Lenovo ThinkAgile VX V3 Systems Enhanced with New AMD and VMware Technologies

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 VX635 V3 (1U 1P), VX645 V3 (1U, 2P), VX655 V3 (2U, 1P) and VX665 V3 (2U, 2P) hyperconverged systems are featured with 4th generation AMD EPYC™ processors and VMware vSAN™ 8 to address these customer trends and lower operations management. The new AMD EPYC 9004 family of processors offer up to 96 cores, up to 3.6 GHz clock speed, up to 6TB memory, and support PCIe 5.0 and NVMe drives.

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.

Lenovo ThinkAgile VX V3 with AMD EPYC 9004 systems based on VMware vSAN provide the ideal cloud-ready foundation for critical applications like Database, Big Data and AI/ML solutions and provide greater consolidation for many workloads. They drive superior performance through support for higher cores, AVX-512 instruction set to accelerate performance and new virtualization features.

Highlights

- **Realize up to 100% better performance on workloads** with the 50% greater number of cores in Lenovo servers equipped with AMD EPYC 9004 processors than on similar servers equipped with AMD'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

ThinkAgile VX V3 Systems

Lenovo ThinkAgile VX Series V3 servers powered by AMD EPYC 9004 processors provide increased performance, bandwidth and speed than ThinkAgile V2 with AMD EPYC 9003 processors. The 4th Gen processors are modernized to support more cores and performance and accelerators. ThinkAgile VX systems support 1U 1 socket, 1U 2 socket, 2U 1 socket, and 2U 2 socket form factors for flexible and scalable deployment for small and medium enterprise requirements.

Applications where the servers would excel include:

- Mission Critical applications
- ERP
- CRM
- Business Intelligence (BI)
- Databases and Data Warehouse
- Analytics
- Virtual Desktops
- High Performance Computing (HPC)
- Artificial Intelligence
- Server Consolidation
- Virtualization

ThinkAgile VX645 V3

ThinkAgile VX655 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 AMD EPYC Processors

All ThinkAgile VX V3 models support vSAN All Flash and Hybrid deployment and VMware vSAN Original Storage Architecture and Express Storage Architecture. vSAN ESA is with a single storage tier and no cache drive or disk groups are required.

Table 1. ThinkAgile VX V3 Models with AMD EPYC 9004 Processors

Model	VX635 V3	VX645 V3	VX655 V3	VX665 V3
Form Factor	1U 1S	1U 2S	2U 1S	2U 2S
Memory	TruDDR5 12 DIMMs (1.5 TB Max)	TruDDR5 24 DIMMs (6 TB Max)	TruDDR5 12 DIMMs (1.5 TB Max)	TruDDR5 24 DIMMs (6 TB Max)
GPU	3xSW 75W	2xSW 75W	8xSW 75W 6xSW 150W 3xDW 300W	8xSW 75W 6xSW 150W 3xDW 300W
Drives NVMe/SAS/SATA	12x2.5"	12x2.5"	32x2.5" 20x3.5"	32x2.5" 20x3.5"
PCIe 5.0	3 Slots 1/10/25/100 GbE	3 Slots 1/10/25/100/ GbE	3 Slots 1/10/25/100 GbE	3 Slots 1/10/25/100 GbE
OCP 3.0	1	1	1	1
VX Integrated System	7D9VCTO1WW	7D9KCTO1WW	7D9WCTO1WW	7D9LCTO1WW
VX Certified Node	7D9VCTO2WW	7D9KCTO2WW	7D9WCTO2WW	7D9LCTO2WW
vSAN	AF / Hybrid	AF / Hybrid	AF / Hybrid	AF / Hybrid
Disk Groups	4	4	5	5

4th Gen AMD EPYC Processors

AMD EPYC 9004 processors:

- Support up to 96 cores per processor, core speeds of up to 4.1 GHz, and TDP ratings of up to 360W.
- 1 Socket systems support up to 12 TruDDR5 memory DIMMs and 2 Socket systems support up to 24 TruDDR5 memory DIMMs with two processors. Each processor has 12 memory channels and 1 DIMM per channel. With 1 DIMM installed per channel (12 DIMMs total per processor), memory operates at 4800 MHz.
- Supports 12x NVMe drives without oversubscription of PCIe lanes

