



# **Oracle Databases on VMware Use Cases**

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## 1. Introduction

VMware vSphere® delivers the performance required to run business critical applications in large scale environments. VMware vSphere provides 2–4 times the performance of the previous generation platform while keeping virtualization overhead to a minimum. With these performance improvements, vSphere is able to run even large resource-intensive databases and, in many cases, enables applications to scale better on newer multi-core servers.

VMware vSphere provides a range of features and capabilities that enable enterprise datacenter applications to achieve unparalleled levels of availability, security, and scalability. For example, with vSphere, all datacenter applications can have enhanced protection from downtime with VMware vSphere High Availability (HA). In addition, applications can be scaled dynamically to meet changing loads with capabilities such as VMware Hot Add (of CPU, memory resources) and VMware Distributed Resource Scheduler (DRS).

Oracle databases have been shown to run successfully on vSphere providing significant scalability, availability and performance benefits. The Oracle database administrator's (DBA) skill set, deployment technique and responsibilities do not change when transitioning from a physical to virtual environment. This document describes key use cases and benefits for virtualizing Oracle databases on vSphere.

Virtualizing database workloads on vSphere significantly reduces the number of physical systems your organization requires, while also achieving more effective utilization of datacenter resources. Clients realize tangible savings from this consolidation along with operational cost savings from reduced datacenter floor space, power, and cooling requirements.

Planned maintenance on hardware such as servers or storage no longer requires downtime as a result of using vSphere features such as Live Migration of servers and storage with VMware vSphere® vMotion®. The encapsulation of each database and operating system within a virtual machine allows clients to run combinations of application VMs that are consolidated on the same physical hardware infrastructure. As the virtual machine is abstracted from the underlying hardware layer (host, storage and network), infrastructure upgrades or replacements can be carried out without the need for major reinstallation and data migrations.

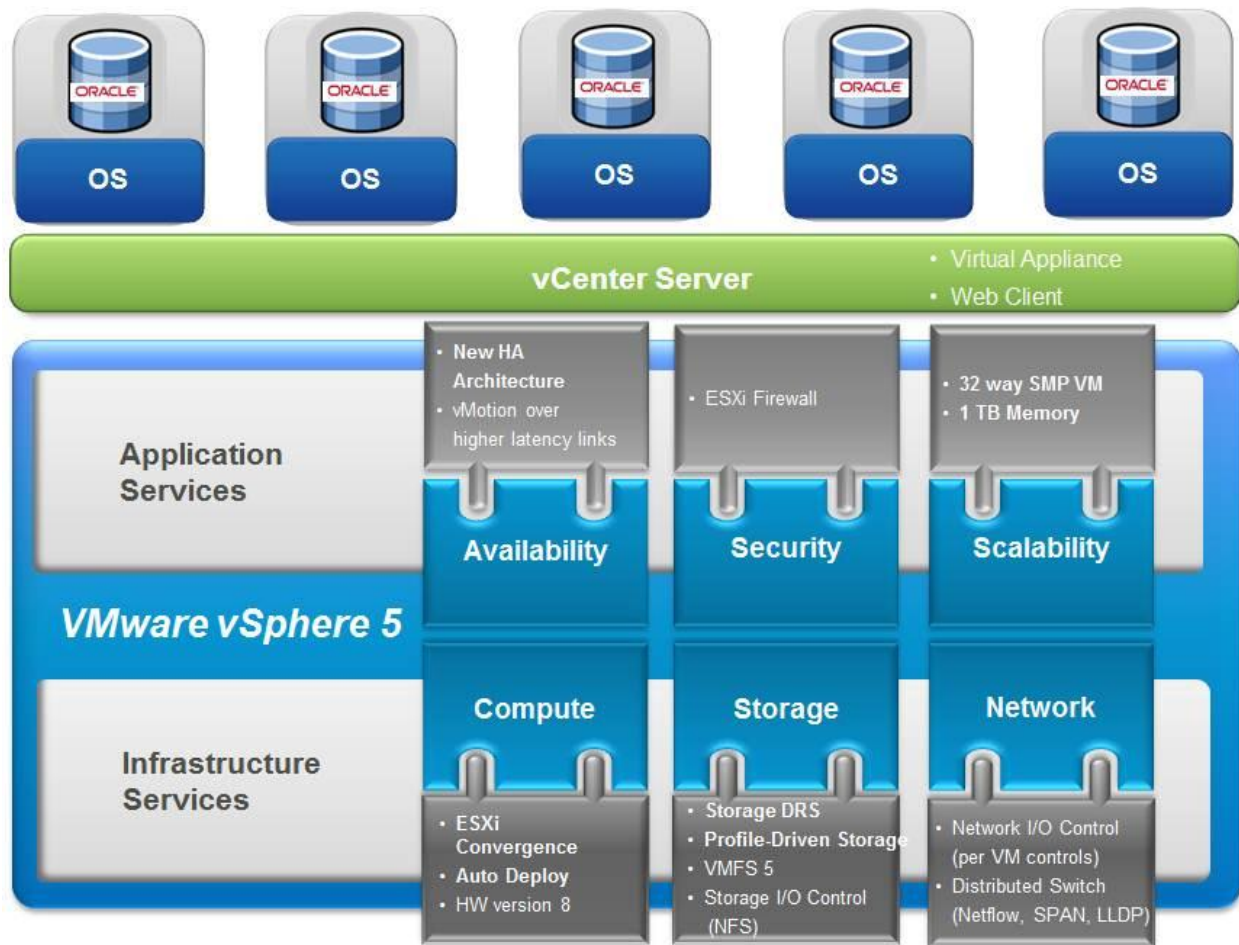
### 1.1 Roles and Responsibilities of the DBA

