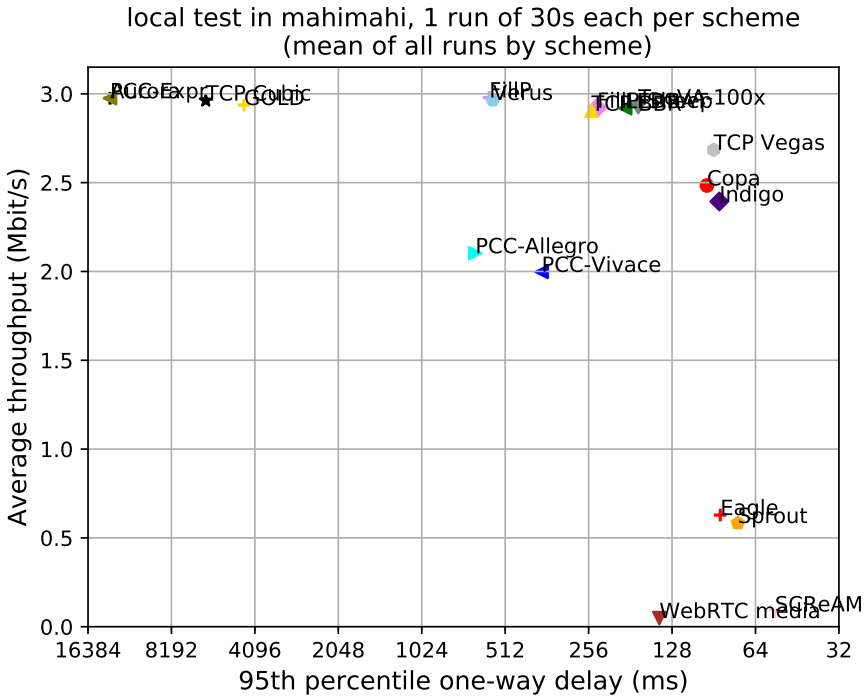
Pantheon Report

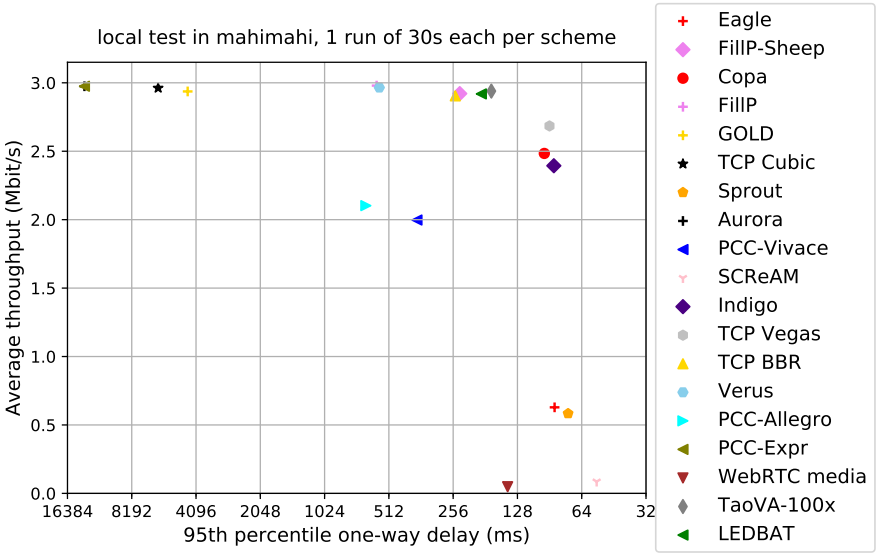
Generated at 2019-07-31 03:04:29 (UTC).
Tested in mahimahi: `mm-delay 40 mm-link 3.04mbps-poisson.trace 3.04mbps-poisson.trace`
Repeated the test of 21 congestion control schemes once.
Each test lasted for 30 seconds running 1 flow.

```
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 @ 45291aaca834696fea56ca274ad8d0d62778688d
third_party/aurora @ f3e943d61015b39960854ba6391797e0c7984d74
third_party/aurora-model @ e292c316c23fb837255c4e142e40590d154bbe95
third_party/eagle @ f66d3a824f0abdd3b1d0afc0cc323607b2c38eca
 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)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
16384
8192
4096
2048
1024
512
256
128
64
32
PCC-Expr
TCP Cubic
GOLD
FillP
Verus
TaoVA-100x
TCP Vegas
Copa
Indigo
PCC-Allegro
PCC-Vivace
Eagle
Sprout
WebRTC media
SCReAM


local test in mahimahi, 1 run of 30s each per scheme
Average throughput (Mbit/s)
95th percentile one-way delay (ms)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
16384
8192
4096
2048
1024
512
256
128
64
32
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

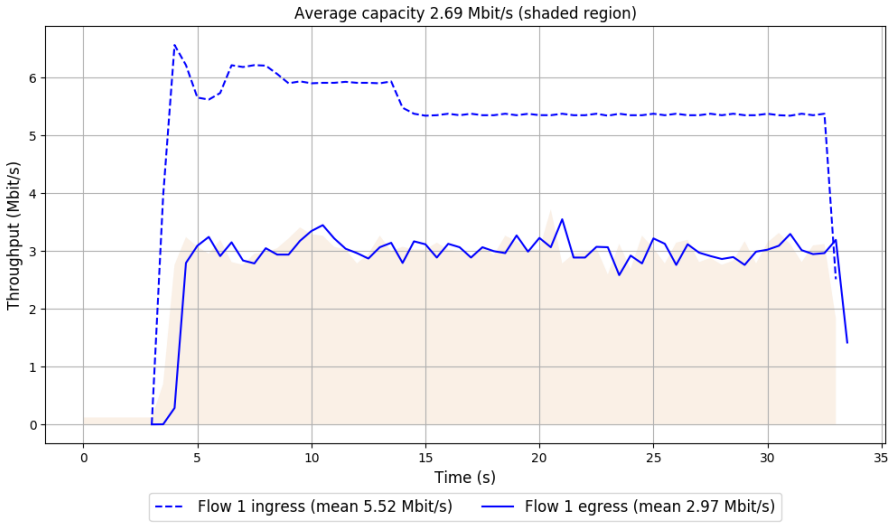
scheme	# runs	mean avg tput (Mbit/s) flow 1	mean 95th-%ile delay (ms) flow 1	mean loss rate (%) flow 1
Aurora	1	2.97	13645.08	46.31
TCP BBR	1	2.90	250.18	0.58
Copa	1	2.48	95.81	0.17
TCP Cubic	1	2.96	6162.67	18.02
Eagle	1	0.63	85.75	0.19
FillP	1	2.98	584.35	2.17
FillP-Sheep	1	2.92	238.44	0.34
GOLD	1	2.94	4482.10	18.79
GoldLSTM	0	N/A	N/A	N/A
Indigo	1	2.39	86.45	0.24
LEDBAT	1	2.92	188.99	0.52
PCC-Allegro	1	2.10	656.08	0.18
PCC-Expr	1	2.97	13648.94	46.30
QUIC Cubic	0	N/A	N/A	N/A
SCReAM	1	0.09	54.47	0.12
Sprout	1	0.58	74.13	0.18
TaoVA-100x	1	2.94	169.55	0.18
TCP Vegas	1	2.68	90.61	0.22
Verus	1	2.97	567.53	1.46
PCC-Vivace	1	2.00	378.37	0.10
WebRTC media	1	0.05	142.28	0.00

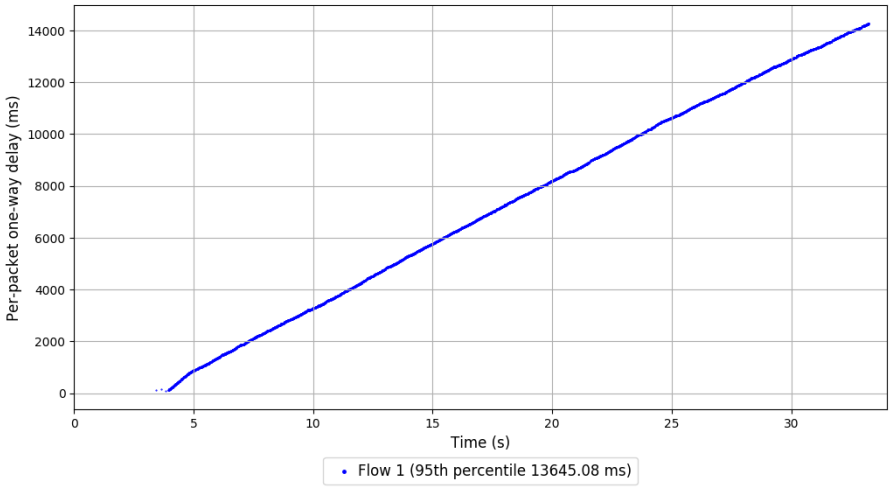
```
Run 1: Statistics of Aurora

