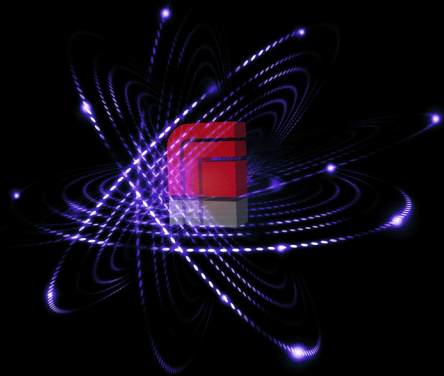


RAID Inc. Ability™ HCI Series powered by Lenovo for Storage Spaces Direct



Microsoft Software Defined Storage solution based on Windows Server 2016



The Challenge

Embrace the Software Defined Data Center (SDDC) to achieve cloud-consistent storage and compute performance efficiencies .

The Solution

RAID Inc. can bring its HPC performance tuning experience to supercharge Windows Server 2016 Lenovo platforms, with ClearPointe managed services for added reliability.

The Results

- 1.6 Million IOPS
80 Read / 20 Write
4k Random
- 27 GB/s throughput
80 Read / 20 Write
32k Random
- Under \$500 per VM
(300 VM at 1C + 2GB)
- Up to 80 Power User
Compute VMs
(4C + 16GB)

As the demand for virtualization and storage continues to advance towards a cloud-consistent Software Defined Data Center (SDDC) architecture, companies need to look for guidance from respected sources with extensive backgrounds. Designing, implementing and managing a cloud-consistent data center is a complex endeavor involving teamwork and partnership.

RAID Inc. has teamed with Lenovo® to provide its high performance computing (HPC) storage and virtualization expertise and performance-tuning with the Lenovo x3650 M5 rack server platform for the release of Storage Spaces Direct (S2D) in Windows Server 2016. The RAID Inc. Ability™ HCI Series powered by Lenovo architecture provides a solid foundation for customers looking to consolidate both storage and compute capabilities on a single hardware platform. This Microsoft certified solution provides outstanding performance, high availability protection and effortless scale-out growth potential to accommodate evolving business needs.

Ability™ HCI Series powered by Lenovo



Your Software Defined Data Center is not an Experiment.

Windows Server 2016 Platform Advancements

Microsoft is unlocking the value of hyperconvergence – from efficiencies in cloud app development and software-defined infrastructure, to solution cost savings across storage and networking investments. Windows Server 2016 brings cloud inspired capabilities to the data center with advances in compute, networking, storage, and security giving you added flexibility to meet changing business requirements.

Windows Server 2016 introduces Windows Server Containers and Hyper-V containers, for “born in the cloud” applications. Nano Server is a new minimal-footprint OS deployment option, which is a more efficient datacenter host and also the perfect lightweight OS for native cloud applications. Some new features unique to Datacenter Edition include an Azure-inspired networking stack, storage enhancements including Shielded VM, Storage replica, and Storage Spaces Direct.

Storage Spaces Direct

The initial Microsoft software-defined storage (SDS) offering in Windows Server 2012 was called “Storage Spaces.” The next iteration of this solution has been introduced in Windows Server 2016 under the name Storage Spaces Direct (S2D), and continues the concept of collecting a virtual pool of multi-node accessible and affordable drives to form a large usable and shareable storage repository. In Windows Server 2016, the architecture expands to encompass support for both SATA and SAS drives, including high-performance NVMe flash devices, that reside internally in the server.

Notable Features

S2D capacity and storage growth:

As demand for storage and/or compute resources grows, additional systems can be scaled into the environment to provide necessary storage expansion.

S2D performance:

Storage — Fast performing NVMe flash acts as a cache repository to the capacity tier, which is placed on traditional SSDs in this tiered storage solution. Data is striped across multiple drives, thus allowing for very fast retrieval from multiple read points.

