

## Pantheon Report

Generated at 2019-10-22 19:53:47 (UTC).

Tested in mahimahi: mm-delay 40 mm-link 120mbps.trace 120mbps.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

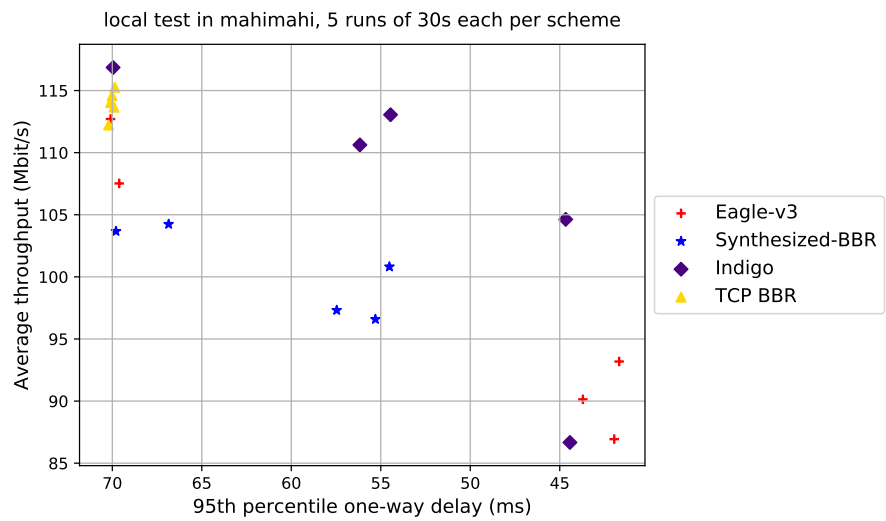
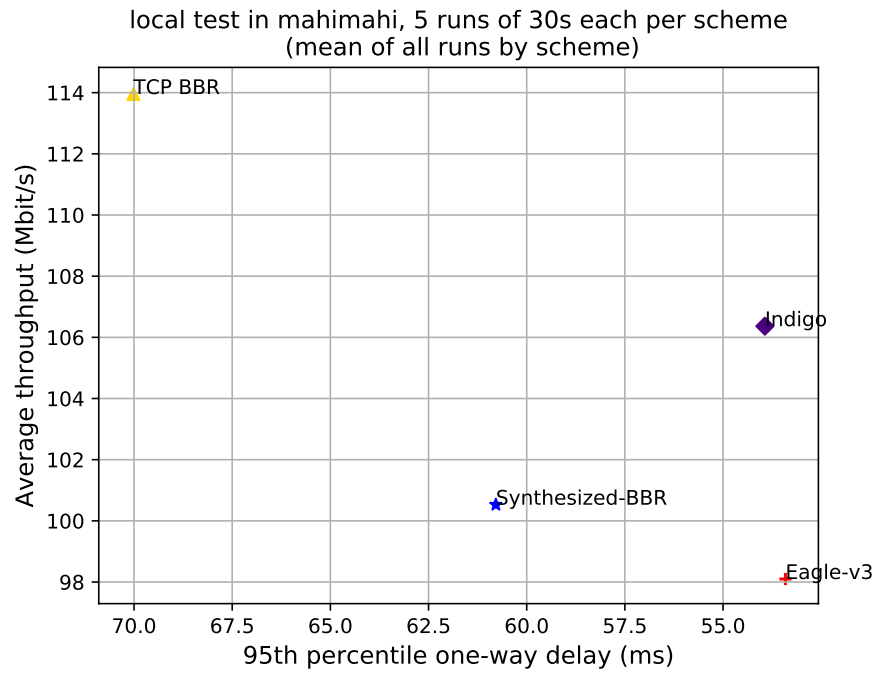
### Git summary:

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 @ d0153f8e594aa89e93b032143cedbdfc58e562f4  
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-quick @ 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.pyc
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.pyc
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.cpython-36.pyc
M sender-receiver/sender-receiver/sender_receiver/envs/model-xentropy/model-xentropy.py
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

```



| scheme          | # runs | mean avg tput (Mbit/s)<br>flow 1 | mean 95th-%ile delay (ms)<br>flow 1 | mean loss rate (%)<br>flow 1 |
|-----------------|--------|----------------------------------|-------------------------------------|------------------------------|
| TCP BBR         | 5      | 113.96                           | 70.02                               | 2.65                         |
| Eagle-v3        | 5      | 98.10                            | 53.41                               | 1.25                         |
| Indigo          | 5      | 106.36                           | 53.94                               | 1.72                         |
| Synthesized-BBR | 5      | 100.53                           | 60.79                               | 0.95                         |

Run 1: Statistics of TCP BBR

Start at: 2019-10-22 19:18:09

End at: 2019-10-22 19:18:39

