Hard Disk Random Access Benchmark

Introduction

This document presents the results of a custom Java random access benchmark compared to a hardware-level test performed with HD Tune Pro. The goal was to measure the Input/Output Operations Per Second (IOPS) and data transfer speeds (MB/s) for different buffer sizes.

IOPS Comparison (Fixed Time)

Buffer Size	Java IOPS	HD Tune IOPS
512 bytes	1104561	23556
4 KB	1258906	20061
64 KB	1094905	12920
1 MB	390326	2580

MB/s Comparison (Fixed Size)

Buffer Size	Java MB/s (Fixed Size)	Java MB/s (Fixed Time)	HD Tune MB/s
512 bytes	477.83	862.94	11.502
4 KB	708.02	728.11	78.366
64 KB	843.48	855.39	807.546
1 MB	4791.41	4879.08	2580.166

Conclusion

After comparing the Java benchmark results with the HD Tune Pro random access test, it is observed that the Java benchmark shows significantly higher IOPS and MB/s values compared to HD Tune, especially at smaller buffer sizes. This discrepancy can be attributed to several factors:

- The Java benchmark operates at the application level, potentially benefiting from OS-level and filesystem-level caching.

- HD Tune Pro performs lower-level access closer to hardware, minimizing cache effects and providing a more realistic measurement of raw disk performance.
- Additionally, NVMe SSDs like the Samsung 970 are optimized for large sequential transfers, and Java may not fully simulate the low-level random access patterns.

In conclusion, while the Java benchmark provides useful insights into relative performance differences across buffer sizes, HD Tune Pro remains a more reliable tool for accurate random access speed measurement at the hardware level.