Solution Brief
July 2021

Intel® Select Solutions for VMware vSAN with 3rd Gen Intel® Xeon® Scalable Processors

Simplify deployment of a scalable hyperconverged solution designed specifically for demanding workloads and facilitate management of hybrid cloud

Executive Summary

Modern businesses need infrastructure designed to handle the needs of data-hungry workloads in the data center. In-memory databases, complex analytics applications, and high-density virtual desktop infrastructure (VDI) deployments all require infrastructure that provides scalability, performance, security, and manageability.

Intel® Select Solutions for VMware vSAN help ensure a fast, pain-free deployment of hyperconverged infrastructure (HCI) so that IT teams can immediately realize the benefits of virtualized compute, storage, and network resources. These preconfigured solutions, which are optimized by VMware and Intel, take advantage of 3rd Generation Intel® Xeon® Scalable processors to handle demanding workloads and enhanced scalability.

Many enterprise workloads require large amounts of system memory to provide peak performance; but for most businesses, simply expanding DRAM is not viable due to cost and capacity limitations. VMware and Intel are collaborating to support and optimize products like vSphere and Intel® Optane™ persistent memory (PMem), helping organizations overcome the capacity limitations of DRAM for performance-critical use cases. vSphere support for Intel Optane PMem 200 series can cost-effectively expand the capacity of memory available to support more or larger VMs, leading to an 81 percent TCO improvement gen-over-gen.[1]

Intel® Optane™ SSDs accelerate access to stored data, delivering up to 6x faster throughput versus Intel® SSD D7-P5600 (Intel's fastest NAND SSD) and lightning-fast response time under any workload.[2] The extremely high endurance of Intel Optane SSDs extends their life span, making them ideal for write-intensive applications such as online transaction processing, high-performance computing, write caching, boot, and logging.

Intel® Select Solutions for VMware vSAN

Intel Select Solutions power VMware vSAN and VMware vSphere deployments with Intel Optane SSDs, Intel® 3D NAND SSDs, 3rd Gen Intel Xeon Scalable processors, Intel® Ethernet Network Adapters, and other Intel® technologies.

Business Challenge

Today's data-intense workloads are constantly pushing businesses and organizations beyond their current resources and infrastructure. These data-driven growing pains are exacerbated by outdated hardware, insufficient storage, and the inability to expand memory due to capacity limitations and costs (see Figure 1). Whatever the reason(s), more and more businesses are looking to modernize on-premises infrastructure with cloud capabilities, which are easier to update or scale as needed. However, the transition into this new environment can be daunting. Testing and evaluating various compute, storage, and networking technologies takes time and resources that few companies can spare.

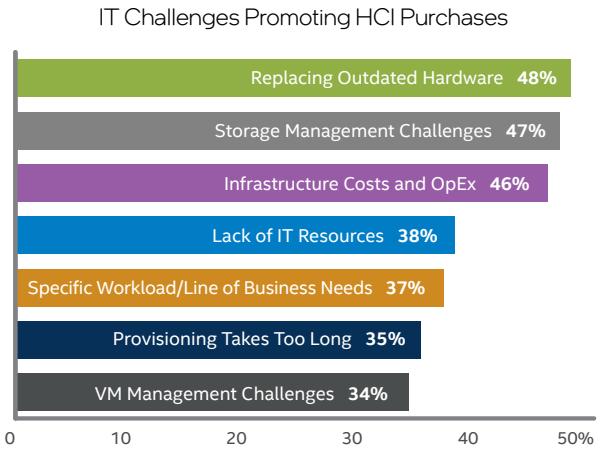

Figure 1. Top IT challenges prompting the purchase of HCI.[3]

HCI—one with tightly integrated and virtualized compute, storage, and networking—can fast-track this transition and allow businesses to confidently move forward.

