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Oracle and Intel® Special Edition

# Building a Database Cloud

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## **Learn to:**

- Build databases in the private cloud
- Leverage engineered database machines
- Deploy to the private cloud to reduce costs while improving performance

**Michael Wessler, OCP & CISSP**



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**by Michael Wessler,  
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## Building a Database Cloud For Dummies®, Oracle and Intel® Special Edition

Published by  
**John Wiley & Sons, Inc.**  
111 River St.  
Hoboken, NJ 07030-5774  
[www.wiley.com](http://www.wiley.com)

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ISBN 978-1-118-60508-0 (pbk); ISBN 978-1-118-60711-4 (ebk)

Manufactured in the United States of America

10 9 8 7 6 5 4 3 2 1

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## **Publisher's Acknowledgments**

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# Introduction



**C**loud computing represents a major evolution in how IT systems are designed, deployed, and managed. When designed and implemented correctly, moving to the cloud increases IT performance and business agility while driving down IT costs. Deploying databases to a cloud, whether a public cloud as Database as a Service (DBaaS) or to a private cloud, is a key avenue to capitalizing on the benefits of cloud computing.

Oracle engineered systems represent the melding together of hardware and software from design time through implementation to build faster, more scalable machines. Oracle Exadata Database Machine is a complete engineered system for deploying Oracle Database to a private cloud. Using a highly scalable architecture, Oracle Exadata is a natural fit for private cloud computing. Deploying database private clouds with Oracle Exadata is a wise solution for companies looking to increase performance and reduce IT costs.

## *About This Book*

This book consists of six short chapters, each written to stand on its own.

**Chapter 1: Getting a Cloud Overview.** This chapter identifies what cloud computing is, as well as its architecture, deployment, and service models.

**Chapter 2: Building a Business Case for the Cloud.**

Here, you find out why the cloud is so powerful and enticing for businesses.

**Chapter 3: Enabling the Cloud with Oracle Exadata.**

This chapter outlines a cloud vision for database computing and how Oracle Exadata supports that vision.

**Chapter 4: Operating Oracle Exadata Database Machine in the Cloud.** Here, you see why using Oracle Exadata Database Machine for cloud computing makes good technical and business sense.

**Chapter 5: Deploying to the Cloud.** This chapter shows how to effectively deploy to the cloud and identifies key items to consider prior to deployment.

**Chapter 6: Ten Things to Consider When Building a Cloud.** In that famous *For Dummies* style, I give you the “Part of Tens” chapter detailing items to help you get started building databases in the cloud.

## *Icons Used in This Book*

Now and then you see icons that call attention to important information. Here's what to expect.



When you see this icon, you may want to, uh, remember it for later on.



I try to keep the techie stuff to a minimum, so these are technical tidbits that aren't essential, but they are nice to know.



This icon usually denotes something I wish someone had told me before I learned it the hard way! Keep these items in mind to make life easier.



# Chapter 1

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## Getting a Cloud Overview

.....

### *In This Chapter*

- ▶ Understanding what the cloud is and what it provides for customers
  - ▶ Identifying the deployment models used in cloud computing
  - ▶ Learning the service models used to deliver cloud services to customers
- .....

**C**loud computing is a powerful architecture that provides businesses unlimited and agile computing power at metered, pay-as-you-go prices.

This chapter provides an overview of the cloud and why it is important. It explains the positioning of different deployment models and defines how capabilities are delivered to customers via service models.

### *Looking at Cloud Computing*

Cloud computing is a computer architecture in which computing resources are managed by a service provider and are made available to consumers over the

network as a shared service. The service provider can be an outside entity but is often within a centralized IT department in support of private clouds. Each consumer's cloud resources' usage is tracked, monitored, and charged based on actual consumption.



Cloud services users are the *consumers*. Those companies and the internal IT organizations that provide and manage the IT resources within the cloud are the *service providers*.

The cloud computing model is an attractive alternative to the traditional expensive practice of hosting a dedicated, custom-built environment for each application. Cloud computing offers these key benefits:

- ✓ **On-demand access and provisioning.** The cloud consumer provisions (allocates) only the resources required, and those resources are immediately available for consumption.
- ✓ **Unlimited, elastic scalability.** The cloud has unlimited capacity, and the consumer only uses what is needed. As resource demands increase, the cloud expands to meet those demands. And as resource demands decrease, the cloud shrinks.
- ✓ **Measured and metered service.** Consumption of resources within the cloud is tracked and measured for each consumer. The consumer is billed for only what is used. This allows for less expensive and more accurate IT cost management.

Cloud computing allows businesses to treat IT resources like those of a public utility, such as power or water. The business has a need for a specific IT resource and

consumption of the resource may increase and decrease as business requirements change. The cloud consumers (often an internal business department) do not need to own or manage the IT resource and will pay only for what is used. This allows for a smarter, more agile, and less expensive way of managing IT resources.

## *Utilizing Cloud Deployment Models*

The intended consumer audience determines the cloud deployment model utilized. Some clouds are open to public usage via the Internet while others lie deep within highly sensitive, secure networks for classified government and industry computing.

