Intel Select Solution for Windows Server Software-Defined Storage with DataON S2D-5000 Hyper-Converged Cluster Appliances, Intel® Xeon® Scalable Processors with Intel C620 Processors, and Intel Data Center SSDs

DataON with Microsoft and Intel

March 2018

Contents

Abstract

Microsoft released Storage Spaces with Windows Server 2012 as the foundation of a Windows Software-Defined Storage (SDS) stack. Microsoft continued the transition to Software-Defined Data Centers (SDDC) with Window Server 2016 and infrastructures built on SDS, hyper-converged and Azure stack hybrid cloud.

Intel created Intel Select Solutions for data centers to simplify and accelerate the process of selecting and deploying the hardware and software needed for today's workloads and applications. Based on Intel Xeon Scalable processors, Intel Select Solutions enable enterprises to make confident choices in deploying data center infrastructures.

DataON is a storage industry veteran and pioneer of cluster-aware storage, delivering certified Windows-based scale-out file server (SoFS) platforms and Cluster-in-a-Box (CiB) appliances. They have emerged as the industry-leading provider of hyper-converged cluster appliances (HCCAs) and storage systems optimized for Microsoft® Windows Server environments. DataON is exclusively focused on customers who have made the "Microsoft choice" to deploy Windows Sever-based storage solutions.

DataON's new S2D-5000 hyper-converged cluster appliances feature Intel® Xeon® Scalable Processors with Intel C620 Chipsets and NVM Express (NVMe™) to deliver incredible performance and responsiveness, with greater VM density. Able to achieve over 3.2M IOPS in a 4-node cluster, the S2D-5000 family is part of the first Intel Select Solution with Windows Server Software-Defined Storage. It has also been validated for Windows Server Software-Defined, making it the first solution to achieve both Intel and Microsoft certifications.

Quest is a global technology management company that provides disaster recovery and data backup & replication services. It needed a hardware partner to power their Veeam Cloud Connect service for disaster recovery. They chose an Intel Select Solution for Windows Server Software-Defined Storage with a DataON S2D-5000 appliance to power their backup infrastructure.

Customer Background

Overview

Quest is a worldwide leader in technology management that operates a global network of Service Delivery Centers that provide hybrid cloud/managed services/on-site configuration focused on security, disaster recovery, business continuity, data backup and replication. Its twenty-five Service Delivery Centers are located in six nations on three continents.

IT Challenge: Find a hardware partner to power a Veeam Cloud Connect solution to provide the most cost-effective backup storage for Quest customers.

Three years ago, Quest became one of the first managed service providers (MSPs) to offer a Veeam Cloud Connect backup service and today they are a Platinum-level Veeam Cloud and Service Provider.

Quest needed to find a hardware partner to power their Veeam Cloud Connect service for disaster recovery. It had previously deployed traditional SANs from vendors such as NetApp, Pure Storage and Dell/EMC but felt their solutions were too expensive for archival storage use. It had also tried white box solutions but couldn't provide the throughput and high-availability needed.

Quest's goals in their search for a storage partner:

- Cost-effective storage
- High availability
- High IOPS and throughput
- Support for Resilient File System (ReFS) file system
- Support for Veeam Cloud Connect

Quest Customer Story At-a-Glance

Customer	**Quest Technology Management** (http://www.questsys.com) Quest is one of the most established and versatile managed service providers, and a worldwide leader in technology management offering a portfolio of professional, cloud, and managed services. Either onsite or from one of over two dozen secure global service deliver center, Quest offers security disaster recovery, business continuity, data backup and replication.

Products and Workloads	**Hardware**:
	
	• Validated Intel Select Solution for Windows Server Software-Defined Storage
	• Validated Microsoft Windows Server Software-Defined Solution
	• DataON S2D-5208i Hyper-Converged Cluster Appliance (optimized for IOPS & capacity)
	  o 1-Node/2U Rack Server
	  o Intel® Xeon® Scalable Processor with Intel C620 Chipsets
	  o Intel Data Center NVMe SSDs for performance and capacity
	  o Mellanox 40GbE SMB3 RDMA networking
	• DataON DNS-2760 12GB SAS JBOD
	  o 4U/60-Bay Rack
	  o 60x 3.5" SAS/SATA HDDs
	
	Workloads:
	
	• Windows Server 2016
	• Storage Spaces Direct
	• Veeam Cloud Connect Backup for Service Providers

Industry	Information Technology, Cloud & Hosting
Organization Size	51 to 200 employees
Country	United States

Intel Select Solutions

Overview

Intel Select Solutions are workload-optimized data center solutions that simplify and accelerate the process of selecting and deploying the hardware and software needed for today's workloads and applications. Intel Select Solutions:

- Simplify evaluation and eliminate guesswork via tightly specified hardware and software components
- Have pre-defined settings and system-wide tuning, enabling smooth deployment
- Are designed and benchmarked to perform optimally for specific workloads

Based on Intel Xeon Scalable processors, Intel Select Solutions enable enterprises to make confident choices in deploying data center infrastructure. The Intel Select Solution for Windows Server Software-Defined Storage features:

- Intel Xeon Scalable processors with Intel C620 Series chipsets
- All-flash in the capacity tier with Intel 3D NAND SSDs using the NVMe or SATA interface

Intel Select Solutions are rigorously tested and benchmarked at a system-wide level. Well-known third party and industry benchmarking tools that simulate real-world loads are used to identify and eliminate pressure points.

Intel Select Solution for Windows Server Software-Defined Storage

The DataON S2D-5000 family is part of the first Intel Select Solution for Windows Server Software-Defined Storage and the first platform featuring Intel Xeon Scalable processors with Intel C620 Series chipsets to achieve this certification. In addition to the Intel® Xeon® Scalable Processors Family, it also leverages NVM Express (NVMe™) to deliver breakthrough performance and incredible responsiveness, with greater VM density.

- Breakthrough performance and dramatically reduced disk latency with greater IOPS performance (over the previous generation) for write-intensive workloads by leveraging NVMe SSDs for the fast cache tier in Window Server 2016.
- Greater VM density per cluster with Intel® Xeon® Scalable Processors, delivering up to 28 cores per socket, 18 DIMMS per CPU memory density, and 224 physical cores for a 4-node Storage Spaces Direct HCI deployment.
- Highest networking efficiency and throughput with SMB3 RDMA fabric delivering 2x throughput compared to TCP/IP, less than 1µsec latency from VM-to-VM communication, and fewer CPU cycles per I/O with better core utilization.

This Intel Select Solution has also achieved Windows Server 2016 Logo certification and Windows Server Software-Defined program certification. These certifications give customers confidence that this pre-configured and stress-tested solution follows Microsoft's requirements and best practices for a software-defined data center.

Microsoft Windows Server Software-Defined (WSSD)

The S2D-5000 family has also achieved Windows Server Software-Defined program certification. The goal of the Microsoft WSSD program is to ensure that customers have a seamless deployment and steady-state operational experience on validated hardware.

Based on Storage Spaces Direct technology, the WSSD program provides guidance for a Windows Server Software-Defined offering. It enables solution vendors to design and validate hardware, and deploy a Windows Server 2016 software-defined infrastructure in a prescriptive manner that follows Microsoft's requirements and best practices.

Windows Server Software-Defined Storage

Overview

Windows Server 2016 is a cloud-ready operating system that delivers new layers of security and Microsoft Azure-inspired innovation for the applications and infrastructure that power your business. From a storage perspective, Windows Server 2016 includes new features and enhancements for software-defined storage, as well as for traditional file servers.

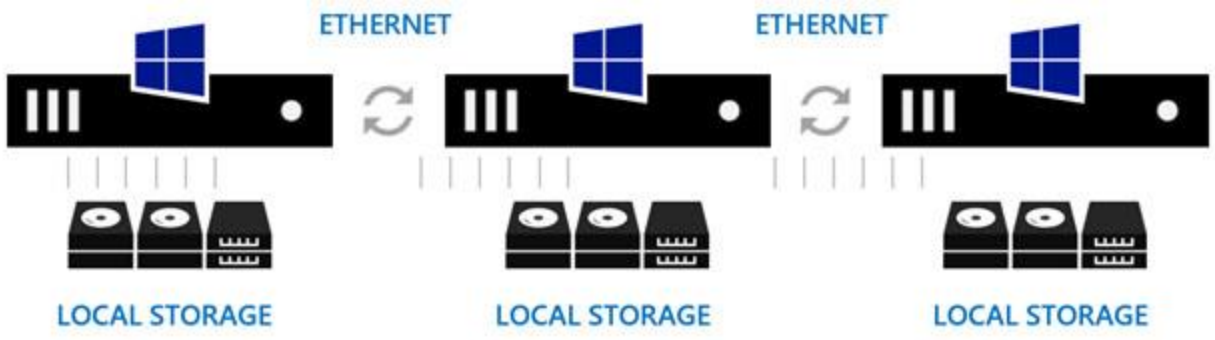
Storage Spaces Direct enables building highly available and scalable storage using servers with local storage, such as DataON S2D-5000 appliances. It simplifies the deployment and management of software-defined storage systems and unlocks use of new classes of disk devices, such as SATA SSD and NVMe disk devices.

Health Service improves the day-to-day monitoring, operations, and maintenance experience of cluster resources on a Storage Spaces Direct cluster.

Storage Spaces Direct

Overview

Storage Spaces Direct is a new feature in Windows Server 2016. It uses servers with locally-attached drives (such as DataON S2D-5000 appliances) to create highly available, highly scalable software-defined storage at a fraction of the cost of traditional SAN or NAS arrays.



- Storage Spaces utilizes NVMe storage devices for better performance and efficiency. These devices greatly reduce the I/O latency for storage, as well as reduce the CPU utilization to server storage.
- You can also use SATA storage devices to lower the cost of storage.
- In a DataON hyper-converged system, storage uses RDMA over Converged Ethernet (RoCE) as the storage fabric instead of having a shared physical storage fabric behind the servers.
- Storage Spaces Direct is included in Windows Server 2016 Datacenter edition.

Hardware

The most common configuration is 2-tiered physical storage, combining SSDs with traditional hard drives. You can also have an all-flash configuration with NVMe SSDs plus traditional SSDs where the NVMe SSDs are used for cache and the SATA SSDs are used for capacity.

In a 3-tiered physical storage configuration, NVMe SSDs are used for caching and both SATA SSDs and HDDs are used for additional tiering in the system. The SATA HDDs can be used to store the coldest data.

A traditional 10GbE or better Ethernet network can be used to connect servers/storage via RDMA. RDMA provides significant advantages because it lowers the latency of the storage I/O in the system and reduces the CPU utilization, resulting in higher IOPS performance in the system.

Feature Highlights

Built-in Always-on Cache – Storage Spaces Direct takes the fastest devices in the system and uses them as a write cache so the applications can continue immediately after writing data. It also acts as a read cache for the most frequently read data from slower devices, for faster workloads. The cache automatically configures itself when you enable Storage Spaces Direct.

Single Pool of Storage – Storage Spaces Direct automatically groups the available storage devices into a single storage pool, eliminating the need for manual configuration or setting up multiple storage pools.

Scale from 2 to 16 nodes – Typically deployments consist of 2, 4, 8, 12 or 16 nodes.

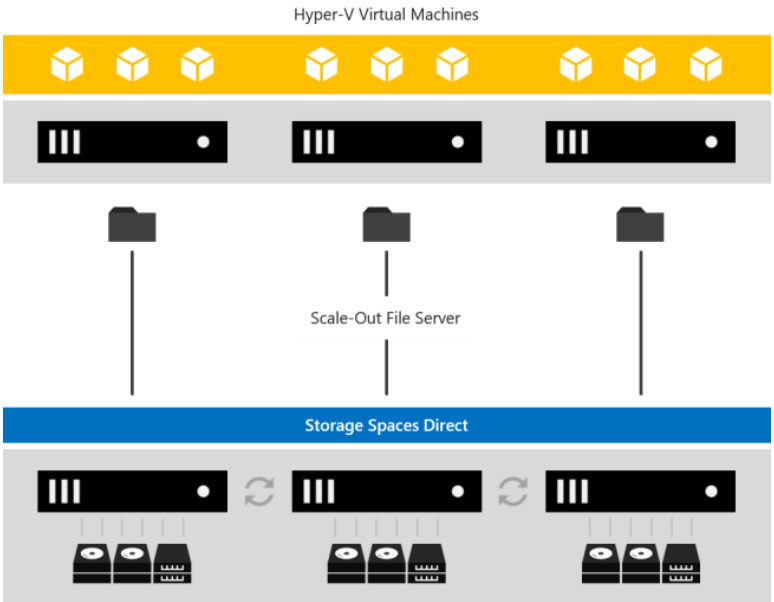
Scales to 400+ drives – These servers can accommodate 26 drives per server, for a total of 416 drives. This provides petabytes of storage capacity in a fully scaled system.

