

Oracle® VM

User's Guide

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Primary Author: Alison Holloway, Pieter Gordebeke

Contributing Author: Michele Dady

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Preface

The preface contains information on how to use the Oracle VM User's Guide. The areas discussed are:

- [Audience](#)
- [Documentation Accessibility](#)
- [Related Documents](#)
- [Command Syntax](#)
- [Conventions](#)

Audience

The Oracle VM User's Guide is intended for system administrators and end users who want to learn the fundamentals of virtualization, Oracle VM, and the provision and management of virtual machines.

Documentation Accessibility

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Related Documents

For more information, see the following documents in the Oracle VM Release 3.0 documentation set:

- *Oracle VM Release Notes*
- *Oracle VM Installation and Upgrade Guide*

You can also get the latest information on Oracle VM by going to the Oracle VM Web site:

<http://www.oracle.com/us/technologies/virtualization/oraclevm>

Command Syntax

Oracle Linux command syntax appears in monospace font. The dollar character (\$), number sign (#), or percent character (%) are Oracle Linux command prompts. Do not enter them as part of the command. The following command syntax conventions are used in this guide:

Convention	Description
backslash \	A backslash is the Oracle Linux command continuation character. It is used in command examples that are too long to fit on a single line. Enter the command as displayed (with a backslash) or enter it on a single line without a backslash: <pre>dd if=/dev/rdsd/c0t1d0s6 of=/dev/rst0 bs=10b \ count=10000</pre>
braces { }	Braces indicate required items: <pre>.DEFINE {macro}</pre>
brackets []	Brackets indicate optional items: <pre>cvtcrt termname [outfile]</pre>
ellipses ...	Ellipses indicate an arbitrary number of similar items: <pre>CHKVAL fieldname value1 value2 ... valueN</pre>
<i>italics</i>	Italic type indicates a variable. Substitute a value for the variable: <pre>library_name</pre>
vertical line	A vertical line indicates a choice within braces or brackets: <pre>FILE filesize [K M]</pre>

Conventions

The following text conventions are used in this document:

Convention	Meaning
boldface	Boldface type indicates graphical user interface elements associated with an action, or terms defined in text or the glossary.
<i>italic</i>	Italic type indicates book titles, emphasis, or placeholder variables for which you supply particular values.
monospace	Monospace type indicates commands within a paragraph, URLs, code in examples, text that appears on the screen, or text that you enter.

What's New in Oracle VM?

This preface introduces the new features and enhancements of Oracle VM. This information is useful to users who have used previous releases of Oracle VM.

What's New in Oracle VM?

The new features and enhancements in Oracle VM Release 3.0 include:

Performance, Scalability and Security

- **Updated Xen 4.0 Hypervisor:** More efficient power management capabilities, broader hardware support, and better performance, scalability and security for both hardware virtualized and paravirtualized guests.
- **Updated Dom0 Linux Kernel with Newer Drivers:** Better hardware support for higher performance, with the latest Unbreakable Enterprise Kernel.
- **Improved Scalability:** Capable of supporting Oracle VM Servers with up to 160 CPUs and 2TB memory.
- **Updated OCFS2 1.8 Cluster File System:** Instant clone support in OCFS2 1.8 enables significantly faster virtual machine provisioning and cloning.
- **Support for OVF:** Customers can now use Oracle VM Manager to import a broad range of Open Virtualization Format (OVF) based software assemblies produced by Oracle to accelerate application deployment. See [Section 8.5.4, "Assemblies"](#) for information on working with assemblies.

Network and Storage Configuration and Management

- **Network Configuration and Management:** All Oracle VM Server logical network configuration and management is now performed using Oracle VM Manager, for example, NIC port bonding, and configuring VLAN Networks. See [Chapter 6, "Managing Networks"](#) for information on network management in Oracle VM Manager.
- **Storage Configuration and Management:** The Oracle VM Storage Connect framework enables Oracle VM Manager to directly access the resources and functionality of existing storage systems, supporting native storage services such as SAN or NFS storage creation, deletion, expansion. This allows the Oracle VM Manager to automatically discover available storage using Oracle VM Manager and create new storage repositories or map raw storage directly to virtual machines. See [Chapter 5, "Managing Storage"](#) for information on storage management.

Improved Usability

- **User Interface:** Based on the latest Oracle ADF the Oracle VM Manager now includes a fully interactive tree view and automatic refresh to show the real-time state of the physical and virtual environment. See [Chapter 3, "Using Oracle VM Manager"](#) for information on using the new user interface.
- **Virtual Machines:** Specify the boot order (for example: disk, CDROM) to simplify installs. Directly attach raw storage or virtual disks (vdisks). See [Chapter 8, "Managing Virtual Machines"](#) for information on virtual machines.

Physical and Virtual Status and Resource Information

- **Resource Information:** Performance statistics are available for CPU, memory, disk and network for each physical Oracle VM Server and virtual machine. Events are displayed for each physical and virtual object, such as port up/down status. IP address and other configuration information is displayed directly in the user interface.

Note: Not all metrics are exposed through the Oracle VM Manager user interface.

Policy-Based Resource Management

- **Distributed Resource Scheduling (DRS) for capacity management:** DRS provides real-time monitoring of Oracle VM Server utilization with the goal to rebalance a server pool to provide consistent resources to the running virtual machines. DRS migrates load away from heavily loaded Oracle VM Servers to less heavily loaded Oracle VM Servers.
- **Distributed Power Management (DPM) to optimize server pool for minimum power consumption:** DPM complements DRS to reduce the Oracle VM Servers in a server pool when there are periods of low resource utilization. It can automatically add capacity as needed when resource utilization ramps up.

See [Section 7.5, "Server Pool Policies"](#) for information on using DRS and DPM.

Introduction to Virtualization

This chapter provides introductory information on virtualization. It discusses why you would want to use virtualization, the technology provided, and a high level overview of Oracle VM. It contains the following sections:

- [Introduction to Virtualization](#)
- [Reasons to Use Virtualization](#)
- [Xen™ Technology](#)
- [Oracle VM for x86](#)

1.1 Introduction to Virtualization

The IT industry's focus on virtualization technology has increased considerably in the past few years. However, the concept has been around much longer, as you can read in the brief history below. This section also provides a high level view of the virtualization technology and methods that exist today, and highlights a number of reasons why organizations are embracing virtualization more and more.

1.1.1 Brief History of Virtualization

The concept of virtualization is generally believed to have its origins in the mainframe days in the late 1960s and early 1970s, when IBM invested a lot of time and effort in developing robust time-sharing solutions. Time-sharing refers to the shared usage of computer resources among a large group of users, aiming to increase the efficiency of both the users and the expensive computer resources they share. This model represented a major breakthrough in computer technology: the cost of providing computing capability dropped considerably and it became possible for organizations, and even individuals, to use a computer without actually owning one. Similar reasons are driving virtualization for industry standard computing today: the capacity in a single server is so large that it is almost impossible for most workloads to effectively use it. The best way to improve resource utilization, and at the same time simplify data center management, is through virtualization.

Data centers today use virtualization techniques to make abstraction of the physical hardware, create large aggregated pools of logical resources consisting of CPUs, memory, disks, file storage, applications, networking, and offer those resources to users or customers in the form of agile, scalable, consolidated virtual machines. Even though the technology and use cases have evolved, the core meaning of virtualization remains the same: to enable a computing environment to run multiple independent systems at the same time.

1.1.2 Hypervisor

If virtualization is defined as enabling multiple operating systems to run on a single host computer, then the essential component in the virtualization stack is the hypervisor. This hypervisor, also called Virtual Machine Monitor (VMM), creates a virtual platform on the host computer, on top of which multiple guest operating systems are executed and monitored. This way, multiple operating systems, which are either multiple instances of the same operating system, or different operating systems, can share the hardware resources offered by the host.

Hypervisors are commonly classified as one of these two types, as show in [Table 1–1](#), "Hypervisor Types".

Table 1–1 Hypervisor Types

Classification	Characteristics and Description
Type 1: <i>native or bare metal</i>	Native hypervisors are software systems that run directly on the host's hardware to control the hardware, and to monitor the guest operating systems. Consequently, the guest operating system runs on a separate level above the hypervisor. Examples of this classic implementation of virtual machine architecture are Oracle VM, Microsoft Hyper-V, VMWare ESX and Xen.
Type 2: <i>hosted</i>	Hosted hypervisors are designed to run within a traditional operating system. In other words, a hosted hypervisor adds a distinct software layer on top of the host operating system, and the guest operating system becomes a third software level above the hardware. A well-known example of a hosted hypervisor is Oracle VM VirtualBox. Others include VMWare Server and Workstation, Microsoft Virtual PC, KVM, QEMU and Parallels.

1.2 Reasons to Use Virtualization

There are many different good reasons for companies and organizations to invest in virtualization today, but it is probably safe to assume that financial motivation is number one on the list: virtualization can save a lot of money. Below is an overview of the key benefits of virtualization.

Table 1–2 Reasons to Use Virtualization

Item	Description
Resource optimization	<p>Today's enterprise level computer resources are so powerful that they often have excess capacity. By virtualizing the hardware and allocating parts of it based on the real needs of users and applications, the available computing power, storage space and network bandwidth can be used much more effectively. Computers no longer need to be idle or performing below their capabilities because there are fewer connected users, or because the hosted application happens to be less demanding than the server can handle.</p> <p>Virtual machines offer software developers isolated, constrained, test environments. Rather than purchasing dedicated physical hardware, virtual machines can be created on the existing hardware. Because each virtual machine is independent and isolated from all the other servers, programmers can run software without having to worry about affecting other applications, or external components affecting the execution of their code.</p>

Table 1–2 (Cont.) Reasons to Use Virtualization

Item	Description
Consolidation	<p>It is common practice to dedicate individual computers to a single application. If several applications only use a small amount of processing power, the administrator can consolidate several computers into one server running multiple virtual environments. For organizations that own hundreds or thousands of servers, consolidation can dramatically reduce the need for floor space, HVAC, A/C power, and co-location resources. This means the cost of ownership is reduced significantly, since less physical servers and floor and rack space are required, which in turn leads to less heat and power consumption, and ultimately a smaller carbon footprint.</p>
Maximizing Uptime	<p>Agility is all about being able to respond to changing requirements as quickly and flexibly as possible. Virtualization brings new opportunities to data center administration, allowing users to enjoy:</p> <ul style="list-style-type: none"> ■ Guaranteed uptime of servers and applications; speedy disaster recovery if large scale failures do occur. ■ Instant deployment of new virtual machines or even aggregated pools of virtual machines via template images. ■ Elasticity, that is, resource provisioning when and where required instead of keeping the entire data center in an <i>always-on</i> state. ■ Reconfiguration of running computing environments without impacting the users.
Automatically Protect Applications from Server Failure	<p>Server virtualization provides a way to implement redundancy without purchasing additional hardware. Redundancy, in the sense of running the same application on multiple servers, is a safety measure: if for any reason a server fails, another server running the same application takes over, thereby minimizing the interruption in service. This kind of redundancy works in two ways when applied to virtual machines:</p> <ul style="list-style-type: none"> ■ If one virtual system fails, another virtual system takes over. ■ By running the redundant virtual machines on separate physical hardware you can also provide better protection against physical hardware failure.
Easily Migrate Workloads as Needs Change	<p>Migration refers to moving a server environment from one place to another. With most virtualization solutions it is possible to move a virtual machine from one physical machine in the environment to another. With physical servers this was originally possible only if both physical machines ran on the same hardware, operating system and processor. In the virtual world, a server can be migrated between physical hosts with entirely different hardware configurations. Migration is typically used to improve reliability and availability: in case of hardware failure the guest system can be moved to a healthy server with limited downtime, if any. It is also useful if a virtual machine needs to scale beyond the physical capabilities of the current host and must be relocated to physical hardware with better performance.</p>

Table 1–2 (Cont.) Reasons to Use Virtualization

Item	Description
Protect Investment in Existing, Legacy Systems	Server hardware will eventually become obsolete, and switching from one system to another can be difficult. In order to continue offering the services provided by these legacy systems, you can run it as a virtual machine on new, modern hardware, while the legacy system itself still behaves as if it were running on the same legacy hardware. From an application perspective, nothing has changed. In fact, its performance may well benefit from the newer underlying hardware. This gives the organization the time to transition to new processes without worrying about hardware issues, particularly in situations where the manufacturer of the legacy hardware no longer exists or cannot fix broken equipment.

1.3 Xen™ Technology

Oracle VM is built upon Xen technology, using the Xen hypervisor. The Xen hypervisor is a small, lightweight bare metal hypervisor for x86-compatible computers. The Xen hypervisor securely executes multiple virtual machines on one host computer. Each virtual machine has its own guest operating system with almost native performance. The Xen hypervisor was originally created by researchers at Cambridge University, and derived from work done on the Linux kernel.

Oracle VM insulates users and administrators from the underlying virtualization technology and allows daily operations to be conducted using goal-oriented GUI interfaces.

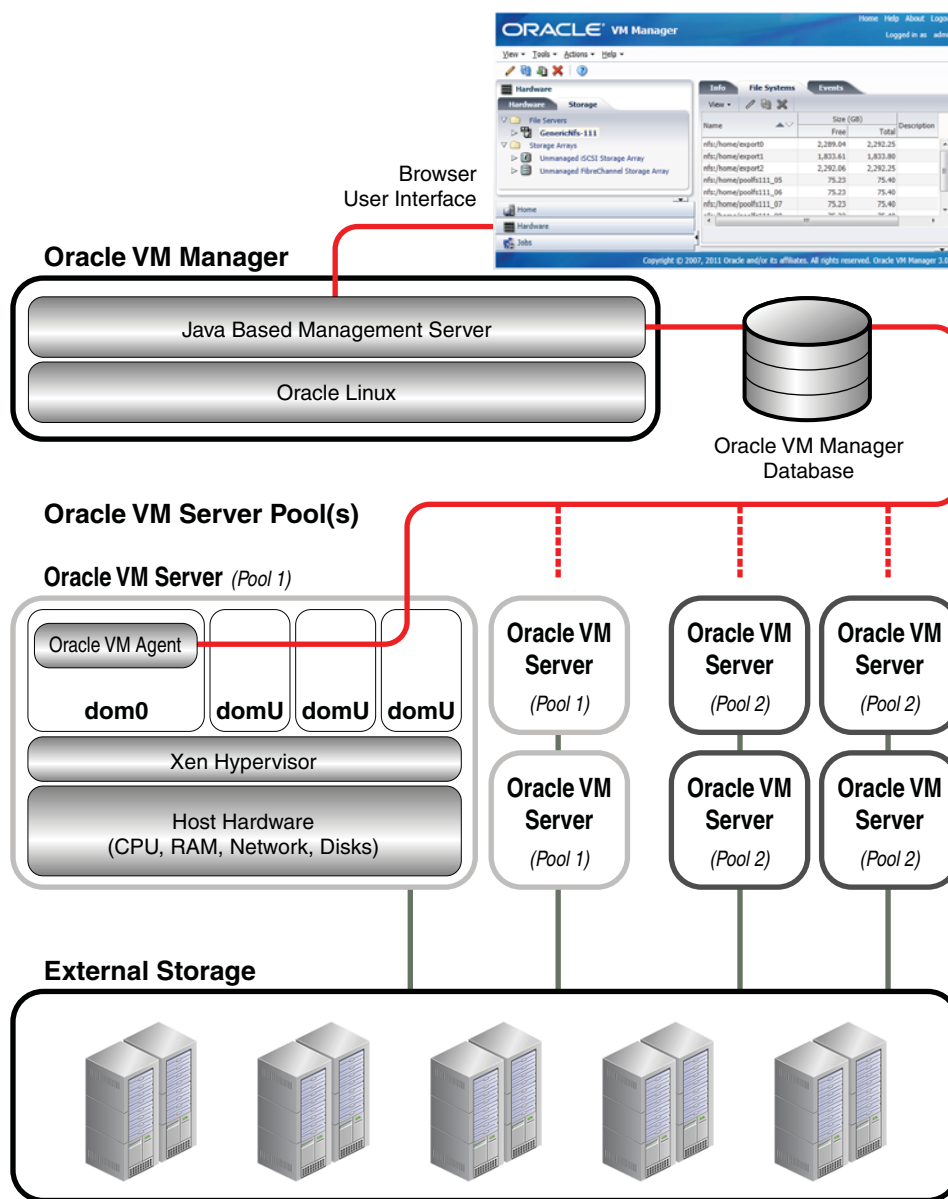
1.4 Oracle VM for x86

Oracle VM for x86 (Oracle VM) is a platform that provides a fully equipped environment with all the latest benefits of virtualization technology. Oracle VM enables you to deploy operating systems and application software within a supported virtualization environment. The components of Oracle VM are:

- **Oracle VM Manager:** Provides the graphical user interface, which is an Application Development Framework (ADF) application, with a familiar web-browser based interface, to manage Oracle VM Servers, virtual machines, and resources. Use Oracle VM Manager to:
 - Create virtual machines
 - Create server pools
 - Power on and off virtual machines
 - Manage networks and storage
 - Import virtual machines, ISO files, and templates
 - Manage high availability of Oracle VM Servers, server pools, and virtual machines
 - Perform live migration of virtual machines
- **Oracle VM Server:** A managed virtualization environment or part of such an environment, designed to provide a lightweight, secure, server-based platform for running virtual machines. Oracle VM Server is based upon an updated version of the underlying Xen hypervisor technology, and includes Oracle VM Agent.

Figure 1–1, "Oracle VM Architecture" shows the components of Oracle VM.

Figure 1–1 Oracle VM Architecture



Oracle VM Manager is an Oracle WebLogic Server application running on Oracle Linux. This can be a standalone computer, or part of a virtual machine running on an instance of Oracle VM Server.

Oracle VM Server is installed on a bare metal computer, and contains the Oracle VM Agent to manage communication with Oracle VM Manager. Dom0 is an abbreviation for *domain zero*, the management domain with privileged access to the hardware and device drivers. DomU is an unprivileged domain with no direct access to the hardware or device drivers. A user-domain (domU) is started and managed on an Oracle VM Server by dom0.

1.4.1 Oracle VM Integrated Support

Oracle has a unique position in the virtualization market as an Enterprise application, operating system and hardware vendor that delivers technologies across the stack. Owning the entire stack has various advantages:

- integration and centralized management of all components
- the ability to pre-package and distribute Oracle technologies via Oracle VM templates
- integrated enterprise support across the entire technology stack, from application to hardware

Oracle VM support is an add-on component of Oracle's enterprise support package that offers an end-to-end single vendor support solution from the application to the disk. A single support call covers the entire Oracle stack which expedites problem resolution. Using Oracle support allows an Oracle support service request (SR) to transition between support teams with issues that require cross stack collaboration. For example, if you open a service request for an application issue and the root cause is at the virtualization layer then the service request will transition between the application and virtualization teams.

Introduction to Oracle VM

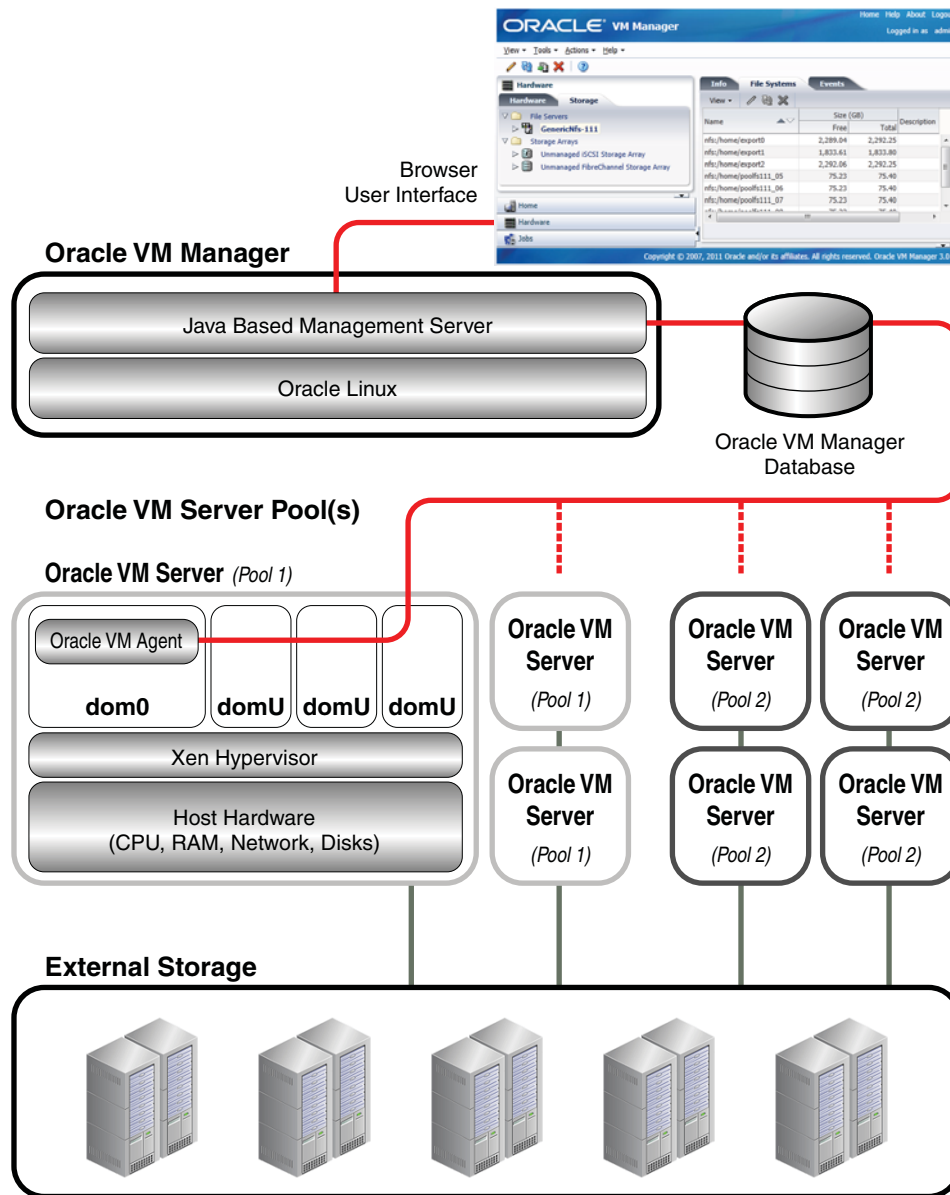
This chapter contains introductory information about Oracle VM, its components, architecture, and deployment options, and contains:

- [Introduction to Oracle VM](#)
- [Oracle VM Features](#)
- [Terminology](#)
- [Servers and Server Pools](#)
- [Storage](#)
- [Networking](#)
- [High Availability, Load Balancing and Power Management](#)
- [Virtual Machines](#)
- [Deployment Options](#)
- [Oracle VM Pre-built Templates](#)
- [Oracle VM Management Pack](#)

2.1 Introduction to Oracle VM

Oracle VM is a platform that provides a fully equipped environment with all the latest benefits of virtualization technology. Oracle VM enables you to deploy operating systems and application software within a supported virtualization environment. The components of Oracle VM are shown in [Figure 2-1, "Oracle VM Architecture"](#).

Figure 2–1 Oracle VM Architecture



- **Oracle VM Manager:** Provides the command line interface or shell, as well as the graphical user interface (GUI). The GUI is an Application Development Framework (ADF) web application you use simply through your browser to manage Oracle VM Servers, virtual machines, and resources. Use Oracle VM Manager to:
 - Configure and manage Oracle VM Servers
 - Configure and manage networks
 - Configure and manage storage
 - Configure and manage resources such as virtual machine images, virtual machine templates, assemblies, and installation media
 - Create virtual machines from installation media, a virtual machine template, an assembly, or a virtual machine image

- Manage virtual machines, including powering on and off, deleting, and live migrating
- Import virtual machines created with Oracle VM or another solution for server virtualization
- **Oracle VM Server:** A managed virtualization environment providing a lightweight, secure, server platform which runs virtual machines. At least one Oracle VM Server is required, but several are needed to take advantage of clustering. Oracle VM Server is based upon an updated version of the underlying Xen hypervisor technology, and includes Oracle VM Agent. It also includes a Linux kernel with support for a broad array of devices, file systems, and software RAID volume management. The Linux kernel is run as dom0 to manage one or more domU virtual machines, each of which could be Linux, Oracle Solaris, or Microsoft Windows.

2.2 Oracle VM Features

This section gives an overview of the Oracle VM Manager features used to manage Oracle VM Servers, virtual machines, storage repositories, networks, and resources. Oracle VM Manager provides the following main capabilities:

- Manages the physical Oracle VM Servers and can, for example, reboot or rediscover the physical hardware.
- Creates and configures server pools.
- Creates and manages Oracle VM Server logical networks, for example, NIC port bonding, and configuring VLAN networks.
- Creates and manages storage repositories.
- Manages resources, including ISO files, virtual machine templates, virtual machine images, and virtual machine assemblies.
- Manages the virtual machine life cycle. This includes creating virtual machines from either installation media or from templates, starting, logging in, shutting down, and deleting virtual machines.
- Imports, clones and migrates virtual machines.
- Performs load balancing of virtual machines in server pools.
- Manages jobs in the Oracle VM environment.
- Manages policies such as High Availability, Distributed Resource Scheduling, and Distributed Power Management.

An API is available for programmatic access to Oracle VM Manager, and therefore all the objects Oracle VM Manager has ownership of. See the *Oracle VM Programmer's Guide* for a description of an API for programmatic access to Oracle VM Manager functions.

2.3 Terminology

This section contains definitions for the terms used throughout this Guide and terms used within Oracle VM.

2.3.1 Hypervisor

The hypervisor present on each Oracle VM Server is an extremely small-footprint virtual machine manager and scheduler. It is designed so that it is the only fully privileged entity in the system. It controls only the most basic resources of the system, including CPU and memory usage, privilege checks, and hardware interrupts.

2.3.2 Domains, Guests and Virtual Machines

The terms "domain", "guest" and "virtual machine" are often used interchangeably, but they have subtle differences. A *domain* is a configurable set of resources, including memory, virtual CPUs, network devices and disk devices, in which virtual machines run. A domain is granted virtual resources and can be started, stopped and restarted independently. A *guest* is a virtualized operating system running within a domain. A guest operating system may be paravirtualized or hardware virtualized. Multiple guests can run on the same Oracle VM Server. A *virtual machine* is a guest operating system and its associated application software.

2.3.3 Management Domain (dom0)

Most of the responsibility of hardware detection in a Oracle VM Server environment is passed to the management domain, referred to as domain zero (or dom0). The dom0 kernel is actually a small-footprint Linux kernel with support for a broad array of devices, file systems, and software RAID and volume management. In Oracle VM Server, the dom0 is tasked with providing access to much of the system hardware, creating, destroying and controlling guest operating systems, and presenting those guests with a set of common virtual hardware.

2.3.4 Domains (domU)

Guest operating systems each have their own management domain called a "user domain", abbreviated to "domU". These domains are unprivileged domains with no direct access to the hardware or device drivers. Each domU is started by Oracle VM Server in dom0.

2.3.5 Storage and Storage Repositories

A storage repository is a central location where various resources to build virtual machines are stored. These resources include templates, ISO files, VM files and so on. Oracle VM Servers have shared access to storage repositories for optimized usage of available disk space in the environment, as well as easy reallocation of virtual machines in case a physical server should malfunction.

However, storage in Oracle VM is more than repositories: it also encompasses server pool file systems for clustered server pools, physical disks, or LUNs, in storage arrays, and local physical disks on the Oracle VM Servers. All these storage elements are used in various ways and managed centrally through Oracle VM Manager.

2.3.6 Server Pools

A server pool is a required entity in Oracle VM, even if it contains a single Oracle VM Server. In practice, several Oracle VM Servers will form a server pool, and an Oracle VM environment may contain one or several server pools. Server pools are typically clustered, although an unclustered server pool is theoretically possible.

Server pools have shared access to storage repositories and exchange and store vital cluster information in the server pool file system. In a server pool, a Master server is

elected, which is responsible for centralized communication with the Oracle VM Manager. If necessary, any other member of the server pool can take over the Master role. Even in case of server failure, the server pool remains accessible at its virtual IP address, which all servers in the pool share.

Within a server pool, virtual machines can be live-migrated for load balancing purposes or for scheduled maintenance. If a pool member disappears for whatever reason, its virtual machines can be recovered and brought back up on another Oracle VM Server because all necessary resources are available on shared storage.

2.3.7 Networks

The networking infrastructure in the Oracle VM environment comprises connections between Oracle VM Servers, between Oracle VM Servers and Oracle VM Manager, between the Oracle VM Servers and their storage sub-systems, as well as communications among virtual machines deployed in the environment, and between virtual machines and external private or public networks. These networking connections can leverage features supported by Oracle VM, such as networked file systems, clustering, redundancy and load balancing, bridging, and support for Virtual LANs (VLANs).

The physical network is the collection of physical connections in Oracle VM Manager and all Oracle VM Servers, and the switches and routers that allow information to reach its destination. A logical network in Oracle VM is built on top of these physical connections. When you create an Oracle VM network, you map available network ports to a set of logical Ethernet networks. You perform this mapping in Oracle VM Manager.

In Oracle VM a network can perform one or more network functions. Oracle VM has the following network functions: server management, live migrate, cluster heartbeat, virtual machine, and storage. Functions can be combined or spread over several different networks; this design decision depends on the available physical network infrastructure, such as the number of NICs in each server.

2.3.8 Jobs and Events

Jobs are a sequence of operations usually triggered by a user action. For example: discovering a server, presenting a repository, creating a VM, and so on. These jobs appear at the bottom of the Home and Hardware views in Oracle VM Manager and their status is refreshed according to their progress. Some jobs are not the result of a specific user action but are a recurring system operation, such as checking the YUM repository for updates. A history of all jobs in the environment is available in the Jobs view, where you can view and filter the job list and display details of each job: status, execution time stamps, operations executed as part of the job, etc.

Events are often also related to user actions, but their main function from a user perspective is to register status information of "objects" for future reference or to make problems easier to trace back. Events are displayed in a separate tab in the Management pane of Oracle VM Manager and the list of events depends on the object selected in the tree view of the Navigation pane. For example, the events list of a VM shows you when it was created, at what point it was started and stopped, when it was migrated, and so on. If you select a server or server pool in the same tree view, different types of events appear, related to that particular object. Events have no status but a severity level: most events will be informational, but they can also be warnings, errors or other situations that require your attention.

2.4 Servers and Server Pools

An Oracle VM environment is built up out of an extensible set of Oracle VM Servers, which are controlled by a single Oracle VM Manager. The Oracle VM Manager runs the database that contains all information about both the physical and the virtual infrastructure. In addition, it hosts the web browser interface that is used to configure and manage the entire environment. Communication between the Oracle VM Manager and the Oracle VM Servers, in order to execute operations on and through the servers, is relayed via the Oracle VM Agent, which is present on all the servers in the environment.

From within the Oracle VM Manager user interface, servers are discovered based on their IP address or host name. Additional servers can be installed and discovered at any time as the need for capacity grows. The Oracle VM Servers provide computing capacity to the virtual machines they host: CPU and RAM. They also host the storage plugins that are used to connect with shared, attached file-based and block-based storage offered by other hardware in the data center. For more details, see [Section 2.5, "Storage"](#) in this chapter, and [Chapter 5, "Managing Storage"](#).

Oracle VM Servers are members of a server pool. Server pools use a virtual IP address and elect one master server that handles interactions with the Oracle VM Manager. If the master server goes down, another server in the pool immediately takes over the master function and the server pool remains reachable at the virtual IP address. Virtual machines running on a failing server can be restored on another server in the pool. This is possible because all members of the server pool have access to the same shared storage, where virtual machine configuration, disks, templates etc. are stored.

In a clustered server pool, which is the typical configuration, high availability is enabled for the servers as well as the virtual machines they host. Clustered server pools use a shared ocfs2 pool file system for the cluster heartbeating function, configuration and other clustering information. Clustering and ocfs2 enable important advanced functionality such as shared block-based storage access, policies for failover, load balancing and power management, etc. For details about server pools, clustering and ocfs2, see [Chapter 7, "Managing Server Pools"](#).

An Oracle VM environment can consist of several server pools. This is a design decision: like in any data center it may be preferred to subdivide resources into groups, isolate these from each other, and assign them to different users (departments, teams, administrators, customers and so on).

2.5 Storage

To cover all aspects of Oracle VM storage we must discuss both the provisioning and the consumption side of the storage functionality. The following sections provide an answer to two major questions:

- How does Oracle VM connect to its storage?
- What storage elements are available within the Oracle VM environment?

2.5.1 Plugin-based Implementation

The entire Oracle VM storage implementation is based on Oracle Storage Connect plugins. The plugins are packaged and distributed as RPM packages and deployed on the Oracle VM Servers. They are divided in two major categories: storage array plugins for any block based storage, and file system plugins for any network file system based storage.

For both categories, generic plugins are included. They offer standard functionality to discover, register and use NFS storage, iSCSI or Fibre Channel SANs, and local storage. For more information about the types of storage supported in Oracle VM, see [Section 5.2, "Storage Types"](#). The standard operations allowed via generic plugins are "passive", in the sense that they can detect and use storage elements offered to the Oracle VM Servers. Interactive management operations on the storage hardware is not possible with generic plugins.

In addition, Oracle cooperates with storage partners and invites storage hardware vendors to develop Oracle Storage Connect plugins for their specific hardware. These vendor-specific plugins can only be used with a specific brand or product line of storage hardware but they offer additional operations from within Oracle VM Manager compared to generic plugins. For example, a generic storage array plugin can only detect LUNs on the storage host and has only a single access group to define which servers can access the storage elements. In contrast, a vendor-specific storage array plugin allows interactive operations such as creating and modifying LUNs, and can configure various access groups for finer-grained storage access management. For detailed information about Oracle Storage Connect plugins, see [Section 5.3, "Storage Connect Plug-ins"](#).

The main benefits of the plugin approach are:

- **Flexibility.** Use and integrate with your existing storage infrastructure, choose between file-based and block-based solutions, and use local storage for testing purposes or virtual machines of minor importance. Use generic or vendor-specific plugins depending on your available hardware or any new hardware you select.
- **Scalability.** Add more storage providers of your preferred type and present them to your server pools as your need for storage increases. Reduce the amount of storage again if the higher storage requirements are temporary. Provision your storage with redundancy and multipathing according to your requirements and preferences.
- **Extensibility.** If you upgrade your storage, consider the added functionality of vendor-specific plugins. If you select hardware for which Oracle Storage Connect plugins are available, ask the manufacturer for the RPM and install the plugin on the Oracle VM Servers with access to this storage hardware.

2.5.2 Usage of Storage Elements

Whatever the Oracle VM Server configuration in your environment is, Oracle VM always requires a location to store environment resources that are essential to the creation and management of virtual machines. These resources include VM templates and assemblies, ISO files (virtual DVD images), VM configuration files and VM virtual disks. The location of such a group of resources is called a storage repository. You present a storage repository to the Oracle VM Servers that need access to those resources; typically all servers in a server pool.

Storage repositories can be configured on an NFS file system or on a physical disk (LUN) of a storage array. However, for storage repositories on physical disk, the servers with access to it must be members of a *clustered* server pool. For unclustered server pools only file server storage is available. For details about the use of storage repositories, see [Section 5.8, "Preparing and Configuring Storage Repositories"](#).

Clustering adds another storage element to the environment: the server pool file system. During server pool creation, the server pool file system specified for the new server pool is accessed and formatted as an OCFS2 file system, whether the file system is accessed by the Oracle VM Servers as an NFS share, a FC LUN or iSCSI LUN. This formatting creates several management areas on the file system including a region for

the global disk heartbeat. The server pool file system plays a key role in clustering and therefore in the high-availability configuration of the Oracle VM environment. For details about server pool clustering, see [Section 7.2, "Server Pool Clusters"](#).

The storage element that is most tangible and visible to all users of Oracle VM is the virtual machine disk. A VM disk is either a disk image file in a storage repository or a raw physical disk. If a physical disk (LUN) is used, it is attached directly to the VM in the same way it would be to a physical machine. For details about virtual machine operation, see [Section 8, "Managing Virtual Machines"](#). Again, the availability of VM disks in a storage location with shared access from all Oracle VM Servers in the server pool is essential for VM high-availability.

2.6 Networking

The networking infrastructure in the Oracle VM environment comprises connections between Oracle VM Servers, between Oracle VM Servers and Oracle VM Manager, between the Oracle VM Servers and their storage sub-systems, as well as communications among virtual machines deployed in the environment, and between virtual machines and external private or public networks.

These networking connections can leverage features supported by Oracle VM, such as networked file systems, clustering, redundancy and load balancing, bridging, and support for Virtual LANs (VLANs).

In Oracle VM Manager, network configuration is the mapping of available network interfaces to a set of logical Ethernet networks. The physical network is the collection of physical connections in Oracle VM Manager and all Oracle VM Servers, and the switches and routers that allow information to reach its destination. A logical network in Oracle VM is built on top of these physical connections. Before you define the logical networks in Oracle VM Manager, you have to review the physical network configuration that you intend to use, such as VLAN and subnet usage. You also take into account the number of network interfaces available to your Oracle VM Servers. The minimum recommended number of ports required on a single Oracle VM Server is two, although one would suffice for test or demonstration purposes. If you have more than two ports on your Oracle VM Servers, you can design more redundancy or traffic isolation in your environment.

Oracle VM identifies different network functions: server management, live migrate, cluster heartbeat, virtual machine, and storage. All network functions can either be on dedicated or shared physical networks (except for the virtual machine intra-server network). For example, a physical network can be dedicated to Virtual Machine or Storage only, or can be dedicated for all network functions. For details about network functions, see [Section 6.2, "Network Usage"](#).

After reviewing your physical network environment and deciding on the logical distribution and grouping of these physical objects, you create the logical constructs in Oracle VM Manager to implement your network design. These logical constructs include network bonds, VLAN groups, networks and bridges. If your network design includes interface bonding, or aggregations of two ports, you create these network bonds first. These bonds are often used in conjunction with VLANs, when traffic from several VLANs is allowed to use the same bond. If your network environment comprises VLANs, your next step is to create VLAN Groups, determining which port or bond, on each Oracle VM Server, will accept traffic from more which VLANs.

After careful evaluation of the available network building blocks and required network functions, you create the necessary logical networks by choosing one of these types:

- network with bonds and ports
- network with VLANs only
- hybrid network connecting bonds and ports, as well as VLAN interfaces
- logical network on a single server (intra-server VM network)

For details, see [Section 6.3, "Building a Network Environment"](#), and the subsequent sections in the chapter.

2.7 High Availability, Load Balancing and Power Management

Oracle VM has high-availability (HA) functionality built in at every level. Even though there is only one Oracle VM Manager in the environment, it distributes vital information over the servers it manages, so that in case of failure the Oracle VM Manager and its infrastructure database can be rebuilt. At the Oracle VM Server and virtual machine level, HA is based on clustering. Members of a clustered server pool use an exchangeable Master server role and a virtual IP to make sure the cluster remains reachable if an Oracle VM Server goes down. If a server is lost, another server can recover the same VM because all required data is available on shared storage. In case of predictable failures or scheduled maintenance, virtual machines can be moved to other members of the server pool using live migration.

In addition, Oracle VM supports HA networking and storage, but these are configurations the system administrator must implement outside Oracle VM Manager (RAID, multipathing, etc.).

Clustered server pools also support advanced management policies called Dynamic Power Management (DPM) and Dynamic Resource Scheduler (DRS). DPM is a policy that optimizes the use of the server pool members to conserve power. When DPM is enabled, the policy will periodically look for Oracle VM Servers that are under utilized and then live-migrate the virtual machines on that server to other servers in the pool. When live migration is complete, the server is shut down, conserving power.

Conversely, if a server becomes overloaded, the policy will look for other servers to off load virtual machines from the busy server. If no other powered up Oracle VM Servers are available, then the policy will start up a powered-down server using its Wake-On-LAN capability, and begin live-migrating virtual machines to balance the overall load. It is a prerequisite that all the servers that participate in DPM have Wake-On-LAN enabled in the BIOS for the physical network interface that connects to the dedicated management network.

Dynamic Resource Scheduler (DRS) uses the same underlying code as DPM. The difference is that DRS will only react to servers that exceed their thresholds for CPU and network usage, and take action to move virtual machines off servers. These thresholds are configurable in the DRS policy, which runs at a specified interval and monitors CPU and network usage over a sample time period. The calculated average load is compared to the threshold and determines if migrations need to be performed.

2.8 Virtual Machines

A virtual machine (VM) can be defined as a virtualized operating system with its associated software and applications. It runs in one of three virtualization modes, also named domain types:

- **Hardware virtualized (HVM).** An unmodified guest operating system executes in complete isolation. Instructions are trapped and emulated at the hardware level

(Intel VT-x/VT-i and AMD-V), allowing excellent performance thanks to limited overhead for guest modifications.

- **Paravirtualized (PVM).** A software interface similar but not identical to the underlying hardware is presented to the guest operating system. Paravirtualization provides hooks for guest instructions so that complicated tasks can be performed by the host instead of the virtual machine, where performance is worse. Paravirtualization requires that the guest kernel is ported to be made aware of the virtual environment.
- **Hardware virtualized with paravirtualized drivers (PVHVM).** Similar to HVM but with additional paravirtualized drivers to off load more processes to the host and increase VM performance. This domain type is typically used to run Microsoft Windows guests with a limited performance penalty.

Virtual machines can be created from different types of resources: either from a template or assembly containing preconfigured virtual machines, or from scratch using an ISO file (image) of an installation DVD. Booting a VM via PXE, or network boot for a PVM guest, is also possible.

The creation of a VM from template is based on cloning: the template is imported as an archive, unpacked and stored as a VM configuration file with images of its disks, which are cloned to create a new instance in the form of a VM. In the same way, an existing VM can be cloned to create a new VM, and to a new template as well. Cloning is discussed in further detail in [Section 8.8, "Cloning a Virtual Machine or Template"](#).

Assemblies can be described as a template of a group of virtual machines, or a collection of multiple VM templates. In Oracle VM Manager, templates and assemblies appear in different tabs of the storage repository, but their VM configuration files and disk images are stored in the same location as those of other virtual machines and templates.

Creating a VM from a virtual DVD (image file, ISO) is different depending on the virtualization mode. When creating an HVM guest, you can assign an ISO file located on a storage repository so that the new VM immediately boots from the virtual DVD. Conversely, a PVM guest cannot simply boot from DVD out of nothing, and uses an ISO file mounted remotely, accessing it via NFS, HTTP or FTP.

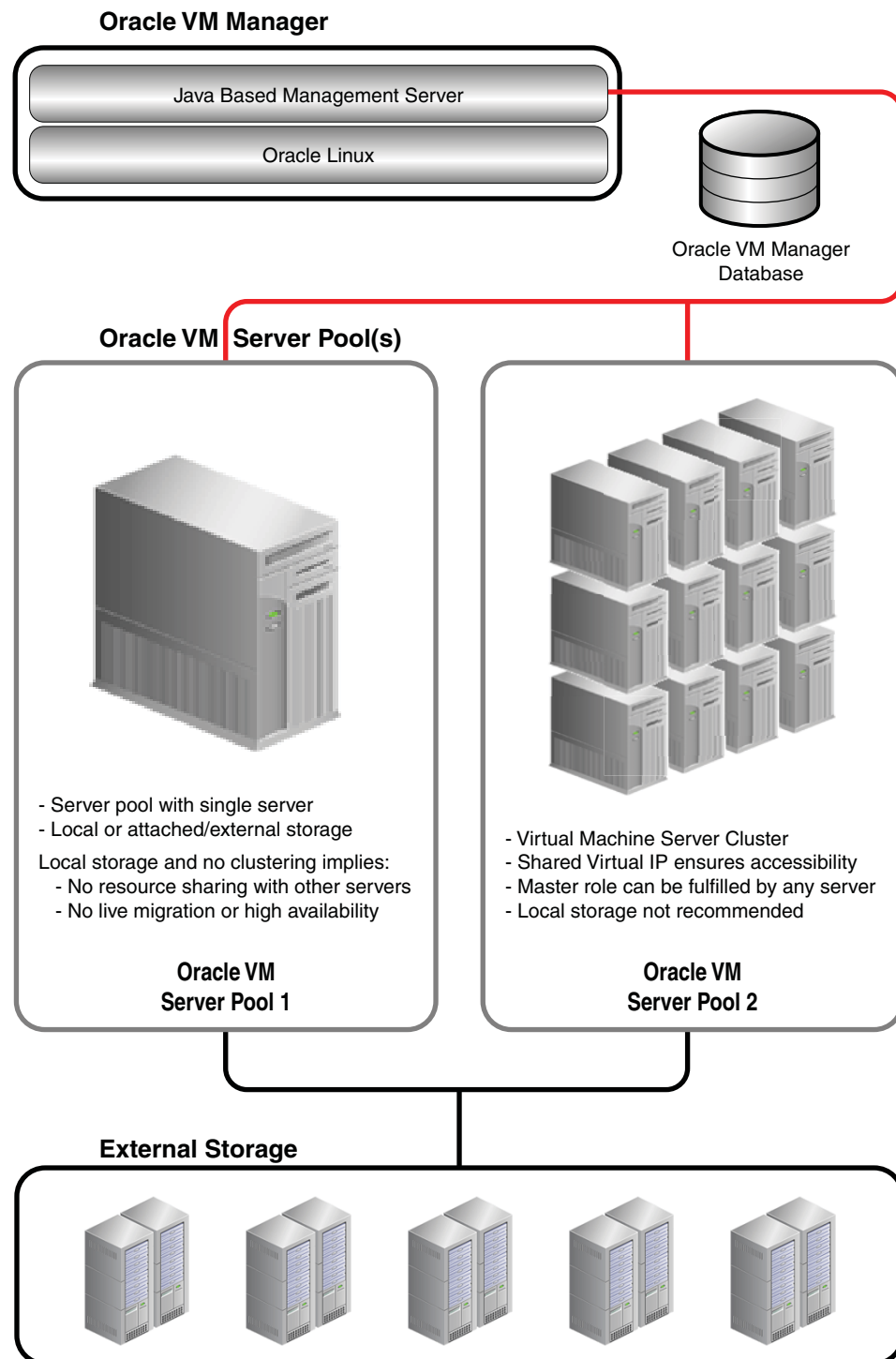
As mentioned in this section and in [Section 2.5, "Storage"](#), virtual machine resources are stored in storage repositories. The contents and structure of storage repositories is described in detail in [Section 8.5, "Virtual Machine Resources"](#).

Once a VM is running, it can be accessed through a VNC console, which allows it to be used as a regular pc. All operations on the VM are executed through Oracle VM Manager, as described in [Section 8.9, "Managing Virtual Machines"](#).

2.9 Deployment Options

This section gives an overview of the deployment options for Oracle VM.

Figure 2-2 Oracle VM Deployment



As shown in [Figure 2-2](#), an Oracle VM deployment, involves these components:

- Oracle VM Manager:** The host machine on which Oracle VM Manager is installed is known as the Oracle VM Manager host. It provides the interface where all virtual machine management tasks are performed. Operational commands are sent to the Oracle VM Servers through the Oracle VM Agent.

- **Oracle VM Server(s):** An Oracle VM Server must always belong to a server pool, even if it is the only member.
The information needed to keep the server pool operational is kept in shared storage and is available to all cluster nodes.
- **Server Pools:** A server pool is an autonomous region that contains one or more Oracle VM Servers. A server pool presents a unified view of the storage in which the virtual machines reside. When clustering is activated, a server pool must have its own shared storage, unless an NFS share is used, as an NFS share can span multiple server pools.
- **Storage:** A shared storage resource is mounted on each Oracle VM Server in a server pool to store virtual machines, external resources, and other data files. In order to perform live migration of virtual machines, each Oracle VM Server involved must have shared access to storage.
See [Chapter 5, "Managing Storage"](#) for more information on creating different types of shared storage.

2.10 Oracle VM Pre-built Templates

Oracle VM templates are self-contained and pre-configured virtual machines with key Oracle technologies. Each Oracle VM template is packaged using Oracle best practices, which eliminates installation and configuration costs, reduces risk and dramatically shortens deployment time lines.

Oracle VM templates of many key Oracle products are available for download, including Oracle Linux, Oracle Solaris, Oracle Database, Fusion Middleware, and many more.

Oracle VM template licensing includes a free download and free trial use with the option to purchase a product license. Oracle VM templates do not have time limits or feature limitations, that is, Oracle VM templates are full featured and do not have expiration dates. Oracle VM templates can be quickly transitioned from evaluation into production by purchasing Oracle technology licenses.

You can download Oracle VM templates from the Oracle Technology Network:

<http://www.oracle.com/technetwork/server-storage/vm/templates-101937.html>

The password for the *root* user of all Oracle VM templates is *ovsroot*. The password for the *oracle* account in the *OVM_os_version_ORACLE_11G* template is *oracle*.

Before using the downloaded templates, you must import them into Oracle VM Manager. See [Section 8.5.3.1, "Importing a Virtual Machine Template"](#) for information on importing templates.

For more information on these templates, see

http://download.oracle.com/otn_software/virtualization/README.templates

2.11 Oracle VM Management Pack

The Oracle VM Management Pack is an Oracle Enterprise Manager plug-in that adds Oracle VM Manager functionality to Oracle Enterprise Manager. The Oracle VM Management Pack provides management at the Oracle VM Server, server pool and virtual machine layers, along with guest operating system monitoring, administration, provisioning and patch management. Oracle VM Servers can be managed from only

one of the two management options, either Oracle VM Manager or from the Oracle VM Management Pack.

The Application Change Console is a separate stand alone application that is licensed with the Oracle VM Management Pack. The Application Change Console (ACC) is able to parse configuration files to track changes/differences and send alerts/notification on when changes are made. The Application Change Console has pre-built parsers for Operating System configuration files. After installing the Application Change Console, you can point the Application Change Console to the Oracle VM Servers and virtual machines using hostnames. The Application Change Console SSHes into a host to gather and track configurations. There are no additional agents required to be installed. All of the Application Change Console components can run on Oracle Linux on Oracle VM.

Using Oracle VM Manager

Management for the Oracle VM environment is provided by Oracle VM Manager, a transaction-based framework that also includes an integrated database and a web-based management user interface.

This chapter discusses using the Oracle VM Manager user interface, and contains:

- [Logging into the User Interface](#)
- [User Interface Overview](#)
- [Using the Global Links](#)
- [Using the Menus](#)
- [Using the Navigation Shortcuts \(Views\)](#)
- [Using the Toolbar](#)
- [Using the Navigation Tree](#)
- [Object Icon Colors](#)

3.1 Logging into the User Interface

To open the Login page of Oracle VM Manager, enter the following address in a Web browser:

```
http[s]://hostname:port/ovm/console
```

Where, *hostname* refers to the host name or IP address of the Oracle VM Manager host, and *port* refers to the port number on which Oracle VM Manager is listening.

To connect to Oracle VM Manager using Secure Sockets Layer (SSL) on a host named example.com, use:

```
https://example.com:7002/ovm/console
```

To connect to Oracle VM Manager on a host named example.com, use:

```
http://example.com:7001/ovm/console
```

Enter your Oracle VM Manager administration username in the **Username** field. This is the administration username you create during the Oracle VM Manager install. Enter the password for the Oracle VM Manager administration username in the **Password** field.

To manage the local instance of Oracle VM Manager (installed on localhost), leave the **Management Server URI** field as the default, `tcp://localhost`. If you want to manage a remote instance of Oracle VM Manager, enter the hostname or IP address for that machine, for example:

tcp://example.com

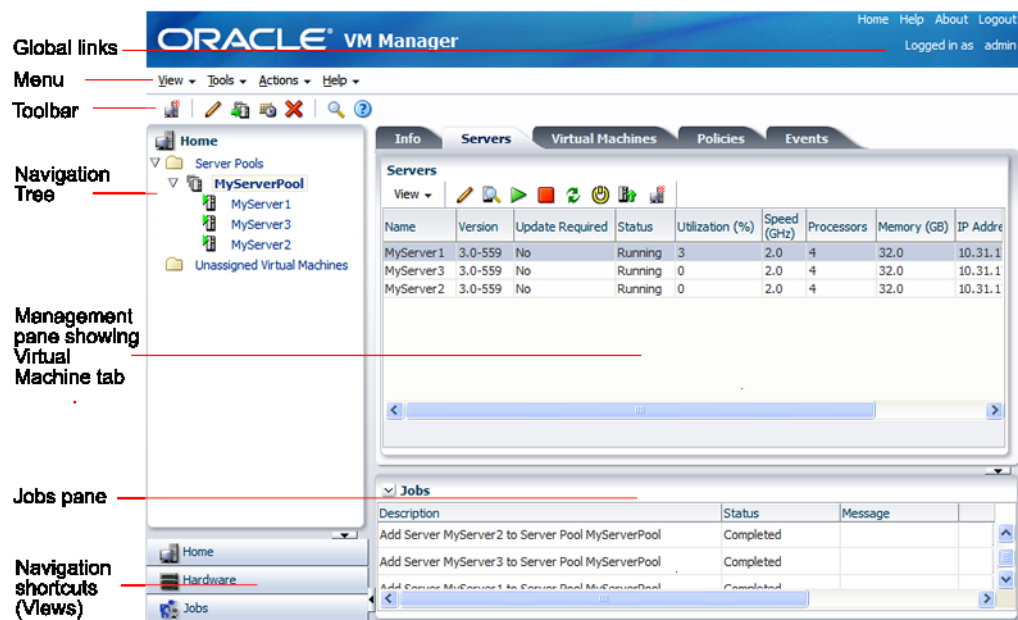
Now you are logged in, you can create storage repositories, server pools, add Oracle VM Servers, and create virtual machines, import resources, and so on.

The user interface displays context sensitive information, relevant to the selection in the navigator and content panes.

3.2 User Interface Overview

The Oracle VM Manager user interface provides a set of work areas (management panes), buttons, menus, and tabs for access to various functions and configuration screens. [Figure 3–1](#) shows the main components of the Oracle VM Manager user interface.

Figure 3–1 Oracle VM Manager User Interface



The components of the Oracle VM Manager user interface are described in more detail in [Table 3–1](#).

Table 3–1 Oracle VM Manager User Interface components

User Interface Item	Description
Global Links	Contain navigation and resources which are relevant to the whole Oracle VM Manager user interface. See Section 3.3, "Using the Global Links" for information on each global link.
Menu	The menus available are View , Tools , Actions , and Help . See Section 3.4, "Using the Menus" for information on each menu item.
Toolbar	Allows quick access to a group of task icons. See Section 3.6, "Using the Toolbar" for information on each toolbar item.

Table 3–1 (Cont.) Oracle VM Manager User Interface components

User Interface Item	Description
Navigation Pane	Contains the navigation tree, and navigation shortcuts. See Section 3.7, "Using the Navigation Tree" and Section 3.5, "Using the Navigation Shortcuts (Views)" for more information on the navigation objects.
Navigation Tree	Shows hierarchy of physical and virtual components. Click on a component to open its default pane and related management panes. See Section 3.7, "Using the Navigation Tree" for more information on the navigation tree.
Management Pane	Contains the management panes for the selected view. The management panes that can be displayed are described under each view. See Section 3.5, "Using the Navigation Shortcuts (Views)" for a list of the panes that can be displayed in each view.
Navigation Shortcuts (Views)	Allow quick access to all views, Home , Hardware , and Jobs . See Section 3.5, "Using the Navigation Shortcuts (Views)" for information on each navigation shortcut.

The sections that follow describe each set of controls and their relationship to one another, in more detail.

3.3 Using the Global Links

The global links are available on every page. The global links are as shown in [Table 3–2](#):

Table 3–2 Global Link Item Descriptions

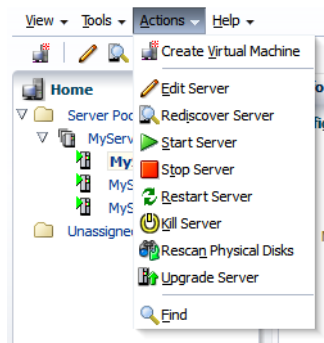
Global Link	Description
Home	Displays the Home view. See Section 3.5.1, "Home" for more information on the Home view.
Help	Displays the Oracle VM Manager online help system in a separate window.
About	Displays the About Oracle VM dialog box which contains the release number. This is synonymous with the Help > About menu item.
Logout	Logs out of the Oracle VM Manager user interface and displays the Oracle VM Manager log in screen.
Logged in as <i>username</i>	Displays the username of the user currently logged in.

3.4 Using the Menus

Oracle VM Manager contains a set of standard menus:

- [View Menu](#)
- [Tools Menu](#)
- [Actions Menu](#)
- [Help Menu](#)

For example, [Figure 3–2](#) shows the Action menu options when an Oracle VM Server is selected in the Home view.

Figure 3–2 Action Menu options when a Oracle VM Server is selected

This section discusses each of the menu options.

3.4.1 View Menu

Use the **View** menu to display a view of the virtualization environment. This is identical functionality to the navigation shortcuts. The **View** menu contains the following options:



- **Home**
- **Hardware**
- **Jobs**

The **View** menu options open the management pane for the selected option. These options are discussed in [Section 3.5, "Using the Navigation Shortcuts \(Views\)"](#).

3.4.2 Tools Menu

Use the **Tools** menu to manage your virtual network interfaces, and configure Oracle VM Server software update notifications. The **Tools** menu options are as shown in [Table 3–3](#).

Table 3–3 Tools Menu Options

Tools Menu Option	Icon	Description
VNIC Manager...		Displays the Virtual Network Interface Card Manager dialog box. Use this option to create virtual NICs for virtual machines. See Section 8.6, "Using the VNIC Manager" for more information on using the VNIC Manager.
Server Update Manager (YUM)...		Displays the Server Update Management (YUM) dialog box. Use this option to configure YUM repositories for automatic updates of the Oracle VM Servers being managed by Oracle VM Manager. See for more information on using the Server Update Manager.

3.4.3 Actions Menu

The **Actions** menu options are context-sensitive, and change to display actions related to the object selected in the navigator. The toolbar icons also change to the same items, depending on which object is selected in the navigator.

The **Actions** menu and toolbar icon options are discussed in [Table 3–4](#).

Table 3–4 Action menu options











Action Menu Option	Icon	Description
Create Server Pool		Displays the Create Server Pool dialog box. Use this option to create a server pool. Select Home > Server Pools , or Hardware > Resources to enable this option.
Create Virtual Machine		Displays the New Virtual Machine Wizard . Use this option to create a virtual machine in the selected server pool. Select the Home view to enable this option.
Edit Server Pool		Displays the Edit Server Pool wizard. Use this option to edit a server pool. Select a server pool in the Home or Hardware view to enable this option.
Add/Remove Servers		Displays the Add/Remove Servers from the Server Pool dialog box. Use this option to add or remove Oracle VM Servers from a server pool. Select a server pool in the Home or Hardware view to enable this option.
Edit Policies		Displays the Configure DRS/DPM dialog box. Use this option to set or edit resource policies for the server pool. Select a server pool in the Home or Hardware view to enable this option.
Edit Server		Displays the Edit Server dialog box. Use this option to edit the name and description for an Oracle VM Server. This is also used to put the Oracle VM Server into maintenance mode, take ownership of it, and to configure remote management of the Oracle VM Server using IPMI (Intelligent Platform Management Interface). Select an Oracle VM Server in the Home or Hardware view to enable this option.
Rediscover Server		Rediscover the Oracle VM Server. Use this to refresh information about the Oracle VM Server. Select an Oracle VM Server in the Home or Hardware view to enable this option.
Start Server		Starts a stopped Oracle VM Server. Select an Oracle VM Server in the Home or Hardware view to enable this option.
Stop Server		Stops a running Oracle VM Server. Select an Oracle VM Server in the Home or Hardware view to enable this option.
Restart Server		Restarts a running Oracle VM Server. Select an Oracle VM Server in the Home or Hardware view to enable this option.

Table 3–4 (Cont.) Action menu options

















Action Menu Option	Icon	Description
Kill Server		<p>Powers off an Oracle VM Server. This is the equivalent of physically pushing the Off button on the hardware.</p> <p>Select an Oracle VM Server in the Home or Hardware view to enable this option.</p>
Rescan Physical Disks		<p>Rescans the local storage on an Oracle VM Server. Use this option to rescan the storage presented to an Oracle VM Server when the storage configuration is changed, for example, a new storage array is added.</p> <p>Select an Oracle VM Server in the Home or Hardware view to enable this option.</p>
Upgrade Server		<p>Updates or upgrades the Oracle VM Server if an update is available in the YUM repository.</p> <p>Select an Oracle VM Server in the Home or Hardware view to enable this option.</p>
Edit		<p>Displays the Edit Virtual Machine wizard. Use this option to edit a virtual machine.</p> <p>Select a virtual machine in the Home view to enable this option.</p>
Start		<p>Starts up a stopped virtual machine.</p> <p>Select a stopped virtual machine in the Home view to enable this option.</p>
Stop		<p>Shuts down a virtual machine.</p> <p>Select a running virtual machine in the Home view to enable this option.</p>
Restart		<p>Restarts a running virtual machine.</p> <p>Select a running virtual machine in the Home view to enable this option.</p>
Kill		<p>Shuts down a running virtual machine.</p> <p>Select a running virtual machine in the Home view to enable this option.</p>
Suspend		<p>Suspends (pauses) a running virtual machine.</p> <p>Select a running virtual machine in the Home view to enable this option.</p>
Resume		<p>Resumes (unpauses) a suspended virtual machine.</p> <p>Select a suspended virtual machine in the Home view to enable this option.</p>
Migrate		<p>Migrates a virtual machine to another Oracle VM Server.</p> <p>Select a virtual machine in the Home view to enable this option.</p>
Clone		<p>Displays the Clone Virtual Machine or Template dialog box. Use this option to clone a virtual machine to create another virtual machine, or to create a template from the virtual machine.</p> <p>Select a virtual machine in the Home view to enable this option.</p>




Table 3–4 (Cont.) Action menu options

Action Menu Option	Icon	Description
Launch Console		Launches the virtual machine console to access the virtual machine. Use this option to connect to a virtual machine's console and access the virtual machine directly. Select a virtual machine in the Home view to enable this option.
Abort Job		Aborts and cancels a job. Select a running job in the Jobs view to enable this option.
Delete		Displays the Delete Confirmation dialog box. Use this option to delete the object selected in the navigator.
Find		Displays the Find dialog box. Use this option to search for server pools, Oracle VM Servers, and virtual machines.

3.4.4 Help Menu

Use the **Help** menu to display the Oracle VM Manager online help, release number, and go to Oracle's home page. The **Help** menu options are as shown in [Table 3–5](#).

