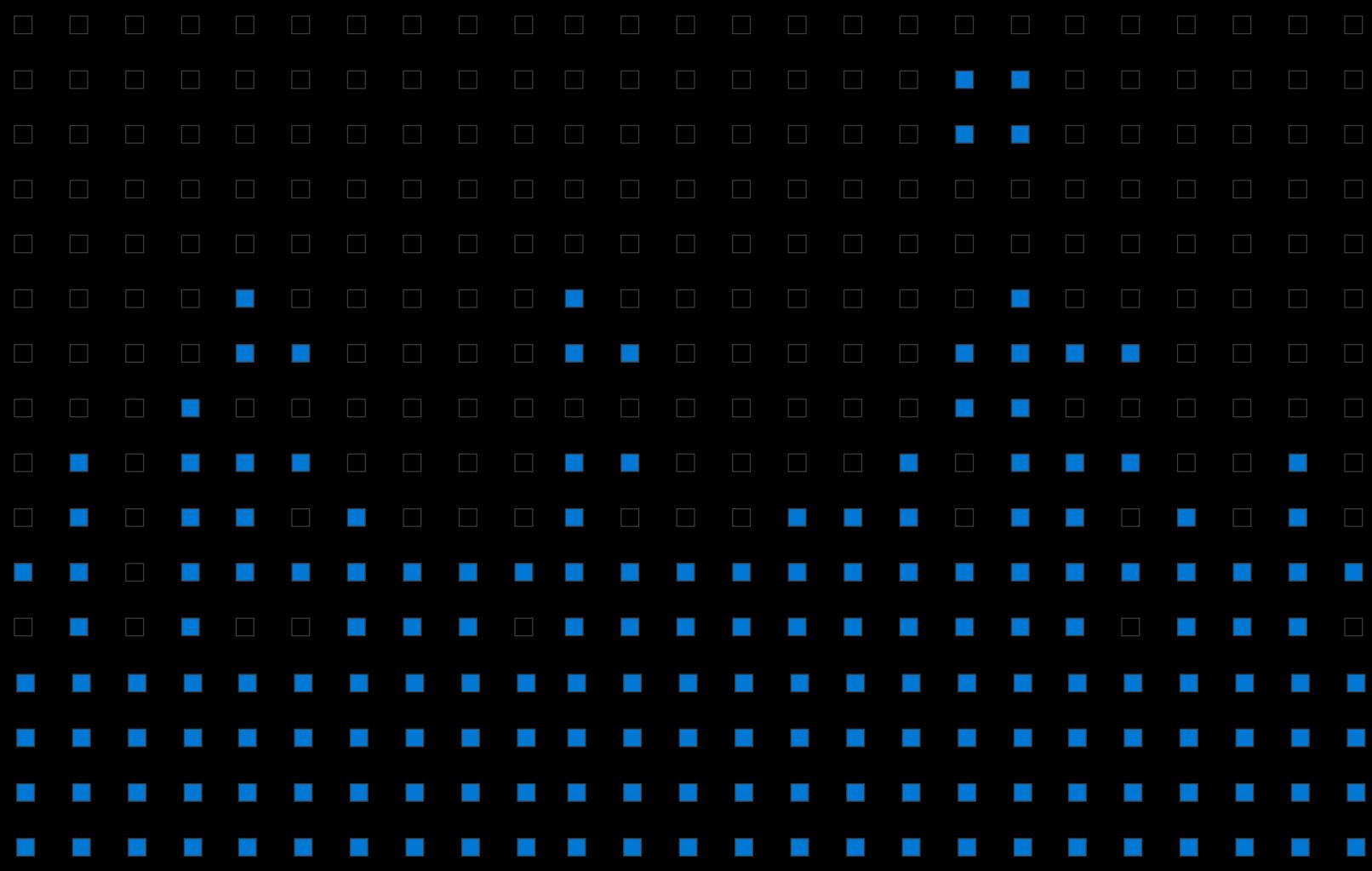


Azure Stack HCI delivers unmatched performance, with a path to hybrid cloud



Businesses in recent years have chosen to host many of their applications in the public cloud to reap benefits such as simpler maintenance and improved scalability. But cloud hosting isn't necessarily the best option for every workload, and many of these same organizations continue to host other services on local infrastructure—to keep operating expenses lower, for example, or to stick with a hosting strategy that already works. And to support these workloads hosted on premises, customers have increasingly been embracing hyperconverged infrastructure (HCI) as the preferred way to lower costs, improve performance and availability, and simplify operations. HCI, in short, is quickly becoming *the* way to deploy servers in the datacenter.

