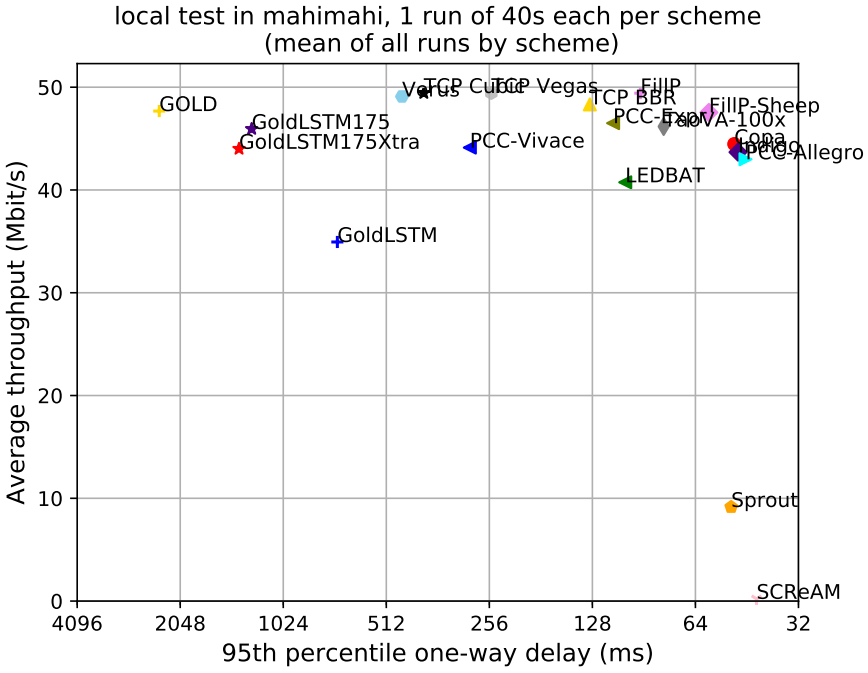
Pantheon Report

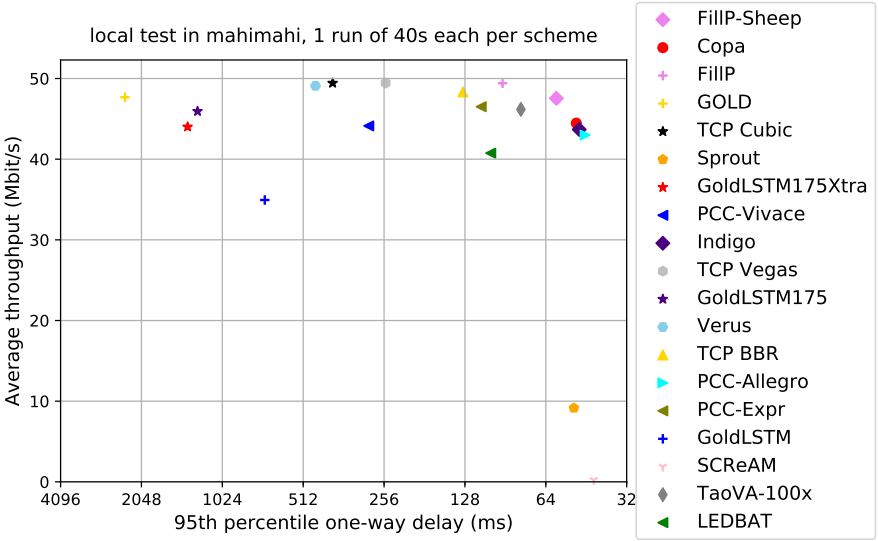
Generated at 2019-07-05 01:28:11 (UTC).
Tested in mahimahi: `mm-delay 40 mm-link 50mbps.trace 100mbps.trace`
Repeated the test of 21 congestion control schemes once.
Each test lasted for 40 seconds running 1 flow.

```
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 @ 8caa0108120a1e5cbbb30238efe7954fa55fbd8d
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 @ 48278d12dd5c310d9876b568565b3e79d402d177
third_party/goldLSTM175 @ 487b326701c3480223e589a62eea8fc843c59cd2
third_party/goldLSTM175xtra @ 951e46757c5e7aefba4e71d4211e40f479612e5f
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, 1 run of 40s each per scheme
(mean of all runs by scheme)
Average throughput (Mbit/s)
95th percentile one-way delay (ms)
GOLD
Verus
TCP Cubic
TCP Vegas
FillP
TCP BBR
FillP-Sheep
PCC-Expr
TaoVA-100x
Copa
Indigo
PCC-Allegro
GoldLSTM175
GoldLSTM175Xtra
PCC-Vivace
LEDBAT
GoldLSTM
Sprout
SCReAM


local test in mahimahi, 1 run of 40s each per scheme
Average throughput (Mbit/s)
95th percentile one-way delay (ms)
FillP-Sheep
Copa
FillP
GOLD
TCP Cubic
Sprout
GoldLSTM175Xtra
PCC-Vivace
Indigo
TCP Vegas
GoldLSTM175
Verus
TCP BBR
PCC-Allegro
PCC-Expr
GoldLSTM
SCReAM
TaoVA-100x
LEDBAT

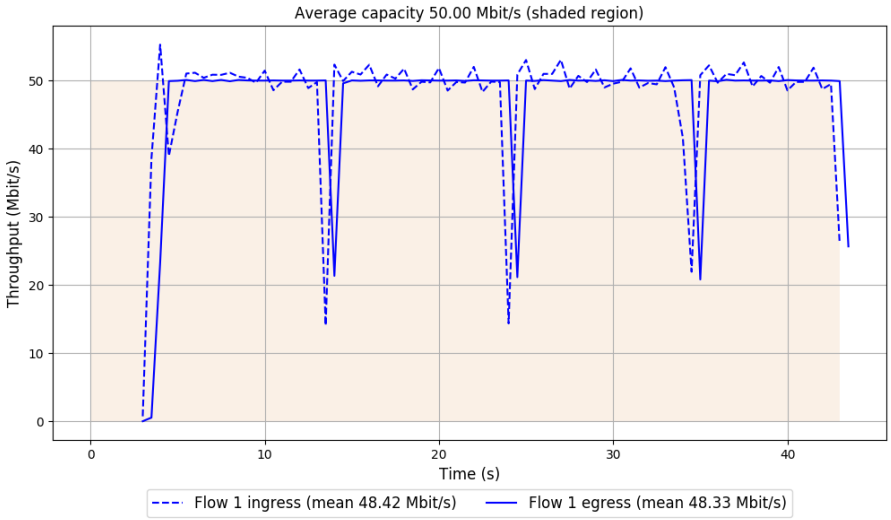
scheme	# runs	mean avg tput (Mbit/s) flow 1	mean 95th-%ile delay (ms) flow 1	mean loss rate (%) flow 1
TCP BBR	1	48.33	130.19	0.31
Copa	1	44.47	49.29	0.12
TCP Cubic	1	49.44	397.86	0.92
FillP	1	49.42	92.71	0.23
FillP-Sheep	1	47.54	58.47	0.13
GOLD	1	47.68	2358.46	3.70
GoldLSTM	1	34.94	711.60	0.64
GoldLSTM175	1	45.94	1266.46	1.46
GoldLSTM175Xtra	1	44.01	1378.98	2.77
Indigo	1	43.68	48.06	0.13
LEDBAT	1	40.75	102.64	0.32
PCC-Allegro	1	42.99	45.69	0.12
PCC-Expr	1	46.50	111.37	0.10
QUIC Cubic	0	N/A	N/A	N/A
SCReAM	1	0.22	42.44	0.10
Sprout	1	9.16	50.33	0.06
TaoVA-100x	1	46.17	79.24	0.08
TCP Vegas	1	49.44	252.57	0.56
Verus	1	49.10	460.62	0.96
PCC-Vivace	1	44.12	291.98	0.11
WebRTC media	0	N/A	N/A	N/A

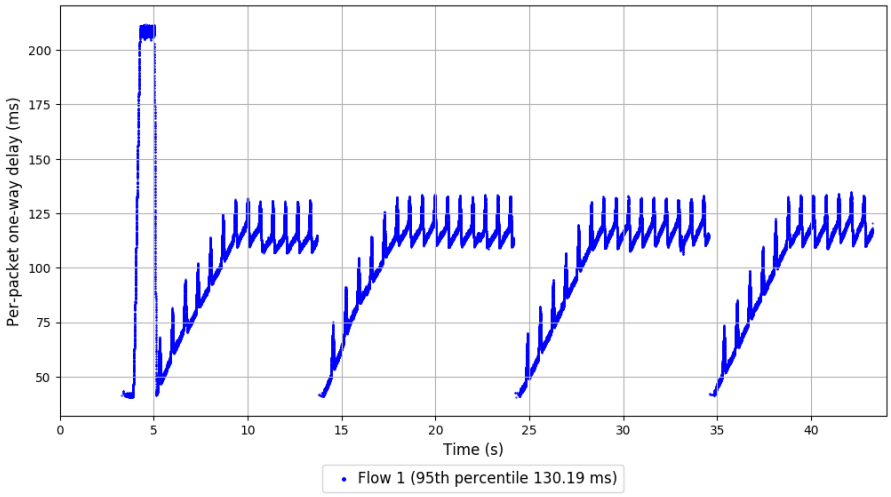
```
Run 1: Statistics of TCP BBR