Database administrators have different goals, roles, and responsibilities depending upon whether they support production or development environments.

Production DBAs are primarily concerned with scalability, performance, and overall resource management. Deploying Oracle databases on vSphere is not significantly different from deploying Oracle on physical servers. DBAs can fully leverage their current skill set while delivering all the benefits associated with virtualization. More than 90 percent of performance issues encountered by our customers resulted from configuration errors at the storage tier—this can be avoided by following storage best practices.

Development DBAs are concerned about providing development and testing environments by creating cost-effective architectures that include efficient consolidation, rapid provisioning, and automation capabilities. Database architects can take advantage of the features and capabilities of vSphere to create their enterprise database strategy and next-generation scalable architectures. Figure 1 illustrates Oracle database servers on vSphere architecture with application services and infrastructure services.

Figure 1. Oracle on VMware vSphere



Oracle databases on vSphere provide the following performance benefits:

- Near Native Performance – Oracle databases run at performance and service levels similar to that of a physical system with minimal virtualization overhead.
- Extreme I/O Scalability – The VMware ESX<sup>®</sup> thin hypervisor layer can drive over 1,000,000 I/Os per second.
- Multi-Core Scaling – Scale up using SMP virtual machines (up to 32 vCPUs) and multiple database instances.
- Large Memory – Scalable memory up to 1TB per database virtual machine, 2TB per host.

The VMware Virtualization TCO and ROI Calculator (<http://roitco.vmware.com/vmw/>) can calculate your savings based on your specific requirements.

The next section describes various use cases and benefits delivered by virtualizing Oracle databases on vSphere.

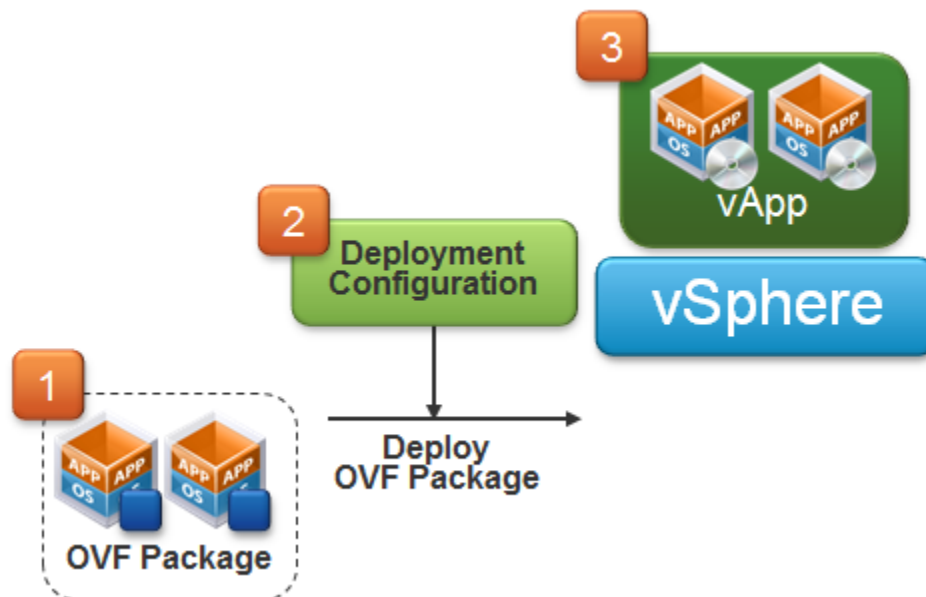
## 2. Oracle Databases on vSphere – Use Cases

