Software- Defined Storage

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New Choices

Sure, traditional storage solutions do the job to secure and manage data. But if you want to add more storage, get in line early—it'll take time and specialized resources. Increasingly, enterprises are unwilling to wait for on-premises options when powerful software-defined storage (SDS) solutions offer the same levels of availability and performance faster and with less friction. SDS is disrupting traditional storage by moving control to the software away from proprietary, expensive hardware. This opens the door to automation and policy-based frameworks. As a result, organizations now can get storage that easily adapts to changing business needs.

Early movers, including cost-sensitive service providers, are leading the move to software-defined storage. They are drawn by its flexibility, scalability, reliability, security, performance, and lower cost. SDS is becoming a third key capability in the service-provider toolkit, alongside software-defined compute and software-defined networking. These companies are aggressively pushing the boundaries of this next wave of technology and demonstrating the power of SDS.

One such company—NTTX Select—offers insight into the benefits of trying SDS.[1] Last year the UK-based hosting provider turned to Microsoft and its software-defined storage solution because it enabled the company to instantly deploy new applications. NTTX says it used to take it as long as nine months to do the same with traditional on-premises Storage Area Network (SAN) and Network Attached Storage (NAS) solutions. NTTX Select also found that using the Microsoft SDS solution helped to slash its storage budget by 30 percent.

Companies dependent upon SAN and NAS storage find themselves heading down the same path as NTTX. Even while buying more physical storage to keep pace with the epic growth of data, some of these organizations are already planning a transition to SDS, the clear next-generation solution for storage.

The question is no longer whether software-defined storage is the way to go. Instead it's how soon can you make the change, and when you do, which brand of software-defined storage makes the most sense? This white paper maps out the reasons why more enterprises such as NTTX Select are exploring the benefits of SDS with Microsoft.

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[1] Microsoft Customer Stories, NTTX Select, Hosting Provider Uses Industry-Standard Storage to Slash Storage Costs by 30 Percent.

Choosing Microsoft Software-Defined Storage

If you are considering software-defined storage, consider the Microsoft solution. You might be in for a surprise—you probably already own it. The Microsoft solution is included in Windows Server 2012 R2.

Windows Server users will find the Microsoft SDS solution familiar. It works just like you would expect—it's easy to configure existing hardware on your own, and if you decide to buy preconfigured options from companies like Dell and HP, it's easy to configure those as well.

The Microsoft solution has the highest throughput of any storage available. It's already used at giant scale with Microsoft Azure public cloud to support more than 30 trillion Storage objects and growing—2,000 new customers sign up for Azure daily. Microsoft has been using Azure to manage data for massive online services like Xbox Live and Office 365 for years, and now, through its SDS solution, it is inviting its customers like you to use those same technologies and services to manage and transform your on-premises datacenters.

Microsoft software-defined storage offers best-in-class flexibility, scalability, reliability, security, and performance. As a result, you can use low-cost, industry standard hardware to change the way you do storage forever:

- **Flexibility**: Gain the flexibility to move storage along virtual machines to the cluster without downtime or loss of availability.
- **Scalability**: Seamlessly scale your storage resources—deploying new storage resources on demand—without interrupting availability or performance.
- **Reliability:** Increase your reliability and elasticity by storing your data on more than one server.
- **Security:** Set access levels by tier, easily providing access to data only to those who need access while excluding others.
- **Performance:** Gain high performance by combining HDDs and SSDs in tiered Storage Spaces to meet demand from intensive workloads.
- **Resiliency:** Achieve resiliency with multiple layers of redundancy across disk, enclosure, connectivity, and file server nodes.
- **Cost:** Eliminate complex and costly SAN infrastructure without sacrificing SAN-like capabilities.

