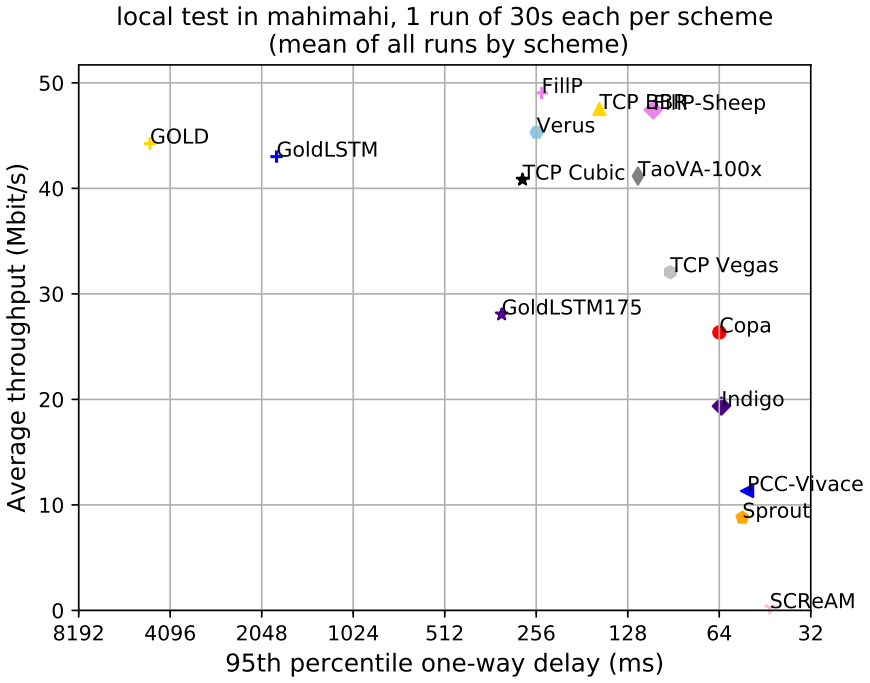
Pantheon Report

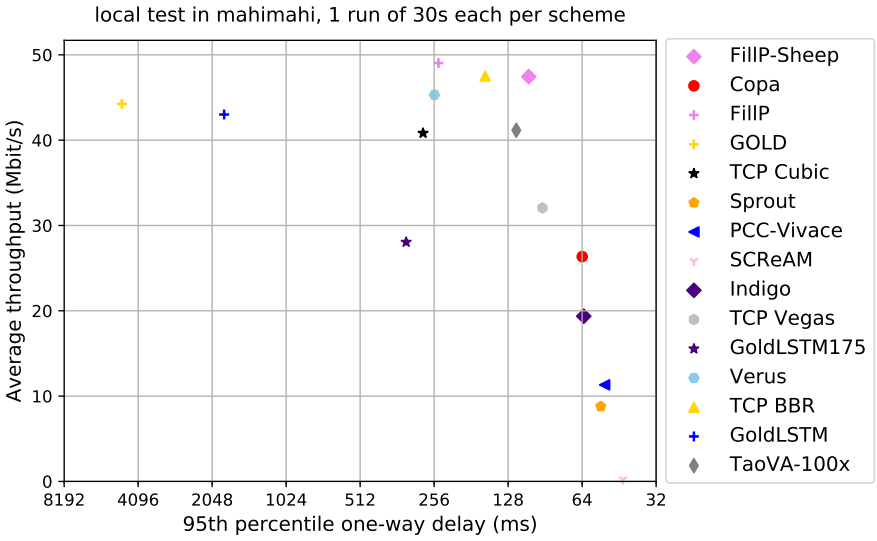
Generated at 2019-07-04 19:23:52 (UTC).
Tested in mahimahi: `mm-delay 40 mm-link 50mbps.trace 50mbps.trace`
Repeated the test of 20 congestion control schemes once.
Each test lasted for 30 seconds running 1 flow.

```
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 @ 0de7df0b5c2cb18dcfc5bf92ff6978c001479877
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/indigo @ 2601c92e4aa9d58d38dc4dfe0ecdbf90c077e64d
third_party/libutp @ b3465b942e2826f2b179eaab4a906ce6bb7cf3cf
third_party/pantheon-tunnel @ f866d3f58d27afd942717625ee3a354cc2e802bd
third_party/pcc @ 1afc958fa0d66d18b623c091a55fec872b4981e1
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 30s each per scheme
(mean of all runs by scheme)
Average throughput (Mbit/s)
95th percentile one-way delay (ms)
FillP
TCP BBR
FillP-Sheep
Verus
GOLD
GoldLSTM
TCP Cubic
TaoVA-100x
TCP Vegas
GoldLSTM175
Copa
Indigo
PCC-Vivace
Sprout
SCReAM
0
10
20
30
40
50
8192
4096
2048
1024
512
256
128
64
32


local test in mahimahi, 1 run of 30s each per scheme
Average throughput (Mbit/s)
95th percentile one-way delay (ms)
FillP-Sheep
Copa
FillP
GOLD
TCP Cubic
Sprout
PCC-Vivace
SCReAM
Indigo
TCP Vegas
GoldLSTM175
Verus
TCP BBR
GoldLSTM
TaoVA-100x
0
10
20
30
40
50
8192
4096
2048
1024
512
256
128
64
32

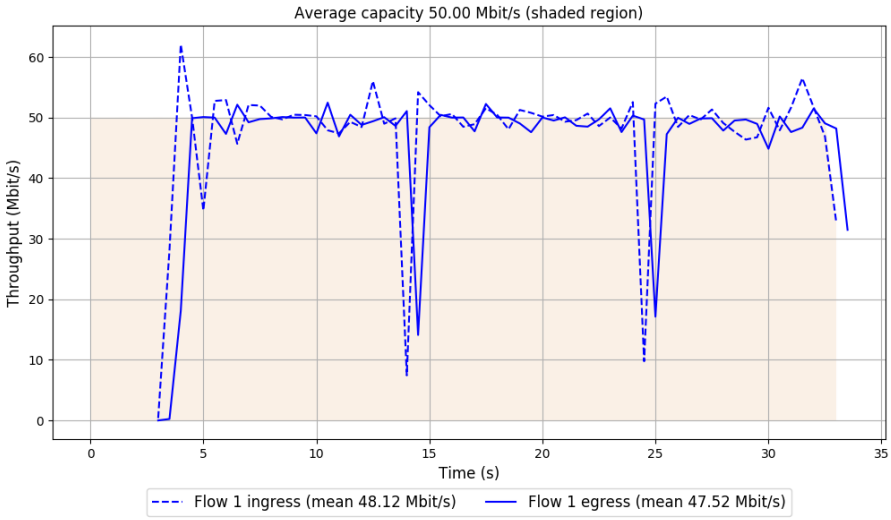
scheme	# runs	mean avg tput (Mbit/s) flow 1	mean 95th-%ile delay (ms) flow 1	mean loss rate (%) flow 1
TCP BBR	1	47.52	158.65	1.39
Copa	1	26.35	63.95	1.40
TCP Cubic	1	40.82	283.99	0.38
FillP	1	49.04	245.89	0.81
FillP-Sheep	1	47.44	105.52	1.33
GOLD	1	44.25	4773.30	19.51
GoldLSTM	1	43.01	1830.60	2.68
GoldLSTM175	1	28.05	332.68	2.47
Indigo	1	19.36	63.01	0.26
LEDBAT	0	N/A	N/A	N/A
PCC-Allegro	0	N/A	N/A	N/A
PCC-Expr	0	N/A	N/A	N/A
QUIC Cubic	0	N/A	N/A	N/A
SCReAM	1	0.22	43.66	0.13
Sprout	1	8.79	53.74	0.24
TaoVA-100x	1	41.16	118.55	2.97
TCP Vegas	1	32.06	92.80	0.36
Verus	1	45.30	255.39	1.94
PCC-Vivace	1	11.32	51.84	0.26
WebRTC media	0	N/A	N/A	N/A

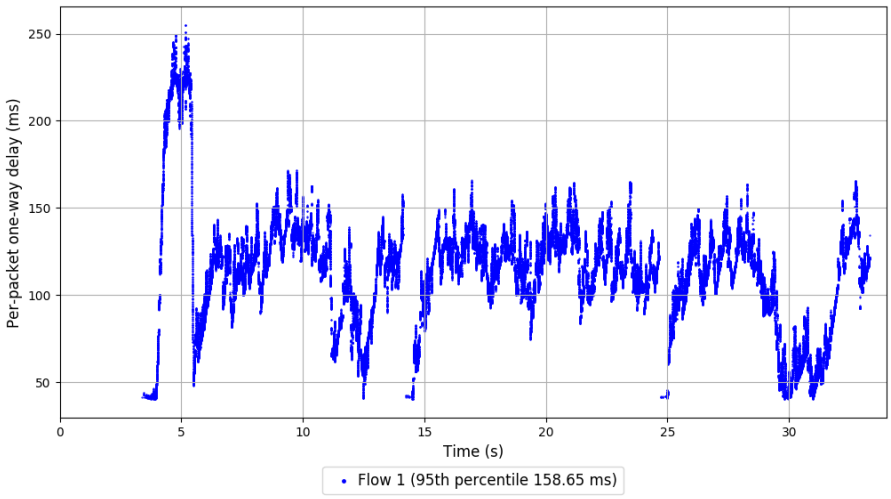
```
Run 1: Statistics of TCP BBR

