

An Oracle White Paper
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Realize the Full Potential of Virtualized Java Applications

*Oracle WebLogic Server on Oracle JRockit Virtual Edition
Oracle Virtual Assembly Builder*

The performance of Oracle WebLogic Server on Oracle JRockit Virtual Edition is 30 percent higher than the same application server running on a guest operating system.

- Oracle benchmark studies

Introduction

Virtualized server environments have proven their ability to reduce costs and increase flexibility by consolidating hardware assets and enabling dynamic provisioning of IT resources. However, many enterprises still follow the same time-consuming practices for installing, configuring and deploying software in virtual machines. Customers who wish to get the most out of their virtualized infrastructures can apply the principles explained in this paper to create a more cost effective and agile infrastructure stack that supports ever-changing business needs. It describes a brand new solution from Oracle that makes running Java applications in a virtualized environment much easier and more practical, accelerating application grid and private cloud deployments without sacrificing performance.

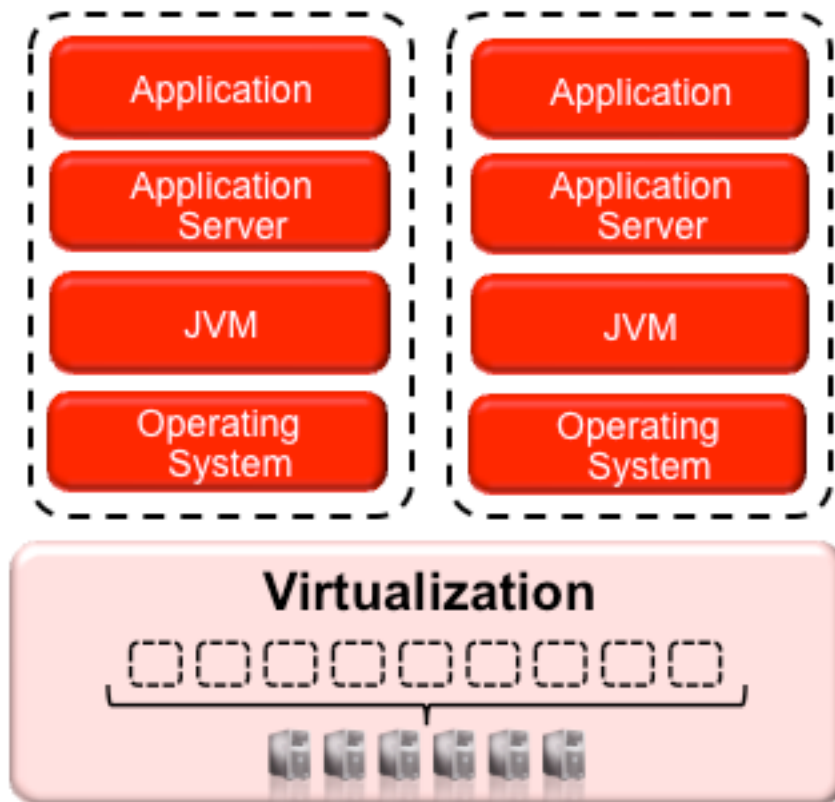
The primary technologies that constitute this solution are Oracle WebLogic Server on Oracle JRockit Virtual Edition and Oracle Virtual Assembly Builder. Oracle WebLogic Server on Oracle JRockit Virtual Edition is an application server designed to run directly on a virtualized server with no operating system, consuming less resources and improving server density. In typical deployments, applications running on Oracle WebLogic Server on Oracle JRockit Virtual Edition show a 30% performance improvement relative to running on top of a guest operating system. Oracle Virtual Assembly Builder automates the analysis, configuration, packaging and deployment of software assemblies in a virtualized environment, reducing the time it takes to deploy those assemblies from weeks to hours. This innovative approach permits IT professionals to easily customize and provision complex enterprise applications in their entirety with a single command onto virtualized and cloud environments. The removal of an operating system as well as the efficient deployment of software assemblies result in superior operational efficiency and agility.

Solving Virtualization Challenges

Virtualization is a term that refers to the abstraction of computer resources, such as when a single computer houses multiple virtual servers or operating environments. Each of the virtual environments is referred to as a virtual machine (VM)—a software implementation of a computer that executes programs like a physical machine. Virtual machines appear to the operating system as independent systems but are actually simulated by the host computer 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 location. It also permits the IT department to reduce overall costs by consolidating hardware and software resources.