### 2.1 Dev/Test Automation with VMware vCloud Director

VMware vCloud® Director™ (VCD) allows customers to build secure private clouds that dramatically increase datacenter efficiency and business agility. Coupled with vSphere, the foundation for cloud computing architectures, vCloud Director delivers cloud computing for an existing datacenter by pooling virtual infrastructure resources and delivering them to users as a catalog-based service.

vCloud Director helps database owners to create faithful replicas of production systems for patch testing and seamlessly transition updated system configurations across testing, staging, and production environments connected to different networks, servers, and storage systems. vCloud Director allows release teams to update systems more quickly, shorten maintenance windows, and avoid downtime.

**Figure 2. Oracle Database Server Virtual Machine and Application Virtual Machine as vApp**



### 2.2 Rapid Provisioning

As shown in Figure 2, VMware virtualization solutions reduce the time to provision new Oracle development, test or production database environments. A new deployment typically requires procurement of new hardware, followed by installation of the operating system and applications. This process takes up valuable time and IT resources in addition to requiring expenditure for dedicated hardware. By using VCD, customers can take advantage of virtual machine libraries and virtual machine templates to provision new preconfigured Oracle database environments in minutes.

Key rapid provisioning benefits include:

- Rapidly provision new Oracle database virtual machines, application virtual machines and webserver virtual machines as vApps from golden virtual machine templates.
- Provide Oracle application images directly from developers to testers.
- Provide Oracle database server images back to development for problem replication and resolution.
- Recreate distributed multi-server Oracle environments in a single virtualized system for test purposes.

- Reset test images after test completion from templates and virtual machine libraries, cutting down on setup and reset time.
- Store different Oracle database servers and versions in virtual machine libraries that can be provisioned instantly.
- Roll back development and test images by using virtual machine snapshots during problem resolution.
- Rapidly provision additional Oracle database servers during peak loads.
- Automate the development and test environment software life cycle with vCloud Director.

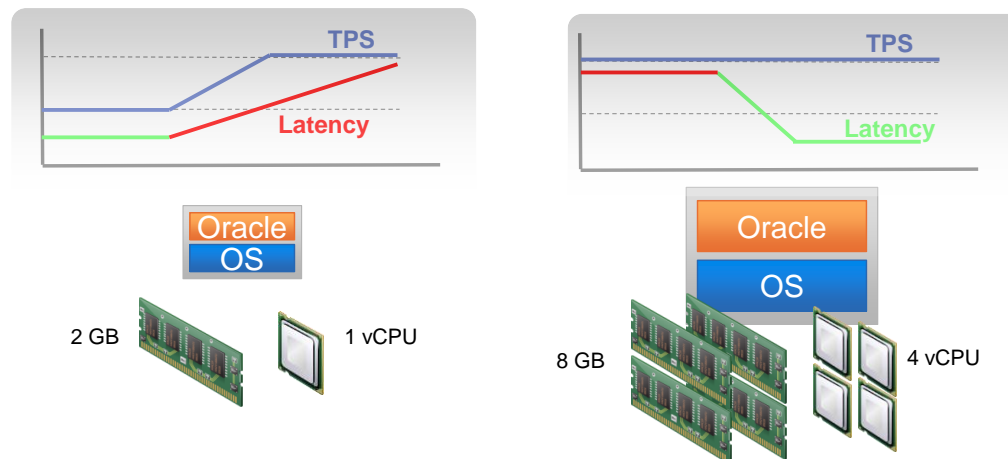
## 2.3 Datacenter Resource Management with vSphere

