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Enterprise Cloud Infrastructure

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- **Leverage Infrastructure as a Service (IaaS)**
- **Drive down IT costs with pretested and proven Oracle Optimized Solutions**

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Enterprise Cloud Infrastructure

FOR

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ORACLE SPECIAL EDITION

by Michael Wessler, OCP & CISSP

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Contents at a Glance

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Introduction

Cloud computing, and specifically Infrastructure as a Service (IaaS), offers many benefits to an enterprise. Cloud computing has matured into a production grade model for the enterprise. When designing cloud infrastructure architecture, multiple design methodologies are available. Selecting the right methodology is critical, with the integration and optimization of components being a key to success.

Oracle Optimized Solution for Enterprise Cloud Infrastructure focuses on careful integration of hardware and software at every level of the infrastructure. Through the use of virtualization technologies and comprehensive management software, cloud computing is enterprise-ready with benefits of reducing costs and complexity, providing faster deployment, improving business agility, and simplifying management in enterprise environments.

About This Book

This book consists of five short chapters, each written as a stand-alone chapter, so feel free to start reading anywhere and skip around throughout the book!

Chapter 1: Introducing the Cloud. This chapter identifies essential cloud characteristics and outlines the key benefits and challenges of cloud computing.

Chapter 2: Implementing Cloud Infrastructure. I introduce Oracle Optimized Solutions and identify the benefits of OOS for Enterprise Cloud Infrastructure.

Chapter 3: Oracle Optimized Solution for Enterprise Cloud Infrastructure. This chapter outlines the hardware, software, and virtualization capabilities of the solution. I explain the architecture of the solution and show you a deployment example.

Chapter 4: Managing Cloud Infrastructure. This chapter delves into how to set up and manage virtualization. Tools to manage the entire Enterprise Cloud Infrastructure are covered.

Chapter 5: Ten (Or So) Things to Consider When Deploying Cloud Infrastructure. In that famous *For Dummies* style, I give you the "Part of Tens" chapter detailing items to help get you get started with Enterprise Cloud Infrastructure.

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. You won't find deep meaning-of-life stuff, but it may be good to know for later.

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

Introducing the Cloud

In This Chapter

- Defining cloud computing fundamentals
- Identifying the characteristics of cloud computing
- Identifying three service models
- Explaining four deployment models
- Looking at scale and velocity

Cloud computing represents an architecture that lends itself to the needs of modern computing via rapidly scalable and deployable computing resources over the network. Cloud benefits are numerous, but one must understand the architecture to reap the greatest benefits.

This chapter examines the characteristics of cloud computing, defines the cloud, and lists the characteristics used to measure a cloud. Three different service models and four deployment models are explained. It is through this understanding that you can achieve the benefits of the cloud.

Cloud Computing Defined

Cloud computing is an emerging and evolving architecture, but as a result, multiple definitions and expectations of the architecture exist. A relatively stable working definition is provided by the National Institute of Standards and Technology (NIST) and is accepted across the IT industry.

"Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, application, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction."

Cloud Computing Characteristics

NIST lists and defines the following five characteristics of cloud computing:

- **On-demand self-service:** A consumer unilaterally provisions computing resources as needed automatically without human interaction.
- **Resource pooling:** Computer resources are pooled to transparently serve multiple consumers.
- **Rapid elasticity:** Capabilities can be rapidly and elastically provisioned, in some cases automatically, to quickly scale out and rapidly released to quickly scale in.
- **Measured service:** Cloud systems automatically control and optimize resource use via a metering capability. Resource usage can be monitored,

controlled, and reported providing transparency for both the provider and consumer of the service.

- **Broad network access:** Capabilities are accessed over the network and accessed through standard mechanisms that promote heterogeneous thin or thick client platforms.

In addition to the NIST definition, two additional characteristics are specific to cloud computing: *scale* and *velocity*. Rather than traditional IT systems with limited numbers of systems with few changes, cloud computing promotes multiple large systems (scale) with constant change (velocity) to support the cloud. Expect the magnitude and dynamic nature of the cloud to be fundamentally different than traditional IT systems.

Service Models

NIST further defines the cloud like this:

"This cloud model promotes availability and is composed of five essential characteristics, three service models, and four deployment models."

The type of computing resource that is offered in a cloud defines a cloud's *service model*. NIST and the industry have identified three common service models that are based on what cloud services are provided: software, platform, and/or infrastructure.

Software as a Service (SaaS)

With Software as a Service (SaaS), service *consumers* get their software applications from the service *provider*. The consumer uses the software as an application while the provider manages the underlying

software and infrastructure. Applications are often delivered to the customer via a web browser in SaaS architecture.

Platform as a Service (PaaS)

In Platform as a Service (PaaS), the consumer uses programming languages and tools from the provider as an application development and deployment platform. The platform may include databases and middleware in addition to application development tools. Virtualized and grid computing are often a key basis for PaaS architectures.

Infrastructure as a Service (IaaS)

With Infrastructure as a Service (IaaS), the provider manages the underlying physical cloud infrastructure (operating system, network, storage) while consumers deploy and run their own application software and provision resources as necessary. Virtualization software is integral to IaaS architectures.

Figure 1-1 shows how service models are related.

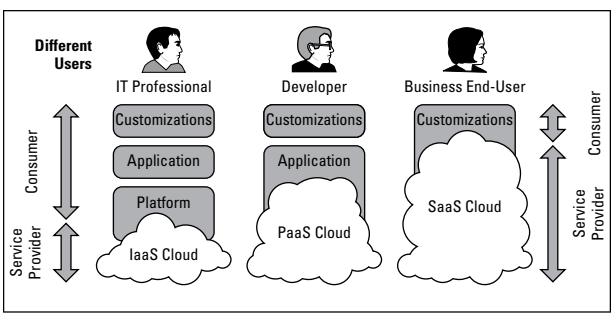

Figure 1-1: Cloud service model hierarchy.