While virtualization improves resource utilization, some virtualization solutions are characterized by lower performance, complex configurations and tedious administration. Packaged virtualization solutions offer little flexibility for reconfiguring Java resources and applications, forcing the IT department to devise ad hoc methods for customizing hostnames and other parameters in the target virtual machine environments. Moreover, despite its increasing popularity, most virtual machines are still configured similar to physically configured servers—with all the management and administration challenges typically associated with non-virtualized environments.



VIRTUALIZATION PROMISES GREATER CONSOLIDATION AND RESOURCE CONTROL BUT OFTEN AT THE EXPENSE OF LOWER PERFORMANCE AND INCREASED ADMINISTRATION DUE TO THE COMPLEXITY OF THE ASSOCIATED TECHNOLOGY STACK.

At a macro level, the goal when creating a virtualized infrastructure is easy to see: to decrease complexity and increase efficiency at the hardware layer by manipulating virtual machines rather than physical ones. However, in most of these virtual environments, provisioning multi-tier application environments remains a complicated and time-consuming task. The software applications associated with these virtualized hardware environments are comprised of many distributed entities, each with a custom-configured stack that includes an operating system, application server environment, database environment, web server environment and other related services. Deploying these applications on virtualized resources may reduce long-term costs, but in the short term it typically involves configuring the operating system and all the software multiple times—a tedious and repetitive chore that is counter-productive to overall IT efficiency.

Strengthening Oracle Application Grid with New Virtualization Offerings

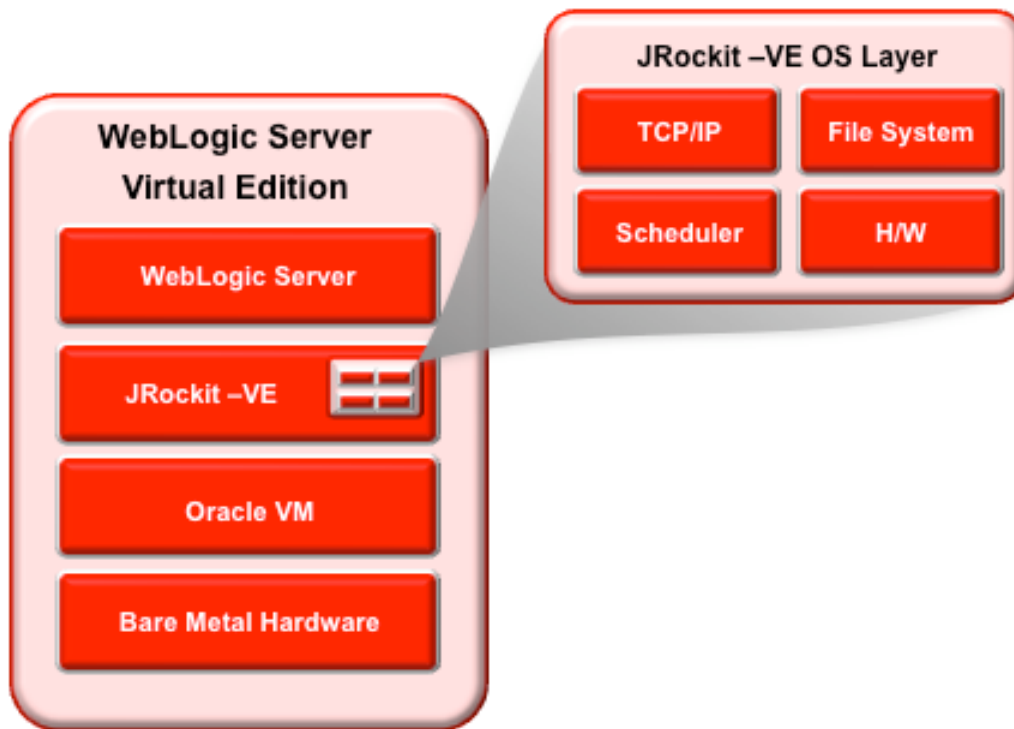
In conjunction with virtualized IT environments, many Oracle customers are leveraging an IT concept called *application grid*, which creates a Java middleware infrastructure beneath the enterprise applications to pool and dynamically provision the resources on which those applications run. These middleware grid deployments bring the same type of efficiency, scalability and quality of service to the application layer that database grids bring to the database layer. They enable application server instances and related Java resources to work together for more efficient capacity planning, utilization and scaling.

