



Get more storage performance...

52% more IOPS
26% lower latency



...with less

while using **one fewer**
HPE ProLiant DL380 Gen10 server

Get more I/O performance on fewer servers with Intel Optane DC SSDs

Adding Intel Optane DC SSDs to an HPE ProLiant DL380 Gen10 server cluster improved response times by 26% and produced 52% more input/output operations per second while using one fewer server

On a workload simulating a multi-VM environment on Microsoft Storage Spaces Direct

Upgrading your business's storage usually achieves one of two outcomes: increased density, or increased storage performance. But what if a storage solution could achieve both? Intel® Optane™ is a technology that aims to accelerate storage performance.¹ In our testing, we set out to see whether adding Intel Optane DC SSDs to a virtualized Microsoft environment could boost I/O performance—while simultaneously improving data center efficiency.

In the Principled Technologies data center, we deployed Microsoft Storage Spaces Direct on two different HPE ProLiant DL380 Gen10 server cluster configurations:

- A four-server cluster using only Intel SATA SSDs
- A three-server cluster using Intel SATA SSDs and Intel Optane DC SSDs

To measure VM storage performance we used VMFleet, a Microsoft tool that produces storage-intensive loads. The configuration with Intel Optane DC SSDs processed 52 percent more input/output operations per second (IOPS) and responded 26 percent faster than the configuration with only SATA SSDs, using just three servers to achieve this better performance. The SATA-only configuration, by contrast, required four servers and still did not respond as quickly or process as many IOPS. With Intel Optane DC SSDs and HPE ProLiant DL380 Gen10 servers, your business doesn't need to choose between storage performance and efficiency—you could get both.

Use fewer servers with Intel Optane DC SSDs and save

In our testing, adding Intel Optane DC SSDs to HPE ProLiant DL380 Gen10 servers allowed us to reduce the number of servers used from four to three—all while producing more IOPS and lowering response times versus a configuration with only SATA SSDs. Using fewer servers and increasing the density of your data center can provide multiple benefits:

- With less equipment to run and keep cool, you could cut down on data center sprawl and **save on power and cooling costs**.
- Less equipment means your admins spend less time on maintenance, allowing you to redirect their time and attention toward projects that **grow your business**.
- With fewer servers to purchase, you could **lower expenditures**. In addition, since you would be using fewer network ports, you could **delay expensive equipment purchases** (like buying a new switch).

With the savings afforded by using fewer servers, you could invest more in strategic ventures that potentially enable your business to **generate more revenue**.

The business benefits of using Intel Optane DC SSDs

The Intel Optane DC SSD is designed to deliver high throughput, low latency, predictably fast service, and high endurance.² Intel claims that Intel Optane SSDs, with Optane memory media, can “perform writes at the byte- or page-level for faster and much more predictable performance, with more balanced read and write performance, and with no need for garbage collection” compared to traditional NAND flash SSDs.³ Intel Optane DC SSDs also offer greater endurance than NAND flash technology: up to 60 drive writes per day (DWPD) versus the NAND flash-based Intel SATA S4510 SSDs we tested, which offer a maximum of two DWPD.⁴ Faster performance and higher durability could enable your business to:

- Support demanding, storage-intensive environments for longer, potentially resulting in fewer storage hardware replacements
- Serve more customers, enabling your business to expand its customer base
- Satisfy your users with faster performance even during periods of high use, minimizing customer drop-off

In our testing, we discovered that adding Intel Optane DC SSDs to HPE ProLiant DL380 Gen10 servers boosted IOPS by 52 percent and lowered response times by 26 percent. More IOPS and faster response times can help your business do more work and serve more customers, potentially increasing revenue.