Start at: 2019-07-31 02:55:41
End at: 2019-07-31 02:56:11

# Below is generated by plot.py at 2019-07-31 03:04:13
# Datalink statistics
-- Total of 1 flow:
Average capacity: 2.69 Mbit/s
Average throughput: 2.97 Mbit/s (110.4% utilization)
95th percentile per-packet one-way delay: 13645.075 ms
Loss rate: 46.31%
-- Flow 1:
Average throughput: 2.97 Mbit/s
95th percentile per-packet one-way delay: 13645.075 ms
Loss rate: 46.31%
```

Run 1: Report of Aurora — Data Link



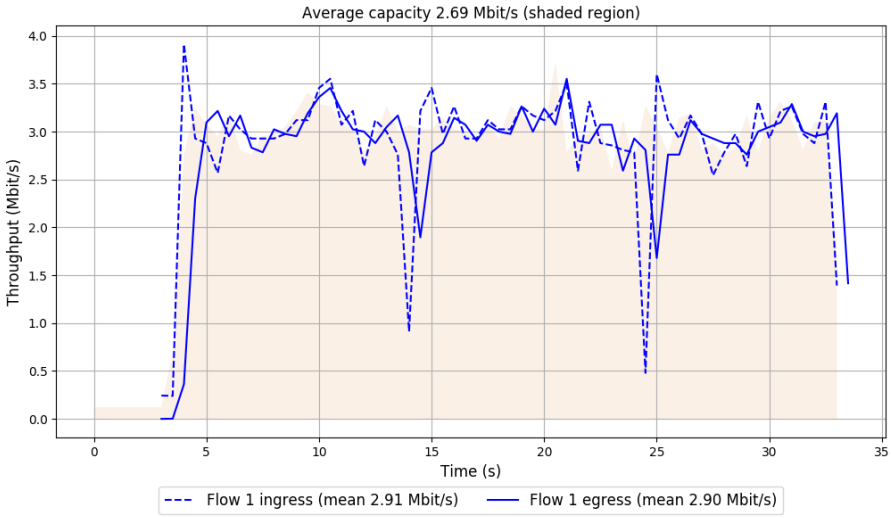


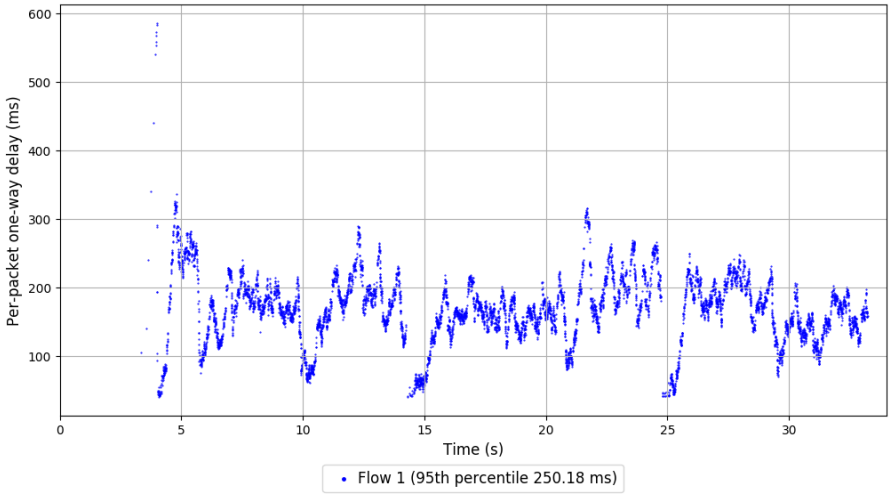
```
Run 1: Statistics of TCP BBR

Start at: 2019-07-31 02:57:24
End at: 2019-07-31 02:57:54

# Below is generated by plot.py at 2019-07-31 03:04:13
# Datalink statistics
-- Total of 1 flow:
Average capacity: 2.69 Mbit/s
Average throughput: 2.90 Mbit/s (107.8% utilization)
95th percentile per-packet one-way delay: 250.175 ms
Loss rate: 0.58%
-- Flow 1:
Average throughput: 2.90 Mbit/s
95th percentile per-packet one-way delay: 250.175 ms
Loss rate: 0.58%
```

Run 1: Report of TCP BBR — Data Link



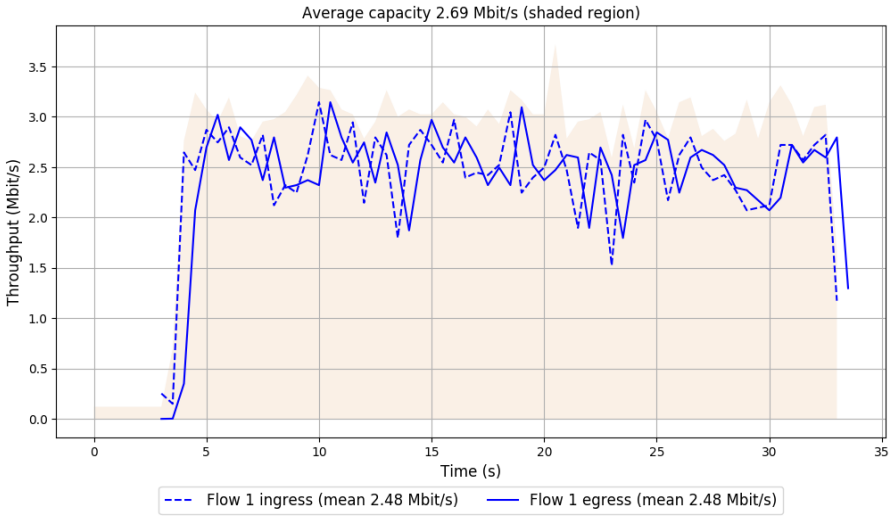


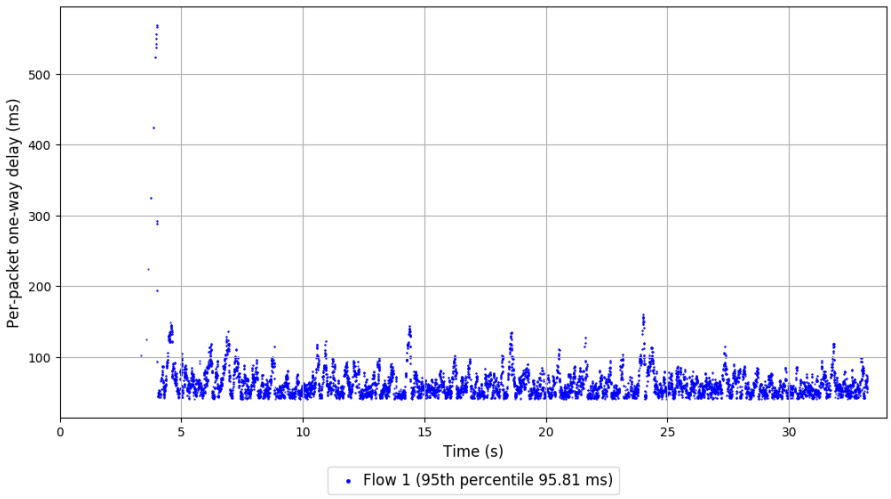
```
Run 1: Statistics of Copa

Start at: 2019-07-31 02:52:15
End at: 2019-07-31 02:52:45

# Below is generated by plot.py at 2019-07-31 03:04:13
# Datalink statistics
-- Total of 1 flow:
Average capacity: 2.69 Mbit/s
Average throughput: 2.48 Mbit/s (92.2% utilization)
95th percentile per-packet one-way delay: 95.805 ms
Loss rate: 0.17%
-- Flow 1:
Average throughput: 2.48 Mbit/s
95th percentile per-packet one-way delay: 95.805 ms
Loss rate: 0.17%
```

Run 1: Report of Copa — Data Link



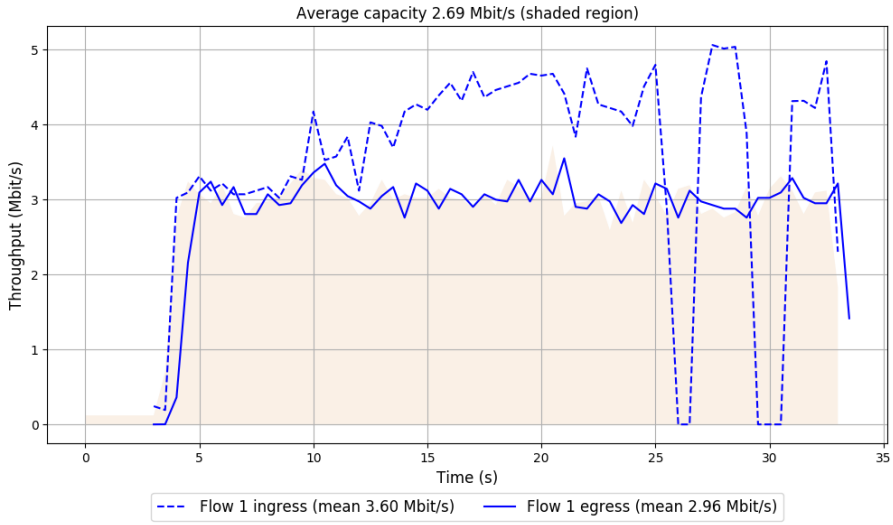


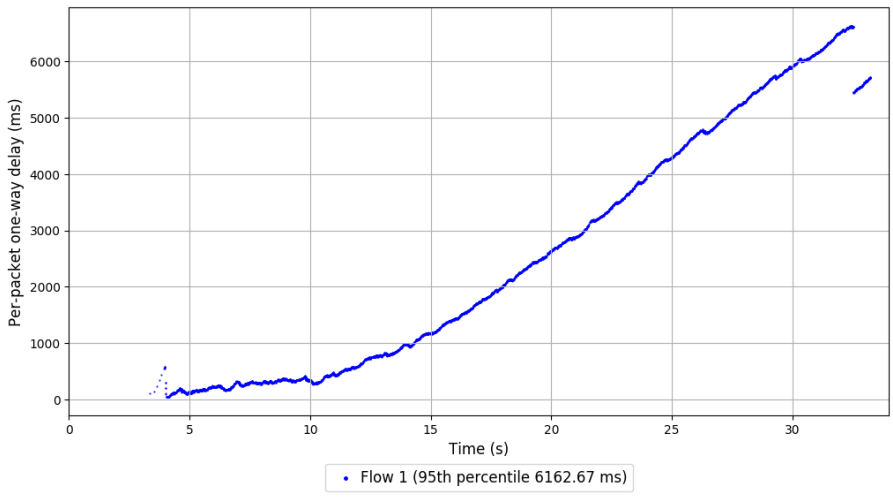
```
Run 1: Statistics of TCP Cubic

