



Software-Defined Storage

SANsymphony™ and DataCore™ Hyperconverged Virtual SAN

EVALUATION GUIDE



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1. IS DATACORE SDS THE SOLUTION TO YOUR RECURRING DATA STORAGE CHALLENGES?

This document is written for IT professionals that are researching Software-defined storage (SDS) alternatives including hyperconverged infrastructure (HCI) solutions. It will help you determine how well DataCore™ SDS addresses recurring data storage challenges that you're likely to face in the short and long term.

Note: No evaluation would be complete without involving a DataCore solution architect who can best match the software's major capabilities and deployment choices to your needs.

“ The infrastructure of the future is all about choice.

- Julia Palmer

Gartner Research

”

1.1. NUMEROUS CUSTOMER EXPERIENCES TO DRAW FROM

Confidence in a well proven solution often ranks high when making strategic infrastructure choices. DataCore SDS serves the needs of over 10,000 diverse customers worldwide, ranging from very small to some of the largest companies in the world, spanning all industries. Their IT environments are similarly diverse, ranging from small single site configurations to sprawling multi-site deployments. Despite this wide variety, all DataCore customers share a critical priority: their business runs on data, and they recognize the importance for it to be safeguarded and rapidly accessible.

1.2. UNMATCHED FLEXIBILITY

In particular, these organizations have acquired incomparable agility to both adapt and modernize non-disruptively in the face of uncertainty—swiftly applying the requisite resources in support of new business opportunities. This while reducing the ongoing acquisition and operational costs that had tied up so much of their budget in the past.

Since deploying DataCore SDS products, our customers report the following benefits:

- Materially higher uptime (often with no storage-related interruptions over several years)
- Greatly improved capacity utilization, allowing them to pool resources and do more with less
- Substantial speed-up in application response while lowering hardware spending
- Unified management / provisioning / data protection practices despite frequent equipment turnover
- Strengthened negotiating position for future purchases and acquisitions by making storage devices and suppliers interchangeable

Choice Drives Down Costs

“ The biggest benefit with DataCore is not being locked into a single vendor for storage. This gives us the flexibility to purchase what we need – high performance SSD or low cost archival storage at affordable prices.

— Ryan Tetzlaff, IT Manager, Open Systems International Inc

Source: Ryan Tetzlaff, IT Manager, Open Systems International Inc

Validated Published: Jan. 22, 2016 TVID: 66E-73A-AF7



1.3. SELECTION CRITERIA

The table below provides some of the top factors to consider in your initial evaluation. Of course, a more detailed technical assessment of your existing infrastructure and application workloads would precede the actual deployment of a DataCore SDS-based solution in your data center(s).

EVALUATION FACTORS	DATACORE SDS RELEVANCE / CONSIDERATIONS
What are your primary objectives in evaluating DataCore SDS?	While DataCore SDS serves a wide range of use cases, customers that seek to drive fundamental change in their infrastructure will see the most value as they can realize the myriad benefits that stem from standardizing their storage infrastructure on a single SDS platform.
What are the primary challenges you seek to address?	Primary benefits include improvements to: uptime/availability, storage utilization, consolidation and reduction of complexity, application performance, and overall TCO.
How would you characterize the growth and volatility of your IT operation?	A core benefit is enabling IT to transform to a future-ready infrastructure, even when the future is unpredictable. IT organizations that have high annual growth rates, and/or tend to face frequent, unpredictable changes will find tremendous value in DataCore SDS.
What are the top priority applications / workloads that you are considering DataCore SDS for? What are their performance and availability requirements?	DataCore SDS can provide infrastructure for the full spectrum of application types and workloads, and allows IT to provision the right resources and services to match up with the application requirements. Customers with applications that have low latency, high performance requirements and stringent SLAs for data availability and data protection, will particularly benefit from DataCore SDS.
How heterogeneous is your existing storage infrastructure?	DataCore SDS provides the broadest levels of support for the key elements within the data center ecosystem—host connectivity, host environments, supported storage devices and interfaces, switches, etc. This is most relevant for customers with a wide range of existing resources that they'd like to fold into the overall aggregated storage pool managed by their SDS platform. This is a crucial differentiator compared to alternatives that are highly sensitive to the ecosystem and support only a very narrow range of environments.
How many sites are you considering for DataCore SDS?	DataCore SDS excels in metro/stretch-clustering, remote data replication, Disaster Recovery for customers that seek to deploy in multiple, potentially diverse data centers.

2. KEY INITIATIVES DRIVE THE URGENCY

Over the years, we've found that one or more of the following initiatives generally trigger the initial interest and installation of DataCore SDS. Soon thereafter, the software's power is used to tackle the remaining storage-related priorities with relative ease.



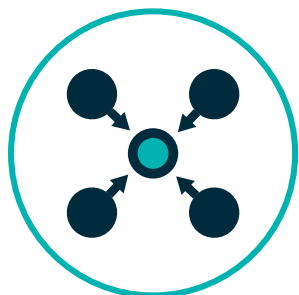
Business Continuity/
Disaster Recovery



Storage
Expansion



Storage
Refresh



Infrastructure Efficiency
& Consolidation



Latency-sensitive,
Virtualized Databases &
Applications



Remote Office/
Branch Office
(ROBO)

3. MARKET PERSPECTIVE

Let's start with a definition: In contrast to traditional top-end SAN controllers, SDS is software running on commodity server hardware that aggregates physical capacity from multiple tiers of storage into shared pools, and delivers a broad set of data services. The scope and robustness of the services offered in an SDS platform are some of the key factors in differentiating amongst the options in the market.

