way delay: 112.229 ms
Loss rate: 2.76%
```

Run 3: Report of TCP BBR — Data Link

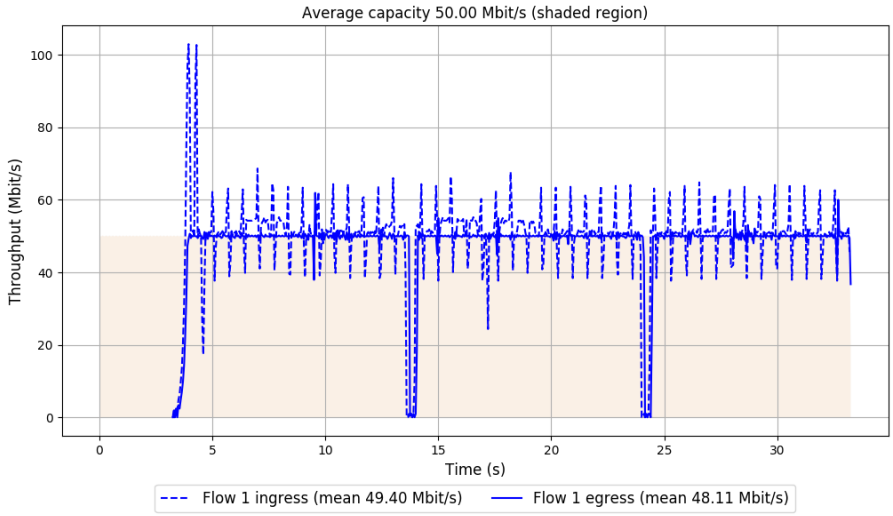


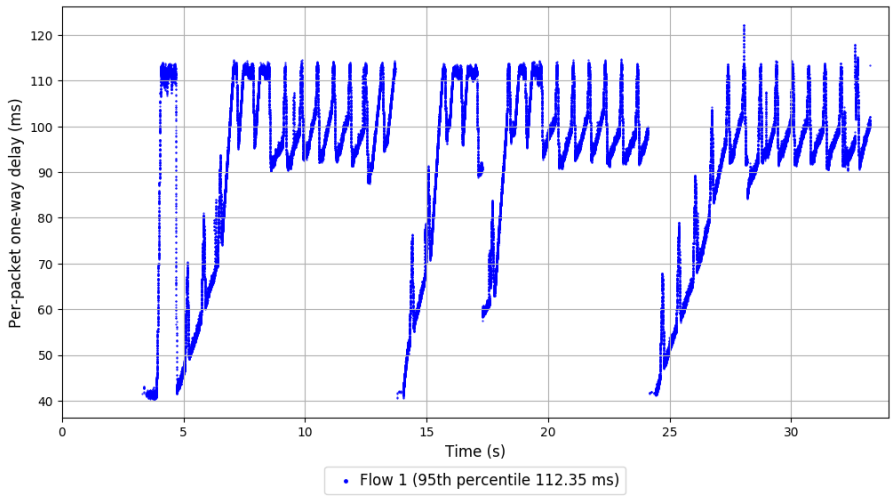
```
Run 4: Statistics of TCP BBR

Start at: 2019-10-22 20:07:07
End at: 2019-10-22 20:07:37

# Below is generated by plot.py at 2019-10-22 20:21:58
# 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: 112.354 ms
Loss rate: 2.72%
-- Flow 1:
Average throughput: 48.11 Mbit/s
95th percentile per-packet one-way delay: 112.354 ms
Loss rate: 2.72%
```

Run 4: Report of TCP BBR — Data Link



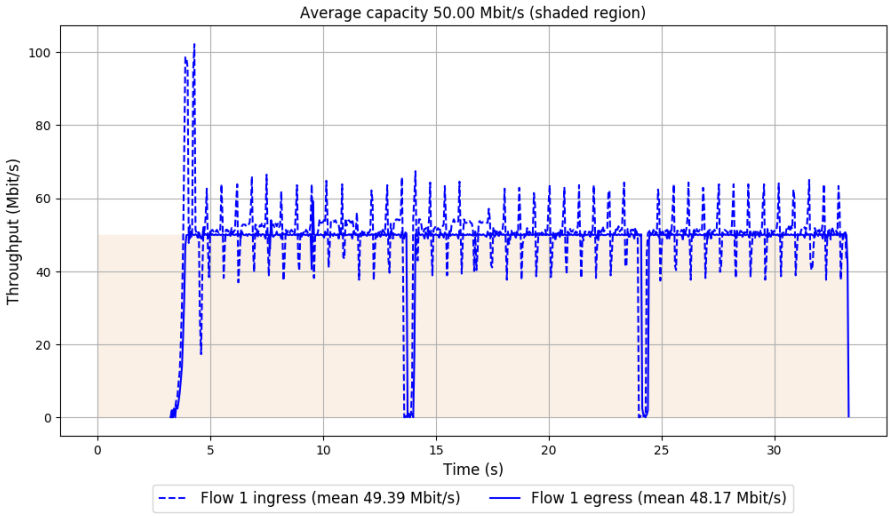


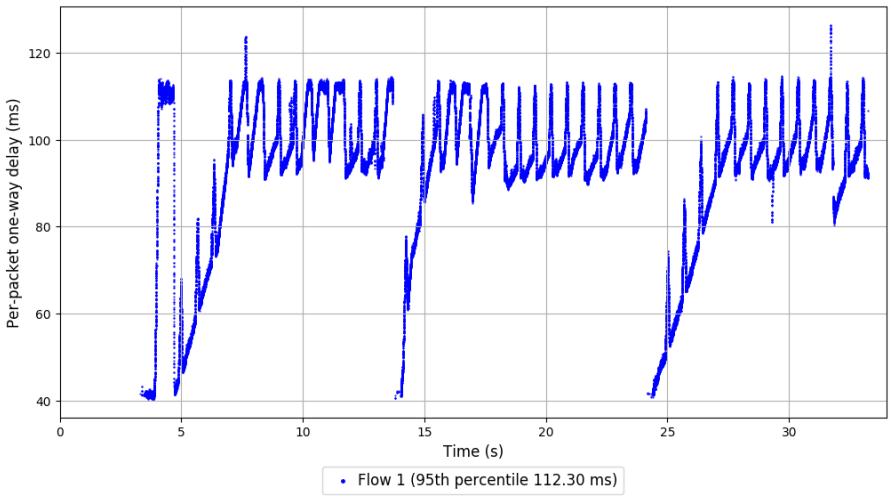
```
Run 5: Statistics of TCP BBR

