

ECSE 4961 Proj 3

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1 Introduction

The purpose of this project was to profile and examine the performance of the memory and storage of a computer. The computer profiled has the following RAM and SSD:

RAM:

Samsung M471A4G43MB1-CTD

SSD:

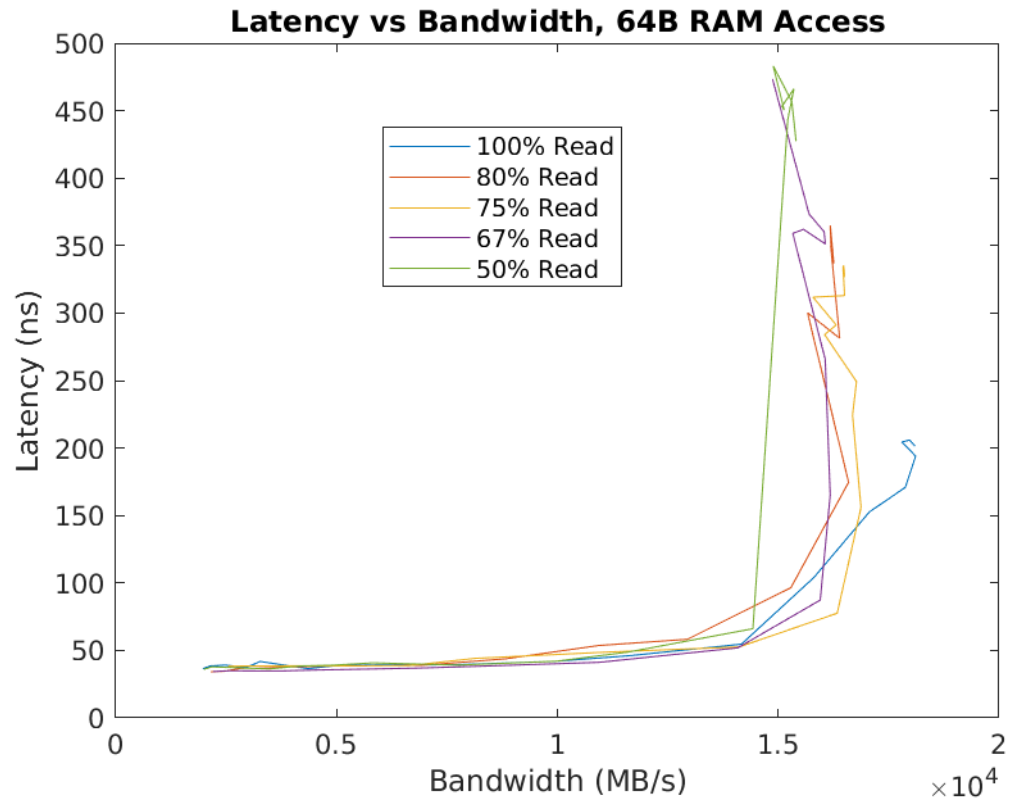
SAMSUNG MZVLB512HBJQ-000L7

2 Profiling Results

2.1 RAM

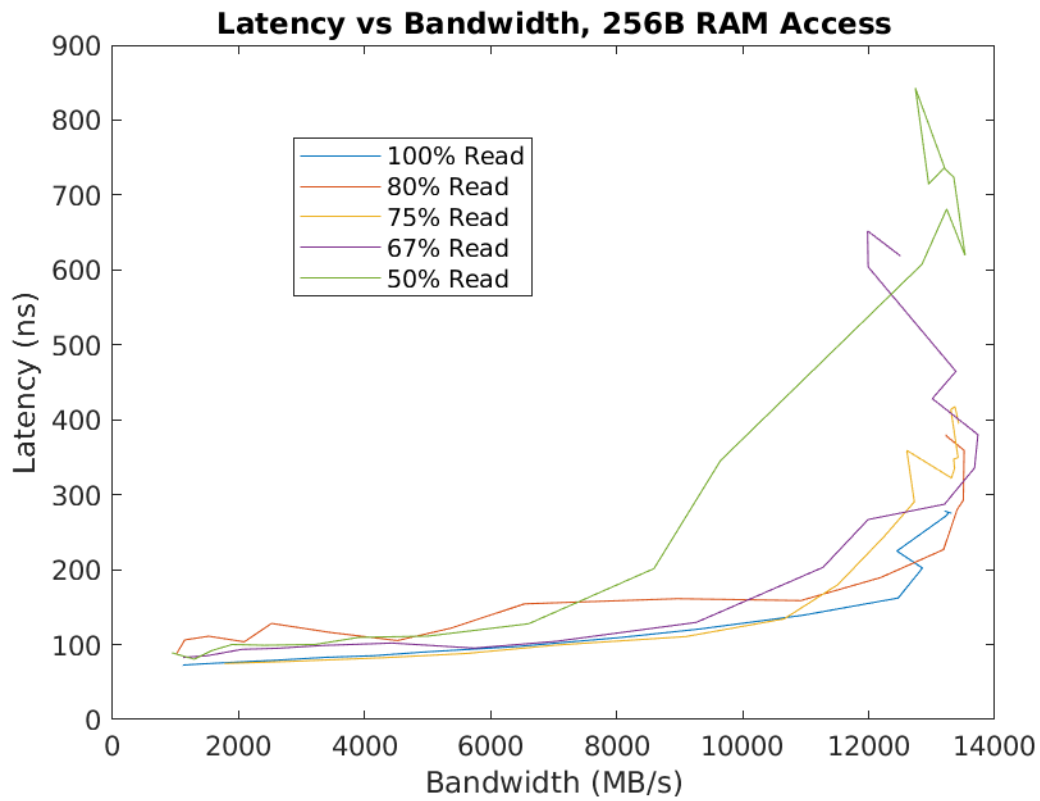
2.1.1 64B Access

