HPE, Mellanox and Micron Demonstrate All-Flash MS SQL Server on Storage Spaces Direct: More Than 2.5 Million Transactions per Minute

HPE, Mellanox and Micron continue their collaboration to move data faster and move data centers farther. Combining state-of-the-art components from each company, the team demonstrated more than 2.5 million transactions per minute with Microsoft® SQL Server 2016 on Windows Server® 2016 Datacenter Storage Spaces Direct. The combination resulted in response times that were consistent and extremely low. The four-node storage cluster leveraged HPE ProLiant DL380 G9 servers, Mellanox's end-to-end RoCE (RDMA over Converged Ethernet) solutions and Micron's 9100MAX NVMe SSDs to highlight new possibilities.

The Configuration

The storage platform was built with four HPE ProLiant DL380 G9 servers, each equipped with two Intel® Xeon® E5-2697 v3 (14 core) processors, 256GB DRAM, two Mellanox ConnectX-4 100Gb/s RoCE adapters and four Micron 9100MAX NVMe SSDs (2.4TB each) – all connected by the Mellanox Spectrum™ switch and LinkX® cables.
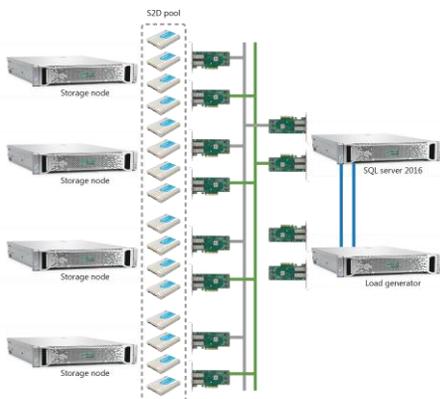

Figure 1: Configuration

S2D + SSD + 100 Gb/E = Extreme SQL

Extreme Performance

Create your own storage system with extreme performance and extreme capability. Combine Micron's 9100MAX NVMe SSD with HPE DL380 G9 servers (running Microsoft Windows Server Datacenter Storage Spaces Direct), Mellanox 100 Gb/s RoCE adapters, Spectrum switch and LinkX cabling for more performance than you thought possible.

Extremely Responsive

With this leading combination, you can leverage extreme database performance that is also extremely responsive: 28ms average latency, 500ms 99.9th percentiles transaction latency for applications that demand nearly instant response

Extremely Easy SDS

Enjoy the capability and simplicity of Windows Storage Spaces Direct to run you Microsoft SQL Server databases better than ever with one of the most capable, flexible hyper-converged infrastructures available. Easily handle extremely diverse workloads and mange unforecasted (unexpected perhaps) demand.

Extreme Capability

Realize the benefits of RDMA and state-of-the-art fabrics. Leverage 100 Gb/E adapters, switches and cables to take full advantage of NVMe SSDs in HPE standard servers. Better use all the features of Windows Server 2016 SDS (like Scale-Out File Server, Clustered Shared Volume File System (CSVFS), Resilient File System (ReFS), Storage Spaces and Failover Clustering) to do more, do it faster and do it easier.

Figure 2: Components

HPE ProLiant DL380 G9

HPE designed their market leading servers like the ProLiant DL380 G9 to reduce costs and complexity, leveraging the latest Intel processors and DDR4 memory. Offering a broad range of configuration options, these platforms enable fast processing and transaction times.

Mellanox End-to-End 100 Gb/E Solution

The Mellanox's end-to-end 100 Gb/E solution includes the Spectrum Switch, ConnectX®-4 NICs and LinkX copper and optical cables, and support for Windows Server 2016 with Ethernet networks operating at speeds of up to 100 Gb/s. This enables the compute and storage traffic to run over a single wire. It also greatly improves the return on investment of hyperconverged infrastructure and enables multicore CPUs to achieve their full capacity to run applications.

Micron 9100MAX NVMe SSD

Designed from the ground up to take advantage of nonvolatile memory and engineered to remove the latency of legacy interfaces, these NVMe SSDs take full advantage of the speed and parallelism of solid state. Using NVMe, the 9100MAX delivers data quickly with minimal burden on the host CPU. The 9100MAX uses the industry-standard hot plug PCIe interface driven by a strong consortium of storage technology providers for a robust ecosystem of host systems and drivers across multiple operating systems.

Storage Spaces Direct

The Storage Spaces Direct stack seamlessly integrates with the Windows Server SDS features you know today, including the Scale-Out File Server, Clustered Shared Volume File System (CSVFS), Resilient File System (ReFS), Storage Spaces and Failover Clustering. Leveraging Microsoft's Windows Server 2016 Datacenter Storage Spaces Direct over HP servers, Mellanox networking products and Micron NVMe SSDs demonstrated exceptional hyperconverged solution performance and efficiency.

The Results

We tested our hyperconverged configuration with Microsoft SQL Server 2016, pushed past 2.5 million transactions per minute and maintained very low and consistent latency.*

Transactions per Minute	More Than 2.5 Million
Average Response Time	Less Than 28ms
99.9th Percentile Response Time	Less Than 500ms

*Tested as per TPC-C specification transaction timeout values. For additional information, please see www.tpc.org.

The test database (with indexes) was approximately 1,200GB when testing started. The dataset was larger than the memory available to the database, resulting in a read-centric workload to disk.

Our joint collaboration highlights what is possible with Microsoft SQL Server 2016, industry-leading servers, networking and SSDs on Microsoft's Storage Spaces Direct. This high-performance/low-latency combination delivers extreme performance and responsiveness, ease of use, and highly capable, highly scalable, easily adopted storage.