

The Lenovo logo is displayed in white text on a black rectangular background.

Oracle and Lenovo X6 Validated Configuration Guide

Read about the validated configurations you can use in your environment today

Take advantage of the bold, cost-effective benefits of scale-up topology

Understand the significant value of configurations validated by industry leaders

Save energy, time, and more, by applying these validations in your environment

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Abstract

This paper describes a validated reference configuration to successfully implement Oracle Database 12c running on Oracle Linux 7.2 and Oracle Unbreakable Enterprise Kernel (UEK), and hosted on a clustered pair of Lenovo System x3950 X6 servers. This configuration is intended for enterprise-level businesses with scaled-up, converged infrastructures, in which cost-effectiveness and productivity are a must.

This paper explains the benefits of a scale-up Oracle database solution based on the 8-socket System x3950 X6 servers. It describes the validation process and the exact configuration used in the testing. The paper also provides additional information on the testing methodology and the tools used.

This paper and the validated configuration it describes is for enterprise customers looking to implement a high-performance fault-tolerant Oracle solution.

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Executive summary

This paper describes a collaboration by subject matter experts from Lenovo® and Oracle. As leaders and innovators in the IT industry, these organizations have partnered to offer you a validated reference configuration. The configuration is intended for midsized to enterprise-level businesses with scaled-up, converged infrastructures, in which cost-effectiveness, superior performance and productivity are a must.

Scale-up topology is particularly valuable in data centers and private clouds where mission-critical, workload-intensive processing can exceed IT resources, for example, for Decision Support System (DSS) and online transaction processing (OLTP) workloads. For these validated configurations, high-level product overviews follow:

- ▶ **Lenovo System x3950 X6 servers:** The Lenovo X6 platform delivers high-end, world-class enterprise computing capability and fast performance for your most critical applications. The X6 architecture offers flexible, leading-edge benefits in scaled-up environments. Advanced reliability, availability, and serviceability (RAS) features make it easy to automate tasks: Many take minutes, rather than days.
- ▶ **Oracle Linux 7, Unbreakable Enterprise Kernel (UEK) for Oracle, and Oracle Database 12c:** Oracle, known for eliminating complexity and simplifying IT, empowers its customers to accelerate innovation. Oracle's open architecture and multiple operating system options provide unmatched benefits from best-of-breed products.

Perhaps the most compelling reasons for implementing the validated configuration are that the configuration is defined, tested, and validated by industry leaders. This greatly decreases the lengthy, costly process of validating your environment independently. Our validated configuration is ready to implement today.

The objectives for this paper are three-fold:

- ▶ To convey the value of scaling up a small cluster of Lenovo X6 servers for performing workload-intensive operations, rather than scaling out distributed servers.
- ▶ To provide a validated reference configuration for a clustered Oracle database solution.
- ▶ To describe the setup procedures and validation processes, from software and hardware stack, to servers, storage, and network components.

This paper is for technical sales specialists, technical marketing specialists, solution architects, those performing database deployment services, systems administrators, and channel customers.

Key takeaways

Primarily, the validations in this paper show that these products, configured as indicated in this paper, comprise validated reference architectures. Using validated reference architectures, you can easily validate your environment, do so much faster, and move your products to market faster.

Other key takeaways include an understanding of the benefits of scale-up topology:

- ▶ How validated configurations simplify deployment
- ▶ The reference architecture for a validated configuration
- ▶ Interpretation of test results

Ongoing partnerships

Lenovo's X6 servers deliver large application virtualization and decrease infrastructure costs and complexity. In conjunction with Oracle's integrated stack of best-in-class hardware and products, Oracle offers complete, open, integrated solutions. Lenovo and Oracle Corporation have partnered on a number of initiatives, combining our talents to produce some of the most exciting products and technologies worldwide. This paper represents one such partnership.

The strength of our partnership is evidenced by the innovative ideas and technologies that have come from it. A small sampling follows, showing how we, as industry leaders, can best address clients' needs when we work together:

- ▶ Lenovo and Oracle offer joint support for Oracle Linux and Oracle VM on System x® servers. Lenovo publishes validated configurations on the Oracle Validated Configurations website, along with Lenovo hardware qualified on Oracle Linux and Oracle VM. The commitment of this partnership demonstrates the potential opportunities for joint development between Oracle software and Lenovo X6 solutions.
- ▶ Lenovo and Oracle maintain a strong alliance with more than 20 years of providing solutions to help businesses improve IT productivity and business value. Lenovo has a proven track record of customer successes with Oracle and Linux-based solutions running on System x servers.

