

Advantages of Dell EMC VxRack Systems for Oracle Databases

Hyperconverged infrastructure for database management

Why hyperconverged systems?

Many IT organizations and database teams are challenged with stagnating budgets and growing management activities such as keeping databases running and tuning performance. Organizations are attempting to address data-center inefficiencies by researching solutions that increase consolidation, automation, virtualization, and standardization. The majority of database administrators have prioritized standardization as their number-one strategy for reducing the time and money that is spent on database-management activities.

Hyperconverged systems accelerate standardization by integrating compute, networking, storage, and virtualization layers. This integration facilitates hyperconverged systems to speed up deployments and simplify IT operations. For Oracle teams, the traditional complexity of designing a silo infrastructure for database performance, scalability, and resiliency is built into a simpler hyperconverged system. Dell EMC offers support for the entire integrated stack through a single enterprise-class support organization, which is available to answer questions and resolve issues for you.

VxRack Systems

Figure 1 shows a Dell™ EMC™ VxRack™ Systems cluster.



Figure 1. VxRack Systems

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Essentials

Hyperconverged virtualized system

- Accelerated standardization with integrated layers
- Faster deployment, simpler IT operations
- Single point of support

Oracle licensing

- No special licensing considerations beyond what is stated in the Oracle License and Service Agreement (OLSA)

VxRack FLEX

- Asymmetric scaling of compute and storage
- Easy provisioning
- OS- and hypervisor-agnostic

VxRack SDDC

- Specified capacity, performance, and availability characteristics
- Separate pools of resources dedicated to Oracle databases

VxRack Systems consist of a hyperconverged rack-scale engineered system with integrated networking, to achieve the scalability and management requirements of traditional and cloud-native workloads. The VxRack System series is designed to enable you to quickly deploy infrastructure-as-a-service (IaaS) or private-cloud architectures.

VxRack Systems tightly integrate the hardware with the software and management layers. The result is a fully tested, pre-configured, hyperconverged system with automated provisioning, simplified management, and robust reporting capabilities at data-center and service-provider scale. VxRack Systems support the deployment of a variety of application workloads, enabling IT to quickly deliver new services while improving overall agility and efficiency.

VxRack Systems enables you to accelerate your modernization initiative by making it easy for you to deploy infrastructure platforms for Oracle. The VxRack System series has a couple of models, both of which you can use with databases:

- Dell EMC VxRack System FLEX (VxRack FLEX)
- Dell EMC VxRack System SDDC (VxRack SDDC)

For more information about the VxRack System series, refer to the Dell EMC web page [VxRack System 1000](#).

VxRack FLEX

The VxRack FLEX uses Dell EMC ScaleIO™ technology to transform a server's direct-attached storage (DAS) into a shared, network-based, block-storage solution, which is similar to a storage-area network (SAN). All nodes in a VxRack FLEX cluster process I/O operations, reducing response times and increasing throughput as the cluster scales up. Massive I/O parallelism reduces I/O-related database wait events, providing the business with fast application response times.

VxRack FLEX benefits include:

- **Asymmetric scale:** Configure the hyperconverged infrastructure to add compute and storage capabilities to address specific workload requirements of Oracle databases.
- **Bare metal:** Use a physical Oracle database infrastructure to fetch data from the hard disk (remain physical) in a hyperconverged infrastructure.
- **Easy provisioning:** Use automation to simplify management and storage lifecycle capabilities for efficient installation, running, and performance of Oracle databases.
- **Flexible personality support:** Provision for multiple hypervisors and dedicated storage.
- **Elastic:** Grow the system with more flexibility and options, as and when required, without application interruption or downtime.
- **Building blocks for growth:** Use step-sized building blocks for future data-center environments.
- **Ready to use:** Use a preconfigured, loaded, tested, and fully optimized IT stack, which is delivered from the factory as a fully assembled and supported solution to help run Oracle databases with minimal tuning of database configuration and performance parameters.
- **Compelling economics:** Use a single support vendor, built-in management reporting, and automated updates to lower the total cost of ownership (TCO) and significantly improve your OPEX and CAPEX

Operating system (OS) and hypervisor-agnostic

Both VxRack FLEX and VxRack SDDC provide fully engineered, validated, and optimized factory builds installed with VMware vSphere 6 (or later) and the VMware vSphere ESXi hypervisor.

