Software-defined storage

HP point of view

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Executive summary

A critical element of the software-defined data center (SDDC), software-defined storage (SDS) is gaining attention both from vendors and the industry at large, with Gartner naming SDS as the #2 hottest data center trend for 2014.[1] The first to market with an SDS solution, a recent Wikibon analysis of the server SAN market named HP as the current leader in both SDS revenue and market share.[2] HP understands available, reliable, scale-out storage architectures, and the need to seamlessly integrate those architectures into multi-hypervisor environments. Both of these elements are critical for the SDDC.

While enterprise vendors like VMware® and EMC are quick to offer competing SDS solutions, this raises a critical question: Why trust storage, a fundamental building block of the SDDC, with a server virtualization software company or an unproven new entrant in the market? HP has been a player in SDS and the SDDC since inception and is the only vendor capable of delivering on all elements of the SDDC—compute, networking, storage, and management—offering a complete SDS strategy and vision based on simplicity, efficiency, and openness that make storage availability a top priority.

Introduction

The SDDC has just recently begun generating widespread discussion as an extension of the general software-defined movement—an extension that takes software-defined approaches to storage and networking to their logical end point. There are many nuances in how the SDDC is defined, but HP views it as the full IT infrastructure stack built on a standard set of platforms with common and interoperable data services, managed via application-aware orchestration and open application programming interfaces (APIs). When approached from this angle, the SDDC promises an efficient means of addressing the relentless demand for rapid deployment of IT resources as organizations seek to satisfy an ever-expanding set of business needs. Today, these needs can be summarized by the following requirements:

• Support growth without complexity

• Accommodate unpredictable demand

• Provide instant access to information

• Deliver high service levels at acceptable costs

• Reduce and manage business risk

• Protect technology investments

In practice, the SDDC enables IT administrators to optimize the rapid and reliable creation and delivery of business services through policy-based automation—from the infrastructure up to the application—using a unified view of physical and virtual resources. In the process, the SDDC effectively aligns business and IT objectives by providing open choice regarding how best to consume or deliver IT resources or services for maximum agility, security, and business value.

HP also believes that the SDDC and the entire software-defined movement is the next step in the evolution of IT beyond virtualization and convergence. Software has become pervasive in all aspects of our lives and businesses. Software delivers capabilities we never previously imagined—we need look no further than our mobile devices, our automobiles, and even our homes for evidence of this. So, it makes sense to extend the capabilities of the IT environment through software. The advantages of software—speed of development and deployment, flexibility, agility—give it clear benefits over hardware-centric approaches of the past.

[1] The Gartner Symposium, October 2013
[2] wikibon.org/wiki/v/The_Rise_of_Server_SAN

Storage for the software-defined data center

To maximize return on investment in the SDDC requires the flexibility to optimize for cost—for example, by deploying virtual storage appliances (VSAs)—as well as for service levels—for example, by investing in dedicated hardware and software that is purpose built for unpredictable, dense, and multi-tenant environments where service-level agreements (SLAs) must be met.

IT departments today are under continuous pressure to deliver greater value at higher velocity with fewer resources. Organizations can't acquire or deploy more or different storage fast enough. Legacy *hardware-defined* storage alone can't meet these demands or ensure desired business outcomes. Even the most engineering-intensive hardware vendors such as HP can't design, develop, test, and produce new storage hardware fast enough to meet business demands for new and different capabilities. This is because the storage needs of organizations today are simply too varied to address with storage hardware alone.

HP, along with a number of storage industry analysts, has identified two fundamental design centers that address the opposite ends of a value continuum on which IT decisions are made. On one end of the spectrum, organizations are motivated by the stringent requirements of their business-critical, tier-1 applications with a bias toward delivering ultra-high performance and meeting SLAs. For these organizations, predictable performance and assured service levels are critical, which requires dedicated, *service-refined storage* (SRS) designed to meet tier-1 requirements at the lowest transaction cost—even when consolidating a large number of unpredictable workloads. SRS relies on capabilities such as multi-tenancy, hardware-acceleration, quality-of-service (QoS) controls, high availability, and elastic scalability through technologies such as storage federation.