What customers say:

"By using Storage Spaces, we're getting storage performance of 450,000 IOPS and roughly a gigabyte per second in throughput—more than 20 times the IOPS and four times the throughput of our SAN."
Daniel Weissenborn,
Solution Architect, ClearPointe

"In the past, a customer bought a SAN with expensive RAID [redundant array of independent disks] drives for an initial purchase price of more than $3,000 a terabyte. With Storage Spaces, our customers can use storage that costs less than $300 a terabyte."
Rand Morimoto,
President, Convergent Computing

Haven't made the leap to Windows Server 2012 R2 and Hyper-V virtualization? Then SDS represents just one more good reason.

Invested in SAN and NAS storage? Let Microsoft help you get the most out of those on-premises resources with Windows Server 2012 R2 and System Center 2012 R2.

With Windows Server 2012 R2, you can create software-defined storage on your own using industry-standard hardware in fewer than two dozen steps. You can use the software to abstract a first few pieces of your underlying hardware, and when you're comfortable with that, you can transition more of your workloads from expensive proprietary solutions to SDS.

What can you expect to find? Your cost of storage will drop dramatically and your enterprise storage solutions will become easier to manage.

Exploring Software-Defined Storage

If you store your data to a volume, you are already using a software-based action. With SDS, you use software to abstract functionality away from hardware, which, along with virtualizing the compute and networking functions, is the logical next step in storage's evolution.

The whole idea behind SDS is to make it easier to provision and access storage resources. With SDS you can forget about physical LUNs, World Wide Names, and complicated SAN switch configurations. With software-defined storage, all of that is masked from users—what they get is a volume resource that provides the capacity and performance attributes that each user needs for any application workload.

Traditional datacenter challenges	Software-defined datacenter benefits
Tight coupling between infrastructure and apps leads to a rigid, hardware-driven approach.	Loosely coupled apps, infrastructure resources, and physical hardware add flexibility by moving control to software.
Expensive, proprietary, and vertically integrated hardware is complex and requires planning for each purchase.	Ability to pool storage using industry-standard, low-cost hardware reduces costs and improves scalability.
Siloed infrastructure and operations results in fractured processes and more wait time.	Moving control to less-expensive, service-focused DevOps roles support faster response time.
Highly customized processes and configurations require specialized skills.	Automated processes and configuration simplify provisioning and management.

Table 1: Benefits of transitioning to a software-defined datacenter. Software-defined storage is one of the components of a modern datacenter, which delivers more flexibility and scalability to help businesses improve agility.

More technically, with software-defined storage, you virtualize your physical storage, pulling the management capability of your on-premises storage hardware into a layer of software. Microsoft enables this with Storage Spaces, which helps you pool low-cost, industry standard storage components into a virtual disk. You use Windows File Server to manage your storage devices using regular SAS connectivity.

As a result, software-defined storage is agile and efficient, and will grow and evolve as you do. Working with traditional SAN and NAS storage is a static and inefficient process, in comparison.

