

Accelerate Your IT Transformation

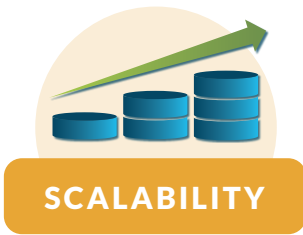
with Dell EMC XC
Family Hyperconverged
Infrastructure Powered
by Nutanix™ and
KIOXIA

KIOXIA

DELLTechnologies


Cloud Evolutions

Accelerate Your IT Transformation with Dell EMC XC Family Hyperconverged Infrastructure



As applications become more complex, enterprises seek to retain high performance and operational agility. Meanwhile, Information Technology (IT) also aims to consolidate workloads and stay on budget, which may compromise all these objectives.

Enterprises seek better performance and scalability while consolidating workloads and are now turning to a hyperconverged infrastructure (HCI). HCI makes data center management easy for enterprise organizations.



Data center management is traditionally handled with hardware solutions. HCI brings simplicity and ease of use to data center management via software and virtualization.

Dell Technologies is the industry leader in hyperconverged infrastructure (HCI). With HCI from Dell EMC powered by Nutanix™ Acropolis Operating System (AOS), your enterprise can improve performance—while simplifying how IT gets done. Nutanix™ powers the Dell EMC XC series, and it makes IT infrastructure invisible with an enterprise cloud platform that delivers the agility and economics of the public cloud, without sacrificing the security and control of on premises infrastructure.



The Dell EMC XC Family offers one of the industry's most versatile and scalable HCI platforms, and its benefits hold up to the most stringent testing scenarios. Cloud Evolutions tested a Dell EMC XC Family platform, powered by KIOXIA PM5 Series SAS SSDs, to simulate a range of extreme scenarios and examine performance. Cloud Evolutions' testing results support the idea that medium to large enterprises can use Dell EMC XC Family platforms to achieve exceptional IT performance.

Cloud Evolutions observed that Dell EMC XC Family platforms served to improve data center management in the following ways:

- ✓ Improve performance running multiple SQL server databases;
- ✓ Converge and consolidate enterprise workloads;
- ✓ Improve responsiveness; and
- ✓ Enhance throughput performance.

WHY SQL SERVER NEEDS HCI

Key to the SQL Server efficiency, scaling and performance is compute, storage and virtualization choices. While virtualizing SQL Server resources, IT administrators should consider innovative ways to facilitate workload management, consolidation

and high availability. SQL Server Database Administrators (DBAs) and IT professionals should consider new ways to house SQL server databases and to address these additional challenges including, but not limited to:

- ✓ Generating and consuming large volumes of data.
- ✓ Supporting platforms that must scale linearly without performance issues.
- ✓ Ensuring higher levels of availability and resilience, especially for mission-critical workloads.
- ✓ High storage-related capital expenditure costs due to larger amounts of data from the Internet of Things (IOT), Artificial Intelligence, or Machine Learning.
- ✓ Exponentially rising complexities that can overwhelm traditional hardware or infrastructure stacks.

SQL Server environments can be subject to many different problems beyond those mentioned here. SQL Server database performance is affected by both technical and business challenges, driven by the growth of big data, the need to support big data, and relentless demand to improve performance.



KIOXIA AND DELL EMC XC FAMILY – A SECOND TO NONE COMBINATION FOR ONLINE TRANSACTION PROCESSING

Mission-critical online transaction processing (OLTP) type of workloads require high transactional performance with consistent low latency. To enhance user experiences related OLTP performance, Dell EMC teamed with KIOXIA to use their PM5 Series 12Gb/s enterprise SAS solid state disks.

In particular, the exceptional capabilities of the KIOXIA's PM5 Series include:



Performance. Up to 82% higher performance levels with KIOXIA PM5 Series than previous generation SAS SSDs.



Reliability. Two flash die failure recovery, power loss protections, and end-to-end data protection.



Quality of Service. KIOXIA's multi-stream write SSD improves performance and endurance.



Data Security. Security options can be added which do not detract from performance—from no encryption to full FIPS 140-2 certification.

What Can the Dell EMC XC Family & KIOXIA Do For You?

