

# White Paper

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## Running Oracle on EMC

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## Introduction

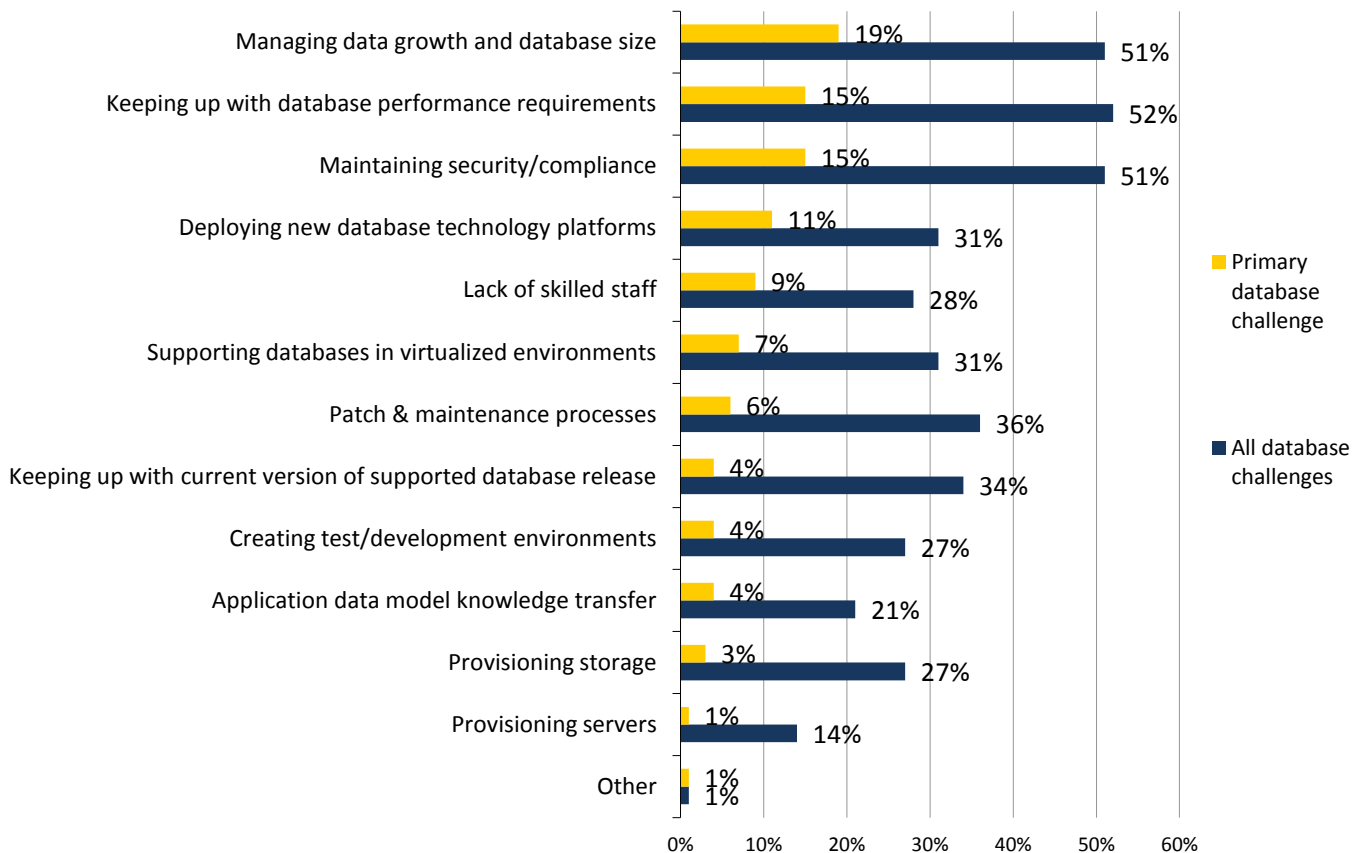
Organizations are continually looking for better ways to stay competitive while controlling costs in challenging economic conditions. According to ESG research,<sup>1</sup> increasing the use of server virtualization and managing data growth overall are top IT priorities that can have a direct impact on lowering costs while improving operational efficiencies. In many organizations where a big portion of IT budgets are allocated to supporting database applications, applying a common approach for managing IT assets may be a bit challenging.

