

## Pantheon Report

Generated at 2018-12-11 13:09:30 (UTC).

Tested in mahimahi: mm-delay 30 mm-link 12mbps.trace 12mbps.trace  
--uplink-queue=droptail --uplink-queue-args=bytes=45000

Repeated the test of 19 congestion control schemes 3 times.

Each test lasted for 30 seconds running 1 flow.

### System info:

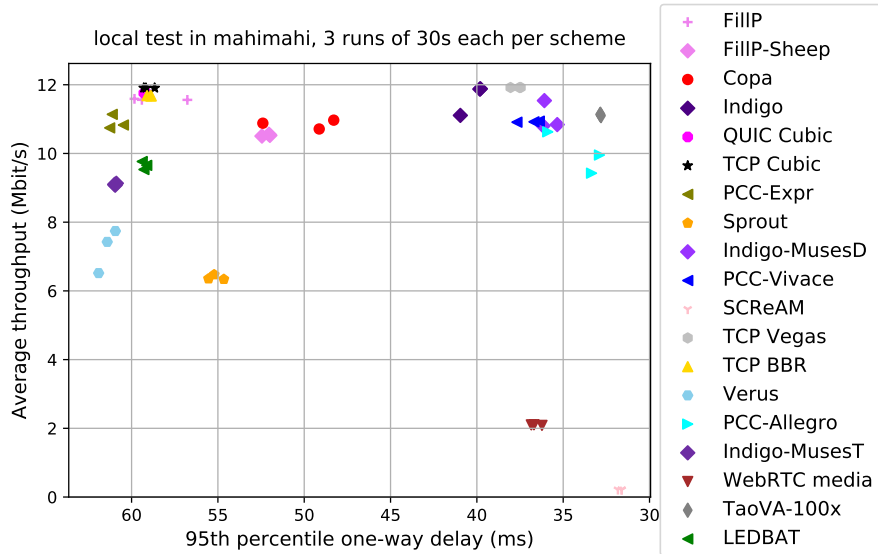
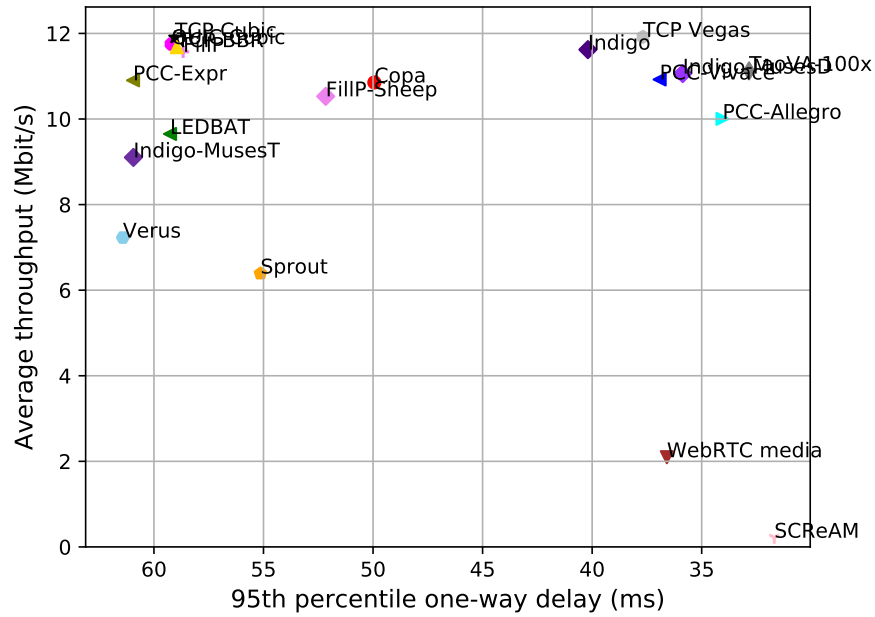
```
Linux 4.15.0-1025-gcp
net.core.default_qdisc = fq
net.core.rmem_default = 16777216
net.core.rmem_max = 536870912
net.core.wmem_default = 16777216
net.core.wmem_max = 536870912
net.ipv4.tcp_rmem = 4096 16777216 536870912
net.ipv4.tcp_wmem = 4096 16777216 536870912
```

### Git summary:

```
branch: muses @ c654af0b7d59d4ef4b914cfac404e1fc2e96dc68
third_party/fillp @ d6da1459332fcee56963885d7eba17e6a32d4519
third_party/fillp-sheep @ 0e5bb722943babcd2b090d2c64fcd45e12e923f9
third_party/genericCC @ d0153f8e594aa89e93b032143cedbdf58e562f4
third_party/indigo @ 2601c92e4aa9d58d38dc4dfe0ecdbf90c077e64d
third_party/libutp @ b3465b942e2826f2b179eaab4a906ce6bb7cf3cf
third_party/muses @ 65ac1b19bbefed0c6349ae986009b4fa8643c40a
third_party/muses-refactored @ 31f8f0ba8ef8b1da76c2bc0cd0a7850c33ff64fb
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-quick @ 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, 3 runs of 30s each per scheme  
(mean of all runs by scheme)



scheme	# runs	mean avg tput (Mbit/s)	mean 95th-%ile delay (ms)	mean loss rate (%)
		flow 1	flow 1	flow 1
TCP BBR	3	11.68	58.96	2.67
Copa	3	10.85	49.94	0.90
TCP Cubic	3	11.91	59.04	0.45
FillP	3	11.57	58.67	1.53
FillP-Sheep	3	10.53	52.16	0.65
Indigo	3	11.62	40.19	0.35
Indigo-MusesD	3	11.06	35.87	0.23
Indigo-MusesT	3	9.10	60.94	26.30
LEDBAT	3	9.65	59.27	0.70
PCC-Allegro	3	10.00	34.05	0.92
PCC-Expr	3	10.90	60.96	0.99
QUIC Cubic	3	11.75	59.21	0.33
SCReAM	3	0.21	31.69	0.04
Sprout	3	6.39	55.14	0.40
TaoVA-100x	3	11.12	32.84	0.78
TCP Vegas	3	11.92	37.68	0.33
Verus	3	7.23	61.42	75.42
PCC-Vivace	3	10.92	36.92	0.15
WebRTC media	3	2.10	36.59	0.11

Run 1: Statistics of TCP BBR

Start at: 2018-12-11 12:40:52

End at: 2018-12-11 12:41:22

# Below is generated by plot.py at 2018-12-11 13:06:56

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 11.67 Mbit/s (97.3% utilization)

95th percentile per-packet one-way delay: 58.861 ms

Loss rate: 2.63%

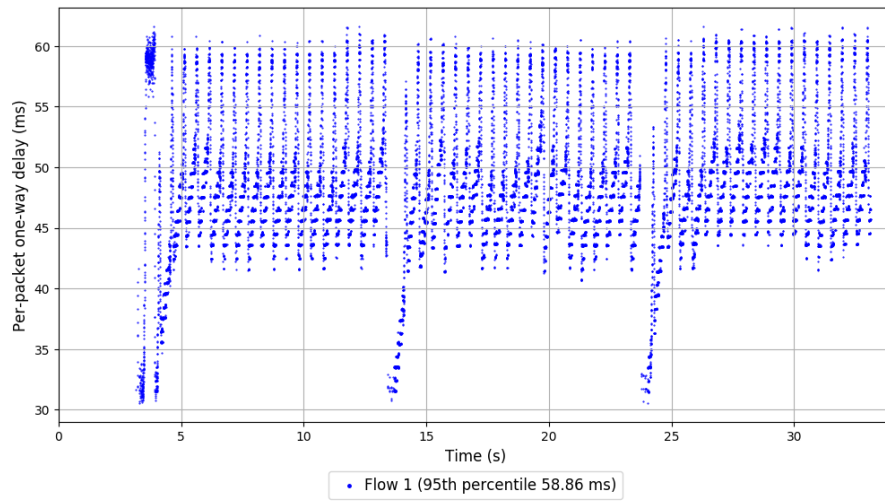
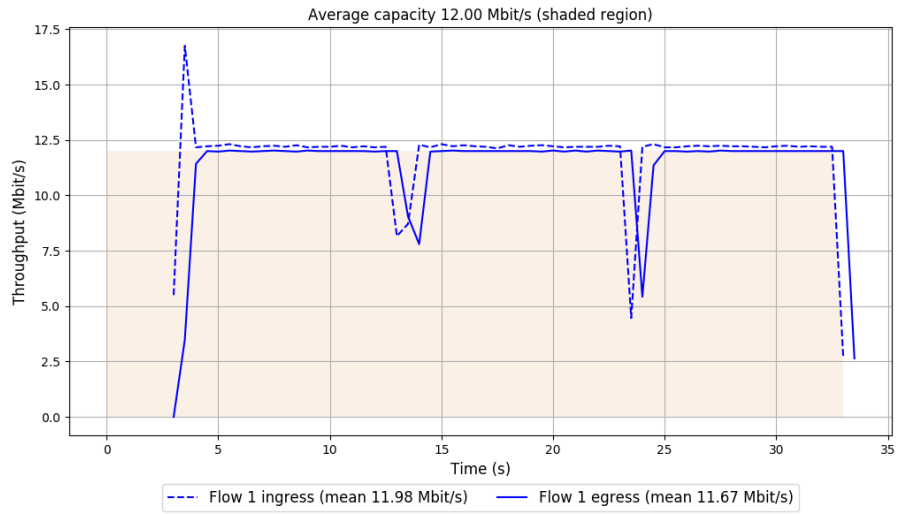
-- Flow 1:

Average throughput: 11.67 Mbit/s

95th percentile per-packet one-way delay: 58.861 ms

Loss rate: 2.63%

# Run 1: Report of TCP BBR — Data Link



Run 2: Statistics of TCP BBR

Start at: 2018-12-11 12:52:07

End at: 2018-12-11 12:52:37

# Below is generated by plot.py at 2018-12-11 13:06:56

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 11.68 Mbit/s (97.4% utilization)

95th percentile per-packet one-way delay: 59.106 ms

Loss rate: 2.66%

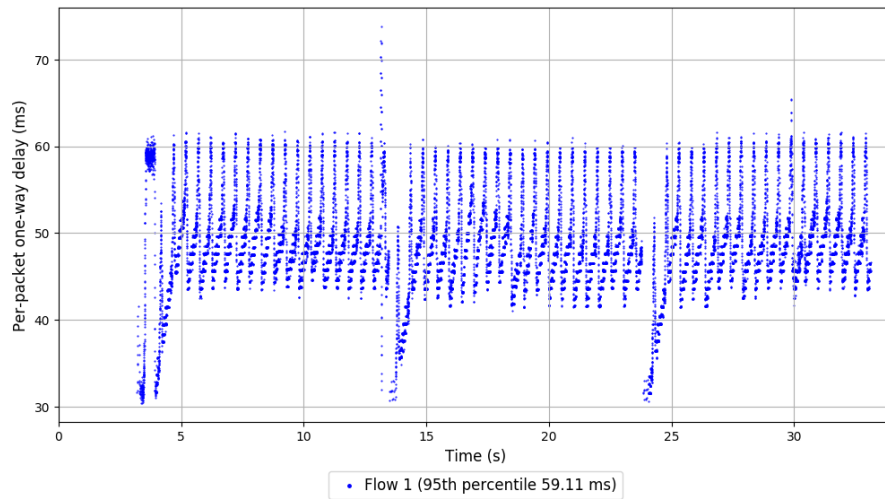
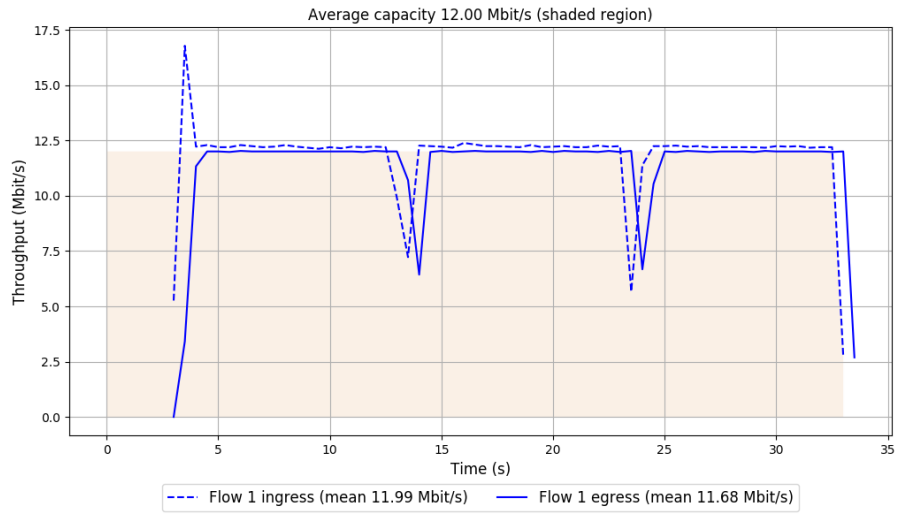
-- Flow 1:

Average throughput: 11.68 Mbit/s

95th percentile per-packet one-way delay: 59.106 ms

Loss rate: 2.66%

## Run 2: Report of TCP BBR — Data Link



Run 3: Statistics of TCP BBR

Start at: 2018-12-11 13:03:24

End at: 2018-12-11 13:03:54

# Below is generated by plot.py at 2018-12-11 13:06:56

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 11.68 Mbit/s (97.3% utilization)

95th percentile per-packet one-way delay: 58.905 ms

Loss rate: 2.72%

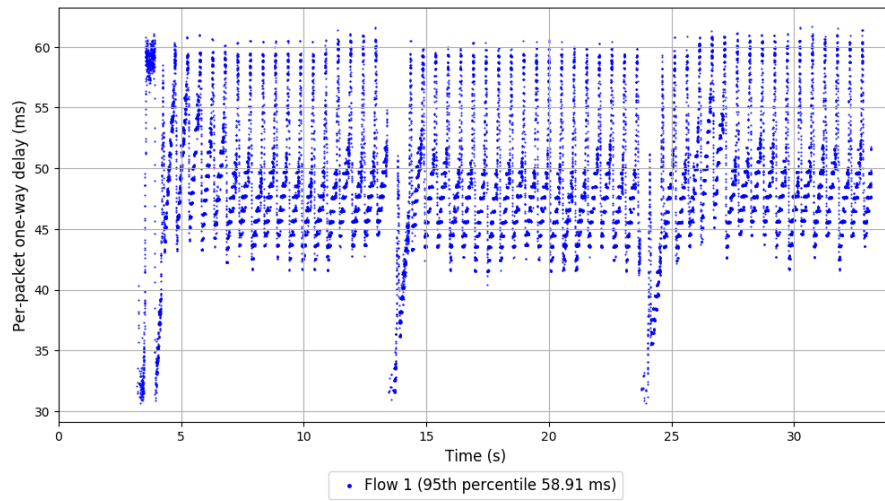
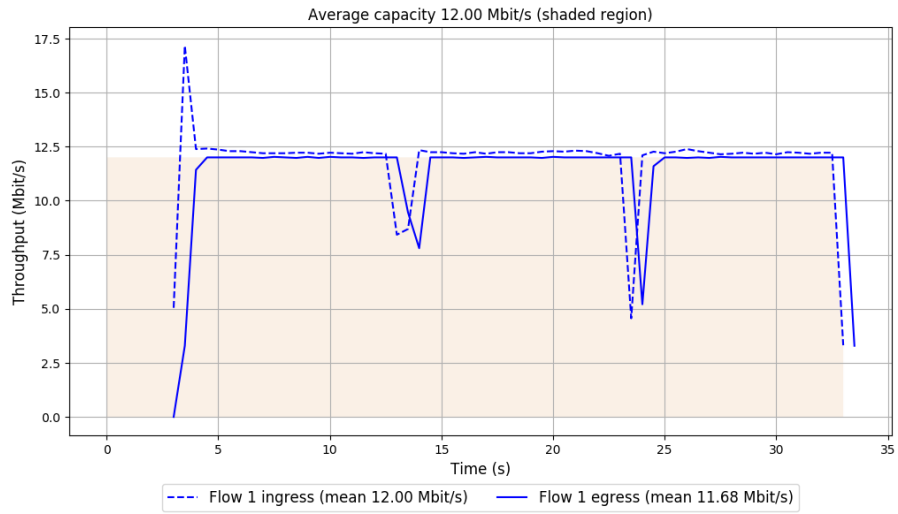
-- Flow 1:

Average throughput: 11.68 Mbit/s

95th percentile per-packet one-way delay: 58.905 ms

Loss rate: 2.72%

### Run 3: Report of TCP BBR — Data Link



Run 1: Statistics of Copa

Start at: 2018-12-11 12:42:03

End at: 2018-12-11 12:42:33

# Below is generated by plot.py at 2018-12-11 13:07:09

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 10.88 Mbit/s (90.7% utilization)

95th percentile per-packet one-way delay: 52.397 ms

Loss rate: 1.04%

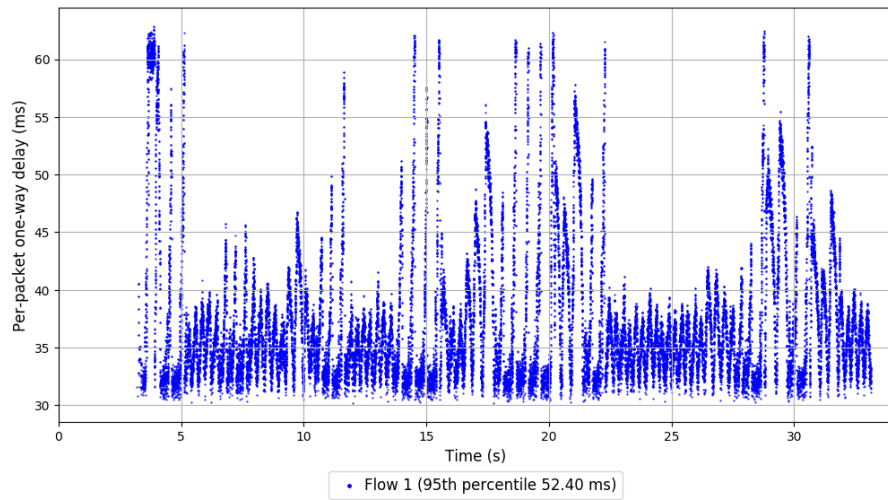
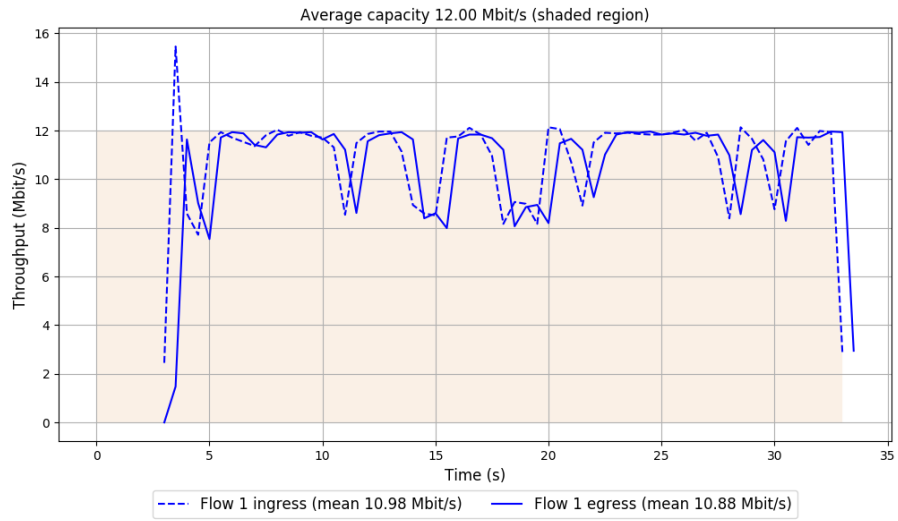
-- Flow 1:

Average throughput: 10.88 Mbit/s

95th percentile per-packet one-way delay: 52.397 ms

Loss rate: 1.04%

