Pantheon Report

Generated at 2019-10-22 18:10:37 (UTC).

Tested in mahimahi: `mm-delay 10 mm-link 100mbps.trace 100mbps.trace --uplink-queue=droptail --uplink-queue-args=packets=300`

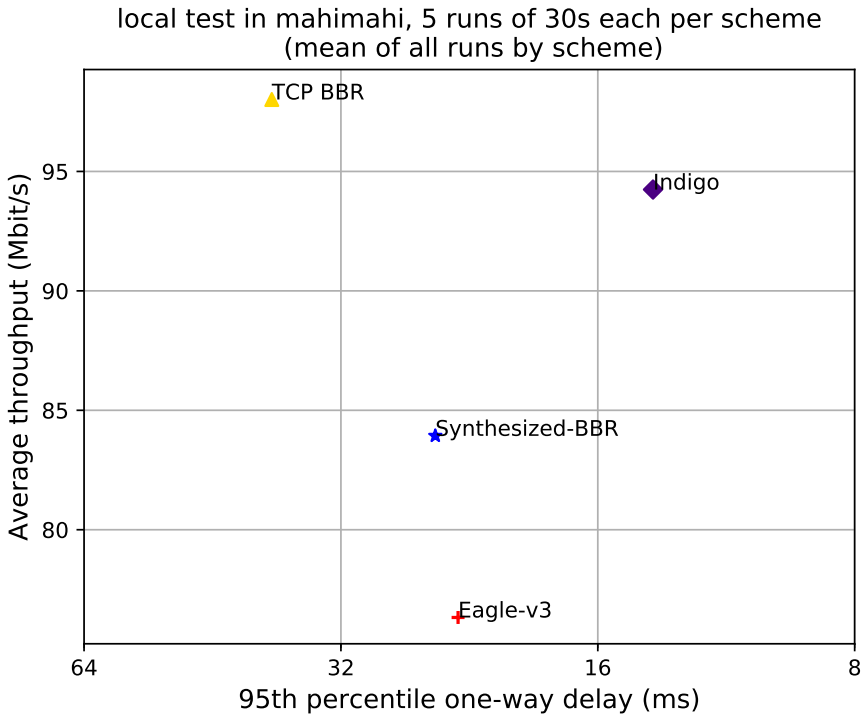
Repeated the test of 4 congestion control schemes 5 times.

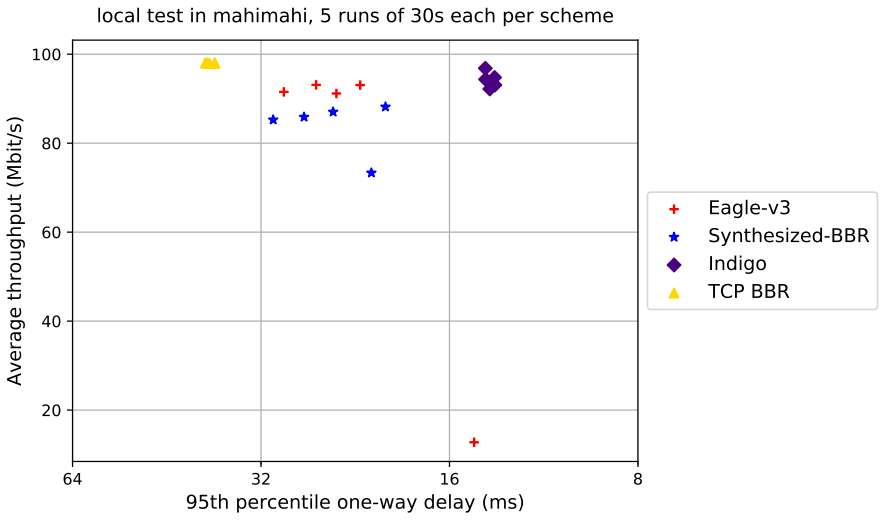
Each test lasted for 30 seconds running 1 flow.

```
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)
95
90
85
80
64
32
16
8
95th percentile one-way delay (ms)


local test in mahimahi, 5 runs of 30s each per scheme
Average throughput (Mbit/s)
100
80
60
40
20
64
32
16
8
95th percentile one-way delay (ms)
Eagle-v3
Synthesized-BBR
Indigo
TCP BBR

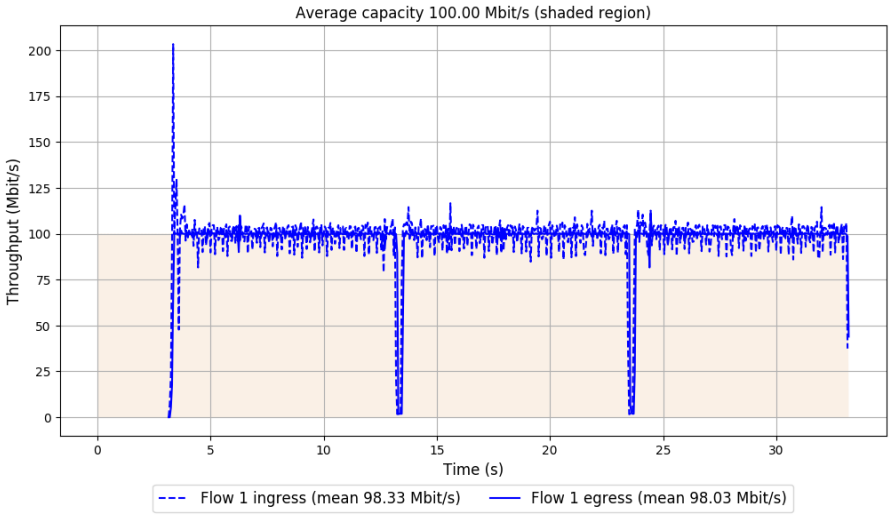
scheme	# runs	mean avg tput (Mbit/s) flow 1	mean 95th-%ile delay (ms) flow 1	mean loss rate (%) flow 1
TCP BBR	5	98.01	38.56	0.30
Eagle-v3	5	76.33	23.33	0.10
Indigo	5	94.24	13.79	0.05
Synthesized-BBR	5	83.93	24.81	0.11

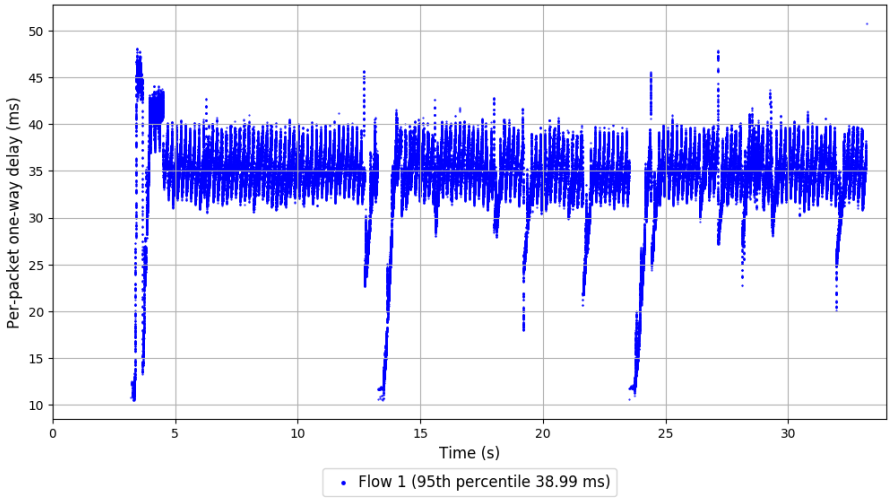
```
Run 1: Statistics of TCP BBR