# Below is generated by plot.py at 2019-10-22 19:49:34

# Datalink statistics

-- Total of 1 flow:

Average capacity: 120.00 Mbit/s

Average throughput: 112.23 Mbit/s (93.5% utilization)

95th percentile per-packet one-way delay: 70.205 ms

Loss rate: 2.51%

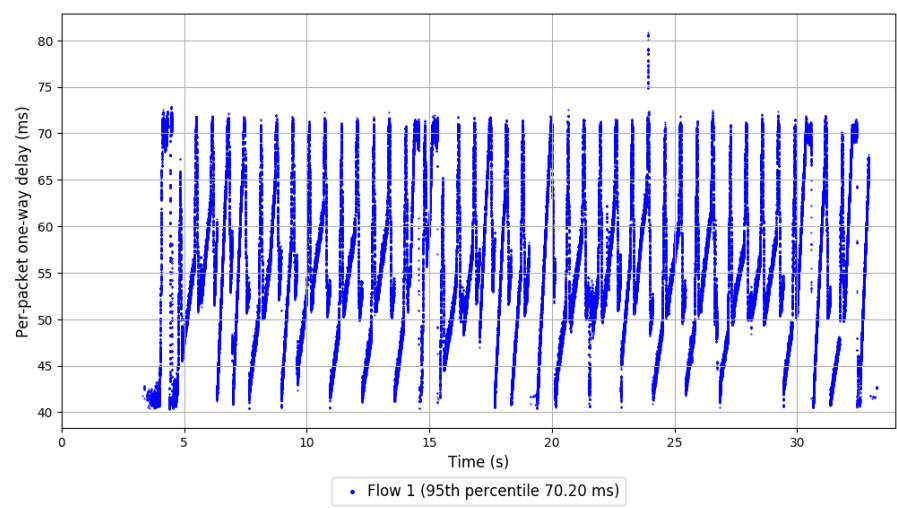
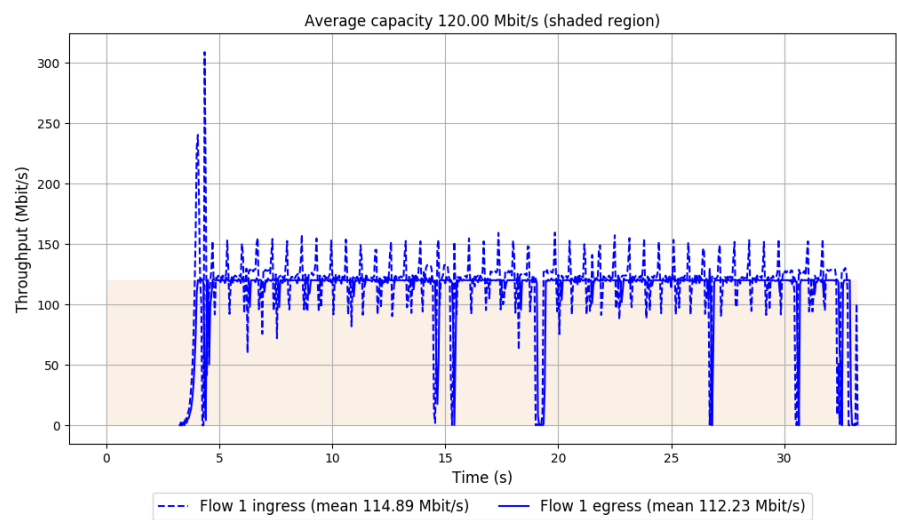
-- Flow 1:

Average throughput: 112.23 Mbit/s

95th percentile per-packet one-way delay: 70.205 ms

Loss rate: 2.51%

Run 1: Report of TCP BBR — Data Link



Run 2: Statistics of TCP BBR

Start at: 2019-10-22 19:20:50

End at: 2019-10-22 19:21:20

# Below is generated by plot.py at 2019-10-22 19:49:34

# Datalink statistics

-- Total of 1 flow:

Average capacity: 120.00 Mbit/s

Average throughput: 113.66 Mbit/s (94.7% utilization)

95th percentile per-packet one-way delay: 69.906 ms

Loss rate: 2.28%

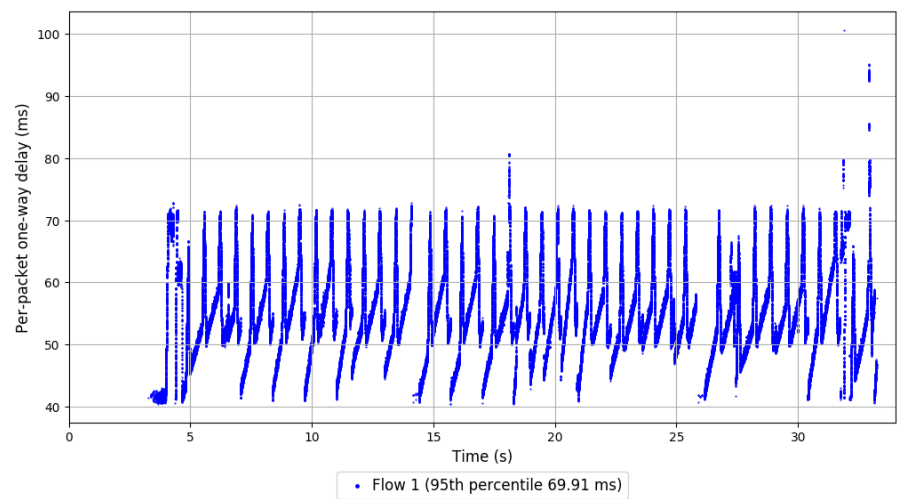
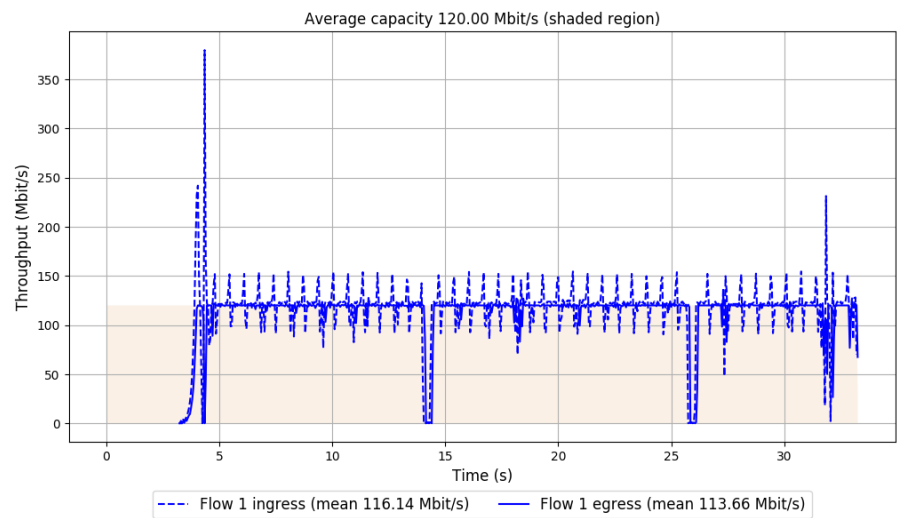
-- Flow 1:

Average throughput: 113.66 Mbit/s

95th percentile per-packet one-way delay: 69.906 ms

Loss rate: 2.28%

Run 2: Report of TCP BBR — Data Link





Run 3: Statistics of TCP BBR

Start at: 2019-10-22 19:23:32

End at: 2019-10-22 19:24:02

# Below is generated by plot.py at 2019-10-22 19:49:41

# Datalink statistics

-- Total of 1 flow:

Average capacity: 120.00 Mbit/s

Average throughput: 114.58 Mbit/s (95.5% utilization)

95th percentile per-packet one-way delay: 70.014 ms

Loss rate: 3.19%

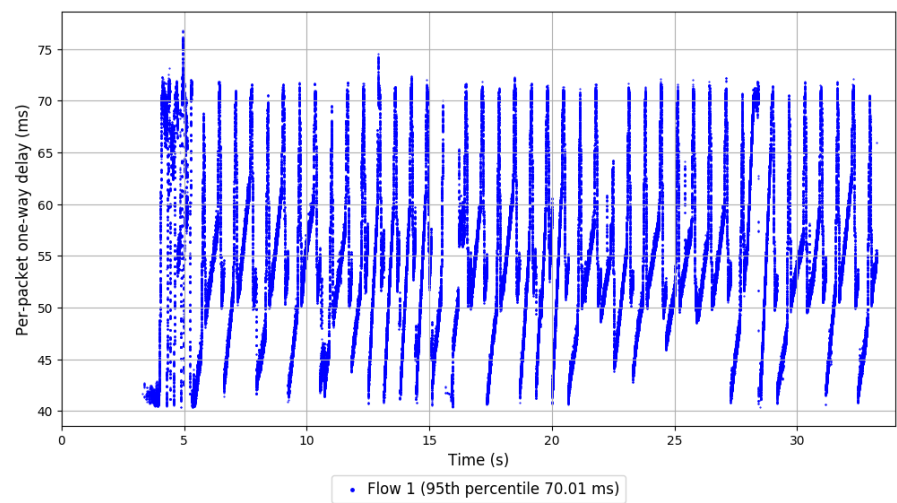
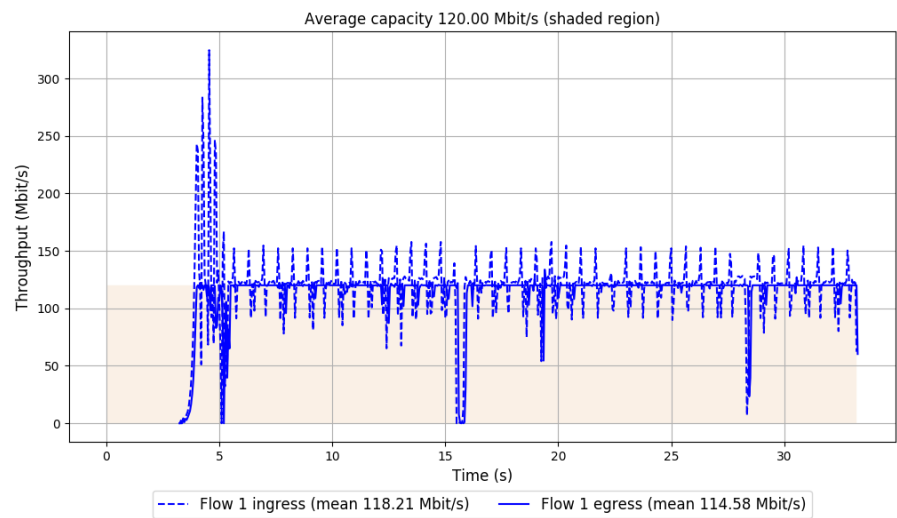
-- Flow 1:

Average throughput: 114.58 Mbit/s

95th percentile per-packet one-way delay: 70.014 ms

Loss rate: 3.19%

Run 3: Report of TCP BBR — Data Link