The cost-effective benefits of scale-up topology

Scale-up topology provides opportunities to increase the efficiency of your IT processes. Better still, you can save on your IT investments considerably. Here, we explain a number of the cost-effective benefits of scale-up topology. Let's begin with a clear definition of this technology.

Scale-up topology, defined

Typically, when more computer resources are needed, more servers are added. The addition of servers and storage is referred to as the scale-out approach. The difficulty is that in a private cloud virtual servers run out of memory before the other resources do. As a result, the resources have to wait for memory to become available. The scale-out approach is an expensive one.

In contrast, validated configurations make use of the scale-up approach, which is the addition of CPUs, memory, I/O, or storage to existing machines. This provides the flexibility to keep pace with your needs over time, and simultaneously minimizes ongoing expenses.

Many applications and workloads lend themselves particularly well to scale-up rather than scale-out deployments. Factors contributing to a decision to scale up rather than scale out include processing and memory requirements, the number of end users, scalability cost, and administrative cost.

For large databases, scale-up architectures can provide higher levels of scalability than large numbers of scale-out distributed databases, and scale-up servers are often easier and less expensive to manage.

Benefits of validated scale-up configurations

The bold cost-effective benefits of this topology include:

- ▶ **Reduced software licensing costs:** With many software packages licensed on a per-processor or per-core basis, reducing the number of systems can significantly lower software support costs.
- ▶ **Improved IT staff productivity:** Scale-up servers reduce the total number of processors and servers being managed. With fewer physical servers, and the added automation and manageability features, administrators' work is less cumbersome.
- ▶ **Reduced end-user productivity losses:** Scale-up servers with mission-critical RAS capabilities (such as the System x3850 X6 and the System x3950 X6) incur less unplanned downtime than do scale-out servers.
- ▶ **Accelerated application deployment:** With virtualized scale-up servers, you can accelerate application deployment. Projects that previously took weeks to size, purchase, install and configure, can now be ready in hours.
- ▶ **Reduced energy consumption:** Today's ever-increasing energy costs are encouraging companies to reduce their server footprint onto fewer, more modern systems to lower energy costs. And, reduced energy consumption can lead to extending the life of existing hardware.
- ▶ **Increased resource utilization (CPU, memory, and network):** Combining workloads onto scale-up servers rather than using dedicated hardware improves resource utilization.
- ▶ **Reduced server hardware cost:** By replacing multiple two-socket servers with much more powerful eight-socket systems, you can reduce initial hardware costs. Reductions in server spending can reduce spending in other infrastructure areas, such as networking infrastructure.
- ▶ **Improved performance:** Scale-up servers are best suited for highly demanding workloads because they have faster processors with more cores, so they can run workloads faster and more efficiently.
- ▶ **Extended data center life:** Reducing the number of physical servers alleviates the pressure on data center capacity, enabling organizations to defer new build-outs.

Overall, by scaling workloads onto fewer, more powerful, eight-socket systems, such as the System x3950 X6, you can reduce operating costs, power and cooling costs, and software licensing costs, while increasing utilization and application performance.

Benefits of application scale-up

Scaling up enables you to add resources to existing servers without requiring that you rewrite applications to harness the added power. For large databases, scale-up architectures can provide higher levels of scalability than large numbers of scale-out distributed databases.

Oracle Database software products support both scale-up and scale-out computing; however, deploying Oracle Databases on scale-up servers offers a number of benefits, including reduced server licensing costs. When scaling-up, Oracle Real Application Cluster (RAC) is not required. Another benefit is that machine resources (especially CPUs) are instantly available for sharing.

As workload performance increases and as memory and scalability requirements increase, the need for scale-up systems increases. This drives the need for individual system scalability and resiliency. Handling your demanding, scale-up, mission-critical workloads is where X6 servers shine.