# Run 1: Report of Copa — Data Link



Run 2: Statistics of Copa

Start at: 2018-12-11 12:53:18

End at: 2018-12-11 12:53:48

# Below is generated by plot.py at 2018-12-11 13:07:09

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 10.71 Mbit/s (89.3% utilization)

95th percentile per-packet one-way delay: 49.132 ms

Loss rate: 0.65%

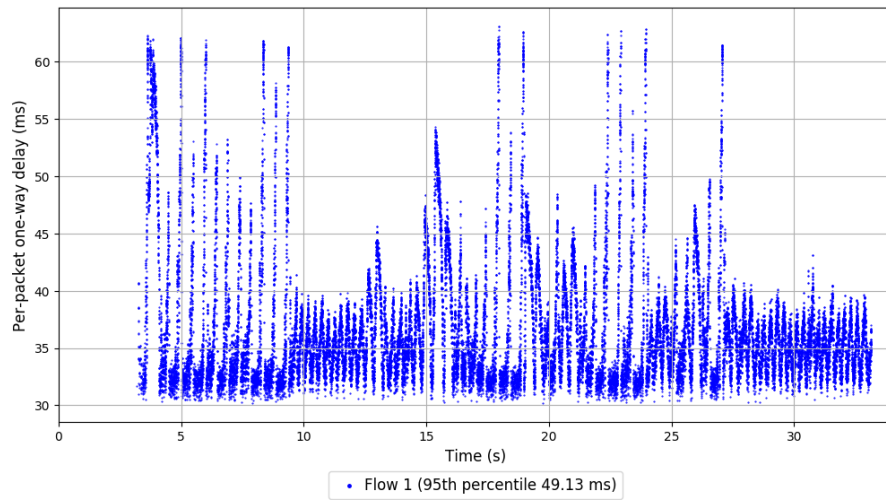
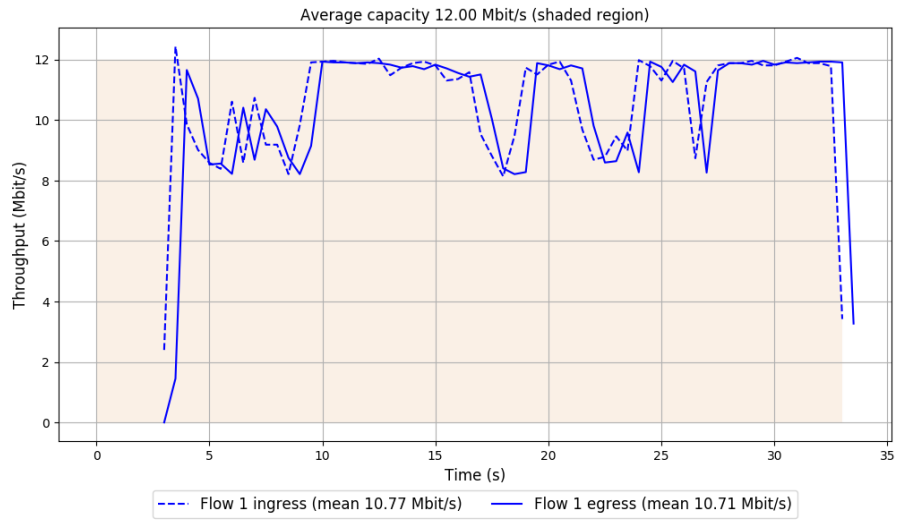
-- Flow 1:

Average throughput: 10.71 Mbit/s

95th percentile per-packet one-way delay: 49.132 ms

Loss rate: 0.65%

## Run 2: Report of Copa — Data Link



Run 3: Statistics of Copa

Start at: 2018-12-11 13:04:35

End at: 2018-12-11 13:05:05

# Below is generated by plot.py at 2018-12-11 13:07:09

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 10.97 Mbit/s (91.4% utilization)

95th percentile per-packet one-way delay: 48.291 ms

Loss rate: 1.02%

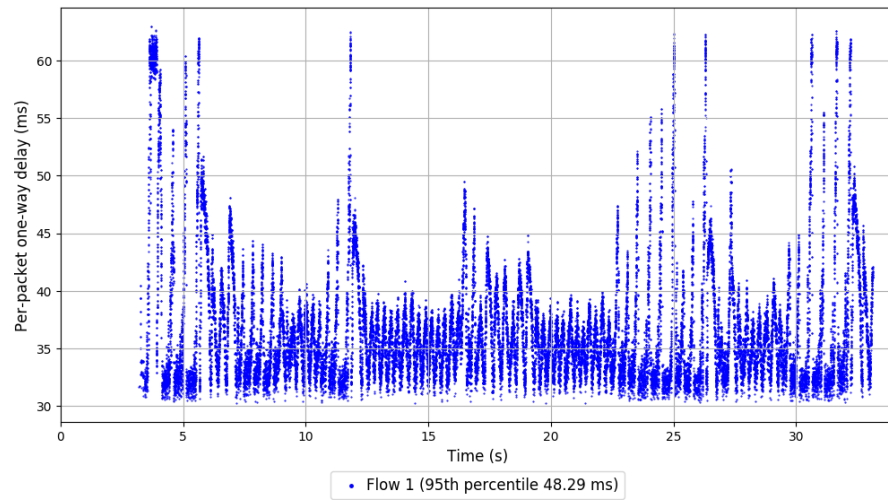
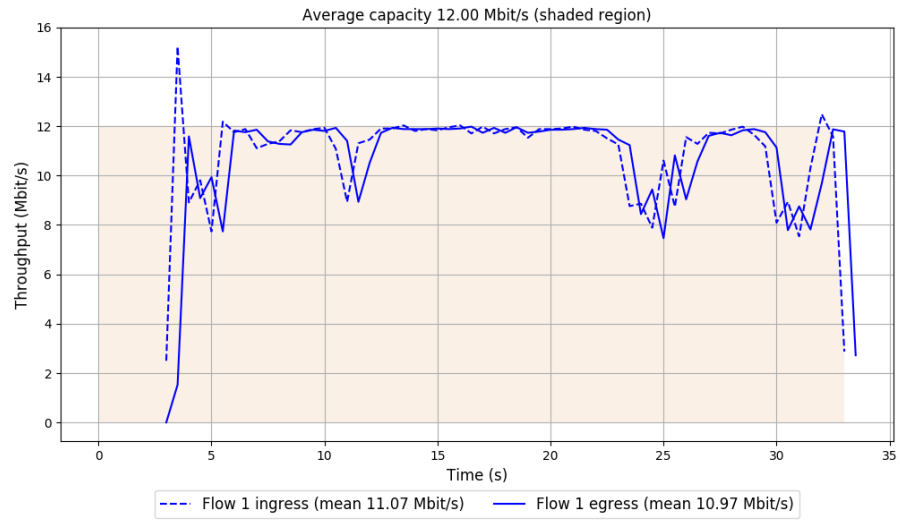
-- Flow 1:

Average throughput: 10.97 Mbit/s

95th percentile per-packet one-way delay: 48.291 ms

Loss rate: 1.02%

### Run 3: Report of Copa — Data Link



Run 1: Statistics of TCP Cubic

Start at: 2018-12-11 12:41:28

End at: 2018-12-11 12:41:58

# Below is generated by plot.py at 2018-12-11 13:07:09

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 11.91 Mbit/s (99.2% utilization)

95th percentile per-packet one-way delay: 58.666 ms

Loss rate: 0.44%

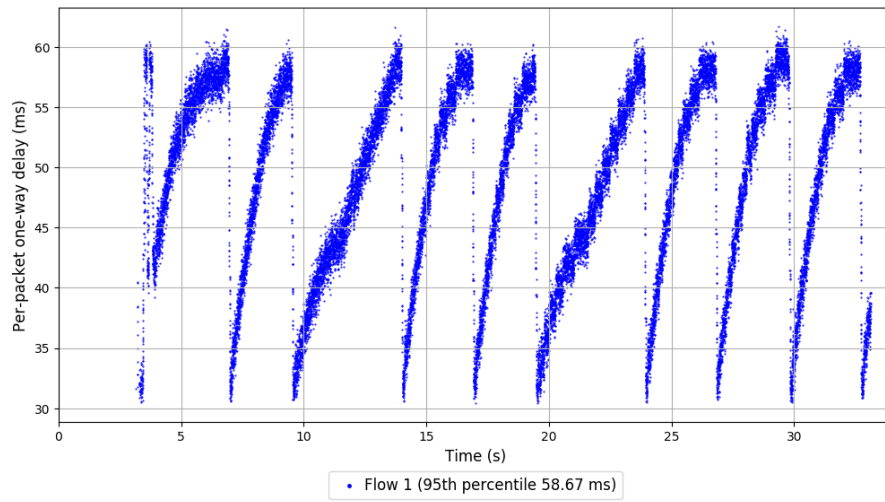
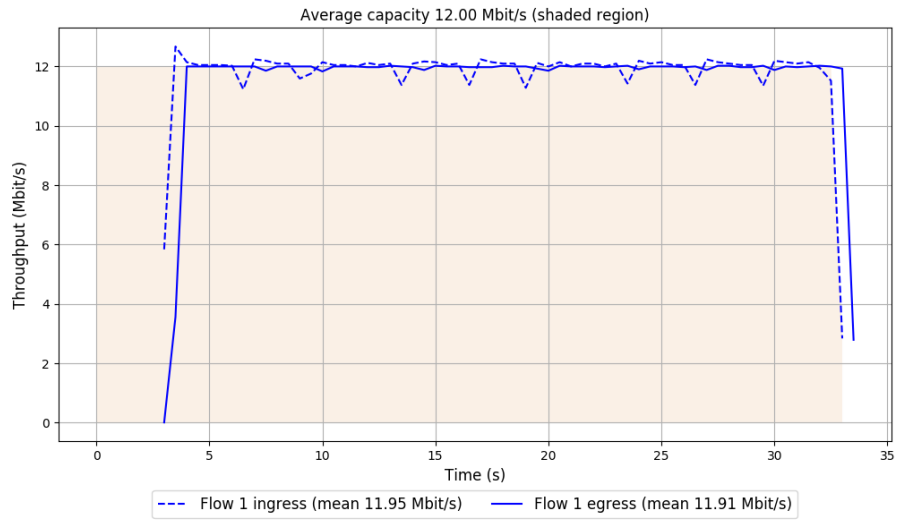
-- Flow 1:

Average throughput: 11.91 Mbit/s

95th percentile per-packet one-way delay: 58.666 ms

Loss rate: 0.44%

# Run 1: Report of TCP Cubic — Data Link



Run 2: Statistics of TCP Cubic

Start at: 2018-12-11 12:52:42

End at: 2018-12-11 12:53:12

# Below is generated by plot.py at 2018-12-11 13:07:09

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 11.90 Mbit/s (99.2% utilization)

95th percentile per-packet one-way delay: 59.168 ms

Loss rate: 0.44%

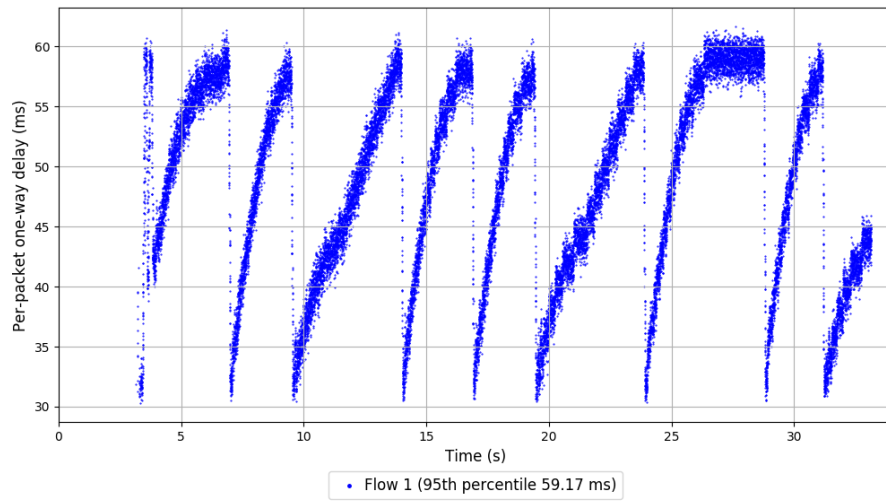
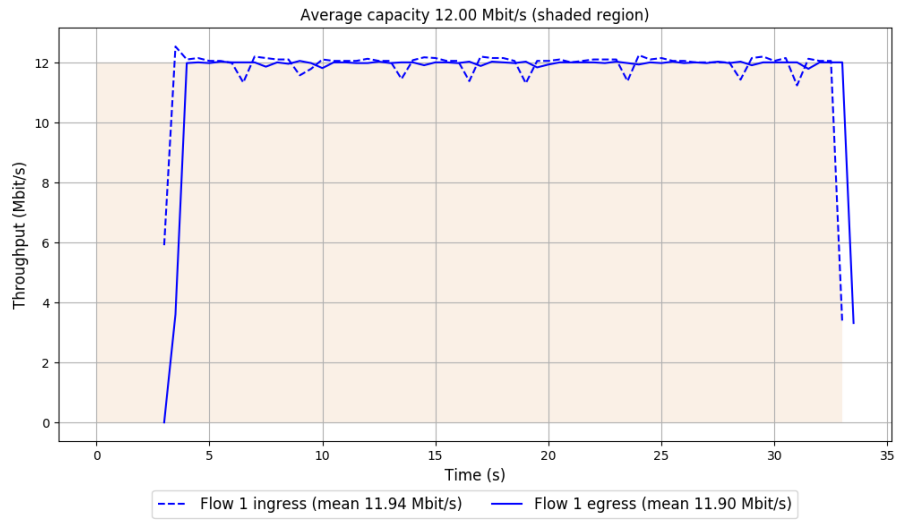
-- Flow 1:

Average throughput: 11.90 Mbit/s

95th percentile per-packet one-way delay: 59.168 ms

Loss rate: 0.44%

## Run 2: Report of TCP Cubic — Data Link



Run 3: Statistics of TCP Cubic

Start at: 2018-12-11 13:04:00

End at: 2018-12-11 13:04:30

# Below is generated by plot.py at 2018-12-11 13:07:20

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 11.91 Mbit/s (99.2% utilization)

95th percentile per-packet one-way delay: 59.293 ms

Loss rate: 0.48%

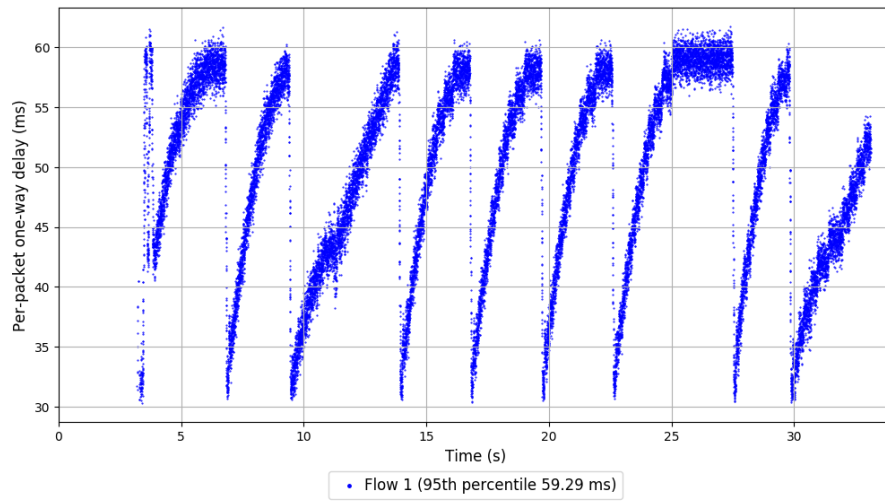
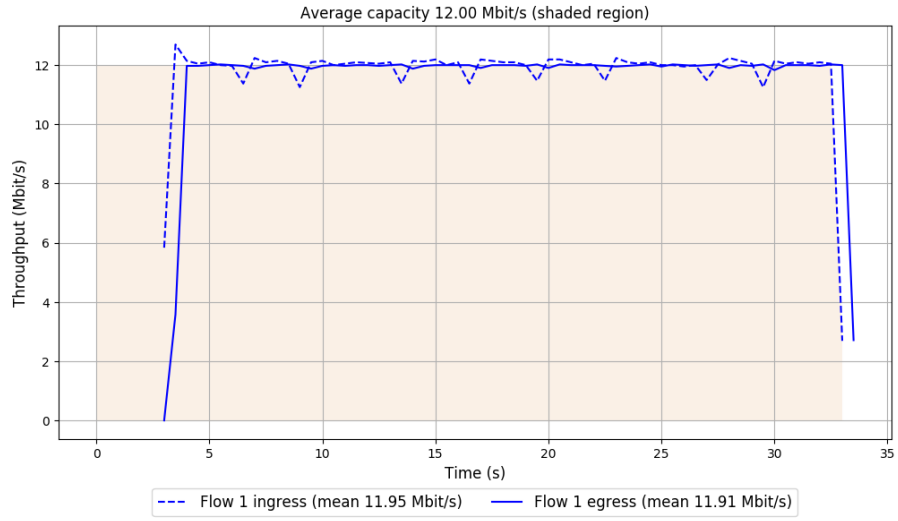
-- Flow 1:

Average throughput: 11.91 Mbit/s

95th percentile per-packet one-way delay: 59.293 ms

Loss rate: 0.48%

### Run 3: Report of TCP Cubic — Data Link



Run 1: Statistics of FillP

Start at: 2018-12-11 12:43:15

End at: 2018-12-11 12:43:45

# Below is generated by plot.py at 2018-12-11 13:07:23

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 11.56 Mbit/s (96.3% utilization)

95th percentile per-packet one-way delay: 59.404 ms

Loss rate: 1.90%

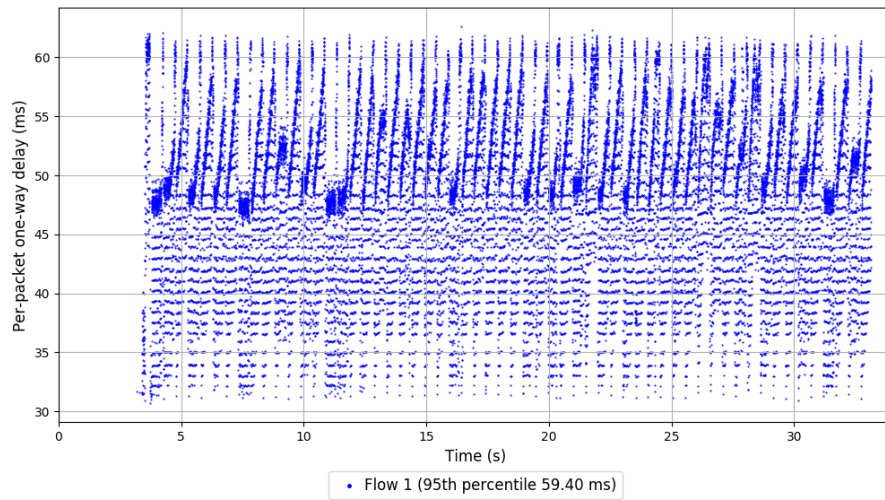
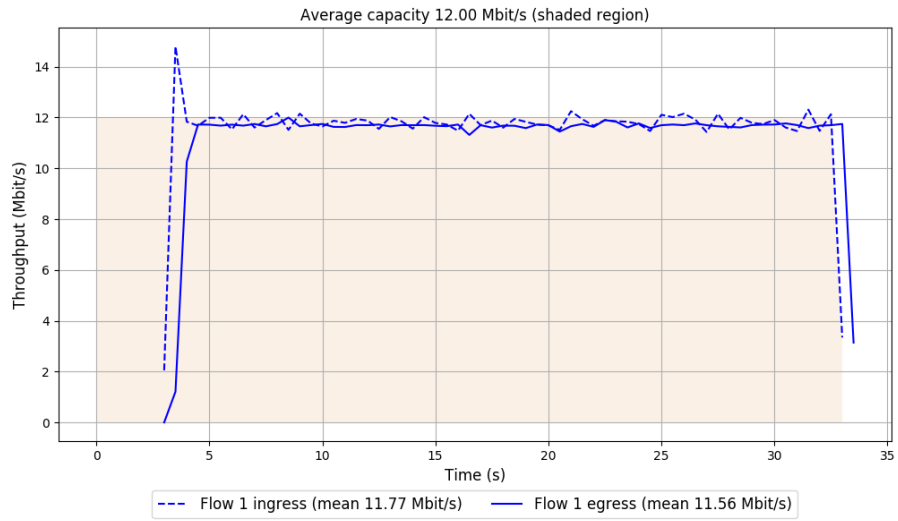
-- Flow 1:

Average throughput: 11.56 Mbit/s

95th percentile per-packet one-way delay: 59.404 ms

Loss rate: 1.90%

# Run 1: Report of FillP — Data Link



Run 2: Statistics of FillP

Start at: 2018-12-11 12:54:30

End at: 2018-12-11 12:55:00

# Below is generated by plot.py at 2018-12-11 13:07:25

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 11.56 Mbit/s (96.3% utilization)

95th percentile per-packet one-way delay: 56.769 ms

Loss rate: 0.70%

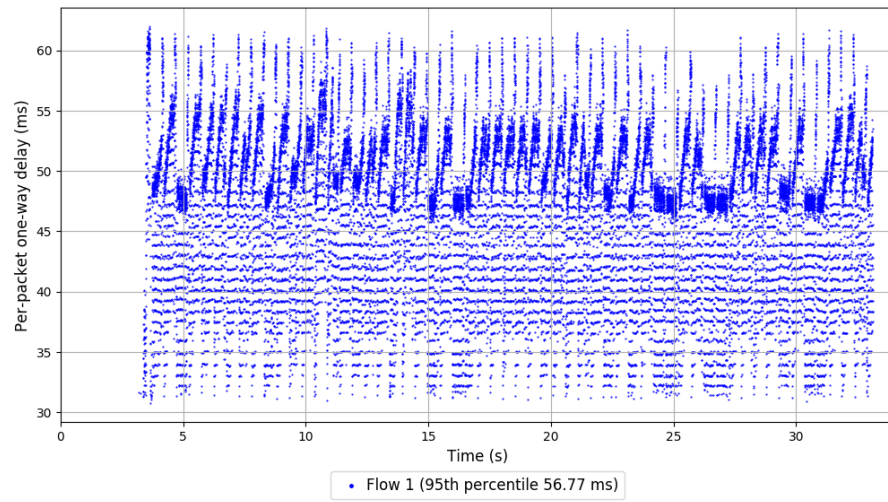
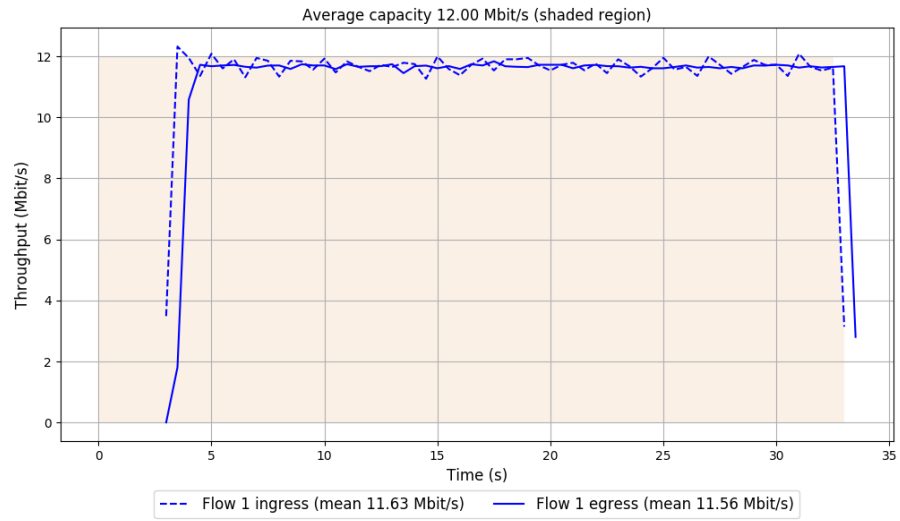
-- Flow 1:

Average throughput: 11.56 Mbit/s

95th percentile per-packet one-way delay: 56.769 ms

Loss rate: 0.70%

## Run 2: Report of FillP — Data Link



Run 3: Statistics of FillP

Start at: 2018-12-11 13:05:47

End at: 2018-12-11 13:06:17

# Below is generated by plot.py at 2018-12-11 13:07:25

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 11.59 Mbit/s (96.6% utilization)

95th percentile per-packet one-way delay: 59.832 ms

Loss rate: 1.98%