Networking — Native dual 10 GbE network paths are more than sufficient to support both Windows Server operating system and storage replication traffic. Additional throughput needs can be satisfied by using higher bandwidth adapters for protection against bandwidth saturation.

S2D resilience:

Traditional disk protection relies on hardware storage controllers. In S2D, high availability of the data is achieved using a host bus adapter (HBA) and adopting software resiliency measures provided by Windows Server 2016. Storage can be configured in 3 “spaces”.

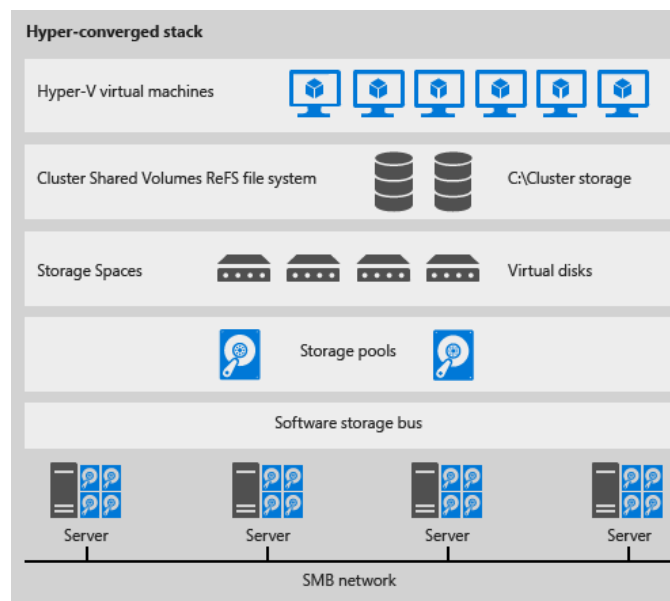
Simple spaces — Stripes data across a set of pool disks. Suitable for high performance workloads where resiliency is either not necessary.

Mirror spaces — Stripes and mirrors data across a set of pool disks. Supports two-way or three-way mirror, which are respectively resilient to single disk, or double disk failures with suitability for the majority of workloads, in both clustered and non-clustered deployments.

Parity spaces — Stripes data across a set of pool disks, with a single disk write block used to store parity information and resilient to a single disk failure. Suitable for large block append-style workloads, such as archiving, in non-clustered deployments.

S2D use cases

The importance of having a SAN in the enterprise space as the high-performance and high-resilience storage platform is changing. S2D is a direct replacement for this role. Whether the primary function of the environment is to provide Windows applications or a Hyper-V virtual machine farm, S2D can be configured as the principal storage provider to these environments. Another use for S2D is as a repository for backup or archival of VHD(X) files. Wherever a shared volume is applicable for use, S2D can be the new solution to support this function.



“By using Storage Spaces, we’re getting storage performance—more than 20 times the IOPS and four times the throughput of our SAN”

– Daniel Weissenborn,
Enterprise Architect, ClearPointe

Lenovo

Power Forward

With the powerful, versatile 2U two-socket System x3650 M5 rack server, you can run even more enterprise workloads, 24/7, and gain faster business insights. Integrated with up to two Intel® Xeon® processors E5-2600 v4 series (up to 44 cores per system), fast TruDDR4 2400MHz Memory, and massive storage capacity, the x3650 M5 fast forwards your business. You can select from an impressive array of storage configurations (up to 28 drive bays) that optimize diverse workloads from Cloud to Big Data.

