



Do More, Spend Less: Faster Insights Equal Shorter Time-to-Market

Intel® Optane™ DC SSDs and Microsoft Storage Spaces Direct* (MS S2D*) increase endurance, reduce latency, and decrease cost

Authors

Alessandro Goncalves
SSD Solutions Architect,
Intel Non-Volatile Solutions Group

Jeffrey R. Galinovsky
Storage Solution Marketing Manager,
Intel

Executive Summary

Organizations large and small are recognizing the importance of actionable business insights from data mining. These insights help with every aspect of product and services design and development, and time-to-market is often critical. But performance can be expensive and many organizations are faced with deciding between speed and price.

Hyperconverged infrastructure (HCI) can help reduce data center costs and ease the burden of maintenance. Microsoft Storage Spaces Direct* (MS S2D*) with Intel® Optane™ DC SSDs gives organizations the option to either speed time to discovery without increasing costs, or reduce costs without compromising performance. MS S2D with Intel Optane DC SSDs is an especially effective way to reduce latency and increase throughput, which decreases the cost per transaction. In tests comparing 375 GB Intel Optane DC SSDs to all-flash 1.6 TB Intel® 3D NAND SSDs, 45 percent higher I/O per second (IOPS) was achieved with the same number of nodes, experiencing higher performance for the same price (see Figure 1).¹

Data Storage Deployments with Intel® Optane™ DC SSDs and Microsoft Storage Spaces Direct*

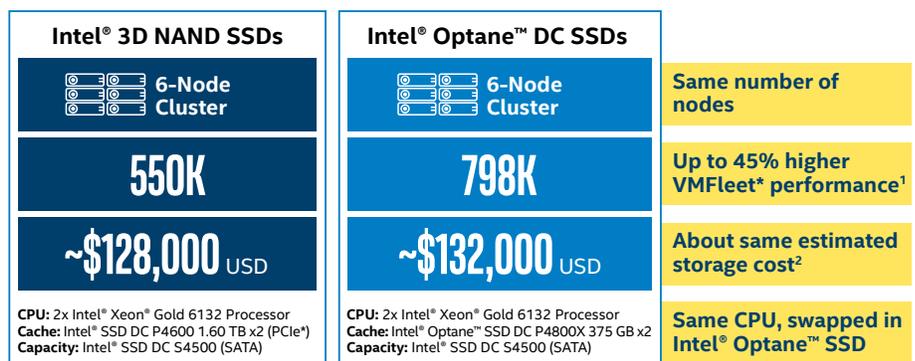


Figure 1. Intel® Optane™ DC SSDs as the cache tier help businesses using Microsoft Storage Spaces Direct* increase I/O per second, reducing the cost per transaction.²

Solution Benefits

With Microsoft Storage Spaces Direct* (MS S2D*) powered by Intel® Xeon® Scalable processors and Intel® Optane™ DC SSDs as the cache tier, organizations can achieve the following:

- **Lower latency.** Intel Optane DC SSDs have outstanding write performance, predictable response time, and consistent performance across workloads.
- **Higher throughput.** Designed for capacity, the solution increases IOPS with the same number of nodes.
- **Decreased costs.** With greater cache efficiency and drive endurance, cost per transaction is reduced significantly.

Business Challenge: Actionable Business Intelligence Takes Time and Money

Organizations across industries are under increased pressure to gain accurate and actionable business insights from large and ever-increasing data sets. But rapidly mining data can be expensive, and many organizations are forced to choose between inexpensive and slower hard disk drives or fast and expensive DRAM. These organizations need a highly flexible and scalable solution that provides high-performance, high-density data handling at a lower cost. HCI—tightly integrated compute, storage, and virtualization solutions such as Microsoft Storage Space Direct* (MS S2D*)—using Intel® Optane™ technology can help overcome these challenges.

Use Case: National Law Firm Increases Performance

Bradley Arant Boult Cummings LLP, a national law firm that provides business clients with a full suite of legal services in dozens of industries and practice areas, needed to update its primary data center. Their goals included moving to HCI, laying the foundation to use hybrid cloud, improve performance, reduce latency, and reduce the overall maintenance and licensing costs.

Bradley selected DataON* S2D HCI, optimized for I/O per second (IOPS) and performance, and an all-flash solution with NVMe*-based Intel® Optane™ DC SSDs. DataON S2D optimized the full stack of MS S2D in a hyperconverged platform. The solution increased performance with near-instantaneous reboot times and much lower latency.¹ According to Bradley, they also significantly reduced maintenance costs and decreased annual licensing fees.

Solution Value: Grow Performance Without Changing Storage

MS S2D offers software-defined-storage (SDS) and design based on internal storage servers, shared-nothing storage architecture, high availability and scalability, and Ethernet/remote direct memory access (RDMA) network storage fabric. Adding Intel Optane DC SSDs to MS S2D as the cache tier in all-flash environments divides read/write activity, where only writes are cached for SSDs, while reads are served directly from the capacity drives. The resulting write characteristics, such as latency, are dictated by the cache drives, resulting in higher performance, lower latency, and lower cost. This provides more flexibility to choose between doing more without increasing costs or spending a little more to gain significantly higher throughput. The solution also extends the life of drives and is particularly useful for massive data volumes, such as used in gaming or media creation.

