

WHITEPAPER

A guide to virtual desktop architectures



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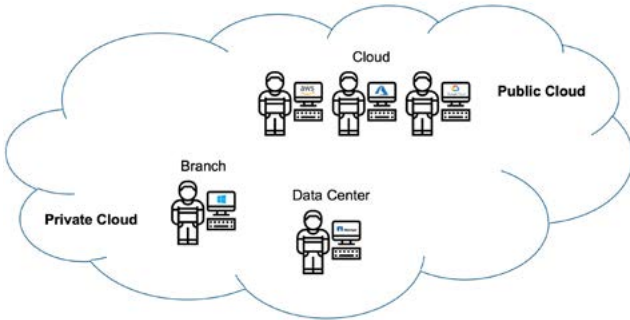
The ripple effect of the cloud: One change has an enormous impact

The success of the cloud is driving dozens of industry initiatives, including hyperconverged infrastructure (HCI). HCI plays a key role in addressing these four ripple effects of the cloud.

Effect #1: Experience and expertise are needed for multiple types of on premises and cloud data domains.

IT organizations must find a way to efficiently support hybrid clouds that consist of data in their on-premises private cloud and data in the public cloud.

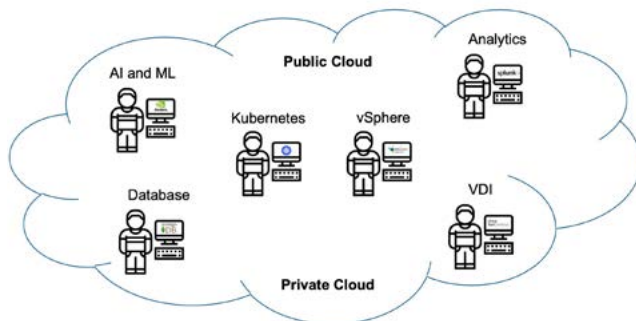
Hybrid cloud



Effect #2: Disaggregation is needed to deliver performance efficiently and cost effectively to different workload-specific data domains.

IT organizations are challenged to meet performance SLAs for databases, virtualization, containerization, analytics, and artificial intelligence (AI) and machine learning (ML) workloads—all with significant differences in the compute and storage resources needed.

Hybrid cloud



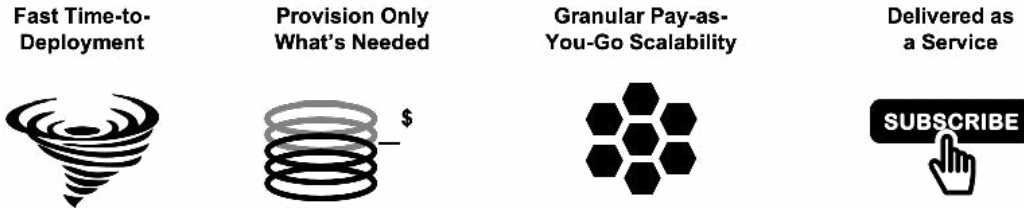
Effect #3: A cloud experience is preferred

In 2020, 14 years after the launch of cloud computing, the majority of IT professionals prefer a “cloud experience” that includes fast time to deployment, the ability to provision only what’s needed, and granular scalability. A growing number of organizations also prefer a subscription for an on-premises infrastructure, where the service provider owns and operates the equipment behind the data fabric.

Effect #4: A scalability gap emerges

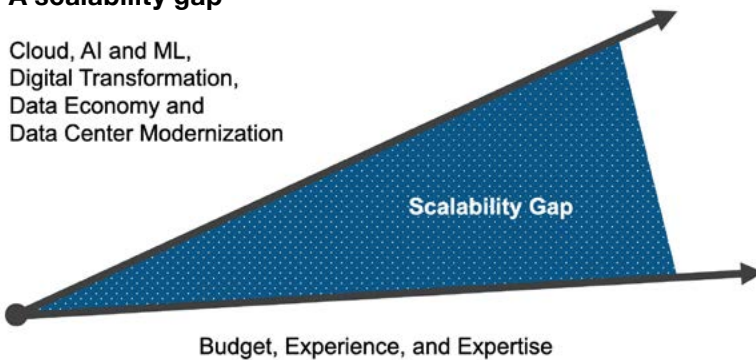
The ripple effect of the cloud means that most organizations are in some phase of implementing initiatives for more efficient hybrid clouds, digital transformation, data analytics, and AI and ML. The need for resources to support these strategic initiatives is growing faster than IT budgets, leaving organizations looking for ways to make up the difference. HCI helps bridge that gap.