Microsoft offers a SDS solution as part of Windows Server 2012 R2, at no extra cost. The solution includes Windows Server 2012 Scale-Out File Server Cluster with Storage Spaces over the Server Message Block (SMB) 3.0 protocol. You can also use Microsoft System Center to provision and manage the storage. Microsoft software-defined storage puts the control into the hands of the Windows administrator, who can carve out more storage as needed using familiar management tools. Managing your storage with SDS gives you improved performance, reliability, availability and efficiency at a fraction of the cost of traditional storage.
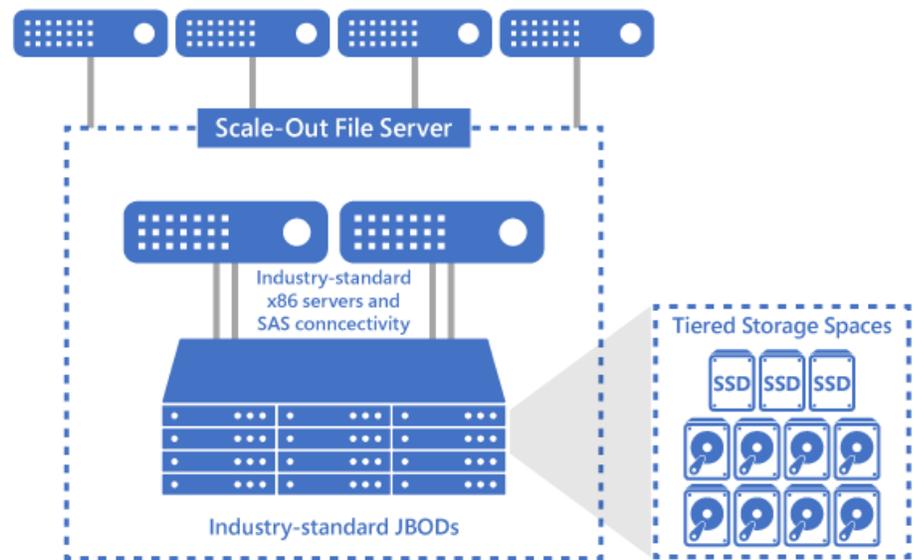
Figure 1: Using Windows Server 2012 R2 to create software-defined storage. *By deploying file share clusters as network storage, you can achieve levels of performance and reliability using industry-standard hardware that were formerly only available on proprietary storage. You can use the resulting SMB shares as storage for Hyper-V virtual machines, SQL databases, and other critical workloads.*

Getting the most from SDS with Storage Spaces

Deploying storage assets quickly is crucial for all companies. Before switching to the Microsoft SDS solution and Storage Spaces, NTTX Select had to wait as long as nine months to get a new service to market after introducing a new server or operating system. The challenge was it had to wait for storage and middleware vendors to write drivers and connectors to one another's technologies.

The delays were "devastating to our business," says Philip Moss, the company's Chief Technology Officer. "During that time, our customers could go somewhere else. With Windows Server 2012 and Storage Spaces, we have the virtual machine capacity and storage flexibility to accommodate just about any customer need, and do so as soon as the product is generally available."

Shrink wait times

Customers like Moss also benefit from not having to deal with separate storage administrators for each of the many storage infrastructures that would otherwise be required. Instead, if they are launching a new application using Storage Spaces, all they need is Windows Server and the right set of drivers and they're good to go.

Gain powerful features

Helping you deploy quicker is only part of what the Microsoft SDS solution offers—it also provides high resiliency and operational simplicity, among other benefits. Here's a list of some of its top features:

Thin provisioning and trim storage: Thin provisioning solutions offer just-in-time allocations of storage, and trim storage gives you the ability to reclaim storage that is no longer needed. The two work together to let you expand and reclaim your storage dynamically.

Tiering: Tiering enables you to automatically place your most frequently-accessed data on your fast solid state drives, and conversely, to park less frequently-accessed data on low-cost, high-capacity spinning disks.

Deduplication: Data deduplication improves storage efficiency by minimizing redundant data on disks.

Resilient storage: Storage Spaces provide resilient storage in the form of mirror spaces with dirty region tracking, and parity spaces with integrated journaling. It also provides rapid recovery via per-pool hot spares. Depending on your workload, you get to choose whether you want two-way mirroring, three-way mirroring, two-way parity, three-way parity, or just simple striping.

Reliability: Unlike traditional SAN-based storage, SDS addresses failure domains by storing data on more than one server. If hardware fails on one server, there's no failover-cluster-like wait for a second sever to take on the load—the data is already on a second server and ready to go almost instantly. Even more importantly, Microsoft offers multiple backups that protect your data, including failover cluster configurations with transparent failover.

Affordability a factor

Using the Microsoft SDS solution is 50 percent more cost effective than traditional SAN-based storage options, according to lab testing done by Enterprise Strategy Group[2] after the release of Windows Server 2012 R2. Most of the savings can be attributed to moving from SAN-based storage to industry-standard hardware. The 2013 test also found that performance between Storage Spaces and traditional SAN storage was largely equal.

