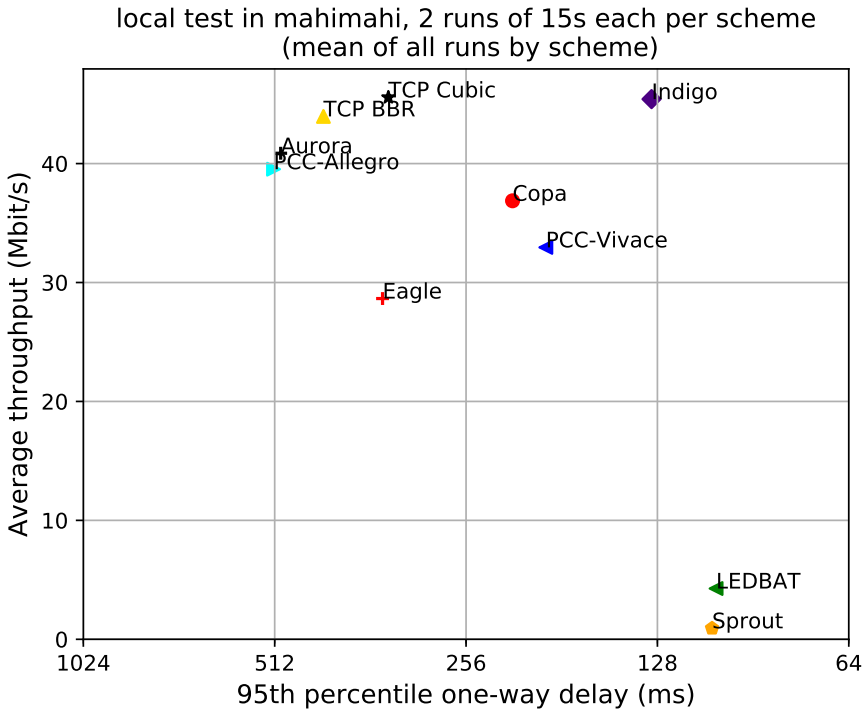
Pantheon Report

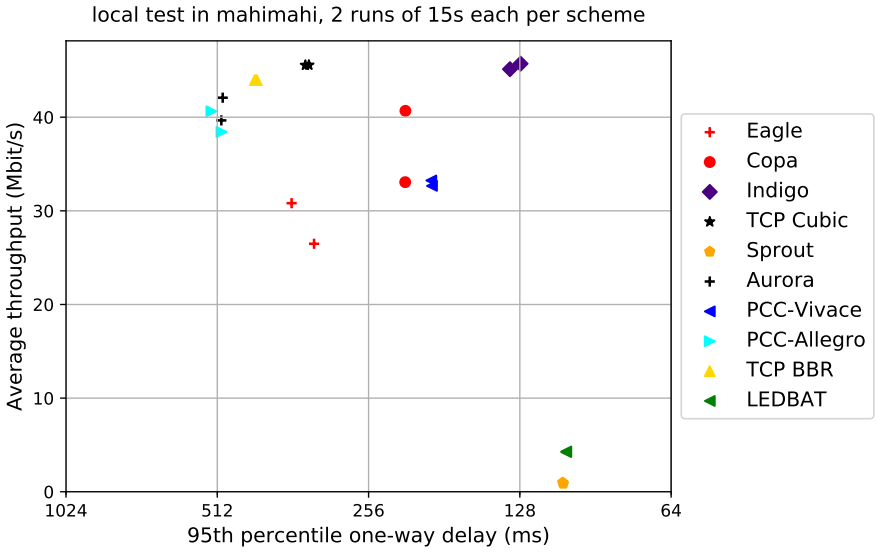
Generated at 2019-07-31 05:24:36 (UTC).
Tested in mahimahi: `mm-delay 100 mm-link 50mbps.trace 50mbps.trace`
Repeated the test of 10 congestion control schemes twice.
Each test lasted for 15 seconds running 1 flow.

```
System info:
Linux 4.15.0-54-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 @ 8cca7b284d3d4ff7c1e1a077655dc88e7efe6557
third_party/aurora @ f3e943d61015b39960854ba6391797e0c7984d74
third_party/aurora-model @ e292c316c23fb837255c4e142e40590d154bbe95
third_party/eagle @ f66d3a824f0abdd3b1d0afc0cc323607b2c38eca
 D sender-receiver/sender-receiver/sender_receiver/envs/model-xentropy.pt
third_party/fillp @ d6da1459332fcee56963885d7eba17e6a32d4519
third_party/fillp-sheep @ 0e5bb722943babcd2b090d2c64fcd45e12e923f9
third_party/genericCC @ d0153f8e594aa89e93b032143cedbdfe58e562f4
third_party/gold @ e47bed6d7495aa223eec8de2c7a43035967074ef
 M environment/__pycache__/datagram_pb2.cpython-36.opt-1.pyc
 M environment/__pycache__/datagram_pb2.cpython-36.pyc
 M environment/__pycache__/environment.cpython-36.opt-1.pyc
 M environment/__pycache__/helpers.cpython-36.opt-1.pyc
 M environment/__pycache__/helpers.cpython-36.pyc
 M environment/__pycache__/mahimahi.cpython-36.opt-1.pyc
 M environment/__pycache__/project_root.cpython-36.opt-1.pyc
 M environment/__pycache__/project_root.cpython-36.pyc
 M environment/__pycache__/receiver.cpython-36.opt-1.pyc
 M environment/__pycache__/receiver.cpython-36.pyc
 M environment/logs.txt
 M model
third_party/goldLSTM @ 6b512ee75b163fd680d7bf3cde4cf6d6aa7102c4
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/verus @ d4b447ea74c6c60a261149af2629562939f9a494
 M src/verus.hpp
 M tools/plot.py
third_party/vivace @ 2baf86211435ae071a32f96b7d8c504587f5d7f4
third_party/webrtc @ 3f0cc2a9061a41b6f9dde4735770d143a1fa2851
```


local test in mahimahi, 2 runs of 15s each per scheme
(mean of all runs by scheme)
TCP Cubic
Indigo
TCP BBR
Aurora
PCC-Allegro
Copa
PCC-Vivace
Eagle
LEDBAT
Sprout
Average throughput (Mbit/s)
0
10
20
30
40
1024
512
256
128
64
95th percentile one-way delay (ms)


local test in mahimahi, 2 runs of 15s each per scheme
Average throughput (Mbit/s)
0
10
20
30
40
1024
512
256
128
64
95th percentile one-way delay (ms)
Eagle
Copa
Indigo
TCP Cubic
Sprout
Aurora
PCC-Vivace
PCC-Allegro
TCP BBR
LEDBAT

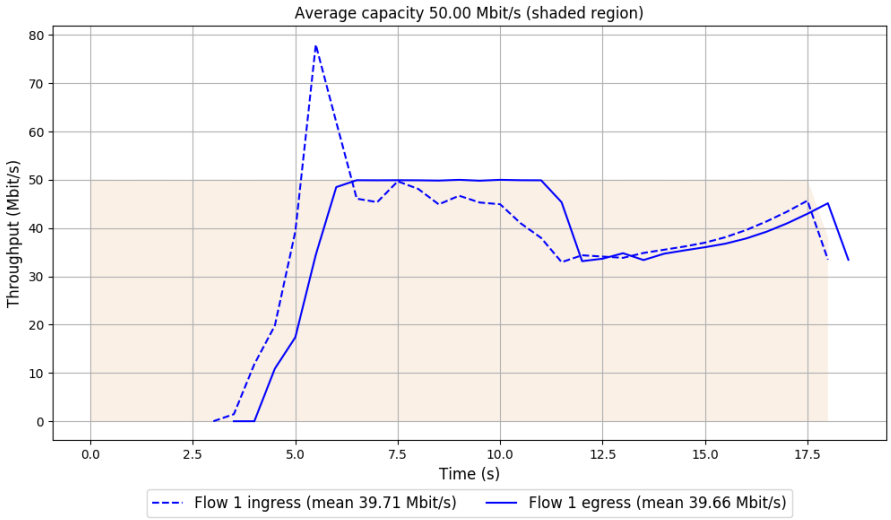
scheme	# runs	mean avg tput (Mbit/s) flow 1	mean 95th-%ile delay (ms) flow 1	mean loss rate (%) flow 1
Aurora	2	40.87	501.00	0.78
TCP BBR	2	43.97	429.13	0.93
Copa	2	36.87	216.33	0.68
TCP Cubic	2	45.56	339.23	2.25
Eagle	2	28.65	346.42	1.12
Indigo	2	45.42	130.75	0.79
LEDBAT	2	4.27	103.51	0.72
PCC-Allegro	2	39.53	514.09	1.00
Sprout	2	0.93	105.01	0.01
PCC-Vivace	2	32.95	191.78	0.77

