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# Oracle VM Server for x86: Administration

Student Guide

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## Author

Dave Goff

## Technical Contributors and Reviewers

John Priest

Barry Isaacman

Rowan Puttergill

Don Naro

Tom Lisjac

Greg King

Yasar Akthar

Jeff Savit

## Editors

Chandrika Kennedy

Malavika Jinka

## Graphic Designers

Seema Bopaiah

Maheshwari Krishnamurthy

## Publishers

Pavithran Adka

Jayanthy Keshavamurthy

Syed Ali

Raghunath M

Srividya Rameshkumar

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# 1

# Introduction

# Objectives

After completing this lesson, you should be able to:

- Define server virtualization and list its benefits
- Explain the different server virtualization types
- Describe Oracle VM within the server virtualization landscape
- List the components of Oracle VM
- Describe the features of Oracle VM
- List the benefits of Oracle VM
- Explore Oracle's virtualization offerings


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# Lesson Overview

- The first section of this lesson introduces server virtualization and explains how the Oracle VM Server for x86 virtualization solution meets your data center challenges.
- The topics in the first section include the following:
  - Why use server virtualization?
  - What are the advantages and challenges of server virtualization?
  - What is application-driven server virtualization?
- The next section goes deeper into the solution and presents concepts to help you to understand the architecture of Oracle VM.
- The last section describes the functionality and features of Oracle VM.

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# Oracle VM with Oracle VM Server for x86

- Oracle VM with Oracle VM Server for x86 is an enterprise-class server virtualization solution.
- It enables you to deploy operating systems and application software within a supported virtualization environment.
- It has been designed from the ground up for excellent scalability, manageability, and ease of use.






In this lesson, you learn how Oracle VM's functionality and architecture have been designed to deliver scalability, manageability, and ease of use.

Oracle VM is an enterprise-class virtualization solution with Oracle VM Server for x86, Oracle VM Server for SPARC, and Oracle VM Manager, which together provide server virtualization technology. Oracle VM is part of Oracle's strategic commitment to deliver application-driven virtualization. This virtualization makes the entire enterprise software and hardware stack easier to deploy, manage, and support, making it possible for IT and businesses to be more agile. Application-driven virtualization is examined in more detail in this lesson when the challenges faced by virtualization are discussed.

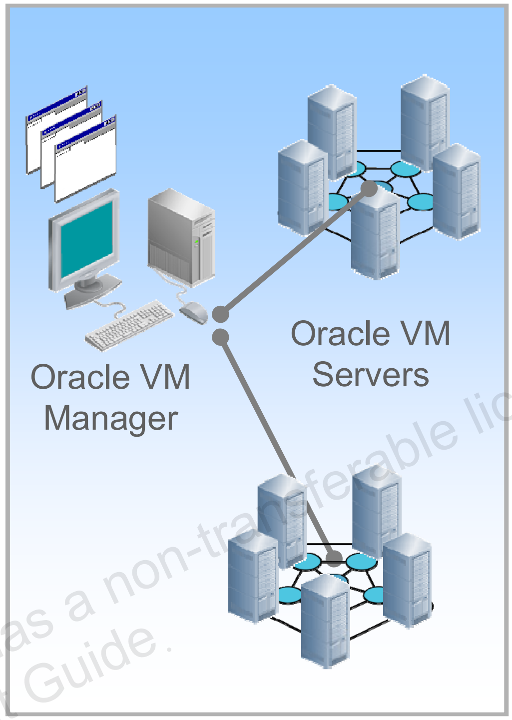
Although Oracle VM has an impact on the entire deployment of your business applications, this course focuses mainly on the virtualization layer, which is comprised of the following:

- The Oracle VM Server for x86 software running on the physical hosts
- The storage and networking infrastructure available to build the virtual environment
- The deployment of virtual machines in the environment

The integration of Oracle VM into every layer of the application deployment stack is discussed in the section titled "Benefits of the Oracle VM Solution."

# Oracle VM Main Components

- Oracle VM Manager:
  – Provides a graphical user interface (UI), a command-line interface (CLI), and a Web Services API (WS-API)
  – Manages Oracle VM servers, resources, and virtual machines
- Oracle VM server:
  – Is the virtualization platform to run virtual machines
  – Uses the Xen hypervisor
  – Consumes the resources managed by the Oracle VM Manager

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**Oracle VM Manager**

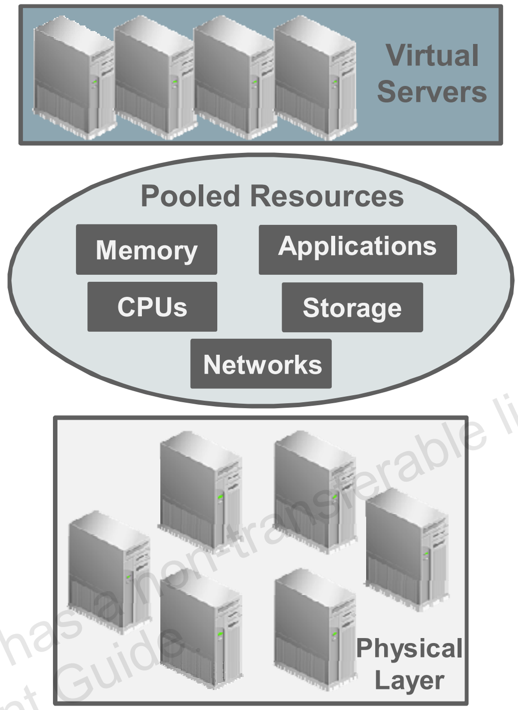
- The Oracle VM Manager is the management platform. It offers an easy-to-use web browser user interface (UI), a command-line interface (CLI), and a Web Services API (WS-API).
- The Oracle VM Manager tracks and manages the resources available in your virtual environment. These resources include the resources in each of the Oracle VM servers, as well as the connected networks and storage. If an action is required on the resources, the Oracle VM Manager delegates an Oracle VM server to carry out the task.
- You use the Oracle VM Manager to create virtual environments (called virtual machines throughout this course), and the virtual machines run on Oracle VM servers.

**Oracle VM Server**

- Each Oracle VM server in the environment is a separate virtualization platform, which runs Oracle VM Server for x86 or Oracle VM Server for SPARC. The main job of the Oracle VM server is to run virtual machines.

## Server Virtualization

- Server virtualization is a technique to abstract the physical hardware.
- The resources of the physical layer are combined as pools of logical resources.
- The administrator deploys virtual servers by using a subset of the available resources.
- The resources of an obsolete virtual server can be redeployed rapidly to create a new virtual server.










Data centers today use virtualization techniques to make abstractions of the physical hardware, create large aggregated pools of logical resources (consisting of CPUs, memory, disks, file storage, applications, and networking), and offer those resources to users or customers in the form of agile, scalable, and consolidated virtual servers.

**Note:** With Oracle VM, virtual servers are deployed as virtual machines.

Although the technology and use cases have evolved, the core function of virtualization remains the same—to enable a computing environment to run multiple independent systems at the same time.

# Advantages of Server Virtualization

- **Consolidation:** Combine workloads to reduce the number of servers and physical network connections.
- **Resource optimization:** Allocate resources from pools for greater efficiency.
- **Support for legacy applications:** Include legacy applications in the virtual environment to facilitate their migration.
- **Protect applications:** Use server virtualization to implement redundancy without purchasing additional hardware.







There are several good reasons for companies and organizations to invest in virtualization. Financial motivation is number one on the list. The following is a partial list of the benefits of virtualization.

**Consolidation**

It is common practice to dedicate individual computers to a single application. If several applications use only a small amount of processing power, the administrator can consolidate several computers into one server that runs multiple virtual environments. For organizations that own hundreds or thousands of servers, consolidation can dramatically reduce the need for floor space, heating, ventilation, and air conditioning (HVAC), alternating current (A/C) power, and co-location resources.

**Resource Optimization**

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.

### Support for Legacy Applications

Server hardware eventually becomes obsolete, and switching from one system to another can be difficult. To continue offering the services provided by these legacy systems, run the systems in virtual machines while the legacy applications still behave as if they are running on the legacy hardware.

### Protect Applications from Server Failure

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:

- 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.

## Challenges with Server Virtualization

- Server virtualization saves capital expenses but does not adequately reduce operational costs.
- Complexity can increase in large virtualization environments.
- To deploy applications, you still need to customize your systems.
- Server virtualization by itself does not address the deployment of multitier applications.





Server virtualization has many benefits, and the most important benefit is the reduction in capital expenses for hardware and related infrastructure.

Server virtualization introduces several levels of complexity, and the complexity increases with the size of the enterprise. Moreover, the tasks of deploying virtual servers with their applications still require a large amount of customization efforts.

Some of the tasks that can become more complex with server virtualization include:

- Provisioning storage for virtual servers or applications
- Providing high availability (HA) for virtual servers and their applications
- Maintaining relationships between the software layers of a single business application

# Application-Driven Virtualization with Oracle VM

Oracle VM overcomes the challenges of server virtualization, and provides a virtualization solution:

- Where applications are easier to deploy, manage, and support
- With tools and products to provision the entire application stack
- With integrated management capabilities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Virtualization needs to evolve beyond simple consolidation and support comprehensive application environments that meet the HA and scalability requirements of data centers.

Virtualization at the operating-system level, which addresses only the bottom layers of the deployment stack, is no longer sufficient. With users looking for a cloud experience, simply provisioning and delivering a virtual operating environment falls short of their goals. IT organizations must rapidly deliver services such as infrastructure-as-a-service (IaaS), platform-as-a-service (PaaS), and software-as-a-service (SaaS). As a result, virtualization solutions need to mature and facilitate flexibility, agility, and speed in deploying complete application stacks to support the new service-based charter. Virtualization solutions need to be application driven and should enable:

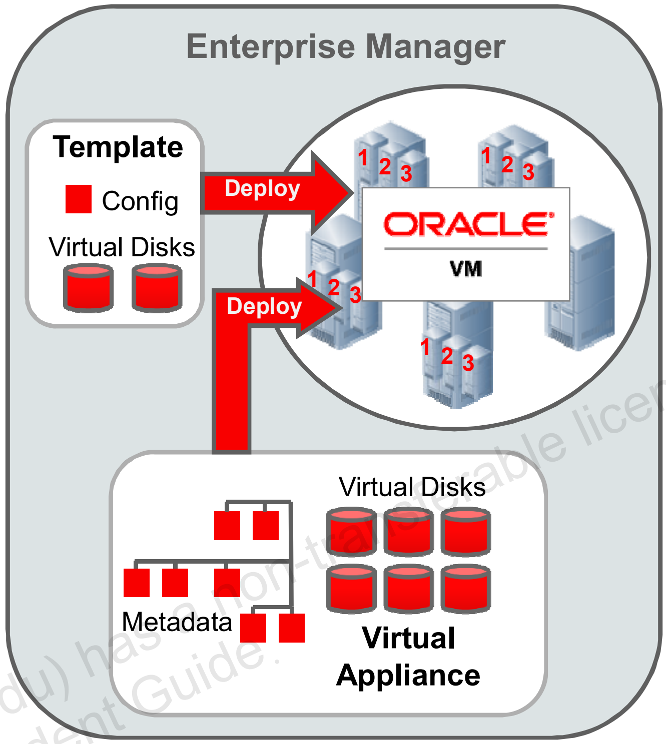
- Easier deployment and management of business-critical applications
- Rapid and automated provisioning of the entire application stack inside the virtual machine
- Integrated management of the complete stack, including the virtual machine and the applications running inside the virtual machine

Oracle VM application-driven virtualization takes a top-down approach, with the application as the main focus. Oracle VM provides the application deployment and management tools that make enterprise applications easier to deploy, manage, and support.

Oracle products are developed and tested in virtualized environments by using Oracle VM, and are engineered to work together. In addition, Oracle VM is an excellent virtualization platform for software from other vendors. You can also create your own Oracle VM templates for custom or third-party applications.

# Application Deployment and Management with Oracle VM

- Templates and virtual appliances accelerate deployment of new infrastructure and applications.
- You can install Enterprise Manager to monitor and control your enterprise applications.








An Oracle VM template is a virtual machine containing Oracle or other software, which is prebuilt, preinstalled, preconfigured, and ready to use. A virtual appliance consists of several virtual machines that offer a preconfigured, multitiered application environment.

Oracle provides templates for all layers of the application deployment stack:

- You can download templates for all flavors of Oracle Linux to serve as the operating platform for your application.
- To make the operating platform as small as possible, you can use the minimal build version of Oracle Linux. You can download and deploy the template to Oracle VM and add packages and features as needed to support your application.
- You use templates for the middleware layer, including templates for Oracle WebLogic, Oracle Fusion Middleware, and Oracle databases.
- Finally, add your application. You install your own application or download a template for many of the enterprise applications offered by Oracle.

You use Enterprise Manager to control and monitor your applications and manage your traditional IT and virtualized stacks. Consult the Enterprise Manager Cloud Control documentation at http://docs.oracle.com/en/enterprise-manager for product requirements.

Templates and virtual appliances are also discussed later in this lesson, as part of Oracle VM's features.

# Quiz

With Oracle VM, you can:

a. Realize the potential of your IT infrastructure
b. Do away with your hardware because everything is virtualized
c. Easily deploy a new virtual environment by using virtual appliances



**Answer: a, c**

# Virtualization Concepts with Oracle VM

- The first section of this lesson introduced Oracle VM as an application-driven server virtualization solution.
- This section covers the virtualization concepts to help you understand the architecture of Oracle VM, and includes the following topics:
  - Server virtualization technologies
  - Hypervisor definition and role
  - Dom0 and domU concepts
  - The Oracle VM virtualization architecture
  - Types of guests on an Oracle VM server

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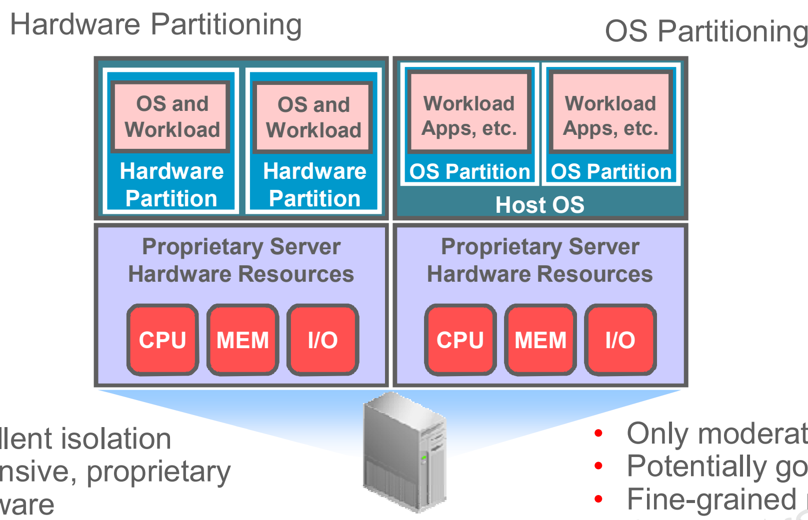
# Server Virtualization Technologies




- Excellent isolation
- Expensive, proprietary hardware
- Coarse grain resources
- Mixed OSs or versions

- Only moderate isolation
- Potentially good scalability
- Fine-grained resources
- Cannot mix OS or patch levels

Server virtualization using software or hardware partitioning techniques

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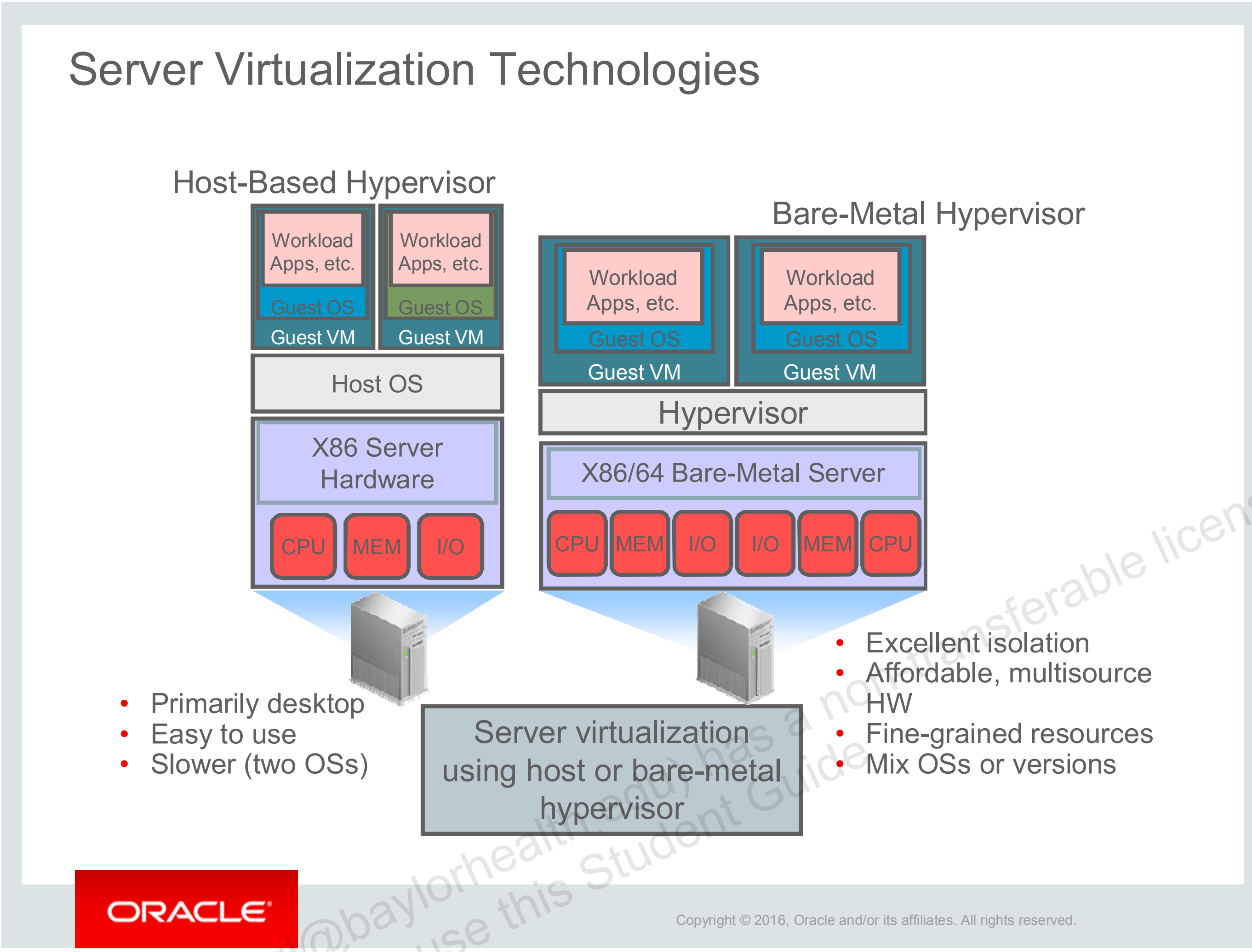
**Hardware Partitioning**

Hardware partitioning is a technique where the resources of a physical server are divided into partitions. This technique provides excellent isolation, but is limited to the hardware platforms that support it. Oracle VM Server for SPARC provides this type of enterprise-class virtualization capabilities for Oracle's SPARC T-Series and M-Series servers.