Scope of the Oracle Validated Configuration Program

The scope of this project is identical to validation projects conducted at Oracle as described in <http://www.oracle.com/technetwork/topics/linux/validated-configurations-085828.html>

“The goal of this program is to validate hardware with Oracle Linux and Oracle VM, and to identify issues and configuration details that would impact customer deployments. Oracle developed the program to go far beyond the standard certification testing normally performed with operating systems. Hardware vendors participating in this program perform thorough testing of the hardware in real-world configurations with Oracle Linux and Oracle VM.

This is not a database certification. Oracle Database is a component of the environment because it is demanding on hardware resources (processor, memory, cache, storage, and network) and the operating system, and well suited for this advanced level of testing. The validation program uses Oracle Database as a tool and hardware is not certified with Oracle Database as a result of the validation program.”

Key configurations, products, and tools

The following describes the cluster configurations that are validated. Diagrams of the cluster configurations are included. We also describe the products that are validated and the tools that are used for each validation.

Configurations

In our configuration, we used a cluster of two x3950 X6 systems, as shown in Figure 1 on page 11.

The System x3950 X6 server continues to be the leading product for clients with mission-critical initiatives in which scale-up and customization are critical components. X6 products are widely used for scalable databases, business analytics, virtualization, enterprise applications, and cloud applications. Additionally:

- ▶ This configuration represents a typical cluster of 8-socket servers with industry-leading storage
- ▶ The hardware and software components of this validated configuration have been shown to provide the needed memory and expansion for private clouds
- ▶ The configuration offers the potential for cost savings from scaling-up and using validated configurations

Products for validation

Key products for these validations are described in this section.

Lenovo System x3950 X6

The System x3950 X6 is the 8-processor 8U server platform in the Lenovo high end portfolio. These systems are fast, agile and, resilient.

X6 is ideal for mission-critical workloads and virtualized environments, as well as large databases and analytics. The System x3950 X6 is the sixth generation of servers based on

Lenovo's enterprise X-Architecture. X6 systems support multiple flash technologies for faster access to storage.

Powered by the Intel Xeon E7-8800 v3 family of processors, this 8-socket platform offers 144 cores of processing power, 192 DIMMs, and support for up to 12 TB of memory. The server is designed to stay in the rack, providing front and rear access for service and upgrades. The unique "bookshelf" design includes modules (or books) for each of the major subsystems, which can be individually slid in and out of the unit like books on a shelf. X6 accommodates multiple generations of processor and memory technologies.

Advanced RAS features automate tasks that were previously executed manually. Now, many actions require only minutes rather than days. The X6 self-healing features ensure high availability by isolating errors *before* they affect server performance. The System x3950 X6 platform delivers high-end enterprise computing capability and fast performance for your most critical business applications.

For product specifications, see the Lenovo Press product guide for the server:

<https://lenovopress.com/tips1251-system-x3950-x6-6241>

Oracle Linux 7

Oracle Linux provides the latest innovations, tools, and features that enable you to innovate, collaborate, and create solutions across traditional, cloud-based, and virtual environments. Providing advanced scalability and reliability for enterprise applications and systems, Oracle Linux delivers truly open cloud with great performance. Oracle Linux is free to use, free to distribute, free to update, and easy to download.

Oracle Linux 7 offers a number of new features and improvements, most notably a new version of the Unbreakable Enterprise Kernel.

Oracle Linux customers can access a number of unique and highly useful features, including:

- ▶ The Ksplice offline client is a feature in our Ksplice service. Ksplice provides updates for your kernel with no downtime. Therefore, this eliminates the requirement for an internet connection for applying Ksplice patches.
- ▶ Support for the journaling file system (XFS): is now available for customers with Premier Support subscriptions using Oracle Linux 7.
- ▶ DTrace for Oracle Linux: DTrace for Oracle Linux is a comprehensive dynamic tracing framework available to Oracle Linux customers. Supported customers can download this from the Oracle Unbreakable Linux Network (ULN).

For product specifications, visit:

<http://www.oracle.com/us/technologies/linux/product/specifications/>

Unbreakable Enterprise Kernel Release 3

The Unbreakable Enterprise Kernel (UEK) Release 3 is Oracle's third major release of its heavily tested and optimized operating system kernel for Oracle Linux 7, x86_64 platforms.

