Pantheon Report

Generated at 2019-10-21 19:03:24 (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 4 congestion control schemes 5 times.

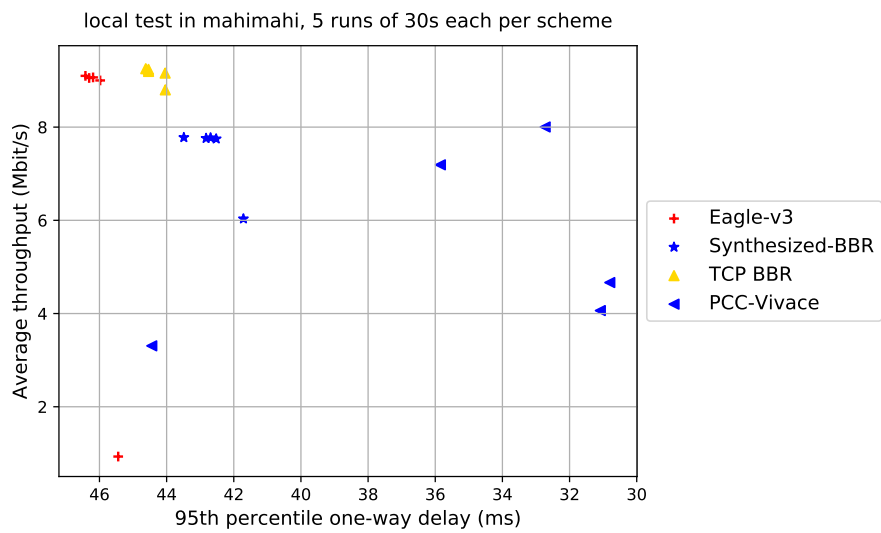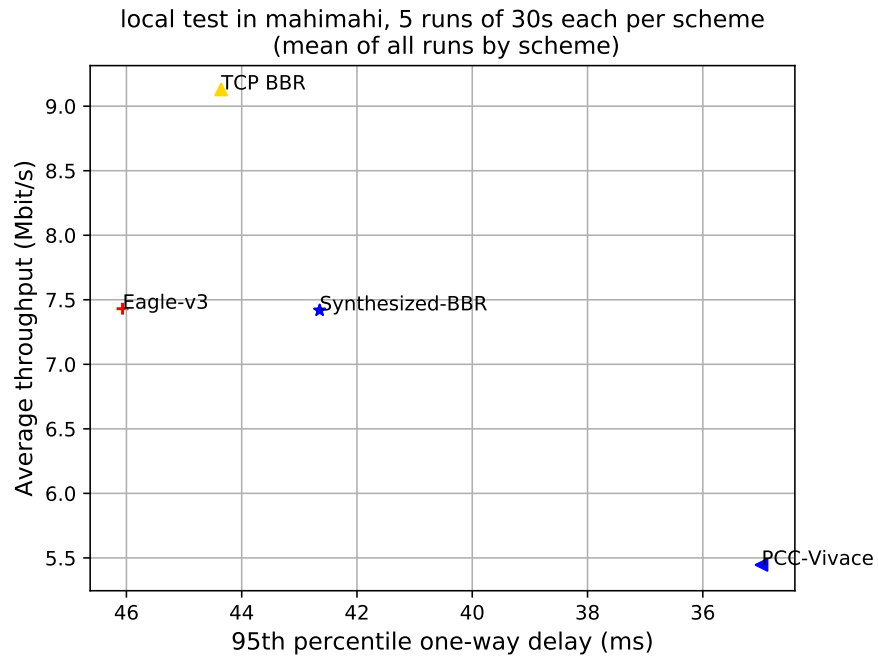Each test lasted for 30 seconds running 1 flow.

```
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 @ 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)

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

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scheme	# runs	mean avg tput (Mbit/s) flow 1	mean 95th-%ile delay (ms) flow 1	mean loss rate (%) flow 1
TCP BBR	5	9.13	44.36	6.84
Eagle-v3	5	7.43	46.07	11.58
Synthesized-BBR	5	7.42	42.65	5.36
PCC-Vivace	5	5.45	34.98	5.11

```
Run 1: Statistics of TCP BBR

Start at: 2019-10-21 18:45:47
End at: 2019-10-21 18:46:17

# Below is generated by plot.py at 2019-10-21 19:02:53
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 9.25 Mbit/s (92.5% utilization)
95th percentile per-packet one-way delay: 44.621 ms
Loss rate: 6.88%
-- Flow 1:
Average throughput: 9.25 Mbit/s
95th percentile per-packet one-way delay: 44.621 ms
Loss rate: 6.88%
```
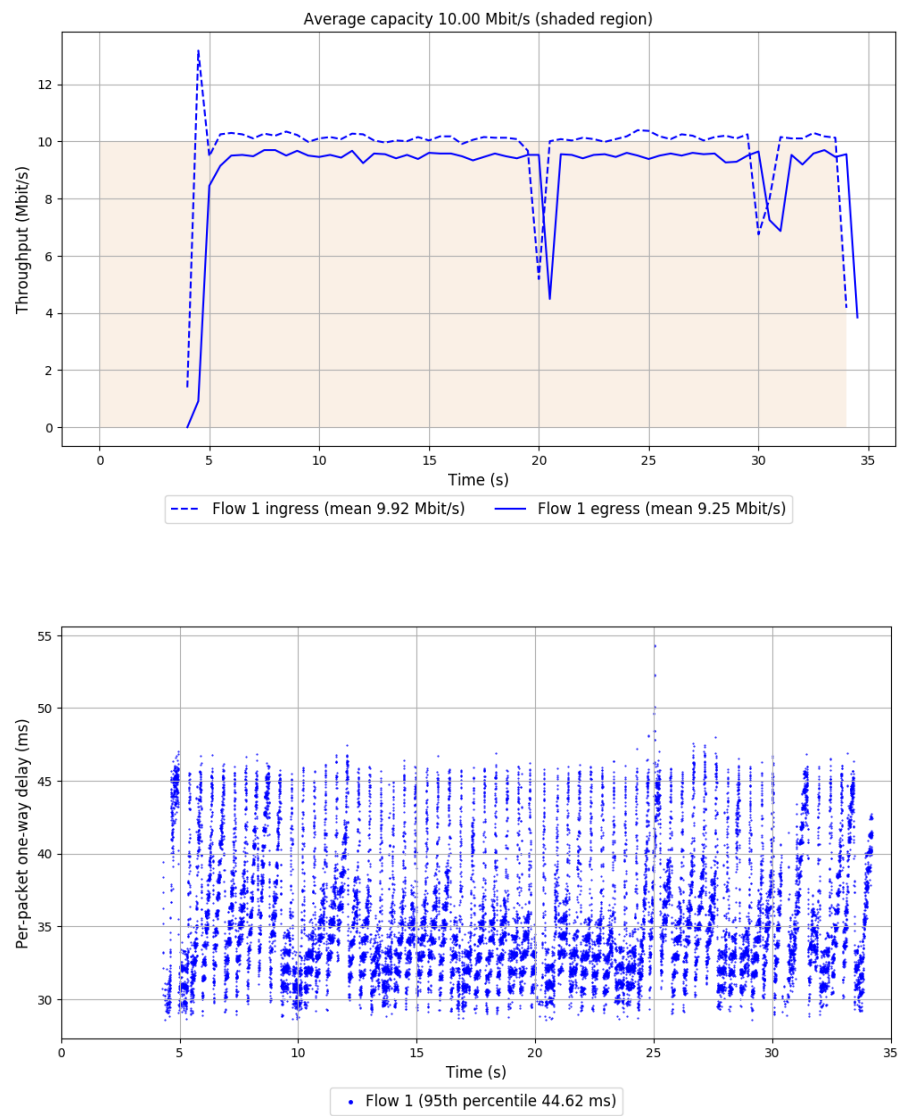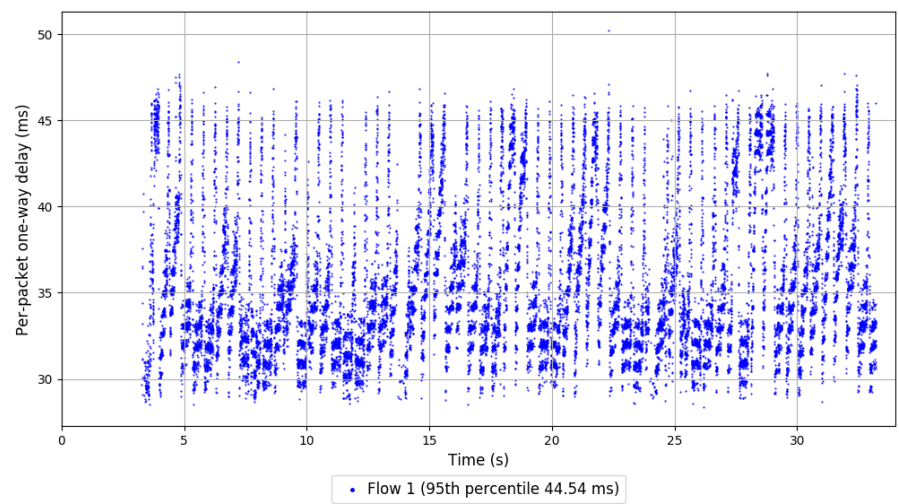
Run 1: Report of TCP BBR — Data Link

Average capacity 10.00 Mbit/s (shaded region)

Flow 1 ingress (mean 9.92 Mbit/s) --- Flow 1 egress (mean 9.25 Mbit/s)

• Flow 1 (95th percentile 44.62 ms)