Start at: 2019-07-05 01:17:19
End at: 2019-07-05 01:17:59

# Below is generated by plot.py at 2019-07-05 01:25:55
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 48.33 Mbit/s (96.7% utilization)
95th percentile per-packet one-way delay: 130.192 ms
Loss rate: 0.31%
-- Flow 1:
Average throughput: 48.33 Mbit/s
95th percentile per-packet one-way delay: 130.192 ms
Loss rate: 0.31%
```

Run 1: Report of TCP BBR — Data Link



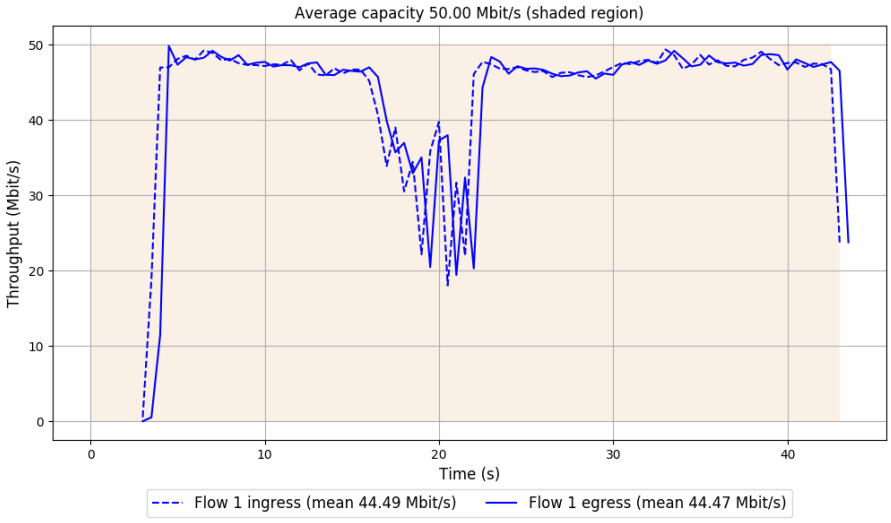


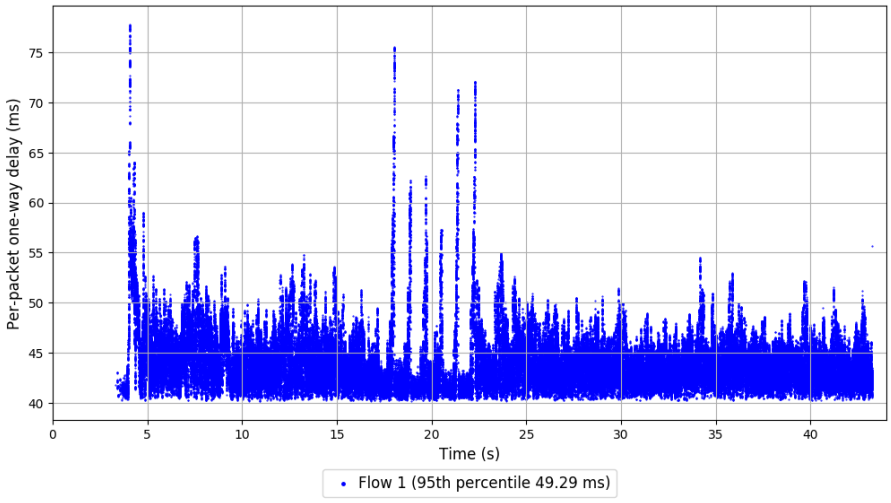
```
Run 1: Statistics of Copa

Start at: 2019-07-05 01:07:39
End at: 2019-07-05 01:08:19

# Below is generated by plot.py at 2019-07-05 01:26:11
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 44.47 Mbit/s (88.9% utilization)
95th percentile per-packet one-way delay: 49.290 ms
Loss rate: 0.12%
-- Flow 1:
Average throughput: 44.47 Mbit/s
95th percentile per-packet one-way delay: 49.290 ms
Loss rate: 0.12%
```

Run 1: Report of Copa — Data Link



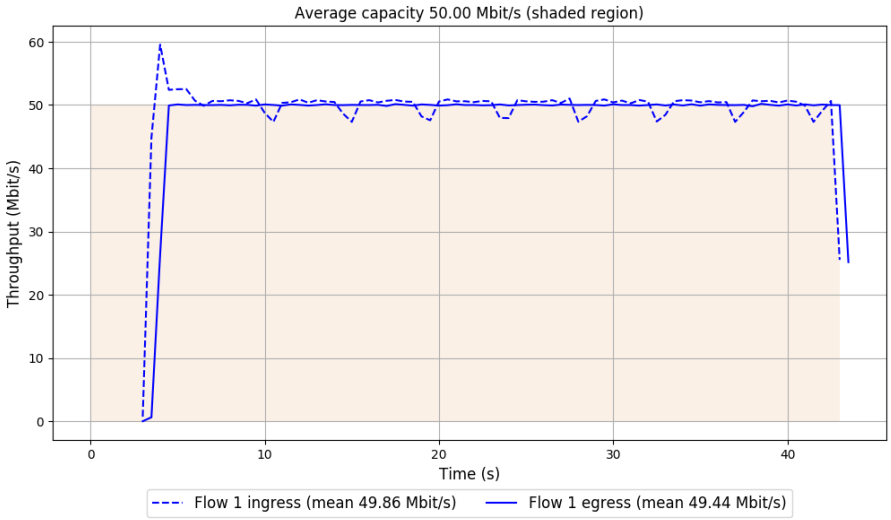


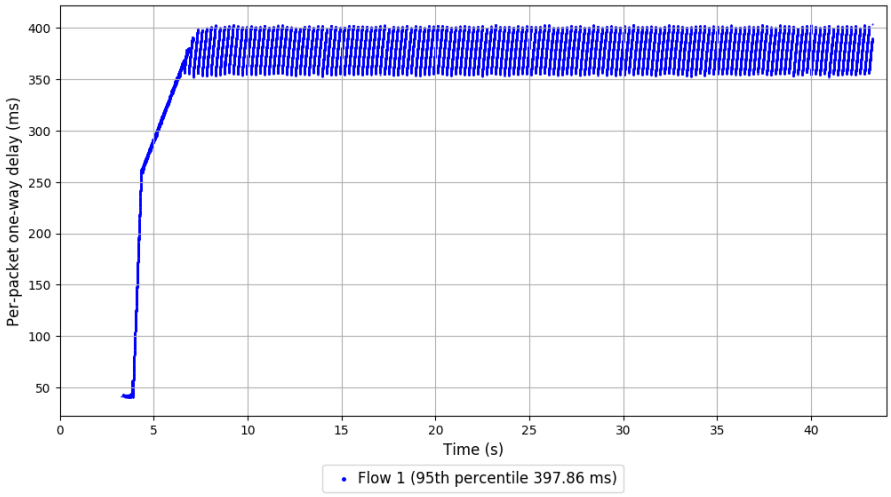
```
Run 1: Statistics of TCP Cubic

Start at: 2019-07-05 01:10:55
End at: 2019-07-05 01:11:35

# Below is generated by plot.py at 2019-07-05 01:26:11
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 49.44 Mbit/s (98.9% utilization)
95th percentile per-packet one-way delay: 397.864 ms
Loss rate: 0.92%
-- Flow 1:
Average throughput: 49.44 Mbit/s
95th percentile per-packet one-way delay: 397.864 ms
Loss rate: 0.92%
```

Run 1: Report of TCP Cubic — Data Link



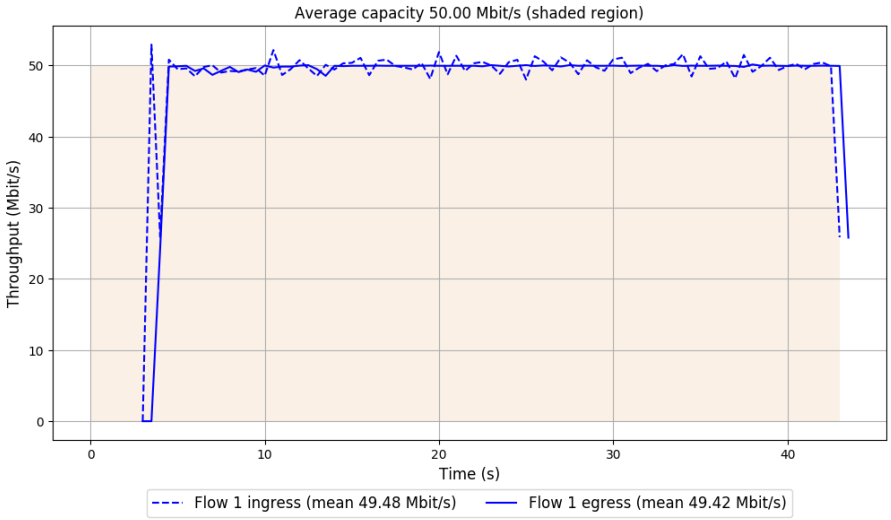


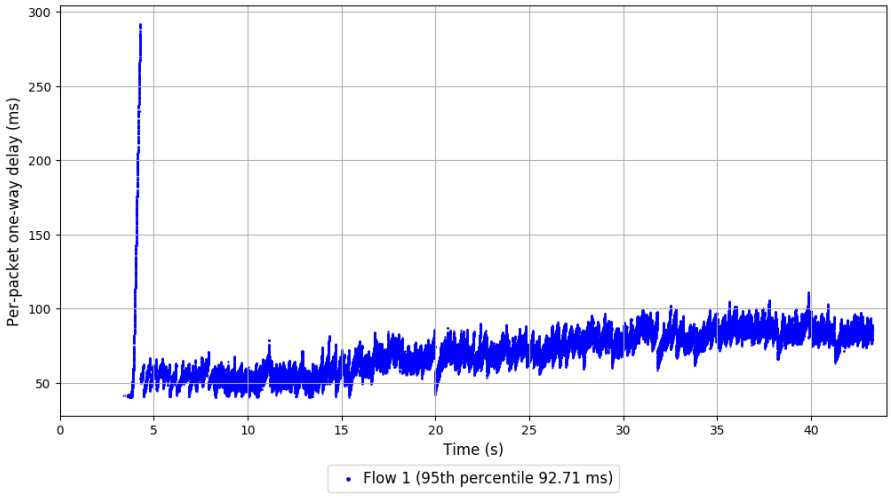
```
Run 1: Statistics of FillP