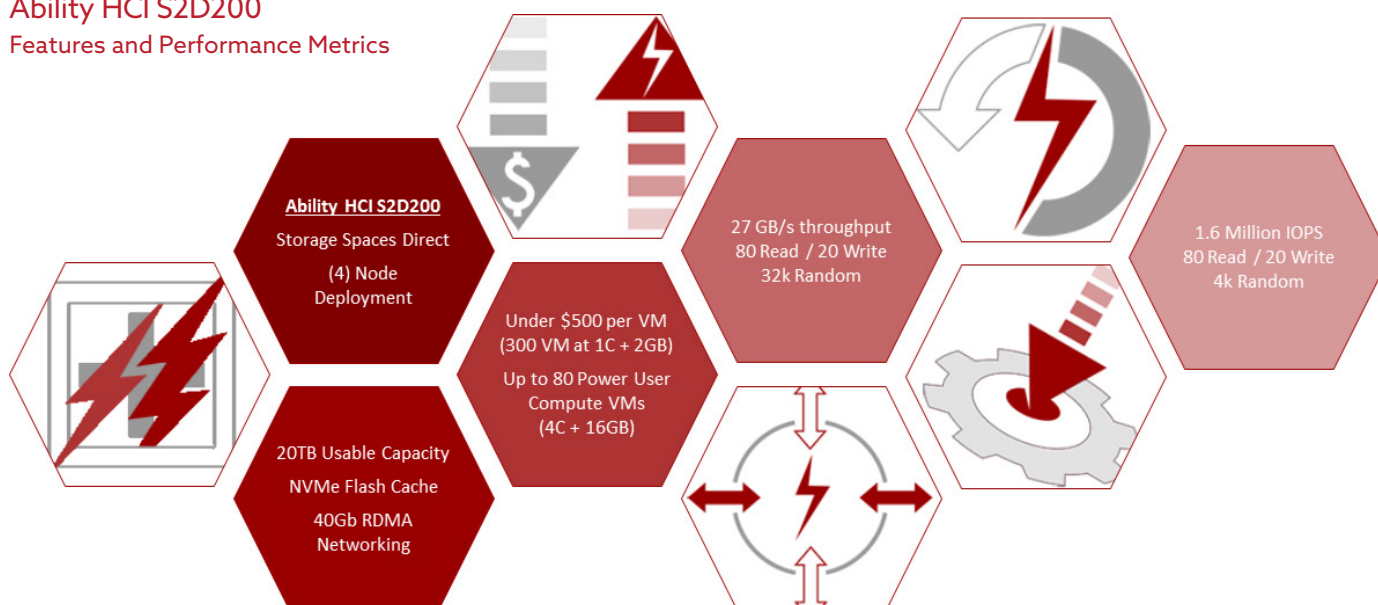
The System x3650 M5 platform incorporates energy-smart features for minimized costs and efficient performance. Dual fan zones support operation in up to 40°C environments. The 80 PLUS Titanium power supply units (PSUs) can deliver 96% efficiency at 50% load. Outstanding memory performance can be achieved by supporting two-RDIMMs-perchannel configurations at speeds up to 12% faster than the Intel specification, while still maintaining worldclass reliability.

Maximum Uptime

Lenovo servers have consistently achieved the highest reliability of all x86 servers in the industry. Predictive failure analysis and the next-generation diagnostic panel facilitate easy serviceability and reduced downtime and costs. Enterprise-class data protection is provided with optional self-encrypting drives, and advanced diagnostic tools facilitate reduced downtime and costs.

Ability HCI S2D200

Features and Performance Metrics



RAID Inc.

Design Experience

As a founding Microsoft partner for Storage Spaces, RAID Inc. designs targeted Windows Server 2016 software-defined storage solutions, in excess of simply providing certified hardware, but as architecting, validating and installing fully managed private and hybrid cloud solutions. Because, your Software Defined Data Center is not an experiment.

With the growing demand for hyperconvergence platforms and software-defined storage, RAID Inc. is making sizeable investments in architecting and fine-tuning Microsoft S2D solutions with the Ability™ HCI Series. By integrating best-of-breed NVMe technologies and RDMA-enabled networking, RAID Inc. leverages its HPC pedigree to supercharge Lenovo-based S2D platforms, built via in-house calibrating and real-world testing.

