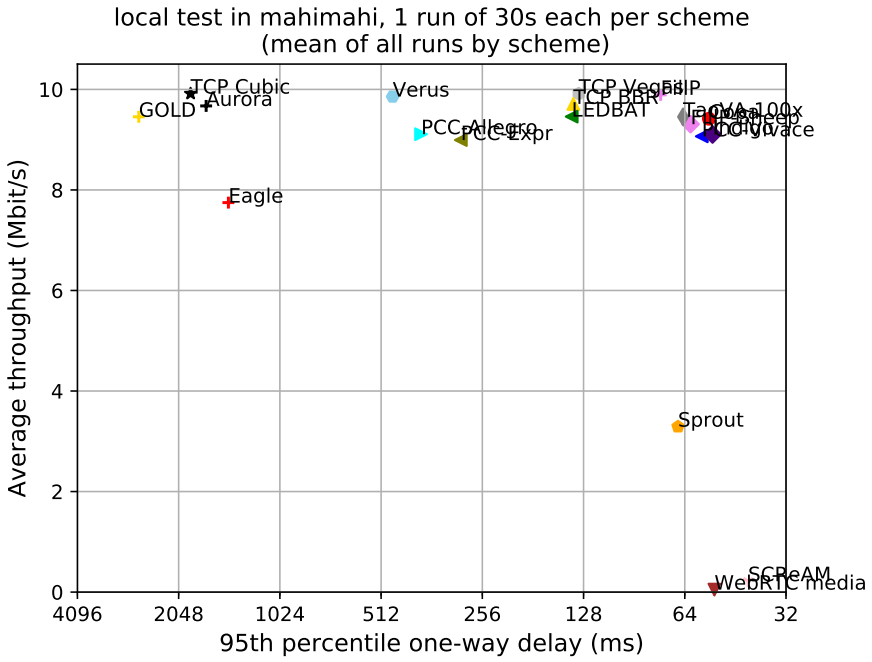
Pantheon Report

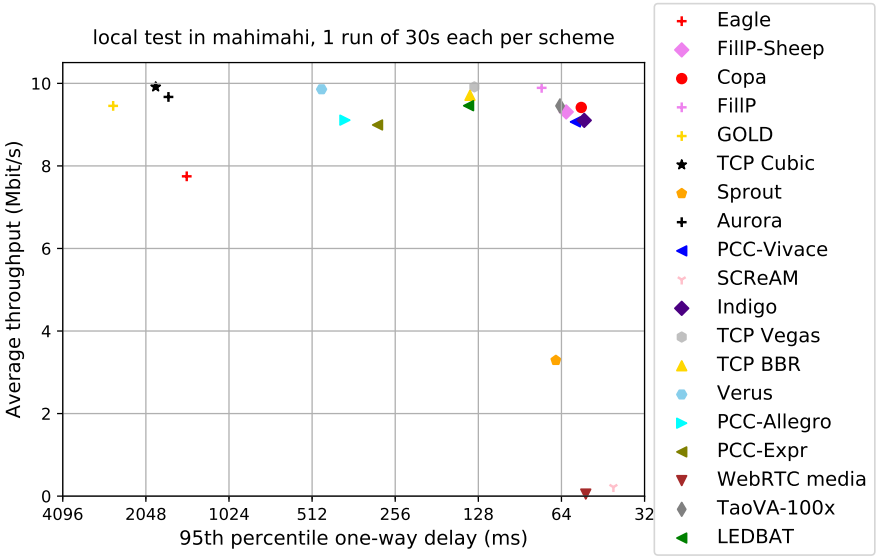
Generated at 2019-07-29 01:56:51 (UTC).
Tested in mahimahi: `mm-delay 40 mm-link 10mbps.trace 10mbps.trace`
Repeated the test of 21 congestion control schemes once.
Each test lasted for 30 seconds running 1 flow.

```
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 @ d735539c9dd7c014acd0994d549842036af77d0e
third_party/aurora @ f3e943d61015b39960854ba6391797e0c7984d74
third_party/aurora-model @ e292c316c23fb837255c4e142e40590d154bbe95
third_party/eagle @ 8733f53138857a4b4d42064d2aedc4cf935539e3
 M sender-receiver/sender-receiver/sender_receiver/envs/example-xentropy.py
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, 1 run of 30s each per scheme
(mean of all runs by scheme)
Average throughput (Mbit/s)
95th percentile one-way delay (ms)
TCP Cubic
Aurora
GOLD
Verus
PCC-Allegro
PCC-Expr
TCP Vegas
FillP
TCP BBR
LEDBAT
Eagle
Sprout
SCReAM
WebRTC media
4096
2048
1024
512
256
128
64
32
0
2
4
6
8
10


local test in mahimahi, 1 run of 30s each per scheme
Average throughput (Mbit/s)
95th percentile one-way delay (ms)
Eagle
FillP-Sheep
Copa
FillP
GOLD
TCP Cubic
Sprout
Aurora
PCC-Vivace
SCReAM
Indigo
TCP Vegas
TCP BBR
Verus
PCC-Allegro
PCC-Expr
WebRTC media
TaoVA-100x
LEDBAT

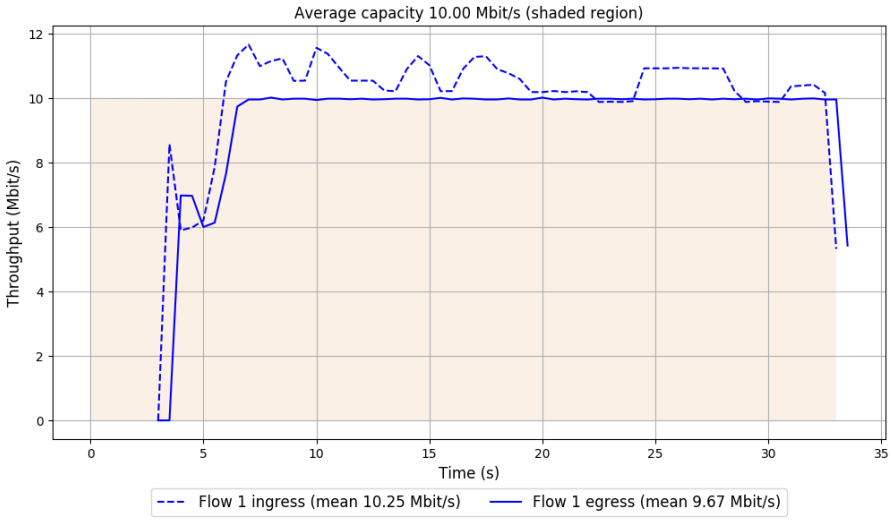
scheme	# runs	mean avg tput (Mbit/s) flow 1	mean 95th-%ile delay (ms) flow 1	mean loss rate (%) flow 1
Aurora	1	9.67	1696.48	5.71
TCP BBR	1	9.71	137.25	0.43
Copa	1	9.42	54.26	0.17
TCP Cubic	1	9.92	1887.18	5.66
Eagle	1	7.75	1456.60	0.10
FillP	1	9.89	75.49	0.22
FillP-Sheep	1	9.31	61.52	0.14
GOLD	1	9.45	2690.42	12.67
GoldLSTM	0	N/A	N/A	N/A
Indigo	1	9.10	52.92	0.16
LEDBAT	1	9.46	138.87	0.48
PCC-Allegro	1	9.11	389.34	0.14
PCC-Expr	1	8.99	296.71	0.80
QUIC Cubic	0	N/A	N/A	N/A
SCReAM	1	0.22	41.50	0.13
Sprout	1	3.29	67.06	0.00
TaoVA-100x	1	9.45	64.77	0.17
TCP Vegas	1	9.91	132.33	0.16
Verus	1	9.86	473.03	1.22
PCC-Vivace	1	9.07	56.98	0.14
WebRTC media	1	0.05	52.25	0.00

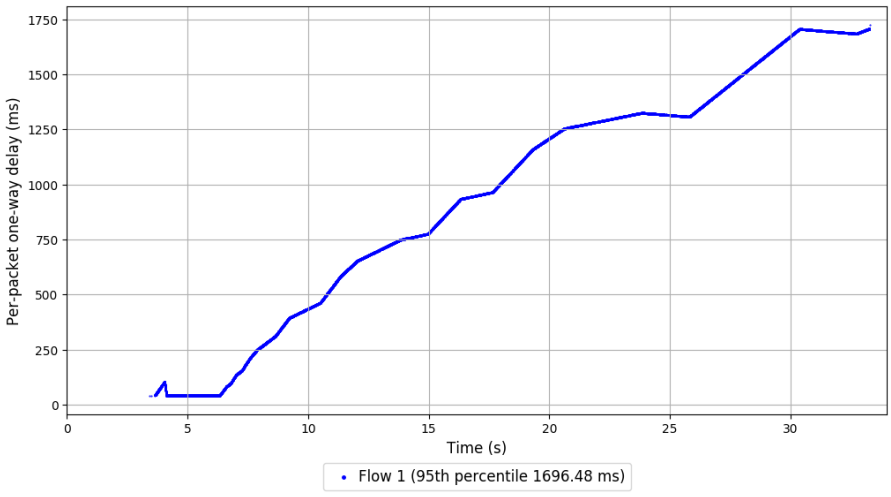
```
Run 1: Statistics of Aurora

