White Paper

Lenovo: Software-defined Storage for a New Generation of Information Technology

An investigation into software-defined storage, and the importance of the right hardware partner

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Introduction

The impact generated by the rapid and perpetual growth of data presents a constant IT challenge and often manifests in a variety of ways. The capital cost of hardware increases as IT departments increase budgets to keep pace with the scale. Managing, protecting, and backing up increasing amounts of data can press existing infrastructure to its limits. This, however, is not a new story. Data growth has plagued IT environments for so long that it is almost clichéd. Over the years, numerous storage technology advances have been released to help address the rising levels of digital content, such as larger capacity drives and scale-out technology. Despite the efforts of these new technologies, the challenge persists. In a recent ESG research study, the rapid rate of data growth was selected by the largest percentage of respondents as their primary data storage challenge.[1] In other words, scalability alone is simply not enough.

The ability to scale helps to minimize the number of storage silos, easing the burden of management. Yet in environments with diverse and evolving workload requirements, scalable storage can simply result in larger silos of storage. Additionally, at contemporary capacity levels, traditional storage architectures once thought to be scalable are no longer sufficient. A new set of storage technologies, referred to as software-defined storage (SDS) solutions, has emerged to offer not just enhanced scalability, but also agility, flexibility, and efficiency. These SDS solutions provide IT organizations the ability to more easily deploy, tailor, and evolve the hardware infrastructure to the needs of the workload. Emerging workloads, such as business intelligence and analytics, have altered the way digital content is accessed. They have also changed storage infrastructure requirements. As workloads evolve and change, IT organizations require a storage architecture that can also evolve and change at a pace demanded by the business.

SDS currently refers to a broad set of storage solutions and is being leveraged by multiple storage vendors for a variety of storage solutions. There is, however, a consistent theme among these solutions. That theme is abstraction. By abstracting the storage software functionality from the hardware components, IT organizations are provided more freedom to deploy new hardware, tune the underlying ecosystem, and evolve the infrastructure as demands change. While some storylines about SDS-based solutions center on the ability to leverage lower cost hardware, these understate the importance of the underlying hardware. SDS enables organizations to deploy the optimal, or "best of breed," hardware. Yet for an IT organization, identifying their specific workload needs and then translating that knowledge into the right hardware ecosystem often requires a new set of skills.

Lenovo, a leader in enterprise server hardware, has focused its efforts on architecting solutions specifically designed for this emerging software-defined storage era. These solutions retain many of the benefits offered by SDS, while automating the hardware integration. As a result, Lenovo has focused its storage development efforts on becoming a leader in designing, integrating, and validating SDS solutions.

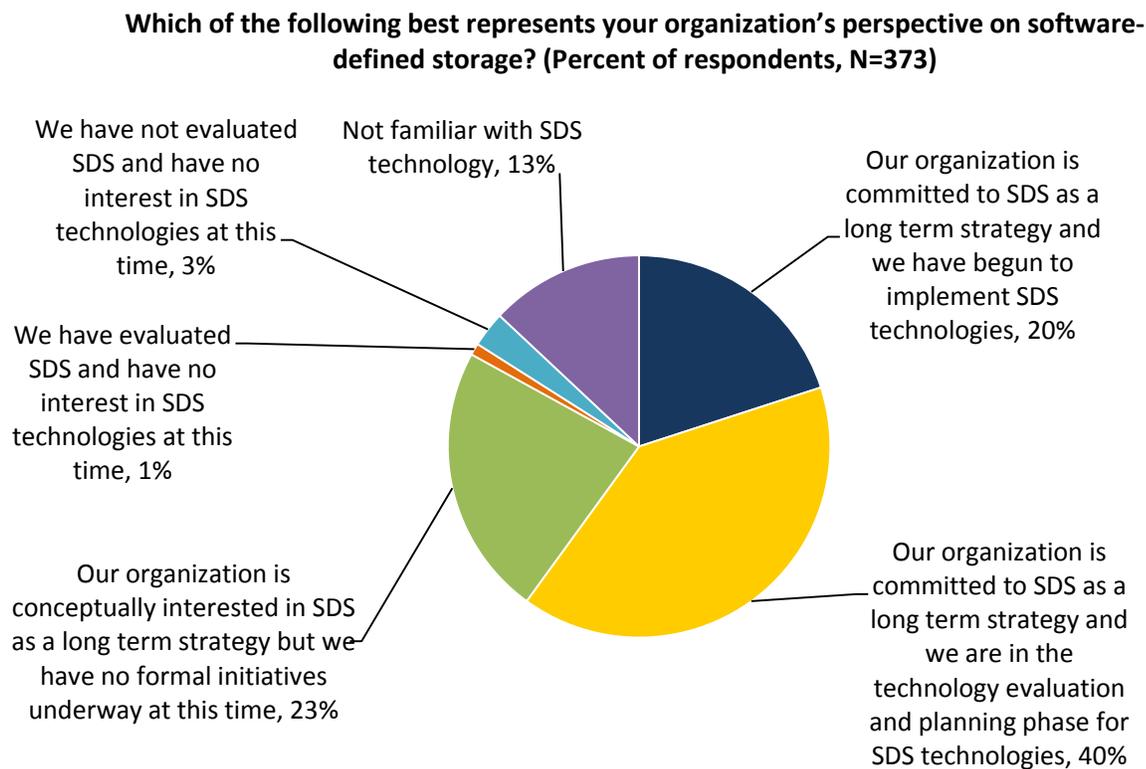## Software-defined Storage: A New Architecture for a New Generation

