

Optimizing Microsoft SQL Server 2022 on Lenovo ThinkSystem SR630 V4

Solution Brief

Data growth challenge and a solution

In our data-rich environment, businesses of all sizes are grappling with a surge of fast-moving information, making the right data collection and management tools crucial. Businesses of all sizes are being inundated by information at increasing velocity. It's important 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 SR630 V4 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. The server is configured with 6th Generation Intel® Xeon® Scalable 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 SR630 V4 server is a storage dense offering, with up to 12 2.5" 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. Optional RAID-0 or RAID-1.

Business database solutions with faster time-to-value

Lenovo SR630 V4 systems are rigorously tested and tuned to save you months of configuration, setup, testing, and tuning. 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
- By using high priority cores and low priority cores a better a better optimization of the power consumption is being made during peak and off-peak hours
- To support high performance SQL server instances, the Lenovo SR630V4 systems support DDR5 memory operating at speeds up to 6400 MHz
- Improve density and support more and larger databases per host

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 ThinkSystem SR630 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 ThinkSystem SR630 V4 servers offer the necessary performance for bare metal or virtualized SQL Servers. High performance can be achieved using Hyper-V and Storage Spaces Direct technology which are built into Windows Server. 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.

In this testing we've installed Azure Stack HCI OS on one node and then deployed Azure Local on it. This approach sets the base for starting small and then adding more nodes as the business grows.

This configuration features the following main components:

- **Server:** Lenovo ThinkSystem SR630 V4
- **Processor:** 2x 6th Gen Intel Xeon, 6787P up to 3.8Ghz (2.00 Ghz base) 86 core
- **Memory:** 2TB of DDR5 5200 MHz memory
- **Storage pool:** 8x ThinkSystem 2.5" U.3 7450 PRO 3.84TB NVMe PCIe
- **OS Storage:** 2x 960GB M.2 NVMe SSDs PCIe 4.0 for the operating system (RAID 1)
- **Software:**
 - Microsoft Azure Stack HCI OS
 - Microsoft SQL Server 2022 Enterprise Edition

Host configuration on ThinkSystem SR630 V4

In our testing we deployed several virtual machines on Azure Local (single node instance). Each virtual machine will have Windows Server 2022 installed and SQL Server 2022 Enterprise Edition.

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

- Configure UEFI (BIOS) settings to set Operating mode to Maximum performance.
- Enable Hyper-threading in the BIOS
- Configure power profile in Azure Stack HCI OS to 'High performance'.



Figure 1. Lenovo ThinkSystem SR630 V4

Performance Testing Details and Results

HammerDB Configuration

HammerDB is an open-source load testing / benchmarking tool for databases available at: <http://www.hammerdb.com>. It offers tools for testing performance on OLTP and Analytics workloads. The OLTP workload is based on TPC-C benchmark from <http://www.tpc.org> and the Analytics workload is based on TPC-H benchmark from [tpc.org](http://www.tpc.org). Hammerdb 4.12 was run on a separate load server. Below are details of the testing and results.

Processor Generation	SR630 V4 - 6th Gen Intel Xeon
Hardware Configuration	ThinkSystem SR630 V4, 2x Intel Xeon 6787P 86 core 3.8 Ghz processors, 2TB memory, 8x ThinkSystem 2.5" U.3 7450 PRO 3.84TB NVMe PCIe
Database tested	MS SQL Server 2022 Enterprise
Benchmarks simulated	TPC-C
Database size: TPC-C	100 GB, 800 warehouse
Virtual Machine Information	4 VM's with 64vCPU and 80GB RAM

Run time parameters: TPC-C	
Virtual users	150
User delay	1 ms
TPC-C results	
TPM	8.23 million Transactions per minute (TPM)
TPC-H results	<i>coming soon</i>

Table 1. TPC-C performance testing details and results

Bill of Materials

7DK1CTO1WW	Server : ThinkSystem SR630V4 CPU+DIMM DWC-3yr Warranty	1
C1XE	ThinkSystem 1U V4 10x2.5" Chassis	1
C5QM	Intel Xeon 6787P 86C 350W 2.0GHz Processor	2
C0TQ	ThinkSystem 64GB TruDDR5 6400MHz (2Rx4) RDIMM	32
C26V	ThinkSystem M.2 RAID B545i-2i SATA/NVMe Adapter	1
BNF5	ThinkSystem 2.5" U.3 7450 PRO 3.84TB Read Intensive NVMe PCIe 4.0 x4 HS SSD	8
C21X	ThinkSystem 1U V4 10x2.5" NVMe Gen5 Backplane	1
BKSR	ThinkSystem M.2 7450 PRO 960GB Read Intensive NVMe PCIe 4.0 x4 NHS SSD	2
BE4U	ThinkSystem Mellanox ConnectX-6 Lx 10/25GbE SFP28 2-port PCIe Ethernet Adapter	1
C4DU	ThinkSystem SR630 V4 x16 PCIe Gen5 Riser 1 for Compute Complex Neptune Core Module	1
C0U3	ThinkSystem 2000W 230V/115V Titanium CRPS Premium Hot-Swap Power Supply	2
BLL6	ThinkSystem SR630 V4 Fan Module for Compute Complex Neptune Core Module	4
C1XQ	ThinkSystem PCIe 5.0 Cable, MCIO 8X STR TO MCIO 8X STR, 600mm	3
C1YA	T ThinkSystem M.2 Signal&Power Cable, ULP 82P-SLX4/2X10 SB, 540/680mm	1
C1YP	ThinkSystem 1U V4 Standard Media Bay	1
C2DH	ThinkSystem Toolless Slide Rail Kit V4	2
7S0XCTO8WW	XClarity Controller Prem-FOD	1
5641PX3	XClarity Pro, Per Endpoint w/3 Yr SW S&S	1
1340	Lenovo XClarity Pro, Per Managed Endpoint w/3 Yr SW S&S	1

Table 2. Bill of Materials

Why Lenovo

Lenovo is a US\$70 billion revenue Fortune Global 500 company serving customers in 180 markets around the world. Focused on a bold vision to deliver smarter technology for all, we are developing world-changing technologies that power (through devices and infrastructure) and empower (through solutions, services and software) millions of customers every day.

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 ThinkSystem SR630 V4: <https://lenovopress.lenovo.com/lp1971-thinksystem-sr630-v4-server>

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

Related product families

Product families related to this document are the following:

- [Microsoft Alliance](#)
- [Microsoft SQL Server](#)
- [ThinkSystem SR630 V4 Server](#)

Trademarks

Lenovo and the Lenovo logo are trademarks or registered trademarks of Lenovo in the United States, other countries, or both. A current list of Lenovo trademarks is available on the Web at <https://www.lenovo.com/us/en/legal/copytrade/>.

The following terms are trademarks of Lenovo in the United States, other countries, or both:

Lenovo®

AnyBay®

ThinkSystem®

XClarity®

The following terms are trademarks of other companies:

Intel®, Intel Optane™, and Xeon® are trademarks of Intel Corporation or its subsidiaries.

Azure®, Hyper-V®, Microsoft®, SQL Server®, Windows Server®, and Windows® are trademarks of Microsoft Corporation in the United States, other countries, or both.

TPC, TPC-C, and TPC-H are trademarks of Transaction Processing Performance Council.

Other company, product, or service names may be trademarks or service marks of others.