

## Pantheon Report

Generated at 2018-09-05 06:48:29 (UTC).

Data path: GCE Sydney on **ens4** (*local*) → GCE Tokyo on **ens4** (*remote*).

Repeated the test of 4 congestion control schemes twice.

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

NTP offsets were measured against `time.google.com` and have been applied to correct the timestamps in logs.

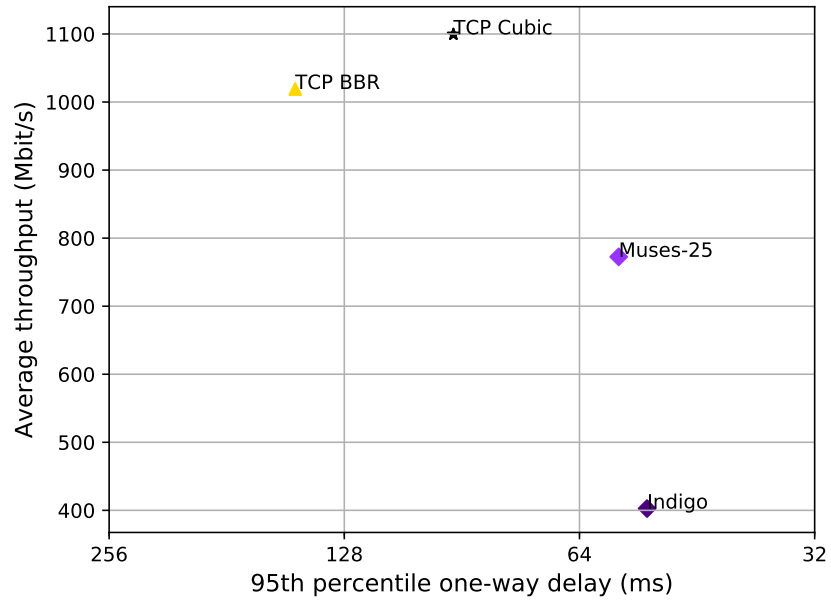
### System info:

```
Linux 4.15.0-1018-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
net.ipv4.tcp_mem = 536870912 536870912 536870912
```

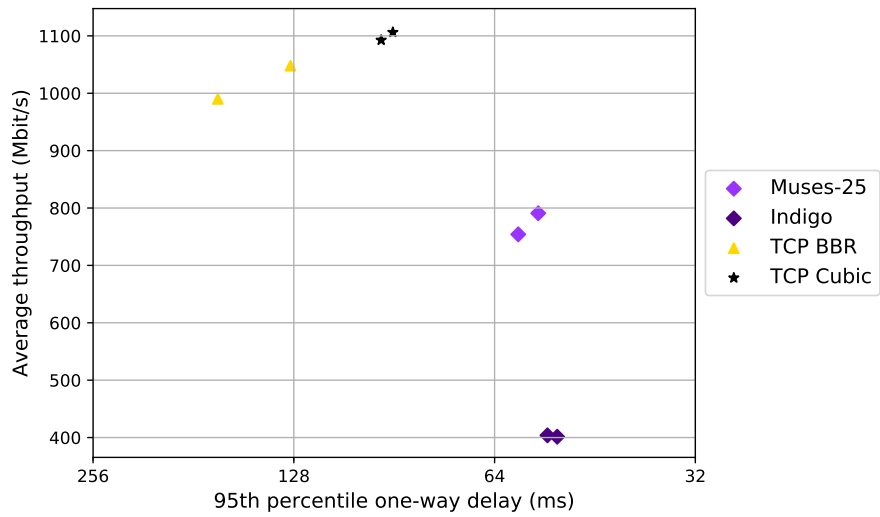
### Git summary:

```
branch: muses @ 71e71e9a55b945431a7dea72180c1c9381097db9
third_party/fillp @ d47f4fa1b454a5e3c0537115c5a28436dbd4b834
third_party/fillp-sheep @ daed0c84f98531712514b2231f43ec6901114ffe
third_party/genericCC @ d0153f8e594aa89e93b032143cedbdf58e562f4
third_party/indigo @ 2601c92e4aa9d58d38dc4dfe0ecd90c077e64d
third_party/libutp @ b3465b942e2826f2b179eaab4a906ce6bb7cf3cf
third_party/muses @ 96fbc95fb38373d71fbc80c5a105e62e7636623b