Start at: 2019-07-29 01:47:47
End at: 2019-07-29 01:48:18

# Below is generated by plot.py at 2019-07-29 01:56:24
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 9.67 Mbit/s (96.7% utilization)
95th percentile per-packet one-way delay: 1696.479 ms
Loss rate: 5.71%
-- Flow 1:
Average throughput: 9.67 Mbit/s
95th percentile per-packet one-way delay: 1696.479 ms
Loss rate: 5.71%
```

Run 1: Report of Aurora — Data Link



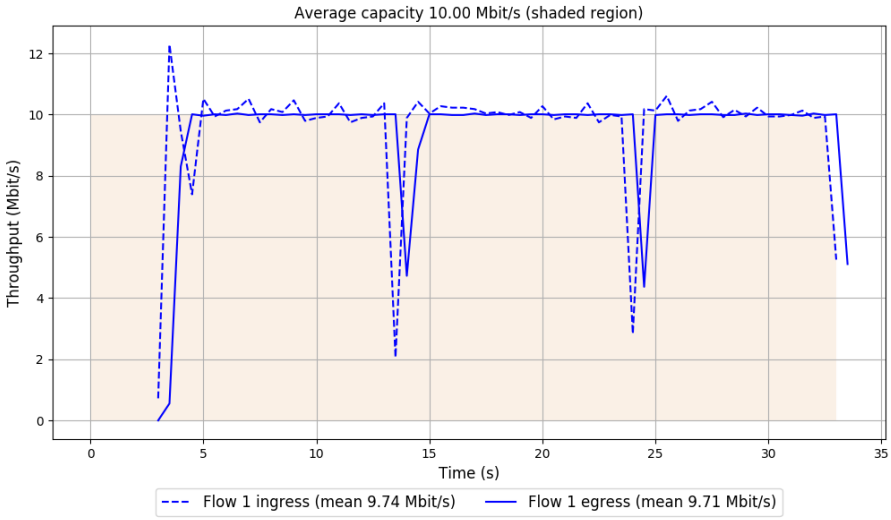


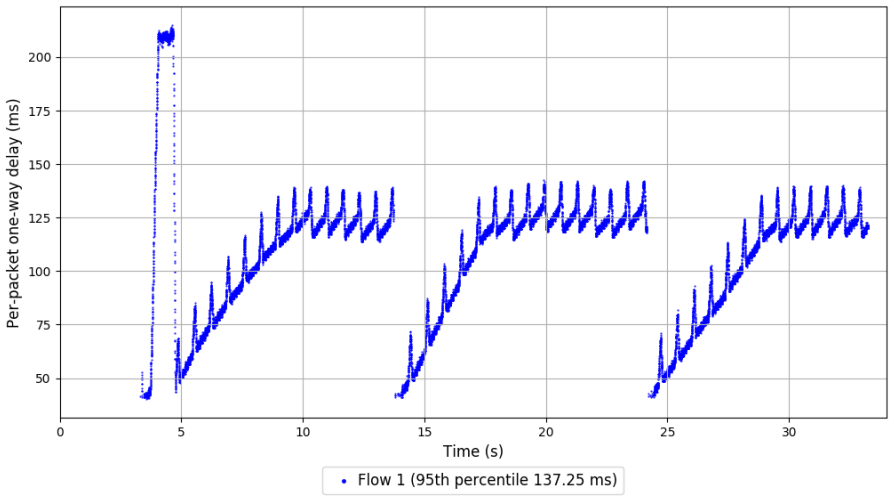
```
Run 1: Statistics of TCP BBR

Start at: 2019-07-29 01:49:32
End at: 2019-07-29 01:50:02

# Below is generated by plot.py at 2019-07-29 01:56:24
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 9.71 Mbit/s (97.1% utilization)
95th percentile per-packet one-way delay: 137.249 ms
Loss rate: 0.43%
-- Flow 1:
Average throughput: 9.71 Mbit/s
95th percentile per-packet one-way delay: 137.249 ms
Loss rate: 0.43%
```

Run 1: Report of TCP BBR — Data Link



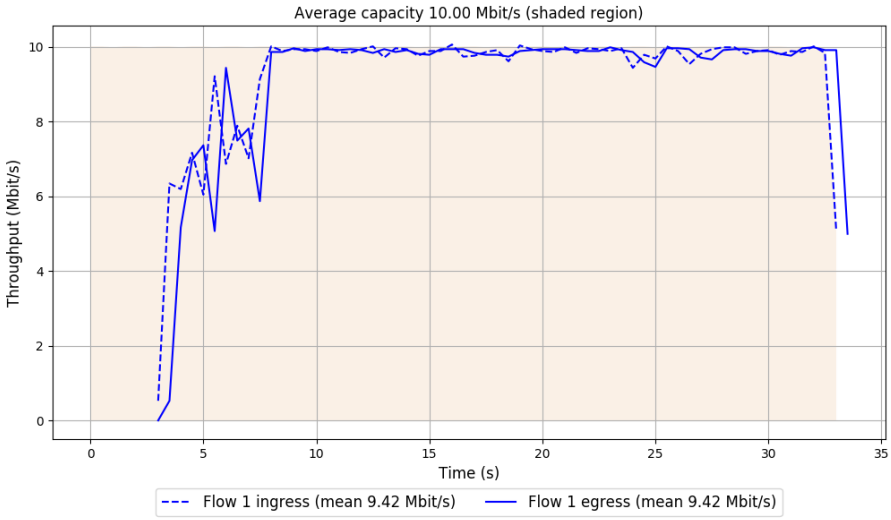


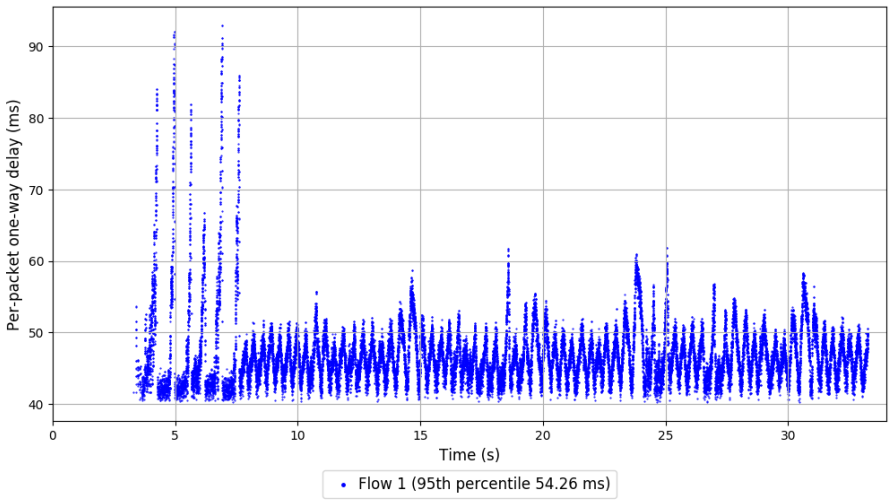
```
Run 1: Statistics of Copa

Start at: 2019-07-29 01:44:19
End at: 2019-07-29 01:44:49

# Below is generated by plot.py at 2019-07-29 01:56:24
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 9.42 Mbit/s (94.2% utilization)
95th percentile per-packet one-way delay: 54.257 ms
Loss rate: 0.17%
-- Flow 1:
Average throughput: 9.42 Mbit/s
95th percentile per-packet one-way delay: 54.257 ms
Loss rate: 0.17%
```

Run 1: Report of Copa — Data Link



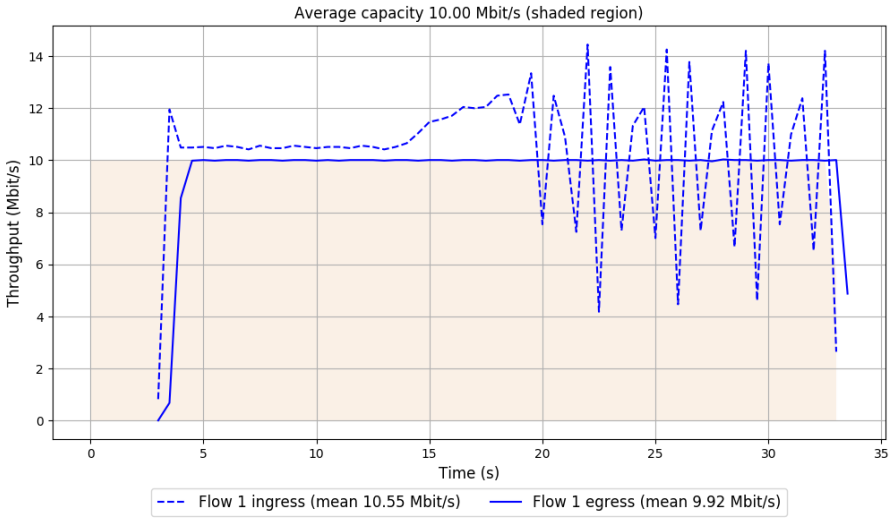


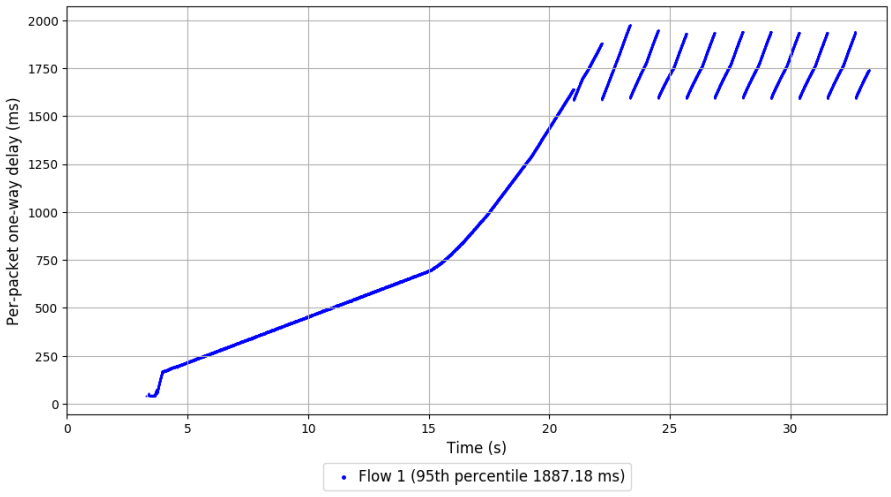
```
Run 1: Statistics of TCP Cubic