Accelerated Erasure Coding – Storage Spaces Direct uses erasure coding for parity calculation in smaller deployments for the best possible efficiency and resiliency for two simultaneous failures. With larger clusters, storage efficiency is increased as there can be more data symbols without increasing the number of parity symbols. Developed in collaboration with Azure, erasure coding is a very efficient way to store data, driving storage efficiency of 50% or higher, compared to 33% for mirroring.

Deployment Options

Storage Spaces Direct is designed for two deployment options:

Converged – In this deployment option, storage and compute resources are in separate clusters. It layers a scale-out file server (SoFS) atop Storage Spaces Direct to provide network-attached storage over SMB3 file share. 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 server providers and enterprises



Hyper-Converged – This deployment option has one cluster for both compute and storage (such as DataON S2D appliances), and runs Hyper-V or SQL Server databases directly on the servers providing 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 business or remote office/brand office deployments. SQL Server runs natively on Storage Spaces Direct, providing outstanding IOPS and throughput for SQL database operations.

Storage Health Services Integration

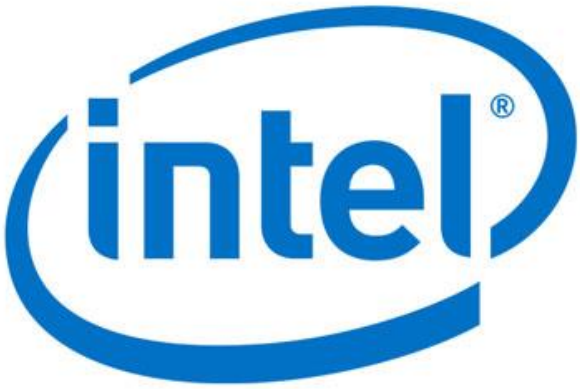
Microsoft believes that partners such as DataON are best positioned to deliver an end-to-end solution user experience for customers. Customers have many different deployment models and use different kinds of hardware so Microsoft provides partners an API foundation to build monitoring and management experiences.

There are two major components of the Microsoft Health Services API:

- **Alerts** – An event-driven model that identifies and surfaces hardware and software problems.
- **Metrics** – Hooks into the core stack in Windows to gather, synchronize, and aggregate statistics.

DataON's exclusive MUST tool is the first to market that leverages the Health Services API to provide visibility, monitoring, and management for Windows Storage deployments.

Intel Technologies for Windows Server 2016



Intel Data Center Blocks for Cloud and Microsoft Windows Server 2016

Intel Server Systems are engineered from the CPU out to help meet a wide range of business needs, from virtualization deployments to high-performance computing (HPC) infrastructure. Each design is built to a high specification, delivering server products with maximum processing power, great flexibility, excellent manageability, and high reliability. Stringent design and manufacturing practices, rigorous validation and testing, and excellent warranty and technical support ensure you receive incredible value.

The Intel® Data Center Blocks for Cloud (Intel® DCB for Cloud) and Microsoft Windows Server 2016 include both single node and multi-node server systems. Server systems within this product family were specifically created to offer Intel customers with pre-configured systems that are Microsoft Windows Server 2016 certified. Intel has extensively tested these systems to ensure best operation and reliability with the Microsoft Windows operating environment.

Intel® Xeon® Scalable Processors with Intel C620 Chipsets

Intel Xeon Scalable Processors with Intel C620 Chipsets, formerly Purley (Skylake-SP and Lewisburg), provides the foundation for a powerful data center platform. Disruptive by design, this innovative processor sets a new level of platform convergence and capabilities across

compute, storage, memory, network, and security. Enterprises and cloud and communications service providers can now drive forward their most ambitious digital initiatives with a feature-rich, highly versatile, and more secure platform.

Enabling Greater Efficiencies and Lower TCO – Systems built on the Intel Xeon Scalable platform are design to deliver agile services and reduce TCO up to 65 percent due to lower software and OS licensing fees, and acquisition, maintenance, and infrastructure costs.

Supports More VMs – Intel Xeon Scalable platform enables 4.2x more VMs per server compared to earlier generations, allowing IT to increase their consolidation of more services on less hardware.

Pervasive, Breakthrough Performance – From its new Intel Mesh Architecture and widely expanded resources to its hardware-accelerating and newly integrated technologies, the Intel Xeon Scalable platform enables a new level of consistent, pervasive, and breakthrough performance.

Higher-Per-Core Performance – Up to 28 cores, delivering high performance and scalability for compute-intensive workloads across compute, storage, and network usages.

Greater Memory Bandwidth/Capacity – 50 percent increased memory bandwidth and capacity. Xix memory channels versus four memory channels of previous generation for memory-intensive workloads.

Expanded I/O: 48 lanes of PCIe 3.0 bandwidth and throughput for demanding I/O-intensive workloads.

Integrated Intel Ethernet with iWARP RDMA – Provides up to four 10GbE ports for high data throughput and low-latency workloads. Ideal for software-defined storage solutions, NVM Express over Fabric solutions, and virtual machine migration. Integrated in the chipset.

Support for Intel Optane™ SSDs and Intel 3D NAND Solid State Drives – Delivers industry-leading combination of high throughput, low latency, high QoS, and ultra-high endurance to break through data access bottlenecks.

Deploy next generation storage with confidence with Intel Volume Management Devices (Intel VMD) – Enables hot swapping of NVMe SSDs from the PCIe bus without shutting down the system. Brings enterprise reliability, availability, and serviceability (RAS) features to NVMe SSDs, enabling deployment of next-generation storage with confidence.

Intel® Solid State Drive Data Center Family

Intel® SSD Data Center family of drives and PCIe storage devices offer full end-to-end data protection, consistent performance with low latencies, high write endurance, and scalability for growing storage needs while helping enterprises and clouds to tackle today's bigger storage challenges. Intel PCIe-based SSDs offer incredible performance and enhanced capabilities, with advanced capacity and performance coming in future Intel® Optane™ SSDs based on 3D XPoint™ Technology.

Intel SSD DC P4600 Series

Pairing a new Intel developed controller, unique firmware innovations, and industry-leading 3D NAND density, the Intel® 3D NAND SSD Data Center P4600 Series delivers an all new design to support the data caching needs of cloud storage and software-defined infrastructures. The Intel® SSD DC P4600 Series is stacked with a combination of performance, capacity, manageability, and reliability to help data centers fast-track their business and meet the overall demands of their digital business.

Optimized for cloud storage architectures – Significantly increases server agility and utilization, while also accelerating applications, across a wide range of cloud workloads.

Optimized for caching across a range of workloads – With the DC P4600, data centers can accelerate caching to enable more users, add more services, and perform more workload per server. Now you can cache faster and respond faster.

Manageability to maximize IT efficiency – New firmware manageability feature help reduce server downtime through improved update processes and expanded monitoring capabilities.

Industry-leading reliability and security – Built-in end-to-end protection, including protection from silent data corruption which can cause catastrophic downtime and errors in major businesses.

Designed for today's modern data centers – Features Intel's new 3D NAND SSD technology for mixed workloads that make it ideal for data caching in software-defined and converged infrastructures.

Intel SSD DC P4600 Series

Intel SSD DC S4500 Series

Protect your data center investment by replacing legacy HDDs with Intel SSD DC S4500 Series. The 2nd Gen Intel 3D NAND SSD family feature a new Intel-developed SATA controller, innovative SATA firmware, and the industry's highest density 3D NAND. Highly reliable, these storage-inspired SSDs enable data centers to reduce costs, increase efficiency, and minimize service disruptions.

Reduce power and cooling – 3.2x more energy efficient

Do more per server – 209x more IOPS/TB

Fewer drive replacements – 3.2x more reliable

Wide range of capacities – 240GB to 4TB

Industry-leading memory media – 2nd Gen Intel 3D NAND SSD family, featuring TLC 3D NAND

Intel SSD DC S4500 Series

Mellanox RDMA over Converged Ethernet (RoCE) Solutions for Windows Server 2016

Low Latency 10/25/40/50/100 Gigabit Ethernet End-to-End Solutions

Mellanox offers complete 10/25/40/50GbE solutions for Windows Server 2016 data centers with end-to-end RoCE support. These end-to-end solutions deliver high bandwidth and low latency to I/O intensive applications and fast flash storage, enabling data centers to operate with high performance and efficiency. By supporting speeds from 10GbE to 100GbE, Mellanox Spectrum switches and ConnectX-4 network adapter cards give IT managers flexibility in how they deploy higher bandwidth to the servers, providing simple upgrade paths from 10GbE to 40GbE, or to 25/100GbE.

10/25/40/50/100 Gigabit Ethernet Switching

The Spectrum SN2700 switch leverages Mellanox's most advanced switching architecture to deliver up to 2Tb/s of switching in a single 1U enclosure. The 32 QSFP ports can be configured to be used as 10/25/40/50/100GbE connections. The SN2700 supports thirty-two 40/100GbE ports, up to sixty-four 10/25GbE ports, up to thirty-two 50GbE ports, up any combination, providing flexibility for network installations. The high bandwidth is delivered with port-to-port latency as low as 300ns for improved application response time.

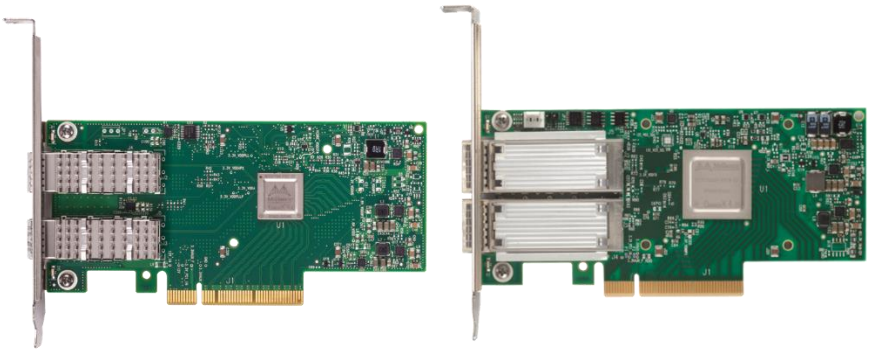
Mellanox Spectrum SN2700 10/25/40/50/100GbE Switch

The non-blocking SN2700 switches deliver the most predictable network performance at the line rate with very little variation at any packet size and I/O pattern. Combined with zero packet loss and a dynamically shared buffer mechanism, the SN2700 switch is an ideal switch for bursty and latency-sensitive storage traffic, especially NVMe SSDs.

Besides the SN2700, the Spectrum switch family also include the SN2410 (1RU, 48 10/25G ports with 8 40/100G uplink ports) and the SN2100 (half-width, 1RU, 16 10/25/40/50/100G ports). The compact design of the SN2100 switches make them ideal for high-density rack designs - Two half-width SN2100 switches side-by-side in 1RU space, with typical power consumption of <94 watts each, provide high availability in the TOR and deliver great savings in both CAPEX and OPEX.