```
Run 2: Statistics of TCP BBR

Start at: 2019-10-21 18:48:05
End at: 2019-10-21 18:48:35


# Below is generated by plot.py at 2019-10-21 19:02:53
# 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: 44.540 ms
Loss rate: 6.91%
-- Flow 1:
Average throughput: 9.24 Mbit/s
95th percentile per-packet one-way delay: 44.540 ms
Loss rate: 6.91%
```
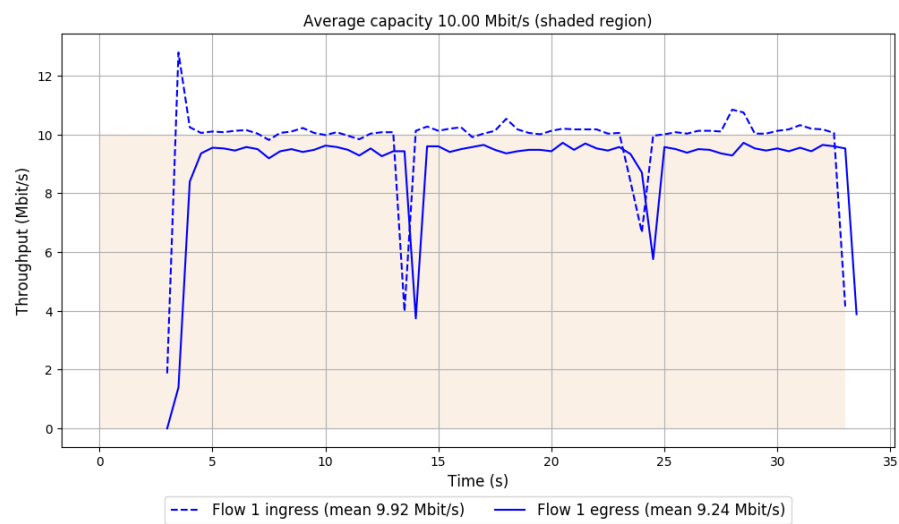
Run 2: Report of TCP BBR — Data Link

Average capacity 10.00 Mbit/s (shaded region)

- - - Flow 1 ingress (mean 9.92 Mbit/s) ——— Flow 1 egress (mean 9.24 Mbit/s)

• Flow 1 (95th percentile 44.54 ms)

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```
Run 3: Statistics of TCP BBR

Start at: 2019-10-21 18:50:23
End at: 2019-10-21 18:50:53

# Below is generated by plot.py at 2019-10-21 19:02:53
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 9.16 Mbit/s (91.6% utilization)
95th percentile per-packet one-way delay: 44.044 ms
Loss rate: 6.96%
-- Flow 1:
Average throughput: 9.16 Mbit/s
95th percentile per-packet one-way delay: 44.044 ms
Loss rate: 6.96%
```
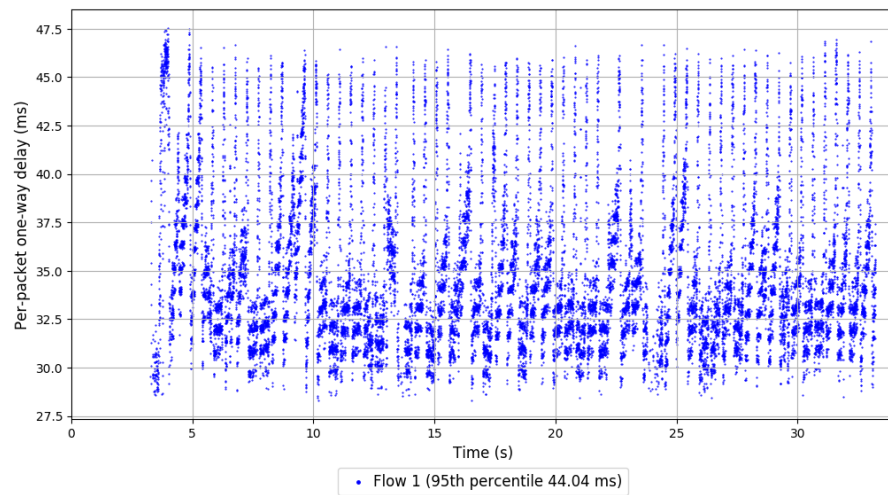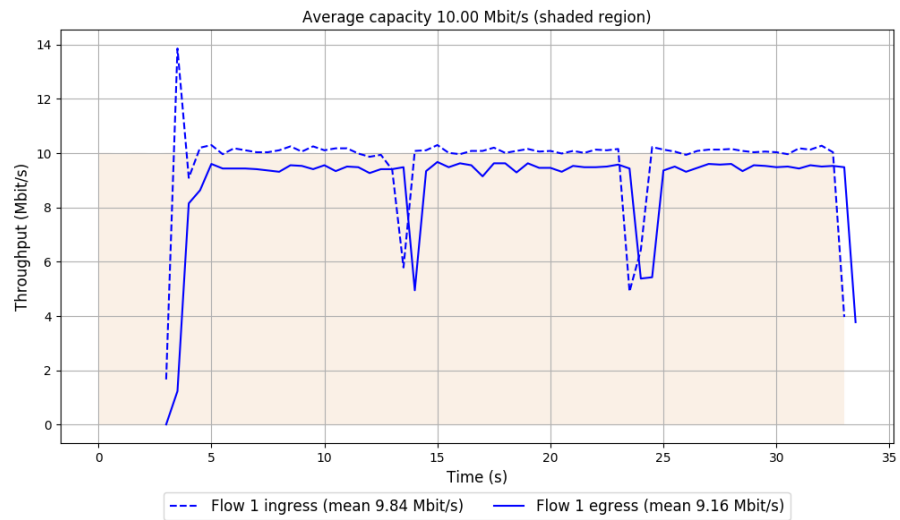
Run 3: Report of TCP BBR — Data Link

Average capacity 10.00 Mbit/s (shaded region)

Flow 1 ingress (mean 9.84 Mbit/s) ----   Flow 1 egress (mean 9.16 Mbit/s) ——

• Flow 1 (95th percentile 44.04 ms)

```
Run 4: Statistics of TCP BBR

Start at: 2019-10-21 18:52:42
End at: 2019-10-21 18:53:12


# Below is generated by plot.py at 2019-10-21 19:02:53
# 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: 44.538 ms
Loss rate: 7.01%
-- Flow 1:
Average throughput: 9.20 Mbit/s
95th percentile per-packet one-way delay: 44.538 ms
Loss rate: 7.01%
```
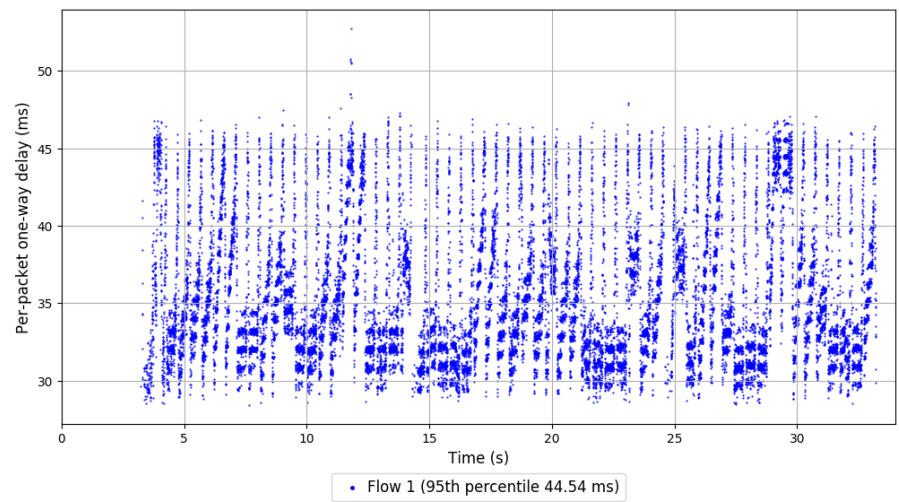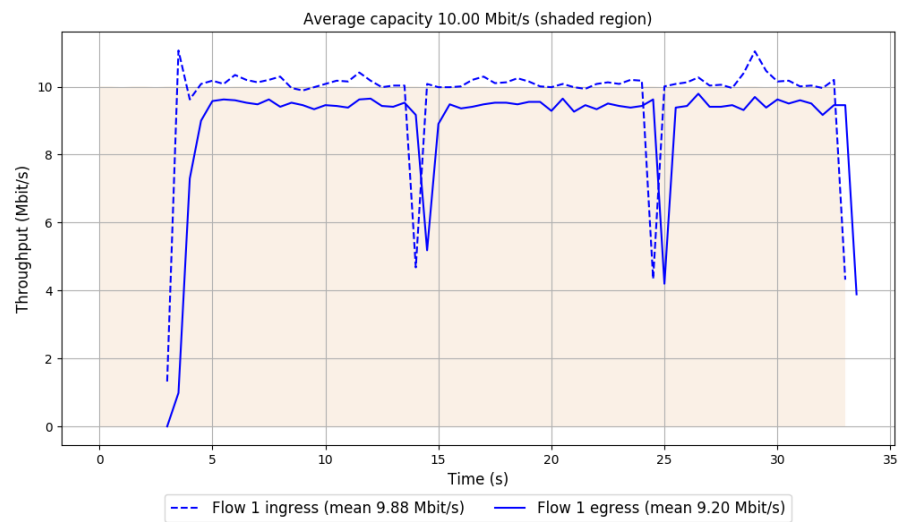
Run 4: Report of TCP BBR — Data Link

Average capacity 10.00 Mbit/s (shaded region)

Flow 1 ingress (mean 9.88 Mbit/s) —— Flow 1 egress (mean 9.20 Mbit/s)