third_party/pantheon-tunnel @ cbfce6db5ff5740d4fe1771f813cd646339e1952
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 @ 77961f1a82733a86b42f1bc8143ebc978f3cfff42
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 GCE Sydney to GCE Tokyo, 2 runs of 30s each per scheme  
 3 flows with 10s interval between flows (mean of all runs by scheme)



test from GCE Sydney to GCE Tokyo, 2 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	2	546.99	503.49	412.31	152.49	122.69	154.35	0.80	0.10	0.62
TCP Cubic	2	585.38	548.15	448.72	86.11	97.09	70.36	0.00	0.09	0.00
Indigo	2	214.86	196.59	176.52	51.55	49.95	53.53	0.00	0.00	0.01
Muses-25	2	407.99	381.78	341.35	57.90	53.84	56.16	0.00	0.00	0.00

Run 1: Statistics of TCP BBR

Start at: 2018-09-05 06:16:13

End at: 2018-09-05 06:16:43

Local clock offset: -0.054 ms

Remote clock offset: 0.007 ms

# Below is generated by plot.py at 2018-09-05 06:47:52

# Datalink statistics

-- Total of 3 flows:

Average throughput: 990.20 Mbit/s

95th percentile per-packet one-way delay: 166.367 ms

Loss rate: 0.69%

-- Flow 1:

Average throughput: 528.11 Mbit/s

95th percentile per-packet one-way delay: 182.363 ms

Loss rate: 0.98%

-- Flow 2:

Average throughput: 479.07 Mbit/s

95th percentile per-packet one-way delay: 104.268 ms

Loss rate: 0.00%

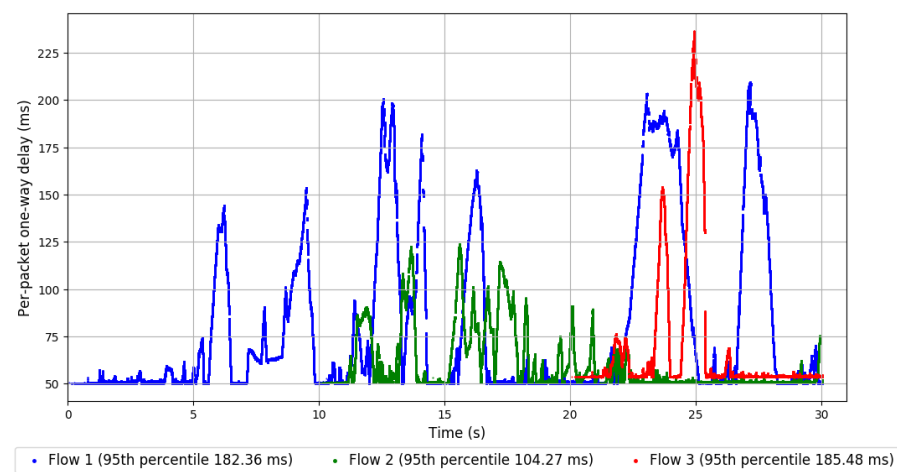
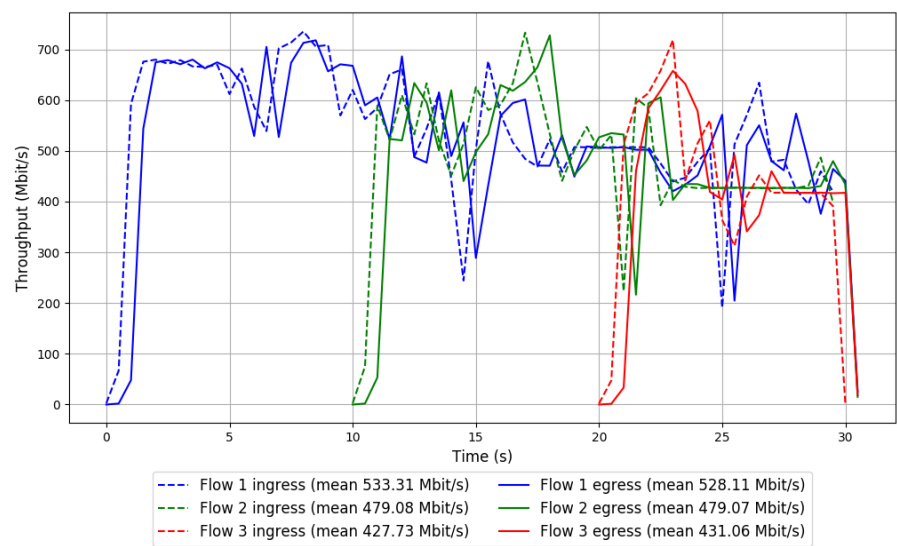
-- Flow 3:

Average throughput: 431.06 Mbit/s

95th percentile per-packet one-way delay: 185.476 ms

Loss rate: 1.18%

Run 1: Report of TCP BBR — Data Link



Run 2: Statistics of TCP BBR

Start at: 2018-09-05 06:24:00

End at: 2018-09-05 06:24:30

Local clock offset: -0.131 ms

Remote clock offset: 0.026 ms

# Below is generated by plot.py at 2018-09-05 06:48:08

# Datalink statistics

-- Total of 3 flows:

Average throughput: 1048.05 Mbit/s

95th percentile per-packet one-way delay: 129.493 ms

Loss rate: 0.42%

-- Flow 1:

Average throughput: 565.87 Mbit/s

95th percentile per-packet one-way delay: 122.613 ms

Loss rate: 0.63%

-- Flow 2:

Average throughput: 527.91 Mbit/s

95th percentile per-packet one-way delay: 141.108 ms