Start at: 2019-07-29 01:46:38
End at: 2019-07-29 01:47:08

# Below is generated by plot.py at 2019-07-29 01:56:24
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 9.92 Mbit/s (99.2% utilization)
95th percentile per-packet one-way delay: 1887.177 ms
Loss rate: 5.66%
-- Flow 1:
Average throughput: 9.92 Mbit/s
95th percentile per-packet one-way delay: 1887.177 ms
Loss rate: 5.66%
```

Run 1: Report of TCP Cubic — Data Link



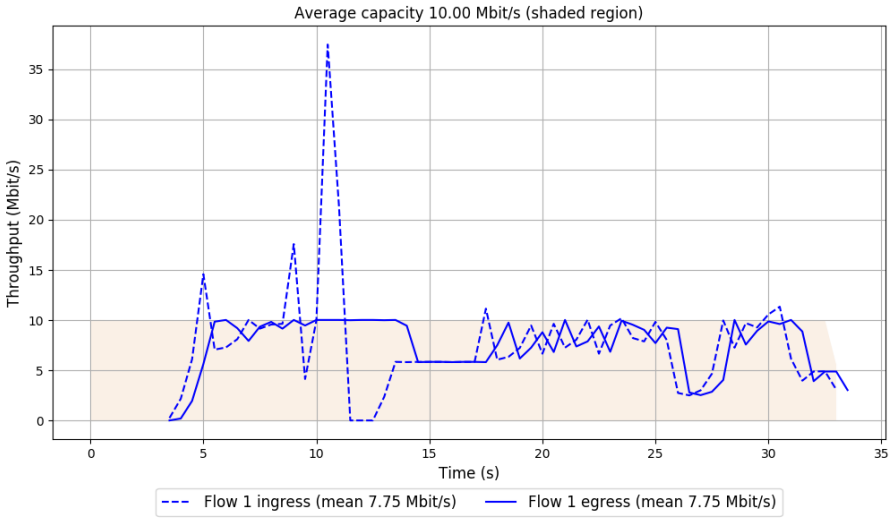


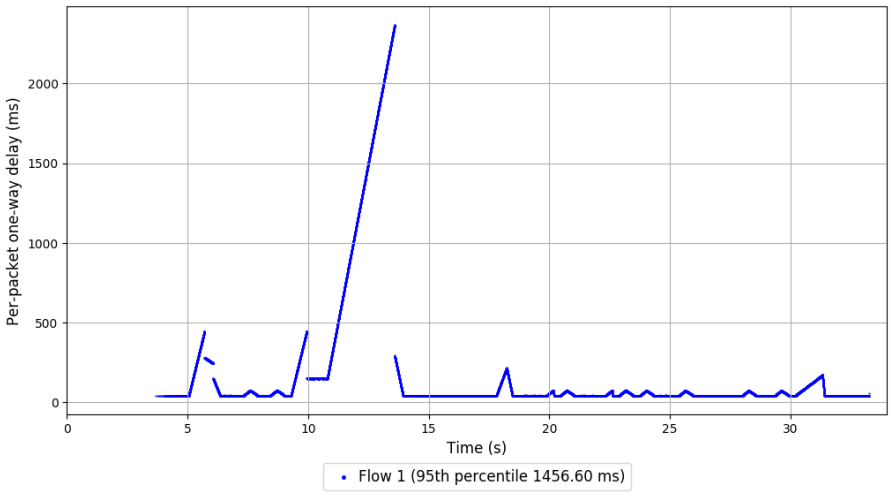
```
Run 1: Statistics of Eagle

Start at: 2019-07-29 01:43:09
End at: 2019-07-29 01:43:39

# Below is generated by plot.py at 2019-07-29 01:56:24
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 7.75 Mbit/s (77.5% utilization)
95th percentile per-packet one-way delay: 1456.600 ms
Loss rate: 0.10%
-- Flow 1:
Average throughput: 7.75 Mbit/s
95th percentile per-packet one-way delay: 1456.600 ms
Loss rate: 0.10%
```

Run 1: Report of Eagle — Data Link



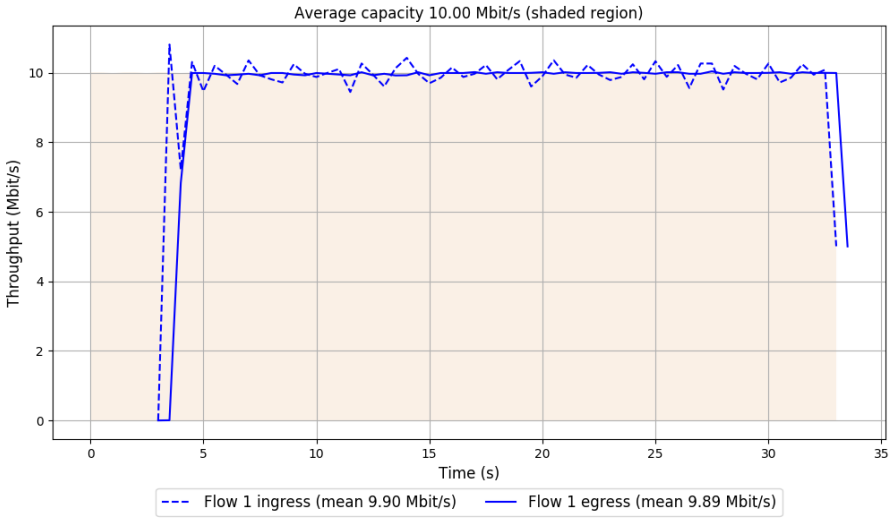


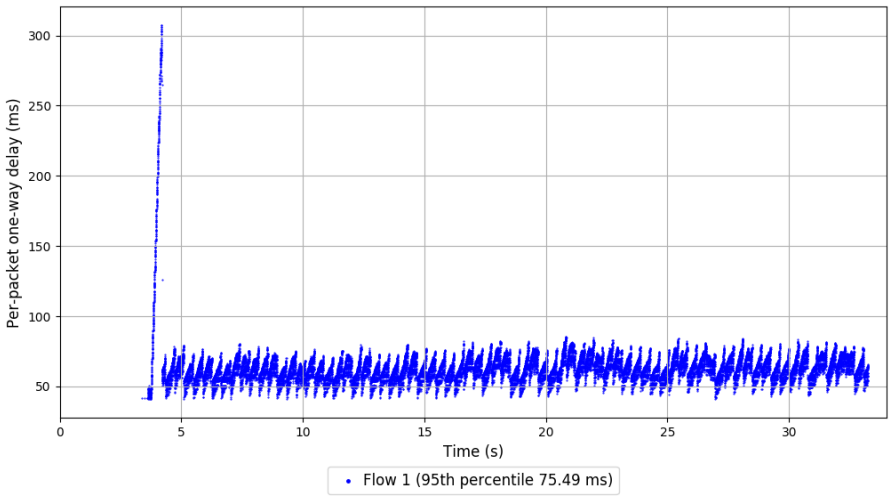
```
Run 1: Statistics of FillP

