Pantheon Report

Generated at 2019-10-22 19:03:24 (UTC).

Tested in mahimahi: `mm-delay 51 mm-loss uplink 0.0006 mm-link 77.72mbps.trace 77.72mbps.trace --uplink-queue=droptail --uplink-queue-args=packets=94`

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
```
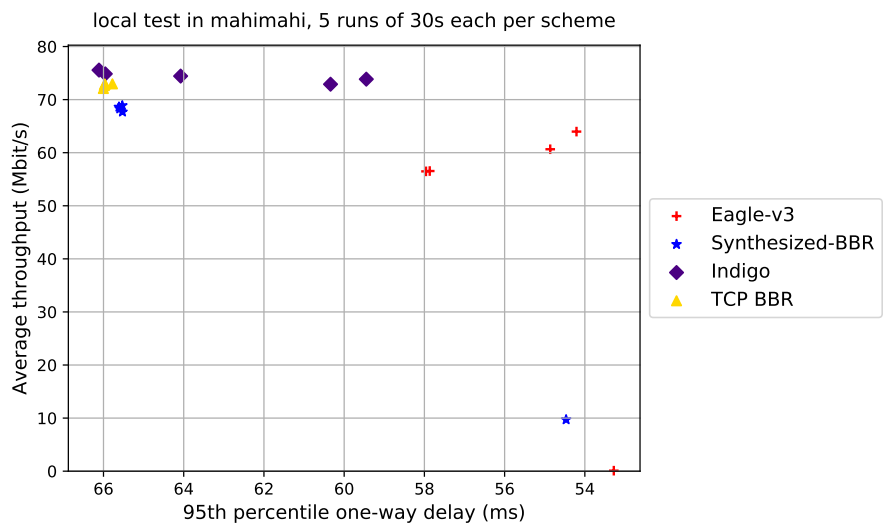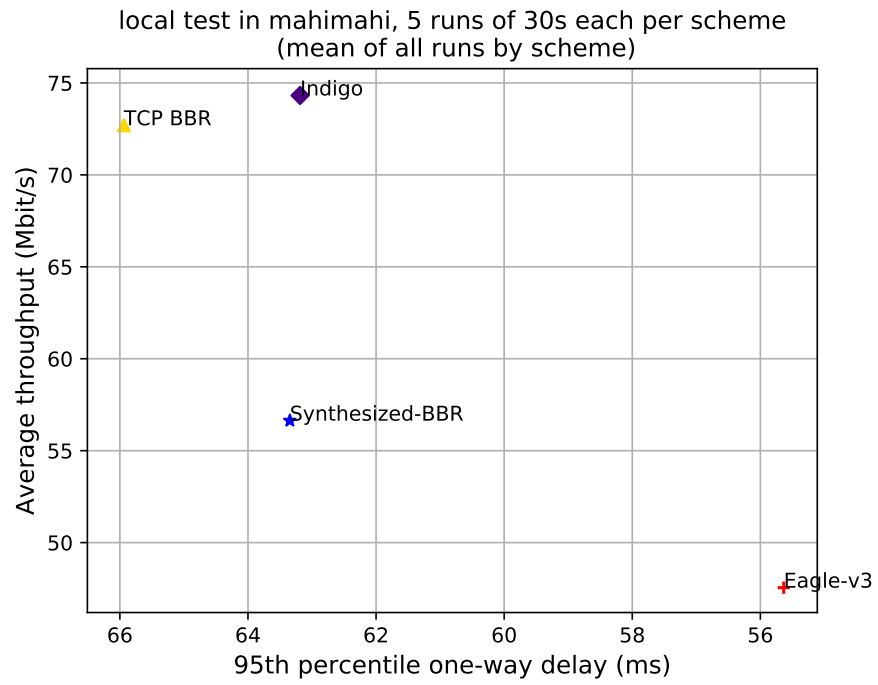
```
 M src/ScreamClient
 M src/ScreamServer
third_party/sprout @ 366e35c6178b01e31d4a46ad18c74f9415f19a26
 M src/examples/cellsim.cc
 M src/examples/sproutbt2.cc
 M src/network/sproutconn.cc
third_party/synthesizedBBR @ a63fea7809d9b57a6dbfc95c54181b54157c2b45
 M sender-receiver/sender-receiver/sender_receiver/__pycache__/__init__.cpython-36.pyc
 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)

local test in mahimahi, 5 runs of 30s each per scheme

scheme	# runs	mean avg tput (Mbit/s) flow 1	mean 95th-%ile delay (ms) flow 1	mean loss rate (%) flow 1
TCP BBR	5	72.70	65.94	3.43
Eagle-v3	5	47.55	55.64	1.55
Indigo	5	74.32	63.19	7.95
Synthesized-BBR	5	56.63	63.35	2.26

```
Run 1: Statistics of TCP BBR

Start at: 2019-10-22 18:47:04
End at: 2019-10-22 18:47:34

# Below is generated by plot.py at 2019-10-22 19:00:54
# Datalink statistics
-- Total of 1 flow:
Average capacity: 77.72 Mbit/s
Average throughput: 72.65 Mbit/s (93.5% utilization)
95th percentile per-packet one-way delay: 65.980 ms
Loss rate: 3.17%
-- Flow 1:
Average throughput: 72.65 Mbit/s
95th percentile per-packet one-way delay: 65.980 ms
Loss rate: 3.17%
```
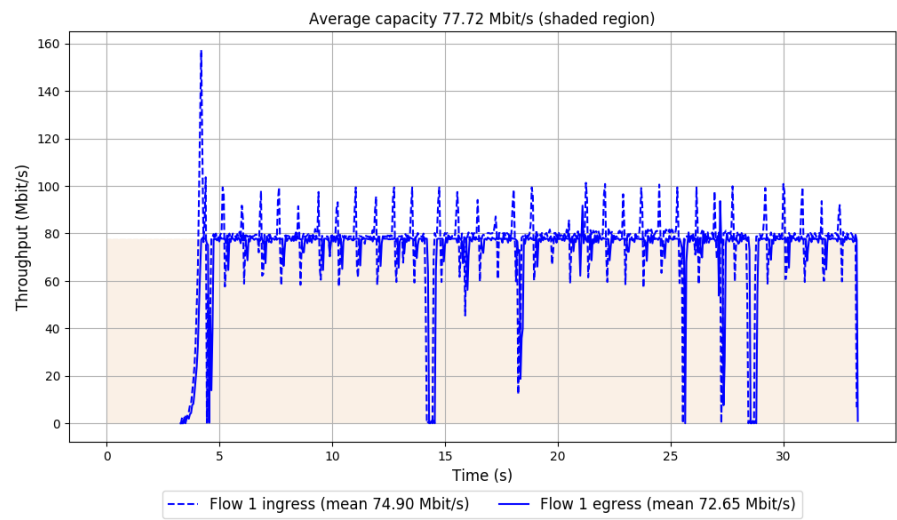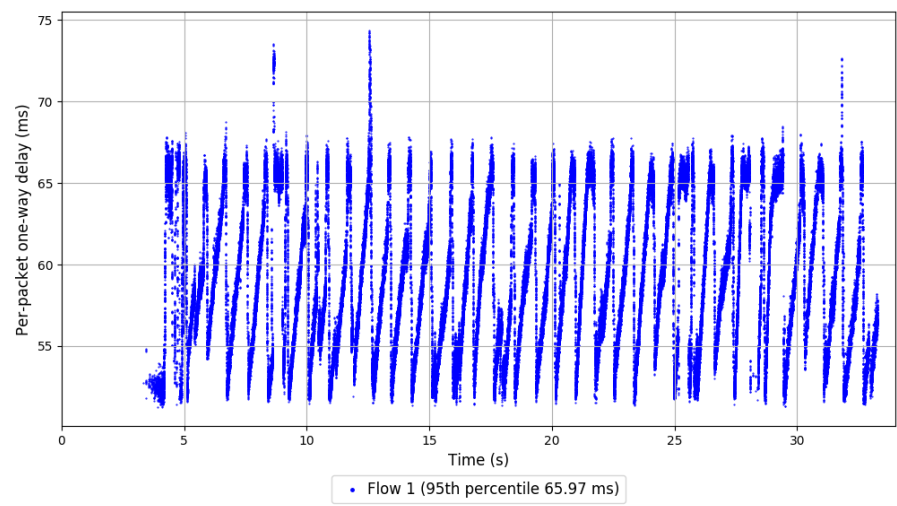
Run 1: Report of TCP BBR — Data Link

Average capacity 77.72 Mbit/s (shaded region)

Flow 1 ingress (mean 74.90 Mbit/s) — Flow 1 egress (mean 72.65 Mbit/s)