For those not familiar with SDS technology, the breadth of solutions can create some confusion. The exact definition of the term can vary across storage providers. While the ability to abstract the software from the underlying hardware is a common theme, different SDS solutions target different workloads and offer different functionality. Various SDS solutions can range from providing block-based storage, to file storage, to even object storage architectures. These solutions can target high performance workloads, large capacity (content storage and long-term archive) storage environments, or even server virtualization solutions. Given the range of SDS solution types, it is more accurate to refer to SDS not as an emerging segment of the storage industry, but a new architecture and new delivery model that targets a variety of storage segments and application workloads. Despite the existence of various definitions, significant interest exists across the industry.

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[1] Source: ESG Research Report, *2015 Data Storage Market Trends,* October 2015. All ESG research references and charts in this white paper have been taken from this research report.

The Potential of a Software-defined Storage Ecosystem

Recently, ESG surveyed 373 IT decision makers responsible for their organizations' data storage infrastructures as part of a research study investigating general storage industry trends. This research study investigated multiple storage technologies, including SDS. When asked for their organization's perspective on SDS, the respondents indicated a significant interest in the technology's potential, as 60% of storage decision makers responded by saying their organizations were committed to SDS. When combined with an additional 23% of decision makers that identified that their organization was conceptually interested in SDS, 83% of organizations polled were positive about the potential of SDS.

Figure 1. Organizations' Perspectives on Software-defined Storage

Which of the following best represents your organization's perspective on software-defined storage? (Percent of respondents, N=373)

We have not evaluated SDS and have no interest in SDS technologies at this time, 3%

Not familiar with SDS technology, 13%

Our organization is committed to SDS as a long term strategy and we have begun to implement SDS technologies, 20%

We have evaluated SDS and have no interest in SDS technologies at this time, 1%

Our organization is conceptually interested in SDS as a long term strategy but we have no formal initiatives underway at this time, 23%

Our organization is committed to SDS as a long term strategy and we are in the technology evaluation and planning phase for SDS technologies, 40%
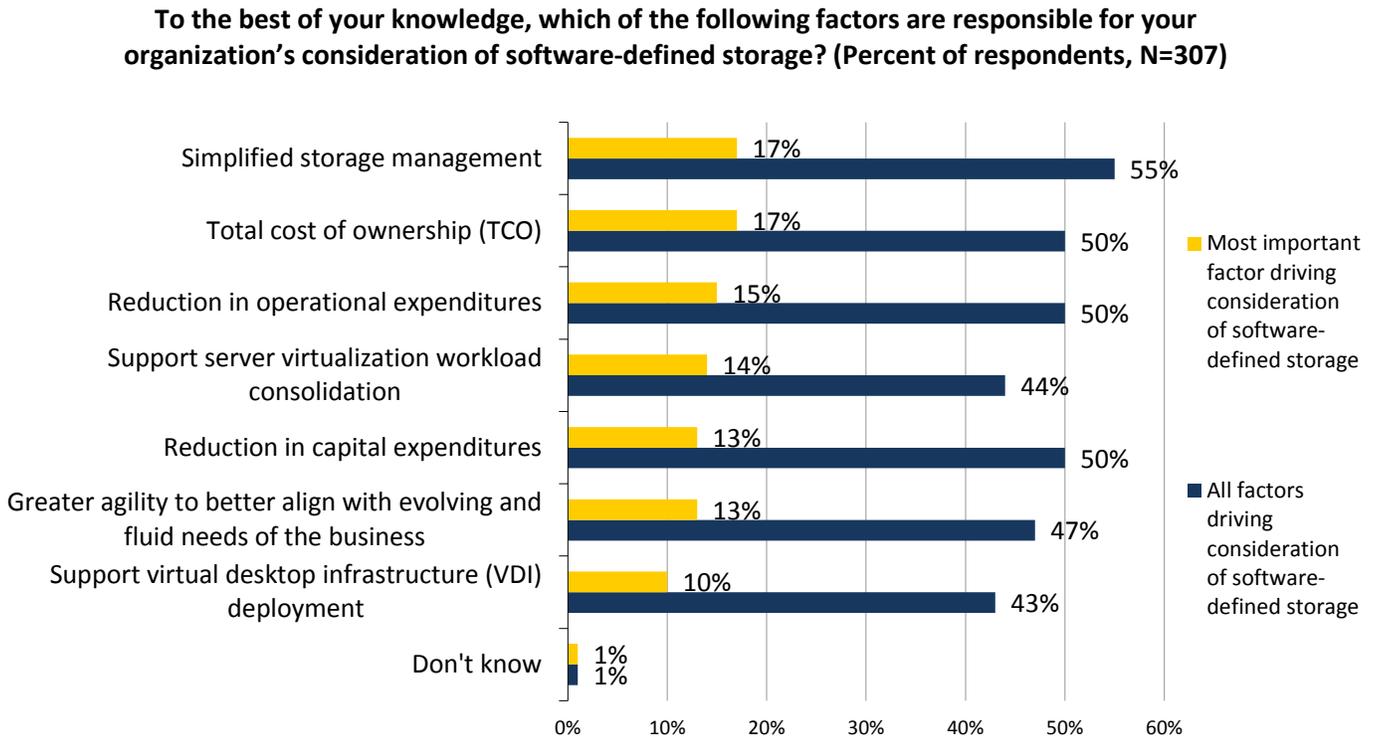
Source: Enterprise Strategy Group, 2016