**OS Partitioning**

OS partitioning enables several “environments,” usually applications, to run within a single operating system. This technique offers only moderate isolation but has other advantages for workloads that require the same type of OS platform: low cost, scalable, and easy to administer.

Oracle Solaris Zones is a software-partitioning product that enables you to maintain a one-application-per-server deployment model. A zone provides a virtual mapping from software services to platform resources, and enables application components to be isolated from each other even though they share a single kernel. The zone establishes boundaries for resource consumption and provides isolation from other zones on the same system. The boundaries can be changed dynamically to adapt to the changing requirements of the applications running in the zone.



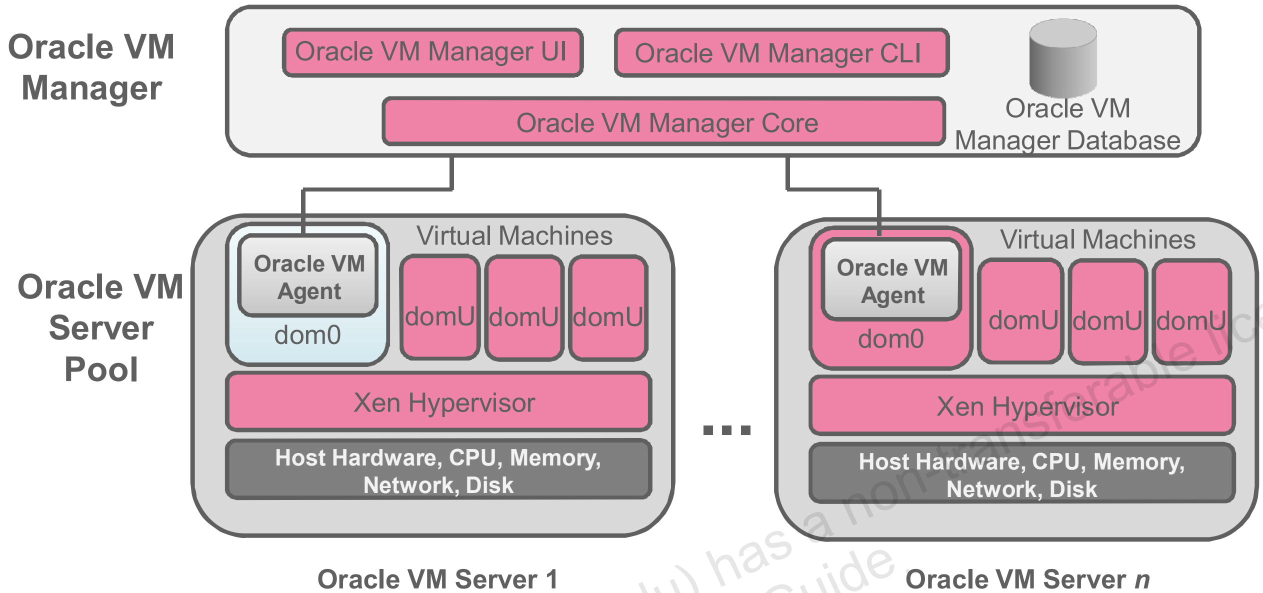

**Host-Based Hypervisor**

Hosted hypervisors are designed to run within a traditional operating system. In other words, a hosted hypervisor adds a distinct software layer to the host operating system, and the guest operating system becomes a third software level above the hardware and the host-based hypervisor. 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.

**Native or Bare-Metal Hypervisor**

Native hypervisors are software systems that run directly on the host's hardware to control the hardware, and to monitor the guest operating systems. The guest operating system runs on a separate level above the hypervisor. Examples of this type of virtualization architecture are Oracle VM, Microsoft Hyper-V, VMware ESX, and Citrix XenServer.

## Oracle VM Virtualization Architecture
## Oracle VM Manager and Oracle VM Servers








The diagram in the slide illustrates the Oracle VM Manager and Oracle VM server components that are part of the Oracle VM architecture. The management interfaces to Oracle VM are discussed in the next slide.

You install either the Oracle VM Server for x86 or the Oracle VM Server for SPARC software on each physical host. Oracle VM servers are grouped into server pools. All Oracle VM servers in the same server pool must run the same software, which determines the type of hypervisor that is present in the server.

**Note:** The Oracle VM Server for SPARC is not shown in the diagram in the slide.

### Hypervisor

The role of a hypervisor is to allocate physical resources to virtual machines without disruption. The hypervisor securely executes multiple virtual machines on one host computer.

### Oracle VM Server for x86

The Oracle VM Server for x86 software automatically installs the open source Xen hypervisor on physical hosts with either x86 Intel or AMD processors. The processors must support the x86_64 bit architecture.

In addition to the hypervisor, the Oracle VM server runs a privileged domain called dom0, which is loaded after the hypervisor at boot time.

Dom0 is responsible for access and security management on the physical server, and generally acts as the server's administrative entity, because the hypervisor's role is limited.

When dom0 is up and running, you can start virtual machines. The virtual machines are unprivileged domains, and each unprivileged domain is referred to as domU.

The hypervisor is responsible for allocating resources to domains, and domains can be started, stopped, or paused and unpaused. In each domain (or virtual machine), you install a guest operating system: Linux, Solaris, or Windows. Oracle VM Server for x86 can support either 64-bit or 32-bit guests. The domains are controlled by the hypervisor but not directly: You use the Oracle VM management interfaces to manage your Oracle VM environment, which in turn communicates with the hypervisor for domain operations.

**Oracle VM Server for SPARC**

On Oracle VM Server for SPARC systems, the SPARC hypervisor is built into the SPARC firmware. As with the Xen hypervisor, each virtual machine is securely executed on a single computer and runs its own guest Oracle Solaris operating system.

**Oracle VM Agent**

On x86-based servers, the dom0 domain runs a process called the Oracle VM Agent. The Oracle VM Agent receives and processes management requests, and provides event notifications and configuration data to the Oracle VM Manager. SPARC-based servers also run an Oracle VM Agent process in their management domain.

**Virtual Machine**

A virtual machine is often called a domain, and the two are similar. Virtual machines are seen as domains by the hypervisor. A virtual machine is a set of resources that are stored on disk. These resources include configuration information and disk resources. When you install a guest operating system in the virtual machine, the operating system and associated applications are stored in these disk resources. The configuration information and disk resources continue to exist, irrespective of whether the virtual machine is running or not.

**Oracle VM Manager**

The Oracle VM Manager is an Oracle WebLogic Server application running on the Oracle VM Manager host. The Oracle VM Manager is generally installed on a stand-alone computer, but can also run in a well-provisioned virtual machine. Running the Oracle VM Manager as a virtual machine on an Oracle VM server is possible, but not recommended.

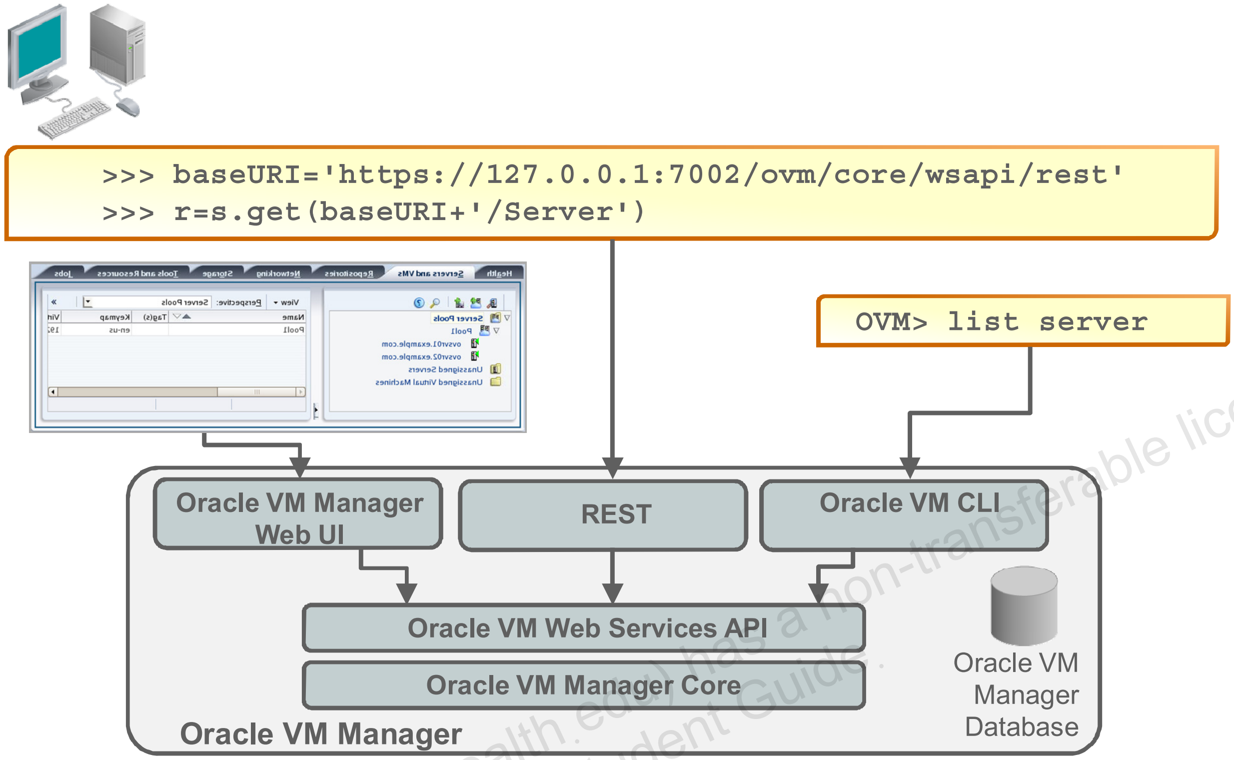
**Note:** Oracle WebLogic Server is an application server for building and deploying enterprise Java applications.

The Oracle VM Manager provides several management interfaces. These interfaces are discussed in the next slide.

**Oracle VM Manager Database**

The Oracle VM Manager stores management information in a MySQL local database. The MySQL database is reserved for Oracle VM Manager operations only.

# Oracle VM Virtualization Architecture Management Interfaces








The diagram in the slide illustrates the management interfaces available in your Oracle VM environment. These management interfaces are discussed in the following sections.

**The Oracle VM Manager UI**

The Oracle VM Manager provides a web-based UI. You connect to the UI by using a secured HTTP (HTTPS) connection, either locally from the Oracle VM Manager host, or remotely from a location with a supported browser. From the Oracle VM Manager UI, you manage your Oracle VM environment by operating on objects. The objects include servers, network interfaces, storage elements, virtual machines, templates, events, and jobs.

**The Oracle VM CLI**

You can also manage your Oracle VM environment by using the Oracle VM CLI, either from the Oracle VM Manager host, or from a remote location. Both methods use the secure shell (SSH) protocol.

**Note:** The Oracle VM Manager UI and Oracle VM CLI offer the same management functionality.

### Access by Using the Oracle VM Web Services API (WS-API)

Note that in the diagram in the slide, both the Oracle VM Manager UI and the Oracle VM CLI interface with the Oracle VM Web Services API (WS-API). In addition to using one of these two management interfaces, you can access the Oracle VM Manager functionality directly, by accessing the Oracle VM WS-API programmatically.

You can choose to access the Oracle VM Web Services API (WS-API) by using REST interfaces. Using REST interfaces, you access the functionality offered by the Oracle VM Manager Core application and operate on Oracle VM objects, such as a server or virtual machine, and execute authorized actions on the objects.

**Note:** The Oracle VM Manager Core is often referred to as the Oracle VM Manager application, or simply the Oracle VM Manager.

You can find information about using the WS-API programmatically in the *Oracle VM Web Services API Developer's Guide*, Part Number E64087_01 or later.

You learn about using the Oracle VM Manager UI and Oracle VM CLI in the lesson titled "Planning and Installation."

For detailed information about using the Oracle VM CLI, consult the *Oracle VM Command Line Interface User's Guide*, Part Number E64086_01 or later.

For detailed information about using the Oracle VM Manager UI, consult the *Oracle VM Manager User's Guide*, Part Number E64082_01 or later. This document describes managed objects, UI screens and their functions, tabs, icons, and general UI behavior.

# Guest Virtualization Modes with Oracle VM

- A guest refers to the operating system running in a virtual machine.
- Guests fall into three types of virtualization modes:
  - Hardware virtualized guest (HVM)
    - The kernel or operating system is not virtualization-aware, and can run unmodified.
    - Device drivers are emulated.
  - Paravirtualized guest (PVM)
    - The guest is virtualization-aware, and is optimized for a virtualized environment.
    - PV guests use generic, idealized device drivers.
  - Hardware virtualized with PV drivers (HVM with PVM drivers)
    - The PV drivers are hypervisor-aware and significantly reduce the overhead of emulated device input/output (I/O).

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**Guest**

After a virtual machine is created, you install a guest operating system in the virtual machine. The operating system in the guest offers different levels of support for virtualization. The different types of virtualization support are referred to as virtualization modes.

**Hardware Virtualized Guest (or HVM – Hardware Virtualized Machine)**

A hardware virtualized guest runs on the virtualization platform as it would on a physical host. Because the device drivers of the hardware virtualized guest are emulated, dom0 must contain device emulation to support the guest's device drivers. The other types of privileged instructions that are issued by the hardware virtualized guest (for example, for CPU or memory access) are not emulated, but are trapped, which also requires support from CPU vendors.

The guest's OS does not require any modification to run as a hardware virtualized guest.

**Paravirtualized Guest (or PVM – Paravirtualized Machine)**

Paravirtualized guests contain a kernel that is virtualization-aware. For this reason, the guest does not attempt operations that are dangerous or do not make sense in a virtualized environment.

Paravirtualized guests use generic, idealized device drivers, called paravirtualized (PV) drivers. These paravirtualized drivers are part of the guest's OS. The I/O operations that use these generic device drivers are mapped to the real device drivers in dom0. The generic, abstracted drivers in the guest seldom change and provide excellent guest stability. The dom0 domain, alternatively, can use the native hardware vendor drivers, and the guests can safely migrate to another dom0 with slightly different drivers.

For other resources such as CPU and memory, paravirtualized kernels make special "hypercalls" to the Xen hypervisor. These hypercalls provide better performance by reducing the number of instructions and context switches required to handle an incoming request. In contrast, on an emulated (hardware virtualized) guest, driver requests engage the guest's interrupt handler, thus increasing the I/O operation overhead.

**Hardware Virtualized Guests with PV Drivers (or PVM with PV Drivers)**

This type of guest is similar to a hardware virtualized guest, but with additional PV drivers, which enable the guest to use the same generic, idealized device drivers used by paravirtualized guests. This provides improved performance for the hardware virtualized guest, and is often used to boost performance for Microsoft Windows guest operating systems.