Run 4: Statistics of TCP BBR

Start at: 2019-10-22 19:26:12

End at: 2019-10-22 19:26:42

# Below is generated by plot.py at 2019-10-22 19:49:41

# Datalink statistics

-- Total of 1 flow:

Average capacity: 120.00 Mbit/s

Average throughput: 114.04 Mbit/s (95.0% utilization)

95th percentile per-packet one-way delay: 70.094 ms

Loss rate: 2.53%

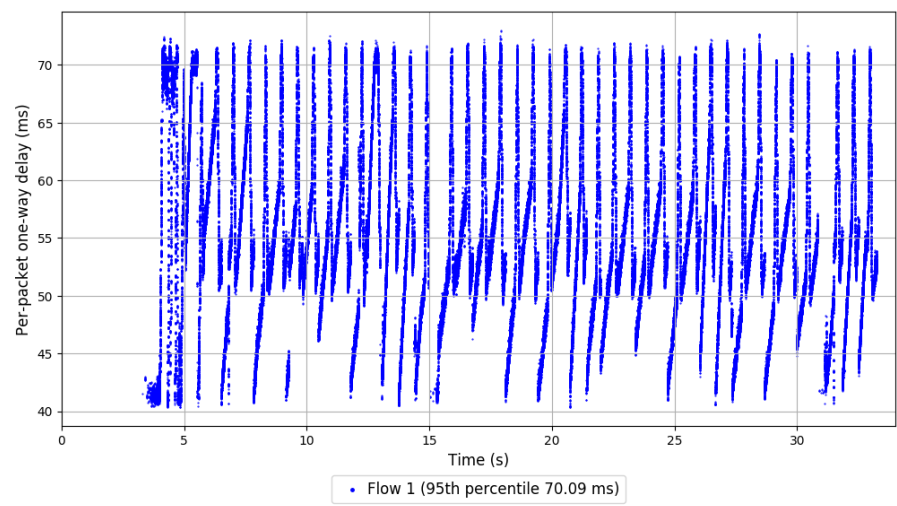
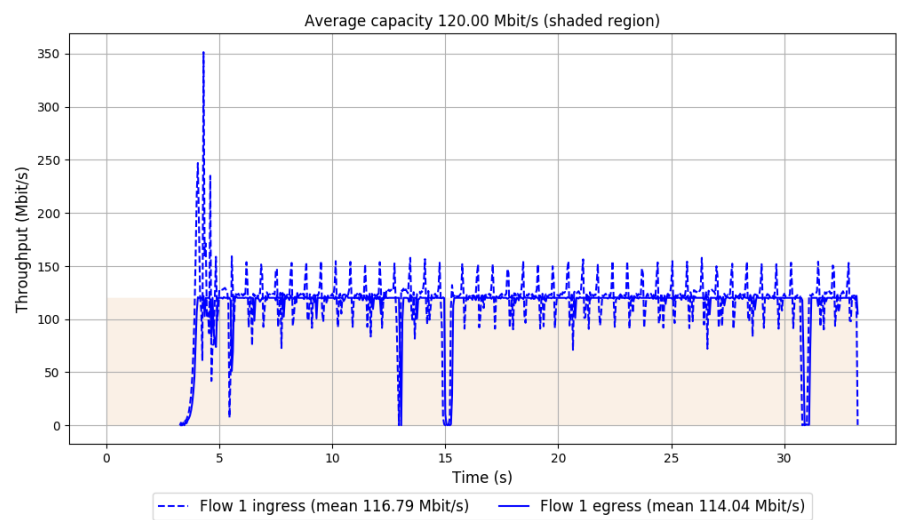
-- Flow 1:

Average throughput: 114.04 Mbit/s

95th percentile per-packet one-way delay: 70.094 ms

Loss rate: 2.53%

Run 4: Report of TCP BBR — Data Link



Run 5: Statistics of TCP BBR

Start at: 2019-10-22 19:28:53

End at: 2019-10-22 19:29:23

# Below is generated by plot.py at 2019-10-22 19:50:46

# Datalink statistics

-- Total of 1 flow:

Average capacity: 120.00 Mbit/s

Average throughput: 115.27 Mbit/s (96.1% utilization)

95th percentile per-packet one-way delay: 69.862 ms

Loss rate: 2.75%

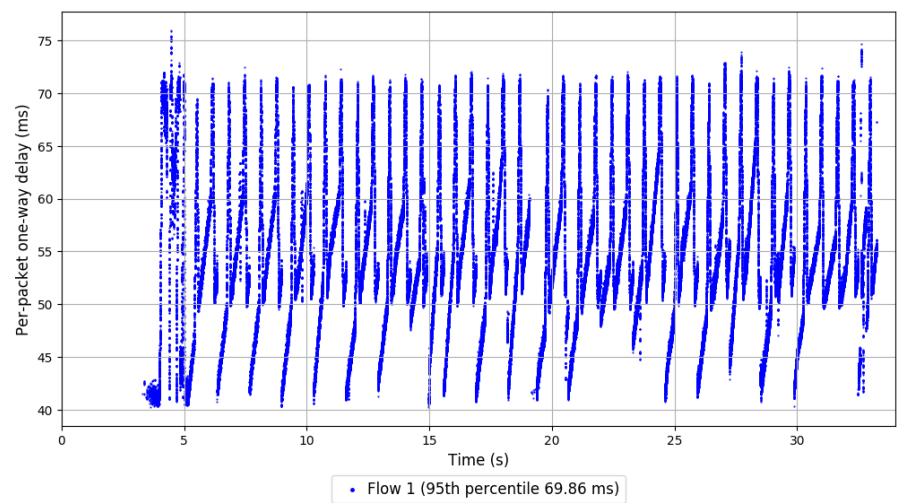
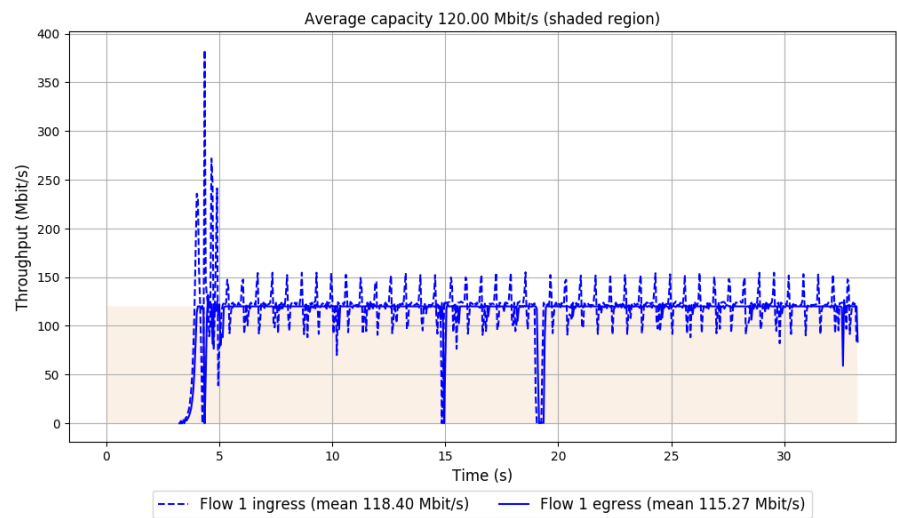
-- Flow 1:

Average throughput: 115.27 Mbit/s

95th percentile per-packet one-way delay: 69.862 ms

Loss rate: 2.75%

Run 5: Report of TCP BBR — Data Link

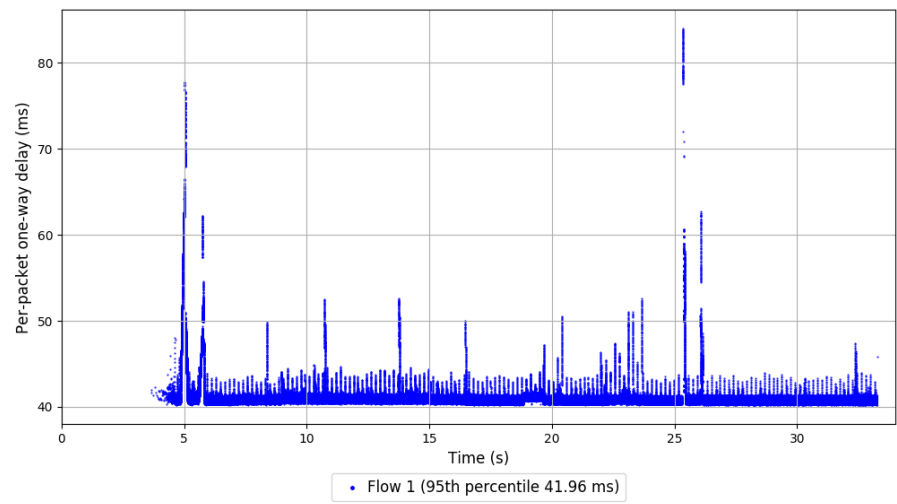
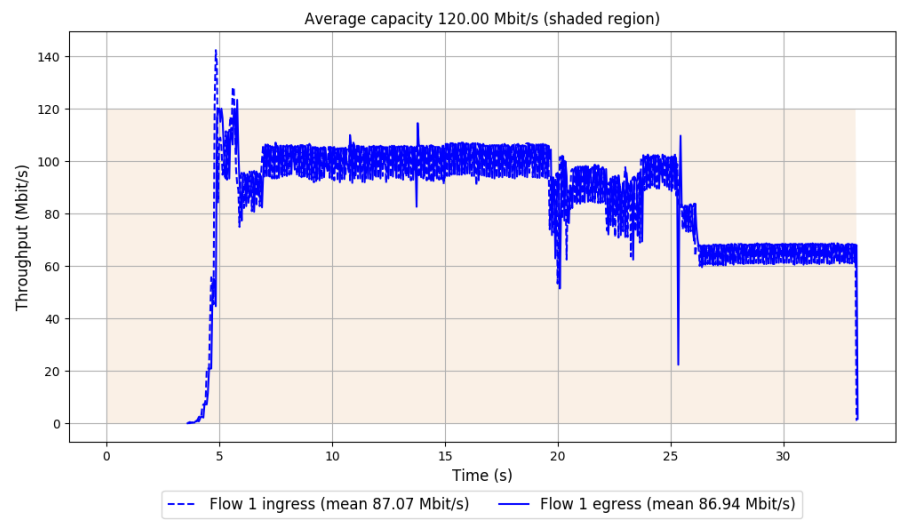


```
Run 1: Statistics of Eagle-v3

Start at: 2019-10-22 19:16:49
End at: 2019-10-22 19:17:19

# Below is generated by plot.py at 2019-10-22 19:50:46
# Datalink statistics
-- Total of 1 flow:
Average capacity: 120.00 Mbit/s
Average throughput: 86.94 Mbit/s (72.4% utilization)
95th percentile per-packet one-way delay: 41.956 ms
Loss rate: 0.31%
-- Flow 1:
Average throughput: 86.94 Mbit/s