The problem for businesses that continue to invest in local infrastructure, however, is that few HCI solutions offer a path toward cloud integration. HCI and cloud, after all, aren't mutually exclusive goals, despite any appearances to the contrary. Many businesses, in fact, hope to gradually progress toward a hybrid cloud model, in which smoothly interoperating resources, managed together, are located both on premises and in the cloud. And these customers, above all, need an HCI solution today that can offer a simple, optional on-ramp to cloud services while still delivering the improved efficiencies that are driving the fast adoption of HCI.

Introducing Azure Stack HCI

Microsoft Azure Stack HCI, a member of the Azure Stack family of technologies, answers the need for such an HCI solution. First and foremost, Azure Stack HCI delivers industry-leading performance for the simple and affordable cost of a Windows Server 2019 Datacenter license.¹ In addition, to ease infrastructure administration and maintenance, Azure Stack HCI builds in optional, vendor-native cloud integrations, including cloud-based backup, update management, security monitoring, and disaster recovery.

Azure Stack portfolio

Extend Azure to consistently build and run hybrid applications across cloud, datacenter, and edge



Figure 1. The Azure Stack family of technologies

Azure Stack HCI solution components

Azure Stack HCI is available through Microsoft hardware partners. These solutions can be prebuilt and typically either preconfigured or bundled with simple configuration software. More than 150 (this number will fluctuate with time)

Azure Stack HCI solutions are available today through at least 20 partners, and the numbers are constantly growing. Azure Stack HCI combines this partner hardware, validated by Microsoft, with the following Windows Server 2019 Datacenter components and management tools:

- Windows Server 2019 Datacenter roles and features:
 - **Hyper-V** to run virtual machines (VMs) on all physical hosts
 - **Software Defined Networking (SDN) (optional)** for network virtualization
 - **Storage Spaces Direct** for software-defined storage
- Management tools:
 - **Windows Admin Center** for central, comprehensive management of local and remote servers through a graphical interface
 - **Azure services (optional)** integrated into Windows Admin Center for optional offsite backups, site recovery, cloud-based monitoring, and other benefits
 - **PowerShell** for scripting and automation

The complete Azure Stack HCI solution is shown in Figure 2.

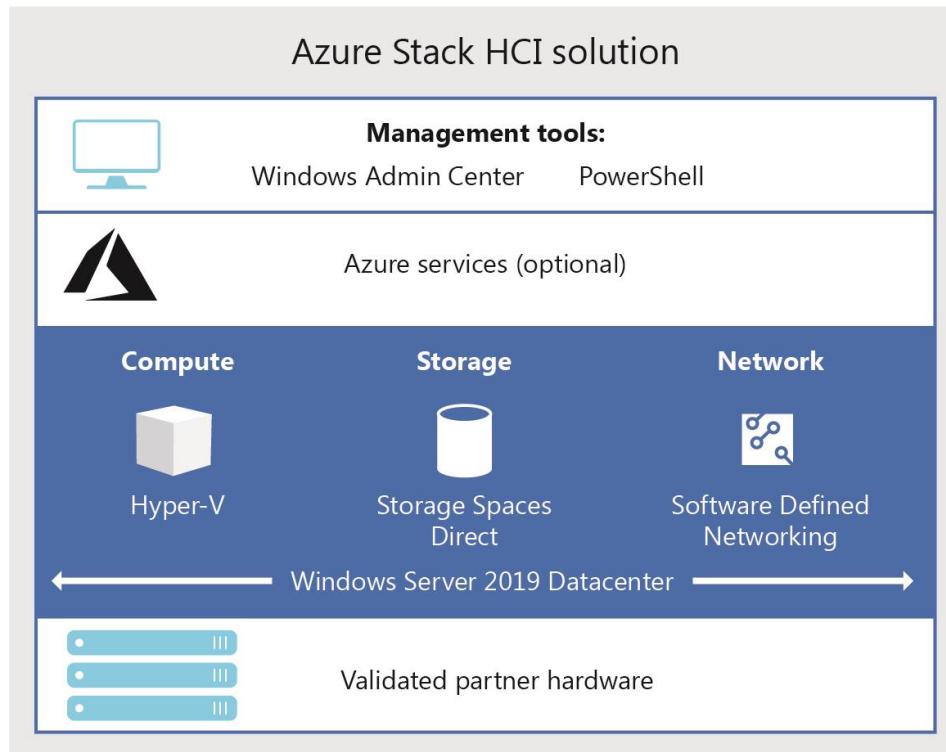


Figure 2. The components of the Azure Stack HCI solution

What is hyperconverged infrastructure (HCI)?

