Pantheon Report

Generated at 2018-09-05 03:57:59 (UTC).

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

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.
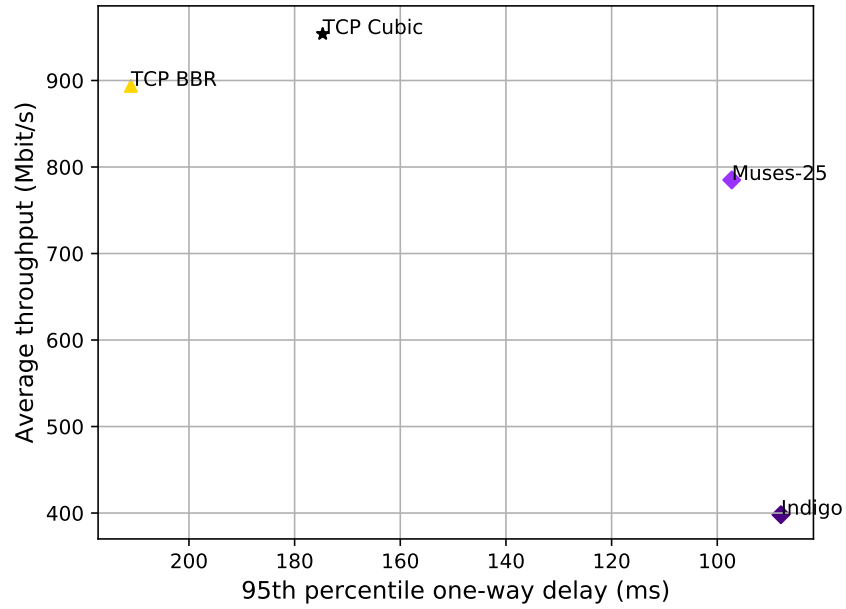
```
System info:
Linux 4.15.0-1018-gcp
net.core.default_qdisc = fq
net.core.rmem_default = 16777216
net.core.rmem_max = 536870912
net.core.wmem_default = 16777216
net.core.wmem_max = 536870912
net.ipv4.tcp_rmem = 4096 16777216 536870912
net.ipv4.tcp_wmem = 4096 16777216 536870912
net.ipv4.tcp_mem = 536870912 536870912 536870912
```
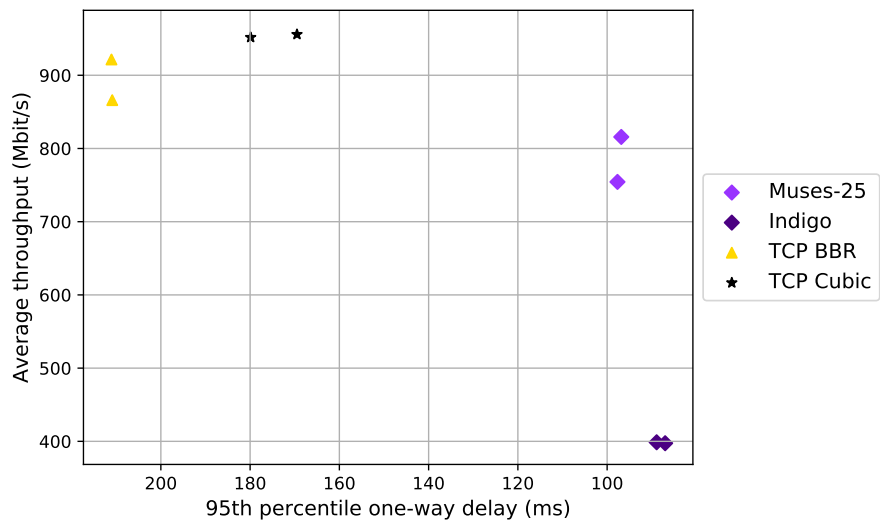
```
Git summary:
branch: muses @ 71e71e9a55b945431a7dea72180c1c9381097db9
third_party/fillp @ d47f4fa1b454a5e3c0537115c5a28436dbd4b834
third_party/fillp-sheep @ daed0c84f98531712514b2231f43ec6901114ffe
third_party/genericCC @ d0153f8e594aa89e93b032143cedbdfe58e562f4
third_party/indigo @ 2601c92e4aa9d58d38dc4dfe0ecdbf90c077e64d
third_party/libutp @ b3465b942e2826f2b179eaab4a906ce6bb7cf3cf
third_party/muses @ 96fbc95fb38373d71fbc80c5a105e62e7636623b
third_party/pantheon-tunnel @ cbfce6db5ff5740dafe1771f813cd646339e1952
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 GCE Iowa to GCE Sydney, 2 runs of 30s each per scheme
3 flows with 10s interval between flows (mean of all runs by scheme)

test from GCE Iowa to GCE Sydney, 2 runs of 30s each per scheme
3 flows with 10s interval between flows

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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	490.94	415.78	385.88	205.95	194.96	220.03	3.44	1.88	5.91
TCP Cubic	2	504.34	483.13	391.54	148.22	157.29	136.55	0.68	0.94	2.57
Indigo	2	209.63	204.22	166.02	87.52	88.81	88.22	0.59	0.90	2.17
Muses-25	2	434.31	355.65	353.50	96.47	99.55	95.84	0.49	0.94	1.36