This test performed 64B accesses (reads and writes) to RAM, at various bandwidth loading points, and measured the latency at this point. The process was repeated for different read/write ratios.



2.1.2 256B Access

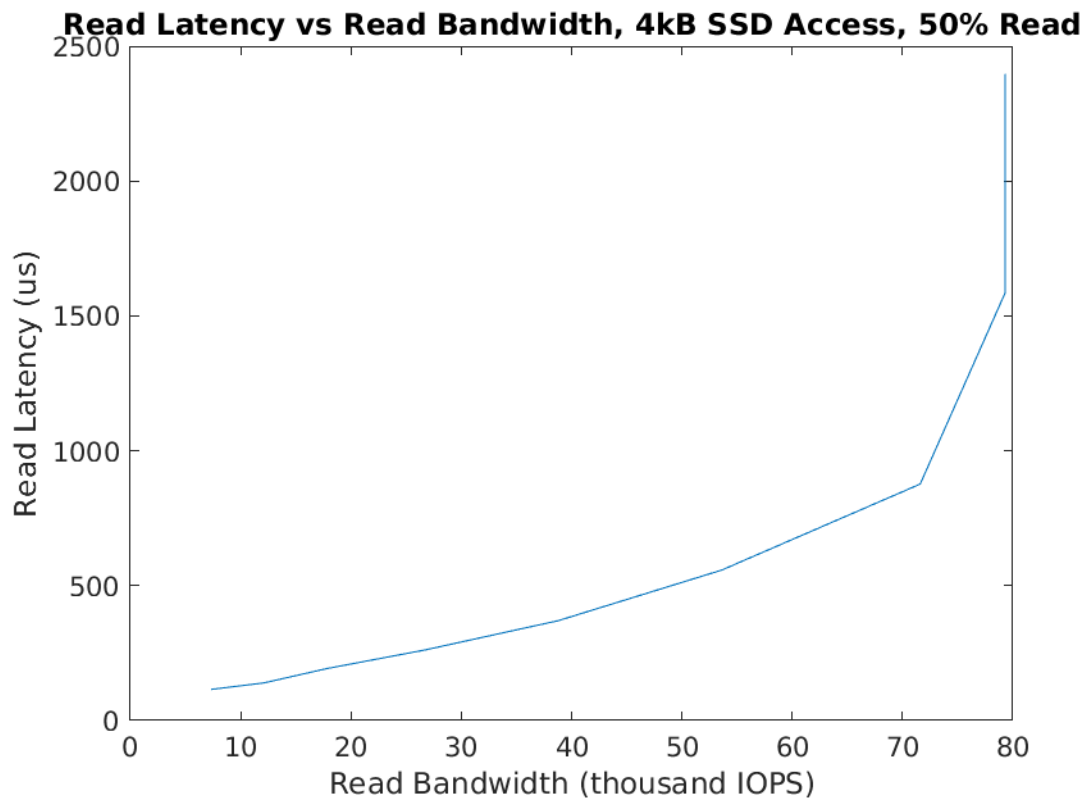
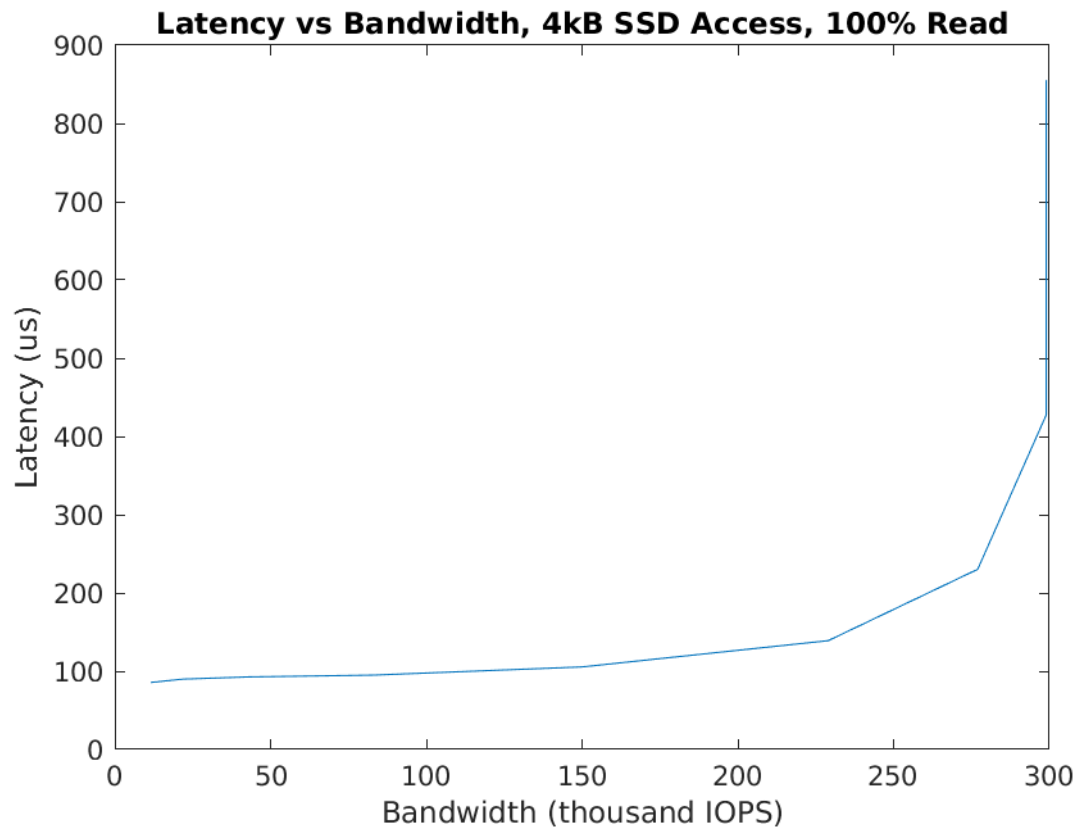
This test performed 256B accesses (reads and writes) to RAM, at various bandwidth loading points, and measured the latency at this point. The process was repeated for different read/write ratios.



