Oracle On Demand Infrastructure:
Virtualization with Oracle VM
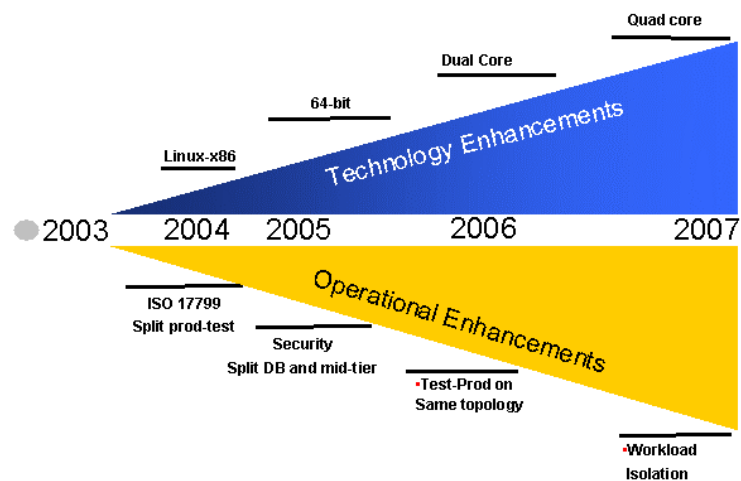
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INTRODUCTION

Oracle On Demand Infrastructure

Oracle On Demand offers the broadest portfolio of solutions in the industry, including subscription and managed applications that accelerate business results, reduce costs, and lower risks. For customers to achieve these benefits, Oracle On Demand invests in advanced technologies and continuously improves services.

Reviewing the evolution of the Oracle On Demand Managed Services Grid gives context and rationale to Oracle's virtualization efforts. Over the last four years, Oracle has leveraged commodity servers to enhance services by hardening security and adhering to new deployment standards. Oracle further enhanced services by improving the test infrastructure and isolating critical production workloads. While these operational enhancements were being deployed, Oracle continued to rapidly adopt new infrastructure technologies that increased customer capacity. Most recently, Oracle has been replacing single-core servers using two units of space in a server rack (2U) with dual-core servers using one unit of space (1U) - in effect, quadrupling the capacity of the Oracle On Demand Managed Services Grid.

On Demand Grid Evolution

Next Generation: Virtualized Environments

Oracle is introducing server virtualization within the Oracle On Demand Managed Services Grid. The introduction of virtualization in On Demand will afford Oracle the opportunity to optimize each customer's configuration, more fully harness the capabilities of these servers, maintain the operational enhancements deployed over the last four years, and introduce new benefits. The purpose of this paper is to provide the rationale for the deployment of this technology as well as highlight how virtualization will directly benefit customers. This paper includes:

- An introduction to server virtualization

- Immediate and potential future benefits to customers

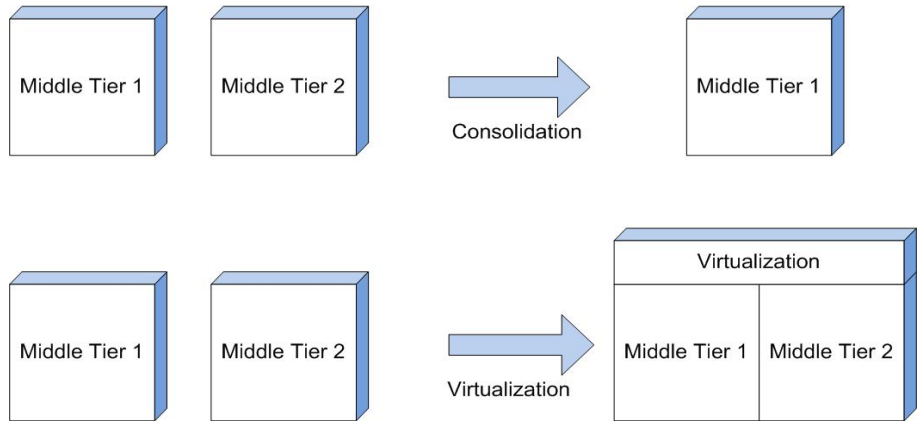- The deployment model chosen by Oracle

SERVER VIRTUALIZATION

Server virtualization enables a single physical server to house multiple operating environments. Virtualization emulates the physical presence of a server so that more than one server, for example a Windows print server and a Linux file server, can be hosted on a single computer. Each of the software server environments is referred to as a virtual machine. Virtual machines are independent operating environments comprised of the underlying operating system and all required server software and data.

