Discover Storage Spaces Direct in Windows Server 2019 with Dell EMC Ready Solutions

Webcast – December 18, 4:00PM – 4:45PM
Steve McMaster, Dell EMC Global Sales Enablement Microsoft Solutions
Cosmos Darwin, Senior PM, Microsoft Core OS Engineering
Hyper-Converged Infrastructure powered by Windows Server

Cosmos Darwin
Senior PM, Core OS Engineering

@cosmosdarwin
There is a revolution happening in the server market.
Why Hyperconverged Infrastructure is so Hot

LAS VEGAS – Hyperconverged Infrastructure didn’t exist as a concept two or three years ago. Today, it is one of the hottest topics in the IT industry.

The Need for Hyperconverged Infrastructure in Today’s Business Environment

By Clint Boulton

The growing scale of operations and complexity always in flux requires infrastructure solutions that can deliver the right solution set for your current needs and scale to meet the challenges of the future.
+78.1% HCI Growth YoY

- IDC Worldwide Converged Systems Report, Q2 2018

“HCI drove second quarter market expansion [...]”

- IDC Worldwide Converged Systems Report, Q2 2018
Traditional “Three Tier” Infrastructure
Traditional “Three Tier” Infrastructure

Hyper-Converged Infrastructure (HCI)

- Ethernet Switches
- Standard x86 servers
- Local drives
- The magic of software

- Hypervisors
- Storage (SAN)
- Storage Fabric
- Misc. Appliances
Hyper-V

Introduced in 2008, ten years ago!
Foundation of our hyperscale Azure cloud

Storage Spaces Direct

Introduced in Windows Server 2016
Foundation of Azure Stack

SDN

Introduced in Windows Server 2016
Foundation of Azure Stack
Included in Windows Server 2016/2019

- ✓ Hypervisor / compute
- ✓ Software-defined storage
- ✓ Software-defined networking
- ✓ Management software
- ✓ Unlimited guest licenses

Source: https://www.microsoft.com/cloud-platform/windows-server-pricing
How Storage Spaces Direct works
Industry-standard servers with internal drives
No shared storage, no fancy cables – just Ethernet
Create cluster
Software-defined “pool” of storage
Create volumes
Volumes have built-in resiliency.
If drives fail
Even if servers go down
All data stays online and accessible
Scale-Out File Server (SoFS)
Hyper-Converged Infrastructure (HCI)
# Enterprise-grade software-defined storage

## Fault Tolerance
- Drive / server / network fault tolerance
- Optional rack and chassis awareness
- Storage replication for BC/DR (sync or async)
- High and continuous availability

## Software RAID
- Two- and three-way mirror (RAID-1)
- Dual parity / erasure coding (RAID-6)
- Mirror-accelerated parity
- Nested resiliency
- Striping (RAID-0)
- Single parity (RAID-5)
- S.M.A.R.T. predictive drive failure
- Drive latency outlier detection
- Automatic repair and resync

## Software Checksum
- File integrity checksum
- Automatic in-line corruption correction
- Proactive file integrity scrubber

## Encryption
- Data-at-rest (BitLocker)
- Data-in-transit (SMB Encryption)

## Efficiency
- Kernel-embedded architecture
- Remote direct memory access (RDMA)
- Data deduplication
- Compression

## Performance
- In-memory cache
- Persistent read/write cache
- Real-time tiering
- Hybrid and all-flash support
- Persistent memory / NVDIMM support
- Intel® Optane™ PMEM support
- NVMe, SATA, SAS support
- Instant VHD creation / expansion
- Instant VHD checkpoint management

## Scale
- Petabyte scale
- Scale-up and scale-out
- Proactive storage balancing
- From 2 to 16 servers
- From 8 to 400+ drives
- Cloud Witness for quorum
- Dynamic quorum

## Flexibility
- Hyper-converged infrastructure (Hyper-V)
- Scale-Out File Server (SoFS)
- Native SQL Server

## Management
- Built-In failure and capacity alerting
- Built-In performance history
- Per-VM Quality of Service (QoS) IOPS limits
- 100% scripting-friendly (PowerShell)
- System Center Integration
Product of the year – Software-Defined Storage

“most useful, well-crafted and innovative”