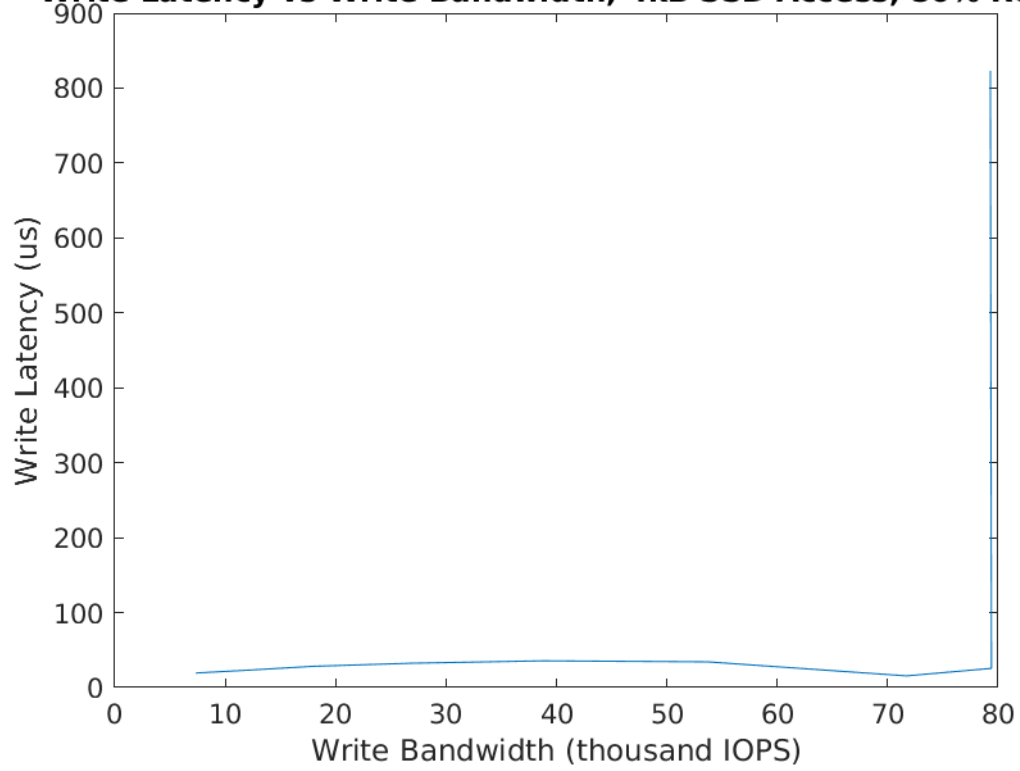
2.2 SSD

2.2.1 4kB Access

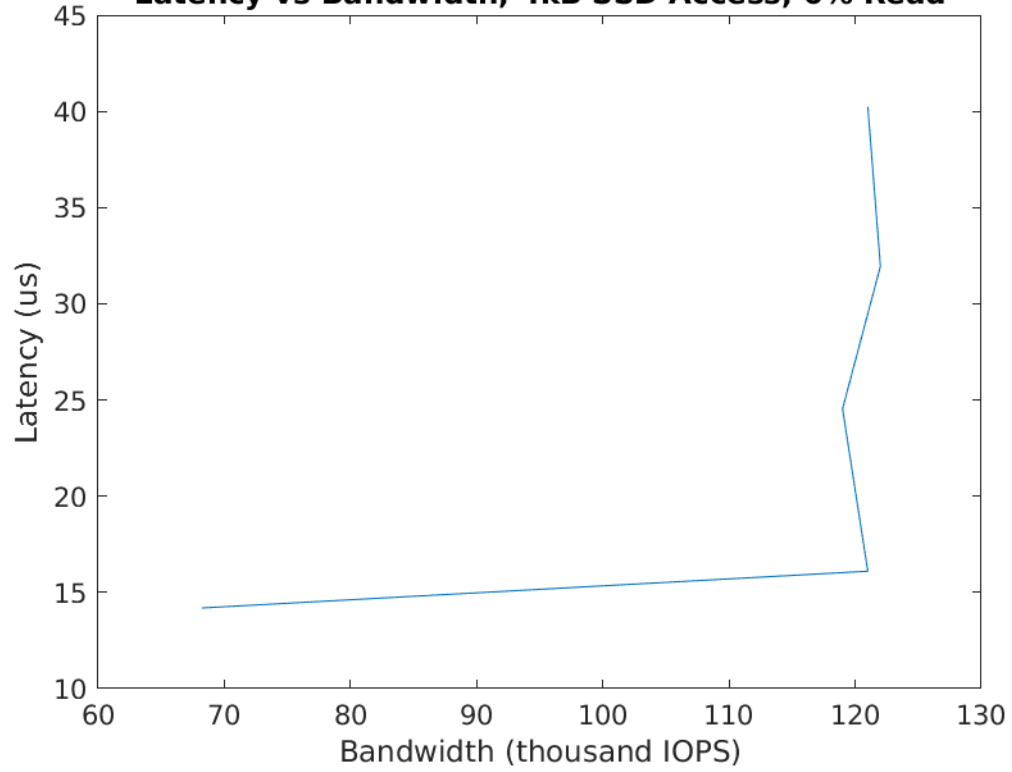
This test performed 4kB accesses to the SSD in a 10GB partition of the drive. This test was performed for a read only workload, 50/50 read/write, and write only.