• Flow 1 (95th percentile 44.54 ms)

```
Run 5: Statistics of TCP BBR

Start at: 2019-10-21 18:55:00
End at: 2019-10-21 18:55:30

# Below is generated by plot.py at 2019-10-21 19:03:00
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 8.80 Mbit/s (88.0% utilization)
95th percentile per-packet one-way delay: 44.039 ms
Loss rate: 6.42%
-- Flow 1:
Average throughput: 8.80 Mbit/s
95th percentile per-packet one-way delay: 44.039 ms
Loss rate: 6.42%
```
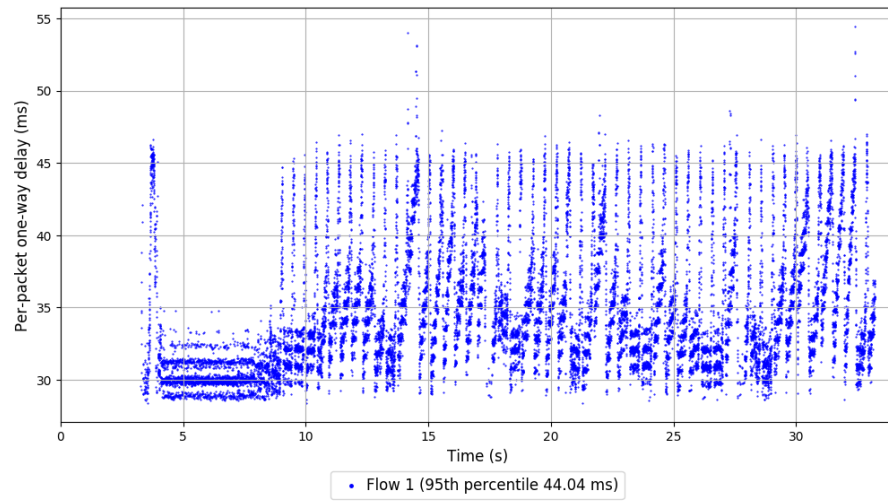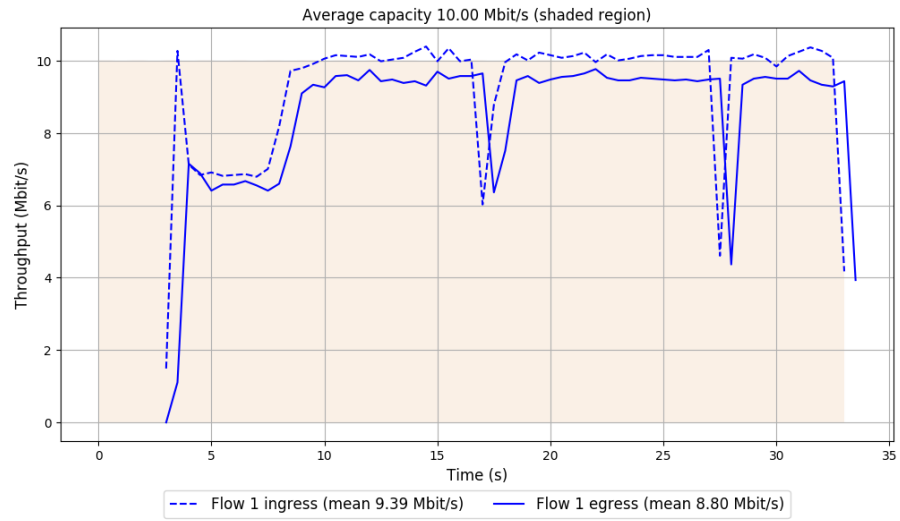
Run 5: Report of TCP BBR — Data Link

Average capacity 10.00 Mbit/s (shaded region)

- - - Flow 1 ingress (mean 9.39 Mbit/s)   ——— Flow 1 egress (mean 8.80 Mbit/s)
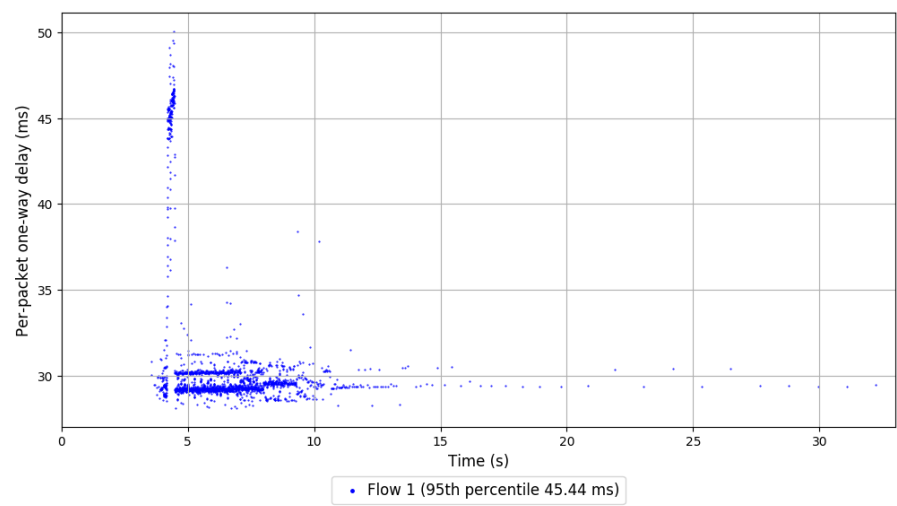

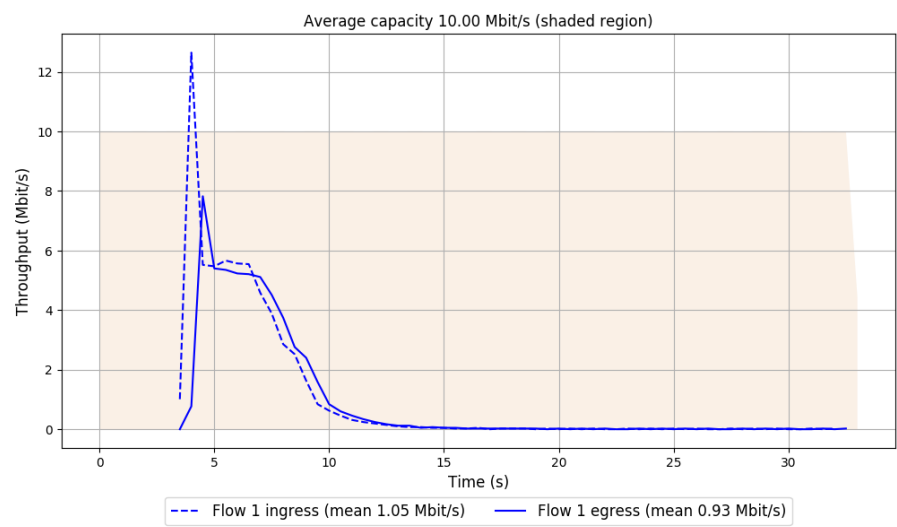
• Flow 1 (95th percentile 44.04 ms)

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```
Run 1: Statistics of Eagle-v3

Start at: 2019-10-21 18:45:11
End at: 2019-10-21 18:45:41

# Below is generated by plot.py at 2019-10-21 19:03:00
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 0.93 Mbit/s (9.3% utilization)
95th percentile per-packet one-way delay: 45.442 ms
Loss rate: 11.66%
-- Flow 1:
Average throughput: 0.93 Mbit/s
95th percentile per-packet one-way delay: 45.442 ms
Loss rate: 11.66%
```

Run 1: Report of Eagle-v3 — Data Link

Average capacity 10.00 Mbit/s (shaded region)

Flow 1 ingress (mean 1.05 Mbit/s) Flow 1 egress (mean 0.93 Mbit/s)

Flow 1 (95th percentile 45.44 ms)

