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Oracle VM 3: Enabling Rapid Migration to a Private Cloud Environment

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Introduction

The intended audience for this white paper is Oracle Applications administrators and application architects interested in learning how an Oracle Applications-driven architecture can help accelerate private cloud deployments. This white paper explains how to deploy complex Oracle Applications in a few hours rather than in weeks, while still allowing customization to suit the unique requirements of the particular deployment, and how to migrate a full application stack into a private cloud environment by using Oracle VM Templates and Oracle VM Server.

Traditional data centers are typically fragmented environments, with various applications installed on different types of operating systems, often running on specialized hardware. Server virtualization is the first step to simplify this, but typically application deployment this is still done the old-fashioned way, meaning applications are installed and configured manually. This is not only a time-consuming process: it's also error-prone.

Multitier enterprise applications are increasingly being deployed in private cloud environments to realize the benefits of consolidation, flexibility, and reduced deployment time. However, as mentioned, administrators still follow the same time-consuming practices for installing, configuring, and deploying all software (operating system, database, middleware, applications, and so on) in virtual machines (VMs) that have traditionally been prescribed for physical environments.

When migrating enterprise applications to a private cloud, a new approach is required. Software components must be standardized and preconfigured in the form of software appliances to be rapidly deployed. These appliances must be easily customizable to suit the unique requirements of the particular deployment.

With Oracle VM Templates and the latest features that are available with Oracle VM 3.4, Oracle offers a new approach by uniquely combining all the capabilities necessary to enable this transformation.

Application Deployment with Oracle VM Templates

Using Oracle VM Templates is an innovative approach to deploying a fully configured software stack by offering preinstalled and preconfigured software images. Oracle VM Templates eliminate installation and configuration costs and reduce ongoing maintenance costs, helping organizations achieve faster time to market and lower cost of operations. Oracle VM Templates are part of key Oracle products that are available for download, including Oracle Linux, Oracle Solaris, Oracle Database, Oracle Fusion Middleware, and many more.

The Oracle VM Guest Additions feature was introduced with Oracle VM 3 and allows the virtual machine software to pass information back and forth through Oracle VM Manager to a VM, thus providing direct integration between guest software and the virtualization layer to assist in the orchestration of complex, multi-VM deployments.

So how does this work in practice? The rest of this chapter will focus on the key components of Oracle VM Templates, how they can be downloaded and deployed, and how they can be customized.

Under the Hood: Key Components of an Oracle VM Template

An Oracle VM Template contains various components such as the VM configuration information, virtual disks that contain the operating system, and any application software. These components are packaged together as an Oracle VM Template file. Older Oracle VM Template files were packaged as compressed tgz files. More-recent Oracle VM Templates are packaged as an ova (Open Virtualization Archive) file according to the industry-standard Open Virtualization Format (OVF) standard from the Distributed Management Task Force (DMTF). The OVF standard provides the industry with a standard packaging format for software solutions based on virtual systems, solving critical business needs for software vendors and cloud computing service providers.

In order to get a complete understanding of the capabilities of Oracle VM Templates, let's look first at the first-generation (tgz) Oracle VM Templates. The first-generation Oracle VM Templates available from the Oracle Software Delivery Cloud site all have the following components in common:

» Each has one or more VM images. For example, your template might simply contain a single VM with your standard OS build, or, if it is a more-complex composite application, it might contain several different VMs with many products. For example, it might include a VM for the web server, a VM for the app server, a third VM for the database, and so on.

» Each VM in-turn includes a minimum of two or three files:

   » A binary system.img file containing the disk image with the boot OS.

   » Optionally, a binary file that is a disk image containing Oracle or other third-party software that is not a part of the OS. Often, this is dictated by software licensing. For example, Oracle Linux is under a GPL license while other software might be under a proprietary license and, thus, it might be desirable to separate non-GPL software onto a different disk from the disk containing software under a proprietary license.

   » A configuration text file called the vm.cfg file, which contains the configuration parameters for that VM.

