OPEN COMPOSABLE COMPATIBILITY LAB

Solution Brief

OpenFlex® Data24 4200 with StarWind NVMe-oF™ Initiator: High-Performance Fabric Storage

DATACORE™

StarWind by DataCore

Challenges

- Lack of native NVMe-oF Support on Windows environment.
- Proprietary storage architectures lead to rigid hardware lock in.
- Tight vendor coupling limits flexibility and future choice.
- Application servers must be deployed on Linux® solely to access NVMe-oF.
- Despite NVMe storage, environments fall back to legacy iSCSI or Fibre Channel due to lack of performance on Windows environment.

Highlights

- Unified access on Windows server with (NVMe-oF over RDMA/TCP).
- Composable disaggregation: scale servers, protocol bandwidth, and storage enclosures independently on Windows environment.
- Enables true NVMe over Fabrics access from Windows to OpenFlex Data24.
- Preserves NVMe command sets, deep queues, and parallelism.
- Delivers near local NVMe latency and throughput across the fabric.
- Cost Saving offered by scaling down the CPU in application servers and save on the core-bound OS licensing with efficient CPU usage

Solution

The combined solution of OpenFlex Data24 and the StarWind NVMe-oF Initiator delivers a powerful, disaggregated storage architecture that enables Windows based workloads to fully exploit shared NVMe performance over standard Ethernet.

OpenFlex Data24 4200 provides dense, scalable, high-performance NVMe™ storage exposed over NVMe over Fabrics (NVMe-oF), while the StarWind NVMe-oF Initiator bridges the traditional Windows gap by offering native NVMe-oF connectivity with low latency and minimal CPU overhead.

Together, they allow enterprises to decouple compute and storage, eliminate the performance limitations of legacy protocols like iSCSI, and achieve near local NVMe throughput for databases, analytics, and data intensive workloads—without relying on Fibre Channel or proprietary hardware.

OpenFlex Data24 4000 Series Storage Platforms

The OpenFlex Data24 4000 series NVMe-oF storage platform extends the high-performance of NVMe flash to shared storage. The 4200 series provide low-latency sharing of NVMe SSDs over a high-performance Ethernet fabric to deliver similar performance to locally attached NVMe SSDs. WD RapidFlex™ NVMe-oF controllers, allows up to six dual pathed hosts to be attached without a switch. The OpenFlex Data24 4200 series uses WD's RapidFlex C2000 Fabric Bridge Adapters to provide up to 12 ports of 100GbE which can connect to RDMA and/or TCP configured host ports.

StarWind NVMe-oF Initiator

StarWind NVMe-oF Initiator is the first software-only solution bringing high-performance NVMe-oF connectivity using TCP and RoCEv2 to Windows applications without needing specialized hardware. Certified for Windows Server, it enables near-native, low-latency storage access for SQL and virtualization workloads. StarWind NVMe-oF Initiator for Windows ensures customers get not only the best performance and lowest latency for their mission-critical applications, but also end-to-end enterprise support from the storage, initiator, and OS vendor.

Reference Architecture

The reference architecture combines OpenFlex Data24 4200 disaggregated NVMe storage with the StarWind NVMe-oF Initiator to deliver shared, high-performance NVMe storage to Windows based compute nodes using connection over RoCEv2/TCP protocol[1]. OpenFlex Data24 4200 systems aggregate dense NVMe SSDs and expose them as NVMe-oF targets across a high bandwidth, low latency IP fabric, while Windows compute servers (such as Dell® PowerEdge® platforms) run the StarWind NVMe-oF Initiator to access these NVMe namespaces using native NVMe semantics. The initiator supports both RDMA (RoCE v2) for ultra low latency and NVMe-oF over TCP for flexible deployment, allowing I/O traffic to bypass traditional storage protocol bottlenecks and significantly reduce CPU overhead. This architecture cleanly separates compute and storage, eliminates the need for Fibre Channel or proprietary interconnects, and enables Windows workloads, Hyper V hosts, and data intensive applications to achieve near local NVMe performance while benefiting from the scalability, resilience, and composability of the OpenFlex Data24 4200 platform. The combined solution offers more efficient CPU usage unlocks the ability to scale down the CPUs in the application servers and save on the core-bound OS licensing. By reusing existing TCP or RoCEv2 networks and avoiding costly upgrading to Fibre Channel or proprietary rNICs, organizations can achieve substantial TCO savings.