Start at: 2019-07-05 01:16:31
End at: 2019-07-05 01:17:11

# Below is generated by plot.py at 2019-07-05 01:26:11
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 49.42 Mbit/s (98.8% utilization)
95th percentile per-packet one-way delay: 92.708 ms
Loss rate: 0.23%
-- Flow 1:
Average throughput: 49.42 Mbit/s
95th percentile per-packet one-way delay: 92.708 ms
Loss rate: 0.23%
```

Run 1: Report of FillP — Data Link



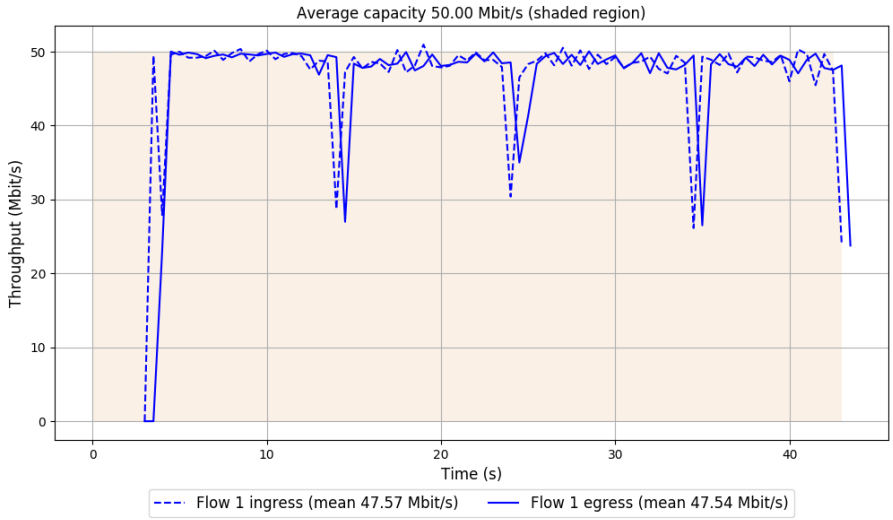


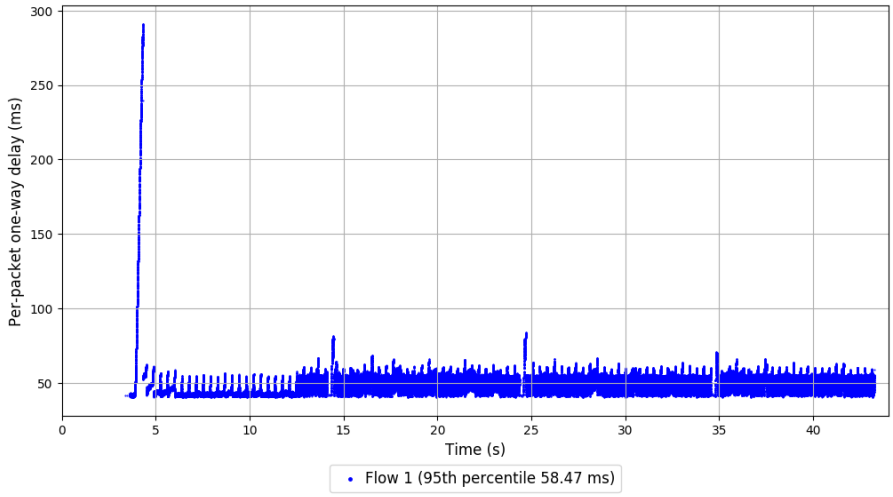
```
Run 1: Statistics of FillP-Sheep

Start at: 2019-07-05 01:06:51
End at: 2019-07-05 01:07:31

# Below is generated by plot.py at 2019-07-05 01:26:33
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 47.54 Mbit/s (95.1% utilization)
95th percentile per-packet one-way delay: 58.467 ms
Loss rate: 0.13%
-- Flow 1:
Average throughput: 47.54 Mbit/s
95th percentile per-packet one-way delay: 58.467 ms
Loss rate: 0.13%
```

Run 1: Report of FillP-Sheep — Data Link



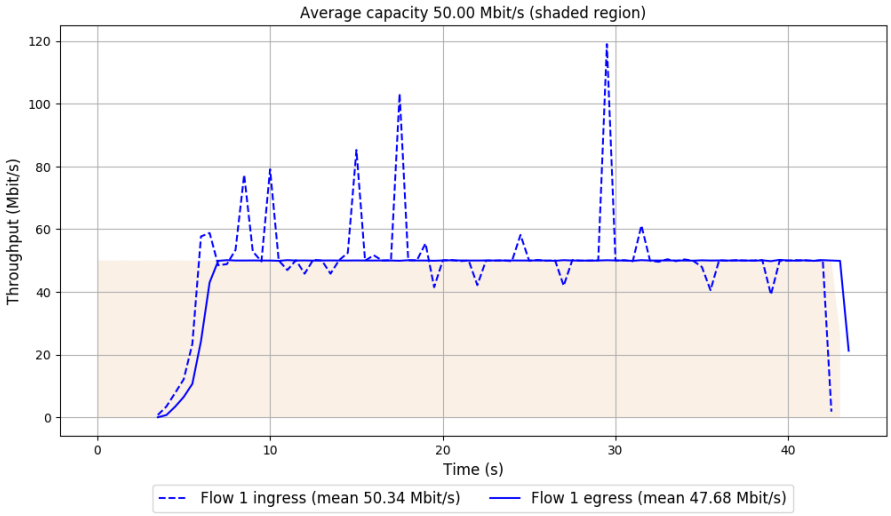


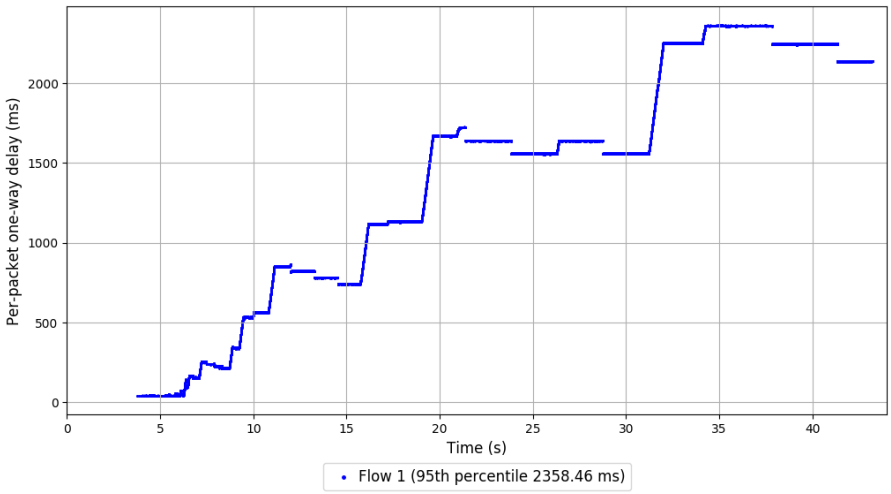
```
Run 1: Statistics of GOLD