Loss rate: 0.20%

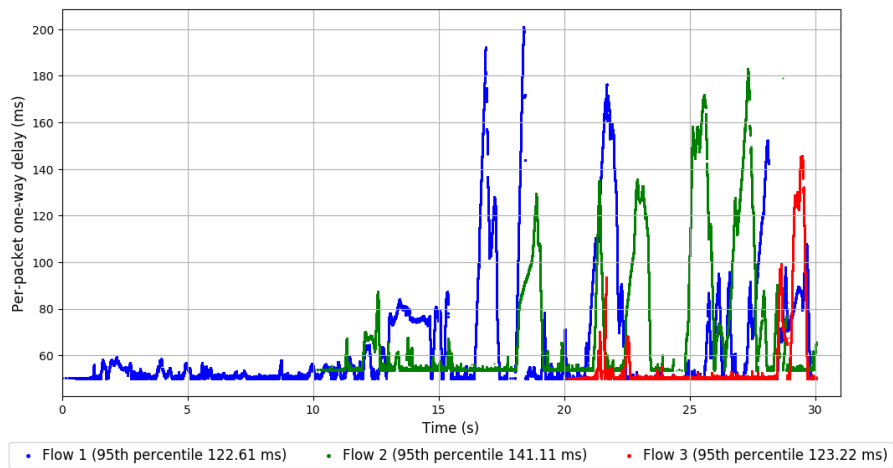
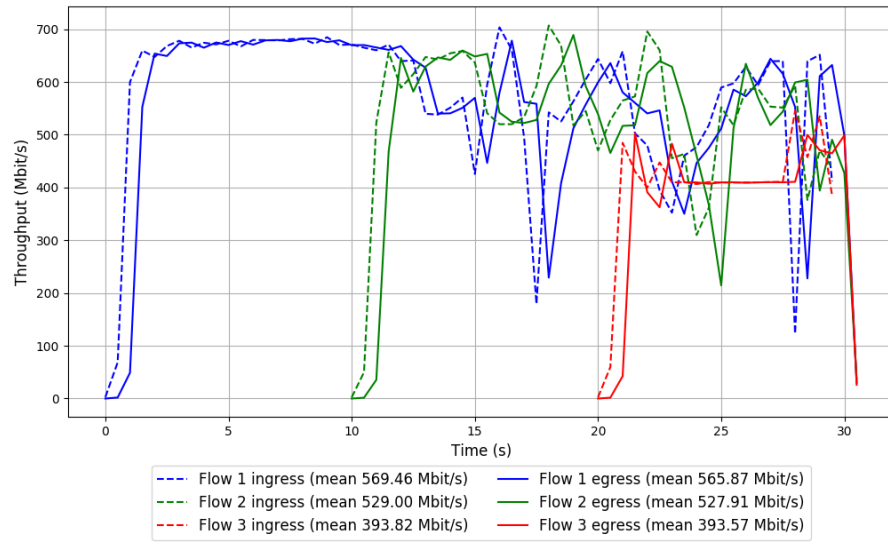
-- Flow 3:

Average throughput: 393.57 Mbit/s

95th percentile per-packet one-way delay: 123.225 ms

Loss rate: 0.07%

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



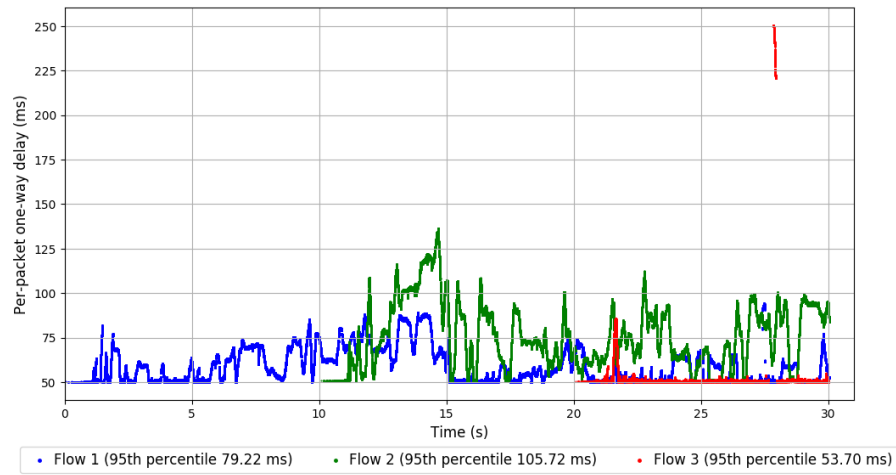
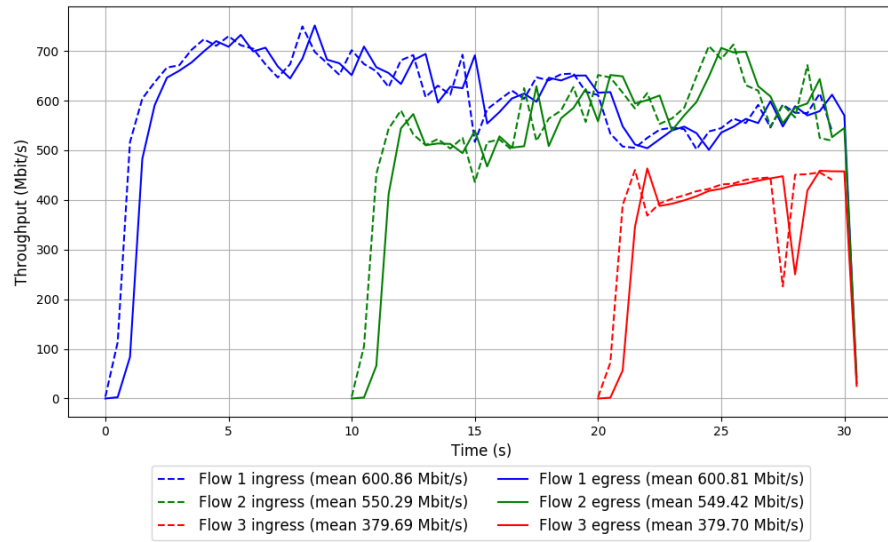
Run 1: Statistics of TCP Cubic

Start at: 2018-09-05 06:20:07  
End at: 2018-09-05 06:20:37  
Local clock offset: -0.331 ms  
Remote clock offset: -0.026 ms

# Below is generated by plot.py at 2018-09-05 06:48:23  
# Datalink statistics  
-- Total of 3 flows:  
Average throughput: 1092.65 Mbit/s  
95th percentile per-packet one-way delay: 94.668 ms  
Loss rate: 0.05%  
-- Flow 1:  
Average throughput: 600.81 Mbit/s  
95th percentile per-packet one-way delay: 79.222 ms  
Loss rate: 0.00%  
-- Flow 2:  
Average throughput: 549.42 Mbit/s  
95th percentile per-packet one-way delay: 105.717 ms  
Loss rate: 0.14%  
-- Flow 3:  
Average throughput: 379.70 Mbit/s  
95th percentile per-packet one-way delay: 53.695 ms  