Oracle WebLogic Server on Oracle JRockit Virtual Edition and Virtual Assembly Builder streamline the creation, deployment and management of application grid environments by enabling system administrators to pool and allocate the runtime infrastructure that supports enterprise applications, such as Java application servers and transaction processing systems. These products also resolve significant virtualization issues related to performance, flexibility, and operational complexity, paving the way for a more efficient and sustainable middleware infrastructure.

Introducing Oracle WebLogic Server on Oracle JRockit Virtual Edition

Oracle WebLogic Server on Oracle JRockit Virtual Edition is a pre-configured software appliance optimized to run Java applications without an operating system (OS). Designed to run directly on a server virtualized with Oracle VM, it significantly improves the performance and decreases the complexity of virtualized environments. In place of an operating system, Oracle WebLogic Server on Oracle JRockit Virtual Edition uses a modified JRockit Java Virtual Machine that runs directly on the Oracle VM's hypervisor.

Removing the OS creates a substantially smaller disk footprint for the appliance. These software appliances are easier to create and configure since there is no OS to worry about. They offer “near-native” performance (meaning nearly comparable to a physical machine) since they have lower processing overhead. They are easier to deploy since a much smaller image is transmitted to, and started on, the virtual server. They are faster to live-migrate since there are fewer bits to transfer. They are easier to administer because there is no OS to patch and upgrade. And they are more secure since there is no OS to breach.



ORACLE WEBLOGIC SERVER ON ORACLE JROCKIT VIRTUAL EDITION ELIMINATES THE OS FROM APPLIANCES FOR GREATER AGILITY.

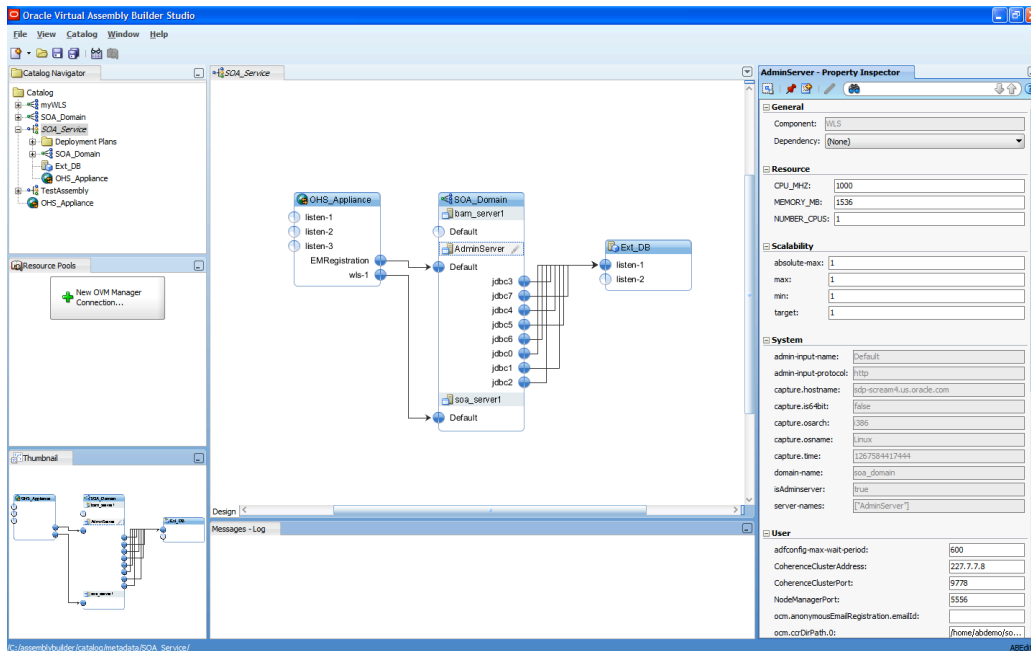
As we shall see in the remainder of this paper, Oracle WebLogic Server on Oracle JRockit Virtual Edition unlocks the full potential of server virtualization for Enterprise Java Applications by improving performance, bolstering security and simplifying development, deployment and management tasks. According to Oracle benchmarks, the performance of Oracle WebLogic Server on Oracle JRockit Virtual Edition is 30 percent higher than the same application server running on a typical guest operating system. .

