ESG Economic Validation

Analyzing the Economic Benefits of Hewlett Packard Enterprise (HPE) Nimble Storage dHCI

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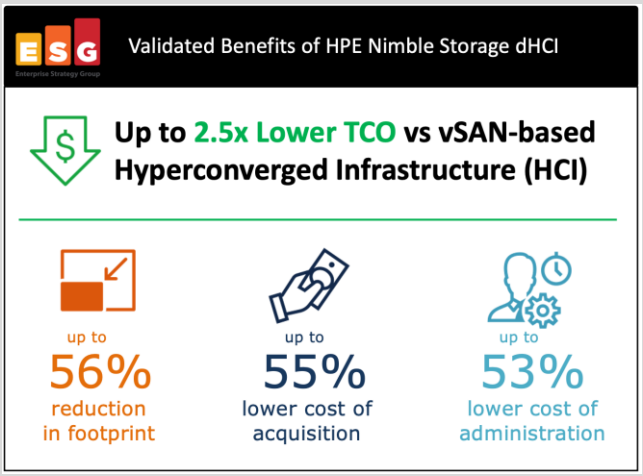
Executive Summary

Today's IT and VM administrators are challenged to meet the growing needs of businesses while reducing technology cost and complexity. Hyperconverged infrastructure (HCI) has addressed the complexity challenges for general purpose workloads but does not cost-efficiently deliver the highest levels of performance and resiliency required for business-critical workloads. ESG validated that HPE Nimble Storage dHCI delivers the HCI-like experience of unified management and automated, VM-centric operations with greater resiliency, faster performance, and flexibility at scale—with AI-assisted support and deep VM analytics.



ESG validated the economic benefits that customers have realized since deploying HPE Nimble Storage dHCI and used this as the basis to compare dHCI with several alternative vSAN-based HCI configurations from a leading vendor. The standard VMware vSAN sizing tool was used to generate configurations to meet the needs of a typical business-critical workload consisting of a mix of general purpose VMs and transactional databases. Our five-year total cost of ownership model found that the HPE Nimble Storage dHCI solution was able to meet the needs of the workload at a cost that was up to **2.5x lower** while providing lower latency and higher levels of resiliency. The dHCI solution provided up to a **56% reduction in footprint**, **55% lower cost of acquisition**, and **53% reduction in operational overhead** to deploy, administer, maintain, and support the system.

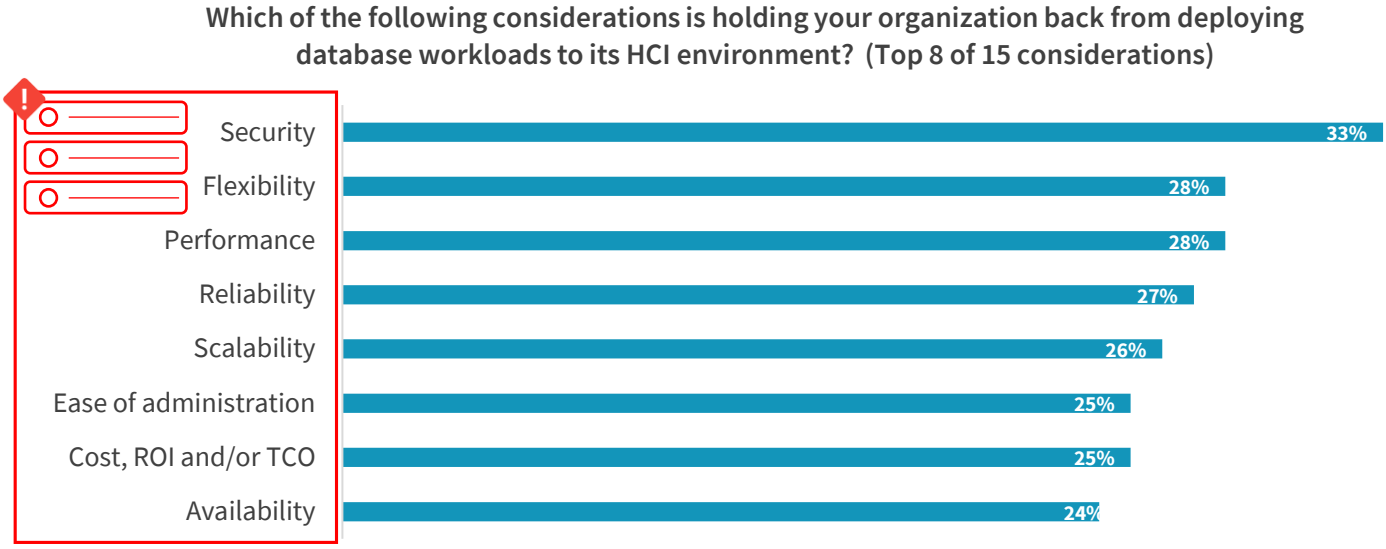
Introduction

This ESG Economic Validation focused on the quantitative and qualitative savings and benefits organizations can expect from deployment of an HPE Nimble Storage dHCI compared with a vSAN-based HCI solution from a leading vendor to handle the same set of business-critical workloads while delivering as close to equivalent levels of performance and availability as possible. ESG created a model that factored in common cost analysis categories including cost of hardware, data protection services, support, floor space, power, cooling, and administration.

