

Boosting Performance, Speed, and Endurance for Key Workloads with Intel® Optane™ SSDs

Open-E demonstrates the value of Intel Optane SSDs as write caches, read caches, and boot mediums in ZFS-based data storage setups



Executive Summary

Open-E, a data storage software provider, has evaluated and certified the performance of the Intel® Optane™ SSDs P5800X and the Intel® Optane™ SSD P1600X. The evaluation of these Intel Optane SSDs was performed using both an all-hard disk drive (HDD) and an all-Flash Open-E JovianDSS-powered data storage system. The devices were tested in various data storage roles, including serving as a cache device that supports write operations (writelog); as a cache device that supports read operations (read cache); and as a device that supports the process of booting up the OS (boot medium).

Thanks to their high performance, low latencies, and suitable endurance, Open-E now recommends these Intel Optane SSDs for use with Open-E JovianDSS in enterprise-level data storage appliances.

Solution Benefits

- **Consistent high performance and low latency.** The unique architecture of Intel® Optane™ SSDs helps deliver consistently high IOPS regardless of whether the SSDs are used as a read cache or a writelog.
- **High endurance.** Intel Optane SSDs can provide better endurance compared to NAND drives, enabling the potential for a longer server life cycle.
- **Right-sized capacity.** Available in a wide range of capacities, organizations can choose the Intel Optane SSD that is best suited for the desired role, such as writelog, read cache, or boot drive.



Intel® Optane™ SSD P5800X devices were tested in various data storage roles.

Achieve High-performance and High-capacity Storage

Improved performance at an affordable price is essential for every data storage solution used by modern enterprises. On top of this, organizations require high storage capacities due to exponential data growth. Data storage software provider Open-E works with customers around the globe to help them address these challenges.

Despite the rising popularity of all-Flash data storage solutions, hard disk drives (HDDs) are still considered the primary means of data storage for video surveillance, archiving, media storing and processing. HDDs are also used in industries such as the public sector, data centers, and other sectors that prioritize both large amounts of data storage capacity and cost-effectiveness over performance. Governments, hospitals, and the security industry regularly prefer HDDs over their faster but more expensive SSD counterparts. However, if an organization wants to increase the performance of its storage configuration while still taking advantage of capacities similar to HDDs, then Intel® Optane™ SSDs are the ideal approach.

Open-E gathers customers' feedback, which forms the basis of its regular evaluations that measure available storage technologies against customers' storage, backup and recovery, and business continuity needs. Open-E also strives to increase the compatibility list with relevant hardware through ongoing testing of new alternatives for a myriad of configurations. To ensure optimal application performance and customer workload support, Open-E carefully evaluates and thoroughly tests its recommended hardware technologies.

There Is an Intel® Optane™ SSD for Every Data Center Role

The capacity of an Intel Optane SSD helps determine what data center role it excels at. Open-E testing (see More Performance and Higher Quality of Service Reduces Total Cost of Ownership) reveals the following:

- **Read cache.** Both the 800 GB and the 1.6 TB Intel® Optane™ SSD P5800X are strongly recommended as a read cache for HDDs thanks to this SSD's high performance and low latency, compared to the same pool without a read cache.
- **Writelog.** Given its high endurance, the Intel Optane SSD P5800X with a capacity of 400 GB works well as a writelog for HDDs. This SSD should be considered for setups that require high write rates (high CPU performance and increased network bandwidth) because it can support high write performance.
- **Boot disk.** Data center servers typically use SATA SSDs as boot drives. But SATA SSDs' performance is not state-of-the-art, and they are usually far larger than what is needed as a boot drive. The Intel Optane SSD P1600X Series, available in 58 GB and 118 GB capacities, helps keep storage costs low while providing excellent read and write performance along with robust endurance.

More Performance and Higher Quality of Service Reduces Total Cost of Ownership

Testing has shown that all Intel Optane SSDs are capable of achieving amazing performance in the relevant application. This new generation of Intel® SSDs assist with creating enterprise-grade data storage setups that can meet even the most demanding business purposes.

“Each Intel Optane SSD has proven itself to be a great choice in a particular role. For example, the Intel Optane SSD P1600X 118 GB is strongly recommended as a boot medium, while the Intel Optane SSD P5800X 400 GB makes an ideal writelog for HDD data disks.”