HCI is an IT architecture in which the compute, storage, and network resources across multiple servers are all virtualized, pooled, and then managed together through software. An HCI cluster is made up of physical servers with local storage, all connected to each other through a fast network called an interconnect. Figure 3 illustrates a four-node HCI cluster.

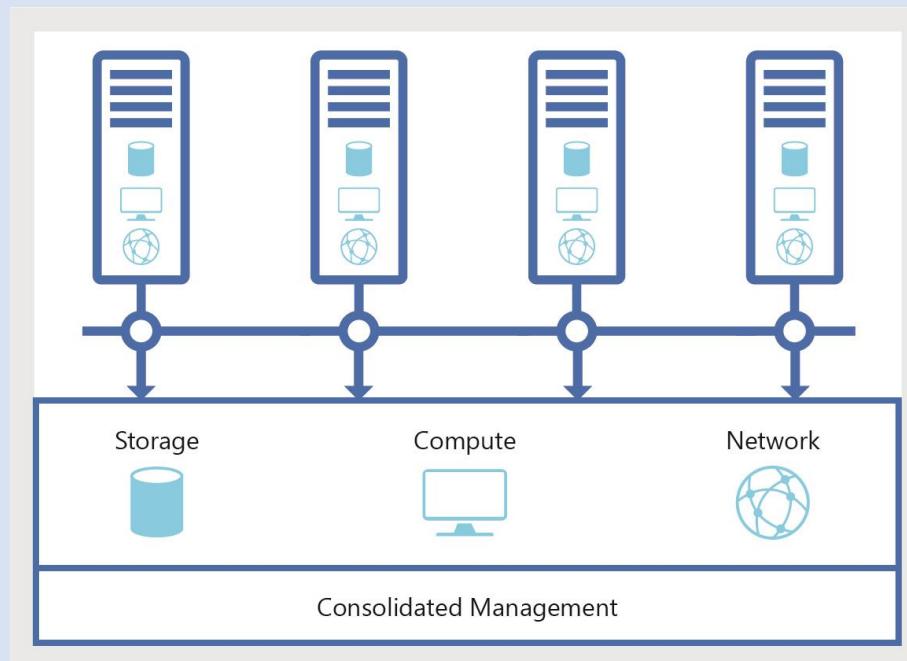


Figure 3. In an HCI cluster, the compute, storage, and networking resources of various servers are virtualized and consolidated through software, and then managed centrally

By virtualizing and pooling all resources, HCI represents a clear alternative to both traditional datacenters and storage area networks (SANs). In a traditional datacenter, physical servers use only locally attached resources, and dedicated hardware appliances provide the other needed network functions such as firewalls, switches, and load balancers. In a SAN, datacenter storage is consolidated in a dedicated network and then allocated to servers outside the SAN as needed.

HCI, in contrast, uses storage that is local to each physical server, but in a way that is shared among all servers, and it uses virtual devices to replace dedicated hardware appliances. In other words, HCI offers the same flexibility with storage provisioning that a SAN does, but it adds flexibility in assigning other network resources as well, and it achieves this while requiring a much lower investment in terms of capital expenditures (CapEx). Finally, because HCI offers the ability to consolidate and centrally manage resources through software, many see HCI as a superior datacenter architecture to older alternatives.

Why Azure Stack HCI?

Azure Stack HCI is the best available solution for HCI because it offers:

- Industry-leading performance
- Simple, affordable pricing

- Azure hybrid services to ease maintenance and administration
- A single trusted vendor for support
- The best and most affordable HCI solution for the remote/branch office

The following sections describe these advantages in more detail.