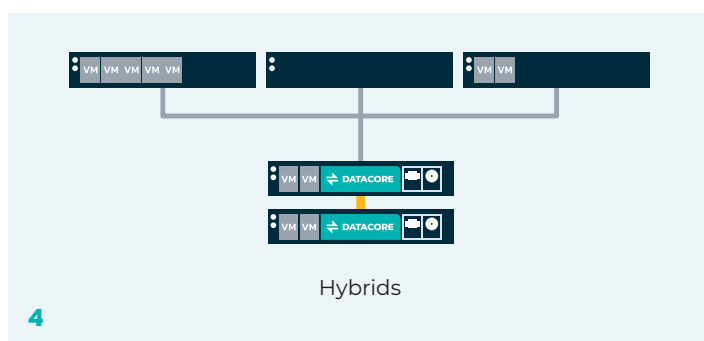
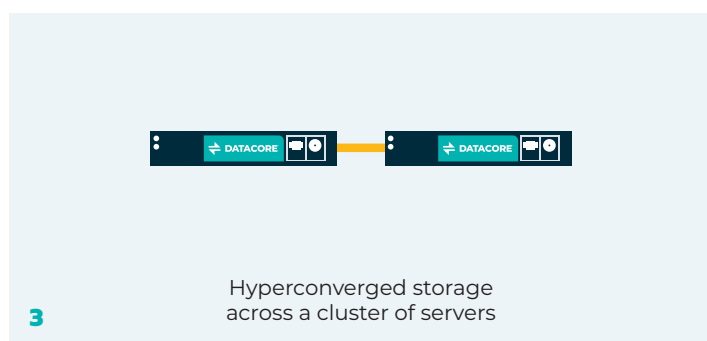
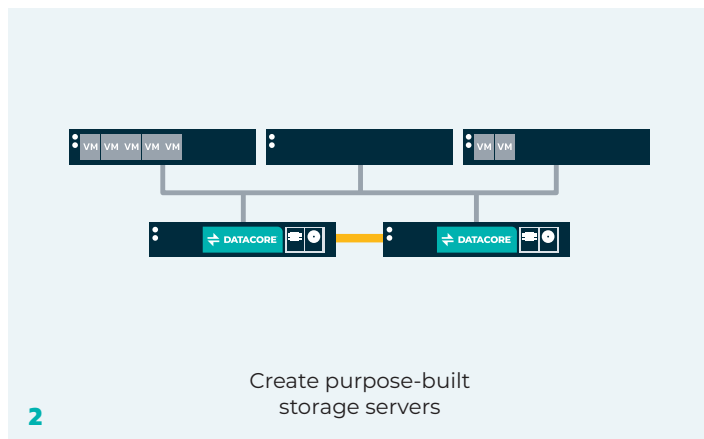
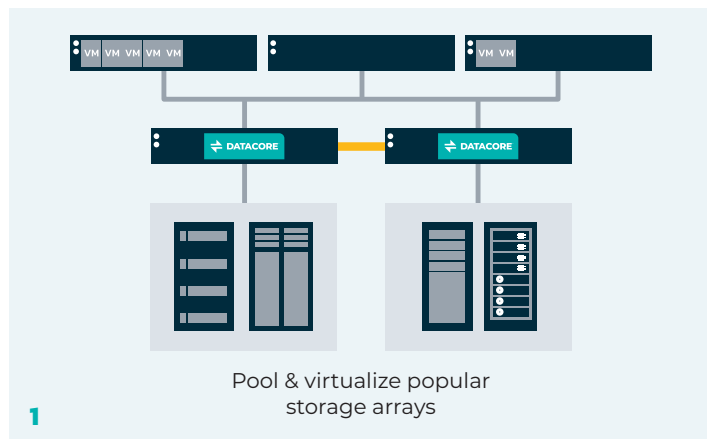
SDS has experienced a surge of adoption—achieving \$9.8 billion in worldwide sales in 2017 with an expected 13.5% annual growth rate to \$16.2 billion by 2021, according to IDC¹.

Market numbers provide limited information—they reveal a trend, but cannot help determine which SDS is the best fit for your environment. What they do reveal is a significant surge in adoption. SDS is not a new concept, and the desire to achieve its benefits are also long standing. What's driving the recent and continued surge are new SDS platforms that overcome the limits of previous generations. In this regard, DataCore offers a truly enterprise-ready SDS solution, ready to deploy today.

¹ IDC, Worldwide Software-Defined Storage Forecast, 2017-2021: SDS Market Growth Significantly Outpaces Enterprise Storage Growth, Led by HCI, Eric Burgener, Ritu Jyoti Amita Potnis, Eric Sheppard, Natalya Yezhkova, September 2017

4. VERSATILE DEPLOYMENT OPTIONS

DataCore SDS pools the collective resources of storage devices, both local and shared, and manages them centrally with a common set of enterprise-wide services, despite incompatibilities among the manufacturers and models underneath. This broad span gives the IT team the choice of 4 deployment options:



1. Storage virtualization, in which all of the storage capacity is in one or more SAN arrays outside of the DataCore nodes, serving storage to virtual machines, containerization platforms and physical servers.

2. Server SAN, as in #1, but expensive external arrays are replaced by internal flash and HDD in the DataCore nodes.

3. Hyperconverged, in which all of the storage is internal to the DataCore nodes, and is served to virtual machines (VMs) executing alongside in the same servers.