```
Run 1: Statistics of TCP BBR

Start at: 2018-09-05 03:29:56
End at: 2018-09-05 03:30:26
Local clock offset: 4.239 ms
Remote clock offset: 1.171 ms


# Below is generated by plot.py at 2018-09-05 03:57:51
# Datalink statistics
-- Total of 3 flows:
Average throughput: 921.56 Mbit/s
95th percentile per-packet one-way delay: 211.066 ms
Loss rate: 4.07%
-- Flow 1:
Average throughput: 498.09 Mbit/s
95th percentile per-packet one-way delay: 215.815 ms
Loss rate: 4.91%
-- Flow 2:
Average throughput: 438.86 Mbit/s
95th percentile per-packet one-way delay: 199.593 ms
Loss rate: 1.86%
-- Flow 3:
Average throughput: 401.70 Mbit/s
95th percentile per-packet one-way delay: 206.419 ms
Loss rate: 5.61%
```
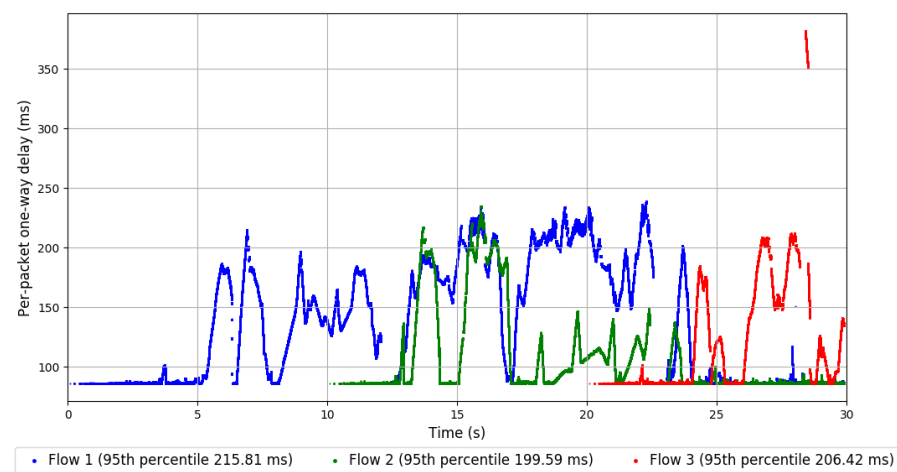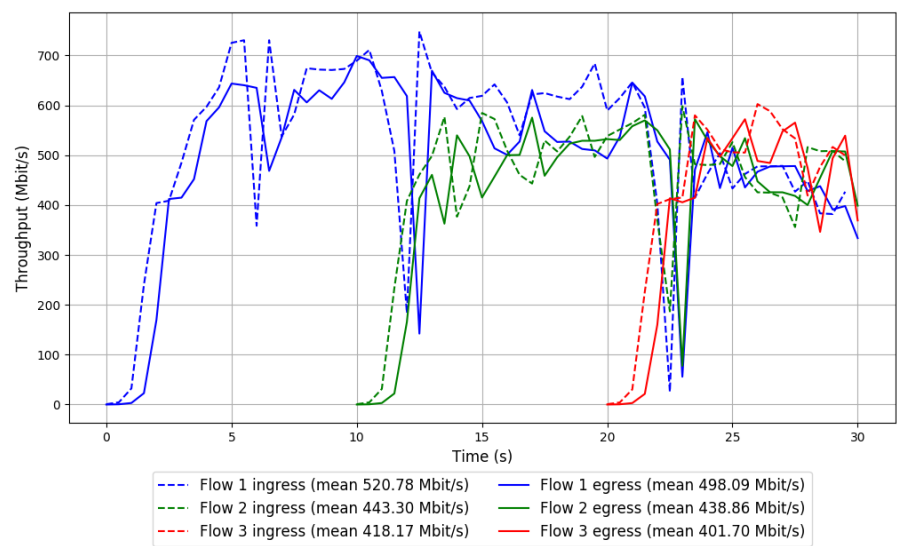
Run 1: Report of TCP BBR — Data Link