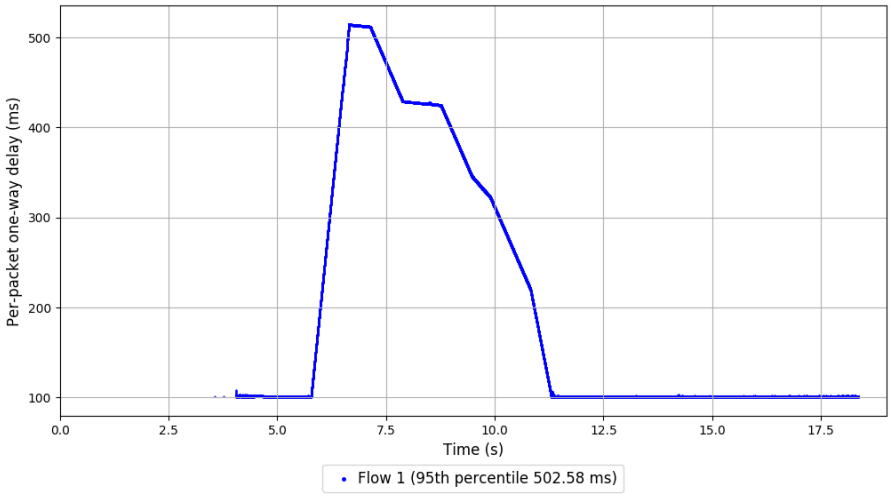
```
Run 1: Statistics of Aurora

Start at: 2019-07-31 05:18:06
End at: 2019-07-31 05:18:21

# Below is generated by plot.py at 2019-07-31 05:23:52
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 39.66 Mbit/s (79.3% utilization)
95th percentile per-packet one-way delay: 502.578 ms
Loss rate: 0.82%
-- Flow 1:
Average throughput: 39.66 Mbit/s
95th percentile per-packet one-way delay: 502.578 ms
Loss rate: 0.82%
```

Run 1: Report of Aurora — Data Link



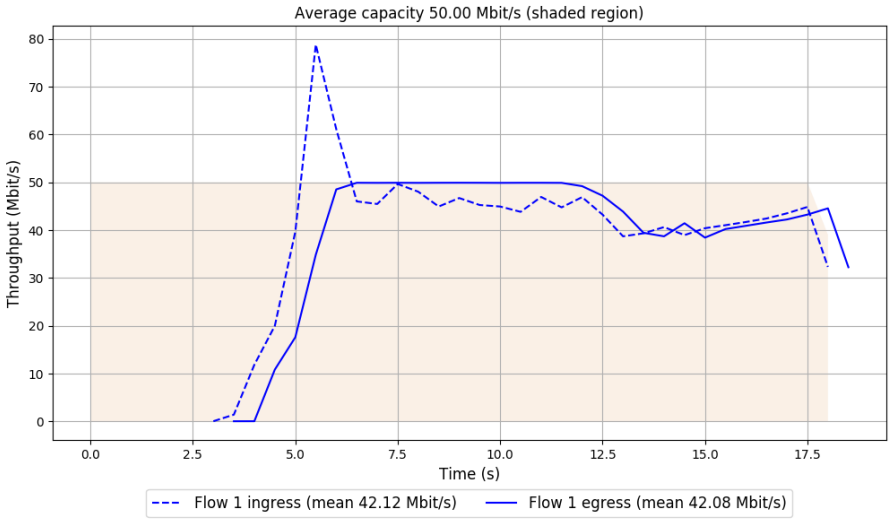


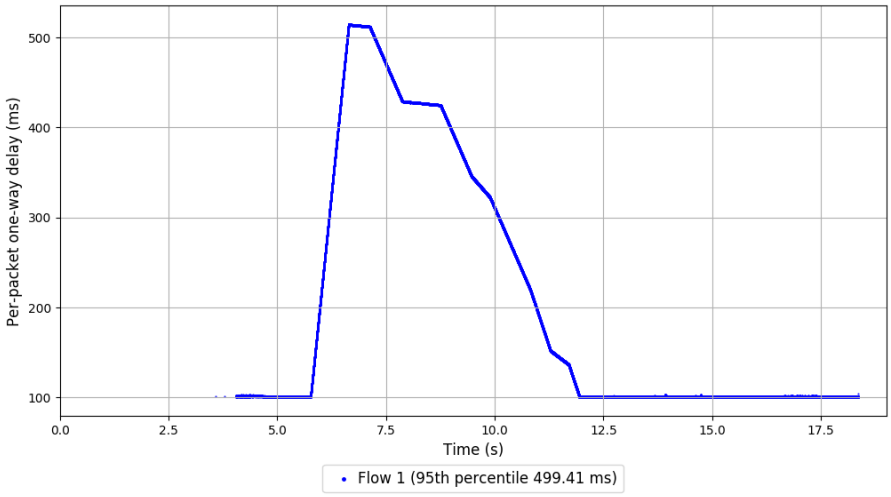
```
Run 2: Statistics of Aurora

Start at: 2019-07-31 05:21:34
End at: 2019-07-31 05:21:49

# Below is generated by plot.py at 2019-07-31 05:23:52
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 42.08 Mbit/s (84.2% utilization)
95th percentile per-packet one-way delay: 499.412 ms
Loss rate: 0.75%
-- Flow 1:
Average throughput: 42.08 Mbit/s
95th percentile per-packet one-way delay: 499.412 ms
Loss rate: 0.75%
```

Run 2: Report of Aurora — Data Link



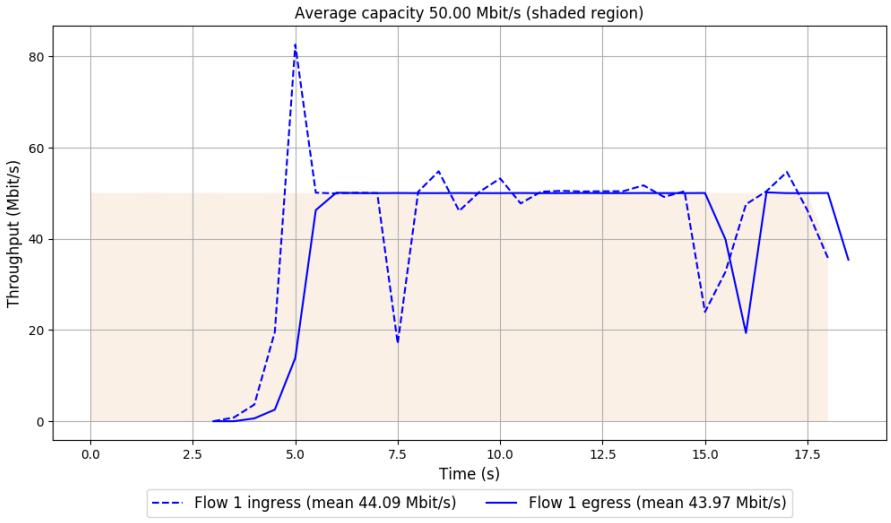


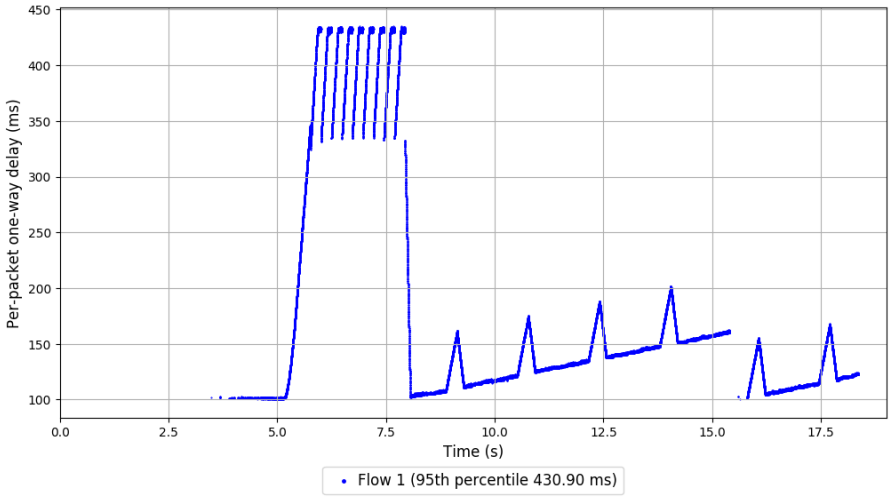
```
Run 1: Statistics of TCP BBR

Start at: 2019-07-31 05:15:40
End at: 2019-07-31 05:15:55

# Below is generated by plot.py at 2019-07-31 05:23:52
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 43.97 Mbit/s (87.9% utilization)
95th percentile per-packet one-way delay: 430.900 ms
Loss rate: 0.94%
-- Flow 1:
Average throughput: 43.97 Mbit/s
95th percentile per-packet one-way delay: 430.900 ms
Loss rate: 0.94%
```