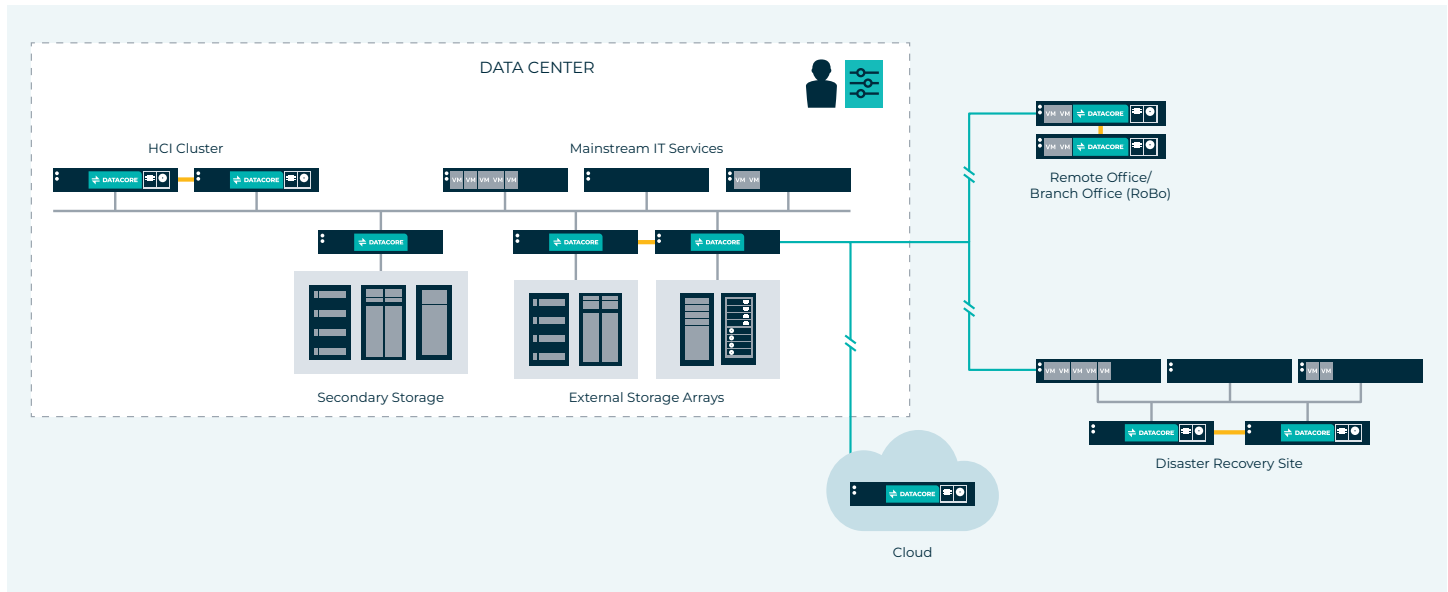
4. Hybrids of above, a combination of 1, 2 and 3 in which both internal storage and external storage are pooled together, serving storage to applications hosted both on external hosts and on the DataCore nodes.

This offers IT maximum flexibility, enabling you to match the best configuration and resources to the applications and workloads, based on your objectives.

4.1. HCI – REALLY ONE OF SEVERAL SDS TOPOLOGIES

As SDS made strides over the last several years, HyperConverged Infrastructure (HCI) emerged as a potential solution to the complexity of the modern data center, and grew into a large IT category, built on a foundation of SDS. HCI offerings combine application host computing, hypervisors, and storage within standard x86 servers or building blocks, delivering a software layer that virtualizes and pools the underlying storage, and provides central management. These building blocks are typically deployed in a cluster or group to provide failover redundancy and load distribution. They offer some form of centralized management, and various storage services built into the core software platform. Given the consolidation of the core elements of

the data center infrastructure into simplified building blocks using standard commodity hardware, HCI promises to offer IT significant value in terms of simplification and cost savings compared to traditional SAN infrastructure. Indeed, this has driven the growth of this the HCI category from \$0 in 2012 to a predicted \$4.7 Billion market by 2019 (IDC).



The first generation of HCI platforms (which currently dominate the HCI landscape) proved adequate for certain use cases, like VDI or remote office environments. However, the performance and functionality limitations of this first wave of HCI offerings, coupled with their inability to use existing SAN capacity, have thus far rendered them unsuitable as the primary infrastructure solution for the majority of enterprise environments.

Recognizing the Gen 1 HCI limitations led DataCore to take a more inclusive approach- which in turn assists customers through a self-paced transition from their current SANs to hyper-converged or hybrids of both. Thus satisfying the key requirements for an SDS or HCI solution to be truly viable for the enterprise-wide IT environment.

In practice, larger organizations apply the most desirable deployment model in specific partitions as illustrated below- all under the common DataCore SDS management console. They orchestrate the overall system behavior with other systems management products through REST APIs and or PowerShell commandlets.

5. ENTERPRISE-CLASS DATA ARCHITECTURE, 20 YEARS IN THE MAKING

The latest version of DataCore SDS is built upon the robust and mature architecture of the market's first true software-defined storage solution—DataCore SANsymphony. The software platform is currently in its 10th major release, and is deployed in more than 30,000 environments across more than 10,000 customers globally. Several of DataCore SDS's primary advantages which competitors cannot match derive directly from this long, successful run in the market:

- **Widest functional range of data services**, based upon years of listening to customers and delivering on their priorities for product improvements and new features
- **Most robust**, in terms of Reliability, Availability, Serviceability (RAS), based on billions of system hours running in customer environments

- **Highest level of interoperability**, based on numerous years of delivering and refining storage software that is built to easily integrate into the existing data center environment, and supports a wide range of options for each major piece of the ecosystem—host connectivity, host environments, supported storage devices and interfaces, switches, etc. In addition, DataCore has built an organizational approach in which interoperability testing and validation are central, mission-critical functions

5.1. BUSINESS CONTINUITY AT ITS FINEST

DataCore SDS gives you a range of business continuity options spanning multiple sites, including the cloud. It also overcomes the difficulties encountered with site-specific differences in equipment.

Non-disruptive Modernization

Inject new technology and decommission older equipment when appropriate without incurring downtime or slowdowns.