Table 3–5 Help Menu Options

Help Menu Option	Icon	Description
Oracle VM Help		Opens a new web browser window which contains the Oracle VM Manager online help system.
Getting Started		Opens a new web browser window which contains the Getting Started chapter of the online help system. Read this section to quickly get started using Oracle VM Manager.
Oracle.com		Opens a new web browser window which contains the Oracle home page.
About		Displays the About Oracle VM dialog box which contains the release number.

3.5 Using the Navigation Shortcuts (Views)

Each navigation shortcut defines a functional area of operations that can be performed in Oracle VM Manager, or a *view*. The navigation shortcuts display the default management pane for each view. The navigation shortcut options are:

- [Home](#)
- [Hardware](#)
- [Jobs](#)

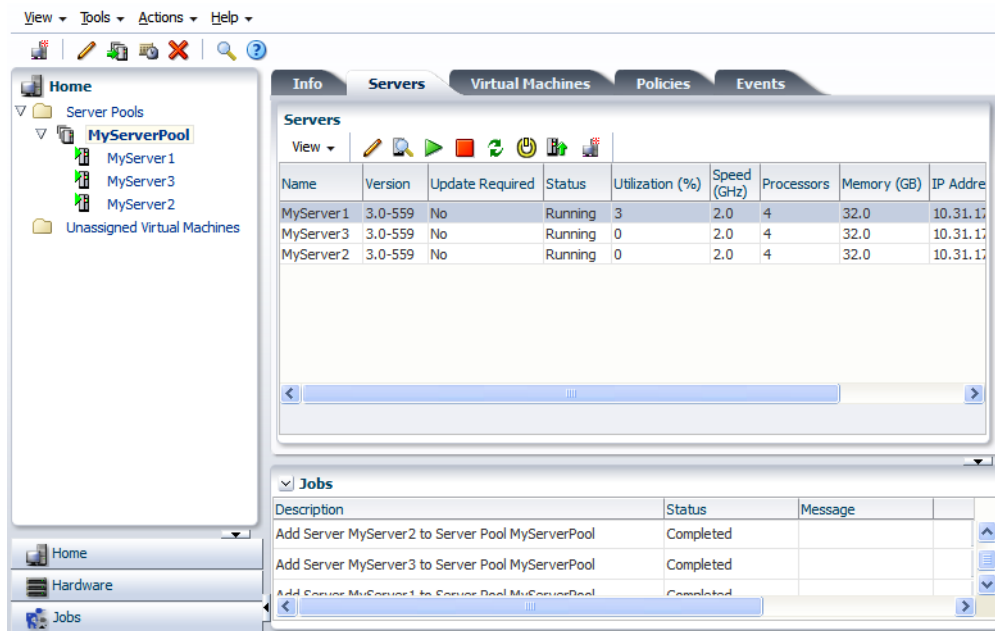
3.5.1 Home

Click **Home** to manage server pools, and virtual machines. To manage the physical objects, use the Hardware view. Use Home to create server pools, assign Oracle VM Servers to server pools, and create and configure virtual machines in server pools.

The Home navigation shortcut displays the Home view.

Figure 3–3 shows the Home view.

Figure 3–3 Home View



The Home view contains the tabs set out in Table 3–6.

Table 3–6 Home View Tabs

Management Pane Tab	Description
Info	<p>Displays a high-level view of server pools, Oracle VM Servers, and virtual machines. The Info tab management pane contents change to reflect information about the object selected in the tree. You can use this management pane to view information about server pools, Oracle VM Servers and virtual machines.</p> <p>Select an object in the tree to display this tab.</p> <p>See Chapter 7, "Managing Server Pools" for information about managing and editing server pools, Section 7.8, "Managing Oracle VM Servers" for information on managing and editing Oracle VM Servers, and Chapter 8, "Managing Virtual Machines" for information on managing virtual machines.</p>
Server Pools	<p>Displays information about the server pools. Use this tab to edit server pool policies, add or remove Oracle VM Servers from a server pool, edit information about a server pool, and delete a server pool.</p> <p>Select the Server Pools folder in the tree to display this tab.</p> <p>For more information about managing server pools, see Chapter 7.7, "Managing Server Pools".</p>

Table 3–6 (Cont.) Home View Tabs

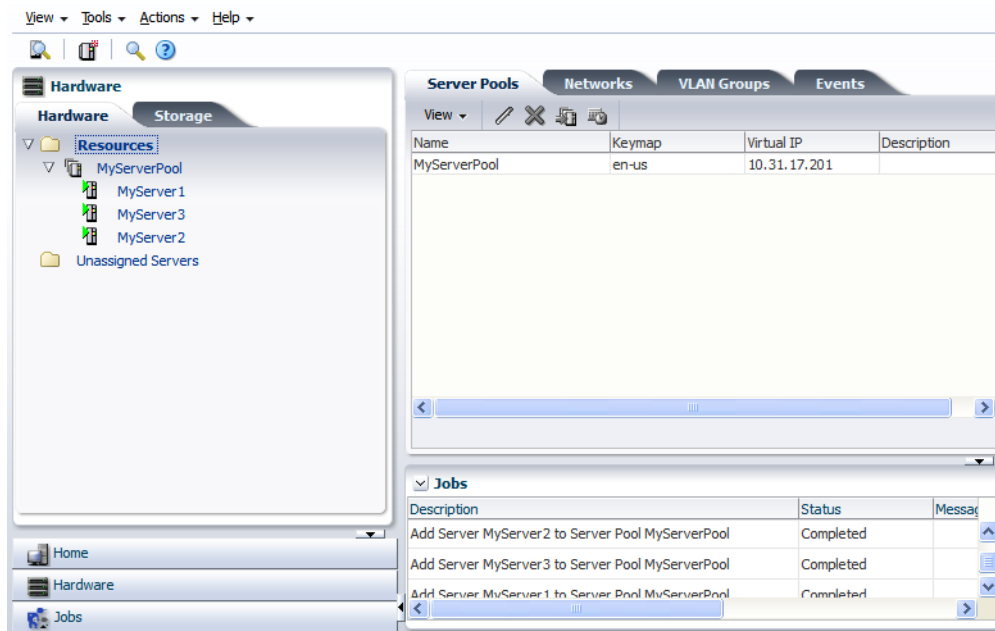
Management Pane Tab	Description
Repositories	<p>Displays information about the storage repositories, and the resources in each repository. Use this tab to discover, create, edit, view and delete storage repositories.</p> <p>You can also use this tab to create and manage the contents of storage repositories; assemblies, ISO files, template files, virtual disks and virtual machine configuration files. To view the contents of each storage repository, select it in the Repositories table, and the sub-tabs display the contents of the repository.</p> <p>Select the Server Pools folder in the tree to display this tab.</p> <p>For more information on managing storage repositories and their contents, see Chapter 5, "Managing Storage".</p>
Templates	<p>Displays information about the virtual machine templates in all storage repositories. Use this tab to import, edit and delete templates.</p> <p>To view configuration, network and storage information for a template, select it in the Templates table, and the sub-tabs display this information about the template.</p> <p>Select the Server Pools folder in the tree to display this tab.</p> <p>See Section 8.5.3, "Virtual Machine Templates" for information on working with virtual machine templates.</p>
Servers	<p>Lists the Oracle VM Servers in the server pool. You can perform actions on the Oracle VM Servers using the tab's toolbar, such as start, stop, and edit. You can also use the tab's toolbar to create a virtual machine on a selected Oracle VM Server.</p> <p>Select a server pool in the tree to display this tab.</p> <p>See Section 7.8, "Managing Oracle VM Servers" for information on managing Oracle VM Servers.</p>
Virtual Machines	<p>Displays information about the virtual machines in the server pool, or on the Oracle VM Server. You can perform actions on the virtual machines using the tab's toolbar, such as start, stop, edit, migrate and clone.</p> <p>Select a server pool or Oracle VM Server in the tree to display this tab.</p> <p>The Virtual Machines tab is also displayed when you select the Unassigned Virtual Machines folder.</p> <p>See Section 8.9, "Managing Virtual Machines" for information on managing virtual machines.</p>
Policies	<p>Displays information about server pool power and resource management policies; Distributed Resource Scheduler (DRS), or Distributed Power Management (DPM). You can create or edit a policy for the server pool using the Edit icon in the tab's toolbar.</p> <p>Select a server pool in the tree to display this tab.</p> <p>See Section 7.5, "Server Pool Policies" for information on managing server pool policies.</p>
Events	<p>An Events tab is displayed for each object in the tree and displays events related to that object.</p> <p>Select an object in the tree to display this tab.</p>

3.5.2 Hardware

Click **Hardware** to manage physical objects such as Oracle VM Servers and networks. The Hardware tab can also be used to manage server pools. To manage virtual objects, use the Home view.

Figure 3–4 shows the Hardware view.

Figure 3–4 Hardware View



The Hardware view contains the tabs set out in Table 3–7.

Table 3–7 Hardware View Tabs

Hardware View Tab	Management Pane Tab	Description
Hardware		Displays information on the physical hardware resources of Oracle VM Servers in the server pool. When an Oracle VM Server is discovered, it is listed in the Unassigned Servers folder. When an Oracle VM Server is added to a server pool, it is listed in the Resources folder. See Section 7.8, "Managing Oracle VM Servers" for more information on managing Oracle VM Servers.
	Server Pools	Displays information about the server pools. Use this tab to edit server pool policies, add or remove Oracle VM Servers from a server pool, edit information about a server pool, and delete a server pool. Select the Resources folder to display this tab. For more information about managing server pools, see Chapter 7.7, "Managing Server Pools" .

Table 3–7 (Cont.) Hardware View Tabs

Hardware View Tab	Management Pane Tab	Description
	Networks	<p>Displays information about the networks available to server pools. Use this tab to create, edit, and delete networks.</p> <p>Select a network in the table to view and edit information about the network ports and VLAN segments used in a network. These network options are displayed in sub-tabs.</p> <p>Select the Resources folder to display this tab.</p> <p>For more information on managing networks, see Chapter 6, "Managing Networks".</p>
	VLAN Groups	<p>Displays information about the VLAN Groups available to the server pool. Use this tab to create, edit and delete VLAN Groups.</p> <p>Select a VLAN Group in the table to view and edit information about the ports and VLAN Segments used in a VLAN Group. These options are displayed in sub-tabs.</p> <p>Select the Resources folder to display this tab.</p> <p>For more information on managing networks, see Chapter 6, "Managing Networks".</p>
	Servers	<p>Lists the Oracle VM Servers in the server pool. You can perform actions on the Oracle VM Servers using the tab's toolbar, such as start, stop, and edit. You can also use the tab's toolbar to create a virtual machine on a selected Oracle VM Server.</p> <p>Select a server pool in the tree to display this tab.</p> <p>See Section 7.8, "Managing Oracle VM Servers" for information on managing Oracle VM Servers.</p>
	Info	<p>Displays information about the object select in the tree.</p>
	Bonding	<p>Lists the bonded ethernet ports on the selected Oracle VM Server. Use this tab to create, edit and delete bonds on ethernet ports.</p> <p>Select an Oracle VM Server in the tree to display this tab.</p> <p>For more information on network bonding, see Section 6.4, "Network Bonding".</p>
	Ethernet Ports	<p>Lists the ethernet ports on the selected Oracle VM Server that can be used for network bridges. Use this tab to edit the type of addressing (none, DHCP or static IP address) used for the ethernet port.</p> <p>Select an Oracle VM Server in the tree to display this tab.</p> <p>For more information on network bridges, see Section 6.5, "Network Bridges".</p>
	Physical Disks	<p>Lists the local storage available on the selected Oracle VM Server. Use this tab to edit, rescan, clone, and delete local storage. You can also use this tab to create or delete an OCFS2 file system on local storage.</p> <p>Select an Oracle VM Server in the tree to display this tab.</p> <p>For more information on local storage, see Section 5.2.1, "Local Storage".</p>
	Events	<p>Displays information about the events related to the object selected in the tree.</p>

Table 3–7 (Cont.) Hardware View Tabs

Hardware View Tab	Management Pane Tab	Description
Storage		Displays information about file servers and storage arrays. See Chapter 5, "Managing Storage" for more information on managing storage.
	File Servers	Lists the file servers which contain file-based storage. Use this tab to register, edit, delete and discover file-based storage. Select File Servers in the tree to display this tab. For more information on file-based storage, see Section 5.2, "Storage Types" .
	File Servers	Lists the storage arrays. Use this tab to register, edit, delete and discover storage arrays. Select Storage Arrays in the tree to display this tab. For more information on storage arrays, see Section 5.2, "Storage Types" .
	Physical Disks	Lists the physical disks on the storage array. Use this tab to edit, clone and delete physical disks. Select a storage array in the tree to display this tab.
	Access Groups	Lists the access groups for the storage array. Use this tab to create, edit and delete storage array access groups. Also use this tab grant access to physical disks in the storage array to Oracle VM Servers using the access groups. Select a storage array in the tree to display this tab.
	Volume Groups	Lists the volume groups for the storage array. Use this tab to create, edit and delete storage array volume groups. Also use this tab grant access to physical disks in the storage array to Oracle VM Servers using the volume groups. Select a storage array in the tree to display this tab.
	Info	Displays information about the storage.
	Servers	Displays the Oracle VM Servers that have access to the disk in the storage array. This is not available for file servers. Select a disk in a storage array to display this tab.
	Events	Displays information about the events related to the object selected in the tree.

3.5.3 Jobs

Click **Jobs** for information on current and past tasks, or *jobs*. A job is a set of one or more operations made in Oracle VM Manager. See [Section B.1, "Working with the Jobs Framework"](#) for more information on managing jobs.

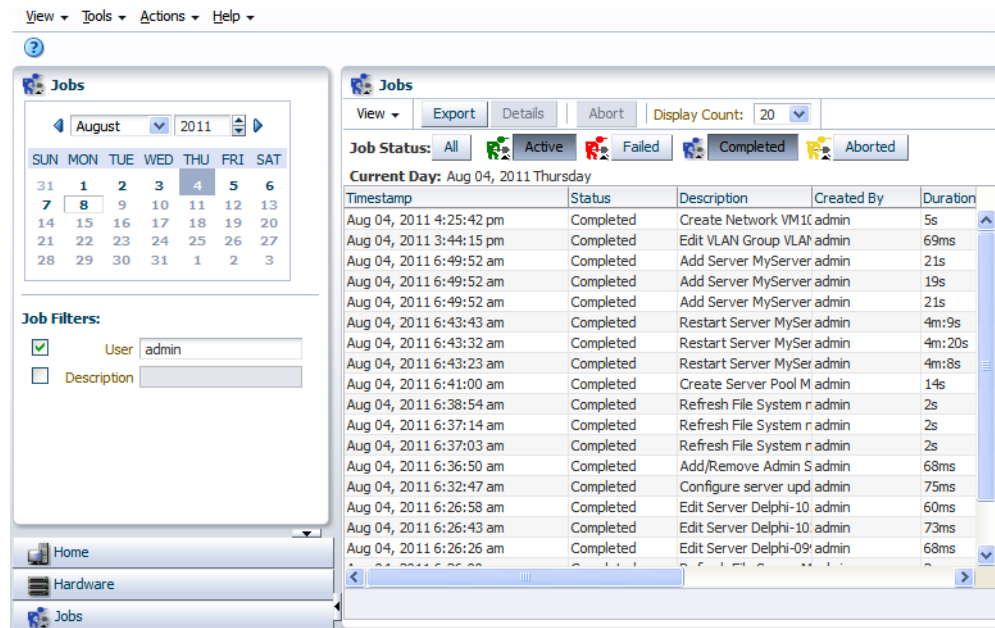
The Jobs view provides comprehensive information on all completed and in-progress jobs in the virtualization environment. The Jobs view is used to get a global view on jobs, to evaluate information on jobs completed or aborted, or to cancel a job in progress.

Jobs can be displayed for all users, or just for the administrator.

The Jobs calendar enables you to display the jobs for a particular date. Select a date in the Jobs calendar and the jobs for that date are displayed in the Jobs management pane.

Figure 3–5 shows the Jobs view.

Figure 3–5 Jobs View



The Jobs view contains the tabs set out in Table 3–8.

Table 3–8 Jobs View Tabs

Management Pane Tab	Subtab	Description
Jobs		Displays information on all jobs in a time-stamped list in the Jobs table. Jobs can be sorted and viewed by any column in the Jobs table. Click a column heading to resort the table content. The table contents can be reordered using View > Reorder Columns in the Jobs tab toolbar. The columns listed in the Jobs table can be selected using View > Columns in the Jobs tab toolbar. You can select which columns to view, and order the columns in the Jobs table using the View drop down menu. Click Export to save a list of the jobs to a spreadsheet file. Select an job in the tab and click Details to see the details of the job. To abort a job, select the job in the table and click Abort .
	Job Detail	This tab is displayed on the Jobs tab. The Job detail tab displays all the available information about the job selected in the Jobs table. If a message is associated with the job detail, it is displayed in the message pane.
	Job Operation	This tab is displayed on the Jobs tab. The Job operations tab displays the operations performed as part of the job.
	Job Events	This tab is displayed on the Jobs tab. The Job events tab displays a list of the events performed during the job.

Table 3–8 (Cont.) Jobs View Tabs

Management Pane Tab	Subtab	Description
Events Tab		<p>Displays information about each event.</p> <p>You can select which columns to view, and order the columns in the Events table using the View drop down menu. You can also use the View drop down menu, or the Query By Example icon to search for events.</p> <p>Click Export to save a list of the events to a spreadsheet file.</p>

3.6 Using the Toolbar

The toolbar is positioned just below the menu. The icons in the toolbar are arranged to support the work-flow required to perform tasks associated with the object selected in a view.

The menu and toolbar are used together to perform specific actions. Depending on the operation, the options in the Actions menu and the buttons in Toolbar change. For example, if you select an Oracle VM Server, the toolbar icons to manage Oracle VM Servers are displayed, as shown in figure [Figure 3–6](#).

Figure 3–6 Toolbar Icons for Managing an Oracle VM Server

In this case, you click the buttons in the toolbar to:

- Create a new virtual machine
- Edit the selected Oracle VM Server
- Rediscover the selected Oracle VM Server
- Start the selected Oracle VM Server
- Stop the selected Oracle VM Server
- Restart the selected Oracle VM Server
- Kill (power off) the selected Oracle VM Server
- Rescan the physical disks on the Oracle VM Server
- Update the Oracle VM Server using the configured YUM server
- Search for Oracle VM Servers, server pools, virtual machines and so on
- Display the online help

The options available in the toolbar mirror those available in the menus. See [Section 3.4.3, "Actions Menu"](#) for more information.

3.7 Using the Navigation Tree

The navigation tree shows the relationship between managed objects. These objects are both physical and virtual, and include Oracle VM Servers, server pools, and virtual machines created using Oracle VM Manager. For example, the Home view shows the relationships between server pools, Oracle VM Servers, and the virtual machines hosted on those Oracle VM Servers.

The content of the navigation tree changes, depending on the object you click in the tree.

A sample of the navigation tree for the **Home** view is shown in figure [Figure 3–7](#).

Figure 3–7 Navigation tree



In this example, the server pool named MyServerPool contains three Oracle VM Servers, named MyServer1, MyServer2, and MyServer3. A stopped virtual machine named MyHVM and a running virtual machine named MyPVM is hosted on MyServer2.

3.8 Object Icon Colors

The icon for an object may be one of three colors: gray, yellow or red. These colors represent the status of the object and the color meanings are listed in table [Table 3–9](#), "Object Icon Colors".

Table 3–9 Object Icon Colors

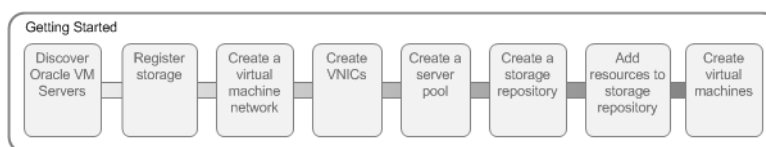
Icon Color	Icon Example	Status
Gray		Normal. No warning or error events.
Yellow		The object has a warning event associated with it.
Red		The object has an error event associated with it.

To see the events associated with an object, select the object in the navigation tree. The object's management pane is displayed, and includes the Events tab. The Events tab lists all the events for that object.

Getting Started

This tutorial describes how to get started with Oracle VM, and walks you through discovering Oracle VM Servers, registering storage, setting up networking, setting up a storage repository and importing resources into it, creating a server pool and creating virtual machines. You should read and follow this tutorial if you are new to Oracle VM and want to quickly get up and running.

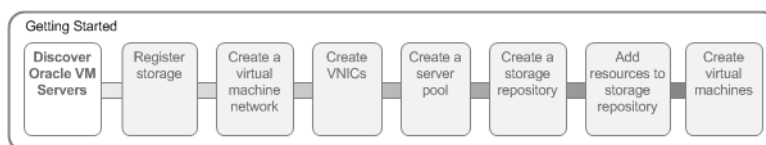
This tutorial includes a visual indicator graphic to show you where you are in relation to the tutorial steps, as shown below.



This tutorial includes the following steps, in the order you should perform them.

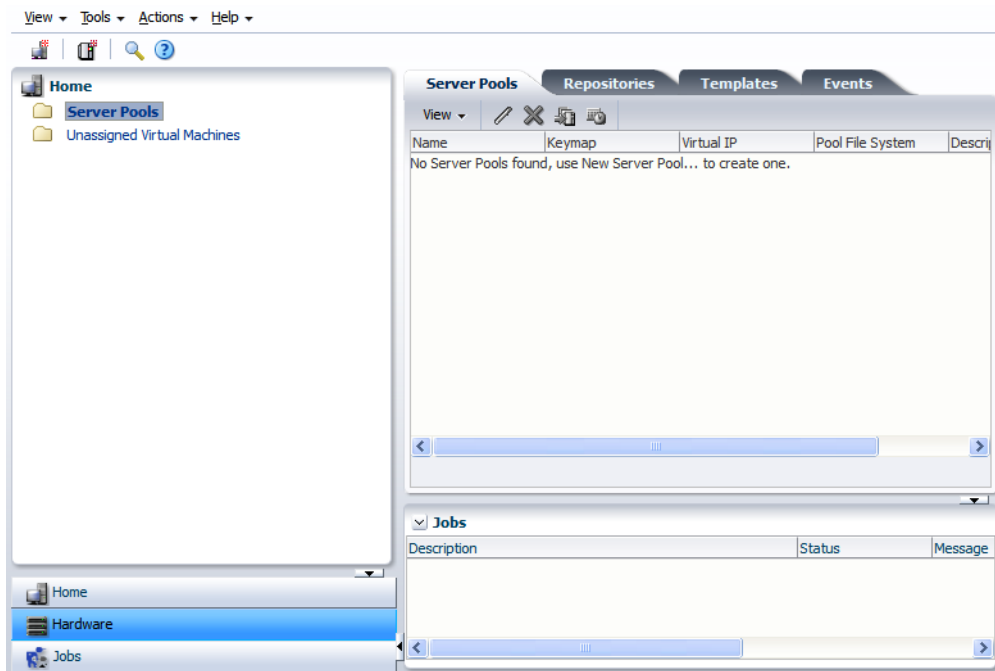
1. [Discover Oracle VM Servers](#)
2. [Register Storage](#)
3. [Create a Virtual Machine Network](#)
4. [Create VNICs](#)
5. [Create a Server Pool](#)
6. [Create a Storage Repository](#)
7. [Add Resources to Storage Repository](#)
8. [Create Virtual Machines](#)

4.1 Discover Oracle VM Servers



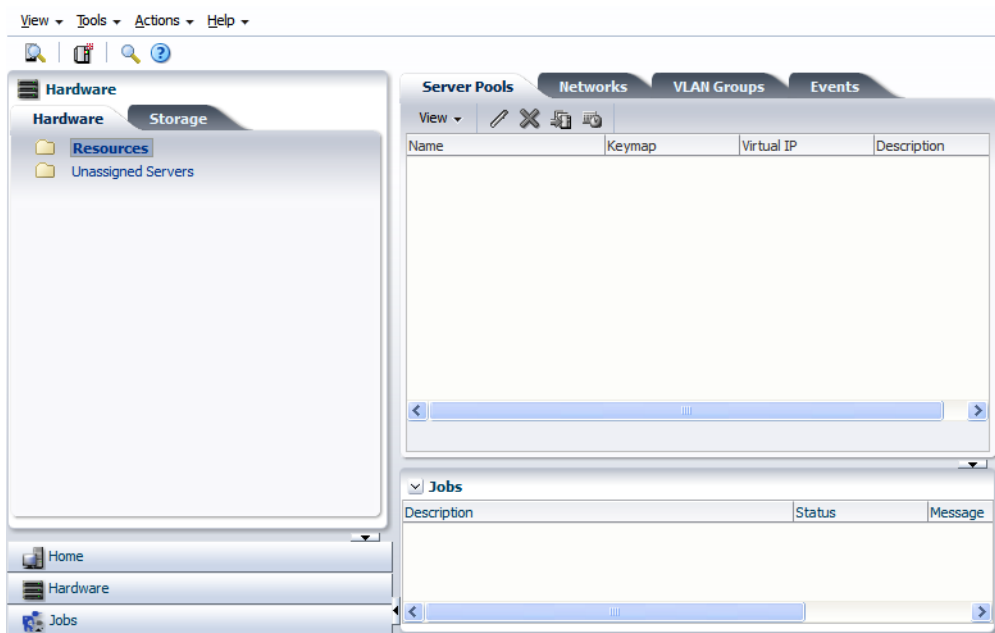
When you log into Oracle VM Manager, the Home view is the first screen displayed.

Figure 4–1 Home view



To set up your Oracle VM environment, you should move to the Hardware view. The Hardware view is where Oracle VM Servers, networking and external storage are added as resources.

Figure 4–2 Hardware view



When you add Oracle VM Servers to your Oracle VM Manager environment, this process is known as *discovering* Oracle VM Servers. This term is used often in this Guide. The first thing you should do to set up your virtualization environment is to *discover* your Oracle VM Servers.

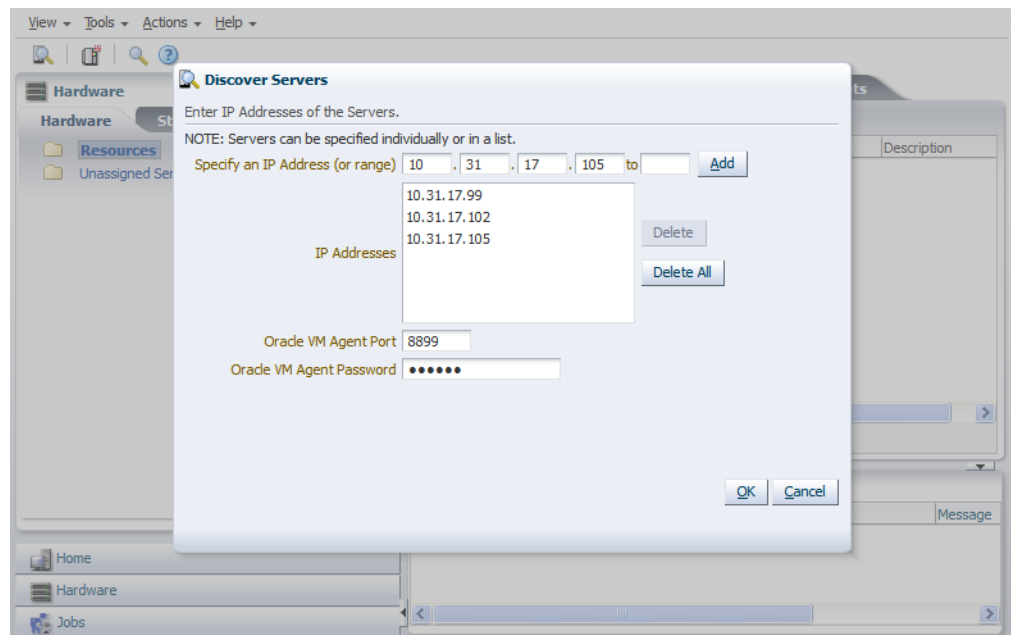
When an Oracle VM Server is discovered, it contains some basic information about itself, and about any immediate connectivity to a shared SAN, but it is considered to be in an unconfigured state. Any storage attached to the Oracle VM Server is also discovered.

Example 4–1 Discover Oracle VM Servers

This example walks through discovering three Oracle VM Servers. Replace the IP addresses and the Oracle VM Agent password for that of your own environment.

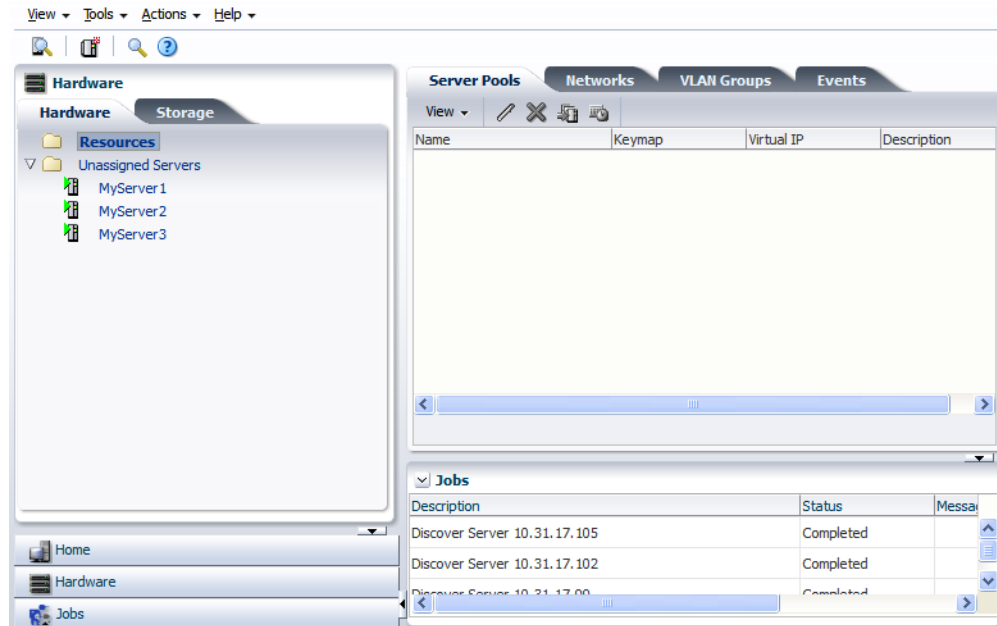
To discover Oracle VM Servers:

1. Select the **Hardware** view.
2. Select **Discover** from the **Actions** menu. The **Discover Servers** dialog box is displayed.
3. Enter information about the Oracle VM Server(s) to be discovered.



Click **OK**.

The Oracle VM Servers are discovered and added to the **Unassigned Servers** folder.

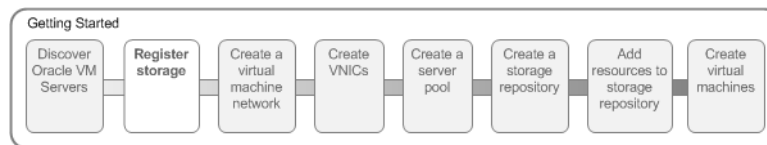


For more information on discovering an Oracle VM Server, see [Section 7.8.1, "Discovering Oracle VM Servers"](#).

Depending on your hardware and networking configuration, external storage may be automatically detected during discovery of the Oracle VM Servers. This is always the case with local OCFS2 storage on an Oracle VM Server.

When you have discovered your Oracle VM Servers, you should register your storage.

4.2 Register Storage



Storage refers to two different types of disk space: the space available for environment resources such as virtual machine templates and ISO files, and the logical or physical disks used by virtual machines. You can use two types of storage for virtual machines:

- **Virtual disks:** disk image files on a file system.
- **Raw physical disks:** LUNs accessed directly by the virtual machine.

Your storage can be any of the following:

- **iSCSI:** Abstracted LUNs or raw disks accessible over existing Ethernet infrastructure (SAN)
- **FCP:** Abstracted LUNs or raw disks accessible over Fibre Channel host bus adapters (SAN)
- **NFS:** File-based storage over existing Ethernet infrastructure (NAS)

In addition to the storage entities you require for storage repositories, you should make sure you leave some disk space available to create storage entities of at least 12GB each to use as server pool file systems. The server pool file system is used to

hold the server pool and cluster data, and is also used for cluster heartbeating. You create server pool file systems the same way you create storage entities for storage repositories. For more information about the use and management of clusters and server pools, see [Chapter 7, "Managing Server Pools"](#).

Your storage may have been automatically discovered when you discovered your Oracle VM Servers. If not, you must register it. If your storage server exposes a writable file system (through an NFS share or a Sun ZFS storage pool) register the file server using the procedure in [Section 5.6.1, "Registering and Configuring File Servers"](#). If your storage server exposes raw disks (SAN volumes, iSCSI targets and LUNs) register the storage array using the procedure in [Section 5.6.3, "Registering and Configuring Storage Arrays"](#).

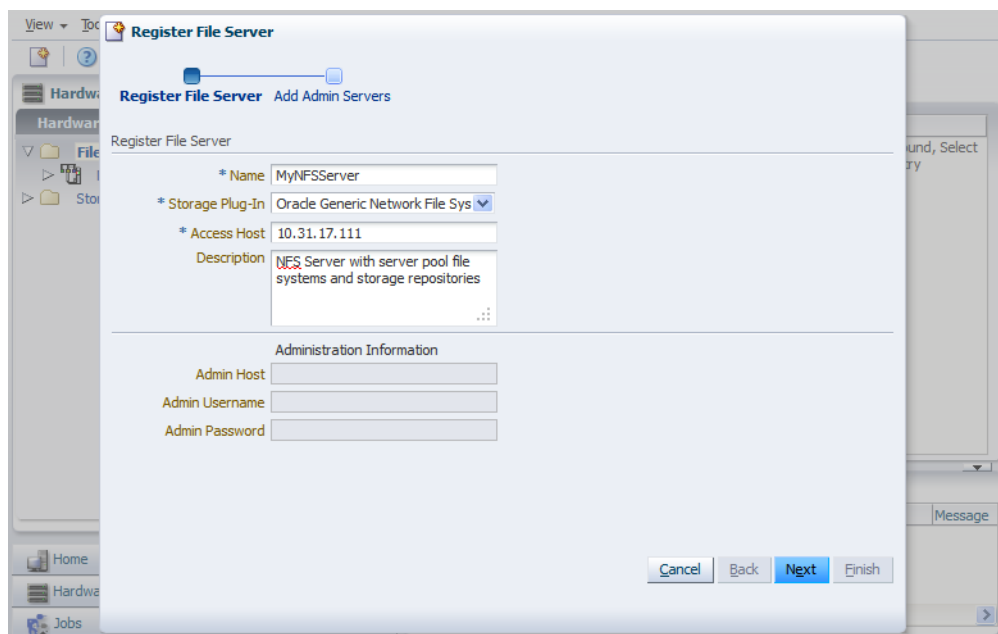
The following examples show how to register a file server, and a storage array. Before you register any storage, you must first perform any storage configuration outside of the Oracle VM environment, such as creating and exporting file system mounts on an NFS server.

Example 4–2 Register NFS file server

This example uses a *file server* storage type (an NFS share). Replace the IP address for that of your own NFS server. On the NFS server you should have at least two file systems, one of at least 12GB for the server pool file system, and one larger file system for the repository.

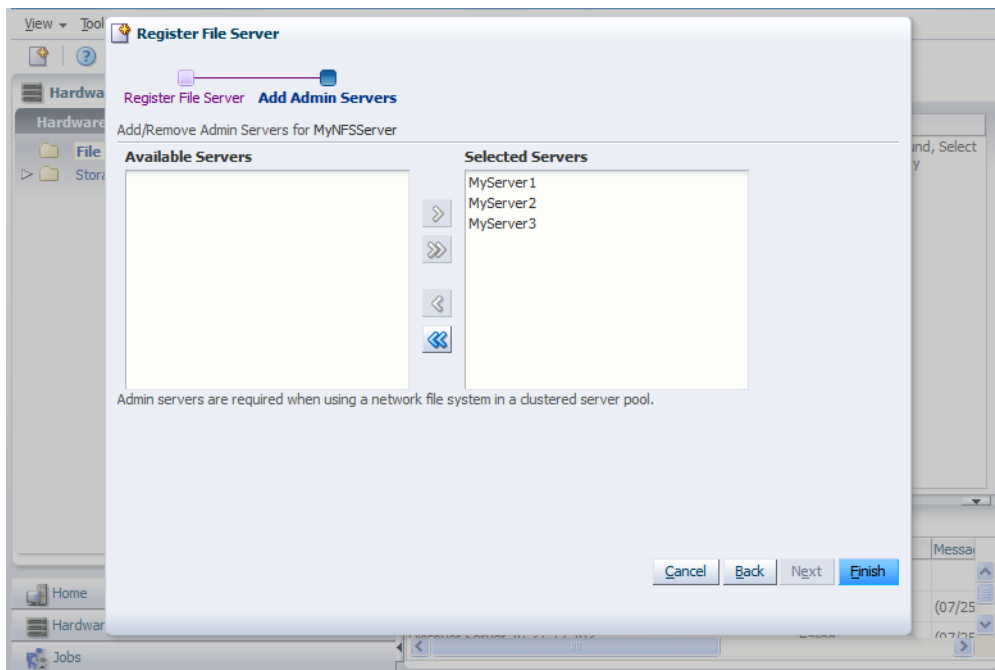
To register a file server:

1. Select the **Hardware** view and open the **Storage** tab in the navigation pane.
2. In the navigation pane, select the **File Servers** tab and select **Register File Server** from the **Actions** menu. The **Register File Server** wizard is displayed.

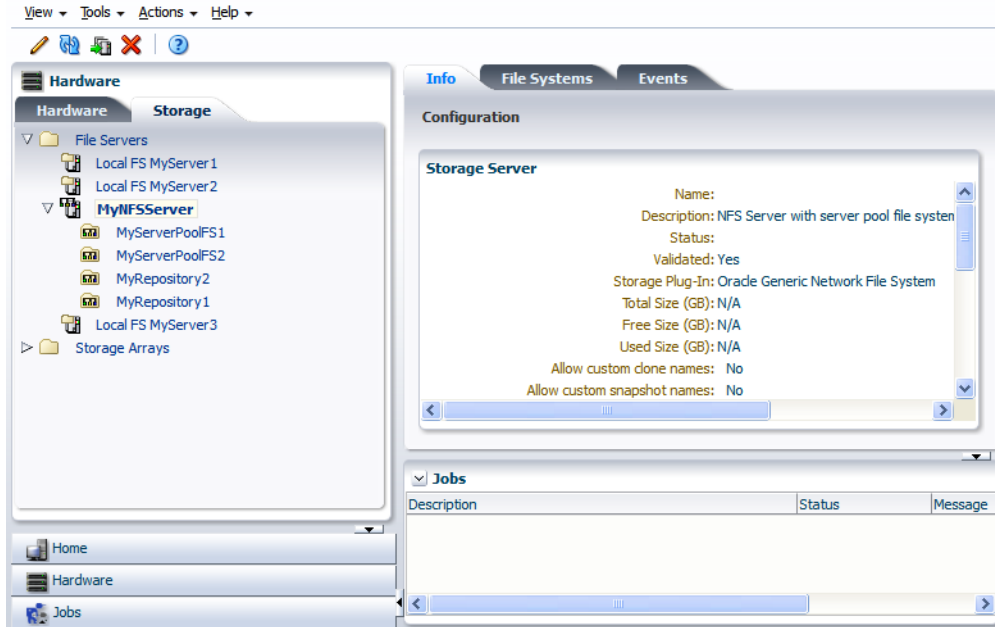


Enter information about your file server such as the IP address and click **Next**.

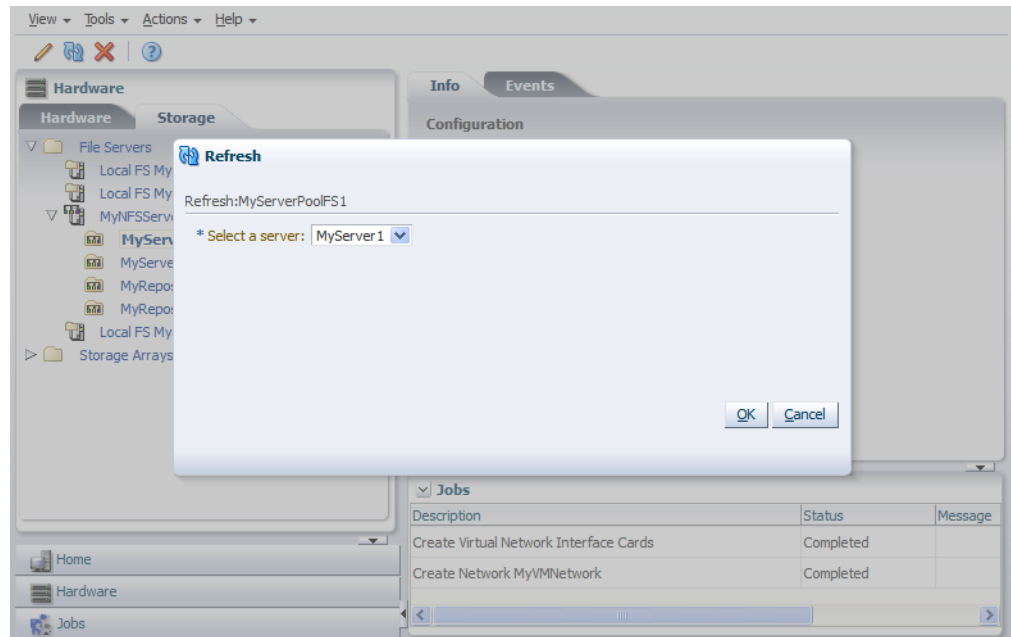
3. Assign one or more Oracle VM Servers to perform any required administration on the file server. Click **Finish**.



4. The new file server is displayed in the navigation pane, under **File Servers**. At this point, the Storage Connect plug-in has established a link to the storage location and discovered each file system on the file server. All the file systems for the NFS file server are added to Oracle VM Manager.



5. Before you can use a mount point, you must *refresh* it. Select each mount point on the file server individually, and select **Refresh File System** from the **Actions** menu.

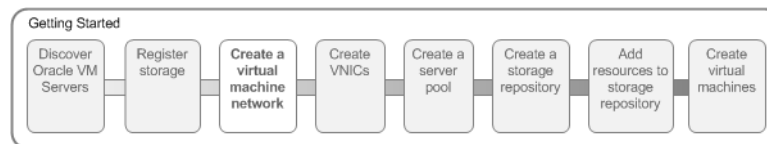


You need to assign an Oracle VM Server to perform the work of refreshing the file system. Select one in the **Refresh** dialog box and click **OK**. Repeat this step to refresh all the server pool file systems and repositories you want to use.

For more information about registering and configuring storage, see [Chapter 5, "Managing Storage"](#).

Now your storage is ready to be used to create a storage repository or server pool file system.

4.3 Create a Virtual Machine Network



Oracle VM has a number of network functions: Server Management, Live Migrate, Cluster Heartbeat, Virtual Machine, and Storage. The Server Management, Live Migrate and Cluster Heartbeat roles are automatically assigned to the management network when you discover Oracle VM Servers. The Virtual Machine and Storage roles are not automatically created, and you must manually create these. The Storage role is only required for Ethernet-based storage, so for the purposes of the NFS-based storage used in this tutorial, is not required. We do, however, need to create a network with the Virtual Machine role. This can be assigned to the existing management network, or a new network can be created and the Virtual Machine role assigned to it. This tutorial shows you how to create a new network.

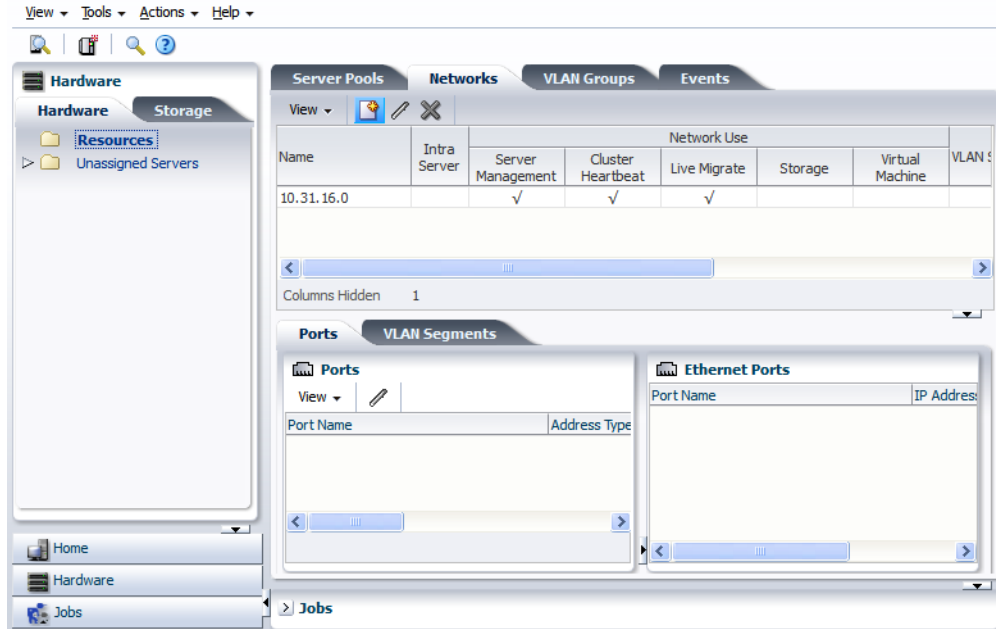
Example 4-3 Create a Virtual Machine Network

This example creates a virtual machine network using network interface cards (NICs) on the Oracle VM Servers discovered earlier. In this example we are using bonded Ethernet ports. Each Oracle VM Server should have a set of Ethernet ports to use for

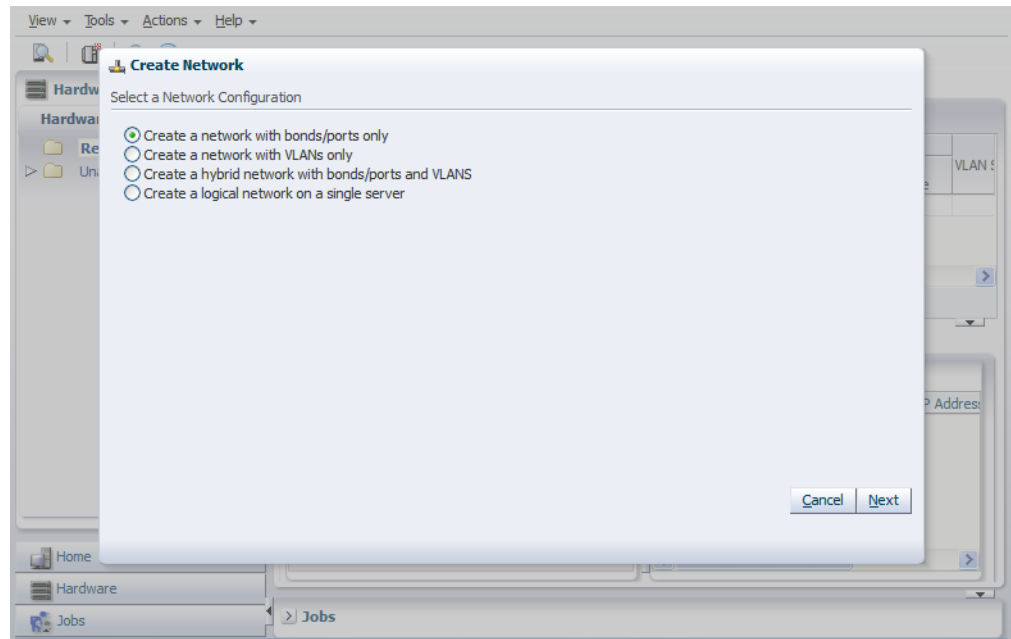
the virtual machine network. Oracle recommends at least two ports per Oracle VM Server, one for the management network, and one for a network with the Virtual Machine role. Replace the information in this example with that of your Oracle VM Servers and environment.

To create a virtual machine network:

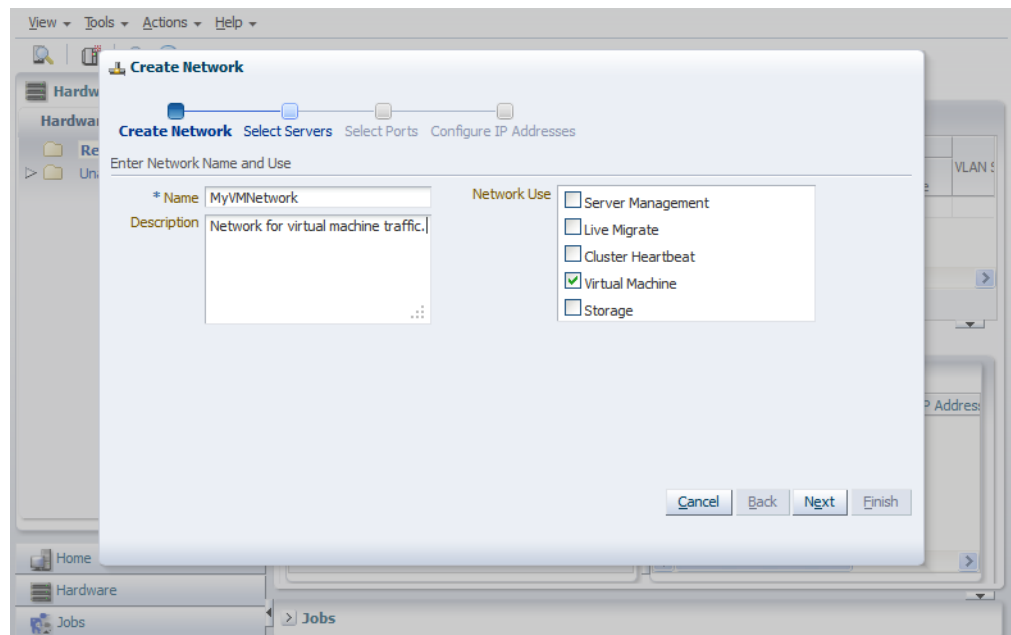
1. Select the **Hardware** view, and select the **Hardware** tab, then the **Resources** folder. Select the **Networks** tab in the management pane.



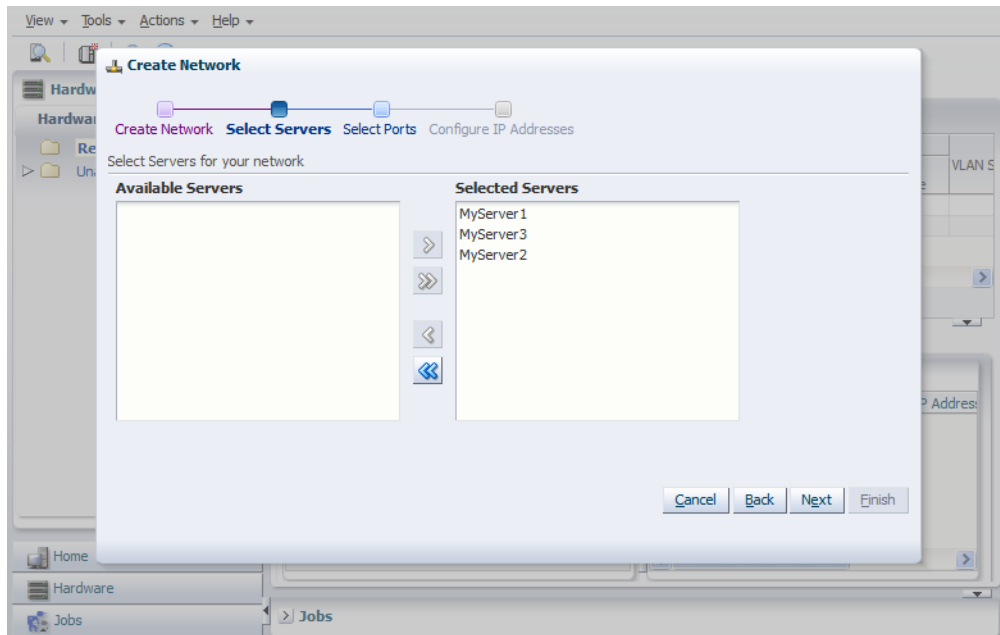
2. Click **Create** to start the **Network Configuration** wizard. Select the type of network to create, based on your network infrastructure. In this example we use the ethernet ports on each Oracle VM Server to create a network for virtual machine traffic. Click **Next**.



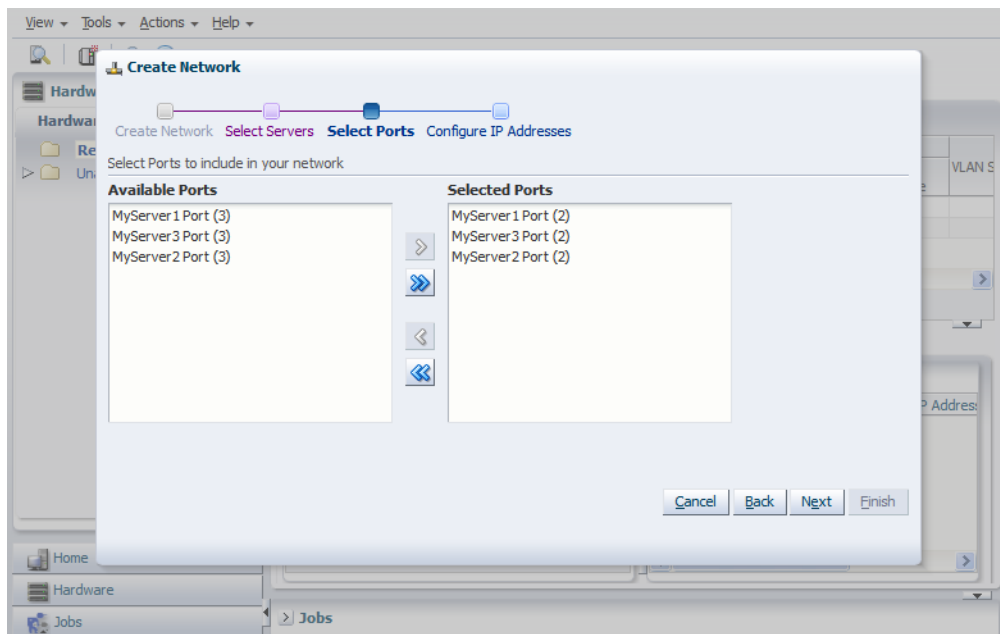
3. At the Create Network step, enter information about the network and the network functions. The **Network Usage** fields are where you decide which network functions are to be assigned to the network. Select **Virtual Machine** and click **Next**.



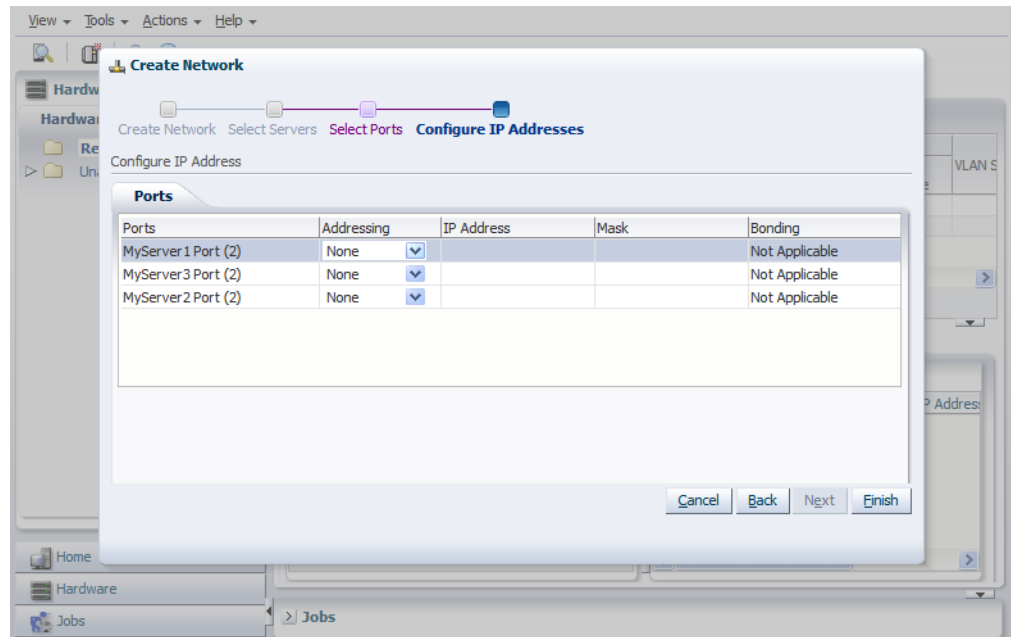
4. To discover the Ethernet ports on the Oracle VM Servers, select them and move them to the **Selected Servers** field, and click **Next**.



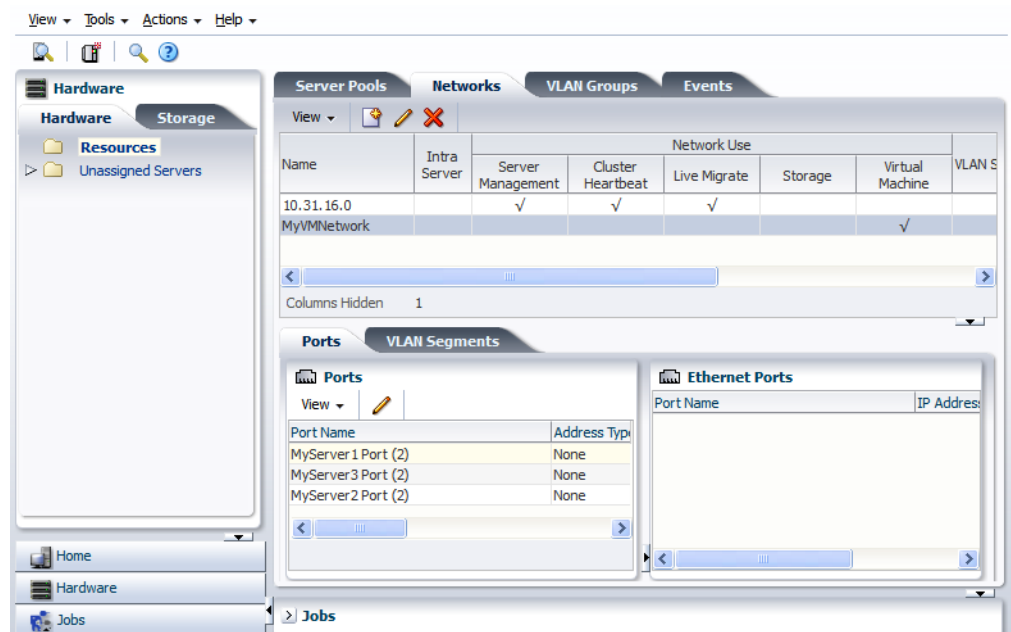
5. Select a port from each Oracle VM Server to use for the virtual machine network and click **Next**.



6. You can use static IP addresses, DHCP or have no IP addresses assigned to the network. In this example we do not need to use IP addresses as we are creating a network for use only by virtual machines, so we set the **Addressing** to **None**. Click **Finish** to create the network.



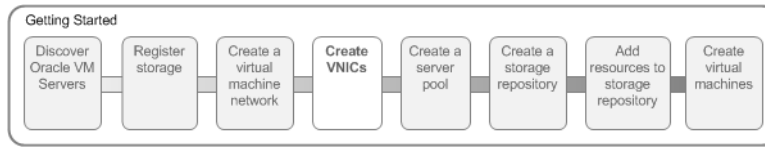
The newly created virtual machine network is created and listed in the **Networks** tab. This virtual machine network is ready to use when creating virtual machines.



See [Chapter 6, "Managing Networks"](#) for information on creating and configuring networks.

Now you have set up the virtual machine network, you should generate some virtual NICs to use in virtual machines to enable network connectivity.

4.4 Create VNICs



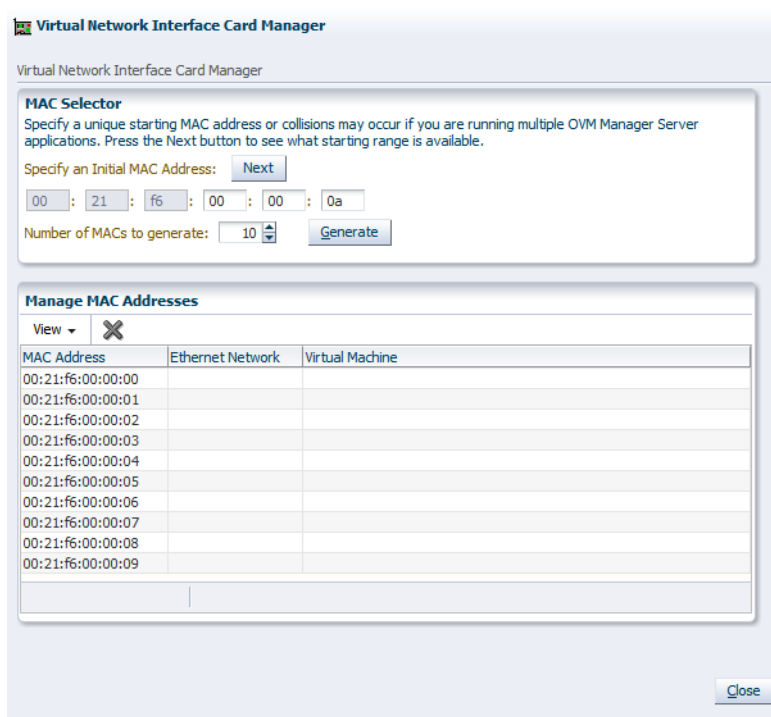
The VNIC Manager creates Virtual Network Interface Cards (VNICs), which can be used by virtual machines as network cards. You create virtual network interfaces by defining a range of MAC addresses to use for each VNIC. Each MAC address corresponds with a single VNIC, which is used by a virtual machine. Before you can create a virtual machine which has the ability to connect to the network, you should generate a set of VNICs with the Vnic Manager. You only need to perform this step when you run out of VNICs, not each time you want to create a virtual machine.

Example 4–4 Generating VNICs

This example generates 10 VNICs to use with virtual machines. The MAC addresses will differ in your environment, but the process is the same as that shown here.

To generate VNICs:

1. Select **Vnic Manager** from the **Tools** menu.

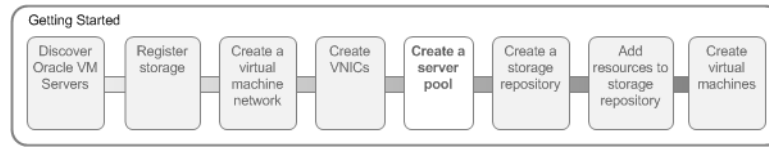


2. Click **Next** in the **MAC Selector** panel to get the next available MAC address.
Select the number of addresses that you want to create and click **Generate**.
Click **Close** to close the Vnic Manager.