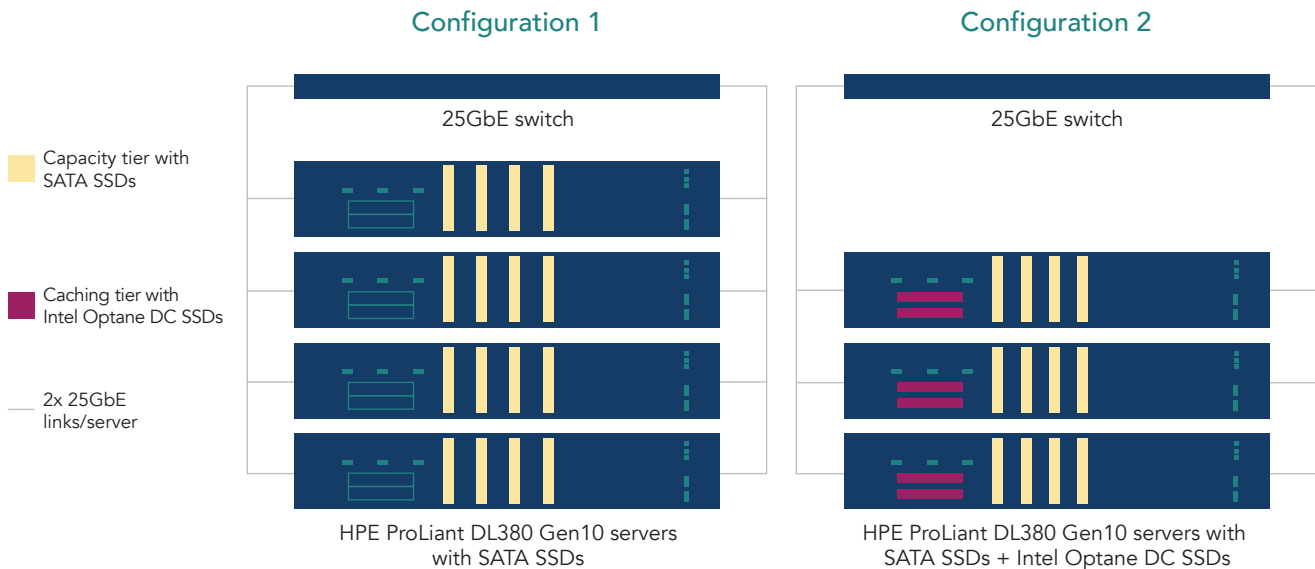
Learn more at <https://www.intel.com/content/www/us/en/architecture-and-technology/optane-technology/optane-for-data-centers.html>.

How we tested

We conducted testing using two different configurations:

- A four-node Microsoft Storage Spaces Direct cluster with HPE ProLiant DL380 Gen10 servers. Each node had four Intel SATA S4510 SSDs in the capacity layer.
- A three-node Storage Spaces Direct cluster with HPE ProLiant DL380 Gen10 servers. Each node had four Intel SATA S4510 SSDs in the capacity layer, plus two Intel Optane DC SSDs in the caching layer.

We chose to run a four-node cluster with Microsoft Storage Spaces Direct to mimic a medium-sized business running many VMs in a hyper-converged cluster. We used a transactional database-like I/O profile (70% read, 30% write, with 8KB block sizes) that closely mimics everyday mixed-use database activity. We measured VM storage performance with VMFleet, a tool that generates random writes to exert pressure on the disk. While VMFleet is a synthetic testing tool, it is an effective way to stress the I/O capabilities of a Microsoft clustered environment, integrating directly with Storage Spaces Direct to distribute the load among the cluster's nodes. For more information about the configuration and testing, see the [science behind the report](#).



Handle more IOPS

Testing the number of input/output operations per second (IOPS) a solution can process gives us important insight into its ability to handle a high volume of data. In our testing, the three-node configuration with Intel Optane DC SSDs produced 52 percent more IOPS than the four-node configuration with only SATA SSDs.

As our testing demonstrates, Intel Optane DC SSDs in HPE ProLiant DL380 Gen10 servers not only boosted IOPS on a workload simulating real-world database work—they did so while using one fewer server. What's more, the configuration with Intel Optane DC SSDs supported the same number of VMs (72) as the SATA-based configuration, despite running on one fewer server. With Intel Optane DC SSDs and HPE ProLiant DL380 Gen10 servers, your organization could get more performance out of everyday database workloads while simultaneously saving on equipment and management costs.

HPE ProLiant DL380 Gen10 servers

The HPE ProLiant DL380 Gen10 two-socket server has an adaptable chassis with modular drive bay configuration options. Featuring processors from the Intel Xeon Scalable processor family, the ProLiant DL380 Gen10 is compatible with Intel Optane drives and supports up to 20 NVMe drives. Its 24 DIMM slots can support anywhere from 128 GB to 3 TB of memory. The HPE ProLiant DL380 Gen10 server also allows the CPU direct access to NVMe storage. HPE designed this direct connection to increase bandwidth and reduce latency as compared to other platforms using a PCIe switch, which could lead to faster response times. According to HPE, the ProLiant DL380 Gen10 server “delivers the latest in security, performance and expandability.”⁵ To learn more about the HPE ProLiant DL380 Gen10 server, visit <https://www.hpe.com/us/en/product-catalog/servers/proliant-servers/pip.hpe-proliant-dl380-gen10-server.1010026818.html>.

