



Lenovo ThinkAgile VX V3 with VMware vSAN ESA

Solution Brief

Business Trends

Software Defined Datacenter Architecture: The growth of technology, modern applications, cloud, artificial intelligence and data-driven ecosystems bring the need for on-premises infrastructure to meet high performance and high-density workload requirements across datacenters. Servers need to have software defined solutions to build robust storage systems and integrated software stacks for cloud and cloud native technologies, and third-party software to build flexible and scalable architecture to meet any workload. This trend means businesses need faster servers and storage to achieve the performance and low latency required.

Infrastructure and Workloads Modernization: Adoption of hybrid cloud, artificial intelligence and machine learning, and open source technologies drives enablement for tens of software and applications to coexist on the shared infrastructure and need increased processing and data storage capabilities. Ever growing data and AI/ML workloads require storage system with low latency and high capacity drives, high speed network adapters and interconnects that are pre-tested and pre-validated engineered solution to reduce deployment complexities. Business needs for consolidation enterprise workloads and rapid provision end-end infrastructure and software stack without compromising performance and integration capabilities.

Lenovo ThinkAgile VX Solutions for VMware vSAN

Lenovo ThinkAgile VX systems are the perfect choice for hyperconverged infrastructure and provide an outstanding platform to support the different VMware vSAN™ architectures. Lenovo and VMware's over 20 year partnership and collaboration continues to strongly drive innovation and technical enablement for vSAN-based storage solutions. This includes validation, certification, configuration and support for ThinkAgile VX systems.

Lenovo ThinkAgile VX V3 hyperconverged systems are equipped with 4th Gen Intel® Xeon® Scalable processors and VMware vSAN 8. They are **Accelerated by Intel** offerings that drive greater performance for CPU and IO intensive workloads.

Lenovo ThinkAgile VX servers are available as Integrated Systems and Certified Nodes. Both are factory integrated, pre-configured systems with Lenovo hardware, VMware software, and deployment services. VX 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.

HCIBench FIO Benchmark on vSAN OSA and ESA

The HCIBench tool (version 2.8.2 and FIO 3.3) was used for measuring performance for OSA and ESA. The maximum performance scenario was used for the testing and it stresses to achieve high throughput and maximum volume performance by saturating the storage system. This scenario uses higher iodepth value and increase in latency occurs when maximum IOPS is reached.

| VM Configuration | Maximum Performance |
|------------------------|--|
| Warm up before testing | 5 mins |
| VCPU | 4 |
| Memory | 8 GB |
| No. of data disks | 4 |
| Disk size | 50 GB |
| IO rate | 100% |
| FIO settings | ioengine=libaio iodepth=2048 iodepth_low=1 latency_target=10000 latency_window=300000 latency_percentile=95.0 |
| Total number of VMs | 16 (4 per node) |

Table below shows different IO scenarios tested with HCIBench and each scenario matches with one or more real world use cases.

| Scenario | Block size | Iodepth (Maximum Performance) | Read % | Write % | Random % | Workload Category |
|--------------------|------------|-------------------------------|--------|---------|----------|---|
| 4K-Read 100% | 4K | 2048 | 100% | 0% | 100% | Read-intensive workload |
| 8K-Read 70% | 8K | 2048 | 70% | 30% | 100% | NoSQL, Dey Value, Generic web workloads |
| 16K-Read 70% | 16K | 2048 | 70% | 30% | 70% | Files and relational databases |
| 32K-Read 50% | 32K | 2048 | 50% | 50% | 50% | SQL |
| 128K-Write 100% | 128K | 2048 | 0% | 100% | 0% | Write-intensive workload |

Maximum Performance Testing with 4th Gen Intel Xeon Processors

Intel performed the benchmark on 4x Lenovo ThinkAgile VX650 V3 servers with Intel Xeon Gold 6448Y 32C processors with 100GbE network and RDMA enabled. The vSAN OSA tests were configured with RAID 1 and 3 disk groups and ESA was configured with RAID 5. All the tests were done with 16 virtual machines. The following are the system configuration used in the testing.