See [Section 8.6, "Using the VNIC Manager"](#) for information on generating VNICs.

When you have generated VNICs, you can use them to add network connectivity to your virtual machines. Next, we create a server pool.

4.5 Create a Server Pool



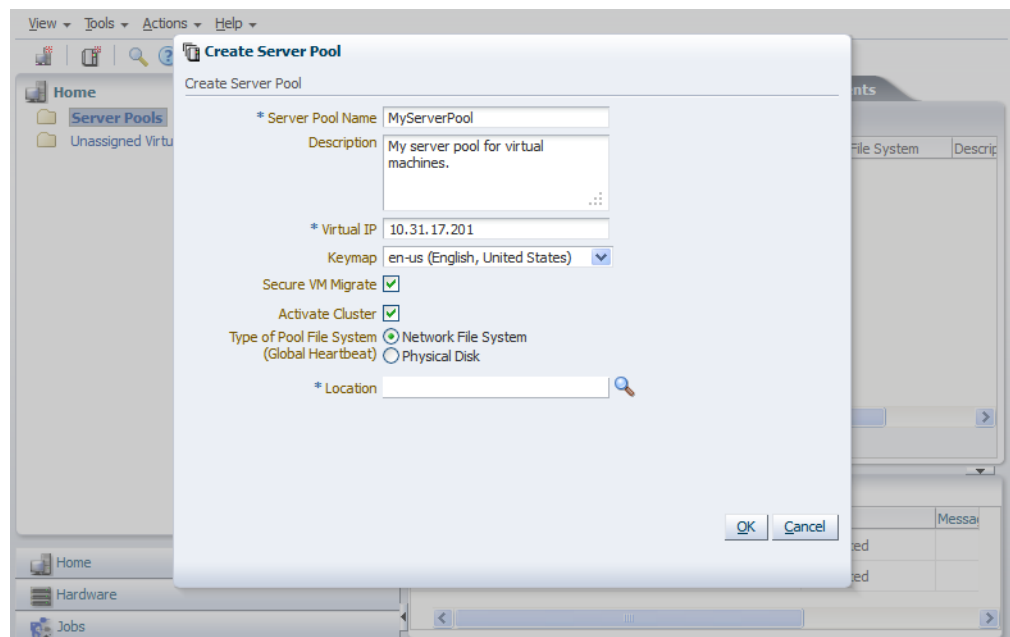
A server pool contains a group of Oracle VM Servers, which as a group perform virtual machine management tasks, such as High Availability (HA), implementation of resource and power management policies, access to networking, storage and repositories.

Example 4–5 Create a server pool

This example creates a server pool using the Oracle VM Servers, and the server pool file system on the file system-based storage (NFS server). You need an IP address to use as the virtual IP address to enable clustering and HA. Replace the server pool information in this example with that of your environment.

To create a server pool:

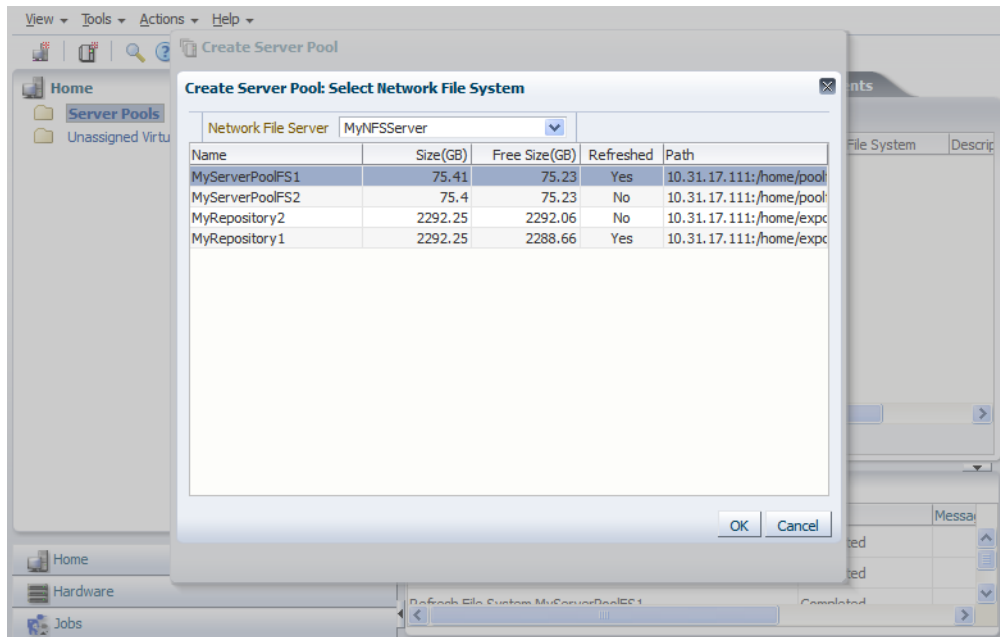
1. Select the **Home** view.
2. Select **Create Server Pool** from the **Actions** menu.
3. The **Create Server Pool** dialog box is displayed. Enter the server pool information:



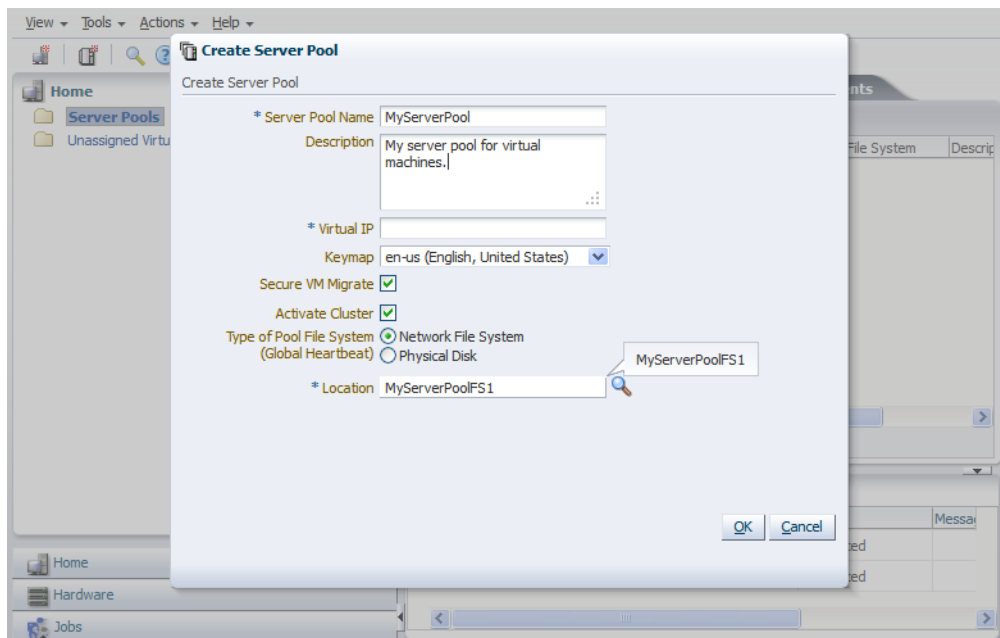
An IP address is required to use as a virtual IP address to identify the master Oracle VM Server, which controls the other Oracle VM Server in the server pool.

Select **Activate Cluster** to enable clustering of the Oracle VM Servers in the server pool, which is required to enable HA.

Select **Network File System** as the file system type to use for the server pool. The server pool file system is used to hold the server pool and cluster data, and is also used for cluster heartbeating. Use the **Location** search icon to search for the server pool file system.

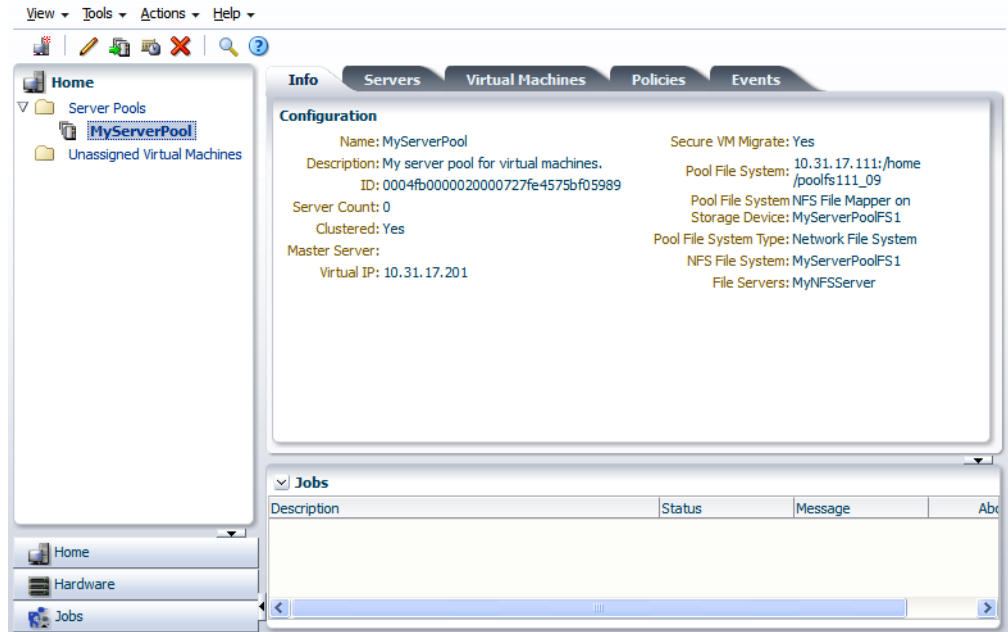


Select the file system to use for the server pool file system and click **OK**.



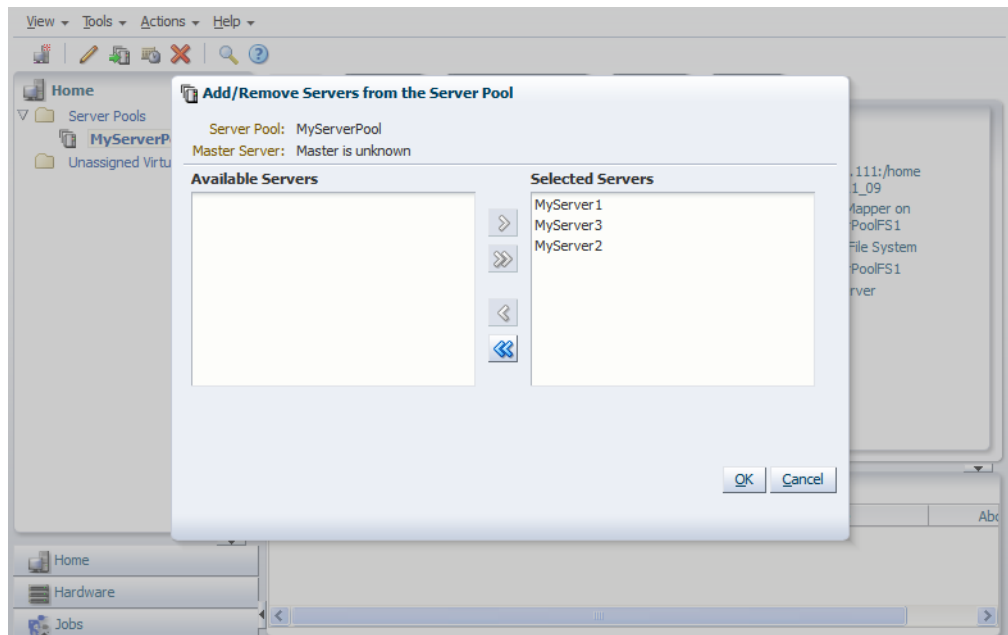
Click **OK** to create the server pool.

4. Now you have created a server pool, you can add the Oracle VM Servers to it.

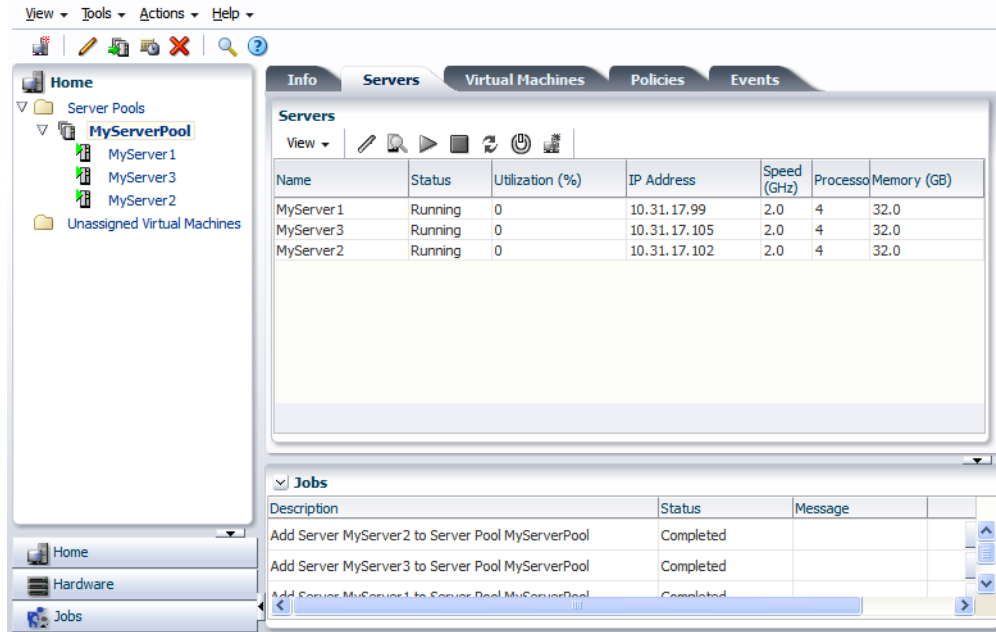


Select the server pool in the navigator, then select **Add/Remove Servers** from the **Actions** menu.

5. Add the Oracle VM Servers to the **Selected Servers** field and click **OK**.



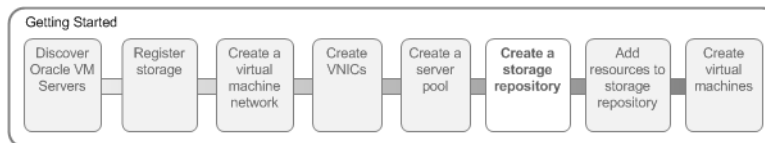
The Oracle VM Servers are added to the server pool and ready to use to create virtual machines.



For more information on creating server pools and adding Oracle VM Servers, see [Section 7.6, "Creating a Server Pool"](#) and [Section 7.7.1, "Adding an Oracle VM Server to a Server Pool"](#).

The next step is to create a storage repository to use for virtual machine resources.

4.6 Create a Storage Repository



A storage repository is where Oracle VM resources may reside on the storage you registered in [Section 4.2, "Register Storage"](#). Resources include virtual machines, templates for virtual machine creation, virtual machine assemblies, ISO files (DVD image files), shared virtual disks, and so on.

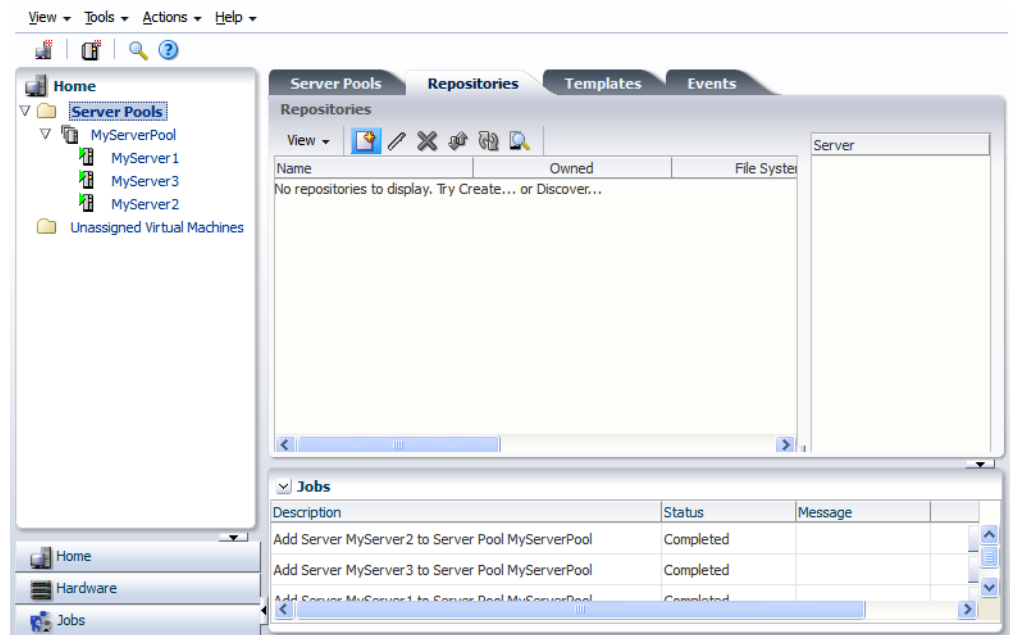
You use Oracle VM Manager to create and configure storage repositories, and to present one or more storage repositories to Oracle VM Servers in a server pool. When the storage repository is accessible, you can start adding storage resources and building virtual machines with those resources.

Example 4–6 Create a storage repository

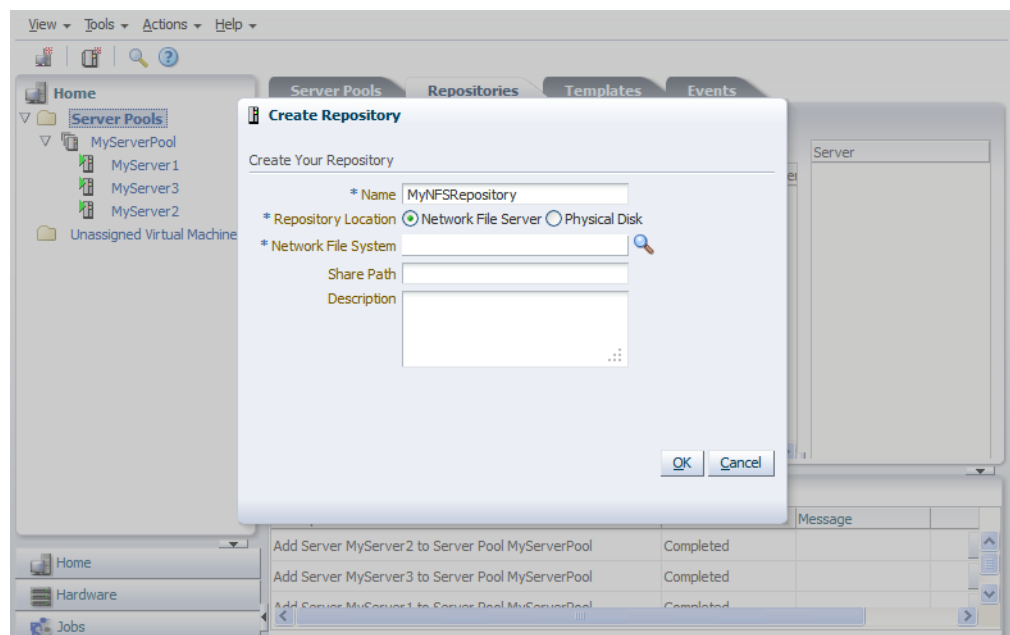
This example creates a storage repository to store virtual machine resources using an NFS file server. Use the larger of the file systems you refreshed earlier. Replace the file server and other names used in this example with that of your own environment.

To create a storage repository:

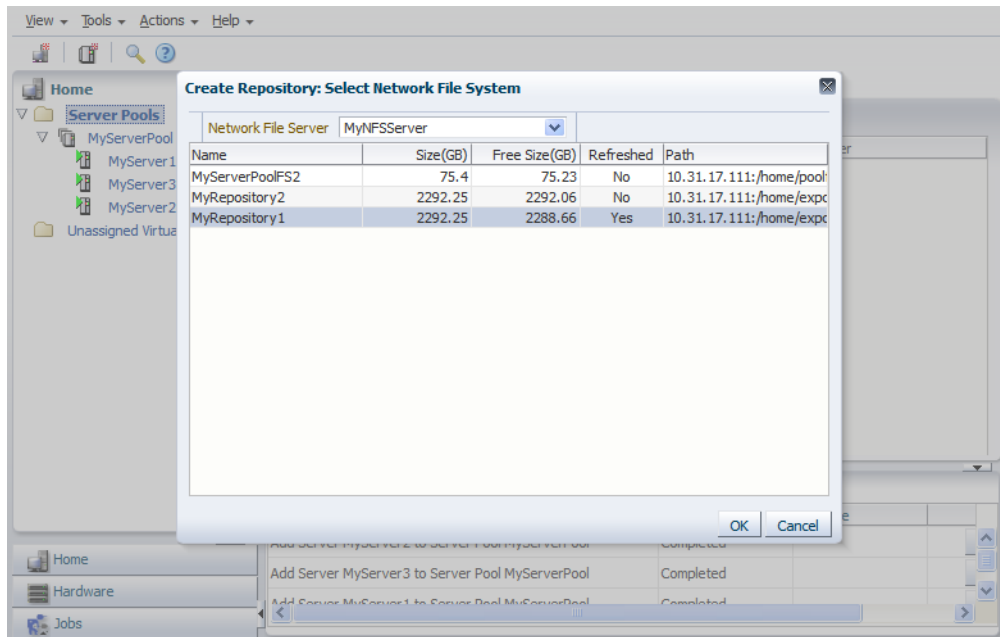
1. Select the **Home** view and select the **Server Pools** folder in the navigator.
2. In the management pane, select the **Repositories** tab.



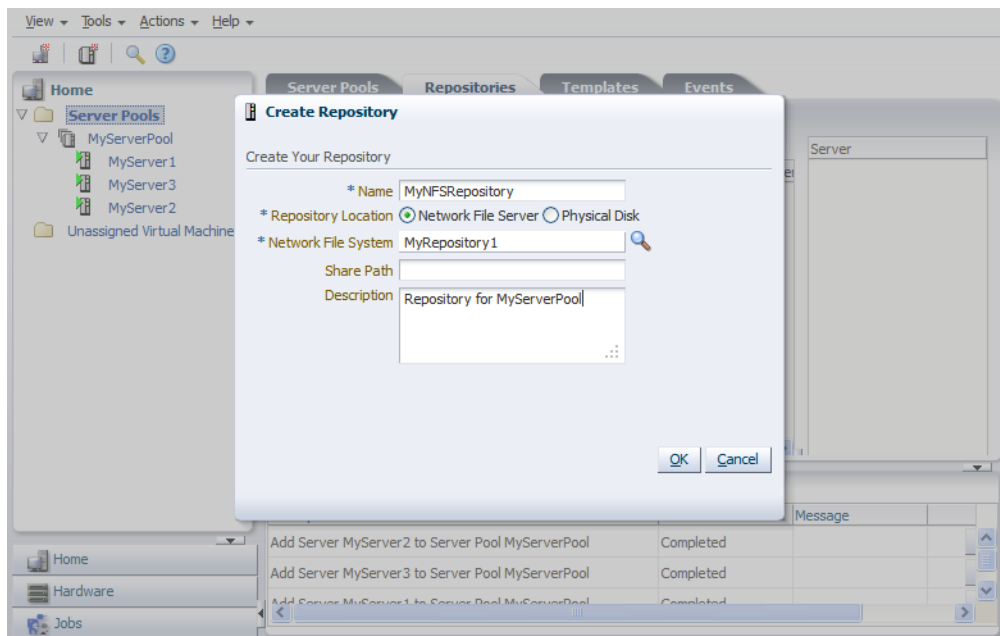
3. Click **Create** to create a new storage repository.
4. In the **Create Repository** dialog box, enter information about the repository.



Select **Network File Server** as the **Repository Location** to use the NFS server. Click the search icon to search for the available file systems on the registered file server.

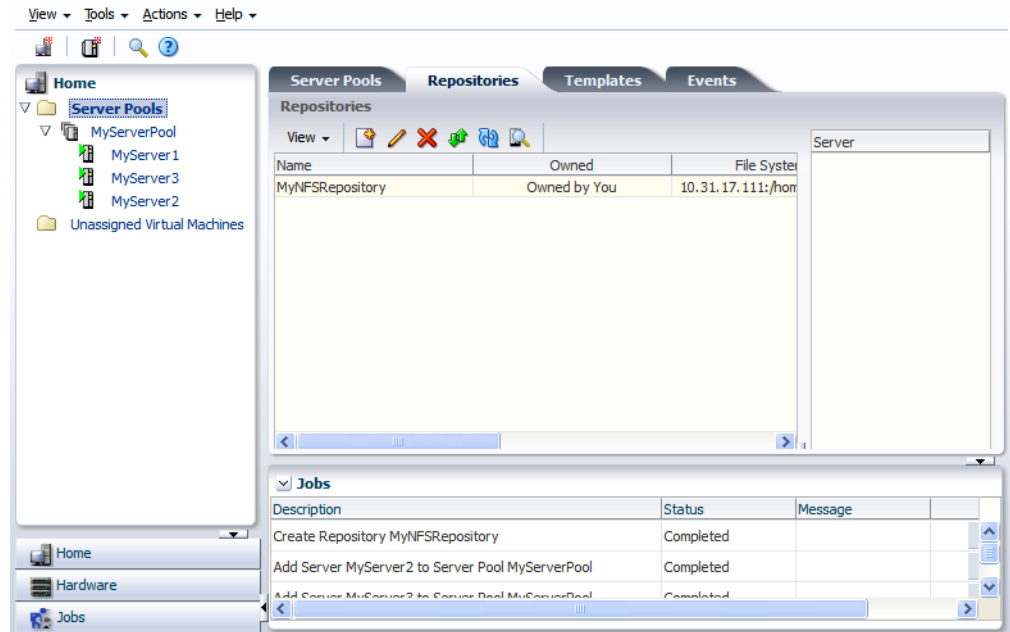


Select a file system and click **OK**.

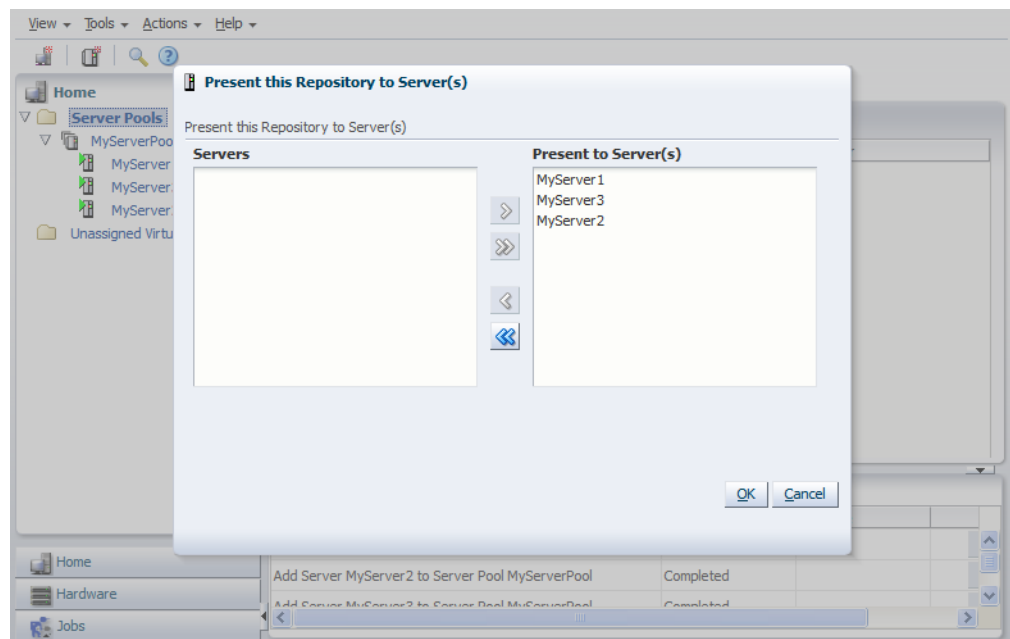


Click **OK** to create the new storage repository.

The new storage repository is displayed in the **Repositories** tab.

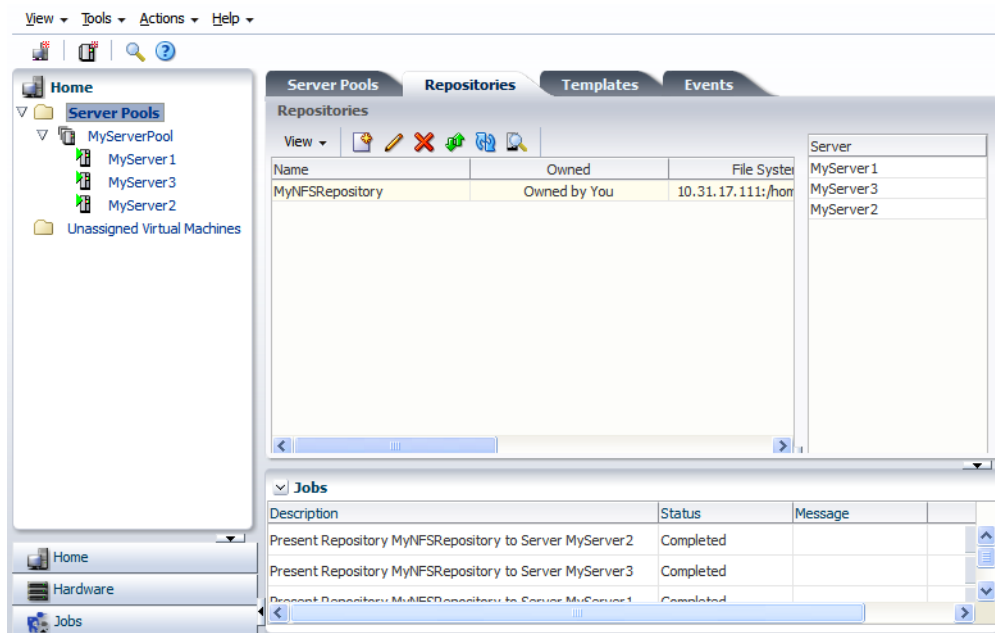


- At this point, the storage repository has been created. However, to enable your Oracle VM Servers to use it, you must *present* the repository to the Oracle VM Servers in your server pool. Select the repository in table and click the **Present/Unpresent Selected Repository** icon.



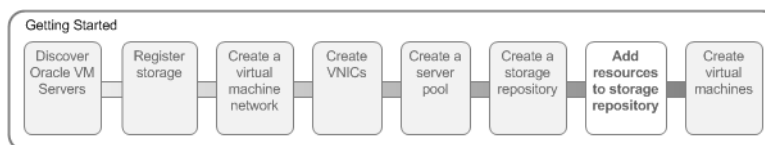
Select the Oracle VM Servers and move them to the **Present to Server(s)** field and click **OK**.

The Oracle VM Servers are now listed in the Server table when you select the repository. This table shows which Oracle VM Servers have access to the repository.



For more information about storage repositories, see [Section 5.8, "Preparing and Configuring Storage Repositories"](#).

4.7 Add Resources to Storage Repository



Virtual machines require some form of installation media, whether it be a virtual machine template, virtual disk, ISO file, or mounted ISO file. Different domain types may require different installation source files. You can read about the different installation media in [Section 8.4, "Virtual Machine Installation Media"](#). The following examples show you how to import a virtual machine template, and an ISO file which are used in later steps to create virtual machines. A virtual machine template contains virtual machine configuration information, virtual disks that contain the operating system and any application software, packaged as a template file. An operating system ISO file is an image of the CDROM or DVD used to perform an operating system installation.

In this tutorial we use a virtual machine template and an Oracle Linux ISO file downloaded from the Oracle Software Delivery Cloud:

<https://edelivery.oracle.com/linux>

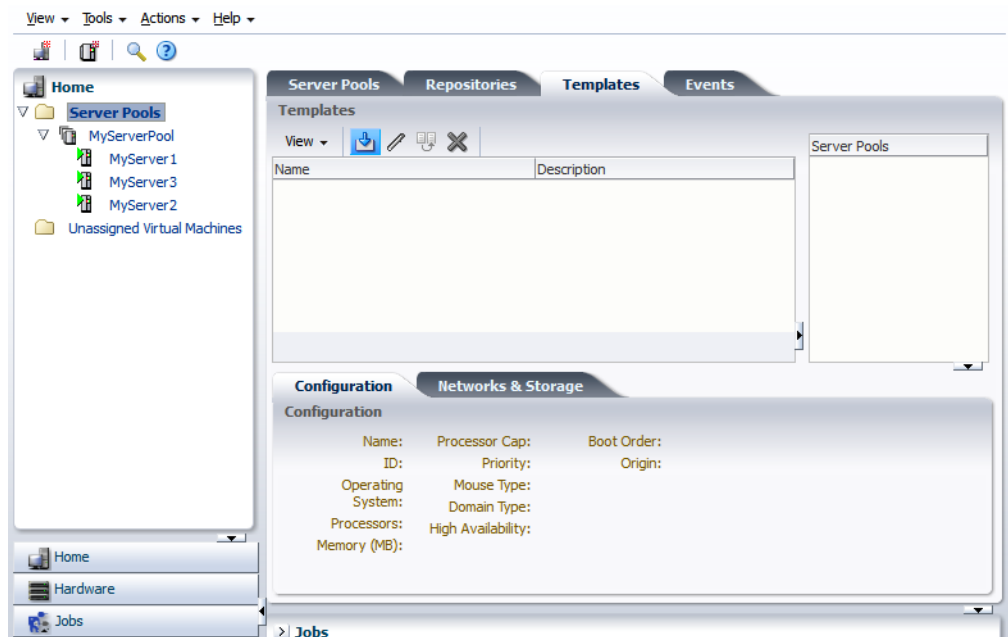
Download an Oracle VM template and an ISO file of the Oracle Linux operating system. Uncompress (unzip) the template file so that it is in the *template.tgz* format, not the downloaded *template.zip* format. Save the template and ISO file on a web server. Templates and other installation media must be available on a web server before being imported into Oracle VM Manager.

Example 4-7 Import a virtual machine template

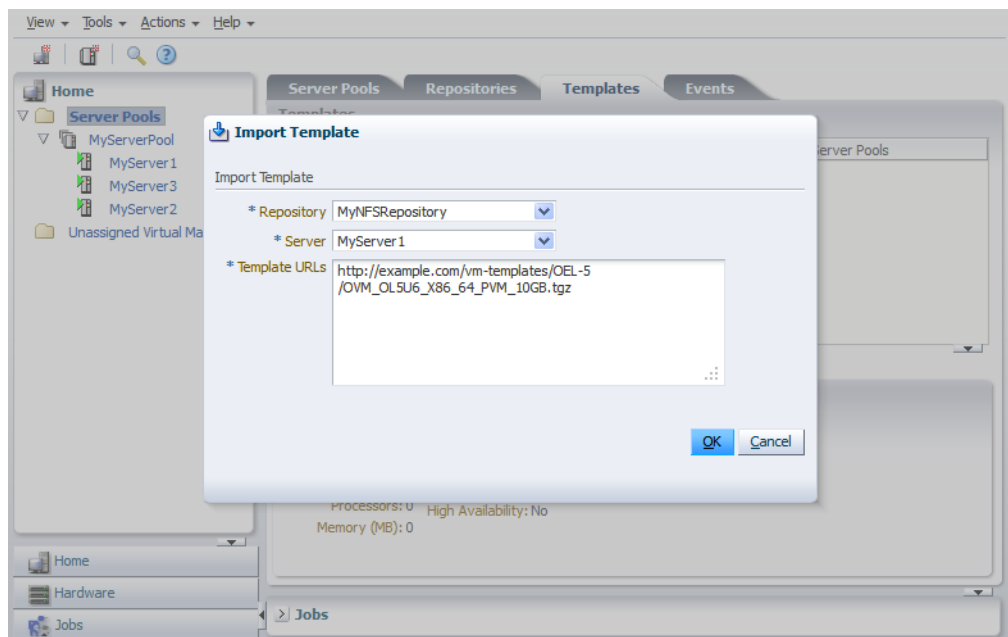
This example shows you how to import the virtual machine template you downloaded from the Oracle Software Delivery Cloud. Replace the name and URL of the template with that of your template.

To import a virtual machine template:

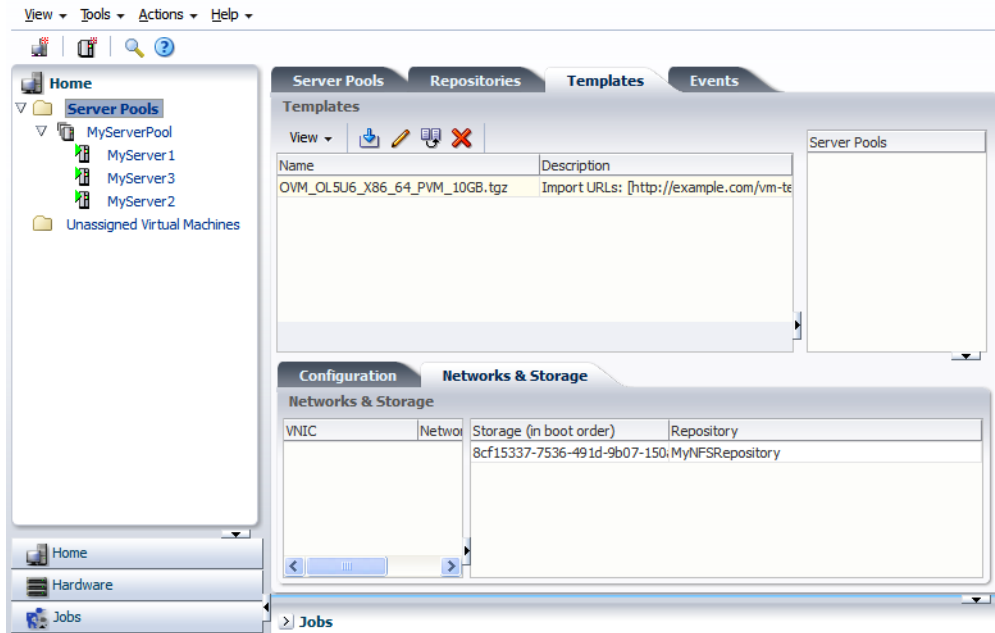
1. In the **Home** view click **Server Pools** in the navigation pane, then open the **Templates** tab in the management pane.



2. Click **Import** to open the **Import Template** dialog box.



Select the repository you created earlier to store the template. Select an Oracle VM Server to use to perform the template import, and enter the URL to the template you downloaded and stored on a web server. Click **OK** to import the template.



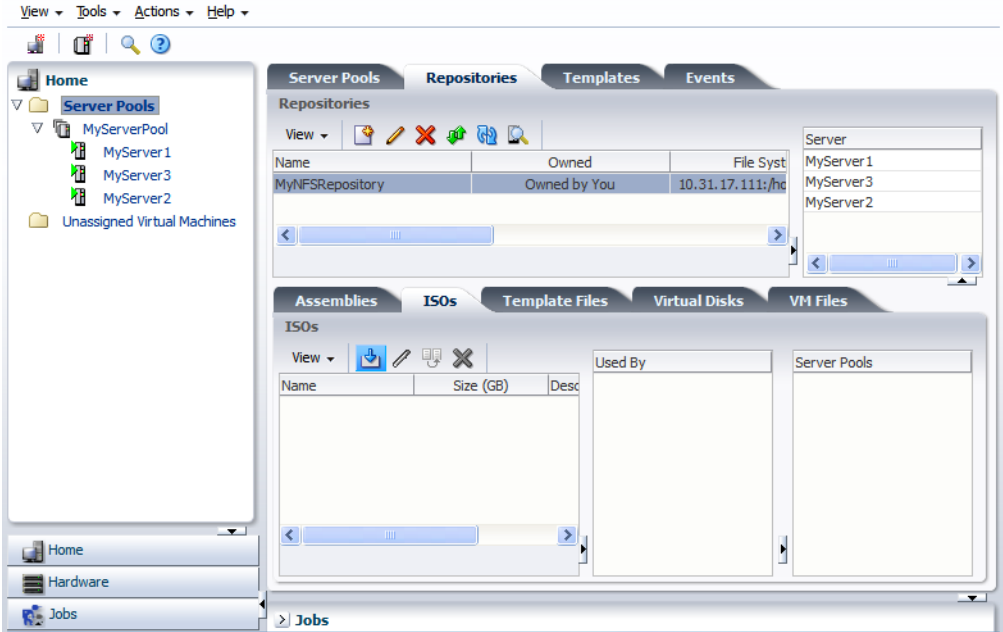
The import job can take some time to complete. When the import is complete, the new template is listed in the **Templates** table.

Example 4–8 Import an ISO file

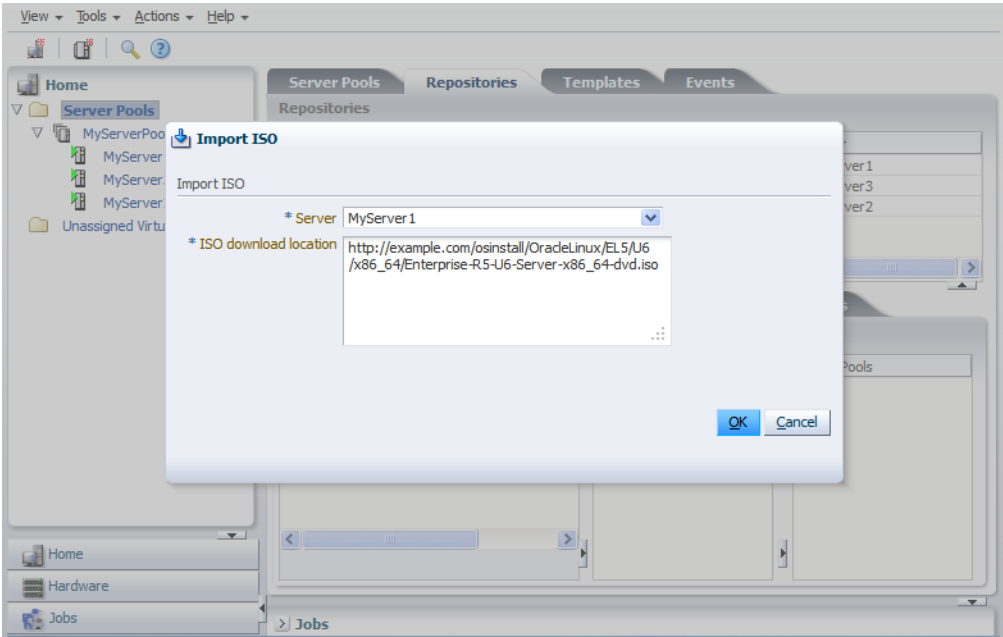
This example shows you how to import the Oracle Linux ISO file you downloaded from the Oracle Software Delivery Cloud. Replace the name and URL of the ISO file with that of your file.

To import an ISO file:

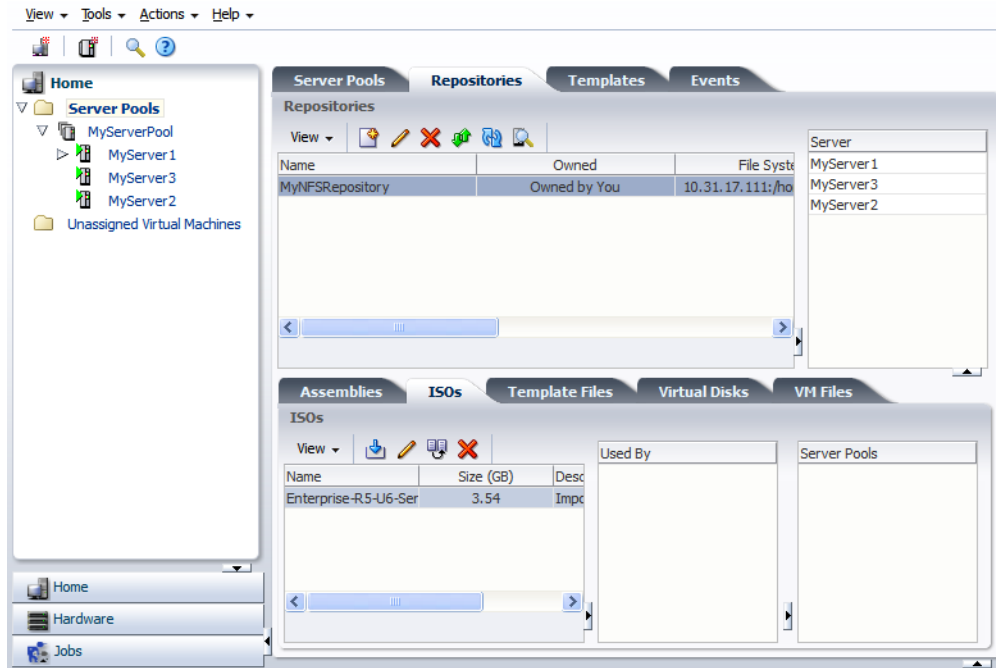
1. In the **Home** view click **Server Pools** in the navigation pane, then open the **Repositories** tab in the management pane.
2. Select the storage repository we created earlier and open the **ISOs** tab below.



3. Click **Import** to open the **Import ISO** dialog box.



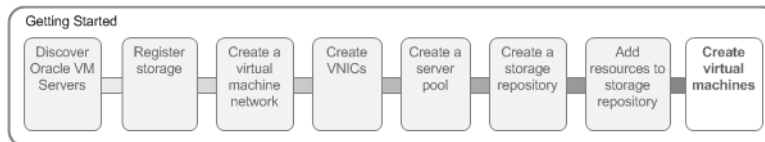
Select an Oracle VM Server from the **Server** list to perform the import, and enter the URL to the ISO file you want to import. Click **OK** to import the ISO file.



The import job can take some time to complete. When the import is complete, the ISO file appears in the table.

See [Section 8.5, "Virtual Machine Resources"](#) for information on importing, managing and using virtual machine resources.

4.8 Create Virtual Machines



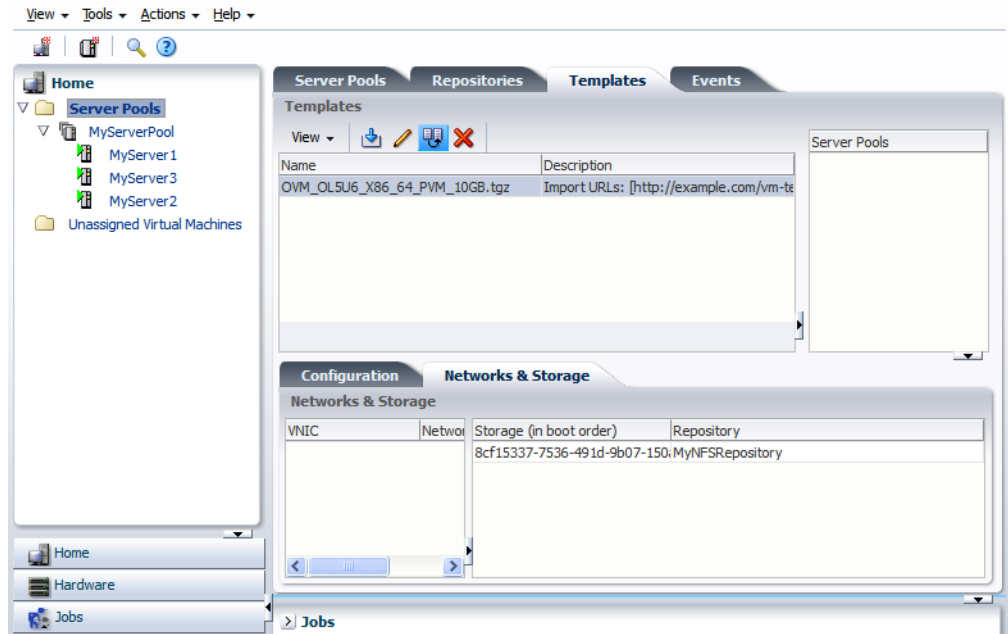
When you have a virtual machine template an/or an ISO file that contains an the installation files for an operating system, you can create a virtual machine. If you use a virtual machine template, you need to clone the template to create a virtual machine. if you use an installation source ISO file, you can create a virtual machine directly from the ISO file. The examples in this tutorial first use a template, then an ISO file to create virtual machines. A final example shows you how to start a virtual machine and connect to the virtual machine’s console.

Example 4–9 Create a virtual machine from a template

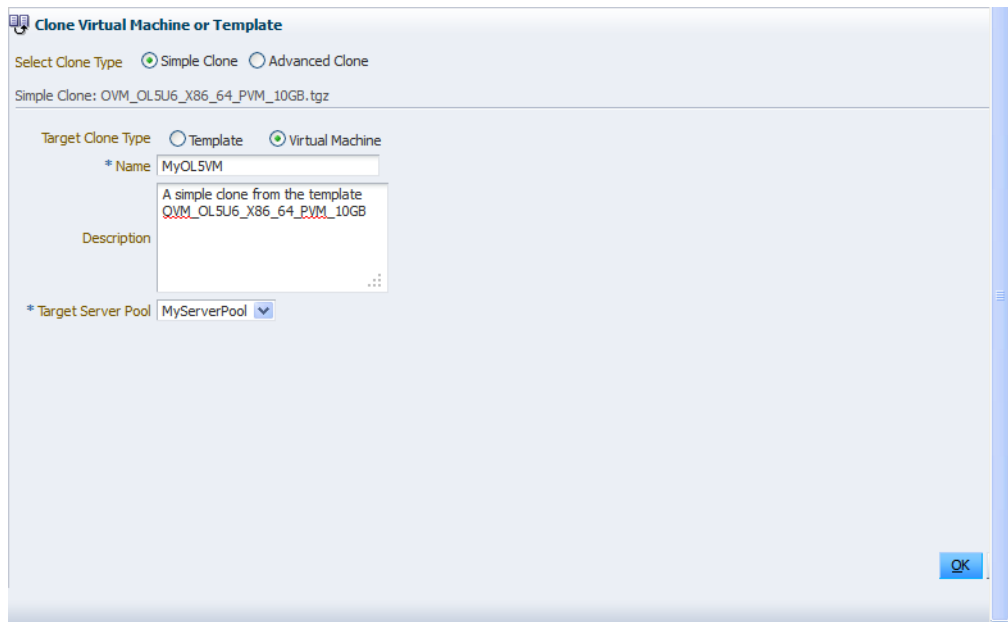
This example uses the virtual machine template you imported in [Example 4–7, "Import a virtual machine template"](#) to create a virtual machine, and deploy it in the server pool.

To create a virtual machine from a template:

1. In the **Home** view click **Server Pools** in the navigation pane, then open the **Templates** tab in the management pane. Select the template to clone and click **Clone**.

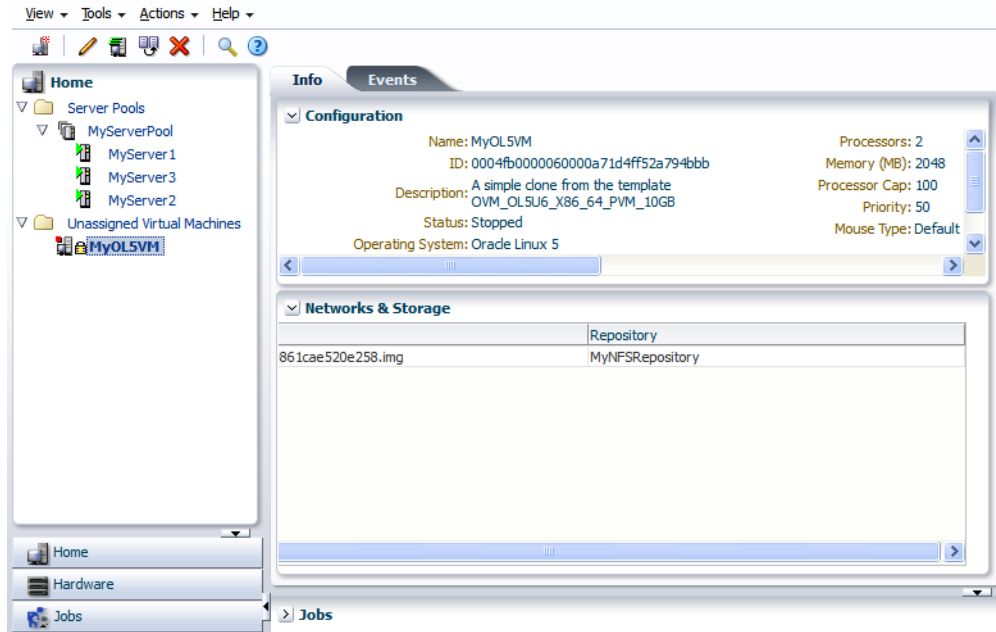


2. The Clone Virtual Machine or Template dialog box is displayed.

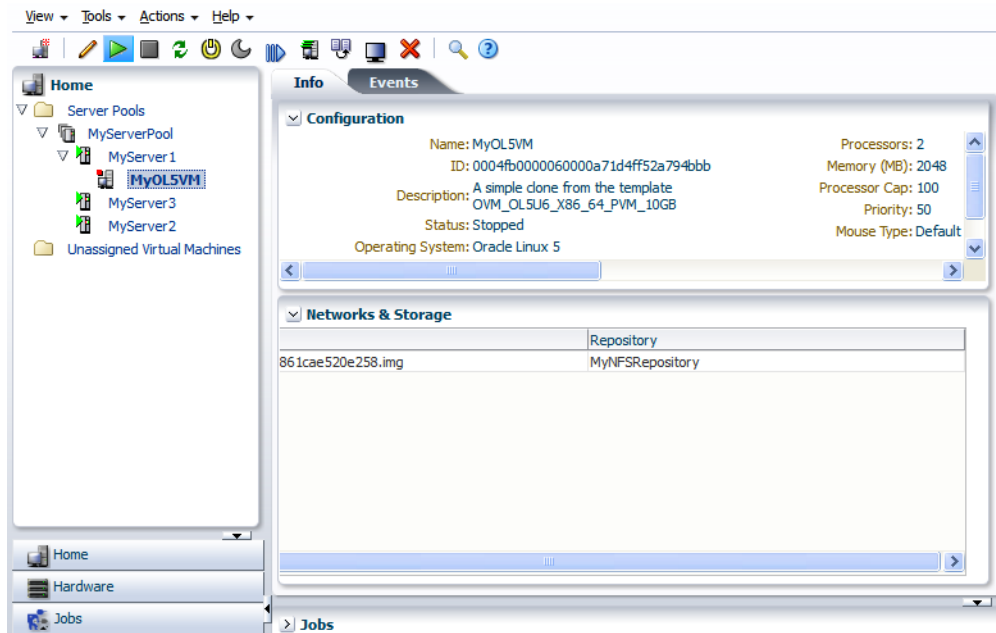


Select the **Simple Clone** radio button, the **Virtual Machine** radio button, and enter a name and optional description of the virtual machine. Select the server pool you created earlier in the **Target Server Pool** drop down. Click **OK**.

The template is cloned to create a virtual machine. The cloning job may take some time. During the clone job, the virtual machine is shown in the **Unassigned Virtual Machines** folder in the navigator.



When the clone job is completed, the virtual machine is deployed to an Oracle VM Server in the server pool.



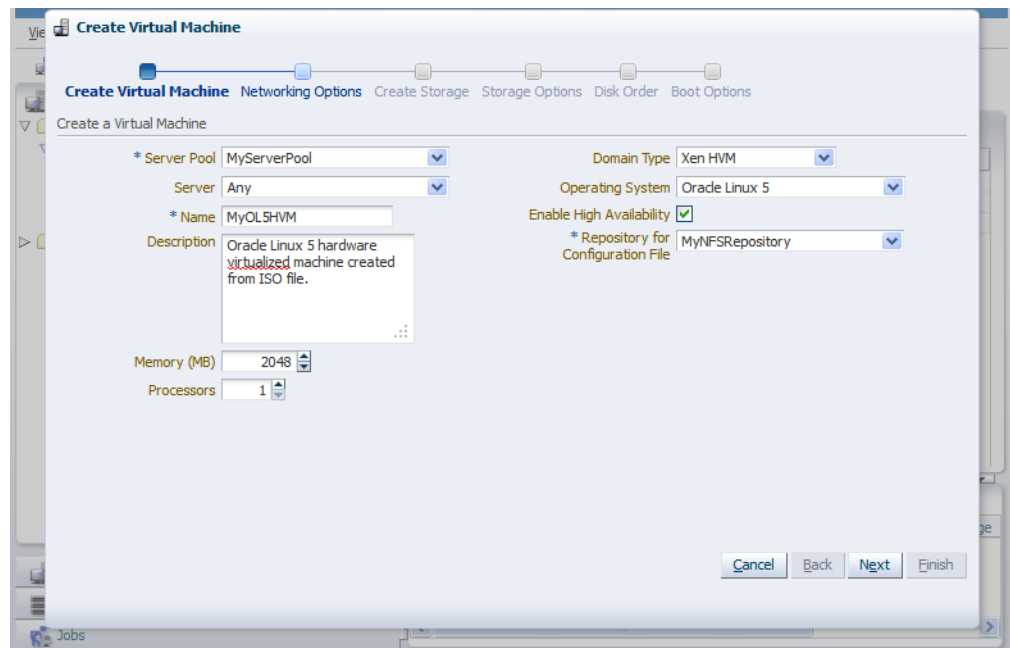
Example 4–10 Create a virtual machine from an ISO file

This example uses the ISO file you imported in [Example 4–8, "Import an ISO file"](#) to create a virtual machine, and deploy it in the server pool.

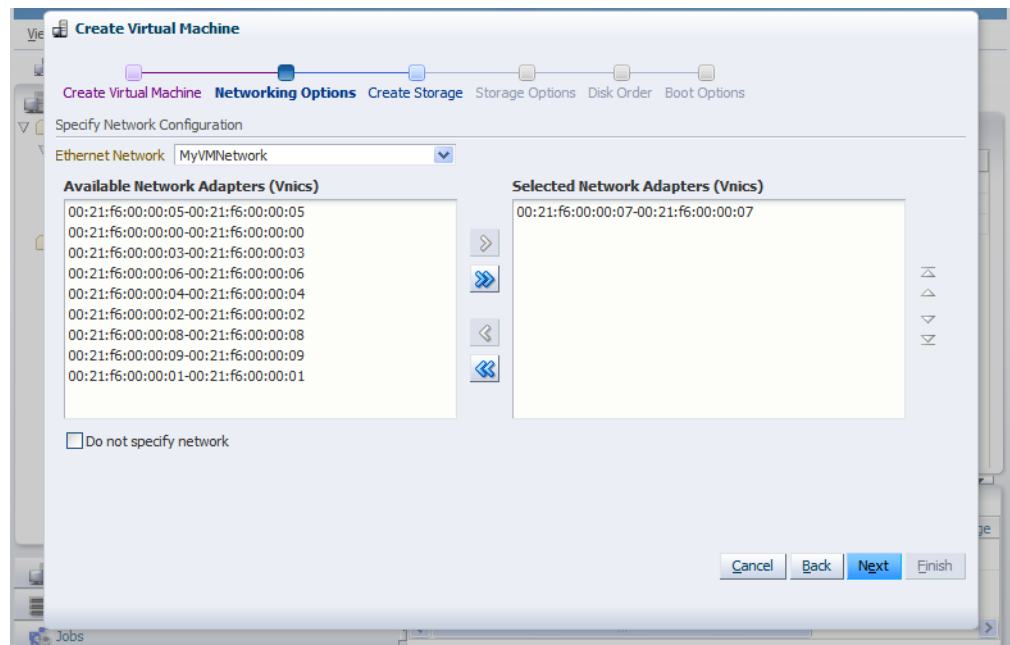
To create a virtual machine from an ISO file:

1. Select the **Home** view and **Create Virtual Machine** from the **Actions** menu.
2. The **Create Virtual Machine** wizard is displayed. In the **Create Virtual Machine** step, select the server pool you created earlier, enter a name for the virtual

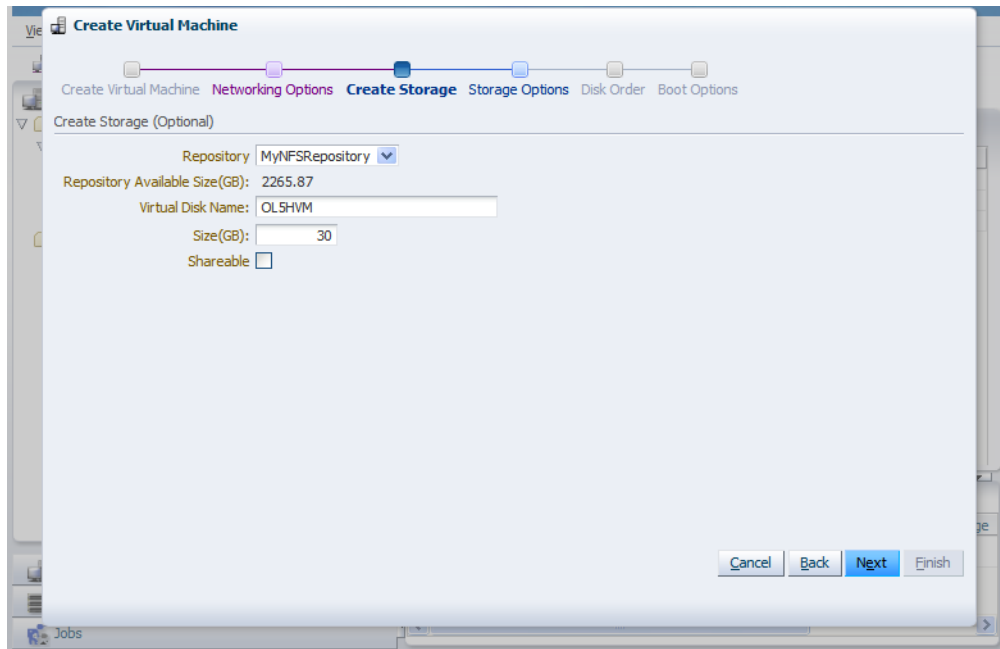
machine, and select the repository you created as the location to store the virtual machine configuration file. Click **Next**.



