

Business Brief
Data Center
Hyperconverged Infrastructure

Hyperconverged infrastructure (HCI): Performance and scalability for digital transformation

Learn how HCI supports a flexible cloud strategy
for your key workloads

A photograph of two men in a data center. The man on the left, wearing a light blue button-down shirt and glasses, is holding a tablet. The man on the right, wearing a dark grey sweater and glasses, is pointing at the tablet. They are standing in front of server racks with blue mesh doors. The background is dimly lit with blue ambient lighting.

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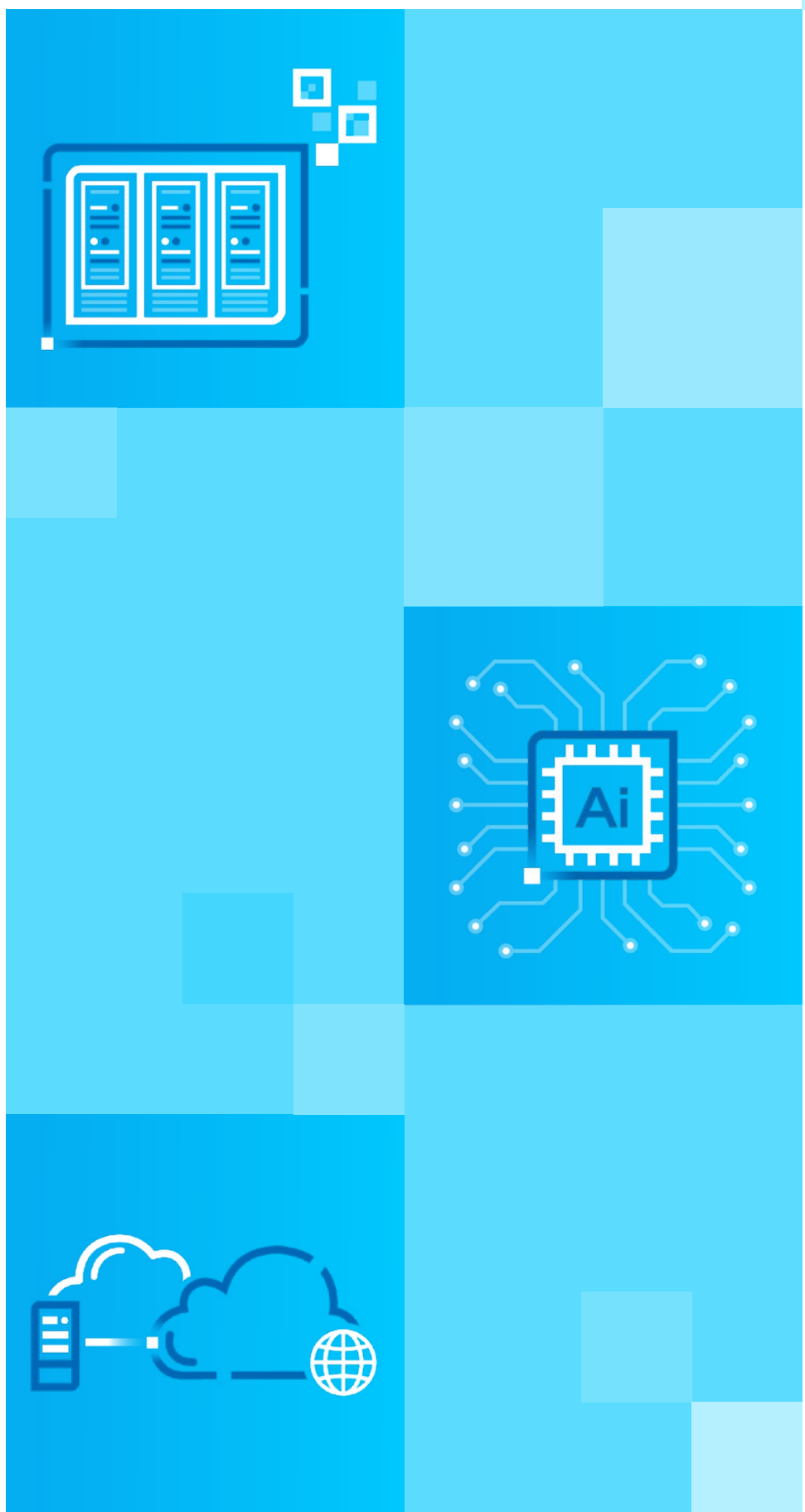
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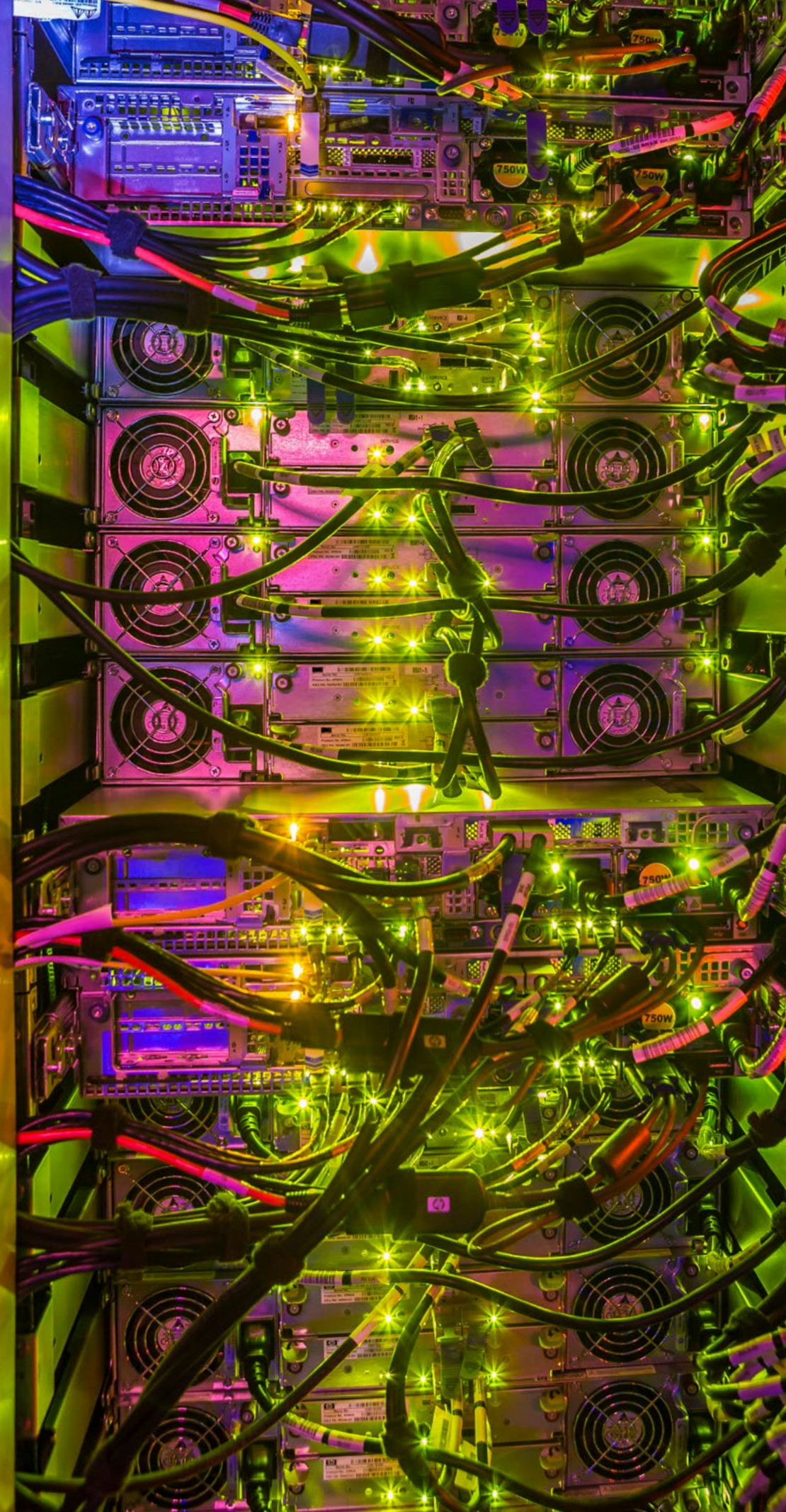
Introduction