IT leaders were then asked to identify the factors responsible for their consideration of SDS. The most common responses selected were the potential for simplified storage management (55%), the potential for cost reduction with benefits to TCO, operational expenditures, and capital expenditures (all of which were selected by 50% of the respondents) (see Figure 2). Despite the promise of SDS to lower upfront storage infrastructure costs, it is important to highlight that the opportunity to reduce capital expenditures, while a high percentage, ranked fourth in the list. These results suggest that, while the organizations continue to value the opportunity to reduce overall capital costs by leveraging SDS, IT organizations likely value the potential for efficiency and operational savings more.

The potential for management simplicity and operational cost savings could likely be attributed to the flexibility provided by SDS architectures to select the optimal hardware systems for the needs of the underlying workload. In fact, 47% of respondents identified greater agility to better align with the evolving and fluid needs of the business as a factor driving their organization's consideration of SDS. Different workloads demand different capabilities. While SDS solutions offer the ability to more easily adapt the underlying infrastructure to the demands of the workload, this flexibility has a cost.

Figure 2. Factors Responsible for Consideration of Software-defined Storage

To the best of your knowledge, which of the following factors are responsible for your organization's consideration of software-defined storage? (Percent of respondents, N=307)

Source: Enterprise Strategy Group, 2016

In a fully abstracted SDS environment, where the software and hardware are procured separately, the responsibility of validation and integration often falls on the IT organizations. Harnessing the enhanced flexibility to select among different hardware options enabled by SDS generally requires the introduction of new skills, and potentially personnel, to address these new responsibilities. In contrast, when organizations purchase integrated storage systems, in which the software and hardware are procured and deployed together, they can leverage a single owner of support and service model from the solution vendor, who pre-validates and integrates the solution.

The Integration Complexity of SDS and the Responsibility Shift

With integrated storage solutions, where the hardware is deployed with the software, the combined solution undergoes an extensive design and validation process to ensure that the full solution stack is resilient and optimized to provide predictable performance. SDS-based solutions offer some validation support with reference architectures. Yet, the flexibility of hardware options can often introduce validation gaps, as components or firmware revisions change. Selecting the right components, designing, and then maintaining the optimal infrastructure often require new skills to evaluate, procure, and validate the hardware in the specific SDS solution. For some organizations, the demand for these new skills leads to new staffing requirements. For other organizations, the answer can be found in selecting the right hardware partner.

Lenovo: Architecting Solutions for an SDS Future

For organizations seeking to reap the cost savings and flexibility benefits enabled by SDS without taking on the added integration responsibility, Lenovo, a world leader in high-quality server hardware, offers a portfolio of SDS-based integrated solutions. Its StorSelect portfolio is the result of close partnerships with leading SDS solution providers, such as Nexenta and Cloudian, and allows Lenovo to deliver a wide range of storage capabilities.

- **Nexenta:** Powered by Nexenta's NexentaStor, the Lenovo Storage DX8200N solution is able to offer multi-protocol unified block and file storage with the ability to support either high performance for transactional workloads, such as databases or virtualization environments. Nexenta's portfolio also supports file protocols (such as SMB and NFS) for file sharing workloads or transactional workloads that leverage file-based protocols.