Start at: 2019-10-22 20:09:34
End at: 2019-10-22 20:10:04

# Below is generated by plot.py at 2019-10-22 20:22:16
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 48.17 Mbit/s (96.3% utilization)
95th percentile per-packet one-way delay: 112.300 ms
Loss rate: 2.57%
-- Flow 1:
Average throughput: 48.17 Mbit/s
95th percentile per-packet one-way delay: 112.300 ms
Loss rate: 2.57%
```

Run 5: Report of TCP BBR — Data Link



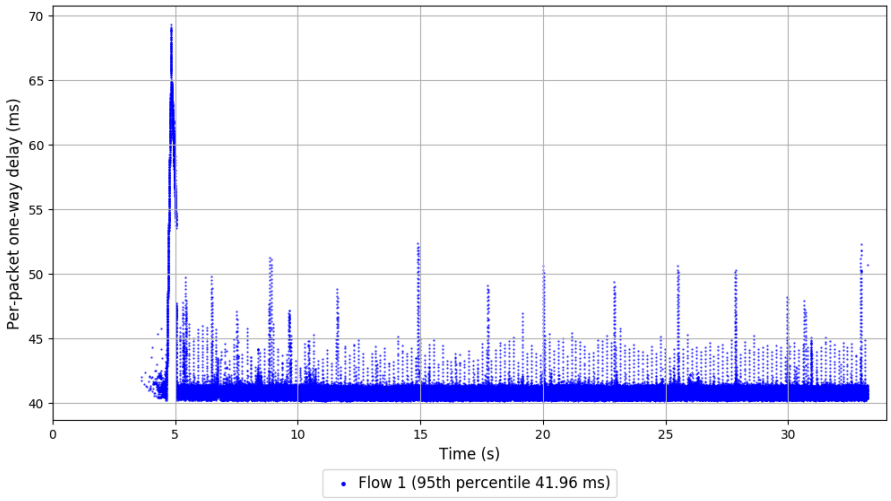


```
Run 1: Statistics of Eagle-v3

Start at: 2019-10-22 19:58:37
End at: 2019-10-22 19:59:07

# Below is generated by plot.py at 2019-10-22 20:22:16
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 36.16 Mbit/s (72.3% utilization)
95th percentile per-packet one-way delay: 41.958 ms
Loss rate: 0.14%
-- Flow 1:
Average throughput: 36.16 Mbit/s
95th percentile per-packet one-way delay: 41.958 ms
Loss rate: 0.14%
```

Run 1: Report of Eagle-v3 — Data Link

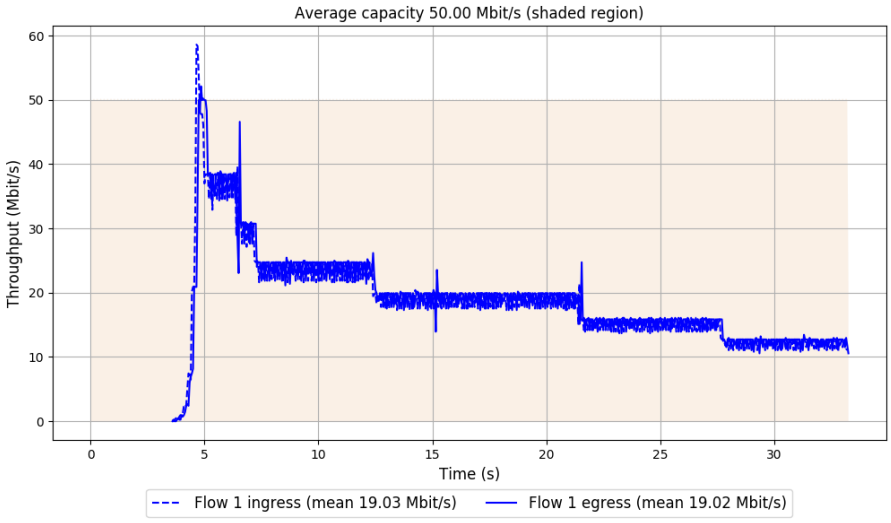


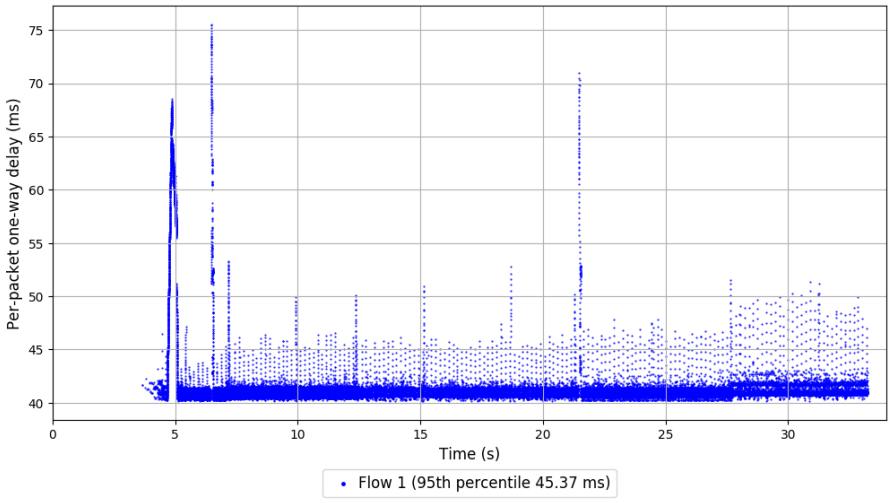
```
Run 2: Statistics of Eagle-v3