## Guest Support with Oracle VM Server for x86

- The guest that you deploy in a virtual machine must run a supported configuration and operating system.
- The following table is a subset of the supported configurations:

| Guest Operating System | Hardware Virtualized 64-bit | Hardware Virtualized 64-bit with PVM Drivers | Paravirtualized 64-bit |
|---|---|---|---|
| Oracle Linux Releases 4.x, 5.x, 6.x | Yes | Yes | Yes |
| Oracle Linux 7.x | Yes | Yes | No |
| Oracle Solaris 11 | N/A | Yes | N/A |
| Oracle Solaris 10 | N/A | Yes | N/A |
| Microsoft Windows Server 2003**, 2008**, 2012** | Yes | Yes | No |

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Oracle VM Server for x86 supports many types of guest operating systems. These supported operating systems are divided into:

- Hardware virtualized guest operating systems, 64-bit or 32-bit, with or without PV drivers for:
  - Oracle Linux 4.x, 5.x, 6.x
  - Oracle Solaris 10 releases (with PV drivers only)
  - Red Hat Enterprise Linux
  - CentOS
  - Microsoft Windows releases
- Hardware virtualized guest operating systems, 64-bit only, for:
  - Oracle Linux 4.x, 5.x, 6.x
  - Oracle Linux 7.x (64-bit only)
  - Oracle Solaris 11 (with PV drivers only)
  - SUSE Linux Enterprise Server (with or without PV drivers)
- Paravirtualized guest operating systems, 64-bit or 32-bit, for:
  - Oracle Linux 4.x, 5.x, 6.x
  - Red Hat Enterprise Linux

**Note:** By default, Oracle Solaris 10 and Oracle Solaris 11 already have the required PV drivers installed as part of the OS.

The table in the slide is a subset of all the supported guest operating systems.

Oracle Linux releases 4.x and later are supported.

Microsoft Windows Server 2003, 2008, and 2012 are supported as hardware virtualized guests, with or without PV drivers, for specific service packs (SPs):

- Microsoft Windows Server 2012
- Microsoft Windows Server 2012 R2
- Microsoft Windows Server 2008 R2 with SP1
- Microsoft Windows Server 2008 with SP2
- Microsoft Windows Server 2003 R2 with SP2

Several Microsoft Windows operating systems for the desktop are also supported.

Consult the *Oracle VM Release Notes*, Part Number E64077_01 or later, for a complete list of supported guest operating systems.

## Quiz

The Oracle VM Agent is installed in the guest operating system of a virtual machine.

a. True

b. False



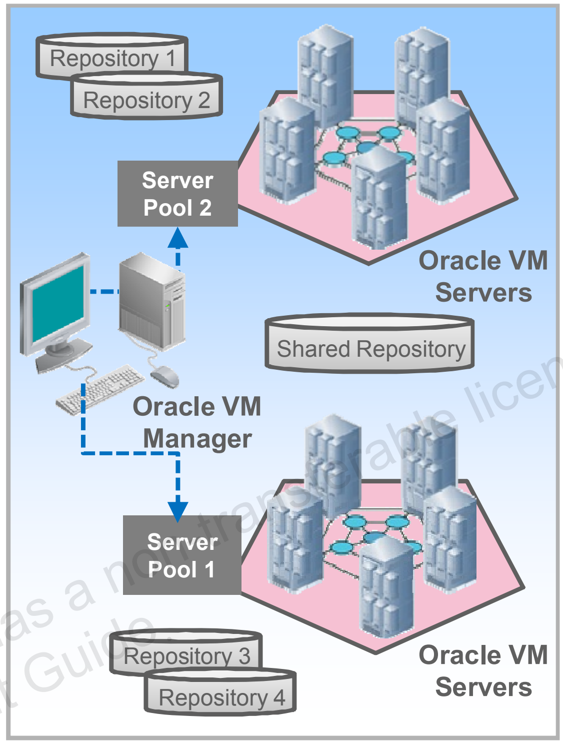




**Answer: b**

## Oracle VM Functional Architecture

- The Oracle VM Manager:
  - Manages Oracle VM servers and virtual machines
  - Stores configuration information, statistics, and events in its database
- The Oracle VM server:
  - Is a member of a server pool
  - Runs virtual machines
- Repositories are:
  - Used to store virtual resources
  - Accessed by Oracle VM servers






**Oracle VM Manager**

You install the Oracle VM Manager on a host that is running Oracle Linux or Red Hat Enterprise Linux. There are prerequisites for this host. These requirements are discussed in the lesson titled "Planning and Installation." The Oracle VM Manager communicates with all Oracle VM servers over the management network.

The Oracle VM Manager controls the virtualization environment, creating and monitoring Oracle VM servers and the virtual machines. The Oracle VM Manager serves as the only administrative interface to the Oracle VM servers, whether you access it using the browser-based Oracle VM Manager UI, the Oracle VM CLI, or the Oracle VM Web Services API. Managing Oracle VM from the Oracle VM servers is not supported.

The Oracle VM Manager is an Oracle Fusion Middleware application, based on the Oracle WebLogic Server application server. The Oracle VM Manager uses a MySQL database as the shared repository, which is installed locally as part of the Oracle VM Manager installation. The MySQL database is used to store management information for the Oracle VM environment.

### Oracle VM Server for x86

You install Oracle VM Server for x86 directly on the server hardware with x86 Intel or AMD processors and do not require a host operating system. Oracle VM Server for x86 requires 64-bit hardware, but can support either 64-bit or 32-bit guest virtual machines.

Oracle VM Server for x86 includes the Oracle VM Agent to communicate with the Oracle VM Manager for management and configuration. Although the Oracle VM Server for x86 software uses several open source components, and is itself an open source, it is a product developed and offered only by Oracle, and is customized and optimized to integrate into Oracle's products.

### Server Pools

Multiple Oracle VM servers are grouped into server pools, as shown in the diagram in the slide. Each Oracle VM server can be a member of only one server pool.

The server pool is the operational unit of Oracle VM. Policies are configured and enforced at the server pool level. Polices are discussed later in this lesson.

### Repositories

You create repositories to store virtual resources:

- Configuration files for virtual machines
- Virtual disks for virtual machines
- Templates and virtual appliances
- ISO files for use by virtual machines

Repositories are created on storage accessible by the Oracle VM servers in a server pool. A repository is generally dedicated to a server pool, as shown in the diagram in this slide, where Repository 1 and Repository 2 belong to Server Pool 2, and Repository 3 and Repository 4 belong to Server Pool 1.

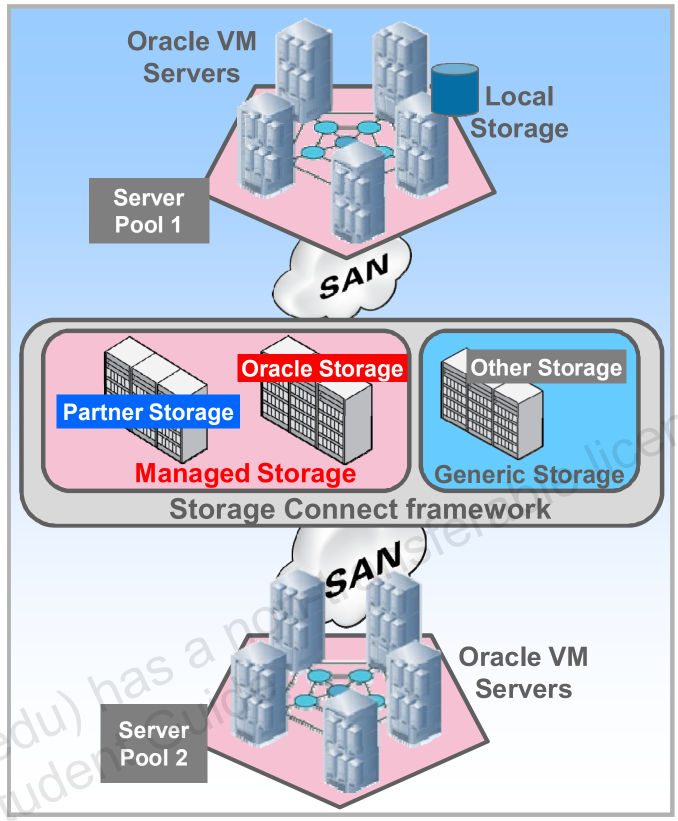
However, network file system (NFS)-type repositories can be shared between server pools. This is shown in the diagram in the slide, where the repository named "Shared Repository" can be accessed by the Oracle VM servers from Server Pool 1 and Server Pool 2.

**Note:** The repositories are used to store virtual resources for virtual machines, and are accessed by Oracle VM servers. They are not databases, and should not be confused with the MySQL database used by the Oracle VM Manager.

Repositories are discussed in the lesson titled "Server Pools and Repositories."

# Oracle VM Functional Architecture: Storage

- All storage:
  - Can be accessed by using iSCSI, FC, or NFS
  - Is used to create repositories or physical disks for virtual machines
  - Provides plug-ins as part of the Storage Connect framework
- Local storage:
  - Is attached to a single Oracle VM server
  - Cannot be used with HA












**External Storage**

All Oracle VM servers in the same server pool must have access to the same external storage, which can be NFS, Fibre Channel (FC), or iSCSI. This allows virtual machines associated with the server pool to start and run on any Oracle VM server within the server pool.

**Storage Connect Framework**

Oracle VM integrates with all types of storage, shown as Generic Storage in the slide, and also provides advanced storage functionality for storage vendors that provide a plug-in to access their storage. This plug-in is part of the Oracle VM's Storage Connect framework, which is discussed in the lesson titled "Managing Storage."

Oracle VM provides its own Storage Connect plug-ins for the Oracle ZFS Storage Appliance and Oracle's Pillar Axiom systems.

How Oracle VM can take advantage of the advanced storage features of the Oracle ZFS Storage Appliance is discussed in the lesson titled "Managing Storage."

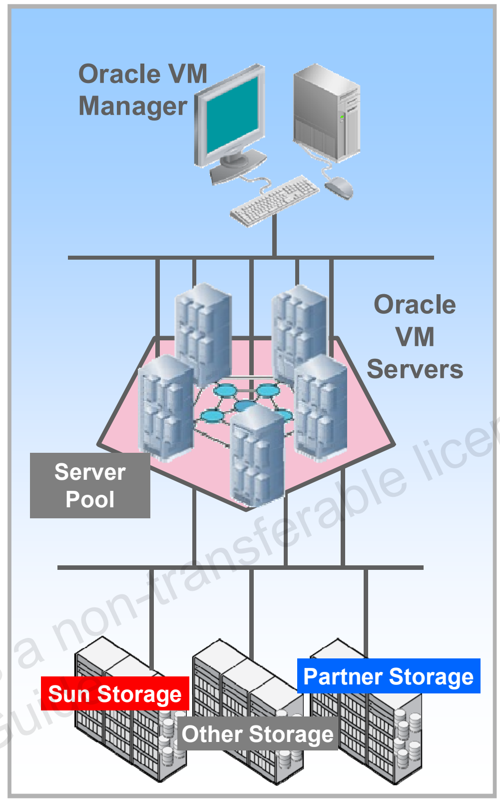
### Local Storage

You can also configure local storage. An example of local storage is shown in the diagram in the slide as an internal disk drive in one of the Oracle VM servers in Server Pool 1. Local storage is often not appropriate for a production environment, because it prevents or sharply constrains the ability of a virtual machine to run anywhere in the server pool in the event of failure of the Oracle VM server that owns the local storage.

# Oracle VM Functional Architecture: Networking

The networking infrastructure in the Oracle VM environment supports a number of functions:

- The management network between the Oracle VM Manager and the Oracle VM servers
- The storage network between the Oracle VM servers and their storage subsystems
- The guest network between the Oracle VM servers and the outside world
- Advanced functions, such as live migration and cluster heartbeat








When you add Oracle VM servers to your Oracle VM environment by using the Oracle VM Manager, one or more management networks are automatically created for you. These networks are used by the Oracle VM Manager to communicate with all the Oracle VM servers in the environment. The management network shown in the diagram in the slide is a network that links the Oracle VM Manager and all the Oracle VM servers in the server pool.

With the Oracle VM Manager, you configure additional networks to support all the functions of your Oracle VM server pools, and to minimize network bandwidth and latency issues.

The Oracle VM network functions include the following:

- Communication between the Oracle VM servers in a server pool: When you create a server pool with the cluster feature, each Oracle VM server sends keep-alive messages to other members of its server pool, indicating that it is up and running.

  This communication is part of the clustering feature of each server pool. Clustered server pools are discussed in the lesson titled “Server Pools and Repositories.”

- The ability to migrate a running virtual machine: In response to high utilization of resources on one Oracle VM server in the pool, Oracle VM can trigger the migration of one or more running virtual machines from the highly utilized Oracle VM server to another server in the server pool to distribute resources more evenly. You can configure and dedicate a network for this function.

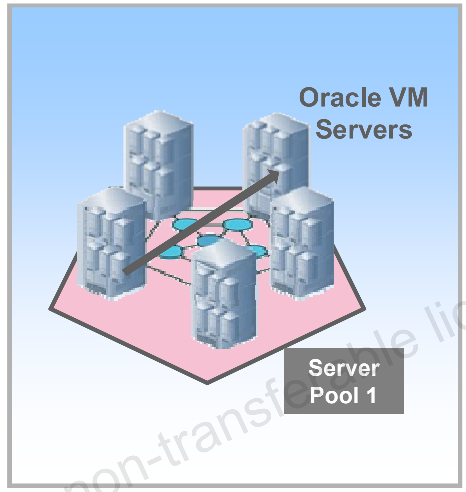
  The live migration feature is discussed in the next slide.
- Access to external storage: Although Oracle VM servers can access their IP-based storage by using the management network, it is often desirable to have a separate network for storage traffic.

  The storage network is shown in the diagram in the slide as a network that links all the Oracle VM servers in the server pool to the storage systems below the server pool. Notice that the Oracle VM Manager is not connected to the storage network.
- Virtual machine networking: Virtual machine networking has requirements that are different from the other networks in your Oracle VM environment. From the Oracle VM Manager, you can create networks that are dedicated to virtual machine traffic.

## Live Migration

Live migration:

- Is a process to move a running virtual machine from one Oracle VM server to another within the same server pool
- Is used by several features and policies in Oracle VM
- Must be performed by using identical computers








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.

**Why Use Live Migration**

This feature is important, and is used in the following ways in Oracle VM:

- To move one or more virtual machines to other Oracle VM servers in the server pool in response to changes in the environment. For example, you can use live migration to free up resources on an Oracle VM server if you wish to increase the allocation of resources for a virtual machine on that server.
- To support a planned shutdown for maintenance purposes
- To support a server pool's Distributed Resource Scheduling (DRS) and Dynamic Power Management (DPM) policies. These policies are discussed later in this lesson.

Live migration across server pools is not allowed. You can live-migrate virtual machines only 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 Oracle VM server and the destination Oracle VM server must be identical.

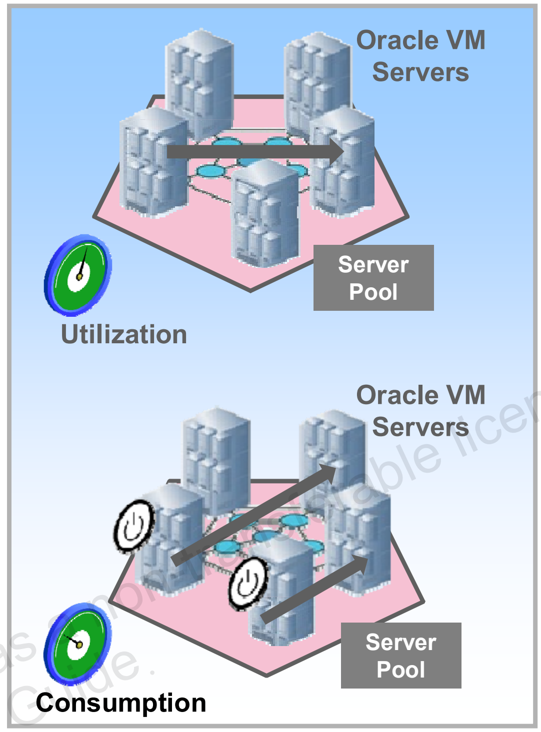
### How Live Migration Works

During the live migration process, a virtual machine's memory content is migrated from the Oracle VM server on which it is currently running, to another Oracle VM server in the same server pool. Because the virtual machine is running and might be modifying its memory pages, a final synchronization is done just before the virtual machine starts running on the target Oracle VM server. This migration of memory pages occurs over the local area network (LAN), and it uses secure sockets layer (SSL) to ensure secure migration.

Oracle VM enables the administrator to create a separate network for live migration. This is part of the networking management features of Oracle VM. Configuring and managing networks is covered in the lesson titled "Managing Servers and Networks."