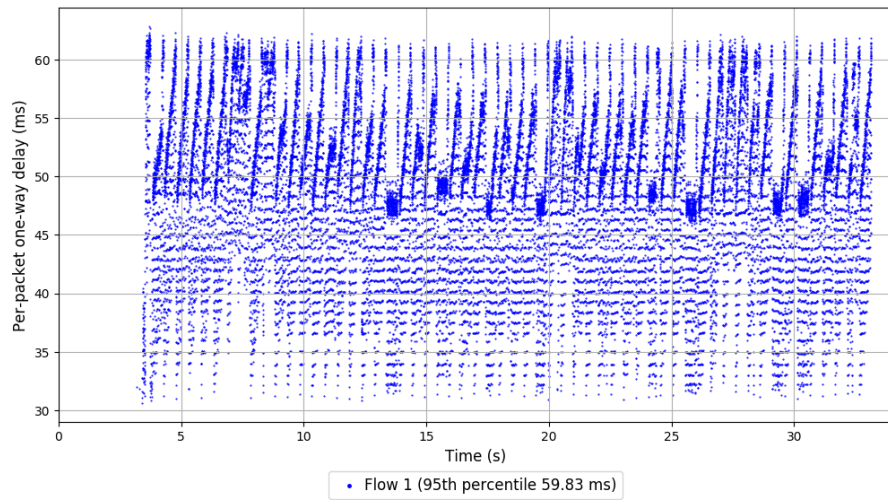
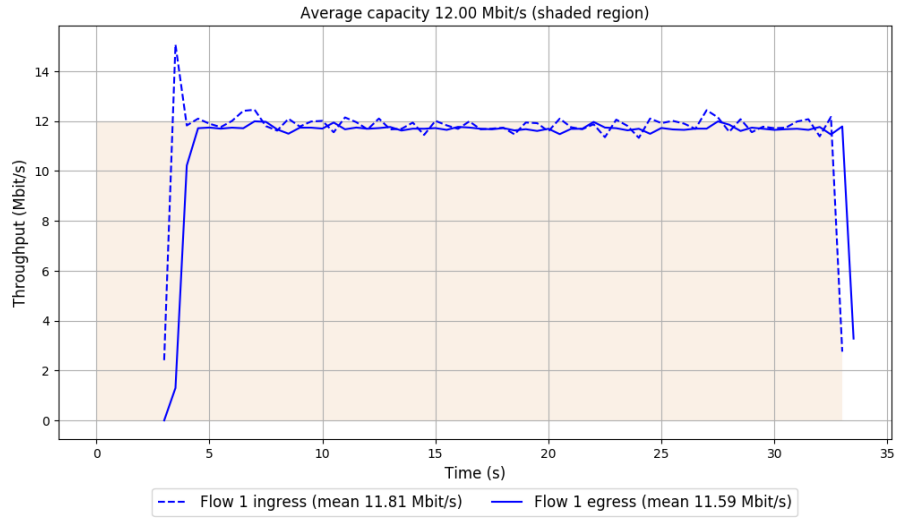
-- Flow 1:

Average throughput: 11.59 Mbit/s

95th percentile per-packet one-way delay: 59.832 ms

Loss rate: 1.98%

### Run 3: Report of FillP — Data Link



Run 1: Statistics of FillP-Sheep

Start at: 2018-12-11 12:36:44

End at: 2018-12-11 12:37:14

# Below is generated by plot.py at 2018-12-11 13:07:25

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 10.56 Mbit/s (88.0% utilization)

95th percentile per-packet one-way delay: 52.042 ms

Loss rate: 0.60%

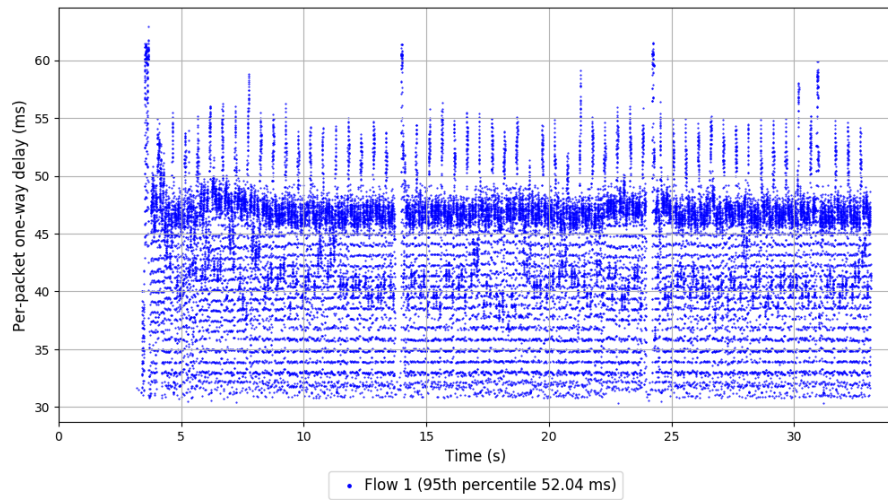
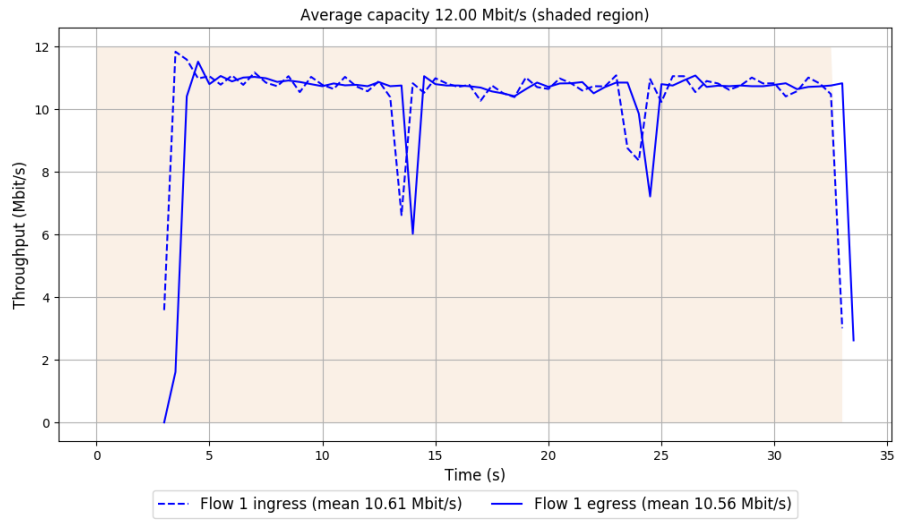
-- Flow 1:

Average throughput: 10.56 Mbit/s

95th percentile per-packet one-way delay: 52.042 ms

Loss rate: 0.60%

# Run 1: Report of FillP-Sheep — Data Link



Run 2: Statistics of FillP-Sheep

Start at: 2018-12-11 12:47:58

End at: 2018-12-11 12:48:28

# Below is generated by plot.py at 2018-12-11 13:07:34

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 10.53 Mbit/s (87.7% utilization)

95th percentile per-packet one-way delay: 51.989 ms

Loss rate: 0.74%

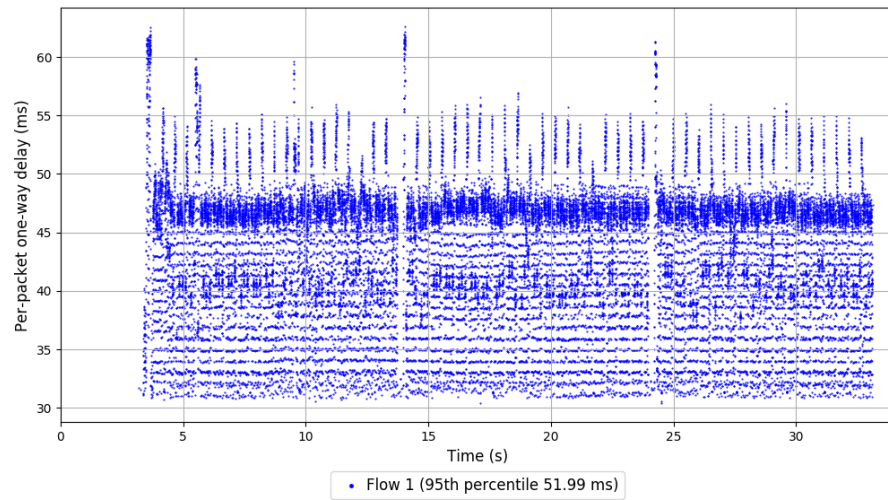
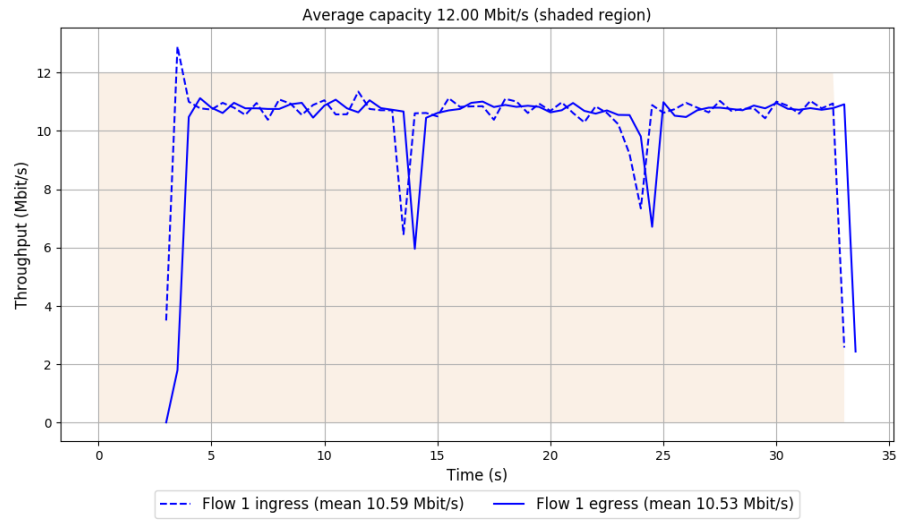
-- Flow 1:

Average throughput: 10.53 Mbit/s

95th percentile per-packet one-way delay: 51.989 ms

Loss rate: 0.74%

## Run 2: Report of FillP-Sheep — Data Link



Run 3: Statistics of FillP-Sheep

Start at: 2018-12-11 12:59:15

End at: 2018-12-11 12:59:45

# Below is generated by plot.py at 2018-12-11 13:07:35

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 10.51 Mbit/s (87.5% utilization)

95th percentile per-packet one-way delay: 52.449 ms

Loss rate: 0.60%

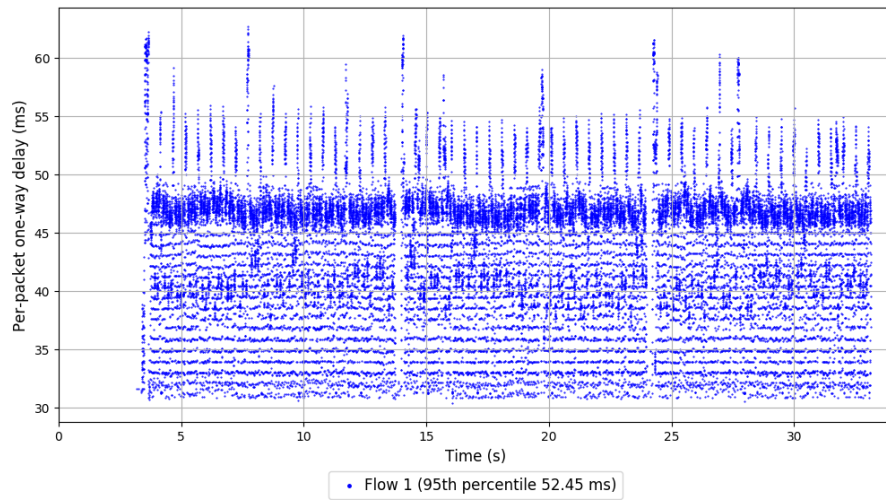
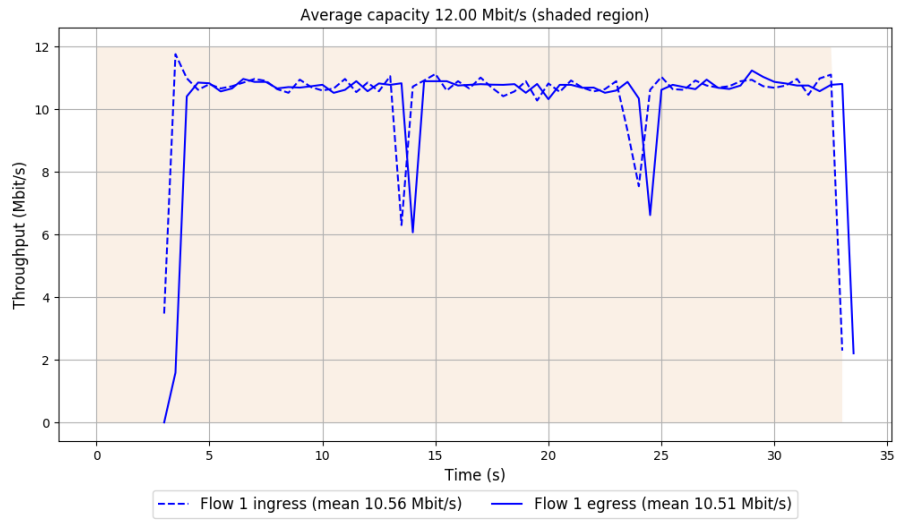
-- Flow 1:

Average throughput: 10.51 Mbit/s

95th percentile per-packet one-way delay: 52.449 ms

Loss rate: 0.60%

### Run 3: Report of FillP-Sheep — Data Link



Run 1: Statistics of Indigo

Start at: 2018-12-11 12:35:33

End at: 2018-12-11 12:36:03

# Below is generated by plot.py at 2018-12-11 13:07:35

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 11.88 Mbit/s (99.0% utilization)

95th percentile per-packet one-way delay: 39.798 ms

Loss rate: 0.42%

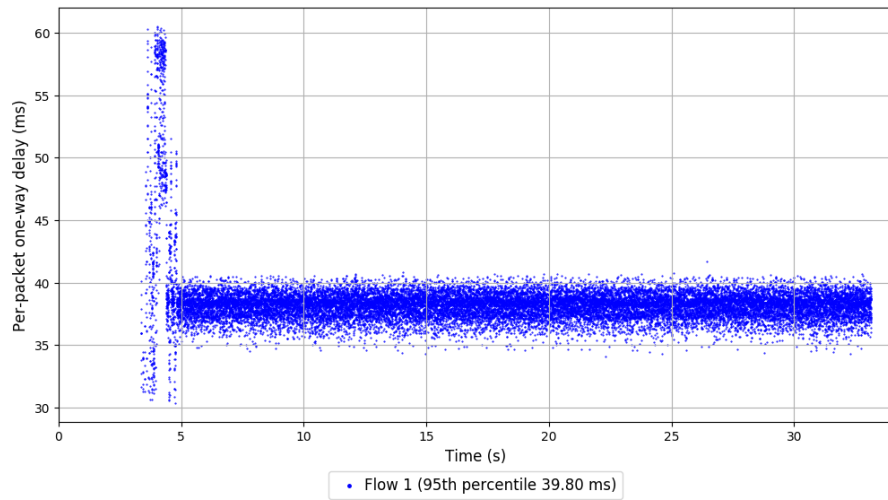
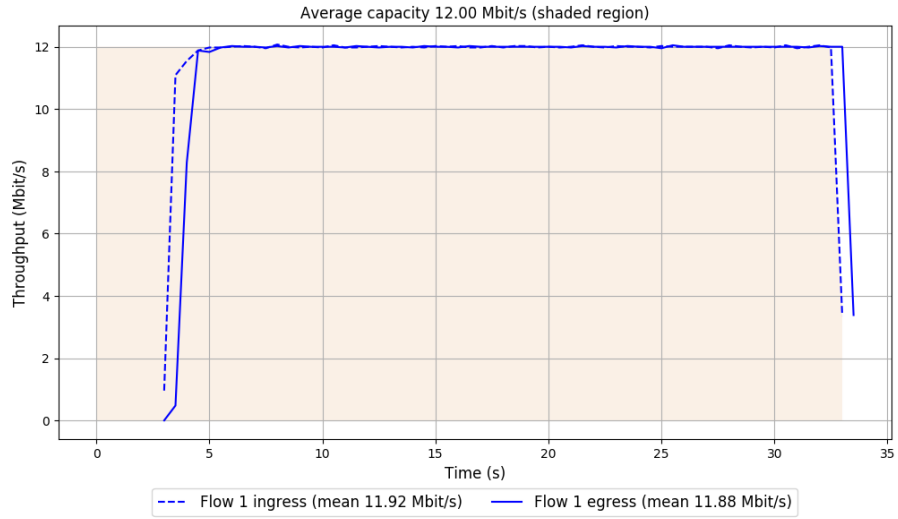
-- Flow 1:

Average throughput: 11.88 Mbit/s

95th percentile per-packet one-way delay: 39.798 ms

Loss rate: 0.42%

# Run 1: Report of Indigo — Data Link



Run 2: Statistics of Indigo

Start at: 2018-12-11 12:46:47

End at: 2018-12-11 12:47:17

# Below is generated by plot.py at 2018-12-11 13:07:40

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 11.11 Mbit/s (92.6% utilization)

95th percentile per-packet one-way delay: 40.957 ms

Loss rate: 0.25%

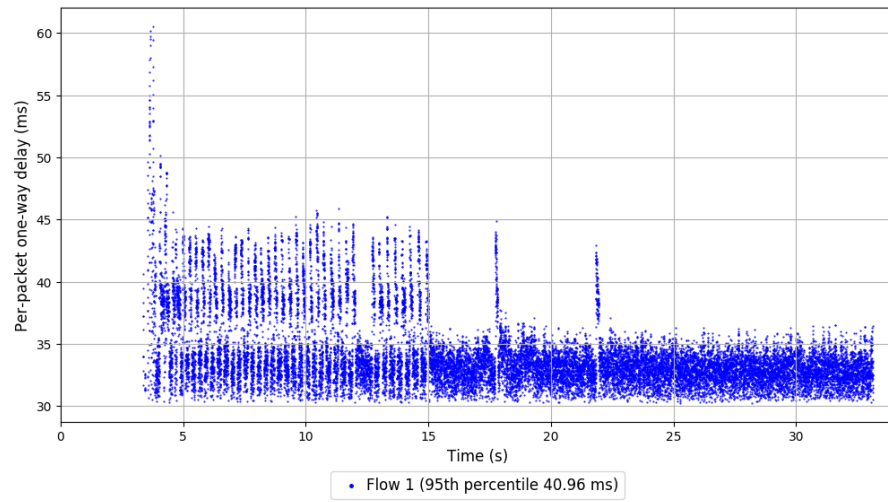
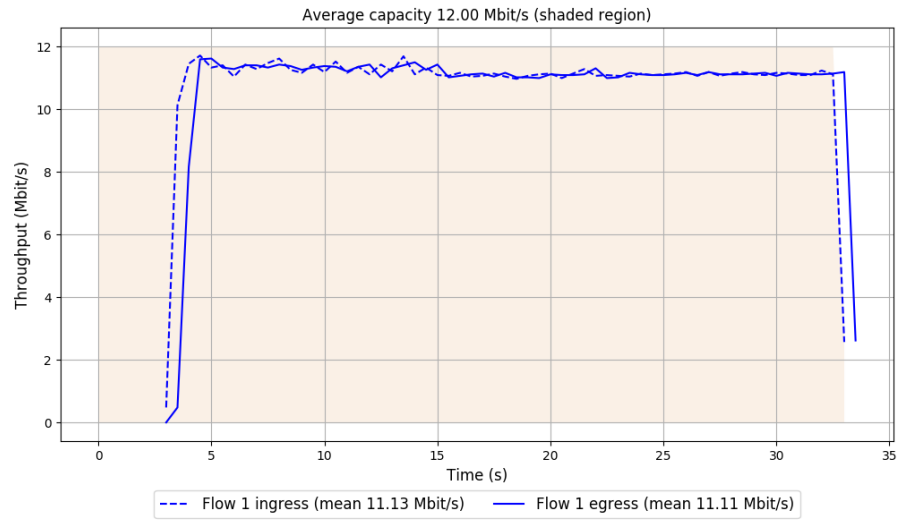
-- Flow 1:

Average throughput: 11.11 Mbit/s

95th percentile per-packet one-way delay: 40.957 ms

Loss rate: 0.25%

## Run 2: Report of Indigo — Data Link



Run 3: Statistics of Indigo

Start at: 2018-12-11 12:58:04

End at: 2018-12-11 12:58:34

# Below is generated by plot.py at 2018-12-11 13:07:46

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 11.87 Mbit/s (98.9% utilization)

95th percentile per-packet one-way delay: 39.826 ms

Loss rate: 0.38%

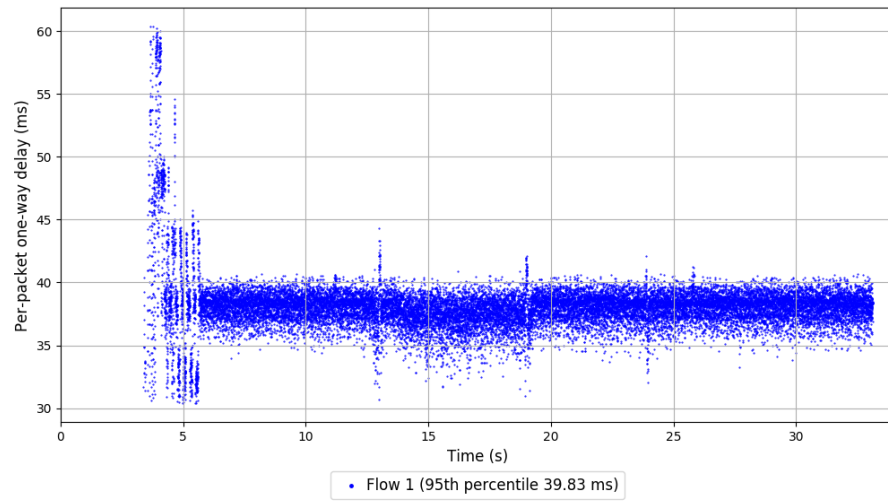
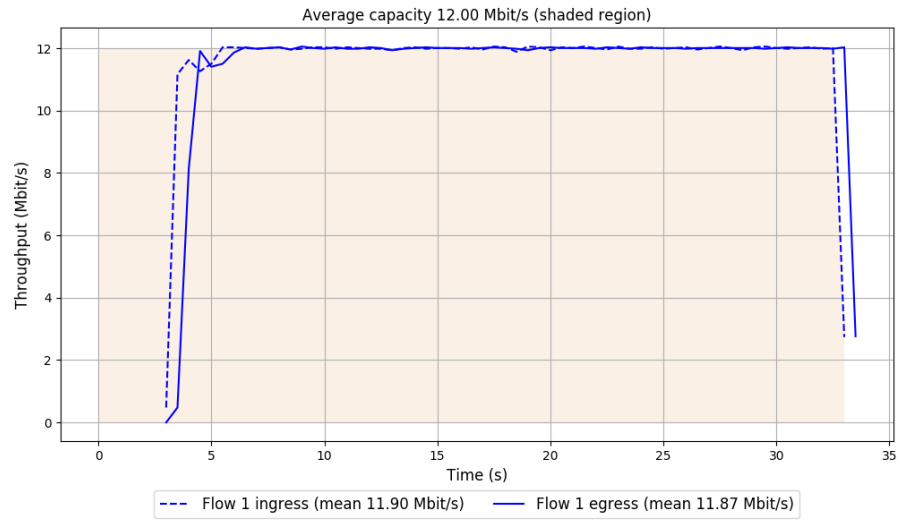
-- Flow 1:

Average throughput: 11.87 Mbit/s

95th percentile per-packet one-way delay: 39.826 ms

Loss rate: 0.38%

### Run 3: Report of Indigo — Data Link



Run 1: Statistics of Indigo-MusesD

Start at: 2018-12-11 12:39:05

End at: 2018-12-11 12:39:35

# Below is generated by plot.py at 2018-12-11 13:07:48

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 11.54 Mbit/s (96.2% utilization)

95th percentile per-packet one-way delay: 36.089 ms

Loss rate: 0.18%

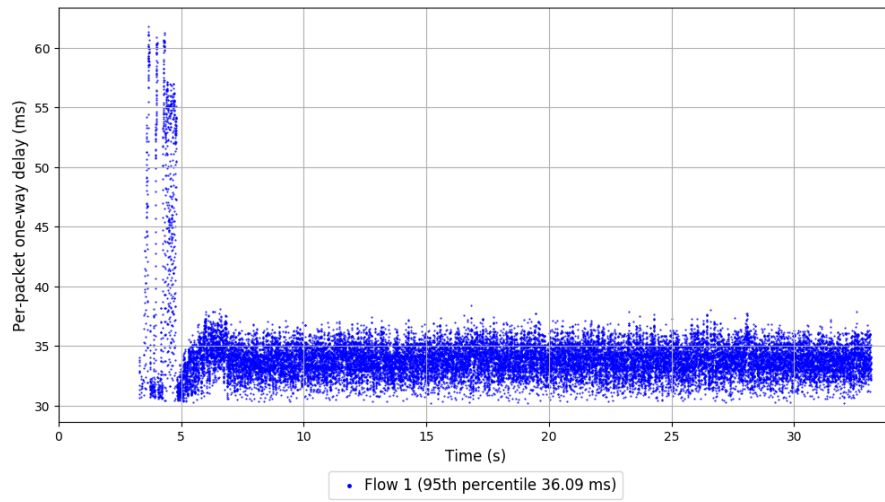
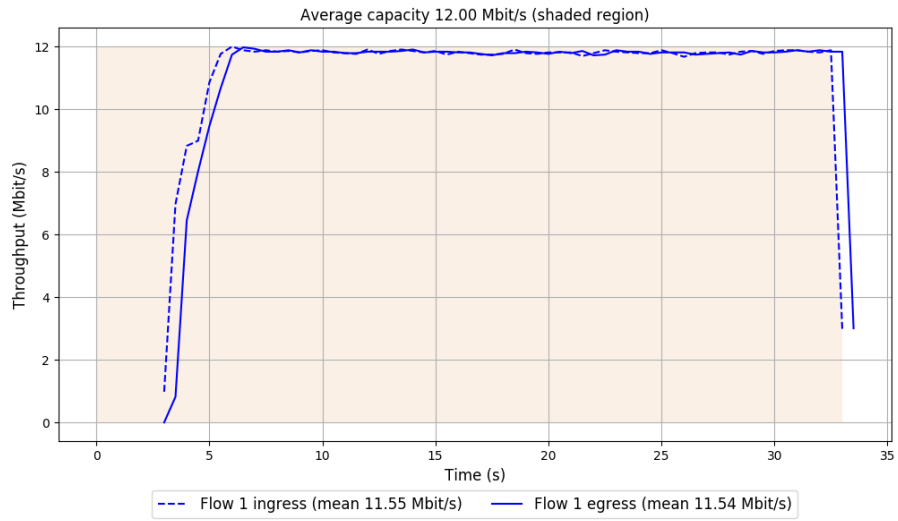
-- Flow 1:

Average throughput: 11.54 Mbit/s

95th percentile per-packet one-way delay: 36.089 ms

Loss rate: 0.18%

# Run 1: Report of Indigo-MusesD — Data Link



Run 2: Statistics of Indigo-MusesD

Start at: 2018-12-11 12:50:19