Table 2. 4th Generation AMD EPYC Processors

TDP	16-48 Cores	64-96 Cores
<=250W	EPYC 9124 16C 200W 3.0GHz EPYC 9224 24C 200W 2.5GHz EPYC 9254 24C 200W 2.9GHz EPYC 9334 32C 210W 2.7GHz	
251-300W	EPYC 9354 32C 280W 3.25GHz EPYC 9354P 32C 280W 3.25GHz EPYC 9374F 32C 320W 3.85GHz EPYC 9454 48C 290W 2.75GHz EPYC 9454P 48C 290W 2.75GHz	EPYC 9534 64C 280W 2.45GHz EPYC 9634 84C 290W 2.25GHz
>300W	EPYC 9174F 16C 320W 4.1GHz EPYC 9274F 24C 320W 4.05GHz EPYC 9474F 48C 360W 3.6GHz	EPYC 9554 64C 360W 3.1GHz EPYC 9554P 64C 360W 3.1GHz EPYC 9654 96C 360W 2.4GHz EPYC 9654P 96C 360W 2.4GHz

Performance Gain from 3rd Gen AMD EPYC Processors

AMD EPYC 9004 processors support more cores, DDR5 and enhanced features for virtualization and acceleration and provide better performance than AMD EPYC 9003 processors. Here is the comparison between AMD EPYC 7763 64C vs. AMD EPYC 9654 96C.

- Up to 15% increase in performance per watt efficiency
- Up to 85% increase in middle tier application transaction throughput performance
- Up to 60% increase in high performance compute workload (GFLOPS)
- Up to 90% increase in integer and floating point operations
- Up to 100% increase in memory bandwidth performance

Virtual Desktop Performance with VMware Horizon and vSAN ESA

Lenovo and AMD teams performed the Login Enterprise benchmark for the knowledge worker profile on ThinkAgile VX665 V3 with AMD EPYC 4th Generation processors. The benchmark details are given below.

Login Enterprise VDI Benchmark

- Knowledge worker 3 VCPU, 2GB Memory and 60 GB disk
- Persistent desktops, Roaming profile
- Horizon Instant Clones
- VMware ESXi, 8.0.1, 21495797
- Horizon 8.9.0 version 2303
- Windows 10 Office 2007

Table 3. LoginEnterprise Test Results with 4th Generation AMD EPYC Processors

950 users test on 3 Node ThinkAgile VX 665 V3 Cluster	1800 user test on 4 Node ThinkAgile VX 665 V3 Cluster
2 x AMD EPYC 9354 32-Core 3.25 GHz 24 x 32GB DDR5 4800 MHz 8 x 3.20TB NVMe SSD ThinkSystem Broadcom 57504 10/25GbE SFP28 4-Port OCP Ethernet Adapter VMware vSAN 8 Express Storage Architecture (ESA), RDMA Disabled Login Enterprise 5.1.2	2 x AMD EPYC 9474F 48-Core 3.6 GHz 24 x 64GB DDR5 4800 MHz 6 x 3.20TB NVMe SSD ThinkSystem Mellanox ConnectX-6 Dx 100GbE QSFP56 2-port PCIe Ethernet Adapter VMware vSAN 8 Express Storage Architecture (ESA), RDMA Enabled Login Enterprise 5.7.2
VSIMax = 876 (292 per node)	**VSIMax = 1761 (440 per node)**

Results

Figures 1 and 2 shows Login Enterprise VSIMax and EUX score for the knowledge worker tests.