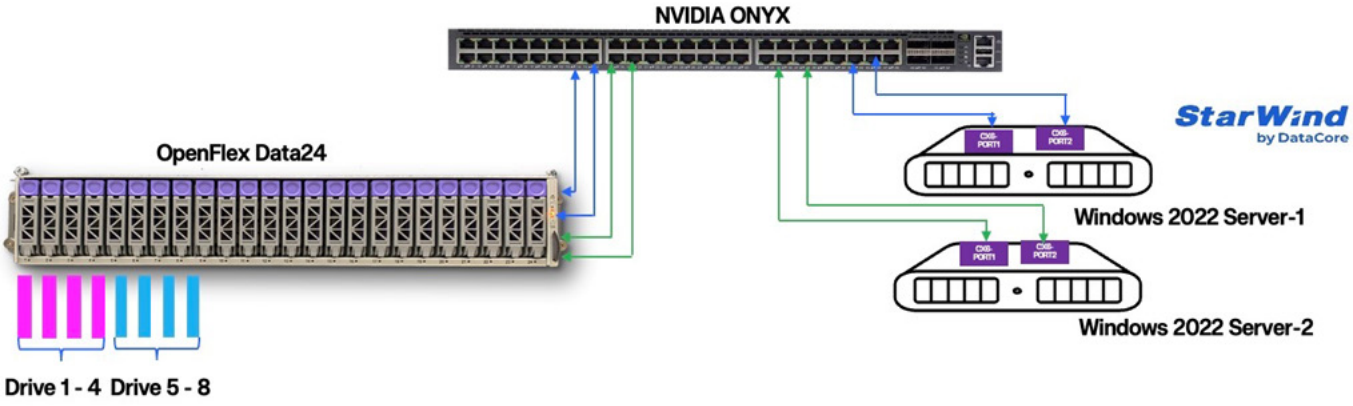
[1]This solution brief is not an endorsement of StarWind by WD, and no warranty of the product is expressed or implied.

OpenFlex Data24 4200 StarWind NVMe-oF Initiator: High-Performance Fabric Storage

Performance Result

The measured performance numbers are specific for the current configuration of StarWind NVMe Initiator with OpenFlex Data24 topology in conjunction with the uses of eight volumes in Multipath connection over RoCEv2 and TCP. FIO tool is used to run the performance benchmarking on the system. The performance test is run using FIO, simultaneously running tests from all the Windows clients. Different test parameters are used to check the overall system performance.