Start at: 2019-07-29 01:51:16
End at: 2019-07-29 01:51:46

# Below is generated by plot.py at 2019-07-29 01:56:24
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 9.89 Mbit/s (98.9% utilization)
95th percentile per-packet one-way delay: 75.492 ms
Loss rate: 0.22%
-- Flow 1:
Average throughput: 9.89 Mbit/s
95th percentile per-packet one-way delay: 75.492 ms
Loss rate: 0.22%
```

Run 1: Report of FillP — Data Link



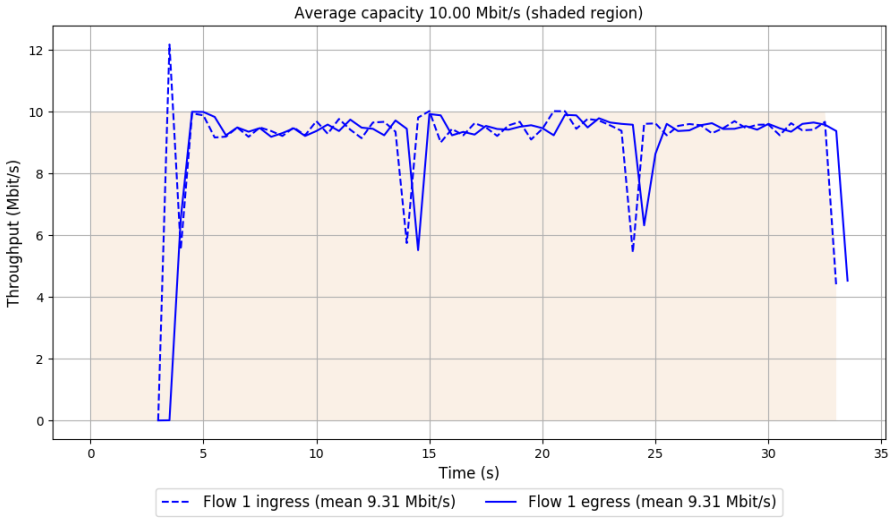


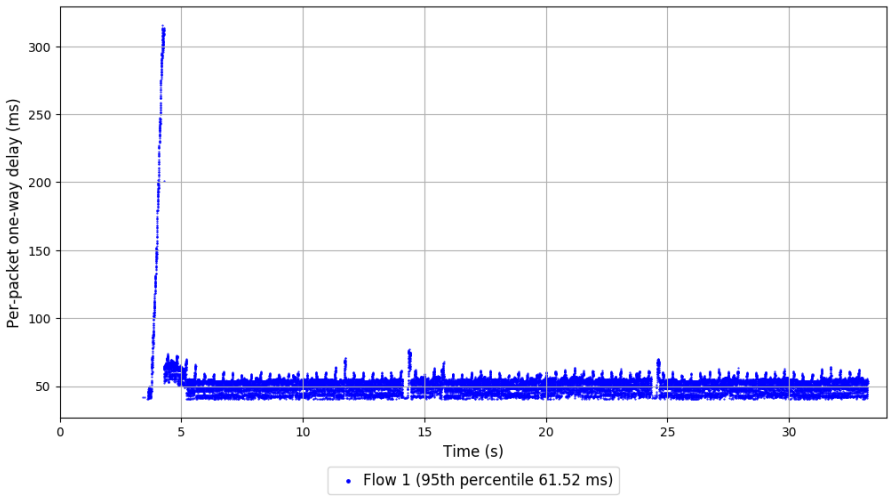
```
Run 1: Statistics of FillP-Sheep

Start at: 2019-07-29 01:43:44
End at: 2019-07-29 01:44:14

# Below is generated by plot.py at 2019-07-29 01:56:26
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 9.31 Mbit/s (93.1% utilization)
95th percentile per-packet one-way delay: 61.518 ms
Loss rate: 0.14%
-- Flow 1:
Average throughput: 9.31 Mbit/s
95th percentile per-packet one-way delay: 61.518 ms
Loss rate: 0.14%
```

Run 1: Report of FillP-Sheep — Data Link



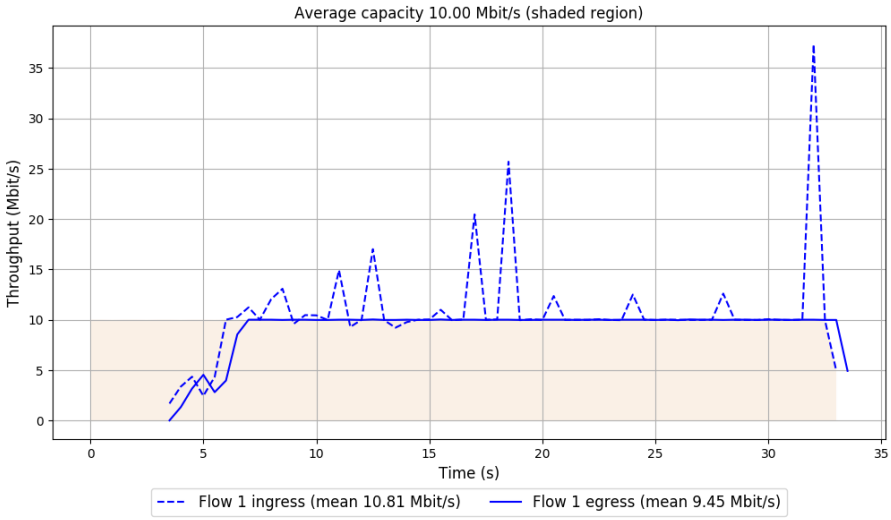


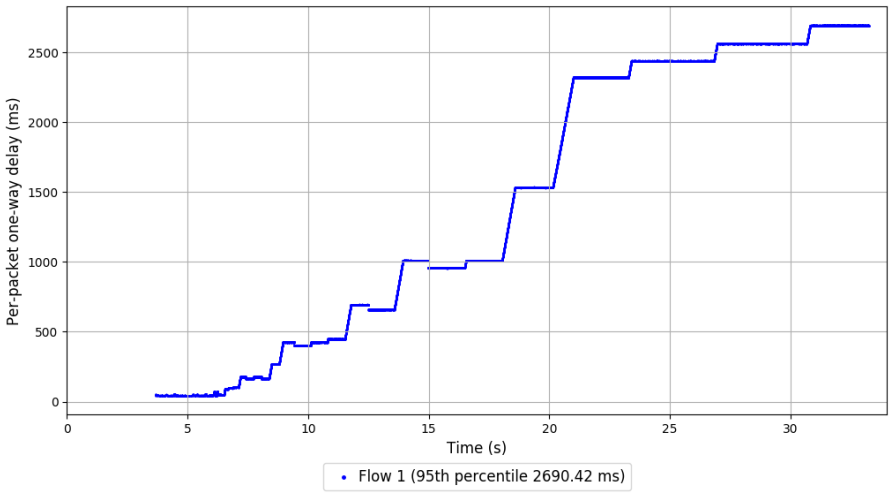
```
Run 1: Statistics of GOLD

Start at: 2019-07-29 01:46:04
End at: 2019-07-29 01:46:34

# Below is generated by plot.py at 2019-07-29 01:56:27
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 9.45 Mbit/s (94.5% utilization)
95th percentile per-packet one-way delay: 2690.416 ms
Loss rate: 12.67%
-- Flow 1:
Average throughput: 9.45 Mbit/s
95th percentile per-packet one-way delay: 2690.416 ms
Loss rate: 12.67%
```

Run 1: Report of GOLD — Data Link

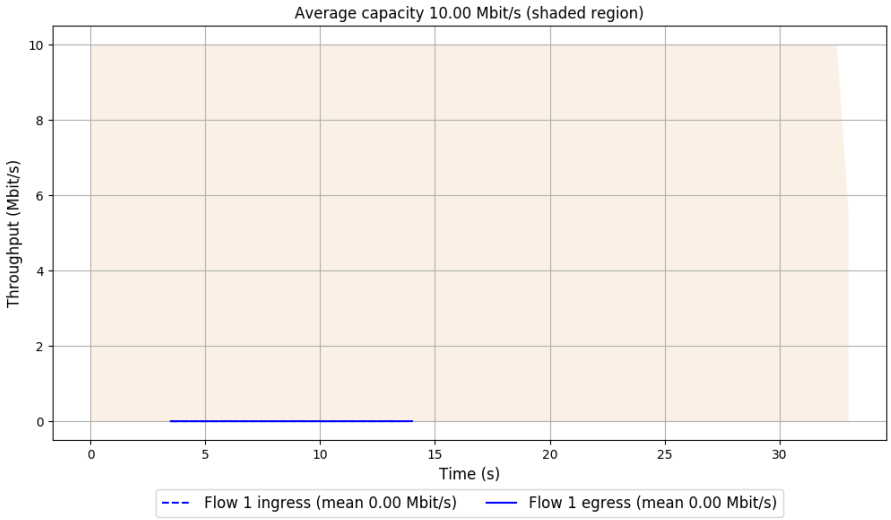


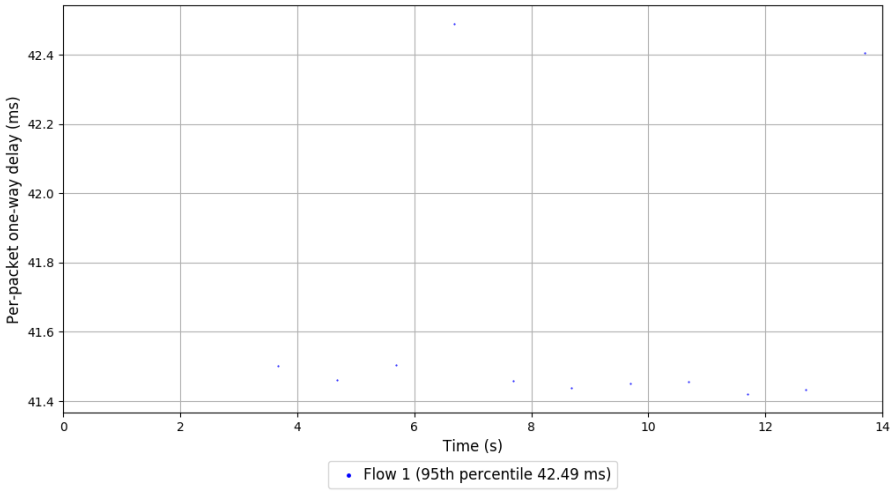