Start at: 2019-07-05 01:10:06
End at: 2019-07-05 01:10:46

# Below is generated by plot.py at 2019-07-05 01:26:33
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 47.68 Mbit/s (95.4% utilization)
95th percentile per-packet one-way delay: 2358.460 ms
Loss rate: 3.70%
-- Flow 1:
Average throughput: 47.68 Mbit/s
95th percentile per-packet one-way delay: 2358.460 ms
Loss rate: 3.70%
```

Run 1: Report of GOLD — Data Link



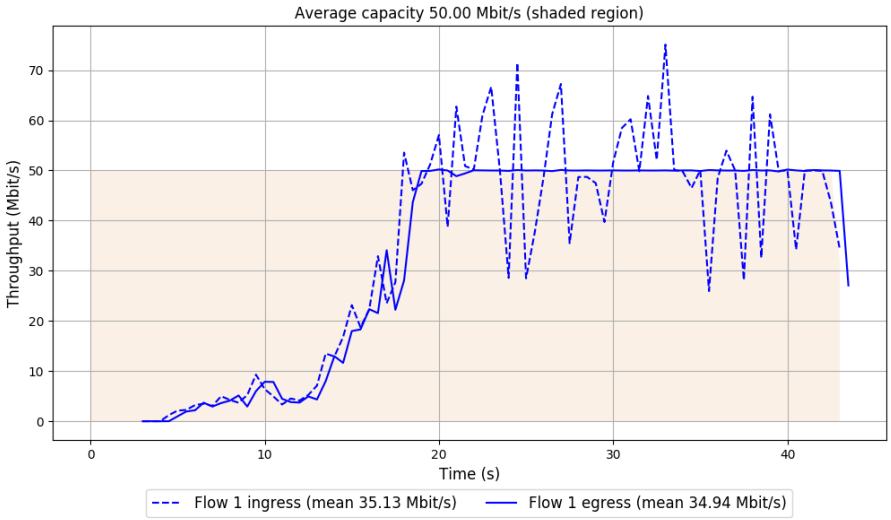


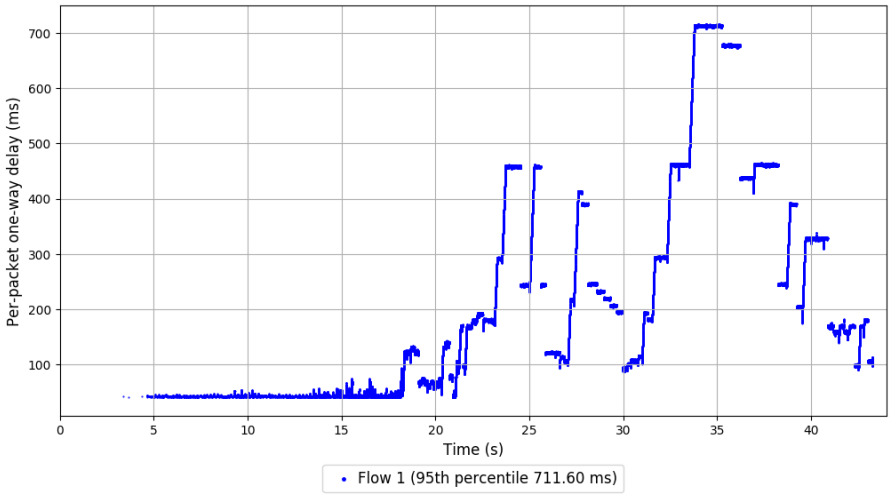
```
Run 1: Statistics of GoldLSTM

Start at: 2019-07-05 01:14:54
End at: 2019-07-05 01:15:34

# Below is generated by plot.py at 2019-07-05 01:26:33
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 34.94 Mbit/s (69.9% utilization)
95th percentile per-packet one-way delay: 711.600 ms
Loss rate: 0.64%
-- Flow 1:
Average throughput: 34.94 Mbit/s
95th percentile per-packet one-way delay: 711.600 ms
Loss rate: 0.64%
```

Run 1: Report of GoldLSTM — Data Link



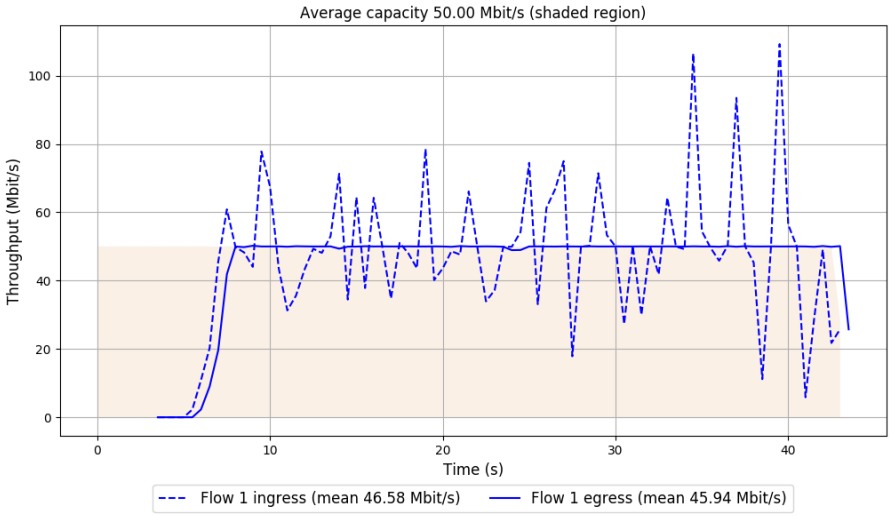


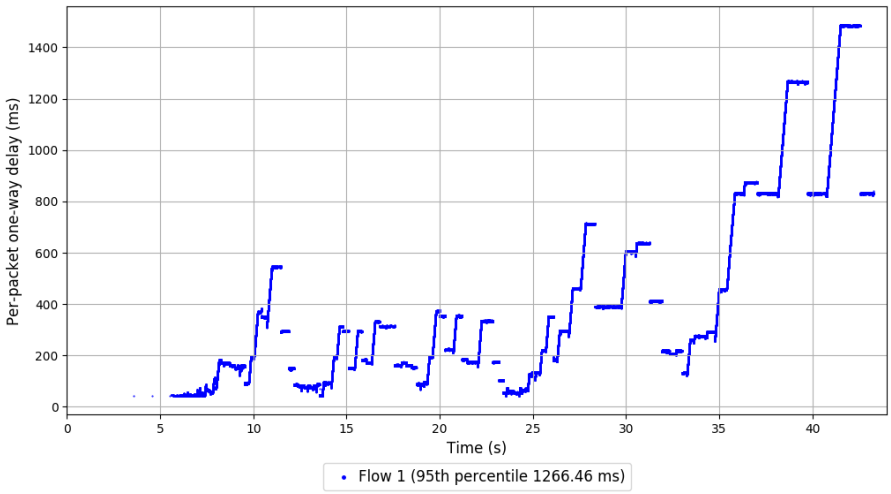
```
Run 1: Statistics of GoldLSTM175

Start at: 2019-07-05 01:12:28
End at: 2019-07-05 01:13:08

# Below is generated by plot.py at 2019-07-05 01:26:45
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 45.94 Mbit/s (91.9% utilization)
95th percentile per-packet one-way delay: 1266.462 ms
Loss rate: 1.46%
-- Flow 1:
Average throughput: 45.94 Mbit/s
95th percentile per-packet one-way delay: 1266.462 ms
Loss rate: 1.46%
```

Run 1: Report of GoldLSTM175 — Data Link



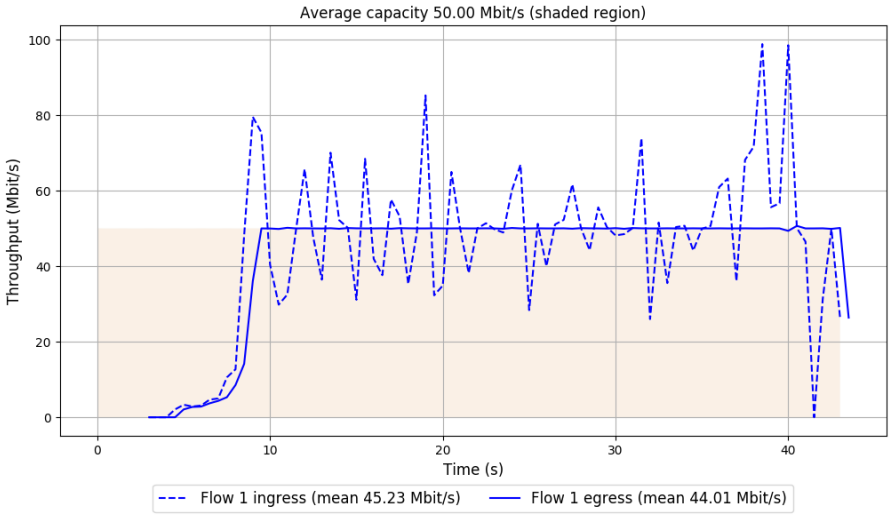


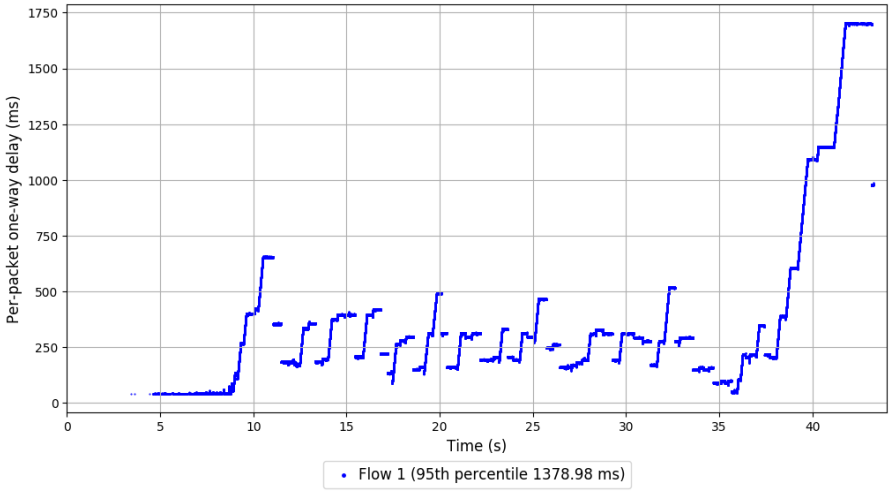
```
Run 1: Statistics of GoldLSTM175Xtra

