Optimizing SQL Server 2022 on Lenovo ThinkSystem and ThinkAgile VX V4 servers with Intel Xeon 6 Processors

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Lenovo hyperconverged infrastructure solution for SQL Server deployment with VMware vSAN

Microsoft SQL Server performance on Lenovo ThinkSystem V4 servers with Intel Xeon 6 Processors and VMware vSphere

Includes benchmark results and Bill of Material

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Data growth problem and a solution

In today's data-driven world, businesses of all sizes are facing an unprecedented influx of fast-moving information, and it necessitates organizations to efficiently manage large amounts of diverse data, ensuring streamlined operations and superior outcomes. It’s important for businesses of all sizes to choose a database solution that matches the requirements of the company, resulting in the most efficient outcome.

Lenovo Solutions for Microsoft SQL Server on ThinkSystem and ThinkAgile VX V4 servers are optimized for both Online Transaction Processing (OLTP) and Data Warehouse (DW). This technical brief features Microsoft SQL Server 2022 Enterprise running on a high-performance Lenovo dual socket 1U rack mount enterprise server with VMware vSphere 8.0u3. The server can support Intel® Xeon® 6 processors, DDR5 6400MHz (1 DIMM per channel) or 5200 MHz (2 DIMM`s per channel) memory and high performance NVMe drives among a variety of storage options, including support for the PCIe 5.0 standard devices for I/O. These new processors from Intel offer also support for MRDIMMs and CXL 2.0 memory.

The ThinkAgile VX630 V4 server is a storage dense offering, with up to 12x2.5" drive bays in the front and rear of the server, 16x E3.S 1T NVMe drives or SAS drives using a variety of 12Gb RAID controllers and SAS HBAs. The server also supports M.2 drives for convenient operating system boot functions or data storage. They can be internally mounted or can be mounted at the front or rear of the server as hot-swap drives.

Business database solutions with faster time-to-value

Lenovo ThinkSystem and ThinkAgile V4 systems with VMware vSphere hypervisor are rigorously tested and tuned to save you months of configuration, setup, testing, and tuning to deploy SQL server databases for variety of workloads. Lenovo ThinkSystem and ThinkAgile V4 offerings are ideal for modernizing your legacy SQL Server applications because of their low cost and high-performance capabilities. They are industry standard x86 servers providing cost effective computing and fast high-density local storage. Lenovo ThinkAgile VX V4 with VMware vSAN hyperconverged storage offer the necessary performance for virtualized SQL Server and several technologies like NVMe storage and Remote Direct Memory Access (RDMA) networking are natively supported in Windows Server to enable the highest levels of performance.

With these new servers, you get the following advantages:

- The new Intel Xeon 6 arrives with architectural improvements that improve performance over the previous generations and lower operational costs
- Better optimization of the power consumption is being made during peak and off-peak hours by using high priority cores and low priority cores

- support DDR5 memory operating at speeds up to 6400 MHz to support high performance SQL server instances
- Improved density and support more and larger databases per host

SQL Server 2022 features

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 column store 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 Column Store 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 and 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 V4 systems with 6th Gen Intel Xeon Processors

Lenovo ThinkSystem V4 servers are bare-metal servers supporting either shared storage or local stored and ThinkAgile VX V4 systems are hyperconverged systems virtualized with VMware vSAN. Omnissa Horizon VDI solution can seamlessly leverage ThinkAgile VX V4 servers and ThinkSystem V4 servers with shared storage such as Lenovo ThinkSystem DE/DM/DG storage.

Lenovo ThinkAgile VX V4 Systems are factory-integrated, pre-validated ready-to-go integrated systems and Fully tested and validated for vSAN compliance.

ThinkSystem SR630 V4

ThinkSystem SR650 V4

ThinkAgile VX630 V4

ThinkAgile VX650 V4

Lenovo ThinkAgile VX V4 Systems and ThinkSystem Series V4 servers powered by Intel Xeon 6 processors provide excellent performance, bandwidth, and speed. Specifications include:

SR650 V4	**SR630 V4**
• 2x Intel Xeon 6700 or 6500-series processors with Performance cores (P-cores) up to 86 cores and 172 threads; TDP up to 350W	• 2x Intel Xeon 6700 or 6500-series processor with P-cores, up to 86 cores and 172 threads; TDP up to 350W • 2x Intel Xeon 6700-series processor with E-cores, up to 144 cores (no Hyper-Threading), TDP ratings up to 330W
• DDR5 memory operating up to 6400 MHz • 8 channels per CPU • 32 DIMMs (16 per processor), 2 DIMMs per channel • Supports RDIMMs, 3DS RDIMMs, and MRDIMMs • Supports CXL 2.0 memory in E3.S 2T form factor, up to 12x DIMMs with two processors • Up to 8TB of system memory	• DDR5 memory operating up to 6400 MHz • 8 channels per CPU • 32 DIMMs (16 per processor), 2 DIMMs per channel • E-cores: Supports RDIMMs • P-cores: Support for 3DS RDIMMs, MRDIMMs, and CXL memory • Up to 8TB of system memory
• Up to 32x NVMe drives for high-performance storage • Up to 16x 3.5”, 40x 2.5” drive bays, 32x E3.S • Support E3.S NVMe drives up to 32 • Support for 2.5” and 3.5” drive bay	• Support for up to 12x 2.5" NVMe drives (front+rear) • Support for E3.S drive formats will allow for greater drive capacities • No support for 3.5-inch drive bay