```
Run 1: Statistics of GoldLSTM

Start at: 2019-07-29 01:50:07
End at: 2019-07-29 01:50:37
```

Run 1: Report of GoldLSTM — Data Link



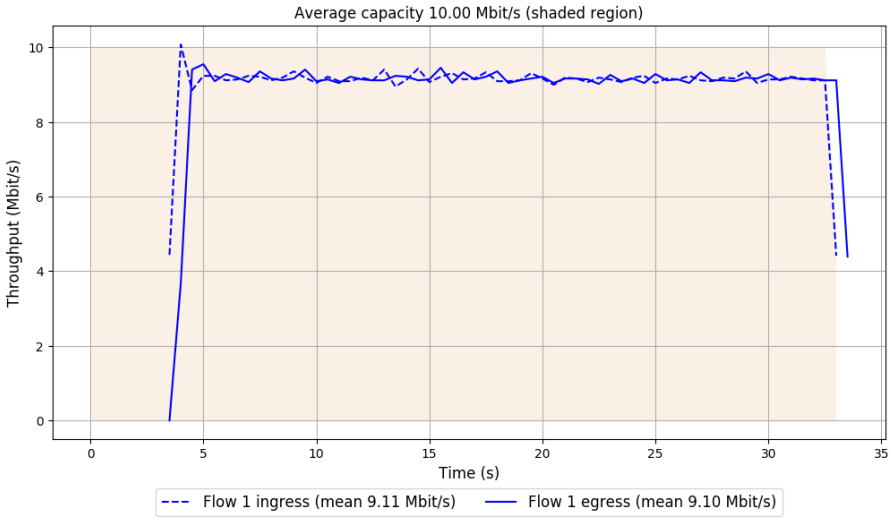


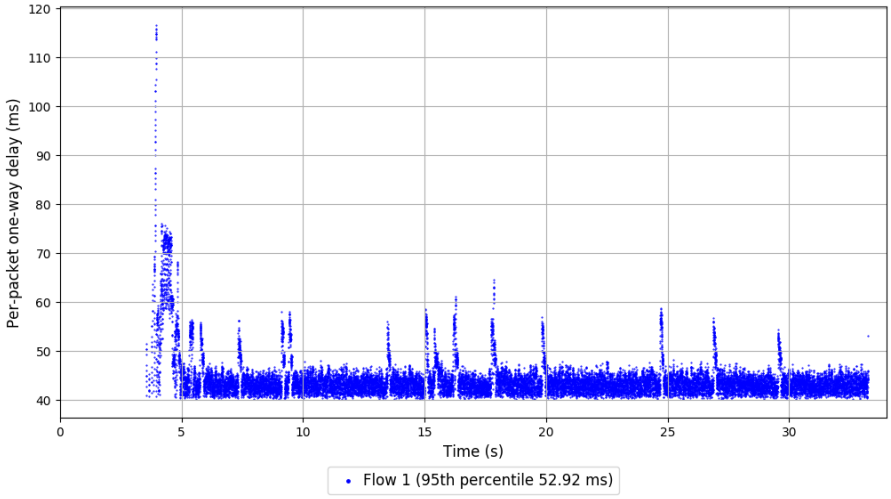
```
Run 1: Statistics of Indigo

Start at: 2019-07-29 01:44:54
End at: 2019-07-29 01:45:24

# Below is generated by plot.py at 2019-07-29 01:56:33
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 9.10 Mbit/s (91.0% utilization)
95th percentile per-packet one-way delay: 52.921 ms
Loss rate: 0.16%
-- Flow 1:
Average throughput: 9.10 Mbit/s
95th percentile per-packet one-way delay: 52.921 ms
Loss rate: 0.16%
```

Run 1: Report of Indigo — Data Link



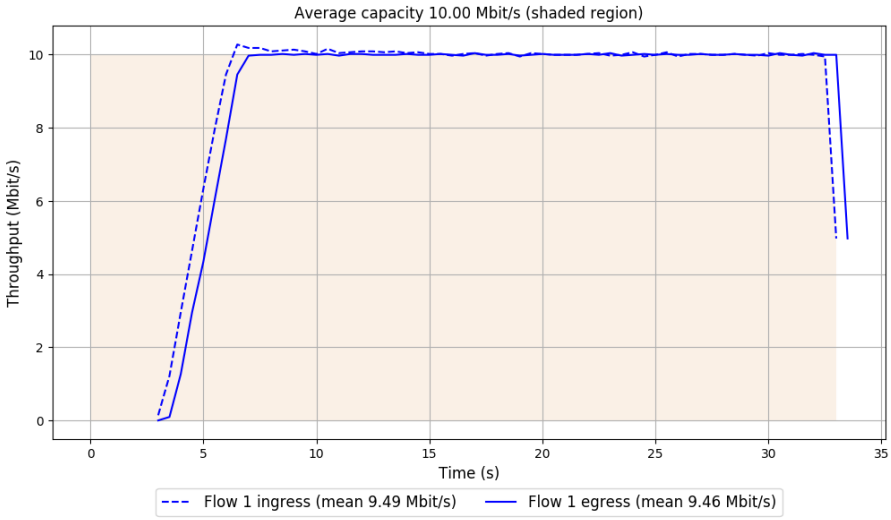


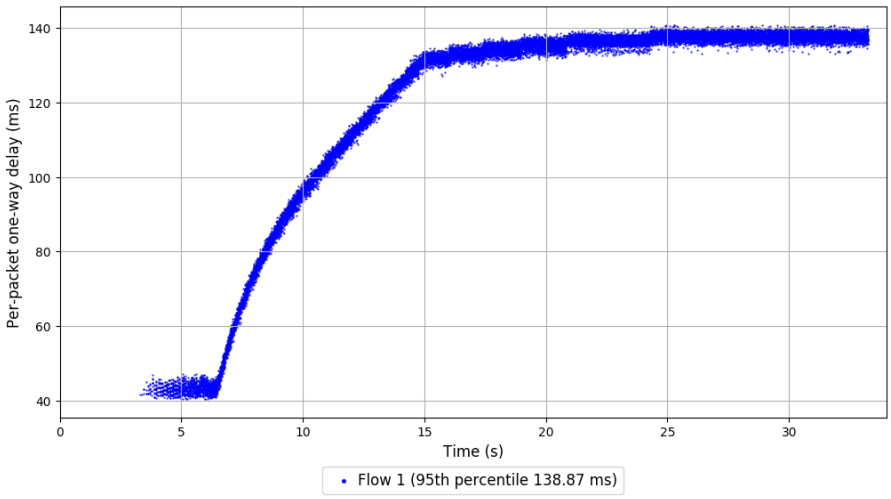
```
Run 1: Statistics of LEDBAT

Start at: 2019-07-29 01:54:08
End at: 2019-07-29 01:54:38

# Below is generated by plot.py at 2019-07-29 01:56:34
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 9.46 Mbit/s (94.6% utilization)
95th percentile per-packet one-way delay: 138.870 ms
Loss rate: 0.48%
-- Flow 1:
Average throughput: 9.46 Mbit/s
95th percentile per-packet one-way delay: 138.870 ms
Loss rate: 0.48%
```

Run 1: Report of LEDBAT — Data Link



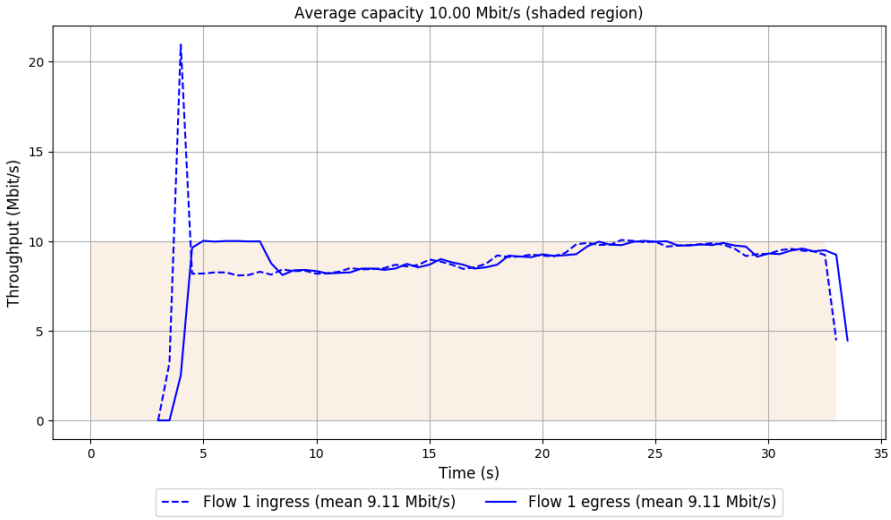


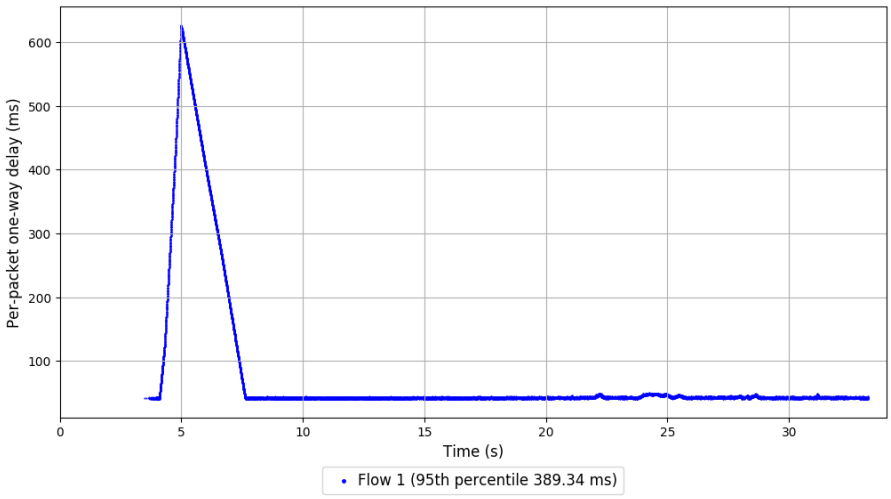
```
Run 1: Statistics of PCC-Allegro