In Figure 1-1, you see SaaS supporting cloud applications, PaaS supporting cloud platforms, and IaaS supporting cloud infrastructure with usage examples of each environment. Notice how the end-user changes from IT professional to developer to business end-user based on the service model used (IaaS to PaaS to SaaS).

It is important to note that each model is *not* dependent on each other. You do not necessarily need PaaS for SaaS or IaaS for PaaS. Furthermore, while your cloud may be built on any two or even three layers, having multiple layers is not required.

Although not an official NIST definition, XaaS (Everything as a Service) refers to the concept of moving everything offered by IT to a service. Additionally, DaaS (Data Storage as a Service) and DBaaS (Database as a Service) represent additional specific implementations of cloud services.

Deployment Models

Four cloud deployment models are defined. These models are defined based on what cloud services are provided: software, platform, and/or infrastructure. When you design your cloud, your requirements will guide you into one of the following four deployment model types.

Private clouds

Private clouds are for the exclusive use of a single private organization. The cloud is often hosted by the same organization in a private datacenter. Private clouds may offer a higher level of control by the

managing organization and are perceived as potentially providing a higher degree of privacy and security.

Due to the degree of control exercised over some private clouds, a consumer may potentially have more options with a public cloud.

Public clouds

Public clouds are used by multiple organizations on a shared basis. The cloud is hosted by an outside party providing the cloud as a service. Public clouds do not require an upfront capital investment and are therefore fast and inexpensive to get started. However, consumers typically have less control and visibility over the service, compared to private clouds, since public clouds are shared and service providers are motivated to provide a standardized offering to reduce their costs.

A common debate in IT is about "build your own" versus using what someone else has already provided. That same theme is present in cloud computing. The security requirements your user-base demands for management control, size and scope, service model, and resources will drive your decision.

Community clouds

Community clouds are used by related organizations or consumers with a common purpose. These are not available to the general public but are available to members of a specific community. Examples include branches of the military, government or educational organizations, and industry partners and suppliers.

These are especially useful when consumers share special needs (for example, high security) or require common services.

Hybrid clouds

Hybrid clouds occur when an organization's IT requirements are supported by a mix of private, public, and community clouds in order to take advantage of the benefits of multiple cloud types. Today, these are most likely special use cases but in the long term, this is the likely future of all IT.

Not all real-world implementations fit neatly in a public, private, or community cloud. In many cases, using both public and either private or community clouds makes sense.

Scale and Velocity

Many of the fundamental components of cloud computing are classic IT principles: virtualization, consolidation, automation, and so on. Perhaps the key differences are the scale and velocity with which these technologies and architectural issues are applied. Simply put, a traditional IT environment may involve dozens or hundreds of systems for which the configurations are changed a few times a year. By contrast, cloud infrastructures combine multiple architectures into shared pools of large numbers of resources (servers and so on) with almost constant change — daily or even hourly. This typically requires a fundamental shift in the way in which IT processes are implemented and carried out.

Of course, enterprise cloud computing may involve significantly different implementations of these cloud attributes than public developer-centric cloud services.

Most enterprise cloud environments will likely place restrictions on the type of code that may be deployed in the enterprise cloud. Additional restrictions may be enforced due to logical and physical security concerns, as well as software licensing. The level of on-demand elastic provisioning in an enterprise cloud environment may require some level of organizational approval. Ultimately, enterprise cloud computing will lead to dramatic improvements in service availability and significant reduction in costs, even while being more restrictive than the typical public cloud environment.

Chapter 2

Implementing Cloud Infrastructure

In This Chapter

- Exploring motivations for Cloud
- Identifying different implementation options
- Benefiting from Optimized Solutions
- Introducing Oracle Optimized Solution for Enterprise Cloud Infrastructure

Modern organizations and IT systems face daunting challenges as requirements increase while resources and timeframes contract. System integration is key, and specific design principles have been established. Different approaches ranging from "Build from Scratch" to highly engineered systems are found in the industry, and optimized solutions have established a firm place covering a broad area of choices.

This chapter looks at the challenges and principles of integrated systems and how optimized solutions yield important benefits. It also introduces the Oracle Optimized Solution for Enterprise Cloud Infrastructure.

Key Factors Driving the Cloud

Successful enterprises share many attributes and challenges. As enterprises progress through their journey in life, specific items and themes continually reoccur.

- **Enterprise requirements of performance, scalability, and availability.** These requirements drive the design of most computer systems regardless of the industry.
- **Standardization.** Common components that are replicated across an enterprise drive down costs while reducing errors and decreasing implementation timeframes. Smart organizations standardize whenever possible.
- **Consolidation.** Combining common components into fewer instances reduces costs and overhead. Consolidation is a huge initiative for organizations attempting to reduce costs.
- **Virtualization.** Virtualized environments are rapidly created to allow sharing of computing resources while providing enterprises the preconfigured components and features they require.
- **Automation.** Performing operations quickly, consistently, and without manual effort to lower costs and reduce errors. Automation of mundane and multi-step tasks yields large benefits.
- **Optimization.** Identify and propagate increased efficiencies across the enterprise. When better performance methods are identified, they need to be implemented in large scale to maximize the positive impact.

Although the goals are almost universal, each enterprise charts its own journey to reach those goals. It's not uncommon to see different organizations within the same company use different strategies simultaneously.

Integrated System Principles

Any system is composed of pieces (components) that are combined (integrated) to perform one or more functions. Man-made systems include mechanical, electrical, and of course IT systems. The components and integration methodologies are what interest us for IT systems.

System components (building blocks)

Modern IT systems are composed of these building blocks:

- Compute node, which is the server processing component, itself composed of memory and CPU.
- Networking communications infrastructure, both within a compute node and outside the server within the network.
- Storage, which includes internal and external storage media such as flash memory, capacity and storage disk, and tape.
- Operating system(s) that provide a critical foundation need to be installed and configured.
- Virtualization software to allow the rapid creation of shared environments in a repeatable, controlled manner is critical to modern IT systems.