— Krzysztof Franek, CEO, Open-E

Open-E conducted testing to determine whether using the Intel Optane SSDs instead of previously recommended solutions would help improve performance for customers' workloads. The previously recommended disks, commonly used for write caching or as data disks, although still good performance-wise, are coming to the end of their support cycle. Therefore, Open-E tested the performance of the newest versions of Intel Optane SSDs as writelogs, read caches, and boot drives, evaluating both write and read operations, all managed using the Open-E JovianDSS application.

Writelog Improves Throughput

The first evaluation (see Figure 1) used Open-E JovianDSS to compare the sequential write performance of the Intel Optane SSD P5800X as a writelog to the performance of the same setup without a writelog. As shown in the figure, the Intel Optane SSD maintained a high, consistent level of sequential writes across a wide number of workload profiles and consistently outperformed the setup without a writelog.¹ Throughput increased by up to 12.9x, with an average increase across all workloads of 4.5x. Using the Intel Optane SSD P5800X for a writelog can significantly benefit time-sensitive, mission-critical applications.

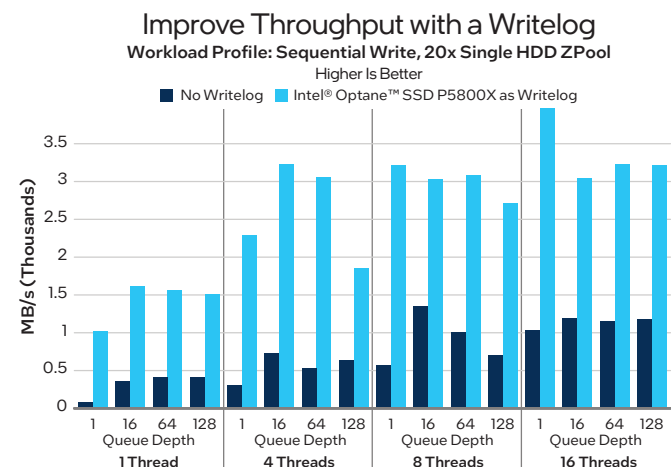


Figure 1. Using the Intel® Optane™ SSD P5800X as a writelog can improve throughput across a wide variety of workload profiles.¹

Writelog Improves Quality of Service

High performance and low latency are also critical for virtualization, online transaction processing (OLTP), and virtual desktop infrastructure (VDI) workloads. The lower, more stable latency (see Figure 2) of the Intel Optane SSD P5800X helps improve overall quality of service. As shown in the figure, the Intel Optane SSD P5800X completed the majority of IOPS within a latency of 0.25 to 0.5 milliseconds (ms).² Also, more write operations can be handled in a lower and narrower latency time period. In this particular case, the test load was at 16 threads and a queue depth of 1.

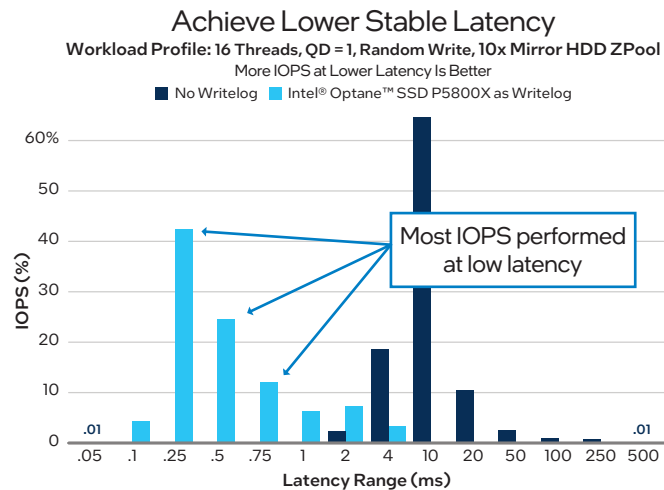


Figure 2. Using the Intel® Optane™ SSD P5800X as a writelog can improve quality of service, helping meet service-level agreements.²

Read Cache Provides Amazing Performance Boost

Open-E also evaluated the performance of the Intel Optane SSD P5800X for read caching (see Figure 3). In this test, a setup with an Intel Optane SSD P5800X as a read cache massively outperformed the same setup without a read cache, across all workload tested profiles.³