## Server Pool Policies

- Distributed Resource Scheduling (DRS):
  - Live migration of virtual machines based on server load
  - Dynamically managed quality of service
- Dynamic Power Management (DPM):
  - Enables automatic power-off of under-utilized servers
  - Consolidates virtual machines onto fewest servers
  - Reverses the process when load increases








**DRS for Capacity Management**

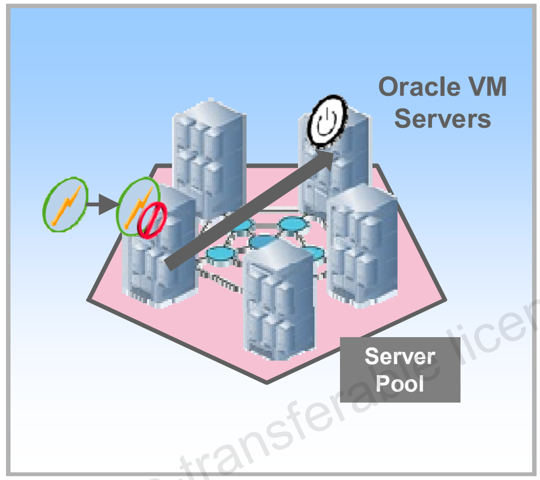
DRS provides real-time monitoring of Oracle VM server utilization with the goal to rebalance a server pool to provide consistent resources to the running virtual machines. DRS migrates load away from heavily loaded Oracle VM servers to less heavily loaded Oracle VM servers.

**DPM to Optimize Server Pool for Minimum Power Consumption**

DPM complements DRS to reduce the number of active 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.

# HA for Virtual Machines

- You can use HA to automatically restart a virtual machine on Oracle VM server or virtual machine failure.
- Oracle VM uses clustering logic to detect server failure in the server pool.
- HA events occur even if the Oracle VM Manager is unavailable.







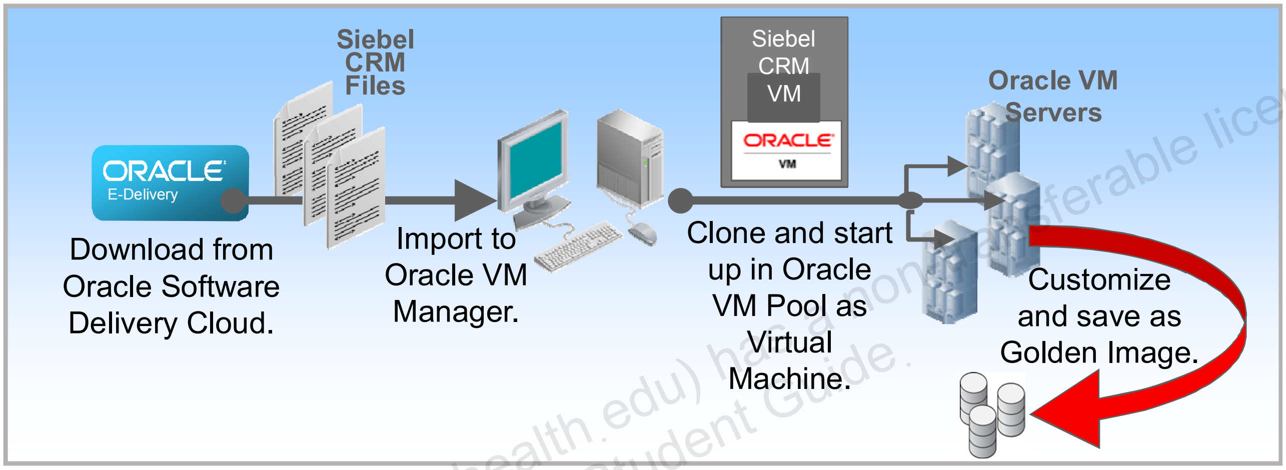

You can set up HA in your Oracle VM server pools to ensure availability of your virtual machines. If HA is configured for the server pool, and an Oracle VM server is restarted or shut down, the virtual machines running on it are restarted on another Oracle VM server.

All of the Oracle VM servers in a clustered server pool are part of the cluster. The cluster ensures controlled access to the virtual resources in the server pool. The cluster logic detects if an Oracle VM server has failed, fences the failed server to prevent corruption of shared resources, and regains access to the virtual resources that were being used by the failed server. All these operations take place without administrator intervention.

The HA features of Oracle VM are configured from the Oracle VM Manager, but the HA events do not depend on the Oracle VM Manager to operate properly. If the Oracle VM Manager fails or is brought down, the HA events take place if triggered by a failure in the environment.

## Fast Deployment with Oracle VM Templates and Virtual Appliances

- A template is a preconfigured virtual machine.
- A virtual appliance contains multiple machines with metadata that describes the relationship between the virtual machines.
- You save days or weeks in configuration time when deploying virtual machines from templates or virtual appliances.






Using templates and virtual appliances with Oracle VM makes it easy to rapidly provision and deploy business applications.

This slide describes the process to bring templates and virtual appliances into your Oracle VM environment:

1. Download the templates (and virtual appliances).
2. Import the template or virtual appliance into Oracle VM.
3. If using a virtual appliance, create a template from the virtual appliance.
4. Create a virtual machine from the template.
5. Start the virtual machine that was created from the template.
6. Customize the virtual machine into a “Golden Image.”

The next slide discusses these steps in more detail.

### Custom Templates or Virtual Appliances

In addition to the Oracle VM templates and virtual appliances that are available from the Oracle Software Delivery Cloud, you can develop your own templates by packaging the files that make up a template:

- A binary `system.img` file containing the disk image with the boot OS
- Optionally, additional binary files that are disk images containing Oracle or other third-party software that are not part of the OS
- A text file called `vm.cfg` that contains the configuration parameters for the virtual machine

A virtual appliance is very similar to an Oracle VM template, except that it usually contains several virtual machines that are to be deployed together, to deliver a multitier application. The virtual appliance can contain additional configuration information and management policies, along with the set of multiple virtual machines, to describe the virtual machines and the interconnectivity between them.

To help you create virtual appliances, Oracle provides the Virtual Assembly Builder. This is a sophisticated development tool for examining the current application environment and creating virtual appliances as a collection of virtual machines, along with all their critical configuration parameters, to allow you to deploy them to a virtual environment. You can find useful information to get started with the Oracle Virtual Assembly Builder at http://www.oracle.com/us/products/middleware/exalogic/virtual-assembly-builder.

In the lesson titled "Managing Virtual Machines," you learn more about using techniques like cloning, templates, and virtual appliances to create and deploy virtual machines.

# Benefits of the Oracle VM Solution

- Fast deployment over the whole stack
- Suitable for all data center workloads
- Flexible management interfaces
- Integration with other Oracle virtualization products

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The previous slides discussed the features of Oracle VM. This slide summarizes these features and points out the benefits associated with the Oracle VM solution.

**Fast Deployment over the Whole Stack**

You can select from hundreds of templates and virtual appliances, which are built to deliver complete software solutions, or build your own templates or virtual appliances. With these templates and virtual appliances, you can easily deploy multitier Oracle and non-Oracle software. You can use Oracle VM as a virtualization platform for software from any vendor.

Oracle VM supports the Open Virtualization Format (OVF). Using this format, you can migrate virtual machines from other virtualization platforms to your Oracle VM environment.

Oracle VM is fully certified for all Oracle software.

**Suitable for All Data Center Workloads**

Because Oracle VM offers support for both x86 and SPARC architectures, you can deploy in a heterogeneous environment and have a single management interface across them.

You can use the Oracle VM Manager to perform operations on your Oracle VM server for SPARC resources, such as discovering your SPARC servers and grouping them into server pools, importing templates and virtual appliances, and creating and managing virtual machines.

The policy-based management capabilities of Oracle VM allow you to fully use your physical servers, and respond to the changing loads in your data center. With live migration and HA features, you add resiliency to your environment.

Oracle VM integrates with Enterprise Manager for full stack management. With the addition of Enterprise Manager, you can extend the management capabilities in your environment to include provisioning and lifecycle management for your Oracle VM servers and virtual machines.

Oracle VM offers centralized network configuration capabilities. You do not have to create network devices on individual servers. Oracle VM also offers support for bonded interfaces (link aggregations), VLANs, and jumbo frames.

You provision and manage your storage with Oracle VM Storage Connect, which taps into the advanced capabilities of your storage subsystem.

**Flexible Management Interfaces**

Oracle VM provides an easy-to-use web-based graphical UI, which you can use to manage your server pools with Oracle VM Server for x86 or Oracle VM Server for SPARC servers.

The UI provides accessibility options for screen readers, a health tab to monitor the overall health and status of your virtualization environment, features such as multiselect of objects, and a tagging facility that allows you to quickly locate and aggregate objects in your environment, based on your own criteria.

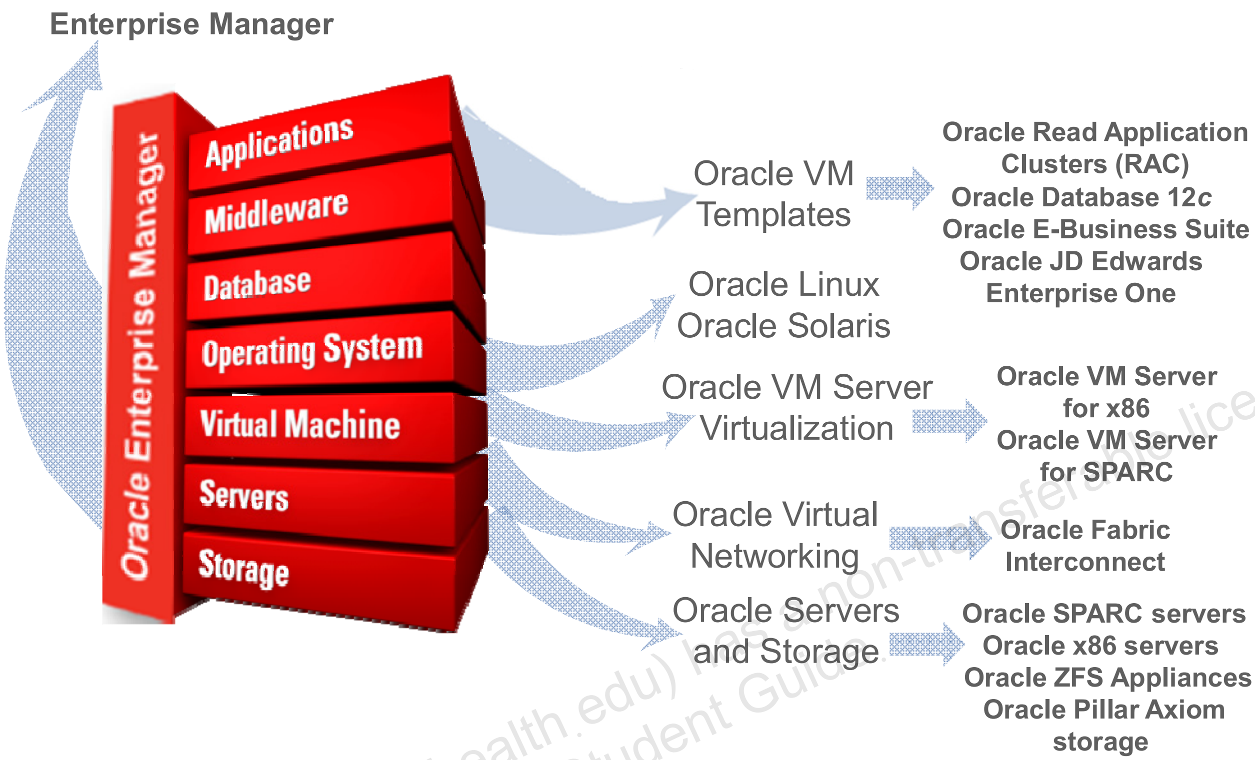
With the Oracle VM CLI, you can perform the same functions as those with the Oracle VM Manager's browser-based UI, such as managing your server pools, servers, and guests. The CLI commands can be scripted and run in conjunction with the Oracle VM Manager UI, thus bringing more flexibility to help you deploy and manage an Oracle VM environment. See the *Oracle VM Command Line Interface User's Guide,* Part Number E50252-03 or later for information about using the CLI.

**Integration with Other Oracle Virtualization Products**

Oracle offers virtualization products that can manage your business applications as well as benefit the users that are accessing them.

The next two slides provide an overview of these virtualization offerings, as well as the training available for these products.

# Oracle Virtualization and the Deployment Stack








Oracle VM is integrated into every layer of the deployment stack for business applications.

The information in the slide provides a high-level view of the entire deployment stack, and how Oracle virtualization provides key components to build a complete cloud infrastructure, to deploy your business applications to the cloud, and to facilitate your users' access to these applications.

1. **Server virtualization:** The foundation of the cloud infrastructure
   - Oracle VM Server for x86 is an enterprise-proven virtualization solution for both Oracle and non-Oracle workloads. In this course, you learn how to install Oracle VM Server for x86, configure the resources available to your Oracle VM environment, provision virtual machines, and manage their life cycles.
   - Oracle VM Server for SPARC enables you to harness the virtualization capabilities of your T-Series and M-Series SPARC servers. You can use the same Oracle VM Manager to deploy your virtual environment with physical servers running either Oracle VM Server for x86 or Oracle VM Server for SPARC.
   - Earlier in this lesson, you learned about Solaris Zones as being an OS partitioning software. Oracle Solaris Zones deliver lightweight virtualization with isolation, security, and native performance. You can use Solaris Zones within your Oracle VM Server for SPARC environment, to provide further isolation and control at the application level.

The Sun SPARC Enterprise M-Series servers offer the dynamic domains feature, which provides the ability to partition hardware resources on the SPARC M-Series server into smaller logical systems, resulting in a very high level of isolation because the partitioning occurs at the hardware level. The hardware resources in a dynamic domain can be redistributed to respond to changing needs. During this reconfiguration, the applications running in the dynamic domain continue to operate without disruption.

2. **Network virtualization:** Delivery of connections in a virtualized environment

   The network infrastructure in a virtualized environment includes management access, connections between physical servers, connections to external networks, and connections to various types of storage. This layer provides the foundation for HA and accessibility throughout the virtual environment.

   Solution architects strive to meet performance demands for cloud environments while reducing deployment costs. Virtualized environments have increased bandwidth requirements as well as complex networking infrastructure. With Oracle Fabric Interconnect (formerly Xsigo Fabric Director), Oracle offers a network virtualization technology that simplifies cloud infrastructure and operations by allowing you to dynamically and flexibly connect any server to any network and storage.

3. **Storage that works with your virtual environment**

   The Oracle ZFS Storage Appliance integrates seamlessly into your virtualization environment. It provides enterprise-class data services and multiprotocol support. In the lesson titled "Managing Storage," you learn how the Oracle ZFS Storage Appliance participates in the Storage Connect infrastructure to provide extended capabilities such as cloning and on-the-fly provisioning of physical disks.

4. **Integration with leading operating systems**

   Oracle Linux with the default Unbreakable Enterprise Kernel (UEK) is fast, reliable, and optimized for all Oracle enterprise applications.

   Oracle Solaris has built-in virtualization capabilities. When you install Solaris, you immediately get the ability to create domains and zones. To manage your domains as virtual machines from the Oracle VM Manager, install the Oracle VM Server for SPARC software, which provides the Oracle VM Agent component to communicate with the Oracle VM Manager.

   Oracle VM also supports Windows workloads and provides paravirtualized drivers for several versions of Windows for enhanced network and disk operations.

5. **The application deployment platform:** Multitier applications, ready to deploy

   As discussed in the slide titled "Fast Deployment with Oracle VM Templates and Virtual Appliances" earlier in this lesson, you can:

   - Download templates and virtual appliances from the Oracle Software Delivery Cloud and quickly provision your business applications
   - Use Oracle Virtual Assembly Builder to virtualize your existing software components, capturing their relationships and redeploying them as virtual appliances, which represent a complete multitier application topology

6. **Access to the cloud:** From anywhere, from any device

   Cloud users span many roles, from customers, cloud analysts, to developers, and more. You can provide each user with customized access to your applications, anywhere—from browser access to mobile devices.

Secure Global Desktop provides secure remote access directly to Oracle applications or systems. It provides reliable browser-based access to these applications from a wide variety of client devices.

7. **Cloud management:** Complete cloud lifecycle management

   Monitoring your cloud infrastructure is no longer enough. Therefore, your cloud management layer now offers complete cloud lifecycle management, including self-service provisioning, policy-based resource management, and integrated chargeback and capacity planning.

   Oracle supports easy integration of Oracle VM Server for x86 or SPARC with Enterprise Manager, to provide comprehensive management of the entire hardware and software stack.

8. **Private Cloud Appliance:** One platform for all your applications

   The Private Cloud Appliance is discussed in the next slide.

## Private Cloud Appliance Preinstalled, Preconfigured Oracle VM

- The Private Cloud Appliance provides:
  - A complete Oracle VM solution that includes servers, storage, networking, and virtualization
  - Fast deployment from power on to launching virtual machines
  - A web-based management console for end-to-end automation and orchestration
- The appliance operates as one unit, not as individual servers.
  - You add capacity by adding one or more compute nodes.

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The Private Cloud Appliance is an integrated, "wire once," software-defined converged system designed for rapid deployment of both infrastructure hardware and application software.

The Private Cloud Appliance controller orchestration software automatically powers up, installs, and configures the hardware and software environment. Many of the configuration tasks that you learn to perform in this course, such as discovering servers and creating server pools, are already done for you. Within minutes, the Private Cloud Appliance is ready, and you can add virtual machines by using standard Oracle VM templates or virtual appliances or by creating them from installation media.