- Management software, meaning tools and utilities to monitor and manage the system components. Cloud management tools, such as Oracle Enterprise Manager 12c, provide provisioning, self-service, metering, and chargeback capabilities.
- Application software, that is, software components that are the application(s) doing the "work" and the supporting software components, such as databases.

Building blocks start as general items during high-level design time but become very specific components as the system design becomes more detailed. Ultimately, a specific product from a specific vendor is identified for each component.

Cloud implementation options

There are three primary methodologies to building clouds, and these methodologies focus on how the building blocks of a system are selected and integrated. Based on the characteristics of the components used and the degree of integration, one of three methodologies is used.

"Best in Class"

"Best in Class" or "Do-It-Yourself" involves selecting the best individual products for each component irrespective of their configuration if they integrate well together. In this methodology, the industry leading or "best" individual compute nodes, application and management software, OS, network, and storage products are acquired.

Because each component is often from a different vendor and often has minimal integration testing with other components, customization and integration is an issue. Individual components are highly customized and integrated together over an extended period of time into a very specific customized environment. This is a common methodology, but it is also a deterrent to cloud adoption.

Major downsides to this methodology include the complexity created by the customer when they build and integrate the system and the large amount of time, effort, and lost productivity it takes to go from design to implementation.

Engineered systems

Preconfigured, highly optimized, and completely integrated, engineered systems represent the polar opposite of "Build from Scratch" systems. Components within engineered systems are preconfigured, integrated, and optimized by the vendor to work together before the system is delivered to the customer. The customer has no customization or integration work to do at the component level; the customer simply installs their specific application on the system and is then ready to operate. Because the complex integration and optimization processes have been performed by the vendor, very rapid implementation at the customer site is possible. This also makes for a greatly simplified environment for the customer.

Prime examples of engineered systems come from Oracle, which is in a unique position to provide the

complete stack with both hardware and software components in an engineered configuration. Special-purpose engineered systems include, but are not limited to, Exadata and Exalogic, which are great choices for building PaaS Clouds.

Designed as a universal platform, SPARC SuperCluster could be used for PaaS and IaaS implementations.

Figure 2-1 shows you the relationship between the design methodologies by charting the evolutionary growth from highly customized "Best in Class" systems to more modern Optimized Solutions and engineered systems.

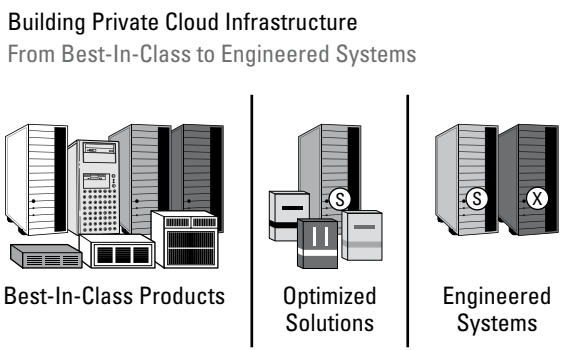

Figure 2-1: Integrated system methodology hierarchy.

Datacenters have room for all three design methodologies. Each implementation methodology has its pros and cons, which is why the methodologies are successful in specific situations. IT departments are expected to have a mix of "Best in Class" systems, Optimized Solutions, and engineered systems based on what is in the datacenter's existing architecture and new system requirements.

Optimized Solutions

Providing the core components of a system in a pretested, optimized configuration is the goal of Optimized Solutions. The customer builds the system with core components according to optimized and fully tested configurations and installation practices. Detailed application configuration and customization remains under the customer's control. This allows the customer to retain control of key customizations specific to their system and business, but without the complexity, cost, and risk of building a system from scratch.

Optimized Solutions are appealing because they allow the customer to build their cloud infrastructure much faster and with lower risk and costs because the vendor has documented and overcome any architectural and integration issues.

Benefits of Oracle Optimized Solutions

Oracle Optimized Solutions fit very well between "Best in Class" systems and engineered systems. A large amount of engineering for integration and optimization goes into an Oracle Optimized Solution, without taking

the customer into the extent seen with an engineered system. The customer still has a large degree of control over the customizations for their environment, which is appealing in many situations.

The key benefits of Oracle Optimized Solutions are

- Enterprise ready infrastructure offering the complete stack of components
- Pretested and prevalidated configuration
- Simple, quick, and risk-free deployment because all of the complex, time-consuming work is already completed
- Simplified operations because an optimized architecture free of inefficiencies is in place
- Lower total cost of ownership (TCO)
- Much faster build and deployment times resulting in greater business agility

To see how much time is saved over "Best in Class" systems, check out Figure 2-2.

As you see in Figure 2-2, up to a 6x reduction in time from Oracle Optimized Solutions is possible due to prebuilding and configuring the core components of the system infrastructure.

Oracle's unique position of owning and managing the development and integration of both hardware and software components allows the creation of Optimized Solutions.

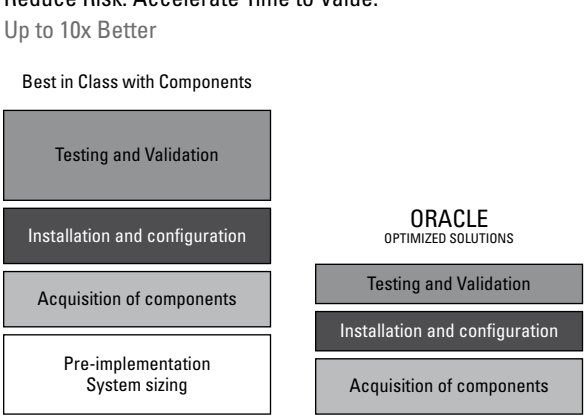

Figure 2-2: Oracle Optimized Solutions time savings.