If performance bottlenecks occur, it is often necessary to scale an application to restore service levels. Unfortunately, when running on dedicated physical servers, resizing applications requires re-provisioning on larger physical hosts, which is a time-consuming and highly disruptive undertaking. Database administrators must forecast capacity requirements years in advance and translate that estimate into system specifications, including CPU and memory. If conditions change, the database must be re-provisioned, causing downtime, disruption, and negative business impact.

vSphere provides a number of capabilities that enable IT operations to scale applications dynamically:

- VMware Hot Add allows IT administrators to increase the capacity of a virtual machine by adding CPU and memory with no downtime. For example, an Oracle database virtual machine can be increased from two to four virtual CPUs and from 4 to 8GB of memory on the fly with supported guest operating systems—Windows Server 2003, 2008 Datacenter Edition x64 and Linux 64-bit as shown in Figure 3.
- VMware Distributed Resource Scheduler (DRS) enables IT administrators to perform live migrations of virtual machines in a DRS cluster from a small, overutilized host to a larger host with more available capacity. DRS guarantees resource pools to Oracle database environments, enabling you to deliver appropriate performance and service levels. DRS help to align infrastructure with business goals, and helps you to right-size IT infrastructure for Oracle database environments.

**Figure 3. Oracle Database Server and VMware Hot Add**



## 2.4 Enhanced High Availability and Disaster Recovery with vSphere

VMware virtualization for Oracle databases delivers enhanced infrastructure and application high availability for critical business functions. Using vSphere, customers can implement a unified disaster recovery (DR) platform that allows many production Oracle virtual machine servers to be recovered in the event of failure without investing in an exact replica of the production hardware. vSphere capabilities such



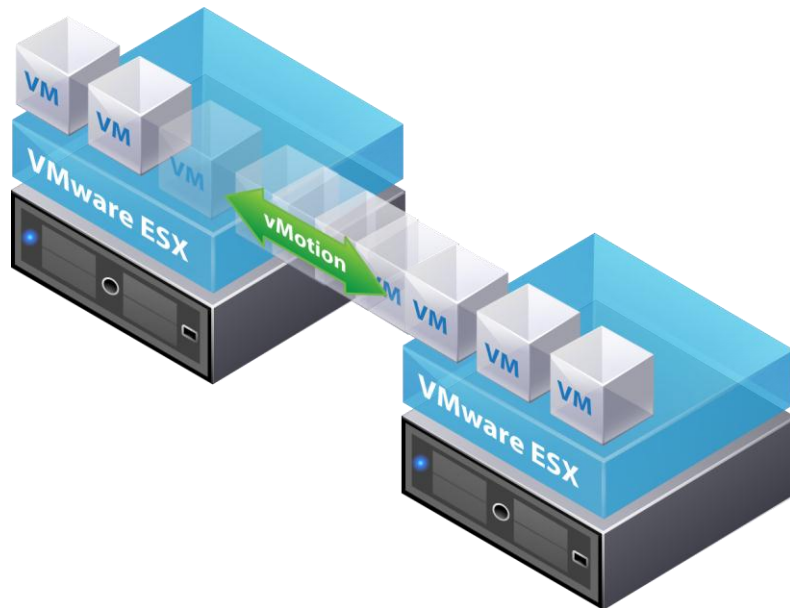
as vMotion, VMware HA, and VMware vCenter Site Recovery Manager™ deliver enhanced levels of availability, service levels, and disaster recovery to virtualized Oracle environments.

Although Oracle provides automated load balancing, distributed transaction processing, and application failover to achieve continuous service availability and transaction integrity, the VMware capabilities described in the following sections enhance the overall availability of an Oracle datacenter environment.

### 2.4.1 Minimizing Planned Downtime with vMotion

In physical database environments, to perform a hardware upgrade or maintenance activity (of server, storage, or other component), the system must be shut down along with the databases to perform the maintenance activity. This is usually scheduled as planned downtime. Using vMotion, the Oracle database virtual machines can be moved to another virtualized server using Live Migration with vMotion and then the hardware can be shut down. This can be done with zero disruption to the end users, thus minimizing the need for planned downtime in the Oracle datacenter environment.