Cloud deployment is available through four common methods:

- ✓ **Public:** Access to the cloud resources is open to multiple companies and resources on a shared, open basis. Security within the cloud is enabled, but access to the cloud is not generally restricted.
- ✓ **Private:** Access is restricted to the exclusive use of a single private organization, company, or agency.
- ✓ **Community:** Access is restricted to a select group of similar organizations or industry partners working toward a common goal. Examples include industry partners or government agencies.
- ✓ **Hybrid:** This is a cloud that's a combination of public, community, and private components.



Hybrid clouds are often used to support *cloud bursting*. Cloud bursting happens when the resource-demand spikes for a private cloud exceed all the available capacity. In that case, the private cloud may cloud burst into a public cloud to support the spike in usage. Once the demand subsides, the cloud contracts back into the private cloud infrastructure.

Although cloud computing is secure, understanding which deployment model best fits the business requirements is essential.

## ***Examining Cloud Service Types***

The service that cloud providers provide consumers varies based on the degree to which consumers want to utilize services from the cloud. Cloud services come in four commonly accepted types:

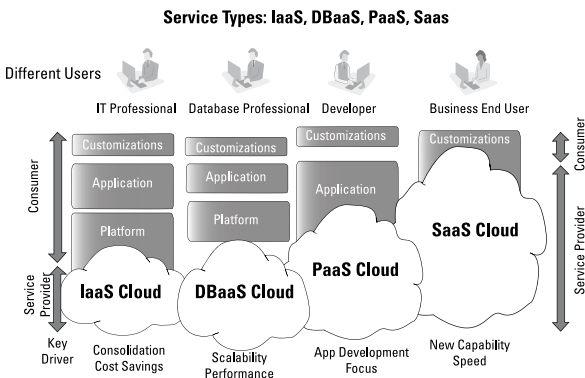
- ✓ **Infrastructure as a Service (IaaS).** Network, disk storage, server hardware, and the operating system are provided to the consumer. The consumer's IT staff installs and manages relevant application software for the users.
- ✓ **Database as a Service (DBaaS).** A database server with database software is provided for immediate use by the consumer. The company stores the data in the cloud on hardware and database software supplied by the service provider. Depending on the arrangement, the service provider may or may not provide database administrative support services.

- ✓ **Platform as a Service (PaaS).** A development or deployment platform, such as a Java development environment, is provided to the consumer.
- ✓ **Software as a Service (SaaS).** Application software is provided directly to the consumers. Users simply log in to the application hosted in the cloud and begin using the software to do their jobs.

Each service type varies in the capabilities, control, and flexibility provided to the consumer.

See Figure 1-1, which shows you how the consumer's requirements dictate the service model selected.

In Figure 1-1, you see that the consumer requirements and focus drive the service type selection. Some businesses commit their internal IT environments to the cloud via IaaS, DBaaS, and PaaS. Other businesses integrate their end users into the cloud via SaaS.



**Figure 1-1:** Cloud service types and consumers.



Gartner predicts that IaaS, cloud management and security devices, and PaaS will grow from \$7.6 billion in 2011 to \$35 billion in 2016. With that kind of potential sales, you can expect top-tier companies to put their best foot forward into cloud computing.

Expect to see growing excitement about cloud computing as more companies realize the opportunities that cloud computing provides.

## Chapter 2

# Building a Business Case for the Cloud

.....

### *In This Chapter*

- ▶ Identifying business drivers for cloud computing
  - ▶ Defining your road map to the cloud
  - ▶ Gaining competitive advantage from cloud-hosted databases
- .....

**B**usinesses benefit from inherent attributes and capabilities that the cloud has to offer. The ability to identify and leverage core cloud capabilities for the business is an important step for any IT decision maker.

This chapter takes a look at why the cloud makes good sense for businesses, how to get to the cloud, and why deploying your database in the cloud is a wise move.

## *Cloud Business Drivers*

The business case and value proposition for cloud computing is very strong. IT budgets continue to shrink or remain stagnant while business requirements and costs grow. The cloud offers increased application

performance, lower complexity, and agility at a lower cost than other alternatives.

Business decision makers like the cloud for the following reasons:

- ✓ **Lower cost:** Little or no upfront capital cost for hardware is involved because the cloud is pre-built and shared. Operating expenses are lower because IT operations are simplified. Costs are based on actual metered usage.
- ✓ **Fast deployment:** Rapid provisioning of new technologies and environments eliminates the traditional long-build durations common in IT. This allows businesses to move quickly to take advantage of new business opportunities.
- ✓ **Lower risk:** Expert cloud service providers manage the cloud, but consumers only move the components they want into the cloud. This allows a lower risk approach to cloud computing.
- ✓ **Greater performance:** The limitless processing power of the cloud can speed up processing and improve performance for applications. Many applications will inherently run faster simply by moving to cloud infrastructure.
- ✓ **Completeness:** A broad suite of technology and business applications is available for any business requirement from simple to complex. Most new software will be designed to run in cloud environments.
- ✓ **Openness:** The cloud is based on standards with no vendor “lock-in,” which promotes flexibility and reduces risk for the consumer.



