

New Intel and VMware Technologies Turbocharge Lenovo ThinkAgile VX V3 Systems

Solution Brief

Business Trends

Accelerating Hybrid Cloud Adoption: The growth of technology, cloud and data-driven ecosystems bring the need for on-premise infrastructure to meet hybrid cloud requirements. Servers need to have virtualization and hybrid cloud capabilities – and be able to scale and operationalize quickly. Also, due to cost and operational factors a variety of workloads are being migrated back to on-premises infrastructure. This trend means businesses need faster servers and storage to achieve the performance and low latency required.

Infrastructure and Workloads Modernization: Many business-critical applications - database, VDI, data science and AI/ML workloads - need increased processing and data storage capabilities. Ever growing data and AI/ML workloads require processors with built-in acceleration and servers with high-speed memory, network adapters, drives and interconnects that are pre-tested and pre-validated engineered solution to reduce deployment complexities.

Lenovo Solution

Lenovo ThinkAgile VX V3 hyperconverged systems are equipped with 4th generation Intel® Xeon® Scalable processors and VMware vSAN™ 8 to address these customer trends and lower operations management. The new Intel processors offer up to 60 cores, up to 8TB memory (32x 4800 MHz DDR5 DIMMs), and support PCIe 5.0, NVMe and embedded accelerators for analytics and security.

ThinkAgile VX V3 systems support VMware's new Extended Storage Architecture (ESA) with NVMe memory in addition to OSA (Original Storage Architecture) with all-flash or hybrid configurations. They also support NVIDIA BlueField-2 data processing units (DPUs) to offload CPU processing power to SmartNICs for improved workload performance.

Lenovo ThinkAgile VX V3 systems based on VMware vSAN provide the ideal cloud-ready foundation for critical applications like Database, Big Data and AI/ML solutions. They are **Accelerated by Intel** offerings that drive greater performance through a number of enhancements, including higher cores, embedded accelerators, GPU, DPU, DDR5 and PCIe Gen 5 components.

Highlights

- **Realize up to 50% better performance on workloads** with double the number of cores in Lenovo servers equipped with 4th gen Intel Xeon Scalable processors than on similar servers equipped with Intel's previous generation processors.
- Improve performance of critical applications, Big Data and AI/ML solutions with higher cores, embedded accelerators, GPU, DPU, DDR5 and PCIe Gen 5 components
- **Achieve 4x higher performance, reduce TCO by up to 40% and reduce the storage footprint by half** with new vSAN Express Storage Architecture in VMware vSAN 8
- Improve security and offloading support with NVIDIA Bluefield-2 DPU (data processing unit) cards (SmartNICs)

ThinkAgile VX V3 Systems

Lenovo ThinkAgile VX Series V3 servers powered by 4th Gen Intel Xeon Scalable processors provide increased performance, bandwidth and speed than ThinkAgile V2 with 3rd Gen Intel Xeon Scalable processors. The 4th Gen processors are modernized to support more cores and performance and embedded accelerators.

Applications where the servers would excel include:

- Mission Critical applications
- SAP HANA and ERP applications
- CRM
- Business Intelligence (BI)
- Databases and Data Warehouse
- Analytics
- Virtual Desktops
- Artificial Intelligence
- Server Consolidation
- Virtualization



ThinkAgile VX650 V3



ThinkAgile VX630 V3

Lenovo ThinkAgile VX V3 servers are available as Integrated Systems and Certified Nodes. Both are factory integrated, pre-configured systems with Lenovo hardware, VMware software, and deployment services. Integrated systems provide a quick and convenient path to implement a hyperconverged solution powered by VMware vSAN and a single point of contact provided by Lenovo for purchasing, deploying, and supporting the solution. VX Certified Nodes come with optional VMware software and services.

ThinkAgile VX integrated systems can also be up and running quickly with a web-based deployment wizard. The installer can install and configure VMware ESXi, vCenter Server and Lenovo XClarity Integrator and either create or join a cluster.

ThinkAgile VX V3 with 4th Gen Intel Xeon Scalable Processors

All ThinkAgile VX V3 models support vSAN All Flash and Hybrid deployment and VMware vSAN Original Storage Architecture and Express Storage Architecture. The vSphere Distributed Services Engine does not support GPU currently and VX V3 DPU systems are with NVIDIA vSAN ESA is with single storage tier and no cache drive or disk groups are required.