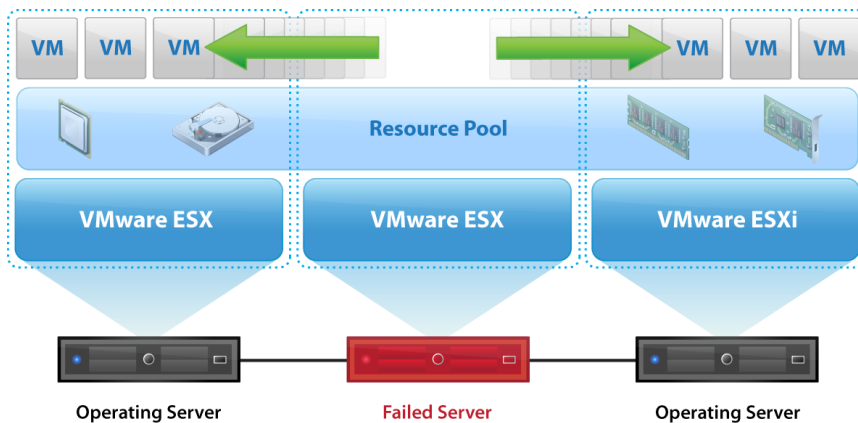
**Figure 4. VMware vSphere vMotion**



### 2.4.2 Minimizing Unplanned Downtime with VMware HA

VMware HA provides easy to use and cost-effective high availability for Oracle applications running in virtual machines. In the event of failure of a physical server or virtual machine, Oracle virtual machines can be automatically restarted on other servers in the pool that have spare capacity. VMware HA minimizes downtime and IT service disruption while eliminating the need for dedicated standby hardware. It provides high availability across the entire virtualized IT environment without the cost and complexity of failover solutions that are tied to operating systems or specific applications. VMware HA can also be used with built-in Oracle database capabilities to enhance the overall availability of the database environments.

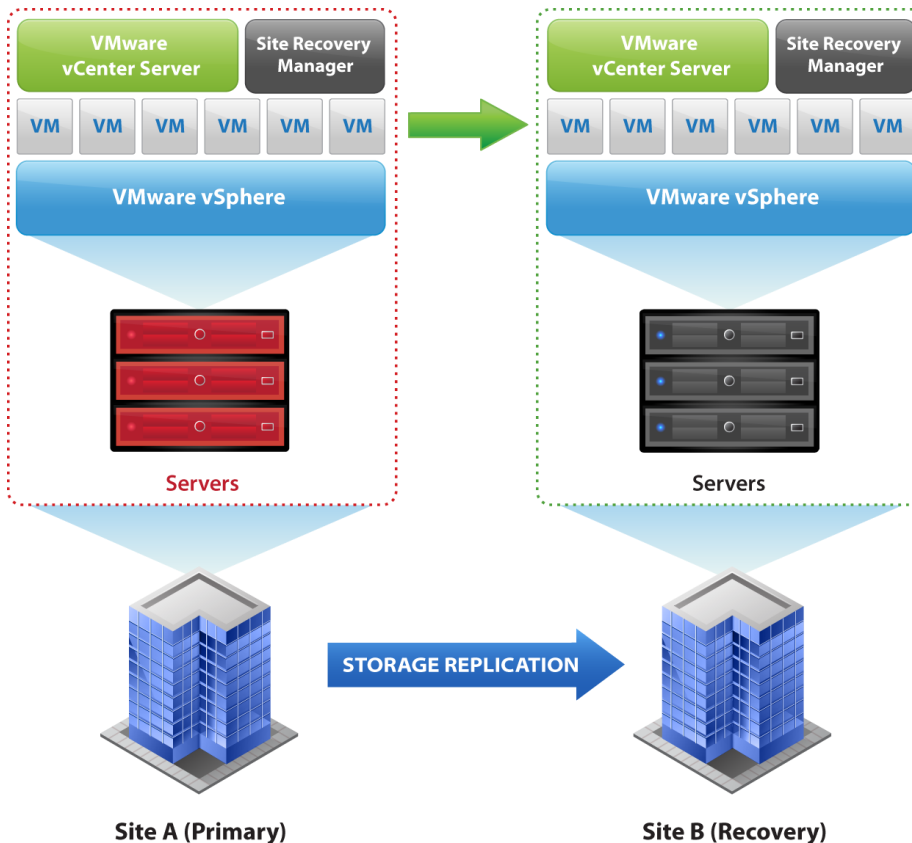
**Figure 5. VMware HA**



### 2.4.3 Disaster Recovery with VMware Site Recovery Manager

Protecting production datacenters running Oracle Database during disasters is critical to any business. VMware vCenter Site Recovery Manager complements the application availability capabilities that Oracle provides to an enterprise datacenter by automating the testing and failover of Oracle production datacenters to a disaster recovery environment. Figure 6 illustrates a basic SRM configuration.

