

## Pantheon Report

Generated at 2018-09-05 03:48:56 (UTC).

Data path: Colombia on **p4p1** (*remote*) → AWS Brazil 2 on **ens5** (*local*).

Repeated the test of 4 congestion control schemes 3 times.

Each test lasted for 30 seconds running 3 flows with 10-second interval between two flows.

NTP offsets were measured against **gps.ntp.br** and have been applied to correct the timestamps in logs.

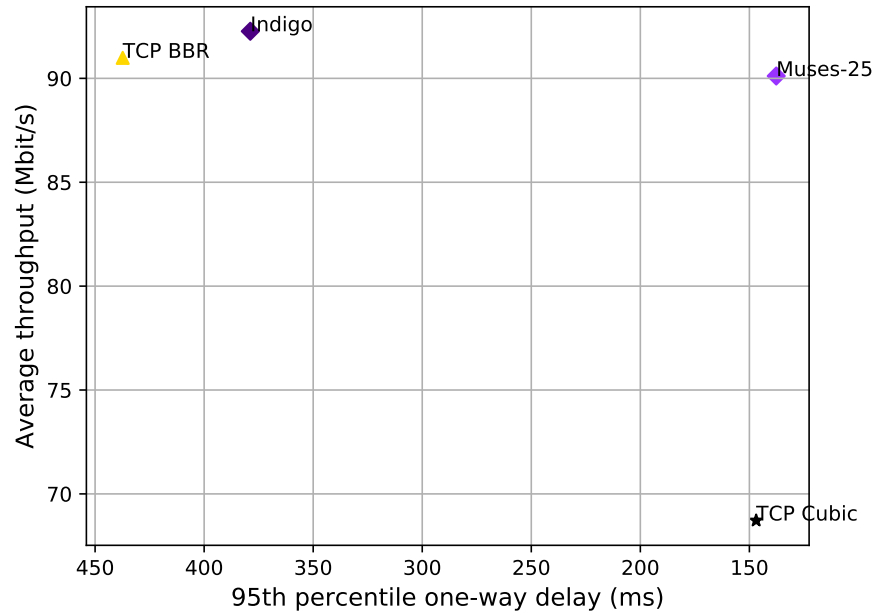
### System info:

```
Linux 4.15.0-1020-aws
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
net.ipv4.tcp_mem = 536870912 536870912 536870912
```

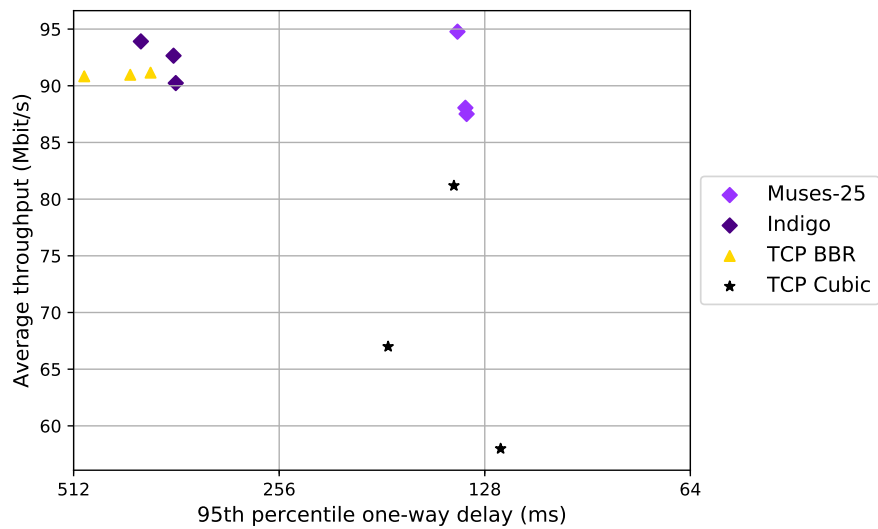
### Git summary:

```
branch: muses @ 71e71e9a55b945431a7dea72180c1c9381097db9
third_party/fillp @ d47f4fa1b454a5e3c0537115c5a28436dbd4b834
third_party/fillp-sheep @ daed0c84f98531712514b2231f43ec6901114ffe
third_party/genericCC @ d0153f8e594aa89e93b032143cedbdf58e562f4
third_party/indigo @ 2601c92e4aa9d58d38dc4dfe0ecd9f90c077e64d
third_party/libutp @ b3465b942e2826f2b179eaab4a906ce6bb7cf3cf
third_party/muses @ 96fbc95fb38373d71fbc80c5a105e62e7636623b
third_party/pantheon-tunnel @ cbfce6db5ff5740dafa1771f813cd646339e1952
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
third_party/verus @ d4b447ea74c6c60a261149af2629562939f9a494
M src/verus.hpp
M tools/plot.py
third_party/vivace @ 2baf86211435ae071a32f96b7d8c504587f5d7f4
third_party/webrtc @ 3f0cc2a9061a41b6f9dde4735770d143a1fa2851
```

test from Colombia to AWS Brazil 2, 3 runs of 30s each per scheme  
 3 flows with 10s interval between flows (mean of all runs by scheme)



test from Colombia to AWS Brazil 2, 3 runs of 30s each per scheme  
 3 flows with 10s interval between flows



scheme	# runs	mean avg tput (Mbit/s)			mean 95th-%ile delay (ms)			mean loss rate (%)		
		flow 1	flow 2	flow 3	flow 1	flow 2	flow 3	flow 1	flow 2	flow 3
TCP BBR	3	55.37	38.65	30.24	394.38	566.56	440.36	2.53	4.72	5.21
TCP Cubic	3	35.27	35.63	29.73	145.43	145.19	140.78	0.51	0.69	2.19
Indigo	3	57.46	38.21	29.12	407.08	133.11	135.62	7.26	2.57	4.06
Muses-25	3	53.31	35.96	39.50	108.22	157.48	380.72	0.62	0.96	3.05

Run 1: Statistics of TCP BBR

Start at: 2018-09-05 03:35:44

End at: 2018-09-05 03:36:14

Local clock offset: 4.397 ms

Remote clock offset: 5.435 ms

# Below is generated by plot.py at 2018-09-05 03:48:26

# Datalink statistics

-- Total of 3 flows:

Average throughput: 90.83 Mbit/s

95th percentile per-packet one-way delay: 493.977 ms

Loss rate: 3.54%

-- Flow 1:

Average throughput: 54.86 Mbit/s

95th percentile per-packet one-way delay: 404.796 ms

Loss rate: 2.85%

-- Flow 2:

Average throughput: 39.02 Mbit/s

95th percentile per-packet one-way delay: 577.780 ms

Loss rate: 3.86%

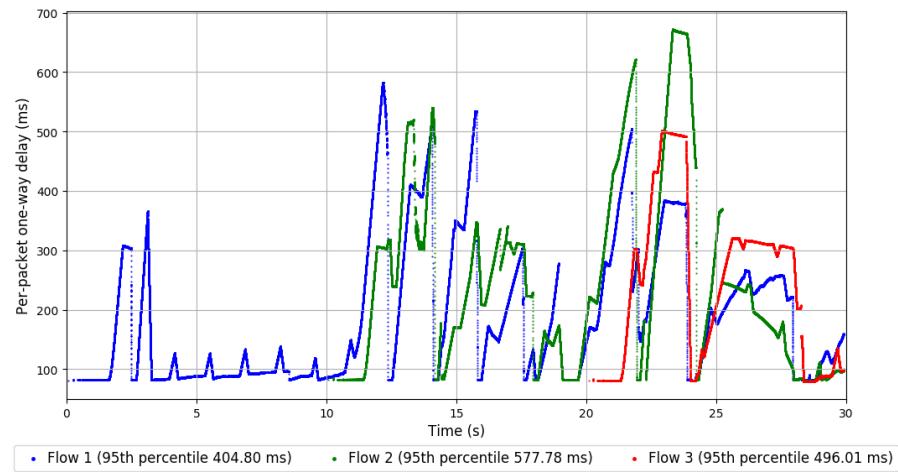
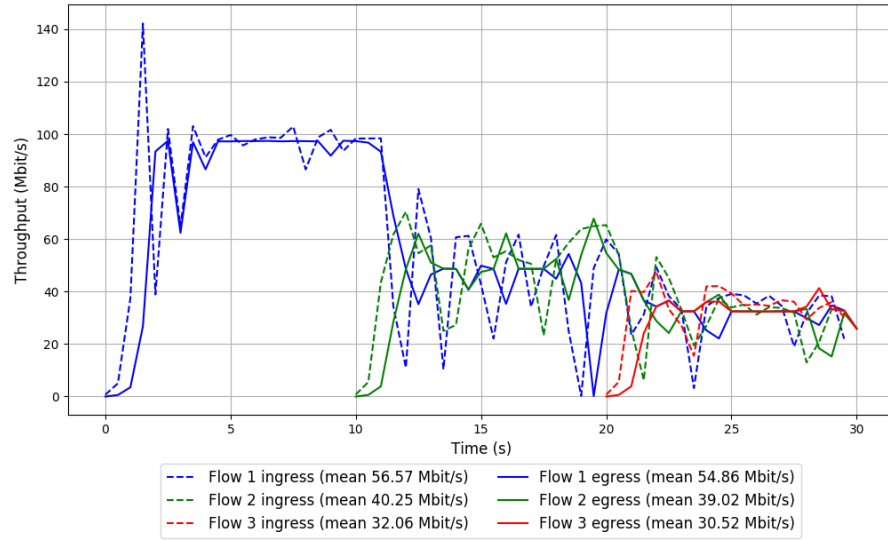
-- Flow 3:

Average throughput: 30.52 Mbit/s

95th percentile per-packet one-way delay: 496.013 ms

Loss rate: 6.36%

# Run 1: Report of TCP BBR — Data Link



Run 2: Statistics of TCP BBR

Start at: 2018-09-05 03:40:58

End at: 2018-09-05 03:41:28

Local clock offset: 5.279 ms

Remote clock offset: 5.928 ms

# Below is generated by plot.py at 2018-09-05 03:48:26

# Datalink statistics

-- Total of 3 flows:

Average throughput: 90.97 Mbit/s

95th percentile per-packet one-way delay: 423.005 ms

Loss rate: 3.90%

-- Flow 1:

Average throughput: 55.61 Mbit/s

95th percentile per-packet one-way delay: 389.616 ms

Loss rate: 2.80%

-- Flow 2:

Average throughput: 38.03 Mbit/s

95th percentile per-packet one-way delay: 718.777 ms

Loss rate: 5.27%

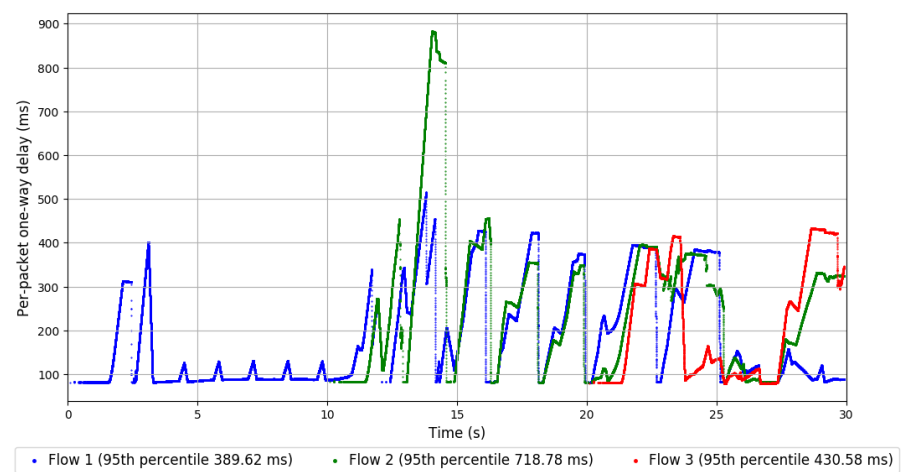
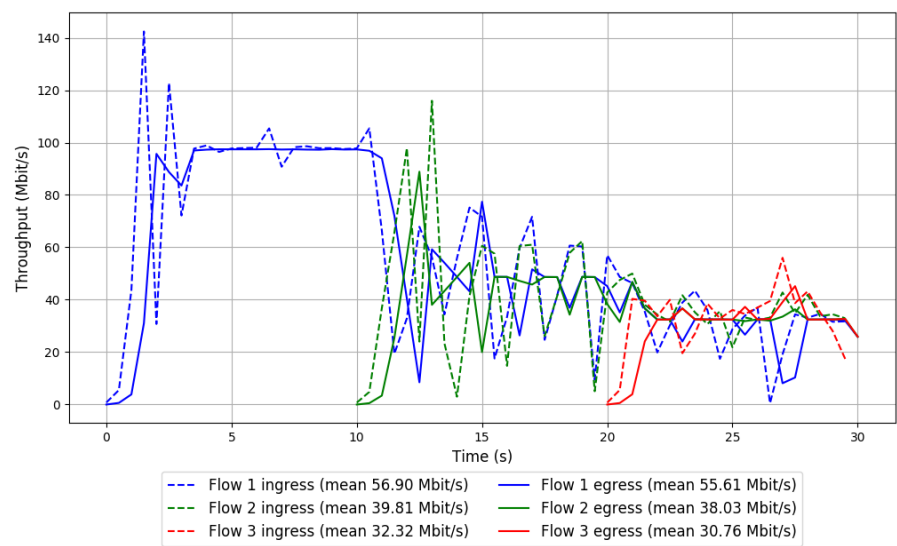
-- Flow 3:

Average throughput: 30.76 Mbit/s

95th percentile per-packet one-way delay: 430.576 ms

Loss rate: 6.37%

Run 2: Report of TCP BBR — Data Link



Run 3: Statistics of TCP BBR

Start at: 2018-09-05 03:46:11

End at: 2018-09-05 03:46:41

Local clock offset: 5.907 ms

Remote clock offset: 3.474 ms

# Below is generated by plot.py at 2018-09-05 03:48:26

# Datalink statistics

-- Total of 3 flows:

Average throughput: 91.16 Mbit/s

95th percentile per-packet one-way delay: 394.997 ms

Loss rate: 2.94%

-- Flow 1:

Average throughput: 55.64 Mbit/s

95th percentile per-packet one-way delay: 388.738 ms

Loss rate: 1.93%

-- Flow 2:

Average throughput: 38.89 Mbit/s

95th percentile per-packet one-way delay: 403.117 ms

Loss rate: 5.03%

-- Flow 3:

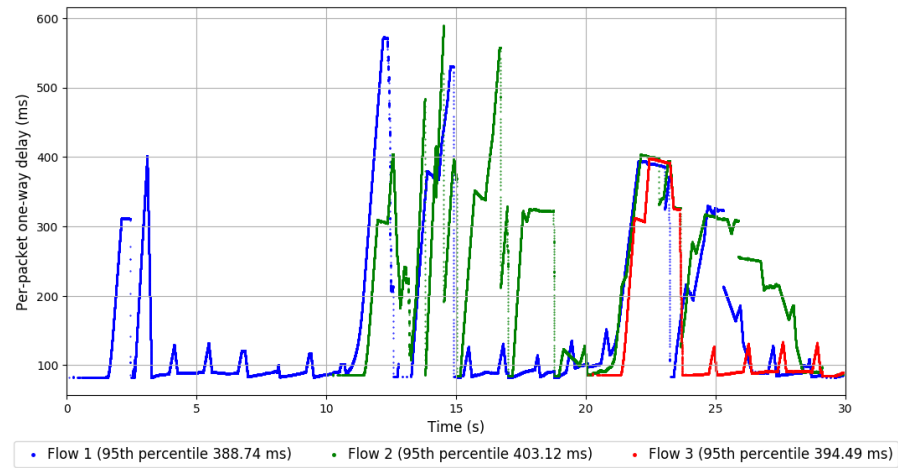
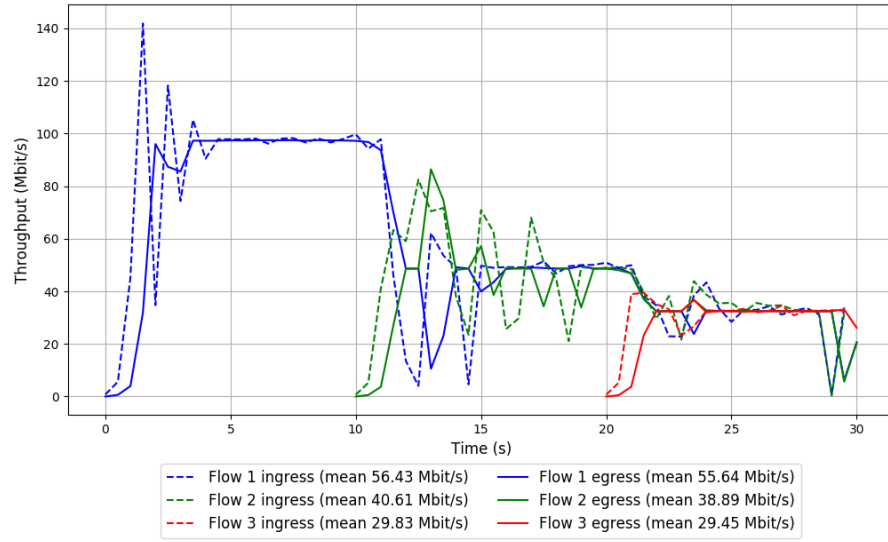
Average throughput: 29.45 Mbit/s

95th percentile per-packet one-way delay: 394.493 ms

Loss rate: 2.91%



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



Run 1: Statistics of TCP Cubic

Start at: 2018-09-05 03:31:41

End at: 2018-09-05 03:32:11

Local clock offset: 2.543 ms

Remote clock offset: 4.894 ms

# Below is generated by plot.py at 2018-09-05 03:48:26

# Datalink statistics

-- Total of 3 flows:

Average throughput: 57.98 Mbit/s

95th percentile per-packet one-way delay: 121.341 ms

Loss rate: 0.93%

-- Flow 1:

Average throughput: 20.54 Mbit/s

95th percentile per-packet one-way delay: 86.878 ms

Loss rate: 0.86%

-- Flow 2:

Average throughput: 39.62 Mbit/s

95th percentile per-packet one-way delay: 152.413 ms

Loss rate: 0.63%

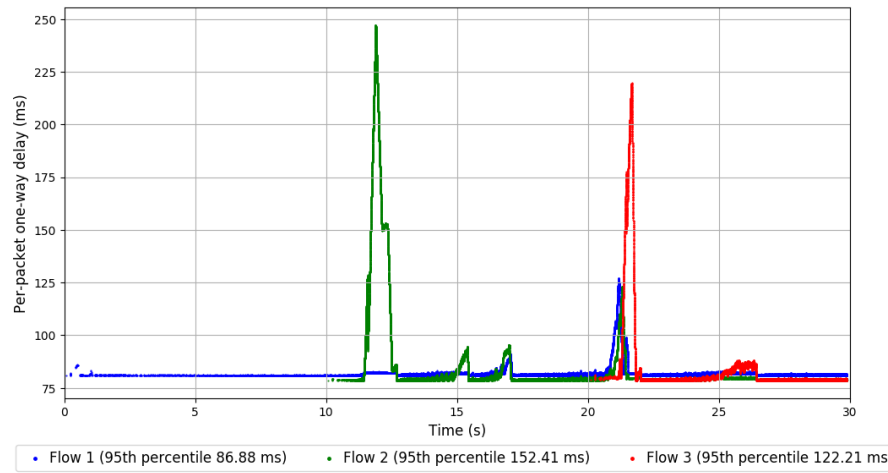
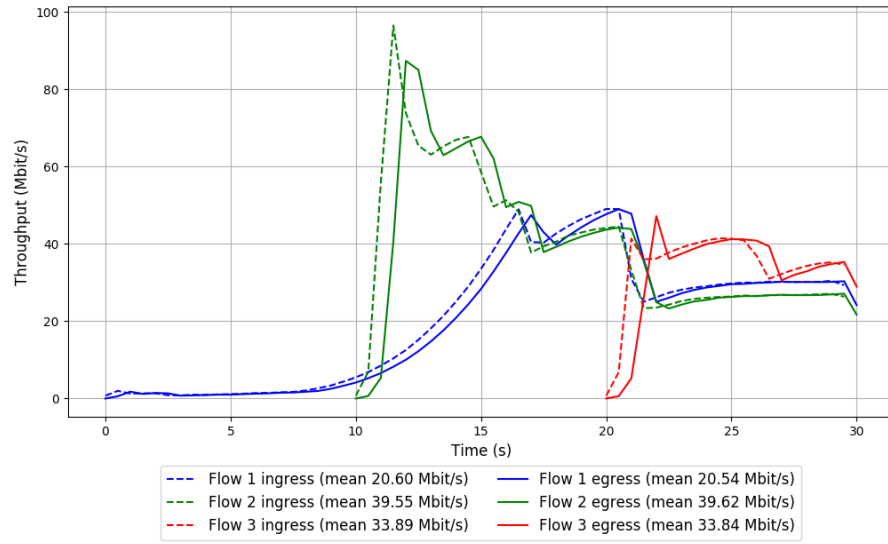
-- Flow 3:

Average throughput: 33.84 Mbit/s

95th percentile per-packet one-way delay: 122.210 ms

Loss rate: 1.76%

## Run 1: Report of TCP Cubic — Data Link



Run 2: Statistics of TCP Cubic

Start at: 2018-09-05 03:37:03

End at: 2018-09-05 03:37:33

Local clock offset: 3.894 ms

Remote clock offset: 7.795 ms

# Below is generated by plot.py at 2018-09-05 03:48:26

# Datalink statistics

-- Total of 3 flows:

Average throughput: 81.18 Mbit/s

95th percentile per-packet one-way delay: 142.038 ms

Loss rate: 0.72%

-- Flow 1:

Average throughput: 44.55 Mbit/s

95th percentile per-packet one-way delay: 156.733 ms

Loss rate: 0.37%

-- Flow 2:

Average throughput: 36.98 Mbit/s

95th percentile per-packet one-way delay: 131.699 ms

Loss rate: 0.72%

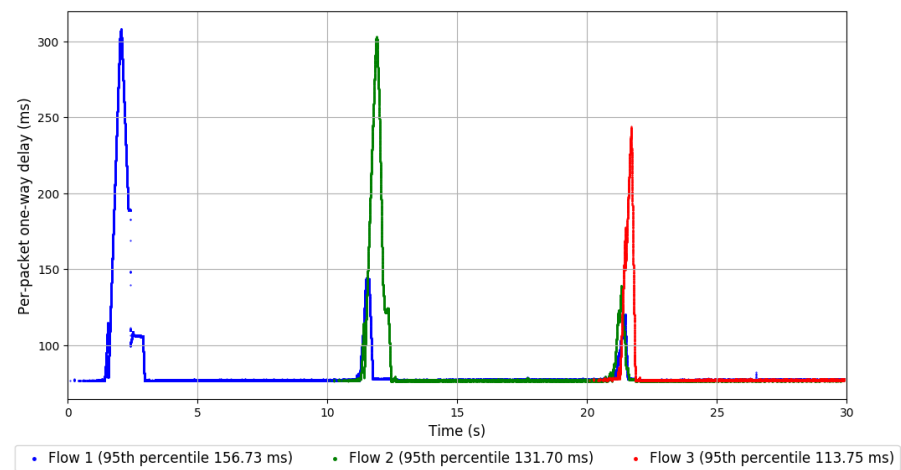
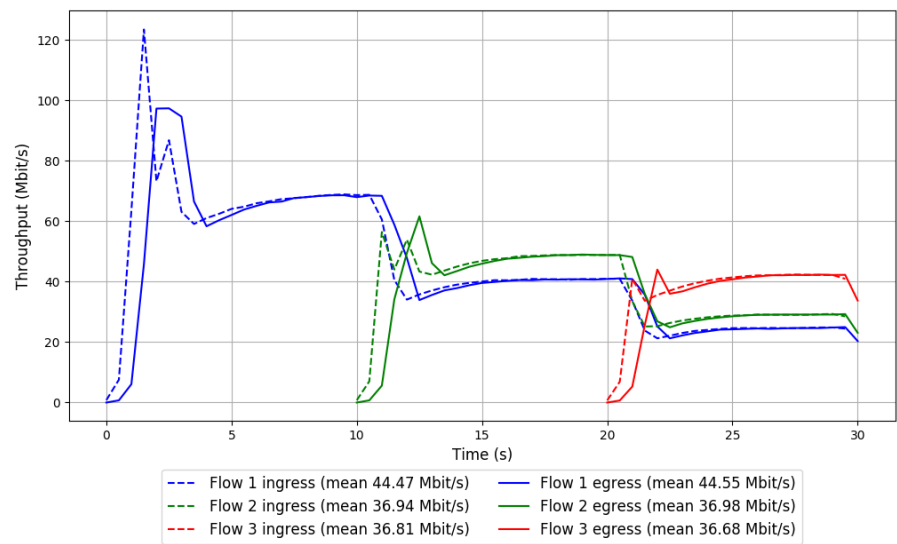
-- Flow 3:

Average throughput: 36.68 Mbit/s

95th percentile per-packet one-way delay: 113.753 ms

Loss rate: 1.98%

Run 2: Report of TCP Cubic — Data Link



Run 3: Statistics of TCP Cubic

Start at: 2018-09-05 03:42:17

End at: 2018-09-05 03:42:47

Local clock offset: 5.36 ms

Remote clock offset: 3.323 ms

# Below is generated by plot.py at 2018-09-05 03:48:26

# Datalink statistics

-- Total of 3 flows:

Average throughput: 66.99 Mbit/s

95th percentile per-packet one-way delay: 177.301 ms

Loss rate: 0.66%

-- Flow 1:

Average throughput: 40.73 Mbit/s

95th percentile per-packet one-way delay: 192.667 ms

Loss rate: 0.31%

-- Flow 2:

Average throughput: 30.30 Mbit/s

95th percentile per-packet one-way delay: 151.458 ms

Loss rate: 0.71%

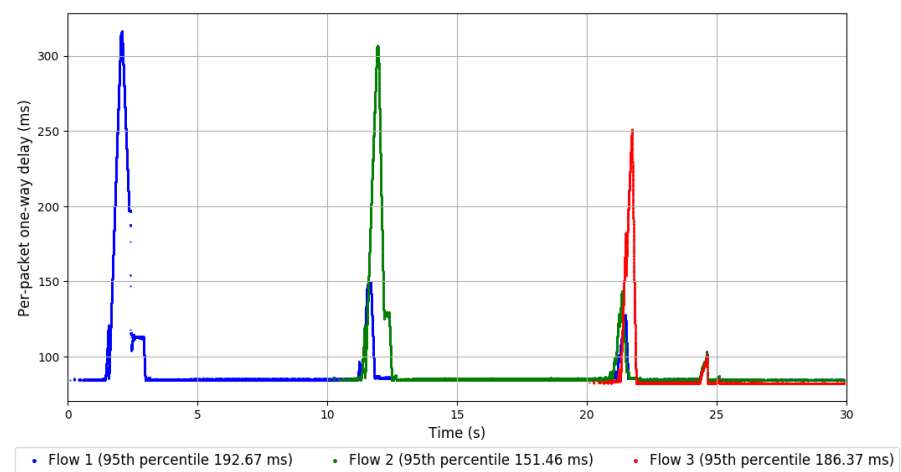
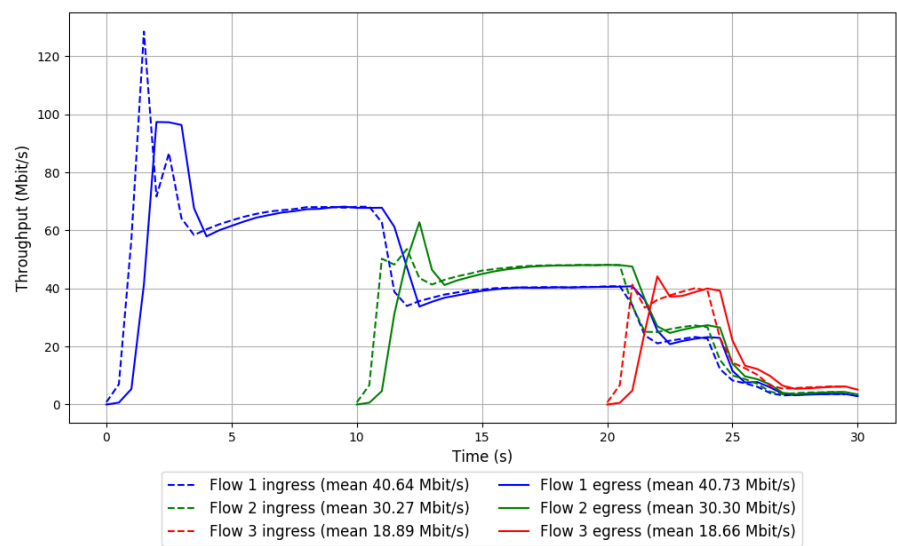
-- Flow 3:

Average throughput: 18.66 Mbit/s

95th percentile per-packet one-way delay: 186.372 ms

Loss rate: 2.83%

Run 3: Report of TCP Cubic — Data Link



Run 1: Statistics of Indigo

Start at: 2018-09-05 03:34:14

End at: 2018-09-05 03:34:44

Local clock offset: 3.222 ms

Remote clock offset: 6.263 ms

# Below is generated by plot.py at 2018-09-05 03:48:28

# Datalink statistics

-- Total of 3 flows:

Average throughput: 92.65 Mbit/s

95th percentile per-packet one-way delay: 365.554 ms

Loss rate: 5.91%

-- Flow 1:

Average throughput: 58.26 Mbit/s

95th percentile per-packet one-way delay: 376.239 ms

Loss rate: 7.34%

-- Flow 2:

Average throughput: 38.23 Mbit/s

95th percentile per-packet one-way delay: 128.194 ms

Loss rate: 2.38%

-- Flow 3:

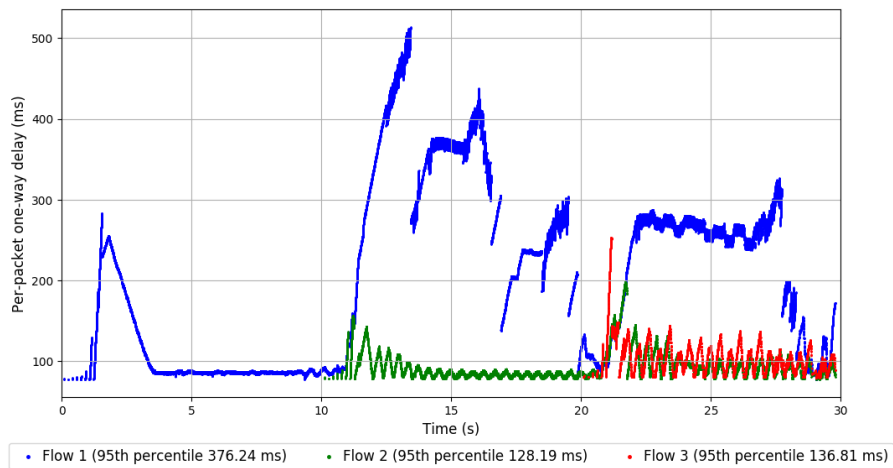
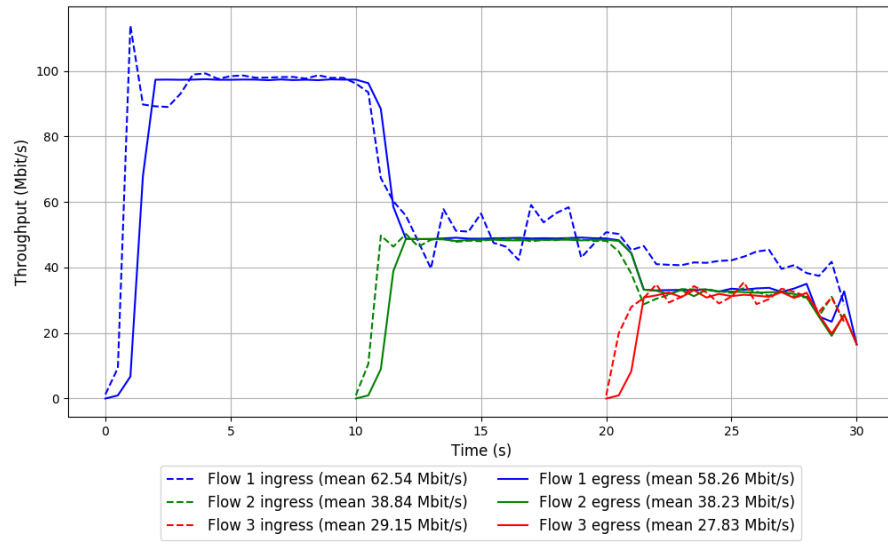
Average throughput: 27.83 Mbit/s

95th percentile per-packet one-way delay: 136.813 ms

Loss rate: 6.10%



## Run 1: Report of Indigo — Data Link



Run 2: Statistics of Indigo

Start at: 2018-09-05 03:39:38

End at: 2018-09-05 03:40:08

Local clock offset: 5.1 ms

Remote clock offset: 3.17 ms

# Below is generated by plot.py at 2018-09-05 03:48:28

# Datalink statistics

-- Total of 3 flows:

Average throughput: 90.24 Mbit/s

95th percentile per-packet one-way delay: 362.822 ms

Loss rate: 5.78%

-- Flow 1:

Average throughput: 55.60 Mbit/s

95th percentile per-packet one-way delay: 404.782 ms

Loss rate: 7.06%

-- Flow 2:

Average throughput: 37.71 Mbit/s

95th percentile per-packet one-way delay: 134.489 ms

Loss rate: 4.20%

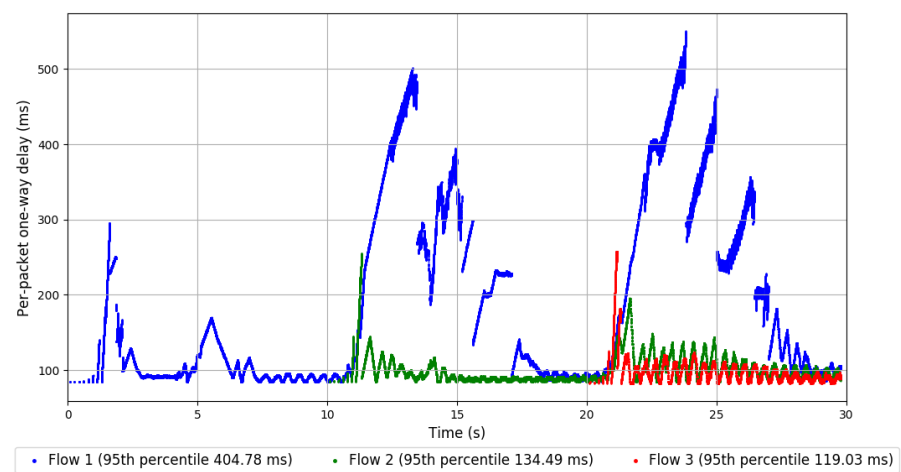
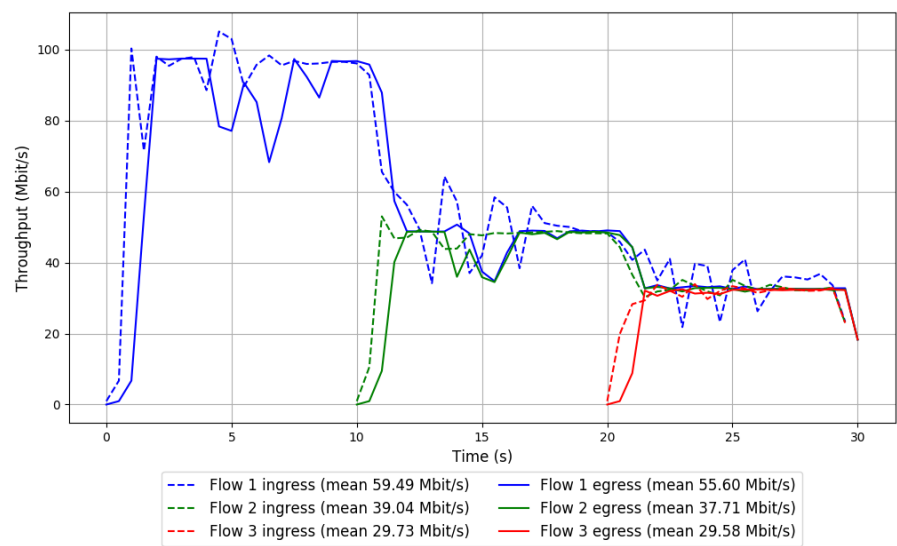
-- Flow 3:

Average throughput: 29.58 Mbit/s

95th percentile per-packet one-way delay: 119.033 ms

Loss rate: 2.15%

Run 2: Report of Indigo — Data Link



Run 3: Statistics of Indigo

Start at: 2018-09-05 03:44:51

End at: 2018-09-05 03:45:21

Local clock offset: 4.912 ms

Remote clock offset: 2.365 ms

# Below is generated by plot.py at 2018-09-05 03:48:49

# Datalink statistics

-- Total of 3 flows:

Average throughput: 93.91 Mbit/s

95th percentile per-packet one-way delay: 408.131 ms

Loss rate: 5.39%

-- Flow 1:

Average throughput: 58.52 Mbit/s

95th percentile per-packet one-way delay: 440.215 ms

Loss rate: 7.37%

-- Flow 2:

Average throughput: 38.68 Mbit/s

95th percentile per-packet one-way delay: 136.649 ms

Loss rate: 1.12%

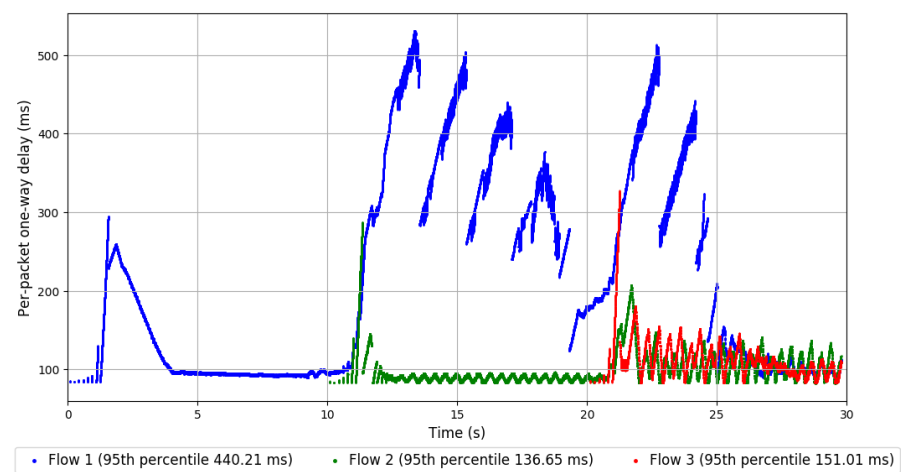
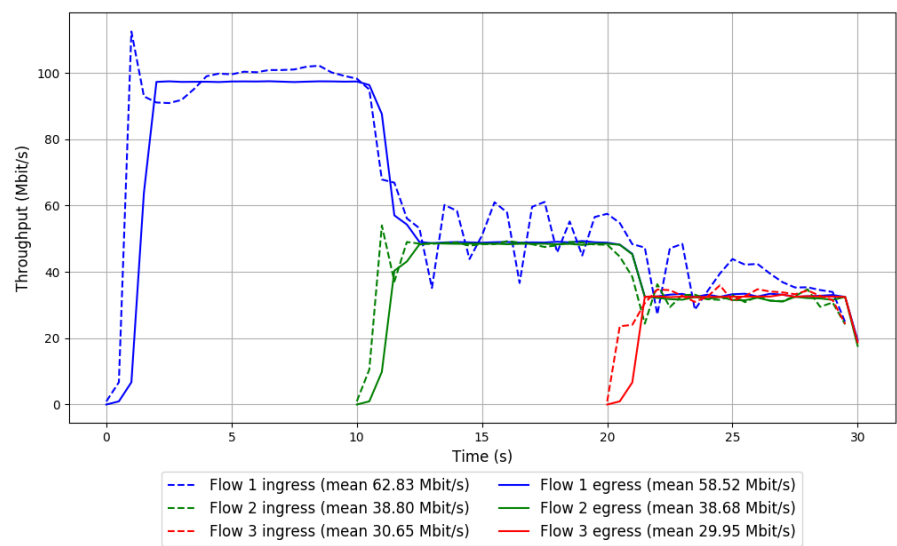
-- Flow 3:

Average throughput: 29.95 Mbit/s

95th percentile per-packet one-way delay: 151.008 ms

Loss rate: 3.92%

Run 3: Report of Indigo — Data Link

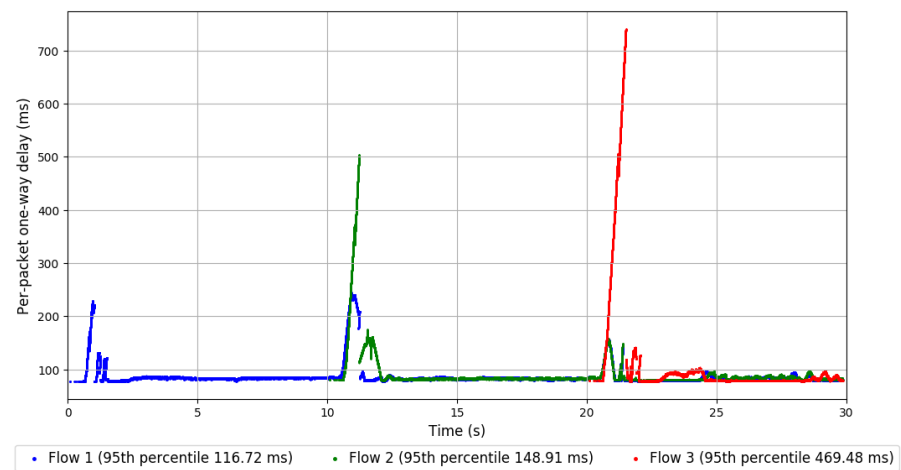
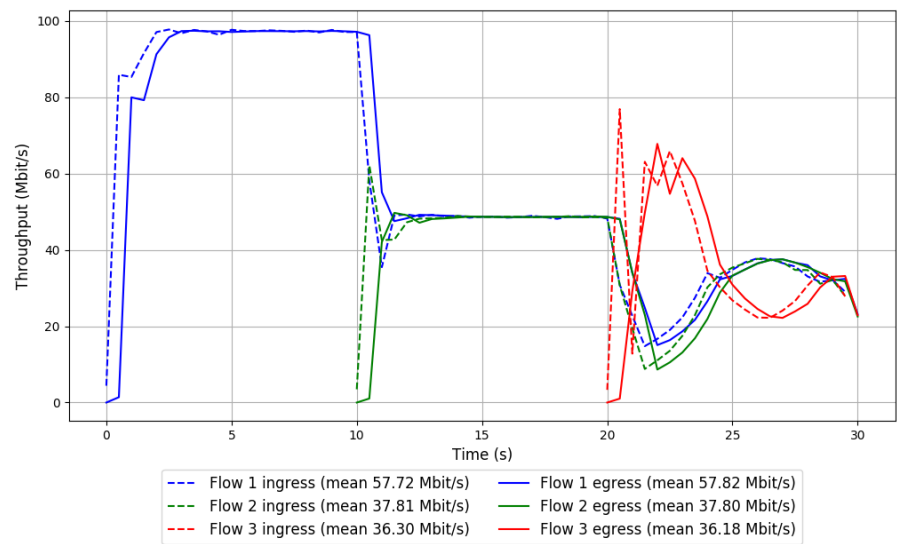


```
Run 1: Statistics of Muses-25

Start at: 2018-09-05 03:32:57
End at: 2018-09-05 03:33:27
Local clock offset: 2.852 ms
Remote clock offset: 6.207 ms

# Below is generated by plot.py at 2018-09-05 03:48:53
# Datalink statistics
-- Total of 3 flows:
Average throughput: 94.77 Mbit/s
95th percentile per-packet one-way delay: 140.341 ms
Loss rate: 0.69%
-- Flow 1:
Average throughput: 57.82 Mbit/s
95th percentile per-packet one-way delay: 116.719 ms
Loss rate: 0.37%
-- Flow 2:
Average throughput: 37.80 Mbit/s
95th percentile per-packet one-way delay: 148.914 ms
Loss rate: 0.84%
-- Flow 3:
Average throughput: 36.18 Mbit/s
95th percentile per-packet one-way delay: 469.481 ms
Loss rate: 1.95%
```