UEK Release 3 is based on the mainline Linux kernel version 3.8.13 and boasts a wide range of new features and improvements relevant for enterprise workloads.

Testing of the UEK includes both the operating system and the full Oracle application stack running on top of it, verifying stability and correct behavior in all situations. The test suite includes installation, functional, stress, and destructive tests, which are executed under varying workloads (e.g., I/O- or CPU-intensive), and various database sizes. Several

parameters are varied during the full run of the test suites, which also include crash scenarios in Oracle Real Application Cluster configurations.

For more information, see

<http://www.oracle.com/technetwork/server-storage/linux/technologies/uek-overview-2043074.html>

Oracle Database 12c Release 1

As organizations embrace the cloud, they seek technologies that will transform business and improve their overall operational agility and effectiveness. Oracle Database 12c is a next-generation database designed to meet these needs, providing a new multitenant architecture on top of a fast, scalable, reliable, and secure database platform. Oracle Database 12c also includes in-memory data processing capabilities for breakthrough analytical performance. By plugging into the cloud with Oracle Database 12c, customers can improve the quality and performance of applications, save time with maximum availability architecture and storage management, and simplify database consolidation by managing hundreds of databases as one.

For more information, see:

<http://docs.oracle.com/database/121>

IBM Storwize V7000 for Lenovo

The IBM Storwize family of storage products helps organizations achieve better data economics by supporting these new workloads that are critical to their success. Storwize family systems can handle the massive volumes of data from mobile and social applications, enable rapid and flexible cloud services deployments, and deliver the performance and scalability needed to gain insights from the latest analytics technologies.

IBM Storwize V7000 Unified and IBM Storwize V7000 are virtualized, enterprise-class hybrid storage systems that provide the foundation for implementing an effective storage infrastructure and transforming the economics of data storage. Designed to complement virtual server environments, these modular storage systems deliver the flexibility and responsiveness required by changing business needs.

In fact, IBM Spectrum Virtualize software for Storwize V7000 Unified and Storwize V7000 provides the latest storage technologies to unlock the business value of stored data, including virtualization and IBM Real-time Compression. In addition, the systems include a powerful hardware platform that can support the massive volumes of data created by today's demanding cloud and analytics applications. They are designed to deliver outstanding efficiency, ease of use and dependability for organizations of all sizes.

For product specifications, see the Lenovo Press product guide:

<https://lenovopress.com/tips1302-ibm-storwize-v7000-for-lenovo>

Lenovo RackSwitch G8124E

The Lenovo RackSwitch™ G8124E is a 10 Gigabit Ethernet (GbE) switch specifically designed for the data center, providing a virtualized, cooler, and easier network solution. The G8124E offers twenty-four 10 GbE ports in a high-density, 1U footprint. The G8124E is designed with ultralow latency and top performance in mind. Redundant power and fans, along with numerous high-availability features, mean that the G8124E is always available for business-sensitive traffic.

The G8124E is virtualized, supporting virtual fabric, which allows for the splitting up of a physical NIC into 2 - 8 vNICs for improved performance, availability, and security, while

reducing cost and complexity. The G8124E runs cool, implementing a choice of directional cooling to maximize data center layout and provisioning. Its superior airflow design complements the hot-aisle and cold-aisle data center cooling model. The G8124E is easy to set up and use, too, with server-oriented provisioning. Its industry-standard CLI and easy interoperability simplifies configurations.

For product specifications, see the Lenovo Press product guide:

<https://lenovopress.com/tips1271-lenovo-rackswitch-g8124e>

Brocade 16 GB FC SAN Switch 6510

The Brocade 6510 meets the needs of your highly virtualized and private cloud storage environments. It is a 48-port, high-performance, enterprise-class switch that delivers market-leading Generation 5 Fibre Channel technology. This switch provides maximum flexibility, simplicity, and reliability.

The Brocade 6510 supports highly virtualized environments. Designed to enable maximum flexibility and reliability, the Brocade 6510 is configurable with 24, 36, or 48 ports and supports 2, 4, 8, 10, or 16 Gbps speeds in an efficiently designed 1U package.