Traditional data center architectures are complicated and expensive to maintain, putting these systems at risk of becoming IT silos. Specialists manage closed closets of compute, storage, and networking, juggling between one another to sustain performance. This balancing act is time-consuming, impacts service levels, and increases operating expenses. As a result, your IT footprint only grows larger.

The Dell EMC XC Family features hyperconverged appliances designed to reduce complexity and promote agility—at lower costs. With XC Family and its virtualization capabilities, applications can run on a single unified, scalable, cost-efficient platform.

With Dell EMC XC Family platform, IT can pivot from task-oriented operations to creating business value. Organizations can meet their storage needs in a timely fashion, and IT's application agenda of Big Data, IoT, and Artificial Intelligence are also supported.

Cloud Evolutions examined performance of Dell XC Family's HCI solutions combined with KIOXIA PM5 Series SAS SSDs. Cloud Evolutions found that this combination is robust, reliable and offers best-in-class performance.

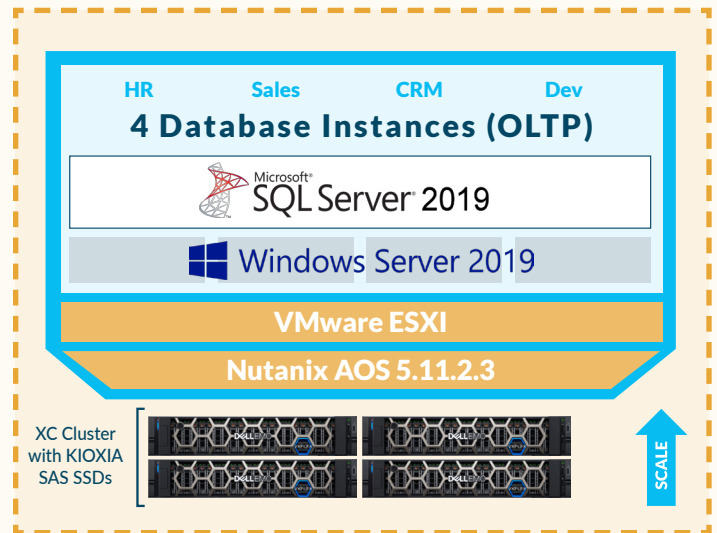
Our Testing Methodology

Cloud Evolutions performed two different tests on Dell EMC XC Family powered by Nutanix™ with KIOXIA PM5 Series SAS SSDs. One test characterized the IO capability of XC platform measuring IOPS from 100% reads and writes. The second test measured performance of the SQL Server database on the XC platform with KIOXIA PM5 Series flash drives under TPC-E type of workloads.

We used the benchmarking tools DiskSPD and Quest Benchmark factory to simulate typical workloads which could correspond to real-world Online Transaction Processing (OLTP) environment such as a trading application of a brokerage firm in the financial industry.

In Search of the Sweet Spot

Cloud Evolutions' motivation in performing these tests was to identify the 'sweet spot' of virtualized resources that can offer best performance. The sweet spot was determined in the context of important parameters. The sweet spot was determined in the context of important parameters such as numbers of virtual Central Processing Unit (vCPU) and the amount of memory-allocated SQL server instances that fetch the highest transactions per second at the lowest latencies per transaction. Database-level performance including, but not limited to, throughput TPS and latency, was the focus of our



testing. We monitored underlying storage performance and noted a low average storage read and write latency. This low latency allowed us to focus on optimally driving the CPU—in other words, finding the CPU's 'sweet spot'—for best results.

For OLTP testing using Quest Benchmark Factory, we looked at sustained performance rather than short-term performance metrics, which makes our results the most realistic measure of real-world performance capability.