Start at: 2019-10-22 17:50:16
End at: 2019-10-22 17:50:46

# Below is generated by plot.py at 2019-10-22 18:06:46
# Datalink statistics
-- Total of 1 flow:
Average capacity: 100.00 Mbit/s
Average throughput: 98.03 Mbit/s (98.0% utilization)
95th percentile per-packet one-way delay: 38.992 ms
Loss rate: 0.30%
-- Flow 1:
Average throughput: 98.03 Mbit/s
95th percentile per-packet one-way delay: 38.992 ms
Loss rate: 0.30%
```

Run 1: Report of TCP BBR — Data Link



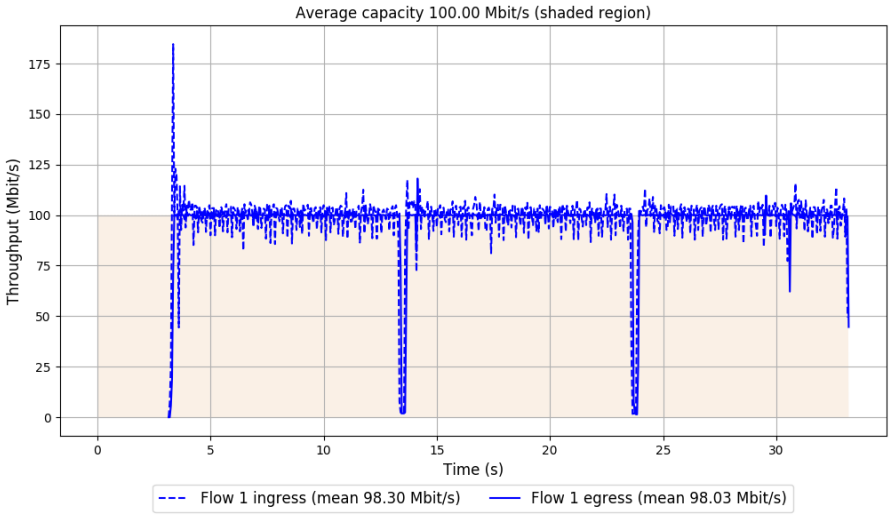


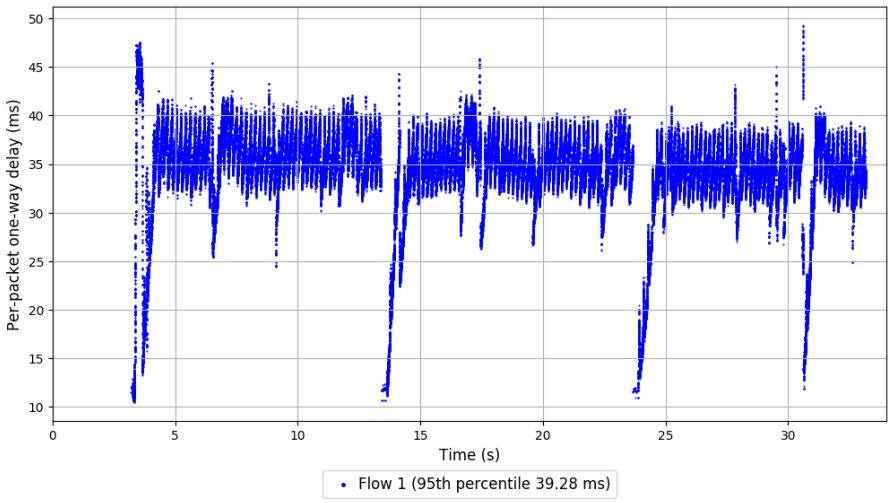
```
Run 2: Statistics of TCP BBR

Start at: 2019-10-22 17:52:53
End at: 2019-10-22 17:53:23

# Below is generated by plot.py at 2019-10-22 18:06:47
# Datalink statistics
-- Total of 1 flow:
Average capacity: 100.00 Mbit/s
Average throughput: 98.03 Mbit/s (98.0% utilization)
95th percentile per-packet one-way delay: 39.277 ms
Loss rate: 0.32%
-- Flow 1:
Average throughput: 98.03 Mbit/s
95th percentile per-packet one-way delay: 39.277 ms
Loss rate: 0.32%
```

Run 2: Report of TCP BBR — Data Link



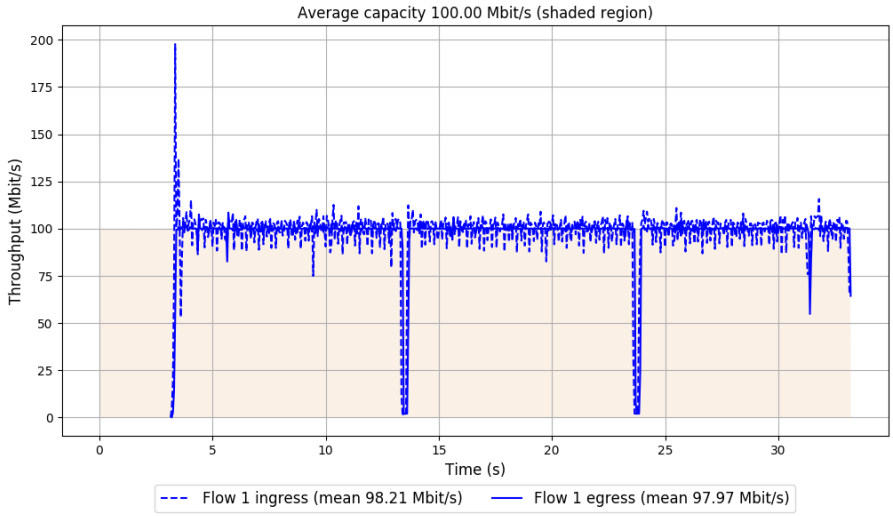


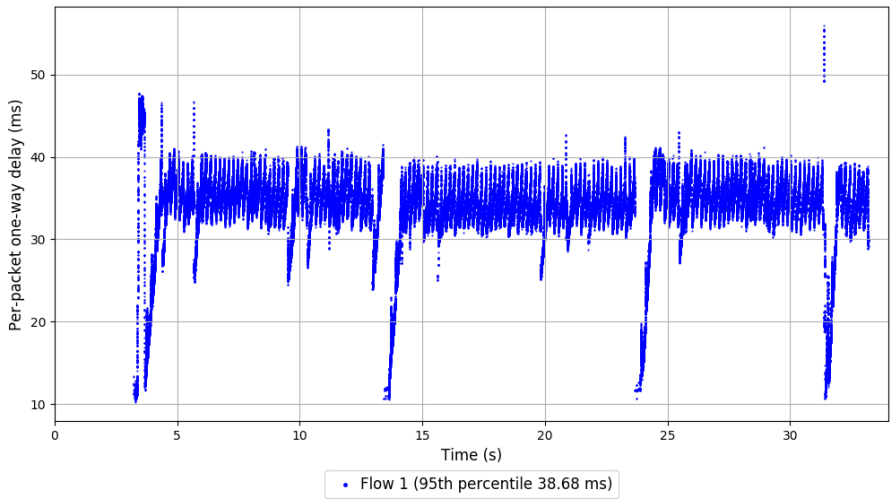
```
Run 3: Statistics of TCP BBR

Start at: 2019-10-22 17:55:26
End at: 2019-10-22 17:55:56

# Below is generated by plot.py at 2019-10-22 18:07:10
# Datalink statistics
-- Total of 1 flow:
Average capacity: 100.00 Mbit/s
Average throughput: 97.97 Mbit/s (98.0% utilization)
95th percentile per-packet one-way delay: 38.683 ms
Loss rate: 0.32%
-- Flow 1:
Average throughput: 97.97 Mbit/s
95th percentile per-packet one-way delay: 38.683 ms
Loss rate: 0.32%
```

Run 3: Report of TCP BBR — Data Link



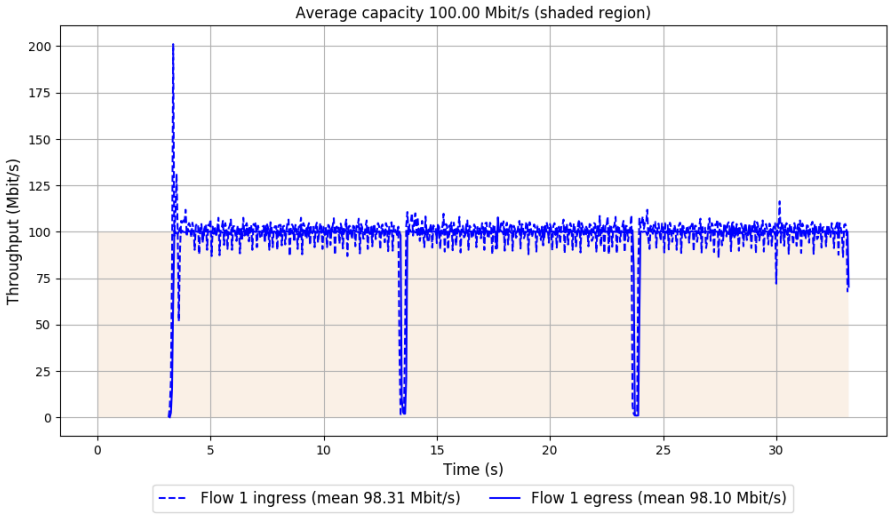


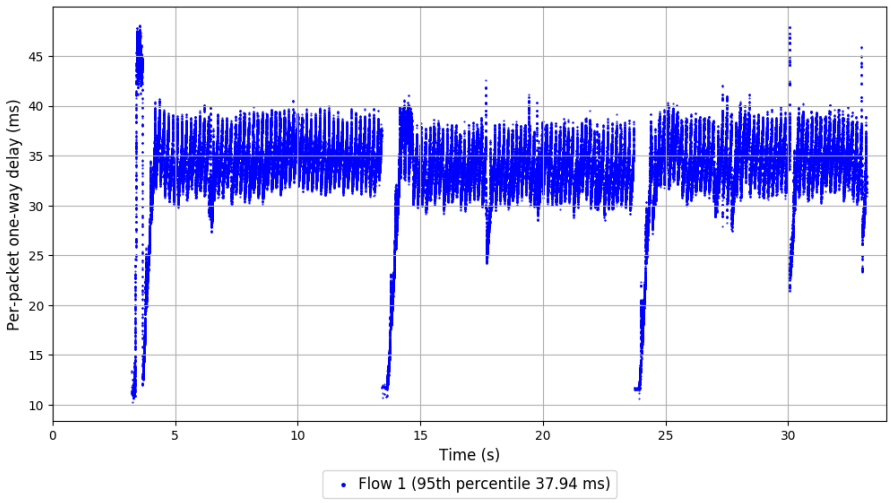
```
Run 4: Statistics of TCP BBR