Write Latency vs Write Bandwidth, 4kB SSD Access, 50% Read

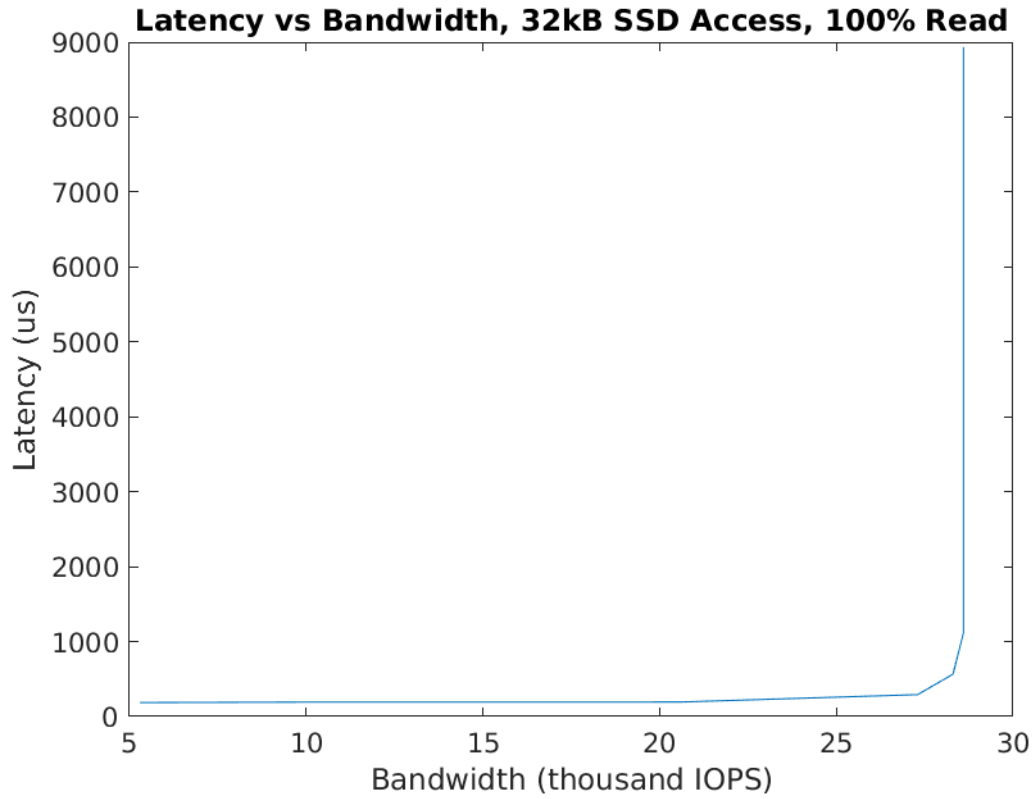