The cloud experience



A scalability gap

Cloud, AI and ML,
Digital Transformation,
Data Economy and
Data Center Modernization

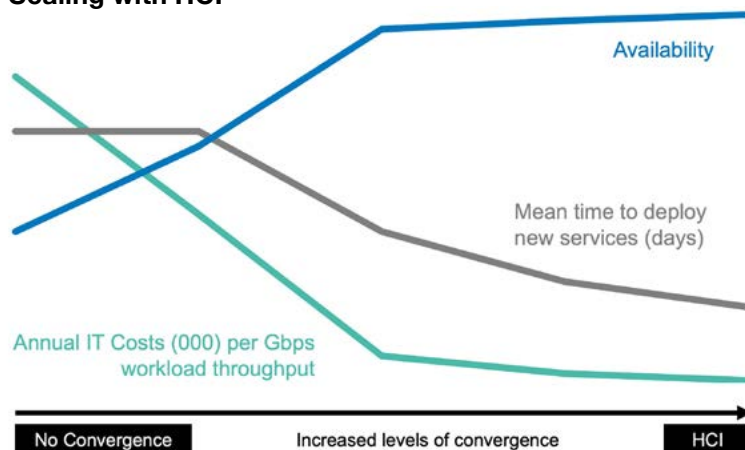


HCI bridges the scalability gap

For decades, IT organizations have been researching, evaluating, purchasing, and integrating their data center infrastructure. The server and storage infrastructure of a typical data center is refreshed every 3 to 5 years. Up to a year of that time is invested in planning and deploying the new environment.

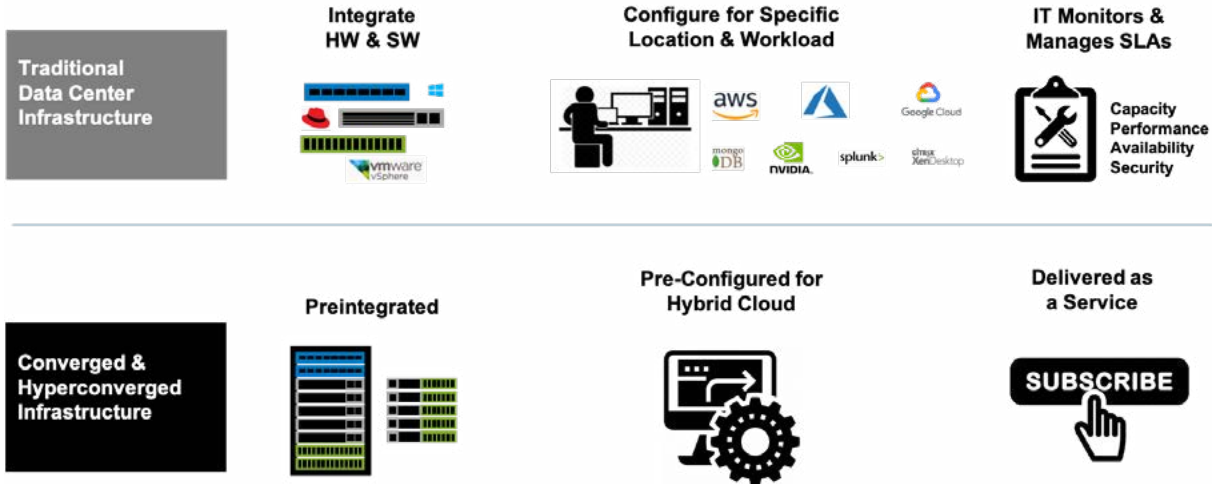
Simply put, HCI is data center infrastructure, preintegrated by vendors after careful design and testing. HCI bridges the scalability gap with proven templates that increase availability while simultaneously lowering time to deployment and cost.

Scaling with HCI



Because HCI is preintegrated, IT organizations no longer need to integrate servers and storage. And it's not necessary to configure hardware and software for specific workloads, because HCI is preconfigured for specific clouds, hypervisors, databases, and virtual desktop infrastructure (VDI) platforms. And for organizations that prefer a cloud experience over an own-and-operate experience, HCI as a service can be implemented with a subscription.

Comparing traditional and hyperconverged infrastructures



Two HCI foundations: Aggregated and disaggregated Systems

HCI promises to free IT pros from the mundane task of implementing data infrastructure so they can spend time on strategic initiatives, like increasing the efficiency of their hybrid cloud and leveraging AI-based analytics.

The next step in fulfilling the promise is understanding the two types of technology behind the solutions: aggregated HCI and disaggregated HCI.

Aggregated HCI

Compute, storage, and networking interfaces are preintegrated by the vendor into an HCI server building block. Operating systems and workload-specific software such as hypervisors, databases, and VDI applications can also be preconfigured. Environments scale by adding server and storage building blocks.

Disaggregated HCI

Disaggregated HCI is like aggregated HCI, except that separate server and storage building blocks are preintegrated and preconfigured by the HCI vendor. This approach increases compute and storage utilization by allowing them to scale independently.