Start at: 2019-07-04 19:17:55
End at: 2019-07-04 19:18:25

# Below is generated by plot.py at 2019-07-04 19:22:37
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 47.52 Mbit/s (95.0% utilization)
95th percentile per-packet one-way delay: 158.646 ms
Loss rate: 1.39%
-- Flow 1:
Average throughput: 47.52 Mbit/s
95th percentile per-packet one-way delay: 158.646 ms
Loss rate: 1.39%
```

Run 1: Report of TCP BBR — Data Link



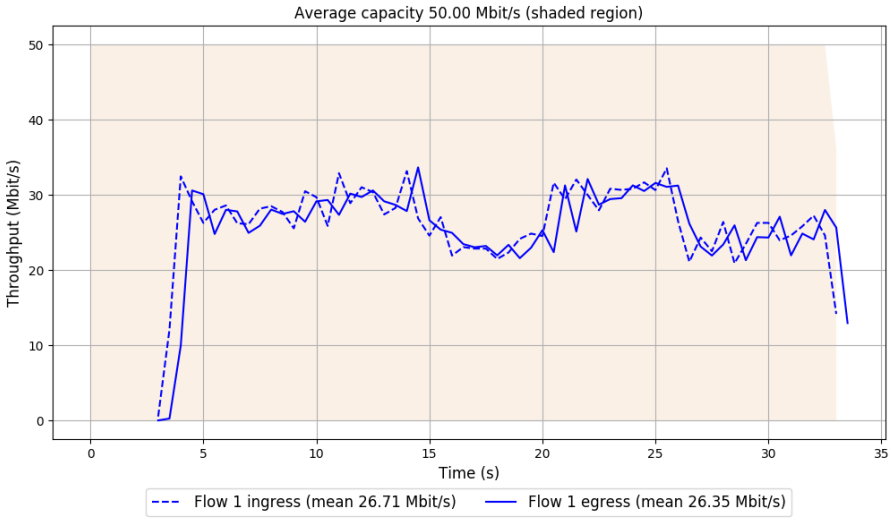


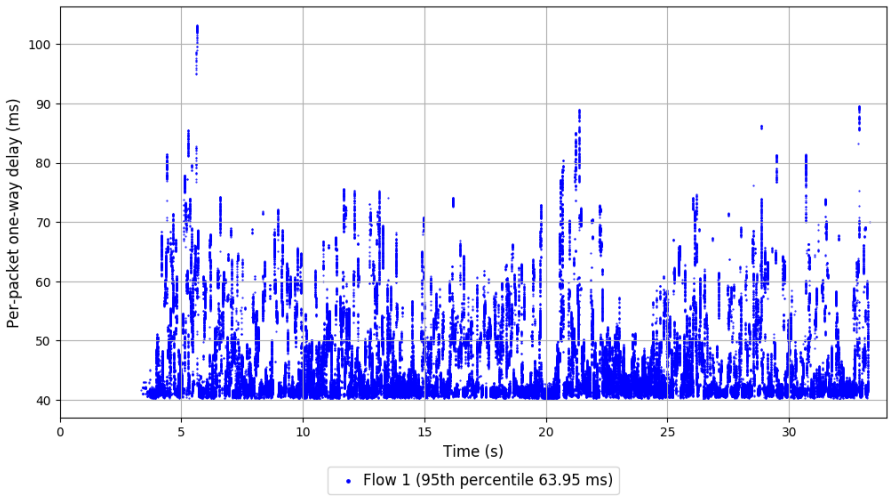
```
Run 1: Statistics of Copa

Start at: 2019-07-04 19:10:35
End at: 2019-07-04 19:11:05

# Below is generated by plot.py at 2019-07-04 19:22:50
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 26.35 Mbit/s (52.7% utilization)
95th percentile per-packet one-way delay: 63.946 ms
Loss rate: 1.40%
-- Flow 1:
Average throughput: 26.35 Mbit/s
95th percentile per-packet one-way delay: 63.946 ms
Loss rate: 1.40%
```

Run 1: Report of Copa — Data Link



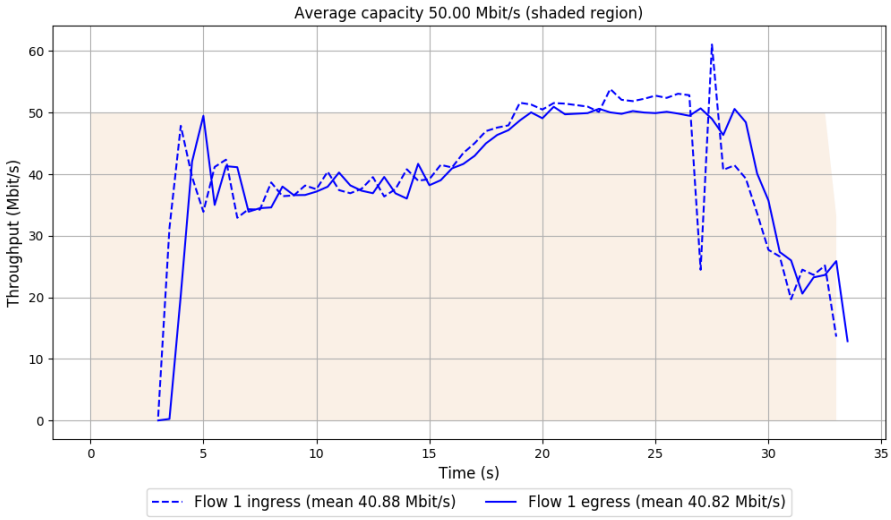


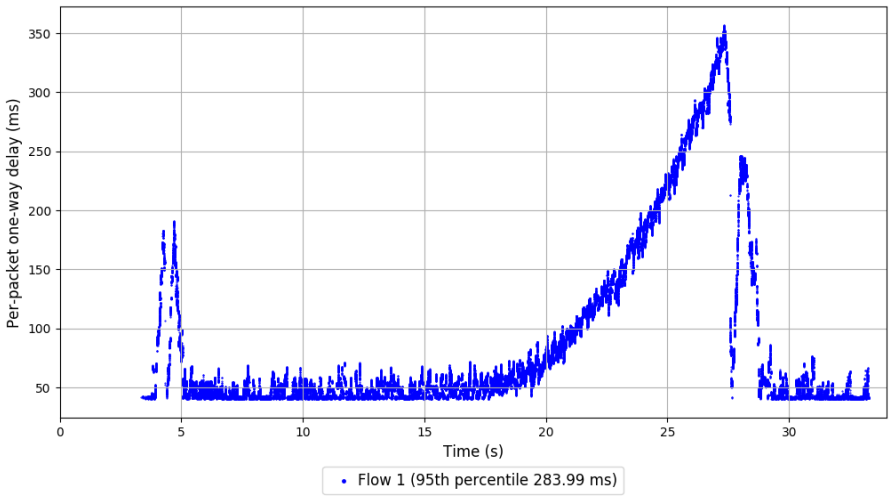
```
Run 1: Statistics of TCP Cubic