Start at: 2019-10-22 17:58:03
End at: 2019-10-22 17:58:33

# Below is generated by plot.py at 2019-10-22 18:07:11
# Datalink statistics
-- Total of 1 flow:
Average capacity: 100.00 Mbit/s
Average throughput: 98.10 Mbit/s (98.1% utilization)
95th percentile per-packet one-way delay: 37.942 ms
Loss rate: 0.24%
-- Flow 1:
Average throughput: 98.10 Mbit/s
95th percentile per-packet one-way delay: 37.942 ms
Loss rate: 0.24%
```

Run 4: Report of TCP BBR — Data Link



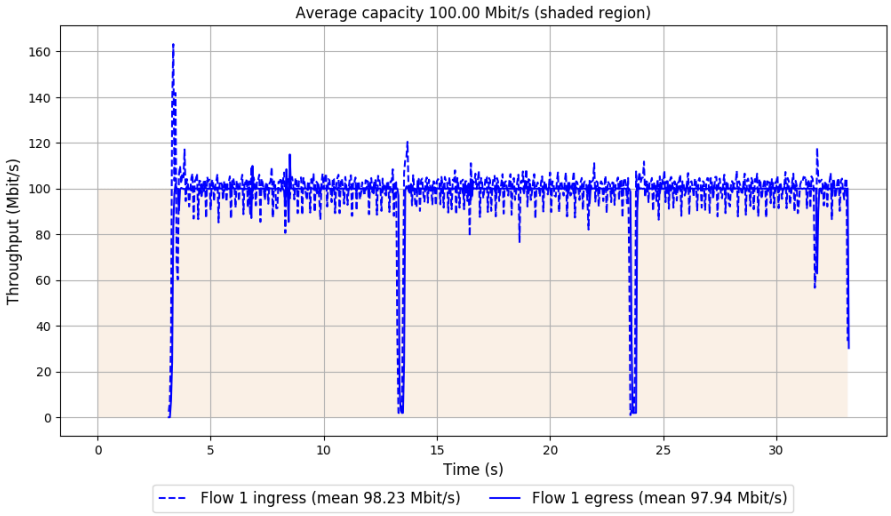


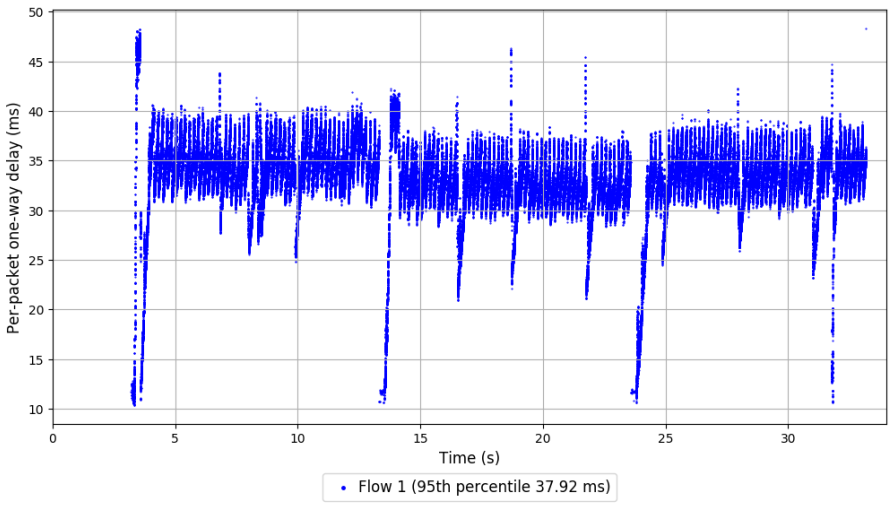
```
Run 5: Statistics of TCP BBR

Start at: 2019-10-22 18:00:39
End at: 2019-10-22 18:01:09

# Below is generated by plot.py at 2019-10-22 18:07:48
# Datalink statistics
-- Total of 1 flow:
Average capacity: 100.00 Mbit/s
Average throughput: 97.94 Mbit/s (97.9% utilization)
95th percentile per-packet one-way delay: 37.917 ms
Loss rate: 0.30%
-- Flow 1:
Average throughput: 97.94 Mbit/s
95th percentile per-packet one-way delay: 37.917 ms
Loss rate: 0.30%
```

Run 5: Report of TCP BBR — Data Link



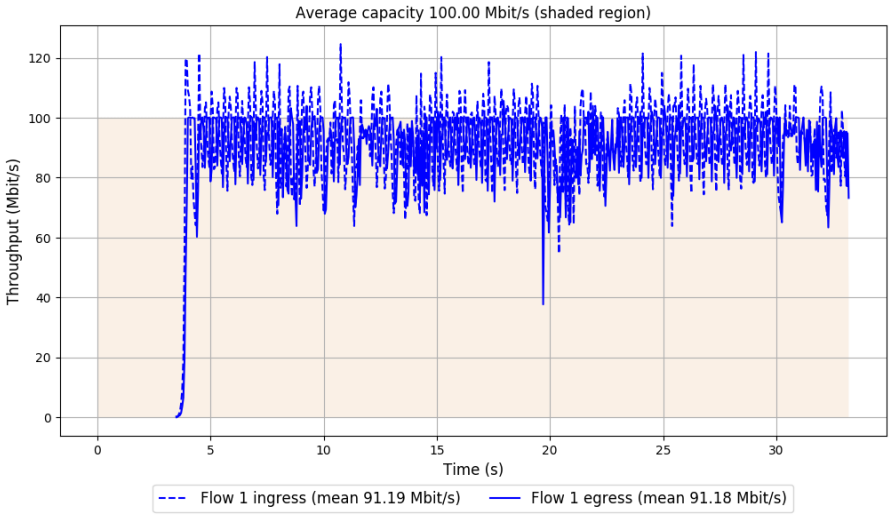


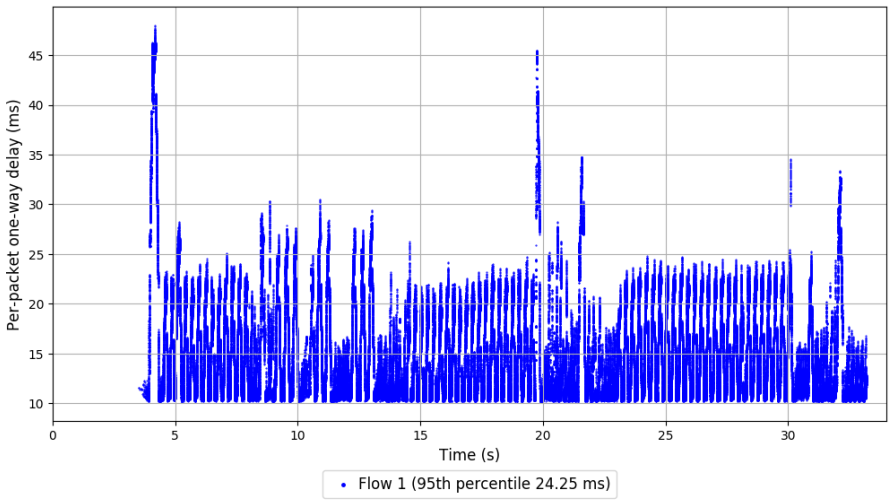
```
Run 1: Statistics of Eagle-v3

Start at: 2019-10-22 17:48:58
End at: 2019-10-22 17:49:28

# Below is generated by plot.py at 2019-10-22 18:07:48
# Datalink statistics
-- Total of 1 flow:
Average capacity: 100.00 Mbit/s
Average throughput: 91.18 Mbit/s (91.2% utilization)
95th percentile per-packet one-way delay: 24.251 ms
Loss rate: 0.06%
-- Flow 1:
Average throughput: 91.18 Mbit/s
95th percentile per-packet one-way delay: 24.251 ms
Loss rate: 0.06%
```

Run 1: Report of Eagle-v3 — Data Link



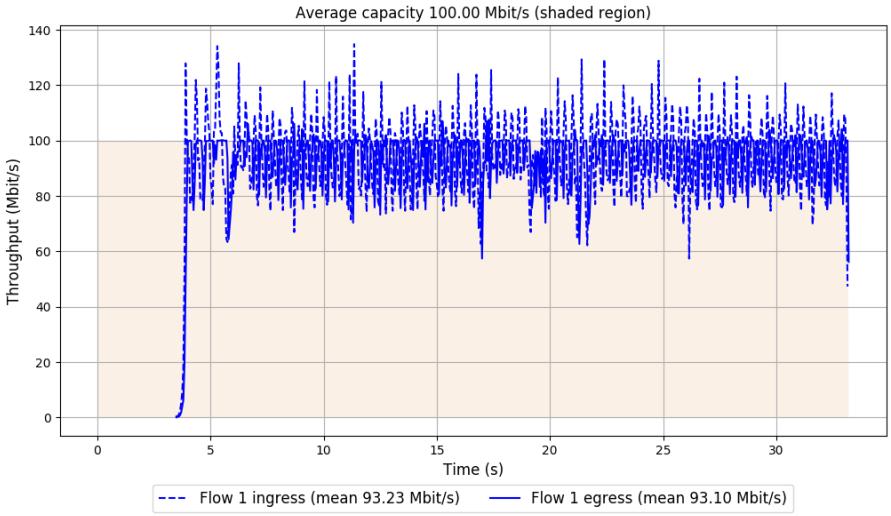


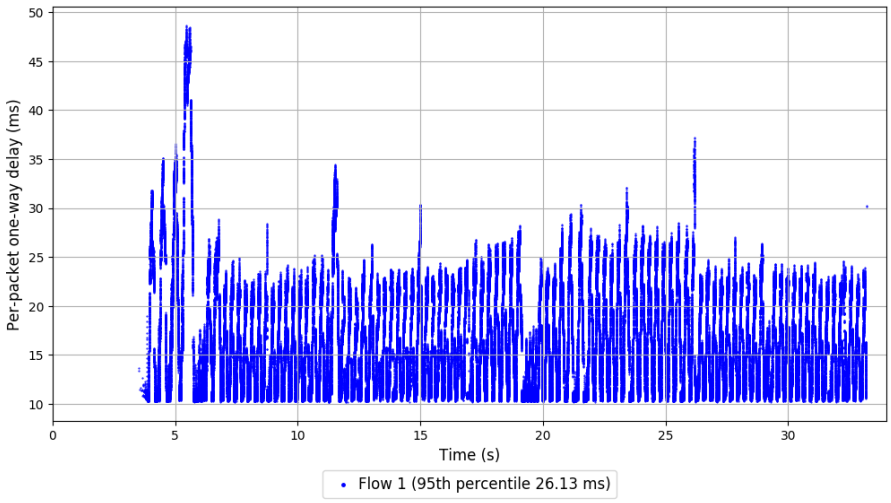
```
Run 2: Statistics of Eagle-v3