Start at: 2019-07-31 02:54:32
End at: 2019-07-31 02:55:02

# Below is generated by plot.py at 2019-07-31 03:04:13
# Datalink statistics
-- Total of 1 flow:
Average capacity: 2.69 Mbit/s
Average throughput: 2.96 Mbit/s (109.9% utilization)
95th percentile per-packet one-way delay: 6162.670 ms
Loss rate: 18.02%
-- Flow 1:
Average throughput: 2.96 Mbit/s
95th percentile per-packet one-way delay: 6162.670 ms
Loss rate: 18.02%
```

Run 1: Report of TCP Cubic — Data Link



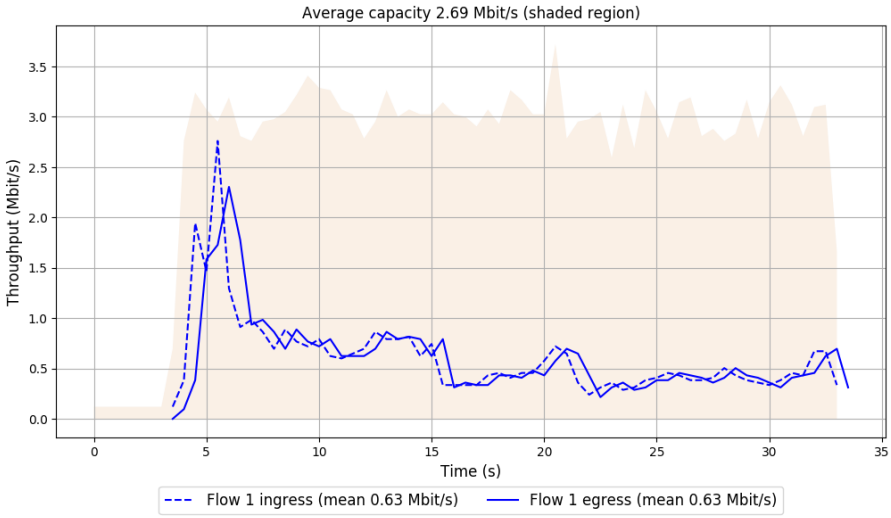


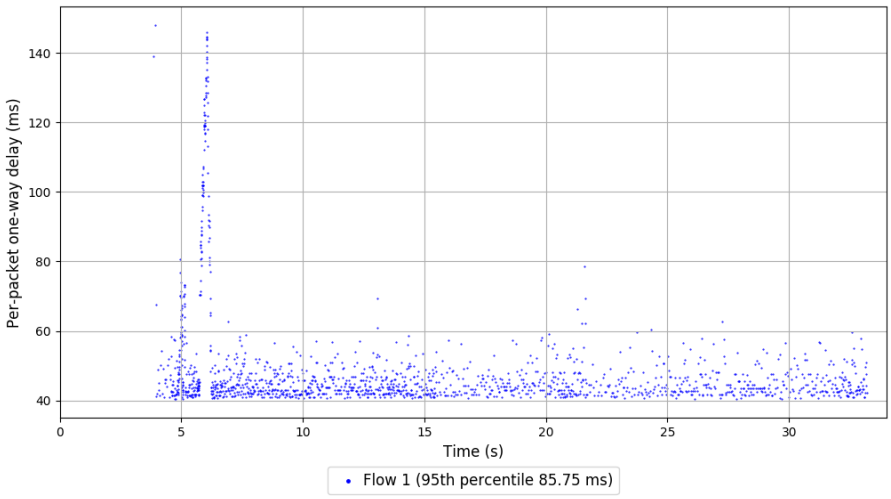
```
Run 1: Statistics of Eagle

Start at: 2019-07-31 02:51:07
End at: 2019-07-31 02:51:37

# Below is generated by plot.py at 2019-07-31 03:04:13
# Datalink statistics
-- Total of 1 flow:
Average capacity: 2.69 Mbit/s
Average throughput: 0.63 Mbit/s (23.3% utilization)
95th percentile per-packet one-way delay: 85.753 ms
Loss rate: 0.19%
-- Flow 1:
Average throughput: 0.63 Mbit/s
95th percentile per-packet one-way delay: 85.753 ms
Loss rate: 0.19%
```

Run 1: Report of Eagle — Data Link



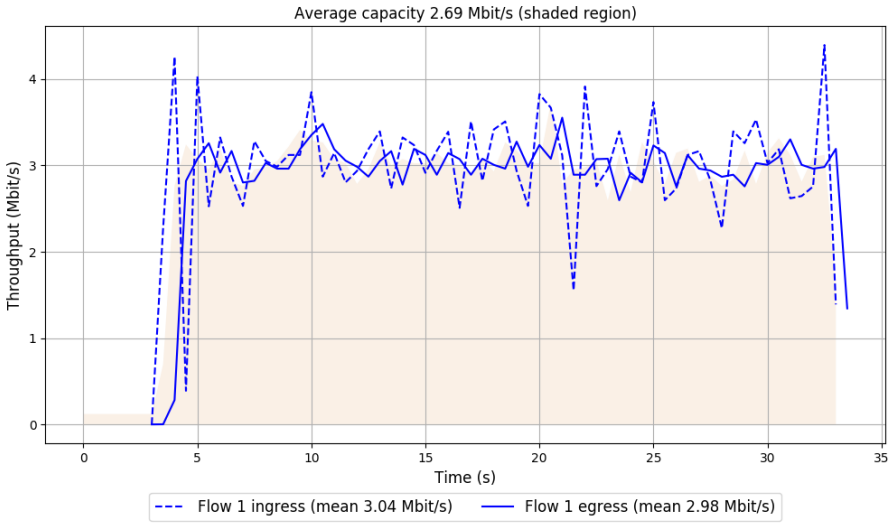


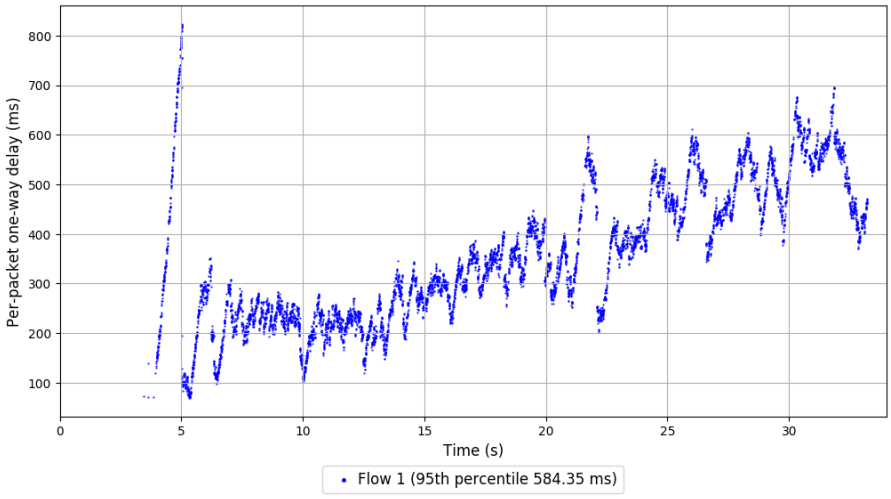
```
Run 1: Statistics of FillP