Aggregated and disaggregated HCI

	Traditional Infrastructure (Nonconverged)	Hyperconverged Infrastructure (HCI)	Disaggregated HCI
Building Blocks	Servers, storage, and networking systems, operating SW, and workload-specific SW	Servers with compute, storage, operating SW, and workload-specific SW integrated inside server	HCI with servers (compute, operating SW, and workload-specific SW) and storage that scales independently
Integrated by	User	Vendor	Vendor

The three big advantages of disaggregated HCI: Higher utilization, performance, and capacity

Advantage #1: Higher utilization of compute and storage resources

The following table shows the number of compute and storage nodes in live NetApp® HCI installations. In no case did they scale the same, and in most cases the difference in the number of compute and storage nodes was at least 3 times. Disaggregated HCI allowed these customers to deploy resources only where they were needed.

In real life, compute and storage scale differently

Actual Use Cases	VDI Private Cloud	Splunk	Kubernetes Private Cloud	VDI Private Cloud	VDI Graphics
HCI Compute	28	62	6	4	2
HCI Storage	8	14	4	6	6

Advantage #2: Higher performance

HCI servers must support compute and storage overhead. Adding storage steals processing power that was previously available for compute. According to the [Gartner Magic Quadrant](#), the storage nodes for NetApp disaggregated HCI use the industry's leading all-flash array technology. The processing power of these nodes is 10% dedicated to storage, and they are highly optimized for scaling performance with heterogeneous and I/O-intensive workloads. Unlike aggregated HCI, disaggregated HCI storage nodes scale performance even with latency-sensitive workloads and when encryption at rest is enabled.

Comparing aggregated and disaggregated HCI performance

Performance Capability	Aggregated HCI	Disaggregated HCI
CPU Overhead	Server processors support overhead of OS, hypervisor, and software-defined storage.	30% less because storage nodes have their own dedicated processors.
Quality of Service	Typically no storage QoS. Noisy neighbor applications disrupt performance of other apps that are accessing data on the HCI server.	Powerful QoS dedicated storage access by fine-grained policies.
Scalability	With large processing overhead, and without storage QoS, scalability is limited.	With less processing overhead and power QoS, scalability is high.

Advantage #3: Higher effective capacity

Another benefit of using disaggregated HCI, — with industry-leading array technology, is superior deduplication and compression capabilities. In a side-by-side comparison, the capacity lost to overhead, and the capacity gained through deduplication and compression, were tabulated to find the effective capacity of a 16-node HCI cluster. The effective capacity of the NetApp disaggregated HCI storage nodes was found to be 15% to 73% higher than comparably equipped clusters using traditional HCI technology.

Comparing aggregated and disaggregated effective capacity

16-Node Solution	Leading Aggregated HCI Vendor A	Leading Aggregated HCI Vendor B	NetApp Disaggregated HCI
Physical space	111.77TB	163.07TB	142.85TB
Effective space after overhead, compression, and deduplication	167.66TB	142.69TB	247.3TB
Percent of physical storage available	150%	87%	173%

Adapt to disruption with three complementary technologies

The previous section explained the different foundations for an HCI architecture. This section completes the story by describing three important parts of the HCI ecosystem.

#1: HCI

With NetApp HCI, you get scale compute and storage on demand. Remember that with a hybrid cloud infrastructure you want predictable performance for your hybrid cloud on a highly flexible, ultra-efficient architecture. In essence, you never pay for what you aren't using. In fact, by consolidating multiple workloads you can reduce your TCO by up to 60%.

That starts with predictable performance where each workload delivers on its SLA. NetApp HCI allows customers to meet the needs of users with different desktop requirements for example task, knowledge, and power users. With independent resource allocation, you can scale resources dynamically. What's more, resource contention is eliminated, storage performance is three times faster, and compute efficiency increases by 22%.

Why NetApp HCI for a digital workspace?

Built to meet the new demands of IT

- **Predictable performance**
Ensure that every workload delivers on its SLA
- **Independent resource allocation**
Scale resources dynamically to build a futureproof solution without any compromises
- **Simplified management and configuration**
Easy deployment with NetApp Hybrid Cloud Control

Enable high-performance workloads and deliver a satisfying user experience for all your users, no matter where they work.