Metro-Clustering between campuses

For two or three datacenters in relatively close proximity, DataCore SDS nodes may be deployed across all sites in stretch-clusters, ensuring applications remain up and running even during a full site outage. The storage makeup can be quite different, as often occurs when the once separate locations picked their own favorite models.

Disaster Recovery (DR) across distant sites

Asynchronous Replication transmits data efficiently between any connected DataCore SDS node as necessary to sidestep regional site outages. A wide choice of recovery options allow the IT team to avoid

disasters or rapidly switch operations to a remote site. This is also an ideal solution for backing up and protecting the data at remote locations including public Clouds. Similarly, smaller remote sites or cells at the edge can replicate back to a main hub for reporting and analysis, as well as for centralized backups.

5.2. PERFORMANCE BREAKTHROUGHS

DataCore SDS incorporates a number of innovations that allow it to deliver the fastest response time in the industry. Most importantly, it has solved a vexing serialization problem that limits the performance of all other SDS and HCI offerings – the I/O bottleneck of the processors in the application host server, which throttles the overall system’s ability to deliver high throughput. DataCore decisively solved it in 2016 with its delivery of the DataCore Parallel I/O technology that is now at the heart of DataCore SDS. Parallel I/O delivers an order of magnitude performance advantage, by spreading I/O requests out amongst all processor cores in the node.

To ensure optimal performance, and give customers maximum choice in their price/performance decisions, DataCore SDS includes a range of performance-enhancing features: automated storage tiering, multi-pathing, automatic load balancing, high-speed caching, and site-specific Quality of Service (QoS) settings. These are described in more detail in the Appendix.

Taken together, the features and functionality of DataCore SDS make it undeniably the most versatile, highest performance, and lowest cost SDS and HCI platform, capable of meeting the requirements of the vast majority of IT infrastructure environments.

“The biggest benefit that we’ve seen with DataCore is 100% uptime. This includes major upgrades, outages, hardware updates, etc.

— Jeff Fuesting, Engineer, Consolidated Communications Holdings

Source: Jeff Fuesting, Engineer, Consolidated Communications Holdings



Validated Published: Jan. 22, 2016 TVID: D09-74B-730

DATACORE CUSTOMER TESTIMONIAL

“The performance gain when using DataCore’s caching capability allows us to utilize lower priced storage without sacrifice.

— IT Manager, State & Local Government

Source: IT Manager, State & Local Government



Validated Published: Mar. 19, 2016 TVID: 04B-CF0-6E7

6. LICENSING / PRICING

The simple, capacity-based licensing model also sets DataCore SDS apart. The approach facilitates scaling out as well as scaling up in just the right increments. Three types of licenses known as “editions” are available. Think of these as first class, business class and economy, with different prices per Terabyte (price/TB):

EN Enterprise class licenses offer the highest performance, richest feature set and most flexibility

ST Standard licenses are ideal for midrange requirements

LS Large scale Secondary storage licenses are tailored for cheap and deep storage where performance is not a factor

DataCore™ SDS Edition	EN	ST	LS
Ideal for	Enterprise class highest performance	Standard, entry & midrange	Large scale secondary storage
Price per TB	\$\$\$	\$\$	\$

The licenses may be configured in hyperconverged, conventional SAN and hybrids both on-premises and in the cloud. A customized subscription program is available for Cloud Service Providers.

EN, ST and LS nodes may synchronously mirror and replicate data between each other and be managed from a common console, enabling you to mix them in the same group. This makes the vision of the fully integrated environment illustrated below a reality.

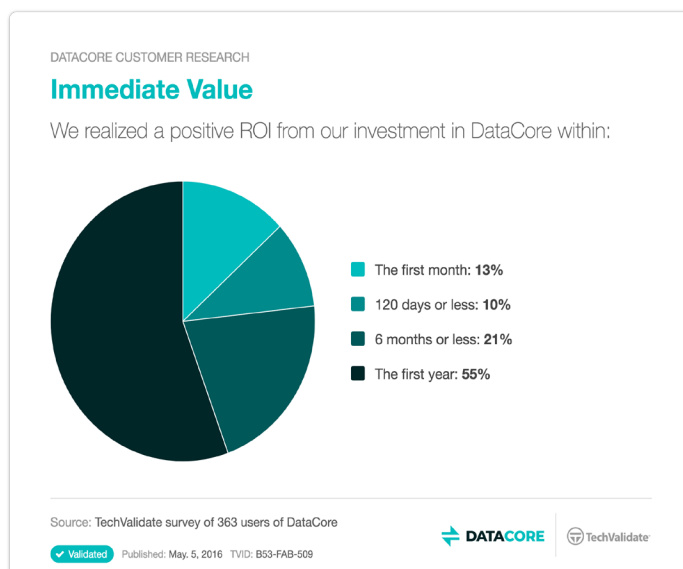
7. COST OF OWNERSHIP

Reducing acquisition costs and reducing overall total cost of ownership (TCO) are primary drivers for both SDS and HCI adoption. As such, any evaluation of a new SDS platform should include an analysis of the expected TCO, and associated savings compared to alternatives.

Given its ability to drive storage utilization up, and make efficient use of existing storage through features like auto-tiering, and thin provisioning, DataCore SDS has demonstrated the ability to deliver remarkable cost savings across a range of capital and operating costs. Collectively, these savings add up quickly, enabling DataCore SDS to achieve a positive

return on investment (ROI) far faster than traditional IT infrastructure solutions.

A survey of 363 DataCore customers found that over half of them (55%) achieved positive ROI within the first year of deployment, and 21% were able to reach positive ROI in less than 6 months, see below.

