

Microsoft SQL Server 2025 on ThinkAgile VX V4 and FX V4

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 the reliability, security, and high-availability capabilities the platform is known for. For organizations modernizing their data infrastructure without sacrificing governance or performance, SQL Server 2025 offers a compelling path forward.

Lenovo ThinkAgile VX V4 and FX V4 hyperconverged systems, powered by Intel Xeon 6 processors and certified with VMware software, provide the infrastructure foundation for SQL Server 2025 deployments. 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. In Lenovo validated testing, a single ThinkAgile VX650 V4 node sustained 9.55 million transactions per minute running SQL Server 2025 Enterprise, with throughput scaling as nodes are added to the cluster.



Figure 1. ThinkAgile VX650 V4 (top) and VX630 V4 (bottom)

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 business demand and infrastructure capability continues to widen.

- **Data Growth and Performance**

ERP, CRM, financial, and IoT workloads generate ever larger datasets. Legacy storage and compute tiers struggle to sustain the required IOPS, throughput, and latency, resulting in degraded performance and missed SLAs.

- **AI Integration**

Business intelligence and AI initiatives increasingly require semantic search, recommendations, and retrieval augmented generation alongside traditional OLTP. Bolting separate AI infrastructure onto a relational estate creates integration complexity, data duplication, and governance gaps.

- **Complexity, Availability, and Cost**

Three-tier architectures carry separate lifecycles and failure modes at every layer, DRAM and licensing costs continue to climb, and many organizations still protect revenue-critical databases with manually managed high-availability configurations.

- **A Closing Modernization Window**

SQL Server 2016 reaches end of extended support on July 14, 2026, and SQL Server 2019 extended support ends January 8, 2030. Because modernization typically takes 12 to 18 months, the window to plan and migrate is closing, and Broadcom's shift away from perpetual VMware licensing adds further urgency to platform decisions.

Solution

The Lenovo ThinkAgile VX V4 and FX V4 hyperconverged systems, running SQL Server 2025 on VMware Cloud Foundation, directly address each of these challenges. The platform consolidates compute, storage, and virtualization into a single, factory-integrated stack that simplifies procurement, accelerates deployment, and delivers consistent, predictable performance at scale.

Each ThinkAgile VX650 V4 node houses dual Intel Xeon 6730P processors delivering 32 cores per socket, paired with 1 TB of DDR5 6400MHz memory as tested; the platform supports up to 8 TB of memory per node for workloads that require it. NVMe PCIe Gen 5 SSDs provide high local storage throughput, and Mellanox 25GbE networking connects nodes in a high-bandwidth cluster fabric.

VMware vSphere provides the virtualization layer, and VCF Data Service Manager enables unified provisioning, cloning, and administration of SQL Server databases across the cluster. An optional NVMe tiering drive helps organizations balance CPU and memory usage and extend the value of existing infrastructure without impacting application performance.

ThinkAgile FX V4 extends this foundation with software-defined flexibility, letting organizations change hypervisors without replacing hardware and protecting infrastructure investment as strategies evolve. Complete hardware, software, and workload configuration details for the validated system, together with the measured OLTP performance results, are provided in the [Test Methodology](#) and [Test Results](#) sections of this brief.

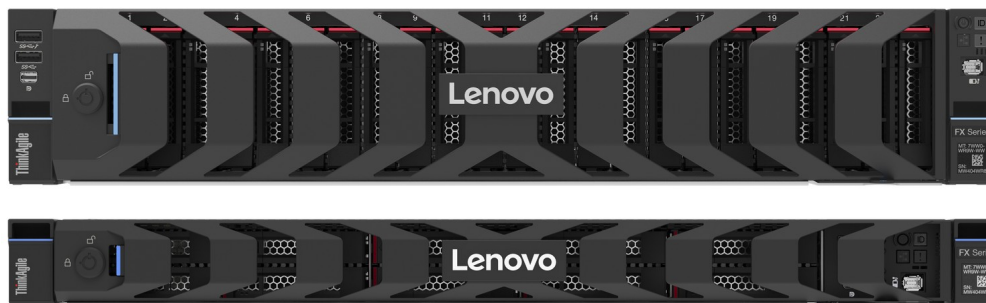


Figure 2. ThinkAgile FX650 V4 (top) and FX630 V4 (bottom) designed for flexible hyperconverged infrastructure

SQL Server 2025 Capabilities

Microsoft SQL Server 2025 pairs this infrastructure with capabilities that extend the platform beyond traditional OLTP:

- **Native Vector Data Type and Search**

Vector functions and approximate vector indexing enable semantic search, recommendations, and retrieval augmented generation directly inside the database engine, without a separate vector store.