Solution Value Proposition

VMware vSAN is an enterprise-class, virtual storage software that can be combined with the VMware vSphere cloud computing platform to help manage compute and storage with a single platform. Companies can use vSAN to reduce the complexity of traditional storage by replacing it with HCI for a hybrid cloud solution.

vSAN serves as a critical building block for the software-defined data center and for private and public cloud deployments. It integrates seamlessly with vSphere as a native HCI for business-critical applications, consolidated virtual desktop infrastructure (VDI), and more. It simplifies operations and reduces costs since administrators are able to use the same familiar tools to manage both compute and storage at the VM level—no additional expertise is needed. Furthermore, administrators can provision and manage data with ease, thanks to the fact that vSAN is embedded within the vSphere hypervisor.

Solution Benefits

- **Simplicity.** The provisioning and management of VMware vSAN is simplified and embedded in the vSphere hypervisor.
- **Agility.** VMware vSAN is a storage solution that doesn't follow the one-size-fits-all strategy, instead allowing administrators to invest incrementally and scale as needed to meet enterprise demands.
- **Low TCO.** VMware vSAN can run on a highly scalable infrastructure. With vSAN, storage can be easily deployed and managed with the VMs—no specialized skillset is required.

vSAN is *not* a one-size-fits-all solution. Rather, it imparts the flexibility for administrators to invest and scale as needed to meet ever-increasing enterprise demands.

Intel® Select Solutions for vSAN take advantage of Intel's continuous innovations across compute, storage, and network. For example, 3rd Gen Intel Xeon Scalable processors offer performance and workload optimizations across hybrid-cloud and intelligent edge applications. Other examples include Intel® Optane™ technology and the Intel® Ethernet 800 Series network adapters.

Intel Select Solutions for vSAN are available in two configurations: Base design and Plus design. The Plus design has certain performance advantages over the Base design that make it a better solution for demanding workloads like in-memory databases and artificial intelligence/machine learning.

What Are Intel® Select Solutions?

Pre-defined, workload-optimized solutions designed to minimize the challenges of infrastructure evaluation and deployment.

Solutions are validated by OEM/ODMs, certified by ISVs, and verified by Intel.

Every Intel Select Solution is a tailored combination of Intel® data center compute, memory, storage, and network technologies that delivers predictable, trusted, and compelling performance. Each solution offers assurance that the workload will work as expected, if not better, while saving the individual business from investing the resources that might be required to evaluate, select, and purchase the necessary hardware components to gain that assurance themselves.

Each system must be composed of at least four instances of hardware nodes (ESXi hosts) to create a vSphere/vSAN cluster.

Solution Architecture Highlights

VMware vSAN software is fully integrated with vSphere, joining all vSAN-supported local storage devices across a vSphere cluster into a shared data pool (see Figure 2).

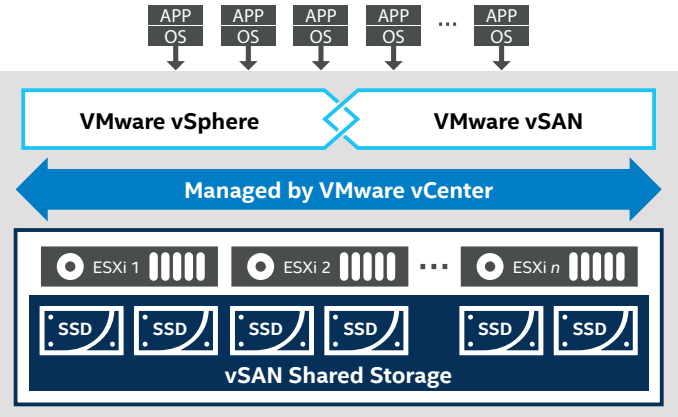

Figure 2. The industry-leading HCI software stack from VMware consists of VMware vSphere for compute virtualization, all-flash VMware vSAN for storage integrated with vSphere, and VMware vCenter for virtual infrastructure management.

vSAN eliminates the need for external shared storage, including storage area network (SAN) and network-attached storage (NAS). It offers users the flexibility to define storage redundancy and security policies and simplify management of storage containers. See the vSAN Datasheet for a general overview of vSAN.