**Figure 6. VMware vCenter Site Recovery Manager**



In case of disaster, SRM fails over all Oracle instances onto the DR Site B, brings up new virtual machines and restarts the application environments. SRM integrates and leverages the storage replication software from leading storage vendors to simplify the use of storage replication software with vSphere.

Testing DR scenarios is a complex and time-consuming process to set up and execute. SRM can automate the testing process as part of the VMware vCenter™ management interface. Some of key SRM features include:

- Non-Disruptive Testing
  - Create and manage recovery plans directly from the vCenter management interface.
  - Extend recovery plans with custom scripts to provide for Oracle database instance failover and restart. Store, view, and export results of test and failover execution from vCenter.
  - Connect virtual machines to an existing isolated network for testing.
  - Automate the execution of recovery plans.
  - Automate the cleanup of testing environments after completing failover tests.
- Automated Failover
  - Monitor the availability of a remote site and alert users of possible site failures.
  - Initiate recovery plan execution from vCenter with a single button.
  - Execute user-defined scripts and halts during recovery.
  - Reconfigure Oracle virtual machines to match network configuration at a failover site.
  - Manage and monitor the execution of recovery plans within vCenter.

In summary, the key VMware high availability and disaster recovery benefits include:

- Automatic restart of failed Oracle database servers in virtual machines using VMware HA.
- Helps capacity availability to support Oracle virtual machine failovers.
- Migration of Oracle application virtual machines from failing server hardware using vMotion Live Migration without disruption to end users.
- Automated testing and failover of Oracle datacenter environments for disaster recovery and business continuity.

## 2.5 Compliance

Organizations must understand their IT assets, including both structured and unstructured data residing in corporate databases. They must define what types of business records are vital and how long they must be stored. Older hardware requires a refresh to stay compliant and current. Compliance with regulatory requirements such as the Sarbanes-Oxley (SOX) Act, as well as other IT policies, might require older Oracle environments and data to remain active beyond normal hardware and software upgrade cycles. The need for dedicated hardware to host these legacy environments beyond their maintenance or warranty cycle can lead to additional costs.

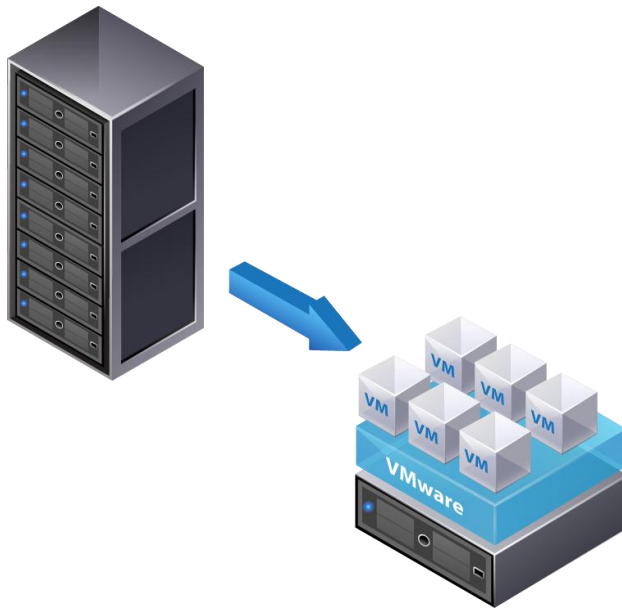
vSphere provides enhanced capabilities to drive compliance in Oracle database environments as follows:

- Helps in providing Standard, compliant operating system and database images that are enforced across the datacenter by leveraging master templates and cloning capabilities.
- Helps hardware infrastructure to stay updated and compliant by re-hosting applications from older hardware onto newer datacenter infrastructure.
- Archive older databases and configurations for compliance and auditing.
- Virtual machine snapshots can capture state and data for future reviews and audits.