Start at: 2019-07-05 01:18:07
End at: 2019-07-05 01:18:47

# Below is generated by plot.py at 2019-07-05 01:27:02
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 44.01 Mbit/s (88.0% utilization)
95th percentile per-packet one-way delay: 1378.979 ms
Loss rate: 2.77%
-- Flow 1:
Average throughput: 44.01 Mbit/s
95th percentile per-packet one-way delay: 1378.979 ms
Loss rate: 2.77%
```

Run 1: Report of GoldLSTM175Xtra — Data Link



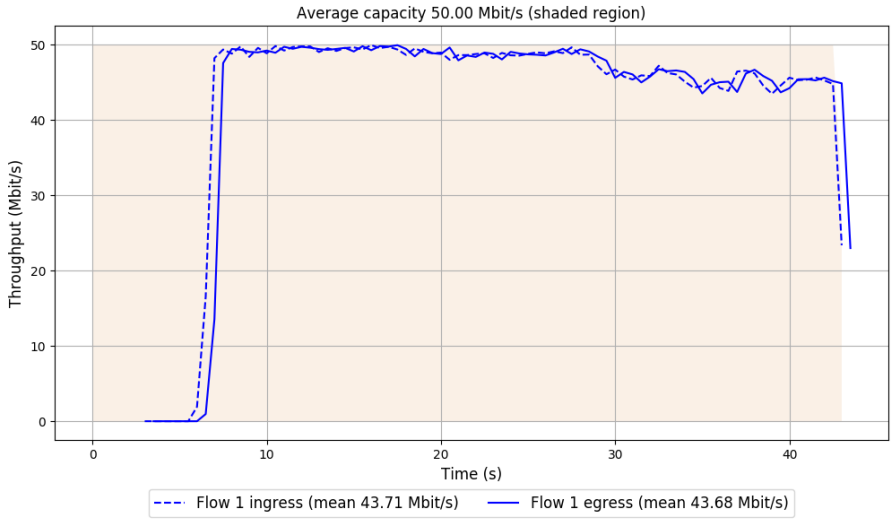


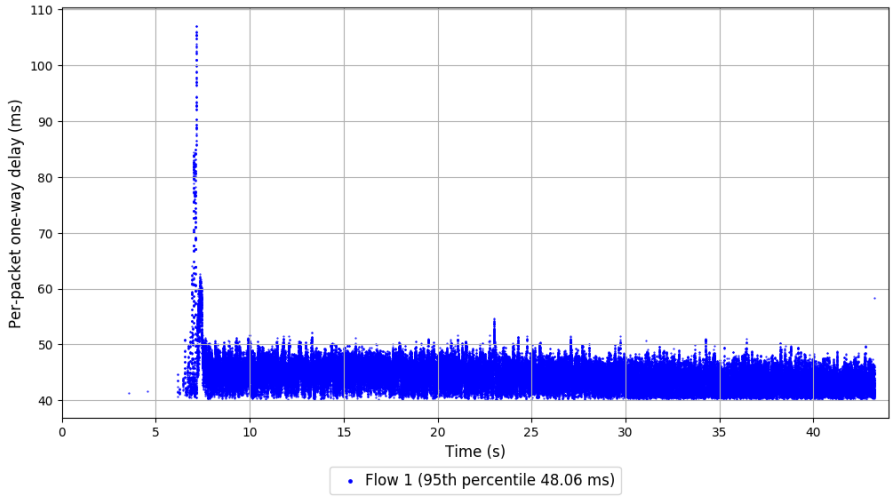
```
Run 1: Statistics of Indigo

Start at: 2019-07-05 01:08:28
End at: 2019-07-05 01:09:08

# Below is generated by plot.py at 2019-07-05 01:27:04
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 43.68 Mbit/s (87.4% utilization)
95th percentile per-packet one-way delay: 48.062 ms
Loss rate: 0.13%
-- Flow 1:
Average throughput: 43.68 Mbit/s
95th percentile per-packet one-way delay: 48.062 ms
Loss rate: 0.13%
```

Run 1: Report of Indigo — Data Link



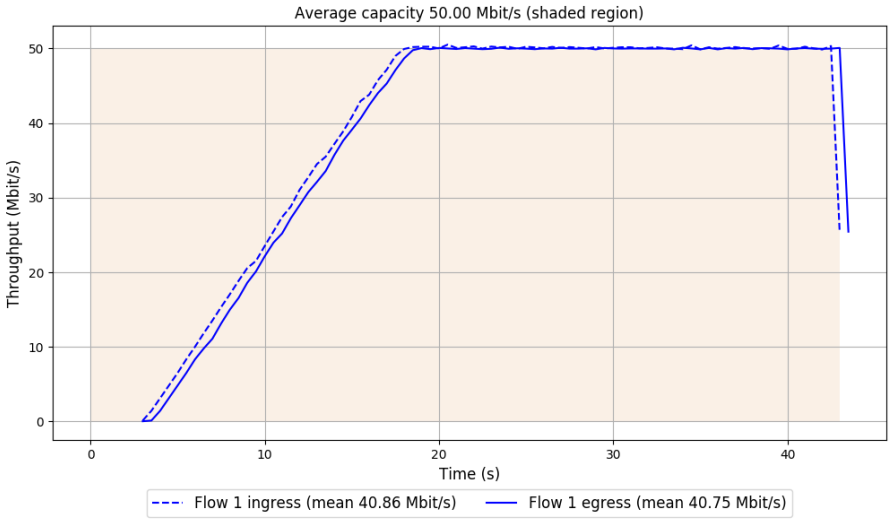


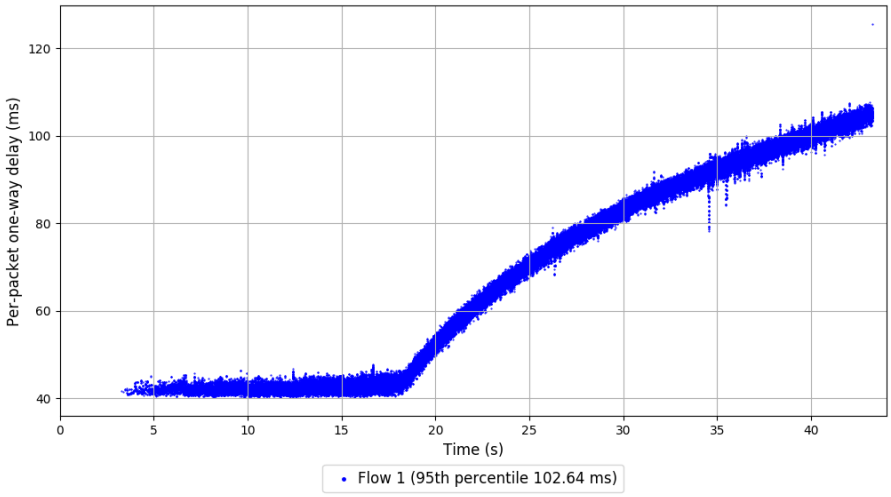
```
Run 1: Statistics of LEDBAT