» For each VM in the template, there are also typically two or more script files:

   » One script to perform a one-time configuration of the OS the first time the VM is booted. This can be used to interactively customize or set network parameters based on the environment for that VM, for example, to set up DHCP or static IP address and related parameters.

   » One or more scripts to configure the Oracle, or other, products at first boot of the VM. If there are multiple products to be configured in the same VM, it is at the developer's discretion as to whether there will be one script per product or a single combined script. Again, this script can prompt the administrator to configure parameters for that particular VM in that particular environment.

All of the above files were packaged together in a compressed archive file (a tgz file) that represented the Oracle VM Template for that product or solution. This archive file was then downloaded and imported into Oracle VM as a VM Template (see Figure 1) to be used as the basis for creating guest VMs.
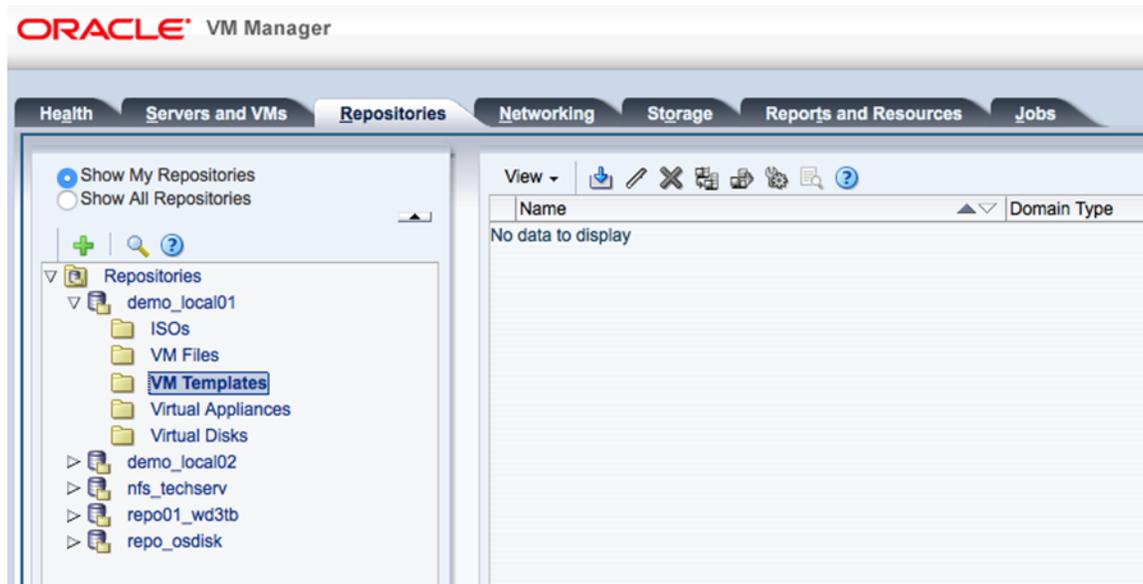
Figure 1: Import of first-generation Oracle VM Templates

As mentioned, newer Oracle VM Templates are OVF-compliant. Their content is similar to the content outlined above with the differences being there is no vm.cfg file and there is an OVF descriptor file that contains metadata about the package and its contents. This descriptor file is an extensible XML document for encoding information such as product details, virtual hardware requirements, and licensing. In addition to the OVF descriptor file, there are one or more disk image files and a manifest (mf) file, which contains SHA1 or SHA2 digests of the OVF file and the disk image files. These files are packaged together in a compressed archive file (an ova file). OVA is also the format used by Oracle VM 3.4 to export and import appliances and templates, as we will see later on.

How Can You Use Oracle VM Templates?

Downloading and Importing Templates to Create Guest VMs

Oracle VM Templates are available for many key Oracle products, and these can be downloaded from the Oracle Software Delivery Cloud. After downloading a template file, you need to unzip (uncompress) the file. Depending on whether it is an older or newer template, you get a tgz file or an ova file.