The pandemic has made digital transformation a more important priority than ever. As they emerge from the crisis, enterprises see this transformation as a matter of survival. It may have started with scaling their remote workforce, and ensuring business continuity. Then evolved with security policies to reduce risk and vulnerability at scale. Now increasingly, digital transformation is about reimagining the customer experience by deriving more insights from analyzing data and employing AI.

The key to a successful transformative strategy is having a strong architectural foundation for its many projects and workloads. Most enterprises are building this foundation on hybrid cloud. Infrastructure is an asset that can deliver new insights, helping to transform the customer experience. But application modernization and data growth are putting new pressures on performance and capacity. Hyperconverged infrastructure (HCI) is often the best path to transform on-premises infrastructure as a vital part of that hybrid cloud foundation.

So, what is HCI? It’s an approach that virtualizes all the elements of data center systems—compute, storage, and networking—in a single server, and these servers are clustered together into a virtualized pool of resources. HCI presents these resources as consumable services, similarly to a cloud platform. Because it does this using a software-defined architecture, HCI integrates well with





public cloud architectures as part of a complete hybrid cloud deployment. As HCI solutions evolve in capabilities, they can also host and manage modern containerized and cloud-native applications. These solutions are frequently central to transformation initiatives.

HCI uses clusters of servers with data distributed across the cluster for durability. It is easy to scale performance with capacity by adding server nodes, optimizing capital expenditure through flexible and incremental investment as needed. HCI benefits from the flexibility, cost, reliability, and regular generational improvements of standard, Intel® technology-based servers connected over a standard Ethernet network. Having multiple nodes on a single data fabric and management plane facilitates cloning, backups and snapshots, and the process of recovery if an outage occurs.

As well as helping integrate private cloud technologies into a hybrid cloud architecture, HCI addresses another of the critical challenges driven by enterprise digital transformation: the data management problem caused by the need to store and analyze huge amounts of data.

As Technology Business Research says, “Digital transformation is a likely driver [of HCI purchase]... as emerging use cases such as AI, [machine learning] and analytics are all data-intensive and modern.”¹ Modern data-intensive AI and analytics workloads are indeed emerging drivers for HCI, but hyperconverged solutions are often the best fit for many workloads. These include real-time collaboration, databases, testing and development, enterprise resource planning

(ERP), virtual desktop infrastructure (VDI), and multivirtualized workload clusters.

Edge environments benefit from HCI as well, due to the space efficiency and power savings it offers, along with ease of remote management. HCI edge deployments support AI and analytics at the point of data ingestion, respecting the gravity of some of the huge datasets created by edge and IOT applications. Additionally, data is stored where it’s generated in HCI edge systems. This feature makes it simpler to manage and secure than data stored locally. The insights generated are shared back to the centralized data center and/or public cloud.

HCI solutions are available from multiple ISVs and server OEMs through a range of consumption models, including standard purchase and infrastructure as a service models. When these options are coupled with simplified deployment and management, and the ability to consolidate aging infrastructure, this gives enterprises even more reasons to consider HCI as they modernize and scale their data center infrastructure.

**25% lower cost
per VM**

deploying 3rd Gen Intel Xeon
Scalable processors with Intel Optane
persistent memory 200 series³

Broad Intel portfolio for HCI addresses users' pain points

All leading HCI vendors take advantage of Intel® technologies in their HCI solution offerings. Intel invests in technology enablement and software optimization with ecosystem leaders, including providing Intel-created software libraries and tools. These contributions make it possible to deliver workload-optimized configurations that tune processing, network and storage resources to deliver a balanced solution with unmatched price and performance. These features can accelerate time to deployment with prevalidated stacks.

Processor innovations for changing workloads

Enterprises demand scalable and flexible compute infrastructure to support increasing and changing workload demands. They continue to run more demanding workloads, and more workloads simultaneously on their HCI clusters. As a result, they need to ensure that the processing capabilities of the cluster can handle both the applications running on it as well as I/O and storage services, such as deduplication, encryption and compression.

The latest 3rd Generation Intel® Xeon® Scalable processors are optimized for cloud, analytics, AI, enterprise, and edge workloads. New benefits include significantly increased I/O bandwidth, together with PCIe-Gen4 support. Increased memory bandwidth, with expanded memory capacity of up to 6TB per CPU. And additional AVX-512 instructions.

