

# Optimizing Microsoft SQL Server 2022 on Lenovo ThinkSystem SR650 V4

## Solution Brief

### Data growth challenge and a solution

In today's data-rich environment organizations of all sizes are addressing 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 SR650 V4 are optimized for both Online Transaction Processing (OLTP) and Analytics / Data Warehouse (DW). This technical brief features Microsoft SQL Server 2022 Enterprise running on a high-performance Lenovo dual-socket 2U rack mount enterprise server. The server is configured with 6th Generation Intel® Xeon® Scalable processors, DDR5 6400MHz 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 also offer support for MRDIMMs and CXL 2.0 memory

The SR650 V4 server is a storage dense offering, with up to 40 2.5" drive bays in the front, mid-bays and rear of the server. Supports NVMe drives or SAS drives using a variety of 12Gb RAID controllers and SAS HBAs. Supports 36x NVMe drives without oversubscription of PCIe lanes. The use of NVMe drives maximizes drive I/O performance, in terms of throughput and latency. 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 SR650 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 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 SR650 V4 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 SR650 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 SR650 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.

This configuration features the following main components:

- **Server:** Lenovo ThinkSystem SR650 V4
- **Processor:** 2x 6th Gen Intel Xeon, 6787P up to 3.8Ghz (2.00 Ghz base) 86 core
- **Memory:** 2TB of DDR5 6400 MHz memory
- **Storage:** 8x Micron 3.8TB NVMe
- **OS Storage:** 2x 960GB M.2 NVMe (RAID 1)
- **Software:**
  - Microsoft Windows Server 2025
  - Microsoft SQL Server 2022 Enterprise Edition

## Host configuration on ThinkSystem SR650 V4

In our testing we deployed several Hyper-V virtual machines in addition to bare metal testing. Each virtual machine runs Windows Server 2022 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 Windows OS to 'High performance'.



Figure 1. Lenovo ThinkSystem SR650 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 4.3 was run on a separate load server. Below are details of the testing and results.

<b>Processor Generation</b>	SR650 V4 - 6th Gen Intel Xeon
<b>Hardware Configuration</b>	ThinkSystem SR650 V4, 2x Intel Xeon 6787P 86 core 3.8 Ghz processors, 2TB memory, Micron 3.8TB NVMe drives
<b>Database tested</b>	MS SQL Server 2022 Enterprise
<b>Benchmarks simulated</b>	TPC-C & TPC-H Bare Metal and Virtual
<b>Database size: TPC-C</b>	100 GB 800 warehouse

<b>Database size: TPC-H</b>	1TB - 1000 scale
<b>Virtual Machine Information</b>	8 VM's with 64vCPU and 80GB RAM
<b>Run time parameters: TPC-H</b>	
Virtual users	7
<b>Run time parameters: TPC-C</b>	
Virtual users	400 Bare metal
Virtual users	150 Virtual machines
User delay	1 ms
<b>TPC-C results</b>	
TPM	Bare Metal - 6.6 million Transactions per minute (TPM) Virtualized – Results coming soon
<b>TPC_H results</b>	
Queries per hour QpH	Results coming soon

Table 1. TPC-C performance testing details and results

## Bill of Materials

7DGDCTO1W W	Server: ThinkSystem SR650 V4 - 3yr Warranty	1
C3QK	ThinkSystem SR650 V4 24x2.5" Chassis	1
C9U9	ThinkSystem Virtualization - Max Performance	1
BVGL	Data Center Environment 30 Degree Celsius / 86 Degree Fahrenheit	1
C5QM	Intel Xeon 6787P 86C 350W 2.0GHz Processor	2
C3QR	ThinkSystem V4 2U Performance Heatsink	2
C0TQ	ThinkSystem 64GB TruDDR5 6400MHz (2Rx4) RDIMM	32
5977	Select Storage devices - no configured RAID required	1
C0ZU	ThinkSystem 2.5" U.2 VA 3.84TB Read Intensive NVMe PCIe 5.0 x4 HS SSD	12
C46P	ThinkSystem 2U V4 8x2.5" NVMe Backplane	2
C0JK	ThinkSystem M.2 B340i-2i NVMe Enablement Adapter	1
BKSR	ThinkSystem M.2 7450 PRO 960GB 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
AUZV	ThinkSystem Broadcom 5719 1GbE RJ45 4-Port PCIe Ethernet Adapter	1
C62D	ThinkSystem SR650/a V4 x16 Rear Direct Riser Slot 5	1
C0UB	ThinkSystem 2700W 230V/115V Platinum CRPS Hot-Swap Power Supply v2.4	2
B4L0	1.0m, 16A/100-250V, C19 to IEC 320-C20 Rack Power Cable	2
C3RQ	ThinkSystem V4 2U Standard Fan Module	6
C2DH	ThinkSystem Toolless Slide Rail Kit V4	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 SR650 V4: [SR650 V4 Detailed Information](#)

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](#)
- [Lenovo Servers and Storage](#)

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