Solution Brief

Pan-Industry
Data Center

Make Your Storage Fast Again!

DataCore™ enhances software-defined storage architecture with Intel® Optane™ SSDs.

Intel® Optane™ Technology Benefits

- Accelerated write speed. Intel® Optane™ SSDs delivered up to 7.5x faster in writing data to storage than traditional NAND flash SSDs.[1]
- Enhanced endurance. The architecture of Intel® Optane™ technology avoids the need to write more data than necessary, helping extend storage device life expectancy.
- Low latency. Consistent low latency for reads and writes means Intel Optane SSDs help maintain fast response times for mission-critical applications.[1]

Executive Summary

Software-defined storage (SDS) specialist DataCore continuously evaluates new technologies to help customers enhance their SDS environments using its SANsymphony™ platform. The company tested the use of Intel® Optane™ Solid State Drives (SSDs) for the hot storage tier as an alternative to traditional NAND flash SSDs. The evaluation showed that Intel Optane SSDs are up to 7.5x faster at writing data, and consistently deliver low latency across workloads, as well as helping to enhance device endurance.[1]

DataCore believes Intel Optane SSDs offer game changing benefits of performance, durability, high availability and speed for SDS environments and the critical business applications they support.

Guiding Principles for SDS Innovation

As a pioneer in software-defined storage (SDS), with over 20 years of experience in the industry, DataCore is committed to delivering flexibility, availability and freedom of choice for its customers. The company believes that SDS has the power to break down data siloes and hardware dependencies to enable IT teams to make storage smarter, more effective, and easier to manage. DataCore's SANsymphony SDS software helps deliver on this vision, providing cost-effective, enterprise-class SDS to companies of all sizes.

SANsymphony is built on Microsoft Windows environments and Intel® architectures. This is done in order to ensure easy integration with many popular enterprise IT components, which are usually supported by this platform first. This also means that as new hardware and capabilities become available, customers can integrate them without needing to make large-scale investments or having to refresh existing kit. For this reason, the team at DataCore is constantly looking ahead to new and emerging storage technologies that can help its customers get more from their SDS environments.

Intel® Optane™ technology is based on an entirely new design that bridges the gap between memory and storage. Byte-level addressability streamlines data storage and helps to accelerate applications. At the same time, it's cost effective, offering more performance per dollar than a comparable NAND drive. The DataCore team evaluated the performance of Intel® Optane Solid State Drives (Intel® Optane™ SSDs) against traditional NAND flash SSDs when using the SANsymphony software as part of a dynamic tiered storage environment.