10/25/40/50/100 Gigabit Ethernet Adapter Cards

ConnectX-4 10/25/40/50/100 Gigabit Ethernet adapters provide exceptional high performance for the most demanding data applications. ConnectX-4 adapters support RoCE specifications delivering low-latency and high-performance over Ethernet networks. Leveraging data center bridging (DCB) capabilities as well as advanced congestion control hardware mechanisms, ConnectX-4 RoCE provides efficient low-latency RDMA services over Layer 2 and Layer 3 networks. In addition to RoCE offload, ConnectX-4 adapters implement a rich set of features, from network function offload (e.g., LSO/LRO/RSS/TSS), SR-IOV support for I/O virtualization and Accelerated Switching and Packet Processing (ASAP^2) technology to perform OVS data plane and VTEP functions.



Mellanox ConnectX-4 10/25/40/50/100GbE Adapters

With RDMA/RoCE offload in the ConnectX-4 adapters and predictable high performance by the Spectrum switches, the Mellanox Ethernet solution accelerates Microsoft Storage Spaces Direct, unleashes the power of faster storage devices such as NVMe SSDs, and greatly improves server CPU and application efficiency.

DataON: The Certified Microsoft Platform

The DataON Difference

DataON is exclusively focused on customers who have made the "Microsoft choice" to deploy a Windows Server-based storage solution. Our team of Microsoft Server experts know how to design, deploy and support Windows Server storage and will work with you to performance tune your workloads. DataON storage solutions are:

- Certified for Windows Server 2012 R2, 2016 SDDC and Windows Server Software-Defined
- Customer-proven with over 600 enterprise installations and 120PB of DataON S2D storage deployments
- Optimized by our team of Microsoft experts to ensure successful deployments into your IT environment, tuned to your workloads

DataON S2D-5000 Hyper-Converged Cluster Appliances (HCCAs)

The DataON S2D-5000 HCCAs are built to optimize the full stack of Microsoft Storage Spaces Direct in a hyper-converged platform. They are built with integrated compute, network and storage infrastructure with near-linear scalability to simplify and maximize the deployment of Microsoft applications, virtualization, data protection and hybrid cloud services. Each pre-configured cluster can support 40 Hyper-V VMs per node, for expanded capacity and operational flexibility.

From scale-out file server (SoFS) and software storage bus to storage and networking hardware, this appliance runs on the cluster Shared Volumes Resilient File System (ReFS) and uses high performance NVMe SSDs with SMB3 networking to maximize performance and capacity.

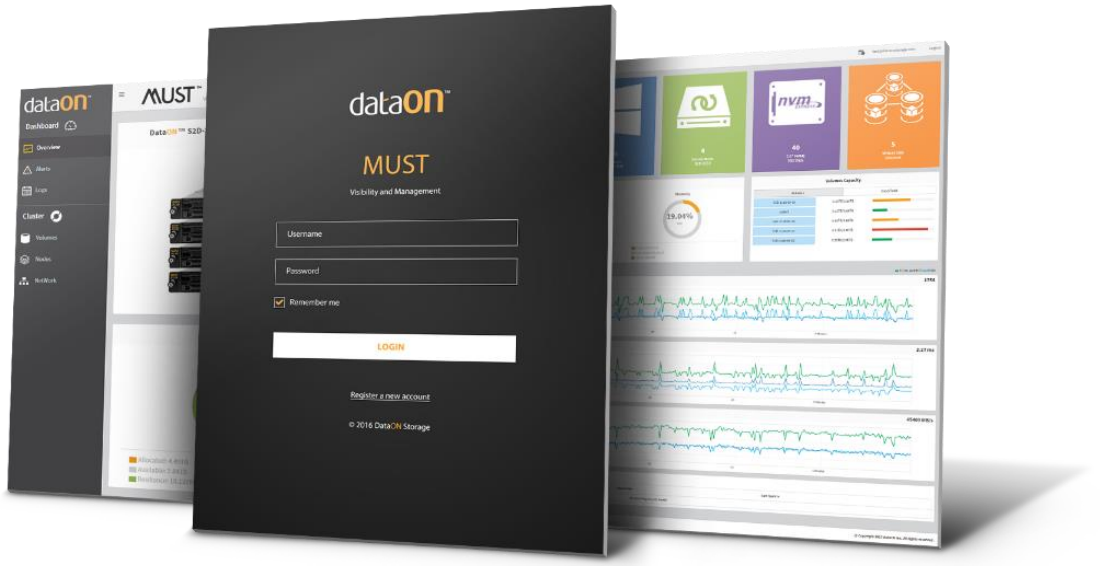
DataON S2D-5208i Hyper-Converged Cluster Appliance

The DataON S2D-5208i is an Intel-based server system that provides scale-out and scale-up infrastructure and management services for deploying Microsoft Windows Server 2016. It features Intel Xeon Scalable Processors with Intel C620 Chipsets and NVMe SSDs. It is optimized for balanced IOPS and capacity for the delivery of core Microsoft services and enterprise applications. The S2D-5208i is design on three core principles:

- Scale-out hyper-converged cluster
- Integrated software-defined services
- Complete visibility and management of the storage infrastructure via DataON's exclusive MUST infrastructure and management software tool

DataON MUST™ (Management Utility Software Tool) Visibility and Management Tool

The DataON S2D and CiB storage solutions are integrated with the exclusive DataON MUST visibility and management tool. It provides infrastructure visibility and management for Microsoft's new suite of software-defined storage stack technologies like Storage Spaces Direct, Storage Replica, and storage quality of service (QoS) which, based on your policy, monitors hardware and software storage infrastructure to identify potential problems. Using an event-driven model for rapid detection with minimal overhead, MUST also provides on-demand access to curated collections of hyper-converged and converged clusters, storage performance, and capacity metrics. The MUST dashboard display is designed to efficiently and dynamically connect the dots to help provide root cause analysis.



MUST offers complete integration with Microsoft Storage Health Services for Windows Server 2016. It is built to provide multiple tiers of storage visibility and monitoring.

SDDC & Hyper-Converged Infrastructure Tier – Provides system-level information on performance, capacity, and hardware inventory, as well as faults and alerts. MUST gives you a dashboard-level view of your operations, analytics, infrastructure health management, storage systems metrics and even event logging insights.

Systems and Storage Services Audit Log Tier – Provides detailed logging-level visibility for events, so you can perform root cause analysis and export source data for analytics.

Hyper-Converged Cluster Appliance (HCCA)/Node Tier – Displays pool, volume and device-level performance, health and operational analytics for your cluster. This enables you to proactively perform systems maintenance and better understand your requirements for workload migrations.

SAN-like Call Home Service Support – Leveraging the Health Services Faults in Windows Server 2016, administrators can have automated email alerts sent to key contacts. You can also leverage third party SNMP monitoring traps to alert you when you need disk or hardware replacements.

Deploying a Windows Server 2016 Software-Defined Storage Solution with Quest.

Finding the Solution

Quest had previously deployed DataON storage solutions, which led them to explore a DataON solution with Windows Server 2016. Windows Server 2016 provides good IOPS performance and would allow Quest to put their backup infrastructure on a Storage Spaces Direct hyper-converged infrastructure.

Windows Server 2016 features the Resilient File System (ReFS) file system, which is designed for high resiliency, performance and scalability. Veeam provides advanced integration with ReFS that supports ReFS volumes on internal, direct-attach storage and Storage Spaces Direct. This provides significantly faster full backup creation and transformation performance, as well as reduce storage requirements and improve reliability.

Quest found Storage Spaces Direct and DataON to be a very flexible solution. Not only could it serve as a disaster recovery and backup repository but it could also serve as compute nodes for their main infrastructure or whatever backup infrastructure they use.

Flexibility and customization is at the core of Quest's values. It is a business that wants to help their customers, and works with its customers to identify their IT needs and build a solution that meets those needs.

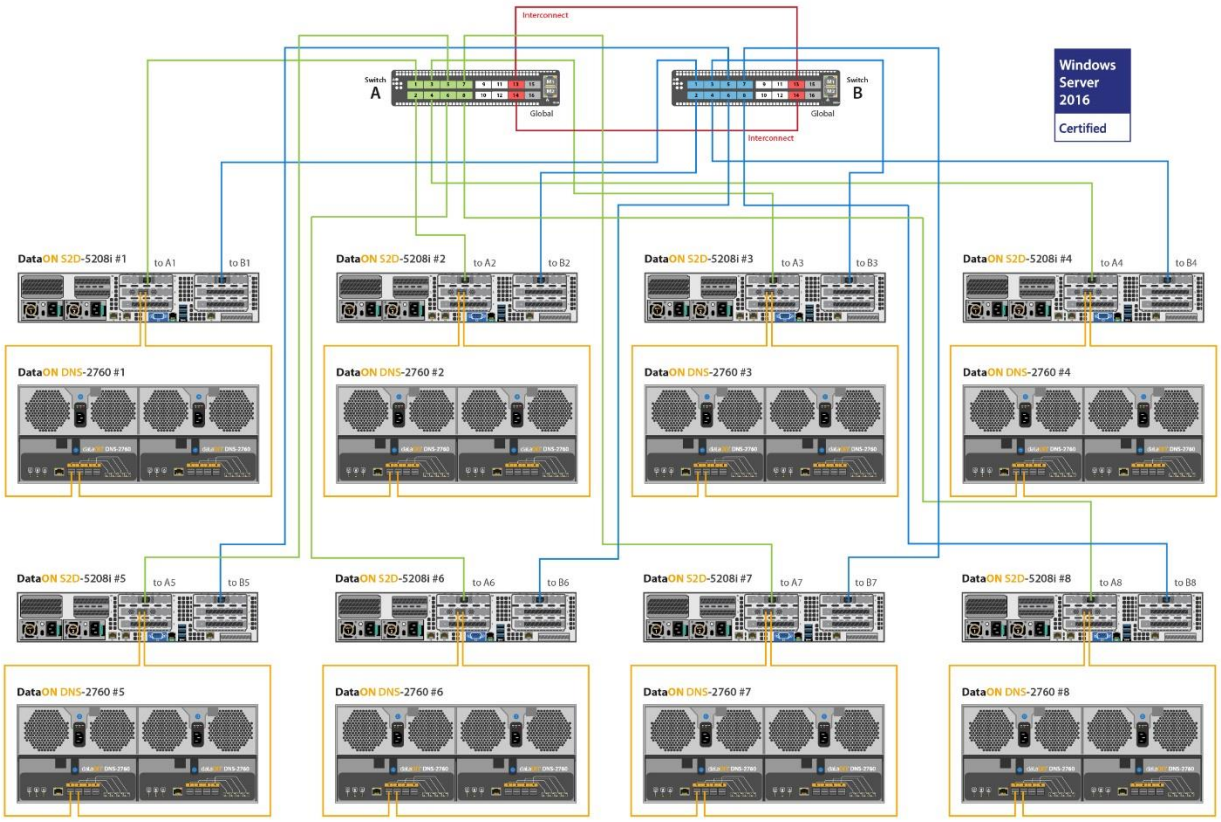
"DataON worked closely with Quest to find the right solution – by talking with us, sharing information, building a solution, and doing the testing and validation," said Lewis Walker, Manager of Systems infrastructure Engineering, Quest.

DataON proposed their S2D-5208i converged cluster appliance with Intel Xeon processors for optimized performance, density and capacity. The S2D-5208u is hybrid solution that can achieve

over 3.2M IOPS in a 4-node cluster. It combines high performance NVMe SSDs with SMB3 networking to maximize performance and capacity.

Paired with the S2D-5208i were DataON DNS-2760 JBODs, which include 3.5" HGST Ultrastar He10 SAS HDDs. These drives are housed in a 4U, 60-bay enclosure. Pre-configured with the S2D-5208i is DataON's exclusive MUST (Management Utility Software Tool) visibility and management software which provides SAN-like storage monitoring features for customers deploying Windows Server software-defined solutions.

"The price for the DataON solution was about half of what the other vendors offered," said Walker. "This meant that we could offer a better price point to our customers. No other Veeam Cloud Connect Partner offers this service at our price point."



Benchmarks and Results

Quest now has two DataON and Windows Server 2016 Storage Spaces Direct deployments in production today. They both run Veeam Cloud Connect and SQL Server – all on a Storage Spaces Direct converged infrastructure.

