Microsoft SQL Server 2025 on Lenovo ThinkAgile HX V4 and FX V4 Systems

Solution Brief

Enterprise organizations manage the full spectrum of data workloads, from high-frequency financial transactions and mission-critical ERP systems to real-time analytics and AI-powered applications. The relational database remains the most trusted foundation for structured, transactional data at enterprise scale, and Microsoft SQL Server 2025 represents a significant evolution of that foundation.

SQL Server 2025 introduces native AI integration, vector data types, intelligent query processing enhancements, and seamless connectivity to Microsoft Fabric, alongside its industry-leading reliability, security, and high-availability capabilities. For organizations modernizing their data infrastructure without sacrificing governance or performance, SQL Server 2025 delivers a compelling platform.

Lenovo ThinkAgile HX V4 and ThinkAgile FX V4 hyperconverged systems, powered by Intel Xeon 6 Processors and certified with Nutanix software, provide the ideal infrastructure for SQL Server 2025 deployments.

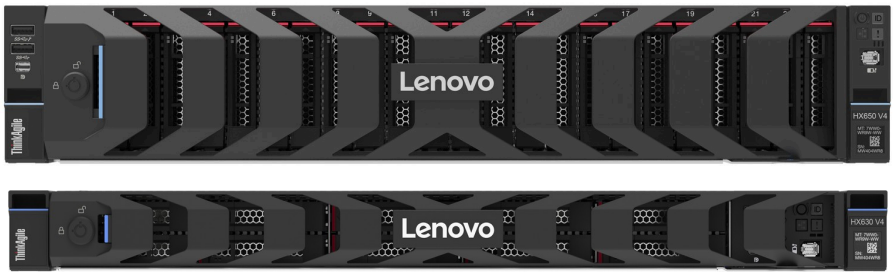

Figure 1. ThinkAgile HX650 V4 (top) and HX630 V4 (bottom) for Nutanix hyperconverged infrastructure

By converging compute, storage, and virtualization into a single validated platform, ThinkAgile simplifies deployment and operations while delivering the density, performance, and resilience that mission-critical workloads demand. Validated testing demonstrates 11.42 million transactions per minute on a single ThinkAgile HX650 V4 node running SQL Server 2025 Enterprise, with throughput scaling as nodes are added to the cluster.

Figure 2. ThinkAgile FX650 V4 (top) and FX630 V4 (bottom) for flexible hyperconverged infrastructure

For detailed deployment guidance including configuration best practices, network design, and step-by-step procedures, see the SQL Server 2025 on Lenovo ThinkAgile HX V4 and FX V4 Planning and Implementation Guide:

https://lenovopress.lenovo.com/lp2457-running-sql-server-2025-on-lenovo-thinkagile-hx-v4-and-fx-v4-servers

The Lenovo ThinkAgile HX and FX Series Reference Architecture provides validated topology diagrams, network design, and storage layout guidance for production deployments:

https://lenovopress.lenovo.com/lp0665-thinkagile-hx-and-fx-series-reference-architecture

Business Challenge

CIOs and enterprise IT leaders face converging pressures that make the status quo unsustainable. Infrastructure deployed three to five years ago was not designed for today's data volumes, workload mix, or AI integration requirements, and the gap between what the business demands and what the infrastructure delivers continues to widen.

Data growth is the first pressure. ERP, CRM, financial ledgers, and operational systems generate ever-larger datasets, while IoT telemetry, event streams, and cloud integrations compound the load. Legacy storage and compute tiers struggle to sustain the IOPS, throughput, and latency required, resulting in degraded application performance and missed SLAs.

AI is the second. Business intelligence and AI initiatives increasingly treat the database as a processing engine, requiring semantic search, recommendation engines, and retrieval-augmented generation (RAG) alongside traditional OLTP. Bolting separate AI infrastructure onto a relational estate creates integration complexity, data duplication, and governance gaps.

Operational complexity and availability risk compound both. Three-tier architectures carry separate lifecycles, patching requirements, vendor relationships, and failure modes at every layer, while many organizations still protect revenue-critical databases with complex, manually managed high-availability configurations. A single unplanned outage can result in lost revenue, regulatory penalties, and reputational damage.

