Pantheon Report

Generated at 2019-10-21 20:00:05 (UTC).

Tested in mahimahi: `mm-delay 28 mm-loss uplink 0.0477 mm-link 10mbps.trace 10mbps.trace --uplink-queue=droptail --uplink-queue-args=packets=14`

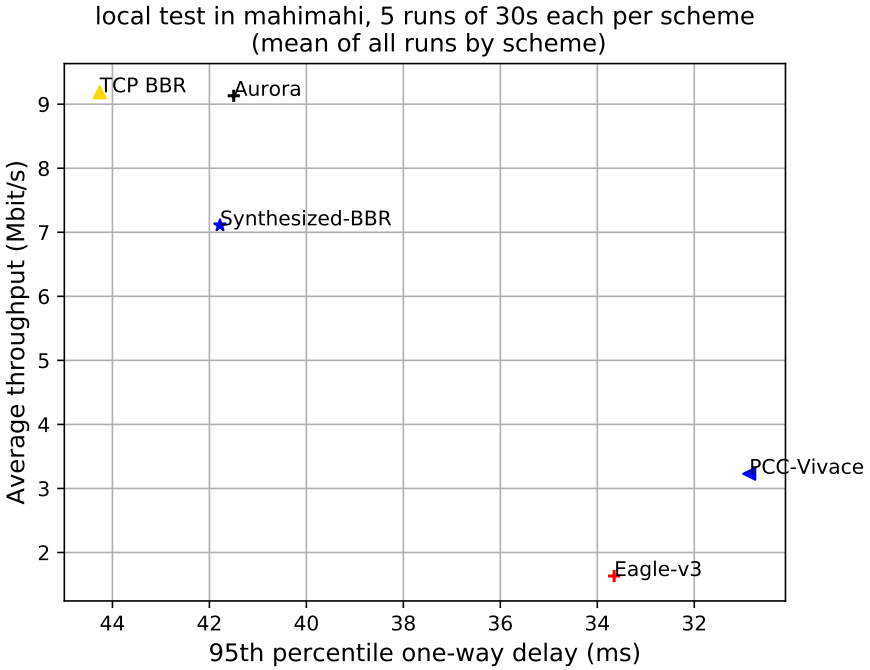
Repeated the test of 5 congestion control schemes 5 times.

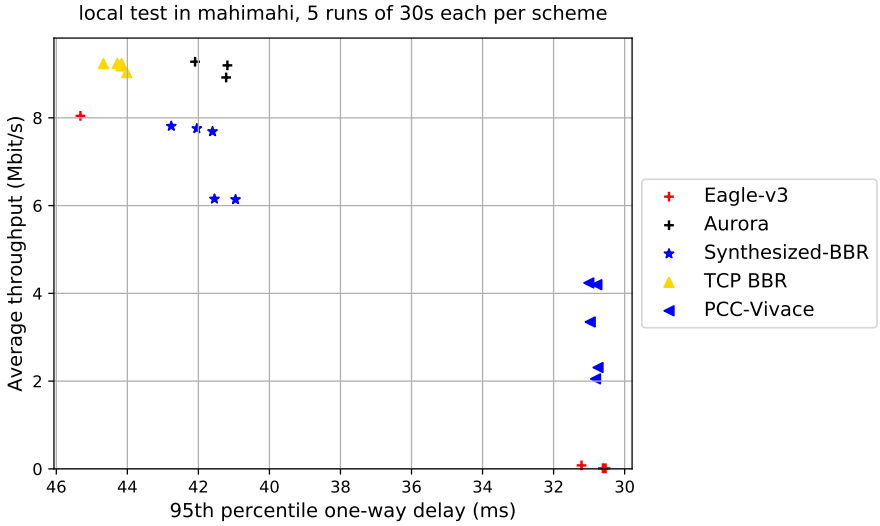
Each test lasted for 30 seconds running 1 flow.

```
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 @ c1ccd879d068023475fa120e962849b2bc171554
 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/example-xentropy-random-switch.py
 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/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 @ 0992b443bd3ec09a5df42ba0e0036cae4372eca1
 M sender-receiver/sender-receiver/sender_receiver/envs/example-xentropy.py
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
Aurora
Synthesized-BBR
PCC-Vivace
Eagle-v3
Average throughput (Mbit/s)
95th percentile one-way delay (ms)
9
8
7
6
5
4
3
2
44
42
40
38
36
34
32


local test in mahimahi, 5 runs of 30s each per scheme
Average throughput (Mbit/s)
95th percentile one-way delay (ms)
Eagle-v3
Aurora
Synthesized-BBR
TCP BBR
PCC-Vivace
8
6
4
2
0
46
44
42
40
38
36
34
32
30

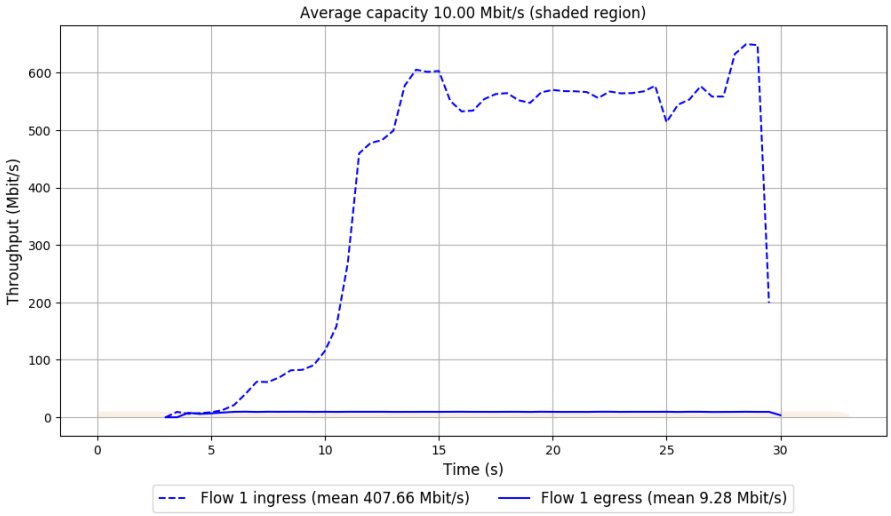
scheme	# runs	mean avg tput (Mbit/s) flow 1	mean 95th-%ile delay (ms) flow 1	mean loss rate (%) flow 1
Aurora	3	9.13	41.50	97.90
TCP BBR	5	9.19	44.26	6.77
Eagle-v3	5	1.63	33.65	10.22
Synthesized-BBR	5	7.11	41.78	5.30
PCC-Vivace	5	3.23	30.87	5.14

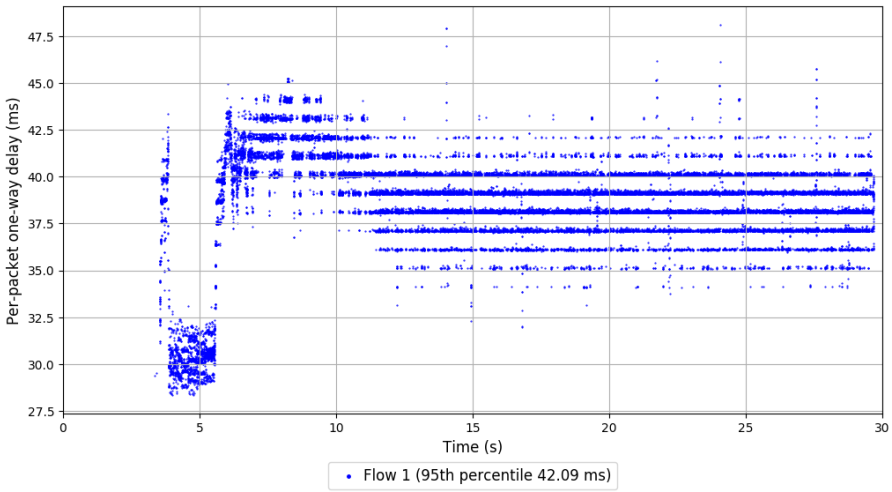
```
Run 1: Statistics of Aurora

Start at: 2019-10-21 19:41:58
End at: 2019-10-21 19:42:28

# Below is generated by plot.py at 2019-10-21 19:59:13
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 9.28 Mbit/s (92.8% utilization)
95th percentile per-packet one-way delay: 42.093 ms
Loss rate: 97.72%
-- Flow 1:
Average throughput: 9.28 Mbit/s
95th percentile per-packet one-way delay: 42.093 ms
Loss rate: 97.72%
```

Run 1: Report of Aurora — Data Link

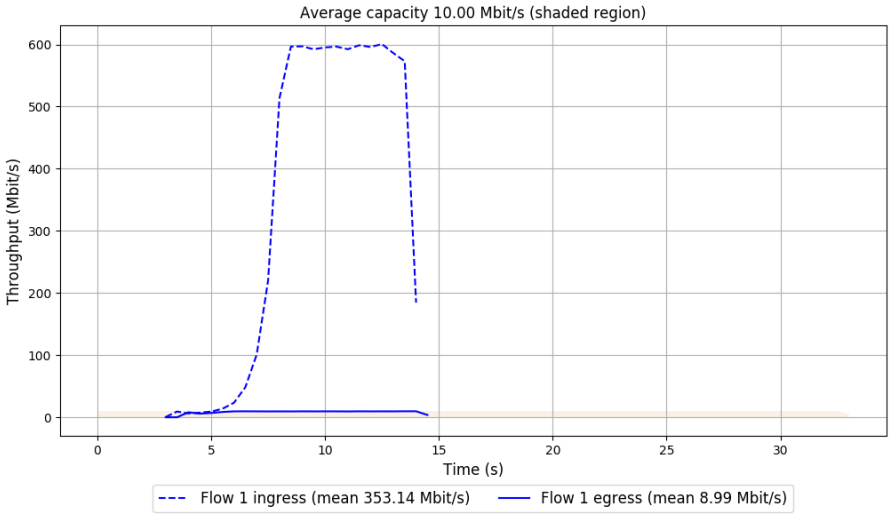


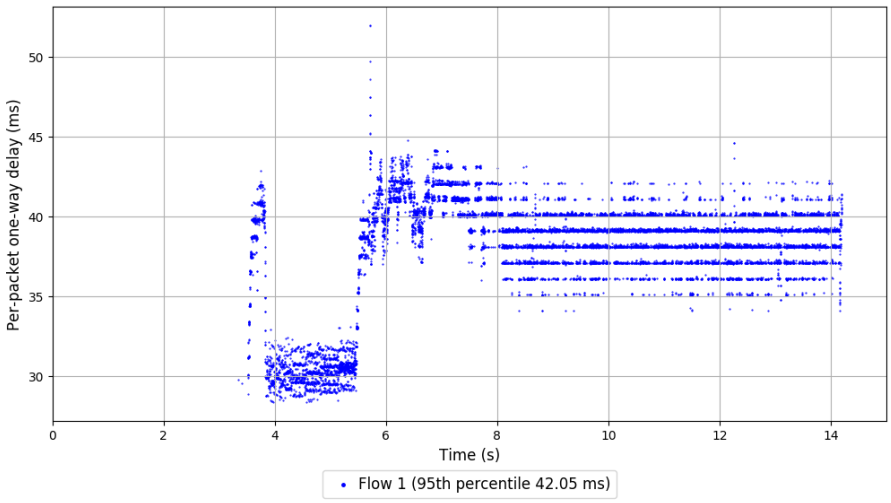


