Hyper Converged Infrastructure
Are You Ready For Next?

Key Benefits

Guaranteed Performance
- Consolidate mixed workloads
- Deliver predictable performance
- Provide granular control at VM level

Flexibility and Scale
- Optimize and protect existing investments
- Scale compute and storage independently
- Eliminate HCI tax

Automated Infrastructure
- Automate and streamline management
- Deploy rapidly
- Simplify via comprehensive API ecosystem

NetApp Data Fabric
- Move data anywhere
- Provide greater data visibility across clouds
- Optimize and protect all your data

Hyper Converged Infrastructure (HCI) continues to evolve rapidly to meet the expectations of the Enterprise. First generation HCI platforms achieved an immediate return on investment and met a simple set of goals to achieve rapid adoption and success:

- The ability to collapse and consolidate large traditional infrastructures to reduce capital expenditures (CAPEX)
- Reduction in operating expenses (OPEX) through simplified management tools and complexity coupled with less of a dependency on specialized technical resources

This mandate for simplicity led to mainstream adoption of HCI platforms, and still stands as the fundamental core design principle for any virtualization project today. While successful at addressing simplicity, first generation HCI platforms scaled inefficiently and suffered from an inability to consolidate and protect multiple workloads running on the same platform. These limitations led to single workload use cases and a lack of adoption of mission critical, core data center workloads. As the virtualization market has matured, additional design points must also be considered to address the limitations of first generation HCI platforms:

- **Intelligent scale.** The ability to independently manage five basic pools of resources: storage performance, storage capacity, virtualized CPUs, virtualized memory, and licensing costs. Grow each dynamic pool based on your unique, non-linear consumption.
- **Confident deployment of all your applications.** Workload isolation provides a robust and predictable infrastructure layer to guarantee performance across the application layer.
- **Efficient storage architecture.** Built from the ground up to prevent data locality issues, stranding of resources, and management overhead that reduces available capacity while at the same time providing industry leading guaranteed performance, data deduplication and compression without compromise
- **Data Services you can trust.** Industry leading data protection and portability.

NetApp is delivering on all of the design points of next generation HCI. Run multiple applications with guaranteed performance to confidently deploy HCI across your data center. Unleash the true power of your infrastructure by simplifying management and independently scaling both compute and storage resources. Integrate with the NetApp Data Fabric so you can access all of your data across your clouds—private, public, or hybrid.

Transform and empower your IT organization so you can move faster, drive operational efficiency, and reduce costs. Realize the true promise of an enterprise-scale hyper converged solution with NetApp HCI.

Intelligent Scale
First generation HCI platforms have multiple scale issues. The first issue is the inability to independently scale. A hyper converged environment consists of five distinct dynamic pools of resources: storage performance, storage capacity, virtualized CPUs, virtualized memory, and licensing costs. Each workload added to the platform consumes a finite amount of each pool but rarely is this consumption rate equal across all pools.

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In addition, individual resource needs may change over time as the application grows and additional workloads are added.

First generation HCI assumes that both the growth of the platform over time will be linear across all five dynamic pools as well as the consumption of the infrastructure by the workloads. This is an unrealistic expectation at any significant scale in the Enterprise. Take a simple example of a mission critical database vs. a standard VDI deployment. The database may require a high level of resource consumption across one or more pools while a virtual desktop implementation may consume less across all pools. In either case, the consumption across all five pools is not linear and will not grow linearly over the lifecycle of the infrastructure.

NetApp HCI. Enterprise-Scale.

NetApp HCI is the enterprise-scale infrastructure solution delivered on a NetApp designed architecture running on innovative SolidFire technology combined with VMware vSphere virtualization and ONTAP Select file services. The ability to independently add right sized storage and compute nodes along with the ability to utilize existing vSphere licensing at any level allows for a true pay as you grow model. Some first generation HCI platforms require expensive and complex virtualization architectures, often relying on many features of vSphere Enterprise Plus which is expensive and at odds with the message of simplicity and cost reduction of HCI platforms.

NetApp HCI comes in 2U x 4-node building blocks (chassis) with compute and storage nodes available in small, medium, and large sizes and works with existing vSphere license levels that may already exist (including Enterprise License Agreements). A minimum configuration is made up of:

- (Two) 2U, 4Node chassis
- (Four) Storage nodes
- (Two) Compute nodes
- (Two) Open bays for expansion nodes

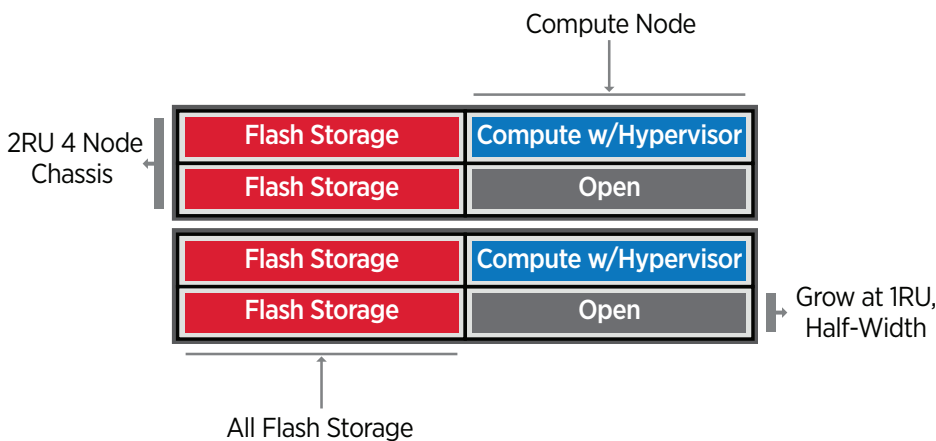Once minimum configuration is met, storage and compute nodes and sizes can be mixed and matched.