A tgz file can be directly imported into Oracle VM Manager as a template, while an ova file is interpreted as a virtual appliance. Once an ova file is imported, you have the option to evaluate which of the VMs that are part of the ova file will be created. The ova file will remain part of your repository, and you will have the option to create more VMs using it.

To import a template (tgz file) using Oracle VM 3.4, do the following:

1. Click the **Repositories** tab in Oracle VM Manager.

2. Select the Repository in which to store the template.

3. Select **VM Templates** in the navigation tree and select **Import VM Template** in the toolbar of the management pane.

The VM Template wizard will start guiding you through the import process.

To import a virtual appliance (ova file) and create one or more VMs out of it using Oracle VM 3.4, do the following:

1. Click the **Repositories** tab in Oracle VM Manager.

2. Select the Repository in which to store the virtual appliance.

3. Select **Virtual Appliances** in the navigation tree and select **Import Virtual Appliance** in the toolbar of the management pane.

The VM Virtual Appliance wizard will start guiding you through the import process.

4. Once the virtual appliance has been imported, you can easily create VMs from it by selecting the imported ova file and selecting **Create Virtual Machine** in the toolbar of the management pane.
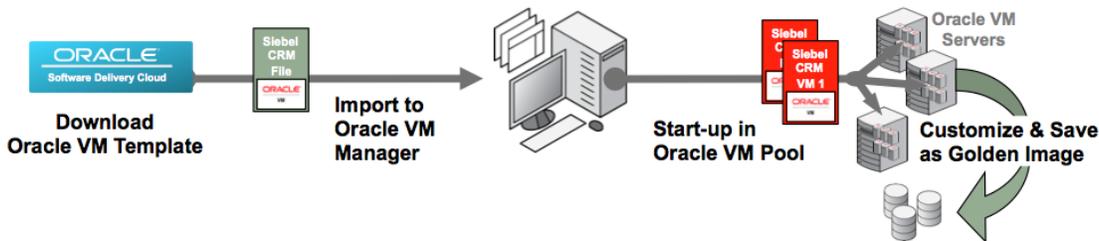
Figure 2. Downloading and deploying Oracle VM Templates from Oracle Software Delivery Cloud

Performing Initial VM Creation and Configuration

Creating VMs from templates or virtual appliances is very straightforward, because the VM creation wizard initiated from the **Servers and VMs** tab in the Oracle VM Manager UI walks you through the steps. Simply select one of the two different options available to clone a VM from an existing Oracle VM Template or from an existing virtual appliance. Then follow the steps that are presented by the wizard.

Figure 3. Creating VMs from templates or virtual appliances

Note that the creation process might take some time depending on the size of the VM in the template and the speed of your pool storage, because the image files are cloned between directories as part of the creation process. This is done so that the original template images remain as pristine source images in one location, while the created VM can then be customized in another location without overwriting the source. However, if you wish to make changes and save those changes to the original template itself, that can be done using the **Save As Template** option described in this white paper: "Oracle VM 3: Oracle VM Templates Automated Virtual Machine Provisioning."

Starting a VM Created from a Template

Once a VM is created, it is associated with the Oracle VM Server with most available resources in the server pool, and its status is "Stopped." When you start the VM, Oracle VM Manager places the VM either on the current Server or on the "best" Server, meaning the Server that has the most available resources at that time. This VM start policy can be generally configured for a pool and also overruled for an individual VM. In addition to these VM start policies, you also have the option to create antiaffinity groups to specify, for example, that specific VMs should never run on the same Server. If a VM was created from a virtual appliance, you'll find it associated to the Oracle VM pool itself.

To start a VM, from the Servers and VMs page, select the VM and click **Start** in the toolbar of the management pane. As was discussed briefly earlier, a VM created from a template will execute any one-time OS configuration and product configuration scripts upon its first boot. Not all templates require a power-on configuration—it depends on what products are contained in the template—so a given template might boot normally without any prompting at all.