The new solution not only improved backup times with high IOPS performance but also provided flexibility that they couldn't get with traditional storage. If Quest is close to reaching their maximum storage capacity, it's easy to expand by adding more drives to their JBODs. Also, the DataON solution can expanded up to 16 nodes. By adding nodes, this increases the usable capacity from 60% to 80%. This flexibility adds a cost savings that can't be calculated.

As far as the cost savings that can be calculated, Quest estimates that they were able to get a 50-80% cost-per-TB savings by moving to Windows Server 2016 Storage Spaces Direct from a traditional SAN.

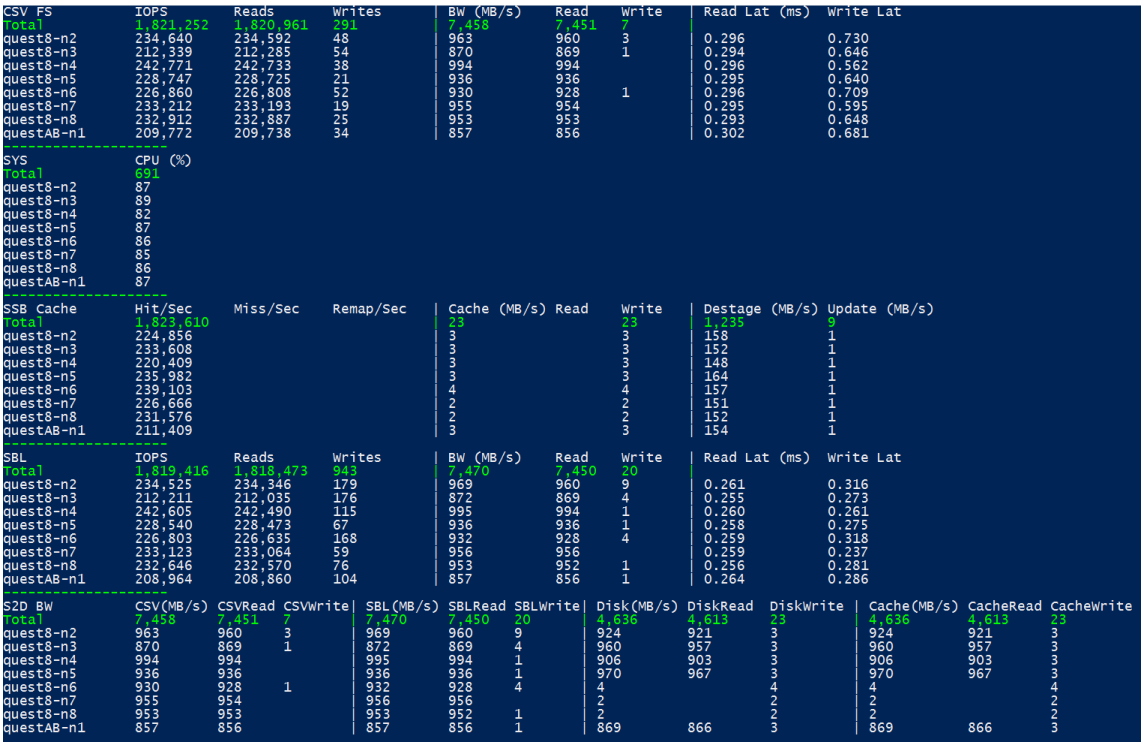
"Because of DataON, Quest is able to disrupt the market with lower price point solutions while still providing customized solutions that meet customers' needs," said Walker.

3-Way-Mirror

VM Fleet testing (20 virtual machines per node)

Random Reads and Writes

Block size 4Kb, 8 threads, 8 outstanding I/O (0% write / 100% read)



CSV FS	IOPS	Reads	Writes	BW (MB/s)	Read	Write	Read Lat (ms)	Write Lat
Total	1,821,252	1,820,961	291	7,458	7,451	7		
quest8-n2	234,640	234,592	48	963	960	3	0.296	0.730
quest8-n3	212,339	212,285	54	870	869	1	0.294	0.646
quest8-n4	242,771	242,733	38	994	994		0.296	0.562
quest8-n5	228,747	228,725	21	936	936		0.295	0.640
quest8-n6	226,860	226,808	52	930	928	1	0.296	0.709
quest8-n7	233,212	233,193	19	955	954		0.295	0.595
quest8-n8	232,912	232,887	25	953	953		0.293	0.648
questAB-n1	209,772	209,738	34	857	856		0.302	0.681

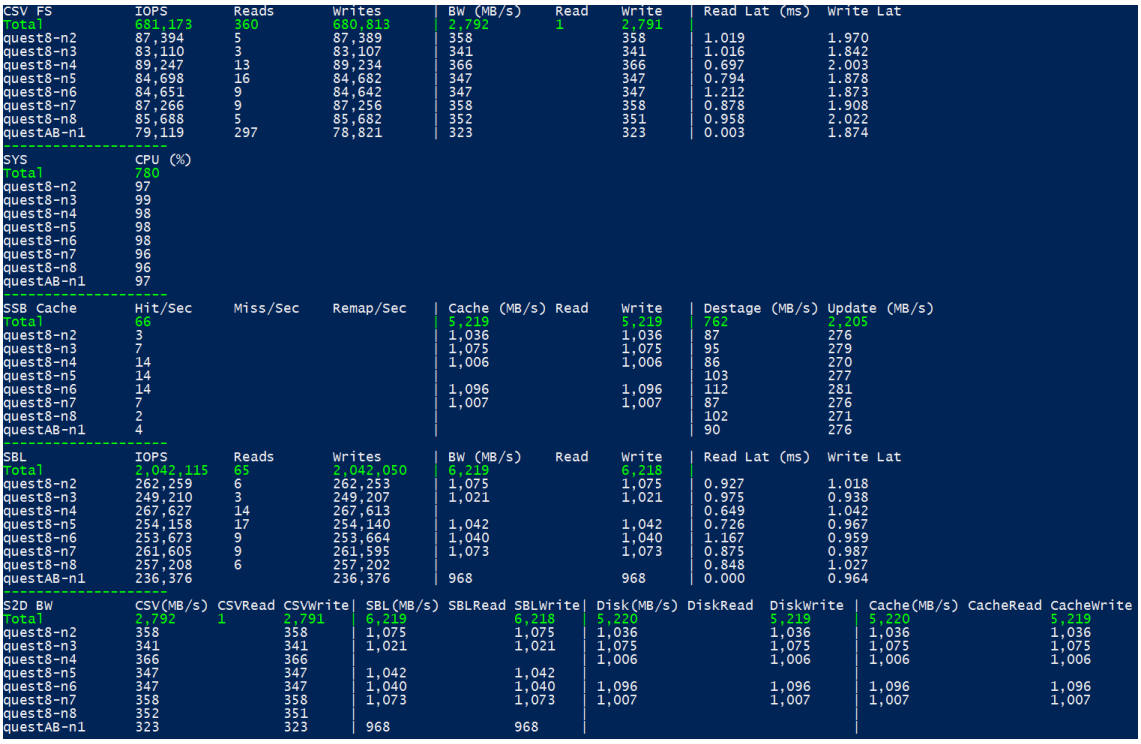
SYS	CPU (%)
Total	691
quest8-n2	87
quest8-n3	89
quest8-n4	82
quest8-n5	87
quest8-n6	86
quest8-n7	85
quest8-n8	86
questAB-n1	87

SSB Cache	Hit/Sec	Miss/Sec	Remap/Sec	Cache (MB/s) Read	Write	Destage (MB/s)	Update (MB/s)
Total	1,823,610			23	23	1,235	9
quest8-n2	224,856			3	3	158	1
quest8-n3	233,608			3	3	152	1
quest8-n4	220,409			3	3	148	1
quest8-n5	235,982			3	3	164	1
quest8-n6	239,103			4	4	157	1
quest8-n7	226,666			2	2	151	1
quest8-n8	231,576			2	2	152	1
questAB-n1	211,409			3	3	154	1

SBL	IOPS	Reads	Writes	BW (MB/s)	Read	Write	Read Lat (ms)	Write Lat
Total	1,819,416	1,818,473	943	7,470	7,450	20		
quest8-n2	234,525	234,346	179	969	960	9	0.261	0.316
quest8-n3	212,211	212,035	176	872	869	4	0.255	0.273
quest8-n4	242,605	242,490	115	995	994	1	0.260	0.261
quest8-n5	228,540	228,473	67	936	936	1	0.258	0.275
quest8-n6	226,803	226,635	168	932	928	4	0.259	0.318
quest8-n7	233,123	233,064	59	956	956		0.259	0.237
quest8-n8	232,646	232,570	76	953	952	1	0.256	0.281
questAB-n1	208,964	208,860	104	857	856	1	0.264	0.286

S2D BW	CSV(MB/s)	CSVRead	CSVWrite	SBL(MB/s)	SBLRead	SBLWrite	Disk(MB/s)	DiskRead	DiskWrite	Cache(MB/s)	CacheRead	CacheWrite
Total	7,458	7,451	7	7,470	7,450	20	4,636	4,613	23	4,636	4,613	23
quest8-n2	963	960	3	969	960	9	924	921	3	924	921	3
quest8-n3	870	869	1	872	869	4	960	957	3	960	957	3
quest8-n4	994	994		995	994	1	906	903	3	906	903	3
quest8-n5	936	936		936	936	1	970	967	3	970	967	3
quest8-n6	930	928	1	932	928	4	4		4	4		4
quest8-n7	955	954		956	956		2		2	2		2
quest8-n8	953	953		953	952	1	2		2	2		2
questAB-n1	857	856		857	856	1	869	866	3	869	866	3

Block size 4Kb, 8 threads, 8 outstanding I/O (100% write / 0% read)



CSV FS	IOPS	Reads	Writes	BW (MB/s)	Read	Write	Read Lat (ms)	Write Lat
Total	681,173	360	680,813	2,792	1	2,791		
quest8-n2	87,394	5	87,389	358		358	1.019	1.970
quest8-n3	83,110	3	83,107	341		341	1.016	1.842
quest8-n4	89,247	13	89,234	366		366	0.697	2.003
quest8-n5	84,698	16	84,682	347		347	0.794	1.878
quest8-n6	84,651	9	84,642	347		347	1.212	1.873
quest8-n7	87,266	9	87,256	358		358	0.878	1.908
quest8-n8	85,688	5	85,682	352		351	0.958	2.022
questAB-n1	79,119	297	78,821	323		323	0.003	1.874

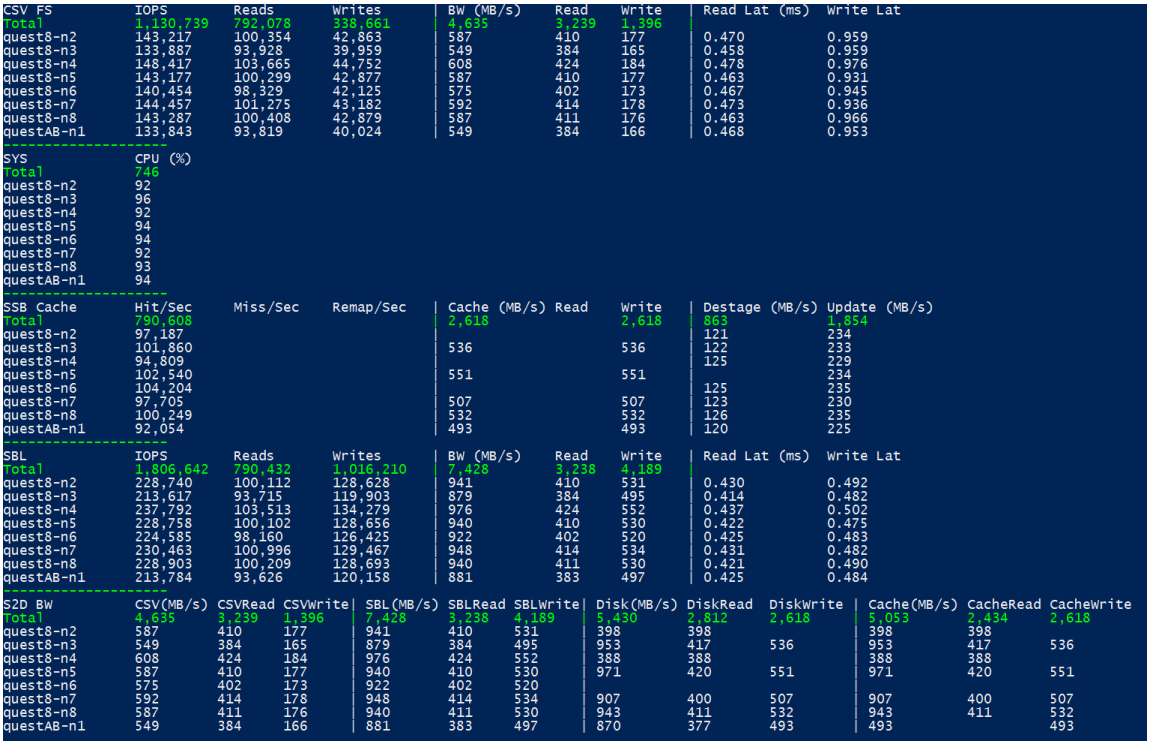
SYS	CPU (%)
Total	780
quest8-n2	97
quest8-n3	99
quest8-n4	98
quest8-n5	98
quest8-n6	98
quest8-n7	96
quest8-n8	96
questAB-n1	97