**Winner**

Storage Spaces Direct
Increase performance
INDUSTRY-LEADING

6, 6, 9, 6, 5, 4, 2

Monday, September 26, 2016 | 16 server nodes running Windows Server 2016

intel  Microsoft
NEW IOPS RECORD

1,3,7,9,8,6,7,4
Windows Server is on the leading edge of x86 hardware innovation

- **NVMe**
  - Full support for M.2, U.2, Add-In-Card (AIC)

- **Intel Xeon® Scalable®**
  - Supported since announcement on Windows Server 2016+

- **Intel Thunderbolt™ 3**
  - Blazing the trail for switchless networking

- **OPTANE™**
  - Supported since announcement on Windows Server 2016+

- **3D XPoint**
  - Use as cache or capacity in Windows Server 2019

- **RDMA**
  - Unique to Windows software-defined storage

- **Persistent memory**
  - Use as cache or capacity in Windows Server 2019
Windows OS: Every server node runs Windows Server 2019 Datacenter Enterprise. It was benchmarked on September 30, 2018. The primary focus is on high performance and all other settings are default, including applying advanced disk-sharing configurations. Specific configurations for Hyper-V and Memory are avoided.

Storage Spaces Direct: Each instance runs on two data units with per-server-levels, or we use SQL with alluring. Environments in 64 TB for about 10TB of total usable storage. Each volume uses three-way mirrored copies with allocation defined to three servers. All other settings, like columns and indexes, are default, to accurately measure IOPS to persistent storage only the inventory CSV must read on Windows.

Hyper-V VMs: On a single server, we create one virtual processor per physical core. For example, with 2 sockets and 12 cores and assign 26 virtual processors per server. This case is to simulate real-world workloads virtual machines x 20 virtual processors. This is the best scenario with 2 VMs across the 12 core nodes. Both VMs run Windows and it requires 4-64 GB of memory.

VMware: Two VMs are assigned and are fixed 40 GB VMDC. When it results and limits are set to 10-95 read for the best performance every VM runs on the server node that owns the volume to VMware DVS. The total data latency was low, except for three-way mirrored exchange. It is 13 GB read in 4-64 GB EU, which is in line with Intel Optane™ DC Persistent Memory.

Benchmark:

There are many ways to measure storage performance depending on the application. For example, you can measure the rate of data transfer (GB/s) by simply copying files, although this is not the best method for databases; you can measure transactions per second (TPS) or, particularly, the number of reads or writes. The virtual machine performance.

More precisely, we know that the Hyper-V virtual machine typically performs a transaction of 4 MB, (though not 4 MB, as in our benchmark of course).

How do you generate 4 MB random IOPS?

- VHD File: We use the open source VHD file that has been used in similar tests. In this case, it is easy to emulate a production environment: the virtual machine running several virtual machines with one that is running a database application. To ensure performance, we specify 4 threads per file with 10% extra trimming (100% per thread). For the Windows volume manager we specify unlimited (Q=inf) file size. We specify 1000-5000 MB and 4 MB block size (size=MB). We vary the transaction size by the above.

In summary, here's the SQL benchmark being measured.
Simplify management
Windows Admin Center for HCI

Q: How long does it take to download and install?
A: Under 5 minutes.

Q: How much does it cost?
A: No cost beyond your Windows licenses.

Q: Does it have dependencies, e.g. SQL Server, System Center?
A: No.

Q: Does it require an Internet connection?
A: No.
Session BRK2231 from Microsoft Ignite 2018

https://www.youtube.com/watch?v=5kaUiW3qo30
Get all the software you need, included in Windows.

Get amazing storage performance.

Get unified management for VMs and storage.
The figure cited is the number of currently active clusters reporting anonymized census-level telemetry, excluding internal Microsoft deployments and those that are obviously not production, such as clusters that exist for less than 7 days (e.g. demo environments) or single-node Azure Stack Development Kits. Clusters which cannot or do not report telemetry are also not included.
In just the last 6 months