You can find a list of the guidelines and restrictions for the Private Cloud Appliance by consulting the *Oracle Private Cloud Appliance Administrator's Guide*, Part Number E40647-02 or later.

**Management Nodes**

The Private Cloud Appliance contains two management nodes. The two nodes run the controller orchestration software and the Oracle VM Manager software. The controller orchestration software handles high availability for the management nodes.

### Compute Nodes

You can increase the capacity of your Private Cloud Appliance by adding one or more compute nodes. Compute nodes are hosts running the Oracle VM Server for x86 software.

### Resources

You can obtain information about the Private Cloud Appliance at http://www.oracle.com/technetwork/server-storage/private-cloud-appliance/overview/index.html.

You can browse the Private Cloud Appliance documentation at http://www.oracle.com/technetwork/server-storage/private-cloud-appliance/documentation/index.html.

## Quiz

Live migration is the process of moving a running virtual machine:

a. From one Oracle VM Manager to another Oracle VM Manager
b. From one Oracle VM server to another in the same server pool
c. From one repository to another belonging to the same server pool
d. To another virtual machine in the same server pool, which is identical to the migrating virtual machine



**Answer: b**

# Summary

In this lesson, you should have learned how to:

- Define server virtualization and list its benefits and challenges
- Explain the different server virtualization types
- Describe Oracle VM within the server virtualization landscape
- List the components of Oracle VM
- Describe the major functions and features of Oracle VM
- List the benefits of Oracle VM
- Explore Oracle's virtualization offerings

# Practice 1: Overview

This practice covers the following topics:

- Becoming familiar with the hosts and networks in your lab environment
- Accessing your lab machine and switching to the `root` user
- Accessing a running host with an active network interface, by using the `ssh` command
- Accessing a running host with the `vncviewer` command

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2

# Planning and Installation

## Objectives

After completing this lesson, you should be able to:

- Plan the installation of your Oracle VM environment
- Install the Oracle VM Server for x86 software
- Prepare the host machine for the Oracle VM Manager installation
- List the installation options for the Oracle VM Manager
- Install the Oracle VM Manager
- Perform post-installation tasks
- Navigate Oracle VM Manager's management interfaces
- Describe the Oracle VM upgrade process

## Planning Your Installation

- The first section of this lesson discusses the steps to prepare your environment for installing the Oracle VM components: Oracle VM Server for x86 and the Oracle VM Manager.
- This section includes the following topics:
  - Hardware requirements
  - Software requirements
  - Networking and network services
  - Storage for your Oracle VM environment

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The topics presented in the first section of this lesson provide information to help you plan the installation of your Oracle VM environment.

The hardware and software requirements for the two components of Oracle VM (the Oracle VM Manager and Oracle VM Server for x86) are presented, along with a general discussion about the network and storage considerations. Networks are discussed further in the lesson titled “Managing Servers and Networks” and storage is discussed in the lesson titled “Managing Storage.”

## Requirements for the Oracle VM Server for x86 Servers

- Oracle VM Server for x86 hardware requirements:
  - A 64-bit processor
    - Hardware virtualization support for hardware-virtualized guests
  - CPU and memory requirements, depending on the type and number of guests that run on the Oracle VM servers
  - A network interface to a network that connects the Oracle VM Manager host and all Oracle VM servers
    - If the interface is part of a virtual LAN (VLAN), the VLAN setup must be in place before installing the Oracle VM server.
- View the certified hardware at http://linux.oracle.com/pls/apex/f?p=117:1:4146577427153959.
- Obtain the Oracle VM Server for x86 software from the https://edelivery.oracle.com/ site.

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When installing, plan your Oracle VM environment:

- Estimate your hardware requirements.
- Design your network and storage configuration.

For the minimum hardware and software installation guidelines, consult the *Oracle VM Installation and Upgrade Guide,* Part Number E64078_01 or later, and the *Oracle VM Release Notes*. Note the following:

- You must install Oracle VM Server for x86 on a host that supports the x86_64 host hardware.
- For hardware-virtualized or unmodified guest operating systems like Microsoft Windows, a CPU with hardware virtualization support is required—either Intel VT or AMD-V. You must also enable this feature in the BIOS.

- The minimum memory requirement is 1 GB of RAM, although at least 2 GB is recommended. The dom0 memory is set to a default value based on the physical memory. It is recommended that you leave memory to its default installation value (512 + 0.0205 * physical memory [in MB]). However, there are cases where it is necessary to increase this size to meet the demand of running applications (for example, presenting one iSCSI LUN takes approximately 1 MB of system memory). Consequently, a system that uses many LUNs quickly requires a larger amount of memory in accordance with the storage configuration.
  Adjusting the memory size in your Oracle VM servers is discussed in this lesson.
- Compute the CPU and memory requirements for all your guest operating systems to determine the workload for your Oracle VM servers. Memory oversubscription is not supported.
- To ensure that your hardware has been certified, you can visit the following website at http://linux.oracle.com/pls/apex/f?p=117:1:4146577427153959.
- Because the Oracle VM Server for x86 software includes a small Linux-based operating system (OS), there are no specific software requirements. All previous OS and data are lost during the software installation.

## Requirements for the Oracle VM Manager Host

- Oracle VM Manager hardware requirements:
  - Host operating system
    - 64-bit Oracle Linux or Red Hat Enterprise Linux
  - 8.0 GB of memory
  - Disk space in the following directories:
    - 3 GB in `/tmp`, 5.5 GB in `/u01`, 300 MB in `/usr`, and 400 MB in `/var`
- Database access
  - The MySQL database is bundled with the installation software, and is installed locally on the Oracle VM Manager host.
- Software packages
  - `zip`
  - `unzip`
  - `perl`

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The host computer on which you install the Oracle VM Manager must have 64-bit processors, with processor speed of at least 1.83 GHz.

You must first install Oracle Linux or Red Hat Enterprise Linux on the host computer to run the Oracle VM Manager.

The Oracle VM Manager is supported on the following 64-bit Linux operating systems:

- Oracle Linux Release 5 Update 5 or later
- Red Hat Enterprise Linux 5 Update 5 or later

Refer to *Oracle VM Installation and Upgrade Guide*, Part Number E64078_01 or later, for the prerequisites for installation, including the supported Linux operating systems.

The Oracle VM Manager requires exclusive use of MySQL on the host on which it is installed. For this reason, back up and uninstall any existing MySQL instance on the system before installing the Oracle VM Manager software.

If you have a minimal installation of Oracle Linux, you might not have all the required packages to complete an install of Oracle VM Manager. These packages are required for the Oracle VM Manager installer to run successfully:

- `zip`
- `unzip`
- `perl`

To install these packages, enter:

```
# yum install zip unzip perl
```

The Oracle VM Manager installer runs additional checks for other software packages that are required to complete the installation. If a required package is missing, the installer might exit with a warning message notifying you of the missing package and the steps that you might need to follow to install it.

Systems that have been installed as a 'minimal' installation might be missing specific packages. For instance, on Oracle Linux 6 and 7 you might be required to install the `libaio` package, while on Oracle Linux 7 you must install the additional `net-tools` and `perl-Data-Dumper` packages.

The Oracle VM Manager installer is responsible for installing a number of different software packages, some of which can have other dependencies. If you have not installed at least a minimal installation of Oracle Linux, the installer might exit at any point and notify you of missing dependencies. In this situation, you must ensure that dependency packages are installed before attempting to resume an installation.

## Licensing with Oracle VM

- The Oracle VM Manager includes restricted licenses for:
  - Oracle WebLogic Server 12*c* Standard Edition, including Application Development Framework (ADF) Release 12*c*
  - MySQL Enterprise Edition
- Before installing the Oracle VM Manager on your selected host, remove any existing MySQL.







**Oracle WebLogic Server**

Oracle WebLogic Server 12*c* Standard Edition, including Application Development Framework (ADF) Release 12*c*, is included with the Oracle VM Manager. Use of Oracle WebLogic Server 12*c* Standard Edition is restricted to the Oracle VM Manager.

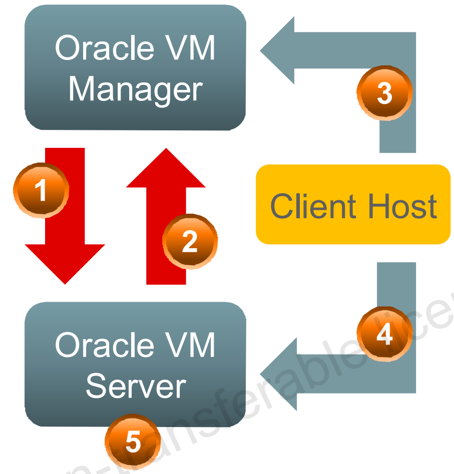
**MySQL Enterprise Edition**

The Oracle VM Manager makes use of its own version of MySQL Enterprise Edition. The MySQL server that is installed uses a non-standard TCP Port (49500) for exclusive use by the Oracle VM Manager. Do not use the bundled database for other applications.

To prevent potential conflicts with existing MySQL installations, remove any existing MySQL installations before installing the Oracle VM Manager. If you are running MySQL on the system where you are installing the Oracle VM Manager, the installer exits to allow you to back up any existing databases and remove the existing MySQL instance before proceeding with the installation.

## Oracle VM Firewall Configuration and Port Usage

1. Oracle VM Manager to Oracle VM servers:
   - Port 8899 (TCP)
   - Ports 6900, 6901,... (TCP)
   - Ports 7900, 7901, ...(TCP)
2. Oracle VM servers to Oracle VM Manager:
   - Port 7002 (TCP), port 123 (UDP)
3. Client host to Oracle VM Manager:
   - Port 7002 (TCP), port 22 (TCP)
   - Port 10000 (TCP)
4. Client host to Oracle VM servers:
   - Port 22 (TCP)
5. Oracle VM server to Oracle VM server:
   - Port 7777 (OCFS2)
   - Port 8002 (TCP), port 8003 (TCP)

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A default Oracle Linux installation on your Oracle VM Manager host enables the firewall (that is, the `iptables` service is enabled). To use the Oracle VM Manager on a system with `iptables` enabled, you can either open all the ports used by the Oracle VM Manager or open all ports by disabling `iptables`.

If the `iptables` service is enabled in your environment, open the following ports in your Oracle VM Manager firewall:

- **123 (UDP):** For Network Time Protocol (NTP) requests from the Oracle VM servers
- **22 (TCP):** For SSH access to the Oracle VM Manager host from any location
- **7002 (TCP):** For HTTPS connection from the local client, from remote clients, and from Oracle VM servers
- **10000 (TCP):** For `ssh` access to the CLI from the local client and from remote clients

The firewall is not active on the Oracle VM server after installing the Oracle VM Server for x86 software. If you configure the `iptables` service on the Oracle VM servers, you must open the following ports in the firewall:

- **Ports 6900, 6901,... (TCP):** For SSL-secured VNC connections to connect to the VNC console for virtual machines that are running on the Oracle VM server, from the Oracle VM Manager

- **Ports 7900, 7901, ... (TCP):** For SSL-secured Telnet emulated serial connections to connect to the serial console for virtual machines that are running on the Oracle VM server, from the Oracle VM Manager
- **Port 8899 (TCP):** For connection to the Oracle VM Agent that is running on the Oracle VM server, by the Oracle VM Manager
- **Port 22 (TCP):** For SSH access to the Oracle VM server host from any location
- **Ports 8002, 8003:** For live migration between Oracle VM servers
- **Port 7777:** For heartbeat communication between the Oracle VM servers in a clustered server pool

The required and optional ports are discussed under the topic “Firewall Configuration” in the chapter titled “Installing Oracle VM Manager,” in the *Oracle VM Installation and Upgrade Guide*, Part Number E64078_01 or later.

# Before You Install the Oracle VM Manager Software

- Create the username `oracle` as a member of the `dba` group, before you start the installation.
- Increase `hard nofiles` and `soft nofiles` in the `/etc/security/limits.conf` file.
- Create the `/u01` directory with at least 2.4 GB of space.
  - Alternatively, you can perform all these steps by running the `createOracle.sh` script to prepare your host for the Oracle VM Manager installation.



While installing the MySQL database and other components as part of the Oracle VM Manager installation, there are several requirements that you might or might not have met, depending on how you customized the operating system on your Oracle VM Manager host. To ensure that your Oracle VM Manager host meets all the necessary requirements, you can run the `createOracle.sh` script, which is provided on the installation media, to perform the configuration and verification steps.

## Networking in the Oracle VM Environment

Network requirements:

- The Oracle VM Manager must be able to communicate with all the Oracle VM servers in the environment.
- All entities must have a static IP address.
- If you plan to use VLANs, you must set up the VLAN infrastructure before installing the Oracle VM servers.
- Plan for additional networks for:
  - Virtual machine traffic
  - Storage access
  - Cluster heartbeat
  - Live migration

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The lesson titled "Managing Servers and Networks" covers the initial configuration of your Oracle VM environment. To begin the initial configuration, discover the Oracle VM servers by using one of the Oracle VM Manager management interfaces: the Oracle VM Manager UI, command-line interface (CLI), or Web Services API.

To initiate the configuration, you must take the following steps:

- Ensure that the network infrastructure that is used for discovering the Oracle VM servers is in place.
- If the environment contains VLAN segments, ensure the VLAN infrastructure is in place before installing Oracle VM Server for x86 on your servers.

All Oracle VM servers must have a static IP address. Network Address Translation (NAT) is not supported to assign IP addresses to Oracle VM servers. If you are using dynamic host configuration protocol (DHCP), reserve fixed addresses for your Oracle VM servers in the DHCP configuration file.

Although all operations in the Oracle VM environment can take place over a single, routable network, it is not a recommended network configuration. Plan for additional networks (for example, one or more networks for configuring and accessing your storage, and one or more networks for the virtual machines to access the services they need).

You also can create separate networks for the cluster heartbeat and the live migration features.

Creating and managing networks, including networks for the cluster heartbeat and the live migration feature, is discussed in the lesson titled “Managing Servers and Networks.”

## Network Services

- All Oracle VM servers must be time-synchronized.
- If you are using the Oracle VM Manager as the time source for your Oracle VM servers, configure your Oracle VM Manager to provide NTP services.
- All entities must have host names that are correctly resolved.
- Oracle VM servers have firewalls disabled at installation time.
- If the firewall on your Oracle VM Manager host is enabled, open the necessary ports to allow access to your Oracle VM Manager management interfaces.
- If you are planning to use dynamic addressing for virtual machines, a DHCP server is required.





- NTP
  - Ensure that all Oracle VM servers, including the Oracle VM Manager, are synchronized by using Network Time Protocol (NTP).
  - Validate your time source before configuring the networks and storage.

    **Note:** When you discover (or re-discover) an Oracle VM server from the Oracle VM Manager, the NTP time source on the Oracle VM server points to the Oracle VM Manager by default. If you configure your own list of NTP servers, these servers can be used instead to configure the NTP time sources on your Oracle VM servers.

    You can change the time sources as needed in your environment by using the Oracle VM CLI or WS-API. You can also make these changes manually on each Oracle VM server.
- DNS and DHCP
  - All hosts, including the Oracle VM Manager and the Oracle VM servers, must have name resolution with forward and reverse lookup capabilities.
  - If DNS is not used in your environment, you must update the `hosts` file on all newly installed Oracle VM servers.

- If the virtual machines deployed in your environment rely on DHCP, a DHCP server must be available to assign network parameters. The Oracle VM Manager does not provide this service.

- HTTP and FTP
  - After configuring your storage repositories, populate them with the templates, Virtual Appliances, and ISO files needed to create virtual machines. You use FTP or HTTP to import these files into the repository. You can specify a proxy for these import operations.
  - Ensure that your FTP and HTTP servers are configured for transfer requests from the Oracle VM servers.
- Firewall
  - Oracle VM servers: After installation, the Oracle VM servers have the firewall service disabled.
  - Oracle VM Manager: Make configuration changes to the firewall on the host where you install the Oracle VM Manager. The changes are dictated by your site policies. Firewall considerations were discussed earlier in this lesson.

## Storage for Oracle VM Servers

- Storage requirements for Oracle VM include:
  - Space to store virtual machine configuration files, templates, assemblies, and installation ISO files
  - Space for virtual or physical disks used by virtual machines
  - A disk area for use by each clustered Oracle VM server pool
- External storage is required to support:
  - Access to repositories by multiple Oracle VM servers
  - Live migration
  - The HA feature for virtual machines
- Oracle VM servers communicate with external storage through Storage Connect, which includes a set of generic and vendor-specific plug-ins.

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Storage administration is integrated into the Oracle VM Manager to simplify and automate storage configuration. The Oracle VM Manager does not access storage directly. When you trigger a storage operation from the Oracle VM Manager, the operation is carried out by an Oracle VM server.

Before installing Oracle VM Server for x86 on your servers, prepare your external storage:

- By creating redundant array of independent disks (RAID) groups to ensure high availability for your external storage.
- By implementing zoning or LUN masking to protect your storage elements from unwanted access.
- By creating the volume groups, LUNs, and NFS shares that become your Oracle VM repositories, server pool file systems, or LUNS to be used by virtual machines.