Table 1. ThinkAgile VX V3 Models with Intel 4th Gen Xeon Scalable Processors

| Model | VX630 V3 | VX650 V3 | VX 650 V3 SAP* | VX650 V3 DPU | VX650 V3 SAP DPU* |
|--------------------------------|-----------------------------------|------------------------------------|------------------------------------|---|---|
| Form Factor | 1U 2S | 2U 2S | 2U 2S | 2U 2S | 2U 2S |
| Memory | TruDDR5 32 DIMMs (8 TB Max) | TruDDR5 32 DIMMs (8 TB Max) | TruDDR5 32 DIMMs (8 TB Max) | TruDDR5 32 DIMMs (8 TB Max) | TruDDR5 32 DIMMs (8 TB Max) |
| GPU | 3xSW 75W | 8xSW 75W 6xSW 150W 3xDW 300W | 8xSW 75W 6xSW 150W 3xDW 300W | | |
| DPU | | | | 1x NVIDIA Bluefield-2 DPU with dual ports of 25GbE | 1x NVIDIA Bluefield-2 DPU with dual ports of 25GbE |
| Drives NVMe/SAS/SATA | 12x2.5" 4x3.5" | 32x2.5" 20x3.5" | 32x2.5" 20x3.5" | 32x2.5" 20x3.5" | 32x2.5" 20x3.5" |
| PCIe 5.0 | 3 Slots 1/10/25/100 GbE | 3 Slots 1/10/25/100/ 200 GbE | 3 Slots 1/10/25/100 GbE | 3 Slots 1/10/25/100 GbE | 3 Slots 1/10/25/100/ 200 GbE |
| OCP 3.0 | 1x1Gb, 10Gb, 25Gb | 1x1Gb, 10Gb, 25Gb | 1x1Gb, 10Gb, 25Gb | | |
| VX Integrated System | 7D6XCTO1WW | 7D6WCTO1WW | * | 7D6WCTO4WW | * |
| VX Certified Node | 7D6XCTO2WW | 7D6WCTO2WW | * | 7D6WCTO5WW | * |
| vSAN | AF / Hybrid | AF / Hybrid | | AF / Hybrid | |
| Disk Groups | 1-4 | 1-5 | 1-5 | 1-5 | 1-5 |
| Max Usable Cache | 1.6 TB | 1.6 TB | 1.6 TB | 1.6 TB | 1.6 TB |
| Max Possible Capacity (OSA) | 4 disk groups, 28x7.68 TB | 4 disk groups, 28x7.68 TB | 4 disk groups, 28x7.68 TB | 4 disk groups, 28x7.68 TB | 4 disk groups, 28x7.68 TB |
| Max Possible Capacity (ESA) | 24x7.68 TB NVMe | 24x7.68 TB NVMe | 24x7.68 TB NVMe | 24x7.68 TB NVMe | 24x7.68 TB NVMe |

* These VX V3 SAP systems are being certified

4th Gen Intel Xeon Scalable Processors

All processors support the following configurations:

- 8 DDR5 memory channels at 2 DIMMs per channel. Many of the 4th Gen processors support a maximum speed of 4800MHz and low-end processors support 4000MHz-4400MHz
- Up to 4 UPI links between processors at 16 GT/s
- 80 PCIe 5.0 I/O lanes
- Embedded accelerators including Intel Data Streaming Accelerator (Intel DSA), QuickAssist Technology (Intel QAT), Intel Dynamic Load Balancer (Intel DLB) and Intel In-Memory Analytics Accelerator (Intel IAA)

Table 2. 4th Generation Intel Xeon Scalable Processors

| Cores | <=16 Cores | <=32 Cores | <=48 Cores | <=60 Cores |
|----------|--|---|---|--|
| <=200W | 6434 8C 195W 3.7GHz 6434H 8C 195W 3.7GHz 6426Y 16C 185W 2.5GHz | 6416H 18C 165W 2.2GHz 6418H 24C 185W 2.1GHz 6421N 32C 185W 1.8GHz 6428N 32C 185W 1.8GHz | | |
| 201-250W | | 6442Y 24C 225W 2.6GHz 6414U 32C 250W 2.0GHz 6438M 32C 205W 2.2GHz 6438N 32C 205W 2.0GHz 6438Y+ 32C 205W 2.0GHz 6448H 32C 250W 2.4GHz 6448Y 32C 225W 2.1GHz 8450H 28C 250W 2.0GHz | | |
| 251-300W | 6444Y 16C 270W 3.6GHz 8444H 16C 270W 2.9GHz | 6430 32C 270W 2.1GHz 6454S 32C 270W 2.2GHz 8454H 32C 270W 2.1GHz | 8452Y 36C 300W 2.0GHz 8460Y+ 40C 300W 2.0GHz 8461V 48C 300W 2.2GHz | 8470N 52C 300W 1.7GHz 8471N 52C 300W 1.8GHz |
| 301-350W | | | 8458 44C 350W 2.7GHz 8460H 40C 330W 2.2GHz 8468 48C 350W 2.1GHz 8468H 48C 330W 2.1GHz 8468V 48C 330W 2.4GHz | 8470 52C 350W 2.0GHz 8480+ 56C 350W 2.0GHz 8490H 60C 350W 1.9GHz |