As of September 14, 2018

The figure cited is the number of currently active clusters reporting anonymized census-level telemetry, excluding internal Microsoft deployments and those that are obviously not production, such as clusters that exist for less than 7 days (e.g. demo environments) or single-node Azure Stack Development Kits. Clusters which cannot or do not report telemetry are also not included.
<table>
<thead>
<tr>
<th>Create</th>
<th>ハッブル大学</th>
<th>Sørøm Kommune</th>
<th>株式会社</th>
<th>Mead &amp; Hunt</th>
<th>Bradley</th>
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<tbody>
<tr>
<td>de stroomlijn</td>
<td>EVGA</td>
<td>King County Library System</td>
<td>ITAREX IT architecture experts</td>
<td>Bennington</td>
<td>MAKE IT</td>
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<tr>
<td>Cherokee County School District</td>
<td>Harrer Ingenieure</td>
<td>Università di Pisa</td>
<td>Cloud Factory</td>
<td>MECOMS a leading company</td>
<td>POINTIVITY™ Cloud Smart</td>
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<td>SETAR</td>
<td>Infront</td>
<td>TIPMONT REMC</td>
<td>Quest IT</td>
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<td>Youth Villages, The lives for families</td>
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<td>Braathe Gruppen</td>
<td>Acuutech</td>
<td>Oblakoteka</td>
<td>Wichmann IT-Services</td>
<td>TEA Energy Authority</td>
<td>TML</td>
</tr>
</tbody>
</table>
Two ways to buy Windows Server HCI

Build your own
with SDDC AQ’d components

Partner offers
Validated and ready-to-go
Dell EMC Microsoft Storage Spaces Direct Ready Nodes

Stephen McMaster
Dell EMC Ready Solutions
Digital transformation is a balancing act

From “status quo” to “embracing change”

Technology will move from the realm of IT to become inherent across the business

- **Last 15 years**
  - IT-centric
  - Systems of record
  - Traditional applications
  - Transactional data and reporting
  - Internet

- **Next 15 years**
  - Business-centric
  - Systems of engagement and insight
  - Cloud-native apps
  - Streams of data and analytics
  - Internet of Everything

Strategic partnerships will matter

- "Optimize" mode
- "Invest" mode

IT investments $
Dell EMC HCI Portfolio – Where does WSSD Fit?

**Build**
- **vSAN Ready Node**
  - Use existing lifecycle management processes

- **VxRail Appliance**
  - Jointly engineered w/ VMware for full lifecycle simplification & single support

**Consume**
- **VxRack SDDC**
  - Easiest and fastest way to stand up a VMware SDDC

**Shared Infrastructure**
- **VxFlex OS**

**Pre-validated, Optimized**
- **Microsoft Hyper-V on Storage Spaces Direct**
  - When customers require Nutanix

- **Ready Solution for WSSD**

**Fully Integrated System**
- **XC Family**
  - Purpose built HCI for Microsoft Azure Stack

**Partner Aligned**
- **Microsoft**
  - Hyper-V | Nutanix

- **Microsoft Hyper-V on Storage Spaces Direct**
  - When customers require Nutanix

- **Ready Solution for WSSD**

- **VxRack AS**
Are you unlocking the value of Windows Server Software-Defined (WSSD)?

<table>
<thead>
<tr>
<th>Designing and configuring <strong>new infrastructure</strong> for is complex.</th>
</tr>
</thead>
<tbody>
<tr>
<td>It is difficult to avoid guesswork when building software-defined clusters</td>
</tr>
<tr>
<td>It takes a long time to <strong>design, configure, test, and validate</strong> hardware</td>
</tr>
<tr>
<td>Multiple interfaces, additional steps to complete tasks and increased need for specialized knowledge drains resources</td>
</tr>
<tr>
<td>With virtualization, it can be <strong>hard to locate the source of a problem</strong>, making it hard to know who to call for help.</td>
</tr>
<tr>
<td>When you have an issue, there’s no time to stop and figure out if the source is related to hardware or software</td>
</tr>
</tbody>
</table>
Dell EMC Ready Solution for WSSD

S2D Ready Nodes are pre-configured, validated and certified server nodes designed to run Microsoft WSSD to deploy a Microsoft Hyper-Converged Infrastructure solution

Benefits

1. **Confidence** — WSSD certified components take the guesswork out of building HCI clusters

2. **Convenience** — Pre-configured solutions make sales and acquisition very convenient

3. **Customer support** — Customers enjoy the simplicity of a solution that’s supported globally by Dell EMC for streamlined, collaborative support from the first call