Loss rate: 0.00%



# Run 1: Report of TCP Cubic — Data Link



Run 2: Statistics of TCP Cubic

Start at: 2018-09-05 06:27:55

End at: 2018-09-05 06:28:25

Local clock offset: -0.14 ms

Remote clock offset: 0.065 ms

# Below is generated by plot.py at 2018-09-05 06:48:26

# Datalink statistics

-- Total of 3 flows:

Average throughput: 1106.21 Mbit/s

95th percentile per-packet one-way delay: 90.942 ms

Loss rate: 0.01%

-- Flow 1:

Average throughput: 569.96 Mbit/s

95th percentile per-packet one-way delay: 92.999 ms

Loss rate: 0.00%

-- Flow 2:

Average throughput: 546.88 Mbit/s

95th percentile per-packet one-way delay: 88.469 ms

Loss rate: 0.03%

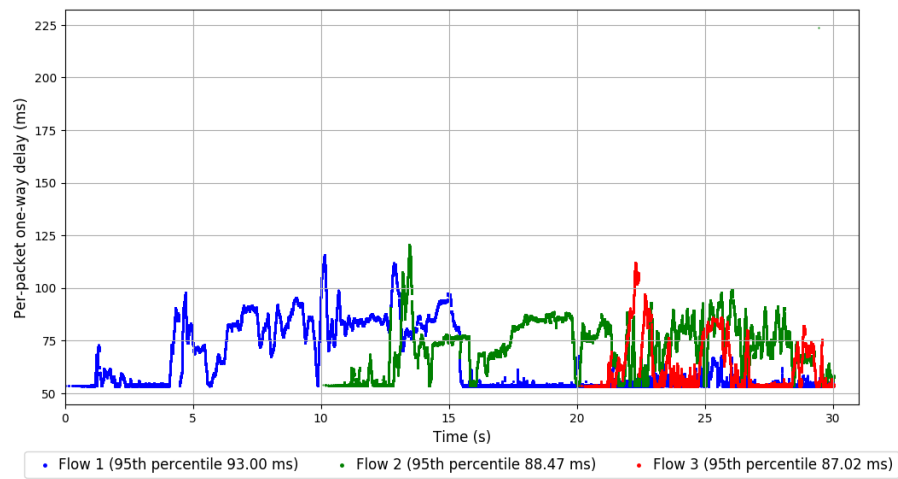
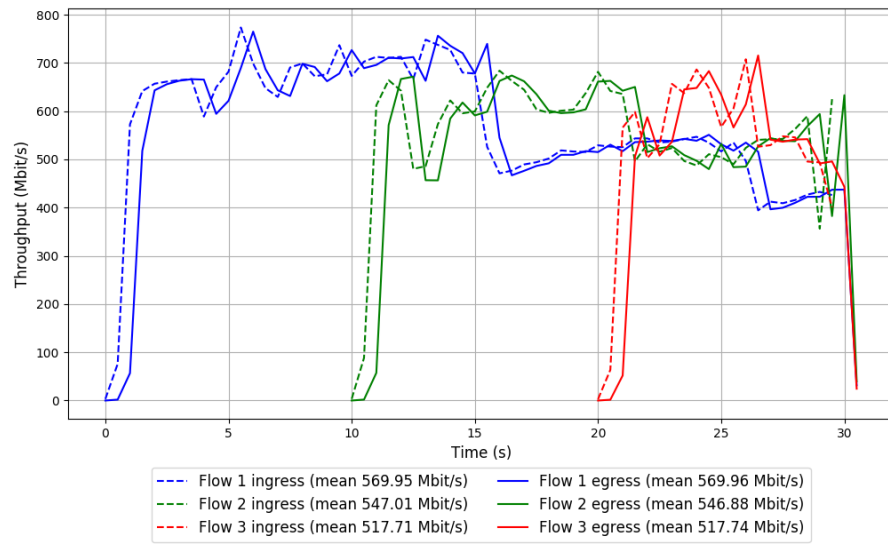
-- Flow 3:

Average throughput: 517.74 Mbit/s

95th percentile per-packet one-way delay: 87.018 ms

Loss rate: 0.00%

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

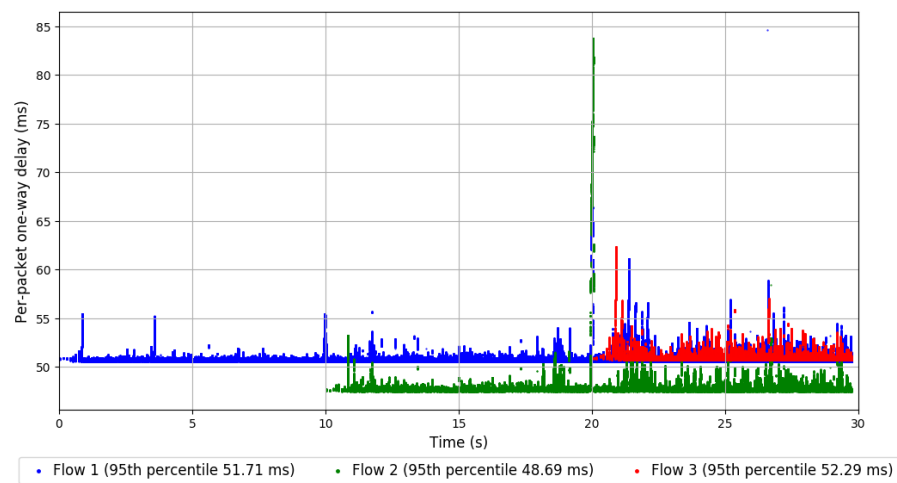
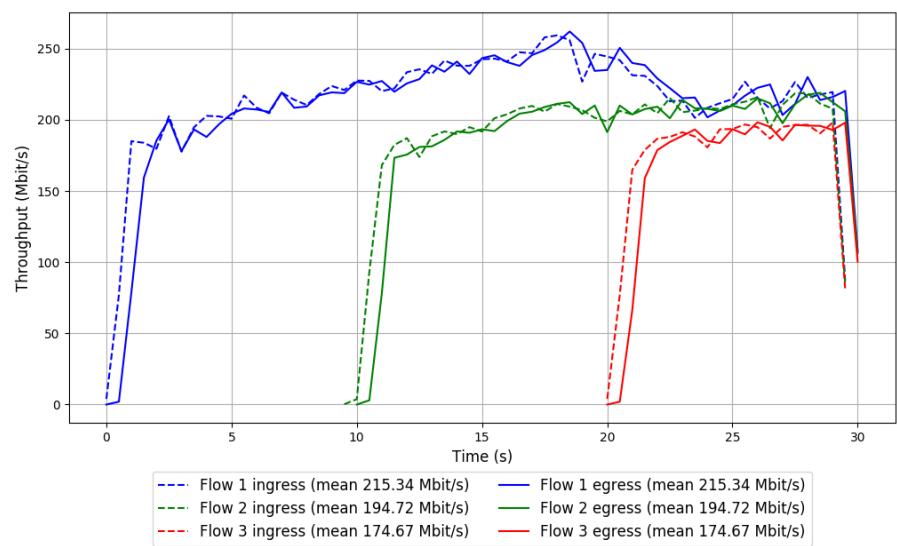


Run 1: Statistics of Indigo