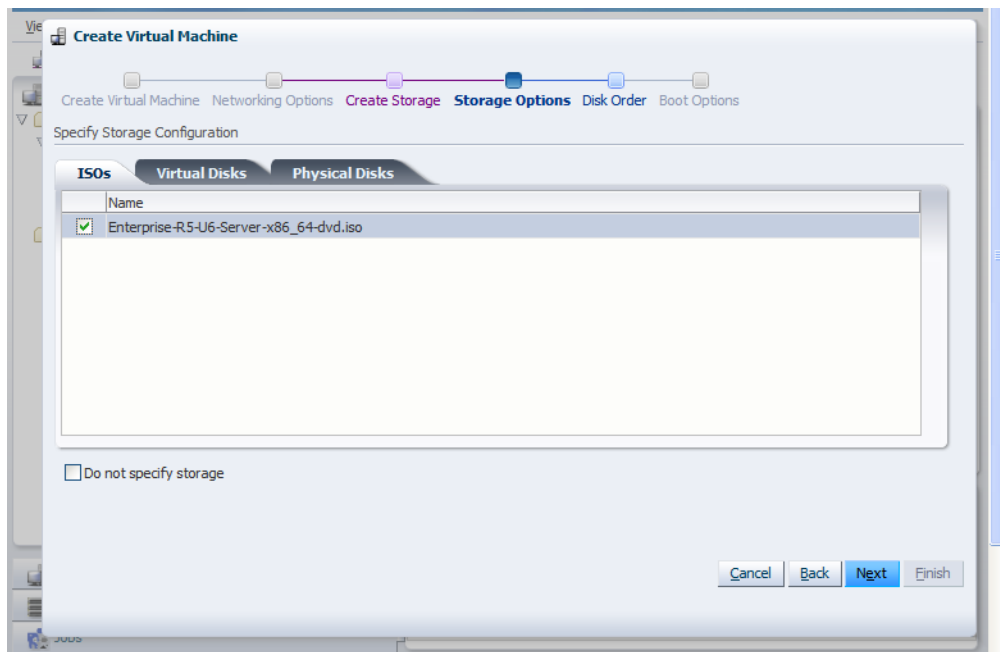
3. In the **Networking Options** step, select one or more VNICs and move them to the **Selected Network Adapters (Vnics)** field to add them to the virtual machine. Click **Next**.



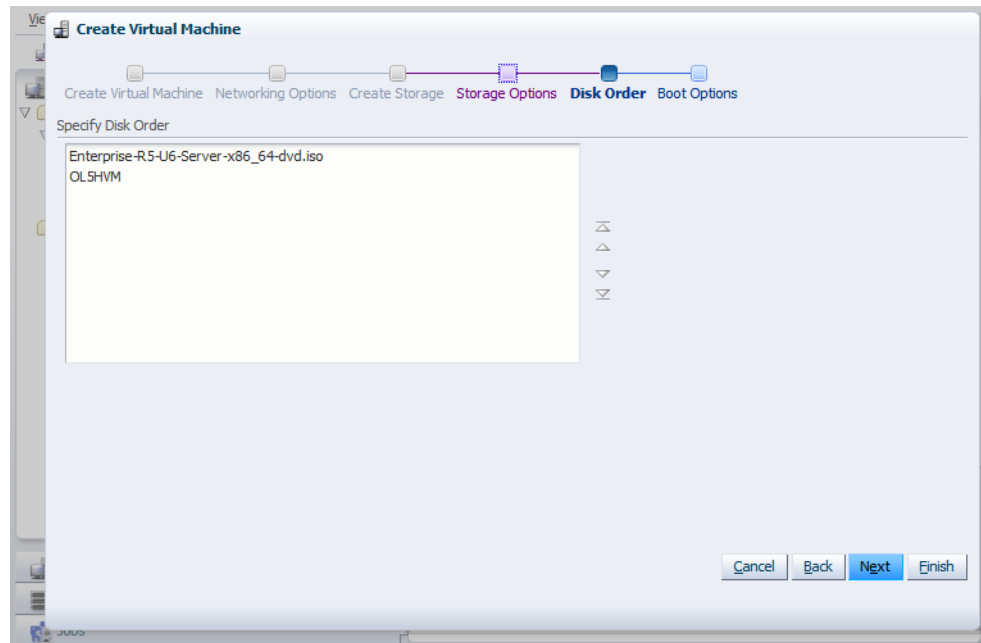
4. In the **Create Storage** step, create a virtual disk to use as the virtual machine's hard disk. Click **Next**.



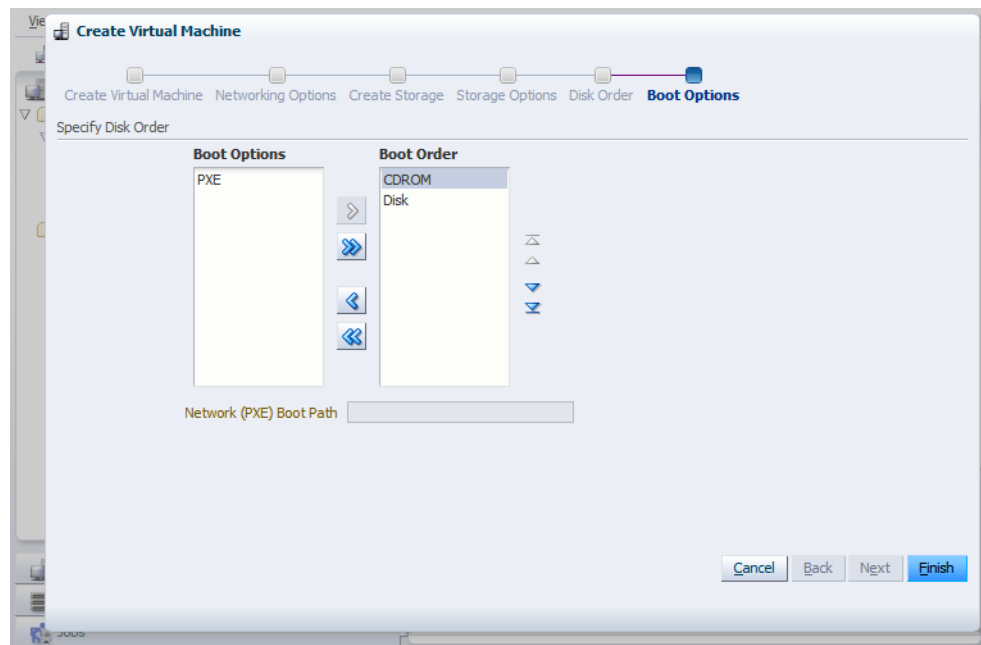
5. In the **Storage Options** step, select the Oracle Linux ISO file you imported. Click **Next**.



6. In the **Disk Order** step, select the disk order for your virtual machine. Move the ISO file to the top, followed by the virtual disk you created earlier in the wizard. Click **Next**.



7. In the **Boot Options** step, select the boot media and order for your virtual machine. Move the **CDROM** to the top, followed by **Disk**. Click **Finish**.

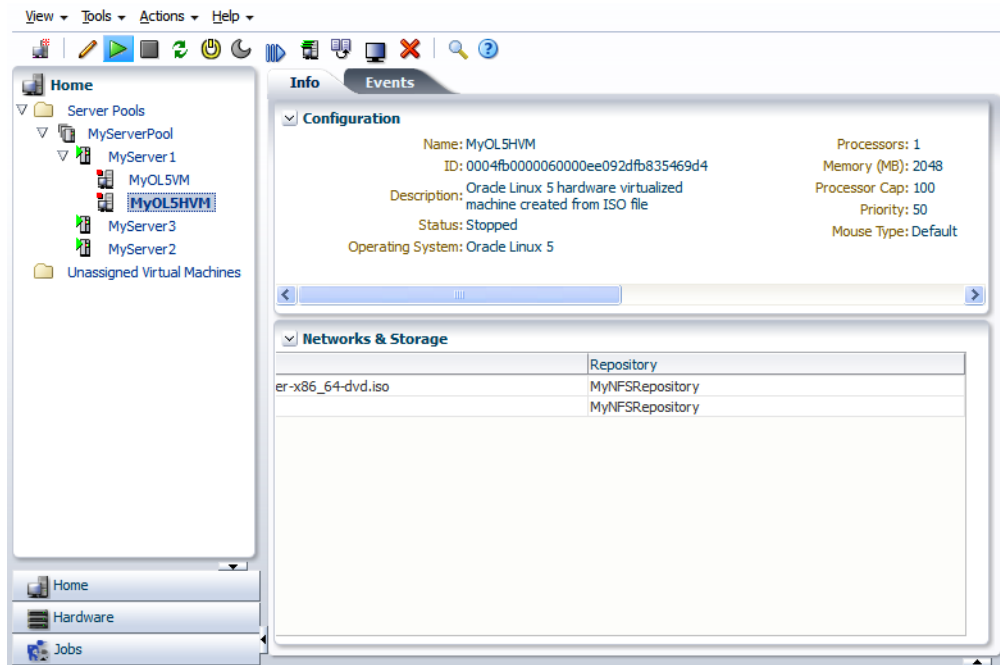


The virtual machine is created and deployed to an Oracle VM Server in the server pool.

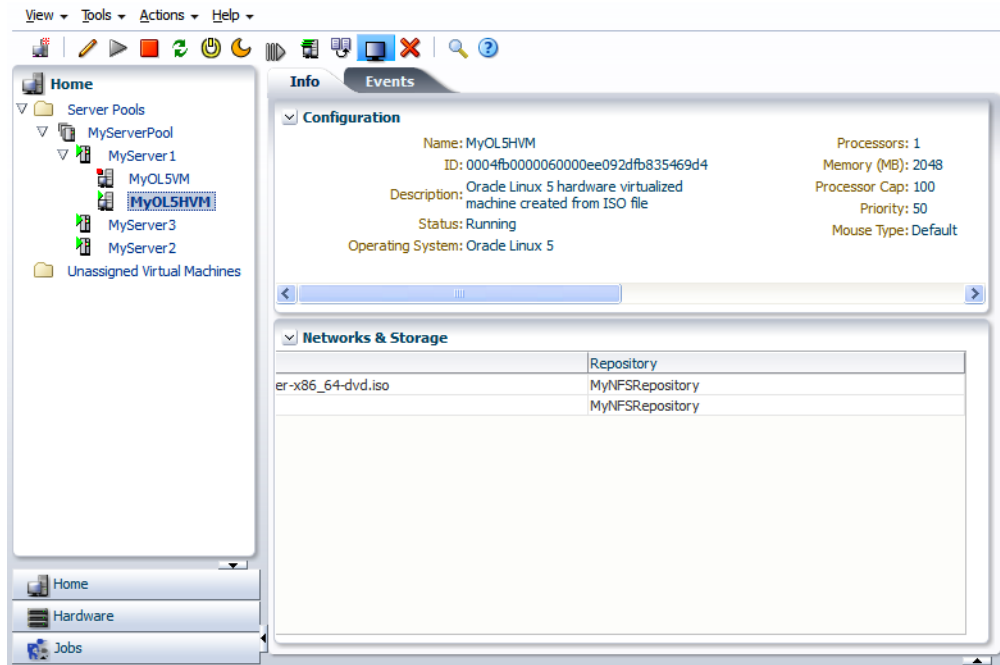
Example 4–11 Starting a virtual machine and connecting to the console

When a virtual machine is created, it is deployed to the server pool in a *stopped* state. This tutorial starts the virtual machine created with an ISO file, and logs into the virtual machine console.

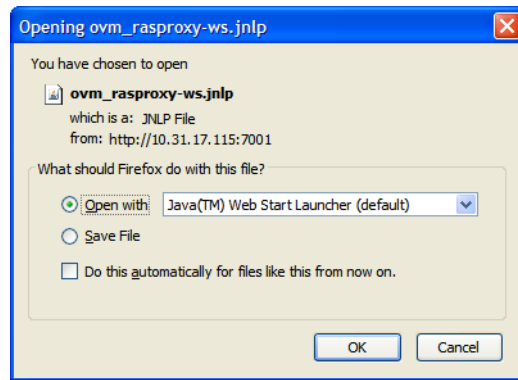
1. To start a virtual machine, select the virtual machine and click **Start**.



2. When the virtual machine is running, you can connect to the virtual machine's console and log in, if required. To connect to the console, click **Console**.



3. A dialog box, similar to the following, is displayed requesting to start a Java proxy to connect to the virtual machine. Click **OK**.



4. A console login dialog box is displayed. Enter the login you use for Oracle VM Manager and click **OK**.



5. The virtual machine console is displayed. Log in and interact with the virtual machine as you would through any other VNC session. This example shows the initial installation screen for the virtual machine created with the Oracle Linux operating system ISO file.



See [Chapter 8, "Managing Virtual Machines"](#) for more information on creating and managing virtual machines.

Managing Storage

To set up and configure the storage providers for your Oracle VM environment you need to be aware of the concepts and design ideas behind the entire storage architecture. That is precisely the information provided in the first topics of this chapter. Next, you will find the necessary instructions to prepare, configure and start using storage elements with Oracle VM.

The topics covered in this chapter are:

- [Storage Overview](#)
- [Storage Types](#)
- [Storage Connect Plug-ins](#)
- [Storage Repositories](#)
- [Storage Configuration Guidelines](#)
- [Preparing and Configuring Storage](#)
- [Enabling Multipath I/O Support](#)
- [Preparing and Configuring Storage Repositories](#)

For information on managing and working with the contents of a storage repository, such as virtual machine templates, ISO files, assemblies, and so on, see [Section 8.5, "Virtual Machine Resources"](#).

5.1 Storage Overview

The particular way in which Oracle VM approaches storage is through plug-ins: Oracle has made storage configuration and integration as flexible and modular as possible by creating a Storage Connect plug-in for each different category and type of storage. These plug-ins are discussed in further detail in [Section 5.3, "Storage Connect Plug-ins"](#).

Storage in Oracle VM refers to two different types of disk storage: the space available for environment resources such as templates and ISO files, and the logical or physical disks used by virtual machines.

Note: In addition there is also disk space used for the pool file systems of clustered server pools, but that is not the focus of this section.

For virtual machine disks Oracle VM offers you two choices:

- **Virtual disks:** disk image files on a file system.
- **Raw physical disks:** LUNs accessed directly by the virtual machine.

The design decision of virtual versus physical storage access depends on your server virtualization use cases as well as the existing storage hardware at your disposal. Virtual storage enables quick and easy on-the-fly configuration but introduces a higher level of abstraction. Physical storage access implies that virtual machine disk storage is mapped directly onto the LUNs configured in the physical storage hardware, which is exactly like the way physical servers access their storage. The advantage here is that existing procedures and storage management practices can be maintained.

Storage can be configured locally, specifically using an OCFS2 file system on a local disk of the Oracle VM Server. However, it is far more performant and reliable to use a separate location for a storage repository, so that it can be addressed by and attached to all Oracle VM Servers in the server pool. This is also essential for live migration and HA configurations. Storage is configured with any of the following technologies:

- Local disks
- Shared Network Attached Storage - NFS
- Shared iSCSI SANs: abstracted LUNs or raw disks accessible over existing network infrastructure
- Fibre Channel SANs connected to one or more host bus adapters (HBAs)

Note: OCFS2 (Oracle Cluster File System) is used in all these storage configurations except for server pools with no clustering enabled.

To enable HA or live migration, you must make sure all Oracle VM Servers have access to the same storage resources. Specifically for live migration the Oracle VM Servers also must be part of the same server pool. Also note that server pools require access to a shared file system where server pool information is stored and retrieved, for example in case of failure and subsequent server role changes. The server pool file system can either be on an NFS share or on a LUN of a storage array. For more information about setting up file servers and storage arrays, see [Section 5.6, "Preparing and Configuring Storage"](#).

5.2 Storage Types

Oracle VM was designed to allow you to use a wide variety of storage types so you can adapt your configuration to your needs. Whether you have a limited hardware setup or a full rack of servers, whether you perform an installation for testing and temporary internal use or design a production environment that requires high availability in every area, Oracle VM offers support for a suitable storage solution.

Making use of both generic and vendor-specific Storage Connect plug-ins, Oracle VM allows you to use the following types of storage:

- [Local Storage](#)
- [Shared Network Attached Storage \(NFS\)](#)
- [iSCSI Storage Attached Network](#)
- [Fibre Channel Storage Attached Network](#)

5.2.1 Local Storage

Local storage consists of hard disks installed locally in your Oracle VM Server. In a default installation, Oracle VM Server will only use the first disk (*/dev/sda*), leaving other disks available for storage.

As long as no partition and data are present the device will be detected as a raw disk. The choice is yours to use the local disks either to provision logical storage volumes as disks for virtual machines or to install a storage repository. If you place a storage repository on the local disk, an OCFS2 file system is installed.

Note: Local storage can never be used for a server pool file system.

Local storage is fairly easy to set up because no special hardware for the disk subsystem is required. Since the virtualization overhead in this setup is limited, and disk access is internal within one physical server, local storage offers reasonably high performance.

However, the downsides are quickly revealed when you think about configurations with multiple Oracle VM Servers. Local storage by definition remains local and cannot be shared between different servers. Therefore, even if you set up a pool of multiple servers and use the advantages of clustering, virtual machines using local storage can never benefit from high availability: they cannot be migrated from one server to another.

Note: In Oracle VM, sharing a local physical disk between VMs is possible but not recommended.

5.2.2 Shared Network Attached Storage (NFS)

Network Attached Storage – typically NFS – is a commonly used file-based storage system that is very suitable for the installation of Oracle VM storage repositories. Storage repositories contain various categories of resources such as templates, virtual disk images, DVD iso files and virtual machine configuration files, which are all stored as files in the directory structure on the remotely located, attached file system.

With Oracle VM you discover NFS storage via the server IP or host name and typically present storage to all the servers in a server pool to allow them to share the same resources. This, along with clustering, helps to enable high availability of your environment: virtual machines can be easily migrated between host servers for the purpose of load balancing or protecting important virtual machines from going offline due to hardware failure.

NFS storage is exposed to Oracle VM Servers in the form of shares on the NFS server which are mounted onto the Oracle VM Server's file system. Since mounting an NFS share can be done on any server in the network segment to which NFS is exposed, it is possible not only to share NFS storage between servers of the same pool but also across different server pools.

In terms of performance, NFS is slower for virtual disk I/O compared to a logical volume or a raw disk. This is due mostly to its file-based nature. For better disk performance you should consider using block-based storage, which is supported in Oracle VM in the form of iSCSI or Fibre Channel SANs.

5.2.3 iSCSI Storage Attached Network

With Internet SCSI, or iSCSI, you can connect storage entities to client machines, making the disks behave as if they are locally attached disks. iSCSI enables this connectivity by transferring SCSI commands over existing IP networks between what is called an initiator (the client) and a target (the storage provider).

To establish a link with iSCSI SANs, all Oracle VM Servers can use configured network interfaces as iSCSI initiators. It is the user's responsibility to:

- configure the disk volumes (iSCSI LUNs) offered by the storage servers
- discover the iSCSI storage through Oracle VM Manager
- set up access groups, which are groups of iSCSI initiators, through Oracle VM Manager, in order to determine which LUNs are available to which Oracle VM Servers

Performance-wise an iSCSI SAN is better than file-based storage like NFS and it is often comparable to direct local disk access. Because iSCSI storage is attached from a remote server it is perfectly suited for a clustered server pool configuration where high availability of storage and the possibility to live migrate virtual machines are important factors.

Provisioning of iSCSI storage can be done through open source target creation software at no additional cost, with dedicated high-end hardware or with anything in between. The generic iSCSI Storage Connect plug-in allows Oracle VM to use virtually all iSCSI storage providers. In addition, vendor-specific Storage Connect plug-ins exist for certain types of dedicated iSCSI storage hardware, allowing Oracle VM Manager to access additional interactive functionality otherwise only available through the management software of the storage provider. Examples are creating and deleting LUNs, extending existing LUNs and so on. Check with your storage hardware supplier if a Storage Connect plug-in is available. For installation and usage instructions, consult your supplier's plug-in documentation.

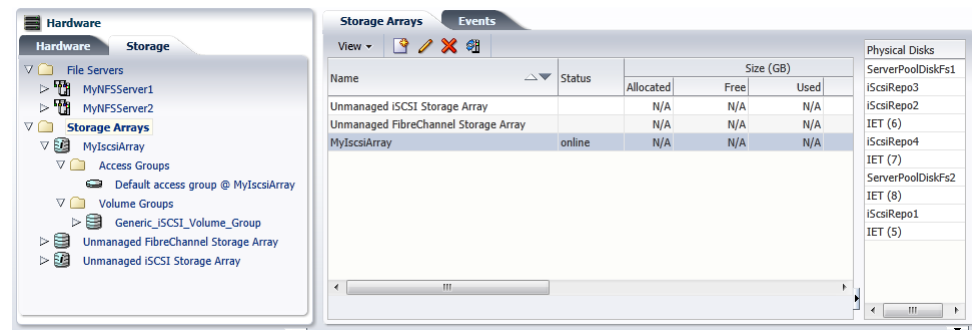
5.2.4 Fibre Channel Storage Attached Network

Functionally, a fibre channel SAN is hardly different from an iSCSI SAN. Fibre channel is actually older technology and uses dedicated hardware instead: special controllers on the SAN hardware, host bus adapters or HBAs on the client machines, and special fibre channel cables and switches to interconnect the components.

Like iSCSI, the Fibre Channel Protocol (FCP) is used to transfer SCSI commands between initiators and targets and establishes a connectivity that is almost identical to direct disk access. The same concepts from the iSCSI SAN, as described above, apply equally to the Fibre Channel SAN. Again, generic and vendor-specific Storage Connect plug-ins exist. Your storage hardware supplier will provide proper documentation with the Storage Connect plug-in.

5.3 Storage Connect Plug-ins

Oracle VM Manager communicates with all storage through a set of plug-ins named Storage Connect. These plug-ins are not actually run from the Oracle VM Manager but rather live on some or all of the Oracle VM Servers. You can see these plug-in files in the local file system of an Oracle VM Server in the `/opt/storage-connect/` directory. In the user interface of Oracle VM Manager you select an available plug-in when creating and configuring storage elements for use in your environment.

Figure 5–1 Storage tab in Hardware view

As you can see in the **Storage** tab of the **Hardware** view in [Figure 5–1](#), storage elements are logically divided in File Servers and Storage Arrays. This distinction refers to the difference between file-based storage and block-based storage, or raw disks. Both types of storage are supported and Storage Connect plug-ins are available for each category described in [Section 5.2, "Storage Types"](#).

Furthermore, Storage Connect plug-ins are split up according to the functionality they offer: there are generic plug-ins and non-generic plug-ins, also referred to as vendor-specific plug-ins. Generic plug-ins offer a limited set of standard storage operations on virtually all storage hardware, such as discovering and operating on existing storage resources. We categorize these operations as ‘passive’ in the sense that they do not interact with the storage management but simply detect the available storage architecture and allow it to be used in the Oracle VM environment.

Vendor-specific plug-ins include a much larger set of operations, which also includes direct, active interventions on the storage hardware: snapshot, clone, create LUNs, resize, and so on. To execute generic storage plug-in operations, only an access host or fibre channel connectivity is required (for iSCSI: typically a host name or IP address with a port number). The non-generic plug-in operations require an additional admin host, with optional administrative user name and password, granting Oracle VM Manager direct access to the configuration of the storage hardware.

5.3.1 Installing Storage Connect Plug-ins

Vendor-specific (non-generic) storage connect plug-ins are available directly from your storage vendor.

Storage connect plug-ins are delivered as an RPM, usually a single RPM, but your storage vendor may provide multiple RPMs. When you have the storage connect plug-in RPM from your storage vendor, install the RPM on your Oracle VM Servers.

Note: You must install the RPM on all the Oracle VM Servers that will use the particular storage.

To install the storage plug-in RPM, on the command line of the Oracle VM Server, enter

```
# rpm -ivh filename.rpm
```

If you are upgrading an existing storage connect plug, use the RPM upgrade parameter:

```
# rpm -Uvh filename.rpm
```

Read the install and configuration documentation for the storage connect plug-in from your storage vendor before you install and use it. There may be extra configuration required that is not documented here.

5.4 Storage Repositories

For file-based storage abstraction, Oracle VM uses the concept of storage repositories. A storage repository is essentially logical disk space made available through a file system on top of physical storage hardware. If the storage repository is created on a file server, for example an NFS share, then a file system is already present; if the repository is created on a LUN, an OCFS2 file system is created first.

A storage repository defines where Oracle VM resources may reside. Resources include virtual machine configuration files, templates for virtual machine creation, virtual machine assemblies, ISO files (DVD image files), shared and unshared virtual disks, and so on.

Before you begin configuring a storage repository, make sure that these requirements are met:

- **NFS-based repository:** At least one Oracle VM Server must be discovered. For the creation of the storage repository the Oracle VM Agent on the server will act as the worker component performing the instructions given through Oracle VM Manager.
- **LUN-based repository:** By design, a storage repository on a LUN is linked to a clustered server pool, because of the nature of the OCFS2 file system it uses. Consequently, a server pool must exist with clustering enabled, and at least one server must be present in the clustered pool.

A repository on a local server storage also belongs in this category, since local disks are always discovered as LUNs. For more information about local storage and repositories, see [Section 5.6.4, "Using Local Storage"](#).

Note: Only NFS storage repositories can be shared by multiple server pools.

For detailed instructions about the configuration and management of storage repositories, see [Section 5.8, "Preparing and Configuring Storage Repositories"](#).

5.5 Storage Configuration Guidelines

It is important to plan your storage configuration in advance of deploying virtual infrastructure. Here are some guidelines to keep in mind:

- Take care when adding, removing, and resizing LUNs as it may require a physical server reboot. Do not resize LUNs that are used as part of Logical disks; instead, create a new LUN and add it to the disk group.
- Test your configuration, especially failover, in a test environment before rolling into production. If your (SAN) array firmware is at a different release number than we have tested, confirm whether there are any differences. You may need to make changes to the multipath configuration files of Oracle VM Server.
- Plan the size and type of storage that you are using by workload. For example:

- Boot volumes can typically be on higher capacity drives as most operating systems have minimal I/O activity on the boot disk, but some of that I/O is memory paging, which is sensitive to response times.
- Applications can be on larger, slower drives (e.g. RAID 5) unless they perform a lot of I/O. Write-intensive workloads should use RAID 10 on medium to fast drives. Ensure that log files are on different physical drives than the data they are protecting.
- Infrastructure servers such as DNS tend to have low I/O needs. These servers can have larger, slower drives.
- If using storage server features such as cloning and snapshots, use raw disks.
- While it may be tempting to create a very large LUN when using logical disks, this can be detrimental to performance as each virtual machine queues I/Os to the same disks. Oracle recommend that storage repositories do not exceed 2TB.
- Be sure to leave some disk space available to create smaller storage entities of, at least, 12GB each to use as server pool file systems. The server pool file system is used to hold the server pool and cluster data, and is also used for cluster heartbeating. You create space for server pool file systems the same way as you create storage entities for storage repositories. For more information about the use and management of clusters and server pools, see [Chapter 7, "Managing Server Pools"](#).
- Place server pool file systems on a separate NFS server or use a small LUN, if possible. The OCFS2 heartbeating function can be disturbed by I/O-intensive operations on the same physical storage. For example: importing a template or cloning a VM in a storage repository on the same NFS server where the server pool file system resides may cause a time-out in the heartbeat communication, which in turn leads to server fencing and reboot. To avoid unwanted rebooting, it is recommended that you choose a server pool file system location with sufficient and stable I/O bandwidth.

5.6 Preparing and Configuring Storage

As described in [Section 5.1, "Storage Overview"](#), Oracle VM Manager distinguishes between File Servers and Storage Arrays in the **Storage** tab of the **Hardware** view. Depending on your hardware and networking configuration, external storage may be detected during discovery of the Oracle VM Servers or a rescan of their physical disks. Local storage is always detected during this discovery operation.

An external storage element is created on storage hardware: a server configured for NAS offering NFS shares, generic iSCSI targets and LUNs, or SAN devices from your preferred storage vendors. The server or disk subsystem offering the storage simply needs to be reachable by the Oracle VM Servers in the Oracle VM environment through a Fibre Channel or Ethernet network. The external storage is offered as a mount point (NFS share) or LUN (iSCSI and fibre channel) which can be discovered through Oracle VM Manager as a potential location for a repository, or a raw disk for use with a VM.

The typical way to attach external storage to the Oracle VM environment is to create a new storage entity in Oracle VM Manager and point to the location of the external storage provider while selecting the appropriate Storage Connect plug-in.

Subsequently, you may choose to configure a storage repository on one or more of the discovered storage entities in order to make storage resources available to servers and server pools in the Oracle VM environment.

These preparation and configuration steps are covered in the following topics:

- [Registering and Configuring File Servers](#)
- [Handling Unmanaged Storage Arrays](#)
- [Registering and Configuring Storage Arrays](#)
- [Using Local Storage](#)
- [Removing Storage](#)

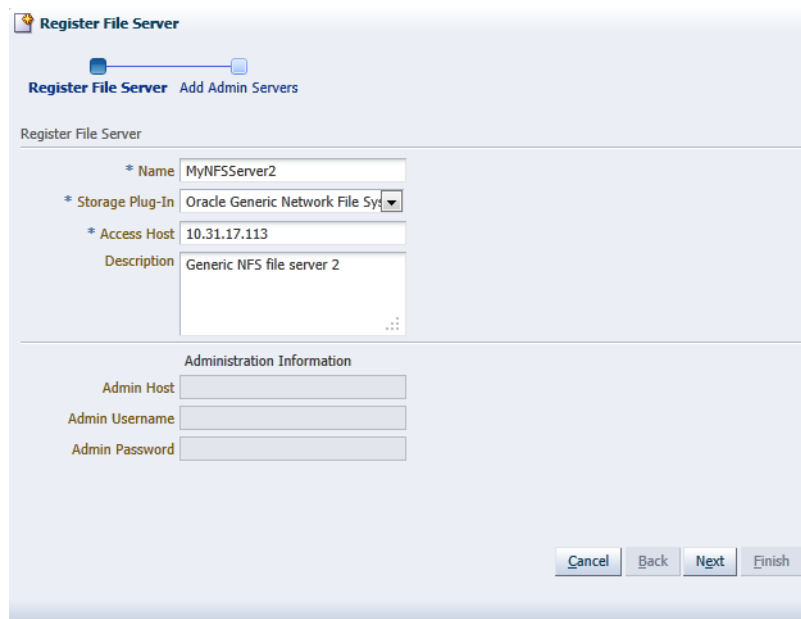
Storage repository configuration is covered in [Section 5.8, "Preparing and Configuring Storage Repositories"](#).

5.6.1 Registering and Configuring File Servers

In Oracle VM, the term *file server* is used to indicate file-based storage made available to the environment from another physical server, as opposed to local storage. Describing the technology used to expose file systems, NFS shares and so on, is beyond the scope of this guide. The procedure below explains how you can bring the exposed file-based storage into Oracle VM, prepare it for the installation of a storage repository, and configure the file server and discovered file systems.

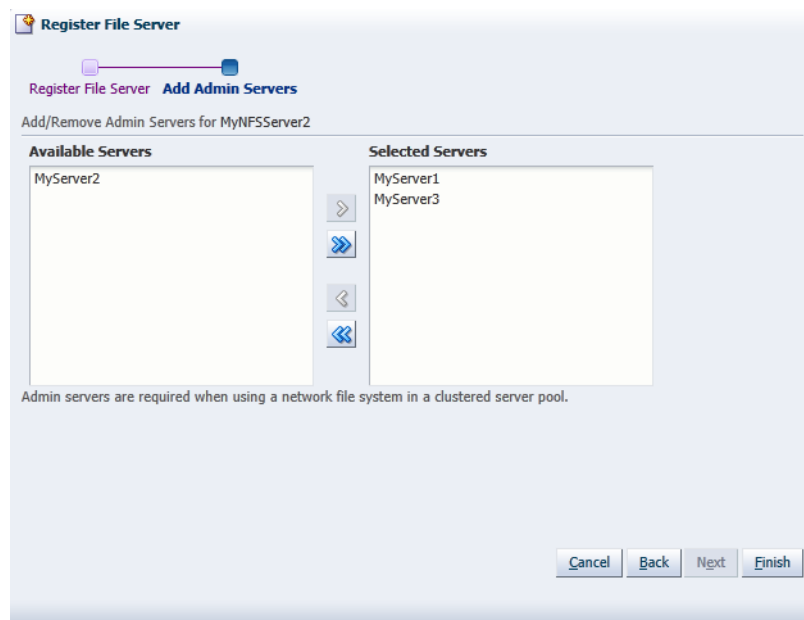
To register a file server:

1. Make sure that your storage server exposes a writable file system (through an NFS share or a Sun ZFS storage pool) to the storage network of your server pool.
2. In Oracle VM Manager open the **Hardware** view and open the **Storage** tab in the navigation pane.
3. In the navigation pane, select and right-click **File Servers**, then select **Register File Server**. The Register File Server dialog box is displayed, where you enter the information necessary for Oracle VM Manager to discover the external storage mount points.



4. Always enter the following information:
 - **Name:** the name you wish to use to identify the file server

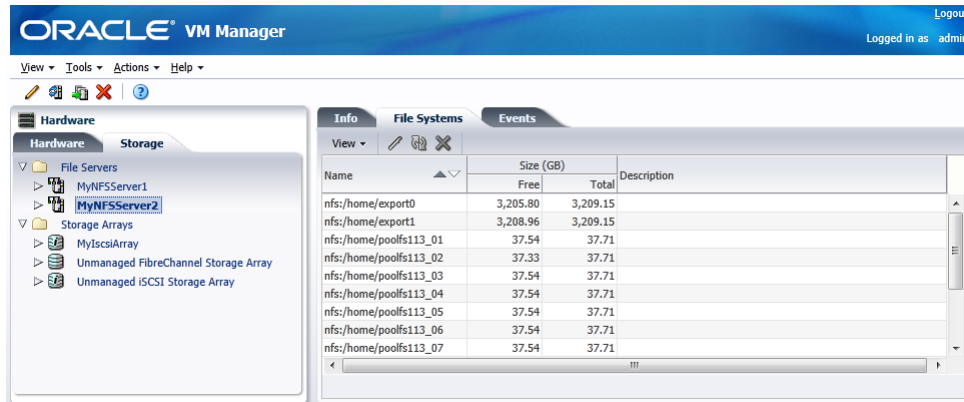
- **Storage Plug-in:** the storage plug-in corresponding to the type of file server (generic NFS or vendor-specific)
 - **Access Host:** the host name or IP address of the server offering the file system
 - **Description:** optional information you would like to add about this file server
5. If you are adding a non-generic file server, for example a Sun ZFS Storage Appliance, also enter the additional plug-in options to enable Oracle VM Manager to access the file server's configuration management functions:
 - **Admin Host:** the host name or IP address where administrative access to the file server is allowed with appropriate credentials
 - **User Name:** a user name with administrator access to the file server
 - **Password:** the administrator password for the user name you entered
 6. Click **Next** to proceed to the admin server selection screen. If you are working with a non-clustered server pool, you may skip this screen.
 7. Use the arrow buttons to move the required Oracle VM Servers to the Selected Servers box. Click **Finish** to complete the file server registration.



The new file server appears in the navigation pane, under File Servers.

Note: If you created shares to be used as server pool file systems, these are discovered in the same process. Since these file systems are relatively small, be sure to keep those available for the server pools and create storage repositories on the higher capacity file systems.

At the end of the file server registration a discovery operation is triggered for the file systems available on the file server. When the operation is complete, the available file systems appear in the navigation pane, under the file server to which they belong. The file systems also show up to the right of the File Servers overview table when you select that particular file server.



Your file server and file systems are now ready to be used either for storage repositories or as server pool file systems. A server pool file system is selected during the creation of the server pool; to create storage repositories on your file systems, see [Section 5.8, "Preparing and Configuring Storage Repositories"](#).

Of course, you can always make changes to the storage configuration you just registered. The steps and options to do so are described below.

To change the registered file server configuration:

1. If you need to modify a file server, select it in the tree structure in the navigation pane, right-click it and choose one of these options:
 - **Edit File Server:** change file server settings such as name, access host, description and plug-in options
 - **Refresh File Server:** request an update of the file server configuration in case changes have been made to the disks and file systems
 - **Add/Remove Admin Server:** determine which Oracle VM Servers are responsible for information exchange with this file server
 - **Delete File Server:** remove the selected file server from your Oracle VM environment
2. If you need to modify a file system, expand the file server it belongs to, select it in the tree structure in the navigation pane, right-click it and choose one of these options:
 - **Edit File System:** change the name and description of the file system
 - **Refresh File System:** request an update of the file system information to see if changes have been made to the size and contents
 - **Delete File System:** stop using the selected file system in your Oracle VM environment

5.6.2 Handling Unmanaged Storage Arrays

The purpose of listing unmanaged storage arrays is that Oracle VM warns you when it detects storage in the environment for which no particular management mechanism is available or in case the appropriate management mechanism cannot be determined. In other words, the unmanaged storage arrays, for iSCSI and for fibre channel, are placeholders for physical disks of which the appropriate location in the storage management tree is unclear.

It should be noted that the unmanaged arrays behave differently for iSCSI and fibre channel. For iSCSI the use of the unmanaged array in practice is temporary, but for fibre channel the situation is different. Because generic fibre channel arrays are simply detected when they are connected to the storage network, there is no mechanism to place them under a separate storage array based on a specific access host. Consequently, generic fibre channel LUNs will remain in the unmanaged fibre channel storage array, which has no access group.

You may choose to delete the unmanaged storage elements from the Oracle VM environment in case you do not intend to use it. In the case of generic iSCSI storage arrays, it is preferable to register them in the correct way by following the procedures in [Section 5.6.3, "Registering and Configuring Storage Arrays"](#). To properly register the storage entries, you should remove them from the unmanaged array. After registration these entries are displayed under a managed storage array of the appropriate type.

Vendor-specific storage, which does not use a generic Storage Connect plug-in, must always be registered with its dedicated plug-in and appears under its own storage array entry in the storage management tree.

5.6.3 Registering and Configuring Storage Arrays

In Oracle VM, the term *storage array* is used to indicate block-based storage made available to the environment from another physical server or possibly as local storage. Describing the technology used to expose raw disk space in the form of iSCSI targets and LUNs or the configuration of a SAN (storage attached network), is beyond the scope of this guide. The procedure below explains how you can bring the exposed block-based storage into Oracle VM and configure the storage array and physical disks either for the installation of a storage repository or direct attachment as physical disk to a VM (virtual machine).

Note: Oracle VM has a default *Unmanaged Fibre Channel Storage Array*. Since only a single generic fibre channel storage array can exist, no additional arrays of this type can be created. Consequently, the instructions below apply to storage arrays using the following types of Storage Connect plugins:

- generic iSCSI
 - vendor-specific iSCSI
 - vendor-specific fibre channel
-
-

The end-to-end procedure is broken down into three phases, discussed in the following sections:

- [Registering a New Storage Array](#)
- [Configuring Storage Array Access through Access Groups](#)
- [Updating the Configuration of a Storage Array](#)

5.6.3.1 Registering a New Storage Array

This first phase covers purely the registration part, meaning how you discover the container of the storage elements you intend to use in your environment.

To register a storage array:

1. Make sure that your storage server exposes raw disks (Fibre Channel SAN volumes, iSCSI targets and LUNs) to the storage network of your server pool.
2. In Oracle VM Manager open the **Hardware** view and open the **Storage** tab in the navigation pane.
3. In the navigation pane, select and right-click **Storage Arrays**, then select **Register Storage Array**. The Register Storage Array dialog box is displayed, where you enter the information necessary for Oracle VM Manager to discover the external storage elements.

4. Enter the following information:
 - **Name:** the name you wish to use to identify the storage array
 - **Description:** optional information you would like to add about this storage array
 - **Storage Type:** the array is either a SAN or an iSCSI storage server
 - **Storage Plug-in:** the storage plug-in corresponding to the type of storage array, which is either generic iSCSI, or a vendor-specific iSCSI or fibre channel plug-in
 - **Access Host:** the host name or IP address of the server or SAN hardware offering the storage elements

Note: This is not applicable to fibre channel storage arrays.

Note: When adding iSCSI storage, add the access port as well. The default access port for iSCSI is 3260.

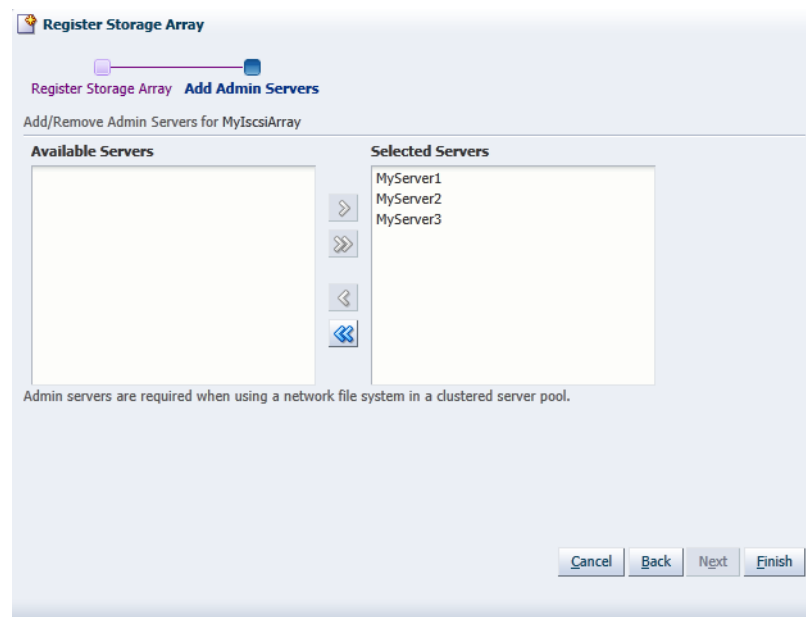
5. Depending on the selected storage type and plug-in, you may be required to enter additional information when registering your storage array:

Table 5–1 Required Information for Registering Different Storage Types

Information Field Required	generic iSCSI	vendor-specific iSCSI	generic Fibre Channel	vendor-specific Fibre Channel
Access host and port	yes	yes	no	no
Access credentials/Chap	no	optional	no	no
Administration information	no	yes	no	yes
Plug-in private data	no	optional	no	optional

Note: When registering a vendor-specific storage array, be sure to double-check the information you entered in the plug-in private data field. Once the storage array is registered, this field can no longer be modified. If you need to update the plug-in private data, you must unregister and re-register the storage array.

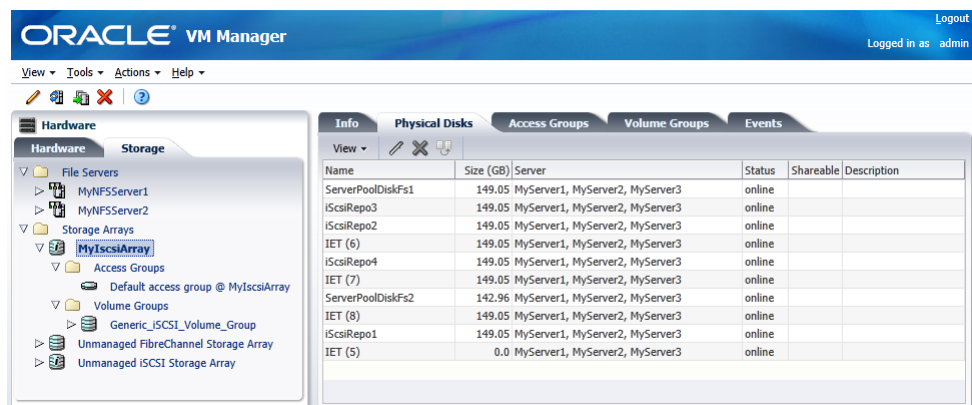
- Click **Next** to proceed to the admin server selection screen. If you are working with a non-clustered server pool, you may skip this screen.
- Use the arrow buttons to move the required Oracle VM Servers to the Selected Servers box. Click **Finish** to complete the storage array registration.



The new storage array appears in the navigation pane, under Storage Arrays. At this point, the Storage Connect plug-in has established a link to the storage location. No new storage elements have been detected yet.

- To discover the physical disks on the storage array, select it and click **Refresh Storage Array**. You can select the storage array either in the navigation pane or in the Storage Arrays management pane.

When the operation is complete, the available physical disks appear in the navigation pane, under the storage array and volume group to which they belong. The physical disks also show up to the right of the Storage Arrays overview table when you select that particular array.



At this point the discovery phase of your storage array is complete: physical disks show up in the Storage tab of the Hardware view. However, the Oracle VM Servers have no access to this storage yet. You must first configure access to physical disks through access groups. The exception to this rule is again the unmanaged fibre channel storage array, which offers its LUNs to all Oracle VM Servers connected to the fibre channel storage network.

5.6.3.2 Configuring Storage Array Access through Access Groups

This section explains the second phase of storage array configuration, which is how you make the discovered storage usable by your Oracle VM Servers.

Except for generic storage arrays, it is possible to create multiple access groups in order to arrange and restrict physical disk access according to your requirements. The generic iSCSI storage arrays have a single access group available by default, where you can simply add or remove storage initiators from your Oracle VM Servers.

Note that generic fibre channel storage has no access groups and is always listed under the Unmanaged Fibre Channel Storage Array.

Select the appropriate procedure for your type of storage array.

To configure an access group for a non-generic iSCSI storage array:

1. In the navigation pane under the Storage tab, select your storage array and go to the **Access Groups** tab, or select Access Groups directly under the storage array in the tree structure.
2. Click the **Create Access Group** button in the toolbar. The Create Access Group dialog box appears. It contains the available storage initiators for this type of storage on the Oracle VM Servers in your environment.
3. Enter a name for your new access group and optionally provide a description.
4. Use the arrow buttons to move the required initiators to the Selected Storage Initiators box.
5. Click OK to create the new access group with the selected initiators. The new access group now appears in the Access Groups tab. When you select the access group, its initiators appear in the Storage Initiators table.
6. Select the access group and click **Present/Unpresent Physical Disk**. A dialog box appears with the available physical disks in the volume groups of the current storage array.
7. Use the arrow buttons to move the required disks to the Selected Physical Disks box. Click OK to present the selected disks to the current access group.

- After configuring the access group it is advisable to refresh the storage array to make sure that the current storage layout and access rules are in effect.

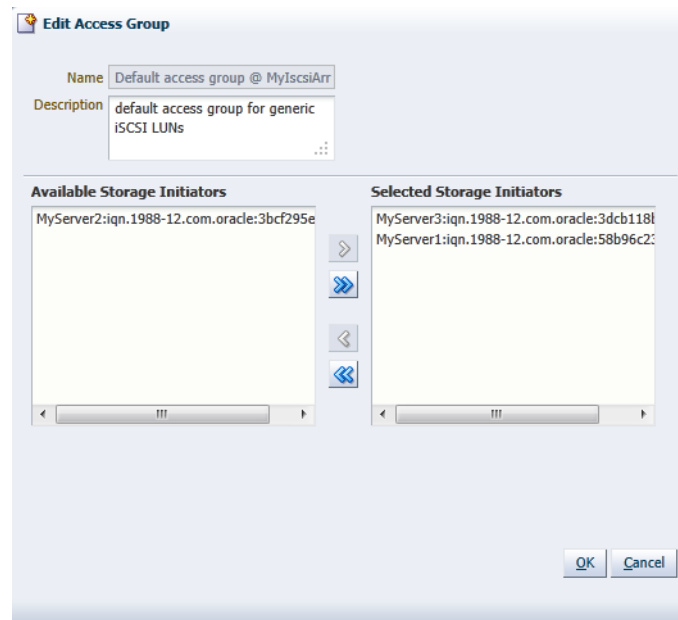
The selected physical disks in your non-generic storage array are now available to the Oracle VM Servers in this access group. The access group configuration of a generic iSCSI storage array is much simpler, as you can see below.

To configure the access group for a generic iSCSI storage array:

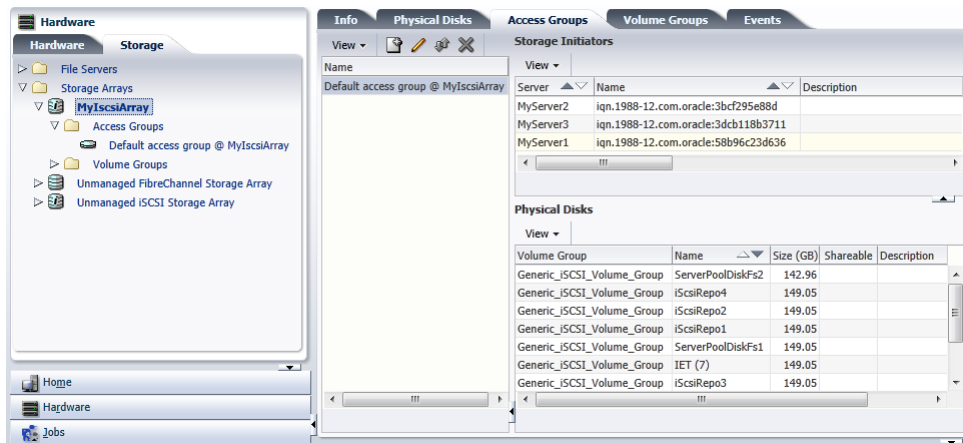
- In the navigation pane under the Storage tab, select your storage array and go to the **Access Groups** tab, or select Access Groups directly under the storage array in the tree structure.

The default access group for this storage array is already present, and all discovered physical disks in the generic storage array are listed.

- Select the default access group and click the **Edit Access Group** button in the toolbar. The Edit Access Group dialog box appears. It contains the available storage initiators for this type of storage on the Oracle VM Servers in your environment.
- You cannot modify the name of the default access group, but if required, provide a description for the access group.



- Use the arrow buttons to move the required initiators to the Selected Storage Initiators box.
- Click OK to save your changes to the default access group. When you select the access group in the Access Groups tab, its initiators appear in the Storage Initiators table. The disks listed in the Physical Disks table are all automatically presented to the selected Oracle VM Servers.



6. After configuring the access group it is advisable to refresh the storage array to make sure that the current storage layout and access rules are in effect.

The Oracle VM Servers in this access group now have the necessary permissions to use the physical disks of the storage array; they can be deployed either as disks for virtual machines (VMs) or for storage repositories. To create storage repositories on your physical disks, see [Section 5.8, "Preparing and Configuring Storage Repositories"](#).

Of course, you can always make changes to the storage configuration you just registered. The steps and options to do so are described below.

Note: In this section we consistently use the tree view in the navigation pane to access various storage elements at different levels. You can also reach these elements through the different tabs available to you when you select the storage array in the navigation pane.

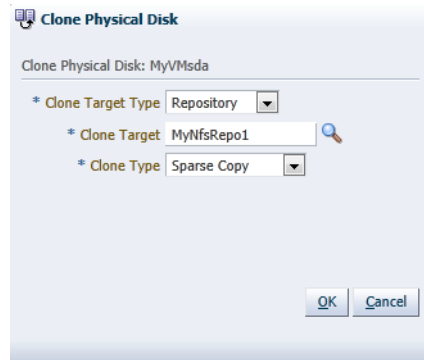
5.6.3.3 Updating the Configuration of a Storage Array

The third and final phase of this section discusses the update options available after a storage array has been registered through Oracle VM Manager.

To change the registered storage array configuration:

1. If you need to modify a storage array, select it in the tree structure in the navigation pane, right-click it and choose one of these options:
 - **Edit Storage Array:** change storage array settings such as name, description, access host and port.
 - **Refresh Storage Array:** request an update of the storage array configuration in case changes have been made to the available physical disk configuration
 - **Delete Storage Array:** remove the selected storage array from your Oracle VM environment
2. If you need to modify a physical disk on a storage array, expand the storage array and volume group, select the item in the tree structure in the navigation pane, right-click it and choose one of these options:
 - **Edit Physical Disk:** change the name and description of the physical disk or make it shareable
 - **Clone Physical Disk:** create a thin clone, sparse copy or non-sparse copy of the physical disk on the selected target. The options are explained in the table below:

Clone Target	Thin Clone	Sparse Copy	Non-sparse Copy
Physical Disk			Yes
Storage Array	Yes		
Storage Repository		Yes	Yes



This applies specifically to a physical disk; for more information about VM cloning, see [Section 8.8, "Cloning a Virtual Machine or Template"](#).

For a definition of these clone target types, see [Glossary](#).

- **Delete:** stop using the selected physical disk in your Oracle VM environment

WARNING: If you effectively delete a LUN from a registered storage array, make sure that you delete it in Oracle VM Manager first, before you physically delete it from the storage server. If you do not respect this order of operations, the system will go into an unknown state, which can only be resolved by rebooting the Oracle VM Servers the deleted LUN is connected to.

3. If you need to modify the way Oracle VM Servers access the physical disks in your storage array, expand the storage array and access groups, select the access group in the tree structure in the navigation pane, right-click it and choose one of these options:
 - **Edit Access Group:** change access group settings such as name, description, and selected storage initiators
 - **Present/Unpresent Physical Disk:** change the selection of physical disks to which this access group has access
 - **Delete:** remove the selected access group configuration

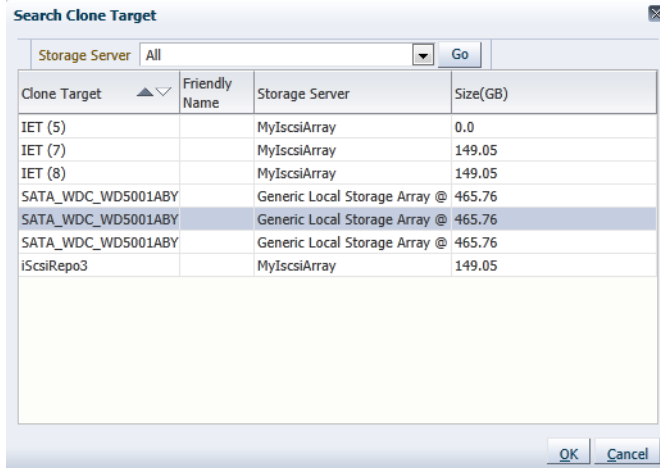
Note: For generic iSCSI storage arrays, only the selected storage initiators can be modified. Other properties cannot be changed.

5.6.4 Using Local Storage

If an Oracle VM Server has unused hard disks, they can be used as local storage for your environment. On condition that these spare disks are completely empty, meaning

they have no partitions or file systems, they are included automatically in the local storage array of the Oracle VM Server.

Note that local storage arrays are not listed under the Storage tab of the Hardware view. You can, however, see the local storage entities in locations where you can use them; for example when you create a storage repository, select a physical disk for a VM, list the physical disks accessible to an Oracle VM Server, or select a physical clone target.



Local storage has the advantage that it is fast and easy to use, but users must be aware that there is no possibility to share this type of storage and that it cannot be used in a high-availability configuration. Consequently, if you need to store important data and run important VMs that require virtually uninterrupted uptime with a high degree of data loss prevention, it is recommended not to use local storage but to invest in attached storage with proper redundancy instead.

In addition, local storage lacks flexibility in a clustered setup with multiple Oracle VM Servers in a server pool. Resources and VM disks that live on local storage cannot be shared with other servers, even if they are within the same server pool. This means that you cannot use a template, ISO or VM disk stored on a local repository on another Oracle VM Server, and that live migration of VMs with locally stored disks is impossible. We strongly advise you to take this into account when designing your Oracle VM environment.

The configuration where local storage is most useful is where you have an unclustered server pool that contains only one Oracle VM Server. By configuring a storage repository (see [Section 5.8, "Preparing and Configuring Storage Repositories"](#)) on local storage you can set up an Oracle VM virtualized environment quickly and easily on a single server: all your resources, VMs and their disks are stored locally. Since there is only one Oracle VM Server, access to resources is guaranteed.

Note: Some properties of local storage elements may be edited through the Oracle VM Server management pane: go to the **Hardware** view, select the applicable server and open the **Physical Disks** tab in the management pane. Disks available to this server are displayed.

5.6.5 Removing Storage

Before you can remove a storage server, you should delete any storage repositories and server pool file systems on it.

If there is a storage repository on the storage server, all virtual machine resources such as virtual machine templates, virtual disks, assemblies and ISO files must be removed from the repository. If the storage repository is on a file server (NFS server), you should also release ownership of the storage repository before you delete the repository. Deleting an unowned storage repository only removes it from the Oracle VM Manager database; it does not delete any files in the repository. If the storage repository is on a storage array (physical disk), all of the contents of the storage repository must be deleted. Then the file system on which the storage repository resides must also be deleted.

If there is a server pool file system on the storage server, the server pool must be deleted to delete the server pool file system.

The storage server may now be shut down and decommissioned.

For more information on working with virtual machine resources, see [Section 8.5, "Virtual Machine Resources"](#). For more information on deleting a server pool, see [Section 7.7.5, "Deleting a Server Pool"](#). For more information on releasing ownership of a storage repository, see [Section 5.8.3, "Editing a Storage Repository"](#). For more information on deleting a storage repository, see [Section 5.8.4, "Deleting a Storage Repository"](#).

5.7 Enabling Multipath I/O Support

Multipathing is the technique of creating more than one physical path between the server CPU and its storage devices. It results in better fault tolerance and performance enhancement. Oracle VM supports multipath I/O out of the box. Oracle VM Servers are installed with multipathing enabled because it is a requirement for SAN disks to be discovered by Oracle VM Manager.

Note: Any system disks (disks that contain / or /boot) are blacklisted by Oracle VM Manager and are not available for use in an Oracle VM environment.

Multipath configuration information is stored in `/etc/multipath.conf` and contains specific settings for Oracle VM along with an extensive set of configuration details for commonly used SAN hardware. In most cases the user should not need to modify this file and is advised not to. Examining the contents of the file may be useful to better understand how it works in Oracle VM and what may need to be configured if your SAN is not using multipathing and your LUNs are not appearing.

In case user action is required to enable multipathing, this section explains how to do so. The required steps depend on the storage hardware implemented. Consequently, the steps below are intended as a guideline and priority should be given to the SAN hardware documentation.

Note: Not all steps apply to your environment. Consult the SAN hardware vendor's documentation for a complete list of steps, the order in which to execute them, and their relevance to your specific environment.

General steps to configure multipathing:

1. Design and document the multipathing configuration you intend to apply to the SAN hardware used in your Oracle VM environment.
2. Ensure that the drivers for your Host Bus Adapters (HBAs) are present. If not, install the drivers.
3. Configure the appropriate zoning on the fibre channel switches.
4. Configure LUN masking on the storage arrays.
5. Configure path optimization features (ALUA or similar) on your disk subsystem, if so instructed by your vendor's documentation.
6. Check the fabric information on each Oracle VM Server that has access to the SAN hardware. Use `multipath -ll` and related commands.
7. Make the necessary changes to the file `/etc/multipath.conf` on the Oracle VM Servers.

Note: You must make the exact same changes to the multipath configuration file on all Oracle VM Servers in your environment.

8. Restart the multipath daemon (`multipathd`).
9. Check the fabric information again to verify the configuration.
10. If so instructed by the vendor's documentation, rebuild `initrd`.
11. Reboot the Oracle VM Servers to verify that the SAN and multipathing configuration come up properly after a restart.

For detailed information and instructions, consult the SAN hardware vendor's documentation.

Note: Booting from a multipath SAN is currently not supported; booting from SAN is only possible in a single-path configuration.

5.8 Preparing and Configuring Storage Repositories

You use Oracle VM Manager to create and configure storage repositories, and to present one or more storage repositories to Oracle VM Servers in a server pool. This chapter discusses the flow of the operations you perform after the discovery of your physical storage hardware, LUNs, file systems and so on, in order to make a storage repository available to the Oracle VM Servers in your server pool. Once the storage repository is accessible, you can start adding storage resources and building VMs with those resources.

Depending on the configuration of Oracle VM Servers in your environment, restrictions may apply to the creation of storage repositories:

- When using server pools without clustering functionality, two storage options are available: file servers (NFS) and local physical disks in a local storage array. Remember that local storage imposes severe restrictions, as described in [Section 5.6.4, "Using Local Storage"](#).
- Local storage, or unused disks in your Oracle VM Servers, are discovered as LUNs in a local storage array. If you want to use a single-server setup with local storage,

be sure to deactivate clustering in your server pool. This eliminates the need for a server pool file system, which cannot be on a local disk by definition.

- Only a server pool with multiple servers, active clustering and attached storage (NFS, iSCSI, fibre channel) can offer high availability, load balancing and similar advanced functionality.

Oracle VM Manager allows you to perform a number of management operations on the storage repositories under its control. [Table 5-2](#) describes the possible operations at the level of a storage repository. To access these functions in Oracle VM Manager, open the **Home** view, select **Server Pools** and go to the **Repositories** tab.

Note: Storage repositories are presented to individual servers, meaning that not all repositories are necessarily available for example when you deploy a VM on a specific Oracle VM Server. To see which servers have access to a storage repository, select the repository in the table and verify the access status on the right-hand side.

Table 5-2 Storage Repository Management Operations

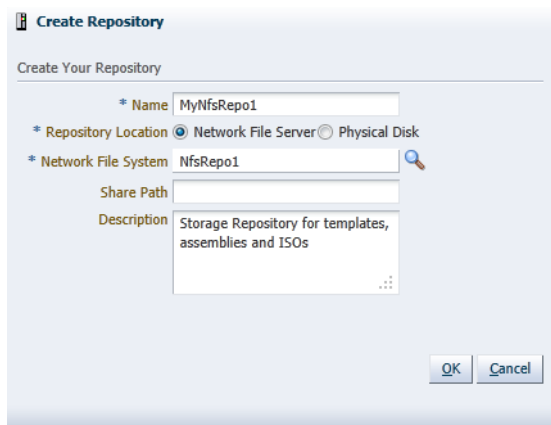
Operation	Description
Create repository	See Section 5.8.1, "Creating a Storage Repository" .
Present repository	<ol style="list-style-type: none"> 1. Select a repository in the table and click Present. 2. In the Present Repository dialog box, use the arrow buttons to determine to which Oracle VM Servers the current repository should be presented (or not presented). 3. Click OK to save your changes. See Section 5.8.2, "Presenting a Storage Repository" .
Edit repository	<ol style="list-style-type: none"> 1. Select a repository in the table and click Edit. 2. In the Edit Repository dialog box you can make the following changes: <ul style="list-style-type: none"> Name: edit the name of the selected repository. Description: optionally enter a more elaborate description of the selected repository. Release Ownership: select this check box to allow the repository to be used by another Oracle VM Manager. 3. Click OK to save the changes to the storage repository. See Section 5.8.3, "Editing a Storage Repository" .
Delete repository	<ol style="list-style-type: none"> 1. Select a repository in the table and click Delete. 2. Click OK to execute the delete operation. See Section 5.8.4, "Deleting a Storage Repository" .
Refresh repository	Select a repository in the table and click Refresh . Oracle VM Manager re-checks the disk contents of the selected repository. Any detected changes will be reflected in the various content tabs (Assemblies, ISO files, ...) of the storage repository.
Discover existing repository	If for any reason a storage repository exists on one of your storage providers, but is not visible in Oracle VM Manager – for example if the Oracle VM Manager host was reinstalled or the storage provider went down or moved to a different address – you can click Discover to detect pre-existing storage repository contents on the storage providers controlled by Oracle VM Manager.