Flow 1 (95th percentile 65.98 ms)
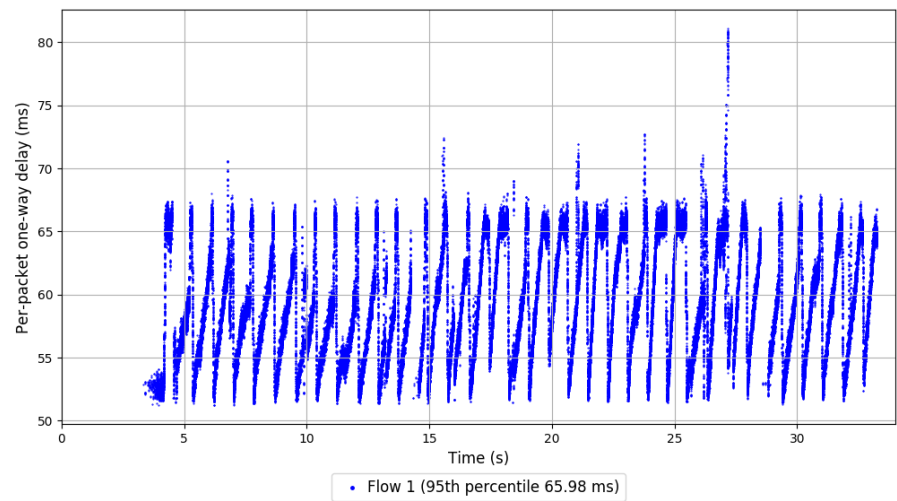
```
Run 2: Statistics of TCP BBR

Start at: 2019-10-22 18:49:37
End at: 2019-10-22 18:50:07


# Below is generated by plot.py at 2019-10-22 19:00:56
# Datalink statistics
-- Total of 1 flow:
Average capacity: 77.72 Mbit/s
Average throughput: 72.95 Mbit/s (93.9% utilization)
95th percentile per-packet one-way delay: 65.967 ms
Loss rate: 3.47%
-- Flow 1:
Average throughput: 72.95 Mbit/s
95th percentile per-packet one-way delay: 65.967 ms
Loss rate: 3.47%
```
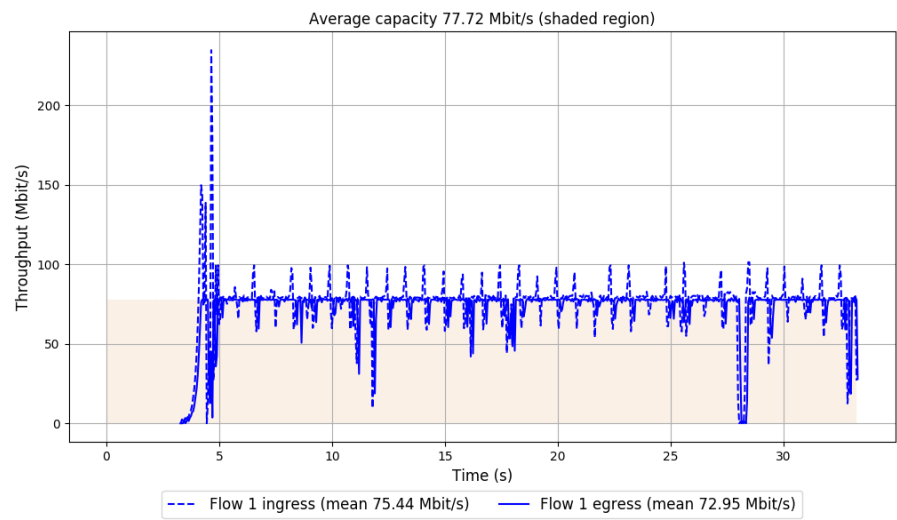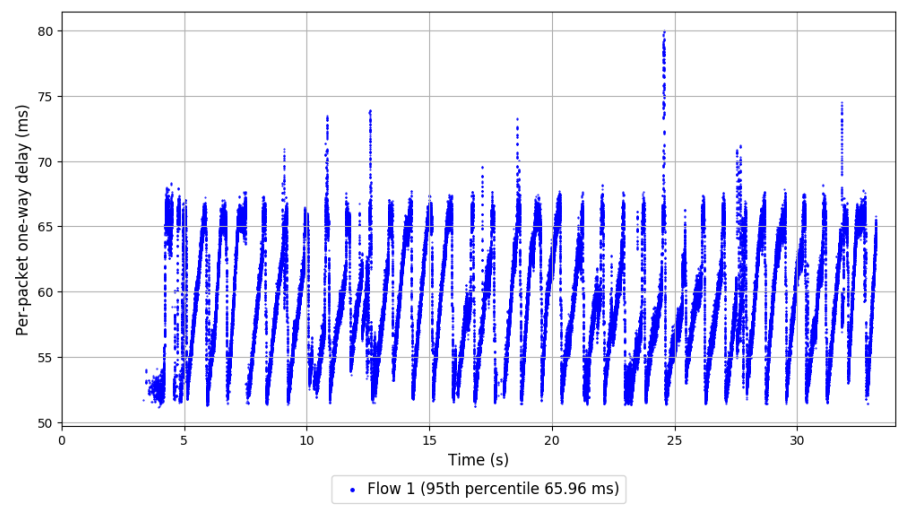
Run 2: Report of TCP BBR — Data Link

Average capacity 77.72 Mbit/s (shaded region)

Flow 1 ingress (mean 75.44 Mbit/s) —— Flow 1 egress (mean 72.95 Mbit/s)

• Flow 1 (95th percentile 65.97 ms)

```
Run 3: Statistics of TCP BBR

Start at: 2019-10-22 18:52:11
End at: 2019-10-22 18:52:41

# Below is generated by plot.py at 2019-10-22 19:00:56
# Datalink statistics
-- Total of 1 flow:
Average capacity: 77.72 Mbit/s
Average throughput: 72.82 Mbit/s (93.7% utilization)
95th percentile per-packet one-way delay: 65.963 ms
Loss rate: 3.39%
-- Flow 1:
Average throughput: 72.82 Mbit/s
95th percentile per-packet one-way delay: 65.963 ms
Loss rate: 3.39%
```
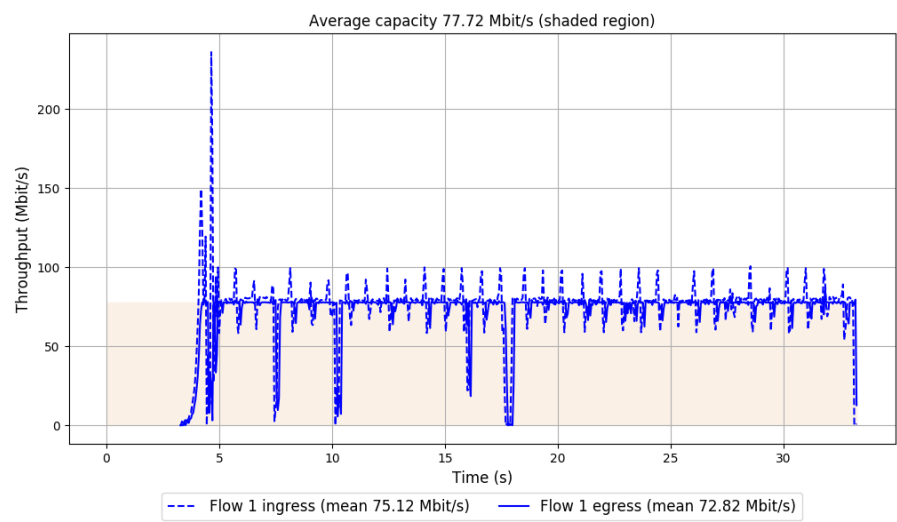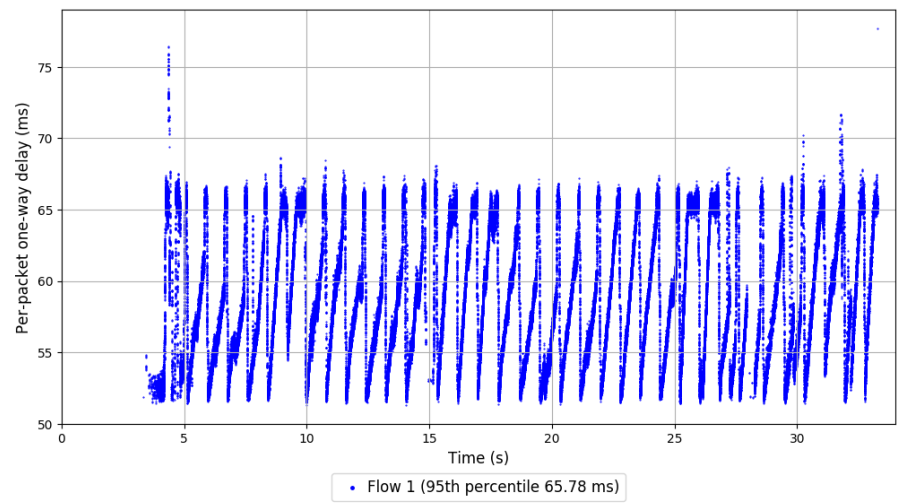
Run 3: Report of TCP BBR — Data Link

Average capacity 77.72 Mbit/s (shaded region)

Flow 1 ingress (mean 75.12 Mbit/s)   Flow 1 egress (mean 72.82 Mbit/s)

Flow 1 (95th percentile 65.96 ms)

```
Run 4: Statistics of TCP BBR

Start at: 2019-10-22 18:54:39
End at: 2019-10-22 18:55:09

# Below is generated by plot.py at 2019-10-22 19:00:56
# Datalink statistics
-- Total of 1 flow:
Average capacity: 77.72 Mbit/s
Average throughput: 72.97 Mbit/s (93.9% utilization)
95th percentile per-packet one-way delay: 65.777 ms
Loss rate: 3.66%
-- Flow 1:
Average throughput: 72.97 Mbit/s
95th percentile per-packet one-way delay: 65.777 ms
Loss rate: 3.66%
```
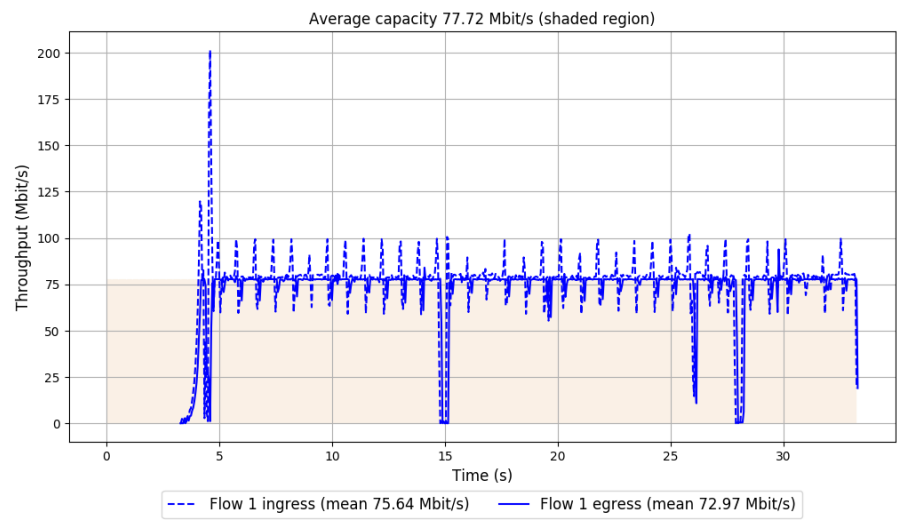
Run 4: Report of TCP BBR — Data Link