Oracle Optimized Solutions are fully documented, pre-tested, and tuned infrastructures made up of uniquely matched components — storage, servers, operating systems, virtual machines, middleware, database, and applications — that are designed and tested together to offer proven complete stack solutions for the enterprise. They are also ideal for organizations that want to implement an Oracle system but retain the flexibility to modify components to fit within their existing IT environment.

Oracle Optimized Solutions integrate each of the following system architecture components:

- Oracle Sun Servers as compute node
- Oracle Sun Storage for storage
- Oracle network components across compute node, storage, and network
- Oracle Solaris and Oracle Linux operating systems
- Oracle Virtualization software
- Oracle Database software
- Oracle Fusion Middleware software
- Oracle Applications software
- Oracle Enterprise Management tools

Oracle's position as the single developer and vendor for each component within the technology stack is a key asset in ensuring integration, performance, and end-to-end support of the Oracle Optimized Solution methodology.

Introducing Oracle Optimized Solution for Enterprise Cloud Infrastructure

Support of the private cloud Infrastructure as a Service (IaaS) architecture is best implemented by Oracle Optimized Solution for Enterprise Cloud Infrastructure. Using Oracle Optimized Solution technology stack as the foundation, private IaaS clouds for the enterprise can be quickly deployed at up to 40–50 percent lower total cost than other solutions.

Figure 2-3 shows you some of the benefits of the Oracle Optimized Solution for Enterprise Cloud Infrastructure.

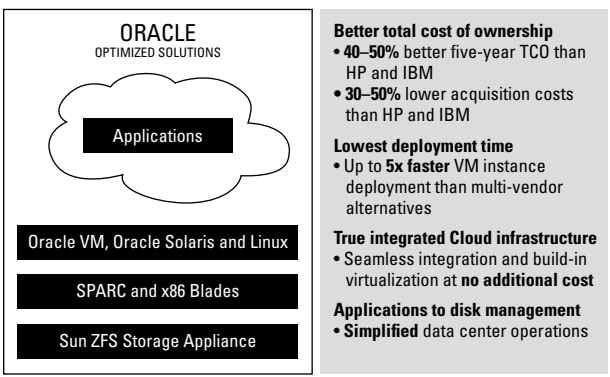

Figure 2-3: The Oracle Optimized Solution benefits for Enterprise Cloud Infrastructure.

Some metrics from Oracle show a 5× to 6× reduction in Virtual Machine deployments compared to other vendors. A total cost reduction of 40–50 percent TCO has also been demonstrated for acquisition, support, and operation.

In Figure 2-4, you see a more detailed description of the savings with Oracle Optimized Solution for Enterprise Cloud Infrastructure.

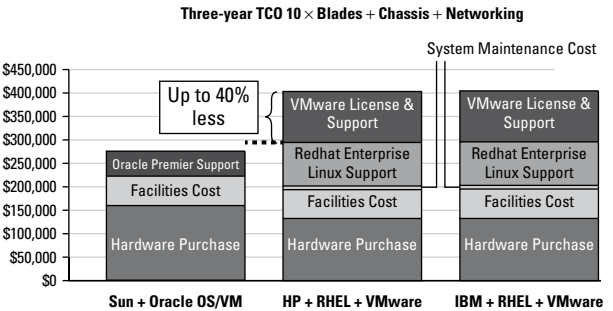

Figure 2-4: Lower TCO with the Oracle Optimized Solution.

For more details and metrics on performance improvements and cost savings, see the Oracle white paper "Accelerating Enterprise Cloud Infrastructure Deployments" at `www.oracle.com/optimizedsolutions`.

Chapter 3

Oracle Optimized Solution for Enterprise Cloud Infrastructure

In This Chapter

- Architecting Enterprise Cloud Infrastructure
- Learning about compute node, storage, networking, and more in Enterprise Cloud Infrastructure
- Virtualizing your operating environments
- Exploring a sample deployment

Oracle Optimized Solution for Enterprise Cloud Infrastructure (ECI) provides hardware and software infrastructure technology stack. A choice of hardware and software configurations is available based on the customer's use case requirements. This chapter explores the architecture and supported components of the Oracle Optimized Solution.

Architectures

Integration and optimization of the Oracle Optimized Solution occur across the full stack of infrastructure hardware and software. The solution for ECI encompasses the compute node, storage infrastructure, network devices,

virtualization software, operating systems, and management software. There are two deployment hardware architectures for Enterprise Cloud Infrastructure: ECI on SPARC Solaris and ECI on x86 and Linux. Customers can choose the most appropriate architecture for their application and data center environment.

Enterprise Cloud Infrastructure with SPARC and Solaris

The ECI solution for Oracle SPARC is ideal for implementing Solaris-based applications on a dynamic, cloud-enabled infrastructure. Featuring Oracle's SPARC T4 servers running Oracle Solaris 11 or 10, the ECI offering provides support for hardware, software, and virtualization, as shown in Figure 3-1.

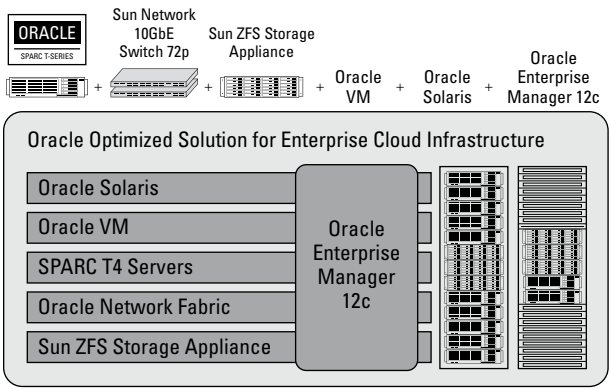

Figure 3-1: Oracle Optimized Solution for Enterprise Cloud Infrastructure for SPARC.