5.8.1 Creating a Storage Repository

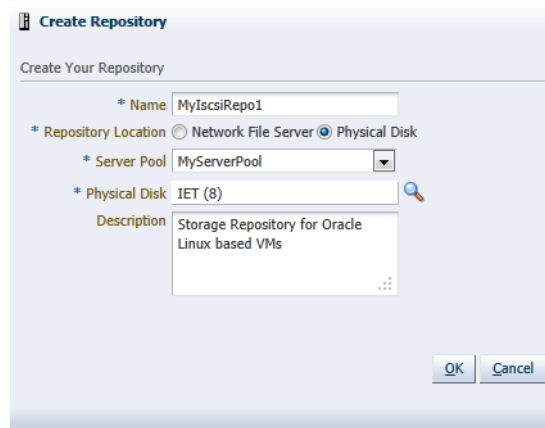
After you complete the preparation phase described above in [Section 5.6.1, "Registering and Configuring File Servers"](#) and [Section 5.6.3, "Registering and Configuring Storage Arrays"](#), Oracle VM Manager is fully aware of the underlying physical storage providers available for use as a storage repository.

To create a storage repository for your server pool:

1. In Oracle VM Manager, open the **Home** view and select **Server Pools** in the navigator.
2. In the management pane, open the **Repositories** tab.
3. Click **Create** to create a new storage repository.
4. In the **Create Repository** dialog box, enter the following information:
 - **Name:** the name you wish to use to identify the repository
 - **Repository Location:** either a network file server or a physical disk
5. If you selected Physical Disk as location, proceed to step 7.
 If you selected Network File Server as location, click the search icon to select a location in the Select Network File System dialog box:
 - Select a **Network File Server** from the list. The available file systems appear. Note that only a refreshed file system can be used.
 - Select the file system you wish to install the storage repository on. Click **OK**.



6. Optionally provide this additional information:
 - **Share Path:** path to a subdirectory on the selected file system
 - **Description:** information you would like to add about this storage repository
 - Proceed to step 9.
7. If you selected Physical Disk as the Repository Location, click the search icon to select a location in the Select Physical Disk dialog box:
 - Select a **Storage Array** and, if applicable, a Volume Group from the respective lists. The available disks appear.
 - Select the physical disk you wish to install the storage repository on. Click **OK**.



8. Select from the list to which **Server Pool** this storage repository should be provided. Optionally enter additional information about this storage repository in the **Description** field.

Note: When you create a storage repository on a LUN, only clustered server pools can be selected.

9. Click **OK** to create the new storage repository. The new storage repository is displayed in the **Repositories** table in the management pane.

At this point, the storage repository has been created and your Oracle VM Manager has taken ownership. However, to enable your Oracle VM Servers to use it to store virtual machines, ISO files, templates and so on, you must first present the repository to the Oracle VM Servers in your server pool. This is described in [Section 5.8.2, "Presenting a Storage Repository"](#).

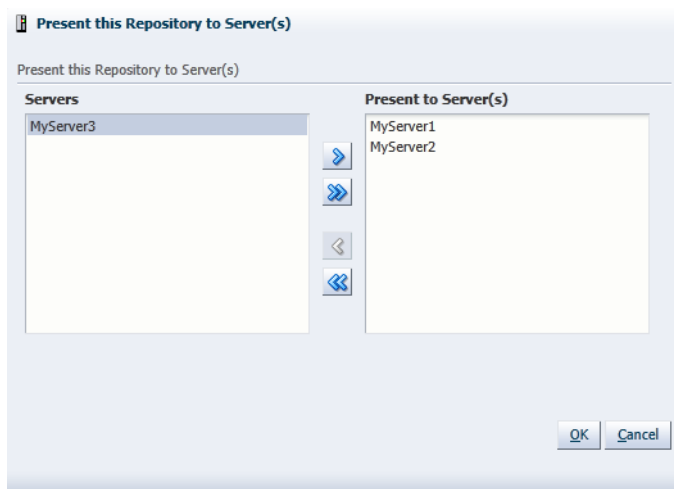
5.8.2 Presenting a Storage Repository

When the storage repository is prepared and created, it still must be made available for use by your Oracle VM Servers before it can be populated. Typically you present the storage repository to all the Oracle VM Servers in the server pool. However, should you wish to set up storage differently, Oracle VM Manager allows you to present a repository to a selection of Oracle VM Servers instead of the entire server pool.

Presenting the storage repository to an Oracle VM Server is the equivalent of mounting a file system. Essentially, when you present the repository to the Oracle VM Servers in your server pool, the repository file system is mounted by the *root* user on each Oracle VM Server. This is an essential factor in the HA configuration of the Oracle VM setup.

To present a storage repository to your Oracle VM Servers:

1. Open the **Home** view and select **Server Pools** in the navigator.
2. In the management pane, open the **Repositories** tab.
3. Select the storage repository of your choice and click **Present** to present or expose the repository to one or more Oracle VM Servers.



4. In the **Present Repository** dialog box, use the arrow buttons to move the required Oracle VM Servers from the left to the right pane.
5. Click **OK** to present the storage repository to the Oracle VM Servers.

Note: NFS-based storage repositories can be shared by multiple server pools controlled by the same Oracle VM Manager. OCFS2-based storage repositories always belong to a single clustered server pool.

Your external storage setup is now complete. The storage repository is available to your Oracle VM Servers. Create a server pool with your Oracle VM Servers and specify this storage repository, see [Chapter 7, "Managing Server Pools"](#). When the server pool is ready you can start creating virtual machines.

5.8.3 Editing a Storage Repository

To edit a storage repository:

1. Select a repository in the table and click **Edit**.
2. In the **Edit Repository** dialog box you can make the following changes:
 - Name:** edit the name of the selected repository.
 - Description:** optionally enter a more elaborate description of the selected repository.
 - Release Ownership:** select this check box to allow the repository to be used by another Oracle VM Manager.
3. Click **OK** to save the changes to the storage repository.

5.8.4 Deleting a Storage Repository

To delete a storage repository:

1. Make sure that all content has been removed from the storage repository you wish to delete.
2. Select the repository in the table and click **Delete**.
3. Confirm that you wish to delete this storage repository: click **OK** to continue.

4. Click **OK** to execute the delete operation.

When your server pool is fully configured with Oracle VM Servers, network and storage, you use Oracle VM Manager for all management and maintenance operations on the storage repository. The storage resources residing in the repository (ISO files, templates, and so on) are also managed through Oracle VM Manager. Management operations on the storage resources inside a storage repository are discussed in detail in a separate chapter: [Section 8.5, "Virtual Machine Resources"](#). Detailed instructions for the use of different types of storage entities with virtual machines are discussed in [Chapter 8, "Managing Virtual Machines"](#).

Managing Networks

Networking is a very broad concept with many different interpretations. Data center administrators typically have their own idea about what the best network configuration is in terms of performance, security and cost-effectiveness. In some cases physical network connections are readily available so bonding is preferred for failover or higher bandwidth, while other configurations use VLANs for network segregation or to compensate for the lack of free NICs. Some will use Ethernet connections for storage while others have dedicated fibre channel hardware at their disposal.

Generally speaking, data center operators tend to think essentially in terms of hardware: switches, routers, firewalls, cables, NICs (Network Interface Cards), and so on. The only widespread network virtualization concept to date is VLAN (Virtual LAN) technology. VLANs are also very frequently used in Oracle VM networking.

The networking infrastructure in the Oracle VM environment comprises connections between Oracle VM Servers, between Oracle VM Servers and Oracle VM Manager, between the Oracle VM Servers and their storage sub-systems, as well as communications among virtual machines deployed in the environment, and between virtual machines and external private or public networks.

These networking connections can leverage features supported by Oracle VM, such as networked file systems, clustering, redundancy and load balancing, bridging, and support for Virtual LANs (VLANs).

This chapter discusses creating and using Oracle VM networks, and contains:

- [Oracle VM Networking Overview](#)
- [Network Usage](#)
- [Building a Network Environment](#)
- [Network Bonding](#)
- [Network Bridges](#)
- [VLAN Groups and VLAN Segments](#)
- [Creating Additional Networks](#)
- [Managing Bonded Interfaces](#)
- [Managing VLAN Groups](#)
- [Managing Networks](#)
- [Editing Network Data](#)

6.1 Oracle VM Networking Overview

When you create an Oracle VM network, you map available network ports to a set of logical Ethernet networks. You perform this mapping in Oracle VM Manager.

The physical network is the collection of physical connections in Oracle VM Manager and all Oracle VM Servers, and the switches and routers that allow information to reach its destination.

A logical network in Oracle VM is built on top of these physical connections. Each physical connection is called a network port. Other names for this physical connection include network interface card, or NIC, or network interface.

You define a name or alias for each logical network that you create. When you have created your networks, you connect the physical network ports to the logical networks.

Before you define the logical networks in Oracle VM Manager, you have to review the physical network configuration that you intend to use, such as VLAN and subnet usage. You also take into account the number of network ports, or NICs, available to your Oracle VM Servers. The minimum recommended number of ports required on a single Oracle VM Server is two, although one would suffice for test or demonstration purposes. If you have more than two ports on your Oracle VM Servers, you can design more redundancy or traffic isolation in your environment.

Oracle VM supports both 1Gbit and 10Gbit NICs. All network functions can either be on dedicated or shared physical networks, except for the virtual machine intra-server. For example, a physical network can be dedicated to Virtual Machine or Storage only, or can be dedicated for all network functions.

6.2 Network Usage

In Oracle VM a network can perform one or more network functions. Oracle VM has the following network functions:

- **Server Management:** is used to manage the physical Oracle VM Servers in a server pool, for example, to update the Oracle VM Agent on the different Oracle VM Servers.

Note: In Oracle VM the management network interface and the public interface (i.e. default route) are expected to be the same on each Oracle VM Server. Other types of network usage are allowed on the same interface, for example through the use of VLANs and/or network bridges.

- **Live Migrate:** is used to migrate virtual machines from one Oracle VM Server to another in a server pool, without changing the status of the virtual machine.
- **Cluster Heartbeat:** is used to verify if the Oracle VM Servers in a clustered server pool are up and running. The heartbeat function has a network component, where a TCP/IP communication channel is created with each Oracle VM Server. Each Oracle VM Server sends regular keep-alive packets and these packets are used to determine if each Oracle VM Server is alive.

Note: It is recommended to separate the cluster heartbeat function from networks with high load, such as storage and live migration networks. If bandwidth drops too low, heartbeating connectivity might be interrupted, which could lead to rebooting of virtual machines and Oracle VM Servers.

- **Virtual Machine:** is used for the network traffic between the different virtual machines in a server pool. The virtual machine role can be either standard Inter-Server (routable through standard switches), or Intra-Server (without a route to an external physical network and dedicated to the selected Oracle VM Server.).

Note that it is possible, and very likely, to have multiple networks with the Virtual Machine role in one Oracle VM Manager.

- **Storage:** is used for all storage transport in a server pool. It is used by the Oracle VM Servers to connect to Ethernet-based storage repositories and server pool file systems. As with the Virtual Machine role, it is possible to have multiple networks with the Storage role.

The first step in configuring your Oracle VM environment is to discover your Oracle VM Servers. This step assumes that the Oracle VM Manager host and all of the Oracle VM Servers can communicate over the same network, though the Oracle VM Servers and Oracle VM Manager can reside in different subnets. When you discover the first Oracle VM Server, the management network is created automatically and takes its name from the subnet to which the Oracle VM Server is connected. Each additional Oracle VM Server discovered from the Oracle VM Manager either adds an entry into the existing management network or creates a new management network if the server is connected to a subnet where no Oracle VM Server was previously discovered. Each server in your Oracle VM environment can only have one interface designated for management, belonging to a single management network object in the Oracle VM Manager's database.

WARNING: Although the Oracle VM Manager and its discovered and owned Oracle VM Servers may be on different subnets as long as they can reach each other, Network Address Translation (NAT) is not supported in this configuration. NAT would lead to a discrepancy between the actual management IP of the Oracle VM Server and the IP provided during discovery.

A network port on every Oracle VM Server is designated as the management interface during the installation of the Oracle VM Server and is configured as a bonded interface. You can add or remove ports in this bond, but you cannot change the bonding mode or remove the bond. Once a management network is created, it can only be deleted again if no servers have ports in the management network anymore.

After your management networks are in place, you plan for the creation of other types of network. Note that once a port is selected for a particular network, it cannot be selected again when creating additional networks. You can use a combination of network bonding and VLAN Groups to create all the networks needed for your environment, using your existing ports. Network bonding is covered in [Section 6.3, "Building a Network Environment"](#); VLAN Groups are covered in [Section 6.6, "VLAN Groups and VLAN Segments"](#).

Figure 6–1 Oracle VM Networking Example

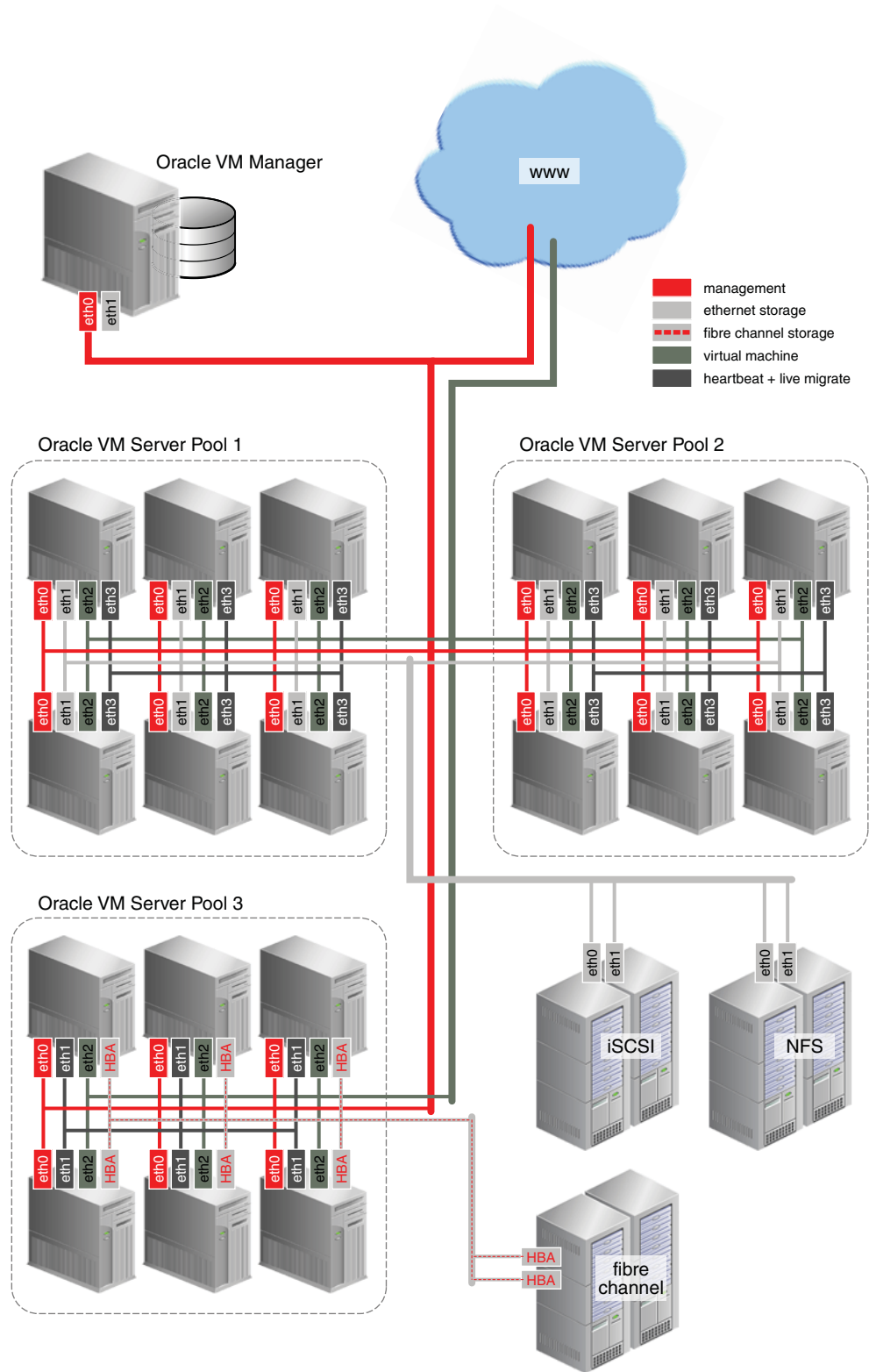


Figure 6–1 shows an example of an Oracle VM environment with split network functions. Each Oracle VM Server is connected to the management network, regardless of which server pool they belong to.

Each server pool has a separate network for heartbeating functionality and live migration. Since this type of network traffic occurs at the level of an individual server pool, the network does not need a gateway. Though you may create several networks for the heartbeating and live migration functions, a server can only belong to one network for each function.

As a rule, virtual machine (VM) traffic requires a dedicated network. In this example the VM network has a route to the internet (or corporate wide area network). You can create as many virtual machine networks as permitted by your network infrastructure.

The first two server pools are connected to a storage network with Ethernet based storage providers. Ethernet based storage is provided as either NFS file servers or iSCSI LUNs. Server Pool 3 has dedicated fibre channel storage, which requires a fibre channel switch and host bus adapters (HBAs) in all connected hardware components. Similar to networks for virtual machines, you create as many storage networks as needed to implement your storage strategy.

6.3 Building a Network Environment

When you create a new network, you choose a network function and network elements to build this network. These network elements include network ports, bonds, or VLAN segments if VLANs are used in your environment. These network elements as well as the networks you create are stored as networking objects in the Oracle VM Manager database. Your Oracle VM Servers are unaware of these Oracle VM Manager network objects. Creating and managing network objects in Oracle VM Manager results in the configuration or deletion of the network devices (for example: ports, VLAN devices, bridges) present on Oracle VM Servers.

After reviewing your physical network environment and deciding on the logical distribution and grouping of these physical objects, you create the logical constructs in Oracle VM Manager to implement your network design. These logical constructs include:

- Network bonds
- VLAN groups
- Networks
- Bridges

Note: Bridges are associated with networks. Network bridges are automatically created when creating networks for virtual machines.

A short description of these objects and their usage is given below in the following sections:

- [Network Bonding](#)
- [Network Bridges](#)
- [VLAN Groups and VLAN Segments](#)

If your network design includes interface bonding, you create these network bonds first. A bond is the aggregation of network ports – in Oracle VM a maximum of two – to provide redundancy and depending on the bonding mode, to increase performance. These bonds are often used in conjunction with VLANs, when traffic from several VLANs is allowed to use the same bond.

If your network environment comprises VLANs, your next step is to create VLAN Groups. With VLAN Groups, you determine which port or bond, on each Oracle VM Server, will accept traffic from more than one VLAN. Next, you specify the VLAN segments, as VLAN IDs, that are part of the VLAN Group.

Once these network building blocks are in place, you are ready to create networks using Oracle VM Manager. For each network, you must answer two questions:

- What is the expected network function for your new network?

Network functions are discussed in [Section 6.2, "Network Usage"](#).

- What are the building blocks for your new network?

These building blocks determine the network type in Oracle VM Manager. The choices when creating a network are:

- Create a network with ports and bonds
- Create a network with VLANs only
- Create a network with ports and bonds, and VLANs
- Create a logical network on a single server

If you create a network with ports, these ports, located on the Oracle VM Servers that will participate in the network, cannot be part of an already existing network.

If you intend to use port bonding, create the bond(s) before creating your network.

If you intend to allow traffic from several VLANs on a single port or bond, create the VLAN Groups before creating the network.

When creating a VLAN Group, you provide the following information:

- The port or bond for each server participating in the network
- The VLAN ID for each VLAN allowed to use the network
- IP addressing is desired, the IP address to assign to each port or VLAN interface specified respectively in the bullet points above.

You can also create a network using a combination of VLAN interfaces, ports and bonds. If you choose this type of network, the bonds must be created first and the VLAN interfaces must already be part of an existing VLAN Group.

Finally, you can create a network which is intended for a single server. This type of network allows communication between the virtual machines running on a single Oracle VM Server, and does not allow external network traffic. A computing environment made up of several virtual machines, where the virtual machines provide services to each other over the network, could benefit from this type of network, without requiring additional network ports on the Oracle VM Server.

The next topics provide more information about network bonding, network bridges, VLAN Groups and VLAN segments. To create VLAN Groups, see [Section 6.9, "Managing VLAN Groups"](#). To create networks, see [Section 6.10, "Managing Networks"](#).

6.4 Network Bonding

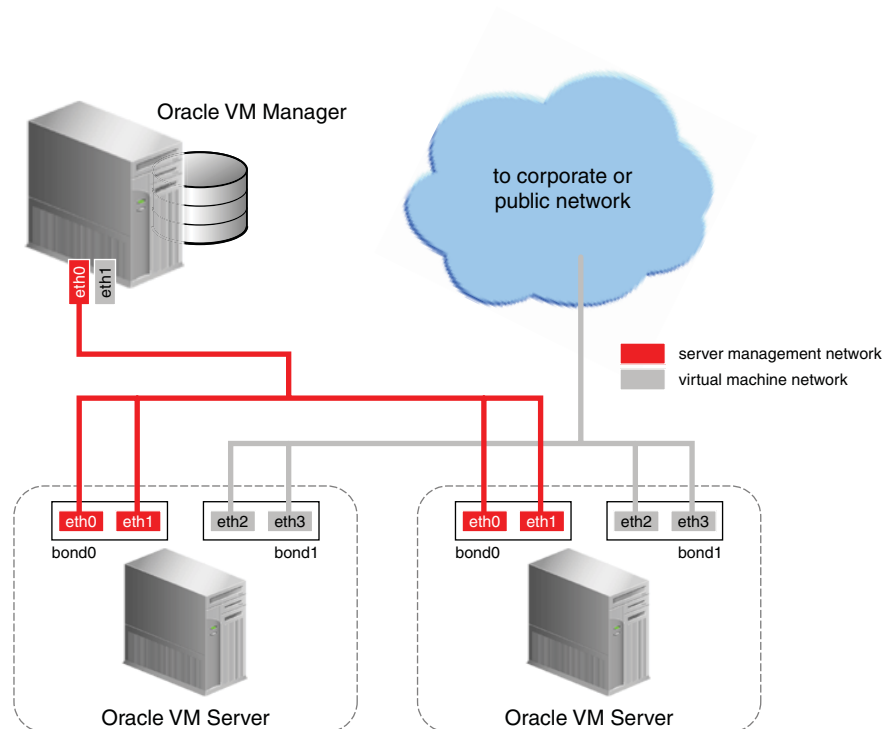
Network bonding refers to the combination of network interfaces on one host for redundancy and/or increased throughput. Redundancy is the key factor: we want to protect our virtualized environment from loss of service due to failure of a single

physical link. This network bonding is the same as the Linux network bonding. Using network bonding in Oracle VM may require some switch configuration.

In Oracle VM, there are three modes of network bonding:

- **Active-Passive:** there is one NIC active while another NIC is asleep. If the active NIC goes down, another NIC becomes active.
- **Link Aggregation:** aggregated NICs act as one NIC which results in a higher throughput.
- **Load Balanced:** the network traffic is equally balanced over the NICs of the machine.

Figure 6–2 Network bonding



During installation of Oracle VM Server, the network interface (selected when prompted for the management port) is configured as a bonded interface. The bond is created with only one interface. This is done because the reconfiguration of the management interface on the Oracle VM Servers is not supported. You can add a second interface to the already existing bond device without affecting the configuration of the original interface. This is illustrated in [Figure 6–2](#), where a second network interface is added to bond0, the network bond created during installation. The bond interface now provides redundancy since the bonding mode is always set to active-passive for the management network.

[Figure 6–2](#) also illustrates the configuration of a second bonded interface, bond1, which can be used for other network usage, such as the virtual machine function.

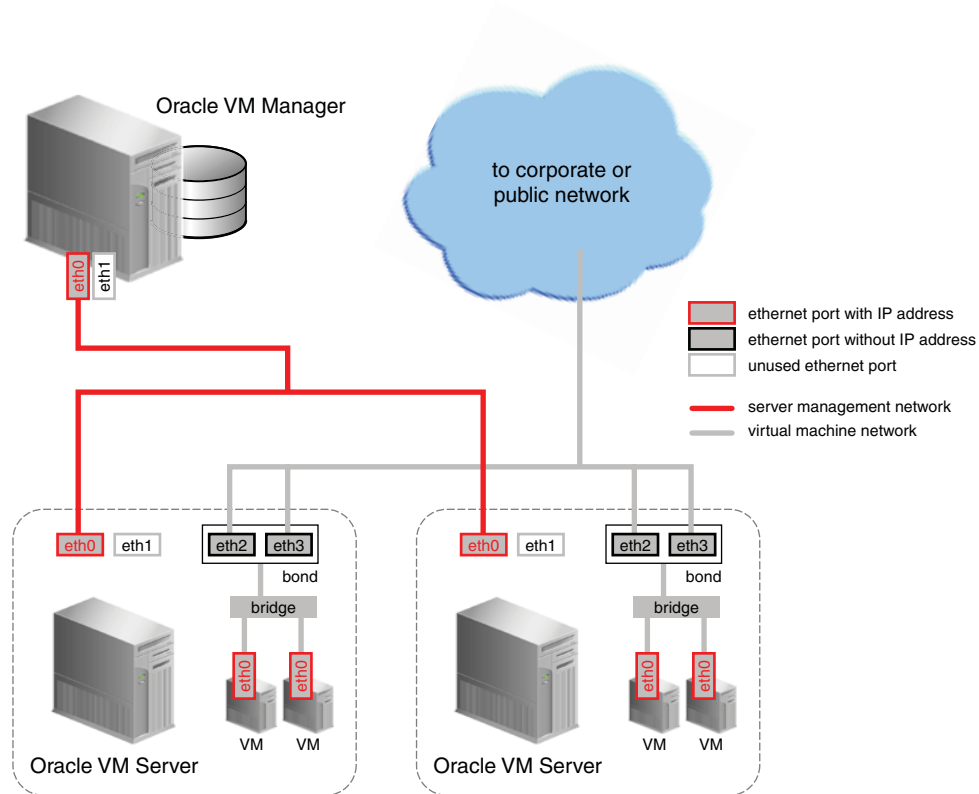
6.5 Network Bridges

When creating a network with the virtual machine role, a bridge is created automatically on the port or bond added to the network for each Oracle VM Server

participating in this network. All network packets generated by the virtual machines are sent to the bridge configured for the virtual machines' network. The bridge acts as a Layer 2 switch, and directs packets to other virtual machines running on the Oracle VM Server, or to the port or bond, if the packets' destination is outside of the Oracle VM Server.

Though each virtual machine deployed within a network is usually assigned an IP address, either static or assigned using DHCP, there is no need to configure an IP address for the bridge on the Oracle VM Servers. When configuring your Virtual Machine network, if you specify an IP address for the port or bond you selected for this network, it is assigned to the bridge. You can choose not to assign an IP address to the selected port or bond. In this case, the bridge does not acquire an address but still functions as a Layer 2 switch.

Figure 6–3 Network bridge



In [Figure 6–3](#), two network ports are specified for the network with the virtual machine role. Therefore, these ports should be configured as a bonded interface. Since this network is configured with the virtual machine role, a bridge is automatically created on each Oracle VM Server in the network. Neither the bridge nor the ports in the virtual machine network, have IP addresses assigned to them, though you may assign IP addresses if you wish during network creation.

Bridges are only created for networks with the virtual machine role.

6.6 VLAN Groups and VLAN Segments

Oracle VM supports multiple virtual LANs, or VLANs, on the same network port or bond. Each VLAN is essentially an independent logical network operating with other VLANs over the same physical connection. This means that virtual machines deployed

on different networks, connected through the same Oracle VM Server port (or bond), can have traffic directed to different VLANs. This feature is implemented using VLAN groups.

Configuring VLANs involves creating one or more VLAN Groups, each of which can house multiple VLANs. Each VLAN is assigned a distinct VLAN identification. The VLAN ID is used by an attached VLAN switch to segregate traffic among the different VLANs operating on the same link. When a VLAN is configured, it functions exactly like a separate physical connection.

6.6.1 Configuring VLANs

You must configure the VLANs needed to support your network before you can use them. This is usually accomplished using switch trunking. Trunking involves configuring ports on the switch to allow multiple VLAN traffic on these ports, to ensure that packets are correctly transmitted to their final destination. Consult your switch vendor's documentation for information regarding trunking.

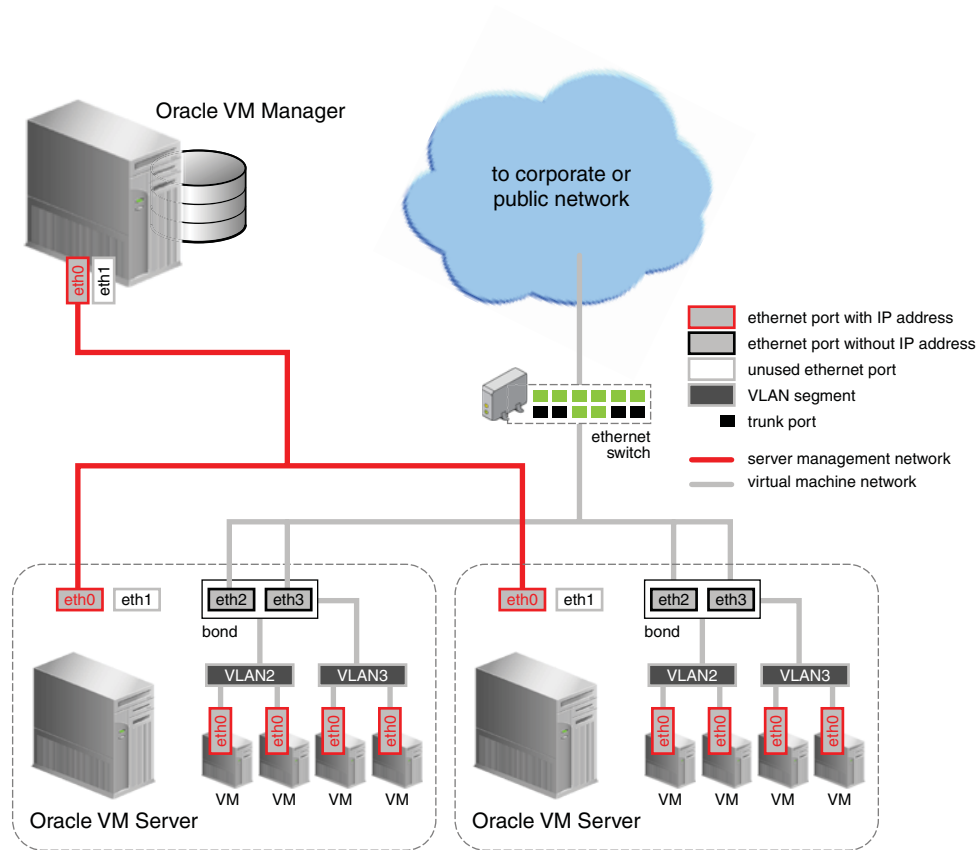
6.6.2 Configuring VLAN Groups

A VLAN Group is a logical grouping of VLANs, either tagged or untagged. If a VLAN is tagged, each packet transmitted to and from this VLAN contains a VLAN ID. Network traffic can contain a mix of tagged and untagged packets. If a packet does not contain a VLAN tag, the packet is destined to an untagged VLAN.

You create a VLAN group to direct the traffic from several VLANs onto a single port or bond on each Oracle VM Server in the server pool. For example, if a port or bond is expected to carry traffic for VLAN with ID 2 and for VLAN with ID 3, you create a VLAN Group and specify the two VLANs, VLAN 2 and VLAN 3. These VLANs appear as VLAN segments in the VLAN Group. After creating the VLAN Group, you create a network and specify one of the VLAN segments present in the VLAN Group. Each packet transmitted from virtual machines on this network is tagged with the VLAN Id for the VLAN segment specified during network creation. If you specify untagged during network creation, the packets can still flow through the port or bond defined in the VLAN groups, but the packets are untagged. The Ethernet switch, to which the Oracle VM Servers are connected, is responsible to transmit the packets to the appropriate VLAN, tagged or untagged.

[Figure 6-4](#) illustrates the case of two virtual machine networks, whose network traffic flows through the same bonded interface.

Figure 6–4 Networks with VLANs and VLAN Group



The VLAN Group needed to support the configuration shown in [Figure 6–4](#) contains two VLANs, with ID 2 and 3. The VLAN Group also contains two ports for each Oracle VM Server in the network. On each server, the ports are configured as a bond device. Once the VLAN Group is created, two virtual machine networks are added: the first network specifies the VLAN segment with ID 2 and the second network specifies the VLAN segment with ID 3, where both segments are defined in the VLAN Group. For each network, a bridge is defined for the specified VLAN segment, without an IP address since none is specified during configuration. Network packets from virtual machines deployed on VLAN segment 2 travel through the bridge and acquire a tag which identifies the packets as belonging to VLAN 2. Similarly, the packets issued from the virtual machines deployed on the network for VLAN segment 3 are tagged for VLAN3 with ID 3. The packets from both networks use either path to the switch if the bond is configured as active-active. The receiving ports on the Ethernet switch are configured using trunking or similar program to recognize network traffic for the two VLANs in the configuration. As such, the trunk ports will direct the packets to the correct VLAN on the switch, or other connected switches.

6.7 Creating Additional Networks

Depending on the number of available network ports on your Oracle VM Servers, and whether or not you use VLANs, you can create additional networks and assign network functions to them. The exception would be the Management function, which is already assigned, and cannot be removed from the management network(s) created when the Oracle VM Servers were discovered. For example, if your Oracle VM Servers have two NICs, you create a second network with the Virtual Machine role. If your

storage is connected to the Management network, you can add the Storage role to your Management network if your storage is connected to the same network as defined by the Management network.

If you have more than two ports on your Oracle VM Servers, or if you are using VLANs, you can create additional networks with the Storage role. These networks connect your Oracle VM Servers to either iSCSI or NFS-based storage. Generally, all Oracle VM Servers that belong to the same pool access the same storage. For each network created, you select a port, bond or VLAN interface on each Oracle VM Server to participate in this network.

You can also create a separate network for the Live Migrate function. After the initial server discovery, the Live Migrate role is assigned to the Management network. Oracle VM encrypts migration traffic using SSL, to protect sensitive data from exploitation and to eliminate the requirement for a dedicated network. Nonetheless, if you have sufficient network resources on your Oracle VM Servers within a server pool, you can choose to create a separate network for live migration.

Similarly, the Cluster Heartbeat network function is assigned to the Management network upon discovering the first Oracle VM Server. The heartbeat communication does not generate a lot of traffic on the network, and therefore does not have much impact on the Management network. It is however susceptible to latency. For this reason, you can choose to create a separate network for the cluster heartbeat function.

Note: Though you can create several networks for the heartbeat and live migration functions, each Oracle VM Server can only participate in one heartbeat and live migration network.

Network configuration is independent of your server pool configuration, but both entities must be taken into account when designing your overall networking infrastructure. Oracle VM Manager communicates with all Oracle VM Servers in the environment, using the management port, independent of how Oracle VM Servers are grouped to form server pools. Some network configuration in your environment might be dependent on the storage available to specific server pools. Virtual machines deployed from separate server pools might use the same external network. For this reason, it is best to plan your network design based on current network and storage setup as well as anticipated growth. Each server in a server pool should have identical network configuration.

The next sections of this chapter describe how to use Oracle VM Manager to translate the network structure of your Oracle VM environment into VLAN Groups and networks. If you expect to use bonding of network ports in your environment, create those first. If your environment contains VLANs, create the VLAN Groups to support your VLAN setup. You can then specify the VLAN segments contained in these VLAN Groups when creating your networks.

6.8 Managing Bonded Interfaces

The management port on each Oracle VM Server is specified at installation time and is automatically configured as a bonded interface. You create additional bonds to add redundancy and if desired, load-balancing to your network environment. Once created, these bonds can be used as building blocks when building VLAN Groups or networks.

This section discusses managing bonded interfaces and contains:

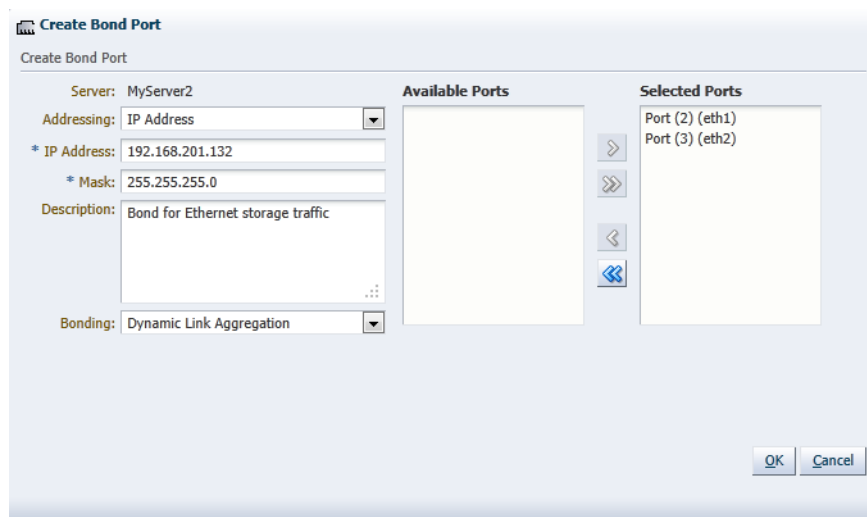
- Creating bond ports

- Making changes to bond ports
- Deleting bond ports

To create a bond port:

1. In the **Hardware** view, select the **Hardware** tab.
2. In the navigation pane, select the Oracle VM Server on which the bond port is to be created. If the server is already part of a server pool, it will be listed under **Resources**. Otherwise, find and select the server in the Unassigned Servers folder.
3. In the management pane, select the **Ethernet Ports** tab. Make sure that the selected server's ports to be used for the bond port are not part of an existing bond, network or VLAN group. Verify that the ports are available.
4. In the management pane, select the **Bonding** tab. Click **Create** to start the Bond Port creation wizard.
5. In the right pane of the **Create Bond Port** window, select the ports to be part of the new bond.

You can also assign an IP address to this bond now, or wait to assign an IP address later, when using the bond to create VLAN Groups or networks. If you chose to assign an IP address now, select the **Addressing** type, and if applicable, the IP address and netmask.



6. Optionally, add a description for this bond.
7. Except for the bond in the management network for each Oracle VM Server, you can specify the bonding mode from the **Bonding** list. See [Section 6.4, "Network Bonding"](#), for more information regarding network bonding modes.
8. Click OK to complete the operation.

Once you have created the bond port, you can make changes to its configuration. You can update its bonding mode, and add or remove ports as well as changing its description and IP addressing.

To update a bond port:

1. In the **Hardware** view, select the **Hardware** tab.
2. In the navigation pane, browse the tree structure and select the Oracle VM Server on which the bond port is to be updated.

3. In the management pane, select the **Bonding** tab.
4. From the list of bond ports for the server, select the bond port to update.
5. You can set or change the IP addressing, the description, or the ports that are part of the bond.
6. Click OK to save and apply your changes.

If the bond port is no longer in use in any VLAN Group or network, it can be deleted.

To delete a bond port:

1. In the **Hardware** view, select the **Hardware** tab.
2. In the navigation pane, browse the tree structure and select the Oracle VM Server on which the bond port is to be deleted.
3. In the management pane, select the **Bonding** tab.
4. From the list of bond ports for the server, select the bond port to delete.
5. Click **Delete** to delete the bond port.

6.9 Managing VLAN Groups

Oracle VM supports multiple virtual LANs (VLANs) on the same NIC port. Each VLAN is essentially an independent logical network operating with other VLANs over the same physical connection. Using VLANs in an ideal way to minimize the number of required physical connections and NICs while concurrently separating traffic.

Configuring networks to support VLAN traffic involves creating one or more VLAN Groups, each of which can house multiple VLANs. Each VLAN is assigned a distinct VLAN identification. The VLAN ID is used by an attached VLAN switch to segregate traffic among the different VLANs operating on the same link. When a VLAN is configured, it functions exactly like a separate physical connection.

VLANs need to be configured in the physical switches before you can use them. See [Section 6.6, "VLAN Groups and VLAN Segments"](#) for more information about using VLANs in your networking environment.

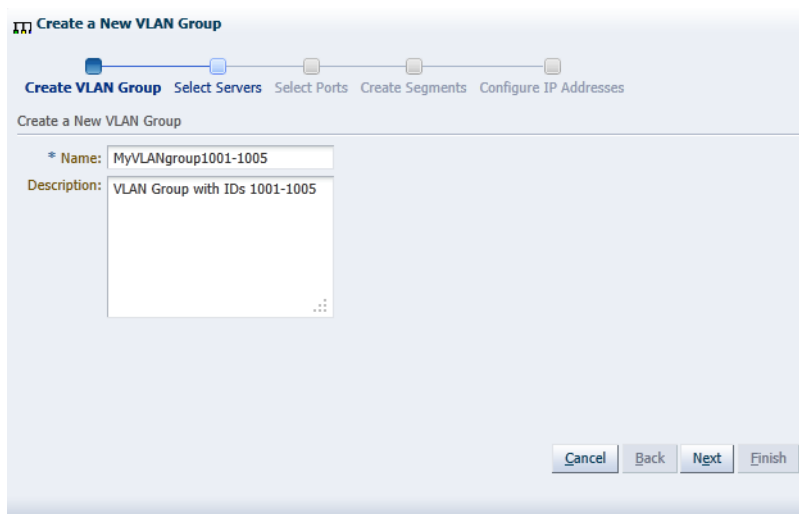
This section discusses using VLAN groups and contains:

- [Creating a VLAN Group](#)
- [Editing a VLAN Group](#)
- [Deleting a VLAN Group](#)

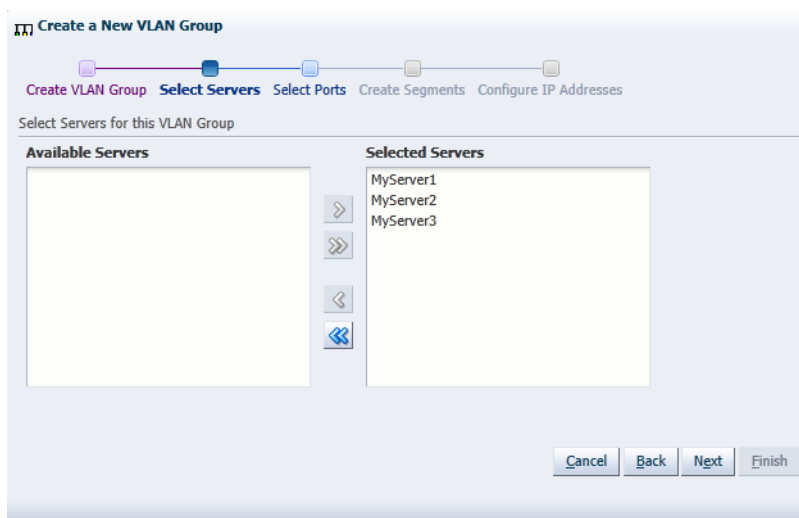
6.9.1 Creating a VLAN Group

To create a VLAN Group:

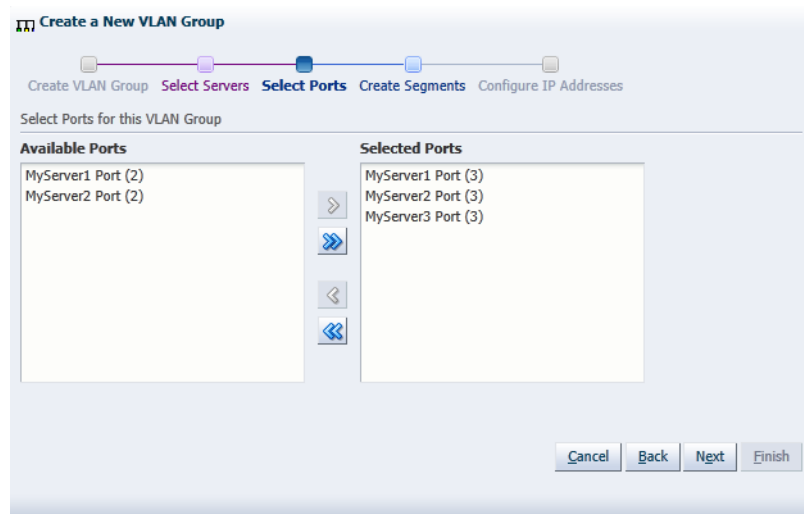
1. In the **Hardware** view, select the **Hardware** tab.
2. In the navigation pane, select **Resources**. In the management pane, select the **VLAN Groups** tab.
3. Click **Create** to start the **VLAN Group** creation wizard.
4. Enter a name in the **Name** field, and optionally a description in the **Description** field for the VLAN group and click **Next**.



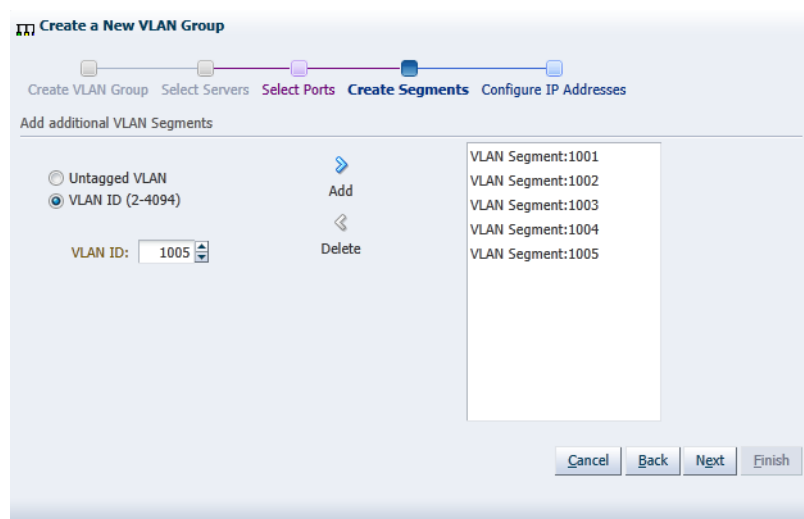
5. Select the Oracle VM Servers that have ports or bonds for this VLAN group and click **Next**.



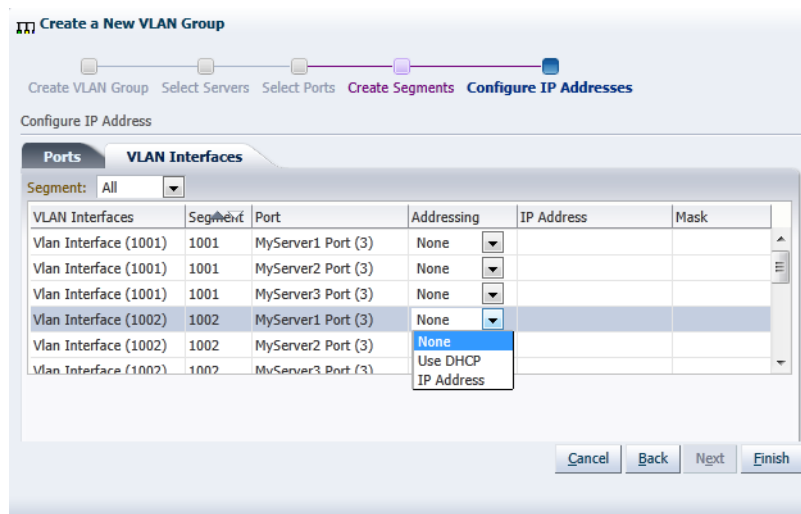
6. Select the port or bond of each Oracle VM Server that belongs to the network and click **Next**. The number between brackets next to the name of the Oracle VM Server corresponds with the NIC of the Oracle VM Server.



7. Add all VLAN Ids which belong to the VLAN group, and optionally select **Untagged VLAN**. Each selected VLAN ID appears as a separate VLAN segment in the VLAN Group.



8. In the next screen, you can set IP addressing to either the ports and bonds or to the VLAN interfaces that are part of this new VLAN Group. Generally, you do not specify IP addresses to VLAN interfaces that are part of a network for virtual machines.



- Click **Finish** to complete the operation.

6.9.2 Editing a VLAN Group

To edit a VLAN Group:

- In the **Hardware** view, select the **Hardware** tab.
- In the navigation pane, select **Resources**. In the management pane, select the **VLAN Groups** tab.
- From the list of VLAN Groups, select the VLAN Group you want to update and click the **Update** icon. The screens in the wizard are identical to the ones displayed in [Section 6.9.1, "Creating a VLAN Group"](#).
- In the Edit VLAN Group screen you can change the name in the **Name** field, and the description in the **Description** field. Click **Next**.
- In the **Select Servers** screen, you can add or remove Oracle VM Servers participating in this VLAN group. Click **Next**.
- In the **Select Ports** screen, you can add or remove ports or bonds for the Oracle VM Servers in this VLAN Group. The number between brackets next to the name of the Oracle VM Server corresponds with the port of the Oracle VM Server. Click **Next**.
- In the **Edit Segments** screen, you can add or remove VLAN IDs from the VLAN Group and optionally select **Untagged VLAN**. Each selected VLAN ID appears as a separate VLAN segment in the VLAN Group. It is possible to combine VLAN IDs with Untagged VLANs, so, first select the proper **VLAN IDs**, and then select **Untagged VLAN**.
- In the **Configure IP Address** screen, you can update information for the ports or bond ports and for the VLAN interfaces that are currently part of the VLAN Group.

Select the **Ports** tab to modify the IP addressing of ports or bond ports that are part of the VLAN Group. You can update the IP addressing type, the IP address if selecting a static address, and the netmask. If the VLAN Group contains bond ports, you can also modify the bonding mode for the bond ports.

Select the **VLAN Interfaces** tab to modify the IP addressing of the VLAN interfaces that are part of the VLAN Group. You can update the IP addressing type, the IP address if selecting a static address, and the netmask.

9. Click **Finish** to complete the update.

6.9.3 Deleting a VLAN Group

You can only delete a VLAN Group if none of the VLAN segments in the VLAN Group are currently being used by a network.

To delete a VLAN Group:

1. In the **Hardware** view, select the **Hardware** tab.
2. In the navigation pane, select **Resources**. In the management pane, select the **VLAN Groups** tab.
3. Select a VLAN Group in the table, and click **Delete**.
4. Click **OK** to confirm the deletion of the VLAN Group.

The VLAN Group is deleted.

6.10 Managing Networks

The initial Oracle VM Server installation configures the bare minimum network configuration. This allows Oracle VM Servers to set up their networking sufficiently to establish communication with Oracle VM Manager.

User created network devices (VLAN or a bond) on an Oracle VM Server are discovered by Oracle VM Manager, but these network devices are not associated with logical networks.

The management network, created during the Oracle VM installation, has the following network functions:

- Server Management
- Live Migrate
- Cluster Heartbeat

When an Oracle VM Server is discovered, the port on which the Oracle VM Manager discovers the Oracle VM Server is added to this management network, and the port is configured as a bonded interface. See [Section 6.4, "Network Bonding"](#) for details about network bonding. You can add a port to this bond, and you can add or remove network functions for this network other than the management role. Other changes are not permitted. You can make the allowed changes to the configuration of the management network at any time using Oracle VM Manager. See [Section 6.11, "Editing Network Data"](#) for details about changing a network configuration in Oracle VM Manager.

Note: In Oracle VM the management network interface and the public interface (i.e. default route) are expected to be the same on each Oracle VM Server. Other types of network usage are allowed on the same interface, for example through the use of VLANs and/or network bridges.

Additional network configuration beyond what is done through the discovery process must be done using Oracle VM Manager.

All network configurations are persistent on the Oracle VM Servers to allow HA to work without requiring Oracle VM Manager. This includes enough logical information to allow the configuration to be recreated on Oracle VM Manager in the event that the Oracle VM Manager database is lost. All network configuration is also persistent on Oracle VM Manager.

When you build a new network, you use ports, bond ports or VLAN interfaces as building blocks for the network. For more information on network building blocks, see [Section 6.3, "Building a Network Environment"](#). You must also select the network usage for your new network. For a discussion of network functions and rules associated with them, consult [Section 6.7, "Creating Additional Networks"](#).

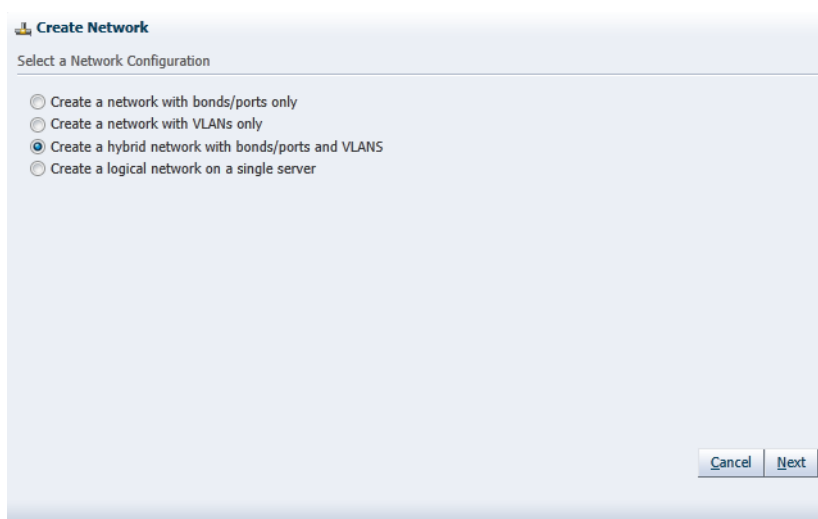
This section discusses managing networks and contains:

- [Creating a Network](#)
- [Editing a Network](#)
- [Deleting a Network](#)

6.10.1 Creating a Network

To create a network:

1. In the **Hardware** view, go to the **Hardware** tab, and select the **Resources** folder.
2. Select the **Networks** tab in the management pane.
3. Click **Create** to start the **Network Configuration** wizard. The wizard offers the following choices:
 - Create a network with bonds/ports only
 - Create a network with VLANs only
 - Create a hybrid network with bonds/ports and VLANs
 - Create a logical network on a single server

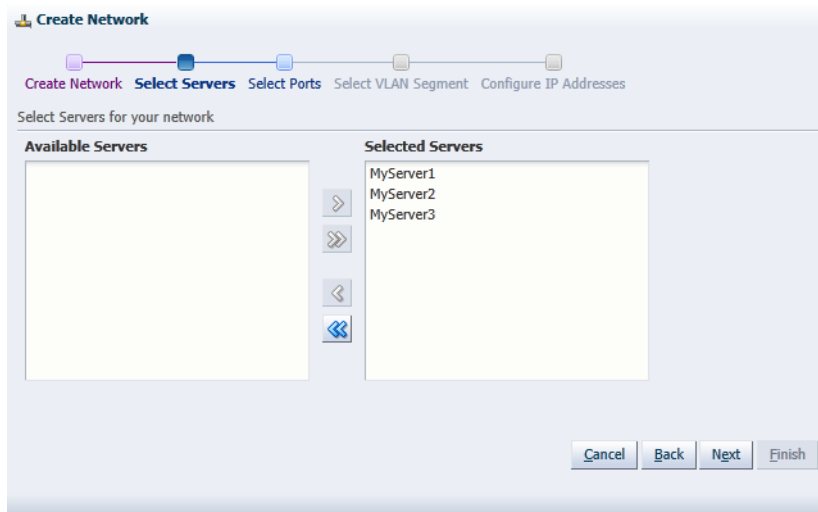


4. Select the type of network to create, based on your network infrastructure.

- If you have created bonds previously, you can now use them to create a network.
 - If you select to create a network with VLANs only, you must have created a VLAN Group previously. See [Section 6.8, "Managing Bonded Interfaces"](#) for details on how to create a VLAN Group.
 - You can also choose to create a network with a combination of bonds and ports, and VLANs.
 - The last selection, to create a logical network on a single server, creates an intra-server on a single Oracle VM Server. See [Section 6.3, "Building a Network Environment"](#) for information about intra-server networks. To create a logical network on a single server, proceed with step 7. For all other network types, continue with step 5.
5. Enter the following network information:
- **Name:** A name for the network.
 - **Description:** A description of the network. This is an optional field.
 - **Network Usage:** Select one or more network functions:
 - Server Management
 - Live Migrate
 - Cluster Heartbeat
 - Virtual Machine
 - Storage

See [Section 6.2, "Network Usage"](#) for more information regarding network functions.

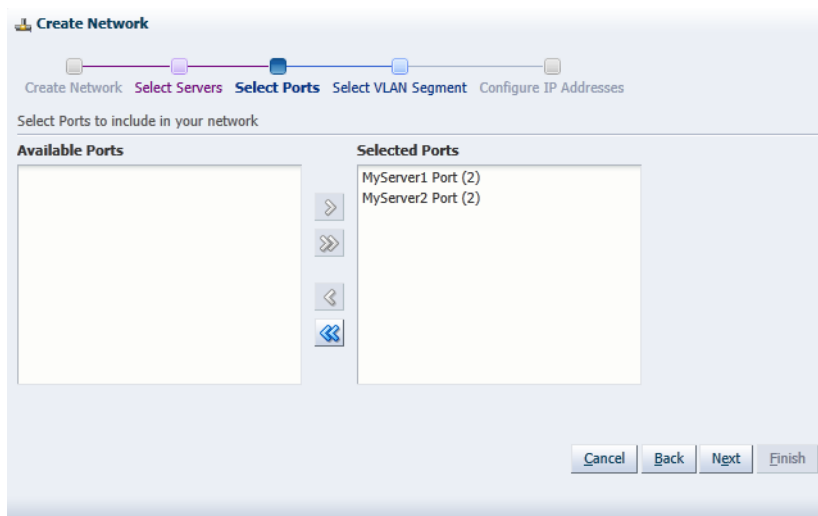
6. Depending on the network type you selected to create, fill out the applicable screens in the wizard as described below:
- **Select Servers** screen
(applies to network type: bonds/ports, hybrid – skip for type VLAN only)
 Add the servers participating in this network. Click Next.



- **Select Ports** screen

(applies to network type: bonds/ports, hybrid – skip for type VLAN only)

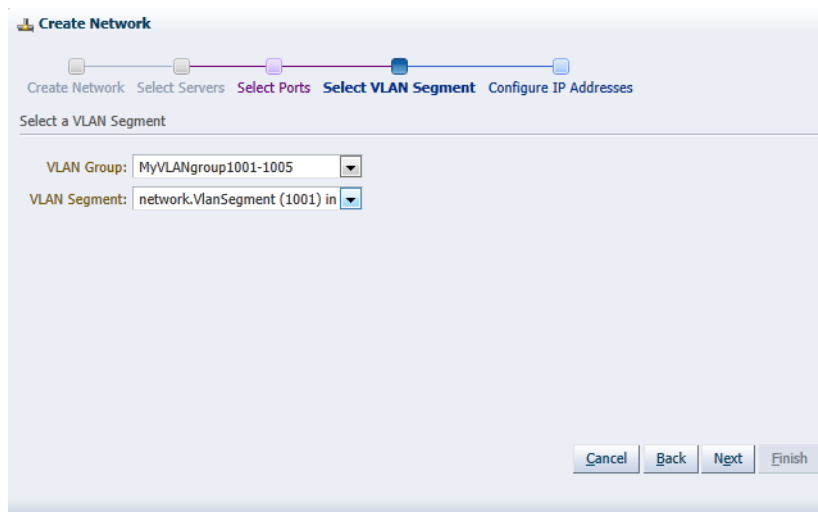
Select the ports or bonds of each Oracle VM Server that participates in this network. The number between brackets next to the name of the Oracle VM Server corresponds with the NIC of the Oracle VM Server. Click Next.



- **Select VLAN Segment** screen

(applies to network type: VLAN only, hybrid – skip for type bonds/ports)

Select the VLAN Group from the list, then select the VLAN segment from the list. All VLAN Groups are available for selection, but VLAN segments already in use do not appear in the drop-down list. Click Next.



- **Configure IP Addresses screen – Ports tab**

(applies to network type: bonds/ports, hybrid – select other tab for VLAN only)

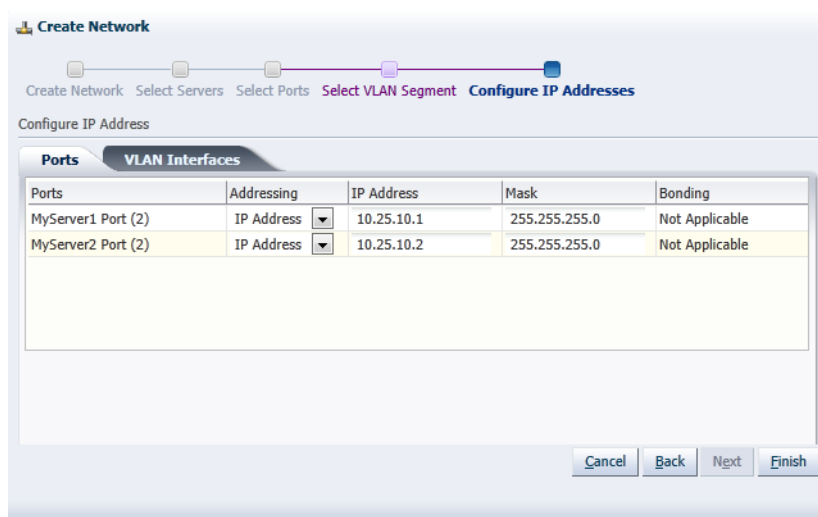
Set the IP configuration for each port or bond. If you use static IP addresses, set the IP address, netmask and gateway. If you select DHCP, you still need to setup a DHCP server in your Oracle VM environment, since Oracle VM does not act as a DHCP server.

If your network has the virtual machine function, you do not have to define the IP data, which is required for all other network functions. See [Section 6.5, "Network Bridges"](#) for details on creating bridges for virtual machine networks.

If bonding is active, select the Bonding mode. See [Section 6.4, "Network Bonding"](#) for a description of the bonding modes.

Note: You cannot change the bonding mode for Management networks.

If you are creating a hybrid type network, select the VLAN Interfaces tab. If you are creating a network with bonds and ports only, click Finish to close the wizard and complete the network creation.