Challenges

Hyperconverged infrastructure (HCI) continues to gain momentum as organizations are turning to the technology to cost-effectively consolidate and simplify their IT infrastructure. ESG research finds that 44% of organizations use hyperconverged technology in their data centers for at least 31% of their production applications/workloads today (and 79% of organizations are expecting to do so over the next two years).[1] HCI delivers an experience that dramatically simplifies how infrastructure is managed, deployed, and scaled. It is ideal for general purpose workloads with predictable growth as compute and storage are scaled together with every node; however, this also makes it costly to meet the workload requirements of business-critical applications that demand higher resiliency and lower latency. HCI becomes cost-prohibitive for business-critical workloads due to heavy performance overheads, increased risk of downtime, and inefficiency of overprovisioned compute and storage resources at scale. ESG research shows that organizations are holding back from deploying business-critical applications like database workloads in their HCI environments. Some of the top considerations holding them back are because they feel that the HCI architecture lacks the necessary security, flexibility, performance, reliability, and scalability and is too costly for those applications.

Figure 1. Top 8 Factors Preventing Organizations from Deploying Database Workloads on HCI environments



Source: Enterprise Strategy Group

Because of how they scale, HCI nodes make very inefficient use of compute and storage resources. In another research question, an overwhelming 92% of our respondents said that the ability of HCI nodes to scale compute and storage resources independently of each other was either "important" or "critical." Organizations running business-critical workloads would benefit from a solution that provided the proven simplicity and automation of HCI with a flexible choice

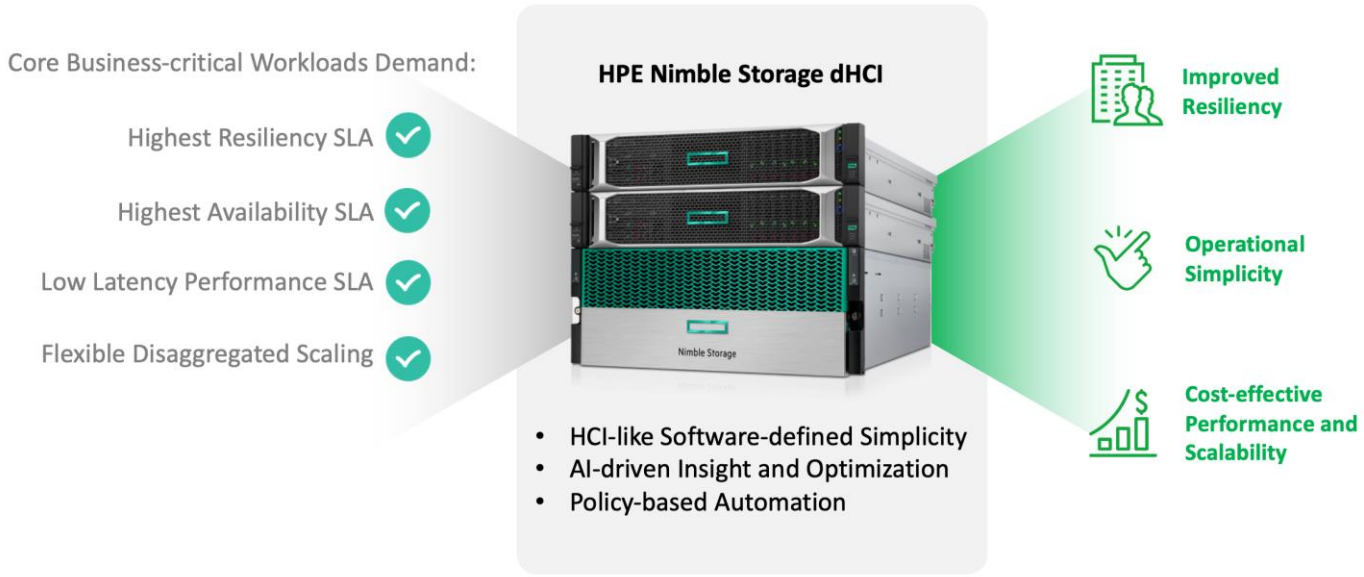
[1] Source: ESG Survey Results, *Hyperconverged Infrastructure 2.0*, October 2021. All ESG research references and charts in this report have been taken from this survey results set, unless otherwise noted.

of enterprise grade components that deliver lower latency, resiliency, and efficient investment through independent scalability of compute and storage resources.