End at: 2018-12-11 12:50:49

# Below is generated by plot.py at 2018-12-11 13:07:48

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 10.84 Mbit/s (90.3% utilization)

95th percentile per-packet one-way delay: 35.344 ms

Loss rate: 0.13%

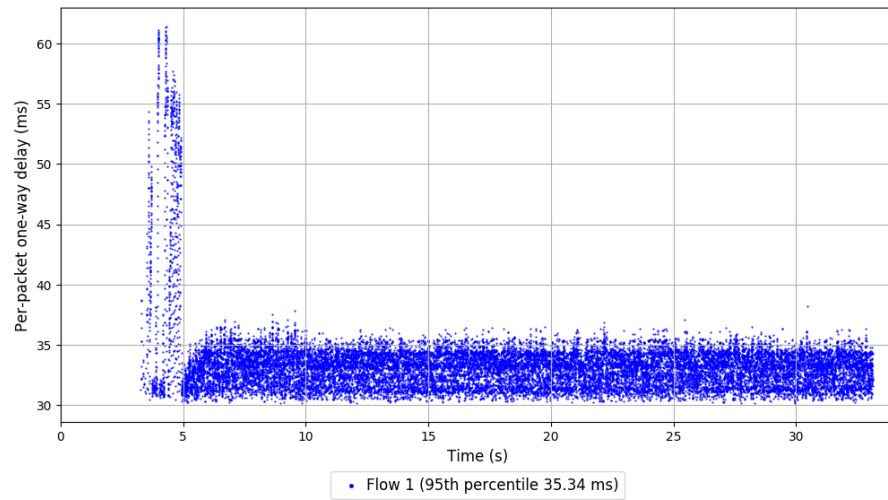
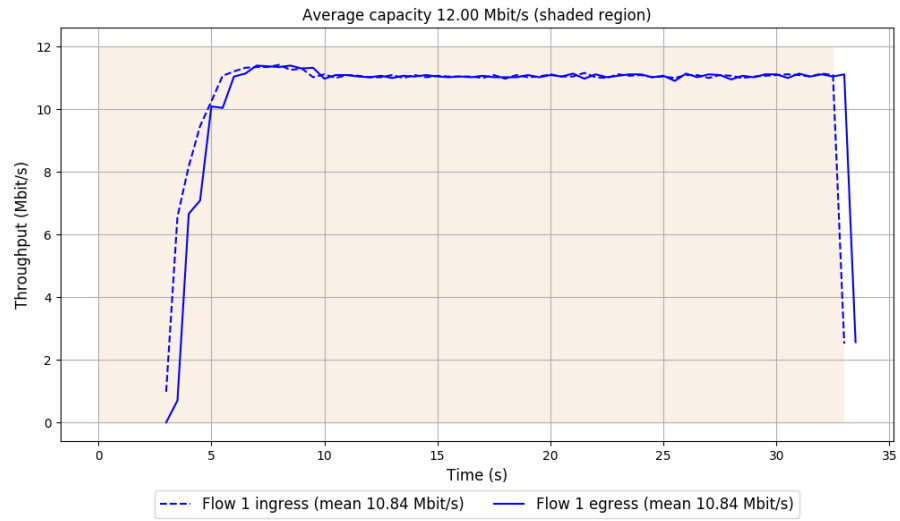
-- Flow 1:

Average throughput: 10.84 Mbit/s

95th percentile per-packet one-way delay: 35.344 ms

Loss rate: 0.13%

## Run 2: Report of Indigo-MusesD — Data Link



Run 3: Statistics of Indigo-MusesD

Start at: 2018-12-11 13:01:37

End at: 2018-12-11 13:02:07

# Below is generated by plot.py at 2018-12-11 13:07:48

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 10.80 Mbit/s (90.0% utilization)

95th percentile per-packet one-way delay: 36.163 ms

Loss rate: 0.38%

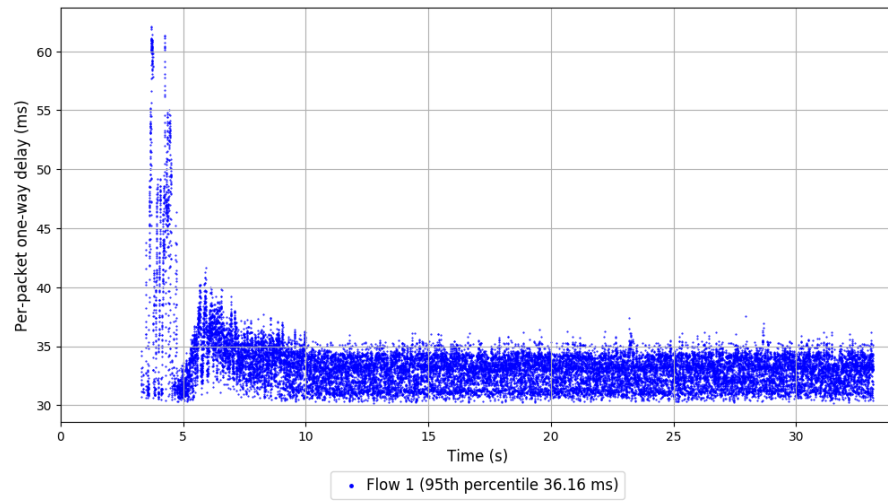
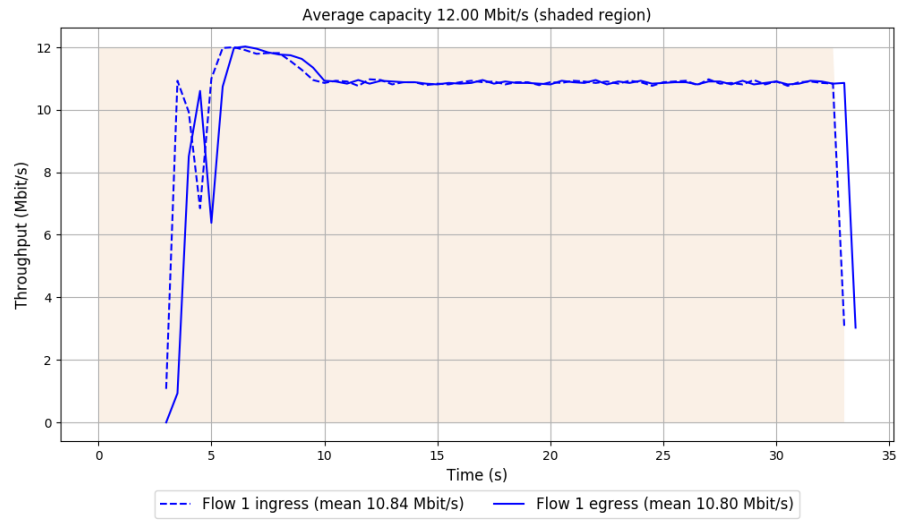
-- Flow 1:

Average throughput: 10.80 Mbit/s

95th percentile per-packet one-way delay: 36.163 ms

Loss rate: 0.38%

### Run 3: Report of Indigo-MusesD — Data Link



Run 1: Statistics of Indigo-MuseST

Start at: 2018-12-11 12:36:09

End at: 2018-12-11 12:36:39

# Below is generated by plot.py at 2018-12-11 13:07:56

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 9.10 Mbit/s (75.8% utilization)

95th percentile per-packet one-way delay: 60.980 ms

Loss rate: 28.40%

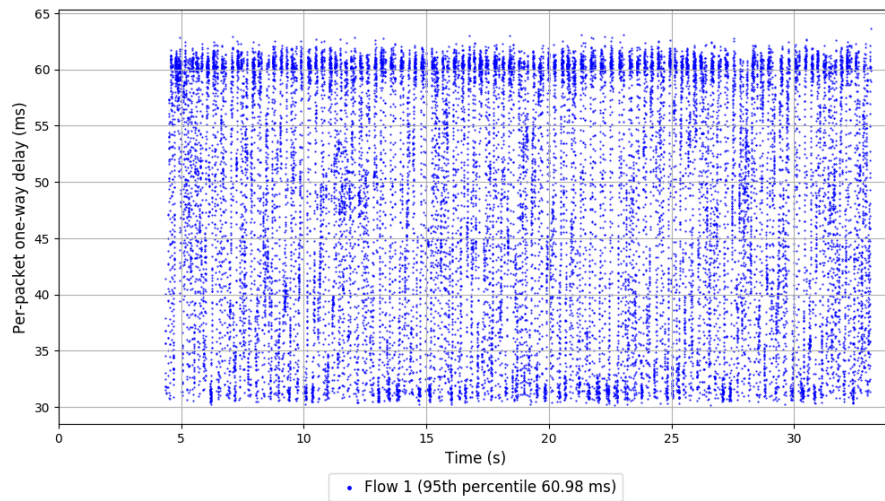
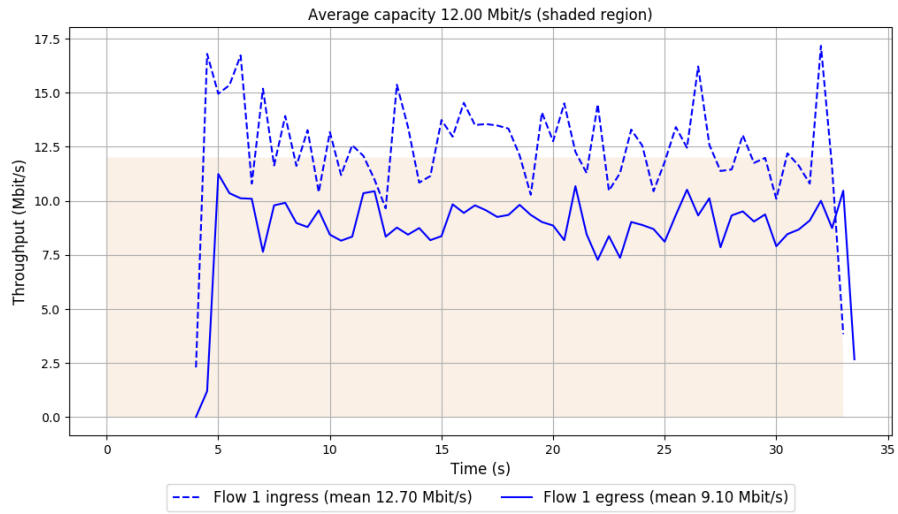
-- Flow 1:

Average throughput: 9.10 Mbit/s

95th percentile per-packet one-way delay: 60.980 ms

Loss rate: 28.40%

# Run 1: Report of Indigo-MusesT — Data Link



Run 2: Statistics of Indigo-MuseST

Start at: 2018-12-11 12:47:22

End at: 2018-12-11 12:47:52

# Below is generated by plot.py at 2018-12-11 13:07:56

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 9.08 Mbit/s (75.6% utilization)

95th percentile per-packet one-way delay: 60.950 ms

Loss rate: 25.91%

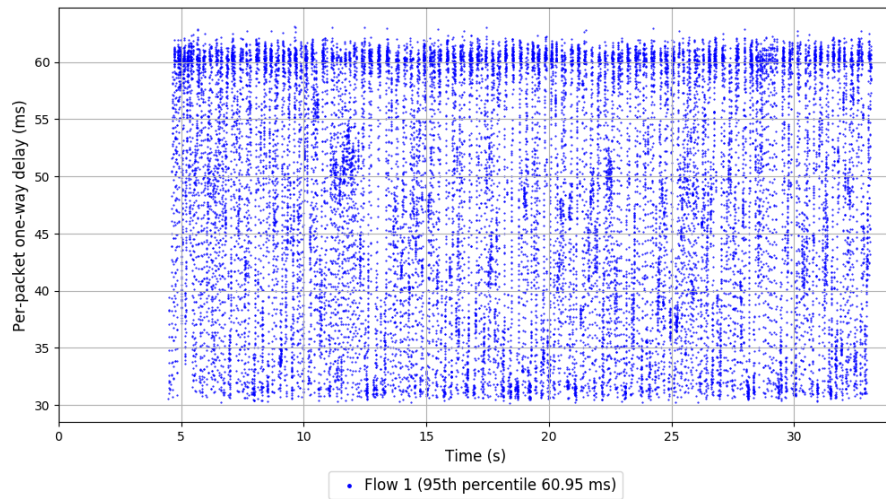
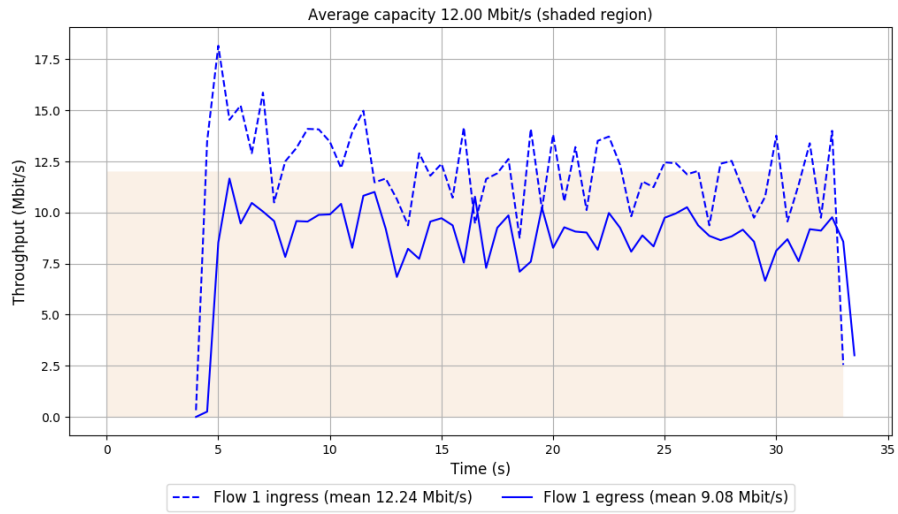
-- Flow 1:

Average throughput: 9.08 Mbit/s

95th percentile per-packet one-way delay: 60.950 ms

Loss rate: 25.91%

## Run 2: Report of Indigo-MusesT — Data Link



Run 3: Statistics of Indigo-MuseST

Start at: 2018-12-11 12:58:40

End at: 2018-12-11 12:59:10

# Below is generated by plot.py at 2018-12-11 13:07:57

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 9.13 Mbit/s (76.1% utilization)

95th percentile per-packet one-way delay: 60.882 ms

Loss rate: 24.59%

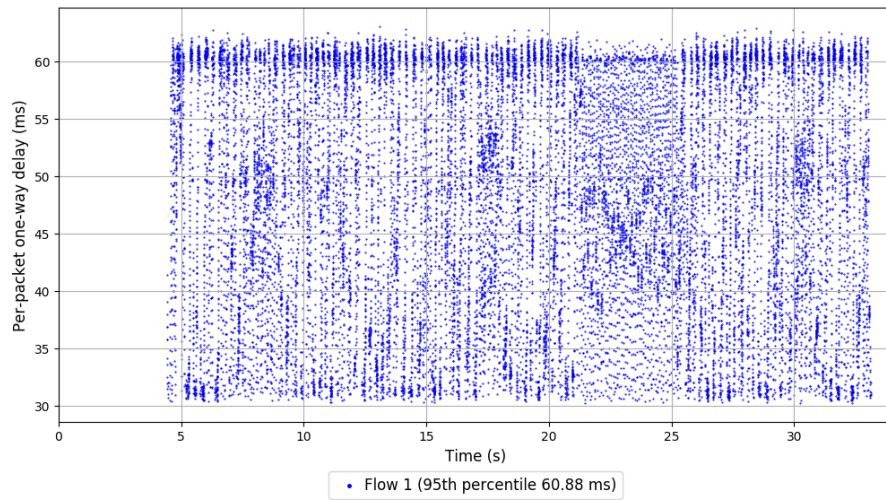
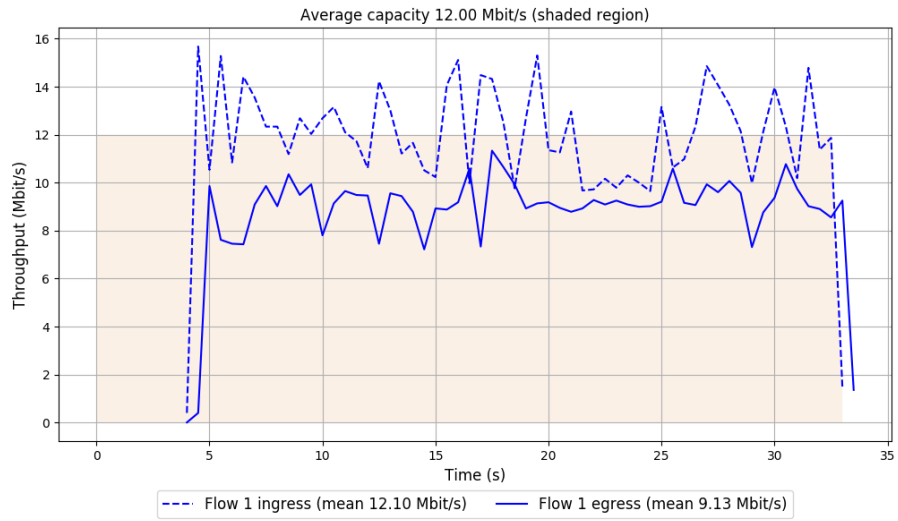
-- Flow 1:

Average throughput: 9.13 Mbit/s

95th percentile per-packet one-way delay: 60.882 ms

Loss rate: 24.59%

### Run 3: Report of Indigo-MusesT — Data Link



Run 1: Statistics of LEDBAT

Start at: 2018-12-11 12:34:58

End at: 2018-12-11 12:35:28

# Below is generated by plot.py at 2018-12-11 13:08:01

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 9.77 Mbit/s (81.4% utilization)

95th percentile per-packet one-way delay: 59.386 ms

Loss rate: 0.54%

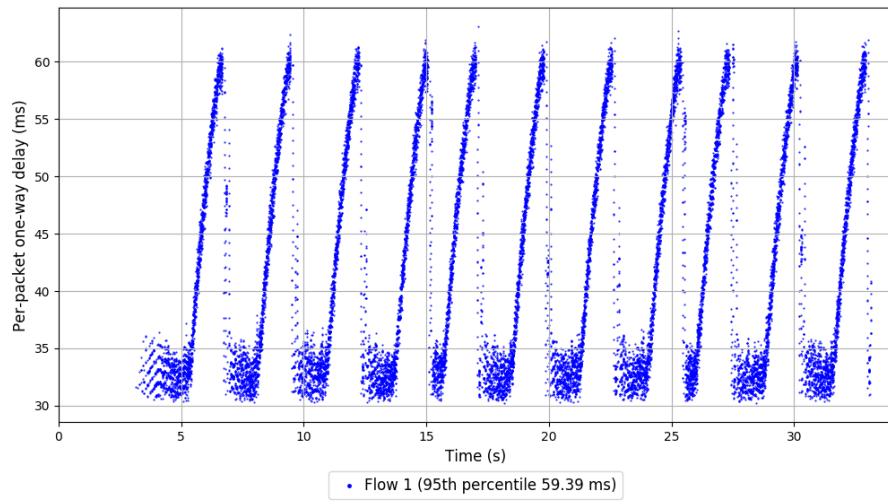
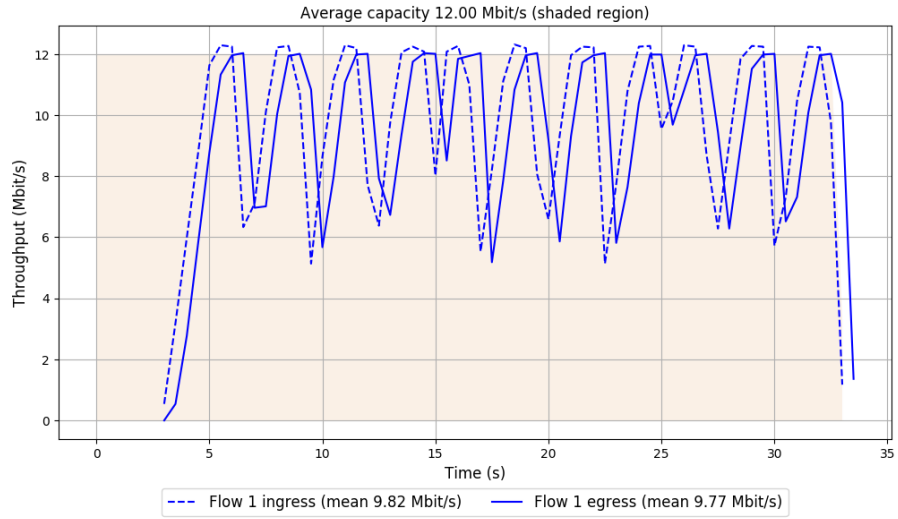
-- Flow 1:

Average throughput: 9.77 Mbit/s

95th percentile per-packet one-way delay: 59.386 ms

Loss rate: 0.54%

# Run 1: Report of LEDBAT — Data Link



Run 2: Statistics of LEDBAT

Start at: 2018-12-11 12:46:11

End at: 2018-12-11 12:46:41

# Below is generated by plot.py at 2018-12-11 13:08:08

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 9.53 Mbit/s (79.4% utilization)

95th percentile per-packet one-way delay: 59.287 ms

Loss rate: 0.69%

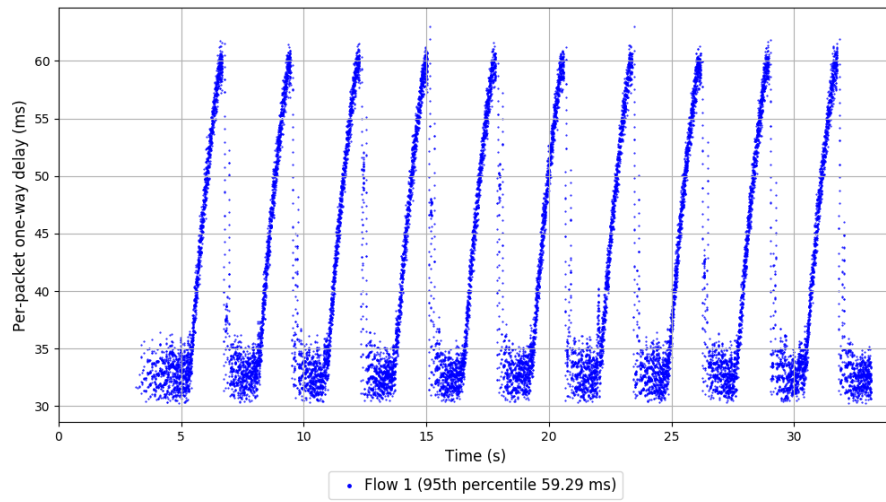
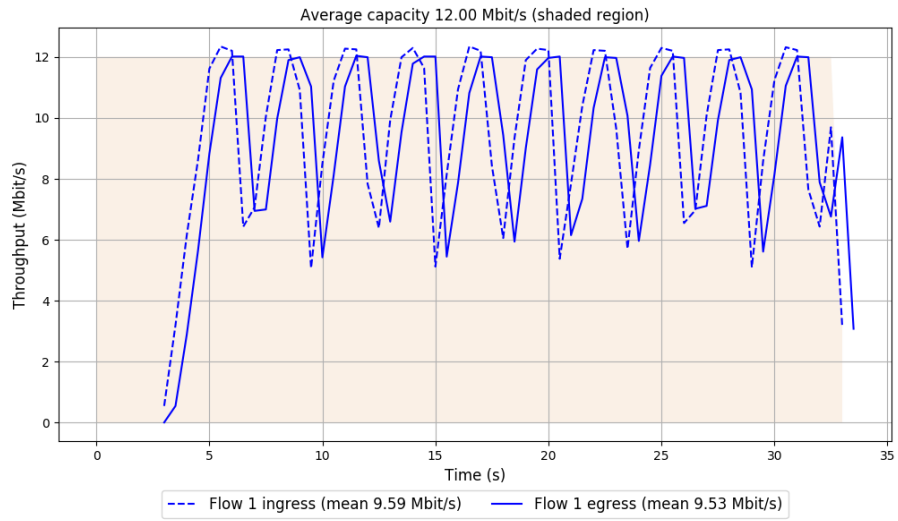
-- Flow 1:

Average throughput: 9.53 Mbit/s

95th percentile per-packet one-way delay: 59.287 ms

Loss rate: 0.69%

## Run 2: Report of LEDBAT — Data Link



Run 3: Statistics of LEDBAT

Start at: 2018-12-11 12:57:29

End at: 2018-12-11 12:57:59

# Below is generated by plot.py at 2018-12-11 13:08:09

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 9.65 Mbit/s (80.4% utilization)

95th percentile per-packet one-way delay: 59.123 ms

Loss rate: 0.88%

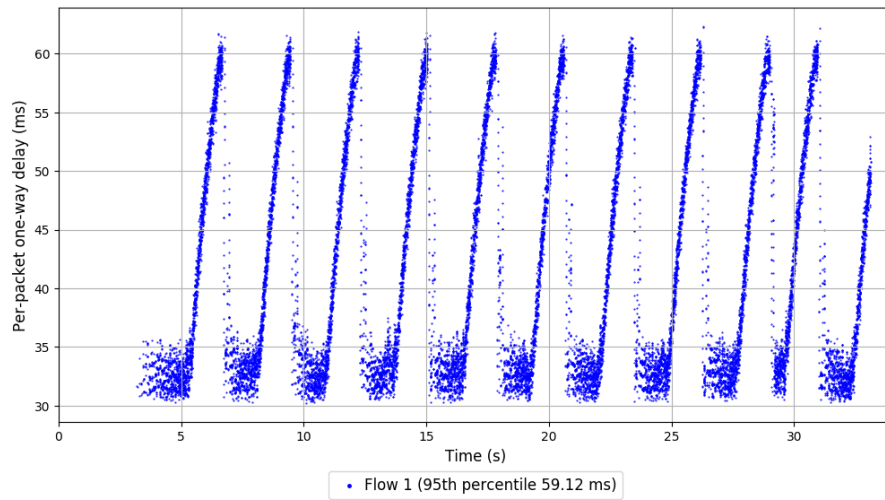