```
Run 2: Statistics of Aurora

Start at: 2019-10-21 19:44:58
End at: 2019-10-21 19:45:28
```

Run 2: Report of Aurora — Data Link



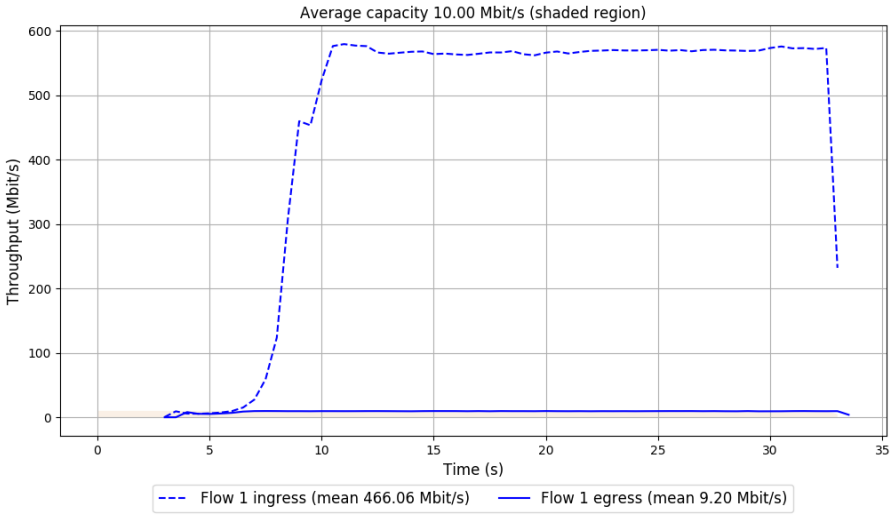


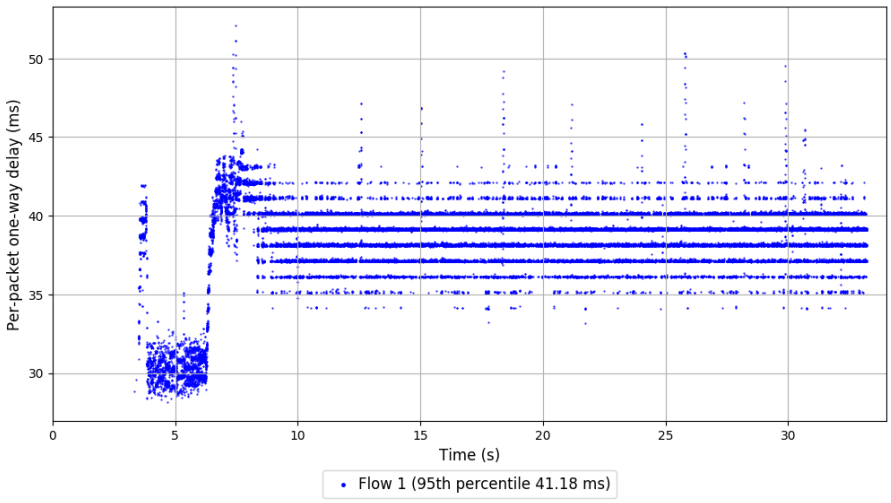
```
Run 3: Statistics of Aurora

Start at: 2019-10-21 19:47:54
End at: 2019-10-21 19:48:24

# Below is generated by plot.py at 2019-10-21 19:59:41
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 9.20 Mbit/s (92.0% utilization)
95th percentile per-packet one-way delay: 41.183 ms
Loss rate: 98.03%
-- Flow 1:
Average throughput: 9.20 Mbit/s
95th percentile per-packet one-way delay: 41.183 ms
Loss rate: 98.03%
```

Run 3: Report of Aurora — Data Link

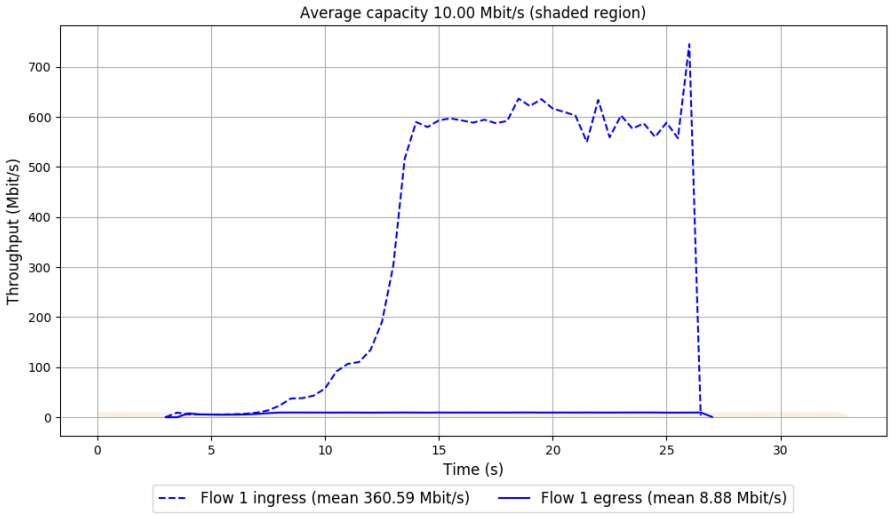


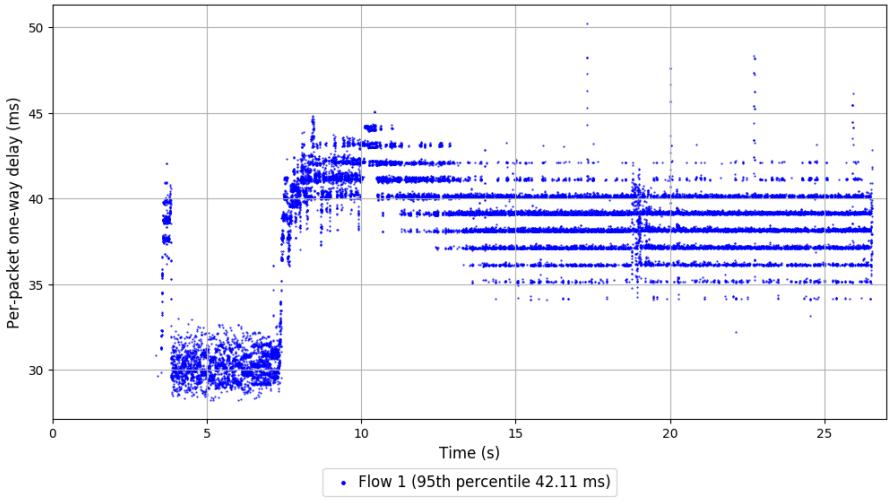


```
Run 4: Statistics of Aurora

Start at: 2019-10-21 19:50:59
End at: 2019-10-21 19:51:29
```

Run 4: Report of Aurora — Data Link



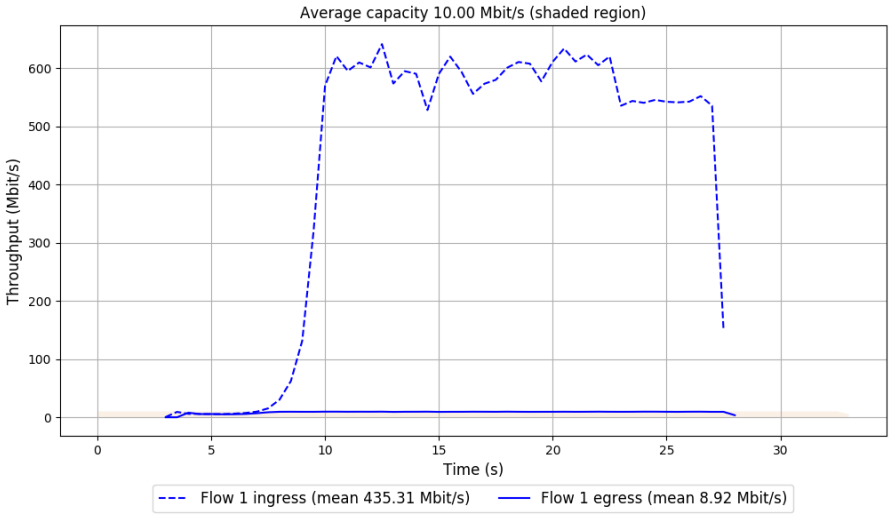


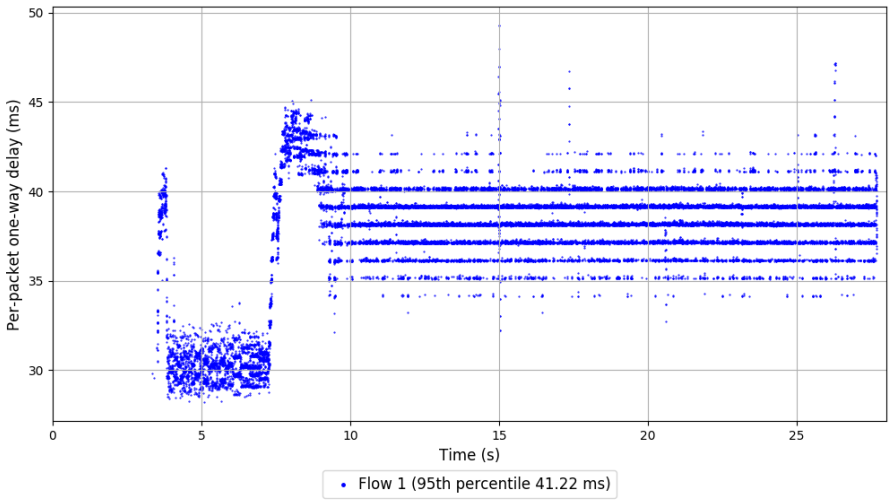
```
Run 5: Statistics of Aurora