Start at: 2019-07-04 19:13:03
End at: 2019-07-04 19:13:33

# Below is generated by plot.py at 2019-07-04 19:22:50
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 40.82 Mbit/s (81.6% utilization)
95th percentile per-packet one-way delay: 283.990 ms
Loss rate: 0.38%
-- Flow 1:
Average throughput: 40.82 Mbit/s
95th percentile per-packet one-way delay: 283.990 ms
Loss rate: 0.38%
```

Run 1: Report of TCP Cubic — Data Link



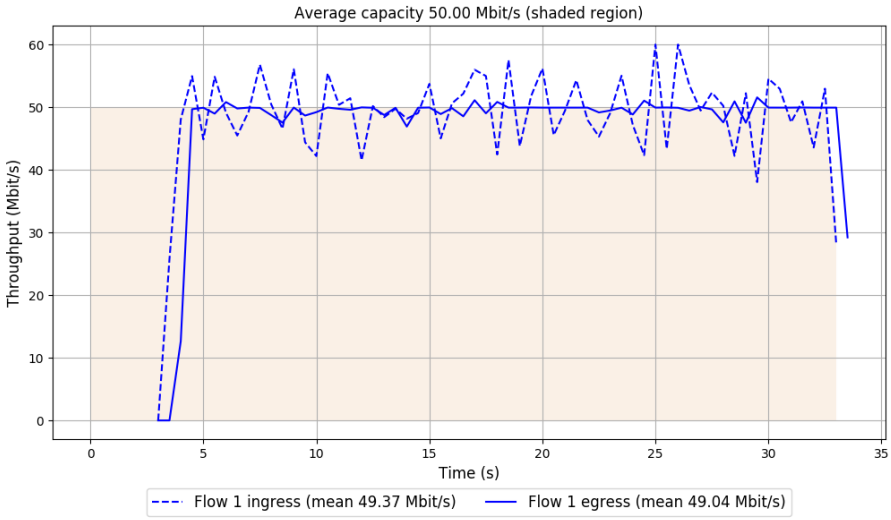


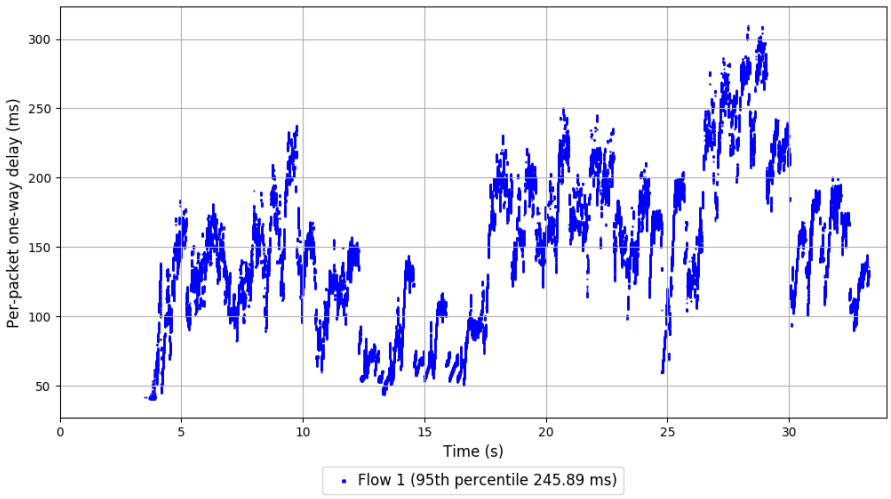
```
Run 1: Statistics of FillP

Start at: 2019-07-04 19:17:18
End at: 2019-07-04 19:17:48

# Below is generated by plot.py at 2019-07-04 19:22:51
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 49.04 Mbit/s (98.1% utilization)
95th percentile per-packet one-way delay: 245.888 ms
Loss rate: 0.81%
-- Flow 1:
Average throughput: 49.04 Mbit/s
95th percentile per-packet one-way delay: 245.888 ms
Loss rate: 0.81%
```

Run 1: Report of FillP — Data Link



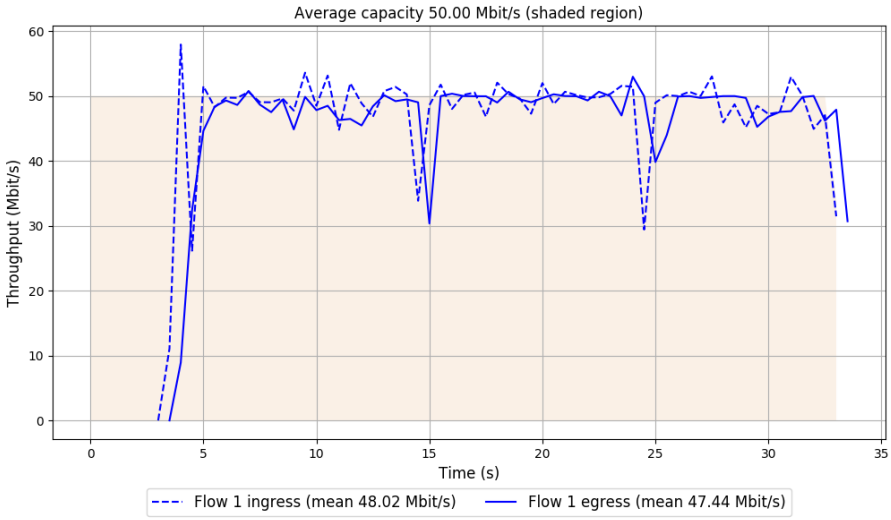


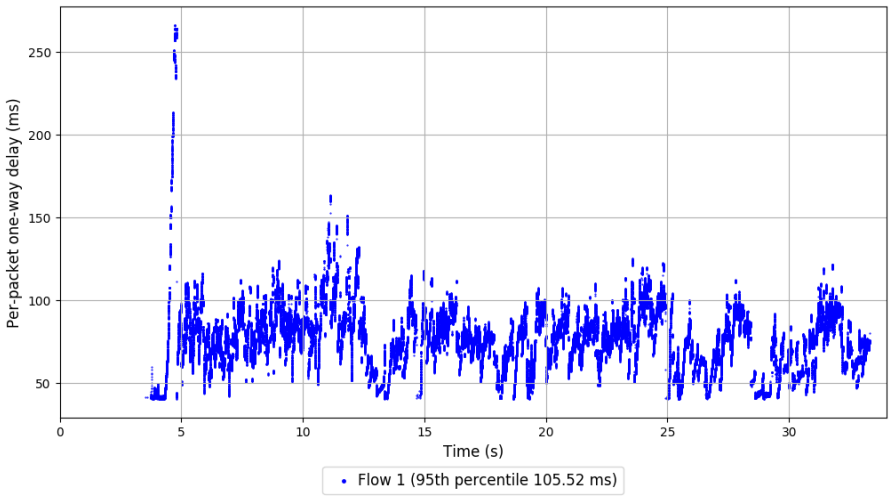
```
Run 1: Statistics of FillP-Sheep