The Brocade6510 offers a simplified deployment process and an easy-to-use user interface. It offers low-cost access to industry-leading storage area network (SAN) technology, while providing pay-as-you-grow scalability to meet your evolving storage needs.

For product specifications, see the Lenovo Press product guide:

<https://lenovopress.com/lp0081-lenovo-b6505-b6510-fc-san-switches>

Emulex VFA5 ML2 Dual Port 10 GbE SFP+ adapter

The Emulex Virtual Fabric Adapter 5 (VFA5) delivers enhancements that improve performance, reduce complexity, and decrease costs. Ideal environments include virtualized enterprises and multi- and single-tenant private/hybrid clouds, I/O intensive workloads, and converged infrastructures.

For product specifications, see the Lenovo Press product guide:

<https://lenovopress.com/lp0052-emulex-vfa52-adapters>

Intel X540-T2 Dual Port 10GBaseT Adapter

The Intel X540 Dual Port 10 GbE adapter is powered by reliable and proven 10 Gb Ethernet technology. This adapter offers full line-rate 10 Gbps performance for I/O-intensive applications, and showcases the next generation in 10 GbE networking features for the enterprise network and data center. The Intel X540-T2 adapter offers 10GBASE-T connectivity with RJ-45 ports, compatibility with existing 1000BASE-T networks, and simplifies the transition to 10 Gb Ethernet technology.

For product specifications, see the Lenovo Press product guide:

<https://lenovopress.com/tips0893-intel-x520-and-x540-10gbe>

QLogic 16 Gb FC Dual-port HBA

The QLogic dual-port FC HBA offers 16 Gbps line-rate performance and extremely low CPU utilization with full hardware offloads. These HBAs are highly useful for high-bandwidth, I/O-intensive applications and server virtualization.

For product specifications, see the Lenovo Press product guide:

<https://lenovopress.com/tips0954-qlogic-16gb-fc-hba>

Key validation tool: Oracle Linux Test

Validations are carried out using the Oracle Linux Test (OLT) kit. OLT is a component of the Oracle Validated Configurations (OVC) program, which provides pretested, validated configurations, including software, hardware, storage, network components, and documented best practices for running Oracle Databases. The OLT home page is:

<https://oss.oracle.com/projects/olt/>

Oracle describes the value of OLT as “a test designed to verify Linux kernel functionality and stability essential for the Oracle Database. The OLT toolkit, which is distributed as a set of RPM files, provides an automated mechanism to define, execute, and analyze tests. The kit contains tools, such as DBT2 and DBT3 workloads against Oracle single instance or clustered databases, in addition to specialized workload simulators. OLT can be used for running tests on Oracle Linux with UEK and Oracle VM, with a variety of topologies (storage area network, network attached storage).”¹

OLT is used to create and run workloads, such as those for a DSS (Decision Support System) or OLTP (On-Line Transaction Processing) environment, and it performs installation, functional, stress, regression, and system verification tests. The OLT User Guide describes how to set up and run the validation tests.

The OLT User’s Guide is available from this link:

https://oss.oracle.com/projects/olt/dist/documentation/OLT_UserGuide.pdf

¹ From <https://oss.oracle.com/projects/olt/>

Validated configuration

The configuration is a cluster of two System x3950 X6 systems, as shown in Figure 1.

All setup and testing is performed according to the Oracle Linux Test (OLT) User's Guide, available from:

https://oss.oracle.com/projects/olt/dist/documentation/OLT_UserGuide.pdf

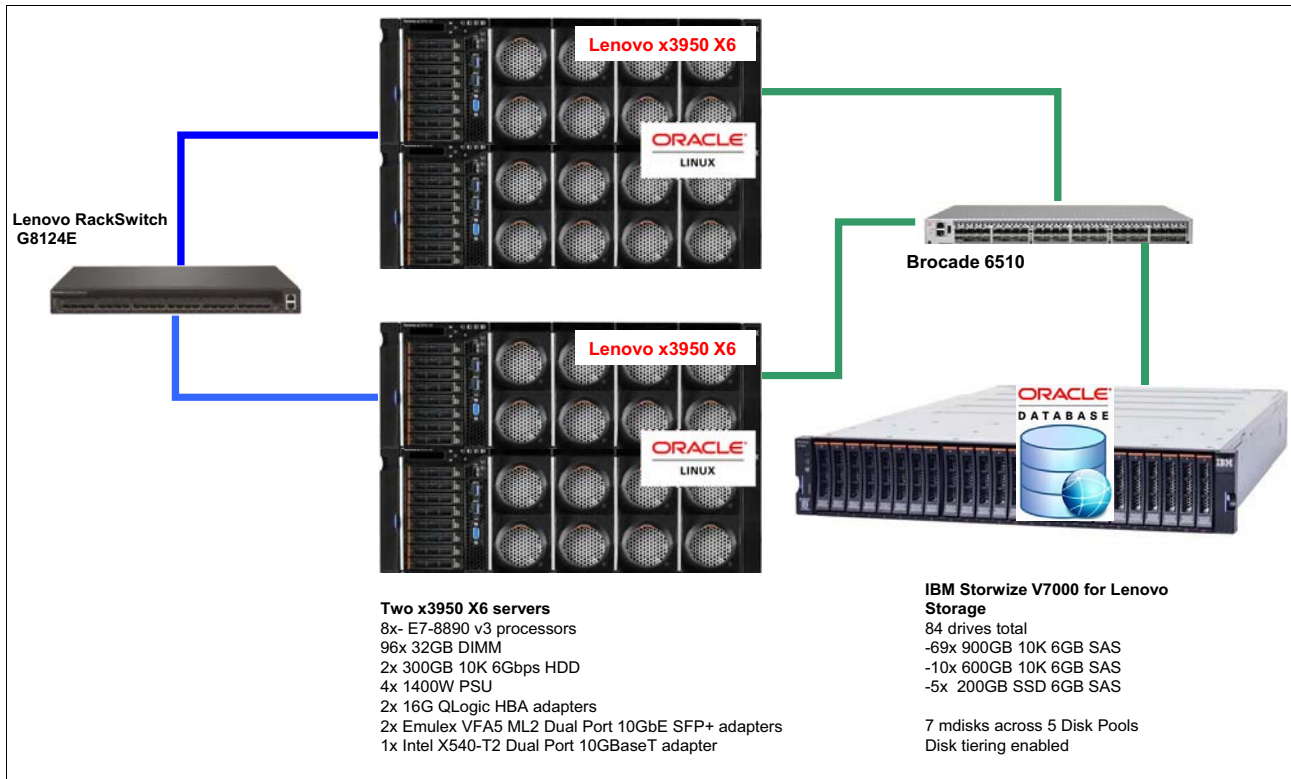


Figure 1 Cluster of two System x3950 X6 systems

The disk layout in the V7000 is shown in Figure 2 on page 12. The V7000, with its block, file, and unified configurations, supports FC, iSCSI, and FCoE connectivity. The disk layout is shown in Figure 2.

