Warehouse Automator Deploys DataON's Largest Intel® Optane™ and all-NVMe Flash Azure Stack HCI Solution

CisCom deploys Microsoft Azure Stack HCI hyper-converged storage solution to house and distribute data-intensive 3D scans and manage high-performance SQL Servers for an automatic material logistic company

The Challenge

- Replace current SAS storage with all-flash, high-capacity and ultra-low latency solution

- Upgrade Infiniband switches for better performance and management

- Update Windows Server 2012 R2 to a Microsoft Azure Stack workload-optimized hyper-converged infrastructure for high-performance SQL Servers, trusted enterprise virtualization, Office, Exchange, and file server workloads

- Repurpose existing JBOD storage investment

- Find a Microsoft-centric vendor with experience in large-scale turnkey deployments

The Solution

- Microsoft Azure Stack HCI solution

- DataON HCI-224 five-node Intel® Optane™ SSD cache tier and Intel P4510 all-NVMe flash SSD hyper-converged storage

- Microsoft HCI cluster with over 15TB of Intel® Optane™ SSD cache tier and over 800TB of Intel P4510 NVMe SSD for storage tier

- InfiniBand 100Gb networking (north-south traffic)

- Mellanox 100GbE RDMA networking (east-west traffic)

- DataON MUST for Monitoring and Management

Organization Overview

As a global systems integrator for the parcel sortation and warehouse automation industries, the automatic material logistic company provides design, engineering and consulting services, field construction services, and after-sales services as part of a turnkey automation solution. Its manufacturing group designs and builds automated sorters, conveyors, extendable loader/unloaders and structural steel support systems. With over two thousand employees, the company has an installed base over five billion dollars globally and completes about a hundred projects a year.

CisCom Solutions, founded in 1996, is a leading managed service provider for enterprises across the Southern Indiana, Louisville, and Lexington, KY area. CisCom Solutions offers premiere managed and hosted services with the latest proven technologies.

IT Challenge: Replace converged storage with an all-flash NVMe, hyper-converged solution able to house and distribute data-intensive 3D scans and video, and manage high-performance SQL Server workloads

CisCom's customer, a growing, large automatic material logistic company was running out of storage. The company's data intensive 3D scans and video, created during the initial stages of warehouse automation design, generated more data than its existing converged storage could handle. The company needed a solution that could provide enough storage for its SQL Servers, Office, Exchange and file server workloads.

The company's infrastructure consisted of Hyper-V clusters on eight OEM servers and a two-node converged scale out file server (SoFS) with three DataON DNS-2640 JBODs running Windows Server 2012 R2 with Storage Spaces in an Infiniband ecosystem.

CisCom sought a high IOPS, all-flash NVMe, ultra-low latency hyper-converged storage solution that could meet the company's data demands, which averaged approximately 160Gb of data per day, up from 20Gb the previous year.

CisCom needed a vendor that could provide cutting edge technology and help architect and build a hyper-converged storage solution that would replace the company's two-node converged SoFS. CisCom also planned to update Windows Server 2012 R2 to a Microsoft hyper-converged infrastructure (HCI) with an Azure Stack HCI solution during the refresh and upgrade its Infiniband networking. Because of the specialized nature of this project, it was important that CisCom find a Microsoft-centric vendor that had the expertise to help architect and build a fully compatible and validated turnkey solution.

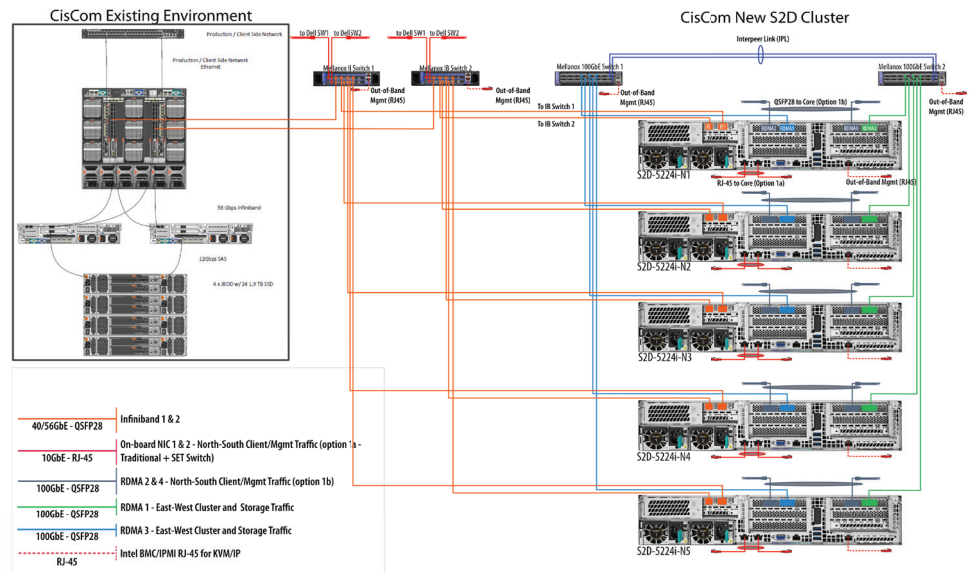CisCom's goals in updating its customer's infrastructure included:

- Replacing current SoFS storage with an all-NVMe flash, high-capacity, ultra-low latency hyper-converged infrastructure to meet rising data demands
- Upgrading Infiniband switches for better performance and management
- Update Windows Server 2012 R2 to Microsoft Azure Stack HCI
- Repurposing its existing JBOD storage investment
- Finding a Microsoft-centric vendor to help architect a fully compatible and validated turnkey solution

The Solution: DataON HCI-224 five-node all-NVMe flash SSD and Intel® Optane™ NVMe SSD hyper-converged infrastructure, Microsoft Azure Stack HCI, Melanox 100GbE RDMA and 100GbE InfiniBand networking, and DataON MUST

Years back, CisCom deployed a Windows Server 2012 R2 Storage Spaces DataON cluster-in-a-box (CiB) solution for its customer. Over the logistic company's data center evolution, CisCom added a DataON SoFS and repurposed the older DataON CiB as a disaster recovery solution. Satisfied with performance and customer support, CisCom once again turned to DataON to upgrade its converged storage.

DataON, at the forefront of implementing new technologies, suggested to CisCom they could greater reduce latency and increase throughput by using Intel® Optane™ SSDs as a cache tier.

Intel® Optane SSDs are a storage solution that fully leverages the caching capabilities of Microsoft Software-Defined Architecture. They deliver consistent read response times regardless of the write throughput applied to the drive and perform up to 63x better than that of a high-endurance NAND SSD under a random write workload. This makes them an ideal storage cache tier solution for their high-performance SQL Servers, delivering high-availability and faster SQL Server workload performance.

Benchmark

- High IOPS, low latency HCI cluster performance in 8 CPU environment—Random 4Kb, 8 Threads, 8 Outstanding I/O, (100% Read)

- Nearly 1 million IOPS (read) and 400K IOPS (write)—Random 4Kb, 8 Threads, 8 Outstanding I/O, (30% Read / 70% Write)

- Excellent throughput and bandwidth for large data file reads—Sequential 512Kb, 1 Thread, 1 Outstanding I/O, (100% Read)

After working with DataON closely for over a month, CisCom deployed a DataON HCI-224 hyper-converged infrastructure for Azure Stack HCI. Configured with 3TB of Intel® Optane™ SSD cache tiering and 128TB of all-NVMe flash (per node), the nodes were connected to the existing eight servers housing the Hyper-V clusters.

The DataON HCI clusters utilize over 15TB of Intel® Optane™ NVMe SSD for cache and 800TB all flash Intel P4510-8TB NVMe SSD for storage. Because of higher data transfer rates associated with all-NVMe flash and Intel® Optane™ solutions, it was important to avoid any bottlenecks. DataON recommended CisCom choose a Mellanox 100GbE RDMA (east-west traffic between nodes) solution for more IOPS and better throughput. For north-south traffic, CisCom upgraded the InfiniBand 100Gb networking to connect to its client's existing eight servers.

The Results

The extensive planning paid off. Delivered as a turnkey solution, CisCom deployed the new DataON infrastructure and Mellanox networking without any issues. There was simply no comparison between the old SoFS SAS-connected JBOD storage and new DataON HCI-224 hyper-converged infrastructure for Azure Stack HCI. Not only was the new solution all-NVMe flash, but the Intel® Optane™ cache tier improved performance and boasted data transfers of over three million IOPS. With Mellanox 100GbE and 100Gb Infiniband networking, CisCom's customer has not had any bottlenecking issues.

The upgrade from Windows Server 2012 R2 to Azure Stack HCI gave them far better performance and storage management. The Azure Stack HCI solution supports the Resilient File System (ReFS), which maximizes data availability and provides better scalability, and allows for larger cluster sizes up to 4PB. The Azure Stack HCI solution also provides trusted enterprise virtualization that leverages virtualization-based security and assurance-certified hardware to protect the company's security-sensitive workloads.