Start at: 2019-07-04 19:09:58
End at: 2019-07-04 19:10:28

# Below is generated by plot.py at 2019-07-04 19:23:09
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 47.44 Mbit/s (94.9% utilization)
95th percentile per-packet one-way delay: 105.520 ms
Loss rate: 1.33%
-- Flow 1:
Average throughput: 47.44 Mbit/s
95th percentile per-packet one-way delay: 105.520 ms
Loss rate: 1.33%
```

Run 1: Report of FillP-Sheep — Data Link



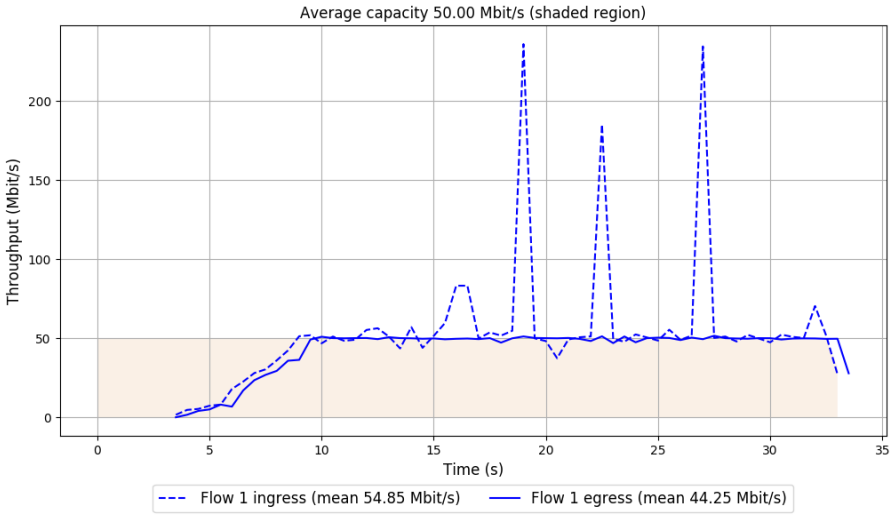


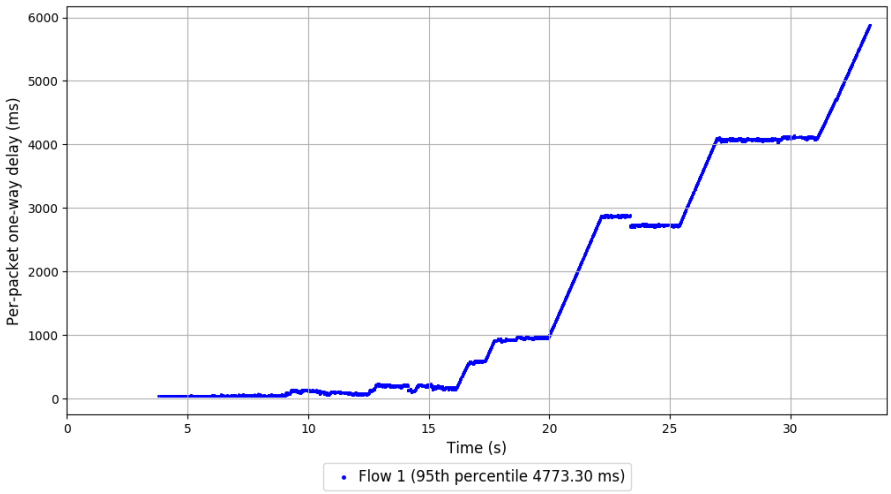
```
Run 1: Statistics of GOLD

Start at: 2019-07-04 19:12:25
End at: 2019-07-04 19:12:55

# Below is generated by plot.py at 2019-07-04 19:23:17
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 44.25 Mbit/s (88.5% utilization)
95th percentile per-packet one-way delay: 4773.300 ms
Loss rate: 19.51%
-- Flow 1:
Average throughput: 44.25 Mbit/s
95th percentile per-packet one-way delay: 4773.300 ms
Loss rate: 19.51%
```

Run 1: Report of GOLD — Data Link



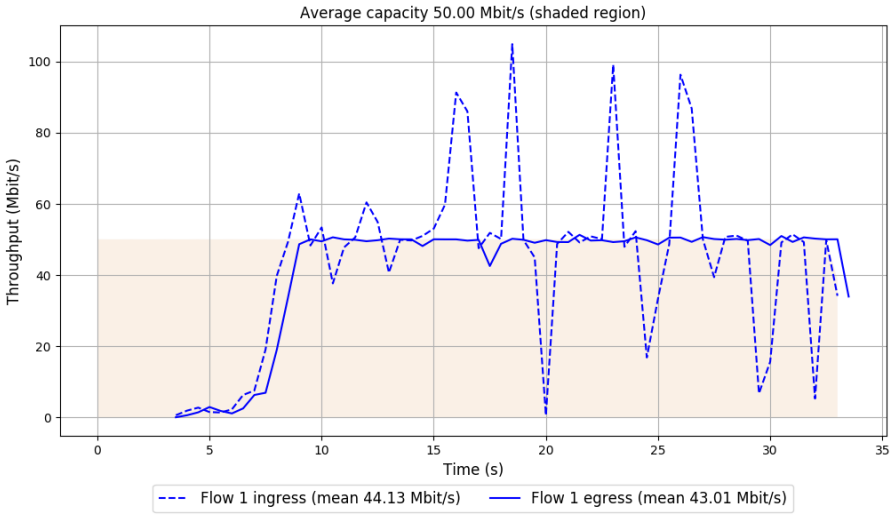


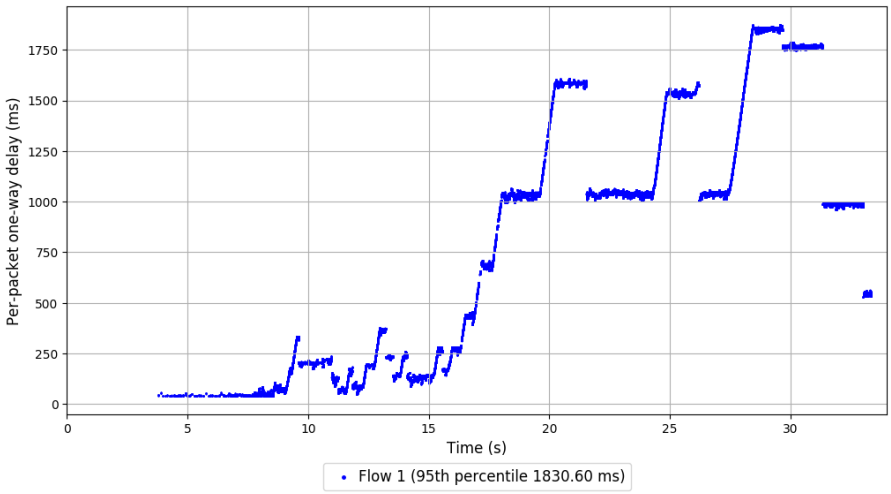
```
Run 1: Statistics of GoldLSTM