Run 1: Report of Muses-25 — Data Link



Run 2: Statistics of Muses-25

Start at: 2018-09-05 03:38:20

End at: 2018-09-05 03:38:50

Local clock offset: 4.89 ms

Remote clock offset: 6.801 ms

# Below is generated by plot.py at 2018-09-05 03:48:53

# Datalink statistics

-- Total of 3 flows:

Average throughput: 87.51 Mbit/s

95th percentile per-packet one-way delay: 136.074 ms

Loss rate: 1.52%

-- Flow 1:

Average throughput: 51.91 Mbit/s

95th percentile per-packet one-way delay: 120.551 ms

Loss rate: 0.59%

-- Flow 2:

Average throughput: 30.16 Mbit/s

95th percentile per-packet one-way delay: 137.912 ms

Loss rate: 1.21%

-- Flow 3:

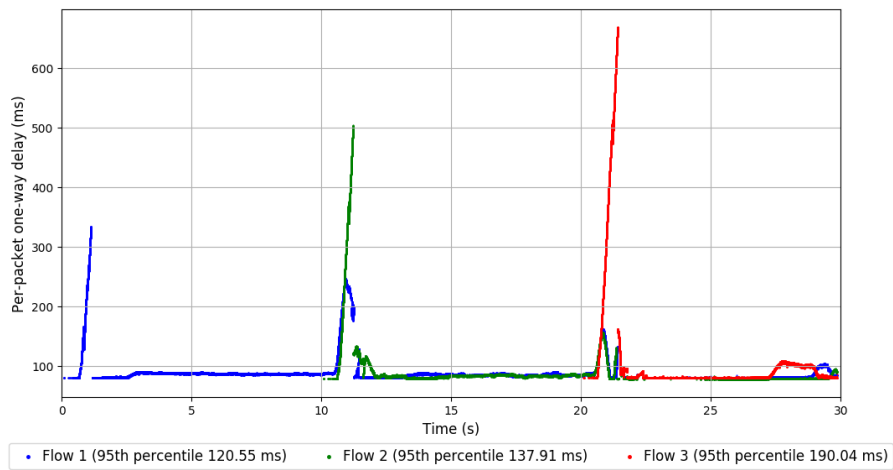
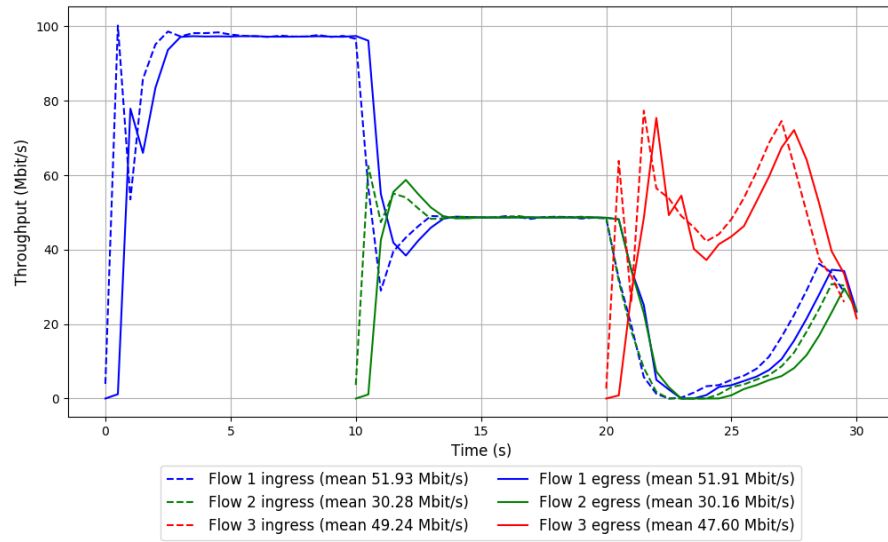
Average throughput: 47.60 Mbit/s

95th percentile per-packet one-way delay: 190.037 ms

Loss rate: 4.87%



## Run 2: Report of Muses-25 — Data Link



Run 3: Statistics of Muses-25

Start at: 2018-09-05 03:43:33

End at: 2018-09-05 03:44:03

Local clock offset: 4.775 ms

Remote clock offset: 8.273 ms

# Below is generated by plot.py at 2018-09-05 03:48:54

# Datalink statistics

-- Total of 3 flows:

Average throughput: 88.06 Mbit/s

95th percentile per-packet one-way delay: 136.650 ms

Loss rate: 1.06%

-- Flow 1:

Average throughput: 50.21 Mbit/s

95th percentile per-packet one-way delay: 87.404 ms

Loss rate: 0.89%

-- Flow 2:

Average throughput: 39.92 Mbit/s

95th percentile per-packet one-way delay: 185.611 ms

Loss rate: 0.82%

-- Flow 3:

Average throughput: 34.71 Mbit/s

95th percentile per-packet one-way delay: 482.645 ms

Loss rate: 2.33%

### Run 3: Report of Muses-25 — Data Link

