intel®

HCI: A critical component for the modern enterprise

Learn how Hyperconverged Infrastructure energizes performance, scalability and flexibility

43%

43% of HCI buyers indicate storage management issues prompted their purchase[1]

Enterprises are looking to modernize legacy infrastructure cost effectively, while solving data management problems. They also need to simplify the path to hybrid cloud.

One approach is through Hyperconverged Infrastructure (HCI), which uses clusters of servers with data distributed across the cluster for durability. HCI makes it easy to scale performance with capacity by adding server nodes, and to optimize capital expenditure (CapEx) incrementally. It virtualizes compute, storage, and networking, allowing single pane of glass management for increased efficiency and decreased operational expenditure (OpEx).

Research from Technology Business Research, Inc. (TBR) confirms storage pain points are a key driver of hyperconverged purchase, with 43 percent[1] of buyers indicating storage management issues prompted purchase. TBR goes on to say:

"Digital transformation is a likely driver behind this pain point, as emerging use cases such as AI, [machine learning] and analytics are all data-intensive and modern. This increase in data is outpacing technology upgrades within the data center, thus becoming a key challenge prompting IT decision makers to consider HCI[2]".

Modern AI and analytics workloads are emerging drivers for HCI, but hyperconverged solutions are a good fit for many workloads, such as real-time collaboration, databases, testing and development, ERP, virtual desktop infrastructure and multi-workload clusters. Edge environments benefit from HCI's space and power efficiency, plus ease of remote management. Flexibility, efficiency, and cost effectiveness, coupled with new capabilities and container support, are making HCI the de-facto foundation from edge to cloud.
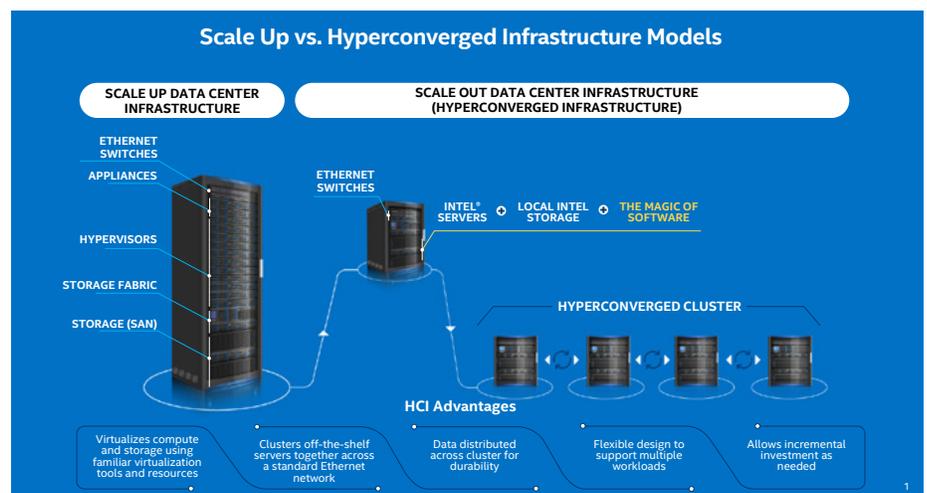

Scale Up vs. Hyperconverged Infrastructure Models

SCALE UP DATA CENTER INFRASTRUCTURE

SCALE OUT DATA CENTER INFRASTRUCTURE (HYPERCONVERGED INFRASTRUCTURE)

ETHERNET SWITCHES
APPLIANCES
HYPERVISORS
STORAGE FABRIC
STORAGE (SAN)

ETHERNET SWITCHES

INTEL® SERVERS + LOCAL INTEL STORAGE + THE MAGIC OF SOFTWARE

HYPERCONVERGED CLUSTER

HCI Advantages

Virtualizes compute and storage using familiar virtualization tools and resources

Clusters off-the-shelf servers together across a standard Ethernet network

Data distributed across cluster for durability

Flexible design to support multiple workloads

Allows incremental investment as needed

Figure 1. HCI supports capacity and performance growth cost effectively

Intel's portfolio addresses users' pain points

Intel technology offers a strong foundation for HCI implementations. Intel delivers an unmatched silicon portfolio, investment in deep enabling with ecosystem leaders, plus Intel-created software libraries and tools. These allow delivery of workload-optimized configurations in market that tune and balance processing, network and storage resources, while accelerating time to deployment with pre-validated stacks.