Start at: 2019-10-22 17:51:34
End at: 2019-10-22 17:52:04

# Below is generated by plot.py at 2019-10-22 18:08:08
# Datalink statistics
-- Total of 1 flow:
Average capacity: 100.00 Mbit/s
Average throughput: 93.10 Mbit/s (93.1% utilization)
95th percentile per-packet one-way delay: 26.126 ms
Loss rate: 0.11%
-- Flow 1:
Average throughput: 93.10 Mbit/s
95th percentile per-packet one-way delay: 26.126 ms
Loss rate: 0.11%
```

Run 2: Report of Eagle-v3 — Data Link



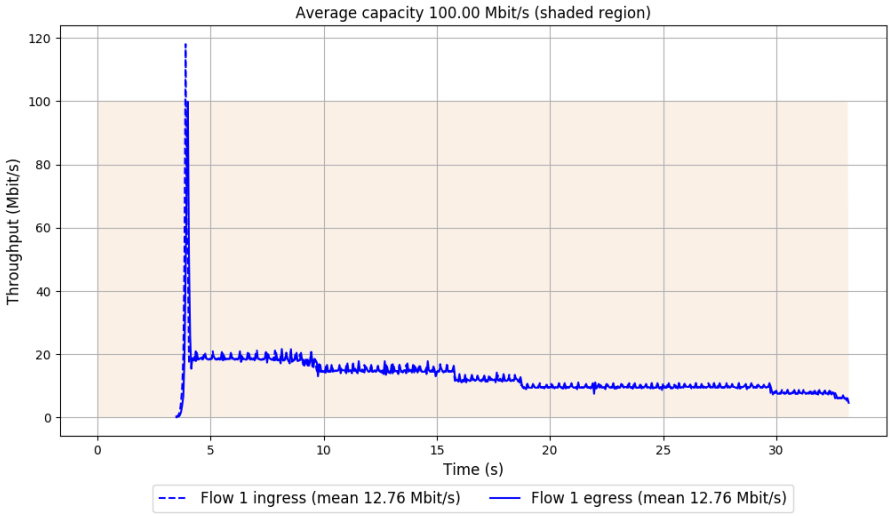


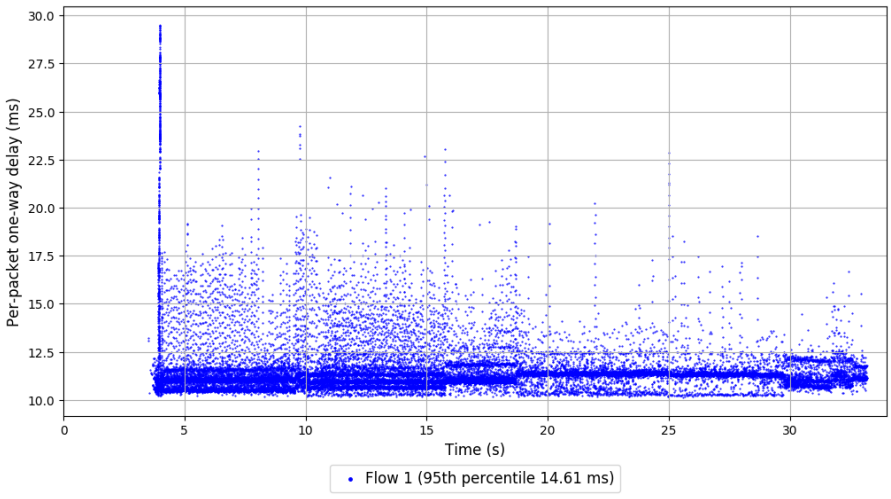
```
Run 3: Statistics of Eagle-v3

Start at: 2019-10-22 17:54:11
End at: 2019-10-22 17:54:41

# Below is generated by plot.py at 2019-10-22 18:08:08
# Datalink statistics
-- Total of 1 flow:
Average capacity: 100.00 Mbit/s
Average throughput: 12.76 Mbit/s (12.8% utilization)
95th percentile per-packet one-way delay: 14.613 ms
Loss rate: 0.02%
-- Flow 1:
Average throughput: 12.76 Mbit/s
95th percentile per-packet one-way delay: 14.613 ms
Loss rate: 0.02%
```

Run 3: Report of Eagle-v3 — Data Link



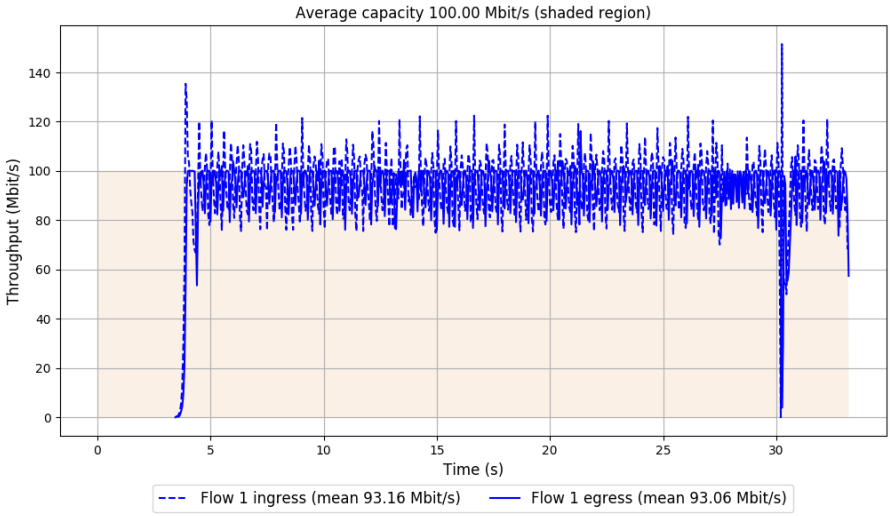


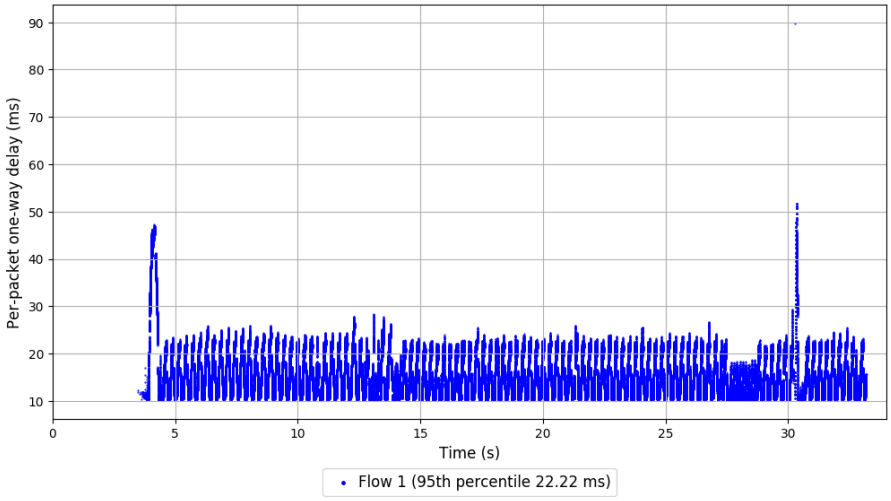
```
Run 4: Statistics of Eagle-v3