SQL Server 2016 reached the end of extended support on July 14, 2026, meaning security patches, hotfixes, and technical support are no longer available for organizations still running it. SQL Server 2019 remains under extended support through January 8, 2030, but because modernization projects typically require 12 to 18 months of planning, procurement, and migration, organizations on SQL Server 2019 are in their optimal planning window now.

Economics have changed as well. SQL Server core licensing generally requires all physical cores to be licensed, with a four-core minimum per processor, although Enterprise Edition with Software Assurance or subscription rights supports unlimited virtualization when all physical cores are licensed. Processor selection, VM density, and workload placement are therefore financial decisions as much as technical ones. At the same time, Broadcom's shift away from perpetual VMware licensing has increased the importance of workload placement and platform fit, prompting many organizations to reassess whether their current hypervisor remains the right long-term operating model.

Solution

The Lenovo ThinkAgile HX V4 and FX V4 hyperconverged systems, running Microsoft SQL Server 2025 on Nutanix AHV with Nutanix Cloud Platform (NCP), directly address each of these business challenges. The platform consolidates compute, storage, and virtualization into a single, fully validated, factory-integrated stack that simplifies procurement, accelerates deployment, and delivers consistent, predictable performance at scale.

The following describes the specific validated reference configuration used for the performance testing

documented in this brief. Contact your Lenovo representative for guidance on alternative configurations including HX and FX V4 variants.

Each ThinkAgile HX650 V4 node houses dual Intel Xeon 6767P processors delivering 64 cores per socket, paired with up to 1 TB of DDR5 6400MHz memory per node. NVMe PCIe Gen 5 SSDs provide industry-leading local storage throughput, while Mellanox 25GbE networking connects nodes in a high-bandwidth cluster fabric. Nutanix AHV provides the virtualization layer, and Nutanix Database Service (NDB) enables unified provisioning, cloning, and administration of SQL Server databases across the cluster.

ThinkAgile FX V4 extends this foundation with software-defined flexibility, allowing organizations to transition between hypervisors without replacing hardware and protecting infrastructure investment as technology strategies evolve. SQL Server 2025 capabilities including native vector data types, T-SQL AI model integration, optimized locking for high-concurrency OLTP, and Always On Availability Group enhancements run on this platform to deliver enterprise AI, analytics, and transactional workloads from a single, governed, on-premises infrastructure stack.

Complete hardware, software, and workload configuration details for the validated system, together with the measured OLTP performance results, are provided in the Test Results section of this document.

What's New in SQL Server 2025

SQL Server 2025 introduces capabilities that directly address enterprise database consolidation, AI integration, and high-concurrency OLTP on Lenovo ThinkAgile infrastructure:

- **Native Vector Data Type and Vector Search.**

  SQL Server 2025 adds a native vector data type, vector functions, and approximate vector indexing, enabling semantic search, recommendations, and RAG applications directly inside the database engine without a separate vector store.

- **Built-in AI Model Integration from T-SQL.**

  New external AI model objects and REST endpoint invocation allow T-SQL workloads to call Azure OpenAI and other AI services natively, enabling embedding generation and intelligent query augmentation without leaving the database.

- **Enhanced Intelligent Query Processing (IQP).**

  New IQP capabilities include cardinality estimation feedback, Optional Parameter Plan Optimization, and DOP feedback enabled by default, reducing query plan instability and improving throughput for mixed OLTP and analytics workloads.

- **Optimized Locking for High-Concurrency OLTP.**

  Optimized locking reduces lock memory consumption, blocking, and lock escalation, directly improving concurrency and throughput for transaction-heavy ERP, CRM, and financial applications.

- **Native JSON and Microsoft Fabric Mirroring.**

  A native JSON data type with indexing simplifies document-style data management. Fabric Mirroring continuously replicates on-premises SQL Server data into Microsoft Fabric for real-time analytics without ETL pipelines.

- **Stronger Security and Availability.**

  TLS 1.3 with TDS 8.0, PBKDF2 password hashing, Microsoft Entra integration, and improved Always On failover behavior deliver a modern, standards-aligned security and resiliency posture.