```
Run 2: Statistics of TCP BBR

Start at: 2018-09-05 03:38:05
End at: 2018-09-05 03:38:35
Local clock offset: 2.211 ms
Remote clock offset: 0.774 ms


# Below is generated by plot.py at 2018-09-05 03:57:51
# Datalink statistics
-- Total of 3 flows:
Average throughput: 866.02 Mbit/s
95th percentile per-packet one-way delay: 210.896 ms
Loss rate: 2.57%
-- Flow 1:
Average throughput: 483.79 Mbit/s
95th percentile per-packet one-way delay: 196.089 ms
Loss rate: 1.97%
-- Flow 2:
Average throughput: 392.71 Mbit/s
95th percentile per-packet one-way delay: 190.323 ms
Loss rate: 1.90%
-- Flow 3:
Average throughput: 370.06 Mbit/s
95th percentile per-packet one-way delay: 233.631 ms
Loss rate: 6.20%
```
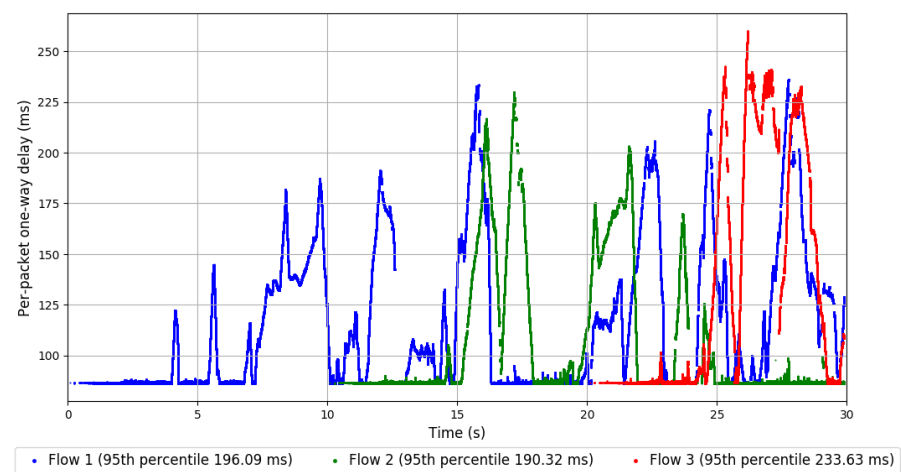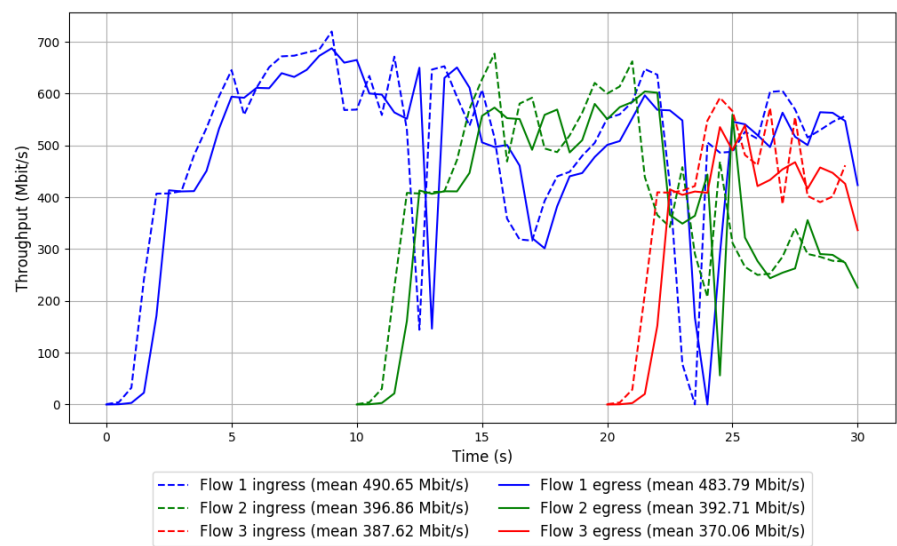
Run 2: Report of TCP BBR — Data Link

```
Run 1: Statistics of TCP Cubic

Start at: 2018-09-05 03:27:51
End at: 2018-09-05 03:28:21
Local clock offset: 4.074 ms
Remote clock offset: 1.408 ms