Start at: 2019-07-05 01:21:57
End at: 2019-07-05 01:22:37

# Below is generated by plot.py at 2019-07-05 01:27:05
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 40.75 Mbit/s (81.5% utilization)
95th percentile per-packet one-way delay: 102.639 ms
Loss rate: 0.32%
-- Flow 1:
Average throughput: 40.75 Mbit/s
95th percentile per-packet one-way delay: 102.639 ms
Loss rate: 0.32%
```

Run 1: Report of LEDBAT — Data Link



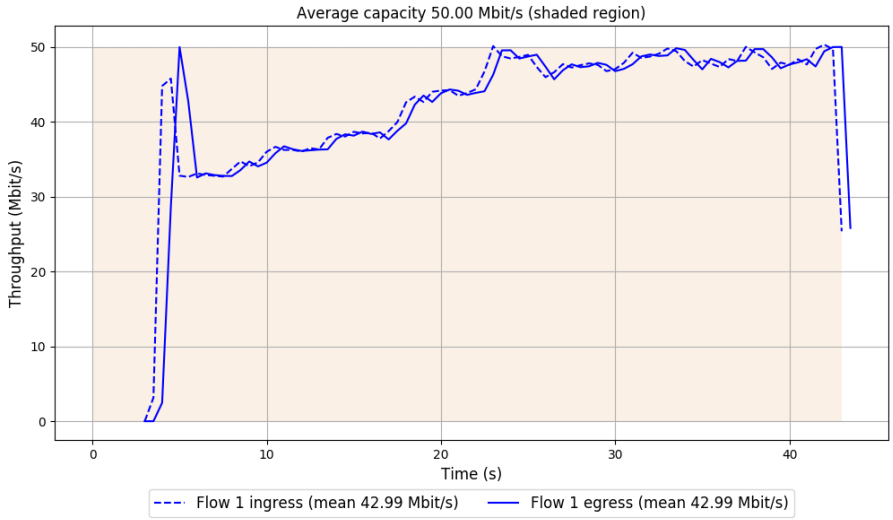


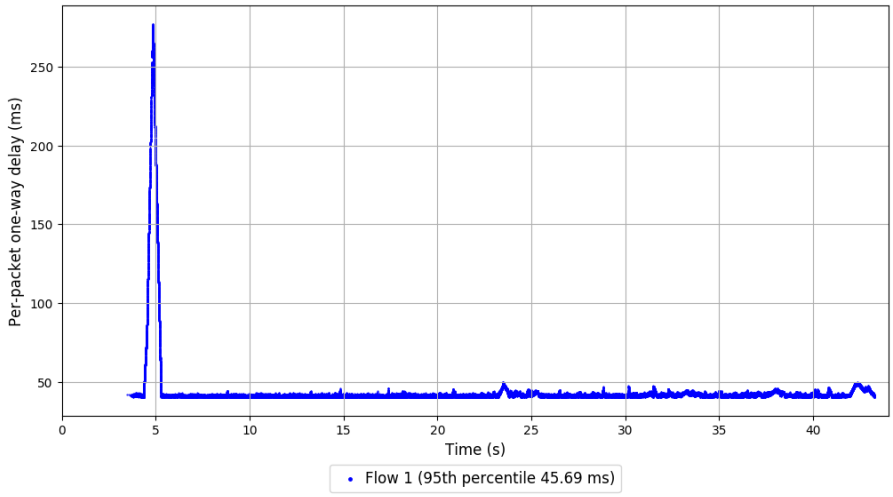
```
Run 1: Statistics of PCC-Allegro

Start at: 2019-07-05 01:20:25
End at: 2019-07-05 01:21:05

# Below is generated by plot.py at 2019-07-05 01:27:21
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 42.99 Mbit/s (86.0% utilization)
95th percentile per-packet one-way delay: 45.687 ms
Loss rate: 0.12%
-- Flow 1:
Average throughput: 42.99 Mbit/s
95th percentile per-packet one-way delay: 45.687 ms
Loss rate: 0.12%
```

Run 1: Report of PCC-Allegro — Data Link



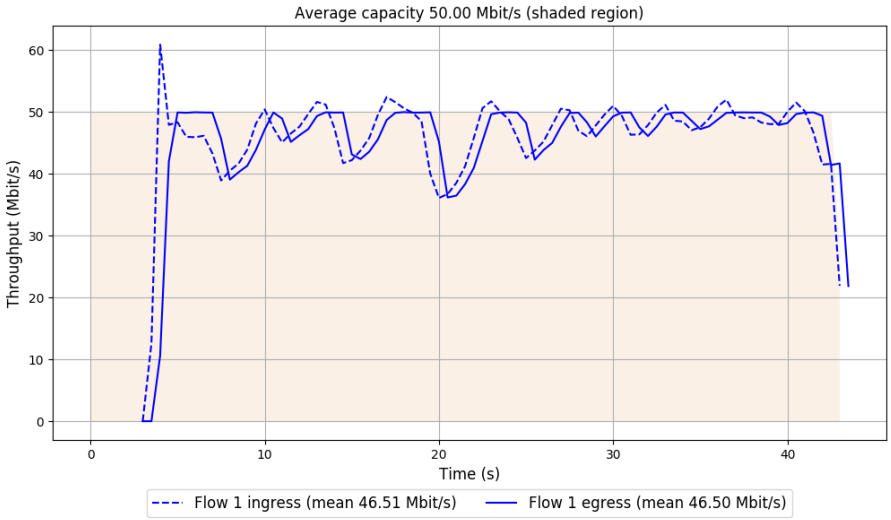


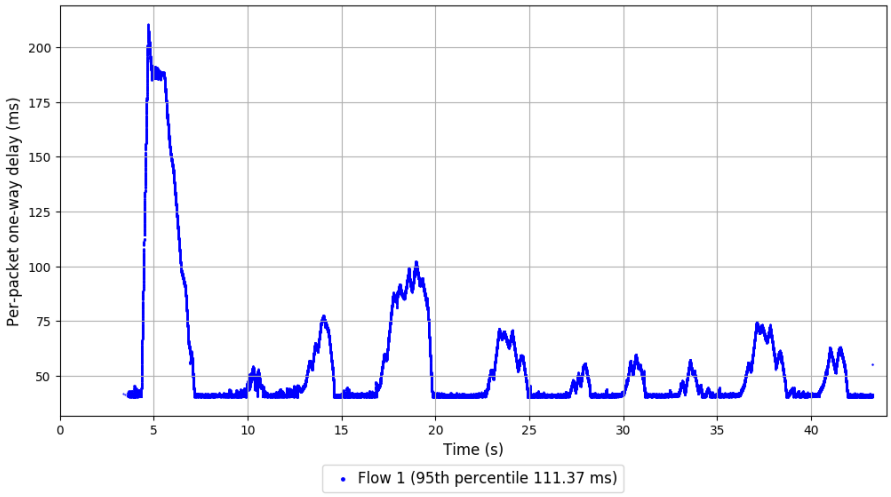
```
Run 1: Statistics of PCC-Expr

Start at: 2019-07-05 01:22:45
End at: 2019-07-05 01:23:25

# Below is generated by plot.py at 2019-07-05 01:27:57
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 46.50 Mbit/s (93.0% utilization)
95th percentile per-packet one-way delay: 111.372 ms
Loss rate: 0.10%
-- Flow 1:
Average throughput: 46.50 Mbit/s
95th percentile per-packet one-way delay: 111.372 ms
Loss rate: 0.10%
```

Run 1: Report of PCC-Expr — Data Link





```
Run 1: Statistics of QUIC Cubic

Start at: 2019-07-05 01:19:41
End at: 2019-07-05 01:20:21
```

Run 1: Report of QUIC Cubic — Data Link

Figure is missing

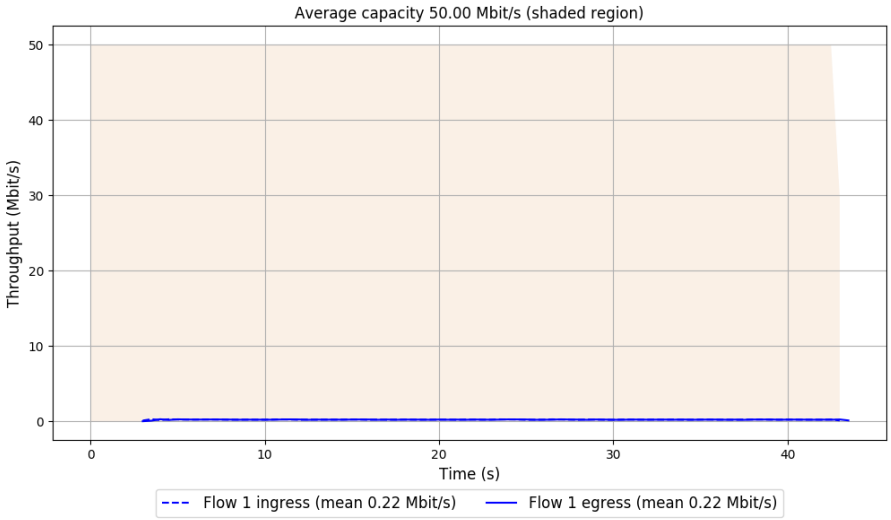
Figure is missing

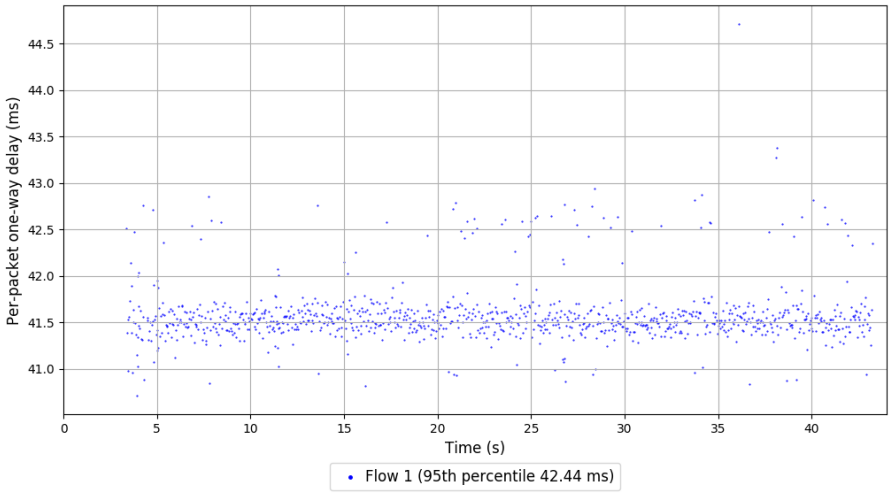
```
Run 1: Statistics of SCReAM

