Pantheon Report

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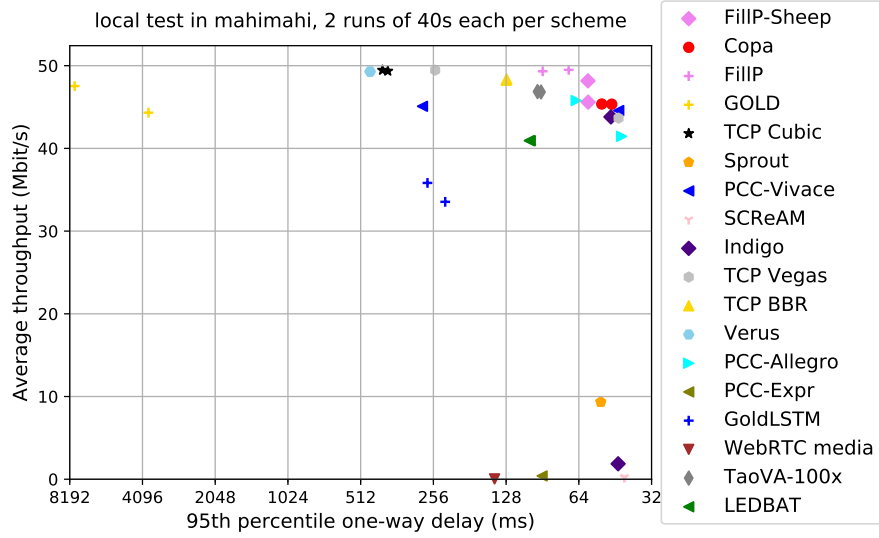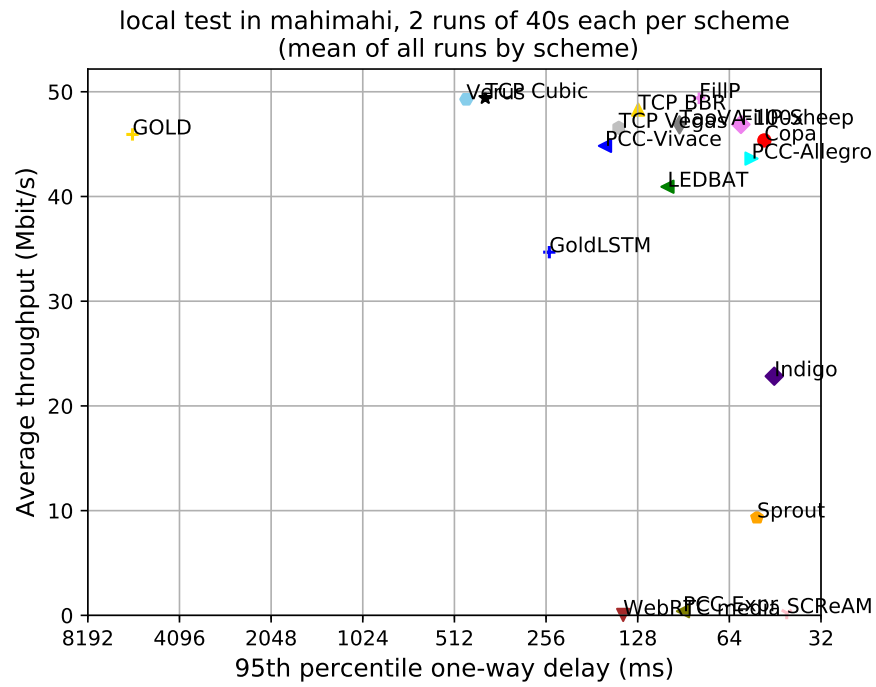Each test lasted for 40 seconds running 1 flow.

```
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 @ b34eb0e8aeb204379e3c2551ae1a0fbed14e03ad
third_party/fillp @ d6da1459332fcee56963885d7eba17e6a32d4519
third_party/fillp-sheep @ 0e5bb722943babcd2b090d2c64fcd45e12e923f9
third_party/genericCC @ d0153f8e594aa89e93b032143cedbdfe58e562f4
third_party/gold @ e47bed6d7495aa223eec8de2c7a43035967074ef
 M environment/__pycache__/datagram_pb2.cpython-36.opt-1.pyc
 M environment/__pycache__/datagram_pb2.cpython-36.pyc
 M environment/__pycache__/environment.cpython-36.opt-1.pyc
 M environment/__pycache__/helpers.cpython-36.opt-1.pyc
 M environment/__pycache__/helpers.cpython-36.pyc
 M environment/__pycache__/mahimahi.cpython-36.opt-1.pyc
 M environment/__pycache__/project_root.cpython-36.opt-1.pyc
 M environment/__pycache__/project_root.cpython-36.pyc
 M environment/__pycache__/receiver.cpython-36.opt-1.pyc
 M environment/__pycache__/receiver.cpython-36.pyc
 M environment/logs.txt
 M model
third_party/goldLSTM @ 6b512ee75b163fd680d7bf3cde4cf6d6aa7102c4
third_party/indigo @ 2601c92e4aa9d58d38dc4dfe0ecdbf90c077e64d
third_party/libutp @ b3465b942e2826f2b179eaab4a906ce6bb7cf3cf
third_party/pantheon-tunnel @ f866d3f58d27afd942717625ee3a354cc2e802bd
third_party/pcc @ 1afc958fa0d66d18b623c091a55fec872b4981e1
 M receiver/src/buffer.h
 M receiver/src/core.cpp
 M sender/src/buffer.h
 M sender/src/core.cpp
third_party/pcc-experimental @ cd43e34e3f5f5613e8acd08fab92c4eb24f974ab
third_party/proto-quic @ 77961f1a82733a86b42f1bc8143ebc978f3cff42
```

```
third_party/scream-reproduce @ f099118d1421aa3131bf11ff1964974e1da3bdb2
 M src/ScreamClient
 M src/ScreamServer
third_party/sprout @ 366e35c6178b01e31d4a46ad18c74f9415f19a26
 M src/examples/cellsim.cc
 M src/examples/sproutbt2.cc
 M src/network/sproutconn.cc
third_party/verus @ d4b447ea74c6c60a261149af2629562939f9a494
 M src/verus.hpp
 M tools/plot.py
third_party/vivace @ 2baf86211435ae071a32f96b7d8c504587f5d7f4
third_party/webrtc @ 3f0cc2a9061a41b6f9dde4735770d143a1fa2851
```

local test in mahimahi, 2 runs of 40s each per scheme
(mean of all runs by scheme)

local test in mahimahi, 2 runs of 40s each per scheme

scheme	# runs	mean avg tput (Mbit/s) flow 1	mean 95th-%ile delay (ms) flow 1	mean loss rate (%) flow 1
TCP BBR	2	48.30	127.56	0.29
Copa	2	45.35	49.11	0.11
TCP Cubic	2	49.41	405.58	1.00
FillP	2	49.41	80.43	0.23
FillP-Sheep	2	46.88	58.63	0.15
GOLD	2	45.92	5844.37	14.21
GoldLSTM	2	34.68	249.78	0.00
Indigo	2	22.84	45.58	0.06
LEDBAT	2	40.93	102.21	0.33
PCC-Allegro	2	43.62	54.12	0.11
PCC-Expr	1	0.40	90.87	0.00
QUIC Cubic	0	N/A	N/A	N/A
SCReAM	2	0.22	41.48	0.10
Sprout	2	9.34	51.92	0.10
TaoVA-100x	2	46.84	93.34	0.10
TCP Vegas	2	46.56	147.77	0.34
Verus	2	49.28	467.92	1.08
PCC-Vivace	2	44.84	163.94	0.10
WebRTC media	1	0.04	142.87	0.00

```
Run 1: Statistics of TCP BBR

Start at: 2019-07-07 22:47:24
End at: 2019-07-07 22:48:04

# Below is generated by plot.py at 2019-07-07 23:13:42
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 48.35 Mbit/s (96.7% utilization)
95th percentile per-packet one-way delay: 127.184 ms
Loss rate: 0.29%
-- Flow 1:
Average throughput: 48.35 Mbit/s
95th percentile per-packet one-way delay: 127.184 ms
Loss rate: 0.29%
```
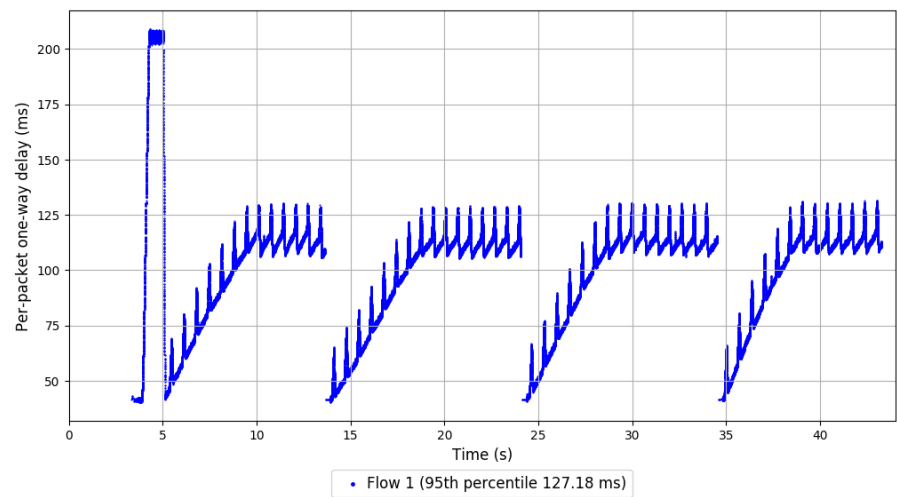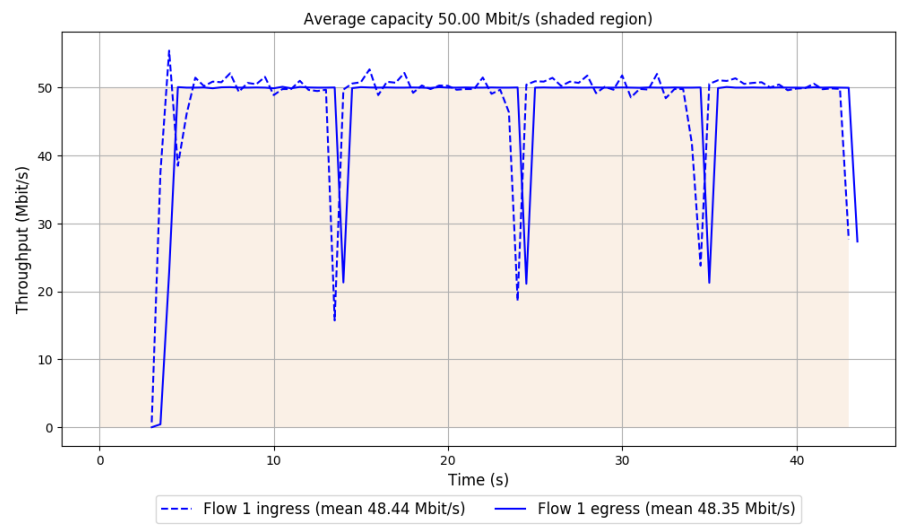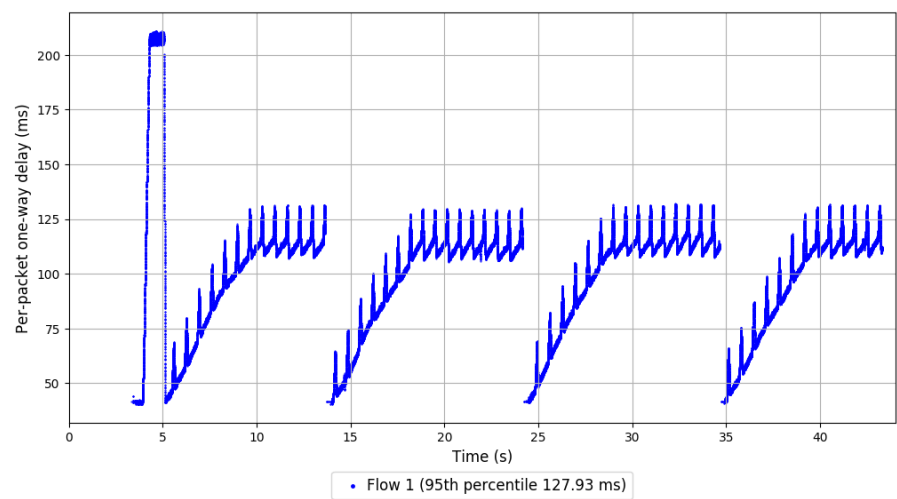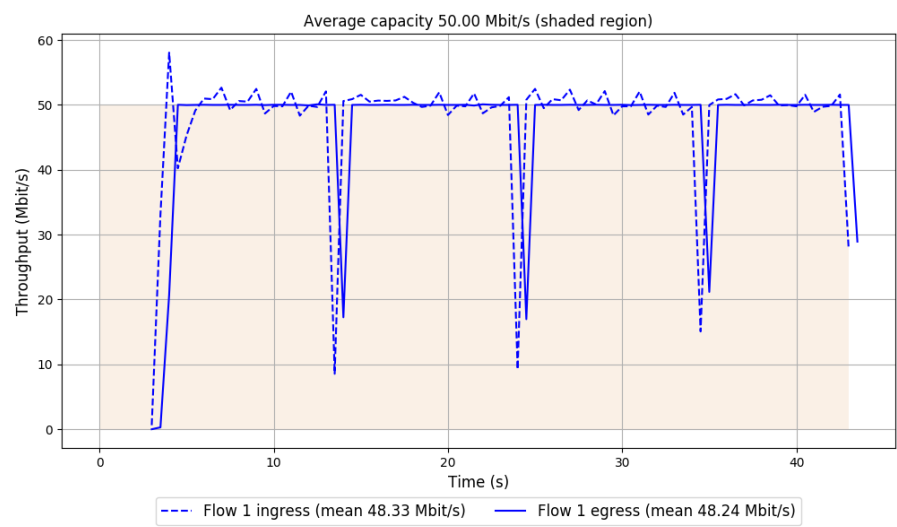
Run 1: Report of TCP BBR — Data Link

Average capacity 50.00 Mbit/s (shaded region)

Flow 1 ingress (mean 48.44 Mbit/s) — Flow 1 egress (mean 48.35 Mbit/s)

Flow 1 (95th percentile 127.18 ms)

Run 2: Statistics of TCP BBR

Start at: 2019-07-07 23:02:53
End at: 2019-07-07 23:03:33

Below is generated by plot.py at 2019-07-07 23:13:42
Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 48.24 Mbit/s (96.5% utilization)
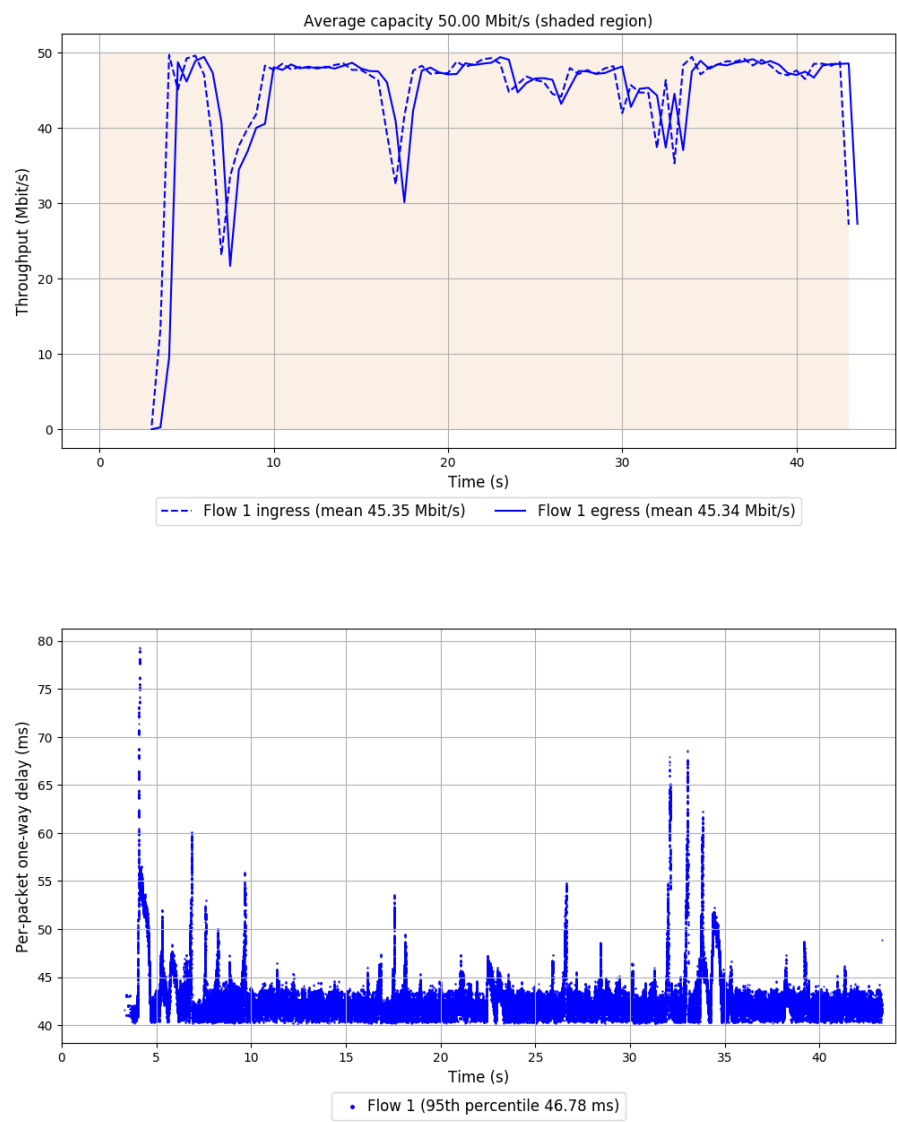95th percentile per-packet one-way delay: 127.933 ms
Loss rate: 0.29%
-- Flow 1:
Average throughput: 48.24 Mbit/s
95th percentile per-packet one-way delay: 127.933 ms
Loss rate: 0.29%