Industry-leading performance

Azure Stack HCI delivers the best performing of all HCI solutions available on the market today, with independent testing revealing that Azure Stack HCI has *four-times-higher performance* than the VMware HCI solution.²

"The [Azure Stack HCI] cluster we've been testing has posted tremendous numbers, the fastest we've seen in a mid-market 4-node HCI cluster."³

— StorageReview.com

Impressive as it is, the Microsoft performance edge happens for an understandable reason: Microsoft owns not just the HCI software, but the kernel, the hypervisor, and the host operating system. In many common HCI scenarios, Microsoft also owns the guest operating system and hosted server application. For this reason, Microsoft alone—unlike any competitor in the HCI space—is able to optimize software performance top to bottom and make sure all the pieces work well together. What's more, this finely tuned software stack is then further optimized by the Microsoft Azure team, which deploys many of these same components on a massive scale.

"Azure Stack HCI is easily 4 times faster than VMware vSAN."⁴

— StorageReview.com

In addition, the Windows hardware ecosystem offers its own separate structural advantage, because Windows Server is usually on the leading edge of x86 hardware innovation. For example, Windows Server 2019 already supports persistent memory (such as Intel Optane DC persistent memory) and leading networking gear like 100 gigabit Ethernet (GbE) with remote direct memory access (RDMA).

Simple, affordable pricing

The complete range of Azure Stack HCI components is included with the price of a Windows Server 2019 Datacenter license. In other words, if you are already paying for Windows Server 2019 Datacenter, you have already paid for Azure Stack HCI. Additionally, not only are the virtual compute, storage, and network resources all unified in one product with one price, but there are also no higher tiers or up-sells needed to unlock additional functionality, such as encryption or deduplication.

Azure hybrid services to ease maintenance and administration

Azure Stack HCI is the only solution available that comes from a vendor that has a leading presence on-premises and a leading public cloud offering. As such, seamless compatibility with selected Azure services is a big advantage of Azure Stack HCI. Because its integration with Azure is optional, Azure Stack HCI offers an easy first step toward the benefits of Microsoft's cloud ecosystem. Azure Stack HCI does not force organizations to make drastic changes to their IT infrastructures, services, or procedures. Instead, it lets an organization consider a long-term strategic shift to Azure while modernizing on-premises infrastructure first. Through Azure services, Azure Stack HCI deployments can easily grow hybrid features over time and clear the way to migrating some workloads to a public cloud, if desired.

The Azure services listed below are those directly available from Windows Admin Center, which is the graphical admin tool for Azure Stack HCI:

- [Azure Site Recovery](#), which provides high availability and disaster recovery as-a-service (DRaaS)
- [Azure Monitor](#), which is a centralized hub to track what's happening across your applications, network, and infrastructure—with advanced analytics powered by artificial intelligence (AI)—that can send you text messages or email alerts when failures are detected
- [Cloud Witness](#), which allows you to use Azure to keep an HCI cluster up and running if a node fails
- [Azure Backup](#), which provides offsite data protection and protects against ransomware
- [Azure Update Management](#), which performs update assessment and update deployments for Windows VMs running in Azure and on premises
- [Azure Network Adapter](#), which allows you to connect on-premises resources with your VMs in Azure via a point-to-site virtual private network (VPN)
- [Azure Security Center](#), which offers threat detection and monitoring services for VMs running both in Azure and on premises

To activate these services in Windows Admin Center, you merely need to connect to your Azure subscription once, and then a set of new buttons representing new features becomes clickable in the user interface (UI), as shown in Figure 4. These optional features help facilitate administration, improve service availability, ensure compliance, and provide other benefits to organizations.