Start at: 2019-10-22 20:01:03
End at: 2019-10-22 20:01:33

# Below is generated by plot.py at 2019-10-22 20:22:16
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 19.02 Mbit/s (38.0% utilization)
95th percentile per-packet one-way delay: 45.374 ms
Loss rate: 0.16%
-- Flow 1:
Average throughput: 19.02 Mbit/s
95th percentile per-packet one-way delay: 45.374 ms
Loss rate: 0.16%
```

Run 2: Report of Eagle-v3 — Data Link



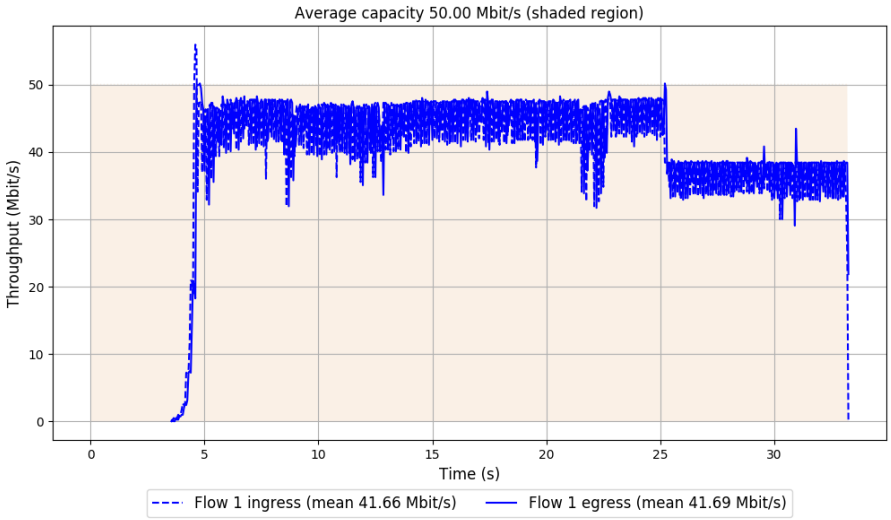


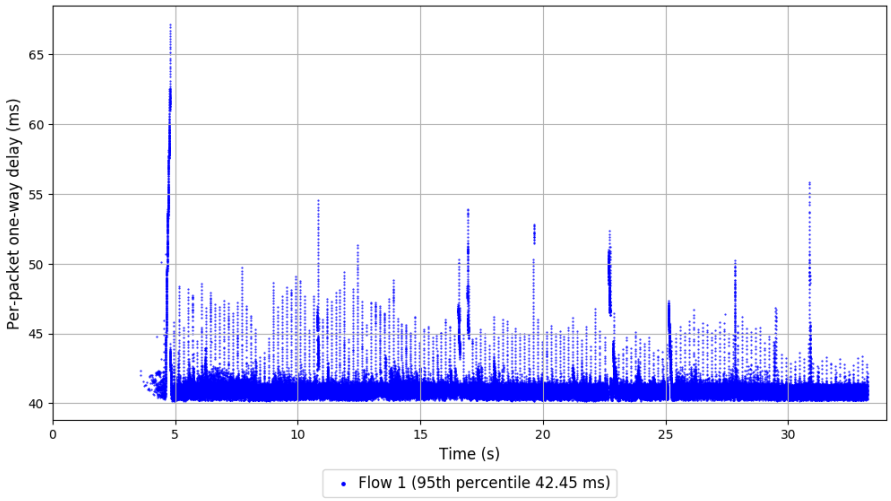
```
Run 3: Statistics of Eagle-v3

Start at: 2019-10-22 20:03:28
End at: 2019-10-22 20:03:58

# Below is generated by plot.py at 2019-10-22 20:22:30
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 41.69 Mbit/s (83.4% utilization)
95th percentile per-packet one-way delay: 42.454 ms
Loss rate: 0.12%
-- Flow 1:
Average throughput: 41.69 Mbit/s
95th percentile per-packet one-way delay: 42.454 ms
Loss rate: 0.12%
```

Run 3: Report of Eagle-v3 — Data Link



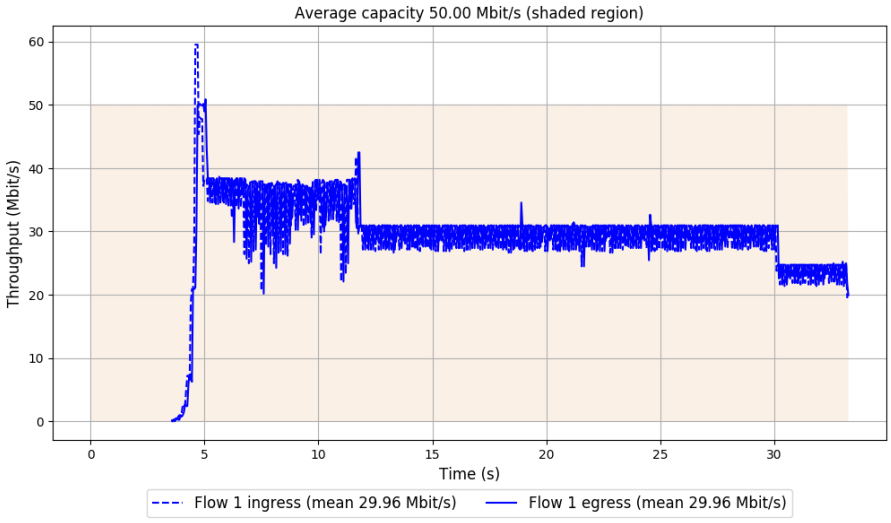


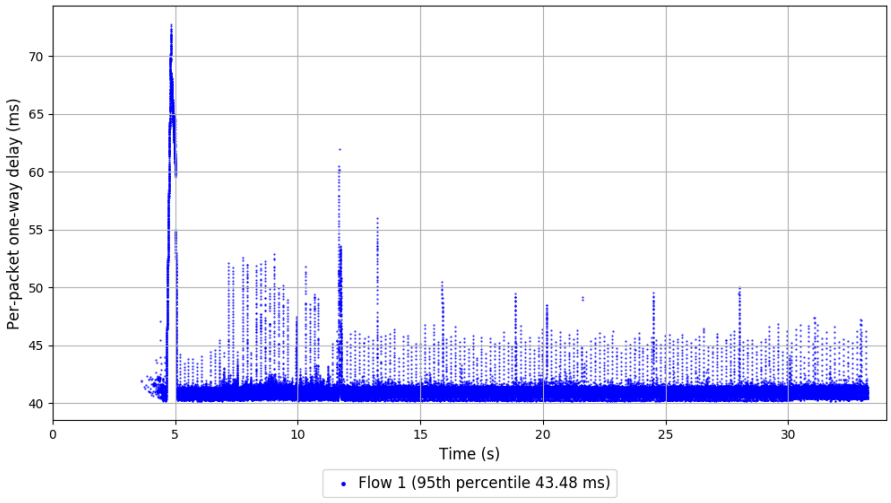
```
Run 4: Statistics of Eagle-v3

Start at: 2019-10-22 20:05:55
End at: 2019-10-22 20:06:25

# Below is generated by plot.py at 2019-10-22 20:22:30
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 29.96 Mbit/s (59.9% utilization)
95th percentile per-packet one-way delay: 43.484 ms
Loss rate: 0.11%
-- Flow 1:
Average throughput: 29.96 Mbit/s
95th percentile per-packet one-way delay: 43.484 ms
Loss rate: 0.11%
```

Run 4: Report of Eagle-v3 — Data Link



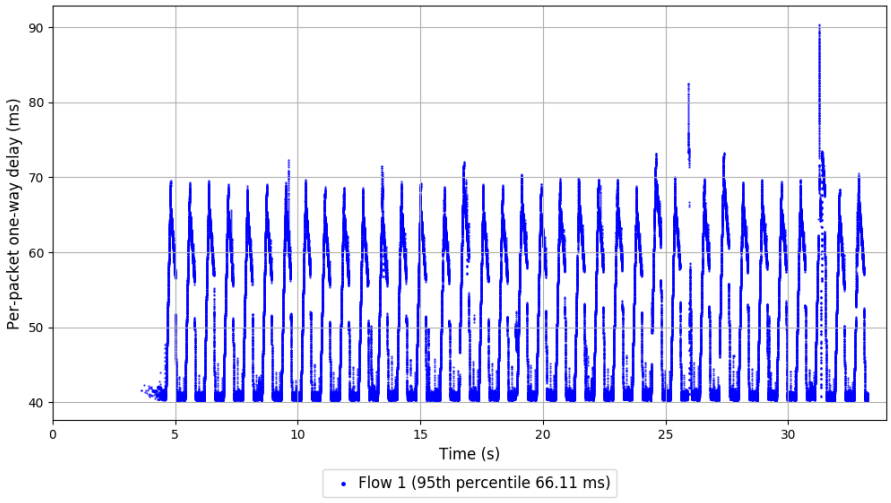