Start at: 2019-07-29 01:52:59
End at: 2019-07-29 01:53:29

# Below is generated by plot.py at 2019-07-29 01:56:35
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 9.11 Mbit/s (91.1% utilization)
95th percentile per-packet one-way delay: 389.342 ms
Loss rate: 0.14%
-- Flow 1:
Average throughput: 9.11 Mbit/s
95th percentile per-packet one-way delay: 389.342 ms
Loss rate: 0.14%
```

Run 1: Report of PCC-Allegro — Data Link



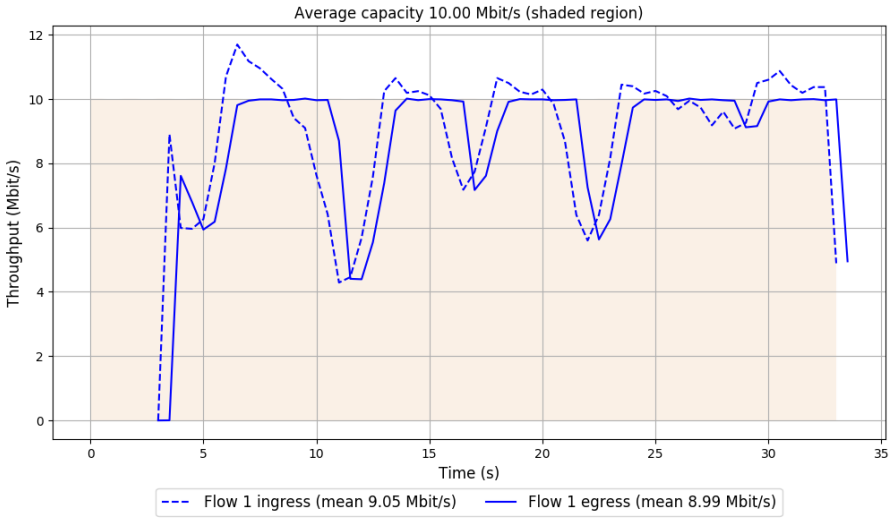


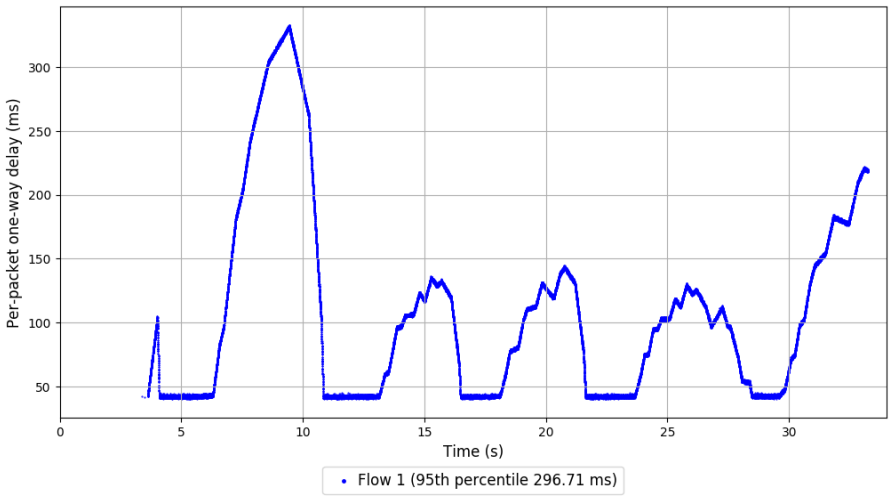
```
Run 1: Statistics of PCC-Expr

Start at: 2019-07-29 01:54:43
End at: 2019-07-29 01:55:13

# Below is generated by plot.py at 2019-07-29 01:56:43
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 8.99 Mbit/s (89.9% utilization)
95th percentile per-packet one-way delay: 296.711 ms
Loss rate: 0.80%
-- Flow 1:
Average throughput: 8.99 Mbit/s
95th percentile per-packet one-way delay: 296.711 ms
Loss rate: 0.80%
```

Run 1: Report of PCC-Expr — Data Link





```
Run 1: Statistics of QUIC Cubic

Start at: 2019-07-29 01:52:25
End at: 2019-07-29 01:52:55
```

Run 1: Report of QUIC Cubic — Data Link

Figure is missing

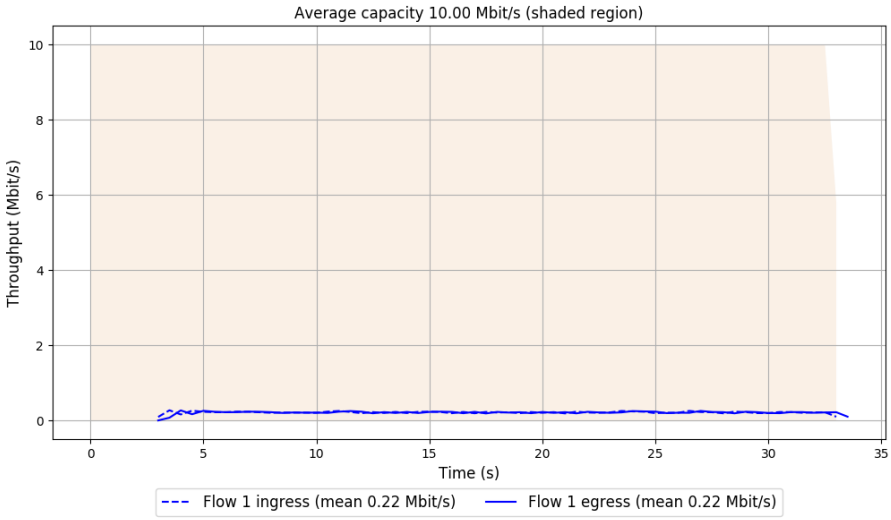
Figure is missing

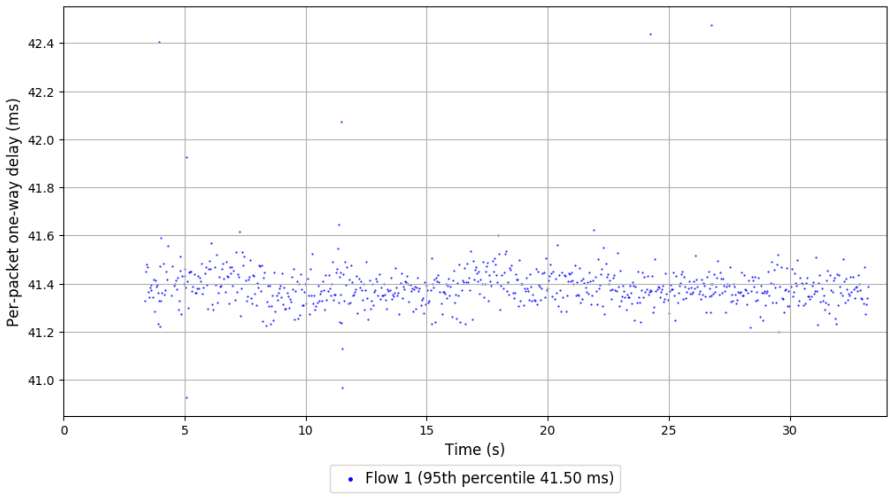
```
Run 1: Statistics of SCReAM