Dell EMC Ready Solution for Microsoft WSSD:
- S2D Ready Nodes on R640, R740xd
- PowerEdge certified R440 server
- Dell EMC 10GbE/25GbE networking
- Dell ProSupport and ProSupport Plus
- Dell ProDeploy and ProDeploy Plus
Dell EMC Ready Solutions for Microsoft WSSD

There are 15 configuration options:

- Two Hybrid Configurations
- One All Flash Configuration
- Four NVMe Configurations

- Two Hybrid Configuration
- Two All Flash Configuration
- Two ROBO Configurations (All Flash and Hybrid)

- One Hybrid Configuration
- One All Flash Configuration

Please see the Solution Overview for detailed configuration options.
## WSSD solutions platforms

<table>
<thead>
<tr>
<th>Platform</th>
<th>R440 WSSD Certified Server</th>
<th>R640 S2D RN</th>
<th>R740xd S2D RN</th>
<th>R740xd2 S2D RN (coming in CY19Q1)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Positioning</strong></td>
<td>Cost and performance optimized 1U form factor HCI solution</td>
<td>Performance and Density optimized 1U form factor HCI solution</td>
<td>Performance and storage optimized 2U form factor HCI solution</td>
<td>Capacity Optimized 2U platform for maximum internal storage</td>
</tr>
<tr>
<td><strong>Targeted customer profile</strong></td>
<td>Edge/ROBO/SMB and space (depth) constrained locations</td>
<td>Small to Medium businesses looking for balance of performance, cost and density</td>
<td>Medium/Large businesses looking for storage dense configurations</td>
<td>Medium/Large businesses looking for high capacity HCI solution for Tier 2/Tier 3/Backup/Archive workloads</td>
</tr>
</tbody>
</table>
WSSD Solution Scalability

2 x S4048/S4112/S41x8/S5048 (TOR)
1 x S3048 (OOB)

Storage Spaces Direct RN as a hyper-converged building block

- Compute and Storage hyper-converged
- Scalable building block
- Storage and Network fabrics converged
- RoCE with DCB enabled on switches for configurations with Mellanox Cards
- iWARP based network configuration with Qlogic card
- Converged or separated networking supported

Dell EMC completed WSSD Certification and will provide support for 16 node clusters

4 x 2U or 1U Storage Spaces Direct RN*
Customers and typical use cases

**Typical Use Cases** are customers who want to:

- Continue to use their known, industry-standard Microsoft Windows Server environments
- Upgrade to Windows Server 2016 and take advantage of its improvements
- Upgrade or host data-heavy applications, such as Microsoft SQL Server®, Microsoft SharePoint®, and Virtual Desktop Infrastructure (VDI)
- Deploy end-to-end, HCI client virtualization solutions using Microsoft RDS or Citrix XenDesktop/XenApp
- Improve storage capacity utilization and make storage management and operations more efficient
- Move forward in their virtualization strategies
- Remote Office / Branch Office (ROBO)
- Those with expiring PS/SC/VNX platforms (3/2/1 program)
Dell EMC makes implementation simple, flexible and worry free!

Installation and configuration

- Certified engineers ensure speed and accuracy
- Less risk and downtime
- Frees your IT staff to work on other priorities
- Flexible options to fit your needs and budget

Single source support

- One-stop cluster level support for hardware & software
- Covers OS, hypervisor and Storage Spaces Direct
- Comprehensive coverage whether license was purchased from Microsoft or Dell EMC
- Timely, reliable issue resolution

Deployment

- 39% faster deployments than in-house resources
- 75% less planning time

Support

- Resolve server issues up to 90% faster*

ProSupport for S2D Statement of Work

#1 Microsoft Partner 24 Gold Competencies 30-year relationship

*Based on Sep 2015 Principled Technologies Test Report commissioned by Dell EMC. Actual results will vary. Full report: http://facts.pt/1P56iW0
University of Pisa improves performance and utilization with S2D Ready Nodes

**BUSINESS NEEDS**

The University of Pisa needed to provide centralized infrastructure as a service (IaaS) for databases, web applications and more

<table>
<thead>
<tr>
<th>25x faster</th>
<th>More responsive</th>
<th>Pre-configured</th>
</tr>
</thead>
<tbody>
<tr>
<td>with NVME, Hybrid configs for tiered storage</td>
<td>web applications and databases</td>
<td>Tested and validated to save time</td>
</tr>
</tbody>
</table>

**BUSINESS RESULTS**

“Our Dell EMC S2D Ready Nodes have significantly boosted our storage speeds and helped us provide our students and university staff consumer-like experience to their Hyper-V applications.”