Start at: 2019-10-21 19:53:58
End at: 2019-10-21 19:54:28

# Below is generated by plot.py at 2019-10-21 20:00:04
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 8.92 Mbit/s (89.2% utilization)
95th percentile per-packet one-way delay: 41.218 ms
Loss rate: 97.95%
-- Flow 1:
Average throughput: 8.92 Mbit/s
95th percentile per-packet one-way delay: 41.218 ms
Loss rate: 97.95%
```

Run 5: Report of Aurora — Data Link



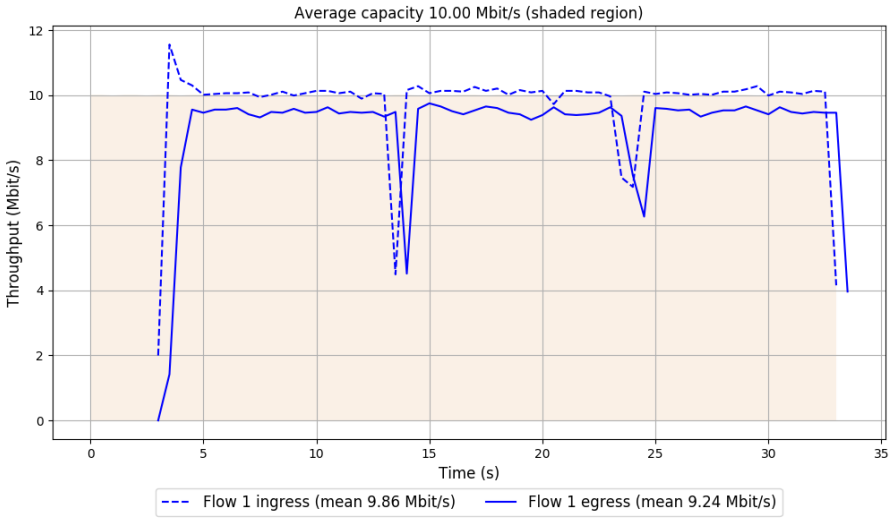


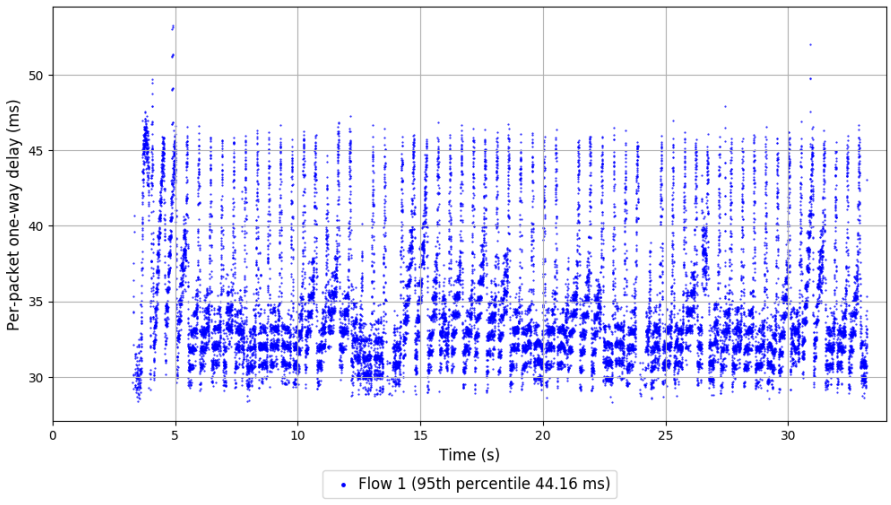
```
Run 1: Statistics of TCP BBR

Start at: 2019-10-21 19:40:14
End at: 2019-10-21 19:40:44

# Below is generated by plot.py at 2019-10-21 20:00:04
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 9.24 Mbit/s (92.4% utilization)
95th percentile per-packet one-way delay: 44.162 ms
Loss rate: 6.41%
-- Flow 1:
Average throughput: 9.24 Mbit/s
95th percentile per-packet one-way delay: 44.162 ms
Loss rate: 6.41%
```

Run 1: Report of TCP BBR — Data Link



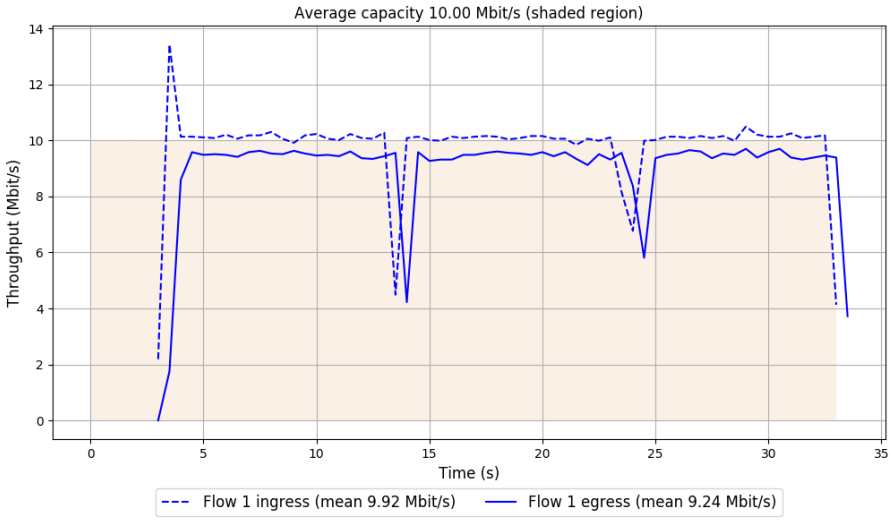


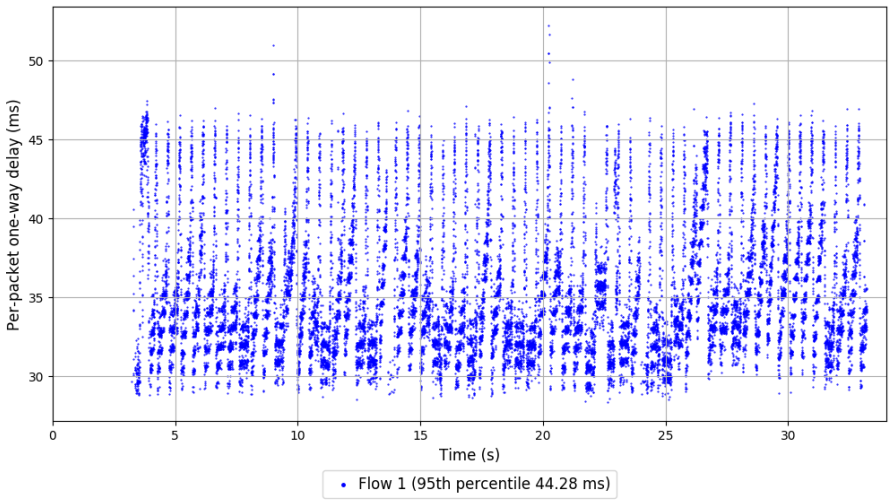
```
Run 2: Statistics of TCP BBR

Start at: 2019-10-21 19:43:15
End at: 2019-10-21 19:43:45

# Below is generated by plot.py at 2019-10-21 20:00:04
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 9.24 Mbit/s (92.4% utilization)
95th percentile per-packet one-way delay: 44.281 ms
Loss rate: 6.96%
-- Flow 1:
Average throughput: 9.24 Mbit/s
95th percentile per-packet one-way delay: 44.281 ms
Loss rate: 6.96%
```

Run 2: Report of TCP BBR — Data Link



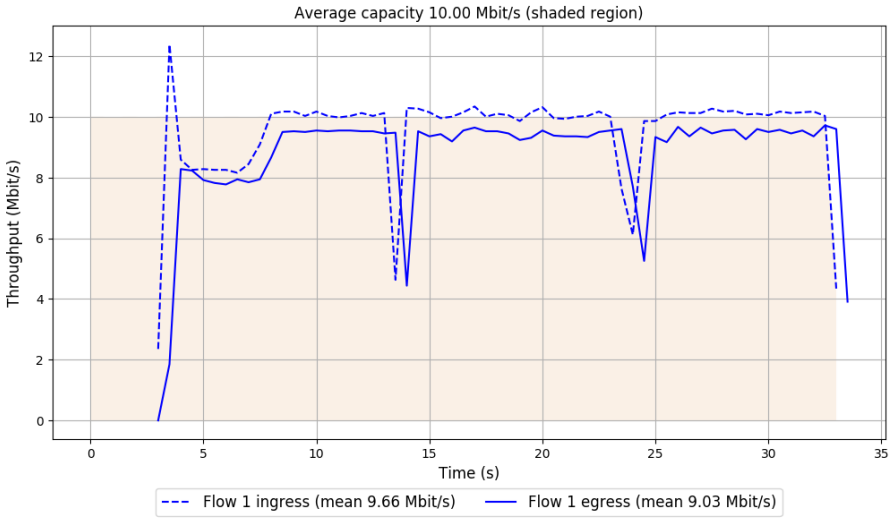


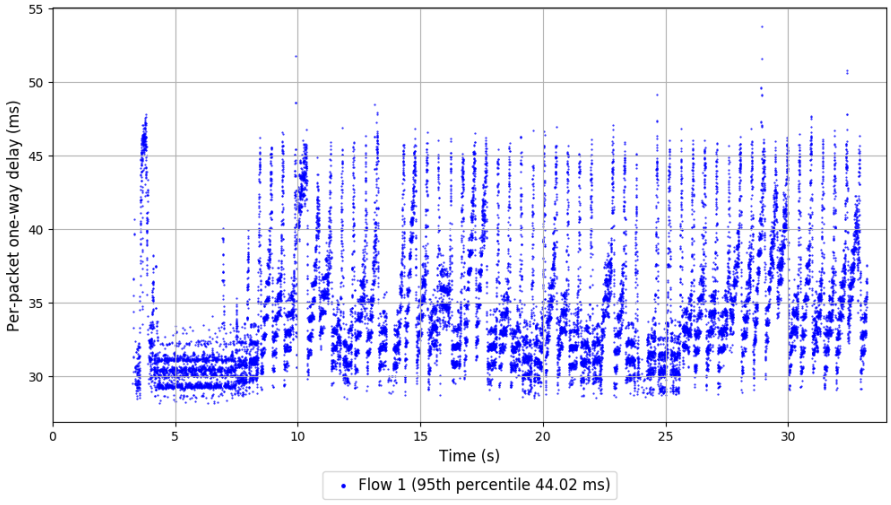
```
Run 3: Statistics of TCP BBR