Start at: 2019-07-04 19:16:03
End at: 2019-07-04 19:16:33

# Below is generated by plot.py at 2019-07-04 19:23:21
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 43.01 Mbit/s (86.0% utilization)
95th percentile per-packet one-way delay: 1830.597 ms
Loss rate: 2.68%
-- Flow 1:
Average throughput: 43.01 Mbit/s
95th percentile per-packet one-way delay: 1830.597 ms
Loss rate: 2.68%
```

Run 1: Report of GoldLSTM — Data Link



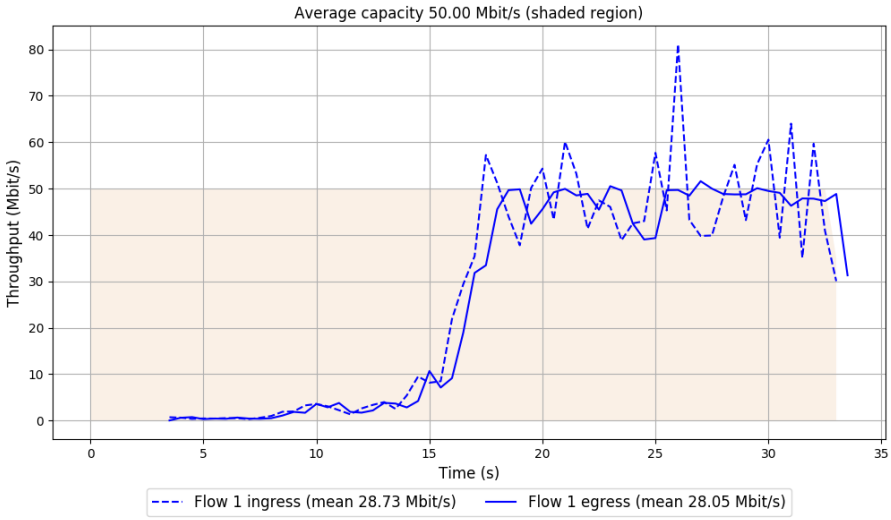


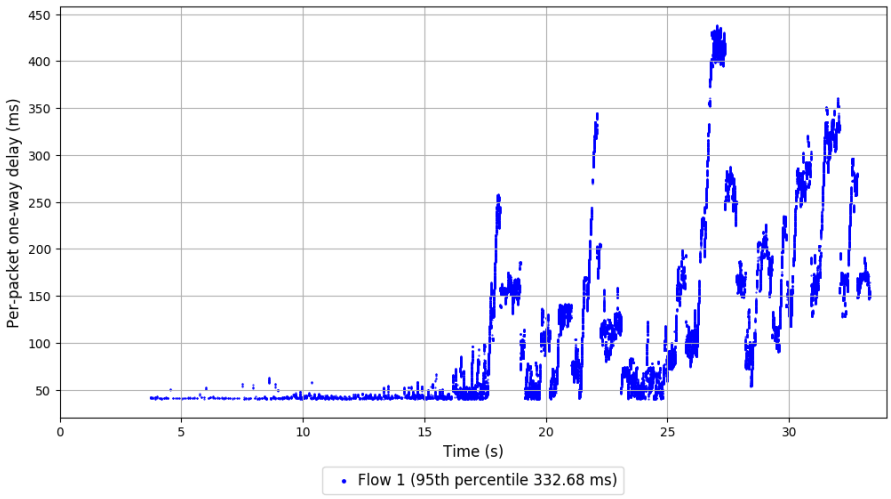
```
Run 1: Statistics of GoldLSTM175

Start at: 2019-07-04 19:14:14
End at: 2019-07-04 19:14:44

# Below is generated by plot.py at 2019-07-04 19:23:21
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 28.05 Mbit/s (56.1% utilization)
95th percentile per-packet one-way delay: 332.683 ms
Loss rate: 2.47%
-- Flow 1:
Average throughput: 28.05 Mbit/s
95th percentile per-packet one-way delay: 332.683 ms
Loss rate: 2.47%
```

Run 1: Report of GoldLSTM175 — Data Link



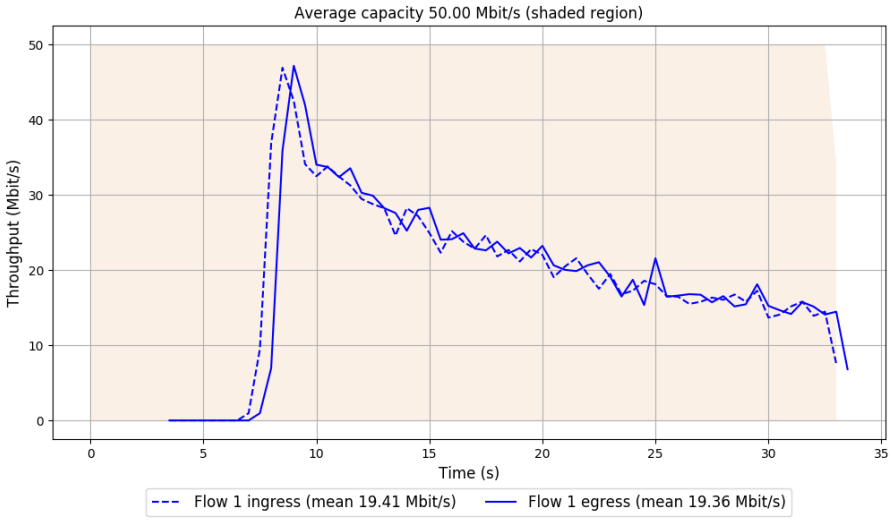


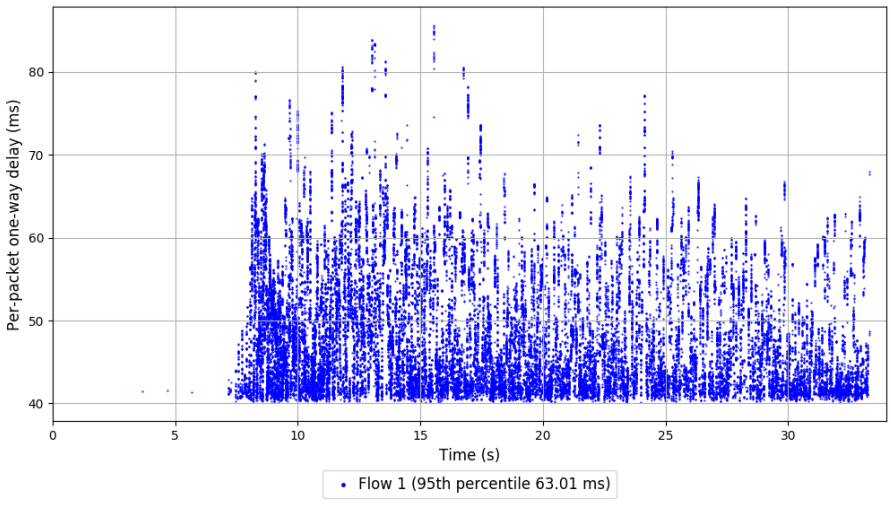
```
Run 1: Statistics of Indigo