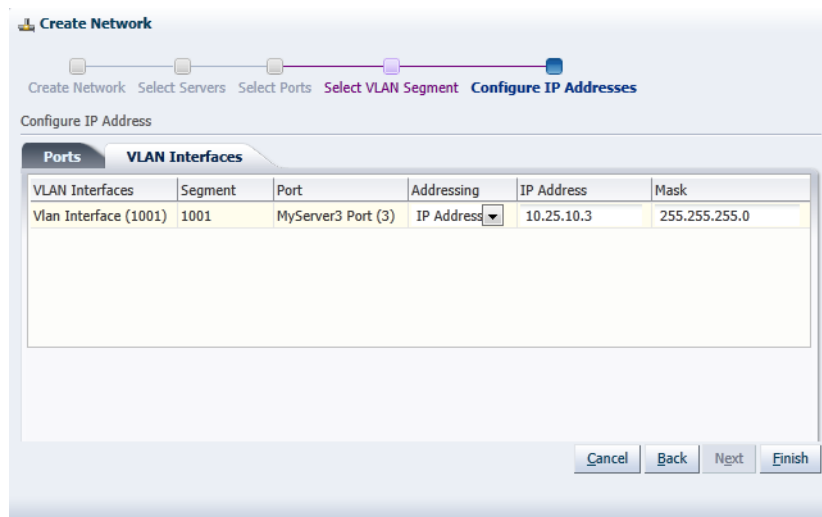
- **Configure IP Addresses screen – VLAN Interfaces tab**

(applies to network type: VLAN only, hybrid – skip for type bonds/ports)

The VLAN interface selected for each port is listed, along with the IP addressing information. If IP information was supplied when creating the VLAN Group, this IP information is displayed. If no IP information was supplied when creating the VLAN Group, none is displayed.

If the network you are creating contains the virtual machine network function only, you *cannot* change the IP information from the VLAN Interfaces tab. If the network you are creating contains any other network function, alone, or combined with the virtual machine network function, you *can* edit the IP information from the VLAN Interfaces tab.

Click **Finish** to close the wizard and complete the network creation.



7. If you are creating a logical network for a single Oracle VM Server:
 - In the Create Network screen, enter a name and optional description for the new network.
 - In the Select Server screen, choose the server from the drop-down list.

Note: The virtual machines deployed on a logical network for a single server, also called an intra-server network, are only accessible through their console if no other network is available.

8. Click **Finish** to complete the network creation.

6.10.2 Editing a Network

The following applies to all types of network except logical networks on a single server (intra-server networks).

To edit a network:

1. In the **Hardware** view, go to the **Hardware** tab, and select the **Resources** folder.
2. Select the **Networks** tab in the management pane, select **Networks** and click **Edit...** to start the **Edit Network** wizard.
3. Edit the network information and configuration as follows:

- **Name:** Change the name of the network.
 - **Description:** Add or change a description for the network. This is an optional field.
 - **Network Usage:** Select or deselect one or more network functions:
 - Server Management
 - Live Migrate
 - Cluster Heartbeat
 - Virtual Machine
 - Storage

See [Section 6.2, "Network Usage"](#) for more information regarding network functions.
4. Depending on the network type you selected to edit, make changes in the applicable screens as described below. The screens in the wizard are identical to the ones displayed in [Section 6.10.1, "Creating a Network"](#).
- **Select Servers** screen
(applies to network type: bonds/ports, hybrid – skip for type VLAN only)
 Select or deselect the servers participating in this network. Click Next.
 - **Select Ports** screen
(applies to network type: bonds/ports, hybrid – skip for type VLAN only)
 Select or deselect the ports or bonds of each Oracle VM Server that participates in this network. The number between brackets next to the name of the Oracle VM Server corresponds with the NIC of the Oracle VM Server. Click Next.
 - **Select VLAN Segment** screen
(applies to network type: VLAN only, hybrid – skip for type bonds/ports)
 Select the VLAN Group from the list, then select the VLAN segment from the list. All VLAN Groups are available for selection, but VLAN segments already in use do not appear in the drop-down list. Click Next.
 - **Configure IP Addresses** screen – **Ports** tab
(applies to network type: bonds/ports, hybrid – select other tab for VLAN only)
 Set or update the IP configuration for each port or bond. If you use static IP addresses, set the IP address, netmask and gateway. If you select DHCP, you still need to setup a DHCP server in your Oracle VM environment, since Oracle VM does not act as a DHCP server.

 If your network has the virtual machine function, you do not have to define the IP data, which is required for all other network functions. See [Section 6.5, "Network Bridges"](#) for details on creating bridges for virtual machine networks.

 If bonding is active, select the Bonding mode. See [Section 6.4, "Network Bonding"](#) for a description of the bonding modes.

Note: You cannot change the bonding mode for Management networks.

 If you are editing a hybrid type network, select the VLAN Interfaces tab. If you are editing a network with bonds and ports only, skip the second tab and proceed to step 5.

- **Configure IP Addresses** screen – **VLAN Interfaces** tab

(applies to network type: VLAN only, hybrid – skip for type bonds/ports)

The VLAN interface selected for each port is listed, along with the IP addressing information. If IP information was supplied when creating the VLAN Group, this IP information is displayed. If no IP information was supplied when creating the VLAN Group, none is displayed.

If the network you are creating contains the virtual machine network function only, you *cannot* change the IP information from the VLAN Interfaces tab. If the network you are creating contains any other network function, alone, or combined with the virtual machine network function, you *can* edit the IP information from the VLAN Interfaces tab.

5. After verifying or making the necessary changes to the network, click **Finish** to complete the network updates.

6.10.3 Deleting a Network

It may occur that a logical network becomes obsolete in Oracle VM. To keep your Oracle VM environment clean, it is recommended to remove all obsolete data, such as obsolete networks.

Note: You cannot remove a virtual machine network if there are running virtual machines using the network.

To delete a network:

1. In the **Hardware** view, go to the **Hardware** tab, and select the **Resources** folder.
2. Select the **Networks** tab in the management pane, select the network in the table and click **Delete**.
3. On the **Delete Confirmation** dialog box, click **OK** to delete the network.

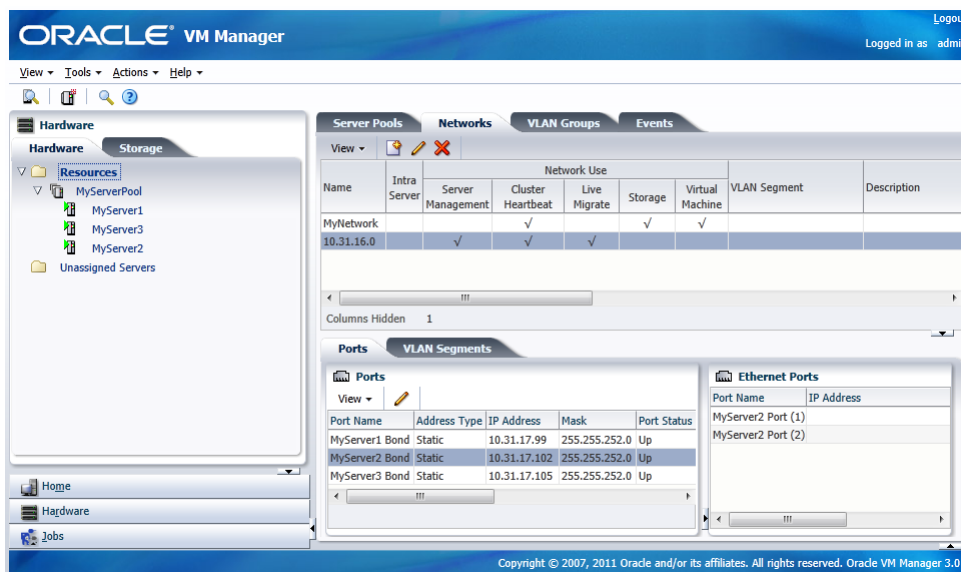
The network is deleted.

6.11 Editing Network Data

To edit networking data, for example adding or removing network functions or updating port definitions, VLAN IDs, and so on, you use the **Edit** button in the respective management panes (**Networks** and **VLAN Groups**).

To go to the Networks and VLAN Groups management pane:

1. Select the **Hardware** view in the **Navigation Tree**.
2. Select the **Hardware** tab, and select **Resources**.



3. Select the **Networks** or **VLAN Groups** tab to view the respective management panes.

Editing a network or VLAN group launches the same wizard as creating networks or VLAN Groups. Update the data in the respective steps of the wizards.

In addition, you can modify most networking configuration data outside these wizards by going into the detailed tabs of the management panes instead of editing the top level network resources step by step.

The table below describes some specific actions to take when editing network ports and bonds. You can update the IP address of ports, and add, remove, and delete bond ports in a network. The following table describes the methods to use for each type of network update.

Function	Method
Update IP information for ports	<p>From the Hardware view, select the server which owns the port under Resources or under Unassigned Servers. Click the Ethernet Ports tab and select the port you wish to update. Click Edit to update the IP information.</p> <p>Note: You can remove Ethernet ports.</p>
Update bond information	<p>From the Hardware view, select the server which owns the bond under Resources or under Unassigned Servers. Click on the Bonding tab and select the bond you wish to update. Click Edit to update the bond. You can update the IP information for the bond, the ports which are part of the bond and the bonding mode. With this release of Oracle VM, you can only have two ports in a bond.</p> <p>Note: Do not change the bonding mode for the bond in the Management network.</p>
Add a bond	<p>From the Hardware view, select the server for which you want to create a bond. Click on Bonding tab and click Create to create the bond. You provide the IP information for the bond, the ports which are part of the bond and the bonding mode.</p>
Delete a bond	<p>From the Hardware view, select the server for which you want to delete a bond. Click on Bonding tab, select the bond and click Delete to remove the bond</p>

Similarly, network objects related to VLAN groups can also be updated through the detailed tabs of the applicable management pane. If you select a VLAN group in the VLAN Groups tab, you can:

- select the **Ports** tab and edit details of a port related to this VLAN group
- select the **VLAN Segments** tab and remove VLAN IDs or simply verify which networks are using the VLANs in this group

You can only view the VLAN interfaces on the VLAN segment. To edit the address information, for example, you must edit the VLAN group and set a static IP or DHCP in the last step of the wizard.

Managing Server Pools

A server pool is a domain of physical and virtual resources to host virtual machines, perform virtual machine migration, HA, and so on.

This chapter describes how to create and manage server pools and includes the following sections:

- [Server Pool Overview](#)
- [Server Pool Clusters](#)
- [Unclustered Server Pools](#)
- [High Availability \(HA\)](#)
- [Server Pool Policies](#)
- [Creating a Server Pool](#)
- [Managing Server Pools](#)
- [Managing Oracle VM Servers](#)

7.1 Server Pool Overview

A server pool consists of one or more Oracle VM Servers, and represents a logical view of the storage where the virtual machines reside.

A server pool is scalable. If you find a server pool does not have sufficient resources, such as CPU or memory, to run the virtual machines, you can expand the server pool by adding more Oracle VM Servers. See [Section 7.7.1, "Adding an Oracle VM Server to a Server Pool"](#).

Oracle VM's deployment architecture utilizes server pools, with shared access to storage across Oracle VM Servers in the server pool. Virtual machines are stored on the shared storage and placed on one of the Oracle VM Servers to balance the workloads of the server pool.

Since the virtual machines are not bound to any specific Oracle VM Server in the server pool, virtual machines are not prevented from starting up simply because an individual Oracle VM Server happens to be down for maintenance or otherwise unavailable at the time. Further, since the load-balancing algorithm assures that a virtual machine is placed on the Oracle VM Server with the most resources available, it also helps assure the maximum aggregate performance from the server pool.

7.2 Server Pool Clusters

Oracle VM works in concert with Oracle OCFS2 to provide shared access to server pool resources residing in an OCFS2 file system. This shared access feature is crucial in the implementation of high availability (HA) for virtual machines running on the Oracle VM Servers that belong to a server pool with clustering enabled.

OCFS2 is a cluster file system for Linux, which allows multiple nodes (Oracle VM Servers) to access the same disk at the same time. OCFS2, which provides both performance and HA, is used in many applications that are cluster-aware or that have a need for shared file system facilities. With Oracle VM, OCFS2 ensures that Oracle VM Servers belonging to the same server pool access and modify resources in the shared repositories in a controlled manner.

The OCFS2 software includes the core file system, which offers the standard file system interfaces and behavioral semantics and also includes a component which supports the shared disk cluster feature. The shared disk component resides mostly in the kernel and is referred to as the O2CB cluster stack. It includes:

- A disk heartbeat to detect live servers
- A network heartbeat for communication between the nodes
- A Distributed Lock Manager (DLM) which allows shared disk resources to be locked and released by the servers in the cluster

OCFS2 also offers several tools to examine and troubleshoot the OCFS2 components. For detailed information on OCFS2, see the OCFS2 documentation at:

<http://oss.oracle.com/projects/ocfs2/documentation/>

Oracle VM decouples storage repositories and clusters so that if a storage repository is taken offline, the cluster is still available. A loss of one heartbeat device does not force an Oracle VM Server to self fence.

When you create a server pool, you have a choice to activate the cluster function which offers these benefits:

- Shared access to the resources in the repositories accessible by all Oracle VM Servers in the cluster.
- Protection of virtual machines in the event of a failure of any Oracle VM Server in the server pool.

To configure the server pool cluster and enable HA in a server pool, select the **Activate Cluster** check box when you create or edit a server pool. See [Section 7.6, "Creating a Server Pool"](#) and [Section 7.7.3, "Editing a Server Pool"](#) for more information on creating and editing a server pool.

When you create a server pool, you specify:

- Server pool name and description
- A virtual IP address
- Whether or not to activate the cluster
- A server pool file system for the global heartbeat and other cluster information

During server pool creation, the server pool file system specified for the new server pool is accessed and formatted as an OCFS2 file system. This formatting creates several management areas on the file system including a region for the global disk heartbeat. Oracle VM formats the server pool file system as an OCFS2 file system

whether the file system is accessed by the Oracle VM Servers as an NFS share, a FC LUN or iSCSI LUN.

The virtual IP address is used by Oracle VM Manager to communicate with the server that is designated as the Master in the server pool. If the master changes, the virtual IP address is transferred to the new Master, insuring that Oracle VM Manager continues to communicate with the Master.

The next step is to add Oracle VM Servers to the newly created server pool. When Oracle VM Servers are added, Oracle VM:

1. Selects a Master Oracle VM Server.
2. Configures the Virtual IP address selected during pool creation as a virtual network interface on top of the management interface for the Master Oracle VM Server.
3. Creates the cluster configuration file and the cluster time-out file.
4. Pushes the configuration files to all Oracle VM Servers in the server pool.
5. Starts the cluster.

On each Oracle VM Server in the cluster, the cluster configuration file is located at `/etc/ocfs2/cluster.conf`, and the cluster time-out file is located at `/etc/sysconfig/o2cb`.

Starting the cluster activates several services and processes on each of the Oracle VM Servers in the cluster. The most important processes and services are discussed in [Table 7-1](#).

Table 7-1 Cluster services

Service	Description
o2net	The o2net process creates TCP/IP intra-cluster node communication channels on port 7777 and sends regular keep-alive packages to each node in the cluster to validate if the nodes are alive. The intra-cluster node communication uses the network with the Cluster Heartbeat role. By default, this is the Server Management network. You can however create a separate network for this function. See Section 6.2, "Network Usage" for information about the Cluster Heartbeat role. Make sure the firewall on each Oracle VM Server in the cluster allows network traffic on the heartbeat network. By default, the firewall is disabled on Oracle VM Servers after installation.
o2hb-diskid	The server pool cluster also employs a disk heartbeat check. The o2hb process is responsible for the global disk heartbeat component of cluster. The heartbeat feature uses a file in the hidden region of the server pool file system. Each pool member writes to its own block of this region every two seconds, indicating it is alive. It also reads the region to maintain a map of live nodes. If a server pool member's block is no longer updated, the Oracle VM Server is considered dead. If an Oracle VM Server dies, the Oracle VM Server is fenced. Fencing forcefully removes dead members from the server pool to make sure active pool members are not obstructed from accessing the fenced Oracle VM Server's resources.
o2cb	The o2cb service is central to cluster operations. When an Oracle VM Server boots, the o2cb service starts automatically. This service must be up for the mount of shared repositories to succeed.
ocfs2	The ocfs2 service is responsible for the file system operations. This service also starts automatically.

Table 7–1 (Cont.) Cluster services

Service	Description
ocfs2_dlm and ocfs2_dlmfs	<p>The DLM modules (ocfs2_dlm, ocfs2_dlmfs) and processes (user_dlm, dlm_thread, dlm_wq, dlm_reco_thread, and so on) are part of the Distributed Lock Manager.</p> <p>OCFS2 uses a DLM to track and manage locks on resources across the cluster. It is called distributed because each Oracle VM Server in the cluster only maintains lock information for the resources it is interested in. If an Oracle VM Server dies while holding locks for resources in the cluster, for example, a lock on a virtual machine, the remaining Oracle VM Servers in the server pool gather information to reconstruct the lock state maintained by the dead Oracle VM Server.</p>

WARNING: Do not manually modify the cluster configuration files, or start and stop the cluster services. Oracle VM Manager automatically starts the cluster on Oracle VM Servers that belong to a server pool. Manually configuring or operating the cluster may lead to cluster failure.

When you create a repository on a shared disk, an OCFS2 file system is created on the shared disk. This occurs for local repositories as well. The resources in the repositories, for example, virtual machine configuration files, virtual disks, ISO files, templates and assemblies, can then be shared safely across the server pool. When a server pool member stops or dies, the resources owned by the departing server are recovered, and the change in status of the server pool members is propagated to all the remaining Oracle VM Servers in the server pool.

[Figure 7–1](#) illustrates server pool clustering, the disk and network heartbeats, and the use of the DLM feature to lock resources across the cluster.

Figure 7-1 Server Pool clustering with OCFS2 features

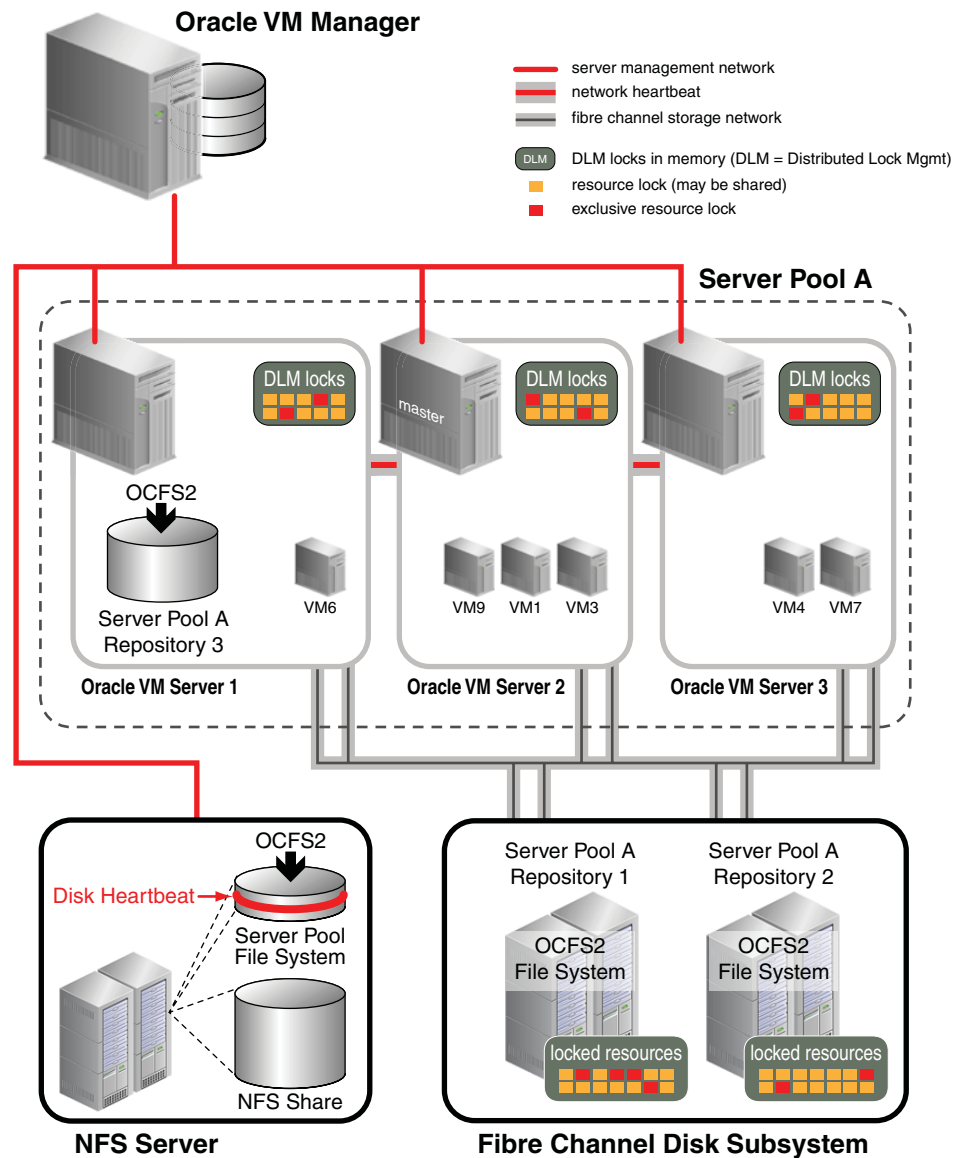


Figure 7-1 represents a server pool with three Oracle VM Servers. The server pool file system associated with this server pool resides on an NFS share. During server pool creation, the NFS share is accessed, a disk image is created on the NFS share and the disk image is formatted as an OCFS2 file system. This technique allows all Oracle VM server pool file systems to be accessed in the same manner, using OCFS2, whether the underlying storage element is an NFS share, an iSCSI LUN or a Fibre Channel LUN.

After the server pool is created, the Oracle VM Servers are added to the server pool. At that time, the cluster configuration is created, and the cluster state changes from *offline* to *heartbeating*. Finally, the server pool file system is mounted on all Oracle VM Servers in the cluster and the cluster state changes from *heartbeating* to *DLM ready*. As seen in Figure 7-1, the heartbeat region is global to all Oracle VM Servers in the cluster, and resides on the server pool file system. The network heartbeat, which is illustrated as a private network connection between the Oracle VM Servers, is configured before creating the first server pool in your Oracle VM environment. Using the network heartbeat, the Oracle VM Servers establish communication channels with other Oracle

VM Servers in the cluster, and send keep-alive packets to detect any interruption on the channels.

For each newly added repository on a physical storage element, an OCFS2 file system is created on the repository, and the repository is usually presented to all Oracle VM Servers in the pool. [Figure 7-1](#) shows one repository, Repository 3, which is accessible by Oracle VM Server 1 only. Any virtual machine whose resources reside on this repository cannot take advantage of the high availability feature afforded by the server pool.

Note that repositories built on NFS shares are not formatted as OCFS2 file systems. See [Section 5.8, "Preparing and Configuring Storage Repositories"](#) for more information on repositories.

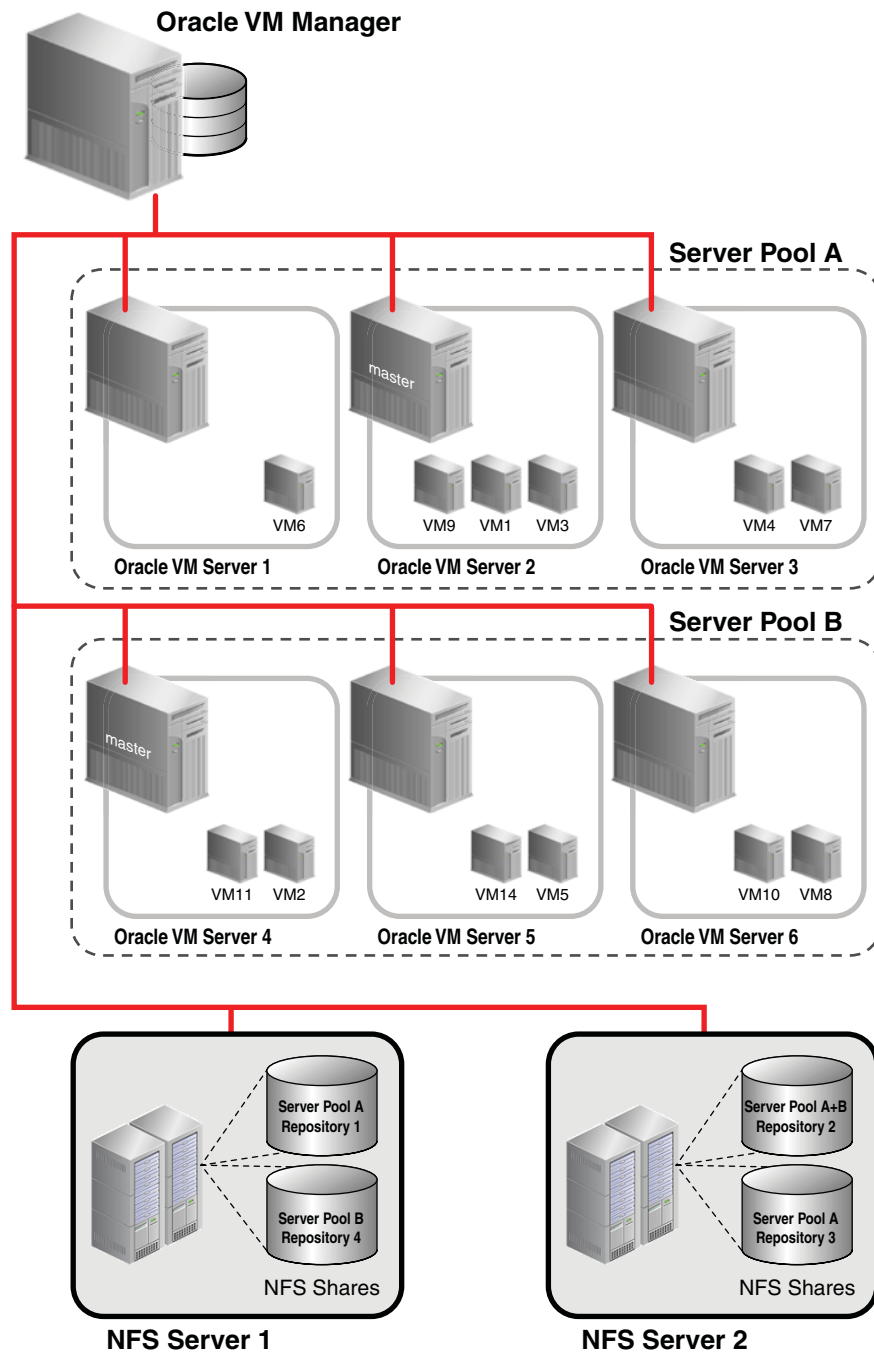
[Figure 7-1](#) shows several virtual machines with resources in shared Repositories 1 and 2. As virtual machines are created, started, stopped, or migrated, the resources for these virtual machines are locked by the Oracle VM Servers needing these resources. Each Oracle VM Server ends up managing a subset of all the locked resources in the server pool. A resource may have several locks against it. An exclusive lock is requested when anticipating a write to the resource while several read-only locks can exist at the same time on the same resource. Lock state is kept in memory on each Oracle VM Server as shown in the diagram. The distributed lock manager (DLM) information kept in memory is exposed to user space in the synthetic file system called `dlimfs`, mounted under `/dlm`. If an Oracle VM Server fails, its locks are recovered by the other Oracle VM Servers in the cluster and virtual machines running on the failed Oracle VM Server are restarted on another Oracle VM Server in the cluster. If an Oracle VM Server is no longer communicating with the cluster via the heartbeat, it can be forcibly removed from the cluster. This is called fencing. An Oracle VM Server can also fence itself if it realizes that it is no longer part of the cluster. The Oracle VM Server uses a machine reset to fence. This is the quickest way for the Oracle VM Server to rejoin the cluster.

7.3 Unclustered Server Pools

When creating a server pool, you specify whether the servers in the pool will be part of a cluster or not. In most cases, you create a clustered server pool. You can create a non-clustered pool when all servers in the pool are expected to use only NFS shares as repositories. If your Oracle VM Servers are also expected to access repositories on physical disks, then these servers should be part of a clustered server pool.

[Figure 7-2](#) illustrates server pools in an unclustered configuration, with shared access to resources on NFS storage but no HA features for the servers.

Figure 7-2 Unclustered Server Pools Using Only NFS Storage



Non-clustered server pools do not require a server pool file system, though a Virtual IP is still required and the Master function is also assigned to one of the server pool members.

A non-clustered server pool does not support HA for virtual machines deployed on its servers. If a server fails, the virtual machines on this server have to be restarted manually on a server in this server pool, or possibly on a server in another server pool, if that server pool also has access to the repositories needed for deploying the virtual machines on the failed server.

Live Migration is supported between servers in a non-clustered pool if the servers have the same CPU affinity (same family and type of CPU).

One cannot create a repository on a physical disk local to a server if that server does not belong to a clustered server pool. If you want to create a pool with one server, and use a physical disk attached to that server as a repository, you have to create a clustered pool and add this single server to the newly defined clustered pool.

Note: Converting non-clustered server pools to clustered server pools is not supported in Release 3.0 of Oracle VM.

7.4 High Availability (HA)

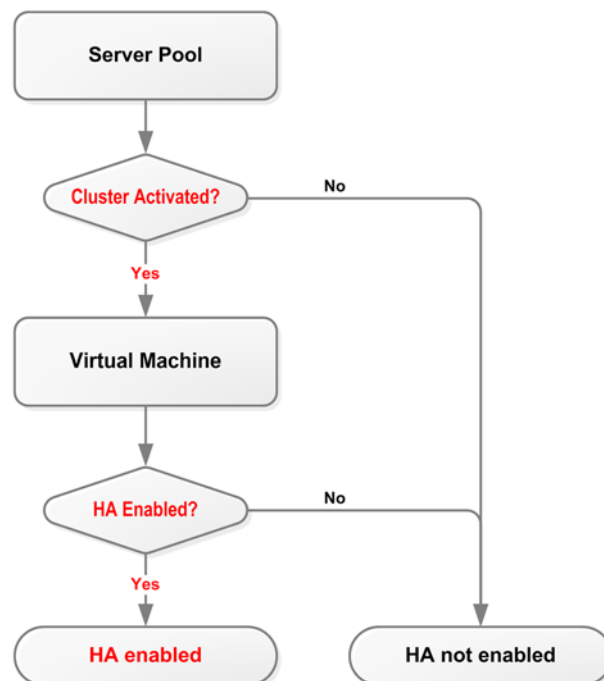
You can set up HA to help ensure the uninterrupted availability of a virtual machine. If HA is configured and a Oracle VM Server is restarted or shut down, the virtual machines running on it are either restarted on, or migrated to, another Oracle VM Server.

The following prerequisites are requirement to implement HA:

- The server pool must contain multiple Oracle VM Servers. HA cannot be implemented with a stand-alone Oracle VM Server.
- All Oracle VM Servers must be Oracle VM Server Release 3.0 or above.

To use HA, you must first enable HA on the server pool, then on all virtual machines, as shown in [Figure 7-3, "Enabling HA"](#). If you enable HA on the server pool and then for virtual machines, when an Oracle VM Server is shut down or fails, the virtual machines are migrated or restarted on another available Oracle VM Server. HA must be enabled for **both** the server pool **and** for virtual machines.

Figure 7-3 Enabling HA



To automatically configure the server pool cluster and enable HA in a server pool, select the **Activate Cluster** check box when you create or edit a server pool. See [Section 7.6, "Creating a Server Pool"](#) and [Section 7.7.3, "Editing a Server Pool"](#) for more information on creating and editing a server pool.

To enable HA on a virtual machine, select the **Enable High Availability** check box when you create or edit a virtual machine. See [Section 8.7, "Creating a Virtual Machine"](#) and [Section 8.9.9, "Editing a Virtual Machine"](#) for more information on creating and editing a virtual machine.

If HA is enabled, when you restart, shut down, or delete an Oracle VM Server in Oracle VM Manager, you are prompted to migrate the running HA-enabled virtual machines to another available Oracle VM Server. If you do not migrate the running virtual machines, Oracle VM attempts to find an available Oracle VM Server on which to restart the virtual machines.

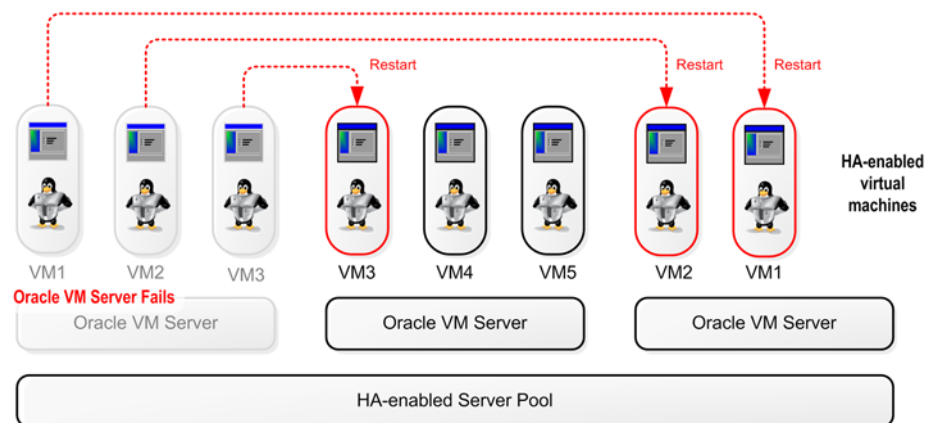
If there are no Oracle VM Servers available, the virtual machines are shut down (Powered Off) and are restarted when an Oracle VM Server becomes available.

The possible HA scenarios are:

- If you shut down or restart an Oracle VM Server in Oracle VM Manager, you are prompted which virtual machines to migrate to another available Oracle VM Server. Any virtual machines which are not migrated, are restarted on an available Oracle VM Server.
- If an Oracle VM Server fails, all running virtual machines are restarted automatically on another available Oracle VM Server.
- If an Oracle VM Server fails and no other Oracle VM Servers are available, all running virtual machines are restarted when an Oracle VM Server becomes available.

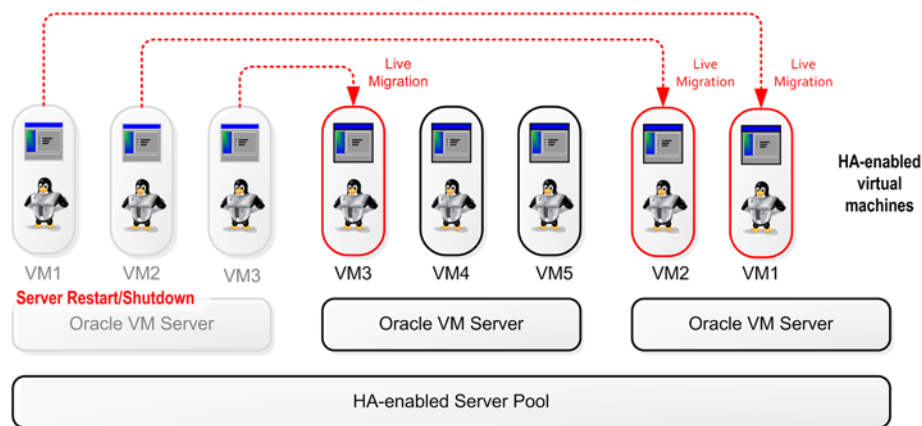
[Figure 7-4](#) shows an Oracle VM Server failing and the virtual machines restarting on other Oracle VM Servers in the server pool.

Figure 7-4 HA in effect for an Oracle VM Server failure



You should test your HA configuration to ensure it is properly configured in the event of a real failure.

[Figure 7-5](#) shows an Oracle VM Server restarting or shutting down and the virtual machines migrating to other Oracle VM Servers in the server pool.

Figure 7-5 HA in effect for an Oracle VM Server restart or shut down

7.5 Server Pool Policies

This section discusses the policies you can set to manage server pools, the Oracle VM Servers and virtual machines in server pools, and the networks used in a server pool. The server pool policies available are:

- [Distributed Resource Scheduler \(DRS\)](#)
- [Distributed Power Management \(DPM\)](#)
- [DRS/DPM Network Policies](#)

7.5.1 Distributed Resource Scheduler (DRS)

The Distributed Resource Scheduler (DRS) optimizes virtual machine resource utilization in a server pool. DRS automatically moves running virtual machines to another Oracle VM Server in a server pool if any of the Oracle VM Servers exceed a specified CPU threshold for a specified period of time. DRS continuously samples performance data from every Oracle VM Server and every virtual machine.

The movement of virtual machines is policy-driven. When a threshold is reached, Oracle VM Manager live migrates the running virtual machine from one Oracle VM Server to another, without down time. Oracle VM Manager allows you to specify a DRS threshold for each server pool, and to choose which Oracle VM Servers participate in the policy.

See [Section 7.7.4, "Editing Server Pool Policies"](#) for information on enabling and configuring the DRS in a server pool.

7.5.2 Distributed Power Management (DPM)

Distributed Power Management (DPM) is used when there are periods of relative low resource utilization to increase the consolidation ratio on fewer Oracle VM Servers. DPM dynamically migrates virtual machines from under-utilized Oracle VM Servers. When there are Oracle VM Servers without virtual machines running the Oracle VM Server can be powered off, conserving power until the Oracle VM Server is needed again.

DPM aims to keep only the minimum necessary number of Oracle VM Servers running. If a periodic check reveals that a Oracle VM Server's CPU utilization is

operating at below a user-set level, virtual machines are live migrated to other Oracle VM Servers in the same server pool.

When all virtual machines are migrated, the Oracle VM Server is shut down.

If an Oracle VM Server exceeds the DPM policy CPU threshold, Oracle VM Manager looks for other Oracle VM Servers to migrate virtual machines to from the busy Oracle VM Server. If no powered Oracle VM Servers are available, Oracle VM Manager finds and starts a powered-off Oracle VM Server to power on. When that Oracle VM Server is running, Oracle VM Manager off-loads the virtual machines from the busy Oracle VM Server to the newly started Oracle VM Server.

Oracle VM Manager allows you to specify a DPM threshold for each server pool, and to choose which Oracle VM Servers participate in the policy.

See [Section 7.7.4, "Editing Server Pool Policies"](#) for information on enabling and configuring DPM in a server pool.

7.5.3 DRS/DPM Network Policies

Both the DRS and DPM policies can also be set for the networks used by Oracle VM Servers in a server pool. When a network used by an Oracle VM Server exceeds its threshold, virtual machines are migrated to other Oracle VM Servers to either balance the resources used (DRS), or reduce the power used (DPM). Each network on an Oracle VM Server can have a threshold set. The threshold applies to either the received data or the transmitted data. If the threshold is set to say 50%, when an Oracle VM Server's receive or transmit traffic on that network exceeds 50% of the theoretical capacity of the network, the Oracle VM Server is deemed to be over the threshold. The theoretical capacity of a network on an Oracle VM Server is equal to the port speed of the physical Ethernet adapter on the Oracle VM Server. If the network is bonded in a fail-over configuration, then the port capacity is equal to the port speed of one of the Ethernet adapters. If the network is bonded on a Oracle VM Server with link aggregation, then the network capacity is equal to the sum of the speed of the bonded Ethernet adapters.

You set the network policies for DRS and DPM when you set up the server pool policy. See [Section 7.7.4, "Editing Server Pool Policies"](#) for information on enabling and configuring network DRS and DPM policies in a server pool.

7.6 Creating a Server Pool

A server pool consists of at least one, but usually multiple Oracle VM Servers. All Oracle VM Servers in a server pool should have CPUs in the same CPU family and of the same type. If they are not in the same CPU family and type, some operations such as live migration may fail. Though the CPUs should be in the same CPU family, they may have differing configurations, such as different number of cores. Other hardware components on the host computer may also differ, such as the amount of RAM, the number and size of disk drives, and so on.

Although the host computers may have differing configurations, Oracle recommends that all Oracle VM Servers in a server pool are identical. Oracle VM Manager contains rules for processor compatibility groups. If live migration is attempted between incompatible processors, an error message is displayed.

Before creating a server pool, you must have:

- IP addresses for the Oracle VM Servers.
- IP address to use as the virtual IP address.

- Password to access the Oracle VM Agent installed on the Oracle VM Server(s).

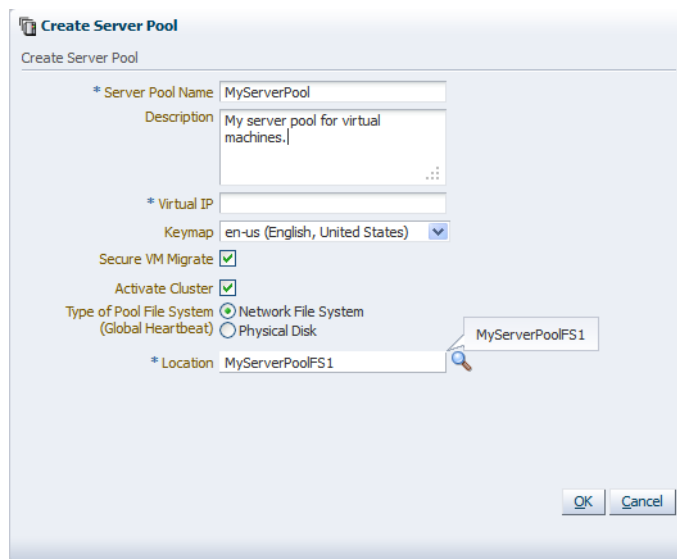
Note: The Oracle VM Agent password must be the same on each Oracle VM Server in a server pool. For information on changing the Oracle VM Agent password on an Oracle VM Server, see the *Oracle VM Installation and Upgrade Guide*.

A server pool should have a dedicated file system (either a NAS export, or a LUN) to use as the server pool's file system. Oracle recommends that you create this storage with a size of at least 10 GB.

If any errors are encountered when you create a server pool, the Oracle VM Servers are returned to the unconfigured state.

To create a server pool:

1. In the **Home** view, select **Create Server Pool** from the Actions menu. The **Create Server Pool** dialog box is displayed.



2. Enter the server pool information:
 - **Server Pool Name:** The name of the server pool.
A server pool name must consist of alphanumeric characters, and must not contain spaces or special characters, except the underscore (_) or hyphen (-) characters. The maximum length of a server pool name is 200 characters.
 - **Description:** A description of the server pool. This field is optional.
 - **Virtual IP:** An IP address used to identify the master Oracle VM Server, which controls the other Oracle VM Server in the server pool. In the event that the master Oracle VM Server fails or is placed into maintenance mode, another Oracle VM Server is selected to perform the master role, and this IP address is then assigned to the new host.
 - **Keymap:** The key mapping to be used when connecting to a virtual machine's console.
 - **Secure VM Migrate:** Select whether to enable encrypted migration of virtual machines. When Secure VM Migrate is checked, virtual machines are migrated

using SSL to protect the data during the migration process. Secure migration of a virtual machine may effect the time taken to perform the migration as the encryption and decryption of data requires more system resources and time.

- **Activate Cluster:** Select whether to enable clustering of the Oracle VM Servers in the server pool to enable HA. See [Section 7.4, "High Availability \(HA\)"](#) for more information on HA policies and configuration.
- **Type of Pool File System:** Select the file system type to use for the server pool, either a **Network File System**, or a **Physical Disk**. The server pool file system is used to hold the server pool and cluster data, and is also used for cluster heartbeating. Oracle recommends that you create this storage with a size of at least 12 GB, as a NAS export or LUN.

A server pool file system is exclusive, just like other storage. That is, in the same way that you cannot create two storage repositories on the same export path, the server pool file system cannot be shared with other server pools, or with storage repositories. Each fully qualified export path (for example, /export/myexport/one, /export/myexport/two) must be used for one, and only one, purpose, that is, for a storage repository, or a server pool file system.

For information on creating storage, see [Chapter 5, "Managing Storage"](#).

- **Network File System:** The file system to use as the pool file system. Click the **Search** icon in the **Location** field to search for a network file system. This field is displayed if you select Network File System in the previous field.
- **Physical Disk:** The file system to use as the pool file system. Click the **Search** icon in the **Location** field to search for a physical disk. This field is displayed if you select Physical Disk in the previous field.

Click **Finish**.

The server pool is created.

When you have created a server pool, the next step is to add Oracle VM Servers to it. Before you can add an Oracle VM Server to a server pool, you must first discover it. See [Section 7.8.1, "Discovering Oracle VM Servers"](#). When the Oracle VM Server is discovered, add it to the server pool, see [Section 7.7.1, "Adding an Oracle VM Server to a Server Pool"](#).

7.7 Managing Server Pools

When you have created a server pool, you can perform a number of actions on it, like adding and removing Oracle VM Servers, and editing server pool policies. This section discusses the actions you can perform on a server pool and contains:

- [Adding an Oracle VM Server to a Server Pool](#)
- [Removing an Oracle VM Server from a Server Pool](#)
- [Editing a Server Pool](#)
- [Editing Server Pool Policies](#)
- [Deleting a Server Pool](#)

7.7.1 Adding an Oracle VM Server to a Server Pool

When you need more resources in a server pool (such as the number of CPUs and the size of memory), you can add more Oracle VM Servers. For example, when you want to run more virtual machines and the resources in the server pool are reaching capacity, you can add more Oracle VM Servers which increases the available resources.

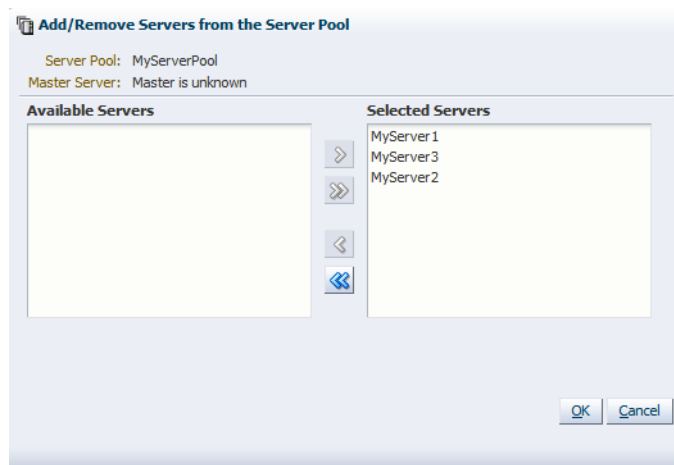
Adding Oracle VM Servers to a server pool requires the modification of both the cluster configuration information and the server pool information, on all Oracle VM Servers. This is performed automatically.

Adding Oracle VM Servers to a server pool may trigger pending HA operations if there were previously insufficient resources to run all HA virtual machines.

Note: All Oracle VM Servers in a server pool must have the same Oracle VM Agent password.

To add Oracle VM Servers to a server pool:

1. In the **Home** view, select the server pool in the **Server Pools** folder in the navigation pane. Select **Add/Remove Servers** from the **Actions** menu. The **Add/Remove Servers from the Server Pool** dialog box is displayed.



2. Select the Oracle VM Servers you want to add to the server pool from the **Available Servers** list box and move them to the **Selected Servers** list box. Click **OK**.

The server pool is updated to include new Oracle VM Servers.

7.7.2 Removing an Oracle VM Server from a Server Pool

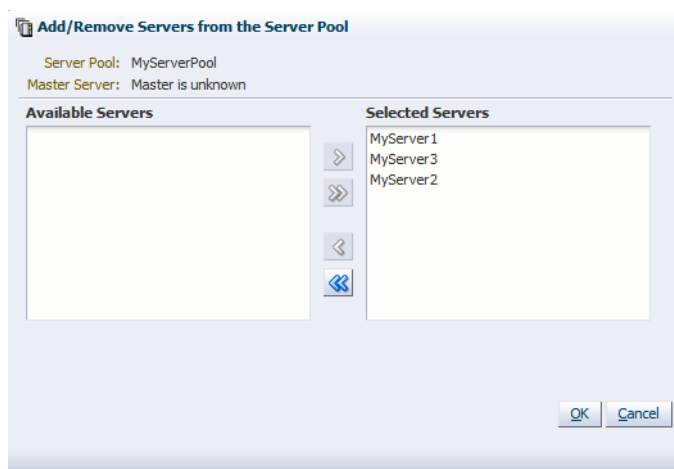
When you want to remove resources in a server pool, perhaps to be used elsewhere, you can remove an Oracle VM Server from a server pool. Removing an Oracle VM Server from a server pool does not delete it, but places it in the unconfigured state.

Before you can remove an Oracle VM Server from a server pool, it must be suspended from participating in all server pool roles and all virtual machines stopped or migrated. To automatically migrate the running virtual machines and suspend all server pool roles, place the Oracle VM Server in maintenance mode. See [Section 7.8.9, "Placing an Oracle VM Server into Maintenance Mode"](#) for information on putting an Oracle VM Server into maintenance mode.

Removing an Oracle VM Server from a server pool requires modification of both cluster configuration information and server pool information on all Oracle VM Servers in the server pool. This is performed automatically.

To remove Oracle VM Servers from a server pool:

1. In the **Home** view, select the server pool in the **Server Pools** folder in the navigation pane. Select **Add/Remove Servers** from the **Actions** menu. The **Add/Remove Servers from the Server Pool** dialog box is displayed.



2. Select the Oracle VM Servers you want to remove from the server pool from the **Available Servers** list box and move them to the **Selected Servers** list box. Click **OK**.

The server pool is updated and the Oracle VM Servers are removed and placed in the Unassigned Servers folder in the Hardware view.

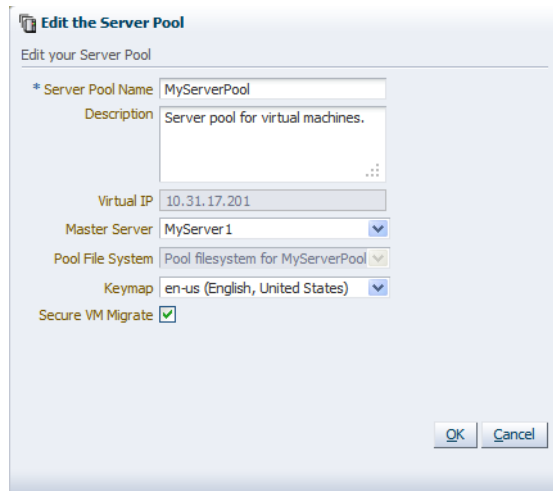
7.7.3 Editing a Server Pool

You can edit the configuration information of a server pool, including the server pool name, description, and key mapping. You can also change the master server, which controls the cluster, as well as whether the virtual machines are migrated securely. You cannot change the virtual IP address or the file system used for the server pool.

To add or remove Oracle VM Servers from a server pool, see [Section 7.7.1, "Adding an Oracle VM Server to a Server Pool"](#) and [Section 7.7.2, "Removing an Oracle VM Server from a Server Pool"](#).

To edit a server pool:

1. In the **Home** view, select the server pool in the **Server Pools** folder in the navigation pane. Select **Edit Server Pool** from the **Actions** menu. The **Edit the Server Pool** dialog box is displayed.



2. Edit the server pool information:

- **Server Pool Name:** The name of the server pool.
A server pool name must consist of alphanumeric characters, and must not contain spaces or special characters, except the underscore (_) or hyphen (-) characters. The maximum length of a server pool name is 200 characters.
- **Description:** A description of the server pool.
- **Virtual IP:** This field cannot be modified.
- **Pool File System:** This field cannot be modified.
- **Keymap:** The key mapping to use in the consoles for all virtual machines in the server pool.
- **Secure VM Migrate:** Select whether to enable encrypted migration of virtual machines.

Click **OK**.

The server pool changes are automatically propagated to all Oracle VM Servers in the server pool by the server master.

7.7.4 Editing Server Pool Policies

You can set power and resource utilization policies for a server pool. The two policies you can set are for:

- **Distributed Resource Scheduler (DRS):** Optimizes virtual machine resource utilization in a server pool.
- **Distributed Power Management (DPM):** Increases the consolidation ratio to use fewer Oracle VM Servers during periods of relative low resource utilization.

The policy is also able to be set for networks used in a server pool. You can set the server pool to use either DRS, or DPM, but not both at the same time.

See [Section 7.5, "Server Pool Policies"](#) for more information on these server pool policies.

To set or edit a server pool policy:

1. In the **Home** view, select the server pool in the **Server Pools** folder in the navigation pane. Select **Edit Policies** from the **Actions** menu.
2. The **Configure Policy** step of the **Configure DRS/DPM** wizard is displayed.

Enter the server pool policy information:

- **Policy Control:**
 - **Policy Type:** You can choose from either DRS, DPM, or none. You cannot set both DRS and DPM to be active at the same time.
 - **Time Period (Minutes):** The time period for the policy job to run. This sets the policy job to run every *n* minutes, for example, 10 sets the policy job to run every 10 minutes. You can enter a number between 1 and 60.
- **Server CPU:**
 - **Enable:** Set whether to enable or disable logging of CPU performance and utilization.
 - **Threshold (%):** The maximum amount of CPU percentage usage allowed before the policy must be enacted. You can enter between 0 and 99.
- **Servers:** Select the Oracle VM Servers for which the policy should be enabled by moving the selected Oracle VM Servers from the **Available Servers** to the **Selected Servers** shuttle box.

Click **Next**.

3. The **Select Networks** step of the **Configure DRS/DPM** wizard is displayed. Select the networks that should be included in the policy. Click **Next**.
4. The **Network Settings** step of the **Configure DRS/DPM** wizard is displayed. Select whether to enable the policy on the network, and select the threshold at which the policy should be enacted for the network. Click **Finish**.

The policy is set for the server pool. When you select a server pool in the navigation pane, a Policies tab is available in the management pane. The Policies tab shows the policy settings for the server pool.

7.7.5 Deleting a Server Pool

Before you can delete a server pool, you must delete all virtual machines and remove all Oracle VM Servers from the server pool.

To delete a virtual machine, see [Section 8.9.10, "Deleting a Virtual Machine"](#). To remove an Oracle VM Server from a server pool, see [Section 7.7.2, "Removing an Oracle VM Server from a Server Pool"](#).

To delete a server pool:

1. In the **Home** view, select the server pool in the **Server Pools** folder in the navigation pane. Select **Delete** from the **Actions** menu.

The **Delete Confirmation** dialog box is displayed.

2. Select **OK** to delete the server pool.

The server pool is deleted.

7.8 Managing Oracle VM Servers

Use Oracle VM Manager to manage Oracle VM Servers. Do not manage Oracle VM Servers directly using the Oracle VM Server command line.

A server pool must contain at least one Oracle VM Server. After installing an Oracle VM Server, you must discover it in Oracle VM Manager before it can be added to a server pool.

Before you discover Oracle VM Servers and add them to a server pool, you must:

- Identify the IP address of the Oracle VM Server(s). If you installed Oracle VM Server with a static IP address (recommended), this is the IP address you use. If you installed Oracle VM Server with a dynamic IP address, log onto the Oracle VM Server and determine the IP address.
- Identify the password to access the Oracle VM Agent installed on the Oracle VM Server.

This section contains:

- [Discovering Oracle VM Servers](#)
- [Rediscovering an Oracle VM Server](#)
- [Taking Ownership of an Oracle VM Server](#)
- [Editing Oracle VM Server Information](#)
- [Starting an Oracle VM Server](#)
- [Stopping an Oracle VM Server](#)
- [Restarting an Oracle VM Server](#)
- [Selecting the Master Oracle VM Server](#)
- [Placing an Oracle VM Server into Maintenance Mode](#)
- [Deleting an Oracle VM Server](#)
- [Updating and Upgrading Oracle VM Servers](#)

7.8.1 Discovering Oracle VM Servers

When an Oracle VM Server is installed and starts up, it listens for Oracle VM Manager server pool discovery events. Before you can add an Oracle VM Server to a server pool, it must first be discovered.

To discover an Oracle VM Server:

1. In the **Hardware** view, select **Discover Servers** from the **Actions** menu. The **Discover Servers** dialog box is displayed.

2. Enter information about the Oracle VM Server(s) to be discovered:
 - **Specify an IP Address (or range):** The IP address of the Oracle VM Server. Click **Add**. If you want to discover more Oracle VM Servers, enter the IP address for each, and click **Add** to add the Oracle VM Server to the **IP Addresses** list box.

Tip: If you want to copy/paste an IP address into this field, copy the IP address into your copy/paste buffer, then in the first IP address field paste the contents of the buffer and press the Tab or Enter key on your keyboard.

- **IP Addresses:** Lists the IP address(es) of the Oracle VM Server(s) to be discovered. Add IP addresses using the **Specify an IP Address** field. To remove an IP address select it and click **Delete**.
- **Oracle VM Agent Port:** The port on which the Oracle VM Agent is listening. This is most likely the default port **8899**.
- **Oracle VM Agent Password:** The password to connect to the Oracle VM Agent. The password must be the same on all Oracle VM Servers.

Click **OK**.

The Oracle VM Servers are discovered and added to the Unassigned Servers folder. The newly discovered Oracle VM Server contains some basic information about itself, and about any immediate connectivity to a shared SAN, but it is considered to be in an unconfigured state. The Oracle VM Server cannot be used to perform any virtual machine, or active cluster operations. Physical network and storage configuration can be performed, and any subsequent storage discovery operations may also be performed.

When an Oracle VM Server is discovered, it is configured to use the Oracle VM Manager host computer as the Network Time Protocol (NTP) time source. This ensures that all Oracle VM Servers are in sync with each other in the Oracle VM Manager environment.

The Utilization % column in the Servers tab does not report the utilization statistics of an Oracle VM Server that is in the Unassigned Servers folder . This field does not report utilization statistics unless an Oracle VM Server is included in a server pool.

Note: Discovered Oracle VM Servers do not use a Virtual IP address until they are properly configured by being included in a server pool.

When an Oracle VM Server has been discovered, it can be added to a server pool. See [Section 7.7.1, "Adding an Oracle VM Server to a Server Pool"](#) for information on adding an Oracle VM Server to a server pool.

7.8.2 Rediscovering an Oracle VM Server

If the physical state of an Oracle VM Server changes, you should discover it again to update the configuration information in Oracle VM Manager.

To rediscover an Oracle VM Server:

1. Select the Oracle VM Server in the navigation pane.
2. Select **Rediscover Server** from the **Actions** menu.

The configuration information about the Oracle VM Server is updated in Oracle VM Manager.

7.8.3 Taking Ownership of an Oracle VM Server

By default, the user to who adds the Oracle VM Server to Oracle VM Manager has ownership of that Oracle VM Server. If an Oracle VM Server is in the Unassigned Servers folder in the Hardware view and does not have ownership by your user, you need perform the following steps to take ownership and use the Oracle VM Server in a server pool.

To take ownership of an Oracle VM Server:

1. In the **Hardware** view, select the Oracle VM Server in the **Unassigned Servers** folder in the navigation pane. Select **Edit Server** from the **Actions** menu. The **Edit Server** dialog box is displayed.

2. Select the **Take Ownership** check box to take ownership of the Oracle VM Server. Click **OK**.

To relinquish ownership of the Oracle VM Server, repeat the same procedure and uncheck the **Take Ownership** check box.

You cannot relinquish ownership of an Oracle VM Server while it is in a server pool, you must first remove it from a server pool. See [Section 7.7.2, "Removing an Oracle VM Server from a Server Pool"](#) for information on removing an Oracle VM Server from a server pool.

7.8.4 Editing Oracle VM Server Information

You can edit the configuration information for an Oracle VM Server to change the name, description, any server pool roles, and to take it offline to perform system maintenance.

To edit the configuration information of an Oracle VM Server:

1. In the **Home** view, select the Oracle VM Server in the navigation pane. Select **Edit Server** from the **Actions** menu. The **Edit Server** dialog box is displayed.
2. Edit the information about the Oracle VM Server:
 - **Name:** The name of the Oracle VM Server.
 - **Description:** A description of the Oracle VM Server.
 - **Maintenance Mode:** Select whether to place the Oracle VM Server in maintenance mode. See [Section 7.8.9, "Placing an Oracle VM Server into Maintenance Mode"](#) for more information about Oracle VM Server maintenance mode.
 - **Take Ownership:** Select to take ownership of the Oracle VM Server. See [Section 7.8.3, "Taking Ownership of an Oracle VM Server"](#) for information on ownership of an Oracle VM Server.

Tip: You cannot edit the ownership of an Oracle VM Server if it is included in a server pool.

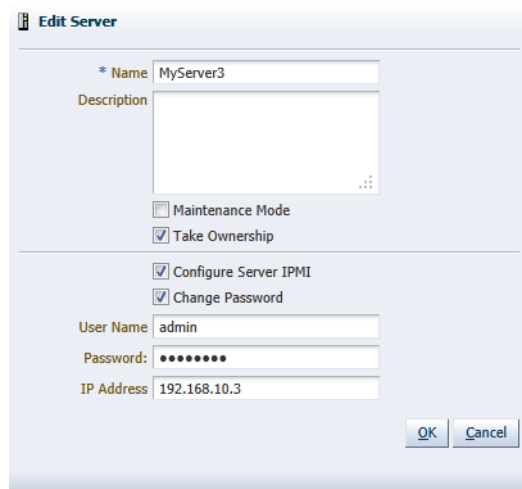
- **Configure Server IPMI:** Select to enable the Intelligent Platform Management Interface (IPMI). IPMI allows you to remotely power off an Oracle VM Server, and to send a *wake on lan* message to power on an Oracle VM Server without

having to physically press the power button. To configure IPMI enter the following information in the fields:

- **Username:** The username for the IPMI.
- **Password:** The password for the IPMI.

To set or modify the IPMI password, you must also select the **Change Password** check box.

- **IP Address:** The IP address of the IPMI.



Click **OK**. The Oracle VM Server is updated.

7.8.5 Starting an Oracle VM Server

When you start an Oracle VM Server, it is started using the Intelligent Platform Management Interface (IPMI), or Wake-on-LAN (WOL). If neither IPMI nor WOL have been configured, the job to start the Oracle VM Server cannot be completed. The Oracle VM Server must then be powered on manually. See [Chapter 7.8.4, "Editing Oracle VM Server Information"](#) for information on configuring IPMI.

To start an Oracle VM Server:

In the **Home** view, select the Oracle VM Server in the navigation pane. Select **Start Server** from the **Actions** menu.

The Oracle VM Server is started.

7.8.6 Stopping an Oracle VM Server

When you stop an Oracle VM Server, it is stopped using the Intelligent Platform Management Interface (IPMI), or a system power off command. Before you can stop an Oracle VM Server, you must stop any running virtual machines, or place the Oracle VM Server into maintenance mode to automatically migrate the running virtual machines.

WARNING: Make sure that the IPMI is properly configured on the Oracle VM Server, otherwise it cannot be started again remotely. See [Chapter 7.8.4, "Editing Oracle VM Server Information"](#) for IPMI configuration.

Alternatively, make sure that the Oracle VM Server are on the same subnet and activate the Wake-on-LAN (WOL) feature in the Oracle VM Server BIOS. If an Oracle VM Server cannot start through IPMI or WOL, it must be power-cycled manually.