**Storage Requirements**

After preparing your external storage, you use this storage to create the following:

- Repositories
  - Repositories are used to store virtual machine configuration files, virtual machine disks, templates, assemblies, and installation ISO files.

- Virtual disks or physical disks for virtual machines
  - **Virtual disks:** You create virtual disks by using the space in the repositories. The repositories must be large enough to contain all the virtual disks for all the virtual machines that you plan to create.
  - **Physical disks:** You can assign entire LUNs as raw disks to virtual machines by using the Oracle VM Manager.
- Server pool file system
  - When you create an Oracle VM server pool, you must supply a server pool file system, which is a storage element (NFS share or iSCSI/FC LUN) used by the server pool to store pool information. Only server pools with the cluster feature activated require the use of a server pool file system. Server pools and server pool file systems are discussed in the lesson titled “Server Pools and Repositories.”

Oracle VM uses the Storage Connect framework for storage management. Storage Connect uses plug-ins for communication between the Oracle VM servers and the available storage. The Storage Connect framework exposes storage functionality through the Oracle VM Manager management interfaces.

Additional information about the Storage Connect framework and the steps to prepare your storage for use with Oracle VM are discussed in the lesson titled “Managing Storage.”

## Installation and Post-Installation Steps for Oracle VM Components

The next section of this lesson describes the installation process and the post-installation tasks for the Oracle VM components:

- The Oracle VM Server for x86 installation process
- The Oracle VM Manager installation process
- Post-installation tasks:
  - Stopping and starting the Oracle VM Manager applications
  - Launching the Oracle VM Manager's user interface
  - Navigating the Oracle VM Manager's user interface
  - Changing the passwords provided during installation (optional)
  - Installing the Oracle VM server support tools (optional)

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The next section of this lesson describes:

- The Oracle VM Server for x86 installation process
- The Oracle VM Manager installation process
- Post-installation tasks for the Oracle VM components:
  - Stopping and starting the Oracle VM Manager applications
  - Launching the Oracle VM Manager user interface
  - Navigating the Oracle VM Manger user interface
  - Changing passwords provided during installation. This is optional.
  - Installing the Oracle VM Server support tools

## Oracle VM Server for x86 Installation Steps

- Download the software from the https://edelivery.oracle.com/ site.
- Burn a DVD from the ISO file or mount the ISO file on a virtual CD-ROM.
- Boot the computer and follow the prompts.
- Reboot the computer when the installation completes.
- Log in to the new Oracle VM server by using the root account.
- Review the installation log.
- Repeat the installation process on all hosts that are selected to become Oracle VM servers.
- Optionally, use a Kickstart installation for your Oracle VM servers.

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Install the Oracle VM Server for x86 software from a bootable CD or from an ISO file. The installation software supports a limited number of CD-ROM devices. If your CD-ROM device is not recognized by the installation software, you can use a virtual CD-ROM device as offered by several Intelligent Platform Management Interface (IPMI) platforms.

The installation process deletes any previous operating system and data on the host machine.

**Upgrading from Previous Releases**

Upgrading from Oracle VM 2.x is not supported.

If you are upgrading Oracle VM servers from an Oracle VM 3.3 to a 3.4 release, you must use the `UpgradeServer.py` script. You can find information about upgrading your Oracle VM servers from Oracle VM 3.3 releases in the chapter titled “Upgrading Oracle VM” in the *Oracle VM Installation and Upgrade Guide*, Part Number E64078-01 or later.

**PXE Boot and Kickstart for Oracle VM Server**

When using a PXE boot and Kickstart setup to perform an Oracle VM Server for x86 installation, make sure that you specify the network interface to be used for the management interface first. If you have multiple network interfaces specified in a Kickstart file, the first interface is used as the management interface. You can use the additional network interfaces to create new networks. Creating networks is covered in the lesson titled “Managing Servers and Networks.”

For information about creating a PXE/Kickstart environment for automating the installation of your Oracle VM servers, refer to the chapter titled “Oracle VM Server Automated Installation” in the *Oracle VM Installation and Upgrade Guide*, Part Number E64078-01 or later.

**Multipath Installation**

You can install the Oracle VM Server for x86 software on a multipathed disk that is attached to a Fibre Channel adapter.

For information about installing on a multipathed disk, refer to the topic titled “Multipath Installation” in the chapter titled “Installing Oracle VM Server on x86 Hardware” in the *Oracle VM Installation and Upgrade Guide*, Part Number E64078-01 or later.

# Oracle VM Server for x86 Installation Prompts

During installation, you are prompted to make selections for:

- Language and keyboard type
- End User License Agreement
- Reinstallation or upgrade if the installation finds an already existing Oracle VM installation
- Hard drives to use for installation
- Management interface (optionally, on a VLAN segment)
- Network configuration for the management interface
- Time zone selection
- Oracle VM Agent password
- Root password

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Perform the installation on all hosts that have been identified as Oracle VM servers.

**Management Interface**

If you have more than one interface available on your Oracle VM server, select the interface for the management network. In most cases, this is `eth0`, but you can select another interface as the management interface. If this interface is connected to a VLAN, specify the VLAN ID for the VLAN.

**Oracle VM Agent Password**

If you plan to discover and take ownership of several Oracle VM servers in a single operation, the Oracle VM Agent for each Oracle VM server must be identical. For this reason, Oracle recommends that you specify the same Oracle VM Agent password during the installation of all Oracle VM servers that you plan to add to the same server pool.

# Oracle VM Server: Post-Installation Status

- The management interface is up and configured as a bonded interface, containing a single port.
- If the management interface is part of a VLAN, a VLAN interface is also configured automatically.
- The firewall is not enabled.
- If internal disks are present and were not used during the installation, they are seen as local storage.
- If Fibre Channel LUNs are accessible to the Oracle VM server, they are discovered during the installation process.
- The Oracle VM Agent is up.

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At the completion of the installation process, the host reboots. You can now log in to your Oracle VM server:

- The network interface that was selected for management during installation is now part of a bond interface, and the bond interface is up.
- Your server can be accessed remotely by using `ssh` as `root`.
- The Oracle VM Agent service is enabled and is listening for server discovery events from the Oracle VM Manager.

To check the status of the Oracle VM Agent, use the service command on the Oracle VM server:

```
[root@ovm_server ~]# service ovs-agent status
log server (pid 3444) is running...
notification server (pid 3451) is running...
remaster server (pid 3454) is running...
monitor server (pid 3457) is running...
ha server (pid 3459) is running...
stats server (pid 3462) is running...
xmlrpc server (pid 3464) is running...
```

If you experience problems with your Oracle VM server, Oracle Support might request that you restart the Oracle VM Agent:

```
# service ovs-agent stop
# service ovs-agent start
```

or

```
# service ovs-agent
```

Restarting the Oracle VM Agent does not affect the virtual machines that were running on the Oracle VM server where the agent was restarted.

Do not make manual changes to your Oracle VM servers, except in the following situations:

- To edit name resolution files such as `/etc/hosts` or `/etc/resolv.conf`
- To edit the NTP configuration file, `/etc/ntp.conf`
- To edit the client side for LDAP authentication

# Oracle VM Manager Installation Steps

1. Download the Oracle VM Manager installation ISO file from https://edelivery.oracle.com/.
2. Prepare a CD with the ISO installation file; insert and mount the CD. If you are using the ISO file, mount this file on an existing mount point; for example:
   a. `# mount -o loop,ro /tmp/ovmm-3.4.1-installer /mnt`
   b. `# cd /mnt`
3. Prepare the host on which you want to install the Oracle VM Manager by using the environment configuration script:
   a. `# ./createOracle.sh`
4. As the `root` user, change the directory to the location where the CD or ISO files reside and launch the installation script:
   a. `# ./runInstaller.sh`
5. Follow the prompts.

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The `createOracle.sh` script automatically does the following:

- Creates the operating system `dba` group
- Creates the `oracle` user and adds it to the `dba` group
- Creates the `/u01` directory with appropriate ownership
- Sets the required parameters in the `/etc/security/limits.conf` file:

```
oracle    soft    nofile     8192
oracle    hard    nofile     8192
oracle    soft    nproc     4096
oracle    hard    nproc     4096
oracle    soft    core     unlimited
oracle    hard    core     unlimited
```

- Opens the required ports in the `/etc/sysconfig/iptables` file. For a list and description of these ports, see the slide titled “Oracle VM Port Usage” earlier in this lesson.

Before running the `createOracle.sh` script, you can verify that ports `7002` and `10000` are not already in use by another application. To verify that these ports are available, enter:

```
# netstat -na |grep 7002
# netstat -na |grep 10000
```

If the ports are not in use, no response is given. If these ports are in use by another application, the services that use the ports are displayed and you must release them.

To run the `createOracle.sh` script, perform the following:

1. You must first mount the Oracle VM Manager installer ISO file or CD. The following example uses an ISO file:

   ```
   # mkdir mount-point
   # mount -o loop OracleVM-Manager-version.iso mount-point
   # cd mount-point
   ```

2. Enter the following command as the `root` user:

   ```
   # ./createOracle.sh
   ```

To run the installation script:

```
# ./runInstaller.sh
```

# Oracle VM Manager Installation Options

```
Oracle VM Manager Release 3.4.1 Installer

Oracle VM Manager Installer log file:
/tmp/ovm-manager-3.4-install-2015-03-25-171118.log

Please select an installation type:
   1: Install
   2: Upgrade
   3: Uninstall
   4: Help

   Select Number (1-4): 1

Starting production with local database installation ...

Verifying installation prerequisites ...
```

Installs everything, including database; one password prompt for all components

Upgrades a running system

Removes all components but leaves database backup files in place



When invoked, the installation program makes several checks on your host to ensure that the requirements for memory, disk space, and kernel parameters are met. After these checks are performed, you are prompted for the installation type.

**Install Option**

This option installs all components, including MySQL Enterprise Edition as the local Oracle VM Manager database. The installation prompts for only one password, and this password is used for every user created that requires a password.

**Upgrade Option**

This option upgrades your Oracle VM Manager software to a major release or an errata release. Always consult the Oracle VM Release Notes for your particular release of Oracle VM, or the README file for errata releases to find out which upgrade paths are allowed.

The upgrade process for both the Oracle VM Manager and Oracle VM servers is discussed later in this lesson.

### Uninstall Option

This option removes all components from your Oracle VM Manager host. Make sure that both the Oracle VM CLI and Oracle VM Manager UI applications are shut down before you perform the uninstall operation:

```
# service ovmcli stop
# service ovmm stop
```

### Installed Components

During installation, the following components are installed:

- MySQL Enterprise Edition, including MySQL Enterprise Backup
- Java (installed to avoid incompatibility with the existing Java environment)
- Oracle WebLogic Server
- Oracle Application Development Framework (ADF)
- Oracle VM Manager applications

### Installation Notes

The installation script, `runInstaller.sh`, performs the following steps:

- Provides the location for the Oracle VM Manager Installer log file
- Checks whether the script is invoked by the `root` user
- Check whether the host name or IP is pingable
- Checks whether there is enough memory on the host where installation is taking place
- Checks whether the `/u01` directory exists, and sets correct permissions on the directory
- Checks whether there is already a service using ports 49500 (for MySQL) and 7002
- Checks the values for `hardnofiles` and `softnofiles` for the `oracle` user
- Checks the `/tmp` and `swap` space
- Installs and configures the MySQL database and backup software
- Installs Java
- Creates a database instance
- Installs Oracle WebLogic Server and Oracle ADF
- Installs the Oracle VM Manager applications and creates the WebLogic domain
- Deploys the Oracle VM Manager applications
- Configures SSL identity and trust key stores
- Installs the Oracle VM Manager tools
- Starts the Oracle VM Manager instance
- Prints an Installation Summary
- Terminates the installation process

**Note:** Not all of the installation steps are listed. Check your installation log for more details about the installation process.

When finished, the installer displays a summary and performs a cleanup of files and directories that were used during the installation process. The summary variables are also available in the `/u01/app/oracle/ovm-manager-3/.config` file. Variables include information about the database instance, and the Oracle VM Manager unique identifier, or UUID. You need this UUID if you are reinstalling the Oracle VM Manager software.

An example of the summary that is displayed at the end of the installation process is as follows:

```
Installation Summary
--------------------
Database configuration:
  Database type                 : MySQL
  Database host name            : localhost
  Database name                 : ovs
  Database listener port        : 49500
  Database user                 : ovs

Weblogic Server configuration:
  Administration username       : weblogic

Oracle VM Manager configuration:
  Username                      : admin
  Core management port          : 54321
  UUID                          : 0004fb0000010000239071 6cb97d53cf
Passwords:
There are no default passwords for any users. The passwords to use for
Oracle VM Manager, Database, and Oracle WebLogic Server have been set
by you during this installation. In the case of a default install, all
passwords are the same.
Oracle VM Manager UI:
  https://ovmmgr01.example.com:7002/ovm/console
Log in with the user 'admin', and the password you set during the
installation.
Note that you must install the latest ovmcore-console package for your
Oracle Linux distribution to gain VNC and serial console access to
your Virtual Machines (VMs).
Please refer to the documentation for more information about this
package.
For more information about Oracle Virtualization, please visit:
  http://www.oracle.com/virtualization/
Oracle VM Manager installation complete.
Please remove configuration file /tmp/ovm_configrINyHH.
```

At this point, the Oracle VM Manager applications are active and the Oracle VM Manager UI and CLI are accessible locally and remotely.

## Other Installation Options for the Oracle VM Manager

```
# ./runInstaller.sh --help

Oracle VM Manager Release 3.4.1 Installer

Usage:  runInstaller.sh [options]

options
  -h, --help                Shows this message
  -c, --config <cfgFile>    Use specified config file to do install
  -u, --uuid <uuid>         Manager UUID (install using the provided
                            manager UUID)
  -i, --installtype <type>  Install type : Install, Uninstall, Upgrade
  -y, --assumeyes           Automatically answer yes on Continue?
                            questions
  -n, --noprereq            Ignore prerequisite checks
  -k, --cleanup             Clean up temporary config file after
                            installation
```

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To display all options for `runInstaller.sh`, use the `--help` option.

Some of the options are described as follows:

- **`--help`**: Shows the options with a brief explanation
- **`--config`**: Specifies an installation configuration file. This file is used to set the installation options in a silent installation. If you are using this option, also use the `--assumeyes` option.
- **`--uuid`**: Sets the UUID for the Oracle VM Manager. Use this option when recovering an Oracle VM Manager instance that used the existing UUID. The Oracle VM Manager configuration file contains the UUID, and is stored in the following location: `/u01/app/oracle/ovm-manager-3/.config`
- **`--installtype`** < *`Install`* | *`Uninstall`* | *`Upgrade`*>: Sets the installation type to use without being prompted during the installation. Use this option during a silent installation.

# Building a Configuration File

To automate the Oracle VM Manager installation:

- Build a configuration file:
  - The file has a `.yml` extension, a YAML file format.
- The YAML format follows a set of syntax rules:
  - Use spaces and not tabs when formatting the configuration file.
  - Separate key/value pairs by a colon plus a space.
  - Mark any associative array by using a name, followed by a colon.
  - Use the same indentation for parallel (or related) keys.
- To install the Oracle VM Manager by using a configuration file, use the following command:

```
# ./runInstaller.sh --config=/<directory
  path>/<config file name.yml> --
  installtype=install -assume yes
```

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**Building a Configuration File**

You can build a configuration file to automate the installation of the Oracle VM Manager. The file has a `.yml` extension, which indicates a YAML format. This type of human-readable format is used by Python during the installation. The YAML format follows a set of syntax rules.

To help you create your configuration file, follow these simplified rules:

- Use spaces and not tabs when formatting the configuration file.
- Separate pairs of key/value by a colon plus a space.
  For example:
  ```
  install    : true
  ```
- Mark any associative array by using a name, followed by a colon.
  For example:
  ```
  weblogic:
      user          : weblogic
  ```

- Use the same indentation for parallel (or related) keys.

  For example:

```
webLogic:
      install       : true
      user          : weblogic
      password      : My1password
```

To install the Oracle VM Manager by using a configuration file, use the following command:

```
# ./runInstaller.sh --config=/<directory path>/<config file name.yml>
   --installtype=install --assumeyes
```

If you are reusing the UUID, use the following format:

```
# ./runInstaller.sh --uuid=<UUID> --config=/ <directory path>/<config
   file name.yml> --installtype=install --assumeyes
```

For more information about automating the Oracle VM Manager installation process, consult the topic titled "Performing a Silent Install" in the chapter titled "Installing Oracle VM Manager" in the *Oracle VM Installation and Upgrade Guide*, Part Number E64078-01 or later.

## Installation Directories

| Component | Location |
|---|---|
| MySQL | /u01/app/oracle/mysql/data |
| MySQL Enterprise Backup | /opt/mysql/meb-3.8/<br>Backups in: /u01/app/oracle/mysql/dbbackup |
| Java | /u01/app/oracle/java/ |
| Oracle WebLogic Server | /u01/app/oracle/Middleware/ |
| Oracle ADF | /u01/app/oracle/Middleware/ |
| Oracle VM Manager application | /u01/app/oracle/ovm-manager-3/ |
| Oracle WebLogic Server domain | /u01/app/oracle/ovm-manager-3/domains/ovm_domain/ |
| Oracle VM CLI | /u01/app/oracle/ovm-manager-3/ovm_cli |
| Oracle VM Manager installation log | /var/log/ovmm |







After the Oracle VM Manager installation completes, several new directories are present on the Oracle VM Manager host. These directories are listed in the table in the slide.