Performance Gain from 3rd Gen Intel Xeon SP

4th Gen Intel Xeon processors support for more cores, DDR5 and accelerators and it provides better performance than 3rd Gen Intel Xeon processors. Here is the comparison between Intel Xeon 8480 56C vs Intel Xeon 8380 40C.

- Up to 40% increase in memory bandwidth
- Up to 50-60% increase in general compute
- Up to 30-50% increase in technical compute
- Up to 40% increase in web workloads
- Up to 45% increase in media workloads
- Up to 200-400% increase in AI inference performance

Use Case: Virtual Desktop Performance with VMware Horizon and vSAN ESA

A virtual desktop benchmark for knowledge worker profile on ThinkAgile VX650 V3 with 4th Gen Intel Xeon processors shown better virtual machine density and performance than 3rd Gen Intel Xeon processors. The benchmark details are given below.

4 Node ThinkAgile VX 650V3 Cluster

- 2 x Intel Xeon Platinum 8468 48C 2.1 GHz
- 32 x 64GB DDR5 4800 MHz
- 4 x 3.20TB NVMe SSD
- Broadcom 57504 25GbE SFP28 4-port OCP Ethernet Adapter
- VMware vSAN 8 Express Storage Architecture (ESA), RDMA Enabled/Disabled
- VMware ESXi, 8.0.1, 21495797
- Horizon 8.9.0 version 2303

VDI Benchmark

- Knowledge worker 3 vCPU, 2GB Memory and 60 GB disk
- 1500 users test with LoginEnterprise 5.1.2
- Persistent desktops, Roaming profile
- Horizon Instant Clones

Results

- The test with RDMA achieved VSIMax value 1425 and it provides ~356 virtual desktop per node at full capacity utilization. On an average ~270 virtual desktops can be hosted per node considering headroom for growth and failover scenarios.
- The test with disabling RDMA resulted ~5% less virtual desktops
- The test with 10GbE links (without RDMA) resulted ~25% less virtual desktops than 25GbE with RDMA
- The EUX score is above 8 and it shows the application response time is good from the start of the test and it starts declining after ~1000 users. The VSIMax is based on application response time threshold and though EUX score is dropping over a period, but it does not mean that application performance is degrading and EUX score above 6 is a good indicator and it proves 4th Gen Intel Xeon processors perform well.
- The application response time is ~30% better with VMware vSAN ESA and 4th Gen Intel Xeon processors than vSAN Original Storage Architecture (OSA) with 3rd Gen Intel Xeon processors with same speed.