Run 1: Report of TCP BBR — Data Link



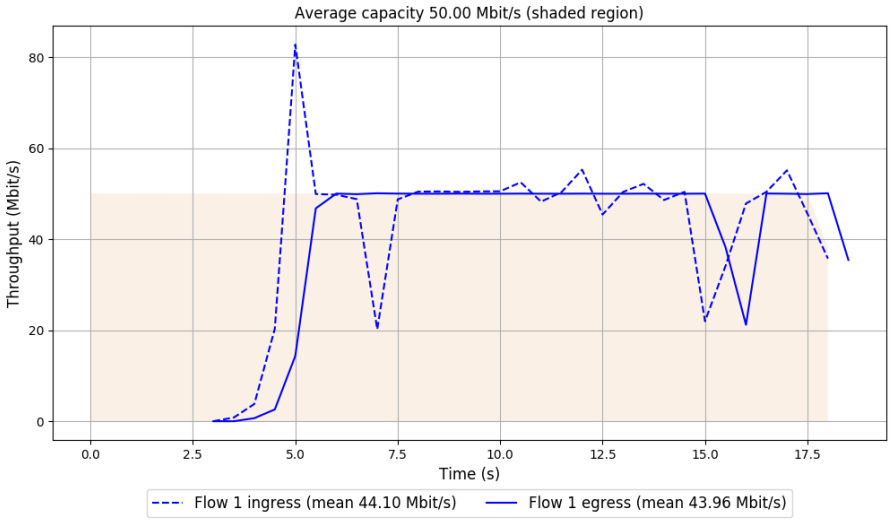


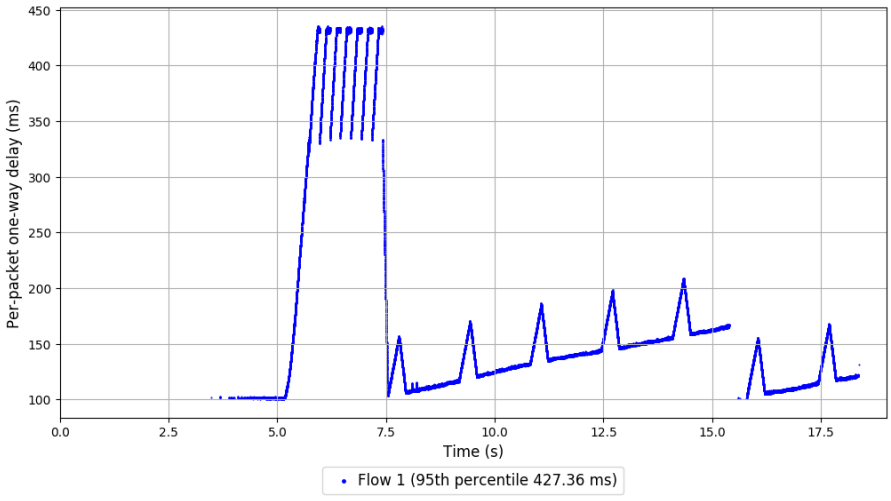
```
Run 2: Statistics of TCP BBR

Start at: 2019-07-31 05:19:08
End at: 2019-07-31 05:19:23

# Below is generated by plot.py at 2019-07-31 05:23:52
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 43.96 Mbit/s (87.9% utilization)
95th percentile per-packet one-way delay: 427.364 ms
Loss rate: 0.92%
-- Flow 1:
Average throughput: 43.96 Mbit/s
95th percentile per-packet one-way delay: 427.364 ms
Loss rate: 0.92%
```

Run 2: Report of TCP BBR — Data Link



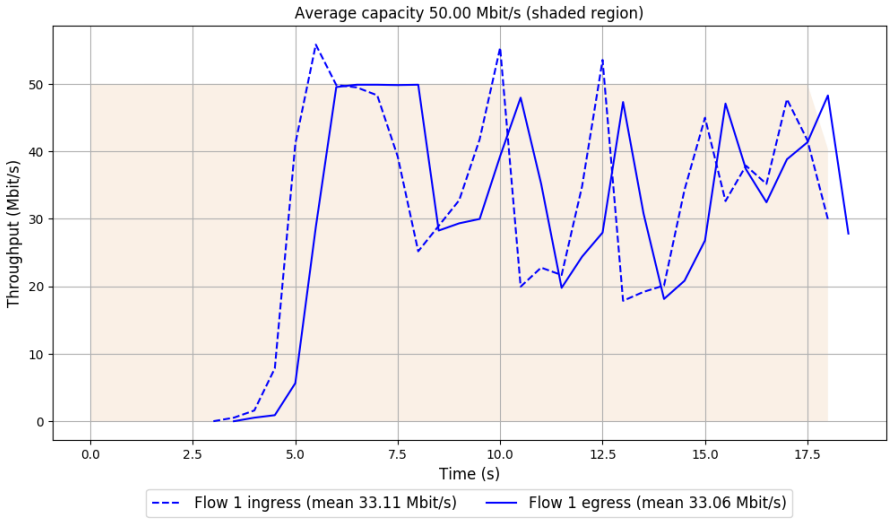


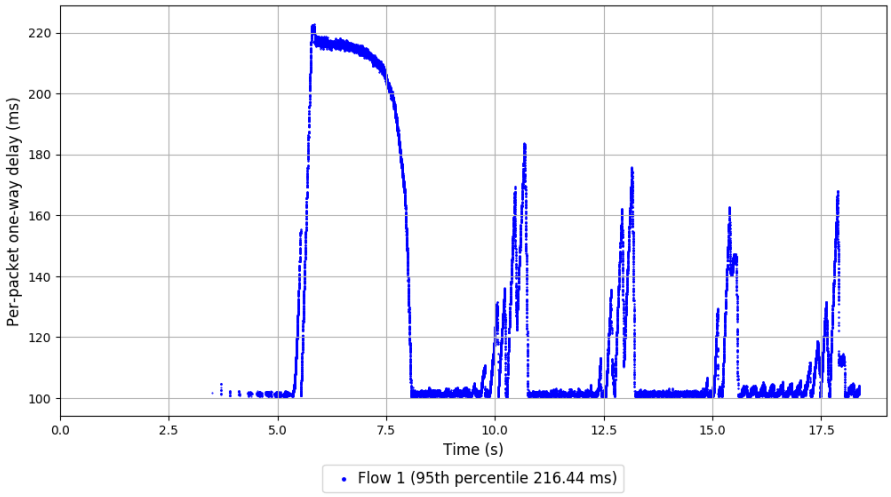
```
Run 1: Statistics of Copa

Start at: 2019-07-31 05:17:25
End at: 2019-07-31 05:17:40

# Below is generated by plot.py at 2019-07-31 05:23:52
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 33.06 Mbit/s (66.1% utilization)
95th percentile per-packet one-way delay: 216.440 ms
Loss rate: 0.81%
-- Flow 1:
Average throughput: 33.06 Mbit/s
95th percentile per-packet one-way delay: 216.440 ms
Loss rate: 0.81%
```

Run 1: Report of Copa — Data Link



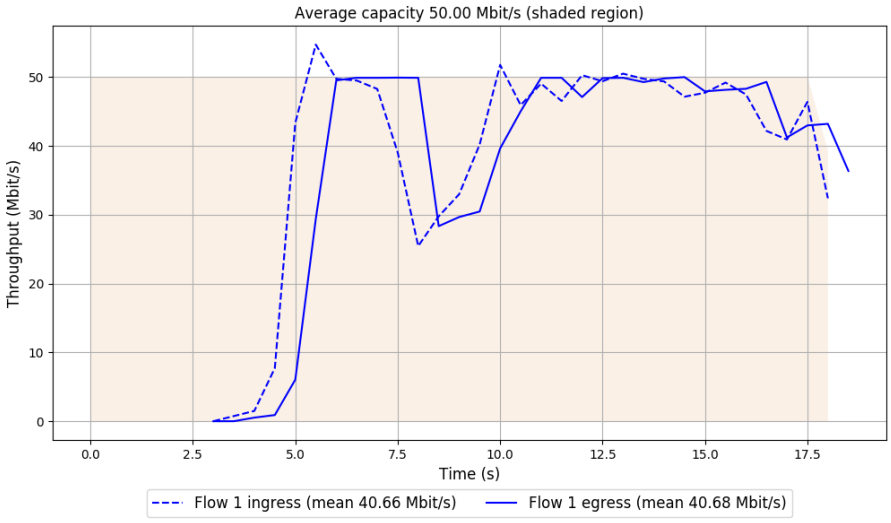


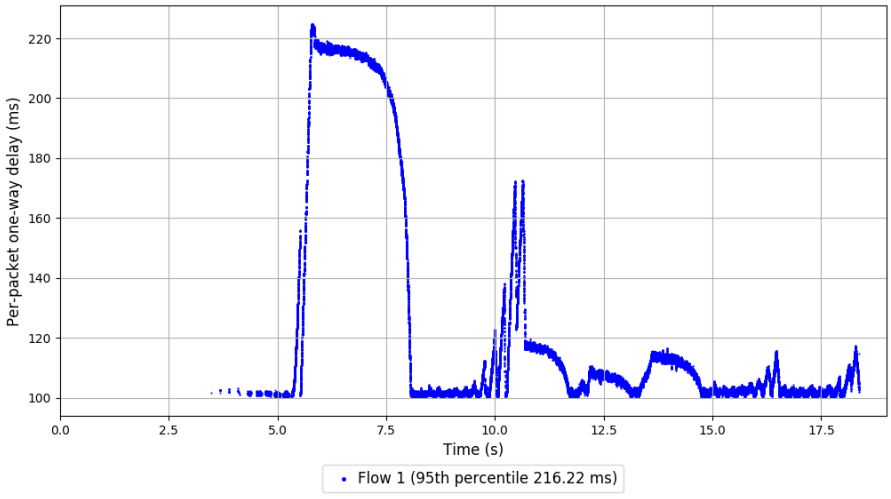
```
Run 2: Statistics of Copa

Start at: 2019-07-31 05:20:52
End at: 2019-07-31 05:21:08

# Below is generated by plot.py at 2019-07-31 05:23:54
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 40.68 Mbit/s (81.4% utilization)
95th percentile per-packet one-way delay: 216.225 ms
Loss rate: 0.55%
-- Flow 1:
Average throughput: 40.68 Mbit/s
95th percentile per-packet one-way delay: 216.225 ms
Loss rate: 0.55%
```