Average capacity 77.72 Mbit/s (shaded region)

--- Flow 1 ingress (mean 75.64 Mbit/s) — Flow 1 egress (mean 72.97 Mbit/s)

• Flow 1 (95th percentile 65.78 ms)

```
Run 5: Statistics of TCP BBR

Start at: 2019-10-22 18:57:13
End at: 2019-10-22 18:57:43


# Below is generated by plot.py at 2019-10-22 19:01:36
# Datalink statistics
-- Total of 1 flow:
Average capacity: 77.72 Mbit/s
Average throughput: 72.10 Mbit/s (92.8% utilization)
95th percentile per-packet one-way delay: 66.003 ms
Loss rate: 3.48%
-- Flow 1:
Average throughput: 72.10 Mbit/s
95th percentile per-packet one-way delay: 66.003 ms
Loss rate: 3.48%
```
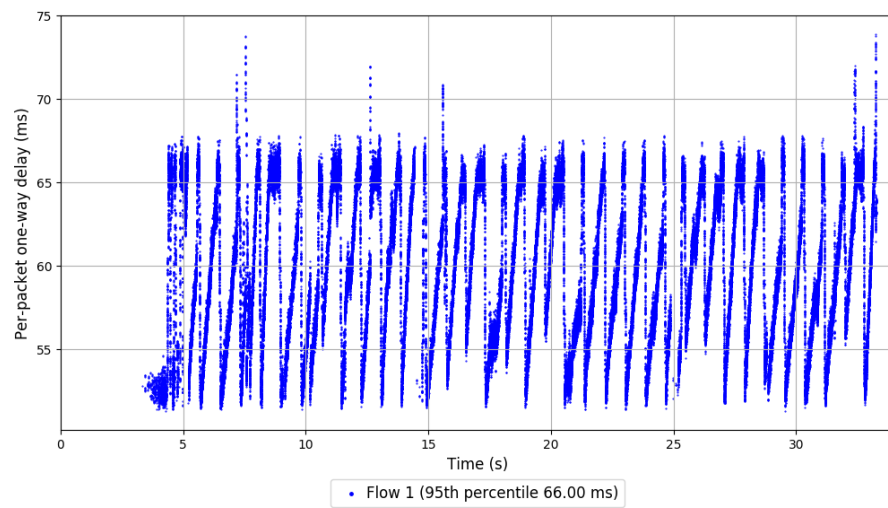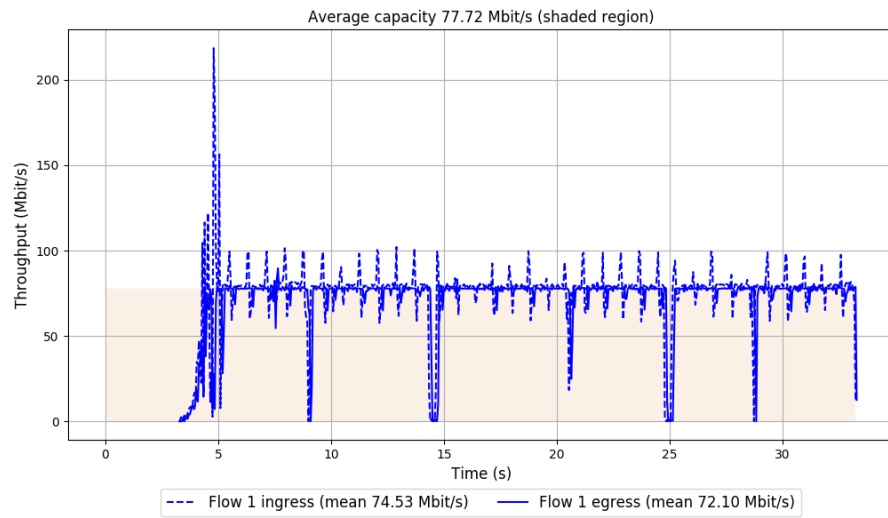
Run 5: Report of TCP BBR — Data Link

Average capacity 77.72 Mbit/s (shaded region)

Flow 1 ingress (mean 74.53 Mbit/s)   Flow 1 egress (mean 72.10 Mbit/s)
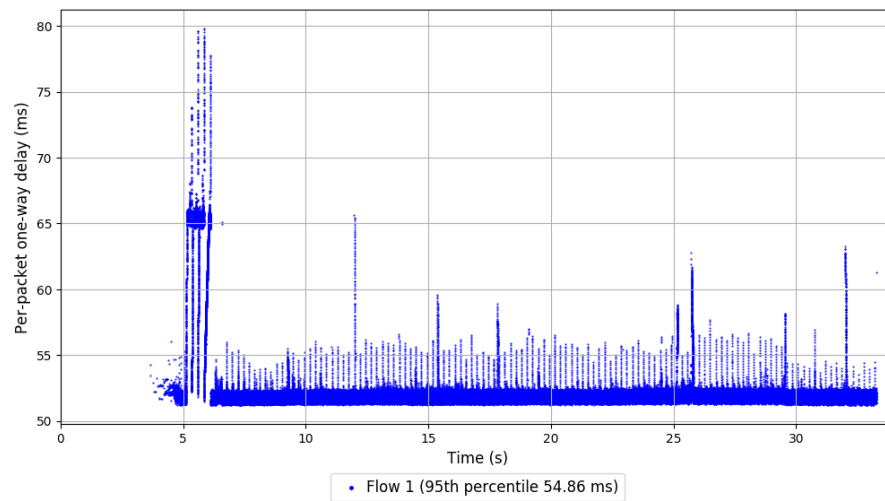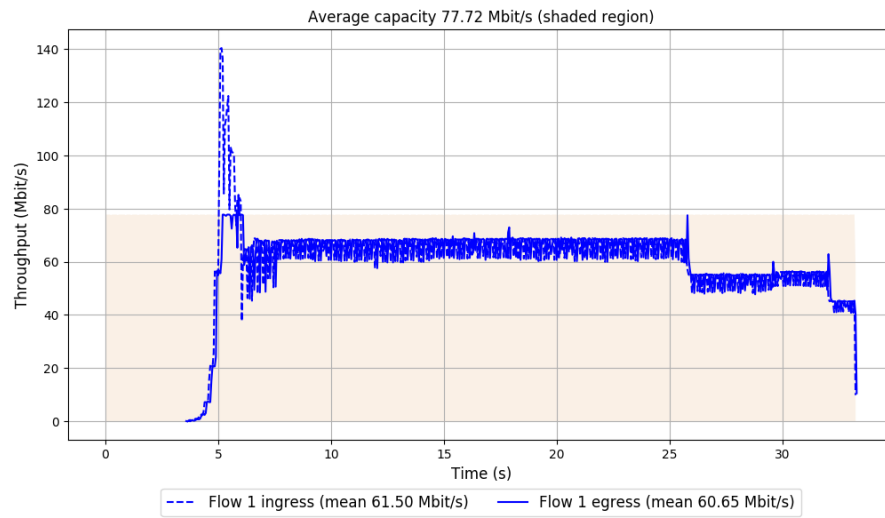

Flow 1 (95th percentile 66.00 ms)

```
Run 1: Statistics of Eagle-v3

Start at: 2019-10-22 18:45:47
End at: 2019-10-22 18:46:17


# Below is generated by plot.py at 2019-10-22 19:01:36
# Datalink statistics
-- Total of 1 flow:
Average capacity: 77.72 Mbit/s
Average throughput: 60.65 Mbit/s (78.0% utilization)
95th percentile per-packet one-way delay: 54.863 ms
Loss rate: 1.53%
-- Flow 1:
Average throughput: 60.65 Mbit/s
95th percentile per-packet one-way delay: 54.863 ms
Loss rate: 1.53%
```

Run 1: Report of Eagle-v3 — Data Link

Average capacity 77.72 Mbit/s (shaded region)

--- Flow 1 ingress (mean 61.50 Mbit/s) —— Flow 1 egress (mean 60.65 Mbit/s)