SSB Cache	Hit/Sec	Miss/Sec	Remap/Sec	Cache (MB/s)	Read	Write	Destage (MB/s)	Update (MB/s)
Total	66			5,219		5,219	762	2,205
quest8-n2	3			1,036		1,036	87	276
quest8-n3	7			1,075		1,075	95	279
quest8-n4	14			1,006		1,006	86	270
quest8-n5	14						103	277
quest8-n6	14			1,096		1,096	112	281
quest8-n7	7			1,007		1,007	87	276
quest8-n8	2						102	271
questAB-n1	4						90	276

SBL	IOPS	Reads	Writes	BW (MB/s)	Read	Write	Read Lat (ms)	Write Lat
Total	2,042,115	65	2,042,050	6,219		6,218		
quest8-n2	262,259	6	262,253	1,075		1,075	0.927	1.018
quest8-n3	249,210	3	249,207	1,021		1,021	0.975	0.938
quest8-n4	267,627	14	267,613				0.649	1.042
quest8-n5	254,158	17	254,140	1,042		1,042	0.726	0.967
quest8-n6	253,673	9	253,664	1,040		1,040	1.167	0.959
quest8-n7	261,605	9	261,595	1,073		1,073	0.875	0.987
quest8-n8	257,208	6	257,202				0.848	1.027
questAB-n1	236,376		236,376	968		968	0.000	0.964

S2D BW	CSV(MB/s)	CSVRead	CSVWrite	SBL(MB/s)	SBLRead	SBLWrite	Disk(MB/s)	DiskRead	DiskWrite	Cache(MB/s)	CacheRead	CacheWrite
Total	2,792	1	2,791	6,219		6,218	5,220		5,219	5,220		5,219
quest8-n2	358		358	1,075		1,075	1,036		1,036	1,036		1,036
quest8-n3	341		341	1,021		1,021	1,075		1,075	1,075		1,075
quest8-n4	366		366				1,006		1,006	1,006		1,006
quest8-n5	347		347	1,042		1,042						
quest8-n6	347		347	1,040		1,040	1,096		1,096	1,096		1,096
quest8-n7	358		358	1,073		1,073	1,007		1,007	1,007		1,007
quest8-n8	352		351									
questAB-n1	323		323	968		968						

Block size 4Kb, 8 threads, 8 outstanding I/O (30% write / 70% read)



CSV FS	IOPS	Reads	Writes	BW (MB/s)	Read	Write	Read Lat (ms)	Write Lat
Total	1,130,739	792,078	338,661	4,635	3,239	1,396		
quest8-n2	143,217	100,354	42,863	587	410	177	0.470	0.959
quest8-n3	133,887	93,928	39,959	549	384	165	0.458	0.959
quest8-n4	148,417	103,665	44,752	608	424	184	0.478	0.976
quest8-n5	143,177	100,299	42,877	587	410	177	0.463	0.931
quest8-n6	140,454	98,329	42,125	575	402	173	0.467	0.945
quest8-n7	144,457	101,275	43,182	592	414	178	0.473	0.936
quest8-n8	143,287	100,408	42,879	587	411	176	0.463	0.966
questAB-n1	133,843	93,819	40,024	549	384	166	0.468	0.953

SYS	CPU (%)
Total	746
quest8-n2	92
quest8-n3	96
quest8-n4	92
quest8-n5	94
quest8-n6	94
quest8-n7	92
quest8-n8	93
questAB-n1	94

SSB Cache	Hit/Sec	Miss/Sec	Remap/Sec	Cache (MB/s)	Read	Write	Destage (MB/s)	Update (MB/s)
Total	790,608			2,618		2,618	863	1,854
quest8-n2	97,187						121	234
quest8-n3	101,860			536		536	122	233
quest8-n4	94,809						125	229
quest8-n5	102,540			551		551		234
quest8-n6	104,204						125	235
quest8-n7	97,705			507		507	123	230
quest8-n8	100,249			532		532	126	235
questAB-n1	92,054			493		493	120	225

SBL	IOPS	Reads	Writes	BW (MB/s)	Read	Write	Read Lat (ms)	Write Lat
Total	1,806,642	790,432	1,016,210	7,428	3,238	4,189		
quest8-n2	228,740	100,112	128,628	941	410	531	0.430	0.492
quest8-n3	213,617	93,715	119,903	879	384	495	0.414	0.482
quest8-n4	237,792	103,513	134,279	976	424	552	0.437	0.502
quest8-n5	228,758	100,102	128,656	940	410	530	0.422	0.475
quest8-n6	224,585	98,160	126,425	922	402	520	0.425	0.483
quest8-n7	230,463	100,996	129,467	948	414	534	0.431	0.482
quest8-n8	228,903	100,209	128,693	940	411	530	0.421	0.490
questAB-n1	213,784	93,626	120,158	881	383	497	0.425	0.484

S2D BW	CSV(MB/s)	CSVRead	CSVWrite	SBL(MB/s)	SBLRead	SBLWrite	Disk(MB/s)	DiskRead	DiskWrite	Cache(MB/s)	CacheRead	CacheWrite
Total	4,635	3,239	1,396	7,428	3,238	4,189	5,430	2,812	2,618	5,053	2,434	2,618
quest8-n2	587	410	177	941	410	531	398	398		398	398	
quest8-n3	549	384	165	879	384	495	953	417	536	953	417	536
quest8-n4	608	424	184	976	424	552	388	388		388	388	
quest8-n5	587	410	177	940	410	530	971	420	551	971	420	551
quest8-n6	575	402	173	922	402	520						
quest8-n7	592	414	178	948	414	534	907	400	507	907	400	507
quest8-n8	587	411	176	940	411	530	943	411	532	943	411	532
questAB-n1	549	384	166	881	383	497	870	377	493	493		493

Block size 4Kb, 8 threads, 8 outstanding I/O (50% write / 50% read)

CSV FS	IOPS	Reads	Writes	BW (MB/s)	Read	Write	Read Lat (ms)	Write Lat
Total	926,662	463,023	463,639	3,796	1,897	1,900		
quest8-n2	118,473	59,035	59,438	485	242	244	0.586	1.313
quest8-n3	108,589	54,192	54,397	445	222	223	0.564	1.292
quest8-n4	121,298	60,845	60,453	497	249	248	0.600	1.343
quest8-n5	116,374	58,104	58,269	477	238	239	0.571	1.276
quest8-n6	115,918	57,870	58,047	475	237	238	0.573	1.269
quest8-n7	120,574	60,270	60,304	494	247	247	0.578	1.268
quest8-n8	114,629	57,272	57,356	470	235	235	0.566	1.306
questAB-n1	110,808	55,434	55,374	454	227	227	0.581	1.264

SYS	CPU (%)
Total	769
quest8-n2	96
quest8-n3	97
quest8-n4	94
quest8-n5	96
quest8-n6	96
quest8-n7	96
quest8-n8	97
questAB-n1	96

SSB Cache	Hit/Sec	Miss/Sec	Remap/Sec	Cache (MB/s) Read	Write	Destage (MB/s)	Update (MB/s)
Total	484,740			3,542	3,542	1,249	1,889
quest8-n2	57,408			706	706		236
quest8-n3	59,767			732	732	206	238
quest8-n4	55,891			695	695	206	235
quest8-n5	60,138					210	238
quest8-n6	61,106						237
quest8-n7	57,826			688	688	205	239
quest8-n8	58,296			721	721	213	232
questAB-n1	54,308					208	233

SBL	IOPS	Reads	Writes	BW (MB/s)	Read	Write	Read Lat (ms)	Write Lat
Total	1,854,294	463,079	1,391,215	5,435	1,897	3,538		
quest8-n2	237,576	59,077	178,499	974	242	732	0.542	0.660
quest8-n3	217,269	54,165	163,104	891	222	669	0.517	0.638
quest8-n4	242,252	60,849	181,403	249	249		0.557	0.686
quest8-n5	233,105	58,149	174,956	955	238	717	0.527	0.638
quest8-n6	232,128	57,894	174,234	237	237		0.527	0.639
quest8-n7	241,006	60,230	180,776	987	247	740	0.533	0.641
quest8-n8	229,507	57,311	172,196	235	235		0.521	0.644
questAB-n1	221,452	55,404	166,048	907	227	680	0.534	0.638

S2D BW	CSV(MB/s)	CSVRead	CSVWrite	SBL(MB/s)	SBLRead	SBLWrite	Disk(MB/s)	DiskRead	DiskWrite	Cache(MB/s)	CacheRead	CacheWrite
Total	3,796	1,897	1,900	5,435	1,897	3,538	5,223	1,681	3,542	5,445	1,904	3,542
quest8-n2	485	242	244	974	242	732	941	235	706	941	235	706
quest8-n3	445	222	223	891	222	669	977	245	732	977	245	732
quest8-n4	497	249	248	249	249		924	229	695	924	229	695
quest8-n5	477	238	239	955	238	717	246	246		246	246	
quest8-n6	475	237	238	237	237		250	250		250	250	
quest8-n7	494	247	247	987	247	740	925	237	688	925	237	688
quest8-n8	470	235	235	235	235		960	239	721	960	239	721
questAB-n1	454	227	227	907	227	680				222	222	

Sequential Reads and Writes

Block size 512Kb, 1 thread, 1 outstanding I/O (0% write / 100% read)

CSV FS	IOPS	Reads	Writes	BW (MB/s)	Read	Write	Read Lat (ms)	Write Lat
Total	75,993	75,940	53	38,375	38,374	1		
quest8-n2	9,707	9,698	9	4,786	4,785		1.736	0.860
quest8-n3	9,321	9,316	5	4,767	4,767		1.836	0.928
quest8-n4	9,792	9,788	3	4,807	4,807		1.721	4.981
quest8-n5	9,289	9,280	9	4,749	4,748		1.824	1.530
quest8-n6	8,714	8,712	2	4,451	4,451		1.964	2.977
quest8-n7	9,240	9,235	5	4,725	4,725		1.825	3.744
quest8-n8	9,364	9,350	14	4,786	4,785		1.809	2.124
questAB-n1	10,567	10,562	5	5,304	5,304		1.731	3.918