On the other side of this continuum are applications and infrastructure deployments that are designed around achieving the greatest resource utilization and lowest deployment cost. This design center is where completely decoupling storage data services from hardware delivers significant advantage and is one reason that SDS has become such a hot topic.

Figure 1. Storage for the SDDC
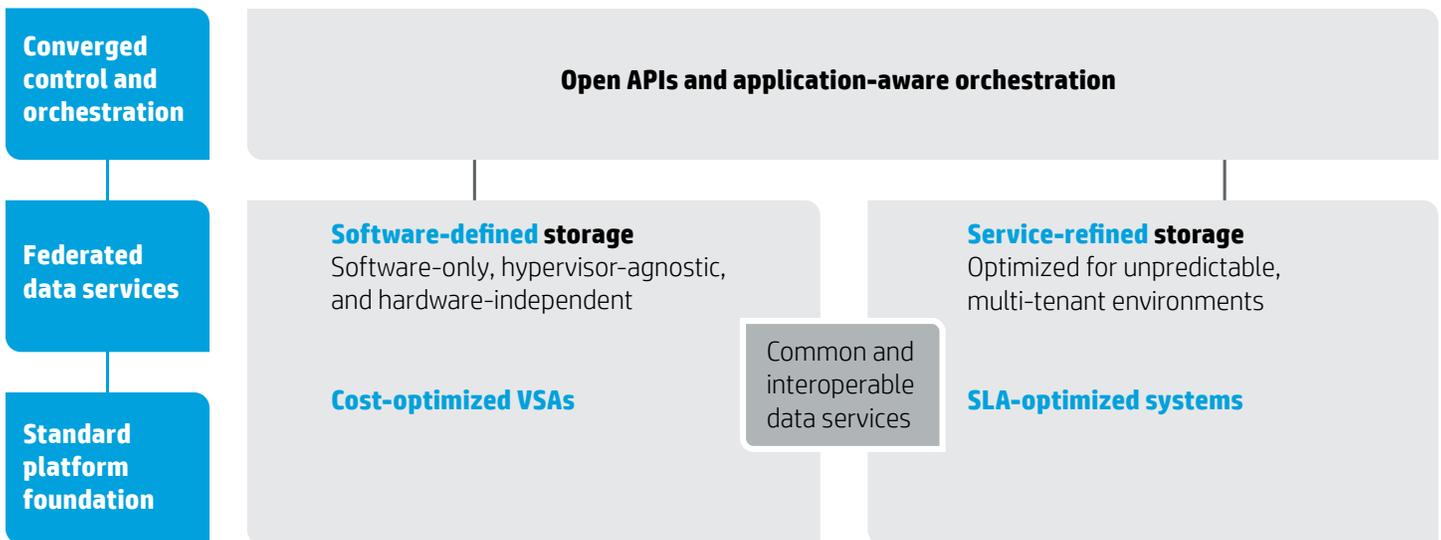
The power of SDS lies in separating out hardware and data services from management and control, thus bringing new value through maximum cost optimization, flexibility, and opportunities for orchestration across the SDDC. In short, SDS allows organizations to create an open pool of shared storage capacity from whatever standards-based hardware they currently have (or will acquire) then use standards-based APIs to drive orchestration between storage resources and other aspects of the data center. This approach gives organizations the freedom to repurpose existing server and storage hardware (or purchase newer commodity hardware) without being tied to a specific supplier. But perhaps more importantly, it opens up new possibilities for simplified management and orchestration across the data center—for example, by enabling OpenStack development for hybrid cloud integration. By eliminating hardware dependency in the physical layer, IT can still deliver advanced data services—including disaster recovery, replication, thin provisioning, deduplication, and more—while benefiting from the cost advantages it gets from the use of commodity hardware. By decoupling hardware from management, new possibilities open up for orchestration and cloud integration.