```
Run 2: Statistics of Eagle-v3

Start at: 2019-10-21 18:47:30
End at: 2019-10-21 18:48:00

# Below is generated by plot.py at 2019-10-21 19:03:01
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 9.07 Mbit/s (90.7% utilization)
95th percentile per-packet one-way delay: 46.190 ms
Loss rate: 11.97%
-- Flow 1:
Average throughput: 9.07 Mbit/s
95th percentile per-packet one-way delay: 46.190 ms
Loss rate: 11.97%
```
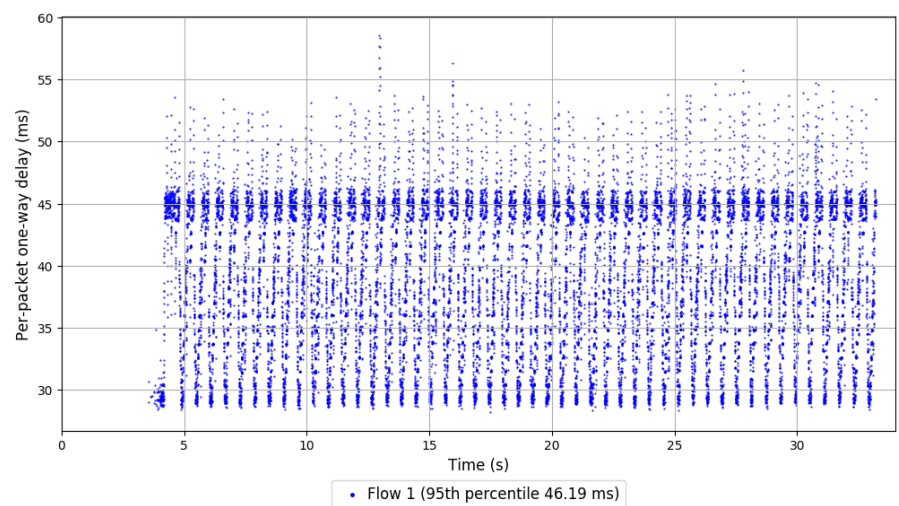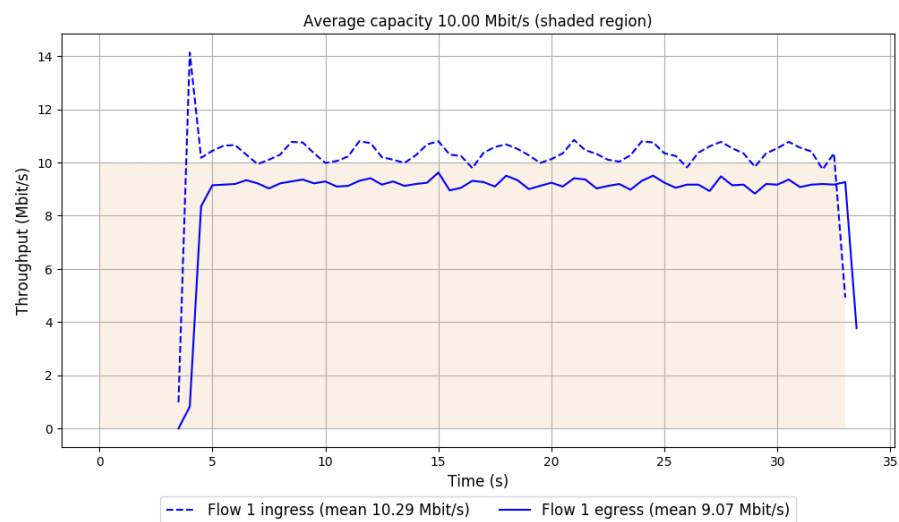
Run 2: Report of Eagle-v3 — Data Link

Average capacity 10.00 Mbit/s (shaded region)

Flow 1 ingress (mean 10.29 Mbit/s)   Flow 1 egress (mean 9.07 Mbit/s)

Flow 1 (95th percentile 46.19 ms)

```
Run 3: Statistics of Eagle-v3

Start at: 2019-10-21 18:49:49
End at: 2019-10-21 18:50:19

# Below is generated by plot.py at 2019-10-21 19:03:01
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 9.05 Mbit/s (90.5% utilization)
95th percentile per-packet one-way delay: 46.307 ms
Loss rate: 11.99%
-- Flow 1:
Average throughput: 9.05 Mbit/s
95th percentile per-packet one-way delay: 46.307 ms
Loss rate: 11.99%
```
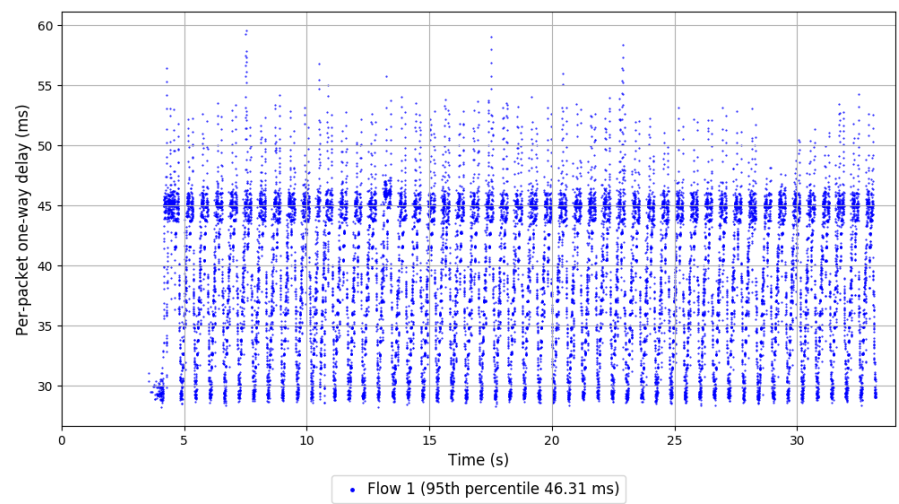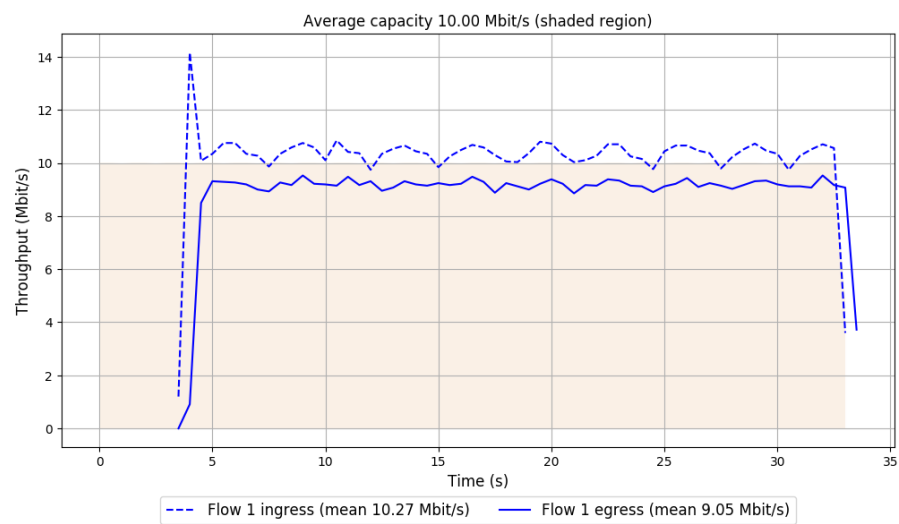
Run 3: Report of Eagle-v3 — Data Link

Average capacity 10.00 Mbit/s (shaded region)

Flow 1 ingress (mean 10.27 Mbit/s) Flow 1 egress (mean 9.05 Mbit/s)

Flow 1 (95th percentile 46.31 ms)

```
Run 4: Statistics of Eagle-v3

Start at: 2019-10-21 18:52:07
End at: 2019-10-21 18:52:37

# Below is generated by plot.py at 2019-10-21 19:03:05
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 9.10 Mbit/s (91.0% utilization)
95th percentile per-packet one-way delay: 46.418 ms
Loss rate: 11.82%
-- Flow 1:
Average throughput: 9.10 Mbit/s
95th percentile per-packet one-way delay: 46.418 ms
Loss rate: 11.82%
```
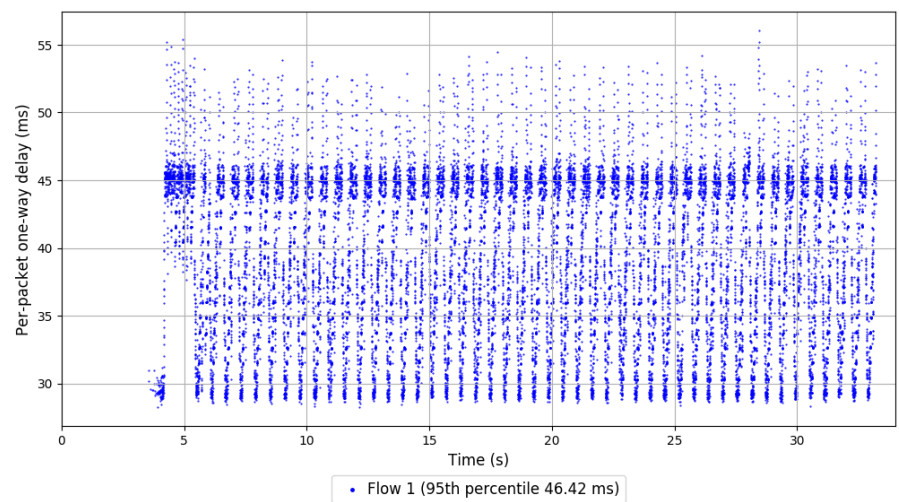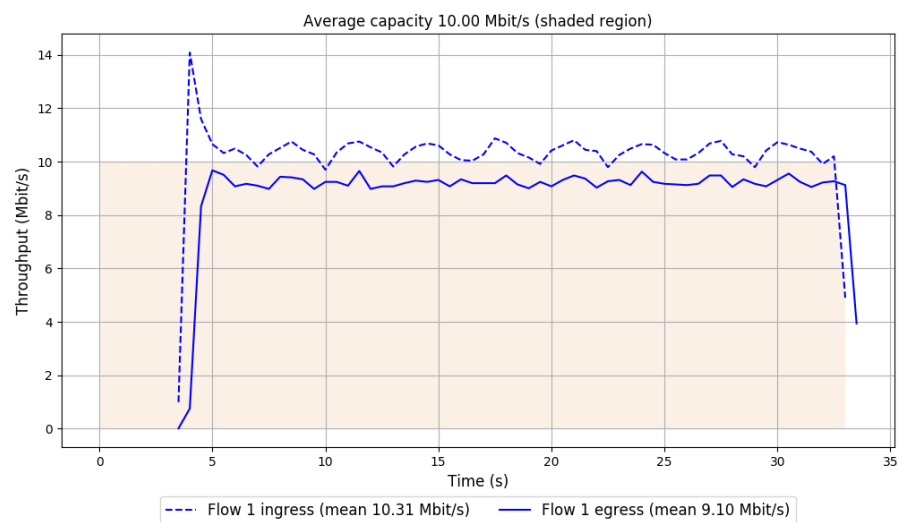
Run 4: Report of Eagle-v3 — Data Link

Average capacity 10.00 Mbit/s (shaded region)

- - - - Flow 1 ingress (mean 10.31 Mbit/s) ——— Flow 1 egress (mean 9.10 Mbit/s)

• Flow 1 (95th percentile 46.42 ms)