Use Cases

Enterprise SQL Server estates rarely serve a single purpose. The same platform is expected to carry transactional systems of record, feed reporting and analytics, support new AI-enabled applications, and

remain available through planned and unplanned disruption. SQL Server 2025 on Lenovo ThinkAgile HX V4 and FX V4 addresses six recurring workload patterns on one validated foundation, allowing organizations to consolidate rather than build a separate environment for each. The following table summarizes each pattern, the SQL Server 2025 and ThinkAgile capabilities that enable it, and the resulting business benefit.

Table 1. Use cases for SQL Server 2025 on Lenovo ThinkAgile HX V4 and FX V4

Use Case	SQL Server 2025 and ThinkAgile Capability	Business Benefit
Mission-Critical OLTP	SQL Server 2025 optimized locking reduces lock memory consumption, blocking, and lock escalation; Intel Xeon 6 processors and NVMe PCIe Gen 5 storage sustain high transaction rates	Predictable response times for ERP, CRM, financial, and order management systems at peak concurrency
Real-Time Analytics and Business Intelligence	Microsoft Fabric Mirroring continuously replicates operational data to Fabric; enhanced IQP adds DOP feedback and cardinality estimation improvements	Near-real-time reporting without ETL pipeline complexity or a separate analytics environment
AI-Augmented Database Applications	Native vector data type, vector indexing, T-SQL embedding generation, and external AI model integration	RAG, semantic search, and recommendation systems built on governed data without a separate vector database
Database Consolidation and Simplification	ThinkAgile HCI consolidates compute, storage, and virtualization; Nutanix Database Service automates provisioning, cloning, and online storage expansion	Reduced rack footprint, fewer platforms to secure and support, and an opportunity to rationalize SQL Server licensing
Disaster Recovery and Business Continuity	Always On Availability Group enhancements combined with Nutanix built-in data protection and cross-cluster replication	Automated failover with deterministic recovery objectives and no manual DR configuration
Virtualization Platform Transition	ThinkAgile FX V4 software-defined flexibility allows hypervisor changes without replacing hardware; Nutanix AHV provides an alternative operating model	A phased, evidence-based path away from subscription-based virtualization licensing without creating a new infrastructure silo

Market Verticals

These workload patterns take different forms in each industry. Regulated sectors weigh data residency, auditability, and control over sensitive data most heavily, while operationally intensive industries prioritize continuity, scale, and analytics close to the point of decision. Because ThinkAgile HX V4 and FX V4 keep data and governance on premises while still supporting AI and analytics integration, the platform maps well to sectors where public cloud deployment is constrained. The following table outlines the primary requirements, platform benefits, and representative applications for key verticals.

Table 2. Market verticals for SQL Server 2025 on Lenovo ThinkAgile HX V4 and FX V4

Industry Vertical	Business Requirements	SQL Server 2025 + ThinkAgile Benefit	Example Use Cases
Financial Services	Transaction integrity, low latency, strict audit and regulatory compliance (SOX, PCI-DSS, Basel III)	On-premises deployment satisfies data residency and regulatory requirements; SQL Server 2025 optimized locking sustains high concurrency at peak transaction volumes	Core banking, trading and settlement, payment processing, fraud analytics

Industry Vertical	Business Requirements	SQL Server 2025 + ThinkAgile Benefit	Example Use Cases
Healthcare and Life Sciences	Data privacy, continuous availability, HIPAA compliance	Protected health information remains under organizational control; native vector search and T-SQL AI integration enable RAG applications without exposing data to public cloud endpoints	EHR systems, clinical data warehouses, clinical decision support, pharmaceutical research
Manufacturing and Supply Chain	Operational continuity, plant efficiency, supply chain visibility	Validated, factory-integrated HCI stack simplifies plant-floor deployment; Fabric Mirroring feeds supply chain analytics without disrupting operational database performance	ERP, MES, quality management, production planning, supply chain visibility
Retail and Consumer Goods	Scale, predictable performance, personalization	Online scaling through NDB storage expansion and Nutanix workload balancing; SQL Server 2025 vector search powers recommendations natively in the relational database	POS, inventory management, loyalty platforms, demand forecasting, recommendation engines
Government and Public Sector	Data sovereignty, security, and classification controls	Supports air-gapped and controlled-network on-premises deployments; TLS 1.3 with TDS 8.0 and Microsoft Entra integration strengthen encryption and access control	Citizen services, records management, public safety systems, case management
Energy and Utilities	Resilience, operational analytics, regulatory reporting	Nutanix built-in data protection delivers resilience without complex manual failover configurations; analytics integration supports predictive models on the same platform	SCADA data management, asset performance monitoring, predictive maintenance, demand forecasting