Virtual machines appear to the guest operating system as independent systems but are actually simulated by the host system. Virtualization, in effect, decouples software from the hardware on which it runs. As a result, virtualization provides a method for managing systems and resources by function rather than by locations or how they are organized.

Consolidation Versus Virtualization

Sometimes the terms *consolidation* and *virtualization* are used interchangeably because both achieve the same end, but by different means. Virtualization provides a way to retain a function (for example, two middle-tier servers in a test environment) while optimizing the underlying hardware. Consolidation is a process that completely removes the function and the underlying hardware.

Virtualization in Mainframes

Although new to some, virtualization has been part of the IT fabric for many decades. When first introduced in mainframes, it enabled IT managers to:

- More effectively manage computing workloads

- Provide a flexible and reliable testing infrastructure without having to fully duplicate the production environment

- Create elegant ways to optimize uptime by reducing outages due to changes in the physical infrastructure

- Create a separation of workloads that does not compromise security or inject new capital expenditures

Potential

Recent advancements in open source virtualization have created an opportunity to optimize the Oracle On Demand Managed Services Grid and lay a foundation that could materially enhance Oracle's Managed Services. Many such benefits mirror those afforded by the initial mainframe virtualization.

BENEFITS OF VIRTUALIZATION IN ON DEMAND

With virtualization, On Demand customers benefit even further through:

- Simplified solutions;

- Reduced down-time;

- A highly available and serviceable architecture.

Simplified Solutions

The current On Demand policy contains deployment scenarios that require additional physical servers, for example the deployment of a DMZ function or an additional instance. With virtualization, the complexity associated with managing additional servers could be reduced in some cases and in others, may be eliminated altogether. For example:

- A non-production DMZ server could be deployed as a virtual machine and still provide the testing function it serves

- An additional instance could be deployed as a virtual machine in the existing non-production infrastructure

Reduced Downtime

Although it is preferable to avoid it, downtime is sometimes inevitable. These outages are either planned or unplanned and often require recycling physical servers. Each time a server is brought down, it must be brought back up and tested before returning the service to affected customers. After virtualization is in place, fewer physical servers will require restarting, therefore reducing the overall downtime when outages occur. As virtualization evolves, there may be opportunities to reduce, or in some cases eliminate, the downtime required to service a customer.

Maintain High Standards While Optimizing the Infrastructure

Oracle has continually enhanced services by separating and isolating specific functions while providing customers with updated technology. Today, On Demand customers are provisioned on 64-bit Oracle Enterprise Linux systems running dual-core or quad-core servers. These powerful systems—backed by the enterprise-class support of Oracle Unbreakable Linux, enable Oracle to consolidate functions while retaining the integrity of the architecture. Examples include:

- Keeping the same topology between production (PROD) and test (TEST) environments. For example, if multiple middle-tier servers are in production, Oracle can provide multiple virtual machines in the test environment to support proper testing of the multiple middle-tier environments;

- Providing a virtual DMZ in the test environment to support proper testing of external functions;

- Segregating application and database tiers into two separate environments.

INTRODUCING ORACLE VM TO ORACLE ON DEMAND

Oracle is introducing server virtualization within the Oracle On Demand Managed Services Grid with Oracle VM, a new server virtualization product which fully supports both Oracle and non-Oracle applications and offers scalable, low-cost server virtualization that is three times more efficient than competitive products.

Backed by Oracle's world-class support organization, On Demand customers now have a single point of enterprise-class support for their entire virtualization environments, including the Linux operating system, Oracle Database, Fusion Middleware and Application software—all of which are supported with Oracle VM.

Industry-leading partners, including AMD, Dell, Emulex, HP, Intel, Liquid Computing, NetApp, Pillar Data Systems, and QLogic have endorsed Oracle VM. And with this announcement, Oracle is the only software vendor that combines the benefits of server clustering and server virtualization technologies to deliver integrated clustering, virtualization, storage, and management for Grid Computing.

For more information about Oracle VM, visit oracle.com/virtualization.

IMPACT OF VIRTUALIZATION ON THE ITIL FRAMEWORK

ITIL is a framework of best practices approaches intended to facilitate the delivery of high quality IT services. Virtualization is a technology that can be exploited to enhance services provided under the ITIL framework.   These key benefits provide further rationale for Oracle's decision to deploy server virtualization in infrastructure.

Release Management

Traditionally, the server initialization process starts with the "rack-up and power-up" of a physical server and extends to network configuration, software installation, and set-up. Server virtualization enables organizations to manage a pool of pre-configured virtual machines. These virtual machines enable applications to be provisioned by simply pointing to one of these environments, thereby significantly reducing provisioning time.