Start at: 2019-07-29 01:51:51
End at: 2019-07-29 01:52:21

# Below is generated by plot.py at 2019-07-29 01:56:43
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 0.22 Mbit/s (2.2% utilization)
95th percentile per-packet one-way delay: 41.496 ms
Loss rate: 0.13%
-- Flow 1:
Average throughput: 0.22 Mbit/s
95th percentile per-packet one-way delay: 41.496 ms
Loss rate: 0.13%
```

Run 1: Report of SCReAM — Data Link



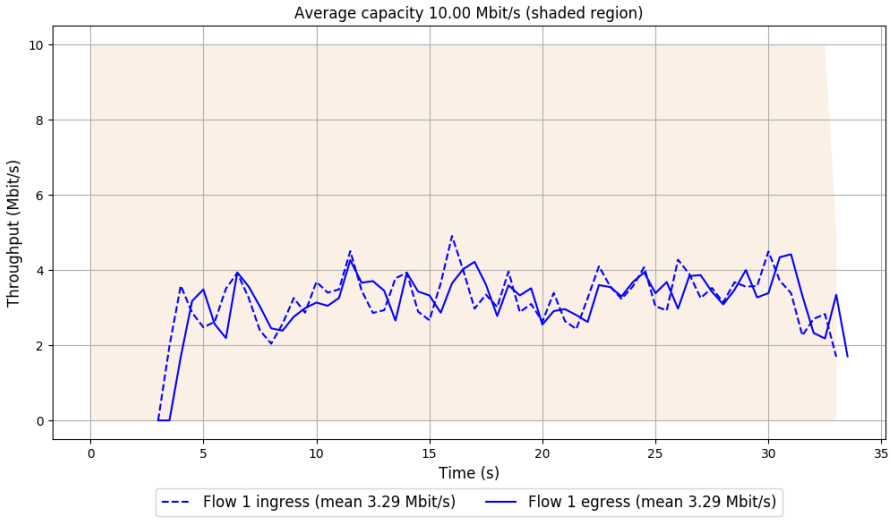


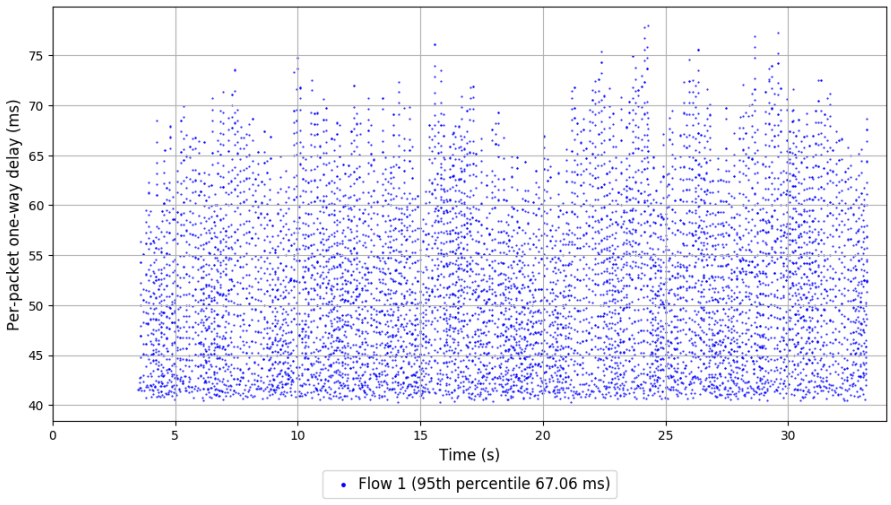
```
Run 1: Statistics of Sprout

Start at: 2019-07-29 01:47:13
End at: 2019-07-29 01:47:43

# Below is generated by plot.py at 2019-07-29 01:56:43
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 3.29 Mbit/s (32.9% utilization)
95th percentile per-packet one-way delay: 67.057 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 3.29 Mbit/s
95th percentile per-packet one-way delay: 67.057 ms
Loss rate: 0.00%
```

Run 1: Report of Sprout — Data Link



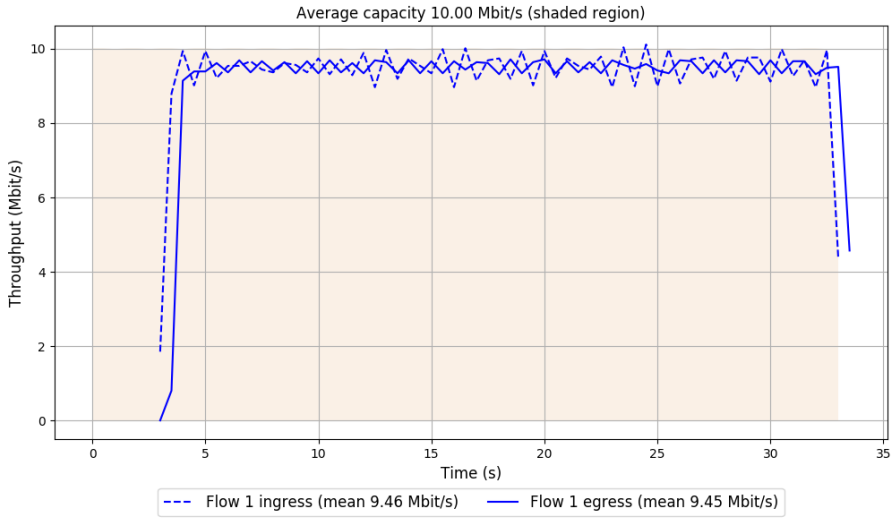


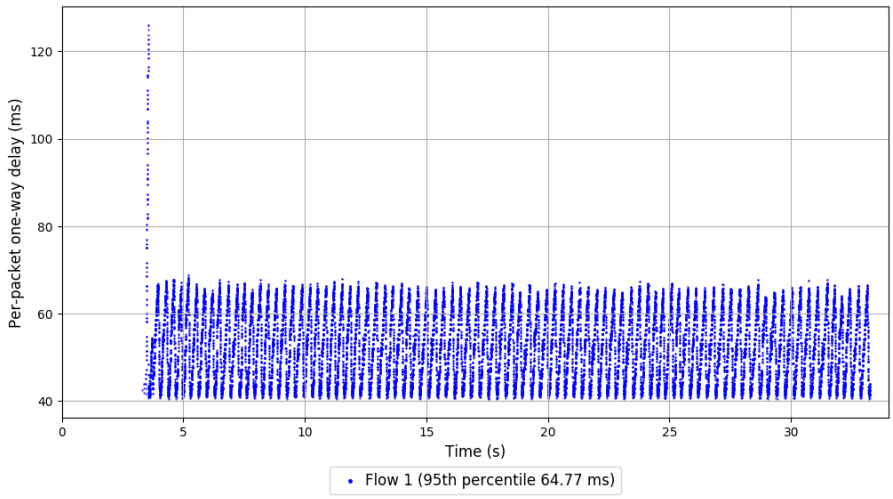
```
Run 1: Statistics of TaoVA-100x

Start at: 2019-07-29 01:50:41
End at: 2019-07-29 01:51:11

# Below is generated by plot.py at 2019-07-29 01:56:48
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 9.45 Mbit/s (94.5% utilization)
95th percentile per-packet one-way delay: 64.765 ms
Loss rate: 0.17%
-- Flow 1:
Average throughput: 9.45 Mbit/s
95th percentile per-packet one-way delay: 64.765 ms
Loss rate: 0.17%
```

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



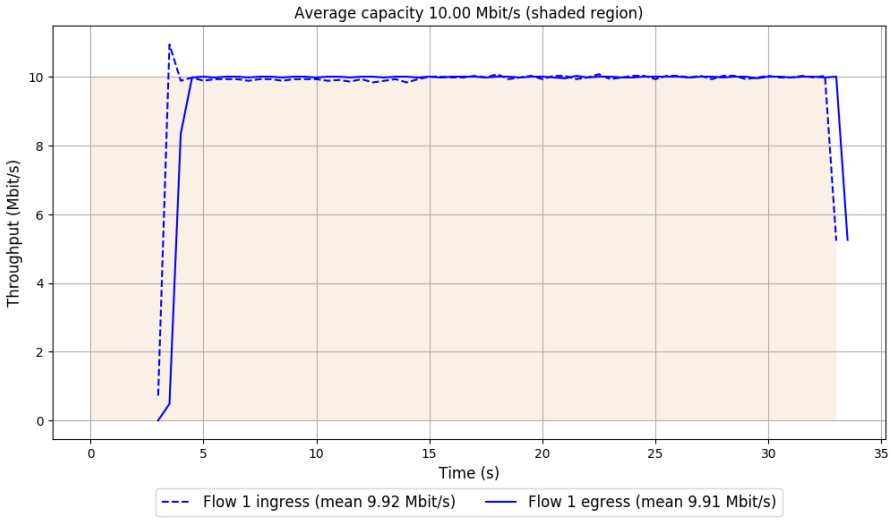


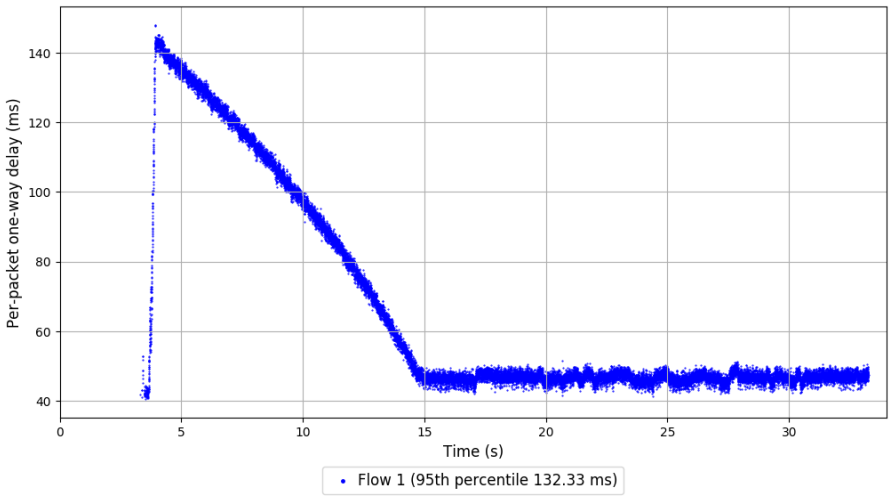
```
Run 1: Statistics of TCP Vegas