A Closer Look at VMware vSAN

The latest major version of VMware vSAN, version 7, modernizes HCI by providing administrators with a unified storage control plane for both block and file protocols. vSAN includes several key enhancements, making it a great solution for both traditional VMs and cloud-native applications. Users can find a solution that simplifies management and provisioning, helps to unify block storage, and supports emerging technologies.

Key enhancements include:

- **vSphere Lifecycle Manager (vLCM).** Native to vSphere, vLCM help administrators maintain a simplified consistent server lifecycle management at scale. It helps facilitate software and firmware updates and can even be used to apply images and monitor compliance.
- **Enhanced Cloud Native Storage.** New native file services within vSAN simplify storage management and help reduce dependencies on external solutions.
- **vSphere Native Key Provider Services.** This support service simplifies enablement of encryption and enhances security.
- **Improved Data Durability.** In the event of an unplanned outage on a host, vSAN will immediately write all incremental updates to another host in addition to the other host holding the active object replica.
- **Remote Direct Memory Access (RMDA) Support.** vSAN supports RDMA for low-latency communication between compute nodes. RDMA allows direct memory access from the memory of one node to the memory of another node without involving the operating system or CPU.

For a more in-depth overview of these and other enhancements, please see the following articles:

- What's New with vSAN 7 Update 2
- What's New with vSAN, the "New Capabilities…" section
- Announcing vSAN 7
- vSAN 7 Technology Overview

Results

For mixed 70/30 percent read/write (100 percent random read) 8 KB block size I/O workloads, customers can expect the following performance from the Plus design:

- Up to 3750 MB/s throughput
- Response times as fast as 1.5 ms

This sustained performance demonstrates the solution's ability to support the most demanding business needs for a variety of workloads including SQL, NoSQL, and files.[4]

When compared to 2nd Gen Intel Xeon Scalable processor performance, Intel Select Solutions for vSAN with 3rd Gen Intel Xeon Scalable processors show substantial benefit to upgrading to the latest Intel technology, including Intel Optane PMem. For example, the 3rd Gen Plus design provided 1.5x more throughput and a 15 percent decrease in latency.[5] Also, vSphere support for Intel Optane PMem 200 series can cost-effectively expand the capacity of memory available to support more or larger VMs, leading to an 81 percent TCO improvement gen-over-gen.[6]

HammerDB/Microsoft SQL

Microsoft SQL workloads show good overall performance for the 3rd Gen Base design, maxing out at 2.78 million new orders per minute (NOPM).[7] The 3rd Gen Plus design equipped with Intel Optane PMem configured in App Direct mode achieved 6.76 million NOPM.[7] This is a more than 142 percent performance gain, and at the same time is a more than 114 percent gain in NOPM per $ when compared to the Base design. In this scenario, vSphere took advantage of Intel Optane PMem in App Direct mode, providing high-performance, direct access, and local storage for the Microsoft SQL database files.

Learn More

You may also find the following resources useful:

- Intel® Select Solutions
- 3rd Gen Intel® Xeon® Scalable processors
- Intel® SSD D7-5500
- Intel® Optane™ SSDs
- Intel® Optane™ PMem
- Intel® Ethernet 800 Series
- VMware vSAN

Find the solution that is right for your organization. Contact your Intel representative.

[1] Plus over Baseline TCO Claim. Test by Intel April 3-6, 2021.