Start at: 2019-07-31 02:59:07
End at: 2019-07-31 02:59:37

# Below is generated by plot.py at 2019-07-31 03:04:13
# Datalink statistics
-- Total of 1 flow:
Average capacity: 2.69 Mbit/s
Average throughput: 2.98 Mbit/s (110.6% utilization)
95th percentile per-packet one-way delay: 584.350 ms
Loss rate: 2.17%
-- Flow 1:
Average throughput: 2.98 Mbit/s
95th percentile per-packet one-way delay: 584.350 ms
Loss rate: 2.17%
```

Run 1: Report of FillP — Data Link



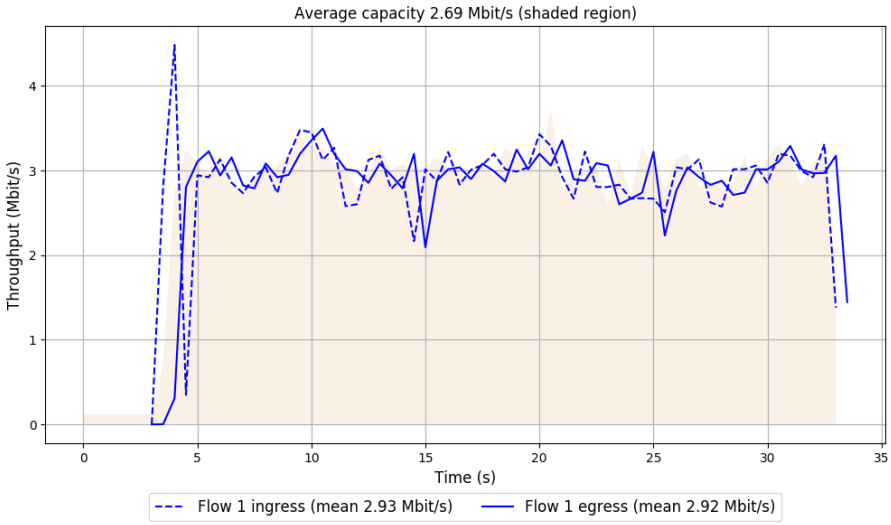


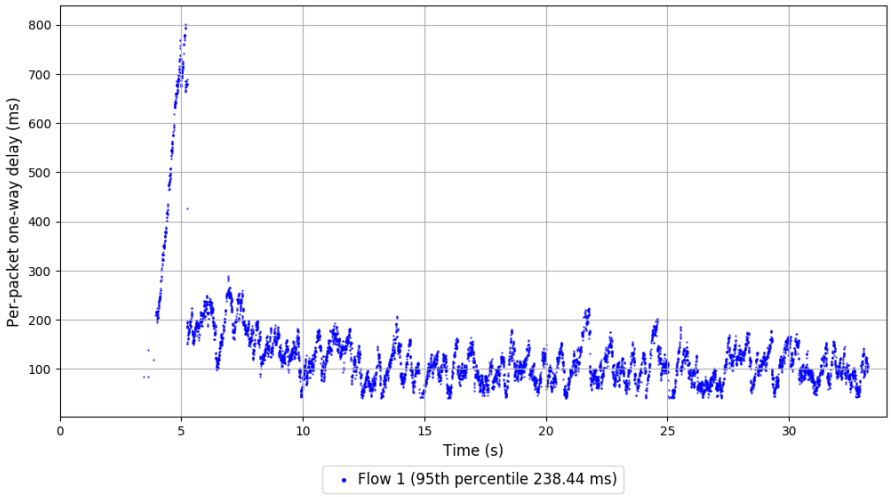
```
Run 1: Statistics of FillP-Sheep

Start at: 2019-07-31 02:51:41
End at: 2019-07-31 02:52:11

# Below is generated by plot.py at 2019-07-31 03:04:13
# Datalink statistics
-- Total of 1 flow:
Average capacity: 2.69 Mbit/s
Average throughput: 2.92 Mbit/s (108.4% utilization)
95th percentile per-packet one-way delay: 238.435 ms
Loss rate: 0.34%
-- Flow 1:
Average throughput: 2.92 Mbit/s
95th percentile per-packet one-way delay: 238.435 ms
Loss rate: 0.34%
```

Run 1: Report of FillP-Sheep — Data Link



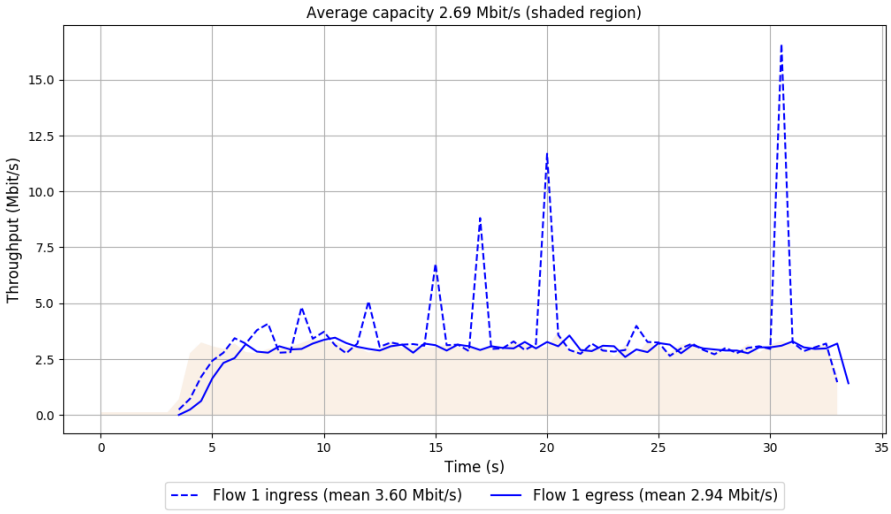


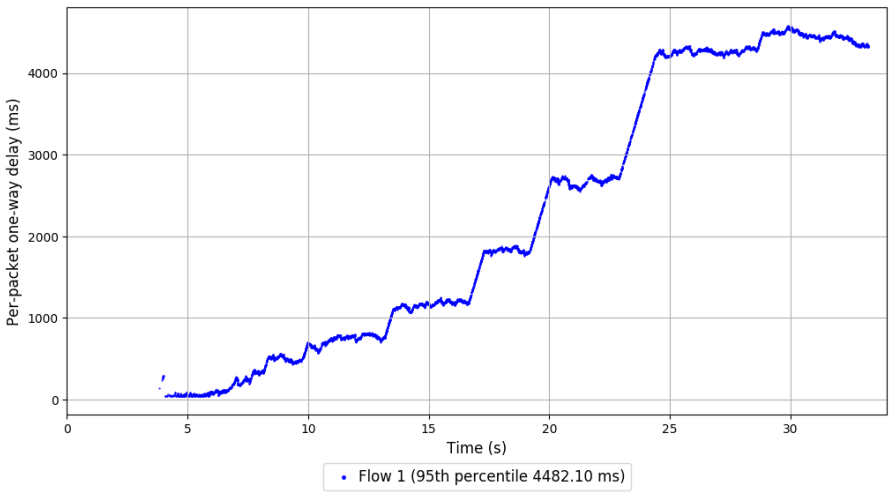
```
Run 1: Statistics of GOLD

Start at: 2019-07-31 02:53:58
End at: 2019-07-31 02:54:28

# Below is generated by plot.py at 2019-07-31 03:04:13
# Datalink statistics
-- Total of 1 flow:
Average capacity: 2.69 Mbit/s
Average throughput: 2.94 Mbit/s (109.0% utilization)
95th percentile per-packet one-way delay: 4482.103 ms
Loss rate: 18.79%
-- Flow 1:
Average throughput: 2.94 Mbit/s
95th percentile per-packet one-way delay: 4482.103 ms
Loss rate: 18.79%
```

Run 1: Report of GOLD — Data Link

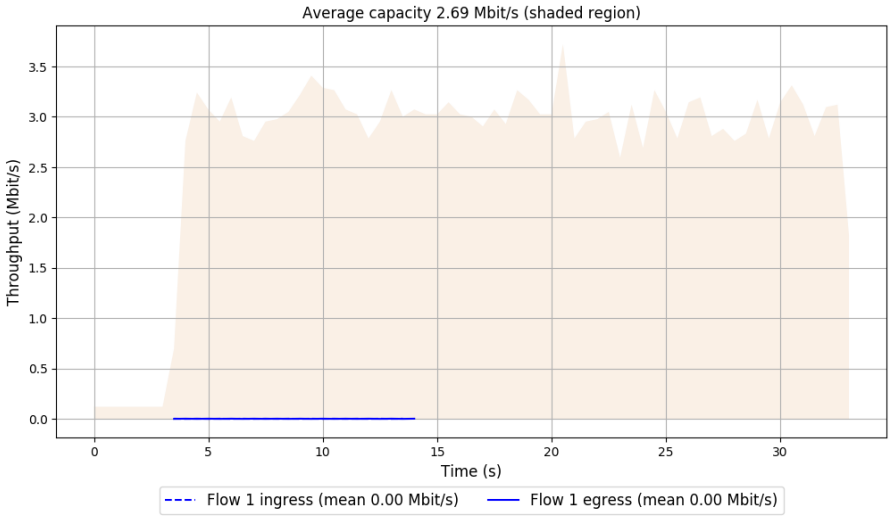


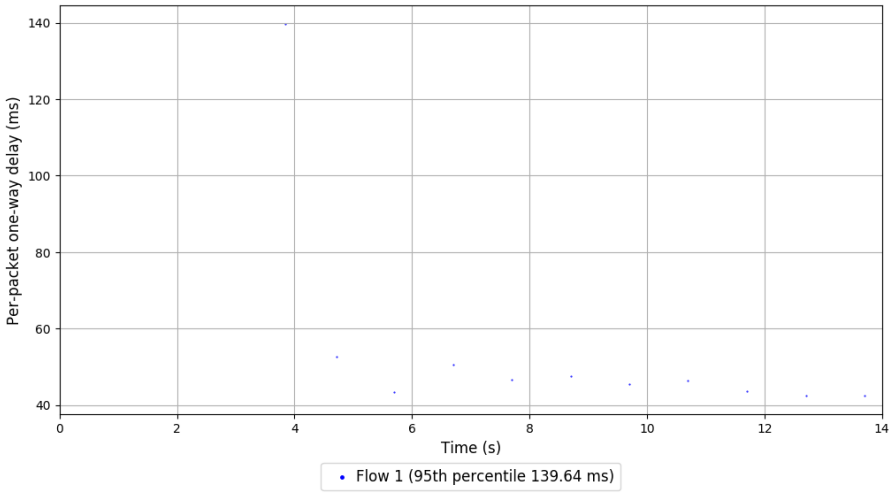