If you want a heterogeneous build with a different operating system (OS) and hypervisor, such as Red Hat Enterprise Linux (RHEL) with KVM or Microsoft Windows Server with Hyper-V, the VxRack FLEX can be shipped as a bare-metal configuration. The OS and hypervisor that you choose, with the ScaleIO implementation, are delivered by a custom services engagement.

VxRack SDDC

VxRack SDDC accelerates standardization, consolidation, and automation with VMware virtualization. VxRack SDDC is powered by VMware Cloud Foundation, which comprises:

- VMware vSphere ESXi (hypervisor)
- VMware NSX (network virtualization)
- VMware vSAN (software-defined virtual storage)
- VMware SDDC Manager (end-to-end automated lifecycle management)

The VxRack SDDC supports both traditional and cloud-native workloads. The VxRack SDDC starts with as few as eight Dell PowerEdge™ server nodes and scales up by adding nodes one at a time, or scales out by adding racks. The VxRack SDDC is based on the Dell PowerEdge R630 or Dell PowerEdge R730xd systems that bring greater capacity and 40 percent more CPU performance without costing more money.

VxRack SDDC benefits include:

- Workload domain feature that enables the creation of separate pools of resources that are dedicated to the Oracle databases
- Lower cost because the databases are part of a larger standardized infrastructure
- Ability to specify capacity, performance, and availability characteristics in an isolated workload domain

VxRack System components

DBAs manage the most critical applications for businesses and, therefore, they must understand the physical and virtual infrastructure to know the performance and resiliency of the system.

Table 1 lists the main components and configuration details of VxRack System.

Table 1. Components of VxRack System

Component	VxRack SDDC configuration	VxRack FLEX configuration
Compute	Dell PowerEdge servers	
Storage	DAS on PowerEdge servers	
Networking	Top-of-rack (ToR) switches, spine, and management switches	

Component	VxRack SDDC configuration	VxRack FLEX configuration
Server virtualization	VMware vSphere 6 or later including: VMware vSphere ESXi, VMware vSphere Server Enterprise Plus, VMware vCenter Server	
Storage virtualization	VMware vSAN	Dell EMC ScaleIO
Network virtualization	VMware NSX	
Management infrastructure	VMware SDDC Manager	Dell EMC Vision™ Intelligent Operations
Environment	Intelligent physical infrastructure consisting of: <ul style="list-style-type: none"> • Cabinet 2.0—fully welded and dynamically load-rated • Smart power distribution units (PDUs) • Human interface device (HID) readers and thermal sensors 	
Data protection	Options for Dell EMC Avamar™, Dell EMC Data Domain™, and Dell EMC RecoverPoint™ for Virtual Machines	Options for Avamar and Data Domain

Compute

VxRack Systems use:

- PowerEdge R630 (1U/1N) servers with VxRack SDDC and VxRack FLEX
- PowerEdge R730xd (2U/1N) servers with VxRack FLEX only

The servers incorporate Intel's latest processors and offer 2.5 times more usable flash capacity than previous-generation nodes. With more usable flash capacity, you can provision more databases with sub-millisecond response times. Application performance is further accelerated with DAS cache, which speeds storage I/O operations, reducing latency and improving performance.

Networking

VxRack System networking uses a ToR model. All servers are connected to switches that are at the top of the rack within the same or adjacent racks. The advantages of ToR switching are that it allows for oversubscription at the rack level, limits the use of copper within racks, and uses fiber-optic cabling. Fiber-optic cabling better positions infrastructure investments as evolving standards will most likely be implemented on fiber first.

Modern data centers use a series of network switches to form the access layer. The rack servers are connected to the ToR switches that form the access layer. The access switches are fully meshed into spine switches so that access switches are no more than one hop away from one another. This network topology minimizes latency and network bottlenecks.