In Figure 3-1, you see that Oracle ECI components are supported via Oracle's SPARC T4 server hardware, a Network 10GbE switch, ZFS Storage Appliance, Oracle VM virtualization software, Oracle Solaris, and Oracle Enterprise Manager 12c.

Enterprise Cloud Infrastructure with Sun x86 and Oracle Linux

For Oracle and third-party applications running on x86 Solaris, Linux, or Microsoft Windows, the Enterprise Cloud Infrastructure leverages Sun x86 systems and Oracle Linux as the ideal foundation for deploying virtualized and cloud infrastructure. Featuring Oracle Sun Blade servers running Oracle Linux or Oracle Solaris, the ECI offering provides support for hardware, software, and virtualization, as shown in Figure 3-2.

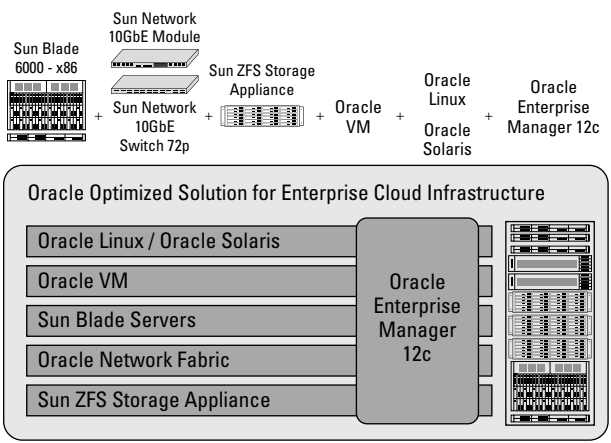

Figure 3-2: Oracle Optimized Solution for Enterprise Cloud Infrastructure with Sun x86 and Oracle Linux.

In Figure 3-2, you see that Oracle ECI components are supported via Oracle Sun Blade server hardware, Oracle Network Fabric, ZFS Storage Appliance, Oracle VM virtualization software, Oracle Linux or Oracle Solaris, and Oracle Enterprise Manager 12c.

Compute Server Nodes

Oracle Optimized Solution for Enterprise Infrastructure currently supports two server node architectures: Oracle SPARC T4 server and Oracle Sun Blade 6000 modular system.

Oracle SPARC T4 server

Oracle SPARC T4 servers are intended for critical business applications, web, and database environments. Extendable and scalable up to ten compute nodes, each compute node supports 2 sockets each with 8-core SPARC T4 processors supporting Oracle Solaris.

Key advantages of the SPARC T4 servers are

- SPARC T4 processor power and performance
- Improved multi-threaded and single-threaded application processing
- Built in virtualization capabilities
- Enhanced performance of cryptographic computing at the chipset level

The SPARC T4 processor is extremely powerful and when combined with virtualization capabilities, makes the compute node very suitable for a cloud infrastructure environment.

Oracle Sun Blade 6000 modular system

The Oracle Sun Blade 6000 modular system allows multiple server compute modules added to the system chassis to increase processing capability. Up to ten compute modules with different memory and CPU capacities can be added to a chassis. Both Oracle's SPARC T4 and Intel x86 processors are supported in the compute modules with the option of Oracle Solaris or Oracle Linux. Combined with Oracle VM virtualization capabilities and the ability to scale up to ten compute modules, the Oracle Sun Blade 6000's ability to respond to capacity requirements is extensive.

Networking

Network support within the Oracle Optimized Solution is via Oracle 10 GbE switches. These switches are integrated within the solution and provide high-speed connectivity to the network attached storage devices and the network infrastructure. Within the solution, network switch options are

- Oracle Sun Blade 6000 Ethernet Switched Network Expansion Modules (NEM) 24 port 10 GbE Network Switch
- Oracle Sun Network 10 GbE Switch 72 port Network Switch

The Oracle Sun Blade 6000 Ethernet switch is intended to support Oracle Sun Blade 6000 chassis. Oracle Sun Network 10 GbE switch is designed to support the highest performance Oracle systems, such as SPARC T4 server; it can also be added to the Top-of-Rack of the SB6000 x86 architecture for additional networking connectivity.

Storage

Storage in Enterprise Cloud Infrastructure is provided by the Oracle ZFS Storage Appliances (ZFS SA), which supports file (NAS) and block (FC and iSCSI) protocols. Oracle ZFS Storage Appliances provide these capabilities:

- High-performance and high-capacity tiered storage
- DTrace Storage Analytics
- Snapshots to allow point-in-time copies of data
- Cloning to allow copies of data snapshots, often used to support virtualized environments
- Replication to transport data to one or more remote locations to support disaster recovery operations
- Compression and in-line deduplication to reduce the amount of space utilized

Based on storage and performance requirements, different sized, speed, and configured ZFS Storage Appliances can be implemented. Hybrid Storage Pools (HSP) can be used to integrate flash drive technology and disk storage. HSPs maintain storage pools and shift high-demand files to faster storage media and lower demand files to slower media to preserve faster overall response time.

Operating Systems

ECI servers are supported with either Oracle Solaris or Oracle Linux. Additionally, Oracle VM virtualization

software can be downloaded from Oracle, which supports Linux, Windows, and Oracle Solaris at the virtual machine level.

Oracle Solaris 11 supports Oracle Solaris Zones, which greatly enhances virtualization in a cloud infrastructure environment. Improved and multilevel security, faster installations and deployments, and high availability features support cloud requirements. Use Oracle Solaris for your most critical, enterprise level systems.

Oracle Linux is Oracle's enterprise level Linux and it tracks mainline Linux closely to quickly incorporate innovations. While it can support small and mid-size environments, Oracle Linux scales for larger implementations such as engineered systems and enterprise cloud architectures.

Virtualization

Virtualization is the ability to abstract the physical hardware resources to create virtual instances that can be used as if they were the actual resource. A prime example is making virtualized instance copies of an operating system (OS) and deploying those OS's on a shared hardware server for multiple customers to use without ever noticing they are sharing a server.