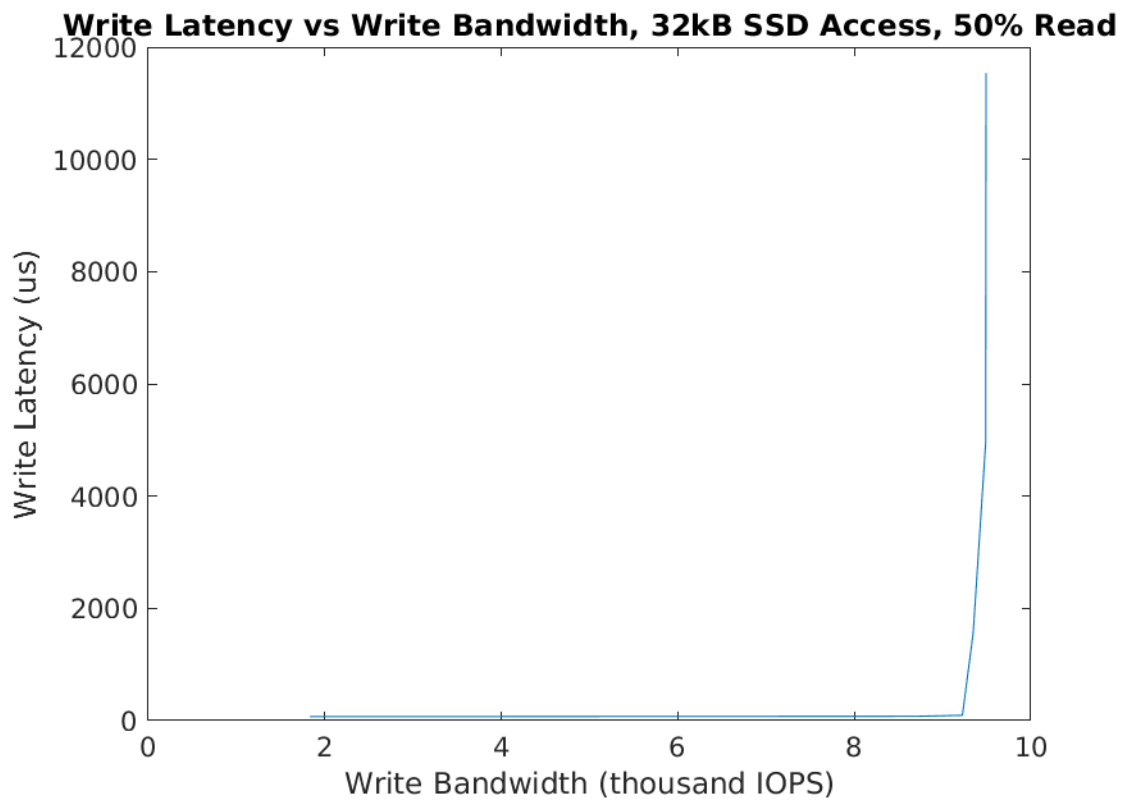
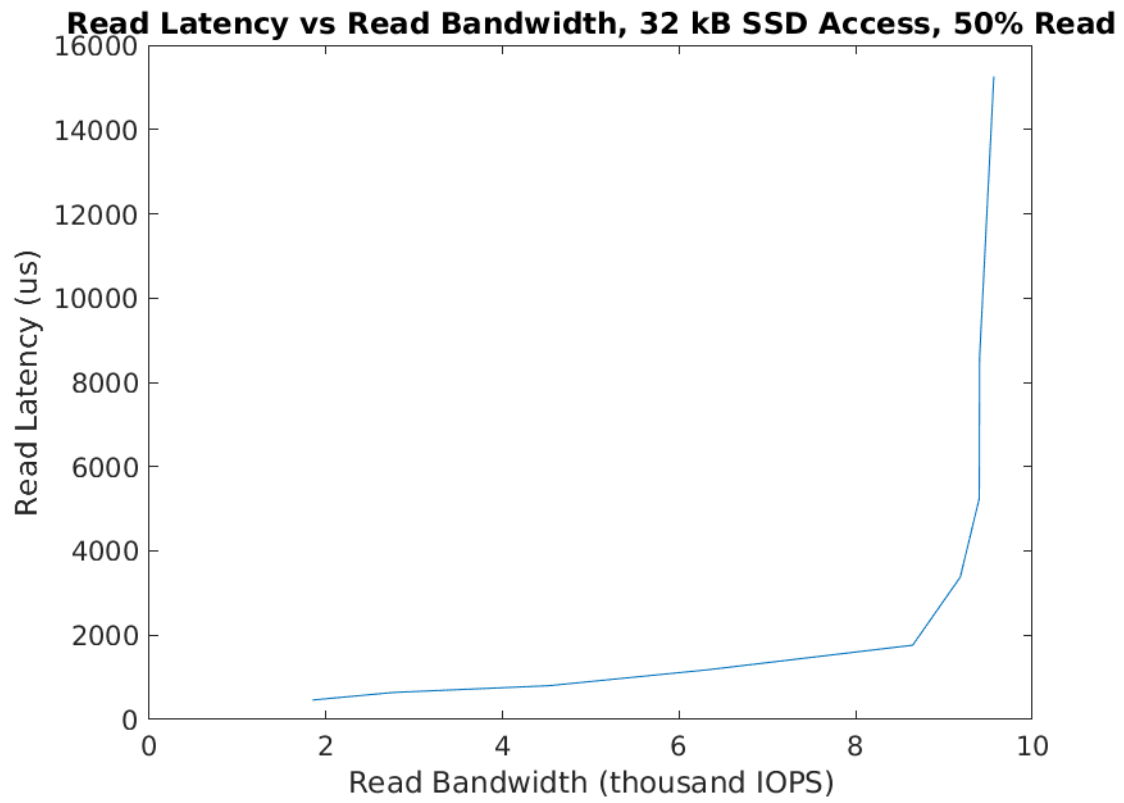
Latency vs Bandwidth, 4kB SSD Access, 0% Read