For scripts that contain user prompts to ask you to enter information, you can easily access the VM console from Oracle VM Manager to respond to the prompts to fully configure the VM and permit the boot cycle to complete. To access the console, select the VM in Oracle VM Manager and click the **Launch Console** button in the toolbar of the management pane.

Once the console is available, you might be prompted for a range of information. Typically, you will be prompted regarding the desired network configuration (DHCP or static) and possibly for other information depending on the products contained in the template, for example, information such as host names, other account passwords, or other information necessary to fully configure the contained products. Once the information has been provided, the VM might need to restart for the changes to take effect.

Tip: The password for the root user of all Oracle VM Templates is `ovsroot`.

Customizing Templates to Create "Golden Images"

By their nature, Oracle VM Templates reflect the general best practices for the products they contain, but any one configuration cannot cover all scenarios, especially in complex, enterprise environments. As a result, you might wish to update a template and then save those changes in your template's VMs, so that any future VMs created from that template would automatically reflect those customizations. This can be easily done by making the changes and then cloning the template.

Oracle VM Manager also allows you to modify a template (the amount of memory, the number of processors, and so on) and define "clone customizers" to specify storage and network mappings. For more details about this, consult the *Oracle VM Manager User's Guide*.

You can find details related to template configuration in this Oracle VM white paper: "Oracle VM 3: Oracle VM Templates Automated Virtual Machine Provisioning."

What Are the Benefits of Oracle VM Templates?

Faster Application Deployment, Lower Cost

Oracle VM eliminates wasted time and expense by providing the ability to rapidly and easily deploy a prebuilt, preconfigured, prepatched guest VM (or multiple VMs, depending on the application) in the form of an Oracle VM Template or virtual appliance. Templates and virtual appliances can contain a complete Oracle software solution, such as Oracle's Siebel Customer Relationship Management (Siebel CRM) or JD Edwards EnterpriseOne solutions, including the operating system (Oracle Linux) and even your internally developed or third-party software. Oracle VM offers a complete solution, ready to start up.

Oracle VM Templates produced by Oracle are available from Oracle Software Delivery Cloud, while templates developed by third parties are made available via those parties' corresponding channels and are ready to download and start up in an Oracle VM infrastructure. Oracle VM Templates are already licensed for production use, so they can save you days or weeks, because you don't have to learn to install and configure a sophisticated product such as Oracle Enterprise Manager Cloud Control 13*c* or Oracle Real Application Clusters 12*c*.

Instead, you can focus on simply downloading and starting a VM to begin using a product right away. And you can have confidence that the product is deploying an exact, validated copy of the VM, not a VM built from scratch that might contain a human error, such as missing a patch dependency or a misconfigured parameter.

Easy Maintenance and Customization

While Oracle VM Templates are prebuilt to reflect the best practices for the included products, you might still want to tailor the solution to your particular environment. VMs created from Oracle VM Templates are still fully user-accessible and directly customizable in your environment. Some software appliance packaging tools create only a "black box" VM that cannot be directly modified by users once it is deployed, creating an inflexible environment and necessitating new change request or implementation processes. Oracle VM Templates, however, can be fully customized or tuned after installation and then saved again as "golden image" templates to serve as a user's enterprise deployment standard to minimize risks and variation across multiple-instance deployments in the enterprise.

Full Support for Production Deployments

Within Oracle VM Templates, Oracle software is laid out in the same manner as the software would be if it were installed and patched manually "the old fashioned way," meaning the exact same directories and Oracle "homes" are used, and the package and patch inventories are completely standard. Oracle VM Templates are fully supported for production environments.

A Test Validation Illustrating the Benefits of Oracle VM Templates

To illustrate how much easier and faster deployment is with Oracle VM Templates, this section refers to a test validation done by the Evaluator Group.