Managing multi-database environments can be complex and require a variety of skill sets and coordination throughout the database application development lifecycle and underlying infrastructure. Mission critical applications running on Oracle databases, for example, demand high performance servers and storage architectures that provide high availability, business continuity, and a sound test and development process that ensures IT can quickly deploy important new features and functionality to the business, minimizing time to market and delivering faster time to revenue.

In a recent ESG survey, when asked about specific challenges related to managing databases, more than 50% of organizations stated managing data growth and database size, maintaining security/compliance, and keeping up with database performance requirements as the top three challenges (see Figure 1).<sup>2</sup>

Figure 1. Challenges with Current Database Environments

**In general, which of the following challenges does your organization have with its current database environment and supporting infrastructure? Which would you characterize as the primary challenge for your organization? (Percent of respondents, N=270)**



Source: Enterprise Strategy Group, 2011.

<sup>1</sup> Source: ESG Research Report, [2011 IT Spending Intentions Survey](#), January 2011.

<sup>2</sup> Source: ESG Research Report, [The Impact of Big Data on Data Analytics](#), September 2011. All subsequent ESG research statistics come from this report unless otherwise specified.

More than 30% of respondents cited deploying new technology platforms, keeping up with current versions of supported database release, patch and maintenance processes, and supporting databases in virtualized environments.

Recently, advancements have been made in server virtualization technology to improve performance (bandwidth and IOPs/throughput), and deliver necessary control features for security and compliance, as well as simplified management. These types of improvements will make it easier for organizations to adopt virtual server technologies for use with their tier-1 database applications, enabling them to address many common database challenges.

## Virtualizing Applications

Claiming the top spot in IT priorities, it is not surprising that server virtualization technology is deployed near-universally in both enterprise and mid-market organizations.<sup>3</sup> In fact, the data points to significant server virtualization growth over the next two years as the number of virtual machines (VMs) deployed across the enterprise increase due to benefits of virtualization that include:

- Lower IT capital and operating costs
- Greater IT efficiencies
- Accelerated application deployment
- Streamlined maintenance & backup/recovery processes
- Improved application availability

Organizations with a large number of virtualized servers have moved beyond test and development database environments to more performance-oriented, high transaction volume applications and workloads. Specifically, more than 60% of ESG research respondents have stated that they are either currently using (35%) or plan to (28%) deploy tier-1 databases (i.e., Oracle Enterprise, IBM DB2, and Sybase) on production VMs.

Deploying server virtualization does not come without challenges or risk. Nearly one-third of respondents with application responsibilities identified ERP and other financial applications, specifically calling out Oracle Applications, PeopleSoft, JD Edwards, and Siebel as the most challenging to deploy on virtual machines.<sup>4</sup> The biggest reasons included:

- Capital costs required for implementing server virtualization
- General lack of information or best practices
- Poor application performance

In addition to the level of support from application vendors for specific server virtualization platforms, application administrators are concerned about the potential inability to revert back to the “safety net” of physical infrastructure once applications have been deployed on virtual machines.

As more and more organizations look to deploy a “virtualize first” strategy—meaning that, when deploying a new or upgrading an application, the default assumption is that it will be run on a virtualization server if at all possible—those responsible for making it happen will look to their virtual server technology providers for guidance and assistance.

Taking the lead on deployed virtual machines, EMC, with VMware, is in an excellent position to help drive customer adoption and get over the virtual hump hindering database application virtualization. Thanks to EMC’s significant investments in virtual server technology improvements, documentation, and training resources specifically related

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<sup>3</sup> Source: ESG Research Report, [The Evolution of Server Virtualization](#), November 2010.