- **Built-in AI Model Integration**

External AI model objects and REST endpoint invocation let T-SQL workloads call Azure OpenAI and other AI services natively, enabling embedding generation and intelligent query augmentation.

- **Enhanced Intelligent Query Processing**

Cardinality estimation feedback, optional parameter plan optimization, and degree of parallelism feedback, enabled by default, reduce query plan instability and improve throughput for mixed OLTP and analytics workloads.

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

Reduced lock memory consumption, blocking, and lock escalation directly improve 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, and Fabric Mirroring continuously replicates on-premises 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

SQL Server 2025 on Lenovo ThinkAgile VX V4 and FX V4 addresses four 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 VX 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; dual Intel Xeon 6730P 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 AI-Augmented Applications	Native vector data type, vector indexing, and T-SQL AI model integration enable RAG and semantic search on governed data; Microsoft Fabric Mirroring replicates operational data to Fabric in near real time.	RAG, semantic search, and recommendation systems built on governed data without a separate vector database, plus near-real-time reporting without ETL pipeline complexity.
Database Consolidation and Simplification	ThinkAgile HCI consolidates compute, storage, and virtualization; VCF Data Service Manager 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 VMware vSAN built-in data protection and cross-cluster replication.	Automated failover with deterministic recovery objectives and no manual DR configuration.

Workloads

SQL Server 2025 on Lenovo ThinkAgile VX V4 and FX V4 is built to run the full range of workloads that make up a modern data estate on one validated platform, rather than requiring a separate environment for each:

- **Mission-Critical OLTP Workloads**

High-concurrency transactional systems, such as ERP, CRM, financial, and order management applications, that demand predictable response times at peak load.

- **Analytics and AI-Augmented Workloads**

Real-time reporting, semantic search, and retrieval augmented generation built directly on governed operational data, without a separate analytics or vector database.

- **Consolidation Workloads**

Multiple SQL Server instances and database workloads unified onto a single HCI stack, reducing rack footprint, platform sprawl, and the number of environments IT must secure and support.

- **Resilience and Continuity Workloads**

Databases that cannot tolerate extended downtime, protected by SQL Server 2025 Always On Availability Groups and VMware vSAN built-in data protection.

Complete hardware configuration, test methodology, and measured performance for these workload profiles are provided in the Test Methodology and Test Results sections of this brief.

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 VX 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 VX 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
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

Industry Vertical	Business Requirements	SQL Server 2025 + ThinkAgile Benefit	Example Use Cases
Retail and Consumer Goods	Scale, predictable performance, personalization	Online scaling through vSAN; 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	vSAN 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 Outcome

Organizations deploying SQL Server 2025 on Lenovo ThinkAgile VX 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 demonstrated 9.55 million transactions per minute across twelve concurrent virtual machines on a single ThinkAgile VX650 V4 node, at 75% host CPU utilization and 375K 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. VCF Data Service Manager 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 VX 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, and NVMe Memory Tiering can further raise consolidation density where memory cost, rather than raw throughput, is the binding constraint.

- **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, and VCF Data Service Manager provisioning and cloning accelerates application development and deployment cycles, reducing time-to-production from weeks to hours.

- **Enterprise Resilience and Business Continuity**

VMware vSAN built-in data protection, SQL Server 2025 Always On Availability Groups, and VCF Data Service Manager 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, and Intel Xeon 6 architecture provides a high-core-count, high-memory foundation capable of supporting growth for five or more years.

Test Methodology

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 virtual machines running on the ThinkAgile VX650 V4 cluster, so the load generator itself did not consume cluster resources.

Each node in the validated cluster used the configuration in the following table.

Table 3. Lenovo ThinkAgile VX650 V4, Hardware Configuration

Component	Specification
Server platform	4x Lenovo ThinkAgile VX650 V4 (2U, 2-socket)
Processor	2x Intel Xeon 6730P, 32 cores, 350W, 2.4GHz per node
Memory	1 TB per node as tested (16x ThinkSystem 64GB TruDDR5 6400MHz RDIMM); platform supports up to 8 TB per node
Boot / OS storage	2x ThinkSystem M.2 7450 PRO 480GB Read Intensive NVMe PCIe 4.0 SSD
Data storage	8x ThinkSystem 2.5-inch U.2 PM9D3a 1.92TB Read Intensive NVMe PCIe 5.0 x4 SSD
NVMe tiering	1x 1.6TB PCIe Gen 5 NVMe SSD
Network	2x Mellanox ConnectX-6 Lx 10/25GbE SFP28 2-port Ethernet Adapter
HCI software	VMware ESXi 9.1.0.0.25370933

Test Results

Lenovo validated SQL Server 2025 OLTP performance on a four-node Lenovo ThinkAgile VX650 V4 cluster using HammerDB, an open source benchmarking tool with an OLTP workload modeled on the TPC-C benchmark standard. Testing characterized the throughput achievable on a single node running multiple concurrent database virtual machines across three sizing scenarios. 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.

