Solid State Storage performance benchmark design, development and execution on HPC systems

What are SSDs?

A solid-state drive (SSD) is a storage device that uses **flash memory.** Compared with the electromechanical drives, SSDs in theory are typically more resistant to physical shock, run silently, and have quicker access time and lower latency. SSDs are more resilient and quicker than HDDs because they don't have any *mechanical* parts spinning around.

Refer to this video below for a quick introduction.

SSDs vs Hard Drives as Fast As Possible

Type of SSDs

SATA 2.5", U.2, M.2 SATA, M.2 NVMe, NVMe PCIe

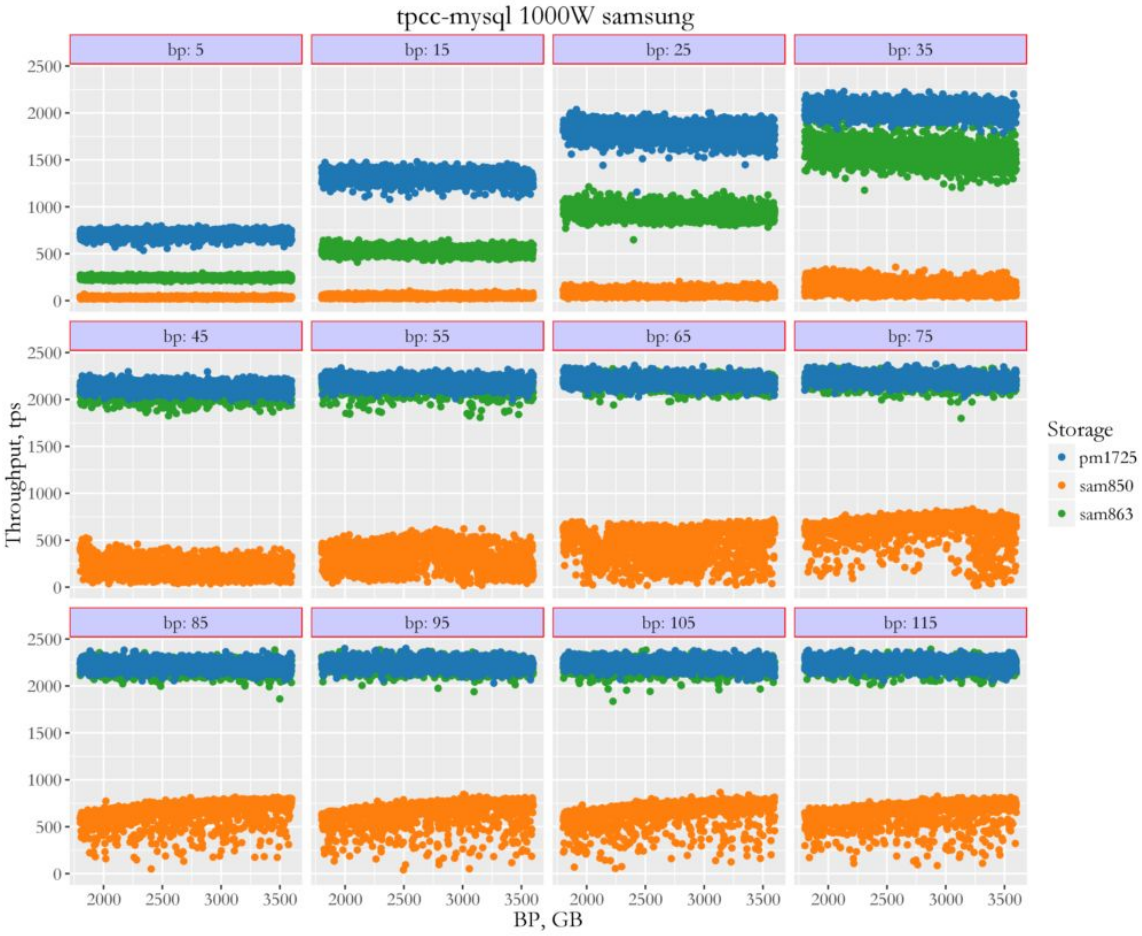
All SSD Types EXPLAINED

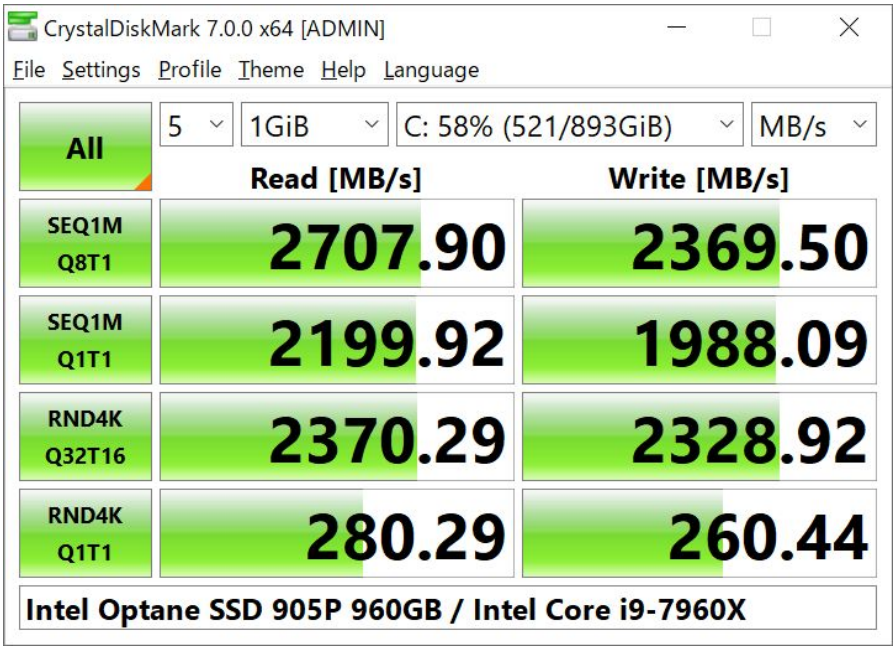
What is benchmarking?

1. Benchmarking is a process of measuring the performance of a device
2. If you are an avid gamer you probably already know what benchmarking is
3. Essentially we collect the data collected from these benchmarks to draw a conclusion about a certain product
4. One might compare two or more CPUs / GPUs by benchmarking them and make a decision of which product is better than the other
5. It will also point out which changes will make the most difference. A real life example of this is overclocking CPUs and using **benchmarks** to determine the best settings for your use case