• Flow 1 (95th percentile 54.86 ms)

```
Run 2: Statistics of Eagle-v3

Start at: 2019-10-22 18:48:21
End at: 2019-10-22 18:48:51


# Below is generated by plot.py at 2019-10-22 19:01:39
# Datalink statistics
-- Total of 1 flow:
Average capacity: 77.72 Mbit/s
Average throughput: 56.55 Mbit/s (72.8% utilization)
95th percentile per-packet one-way delay: 57.867 ms
Loss rate: 1.95%
-- Flow 1:
Average throughput: 56.55 Mbit/s
95th percentile per-packet one-way delay: 57.867 ms
Loss rate: 1.95%
```
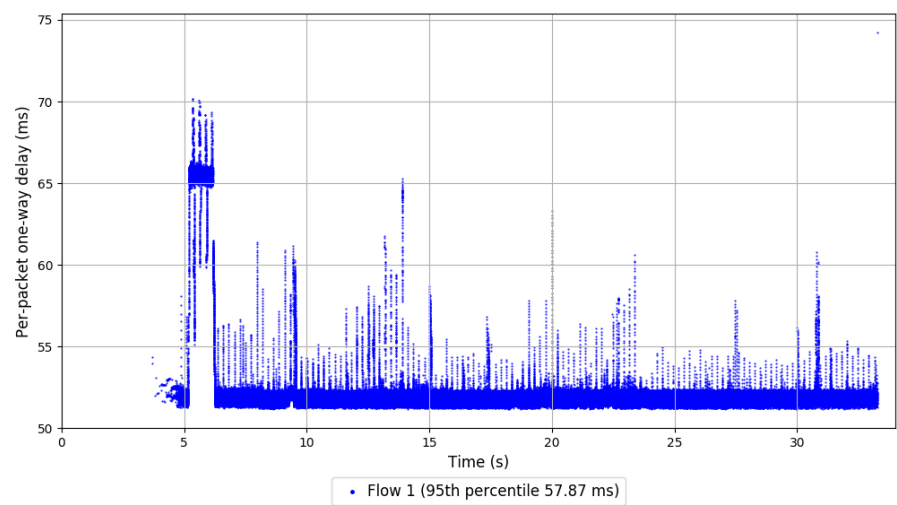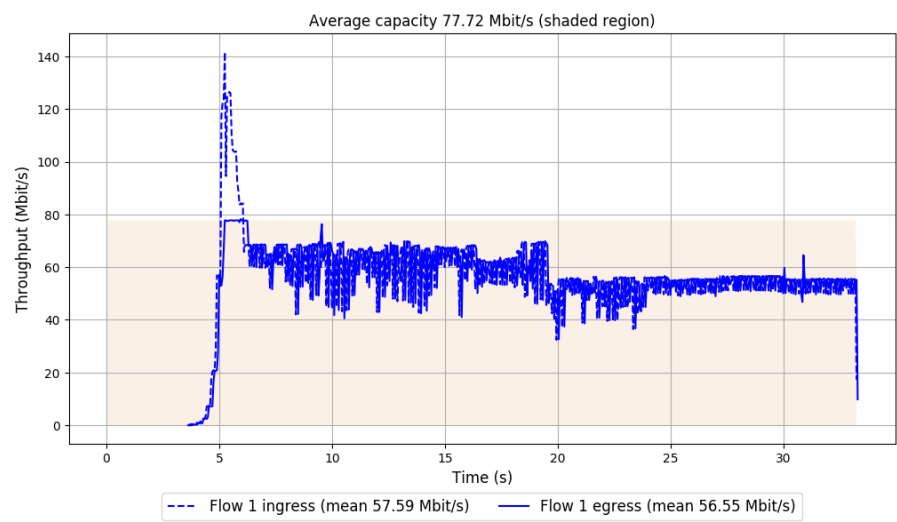
Run 2: Report of Eagle-v3 — Data Link

Average capacity 77.72 Mbit/s (shaded region)

--- Flow 1 ingress (mean 57.59 Mbit/s)   —— Flow 1 egress (mean 56.55 Mbit/s)

• Flow 1 (95th percentile 57.87 ms)

```
Run 3: Statistics of Eagle-v3

Start at: 2019-10-22 18:50:54
End at: 2019-10-22 18:51:24

# Below is generated by plot.py at 2019-10-22 19:01:39
# Datalink statistics
-- Total of 1 flow:
Average capacity: 77.72 Mbit/s
Average throughput: 63.97 Mbit/s (82.3% utilization)
95th percentile per-packet one-way delay: 54.208 ms
Loss rate: 2.03%
-- Flow 1:
Average throughput: 63.97 Mbit/s
95th percentile per-packet one-way delay: 54.208 ms
Loss rate: 2.03%
```
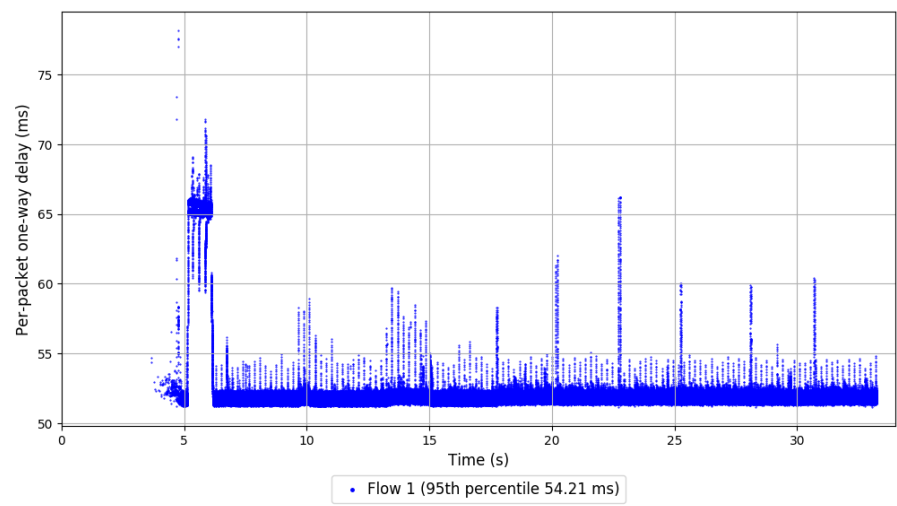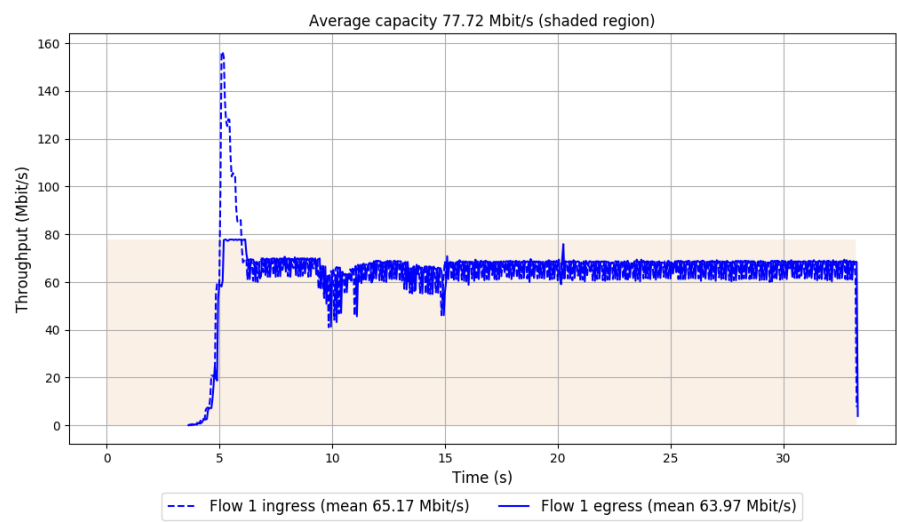
Run 3: Report of Eagle-v3 — Data Link

Average capacity 77.72 Mbit/s (shaded region)

--- Flow 1 ingress (mean 65.17 Mbit/s)   —— Flow 1 egress (mean 63.97 Mbit/s)

• Flow 1 (95th percentile 54.21 ms)

```
Run 4: Statistics of Eagle-v3

Start at: 2019-10-22 18:53:28
End at: 2019-10-22 18:53:58

# Below is generated by plot.py at 2019-10-22 19:01:39
# Datalink statistics
-- Total of 1 flow:
Average capacity: 77.72 Mbit/s
Average throughput: 0.10 Mbit/s (0.1% utilization)
95th percentile per-packet one-way delay: 53.278 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 0.10 Mbit/s
95th percentile per-packet one-way delay: 53.278 ms
Loss rate: 0.00%
```
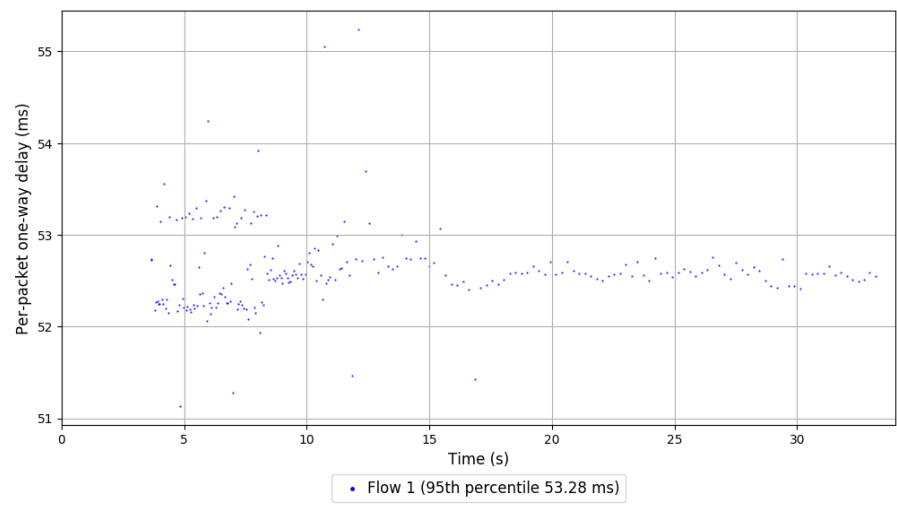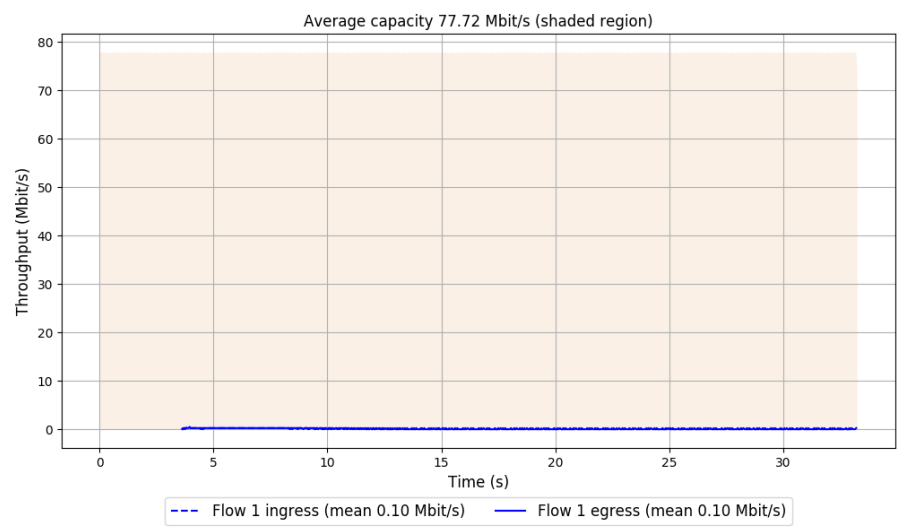
Run 4: Report of Eagle-v3 — Data Link

Average capacity 77.72 Mbit/s (shaded region)