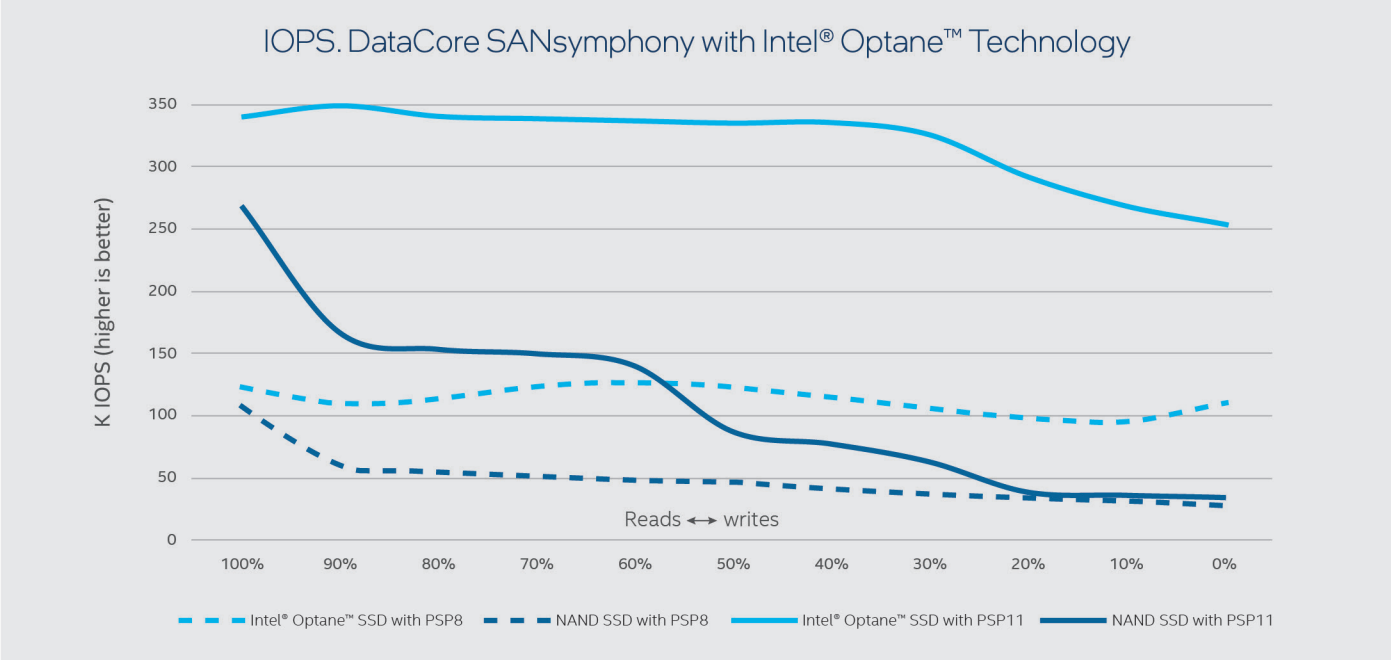

Figure 1. IOPS: DataCore SANsymphony with Intel® Optane™ SSDs vs NAND SSDs.[1]

Solution Evaluation

The DataCore team developed a testing script based on IOmeter to compare the performance of Intel® Optane™ SSD DC P4800X with flash-based Intel® SSD DC P4510 drives. The script generates a worst-case scenario for the SANsymphony software to determine the minimum achievable performance of the system. Running a synthetic workload over multiple hours helped determine whether the performance achieved was consistent.

A key performance metric in the evaluation was write speed. This can be a challenge for SANsymphony, as reads can be served ultra-fast from DRAM-based cache, while writes must go down to a non-volatile storage in the end. This leads to storage-related bottlenecks for any technology showing high write penalty.

Solution Summary

The DataCore team first evaluated the performance of the SANsymphony PSP8 release running on both Intel Optane SSDs and NAND SSDs. In this test, the Intel Optane technology enabled a 3.8x performance improvement.[1] The DataCore and Intel teams then worked together to further optimize the software to achieve greater performance improvements and deliver more value for customers. This was reflected when they ran the test again, using the SANsymphony PSP11 release. In this evaluation, the Intel Optane SSDs were up to 7.5x faster in writing data to storage (see figure 1).[1] This is due to the difference in the way in which the NAND and Intel Optane technologies are architected. As NAND SSDs typically hold multiple bytes per flash cell and cells are organized in larger pages, every time one byte needs to change, additional writes must also be performed to replace the other bytes on that cell and on all other cells making up a page. Intel Optane technology allows each byte to be changed independently, avoiding this scenario entirely (see figure 2).

This architectural feature of Intel Optane technology also helps avoid another common challenge of NAND SSDs: write amplification. Every time data is saved to a flash storage drive, existing data and metadata must be erased, redistributed and re-written, often multiple times. These continuous multiple writes can cause the cell to degrade more quickly, leading to lower life expectancy and lower speed for the device. By allowing only the bytes being changed to be erased and replaced, Intel Optane technology helps boost the overall durability of the storage environment. For example, Intel Optane SSD DC P4800X offers endurance of up to 60 drive writes per day (DWPD) over five years.[2]

The DataCore evaluation also compared the two SSD technologies for latency, evaluating the full read-write workload spectrum. It found that the latency of the NAND drive was significantly higher than that of the Intel Optane technology device for 100 percent write. The NAND drive took up to 1.89 milliseconds on average, compared to 0.25 milliseconds on average per operation on the Intel Optane SSD (see figure 3)[1] When running many enterprise workloads, this difference in latency can have a powerful impact on customer satisfaction and business performance. For example, ecommerce websites must carry out hundreds of transactions per user request and respond to customer actions at split-second speed. A delay of even one second can impact the customer experience[3] and begin to risk customers abandoning a purchase and not coming back.