The Evaluator Group assessed Oracle VM with Oracle Real Application Clusters (Oracle RAC) and Oracle E-Business Suite. There were two deployment scenarios: Oracle VM and VMware vSphere two-node cluster environments. They concluded deploying Oracle VM Templates for Oracle RAC and Oracle E-Business Suite with Oracle VM was much faster than deploying into a VMware vSphere virtualized environment installing the same applications with a traditional rapid installer on a two-node cluster. Each template prompts for configuration information (for example, node names, IP addresses, and so on), and the template does the rest in less than half a day.

The Oracle RAC template automatically provides a two-node cluster with the ability to add additional nodes. Oracle E-Business Suite was just as easy to install by filling out a few questions for the application database and application server, and it was installed in less than three hours. On the VMware vSphere platform, the installation of Oracle RAC took almost 40 hours (10 times longer), and the installation of Oracle E-Business Suite took 15 hours and 15 minutes (almost 7 times longer).

They also noted that Oracle VM Templates are different from how VMware offers templates. Oracle VM Templates are prebuilt, preconfigured, pretested, and ready for deployment once downloaded. VMware templates require end users to manually install the application on a guest OS and then—through scripts, tools, and cloning—generate their own VMware template. Then, that clone can be customized for new VMs.

For more details, consult the Test Report page.

You can evaluate the same model in a demo environment, thanks to the Oracle VM hands-on labs available at http://www.oracle.com/technetwork/server-storage/vm/downloads/hol-oraclevm-2368799.html.

Oracle VM 3.4 New Features

Oracle VM 3.4, Oracle's latest server virtualization product release, introduced a huge list of new enhancements and features. Among them, we can find one important feature related to the Open Virtualization Archive (OVA) format.

Exporting VMs to OVA Format

Oracle VM 3.4 introduces a feature for exporting one or more VMs into one single ova file. This feature allows you to prepare, package, and export multitier applications on Oracle VM.

Once exported, a virtual appliance can be reused on additional Oracle VM environments or, for example, imported into Oracle VM VirtualBox for development or test purposes.

Creating and Exporting a Virtual Appliance with Oracle VM 3.4

Capturing and deploying an entire multitier application topology takes only three steps:

1. Define the architecture and prepare the VMs to be exported.

Starting from existing Oracle VM Templates or virtual appliances, you can prepare and define your custom architecture composed of, for example, one database server, one application server, and one web server.

One of the tasks is to enable the Oracle VM daemon (ovmd) on these VMs before stopping them. Further details on this procedure can be found here.

2. Export the VMs to standard OVA format using Oracle VM Manager 3.4.

Once Step 1 has been completed and all VMs, the target of your architecture, have been shut down, you can proceed to export them into one single ova file.

This operation is pretty easy and can be completed in the **Servers and VMs** tab of Oracle VM Manager; just select your VMs, right-click, and then select **Export to Virtual Appliance**.
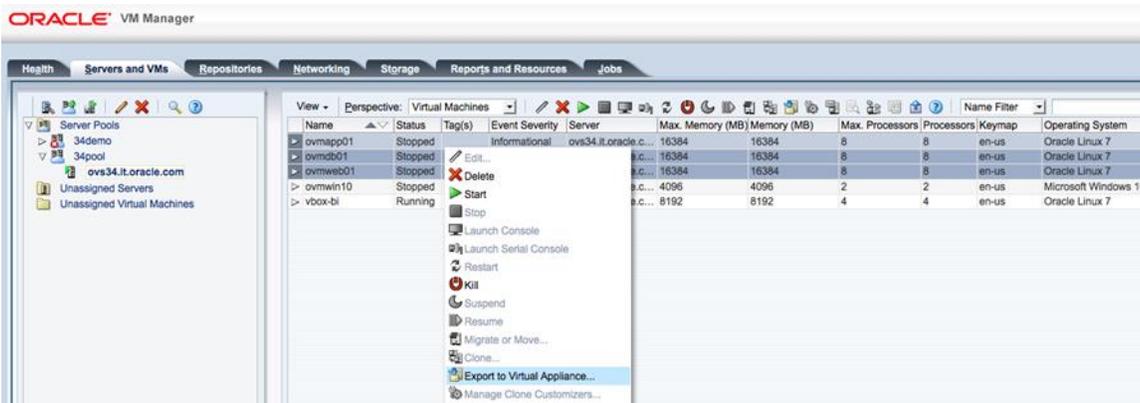
Figure 1. Exporting VMs to a virtual appliance