Flow 1 ingress (mean 0.10 Mbit/s) — Flow 1 egress (mean 0.10 Mbit/s)

Flow 1 (95th percentile 53.28 ms)

```
Run 5: Statistics of Eagle-v3

Start at: 2019-10-22 18:55:56
End at: 2019-10-22 18:56:26


# Below is generated by plot.py at 2019-10-22 19:01:59
# Datalink statistics
-- Total of 1 flow:
Average capacity: 77.72 Mbit/s
Average throughput: 56.48 Mbit/s (72.7% utilization)
95th percentile per-packet one-way delay: 57.960 ms
Loss rate: 2.25%
-- Flow 1:
Average throughput: 56.48 Mbit/s
95th percentile per-packet one-way delay: 57.960 ms
Loss rate: 2.25%
```
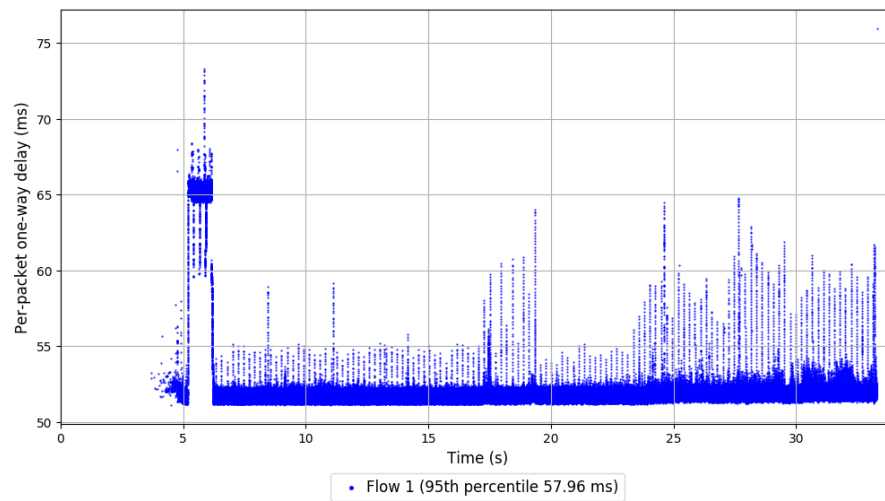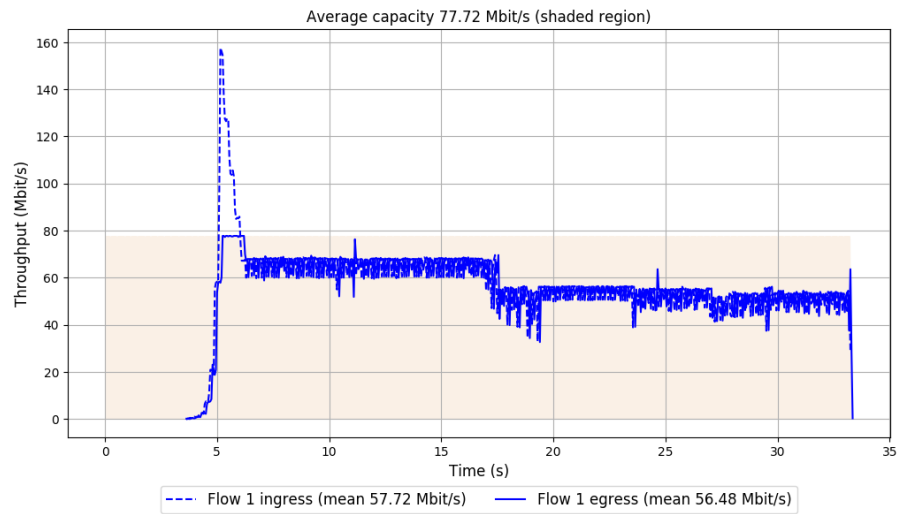
Run 5: Report of Eagle-v3 — Data Link

Average capacity 77.72 Mbit/s (shaded region)

Flow 1 ingress (mean 57.72 Mbit/s)   Flow 1 egress (mean 56.48 Mbit/s)

Flow 1 (95th percentile 57.96 ms)

```
Run 1: Statistics of Indigo

Start at: 2019-10-22 18:47:42
End at: 2019-10-22 18:48:12

# Below is generated by plot.py at 2019-10-22 19:02:24
# Datalink statistics
-- Total of 1 flow:
Average capacity: 77.72 Mbit/s
Average throughput: 73.85 Mbit/s (95.0% utilization)
95th percentile per-packet one-way delay: 59.448 ms
Loss rate: 1.66%
-- Flow 1:
Average throughput: 73.85 Mbit/s
95th percentile per-packet one-way delay: 59.448 ms
Loss rate: 1.66%
```
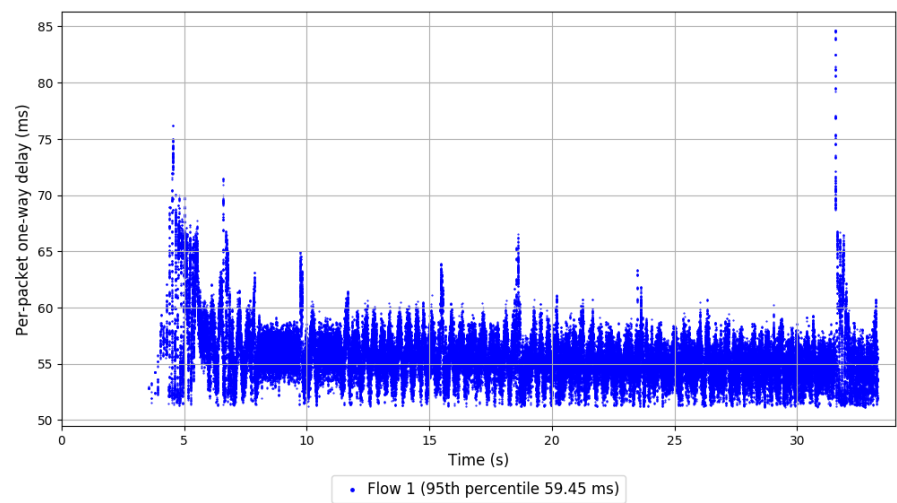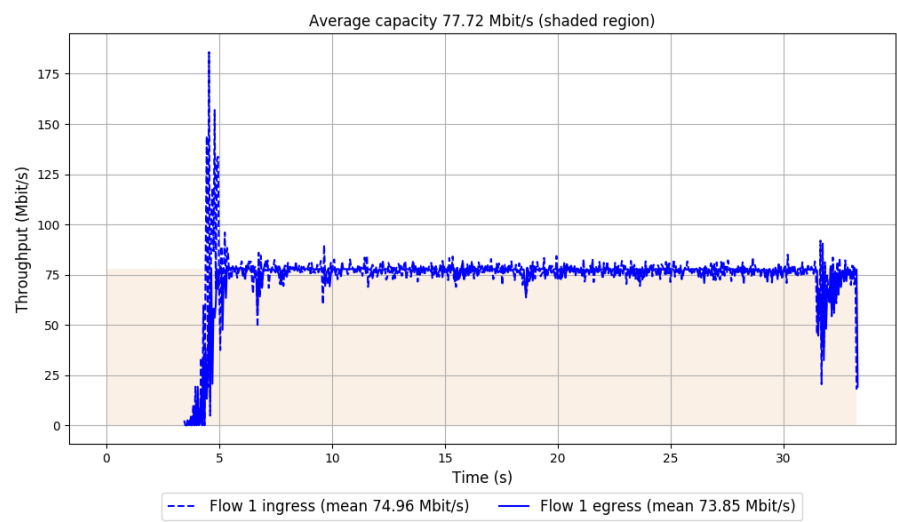
Run 1: Report of Indigo — Data Link

Average capacity 77.72 Mbit/s (shaded region)

Flow 1 ingress (mean 74.96 Mbit/s) — Flow 1 egress (mean 73.85 Mbit/s)

Flow 1 (95th percentile 59.45 ms)

```
Run 2: Statistics of Indigo

Start at: 2019-10-22 18:50:15
End at: 2019-10-22 18:50:45

# Below is generated by plot.py at 2019-10-22 19:02:24
# Datalink statistics
-- Total of 1 flow:
Average capacity: 77.72 Mbit/s
Average throughput: 74.43 Mbit/s (95.8% utilization)
95th percentile per-packet one-way delay: 64.077 ms
Loss rate: 4.68%
-- Flow 1:
Average throughput: 74.43 Mbit/s
95th percentile per-packet one-way delay: 64.077 ms
Loss rate: 4.68%
```
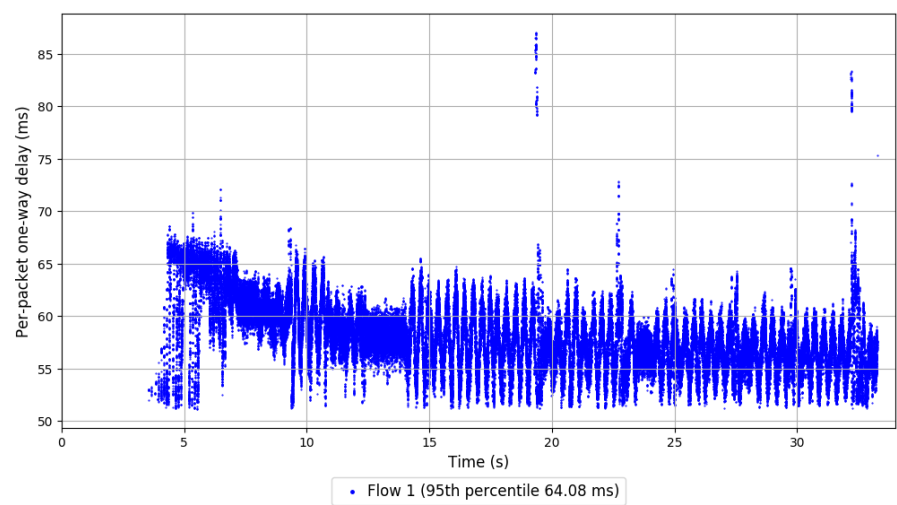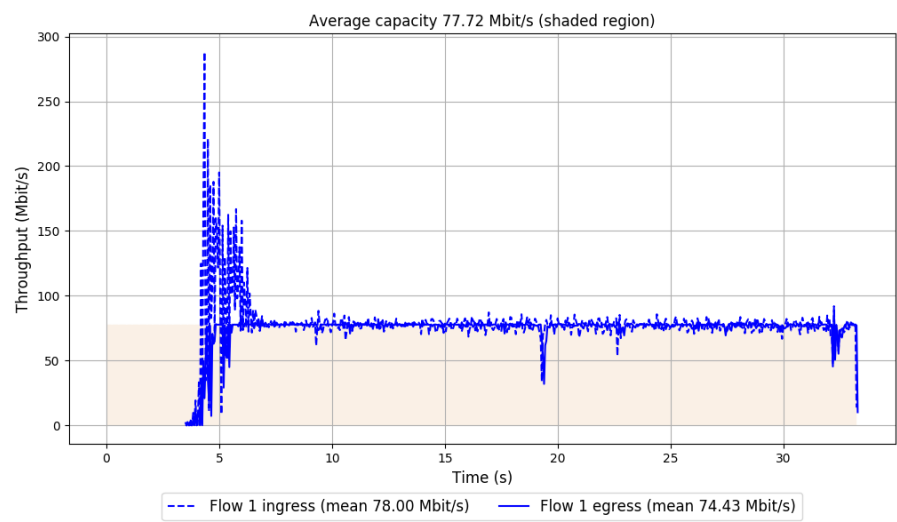
Run 2: Report of Indigo — Data Link

