Business Brief

Data Center | Software-Defined Storage

Turn Massive Data into a Competitive Advantage

Together, Intel® Optane™ technology and Microsoft Azure Stack HCI transform data center efficiency and accelerate your organization's insights

Business Drivers and Desired Outcomes

Don't let traditional memory and storage infrastructure hold back your business.

- Make full use of massive amounts of available data to create applications and services for modern workloads
- Speed time-to-insight
- Do more with less: accelerate processes, increase productivity, and innovate in the face of budgets that are flat or shrinking
- Stay competitive by confidently deploying leading technologies in your data center

Solution Ingredients

- 2nd Generation Intel® Xeon® Scalable processors
- Intel® Optane™ SSDs
- Intel® Optane™ persistent memory
- Microsoft Azure Stack HCI (including Microsoft Storage Spaces Direct and Microsoft Hyper-V)

Microsoft Azure

Industry Strategic Challenges

Data is growing at a 26 percent CAGR.[1] Existing memory and high-latency storage systems are not engineered for the high-throughput, high-bandwidth demands required to make use of this data.

An efficient infrastructure that can respond to the memory and storage needs of high-demand workloads is needed to speed data access. HCI is recognized as the scalable solution that provides affordable handling of high-density data. The HCI market is accelerating at a CAGR of more than 32 percent.[2] Microsoft Azure Stack HCI combines highly virtualized compute, storage, and networking on industry-standard servers and components, making it possible to run virtualized applications on premises, as well as connect to Azure for cloud services.

Microsoft Azure Stack HCI is optimized for 2nd Generation Intel® Xeon® Scalable processors. And combined with Intel® Optane™ technology, it offers a flexible, scalable solution that can affordably handle large quantities of data—with higher data throughput, lower latency, increased memory capacity, and potential for consolidating workloads on a smaller data center footprint. This solution is well suited for virtual desktop infrastructures (VDI); trusted enterprise virtualization; resilient, high-performance SQL Server; scale-out storage; and new edge workloads.

With Intel Optane technology, enterprises gain a low-latency architecture that boosts performance for massive datasets and demanding workloads. They also can increase infrastructure agility, optimize resource utilization, and consolidate servers, apps, and users to help reduce costs in the data center. Intel's continuous innovation and vast ecosystem of partners brings confidence to infrastructure design and helps future-proof investments.

Intel Optane technology is a revolutionary class of non-volatile memory and storage media that modernizes data center architecture by filling the gap between high-performing volatile memory and lower-performing NAND storage and HDDs. By placing data closer to the CPU, Intel Optane technology enables architects to confidently deploy an agile, high-performing infrastructure that helps their organizations create innovative services and optimize their infrastructure investments.

Three Options to Improve Working Storage

Intel® Optane™ SSDs enable greater throughput with fewer servers.[3] Azure Stack HCI environments can benefit from Intel Optane technology in a number of ways. The following three reference architectures use Intel Optane SSDs; options two and three add in Intel Optane persistent memory (PMem).

Option 1. Increase Caching Speed

Use Intel Optane SSDs as cache, plus SATA-based Intel® 3D NAND SSDs for the capacity tier, to speed caching and increase VM density—leading to server consolidation. Faster caching enables server consolidation to increase data center efficiency.[4]

Up To **52%** More IOPS

Up To **26%** Less Latency

Option 2. Increase Available Memory

Workloads that need more memory can benefit from Intel Optane PMem and can replace DRAM to increase overall system memory and VM density, which can help reduce the cost per VM.[5]

Up To **33%** More Memory

Up To **36%** More VMs Per Node

Option 3. Increase Bandwidth and Memory

Workloads that not only need additional memory but also need extremely low latency can use Intel Optane PMem in App Direct-Dual Mode, which allows for faster cache allocation and frees up drive bays for more capacity.

App Direct-Dual Mode allocates some Intel Optane PMem in Memory Mode and uses the rest in Storage Over App Direct Mode. This approach increases both VM density and throughput. To increase both speed and memory, use Intel Optane PMem in App Direct-Dual Mode.[6]

Up To **41%** More VMs Per Node

Up To **76%** More Throughput

Solution Provided By:

Microsoft intel

intel OPTANE™

Intel® Optane™ Technology Advantages

Intel® Optane™ SSDs help remove data bottlenecks to accelerate transactions and time to insights so users get what they need, when they need it. With high quality of service and at least 6x faster performance than NAND SSDs at low queue depths, Intel Optane SSDs deliver fast, predictable performance even in the most demanding environments.[7]

Intel® Optane™ persistent memory gives enterprises the ability to extract more from larger datasets by combining more capacity and native persistence in a DIMM form factor. Data can be accessed, processed, and analyzed in near real time to deliver deep insights, improve operations, and create new revenue streams.

Enabling Transformation

Augmenting traditional memory and storage options with Intel Optane technology can transform how businesses capitalize on the data available to them. This solution provides a new option to expand memory and optimize storage without compromising on performance or cost. It allows for faster, better use of data and cost-effective scaling, enabling competitive advantage now and in the future.

