Lenovo Software Defined Storage with Windows Server 2016 Datacenter Storage Spaces Direct

Quick Reference Guide

Microsoft and Lenovo have worked together to validate a software-defined storage solution running on Lenovo servers to create hardware configurations that have excellent performance and reliability.

Lenovo validated configurations include production deployment tools and procedures. These offerings are designed, assembled, and validated to meet Microsoft's requirements for private cloud environments, helping to ensure reliable operation. Plus, for the third year in a row, Lenovo servers were rated the most reliable x86 servers in the world giving you additional peace of mind when you deploy with Lenovo servers.*

Working with Lenovo you can get up and running faster. Lenovo has developed a deployment tool to help automate the creation and deployment of cluster setups.

Configuration Options	
Entry Configuration	This configuration allows customers to start with 2 nodes as an entry storage spaces direct solution that has been pre-validated by Lenovo and Microsoft together. This 2 node solution is optimized for medium performance I/O requirements. Performance is delivered through 1.6TB SSD for Cache Tiering with up to 16TB capacity per Node along with 256 GB RAM and dual Intel Xeon E5-2650 v4 Processors. Minimum of 2 nodes per cluster is required with this configuration to match the pre-validated configuration tested with Microsoft for maximum performance and reliability.
Balanced Configuration	This configuration is a medium performance pre-validated hardware foundation for Microsoft Storage Spaces Direct clusters optimized for Balanced I/O workloads. Performance is delivered through 3.2 TB SSD for Cache Tiering with up to 40TB capacity per Node along with 256 GB RAM and dual Intel Xeon E5-2680 v4 Processors. Minimum of 4 nodes per cluster is required with this configuration to match the pre-validated configuration tested with Microsoft for maximum performance and reliability.

*according to the latest ITIC 2015-2016 Global Server Hardware and OS Reliability Survey

Performance Configuration	This configuration is a pre-validated hardware foundation for Microsoft Storage Spaces Direct clusters optimized for high I/O workloads. Performance is delivered through 6.4 SSD for Cache Tiering with up to 60TB capacity per Node along with 256 GB RAM and dual Intel Xeon E5-2680 v4 Processors. Minimum of 4 nodes per cluster is required with this configuration to match the pre-validated configuration tested with Microsoft for maximum performance and reliability.
High Performance Configuration	This configuration is a high performance pre-defined hardware foundation for Microsoft Storage Spaces Direct clusters optimized for demanding I/O workloads. Performance is delivered through 6 TB NVMe for Cache Tiering with up to 60TB capacity per Node along with 512 GB RAM and dual Intel Xeon E5-2690 v4 Processors. Minimum of 4 nodes per cluster is required with this configuration to match the pre-validated configuration tested with Microsoft for maximum performance and reliability.

Lenovo and Microsoft Pre—Validated Configurations

Title	Boot Device	NVMe	SSD	HDD	NIC	RAM	Intel Xeon CPU	Nodes Required	Part Number
Entry Configuration	2x SAS (300)	N/A	2x 800GB (S3710)	4x 4TB	1x DP CX4 10/25Gb	256GB	E5-2650v4	2 or more	
Balanced Configuration	2x SAS (600)	N/A	4x 800GB (S3710)	10x 4TB	1x DP CX4 10/25Gb	256GB	E5-2680v4	4 or more	CLDMS2DBL71
Performance Configuration	2x SAS (600)	N/A	4x 1.6TB	10x 6TB	1x DP CX4 10/25Gb	256GB	E5-2680v4	4 or more	CLDMS2DPR71
High Performance Configuration	2x SAS (600)	3x 2TB AIC	N/A	10x 6TB	1x DP CX4 10/25Gb	512GB	E5-2690v4	4 or more	CLDMS2DUP71

For Windows Server 2016 Datacenter and client access license part numbers go to:
https://www.lenovosalesportal.com/public-resources.aspx?item=511
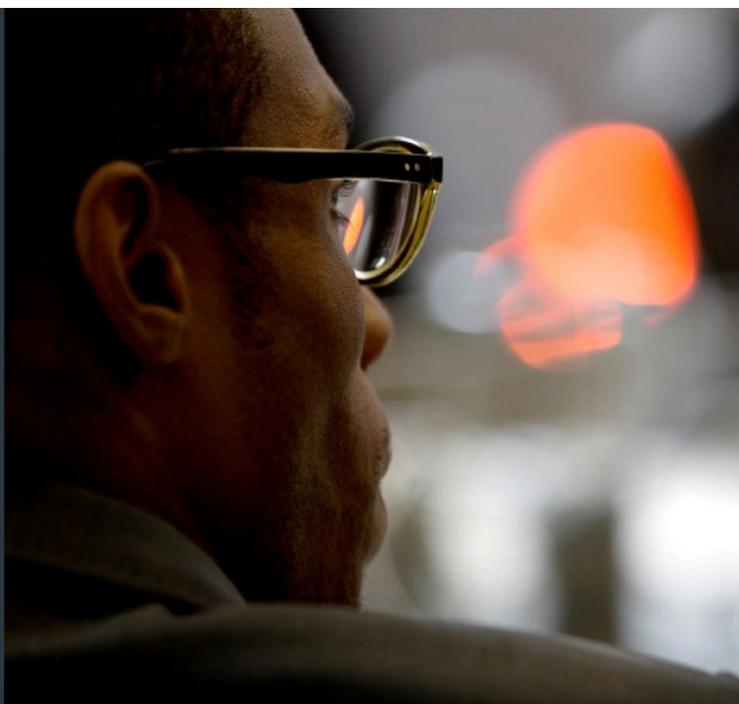
What is Software Defined Storage

Software-defined storage is an approach to data storage in which the programming that controls storage-related tasks is decoupled from the physical storage hardware. Administrators can utilize software to allocate and share storage assets across all workloads according to their needs.