Virtualization provides the following advantages:

- Reduces costs, simplifies administration, and maximizes the use of the current hardware resources via server consolidation
- Improves fault tolerance and business continuity by creating server pools with automatic failover

- Allows rapid OS provisioning
- Lowers the cost of deploying new applications

Oracle VM Server for SPARC and Oracle VM Server for x86 are available for the Oracle Optimized Solution for Enterprise Cloud Infrastructure. Oracle VM offers

- Virtualization of guest OS including Oracle Solaris, Linux, and Microsoft Windows
- Live migration, high availability, dynamic resource scheduling
- Template deployments to promote consistency
- Large-scale database and middleware workload support
- Certification for use with all Oracle products

You can find additional information at `www.oracle.com/us/technologies/virtualization/ovm3-app-driven-459334.pdf`.

Within Oracle Solaris, further virtualization is possible with Solaris Zones. These virtualized operating environments provide isolation of applications within their operating environment, yet dynamically share and control the hardware resources available on the server. This magnifies computing capabilities while improving security, supporting consolidation, and reducing costs.

Enterprise Cloud Infrastructure Deployment

Seeing how the cloud infrastructure is actually deployed is beneficial to visualizing the architectural components and how they tie together. Both SPARC and x86

architectures are supported and displayed in the figures that follow. Figure 3-3 shows a sample deployment of a SPARC-based IaaS cloud supporting Oracle Applications, Oracle Fusion Middleware, and Oracle 11g databases.

Figure 3-4 shows a sample deployment of an x86 based IaaS cloud supporting Oracle Applications, Oracle Fusion Middleware, and Oracle 11g databases.

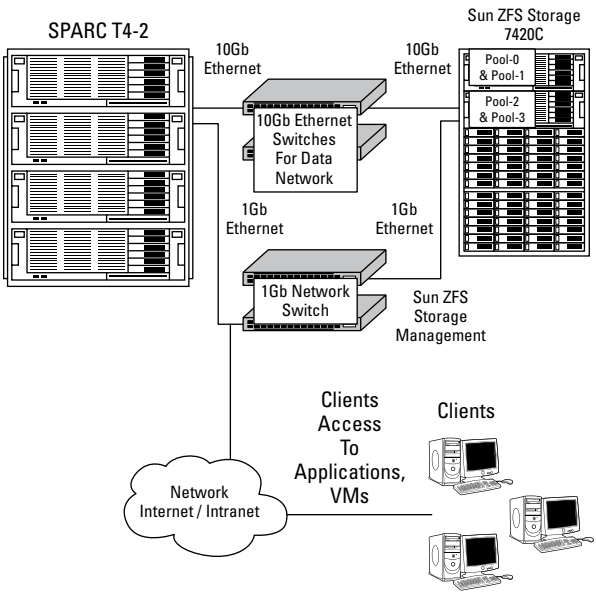

Figure 3-3: Enterprise Cloud Infrastructure with SPARC supporting IaaS cloud.

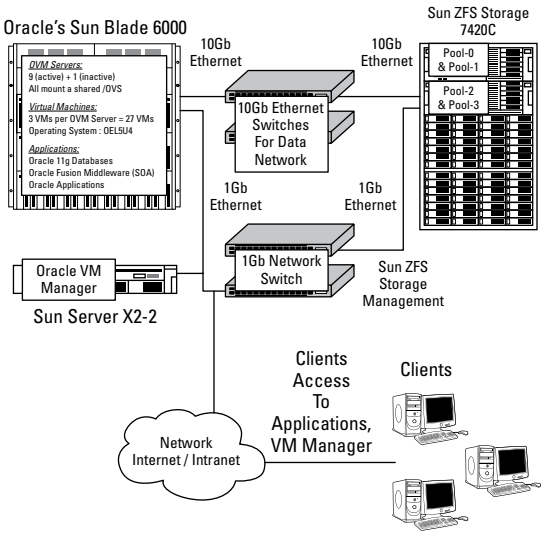

Figure 3-4: Enterprise Cloud Infrastructure with x86 and Linux supporting IaaS cloud.

In Figures 3-3 and 3-4, you see how SPARC with Solaris and x86 with Linux support the IaaS cloud. Utilizing Oracle Virtual Machine technology, a total of 27 virtual Linux machines are supporting the Oracle Applications, Fusion Middleware, and database software. The Oracle Virtual Machines are managed via a Sun x86 server. The server compute nodes are connected to the Sun ZFS Storage Appliance with 10Gb Ethernet switches. Finally, since this is a cloud, the clients are connected to the cloud infrastructure over the Internet or their Intranet.

Chapter 4

Managing Cloud Infrastructure

In This Chapter

- Using Oracle VM Templates to deploy software
- Creating software operating environments with Oracle Virtual Assembly Builder
- Managing the entire datacenter with Oracle Enterprise Manager Ops Center
- Controlling the cloud via Oracle Enterprise Manager 12c

Virtualization is key to cloud computing and the Oracle Optimized Solution architecture. Understanding and using the right tools to implement virtualization makes this process much easier. Management of the complete enterprise across all levels of hardware and software allows for a better executed cloud environment and ultimately a more successful enterprise.

This chapter examines the tools necessary to intelligently and efficiently virtualize your environment and looks at the tools needed to manage the resulting environment.

Oracle VM Templates

An Oracle VM Template is a virtual machine (VM), or group of VMs, containing Oracle or other software that is prebuilt, preinstalled, preconfigured, and ready to use — with no installation required. The benefit is that software doesn't need to be installed, patched, or configured; it is ready to use off the template image. This allows environments to be created in a rapid manner using a safe, standardized image.