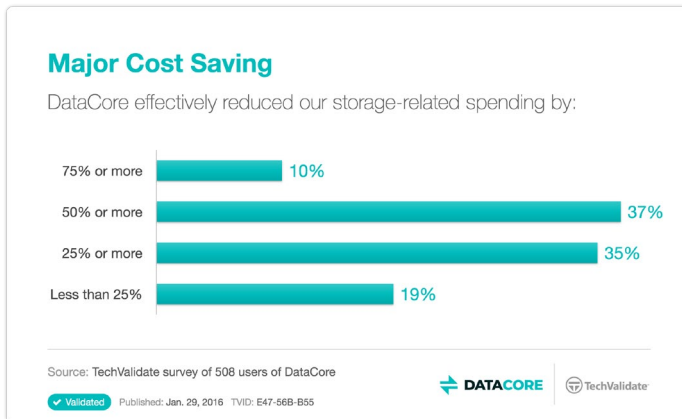


While a detailed TCO analysis is recommended, the following table highlights the key ways in which DataCore SDS delivers significant cost savings.

	DATACORE SDS TCO IMPACT
COST OF ACQUISITION - CAPEX	Requires fewer and less costly resources compared to alternatives while addressing the same use cases
	Defers new storage purchases by unlocking stranded capacity from existing resource silos while extending their useful life
	Reduces dependency on premium priced flash through in-memory caching and auto-tiering
	Enhances negotiating positioning when shopping for new technology since storage hardware and suppliers become largely interchangeable
OPEX- DIRECT SPENDING	
HARDWARE AND SOFTWARE MAINTENANCE	Lowers maintenance expenses through use of fewer and less complex hardware components
DATA CENTER COSTS	Higher resource efficiency reduces power, cooling and space consumption
LABOR	Less time spent managing and troubleshooting storage-related problems
OPEX- INDIRECT SPENDING	
APPLICATION PERFORMANCE IMPROVEMENTS	Faster app performance improves productivity, customer satisfaction and drives down labor costs
DOWNTIME COSTS	Uninterrupted data access can substantially avoid lost revenue, prevent data loss and mitigate risks

8. CUSTOMER TESTIMONIALS

For a glance at how other customers take advantage of DataCore SDS, please visit our website in the Resources tab and select Case Studies to search among numerous customer testimonials.



“ **Software-Defined Storage is the future. By decoupling the hardware from the storage software, we were able to choose the best hardware at the lowest price while ensuring enterprise-grade storage was provided to our end users.**

- Customer

Review on G2Crowd

”

9. THE HUMAN TOUCH- EVALUATING DATACORE SUPPORT

This document has devoted some significant space to the power of automation, and the associated benefit of a reduction in manual labor to perform various tasks. Paradoxically perhaps, the human touch—in the form of rapid, professional, and effective support is a critical factor in evaluating SDS solutions. If and when deployments get stuck, or systems fail, you need to have confidence that your vendor will be there for you, ensuring you successfully complete the deployment and/or get back to normal operations as quickly as possible.

For DataCore, the Support organization has been one of the company’s primary differentiators, since the origin of the company. DataCore offers 24x7 live support, gives customers a choice in how best to communicate, and is committed to staying on any urgent case through resolution. Importantly, DataCore always begins ticket resolution by assuming problem ownership, and providing the customer with a single point of contact to lead the troubleshooting process, eliminating the potential for confusion. This is crucial in an SDS environment, in which solutions consist of multiple hardware components in addition to the SDS software, potentially creating confusion for the customer about which support organization is responsible for which problems. And to ensure the highest level of support and rapid resolution, the support team is only staffed with senior Level 3 engineers, each of which is a product expert and is empowered to identify and deliver the right solution to the given problem.

Based on its support excellence, DataCore is always ranked amongst the top vendors for customer satisfaction across the storage industry, with a customer satisfaction rating greater than 95% and has won the Stevie Award for Customer Service excellence several times.

10. CONCLUSIONS & NEXT STEPS

In evaluating DataCore SDS as a strategic component of your infrastructure, it is important to map your objectives and requirements against DataCore’s capabilities and determine the extent to which DataCore is a good fit for you. Unlike point products confined to a very narrow scope, DataCore cost-effectively maximizes the collective value of current and future storage assets, regardless of hardware model or brand.

Hopefully, the preceding information leads you to conclude that we are indeed an ideal solution for your recurring data storage challenges.

We encourage you to schedule a one-on-one discussion with a DataCore solution architect who can provide the next level of detail needed to finalize your decision.

11. PRODUCT REVIEWS BY CUSTOMERS AND ANALYSTS



 <https://www.techvalidate.com/product-research/datacore-sansymphony>



 <https://www.gartner.com/reviews/market/hyperconverged-infrastructure/vendor/datacore-software/?pid=39644>




 <https://www.itcentralstation.com/products/datacore-sansymphony-reviews>



 <https://www.whatmatrix.com/comparison/SDS-and-HCI>

GET STARTED!