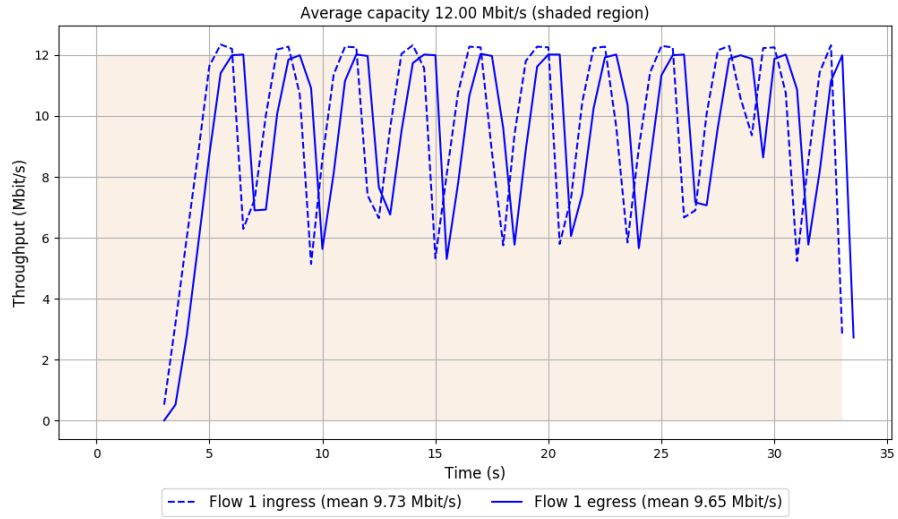
-- Flow 1:

Average throughput: 9.65 Mbit/s

95th percentile per-packet one-way delay: 59.123 ms

Loss rate: 0.88%

### Run 3: Report of LEDBAT — Data Link



Run 1: Statistics of PCC-Allegro

Start at: 2018-12-11 12:33:12

End at: 2018-12-11 12:33:42

# Below is generated by plot.py at 2018-12-11 13:08:11

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 9.43 Mbit/s (78.5% utilization)

95th percentile per-packet one-way delay: 33.357 ms

Loss rate: 0.89%

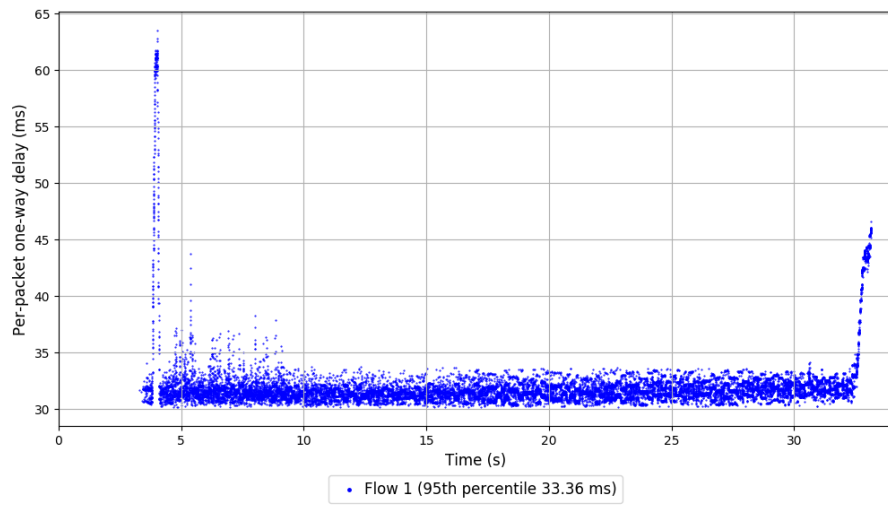
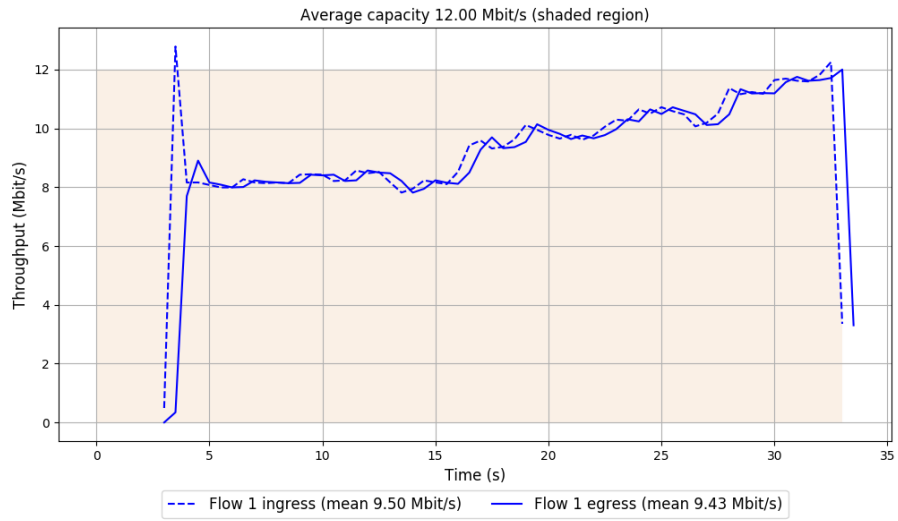
-- Flow 1:

Average throughput: 9.43 Mbit/s

95th percentile per-packet one-way delay: 33.357 ms

Loss rate: 0.89%

# Run 1: Report of PCC-Allegro — Data Link



Run 2: Statistics of PCC-Allegro

Start at: 2018-12-11 12:44:25

End at: 2018-12-11 12:44:55

# Below is generated by plot.py at 2018-12-11 13:08:12

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 10.63 Mbit/s (88.6% utilization)

95th percentile per-packet one-way delay: 35.893 ms

Loss rate: 0.77%

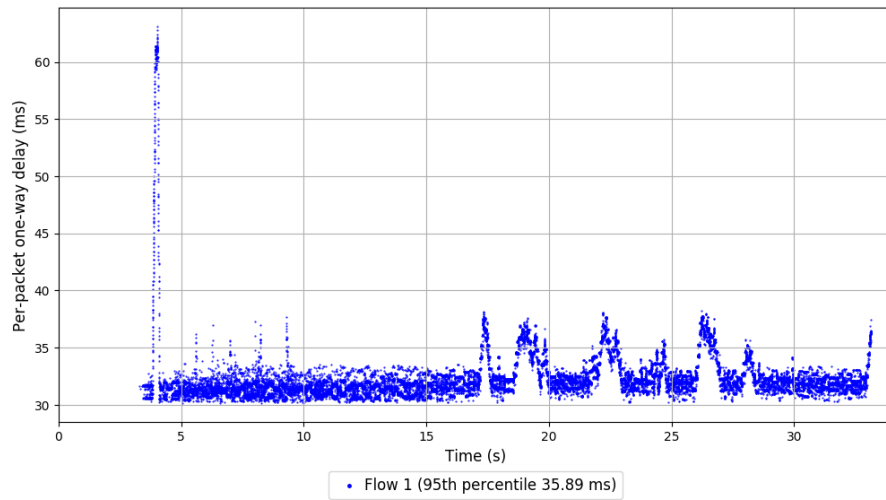
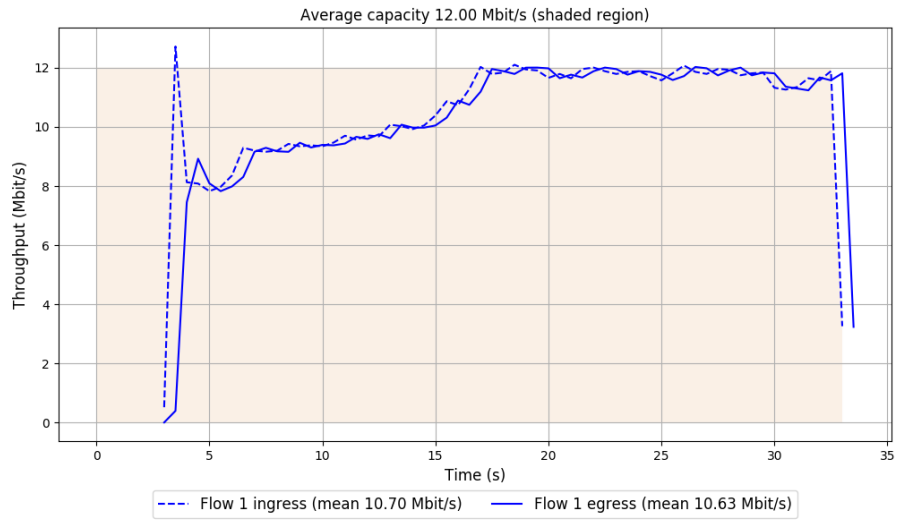
-- Flow 1:

Average throughput: 10.63 Mbit/s

95th percentile per-packet one-way delay: 35.893 ms

Loss rate: 0.77%

## Run 2: Report of PCC-Allegro — Data Link



Run 3: Statistics of PCC-Allegro

Start at: 2018-12-11 12:55:40

End at: 2018-12-11 12:56:10

# Below is generated by plot.py at 2018-12-11 13:08:17

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 9.95 Mbit/s (83.0% utilization)

95th percentile per-packet one-way delay: 32.898 ms

Loss rate: 1.11%

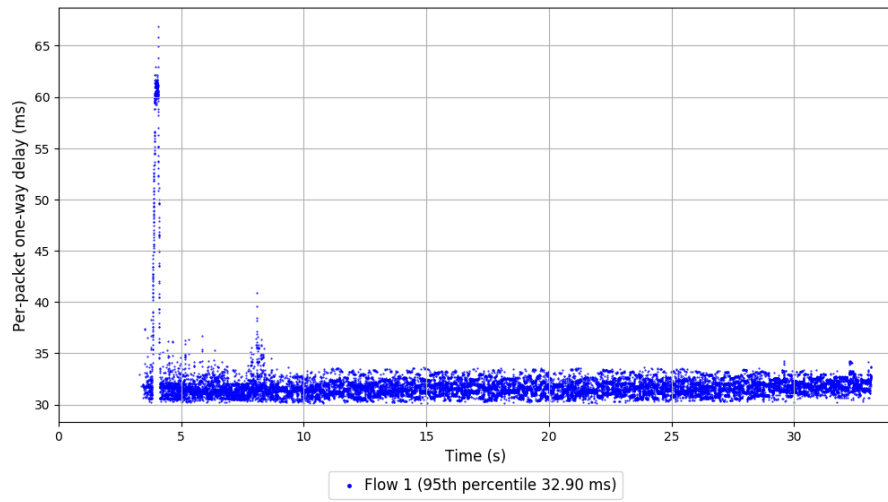
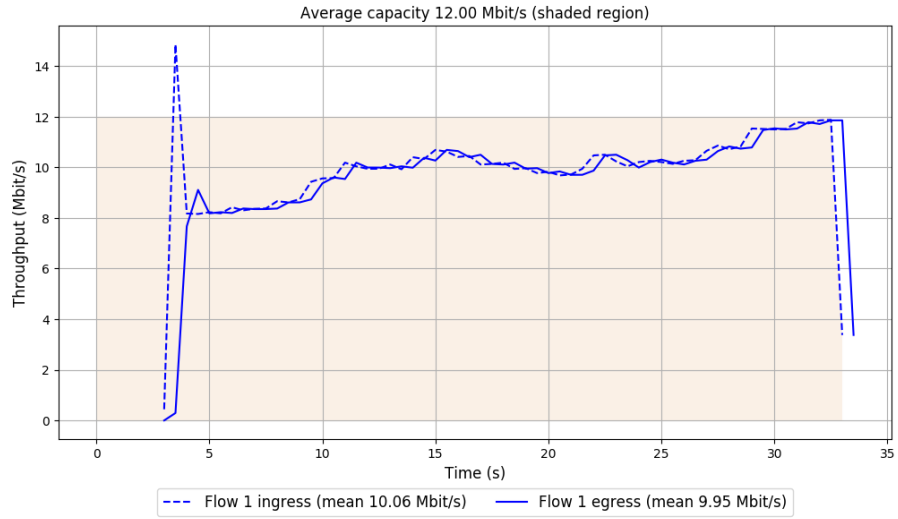
-- Flow 1:

Average throughput: 9.95 Mbit/s

95th percentile per-packet one-way delay: 32.898 ms

Loss rate: 1.11%

### Run 3: Report of PCC-Allegro — Data Link



Run 1: Statistics of PCC-Expr

Start at: 2018-12-11 12:39:41

End at: 2018-12-11 12:40:11

# Below is generated by plot.py at 2018-12-11 13:08:34

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 10.74 Mbit/s (89.5% utilization)

95th percentile per-packet one-way delay: 61.269 ms

Loss rate: 1.53%

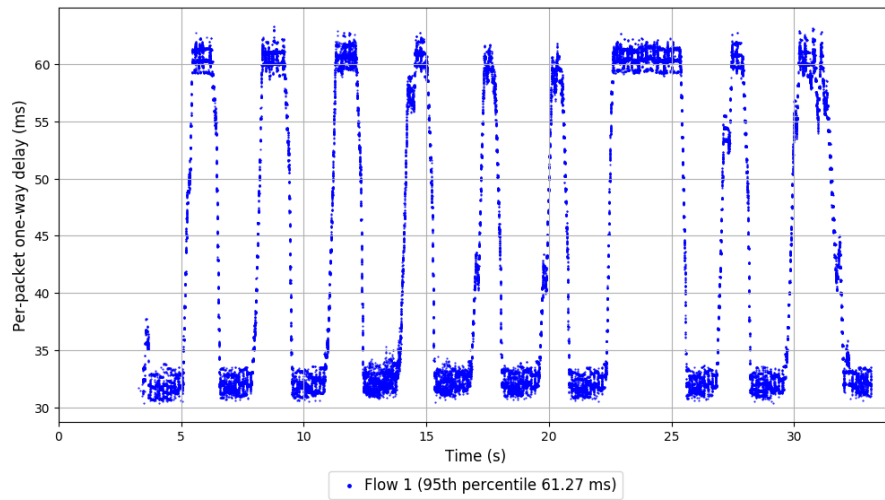
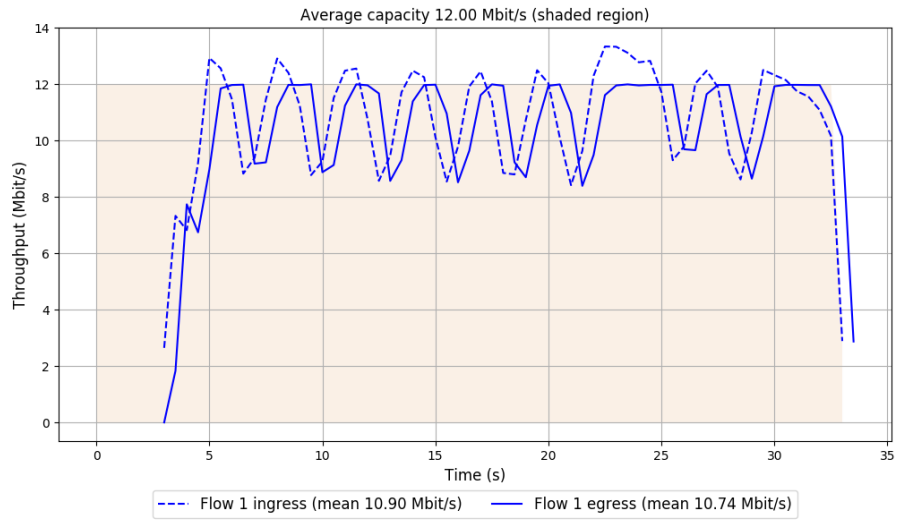
-- Flow 1:

Average throughput: 10.74 Mbit/s

95th percentile per-packet one-way delay: 61.269 ms

Loss rate: 1.53%

# Run 1: Report of PCC-Expr — Data Link



Run 2: Statistics of PCC-Expr

Start at: 2018-12-11 12:50:55

End at: 2018-12-11 12:51:25

# Below is generated by plot.py at 2018-12-11 13:08:36

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 11.14 Mbit/s (92.8% utilization)

95th percentile per-packet one-way delay: 61.122 ms

Loss rate: 1.02%

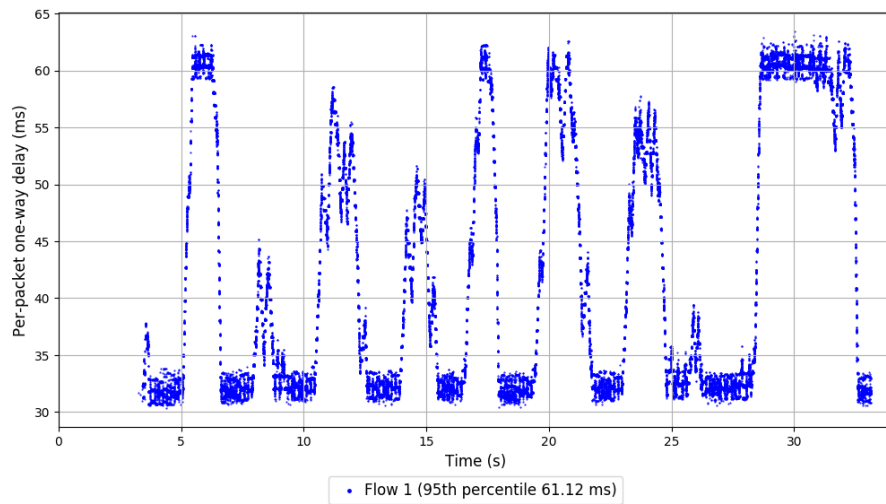
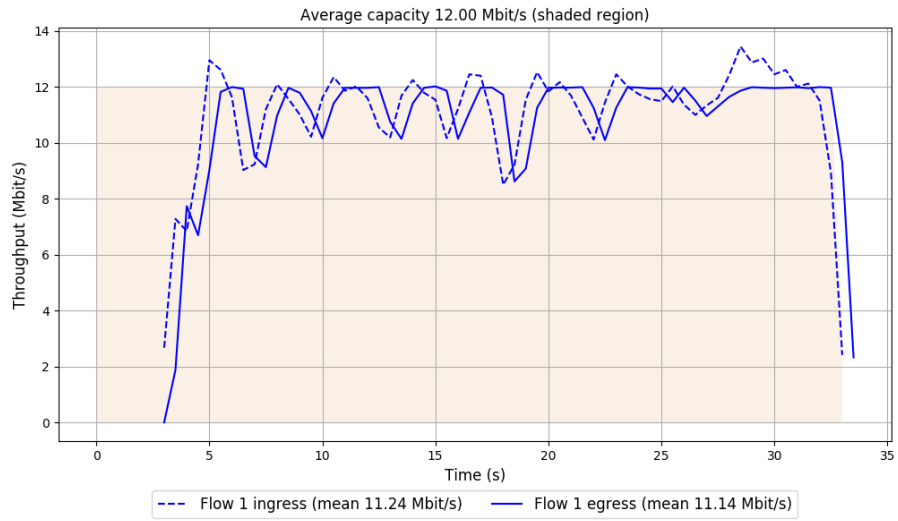
-- Flow 1:

Average throughput: 11.14 Mbit/s

95th percentile per-packet one-way delay: 61.122 ms

Loss rate: 1.02%

## Run 2: Report of PCC-Expr — Data Link



Run 3: Statistics of PCC-Expr

Start at: 2018-12-11 13:02:12

End at: 2018-12-11 13:02:42

# Below is generated by plot.py at 2018-12-11 13:08:40

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 10.83 Mbit/s (90.2% utilization)

95th percentile per-packet one-way delay: 60.475 ms

Loss rate: 0.43%

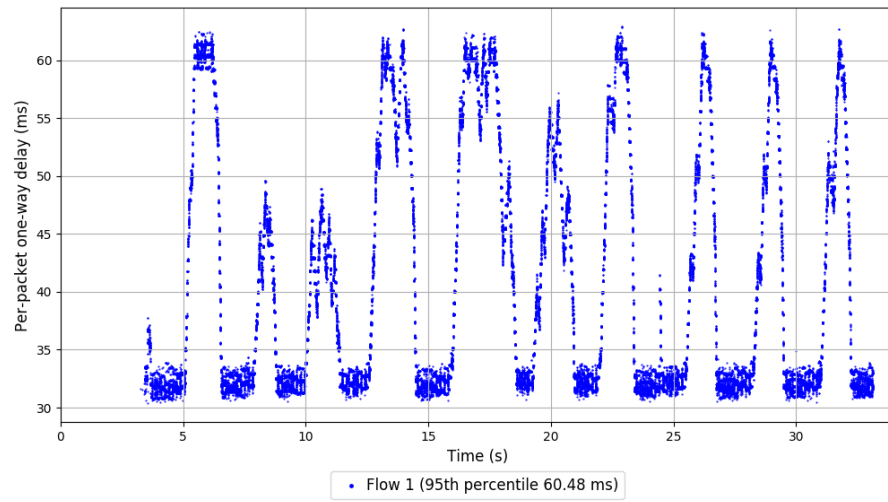
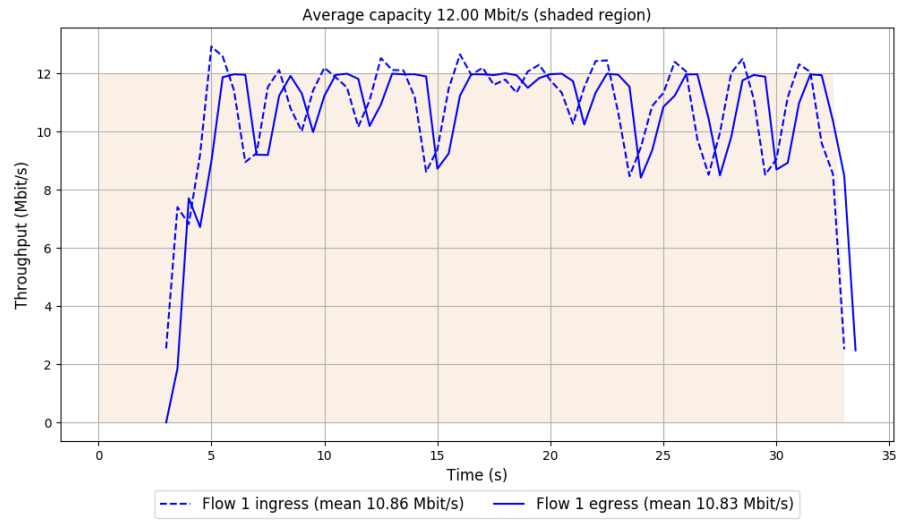
-- Flow 1:

Average throughput: 10.83 Mbit/s

95th percentile per-packet one-way delay: 60.475 ms

Loss rate: 0.43%

### Run 3: Report of PCC-Expr — Data Link



Run 1: Statistics of QUIC Cubic

Start at: 2018-12-11 12:38:30

End at: 2018-12-11 12:39:00

# Below is generated by plot.py at 2018-12-11 13:08:40

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 11.74 Mbit/s (97.9% utilization)

95th percentile per-packet one-way delay: 59.195 ms

Loss rate: 0.33%

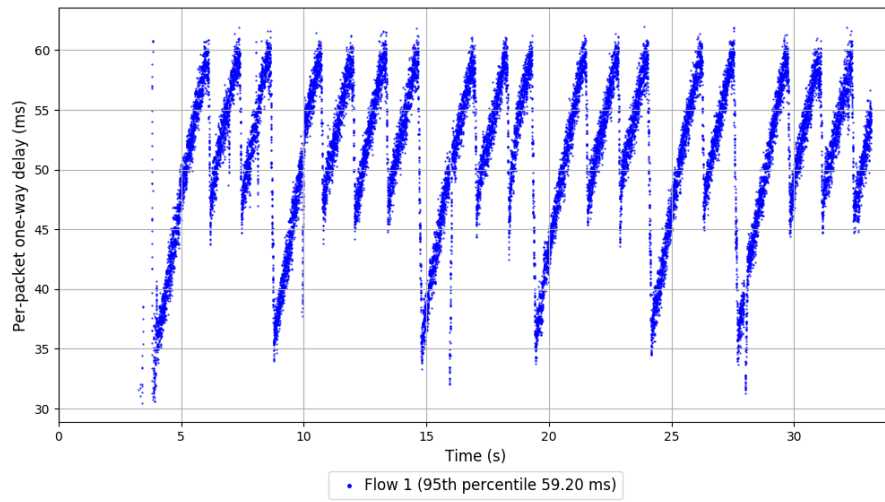
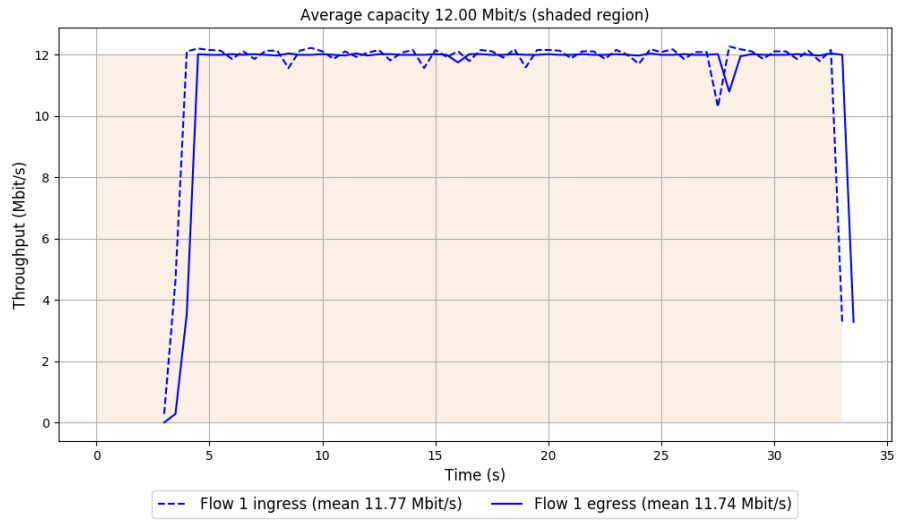
-- Flow 1:

Average throughput: 11.74 Mbit/s

95th percentile per-packet one-way delay: 59.195 ms

Loss rate: 0.33%

# Run 1: Report of QUIC Cubic — Data Link



Run 2: Statistics of QUIC Cubic

Start at: 2018-12-11 12:49:44

End at: 2018-12-11 12:50:14