Benchmarks as Fast As Possible

A few examples of benchmarks in storage devices

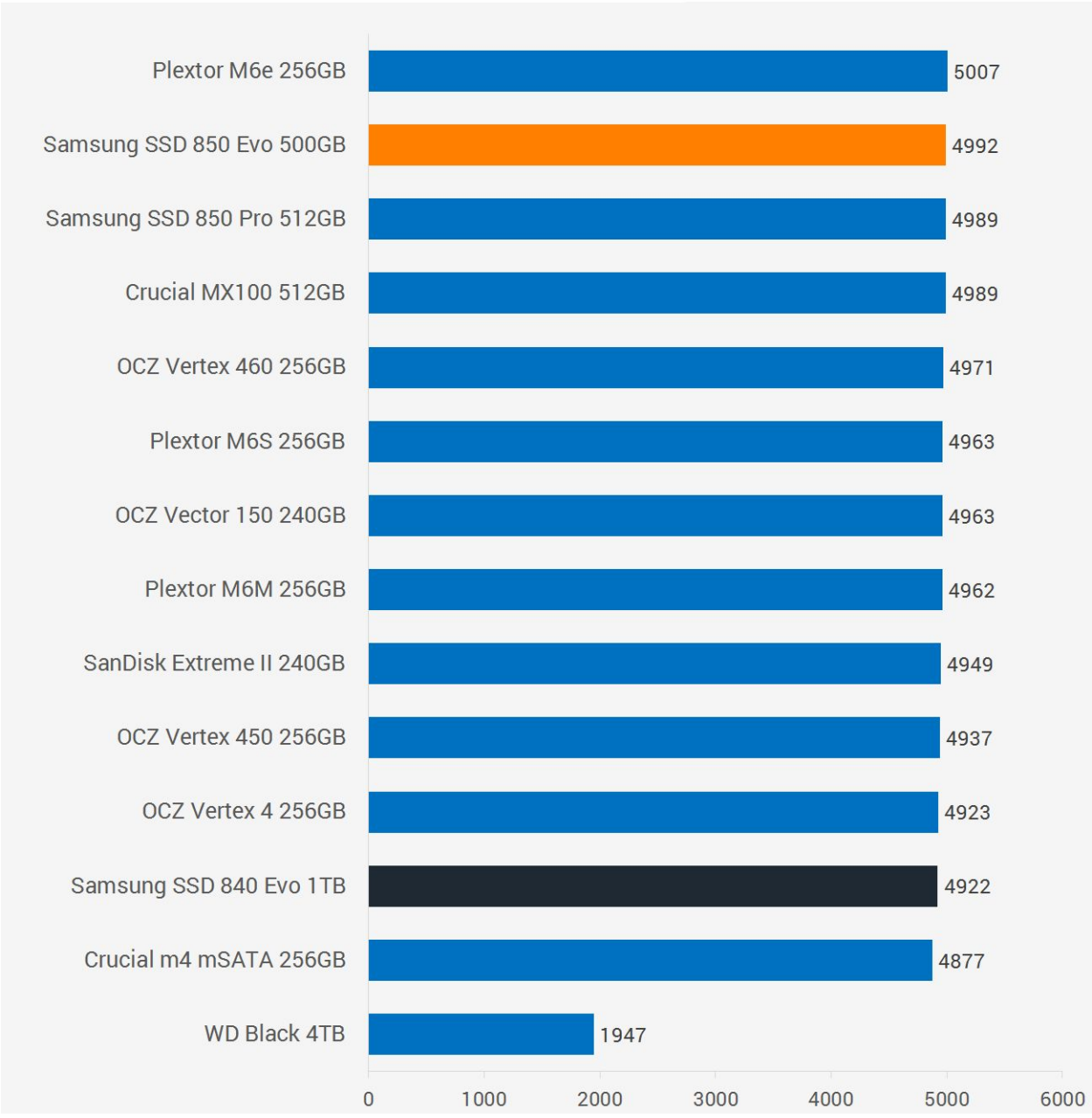




PCMark 8

Storage Score

Higher is Better



SSDs in High Performance Computing

These storage devices can be used to improve performance of applications with **random I/O access.** The first video linked in this document mentions that SSDs are better at random data access than traditional HDDs. This is due to SSDs not having a physical drive head that moves around the drive like hard drives do. In certain situations they can even perform 1000x more read/write operations per second than a standard HDD.

Goals for the project

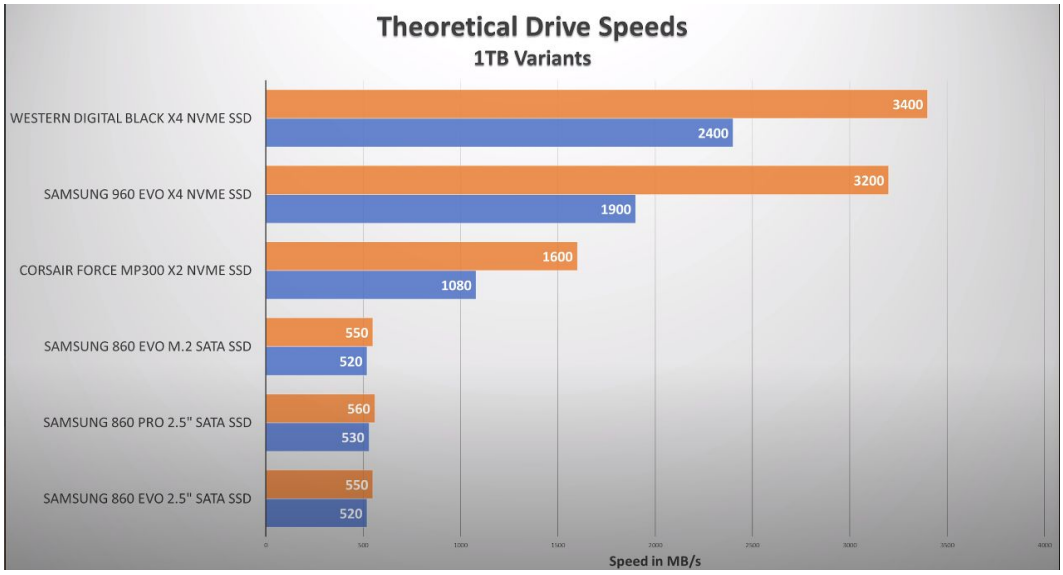
1. Design and development of a performance test suite
2. Evaluating metrics like bandwidth, IOPS and latency etc
3. Analysing the results and identifying bottlenecks in the system
4. Suggesting improvements and preparation of required reports

List of some storage benchmarking tools

1. Iometer
2. Vdbench
3. Diskspd
4. SNIA Emerald Power Measurement - Performance per Watt
5. IPERF - Could be used to test the network link for NAS devices

This is an interesting blog I found related to **Storage Benchmarks**

Our focus will be on NVMe SSDs



What is NVMe?

NVMe (nonvolatile memory express) is a new storage access and transport protocol for flash and next-generation solid-state drives (SSDs) that delivers the highest throughput and fastest response times yet for all types of enterprise workloads.

For more details read this : NVMe - Western Digital
A brief talk on NVMe : NVMe Introduction and Tutorial

Conclusion

Summing up — read about various types of SSDs, understand why NVMe SSDs are faster than other storage devices, how we can use them to improve the performance of a I/O intensive application. Evaluate performance metrics by building a performance test suit.