Processor innovations for changing workloads

The broad range of 2nd generation Intel® Xeon® Scalable processors allows HCI vendors to choose a processor that delivers the performance needed to meet various workload requirements. Intel has invested in multiple generations of virtualization technologies (i.e. Intel® Virtual Machine Control Structure (VMCS), Intel® Infrastructure Management Technologies (IMT), etc.) built into the Intel Xeon processor families, increasing virtualized workload throughput and VM density. Intel Xeon processors allow easy VM and workload migration between servers and across CPU generations.

Intel delivers hardware-enhanced security to help thwart malicious exploits, while reducing performance overhead. Intel Xeon Scalable processors are certified, optimized, and validated for dozens of leading enterprise applications. Intel® Optane™ persistent memory, supported on 2nd gen Intel Xeon Scalable processors, offers breakthrough memory innovation to either increase memory available to applications or provide persistence for faster recovery.

Intel® Optane™ Technology provides key breakthroughs for today's HCI solutions

HCI relies on high-performance storage and memory. Intel® Optane™ technology–the first new memory architecture since the 1970s–delivers significant performance gains and creates a new tier of memory between DRAM and storage. It is available in DIMM and SSD form factors.

Performance boost for data-intensive applications

Intel® Optane™ persistent memory, in the DIMM form factor, makes it financially feasible to hold very large datasets in memory. This improves performance for in-memory databases. In virtualized systems, this can mean up to 135x faster restart from service interruption or added durability for databases[3].

Intel Optane persistent memory provides native persistence at the substrate level, meaning that it can be used to replace storage for high-performance workloads, offering nearly the speed of DRAM with the persistence of storage media.
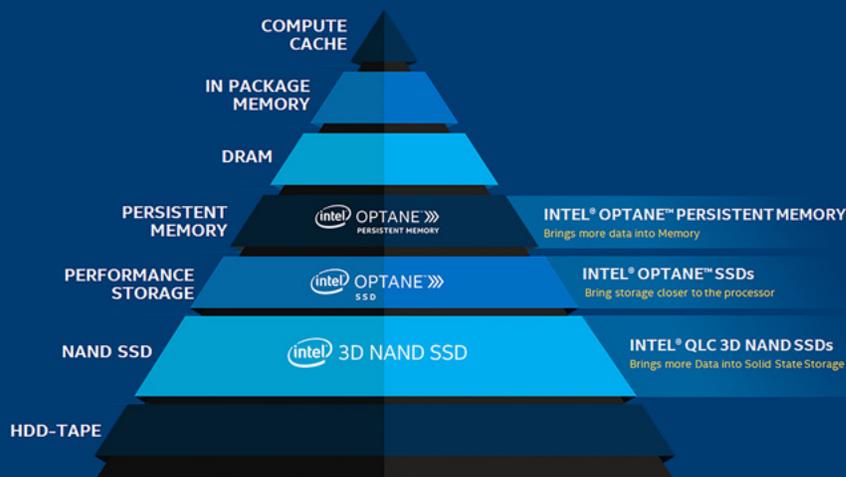
Greater VM density for virtualized systems

Intel® Optane™ persistent memory delivers the performance your workloads demand while lowering costs. With Intel® Select Solutions for Microsoft Azure Stack HCI, we used Intel Optane persistent memory in dual mode, for memory and storage, providing 33 percent more memory than a base configuration with 384GB DRAM. The solution achieved up to 41 percent more VMs per node, up to 76 percent improved I/O throughput, and all at 33 percent more performance TCO, measured in VMs per dollar[4].

Faster storage for speedy retrieval

Intel Optane SSDs deliver breakthrough storage performance, with the low latency and high endurance required for the HCI cache or metadata tier. Intel Optane SSDs deliver up to 22 percent more IOPS and 59 percent lower latency in hyperconverged systems[5]. For all uses, this delivers predictably fast storage with 99 percent quality of service (QoS) levels—up to 60x better than 3D NAND SSDs[6].