## 2.6 Server Consolidation

Nearly all applications require that their databases reside on their own dedicated server hardware, and many organizations are faced with spiraling database server sprawl and costs. Databases also tend to be the most over-provisioned applications in the datacenter and are costly in terms of high license costs and top-tier infrastructure requirements. Figure 7 illustrates how Oracle database server consolidation with vSphere helps to reduce cost on hardware and increase server utilization.

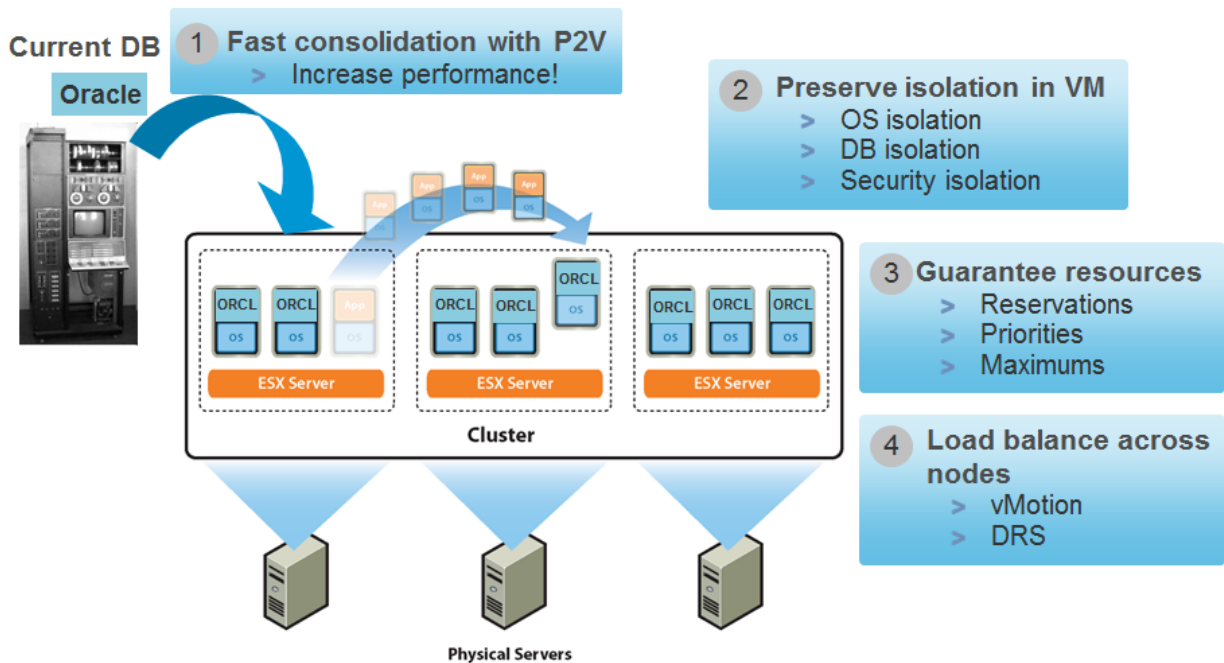
**Figure 7. Oracle Database Server Consolidation**



Consolidating databases with vSphere delivers several unique benefits over conventional approaches, as illustrated in Figure 8:

- Optimal resource utilization – Run multiple underutilized database server environments on a single virtualized system and deliver a high level of server consolidation.
- Legacy application re-hosting – With vSphere, consolidating existing legacy databases is simple. Databases can be migrated with a simple physical-to-virtual (P2V) migration, or re-provisioned in a virtual machine with their existing operating system and database configurations. This eliminates the need to retest and update databases to run on standardized operating system and database configurations while eliminating the need to retain old hardware.
- Isolation – Databases consolidated on vSphere preserve perfect isolation between instances (configuration, fault, security, and resource isolation). Databases can run on their own operating system and database versions, and a single operating system failure impacts only a single database. This is a unique virtualization benefit that is not possible with conventional database consolidation approaches.
- Resource guarantees – Oracle database servers requiring additional resources can be automatically moved to other virtualized servers using vMotion. DRS delivers optimal resources to maintain database performance and service levels. This helps with resource guarantees and provides right-sized Oracle database environments that do not require over-provisioning of datacenter resources.