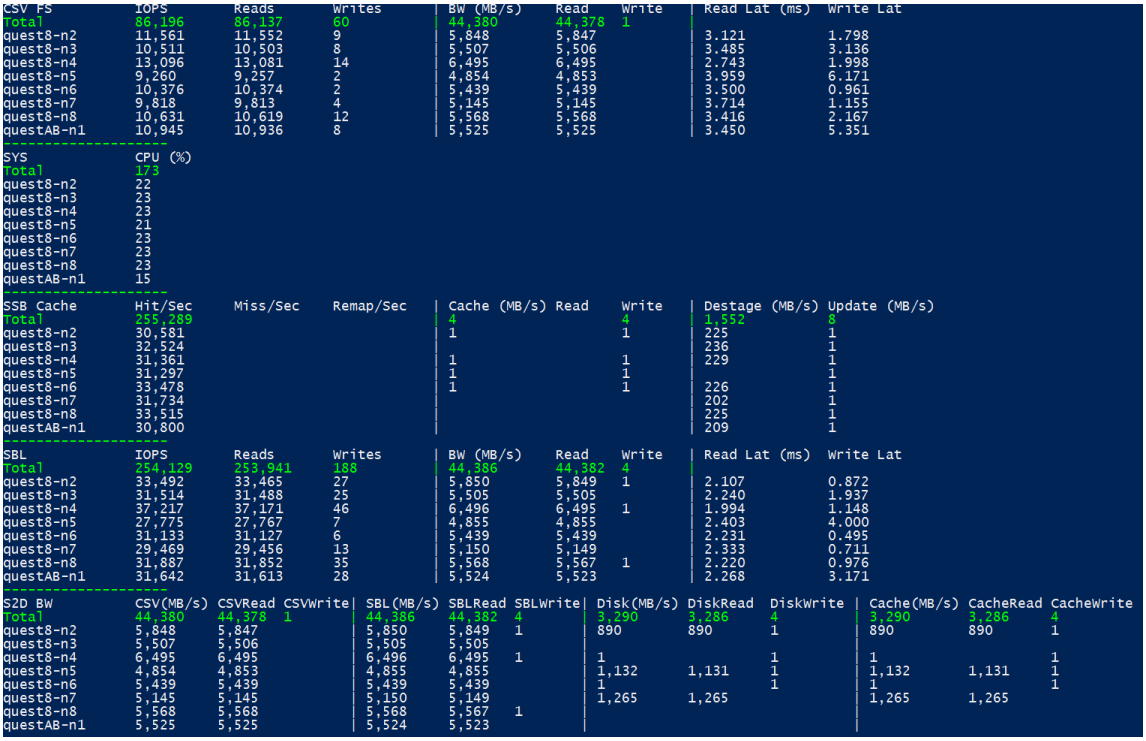
SYS	CPU (%)
Total	156
quest8-n2	20
quest8-n3	22
quest8-n4	21
quest8-n5	21
quest8-n6	20
quest8-n7	21
quest8-n8	20
questAB-n1	11

SSB Cache	Hit/Sec	Miss/Sec	Remap/Sec	Cache (MB/s) Read	Write	Destage (MB/s)	Update (MB/s)
Total	219,311			4	4	1,930	9
quest8-n2	26,816					241	1
quest8-n3	28,387			1	1	236	1
quest8-n4	25,367					235	1
quest8-n5	28,654			1	1	242	1
quest8-n6	30,254					248	1
quest8-n7	27,461					238	1
quest8-n8	27,362			1	1	237	1
questAB-n1	25,010			1	1	253	1

SBL	IOPS	Reads	Writes	BW (MB/s)	Read	Write	Read Lat (ms)	Write Lat
Total	219,760	219,590	171	38,383	38,379	4		
quest8-n2	27,403	27,375	28	4,784	4,784	1	1.253	0.402
quest8-n3	27,298	27,281	16	4,770	4,769		1.312	0.499
quest8-n4	27,521	27,509	12	4,810	4,809		1.250	3.044
quest8-n5	27,208	27,179	30	4,750	4,749	1	1.280	1.020
quest8-n6	25,475	25,466	9	4,451	4,451		1.381	1.879
quest8-n7	27,056	27,040	16	4,726	4,725		1.284	1.335
quest8-n8	27,427	27,384	43	4,787	4,786	1	1.264	0.981
questAB-n1	30,373	30,357	16	5,306	5,306		1.275	2.519

S2D BW	CSV(MB/s)	CSVRead	CSVWrite	SBL(MB/s)	SBLRead	SBLWrite	Disk(MB/s)	DiskRead	DiskWrite	Cache(MB/s)	CacheRead	CacheWrite
Total	38,375	38,374	1	38,383	38,379	4	3,561	3,557	4	3,787	3,783	4
quest8-n2	4,786	4,785		4,784	4,784	1						
quest8-n3	4,767	4,767		4,770	4,769		917	917	1	917	917	1
quest8-n4	4,807	4,807		4,810	4,809					227	226	
quest8-n5	4,749	4,748		4,750	4,749	1	656	656	1	656	656	1
quest8-n6	4,451	4,451		4,451	4,451		826	826		826	826	
quest8-n7	4,725	4,725		4,726	4,725		572	571		572	571	
quest8-n8	4,786	4,785		4,787	4,786	1	480	479	1	480	479	1
questAB-n1	5,304	5,304		5,306	5,306		109	108	1	109	108	1

Block size 512Kb, 1 thread, 2 outstanding I/O (0% write / 100% read)



CSV FS	IOPS	Reads	Writes	BW (MB/s)	Read	Write	Read Lat (ms)	Write Lat
Total	86,196	86,137	60	44,380	44,378	1		
quest8-n2	11,561	11,552	9	5,848	5,847		3.121	1.798
quest8-n3	10,511	10,503	8	5,507	5,506		3.485	3.136
quest8-n4	13,096	13,081	14	6,495	6,495		2.743	1.998
quest8-n5	9,260	9,257	2	4,854	4,853		3.959	6.171
quest8-n6	10,376	10,374	2	5,439	5,439		3.500	0.961
quest8-n7	9,818	9,813	4	5,145	5,145		3.714	1.155
quest8-n8	10,631	10,619	12	5,568	5,568		3.416	2.167
questAB-n1	10,945	10,936	8	5,525	5,525		3.450	5.351

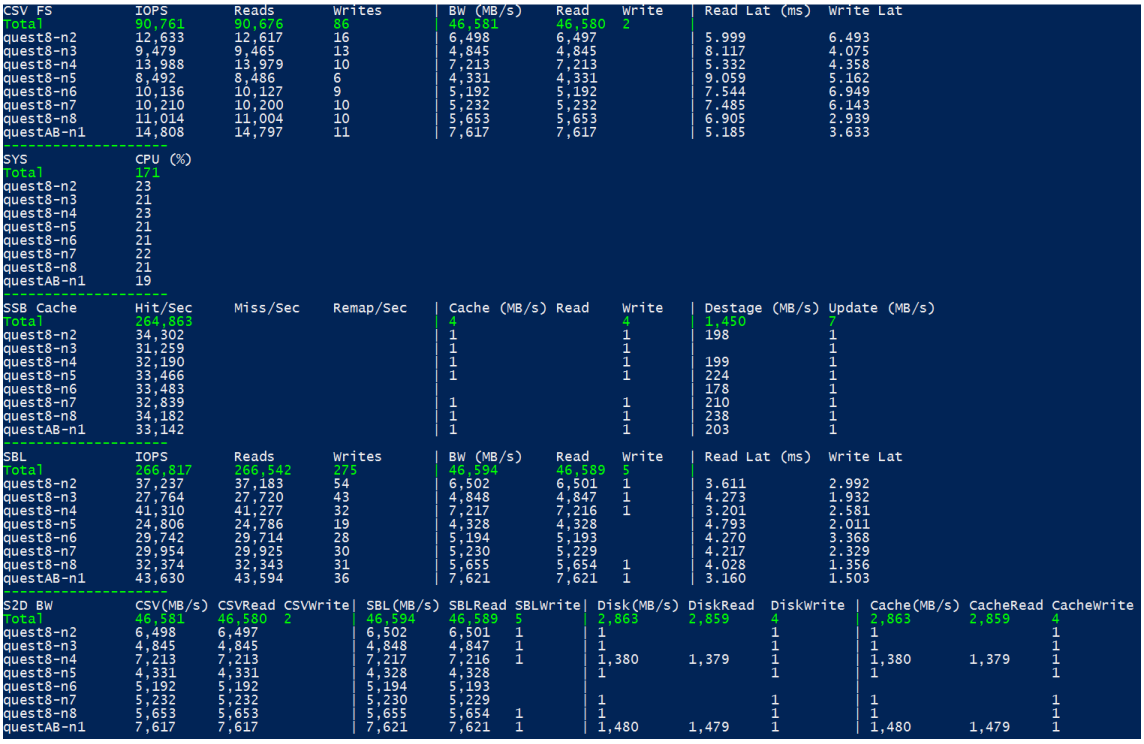
SYS	CPU (%)
Total	173
quest8-n2	22
quest8-n3	23
quest8-n4	23
quest8-n5	21
quest8-n6	23
quest8-n7	23
quest8-n8	23
questAB-n1	15

SSB Cache	Hit/Sec	Miss/Sec	Remap/Sec	Cache (MB/s) Read	Write	Destage (MB/s)	Update (MB/s)
Total	255,289			4	4	1,552	8
quest8-n2	30,581			1	1	225	1
quest8-n3	32,524					236	1
quest8-n4	31,361			1	1	229	1
quest8-n5	31,297			1	1		1
quest8-n6	33,478			1	1	226	1
quest8-n7	31,734					202	1
quest8-n8	33,515					225	1
questAB-n1	30,800					209	1

SBL	IOPS	Reads	Writes	BW (MB/s)	Read	Write	Read Lat (ms)	Write Lat
Total	254,129	253,941	188	44,386	44,382	4		
quest8-n2	33,492	33,465	27	5,850	5,849	1	2.107	0.872
quest8-n3	31,514	31,488	25	5,505	5,505		2.240	1.937
quest8-n4	37,217	37,171	46	6,496	6,495	1	1.994	1.148
quest8-n5	27,775	27,767	7	4,855	4,855		2.403	4.000
quest8-n6	31,133	31,127	6	5,439	5,439		2.231	0.495
quest8-n7	29,469	29,456	13	5,150	5,149		2.333	0.711
quest8-n8	31,887	31,852	35	5,568	5,567	1	2.220	0.976
questAB-n1	31,642	31,613	28	5,524	5,523		2.268	3.171

S2D BW	CSV(MB/s)	CSVRead	CSVWrite	SBL(MB/s)	SBLRead	SBLWrite	Disk(MB/s)	DiskRead	DiskWrite	Cache(MB/s)	CacheRead	CacheWrite
Total	44,380	44,378	1	44,386	44,382	4	3,290	3,286	4	3,290	3,286	4
quest8-n2	5,848	5,847		5,850	5,849	1	890	890	1	890	890	1
quest8-n3	5,507	5,506		5,505	5,505							
quest8-n4	6,495	6,495		6,496	6,495	1	1		1	1		1
quest8-n5	4,854	4,853		4,855	4,855		1,132	1,131	1	1,132	1,131	1
quest8-n6	5,439	5,439		5,439	5,439		1		1	1		1
quest8-n7	5,145	5,145		5,150	5,149		1,265	1,265		1,265	1,265	
quest8-n8	5,568	5,568		5,568	5,567	1						
questAB-n1	5,525	5,525		5,524	5,523							

Block size 512Kb, 1 thread, 4 outstanding I/O (0% write / 100% read)



CSV FS	IOPS	Reads	Writes	BW (MB/s)	Read	Write	Read Lat (ms)	Write Lat
Total	90,761	90,676	86	46,581	46,580	2		
quest8-n2	12,633	12,617	16	6,498	6,497		5.999	6.493
quest8-n3	9,479	9,465	13	4,845	4,845		8.117	4.075
quest8-n4	13,988	13,979	10	7,213	7,213		5.332	4.358
quest8-n5	8,492	8,486	6	4,331	4,331		9.059	5.162
quest8-n6	10,136	10,127	9	5,192	5,192		7.544	6.949
quest8-n7	10,210	10,200	10	5,232	5,232		7.485	6.143
quest8-n8	11,014	11,004	10	5,653	5,653		6.905	2.939
questAB-n1	14,808	14,797	11	7,617	7,617		5.185	3.633

SYS	CPU (%)
Total	171
quest8-n2	23
quest8-n3	21
quest8-n4	23
quest8-n5	21
quest8-n6	21
quest8-n7	22
quest8-n8	21
questAB-n1	19