12.1. REQUEST A DEMO

 <https://www.datacore.com/get-started/>

12.2. CONTACT US

 <https://www.datacore.com/company/contact-us/>

APPENDIX

13. FEATURE DESCRIPTIONS

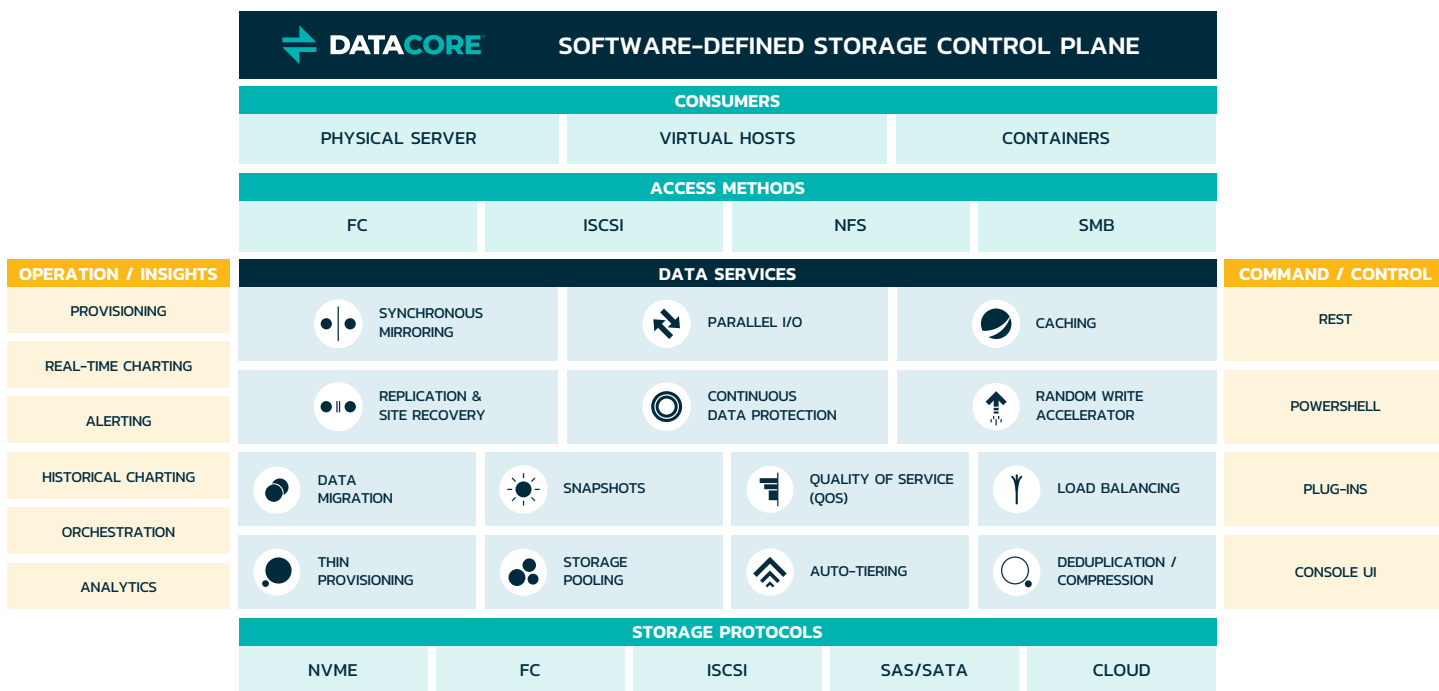
Built on the foundation of a robust, proven and mature storage virtualization platform, DataCore SDS offers the widest range of native features and data services compared to both traditional SDS and HCI competitors, as well as contemporary SAN alternatives.

Many core features, like storage pooling, centralized management, and high availability, are relevant across all implementations. In addition, DataCore SDS includes an extensive list of optional data services that can be enabled and tuned at the volume or workload level.

In order to properly assess the rich set of capabilities requires a formal and controlled evaluation process on an adequately configured system. One where DataCore experts guide you through best practices. This is not something one can gauge from the small scale sample scenario included in the trial package meant to get you acquainted.

13.1. CONTROL PLANE AND DATA SERVICES

The following section summarizes the full list of these data services, and provides insights on their value, and which use cases each is most relevant for. See the chart below for a summary of the core data services and management features of DataCore SDS:



13.2. DATA AVAILABILITY AND PROTECTION FEATURES

Built for the enterprise, where data availability and data protection are at the heart of IT's role, DataCore SDS is built with a resilient architecture, and offers

a range of baseline functions, and optional features for high availability, local data protection, and offsite disaster recovery, allowing IT to deliver the right level of services for each unique workload. They give IT confidence in its ability to ensure all availability and protection SLAs are met.

Resilient, Fault Tolerant Architecture

Redundancy, and the elimination of single points of failure, are fundamental design principles for DataCore SDS. As a software-only solution, it is designed to leverage the enterprise-class architectures of the underlying hardware, including storage controller redundancy, RAID protection, storage path I/O redundancy, etc. It also can provide software mirroring and striping across physical disks behind each node, as needed. DataCore deployments are designed to allow for component or system-level failures without application outages.

Synchronous Mirroring

Synchronous mirroring is a fundamental aspect of any DataCore SDS configuration, and is available within the data center or across data centers (as part of a metro-cluster topology). It allows for continuous operations in the event that a node incurs an outage by keeping active-active copies synchronized across two or three nodes. Moreover, DataCore's storage-agnostic approach, mirrors and replicates between otherwise incompatible storage hardware devices.

Asynchronous Remote Replication/ Advanced Site Recovery

Asynchronous remote replication and its companion advanced site recovery represent the underlying technology behind DataCore's high-end, robust disaster recovery solution. When configured for DR, the data in the production environment is replicated to the remote site, and becomes quickly accessible in the event of system failure or site disaster. As with everything else, DataCore offers a range of options for the target system – it can be another data center environment, a co-location or a dedicated environment in the public cloud.

Non-disruptive recovery testing, on-demand failover and auto-resynchronization prior to failback are all standard features which allow the IT team to navigate a stressful situation with the confidence that systems will be restored quickly, and data integrity will be maintained.

Snapshots

Snapshots are another “table stakes” feature of the enterprise storage environment, providing IT with insurance to easily overcome logic or people errors. DataCore SDS offers native, point-in-time volume

snapshot capabilities. Snapshots can be full volume or differential, and can be set for any frequency desired. When needed, snapshots can easily be leveraged, allowing IT to revert a volume back to a previous point in time (for example, following a failed OS upgrade or database corruption event). Snapshots can also be mounted to a backup server for regular daily backup operations. DataCore supports a wide set of 3rd party backup tools, allowing for simplified and automated operations.