2.2.2 32kB Access

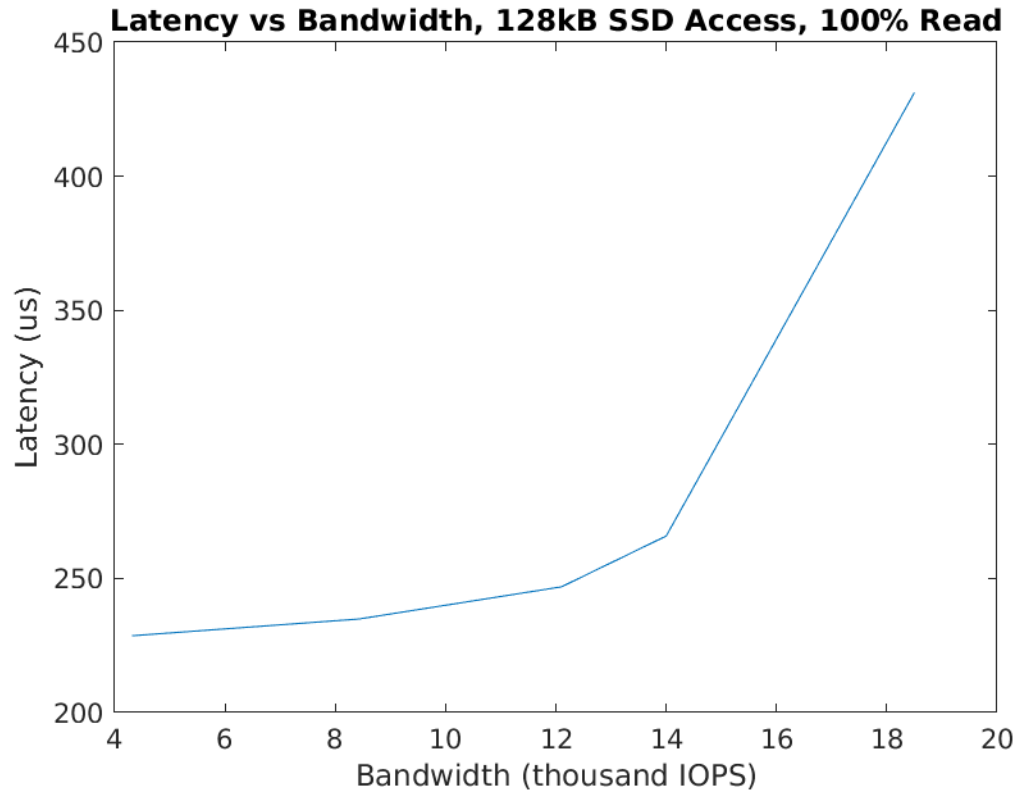
This test performed 32kB accesses to the SSD in a 10GB partition of the drive. This test was performed for a read only workload and 50/50 read/write. Write