# Below is generated by plot.py at 2018-09-05 03:57:58
# Datalink statistics
-- Total of 3 flows:
Average throughput: 955.80 Mbit/s
95th percentile per-packet one-way delay: 169.498 ms
Loss rate: 0.99%
-- Flow 1:
Average throughput: 494.03 Mbit/s
95th percentile per-packet one-way delay: 110.067 ms
Loss rate: 0.63%
-- Flow 2:
Average throughput: 506.34 Mbit/s
95th percentile per-packet one-way delay: 185.155 ms
Loss rate: 0.90%
-- Flow 3:
Average throughput: 382.26 Mbit/s
95th percentile per-packet one-way delay: 138.193 ms
Loss rate: 2.62%
```
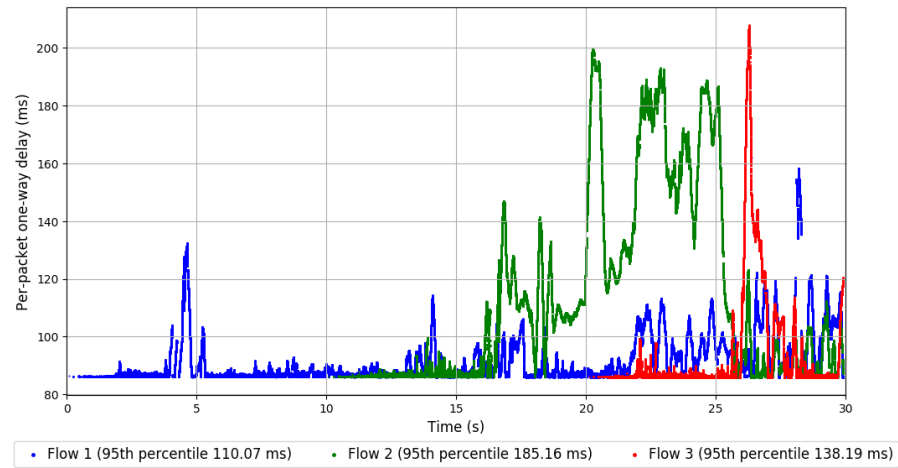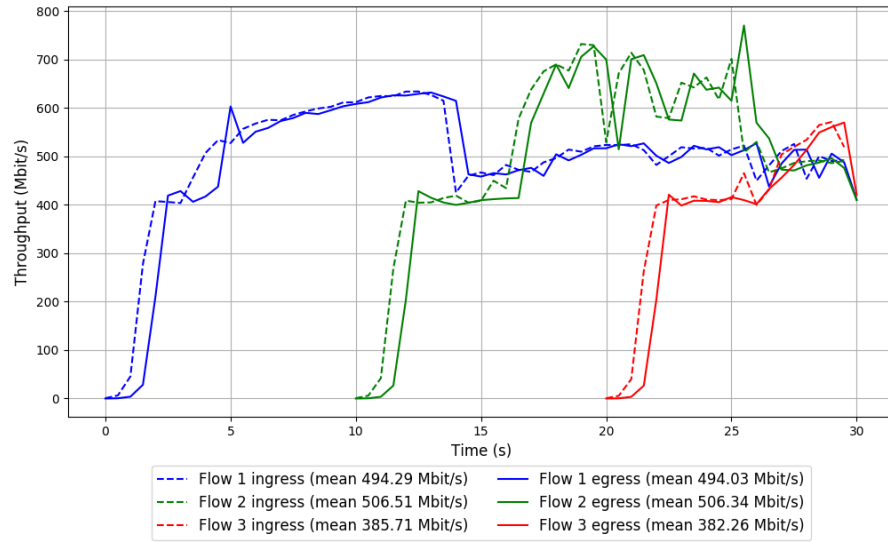
Run 1: Report of TCP Cubic — Data Link

Flow 1 ingress (mean 494.29 Mbit/s) --- Flow 1 egress (mean 494.03 Mbit/s)
Flow 2 ingress (mean 506.51 Mbit/s) --- Flow 2 egress (mean 506.34 Mbit/s)
Flow 3 ingress (mean 385.71 Mbit/s) --- Flow 3 egress (mean 382.26 Mbit/s)

Flow 1 (95th percentile 110.07 ms)   Flow 2 (95th percentile 185.16 ms)   Flow 3 (95th percentile 138.19 ms)

```
Run 2: Statistics of TCP Cubic

Start at: 2018-09-05 03:36:00
End at: 2018-09-05 03:36:30
Local clock offset: 2.641 ms
Remote clock offset: 0.794 ms