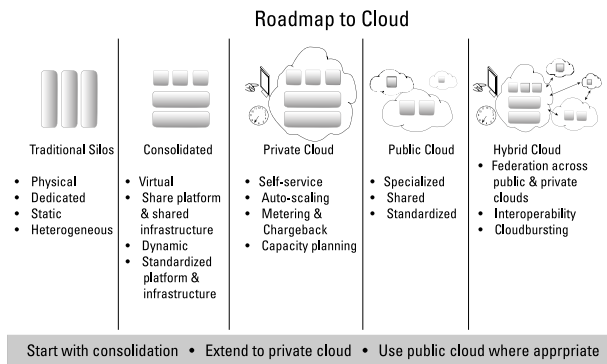


The business drivers for migrating to the cloud are strong — lower cost, increased performance, and agility to respond to business needs over current IT solutions.

## Roadmap to the Cloud

Organizations tend to progress to the cloud rather than jumping directly into the cloud. Initial implementations using legacy systems, siloed-infrastructures, and attempts at consolidation naturally lead most organizations to the cloud.

Figure 2-1 shows you the progression to cloud computing taken by many companies.



**Figure 2-1:** Roadmap to cloud computing.

In Figure 2-1, you see the typical path that a customer takes to the cloud. First, the failures of a siloed architecture lead companies to consolidated infrastructure, which is where many companies stand today. When a company is ready to move into the cloud, a low-risk private cloud is frequently the best choice. Some situations will have customers move to public and hybrid clouds, but often private clouds are the best fit for a company's needs.



Don't become worried and think you need to move all your applications to the cloud in the next six months; datacenters will be a mix of cloud and non-cloud computing for years to come. Not all applications can move easily to the cloud overnight. What is important is to start moving your cloud-ready applications so that you *evolve* into cloud computing.

## Databases in the Cloud

Companies find that Private Database Clouds are an excellent cloud entry point (refer to Chapter 1). Databases are particularly well suited for deployment on the cloud for these reasons:

- ✓ Elastic scalability from small to large based on database growth and processing requirements
- ✓ Unlimited capacity to expand as additional processing nodes and storage are rapidly provisioned
- ✓ High performance due to the boundless processing capabilities of cloud infrastructure (hardware, software, network, and storage)

- ✓ Limited risk because databases are a known, manageable asset, which is easily managed and measured
- ✓ High return on investment (ROI) due to the savings and reduced complexity realized by DBaaS deployments



Databases in the cloud can make good sense for companies and Private Database Clouds are a good way to offer the best technical platform for databases while the ROI from cloud computing is easily and quickly realized.



## Chapter 3

# Enabling the Cloud with Oracle Exadata

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### *In This Chapter*

- ▶ Introducing Oracle's cloud vision
  - ▶ Exploring the capabilities of Oracle Exadata for cloud computing
  - ▶ Seeing what benefits Oracle Exadata brings to the table
- 

**T**his chapter discusses how Oracle views the cloud and what benefits the cloud brings to its customers. It also examines Oracle Exadata Database Machine, a key enabler for private cloud database computing.

### *Understanding the Cloud Vision*

Technology experts and the overall IT industry recognize that the pay-as-you-go model of cloud computing

is attractive to many businesses. Although cloud adoption is still in its early phases in many sectors, the cloud has the attention of business decision makers and IT staffs and will continue to grow.

The overall IT industry, with Oracle in particular, realizes the importance of the cloud and supports its widespread industry adoption in the following ways:

- ✓ **A commitment to cloud computing.** Oracle is committed to cloud computing with its software and hardware technology. That commitment puts the full weight of Oracle's experience and research and development dollars behind cloud computing.
- ✓ **A complete and integrated cloud functionality.** The complete stack of Oracle technology (hardware, software, storage, networking, databases, middleware, and applications) is engineered to work together within the cloud. This provides cloud customers with maximum flexibility and functionality.
- ✓ **Scalability.** Oracle engineered systems are designed to optimize cloud computing. Oracle's offerings scale as large or small as necessary to meet customers' changing requirements. This opens the entry point to cloud computing for smaller companies to start at an appropriate size and grow as dictated by business requirements.
- ✓ **Performance.** Oracle's cloud architecture has many features designed for enhanced performance. These advances are due to the benefits of

engineering hardware and software solutions that work together from the start. By optimizing hardware and software together at the start of the design process, rather than designing them independently, far greater performance optimizations are possible.



Oracle Exadata is the ideal platform for consolidating and unifying your OLTP (Online Transaction Procession), data warehousing, and database cloud workloads.

Oracle has leveraged the best practices of thousands of customers into prebuilt hardware and software solutions so that the customer doesn't need to "reinvent the wheel." Oracle cloud systems provide a faster way to get to a prebuilt, optimized solution.