Run 2: Report of TCP BBR — Data Link

Average capacity 50.00 Mbit/s (shaded region)

Flow 1 ingress (mean 48.33 Mbit/s)   Flow 1 egress (mean 48.24 Mbit/s)

Flow 1 (95th percentile 127.93 ms)

```
Run 1: Statistics of Copa

Start at: 2019-07-07 22:40:51
End at: 2019-07-07 22:41:31

# Below is generated by plot.py at 2019-07-07 23:14:15
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 45.34 Mbit/s (90.7% utilization)
95th percentile per-packet one-way delay: 46.778 ms
Loss rate: 0.11%
-- Flow 1:
Average throughput: 45.34 Mbit/s
95th percentile per-packet one-way delay: 46.778 ms
Loss rate: 0.11%
```
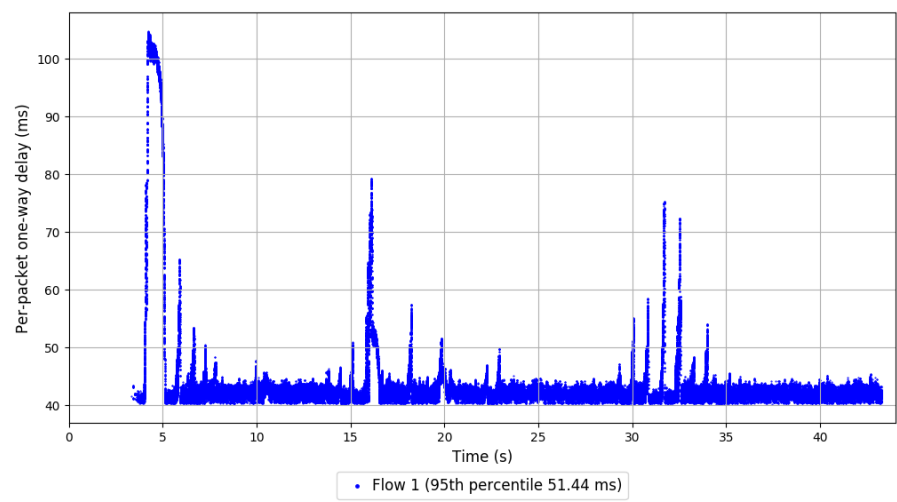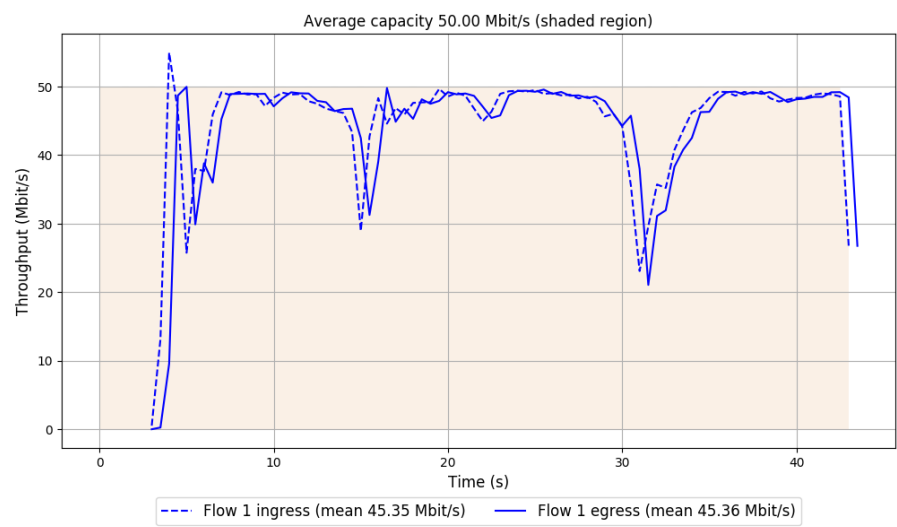
Run 1: Report of Copa — Data Link

Average capacity 50.00 Mbit/s (shaded region)

Flow 1 ingress (mean 45.35 Mbit/s) — Flow 1 egress (mean 45.34 Mbit/s)

Flow 1 (95th percentile 46.78 ms)

Run 2: Statistics of Copa

Start at: 2019-07-07 22:56:16
End at: 2019-07-07 22:56:56

Below is generated by plot.py at 2019-07-07 23:14:43
Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 45.36 Mbit/s (90.7% utilization)
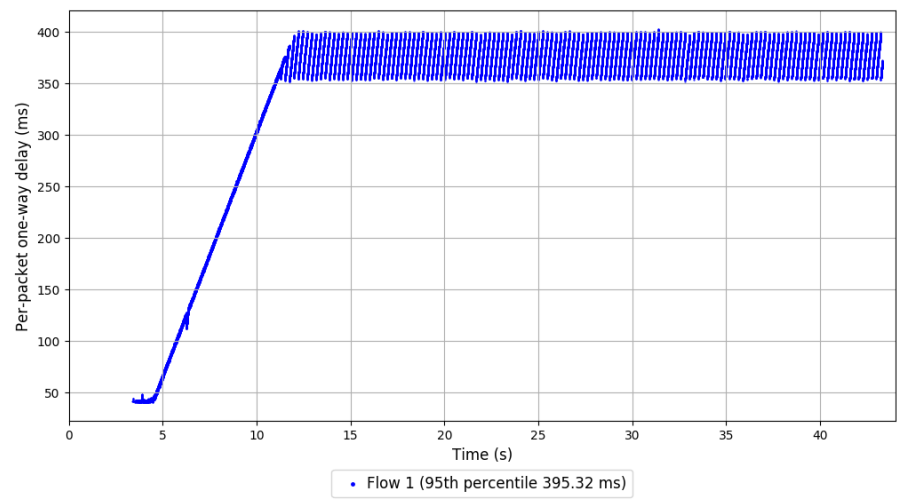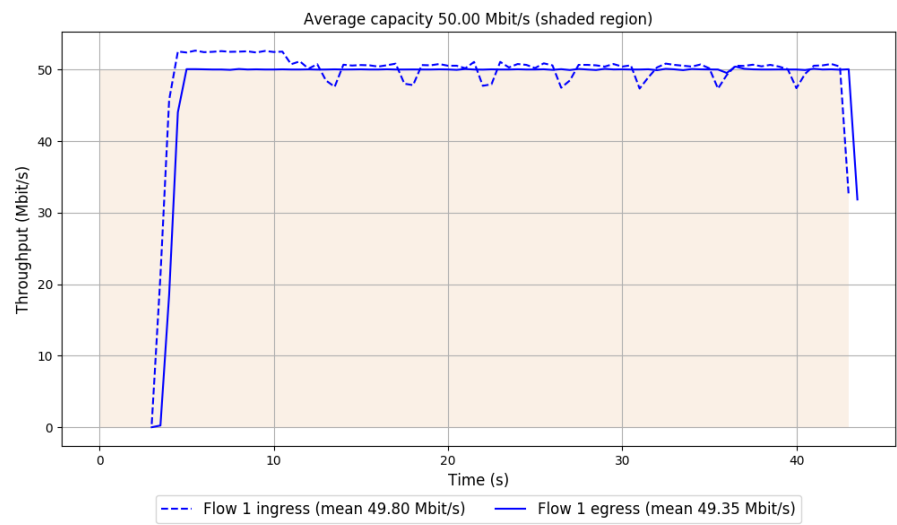95th percentile per-packet one-way delay: 51.444 ms
Loss rate: 0.11%
-- Flow 1:
Average throughput: 45.36 Mbit/s
95th percentile per-packet one-way delay: 51.444 ms
Loss rate: 0.11%

Run 2: Report of Copa — Data Link

Average capacity 50.00 Mbit/s (shaded region)

- - - Flow 1 ingress (mean 45.35 Mbit/s) ——— Flow 1 egress (mean 45.36 Mbit/s)

• Flow 1 (95th percentile 51.44 ms)

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```
Run 1: Statistics of TCP Cubic

Start at: 2019-07-07 22:44:10
End at: 2019-07-07 22:44:50

# Below is generated by plot.py at 2019-07-07 23:14:43
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 49.35 Mbit/s (98.7% utilization)
95th percentile per-packet one-way delay: 395.320 ms
Loss rate: 0.97%
-- Flow 1:
Average throughput: 49.35 Mbit/s
95th percentile per-packet one-way delay: 395.320 ms
Loss rate: 0.97%
```
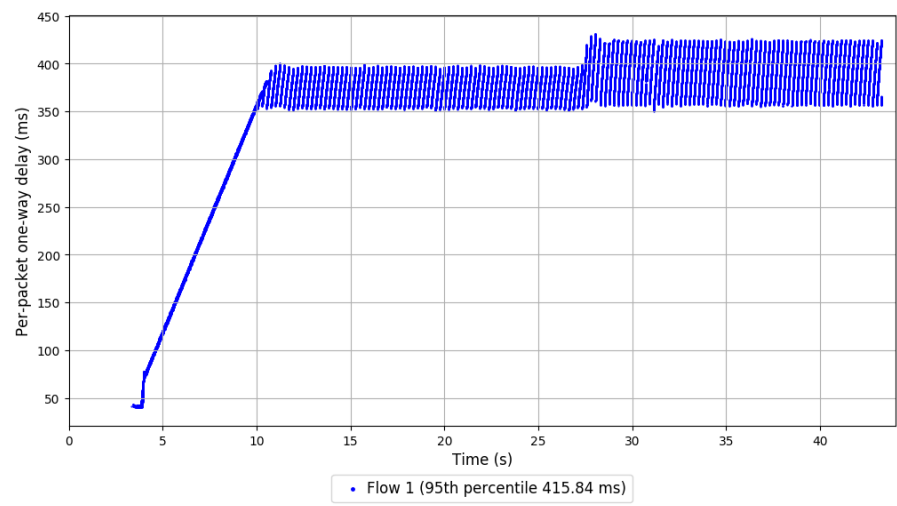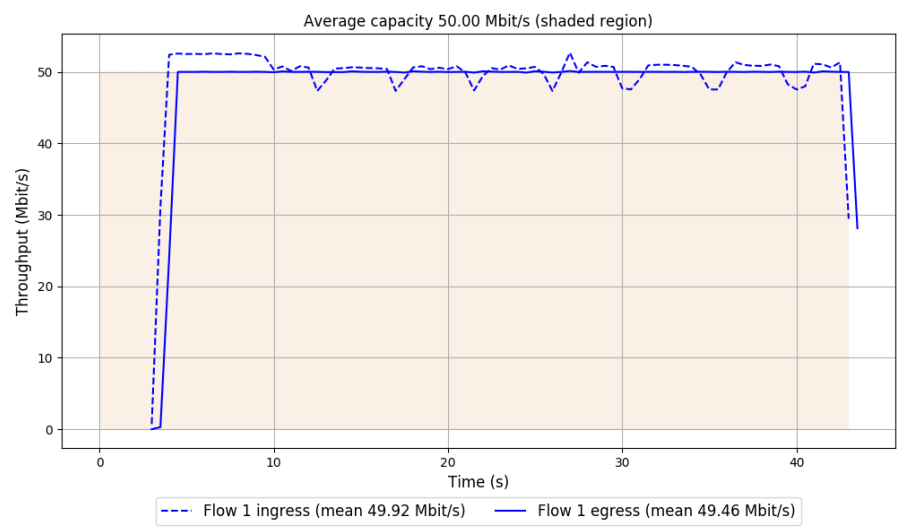
Run 1: Report of TCP Cubic — Data Link

Average capacity 50.00 Mbit/s (shaded region)

Flow 1 ingress (mean 49.80 Mbit/s)   Flow 1 egress (mean 49.35 Mbit/s)

Flow 1 (95th percentile 395.32 ms)

```
Run 2: Statistics of TCP Cubic

Start at: 2019-07-07 22:59:38
End at: 2019-07-07 23:00:18

# Below is generated by plot.py at 2019-07-07 23:14:43
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 49.46 Mbit/s (98.9% utilization)
95th percentile per-packet one-way delay: 415.837 ms
Loss rate: 1.04%
-- Flow 1:
Average throughput: 49.46 Mbit/s
95th percentile per-packet one-way delay: 415.837 ms
Loss rate: 1.04%
```

Run 2: Report of TCP Cubic — Data Link

```
Run 1: Statistics of FillP

Start at: 2019-07-07 22:49:55
End at: 2019-07-07 22:50:35

# Below is generated by plot.py at 2019-07-07 23:15:02
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 49.49 Mbit/s (99.0% utilization)
95th percentile per-packet one-way delay: 70.504 ms
Loss rate: 0.16%
-- Flow 1:
Average throughput: 49.49 Mbit/s
95th percentile per-packet one-way delay: 70.504 ms
Loss rate: 0.16%
```
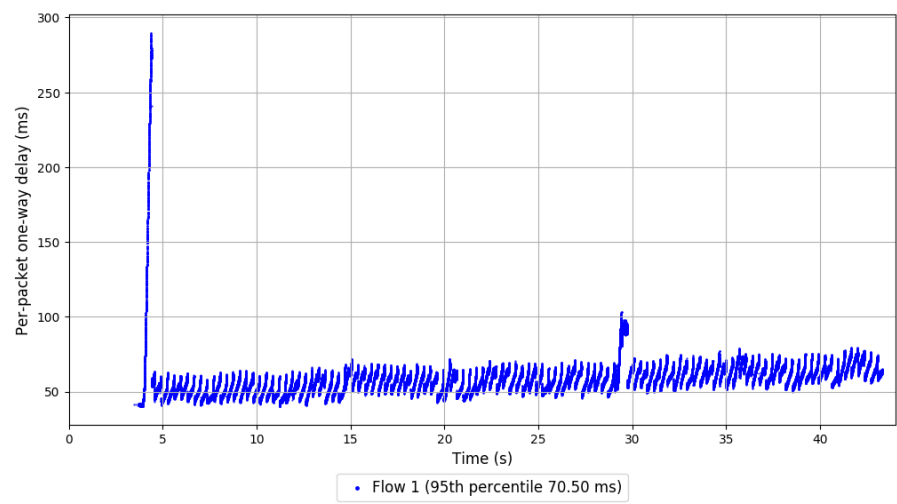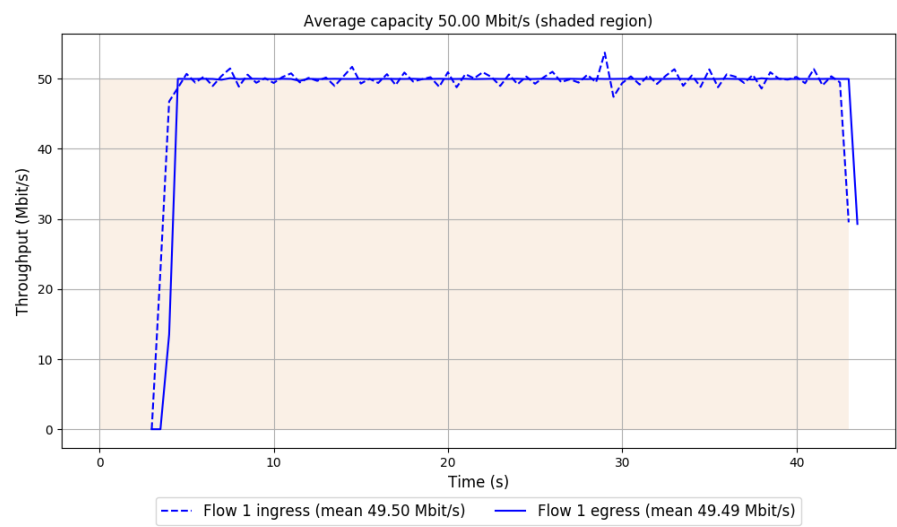
Run 1: Report of FillP — Data Link

Average capacity 50.00 Mbit/s (shaded region)

---- Flow 1 ingress (mean 49.50 Mbit/s)   —— Flow 1 egress (mean 49.49 Mbit/s)

• Flow 1 (95th percentile 70.50 ms)

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```
Run 2: Statistics of FillP

Start at: 2019-07-07 23:05:24
End at: 2019-07-07 23:06:04


# Below is generated by plot.py at 2019-07-07 23:15:02
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 49.32 Mbit/s (98.6% utilization)
95th percentile per-packet one-way delay: 90.350 ms
Loss rate: 0.31%
-- Flow 1:
Average throughput: 49.32 Mbit/s
95th percentile per-packet one-way delay: 90.350 ms
Loss rate: 0.31%
```
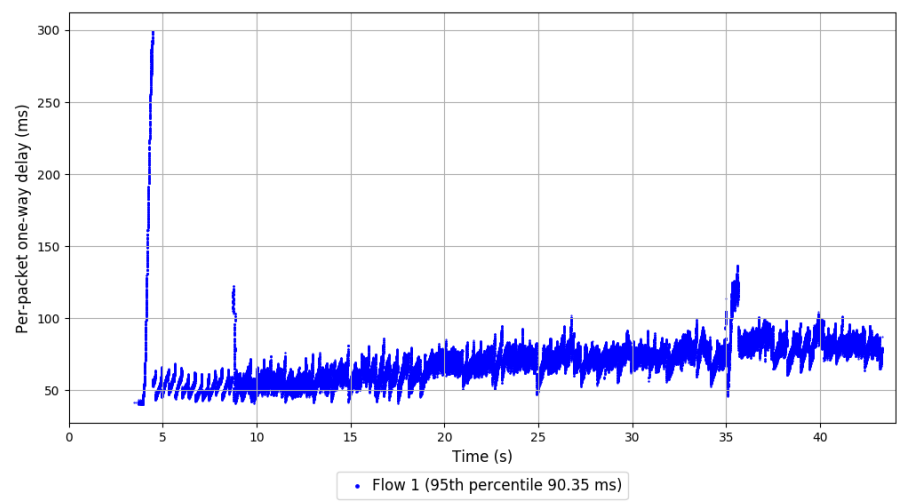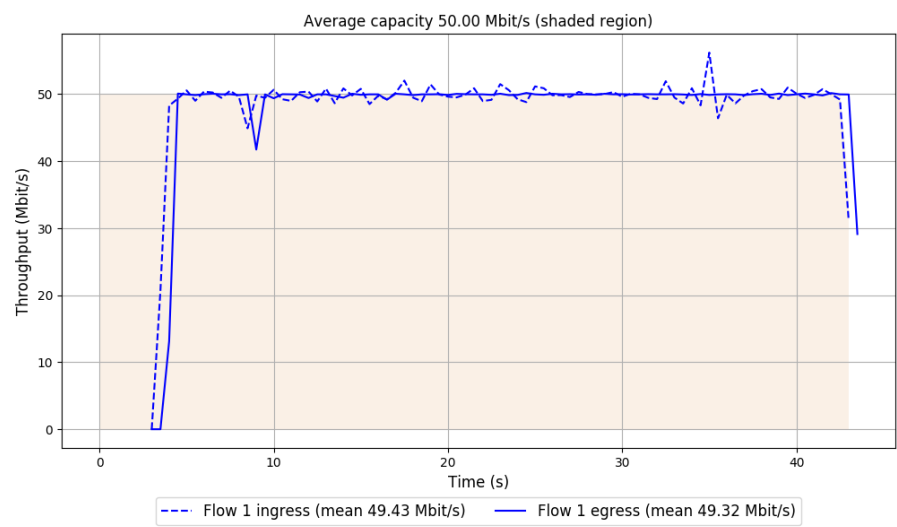
Run 2: Report of FillP — Data Link