NTTX is certainly enjoying the cost savings, but the benefits of the Microsoft SDS solution go beyond just saving dollars, says Moss, the company's CTO.

"By using Storage Spaces, Hyper-V over SMB, and other new features, I eliminate big, lumpy capital expenditures," Moss says. "With SANs, you have to buy big chunks of storage, usually more than you need, and big expensive controllers. With Storage Spaces, I can buy inexpensive storage, buy only what I need, and scale in a completely linear manner. When a customer wants a new service, we simply plug in a bare-bones server and bring up new compute and storage resources instantly. Storage is now about 25 percent of our budget versus 40 percent before."

Enterprise Strategy Group's test found that using the Microsoft SDS solution would cost a typical customer $3.33 per gigabyte. The comparable SAN-based solutions studied cost double that—$6.65 per gigabyte for one type referenced in the study and $6.19 per gigabyte for another.

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[2] Enterprise Strategy Group, Lab Review Report July 2013, Microsoft Windows Server 2012 Storage Performance and Cost Analysis

Maximizing existing storage investments in SAN and NAS with Microsoft

Enterprises heavily invested in traditional storage area network (SAN) or network-attached storage (NAS) may not be ready to switch to software-defined storage (SDS). In that scenario, consider using Windows Server 2012 R2 and System Center 2012 R2 to help manage existing on-premises storage without re-engineering infrastructure, systems management, or applications. Support includes:

- **Automatic discovery:** Identify your SAN and NAS resources and discover storage devices that reference the Storage Management Initiative, either Specification (SMI-S) or Storage Management Provider (SMP) standards.
- **Rapid, end-to-end provisioning:** Configure, provision, classify, and manage all of your key storage components.
- **Offloaded Data Transfers:** Improve performance during provisioning and operation. Large files that would normally be transferred across the network are moved within your high-speed SAN environment, saving virtualization host CPU cycles and network bandwidth.
- **Multi-vendor virtualization:** Extend your storage environment discovery, provisioning and management to third-party virtualization environments, including VMware ESX and Citrix XenServer.
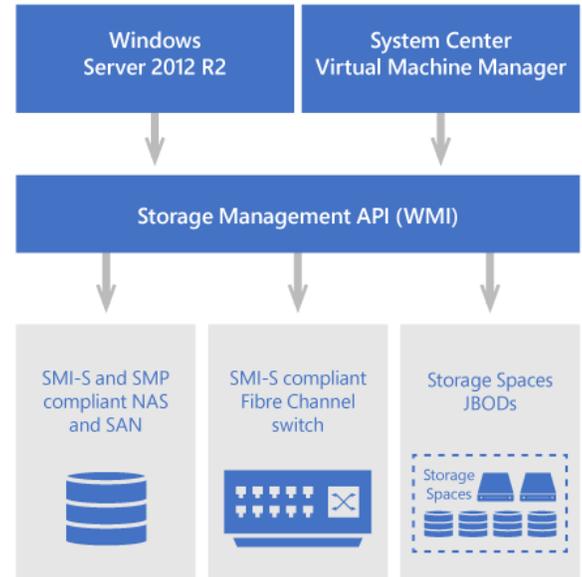
Figure 2: Microsoft can help you prepare for the move to modern storage. Software you may already own can help you manage a wide range of storage types and devices and begin the transition to software-defined storage.

Supporting traditional hardware along with virtualized storage with Windows Server 2012 R2
Windows Server 2012 R2 enables you to get more from your current investments with support for a wide range of file system types and protocols. Supported protocols and file systems include:
- Server Message Block (SMB) 3.0 Support
- Fibre Channel
- Network File System (NFS) 4.1 support

Charting the Path Forward

Exploring software-defined storage is a first step toward your next generation datacenter. With Storage Spaces, storage tiering, and data deduplication all built into Windows Server, organizations can gain the same level of performance, resiliency, and availability that they get with traditional storage at a fraction of the cost.