The Solution: HPE Nimble Storage dHCI

HPE Nimble Storage dHCI delivers the HCI experience to workloads with unpredictable growth by combining the simplified and unified management architecture of HCI with the capabilities of enterprise-class disaggregated storage. Built on a secure foundation of HPE ProLiant servers with silicon root of trust (SRT) and self-managing flash storage of HPE Nimble Storage, the platform gives enterprises the operational simplicity of HCI with the flexibility to independently scale compute and storage resources. HPE Nimble Storage dHCI has built-in automation software that simplifies cluster deployment and scaling, and all data services can be managed from a single-pane VMware vCenter. The system is architected to provide AI-driven intelligence and automated administration, to predict and prevent disruptions, and to self-optimize the entire virtualization stack. It is designed with no single point of failure, can withstand three simultaneous drive failures, and is resilient with a minimum of 99.9999% guaranteed availability.

Figure 2. HPE Nimble Storage dHCI



Source: Enterprise Strategy Group

ESG Economic Validation

ESG completed a quantitative economic analysis of HPE Nimble Storage dHCI. Focus was placed on the economic benefits organizations can expect when leveraging a dHCI solution.

ESG's Economic Validation process is a proven method for understanding, validating, quantifying, and modeling the economic value propositions of a product or solution. The process leverages ESG's core competencies in market and industry analysis, forward-looking research, and technical/economic validation. ESG conducted in-depth interviews with end-users to better understand and quantify how the HPE Nimble Storage dHCI platform has impacted their organizations, particularly in comparison with previously deployed and/or experienced solutions. The qualitative and quantitative findings were used as the basis for a simple economic model comparing a dHCI solution with a vSAN-based HCI solution from a leading vendor to handle the same set of business-critical and mixed-workload requirements while delivering as close to equivalent levels of performance and availability as possible.

HPE Nimble Storage dHCI Validated Savings and Benefits

ESG's economic analysis revealed that an effective deployment of an HPE Nimble Storage dHCI solution can provide significant savings and benefits over a three-year period when compared with three-tier architectures and vSAN-based HCI solutions. ESG found that HPE Nimble Storage dHCI provided its customers with significant savings and benefits in the following categories:

- Improved Resiliency – dHCI offers dramatically improved resiliency compared to HCI without the need to overprovision resources while predictive analytics ensure data availability and enhanced data protection results in greater uptime and reduced risk to the organization.
- Cost-effective Performance and Scalability – Improved data efficiency, flexibility to scale storage and/or compute independently, and more effective use of resources relative to HCI lowered footprint and helped to reduce costs.
- Improved Operational Efficiency – Built-in automation and integration result in faster deployments with reduced administrative complexity, increased visibility, AI-assisted single-tier support, and deep virtualization intelligence, resulting in lower cost of administration and faster time to value.

Improved Resiliency

HPE Nimble Storage dHCI ensures that business-critical workloads continue to run at scale without interruption through the use of proven enterprise-grade components, advanced RAID and cascade checksum protection, and flexible data protection options. HPE customers found that their dHCI solution provided:

- Resiliency and Durability – Customers were assured, knowing that HPE dHCI was built on the most reliable and secure enterprise servers, storage, and networking instead of the commodity components used to build many HCI nodes. HPE Nimble Storage dHCI is designed with no single point of failure, redundant hardware, and hardened RAID protection with triple parity+ and checksums, and the ability to tolerate three simultaneous drive failures. ESG validated calculations that show that dHCI is up to 35x more resilient than most HCI and 4x more resilient than the most robust HCI protection configurations that can require significant overprovisioning of nodes and storage capacity for redundancy. One customer told us: "*We lost so much capacity on our HCI because we had to have many copies across the nodes, and our resiliency was limited for smaller configurations based on only having a few nodes.*"

"There is a lot less worrying with our dHCI solution. We know it will be fine at scale versus our past HCI clusters where we were always worried about a failed drive or node maintenance."