```
Run 5: Statistics of Eagle-v3

Start at: 2019-10-21 18:54:25
End at: 2019-10-21 18:54:55


# Below is generated by plot.py at 2019-10-21 19:03:08
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 9.00 Mbit/s (90.0% utilization)
95th percentile per-packet one-way delay: 45.979 ms
Loss rate: 10.45%
-- Flow 1:
Average throughput: 9.00 Mbit/s
95th percentile per-packet one-way delay: 45.979 ms
Loss rate: 10.45%
```
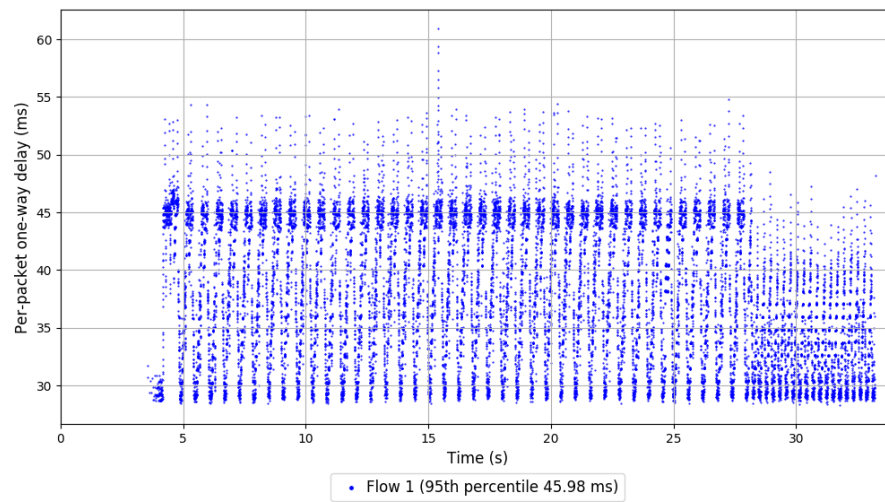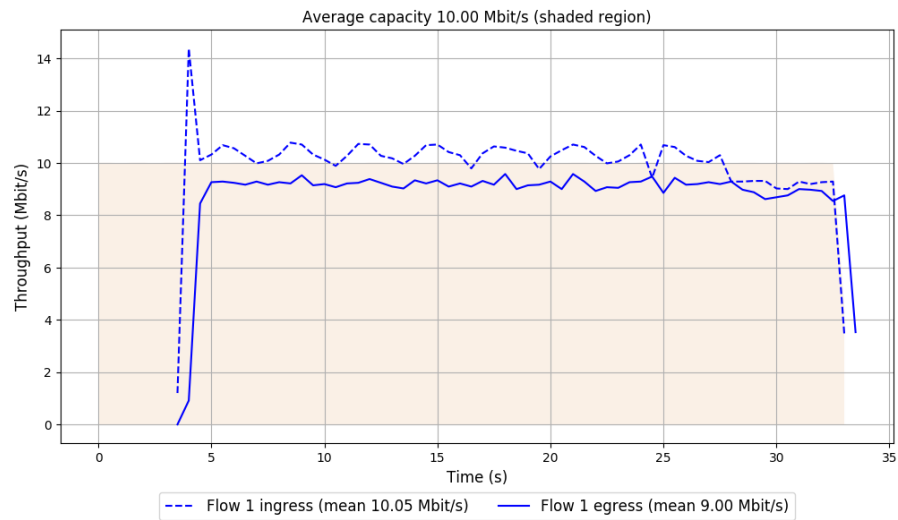
Run 5: Report of Eagle-v3 — Data Link

Average capacity 10.00 Mbit/s (shaded region)

- - - Flow 1 ingress (mean 10.05 Mbit/s) ——— Flow 1 egress (mean 9.00 Mbit/s)

• Flow 1 (95th percentile 45.98 ms)

```
Run 1: Statistics of Synthesized-BBR

Start at: 2019-10-21 18:46:21
End at: 2019-10-21 18:46:51

# Below is generated by plot.py at 2019-10-21 19:03:09
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 7.75 Mbit/s (77.5% utilization)
95th percentile per-packet one-way delay: 42.524 ms
Loss rate: 5.38%
-- Flow 1:
Average throughput: 7.75 Mbit/s
95th percentile per-packet one-way delay: 42.524 ms
Loss rate: 5.38%
```
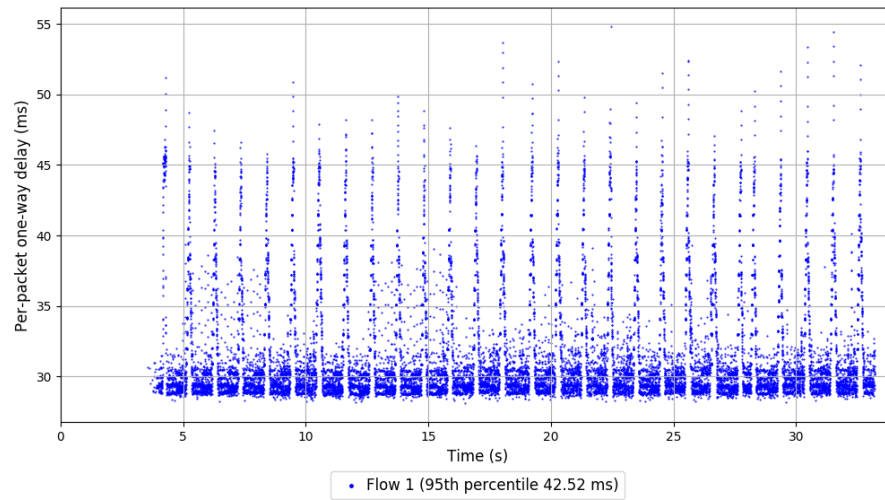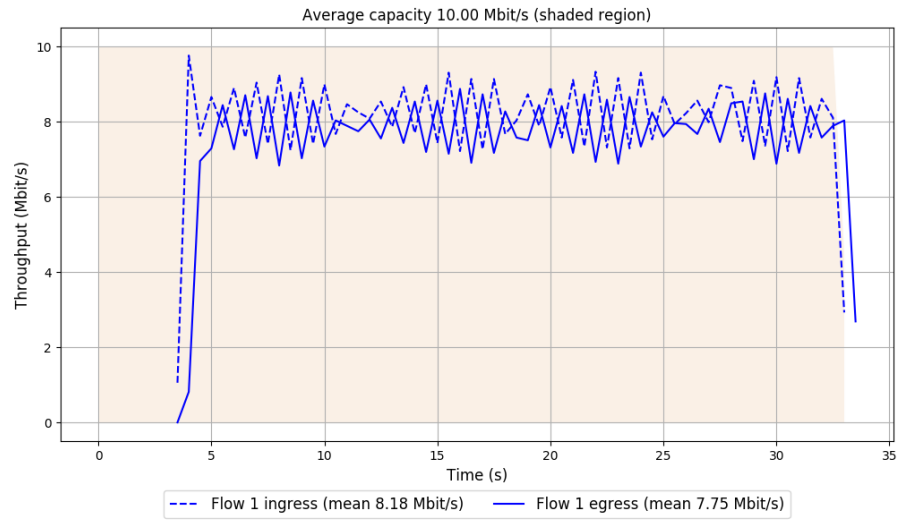
Run 1: Report of Synthesized-BBR — Data Link

Average capacity 10.00 Mbit/s (shaded region)

Flow 1 ingress (mean 8.18 Mbit/s)   Flow 1 egress (mean 7.75 Mbit/s)

Flow 1 (95th percentile 42.52 ms)

```
Run 2: Statistics of Synthesized-BBR

Start at: 2019-10-21 18:48:40
End at: 2019-10-21 18:49:10

# Below is generated by plot.py at 2019-10-21 19:03:10
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 7.77 Mbit/s (77.7% utilization)
95th percentile per-packet one-way delay: 42.692 ms
Loss rate: 5.39%
-- Flow 1:
Average throughput: 7.77 Mbit/s
95th percentile per-packet one-way delay: 42.692 ms
Loss rate: 5.39%
```
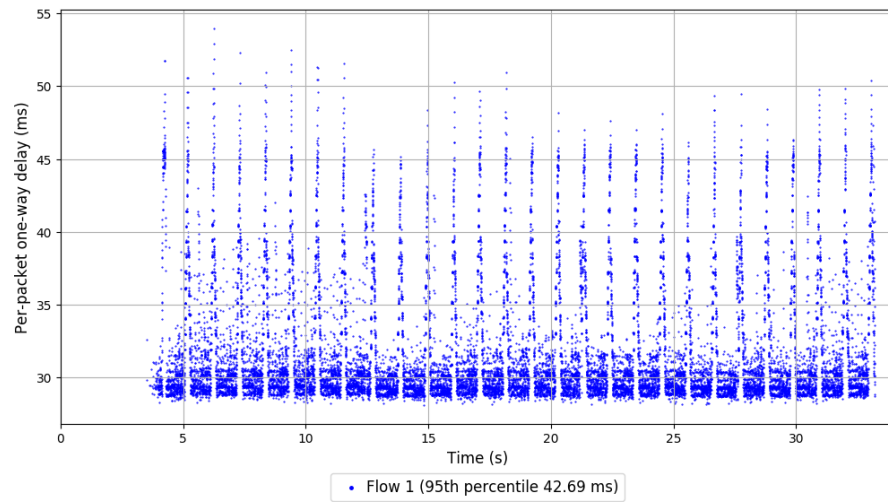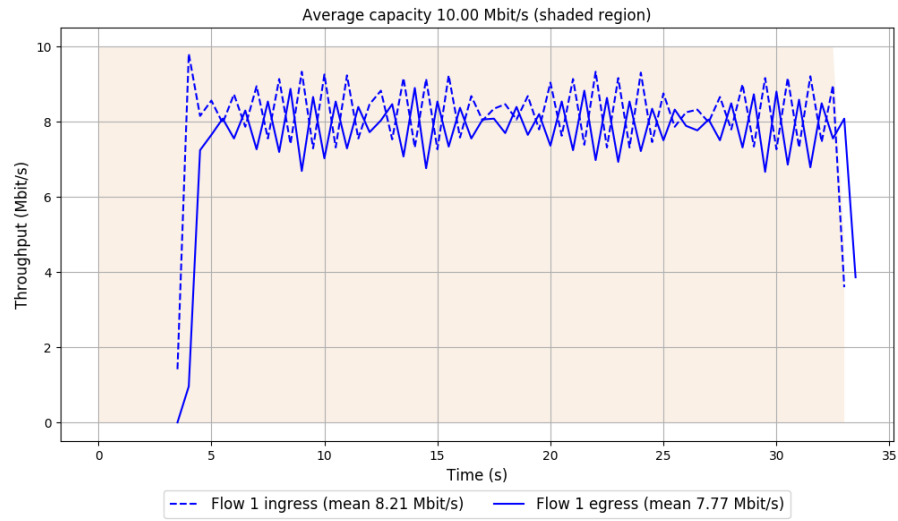
Run 2: Report of Synthesized-BBR — Data Link

Average capacity 10.00 Mbit/s (shaded region)

--- Flow 1 ingress (mean 8.21 Mbit/s) — Flow 1 egress (mean 7.77 Mbit/s)

• Flow 1 (95th percentile 42.69 ms)