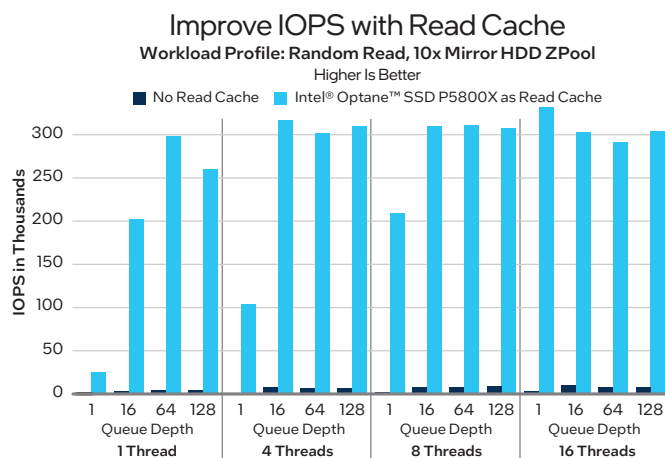


Figure 3. Give random reads a huge performance boost by using the Intel® Optane™ SSD P5800X as a read cache.³

“Expanded capacity and high performance are vital features that every data disk needs in the current data storage market. Our customers value a good price-performance ratio. That is why we strive to provide them with the best offers and advanced features.”

— Krzysztof Franek, CEO, Open-E

Using the Intel Optane SSD P5800X as a read cache is an ideal option for any setup that requires powerful read cache capabilities, such as ??? REVIEWERS: Can you provide a couple concise examples of when this might come in handy?

Boot Drive Performance Is Also Improved

The Intel Optane SSD P1600X was tested as a boot medium. The graphs in Figures 4 and 5 show the Intel Optane SSD P1600X performed well against a SATA-based SSD for both random read and random write.⁴

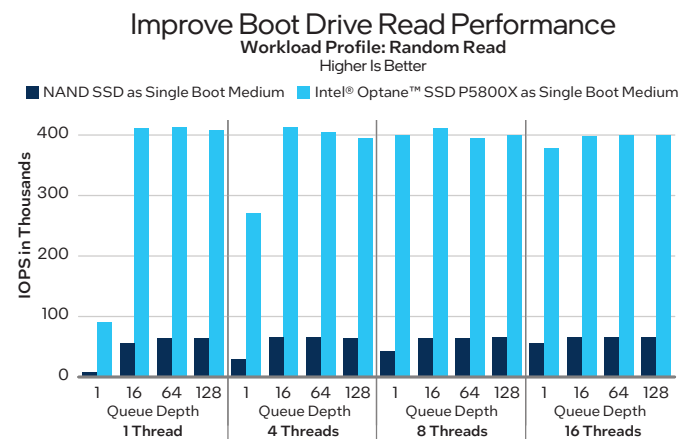


Figure 4. Random read performance on a single boot medium is far higher than the SATA-based SSD.⁴

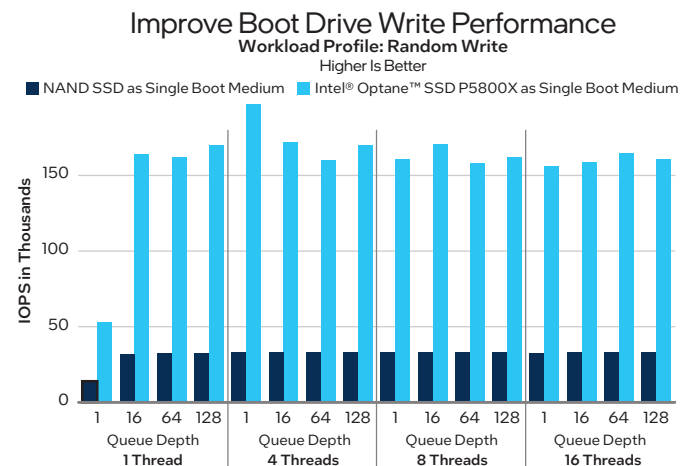
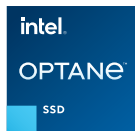
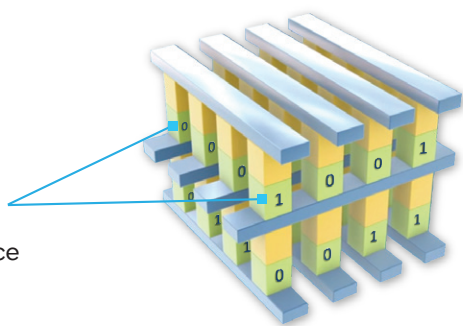


Figure 5. Random write performance on a single boot medium is also much higher than the SATA-based SSD.⁴