Where to Get More Information

- Intel® Optane™ Technology
- Intel® Optane™ SSDs
- Intel® Optane™ persistent memory
- 2nd Generation Intel® Xeon® Scalable processors
- Intel® Ethernet Technology
- Microsoft Azure Stack HCI
- Intel® Select Solutions for Azure Stack HCI

[1] IDC. "IDC's Global DataSphere Forecast Shows Continued Steady Growth in the Creation and Consumption of Data." May 2020. idc.com/getdoc.jsp?containerId=prUS46286020

[2] Reportlinker, Jan 14, 2019. prnewswire.com/news-releases/the-global-hci-market-size-is-expected-to-grow-from-usd-4-1-billion-in-2018-to-usd-17-1-billion-by-2023--at-a-compound-annual-growth-rate-cagr-of-32-9-300777557.html

[3,4] Testing by Principled Technologies as of August 7, 2019. For more information, visit principledtechnologies.com/Hpe/Intel-Optane-HPE-ProLiant-Storage-Spaces-Direct-0919.pdf and principledtechnologies.com/Hpe/Intel-Optane-HPE-ProLiant-Storage-Spaces-Direct-science-0919.pdf. **Common configuration:** 2x Intel® Xeon® Gold 6154 processor @ 3.0 GHz (18 cores); 12 x 32 GB DDR4-2666 (total memory=384 GB); OS drive=1x Intel® SSD DC S3700 400 GB; Intel® Hyper-Threading Technology=ON; Intel® Turbo Boost Technology=ON; BIOS=U30 v1.46 (10/02/2018); BIOS setting=Performance; OS=Windows Server 2019 Build 1809 (patched 8/2/19); Power management policy=Static High Performance Mode; NIC=2x Intel® Ethernet Adapter XXV710 (25 GbE). **All-SATA Configuration:** four-node cluster; 4x Intel® SSD D3-S4510 3.84 TB. Results: IOPS=387,092; Latency=6.0 ms. **SATA plus Intel Optane SSD configuration:** three-node cluster; 4x Intel® SSD D3-S4510 3.84 TB and 2x Intel Optane SSD DC P4800X 375 GB. **Results:** IOPS=592,173; Latency=4.4 ms. **Workload:** VMFleet/DISKSPD 2.0.21a

[5] Performance results are based on testing by Intel as of February 8, 2019 and may not reflect all publicly available security updates. **Common configuration:** Intel® Xeon® Gold 6230 processor @ 2.10 GHz. **All-DRAM configuration:** 384 GB DDR4 DRAM memory. **Benchmark Setup:** VMFleet Test: 18 VMs/node, each VM with 4 cores, 8 GB Memory, 40 GB VHDX, testfile: 10 GB; test setup: threads=4, buffer size=4 KB, pattern=random, duration=300 seconds, queue depth=16, 30% write, OS: Windows Server 2019 Standard (Desktop) with updated patch. **DRAM + Intel® Optane™ persistent memory configuration:** 192 GB DDR4 DRAM memory + 512 GB Intel Optane persistent memory in Memory Mode. **Benchmark Setup:** VMFleet Test: Each VM with 1 core, 8 GB; memory, 40 GB VHDX; test setup: threads=2; buffer size=4 KB; pattern=random, duration=300 seconds; queue depth=16, 30% write; OS: Windows Server 2019 Standard (desktop) with updated patch.

[6] Testing by Intel as of February 8, 2019. **All-DRAM configuration:** 2x Intel® Xeon® Gold 6230 processor with 384 GB DDR4 DRAM. **Benchmark Setup:** VMfleet Test: 18 VMs/node, each VM with 4 cores, 8 GB Memory, 40 GB VHDX, testfile: 10 GB. Test setup: threads=4, buffer size=4 KB, pattern=random, duration=300 seconds, queue depth=16, 30% write, OS: Windows Server 2019 standard (desktop) with updated patch. **DRAM + Intel Optane PMem configuration:** 2x Intel® Xeon® Gold 6252 processor with 192 GB DDR4 DRAM and 1,536 GB Intel Optane PMem in App Direct-Dual Mode; PMem as cache: 2x 512 GB segments. **Benchmark Setup:** VMfleet Test: Each VM with 1 Core, 8 GB Memory, 40 GB VHDX; test setup: threads=2 , buffer size=4kb, pattern=random, duration=300 seconds, queue depth=16, 30% write, OS: Windows Server 2019 Standard (desktop) with updated patch.

[7] Intel-tested as of November 15, 2018. 4K 70/30 read/write performance at low QD. Measured using FIO 3.1. **Common configuration:** Intel 2U Server System, OS: CentOS 7.5, kernel 4.17.6-1.el7.x86_64, 2x Intel Xeon Gold 6154 processor at 3.0 GHz (18 cores), 256 GB DDR4 RAM at 2,666 MHz. **Configuration:** 375 GB Intel Optane SSD DC P4800X compared to 1.6 TB Intel SSD DC P4600. **Intel microcode:** 0x2000043; system BIOS: 00.01.0013; Intel ME firmware: 04.00.04.294; BMC firmware: 1.43.91f76955; FRUSDR: 1.43. The benchmark results may need to be revised as additional testing is conducted.

0621/KMAH/KC/PDF 342027-003US