Confident Deployment All Your Applications

The second scale issue with first generation HCI platforms is the inability to guarantee performance to every workload in a consolidated environment. One of the biggest challenges in any data center is delivering predictable performance, especially in the face of proliferating applications and workloads—many of which can be extremely resource intensive. Any time you have multiple applications sharing the same infrastructure, the potential exists for one application to interfere with the performance of another. Important applications, such as virtual desktop infrastructure (VDI) and database applications, have very different I/O patterns that tend to impact one another.

Storage performance at scale is the Achilles heel of first generation HCI platforms. The reason for this is true application isolation to guarantee performance wasn't a core principal of first generation HCI. The only way to truly solve the issue of guaranteed performance is to initially design the storage architecture with this goal in mind.

A few attempts have been made to add predictable performance later on, with mixed results. This has led to a lack of true scale and consolidation. None of the following methods scale well. There have been three main attempts at storage performance:

- **Rate Limiting.** Every application is given a maximum amount of performance capacity. While this does prevent some workloads from consuming too much, it still doesn't protect against multiple workloads in contention at the same time. It also does nothing to address predictable performance. A minimum guarantee is the only way to provide this guarantee.
- **Tiering.** Workloads are placed in storage pools with certain performance characteristics. Based on utilization, the workload is moved from one tier to another at periods of low utilization based on past history. This model only looks back, it doesn't address present or future workload needs and often creates unnecessary movement of data.

Figure 1) NetApp HCI Minimum Configuration

NetApp HCI
Ready for Next

Guaranteed Performance

Flexibility and Scale

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NetApp Data Fabric

- **Prioritization.** Every workload is given a priority during times of contention. For instance, a production database will be given high priority while test and development environments are given a low priority. This method falls apart if a workload with a high priority is the one actually causing the contention. All applications below it in priority are affected.

NetApp HCI provides the solution for IT predictability challenges with SolidFire's unique Quality of Service (QoS) that provides a dynamic, dedicated performance window to allow the granular control of every application, eliminating noisy neighbors, meeting unique performance needs, and satisfying all performance SLAs.

Efficient Storage Architecture
The third issue with first generation HCI platforms is inefficiency at the storage layer. Operating the storage layer in an HCI platform in a highly available manner while still guaranteeing maximum efficiency characteristics such as predictable performance, compression, and deduplication without detracting from the available performance and capacity.

Look out for the following inefficiencies in first generation HCI:

- **Intermittent or non-existent global deduplication and compression.** Due to differences in architecture design, first generation HCI often requires significant computational overhead to achieve compression and/or deduplication. The amount required often creates a threshold that has to be achieved for the feature to activate. Furthermore, these features are only offered in a complex configuration of a limited number of disk groups and not in a global pool, further limiting the effectiveness. Performance is dependent on data placement. Because of this, the storage layout becomes very

important and the architecture behind disk groups may seem simple at first, but will be hard to optimize and ultimately limiting. This leads to complexity in node type selection and configuration.
- **Data locality to maintain performance.** Due to east-west traffic and bandwidth limitations in first generation HCI, in order to guarantee performance, storage and virtualized compute resources are often co-located on the same node. This leads to stranding of resources and limitations to the total available capacity throughout the solution. Another disadvantage of this approach is degradation in system performance in a failed HA scenario, data locality is no longer present.
- **Management control plane overhead.** In this shared core model, management of control plane resources is often handled by large virtual machines in the same dynamic pools designated for workloads and applications. This "HCI tax" can take 10%-30% on average of available memory and compute from the node just to turn on and operate the storage.

NetApp HCI doesn't suffer from any of these storage inefficiencies. NetApp HCI's always on global dedupe and compression in a scale out architecture eliminates the need for data locality and abolishes the HCI tax.

Data Services You Can Trust
Enterprises are under tremendous pressure to harness today's wealth of data and apply it to create new value across the entire organization—all with limited time, skills, and budget. The NetApp Data Fabric allows the full potential of data to be unleashed across your environment—whether they be on-premises, public, or hybrid cloud. NetApp HCI integrates into the NetApp Data Fabric for enhanced data portability, visibility, and protection.

NetApp HCI incorporates ONTAP Select to provide world class file services. In addition, NetApp HCI offers interopability with on-prem hybrid or public cloud solutions such as NetApp OnCommand Insight, StorageGRID Webscale, AltaVault, Snap Mirror, and Snap Center.

Transform and Empower Your IT Operations

NetApp HCI is about correcting the limitations of first generation HCI platforms. NetApp HCI's combination of independent scale of compute and storage, guaranteed performance and efficiency, and Data Fabric interoperability achieves the vision needed for the next generation of virtualized platforms for workload consolidation from edge to core data center.

About NetApp

NetApp is the data authority for hybrid cloud. We provide a full range of hybrid cloud data services that simplify management of applications and data across cloud and on-premises environments to accelerate digital transformation. Together with our partners, we empower global organizations to unleash the full potential of their data to expand customer touchpoints, foster greater innovation and optimize their operations. For more information, visit www.netapp.com. #DataDriven