Enter a name for the virtual appliance, and select which Oracle VM Repository will host your OVA file.
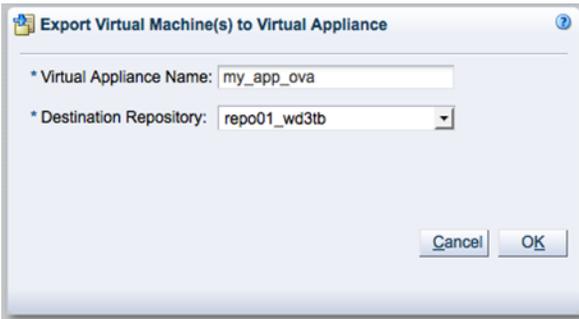
Figure 5. Choose a name for the virtual appliance and the target destination

Then an Oracle VM Manager job will start and you can see all the details:
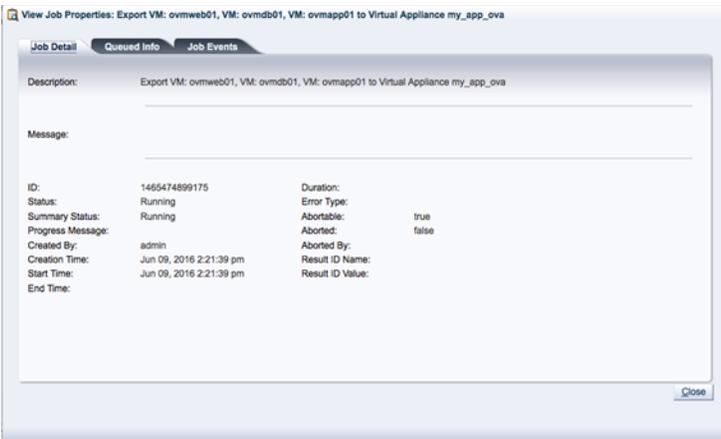
Figure 6. Export job progress and details

Once completed, you'll find your ova file in the repository you selected. You can identify the virtual appliance in the **Repositories** tab of Oracle VM Manager (see the "ID" column).
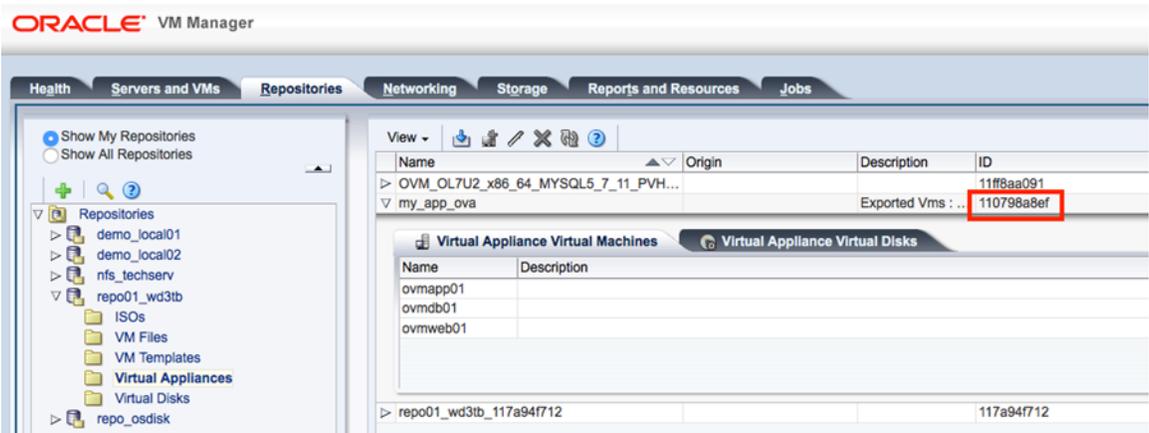
Figure 7. Virtual appliance details shown in Oracle VM Manager