Start at: 2019-07-04 19:11:12
End at: 2019-07-04 19:11:42

# Below is generated by plot.py at 2019-07-04 19:23:26
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 19.36 Mbit/s (38.7% utilization)
95th percentile per-packet one-way delay: 63.011 ms
Loss rate: 0.26%
-- Flow 1:
Average throughput: 19.36 Mbit/s
95th percentile per-packet one-way delay: 63.011 ms
Loss rate: 0.26%
```

Run 1: Report of Indigo — Data Link





```
Run 1: Statistics of LEDBAT

Start at: 2019-07-04 19:20:50
End at: 2019-07-04 19:21:20
```

Run 1: Report of LEDBAT — Data Link

Figure is missing

Figure is missing

```
Run 1: Statistics of PCC-Allegro

Start at: 2019-07-04 19:19:41
End at: 2019-07-04 19:20:11
```

Run 1: Report of PCC-Allegro — Data Link

Figure is missing

Figure is missing

```
Run 1: Statistics of PCC-Expr

Start at: 2019-07-04 19:21:24
End at: 2019-07-04 19:21:54
```

Run 1: Report of PCC-Expr — Data Link

Figure is missing

Figure is missing

```
Run 1: Statistics of QUIC Cubic

Start at: 2019-07-04 19:19:07
End at: 2019-07-04 19:19:37
```

Run 1: Report of QUIC Cubic — Data Link

Figure is missing

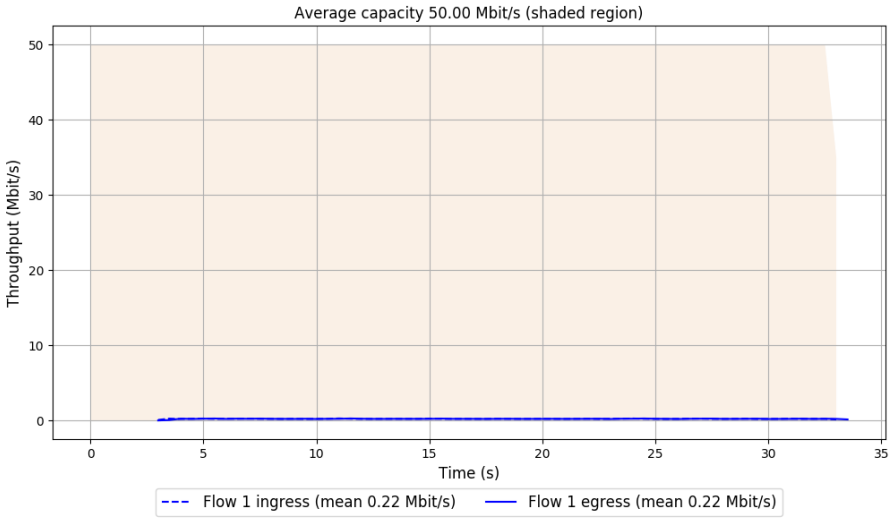
Figure is missing

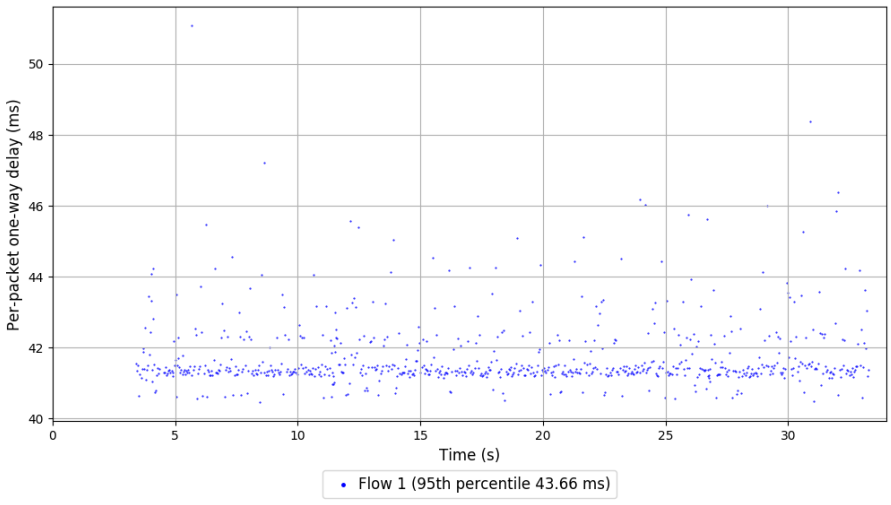
```
Run 1: Statistics of SCReAM

Start at: 2019-07-04 19:18:32
End at: 2019-07-04 19:19:02

# Below is generated by plot.py at 2019-07-04 19:23:26
# 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: 43.658 ms
Loss rate: 0.13%
-- Flow 1:
Average throughput: 0.22 Mbit/s
95th percentile per-packet one-way delay: 43.658 ms
Loss rate: 0.13%
```

Run 1: Report of SCReAM — Data Link



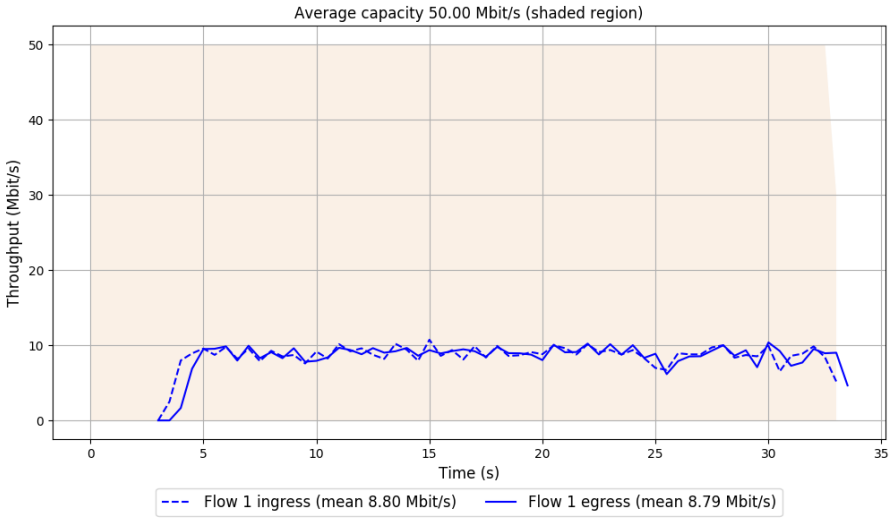


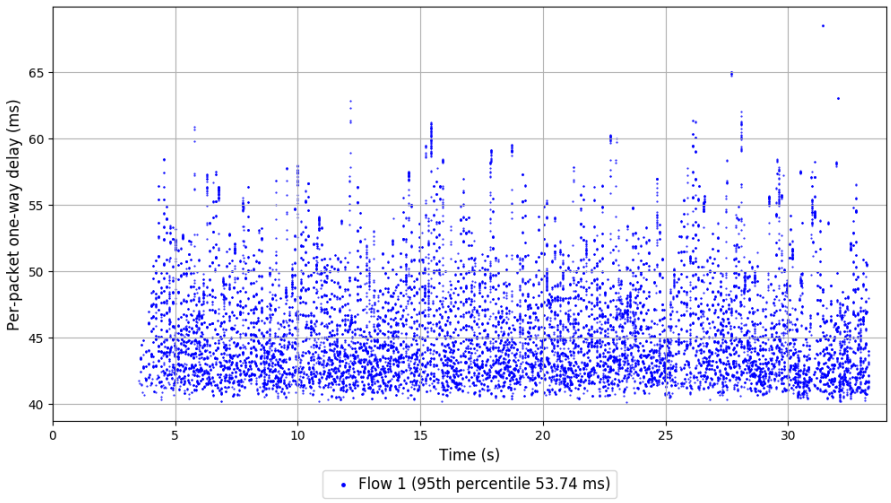
```
Run 1: Statistics of Sprout