Average capacity 77.72 Mbit/s (shaded region)

--- Flow 1 ingress (mean 78.00 Mbit/s) —— Flow 1 egress (mean 74.43 Mbit/s)

• Flow 1 (95th percentile 64.08 ms)

```
Run 3: Statistics of Indigo

Start at: 2019-10-22 18:52:49
End at: 2019-10-22 18:53:19

# Below is generated by plot.py at 2019-10-22 19:02:24
# Datalink statistics
-- Total of 1 flow:
Average capacity: 77.72 Mbit/s
Average throughput: 72.90 Mbit/s (93.8% utilization)
95th percentile per-packet one-way delay: 60.340 ms
Loss rate: 1.74%
-- Flow 1:
Average throughput: 72.90 Mbit/s
95th percentile per-packet one-way delay: 60.340 ms
Loss rate: 1.74%
```
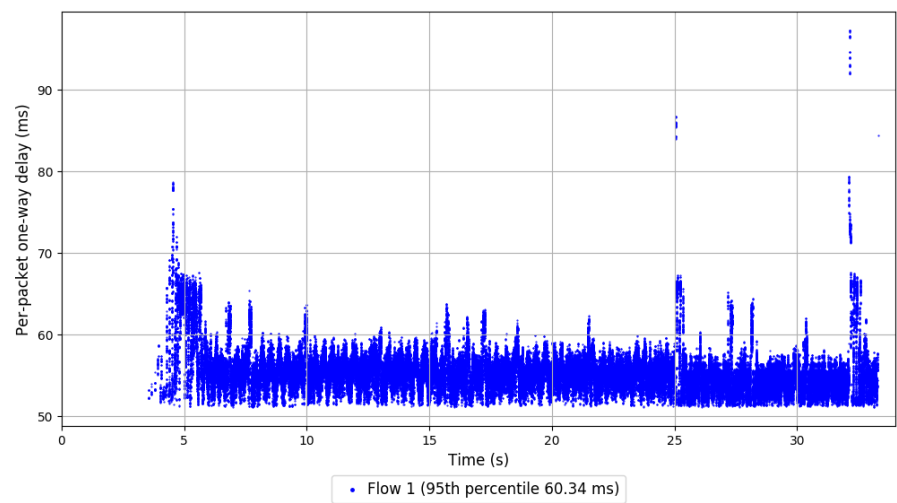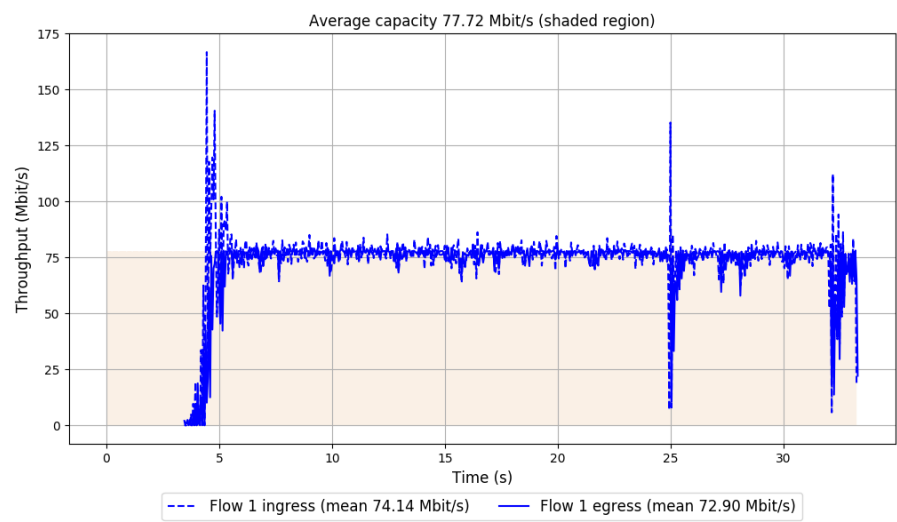
Run 3: Report of Indigo — Data Link

Average capacity 77.72 Mbit/s (shaded region)

--- Flow 1 ingress (mean 74.14 Mbit/s) —— Flow 1 egress (mean 72.90 Mbit/s)

• Flow 1 (95th percentile 60.34 ms)

```
Run 4: Statistics of Indigo

Start at: 2019-10-22 18:55:17
End at: 2019-10-22 18:55:47

# Below is generated by plot.py at 2019-10-22 19:02:53
# Datalink statistics
-- Total of 1 flow:
Average capacity: 77.72 Mbit/s
Average throughput: 75.56 Mbit/s (97.2% utilization)
95th percentile per-packet one-way delay: 66.112 ms
Loss rate: 17.81%
-- Flow 1:
Average throughput: 75.56 Mbit/s
95th percentile per-packet one-way delay: 66.112 ms
Loss rate: 17.81%
```
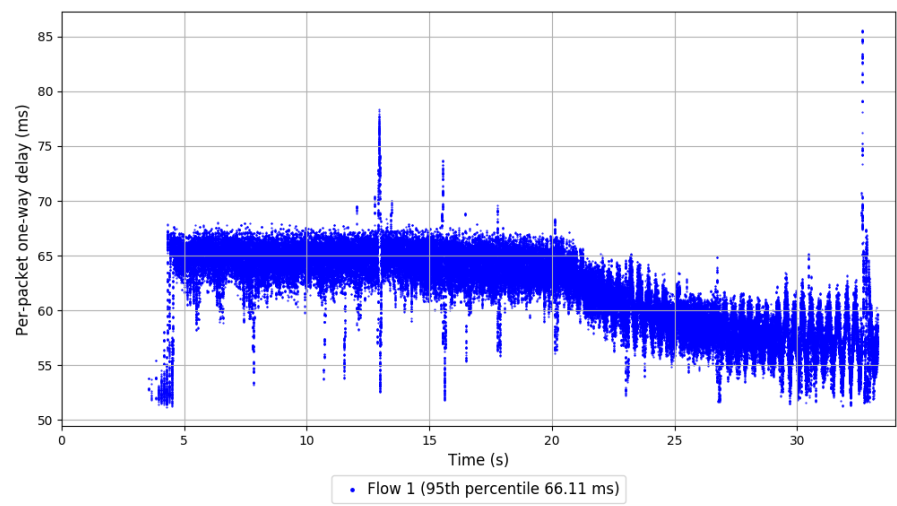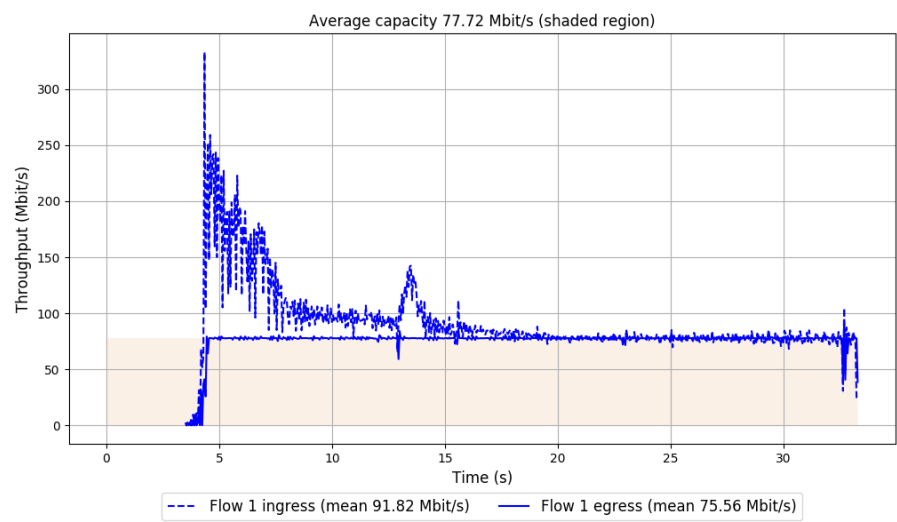
Run 4: Report of Indigo — Data Link

Average capacity 77.72 Mbit/s (shaded region)

Flow 1 ingress (mean 91.82 Mbit/s)   Flow 1 egress (mean 75.56 Mbit/s)