## *Oracle Exadata Architecture*

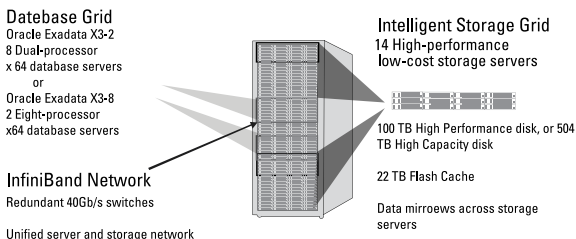
Building on previous successful generations of Oracle Exadata machines, the newest version, Oracle Exadata X3, is built upon these primary components:

- ✔ **Database server.** High-volume database server node running Oracle Database and Real Application Cluster (RAC) software. Each database server runs Oracle Solaris or Oracle Enterprise Linux and supports multi-core x86 processors.
- ✔ **Oracle Exadata storage servers.** High-volume storage server hosting flash memory, and high-speed and high-capacity disk. Database storage is managed via Automatic Storage Manager (ASM). Each

intelligent storage server runs Oracle Enterprise Linux, Intel Xeon processors, and flash. Oracle Exadata Storage Server Software is intelligent; it works to maximize processing at the storage server level rather than moving excess data to the database for processing.

- ✓ **InfiniBand network switch.** High-speed network fiber for internal communications between database and storage servers and a connection to the external network.
- ✓ **Oracle Database software.** Oracle Database software running in RAC configuration.

Figure 3-1 shows the core components of Oracle Exadata.



**Figure 3-1:** Oracle Exadata architecture.

In Figure 3-1, you see core Oracle Exadata components of database server grid, storage servers, and InfiniBand network.



## ***Oracle Exadata Business Benefits***

The advanced technology and optimized and integrated components of Oracle Exadata manifest themselves into extreme performance, scalability, high availability, and mixed workloads.

### ***Scalability***

Oracle Exadata is designed for scale-out growth as workload requirements increase. Oracle Exadata configurations are available in eighth, quarter, half, full rack, and multi-rack. Compute and storage capacity is added seamlessly and without downtime. Scale-out growth is important because it allows companies of any size to utilize Oracle Exadata and grow as needed.

### ***Performance***

Extreme performance is a hallmark of Oracle Exadata at every component tier. One key performance area is with flash technology. Oracle Exadata has 22 TB of flash, which allows all active data to be cached in memory for much faster processing. Entire databases can reside in flash resulting in incredible performance gains.

### ***High availability***

Elimination of single points of failure is engineered at every layer within Oracle Exadata. Redundant database servers, storage servers, disk technologies, network

fabric, and RAC virtually eliminate unplanned downtime. Rolling upgrades and patches minimize and eliminate scheduled service interruptions.

## ***Mixed workloads***

Companies inherently must support a myriad of workload types: OLTP, data warehousing, Business Intelligence, and hybrid systems. Oracle Exadata has the capacity and architecture to support mixed workloads on the same platform. This reduces both cost and complexity while supporting datacenter consolidation.

The technical benefits of Oracle Exadata translate to real business benefits.

## ***Lower cost***

Purchasing the right-sized Oracle Exadata Database Machine prevents companies from overbuying capacity they don't need, thus reducing costs. Furthermore, the engineered architecture and simplified management requirements reduce the need for teams of skilled performance tuners, integrators, and administrators.

## ***Simplified administration***

The engineered architecture takes much of the complex administration out of the Oracle Exadata configuration and administration. Additionally, Oracle OEM 12c and other Oracle Exadata management tools are feature rich and allow more complete administration with less effort by the technical staff.

## ***Faster deployments***

Oracle Exadata Database Machine is installed and running much faster at companies' datacenters than traditional systems; this is again due to the engineered architecture.

Instead of months to deploy to production, Oracle Exadata can be production ready in days to weeks.

## ***Enabling Database Cloud Computing with Oracle Exadata***

Oracle Exadata Database Machine leverages technology that makes it particularly well suited to supporting private database clouds. Using a mix of faster technology, engineered architecture, and the full weight of Oracle's years of expertise, Oracle Exadata provides database cloud computing capabilities for customers not found in other solutions.

## ***Random transactions against the database***

Random transactions against the database are a key metric in determining the performance of a database. Oracle Exadata is an engineered database machine optimized for fast random access. New technologies such as flash, advanced storage servers, and intelligent query processing at the disk storage level are powerful means to optimize heavy random transaction workloads.

## ***Leveraging flash***

A major enhancement with Oracle Exadata X3 is that flash memory has been increased by a factor of four times greater than previous versions. This changes Oracle Exadata from a disk-based architecture to a memory-based architecture. Both reads and writes are now cached in flash memory, which is enormously faster than disk. Entire OLTP databases now reside in flash memory with exceptionally fast performance. Data warehousing and reporting applications also benefit greatly by increased flash memory capability.

## ***Using Hybrid Columnar Compression***

Hybrid Columnar Compression (HCC) allows data to be stored, compressed, and accessed without a performance impact. The benefit is that more raw data can be stored compressed, taking on average 10 to 15 times less storage space. This reduces the amount of disk required and lowers storage costs. As storage requirements explode, HCC provides a counter measure to keep storage costs under control.

## ***Easing implementation challenges with expert startup packs***

Engineered systems such as Oracle Exadata and cloud computing are a departure from traditional IT, but cloud computing with Oracle Exadata need not be difficult. Oracle offers expert startup packs and consulting to assist customers installing and migrating to Oracle Exadata in days and weeks rather than months. This ensures customer success and a faster ROI.