```
Run 5: Statistics of Eagle-v3

Start at: 2019-10-22 20:08:20
End at: 2019-10-22 20:08:51

# Below is generated by plot.py at 2019-10-22 20:22:47
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 44.75 Mbit/s (89.5% utilization)
95th percentile per-packet one-way delay: 66.110 ms
Loss rate: 0.19%
-- Flow 1:
Average throughput: 44.75 Mbit/s
95th percentile per-packet one-way delay: 66.110 ms
Loss rate: 0.19%
```

Run 5: Report of Eagle-v3 — Data Link

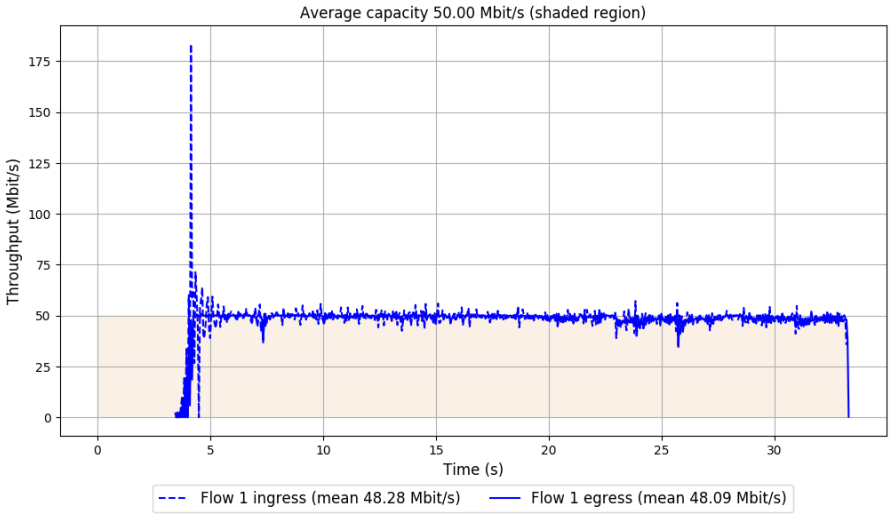


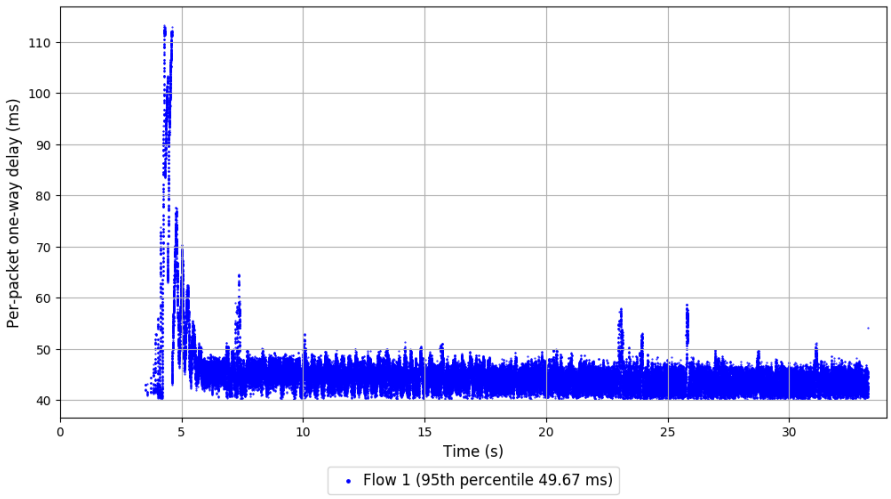
```
Run 1: Statistics of Indigo

Start at: 2019-10-22 20:00:26
End at: 2019-10-22 20:00:56

# Below is generated by plot.py at 2019-10-22 20:22:47
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 48.09 Mbit/s (96.2% utilization)
95th percentile per-packet one-way delay: 49.670 ms
Loss rate: 0.49%
-- Flow 1:
Average throughput: 48.09 Mbit/s
95th percentile per-packet one-way delay: 49.670 ms
Loss rate: 0.49%
```

Run 1: Report of Indigo — Data Link



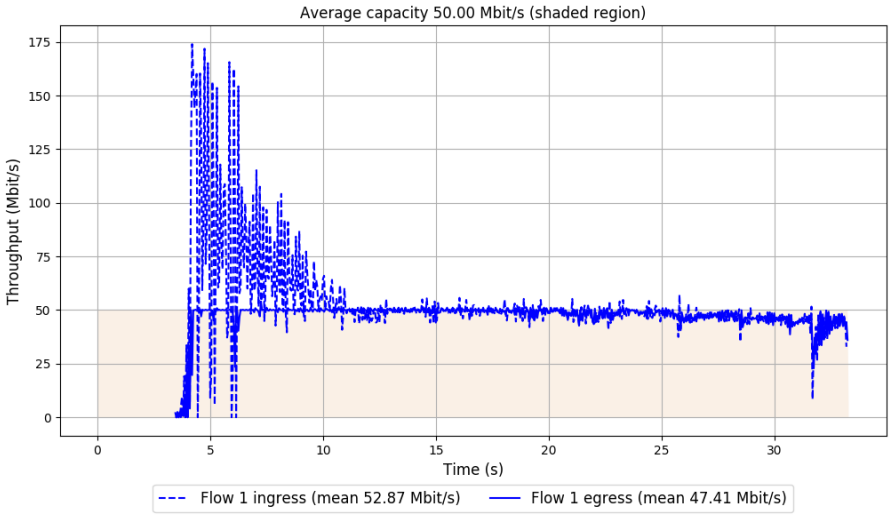


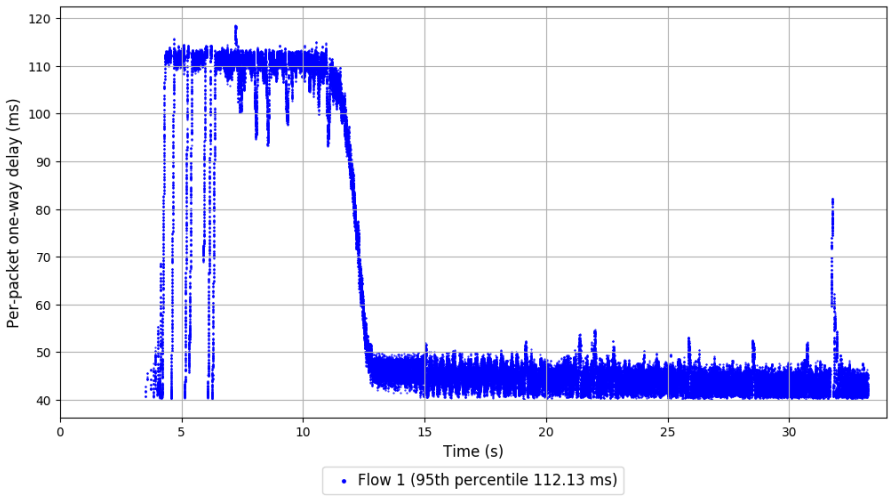
```
Run 2: Statistics of Indigo