Introducing Oracle Virtual Assembly Builder

Oracle Virtual Assembly Builder is a graphical tool that lets application administrators quickly create and configure entire multi-tier application topologies and provision them onto virtualized resources. It enables these IT professionals to take multi-tier enterprise applications—for example, a web server, application server and database—and package them into self-contained, single-purpose virtual machines called software *appliances*. Going further, Virtual Assembly Builder structures the process of combining these appliances into cohesive, reusable units known as *assemblies*. It makes the necessary connections between these appliances and then deploys the entire assembly—which comprises the complete multi-tier application—as a single unit. When that assembly is deployed, the components are configured automatically.

For example, using the Oracle VM virtualization environment, a customer could deploy an entire assembly onto a virtual infrastructure with all connections and configurations intact,

scaled to the requisite size for the needs of the application. This unique solution helps enterprises fulfill the goals of fast deployment and operational agility.



VIRTUAL ASSEMBLY BUILDER SIMPLIFIES DEPLOYMENT AND MANAGEMENT OF VIRTUAL SOFTWARE APPLIANCES.

Virtual Assembly Builder includes the following product components:

Introspector: an introspection tool that allows users to capture the configuration and assets of an existing multi-tier enterprise applications and produce the equivalent assembly and appliance metadata.

Assembly Editor: a metadata editing tool that allows users to create a new assembly from any existing appliances or assemblies and to change their properties by manipulating the appliance or assembly metadata.

Template Creator: A tool that creates the necessary Oracle VM disk images and configurations of the introspected system into deployable artifacts for every appliance within an assembly. (This process is called *packaging*.)

Deployer: a deployment tool that allows users to instantiate a complete assembly with all the appliances provisioned on a resource pool of virtualized servers and configured to connect with each other automatically.

An assembly is simply a collection of interrelated software appliances that are automatically configured upon deployment. Assemblies are typically deployed onto a set of virtualized hardware resources to ensure high levels of hardware utilization and efficiency.

Oracle VM Server Virtualization

Oracle VM server virtualization makes enterprise software easier to deploy, manage and support. Backed by Oracle's worldwide, 24x7 support, and full certification with all Oracle software, Oracle VM offers IT efficiency and agility with scalable, efficient and cost-effective virtualization technology. Oracle VM is available as a free download ([link to edelivery.oracle.com/oraclevm](http://edelivery.oracle.com/oraclevm)).

Consisting of open source server software and an integrated Web browser-based management console, Oracle VM provides an easy-to-use graphical interface for creating and managing virtual server pools, running on x86 and x86-64-based systems, across an enterprise. Users can create and manage Virtual Machines (VMs) that exist on the same physical server but behave like independent physical servers. Each virtual machine created with Oracle VM has its own virtual CPUs, network interfaces, storage and operating system. With Oracle VM, users have an easy-to-use browser-based tool for creating, cloning, sharing, configuring, booting and live migrating virtual machines.