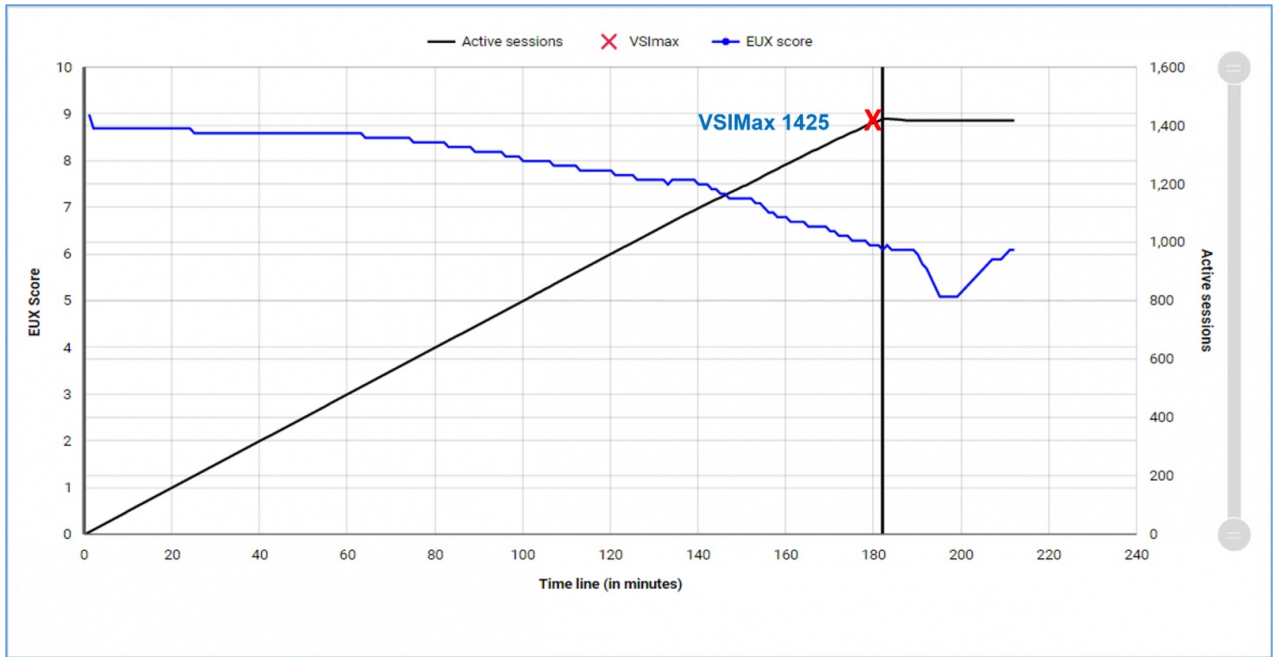


Figure 1. VMware Horizon Virtual Desktop Performance

VMware vSAN Express Storage Architecture Configuration

vSAN ESA is single tier storage solution composed of NVMe drives to provide better performance.

- Minimum 4 drives are needed and supported up to 24 drives
- Minimum 25GbE connectivity is required and the cards should support RDMA (RoCE v2). It is recommended to use 100GbE as 25GbE can be saturated during high workload.
- RAID-1(mirroring) and RAID-5/6 (Erasure Coding) storage policies are supported as in vSAN OSA. RAID-5/6 provides space efficiency without compromising performance.
- The table below shows the list of NIC cards supported for ESA solution.

Table 3. Network Interface Cards (NICs) supported with the ESA Solution

| Part Number | Description |
|-------------|--|
| 4C57A14177 | ThinkSystem Mellanox ConnectX-6 HDR100/100GbE QSFP56 1-port PCIe VPI Adapter |
| 4C57A14178 | ThinkSystem Mellanox ConnectX-6 HDR100/100GbE QSFP56 2-port PCIe VPI Adapter |
| 4XC7A08248 | ThinkSystem Mellanox ConnectX-6 Dx 100GbE QSFP56 2-port PCIe Ethernet Adapter |
| 4XC7A62574 | ThinkSystem Mellanox ConnectX-5 EN 10/25GbE SFP28 2-port PCIe Ethernet Adapter |
| 4XC7A62580 | ThinkSystem Mellanox ConnectX-6 Lx 10/25GbE SFP28 2-port PCIe Ethernet Adapter |
| 4XC7A78166 | ThinkSystem Mellanox ConnectX-6 Dx 10/25GbE SFP28 2-port PCIe Ethernet Adapter |

vSphere Data Processing Engine and NVIDIA BlueField-2 DPU Support

ThinkAgile VX V3 platforms support NVIDIA BlueField-2 data processing units (DPUs), which provide a hardware acceleration engine to offload networking and computing services. VMware vSphere 8 leverages DPUs to offload many of the management and network functions from the CPU and it is integrated with SDDC components. **Lenovo XClarity** supports the management of NVIDIA BlueField-2 and is integrated with VMware vCenter to upgrade and patch.

- Unified installation of ESXi and DPU and DPU management via vCenter and vLCM
- vSphere distributed switch offload
- NSX Overlay Offload with Enhanced Data Path (requires license)
- Improve zero-trust and infrastructure security

Lenovo XClarity also supports firmware upgrades for NVIDIA BlueField-2. ThinkAgile VX V3 BIOS settings are applied in factory and are available in the [ThinkAgile VX Best Recipe](#).