Compared to 3D NAND (1.6 TB) technology, using an Intel® Optane™ SSD DC P4800X (375 GB) as the caching tier supports more I/O-intensive workloads at a lower cost per transaction. The results included the following (see Figure 2):

- **Higher throughput.** Intel Optane DC SSDs achieved up to 45 percent higher IOPS on random workloads over 3D NAND.¹
- **Lower latency.** Intel Optane DC SSDs as the cache tier reduced latency with no additional CPU consumption.³
- **Lower cost.** Intel Optane DC SSDs allow businesses to choose between reducing overall cost or achieving higher performance without increasing cost.²

The performance gains that Intel Optane DC SSDs deliver help organizations break through storage bottlenecks, achieve more per server, and reduce the cost of latency-sensitive workloads.

	Intel® 3D NAND SSD Cache	Intel® Optane™ DC SSD Cache
CPU	 2x Intel® Xeon® Processors	 2x Intel® Xeon® Processors
Memory	 DRAM	 DRAM
Cache	 2x Intel® SSD DC P4600 1.6 TB	 2x Intel® Optane™ SSD DC P4800X 375 GB
Storage	 22x Intel® SSD DC S4500	 22x Intel® SSD DC S4500

Figure 2. Microsoft Storage Spaces Direct* solutions produced up to 45 percent greater throughput¹ with 375 GB Intel® Optane™ DC SSDs, delivering high performance at the same cost.

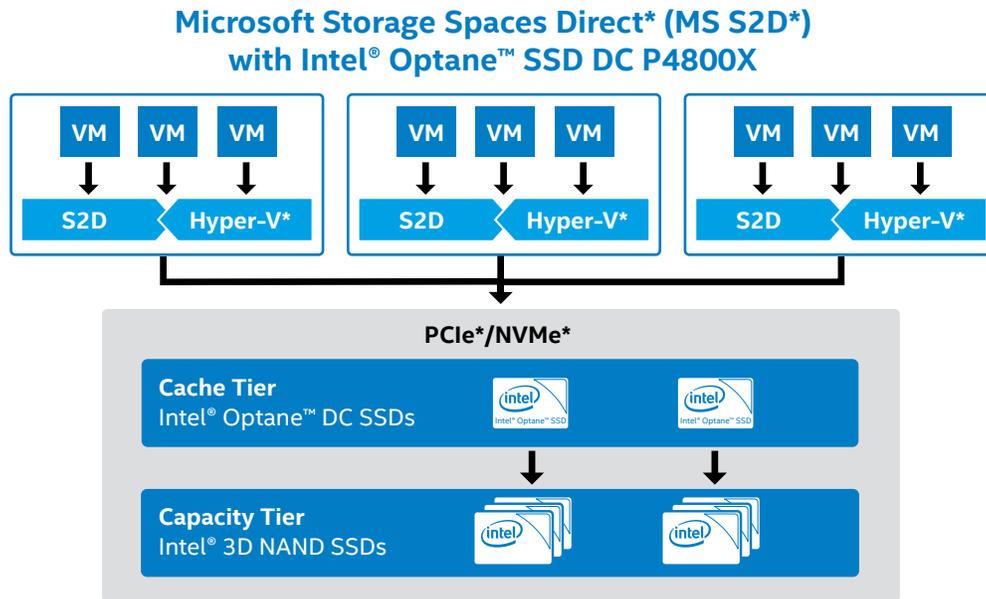


Figure 3. Increase the number of virtual machines (VMs) per node by moving the reads to the capacity tier and handling the writes with Intel® Optane™ DC SSDs at the cache tier.

Solution Architecture: More VMs Per Node

MS S2D uses industry-standard servers with local-attached drives to create highly available, highly scalable SDS at a fraction of the cost of traditional storage arrays. HCI dramatically simplifies deployment, while caching, storage tiers, and erasure coding, together with the latest hardware, deliver exceptional efficiency and performance.

Organizations can use Intel Optane DC SSDs at the cache tier to separate write-focused cache from read-focused storage in the capacity tier when deployed in all-flash environments. More CPU resources are available, as well as more virtual machines (VMs) per node. With MS S2D, cache drives can be added or removed at any time (see Figure 3).

Conclusion

I/O-intensive workloads can force companies to choose between slower, less expensive solutions or costly DRAM. But time-to-market is highly dependent on the ability to gain insights quickly. HCI can dramatically improve deployment and management, and replacing standard SSDs with Intel Optane DC SSDs at the cache tier can further help businesses speed insights or reduce costs. Using Intel Optane DC SSDs as the cache tier for dedicated writes moves reads to the capacity tier, reducing latency and increasing IOPS up to 45 percent.¹ More transactions per second results in much lower cost per transaction.