Java is installed as part of the Oracle VM Manager installation. If you need to upgrade or change your Java Runtime Environment (JRE), contact Oracle Support for information about the procedure to perform the upgrade.

The Oracle WebLogic application server is a Java platform for developing and deploying applications. The Oracle VM Manager application is deployed on top of Oracle WebLogic.

The file named `.config` in the `/u01/app/oracle/ovm-manager-3` directory contains important information about your Oracle VM Manager installation.

Example of the `.config` file:

```
DBTYPE=MySQL
DBHOST=localhost
SID=ovs
LSNR=49500
OVSSCHEMA=ovs
APEX=8080
WLSADMIN=weblogic
```

```
OVSADMIN=admin
COREPORT=54321
UUID=0004fb00000100002390716cb97d53cf
BUILDID=3.4.1.<Build Number>
```

The UUID of your Oracle VM Manager is used when creating resources in your environment. For example, when you create a repository, the repository is tied to the Oracle VM Manager's UUID. If you restore your Oracle VM Manager environment, you need the UUID to reclaim the resources that existed in your previous environment.

The Oracle VM Manager logs, including the Oracle VM CLI logs, reside in the following directory:

`/u01/app/oracle/ovm-manager-3/domains/ovm_domain/servers/AdminServer/logs`

The Oracle VM CLI files are located in `/u01/app/oracle/ovm-manager-3/ovm_cli`. This directory contains a subdirectory for the CLI docs, script examples that use Expect, and a `config` subdirectory that contains the CLI's configuration file.

## Post-Installation Tasks

- After installing your Oracle VM servers, you can make the following changes:
  - Change the Oracle VM Agent password for one or more Oracle VM servers in a server pool by using the Oracle VM CLI or the Oracle VM Manager UI.
  - Change dom0's memory size by editing the `/boot/grub/grub.conf` file.
  - Install the Oracle VM Server for x86 diagnostic tools.
- After installing the Oracle VM Manager, you can perform the following tasks:
  - Change the administrator password by using the `ovm_admin` command.
  - Change the Oracle VM Manager UI session timeout.
  - Back up the Oracle VM Manager.

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### Changing the Oracle VM Agent Password on Oracle VM Servers

Oracle recommends that you use the same password for the Oracle VM Agent for all Oracle VM servers that you plan to add to the same server pool.

You can change the Oracle VM Agent password as follows:

- For one Oracle VM server with the Oracle VM CLI, by using the `changeServerAgentPassword` command

  The Oracle VM CLI is discussed later in this lesson.
- For all the Oracle VM servers in a server pool with the Oracle VM Manager UI, by using the "Change Servers Agent Password" action

### Installing Oracle VM Server for x86 Diagnostic Tools

Optionally, you can install diagnostic tools that can be used by Oracle Support to help debug and diagnose issues such as system crashes, hanging, unscheduled reboots, and Oracle Cluster File System 2 (OCFS2) cluster errors. For more information about these diagnostic tools, see the topic titled "Installing Oracle VM Server Diagnostic Tools" in the *Oracle VM Administration Guide*, Part Number E64083-01 or later.

### Adjusting Memory Size on Oracle VM Servers

You might encounter performance issues if the dom0 memory size is not set appropriately for your needs on Oracle VM servers. For example, you can encounter performance issues when you are running more than 10 virtual machines on an Oracle VM server, or when presenting a large number of iSCSI LUNs to your Oracle VM servers.

To change the dom0 memory allocation, edit the `/boot/grub/grub.conf` file on the Oracle VM server and change the `dom0_mem` parameter. For example, to change the memory allocation to 4000 MB, edit the file to be:

```
kernel /xen.gz console=com1,vga com1=57600,8n1 dom0_mem=4000M allowsuperpage
```

### Changing the Oracle VM Manager Administrator Password

The default name for the administrator is `admin`. You use this account name to log in to the Oracle VM Manager user interface and to authenticate when using the Oracle VM Web Services API. You set the administrator's password during Oracle VM Manager installation. To change the password for the Oracle VM Manager administrator account, log in to the Oracle VM Manager host as the `root` user and perform the following:

```
# cd /u01/app/oracle/ovm-manager-3/bin
#./ovm_admin --modifyuser
```

The program starts and prompts you for a username. Enter `admin` as the username:

```
Oracle VM Manager Release 3.4.1 Admin tool
Please enter the username : admin
```

The program prompts you for the current password for `admin`. The password is the one that you supplied during Oracle VM Manager installation:

`Please enter the current password :` **`Welcome1`** (example only)

Next, you are prompted to enter a new password, and then to re-enter the same password:

`Please enter a new password for admin (minimum 8 chars. with one numeric/special char.) :` **`Myadmin1`** (example only)

`Please re-enter the password :` **`Myadmin1`**

Finally, you are prompted to enter the password for WebLogic, which you set during Oracle VM Manager installation:

`Please enter the password for weblogic :` **`Welcome1`** (example only)

The WebLogic scripting shell is invoked and connects to the WebLogic server to change the password for the `admin` user:

```
Initializing WebLogic Scripting Tool (WLST) ...
Welcome to WebLogic Server Administration Scripting Shell
Type help() for help on available commands
Connecting to WebLogic server ...
Connected ...
Modifying user 'admin' ...
Modified user 'admin' successfully ...
Disconnected from weblogic server: AdminServer
Exiting...
```

The password for the `admin` user has been changed.

**Changing the Oracle VM Manager UI Session Timeout Value**

Changing the session timeout value for an Oracle VM Manager session involves logging in to the WebLogic Server console. The complete list of steps to perform this task is provided in the *Oracle VM Administrator's Guide*, under the topic titled "Configuring Oracle VM Manager UI Session Timeout."

**Backing Up the Oracle VM Manager**

This topic is discussed in the next slide.

# Backing Up the Oracle VM Manager

- Back up the Oracle VM Manager configuration file, which is named `.config` and located in the `/u01/app/oracle/ovm-manager-3` directory.
  - This file contains the UUID for your Oracle VM Manager.
- The MySQL database in your Oracle VM Manager host is backed up automatically every day.
  - If you make changes to your Oracle VM Manager environment, you can perform a manual backup.
- Automatic database backup files are stored in the `/opt/mysql/meb-3.12/bin/mysqlbackup` directory.
  - Consider making this location an NFS share to protect the database backup files.



**Backing Up the Oracle VM Manager Configuration File**

The configuration file, `/u01/app/oracle/ovm-manager-3/.config`, is recreated if you reinstall the Oracle VM Manager software. However, it is a good idea to keep a copy in the event of failure of your Oracle VM Manager host. To protect this file, copy it to a remote location.

The UUID for the Oracle VM Manager is stored in this file, and is also stored in the `/etc/sysconfig/ovmm` file.

**Automatic Backups for the Oracle VM Manager Database**

Your Oracle VM Manager database is backed up automatically each day and the system keeps the 21 most recent backups.

The database backup files are stored in the `/opt/mysql/meb-3.12/bin/mysqlbackup` directory by default. This default location is identified in the `/etc/sysconfig/ovmm` file. You can change the location for storing the database backup files by editing this file.

Oracle recommends that you configure the location for the Oracle VM Manager database backup files as an NFS share that is offered by a remote NFS server.

**Manual Backups for the Oracle VM Manager Database**

You can initiate manual backups for your Oracle VM Manager database.

To trigger a manual backup, issue the following command:

```
# /u01/app/oracle/ovm-manager-3/ovm_tools/bin/BackupDatabase
```

The backup script prompts you for your Oracle VM Manager username, usually `admin`, and password.

By default, the backup script stores the backup file by using a different name such as `ManualBackup-20140326_162358`, to avoid the rotation that takes place for automatic backups.

**Oracle VM Manager Keystore**

During the installation of the Oracle VM Manager software, a keystore is created on the Oracle VM Manager host to store SSL certificates. The installation step to create the keystore is listed in the notes section of the “Oracle VM Manager Installation Options” slide, which was discussed earlier in this lesson.

The Oracle VM Manager keystore is backed up automatically as part of any database backup, either automatic or manually invoked.

## Launching the Oracle VM Manager User Interface

- Launch the Oracle VM Manager UI from your browser:
  - For local access:
    `https://localhost:7002/ovm/console`
  - For remote access:
    `https://<Oracle VM Manager hostname>:7002/ovm/console`
- Log in to the application by using the `admin` username and the password provided during installation.
- To stop and start the Oracle VM Manager UI:

```
# /sbin/service ovmm stop
# /sbin/service ovmm start
```

OR

```
# /sbin/service ovmm restart
```

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When the Oracle VM Manager is installed, it automatically starts the Oracle VM Manager UI and CLI applications, and configures both as services that are set to start when the operating system starts.

If you want to disable automatic restart for the Oracle VM Manager UI, enter:

```
# chkconfig --del ovmm
```

To manually start or stop the Oracle VM Manager UI or the Oracle VM CLI, as the `root` user, use the following syntax:

```
/sbin/service ovmm [start|stop|status|check|restart]
/sbin/service ovmcli [start|stop|status|check|restart]
```

Alternatively, you can use the following syntax:

```
/etc/init.d/ovmm [start|stop|status|check|restart]
/etc/init.d/ovmcli [start|stop|status|check|restart]
```

For example:

```
# /etc/init.d/ovmm status
Oracle VM Manager is running...
```

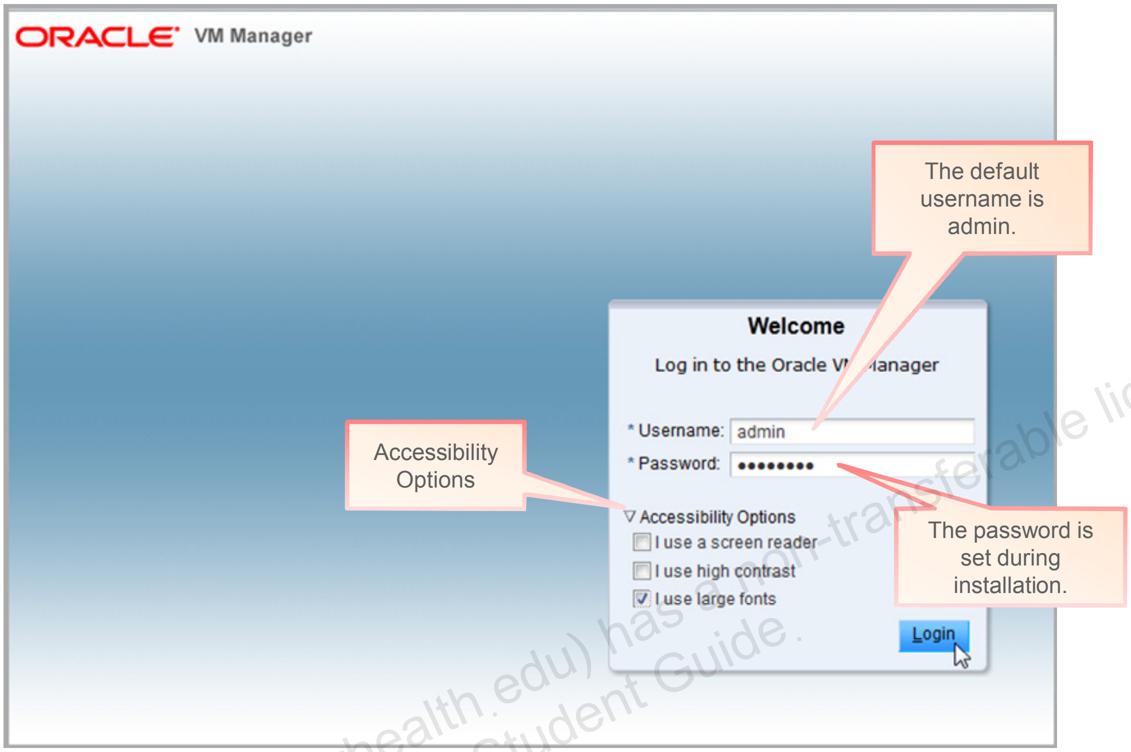
If the Oracle VM Manager host runs a full graphical desktop environment, you can also use the Services dialog to start and stop the Oracle VM Manager services.

To access the Oracle VM Manager UI from your browser, use the following URL:

`https://<Oracle VM Manager hostname>:7002/ovm`

As stated in an earlier slide, make sure that you open port 7002 in the firewall on your Oracle VM Manager host.

# Navigating the Graphical User Interface: The Login Window






With the Oracle VM Manager UI, you can configure the following accessibility features:

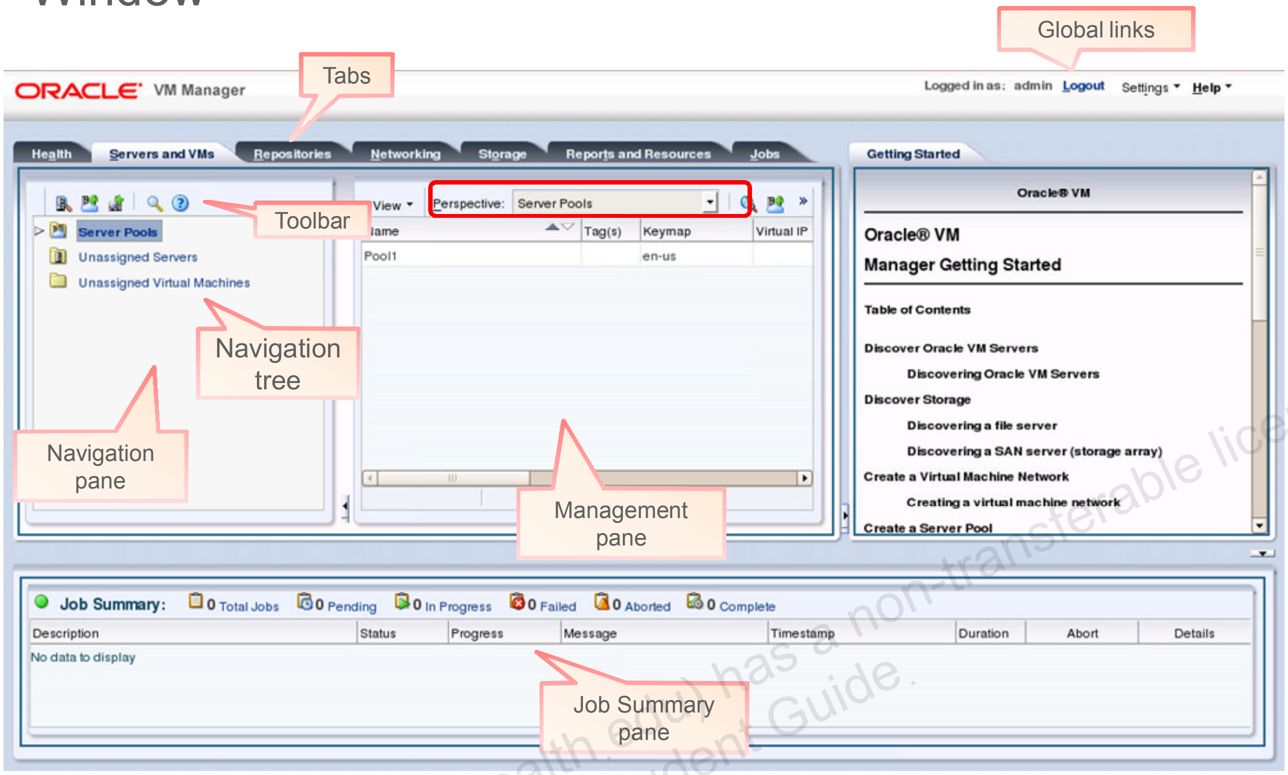
- Support for screen reader
- Support for high contrast
- Support for large fonts

You can configure the Oracle VM Manager's accessibility features before or after you log in to the user interface.

To view the accessibility features, click the arrow to expand Accessibility Options. Select one or more accessibility features. The selected features are in effect after you log in to the user interface.

After you log in, you can access the accessibility features from the Settings global link, in the top-right corner of the main window that appears after a successful login. You can see the Settings global link in the next slide.

# Navigating the Graphical User Interface: The Main Window

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The Oracle VM Manager UI provides a set of work areas or management panes, buttons, toolbars, menus, and tabs for access to various functions and configuration screens.

**Navigation Pane**

The navigation pane, on the left, contains the navigation tree.

**Navigation Tree**

The navigation tree shows the physical or virtual entities in a hierarchical fashion, with buttons to expand and collapse the branches of the navigation tree.

**Management Pane**

The management pane, to the right of the navigation pane, displays objects that depend on the selection in the navigation pane and also on the selected tab.

**Tabs**

When managing your Oracle VM environment, you click a tab depending on the type of action that you want to perform. For example, to create virtual machines, click the Servers and VMs tab. After clicking a tab, the navigation and management panes reflect the selected tab.

Some tab views, for example, the Health tab, the Networking tab, or the Tools and Resources tab, provide only one pane.