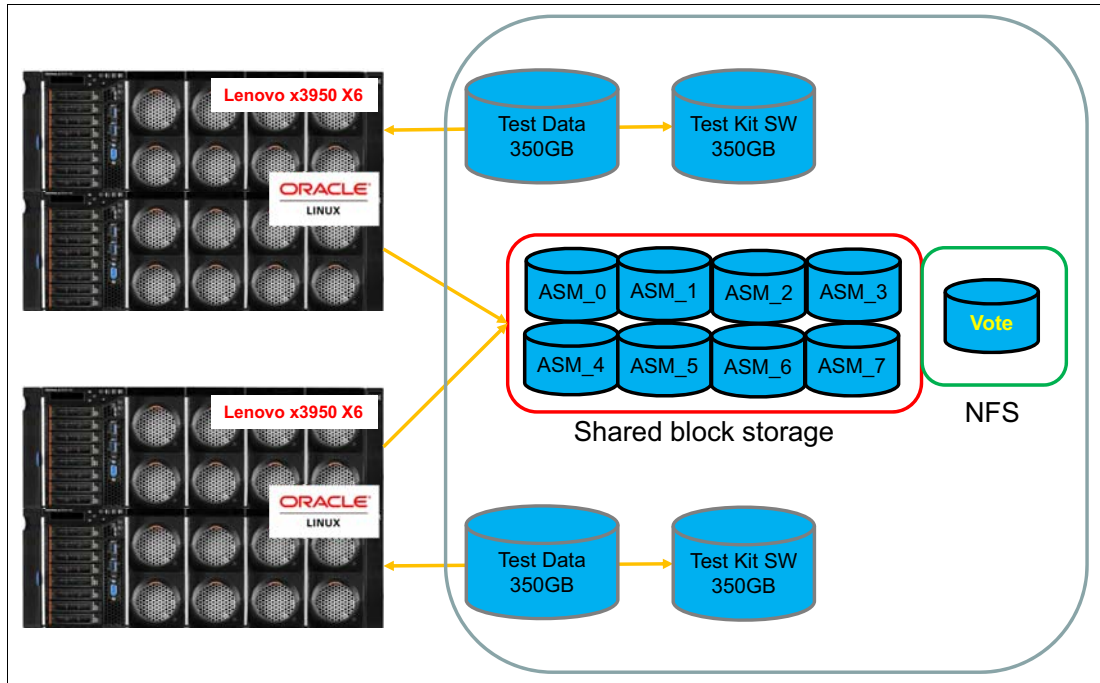


Figure 2 Disk layout of the V7000

Table 1 lists the details of the validated configuration.

As part of the validation, we confirmed the following:

- ▶ System x and Oracle passed a rigorous validation test suite.
- ▶ The x3950 X6 can withstand hardware faults, such as in HBA, switch, and storage subsystems.
- ▶ The x3950 X6 can sustain software faults or instance crashes and still maintain a running Oracle Database

More details about the validated configuration, including the packages used, parameters used in configuration files, and driver details, are available from:

http://linux.oracle.com/pls/apex/f?p=102:2:272195739983::N0::P2_VC_ID:678

Table 1 Validated configuration details

Specification	Information
Summary	
Configuration Summary	Oracle Linux 7 Update 2 x86_64 on Lenovo System x3950 X6 and IBM Storwize V7000 with Oracle Database 12c Release 1
Publication Date	01-APR-16
Version	1.0
Server Platform	Lenovo System x3950 X6
Storage Model	IBM Storwize V7000

Specification	Information
Oracle Software	Oracle Database 12c Release 1 (12.1.0.2.0) for Linux x86-64
Linux Distribution	Oracle Linux 7 Update 2 x86_64
Server and Storage Platform Details	
Server Model	2x Lenovo System x3950 X6
Processors	8x 18-core Intel Xeon processor E7-8890 v3 2.5GHz
Memory	2TB RAM
Onboard Storage	69x 900GB 10K 6GB SAS HDD 5x 200GB 6GB SAS SSD 10x 600GB 10K 6GB SAS HDD
RAID	M5210 – LSI MegaRAID SAS-3 3108 adapter
Network/Interconnect	Intel X540-T2 Dual Port 10GBaseT Adapter 2x Emulex VFA ML2 Dual Port 10 GbE SFP+ adapter
HBA	2x QLogic QLE2662 16Gb FC Dual-port HBA for System x.
Multipath	Device mapper multipath 0.4.9-77.el7.x86_64
Storage Model	IBM Storwize V7000
Switch Details	
Switch Model	Lenovo RackSwitch G8124E
Switch Type	10GbE Network Switch
Additional Info.	Used for private network and storage
Switch Model	Brocade 16GB FC SAN Switch 6510
Switch Type	FC Switch
Additional Info.	None
Linux Distribution Details	
OS	Oracle Linux 7 Update 2 x86_64
Kernel	kernel-uek-3.8.13-98.6.1.el7uek.x86_64.rpm or higher

Additional guidance

This section is comprised of the following topics:

- ▶ “How to prepare the validation environment” on page 14
- ▶ “Processes for configuration and tuning” on page 14
- ▶ “Test methodology” on page 15

How to prepare the validation environment

Begin by setting up Oracle OLT. High-level process steps follow:

1. Open the Oracle Linux Test (OLT) User Guide, available at:
https://oss.oracle.com/projects/olt/dist/documentation/OLT_UserGuide.pdf
2. Download and set up the Oracle software for OLT as described in the *Oracle Linux Test (OLT) User Guide*
3. Set up Oracle patches (if required)
4. Set up the ORACLE_VERSION and patches that the OLT will use
5. Run the silent install tests to install Oracle

Processes for configuration and tuning

The following describes the hardware and software processes for configuration and tuning.