Start at: 2019-10-22 20:02:51
End at: 2019-10-22 20:03:21

# Below is generated by plot.py at 2019-10-22 20:22:57
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 47.41 Mbit/s (94.8% utilization)
95th percentile per-packet one-way delay: 112.132 ms
Loss rate: 10.45%
-- Flow 1:
Average throughput: 47.41 Mbit/s
95th percentile per-packet one-way delay: 112.132 ms
Loss rate: 10.45%
```

Run 2: Report of Indigo — Data Link



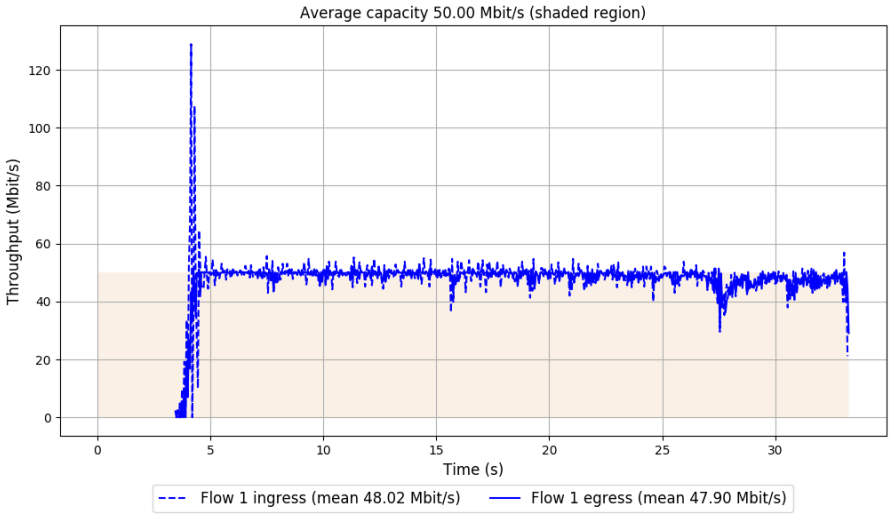


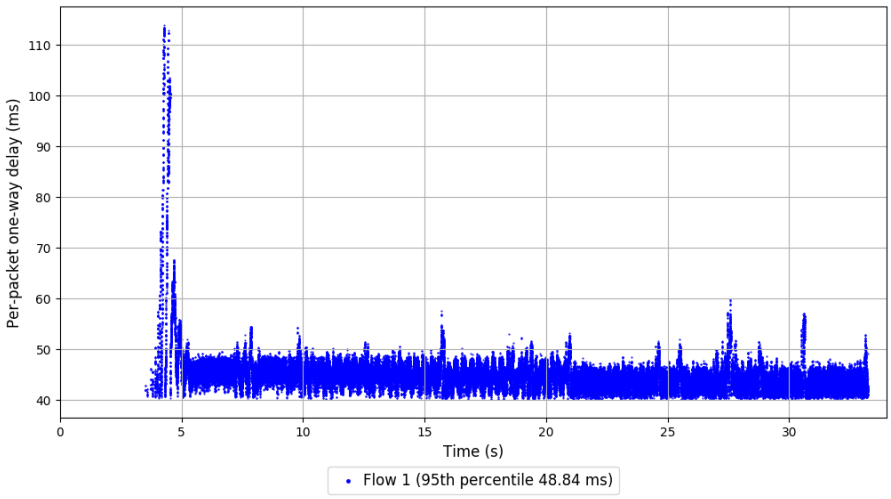
```
Run 3: Statistics of Indigo

Start at: 2019-10-22 20:05:18
End at: 2019-10-22 20:05:48

# Below is generated by plot.py at 2019-10-22 20:23:01
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 47.90 Mbit/s (95.8% utilization)
95th percentile per-packet one-way delay: 48.837 ms
Loss rate: 0.36%
-- Flow 1:
Average throughput: 47.90 Mbit/s
95th percentile per-packet one-way delay: 48.837 ms
Loss rate: 0.36%
```

Run 3: Report of Indigo — Data Link



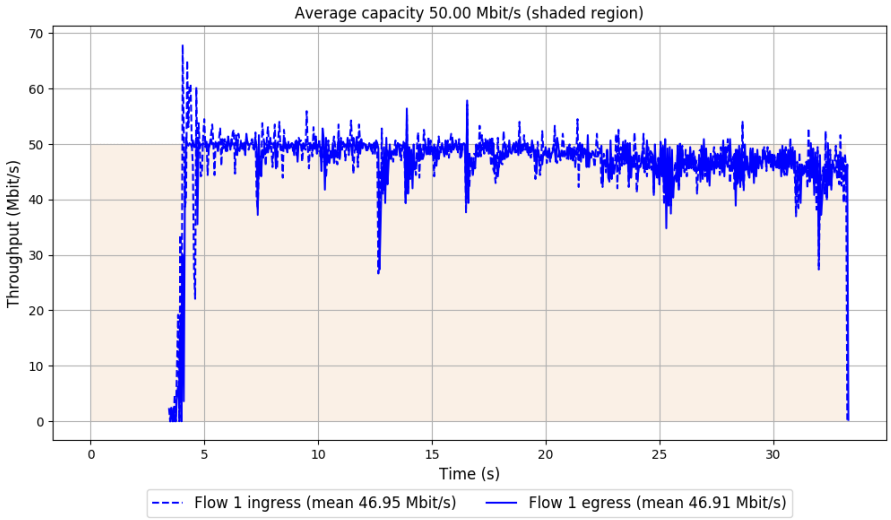


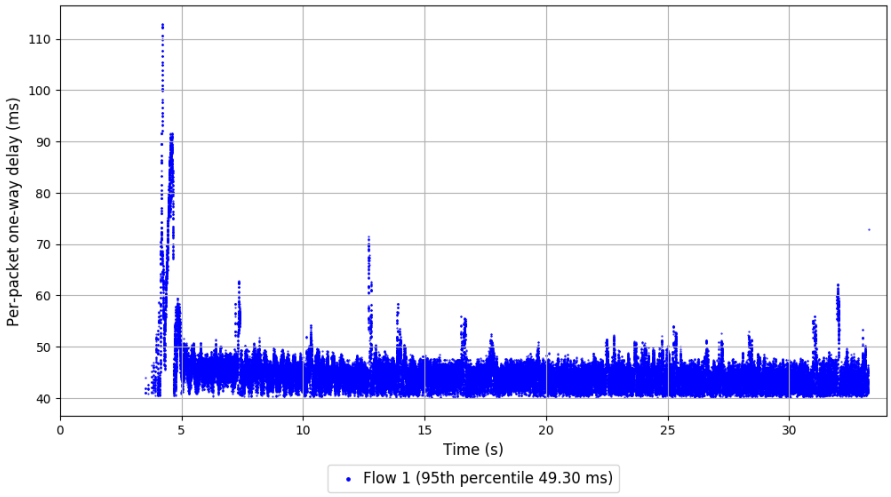
```
Run 4: Statistics of Indigo

