PA1: Ping Pong

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CS 415

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Problem

This project asked us to calculate the following:

- How long it takes to pass an integer from Process A to Process B on the same box.
- How long it takes to pass an integer from Process A to Process B on different boxes.
- When adding one more integer to a buffer changes the send time drastically.

Procedure

For calculating the first and second part, I designed a system that would send an integer from process 0 to process 1. Upon receiving, process 1 would then send back that same integer to process 0. This whole turn around would be timed. To ensure that variations would not invalidate my data, I timed one million of these interactions and then averaged the round-trip time. The difference in destination were implemented by setting specific runtime arguments in the cluster manager, slurm. (number of nodes, number of tasks per node)

For the third part, I created a buffer of integers 10000 elements in size. I then timed 100 round-trips in a similar manner to parts 1 and 2. However time, each set of 100 timings was sending a larger buffer (by one int) from 1 to 10000. This test was performed sending from one box to another box.

Data

I ran part 1 and found the average time for the one million round-trips, then I ran the same script 9 more times so I had 10 averages.

Run	Total Time (s)	Average Time (s)
1	1.2106738091	0.0000012106738091
2	1.2300949097	0.0000012300949097
3	1.1395790577	0.0000011395790577
4	1.2270026207	0.0000012270026207
5	0.9866313934	0.0000009866313934
6	1.2281246185	0.0000012281246185
7	0.9137353897	0.0000009137353897
8	0.9331095219	0.0000009331095219
9	1.1453025341	0.0000011453025341
10	1.2295234203	0.0000012295234203

Table 1: Ten runs of 1,000,000 round-trips each on the same box.

Mean	0.0000011243777275
Median	0.0000011779881716
Std. Dev	0.0000001297736237
Std. Error	0.0000000410380231

Table 2: Statistics for the average of 10,000,000 round-trips on the same box.

For part 2, I again ran 10 runs of one million round-trips.

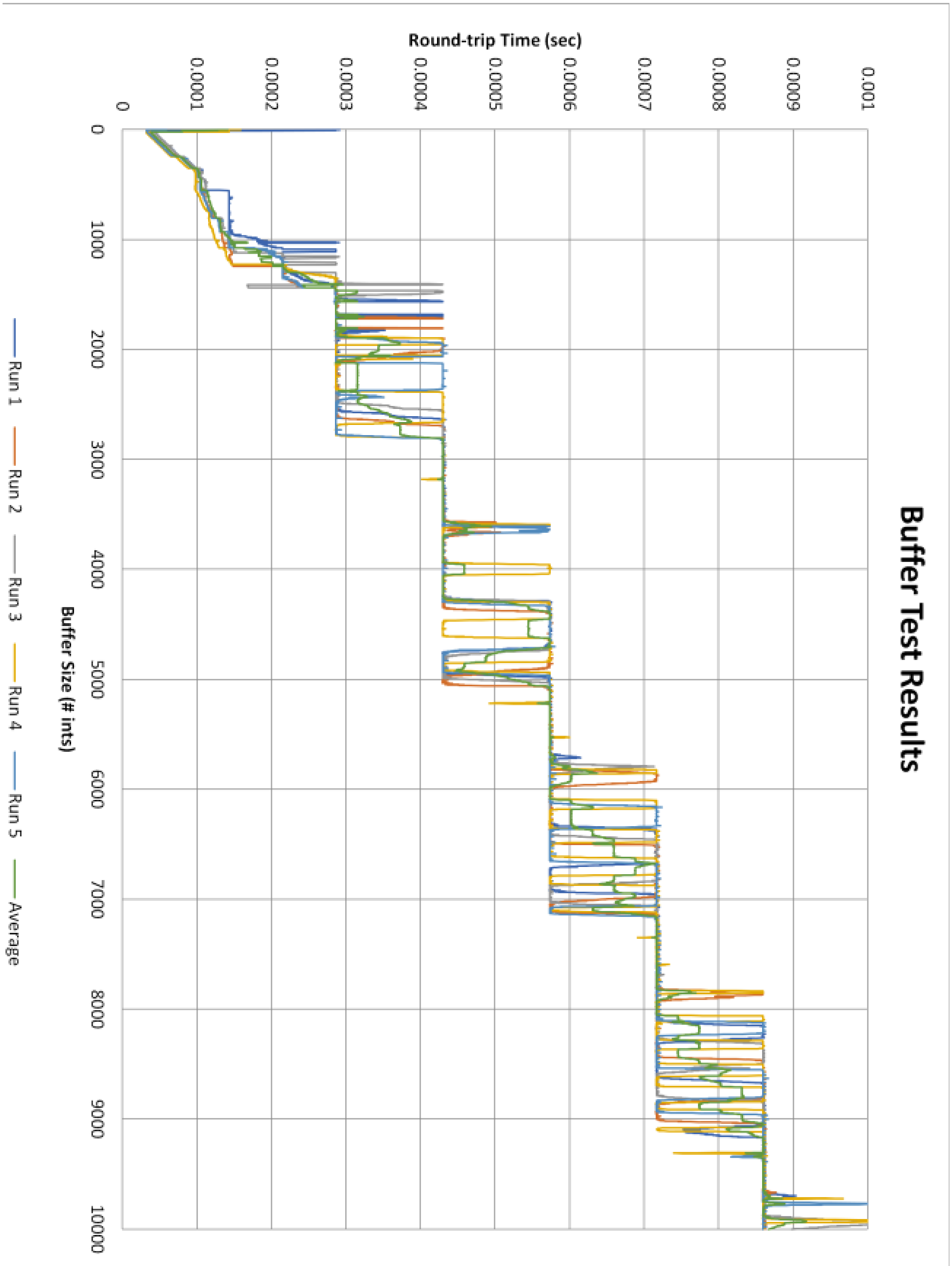
Run	Total Time (s)	Average Time (s)
1	32.7729513645	0.0000327729513645
2	34.0277369022	0.0000340277369022
3	39.3089463711	0.0000393089463711
4	33.0230166912	0.0000330230166912
5	33.3696976662	0.0000333696976662
6	32.6418619156	0.0000326418619156
7	32.4267661572	0.0000324267661572
8	33.2292571068	0.0000332292571068
9	29.1514682770	0.0000291514682770
10	40.2316765785	0.0000402316765785

Table 3: Ten runs of 1,000,000 round-trips each from one box to another.

Mean	0.0000340183379030
Median	0.0000331261368990
Std. Dev	0.0000033048019797
Std. Error	0.0000010450701472

Table 4: Statistics for the average 10,000,000 round-trips from one box to another.

For Part 3 the results are seen on the chart below.


Buffer Test Results
Round-trip Time (sec)
0
0.0001
0.0002
0.0003
0.0004
0.0005
0.0006
0.0007
0.0008
0.0009
0.001
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
Buffer Size (# ints)
Run 1
Run 2
Run 3
Run 4
Run 5
Average

Results
For Part 1, the average round-trip time was $1.12 \pm 0.04\ \mu s$.

For part 2, the average round-trip time was $34.0 \pm 1.0\ \mu s$. So, a round-trip from one machine to another takes about 2900% longer than a round-trip entirely contained on a single machine.

For part 3, interpretation was not quite as clear cut. Looking at the graph of the results, the data seems to suggest that the first major jump in time is at around 1500 ints. There's some variation, likely due to fluctuations in network traffic and machine usage, so this occurs somewhere between 1500 and 2700 ints, depending on the run. The next major jump seems to occur at between 3500 and 5000 ints, with more happening periodically after that.