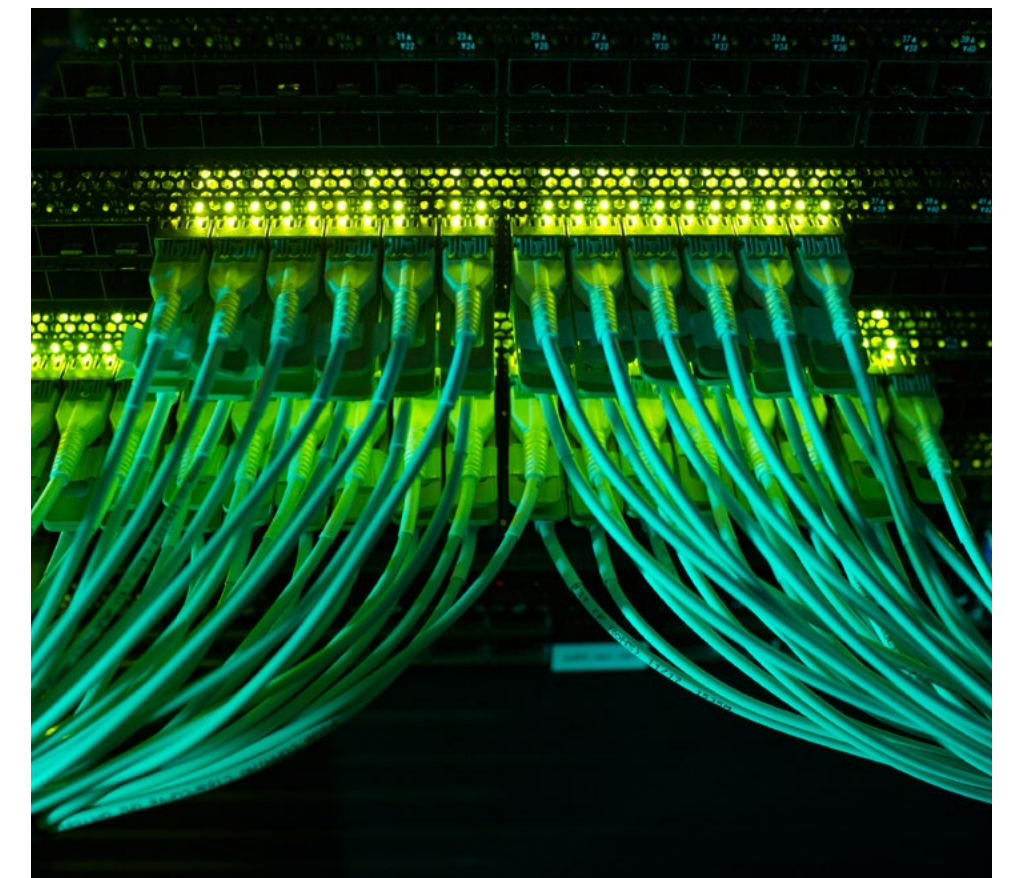
Intel has invested in generation after generation of virtualization technologies. These capabilities are built into the Intel Xeon processor families to help increase virtualized workload throughput and provide higher virtual machine (VM) density. Because of Intel® Virtualization Technologies, Intel Xeon Scalable processors provide easy VM and workload migration between servers across multiple CPU generations, and enabling easier workload portability across clouds.

As well as optimizing workload performance, it is important to protect the security of workload data at rest, in motion, and in use. Intel has long delivered hardware-enhanced security to thwart malicious exploits, maintaining workload integrity and reducing performance overhead. The 3rd Generation Intel Xeon Scalable platform includes:

- **Intel® Software Guard Extensions (Intel® SGX)** help protect data and application code in real time using a trusted execution environment. These capabilities enable enhanced collaboration (for example for federated learning in AI) using shared data, without compromising privacy.
- **Intel® Crypto Acceleration** increases the performance of encryption-intensive workloads on your HCI clusters, enabling pervasive encryption by reducing the performance impact.

- **Intel® Total Memory Encryption (TME)** lets you encrypt the entirety of physical memory of a system. The Multi-Key version, (Intel TME-MK), provides support to use multiple keys to separately encrypt each VM or container.

Intel Xeon Scalable processors are certified, optimized, tested and validated for dozens of the leading enterprise applications and workloads. This benefits HCI customers in application performance, in the efficiency of storage data services, and software licensing costs.





Enhance memory and storage capabilities for expanding data needs

As we've seen, workloads running on HCI can be highly data intensive. They are also often latency sensitive—like database transactions or AI—needing fast, reliable and scalable access to complex datasets in order to derive insight. This sensitivity means that the right data must be held in the right place at the right time. IT teams must hold hot data as close to the CPU as possible, all while managing costs.

Organizations that are planning infrastructure upgrades face three common challenges in achieving this delicate balancing act: scaling effectively as data volumes grow, meeting application performance demands, and minimizing infrastructure complexity.