- The test with AMD EPYC 9354 32C achieved VSIMax of 292 per node at 100% CPU utilization. On average, 220 virtual desktops can be hosted per node considering headroom for growth and failover scenarios.
- The test with AMD EPYC 9474F 48C achieved VSIMax of 440 per node and we can size to 330 virtual desktops per host with 75-80% CPU utilization.
- vSAN ESA supports up to 500 virtual machines per host and using 4th Gen AMD EPYC processors with high core count allows you to achieve more density. Based on the test results, VDI density can be increased either by scaling up with high core processors or by scaling out with more nodes per cluster.
- The EUX score is above 8 at the beginning of the test and it shows 4th Gen AMD EPYC processors provides lower latency for VDI applications and improves end user experience. The application response is gradually decreasing after 75% CPU utilization and EUX score is above 6 even at 100% CPU utilization which proves 4th Gen AMD EPYC Processors can deliver application with lower latency during peak load scenarios.
- AMD EPYC 4th Generation processors with higher number of cores can provide up to 2x-4x more density than the previous generation processors.
- ThinkAgile VX V3 systems with AMD EPYC 9004 processors and vSAN ESA can provide linear scaling for many virtual desktop profiles.
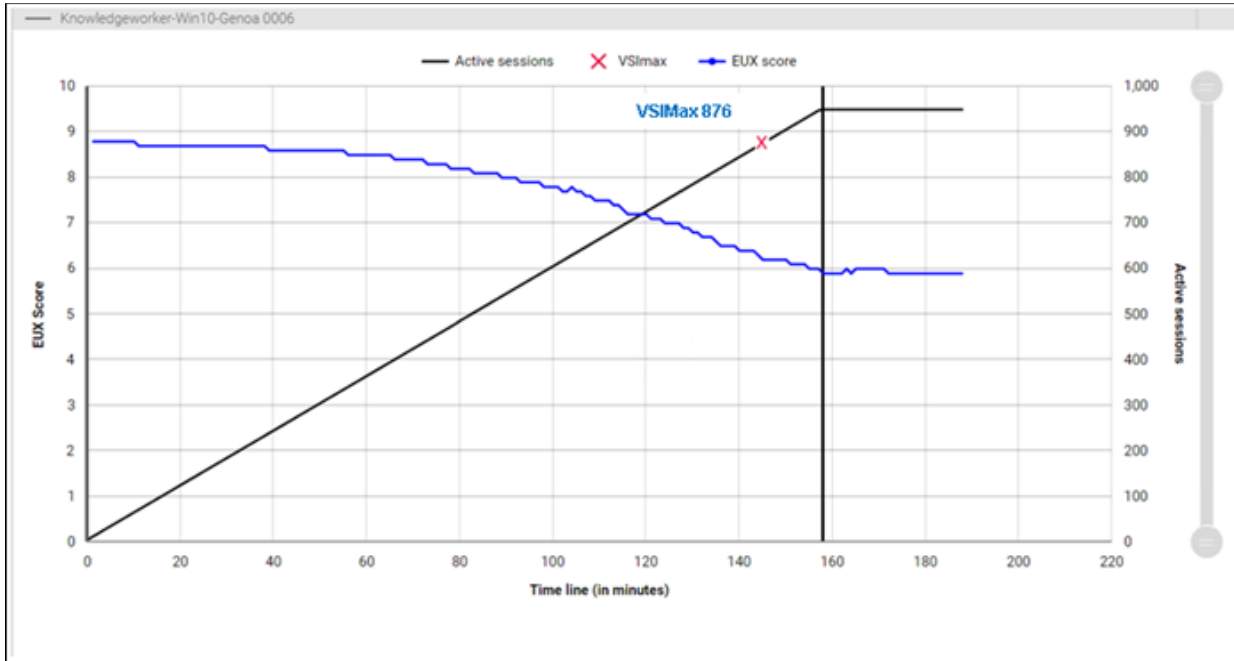- Enabling RDMA can result ~5% more virtual desktops and it requires 25GbE/100GbE network.