# Below is generated by plot.py at 2018-09-05 03:57:58
# Datalink statistics
-- Total of 3 flows:
Average throughput: 951.77 Mbit/s
95th percentile per-packet one-way delay: 179.881 ms
Loss rate: 1.06%
-- Flow 1:
Average throughput: 514.66 Mbit/s
95th percentile per-packet one-way delay: 186.383 ms
Loss rate: 0.73%
-- Flow 2:
Average throughput: 459.93 Mbit/s
95th percentile per-packet one-way delay: 129.419 ms
Loss rate: 0.97%
-- Flow 3:
Average throughput: 400.82 Mbit/s
95th percentile per-packet one-way delay: 134.912 ms
Loss rate: 2.52%
```
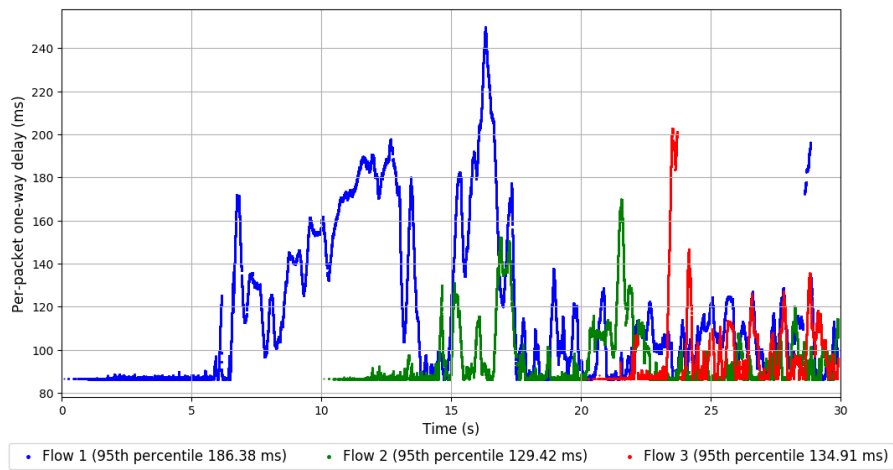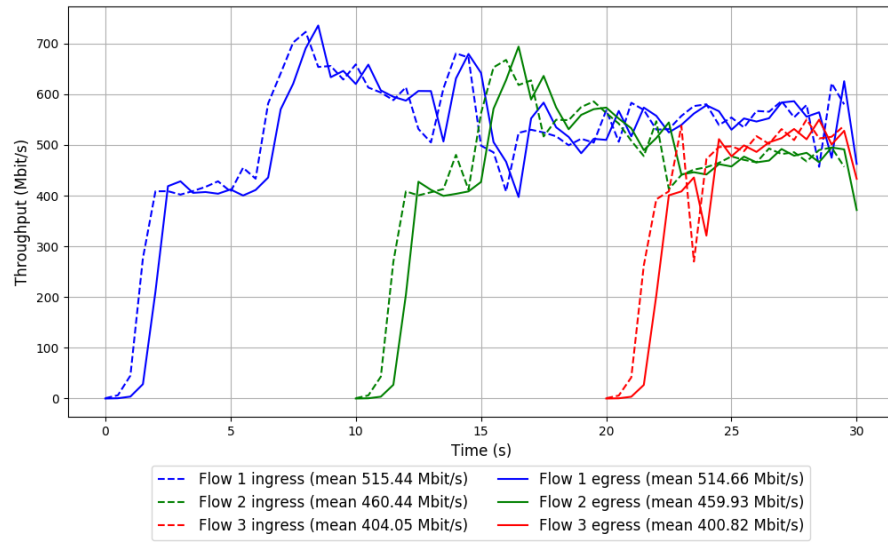
Run 2: Report of TCP Cubic — Data Link

Flow 1 ingress (mean 515.44 Mbit/s) --- Flow 1 egress (mean 514.66 Mbit/s)
Flow 2 ingress (mean 460.44 Mbit/s) --- Flow 2 egress (mean 459.93 Mbit/s)
Flow 3 ingress (mean 404.05 Mbit/s) --- Flow 3 egress (mean 400.82 Mbit/s)