SSB Cache	Hit/Sec	Miss/Sec	Remap/Sec	Cache (MB/s) Read	Write	Destage (MB/s)	Update (MB/s)
Total	264,863			4	4	1,450	7
quest8-n2	34,302			1	1	198	1
quest8-n3	31,259			1	1		1
quest8-n4	32,190			1	1	199	1
quest8-n5	33,466			1	1	224	1
quest8-n6	33,483					178	1
quest8-n7	32,839			1	1	210	1
quest8-n8	34,182			1	1	238	1
questAB-n1	33,142			1	1	203	1

SBL	IOPS	Reads	Writes	BW (MB/s)	Read	Write	Read Lat (ms)	Write Lat
Total	266,817	266,542	275	46,594	46,589	5		
quest8-n2	37,237	37,183	54	6,502	6,501	1	3.611	2.992
quest8-n3	27,764	27,720	43	4,848	4,847	1	4.273	1.932
quest8-n4	41,310	41,277	32	7,217	7,216	1	3.201	2.581
quest8-n5	24,806	24,786	19	4,328	4,328		4.793	2.011
quest8-n6	29,742	29,714	28	5,194	5,193		4.270	3.368
quest8-n7	29,954	29,925	30	5,230	5,229		4.217	2.329
quest8-n8	32,374	32,343	31	5,655	5,654	1	4.028	1.356
questAB-n1	43,630	43,594	36	7,621	7,621	1	3.160	1.503

S2D BW	CSV(MB/s)	CSVRead	CSVWrite	SBL(MB/s)	SBLRead	SBLWrite	Disk(MB/s)	DiskRead	DiskWrite	Cache(MB/s)	CacheRead	CacheWrite
Total	46,581	46,580	2	46,594	46,589	5	2,863	2,859	4	2,863	2,859	4
quest8-n2	6,498	6,497		6,502	6,501	1	1		1	1		1
quest8-n3	4,845	4,845		4,848	4,847	1	1		1	1		1
quest8-n4	7,213	7,213		7,217	7,216	1	1,380	1,379	1	1,380	1,379	1
quest8-n5	4,331	4,331		4,328	4,328		1		1	1		1
quest8-n6	5,192	5,192		5,194	5,193							
quest8-n7	5,232	5,232		5,230	5,229		1		1	1		1
quest8-n8	5,653	5,653		5,655	5,654	1	1		1	1		1
questAB-n1	7,617	7,617		7,621	7,621	1	1,480	1,479	1	1,480	1,479	1

Block size 512Kb, 1 thread, 8 outstanding I/O (0% write / 100% read)

CSV FS	IOPS	Reads	Writes	BW (MB/s)	Read	Write	Read Lat (ms)	Write Lat
Total	95,503	95,348	155	48,554	48,552	2		
quest8-n2	14,296	14,275	21	7,390	7,390		10.862	3.977
quest8-n3	12,837	12,823	15	6,350	6,349		12.178	7.259
quest8-n4	11,669	11,648	20	6,014	6,014		13.354	3.810
quest8-n5	11,549	11,537	12	5,932	5,932		13.530	6.351
quest8-n6	11,364	11,342	22	5,668	5,668		13.714	9.881
quest8-n7	9,708	9,697	11	4,853	4,853		15.901	3.865
quest8-n8	11,665	11,634	31	5,943	5,942		13.304	8.466
questAB-n1	12,415	12,392	23	6,403	6,403		12.557	4.561

SYS	CPU (%)
Total	168
quest8-n2	23
quest8-n3	23
quest8-n4	21
quest8-n5	21
quest8-n6	22
quest8-n7	21
quest8-n8	23
questAB-n1	13

SSB Cache	Hit/Sec	Miss/Sec	Remap/Sec	Cache (MB/s) Read	Write	Destage (MB/s)	Update (MB/s)
Total	275,902			6	6	177	2
quest8-n2	34,953					33	
quest8-n3	32,942			1	1	21	
quest8-n4	34,778			1	1	9	
quest8-n5	35,089			1	1	26	
quest8-n6	35,335			1	1	40	
quest8-n7	34,559			1	1	20	
quest8-n8	36,124			1	1	21	
questAB-n1	32,123			1	1	7	

SBL	IOPS	Reads	Writes	BW (MB/s)	Read	Write	Read Lat (ms)	Write Lat
Total	278,290	277,816	474	48,559	48,554	5		
quest8-n2	42,344	42,281	63	7,393	7,393		5.688	1.733
quest8-n3	36,362	36,317	45	6,347	6,347		6.366	2.691
quest8-n4	34,464	34,404	60	6,011	6,010		6.885	1.805
quest8-n5	33,973	33,934	39	5,935	5,934	1	6.847	2.801
quest8-n6	32,494	32,428	66	5,666	5,665	1	7.539	3.518
quest8-n7	27,811	27,778	33	4,857	4,857		7.700	1.854
quest8-n8	34,112	34,017	95	5,943	5,942	1	7.530	3.046
questAB-n1	36,731	36,657	73	6,406	6,405	1	6.366	1.974

S2D BW	CSV(MB/s)	CSVRead	CSVWrite	SBL(MB/s)	SBLRead	SBLWrite	Disk(MB/s)	DiskRead	DiskWrite	Cache(MB/s)	CacheRead	CacheWrite
Total	48,554	48,552	2	48,559	48,554	5	6		6	6		6
quest8-n2	7,390	7,390		7,393	7,393							
quest8-n3	6,350	6,349		6,347	6,347		1		1	1		1
quest8-n4	6,014	6,014		6,011	6,010		1		1	1		1
quest8-n5	5,932	5,932		5,935	5,934	1	1		1	1		1
quest8-n6	5,668	5,668		5,666	5,665	1	1		1	1		1
quest8-n7	4,853	4,853		4,857	4,857		1		1	1		1
quest8-n8	5,943	5,942		5,943	5,942	1	1		1	1		1
questAB-n1	6,403	6,403		6,406	6,405	1	1		1	1		1

Block size 512Kb, 1 thread, 1 outstanding I/O (100% write / 0% read)

CSV FS	IOPS	Reads	Writes	BW (MB/s)	Read	Write	Read Lat (ms)	Write Lat
Total	18,348	1,982	16,366	8,552	2	8,550		
quest8-n2	2,471	397	2,075	1,084		1,083	0.004	9.210
quest8-n3	2,376	298	2,078	1,086		1,086	0.004	9.198
quest8-n4	2,484	394	2,090	1,094		1,094	0.005	9.145
quest8-n5	2,253	295	1,958	1,022		1,022	0.004	9.797
quest8-n6	2,281	300	1,981	1,032		1,032	0.004	9.692
quest8-n7	2,393	298	2,095	1,096		1,095	0.004	9.127
quest8-n8	2,016		2,016	1,054		1,054	0.000	9.494
questAB-n1	2,073		2,073	1,083		1,083	0.000	9.449

SYS	CPU (%)
Total	139
quest8-n2	17
quest8-n3	21
quest8-n4	18
quest8-n5	18
quest8-n6	19
quest8-n7	17
quest8-n8	17
questAB-n1	11

SSB Cache	Hit/Sec	Miss/Sec	Remap/Sec	Cache (MB/s) Read	Write	Destage (MB/s)	Update (MB/s)
Total				2,356	2,356	6,414	512
quest8-n2				984	984	1,167	63
quest8-n3						1,019	67
quest8-n4						1,210	62
quest8-n5						1,008	67
quest8-n6				1,372	1,372	923	66
quest8-n7							62
quest8-n8						1,087	65
questAB-n1							61

SBL	IOPS	Reads	Writes	BW (MB/s)	Read	Write	Read Lat (ms)	Write Lat
Total	147,074		147,074	1,979		1,979		
quest8-n2	18,659		18,659				0.000	5.089
quest8-n3	18,695		18,695				0.000	5.133
quest8-n4	18,788		18,788				0.000	5.102
quest8-n5	17,579		17,579	950		950	0.000	5.224
quest8-n6	17,751		17,751				0.000	5.238
quest8-n7	18,851		18,851				0.000	5.068
quest8-n8	18,126		18,126	1,029		1,029	0.000	5.194
questAB-n1	18,624		18,624				0.000	5.244

S2D BW	CSV(MB/s)	CSVRead	CSVWrite	SBL(MB/s)	SBLRead	SBLWrite	Disk(MB/s)	DiskRead	DiskWrite	Cache(MB/s)	CacheRead	CacheWrite
Total	8,552	2	8,550	1,979		1,979	2,356		2,356	2,356		2,356
quest8-n2	1,084		1,083				984		984	984		984
quest8-n3	1,086		1,086									
quest8-n4	1,094		1,094									
quest8-n5	1,022		1,022	950		950						
quest8-n6	1,032		1,032				1,372		1,372	1,372		1,372
quest8-n7	1,096		1,095									
quest8-n8	1,054		1,054	1,029		1,029						
questAB-n1	1,083		1,083									

Block size 512Kb, 1 thread, 2 outstanding I/O (100% write / 0% read)

CSV FS	IOPS	Reads	Writes	BW (MB/s)	Read	Write	Read Lat (ms)	Write Lat
Total	20,765	3,276	17,490	9,067	3	9,064		
quest8-n2	2,703	476	2,227	1,160		1,159	0.003	17.592
quest8-n3	2,594	521	2,073	1,079		1,078	0.004	18.896
quest8-n4	2,880	521	2,359	1,226		1,225	0.004	16.585
quest8-n5	2,219	179	2,041	1,054		1,054	0.006	19.304
quest8-n6	2,606	521	2,085	1,078		1,078	0.004	18.857
quest8-n7	2,679	521	2,158	1,114		1,113	0.003	18.277
quest8-n8	2,551	268	2,283	1,177		1,177	0.003	17.240
questAB-n1	2,534	269	2,265	1,180		1,180	0.001	17.415

SYS	CPU (%)
Total	140
quest8-n2	18
quest8-n3	20
quest8-n4	18
quest8-n5	17
quest8-n6	19
quest8-n7	17
quest8-n8	19
questAB-n1	12

SSB Cache	Hit/Sec	Miss/Sec	Remap/Sec	Cache (MB/s) Read	Write	Destage (MB/s)	Update (MB/s)
Total			4	3,590	3,590	3,639	553
quest8-n2						690	74
quest8-n3						1,029	65
quest8-n4				1,381	1,381	309	80
quest8-n5						888	69
quest8-n6							60
quest8-n7				1,072	1,072		67
quest8-n8			2			723	69
questAB-n1			2	1,136	1,136		69

SBL	IOPS	Reads	Writes	BW (MB/s)	Read	Write	Read Lat (ms)	Write Lat
Total	156,342	1	156,340	3,907		3,907		
quest8-n2	19,957		19,957				0.000	6.069
quest8-n3	18,592		18,592	1,107		1,107	0.000	6.118
quest8-n4	21,103		21,103				0.000	6.156
quest8-n5	18,176	1	18,174				0.290	6.750
quest8-n6	18,615		18,615				0.000	6.238
quest8-n7	19,242		19,242				0.000	6.562
quest8-n8	20,307		20,307	1,394		1,394	0.000	6.061
questAB-n1	20,350		20,350	1,406		1,406	0.000	6.282

S2D BW	CSV(MB/s)	CSVRead	CSVWrite	SBL(MB/s)	SBLRead	SBLWrite	Disk(MB/s)	DiskRead	DiskWrite	Cache(MB/s)	CacheRead	CacheWrite
Total	9,067	3	9,064	3,907		3,907	3,590		3,590	3,590		3,590
quest8-n2	1,160		1,159									
quest8-n3	1,079		1,078	1,107		1,107						
quest8-n4	1,226		1,225				1,381		1,381	1,381		1,381
quest8-n5	1,054		1,054									
quest8-n6	1,078		1,078									
quest8-n7	1,114		1,113				1,072		1,072	1,072		1,072
quest8-n8	1,177		1,177	1,394		1,394						
questAB-n1	1,180		1,180	1,406		1,406	1,136		1,136	1,136		1,136

Block size 512Kb, 1 thread, 4 outstanding I/O (100% write / 0% read)