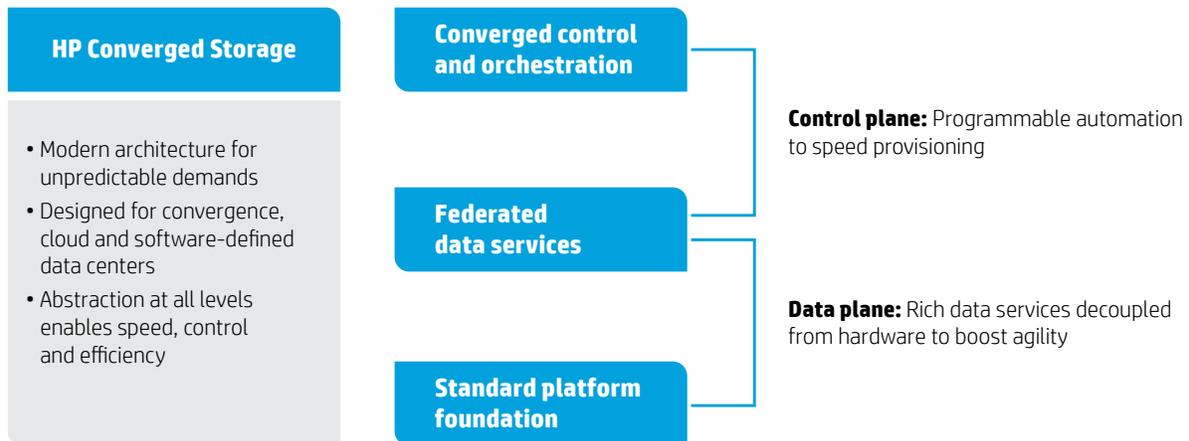## HP Converged Storage and the software-defined data center

The HP view of the SDDC and its storage requirements has evolved as a natural extension of physical infrastructure convergence. The importance of virtualization, resource abstraction, and decoupling hardware from management and orchestration have long permeated the HP Converged Storage strategy, which is built around the concept of polymorphic simplicity—the delivery of a common set of data services delivered in different shapes and sizes and managed through common tools. Polymorphic refers to the ability to change as the situation changes. With polymorphic storage architecture, as business needs and desired outcomes change, the shapes and sizes of provisioned data services can easily change to match without being encumbered by underlying infrastructure.

HP was an early proponent of the SDDC and, from the beginning, has understood the implications of widespread cloud computing adoption and the emergence of software-defined IT resources. Since this time, the company has continued to pursue development of both SRS and SDS design centers as critical anchors that allow the HP Converged Storage portfolio to span the continuum of needs that organizations face today and are likely to face in the future.

Building on HP's position as the world's largest infrastructure provider with a long history of open, standards-based solutions, the company has taken the approach that unified management and open orchestration should also span both ends of this spectrum and not limit itself to SDS. There are a number of use cases where an organization may want to apply the same set of data services across a variety of dedicated appliances and virtualized appliances at remote offices, in the data center, and in the cloud. The agility and flexibility of these data services (delivered as software that is federated across the enterprise) provides the functionality needed for applications to directly automate provisioning as workloads change over time, or as new workloads are added—even those not yet envisioned at the time of deployment.

Achieving this vision has meant architecting to address the unpredictable needs of virtualization, IT as a service (ITaaS), and the cloud by abstracting hardware, software, and orchestration into discrete elements. By building in automation, provisioning of resources can be expedited and costs reduced. HP also recognized early on the rapidly evolving power of open standards and made a design commitment to using x86 as a hardware building block for its converged infrastructure solutions in conjunction with active participation in the OpenStack community and development of open management and orchestration.

Figure 2. HP Converged Storage is storage for the SDDC

HP Converged Storage
• Modern architecture for unpredictable demands
• Designed for convergence, cloud and software-defined data centers
• Abstraction at all levels enables speed, control and efficiency

Converged control and orchestration

Control plane: Programmable automation to speed provisioning

Federated data services

Data plane: Rich data services decoupled from hardware to boost agility

Standard platform foundation

The future of storage is software-defined

The industry's leading analysts echo the HP position on the importance of the SDDC and its impact for storage. For example, Gartner listed the software-defined movement as the #2 hottest data center trend for 2014 with SDS as a prime example. IDC has taken the position that, "Software-based storage will slowly but surely become a dominant part of every data center."[3] These analysts agree that SDS will effect a sea change in modern IT by delivering economic value and operational flexibility that was previously unattainable.