Oracle VM Templates are available for these software packages:

- Oracle VM Manager
- Oracle Enterprise Grid Control
- Oracle E-Business Suite
- JD Edwards and Siebel CRM
- PeopleSoft ELM, FSCM, CRM, Portal, and HCM
- Oracle WebLogic Server
- Oracle Business Intelligence Enterprise Edition
- Oracle Application Server
- WebCenter
- Oracle Identity Management
- Oracle Fusion Middleware SOA
- Oracle RAC Database
- Oracle Database
- MySQL Database
- Oracle Linux and Oracle Solaris

More information and downloads for Oracle VM Templates are available at `www.oracle.com/technetwork/server-storage/vm/templates-101937.html`.

Is the template that you're using close to what you want, but not exactly configured the way you want it? You can make your updates to a virtualized environment and then save that environment as your "Golden Image" template to reuse whenever you want.

Oracle VM is the foundation used to create Oracle VM Templates, thus the images are deployed to virtualized machines via the Oracle VM toolset. You can execute scripts to make specific updates post deployment as well.

The benefit of using Oracle VM Templates is the large time savings of *not* having to install, upgrade, patch, and configure each environment by hand. Building individual environments manually can be a time-consuming, error-prone, mundane task that prevents the administrator from doing more valuable work for the enterprise.

In Figure 4-1, you see how rapid application deployment is possible with Oracle VM Templates.

Figure 4-1 shows the end-to-end process of downloading the desired template and deploying it to the target virtualized environment saving days to weeks of time installing, patching, and configuring.

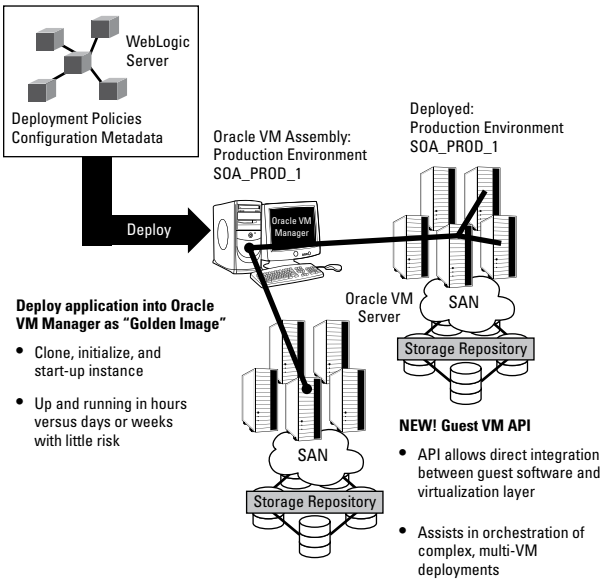

Figure 4-1: Deploying Oracle VM Templates.

Oracle Virtual Assembly Builder

Oracle Virtual Assembly Builder (OVAB) is designed for administrators to quickly create, configure, and deploy multitier application topologies to virtualized environments. In its essence, preconfigured software application components are created and deployed to target

virtual machines to create functional operating environments.

Software components are captured and packaged into self-contained building blocks called *appliances.* The appliances are then modified to create application blueprints known as *assemblies.*

These assemblies are then packaged and provisioned onto virtual machines creating the software environment on the target virtual machine. The result is the rapid creation of new software environments in a consistent manner without having to install, patch, and configure individual software components across multiple machines.

Examples of appliances that can be deployed include

- Web server software such as Oracle HTTP Server, Oracle Web Cache, and Oracle Traffic Director
- Middleware software such as Oracle WebLogic application server, Oracle Coherence Web, Oracle SOA Suite, Oracle Service Bus, and Oracle Tuxedo
- Databases software including Oracle Real Application Cluster (RAC) and single instance databases
- Generic and external appliances

Existing software installations can be captured and rolled into appliances to be provisioned to other environments. Custom configuration for specific environments can be captured, stored as metadata, and later included in deployments.

OVAB supports both GUI interfaces and command line tools that allow scripting and automation for the capture, creation, and deployment of environments. The

ease of use and consistency of the provisioned environments allow for great savings in time building and rebuilding complex environments on virtualized machines.

Oracle Enterprise Manager Ops Center 12c

Oracle Enterprise Manager Ops Center 12c (often referred to as Ops Center 12c) is designed for enterprise cloud infrastructure support. It integrates with all infrastructure components in the datacenter and provides full life cycle management. Ops Center 12c is designed to provide total control of your IaaS cloud environment.

A single console with Oracle Enterprise Manager Ops Center is used to manage:

- Virtual Machines and Oracle Solaris Zones
- Enterprise Servers and Engineered Systems
- Operating systems
- Storage systems
- Network fabric and devices

Oracle Enterprise Manager Ops Center 12c is integrated with Oracle Support to facilitate faster response to issues via Automatic Service Requests (ASRs), health checks and recommendations, and patch management. Furthermore, Ops Center 12c is integrated with Oracle Enterprise Manager 12c to extend management control to middleware, applications, and databases.

Figure 4-2 shows how Ops Center 12c manages all the infrastructure components in the enterprise.

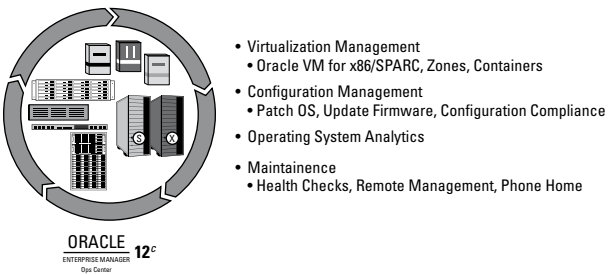

Figure 4-2: Managing the datacenter with Oracle Enterprise Manager Ops Center 12c.

As you see in Figure 4-2, Oracle Enterprise Manager Ops Center 12c provides a powerful capability to ensure all infrastructure components in the cloud architecture are monitored and managed in a fast, efficient manner.