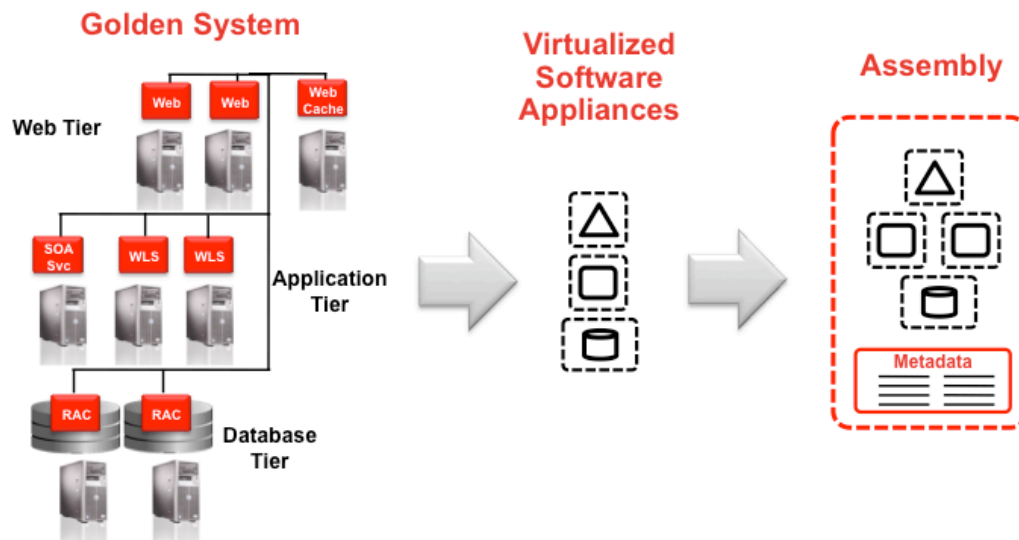
A Powerful Solution

Running on Oracle VM, Oracle WebLogic Server on Oracle JRockit Virtual Edition creates a powerful runtime environment for Java EE applications. Virtual Assembly Builder adds automated packaging, configuration, and provisioning tools to create a virtualization solution that reduces operational complexity. Let's take a closer look at how these tools work together in practice.

Most enterprise applications aren't single, self-contained entities that run on a single physical server, but rather a composite of many different entities distributed across different machines. Every time developers build such an application they have to re-create a large portion of that topology, which entails repeatedly provisioning the operating system, web server, application server and database. Only after this infrastructure foundation is in place can they add the specific modules unique to the application at hand. Virtual Assembly Builder simplifies this process by "packaging up" multi-tier, distributed applications into reusable appliances and assemblies.

Virtual Assembly Builder automates the configuration and deployment of these complex topologies, simplifying WebLogic Server development activities. Users use it to assemble multi-tier application topologies from existing appliances or "building blocks" as well as to customize configuration parameters on these appliances prior to deployment.

In practice, Virtual Assembly Builder gives administrators two primary options: they can start with general-purpose software appliances representing the various components in an application topology or they can capture the configuration of a "golden" application environment and package all of its components into a collection of customized software appliances.



BY STARTING WITH ASSEMBLIES, APPLICATION BUILDERS CAN AVOID TEDIOUS TOPOLOGY-BUILDING EXERCISES AND CONCENTRATE ON THE UNIQUE APPLICATION CODE THEY WISH TO DEPLOY.

A Foundation for Platform as a Service (PaaS) and Private Clouds

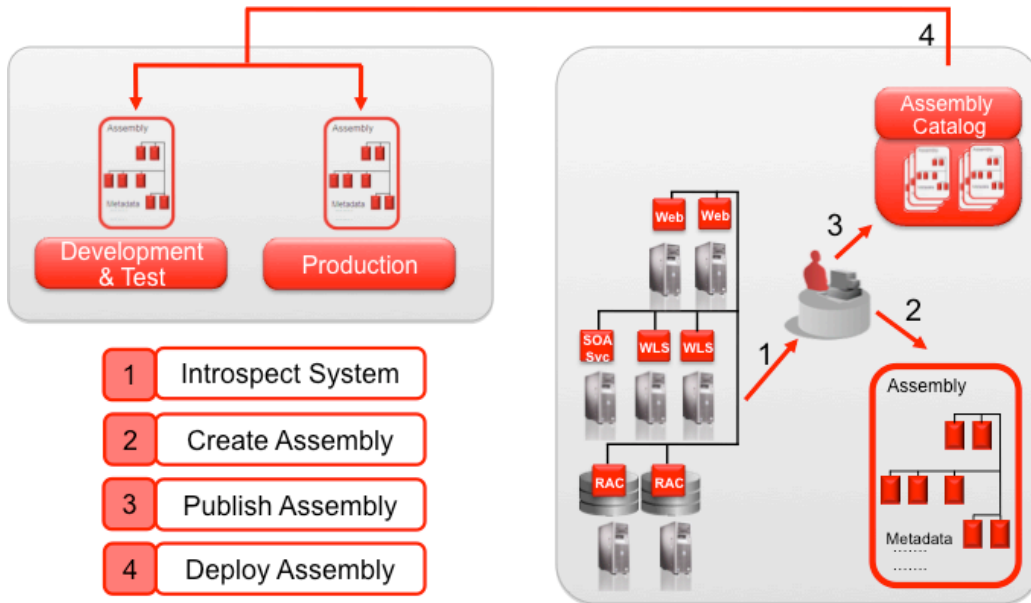
Cloud computing is a model for enabling convenient, on-demand access to a shared pool of configurable computing resources that can be rapidly provisioned and released with minimal effort from the IT department or a service provider. Many enterprises prefer private clouds that are operated solely for their organization, either by the IT department or by a third-party, and either on premise or off premise. As described in other white papers, Oracle provides the tools and software infrastructure that allow customers to build their own private Infrastructure as a Service (IaaS) and Platform as a Service (PaaS) cloud environments.