Hardware configuration overview

Configuration of the hardware is performed in accord with the Oracle Linux Test (OLT) User Guide, available from:

https://oss.oracle.com/projects/olt/dist/documentation/OLT_UserGuide.pdf

High-level features of the hardware configuration are:

- ▶ Hardware high availability
 - No single point of failure
 - Redundancy is incorporated into significant components (servers, storage controllers, networking components, database)
- ▶ Database high availability
 - Oracle RAC Database is configured on System x machines
- ▶ SAN high availability
 - Controllers enable IPC at the controller level. If one controller were to go down, the database will continue to access the storage enclosures. As a best practice, the four Fibre Channel front end ports on each of the controllers are configured as virtual ports.

Software configuration overview

Configuration of the OS, network, and storage requirements is performed in accord with the Oracle Linux Test (OLT) User Guide, available from:

https://oss.oracle.com/projects/olt/dist/documentation/OLT_UserGuide.pdf

High-level features of the software configuration are:

- ▶ Operating system
 - The Oracle database servers are installed with Oracle Linux 7.2 running the Unbreakable Enterprise Kernel.
- ▶ RPMs
 - Oracle users, groups, permissions, and recommended kernel and database parameters are set in accord with Oracle's validated pre-install RPM for Oracle Database 12c.

- ▶ Testing software
 - The OLT toolkit is used to stress test and validate the configurations.
 - OS configuration, network, and the storage requirements are configured in accord with the Oracle Linux Test (OLT) User's Guide.
 - The Oracle Grid Infrastructure and RAC Database 12c are installed using the silent install test from the OLT toolkit.
- ▶ Storage volumes
 - Volumes needed for the OLT tests are created as thin provisioned volumes.
 - Disks for the Oracle Clusterware and data files are configured as Oracle Automatic Storage Management (ASM) disks.
 - ASMLib is used to configure the ASM disks using the OLT User's Guide.
- ▶ Multipath configurations
 - On the Linux host, the storage volumes are configured using the device-mapper.

Test methodology

The following high-level steps are carried out to install the OLT toolkit. Selected test cases that are performed using this toolkit are also listed. Processes are performed in accord with the OLT User Guide, available from:

https://oss.oracle.com/projects/olt/dist/documentation/OLT_UserGuide.pdf

OLT Steps

Perform OLT steps as follows:

- ▶ Verification of hardware requirements for OLT testing
- ▶ OLT preinstallation
- ▶ Operating system configuration
 - Storage configuration
 - OLT installation and configuration

OLT Test cases

Perform OLT test cases as follows:

- ▶ Stress Tests for RACs
- ▶ RAC Destructive Tests:
- ▶ Multipath tests:
 - Host-side testing
 - Switch-side testing
 - Storage-side testing

Conclusions

By applying the guidance from this paper, using the products and technologies discussed and running the OLT tests successfully, your environment is now validated. This implies that:

- ▶ The configuration is validated as functional as it applies to Lenovo X6 servers and to Oracle Linux 7 with UEK and Oracle Database 12c Release 1.
- ▶ The configuration is deemed by Oracle as an Oracle Validated Configuration. A link to the Oracle web site for validated configurations is located at <http://linux.oracle.com/pls/apex/f?p=102:1:14455153592073::NO>

Most importantly, this validated configuration, as a result of the collaboration of Lenovo and Oracle, provides you with the confidence to address your most critical business needs using these reliable products, technologies, and validated configurations.

Look for new and exciting collaborations between Lenovo and Oracle as we work to provide you with energy-, time-, and cost-saving products and technologies. We stand behind you in enabling your staff to address the complex needs of systems integration.

About the authors

Thanks to the following people who helped with this project:

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- ▶ **Ajay Dholakia** is a Master Inventor, Senior Technical Staff Member and Solution Architect with Lenovo. His current focus is on solution architectures in the areas of big data, analytics, cloud computing, and health care. In his more than 20 years with Lenovo, and IBM before that, Ajay has led diverse projects ranging from research and technology to product development, as well as business and technical strategy.
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This document was created or updated on April 21, 2016.

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