95th percentile per-packet one-way delay: 41.956 ms
Loss rate: 0.31%
```

Run 1: Report of Eagle-v3 — Data Link





Run 2: Statistics of Eagle-v3

Start at: 2019-10-22 19:19:29

End at: 2019-10-22 19:19:59

# Below is generated by plot.py at 2019-10-22 19:50:52

# Datalink statistics

-- Total of 1 flow:

Average capacity: 120.00 Mbit/s

Average throughput: 107.52 Mbit/s (89.6% utilization)

95th percentile per-packet one-way delay: 69.615 ms

Loss rate: 1.33%

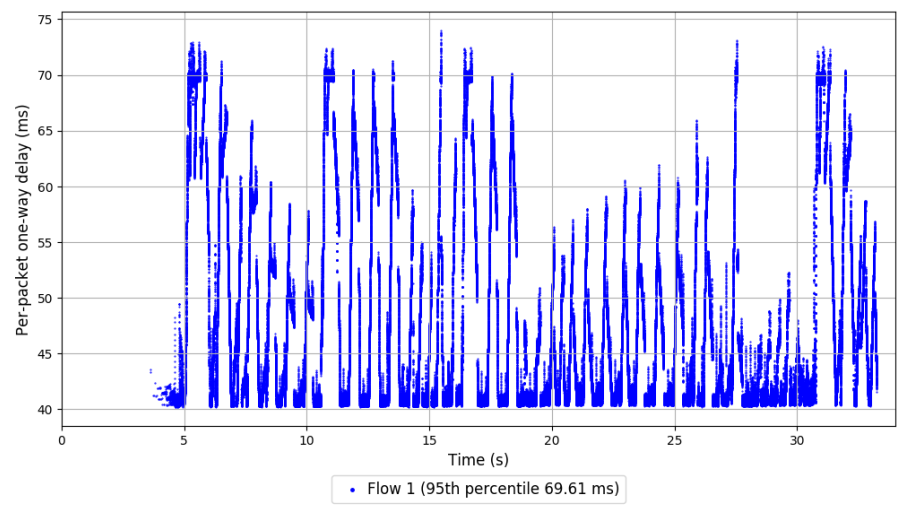
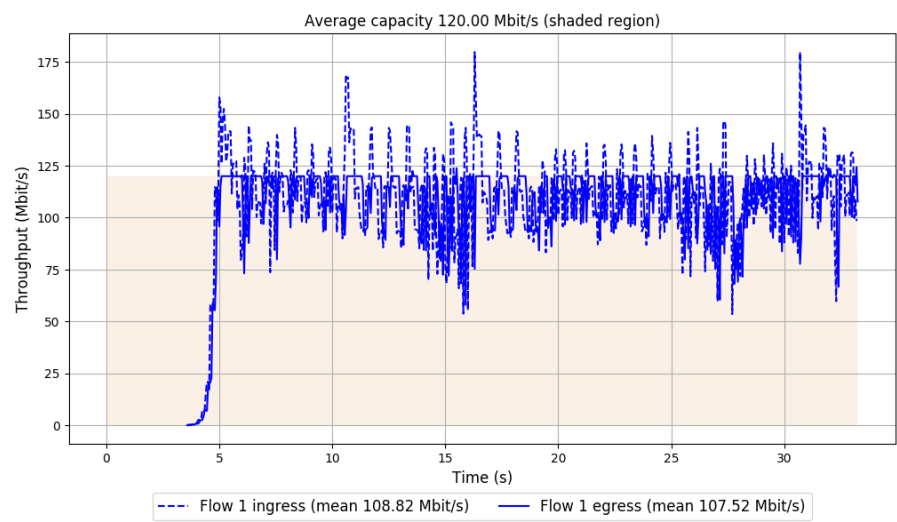
-- Flow 1:

Average throughput: 107.52 Mbit/s

95th percentile per-packet one-way delay: 69.615 ms

Loss rate: 1.33%

Run 2: Report of Eagle-v3 — Data Link



Run 3: Statistics of Eagle-v3

Start at: 2019-10-22 19:22:11

End at: 2019-10-22 19:22:41

# Below is generated by plot.py at 2019-10-22 19:50:52

# Datalink statistics

-- Total of 1 flow:

Average capacity: 120.00 Mbit/s

Average throughput: 112.71 Mbit/s (93.9% utilization)

95th percentile per-packet one-way delay: 70.098 ms

Loss rate: 2.79%

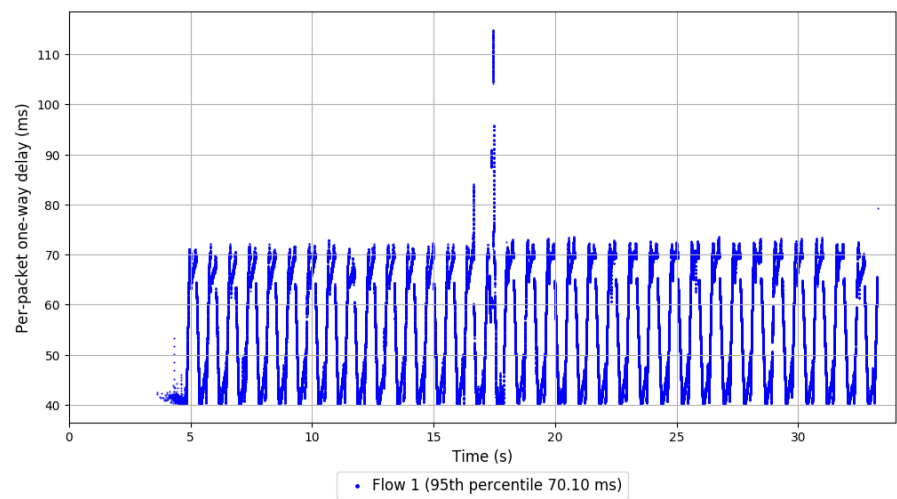
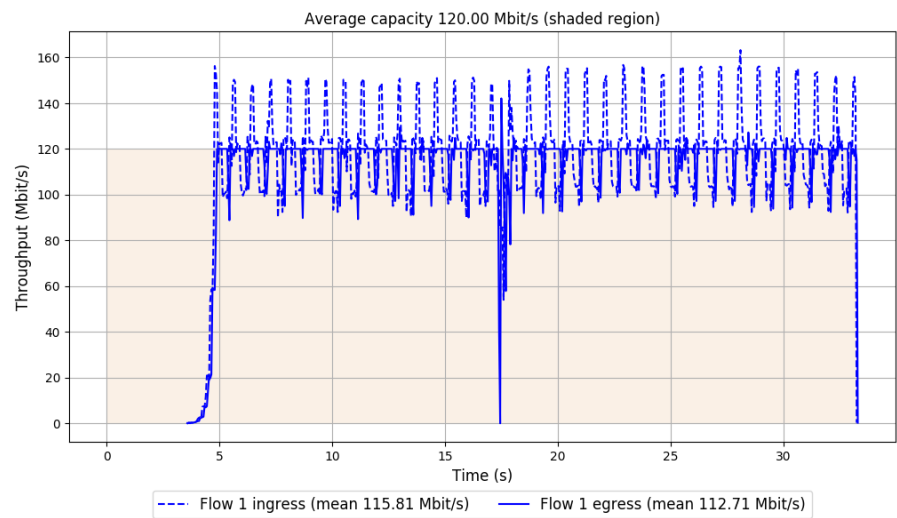
-- Flow 1:

Average throughput: 112.71 Mbit/s

95th percentile per-packet one-way delay: 70.098 ms

Loss rate: 2.79%

Run 3: Report of Eagle-v3 — Data Link



Run 4: Statistics of Eagle-v3

Start at: 2019-10-22 19:24:52

End at: 2019-10-22 19:25:22

# Below is generated by plot.py at 2019-10-22 19:51:15

# Datalink statistics

-- Total of 1 flow:

Average capacity: 120.00 Mbit/s

Average throughput: 90.14 Mbit/s (75.1% utilization)

95th percentile per-packet one-way delay: 43.707 ms

Loss rate: 1.65%