Start at: 2019-07-05 01:18:55
End at: 2019-07-05 01:19:35

# Below is generated by plot.py at 2019-07-05 01:27:57
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 0.22 Mbit/s (0.4% utilization)
95th percentile per-packet one-way delay: 42.435 ms
Loss rate: 0.10%
-- Flow 1:
Average throughput: 0.22 Mbit/s
95th percentile per-packet one-way delay: 42.435 ms
Loss rate: 0.10%
```

Run 1: Report of SCReAM — Data Link



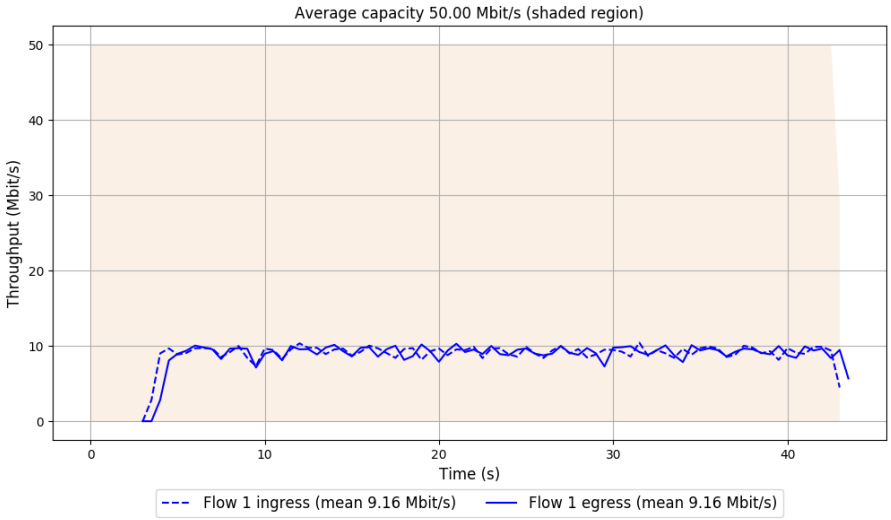


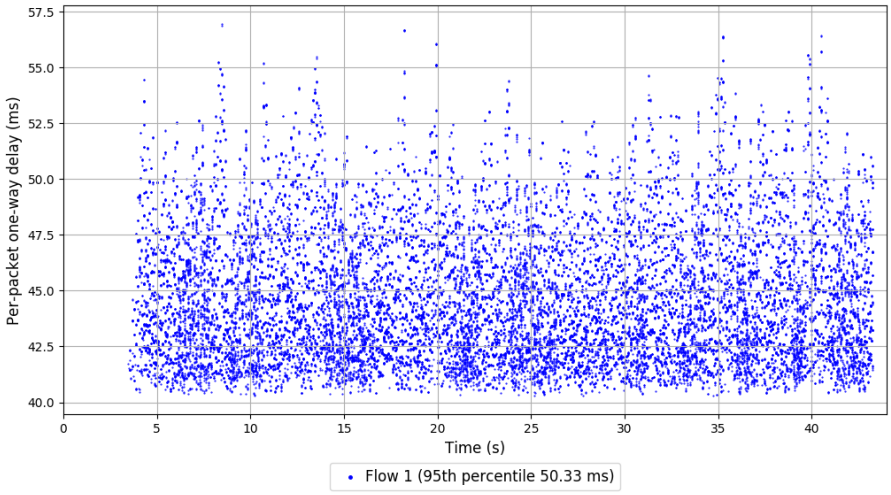
```
Run 1: Statistics of Sprout

Start at: 2019-07-05 01:11:43
End at: 2019-07-05 01:12:23

# Below is generated by plot.py at 2019-07-05 01:27:57
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 9.16 Mbit/s (18.3% utilization)
95th percentile per-packet one-way delay: 50.330 ms
Loss rate: 0.06%
-- Flow 1:
Average throughput: 9.16 Mbit/s
95th percentile per-packet one-way delay: 50.330 ms
Loss rate: 0.06%
```

Run 1: Report of Sprout — Data Link



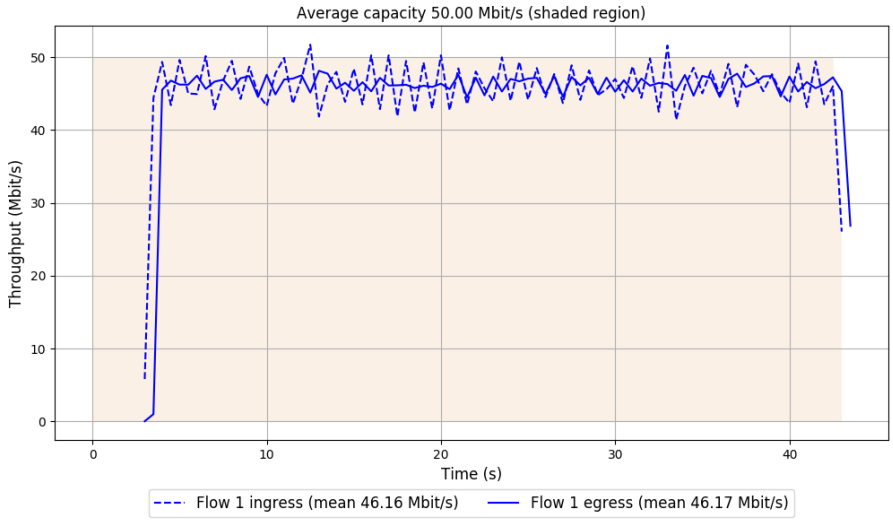


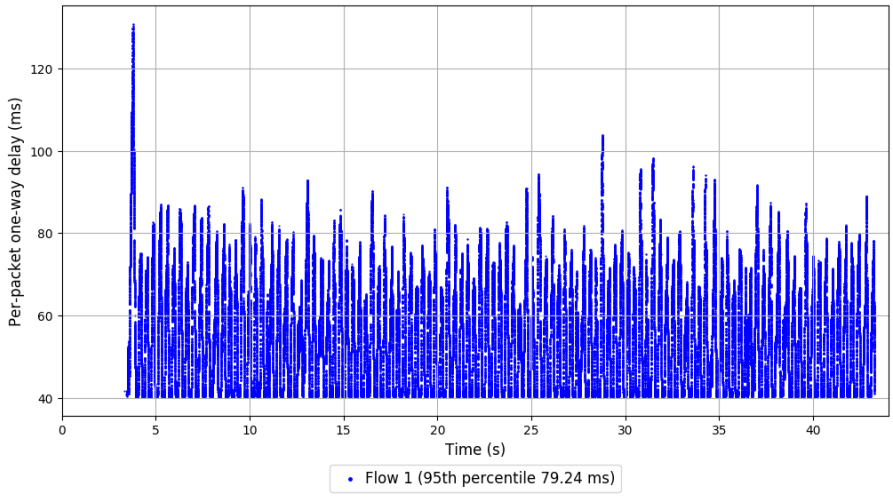
```
Run 1: Statistics of TaoVA-100x

Start at: 2019-07-05 01:15:41
End at: 2019-07-05 01:16:21

# Below is generated by plot.py at 2019-07-05 01:28:06
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 46.17 Mbit/s (92.3% utilization)
95th percentile per-packet one-way delay: 79.242 ms
Loss rate: 0.08%
-- Flow 1:
Average throughput: 46.17 Mbit/s
95th percentile per-packet one-way delay: 79.242 ms
Loss rate: 0.08%
```

Run 1: Report of TaoVA-100x — Data Link



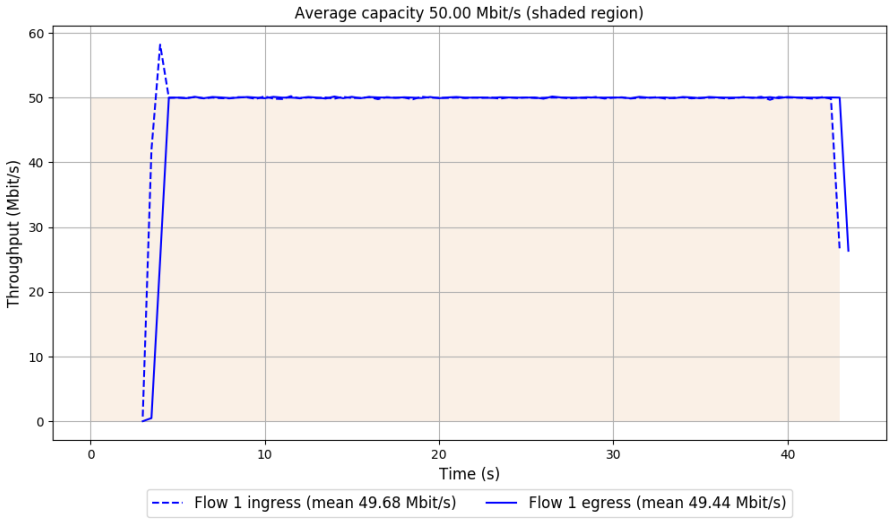


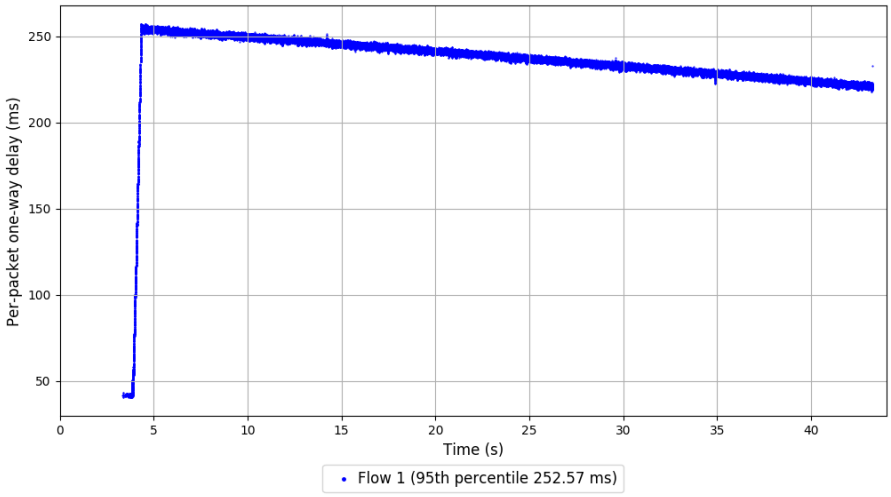
```
Run 1: Statistics of TCP Vegas