- [SQL Server 2025 VM and Workload Configuration](#)
- [Performance Results](#)
- [Key Observations](#)

SQL Server 2025 VM and Workload Configuration

Testing used three virtual machine sizing profiles against a single node, each running Microsoft SQL Server 2025 Enterprise; per-scenario VM sizing and results appear in the Performance Results table below. The following parameters were shared across all three scenarios:

Table 4. SQL Server 2025 VM and Workload Configuration

Parameter	Value
Database engine	Microsoft SQL Server 2025 Enterprise
Operating system	Windows Server 2025 Datacenter
Nodes under test	1 (single-node characterization)
OS and TempDB disk	512 GB
Data disk	512 GB
Log disk	512 GB
Backup disk	512 GB
Database size	1,000 warehouses (approximately 80 GB)
Ramp-up period	15 minutes
Steady-state period	10 minutes

Performance Results

The following results were recorded after a 15 minute ramp up period, during steady state operation, across the three virtual machine sizing scenarios tested individually on a single ThinkAgile VX650 V4 node,

with and without NVMe Memory Tiering enabled:

Table 5. SQL Server 2025 on ThinkAgile VX650 V4, OLTP Performance Results

Metric	Scenario 1	Scenario 2	Scenario 3
VM configuration	6 vCPUs, 80 GB memory	6 vCPUs, 64 GB memory	10 vCPUs, 150 GB memory
Number of VMs	12	12	6
Virtual users	35	70	50
Warehouses per user	1	1	20
Host CPU utilization	75%	76%	55%
Active memory	250 GB	450 GB	500 GB
TPM (DRAM)	9.55M	9.54M	7.9M
NOPM (DRAM)	4.11M	4.11M	3.5M
TPM (NVMe Tiering)	8.35M	7.69M	5.4M
NOPM (NVMe Tiering)	3.59M	3.30M	2.7M
Tiering performance tradeoff	~10-12%	~15-20%	20%+

Across all three scenarios, the node sustained high transaction throughput while host CPU utilization stayed at or below 76%, leaving headroom for virtualization overhead and VMware vSAN. NVMe Memory Tiering delivered transaction throughput within an acceptable range of DRAM-only performance, with the performance tradeoff growing from approximately 10 percent at the lowest tested memory footprint to more than 20 percent at the highest.

Key Observations

Beyond the throughput and latency figures reported above, the test results point to several practical conclusions for planning a production deployment. The observations below translate the measured data into guidance on compute headroom, scale-out expectations, and the tradeoffs between DRAM-only and NVMe Memory Tiering configurations.

- **Storage Is Not the Bottleneck**

375K average IOPS at a 75/25 read write ratio across 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 55% to 76% host CPU utilization across the DRAM-only scenarios, reflecting effective use of available compute resources while preserving capacity for virtualization overhead, VMware vSAN, transient workload spikes, and routine database maintenance. Production environments typically benefit from maintaining reserve CPU capacity rather than operating continuously at maximum utilization, and organizations consolidating multiple database servers can use these results as a baseline for modeling consolidation ratios against their own headroom and node-failure reserve policies.

- **Linear Scale-Out with VMware vSAN**

Testing characterized single-node throughput under conservative, worst-case conditions. In a production deployment, VMware vSAN distributes workloads across nodes, allowing throughput to scale approximately linearly as nodes are added, so a four-node cluster is expected to sustain roughly four times the single-node throughput measured here.

- **SQL Server 2025 Optimized Locking Reduces Contention**

SQL Server 2025 optimized locking reduces lock memory consumption and blocking under high-concurrency OLTP. This is reflected in throughput that scaled consistently across all three tested scenarios, from 35 to 70 concurrent virtual users, without significant lock-wait degradation at peak load.

- **NVMe Memory Tiering Trades Some Throughput for Higher Consolidation**

Across the tested scenarios, active memory footprints ranged from 250 GB to 500 GB. NVMe Memory Tiering enabled roughly 1.5 to 2 times higher consolidation density than DRAM-only sizing, with transaction throughput and New Orders Per Minute remaining within an acceptable range of DRAM-only performance, an option worth evaluating wherever memory cost, rather than raw throughput, is the binding constraint.