Average capacity 50.00 Mbit/s (shaded region)

---- Flow 1 ingress (mean 49.43 Mbit/s)   —— Flow 1 egress (mean 49.32 Mbit/s)

• Flow 1 (95th percentile 90.35 ms)

```
Run 1: Statistics of FillP-Sheep

Start at: 2019-07-07 22:40:03
End at: 2019-07-07 22:40:43

# Below is generated by plot.py at 2019-07-07 23:15:07
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 45.59 Mbit/s (91.2% utilization)
95th percentile per-packet one-way delay: 58.580 ms
Loss rate: 0.15%
-- Flow 1:
Average throughput: 45.59 Mbit/s
95th percentile per-packet one-way delay: 58.580 ms
Loss rate: 0.15%
```
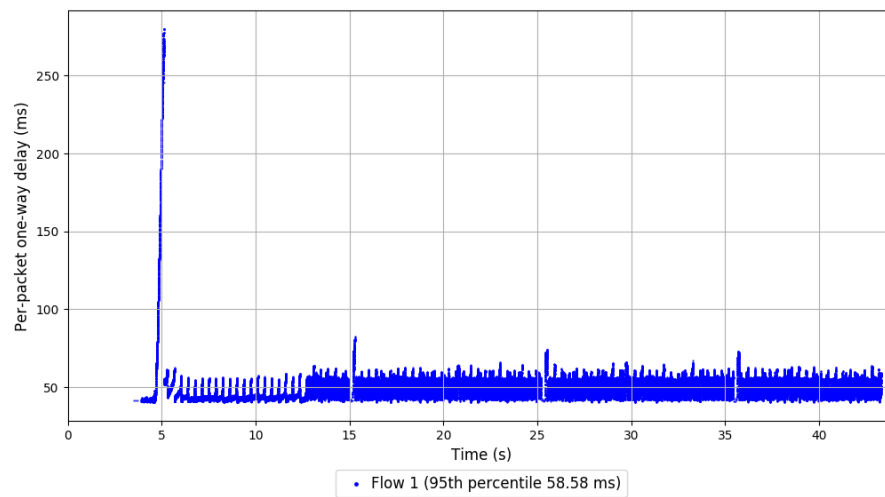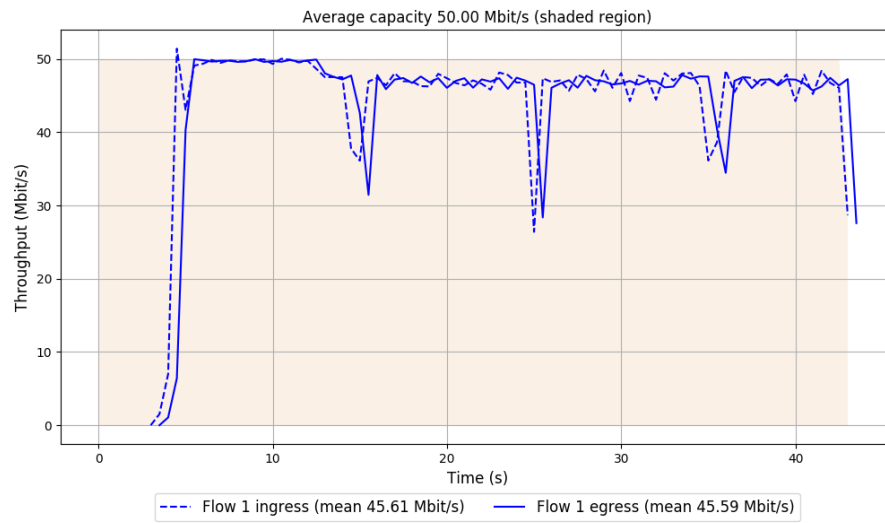
Run 1: Report of FillP-Sheep — Data Link

Average capacity 50.00 Mbit/s (shaded region)

- - - Flow 1 ingress (mean 45.61 Mbit/s) ——— Flow 1 egress (mean 45.59 Mbit/s)

• Flow 1 (95th percentile 58.58 ms)

```
Run 2: Statistics of FillP-Sheep

Start at: 2019-07-07 22:55:27
End at: 2019-07-07 22:56:07


# Below is generated by plot.py at 2019-07-07 23:15:14
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 48.17 Mbit/s (96.3% utilization)
95th percentile per-packet one-way delay: 58.678 ms
Loss rate: 0.16%
-- Flow 1:
Average throughput: 48.17 Mbit/s
95th percentile per-packet one-way delay: 58.678 ms
Loss rate: 0.16%
```
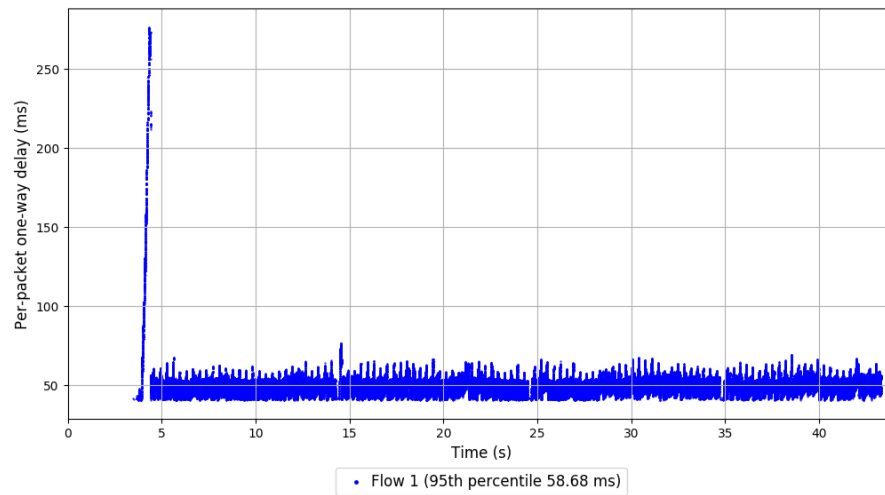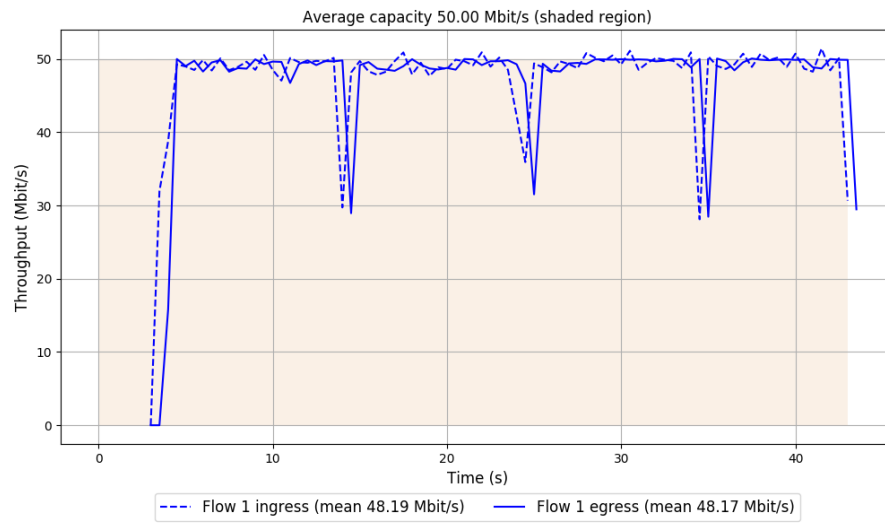
Run 2: Report of FillP-Sheep — Data Link

Average capacity 50.00 Mbit/s (shaded region)

- - - - Flow 1 ingress (mean 48.19 Mbit/s) ——— Flow 1 egress (mean 48.17 Mbit/s)

• Flow 1 (95th percentile 58.68 ms)

```
Run 1: Statistics of GOLD

Start at: 2019-07-07 22:43:19
End at: 2019-07-07 22:44:00

# Below is generated by plot.py at 2019-07-07 23:15:49
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 47.53 Mbit/s (95.1% utilization)
95th percentile per-packet one-way delay: 7819.291 ms
Loss rate: 17.99%
-- Flow 1:
Average throughput: 47.53 Mbit/s
95th percentile per-packet one-way delay: 7819.291 ms
Loss rate: 17.99%
```
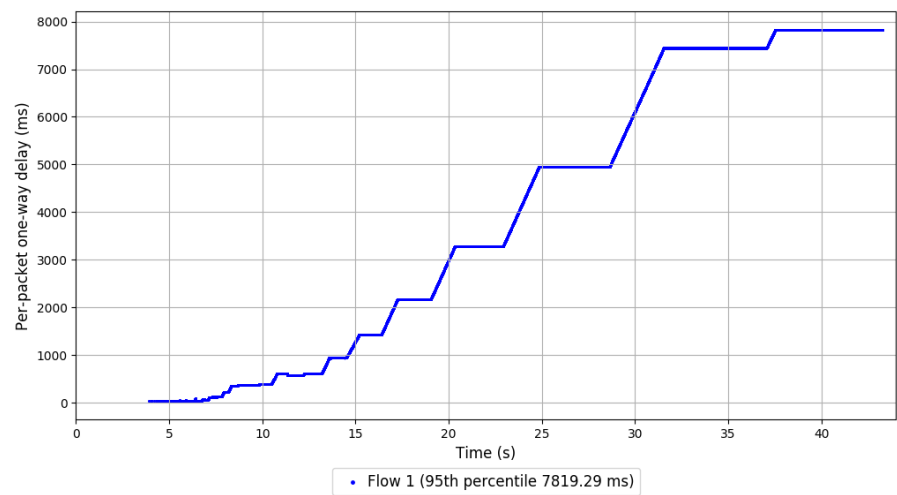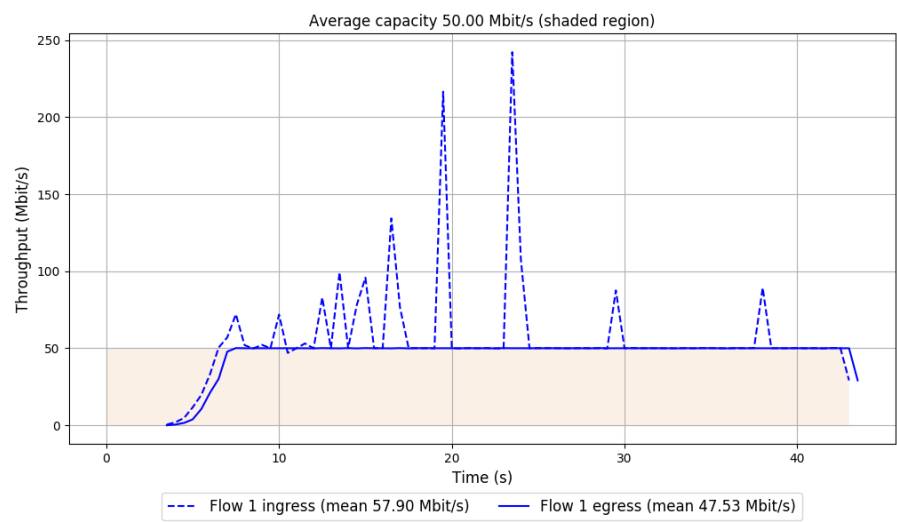
Run 1: Report of GOLD — Data Link

Average capacity 50.00 Mbit/s (shaded region)

--- Flow 1 ingress (mean 57.90 Mbit/s)   — Flow 1 egress (mean 47.53 Mbit/s)

• Flow 1 (95th percentile 7819.29 ms)

```
Run 2: Statistics of GOLD

Start at: 2019-07-07 22:58:48
End at: 2019-07-07 22:59:28

# Below is generated by plot.py at 2019-07-07 23:16:03
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 44.32 Mbit/s (88.6% utilization)
95th percentile per-packet one-way delay: 3869.451 ms
Loss rate: 10.44%
-- Flow 1:
Average throughput: 44.32 Mbit/s
95th percentile per-packet one-way delay: 3869.451 ms
Loss rate: 10.44%
```
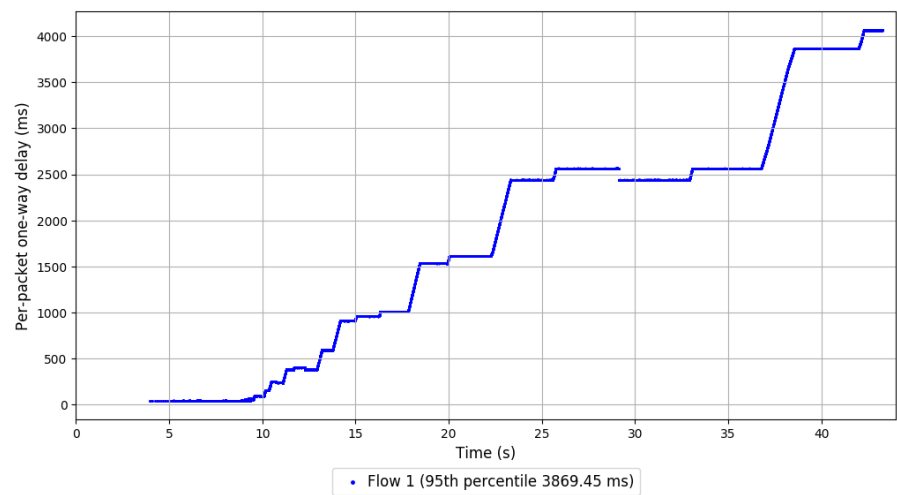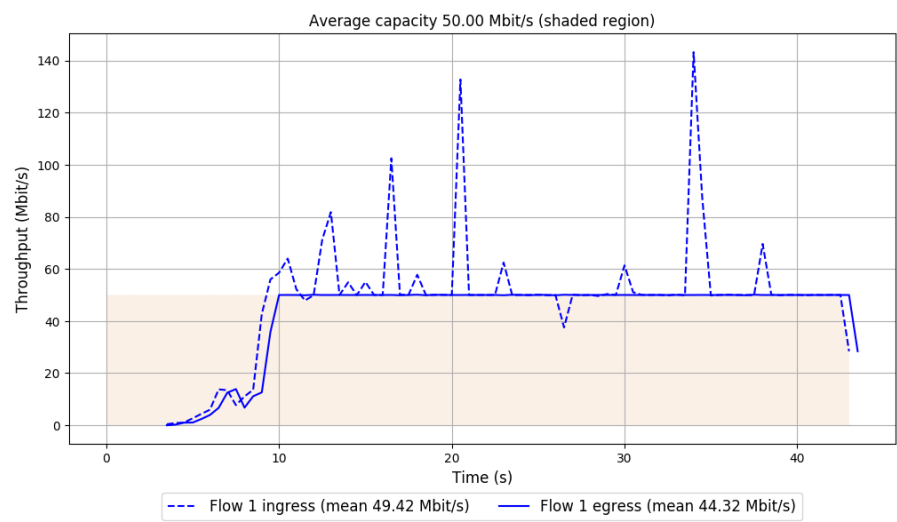
Run 2: Report of GOLD — Data Link