```
Run 1: Statistics of GoldLSTM

Start at: 2019-07-31 02:57:58
End at: 2019-07-31 02:58:28
```

Run 1: Report of GoldLSTM — Data Link



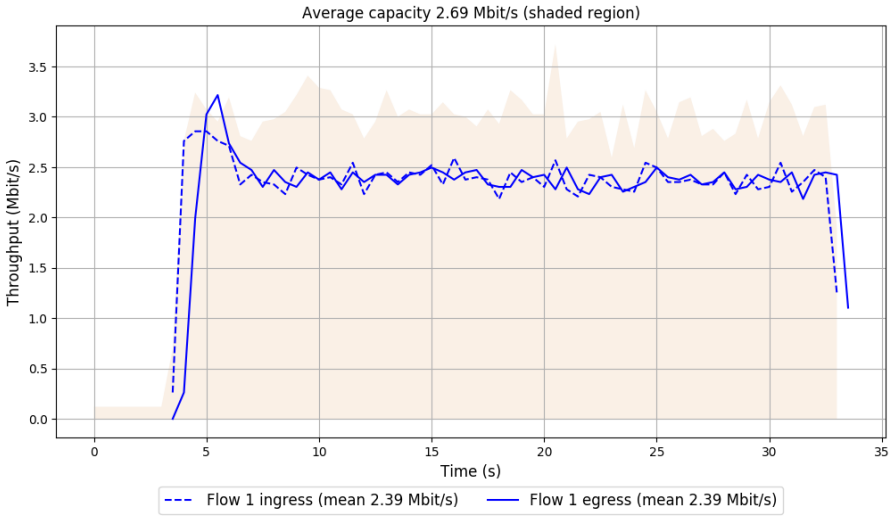


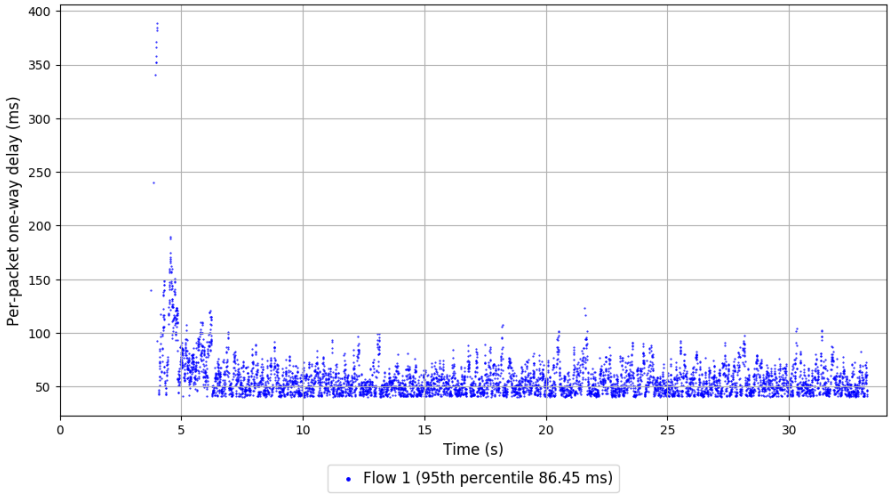
```
Run 1: Statistics of Indigo

Start at: 2019-07-31 02:52:49
End at: 2019-07-31 02:53:20

# Below is generated by plot.py at 2019-07-31 03:04:13
# Datalink statistics
-- Total of 1 flow:
Average capacity: 2.69 Mbit/s
Average throughput: 2.39 Mbit/s (88.9% utilization)
95th percentile per-packet one-way delay: 86.451 ms
Loss rate: 0.24%
-- Flow 1:
Average throughput: 2.39 Mbit/s
95th percentile per-packet one-way delay: 86.451 ms
Loss rate: 0.24%
```

Run 1: Report of Indigo — Data Link



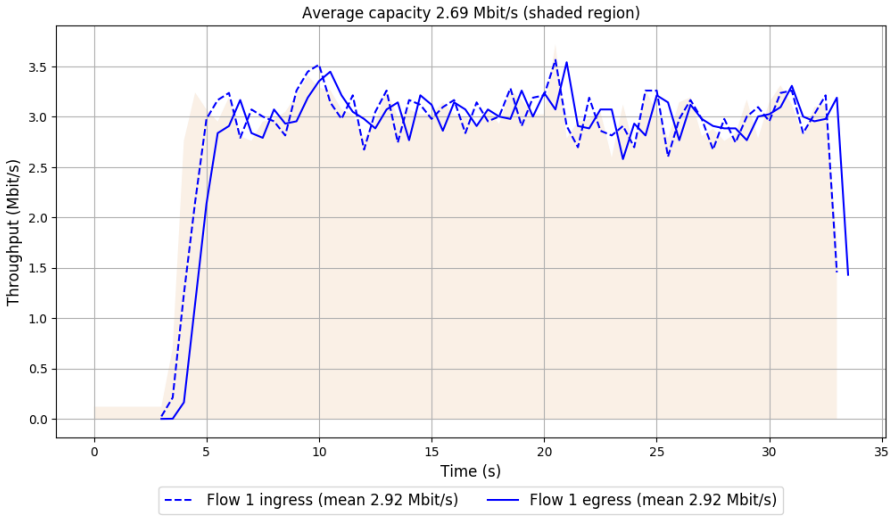


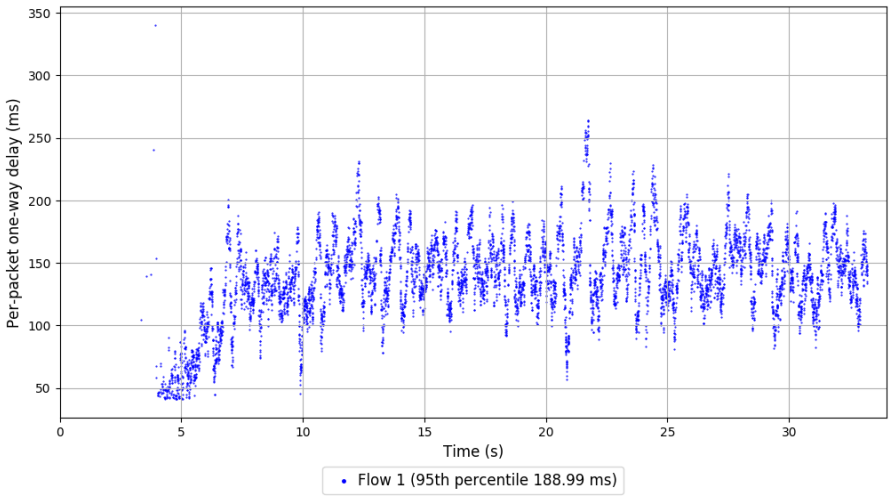
```
Run 1: Statistics of LEDBAT

Start at: 2019-07-31 03:01:58
End at: 2019-07-31 03:02:28

# Below is generated by plot.py at 2019-07-31 03:04:16
# Datalink statistics
-- Total of 1 flow:
Average capacity: 2.69 Mbit/s
Average throughput: 2.92 Mbit/s (108.4% utilization)
95th percentile per-packet one-way delay: 188.986 ms
Loss rate: 0.52%
-- Flow 1:
Average throughput: 2.92 Mbit/s
95th percentile per-packet one-way delay: 188.986 ms
Loss rate: 0.52%
```

Run 1: Report of LEDBAT — Data Link



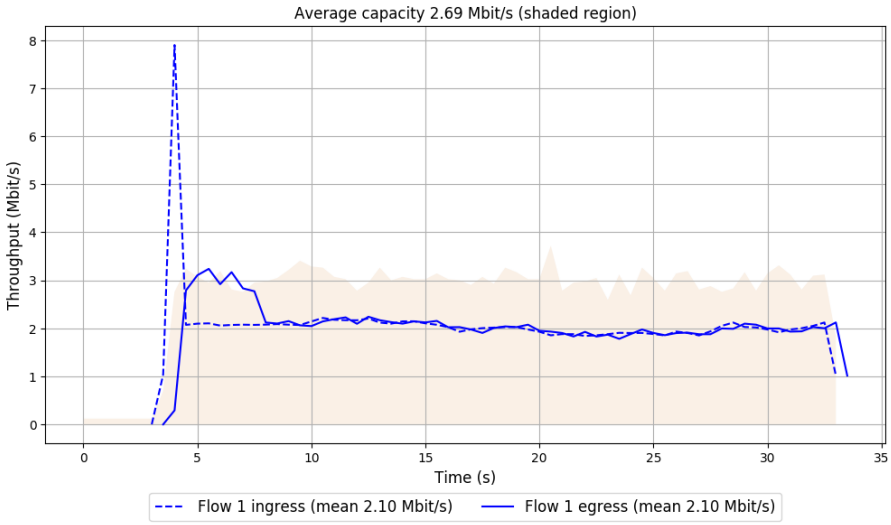


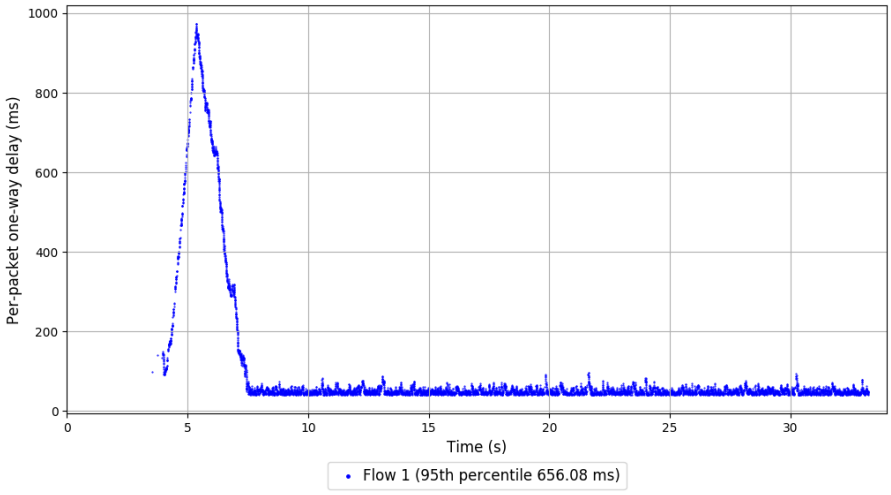
```
Run 1: Statistics of PCC-Allegro