Start at: 2019-10-21 19:46:10
End at: 2019-10-21 19:46:40

# Below is generated by plot.py at 2019-10-21 20:00:04
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 9.03 Mbit/s (90.3% utilization)
95th percentile per-packet one-way delay: 44.016 ms
Loss rate: 6.60%
-- Flow 1:
Average throughput: 9.03 Mbit/s
95th percentile per-packet one-way delay: 44.016 ms
Loss rate: 6.60%
```

Run 3: Report of TCP BBR — Data Link



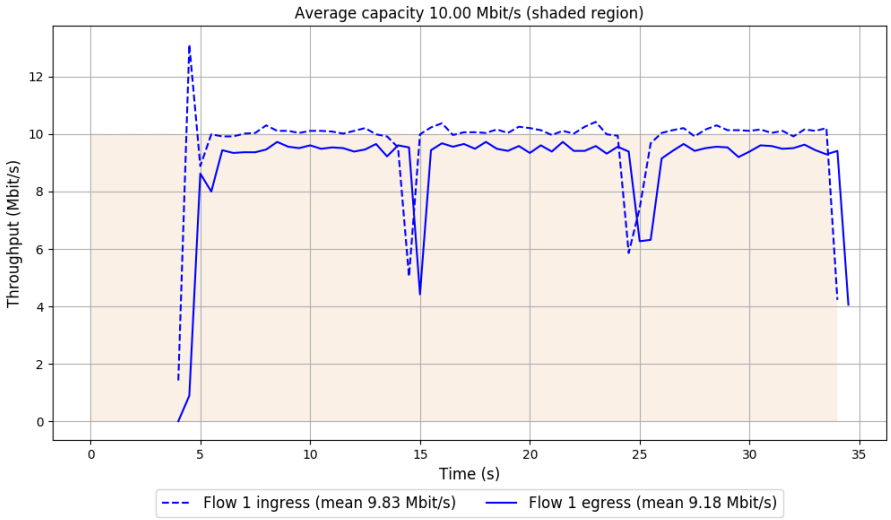


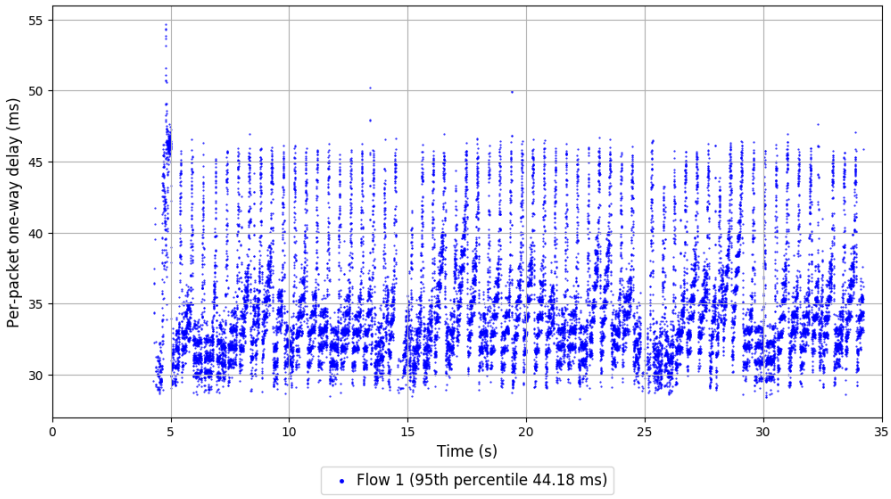
```
Run 4: Statistics of TCP BBR

Start at: 2019-10-21 19:49:15
End at: 2019-10-21 19:49:45

# Below is generated by plot.py at 2019-10-21 20:00:04
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 9.18 Mbit/s (91.8% utilization)
95th percentile per-packet one-way delay: 44.179 ms
Loss rate: 6.66%
-- Flow 1:
Average throughput: 9.18 Mbit/s
95th percentile per-packet one-way delay: 44.179 ms
Loss rate: 6.66%
```

Run 4: Report of TCP BBR — Data Link



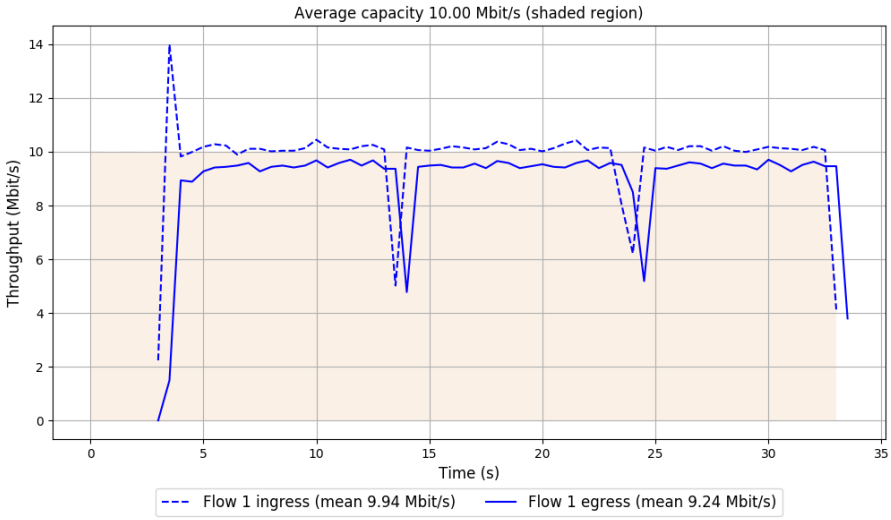


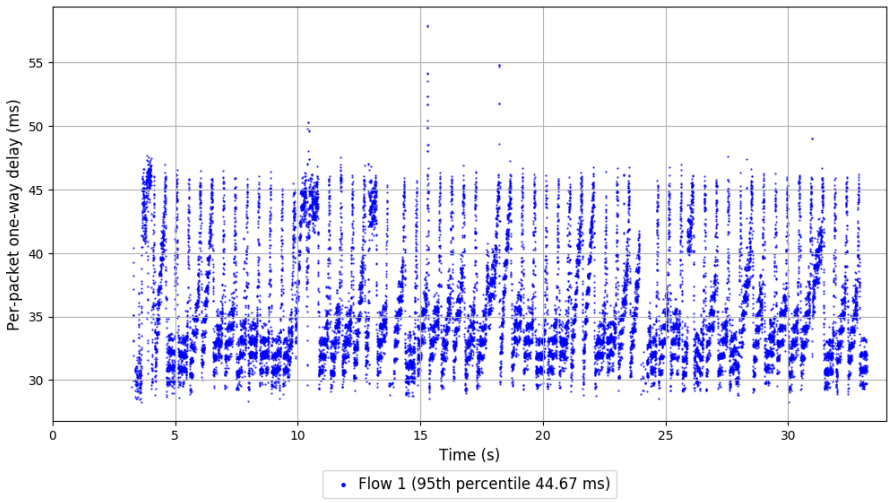
```
Run 5: Statistics of TCP BBR

Start at: 2019-10-21 19:52:14
End at: 2019-10-21 19:52:44

# Below is generated by plot.py at 2019-10-21 20:00:04
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 9.24 Mbit/s (92.4% utilization)
95th percentile per-packet one-way delay: 44.670 ms
Loss rate: 7.21%
-- Flow 1:
Average throughput: 9.24 Mbit/s
95th percentile per-packet one-way delay: 44.670 ms
Loss rate: 7.21%
```

Run 5: Report of TCP BBR — Data Link



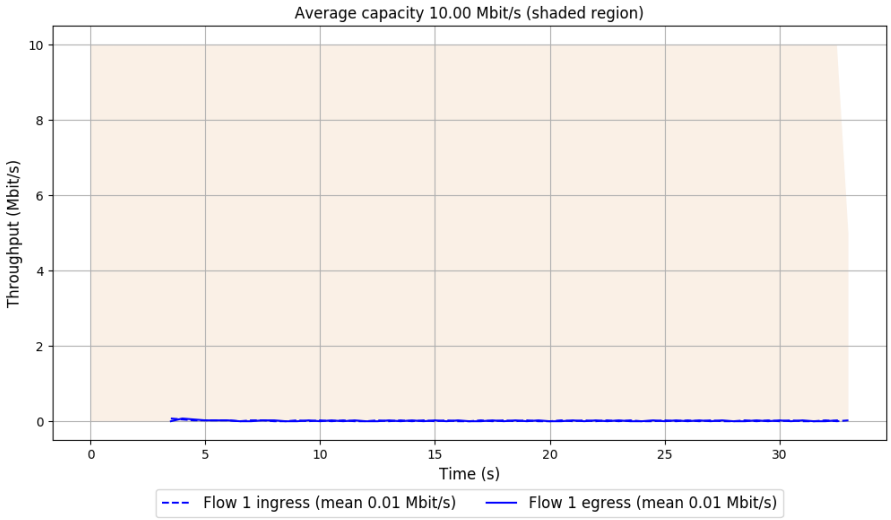


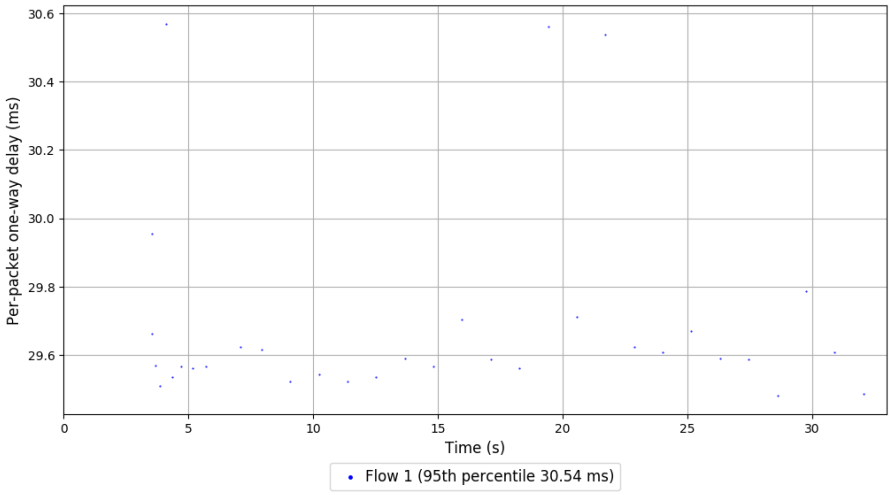
```
Run 1: Statistics of Eagle-v3

Start at: 2019-10-21 19:39:40
End at: 2019-10-21 19:40:10

# Below is generated by plot.py at 2019-10-21 20:00:04
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 0.01 Mbit/s (0.1% utilization)
95th percentile per-packet one-way delay: 30.536 ms
Loss rate: 6.05%
-- Flow 1:
Average throughput: 0.01 Mbit/s
95th percentile per-packet one-way delay: 30.536 ms
Loss rate: 6.05%
```

Run 1: Report of Eagle-v3 — Data Link



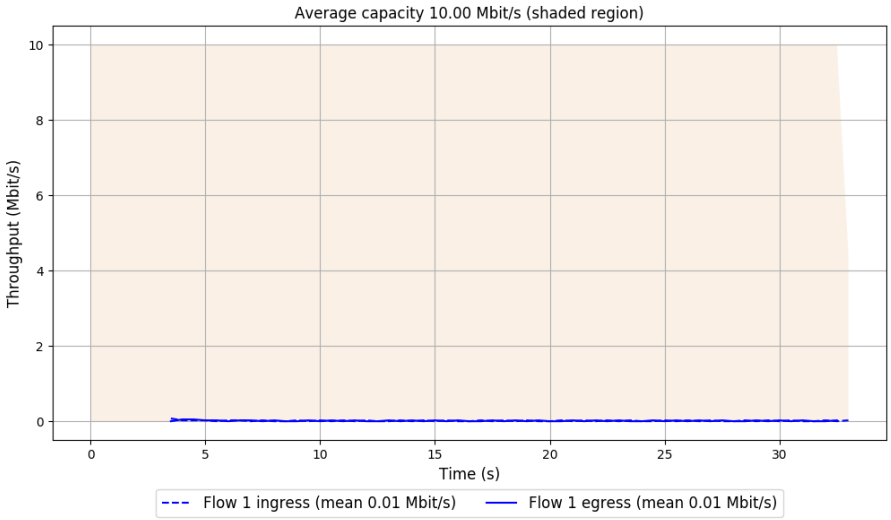


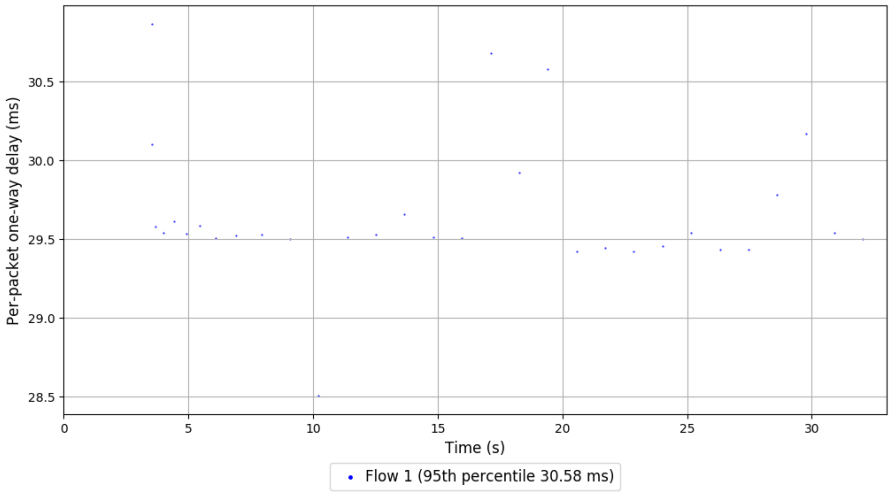
```
Run 2: Statistics of Eagle-v3