Start at: 2019-10-22 17:56:44
End at: 2019-10-22 17:57:14

# Below is generated by plot.py at 2019-10-22 18:08:32
# Datalink statistics
-- Total of 1 flow:
Average capacity: 100.00 Mbit/s
Average throughput: 93.06 Mbit/s (93.1% utilization)
95th percentile per-packet one-way delay: 22.222 ms
Loss rate: 0.15%
-- Flow 1:
Average throughput: 93.06 Mbit/s
95th percentile per-packet one-way delay: 22.222 ms
Loss rate: 0.15%
```

Run 4: Report of Eagle-v3 — Data Link



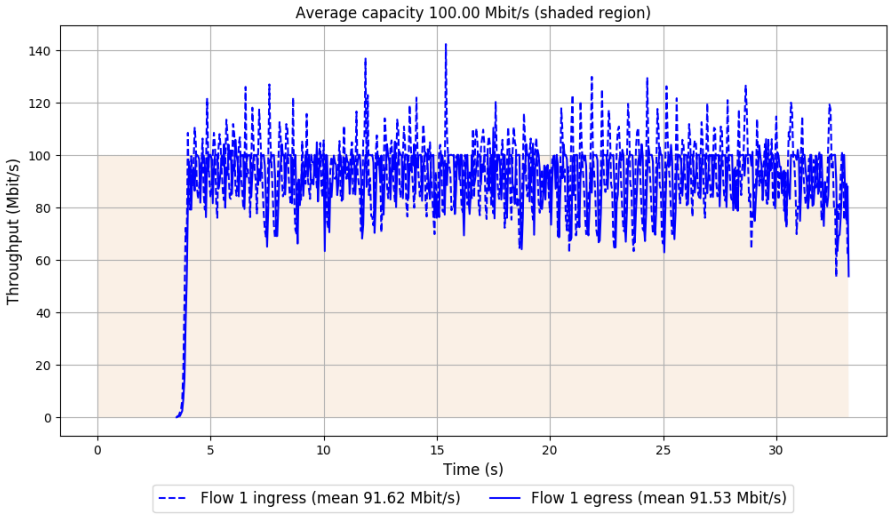


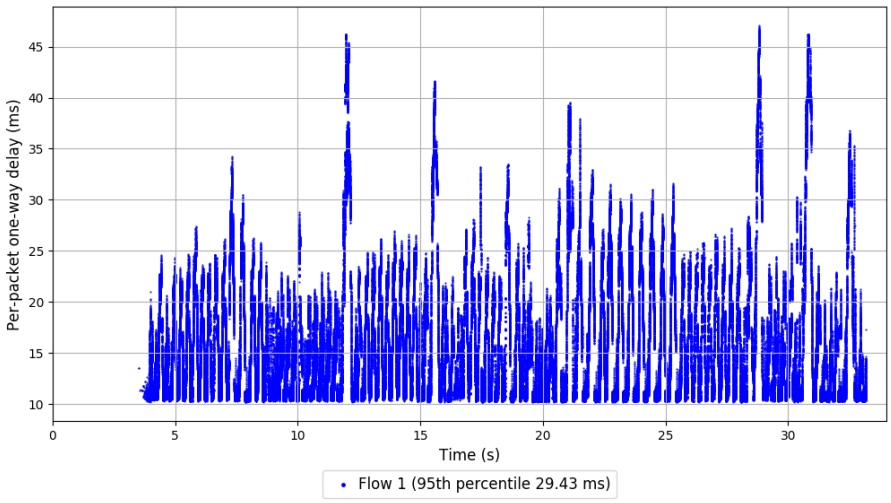
```
Run 5: Statistics of Eagle-v3

Start at: 2019-10-22 17:59:21
End at: 2019-10-22 17:59:51

# Below is generated by plot.py at 2019-10-22 18:08:42
# Datalink statistics
-- Total of 1 flow:
Average capacity: 100.00 Mbit/s
Average throughput: 91.53 Mbit/s (91.5% utilization)
95th percentile per-packet one-way delay: 29.425 ms
Loss rate: 0.14%
-- Flow 1:
Average throughput: 91.53 Mbit/s
95th percentile per-packet one-way delay: 29.425 ms
Loss rate: 0.14%
```

Run 5: Report of Eagle-v3 — Data Link



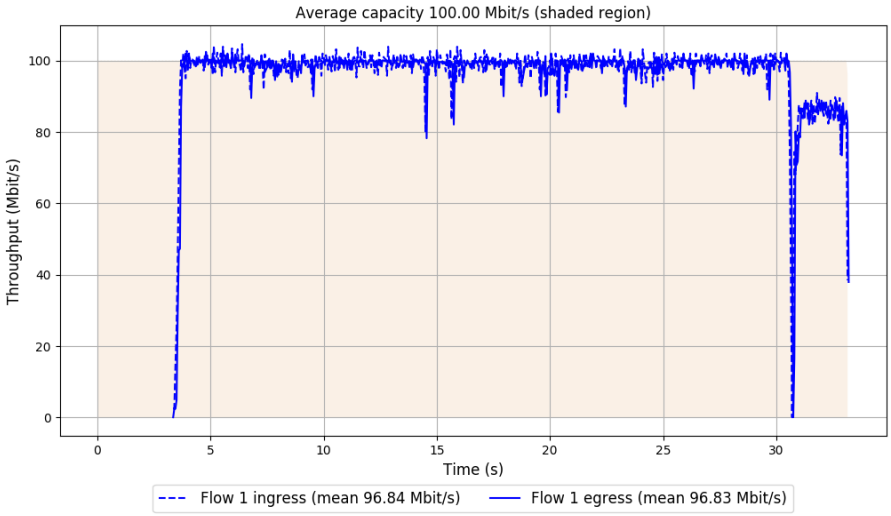


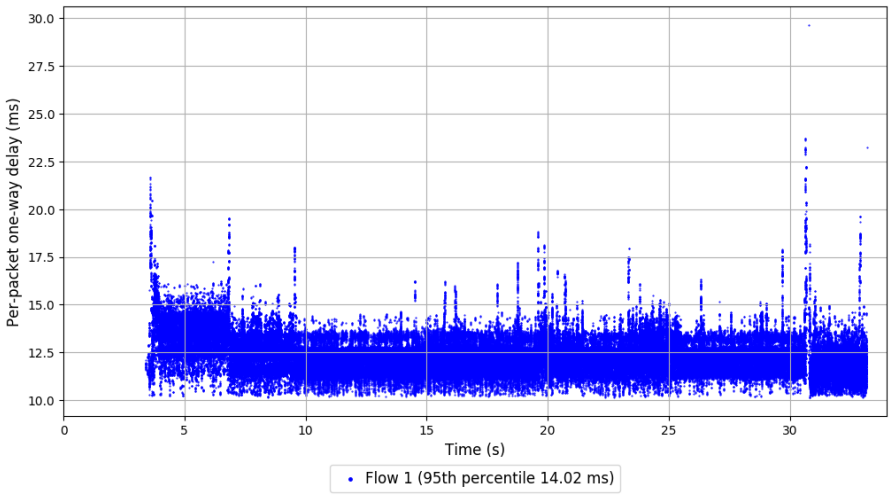
```
Run 1: Statistics of Indigo

Start at: 2019-10-22 17:50:55
End at: 2019-10-22 17:51:25

# Below is generated by plot.py at 2019-10-22 18:08:46
# Datalink statistics
-- Total of 1 flow:
Average capacity: 100.00 Mbit/s
Average throughput: 96.83 Mbit/s (96.8% utilization)
95th percentile per-packet one-way delay: 14.024 ms
Loss rate: 0.05%
-- Flow 1:
Average throughput: 96.83 Mbit/s
95th percentile per-packet one-way delay: 14.024 ms
Loss rate: 0.05%
```

Run 1: Report of Indigo — Data Link



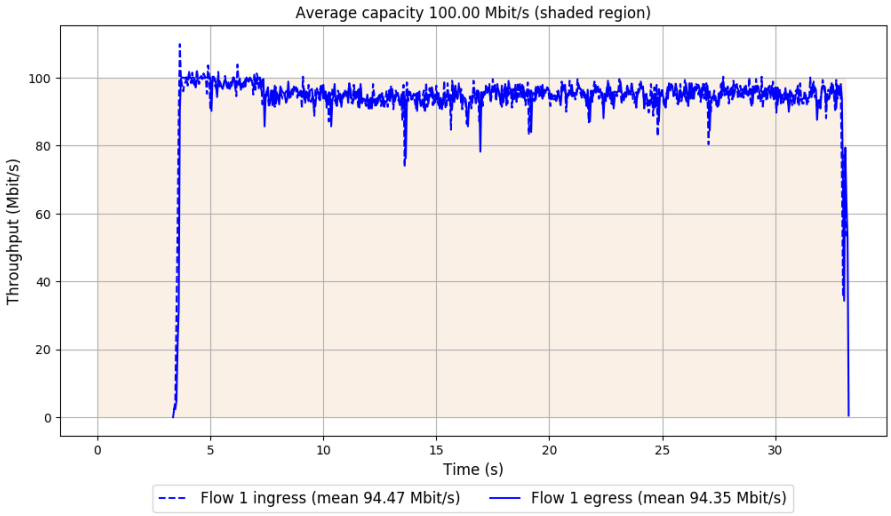


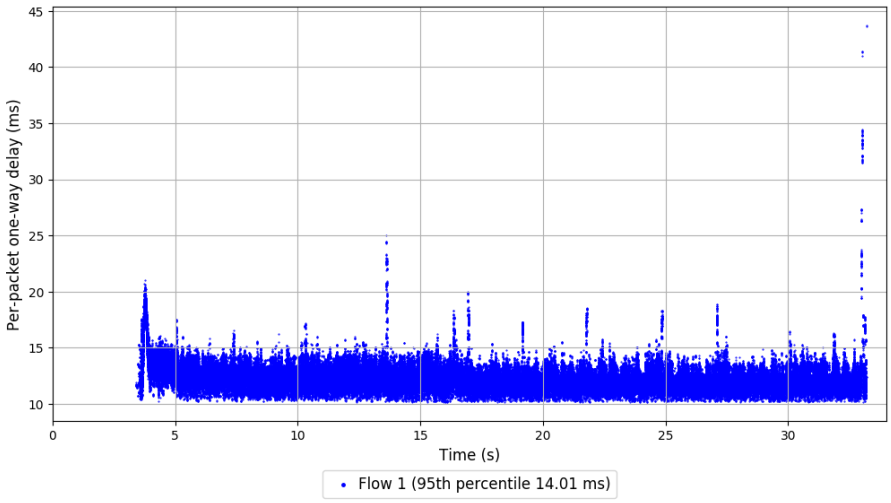
```
Run 2: Statistics of Indigo