Virtual Assembly Builder is a powerful way to build and deploy these private cloud services. As we've seen, many applications have a similar topology, with a couple of Web servers on the front end, a cluster of application servers running the core logic, and a cluster of database servers managing the data. Whenever developers construct an application like this they have to recreate much of that topology and then add the specific modules that are unique to their specific application requirements. Previously assembling the common elements of the topology into a pre-built assembly enables developers and application builders to simply add their unique application code and then deploy the finished product.

The progression is typically as follows. First the IT department defines standardized appliances and assemblies that include the necessary services, processes and user interface components. They also create a self-service application or portal as an interface to procuring these IT resources. Many companies use Oracle WebCenter to create the self-service portal and Oracle Identity Management Suite to define roles and access requirements. Application owners utilize this infrastructure to login to the portal, request resources and assemble applications. Depending on their role, some users can provision IT resources directly and others must route their requests to management for approval, just like in a traditional server procurement process.

Once the application is in production, the application owner can monitor actual resource usage based on demands. If the application starts to approach the capacity limits, the system can be

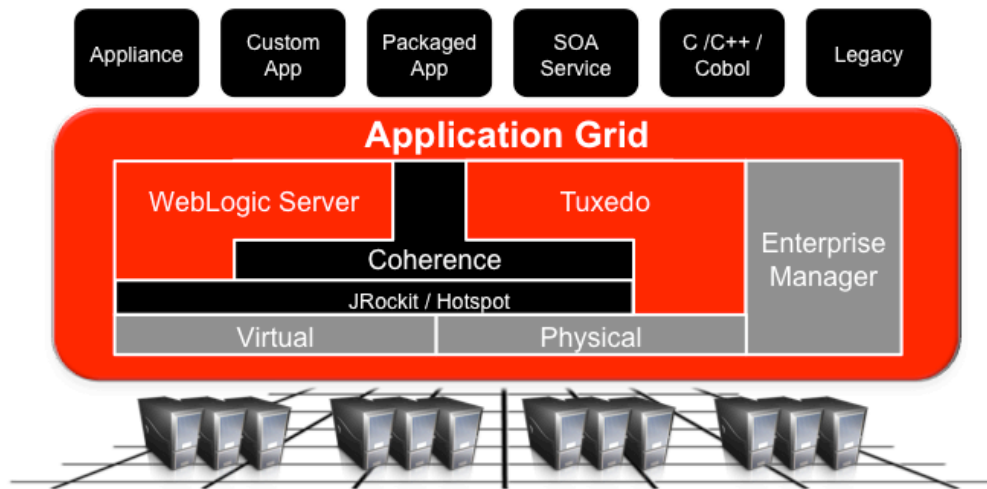
set to scale the back-end resources automatically, thanks to the underlying grid architecture at the database and middleware levels, in conjunction with Oracle Enterprise Manager Grid Control. Oracle Enterprise Manager also tracks resource usage – a process called metering. This data can be used to charge back to the departments or lines of business.



ENABLING SELF-SUFFICIENCY FOR CONSUMERS IN A PRIVATE CLOUD ENVIRONMENT.

Assembling Components in an Application Grid

Application grid environments enable system administrators to pool and allocate the runtime infrastructure that supports enterprise applications, such as Java application servers and transaction processing systems. Just as an application grid provides a shared, dynamically allocated pool of middleware resources for a given set of applications, the components that form the application grid can be packaged up as appliances and deployed in a virtualized environment. As appliances proliferate, Virtual Assembly Builder makes it easier to create and configure these virtualized environments as a precursor to a more dynamic IT operation.



APPLICATION GRID IS A FOUNDATION FOR SHARED MIDDLEWARE RESOURCES THAT CAN BE DYNAMICALLY SCALED.