- XClarity support deploy OS image to ARM system and configure UEFI settings and security
- DPU firmware and driver update will be available in recipe release cycle. Update can be done through vLCM (vSphere Lifecycle Manager) also
- Minimum ESXi 8.0u1 is required
- DPU ESXi DCUI/shell can be accessed through out of band serial console for troubleshooting

The following parts are available for VX650 V3 DPU systems:

Table 4. Network Interface Cards (NICs) supported with the ESA Solution

Table 5. Parts Available for VX650 V3 DPU Systems

| Feature Code | Description |
|--------------|--|
| BRPK | ThinkSystem NVIDIA BlueField-2 25GbE SFP56 2-Port PCIe Ethernet DPU w/BMC & Crypto |
| BSH7 | ThinkSystem OCP Enablement Kit for Distributed Services Engine |

VMware vSAN Data Persistence Platform

VMware vSAN DDP supports adding third party Kubernetes operators, storage classes and vCenter services to provide object storage for containers and integrate with VMware Cloud Foundation with VMware Tanzu. . It enables running stateful services and it is supported on both vSAN Shared Nothing Architecture (SNA) and vSAN Direct configurations. The complete lifecycle management and maintenance operations are integrated and it provides seamless experience to run third party Kubernetes services.

Software Support

ThinkAgile VX V3 systems come with an option to buy the following software from Lenovo:

- VMware vSAN: Standard, Advanced, Enterprise, Enterprise Plus, ROBO or Desktop
- VMware vCenter Server: Foundation or Standard
- VMware vSphere: Standard, Enterprise Plus or ROBO
- HCI Kit: Essentials, Standard, Advanced, Enterprise or ROBO
- VMware Horizon: Standard, Advanced or Enterprise
- VMware Cloud Foundation (VCF): Basic, Standard, Advanced, Enterprise or for VDI
- VMware Tanzu Basic
- VMware NSX-T

Bill of Material

Table 6. Bill of Materials

| Part number Feature code | Product Description | Qty |
|-----------------------------|--|-----|
| 7D6WCTO1WW | Server : Lenovo ThinkAgile VX650 V3 Integrated System | 1 |
| BRY9 | ThinkAgile VX V3 2U 24x2.5" Chassis | 1 |
| B0W3 | XClarity Pro | 1 |
| BUE2 | VMware vSAN 8 Enterprise | 1 |
| BPQF | Intel Xeon Gold 6426Y 16C 185W 2.5GHz Processor | 2 |
| BKTM | ThinkSystem 32GB TruDDR5 4800MHz (2Rx8) RDIMM | 16 |
| 5977 | Select Storage devices - no configured RAID required | 1 |
| B8P1 | ThinkSystem 440-16i SAS/SATA PCIe Gen4 12Gb Internal HBA | 1 |
| B5MC | vSAN All Flash Config | 1 |
| B8LU | ThinkSystem 2U 8x2.5" SAS/SATA Backplane | 1 |
| BH8B | ThinkSystem 2U/4U 8x2.5" AnyBay Backplane | 1 |
| BM8X | ThinkSystem M.2 SATA/x4 NVMe 2-Bay Enablement Kit | 1 |
| BTTY | M.2 NVMe | 1 |
| BS7M | Intel VROC (VMD NVMe RAID) Standard for M.2 | 1 |
| BS7F | M.2 NVMe Array 1 RAID 1 | 1 |
| BKSR | ThinkSystem M.2 7450 PRO 960GB Read Intensive NVMe PCIe 4.0 x4 NHS SSD | 2 |
| BPPW | ThinkSystem Broadcom 57504 10/25GbE SFP28 4-Port OCP Ethernet Adapter | 1 |
| BPK9 | ThinkSystem 1800W 230V Titanium Hot-Swap Gen2 Power Supply | 2 |
| BLL6 | ThinkSystem 2U V3 Performance Fan Module | 6 |
| BQQ2 | ThinkSystem 2U V3 EIA Latch Standard | 1 |
| BVMC | Trigger MFG to scan the SN from the CPU Board via this MI | 1 |
| BS7J | M.2 NVMe Array 1 HDDs | 2 |
| BTSL | ThinkAgile VX650 V3 IS | 1 |
| BC4X | MS 2FH Riser Filler | 1 |
| BQBP | ThinkSystem MCC CPU Clip | 2 |
| BM8T | ThinkSystem SR650 V3 Firmware and Root of Trust Security Module | 1 |
| BPD9 | ThinkSystem 1800W Ti Power rating Label WW | 1 |
| B986 | ThinkSystem HV 2U WW General PKG BOM | 1 |
| BTS5 | ThinkAgile SR650 V3 Service Label - WW | 1 |
| BSWK | ThinkAgile SR650 V3 Agency Label - No CCC | 1 |
| BP46 | ThinkSystem 2U Main Air Duct | 1 |
| B8MM | ThinkSystem 2U MS 3FH Riser Filler | 1 |
| BQQ6 | ThinkSystem 2U V3 EIA right with FIO | 1 |
| AUTQ | ThinkSystem small Lenovo Label for 24x2.5"/12x3.5"/10x2.5" | 1 |
| AVEQ | ThinkSystem 8x1 2.5" HDD Filler | 1 |
| AVEN | ThinkSystem 1x1 2.5" HDD Filler | 8 |
| BLL3 | ThinkSystem SR650 V3 PSU Duct | 1 |
| BPDQ | ThinkSystem SR650 V3 AL Extrusion Entry Heatsink | 2 |
| BMPF | ThinkSystem V3 2U Power Cable from MB to Front 2.5" BP v2 | 2 |
| BRQ3 | ThinkSystem V3 2U WH CBL, 20Pin, 320mm, Tin-plated | 1 |
| BRPW | ThinkSystem SR650 V3, PCIe Gen4 CBL, SLx8-Swift, M.2-PCIe3 | 1 |
| BACB | ThinkSystem V3 2U SAS/SATA Y Cable from CFF C0, C1/ C2, C3 to Front 8x2.5" BP | 2 |
| BSYM | ThinkSystem SR650 V3, PCIe4 Cable, Swift8x-SL8x, 2in1, PCIe 6/5(MB) to BP1/BP2 | 1 |