```
Run 3: Statistics of Synthesized-BBR

Start at: 2019-10-21 18:50:58
End at: 2019-10-21 18:51:28

# Below is generated by plot.py at 2019-10-21 19:03:13
# 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: 42.824 ms
Loss rate: 5.15%
-- Flow 1:
Average throughput: 7.76 Mbit/s
95th percentile per-packet one-way delay: 42.824 ms
Loss rate: 5.15%
```
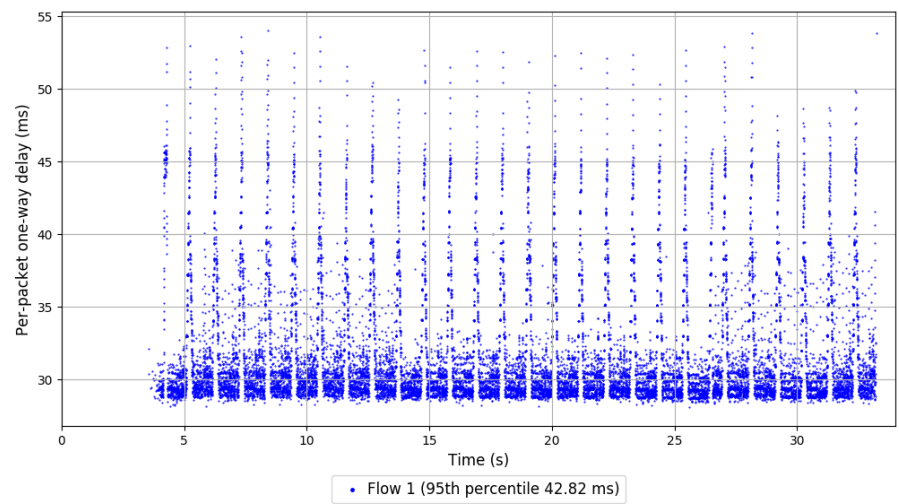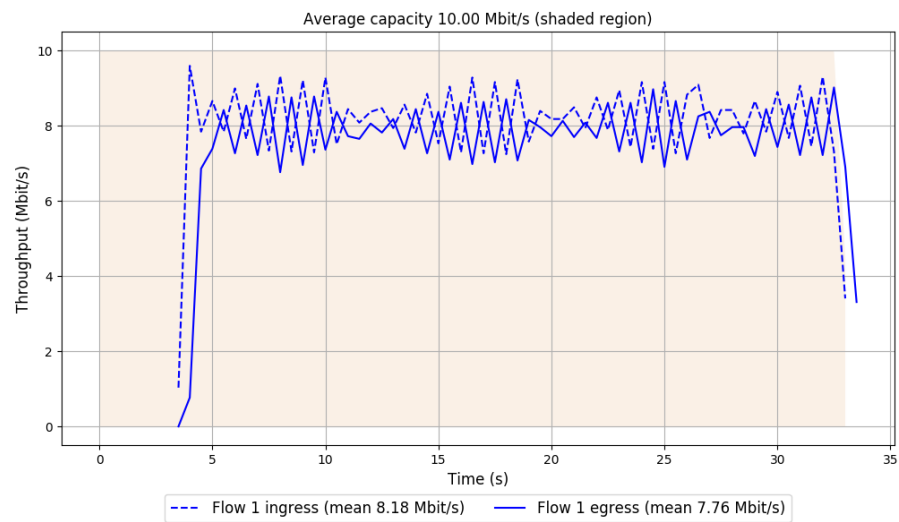
Run 3: Report of Synthesized-BBR — Data Link

Average capacity 10.00 Mbit/s (shaded region)

--- Flow 1 ingress (mean 8.18 Mbit/s)   — Flow 1 egress (mean 7.76 Mbit/s)

• Flow 1 (95th percentile 42.82 ms)

```
Run 4: Statistics of Synthesized-BBR

Start at: 2019-10-21 18:53:17
End at: 2019-10-21 18:53:47

# Below is generated by plot.py at 2019-10-21 19:03:15
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 6.03 Mbit/s (60.3% utilization)
95th percentile per-packet one-way delay: 41.713 ms
Loss rate: 5.33%
-- Flow 1:
Average throughput: 6.03 Mbit/s
95th percentile per-packet one-way delay: 41.713 ms
Loss rate: 5.33%
```
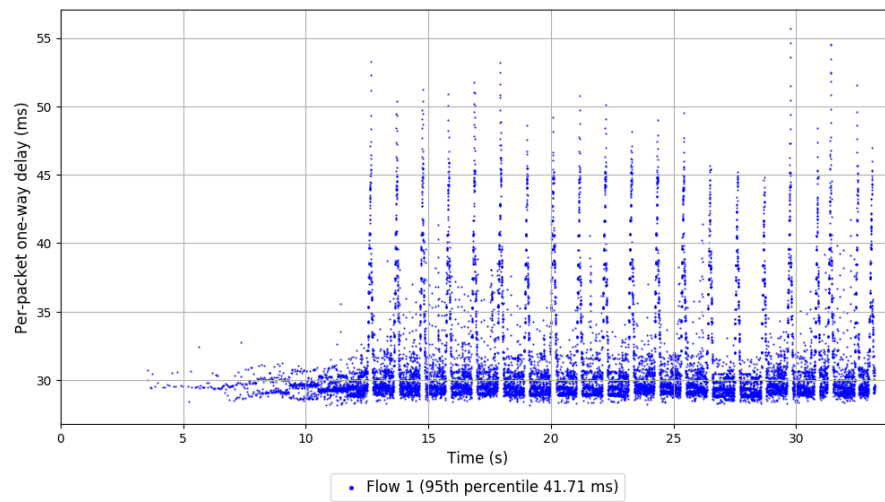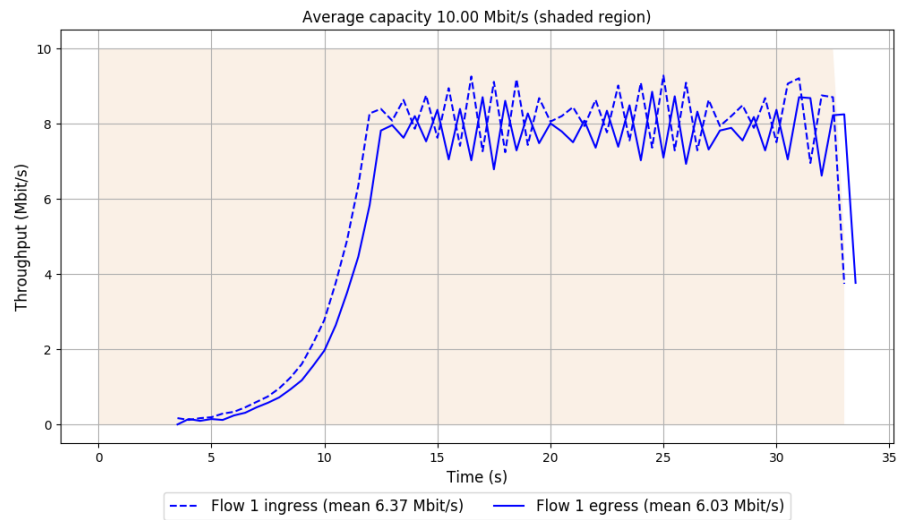
Run 4: Report of Synthesized-BBR — Data Link

Average capacity 10.00 Mbit/s (shaded region)

Flow 1 ingress (mean 6.37 Mbit/s) —— Flow 1 egress (mean 6.03 Mbit/s)

• Flow 1 (95th percentile 41.71 ms)