Average capacity 50.00 Mbit/s (shaded region)

--- Flow 1 ingress (mean 49.42 Mbit/s) — Flow 1 egress (mean 44.32 Mbit/s)
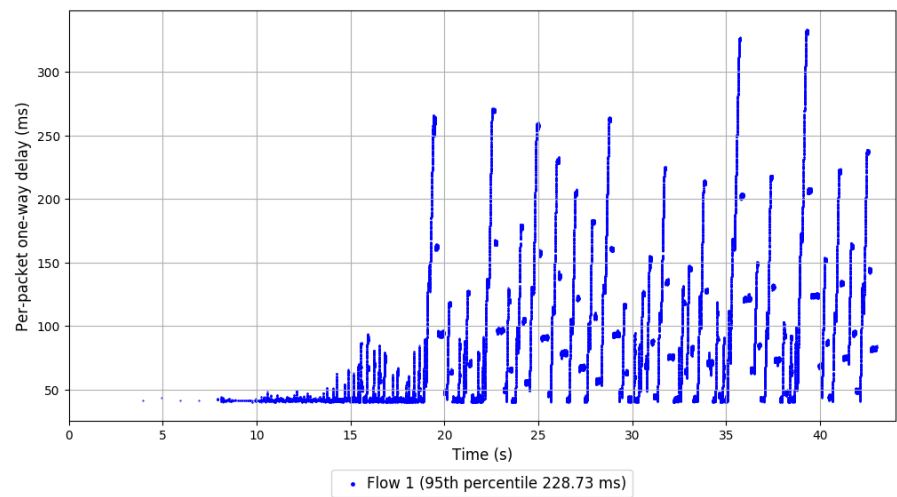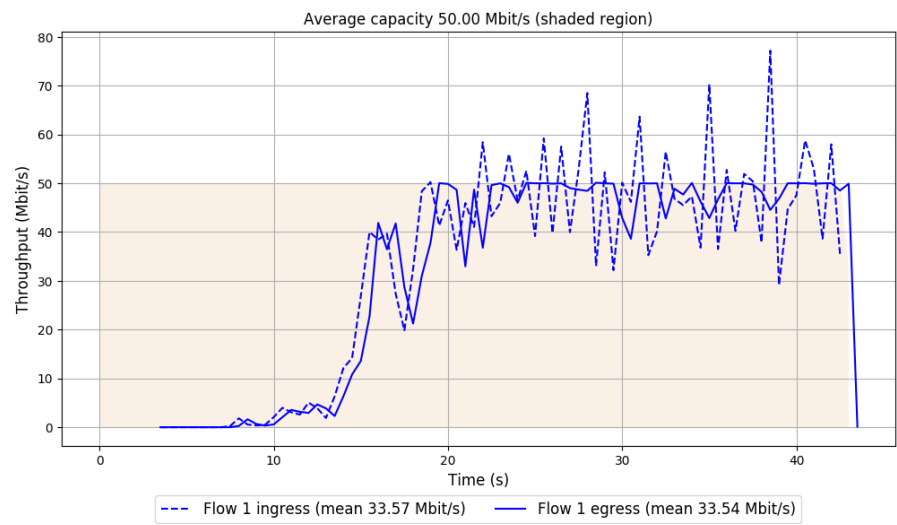

• Flow 1 (95th percentile 3869.45 ms)

```
Run 1: Statistics of GoldLSTM

Start at: 2019-07-07 22:48:13
End at: 2019-07-07 22:48:53


# Below is generated by plot.py at 2019-07-07 23:16:03
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 33.54 Mbit/s (67.1% utilization)
95th percentile per-packet one-way delay: 228.726 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 33.54 Mbit/s
95th percentile per-packet one-way delay: 228.726 ms
Loss rate: 0.00%
```

Run 1: Report of GoldLSTM — Data Link

Average capacity 50.00 Mbit/s (shaded region)

--- Flow 1 ingress (mean 33.57 Mbit/s) —— Flow 1 egress (mean 33.54 Mbit/s)

• Flow 1 (95th percentile 228.73 ms)

```
Run 2: Statistics of GoldLSTM

Start at: 2019-07-07 23:03:42
End at: 2019-07-07 23:04:22

# Below is generated by plot.py at 2019-07-07 23:16:03
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 35.82 Mbit/s (71.6% utilization)
95th percentile per-packet one-way delay: 270.830 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 35.82 Mbit/s
95th percentile per-packet one-way delay: 270.830 ms
Loss rate: 0.00%
```
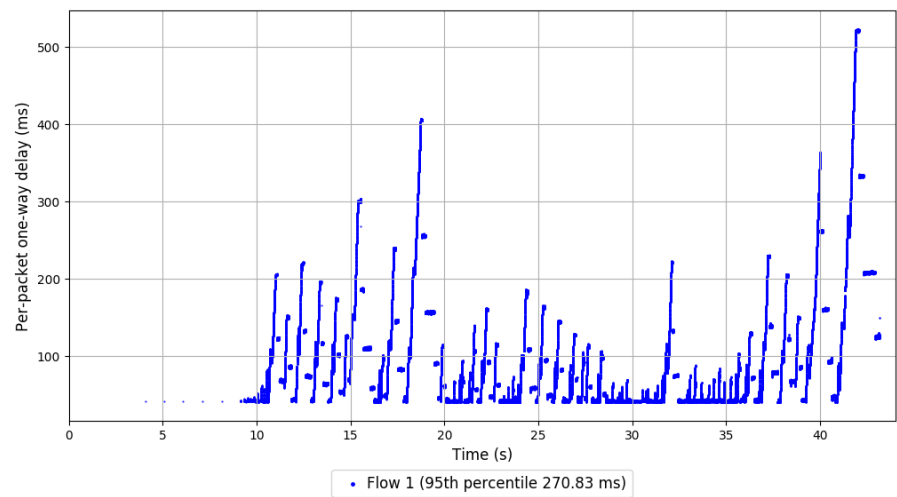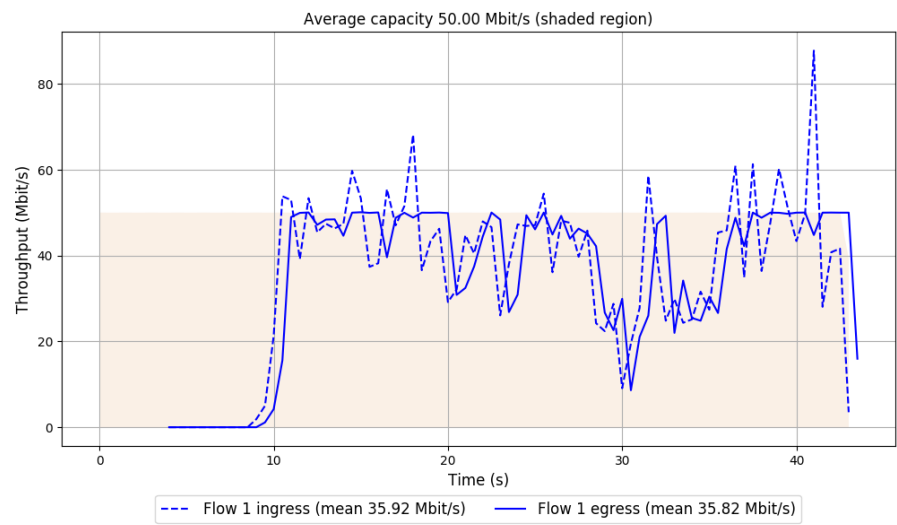
Run 2: Report of GoldLSTM — Data Link

Average capacity 50.00 Mbit/s (shaded region)

- - - Flow 1 ingress (mean 35.92 Mbit/s) —— Flow 1 egress (mean 35.82 Mbit/s)
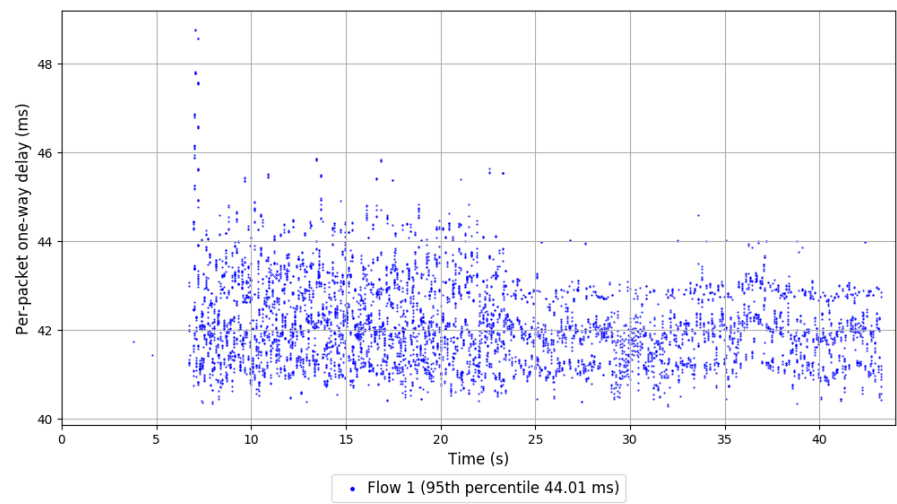

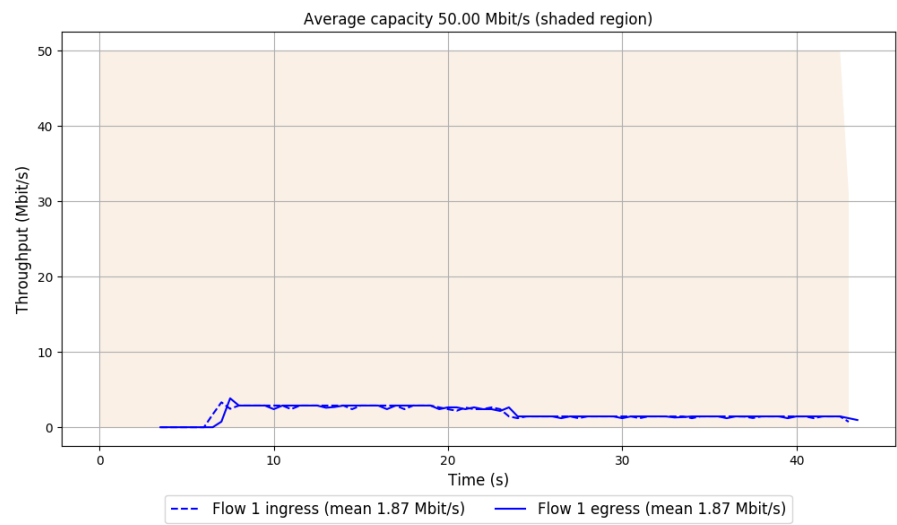• Flow 1 (95th percentile 270.83 ms)

```
Run 1: Statistics of Indigo

Start at: 2019-07-07 22:41:43
End at: 2019-07-07 22:42:23

# Below is generated by plot.py at 2019-07-07 23:16:03
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 1.87 Mbit/s (3.7% utilization)
95th percentile per-packet one-way delay: 44.007 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 1.87 Mbit/s
95th percentile per-packet one-way delay: 44.007 ms
Loss rate: 0.00%
```

Run 1: Report of Indigo — Data Link

Average capacity 50.00 Mbit/s (shaded region)

- - - Flow 1 ingress (mean 1.87 Mbit/s) ——— Flow 1 egress (mean 1.87 Mbit/s)

• Flow 1 (95th percentile 44.01 ms)

```
Run 2: Statistics of Indigo

Start at: 2019-07-07 22:57:08
End at: 2019-07-07 22:57:48

# Below is generated by plot.py at 2019-07-07 23:16:29
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 43.81 Mbit/s (87.6% utilization)
95th percentile per-packet one-way delay: 47.147 ms
Loss rate: 0.11%
-- Flow 1:
Average throughput: 43.81 Mbit/s
95th percentile per-packet one-way delay: 47.147 ms
Loss rate: 0.11%
```
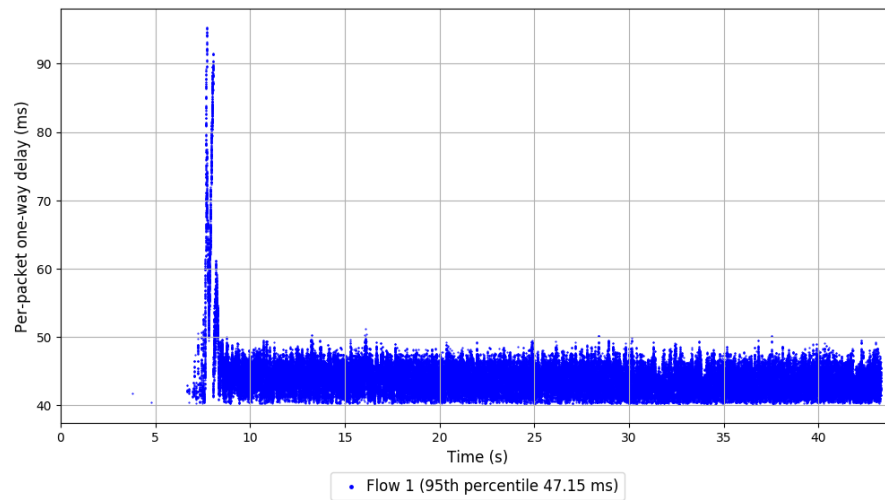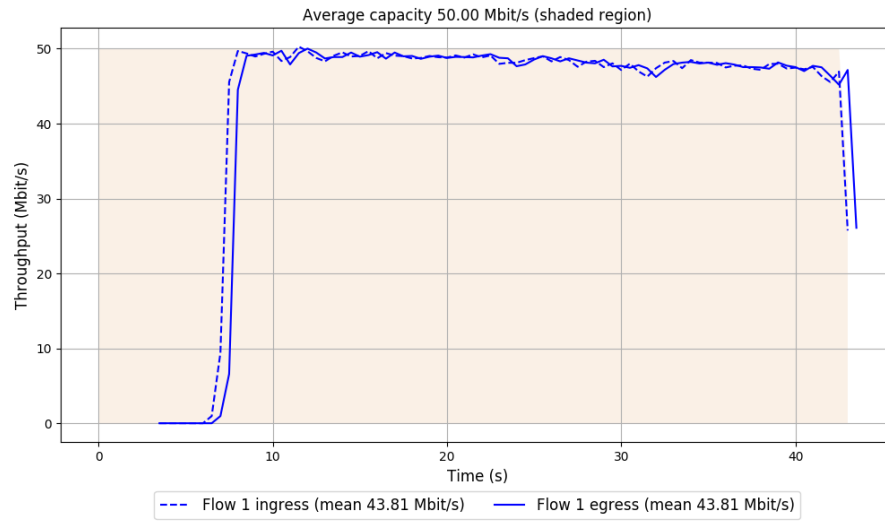
Run 2: Report of Indigo — Data Link

Average capacity 50.00 Mbit/s (shaded region)

Flow 1 ingress (mean 43.81 Mbit/s) — Flow 1 egress (mean 43.81 Mbit/s)

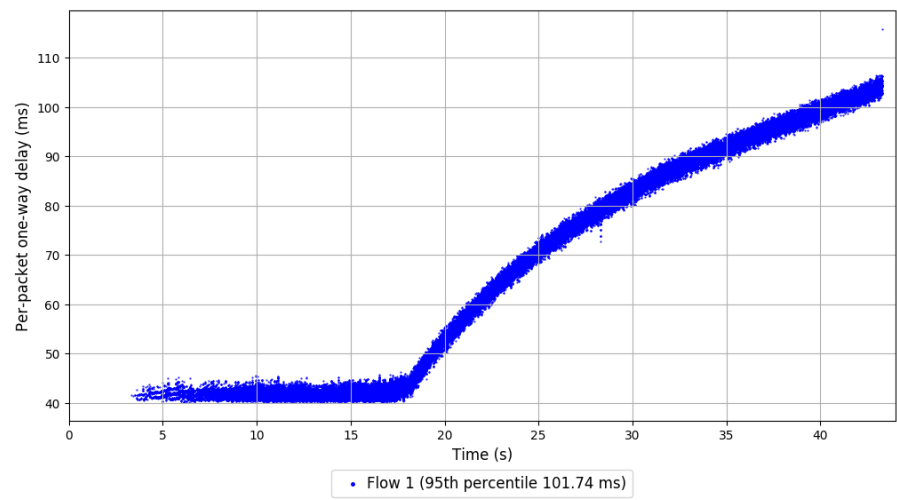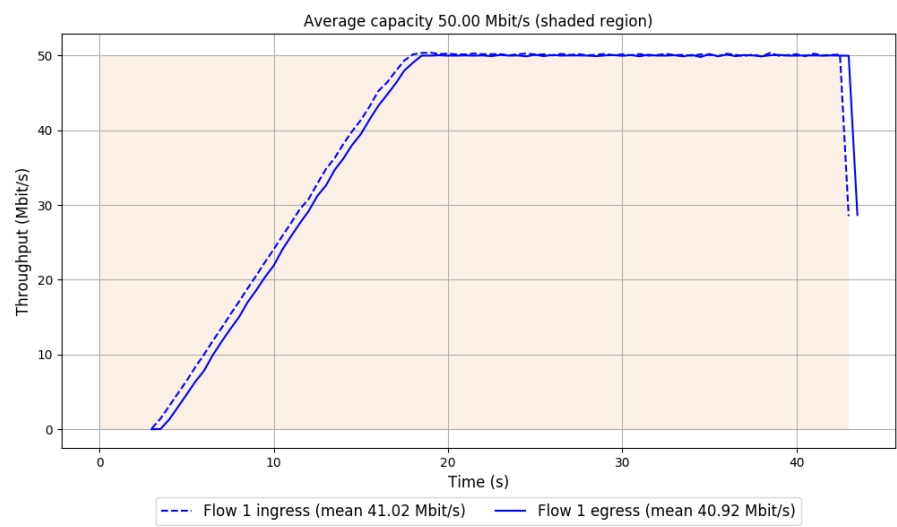

Flow 1 (95th percentile 47.15 ms)

```
Run 1: Statistics of LEDBAT

Start at: 2019-07-07 22:53:52
End at: 2019-07-07 22:54:32

# Below is generated by plot.py at 2019-07-07 23:16:35
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 40.92 Mbit/s (81.8% utilization)
95th percentile per-packet one-way delay: 101.742 ms
Loss rate: 0.32%
-- Flow 1:
Average throughput: 40.92 Mbit/s
95th percentile per-packet one-way delay: 101.742 ms
Loss rate: 0.32%
```