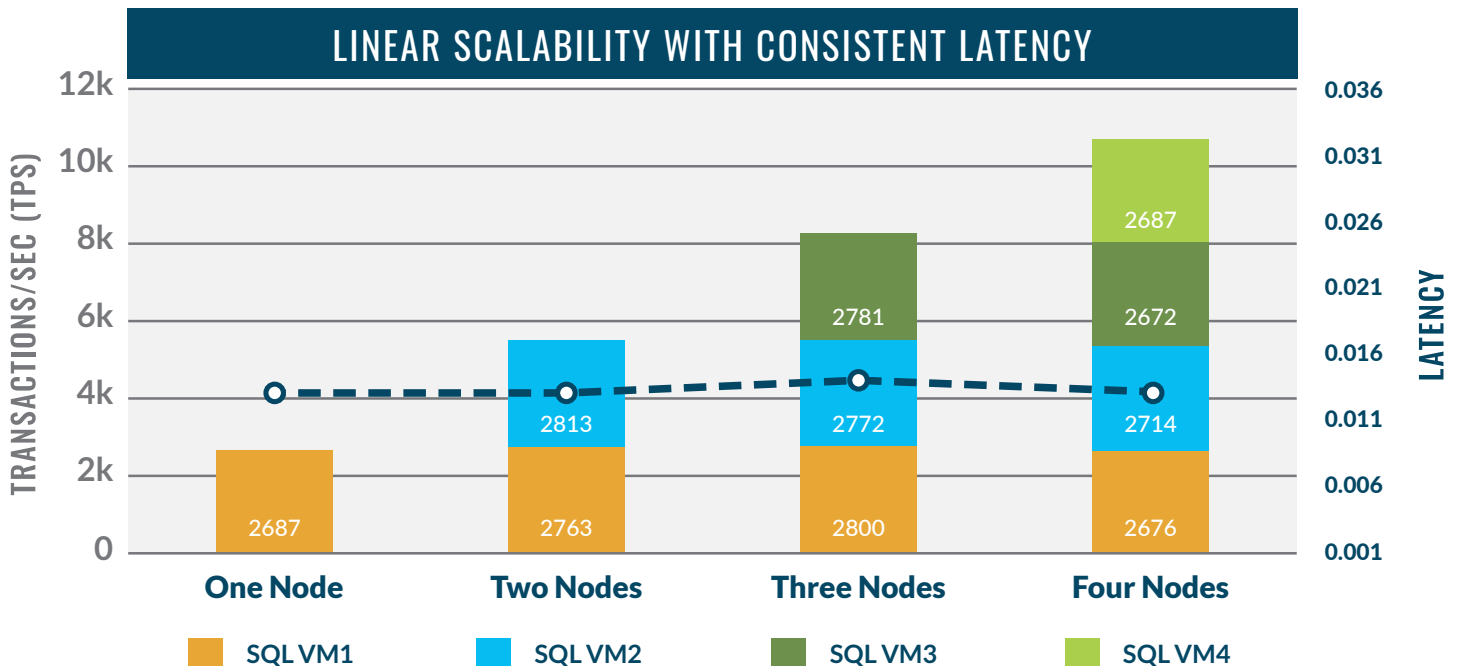
EXPLORING THE RESULTS: Scalable, Reliable, & High-Performing DELL EMC XC FAMILY POWERED BY NUTANIX™ WITH KIOXIA PM5 SERIES SAS SSDS