Start at: 2019-07-05 01:13:17
End at: 2019-07-05 01:13:57

# Below is generated by plot.py at 2019-07-05 01:28:06
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 49.44 Mbit/s (98.9% utilization)
95th percentile per-packet one-way delay: 252.572 ms
Loss rate: 0.56%
-- Flow 1:
Average throughput: 49.44 Mbit/s
95th percentile per-packet one-way delay: 252.572 ms
Loss rate: 0.56%
```

Run 1: Report of TCP Vegas — Data Link



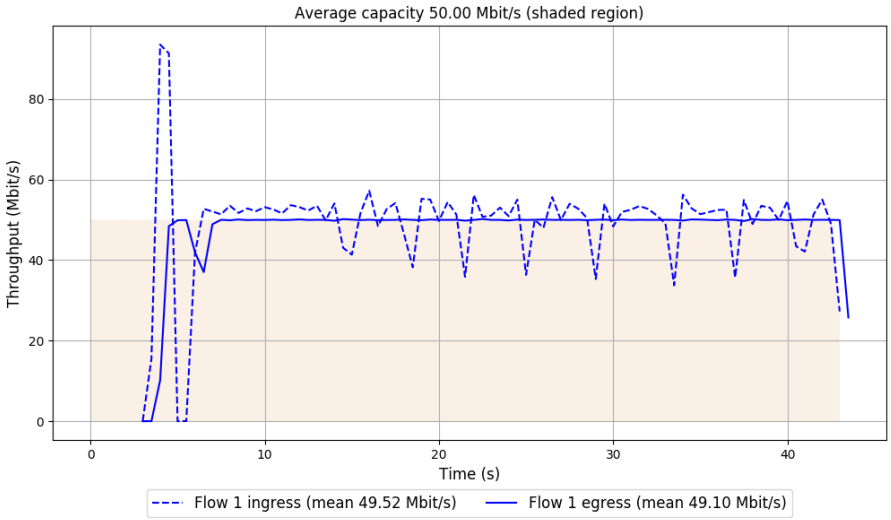


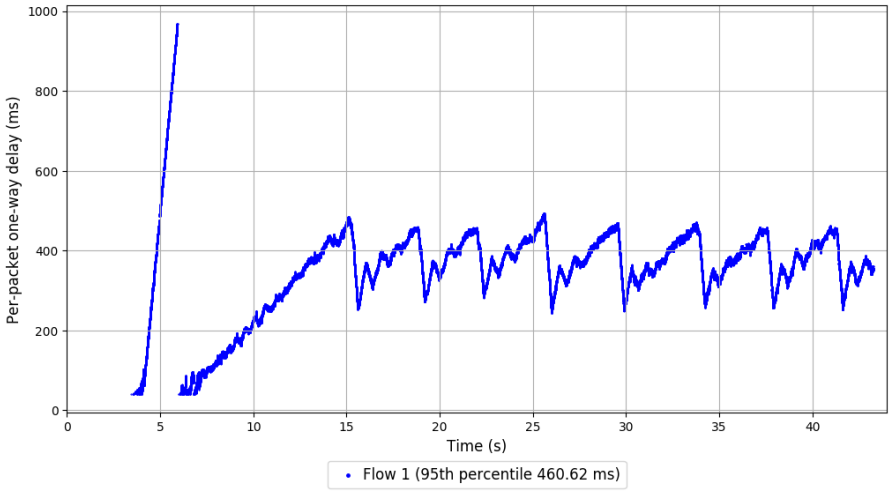
```
Run 1: Statistics of Verus

Start at: 2019-07-05 01:09:17
End at: 2019-07-05 01:09:57

# Below is generated by plot.py at 2019-07-05 01:28:06
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 49.10 Mbit/s (98.2% utilization)
95th percentile per-packet one-way delay: 460.619 ms
Loss rate: 0.96%
-- Flow 1:
Average throughput: 49.10 Mbit/s
95th percentile per-packet one-way delay: 460.619 ms
Loss rate: 0.96%
```

Run 1: Report of Verus — Data Link



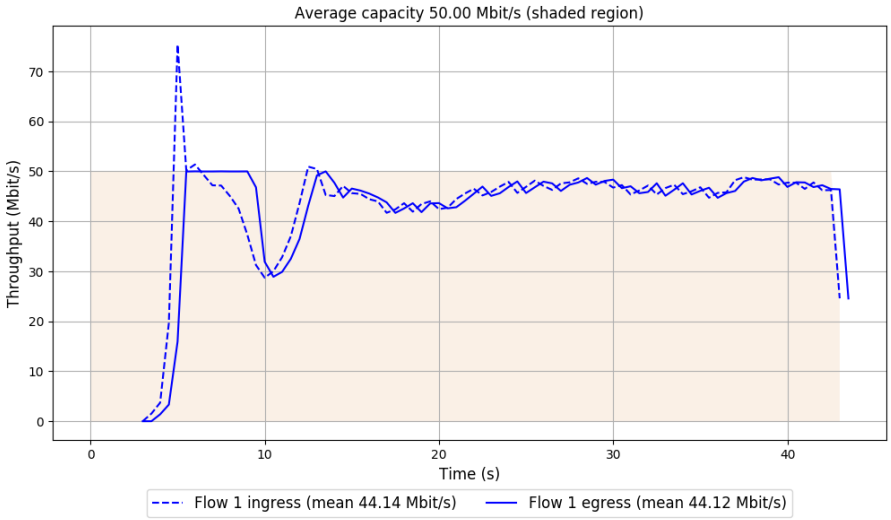


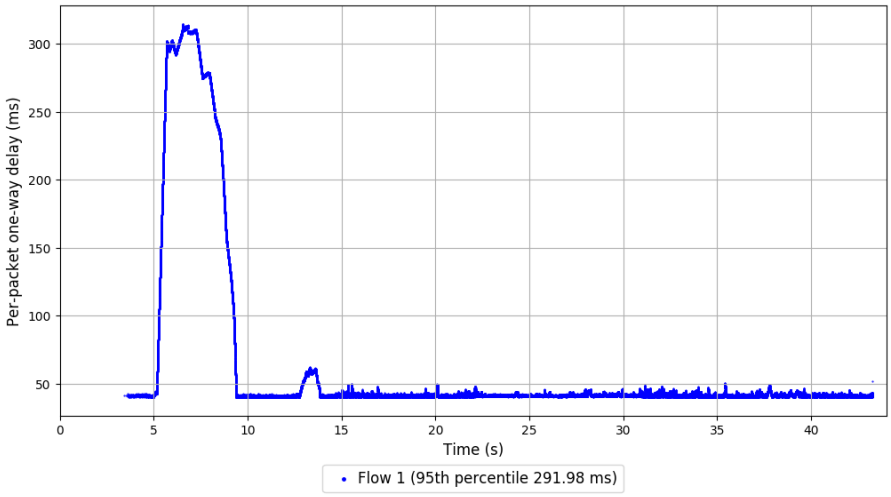
```
Run 1: Statistics of PCC-Vivace

Start at: 2019-07-05 01:14:05
End at: 2019-07-05 01:14:45

# Below is generated by plot.py at 2019-07-05 01:28:09
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 44.12 Mbit/s (88.2% utilization)
95th percentile per-packet one-way delay: 291.979 ms
Loss rate: 0.11%
-- Flow 1:
Average throughput: 44.12 Mbit/s
95th percentile per-packet one-way delay: 291.979 ms
Loss rate: 0.11%
```

Run 1: Report of PCC-Vivace — Data Link





```
Run 1: Statistics of WebRTC media

Start at: 2019-07-05 01:21:12
End at: 2019-07-05 01:21:52
```

Run 1: Report of WebRTC media — Data Link