Configuration Best Practices

The following configuration settings were applied during testing and are recommended for production SQL Server 2025 deployments on Lenovo ThinkAgile VX V4 and FX V4 systems:

Table 6. Recommended Configuration Settings for SQL Server 2025 on ThinkAgile VX 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 the OS and VMware vSAN
TempDB configuration	Default configuration 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 VX650 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. Bill of Materials

Part Number / Feature Code	Product Description	Quantity
7DG6CTO1WW	Lenovo ThinkAgile VX650 V4 (dual socket, 2U)	1
C68E	ThinkAgile VX650 V4 24x2.5-inch Chassis	1
C5R4	Intel Xeon 6730P 32C 250W 2.5GHz Processor	2
C3QR	ThinkSystem 2U V4 Performance Heatsink	2
BYTJ	ThinkSystem 32GB TruDDR5 6400MHz (2Rx8) RDIMM	32
C26V	ThinkSystem M.2 RAID B545i-2i SATA/NVMe Adapter	1
C2BR	ThinkSystem 2.5-inch U.3 7500 PRO 1.92TB RI NVMe PCIe 4.0 x4 HS SSD	8
CGSM	ThinkSystem 2.5" U.2 7600 MAX 1.6TB Mixed Use NVMe PCIe 5.0 x4 HS SSD	1

Part Number / Feature Code	Product Description	Quantity
C46P	ThinkSystem 2U V4 8x2.5-inch NVMe Gen5 Backplane	1
CGH5	ThinkSystem M.2 PM9D3a 480GB RI NVMe PCIe 5.0 x4 NHS SSD	2
AUZV	ThinkSystem Broadcom 5719 1GbE RJ45 4-port OCP Ethernet Adapter	1
BE4T	ThinkSystem Mellanox ConnectX-6 Lx 10/25GbE SFP28 2-port OCP Ethernet Adapter	1
C62D	ThinkSystem SR650 V4 x16 PCIe Gen5 Riser	1
C0UC	ThinkSystem 2700W 230V Titanium CRPS Premium Hot-Swap Power Supply	2
C3RD	ThinkSystem SR650a V4 Performance Fan Module option kit	6
C1YR	ThinkSystem 1U/2U V4 USB Ports Extension Board	1
C2DH	ThinkSystem Toolless Slide Rail Kit V4	1
SCJD	XClarity One, Standard, Per Endpoint w/3-Yr SW S&S	1
BPKR	TPM 2.0	1
B3XQ	Solution Level Warranty Period (3 yr)	1
BVGL	Data Center Environment 30C / 86F	1
CJT8	Memory Tiering	1

For ThinkAgile FX V4 configurations or alternative node sizes, contact your Lenovo representative. Full configuration guides and additional BOM options are available at lenovopress.lenovo.com.

Conclusion

Lenovo ThinkAgile VX V4 and FX V4 with SQL Server 2025 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 9.55 million transactions per minute proven on a single node, NVMe Memory Tiering raising consolidation density without sacrificing throughput, and vSAN resilience built in, the platform is ready to run and scale from day one.

For More Information

To learn more about Microsoft SQL Server 2025 on Lenovo ThinkAgile VX V4 and FX V4, contact your Lenovo representative or Lenovo Business Partner, or visit the resources below.

References:

- Solution Brief - Modernize Microsoft SQL Server 2025 with Lenovo:
<https://lenovopress.lenovo.com/lp2480>
- Lenovo ThinkAgile VX Series Datasheet:
<https://lenovopress.lenovo.com/datasheet/ds0104-thinkagile-vx-series>
- Lenovo ThinkAgile VX650 V4 Product Guide:
<https://lenovopress.lenovo.com/lp2135-lenovo-thinkagile-vx650-v4-hyperconverged-system>
- Lenovo ThinkAgile FX650 V4 Product Guide:
<https://lenovopress.lenovo.com/lp2338-lenovo-thinkagile-fx650-v4-hyperconverged-system>
- Multi-Vendor Hyperconverged Infrastructure with Lenovo ThinkAgile FX V4:
<https://lenovopress.lenovo.com/lp2520-multi-vendor-hyperconverged-infrastructure-with-lenovo-thinkagile-fx-v4>
- VMware Data Service Manager:
<https://www.vmware.com/products/cloud-infrastructure/advanced-services/data-services-manager>
- Optimizing VCF Private Cloud Economics with NVMe Memory Tiering on ThinkAgile VX:
<https://lenovopress.lenovo.com/lp2518-optimizing-vcf-private-cloud-economics-with-nvme-memory-tiering-on-thinkagile-vx>

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Related product families

Product families related to this document are the following:

- [Microsoft SQL Server](#)
- [ThinkAgile FX Series](#)
- [ThinkAgile VX Series for VMware](#)

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