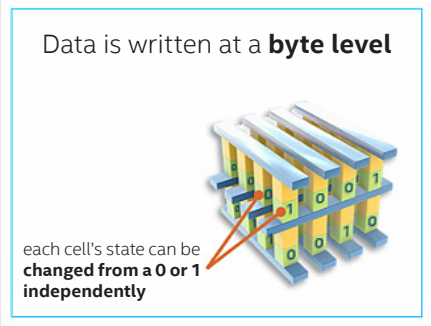

Figure 2. Byte-level addressability of Intel® Optane™ technology fundamentally streamlines data storage.[1]

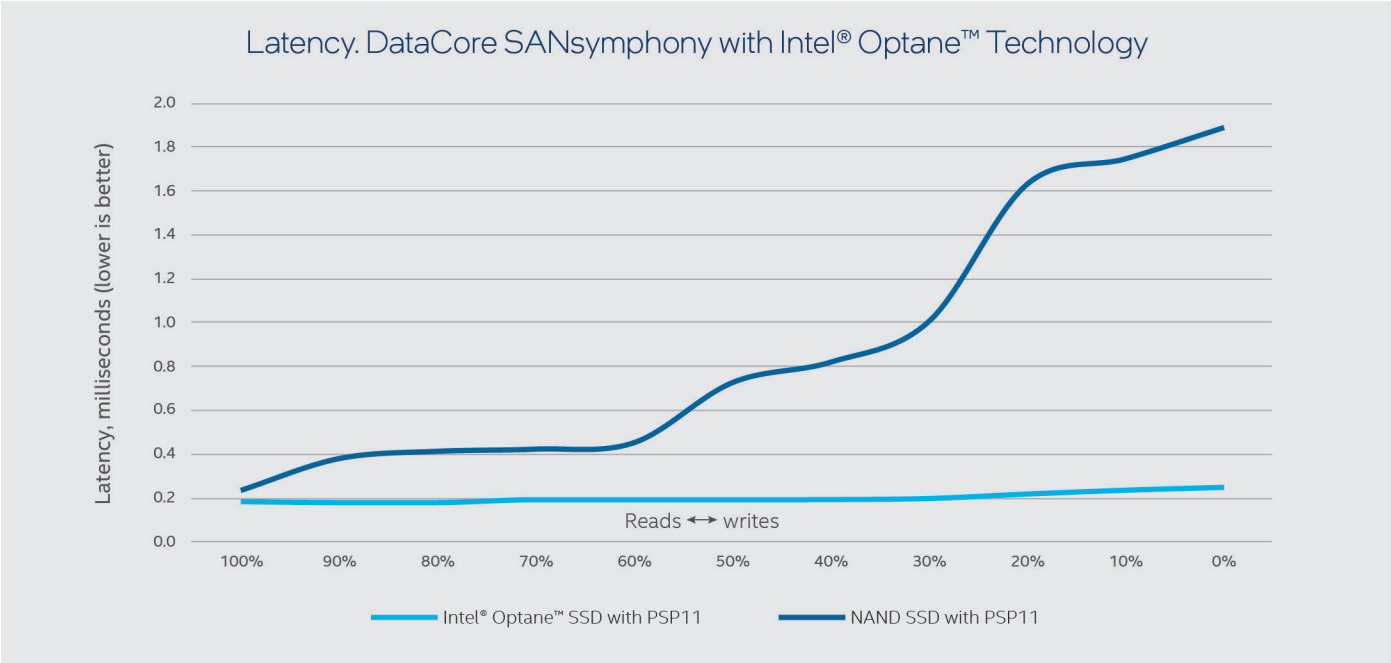

Figure 3. Intel® Optane™ SSDs deliver lower latency than NAND SSDs.[1]

Business Value

The results of DataCore's evaluation convinced the company that using Intel Optane SSDs would help its customers enhance the performance of their SDS environments. Subsequent testing on real-world workloads generated results in line with those of the synthetic workloads.