Flow 1 (95th percentile 66.11 ms)

```
Run 5: Statistics of Indigo

Start at: 2019-10-22 18:57:51
End at: 2019-10-22 18:58:21


# Below is generated by plot.py at 2019-10-22 19:02:59
# Datalink statistics
-- Total of 1 flow:
Average capacity: 77.72 Mbit/s
Average throughput: 74.85 Mbit/s (96.3% utilization)
95th percentile per-packet one-way delay: 65.955 ms
Loss rate: 13.85%
-- Flow 1:
Average throughput: 74.85 Mbit/s
95th percentile per-packet one-way delay: 65.955 ms
Loss rate: 13.85%
```
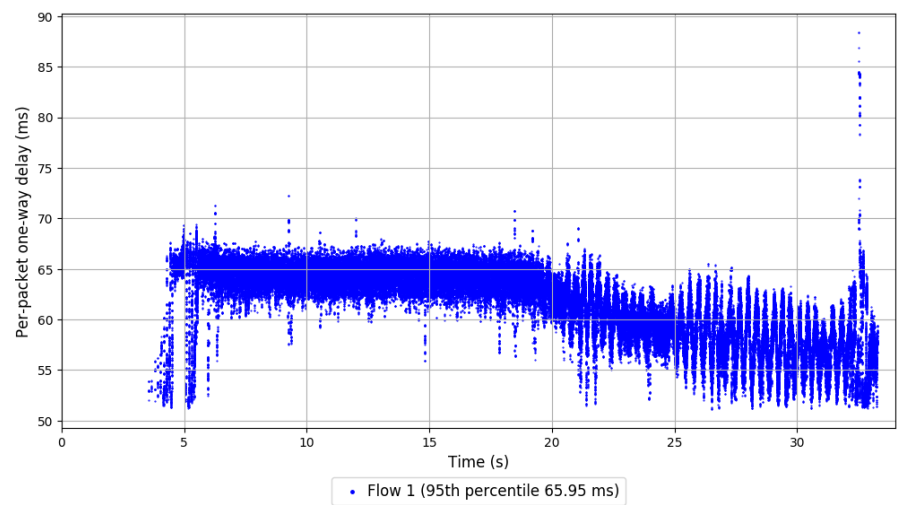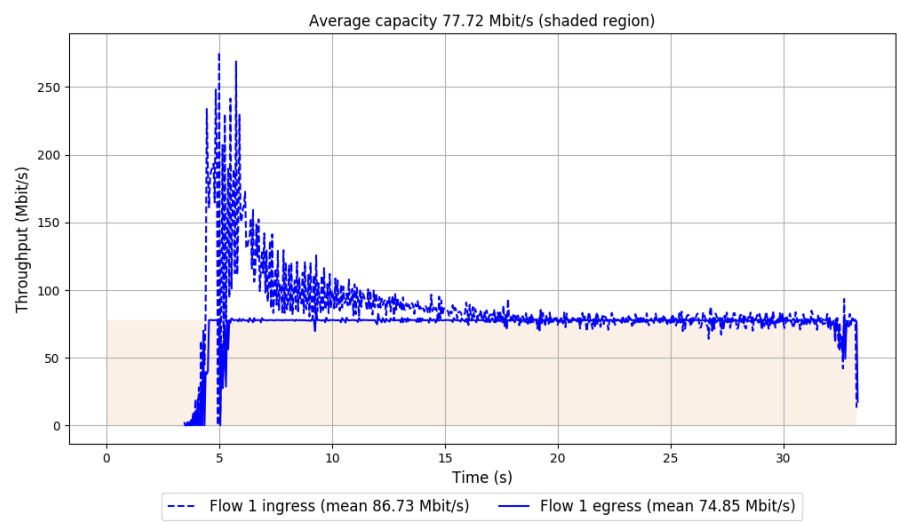
Run 5: Report of Indigo — Data Link

Average capacity 77.72 Mbit/s (shaded region)

Flow 1 ingress (mean 86.73 Mbit/s)   Flow 1 egress (mean 74.85 Mbit/s)
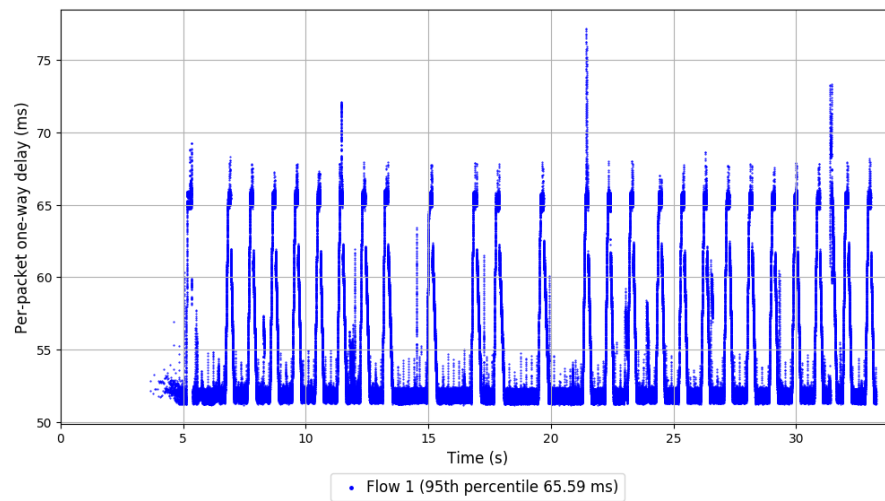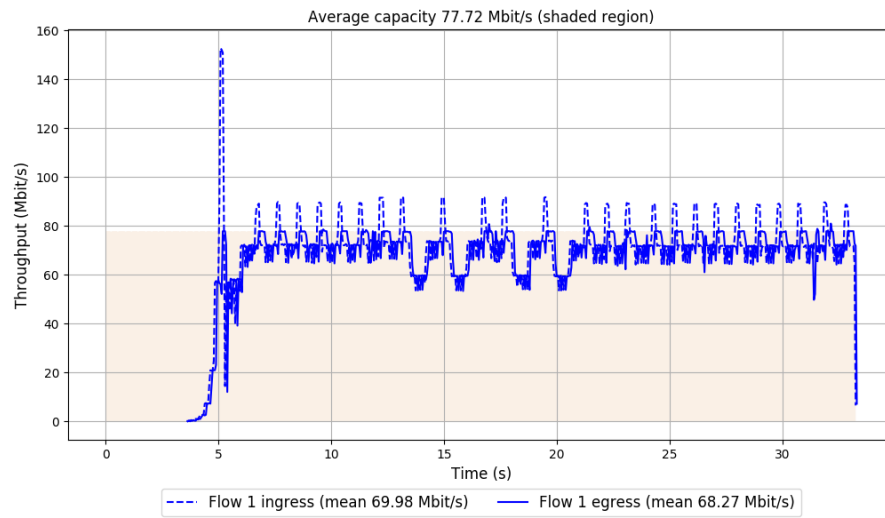

Flow 1 (95th percentile 65.95 ms)

```
Run 1: Statistics of Synthesized-BBR

Start at: 2019-10-22 18:46:25
End at: 2019-10-22 18:46:55

# Below is generated by plot.py at 2019-10-22 19:03:06
# Datalink statistics
-- Total of 1 flow:
Average capacity: 77.72 Mbit/s
Average throughput: 68.27 Mbit/s (87.8% utilization)
95th percentile per-packet one-way delay: 65.593 ms
Loss rate: 2.61%
-- Flow 1:
Average throughput: 68.27 Mbit/s
95th percentile per-packet one-way delay: 65.593 ms
Loss rate: 2.61%
```

Run 1: Report of Synthesized-BBR — Data Link

Average capacity 77.72 Mbit/s (shaded region)

- - - Flow 1 ingress (mean 69.98 Mbit/s) ——— Flow 1 egress (mean 68.27 Mbit/s)

• Flow 1 (95th percentile 65.59 ms)

```
Run 2: Statistics of Synthesized-BBR

Start at: 2019-10-22 18:48:59
End at: 2019-10-22 18:49:29


# Below is generated by plot.py at 2019-10-22 19:03:08
# Datalink statistics
-- Total of 1 flow:
Average capacity: 77.72 Mbit/s
Average throughput: 67.69 Mbit/s (87.1% utilization)
95th percentile per-packet one-way delay: 65.527 ms
Loss rate: 1.87%
-- Flow 1:
Average throughput: 67.69 Mbit/s
95th percentile per-packet one-way delay: 65.527 ms
Loss rate: 1.87%
```
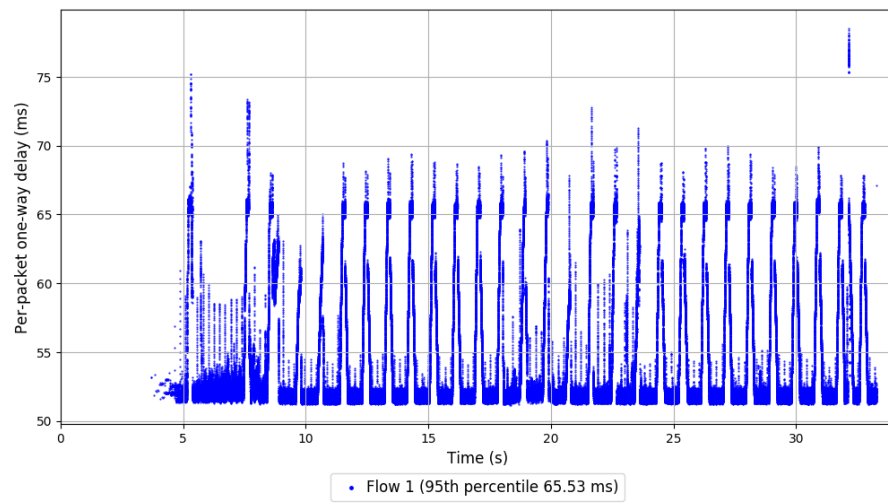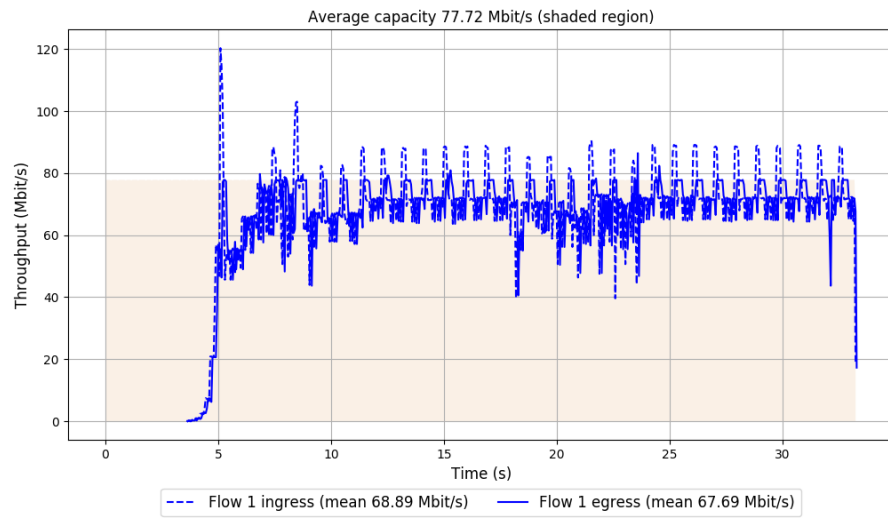
Run 2: Report of Synthesized-BBR — Data Link