Start at: 2019-10-22 20:07:44
End at: 2019-10-22 20:08:14

# Below is generated by plot.py at 2019-10-22 20:23:10
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 46.91 Mbit/s (93.8% utilization)
95th percentile per-packet one-way delay: 49.305 ms
Loss rate: 0.20%
-- Flow 1:
Average throughput: 46.91 Mbit/s
95th percentile per-packet one-way delay: 49.305 ms
Loss rate: 0.20%
```

Run 4: Report of Indigo — Data Link



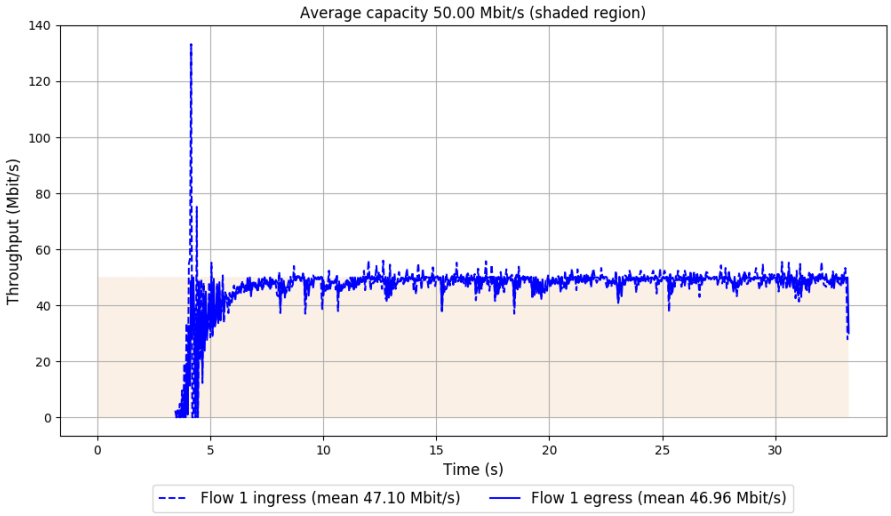


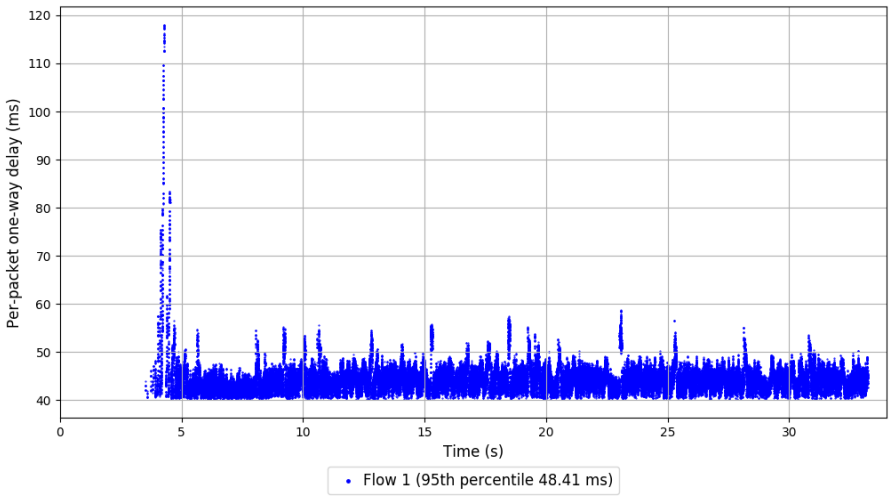
```
Run 5: Statistics of Indigo