Start at: 2019-07-29 01:48:58
End at: 2019-07-29 01:49:28

# Below is generated by plot.py at 2019-07-29 01:56:48
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 9.91 Mbit/s (99.1% utilization)
95th percentile per-packet one-way delay: 132.327 ms
Loss rate: 0.16%
-- Flow 1:
Average throughput: 9.91 Mbit/s
95th percentile per-packet one-way delay: 132.327 ms
Loss rate: 0.16%
```

Run 1: Report of TCP Vegas — Data Link



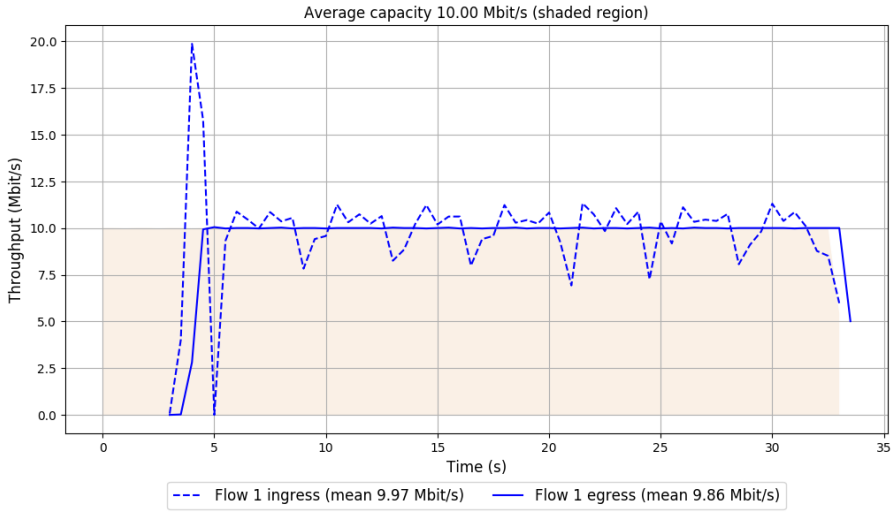


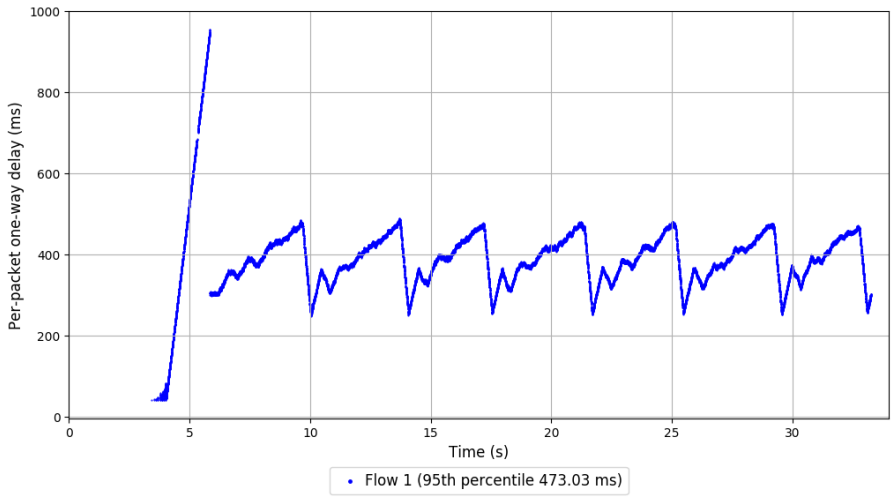
```
Run 1: Statistics of Verus

Start at: 2019-07-29 01:45:29
End at: 2019-07-29 01:45:59

# Below is generated by plot.py at 2019-07-29 01:56:48
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 9.86 Mbit/s (98.6% utilization)
95th percentile per-packet one-way delay: 473.032 ms
Loss rate: 1.22%
-- Flow 1:
Average throughput: 9.86 Mbit/s
95th percentile per-packet one-way delay: 473.032 ms
Loss rate: 1.22%
```

Run 1: Report of Verus — Data Link



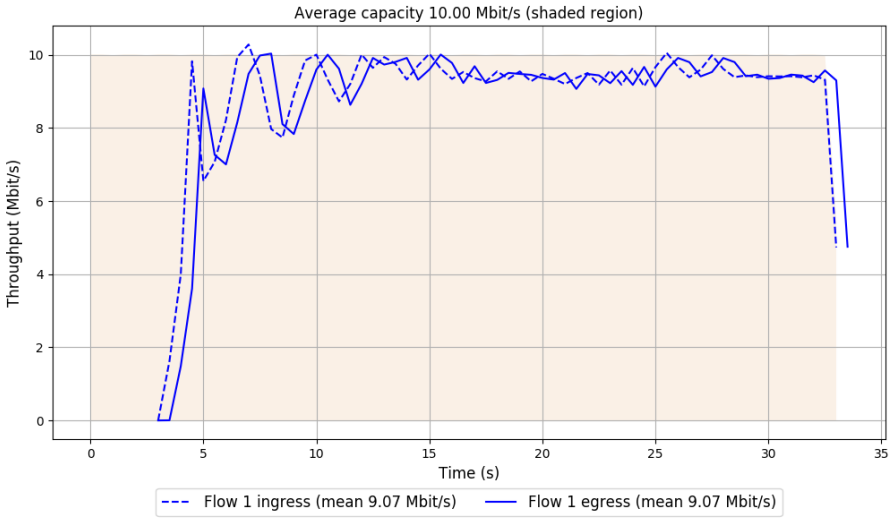


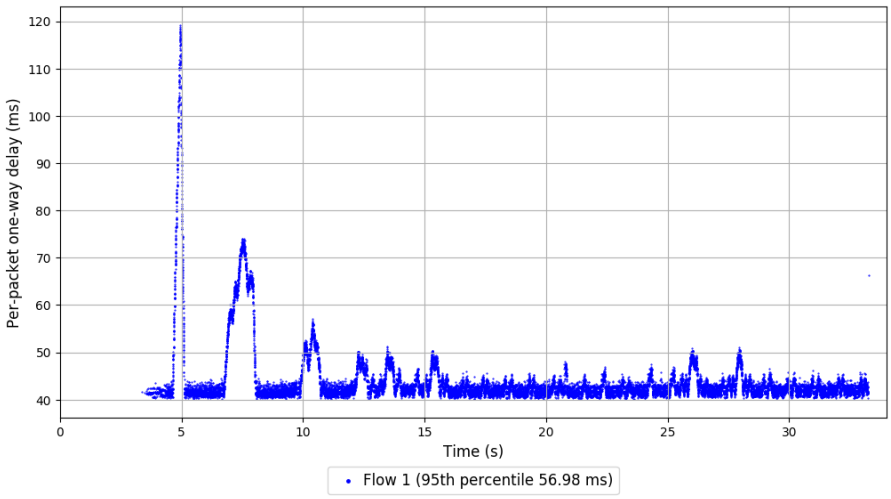
```
Run 1: Statistics of PCC-Vivace

Start at: 2019-07-29 01:48:23
End at: 2019-07-29 01:48:53

# Below is generated by plot.py at 2019-07-29 01:56:48
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 9.07 Mbit/s (90.7% utilization)
95th percentile per-packet one-way delay: 56.980 ms
Loss rate: 0.14%
-- Flow 1:
Average throughput: 9.07 Mbit/s
95th percentile per-packet one-way delay: 56.980 ms
Loss rate: 0.14%
```

Run 1: Report of PCC-Vivace — Data Link





```
Run 1: Statistics of WebRTC media

Start at: 2019-07-29 01:53:34
End at: 2019-07-29 01:54:04

# Below is generated by plot.py at 2019-07-29 01:56:48
# Datalink statistics
-- Total of 1 flow:
Average capacity: 10.00 Mbit/s
Average throughput: 0.05 Mbit/s (0.5% utilization)
95th percentile per-packet one-way delay: 52.254 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 0.05 Mbit/s
95th percentile per-packet one-way delay: 52.254 ms
Loss rate: 0.00%
```

Run 1: Report of WebRTC media — Data Link