These virtual machines can be used to provision additional environments while performing multi-phased implementations. A reduced provisioning cycle will result in faster implementations because these additional environments can be provisioned from the same pool of pre-configured virtual machines.

Problem Management

Virtualization provides the ability to copy or make a snapshot of a live instance within minutes. In the event of a software problem, a snapshot of the virtual machine can be taken before the virtual machine is restarted. This snapshot can be used to analyze the problem and test a resolution. This function could reduce the amount of "REFRESH" and the associated latency that it introduces in the problem management flow.

Change Management

Accelerating the change management process is another area where server virtualization can provide new capabilities. By using virtualization, businesses can

create "virtual" test grids where environments can rapidly be provisioned, tests can occur, and results can be cloned back into an existing system.

Capacity Management

Businesses can improve capacity management by creating a "capacity grid" that consists of virtual machines. These virtual machines can be rapidly added to environments during different workload needs. The same capacity grid can be leveraged to alleviate discrete performance issues while the issue is being diagnosed.

DEPLOYMENT OF VIRTUALIZATION IN ON DEMAND

When applied to commodity servers, each type of virtualization has its own set of trade offs and benefits. Oracle is deploying what the industry defines as "hardware virtualization". Oracle chose hardware virtualization because Oracle believes it is the most appropriate technology for the targeted infrastructure. A detailed description of each virtualization method is provided in Appendix A.

In the initial phase of the virtualization rollout, Oracle has opted to implement the virtualization layer solely in servers used for non-production workloads. Oracle has performed extensive tests to determine the impact of virtualization on specific service flows. Although it is possible to deploy many virtual machines on a single physical server, Oracle On Demand has defined configuration standards that specify that only a fixed number of virtual machines will be deployed on a single physical server. Each virtual machine is configured with its own dedicated processor and memory footprint. This deployment model allows proper separation across virtual machines.

From a security standpoint, Oracle On Demand has implemented explicit network virtualization to provide a security level equivalent to physically separated environments. Oracle Corporate Security has certified the deployment model chosen by Oracle On Demand.

SUMMARY

Oracle is providing this document to explain the key drivers around Oracle's decision to deploy Oracle VM in the Oracle On Demand Managed Services Grid. It is Oracle's goal to optimize Oracle infrastructure while delivering customer benefits. Oracle has taken many steps towards this goal, from testing to security validation.

Virtualization goes beyond optimizing infrastructure. Oracle views virtualization as a means to enhance Oracle On Demand services. And with the introduction of Oracle VM, Oracle is now the only software vendor to combine the benefits of server clustering and server virtualization technologies, delivering integrated clustering, virtualization, storage, and management for Grid Computing.

CONTACT ORACLE ON DEMAND

To find out more about how Oracle is implementing server virtualization, see the *Server Virtualization FAQ* or contact your On Demand Service Delivery Manager. To learn more about Oracle On Demand, visit oracle.com/ondemand.

APPENDIX A: VIRTUALIZATION METHODS

Software Level

Server virtualization can be implemented entirely at the software level, where the hardware is fully emulated. This enables the operating systems to run unmodified, but operating system calls to hardware are trapped and simulated by a thick software layer. Typically, performance is relatively poor with this model and driver support is very limited.

Hardware Level

Server virtualization can be implemented at the hardware level, again with an unmodified operating system where a very thin software layer, known as the hypervisor, controls the use of resources. IBM mainframes have long used this model. The industry overall, including processor manufacturers, has placed a lot of emphasis on optimizing virtualization at the hardware level. One of the key benefits of hardware-level virtualization is that applications do not need to be modified or "re-certified"; therefore it is viewed as the least disruptive method.

Operating System Subsets

Another way to implement server virtualization is to create subsets of the operating system. These are not really fully individual virtual machines with their own operating systems, but virtual environments that share some amount of operating system context with each other. Performance is generally better than other methods because a large amount of resources can be shared between environments. However, the operating systems must be heavily modified for this model. Because this model does not create a full virtual server abstraction, creating different environments by creating operating system subsets is not true server virtualization.

Paravirtualization

Server virtualization can also be implemented by a thin paravirtualization software layer, which requires small modifications to the operating system. This layer partitions the physical server into separate areas on which the virtual machines then run. Computing resources from the underlying server are viewed as a pool of resources that can then be shared amongst the virtual machines. With the exception of sharing these computing resources, each virtual machine is independent. Problems with an application on one virtual machine do not affect other virtual machines on the same hardware platform. With paravirtualization, virtual machines are similar to separate physical servers. Each has its own distinct hostnames, IP addresses, and configurations. Each virtual machine is managed independently of the others.

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