Start at: 2019-10-22 17:53:32
End at: 2019-10-22 17:54:02

# Below is generated by plot.py at 2019-10-22 18:09:05
# Datalink statistics
-- Total of 1 flow:
Average capacity: 100.00 Mbit/s
Average throughput: 94.35 Mbit/s (94.3% utilization)
95th percentile per-packet one-way delay: 14.013 ms
Loss rate: 0.06%
-- Flow 1:
Average throughput: 94.35 Mbit/s
95th percentile per-packet one-way delay: 14.013 ms
Loss rate: 0.06%
```

Run 2: Report of Indigo — Data Link



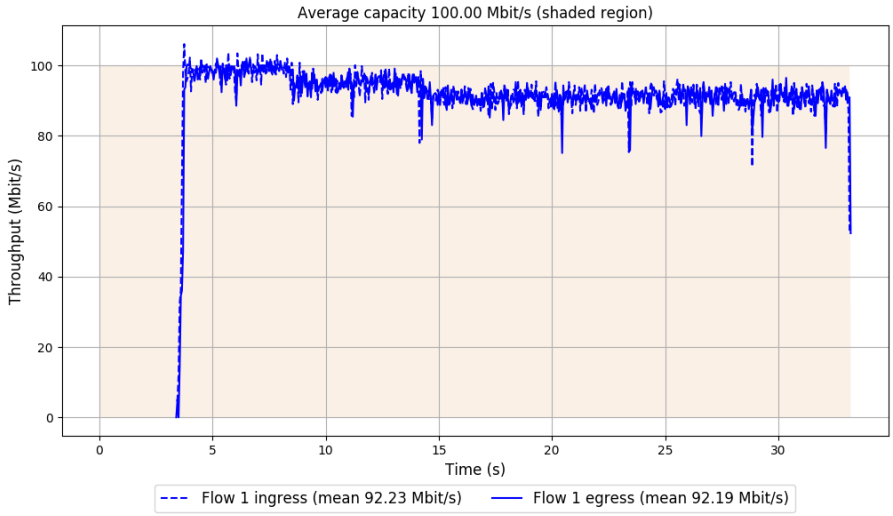


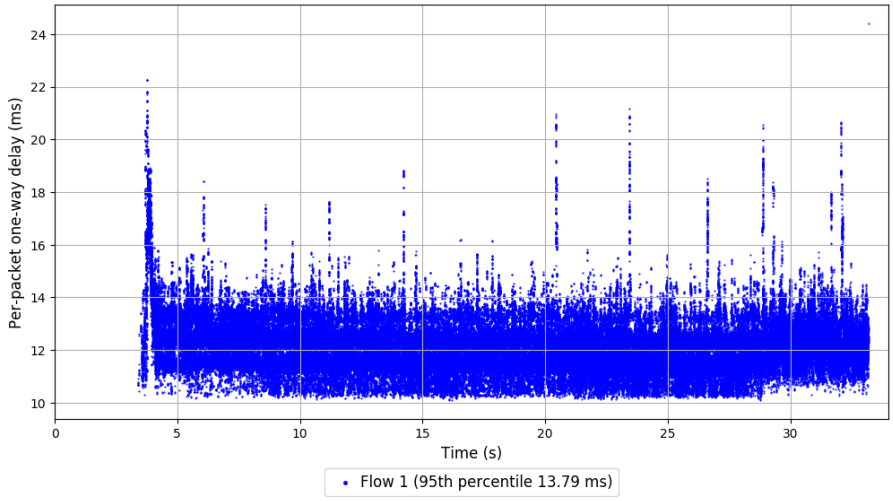
```
Run 3: Statistics of Indigo

Start at: 2019-10-22 17:56:05
End at: 2019-10-22 17:56:35

# Below is generated by plot.py at 2019-10-22 18:09:34
# Datalink statistics
-- Total of 1 flow:
Average capacity: 100.00 Mbit/s
Average throughput: 92.19 Mbit/s (92.2% utilization)
95th percentile per-packet one-way delay: 13.795 ms
Loss rate: 0.04%
-- Flow 1:
Average throughput: 92.19 Mbit/s
95th percentile per-packet one-way delay: 13.795 ms
Loss rate: 0.04%
```

Run 3: Report of Indigo — Data Link



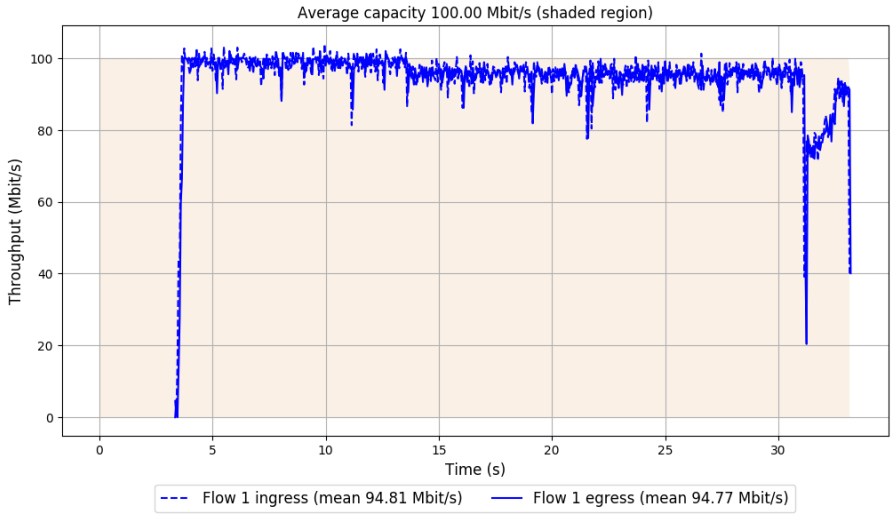


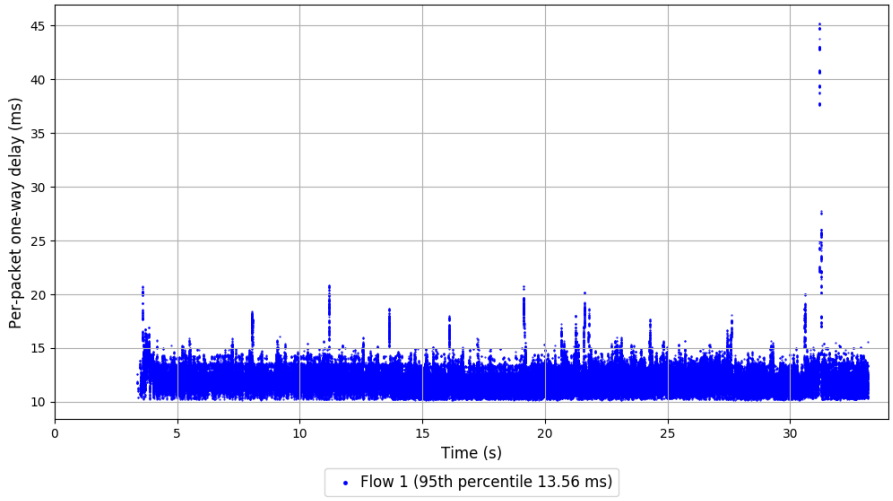
```
Run 4: Statistics of Indigo