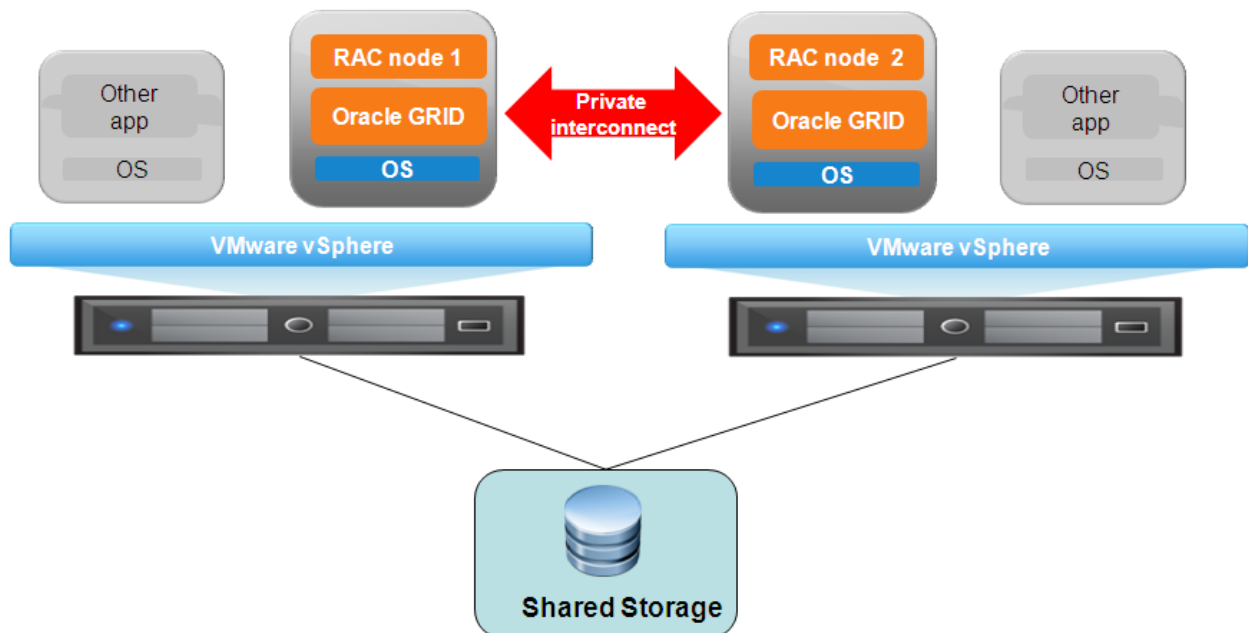
**Figure 8. Oracle Database Server Consolidation Steps**



## 2.7 Virtualizing Oracle Real Application Clusters

Oracle Real Application Clusters (RAC) is a cluster database with a shared cache architecture that provides highly scalable and available database solutions for business applications. The deployment of RAC on VMware is fundamentally similar to physical environments except that each node corresponds to a separate virtual machine which typically resides on a separate ESX host. This is illustrated in Figure 9.

**Figure 9. Oracle RAC on VMware**



The features of a virtualized RAC deployment are as follows:

- Facilitates consolidation – while each RAC node virtual machine resides on a separate ESX host, spare capacity on each ESX host allows hosting of other virtual machines.
- VMware templates can be used to quickly provision new RAC nodes – the operating system can be pre-installed and patched and stored in a template from which further virtual machine RAC nodes can be created.
- In training environments, RAC can be installed in multiple virtual machines on the same ESX host. This minimizes the need for multiple servers but still enables RAC functionality to be tested and deployed in a similar manner to production landscapes.

### 3. Conclusion

VMware vSphere delivers unparalleled performance and service levels to Oracle database environments while driving significant cost and operational efficiency in enterprise datacenters.

VMware vSphere and VMware vCenter provide the ideal platform to develop and run both legacy and next-generation applications, including a full set of capabilities and solutions to streamline the entire “build-run-manage” cycle, bringing down the barriers between development and production. With VMware, application teams and IT organizations can accelerate the Oracle application lifecycle from development to production, and improve application quality of service.

Now is the time to join the many VMware customers on the next step of your journey to transform your infrastructure into a dynamic internal cloud. Run your business-critical Oracle databases on VMware vSphere with breakthrough performance and outstanding reliability, scalability, and availability. Build a flexible cloud computing infrastructure that can deliver business-critical applications as dynamic, cost-efficient, and reliable IT services.

Go to <http://www.vmware.com/oracle> for more information, or contact your local VMware sales representative.