Maurizio Davini
CTO University of Pisa in Italy
ProSupport for S2D Statement of Work

Commercial Service Contracts

Please choose your region and country below or consult the FAQ section for further information.

North America
- United States
- Anguilla (English)
- Antigua & Barbuda (English)
- Antigua & Barbuda (Spanish)
- Aruba (Engish)
- Aruba (Spanish)
- Bahamas (English)
- Bahamas (Spanish)
- Barbados (English)
- Barbados (Spanish)
- Bermuda (English)
- Bermuda (Spanish)
- British Virgin Islands (English)
- British Virgin Islands (Spanish)

Latin America
- Argentina (Spanish)
- Belize (English)
- Belize (Spanish)
- Bolivia (English)
- Bolivia (Spanish)
- Chile (English)
- Chile (Spanish)
- Colombia (Spanish)
- Costa Rica (English)
- Costa Rica (Spanish)
- Dominican Republic (English)
- Dominican Republic (Spanish)
- Ecuador (English)
- Ecuador (Spanish)
- El Salvador (English)
- El Salvador (Spanish)
- Guatemala (English)
- Guatemala (Spanish)
- Mexico (English)

South America
- Brazil (Portuguese)
- Guyana (English)
- Guyana (Spanish)
- Suriname (Spanish)
- Suriname (English)

Service Description Supplement

Dell EMC ProSupport for Software for Storage Spaces Direct Ready Nodes Supplement

Introduction

Dell EMC is pleased to provide Dell EMC ProSupport for Software for Dell EMC Storage Spaces Direct Ready Nodes. Supplement together with corresponding ProSupport for Software service on Dell EMC Storage Spaces Direct Ready Nodes Solution as set forth in the Order Form, the "Service". This document supplements the ProSupport for Software service description, this document, together with your corresponding ProSupport for Software service description, are the "Service Description", and amendments, supplements, is incorporated by reference into, and shall be read together with your corresponding ProSupport for Software service description, and with any applicable master agreements, as described in the Dell Services Terms & Conditions section of the service description for your ProSupport for Enterprise Suite service. The terms of the ProSupport for Software and ProSupport Enterprise Suite service descriptions are available at www.dell.com/servicescontracts/global.

Dell EMC ProSupport for Software for Storage Spaces Direct Ready Nodes is offered only on Dell EMC Storage Spaces Direct Ready Nodes and is only available in conjunction with ProSupport, ProSupport Plus for Enterprise, ProSupport One, or ProSupport Plus for Data Center service the "ProSupport Enterprise Suite" offered on the Ready Node.

For additional assistance, or to request a copy of your governing agreement applicable to the Services, contact your Dell EMC sales representative.

Scope of Service

- Call handling by the Dell EMC ProSupport team and Storage Spaces Direct solution specialists with knowledge of the Dell EMC hardware, software defined storage, networking technologies, and MS Windows, and how these products and technologies interoperate to provide a hyper-converged storage solution.
- On-site cluster level support for hardware and software which encompasses the entire solution rather than per component.
- Combined with the deployment guide and support matrix, it offers complete solution solution.
- When required, we offer direct technical support for component failures that are validated for Dell EMC Storage Spaces Direct Ready Node, ensuring that there is little downtime of the environment.
- ProSupport for Software for Dell EMC Storage Spaces Direct Ready Nodes support includes cluster-level support for both OEM and Bring Your Own License (BYOL).
- Support is available only on Dell EMC Storage Spaces Direct Ready Nodes configuration.
- The following Dell EMC Storage Spaces Direct Ready Node products are covered: Hyper-V, File and Block Clustering, Storage Spaces Direct, Storage Replica, native Windows Backup, and Windows Volume Snapshot Service (VSS).
- The following operating system features via�e are included: Storage Spaces Direct are not covered: Windows Server Software Defined (WSSD) Premium, BitLocker, Shielded VMs and DSU.
- The Storage Spaces Direct solution specialists will provide remote support in the following areas:
  - Advise on features, functionality, cluster configuration issues, firmware versions, interoperability, and other cluster concerns. This is done in alignment with the best practices set forth in the Dell