```
Run 5: Statistics of Synthesized-BBR

Start at: 2019-10-21 18:55:35
End at: 2019-10-21 18:56:05

# Below is generated by plot.py at 2019-10-21 19:03:16
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 7.78 Mbit/s (77.8% utilization)
95th percentile per-packet one-way delay: 43.487 ms
Loss rate: 5.55%
-- Flow 1:
Average throughput: 7.78 Mbit/s
95th percentile per-packet one-way delay: 43.487 ms
Loss rate: 5.55%
```
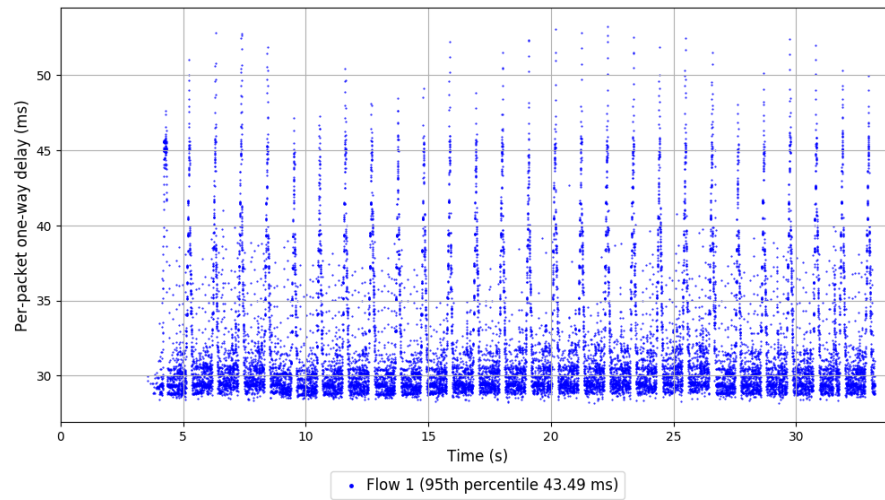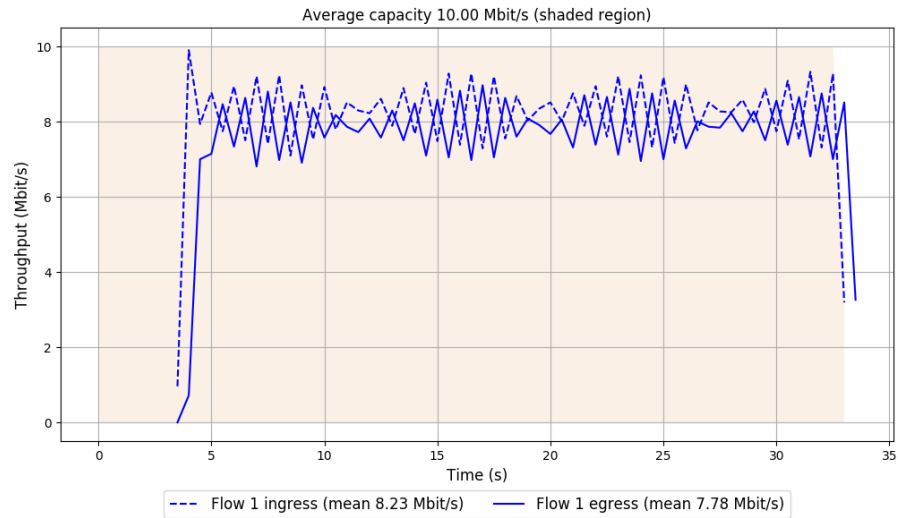
Run 5: Report of Synthesized-BBR — Data Link

Average capacity 10.00 Mbit/s (shaded region)

Flow 1 ingress (mean 8.23 Mbit/s) ----   Flow 1 egress (mean 7.78 Mbit/s) ——

• Flow 1 (95th percentile 43.49 ms)

```
Run 1: Statistics of PCC-Vivace

Start at: 2019-10-21 18:46:56
End at: 2019-10-21 18:47:26

# Below is generated by plot.py at 2019-10-21 19:03:19
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 7.19 Mbit/s (71.9% utilization)
95th percentile per-packet one-way delay: 35.848 ms
Loss rate: 4.90%
-- Flow 1:
Average throughput: 7.19 Mbit/s
95th percentile per-packet one-way delay: 35.848 ms
Loss rate: 4.90%
```
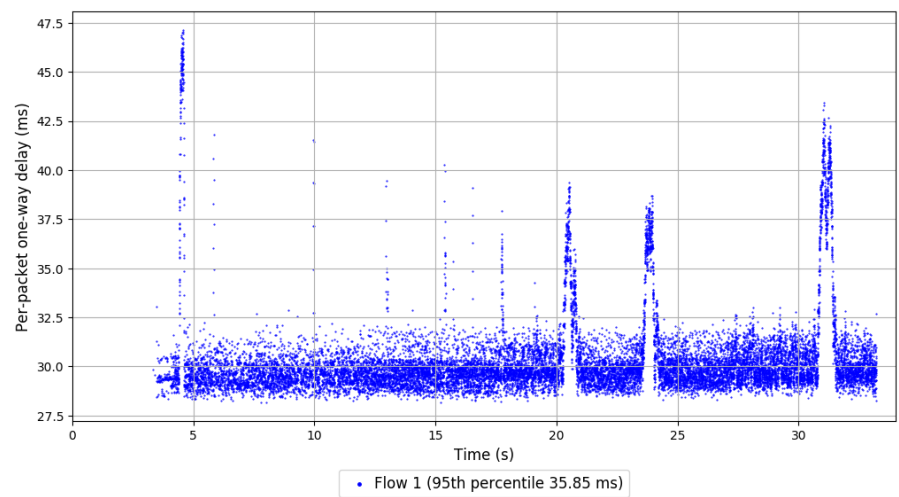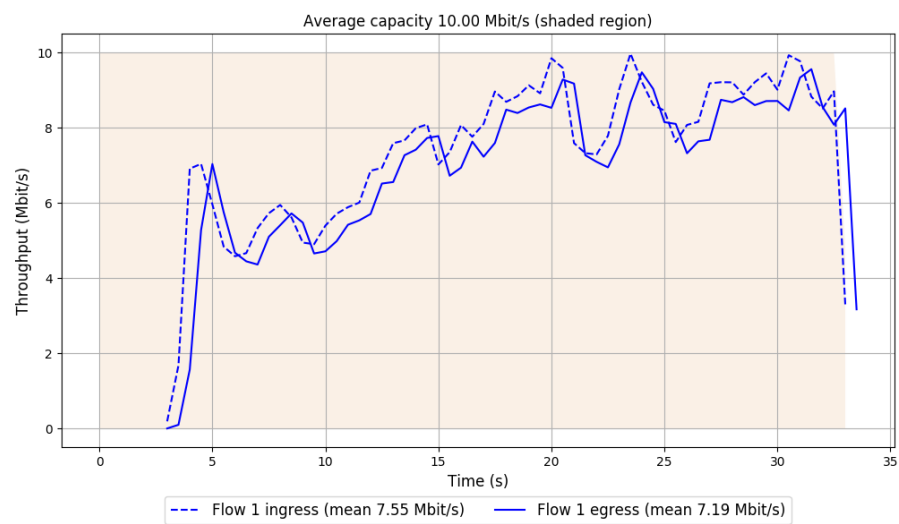
Run 1: Report of PCC-Vivace — Data Link

Average capacity 10.00 Mbit/s (shaded region)

--- Flow 1 ingress (mean 7.55 Mbit/s) —— Flow 1 egress (mean 7.19 Mbit/s)

• Flow 1 (95th percentile 35.85 ms)

```
Run 2: Statistics of PCC-Vivace

Start at: 2019-10-21 18:49:14
End at: 2019-10-21 18:49:44


# Below is generated by plot.py at 2019-10-21 19:03:19
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 4.06 Mbit/s (40.6% utilization)
95th percentile per-packet one-way delay: 31.085 ms
Loss rate: 4.49%
-- Flow 1:
Average throughput: 4.06 Mbit/s
95th percentile per-packet one-way delay: 31.085 ms
Loss rate: 4.49%
```
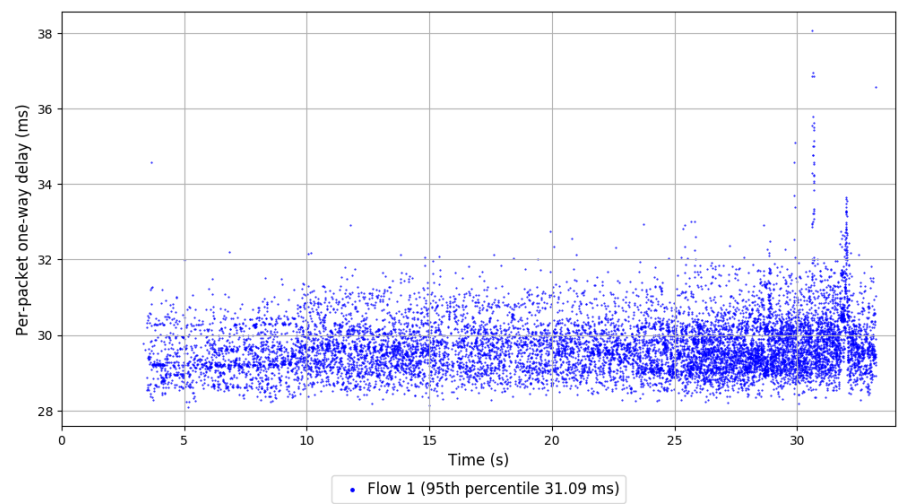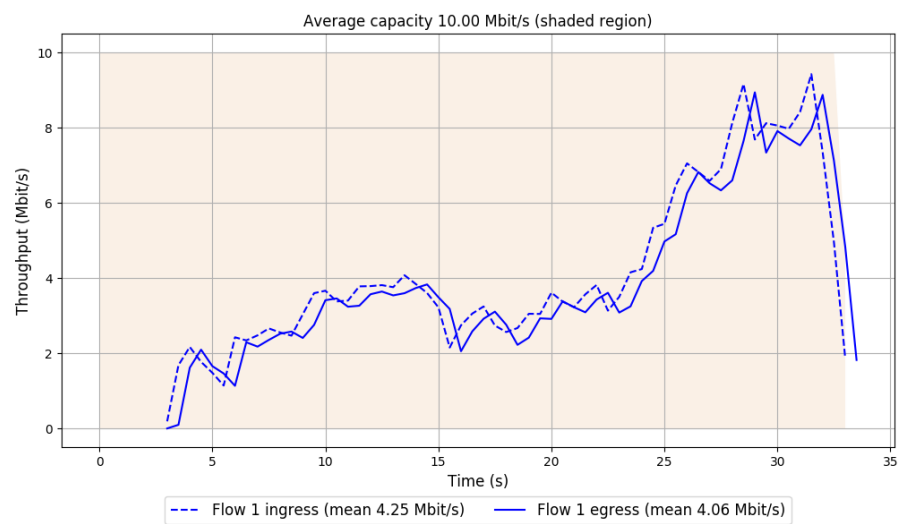
Run 2: Report of PCC-Vivace — Data Link

Average capacity 10.00 Mbit/s (shaded region)

Flow 1 ingress (mean 4.25 Mbit/s) —— Flow 1 egress (mean 4.06 Mbit/s)

Flow 1 (95th percentile 31.09 ms)