One of the ways that storage will continue to evolve to meet the SDDC is through moving storage and compute closer together. The software-enabled decoupling of storage intelligence from specific hardware and the more widespread adoption of flash-based media within the enterprise are major enablers of this evolution. Converged infrastructure and hyperscale architectures further simplify IT operations. With the advent of high-speed, low latency networking, flash-based media, and the continued explosion of new application concepts, it is now possible to move storage functionality back into software that can work with almost any hardware.

[3] Worldwide Software-Defined Storage Taxonomy, IDC, 2014

In addition, technical trends such as virtualization, cloud computing, Big Data, mobility, and other new workloads are coming together to create an ideal alignment of business needs and technology advances:

• **Increased server power:** Single-CPU servers could efficiently handle the management of one or at most a few virtual machines, but often at a performance penalty when compared to those same servers running directly as dedicated systems. Today's powerful servers have multiple processors to deliver robust platforms that can easily support the performance needs of both virtual applications and virtual storage appliances co-resident on the same system.

• **Rising adoption of solid state drives (SSDs):** As flash-based media has continued to experience dramatic reduction in price, the increase in disk performance of SSDs and hybrid SSD and HDD combinations, along with increased capacity, has made it possible for software-defined storage to perform as well or better than conventional HDD storage in terms of both IOPS and dollar per IOPS.

• **Widespread adoption of virtualization:** Server virtualization has created demand for highly available, flexible shared storage. Widespread adoption of virtualization has created demand for greater storage efficiencies, and points to the ability to apply virtualization concepts to storage in order to achieve this. However, this requires that storage be open and flexible, including the ability to support multi-hypervisor and cloud environments.

All these factors have combined to drive interest in SDS, fueled by business needs for IT efficiency, flexibility, and choice.

Critical attributes of software-defined storage

As the SDDC and SDS have become hotter and more visible trends, vendors have scrambled to take a position on the SDDC and to bring software-defined storage solutions to market. However, not everything that is marketed as SDS actually delivers on the core values of SDS. For example, a recent analysis by Wikibon[4] showed that organizations are demanding tools that function across multi-hypervisor virtualized environments while also providing flexibility and new options for handling unknown future demands resulting from rapidly changing business environments. However, solutions such as VMware Virtual SAN (vSAN), with clear allegiance to a single hypervisor, do not meet these needs.

A recently published IDC Opinion[5] touches on the true value of the vendor-agnostic, software-enabled decoupling that SDS provides by stating that, "customers will begin adopting multiple hypervisors over coming quarters and look for solutions that can work across heterogeneous environments." The HP view is that, in order for storage to be truly software defined, it must meet three critical attributes that have proven their value by enabling cost optimization and maximum flexibility within the data center:

• **Hardware independence:** By taking advantage of hypervisor virtualization technologies, VSAs can run on virtually any x86-based server and enable the redeployment of existing legacy storage arrays, allowing the reuse of older equipment or the efficient optimization of newly acquired technologies, effectively maximizing the capital investment.

• **Hypervisor agnosticism:** Long-term investment protection means that hypervisor technology lock-in must be eliminated. True SDS allows an organization to employ common management and data services across multiple hypervisors (VMware, Hyper-V, Kernel-based Virtual Machine [KVM]) at one time, and also provides options to seamlessly change hypervisor infrastructures at a later time when business requirements demand it.