Business Outcomes

Organizations deploying SQL Server 2025 on Lenovo ThinkAgile HX V4 and FX V4 realize measurable improvements across performance, operational efficiency, total cost of ownership, and long-term infrastructure resilience:

- **Performance at Scale.**

  Validated HammerDB TPC-C-style testing demonstrates 11.42 million transactions per minute across four VMs on a single ThinkAgile HX650 V4 node, at 85% CPU utilization and 91K average IOPS. This provides a validated performance baseline for sizing, capacity planning, and workload consolidation assessments.

- **Reduced Infrastructure Complexity.**

  Consolidating compute, storage, and virtualization into a single HCI stack eliminates the operational complexity of separate infrastructure layers. Nutanix NDB provides unified database lifecycle management, replacing multiple point tools for provisioning, patching, cloning, and backup, freeing IT teams for higher-value initiatives.

- Lower Total Cost of Ownership.

  High-density ThinkAgile HX V4 nodes reduce rack space, power, and cooling requirements compared to equivalent three-tier configurations. Consolidating multiple database workloads reduces per-workload licensing and support costs. A single Lenovo-validated stack simplifies procurement and reduces multi-vendor support complexity.

- **Faster Time-to-Value.**

  Factory-integrated and pre-validated ThinkAgile systems eliminate lengthy procurement and integration cycles. SQL Server 2025 can be operational within days of hardware delivery. Nutanix NDB provisioning and cloning accelerates application development and deployment cycles, reducing time-to-production from weeks to hours.

- **Enterprise Resilience and Business Continuity.**

  Nutanix built-in data protection, SQL Server 2025 Always On Availability Groups, and NDB automated backup deliver deterministic, low-RTO recovery without manual intervention. Organizations can meet aggressive RTO and RPO commitments while eliminating the complexity and risk of manually maintained DR configurations.

- **Future-Proof Investment.**

  ThinkAgile FX V4 software-defined flexibility allows hypervisor transitions without hardware replacement. SQL Server 2025 hybrid cloud integration with Azure and Microsoft Fabric preserves optionality for future cloud or hybrid deployments. Intel Xeon 6 architecture provides a high-core-count, high-memory foundation capable of supporting growth for five or more years.

Test Results

Lenovo tested SQL Server 2025 OLTP performance on a four-node Lenovo ThinkAgile HX650 V4 cluster to characterize the transaction throughput achievable on a single node with multiple concurrent database VMs. Testing used HammerDB with an OLTP workload modeled on the TPC-C benchmark standard. Results are not comparable to published TPC-C results and do not comply with TPC-C benchmark standards. Actual results will vary based on workload, configuration, and environment.

In this section:

Test Tool: HammerDB

HammerDB is an open-source database benchmarking tool that includes an OLTP workload derived from the TPC-C benchmark specification. It simulates a high-concurrency order-entry system with multiple warehouse districts, customers, orders, and stock transactions running simultaneously. HammerDB was deployed on a dedicated external server to generate load against the SQL Server VMs running on the ThinkAgile HX650 V4 cluster, ensuring the load generator did not consume cluster resources.

Hardware Configuration

The following table details the hardware components of the four-node ThinkAgile HX650 V4 cluster used for all SQL Server 2025 OLTP performance testing in this brief.