Start at: 2019-10-21 19:42:41
End at: 2019-10-21 19:43:11

# Below is generated by plot.py at 2019-10-21 20:00:04
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 0.01 Mbit/s (0.1% utilization)
95th percentile per-packet one-way delay: 30.579 ms
Loss rate: 3.22%
-- Flow 1:
Average throughput: 0.01 Mbit/s
95th percentile per-packet one-way delay: 30.579 ms
Loss rate: 3.22%
```

Run 2: Report of Eagle-v3 — Data Link



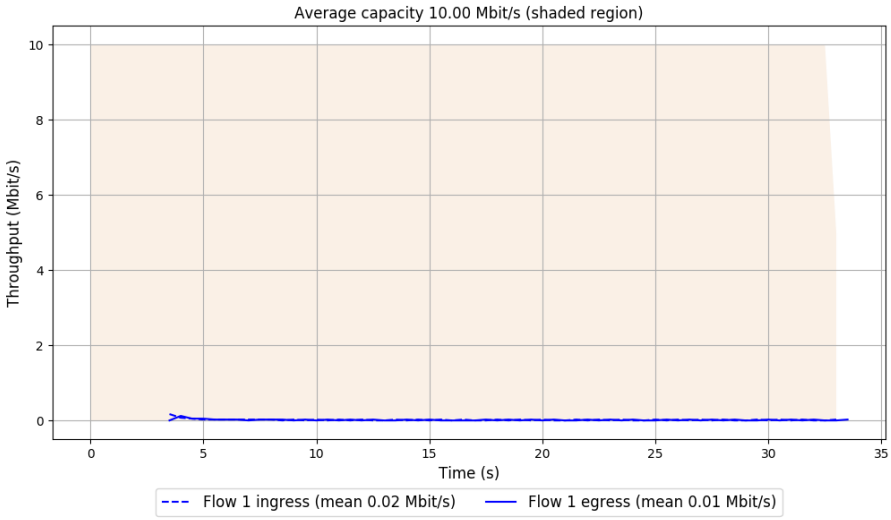


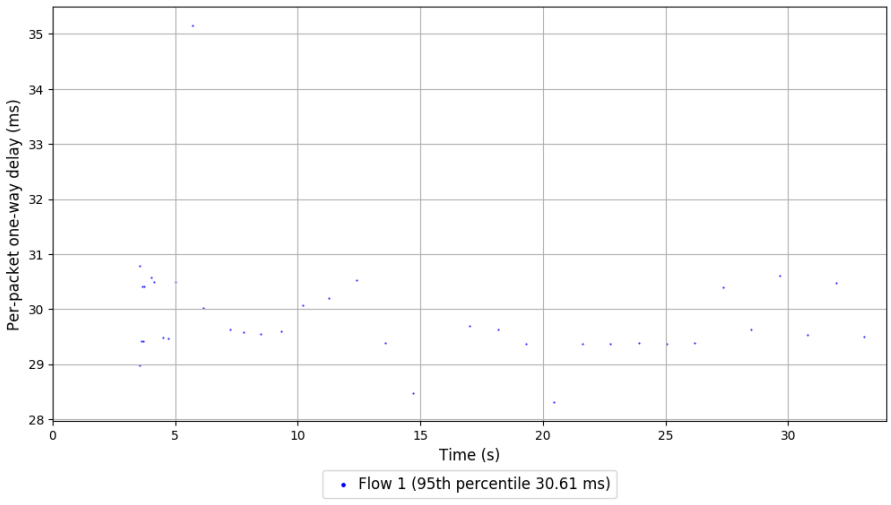
```
Run 3: Statistics of Eagle-v3

Start at: 2019-10-21 19:45:36
End at: 2019-10-21 19:46:06

# Below is generated by plot.py at 2019-10-21 20:00:04
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 0.01 Mbit/s (0.1% utilization)
95th percentile per-packet one-way delay: 30.613 ms
Loss rate: 12.19%
-- Flow 1:
Average throughput: 0.01 Mbit/s
95th percentile per-packet one-way delay: 30.613 ms
Loss rate: 12.19%
```

Run 3: Report of Eagle-v3 — Data Link



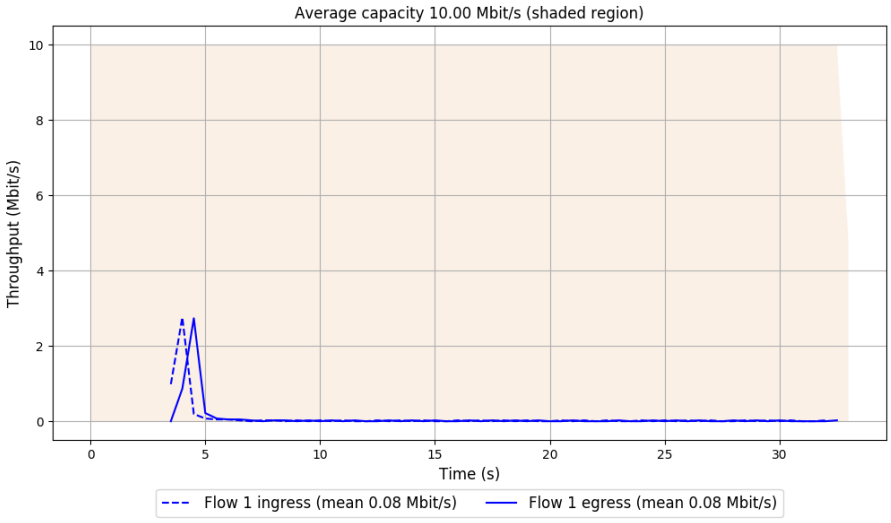


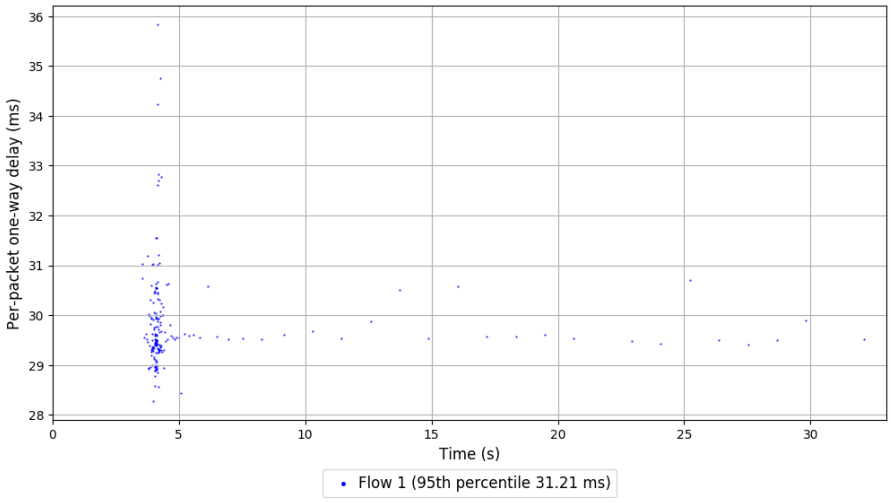
```
Run 4: Statistics of Eagle-v3

Start at: 2019-10-21 19:48:40
End at: 2019-10-21 19:49:10

# Below is generated by plot.py at 2019-10-21 20:00:04
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 0.08 Mbit/s (0.8% utilization)
95th percentile per-packet one-way delay: 31.214 ms
Loss rate: 3.59%
-- Flow 1:
Average throughput: 0.08 Mbit/s
95th percentile per-packet one-way delay: 31.214 ms
Loss rate: 3.59%
```

Run 4: Report of Eagle-v3 — Data Link



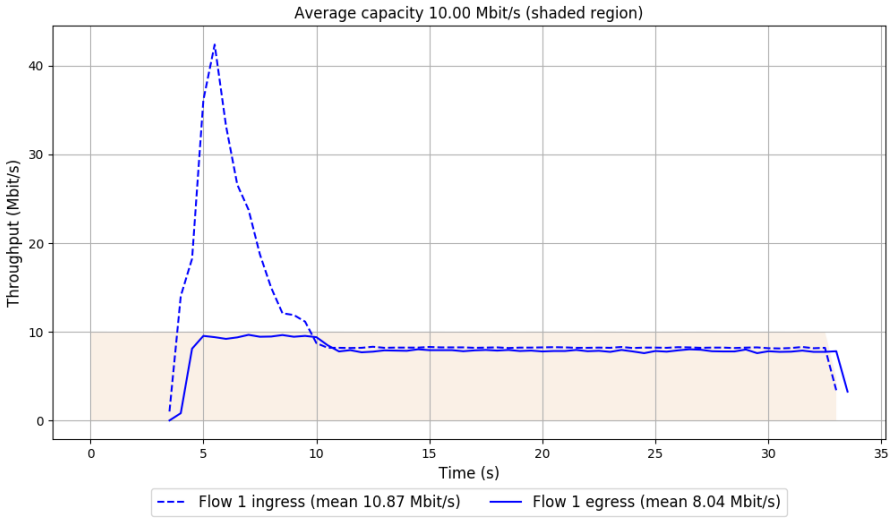


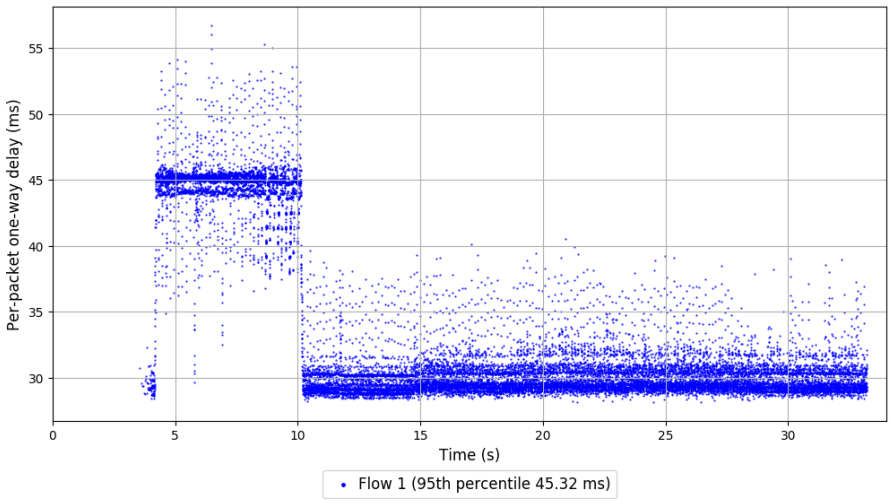
```
Run 5: Statistics of Eagle-v3