Start at: 2018-09-05 06:22:13  
End at: 2018-09-05 06:22:43  
Local clock offset: -0.189 ms  
Remote clock offset: -2.893 ms

# Below is generated by plot.py at 2018-09-05 06:48:26  
# Datalink statistics  
-- Total of 3 flows:  
Average throughput: 401.43 Mbit/s  
95th percentile per-packet one-way delay: 51.560 ms  
Loss rate: 0.00%  
-- Flow 1:  
Average throughput: 215.34 Mbit/s  
95th percentile per-packet one-way delay: 51.714 ms  
Loss rate: 0.00%  
-- Flow 2:  
Average throughput: 194.72 Mbit/s  
95th percentile per-packet one-way delay: 48.691 ms  
Loss rate: 0.00%  
-- Flow 3:  
Average throughput: 174.67 Mbit/s  
95th percentile per-packet one-way delay: 52.291 ms  
Loss rate: 0.00%

Run 1: Report of Indigo — Data Link

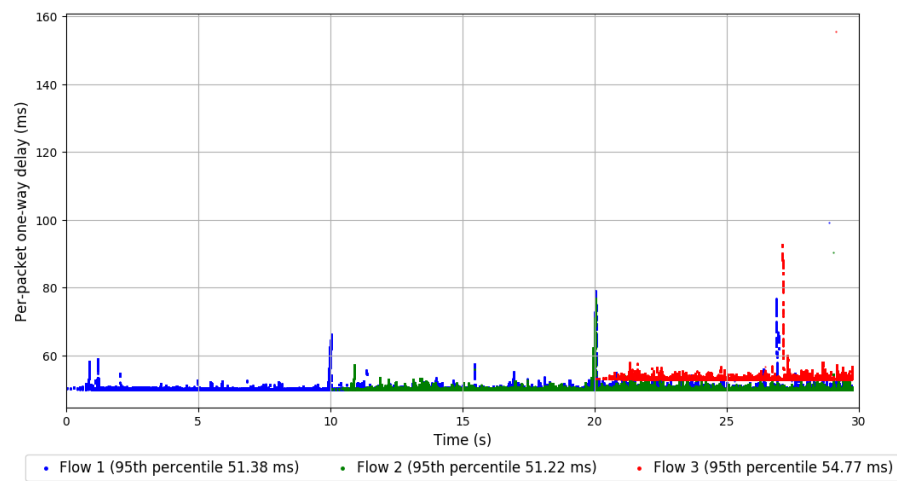
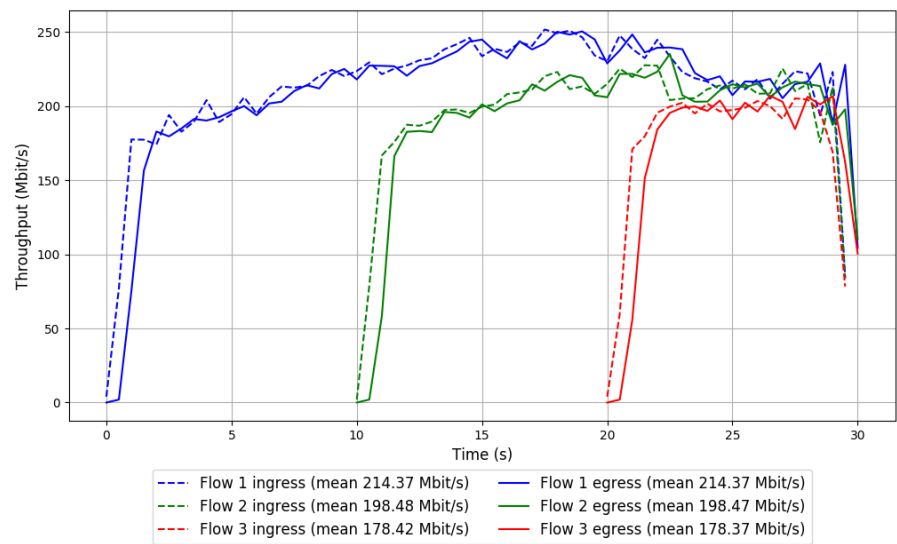


Run 2: Statistics of Indigo

Start at: 2018-09-05 06:30:01  
End at: 2018-09-05 06:30:31  
Local clock offset: 0.057 ms  
Remote clock offset: -0.038 ms

# Below is generated by plot.py at 2018-09-05 06:48:26  
# Datalink statistics  
-- Total of 3 flows:  