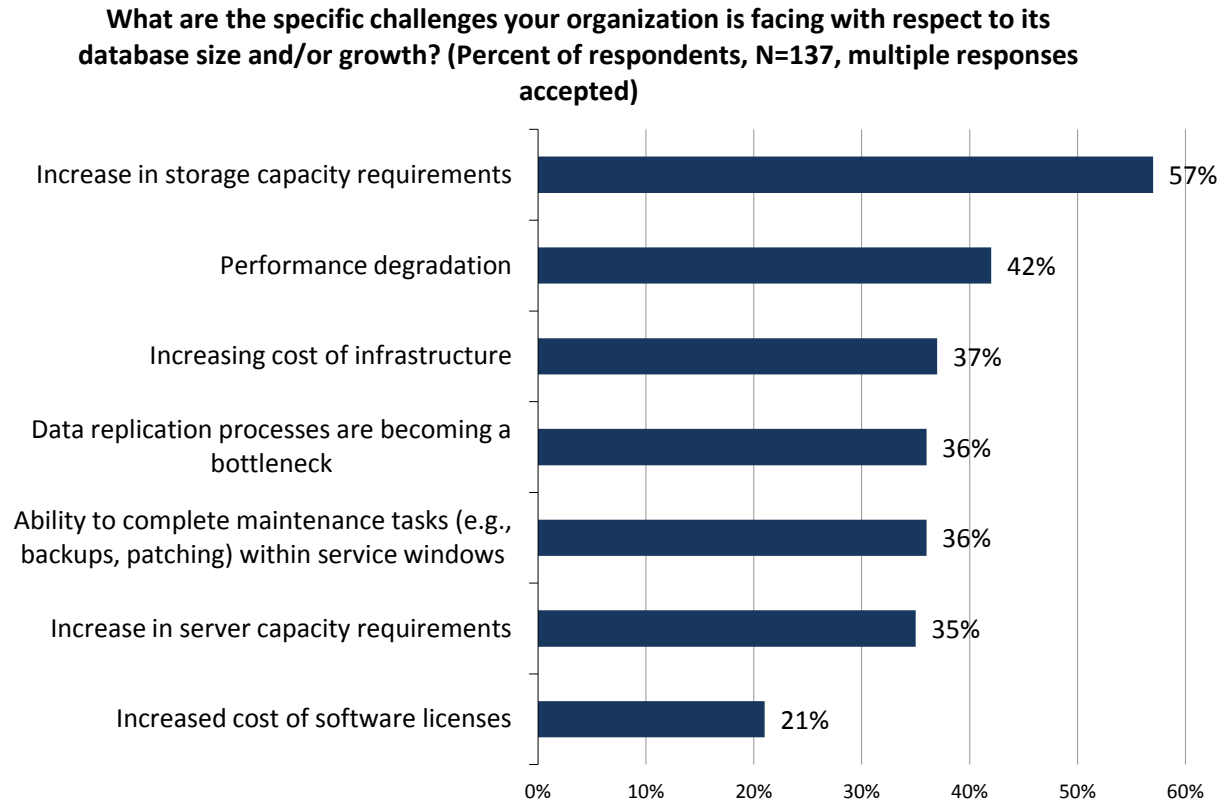
<sup>4</sup> Source: ESG Research Brief, [Application Virtualization Challenges](#), March 2011.

to deploying EMC technology for Oracle databases, customers can go beyond just server virtualization to storage virtualization and private cloud architecture for their tier-1 database applications.

### Storage Virtualization

With controlling costs as a top business priority and managing data growth a top IT priority, organizations need a plan that optimizes storage assets as data growth rates show no signs of abating. ESG research identified increases in storage capacity, performance degradation, and an increase in infrastructure costs as top challenges when asked specifically about issues relating to managing data growth and database sizes.