[4] wikibon.org/wiki/v/The_Rise_of_Server_SAN
[5] "Buyer case study: Large geo-imaging firm leverages Tintri for consolidating dev./test environments," IDC, October 2013
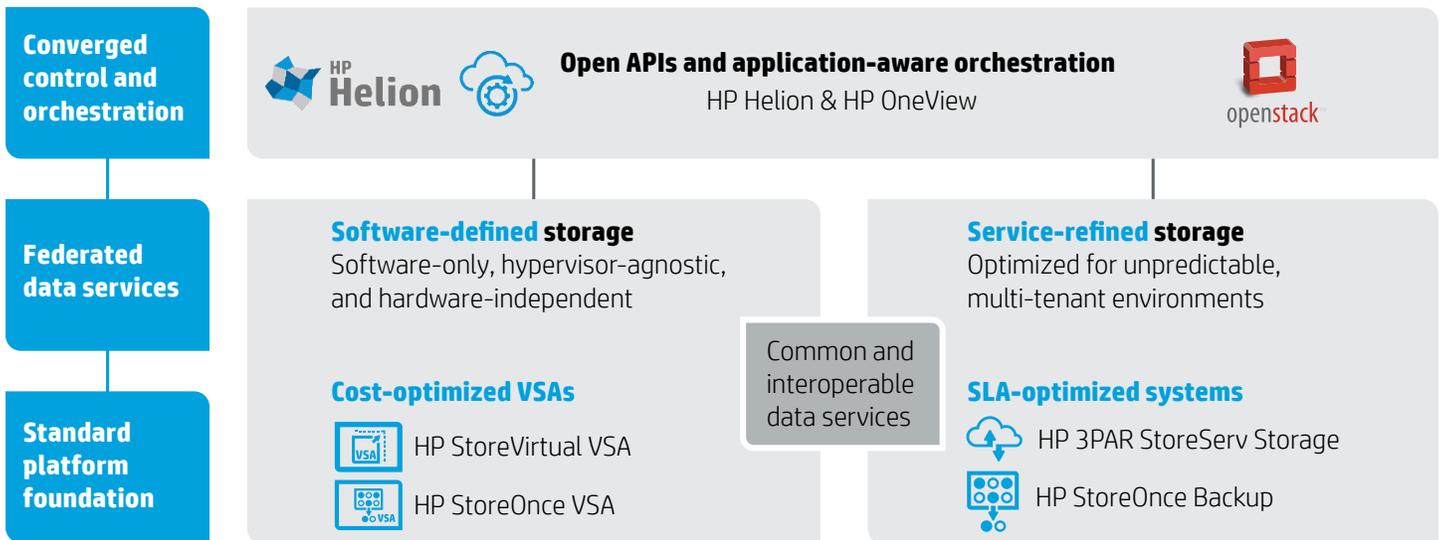
• **Scale-out data services architecture:** As needs grow over time, federation and autonomic management prevent an organization from being restricted to isolated towers of storage that do not interact easily with the rest of the environment. Scale-out data services provide a non-disruptive response to constantly changing demands as well as non-disruptive capacity growth.

With true SDS implementations, organizations are not locked in to any particular storage hardware, and they are no longer locked in to any hypervisor either. Organizations can mix and match their virtualization environments as easily as they mix hardware. In the end, SDS should allow organizations to create open pools of shared storage capacity with whatever standards-based hardware they currently have or may acquire and still respond non-disruptively to changing business demands in multi-hypervisor environments. These three attributes provide a compelling foundation for the SDS business case.

HP leadership in storage for the software-defined data center

The first major vendor to bring an SDS solution to market, HP is also the current SDS market leader with 37 percent of the enterprise server SAN market in 2013[6] and more than one million VSA licenses distributed to date.[7] Early on, HP bet big on modern architectures built around the needs of virtual environments and hybrid cloud infrastructures. Building on HP-owned intellectual property, the company created a strong portfolio of modern storage solutions built to deal with the unpredictable demands of highly virtualized environments that HP continues to evolve under the umbrella of HP Converged Storage.

Figure 3. HP Converged Storage: Storage for the SDDC

Converged control and orchestration

HP Helion

Open APIs and application-aware orchestration
HP Helion & HP OneView

openstack

Federated data services

Software-defined storage
Software-only, hypervisor-agnostic, and hardware-independent

Service-refined storage
Optimized for unpredictable, multi-tenant environments

Common and interoperable data services

Standard platform foundation

Cost-optimized VSAs

HP StoreVirtual VSA

HP StoreOnce VSA

SLA-optimized systems

HP 3PAR StoreServ Storage

HP StoreOnce Backup

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[6] wikibon.org/wiki/v/The_Rise_of_Server_SAN
[7] Based on HP internal sales and license distribution records as of July 2014

HP views the SDDC as the full IT infrastructure stack built on a standard set of platforms with common and interoperable data services, managed via application-aware orchestration and open APIs. When you abstract the physical platform through virtualization, you have two main components of SDS: the control plane, which automates the orchestration of both physical and virtual assets, as well as the data plane, which provides rich data services that are not dependent upon any underlying proprietary hardware.