Table 3. Lenovo ThinkAgile HX650 V4 — Hardware Configuration

Component	Specification
Server platform	4x Lenovo ThinkAgile HX650 V4 (2U, 2-socket)
Processor	2x Intel Xeon 6767P — 64 cores, 350W, 2.4GHz per node
Memory	1 TB per node — 16x ThinkSystem 64GB TruDDR5 6400MHz (2Rx4) RDIMM
Boot / OS storage	2x ThinkSystem M.2 7450 PRO 480GB Read Intensive NVMe PCIe 4.0 NHS SSD

Component	Specification
Data storage	8x ThinkSystem 2.5" U.2 PM9D3a 1.92TB Read Intensive NVMe PCIe 5.0 x4 HS SSD
Network	2x Mellanox ConnectX-6 Lx 10/25GbE SFP28 2-port PCIe Ethernet Adapter
HCI software	Nutanix AHV 10.3.0.1 / AOS 7.3.0.5
CVM	16 vCPUs, 64 GB RAM per node

SQL Server 2025 VM and Workload Configuration

The following table summarizes the SQL Server 2025 virtual machine configuration and HammerDB workload parameters applied during testing. Four identically configured VMs ran concurrently on a single HX650 V4 node.

Table 4. SQL Server 2025 VM and Workload Configuration

Parameter	Value
Database engine	Microsoft SQL Server 2025 Enterprise
Operating system	Windows Server 2025 Datacenter
VM configuration	32 vCPUs, 64 GB memory, 2 TB total disk
Nodes under test	1 node (single-node characterization)
Concurrent VMs	4 SQL Server VMs
OS + TempDB disk	512 GB
Data disk	512 GB
Log disk	512 GB
Backup disk	512 GB
Database size	800 warehouses (~80 GB)
Virtual users	150 per VM
Ramp-up period	5 minutes

Performance Results

The following results were recorded after the 5-minute ramp-up period, during steady-state operation with all four SQL Server VMs running concurrently on a single ThinkAgile HX650 V4 node.

Table 5. SQL Server 2025 on ThinkAgile HX650 V4 — OLTP Performance Results

Metric	Result
Transactions Per Minute (TPM)	11,420,000
Host CPU utilization	85%
Average IOPS	91,000
Read / Write IOPS split	75% reads / 25% writes
Concurrent SQL Server VMs	4
Virtual users (total)	600 (150 per VM)

The node reached approximately 85% host CPU utilization across 128 cores, indicating effective use of the available compute resources while preserving operational capacity for virtualization overhead and Nutanix CVM services. The 91,000 average IOPS result — sustained across four concurrent VMs — confirms that the NVMe PCIe Gen 5 storage subsystem does not become a bottleneck under this OLTP

workload profile.

Key Observations

Analysis of the steady-state test results highlights several characteristics relevant to production capacity planning and workload consolidation decisions:

- **Storage is not the bottleneck.**

  91,000 IOPS at 75/25 read-write ratio with eight PCIe Gen 5 NVMe drives per node leaves significant storage headroom. Workloads with a higher write ratio or larger database footprints can be accommodated without storage re-architecture.

- **Efficient resource utilization.**

  The validated configuration reached approximately 85% host CPU utilization, indicating effective use of available compute resources while preserving operational capacity for virtualization overhead, Nutanix CVM services, transient workload spikes, and routine database maintenance activities. Production environments typically benefit from maintaining reserve CPU capacity rather than operating continuously at maximum utilization. Organizations consolidating multiple database servers can use this result as a baseline for modeling consolidation ratios against their own headroom and node-failure reserve policies.

- **Linear scale-out with Nutanix.**

  The four-node cluster was tested on a single node for conservative, worst-case single-node characterization. In a production deployment, Nutanix distributed storage and AHV workload distribution allow throughput to scale linearly as nodes are added to the cluster, supporting multi-node throughput of 40M+ TPM on a four-node cluster.

- **SQL Server 2025 optimized locking reduces contention.**

  The optimized locking feature in SQL Server 2025 reduces lock memory usage and blocking under high-concurrency OLTP. This is reflected in the linear throughput scaling across all 150 virtual users per VM without significant lock wait degradation at peak load.

Configuration Best Practices

The following table lists the configuration settings that were applied during testing and are recommended for production SQL Server 2025 deployments on Lenovo ThinkAgile HX V4 and FX V4 systems.