Run 1: Report of LEDBAT — Data Link

Average capacity 50.00 Mbit/s (shaded region)

----- Flow 1 ingress (mean 41.02 Mbit/s) ——— Flow 1 egress (mean 40.92 Mbit/s)

• Flow 1 (95th percentile 101.74 ms)

```
Run 2: Statistics of LEDBAT

Start at: 2019-07-07 23:09:17
End at: 2019-07-07 23:09:57

# Below is generated by plot.py at 2019-07-07 23:17:04
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 40.94 Mbit/s (81.9% utilization)
95th percentile per-packet one-way delay: 102.675 ms
Loss rate: 0.33%
-- Flow 1:
Average throughput: 40.94 Mbit/s
95th percentile per-packet one-way delay: 102.675 ms
Loss rate: 0.33%
```
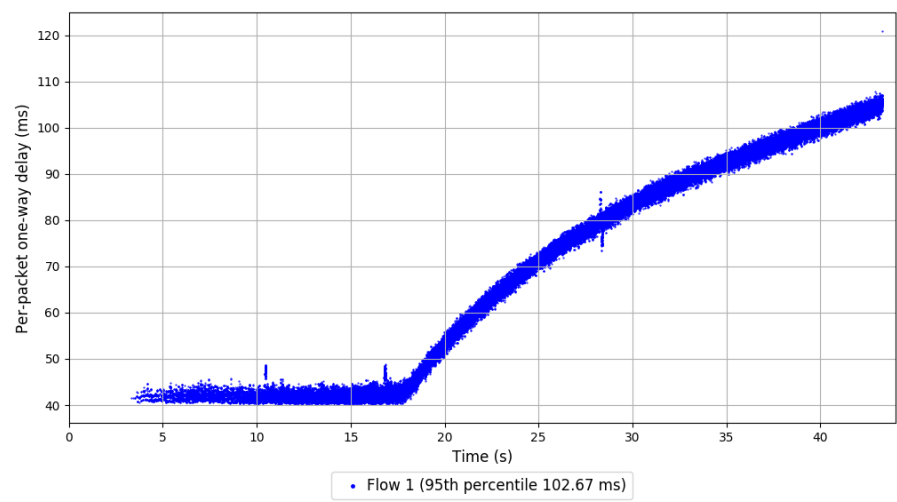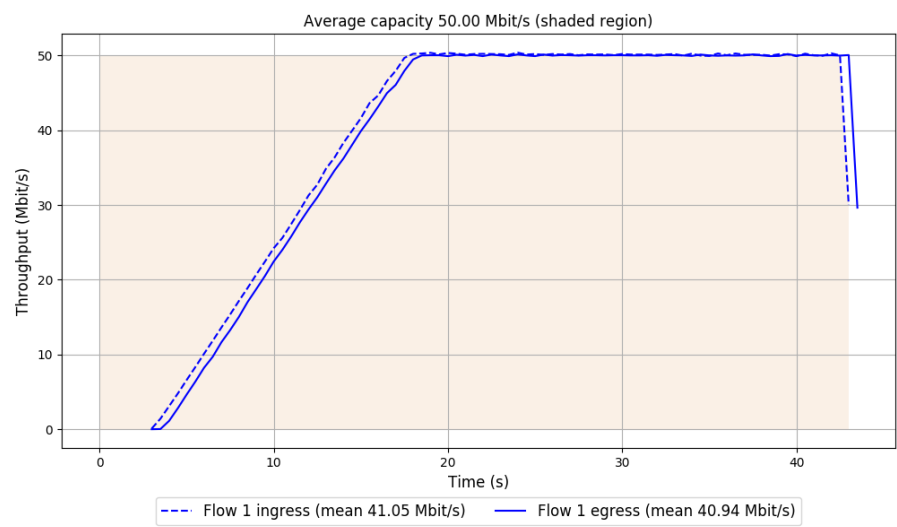
Run 2: Report of LEDBAT — Data Link

Average capacity 50.00 Mbit/s (shaded region)

Flow 1 ingress (mean 41.05 Mbit/s) ----- Flow 1 egress (mean 40.94 Mbit/s)
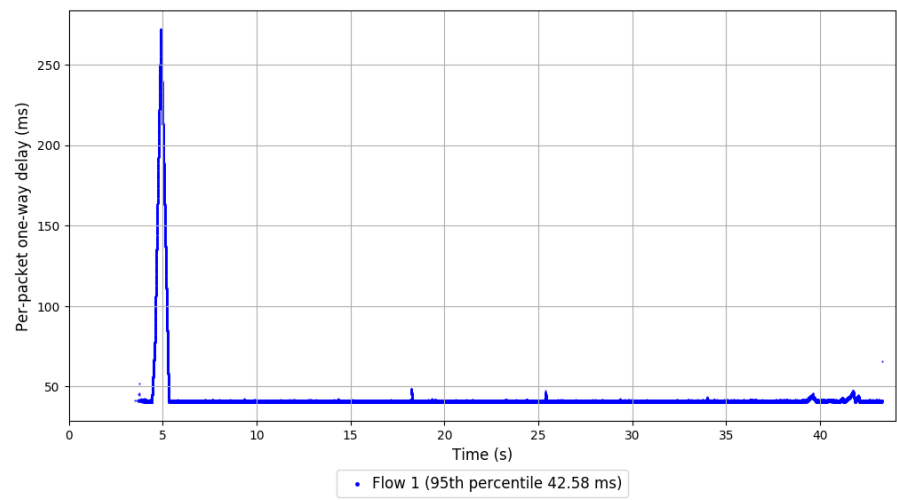

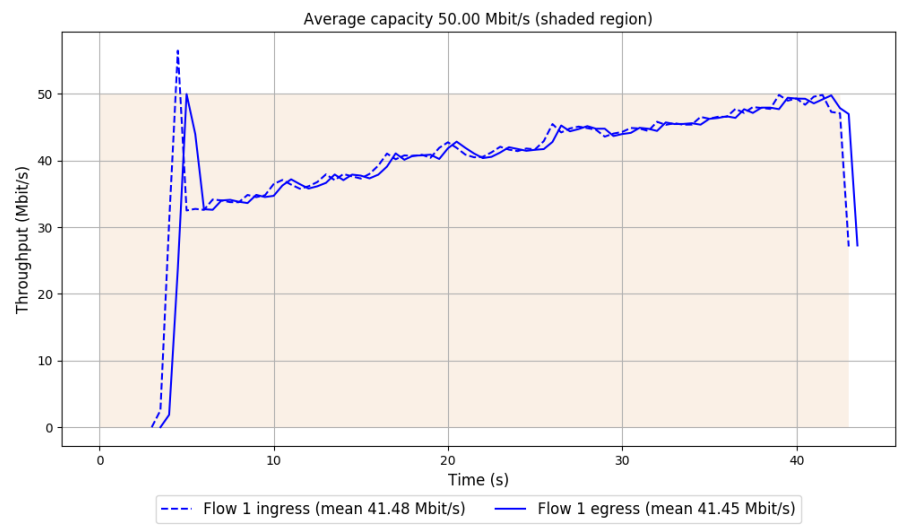Flow 1 (95th percentile 102.67 ms)

```
Run 1: Statistics of PCC-Allegro

Start at: 2019-07-07 22:52:13
End at: 2019-07-07 22:52:53

# Below is generated by plot.py at 2019-07-07 23:17:04
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 41.45 Mbit/s (82.9% utilization)
95th percentile per-packet one-way delay: 42.582 ms
Loss rate: 0.12%
-- Flow 1:
Average throughput: 41.45 Mbit/s
95th percentile per-packet one-way delay: 42.582 ms
Loss rate: 0.12%
```

Run 1: Report of PCC-Allegro — Data Link

Average capacity 50.00 Mbit/s (shaded region)

- - - Flow 1 ingress (mean 41.48 Mbit/s) —— Flow 1 egress (mean 41.45 Mbit/s)

• Flow 1 (95th percentile 42.58 ms)

```
Run 2: Statistics of PCC-Allegro

Start at: 2019-07-07 23:07:42
End at: 2019-07-07 23:08:22

# Below is generated by plot.py at 2019-07-07 23:17:16
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 45.78 Mbit/s (91.6% utilization)
95th percentile per-packet one-way delay: 65.657 ms
Loss rate: 0.11%
-- Flow 1:
Average throughput: 45.78 Mbit/s
95th percentile per-packet one-way delay: 65.657 ms
Loss rate: 0.11%
```
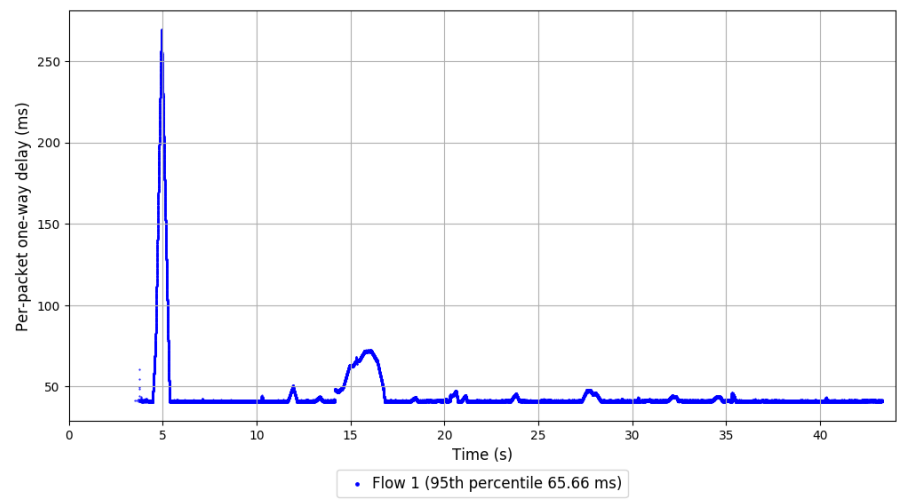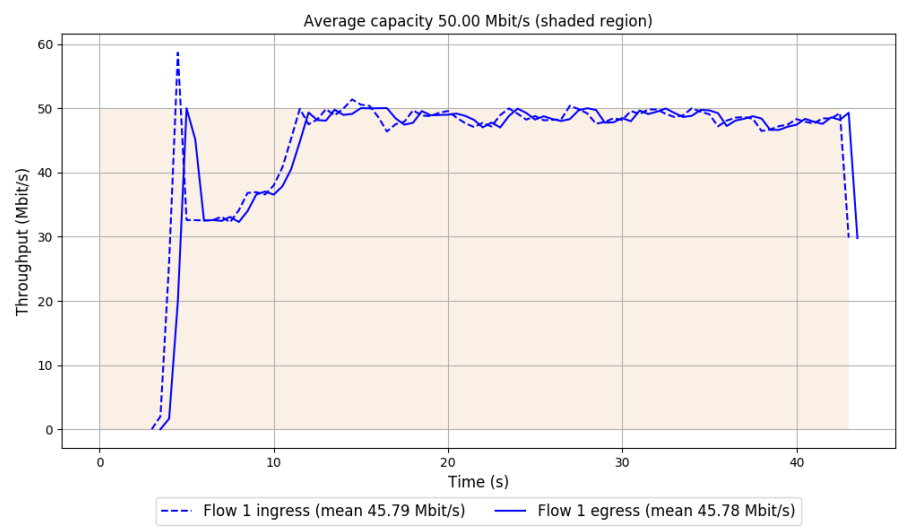
Run 2: Report of PCC-Allegro — Data Link

Average capacity 50.00 Mbit/s (shaded region)

Flow 1 ingress (mean 45.79 Mbit/s)   Flow 1 egress (mean 45.78 Mbit/s)

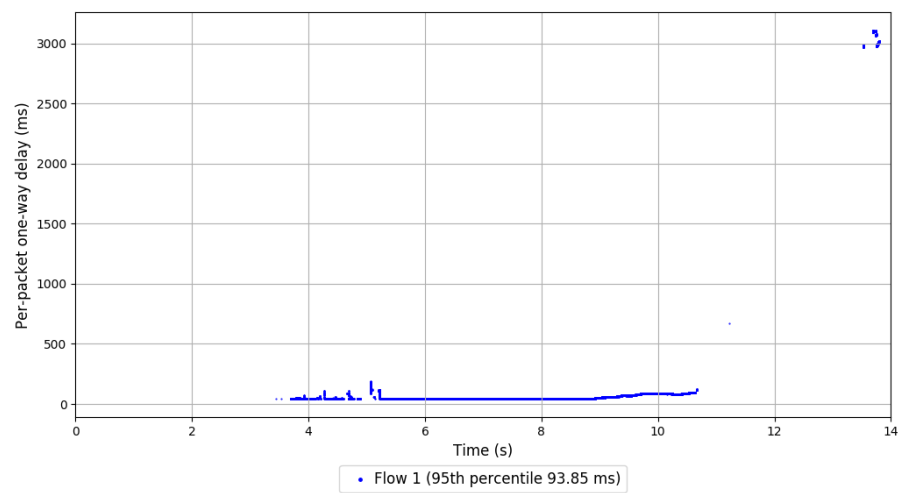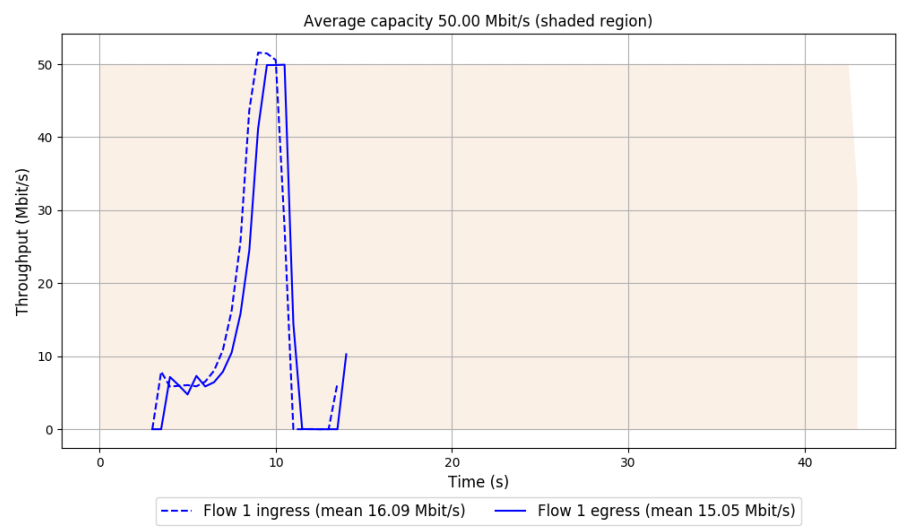Flow 1 (95th percentile 65.66 ms)

44

Run 1: Statistics of PCC-Expr

Start at: 2019-07-07 22:54:41
End at: 2019-07-07 22:55:21

Run 1: Report of PCC-Expr — Data Link

Average capacity 50.00 Mbit/s (shaded region)

- - - Flow 1 ingress (mean 16.09 Mbit/s) —— Flow 1 egress (mean 15.05 Mbit/s)