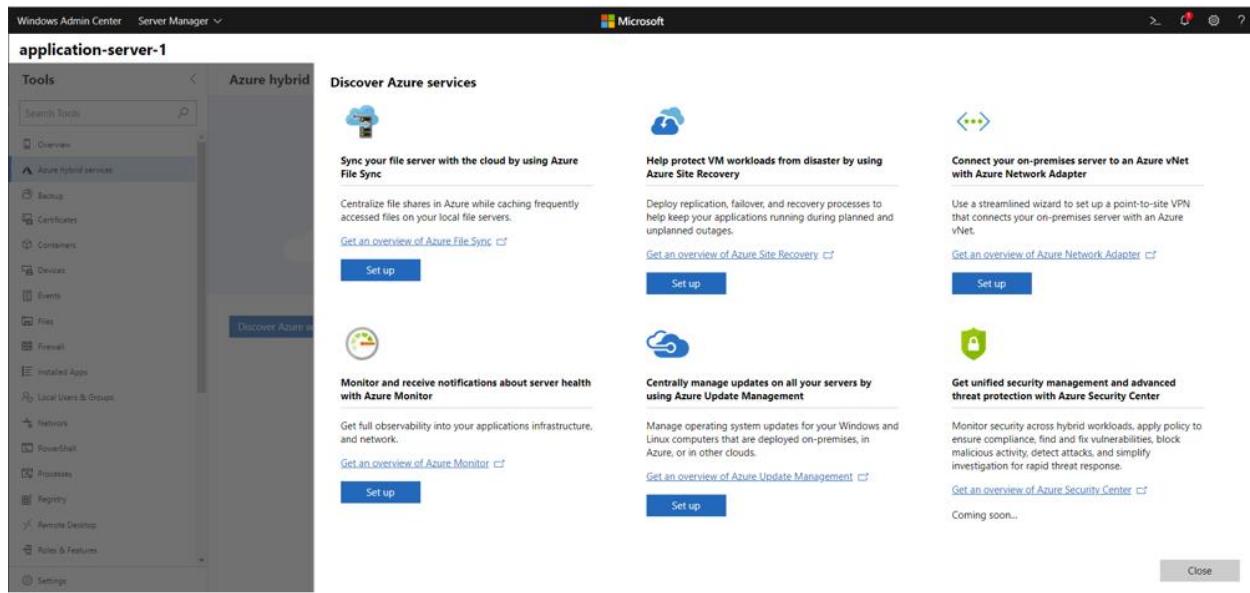


Figure 4. Azure Stack HCI makes Azure hybrid services available through Windows Admin Center

Beyond these Azure services that appear in Windows Admin Center, Windows Server 2019 Datacenter also delivers built-in features such as [Storage Migration Service](#) and [System Insights](#), which are not directly related to HCI, but which offer additional cloud integration that can enhance an Azure Stack HCI deployment.

A single trusted vendor for support

In Azure Stack HCI, Microsoft is the single solution vendor for the host operating system, the hypervisor, the HCI infrastructure, and often the guest operating system—along with a significant number of the applications (such as Microsoft SQL Server) within the guest operating system that the platform is likely to host. The fact that a single company is responsible for the software is an enormous advantage when it comes to tech support. Unlike with other solutions, when service is needed, there is only one party responsible, and you won't run into the all-too-frequent problem of a vendor "passing the buck" or unnecessarily blaming malfunctions, errors, or performance issues on another vendor in the software stack.

Furthermore, Microsoft is also a well-known, stable, and trusted vendor. Customers trust that Microsoft will be around for decades to provide support and respond immediately to new vulnerabilities when they appear.

Finally, because IT admins already understand Microsoft technologies well, Azure Stack HCI builds on what they already know. What they need to learn to implement and support Azure Stack HCI in their environments represents just a small increment to their existing skillset. With other vendors, there is much more to learn.

The best, most affordable HCI for the remote/branch office

Azure Stack HCI can scale to 16 nodes (and more than 1,000 nodes through a new Windows Server 2019 feature called [cluster sets](#)), but it is also the best and most affordable solution for small deployments.

The price for remote office/branch office deployments can remain low thanks to a minimal hardware footprint that starts at just two nodes. (At the time of this writing, two-node deployments are not fully supported by other HCI vendors.) This small hardware footprint

is made possible through technologies such as a USB witness, which dispenses with the need for a third server to keep the HCI cluster running after a node failure. (Alternatively, Azure Stack HCI can take advantage of [Azure Cloud Witness](#) to perform the same witness function for the solution.)

Azure Stack HCI also spares you from having to purchase a high-speed (10 gigabits per second [Gb/s] or faster) switch to place between nodes, letting you build the storage network instead through a direct connection over a crossover cable. With Azure Stack HCI, this type of switchless networking is fully supported with no performance degradation, including with RDMA for ultra-low latency and high throughput. (Microsoft fully supports this scenario, and other vendors do not.)

The minimum CPU and RAM requirements for the solution are also low thanks to the solution's kernel-embedded architecture, supporting lower-cost deployments, greater VM density, and low total cost of ownership (TCO).⁵ In addition, cache drives aren't required, unlike with some other vendors. And simple Serial ATA (SATA) technology is supported for hard drives.

The minimal hardware requirements and cost-reducing features in two-node deployments for Azure Stack HCI make HCI affordable even for small businesses. And for companies with many sites, such as retail chains with many stores, they can add up to tremendous savings.