Figure 1. VMware Horizon Virtual Desktop Performance with AMD EPYC 9354 32C vSAN ESA Cluster
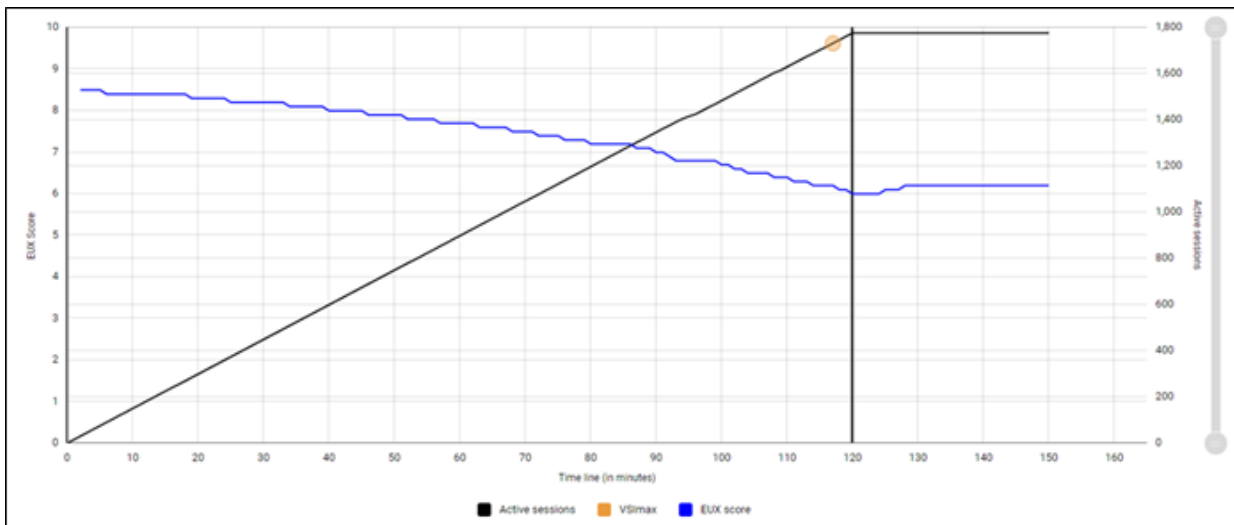

Figure 2. VMware Horizon Virtual Desktop Performance with AMD EPYC 9474F 48C vSAN ESA Cluster

VMware vSAN Express Storage Architecture Configuration

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

- Minimum 1 drive is needed and supported up to 36 drives.
- Minimum 10GbE connectivity is required and the cards should support RDMA (RoCE v2) to leverage RDMA. It is recommended to use 25GbE/100GbE to achieve lower latency and end user experience.
- RAID-5 is default and recommended configuration for vSAN ESA. It supports RAID-1(mirroring) and RAID-6 which are enabled through storage policies.
- The limits may vary for different vSphere versions and ThinkAgile VX platforms, so refer appropriate product guides.

The table below shows the list of RDMA supported NIC cards recommended for ESA solution.

Table 4. 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
4XC7A08237	ThinkSystem Broadcom 57414 10/25GbE SFP28 2-port PCIe Ethernet Adapter
4XC7A62580	ThinkSystem Mellanox ConnectX-6 Lx 10/25GbE SFP28 2-port PCIe Ethernet Adapter
4XC7A80566	ThinkSystem Broadcom 57504 10/25GbE SFP28 4-Port PCIe Ethernet Adapter

VMware vSAN Data Persistence Platform

VMware vSAN DPp 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 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 a 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 5. Bill of Materials