Run 2: Report of Copa — Data Link



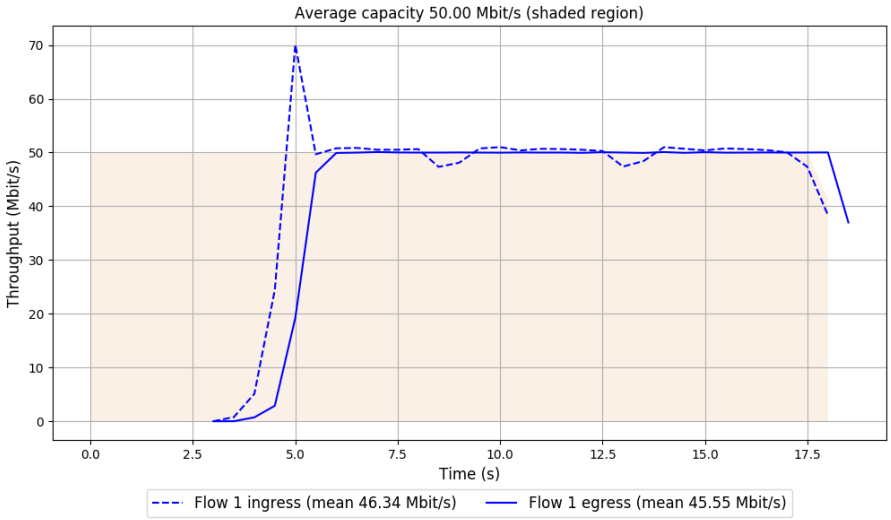


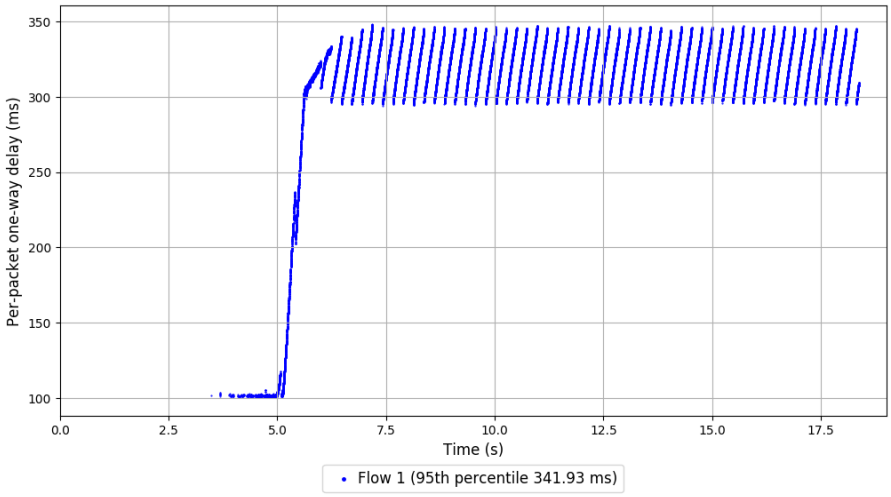
```
Run 1: Statistics of TCP Cubic

Start at: 2019-07-31 05:16:43
End at: 2019-07-31 05:16:58

# Below is generated by plot.py at 2019-07-31 05:24:07
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 45.55 Mbit/s (91.1% utilization)
95th percentile per-packet one-way delay: 341.926 ms
Loss rate: 2.34%
-- Flow 1:
Average throughput: 45.55 Mbit/s
95th percentile per-packet one-way delay: 341.926 ms
Loss rate: 2.34%
```

Run 1: Report of TCP Cubic — Data Link



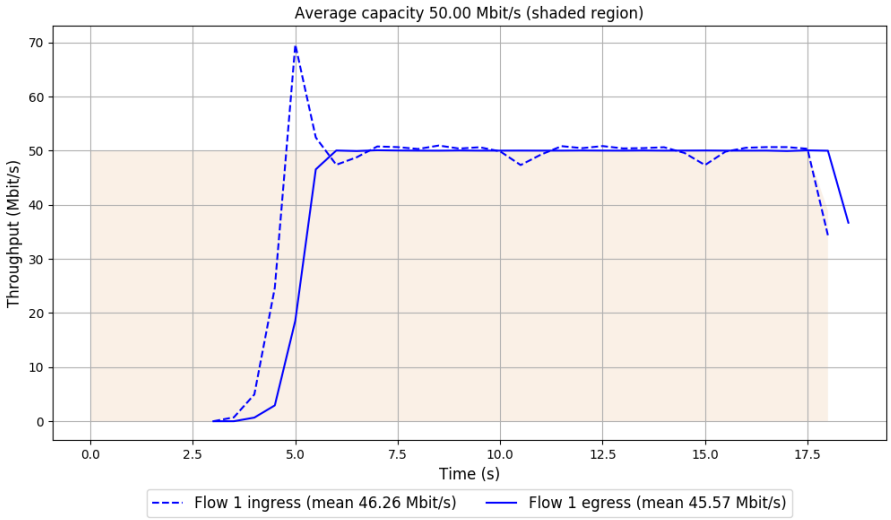


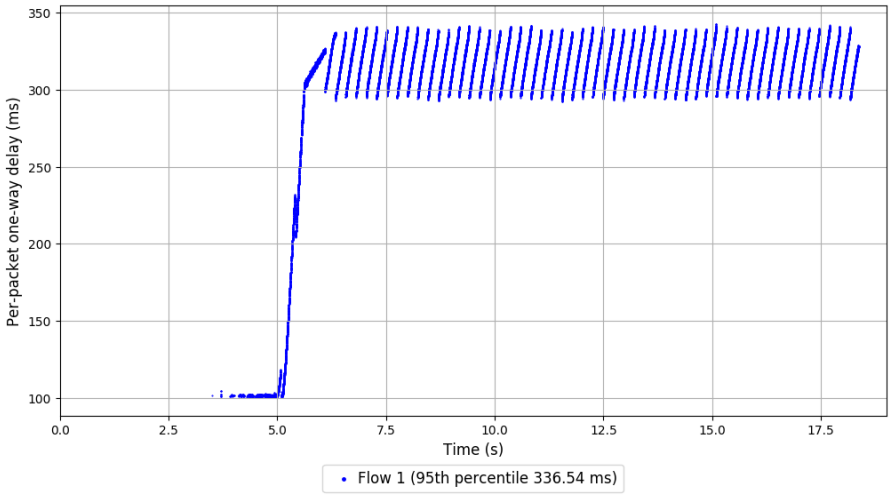
```
Run 2: Statistics of TCP Cubic

Start at: 2019-07-31 05:20:10
End at: 2019-07-31 05:20:25

# Below is generated by plot.py at 2019-07-31 05:24:07
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 45.57 Mbit/s (91.1% utilization)
95th percentile per-packet one-way delay: 336.541 ms
Loss rate: 2.16%
-- Flow 1:
Average throughput: 45.57 Mbit/s
95th percentile per-packet one-way delay: 336.541 ms
Loss rate: 2.16%
```