Start at: 2019-07-31 03:00:49
End at: 2019-07-31 03:01:19

# Below is generated by plot.py at 2019-07-31 03:04:17
# Datalink statistics
-- Total of 1 flow:
Average capacity: 2.69 Mbit/s
Average throughput: 2.10 Mbit/s (78.0% utilization)
95th percentile per-packet one-way delay: 656.080 ms
Loss rate: 0.18%
-- Flow 1:
Average throughput: 2.10 Mbit/s
95th percentile per-packet one-way delay: 656.080 ms
Loss rate: 0.18%
```

Run 1: Report of PCC-Allegro — Data Link



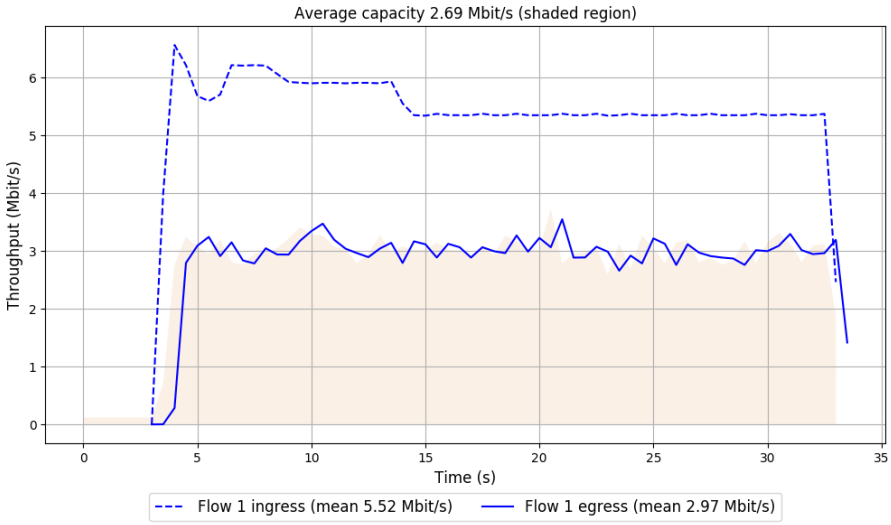


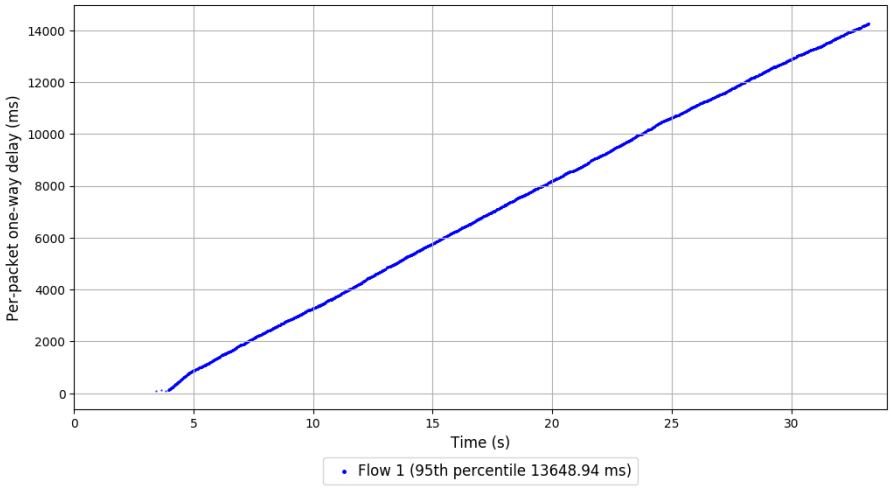
```
Run 1: Statistics of PCC-Expr

Start at: 2019-07-31 03:02:32
End at: 2019-07-31 03:03:02

# Below is generated by plot.py at 2019-07-31 03:04:25
# Datalink statistics
-- Total of 1 flow:
Average capacity: 2.69 Mbit/s
Average throughput: 2.97 Mbit/s (110.4% utilization)
95th percentile per-packet one-way delay: 13648.938 ms
Loss rate: 46.30%
-- Flow 1:
Average throughput: 2.97 Mbit/s
95th percentile per-packet one-way delay: 13648.938 ms
Loss rate: 46.30%
```

Run 1: Report of PCC-Expr — Data Link





```
Run 1: Statistics of QUIC Cubic

Start at: 2019-07-31 03:00:15
End at: 2019-07-31 03:00:45
```

Run 1: Report of QUIC Cubic — Data Link

Figure is missing

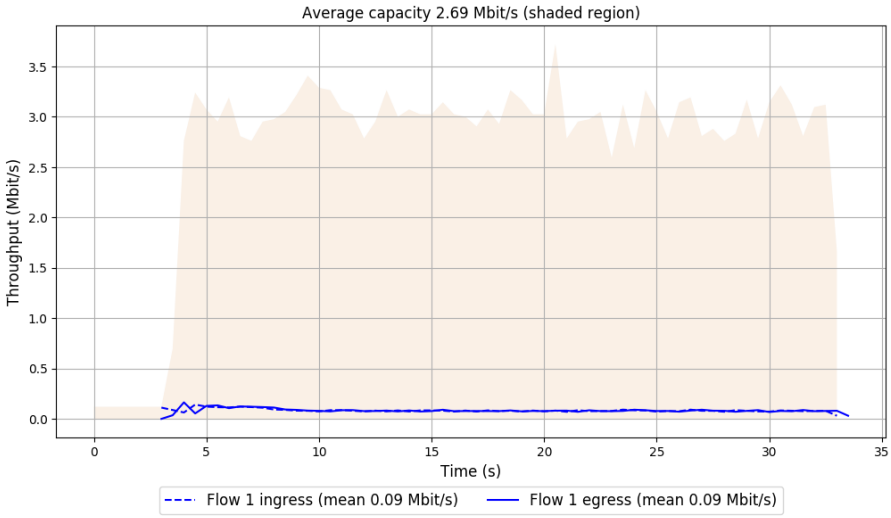
Figure is missing

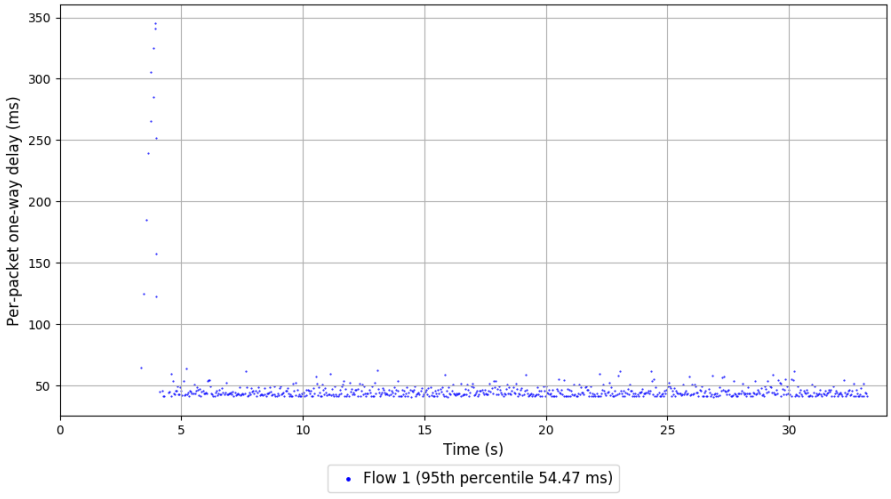
```
Run 1: Statistics of SCReAM