## ***Improving I/O with Smart Scan Processing***

Smart Scan Processing makes the database aware of the storage layer as a location to execute queries. Use Smart Scan Processing to perform query processing at the storage server level to prevent large amounts of data from moving to the database server node for query processing. This reduces data movement, leverages processors at the storage layer, reduces processing at the database node layer, and dramatically improves query performance.

Oracle Exadata Database Machine is the result of engineered integration of database, hardware, software, and networking components; all in an optimized configuration. The resulting solution allows customers to deploy databases in the private cloud faster and easier than with other solutions. This translates to a more effective realization of cloud computing benefits for customers.



## Chapter 4

# Operating Oracle Exadata Database Machine in the Cloud

.....

### *In This Chapter*

- ▶ Understanding the challenges of operating in the cloud environment
  - ▶ Positioning Oracle Exadata in the cloud
  - ▶ Identifying the benefits of cloud computing with Oracle Exadata
  - ▶ Organizing the Oracle Exadata management team
  - ▶ Leveraging administrative and management tools
- .....

**C**loud computing offers many benefits, but it also brings challenges. Oracle Exadata Database Machine is well suited to meet those challenges and offers great benefits to database cloud consumers.

This chapter shows how Oracle Exadata fits in the cloud, the many benefits it provides, and how to operate it effectively.

## ***Identifying the Challenges of Operating in the Cloud Environment***

To be successful, cloud computing requires a different architecture and mindset among IT people. While many major companies have embraced cloud computing, much of the computer industry is moving into cloud computing at a more conservative pace. (That pace is rapidly picking up in both the commercial and government sectors, however.)

Many reasons exist for this reluctance, some valid and some less valid, but common concerns relate to workload fluctuations and performance, scalability requirements, and security. Fortunately, Oracle Exadata Database Machine is capable of addressing those concerns.



Cisco Global Cloud Index reports that by 2016 nearly two-thirds of the total datacenter traffic will be global cloud traffic.

### ***Workload fluctuation***

The cloud is a shared environment, which is one of its greatest benefits, but it is also the greatest area of concern. Workloads represented by different applications and processing characteristics can compete for resources, potentially leaving some applications without the resources necessary to be successful. Worse yet, workload fluctuations are often varied and unpredictable.



Oracle Exadata successfully absorbs workload fluctuations because of its extreme capacity and performance. Oracle Exadata is designed with enough performance and capacity “head room” to transparently absorb fluctuations in a cloud workload without impacting users. Oracle Exadata has a unique ability to consolidate mixed workloads while maintaining fast performance.

Oracle Exadata has a rich set of controls in place to isolate and contain “resource hogs.” Resource limits and Quality of Service (QoS) software are in place to ensure that no one application consumes more resources than it is allocated at the expense of other applications.

Most “hog” applications run very well despite internal coding issues because of the performance capabilities of Oracle Exadata and the self-tuning features of Oracle Exadata Database Machine. This further nullifies the impact of fluctuating workloads and heavy resource consumers in the shared cloud environment.



As a DBA on traditional database systems, I cannot count the number of times I’ve received calls complaining about poor performance on multiple applications being caused by one specific application or process hogging all the resources on a shared server. Oracle Exadata solves this common pain-point.

## ***Performance and scalability requirements***

“If we move to the cloud, will our performance suffer?” is a common question for companies timid about adopting

cloud computing. The concern is understandable — many people don't understand how cloud computing accounts for performance and growth.

Oracle Exadata is designed to maximize performance at all levels and to scale upward or downward to meet the needs of the cloud consumer. Oracle Exadata sizing starts at an eighth of a full rack for smaller customers initially entering the cloud. As workload requirements increase, the eighth rack is seamlessly turned into a quarter rack. With continued workload increases, additional database compute nodes and storage servers are added to bring Oracle Exadata into half or full rack configurations.

For the largest customers, multiple Oracle Exadata servers are joined via a high-speed InfiniBand network for nearly unlimited processing power and performance.



When moving your application to a shared cloud environment (both public and private), the cloud provider will likely promote the server scalability capabilities. However, one common error is to oversubscribe applications to a server until no excess capacity is available for growth. Be sure to specify in writing that excess capacity will be available as well in the event your application needs to grow. Also, identify the terms for your application to move to a different server environment with capacity. It is for moves like this that virtualization software is beneficial.

## **Security in the cloud**

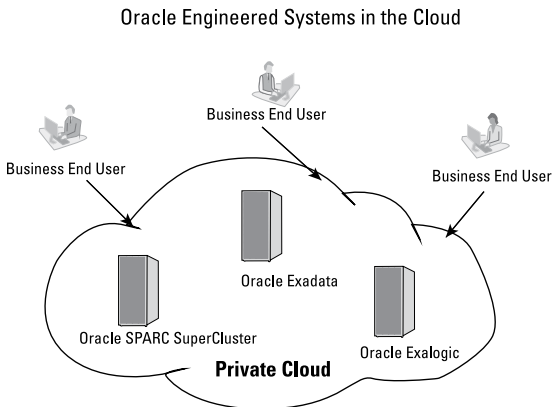
Since the majority of sensitive data in most organizations resides in databases, consolidation onto private clouds represents an opportunity to improve information security and compliance. Consolidation enables organizations to replace traditional insecure data silos and reduce the cost and scope of data security initiatives. This leads to better security at lower cost and complexity with centralized and standard security.