Run 2: Report of TCP Cubic — Data Link



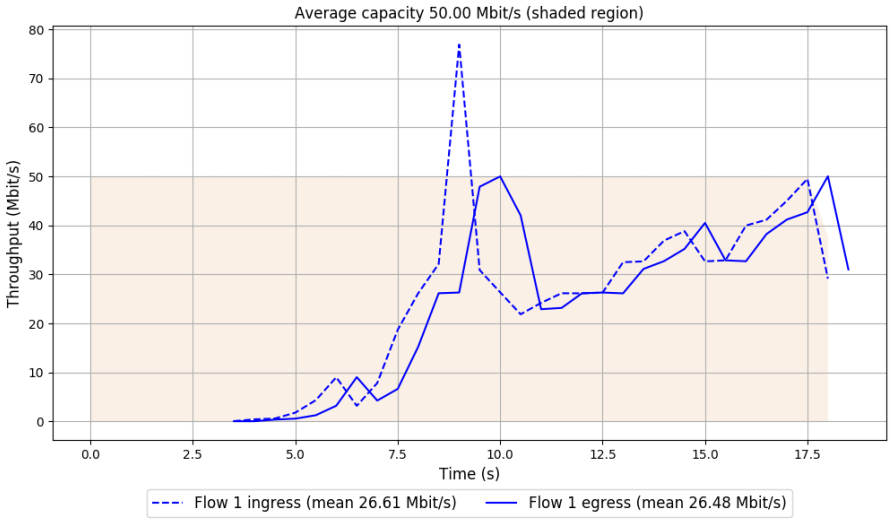


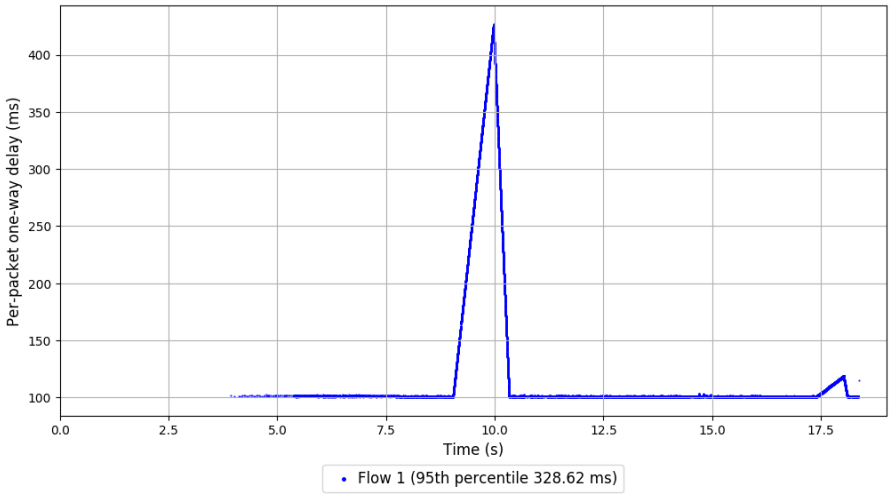
```
Run 1: Statistics of Eagle

Start at: 2019-07-31 05:15:20
End at: 2019-07-31 05:15:35

# Below is generated by plot.py at 2019-07-31 05:24:07
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 26.48 Mbit/s (53.0% utilization)
95th percentile per-packet one-way delay: 328.620 ms
Loss rate: 1.07%
-- Flow 1:
Average throughput: 26.48 Mbit/s
95th percentile per-packet one-way delay: 328.620 ms
Loss rate: 1.07%
```

Run 1: Report of Eagle — Data Link



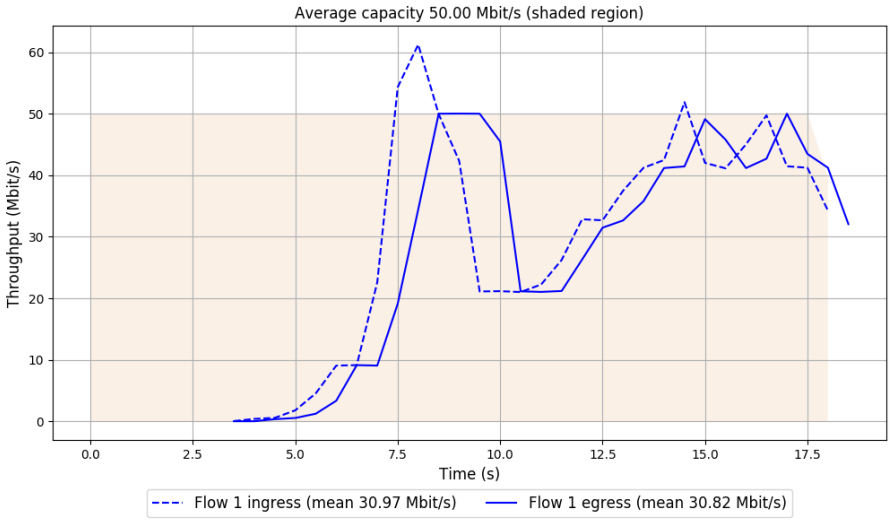


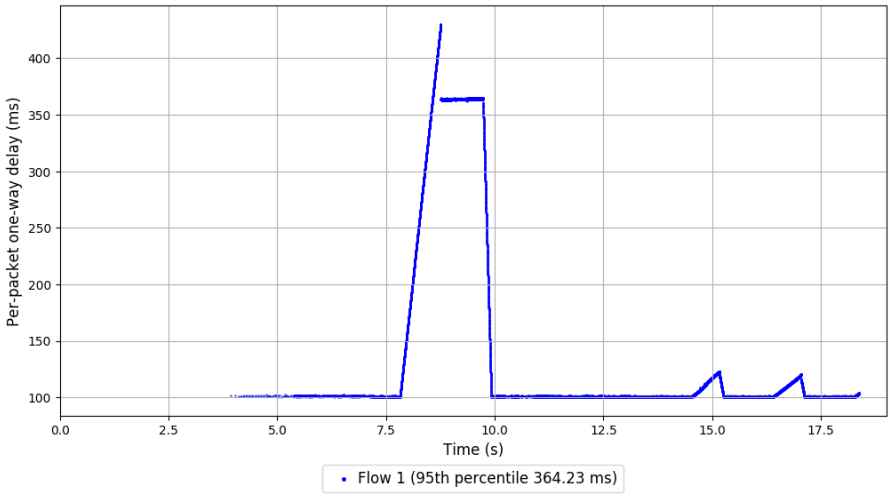
```
Run 2: Statistics of Eagle

Start at: 2019-07-31 05:18:47
End at: 2019-07-31 05:19:02

# Below is generated by plot.py at 2019-07-31 05:24:09
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 30.82 Mbit/s (61.6% utilization)
95th percentile per-packet one-way delay: 364.228 ms
Loss rate: 1.18%
-- Flow 1:
Average throughput: 30.82 Mbit/s
95th percentile per-packet one-way delay: 364.228 ms
Loss rate: 1.18%
```

Run 2: Report of Eagle — Data Link



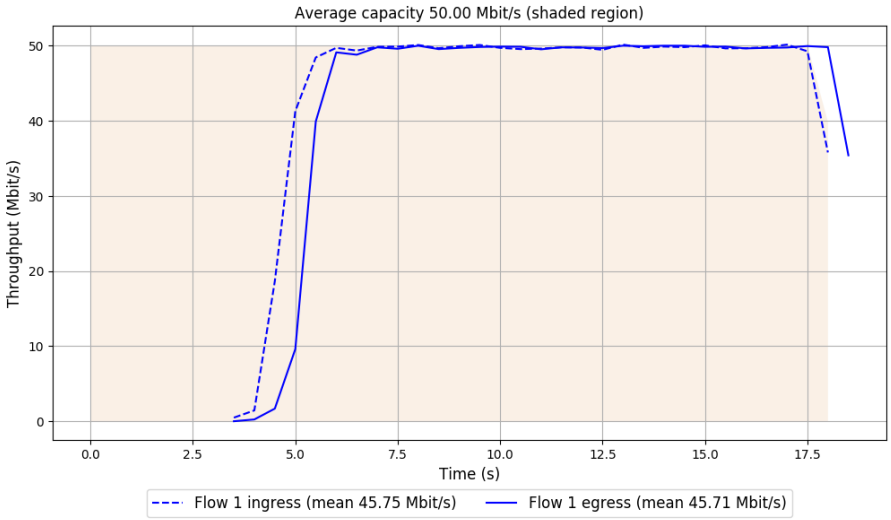


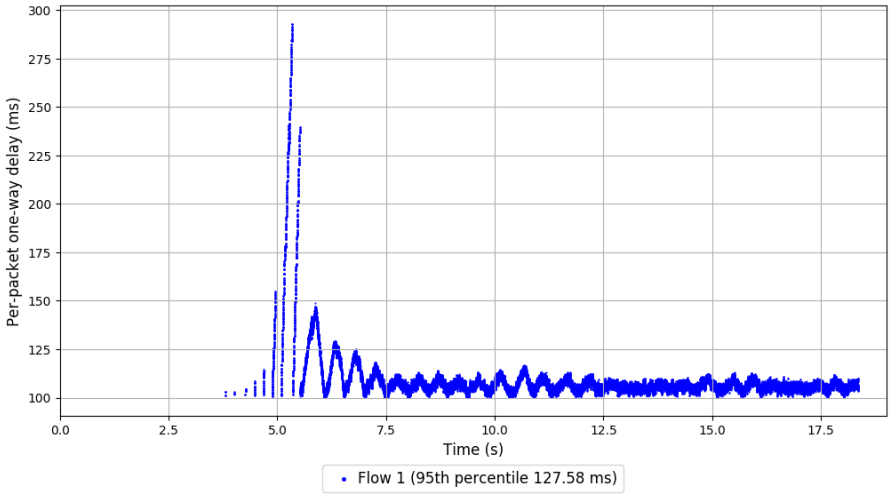
```
Run 1: Statistics of Indigo

Start at: 2019-07-31 05:17:04
End at: 2019-07-31 05:17:19

# Below is generated by plot.py at 2019-07-31 05:24:17
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 45.71 Mbit/s (91.4% utilization)
95th percentile per-packet one-way delay: 127.579 ms
Loss rate: 0.78%
-- Flow 1:
Average throughput: 45.71 Mbit/s
95th percentile per-packet one-way delay: 127.579 ms
Loss rate: 0.78%
```