Table 6. Recommended Configuration Settings for SQL Server 2025 on ThinkAgile HX V4

Setting	Recommended Value
UEFI operating mode	Maximum Performance
Windows power profile	High Performance
NTFS cluster size (data and log drives)	64 KB
NTFS cluster size (OS and SQL binaries)	4 KB (default)
SQL Server data and log files	Separate physical drives
SQL Server max memory	Set explicitly — reserve memory for OS and CVM
TempDB configuration	Default is suitable for most OLTP workloads
DOP feedback (SQL Server 2025)	Enabled by default — no additional configuration required

Bill of Materials

The following bill of materials lists the components used in the validated Lenovo ThinkAgile HX650 V4 configuration. This represents a single-node BOM. A four-node cluster requires four units of each server-level component. Part numbers and feature codes are provided for reference and procurement purposes. Contact your Lenovo representative or authorized Lenovo Business Partner for current pricing, availability, and configuration guidance.

Table 7. Lenovo ThinkAgile HX650 V4 — Bill of Materials (Single Node)

Part Number / Feature Code	Product Description	Quantity
7DG4CTO1WW	Lenovo ThinkAgile HX650 V4 Hyperconverged System (server base unit)	1
C6TQ	ThinkAgile HX650 V4 Base	1
B15S	Nutanix Software Stack on Nutanix AHV	1
BVKV	Nutanix Cloud Platform (NCP) Pro Software License with Mission Critical Support	1
C5QY	Intel Xeon 6767P 64C 350W 2.4GHz Processor	2
C0TQ	ThinkSystem 64GB TruDDR5 6400MHz (2Rx4) RDIMM	16
C26V	ThinkSystem M.2 RAID B545i-2i SATA/NVMe Adapter	1
C46P	ThinkSystem 2U V4 8x2.5" NVMe Backplane	2
B0SW	Nutanix Flash Node Config	1
C2BR	ThinkSystem 2.5" U.3 7500 PRO 1.92TB Read Intensive NVMe PCIe 4.0 x4 HS SSD	6
BKSR	ThinkSystem M.2 7450 PRO 960GB Read Intensive NVMe PCIe 4.0 x4 NHS SSD	2
BN2T	ThinkSystem Broadcom 57414 10/25GbE SFP28 2-Port OCP Ethernet Adapter	1
C0U3	ThinkSystem 2000W 230V Titanium CRPS Premium Hot-Swap Power Supply	2
6400	2.8m, 13A/100-250V, C13 to C14 Jumper Cord	2
SCJC	XClarity One — Managed Device, Per Endpoint w/1 Yr SW S&S	1

Conclusion

Lenovo ThinkAgile HX V4 and FX V4 with SQL Server 2025 and Intel Xeon 6 give IT leaders a single, validated, factory-integrated stack that handles today's mission-critical databases, tomorrow's AI workloads, and the compliance demands of the most regulated industries. With 11.42 million transactions per minute proven on a single node and Nutanix-powered resilience built in, the platform is ready to run and scale from day one.

For More Information

Ready to modernize your database infrastructure? Contact your Lenovo representative or visit the Lenovo ThinkAgile HX V4 and FX V4 product pages at lenovopress.lenovo.com to learn more and request a proof-of-concept engagement.

References:

- Modernize Microsoft SQL Server 2025 with Lenovo: https://lenovopress.lenovo.com/lp2480
- Lenovo ThinkAgile HX Solutions: https://lenovopress.lenovo.com/datasheet/ds0019
- Lenovo ThinkAgile HX650 V4: https://lenovopress.lenovo.com/lp2133
- Lenovo ThinkAgile FX650 V4: https://lenovopress.lenovo.com/lp2338
- Microsoft SQL Server 2025 Documentation: https://learn.microsoft.com/sql
- Nutanix Database Service (NDB): https://www.nutanix.com/products/database-service

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Related product families

Product families related to this document are the following:

- Microsoft Alliance
- Microsoft SQL Server
- ThinkAgile FX Series
- ThinkAgile HX Series for Nutanix

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