Start at: 2019-10-22 17:58:41
End at: 2019-10-22 17:59:11

# Below is generated by plot.py at 2019-10-22 18:09:38
# Datalink statistics
-- Total of 1 flow:
Average capacity: 100.00 Mbit/s
Average throughput: 94.77 Mbit/s (94.8% utilization)
95th percentile per-packet one-way delay: 13.556 ms
Loss rate: 0.07%
-- Flow 1:
Average throughput: 94.77 Mbit/s
95th percentile per-packet one-way delay: 13.556 ms
Loss rate: 0.07%
```

Run 4: Report of Indigo — Data Link



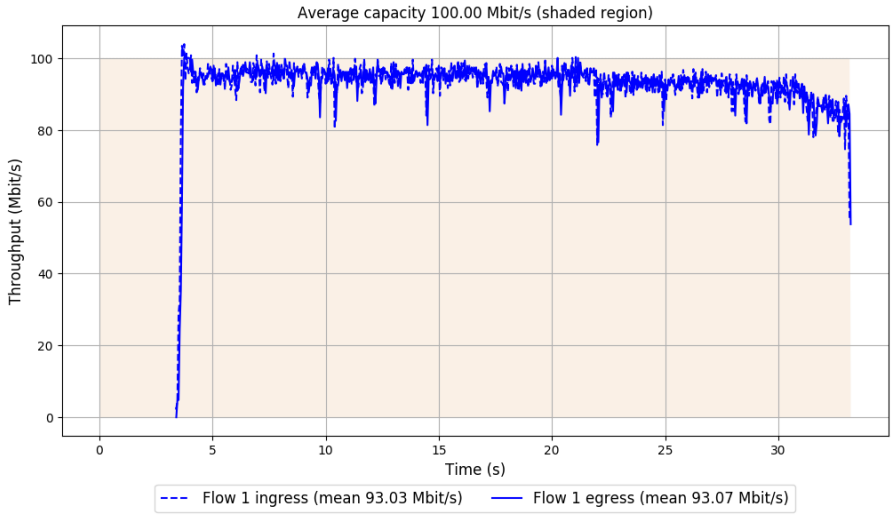


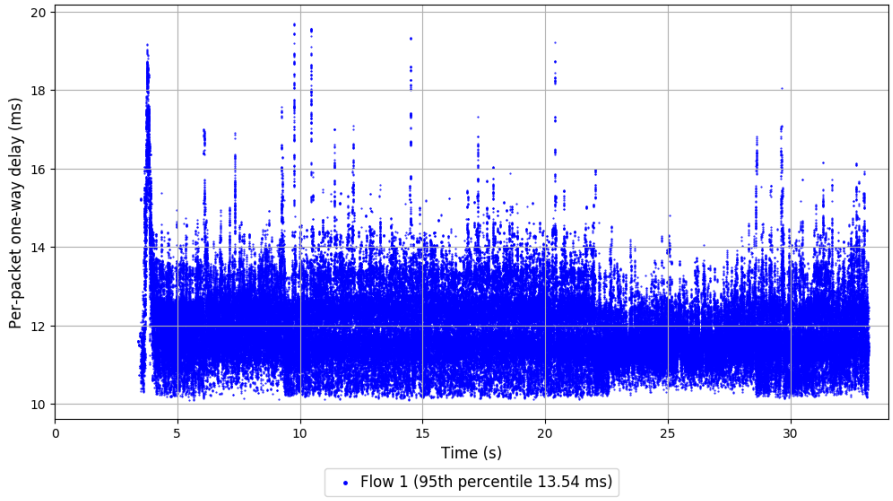
```
Run 5: Statistics of Indigo

Start at: 2019-10-22 18:01:17
End at: 2019-10-22 18:01:47

# Below is generated by plot.py at 2019-10-22 18:09:39
# Datalink statistics
-- Total of 1 flow:
Average capacity: 100.00 Mbit/s
Average throughput: 93.07 Mbit/s (93.1% utilization)
95th percentile per-packet one-way delay: 13.540 ms
Loss rate: 0.04%
-- Flow 1:
Average throughput: 93.07 Mbit/s
95th percentile per-packet one-way delay: 13.540 ms
Loss rate: 0.04%
```

Run 5: Report of Indigo — Data Link



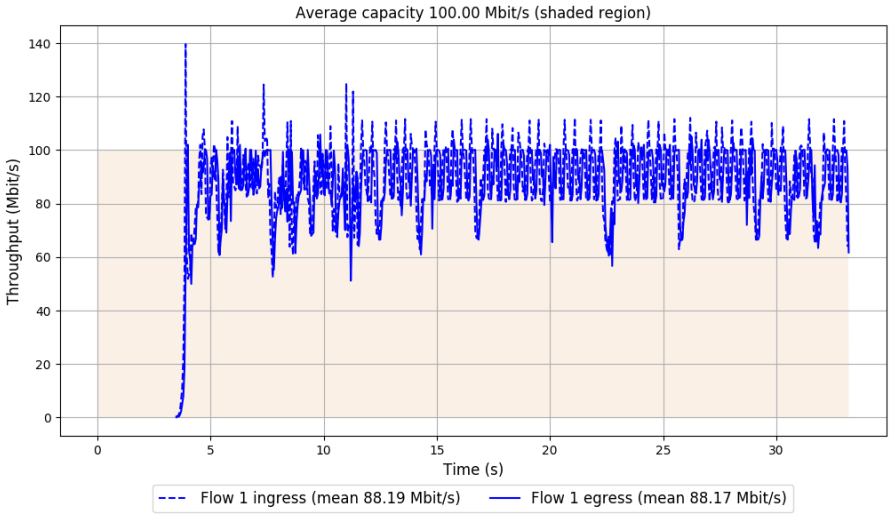


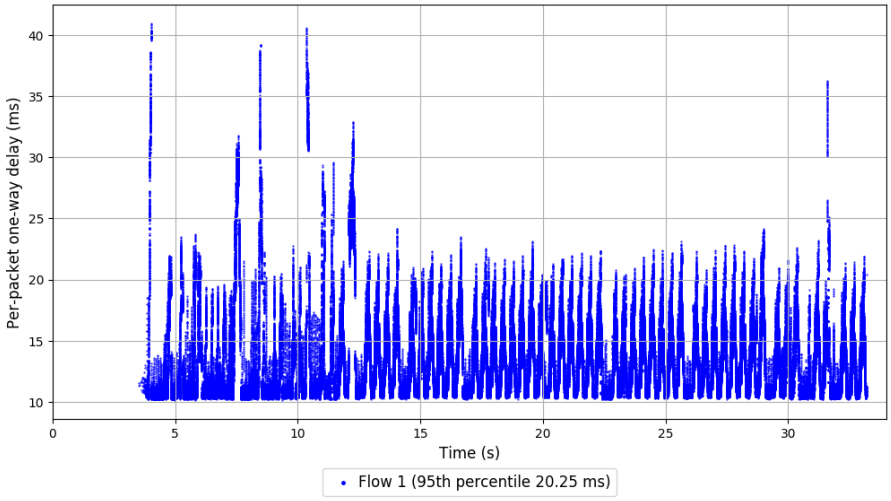
```
Run 1: Statistics of Synthesized-BBR

Start at: 2019-10-22 17:49:37
End at: 2019-10-22 17:50:07

# Below is generated by plot.py at 2019-10-22 18:10:04
# Datalink statistics
-- Total of 1 flow:
Average capacity: 100.00 Mbit/s
Average throughput: 88.17 Mbit/s (88.2% utilization)
95th percentile per-packet one-way delay: 20.247 ms
Loss rate: 0.07%
-- Flow 1:
Average throughput: 88.17 Mbit/s
95th percentile per-packet one-way delay: 20.247 ms
Loss rate: 0.07%
```

Run 1: Report of Synthesized-BBR — Data Link



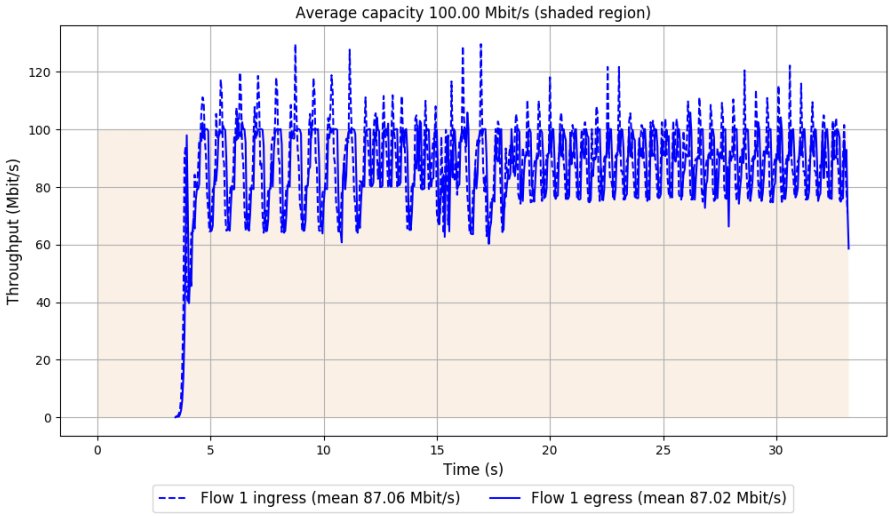


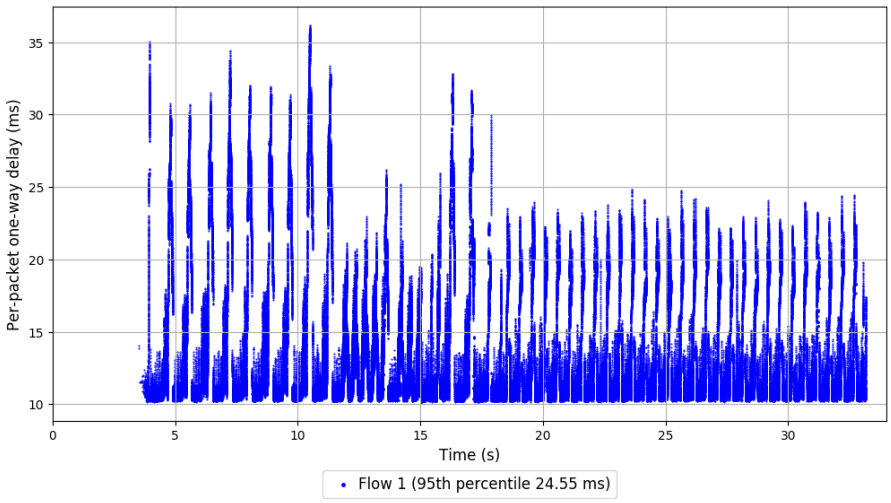
```
Run 2: Statistics of Synthesized-BBR