only workload was not performed because even a single job setup at 32kB saturated the write throughput of the SSD.

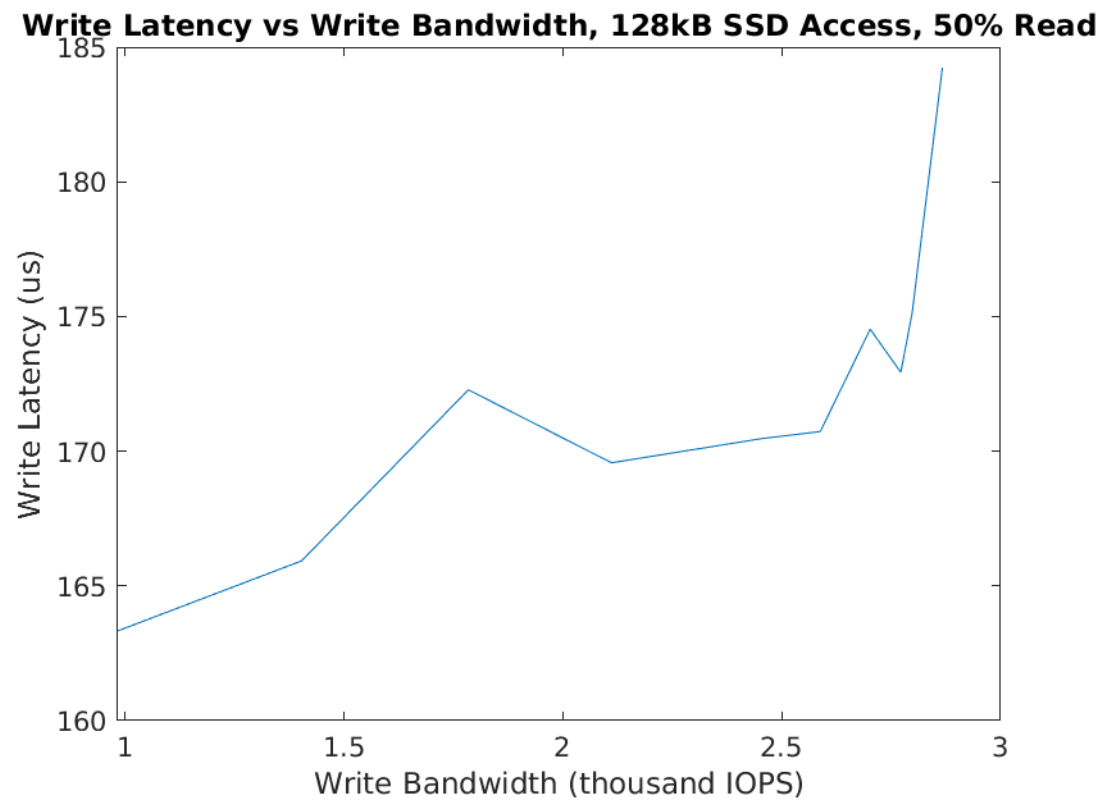
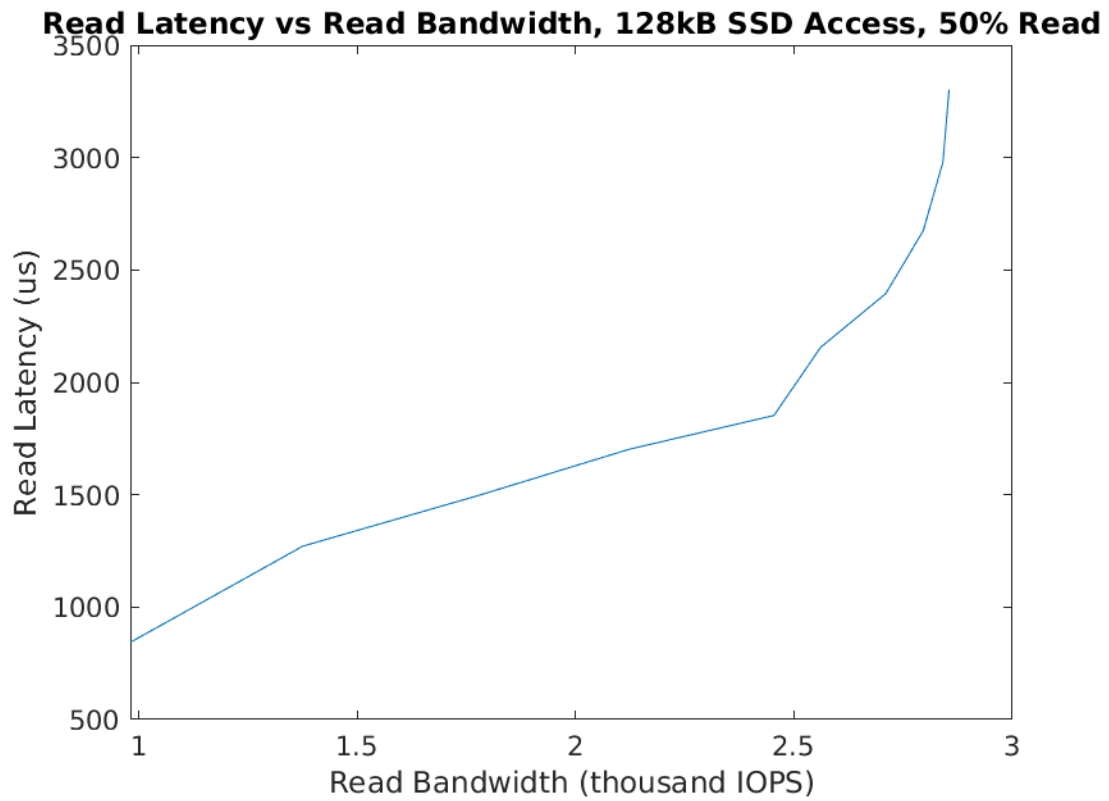