Intel® Optane™ technologies offer the right balance of scalability, performance and simplicity. For example, Intel® Optane™ persistent memory (PMem) supports memory-intensive workloads such as in-memory databases. PMem also increases the number of users that can be supported for VDI. With Intel® Optane™ Solid State Drives (SSDs) in the cache tier, performance is increased, latency is reduced, and endurance is enhanced. On VMware vSAN, for example, combining 3rd Generation Intel® Xeon® Scalable processors with Intel® Optane™ SSD DC P5800X Series SSDs enables more vSAN VMs per host, resulting in the need for 30 percent fewer hosts at 20 percent lower costs than the previous generation².

NVMe reduces overhead and brings performance improvements and reduced latency as 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 and serviceability of NVMe SSDs with robust event and error handling. Intel VMD supports hot plug and surprise unplug. And it controls status LEDs to help IT technicians identify SSDs that require service.

The combination of 3rd Gen Intel Xeon Scalable and Intel Optane technologies delivers even greater performance and cost benefits to HCI infrastructures. For example, you can lower costs per VM by up to 25 percent for the same performance when deploying 3rd Gen Intel Xeon Scalable processors with Intel Optane persistent memory 200 series³.

30% fewer hosts

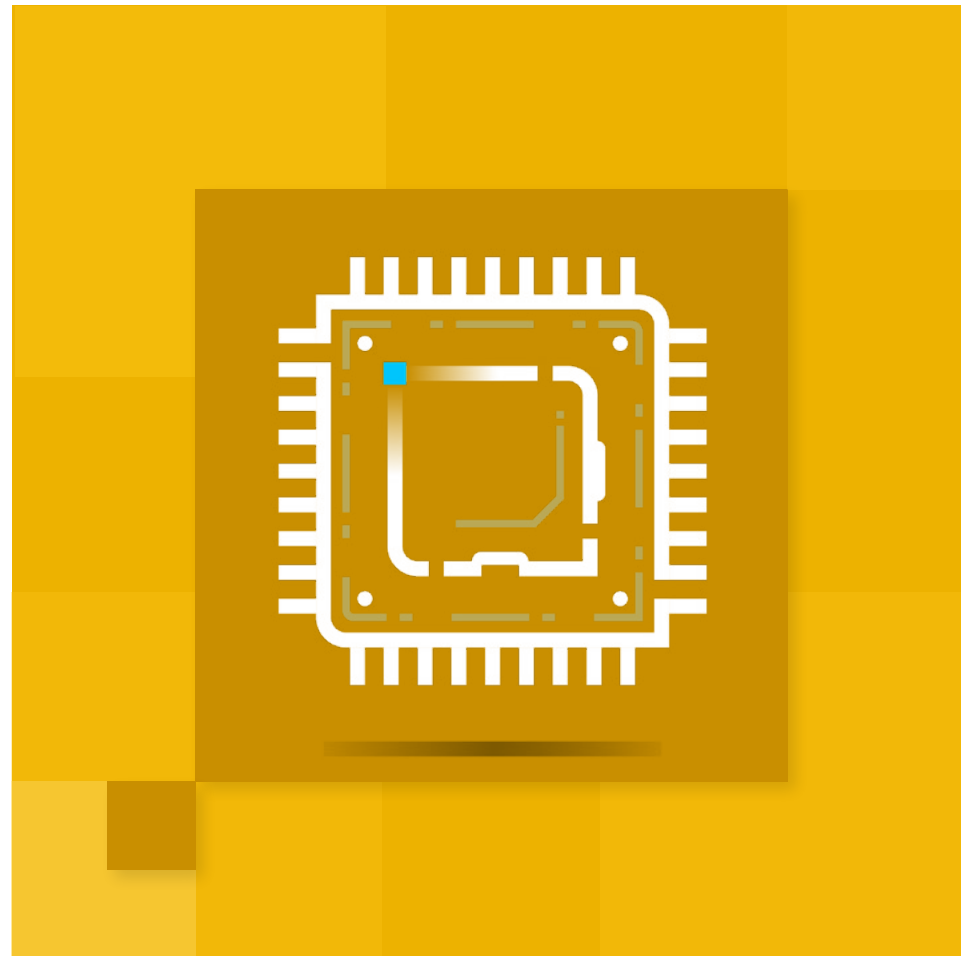
20% cost reduction

on VMware vSAN using 3rd Gen Intel Xeon Scalable processors with Intel Optane SSDs²

Remove bottlenecks in data transport

As HCI clusters scale, more and more data traffic flows between the nodes. Ensuring adequate network bandwidth becomes critical to overall cluster performance.