Baseline (2nd Gen Intel® Xeon® Scalable processor): 4-node, 2x Intel® Xeon® Platinum 8268 processor, 1x Intel® Server Board S2600WF0R, Total Memory 1536 GB (2LM) - 384 GB DRAM (12 slots/32 GB/2666 MHz) + 1536 GB Intel® Optane™ persistent memory series 100 (12 slots/128 GB/2666 MHz), Intel® Hyper-Threading Technology ON, Intel® Turbo Boost Technology ON, Intel® VMD Disabled, BIOS: SE5C620.86B.02.01.0011.032620200659 (ucode: 0x05002f00), Storage (boot): 1x 480 GB Intel® SSD D3-S4510 Series, Storage (cache): 2x 375 GB Intel® Optane™ SSD DC P4800X, Storage (capacity): 6x 2 TB Intel® SSD DC P4510, Network devices: 1x Intel® Ethernet Converged Network Adapter XXV710-DA2 at 25 GbE, Network speed: 25 GbE, OS/Software: VMware 7.0.1, 17325551, HCIBench 2.5.3 8K profile (I/O size 8K, Read percentage 70%, Random percentage 100%, #VMs per cluster 16, vCPU 4, vRAM 8, # data disks per VM 16, size of disk 50 GB), Baseline: Throughput 2655 MB/s, latency 1.69ms. Estimated system cost is $54,648.

Base Design (3rd Gen Intel Xeon Scalable processor): 4-node, 2x Intel® Xeon® Gold 6330 processor, 1x Intel® Server Board M50CYP2UR,Total Memory 512 GB (16 slots/32 GB/3200 MHz), Intel Hyper-Threading Technology ON, Intel Turbo Boost Technology ON, Intel VMD Disabled, BIOS: SE5C6200.86B.0022.D08.2103221623 (ucode: 0x0d000270), Storage (boot): 1x 512 GB Intel® SSD DC P4101, Storage (cache): 2x 400 GB Intel® Optane™ DC SSD P5800X, Storage (capacity): 6x 4 TB Intel® SSD DC P5510, Network devices: 1x Intel® Ethernet E810-XXVAM2 at 25 GbE, Network speed: 25 GbE, RDMA RoCE: enabled, OS/Software: VMware 7.0.2, 17630552, HCIBench 2.5.3 8K profile, Throughput 3398 MB/s, latency 1.52ms. Estimated system cost is $40,917.

Plus Design (3rd Gen Intel Xeon Scalable processor): 4-node, 2x Intel® Xeon® Gold 6348 processor, 1x Intel Server Board M50CYP2UR, Total Memory 1024 GB (2LM) - 256 GB (8 slots/32 GB/3200 MHz) + 1024 GB Intel Optane PMem 200 series (8 slots/128 GB/3200 MHz), Intel Hyper-Threading Technology ON, Intel Turbo Boost Technology ON, Intel® VMD Disabled, BIOS: SE5C6200.86B.0022.D08.2103221623 (ucode: 0x0d000270), Storage (boot) 1x 512 GB Intel SSD P4101, Storage (cache): 2x 400 GB Intel Optane DC SSD P5800X, Storage (capacity): 6x 4 TB Intel SSD DC P5510, Network devices: 1x Intel Ethernet E810-XXVAM2 at 25 GbE, Network speed: 25 GbE, RDMA RoCE: enabled, VMware 7.0.2, 17630552, using HCIBench 2.5.3 8K profile, Baseline: Throughput 4155 MB/s, latency 1.43ms. Estimated system cost is $47,209.

[2] https://www.intel.com/content/www/us/en/products/docs/memory-storage/solid-state-drives/data-center-ssds/optane-ssd-p5800x-p5801x-brief.html

[3] VMware, App Modernization in a Multi-Cloud World Market Study of 1,205 organizations

[4] Testing by Intel as of April-May 2021. Plus design: 4 nodes, 2x Intel® Xeon® Gold 6348 processor, Total Memory Total Memory 1024 GB (2LM) - 256 GB (8 slots/32 GB/3200 MHz) + 1024 GB Intel Optane PMem 200 series (8 slots/128 GB/3200 MHz), Intel Hyper-Threading Technology ON, Intel Turbo Boost Technology ON, Intel® VMD: Disabled, BIOS: SE5C6200.86B.0022.D08.2103221623 (ucode: 0x0d000270), Storage (boot): 1x Intel® Optane™ SSD P1600X M.2 (Intel® VROC Boot RAID-1), Storage (cache): 2x Intel® Optane™ SSD DC P5800X 400 GB, Storage (capacity): 6x Intel® SSD D7-P5510 3.84 TB, Network devices: 1x Intel® Ethernet Network Adapter E810-XXVDA2 (2x 25 GbE ports), Network speed: 25 GbE, RDMA RoCE: enabled, VMware 7.0.2, 17630552, HCIBench 2.5.3 8K profile.