Run 1: Report of Indigo — Data Link



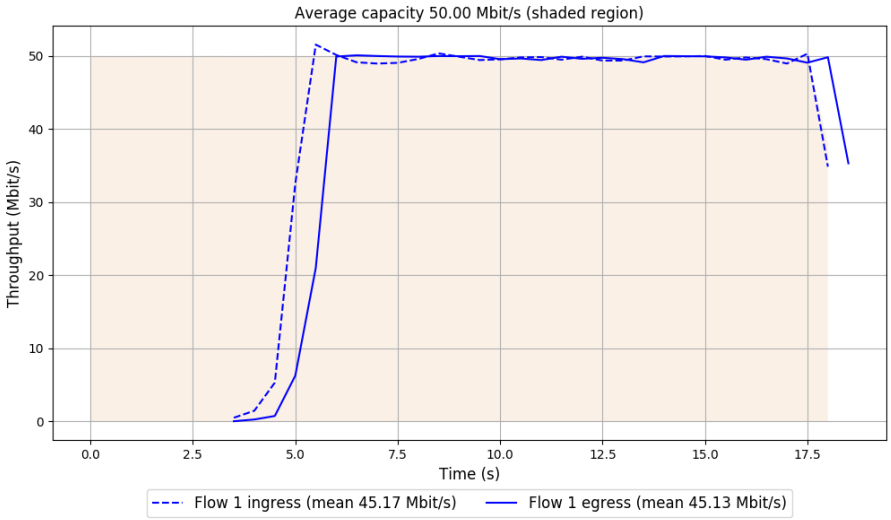


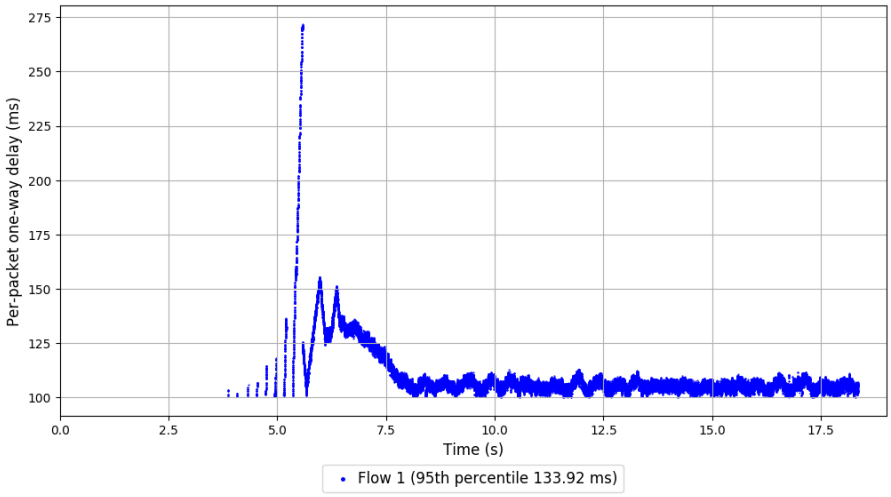
```
Run 2: Statistics of Indigo

Start at: 2019-07-31 05:20:31
End at: 2019-07-31 05:20:46

# Below is generated by plot.py at 2019-07-31 05:24:20
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 45.13 Mbit/s (90.2% utilization)
95th percentile per-packet one-way delay: 133.923 ms
Loss rate: 0.79%
-- Flow 1:
Average throughput: 45.13 Mbit/s
95th percentile per-packet one-way delay: 133.923 ms
Loss rate: 0.79%
```

Run 2: Report of Indigo — Data Link



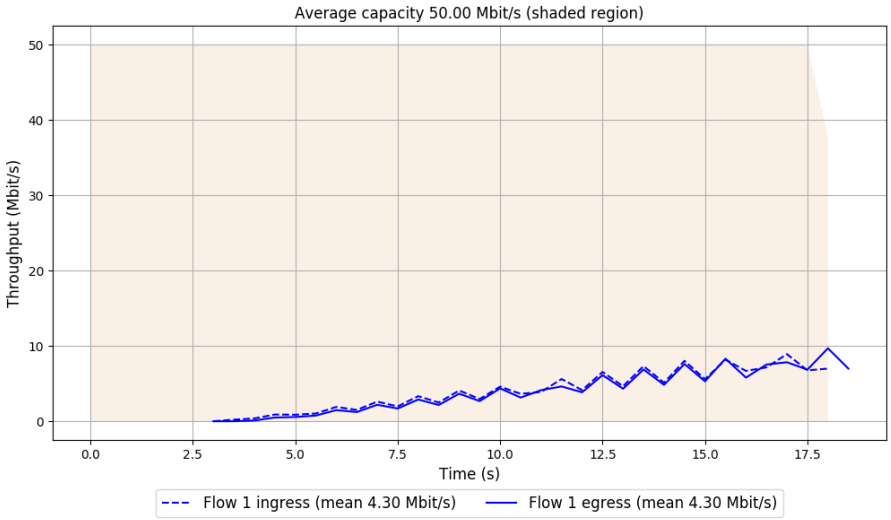


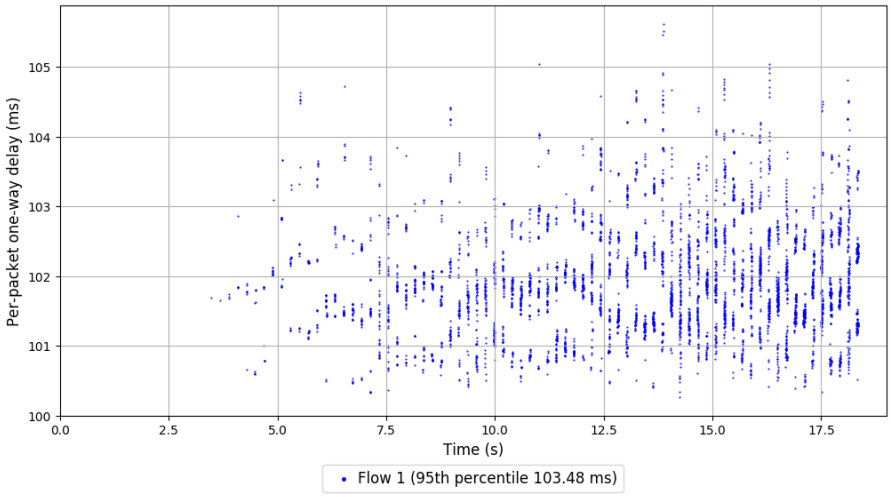
```
Run 1: Statistics of LEDBAT

Start at: 2019-07-31 05:18:28
End at: 2019-07-31 05:18:43

# Below is generated by plot.py at 2019-07-31 05:24:20
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 4.30 Mbit/s (8.6% utilization)
95th percentile per-packet one-way delay: 103.476 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 4.30 Mbit/s
95th percentile per-packet one-way delay: 103.476 ms
Loss rate: 0.00%
```

Run 1: Report of LEDBAT — Data Link



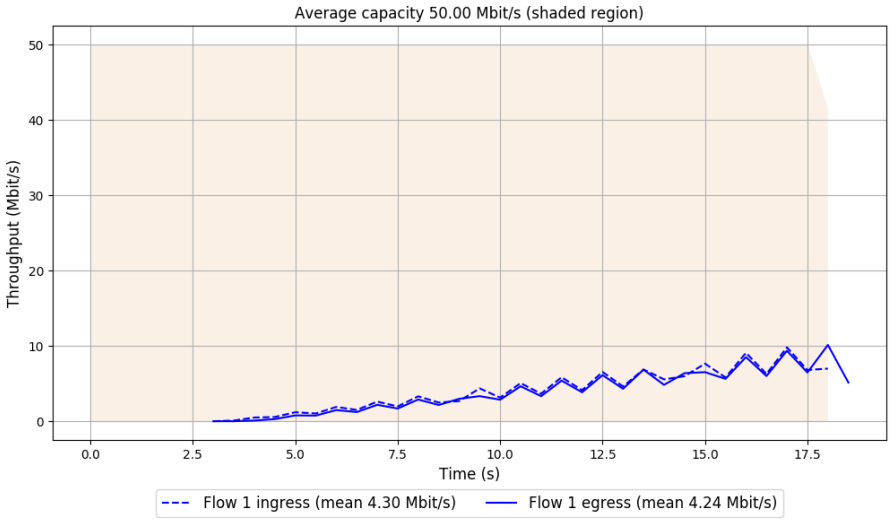


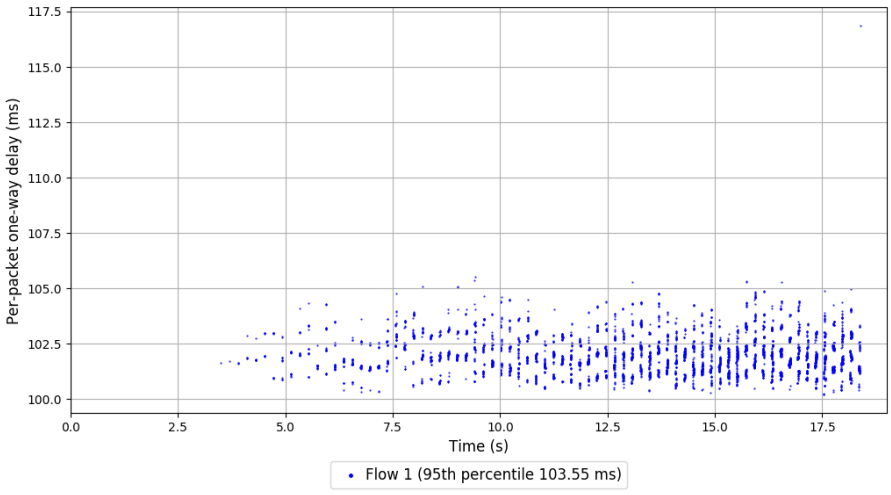
```
Run 2: Statistics of LEDBAT

Start at: 2019-07-31 05:21:56
End at: 2019-07-31 05:22:11

# Below is generated by plot.py at 2019-07-31 05:24:20
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 4.24 Mbit/s (8.5% utilization)
95th percentile per-packet one-way delay: 103.550 ms
Loss rate: 1.45%
-- Flow 1:
Average throughput: 4.24 Mbit/s
95th percentile per-packet one-way delay: 103.550 ms
Loss rate: 1.45%
```