Part number Feature code	Product Description	Qty
7D9WCTO2WW	**Server : Lenovo ThinkAgile VX665 V3 Certified Node**	1
BRY9	ThinkAgile VX V3 2U 24x2.5" Chassis	1
BVGL	Data Center Environment 30 Degree Celsius / 86 Degree Fahrenheit	1
B0W3	XClarity Pro	1
BN8K	ThinkAgile VX Remote Deployment	1
BPVJ	ThinkSystem AMD EPYC 9554 64C 360W 3.1GHz Processor	1
BQ3D	ThinkSystem 64GB TruDDR5 4800MHz (2Rx4) 10x4 RDIMM-A	12
5977	Select Storage devices - no configured RAID required	1
BC4V	Non RAID NVMe	1
BT2G	vSAN ESA	1
BNF5	ThinkSystem 2.5" U.3 7450 PRO 3.84TB Read Intensive NVMe PCIe 4.0 x4 HS SSD	4
BS7Y	ThinkSystem V3 2U 8x2.5" NVMe Gen5 Backplane	1
B8P9	ThinkSystem M.2 NVMe 2-Bay RAID Enablement Kit	1
BTTY	M.2 NVMe	1
BKSR	ThinkSystem M.2 7450 PRO 960GB Read Intensive NVMe PCIe 4.0 x4 NHS SSD	2
BQS8	VMware ESXi 8.0 U1 (Factory Installed)	1
BPPW	ThinkSystem Broadcom 57504 10/25GbE SFP28 4-Port OCP Ethernet Adapter	1
BLKM	ThinkSystem V3 2U x16/x16/E PCIe Gen4 Riser1 or 2	1
BPK9	ThinkSystem 1800W 230V Titanium Hot-Swap Gen2 Power Supply	2
B8LA	ThinkSystem Toolless Slide Rail Kit v2	1
BQQ3	ThinkSystem 2U V3 EIA Latch with VGA Port	1
BLL6	ThinkSystem 2U V3 Performance Fan Module	6
BPKR	TPM 2.0	1
BQ80	ThinkSystem SR655 V3 MB	1
BS6Y	ThinkSystem 2U V3 M.2 Signal & Power Cable, SLx4 with 2X10/1X6 Sideband, 330/267/267mm	1
BSHZ	PCIe MB-BP Cable MCIO 1 2(MB) 12x3.5/8x2.5" 430mm to 8x2.5	1
BSJ2	PCIe MB-BP Cable MCIO 3 4(MB) 12x3.5/8x2.5" 340/390mm to 8x2.5	1
BMPF	ThinkSystem V3 2U Power Cable from MB to Front 2.5" BP v2	1
BQ12	G4 x16/x16/E PCIe Riser BLKM for Riser 1 Placement	1
B8MM	ThinkSystem 2U MS 3FH Riser Filler	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
AVEN	ThinkSystem 1x1 2.5" HDD Filler	4
BSR6	ThinkSystem SR635 V3/SR655 V3 RoT Module LV-RoW	1
BQ81	ThinkSystem SR655 V3 Main Airduct	1
BTT4	ThinkAgile SR655 V3 Service Label - WW	1

Part number Feature code	Product Description	Qty
AWF9	ThinkSystem Response time Service Label LI	1
BTSW	ThinkAgile SR655 V3 Agency Label - No CCC	1
B986	ThinkSystem HV 2U WW General PKG BOM	1
BXGY	Right EIA with FIO assembly	1
BQQ6	ThinkSystem 2U V3 EIA right with FIO	1
AVEQ	ThinkSystem 8x1 2.5" HDD Filler	2
AUTQ	ThinkSystem small Lenovo Label for 24x2.5"/12x3.5"/10x2.5"	1
BQF9	ThinkSystem SR655 V3 2U High Performance Heatsink	1
B265	ThinkAgile VX Pubkit	1
BQ31	ThinkSystem MS 2U common Airductr Filler	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
5PS7B12166	Premier Essential ThinkAgile CN - 3Yr 24x7 4Hr Resp + YDYD VX655 V3	1
5AS7B12280	Hardware Installation (Business Hours) for VX655 V3	1
5MS7A87711	ThinkAgile VX Remote Deployment (up to 4 node cluster)	1
7S0XCTO5WW	XClarity Controller	1
SBCV	Lenovo XClarity XCC2 Platinum Upgrade (FOD)	1

Conclusion

ThinkAgile VX V3 Integrated systems and certified nodes with VMware vSAN 8 and 4th Gen AMD EPYC processors provide superior performance, scalability and higher consolidation for different workloads. ThinkAgile VX systems are prevalidated and factory installed with VMware vSphere and VMware vSAN. VX systems simplify deployment and enable applications to address latency and security issues seamlessly. These next generation engineered hardware and software solutions from Lenovo and AMD are a one-stop scalable solution for modern application development and hybrid cloud scenarios with reduced TCO.

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 VX635 V3, VX645 V3, VX655 V3 and VX665 V3 servers, contact your Lenovo Business Partner or visit: https://www.lenovo.com/systems/solutions

References:

Lenovo ThinkAgile VX635 V3 1U Integrated System and Certified Node: https://lenovopress.lenovo.com/lp1689

Lenovo ThinkAgile VX645 V3 1U Integrated System and Certified Node: https://lenovopress.lenovo.com/lp1648

Lenovo ThinkAgile VX655 V3 2U Integrated System and Certified Node: https://lenovopress.lenovo.com/lp1690

Lenovo ThinkAgile VX665 V3 2U Integrated System and Certified Node: https://lenovopress.lenovo.com/lp1641

Related product families

Product families related to this document are the following:

- ThinkAgile VX Series for VMware
- VMware Alliance

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This document, LP1818, was created or updated on March 21, 2024.

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