| OSA | ESA |
|---|---|
| 3 disk groups Cache tier - 3 x P5800X 800GB Write Intensive NVMe PCIe 4.0 x 4 HS SSD Capacity tier - 9 x ThinkSystem P5620 3.2TB Mixed Use NVMe PCIe 4.0 x 4 HS SSD | 10 x ThinkSystem P5620 3.2TB Mixed Use NVMe PCIe 4.0 x 4 HS SSD |
| ThinkSystem Broadcom 57508 100GbE QSFP56 2-port PCIe 4 Ethernet Adapter | ThinkSystem Broadcom 57508 100GbE QSFP56 2-port PCIe 4 Ethernet Adapter |
| RAID 1 | RAID 5 |
| 100 GbE | 100 GbE |
| RDMA Enabled | RDMA Enabled |
| VMware ESXi 8.0.1c, 22088125 | VMware ESXi 8.0.1c, 22088125 |

The results show ESA provides better performance than OSA for many of the scenarios and more than 2x performance benefit for 8K and 32K scenarios. OSA performance for write only workload is comparatively higher than ESA which could be correlated to write cache buffer in OSA. vSAN ESA leverages 100 GbE network and provides maximum throughput. The OSA requires more drives to scale throughput, and it eventually increases cost.

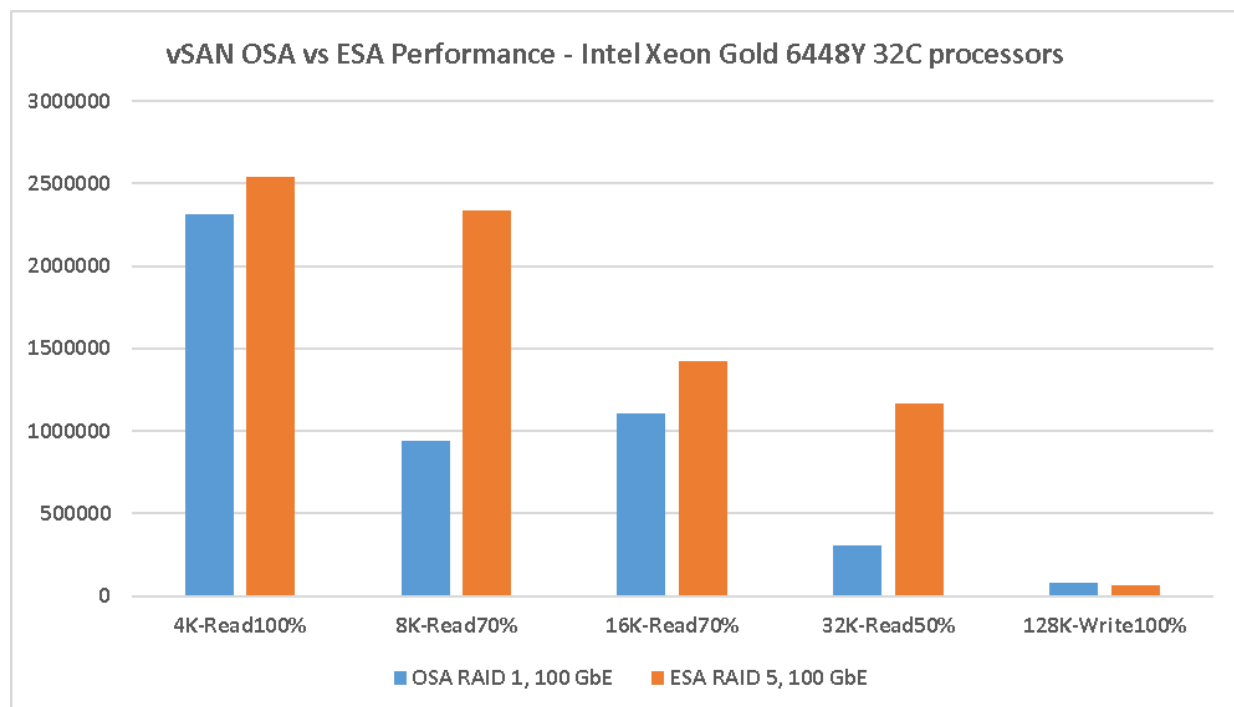


Figure 1. HCI Bench Maximum Performance Results with Intel Xeon Gold 6448Y 32C processors – OSA vs ESA