OpenFlex Data24 with StarWind NVMe-oF RDMA Configuration

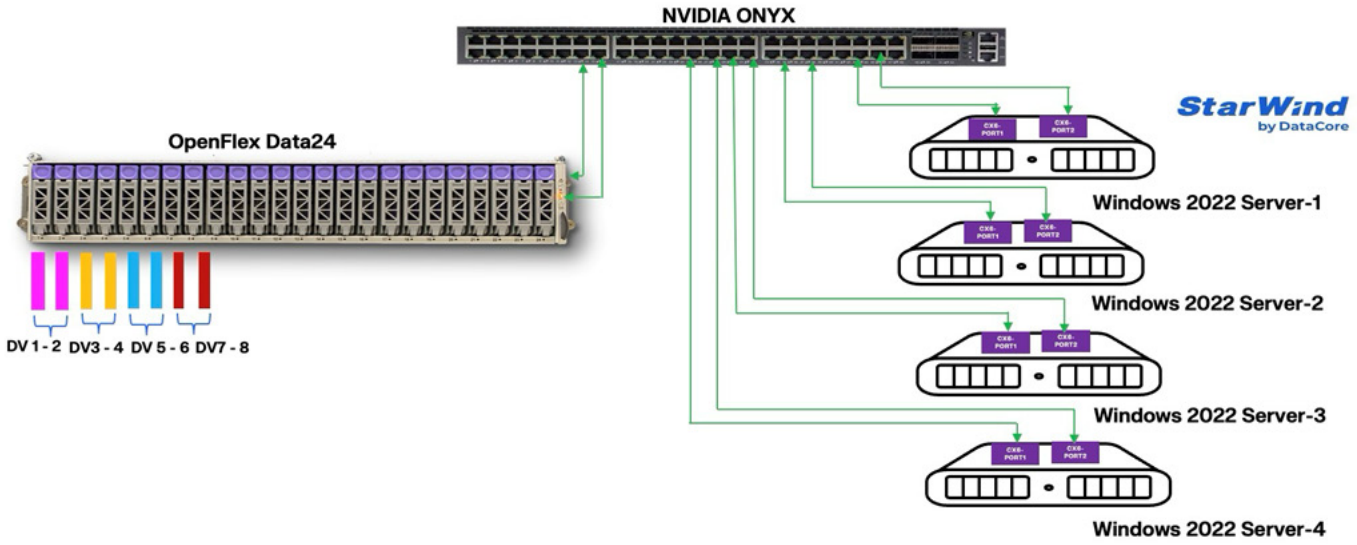


Performance Results with RDMA-RoCEv2 Configuration

RoCEv2 - Two Host with 4x Drives per Host using Multipath Connection	
Profile Details	Performance Details
Sequential Read (Block Size=128K)	45.5 GBps
Sequential Write (Block Size=128K)	29.9 GBps
Random Read (Block Size=4K)	2093 K IOPS
Random Write (Block Size=4K)	2880 K IOPS

Configuration Details
2x Windows Server 2022 with one CX6 card per server
4x RFX ports of OpenFlex Data24 4200
1x NVIDIA Onyx™ Management 3700 switch
8x SN655 15.36TB **Model**: WUS5EA1A1ESP7E3 **FW**: RC610008

OpenFlex Data24 with StarWind NVMe-oF TCP Configuration



OpenFlex Data24 4200 StarWind NVMe-oF Initiator: High-Performance Fabric Storage

Performance Results with TCP Configuration[1]

TCP - Two Host with 4x Drives per Host using Multipath Connection	
Profile Details	Performance Details[2,3]
Sequential Read (Block Size=128K)	21.74 GBps
Sequential Write (Block Size=128K)	20 GBps
Random Read (Block Size=4K)	1638 K IOPS
Random Write (Block Size=4K)	1271 K IOPS

Configuration Details
4x Windows Server 2022 with one CX6 card
2x RFX ports of OpenFlex Data24 4200
1x NVIDIA Onyx Management 3700 switch
8x SN655 15.36TB **Model**: WUS5EA1A1ESP7E3 **FW**: RC610008

Advantages

With advanced NVMe-oF and composable infrastructure technologies and StarWind NVMe-oF Initiator, organizations can achieve:

Scaling and Efficiency

With OpenFlex Data24 Composable disaggregation, it easy to scale servers, protocol bandwidth, and storage enclosures independently on Windows Environment. Compared to legacy FC and iSCSI, NVMe-oF offers a much lower CPU cost on the IOPS delivered to the applications with StarWind NVMe-oF Imitator, which means less of the application server CPU is wasted on storage processing and more of it available to your applications.

Performance

NVMe-oF delivers 100% of the underlying storage performance and close to 100% of the original NVMe latency. Moreover, it offers unrivalled parallelism that enables this performance to all of the applications working with the storage.

Cost Savings

More efficient CPU usage unlocks the ability to scale down the CPUs in the application servers and save on the core-bound OS licensing. The ability to use existing TCP or RoCE v2 instead of upgrading to FC or proprietary rNICs in every server is also a huge source of savings.

Conclusion

The solution has been done to validate the StarWind NVMe-oF Initiator features and performance. This allows users to overcome the performance limitations of NVMe-oF configuration over Windows environment using RoCEV2 and TCP protocol. The deployment of the StarWind NVMe-oF Initiator with OpenFlex Data24 represents a modern, future ready approach to high-performance storage for windows environment. By combining OpenFlex Data24's disaggregated, scalable NVMe storage with StarWind's windows native NVMe-oF connectivity, organizations can break free from the limitations of legacy storage protocols and architectures. This solution delivers near local NVMe performance over standard Ethernet, significantly reduces CPU overhead, and enables true separation of compute and storage. As a result, enterprises can confidently support data intensive workloads—such as databases, analytics, media processing, and virtualization—while gaining the flexibility, efficiency, and scalability required for next generation data centers.

[2] All the performance data are subject to change depending on the drive model, capacity, workloads, servers, CPU, tunings and HA topology used.
[3] The performance results are captured after running multiple iterations with different data size (block size, queue depth, number of jobs, CPU parameters, Max Transfer length and Max IO queues).
[4] The Performance will improve by increasing the number of NVMe-oF initiator hosts, utilizing all available RFX ports, and ensuring that all 24 drives from the OpenFlex Data24 4200 are in use.

5601 Great Oaks Parkway
San Jose, CA 95119, USA
www.westerndigital.com

March 2026 / Revision 02