Performance Tuning

The RAID Inc. Ability HCI Series is powered by Lenovo and managed by ClearPointe to create an Azure Stack inspired Storage Spaces Direct solution. The Ability HCI Series performance-tuned architecture includes both and NVMe and SATA storage to deliver maximum storage IOPS and throughput levels with the added benefit of lessening the cost of the infrastructure hardware. By including a NVMe flash cache (Tier 0) the Ability HCI Series is tuned to excel in running nearly all workload types, including Hyper-V virtualized and enterprise applications, SQL databases, Remote Desktop Services for virtualized desktops, Azure-ready hybrid clouds, and big data analytics, with improved efficiency and scalability.

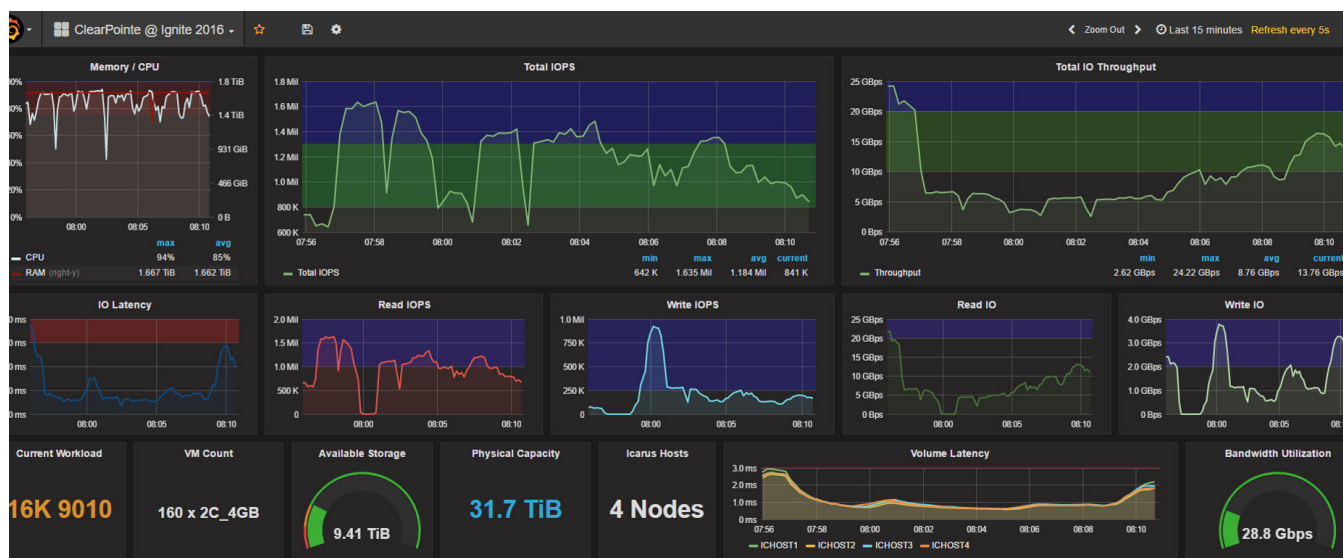
The Ability HCI Series represents a predictable S2D architecture capable of delivering quantifiable and measurable performance workloads and storage and virtualization scalability with hyperconvergence TCO benefits of physical rack consumption, power and cost reductions. RAID Inc. can be your single source for certified Storage Spaces guidance and support based upon best of breed technology using industry leading drop-in tooling and monitoring from ClearPointe.