People incorrectly assume that if their data is in the cloud, it isn't secure and anyone can see it. That isn't true. First, when Oracle Exadata is deployed as a private cloud, the public isn't even connected to that hardware infrastructure. Remember that not all cloud deployment architectures are the same and some, such as private clouds, do not have public users. Even though the environment is "in the cloud," all the same trusted security protocols and technologies for non-cloud architectures are still in place.

## ***Oracle Exadata Positioned in the Cloud***

Oracle Exadata does not exist in isolation. Few systems are database only, and most systems are complex and often involve non-Oracle components. It is beneficial to see how a large Oracle database shop can leverage engineered systems in the cloud with Oracle middle-ware and non-Oracle systems.

Figure 4-1 shows how Oracle Exadata could exist in a large private cloud.



**Figure 4-1:** Oracle Exadata cloud deployment.

In Figure 4-1, you see a typical private cloud implementation. The database is, of course, Oracle and is running on Oracle Exadata. The company has wisely migrated its application tier to the Oracle Fusion Middleware stack running on Oracle Exalogic. However, it still must maintain legacy non-Oracle software and has done so using the Oracle SPARC SuperCluster T4-4 engineered solution. All components are within the private cloud.



Don't assume that only Oracle products can take advantage of cloud computing and engineered systems. Non-Oracle applications are easily supported on the Oracle SPARC SuperCluster T4-4, and Oracle Exalogic will

support non-Oracle middleware applications. Additionally, you don't have to run Oracle Exadata in the cloud environment; it can run in a non-cloud-enabled configuration.

## *Benefits of Oracle Exadata in the Cloud*

Oracle Exadata enables database consolidation and promotes private-cloud computing. The core benefits that a company will experience with Oracle Exadata are organized into the following function areas:

- ✓ **Performance:** Engineered and integrated to create the complete Oracle database solution, Oracle Exadata is designed to be faster than other database platforms. The mere act of moving an application to Oracle Exadata often improves performance.
- ✓ **Simplicity:** The prebuilt, preconfigured, and integrated nature of the engineered Oracle Exadata solution is actually easier to manage than traditional database systems. A rich set of management tools (OEM 12c) is available to streamline and automate many complex administrative tasks.
- ✓ **Risk reduction:** Deploying an Oracle database on Oracle's flagship database hardware platform will fully comply with Oracle's product certification matrix. This compliance obligates Oracle to work with the customer to resolve issues and work toward a successful deployment. Rather than attempting to cobble together a custom solution that may or may not be successful, sticking with the Oracle stack assures clients they are in product certification compliance and will have Oracle support.

- ✓ **Portability:** Any database application that can upgrade to Oracle Database 11g Release 2 can run fast and effectively on Oracle Exadata. OLTP, data warehousing, data-mining, Oracle applications, and analytic applications cannot only move to Oracle Exadata, but they generally run faster on Oracle Exadata than on any other platform.
- ✓ **Enterprise strength:** Oracle Exadata is built for the largest, most-critical database workloads in existence. Being engineered for maximized performance, security, scalability, and high availability makes Oracle Exadata the choice for enterprise grade database workloads.
- ✓ **Security:** Due to the engineered architecture of Oracle Exadata, fewer custom configurations that may open security holes are present. The same proven security features of non-engineered systems are included in Oracle Exadata. Additional security options include transparent data encryption and privileged user access controls to protect sensitive data and provide separation of duties and least privileged. Finally, integration with Oracle Support Services allows for easy application of tested security patches when they are released.
- ✓ **Elasticity:** Unpredictable and varying workload fluctuations exist in the cloud. Oracle Exadata performance and scalability for larger and smaller workloads provide an elastic processing environment. This elasticity ensures that the right amount of resources are allocated (and charged for) to meet the needs of the system despite a fluctuating environment.

As you can see, Oracle Exadata was designed from the ground up for large database environments and is well suited for the cloud.

## *Oracle Exadata Management Structure*

The engineered nature of Oracle Exadata requires a rethinking of traditional administrative roles. Traditional IT shops had a DBA team that only focused on database technologies; storage, system administration, networking, and security were other separate teams. Due to the integration of so many components with engineered systems, the old method of separate teams is not always the best. Newer common management options for engineered systems are

- ✓ **Multiple support team:** A traditional team structure is in place with strict roles of responsibility among DBAs, system administrators, networking, storage, and security personnel. This team approach is functional, but it is not optional or agile.
- ✓ **Database Machine Administration (DBMA) team:** DBAs are responsible for all aspects including database, OS, storage, and networking and only consult with outside specialists. This team approach represents an arrangement where the DBA team is highly skilled in areas outside of core database management. DBMA represents a highly agile, expert-level team organization.
- ✓ **Oracle Exadata Database Administration (EDMA) team:** The DBA team is primarily responsible for the database and relies heavily on outside specialists

for support of OS, storage, and networking management. This team approach is a logical evolution from traditional multi-team support because the existing teams still exist, but the DBAs are largely in charge of the Oracle Exadata.