True SDS automation should fit the user's business demands, and not lock the user into any proprietary orchestration tool. To this end, HP has invested in building the entire foundation of SDDC infrastructure (servers, storage, and networking) around the application of industry-standard, RESTful APIs. This investment takes advantage of a common industry language that enables the automated orchestration and provisioning of all storage data services—whether they are employed by physical or virtual arrays.

By making deliberate investments in this open architecture, HP provides choice and investment protection to the customer by surfacing the same robust data services in whatever orchestration tool best fits the user's needs today or in the future. This application of polymorphic simplicity offers the same level of features from within VMware vCenter, Microsoft® System Center Virtual Machine Manager (SCVMM), and OpenStack distributions such as HP Helion OpenStack and HP Helion OpenStack Community Edition. This practice allows HP to rapidly bring innovation into all three orchestration tools so that the user always has the option to easily manage multiple environments at the same time, or easily migrate between proprietary environments over time.

Cost savings and flexibility are fundamental tenets of SDS, and HP continues to invest in industry-leading innovations within the data plane, providing robust data services that can be applied to any underlying hardware. Building on the HP industry leadership in the development of HP StoreVirtual VSA software for primary storage, HP has expanded its portfolio to provide the same value and flexibility in the area of backup recovery and archive (BURA) in the form of HP StoreOnce VSA software. Both VSAs span multiple hypervisor environments to cover primary storage and data protection needs. Continued investment in this area will further expand the data services available to HP customers.

Understanding the need for simplicity and openness, HP designed these attributes into every aspect of the portfolio by abstracting tasks at all levels while enabling speed, control, and efficiency that positively impact the customer's bottom line. HP also offers a full lineup of servers, storage, and networking as a foundation for an organization's business needs. In the process, the company has standardized on the x86 platform, RESTful APIs, and OpenStack to make sure organizations don't get locked into one solution.

In addition, HP has included federated data services such as thin provisioning and replication into its SDS software and a control plane that monitors and orchestrates all of these components together. Flexibility is built in from the start. An organization can apply the same set of data services across dedicated appliances and virtualized appliances in the data center or in the cloud. The agility and flexibility of virtualized data services provide the functionality needed to allow applications to directly automate provisioning and reprovisioning as workloads change over time.

In terms of delivering the key features of SDS, HP offers it all:

Key SDS features	HP competitive advantage
Multi-hypervisor support (VMware, Microsoft, KVM)	Avoids vendor lock-in and provides an open choice of orchestration
Active-active synchronous replication	Enables business continuity
Automated tiering	Enables high performance with efficient cost savings
Support of HDD-only servers for capacity storage	Allows extended high capacity at lower cost
External storage expansion (iSCSI, Fibre Channel [FC], direct-attached storage [DAS])	Increases options and flexibility, improving data center technology investments
Physical server deployment	Provides shared storage flexibility for both physical and virtual deployments
Federated data mobility to physical disk arrays	Improves investments by tiering and migrating workloads between SDS and SRS resources
Backup VSA with open backup independent software vendor (ISV) ecosystem	Protects data while avoiding lock-in