- Enhanced Data Protection – HPE dHCI's built-in data protection and application-consistent snapshots and advanced replication result in greater backup granularity and faster restores from any HPE or non-HPE device. Simple integration with RMC StoreOnce, CloudVolumes Backup, and ISV-validated backup solutions from Veeam and CommVault provide advanced capabilities. Additional flexibility and functionality can be added by using HPE Backup and Recovery service for VMware to back up and recover VMs (using snapshots, local, or cloud backups) or by using Zerto for continuous data protection and disaster recovery to any vendor or cloud solution.
- Reduced Risk of Downtime and Degraded Operations – Customers enjoyed peace of mind knowing that the business-critical applications running on their dHCI cluster with HPE Infosight predictive analytics deliver

99.9999% data availability and help to detect and avoid potential issues before they happen. Customers said that dHCI helped them to avoid the potential application impact that they experienced with HC solutions when performing data-in-place upgrades, updates, and resource scaling. Rebooting and rebalancing their HCI nodes had resulted in potential downtime, performance impact, and reduced availability. Because dHCI is designed with 100% headroom built in, there is zero performance impact for operating in a degraded state when a controller or server is rebooted, updated, or upgraded. In addition, maintenance operations in dHCI never result in losing access to drives—this is a major factor in maintaining storage efficiency and resiliency even under duress.

Cost-effective Performance and Scalability

The disaggregated design of dHCI provided improved performance, scalability, and cost savings by avoiding many inefficient functions of a scale-out architecture, making more efficient use of resources, and deploying less hardware to meet workload requirements. ESG found that HPE Nimble Storage dHCI provided customers with:

- Improved Data Efficiency – ESG validated the results of testing that demonstrated that dHCI improves storage efficiency by up to 5x compared to vSAN-based HCI while delivering high levels of performance without placing any burden on compute resources as is the case for HCI. Many vSAN-based HCI deployments do not recommend turning on deduplication for business-critical workloads for this reason.

- Flexibility and Scalability – Customers told ESG that dHCI enabled simple independent addition of compute and/or storage and eliminated the need to overprovision, rebalance data across nodes, or tune and optimize any layer. When using HCI, these customers often had to purchase more compute than necessary to meet storage requirements, or more storage than was required due to the need for additional compute cores. dHCI storage controllers handled all storage functions compared to HCI, which requires compute and memory resources from every node to handle storage and data services. In addition, dHCI gave customers flexibility to leverage hardware they already had and improve agility by cost-effectively delivering VMs as a service with HPE GreenLake.

"With dHCI, if we have a sudden need for a large amount of storage, we just bring in another disk shelf and cable it in, instead of having to add ten HCI nodes knowing that the memory and CPU on those nodes will go unused."

- Improved Performance – HCI architecture is reliant on heavy inter-node network traffic that adds latency and results in resource contention. This is compounded by the fact that HCI data services and maintenance operations require resources from every node. ESG validated that dHCI provided noticeable performance improvements for customers migrating from HCI; getting the most out of the compute, network, and storage resources; and providing up to 10x lower latency, especially for write operations that are critical for transactional workloads.

"When we just moved some of our big database servers from our HCI cluster to dHCI we immediately saw a 40% reduction in latency and outstanding operations."

- Reduced Footprint – ESG interviewed customers who confirmed that dHCI provides more usable compute power, storage capacity, and resiliency in a smaller footprint, helping to reduce infrastructure costs. Their HCI deployments had to be overprovisioned to achieve similar levels of performance and availability, resulting in higher costs to operate and wasted resources. We also found that scaling storage separate from compute helped to avoid unnecessarily paying higher

license and networking costs for expensive core or socket-based virtualization and database licenses. One customer stated, "*I was worried about having to add more nodes because now I have to also buy more Windows Datacenter, backup licenses, and VMware licenses too.*"

Operational Efficiency

HPE Nimble Storage dHCI was simpler to deploy, manage, scale, maintain, and support compared with alternative vSAN-based HCI systems that customers had deployed. ESG found that HPE Nimble Storage dHCI provided customers with:

- Simplified Deployment – HPE's automated deployment of servers and storage, configuration, provisioning, and cluster setup eliminated hundreds of manual steps, allowing customers to self-install the system at scale in under 15 minutes compared to some vSAN-based HCI that can take hours.

- Simplified Management – Customers told ESG that dHCI was simple to manage. Admins were already familiar with VM-centric management vCenter console environments, and they didn't need server or storage expertise, additional appliances, element managers, or training. If needed, advanced storage functions and insight were made simple through the single-pane-of-glass management software portal on the HPE Nimble Storage platform. They also reported that the dHCI system saved additional time and reduced complexity because it's automatically optimized with built-in best practices and data services. One customer reported that his team was easily able to grow from managing under 100 VMs to over 4,500 VMs without the need to add resources.

"Data store provisioning went from five days to five seconds."