The Microsoft SDS solution has been put through its paces since it debuted in Windows Server 2012 and has since become a recommended deployment model for Hyper-V deployments.

Once companies start transitioning to the more versatile and affordable SDS storage, they will begin to get the best of all worlds—all of what they like about traditional storage and none of what they don't like.

Storage feature or service	Third-party NAS/SAN	Microsoft Software-Defined Storage Solution
Fabric	Block protocol	File protocol
Network	Low latency network with FC	Low latency with SMB3Direct
Management	Management of LUNs	Management of file shares
Data deduplication	Data deduplication	Data deduplication
Resiliency	RAID resiliency groups	Flexible resiliency options
Pooling	Pooling of disks	Pooling of disks
Availability	High	Continuous (via redundancy)
Copy offload, Snapshots	Copy offload, Snapshots	SMB copy offload, Snapshots
Tiering	Storage tiering	Performance with tiering
Persistent write-back cache	Persistent write-back cache	Persistent write-back cache
Scale up	Scale up	Automatic scale-out rebalancing
Storage Quality of Service (QoS)	Storage QoS	Storage QoS (Windows Server 2016)
Replication	Replication	Storage Replica (Windows Server 2016)
Updates	Firmware updates	Rolling cluster upgrades (Windows Server 2016)
		Storage Spaces Direct (Windows Server 2016)
		Azure-consistent storage (Windows Server 2016)

Table 2: What's in the box: Comparing traditional and Microsoft SDS. There's nothing mystical about proprietary SAN and NAS storage once you get past the price tag. Microsoft offers a parallel set of services, features and benefits using faster protocols and lower-cost hardware.

As Microsoft continues to make improvements to its SDS offerings, IT pros who lead the transition to software-based storage will be positioned to introduce their companies to a seamless world where they can use consistent software to move storage between on-premises, the public cloud, such as Microsoft Azure, or a hybrid-cloud option mixing the best of all worlds.

Whether or not you are building applications in the cloud today, it makes sense to choose a software-defined storage solution that delivers a consistent management capability across all environments with proven flexibility, scalability, reliability, security, and performance.

With the recent release of Windows Server 2016 Technical Preview, Microsoft showed that it is already moving down that road. At its Ignite Conference in May, the company introduced Microsoft Azure Stack, which extends the agile Azure model of application development and deployment to company datacenters, and invited curious IT pros to check out Storage Spaces Direct, which improves ability to create highly available storage.

It's a good time to explore SDS further. Microsoft solutions enable you to do that. You can even keep your existing infrastructure in place while you chart a course for the future—a future when you can add storage easily without waiting in line and get the flexibility, scalability, reliability, security, and performance you need, on-premises or in the cloud.

Resources

Want to find out more about Microsoft software-defined storage? Here are some resources worth reviewing.

Storage QoS
Learn how to use Storage Quality of Service to centrally monitor and manage storage performance for your virtual machines using Hyper-V and Scale-Out File Server roles.

Storage Replica
Learn about a new feature in Windows Server Technical Preview that enables storage-agnostic, block-level, synchronous replication between clusters or servers for disaster preparedness and recovery, among other features.

Rolling Upgrades
Learn about a new feature in Windows Server Technical Preview that lets you upgrade the operating system of the cluster nodes from Windows Server 2012 R2 to Windows Server Technical Preview without stopping the Hyper-V or the Scale-Out File Server workloads.

Storage Spaces Direct
Learn how to build highly available storage systems with local storage.

Windows Server 2012 R2 Storage Whitepaper
Read more about storage capabilities available today in Windows Server 2012 R2.

Step-by-step for Storage Spaces Tiering in Windows Server 2012 R2
Get started yourself using this blog post with links to resources.

What's new in Windows Server Technical Preview
Download the Windows Server Technical Preview.