In addition, you can get details for the virtual appliance in Oracle VM Server (the ID can help you identify it):
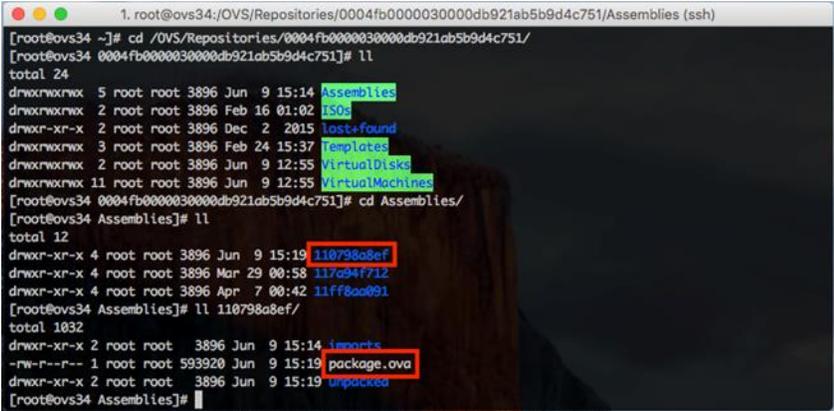
Figure 8. Virtual appliance details provided by Oracle VM Server

3. Make the virtual appliance available for further Oracle VM or Oracle VM VirtualBox environments.

Once exported, this appliance can be immediately used to deploy further architectures in the Oracle VM pool where it has been created. If you want to share the appliance with other systems or get the appliance in your Oracle VM VirtualBox environment, you have two options:

» Option 1: Export the Oracle VM Repository as one NFS share.

This NFS share can be mounted by an external system and the ova file copied. Sharing one repository is pretty simple through Oracle VM Manager: on the **Servers and VMs** tab, choose your Oracle VM Server, selecting **Repository Exports** in the Perspective list, and click **OK**.
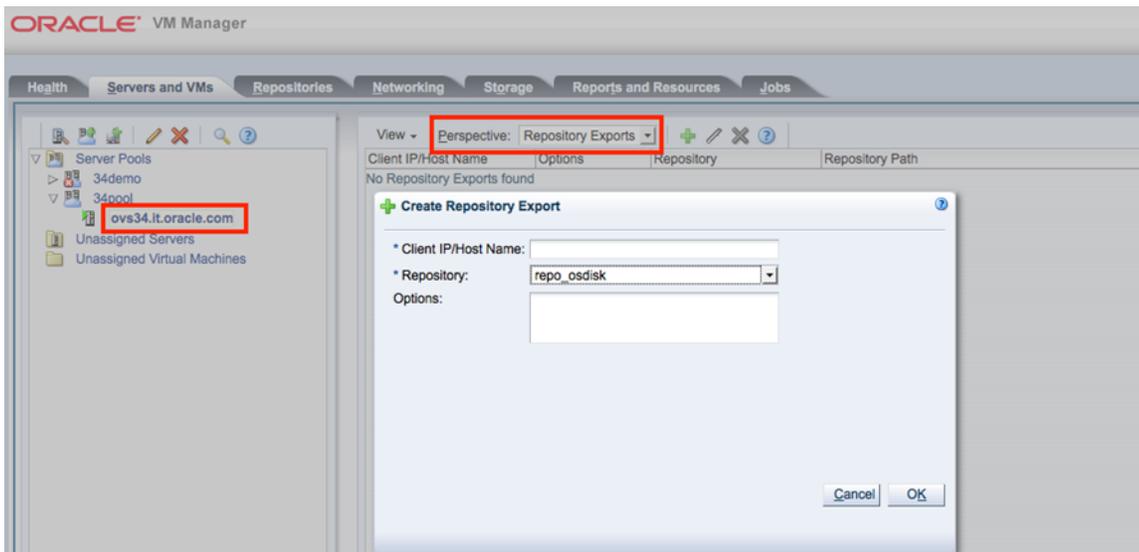
Figure 9. Export an Oracle VM Repository as an NFS share

» Option 2: Copy the virtual appliance to a different system.