- Simplified Growth and Upgrades – Many customers noted that dHCI was as easy to scale and upgrade with a single click as their HCI systems but with less disruption to applications. All resources are software-defined and were easily auto-discovered. Customers experienced the added benefit of being able to grow without the need to rebalance data (helping to keep latency low and predictable) or run in a temporary degraded state when updating or restarting components (reducing availability and introducing unacceptable risk). One customer said, "*When we lifecycled our [alternative HCI] solution it took several hours for our smallest cluster and a whole weekend for our largest clusters. With dHCI, it's just a few minutes per server and we are never worried that we are running in a degraded state.*"

"We spent months and months trying to alleviate bottlenecks on our old solution, while HPE Nimble Storage dHCI is just turnkey."

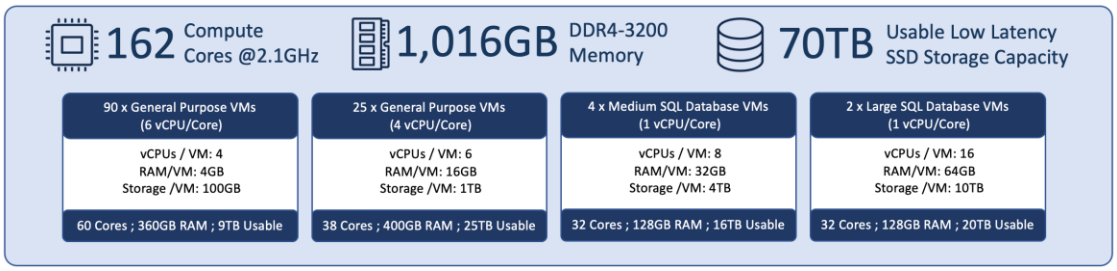
- Simplified Support – Customers reported that HPE InfoSight predictive analytics system and support automation simplified infrastructure support by enabling full stack monitoring and recommendations with global intelligence. HP InfoSight leveraged AI to proactively resolve, warn, and protect from many issues, resulting in fewer issues, improved visibility, and faster troubleshooting and resolution. Customers were thrilled with how easy it was to directly access Level 3 support. This saved much frustration for customers who felt that they resolved issues hours to days faster than alternative vendor support experiences: "*If we have an issue, in like 15 minutes we will have a high-level engineer already engaged with us on a Zoom, compared to past support experiences where we pay a huge amount of money for top-tier support and you are lucky if they call you back in a few hours.*"

ESG Analysis

ESG leveraged the information collected through vendor-provided material, public and industry knowledge of economics and technologies, and the results of customer interviews to create a five-year TCO/ROI model that compares the expected costs and benefits of deploying, managing, and maintaining HPE Nimble Storage dHCI with those of a leading vSAN-based HCI solution. ESG's interviews with customers who have recently made the transition, our experience and expertise in economic modeling and technical validation of HCI products, and the use of the publicly available vSAN ReadyNode Sizer tool helped to form the basis for our modeled scenario.

Our model assumed that an organization was looking to deploy an easy-to-manage converged infrastructure solution to support its business-critical virtualized general purpose and transactional database workloads. Based on the characteristics highlighted in Figure 3, the 121 virtual machines required a total of 162 physical cores, 1,016GB of memory, and 70TB of usable SSD storage. The mixed workloads ranged from large 10TB and medium 4TB transactional databases to smaller general-purpose workloads.

Figure 3. Summary of Workload Requirements Used to Size dHCI and vSAN Configurations