The new environment also includes Windows Admin Center, a centralized system management center that delivers better management and visibility of Storage Spaces Direct clusters.

Random- 4K, 8 Threads, 8 outstanding IO (100%Read)

CSV FS	IOPS	Reads	Writes	BW (MB/s)	Read	Write	Read Lat (ms)	Write Lat
Total	2,028,382	2,028,305	77	8,309	8,309			
Ciscom-N1	399,127	399,115	12	1,635	1,635		0.234	0.840
Ciscom-N2	394,330	394,316	14	1,615	1,615		0.254	0.935
Ciscom-N3	405,220	405,207	13	1,660	1,660		0.274	1.099
Ciscom-N4	405,162	405,134	28	1,660	1,660		0.251	1.082
Ciscom-N5	424,543	424,534	9	1,739	1,739		0.271	1.081

Sequential- 512K, 1 Threads, 1 Outstanding (100%Read)

CSV FS	IOPS	Reads	Writes	BW (MB/s)	Read	Write	Read Lat (ms)	Write Lat
Total	78,767	77,716	1,051	40,650	40,623	27		
Ciscom-N1	15,781	15,523	258	8,115	8,112	3	1.169	0.888
Ciscom-N2	11,584	11,432	152	5,979	5,971	8	1.629	1.397
Ciscom-N3	16,285	16,029	256	8,391	8,383	8	1.133	1.124
Ciscom-N4	16,756	16,632	124	8,694	8,693	1	1.078	1.233
Ciscom-N5	18,361	18,100	260	9,472	9,464	8	0.985	1.440

SSB Cache	Hit/Sec	Miss/Sec	Remap/Sec	Cache (MB/s) Read	Write	Destage (MB/s) Update (MB/s)
Total				85	85	
Ciscom-N1				20	20	
Ciscom-N2				9	9	
Ciscom-N3				19	19	
Ciscom-N4				15	15	
Ciscom-N5				22	22	

SBL	IOPS	Reads	Writes	BW (MB/s)	Read	Write	Read Lat (ms)	Write Lat
Total	236,102	232,684	3,418	40,706	40,624	82		
Ciscom-N1	47,263	46,470	793	8,119	8,112	8	0.629	0.464
Ciscom-N2	34,745	34,212	533	5,993	5,970	23	0.764	0.644
Ciscom-N3	48,855	48,005	850	8,407	8,382	24	0.611	0.562
Ciscom-N4	50,177	49,800	377	8,700	8,696	3	0.569	0.627
Ciscom-N5	55,061	54,196	865	9,487	9,463	24	0.506	0.669

S2D BW	CSV(MB/s)	CSVRead	CSVWrite	SBL (MB/s)	SBLRead	SBLWrite	Disk(MB/s)	DiskRead	DiskWrite	Cache(MB/s)	CacheRead	CacheWrite
Total	40,650	40,623	27	40,706	40,624	82	1,994	1,909	85	85		85
Ciscom-N1	8,115	8,112	3	8,119	8,112	8	28	8	20	20		20
Ciscom-N2	5,979	5,971	8	5,993	5,970	23	9		9	9		9
Ciscom-N3	8,391	8,383	8	8,407	8,382	24	1,794	1,774	19	19		19
Ciscom-N4	8,694	8,693	1	8,700	8,696	3	142	127	15	15		15
Ciscom-N5	9,472	9,464	8	9,487	9,463	24	22		22	22		22

Hyper-V LCPU	Logical Total%	Guest%	Hypervisor%	Root Total%	Guest%	Hypervisor%	Remote%
Total	23.92	20.96	2.96	19.66	17.95	1.71	0.00
Ciscom-N1	24.69	21.64	3.04	19.82	18.06	1.76	0.00
Ciscom-N2	21.76	19.00	2.76	18.38	16.74	1.64	0.00
Ciscom-N3	23.47	20.48	2.99	19.34	17.62	1.72	0.00
Ciscom-N4	25.13	22.17	2.95	20.76	19.08	1.68	0.00
Ciscom-N5	24.57	21.52	3.05	20.00	18.24	1.76	0.00

Random- 4K, 8 Threads, 8 outstanding IO (70%Read/30%Write)