Start at: 2019-07-31 02:59:41
End at: 2019-07-31 03:00:11

# Below is generated by plot.py at 2019-07-31 03:04:25
# Datalink statistics
-- Total of 1 flow:
Average capacity: 2.69 Mbit/s
Average throughput: 0.09 Mbit/s (3.2% utilization)
95th percentile per-packet one-way delay: 54.474 ms
Loss rate: 0.12%
-- Flow 1:
Average throughput: 0.09 Mbit/s
95th percentile per-packet one-way delay: 54.474 ms
Loss rate: 0.12%
```

Run 1: Report of SCReAM — Data Link



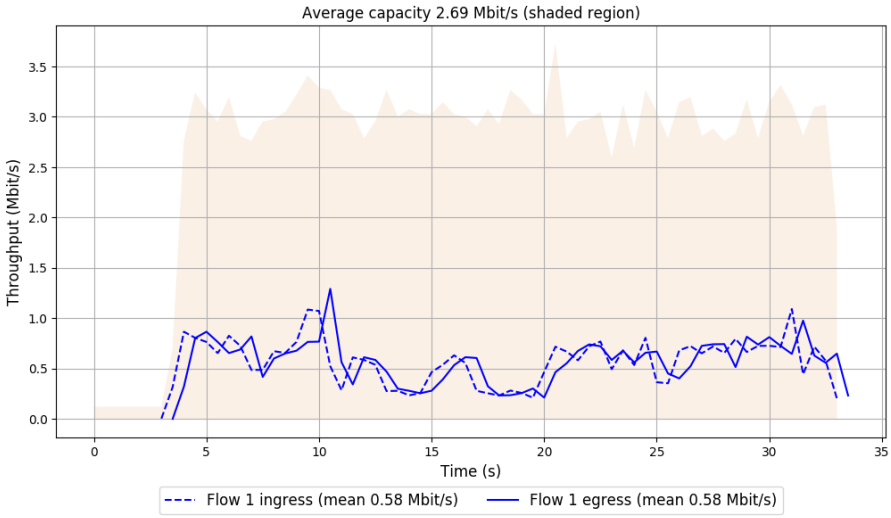


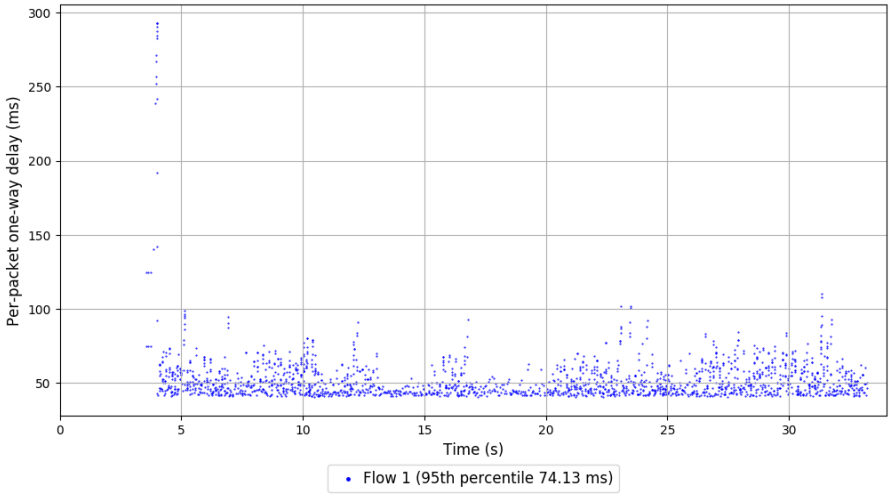
```
Run 1: Statistics of Sprout

Start at: 2019-07-31 02:55:07
End at: 2019-07-31 02:55:37

# Below is generated by plot.py at 2019-07-31 03:04:25
# Datalink statistics
-- Total of 1 flow:
Average capacity: 2.69 Mbit/s
Average throughput: 0.58 Mbit/s (21.7% utilization)
95th percentile per-packet one-way delay: 74.128 ms
Loss rate: 0.18%
-- Flow 1:
Average throughput: 0.58 Mbit/s
95th percentile per-packet one-way delay: 74.128 ms
Loss rate: 0.18%
```

Run 1: Report of Sprout — Data Link



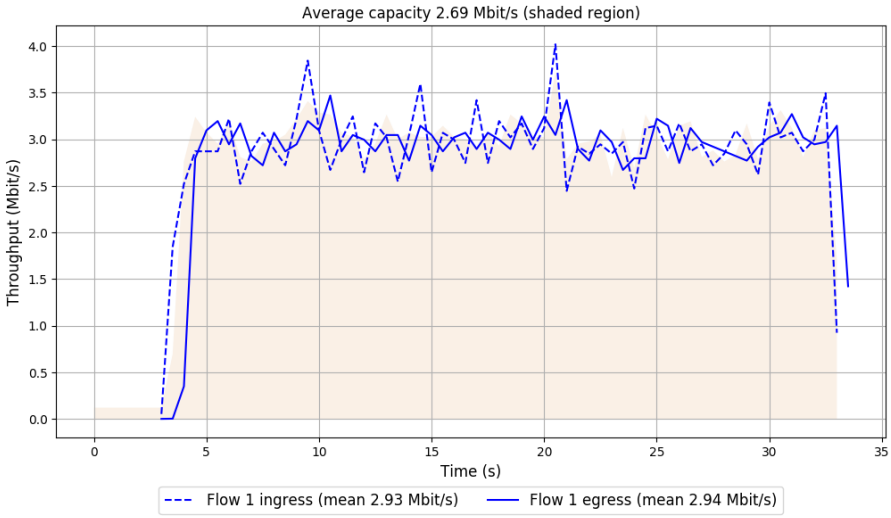


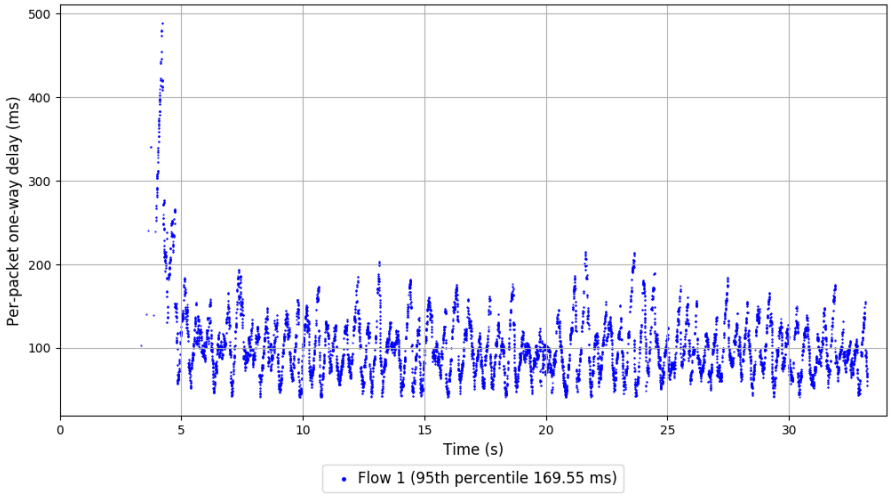
```
Run 1: Statistics of TaoVA-100x

Start at: 2019-07-31 02:58:32
End at: 2019-07-31 02:59:02

# Below is generated by plot.py at 2019-07-31 03:04:25
# Datalink statistics
-- Total of 1 flow:
Average capacity: 2.69 Mbit/s
Average throughput: 2.94 Mbit/s (109.2% utilization)
95th percentile per-packet one-way delay: 169.551 ms
Loss rate: 0.18%
-- Flow 1:
Average throughput: 2.94 Mbit/s
95th percentile per-packet one-way delay: 169.551 ms
Loss rate: 0.18%
```

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



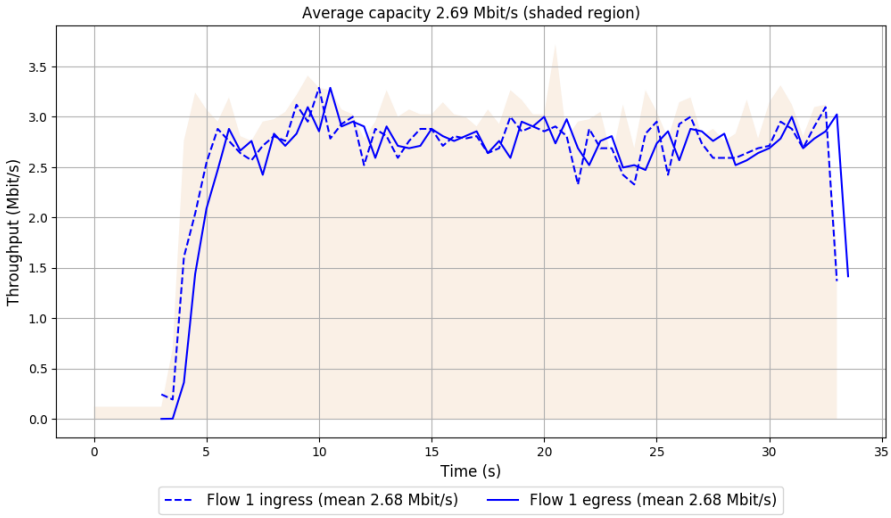


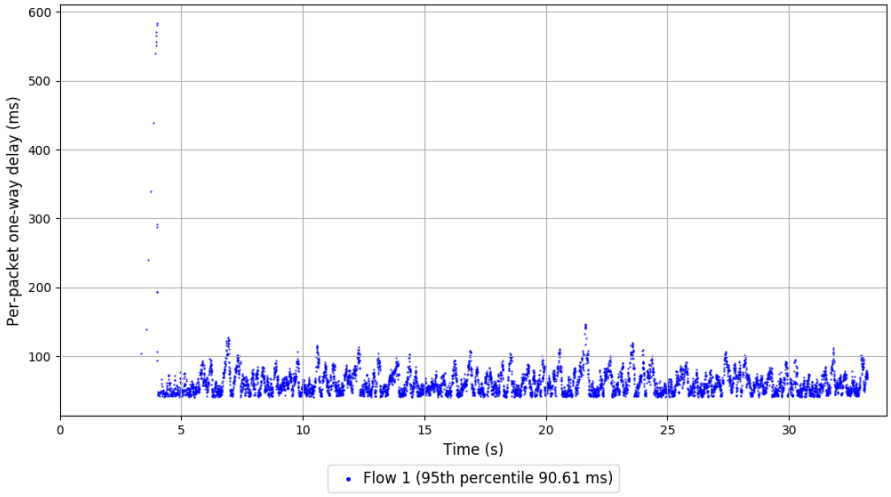
```
Run 1: Statistics of TCP Vegas