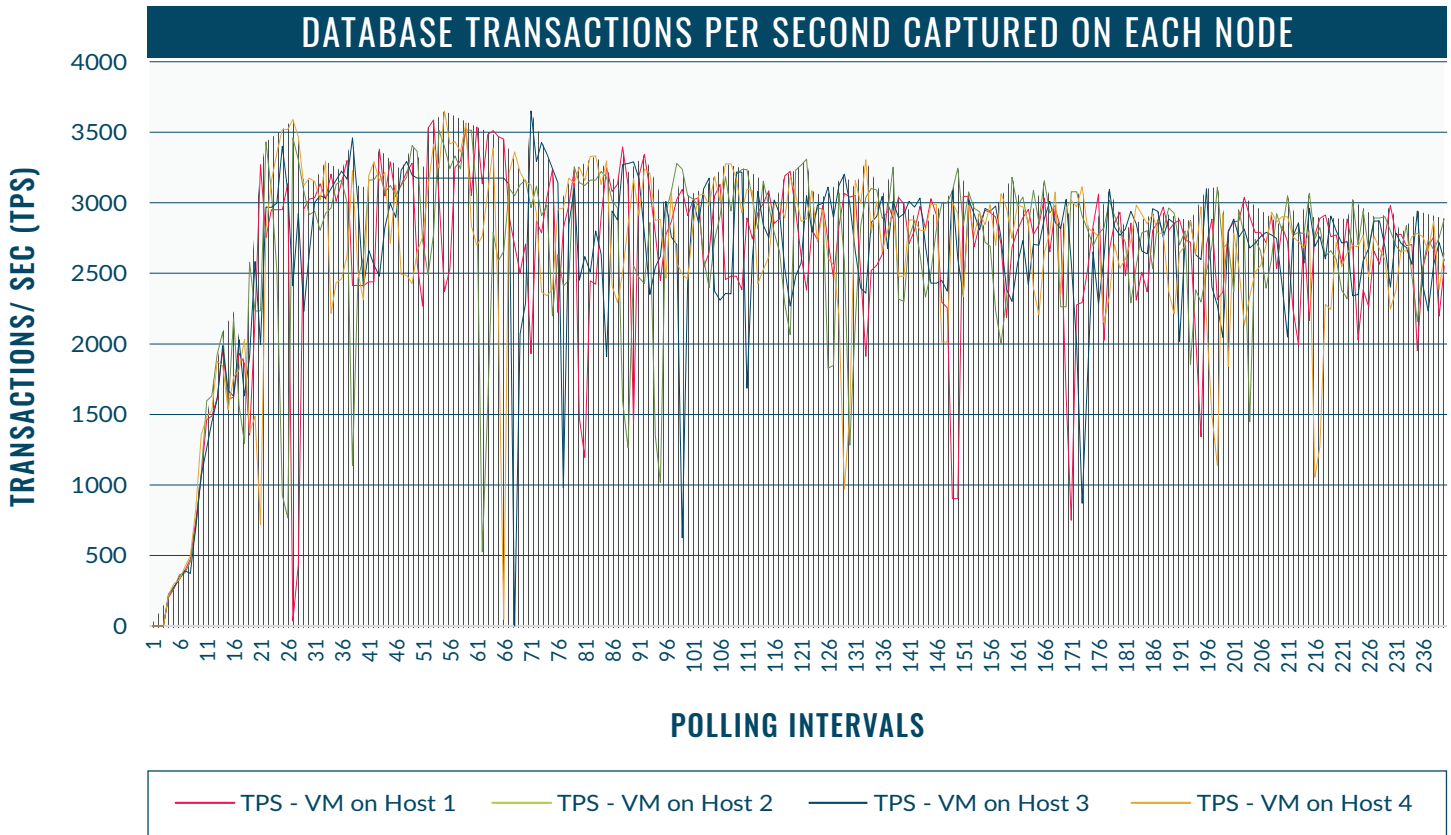
Tests were designed and conducted to fully utilize the CPU, memory, database, and KIOXIA SAS SSDs. To test scalability, reliability, and performance, we tested a large number of concurrent users per database with a “no think time and no delay” test parameter. The goal of this testing configuration was to measure the performance for consistency and scalability.

Scalable performance is vitally important when evaluating hyperconverged infrastructures or HCIs. Cloud Evolutions was particularly interested in evaluating financial transaction (OLTP) performance for scalability and workload distribution as more virtual machines (VMs) and SQL server instances were added to the cluster. Several tests were performed to determine optimal configuration of a single VM and SQL Server instance configuration. Test runs were completed as a benchmark to determine how platform scales by adding more VMs and database instances.

As you can see in the figure below, not only did TPS scale linearly, but the average transaction response time remained low and held remarkably steady.

Upon completion of testing with four database instances running on four XC hosts, the total number of transactions/second/instance followed a very narrow band from 2,672 TPS to 2,714 TPS, totaling to 10,749 TPS and an average of 2,687 TPS. These results demonstrate the system’s exceptional scalability, making it ideal for all sizes of enterprise organizations.