The Memory/Storage Hierarchy

COMPUTE CACHE
IN PACKAGE MEMORY
DRAM
PERSISTENT MEMORY — (intel) OPTANE ››› PERSISTENT MEMORY — **INTEL® OPTANE™ PERSISTENT MEMORY** Brings more data into Memory
PERFORMANCE STORAGE — (intel) OPTANE ››› SSD — **INTEL® OPTANE™ SSDs** Bring storage closer to the processor
NAND SSD — (intel) 3D NAND SSD — **INTEL® QLC 3D NAND SSDs** Brings more Data into Solid State Storage
HDD-TAPE

Enhance storage capabilities for expanding data needs

Optimal HCI performance relies on minimizing data latency. Intel® Optane™ SSDs deliver the combination of low latency, high endurance, quality of service, and high throughput, optimized to break through storage bottlenecks and ideal for the HCI cache or metadata tier. Using Intel Optane SSDs on VMware vSAN, HCI systems can achieve up to 30 percent the storage consolidation and up to 60 percent the IOMark VMs per node vs. using standard PCIe SSDs[7]. The 2nd generation of Intel® 3D NAND SSDs extend capacity to enable more HCI workloads per server. NVMe reduces overhead and brings performance improvements and reduced latency compared to hard drives or solid-state drives running on legacy SATA or SAS interfaces. Intel® Volume Management Device (Intel® VMD) is a feature of the Intel Xeon Scalable processor that improves management of NVMe SSDs with robust event/ error handling. It supports hot plug and surprise unplug, and controls status LEDs to help IT technicians identify SSDs that require service.

Remove bottlenecks in data transport

As HCI clusters scale, ensuring adequate network bandwidth becomes critical. Intel® Ethernet Adapters for 10/25/40/100GbE provide intelligence and performance for virtualization with network packet processing, and flexible and scalable I/O virtualization for storage. Intelligent offloads and remote direct memory access (RDMA) streamline and accelerate node-to-node network traffic, critical to the performance of larger HCI clusters.

Get up and running quickly with pre-validated stacks

Intel collaborates with leading HCI solution providers to deliver Intel® Select Solutions – proven solutions for HCI and hybrid cloud, available from a wide variety of server vendors, allowing you to:

- Optimize configurations for a specific HCI solution running key workloads
- Reduce the time required to evaluate, select, and purchase the necessary hardware and software components
- Minimize the time required to deploy new infrastructure

Intel Select Solutions offer a simplified approach to evaluating and choosing an HCI solution, helping accelerate time to deployment. They include:

- Intel® Select Solution for Google Cloud's Anthos Google Cloud's Anthos software allows you to quickly and easily deploy and manage apps and workloads using virtual machines or Kubernetes containers across your on premises environment, on your hybrid cloud, or to your preferred cloud provider.

- Intel® Select Solution for Microsoft Azure Stack HCI, which provides a simplified, low-cost, hyperconverged infrastructure tailored to the different compute, memory, and storage needs at the edge, in the data center, and on your Microsoft Azure public cloud.

- Intel® Select Solution for Nutanix HCI, which offers a scalable hybrid cloud architecture that lets you replace complex legacy infrastructure with performance-tuned hyperconverged configurations running on Nutanix's hypervisor-agnostic platform, giving customers both flexibility and speed of deployment.

- Intel® Select Solution for VMware vSAN, which combines optimized Intel® hardware components to enable organizations to quickly deploy reliable, comprehensive VMware vSAN, built on a performance-optimized vSphere integrated infrastructure.

Intel's unmatched engagement with industry leaders

Intel supports a broad and deep ecosystem of partners who are building HCI solutions on Intel architecture.

Intel helps Telefónica meet demanding storage SLAs[8]

Telefónica Business Solutions is dedicated to managing, at a global level, business segments for enterprises, multinational corporations, wholesale and roaming.

Telefónica's customers require sustained high throughput and low storage latency for critical workloads. However, as Telefónica's Virtual Data Center (VDC) service evolved over time, a heterogeneous data center environment hindered operational efficiency, and total cost of ownership (TCO) suffered.

An optimized hyperconverged infrastructure (HCI) solution with Intel® Optane™ SSDs and Intel® Xeon® Scalable processors enabled Telefónica's VMware vSAN–based infrastructure to meet the most demanding storage service level agreements (SLAs). With Intel Optane SSDs as the cache device, Telefónica's customers can expect consistent, first-class I/O performance.

Summary

HCI is flexible, scalable and meets current and future workload needs in the data center and at the edge. The latest generation of HCI systems can deliver outstanding results, when driven by the latest innovations in computing, storage and transport. Intel's technologies, partnerships, and solutions are easing adoption and development of this transformative architecture.

HCI Ecosystem Partners

Anthos · aws · CISCO · DELLEMC · FUJITSU · HITACHI · Hewlett Packard Enterprise · inspur · Lenovo · Microsoft · Microsoft Azure · NUTANIX · Pivot3 · QCT · Red Hat · SUPERMICRO · vmware

"Finally, we can get a hyperconverged system that can match or exceed the performance of our traditional top-tier storage"

—José María Cuéllar
B2B Global Cloud Director, Telefónica Business Solutions

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 www.intel.com/benchmarks.