# Below is generated by plot.py at 2018-12-11 13:08:40

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 11.76 Mbit/s (98.0% utilization)

95th percentile per-packet one-way delay: 59.291 ms

Loss rate: 0.33%

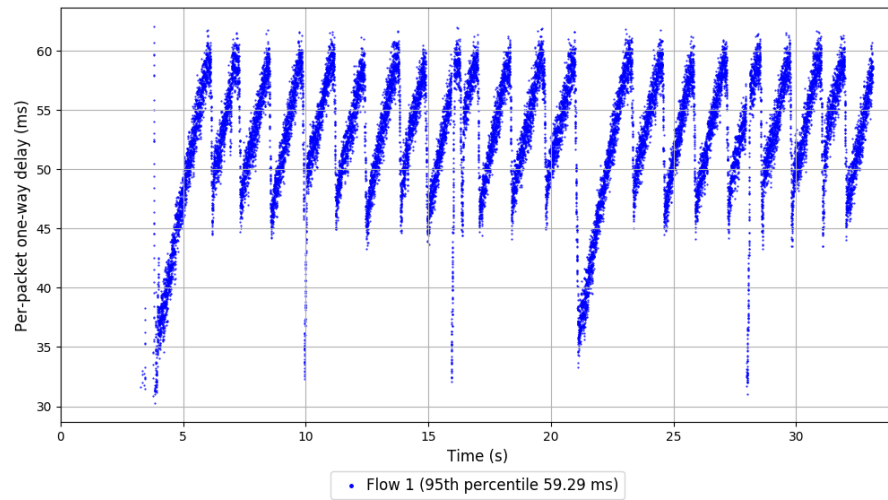
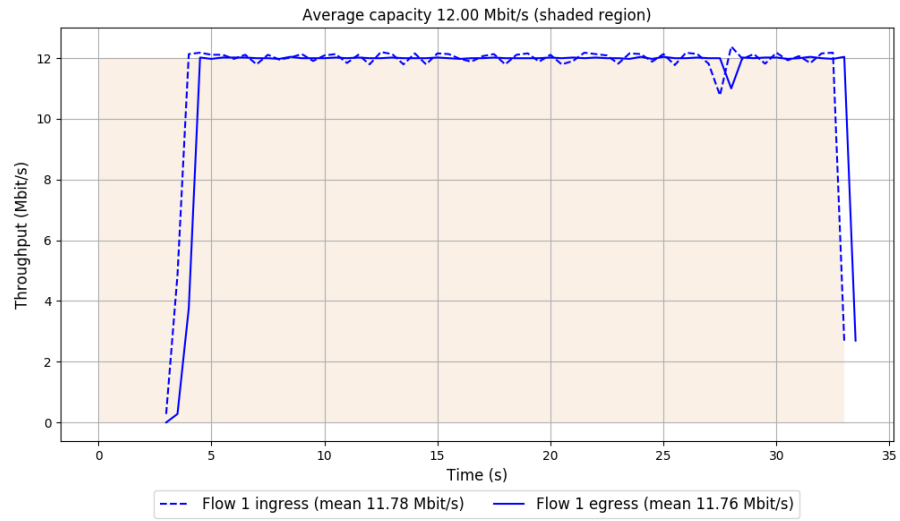
-- Flow 1:

Average throughput: 11.76 Mbit/s

95th percentile per-packet one-way delay: 59.291 ms

Loss rate: 0.33%

## Run 2: Report of QUIC Cubic — Data Link



Run 3: Statistics of QUIC Cubic

Start at: 2018-12-11 13:01:01

End at: 2018-12-11 13:01:31

# Below is generated by plot.py at 2018-12-11 13:08:40

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 11.76 Mbit/s (98.0% utilization)

95th percentile per-packet one-way delay: 59.134 ms

Loss rate: 0.33%

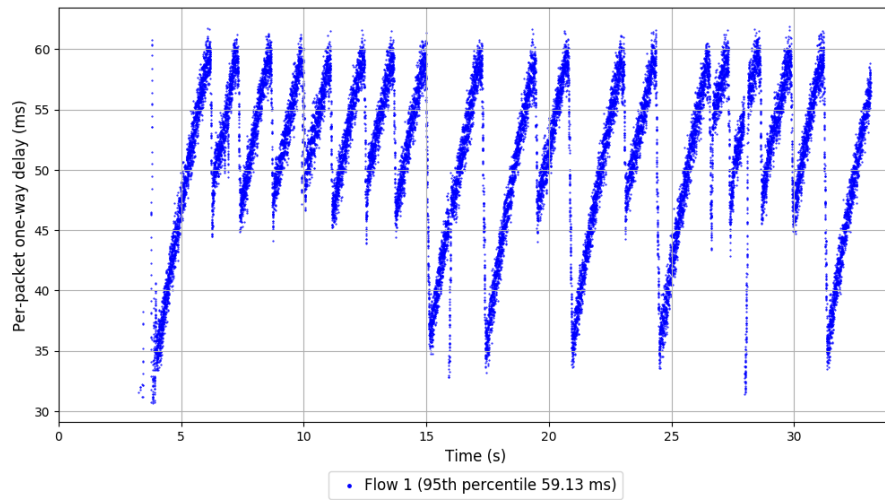
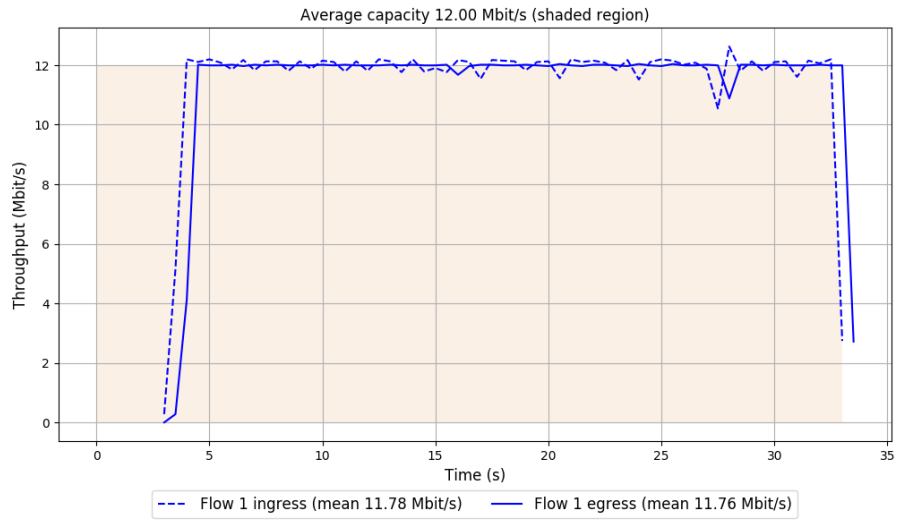
-- Flow 1:

Average throughput: 11.76 Mbit/s

95th percentile per-packet one-way delay: 59.134 ms

Loss rate: 0.33%

### Run 3: Report of QUIC Cubic — Data Link



Run 1: Statistics of SCReAM

Start at: 2018-12-11 12:33:47

End at: 2018-12-11 12:34:17

# Below is generated by plot.py at 2018-12-11 13:08:40

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 0.21 Mbit/s (1.8% utilization)

95th percentile per-packet one-way delay: 31.614 ms

Loss rate: 0.13%

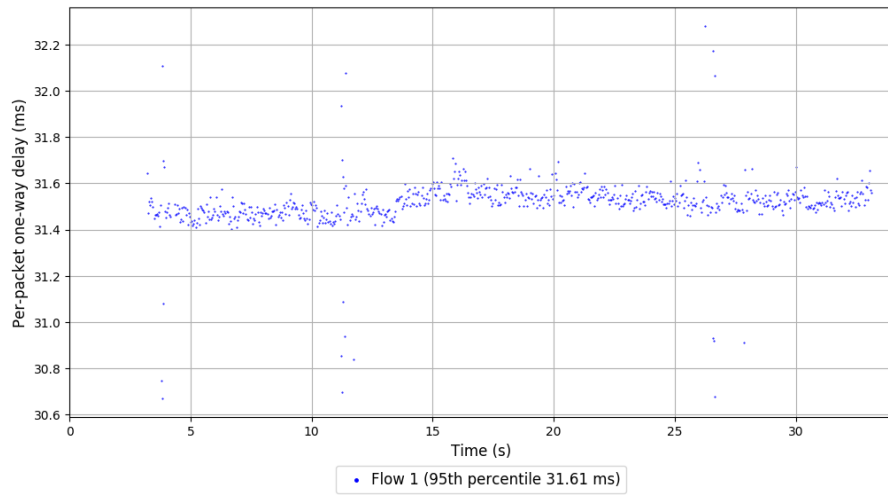
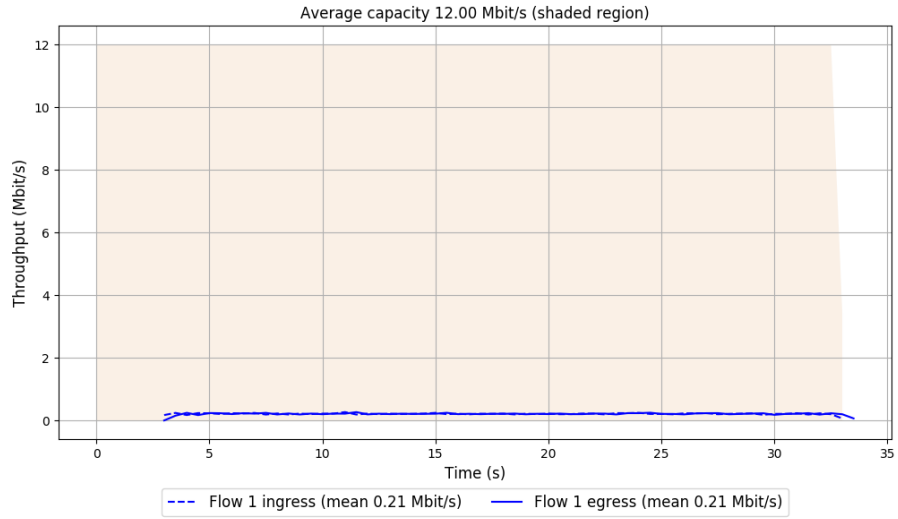
-- Flow 1:

Average throughput: 0.21 Mbit/s

95th percentile per-packet one-way delay: 31.614 ms

Loss rate: 0.13%

# Run 1: Report of SCReAM — Data Link



Run 2: Statistics of SCReAM

Start at: 2018-12-11 12:45:01

End at: 2018-12-11 12:45:31

# Below is generated by plot.py at 2018-12-11 13:08:40

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 0.21 Mbit/s (1.8% utilization)

95th percentile per-packet one-way delay: 31.831 ms

Loss rate: 0.00%

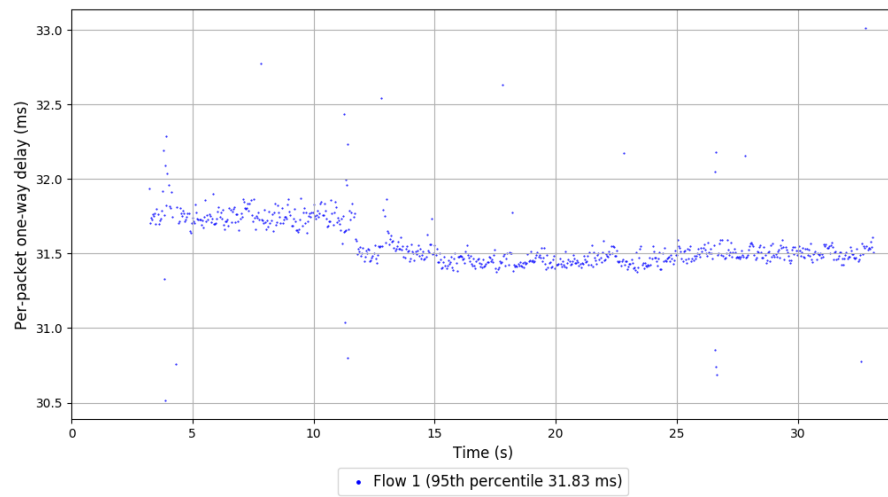
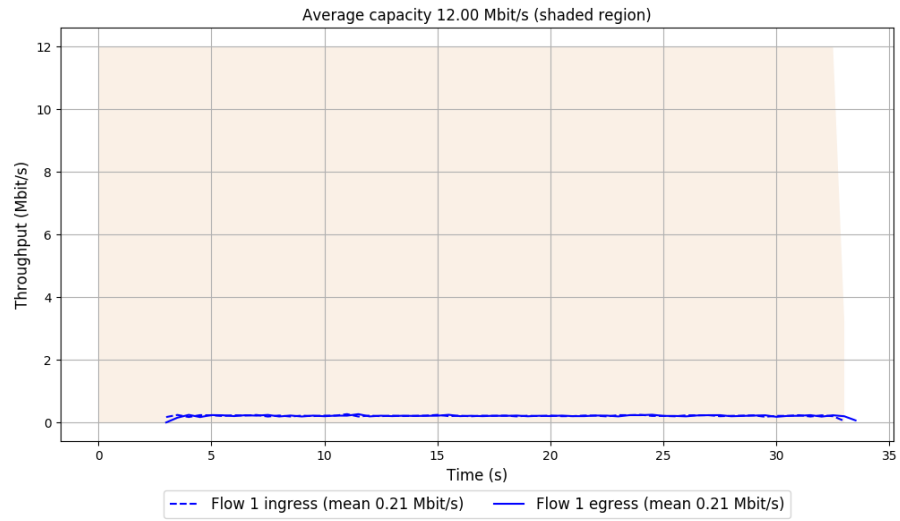
-- Flow 1:

Average throughput: 0.21 Mbit/s

95th percentile per-packet one-way delay: 31.831 ms

Loss rate: 0.00%

## Run 2: Report of SCReAM — Data Link



Run 3: Statistics of SCReAM

Start at: 2018-12-11 12:56:16

End at: 2018-12-11 12:56:46

# Below is generated by plot.py at 2018-12-11 13:08:40

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 0.21 Mbit/s (1.8% utilization)

95th percentile per-packet one-way delay: 31.610 ms

Loss rate: 0.00%

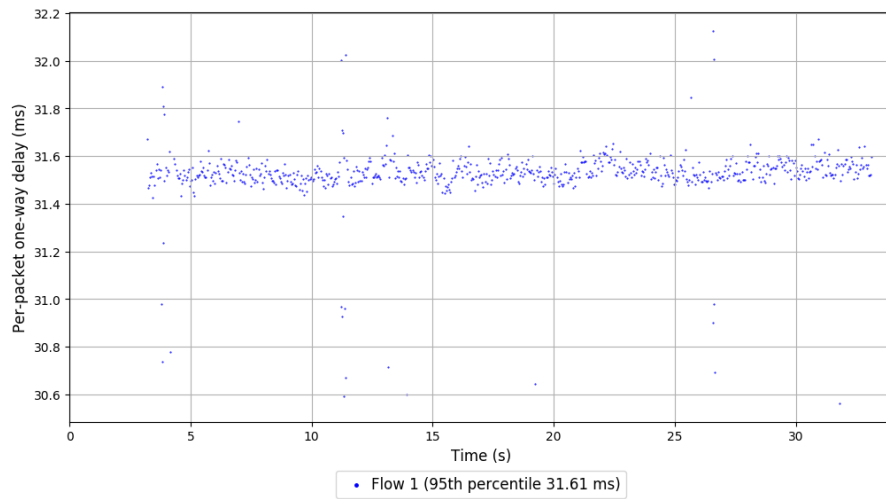
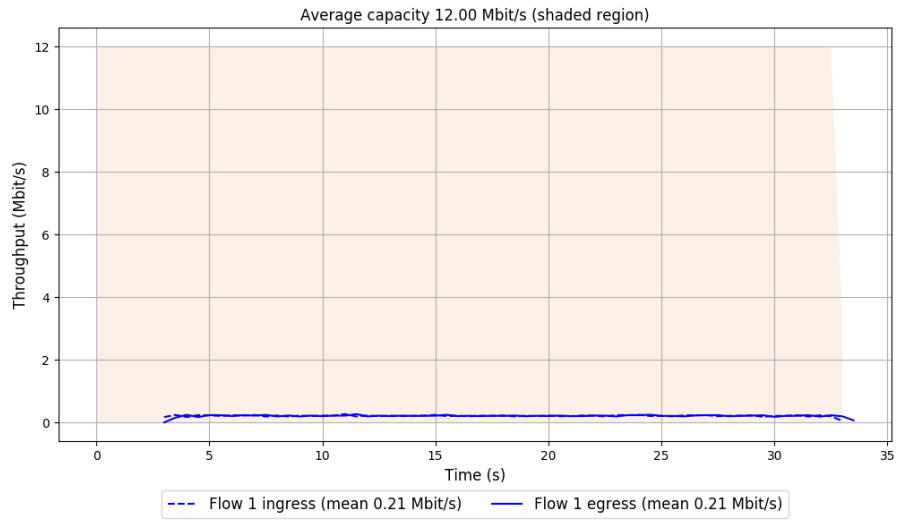
-- Flow 1:

Average throughput: 0.21 Mbit/s

95th percentile per-packet one-way delay: 31.610 ms

Loss rate: 0.00%

### Run 3: Report of SReAM — Data Link



Run 1: Statistics of Sprout

Start at: 2018-12-11 12:37:20

End at: 2018-12-11 12:37:50

# Below is generated by plot.py at 2018-12-11 13:08:44

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 6.34 Mbit/s (52.8% utilization)

95th percentile per-packet one-way delay: 54.657 ms

Loss rate: 0.21%

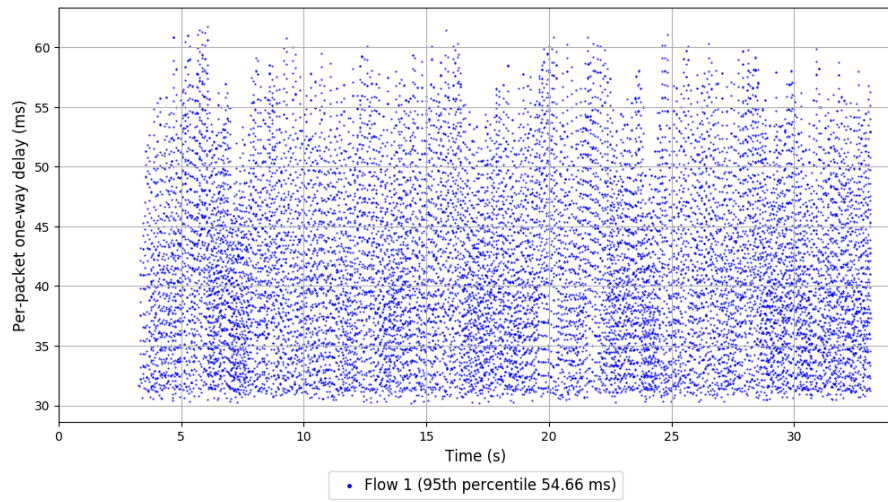
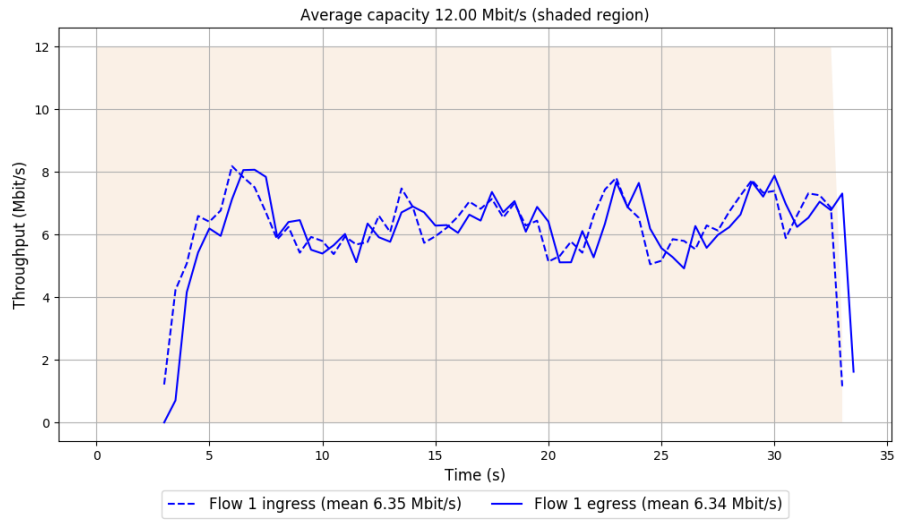
-- Flow 1:

Average throughput: 6.34 Mbit/s

95th percentile per-packet one-way delay: 54.657 ms

Loss rate: 0.21%

# Run 1: Report of Sprout — Data Link



Run 2: Statistics of Sprout

Start at: 2018-12-11 12:48:33

End at: 2018-12-11 12:49:03

# Below is generated by plot.py at 2018-12-11 13:08:45

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 6.35 Mbit/s (53.0% utilization)

95th percentile per-packet one-way delay: 55.542 ms

Loss rate: 0.34%

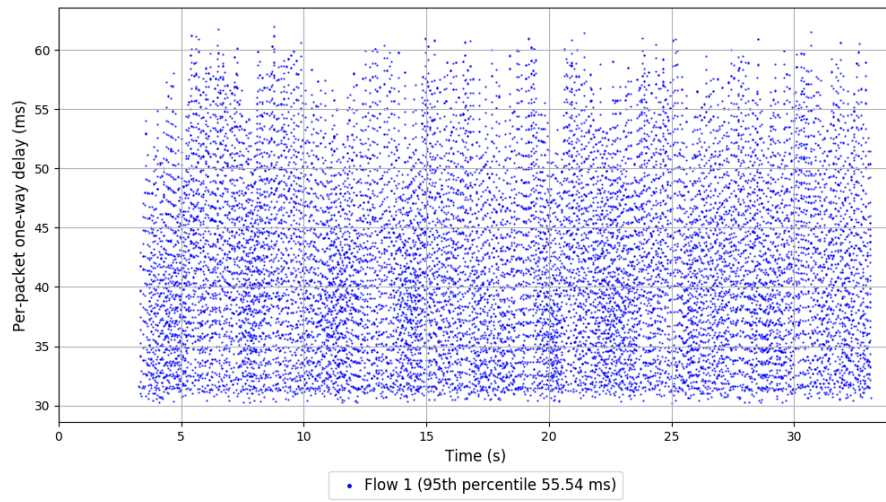
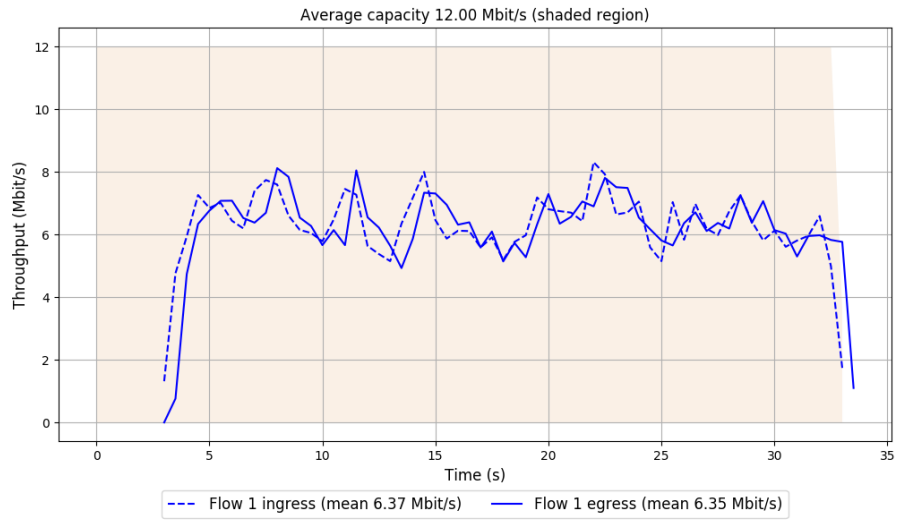
-- Flow 1:

Average throughput: 6.35 Mbit/s

95th percentile per-packet one-way delay: 55.542 ms

Loss rate: 0.34%

## Run 2: Report of Sprout — Data Link



Run 3: Statistics of Sprout

Start at: 2018-12-11 12:59:51

End at: 2018-12-11 13:00:21

# Below is generated by plot.py at 2018-12-11 13:08:49

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 6.47 Mbit/s (53.9% utilization)

95th percentile per-packet one-way delay: 55.216 ms

Loss rate: 0.64%

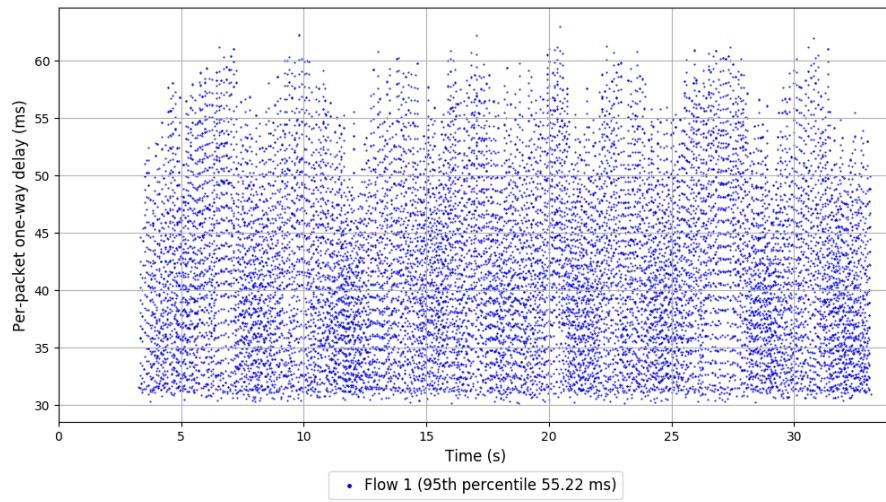
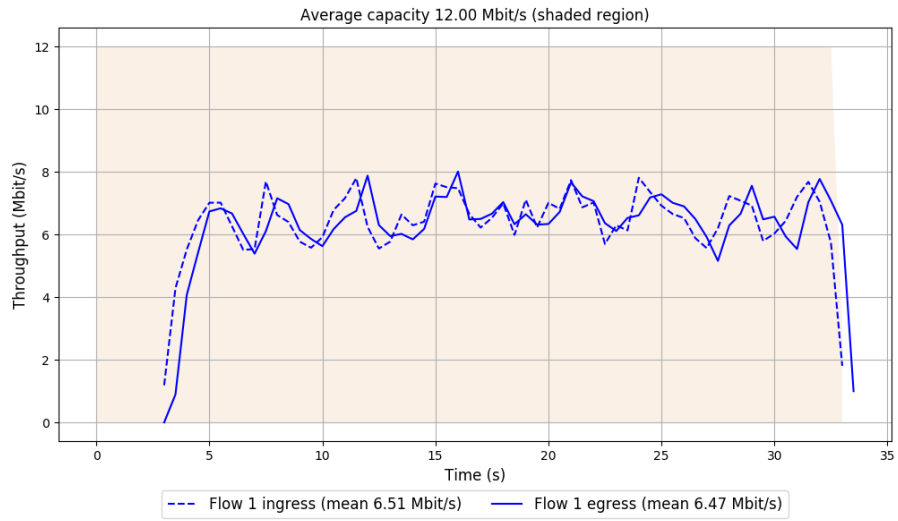
-- Flow 1:

Average throughput: 6.47 Mbit/s