Intel® Ethernet 800 Series Network Adapters for 10/25/40/100/200 GbE 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 prevalidated stacks

Intel engages with a broad and deep ecosystem of partners who are building HCI solutions on Intel architecture. Intel has closely collaborated with independent software vendors (ISVs) that are building HCI software, original equipment manufacturers (OEMs) building HCI systems, and public cloud providers offering on-premises HCI solutions. Working together, this vibrant ecosystem provides optimized hybrid and multi-cloud solutions, allowing enterprises to modernize and scale out their data center infrastructure as their needs grow.

Intel® Select Solutions simplify and accelerate infrastructure evaluation and deployment

One of the ways this collaboration with leading HCI solution providers delivers value to customers is through Intel® Select Solutions. These proven solutions for HCI and hybrid cloud are available from a wide variety of server vendors and other data center solution providers. Intel Select Solutions go through rigorous benchmarking of multiple configuration options, delivering:

- Price/performance optimized configurations for a specific HCI solution running key workloads.
- Performance designed to meet or exceed a specific threshold across compute, storage, and network on trusted Intel® Architecture.
- Reduced time required to evaluate, select, and purchase the necessary hardware and software components.

Intel Select Solutions offer a simplified approach to evaluating and choosing an HCI solution. They help accelerate the time to deployment, time to innovation, and time to transformation of your IT infrastructure. They include:

- Cisco HyperFlex, an Intel® Select Solution that delivers a scalable and flexible HCI solution on Cisco UCS servers. When combined with Cisco Intersight, it offers hybrid cloud management through a single pane of glass across data center, edge, and public cloud deployments.
- Intel® Select Solution for Microsoft Azure Stack HCI provides a simplified hybrid cloud solution that combines HCI infrastructure with an Microsoft Azure service, tailored to the range of compute, memory, and storage needs at the edge and in the data center.
- Intel® Select Solution for Nutanix. This 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 combines optimized Intel hardware components to enable organizations to deploy reliable, comprehensive VMware vSAN, built on a performance-optimized vSphere-integrated infrastructure.

Summary

HCI facilitates digital transformation that is efficient, flexible, and scalable. As part of a hybrid cloud strategy, it meets current and future workload needs for many enterprises in the data center and at the edge. The latest generation of HCI systems can deliver outstanding business outcomes, when driven by the latest innovations in computing, storage and networking. Intel's technologies, collaborations, enablement, and solutions are easing and accelerating adoption and development of this transformative architecture.

See how Intel's partners and customers are using Intel-based HCI solutions to drive their digital transformations.

Learn more HERE →



¹ TBR Hyperconverged Platforms Customer Research 2H19

² **Previous generation:** Based on Intel testing as of 5/10/2021 with 2nd Generation Intel® Xeon® Scalable processors and Intel® Optane™ SSD DC P4800X Series. Configuration: 4 nodes, 2 x Intel Xeon Gold 6248 processor, 20 cores, Intel Hyper-Threading Technology (Intel HT Technology) on, Intel Turbo Boost Technology on, 384 GB total DRAM (12 slots/32 GB/2,933 megatransfers per second [MT/s]), 2 x Intel Optane SSD DC P4800X Series (cache), 8 x 3.84 TB Intel® SSD D7-P5510 (capacity), 1 x 100 gigabit Ethernet (GbE) Intel Ethernet Network Adapter E810C, BIOS 2.1 (ucode: 05003003), running VMware vSphere 7.0U2, VMware vSAN 7.0U2, and HCI Bench 2.5.3 with 8 x VMs per host, 2 x 150 GB vDisks per VM, and 100-percent widescreen signaling (WSS).

Current generation: Based on Intel testing as of 5/10/2021 with 3rd Generation Intel Xeon Scalable processors and Intel Optane SSD P5800X Series. 4 nodes, 2 x Intel Xeon Gold 6348 processor, 28 core, Intel HT Technology on, Intel Turbo Boost Technology on, 256 GB total DRAM (16 slots/32 GB/3,200 MT/s), 2 x Intel Optane SSD P5800X Series (cache), 8 x 3.84 TB Intel SSD D7-P5510 (capacity), 1 x 100 GbE Intel Ethernet Network Adapter E810C, BIOS 2.1 (ucode: 0x8d055260), running vSphere 7.0U2, vSAN 7.0U2, and HCI Bench 2.5.3 with 8 x VMs per host, 2 x 150 GB vDisks per VM, and 100-percent WSS.

³ See [80] at www.intel.com/3gen-xeon-config for details. Results may vary.

Performance varies by use, configuration and other factors. Learn more at www.Intel.com/PerformanceIndex.

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.

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