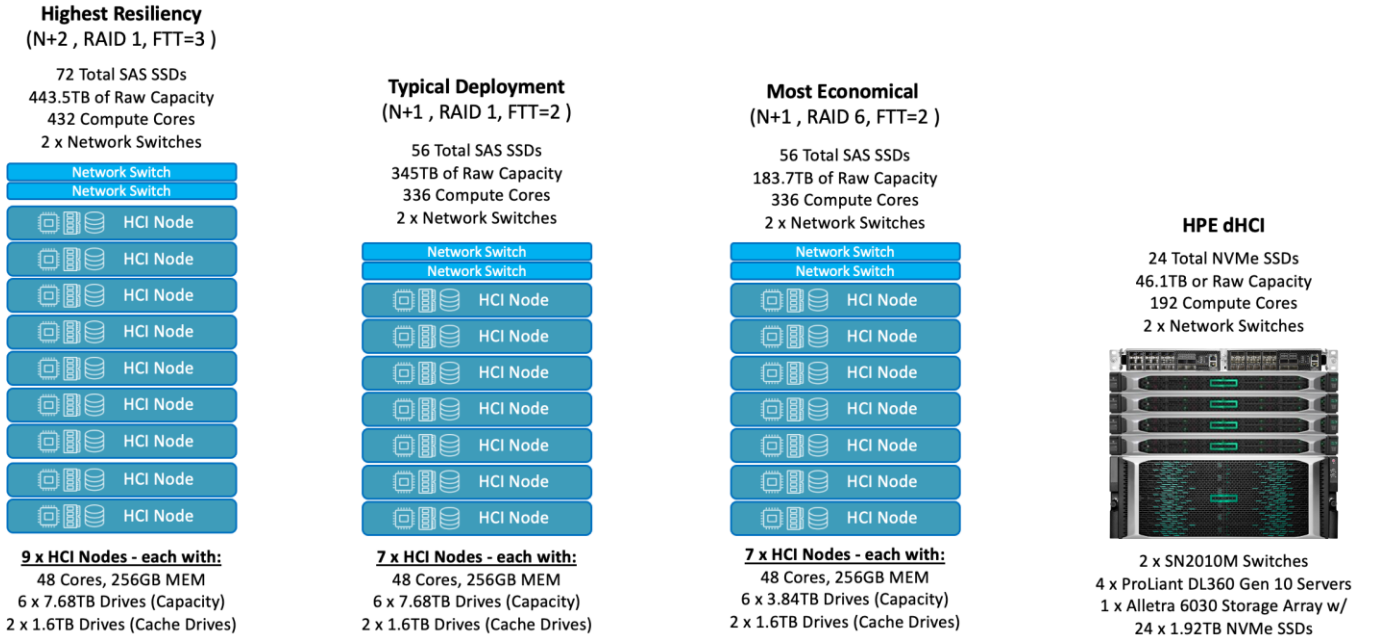


Source: Enterprise Strategy Group

Taking these workload characteristics into consideration, HPE provided us with a bill of materials for a dHCI configuration that could meet the given requirements while delivering the low, sub-millisecond latency and high levels of resiliency required by business-critical workloads. ESG required that the solution be able to survive a triple drive failure with no data loss and provide continuous operations even when performing major updates on components. Next, ESG used the vSAN ReadyNode Sizer tool to generate three possible configurations for a vSAN-based HCI solution. Each of these configurations was sized using the compute and disk technology option that resulted in minimal overprovisioning of node quantity, disk count, and core count. The first solution met the resiliency requirements defined above but required a total of 9 HCI nodes and quadruple mirroring, which would come at a high cost and result in far more compute cores and storage than necessary. For this configuration, we assumed that extra nodes would be deployed in an N+2 configuration to handle additional failures during a node update operation and a combination of host failure tolerance (FTT) of 3 with Raid 1 protection to be able to survive any three drive failures. It should be mentioned that ESG reviewed detailed calculations that showed that even the high resiliency configuration would not provide the same level of resiliency as the dHCI solution.

Because not all organizations would deploy such a highly resilient configuration, we also sized out a typical configuration (N+1, FTT=2, RAID1) and an economical solution (N+1, FTT=2, RAID6). Each of these configurations required a total of 7 HCI nodes. To provide adequate resiliency, the vSAN-based HCI configurations required far more drives and capacity than the dHCI solution (2.3x-3.0x the number of drives and 75% to 90% more total raw capacity). This includes both the drives used for capacity and caching on the VSAN configurations. It is expected that the resulting configurations would be overprovisioned and would provide more IOPS (when operating in a non-degraded state) than required of the workloads but could still not provide latency as low as the dHCI NVMe solution based on the dependency on inter-node network operations that would add latency to every operation. The resulting configurations are compared in Figure 4.