From one Oracle VM Server (dom0) part of the pool, you can copy the package.ova file to an external system (for example, your desktop or laptop) and use it, for instance, for development or demo purposes with Oracle VM VirtualBox.
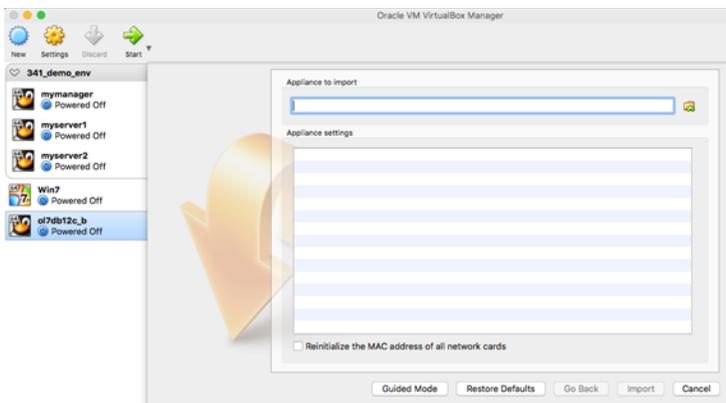
Figure 10. Oracle VM VirtualBox: Import Appliance interface

Oracle Enterprise Manager

Oracle Enterprise Manager 13*c* helps Oracle customers deliver enterprise private cloud services. It leverages its integration with Oracle VM Manager to manage the Oracle VM–based infrastructure and offers complete management of the entire software and systems stack—from the infrastructure to business applications.

Oracle Enterprise Manager provides an out-of-the-box self-service portal that allows self-service users to access cloud services (provisioning applications) without IT intervention. An administrator can use a guided cloud setup wizard to define allowable VM sizes, assign quotas to users and roles, define access boundaries and placement rules, set up chargeback plans, and publish Oracle VM Templates and virtual appliances (multitier applications) in the software library of Oracle Enterprise Manager. The self-service capability of Oracle Enterprise Manager allows application owners to select, test, and deploy applications on demand and reduces enterprise application deployment time from months and days to hours.

For example, when an application needs to be deployed that requires a guest VM to power-on, Oracle Enterprise Manager automatically selects the physical Oracle VM Server to use from a pool of healthy, available servers using a pool load-balancing algorithm. This, along with performance and resource monitoring offered by Oracle Enterprise Manager, is the kind of automation organizations need.

Finally, Oracle Enterprise Manager chargeback gives organizations a mechanism for metering cloud resources and charging internal users based on their consumption. This means that users pay only for the resources they use, allowing them to monitor their usage accurately and efficiently.

If you need further details you can find a demo environment, thanks to the pre-built images for Oracle VM Server and Oracle VM Manager available here.

Conclusion

Both Oracle VM Templates and Oracle VM Server help IT administrators to reliably migrate their application stack into a private cloud environment. The innovative approach they offer makes it practical for complex enterprise applications to be easily customized and provisioned with minimal to no manual intervention.

Oracle VM Templates and Oracle VM Server features provide many benefits to do the following:

» Improve operational efficiency without sacrificing flexibility
» Significantly lower the risk of mistakes
» Capture and provision complete multitier application environments for development, testing, or production
» Create and deploy software solutions faster and easily, resulting in lower costs
» Leverage the most-complete enterprise technology stack—including Oracle Linux, server virtualization, and Oracle Database—to create a total solution backed by Oracle
» Leverage best practices for deploying these applications

For the latest information on Oracle VM Templates and Oracle VM Server, consult the Oracle VM Templates web page and the Oracle Virtualization web page.

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Integrated Cloud Applications & Platform Services

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