Flow 1 (95th percentile 186.38 ms) · Flow 2 (95th percentile 129.42 ms) · Flow 3 (95th percentile 134.91 ms)

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Run 1: Statistics of Indigo

Start at: 2018-09-05 03:25:56
End at: 2018-09-05 03:26:26
Local clock offset: 3.941 ms
Remote clock offset: 1.691 ms


# Below is generated by plot.py at 2018-09-05 03:57:58
# Datalink statistics
-- Total of 3 flows:
Average throughput: 397.42 Mbit/s
95th percentile per-packet one-way delay: 86.998 ms
Loss rate: 0.87%
-- Flow 1:
Average throughput: 213.92 Mbit/s
95th percentile per-packet one-way delay: 86.820 ms
Loss rate: 0.56%
-- Flow 2:
Average throughput: 203.35 Mbit/s
95th percentile per-packet one-way delay: 86.907 ms
Loss rate: 0.90%
-- Flow 3:
Average throughput: 152.17 Mbit/s
95th percentile per-packet one-way delay: 87.703 ms
Loss rate: 2.11%
```
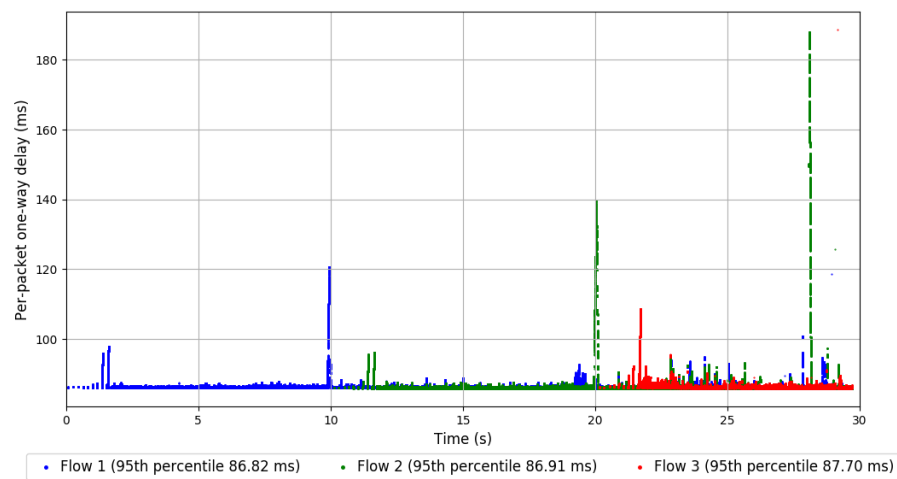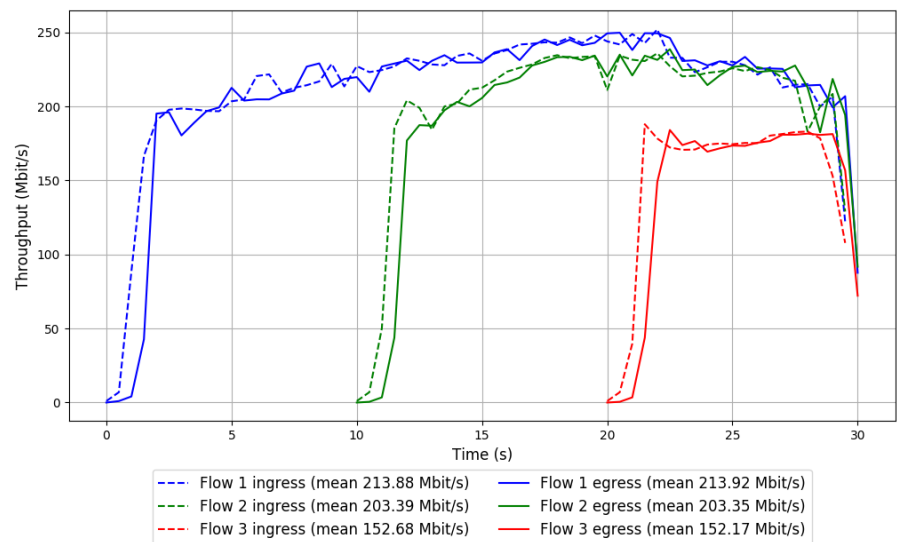
Run 1: Report of Indigo — Data Link