Lenovo XClarity Administrator offers comprehensive hardware management tools that help to increase uptime, reduce costs and improve productivity through advanced server management capabilities.

Performance Testing Details and Results

HammerDB Configuration

HammerDB is an open-source database transactional and analytics load testing/benchmarking tool for databases. The OLTP workload is derived from the TPC-C Benchmark standard, and it is not comparable to published TPC-C and do not comply with the TPC-C benchmark standards. The testing described below used HammerDB instance running on a separate server. The testing was performed on one node ThinkSystem SR640 V4 cluster with the following configuration parameters for operating system and SQL Server database.

Table 1. TPC-C performance testing hardware configuration

Component	Details
Server	1 x Lenovo ThinkSystem SR630 V4
CPU	2 socket, Intel Xeon 6787P 86 Core @ 3.8 GHz
RAM	1.5 TB (24 x Lenovo ThinkSystem 64GB TruDDR5 6400MHz)
Network adapter	ThinkSystem Mellanox ConnectX-6 Dx 100GbE QSFP56 2-port PCIe Ethernet Adapter)
Disks	4 x ThinkSystem 2.5" U.3 7450 PRO 1.92TB Read Intensive NVMe PCIe 4.0 x4 HS SSD 2 x ThinkSystem M.2 7450 PRO 960GB Read Intensive NVMe PCIe 4.0 x4 NHS SSD
Hypervisor	VMware vSphere 8.0u3
Operating System	Windows Server 2022 Datacenter
SQL Server Database (Enterprise Edition)	Microsoft SQL Server 2022 Enterprise Edition
HammerDB	5.0
Database size	100 GB
Number of warehouses	800
Virtual Users	150
Ramp Up	2 mins
Number of VMs	4
Transactions Per Minute (TPM)	9.71 million

Bill of Materials: ThinkAgile VX630 V4

Part number	Product Description	Qty
7DG5CTO1WW	Server: Lenovo ThinkAgile VX630 V4	1
C68J	ThinkAgile VX630 V4 10x2.5 Chassis	1
C5QM	Intel Xeon 6787P 86C 350W 2.0GHz Processor	2
C1XJ	ThinkSystem 1U V4 Performance Heatsink	2
C0TQ	ThinkSystem 64GB TruDDR5 6400MHz (2Rx4) RDIMM	32
C26V	ThinkSystem M.2 RAID B545i-2i SATA/NVMe Adapter	1
C2BS	ThinkSystem 2.5" U.3 7500 PRO 3.84TB Read Intensive NVMe PCIe 4.0 x4 HS SSD	8
C21X	ThinkSystem 1U V4 10x2.5" NVMe Gen5 Backplane	1
BQ1Y	ThinkSystem M.2 5400 PRO 480GB Read Intensive SATA 6Gb NHS SSD	2
BPPW	ThinkSystem Broadcom 57504 10/25GbE SFP28 4-Port OCP Ethernet Adapter	1
C1ZB	ThinkSystem SR630 V4 x16 PCIe Gen5 Riser 1 or 2	1
C0U3	ThinkSystem 2000W 230V Titanium CRPS Premium Hot-Swap Power Supply	2
C1YT	ThinkSystem 1U V4 Performance Fan Module	4
C1YP	ThinkSystem 1U V4 Standard Media Bay	1
C2DH	ThinkSystem Toolless Slide Rail Kit V4	1
SCY0	XClarity One - Managed Device, Per Endpoint w/3 Yr SW S&S	1
BVXG	VMware Cloud Foundation (VCF)	1

References:

Lenovo ThinkSystem SR650 V4 Server

https://lenovopress.lenovo.com/lp2127-thinksystem-sr650-v4-server

https://lenovopress.lenovo.com/lp1971-thinksystem-sr630-v4-server

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Lenovo ThinkAgile VX630 V4 Hyperconverged System

https://lenovopress.lenovo.com/lp2134-lenovo-thinkagile-vx630-v4-hyperconverged-system

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SQL Server Solutions
https://lenovopress.lenovo.com/software/database/sql

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