CSV FS	IOPS	Reads	Writes	BW (MB/s)	Read	Write	Read Lat (ms)	Write Lat
Total	1,291,469	904,173	387,296	5,287	3,700	1,587		
Ciscom-N1	260,563	182,060	78,503	1,067	745	322	0.361	1.757
Ciscom-N2	241,625	169,344	72,281	989	693	296	0.406	1.874
Ciscom-N3	250,515	175,661	74,854	1,026	719	307	0.442	1.886
Ciscom-N4	271,289	189,952	81,337	1,110	777	333	0.375	1.648
Ciscom-N5	267,478	187,157	80,321	1,096	766	329	0.445	1.972

Used in tandem and within Windows Admin Center, the DataON management utility software tool (MUST) provides even more management with multiple tiers of storage visibility, monitoring and a call home service. If there is an issue with a cluster or drive, MUST emails CisCom and its customer's administrators, improving response times to resolve any issues that might lead to downtime or data loss.

Sequentail- 512K, 1 Threads, 1 OutstandingIO (100%Write)

CSV FS	IOPS	Reads	Writes	BW (MB/s)	Read	Write	Read Lat (ms)	Write Lat
Total	24,860	834	24,026	12,557	1	12,556		
Ciscom-N1	5,736	434	5,302	2,751	1	2,751	0.048	3.653
Ciscom-N2	5,532		5,532	2,897		2,897	0.000	3.475
Ciscom-N3	3,780		3,780	1,979		1,979	0.000	5.158
Ciscom-N4	5,360	400	4,960	2,598		2,598	0.001	3.893
Ciscom-N5	4,452		4,452	2,331		2,331	0.000	4.361

SSB Cache	Hit/Sec	Miss/Sec	Remap/Sec	Cache (MB/s) Read	Write	Destage (MB/s) Update (MB/s)
Total				3,299	3,299	
Ciscom-N1				1,311	1,311	
Ciscom-N2				1,000	1,000	
Ciscom-N3				988	988	
Ciscom-N4						
Ciscom-N5						

SBL	IOPS	Reads	Writes	BW (MB/s)	Read	Write	Read Lat (ms)	Write Lat
Total	215,918	41	215,877	100		100		
Ciscom-N1	47,446	37	47,409				0.535	0.958
Ciscom-N2	49,776	4	49,772	100		100	0.446	0.942
Ciscom-N3	34,002		34,002				0.000	1.160
Ciscom-N4	44,637		44,637				0.000	0.963
Ciscom-N5	40,057		40,057				0.000	1.055

S2D BW	CSV(MB/s)	CSVRead	CSVWrite	SBL(MB/s)	SBLRead	SBLWrite	Disk(MB/s)	DiskRead	DiskWrite	Cache(MB/s)	CacheRead	CacheWrite
Total	12,557	1	12,556	100		100	3,300		3,299	3,299		3,299
Ciscom-N1	2,751	1	2,751				1,311		1,311	1,311		1,311
Ciscom-N2	2,897		2,897	100		100	1,000		1,000	1,000		1,000
Ciscom-N3	1,979		1,979				988		988	988		988
Ciscom-N4	2,598		2,598									
Ciscom-N5	2,331		2,331									

Hyper-V LCPU	Logical Total%	Guest%	Hypervisor%	Root Total%	Guest%	Hypervisor%	Remote%
Total	25.19	21.28	3.91	22.47	19.88	2.59	0.00
Ciscom-N1	27.12	23.15	3.97	24.18	21.56	2.63	0.00
Ciscom-N2	28.03	24.22	3.81	25.22	22.71	2.52	0.00
Ciscom-N3	24.51	20.61	3.90	22.00	19.39	2.61	0.00
Ciscom-N4	24.33	20.35	3.98	21.58	18.95	2.63	0.00
Ciscom-N5	21.97	18.07	3.90	19.37	16.81	2.56	0.00
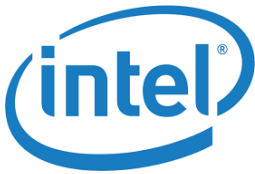
About DataON

DataON is a hybrid cloud computing company focused on delivering Microsoft Azure Stack HCI solutions, on-premises storage systems, intelligent edge appliances, and cloud-based Microsoft Azure Services. Our company is helping enterprises and customers who have made the "Microsoft choice" to modernize their IT with Microsoft applications, virtualization, and data protection through a complete and turnkey experience. With over 650 HCI clusters and 150PB of storage deployed, DataON enterprise-level solutions are designed to provide the highest level of performance, manageability, and security offered. DataON is a Microsoft Gold Partner, Microsoft Cloud Service Provider (CSP), and an Intel Platinum Partner.