Continuous Data Protection & Recovery

Continuous Data Protection (CDP) provides a level of resiliency and recoverability from unintentional updates, erasure and ransomware, above that of traditional snapshots and backups. CDP can be set at the volume level. It records every write I/O (or change), with a corresponding timestamp, that occurs against a protected volume. With CDP, a rollback volume can be created representing any point-in-time just before the undesired event occurred. The rollback volume is then mapped to the original application server or a different one. With CDP, IT can roll back to a previous point-in-time prior to a disaster, virus attack or other disruptive event without doing an explicit backup. CDP delivers one-second granularity on rollbacks and provides the best Recovery Point Objective (RPO) and Recovery Time Objective (RTO) of any localized data protection solution.

Key Takeaways on Data Availability and Protection

Given the value of data to every organization, the highest levels of data availability and data protection are absolute must haves for a viable solution. As the section above demonstrates, the core capabilities of DataCore SDS allow the IT team to meet or exceed stringent enterprise SLAs for availability and protection, and have enabled it to become the only truly enterprise-class SDS solution on the market.

13.3. EFFICIENCY FEATURES

Recognizing that cost containment is a constant and primary goal of the enterprise IT team, DataCore SDS is designed with multiple built-in resource efficiency features. Moreover, the DataCore engineering team consists of veterans that have designed robust real time computing solutions, which always entail significant hardware resource constraints, and therefore require very efficient utilization of resources. Thus, DataCore SDS has a “light footprint” compared to all other alternatives, capable of delivering high-end

performance and resiliency with minimal resource consumption. And with each new major release of the platform, the engineering team is continually challenged to achieve new breakthroughs in resource efficiency.

Features that allow DataCore SDS to drive up resource utilization, and significantly drop overall TCO include:

- **Heterogeneous Storage Pooling**, allowing IT to aggregate disparate resources into a single, easy to manage pool, and deliver tiering of resources within the pool for optimal price/performance tuning. Heterogeneous storage support also delivers cost efficiency in that it eliminates the risk of storage vendor lock-in, allowing IT to continually seek new solutions and negotiate prices, regardless of the manufacturer.
- **Thin Provisioning**, allowing IT to define large virtual volumes to workloads, without the need to tie-up physical space on disk until it is needed
- **Deduplication and Compression**, allowing IT to optionally run post-process activities to find and eliminate redundancies within the storage pool, allowing for overall increased utilization, particularly for workloads that inherently contain significant amounts of redundant data

13.3.1. FOR A LIST OF SUPPORTED DEVICES AND PROTOCOLS, SEE:

<https://www.datacore.com/products/software-defined-storage/tech/compatibility/storage/>

<https://www.datacore.com/partners/datacore-ready/>

Key Takeaways on DataCore SDS Efficiency

DataCore SDS allows IT to dramatically drive down infrastructure cost as a result of its method of pooling heterogeneous storage, eliminating islands that waste capacity, and extending the life of existing resources by bringing the storage services into the SDS node while using the capacity and I/O capabilities of the storage devices. Optional features that include thin provisioning and deduplication, and compression can further drive up resource efficiency. In addition to the efficiency of the physical resources in the data center, DataCore SDS also brings new levels of human resource efficiency by significantly simplifying infrastructure management, and eliminating the need to learn and

manage many incompatible systems, each with their own proprietary management systems.

13.4. ADAPTIVE INFRASTRUCTURE

As this document has demonstrated, there is tremendous value in moving from a relatively static, inflexible infrastructure to a flexible and dynamic one, and this is at the heart of the value that SDS can deliver to the IT organization. Within a flexible infrastructure, workloads are mobile and can easily be moved (or even move themselves) to enable a change to the underlying hardware, or to take advantage of a new set or resources that has been added to the storage pool. Thus, simply by abstracting the storage services away from the underlying storage hardware, and creating the aggregated pool, DataCore SDS enables a significant leap forward in infrastructure flexibility.

To supplement this, DataCore SDS also includes a set of functions, each of which simplifies the various aspects of traditional heterogeneous storage management that are known to cause significant challenges and overall angst, including:

- **Online Systems Maintenance Operations** – With DataCore SDS most maintenance operations, including upgrading or patching the DataCore SDS nodes, adding or removing physical disks, or upgrading an underlying resource, are performed while the system stays online, and applications continue to run without interruption
- **Simplified Scaling** – Capacity and Performance can be scaled independently by adding the relevant resources as needed while keeping applications online and uninterrupted.
- **Unified Storage management** – DataCore SDS delivers the highest level of interoperability, and supports a wide range of storage devices, across the full set of standard interfaces and protocols. This is a key factor for large heterogeneous environments that seek to continue to leverage their existing resources.
- **Self-provisioning from familiar tools** - Access to virtual disks from bare metal servers, virtual machines and containerization platforms follows the same steps your users are accustomed to thanks to integration with VMware vSphere, Hyper-V Server Manager and Docker/Kubernetes, bringing further efficiency and simplification to the data center operation.

- **Data Migration** – DataCore SDS allows IT to transparently scale and modernize the storage infrastructure non-disruptively by moving and migrating data behind the scenes when new equipment is added or upgraded.

Key Takeaways on DataCore SDS-Enabled Infrastructure Flexibility

In many ways, the operations listed above are lower-level tasks, and none of them on their own deliver significant, differentiated value. However, collectively, they represent a common set of storage management tasks that IT teams need to plan for and manage on a regular basis. The challenges associated with managing these tasks in a traditional SAN environment are a continual source of frustration for IT teams today. In contrast, by simplifying and automating these tasks while keeping systems online, DataCore SDS delivers significant value in terms of IT staff time and system availability—thereby demonstrating one aspect of the value of infrastructure flexibility that it delivers.