2.2.3 128kB Access

This test performed 128kB accesses to the SSD in a 10GB partition of the drive. This test was performed for a read only workload and 50/50 read/write. Write only workload was not performed because even a single job setup at 128kB saturated the write throughput of the SSD.





3 Analysis

All of the tests, both RAM and SSD, showed the relationship between latency and bandwidth to be a positive, concave up shape. As bandwidth increased, latency would increase faster and faster. This is consistent with our expectation from queuing theory.

For RAM testing, we can see that most of the read/write ratios have a quite similar latency bandwidth relationship, although for higher bandwidths it would appear that write heavy loads did have a longer latency. This is especially true for the 256B case.

For SSD testing, we can see lots of differences in latency bandwidth relationship as the read/write ratio is changed. For read only loads, we see a gradually increasing read latency as bandwidth increases. For write only loads, we can see that the latency sharply increases once we hit the maximum bandwidth. This is likely explained by the fact that the latency we are measuring is just the latency to get the write operation into the SSD internal RAM. If we were to include the queuing action inside the SSD itself, we would likely see a more gradual sloping latency bandwidth relationship. We see this same trend in the 50/50 read/write tests, with read latency gradually increasing with bandwidth, and write latency sharply increasing once hitting a threshold. The 32kB accesses and 128kB accesses were not performed as a write only load, since these block sizes reached the SSD throughput limit even at the lowest FIO setting.

4 Question

Enterprise grade SSDs may advertise this lower throughput because they are not counting use cases that reach higher throughputs with significantly longer latencies. The higher throughput is not all that applicable since most applications require a somewhat low latency as well.

5 Conclusion

The hardware environment that is my laptop was successfully explored and is now understood fuller and more clearly. The results obtained are presented graphically and interesting realizations were investigated.