When it comes to adding new components to an application grid environment, Virtual Assembly Builder simplifies that task for administrators because they no longer have to manually install, configure and wire it all together. Both computing paradigms work towards a similar goal: a virtual infrastructure that can be dynamically configured, provisioned and scaled.

Oracle WebLogic Server on Oracle JRockit Virtual Edition and Private Clouds

Another important attribute of today's cloud models is on-demand self-service, which permits IT "consumers" to provision computing capabilities without interacting with a system administrator. Oracle WebLogic Server on Oracle JRockit Virtual Edition appliances are particularly useful in a PaaS setting since the IT department can create preconfigured application server appliances as a basis for applications to be created by departmental application owners. Departmental users simply add the Java code and other modules that constitute the individual application and then deploy the appliance with these additions.

This self-service model can easily evolve into a pay-per-use environment, similar to Amazon Web Services. A user would simply visit an employee portal and make a request for a virtual machine with a certain amount of CPU, memory and disk capacity, pick a VM image for the database or middleware and click "submit." The resources will be provisioned in a matter of minutes. Once the consumer deploys the application, policy-based resource management capabilities automatically make capacity adjustments, and the employee's business unit gets an internal charge every month based on how much IT resources they consume.

These cloud environments follow a natural evolution. Oracle customers often begin with a grid or virtualized environment as they move from using dedicated, physical resources for each application to a virtual environment with shared services, dynamic provisioning and standardized configurations or appliances.

Case in Point: Global Investment Bank

Challenge:

- **“Server sprawl” – a heterogeneous environment with multiple versions of servers**
- **Lack of standardization at higher layers – each application needed to organize component providers and related SLAs**
- **Systematic component patching was a major challenge, with developer support constantly needed for production applications**
- **Audit and regulatory compliancy requirements required constant resource monitoring and control**

Solution:

- **The bank built a self-service platform for provisioning application servers based on Oracle WebLogic Server**
- **It is characterized by shared services and dynamic resource provisioning**
- **Standardized operating procedures and support tasks automate routine management**
- **The new IT environment embodies a Platform as a Service (PaaS) cloud architecture**

Results:

- **Centralized and rapid deployment of more than 200 applications**
- **A 35% reduction in operating costs**
- **Consolidated from 2,800 to 400 servers**
- **Avoided power consumption increase of 44% over four years while doubling IT capacity**
- **No downtime incidents in three years**
- **Security governance changes now implemented in two nights instead of three months**

Automating the Lifecycle: Deployment and Management

Managing Assemblies and Appliances

In simple terms, an assembly consists of two or more appliances, plus configuration metadata in a standardized format. The metadata contains:

- Configuration of internal wiring and external dependencies
- Information about appliance boot order and dynamic startup parameters
- Number of appliance instances to be started upon deployment

Prior to deployment, users can view all configurable properties for the appliances and create their own customized deployment plans for the assemblies using Virtual Assembly Builder Studio.

Once deployed, administrators can continue to use existing management tools such as Oracle WebLogic Server Console and Oracle Fusion Middleware Control to monitor and manage application components within the middleware appliances, and Oracle Enterprise Manager Grid Control for end-to-end performance management, enforcing Service Level Agreements (SLA) and ensuring application resilience.

Conclusion

Designed to run directly on a server virtualized with Oracle VM with no guest operating system, Oracle WebLogic Server on Oracle JRockit Virtual Edition enables a ready-to-run platform for Enterprise Java Applications. Because they are optimized for virtualized environments, these applications consume less resources and perform better at runtime. In addition, Virtual Assembly Builder provides the ability to quickly package and configure custom appliances and establish relationships between them to create assemblies representing the entire multi-tier application. Virtual Assembly Builder enables users to take these assemblies and use them as reference blueprints to configure and repeatedly deploy customized instances into virtual environments—improving flexibility for the business and reducing turnaround time and management challenges for IT.

Today's application infrastructure is way too complex, with multiple independent layers of software that require installation, configuration, updating and management. Starting with appliances and assemblies avoids tedious topology-building exercises and lets application builders concentrate on the unique aspects of each application. There is less development, configuration and testing required, which removes a great deal of time and risk from the application development and deployment process.

In summary, the Oracle solution described here helps enterprises realize the full potential of their virtualized infrastructure and Enterprise Java applications, with near-native performance, operational agility and efficiency, and ultra-fast deployment capabilities.



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