Ability HCI S2D200	Specifications (per node)
Form Factor/Height	2U Rack
Processor (max)/Cache (max)	Up to two 22-core Intel® Xeon® processors E5-2600 v4 series / Up to 55 MB per processor
Memory (max)	Up to 1.5TB – 2400 MHz – with 64GB TruDDR4 Memory LRDIMMs; system supports RDIMM/LRDIMM
Cache (Tier 0)	Up to (4) internal NVMe flash PCIe cards
Maximum Internal Cache	Up to 12.8TB — based upon (4) 3.2TB NVMe cards
Disk Bays	(24) front SFF 2.5" drive-bays and up to (4) rear SFF 2.5" SSDs
Maximum Internal Storage	Up to 368TB — based upon (24) 15.36TB SATA SSDs
HBA Support	12Gb/s dedicated slot for the first HBA; support for up to four adapters
Power Supply (std/max)	1/2 redundant 550W AC, 750W AC, 900W AC, 1500W AC, 900W DC 80 PLUS® Platinum
Hot-Swap Components	Power supplies, fan modules and (24) SFF 2.5" drive-bays
Network Interface	(4) × 1GbE (std.) and (1) × IMM; optional 10/40GbE ML2 or PCIe adapter; Trusted Platform Module built-in
Expansion Slots	1 – 8 PCIe 3.0 slots (supports up to 4 GPUs and up to 1 x ML2) and 1 dedicated HBA slot
Energy-Efficiency	ENERGY STAR® compliance (model dependent); up to 40°C operating temp; (2) fan zones with up to (6) fans

ClearPointe End-to-end Support

ClearPointe private cloud solutions are deployed with decades of first-hand experience dealing with the complexities and nuances of datacenter technology. ClearPointe has worked closely with Microsoft and RAID Inc. to validate solutions and ensure everything is working at the highest level of compatibility, stability, and efficiency. Hardware and workloads are monitored using industry-leading tools by expert technicians allowing ClearPointe rapid response to issues and proactively engage potential situations 24x7. We believe your private cloud should not be an experiment.

ClearPointe is a single source for the support and remediation of the Ability™ HCI Series powered by Lenovo with the ability to deliver and manage from design through installation and as you scale to match your demand. With technologies changing at exponential rates, decision makers often have to consider timing when deploying technology- deciding on when to implement and when to wait for the next generation of something to arrive. By leveraging these cutting edge technologies, you receive the most value for your investment today, and position your organization to transition to Azure Stack as it becomes available. The management and monitoring tools translate directly into a model that scales into Azure Stack, and therefore Azure, to create a harmonious hybrid ecosystem that can scale and work together across on premise and cloud environments, all while being monitored by ClearPointe.



Summary

Windows Server 2016 introduces Storage Spaces Direct (S2D), which enables building highly available and scalable storage systems with local storage. This step forward in Microsoft Windows Server software-defined storage (SDS) brings simplicity to the deployment and management of SDS systems and introduces new classes of disk devices, such as SATA and NVMe flash devices, that were previously not possible with clustered Storage Spaces with shared disks.

The RAID Inc. Ability™ HCI Series powered by Lenovo for Storage Spaces Direct in Windows Server 2016 can reduce the total cost of ownership of IT infrastructure by condensing and consolidating resources into a performance-tuned, holistic designed and managed, market leading reliable solution. The Lenovo-based Ability™ HCI Series appliances are expected to be available in tandem with the general availability launch of Windows Server 2016 with an aggressive go-to market strategy and S2D hyperconverged appliance solution price point of under \$500 per. Innovators and early adopters are encouraged to work with their RAID Inc. technical computing expert to design a proof of concept Lenovo-based solution, tuned for performance, and ClearPointe health management and monitoring for Azure cloud integrations.



RAID Inc. was founded in 1994 to deliver end-to-end performance-driven technical computing and storage solutions. The company has earned industry praise for providing platform agnostic technical guidance in high performance computing (HPC), big data, cloud and software-defined data centers—in the most efficient, reliable and cost effective manner. The world's leading research facilities, government, life science, financial, healthcare, energy, and cloud service providers can leverage the our team of engineers' extensive academic, research lab and commercial expertise that makes RAID Inc. a trusted industry leader.

More information found at www.RAIDinc.com, call +1 (800)330-7335 or comment via [@RAIDinc](https://twitter.com/RAIDinc).