95th percentile per-packet one-way delay: 55.216 ms

Loss rate: 0.64%

### Run 3: Report of Sprout — Data Link



Run 1: Statistics of TaoVA-100x

Start at: 2018-12-11 12:40:17

End at: 2018-12-11 12:40:47

# Below is generated by plot.py at 2018-12-11 13:09:11

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 11.10 Mbit/s (92.5% utilization)

95th percentile per-packet one-way delay: 32.811 ms

Loss rate: 0.82%

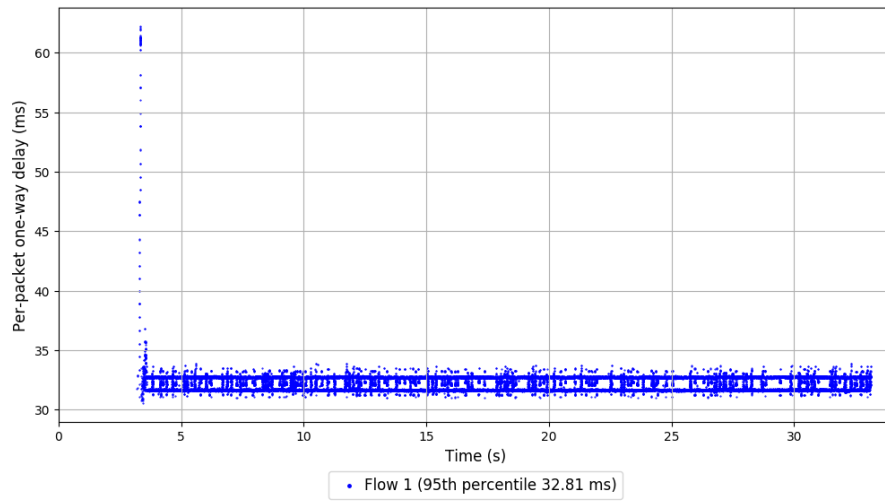
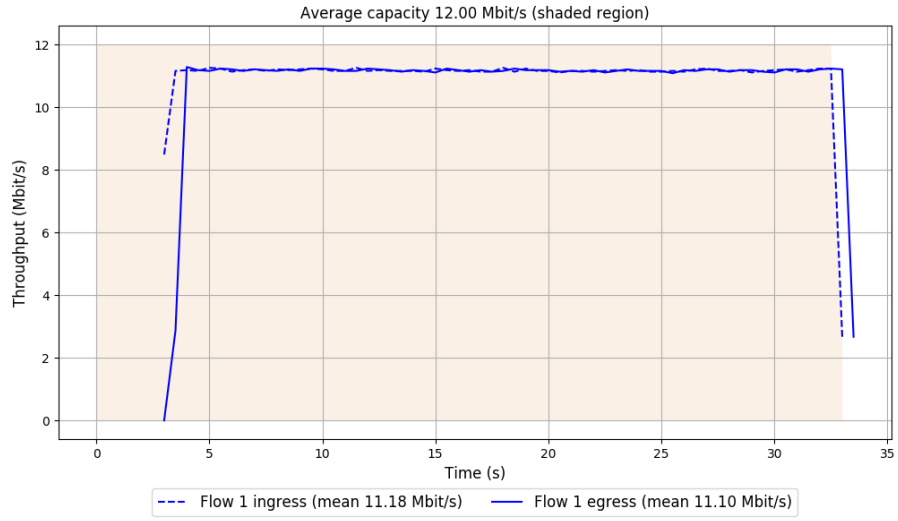
-- Flow 1:

Average throughput: 11.10 Mbit/s

95th percentile per-packet one-way delay: 32.811 ms

Loss rate: 0.82%

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



Run 2: Statistics of TaoVA-100x

Start at: 2018-12-11 12:51:31

End at: 2018-12-11 12:52:01

# Below is generated by plot.py at 2018-12-11 13:09:11

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 11.14 Mbit/s (92.8% utilization)

95th percentile per-packet one-way delay: 32.845 ms

Loss rate: 0.69%

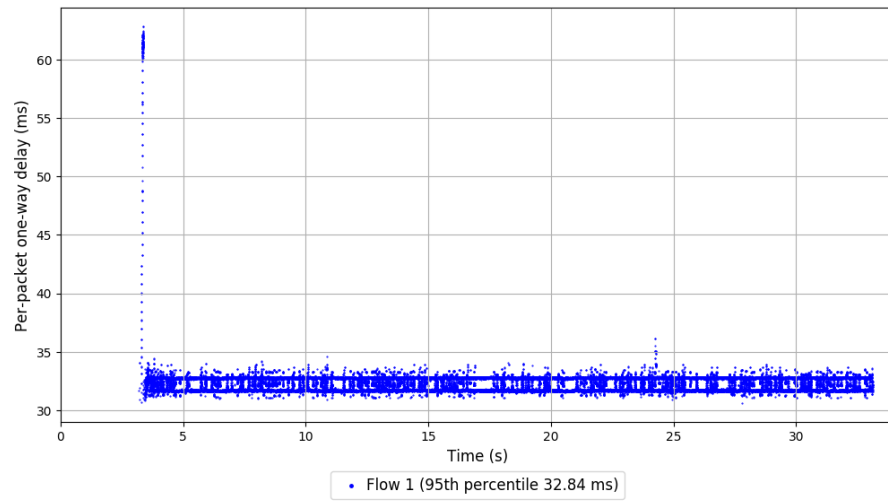
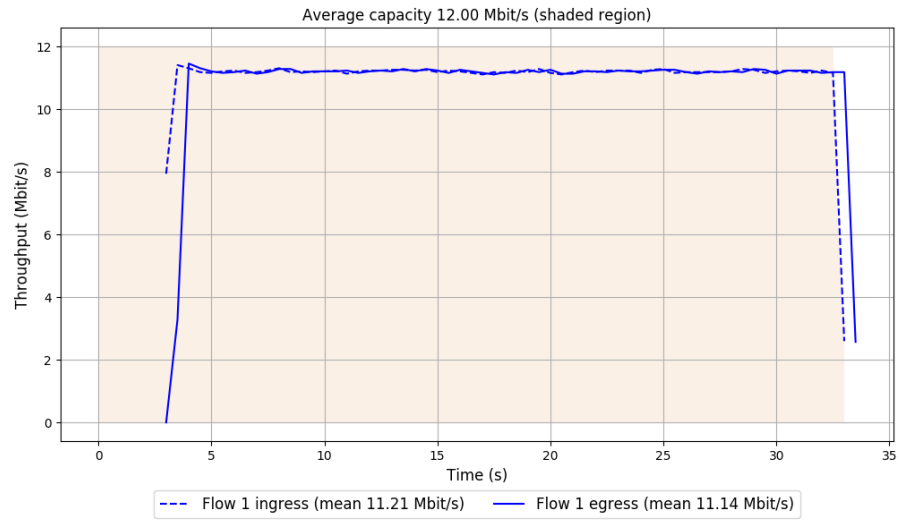
-- Flow 1:

Average throughput: 11.14 Mbit/s

95th percentile per-packet one-way delay: 32.845 ms

Loss rate: 0.69%

## Run 2: Report of TaoVA-100x — Data Link



Run 3: Statistics of TaoVA-100x

Start at: 2018-12-11 13:02:48

End at: 2018-12-11 13:03:18

# Below is generated by plot.py at 2018-12-11 13:09:12

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 11.13 Mbit/s (92.8% utilization)

95th percentile per-packet one-way delay: 32.856 ms

Loss rate: 0.82%

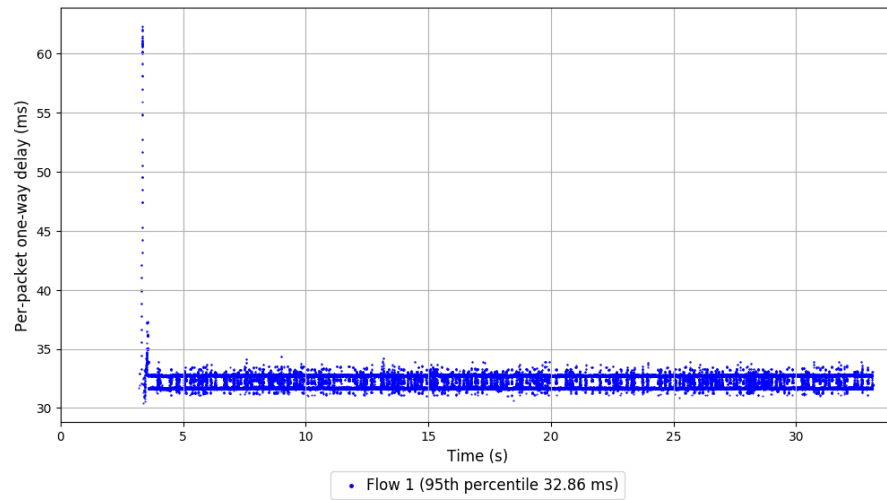
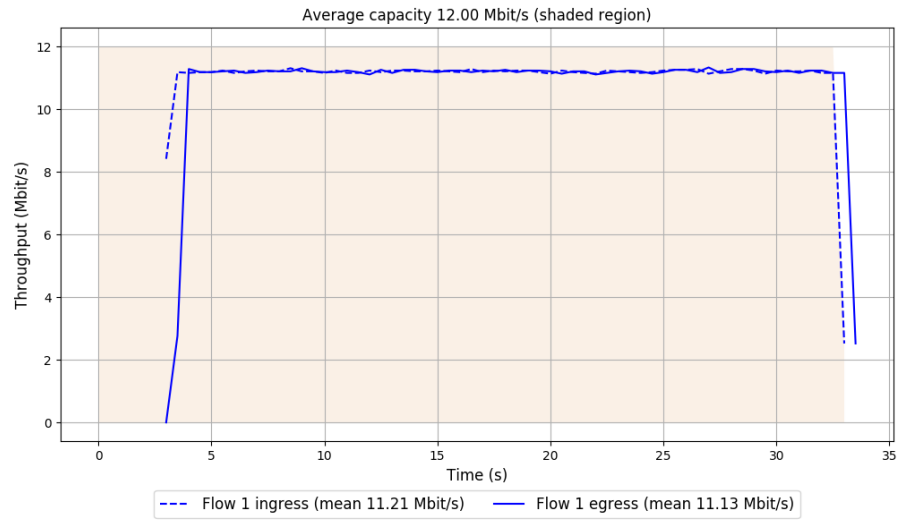
-- Flow 1:

Average throughput: 11.13 Mbit/s

95th percentile per-packet one-way delay: 32.856 ms

Loss rate: 0.82%

### Run 3: Report of TaoVA-100x — Data Link



Run 1: Statistics of TCP Vegas

Start at: 2018-12-11 12:37:55

End at: 2018-12-11 12:38:25

# Below is generated by plot.py at 2018-12-11 13:09:12

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 11.92 Mbit/s (99.3% utilization)

95th percentile per-packet one-way delay: 38.050 ms

Loss rate: 0.33%

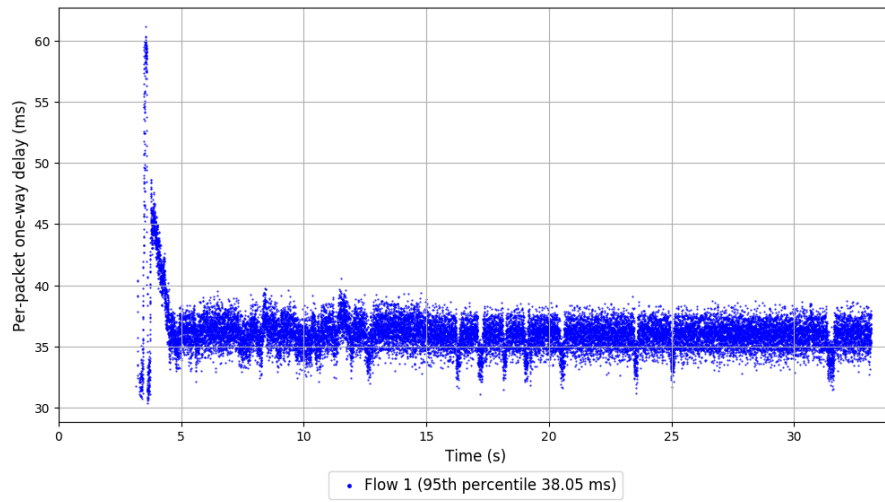
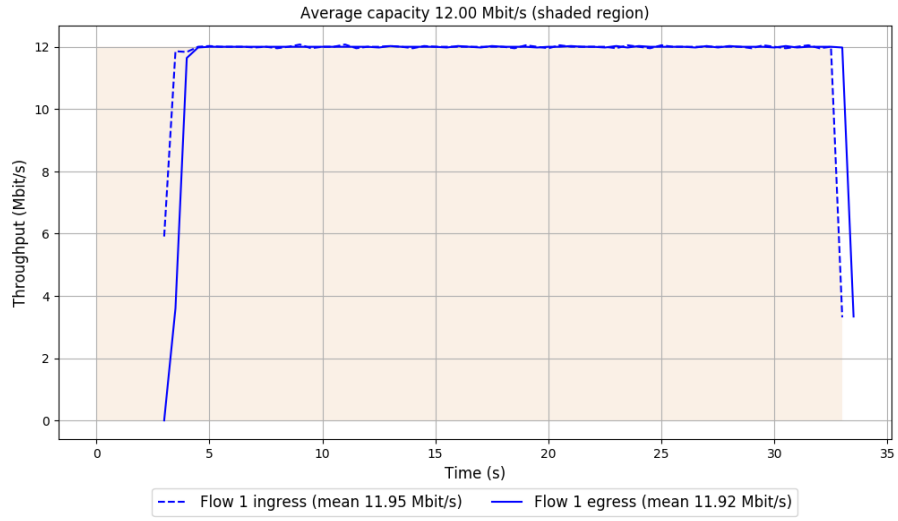
-- Flow 1:

Average throughput: 11.92 Mbit/s

95th percentile per-packet one-way delay: 38.050 ms

Loss rate: 0.33%

# Run 1: Report of TCP Vegas — Data Link



Run 2: Statistics of TCP Vegas

Start at: 2018-12-11 12:49:08

End at: 2018-12-11 12:49:38

# Below is generated by plot.py at 2018-12-11 13:09:12

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 11.92 Mbit/s (99.3% utilization)

95th percentile per-packet one-way delay: 37.462 ms

Loss rate: 0.33%

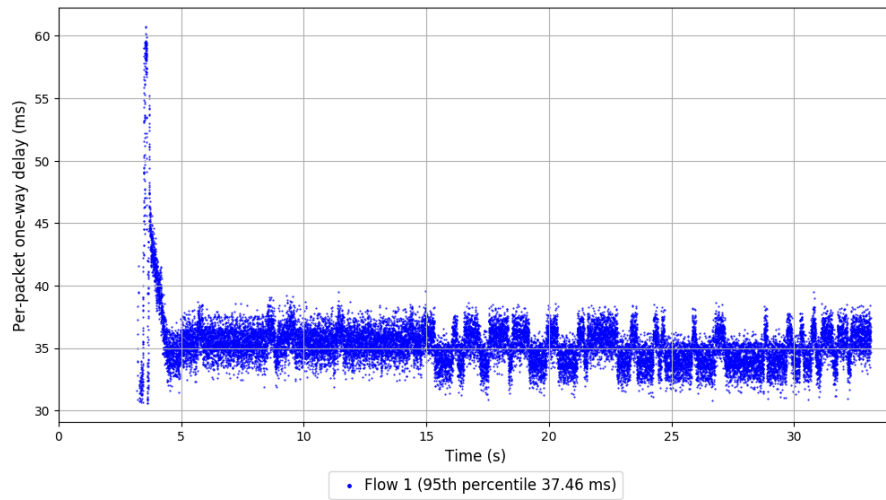
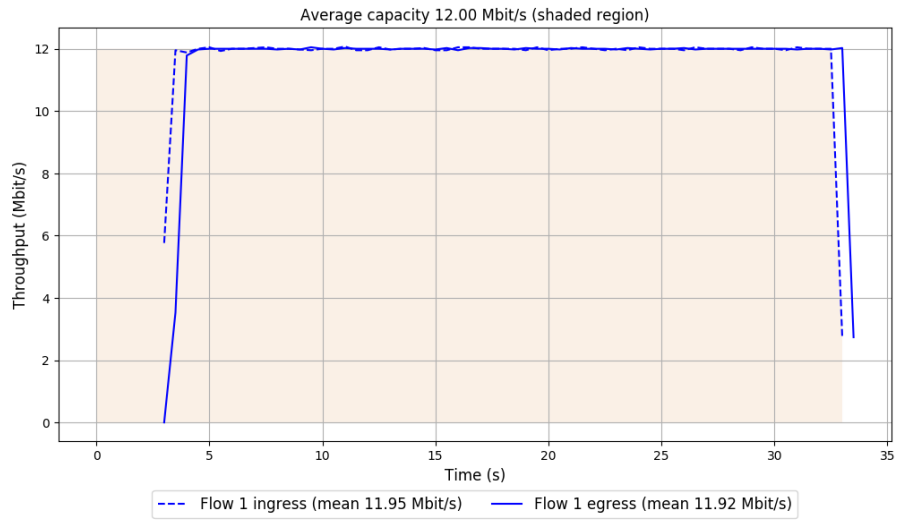
-- Flow 1:

Average throughput: 11.92 Mbit/s

95th percentile per-packet one-way delay: 37.462 ms

Loss rate: 0.33%

## Run 2: Report of TCP Vegas — Data Link



Run 3: Statistics of TCP Vegas

Start at: 2018-12-11 13:00:26

End at: 2018-12-11 13:00:56

# Below is generated by plot.py at 2018-12-11 13:09:12

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 11.92 Mbit/s (99.3% utilization)

95th percentile per-packet one-way delay: 37.526 ms

Loss rate: 0.33%

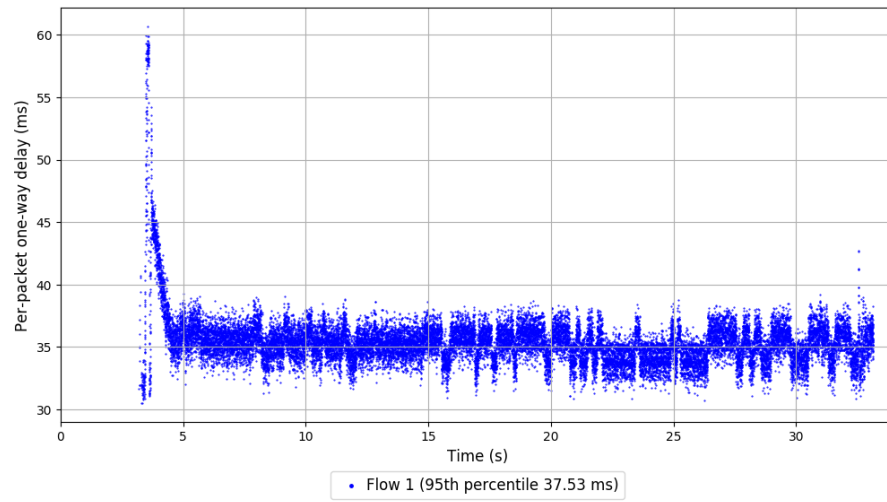
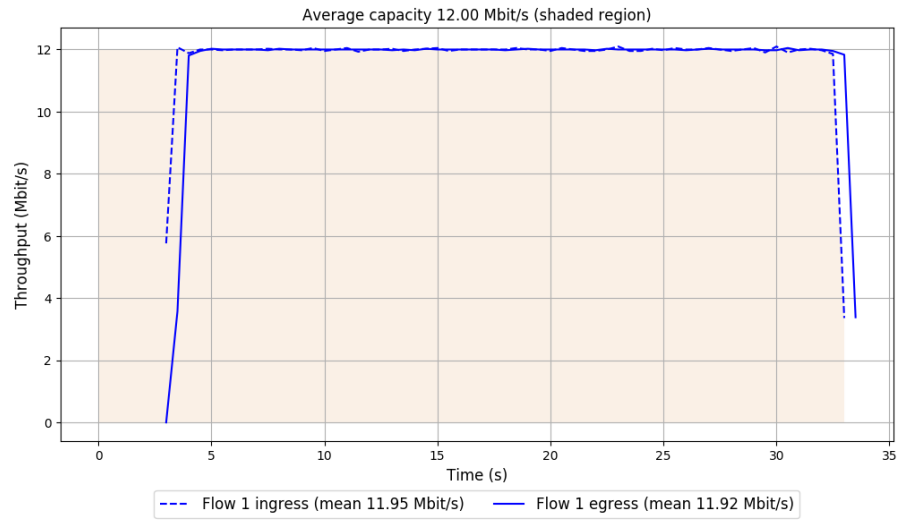
-- Flow 1:

Average throughput: 11.92 Mbit/s

95th percentile per-packet one-way delay: 37.526 ms

Loss rate: 0.33%

### Run 3: Report of TCP Vegas — Data Link



Run 1: Statistics of Verus

Start at: 2018-12-11 12:34:22

End at: 2018-12-11 12:34:52

# Below is generated by plot.py at 2018-12-11 13:09:17

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 7.43 Mbit/s (61.9% utilization)

95th percentile per-packet one-way delay: 61.409 ms

Loss rate: 83.42%

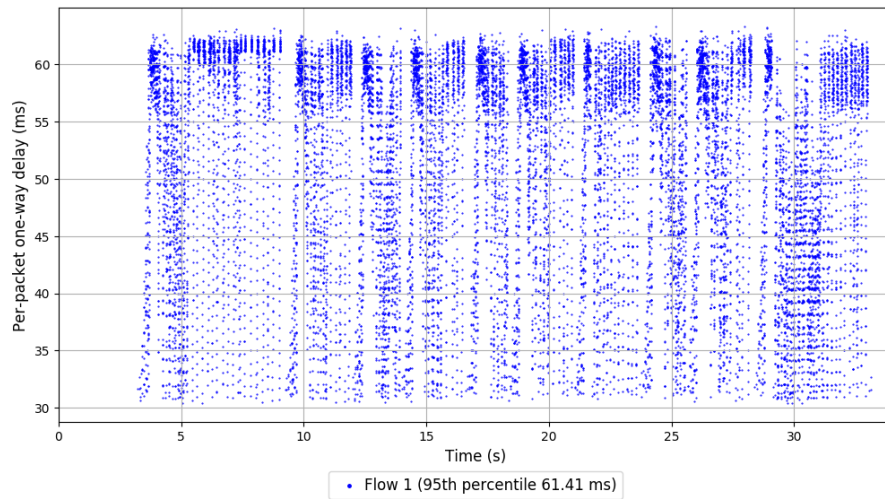
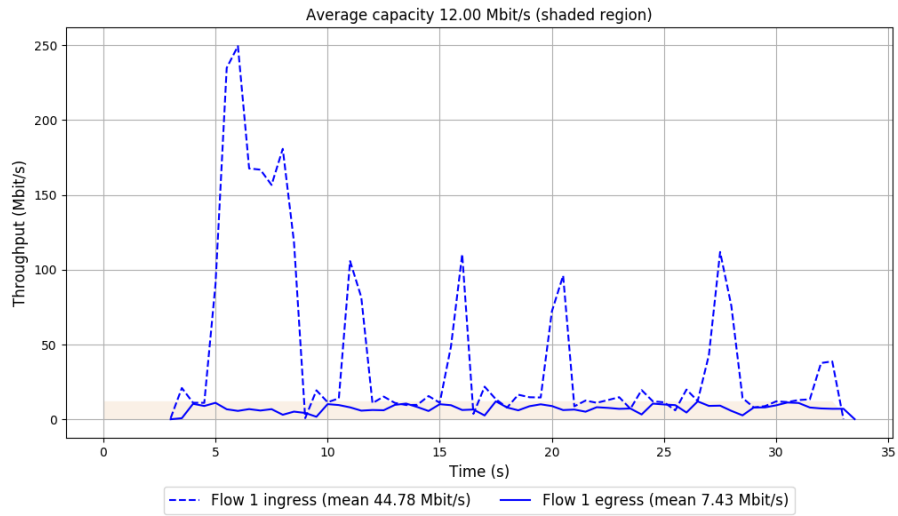
-- Flow 1:

Average throughput: 7.43 Mbit/s

95th percentile per-packet one-way delay: 61.409 ms

Loss rate: 83.42%

# Run 1: Report of Verus — Data Link



Run 2: Statistics of Verus

Start at: 2018-12-11 12:45:36

End at: 2018-12-11 12:46:06

# Below is generated by plot.py at 2018-12-11 13:09:17

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 7.74 Mbit/s (64.5% utilization)