```
Run 3: Statistics of PCC-Vivace

Start at: 2019-10-21 18:51:33
End at: 2019-10-21 18:52:03

# Below is generated by plot.py at 2019-10-21 19:03:22
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 8.00 Mbit/s (80.0% utilization)
95th percentile per-packet one-way delay: 32.728 ms
Loss rate: 4.90%
-- Flow 1:
Average throughput: 8.00 Mbit/s
95th percentile per-packet one-way delay: 32.728 ms
Loss rate: 4.90%
```
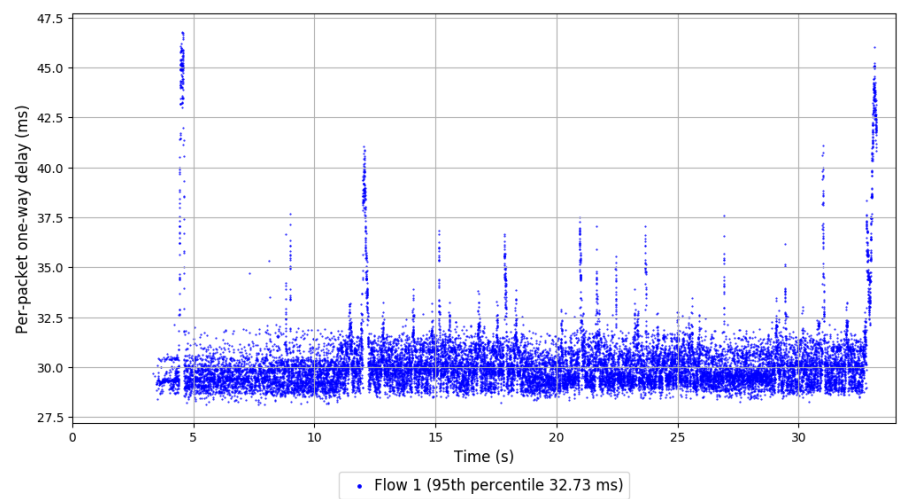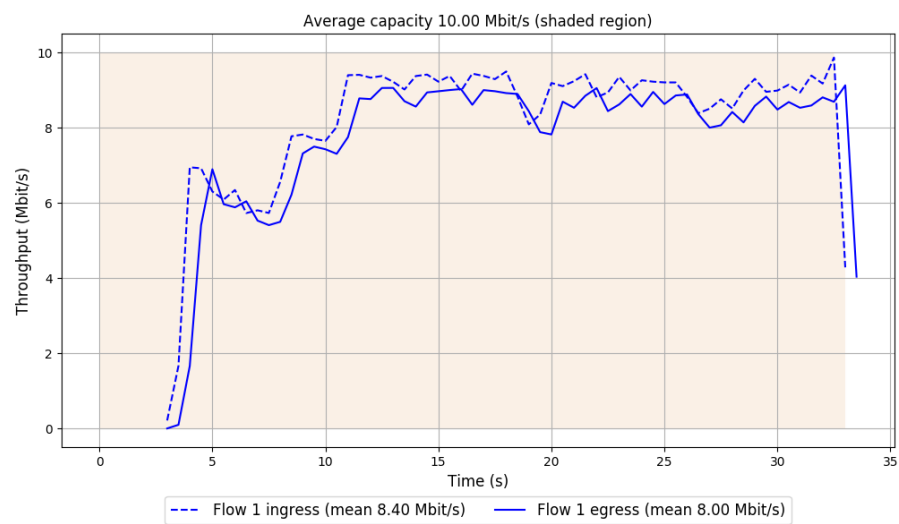
Run 3: Report of PCC-Vivace — Data Link

Average capacity 10.00 Mbit/s (shaded region)

Flow 1 ingress (mean 8.40 Mbit/s) — Flow 1 egress (mean 8.00 Mbit/s)

• Flow 1 (95th percentile 32.73 ms)

```
Run 4: Statistics of PCC-Vivace

Start at: 2019-10-21 18:53:51
End at: 2019-10-21 18:54:21

# Below is generated by plot.py at 2019-10-21 19:03:22
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 3.31 Mbit/s (33.1% utilization)
95th percentile per-packet one-way delay: 44.443 ms
Loss rate: 6.18%
-- Flow 1:
Average throughput: 3.31 Mbit/s
95th percentile per-packet one-way delay: 44.443 ms
Loss rate: 6.18%
```
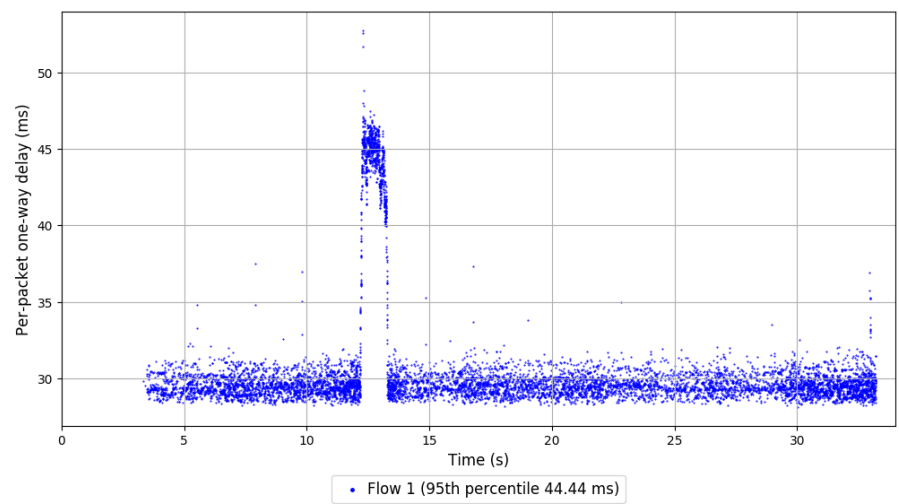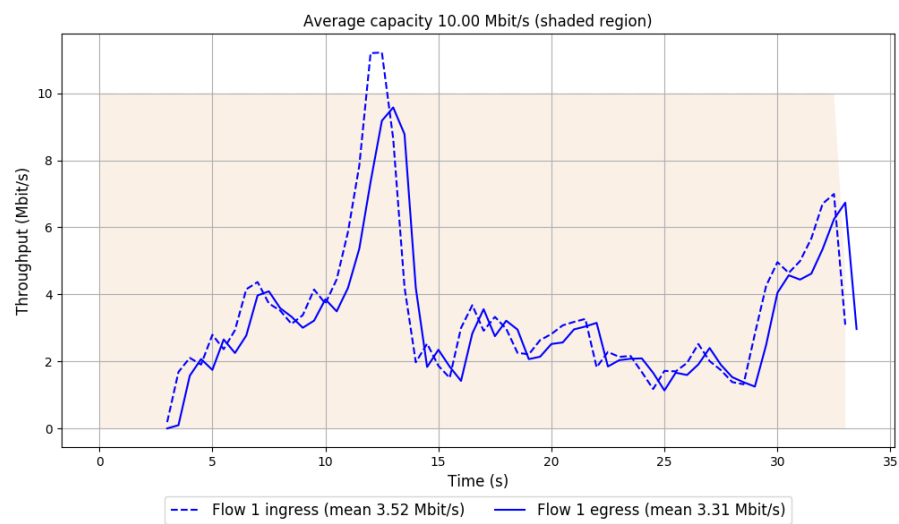
Run 4: Report of PCC-Vivace — Data Link

Average capacity 10.00 Mbit/s (shaded region)

--- Flow 1 ingress (mean 3.52 Mbit/s) —— Flow 1 egress (mean 3.31 Mbit/s)

• Flow 1 (95th percentile 44.44 ms)

```
Run 5: Statistics of PCC-Vivace

Start at: 2019-10-21 18:56:09
End at: 2019-10-21 18:56:39

# Below is generated by plot.py at 2019-10-21 19:03:23
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 4.67 Mbit/s (46.7% utilization)
95th percentile per-packet one-way delay: 30.803 ms
Loss rate: 5.08%
-- Flow 1:
Average throughput: 4.67 Mbit/s
95th percentile per-packet one-way delay: 30.803 ms
Loss rate: 5.08%
```

Run 5: Report of PCC-Vivace — Data Link

Average capacity 10.00 Mbit/s (shaded region)

Flow 1 ingress (mean 4.91 Mbit/s) ——— Flow 1 egress (mean 4.67 Mbit/s)

• Flow 1 (95th percentile 30.80 ms)