Average throughput: 403.83 Mbit/s  
95th percentile per-packet one-way delay: 53.324 ms  
Loss rate: 0.00%  
-- Flow 1:  
Average throughput: 214.37 Mbit/s  
95th percentile per-packet one-way delay: 51.381 ms  
Loss rate: 0.00%  
-- Flow 2:  
Average throughput: 198.47 Mbit/s  
95th percentile per-packet one-way delay: 51.215 ms  
Loss rate: 0.00%  
-- Flow 3:  
Average throughput: 178.37 Mbit/s  
95th percentile per-packet one-way delay: 54.767 ms  
Loss rate: 0.02%

Run 2: Report of Indigo — Data Link



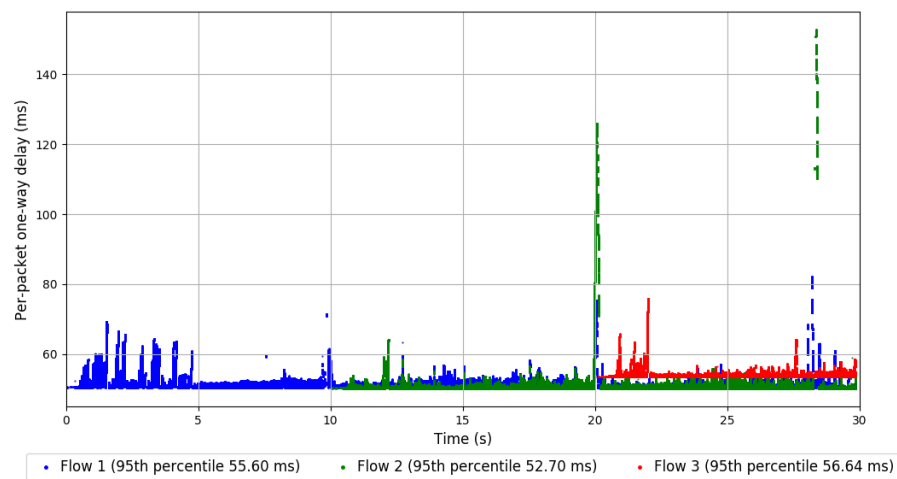
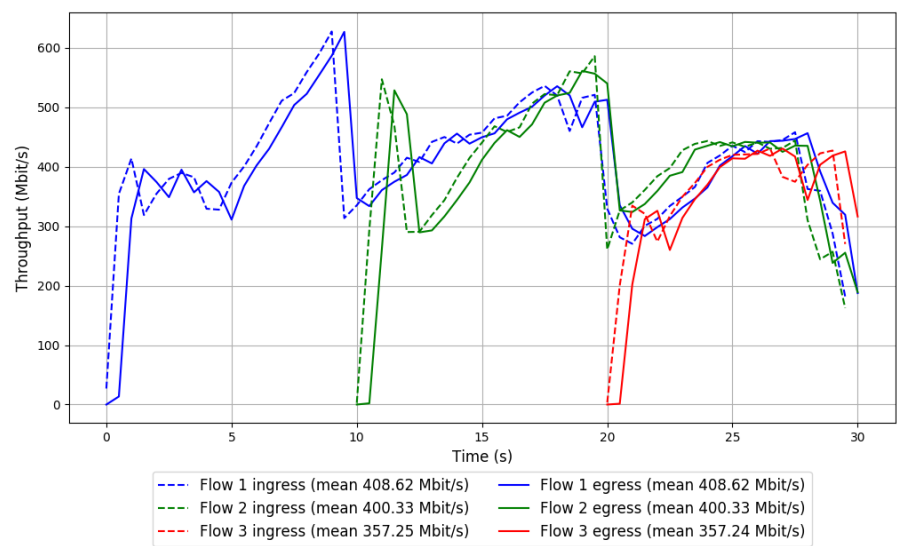
```
Run 1: Statistics of Muses-25

Start at: 2018-09-05 06:18:18
End at: 2018-09-05 06:18:48
Local clock offset: 0.057 ms
Remote clock offset: 0.188 ms

# Below is generated by plot.py at 2018-09-05 06:48:26
# Datalink statistics
-- Total of 3 flows:
Average throughput: 790.91 Mbit/s
95th percentile per-packet one-way delay: 55.045 ms
Loss rate: 0.00%
-- Flow 1:
Average throughput: 408.62 Mbit/s
95th percentile per-packet one-way delay: 55.597 ms