To stop an Oracle VM Server:

1. Stop or migrate any running virtual machines. To stop the virtual machines see [Section 8.9.5, "Shutting Down a Virtual Machine"](#). To automatically migrate the virtual machines to other Oracle VM Servers in the server pool, place the Oracle VM Server into maintenance mode, see [Section 7.8.9, "Placing an Oracle VM Server into Maintenance Mode"](#).
2. In the **Home** view, select the Oracle VM Server in the navigation pane. Select **Stop Server** from the **Actions** menu.

The Oracle VM Server is powered off.

7.8.7 Restarting an Oracle VM Server

When you restart an Oracle VM Server, an operating system restart command is sent and the Oracle VM Server is restarted. Before you can restart an Oracle VM Server, you must stop any running virtual machines, or place the Oracle VM Server into maintenance mode to automatically migrate the running virtual machines.

When the Oracle VM Server is restarted and rejoins the server pool, the master Oracle VM Server initiates any pending HA operations in the server pool. When Oracle VM Manager is notified that the Oracle VM Server is online and available, any pending state changes are reconciled before any policy actions are resumed.

To restart an Oracle VM Server:

1. Stop or migrate any running virtual machines. To stop the virtual machines see [Section 8.9.5, "Shutting Down a Virtual Machine"](#). To automatically migrate the virtual machines to other Oracle VM Servers in the server pool, place the Oracle VM Server into maintenance mode, see [Section 7.8.9, "Placing an Oracle VM Server into Maintenance Mode"](#).
2. In the **Home** view, select the Oracle VM Server in the navigation pane. Select **Restart Server** from the **Actions** menu.

The Oracle VM Server is restarted.

7.8.8 Selecting the Master Oracle VM Server

You can select which Oracle VM Server performs the master Oracle VM Server role in a server pool with the Edit the Server Pool dialog box. See [Section 7.7.3, "Editing a Server Pool"](#) for information on using the Edit the Server Pool dialog box.

7.8.9 Placing an Oracle VM Server into Maintenance Mode

An Oracle VM Server can be placed into *maintenance mode* to perform hardware or software maintenance. When an Oracle VM Server is placed in maintenance mode, any virtual machines running on the Oracle VM Server are automatically migrated to other Oracle VM Servers in the server pool, if they are available, otherwise they are stopped. If the Oracle VM Server is the master Oracle VM Server in the server pool, this role is moved to another Oracle VM Server in the server pool, if available.

To place an Oracle VM Server into maintenance mode:

1. In the **Home** view, select the Oracle VM Server in the navigation pane. Select **Edit Server** from the **Actions** menu. The **Edit Server** dialog box is displayed.
2. Select the **Maintenance Mode** check box to place the Oracle VM Server into maintenance mode. Click **OK**.

The Oracle VM Server is placed into maintenance mode.

When you have finished performing maintenance on the Oracle VM Server and you are ready for it to rejoin the server pool, perform the same procedure and uncheck the **Maintenance Mode** check box.

7.8.10 Deleting an Oracle VM Server

When you delete an Oracle VM Server, it is removed from the Oracle VM Manager repository and becomes unmanaged. The Oracle VM Server is not stopped, nor is anything physically done to the Oracle VM Server.

Before you can delete an Oracle VM Server, you must stop any running virtual machines, or place the Oracle VM Server into maintenance mode to automatically migrate the running virtual machines. You must also remove the Oracle VM Server from the server pool.

To delete an Oracle VM Server and remove it from Oracle VM Manager:

1. Stop or migrate any running virtual machines. To stop the virtual machines see [Section 8.9.5, "Shutting Down a Virtual Machine"](#). To automatically migrate the virtual machines to other Oracle VM Servers in the server pool, place the Oracle VM Server into maintenance mode, see [Section 7.8.9, "Placing an Oracle VM Server into Maintenance Mode"](#).
2. Remove the Oracle VM Server from the server pool. See [Section 7.7.2, "Removing an Oracle VM Server from a Server Pool"](#) for information on removing Oracle VM Server from server pools.
3. Select the **Hardware** view. Select the **Hardware** tab in the navigation pane, and select the **Unassigned Servers** folder. Select the Oracle VM Server and select **Delete** from the **Actions** menu.
4. The **Delete Confirmation** dialog box is displayed. Click **OK**.

The Oracle VM Server is deleted from Oracle VM Manager.

7.8.11 Updating and Upgrading Oracle VM Servers

Updates and upgrades to Oracle VM Servers can be automatically performed using a Yum repository. To access patch updates for Oracle VM, you should contact Oracle to purchase an Oracle VM Support contract and gain access to the Unbreakable Linux Network (ULN) which contains updates for Oracle VM. If you have access to ULN you can use this to set up your own Yum repository to use when updating your Oracle VM Servers. Setting up a Yum repository is beyond the scope of this documentation,

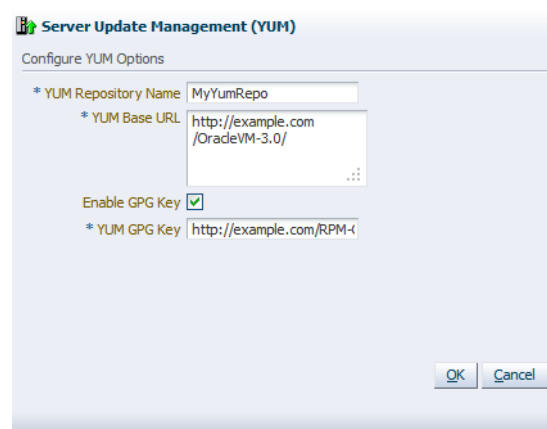
however you can read about setting one up in an OTN article "*Yum Repository Setup*" at:

<http://www.oracle.com/technetwork/topics/linux/yum-repository-setup-085606.html>

Make sure you subscribe to the Oracle VM Release 3.0 channel on ULN when you set up your Yum repository. If you have a Yum repository configured for Oracle VM Server updates, you add this to Oracle VM Manager and perform the updates from within the Oracle VM Manager user interface.

To add a Yum repository:

1. Select **Server Update Management (YUM)** from the **Tools** menu. The **Server Update Management (YUM)** dialog box is displayed.



2. Enter the following information about the Yum repository:
 - **YUM Repository Name:** A name for the Yum repository.
 - **YUM Base URL:** The URL to access the Yum repository, for example:
`http://example.com/OracleVM-3.0/`
 - **Enable GPG Key:** Whether to use a GPG key for the Yum repository. The GPG key (or GnuPG key) is the key used in the GNU project's implementation of the OpenPGP key management standard. The GPG key is used to check the validity of the Yum repository, and any packages (RPMs) downloaded from the repository.
 - **YUM GPG Key:** The GPG key for the Yum repository, for example:
`http://example.com/RPM-GPG-KEY-OVM-3.0`

The GPG key must be available via one of HTTP, FTP, FILE or HTTPS protocols.

The GPG key for Oracle-signed updates from ULN is pre-installed on Oracle VM Server at `/etc/pki/rpm-gpg/RPM-GPG-KEY-oracle`. If you want to use this GPG key, enter:

```
file:///etc/pki/rpm-gpg/RPM-GPG-KEY-oracle
```

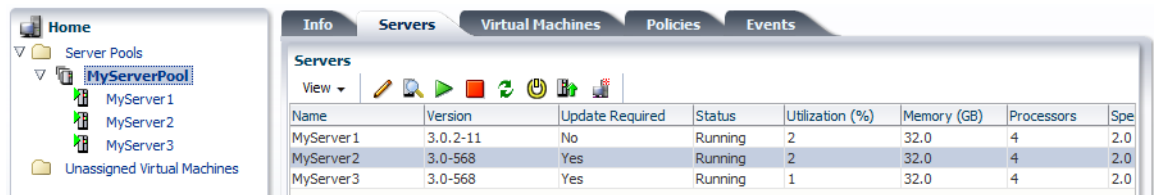
This field is only enabled when you select **Enable GPG Key**.

3. Click **OK**.

The YUM repository is added and ready to use.

When an Oracle VM Server update is available, an event is posted to the Oracle VM Server and displayed in the **Update Required** column in the **Servers** tab.

Figure 7–6 Update Required field in the Servers tab



To update an Oracle VM Server, the virtual machines on the Oracle VM Server must first be migrated to another Oracle VM Server. You can manually migrate the virtual machines if you prefer, or have the upgrade job perform the virtual machine migration automatically. If the Oracle VM Server is a master Oracle VM Server, the master role is transferred to another Oracle VM Server in the server pool.

To update an Oracle VM Server:

1. Select the Oracle VM Server in the navigation pane and select **Upgrade Server** from the **Actions** menu. The Oracle VM Server is placed into maintenance mode, and the update performed. Any virtual machines on the Oracle VM Server are automatically migrated to another Oracle VM Server when it is put into maintenance mode. When the update is complete the Oracle VM Server is restarted and remains in maintenance mode.
2. To have the Oracle VM Server rejoin the server pool as a fully functioning member, edit the Oracle VM Server and take it out of maintenance mode.

For information on manually migrating virtual machines, see [Section 8.9.2, "Live Migration of a Virtual Machine"](#). For information on taking an Oracle VM Server out of maintenance mode, see [Section 7.8.9, "Placing an Oracle VM Server into Maintenance Mode"](#).

Managing Virtual Machines

In this chapter we describe in detail all types of virtual machine activities. A virtual machine is a guest operating system, for example, Linux, Windows, or Solaris, and its associated application software. A virtual machine runs on an Oracle VM Server in a server pool. Full management of a virtual machine is performed using Oracle VM Manager.

This chapter describes how to create and use virtual machines. It includes the following sections:

- [Virtual Machines Overview](#)
- [Virtualization Modes \(Domain Types\)](#)
- [Supported Guest Operating Systems](#)
- [Virtual Machine Installation Media](#)
- [Virtual Machine Resources](#)
- [Using the VNIC Manager](#)
- [Creating a Virtual Machine](#)
- [Cloning a Virtual Machine or Template](#)
- [Managing Virtual Machines](#)
- [Connecting to a Virtual Machine](#)
- [Installing Paravirtualized Drivers](#)

8.1 Virtual Machines Overview

The terms domain, guest and virtual machine are often used interchangeably, but they have subtle differences. A *domain* is a configurable set of resources, including memory, virtual CPUs, network devices and disk devices, in which virtual machines run. A domain is granted virtual resources and can be started, stopped and restarted independently. A *guest* is a virtualized operating system running within a domain. A guest operating system may be paravirtualized, hardware virtualized, or hardware virtualized with paravirtualized drivers. Multiple guests can run on the same Oracle VM Server. A *virtual machine* is a guest operating system and its associated application software. For the sake of simplicity, in this Guide we use the term *virtual machine* to encompass domain, guest and virtual machine. They are synonymous with each other and may be used interchangeably.

Virtual machines can be created using:

- ISO files in a repository (hardware virtualized only)

- Mounted ISO files on an NFS, HTTP or FTP server (paravirtualized only)
- Virtual machine templates (by cloning a template)
- Existing virtual machine (by cloning the virtual machine)
- Virtual machine assemblies

Virtual machines require most installation resources to be in a storage repository, managed by Oracle VM Manager, with the exception of mounted ISO files for paravirtualized guests. See [Section 8.5, "Virtual Machine Resources"](#) for information on importing and managing virtual machine resources.

Before you create a virtual machine that requires network connectivity, or a paravirtualized machine which requires network connectivity to perform the operating system install, you should generate some virtual network interfaces using the VNIC Manager. See [Section 8.6, "Using the VNIC Manager"](#) for information on using the VNIC Manager.

8.2 Virtualization Modes (Domain Types)

Virtual machines may run in one of two main modes, paravirtualized (PVM) or hardware virtualized (HVM). In paravirtualized mode, the kernel of the guest operating system is recompiled to be made aware of the virtual environment. This allows the paravirtualized guest to run at near native speed, since most memory, disk and network accesses are optimized for maximum performance.

If support for hardware virtualization is available (either Intel VT or AMD-V), the guest operating system may run completely unmodified. This hardware virtualized guest is carefully monitored and trapped by Oracle VM Server when any instruction is executed which would violate the isolation with other guests or dom0. In the current implementation, there may be performance penalty for certain types of guests and access types, but hardware virtualization also allows many Microsoft Windows™ operating systems and legacy operating systems to run unmodified.

The third virtualization mode is hardware virtualized, with paravirtualized drivers (PVHVM). This mode is identical to hardware virtualized, but with additional paravirtualized drivers installed in the guest's operating system to improve virtual machine performance.

Oracle recommends you create paravirtualized virtual machines if possible, as the performance of a paravirtualized virtual machine is superior to that of a hardware virtualized guest.

There are three virtual machine virtualization modes, or domain types, as shown in [Table 8–1](#). When you create a virtual machine using the Virtual Machine wizard you must select which mode to use.

Table 8–1 Domain Types

Domain Type	Description
Hardware virtualized (HVM)	<p>Hardware virtualization, or fully virtualized. When you create an HVM guest, you must supply an ISO file in a repository from which to create the virtual machine. See Section 8.5.5, "ISO Files (CD/DVD Images)" for information on importing an ISO file into a repository.</p> <p>To create HVM guests, you may need to activate the hardware virtualization in the BIOS of the server on which you install the Oracle VM Server.</p>

Table 8–1 (Cont.) Domain Types

Domain Type	Description
Hardware virtualized, with paravirtualized drivers (PVHVM)	Identical to HVM, but with additional paravirtualized drivers for improved performance of the virtual machine. See Section 8.11, "Installing Paravirtualized Drivers" for more information about using paravirtualized drivers. This Domain Type is used to run Microsoft Windows guest operating systems with an acceptable performance level.
Paravirtualized (PVM)	Paravirtualized. Enables you to select a location for the mounted ISO file from which to create the virtual machine. Before you create the virtual machine using the paravirtualized method, mount the ISO file on an NFS share, or HTTP or FTP server. You supply the location of the mounted ISO file in the Boot Options step of the wizard. For information on creating a mounted ISO file, see Section 8.4, "Virtual Machine Installation Media" .

8.3 Supported Guest Operating Systems

An operating system installed in a virtual machine is known as a guest operating system. Oracle VM supports a variety of guest operating systems. For a list of the supported guest operating systems, see the *Oracle VM Release Notes*.

8.4 Virtual Machine Installation Media

Virtual machines require some form of installation media, whether it be a template, assembly, ISO file, or mounted ISO file. Different domain types may require slightly different installation source files. [Table 8–2](#) lists the installation sources available for HVM and PVM guests.

Table 8–2 Virtual machine installation sources

Installation Source	HVM	PVM
Template (clone)	Yes	Yes
ISO file in repository	Yes	No
Mounted ISO file on NFS, HTTP or FTP server	No	Yes
Assembly	Yes	Yes

When you create an HVM guest from an ISO file, you must supply an ISO file which has been preloaded into a storage repository that is presented to the Oracle VM Server on which the virtual machine is to be deployed. See [Section 8.5.5, "ISO Files \(CD/DVD Images\)"](#) for information on importing ISO files.

When you create a PVM guest from an ISO file, you cannot use an ISO file from a repository to install the operating system. Instead, you must use a mounted ISO file. A mounted ISO file explodes the contents of the ISO file on to disk and makes the operating system installation tree available to the virtual machine. The mounted ISO file can be made available via an NFS, HTTP or FTP server. When you specify the location of the installation media in the **Network Boot Path** field in the **Create Virtual Machine** wizard, you enter the NFS, HTTP or FTP path to the mounted ISO file. The following examples show how to create and use mounted ISO files on an NFS share, and on an HTTP server.

Example 8-1 Creating an installation tree on an NFS share

This example creates an installation tree for paravirtualized guests by mounting an ISO file. The installation tree is made available via an NFS share. On the NFS server, enter

```
# mkdir -p /isos/EL5u6-x86_64
# mount -o ro,loop /path/Enterprise-R5-U6-Server-x86_64-dvd.iso /isos/EL5u6-x86_64
# exportfs */isos/EL5u6-x86_64/
```

When you create the virtual machine, enter the installation location in the **Network Boot Path** field in the **Create Virtual Machine** wizard as:

```
nfs:example.com:/isos/EL5u6-x86_64
```

Example 8-2 Creating an installation tree on an HTTP server

This example creates an installation tree from an ISO file that can be accessed via HTTP. On the HTTP server, enter

```
# cd /var/www/html
# mkdir EL5u6-x86_64
# mount -o ro,loop /path/Enterprise-R5-U6-Server-x86_64-dvd.iso EL5u6-x86_64
```

When you create the virtual machine, enter the installation location in the **Network Boot Path** field in the **Create Virtual Machine** wizard as:

```
http://example.com/Enterprise-R5-U6-Server-x86_64-dvd.iso/
```

Tip: If you have multiple ISO files (CDs), you can mount each ISO file (CD) and copy the contents into a single directory. All the ISO files are then available from the same location.

8.5 Virtual Machine Resources

The resources required to create virtual machines are stored in a storage repository. This section provides information on the structure of storage repositories, and describes how you manage virtual machine resources in storage repositories. It includes the following sections:

- [Overview of Virtual Machine Resources in a Storage Repository](#)
- [Storage Repository Contents and Structure](#)
- [Virtual Machine Templates](#)
- [Assemblies](#)
- [ISO Files \(CD/DVD Images\)](#)
- [Virtual Disks](#)
- [Virtual Machine Configuration Files](#)

8.5.1 Overview of Virtual Machine Resources in a Storage Repository

A storage repository is used to store virtual machine resources, so that these resources can be made available to Oracle VM Servers in a server pool, without having to copy the resources to each Oracle VM Server. The Oracle VM Servers in a server pool gain access to these virtual machine resources by having the storage repository *presented* to the them. If your storage is file-based storage, you can present a storage repository to multiple server pools.

The types of virtual machine resources can be categorized as:

- **Virtual machine templates:** Reusable virtual machine templates used to create multiple virtual machines.
- **Assemblies:** Template containing a configuration of multiple virtual machines with their virtual disks and the inter connectivity between them.
- **ISO files:** DVD/CD image files used to create virtual machines from scratch using the installation media.
- **Virtual disks:** Virtual disks used by virtual machines to perform boot operations, to run the operating system, and to extend the storage capability of virtual machines.
- **Virtual machine files:** Configuration files of your virtual machines.

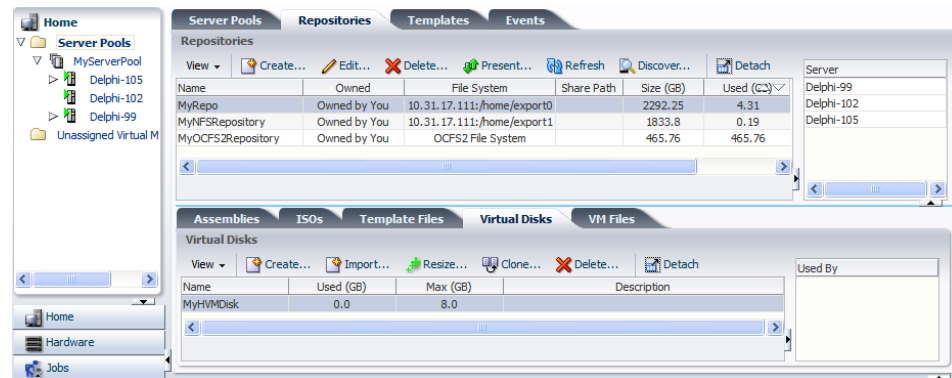
You access and manage virtual machine resources in a storage repository using the **Home** view, selecting **Server Pools** in the navigation pane, and selecting the **Repositories** tab in the management pane.

The following sections describe the structure of a storage repository, and how to manage their contents.

8.5.2 Storage Repository Contents and Structure

Each storage repository has a predefined structure, which is visible in Oracle VM Manager, and maps to the directory structure of the underlying physical storage. [Figure 8–1](#) shows the repository as seen through the Oracle VM Manager user interface. The directory structure is listed in [Table 8–3, "Storage Repository Directory Structure"](#).

Figure 8–1 Graphical User Interface view of storage repository contents



The directories listed in [Table 8–3](#) are subdirectories of a storage repository file system. On disk they are, in fact, located under the path:

`/OVS/Repositories/repository_id/...`

Table 8–3 Storage Repository Directory Structure

Directory Name	Description
Templates	<p>This tab is one level up from the other tabs: it is placed alongside the Repositories tab to allow the user to manage templates within the managed environment more easily.</p> <p>This is the directory that contains guest virtual machine templates.</p> <p>See Section 8.5.3, "Virtual Machine Templates" for information on working with virtual machine templates.</p>
Assemblies	<p>Contains preconfigured sets of virtual machines, typically created with Oracle Assembly Builder.</p> <p>See Section 8.5.4, "Assemblies" for information on working with assemblies.</p>
ISO files	<p>Contains ISO files that can be mounted as virtual DVD drives on guest virtual machines.</p> <p>See Section 8.5.5, "ISO Files (CD/DVD Images)" for information on working with ISO files.</p>
VirtualDisks	<p>Contains virtual disks, which can be either dedicated to a virtual machine or shared by multiple virtual machines.</p> <p>See Section 8.5.6, "Virtual Disks" for information on working with virtual disks.</p>
VirtualMachines	<p>Contains virtual machine configuration files.</p> <p>See Section 8.5.7, "Virtual Machine Configuration Files" for information on working with virtual machine configuration files.</p>

8.5.3 Virtual Machine Templates

A virtual machine template is a fully pre-installed, pre-configured virtual machine that can be repeatedly used to create new virtual machines. Typically, a virtual machine template might contain:

- An operating system.
- A file which contains the basic configuration information, such as the number of virtual CPUs, the amount of memory, the size of disk, and so on.
- Pre installed applications.

Virtual machine templates contain the configuration of a single virtual machine. Virtual machine templates are shared among users to create new virtual machines. New virtual machines inherit the same contents and configuration from the template. Typically, a virtual machine template contains basic configuration, such as the number of virtual CPUs, the size of memory, virtual disks, virtual network interfaces (VIFs), and so on. It may also contain some software applications.

You can obtain or create a virtual machine template by:

- Downloading an Oracle VM template from the Oracle Technology Network, and importing it into Oracle VM Manager. See [Section 2.10, "Oracle VM Pre-built Templates"](#) for more information on downloading a template.
- Cloning an existing virtual machine or template as a template in Oracle VM Manager. For information on cloning virtual machine templates, see [Section 8.8, "Cloning a Virtual Machine or Template"](#).

This section contains:

- [Importing a Virtual Machine Template](#)
- [Using a Virtual Machine Template](#)
- [Editing a Virtual Machine Template](#)
- [Deleting a Virtual Machine Template](#)

8.5.3.1 Importing a Virtual Machine Template

Before you can use a virtual machine template, you must import it into Oracle VM Manager and make it available to your server pool(s). Virtual machine templates are stored in the server pool's storage repository by importing them from a web server into Oracle VM Manager.

In a storage repository, templates are typically imported as an archive (.tgz, .tar or other). The archive contains a virtual machine configuration file (.cfg) file, and at least one virtual disk image (.img file).

Note: On disk, a template archive is unpacked after import. The .cfg file of the virtual machine is always referenced from the Templates folder, but the virtual disk image files (.img) are placed in the VirtualDisks folder. This makes the creation of virtual machines from template a lot faster, which also applies to cloning of virtual machines.

To import a virtual machine template:

1. Place the archive containing the Oracle VM template in a location accessible from your Oracle VM environment using either of these protocols: HTTP, HTTPS or FTP.
2. In the **Home** view click **Server Pools** in the navigation pane, then open the **Templates** tab in the management pane.
3. Click **Import** to open the **Import Template** dialog box. Select or edit the following:
 - **Repository:** The storage repository in which to import the template.
 - **Server:** The Oracle VM Server to use the perform the template import.
 - **Template URLs:** The URLs for the templates. You can enter multiple URLs in a comma separated list.

Click **OK** to import the template(s). When the import is complete, the new template(s) appear in the **Templates** table.

4. Optionally, click **Edit** to change the name of the template and add a description.
5. To remove a template from the storage repository, select it and click **Delete**.

For information about creating a virtual machine from a template, see [Section 8.8, "Cloning a Virtual Machine or Template"](#).

8.5.3.2 Using a Virtual Machine Template

A virtual machine template can be used to create virtual machines, and to create new templates based on the original. To create a virtual machine, or another template from the original, you clone the template. You can either create a simple, or advanced clone, the latter giving you the opportunity to modify the configuration and deployment options for the template. If you used an advanced clone, you must first create a clone definition for the template, then use the clone definition to create a virtual machine, or

another template. See [Section 8.8, "Cloning a Virtual Machine or Template"](#) for information on cloning.

8.5.3.3 Editing a Virtual Machine Template

You can edit some basic meta information about a virtual machine template.

To edit a virtual machine template:

1. In the **Home** view click **Server Pools** in the navigation pane, then open the **Templates** tab in the management pane.
2. Select a template to edit and click **Edit...** to display the **Edit Template** dialog box.
3. Edit the following:
 - **Template Name:** The name of the template
 - **Description:** A description of the template.

Click **OK** to save the template information.

8.5.3.4 Deleting a Virtual Machine Template

You can delete a virtual machine template, and the virtual disks associated with it.

To delete a virtual machine template:

1. In the **Home** view click **Server Pools** in the navigation pane, then open the **Templates** tab in the management pane.
2. Select a template to edit and click **Delete...** to display the **Delete Confirmation** dialog box.
3. Select the virtual disks associated with the template you want to delete. Click **OK** to delete the template.

8.5.4 Assemblies

An assembly is a kind of infrastructure template containing a configuration of multiple virtual machines with their virtual disks and even the inter connectivity between them. Assemblies can be created as a set of .ovf (Open Virtualization Format) and .img (disk image) files, or may all be contained in a single .ova (Open Virtualization Format Archive) file.

To use an assembly, you must first import it into a repository, then create one or more templates from the assembly. You create one virtual machine template for each virtual machine in the assembly. You can then use the template(s) to deploy the virtual machines that originated from the assembly. You cannot deploy all virtual machines in an assembly in one step; you must deploy each virtual machine individually. To perform deployment of all virtual machines, including the associated networking configuration, you should use Oracle Enterprise Manager.

For ease of use, you should use a single .ova file when working with assemblies in Oracle VM. You can also use the .ovf format with the associated disk image files, but you must import all the disk files individually as virtual disks, then import the .ovf file as an assembly before you can use the assembly to create a template.

To import an assembly:

1. Create or locate an assembly file. This should be a single .ova file, which contains the .ovf descriptive file(s), and disk image file(s) for the assembly. If you do not have the assembly in the archive (.ova) format, but instead have a series of virtual disk images and the .ovf file, you must first import all the virtual disk files, then

continue with this procedure to import the .ovf file. See [Section 8.5.6, "Virtual Disks"](#) for information on importing virtual disk files.

2. Place the assembly file in a location accessible from your Oracle VM Manager host computer using either of these protocols: HTTP, HTTPS or FTP.
3. In the **Home** view click **Server Pools** in the navigation pane, then open the **Repositories** tab in the management pane.
4. Select the storage repository of your choice and open the **Assemblies** tab below.
5. Click **Import** to open the **Import Assembly** dialog box. Select an Oracle VM Server from the **Server** list to perform the import, and enter the URL to the assembly file you want to import.
6. Click **OK** to import the assembly file. When the import is complete, the assembly file appears in the table. The virtual machines contained in the assembly are listed in the **Assembly Virtual Machines** pane.

When the assembly file(s) are imported, you can use the assembly to create a template for each virtual machine in the assembly. Select the assembly and click the **Create Template** icon in the **Assemblies** sub-tab to create a template for a virtual machine in the assembly. The template is created in the same repository as the assembly is located. When you have created a template from the assembly, you can use the template to create and deploy virtual machines. See [Section 8.5.3.2, "Using a Virtual Machine Template"](#) for information on using a template to create a virtual machine.

8.5.5 ISO Files (CD/DVD Images)

Virtual machines have no access to the physical DVD or CD-ROM drive. You can assign virtual drives to virtual machines by offering ISO files containing the image of a DVD or CD-ROM. These image files can be found in the ISOs tab of the storage repository.

You can import ISO files from a web server into Oracle VM Manager. You can then select the installation media as an ISO file when you create a virtual machine. To create a virtual machine using an ISO file, see [Section 8.7, "Creating a Virtual Machine"](#).

To be able to use an ISO file with your virtual machine you must first import the file into an appropriate storage repository, namely one that can be accessed by the server pool where the virtual machine is to be created. If your storage repository uses file-based storage, you can make repository available to multiple server pools, therefore making an ISO file available to multiple server pools. If you are using storage array-based storage, you can only make a repository available to a single server pool. Virtual machines can only access ISO files that have been assigned to the server pool to which they belong.

To import and make available an ISO file:

1. Create or locate an ISO file that contains the disk image of the DVD or CD-ROM you want to make available to your virtual machines.
2. Place the ISO file in a location accessible from your Oracle VM Manager host computer using either of these protocols: HTTP, HTTPS or FTP.
3. In the **Home** view click **Server Pools** in the navigation pane, then open the **Repositories** tab in the management pane.
4. Select the storage repository of your choice and open the **ISOs** tab below.
5. Click **Import** to open the **Import ISO** dialog box. Select an Oracle VM Server from the **Server** list to perform the import, and enter the URL to the ISO file you want to

import. The ISO file must be available via HTTP, HTTPS or FTP. For example, enter:

`http://example.com/isos/myiso.iso`

6. Click **OK** to import the ISO file. When the import is complete, the ISO file appears in the table.
7. Select the ISO file you just imported and click **Assign** to open the **Assign ISO to Server Pools** dialog box.
8. If you are using file-based storage for the storage repository, use the arrow buttons to move the server pools to the right pane to make the ISO file available to them.
9. When finished, click **OK**. The pane to the right of the ISOs table displays the server pools to which the selected ISO file has been assigned.
10. Optionally, click **Edit** to change the name of the ISO file and add a description.
11. To remove an ISO file from the storage repository, select it and click **Delete**.
12. To use an ISO as a virtual DVD drive with your virtual machine, you must add the ISO file in the storage configuration of your virtual machine first, and possibly modify its boot configuration. For details, see [Section 8.7, "Creating a Virtual Machine"](#).

8.5.6 Virtual Disks

A virtual machine needs at least one disk – that is, a disk to boot from and to run the operating system. Virtual disks can be part of a template, can be created as part of the virtual machine creation process, or can be created independently inside the storage repository. Virtual disks can be shared across virtual machines, or dedicated to one virtual machine. All virtual disks available in the storage repository appear in the Virtual Disks tab, regardless of how they are created.

In addition to the standard create and delete operations, Oracle VM Manager also allows you to resize a virtual disk, provided the storage repository has sufficient disk space to offer the requested size.

To create a new virtual disk:

1. In the **Home** view click **Server Pools** in the navigation pane, then open the **Repositories** tab in the management pane.
2. Select the storage repository of your choice and open the **Virtual Disks** tab below.
3. Click **Create...** to open the **Create Virtual Disk** dialog box. Enter the following information in the fields:
 - **Virtual Disk Name:** A name for the virtual disk.
 - **Size (GB):** The size of the disk, in GB.
 - **Description:** A description of the virtual disk.
 - **Shareable:** Whether the virtual disk is shareable. Shareable disks have read/write privileges in multiple virtual machines and should be used with caution.
4. Click **OK** to create the new disk. It appears in the table.
5. To remove a virtual disk from the storage repository, select it and click **Delete**.

When you create a virtual machine from scratch, you are given the opportunity to either create a new virtual disk or use an existing one. The virtual disk you created

above is available for selection. For more information about creating a virtual machine from scratch, see [Section 8.7, "Creating a Virtual Machine"](#).

Note: The pane to the right of the Virtual Disks table displays the virtual machine to which the selected virtual disk is attached.

To import a virtual disk:

1. In the **Home** view click **Server Pools** in the navigation pane, then open the **Repositories** tab in the management pane.
2. Select the storage repository of your choice and open the **Virtual Disks** tab below.
3. Click the **Import Virtual Disk** icon to display the **Import Virtual Disk** dialog box. Select an Oracle VM Server from the **Server** list to perform the import, and enter the URL to the virtual disk file you want to import.
4. Click **OK** to import the virtual disk file. When the import is complete, the virtual disk file appears in the table.

To resize a virtual disk:

1. In the table of the **Virtual Disks** tab, select the virtual disk you wish to resize.
2. Click **Resize** to open the Resize Virtual Disk dialog box. Enter a new size in GB for the selected virtual disk and click **OK**.

Note: When resizing a disk there is always a risk of data corruption. Also, the file system on the virtual disk may not be aware of the resize operation, so you may have to run a certain procedure to make the guest aware of the change in disk size.

8.5.7 Virtual Machine Configuration Files

The final tab in the storage repository contents section is the **VM Files** tab. In the Create Virtual Machine wizard you specify which storage repository to use to store the configuration file of your virtual machine. Consider the VM Files tab to be the home location of all the virtual machines that have been created in the selected storage repository.

When a virtual machine template is imported into a repository, the template is unpacked on disk and the virtual machine configuration file (.cfg) is saved to the Templates folder, and the virtual disk image files (.img) are saved in the VirtualDisks folder.

As well as providing a convenient overview of the virtual machines you deployed, this tab also offers you the possibility to remove virtual machine configuration files from the storage repository by selecting the file and clicking **Delete**. After this, the virtual machine no longer exists, even if its virtual disks remain in the storage repository.

8.6 Using the VNIC Manager

The VNIC Manager creates virtual NICs, which are used by virtual machines. Basically, you provide virtual network interfaces by defining a range of MAC addresses. Each MAC address corresponds with a single virtual NIC, which is used by a virtual machine.

To create a VNIC:

1. Select **Vnic Manager...** from the **Tools** menu.
2. Click **Next** in the **MAC Selector** panel to get the next available MAC address. Alternatively you can enter a specific MAC address.
3. Select the number of addresses that you want to create, and click **Generate**.
4. Click **OK** to close the Vnic Manager.

After the creation of the VNICs you are able to use them when you create virtual machines. For more information on creating virtual machines, see [Chapter 8, "Managing Virtual Machines"](#).

Caution: If you run more than one Oracle VM Manager instance, you must not have overlapping MAC address ranges. If you create a MAC address that is already in the Oracle VM Manager database, an error message is displayed.

8.7 Creating a Virtual Machine

Before you create a new virtual machine, make sure that the following resources are available:

- A server pool. See [Section 7.6, "Creating a Server Pool"](#) for information on creating server pools.
- An Oracle VM Server as part of the server pool.
- Source file(s) in a repository from which to create the virtual machine. The source files can be any of the following:
 - Imported ISO file. See [Section 8.5.5, "ISO Files \(CD/DVD Images\)"](#) for more information on how to import ISO files.
 - Virtual machine template. See [Section 8.5.3, "Virtual Machine Templates"](#) for more information on how to import a virtual machine template.
 - Virtual machine assembly. See [Section 8.5.4, "Assemblies"](#) for more information on how to import an assembly.

To create a virtual machine:

1. Select the **Home** view and select **Create Virtual Machine** from the **Actions** menu.
2. The **Create Virtual Machine** step is displayed in the wizard.

The screenshot shows the 'Create Virtual Machine' wizard with the following settings:

- Server Pool:** MyServerPool
- Server:** Any
- Name:** MyVM
- Description:** My hardware virtualized machine
- Memory (MB):** 2048
- Processors:** 2
- Priority:** 50
- Processor Cap %:** 100
- Domain Type:** Xen HVM
- Operating System:** Oracle Linux 5
- Enable High Availability:**
- Repository for Configuration File:** MyRepository

Enter or select the following:

- **Server Pool:** The server pool on which to create the virtual machine.
- **Server:** A Oracle VM Server on which to run the virtual machine. If you do not have a preference as to which Oracle VM Server to use, select **Any** and the Oracle VM Server with the most available resources is selected to host the virtual machine.
- **Name:** A name for the virtual machine.
A virtual machine name must consist of alphanumeric characters, and must not contain spaces or special characters, except the underscore (_) or hyphen (-) characters. The maximum name length is 200 characters. The name need not be unique.
- **Description:** A description of your virtual machine.
- **Memory (MB):** The size of the memory the virtual machine is to be allocated.
- **Processors:** The number of processors to be used by the virtual machine. The number of processors is expressed in number of physical CPU cores, and is limited to 128.
- **Priority:** The CPU priority of the virtual machine. You can select a high (100), intermediate (50), or low (1) priority for the virtual CPUs, or a self-defined priority, by moving the slider. The higher the priority, the more physical CPU cycles are given to the virtual machine.
- **Processor Cap %:** Increase or decrease the percentage to which the virtual CPUs can receive scheduled time. This parameter defines the maximum percentage to which the virtual CPUs can receive scheduled time. You can select a high (100), intermediate (50), or low (1) percentage of scheduled time for the virtual CPUs, or a custom percentage, by moving the slider. Use this parameter to keep low priority virtual machines from consuming too many CPU cycles on a Virtual Machine Server.
- **Domain Type:** The domain type of the virtual machine. Oracle recommends you create paravirtualized virtual machines if possible, as the performance of

a paravirtualized virtual machine is superior to that of a hardware virtualized guest.

- **Xen HVM:** Hardware virtualization, or fully virtualized. When you select this option you must supply an ISO file in a repository (in the Create Storage step of the wizard) from which to create the virtual machine. See [Section 8.5.5, "ISO Files \(CD/DVD Images\)"](#) for information on importing an ISO file into a repository.
- **Xen HVM, PV Drivers:** Identical to Xen HVM, but with additional paravirtualized drivers for improved performance of the virtual machine. See [Section 8.11, "Installing Paravirtualized Drivers"](#) for more information about using paravirtualized drivers. This Domain Type is used to run Microsoft Windows guest operating systems with an acceptable performance level.
- **Xen PVM:** Paravirtualized. Enables you to select a location for the mounted ISO file from which to create the virtual machine. Before you create the virtual machine using the paravirtualized method, mount the ISO file on an NFS share, or HTTP or FTP server. You supply the location of the mounted ISO file in the **Network Boot Path** field in the **Boot Options** step of the wizard.

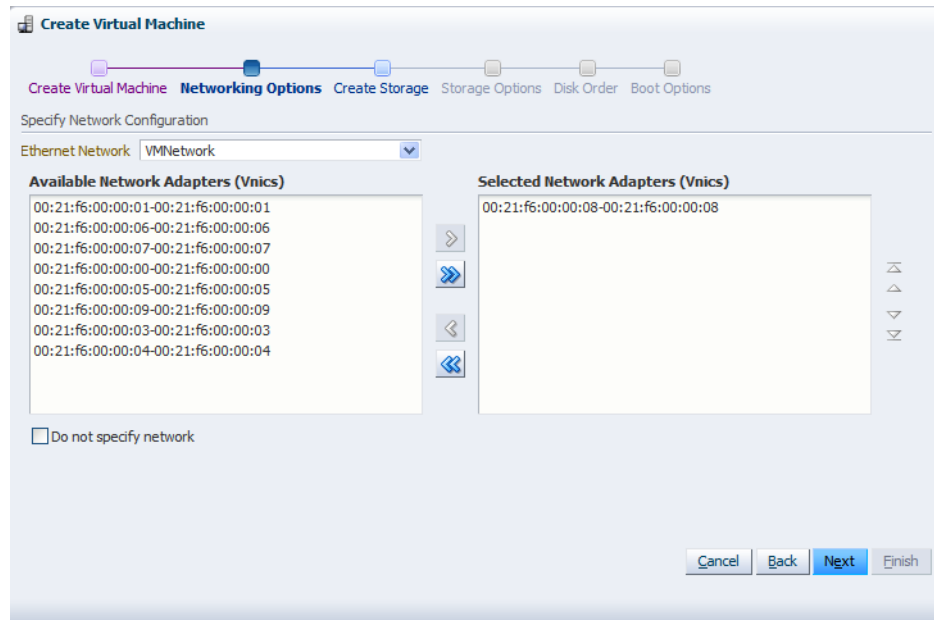
For information on creating a mounted ISO file, see [Section 8.4, "Virtual Machine Installation Media"](#).

- **Operating System:** The operating system of your virtual machine. This setting enables or disables certain virtual machine settings that your guest operating system may require.
- **Enable High Availability:** Select to enable HA. See [Section 7.4, "High Availability \(HA\)"](#) for more information on HA.
- **Repository for Configuration File:** Select the repository in which to create the virtual machine configuration file.

The **Priority** and **Processor Cap%** parameters are passed to the hypervisor, which determines the percentage. These two parameters are always combined by the hypervisor and are a key factor for the performance of the virtual machine.

Click **Next**.

3. The **Networking Options** step is displayed in the wizard.



Select one or more VNICs from the **Network Adapter (Vnics)** column and add them to the virtual machine. A virtual machine can have up to eight virtual network interfaces for emulated guests and up to 31 for PVM guests.

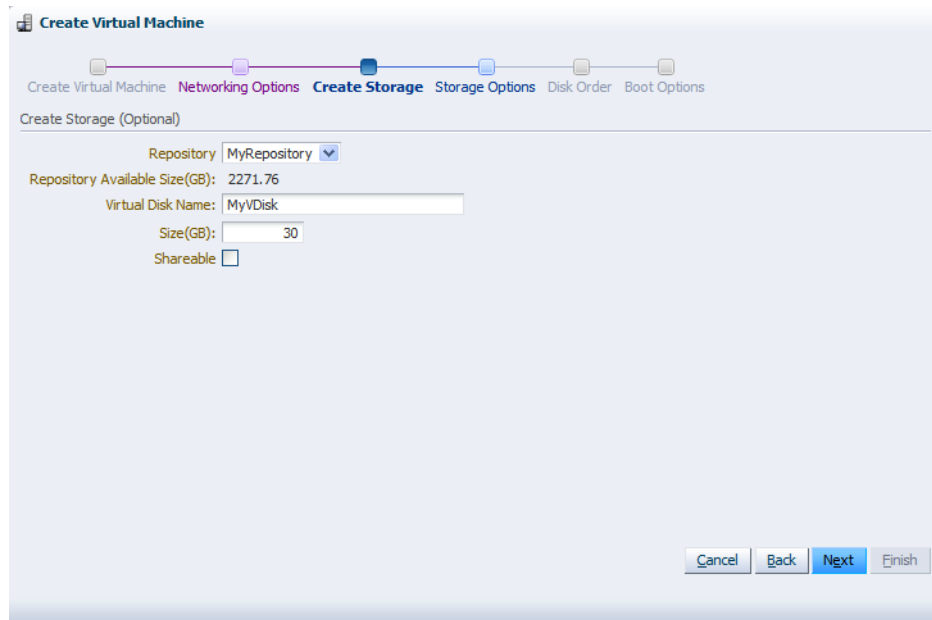
A PVM guest requires network connectivity to perform the operating system install and must have a VNIC.

To select VNICs from another network, select the network in the **Ethernet Network** drop down. The available VNICs for that network are then displayed in the **Network Adapter (Vnic)** column.

If you do not want to specify any network settings, check the **Do not specify network** box.

Click **Next**.

4. The **Create Storage** step is displayed in the wizard.



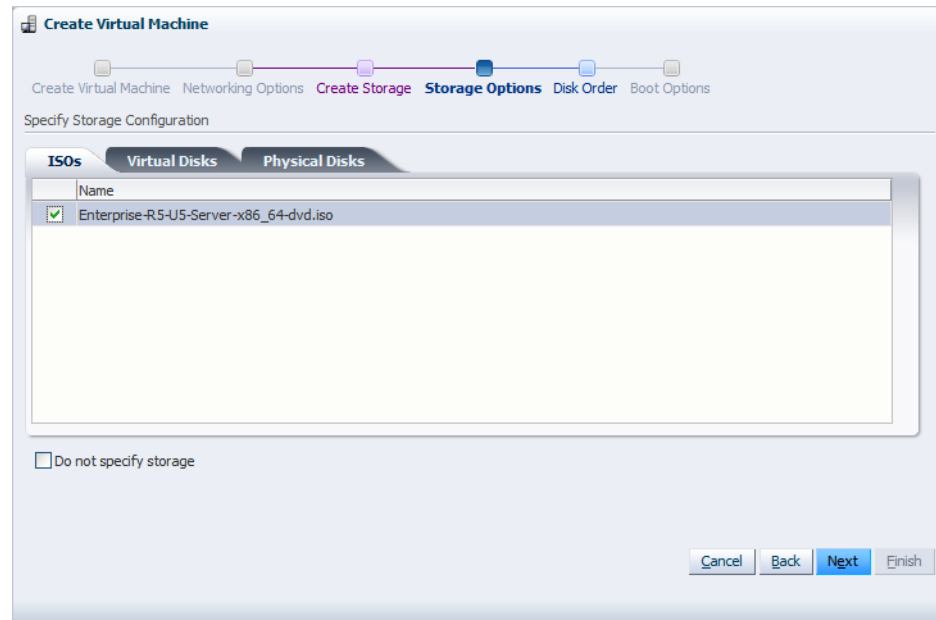
In the **Create Storage** step, optionally create a virtual disk. Enter or select the following to create a virtual disk:

- **Repository:** The repository on which the virtual disk is to be created.
- **Virtual Disk Name:** The name of the virtual disk to be created and made available to the virtual machine. See [Section 8.5.6, "Virtual Disks"](#) for more information about using virtual disks.
- **Size (GB):** The disk size in GB of the virtual disk.
- **Shareable:** Whether the virtual disk should be shareable (read/write) with other virtual machines.

Click **Next**.

Note: If your virtual machine needs more than one disk, you can create the disk(s) afterwards in the repository, and add them to the virtual machine. See [Section 8.5.6, "Virtual Disks"](#) for more information.

5. The **Storage Options** step is displayed in the wizard.



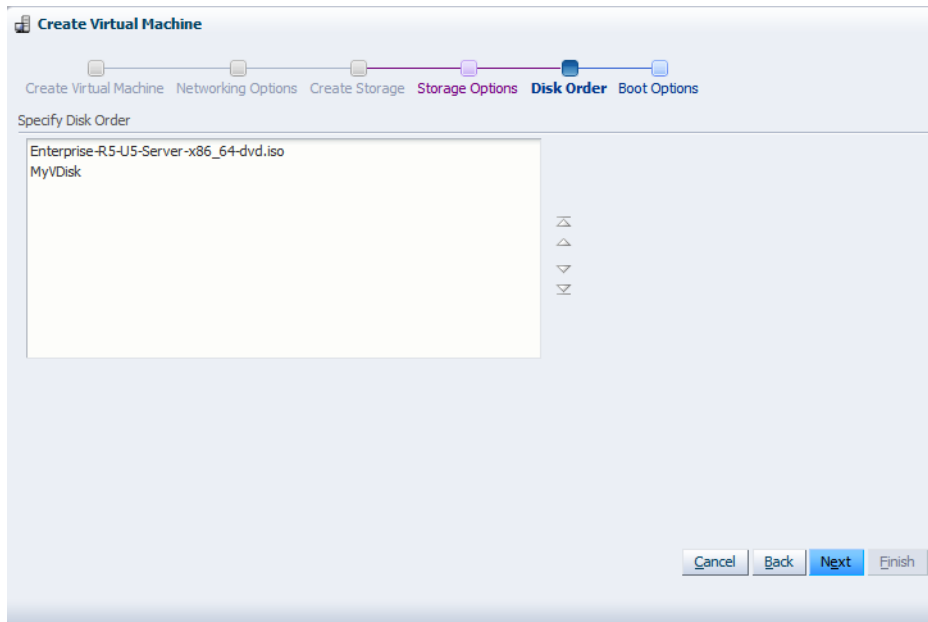
Select the desired storage configuration of your virtual machine, such as virtual and physical disk(s) and ISO file(s).

- **ISOs:** Select the ISO files to add to the virtual machine. ISO files are used to create HVM and PVHVM virtual machines. When creating a virtual machine from an ISO file, you must use a single file. Installations that span multiple ISO files are not supported. ISO files cannot be used to create PVM virtual machines.
- **Virtual Disks:** Select the desired virtual disk(s) to add to the virtual machine.
- **Physical Disks:** Select the physical disks to add to the virtual machine. The physical disks are the disks in a storage array. Physical disks can be shared by virtual machines.

If you do not want to specify any storage settings, check the **Do not specify storage** box.

Click **Next**.

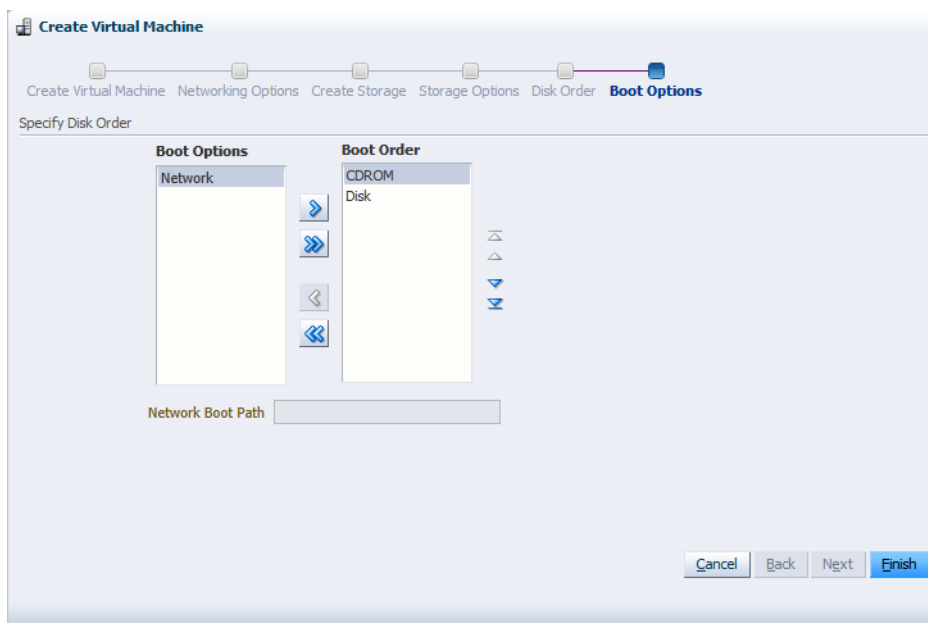
6. The **Disk Order** step is displayed in the wizard.



Set the order the disks should appear in the virtual machine. The disk with the boot partition or installation media should be the first disk listed.

Click **Next**.

7. The **Boot Options** step is displayed in the wizard.



Select the boot media and order for your virtual machine.

If you are creating a hardware virtualized virtual machine (HVM), you can choose the **PXE** boot option (not shown above) as well. If so, remember to put PXE first in the **Boot Order** field, and change the boot order again after installation and before rebooting the VM. To use PXE, you must configure a PXE/tftp environment to offer the necessary boot media and instructions to the VM.

If you are creating a paravirtualized virtual machine (PVM), specify **Network** to be at the top of the **Boot Order** column, and enter the location of the mounted ISO file from which to perform the operating system installation in the **Network Boot Path** field, for example

```
http://example.com/Enterprise-R5-U6-Server-x86_64-dvd.iso/
```

For information on creating a mounted ISO file, see [Section 8.4, "Virtual Machine Installation Media"](#).

You cannot use the **Network Boot Path** field to boot a virtual machine using PXE. This field can only be used to specify the path to a mounted ISO file to use when installing a PVM guest.

Note: If you are creating an Oracle Linux 6 PVM you must also add the kernel and ramdisk parameters in the **Network Boot Path** field, for example:

```
--kernel images/pxeboot/vmlinuz --ramdisk images/pxeboot/initrd.img  
http://example.com/OracleLinux-R6-U1-Server-x86_64-dvd.iso/
```

Click **Finish**.

The virtual machine is created. The status of the virtual machine is **Stopped**. Now you can start and log in to the virtual machine.

To access the virtual machine, select the **Home** view, and go to the **Server Pools** folder. Select the server pool and find the virtual machine in the **Virtual Machines** tab in the management pane.

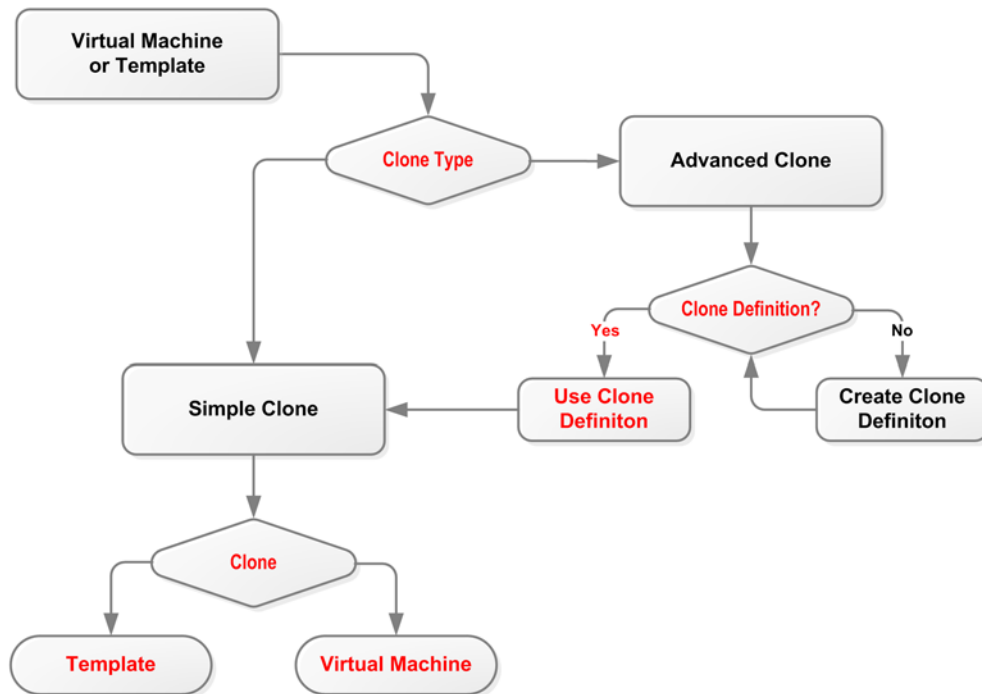
If you created a PVM, there are some steps you should take after the operating system installation is completed:

1. Stop the virtual machine.
2. Edit the virtual machine and remove **PXE** from the **Boot Order** column in the **Boot Options** step of the **Edit Virtual Machine** wizard.
3. Start the virtual machine and complete the installation if necessary.

To edit the virtual machine configuration information, see [Section 8.9.9, "Editing a Virtual Machine"](#).

8.8 Cloning a Virtual Machine or Template

Cloning a virtual machine or template enables you to create multiple virtual machines or templates based on the original. There are two methods of cloning virtual machines; a simple clone, and an advanced clone. A simple clone sets up the clone with the same configuration information as the original. An advanced clone enables you to create and use a clone definition with differing configuration from the original. For example, you can change the cloned virtual machine or template to deploy to a different server pool or repository, with changed memory, virtual CPU number, network settings, and so on. [Figure 8-2](#) shows the process of creating a clone of a virtual machine or template.

Figure 8–2 Cloning a virtual machine or template

To modify the clone parameters, such as virtual disks, network, memory, and so on, you should use a clone definition, and use that clone definition to perform cloning. See [Section 8.8.1, "Creating a Clone Definition"](#) to create a clone definition to during cloning.

A *cold* clone is a clone created from a stopped virtual machine. A cold clone performs a clone of the virtual machine, with safe and consistent virtual disk status. This is useful for creating a virtual machine or template from the original virtual machine. A *hot* clone is created from a running virtual machine. A hot clone creates a clone with inconsistent disk status, and should only be used as a *snapshot* or back up of a virtual machine, perhaps on a virtual machine that requires 100% uptime and cannot be shut down. If you want to use the hot-cloned virtual machine, you should first repair any virtual disks, using a disk repair utility such as `fsck`. Do not use hot cloning for virtual machines running an Oracle Database. Instead, you should use an Oracle Database backup strategy, such as the `rman` utility.

A *thin* clone means copies the virtual machine files and only take up the amount of disk space actually used, not the full specified disk size. Thin cloning can only be used when cloning from and to the same repository, and when the storage used for the storage repository is non-generic (for example, a Sun 7000 or NetApp Storage Connect plug in). Thin cloning is the fastest and most efficient cloning method.

A clone can also be performed using two other file copy methods: *sparse* copy, and *non-sparse* copy. These two cloning methods can be used when cloning from and to different repositories, and when the storage used for the storage repository uses a generic Storage Connect plug in. These cloning methods are slower than thin cloning, but more versatile.

To create a clone:

1. Select the virtual machine or template to clone and display the **Clone Virtual Machine or Template** dialog box. You display this dialog box from different locations, depending on whether you are cloning a virtual machine or a template.
 - **Virtual Machine:** In the **Home** view, select the virtual machine to clone in the navigation pane, right click and select **Clone** from the menu.
 - **Virtual Machine Template:** In the **Home** view click **Server Pools** in the navigation pane, then open the **Templates** tab in the management pane. Select the template to clone and click **Clone**
2. Select the clone type radio button, either **Simple Clone** or **Advanced Clone**. Select or enter the following:
 - **Clone Definition:** Click Search to find the clone definition to use, or to create a new one to use. See [Section 8.8.1, "Creating a Clone Definition"](#). This field is only displayed if you select **Advanced Clone**.

Tip: If you clone a virtual machine or template using the Simple Clone option, the storage repository is locked for the duration of the cloning job; this may be some time in some circumstances. To quickly create clones and not lock the storage repository, use the Advanced Clone option with a clone definition.
 - **Target Clone Type:** Select the clone type, either **Template** or **Virtual Machine**, to specify the object to create from the clone.
 - **Name:** A name for the virtual machine or template.
 - **Description:** A description for the virtual machine or template.
 - **Target Repository:** The repository to store the clone files, such as virtual disks. This field is only displayed if you select **Advanced Clone**.
 - **Target Server Pool:** The server pool on which the clone is to be deployed.

Click **OK**.

8.8.1 Creating a Clone Definition

Cloning a virtual machine or template means making a copy of it, so that you can create multiple virtual machines or templates from the original. When you create an advanced clone a virtual machine or template, you must first create a clone definition to set up the clone parameters, such as networking, and the virtual disk, and ISO resources.

To create a clone definition:

1. Select the virtual machine or template and display the **Clone Virtual Machine or Template** dialog box by:
 - **Virtual Machine:** In the **Home** view, select the virtual machine to clone in the navigation pane, right click and select **Clone...** from the menu.
 - **Virtual Machine Template:** In the **Home** view click **Server Pools** in the navigation pane, then open the **Templates** tab in the management pane. Select the template to clone and click **Clone...**
2. Select **Create New Clone Definition** and click **Next**.
3. Enter a **Name** and **Description** for the clone definition, and click **Next**.

4. Select the virtual disks in the template that you want to include in the clone from the **Disk** column, and the type of storage on which to store the cloned virtual disks from the **Clone Target Type** drop down. Click **Next**.
5. Select the storage location for the cloned virtual disks from the **Clone Target** drop down, and click **Next**.
6. Select whether to use sparse or non-sparse files for the virtual disks, or to use thin cloning in the **Clone Type** drop down.

If you select thin cloning of a virtual disk, you can create a cloned virtual disk with minimal disk space usage. The original virtual disk is used as a base read-only disk, and any copies created from this clone definition only require disk space to store differences in the new virtual disks.

Click **Next**.

7. Select the **VNICs** from the template that you want to include in your clone definition, and the **Ethernet Network** to which they should belong. Click **Finish**.

The clone definition is now available to use to create a virtual machine, or template. See [Section 8.8, "Cloning a Virtual Machine or Template"](#) for information on using the clone definition to create a virtual machine or template.

You cannot display a list of all the available clone definitions. To see the clone definitions for a virtual machine or template, select the virtual machine or template and display the Clone Virtual Machine or Template dialog box.

8.9 Managing Virtual Machines

When you have created a virtual machine, there are a number of actions you can perform on them in Oracle VM Manager. This section describes the actions you can perform on virtual machines and contains:

- [Starting a Virtual Machine](#)
- [Live Migration of a Virtual Machine](#)
- [Suspending a Virtual Machine](#)
- [Resuming a Virtual Machine](#)
- [Shutting Down a Virtual Machine](#)
- [Killing a Virtual Machine](#)
- [Restarting a Virtual Machine](#)
- [Viewing Virtual Machine Details](#)
- [Editing a Virtual Machine](#)
- [Deleting a Virtual Machine](#)

8.9.1 Starting a Virtual Machine

After a virtual machine is created, you can start it. Starting a virtual machine is analogous to starting a computer by pressing the **Power On** button.

To start a virtual machine:

1. Select the **Home** view, and select the virtual machine in the **Server Pools** folder.
2. Right-click on the virtual machine and select **Start** from the menu.

The virtual machine is started.

8.9.2 Live Migration of a Virtual Machine

Live migration is a process to move a running virtual machine from one Oracle VM Server to another, while applications on the existing virtual machine continue to run. Live migration ensures high availability of virtual machines. This feature is important, and useful, when the existing Oracle VM Server may be out of commission, or on a planned shutdown for maintenance purposes.

You can only migrate one virtual machine at a time. Cross-server pool live migration is not allowed. You can only migrate virtual machines from one Oracle VM Server to another within the same server pool. You must use identical computers to perform live migrations, that is, the computer make and model number of both the source computer and the destination computer must be identical.

To migrate a virtual machine:

1. Select the **Home** view, and select the virtual machine in the **Server Pools** folder.
2. Right-click the virtual machine, and select **Migrate** from the context menu.
3. Select the Oracle VM Server to which you want to migrate your virtual machine and click **OK**.

The virtual machine is migrated.

8.9.3 Suspending a Virtual Machine

Suspending a virtual machine is analogous to putting a computer into sleep mode. When a virtual machine is suspended, the current state of the operating system, and applications is saved, and the virtual machine put into a suspended mode. When you resume the virtual machine, the operating system and applications continue from the same point you suspended the virtual machine.

The Oracle VM Server resources used by the virtual machine are not released. If you want to release these resources, you should shut down the virtual machine.

To suspend a virtual machine:

1. Select the **Home** view, and select the virtual machine in the **Server Pools** folder.
2. Right-click on the virtual machine and select **Suspend** from the menu.

The virtual machine state is saved and the virtual machine suspended.

To resume the virtual machine, see [Section 8.9.4, "Resuming a Virtual Machine"](#).

8.9.4 Resuming a Virtual Machine

Resuming a suspended virtual machine is analogous to waking up a computer that has been in sleep mode. When you resume a suspended virtual machine, the operating system and applications continue from the same point you suspended the virtual machine.

The Oracle VM Server resources used by the virtual machine are not released. If you want to release these resources, you should shut down the virtual machine.