Start at: 2019-07-31 02:56:50
End at: 2019-07-31 02:57:20

# Below is generated by plot.py at 2019-07-31 03:04:25
# Datalink statistics
-- Total of 1 flow:
Average capacity: 2.69 Mbit/s
Average throughput: 2.68 Mbit/s (99.7% utilization)
95th percentile per-packet one-way delay: 90.605 ms
Loss rate: 0.22%
-- Flow 1:
Average throughput: 2.68 Mbit/s
95th percentile per-packet one-way delay: 90.605 ms
Loss rate: 0.22%
```

Run 1: Report of TCP Vegas — Data Link



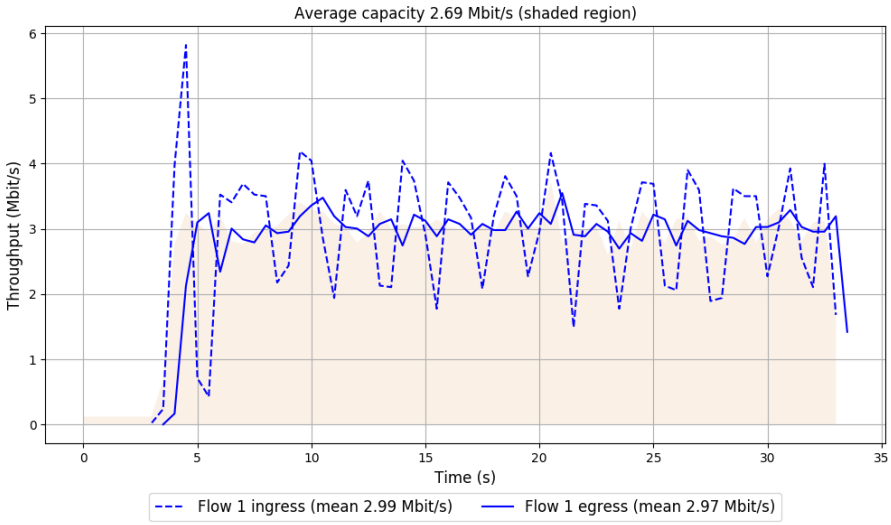


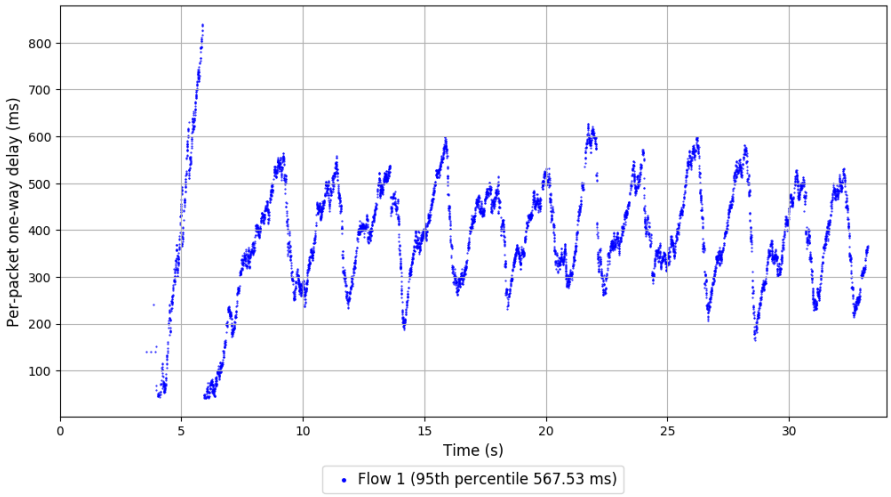
```
Run 1: Statistics of Verus

Start at: 2019-07-31 02:53:24
End at: 2019-07-31 02:53:54

# Below is generated by plot.py at 2019-07-31 03:04:25
# Datalink statistics
-- Total of 1 flow:
Average capacity: 2.69 Mbit/s
Average throughput: 2.97 Mbit/s (110.1% utilization)
95th percentile per-packet one-way delay: 567.530 ms
Loss rate: 1.46%
-- Flow 1:
Average throughput: 2.97 Mbit/s
95th percentile per-packet one-way delay: 567.530 ms
Loss rate: 1.46%
```

Run 1: Report of Verus — Data Link



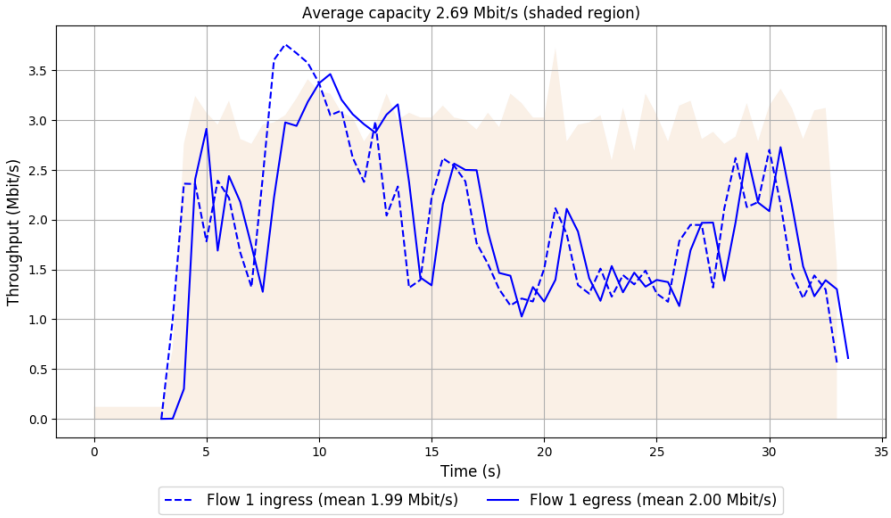


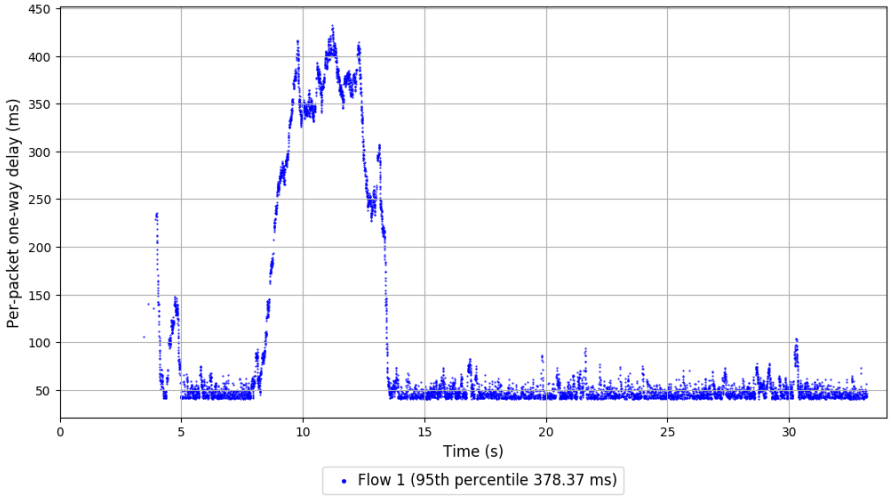
```
Run 1: Statistics of PCC-Vivace

Start at: 2019-07-31 02:56:15
End at: 2019-07-31 02:56:45

# Below is generated by plot.py at 2019-07-31 03:04:25
# Datalink statistics
-- Total of 1 flow:
Average capacity: 2.69 Mbit/s
Average throughput: 2.00 Mbit/s (74.2% utilization)
95th percentile per-packet one-way delay: 378.373 ms
Loss rate: 0.10%
-- Flow 1:
Average throughput: 2.00 Mbit/s
95th percentile per-packet one-way delay: 378.373 ms
Loss rate: 0.10%
```

Run 1: Report of PCC-Vivace — Data Link





```
Run 1: Statistics of WebRTC media

Start at: 2019-07-31 03:01:24
End at: 2019-07-31 03:01:54

# Below is generated by plot.py at 2019-07-31 03:04:25
# Datalink statistics
-- Total of 1 flow:
Average capacity: 2.69 Mbit/s
Average throughput: 0.05 Mbit/s (1.8% utilization)
95th percentile per-packet one-way delay: 142.282 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 0.05 Mbit/s
95th percentile per-packet one-way delay: 142.282 ms
Loss rate: 0.00%
```

Run 1: Report of WebRTC media — Data Link