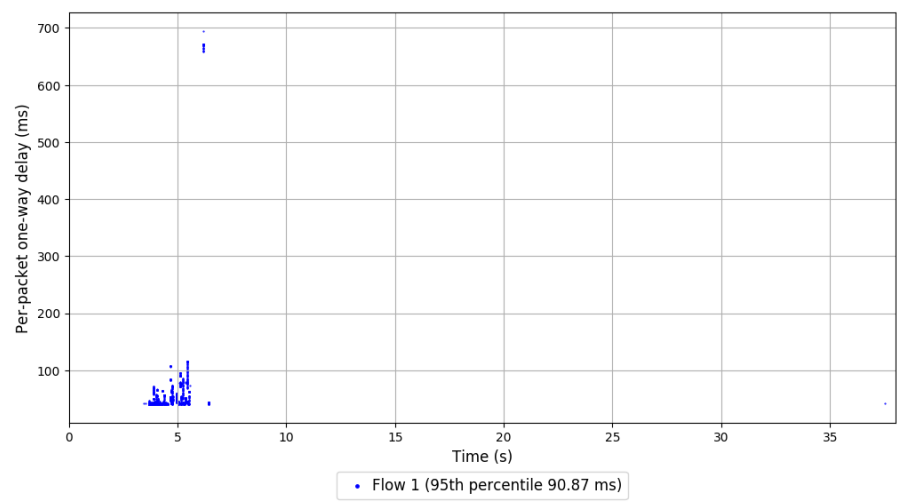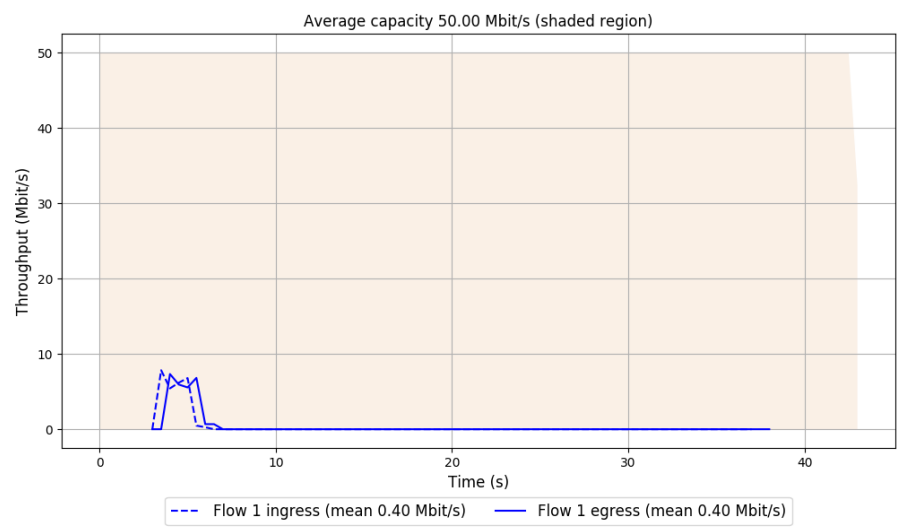• Flow 1 (95th percentile 93.85 ms)

```
Run 2: Statistics of PCC-Expr

Start at: 2019-07-07 23:10:06
End at: 2019-07-07 23:10:46


# Below is generated by plot.py at 2019-07-07 23:17:16
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 0.40 Mbit/s (0.8% utilization)
95th percentile per-packet one-way delay: 90.871 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 0.40 Mbit/s
95th percentile per-packet one-way delay: 90.871 ms
Loss rate: 0.00%
```

Run 2: Report of PCC-Expr — Data Link

Average capacity 50.00 Mbit/s (shaded region)

--- Flow 1 ingress (mean 0.40 Mbit/s) — Flow 1 egress (mean 0.40 Mbit/s)

• Flow 1 (95th percentile 90.87 ms)

48

Run 1: Statistics of QUIC Cubic

Start at: 2019-07-07 22:51:29
End at: 2019-07-07 22:52:09

Run 1: Report of QUIC Cubic — Data Link

Figure is missing

Figure is missing

Run 2: Statistics of QUIC Cubic

Start at: 2019-07-07 23:06:58
End at: 2019-07-07 23:07:38

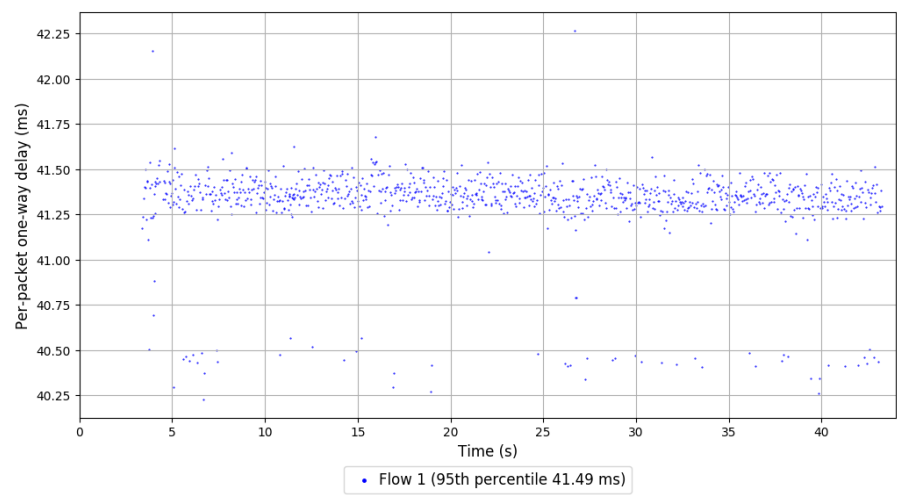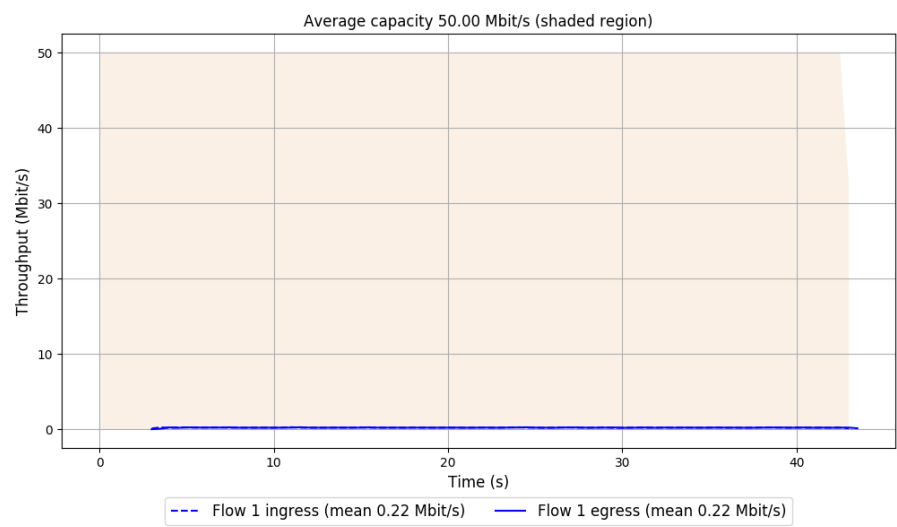Run 2: Report of QUIC Cubic — Data Link

Figure is missing

Figure is missing

```
Run 1: Statistics of SCReAM

Start at: 2019-07-07 22:50:43
End at: 2019-07-07 22:51:23

# Below is generated by plot.py at 2019-07-07 23:17:16
# 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: 41.486 ms
Loss rate: 0.10%
-- Flow 1:
Average throughput: 0.22 Mbit/s
95th percentile per-packet one-way delay: 41.486 ms
Loss rate: 0.10%
```

Run 1: Report of SCReAM — Data Link

Average capacity 50.00 Mbit/s (shaded region)

Flow 1 ingress (mean 0.22 Mbit/s) --- Flow 1 egress (mean 0.22 Mbit/s)

Flow 1 (95th percentile 41.49 ms)

```
Run 2: Statistics of SCReAM

Start at: 2019-07-07 23:06:12
End at: 2019-07-07 23:06:53

# Below is generated by plot.py at 2019-07-07 23:17:16
# 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: 41.466 ms
Loss rate: 0.10%
-- Flow 1:
Average throughput: 0.22 Mbit/s
95th percentile per-packet one-way delay: 41.466 ms
Loss rate: 0.10%
```
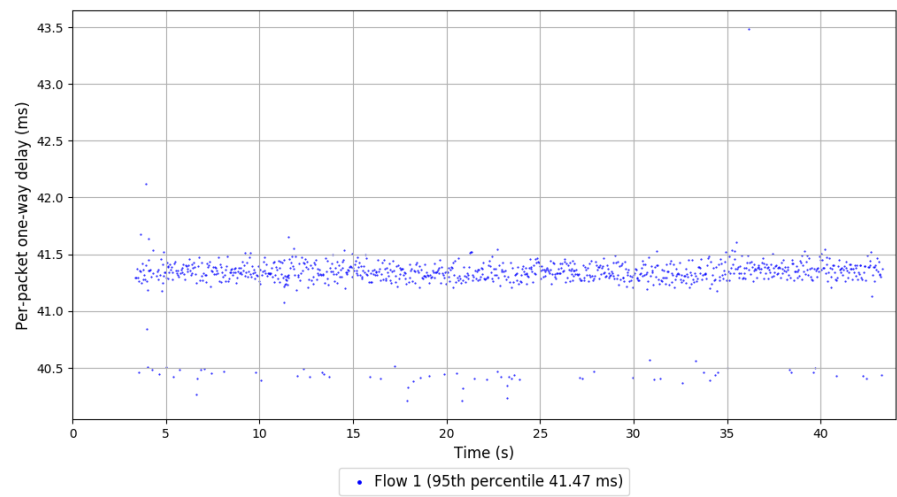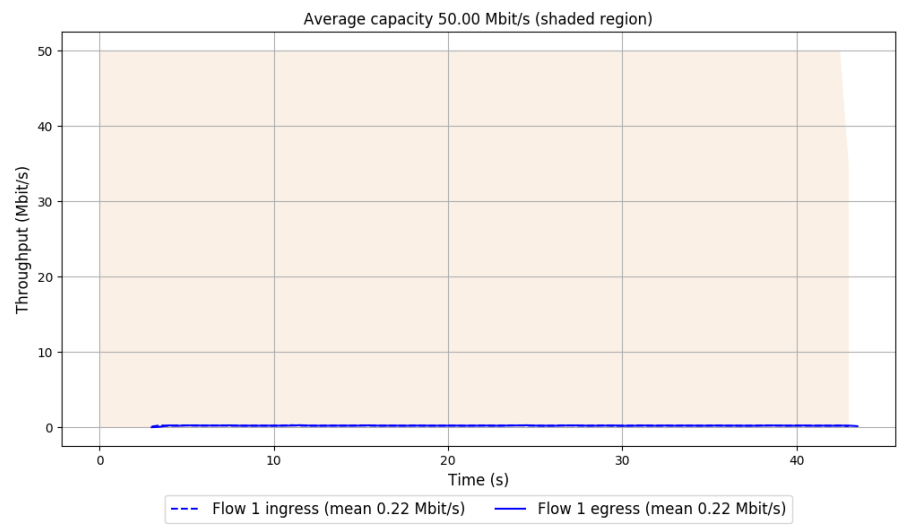
Run 2: Report of SCReAM — Data Link

Average capacity 50.00 Mbit/s (shaded region)

- - - Flow 1 ingress (mean 0.22 Mbit/s) ——— Flow 1 egress (mean 0.22 Mbit/s)

• Flow 1 (95th percentile 41.47 ms)

```
Run 1: Statistics of Sprout

Start at: 2019-07-07 22:44:59
End at: 2019-07-07 22:45:39

# Below is generated by plot.py at 2019-07-07 23:17:27
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 9.36 Mbit/s (18.7% utilization)
95th percentile per-packet one-way delay: 51.921 ms
Loss rate: 0.11%
-- Flow 1:
Average throughput: 9.36 Mbit/s
95th percentile per-packet one-way delay: 51.921 ms
Loss rate: 0.11%
```
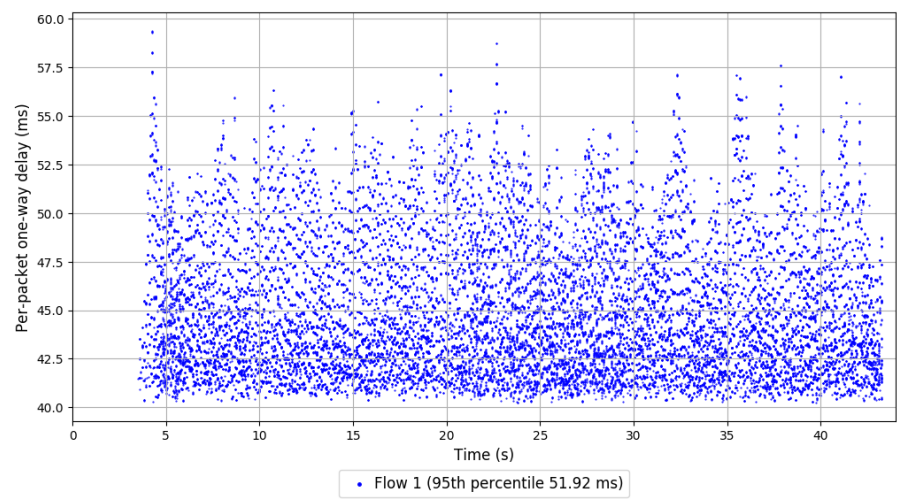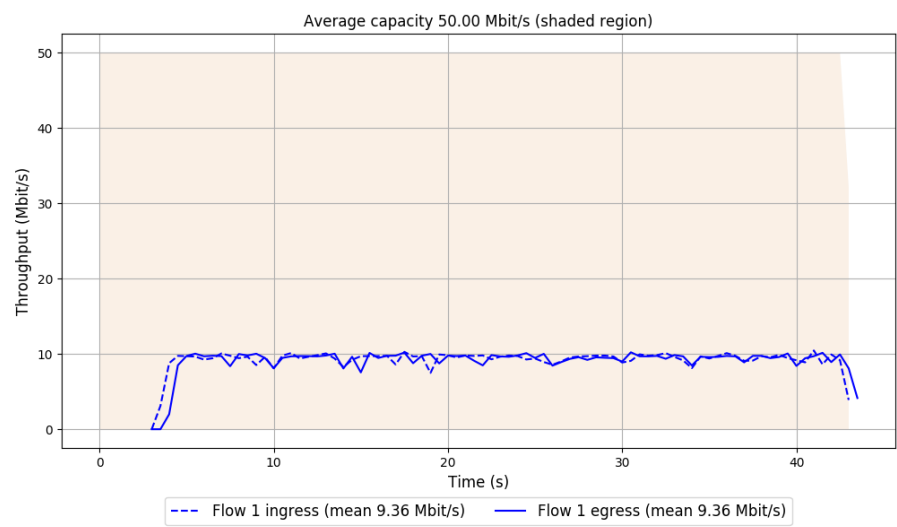
Run 1: Report of Sprout — Data Link

Average capacity 50.00 Mbit/s (shaded region)

Flow 1 ingress (mean 9.36 Mbit/s)   Flow 1 egress (mean 9.36 Mbit/s)

Flow 1 (95th percentile 51.92 ms)

```
Run 2: Statistics of Sprout

Start at: 2019-07-07 23:00:28
End at: 2019-07-07 23:01:08


# Below is generated by plot.py at 2019-07-07 23:17:27
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 9.33 Mbit/s (18.7% utilization)
95th percentile per-packet one-way delay: 51.918 ms
Loss rate: 0.09%
-- Flow 1:
Average throughput: 9.33 Mbit/s
95th percentile per-packet one-way delay: 51.918 ms
Loss rate: 0.09%
```
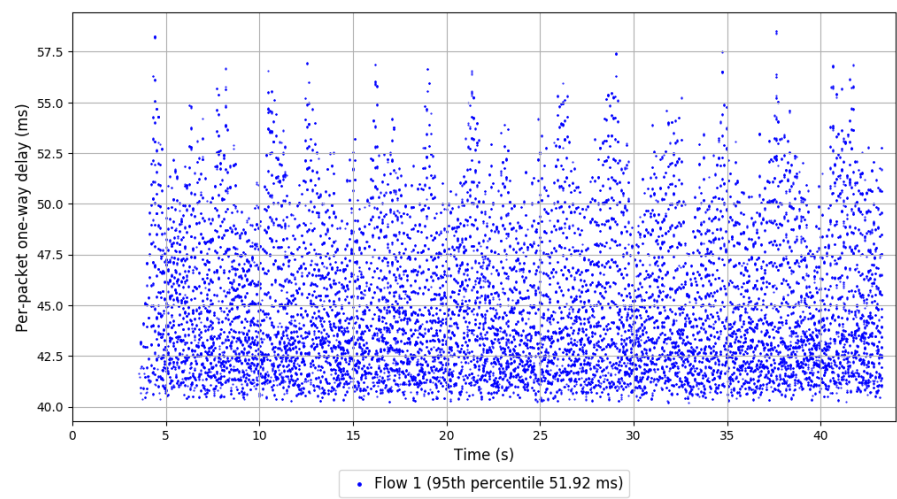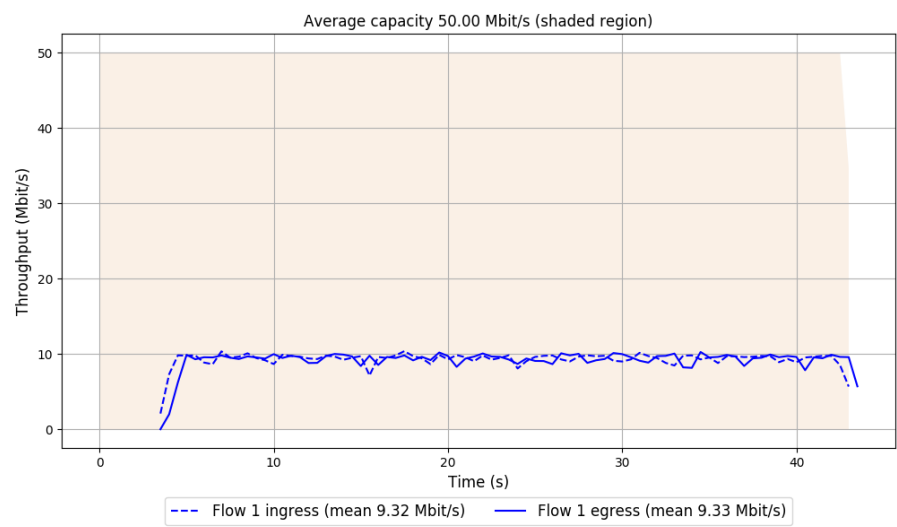
Run 2: Report of Sprout — Data Link