SCALING WITH PERFORMANCE

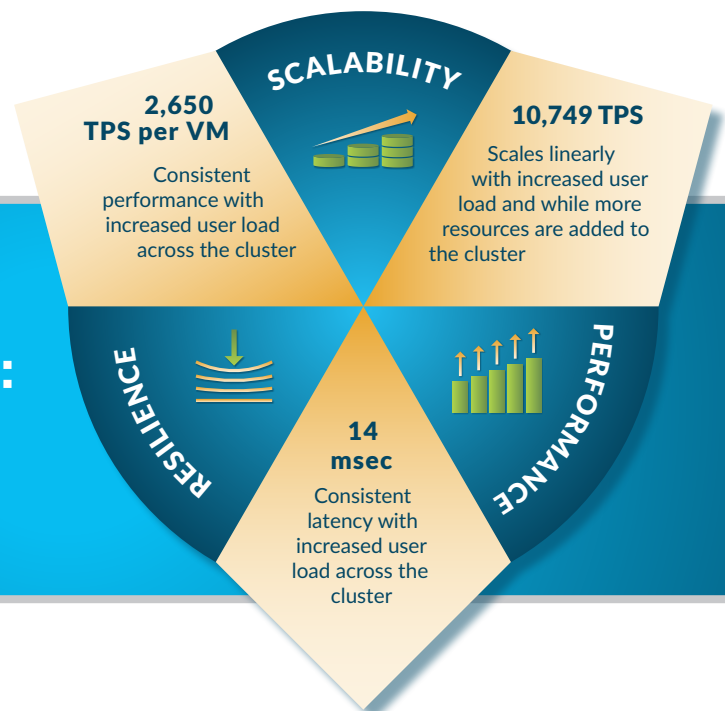
As we scaled the SQL Server database workload, we observed impressive response times—an average transaction response time of 14 milliseconds. This response time accounted for more than just storage latency, factoring in database responsiveness with compute.

The Dell EMC XC solution consistently reduced response time by keeping latencies between 13-15 milliseconds for each TPC-E type OLTP transaction while all four nodes ran the workload simultaneously.

High performance, reliability, quality of service, and data security are all features of the KIOXIA PM5 Series 12Gb/s enterprise SAS SSDs. While database performance was the focus of our testing, we also monitored underlying storage performance. Throughout, storage averaged 29K to 50K and 30K IOPS, respectively, and we noted an average storage read-and-write latency in the sub-millisecond range.

This remarkably low disk latency allowed us to focus on driving CPU at its 'sweet spot' for the best results. To put these results in context, keep in mind that for the OLTP testing, the tests were all examining sustained performance. In other words, target performance is the highest steady-state performance with little variability. This makes the target a truly realistic measure of real-world performance.

Results Matter: CONCLUSION



Dell EMC XC Family with KIOXIA PM5 Series SAS SSDs could provide a significant advantage over traditional hardware-based data center infrastructures. Indeed, we discovered a combination of near-linear input/output operations per second (IOPS) and low-latency scale observed in our testing that underscored the excellent performance inside the Dell EMC XC platform. The combination of Dell EMC XC Family and KIOXIA SSDs may be the “secret sauce” driving scalable, reliable, and high performing hyperconverged infrastructure (HCI).

Cloud Evolutions tested the Dell EMC XC Family with KIOXIA PM5 Series SAS SSDs to determine its utility as an alternative to traditional infrastructures. The outcomes of testing by Cloud Evolutions proved that the HCI solution, Dell EMC XC Family with KIOXIA PM5 Series, delivered outstanding performance, with exceptional scalability and reliability.

The results prove that the XC Family represents a viable virtualization alternative that performs better than traditional hardware-based database infrastructures. The Dell EMC XC Family can more efficiently handle database workloads compared to traditional hardware-based databases. The XC Family also offers a scalable, agile platform for ever-changing requirements.

Appendix A

HARDWARE	
XC 640 Node Configuration	4 x XC (640 Servers)
	Intel® Xeon® Gold 6254 3.1G, 18C /36T, 10.4GT/s, 24.75M Cache
	Memory: 384-GB RAM (24 x 16 - GB DIMMs)
	Storage: KIOXIA PM5 Series 12Gb/s SAS SSDs 10 x 1.92 TB
Network	Mellanox ConnectX-4 LX Dual Port 10/25GbE SFP28 Adapter
	Intel® X710 Dual Port 10GbE SFP + & i350 Dual Port 1GbE, rNDC
Network Switch	Dell PowerConnect S5048 (25GB)
SOFTWARE	
SQL Server Configuration	SQL Server 2019
SQL Server VM Configuration	32 vCPUs
	64G Memory
	8 x 100Gb Drives
SQL Server Database Instance Configuration	16GB SQL Server Memory
	4 x 100 GB for Data
	2 x 100 Log Drive
Nutanix CVM Configuration	12 x vCPU, 32 GB Memory
Quest Benchmark Factory VM Configuration	2 x vCPU, 4GB Memory
	399.42 Gb Database Size
	Scale Factor 41
Nutanix AOS	AOS 5.11.2.3
Hypervisor	ESXi 6.7
Operating System	Windows Server 2019

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