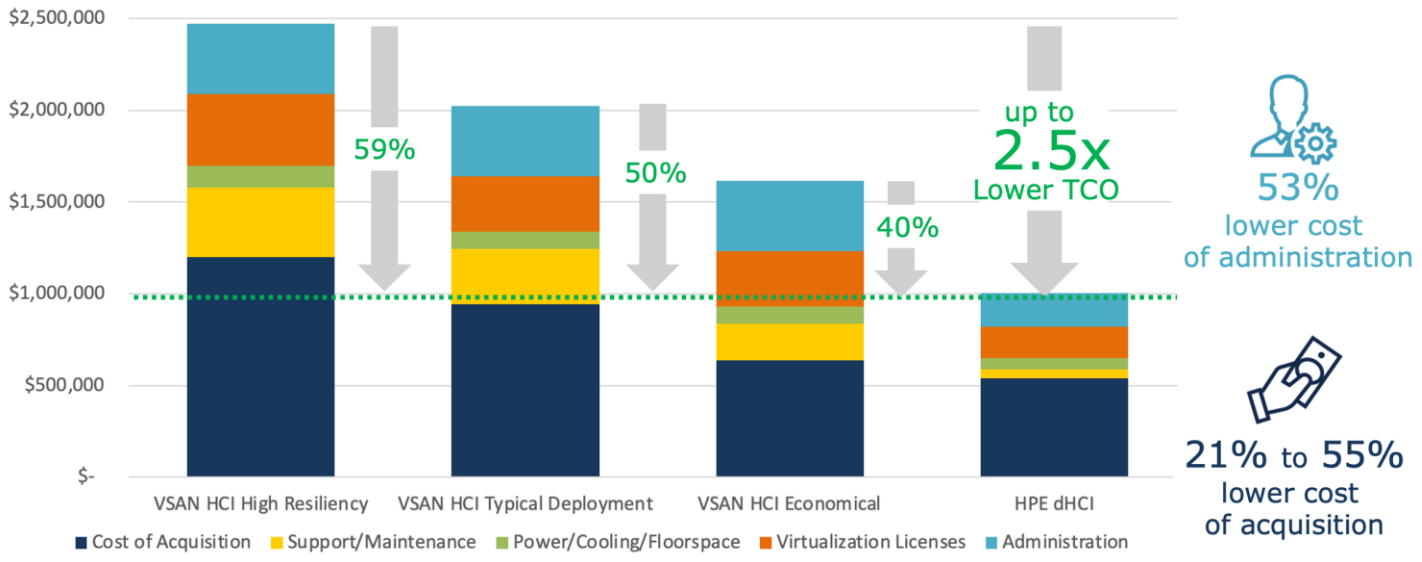
Figure 4. Comparison of Configuration Details in ESG's Modeled Scenario



Source: Enterprise Strategy Group

ESG then modeled the expected costs of acquisition, support/maintenance, power/cooling/floorspace, virtualization licenses, and administration for each of the four configurations. Acquisition, support, and maintenance costs were based on HPE-provided quotes and publicly available price lists and bills of materials for a leading HCI vendor using equivalent discount levels. The results of ESG's five-year modeled scenario are shown in Figure 5.

Figure 5. ESG's Modeled Five-Year Total Cost of Ownership Comparison



Source: Enterprise Strategy Group

Our models predicted that HPE dHCI could provide up to a 2.5x lower total cost of ownership over a five-year period than an alternative vSAN-based HCI solution from a leading vendor. The modeled analysis predicted that the HPE dHCI solution would provide substantial TCO savings for the organization when compared to the high resiliency configuration (59% TCO savings), the typical configuration (50% TCO savings), and even the most economical configuration (40% savings). It should

be noted that none of these vSAN-based HCI configurations provide as resilient a solution as the dHCI configuration, nor would they be expected to deliver the same low latency, especially for writes.

What the Numbers Mean

- 21% to 55% lower cost of acquisition – The dHCI solution required the deployment of far less hardware than the HCI solutions. The HCI solution required that every node be configured with identical compute, capacity, and cache storage drives and relied on multiple copies of data and additional nodes to provide resiliency against failures or impact during operations. This overprovisioning of hardware resources is reflected in the higher up-front cost of acquisition for the HCI configuration.

- 78% to 87% lower cost of support and maintenance contracts – Support and maintenance contracts generally scale with the cost of acquisition. ESG found in this pricing exercise that HPE not only provided a simplified and improved support experience, but also did so at significant cost savings compared to the vendor we priced. It should be noted that additional discounts could bring these costs more in line with acquisition cost savings.

- 35% to 49% lower cost of power, cooling, and floorspace –The 8U HPE dHCI configuration required 43% to 56% less rack space than the 14U and 18U alternative HCI configurations and consumed 17% to 35% fewer total watts. ESG leveraged vendor power calculators and assumed conservative assumptions of 70% cpu utilization, $0.12/kWh, and $75/RU/month floorspace cost.

- 43% to 56% lower cost of virtualization licenses – ESG assumed each 48-core server would require two vSphere Enterprise Plus licenses. The dHCI configuration required only 4 compute servers while the economical and typical HCI configurations each required 7 nodes and the high resiliency configuration required 9 nodes. Even though the cores of these nodes are being used for compute, storage, and system operations, all cores must be licensed, leading to much higher virtualization costs (which would also be true for any other license priced per physical core).

- 53% lower cost of administration – ESG modeled the expected hours required for daily administration, deployment, maintenance and updates, and support events. While both HCI and dHCI are simple to manage and maintain, ESG found that dHCI could be deployed in minutes rather than hours, could take only 5 minutes per host to update instead of 30 minutes per HCI node, could proactively avoid 50% of the expected simple support events, and could provide resolution of complex support events requiring L3 support up to 75% faster.