Start at: 2019-07-04 19:13:39
End at: 2019-07-04 19:14:09

# Below is generated by plot.py at 2019-07-04 19:23:26
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 8.79 Mbit/s (17.6% utilization)
95th percentile per-packet one-way delay: 53.741 ms
Loss rate: 0.24%
-- Flow 1:
Average throughput: 8.79 Mbit/s
95th percentile per-packet one-way delay: 53.741 ms
Loss rate: 0.24%
```

Run 1: Report of Sprout — Data Link



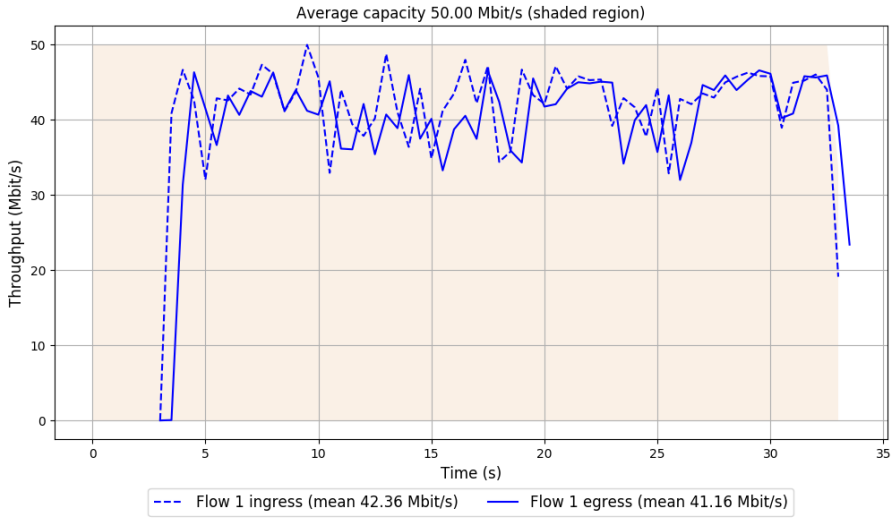


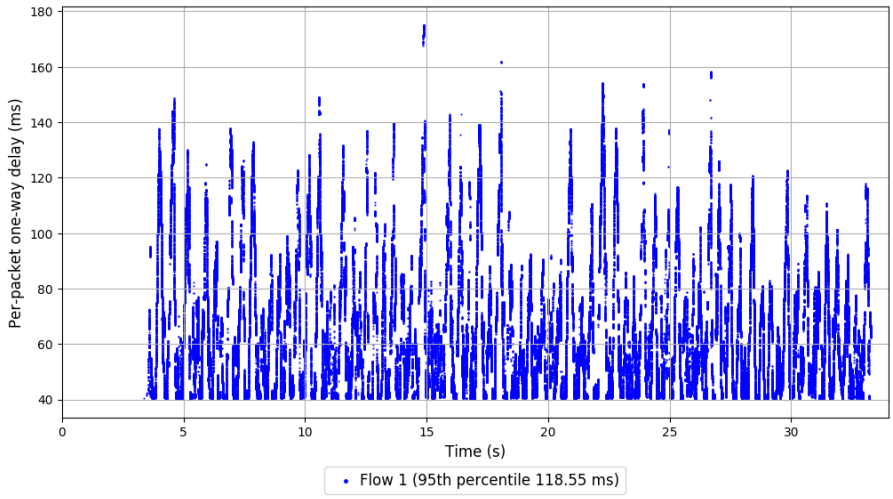
```
Run 1: Statistics of TaoVA-100x

Start at: 2019-07-04 19:16:40
End at: 2019-07-04 19:17:10

# Below is generated by plot.py at 2019-07-04 19:23:50
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 41.16 Mbit/s (82.3% utilization)
95th percentile per-packet one-way delay: 118.549 ms
Loss rate: 2.97%
-- Flow 1:
Average throughput: 41.16 Mbit/s
95th percentile per-packet one-way delay: 118.549 ms
Loss rate: 2.97%
```

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



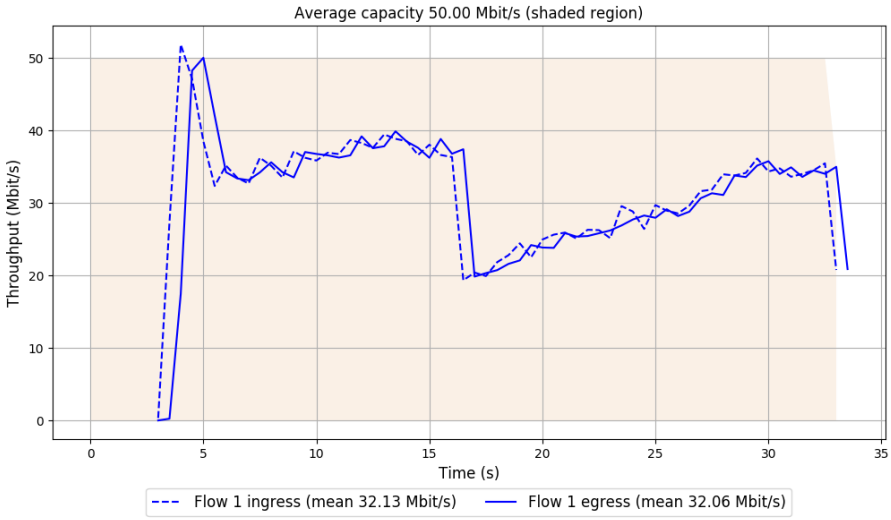


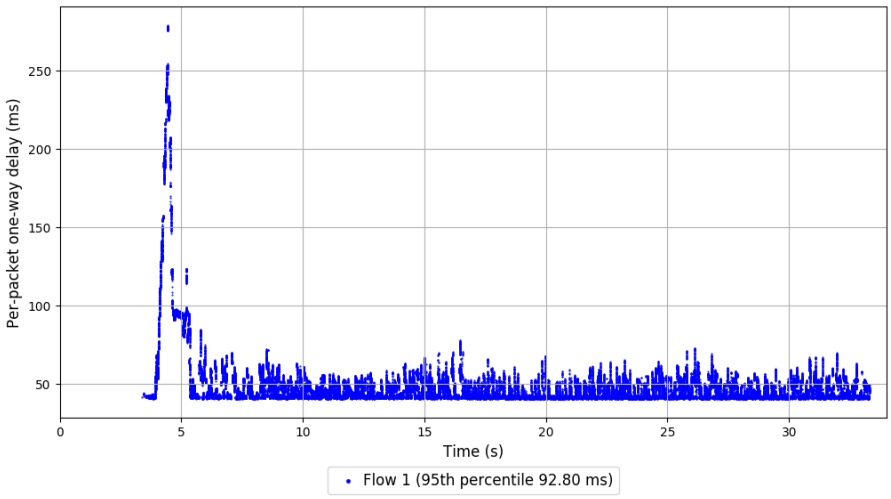
```
Run 1: Statistics of TCP Vegas