30x Faster Imaging	Instant App Delivery	Configure in Less Than Half the Steps and Time Compared to Other Solutions
Contextual Policy	Zero Downtime for Updates	

92% less administrative work with non disruptive scaling and zero downtime

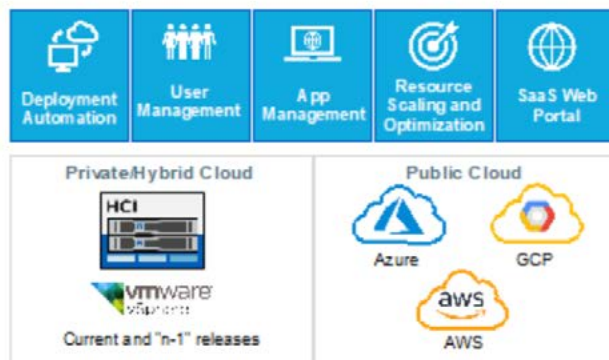


#2: Cloud

Organizations today are shifting their workforce productivity models from traditional desktop environments to cloud-driven virtual desktop solutions. Organizations anywhere in the world can deploy a validated solution to address the challenges and inefficiencies that they face when managing legacy virtual desktop solutions.

NetApp Virtual Desktop Service supports Remote Desktop Services (RDS) on major public cloud environments, including Microsoft Azure, Amazon Web Services, and Google Cloud, as well as on-premises environments. It also offers native support for the Microsoft Windows Virtual Desktop (WVD) solution in Microsoft Azure.

Streamlined Virtual Desktop Service Management & Automation with NetApp VDS

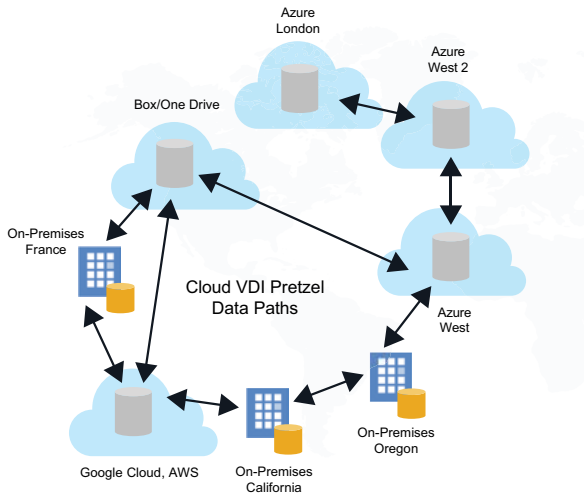


#3: Data management

The third piece in this HCI ecosystem is data. With the continuing growth of data – especially unstructured data – companies must consolidate into the cloud for more cost-effective backup and access. With NetApp Global File Cache, companies can enable real-time global file sharing for their distributed workforce.

This approach allows enterprises to securely consolidate silos of file servers into one cohesive global storage footprint in the public cloud, which streamlines overall IT management, significantly cuts costs, and boosts business productivity on a global scale.

Global File Cache for a digital workspace



Cloud VDI user data challenge

- Managing "islands of data" in multiple cloud regions, multiple cloud vendors, and on premises to cloud
- VDI performance issues with distributed profiles and user data
- Local storage, data replication, and backups cause poor recovery times
- Complex IT operations management

Resolution – NetApp Global File Cache

- ✓ Cache user profiles and data in cloud or on premises
- ✓ Provide remote files with local speed
- ✓ Cache files on NetApp Cloud Volumes ONTAP®, NetApp Cloud Volumes Service, or Azure NetApp Files which is the fastest SSD storage in the public cloud
- ✓ No profile black screen of death
- ✓ Simple operations and no complexity

The advancements around virtual desktop infrastructure center on the improved integration of HCI, cloud, and data. NetApp combines these solutions in seamless ways to bring more value to the enterprise. As a result, NetApp HCI is the first hybrid cloud infrastructure built specifically for today's complex environments. It's the only hybrid cloud infrastructure that meets hybrid multicloud demand and allows you to scale compute and storage independently. And with NetApp HCI, your data fabric simplifies data services orchestration across hybrid multiclouds.

In addition, NetApp Virtual Desktop Service functions as an extension of the cloud. It allows you to deploy, manage, and optimize virtual desktop environments through a SaaS-delivered global control plane.

Finally, NetApp Global File Cache creates a software fabric that caches "active data" sets in distributed offices globally. Business users are guaranteed transparent data access and optimal performance on a global scale.

As your business adopts a hybrid multicloud approach, you'll need to create your own unique strategy, probably with some data stored in the public cloud and other data stored on your premises. The key is to maximize the full potential of your data – wherever it resides.

About NetApp

In a world full of generalists, NetApp is a specialist. We're focused on one thing, helping your business get the most out of your data. NetApp brings the enterprise-grade data services you rely on into the cloud, and the simple flexibility of cloud into the data center. Our industry-leading solutions work across diverse customer environments and the world's biggest public clouds.

As a cloud-led, data-centric software company, only NetApp can help build your unique data fabric, simplify and connect your cloud, and securely deliver the right data, services and applications to the right people—anytime, anywhere.