*Figure 2. Organizations Identify Specific Challenges Related to Managing Data Growth and Database Sizes*



*Source: Enterprise Strategy Group, 2011.*

If data volumes continue to grow without a corresponding investment in the underlying infrastructure or a data growth management strategy, database administrators and storage administrators will continue to be challenged to maintain performance, meet SLAs, and stay within budget. They need database and storage technology providers to work more closely to achieve tighter technical integration and closer customer support relationships to keep their customers satisfied. Specifically, when storage infrastructure itself can automatically tune and self-tier to better align to changing performance requirements for data sets within the database, DBAs can spend less time manually managing performance related tasks. When problems arise between the database and storage tiers, the closer the alignment between the database and storage support organizations, the quicker time to resolution for customers.

### The EMC/Oracle Relationship Today

Over the last two decades, EMC and Oracle have celebrated a long and successful strategic relationship, providing best of breed software and hardware solutions. With more than 70,000 joint customers, EMC has enjoyed a strong global alliance with Oracle that is aimed specifically at streamlining support and enhancing the Oracle-EMC technology experience. However, as each organization has expanded its product portfolio via internal R&D or strategic acquisitions, EMC (historically known as a storage hardware company) and Oracle (historically known as a

database and application software company) are now enjoying a relationship more based on co-opetition—not unlike many large IT vendors today.

Very few successful technology providers continue to maintain strategic alliances without some form of competition among individual product groups. As technology providers continue to consolidate, overlaps in product portfolios will most likely increase. In the case of EMC and Oracle, the product portfolios appear to significantly overlap at first glance. However, when looking at market adoption and associated product revenues, the intersections are less significant and more complimentary in nature. Oracle continues to enjoy a market leadership position with respect to its flagship databases management and application software. The same is true of EMC's storage and virtualization offerings.

While both organizations are motivated to maintain the quality of support that a strong joint installed base expects, customer challenges will demand new integration in areas like storage utilization and performance, better DBA efficiency, and continuous data availability reference configurations. With private and public cloud architectures becoming more prevalent, EMC has expressed its commitment to help Oracle customers extract the most value from their existing Oracle software investment and build the best infrastructure on a path to the private cloud.

## **EMC Private Cloud Solutions for Oracle Customers**

EMC has done its customers a service by investing in the development of an EMC/Oracle integrated technology stack to accelerate the journey to the private cloud. EMC packages these offerings into what are called “Proven Solutions”—tested, validated, documented combinations of Oracle software, EMC virtual infrastructure, and third-party servers, operating systems, and networking. The focus of these Proven Solutions is to leverage existing investments in Oracle software, people, and processes, and extend value through virtual infrastructure. With almost every IT organization running another vendor's software along with Oracle technology, it is important to consider the choice of running common cloud or virtualization technology versus running a different cloud or virtualization technology that is unique for each and every application. One of the key attributes of a virtual infrastructure from EMC is that VMware solutions can be deployed universally across Oracle and non-Oracle software environments simplifying maintenance and support.

This is an added benefit as most organizations deploy applications in a heterogeneous database and application server environment. Leveraging a common platform for virtualization minimizes the number of technologies that already-overburdened administrators have to master. For organizations building out their private cloud architectures, this offers some added efficiencies, control, and choice as they respond to business needs.

In designing a private cloud infrastructure, EMC has focused on Proven Solutions with the following concepts in mind:

- Increased hardware and Oracle license utilization
- Higher storage IO performance with lower overall storage costs
- Faster Oracle database and application deployments
- More efficient Oracle backup and recovery
- Enhanced Oracle high availability

### **Increased Utilization**

Many IT organizations purchase Oracle on a per-CPU basis. For those customers, given Oracle's software licensing policy, the full server must be licensed in order to deploy virtual machines. However, once licensed, more virtual Oracle database machines can be deployed on that same physical server. In a physical world, most IT organizations leave excess server processing power unused for headroom and growth. Leveraging VMware server virtualization and EMC storage virtualization, organizations are able to provision more Oracle databases per physical CPU. More Oracle database instances can be deployed and quickly provisioning or de-provisioned as necessary, allowing up to 80% more utilization of servers in many cases.