Lenovo servers running Storage Spaces Direct in Windows Server 2016 Datacenter allow you to provision and manage storage independent of the underlying hardware to achieve an agile and cost effective software defined storage solution.

"ONE CLIENT REPLACED ITS COSTLY AND UNDER-PERFORMING SAN STORAGE ENVIRONMENT WITH MICROSOFT STORAGE SPACES DIRECT RUNNING ON LENOVO, SLASHING THEIR COSTS AND BOOSTING THEIR STORAGE CAPACITY AND I/O BY A FACTOR OF TEN.

WE KNOW THAT WE CAN RELY ON THE LENOVO SERVERS TO SEAMLESSLY SUPPORT THE STORAGE SPACES DIRECT SOLUTION, AS THE SERVER, DISK AND NETWORKING CONFIGURATIONS HAVE ALL BEEN VALIDATED BY MICROSOFT."

— Philip Moss, Chief Product Officer, Acuutech

Lenovo™

Storage Spaces Direct Key Benefits

Cost: Because Storage Spaces Direct is a no added cost feature of Windows Server 2016 Datacenter, customers can use standard HDDs and potentially save thousands of dollars by avoiding the purchase of costly NAS or SAN devices and additional software.

Simplicity: Deploy Storage Spaces Direct cluster in under 15 minutes.

Unrivaled Performance: exceeds 150,000 mixed 4k random IOPS per server.

Fault Tolerance: If hardware fails, just swap it out with no complicated management steps.

Resource Efficiency: Erasure coding delivers up to 2.4x greater storage efficiency.

Manageability: Storage QoS provides minimum and maximum per-VM IOPS limits and continuous monitoring and alerting.

Scalability: Up to 16 servers and 400+ drives, petabytes of storage per cluster. To scale out, simply add drives or add more servers; Storage Spaces Direct will automatically onboard new drives and begin using them.

For more detail on storage spaces direct and information on listed performance specifications go to: https://docs.microsoft.com/en-us/windows-server/storage/storage-spaces/storage-spaces-direct-overview

How to Sell with Lenovo in 3 Steps

1 Select pre — validated Lenovo configuration

2 Add Windows Server 2016 Datacenter Lenovo Reseller Option Kit to order

3 Add user, device and RDS client access licenses as necessary

- Storage Spaces Direct is a feature found only in Windows Server 2016 Datacenter

- Lenovo sells Windows Server as a Reseller Option Kit (ROK)

- ROK is a software distribution model that is a cost-effective, install-ready kit to help you sell and deploy Microsoft Windows Server operating systems on OEM server hardware.

Drive Options

Storage Spaces Direct currently works with three different drive types NVMe, SSD and HDD (including SAS). Customers can deploy hard drives in a number of configurations based on performance and budget considerations.

We recommend limiting the total storage capacity per server to approximately 100 terabytes (TB). The more storage capacity per server, the longer the time required to resync data after downtime or rebooting, such when applying software updates.

The current maximum size per storage pool is 1 petabyte (PB), or 1,000 terabytes.
Every server must have at least two cache drives (the minimum required for redundancy). We recommend making the number of capacity drives a multiple of the number of cache drives. For example, if you have 4 cache drives, you will experience more consistent performance with 8 capacity drives (1:2 ratio) than with 7 or 9.

Deployment options

Storage Spaces Direct was designed for two distinct deployment options: converged and hyperconverged.

Storage and compute in separate clusters. The converged deployment option, also known as 'disaggregated', layers a Scale-out File Server (SoFS) atop Storage Spaces Direct to provide network-attached storage over SMB3 file shares. This allows for scaling compute/workload independently from the storage cluster, essential for larger-scale deployments such as Hyper-V IaaS (Infrastructure as a Service) for service providers and enterprises.

One cluster for compute and storage. The hyper-converged deployment option runs Hyper-V virtual machines or SQL Server databases directly on the servers providing the storage, storing their files on the local volumes. This eliminates the need to configure file server access and permissions, and reduces hardware costs for small-to-medium businesses or remote office/branch office deployments.

Frequently Asked Questions

- **How is S2D licensed?** S2D is a feature found in Windows Server 2016 Datacenter edition. You can purchase Windows Server 2016 Datacenter from Lenovo as a Reseller Option Kit with great pricing.
- **How complicated to setup is it?** Go from industry-standard servers running Windows Server 2016 to your first Storage Spaces Direct cluster in under 15 minutes. For System Center users, deployment is just one checkbox.
- **How does core licensing work?** Customers must have a minimum of 16 cores per server and a minimum of 8 cores per processor licensed. Additional Core license packs are sold as small as packs of two. All active cores must be licensed.

Additional Resources

Lenovo Software Defined Storage page: http://www3.lenovo.com/us/en/data-center/solutions/cloud/

Reference Architecture for Microsoft Storage Spaces Direct (S2D): https://lenovopress.com/lp0569.pdf

Microsoft Storage Spaces Direct (S2D) Deployment Guide: https://lenovopress.com/lp0064.pdf

Demo: https://youtu.be/raeUiNtMk0E

Case Studies:
1. Acuutech: http://news.lenovo.com/customer-stories/acuutech-boosts-client-services-by-harnessing-power-software-defined-storage.htm
2. SE Cloud Factory: http://www.lenovo.com/images/products/system-x/pdfs/testimonials/se_cloud_factory_cs.pdf