Find the right solution for your organization. Contact your Intel representative or visit [intel.com/optane](https://www.intel.com/optane).

Learn More

You may also find the following resources useful:

- [Intel® Optane™ Technology](#)
- [Intel® Xeon® Scalable Processors](#)
- [The Age of Data Center Convergence Gives Storage a Boost](#)
- [Adding Intel® Optane™ SSDs to VMware vSAN* Data Storage Increases Performance While Reducing Costs paper](#)

Solution Provided By:

¹ Source – DataOn, Inc. - System Configuration – Intel® DC SSD P4600 1.6 TB - 2x, Intel® DC S4500 3.8 TB x22, Intel® Xeon® Gold 6132 processor, 2.60 GHz, 28 cores, 56 logical processors. 768 GB DDR4, IOPs = 548K, latency = R-0.25ms/W-0.15ms; Intel® Optane™ SSD DC P4800X 375 GB - 2x, Intel® DC S4500 3.8 TB x22, Intel® Xeon® Gold 6132 processor, 2.60 GHz, 28 cores, 56 logical processors. 768 GB DDR4, IOPs = 798K, latency = R- 0.192ms W - 0.21ms; Mixed workload 70%R/30%W - VMfleet (20 VMs per node) Six nodes; test profile - Random-4K, 8 Threads, one outstanding IO (70%Read/30%Write). Performance results are based on testing as of June 30, 2018 and may not reflect all publicly available security updates. See dataonstorage.com/customer-stories/law-firm-looks-to-the-future-with-a-microsoft-hci. Intel does not control or audit third-party benchmark data or the web sites referenced in this document. Visit the referenced web site and confirm whether referenced data are accurate.

² Source for Pricing (as of April 2019): S4500 3.84 TB – USD 890 per drive*6*22*890 = USD 117,480 - amazon.com/Intel-S4500-Internal-Solid-State/dp/B075HRYWC4; P4600 1.6 TB – USD 861.64 per drive*6*2 = USD 10,339.68 - newegg.com/Product/Product.aspx?Item=1B4-008A-000W2; P4800X 375 GB – USD 1,172.92 per drive*6*2 = USD 14,075.04 - newegg.com/Product/Product.aspx?Item=9SIA1K68TS2216. Storage Configuration 1 – 6 nodes, each node with 2x P4600 1.6 TB + 22x S4500 3.84 TB = Total cost is USD 127,819.68. Storage Configuration 2 – 6 nodes, each node with 2x P4800X 375 GB + 22x S4500 3.84 TB = Total cost is USD 131,555.04.

³ Source – Intel-tested: Average read latency measured at queue depth 1 during 4k random write workload. Measured using FIO 3.1. Common Configuration - Intel® 2U Server System, OS CentOS* 7.5, kernel 4.17.6-1.el7.x86_64, CPU 2 x Intel® Xeon® Gold 6154 processor @ 3.1 GHz (18 cores), RAM 256 GB DDR4 @ 2666 MHz. Configuration – Intel® Optane™ SSD DC P4800X 375 GB and Intel® SSD DC P4600 1.6 TB. Latency – Average read latency measured at QD1 during 4K Random Write operations using FIO 3.1. Intel® Microcode: 0x2000043; System BIOS: 00.01.0013; ME Firmware: 04.00.04.294; BMC Firmware: 1.43.91f76955; FRUSDR: 1.43. SSDs tested were commercially available at time of test. The benchmark results may need to be revised as additional testing is conducted. Performance results are based on testing as of July 24, 2018 and may not reflect all publicly available security updates. See configuration disclosure for details.

No product can be absolutely secure. Software and workloads used in performance tests may have been optimized for performance only on Intel microprocessors. Performance tests, such as SYSmark and MobileMark, are measured using specific computer systems, components, software, operations and functions. Any change to any of those factors may cause the results to vary. You should consult other information and performance tests to assist you in fully evaluating your contemplated purchases, including the performance of that product when combined with other products. For more complete information visit intel.com/benchmarks.

Intel technologies' features and benefits depend on system configuration and may require enabled hardware, software, or service activation. Performance varies depending on system configuration. No computer system can be absolutely secure. Check with your system manufacturer or retailer, or learn more at intel.com/content/www/us/en/solid-state-drives/optane-ssd-dc-p4800x-brief.html.

Cost reduction scenarios described are intended as examples of how a given Intel-based product, in the specified circumstances and configurations, may affect future costs and provide cost savings. Circumstances will vary. Intel does not guarantee any costs or cost reduction. Intel, the Intel logo, Optane, and Xeon are trademarks of Intel Corporation or its subsidiaries in the U.S. and/or other countries.

*Other names and brands may be claimed as the property of others. © Intel Corporation

0519/JGAL/KC/PDF 338360-001US