Microsoft SQL Server 2022 at the Edge with Lenovo ThinkAgile MX455 V3

Solution Brief

Information growth and a solution

In today's environment, information is a valuable asset that requires appropriate tools for storing and managing essential business data. Companies are being overwhelmed by the growing influx of information in their data centers. Placing MX455 V3 servers at remote edge locations can help distribute the data and processing demands. Consolidating SQL Server and other workloads within virtual machines on Azure Stack HCI clusters can improve processing efficiency. The MX455 V3 is edge-optimized and also ideal for AI and Telco workloads.

Lenovo Solutions for Microsoft SQL Server on ThinkAgile MX455 V3 are optimized for Online Transaction Processing (OLTP) such as TPC-C workloads. This technical brief features Microsoft SQL Server 2022 Enterprise Edition running in virtual machines on compact, high-performance Lenovo 2U rack or shelf mounted systems. The server is configured with 4th Generation AMD 8004 Siena processors, TruDDR5 4800MHz memory and NVMe SSD drives. The new processors from AMD support up to 64 cores and 6x 96GB memory DIMMs.

The MX455 V3 server is a storage dense offering for its size. It supports up to 8 2.5" drives including 4 front and 4 internal bays plus an additional 2 internal M.2 drives for the OS. The MX455 V3 servers include Azure Stack HCI pre-loaded and ready to setup in a cluster configuration.

Azure Stack HCI

Microsoft Azure Stack HCI (Hyper-Converged Infrastructure) is a hybrid cloud solution that integrates on-premises infrastructure with Azure cloud services. It enables businesses to run virtualized workloads on industry-standard hardware, combining the benefits of cloud computing with the control and customization of on-premises solutions. Azure Stack HCI supports a range of applications, including virtual desktops, databases, and high-performance workloads, while providing features like software-defined storage and networking, enhanced security, and simplified management through integration with Azure.

Highlights

- Reduce time to value with pretested and sized hardware configurations
- Simplified evaluation, fast and easy deployment and workload optimized performance
- Database sized solution with optimal compute, memory, storage and networking components
- Reduce TCO through better performance, rapid deployment and advanced hardware
- Optimize performance with pretested ThinkAgile MX455 V3 hardware configurations

Microsoft SQL Server 2022

SQL Server 2022 includes updates to existing features like Intelligent Query Processing in addition to management, platform or language.

Starting with SQL 2022, runtimes for R, Python, and Java are no longer installed with SQL Setup. Instead, install any desired custom runtime(s) and packages.

Here are some performance enhancements in SQL Server 2022:

- Improvements have been made to all columnstore indexes that benefit from enhanced segment elimination by data type.
- Concurrent updates to global allocation map pages reduce page latch contention
- Improvements in buffer pool scan operations on large-memory systems by using multiple CPU cores for parallel scans
- Improvements to Clustered ColumnStore Indices to sort existing data in memory before index builder compresses the data
- Support for Intel QuickAssist Technology (QAT) backup compression with software or hardware acceleration (only software compression is available in SQL Standard)
- TempDB performance enhancements for scalability
- Shrink database uses low priority processing to minimize impact on performance
- In-memory OLTP enhancements

Here are some management improvements:

- Additional Azure integration
- Link to Azure SQL Managed Instance
- Accelerated Database Recovery (ADR)
- Always On Availability Group enhancements

Lenovo ThinkAgile MX455 V3

Lenovo ThinkAgile MX455 V3 offerings are ideal for virtualizing your legacy SQL Server applications because of their low cost and high-performance capabilities. They are industry standard servers providing cost effective computing and fast high-density local storage at the edge. With it's smaller foot print, the MX455 V3 is ideal for deployment in remote office and edge locations.

Each server configuration features the following main components:

- **Server:** Lenovo ThinkAgile MX455 V3
- **Processor:** 1x 4th Gen AMD EPYC (Siena) 8324P 32C 180W 2.65GHz
- **Memory:** 192GB of TRUDDR5 4800 MT/s memory
- **Storage pool:** 4x 7450 PRO 1.2TB NVMe SSDs
- **OS Storage:** 2x 7450 PRO 480GB M.2 NVMe SSDs (RAID 1)
- **Software:**
  - Azure Stack HCI OS
  - Microsoft Windows Server 2022 VMs
  - Microsoft SQL Server 2022 Standard Edition

Best practices for SQL Server on ThinkAgile MX455 V3

For a high-performance SQL Server solution, implement the following best practices:

- Configure UEFI (BIOS) settings for Operating mode to Maximum performance.
- Enable Simultaneous Multithreading.
- Set networking MTU to 9000
- Avoid over-subscribing VM memory or processors beyond physical availability.
- Configure power profile in Windows Server VM to ‘High performance’.
- SQL server database and log drives are recommended to be formatted with 64KB NTFS cluster size.
- SQL server database and log files should be on separate physical drives.
- The OS and SQL server binary drives are recommended to be formatted with standard 4KB NTFS cluster size.
- TempDB is shared by many processes and users as a temporary working area and should be configured appropriately. Default configuration will be suitable for most workloads. Use the install experience for guided configuration. More info in Microsoft TempDB Database documentation.
- If the server is dedicated to the SQL Server workload, use the default dynamic memory management model or follow Microsoft SQL documentation guidelines for manually configuring memory options if finer grain control is desired.

Figure 1. Lenovo ThinkAgile MX455 V3

Performance Testing Details and Results

HammerDB and VMFleet

HammerDB is an open-source load testing / benchmarking tool for databases available at: http:///www.hammerdb.com. It offers tools for testing performance of OLTP and Analytics workloads. The OLTP workload is based on TPC-C benchmark from http://www.tpc.org. HammerDB version 4.7 was used.

VMFleet is a Microsoft tool that automates Diskspd tests on multiple VMs for validating HCI storage I/O. It reports total IOPs achieved.

Table 1. TPC-C and VMFleet performance testing details and results

Database tested	**MS SQL Server 2022 Standard Edition**
System	MX455 V3 Edge Node - 4th Gen AMD
Hardware Configuration	2x ThinkAgile MX455 V3 in 2 node cluster, 1x AMD EPYC 8324P 32C 180W 2.65GHz processor, 192GB memory, 4x 7450 PRO 1.92TB NVMe drives
VM configuration	10 VMs, each with 12 CPU, 32GB RAM
Benchmarks simulated	TPC-C
Database size: TPC-C	100GB 800 warehouse, on each VM
Virtual users	150 per VM
User delay	1 ms
TPC-C results	**Total from 10 VMs**
Transactions Per Minute (TPM)	3.17 million TPM
VMFleet results	Total IOPs - 4k Random 90/10 R/W 1.12 million

Bill of Materials

Table 2. Bill of Materials

7DGPCTO1WW	Server: ThinkAgile MX455 V3 Edge	1
BW2T	ThinkEdge SE455 V3 AMD EPYC 8324P 32C 180W 2.65GHz Processor	1
BW3M	ThinkEdge SE455 V3 2U Heatsink	1
BQ37	ThinkSystem 32GB TruDDR5 4800MHz (2Rx8) RDIMM-A	6
BNF2	ThinkSystem 2.5" U.3 7450 PRO 1.92TB Read Intensive NVMe PCIe 4.0 x4 HS SSD	4
BVUU	ThinkEdge SE455 V3 2.5" NVMe Backplane	1
BZPA	ThinkEdge SE455 V3 M.2 RAID B540i-2i SAS/SATA Adapter with Carrier	1
BS2P	ThinkSystem M.2 7450 PRO 480GB Read Intensive NVMe PCIe 4.0 x4 NHS SSD	2
BE4T	ThinkSystem Mellanox ConnectX-6 Lx 10/25GbE SFP28 2-Port OCP Ethernet Adapter	1
BCD6	ThinkSystem Intel E810-DA2 10/25GbE SFP28 2-Port PCIe Ethernet Adapter	1
BVUS	ThinkEdge SE455 V3 Riser2	1
BVUR	ThinkEdge SE455 V3 Riser1	1
BMH8	ThinkEdge 1100W 230V/115V Platinum Hot-Swap Power Supply	2
6400	2.8m, 13A/100-250V, C13 to C14 Jumper Cord	2
BPKQ	TPM 2.0 with Secure Boot	1
BRPJ	XCC Platinum	1

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For More Information

To learn more about this Lenovo solution contact your Lenovo Business Partner or visit: https://www.lenovo.com/us/en/servers-storage/solutions/database/

References:

Lenovo ThinkAgile MX Edge servers: https://lenovopress.lenovo.com/ds0112

Microsoft SQL Server 2022: https://learn.microsoft.com/en-us/sql/sql-server/what-s-new-in-sql-server-2022?view=sql-server-ver16

Azure Stack HCI: Link

Related product families

Product families related to this document are the following:

- Edge Servers
- Microsoft Alliance
- Microsoft SQL Server
- ThinkAgile MX Series for Microsoft Azure Stack HCI

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