Loss rate: 0.00%
-- Flow 2:
Average throughput: 400.33 Mbit/s
95th percentile per-packet one-way delay: 52.698 ms
Loss rate: 0.00%
-- Flow 3:
Average throughput: 357.24 Mbit/s
95th percentile per-packet one-way delay: 56.638 ms
Loss rate: 0.00%
```



Run 1: Report of Muses-25 — Data Link



Run 2: Statistics of Muses-25

Start at: 2018-09-05 06:26:07

End at: 2018-09-05 06:26:37

Local clock offset: -0.09 ms

Remote clock offset: 0.001 ms

# Below is generated by plot.py at 2018-09-05 06:48:26

# Datalink statistics

-- Total of 3 flows:

Average throughput: 754.13 Mbit/s

95th percentile per-packet one-way delay: 58.982 ms

Loss rate: 0.00%

-- Flow 1:

Average throughput: 407.35 Mbit/s

95th percentile per-packet one-way delay: 60.195 ms

Loss rate: 0.00%

-- Flow 2:

Average throughput: 363.24 Mbit/s

95th percentile per-packet one-way delay: 54.988 ms

Loss rate: 0.00%

-- Flow 3:

Average throughput: 325.45 Mbit/s

95th percentile per-packet one-way delay: 55.676 ms

Loss rate: 0.00%

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