Issues to Consider:

- While no modeled scenario could ever accurately represent the economics behind every deployment, ESG encourages organizations to perform their own analysis to see how much they can save.

- ESG's analysis was based on vSAN-based HCI architectures. There are proprietary HCI offerings that offer improved deployment times, automation, and hardware flexibility. ESG expects that while some of the administrative benefits may not be as large, many of the dHCI advantages would still hold true versus these products (such as the ability to scale compute and storage resources independently, reduce footprint, provide lower latency and higher resiliency operations, etc.).

- ESG's conservative analysis was based on the optimal vSAN Sizer-produced configuration. We performed sensitivity analysis of alternative compute and storage choices to determine the ideal configuration from a size

and cost perspective. It should be noted that whatever processor and storage choice is made at time of acquisition carries forward for that cluster and determines the granularity of future node expansions.

- To demonstrate how dHCI makes better use of equivalent hardware, ESG also performed an analysis normalizing the processor type and disk capacity (1.92TB drives) between the vSAN and dHCI solution. For this case the vSAN solution required far more nodes, drives, and compute cores, and dHCI provided up to 2.8x savings.
- The average time to problem resolution for dHCI and HPE Nimble Storage is, on average, around 40 minutes from the time a customer calls human support (HPE explained that the number would be far lower if they counted the issues solved/prevented by AI support). This time savings was modeled conservatively in our administration analysis but may be an even more important business risk mitigation consideration for many businesses.
- Even though they are not included in our model, ESG noted a few additional areas in which organizations could potentially save with dHCI, including the ability to consolidate vendors, the business benefits that come as a result of faster time to value and improved business agility, the financial flexibility provided by HPE GreenLake, the ability to lower cost by repurposing existing HPE hardware, and the ability to greatly reduce costs for other per-physical-core licenses (such as Oracle and Microsoft).

The Bigger Truth

As organizations modernize their IT operations at the core to better support the needs of an increasingly dynamic business, it is critical that their systems are capable of providing services with cloud-like provisioning agility and operational simplicity. While hyperconverged infrastructure (HCI) provides exactly this for general purpose virtualized workloads that run at the edge and other locations, HCI is not a simple or cost-effective solution for many virtualized business-critical workloads that run at the core. Business-critical workloads demand low latency performance at scale and the highest levels of resiliency and availability. While HCI provides simplified scaling and operational simplicity, the demands of business-critical workloads begin to expose the inefficiencies of the scale-out architecture such as the heavy performance overhead, increased risk of downtime, and inefficiency of wasted/unnecessary resources at scale.

ESG validated that HPE Nimble Storage dHCI delivers the operational simplicity that HCI brings to general purpose workloads (VM-centric management, software-defined architecture, policy-based automation, simple upgrades and scalability, and built-in data services) while also meeting the demands of business-critical workloads (low latency performance, highest levels of resiliency and availability, and flexible and efficient scalability of resources). After migrating business-critical workloads from 3-tier architectures and HCI nodes to HPE Nimble Storage dHCI, customers immediately noticed a reduction in latency, improved uptime, and a reduction in the time to manage, update, and support the deployment.

Our models predicted that HPE Nimble Storage dHCI could provide up to a 2.5x lower total cost of ownership over a five-year period than an alternative vSAN-based HCI solution from a leading vendor. This includes up to a 55% lower cost of acquisition, 87% lower cost of support/maintenance, 49% lower cost of power/cooling/floorspace, 56% lower cost of virtualization licenses, and 53% lower cost of administration. The conservative models showed significant savings versus several possible configurations of HCI (high resiliency, typical, and economical) while providing an expected reduction in latency and improvement in resiliency over all three configurations. The majority of the savings come from the expected complexity and inefficient overprovisioning of storage and compute resources required by the HCI configuration to meet the demands of the business-critical workloads.

By combining the operational simplicity that HCI brings to general purpose workloads with the highest levels of resiliency, availability, performance, and the ability to flexibly scale compute and storage resources independently, HPE Nimble Storage dHCI can enable cloud-like agility for virtualized business-critical applications and mixed workloads in your core

data center. Bringing this level of agility to business workloads that have been historically slow to scale due to the cost and complexity of resources required can have significant impact to many businesses—potentially enabling revenue growth, improved business optimization, and reducing risk. ESG recommends that organizations looking to modernize and transform IT operations for their virtualized business-critical workloads while lowering costs and improving time to value consider HPE Nimble Storage dHCI.

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