| Part number Feature code | Product Description | Qty |
|-----------------------------|--|-----|
| BMP2 | ThinkSystem V3 2U Power Cable from MB to CFF / Exp v2 | 1 |
| BRPV | ThinkSystem SR650 V3, PCIe Gen4 CBL, SLx8-Swift, CFF IN-PCIe4 | 1 |
| BPE3 | ThinkSystem SR650 V3 MCIO8x to SL8x CBL, PCIe4, 8x2.5AnyBay, 200mm | 2 |
| BPK3 | ThinkSystem WW Lenovo LPK | 1 |
| BQ11 | G4 x16/x8/x8 PCIe Riser BLKL for Riser 1 Placement | 1 |
| BLKL | ThinkSystem V3 2U x16/x8/x8 PCIe Gen4 Riser1 or 2 | 1 |
| BNW9 | ThinkSystem 2.5" PM1655 1.6TB Mixed Use SAS 24Gb HS SSD | 2 |
| BNWF | ThinkSystem 2.5" PM1653 3.84TB Read Intensive SAS 24Gb HS SSD | 6 |
| 7S06CTOSWW | VMware vSAN for VX | 1 |
| SAQT | VMware vSAN 8 Enterprise for 1 processor w/Lenovo 3Yr S&S | 2 |
| 5PS7B14942 | Essential ThinkAgile IS - 3Yr 24x7 4Hr Resp + YDYD VX650 V3 | 1 |

Conclusion

ThinkAgile VX V3 Integrated systems and certified nodes with VMware vSAN 8 and Intel Xeon 4th Gen Scalable Processors are a perfect fit for mission critical applications and provide higher consolidation for different workloads. ThinkAgile Systems are prevalidated and factory installed with VMware vSphere and vSphere Distributed Engine which simplifies deployment, offloads networking functions and enables applications to address latency and security issues seamlessly. These next generation engineered hardware and software solutions from Lenovo, Intel, VMware and NVIDIA are a one-stop scalable solution for modern application development and hybrid cloud scenarios with reduced TCO.

Accelerated by Intel

To deliver the best experience possible, Lenovo and Intel have optimized this solution to leverage Intel capabilities like processor accelerators not available in other systems. Accelerated by Intel means enhanced performance to help you achieve new innovations and insight that can give your company an edge.



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 Lenovo workload solutions on ThinkAgile VX650 V3 and VX630 V3 servers, contact your Lenovo Business Partner or visit: <https://www.lenovo.com/systems/solutions>

References:

Lenovo ThinkAgile VX650 V3 Integrated System and Certified Node: <https://lenovopress.lenovo.com/lp1673>

Lenovo ThinkAgile VX630 V3 Integrated System and Certified Node: <https://lenovopress.lenovo.com/lp1672>

Related product families

Product families related to this document are the following:

- [ThinkAgile VX Series for VMware](#)
- [VMware Alliance](#)

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