Average capacity 50.00 Mbit/s (shaded region)

Flow 1 ingress (mean 9.32 Mbit/s) — Flow 1 egress (mean 9.33 Mbit/s)
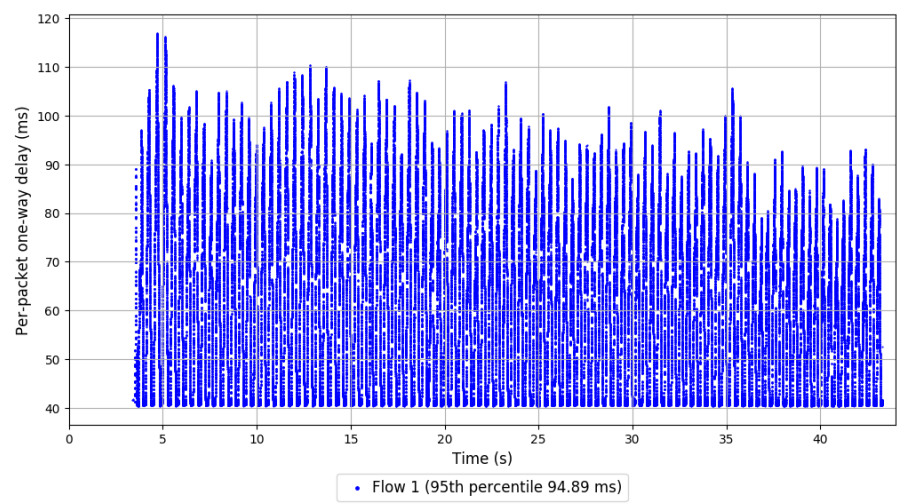
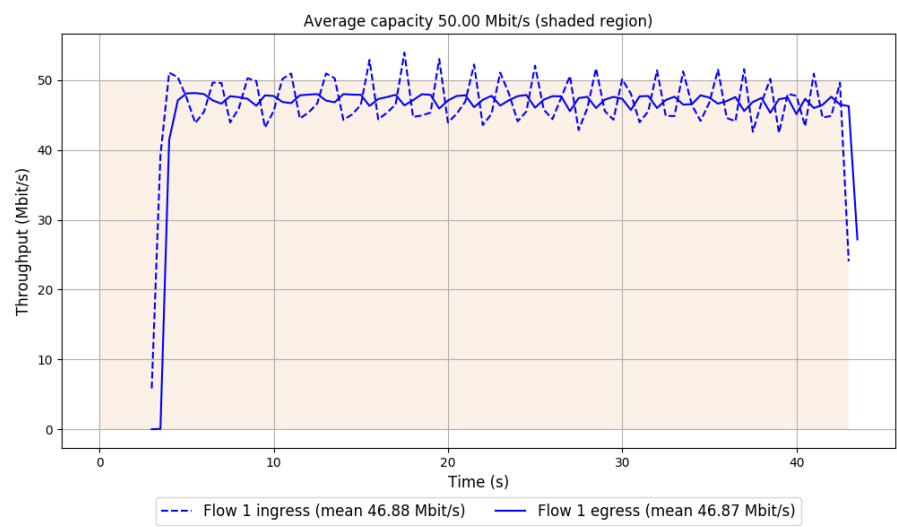

• Flow 1 (95th percentile 51.92 ms)

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

Start at: 2019-07-07 22:49:02
End at: 2019-07-07 22:49:42

# Below is generated by plot.py at 2019-07-07 23:18:57
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 46.87 Mbit/s (93.7% utilization)
95th percentile per-packet one-way delay: 94.892 ms
Loss rate: 0.10%
-- Flow 1:
Average throughput: 46.87 Mbit/s
95th percentile per-packet one-way delay: 94.892 ms
Loss rate: 0.10%
```

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

Average capacity 50.00 Mbit/s (shaded region)

Flow 1 ingress (mean 46.88 Mbit/s)   Flow 1 egress (mean 46.87 Mbit/s)

Flow 1 (95th percentile 94.89 ms)

```
Run 2: Statistics of TaoVA-100x

Start at: 2019-07-07 23:04:32
End at: 2019-07-07 23:05:12


# Below is generated by plot.py at 2019-07-07 23:18:57
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 46.82 Mbit/s (93.6% utilization)
95th percentile per-packet one-way delay: 91.780 ms
Loss rate: 0.10%
-- Flow 1:
Average throughput: 46.82 Mbit/s
95th percentile per-packet one-way delay: 91.780 ms
Loss rate: 0.10%
```
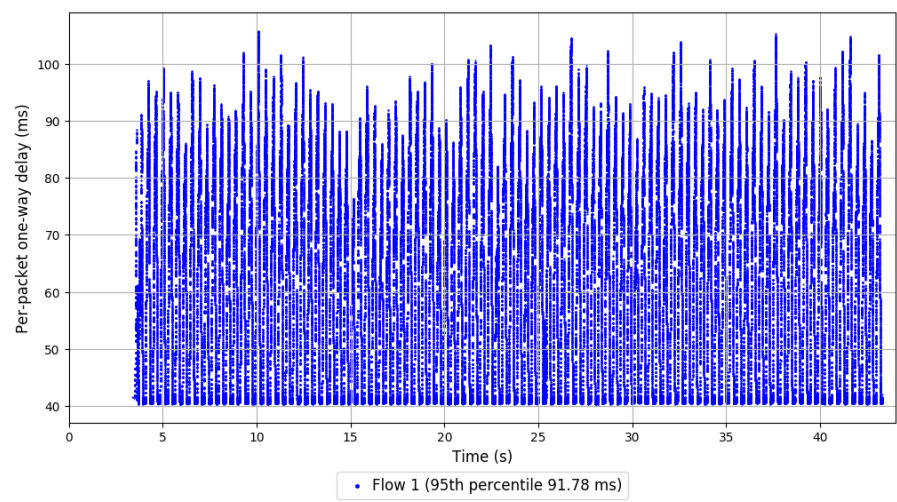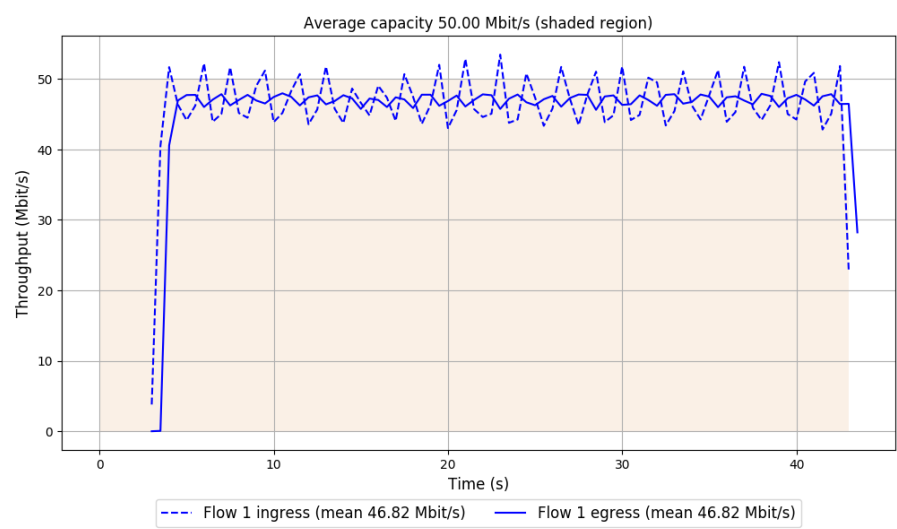
Run 2: Report of TaoVA-100x — Data Link

Average capacity 50.00 Mbit/s (shaded region)

- - - Flow 1 ingress (mean 46.82 Mbit/s) —— Flow 1 egress (mean 46.82 Mbit/s)

• Flow 1 (95th percentile 91.78 ms)

64

```
Run 1: Statistics of TCP Vegas

Start at: 2019-07-07 22:46:35
End at: 2019-07-07 22:47:15

# Below is generated by plot.py at 2019-07-07 23:18:57
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 49.46 Mbit/s (98.9% utilization)
95th percentile per-packet one-way delay: 251.701 ms
Loss rate: 0.55%
-- Flow 1:
Average throughput: 49.46 Mbit/s
95th percentile per-packet one-way delay: 251.701 ms
Loss rate: 0.55%
```
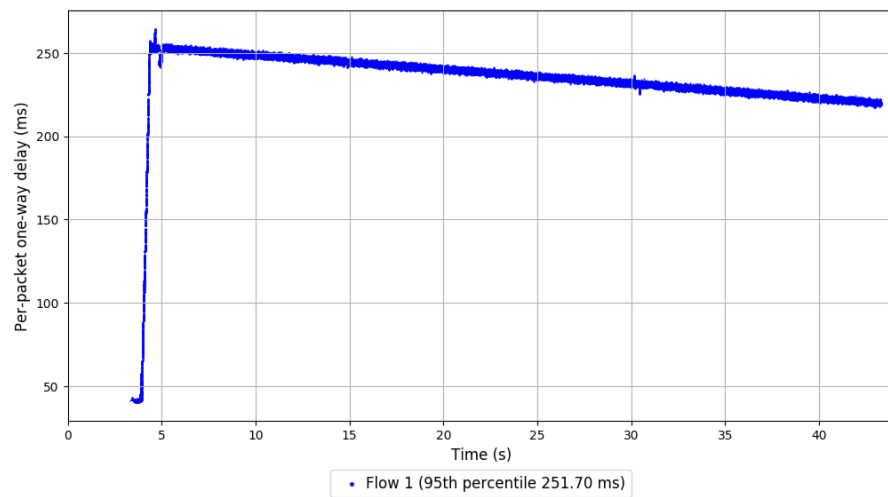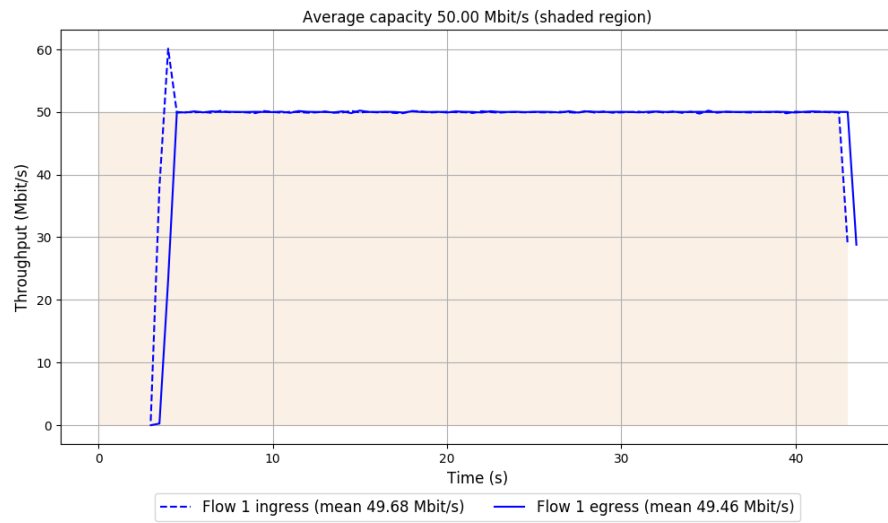
Run 1: Report of TCP Vegas — Data Link

Average capacity 50.00 Mbit/s (shaded region)

Flow 1 ingress (mean 49.68 Mbit/s) Flow 1 egress (mean 49.46 Mbit/s)

Flow 1 (95th percentile 251.70 ms)

66

```
Run 2: Statistics of TCP Vegas

Start at: 2019-07-07 23:02:04
End at: 2019-07-07 23:02:44

# Below is generated by plot.py at 2019-07-07 23:18:57
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 43.66 Mbit/s (87.3% utilization)
95th percentile per-packet one-way delay: 43.838 ms
Loss rate: 0.12%
-- Flow 1:
Average throughput: 43.66 Mbit/s
95th percentile per-packet one-way delay: 43.838 ms
Loss rate: 0.12%
```
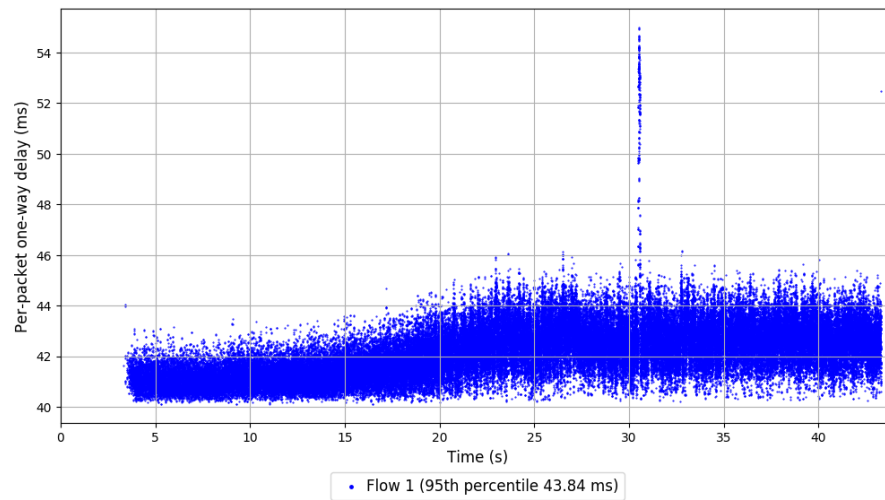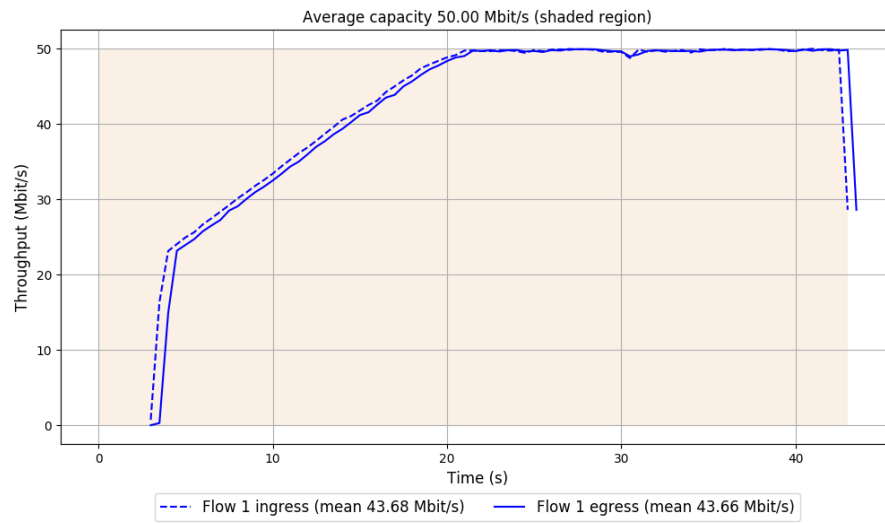
Run 2: Report of TCP Vegas — Data Link

Average capacity 50.00 Mbit/s (shaded region)

Flow 1 ingress (mean 43.68 Mbit/s)   Flow 1 egress (mean 43.66 Mbit/s)

Flow 1 (95th percentile 43.84 ms)

```
Run 1: Statistics of Verus

Start at: 2019-07-07 22:42:29
End at: 2019-07-07 22:43:09

# Below is generated by plot.py at 2019-07-07 23:18:57
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 49.31 Mbit/s (98.6% utilization)
95th percentile per-packet one-way delay: 467.926 ms
Loss rate: 1.07%
-- Flow 1:
Average throughput: 49.31 Mbit/s
95th percentile per-packet one-way delay: 467.926 ms
Loss rate: 1.07%
```
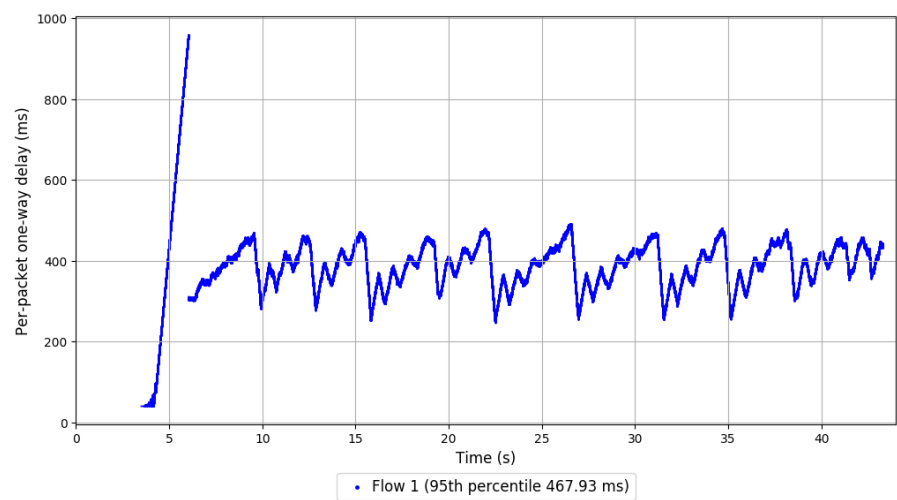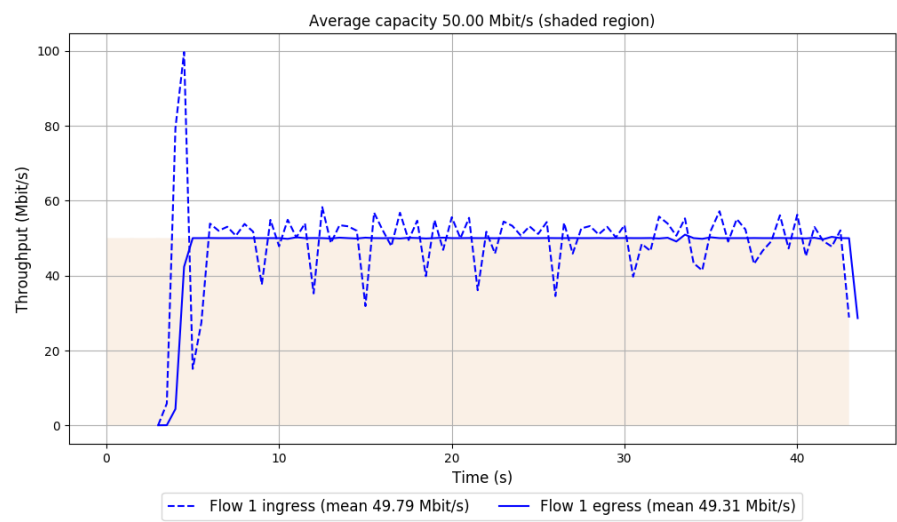
Run 1: Report of Verus — Data Link

Average capacity 50.00 Mbit/s (shaded region)

- - - Flow 1 ingress (mean 49.79 Mbit/s) —— Flow 1 egress (mean 49.31 Mbit/s)

• Flow 1 (95th percentile 467.93 ms)