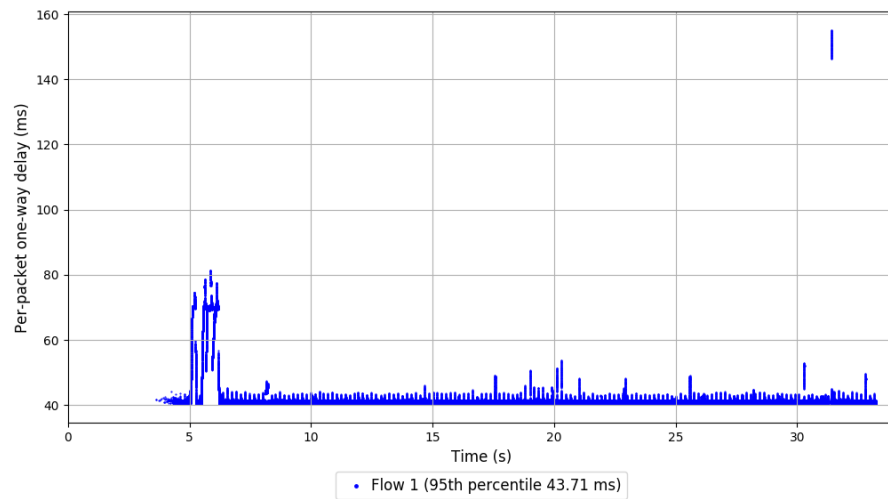
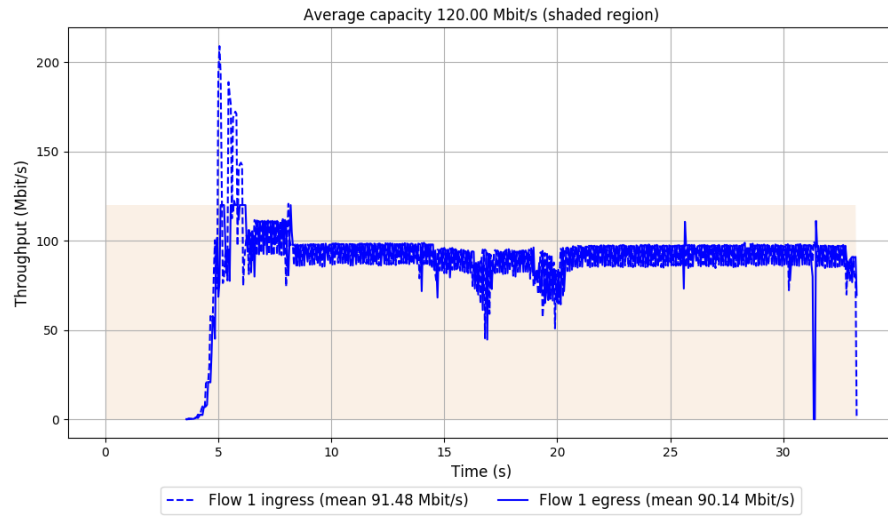
-- Flow 1:

Average throughput: 90.14 Mbit/s

95th percentile per-packet one-way delay: 43.707 ms

Loss rate: 1.65%

#### Run 4: Report of Eagle-v3 — Data Link



Run 5: Statistics of Eagle-v3

Start at: 2019-10-22 19:27:33

End at: 2019-10-22 19:28:03

# Below is generated by plot.py at 2019-10-22 19:51:35

# Datalink statistics

-- Total of 1 flow:

Average capacity: 120.00 Mbit/s

Average throughput: 93.19 Mbit/s (77.7% utilization)

95th percentile per-packet one-way delay: 41.681 ms

Loss rate: 0.17%

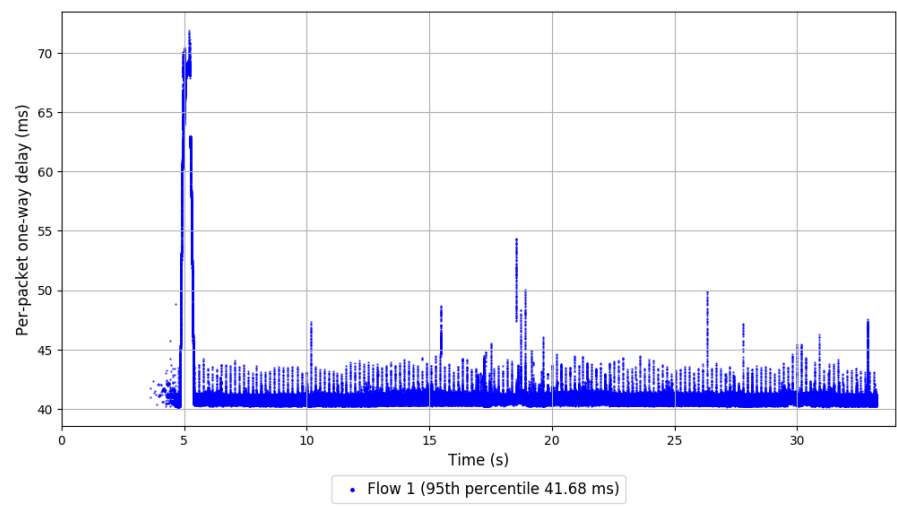
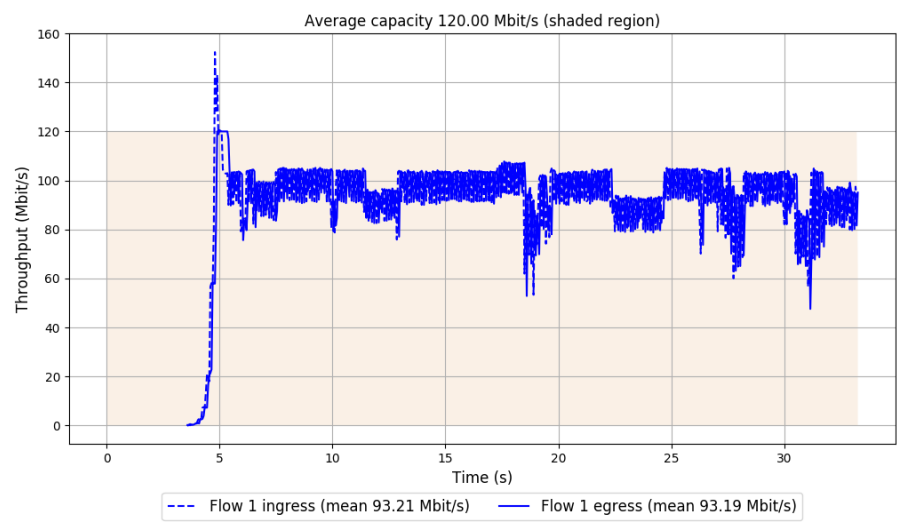
-- Flow 1:

Average throughput: 93.19 Mbit/s

95th percentile per-packet one-way delay: 41.681 ms

Loss rate: 0.17%

Run 5: Report of Eagle-v3 — Data Link





Run 1: Statistics of Indigo

Start at: 2019-10-22 19:18:49

End at: 2019-10-22 19:19:19

# Below is generated by plot.py at 2019-10-22 19:51:55

# Datalink statistics

-- Total of 1 flow:

Average capacity: 120.00 Mbit/s

Average throughput: 110.62 Mbit/s (92.2% utilization)

95th percentile per-packet one-way delay: 56.167 ms

Loss rate: 0.25%

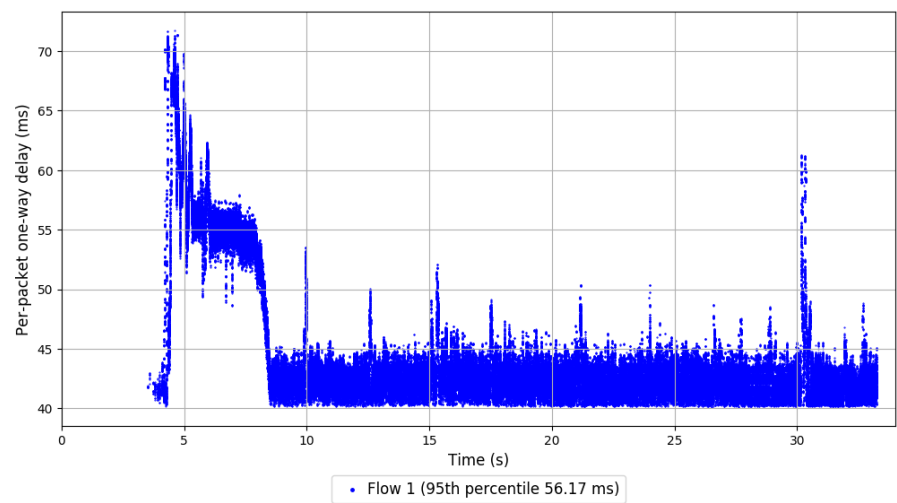
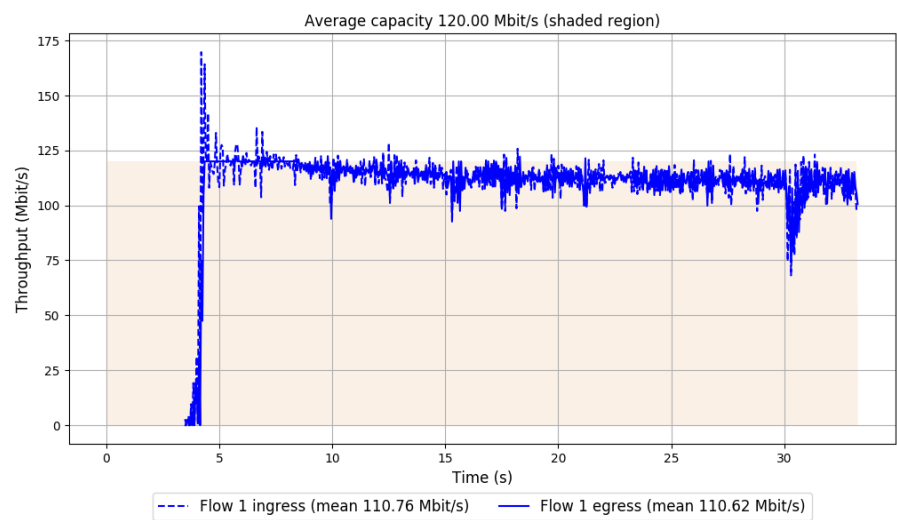
-- Flow 1:

Average throughput: 110.62 Mbit/s

95th percentile per-packet one-way delay: 56.167 ms

Loss rate: 0.25%

Run 1: Report of Indigo — Data Link



Run 2: Statistics of Indigo

Start at: 2019-10-22 19:21:30

End at: 2019-10-22 19:22:00

# Below is generated by plot.py at 2019-10-22 19:51:57

# Datalink statistics

-- Total of 1 flow:

Average capacity: 120.00 Mbit/s

Average throughput: 113.05 Mbit/s (94.2% utilization)