Start at: 2019-10-22 17:52:14
End at: 2019-10-22 17:52:44

# Below is generated by plot.py at 2019-10-22 18:10:30
# Datalink statistics
-- Total of 1 flow:
Average capacity: 100.00 Mbit/s
Average throughput: 87.02 Mbit/s (87.0% utilization)
95th percentile per-packet one-way delay: 24.545 ms
Loss rate: 0.08%
-- Flow 1:
Average throughput: 87.02 Mbit/s
95th percentile per-packet one-way delay: 24.545 ms
Loss rate: 0.08%
```

Run 2: Report of Synthesized-BBR — Data Link



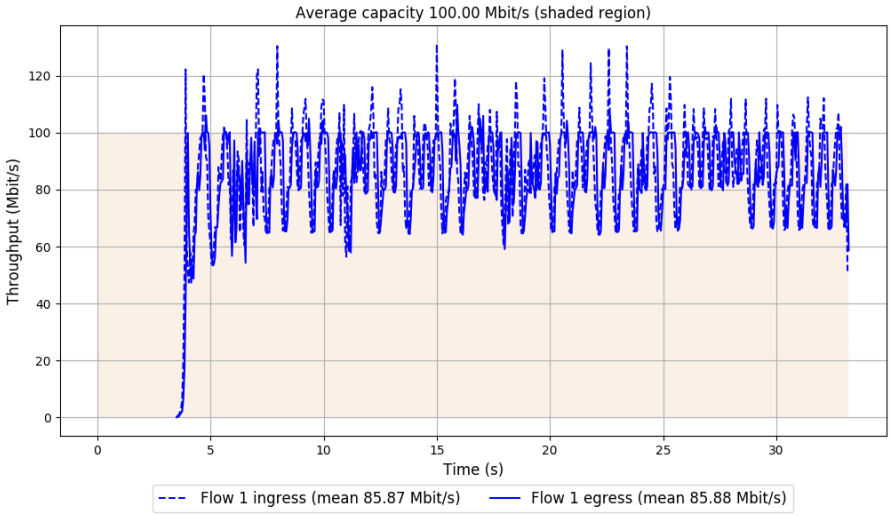


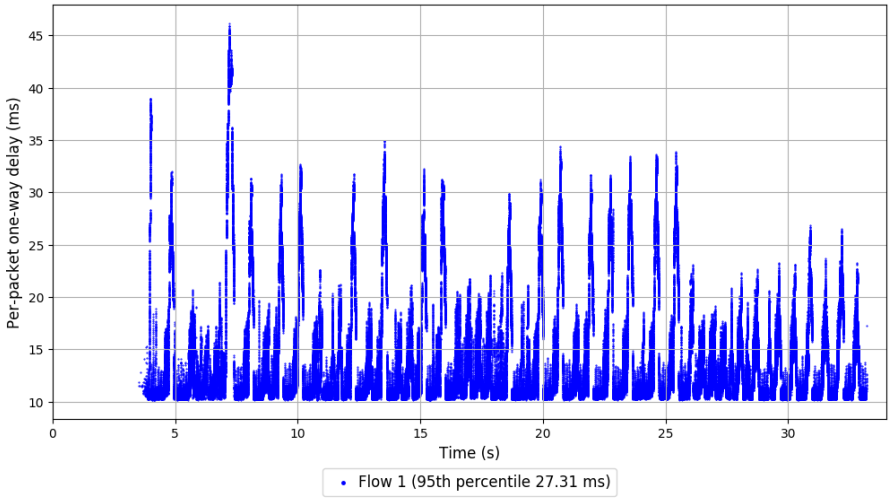
```
Run 3: Statistics of Synthesized-BBR

Start at: 2019-10-22 17:54:47
End at: 2019-10-22 17:55:17

# Below is generated by plot.py at 2019-10-22 18:10:32
# Datalink statistics
-- Total of 1 flow:
Average capacity: 100.00 Mbit/s
Average throughput: 85.88 Mbit/s (85.9% utilization)
95th percentile per-packet one-way delay: 27.314 ms
Loss rate: 0.03%
-- Flow 1:
Average throughput: 85.88 Mbit/s
95th percentile per-packet one-way delay: 27.314 ms
Loss rate: 0.03%
```

Run 3: Report of Synthesized-BBR — Data Link



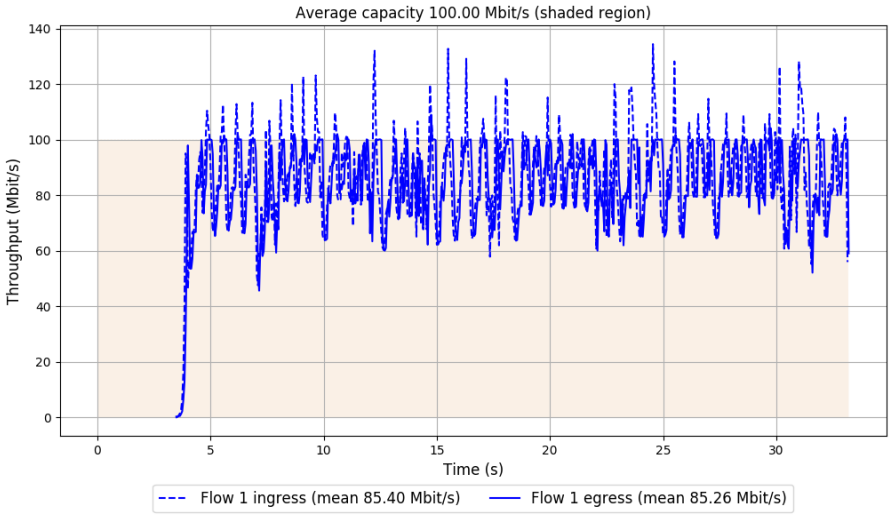


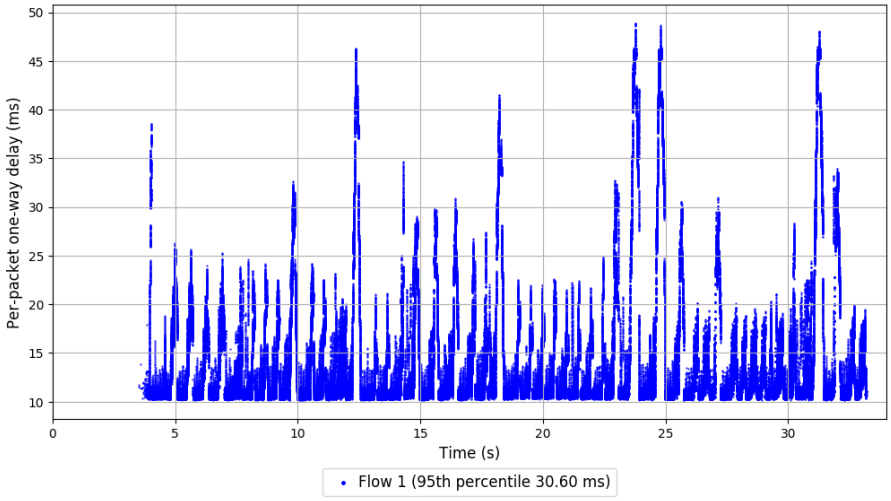
```
Run 4: Statistics of Synthesized-BBR

Start at: 2019-10-22 17:57:24
End at: 2019-10-22 17:57:54

# Below is generated by plot.py at 2019-10-22 18:10:32
# Datalink statistics
-- Total of 1 flow:
Average capacity: 100.00 Mbit/s
Average throughput: 85.26 Mbit/s (85.3% utilization)
95th percentile per-packet one-way delay: 30.599 ms
Loss rate: 0.21%
-- Flow 1:
Average throughput: 85.26 Mbit/s
95th percentile per-packet one-way delay: 30.599 ms
Loss rate: 0.21%
```

Run 4: Report of Synthesized-BBR — Data Link





```
Run 5: Statistics of Synthesized-BBR

Start at: 2019-10-22 18:00:00
End at: 2019-10-22 18:00:30

# Below is generated by plot.py at 2019-10-22 18:10:36
# Datalink statistics
-- Total of 1 flow:
Average capacity: 100.00 Mbit/s
Average throughput: 73.33 Mbit/s (73.3% utilization)
95th percentile per-packet one-way delay: 21.324 ms
Loss rate: 0.15%
-- Flow 1:
Average throughput: 73.33 Mbit/s
95th percentile per-packet one-way delay: 21.324 ms
Loss rate: 0.15%
```

Run 5: Report of Synthesized-BBR — Data Link