Virtualization

The VxRack FLEX and VxRack SDDC both use VMware vSphere 6 as the virtualization platform. With SDDC Manager, you can provision and configure vSphere clusters in the VxRack System. You can then use vCenter to deploy virtual machines (VMs) to that cluster.

In an Independent Oracle Users Group (IOUG) survey conducted in 2016, Oracle DBAs indicated that vSphere was a major component in critical Oracle Database management functions in 79 percent of companies. Acceptance of vSphere is widespread and accelerating among Oracle DBAs and DBAs who make database infrastructure-related decisions. For a summary of the survey results, refer to [The Empowered Database: 2016 Enterprise Platform Decision Survey](#).

Oracle licensing on VxRack Systems

House of Brick Technologies has produced one of the most detailed Oracle database-licensing guides available. In the white paper, which can be requested from House of Brick Technologies at [Licensing Databases on EMC and VMware Technology](#), the VxRack System is reviewed for any database licensing impact customers might have when using the hyperconverged solution.

Oracle licensing rules are applicable to both the VxRack FLEX and VxRack SDDC:

- The Oracle contract defines a "processor" as all processors where the Oracle programs are installed or running. A customer must pay for database-processor licenses where the database is running (present tense) or installed (past tense).
- Customer have no contractual obligation to license the database on processor cores where the databases are not installed or running.

The processor-based licensing rules are the cornerstone of an Oracle contract and define how to remain in compliance. The VxRack FLEX and VxRack SDDC are similar to any other infrastructure. They do not require special licensing considerations beyond what is stated in the Oracle License and Service Agreement (OLSA).

Guidelines for running Oracle databases in a vSphere virtual infrastructure such as the VxRack SDDC are:

- **Affinity rules:** Applied to VMs to specify the physical hosts on which the VMs can run. Many customers use affinity rules for licensing compliance, for example, to ensure VMs only use hosts that are licensed for Oracle databases. You must prevent a VM from migrating to a non-licensed host, which would result in a compliance gap.
- **Anti-affinity rules:** Applied to VMs to keep them apart from each other. A common method is to reserve compute, memory, and storage for production databases to ensure consistent performance and prevent VMs from using the same resources.
- **Workload domains:** Applied to the VxRack SDDC only. Use SDDC Manager to create policy-driven capacity deployments. Workload domains are a group of physical nodes that are selected based on the administrator specifications for the compute, storage, and memory resources requirements for databases and other workloads. Use workload domains to specify hardware resources that comply with the terms of the OLSA.

Workload domains can be expanded, which could cause a license compliance gap. You must have licensing policies in place before modifying a workload domain that supports databases. For details, refer to [Working with Management Domains and Workload Domains](#) on the VMware Cloud Foundation Documentation Center web page.

The appendix of the database-licensing white paper includes a couple of important notes about restricting VMs to hosts. Manual operations and VMware vSphere High Availability (HA) can violate affinity rules.

In the *Empowered Database* survey (page 5), DBAs who virtualized their databases indicate that the benefits include cost reduction and greater systems agility. To achieve those ends, Dell EMC uses its partnerships with vendors such as VMware, Oracle, and House of Brick Technologies to create a database infrastructure on the VxRack System. This database infrastructure provides the benefits of a hyperconverged, virtualized infrastructure while ensuring that you remain in compliance with Oracle database licensing. You can accelerate migrating to a new hyperconverged infrastructure with little to no risk and without worrying about Oracle licensing costs.

Dell EMC recommends that you read the entire Oracle database licensing guide for a comprehensive understanding of how to remain in compliance with your database contract.

Benefits of software-defined virtual storage for Oracle databases

VxRack FLEX

The VxRack FLEX is engineered to use ScaleIO technology. You can implement ScaleIO in one of the following ways:

- **Two-layer mode:** ScaleIO performs like a traditional SAN at one layer and like a dedicated compute resource at the other layer. This mode enhances application performance because the competition for database resources is minimized.
- **One-layer mode:** Compute and storage co-exist. This mode improves the input/output operations per second (IOPS) that the storage system of the Oracle database requires to provide the best performance at the optimal cost.