> "We believe Intel® Optane™ technology is a real game changer, and we're working with our channel to help customers understand the benefits it can bring to them."
>
> **—Alexander Best,**
> Regional Technologist Central Europe, DataCore

"Intel Optane technology creates the opportunity for a new class of performance, and we're making sure our customers can fully benefit from that by optimizing our SANsymphony software to take advantage of parallel processing." In the past, this has been unnecessary as one processor core can serve hundreds of hard disk drives (HDDs), or one flash drive. However, with Intel Optane technology, the balance has shifted. The speed of the Intel Optane SSD means compute power now becomes more important than ever to deliver an excellent user experience. DataCore's latest SANsymphony release now unlocks the power of multiple cores working in parallel all the way through the stack, from the client side all the way down to the device level. This ensures best-in-class performance with every new technology that becomes available.

By continuing to evolve its software offering in line with advancements in hardware like this, DataCore ensures that its customers benefit from the compelling SDS capabilities. "Through this work with Intel, we're able to strengthen the service we provide to our customers and help them make informed investment decisions so they can build a long-lasting and cost-effective SDS environment," says Best. "For example, it's possible to get the benefit of Intel Optane technology in a tiered storage environment for a relatively small investment. We tell our customers that rather than purchasing a lot of new flash devices, they can buy one Intel Optane device that will also deliver all the advantages we've demonstrated in this evaluation."

This approach enables DataCore's customers to streamline their storage environment while at the same time enhancing its performance per dollar, latency and durability. Organizations using SANsymphony to manage their SDS can easily scale up as they add more workloads, helping ensure plenty of headroom for business growth.

Learn More

- Webpage: DataCore SANsymphony
- Webpage: Intel® Optane™ SSDs for Data Center

Find the solution that's right for your organization. Contact your Intel representative or visit **www.intel.com/optane**

[1] The performance fingerprint is a series of performance tests run with IOmeter against a given storage unit as part of a DataCore SANsymphony storage pool. The test itself consists of 11 individual performance profiles.

100R8K – 100% read, 0% write, 8 Kilobytes IO size, 100% random, 0% sequential
90R8K – 90% read, 10% write, 8 Kilobytes IO size, 100% random, 0% sequential
80R8K – 80% read, 20% write, 8 Kilobytes IO size, 100% random, 0% sequential
70R8K – 70% read, 30% write, 8 Kilobytes IO size, 100% random, 0% sequential
60R8K – 60% read, 40% write, 8 Kilobytes IO size, 100% random, 0% sequential
50R8K – 50% read, 50% write, 8 Kilobytes IO size, 100% random, 0% sequential
40R8K – 40% read, 60% write, 8 Kilobytes IO size, 100% random, 0% sequential
30R8K – 30% read, 70% write, 8 Kilobytes IO size, 100% random, 0% sequential
20R8K – 20% read, 80% write, 8 Kilobytes IO size, 100% random, 0% sequential
10R8K – 10% read, 90% write, 8 Kilobytes IO size, 100% random, 0% sequential
0R8K – 0% read, 100% write, 8 Kilobytes IO size, 100% random, 0% sequential

The 100% random IO is chosen to simulate the worst case situation for any kind of caching architecture. This should reveal the raw device performance of the given equipment and also the IO coalescing benefits of the DataCore layer sitting in front of the storage system. The whole series of tests is repeated 10 times to create enough data for analysis. The data is compiled in average values.

The test uses 4 workers with 16 outstanding IOs per worker at 1 test device.

Compared disks:

- Flash: 4x Intel® SSD DC P4510 Series (1.0TB, 2.5in PCIe 3 TLC Flash), 1 DWPD / 1.920 PBW
- Optane: 4x Intel® Optane™ SSD P4800X Series (375GB, ½ Height PCIe x4, 20nm, 3D Xpoint™), 60 DWPD / 41 PBW

The compared disks were built in a DataCore server (non-mirrored). CPU: 2x Intel® Xeon® CPU E5-2637 v3 @ 3.50GHz (4 Cores / 8 Threads), RAM: 128GB – 83GB SANsymphony Cache, Connectivity: 5x Fibre

DataCore SANsymphony version used in performance evaluations is v10 PSP8 & PSP11. OS - Microsoft Windows Server 2016.

[2] https://www.intel.com/content/www/us/en/products/docs/memory-storage/solid-state-drives/data-center-ssds/optane-ssd-dc-p4800x-p4801x-brief.html

[3] https://www.nngroup.com/articles/response-times-3-important-limits/

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Performance results are based on testing as of dates shown in configurations and may not reflect all publicly available updates. See backup for configuration details. No product or component can be absolutely secure.

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