[5] Test by Intel as of April 3-6, 2021.

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3rd Generation Intel® Xeon® Scalable processor Base design (HCIBench): 4 nodes, 2x Intel® Xeon® Gold 6330 processor, 1x Intel® Server Board M50CYP2UR, Total Memory 512 GB (16 slots/32 GB/3200 MHz), Intel Hyper-Threading Technology ON, Intel Turbo Boost Technology ON, Intel® VMD: Disabled, BIOS: SE5C6200.86B.0022.D08.2103221623 (ucode: 0x0d000270), Storage (boot): 1x 512 GB Intel® SSD DC P4101, Storage (cache): 2x 400 GB Intel® Optane™ SSD DC P5800X, Storage (capacity): 6x 4 TB Intel® SSD DC P5510, Network devices: 1x Intel® Ethernet E810-XXVAM2 at 25 GbE, Network speed: 25 GbE, RDMA RoCE: disabled, OS/Software: VMware 7.0.2, 17630552, HCIBench 2.5.3 8K profile, Throughput 3398 MB/s, latency 1.52ms.

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[6] See endnote 1.

[7] Testing by Intel as of June 2021.

3rd Generation Intel® Xeon® Scalable processor Base design (HammerDB/MSSQL): 4 nodes, 2x Intel® Xeon® Gold 6330 processor, 1x Server Board M50CYP2UR, Total Memory 512 GB (16 slots/32 GB/3200 MHz), HyperThreading: Enabled, Turbo: Enabled, Intel VMD: Disabled, BIOS: SE5C6200.86B.0022.D27.2104140041 (ucode:0x0d000280), 1x 512 GB Intel SSD P4101 Series, Storage (cache): 2x 400 GB Intel® Optane™ DC SSD P5800X Series, Storage (capacity): 6x 4 TB Intel SSD DC P5510 Series PCIe NVMe, Network devices: 1x Intel Ethernet E810-XXVAM2 at 25 GbE, Network speed: 25 GbE, RDMA RoCE: disabled, OS/Software: VMware 7.0.2, 17630552, Test by Intel as of 09/06/2021. HammerDB 4.1 750 Warehouses, 75 Users, 1000000 Total Transaction per User, 10 minutes rampup + 20 minutes test duration, used all Warehouses, 7 VMs: 2789340 NOPM.

3rd Generation Intel® Xeon® Scalable processor Plus design (HammerDB/MSSQL): 4 nodes, 2x Intel® Xeon® Gold 6348 processor, 1x Server Board M50CYP2UR, Total Memory 1024 GB (2LM) - 256 GB (8 slots/32 GB/3200 MHz) + 1024 GB DCPMM 200 (8 slots/128 GB DCPMM/3200 MHz), HyperThreading: Enabled, Turbo: Enabled, Intel VMD: Disabled, BIOS: SE5C6200.86B.0022.D27.2104140041 (ucode:0x0d000280), 1x 512 GB Intel SSD P4101 Series, Storage (cache): 2x 400 GB Intel® Optane™ DC SSD P5800X Series, Storage (capacity): 6x 4 TB Intel SSD DC P5510 Series PCIe NVMe, Network devices: 1x Intel Ethernet E810-XXVAM2 at 25 GbE, Network speed: 25 GbE, RDMA RoCE: enabled, VMware 7.0.2, 17630552, Test by Intel as of 16/06/2021. HammerDB 4.1 750 Warehouses, 75 Users, 1000000 Total Transaction per User, 10 minutes rampup + 20 minutes test duration, used all Warehouses, 8 VMs: 6760397 NOPM.