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54
Ready Solution for WSSD: QuickStart Config for SMB/ROBO/Edge environments

Highly available, end-to-end HCI solution: Simplify design, ordering, deployment and support

QuickStart 4x2 Configuration

- Improved Sales Velocity for direct and channel
- Simpler configuration and T-Shirt sizing
- Detailed deployment and operations guidance
- Solution Components:
  - 4 R640 / R740xd S2D Ready Nodes
  - 2 Fully redundant S4112-ON Switches
  - Windows Server 2016
  - ProSupport and ProDeploy Services
  - Racks and PDUs (DCI)

1U

4U

Windows Server 2016

4x R640/R740xd S2D Ready Nodes

- OOB network (iDRAC – optional)
- Management/VM network (10 GbE)
- Storage RDMA traffic (25 GbE)
Ready Solution for Microsoft SQL Server Benefits
With all-flash Storage Spaces Direct Ready Nodes

NEW modern hyper-converged solution

Savings vs AWS & Legacy
29% less expensive than AWS *
Compared to dedicated M5 w/3 years upfront + monthly expenses

Consolidation & Performance
60% less expensive than legacy systems
11 PowerEdge R720 servers + power & cooling + VMware licensing

Nearly 3 to 1 server consolidation
11 PowerEdge R720 servers replaced by 4 S2D Ready Nodes

Sub-millisecond latency + high IOPS
Peak and average storage latency times below 1 millisecond

Scalability & Protection
Near linear scalability
Findings show all-flash design scales with database workloads

Backup in 3.8 min and restore in 9.25 min
Data Domain DD6300 backed up and restored 431 GB database

Storage Spaces Direct
4 x PowerEdge R640

* Based on Dell EMC internal analysis, August 2018. Estimated costs with U.S. pricing calculated over 3 years, comparing the Ready Solution to an equivalent AWS cloud solution. Includes up-front costs, power and cooling costs, and administration and support costs. The AWS solution also includes 36 months of monthly expenses. Public online calculator used for AWS pricing estimates. Actual costs will vary.
## Windows Server 2019 Datacenter edition
### Key new WSSD Storage Spaces Direct features

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Admin Center Integration</td>
<td>Storage Migration Service, Storage Replica and Azure</td>
</tr>
<tr>
<td>Deduplication with ReFS Volumes</td>
<td>Windows Server block based deduplication comes to ReFS volumes delivering significant storage and cost savings with the greater resiliency of ReFS.</td>
</tr>
<tr>
<td>Efficiency: Mirror Accelerated Parity</td>
<td>Achieve the best combination of storage efficiency and performance</td>
</tr>
<tr>
<td>Storage Class Memory Support</td>
<td>This new type of device brings flash closer to the processor to drastically reduce latency and increase performance.</td>
</tr>
<tr>
<td>Cluster Sets</td>
<td>Create massive scale out clusters with cluster sets.</td>
</tr>
<tr>
<td>Scale: Industry Leading Scale</td>
<td>Windows Server 2019 raises the scalability limits to new heights for Storage Spaces Direct.</td>
</tr>
</tbody>
</table>
Dell EMC Consulting Services for Microsoft

Advise
- Workshops, Assessments & Advisories

Plan
- Design, Architecture & Blueprints

Execute
- Implement & Integrate, Migrate & Replatform, Operate & Optimize

51 Microsoft Partner of the Year awards
28 Global Microsoft Competencies
16,000 Global certified Microsoft service professionals

Azure | Active Directory | Dynamics 365 | Exchange | Power BI | Office 365 | SharePoint | SQL Server | System Center | Windows Server
Resources

Ready Solution for WSSD

Inside Dell

Sales Portal

Operations Guide

Dell EMC Partner Portal

Solution Overview

Knowledge Base

Deployment Guide
For any question or assistance needed regarding Microsoft Storage Spaces Direct of the Dell EMC S2D Ready Nodes, please reach out:

S2D_ReadyNode@Dell.com

Thank you!