CSV FS	IOPS	Reads	Writes	BW (MB/s)	Read	Write	Read Lat (ms)	Write Lat
Total	19,636	2,872	16,764	8,745	3	8,742		
quest8-n2	2,566	388	2,178	1,134		1,134	0.007	36.389
quest8-n3	2,761	517	2,244	1,174		1,173	0.003	35.244
quest8-n4	2,248	179	2,069	1,082		1,082	0.004	38.288
quest8-n5	2,493	517	1,976	1,028		1,027	0.005	40.362
quest8-n6	2,416	525	1,891	988		987	0.004	42.021
quest8-n7	2,592	477	2,115	1,102		1,102	0.008	37.449
quest8-n8	2,352	223	2,128	1,112		1,112	0.003	37.289
questAB-n1	2,208	45	2,163	1,126		1,126	0.017	36.960

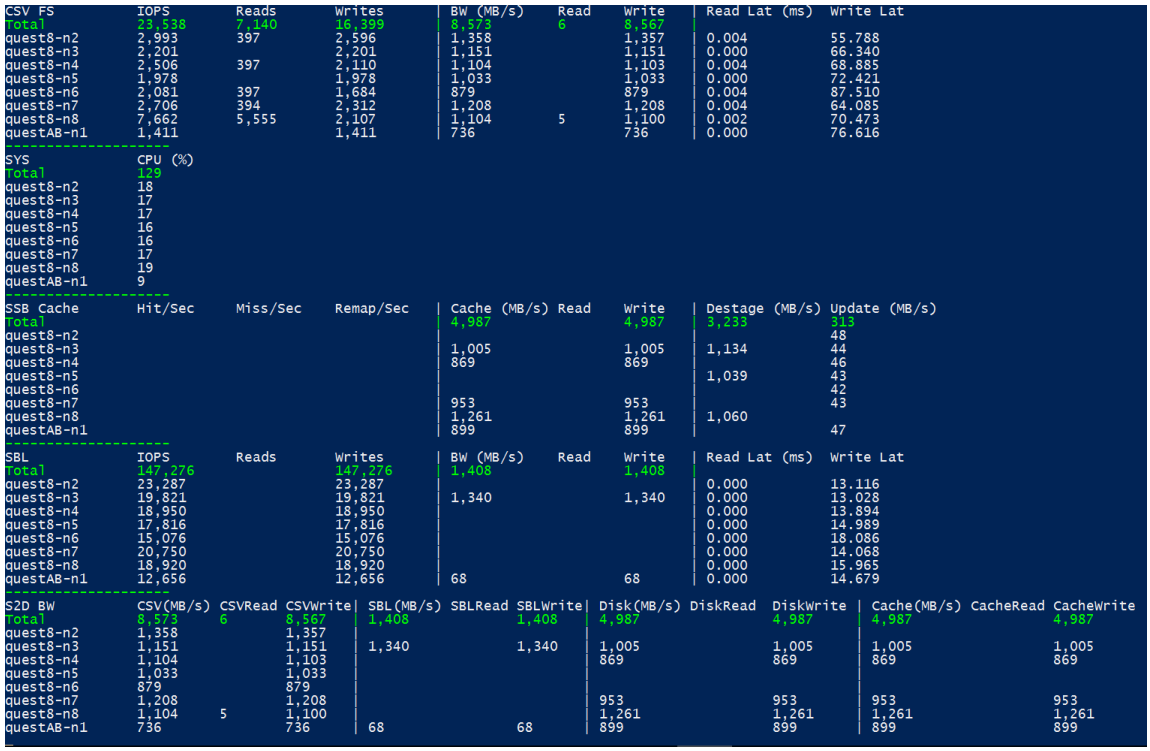
SYS	CPU (%)
Total	121
quest8-n2	15
quest8-n3	18
quest8-n4	15
quest8-n5	17
quest8-n6	16
quest8-n7	14
quest8-n8	16
questAB-n1	10

SSB Cache	Hit/Sec	Miss/Sec	Remap/Sec	Cache (MB/s) Read	Write	Destage (MB/s)	Update (MB/s)
Total	3			4,180	4,180	4,193	446
quest8-n2	1			1,143	1,143	1,107	57
quest8-n3							56
quest8-n4				1,022	1,022	1,078	55
quest8-n5	1						56
quest8-n6							56
quest8-n7				772	772	879	50
quest8-n8				1,244	1,244		58
questAB-n1						1,129	58

SBL	IOPS	Reads	Writes	BW (MB/s)	Read	Write	Read Lat (ms)	Write Lat
Total	150,409	3	150,405	4,760		4,760		
quest8-n2	19,541	1	19,540	1,274		1,274	1.080	10.166
quest8-n3	20,178		20,178	1,407		1,407	0.000	9.297
quest8-n4	18,588		18,587	1,113		1,113	0.674	10.614
quest8-n5	17,694		17,693	967		967	1.299	10.490
quest8-n6	16,961		16,961				0.000	11.021
quest8-n7	18,980		18,979				2.821	9.426
quest8-n8	19,103		19,103				0.000	10.333
questAB-n1	19,366	1	19,365				1.170	10.969

S2D BW	CSV(MB/s)	CSVRead	CSVWrite	SBL(MB/s)	SBLRead	SBLWrite	Disk(MB/s)	DiskRead	DiskWrite	Cache(MB/s)	CacheRead	CacheWrite
Total	8,745	3	8,742	4,760		4,760	4,180		4,180	4,180		4,180
quest8-n2	1,134		1,134	1,274		1,274	1,143		1,143	1,143		1,143
quest8-n3	1,174		1,173	1,407		1,407						
quest8-n4	1,082		1,082	1,113		1,113	1,022		1,022	1,022		1,022
quest8-n5	1,028		1,027	967		967						
quest8-n6	988		987									
quest8-n7	1,102		1,102				772		772	772		772
quest8-n8	1,112		1,112				1,244		1,244	1,244		1,244
questAB-n1	1,126		1,126									

Block size 512Kb, 1 thread, 8 outstanding I/O (100% write / 0% read)



CSV FS	IOPS	Reads	Writes	BW (MB/s)	Read	Write	Read Lat (ms)	Write Lat
Total	23,538	7,140	16,399	8,573	6	8,567		
quest8-n2	2,993	397	2,596	1,358		1,357	0.004	55.788
quest8-n3	2,201		2,201	1,151		1,151	0.000	66.340
quest8-n4	2,506	397	2,110	1,104		1,103	0.004	68.885
quest8-n5	1,978		1,978	1,033		1,033	0.000	72.421
quest8-n6	2,081	397	1,684	879		879	0.004	87.510
quest8-n7	2,706	394	2,312	1,208		1,208	0.004	64.085
quest8-n8	7,662	5,555	2,107	1,104	5	1,100	0.002	70.473
questAB-n1	1,411		1,411	736		736	0.000	76.616

SYS	CPU (%)
Total	129
quest8-n2	18
quest8-n3	17
quest8-n4	17
quest8-n5	16
quest8-n6	16
quest8-n7	17
quest8-n8	19
questAB-n1	9

SSB Cache	Hit/Sec	Miss/Sec	Remap/Sec	Cache (MB/s) Read	Write	Destage (MB/s)	Update (MB/s)
Total				4,987	4,987	3,233	313
quest8-n2							48
quest8-n3				1,005	1,005	1,134	44
quest8-n4				869	869		46
quest8-n5						1,039	43
quest8-n6							42
quest8-n7				953	953		43
quest8-n8				1,261	1,261	1,060	
questAB-n1				899	899		47

SBL	IOPS	Reads	Writes	BW (MB/s)	Read	Write	Read Lat (ms)	Write Lat
Total	147,276		147,276	1,408		1,408		
quest8-n2	23,287		23,287				0.000	13.116
quest8-n3	19,821		19,821	1,340		1,340	0.000	13.028
quest8-n4	18,950		18,950				0.000	13.894
quest8-n5	17,816		17,816				0.000	14.989
quest8-n6	15,076		15,076				0.000	18.086
quest8-n7	20,750		20,750				0.000	14.068
quest8-n8	18,920		18,920				0.000	15.965
questAB-n1	12,656		12,656	68		68	0.000	14.679

S2D BW	CSV(MB/s)	CSVRead	CSVWrite	SBL(MB/s)	SBLRead	SBLWrite	Disk(MB/s)	DiskRead	DiskWrite	Cache(MB/s)	CacheRead	CacheWrite
Total	8,573	6	8,567	1,408		1,408	4,987		4,987	4,987		4,987
quest8-n2	1,358		1,357									
quest8-n3	1,151		1,151	1,340		1,340	1,005		1,005	1,005		1,005
quest8-n4	1,104		1,103				869		869	869		869
quest8-n5	1,033		1,033									
quest8-n6	879		879									
quest8-n7	1,208		1,208				953		953	953		953
quest8-n8	1,104	5	1,100				1,261		1,261	1,261		1,261
questAB-n1	736		736	68		68	899		899	899		899

Summary

Quest provides disaster recovery and backup & replication services, operating Service Delivery Centers in six nations across three continents. It was looking for a hardware partner to power their Veeam Cloud Connect service for disaster recovery, one that shared their core values of providing flexibility and customization for their customers. Through conversations with DataON, it decided on a DataON and Windows 2016 Storage Spaces Direct solution for their backup infrastructure.

Quest deployed eight DataON S2D-5208I hyper-converged cluster appliances with DataON DNS-2760 12GB JBODs. The S2D-5208i was powered by Intel Xeon Scalable processors with Intel C620 Series chipsets and Intel NVMe SSDs. The new Windows SDS solution utilized RDMA networking with 100GbE Mellanox switches, for low latency performance and increased CPU efficiency.

The S2D-5208i is part of the first Intel Select Solution for Windows Server Software-Defined Storage. The solution has also achieved Microsoft Windows Server Software-Defined certification and for Windows Server 2016 SDDC and is the first solution to achieve both Intel and Microsoft certifications. Having these certifications gave Quest confidence that this stress-tested solution follows Microsoft's requirements and best practices for a software-defined data center.

The S2D-5208i clusters were pre-configured with DataON's exclusive MUST tool to provide visibility, monitoring, and management for Windows SDS. The inclusion of MUST completes the solution with Storage Spaces Direct as a viable SAN replacement.

Quest's new data center now runs Veeam Cloud Connect and SQL Server on a Storage Spaces Direct converged infrastructure. The new solution improved backup times with high IOPS performance but also gained flexibility from the ability to increase storage simply by adding more drives to the DNS-2760 JBOD.

Quest's new software-defined storage solution not only provided cost savings upfront but also provided an additional cost savings that could not be calculated via the flexibility to add additional nodes. Quest estimates that they were able to get a 50-80% cost-per-TB savings by moving to a Windows Server 2016 Storage Spaces Direct solution from a traditional SAN.

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Appendix

System Specifications

- 8x DataON TracSystem S2D-5208i Nodes
  - Intel Xeon Silver 4110 2.1GHz (8 Cores x2)
  - 2x Mellanox ConnectX-4 EN Single-port 40/56GbE RDMA NIC
  - 8x Broadcom/LSI 9300-8i 12Gb SAS HBA
  - 16x Intel DC S3520 240GB SATA M.2 SSDs (boot drive)
  - 24x Intel DC P3520 NVMe 2.0TB 2.5" SSD (cache cache)
  - 24x HGST Ultrastar He10 10TB 3.5" 7200RPM 12GB SAS HDD (performance tier)
- DataON DNS-2760 12Gb SAS JBOD
  - 192x HGST Ultrastar He10 10TB 3.5" 7200RPM 12GB SAS HDD (capacity tier)
- Mellanox Spectrum 40GbE Switch with 16 ports

Collateral & Resources

Collateral

Microsoft Windows Server 2016 datasheet

DataON S2D-5000 Family datasheet

DataON DNS-2760 datasheet

DataON MUST datasheet

Mellanox Ethernet Switches

Mellanox Ethernet Adapters

Videos

Storage Spaces Direct in Windows Server 2016 presentation

DataON MUST demo video