To resume a virtual machine:

1. Select the **Home** view, and select the virtual machine in the **Server Pools** folder.
2. Right-click on the virtual machine and select **Resume** from the menu.

The virtual machine state is retrieved and the virtual machine started.

8.9.5 Shutting Down a Virtual Machine

When a virtual machine is not in use, you should shut it down to release system resources. Stopping a virtual machine is analogous to a normal shutdown of a physical computer.

If you want to save the state of the virtual machine, you should suspend it. See [Section 8.9.3, "Suspending a Virtual Machine"](#) for information on suspending a virtual machine.

To shut down a virtual machine:

1. Select the **Home** view, and select the virtual machine in the **Server Pools** folder.
2. Right-click on the virtual machine and select **Stop** from the menu.

Note: You can also shut down a virtual machine from within your virtual machine, the same way you shut down a physical computer.

Note

After issuing the stop command, the status of the VM is changed to *"Stopped"*. However, this only indicates that the command was acknowledged. There is no guarantee that the VM is effectively shut down correctly. This is expected behavior since an operating system running on a physical pc may also "hang" during the shutdown sequence.

If the virtual machine fails to shut down, you can power it off using the kill virtual machine option, which is similar to unplugging the power cable from a physical machine. To perform a power off (kill) of a virtual machine, see [Section 8.9.6, "Killing a Virtual Machine"](#).

8.9.6 Killing a Virtual Machine

To kill a virtual machine is equivalent to performing a power off of a virtual machine, similar to unplugging the power cable from a physical machine. This is not the recommended method of shutting down a virtual machine, but may be used if the shut down command fails to shut down the virtual machine.

To kill a virtual machine:

1. Select the **Home** view, and select the virtual machine in the **Server Pools** folder.
2. Right-click on the virtual machine and select **Kill** from the menu.

8.9.7 Restarting a Virtual Machine

Restarting a virtual machine is analogous to rebooting a computer. You may need to restart a virtual machine if an operating system update requires you to restart the virtual machine, for example Microsoft Windows updates.

To restart a virtual machine:

1. Select the **Home** view, and select the virtual machine in the **Server Pools** folder.
2. Right-click on the virtual machine and select **Restart** from the menu.

8.9.8 Viewing Virtual Machine Details

You can view information about a virtual machine on the virtual machine's Info tab. The Info tab contains information about the configuration, networks and storage, and jobs associated with the virtual machine.

To view details of a virtual machine:

1. Select the **Home** view.
2. Select the virtual machine from the **Server Pools** folder. The configuration information about the virtual machine is displayed in the **Info** tab.

The **Configuration** management pane contains information about the virtual machine's operating system, processors, memory, repository location, and so on. The **Networks & Storage** management pane contains information on the virtual machine's network configuration, virtual disks, ISOs, repository contents, and so on. The **Jobs** management pane lists all the jobs associated with the virtual machine.

All events associated with the virtual machine are displayed in the **Events** tab.

To edit the virtual machine details, see [Section 8.9.9, "Editing a Virtual Machine"](#).

8.9.9 Editing a Virtual Machine

To edit a virtual machine:

1. Select the **Home** view, and select the virtual machine from the **Server Pools** folder.
2. Right-click the virtual machine and select **Edit** from the menu.

The **Edit Virtual Machine** wizard starts. Follow the steps in the wizard to edit the virtual machine. See [Section 8.7, "Creating a Virtual Machine"](#) for the details of the wizard.

8.9.10 Deleting a Virtual Machine

When you delete a virtual machine, all the files and data associated with this virtual machine are removed from Oracle VM Manager. Before deleting a virtual machine, make sure you do not need it any longer.

Note: Delete the virtual machine only when the virtual machine status is **Stopped** or **Error**.

To delete a virtual machine in the Stopped or Error status:

1. Select the **Home** view, and select the virtual machine from the **Server Pools** folder.
2. In the Toolbar, click the **Delete** button.
3. Select any virtual disks associated with the virtual machine that you want to delete. Click **OK** to delete the virtual machine and the selected virtual disks.

8.10 Connecting to a Virtual Machine

You can connect to a virtual machine using its *console*. The console is the remote control system of Oracle VM, and enables you to work and interact with your virtual machines.

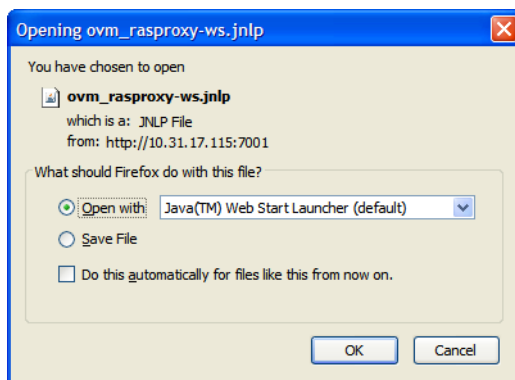
If you have VNC Viewer (from RealVNC), or TightVNC Viewer installed on your client computer, the Oracle VM Manager user interface finds the installation and uses

it to create the connection with the virtual machine. Oracle recommends you install RealVNC on the client computer as it renders more quickly, and has less mouse control issues than Tight VNC.

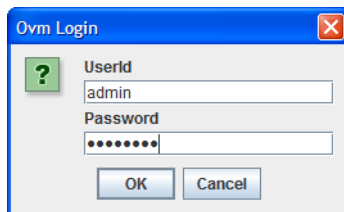
If no client viewer is available, the Oracle VM Manager user interface looks for TightVNC on the Oracle VM Manager host computer and uses this to create the connection with the virtual machine. See *Oracle VM Installation and Upgrade Guide* for information on installing TightVNC on the Oracle VM Manager host computer.

To connect to a virtual machine's console:

1. Select the **Home** view, and select the virtual machine in the **Server Pools** folder in the navigation pane.
2. Select **Launch Console** from the **Actions** menu.
3. A dialog box is displayed requesting to start a Java proxy to connect to the virtual machine. Click **OK**.



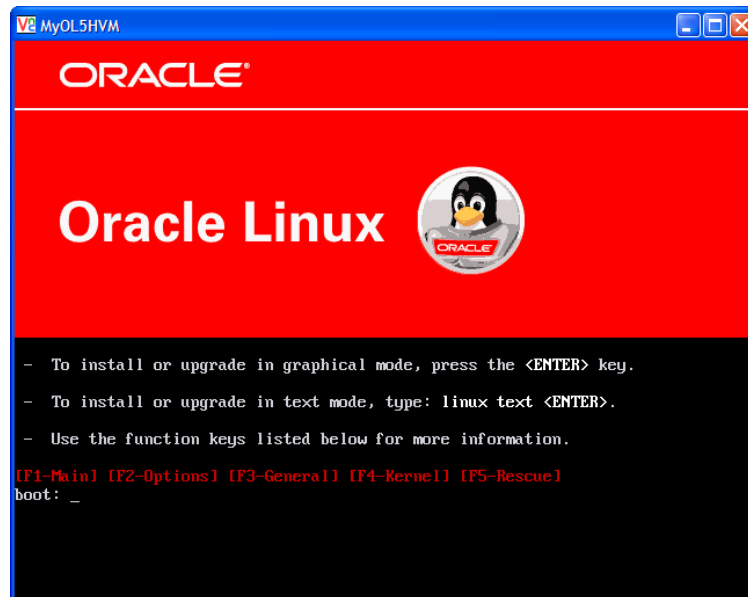
4. If a VNC viewer is found, it is started. A console login dialog box is displayed. Enter the login you use for Oracle VM Manager and click **OK**.



If the console does not start, check that your browser allows pop-ups to be displayed.

You can configure which VNC viewer to use with the **Options > Configuration** menu item of the Java proxy window. Enter the path to the VNC client and click **OK**. Use quotes around the path if it contains spaces.

5. The virtual machine console is displayed. Log in and interact with the virtual machine as you would through any other VNC session. This example shows the initial installation screen for a virtual machine created with an Oracle Linux operating system ISO file.



If required, enter the user name and password of the guest operating system to log in to the operating system.

Depending on the method by which you created the virtual machine, you may need to continue with some further tasks before you can use the virtual machine.

- If you created the virtual machine based on a template, you can directly use the guest operating system and applications installed in advance, without any further configuration.
- If you created the virtual machine using the fully virtualized method, the installation of the guest operating system is triggered after your first login. Follow the installation wizard to install the guest operating system. For more information on creating virtual machines using the fully virtualized method, see [Section 8.7, "Creating a Virtual Machine"](#).

Note: You must install the guest operating system using a single ISO file. If your operating system installer consists of multiple ISO files, you cannot install it.

For information on the supported guest operating systems, see *Oracle VM Release Notes*.

8.11 Installing Paravirtualized Drivers

For optimized performance, you can install paravirtualized drivers on hardware virtualized machines. Paravirtual drivers are optimized and improve the performance of the operating system in a virtual machine. These drivers enable high performance throughput of I/O operations in guest operating systems on top of the Oracle VM Server hosts.

Creating hardware virtualized machines may require that you install paravirtual drivers for your hardware on the guest operating system.

To install paravirtual drivers on an Oracle Linux guest operating system:

1. Download the paravirtualized kernel on the virtual machine, for example for an Oracle Enterprise Linux 5.5 64-bit guest, download:

```
http://public-yum.oracle.com/repo/EnterpriseLinux/EL5/5/base/x86_64/kernel-xen-2.6.18-194.el5.x86_64.rpm
```

2. Install the paravirtualized kernel on the virtual machine:

```
# rpm -ivh kernel-xen-version.type.rpm
Preparing...                               ##### [100%]
   1:kernel-xen                             ##### [100%]
```

3. Back up the old initrd file, and make the new one with xennet, xenblk driver:

```
# mv initrd-oldversion.el5xen.img initrd-oldversion.el5xen.img.old
# mkinitrd initrd-newversion.el5xen.img newversion.el5xen --with=xenblk
--with=xennet --preload=xenblk --preload=xennet
```

4. Edit the `/boot/grub/grub.conf` file to be:

```
default=0
timeout=5
splashimage=(hd0,0)/grub/splash.xpm.gz
hiddenmenu
title Enterprise Linux Enterprise Linux Server (version.el5xen)
    root (hd0,0)
    kernel /vmlinuz-version.el5xen ro root=LABEL=/
    initrd /initrd-version.el5xen.img
```

5. Modify the `/etc/modprobe.conf` file to include:

```
alias scsi_hostadapter xenblk
alias eth0 xennet
```

6. Shut down the virtual machine. See [Section 8.9.5, "Shutting Down a Virtual Machine"](#) for information on shutting down a virtual machine.
7. Edit the virtual machine and change the **Domain Type** to Xen PVM. See [Section 8.9.9, "Editing a Virtual Machine"](#) for information on editing a virtual machine.
8. Start the virtual machine. See [Section 8.9.1, "Starting a Virtual Machine"](#) for information on starting a virtual machine.

Converting Hosts

This chapter discusses creating hardware virtualized guest images from existing physical computers running any of the operating systems supported by Oracle VM.

9.1 Converting a Host

You can convert the operating system and application software on a computer to an Oracle VM hardware virtualized guest image using the Physical to Virtual (P2V) conversion utility. The P2V utility is included on the Oracle VM Server CD. The operating system must be one of the Oracle VM supported guest operating systems. See the *Oracle VM Release Notes* for a list of the supported guest operating systems. To perform a P2V conversion, the host computer must have a CPU that supports PAE (Physical Address Extension).

The P2V conversion process creates a virtual machine configuration file (vm.cfg), allows you to make some modifications in terms of sizing of the virtual machine hardware, and then replicates the physical image and transfers it over the network to a storage repository using Oracle VM Manager. The image on your physical computer is not changed in any way.

The P2V utility converts disks on the computer to virtual disk images. The first four virtual disk images are created as IDE disks (hda, hdb, hdc, and hdd) on the guest, using the original disk names. Up to seven additional disks are created as SCSI devices (sda, sdb, sdc, and so on). The disk entries in the vm.cfg file look similar to:

```
disk = ['file:System-sda.img,hda,w',  
'file:System-sdb.img,hdb,w',  
'file:System-sdc.img,hdc,w',  
'file:System-sdd.img,hdd,w',  
'file:System-sde.img,sda,w',  
'file:System-sdf.img,sdb,w',  
'file:System-sdg.img,sdc,w',  
'file:System-sdh.img,sdd,w',  
'file:System-sdi.img,sde,w',  
'file:System-sdj.img,sdf,w',  
'file:System-sdk.img,sdg,w',  
]
```

The hardware virtualized guest created by the P2V utility must have its own network configuration. If you use the same network configuration as the original computer, a network clash may occur as two computers on the network may have the same IP and MAC address. When the guest is started, make sure the network device is detected and a new network device is configured.

You can run the P2V utility interactively, or as an automated process using a kickstart configuration file. When you use the P2V utility with a kickstart file, no user intervention is required.

9.1.1 Using the P2V Utility

When you use the P2V utility, you are prompted for all required information.

To create a virtual machine image of a computer:

1. Insert the Oracle VM Server CDROM into the CDROM drive of the computer you want to image.

Note: This procedure is for 64-bit computers. If you want to convert a 32-bit host computer to a virtual machine template, you must use the Oracle VM 2.x CD.

2. Start the computer with the Oracle VM Server CDROM.
3. The **Oracle VM Server** screen is displayed.

Figure 9–1 Oracle VM Server Installation Screen



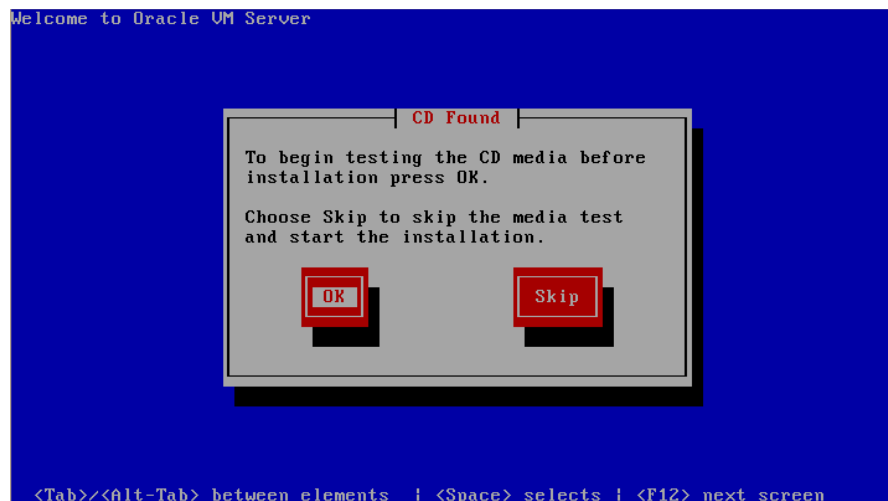
At the boot : prompt, enter:

p2v

Press **Enter**.

4. The **CD Found** screen is displayed.

Figure 9-2 CD Found Screen

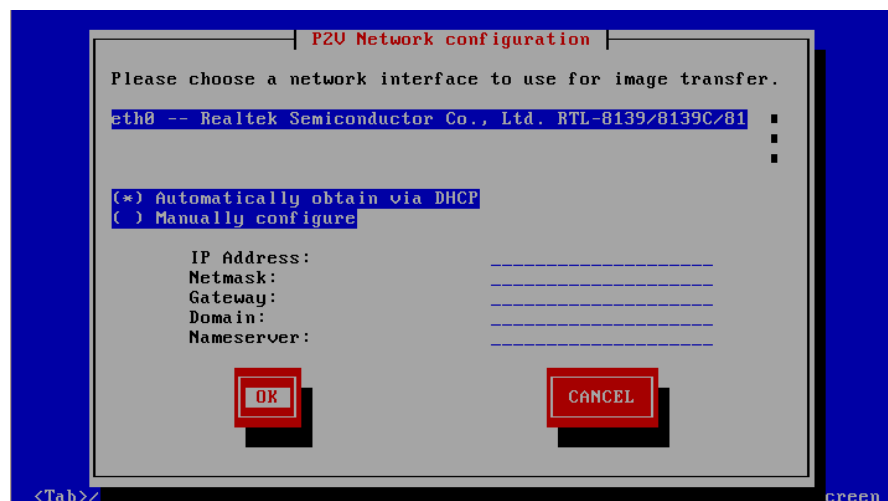


If you want to make sure the CDROM is error free, you can have the installer test it for errors. To test the CDROM, select **OK** and press **Enter**. The CDROM is tested and any errors are reported.

To skip media testing and continue with the installation, select **Skip** and press **Enter**.

5. The **P2V Network Configuration** screen is displayed.

Figure 9-3 P2V Network Configuration Screen



Select your Ethernet driver from the list displayed.

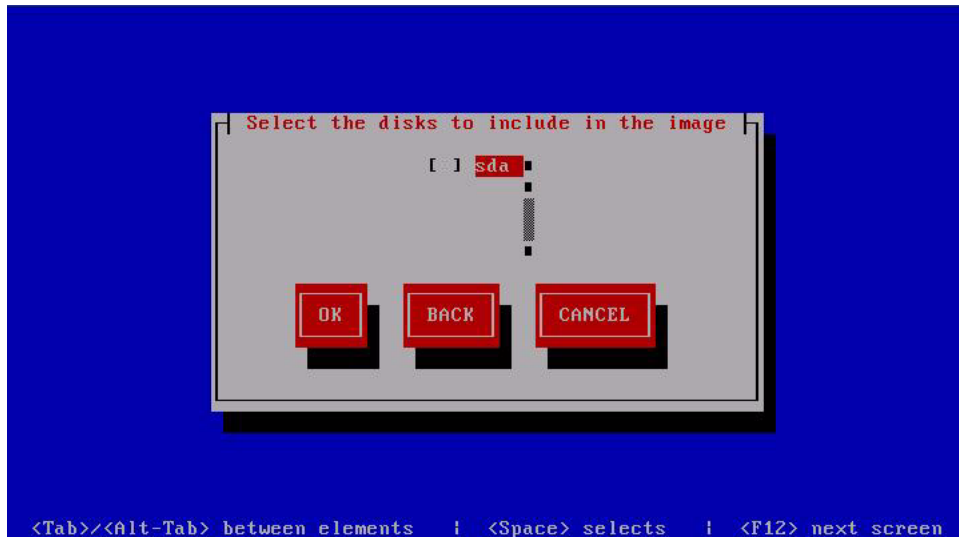
If your computer uses DHCP to assign its IP address, select **Automatically obtain via DHCP**.

If your computer uses a static IP address, select **Manually configure**, and enter the IP address and netmask, gateway, domain and name server for your computer.

Select **OK** and press **Enter**.

6. The disk selection screen is displayed.

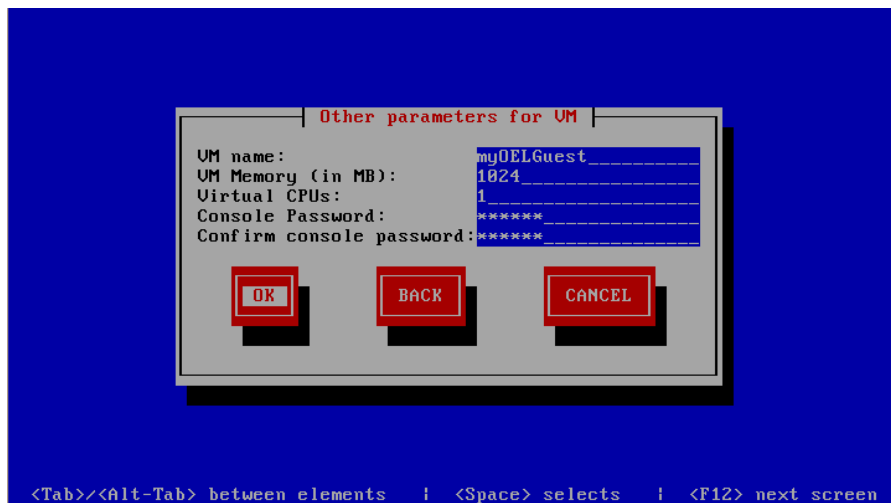
Figure 9–4 Disk Selection Screen



Select the disk partition(s) on the computer to include in the guest image. Select **OK** and press **Enter**.

7. The **Other parameters for VM** screen is displayed.

Figure 9–5 Other Parameters for VM Screen

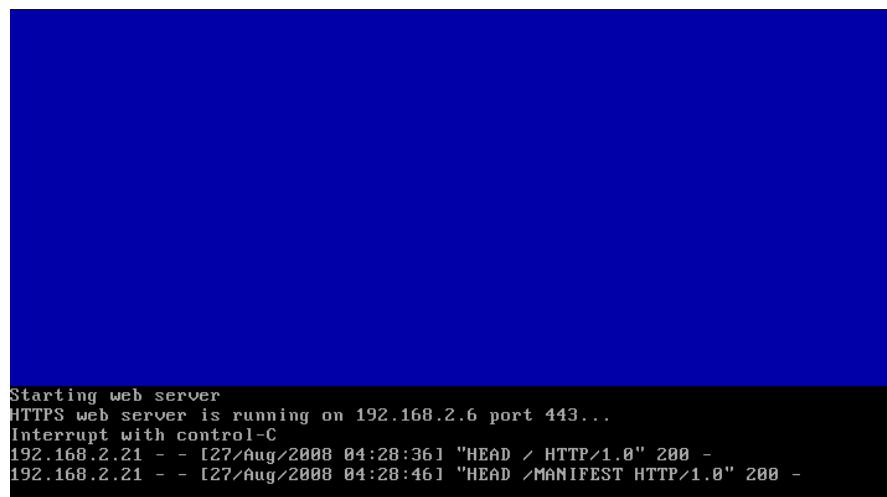


Enter information about the guest image for:

- VM (guest) name
- VM (guest) memory
- Number of virtual CPUs
- Console password. This is no longer required, but you must enter a value.

Select **OK** and press **Enter**.

8. A secure web server (HTTPS) is started. The IP address of the computer, and port number the web server is available on is displayed.

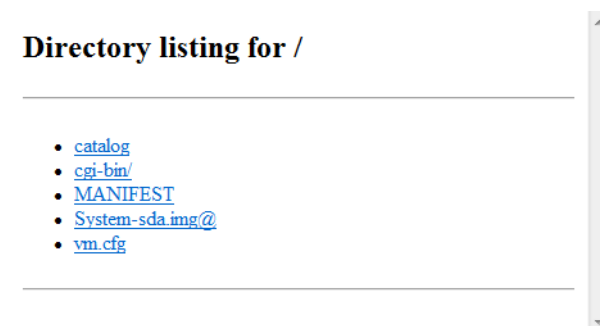
Figure 9–6 Web Server Screen


```
Starting web server
HTTPS web server is running on 192.168.2.6 port 443...
Interrupt with control-C
192.168.2.21 - - [27/Aug/2008 04:28:36] "HEAD / HTTP/1.0" 200 -
192.168.2.21 - - [27/Aug/2008 04:28:46] "HEAD /MANIFEST HTTP/1.0" 200 -
```

Open a web browser on another computer and enter the URL created using the information displayed on the computer running the P2V utility, for example

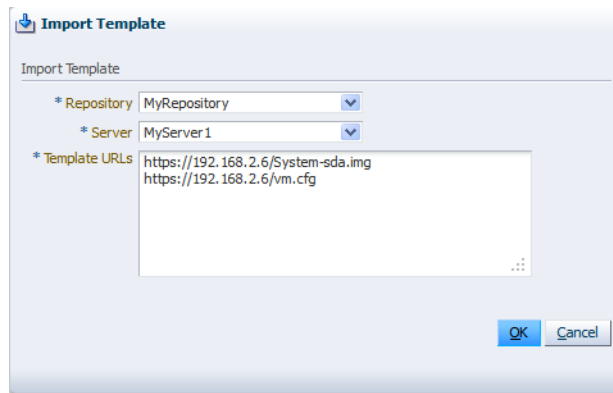
`https://192.168.2.6/`

You do not need to enter the port number as this is the default port number for HTTP's connections. A directory listing is displayed which contains the files created by the P2V utility. Take a note of the URLs for the `vm.cfg` and `*.img` files as you use them in the next step when importing the virtual machine into Oracle VM Manager.

Figure 9–7 List of P2V files

Log in to Oracle VM Manager and import the guest using the import template feature. When you import the guest, you should add the URLs for each virtual disk image and the virtual machine configuration file on a new line in **Template URLs** field in the **Import Template** dialog, as shown in [Figure 9–8](#).

Figure 9–8 Importing a virtual machine using P2V



See [Section 8.5.3.1, "Importing a Virtual Machine Template"](#) for information on importing templates.

9. When the virtual machine template is added to the repository, you should terminate the P2V utility on the host computer. Press **Control+C** to terminate the P2V utility on the computer. Remove the Oracle VM Server CDROM from your CDROM drive. Restart the computer.

The guest image is created and available in the repository as a hardware virtualized virtual machine template.

9.1.2 Using the P2V Utility with a Kickstart File

You can use a kickstart file to automate the creation of a guest image of a physical computer using the P2V utility. When you use the P2V utility with a kickstart file, no user intervention is required. If there are any missing parameters in the kickstart file, you are prompted to enter them.

To use a P2V kickstart file, you must create a file with the P2V configuration options and parameters and place it on a kickstart server. The kickstart server can be made available using NFS, FTP, or HTTP. The kickstart server is set up in the same way as a standard Oracle Linux or Red Hat kickstart server and is beyond the scope of this book.

The following example P2V kickstart file starts sends the guest image to an instance of Oracle VM Manager via network device eth0, which obtained an IP address via DHCP:

```
p2v
cdrom
lang en_US.UTF-8
keyboard us
target --ovmmmanager
network --device eth0 --bootproto dhcp
diskimage --device /dev/sda --type IDE
vm_options --name myGuest --mem 1024 --vcpus 1 --consolepasswd mypassword
```

See [Appendix A, "P2V Parameters"](#) for detailed information on the P2V kickstart file options and parameters.

To create an Oracle VM virtual machine image of a computer using the P2V utility with a kickstart file:

1. Create a P2V kickstart file and copy it to your kickstart server.

2. Insert the Oracle VM Server CDROM into your CDROM drive of the computer you want to image.
3. Restart the computer with the Oracle VM Server CDROM.
4. The **Oracle VM Server** screen is displayed. At the `boot :` prompt, enter `p2v` and the protocol and location for the kickstart file. For example, to use a kickstart file called `ks.cfg` on an HTTP server named `http://example.com`, enter:

```
p2v ks=http://example.com/mypath/ks.cfg
```

Press **Enter**.

5. If there are any missing parameters in the kickstart file, you are prompted to enter them.
6. If the kickstart file includes the directive to import the guest image to Oracle VM Manager, a secure web server (HTTPS) is started. A screen is displayed giving the IP address of the computer, and port number the web server is available on. Log in to Oracle VM Manager and import the guest using the import template feature as described in [Section 9.1.1, "Using the P2V Utility"](#).
7. When the virtual machine template is added to the repository, you should terminate the P2V utility on the host computer. Press **Control+C** to terminate the P2V utility on the computer. Remove the Oracle VM Server CDROM from your CDROM drive. Restart the computer.

The guest image is created and available in the repository as a hardware virtualized virtual machine template.

A

P2V Parameters

This appendix contains information about the Physical to Virtual (P2V) conversion utility and details the usage, syntax and parameters.

P2V

The P2V conversion utility enables you to convert a computer's operating system (Linux and Windows) and applications to an Oracle VM hardware virtualized guest image. The P2V utility is included on the Oracle VM Server CD. You can access the P2V utility by restarting a computer with the Oracle VM Server CD. The Oracle VM Server startup screen is displayed. At the `boot :` prompt, enter:

```
p2v
```

You can use a P2V kickstart file to automate creation of hardware virtualized guest images from physical computers. This section discusses the options and parameters of the P2V kickstart file.

The P2V utility converts disks on the computer to virtual disk images. The virtual disk images are created as IDE disks (`hda`, `hdb`, `hdc`, `hdd`, and so on) on the guest, using the original disk names. When you use a P2V kickstart file, up to four disks are automatically deployed in the guest. Any extra disks are converted and added to the guest configuration file (`vm.cfg`), although they are not deployed. To deploy the additional disks in the guest, edit the guest configuration file, remove the comments from the disk entries, and map the additional disks to SCSI device names, for example, `sda`, `sdb`, and `sdc`. The boot disk must always be mapped to device `hda`. Any files on the guest which contain references to these devices must also be changed, for example, the `/etc/fstab` file may contain references to `/dev/hda1`, `/dev/sda1`, and so on.

When you use a P2V kickstart file, at least one network interface must use DHCP. This is required for the computer running the P2V utility to read the kickstart file over the network. The network configuration for this network interface cannot be modified from the kickstart file.

If you want the P2V utility's web server to listen using a network interface other than the one used to initiate the kickstart session, the network configuration (DHCP or static IP address) for that network interface can be specified in the kickstart file.

A number of screens may be displayed prior to the P2V utility starting with a kickstart file. You can suppress these screens to fully automate the P2V utility. Prior to the P2V utility starting, you may see up to four screens:

- P2V Network Configuration screen
- Language selection screen
- Keyboard selection screen
- Installation source screen

The following sections give examples on how to suppress these screens.

Suppressing the P2V Network Configuration Screen

To suppress the P2V Network Configuration screen, supply the ethernet device on the command line, for example:

```
p2v ks=http://example.com/ks.cfg ksdevice=eth0
```

Suppressing the Language Selection Screen

To suppress the Language selection screen, supply the language kickstart parameter, for example:

```
lang en_US.UTF-8
```

Suppressing the Keyboard Selection Screen

To suppress the Keyboard selection screen, supply the keyboard kickstart parameter, for example:

```
keyboard us
```

Suppressing the Installation Source Screen

To suppress the Installation source screen, supply the source kickstart parameter, for example:

```
cdrom
```

Example P2V Kickstart File

An example P2V kickstart file follows:

```
p2v
cdrom
lang en_US.UTF-8
keyboard us
target --ovmmanager
network --device eth0 --bootproto dhcp
diskimage --device /dev/sda --type IDE
vm_options --name myGuest --mem 1024 --vcpus 1 --consolepasswd mypassword
```

Options

The following parameters are accepted in a P2V kickstart file.

p2v

Indicates the kickstart file is intended to automate a P2V conversion. This parameter is required in order to perform an automated P2V conversion and should be supplied at the Oracle VM Server `boot: prompt` instead of `install`, `update`, or `rescue`. It accepts no parameters.

target [option]

Sets the end destination for the guest image.

The *option* parameter can only contain the following:

```
--ovmmanager
```

Sets the P2V utility to operate in HTTPS server mode to transfer the guest image to a running instance of Oracle VM Manager.

diskimage [option...]

Denotes a disk to be included in the guest image. The P2V utility uses device mapper-based snapshotting to copy the disk as a *system-*.img* file on the target computer. There may be multiple `diskimage` directives in a P2V kickstart file, each resulting in a disk image in the guest image. The `--device` parameter must always be used with the `diskimage` directive to indicate which device should be imaged.

The *option* parameter is one or more of the following:

```
--device path
```

The device to image. *path* must be the full path to the device. For example:

```
diskimage --device /dev/sda
```

```
--type [IDE | SCSI | LVM | MDRAID]
```

Sets the type of disk. Must be one of IDE, SCSI, LVM, or MDRAID. Devices /dev/hda, /dev/hdb, /dev/hdc, and /dev/hdd should be IDE. Devices /dev/sd[a-zz] should be SCSI. A logical volume should be LVM. Devices /dev/md[a-zz] should be MDRAID. For example:

```
diskimage --device /dev/hda --type IDE
```

network [option...]

Configures network information for the computer.

The *option* parameter is one or more of the following:

```
--bootproto [dhcp | bootp | static]
```

Sets the method by which the network configuration is determined. Must be *dhcp*, *bootp*, or *static*. The default is *dhcp*. *bootp* and *dhcp* are treated as the same.

dhcp uses a DHCP server to obtain the networking configuration, for example:

```
network --bootproto dhcp
```

static requires all the necessary networking information. As the name implies, this information is static and is used during and after the installation. The entry for static networking is more complex, as you must include all network configuration information on one line. You must specify the IP address, netmask, gateway, and nameserver, for example:

```
network --bootproto static --ip 10.0.2.15 --netmask 255.255.255.0 --gateway 10.0.2.254 --nameserver 10.0.2.1
```

The *static* method has the following restrictions:

- All static networking configuration information must be specified on one line; you cannot wrap lines using a backslash.
- You can only specify one nameserver.

```
--ip ipaddress
```

The IP address for the computer.

```
--gateway ipaddress
```

The IP address for the default gateway.

```
--nameserver ipaddress
```

The IP address for the primary nameserver.

```
--netmask netmask
```

The netmask for the computer.

vm_options [option...]

Sets the configuration options for the guest.

```
--name name
```

The name of the guest.

```
--mem size
```

The memory allocation for the guest in Mb.

```
--vcpus number
```

The number of VCPUs for the guest.

`--consolepasswd password`

The console password for the guest. For example:

```
vm_options --name myGuest --mem 1024 --vcpus 1 --consolepasswd mypassword
```

Troubleshooting

This chapter contains information on using the jobs framework, and troubleshooting Oracle VM, and contains:

- [Working with the Jobs Framework](#)
- [Troubleshooting Oracle VM Server](#)
- [Troubleshooting Oracle VM Manager](#)

For additional information, see the Oracle support-oriented Web sites:

- My Oracle Support, <http://support.oracle.com>
- Oracle Virtualization Forum, <http://forums.oracle.com/forums/forum.jspa?forumID=823>

B.1 Working with the Jobs Framework

Oracle VM Manager uses a job operations framework that supports a flexible approach to the configuration of physical and virtual objects. Oracle VM Manager maintains an accurate and consistent view of the virtualization environment while users perform separate and simultaneous jobs. Each configuration change (a transaction performed by a single user) is considered a *job*.

The following sections describe jobs, and how resources are locked and released at the start and conclusion of each job, and how to manage jobs. This section contains:

- [Jobs Overview](#)
- [Jobs and Resource Locking](#)
- [Locks and Multiple Users](#)
- [Job Failure and Rollback](#)
- [Jobs and Events](#)
- [Job States](#)
- [Starting A Job](#)
- [Aborting A Job](#)
- [Determining the Cause of a Job Failure](#)

B.1.1 Jobs Overview

A job is a configuration change that affects one or more physical or virtual objects. Examples of user operations that can be included in a job are:

- Adding or deleting a server pool
- Adding a VNIC to a virtual machine

A single job can contain one or many individual operations. When a job is in progress, a yellow lock appears to the left of the resources included in the job.

B.1.2 Jobs and Resource Locking

A single job can contain one or many individual operations. When a job is in progress, a yellow lock appears to the left of the resources included in the job.

Objects involved in a job are locked to all other Oracle VM Manager users until the job is completed or aborted. Only a user with the same permission level on the object can unlock it. This assures that a consistent and accurate view is maintained for all users.

The state of locked objects cannot be known until the locks are cleared. The state of Oracle VM Manager is always accurately reflected by the state of objects that are not locked.

B.1.3 Locks and Multiple Users

A number of different users may perform jobs simultaneously, provided they are performed on different objects. For example, suppose User A has created a Finance-One server pool and begins a job by moving Oracle VM Servers into another server pool. At the same time, User B modifies the resources of the Commodities server pool. Each user has a separate job pane for jobs, and would see each other's objects as locked. The objects remain locked until the jobs are completed.

Prior to completing a job, a lock can be cleared in two ways:

- By logging out the user who initiated the lock. This action can be performed by the user, or by an Oracle VM Manager administrator.
- By direct action of an Oracle VM Manager administrator.

As a job completes, its progress is shown in the Jobs tab. All locks are cleared when a job completes.

B.1.4 Job Failure and Rollback

Job operations are validated by Oracle VM Manager as they are added to the Job tab. The failure of any operation causes the following to happen:

- The job is cancelled.
- All operations specified by the job are cancelled.
- The state of Oracle VM Manager is rolled back to the state it was prior to the start of the job.
- All locks in the operation are released.

B.1.5 Jobs and Events

When a job operation fails, one or more events may be generated and displayed in Oracle VM Manager. Events are flagged with yellow icons in the navigation tree.

To get information on failed events, click the **Events** tab in the **Jobs** management pane.

B.1.6 Job States

A job listed in the Job tab can have any of the states defined in [Table B-1](#).

Table B-1 Job states

Job State	Definition
Completed	The job has completed.
Running	The job is in progress.
Aborted	The job has been aborted. Oracle VM Manager has rolled-back to its previous state and all locks have been released.
Failed	The job has failed. Oracle VM Manager has rolled-back to its previous state and all locks have been released.

B.1.7 Starting A Job

A job begins when you make any change in Oracle VM Manager. Each change you make appears in the Job pane as a discrete operation. Job operations can be comparatively minor actions, such as renaming a virtual machine. Operations may also have a wider scope, such as the creation of a new network or storage device. Performing any of these actions changes the configuration of Oracle VM Manager. When a new job is started, information about the job is displayed in the Jobs pane at the bottom of the management pane to show the job's progress.

B.1.8 Aborting A Job

If a job is running or fails to complete, you can abort the job to cancel it. Administrators can abort the jobs of all users.

If you abort a job, all queued operations roll back to the pre-job state. Some job operations, such as renaming an object, complete quickly. Others, such as adjusting the memory used by a virtual machine, take longer.

There are two ways to abort a job:

- Using the Jobs view
- Using the Jobs pane in any view, other than the Jobs view.

Both procedures for aborting jobs are listed below.

To abort a job using the Jobs view:

1. Select the **Jobs** view.
2. Select the **Jobs** tab.
3. Select the job in the **Jobs** table.
4. Click **Abort** in the toolbar.

To abort a job using the Jobs pane:

1. In any view, other than the Jobs view, select the job in the **Jobs** pane.
2. Click **Abort** in the **Abort** column.

B.1.9 Determining the Cause of a Job Failure

If a job succeeds, all operations associated with it performed in Oracle VM Manager. A **Job Succeeded** message appears in the **Job Progress** area.

If a job fails, the state of Oracle VM Manager returns to its pre-job state. Click **Details** to see high-level information on all operations in the job.

B.2 Troubleshooting Oracle VM Server

This section describes some problems you may encounter when using Oracle VM Server, and explains how to resolve them. It includes the following topics:

- [Debugging Tools](#)
- [Using DHCP](#)
- [Guest Console Access](#)
- [Cannot Display Graphical Installer When Creating Guests](#)
- [Hardware Virtualized Guest Console Not Displayed](#)
- [Setting the Guest's Clock](#)
- [Wallclock Time Skew Problems](#)
- [Mouse Pointer Tracking Problems](#)
- [Hardware Virtualized Guest Stops](#)
- [Hardware Virtualized Guest Devices Not Working as Expected](#)
- [CD-ROM Image Not Found](#)
- [Migrating Domains](#)
- [Attaching to a Console with the Grub Boot Loader](#)

B.2.1 Debugging Tools

If domain creation fails, check the Oracle VM Server log files and use the command-line tools to help you find the cause of a problem. There are a number of useful command-line tools, important directories, and log files that you should check when troubleshooting problems with Oracle VM Server. This section discusses:

- Oracle VM Server directories
- Oracle VM Server log files
- Oracle VM Server command-line tools

B.2.1.1 Oracle VM Server Directories

The important Oracle VM Server directories you should check when troubleshooting problems with Oracle VM Server are listed in [Table B-2, "Oracle VM Server directories"](#)

Table B-2 Oracle VM Server directories

Directory	Purpose
/etc/xen	Contains Oracle VM Server configuration files for the Oracle VM Server daemon and virtualized guests.
/etc/xen/scripts	Contains networking related scripts.

Table B–2 (Cont.) Oracle VM Server directories

Directory	Purpose
/var/log	Contains the Oracle VM Agent log file, ovs-agent.log. Contains the ovmwatch.log, which logs virtual machine life cycle events. Contains the ovm-console.log, which logs remote VNC console access, and all communication with Oracle VM Manager.
/var/log/xen	Contains Oracle VM Server log files.
/var/log/messages	Contains Oracle VM Server messages.

B.2.1.2 Oracle VM Server Log Files

The Oracle VM Server log files you should check when troubleshooting problems with Oracle VM Server are listed in [Table B–3, "Oracle VM Server log files"](#)

Table B–3 Oracle VM Server log files

Log File	Purpose
xend.log	Contains a log of all the actions of the Oracle VM Server daemon. Actions are normal or error conditions. This log contains the same information as output using the <code>xm log</code> command. This file is located in the <code>/var/log/xen</code> directory.
xend-debug.log	Contains more detailed logs of the actions of the Oracle VM Server daemon. This file is located in the <code>/var/log/xen</code> directory.
xen-hotplug.log	Contains a log of hotplug events. Hotplug events are logged if a device or network script does not start up or become available. This file is located in the <code>/var/log/xen</code> directory.
qemu-dm. <i>pid</i> .log	Contains a log for each hardware virtualized guest. This log is created by the <code>qemu-dm</code> process. Use the <code>ps</code> command to find the <i>pid</i> (process identifier) and replace this in the file name. This file is located in the <code>/var/log/xen</code> directory.

B.2.1.3 Oracle VM Server Command-Line Tools

The Oracle VM Server command-line tools you should use when troubleshooting problems with Oracle VM Server are listed in [Table B–4, "Oracle VM Server command-line tools"](#).

Table B–4 Oracle VM Server command-line tools

Command-Line Tool	Purpose
xentop	Displays real-time information about Oracle VM Server and domains.
xm dmesg	Displays log information on the hypervisor.
xm log	Displays log information of the Oracle VM Server daemon.

B.2.2 Using DHCP

It is recommended that you install Oracle VM Server on a computer with a static IP address. If your computers uses DHCP you should configure your DHCP server to assign static DHCP addresses. This makes sure your host always receives the same IP address. The behavior of the Oracle VM Server host is undefined if used in an environment where your IP address may change due to DHCP lease expiry.

B.2.3 Guest Console Access

You can connect to a guest's console using Oracle VM Manager. If you do not have access to Oracle VM Manager, you can configure access to a guest's console with VNC (Virtual Network Computing). VNC access to guests requires that VNC access is enabled in the guest's configuration file, `vm.cfg`. Some VNC parameters (for example, the listening address and password) can be configured in one, either, or both of the following locations:

- The Oracle VM Server configuration file:
`/etc/xen/xend-config.sxp`
- The guest configuration file in either of the following locations:
`/etc/xen/name`
`/OVS/running_pool/name/vm.cfg`

Hardware virtualized guests use the `vnc=1` parameter in the guest configuration file, for example

```
vnc=1
vnclisten '0.0.0.0'
```

Paravirtualized guests use the VNC virtual frame buffer in the guest configuration file, for example

```
vfb = ['type=vnc,vncunused=1,vnclisten=0.0.0.0,vncpasswd=mypassword']
```

VNC settings defined in the guest configuration file override the settings in the Oracle VM Server configuration file. For example, if the following is specified in a hardware virtualized guest configuration file:

```
vnc=1
vnclisten '0.0.0.0'
vncpassword 'mypassword'
```

The values set in the guest configuration file are used for VNC access, rather than any corresponding values set in the Oracle VM Server configuration.

Note: Setting `vnclisten` to `0.0.0.0` sets VNC to allow access to any computer. This may compromise security on the host computer.

If the following is specified in a hardware virtualized guest configuration file:

```
vnc=1
```

VNC is enabled in the guest, and the `vnclisten` parameter is used from the Oracle VM Server configuration file. If `vnclisten` is not specified in the Oracle VM Server configuration file, a default value of `127.0.0.1` is used. If the following is specified in the hardware virtualized guest configuration file:

```
vnc=0
```

VNC access to the guest is disabled.

Setting the default configuration options for VNC access in the Oracle VM Server configuration file enables you to configure access for all guests, and then individually override VNC access by setting the VNC parameters in the guest configuration file.

The following example is a VNC configuration entry in a paravirtualized guest configuration file:

```
vfb = ['type=vnc,vncunused=1,vnclisten=0.0.0.0,vncpasswd=mypassword']
```

The following example as a VNC configuration entry in a hardware virtualized guest configuration file:

```
vnc = 1                # vnc=1 enabled, 0=disabled
vncconsole = 1        # vncconsole=1 enables spawning VNC viewer for domain's
                      # console. Default=0
vnclisten = 0.0.0.0   # Address that should be listened on for the VNC server
                      # if VNC is set. Default (if vnc=0) is to use
                      # 'vnc-listen' setting from /etc/xen/xend-config.sxp
vncpasswd = 'mypassword' # VNC password
vncunused = 1         # vncunused=1 - find an unused port for the VNC server
                      # to listen on. Default=1
```

In this example, the `vncunused=1` parameter allocates a new VNC port number each time a guest is created and assigns it to the guest. Port numbers are allocated starting at the default VNC port number of 5900, so dom1 is allocated port 5900, dom2 is allocated port 5901, dom3 port 5902, and so on.

Connect to the guest on the host computer with the command

```
# vncviewer -Shared ipaddress:port
```

The `-Shared` parameter enables you to share the VNC connection. If you do not include this parameter, another user may destroy your VNC session if they connect at the same time. Connect from a remote computer with a VNC viewer using the connection string:

```
ipaddress:port
```

In both examples, `ipaddress` is the IP address or hostname of the Oracle VM Server, and `port` is the VNC port number of the guest.

B.2.4 Cannot Display Graphical Installer When Creating Guests

If the graphical installer does not start when creating a guest using the `virt-install` command-line tool, you should check your X11 configuration. If you are using a console through an `ssh` (Secure Shell) connection, connect to the console and set the `DISPLAY` environment variable, for example

```
# ssh root@example
# export DISPLAY=example:0.0
```

Alternatively, you can enable connect to a console and enable `ssh` forwarding using the `ssh -X` command, for example

```
# ssh -X root@example
```

If you use Putty to connect to a console, you must connect from an X11 capable operating system.

B.2.5 Hardware Virtualized Guest Console Not Displayed

If a console is not displayed after you create a hardware virtualized guest, your disk device specification may be incorrect. When you create a hardware virtualized guest, you must specify the VNC console setup. This is not required for a paravirtualized guest.

B.2.6 Setting the Guest's Clock

Paravirtualized guests may perform their own system clock management, for example, using the NTPD (Network Time Protocol daemon), or the hypervisor may perform system clock management for all guests.

You can set paravirtualized guests to manage their own system clocks by setting the `xen.independent_wallclock` parameter to 1 in the `/etc/sysctl.conf` file. For example

```
"xen.independent_wallclock = 1"
```

If you want to set the hypervisor to manage paravirtualized guest system clocks, set `xen.independent_wallclock` to 0. Any attempts to set or modify the time in a guest will fail.

You can temporarily override the setting in the `/proc` file. For example

```
"echo 1 > /proc/sys/xen/independent_wallclock"
```

Note: This setting does not apply to hardware virtualized guests.

B.2.7 Wallclock Time Skew Problems

Oracle VM Release 2.1.1 introduces the use of the `timer_mode` parameter for hardware virtualized guests. This parameter, when properly applied, can reduce or even eliminate problems with wallclock time skew in most hardware virtualized guests. Wallclock time skew problems do not occur in paravirtualized guests.

Since the application of the correct value of the `timer_mode` parameter can be difficult to determine, you can pass the `os-type` and `os-variant` command-line switches to `virt-install` to select the best `timer_mode` value for the guest operating system. When you use these `virt-install` parameters, the correct `timer_mode` value is automatically added to the guest configuration file. For example, to create an Oracle Linux 5 64-bit guest, add the following to the `virt-install` command-line:

```
# virt-install --hvm ... --os-type=linux --os-variant=e15_64 ...
```

For best results, additional parameters may be needed in the boot loader (`grub.conf`) configuration file for certain operating system variants after the guest is installed. Specifically, for optimal clock accuracy, Linux guest boot parameters should be specified to ensure that the `pit` clock source is utilized. Adding `clock=pit nohpet nopmtimer` for most guests will result in the selection of `pit` as the clock source for the guest. Published templates for Oracle VM will include these additional parameters.

Proper maintenance of virtual time can be tricky. The various parameters provide tuning for virtual time management and supplement, but do not replace, the need for an `ntp` time service running within guest. Ensure that the `ntpd` service is running and that the `/etc/ntp.conf` configuration file is pointing to valid time servers.

B.2.8 Mouse Pointer Tracking Problems

If your mouse pointer fails to track your cursor in a VNC Viewer session in a hardware virtualized guest, add the following to the Oracle VM Server configuration file located at `/etc/xen/xend-config.sxp` to force the device model to use absolute (tablet) coordinates:

```
usbdevice='tablet'
```

Restart the Oracle VM Server for the changes to take effect. You may need to do this for each Oracle VM Server in the server pool.

B.2.9 Hardware Virtualized Guest Stops

When running hardware virtualized guests, the QEMU process (qemu-dm) may have its memory usage grow substantially, especially under heavy I/O loads. This may cause the hardware virtualized guest to stop as it runs out of memory. If the guest is stopped, increase the memory allocation for dom0, for example from 512MB to 768MB.

B.2.10 Hardware Virtualized Guest Devices Not Working as Expected

Some devices, such as sound cards, may not work as expected in hardware virtualized guests. In a hardware virtualized guest, a device that requires physical memory addresses instead uses virtualized memory addresses, so incorrect memory location values may be set. This is because DMA (Direct Memory Access) is virtualized in hardware virtualized guests.

Hardware virtualized guest operating systems expect to be loaded in memory starting somewhere around address 0 and upwards. This is only possible for the first hardware virtualized guest loaded. Oracle VM Server virtualizes the memory address to be 0 to the size of allocated memory, but the guest operating system is actually loaded at another memory location. The difference is fixed up in the shadow page table, but the operating system is unaware of this.

For example, a sound is loaded into memory in a hardware virtualized guest running Windows at an address of 100MB may produce garbage through the sound card, instead of the intended audio. This is because the sound is actually loaded at 100MB *plus* 256MB. The sound card receives the address of 100MB, but it is actually at 256MB.

An IOMMU (Input/Output Memory Management Unit) in the computer's memory management unit would remove this problem as it would take care of mapping virtual addresses to physical addresses, and enable hardware virtualized guests direct access to the hardware.

B.2.11 CD-ROM Image Not Found

If you create a paravirtualized or hardware virtualized guest using a configuration file, and the CDROM image cannot be found during the installation, you may have the IDE devices in the incorrect order. Putting the IDE devices in order fixes this problem. Check that the `disk = [...]` parameter is defined as `hdc:cdrom` and is included *before* `hda`, otherwise the usual `boot='dc'` configuration fails to find the CDROM image.

B.2.12 Firewall Blocks NFS Access

Oracle VM Server blocks NFS access from any external computer (or guest) by default. This may cause problems when trying to create a guest using an NFS connection. To resolve this, disable the firewall with the following command:

```
# service iptables stop
```

B.2.13 Migrating Domains

You cannot migrate domains on computers with hardware that is not identical. To migrate a domain, you must have hardware that is the same make and model. You must also have the same Oracle VM Server release.

B.2.14 Attaching to a Console with the Grub Boot Loader

Tracking down startup problems with a hardware virtualized guest may be difficult because you may not be able to attach a console using the `xm console` command. To work around this problem, you can include a console in the guest's Grub boot loader, and connect to a console during boot.

To include a console in the Grub boot loader, add the following lines before the first "title ..." line in the `/etc/grub.conf` file:

```
serial --unit=0 --speed=9600 --word=8 --parity=no --stop=1
terminal --timeout=10 serial console
```

B.3 Troubleshooting Oracle VM Manager

This section describes some problems you may encounter when using Oracle VM Manager, and explains how to resolve them. It includes the following topics:

- [Log Files](#)
- [Cannot Start Virtual Machine Console](#)
- [Cannot Create a Virtual Machine from Installation Media](#)
- [Cannot Change CD in the Virtual Machine](#)

B.3.1 Log Files

Oracle VM Manager messages are displayed in the User Interface, in the Jobs view, or under the object's Events tab.

[Table B-5, "Oracle VM Manager Log Files"](#) lists any other log files for Oracle VM Manager.

Table B-5 Oracle VM Manager Log Files

Log File	Description
<code>/u01/app/oracle/ovm-manager-3/machine1/base_adf_domain/servers/AdminServer/logs</code>	The Oracle WebLogic application log, which contains Oracle VM Manager messages.

B.3.2 Cannot Start Virtual Machine Console

If you launch the console of a virtual machine in Oracle VM Manager, and an error is displayed, you may not have installed the VNC viewer on the Oracle VM Manager host computer. If you do not have the VNC viewer installed on the Oracle VM Manager host computer, the following error is displayed when you attempt to launch the virtual machine console:

```
Unable to launch the application.
Name: VncViewer
Publisher: TightVnc
From: URL
```

To resolve this problem, install a VNC viewer on the Oracle VM Manager host. See the *Oracle VM Release Notes* for more information.

You can also install a VNC viewer on the client accessing the Oracle VM Manager UI. Oracle recommends you also install a VNC viewer on the Oracle VM Manager host computer so that if a client does not have a VNC viewer, this problem will not occur.

B.3.3 Cannot Create a Virtual Machine from Installation Media

The following message is displayed: "Error: There is no server supporting hardware virtualization in the selected server pool."

To solve this problem, make sure the Virtual Machine Server supports hardware virtualization.

Follow these steps to check:

1. Run the following command to check if hardware virtualization is supported by the CPU:

```
# cat /proc/cpuinfo |grep -E 'vmx|smx'
```

If any information that contains `vmx` or `smx` is displayed, it means that the CPU supports hardware virtualization. Here is an example of the returned message:

```
flags : fpu tsc msr pae mce cx8 apic mtrr mca cmov pat pse36 clflush dts acpi
mmx fxsr sse sse2 ss ht tm pbe nx lm constant_tsc pni monitor ds_cpl vmx est
tm2 cx16 xtpr lahf_lm
```

2. Make sure you have enabled hardware virtualization in the BIOS.
3. Run the following command to check if the operating system supports hardware virtualization:

```
# xm info |grep hvm
```

The following is an example of the returned message:

```
xen_caps : xen-3.0-x86_64 xen-3.0-x86_32p hvm-3.0-x86_32 hvm-3.0-x
```

If the CPU does not support hardware virtualization, use the paravirtualized method to create the virtual machine. See [Section 8.7, "Creating a Virtual Machine"](#).

B.3.4 Cannot Change CD in the Virtual Machine

To change the CD in a virtual machine:

1. Unmount the first CD:

```
# umount mount-point
```

2. Select the second ISO file, and click **Change CD**.

3. Mount the second CD:

```
# mount /dev/cdrom mount-point
```

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This Appendix includes the software licenses for third party software products included as part of Oracle VM. The product licenses in this Appendix are:

- [Open-OVF](#)
- [Python-hashlib](#)
- [Python-zope-interface](#)
- [Multiprocessing](#)
- [Python-twisted-core](#)
- [PyYAML](#)
- [Unzip](#)
- [GPL and LGPL Licenses](#)

C.1 Open-OVF

Open-ovf is included with Oracle VM Server.

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Oracle has modified the following files:

```
setup.py
py/ovf/__init__.py
py/ovf/Ovf.py
py/ovf/OvfCertificate.py
py/ovf/OvfPlatform.py
py/ovf/OvfFile.py
py/ovf/OvfManifest.py
py/ovf/OvfReferencedFile.py
py/ovf/OvfSet.py
py/ovf/OvfLibvirt.py
```

```
py/ovf/OvfTransport.py
py/ovf/env/EnvironmentSection.py
py/ovfapi/__init__.py
py/ovfapi/ovfapi.py
py/ovfapi/ovfova.py
py/scripts/chovf
py/scripts/lsovf
py/scripts/mkovf
py/scripts/rmovf
py/scripts/ova
schemas/README.ORACLE
schemas/ovf-envelope.xsd
schemas/ovf-environment.xsd
schemas/CIM_ResourceAllocationSettingData.xsd
schemas/CIM_VirtualSystemSettingData.xsd
schemas/ovf-envelope-ovm.xsd
```

The modifications made to the files are:

- Update version and schemas to OVF spec 1.1.0
- Support OVM extensions
- Add XML namespace to elements in envelope and environment files
- Support chunksize/compression attribute of File element
- Support certificate file creation with user supplied X509 certificate and private key
- Verify certificate as part of ova package validation
- Extract the contents of the appliance to a specified location after validating the appliance
- Add Oracle VM specific VirtualSystemTypes
 - 'DMTF:Oracle:OracleVM:PVM' for xenpv
 - 'DMTF:Oracle:OracleVM:HVM' for xenfv
- Remove libvirt dependency
- Other minor fixes

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Glossary

Affinity

Specify that specific virtual machines should always run on the same host.

Anti-affinity

Specify that specific virtual machines should never run on the same host.

Assembly

An infrastructure template containing a configuration of multiple virtual machines with their virtual disks, and the inter-connectivity between them. Assemblies can be created as a set of .ovf (Open Virtualization Format) and .img (disk image) files, or may all be contained in a single .ova (Open Virtualization Format Archive) file.

Domain

A configurable set of resources, including memory, virtual CPUs, network devices and disk devices, in which virtual machines run. A domain is granted virtual resources and can be started, stopped and rebooted independently.

See also [dom0](#) and [domU](#).

dom0

An abbreviation for *domain zero*. The management domain with privileged access to the hardware and device drivers. Dom0 is the first domain started by the Oracle VM Server at boot time. Dom0 has more privileges than domU. It can access the hardware directly and can manage the device drivers for other domains. It can also start new domains.

domU

An unprivileged domain with no direct access to the hardware or device drivers. Each domU is started by Oracle VM Server in dom0.

Guest

A guest operating system that runs within a domain in Oracle VM Server. A guest may be paravirtualized or hardware virtualized. Multiple guests can run on the same Oracle VM Server.

Hardware virtualized machine

A virtual machine with an unmodified guest operating system. It is not recompiled for the virtual environment. There may be substantial performance penalties running as a hardware virtualized guest. Enables Microsoft Windows™ operating system to be run, as well as legacy operating systems. Hardware virtualization is only available on Intel VT or AMD SVM CPUs.

Host computer

The physical computer on which Oracle VM Server is installed.

Hypervisor

The hypervisor, monitor, or Virtual Machine Manager (VMM). It is the only fully privileged entity in the system. It controls only the most basic resources of the system, including CPU and memory usage, privilege checks, and hardware interrupts.

Management domain

See [dom0](#).

Non-Sparse Copy

A clone of the type "non-sparse copy" is a disk image file of a physical disk, taking up the space equivalent to the full specified disk size, including empty blocks. See also [Sparse Copy](#).

Oracle VM Agent

An application installed with Oracle VM Server. It communicates with Oracle VM Manager for management of virtual machines. Oracle VM Manager manages the virtual machines running on Oracle VM Server by communicating with Oracle VM Agent. It contains three components: Server Pool Master, Utility Server, and Virtual Machine Server.

Oracle VM Server

A self-contained virtualization environment designed to provide a lightweight, secure, server-based platform for running virtual machines. Oracle VM Server is based upon an updated version of the Xen hypervisor technology. Includes Oracle VM Agent to enable communication with Oracle VM Manager.

Oracle VM Manager

Provides the user interface, which is an Application Development Framework (ADF) web application, to manage Oracle VM Server pools. Manages virtual machine lifecycle, including creating virtual machines from templates or from installation media, deleting, powering off, uploading, deployment and live migration of virtual machines. Manages resources including ISO files, templates and shared virtual disks. Also provides an API via a web service to Oracle VM Server.

Paravirtualized machine

A virtual machine with a kernel that is recompiled to be made aware of the virtual environment. Runs at near native speed, with memory, disk and network access optimized for maximum performance.

Preferred Server

A Virtual Machine Server that provides resources such as memory, CPU, network interface cards (NICs), and disk to the virtual machine. If you select only one Virtual Machine Server as the preferred server, the virtual machine always starts from and runs on this server. If you select multiple preferred servers, each time the virtual machine starts, it runs on the machine with the maximum available resources.

QEMU

Also referred to as `qemu-dm`, which is the process name. The virtualization process which allows full virtualization of a PC system within another PC system.

Server Pool

Logically an autonomous region that contains one or more physical Oracle VM Servers. Presents a unified view of the storage where the virtual machines reside, and groups the users of these virtual machines into a single community called a *group*, in which each user is a server pool member.

Server Pool Master

A component of Oracle VM Agent. An application that acts as the contact point to Oracle VM Manager, and to other Oracle VM Agents. Provides virtual machine host load-balancing, and local persistency for Oracle VM Server.

There is only one Server Pool Master in a server pool. A physical server can perform as the Server Pool Master, Utility Server and Virtual Machine Server simultaneously.

Sparse Copy

A clone of the type "sparse copy" is a disk image file of a physical disk, taking up only the amount of space actually in use; not the full specified disk size. See also [Non-Sparse Copy](#).

Thin Clone

A thin clone is a clone of a physical disk that takes up only the amount of disk space actually in use; not the full specified disk size.

Utility Server

A component of Oracle VM Agent. An application that handles I/O intensive operations for virtual machines, server pools and servers, for example, copying, moving and renaming files.

There can be more than one Utility Server in a server pool. A physical server can perform as the Server Pool Master, Utility Server and Virtual Machine Server simultaneously.

vif

A virtual network interface for bridging network interfaces between domUs and dom0. When a domU is started it is assigned a number. This number is used to bridge the network interface from `ethn` to `vifn.0`.

Virtual disk

A file or set of files, usually on the host file system although it may also be a remote file system, that appears as a physical disk drive to the guest operating system.

Virtual Machine (VM)

A guest operating system and the associated application software that runs within Oracle VM Server. May be paravirtualized or hardware virtualized machines. Multiple virtual machines can run on the same Oracle VM Server.

Virtual Machine Manager (VMM)

See [Hypervisor](#).

Virtual Machine Server

A component of Oracle VM Agent. An application which runs Oracle VM Server virtual machines. It can start and stop virtual machines, and collect performance data for the host and guest operating systems. Enables communication between the Server Pool Master, Utility Server and Virtual Machine Servers.

There can be more than one Virtual Machine Server in a server pool. A physical server can perform as the Server Pool Master, Utility Server and Virtual Machine Server simultaneously.

Virtual Machine Template

A template of a virtual machine. Contains basic configuration information such as the number of CPUs, memory size, hard disk size, and network interface card (NIC). Create virtual machines based on a virtual machine template using Oracle VM Manager.

VMM

See [Virtual Machine Manager \(VMM\)](#).

Xen™

The Xen hypervisor is a small, lightweight, software virtual machine monitor, for x86-compatible computers. The Xen hypervisor securely executes multiple virtual machines on one physical system. Each virtual machine has its own guest operating system with almost native performance. The Xen hypervisor was originally created by researchers at Cambridge University, and derived from work done on the Linux kernel.

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