- **Cloudian:** The Lenovo Storage DX8200C, powered by Cloudian, is an object-based storage system designed for massive capacity scale-out content storage. Cloudian offers AWS/S3 compliance designed for private cloud environments. The solution also supports the sharing of data across data centers and regions for greater resiliency and improved performance at those locations.

StorSelect Overview

DX8200N with NexentaStor:

- **Multi-protocol:** FC, iSCSI, NFS, SMB
- **Massive Scalability:** Scale-up Architecture
- **Workload Targets:** Transactional enterprise applications, virtual machines, virtual desktops, file serving, and backup

DX8200C with Cloudian:

- **Multi-protocol:** S3, NFS
- **Massive Scalability:** Scale-out Architecture
- **Workload Targets:** Backup, archive, and private cloud environments

In addition to features offered by the software functionality, Lenovo offers some key benefits in its validated hardware and solution approach, including:

- **Factory-integrated, pre-tested, pre-certified:** Lenovo's solutions ensure that the resulting solution is designed and validated to provide the expected level of performance and availability. This approach can differ from that of many "whitebox" hardware-only vendors. Additionally, Lenovo offers the combined solution with a single part number, designed for simple procurement and deployment.

- **Single point of contact for global service and support and delivery**: When the hardware and software are procured separately, often the service and support responsibilities are separated as well. Lenovo offers one central contact responsible for supporting the combined hardware and software solution.

- **Proven platform:** Lenovo's server systems are among the leaders in the industry and have won a number of industry awards. Lenovo's systems were rated number one in reliability by Information Technology Intelligence Consulting (ITIC) for the third year in a row,[2] and number one in customer satisfaction by Technology Business Research (TBR) for 2014 and 2015.[3] Lenovo also offers several hardware-based features to ensure enhanced resiliency of the resulting solution, such as predictive failure analysis, light path diagnostics, and trusted platform assurance. The servers demonstrated the highest fully audited performance results as of May 2016 for the industry established SPECvirt_sc2013 benchmark across virtualized, HPC, transactional database, and high

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[2] http://www.lenovo.com/images/products/system-x/pdfs/white-papers/itic_2015_reliability_wp.pdf
[3] http://www.lenovo.com/images/products/system-x/pdfs/white-papers/tbr_x86servers_top_csat_4q15_wp.pdf

frequency trading workloads, and they ranked highest in total server energy efficiency (performance per watt) for virtualized workloads.[4]

Lenovo's SDS solution-centric approach to delivering its storage portfolio is possible in part thanks to the firm's relatively new entry into the storage marketplace. Without a legacy portfolio of storage offerings to support, Lenovo can focus its development investment predominantly on open-standard, SDS-based solutions. Additionally, as Lenovo continues to build out its SDS-based portfolio, the firm may be able to offer IT organizations some level of neutrality when proposing an SDS-based solution. It is expected that Lenovo will position its hardware and its solutions ahead of competing offerings, similar to the vast majority of IT vendors. Among its partnerships, however, Lenovo has the potential to offer insight into the relative benefits the prospective IT organizations might expect, without the requirement to justify the software development investment incurred by its partners.

The Bigger Truth

The cumulative impact of years of exponential data growth has taken a toll on legacy storage infrastructures. Almost paradoxically, scalability is both simultaneously paramount and insufficient. New workload demands have increased the requirements of storage infrastructure, while simultaneously adding new expectations in deployment agility. For many organizations, the traditional three to four year storage silo lifecycle model is simply no longer sustainable. The emergence of SDS has enabled IT organizations to deploy storage solutions that can offer a consistent storage experience and interface as the underlying hardware evolves and adapts to the growing and evolving needs of the business.

The underlying hardware plays an important part in the overall solution. Different vendors, components, and firmware revisions all introduce nuances that can impact performance or power and cooling, and at the extreme can impact data resiliency and availability. The adopters of SDS-based solutions have to balance these tradeoffs. Those who procure the software and hardware separately must ramp up skills to integrate and validate the resulting solution. For many IT organizations, increasing staffing to provide new skills is not an option. For these organizations, working with a trusted leader in IT hardware can provide an opportunity to reap the benefits of SDS, while leveraging the integration expertise of the vendor. Lenovo's history of server reliability, quality, and innovation positions the company well as a trusted advisor when evaluating and deploying SDS-based solutions. With its portfolio of solutions with SDS leaders such as Nexenta and Cloudian, Lenovo is poised to become a strong player in the SDS space.

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[4] http://www.spec.org/virt_sc2013/results/res2016q2/virt_sc2013-20160419-00049-perf.html

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