From a storage perspective, most IT organizations provision storage manually, allocating underlying groups of storage devices and RAID groups to servers physically and allocating significant un-used capacity for growth. With virtual provisioning within storage, the underlying storage devices can be abstracted from the database servers and pooled together. These virtual pools can then be provisioned or de-provisioned dynamically, allowing more usable capacity to be presented to Oracle databases than is physically allocated.

In both cases, tight integration is required between the database, virtualization and underlying storage layers. EMC and VMware have tightly integrated their management tools to allow for end-to-end virtual infrastructure monitoring, alerts and tuning to ensure virtual servers and storage are provisioned accurately as Oracle workloads change. In addition, EMC and Oracle have jointly engineered the combined use of Oracle Automated Storage Management (ASM) with EMC Virtual Provisioning to allow reclaiming of un-used capacity in virtual pools and more effectively manage virtual storage provisioning in Oracle database environments.

## **Tiered Storage**

Maximizing performance of Oracle databases and applications in a physical infrastructure model has traditionally required either adding more physical storage spindles and/or scaling out additional storage arrays, both at additional cost and resources.

Not too long ago, the concept of information lifecycle management (ILM) was introduced—by aligning the value businesses place on information with its underlying infrastructure, they can realize better optimization of technology investments. By applying ILM-based strategies to Oracle databases, DBAs can take advantage of advancements in storage including new high performance storage tiers such as enterprise flash drives for latency-sensitive Oracle data while leveraging more cost effective storage such as SATA drives for aging, less active database data. However, the processes for setting and updating the appropriate tiers of storage as Oracle workloads change has historically been a very time consuming task, often taking hours or days and involving application downtime. By applying EMC's new Fully Automated Storage Tiering (FAST), FAST Cache, and FAST VP, organizations can recognize significant improvements in performance and operational efficiencies.

### **EMC FAST**

Leveraging the intelligence found within the Oracle database itself, EMC developed new FAST capabilities to minimize DBA intervention by seamlessly and automatically migrating hot data to more performing disk groups based on policy while relegating the balance of information stored on more cost effective storage. EMC FAST was validated by ESG Lab to significantly reduce the amount of time it takes to manage a tiered storage implementation for an Oracle database from about half a day to approximately half an hour.

EMC then introduced FAST Cache as an extra layer of flash drives between the Oracle database server memory and CPU and the underlying storage arrays. FAST Cache automatically prioritizes latency-sensitive Oracle workloads to FAST Cache, delivering performance at flash speeds with the added benefit of flushing Oracle data out of FAST Cache when performance is no longer needed. This combination can dramatically increase Oracle performance (up to 200%) while reducing the amount of back-end storage required by up to 50%.

Through close alignment with Oracle engineering, EMC has developed best practices to optimize FAST and FAST Cache with Oracle RAC and ASM Grid Computing to dynamically tier storage resources as Oracle RAC grid computing environments scale or change workload profiles.

As noted earlier, one concern with deploying Oracle databases and applications on virtual machines is the impact on performance. VMware has documented that, with the latest release of VMware vSphere, the impact on Oracle performance is negligible (under 3-5% overhead on the Oracle database server). In a virtual server environment, automated storage tiering is almost a requirement as virtual machines can be added or removed on the fly, changing the amount of performance required from the storage infrastructure for Oracle database instances.

EMC FAST for Virtual Pools (or FAST VP) offers the ability to perform sub-LUN tiering using application policies and intelligent tiering algorithms to automatically move more granular chunks of storage capacity to the right tier at the

right time. ESG Lab<sup>5</sup> validated the performance improvements, that FAST VP can deliver an Oracle RAC database with configuration simulated OLTP workload as the number of users increases. EMC has also tested and documented the use of FAST VP in a virtualized Oracle environment, comparing performance to a physical Oracle database model, including the use of Oracle RAC.