Oracle Enterprise Manager 12c

Oracle Enterprise Manager 12c is designed for total management control of the enterprise cloud. Key components are total life cycle management and unified and automated management from the single product.

Figure 4-3 shows you how Oracle Enterprise Manager 12c manages the full life cycle within the cloud.

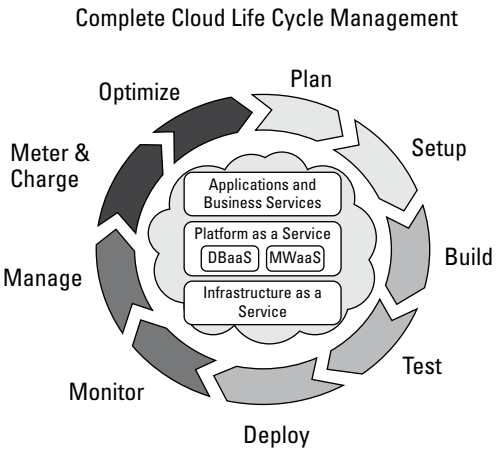

Figure 4-3: Life cycle management with OEM 12c.

As you can see in Figure 4-3, items critical to cloud computing such as provisioning, metering and chargeback, deployments, capacity management, and performance are managed. These are examples of the total cloud control provided by Oracle Enterprise Manager 12c.

Chapter 5

Ten (Or So) Things to Consider When Deploying Cloud Infrastructure

In This Chapter

- Optimizing your cloud via the Oracle Optimized Solution for Enterprise Cloud Infrastructure

This chapter identifies several tips for maximizing your Infrastructure as a Service cloud environment.

Enterprise-Ready Optimized Hardware and Software

Consider the value of starting off a new system with a solid, enterprise-ready technology stack that has already been pretested, validated, and optimized. How much time and resources would you save while reducing your risks with such a head start?

By using an Oracle Optimized Solution and *not* having to "reinvent the wheel," you can focus your resources on implementing the application and supporting the

business. Using an Oracle Optimized Solution frees your organization to focus on application and business-specific requirements where your resource expenditure is most effective.

Use the Best Ingredients and Recipes

The secret recipe for the success of Oracle Optimized Solutions is using top-quality individual components and optimizing them to run together quickly, efficiently, and less expensively. Oracle starts with high-quality servers, networking, and storage hardware components. Industry-leading operating systems, virtualization software, and management software are intelligently combined with the hardware components. The "mixing together" of the high-end individual components forms a system with far greater capability than the sum of its parts.

Take Advantage of Solaris 11 Features to Optimize Your Cloud

Oracle Solaris 11 built-in virtualization is a key component to cloud computing. Via Oracle Solaris Zones, hardware resources can be virtualized across multiple operating environments. As new environments are needed, they can be quickly provisioned in a consistent and secure manner. Allocation of computing power can be dynamically controlled across the operating environments to ensure optimal performance.

Cloud-specific security capabilities include multilevel security, immutable zones, data link protection,

role-based administration, and support for hardware-accelerated encryption. Enhancements in higher availability, quicker software installation, and faster software deployments all further optimize your cloud experience.

Achieve Total Cloud Control

Oracle Enterprise Manager 12c (OEM 12c) is designed for managing all components within the cloud. OEM 12c is the central point for all management within the cloud. Indeed, all managed components are integrated with OEM 12c. Use this tool to manage Oracle software components such as databases, applications, and middleware but with an emphasis on cloud computing, life cycle management, and automation.

Infrastructure hardware and software components such as server hardware, operating systems, virtualized environments, storage and network devices are managed by OEM Ops Center 12c. The Ops Center 12c component is integrated with OEM 12c to provide total unified control. Unified management includes provisioning, server, network, and storage management, along with patching.

Lower Virtualization Costs

Consider Oracle Linux, Oracle Solaris, and Oracle VM to drastically reduce virtualized infrastructure licensing and support costs. Total cost of ownership (TCO) for many popular virtualization solutions is driven largely by complex license schemas with high acquisition, support, and management costs. Oracle's OS, virtualization, and management license and support are included at no

additional cost with Oracle Server support. Oracle VM is free to download, use, and distribute, support fees are affordable, and licensing is simple. Oracle VM for SPARC, Dynamic Domains, and Solaris Zones are also included with Oracle SPARC servers.

Encourage Standardization with Ease of Deployment with Templates and OVAB

Attempting to maintain a zoo of disjointed, nonstandard software environments is at best a full-time job. However, using Oracle VM Templates and Oracle Virtual Assembly Builder (OVAB), you can easily create standardized images of any software environment. That environment can then become standard and deployed to virtualized environments for use in development, testing, or production.

The benefit of using templates and OVAB is improved quality control and security, saving the administrator time building and supporting environments and promoting consolidation as fewer environments are needed. The end result is a better-managed environment and reduced costs.

Use Oracle's TCO Calculator (`www.oracle.com/us/media/calculator/vm/index.html`) to compare Oracle VM and VMware costs.

Build an Enterprise Cloud Infrastructure supporting IaaS!

Cloud computing and specifically Infrastructure as a Service (IaaS) is critical to the success of many enterprises. Choosing the right infrastructure technologies is essential to capitalizing on the benefits of cloud computing. Oracle Optimized Solution for Enterprise Cloud Infrastructure helps identify the right hardware and software stack and provides configuration guidelines for your cloud.

- ***Understand Enterprise Cloud Infrastructure* — find out how to jumpstart your IaaS cloud plans**
- ***Discover Oracle Optimized Solutions* — learn how integration testing and proven best practices maximize your IT investments**
- ***Accelerate implementations* — see how to architect and deploy your IaaS cloud to drive down costs and improve performance**

Open the book and find:

- **How to understand and select the right private cloud strategy for you**
- **Key cloud infrastructure elements and how to use them to achieve your business goals**
- **How Oracle Optimized Solutions help reduce integration risks and lower costs**

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