```
Run 2: Statistics of Verus

Start at: 2019-07-07 22:57:58
End at: 2019-07-07 22:58:38


# Below is generated by plot.py at 2019-07-07 23:18:57
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 49.26 Mbit/s (98.5% utilization)
95th percentile per-packet one-way delay: 467.920 ms
Loss rate: 1.10%
-- Flow 1:
Average throughput: 49.26 Mbit/s
95th percentile per-packet one-way delay: 467.920 ms
Loss rate: 1.10%
```
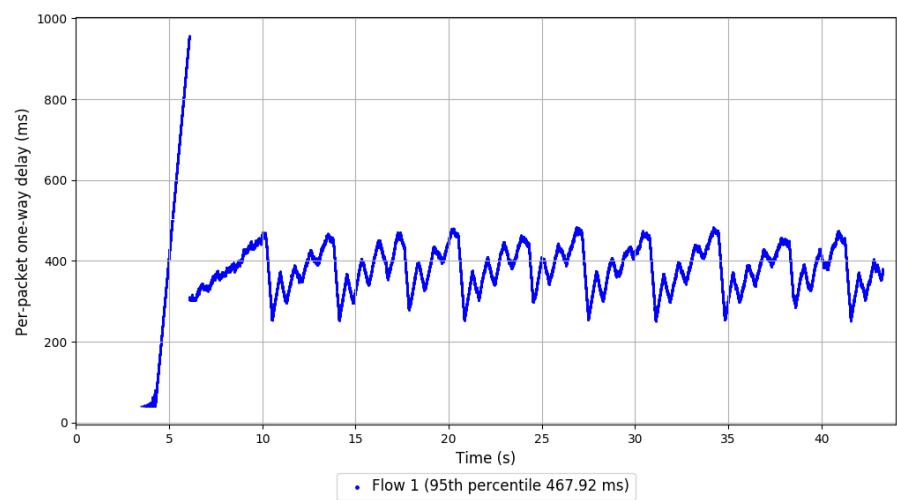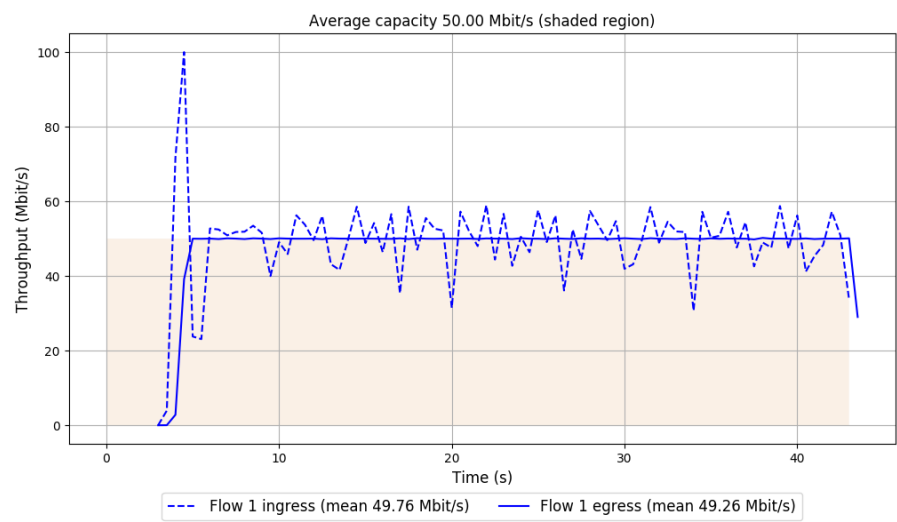
Run 2: Report of Verus — Data Link

Average capacity 50.00 Mbit/s (shaded region)

```
Run 1: Statistics of PCC-Vivace

Start at: 2019-07-07 22:45:45
End at: 2019-07-07 22:46:25

# Below is generated by plot.py at 2019-07-07 23:19:14
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 44.58 Mbit/s (89.2% utilization)
95th percentile per-packet one-way delay: 43.773 ms
Loss rate: 0.10%
-- Flow 1:
Average throughput: 44.58 Mbit/s
95th percentile per-packet one-way delay: 43.773 ms
Loss rate: 0.10%
```
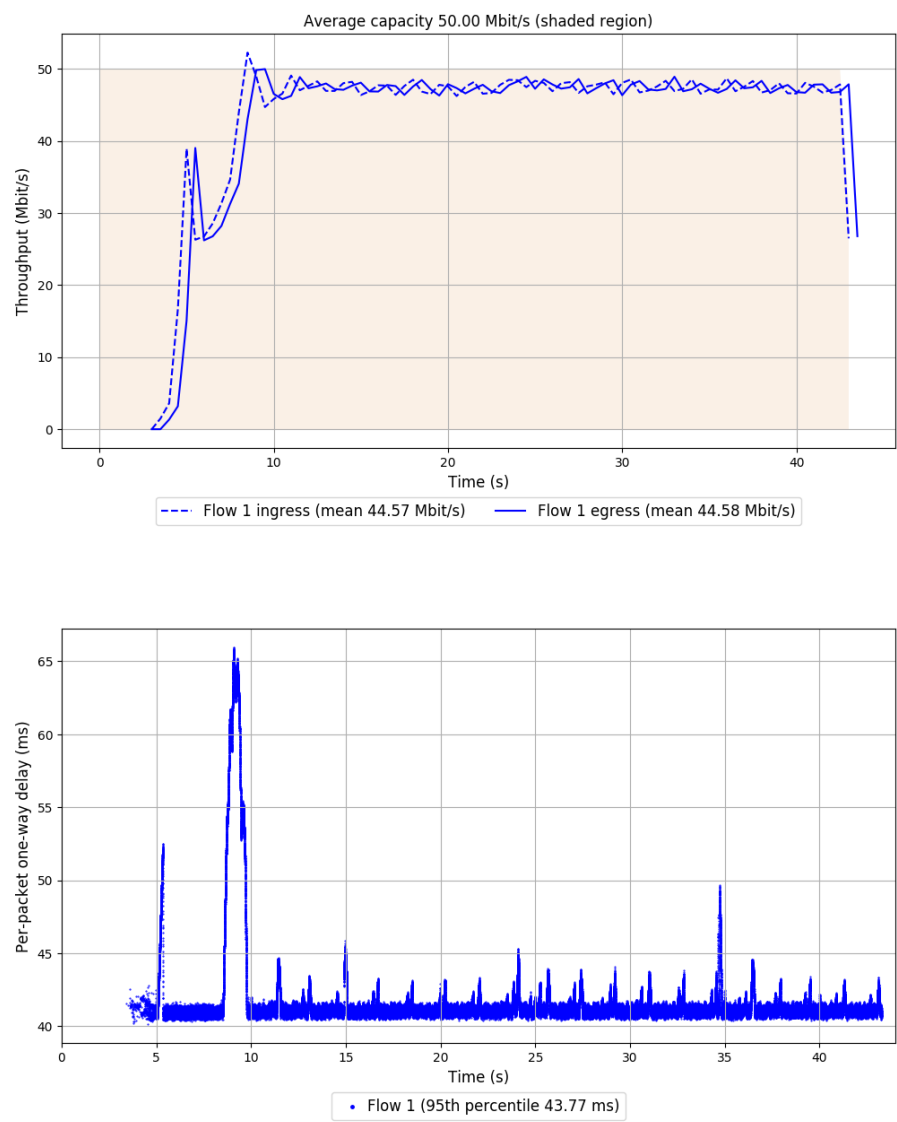
Run 1: Report of PCC-Vivace — Data Link

Average capacity 50.00 Mbit/s (shaded region)

- - - Flow 1 ingress (mean 44.57 Mbit/s)　——— Flow 1 egress (mean 44.58 Mbit/s)

· Flow 1 (95th percentile 43.77 ms)

```
Run 2: Statistics of PCC-Vivace

Start at: 2019-07-07 23:01:14
End at: 2019-07-07 23:01:54

# Below is generated by plot.py at 2019-07-07 23:19:15
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 45.09 Mbit/s (90.2% utilization)
95th percentile per-packet one-way delay: 284.103 ms
Loss rate: 0.10%
-- Flow 1:
Average throughput: 45.09 Mbit/s
95th percentile per-packet one-way delay: 284.103 ms
Loss rate: 0.10%
```
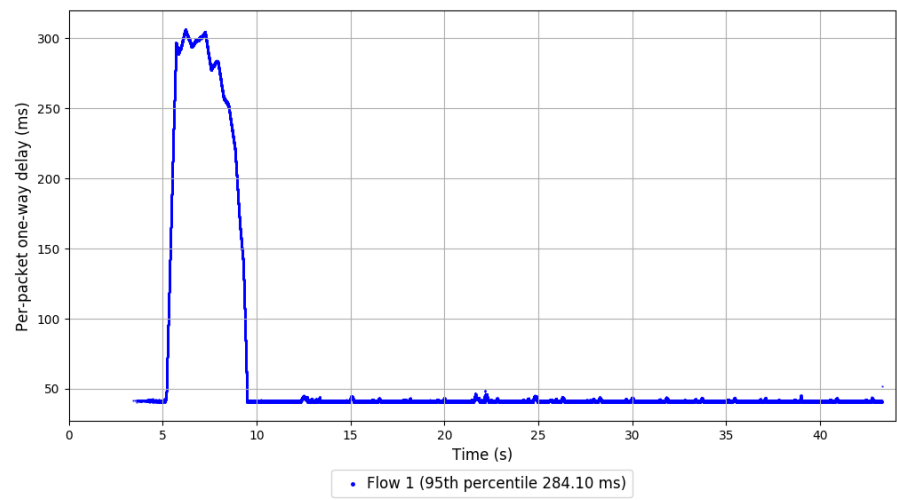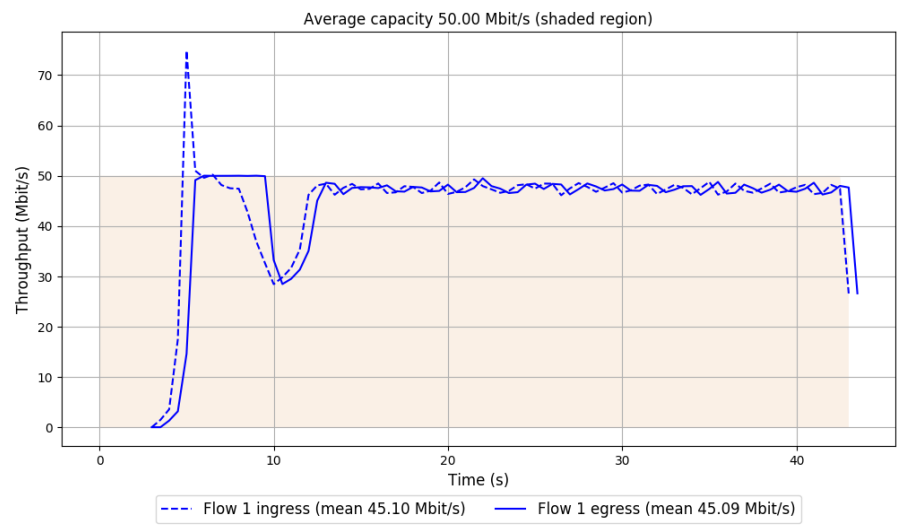
Run 2: Report of PCC-Vivace — Data Link

Average capacity 50.00 Mbit/s (shaded region)

- - - Flow 1 ingress (mean 45.10 Mbit/s) ——— Flow 1 egress (mean 45.09 Mbit/s)
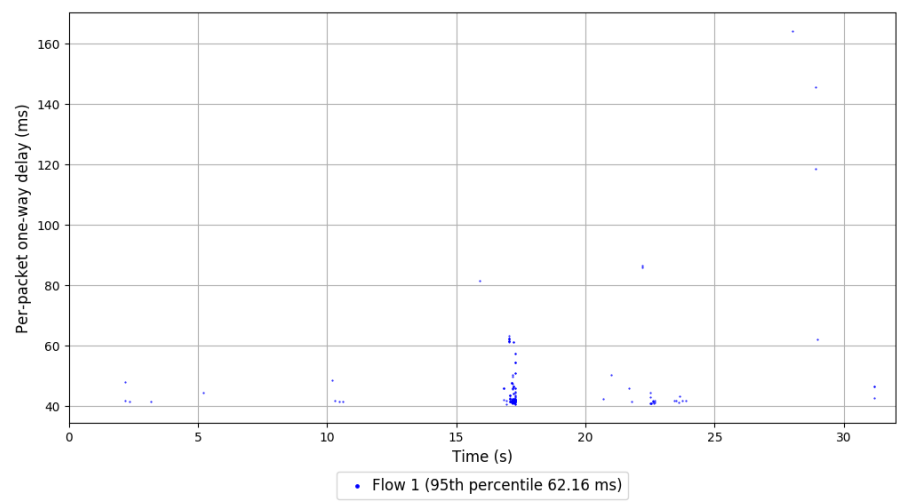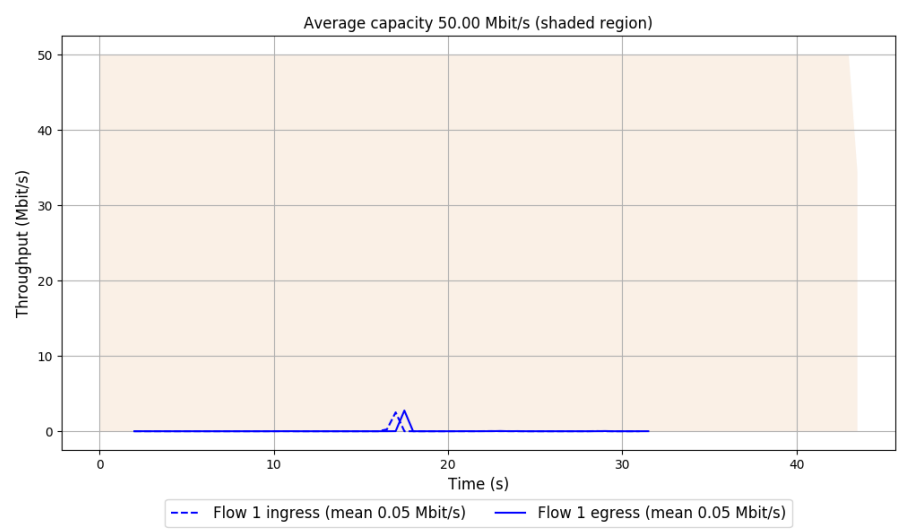

- Flow 1 (95th percentile 284.10 ms)

Run 1: Statistics of WebRTC media

Start at: 2019-07-07 22:53:01
End at: 2019-07-07 22:53:46

Run 1: Report of WebRTC media — Data Link

Average capacity 50.00 Mbit/s (shaded region)

Flow 1 ingress (mean 0.05 Mbit/s)   Flow 1 egress (mean 0.05 Mbit/s)

Flow 1 (95th percentile 62.16 ms)

```
Run 2: Statistics of WebRTC media

Start at: 2019-07-07 23:08:31
End at: 2019-07-07 23:09:11


# Below is generated by plot.py at 2019-07-07 23:19:15
# Datalink statistics
-- Total of 1 flow:
Average capacity: 50.00 Mbit/s
Average throughput: 0.04 Mbit/s (0.1% utilization)
95th percentile per-packet one-way delay: 142.868 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 0.04 Mbit/s
95th percentile per-packet one-way delay: 142.868 ms
Loss rate: 0.00%
```

Run 2: Report of WebRTC media — Data Link

Average capacity 50.00 Mbit/s (shaded region)

Flow 1 ingress (mean 0.04 Mbit/s) —— Flow 1 egress (mean 0.04 Mbit/s)

Flow 1 (95th percentile 142.87 ms)