- Higher Density
- Larger Capacity
- Lower Latency
- Higher Endurance



Solution Architecture: Intel Optane SSDs

Intel Optane SSDs are manufactured from a unique combination of materials and are built on an advanced architecture that allows memory cells to be individually addressed in a dense, transistor-less, stackable design. The consistently high performance and excellent endurance of Intel Optane SSDs are enabled by the unique Intel® Optane™ memory media that supports write-in-place and offers several benefits compared to NAND technology. The benefits include higher densities, larger capacity, lower latency, and higher endurance.⁵ Here are just a few ways in which Intel Optane SSDs achieve these benefits:

- Increased performance by avoiding the compute resource overhead associated with garbage collection.
- Elimination of the extra writes needed in NAND-based systems.
- No write amplification concerns, such as optimizing for sequential writes over random writes and leaving sufficient free space.

Conclusion

Thanks to powerful Intel Optane SSDs and a ZFS-based data storage solution such as Open-E JovianDSS, it is now possible to deploy storage architecture specifically tailored to your business and budget. That being said, we recommend analyzing the precise current requirements of your organization and how those requirements can evolve in the future before making any purchase. These needs will help determine the criteria for any new storage solution and help your organization choose a solution design that will fulfill today and tomorrow's needs.

Learn More

You may find the following resources helpful:

- [Intel Optane SSD P5800X Series](#)
- [Intel Optane SSD P1600X Series](#)
- [Open-E JovianDSS Advanced Caching with Intel Optane SSDs](#)
- [Open-E, Inc. home page](#)

Find the solution that is right for your organization. Visit intel.com/optane or contact your Intel representative.

Spotlight on Open-E, Inc.

Open-E, Inc. develops IP-based storage management software, with headquarters in the United States and Europe. Founded in 1998, the company sells its line of storage management software through a worldwide network of system integrators and resellers. The Open-E JovianDSS and Open-E DSS V7 line of products enjoy a reputation for best-in-class performance, flexibility, reliability, scalability, and return on investment.

Solution Provided By:



¹ Testing by Open-E as of December 15, 2021. 2x Intel® Xeon® Gold 6330 processor, 4x 16 GB DDR4 3200 MHz. Baseline config had no writelog device; SUT had 1x Intel® Optane™ SSD P5800X 400 GB (U.2 2.5") as writelog device (ZFS SLOG device). ZPool: 20x single HDD ZPool using Toshiba AL13SEB900 SAS HDD 10K 900 GB. Software: Open-E JovianDSS up29r1 b44475, Fio for Linux, v3.28. Workload: sequential write, blocksize = 1 MB.

² Testing by Open-E as of December 15, 2021. 2x Intel® Xeon® Gold 6330 processor, 4x 16 GB DDR4 3200 MHz. Baseline config had no writelog device; SUT had 1x Intel® Optane™ SSD P5800X 400 GB (U.2 2.5") as writelog device (ZFS SLOG device). ZPool: 10x mirror HDD ZPool using Toshiba AL13SEB900 SAS HDD 10K 900 GB. Software: Open-E JovianDSS up29r1 b44475, Fio for Linux, v3.28. Workload: random read, blocksize = 4 KB.

³ Testing by Open-E as of December 15, 2021. 2x Intel® Xeon® Gold 6330 processor, 4x 16 GB DDR4 3200 MHz. Baseline config had no read cache device; SUT had 1x Intel® Optane™ SSD P5800X 400 GB (U.2 2.5") as read cache device (ZFS L2ARC device). ZPool: 10x mirror HDD ZPool using Toshiba AL13SEB900 SAS HDD 10K 900 GB. Software: Open-E JovianDSS up29r1 b44475, Fio for Linux, v3.28. Workload: random read, blocksize = 4 KB.

⁴ Testing by Open-E as of December 15, 2021. 2x Intel® Xeon® Gold 6330 processor, 4x 16 GB DDR4 3200 MHz. Baseline config used 1x SATA NAND drive (S4510 480 GB M.2) as a single boot medium; SUT used 1x Intel® Optane™ SSD P1600X 58 GB (M.2 22 x 80mm) as a single boot medium. Software: Open-E JovianDSS up29r1 b44475, Fio for Linux, v3.28. Workload: random read, blocksize = 4 KB and random write, blocksize = 4 KB.

⁵ See <https://www.intel.com/content/www/us/en/architecture-and-technology/intel-optane-technology.html>