Start at: 2019-10-21 19:51:40
End at: 2019-10-21 19:52:10

# Below is generated by plot.py at 2019-10-21 20:00:04
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 8.04 Mbit/s (80.4% utilization)
95th percentile per-packet one-way delay: 45.320 ms
Loss rate: 26.07%
-- Flow 1:
Average throughput: 8.04 Mbit/s
95th percentile per-packet one-way delay: 45.320 ms
Loss rate: 26.07%
```

Run 5: Report of Eagle-v3 — Data Link



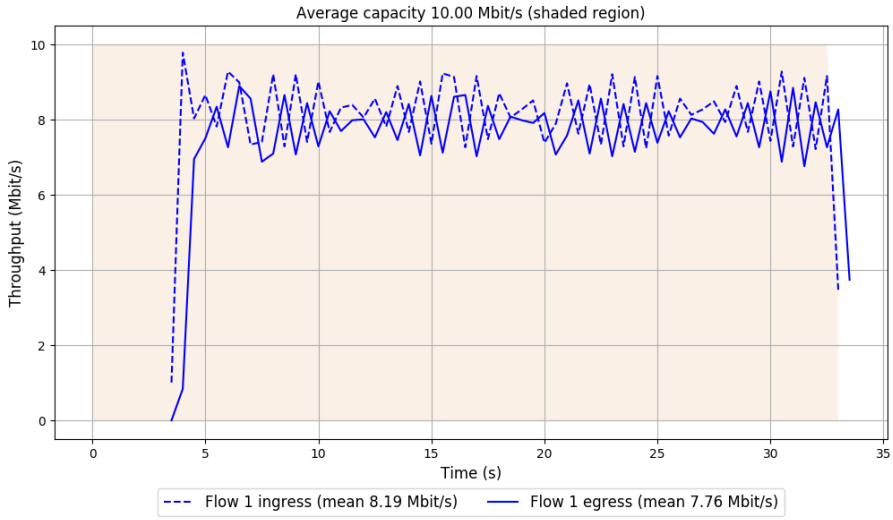


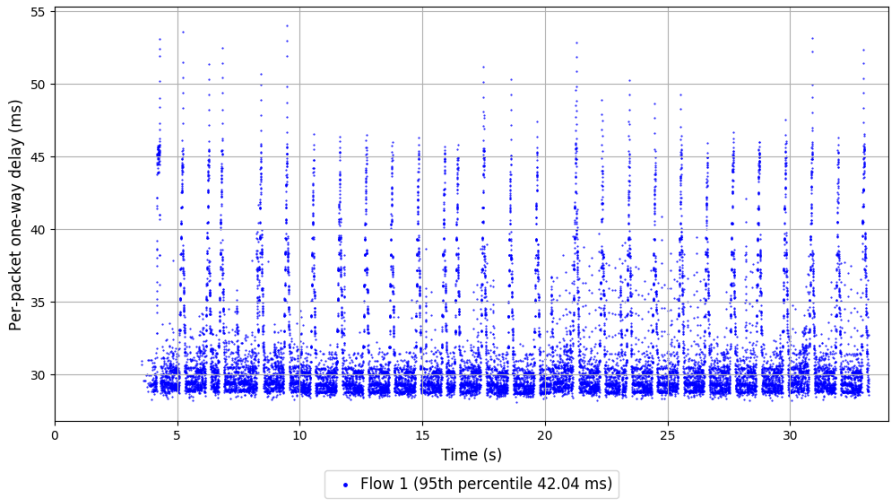
```
Run 1: Statistics of Synthesized-BBR

Start at: 2019-10-21 19:40:49
End at: 2019-10-21 19:41:19

# Below is generated by plot.py at 2019-10-21 20:00:04
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 7.76 Mbit/s (77.6% utilization)
95th percentile per-packet one-way delay: 42.043 ms
Loss rate: 5.40%
-- Flow 1:
Average throughput: 7.76 Mbit/s
95th percentile per-packet one-way delay: 42.043 ms
Loss rate: 5.40%
```

Run 1: Report of Synthesized-BBR — Data Link



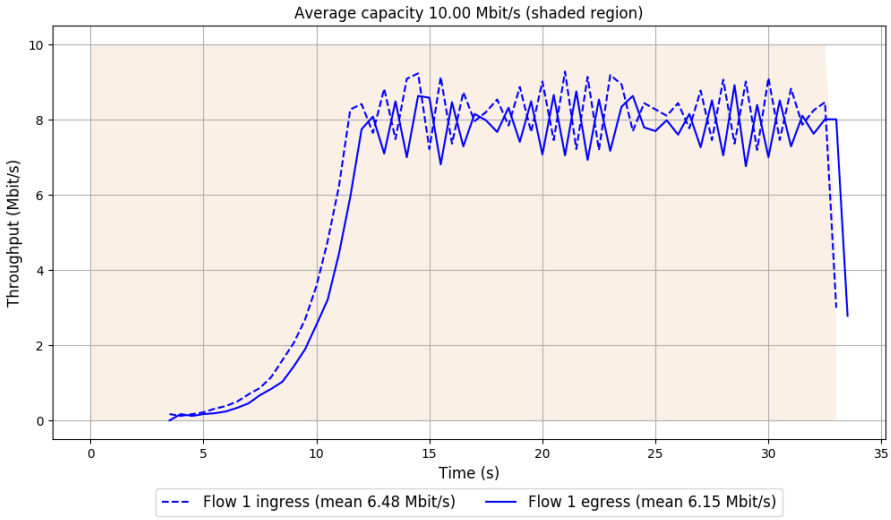


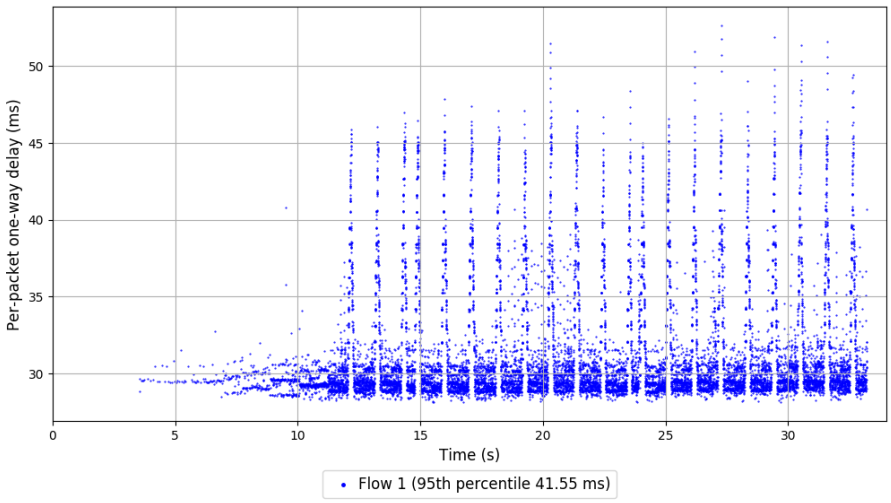
```
Run 2: Statistics of Synthesized-BBR

Start at: 2019-10-21 19:43:49
End at: 2019-10-21 19:44:19

# Below is generated by plot.py at 2019-10-21 20:00:04
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 6.15 Mbit/s (61.5% utilization)
95th percentile per-packet one-way delay: 41.547 ms
Loss rate: 5.07%
-- Flow 1:
Average throughput: 6.15 Mbit/s
95th percentile per-packet one-way delay: 41.547 ms
Loss rate: 5.07%
```

Run 2: Report of Synthesized-BBR — Data Link



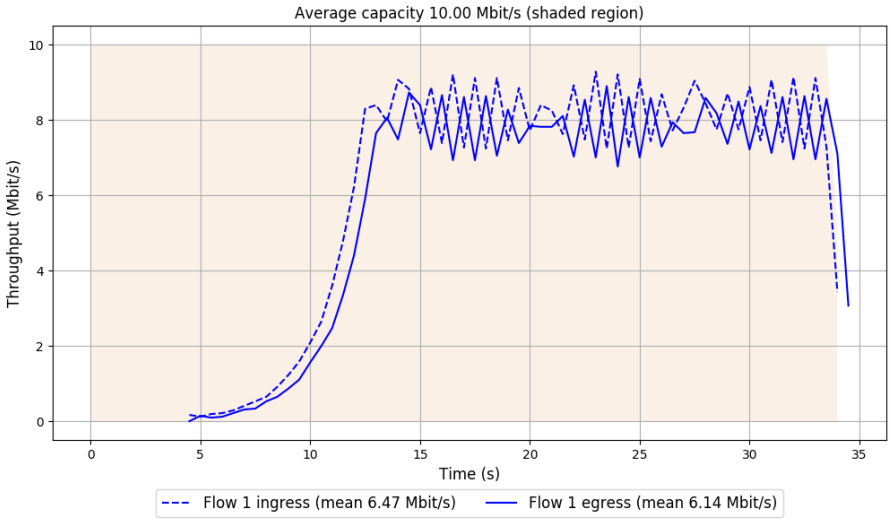


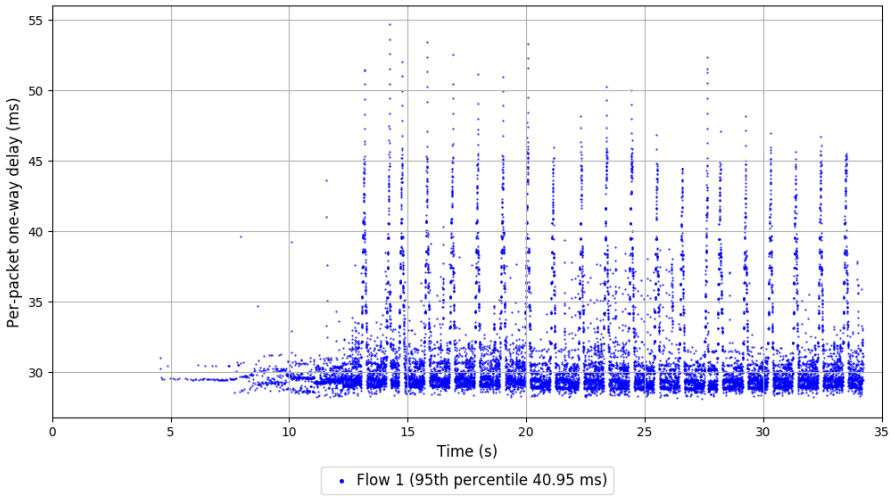
```
Run 3: Statistics of Synthesized-BBR