Run 2: Report of LEDBAT — Data Link



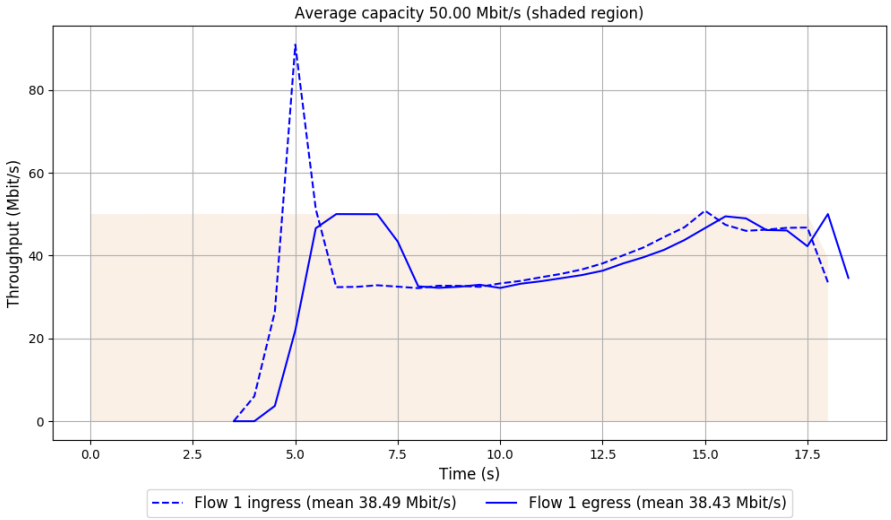


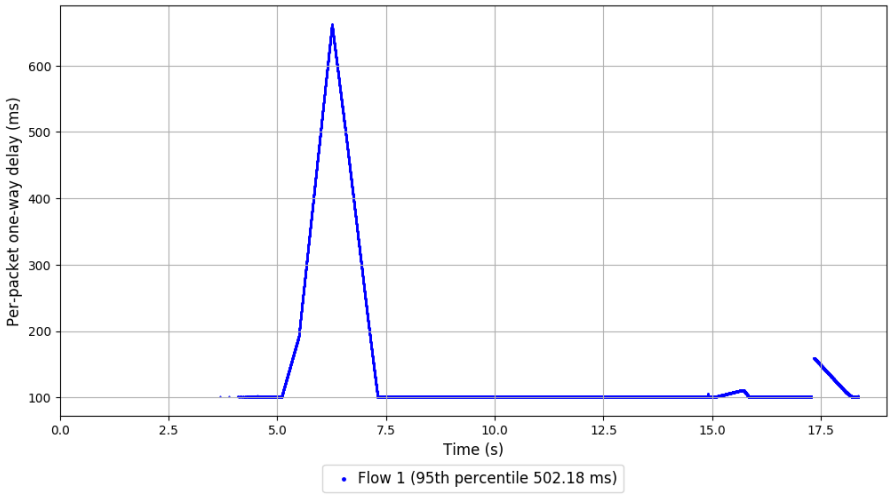
```
Run 1: Statistics of PCC-Allegro

Start at: 2019-07-31 05:16:22
End at: 2019-07-31 05:16:37

# Below is generated by plot.py at 2019-07-31 05:24:29
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 38.43 Mbit/s (76.9% utilization)
95th percentile per-packet one-way delay: 502.175 ms
Loss rate: 0.84%
-- Flow 1:
Average throughput: 38.43 Mbit/s
95th percentile per-packet one-way delay: 502.175 ms
Loss rate: 0.84%
```

Run 1: Report of PCC-Allegro — Data Link



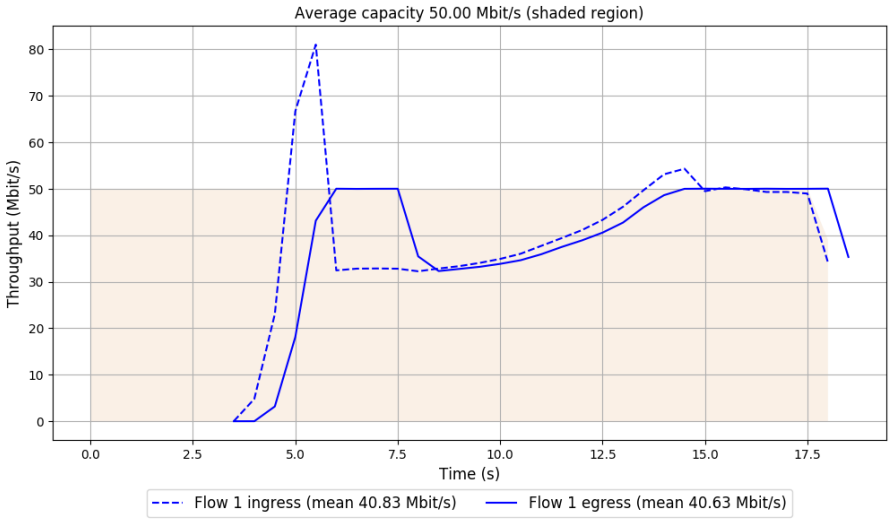


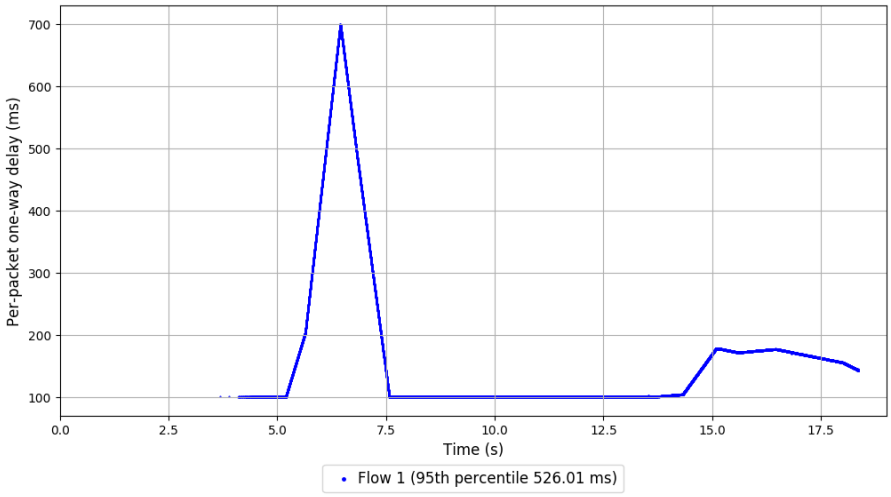
```
Run 2: Statistics of PCC-Allegro

Start at: 2019-07-31 05:19:50
End at: 2019-07-31 05:20:05

# Below is generated by plot.py at 2019-07-31 05:24:31
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 40.63 Mbit/s (81.3% utilization)
95th percentile per-packet one-way delay: 526.008 ms
Loss rate: 1.16%
-- Flow 1:
Average throughput: 40.63 Mbit/s
95th percentile per-packet one-way delay: 526.008 ms
Loss rate: 1.16%
```