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Run 2: Statistics of Indigo

Start at: 2018-09-05 03:34:06
End at: 2018-09-05 03:34:36
Local clock offset: 3.289 ms
Remote clock offset: 0.882 ms


# Below is generated by plot.py at 2018-09-05 03:57:58
# Datalink statistics
-- Total of 3 flows:
Average throughput: 398.73 Mbit/s
95th percentile per-packet one-way delay: 88.905 ms
Loss rate: 0.95%
-- Flow 1:
Average throughput: 205.35 Mbit/s
95th percentile per-packet one-way delay: 88.222 ms
Loss rate: 0.62%
-- Flow 2:
Average throughput: 205.10 Mbit/s
95th percentile per-packet one-way delay: 90.720 ms
Loss rate: 0.90%
-- Flow 3:
Average throughput: 179.87 Mbit/s
95th percentile per-packet one-way delay: 88.728 ms
Loss rate: 2.24%
```
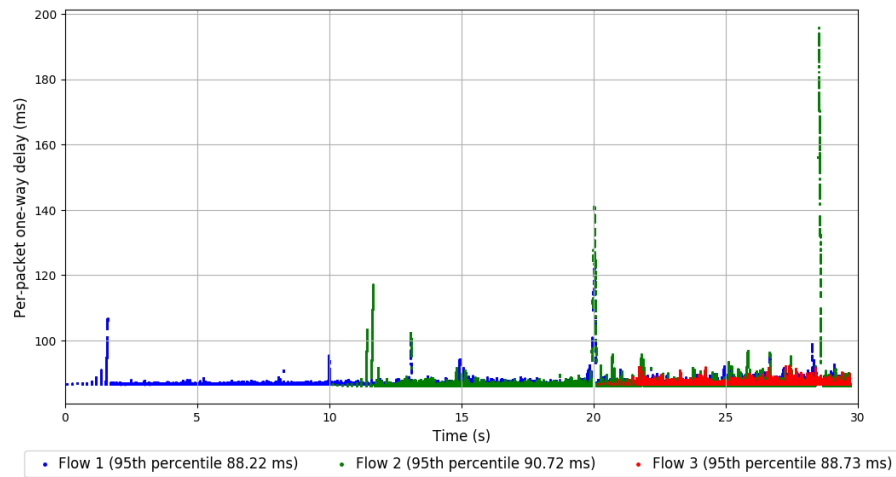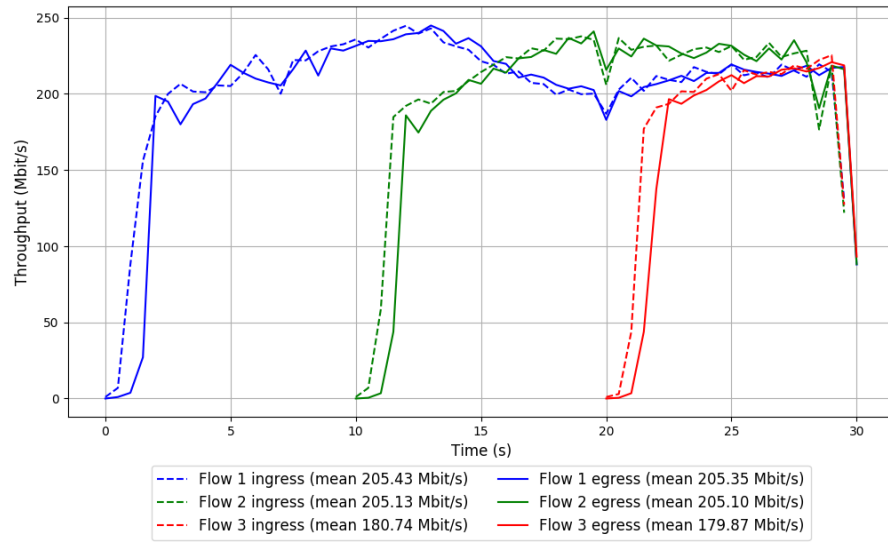
Run 2: Report of Indigo — Data Link

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Run 1: Statistics of Muses-25

Start at: 2018-09-05 03:32:08
End at: 2018-09-05 03:32:38
Local clock offset: 3.91 ms
Remote clock offset: 0.977 ms


# Below is generated by plot.py at 2018-09-05 03:57:58
# Datalink statistics
-- Total of 3 flows:
Average throughput: 815.77 Mbit/s
95th percentile per-packet one-way delay: 96.830 ms
Loss rate: 0.72%
-- Flow 1:
Average throughput: 465.68 Mbit/s
95th percentile per-packet one-way delay: 96.547 ms
Loss rate: 0.60%
-- Flow 2:
Average throughput: 347.35 Mbit/s
95th percentile per-packet one-way delay: 98.775 ms
Loss rate: 0.70%
-- Flow 3:
Average throughput: 370.39 Mbit/s
95th percentile per-packet one-way delay: 93.923 ms
Loss rate: 1.20%
```
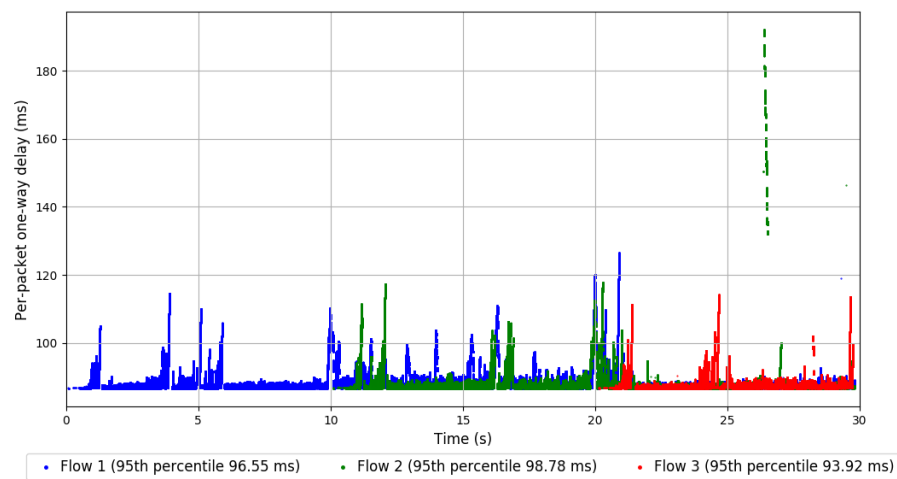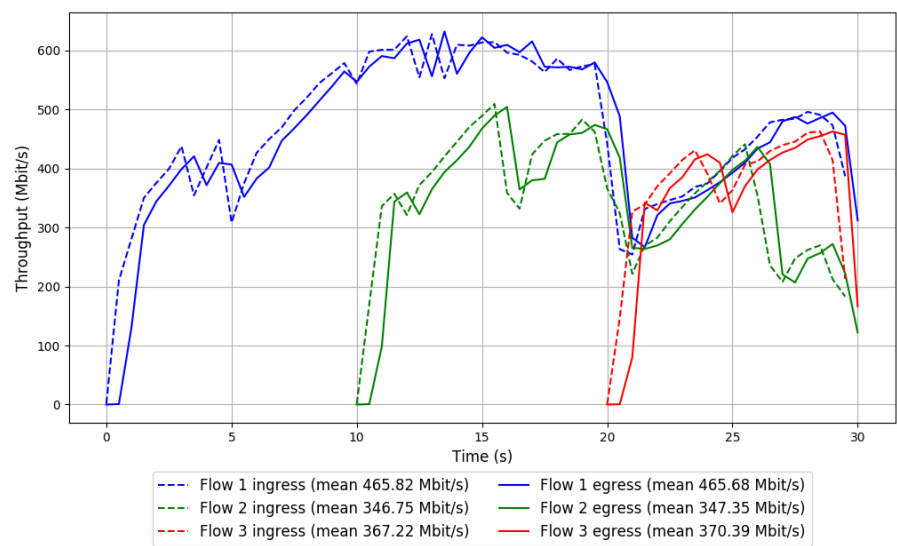
Run 1: Report of Muses-25 — Data Link