Start at: 2019-10-21 19:46:46
End at: 2019-10-21 19:47:16

# Below is generated by plot.py at 2019-10-21 20:00:04
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 6.14 Mbit/s (61.4% utilization)
95th percentile per-packet one-way delay: 40.954 ms
Loss rate: 5.18%
-- Flow 1:
Average throughput: 6.14 Mbit/s
95th percentile per-packet one-way delay: 40.954 ms
Loss rate: 5.18%
```

Run 3: Report of Synthesized-BBR — Data Link



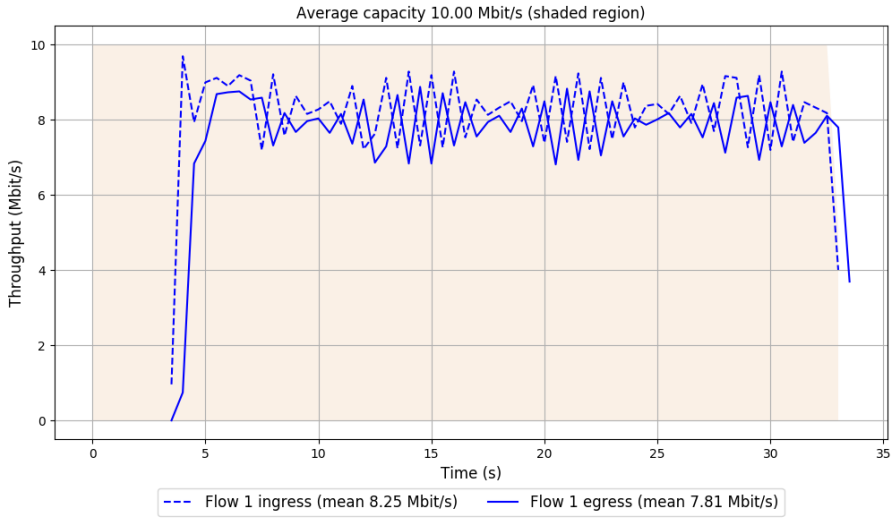


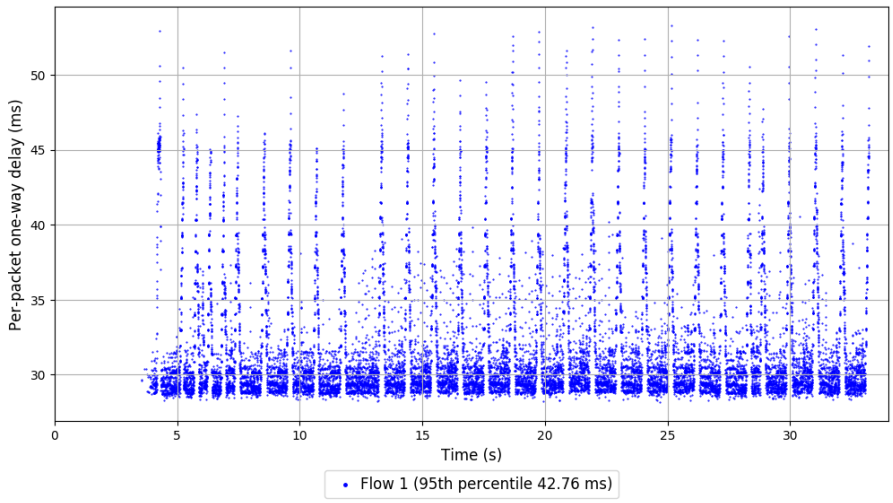
```
Run 4: Statistics of Synthesized-BBR

Start at: 2019-10-21 19:49:50
End at: 2019-10-21 19:50:20

# Below is generated by plot.py at 2019-10-21 20:00:04
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 7.81 Mbit/s (78.1% utilization)
95th percentile per-packet one-way delay: 42.762 ms
Loss rate: 5.36%
-- Flow 1:
Average throughput: 7.81 Mbit/s
95th percentile per-packet one-way delay: 42.762 ms
Loss rate: 5.36%
```

Run 4: Report of Synthesized-BBR — Data Link



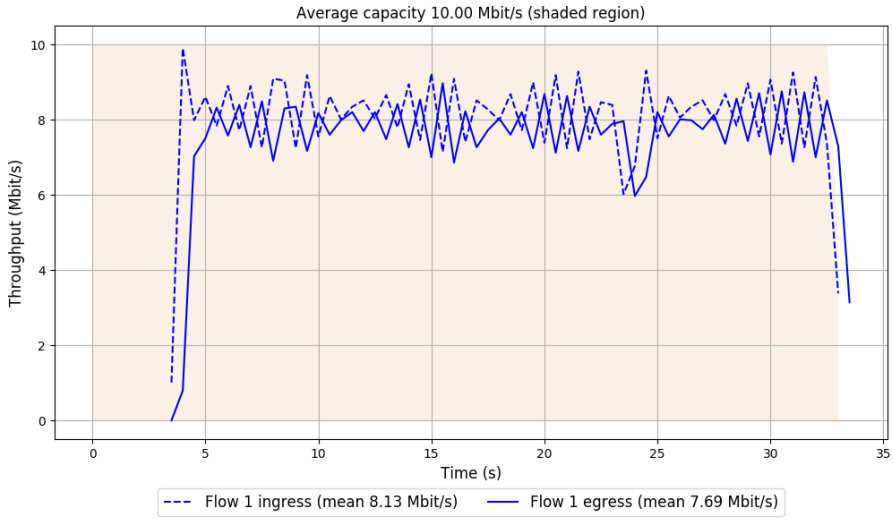


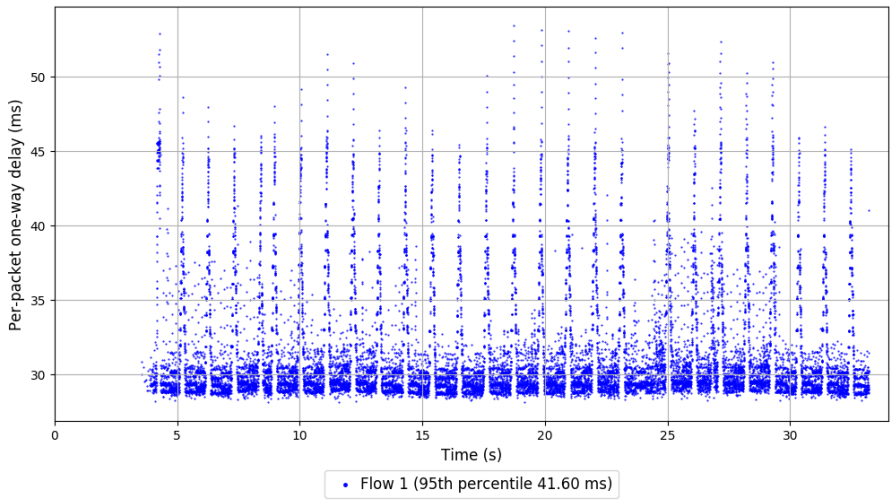
```
Run 5: Statistics of Synthesized-BBR

Start at: 2019-10-21 19:52:49
End at: 2019-10-21 19:53:19

# Below is generated by plot.py at 2019-10-21 20:00:04
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 7.69 Mbit/s (76.9% utilization)
95th percentile per-packet one-way delay: 41.602 ms
Loss rate: 5.48%
-- Flow 1:
Average throughput: 7.69 Mbit/s
95th percentile per-packet one-way delay: 41.602 ms
Loss rate: 5.48%
```

Run 5: Report of Synthesized-BBR — Data Link



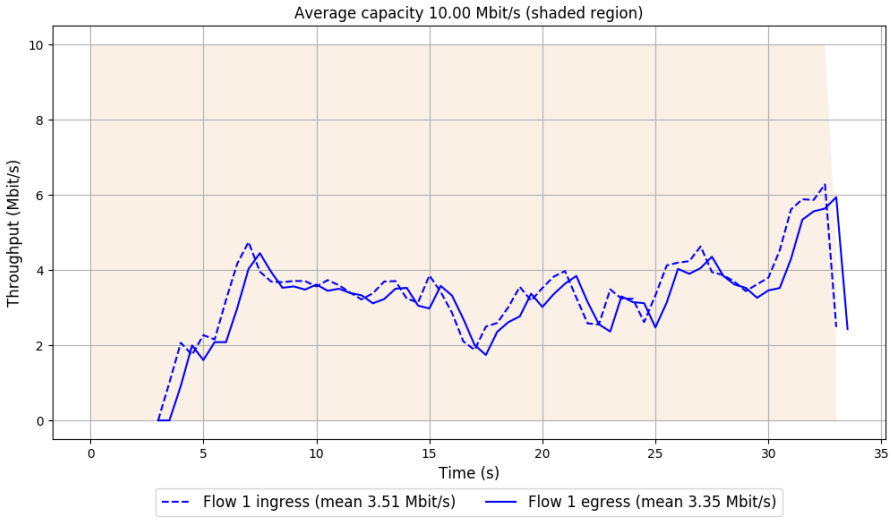


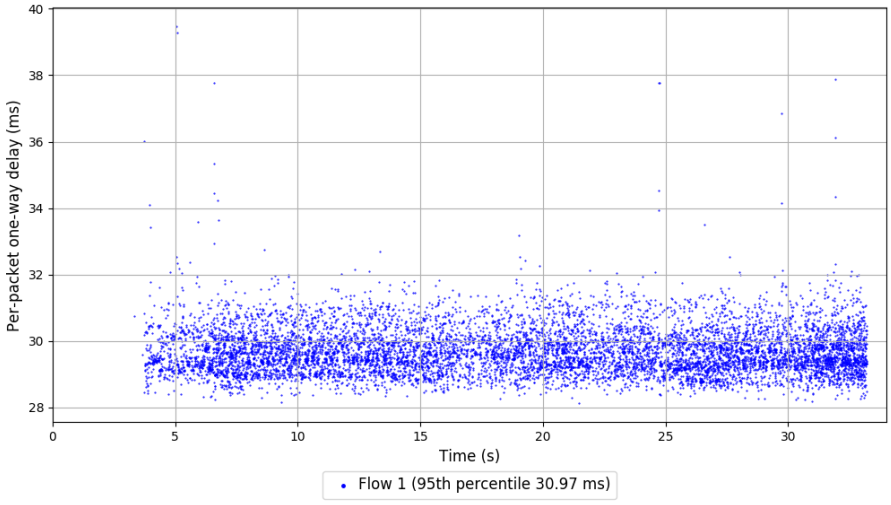
```
Run 1: Statistics of PCC-Vivace