Run 2: Report of PCC-Allegro — Data Link



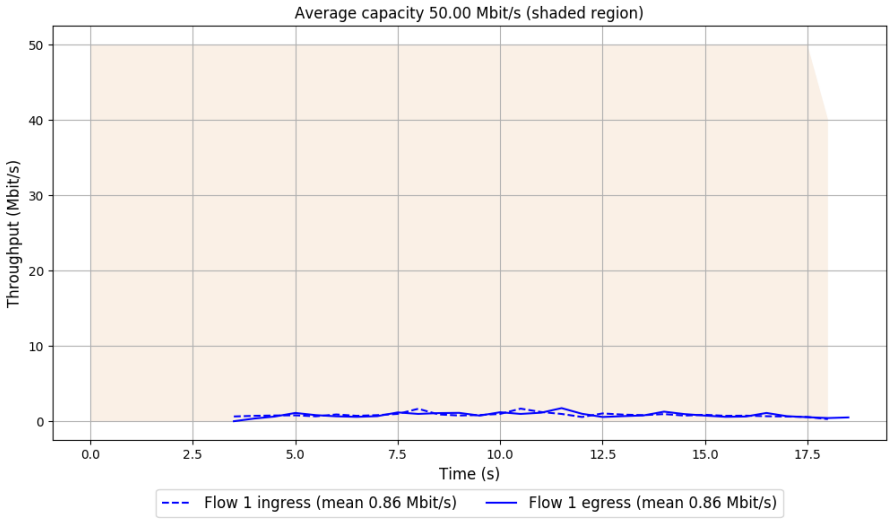


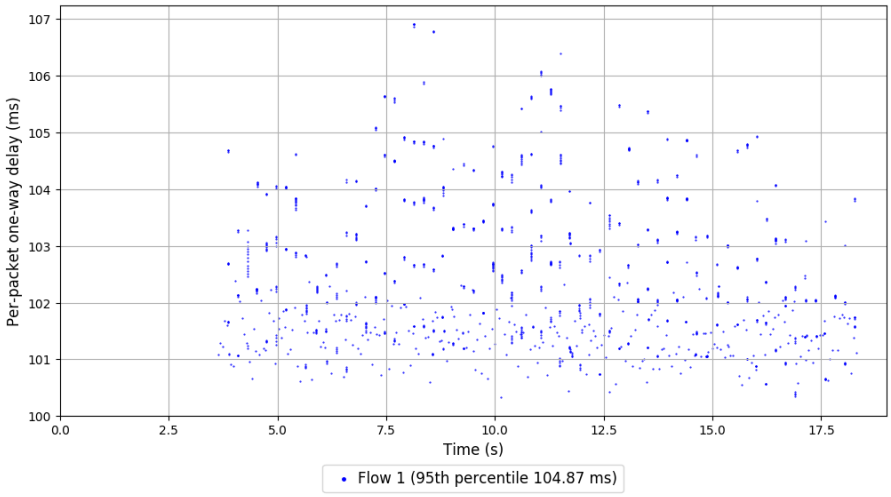
```
Run 1: Statistics of Sprout

Start at: 2019-07-31 05:17:46
End at: 2019-07-31 05:18:01

# Below is generated by plot.py at 2019-07-31 05:24:31
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 0.86 Mbit/s (1.7% utilization)
95th percentile per-packet one-way delay: 104.869 ms
Loss rate: 0.01%
-- Flow 1:
Average throughput: 0.86 Mbit/s
95th percentile per-packet one-way delay: 104.869 ms
Loss rate: 0.01%
```

Run 1: Report of Sprout — Data Link



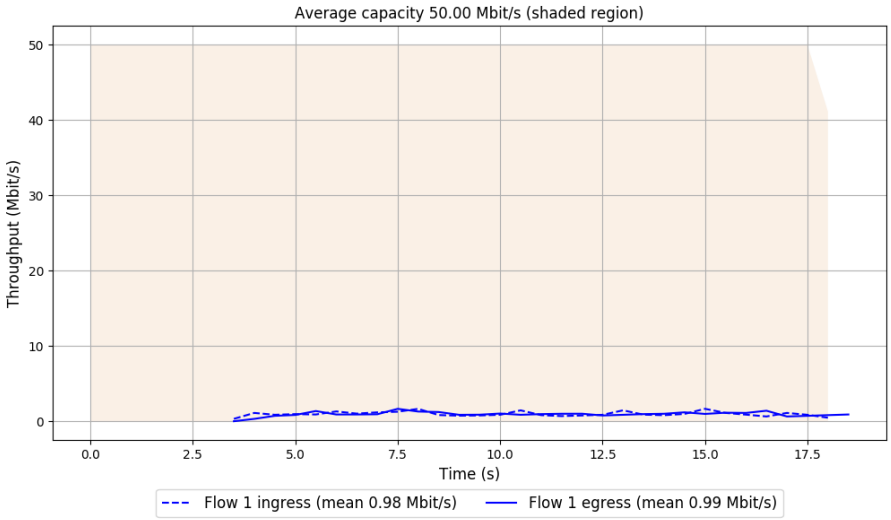


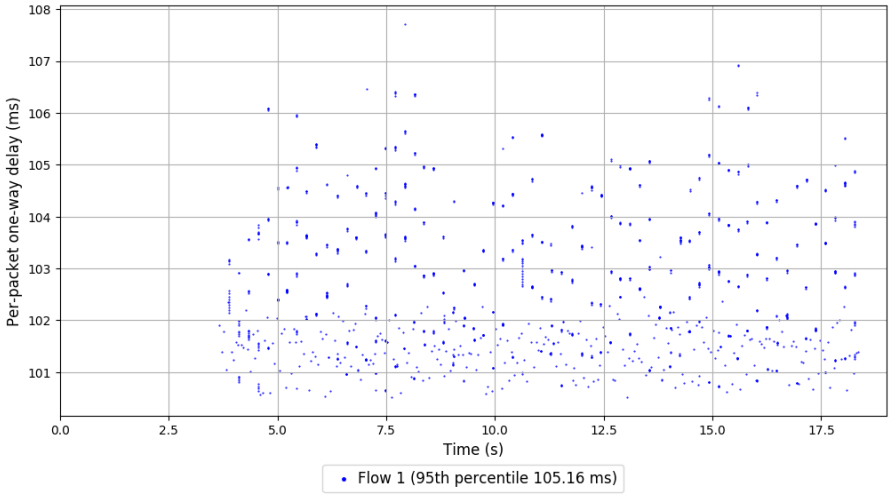
```
Run 2: Statistics of Sprout

Start at: 2019-07-31 05:21:14
End at: 2019-07-31 05:21:29

# Below is generated by plot.py at 2019-07-31 05:24:31
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 0.99 Mbit/s (2.0% utilization)
95th percentile per-packet one-way delay: 105.160 ms
Loss rate: 0.01%
-- Flow 1:
Average throughput: 0.99 Mbit/s
95th percentile per-packet one-way delay: 105.160 ms
Loss rate: 0.01%
```

Run 2: Report of Sprout — Data Link



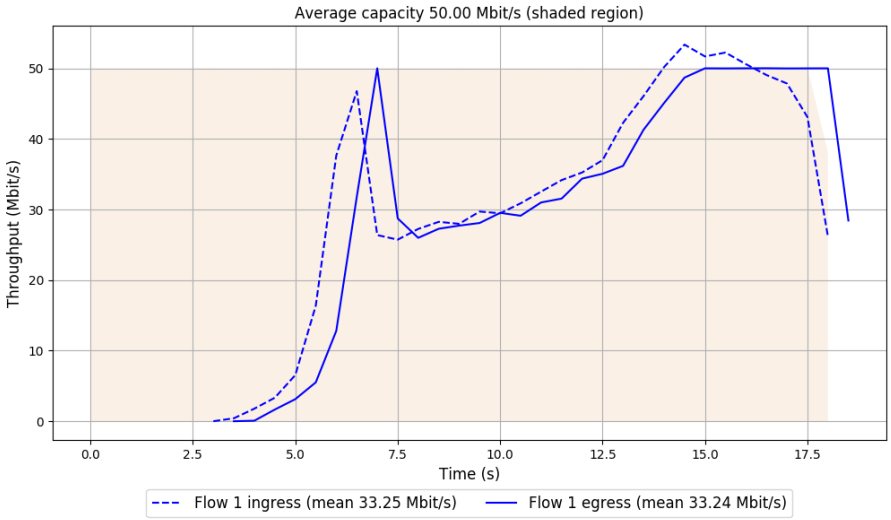


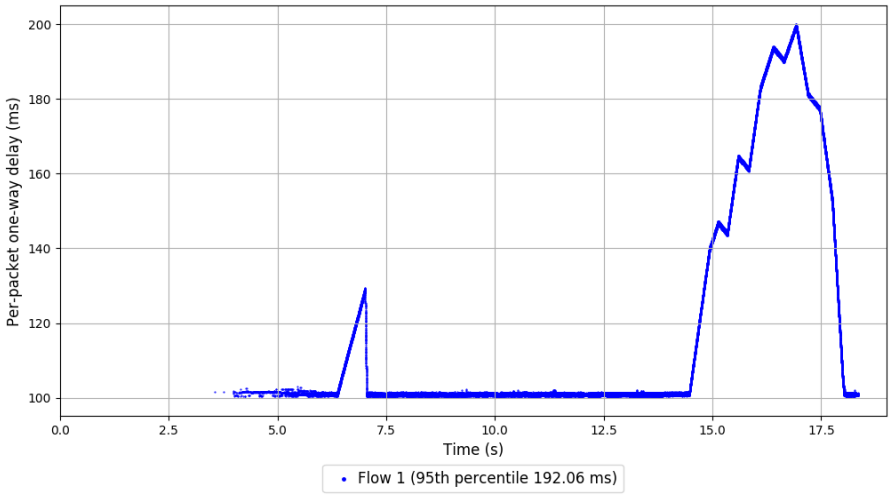
```
Run 1: Statistics of PCC-Vivace

Start at: 2019-07-31 05:16:01
End at: 2019-07-31 05:16:16

# Below is generated by plot.py at 2019-07-31 05:24:33
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 33.24 Mbit/s (66.5% utilization)
95th percentile per-packet one-way delay: 192.060 ms
Loss rate: 0.70%
-- Flow 1:
Average throughput: 33.24 Mbit/s
95th percentile per-packet one-way delay: 192.060 ms
Loss rate: 0.70%
```

Run 1: Report of PCC-Vivace — Data Link





```
Run 2: Statistics of PCC-Vivace

Start at: 2019-07-31 05:19:29
End at: 2019-07-31 05:19:44

# Below is generated by plot.py at 2019-07-31 05:24:33
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 32.66 Mbit/s (65.3% utilization)
95th percentile per-packet one-way delay: 191.493 ms
Loss rate: 0.84%
-- Flow 1:
Average throughput: 32.66 Mbit/s
95th percentile per-packet one-way delay: 191.493 ms
Loss rate: 0.84%
```

Run 2: Report of PCC-Vivace — Data Link