## **Accelerating Oracle Database and Application Deployment**

Creating and managing copies of Oracle production data is a common challenge for practically every IT organization that manages databases. Test and development teams need copies of production data, but the copy process cannot impact production database performance.

### ***EMC Storage Replication***

Traditional copy methods require suspending database and storage IO or shutting down the database and moving data over corporate networks, which can take hours or even days for large databases. Storage replication allows Oracle data to be copied at disk speed, dramatically improving replication time.

EMC offers two copy options for Oracle databases: full volume copies and snaps. Full volume copies are block-for-block actual copies of the production database. These are ideal for Oracle recovery and consume the same amount of storage as production. Snaps, which can be created faster than clones and consume less storage, can also be used as full virtual copies for applications where the amount of change to the database is relatively low<sup>6</sup>. Both full clones and virtual snaps of Oracle databases can be created using EMC's simple GUI-based interface, empowering Oracle DBAs with the ability to create test and development environments much more efficiently.

### ***VMware Server Virtualization***

When VMware server virtualization is leveraged, similar speed and efficiency as storage replication can be applied to the OS and configuration data of the Oracle database or application server. Once Oracle servers are virtualized, IT organizations can leverage a template representing an exact copy of that servers OS and configuration data. Templates take minutes to create and once deployed, Oracle servers can be deployed repeatedly to scale production or quickly deploy test and development environments.

EMC has integrated with the Oracle database clone feature for accelerating test and development server and storage deployments. Many customers set up dev/test with a physical server for each copy in a physical 1:1 model, requiring excess infrastructure and time to create and recreate these copies. With virtual infrastructure, EMC can replicate Oracle and deploy a virtual server in minutes. EMC has worked closely with Oracle to combine the use of a new feature called "clonedb" which allows Oracle DBAs to create dev/test Oracle database copies in seconds with the new server/storage infrastructure that EMC and VMware have provided.

## **More Efficient Oracle Backup and Recovery**

### ***Oracle Efficient Local & Remote Backups***

Backing up Oracle environments is the baseline of protection used in most Oracle environments today. One common challenge with Oracle backup and recovery today is the time it takes to perform the backup, during which the database may be in hot backup mode, impacting production database performance.

EMC and Oracle have worked for many years in this area to combine the use of EMC replication with Oracle Recovery Manager (RMAN), the backup management tool used by Oracle DBAs. Rather than having to backup the database from the production database instance, Oracle DBAs can first create a copy with EMC replication and make backups using this copy. This can seriously reduce the performance hit on an Oracle database while it is tracking changed data during the backup. Because Oracle RMAN is leveraged the database can be brought back to

<sup>5</sup> Source: ESG Lab Analysis, [EMC Symmetrix VMAX Engenuity Version 5875](#), January 2011.

<sup>6</sup> Snap copies utilize a shared pool of storage to keep track of changed blocks since the snap was taken. It is common practice to allocate 20% of the source application's original size for the shared storage pool.

any point in time needed should an outage occur taking the last copy created from EMC and applying any changes Oracle has tracked. As an example, EMC Global IT has a 10 TB data warehouse which took 16 hours to back up. By using split-mirror replication, EMC was able to pare the window down to just 4 hours.

A second challenge with Oracle backup and recovery is managing the backup and recovery process as Oracle database environments scale. In most Oracle environments, only a certain percentage of that data is actually changed since the last time it was backed up. It would be beneficial to create a full backup copy while only having to physically backup the incremental changes.

The EMC Data Domain appliance is designed to provide this capability, allowing “in-line” deduplication, which means Oracle data is deduplicated before it is sent to backup. The first major effect of this is that EMC can dramatically reduce the amount of backup storage needed (disk or tape). One EMC best practice showed how to reduce over 90% of backup storage in just five weeks.

With deduplication, Oracle full backups can be done more frequently. Most customers only perform a full backup every so often (once a week for example) and perform incremental backups between those. If they need to recover, they would need to take their last full backup and merge it with their incremental backups, which can be time consuming, manual, and inaccurate. Deduplication allows more full Oracle backups, which means faster recovery should a customer have an outage.