Start at: 2019-10-21 19:41:23
End at: 2019-10-21 19:41:53

# Below is generated by plot.py at 2019-10-21 20:00:04
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 3.35 Mbit/s (33.5% utilization)
95th percentile per-packet one-way delay: 30.970 ms
Loss rate: 4.70%
-- Flow 1:
Average throughput: 3.35 Mbit/s
95th percentile per-packet one-way delay: 30.970 ms
Loss rate: 4.70%
```

Run 1: Report of PCC-Vivace — Data Link



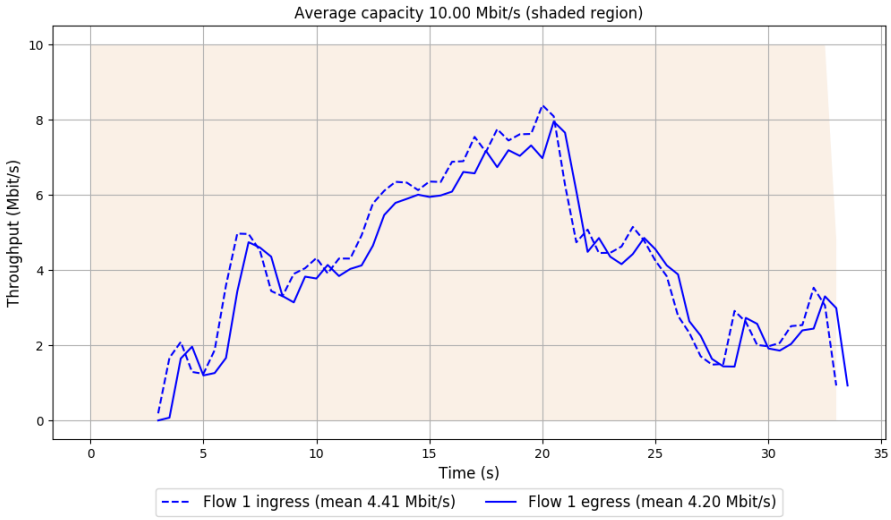


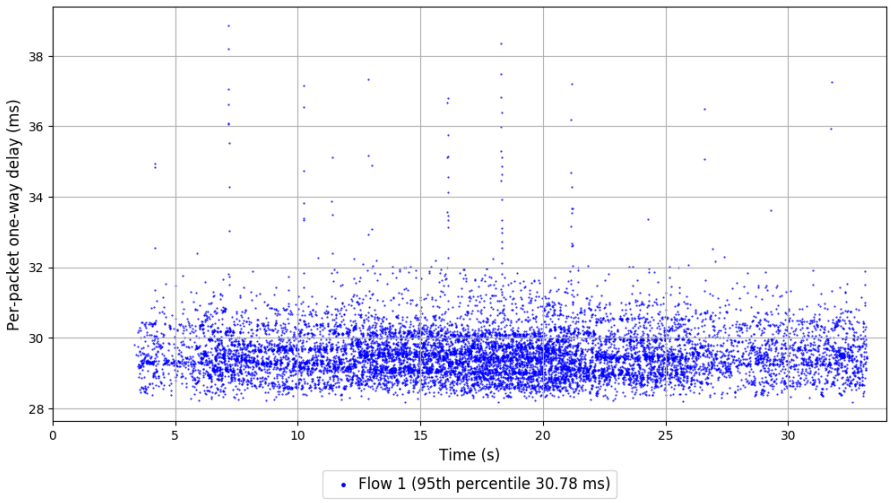
```
Run 2: Statistics of PCC-Vivace

Start at: 2019-10-21 19:44:24
End at: 2019-10-21 19:44:54

# Below is generated by plot.py at 2019-10-21 20:00:04
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 4.20 Mbit/s (42.0% utilization)
95th percentile per-packet one-way delay: 30.783 ms
Loss rate: 4.82%
-- Flow 1:
Average throughput: 4.20 Mbit/s
95th percentile per-packet one-way delay: 30.783 ms
Loss rate: 4.82%
```

Run 2: Report of PCC-Vivace — Data Link



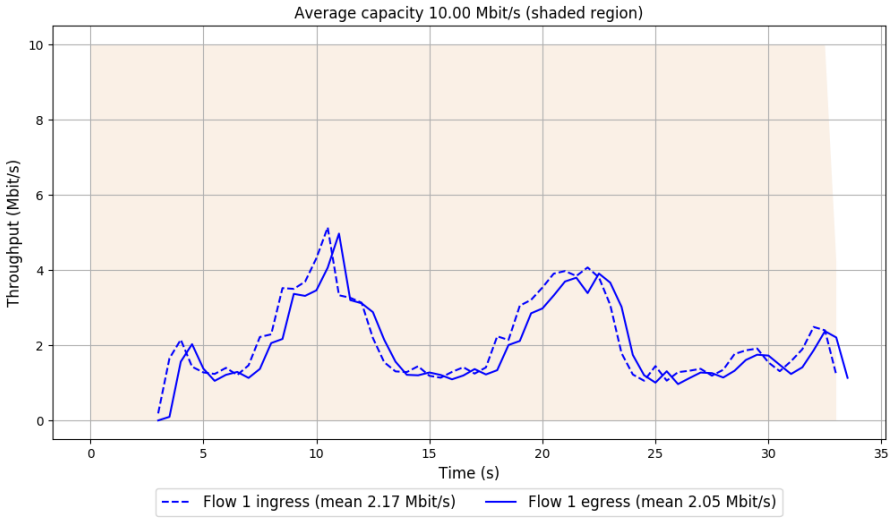


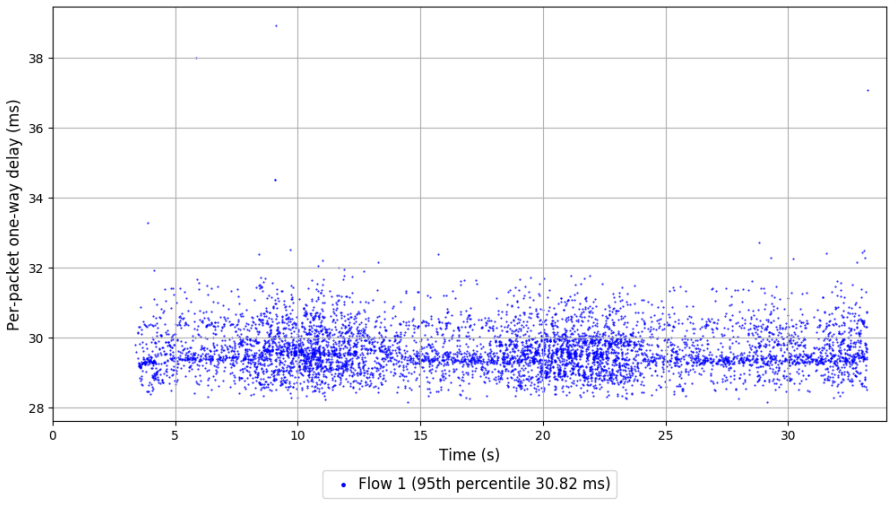
```
Run 3: Statistics of PCC-Vivace

Start at: 2019-10-21 19:47:20
End at: 2019-10-21 19:47:50

# Below is generated by plot.py at 2019-10-21 20:00:04
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 2.05 Mbit/s (20.5% utilization)
95th percentile per-packet one-way delay: 30.820 ms
Loss rate: 5.65%
-- Flow 1:
Average throughput: 2.05 Mbit/s
95th percentile per-packet one-way delay: 30.820 ms
Loss rate: 5.65%
```

Run 3: Report of PCC-Vivace — Data Link



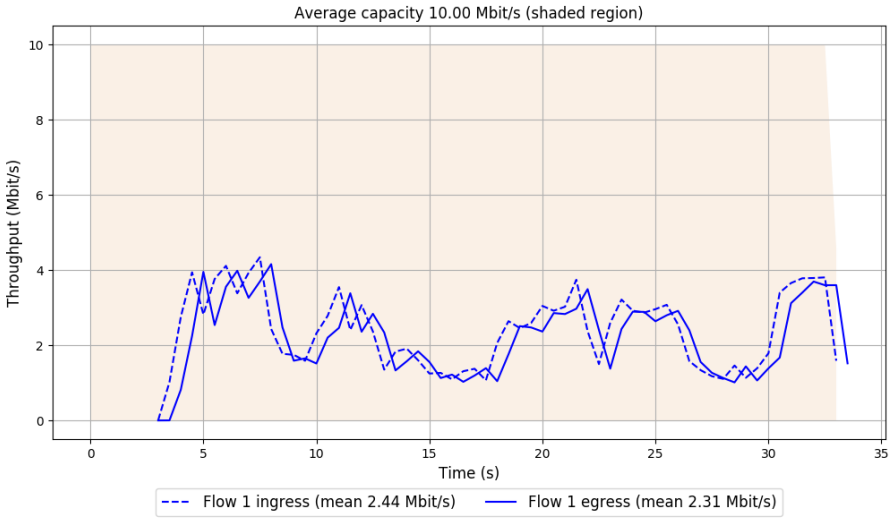


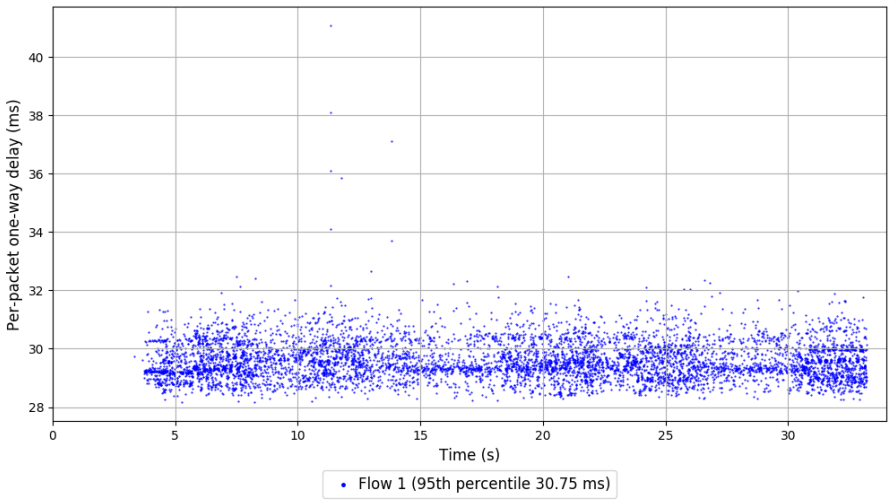
```
Run 4: Statistics of PCC-Vivace

Start at: 2019-10-21 19:50:24
End at: 2019-10-21 19:50:54

# Below is generated by plot.py at 2019-10-21 20:00:04
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 2.31 Mbit/s (23.1% utilization)
95th percentile per-packet one-way delay: 30.750 ms
Loss rate: 5.41%
-- Flow 1:
Average throughput: 2.31 Mbit/s
95th percentile per-packet one-way delay: 30.750 ms
Loss rate: 5.41%
```

Run 4: Report of PCC-Vivace — Data Link





```
Run 5: Statistics of PCC-Vivace

Start at: 2019-10-21 19:53:24
End at: 2019-10-21 19:53:54

# Below is generated by plot.py at 2019-10-21 20:00:04
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 4.24 Mbit/s (42.4% utilization)
95th percentile per-packet one-way delay: 31.009 ms
Loss rate: 5.11%
-- Flow 1:
Average throughput: 4.24 Mbit/s
95th percentile per-packet one-way delay: 31.009 ms
Loss rate: 5.11%
```

Run 5: Report of PCC-Vivace — Data Link