IOPS

70%/30% read/write workload
Higher is better

Configuration with SATA SSDs
+ Intel Optane DC SSDs

52.9%
more IOPS

592,173

Configuration with SATA SSDs

387,092

What is Microsoft Storage Spaces Direct?

A Microsoft Windows Server software-defined storage solution, Storage Spaces Direct pools direct-attached storage from the servers in your server cluster. According to Microsoft, the converged or hyper-converged architecture of Storage Spaces Direct “radically simplifies procurement and deployment.”⁶ Learn more about Storage Space Direct at <https://docs.microsoft.com/en-us/windows-server/storage/storage-spaces/storage-spaces-direct-overview>.

Boost storage response times and improve user experience

Latency is the time a disk takes to process a request. As the graph below demonstrates, the Intel Optane DC SSD-based configuration processed requests in 26 percent less time than the SATA-only configuration. When a solution can provide more IOPS at lower latency, it can likely process a large volume of transactions while preventing applications and users from waiting. Improved performance can help your organization do more database work, while a better user experience can lead to happier customers—and more sales.

Intel Xeon Scalable processors

Intel Xeon Scalable processors feature four configurations designed for various workloads: Platinum, Gold, Silver, and Bronze. In our testing, each of the HPE ProLiant DL380 Gen10 nodes used two Intel Xeon Gold 6154 processors. The Intel Xeon Gold 6154 processor contains 18 cores running at 3.00GHz frequency, with a max turbo frequency of 3.70 GHz. To learn more about Intel Xeon Scalable processors, visit <https://www.intel.com/content/www/us/en/products/processors/xeon/scalable.html>.

Average latency (ms)

70/30% read/write workload

Lower is better

Configuration with SATA SSDs
+ Intel Optane DC SSDs

26.6%
lower latency

4.4

Configuration with SATA SSDs

6.0

About the benchmark

We used VMFleet, a set of scripts developed by Microsoft, to test the solution's storage performance. With VMFleet, the user deploys multiple VMs, each running a storage load generator known as DiskSpd. According to Microsoft, "DiskSpd combines robust and granular IO workload definitions with flexible runtime and output options, creating an ideal tool for synthetic storage subsystem testing and validation."⁷



Conclusion

In our testing, adding Intel Optane DC SSDs to HPE ProLiant DL380 Gen10 servers boosted IOPS by 52 percent and improved response times by 26 percent compared to a solution using only SATA SSDs. The configuration with Intel Optane DC SSDs achieved this better performance even while using one fewer server than the SATA-based configuration. If your business is searching for a storage solution that can provide more I/O performance while using resources more efficiently—potentially boosting revenue in the process—Intel Optane DC SSDs paired with HPE ProLiant DL380 Gen10 servers could be the answer.

- 1 Intel, "Breakthrough Performance Expands Datasets, Eliminates Bottlenecks," accessed September 1, 2019, <https://www.intel.com/content/dam/www/public/us/en/documents/product-briefs/optane-ssd-dc-p4800x-p4801x-brief.pdf>.
- 2 Intel, "Breakthrough Performance Expands Datasets, Eliminates Bottlenecks."
- 3 Intel, "Reimagining Memory and Storage in the Data Center," accessed September 1, 2019, <https://www.intel.com/content/www/us/en/products/docs/memory-storage/solid-state-drives/data-center-ssds/optane-ssds-transform-memory-storage-hierarchy-brief.html>.
- 4 Intel, "Product Brief: Intel SATA S4510 SSDs," accessed September 1, 2019, <https://www.intel.com/content/dam/www/public/us/en/documents/product-briefs/dc-d3-s4510-s4610-series-brief.pdf>.
- 5 HPE, accessed September 1, 2019, <https://www.hpe.com/us/en/product-catalog/servers/proliant-servers/pip.hpe-proliant-dl380-gen10-server.1010026818.html>.
- 6 Microsoft, "Storage Spaces Direct overview," accessed September 1, 2019, <https://docs.microsoft.com/en-us/windows-server/storage/storage-spaces/storage-spaces-direct-overview>.
- 7 Microsoft, "DiskSpd: A Robust Storage Performance Tool," accessed September 1, 2019, <https://gallery.technet.microsoft.com/DiskSpd-A-Robust-Storage-6ef84e62>.

Read the science behind this report at <http://facts.pt/rfok6b3> ►



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