- ✓ **Outsourced administration:** An outside party manages all aspects of Oracle Exadata. This team approach transfers the responsibility from the client to another entity. If the management team is highly skilled and IT is not the core business of the consumer, this approach often has benefits.

The Oracle Exadata management model selected is determined by the in-house technical expertise of the IT staff, the corporate culture, and security requirements, as well as the direction that management wants to move regarding Oracle Exadata and cloud computing.

## ***Oracle Enterprise Manager 12c Management***

Oracle Exadata is designed to be managed by Oracle Enterprise Manager (OEM) 12c. This unified toolset manages all aspects of the Oracle Exadata Database Machine and the cloud; it is far beyond simply managing Oracle databases. Key features include

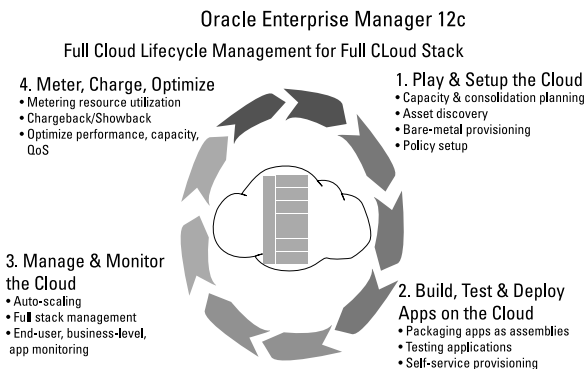
- ✓ Full graphical control of database servers, storage servers, and deployed applications
- ✓ Automated monitoring tools and jobs to manage the entire machine without constant human intervention



- ✓ Specialized tools for metering and chargeback and to guarantee Quality of Service (QoS)
- ✓ Full lifecycle management of all components within Oracle Exadata and the cloud

Figure 4-2 shows the scope of capabilities of OEM 12c where the complete cloud lifecycle is managed. What you see is OEM 12c managing the initial cloud setup, testing and deploying applications, managing and monitoring the cloud, and finally metering and charging based on resource utilization.

OEM 12c is the optimal tool for the management of Oracle Exadata cloud and will be a critical part of any Oracle Exadata implementation.



**Figure 4-2: OEM 12c lifecycle management.**



## Chapter 5

# Deploying to the Cloud

### *In This Chapter*

- ▶ Understanding deployment options
- ▶ Identifying key cloud deployment considerations

**M**any options exist when deploying to the cloud. Once in the cloud, the right management team and tools are essential. This chapter covers the options available for cloud deployments and important options to consider prior to deployment.

### *Deployment Hosting Options*

The decision of how to host your cloud environment is a big one. Several options exist, and each one has its pros and cons. The option you select depends on what you want the cloud to do, your budget, your line of business, and the technical expertise and willingness of your staff. The following sections discuss the cloud hosting options available for companies looking to deploy to the cloud.

## ***Do It Yourself (DIY)***

With DIY, the company hosts the cloud infrastructure and services internally without outside assistance. This option is the most expensive and complex one requiring a skilled IT staff, but it retains the greatest control for the consumer. This option would be appropriate for private or community clouds with the required in-house expertise typically found within larger companies or agencies.

## ***Hosted model***

Hosted models are the opposite of DIY. A hosted model requires that the consumer company subscribe to a cloud where the infrastructure, hardware, and software are managed by an outside provider. This option allows a fast, low-cost, and low-risk entry into the cloud.

However, it turns control over to the hosting provider, which may or may not be acceptable to the consumer. Any cloud deployment model (public, private, hybrid, or community) can be supported under the hosted model.

## ***Hybrid model***

With a hybrid model arrangement, an outside hosting provider manages hardware and infrastructure support of the cloud, but the consumer manages some software aspect. This option is in between DIY and hosted models in terms of cost, complexity, and control. The terms of the hosting arrangement and cloud service type (IaaS, DBaaS, PaaS, or SaaS) determines the degree of control the consumer has under this model.

## ***Oracle Public Cloud Offerings***

Oracle offers several hosting services for database cloud computing. Each option leverages expert Oracle

services, high availability and high-performance architecture, and support to maximize the benefits of the cloud for the consumer.

- ✔ **Oracle database cloud service.** With Oracle Exadata, Oracle provides a database cloud to the consumer. The consumer loads the database onto Oracle Exadata and executes an application against their database. Oracle Exadata provides the architectural foundation for the public cloud service, but it is transparent to the consumer.
- ✔ **Oracle Exadata On Demand.** The Oracle Exadata Database Machine is hosted at either the consumer's site or within an Oracle datacenter. Oracle provides the administrative support in coordination with the consumer's requirements.
- ✔ **Oracle Infrastructure as a Service.** Oracle will provide Infrastructure as a Service (IaaS) to companies with the hardware either at Oracle or at the customer's site. The full suite of Oracle Engineered Systems is offered: Exadata, Exalogic, Exalytics, and SPARC SuperCluster plus ZFS Storage Appliances.



Carefully consider the strengths and weaknesses of your organization, combined with your core business objectives and commitment to cloud computing when selecting a hosting model.