Start at: 2019-07-04 19:14:51
End at: 2019-07-04 19:15:21

# Below is generated by plot.py at 2019-07-04 19:23:50
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 32.06 Mbit/s (64.1% utilization)
95th percentile per-packet one-way delay: 92.802 ms
Loss rate: 0.36%
-- Flow 1:
Average throughput: 32.06 Mbit/s
95th percentile per-packet one-way delay: 92.802 ms
Loss rate: 0.36%
```

Run 1: Report of TCP Vegas — Data Link



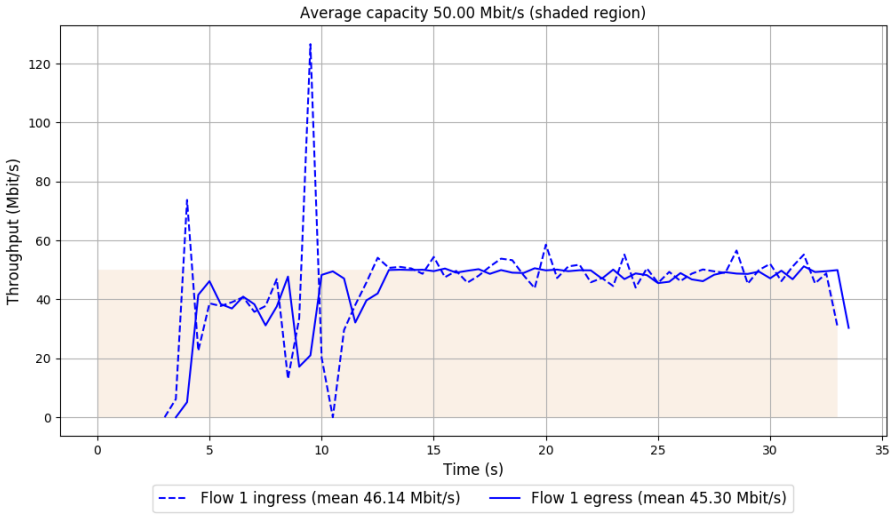


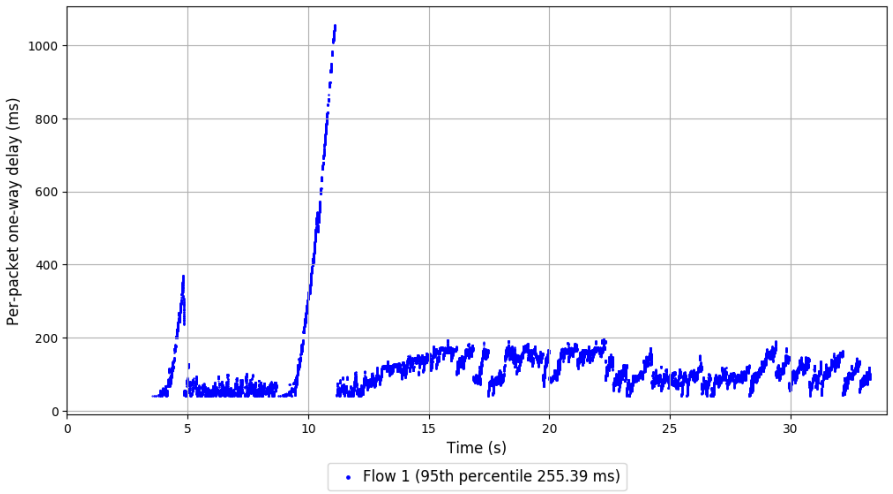
```
Run 1: Statistics of Verus

Start at: 2019-07-04 19:11:48
End at: 2019-07-04 19:12:18

# Below is generated by plot.py at 2019-07-04 19:23:50
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 45.30 Mbit/s (90.6% utilization)
95th percentile per-packet one-way delay: 255.386 ms
Loss rate: 1.94%
-- Flow 1:
Average throughput: 45.30 Mbit/s
95th percentile per-packet one-way delay: 255.386 ms
Loss rate: 1.94%
```

Run 1: Report of Verus — Data Link



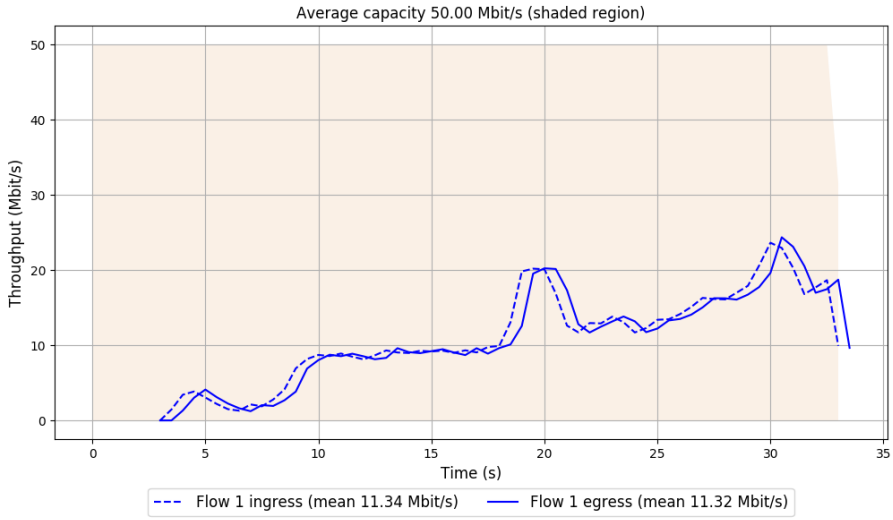


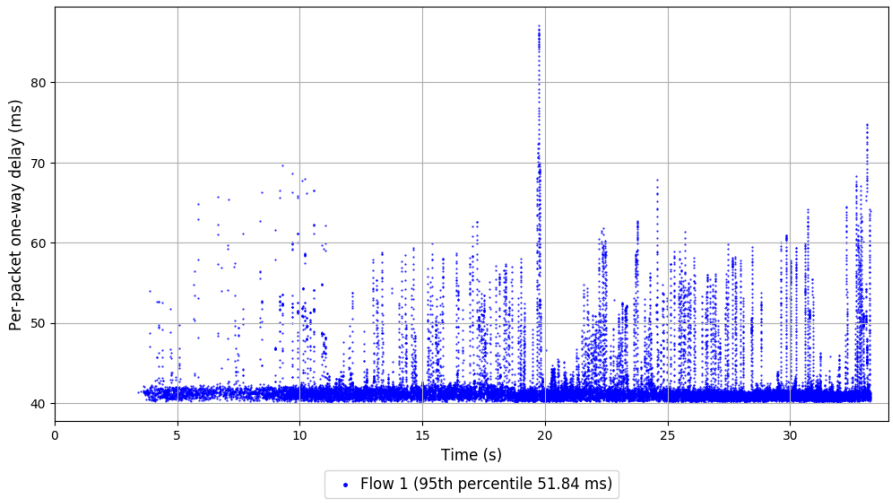
```
Run 1: Statistics of PCC-Vivace

Start at: 2019-07-04 19:15:27
End at: 2019-07-04 19:15:57

# Below is generated by plot.py at 2019-07-04 19:23:50
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 11.32 Mbit/s (22.6% utilization)
95th percentile per-packet one-way delay: 51.845 ms
Loss rate: 0.26%
-- Flow 1:
Average throughput: 11.32 Mbit/s
95th percentile per-packet one-way delay: 51.845 ms
Loss rate: 0.26%
```

Run 1: Report of PCC-Vivace — Data Link





```
Run 1: Statistics of WebRTC media

Start at: 2019-07-04 19:20:15
End at: 2019-07-04 19:20:45
```

Run 1: Report of WebRTC media — Data Link