Start at: 2019-10-22 20:10:10
End at: 2019-10-22 20:10:40

# Below is generated by plot.py at 2019-10-22 20:23:23
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 46.96 Mbit/s (93.9% utilization)
95th percentile per-packet one-way delay: 48.411 ms
Loss rate: 0.44%
-- Flow 1:
Average throughput: 46.96 Mbit/s
95th percentile per-packet one-way delay: 48.411 ms
Loss rate: 0.44%
```

Run 5: Report of Indigo — Data Link



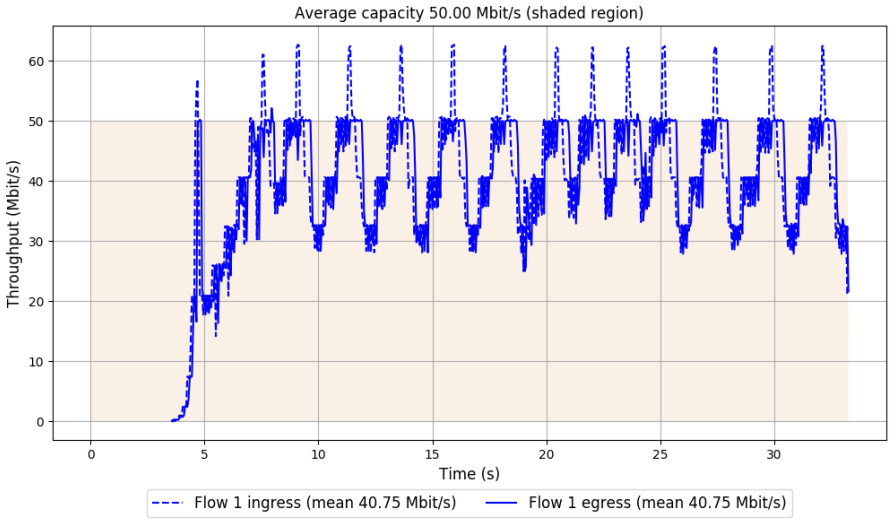


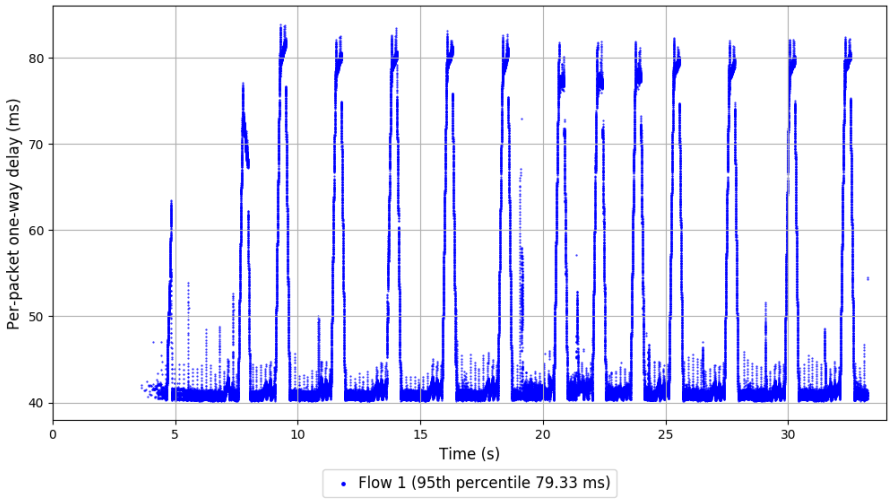
```
Run 1: Statistics of Synthesized-BBR

Start at: 2019-10-22 19:59:14
End at: 2019-10-22 19:59:44

# Below is generated by plot.py at 2019-10-22 20:23:23
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 40.75 Mbit/s (81.5% utilization)
95th percentile per-packet one-way delay: 79.326 ms
Loss rate: 0.11%
-- Flow 1:
Average throughput: 40.75 Mbit/s
95th percentile per-packet one-way delay: 79.326 ms
Loss rate: 0.11%
```

Run 1: Report of Synthesized-BBR — Data Link



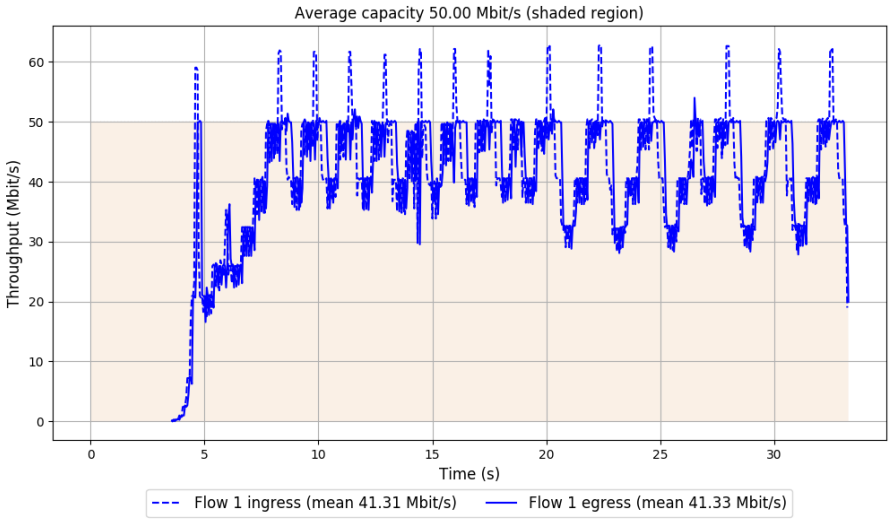


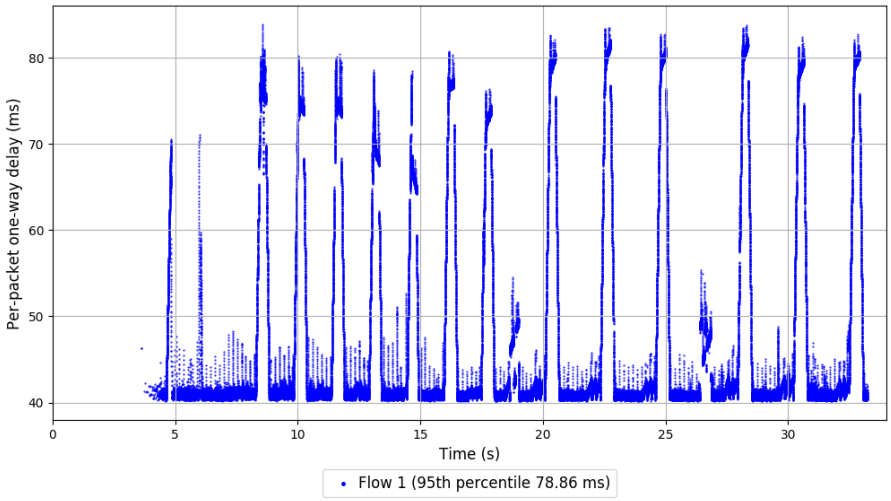
```
Run 2: Statistics of Synthesized-BBR