Bill of Material

Table 1. 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 |
| BZAK | Customer has VMware by Broadcom Software License | 1 |
| BN8K | ThinkAgile VX Remote Deployment | 1 |
| BPQD | Intel Xeon Gold 6448Y 32C 225W 2.1GHz Processor | 2 |
| BNF9 | ThinkSystem 64GB TruDDR5 4800MHz (2Rx4) 10x4 RDIMM | 16 |
| 5977 | Select Storage devices - no configured RAID required | 1 |
| B8P1 | ThinkSystem 440-16i SAS/SATA PCIe Gen4 12Gb Internal HBA | 1 |
| BT2G | vSAN ESA | 1 |
| BYRN | AF-2 | 1 |
| BNEH | ThinkSystem 2.5" U.2 P5620 3.2TB Mixed Use NVMe PCIe 4.0 x4 HS SSD | 6 |
| B8LU | ThinkSystem 2U 8x2.5" SAS/SATA Backplane | 1 |
| BH8B | ThinkSystem 2U/4U 8x2.5" AnyBay Backplane | 1 |
| B8P9 | ThinkSystem M.2 NVMe 2-Bay RAID Adapter | 1 |
| BTTY | M.2 NVMe | 1 |
| BKSR | ThinkSystem M.2 7450 PRO 960GB Read Intensive NVMe PCIe 4.0 x4 NHS SSD | 2 |
| BLA3 | SW stack for ThinkAgile VX Appliance | 1 |
| BN2T | ThinkSystem Broadcom 57414 10/25GbE SFP28 2-Port OCP Ethernet Adapter | 1 |
| BK1J | ThinkSystem Broadcom 57508 100GbE QSFP56 2-port PCIe 4 Ethernet Adapter | 1 |
| BPK9 | ThinkSystem 1800W 230V Titanium Hot-Swap Gen2 Power Supply | 2 |
| 6400 | 2.8m, 13A/100-250V, C13 to C14 Jumper Cord | 2 |
| BLL6 | ThinkSystem 2U V3 Performance Fan Module | 6 |
| BRPJ | XCC Platinum | 1 |
| BTSL | ThinkAgile VX650 V3 IS | 1 |
| BQQ6 | ThinkSystem 2U V3 EIA right with FIO | 1 |
| BM8T | ThinkSystem SR650 V3 Firmware and Root of Trust Security Module | 1 |
| BP46 | ThinkSystem 2U Main Air Duct | 1 |
| BLL3 | ThinkSystem SR650 V3 PSU Duct | 1 |
| BSWK | ThinkAgile SR650 V3 Agency Label - No CCC | 1 |
| BPDR | ThinkSystem SR850 V3/SR650 V3 Standard Heatsink w/ Heatpipes | 2 |
| BMPF | ThinkSystem V3 2U Power Cable from MB to Front 2.5" BP v2 | 2 |
| BS6Y | ThinkSystem 2U V3 M.2 Signal & Power Cable, SLx4 with 2X10/1X6 Sideband, 330/267/267mm | 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 |
| 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 |

| Part number Feature code | Product Description | Qty |
|-----------------------------|--|-----|
| BP0E | N+N Redundancy With Over-Subscription | 1 |
| BK15 | High voltage (200V+) | 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 |
| 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 |
| B8Q8 | ThinkSystem 440-16i SAS/SATA PCIe Gen4 12Gb Internal HBA Placement | 1 |
| 5PS7B73066 | Premier Advanced ThinkAgile IS - 3Yr 24x7 6Hr CSR + YDYG VX650 V3 | 1 |
| 5AS7B15971 | Hardware Installation (Business Hours) for VX650 V3 | 1 |
| 5MS7A87711 | ThinkAgile VX Remote Deployment (up to 4 node cluster) | 1 |

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.



Lenovo and VMware

With co-located engineering organizations and a history of technical collaboration, VMware and Lenovo consistently deliver innovative joint solutions for the data center. Lenovo's leadership in reliability, customer satisfaction, and performance, combined with VMware's leadership in software and cloud services, continues to deliver innovative data center solutions and lower TCO for our joint customers.

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 workload solutions on Lenovo ThinkAgile VX650 V3, contact your Lenovo Business Partner or visit: <https://www.lenovo.com/us/en/servers-storage/sdi/thinkagile-vx-series/>

References:

Lenovo ThinkAgile VX650 V3 2U Integrated Systems and Certified Nodes:
<https://lenovopress.lenovo.com/lp1673>

Scalable VMware vSAN Storage Architectures on Lenovo ThinkAgile VX:
<https://lenovopress.lenovo.com/lp1872>

Related product families

Product families related to this document are the following:

- [ThinkAgile VX Series for VMware](#)
- [ThinkSystem SR630 V3 Server](#)
- [ThinkSystem SR650 V3 Server](#)
- [VMware Alliance](#)

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