[1] TBR Hyperconverged Platforms Customer Research 2H19

[2] TBR Hyperconverged Platforms Customer Research 2H19

[3] https://www.intel.com/content/www/us/en/processors/xeon/scalable/software-solutions/enabled-applications-marketing-guide.html

[4] **Base Configuration (4 node)**: 2- Xeon Gold 6230 CPU at 2.1 Ghz, 20C/40T, 2- Intel Optane DC P4800X Series or higher at 375GB, 4- Intel SSD DC P4510 Series at 4TB capacity drives, 4- 512GB (4x 128GBIntel Optane DC persistent memory) and 192 GB(12x 16 GB 2666 Mhz, 288-pin DDR4 RDIMM); 1- 1GbE Mgmt Network; Intel SSD DC S4510 series at 480GB; 1- 10Gb Intel C620 Series Chipset with integrated Intel Etherenet Network Connection X722 OCP X527-DA2 network adapter

Plus Configuration (4 node): 2- Xeon Gold 6252 CPU at 2.1 Ghz, 24C/48T, 2- 2x 500 Gb (12x 128 GB Intel Optand DC persistent memory)- 66% in Storage over App Direct Mode, 4- Intel SSD DC P4510 Series at 4TB capacity drives, 12- 512GB (12x 128GB Intel Optane DC persistent memory)1 34% in memory mode and 192 GB (12x 16 GB 2666 Mhz, 288-pin DDR4 RDIMM); 1- 1GbE Mgmt Network; 2- Intel SSD DC S4510 series at 480GB; 1- 25Gbe dual port network adapter, https://www.intel.com/content/www/us/en/products/solutions/select-solutions/cloud/microsoft-azure-stack-hci-ver-2.html

[5] https://www.esg-global.com/validation/esg-technical-validation-dell-emc-vxrail-with-intel-xeon-scalable-processors-and-intel-optane-ssds

[6] **Dell EMC VxRail with NAND SSDs**: SSD Cache per node: 1x Toshiba PX55MB080Y, 800GB; Data Storage per node: 6x Toshiba PX05SRB192Y 1.92TB, vSAN Storage Configuration per node: 2 disk groups (3 PX05RB192Y); CPU: Intel Xeon Gold 6254 * 2 (36 cores per node); Memory: 384 GB; Network: 25 GbE Mellanox network card; Virtualization Configuration: VMware vCenter 6.7.0 & VMware ESXi 6,7,0; Storage Configuration: Deduplication and compression disabled; Network Configuration: Jumbo frames enabled; SQL Server VM Configuration: 8 vCPUs; Memory: 64GB RAM; vNIC: VMXNET3, OS: Microsoft Windows Server 2016; Database: Microsoft SQL Server Native Client 11.0. Testing conducted August 26, 2019.

Dell EMC VxRail with Intel Optane SSDs: SSD Cache per node: 1x Intel Dell Express Flash NVMe P4800X, 375GB; Data Storage per node: 6x Toshiba PX05SRB192Y 1.92TB, vSAN Storage Configuration per node: 2 disk groups (3 PX05RB192Y); CPU: Intel Xeon Gold 6254 * 2 (36 cores per node); Memory: 384 GB; Network: 25 GbE Mellanox network card; Virtualization Configuration: VMware vCenter 6.7.0 & VMware ESXi 6,7,0; Storage Configuration: Deduplication and compression disabled; Network Configuration: Jumbo frames enabled; SQL Server VM Configuration: 8 vCPUs; Memory: 64GB RAM; vNIC: VMXNET3, OS: Microsoft Windows Server 2016; Database: Microsoft SQL Server Native Client 11.0. Testing conducted August 26, 2019.

[7] Tests by The Evaluator Group. Configuration details available from The Evaluator Group at https://www.evaluatorgroup.com/document/lab-insight-latest-intel-technologies-power-new-performance-levels-vmware-vsan-2018-update/. See server cost estimate details and assumptions.

[8] https://www.intel.com/content/www/us/en/customer-spotlight/stories/telefonica-virtual-data-center-customer-story.html?elq_cid=2720898&erpm_id=1535290

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.

Your costs and results may vary.

Intel technologies may require enabled hardware, software or service activation.

Intel does not control or audit third-party data. You should consult other sources to evaluate accuracy.