95th percentile per-packet one-way delay: 54.454 ms

Loss rate: 0.39%

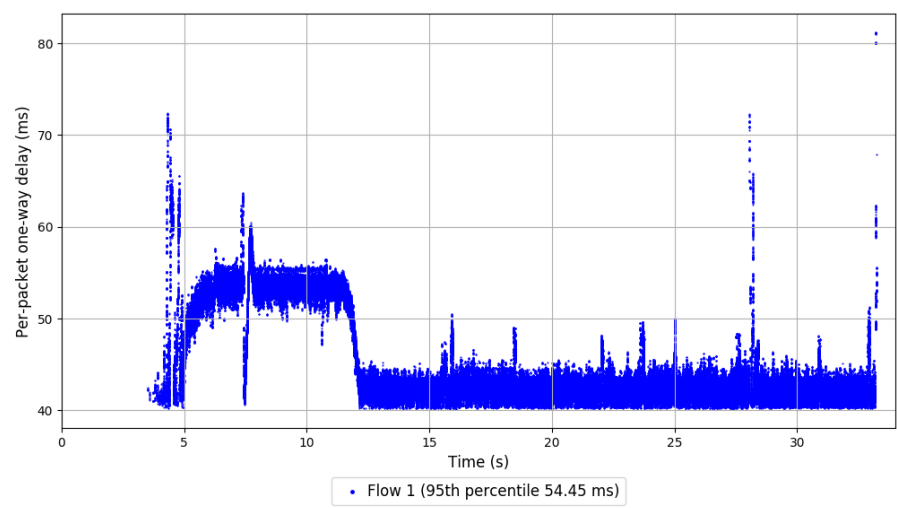
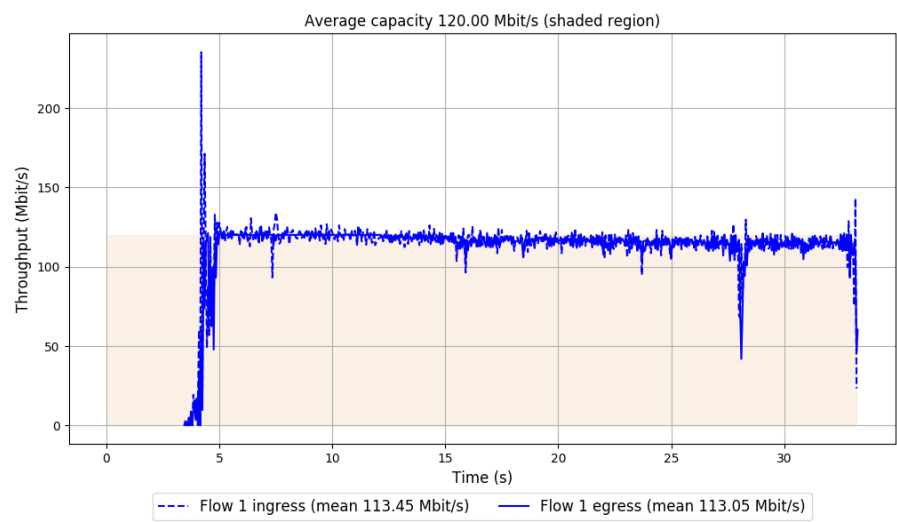
-- Flow 1:

Average throughput: 113.05 Mbit/s

95th percentile per-packet one-way delay: 54.454 ms

Loss rate: 0.39%

Run 2: Report of Indigo — Data Link



Run 3: Statistics of Indigo

Start at: 2019-10-22 19:24:12

End at: 2019-10-22 19:24:42

# Below is generated by plot.py at 2019-10-22 19:52:21

# Datalink statistics

-- Total of 1 flow:

Average capacity: 120.00 Mbit/s

Average throughput: 104.63 Mbit/s (87.2% utilization)

95th percentile per-packet one-way delay: 44.668 ms

Loss rate: 0.42%

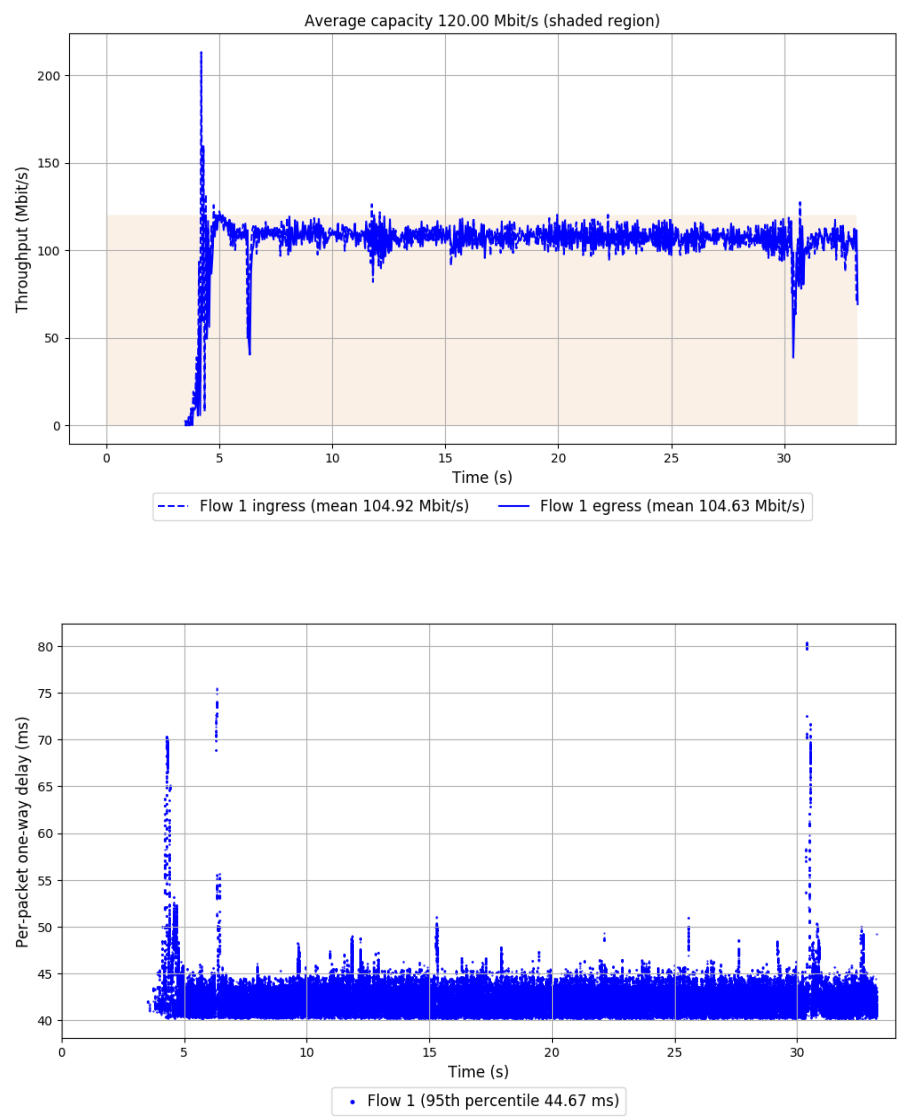
-- Flow 1:

Average throughput: 104.63 Mbit/s

95th percentile per-packet one-way delay: 44.668 ms

Loss rate: 0.42%

Run 3: Report of Indigo — Data Link



Run 4: Statistics of Indigo

Start at: 2019-10-22 19:26:52

End at: 2019-10-22 19:27:22

# Below is generated by plot.py at 2019-10-22 19:52:47

# Datalink statistics

-- Total of 1 flow:

Average capacity: 120.00 Mbit/s

Average throughput: 116.85 Mbit/s (97.4% utilization)

95th percentile per-packet one-way delay: 69.955 ms

Loss rate: 7.21%

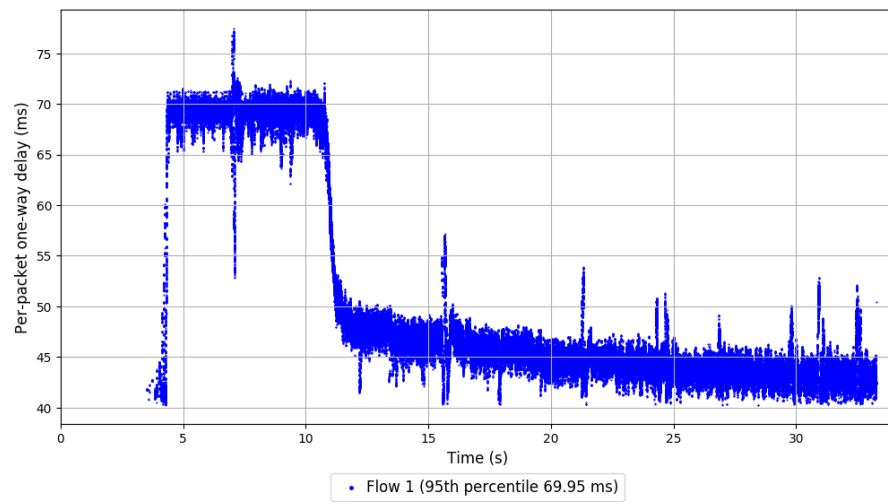
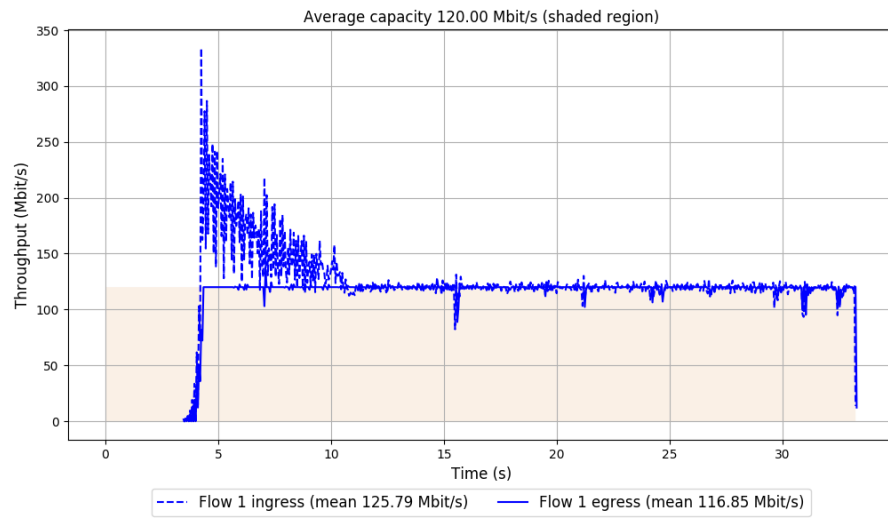
-- Flow 1:

Average throughput: 116.85 Mbit/s

95th percentile per-packet one-way delay: 69.955 ms

Loss rate: 7.21%

#### Run 4: Report of Indigo — Data Link





Run 5: Statistics of Indigo

Start at: 2019-10-22 19:29:32

End at: 2019-10-22 19:30:02

# Below is generated by plot.py at 2019-10-22 19:52:47

# Datalink statistics

-- Total of 1 flow:

Average capacity: 120.00 Mbit/s

Average throughput: 86.67 Mbit/s (72.2% utilization)

95th percentile per-packet one-way delay: 44.431 ms

Loss rate: 0.33%

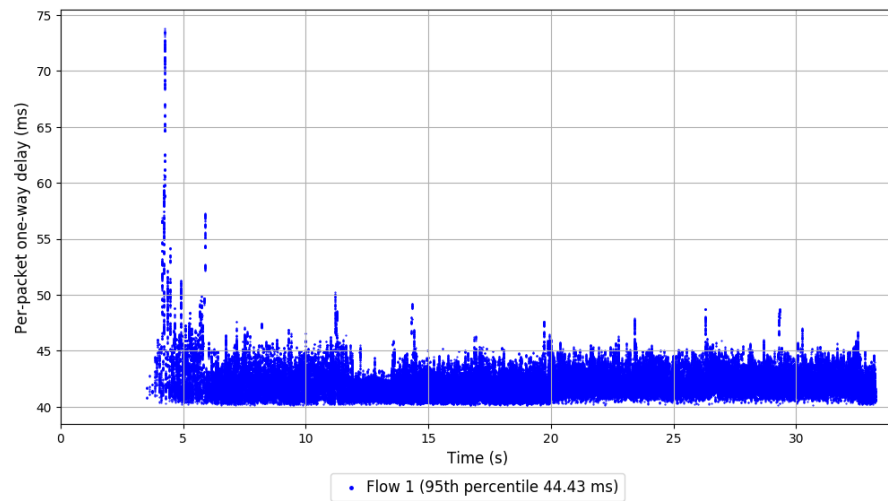
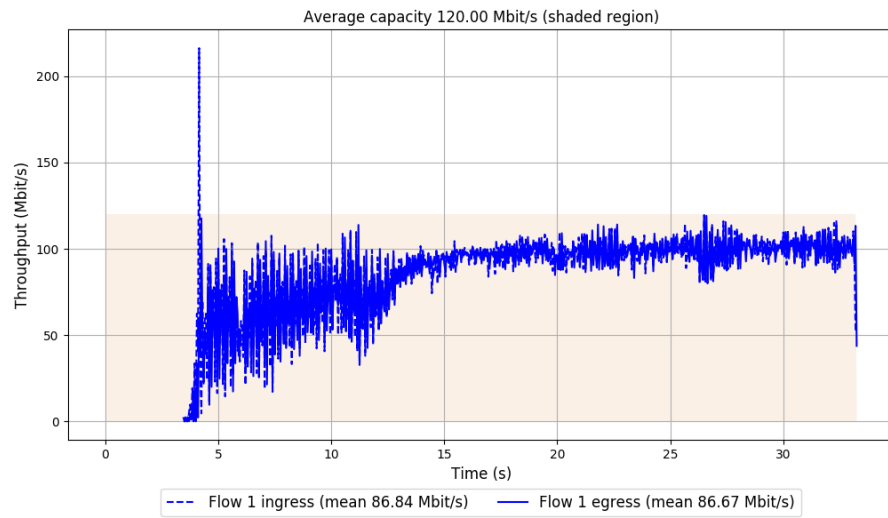
-- Flow 1:

Average throughput: 86.67 Mbit/s

95th percentile per-packet one-way delay: 44.431 ms

Loss rate: 0.33%

## Run 5: Report of Indigo — Data Link

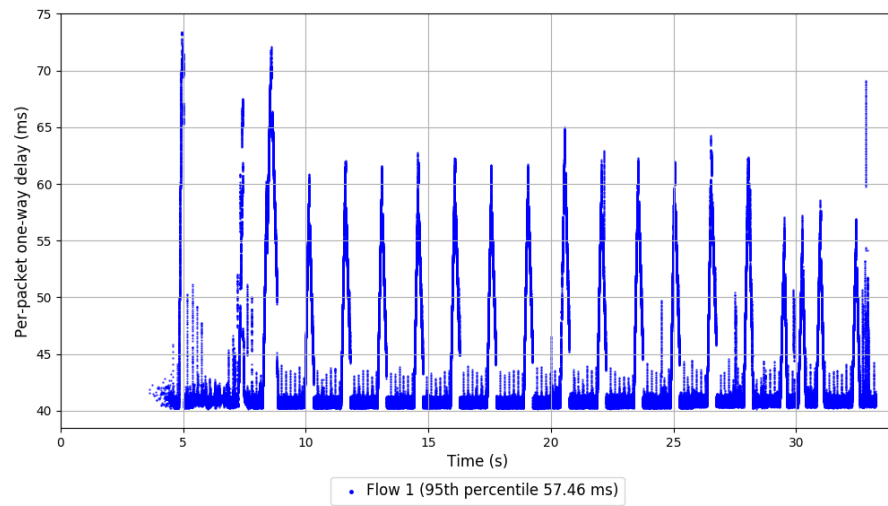
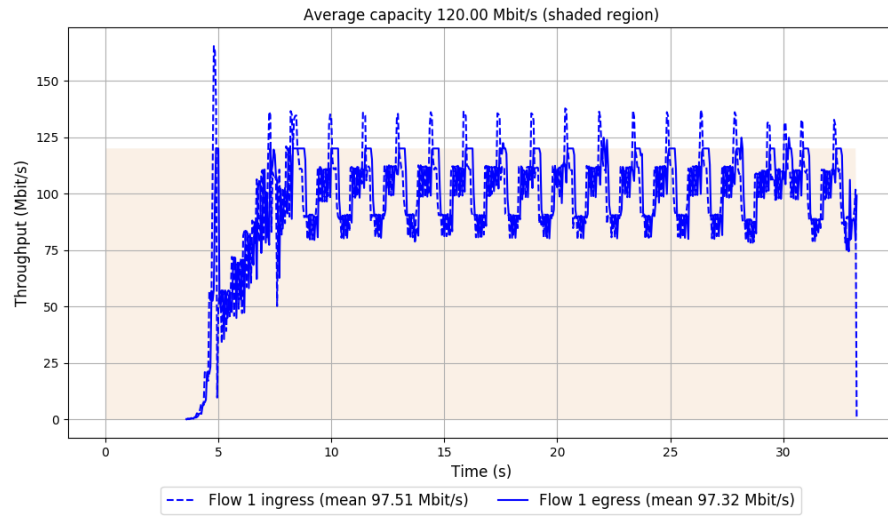


```
Run 1: Statistics of Synthesized-BBR

Start at: 2019-10-22 19:17:29
End at: 2019-10-22 19:17:59

# Below is generated by plot.py at 2019-10-22 19:53:03
# Datalink statistics
-- Total of 1 flow:
Average capacity: 120.00 Mbit/s
Average throughput: 97.32 Mbit/s (81.1% utilization)
95th percentile per-packet one-way delay: 57.464 ms
Loss rate: 0.40%
-- Flow 1:
Average throughput: 97.32 Mbit/s
95th percentile per-packet one-way delay: 57.464 ms
Loss rate: 0.40%
```

## Run 1: Report of Synthesized-BBR — Data Link



Run 2: Statistics of Synthesized-BBR

Start at: 2019-10-22 19:20:10

End at: 2019-10-22 19:20:40

# Below is generated by plot.py at 2019-10-22 19:53:26

# Datalink statistics

-- Total of 1 flow:

Average capacity: 120.00 Mbit/s

Average throughput: 104.24 Mbit/s (86.9% utilization)

95th percentile per-packet one-way delay: 66.853 ms

Loss rate: 1.30%

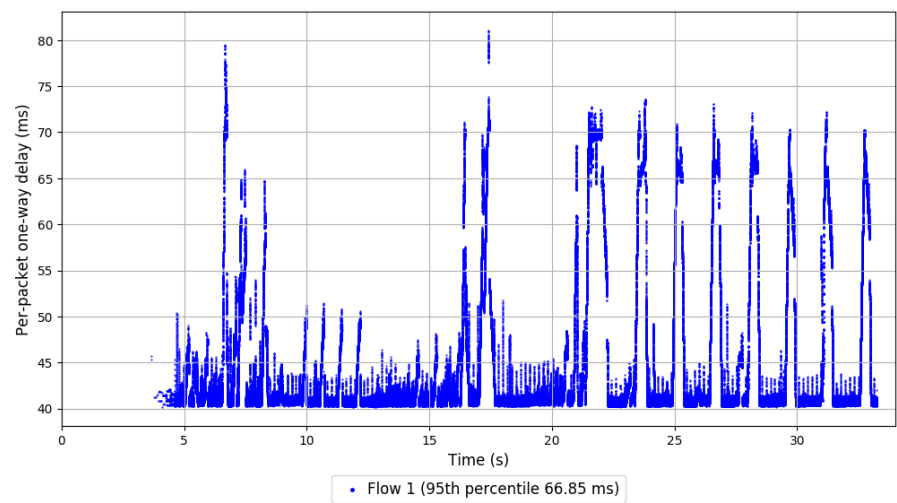
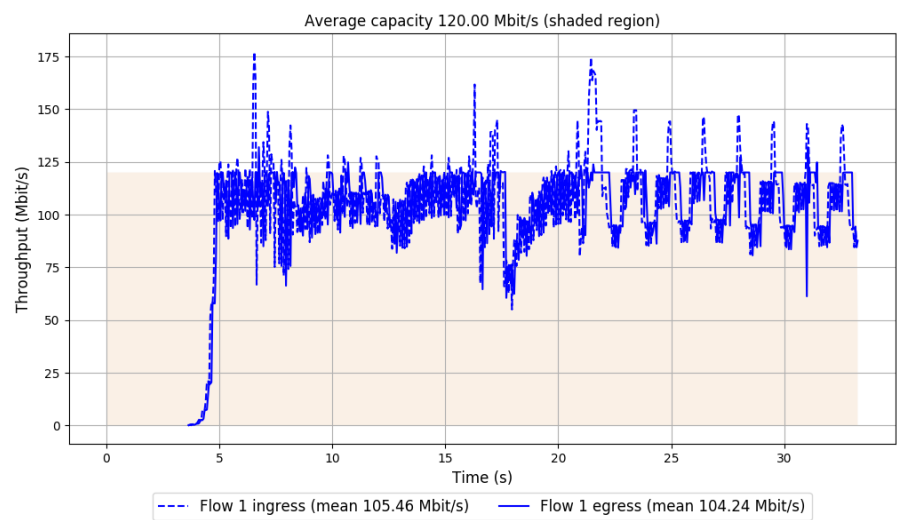
-- Flow 1:

Average throughput: 104.24 Mbit/s

95th percentile per-packet one-way delay: 66.853 ms

Loss rate: 1.30%

Run 2: Report of Synthesized-BBR — Data Link



Run 3: Statistics of Synthesized-BBR

Start at: 2019-10-22 19:22:52