Average capacity 77.72 Mbit/s (shaded region)

Flow 1 ingress (mean 68.89 Mbit/s) --- Flow 1 egress (mean 67.69 Mbit/s)

Flow 1 (95th percentile 65.53 ms)

```
Run 3: Statistics of Synthesized-BBR

Start at: 2019-10-22 18:51:32
End at: 2019-10-22 18:52:02

# Below is generated by plot.py at 2019-10-22 19:03:20
# Datalink statistics
-- Total of 1 flow:
Average capacity: 77.72 Mbit/s
Average throughput: 68.88 Mbit/s (88.6% utilization)
95th percentile per-packet one-way delay: 65.531 ms
Loss rate: 2.47%
-- Flow 1:
Average throughput: 68.88 Mbit/s
95th percentile per-packet one-way delay: 65.531 ms
Loss rate: 2.47%
```
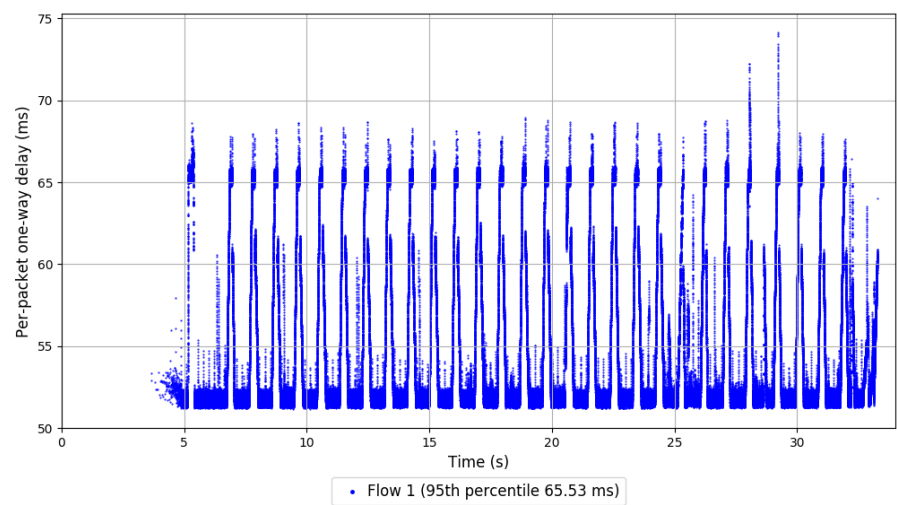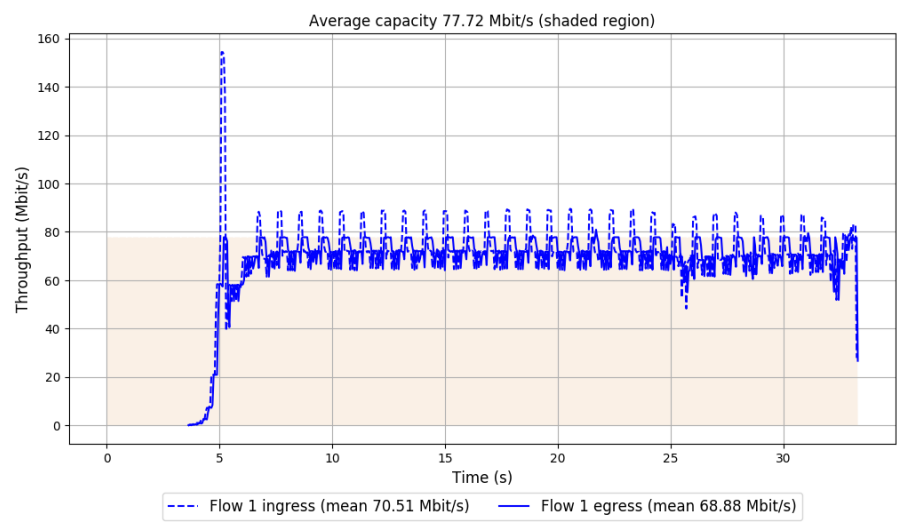
Run 3: Report of Synthesized-BBR — Data Link

Average capacity 77.72 Mbit/s (shaded region)

- - - Flow 1 ingress (mean 70.51 Mbit/s)   —— Flow 1 egress (mean 68.88 Mbit/s)

• Flow 1 (95th percentile 65.53 ms)

```
Run 4: Statistics of Synthesized-BBR

Start at: 2019-10-22 18:54:03
End at: 2019-10-22 18:54:33


# Below is generated by plot.py at 2019-10-22 19:03:20
# Datalink statistics
-- Total of 1 flow:
Average capacity: 77.72 Mbit/s
Average throughput: 9.71 Mbit/s (12.5% utilization)
95th percentile per-packet one-way delay: 54.467 ms
Loss rate: 1.52%
-- Flow 1:
Average throughput: 9.71 Mbit/s
95th percentile per-packet one-way delay: 54.467 ms
Loss rate: 1.52%
```
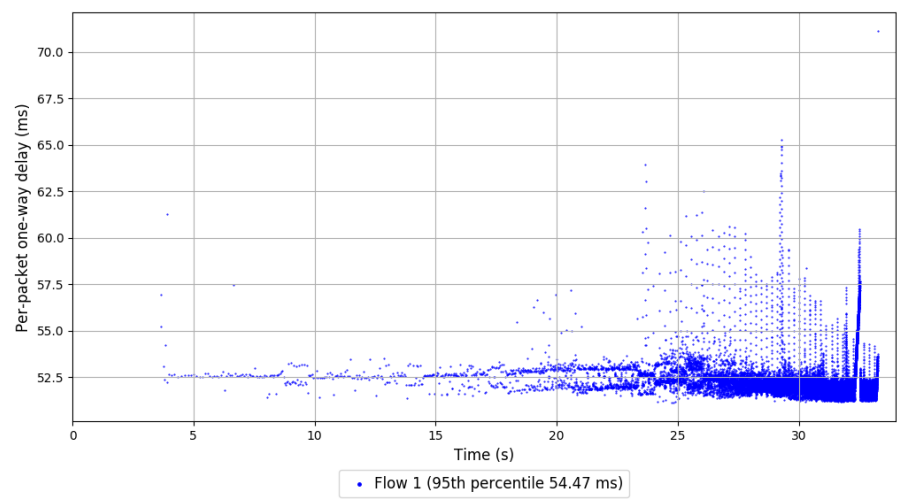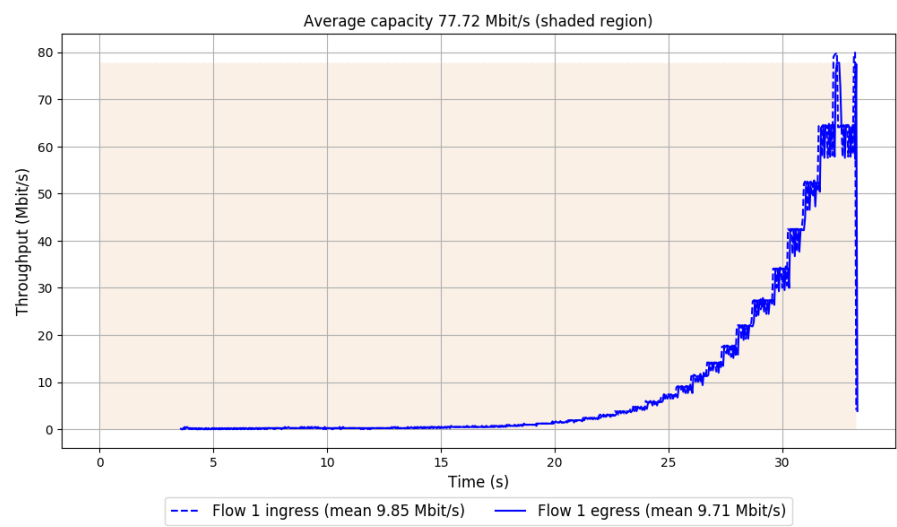
Run 4: Report of Synthesized-BBR — Data Link

Average capacity 77.72 Mbit/s (shaded region)

Flow 1 ingress (mean 9.85 Mbit/s) — — — Flow 1 egress (mean 9.71 Mbit/s)

Flow 1 (95th percentile 54.47 ms)

```
Run 5: Statistics of Synthesized-BBR

Start at: 2019-10-22 18:56:34
End at: 2019-10-22 18:57:04


# Below is generated by plot.py at 2019-10-22 19:03:23
# Datalink statistics
-- Total of 1 flow:
Average capacity: 77.72 Mbit/s
Average throughput: 68.61 Mbit/s (88.3% utilization)
95th percentile per-packet one-way delay: 65.614 ms
Loss rate: 2.85%
-- Flow 1:
Average throughput: 68.61 Mbit/s
95th percentile per-packet one-way delay: 65.614 ms
Loss rate: 2.85%
```

Run 5: Report of Synthesized-BBR — Data Link