Finally, the Data Domain technology operates transparently to the existing Oracle RMAN backup processes discussed earlier; no changes need to be made to the Oracle backup scripts or systems architecture.

### **High Availability for Oracle Recovery & Active-Active Configurations**

As Oracle environments scale, it becomes critical to ensure the fastest and most complete recovery of not just the Oracle databases, but the applications themselves and the middleware which supports them. Oracle software provides technologies for recovery for the database, such as Oracle DataGuard and previously mentioned RMAN. However, during a failure, the application and middleware also needs to be recovered seamlessly.

EMC virtual infrastructure allows the use of application-aware recovery software which can simultaneously track every Oracle incoming write before it is written to disk and log it into a recovery journal. This recovery journal is kept on local disk and can be replicated remotely. It is also compressed and deduplicated which EMC states can reduce the cost of disaster recovery bandwidth by up to 9X.

This technology allows EMC to set more granular recovery points for Oracle applications, rolling them back to any point in time needed using just one tool rather than combining backups, database replication, and other tools.

When Oracle production servers are virtualized, users can conduct non-disruptive testing of disaster recovery plans. Using virtual machines, they can quickly and transparently failover production to another set of virtual servers and perform recovery in a secure, separate environment to see what recovery would look like in the event of a disaster.

When the ultimate goal is to never need recovery, having Oracle environments remain continuously active within or across data centers is ideal. Oracle and EMC have worked together to develop a solution to actually enable active-active deployment of applications across two physically separate sites. This would allow for seamless movement of applications across arrays without downtime, ensuring they retain continuous access to users and data. This would also allow for remote site infrastructure to be actively utilized, increasing return on investment for that infrastructure.

To address these IT needs, EMC developed VPLEX, a new storage platform that is inserted into the SAN between hosts and storage, and can extend data over distance, within, between, and across data centers—referred to as “AccessAnywhere.” This has three very powerful advantages for Oracle environments:

- **Mobility.** Once VPLEX is deployed into Oracle environment, customers can move Oracle environments seamlessly within or across data centers without any downtime. This can be useful for migrating Oracle applications to new infrastructure or even a new data center. Synchronous availability is currently limited

to 100km, after which asynchronous mode would be needed to retain active mobility (introducing some latency).

- **Disaster Avoidance.** In an active-active mode, there is no need for recovery or restart, and no manual intervention. Should an outage occur at one site, applications are available and running immediately at the second site (within synchronous distances).
- **Single Copy.** Finally, the same copy of Oracle data can be leveraged by multiple users located miles apart while tracking the data changes and ensuring transaction integrity as databases and applications are accessed and changed simultaneously (note: synchronous distances are limited to <100 km). This could be used to allow development and testing across multiple groups in multiple locations.

## The Bigger Truth

ESG research confirms that while the business is focused on cost containment and improved efficiency, IT is still struggling to keep up with changing business requirements in today's fast-paced, dynamic global economy. Data volumes continue to grow, and businesses continue to submit requests for new or upgraded applications. Skill shortages in the areas of database administration, virtualization administration, and application development still plague IT departments.

Virtual infrastructure promises one of the highest returns on investment for servers and storage. Yet applications with a higher IT investment that are less virtualized today are Oracle-based applications. EMC has made tremendous investments in both technology and customer support to help organizations make the move and virtualize their Oracle database applications. With a combination of best of breed technology from EMC for virtual infrastructure and from Oracle for database and application software, Oracle customers cannot ignore the opportunity to increase performance and availability, increase efficiency of DBAs and storage administrators, and reduce cost by leveraging the best from both companies.

The trend for server and storage virtualization adoption is continuing in a strong direction beyond just non-production environments. As organizations broaden their server and storage virtualization adoption, EMC is well positioned as a market leader to accelerate customer virtual deployments for Oracle environments.



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