High availability and resiliency at the edge

Another feature that makes Azure Stack HCI the best solution for small deployments is a feature called nested resiliency. This feature enables two-node clusters to withstand multiple hardware failures at the same time without losing storage availability. It thus allows users, apps, and VMs in a two-node HCI cluster to run through hardware failures without disruption, and without the added expense of a hardware RAID. No other HCI solution offers this feature.

Intel innovations boost Azure Stack HCI

Windows Server is on the leading edge of x86 hardware innovation, and Intel and Microsoft often work together to co-engineer new hardware and software optimizations on the server platform. Consequently, Windows Server is consistently one of the first platforms and hypervisors to support new Intel® hardware solutions that can greatly enhance performance.

Intel® Optane™ technology

Azure Stack HCI supports Intel Optane technology in Intel Optane DC persistent memory modules and in Intel Optane DC Solid State Drives (SSDs). You can use persistent memory in Memory Mode to maximize the number of VMs hosted per node, at a lower cost per VM than is possible with all-DRAM solutions. You can also use Intel Optane DC SSDs as cache drives to deliver heightened throughput for Storage Spaces Direct when SATA-based SSDs or hard disk drives (HDDs) are used for capacity. The power of Intel Optane technology to accelerate Azure Stack HCI has been demonstrated with a world-record performance of nearly [13.8M input/output \(I/O\) operations per second \(IOPS\)](#).

Intel® Ethernet Network Adapters for RDMA

Internet Wide-Area RDMA Protocol (iWARP) is one of the network protocol options used to implement RDMA, a required technology for Storage Spaces Direct in Azure Stack HCI. The following Intel network adapters support iWARP:

- Intel Ethernet Network Adapter X722-DA2
- Intel Ethernet Network Adapter X722-DA4

In addition, Intel Ethernet 800 Series controllers, such as the Intel Ethernet Controller E810, support both iWARP and the second RDMA protocol option, RDMA over Converged Ethernet version 2 (RoCE v2). For more information about Intel Ethernet 800 Series controllers and other Intel innovations for Ethernet, see www.intel.com/ethernet.

Intel® Select Solutions for Azure Stack HCI

Intel Select Solutions are predefined combinations of Intel compute, memory, storage, and network products that are designed to support specific workloads in basic ("Base") and advanced ("Plus") configurations. Intel has released Intel Select Solutions for Azure Stack HCI, which are [available here](#).

The top performing HCI solution for a low price, with a path to Azure

Azure Stack HCI is the best-performing HCI solution in the market, and it's included with the low price of a Windows Server 2019 Datacenter license. Based on the Windows Server technologies and services you already know, Azure Stack HCI lets you build incrementally on your company's existing IT expertise, instead of having to learn a new technical ecosystem from scratch. Finally, Azure Stack HCI is able to provide these benefits and modernize your local infrastructure while simultaneously providing a path to hybrid cloud through built-in Azure services.

To learn more about Azure Stack HCI, you can visit "[Azure Stack HCI solutions](#)," the [Azure Stack HCI catalog](#), and [Intel Select Solutions for Azure Stack HCI](#).

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¹ StorageReview. "Microsoft Azure Stack HCI Review (DataON HCI-224 with Intel Optane NVMe)." September 2019.

www.storagereview.com/microsoft_azure_stack_hci_review_dataon_hci224_with_intel_optane_nvme.

² Performance testing on the same hardware by StorageReview.com indicates that VMware vSAN maxes out at 521K IOPS, whereas Azure Stack HCI achieves more than 2M IOPS. StorageReview. "Microsoft Azure Stack HCI Review (DataON HCI-224 with Intel Optane NVMe)." September 2019.

https://www.storagereview.com/microsoft_azure_stack_hci_review_dataon_hci224_with_intel_optane_nvme.

³ [Repeat endnote 1] StorageReview. "Microsoft Azure Stack HCI Review (DataON HCI-224 with Intel Optane NVMe)." September 2019.
www.storagereview.com/microsoft_azure_stack_hci_review_dataon_hci224_with_intel_optane_nvme.

⁴ [Repeat endnote 1] StorageReview. "Microsoft Azure Stack HCI Review (DataON HCI-224 with Intel Optane NVMe)." September 2019.
www.storagereview.com/microsoft_azure_stack_hci_review_dataon_hci224_with_intel_optane_nvme.

⁵ Microsoft. "Storage Spaces Direct hardware requirements." August 2019. <https://docs.microsoft.com/en-us/windows-server/storage/storage-spaces/storage-spaces-direct-hardware-requirements>.