For Oracle environments, Dell EMC recommends that you use two-layer mode because you can dedicate compute resources to specific databases to maximize your licensing investment. In a recent article by StorageReview.com, the benefits of the two-layer mode include:

- Simple deployment and management
- Ultimate flexibility in deployment
- Incredibly high performance

For the full review, refer to [EMC VxRack Node powered by ScaleIO Review](#).

ScaleIO is software-defined block storage that offers multiple deployment options. Each deployment drives:

- Agility
- High performance
- Dense compute delivering low latencies
- Flexibility and a small footprint

For more information about running Oracle with the VxRack FLEX and ScaleIO storage, refer to the [EMC ScaleIO for Oracle Database 12c Solutions: Oracle RAC and Data Guard Replication White Paper](#).

VxRack SDDC

The VxRack SDDC is engineered to use vSAN, which enables you to create dedicated all-flash storage for databases using a modular approach. Space efficiency in VMware vSAN 6.2 introduces storage deduplication, compression, and RAID 5/6 erasure coding to reduce capacity consumption on all-flash drives.

For details about VMware vSAN, refer to the [What's New with VMware Virtual SAN 6.2 White Paper](#).

In a VMware reference architecture for running Oracle Database 12c on vSAN, deduplication and compression provided a 45 percent space savings. Other benefits include:

- **Manageability:** Set up, manage, and provision storage easily.
- **Lower TCO:** Deploy storage using inexpensive local server storage. Using DAS all-flash provides one of the lowest cost configurations for sub-millisecond response times.

For details, refer to the [Oracle Database 12c on VMware vSAN 6.2 All-Flash Reference Architecture](#).

Because vSAN and ScaleIO provide a storage abstraction layer to Oracle, the VxRack System presents no database licensing implications. Oracle customers using the VxRack SDDC or VxRack FLEX can gain all the benefits of a software-defined data center without any licensing risks.

Summary

IT organizations use the VxRack System hyperconverged infrastructure because of its tight component integration and validation, which means a faster time to value. Every VxRack System is pre-integrated, tested, and validated. Customers receive the system within 45 days as a prepackaged solution that is operational within hours of arrival.

VxRack Systems are ideal for Oracle databases because the infrastructure eliminates hardware complexities, and provides flexibility, performance, and protection at enterprise levels. For example, with the current VxRack System setup, you can protect a database environment using Avamar software with the Data Domain system, Data Domain with Dell EMC DD Boost™ software for Oracle, and EMC RecoverPoint for Virtual Machines.

Enterprise-class support for the hyperconverged infrastructure with lifecycle-system assurance ensures the best system performance. Other benefits of using VxRack Systems include:

- All-flash storage configurations maximize performance for mission-critical workloads. You can deliver submillisecond performance for physical reads and writes for Oracle databases.
- Extreme scalability, enabling growth and performance by adding nodes. Adding nodes is seamless and non-disruptive to an existing VxRack System, making expansion easy.

The advantages of using the VxRack System with Oracle databases include:

- A hyperconverged solution accelerates standardization, speeds up deployment, and simplifies IT operations.
- Support for the entire integrated stack is through a single support organization for all layers, which helps to refocus investment from OPEX to CAPEX.
- The database infrastructure ensures continued compliance with Oracle database licensing

- Nodes and ScaleIO technology transform a server DAS into a shared, network-based, block-storage solution

References

[VxRack System 1000 with SDDC Nodes Product Overview](#)

[VxRack System 1000 Series Product Overview](#)

[EMC ScaleIO for Oracle Database 12c Solutions: Oracle RAC and Data Guard Replication White Paper](#)

[The Empowered Database: 2016 Enterprise Platform Decision Survey](#)

[Understanding Oracle Certification, Support and Licensing for VMware Environments White Paper](#)

[Oracle Database 12c on VMware Virtual SAN 6.2 All-Flash Reference Architecture](#)

[EMC VxRack Node powered by ScaleIO Review](#) (review)

[Licensing Databases on EMC and VMware Technology](#) (web page)

[Dell EMC VxRack System 1000](#) (web page)

[Hyperconverged System Optimized for Scale and Agility](#) (web page)

[Working with Management Domains and Workload Domains](#) (VMware Cloud Foundation Documentation Center)

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