End at: 2019-10-22 19:23:22

# Below is generated by plot.py at 2019-10-22 19:53:41

# Datalink statistics

-- Total of 1 flow:

Average capacity: 120.00 Mbit/s

Average throughput: 103.67 Mbit/s (86.4% utilization)

95th percentile per-packet one-way delay: 69.797 ms

Loss rate: 2.39%

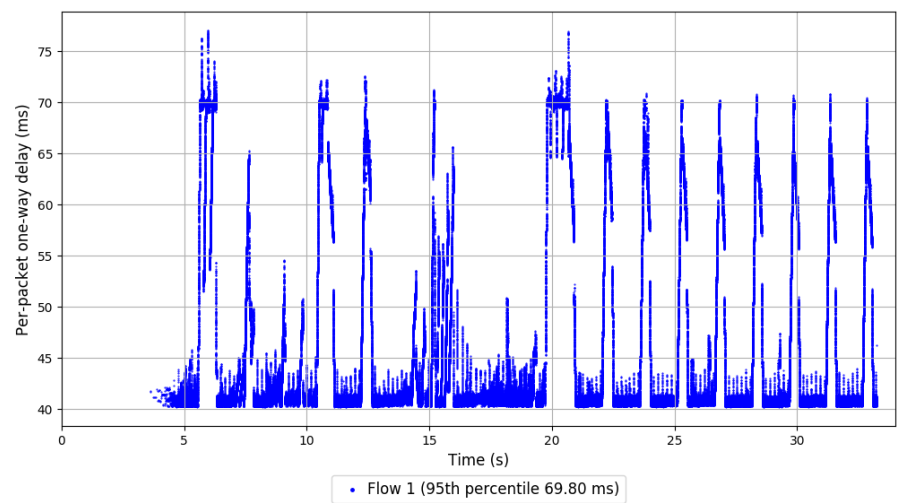
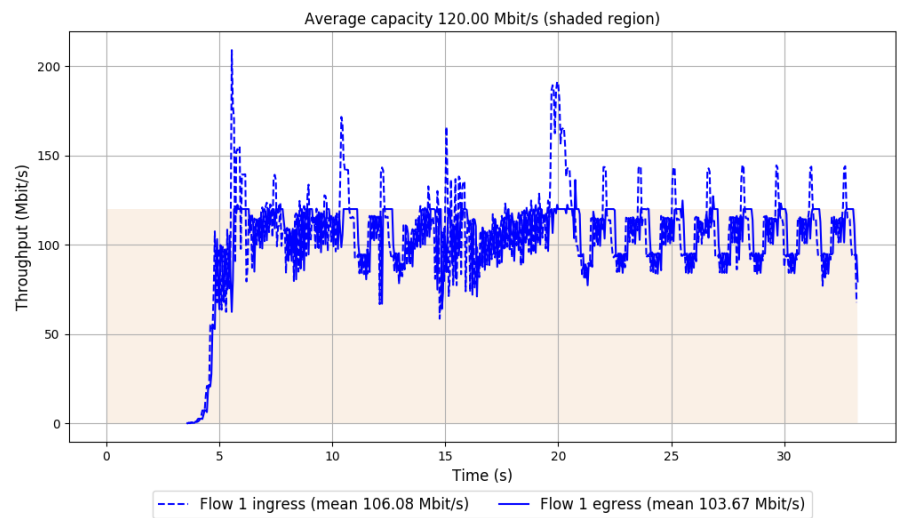
-- Flow 1:

Average throughput: 103.67 Mbit/s

95th percentile per-packet one-way delay: 69.797 ms

Loss rate: 2.39%

Run 3: Report of Synthesized-BBR — Data Link





Run 4: Statistics of Synthesized-BBR

Start at: 2019-10-22 19:25:32

End at: 2019-10-22 19:26:02

# Below is generated by plot.py at 2019-10-22 19:53:43

# Datalink statistics

-- Total of 1 flow:

Average capacity: 120.00 Mbit/s

Average throughput: 96.59 Mbit/s (80.5% utilization)

95th percentile per-packet one-way delay: 55.299 ms

Loss rate: 0.47%

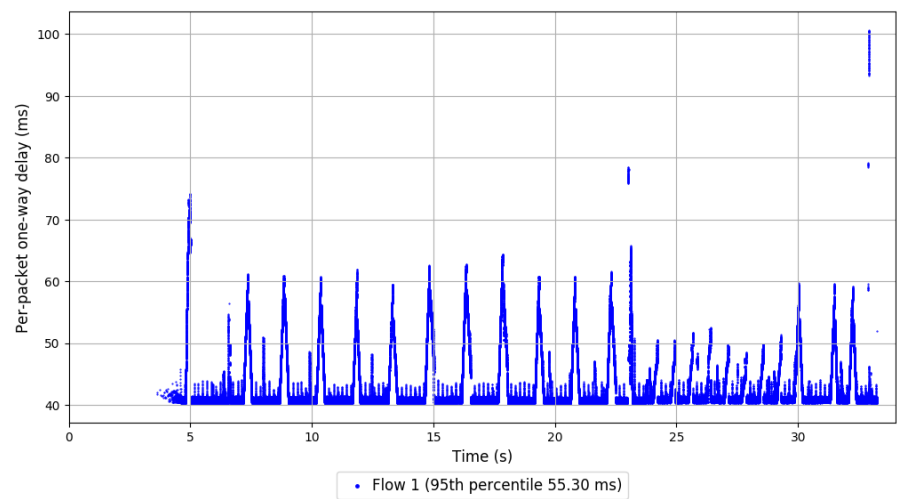
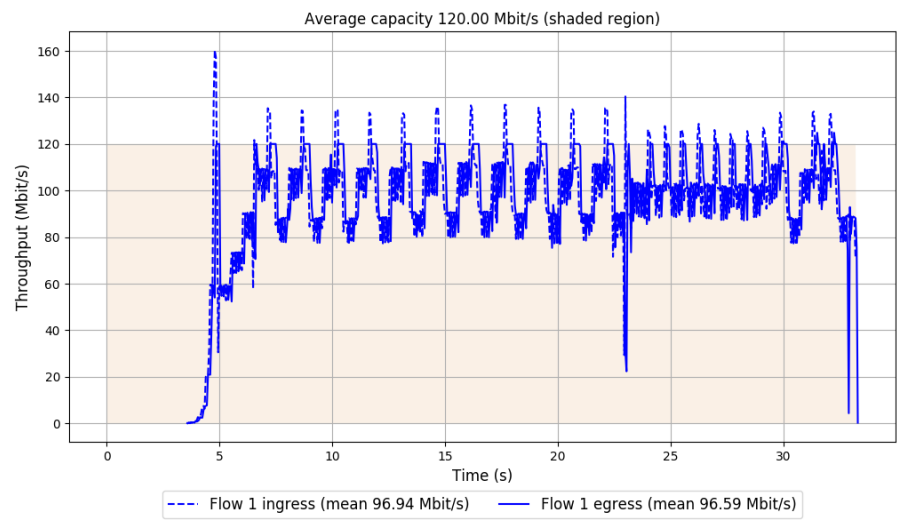
-- Flow 1:

Average throughput: 96.59 Mbit/s

95th percentile per-packet one-way delay: 55.299 ms

Loss rate: 0.47%

Run 4: Report of Synthesized-BBR — Data Link



Run 5: Statistics of Synthesized-BBR

Start at: 2019-10-22 19:28:13

End at: 2019-10-22 19:28:43

# Below is generated by plot.py at 2019-10-22 19:53:46

# Datalink statistics

-- Total of 1 flow:

Average capacity: 120.00 Mbit/s

Average throughput: 100.82 Mbit/s (84.0% utilization)

95th percentile per-packet one-way delay: 54.517 ms

Loss rate: 0.17%

-- Flow 1:

Average throughput: 100.82 Mbit/s

95th percentile per-packet one-way delay: 54.517 ms

Loss rate: 0.17%

Run 5: Report of Synthesized-BBR — Data Link