Flow 1 ingress (mean 465.82 Mbit/s)   Flow 1 egress (mean 465.68 Mbit/s)
Flow 2 ingress (mean 346.75 Mbit/s)   Flow 2 egress (mean 347.35 Mbit/s)
Flow 3 ingress (mean 367.22 Mbit/s)   Flow 3 egress (mean 370.39 Mbit/s)

Flow 1 (95th percentile 96.55 ms)   Flow 2 (95th percentile 98.78 ms)   Flow 3 (95th percentile 93.92 ms)

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```
Run 2: Statistics of Muses-25

Start at: 2018-09-05 03:40:12
End at: 2018-09-05 03:40:42
Local clock offset: 1.743 ms
Remote clock offset: 0.774 ms

# Below is generated by plot.py at 2018-09-05 03:57:58
# Datalink statistics
-- Total of 3 flows:
Average throughput: 754.35 Mbit/s
95th percentile per-packet one-way delay: 97.682 ms
Loss rate: 0.80%
-- Flow 1:
Average throughput: 402.94 Mbit/s
95th percentile per-packet one-way delay: 96.397 ms
Loss rate: 0.38%
-- Flow 2:
Average throughput: 363.96 Mbit/s
95th percentile per-packet one-way delay: 100.323 ms
Loss rate: 1.18%
-- Flow 3:
Average throughput: 336.61 Mbit/s
95th percentile per-packet one-way delay: 97.758 ms
Loss rate: 1.53%
```

Run 2: Report of Muses-25 — Data Link