## *Cloud Deployment Factors*

Deploying to the cloud offers many benefits but should not be taken lightly. Before you move to the cloud, you need to consider several key factors.

## ***Embrace the cloud model***

Some people think they can still do business as usual and label their system “cloud enabled”; that’s not true. You must follow the tenants of cloud computing to be truly cloud enabled.

## ***Determine your cloud fit***

Not all systems fit neatly into the cloud computing model. Standardized systems are good cloud candidates; highly customized or esoteric systems are not good fits. Move your standardized and well-documented systems to the cloud first and leave highly customized and non-standardized systems in their existing environments until they are ready for the cloud.

## ***Evolve into the cloud***

Do not blindly move all your systems into the cloud at once. Cloud computing is more than just a technology; it is a mindset. Your organization needs to mature into the cloud computing model at both a technical and a mindset level. The culture of both IT and the business units requesting IT services must evolve to fit the cloud services model.

## Chapter 6

# Ten Things to Consider When Building a Cloud

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### *In This Chapter*

- ▶ Improving performance and capability with database technologies deployed to the cloud
- .....

**T**his chapter highlights key items to consider when building a database in the cloud.

### *Paying Only for What You Use*

A core tenant of cloud computing is measured service. Instead of paying for excess capacity to guard against usage spikes, cloud consumers are billed only for what they use. Business units see exactly how much they are paying based on their usage. This pay-as-you-go approach allows for lower and more accurate billing for cloud consumers.

### *Restructuring IT Resources*

IT resources are highly trained assets for your company. Cloud computing and the simplified Oracle Exadata platform allow these folks to focus their

talents on advancing core business initiatives rather than mundane database infrastructure support. This allows your top technical talent to focus their energies on supporting core business initiatives.

## ***Performing Technology Refreshes***

A technology refresh of aging computer systems is often time consuming and complex. Cloud computing transfers the complexity to the cloud provider that is expert in performing seamless technology refreshes. This transference of responsibility allows the consumer to focus on core business processes rather than mundane IT support and upgrades.

## ***Value of Business Performance***

Engineered systems such as Oracle Exadata provide real business value. Customers can expect a simplified and improved database experience. Enhanced database performance, simplified infrastructure, administration, and support translate to lower costs and greater business agility and capability. Investment in solutions such as Oracle Exadata will translate into quantifiable business savings and ultimately increased capabilities.

## ***Upgrading for the Cloud***

A move to cloud computing generally puts you on newer, faster, better hardware and software. It also forces you to clean up inefficient processes that otherwise would remain a hindrance on the cloud. The end result is often a better-performing computer system that comes as an additional benefit of cloud computing.



## ***Supporting Datacenter Consolidation***

Migrating to the cloud reduces excess databases, which lowers hardware, software, licensing, and administrator support costs. Oracle Exadata has the capacity to consolidate multiple databases into one machine, and its powerful administrative tools allow a reduction or repurposing of highly trained administrative staffs. Oracle Exadata will effectively consolidate your OLTP, data warehousing, data mining, and applications workloads onto a faster and lower total cost platform.

## ***Enhancing Management Infrastructure***

The core cloud requirements of rapid provisioning and metered service require advanced and consolidated management tools at every level of the cloud stack. These management tools inherently reduce the administrative costs of managing the technology supporting the cloud while improving efficiency.

## ***Having Better Security***

Data consolidation provides increased business efficiencies, cost savings, and ultimately stronger security as fewer databases need to be protected and monitored. Oracle Exadata security can help block threats and detect unauthorized activity. Misuse of privileged user credentials, insider threats, and SQL injection are just a few of the threats that can be detected and prevented.

Additionally, a modern Identity Management stack is necessary for the cloud and can be a beneficial side effect of cloud computing. Automated user provisioning, de-provisioning, and management yield the benefits of improved security, better auditing and regulatory compliance, and a reduced workload for account management staff.

## ***Increasing Cloud User Access***

By definition, the cloud is network deployed. Moving to the cloud inherently means more components will be reachable via the network, which may not have been the case previously. Users at more locations will be able to connect securely and remotely. This enables more users (and potentially customers) to take advantage of the services deployed in the cloud.

## ***Embracing Technological Change***

The IT industry is moving to the cloud and many early adopters are already in the cloud. Some organizations accept change more easily than others; where does yours stand? You need to be a good fit for the cloud and the changes it requires. Organizations that foster a culture of innovation and continuous improvement are better suited for cloud deployments than organizations that resist change.

# Build private clouds for Database as a Service (DBaaS)!

Cloud computing is at the forefront of high-performance, lower-cost IT systems. Engineered database machines are the premier database platform. Deploying engineered database machines to the private cloud yields incredible benefits.

- **Understand cloud computing** — *find out what cloud computing is and what it offers*
- **Leverage engineered systems** — *learn what engineered systems are and why they are the premier database platform*
- **Deploy databases to the cloud** — *see how to deploy databases to the private cloud as DBaaS with engineered database machines*



**Open the book and find:**

- What DBaaS is and how it helps your company
- Why engineered database machines and the private cloud fit together so well
- Key elements to understand so that you have a successful database cloud

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