Start at: 2019-10-22 20:01:39
End at: 2019-10-22 20:02:09

# Below is generated by plot.py at 2019-10-22 20:23:31
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 41.33 Mbit/s (82.7% utilization)
95th percentile per-packet one-way delay: 78.859 ms
Loss rate: 0.11%
-- Flow 1:
Average throughput: 41.33 Mbit/s
95th percentile per-packet one-way delay: 78.859 ms
Loss rate: 0.11%
```

Run 2: Report of Synthesized-BBR — Data Link



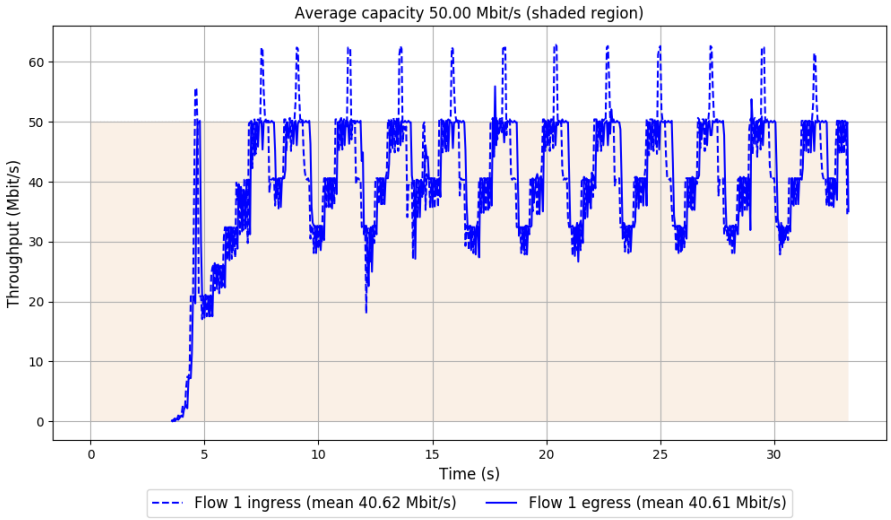


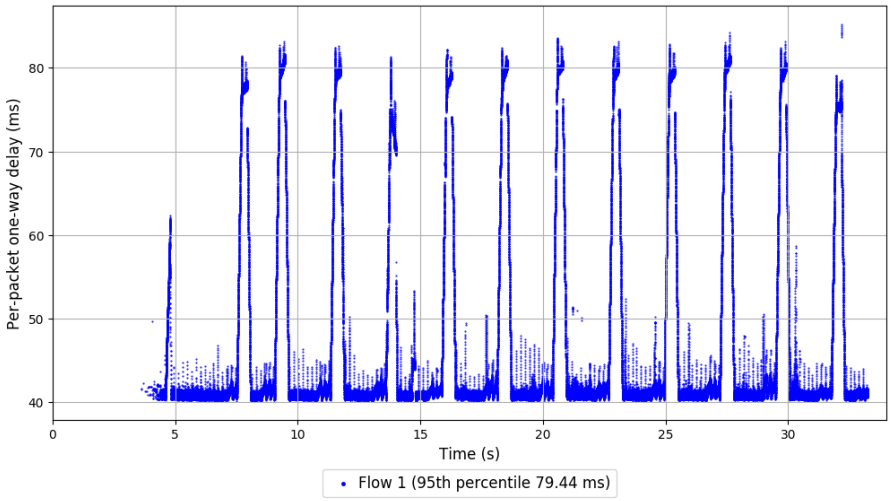
```
Run 3: Statistics of Synthesized-BBR

Start at: 2019-10-22 20:04:05
End at: 2019-10-22 20:04:35

# Below is generated by plot.py at 2019-10-22 20:23:35
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 40.61 Mbit/s (81.2% utilization)
95th percentile per-packet one-way delay: 79.440 ms
Loss rate: 0.17%
-- Flow 1:
Average throughput: 40.61 Mbit/s
95th percentile per-packet one-way delay: 79.440 ms
Loss rate: 0.17%
```

Run 3: Report of Synthesized-BBR — Data Link



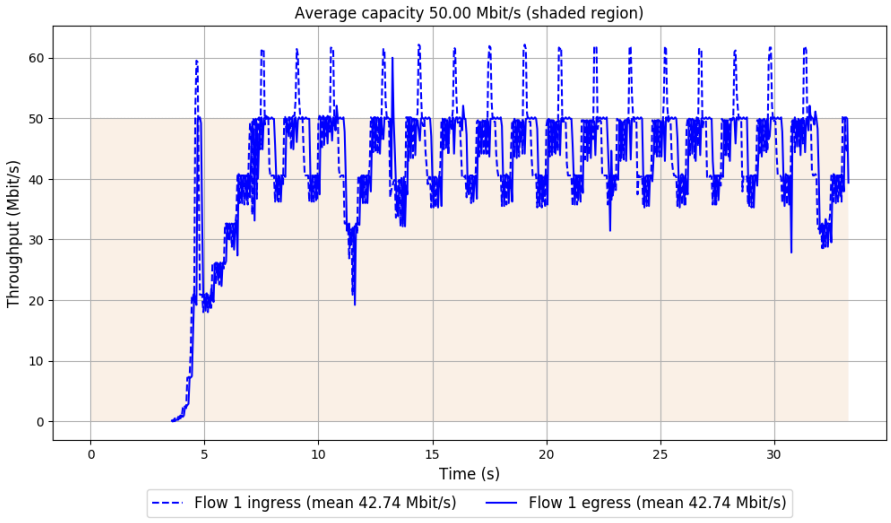


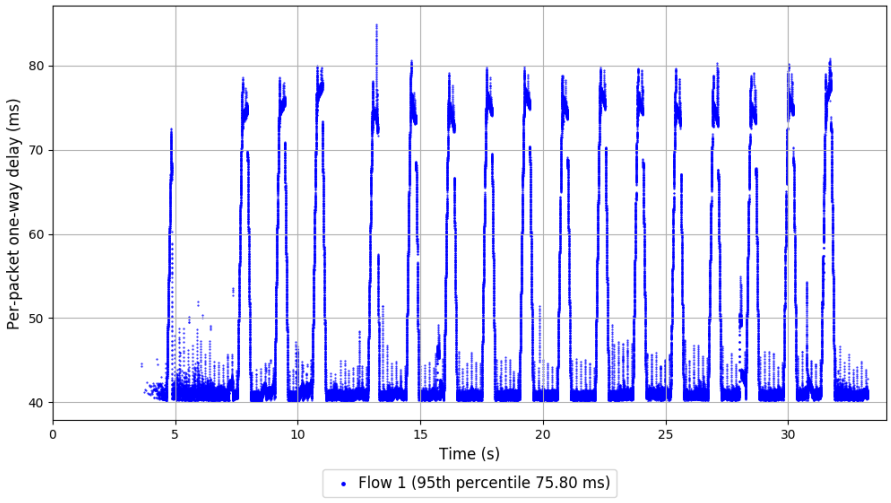
```
Run 4: Statistics of Synthesized-BBR

Start at: 2019-10-22 20:06:31
End at: 2019-10-22 20:07:01

# Below is generated by plot.py at 2019-10-22 20:23:40
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 42.74 Mbit/s (85.5% utilization)
95th percentile per-packet one-way delay: 75.804 ms
Loss rate: 0.16%
-- Flow 1:
Average throughput: 42.74 Mbit/s
95th percentile per-packet one-way delay: 75.804 ms
Loss rate: 0.16%
```

Run 4: Report of Synthesized-BBR — Data Link





```
Run 5: Statistics of Synthesized-BBR

Start at: 2019-10-22 20:08:57
End at: 2019-10-22 20:09:27

# Below is generated by plot.py at 2019-10-22 20:23:41
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 41.40 Mbit/s (82.8% utilization)
95th percentile per-packet one-way delay: 74.361 ms
Loss rate: 0.18%
-- Flow 1:
Average throughput: 41.40 Mbit/s
95th percentile per-packet one-way delay: 74.361 ms
Loss rate: 0.18%
```

Run 5: Report of Synthesized-BBR — Data Link