95th percentile per-packet one-way delay: 60.937 ms

Loss rate: 46.82%

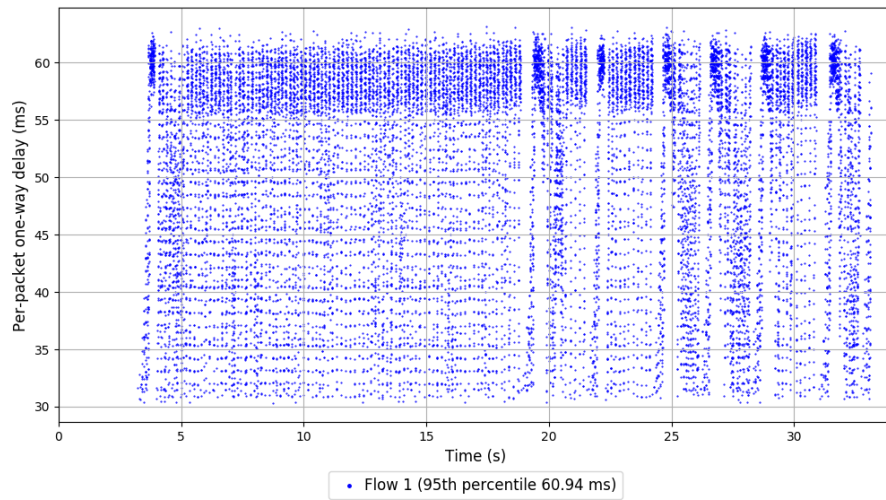
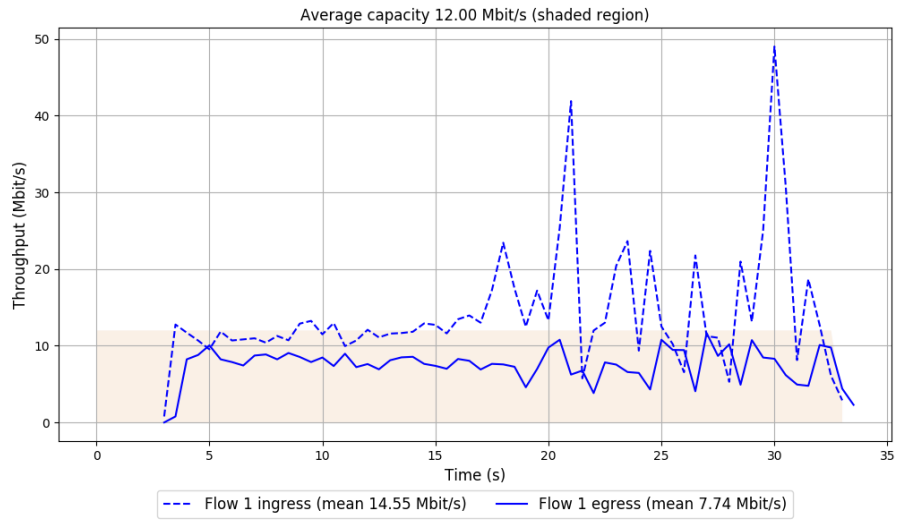
-- Flow 1:

Average throughput: 7.74 Mbit/s

95th percentile per-packet one-way delay: 60.937 ms

Loss rate: 46.82%

## Run 2: Report of Verus — Data Link



Run 3: Statistics of Verus

Start at: 2018-12-11 12:56:51

End at: 2018-12-11 12:57:21

# Below is generated by plot.py at 2018-12-11 13:09:29

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 6.52 Mbit/s (54.3% utilization)

95th percentile per-packet one-way delay: 61.908 ms

Loss rate: 96.01%

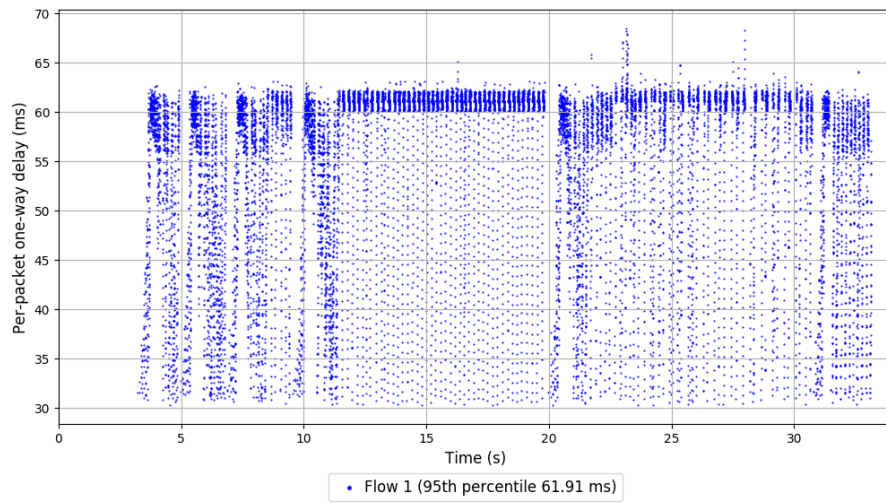
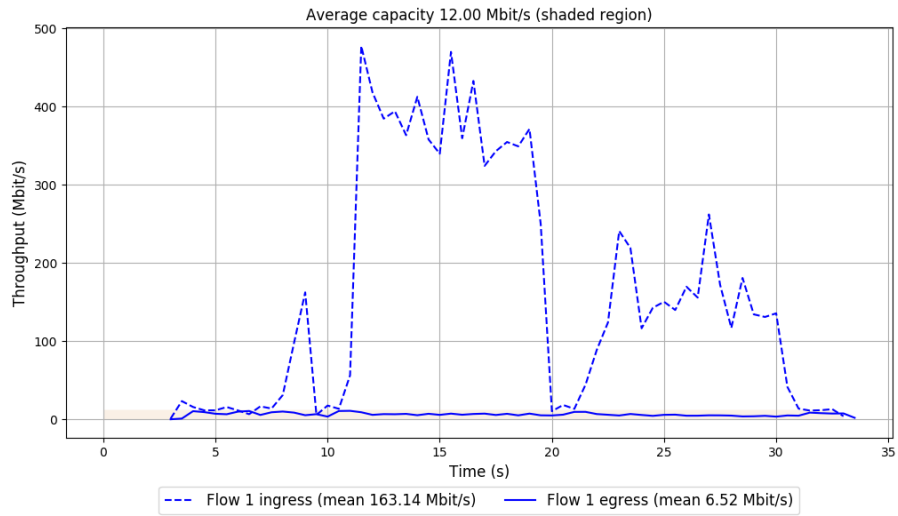
-- Flow 1:

Average throughput: 6.52 Mbit/s

95th percentile per-packet one-way delay: 61.908 ms

Loss rate: 96.01%

### Run 3: Report of Verus — Data Link



Run 1: Statistics of PCC-Vivace

Start at: 2018-12-11 12:42:39

End at: 2018-12-11 12:43:09

# Below is generated by plot.py at 2018-12-11 13:09:29

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 10.91 Mbit/s (90.9% utilization)

95th percentile per-packet one-way delay: 37.680 ms

Loss rate: 0.15%

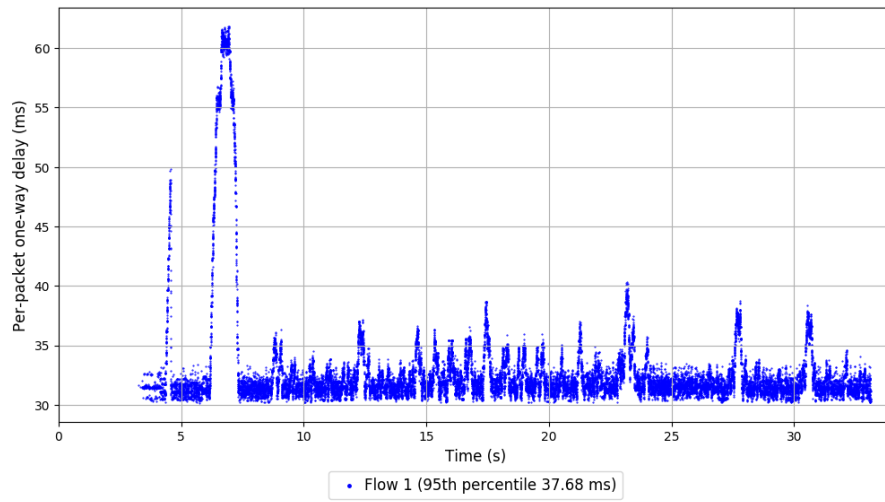
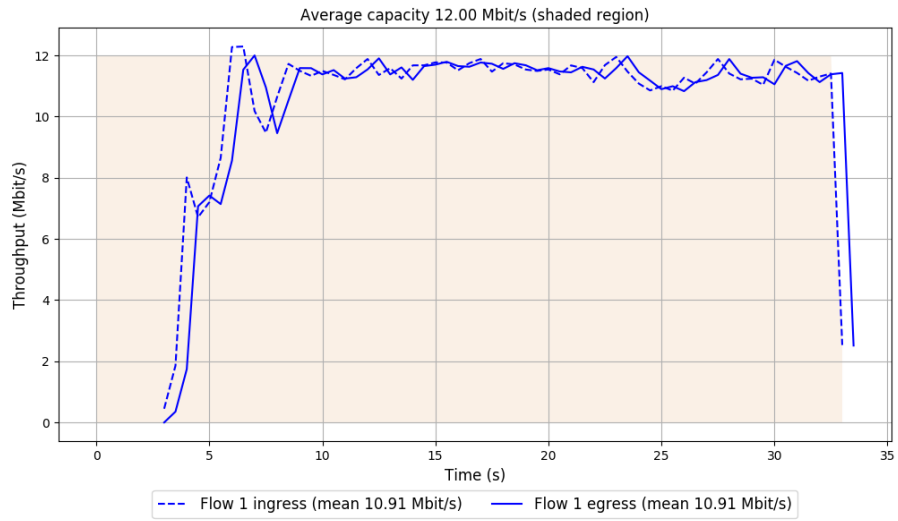
-- Flow 1:

Average throughput: 10.91 Mbit/s

95th percentile per-packet one-way delay: 37.680 ms

Loss rate: 0.15%

# Run 1: Report of PCC-Vivace — Data Link



Run 2: Statistics of PCC-Vivace

Start at: 2018-12-11 12:53:54

End at: 2018-12-11 12:54:24

# Below is generated by plot.py at 2018-12-11 13:09:29

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 10.94 Mbit/s (91.2% utilization)

95th percentile per-packet one-way delay: 36.386 ms

Loss rate: 0.16%

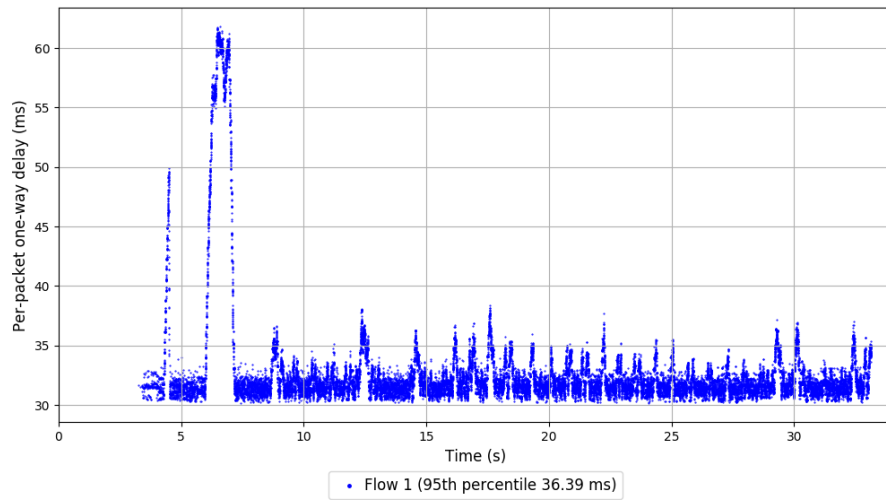
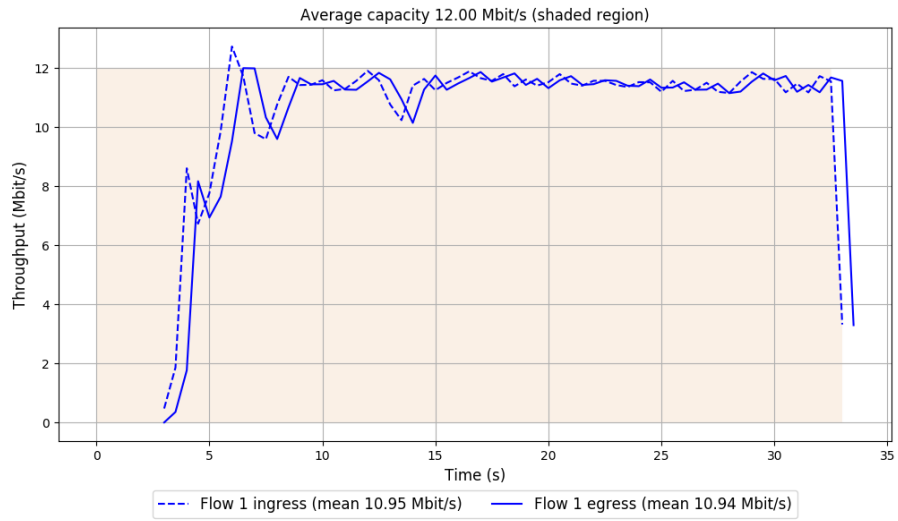
-- Flow 1:

Average throughput: 10.94 Mbit/s

95th percentile per-packet one-way delay: 36.386 ms

Loss rate: 0.16%

## Run 2: Report of PCC-Vivace — Data Link



Run 3: Statistics of PCC-Vivace

Start at: 2018-12-11 13:05:11

End at: 2018-12-11 13:05:41

# Below is generated by plot.py at 2018-12-11 13:09:29

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 10.92 Mbit/s (91.0% utilization)

95th percentile per-packet one-way delay: 36.695 ms

Loss rate: 0.13%

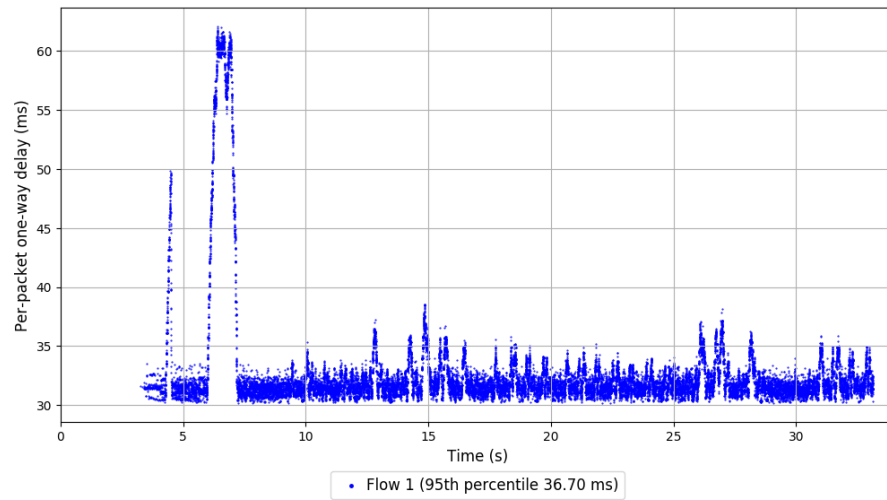
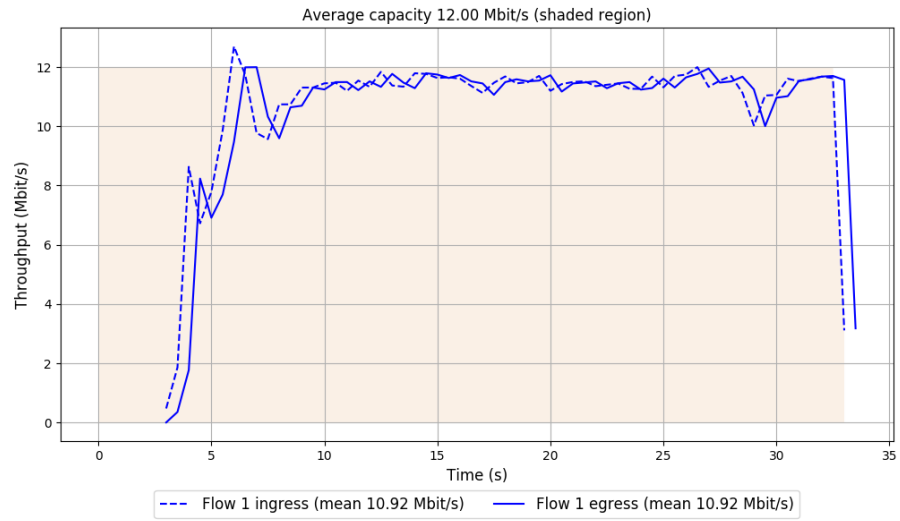
-- Flow 1:

Average throughput: 10.92 Mbit/s

95th percentile per-packet one-way delay: 36.695 ms

Loss rate: 0.13%

### Run 3: Report of PCC-Vivace — Data Link



Run 1: Statistics of WebRTC media

Start at: 2018-12-11 12:32:36

End at: 2018-12-11 12:33:06

# Below is generated by plot.py at 2018-12-11 13:09:29

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 2.10 Mbit/s (17.5% utilization)

95th percentile per-packet one-way delay: 36.693 ms

Loss rate: 0.09%

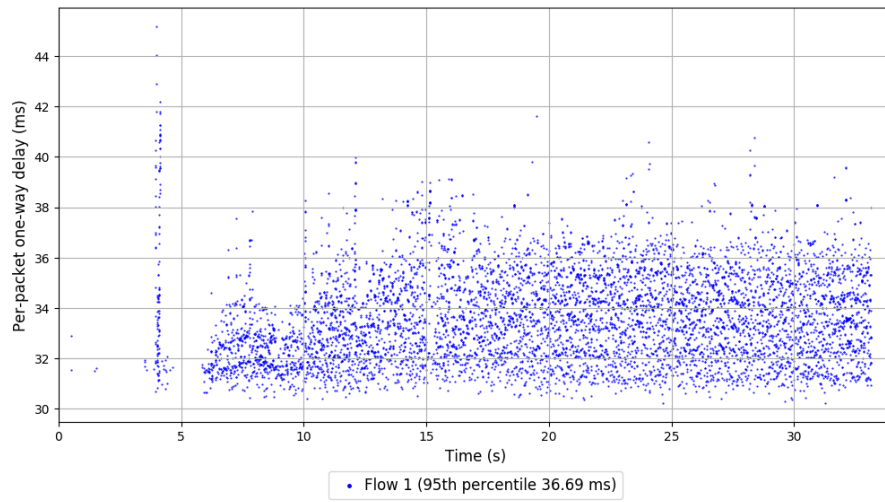
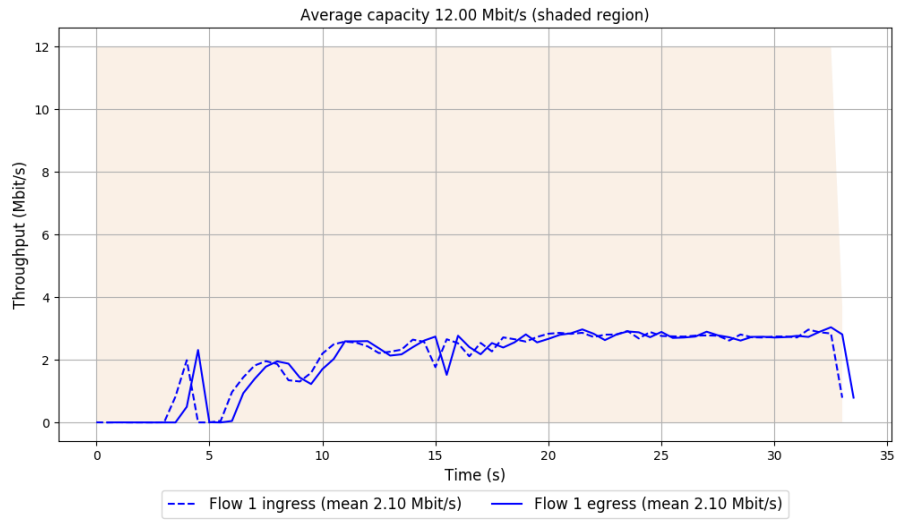
-- Flow 1:

Average throughput: 2.10 Mbit/s

95th percentile per-packet one-way delay: 36.693 ms

Loss rate: 0.09%

# Run 1: Report of WebRTC media — Data Link



Run 2: Statistics of WebRTC media

Start at: 2018-12-11 12:43:50

End at: 2018-12-11 12:44:20

# Below is generated by plot.py at 2018-12-11 13:09:29

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 2.09 Mbit/s (17.4% utilization)

95th percentile per-packet one-way delay: 36.229 ms

Loss rate: 0.15%

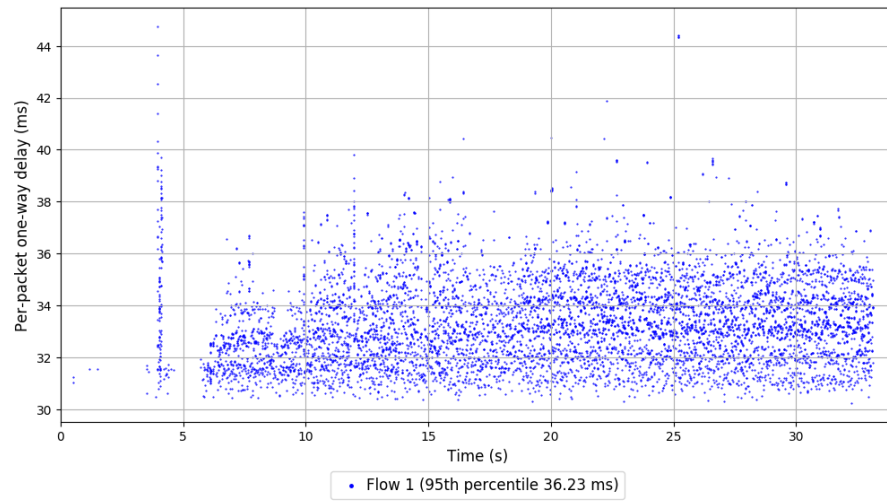
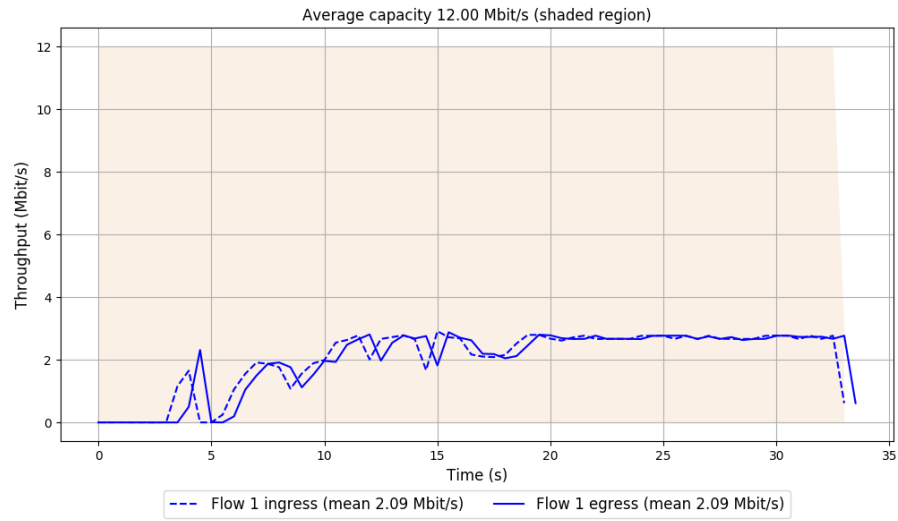
-- Flow 1:

Average throughput: 2.09 Mbit/s

95th percentile per-packet one-way delay: 36.229 ms

Loss rate: 0.15%

## Run 2: Report of WebRTC media — Data Link



Run 3: Statistics of WebRTC media

Start at: 2018-12-11 12:55:05

End at: 2018-12-11 12:55:35

# Below is generated by plot.py at 2018-12-11 13:09:29

# Datalink statistics

-- Total of 1 flow:

Average capacity: 12.00 Mbit/s

Average throughput: 2.10 Mbit/s (17.5% utilization)

95th percentile per-packet one-way delay: 36.846 ms

Loss rate: 0.10%

-- Flow 1:

Average throughput: 2.10 Mbit/s

95th percentile per-packet one-way delay: 36.846 ms

Loss rate: 0.10%

### Run 3: Report of WebRTC media — Data Link