13.5. SIMPLIFIED MANAGEMENT

All of the unique elements of value that DataCore SDS delivers (covered in the sections above) come together through its single, universal management console. Through its management GUI, IT is empowered to run its entire storage operation, managing distributed, heterogeneous storage resources that span all of its virtual environments and physical sites, including the cloud. The core storage operations-- provisioning, data protection, control and monitoring are simplified and delivered through this intuitive interface. The GUI is highly configurable to accommodate individual preferences and includes guided wizards and workflows to simplify administration. It also offers rich analysis and reporting capabilities, allowing the IT team to plan for performance and capacity, then closely monitor and analyze production deployments in order to track utilization rates, potential performance hot spots, and the like.

For more complex environments, DataCore SDS offers a REST interface, allowing for integration with higher level infrastructure management and/or orchestration systems. This allows the DataCore SDS deployment to be actively managed and monitored by the IT team, using their existing management system.

DataCore SDS also is ideal for containerized environments, providing highly-available, high-performance universal block storage for Docker and

Kubernetes environments, radically improving the speed of container and application deployment.

Finally, all operations and commands are available using an extensive library of REST API and PowerShell-scripting commandlets.

Key Takeaways on DataCore SDS Management

A key defining characteristic of any SDS platform is that centralized management of a virtualized pool of storage that aggregates the resources across a range of heterogeneous devices. The DataCore SDS management console delivers all of the power and promise of DataCore SDS to the IT team, allowing them to leverage the functionality and differentiated storage services that the platform delivers, and capture the value of simplification and infrastructure flexibility as they run all storage operations globally from a single pane.

13.6. PERFORMANCE FEATURES

Every IT pro knows that performance is tricky. Application response time, latency, and I/O throughput all depend on a chain of activities that cross networks, systems, and geography. Different applications have a wide range of I/O profiles, each requiring different resources from the underlying infrastructure to optimize performance. And the stakes are high: In some transactional applications, a delta of 1-2 milliseconds in latency can have significant financial consequences. And of course there is cost.... Raw performance can be achieved by dedicating millions of dollars of high-end gear to an environment, but it is more telling to analyze the ratio of the cost of the system to the performance it delivers. The best approach is to use standard ratios, like cost per IOPS, which allows you to get an accurate apples-to-apples comparison, not just of the throughput achieved, but also of the resources required in order to achieve the throughput.

Fortunately, performance is an area where DataCore excels, leveraging the hard-earned experience of a team of seasoned performance engineers, with deep experience in real time systems (where performance is paramount.) Based on the recognition that the final performance measurement is the result of several key variables, DataCore SDS includes a suite of patented performance technologies that enable IT to confidently deliver the requisite price/performance on a per workload basis. And given DataCore's intimate understanding of the nuances of performance, all of

these features come with strong analysis and reporting tools, allowing for fast and efficient measurements, trouble-shooting, and tuning.

Parallel I/O

DataCore's patented Parallel I/O technology is a standard, "always-on" feature of DataCore SDS. It elegantly eliminates the server I/O bottleneck by processing I/Os in parallel leveraging multi-core processor systems. On the strength of this new technology, DataCore set records for industry benchmarks, with measurements of 459,000 IOPS, price performance of \$0.10 per IOPS, and application latency of just 0.22 ms—all with a low cost, 2 node HCI configuration using standard Lenovo servers.² These measurements were 2-4X better than those of competing solutions, including expensive all flash arrays.

Auto-Tiering

DataCore SDS includes dynamic block-level auto-tiering. This function moves data at a granular level to the storage device that delivers the best performance, based on the observed performance profile for each application. This allows IT to gain significant performance advantages when the hard disk drives are suspected performance bottlenecks. Block-level auto-tiering uses machine learning to assess likely storage bottlenecks and then automatically moves the "hot" blocks to the fastest media resource, eliminating the bottleneck and bolstering overall application performance. To emphasize the value, by adding a relatively small amount of flash storage to the DataCore SDS storage pool, IT can realize performance gains that are superior to adding entire all-flash arrays to other environments.

High-Speed Intelligent Caching

High-Speed Caching is a proprietary caching algorithm that accelerates I/O by leveraging RAM as a read and write cache. DataCore supports up to 8 TBs of high-speed cache per node, creating a true "mega-cache" to turbocharge application performance. Given that RAM is the fastest storage component in the architecture, a RAM-based cache can deliver a 3-5x performance boost to applications, while simultaneously freeing up application servers to perform other tasks. Using RAM-based cache also extends the life of traditional storage components by minimizing the stress experienced from disk thrashing.

Quality of Service Controls

QoS is an integral feature that allows the IT team to ensure that high-priority workloads meet SLAs with predictable I/O performance. This is particularly useful in environments with many applications and workloads of differing priority, all sharing the same storage pool. QoS allows IT to set thresholds and limits on lower priority workloads ensuring that the top tier applications do not suffer in performance based on resource contention with lower priority applications.

Key Takeaways on Performance

Performance is a fundamental success factor for the IT environment, and DataCore SDS is built from the ground up to deliver the highest levels of performance, superior to far more expensive traditional SAN solutions. Together, this set of performance features deliver both the raw horsepower and the controls and tuning tools that the IT team needs to confidently plan for, and meet, the performance SLA commitments for all of the workloads in their environment.

² SPC benchmark 1™ full disclosure report, DataCore Software Corporation, DataCore SANsymphony 10.0, (Dual node, high availability, hyper-converged), storage performance council, June 2016.

For additional information, please visit datacore.com or email info@datacore.com