HP delivers all of these capabilities. Other vendors may hit a few of them, but can't deliver the full set. In addition, when it comes to the SDDC, HP doesn't just deliver on SDS but, as mentioned earlier, offers solutions that address a wide spectrum of business needs. While SDS offers extreme flexibility and cost-optimization, organizations typically opt for service-refined storage (SRS) when faced with massive consolidation while requiring sustained performance. The HP implementation of SRS delivers the highest efficiency for the lowest possible transaction cost. The use of purpose-built ASICs means that SRS can handle advanced data services such as compression, thin provisioning, and thin deduplication without compromising performance or high availability—all of which enable non-disruptive responses to business needs. And, since SRS is federated and autonomic, it allows for instant response and transparent mobility.
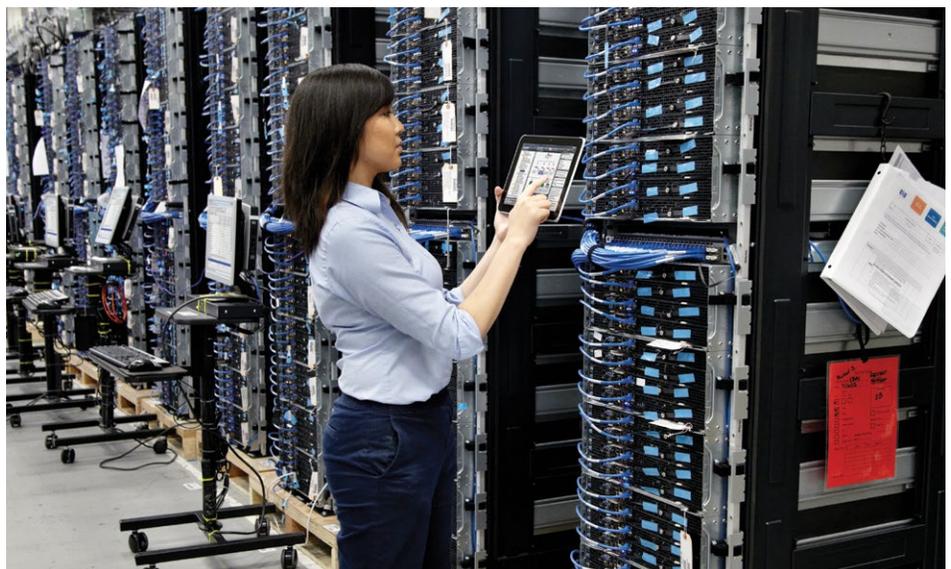
The future of storage for the software-defined data center

SDS is both the present and future of storage. "Software-based platforms will continue to grow faster than any other market segment. This growth will primarily be driven by a rich and diverse set of data-intensive use cases across multiple industries and geographies. Software-based storage will slowly but surely become a dominant part of every data center, either as a component of a software-defined data center or simply as a means to store data more efficiently and cost-effectively," said IDC Research Director, Ashish Nadkarni in a published statement from 2013.

The momentum around SDS has only increased. HP has moved from being an SDS pioneer to a market leader. Already there are over three exabytes of HP-based SDS and based on over one million HP VSA licenses distributed to date.

To maintain this leadership, HP is committed to the continued advancement of SDS via:

• Expanding its investment in OpenStack with features such as QoS, automated storage provisioning, and integrated disaster recovery

• Enabling organizations to simply and quickly provision, deploy, and manage HP VSAs from their choice of orchestration tools

• Increasing capabilities within HP OneView through added functionality such as backup, recovery, and archive capabilities

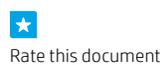• Delivering innovative SDDC solutions that address the New Style of IT as it evolves

HP is integrating SDS technology into every aspect of the SDDC to instantly take advantage of underlying hardware capabilities, opening the door to being able to dynamically build up and tear down data services specific to business needs of any point in time.

With HP VSA technology built in to HP Helion OpenStack, and VSA software deployed as an integral part of all HP ProLiant and HP BladeSystem servers, you can instantly see how HP provides the infrastructure needed to rapidly build out a modern hybrid data center. Native disaster recovery and backup from physical servers to public and private clouds are possible through the use of whichever automated orchestration tools are chosen, driving efficiencies in both operational and capital investments. In the near future, applications will directly request persona-based storage services and the SDDC will be able to dynamically deploy, provision, and service this request from a catalog of resources within the data center and tiers of storage based in the cloud.

What does this mean for you? You are responsible for building the most cost-optimized and flexible IT infrastructure possible to take advantage of dynamic business challenges at a moment's notice. The agility and simplicity of the HP software portfolio enables you to be the superhero that meets your internal customers' needs and positively impacts your company's bottom line. Don't get locked in to proprietary technology that dictates your choice of orchestration and storage options. Partner with HP to lead the way as you transform your business for the uncertainty and opportunity that the future holds for you.

Learn more at
hp.com/go/SDS