### Management Pane Perspective

Within the management pane, you can select a different view from the Perspective drop-down list. This list is highlighted with a red box in the diagram in the slide, at the top of the management pane.

Perspectives are similar to subtabs. For example, if you click the Servers and VMs tab, and then select Server Pools from the navigation tree in the navigation pane, you can choose one of the following perspectives: Server Pools or Server Processor Compatibility.

### Job Summary Pane

The Job Summary pane provides a list of the most recent jobs executed and their current status. To view more information about all jobs, click the Jobs tab.

### Actions

You can carry out many of the actions or operations on a selected entity in a pane by selecting either an action from the shortcut menu of the entity or an action on a toolbar.

### Toolbar

Toolbars appear in the navigation pane and in the management pane. The toolbar contains actions that are either valid for the entity selected in the navigation pane (for example, the Delete icon to delete the currently highlighted virtual machine) or entity-independent (for example, the “Create Virtual Machine” icon is independent of the currently selected entity).

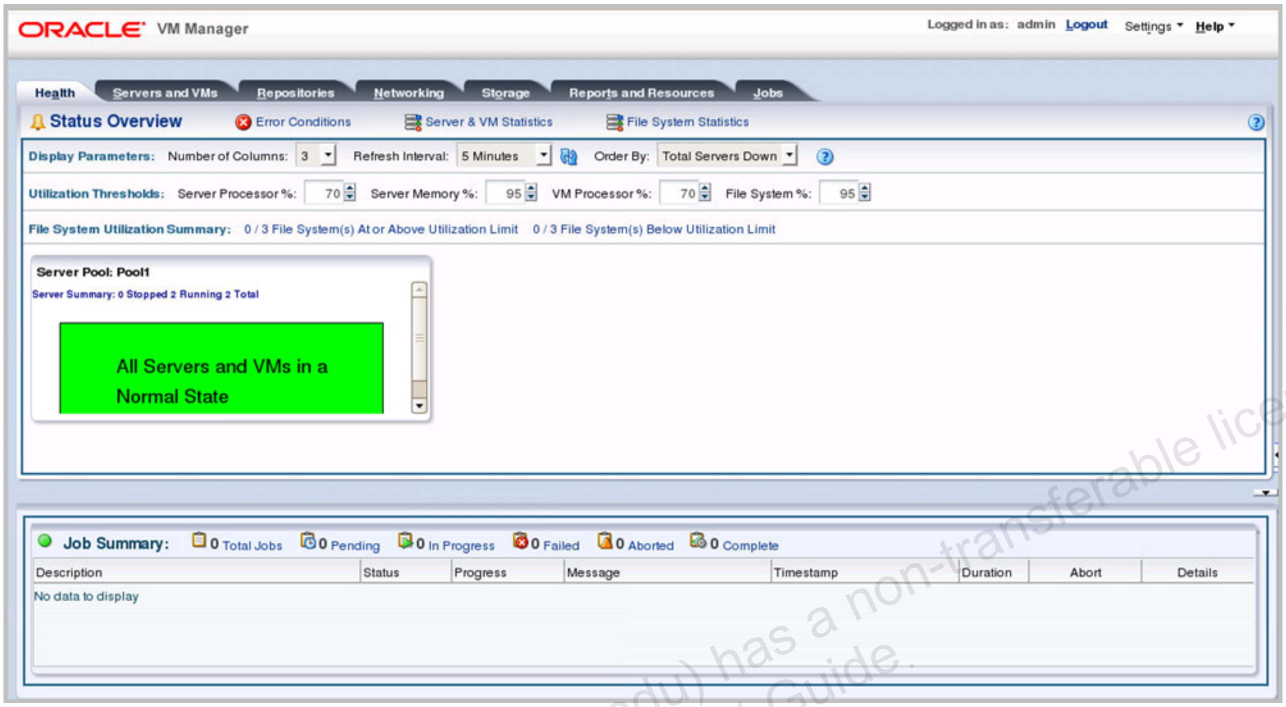
### Getting Started Tab

The Getting Started tab contains a tutorial that describes how to get started with the Oracle VM Manager. To show or hide the tutorial, click the arrow to the right of the management pane.

### Collapsing and Restoring Panes

As described previously, you can click the arrows at the edge of the panes to either collapse or restore a pane. Using this feature, you can increase or decrease the space used by a particular pane.

# Using the Tabs in the Graphical User Interface






Each tab defines different objects and functional areas of operations that you can perform in the Oracle VM Manager. When you click a tab, the default management pane for that tab is displayed.

The order of the tabs is determined by the frequency of use after you have completed the initial configuration of your Oracle VM environment. The order does not indicate the order of the tasks that you perform when configuring your environment.

## Tab Usage in the Graphical User Interface

| Tab | Usage |
|---|---|
| Health | To monitor the overall health and status of your virtualization environment |
| Servers and VMs | To discover Oracle VM servers, create and manage server pools, and create and configure virtual machines in server pools |
| Repositories | To create, refresh, populate, and delete repositories, and present them to Oracle VM servers |
| Networking | To create and manage networks, VLAN interfaces, and virtual NICs (VNICs) |
| Storage | To discover file servers and SAN servers, and manage storage elements |
| Tools and Resources | To manage tags, YUM repositories, and configurable parameters |
| Jobs | To view job lists by using filters and to display job details |





**Health Tab**

Use the Health tab to monitor the overall health and status of your virtualization environment and to view historical statistics such as memory and CPU usage. When you access this tab, the dashboard displays the Status Overview subtab by default, which provides information about server pools and servers, and the number of Oracle VM servers that are running or stopped.

If you click the Statistics link, you access the Statistics subtab where you can view historical statistics for your Oracle VM servers and virtual machines.

**Servers and VMs Tab**

Click the Servers and VMs tab to discover the Oracle VM servers, create and manage server pools, assign Oracle VM servers to server pools, and create and configure virtual machines in server pools.

From this tab, you can select different perspectives, depending on which object you select in the navigation pane. For example, if you select a server pool in the navigation tree, you can choose to display and manage the server object by using one of the following perspectives:

- (General) Info
- Servers
- Virtual Machines

- Anti-Affinity Group
- Policies
- Server Update Repositories
- Events

If you choose another object in the navigation tree, you are given a different set of perspectives.

The Repositories and Storage tabs also offer a selection of perspectives.

**Repositories Tab**

Use the Repositories tab to perform the following operations:

- Create, configure, and delete storage repositories.
- Populate repositories by using the import or cloning function.
- Create, import, or clone virtual disks.
- Present repositories to Oracle VM servers or to a server pool.
- Refresh repositories.

**Networking Tab**

From this tab, you can create and manage networks, VLAN interfaces, and virtual NICs (VNICs). However, you manage Ethernet ports and bonded interfaces from the Servers and VMs tab.

**Storage Tab**

From this tab, you perform the following tasks:

- Discover your file servers and your iSCSI or FC storage arrays.
- Discover the storage elements in your file servers and storage arrays.
- Refresh the storage objects, such as file servers or file systems.
- For managed storage, create and delete physical disks.
- Manage the file systems on your storage elements.

**Tools and Resources Tab**

From this tab, you perform the following tasks:

- Manage tags that can be used to identify and group objects within the Oracle VM Manager.
- Configure server upgrade (Yum) repositories for automatic or manual updates of the Oracle VM servers being managed by the Oracle VM Manager.
- Specify the timeout value (or no timeout) when refreshing the list of file systems.
- Control how frequently statistics are collected for Oracle VM servers. You can view the statistics on the Health tab.

### Jobs Tab

Use the Jobs tab to view information about the current and past jobs. A job is a set of one or more operations triggered by the Oracle VM Manager, either automatically or as a result of a request to perform a task.

The Jobs tab provides comprehensive information about all completed and in-progress jobs in the virtualization environment. From this tab, you can examine information about jobs that were completed or aborted, or cancel a job in progress.

## Oracle VM CLI

- The Oracle VM CLI is installed as part of the Oracle VM Manager installation.
- You can perform all configuration tasks from the Oracle VM CLI.
- To automate these configuration tasks, use the CLI with Expect scripts.
- Changes that you make to your environment by using the CLI appear immediately in the Oracle VM Manager UI.







The CLI is installed when you install the Oracle VM Manager. The Oracle VM CLI offers the same features as the Oracle VM Manager UI plus a few other operations, such as setting a new Oracle VM Agent password or a new NTP server on an Oracle VM server.

Start a CLI session from the Oracle VM Manager host or from another client computer by using an `ssh` connection. You can make multiple CLI connections to a single instance of the Oracle VM Manager. When using the CLI to make changes to your Oracle VM environment, the changes are reflected in real time in the Oracle VM Manager UI.

You can configure the graphical SSH client PuTTY to connect to the CLI.

If you want to connect to the CLI without having to specify the password for the `admin` user, you can set up key-based authentication.

To automate the configuration of your Oracle VM environment, you can use the CLI with Expect scripts. For information about and examples on how to use Expect scripts with the CLI, refer to the topic titled “Sample Scripts” in the *Oracle VM Command Line Interface User’s Guide*, Part Number E64086-01 or later.

# Using the Oracle VM CLI

- Use the `ssh` command to launch the CLI.

```
root# ssh -l admin ovmmgr.example.com -p 10000
OVM>
```

- The commands that are available include `list`, `show`, `edit`, `create`, and many more.

```
OVM> list server
OVM> show server name=ovsvr01.example.com
OVM> create vm domainType=XEN_PVM name=pvm1
  repository=iscsiRepository1
```

- The CLI supports tab completion, in-line help, and command history recall.

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Start a session to the Oracle VM CLI by using the `ssh` command and specify the `admin` user, the IP address or host name of the host where the Oracle VM Manager is installed, and the port listening for the CLI connection. This port defaults to 10000.

If you are launching a session to the Oracle VM CLI from the Oracle VM Manager host, you can use `localhost` for the host name.

You are then prompted for the `admin` user's password, except if you have configured key-based authentication. You are prompted for a password when connecting to the CLI for the first time after you configure key-based authentication. After this first connection, you are no longer prompted for a password until you restart the Oracle VM Manager service, or the session timeout for the CLI has been reached.

To configure session timeout and other parameters, such as the port for the `ssh` connection, edit the `CLIConfigParams.xml` file located in the `/u01/app/oracle/ovm-manager-3/ovm_cli/config` directory on the Oracle VM Manager host. You must restart the Oracle VM Manager for the changes to take effect.

The Oracle VM CLI offers in-line help. With this feature, you can work your way through the command options by using the `?` character and the Enter key. When the command is complete, press Enter to execute it.

Other features of the Oracle VM CLI include command completion by using the Tab key, and command history recall by using the up and down arrow keys.

# Upgrading Oracle VM: Oracle VM Manager

Upgrading the Oracle VM Manager:

- Upgrade the Oracle VM Manager first, and then upgrade the Oracle VM servers.
- Back up the Oracle VM Manager database and configuration file before proceeding with the upgrade.
- Download the Oracle VM Manager software from the Oracle Software Delivery Cloud.
- Perform the upgrade from the ISO file or burn a CD.
- Run the `runInstaller.sh` script and select the Upgrade option.

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When upgrading Oracle VM, you must upgrade the Oracle VM Manager first, and then upgrade the Oracle VM servers that are managed by the Oracle VM Manager. You must upgrade all the Oracle VM servers managed by the instance of the Oracle VM Manager before you can return the Oracle VM environment to normal operations.

Some upgrade paths are not supported for the Oracle VM Manager software. For example, you cannot upgrade from Oracle VM Release 2.x to Release 3.4. Consult the *Oracle VM Release Notes* and the *Oracle VM Installation and Upgrade Guide* for information about the upgrade paths for Oracle VM.

**Upgrading the Oracle VM Manager**

You perform the Oracle VM Manager upgrade with the Oracle VM Manager ISO file or CD.

- If you are using the ISO file or CD/DVD, download the Oracle VM Manager software from the Oracle Software Delivery Cloud at: http://edelivery.oracle.com/oraclevm, burn a DVD if desired, mount the DVD or ISO file, and execute the `runInstaller.sh` program that is located in the top directory of the DVD or ISO file.

The upgrade process prompts you to supply the current Oracle VM Manager password and to set the new Oracle WebLogic Server password. In many cases, this is the same password. You can reuse the current password as the new WebLogic Server password. If you select a new WebLogic Server password, make note of this new password for future reference.

The Oracle VM Manager must be running to perform the upgrade. If the Oracle VM Manager is not running, start it by using the following `service` command:

```
# service ovmm start
```

## Upgrading Oracle VM: Oracle VM Servers

- You can upgrade your Oracle VM servers by using one of the following three methods:
  - Use the `UpgradeServers.py` script, which allows you to perform batch upgrades.
  - Use the Oracle VM Manager, which retrieves updates from the Yum repository, to perform upgrades on a per-server basis.
  - Upgrade each Oracle VM server by using the Oracle VM Server for x86 CD.
- If you are performing a major upgrade, for example, Oracle VM release 3.3 to release 3.4, you must use the `UpgradeServers.py` script to upgrade your Oracle VM servers.

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**Important Note on Upgrading Your Oracle VM Environment**

Any upgrade process is release-sensitive. Always refer to the latest documentation before performing any upgrade.

**The `UpgradeServers.py` Script Upgrade Method**

You can use this upgrade method for minor release updates and, depending on your current release, for major upgrades as well. The information in this topic is related to performing a minor upgrade.

When using the `UpgradeServers.py` script, you can perform batch upgrades for your Oracle VM servers. Oracle recommends that you update a single server to make sure that the upgrade is error-free before performing batch upgrades.

The `UpgradeServers.py` script, which you run from the Oracle VM Manager host, is located in the `/u01/app/oracle/ovm-manager-3/ovm_tools/bin` directory. The script obtains Yum information from the Oracle VM Manager. Therefore, before executing the script, you must set up your own Yum repository or configure a Yum repository based on the appropriate Oracle VM Release channel on the Oracle Unbreakable Linux Network (ULN). You can find instructions for building your own Yum repository based on the Oracle VM Server for x86 ISO file in the topic titled "Preparing the Yum Repositories" in the *Oracle VM Installation and Upgrade Guide,* Part Number E64078-01 or later.

Configure the Yum repository information by using the Oracle VM Manager UI. You perform this step from the Tools and Resources tab.

**The Oracle VM Manager UI Upgrade Method**

Prepare your Yum repository and configure it by using the Oracle VM Manager UI or the Oracle VM CLI, in a manner similar to the process described in the previous upgrade method.

After configuring the Yum repository information, use the Update Server function of the Oracle VM Manager UI to upgrade your server. The server is put into maintenance mode and any running virtual machines are migrated to other servers before the upgrade process.

**The Oracle VM Server for x86 CD or ISO Upgrade Method**

- Burn the downloaded ISO file to a bootable CD if needed.
- Start or restart your Oracle VM server and boot from the CD or ISO file.
- If an existing Oracle VM Server for x86 installation is found on the computer, you are prompted to reinstall the system or perform an upgrade. Follow the instructions on the screen to perform the upgrade. When the upgrade is complete, remove the CD and select Reboot to restart the server.

## Quiz

Which components are installed as part of the Oracle VM Manager installation?

a. Oracle VM Manager applications
b. Oracle VM Agent
c. Oracle WebLogic Server
d. MySQL Enterprise Edition, including MySQL Enterprise Backup







**Answer: a, c, d**

## Quiz

Which two statements reflect the state of the Oracle VM server following the first reboot after installation?

a. The firewall is enabled.
b. The Oracle VM Agent is down.
c. The management interface is up.
d. The newly installed Oracle VM server is accessible by using `ssh`.



**Answer: c, d**

# Summary

In this lesson, you should have learned how to:

- Plan the installation of your Oracle VM environment
- Install the Oracle VM Server for x86 software
- Prepare the host machine for the Oracle VM Manager installation
- List the installation options for the Oracle VM Manager
- Install the Oracle VM Manager
- Perform post-installation tasks
- Navigate Oracle VM Manager's management interfaces
- Describe the Oracle VM upgrade process

## Practice 2: Overview

In this practice, you perform the following tasks:

- Verify that the virtual host for `ovsvr02.example.com` is running.
- Install Oracle VM Server for x86 in the second server, `ovsvr02.example.com`.
- Examine the host where the Oracle VM Manager is to be installed.
- Install the Oracle VM Manager on `ovmmgr01.example.com`.
- Perform post-installation verification.
- Verify access the Oracle VM Manager CLI and set up key-based authentication.

3

# Managing Servers and Networks

# Objectives

After completing this lesson, you should be able to:

- List the steps to prepare your environment for Oracle VM
- Discover your Oracle VM servers
- Manage your Oracle VM servers
- Discuss the role of networking in the Oracle VM environment
- List and describe the various network functions
- Explain the role of bridges and virtual LANs (VLANs) in the Oracle VM environment
- Create networks with or without VLANs
- Modify an existing network configuration

## Lesson Overview

- The first section of this lesson describes the configuration steps to prepare your Oracle VM environment for virtual machine creation.
- In the next section, you learn to discover and manage the Oracle VM servers that were previously installed.
- The rest of the lesson is dedicated to networking in the Oracle VM environment.

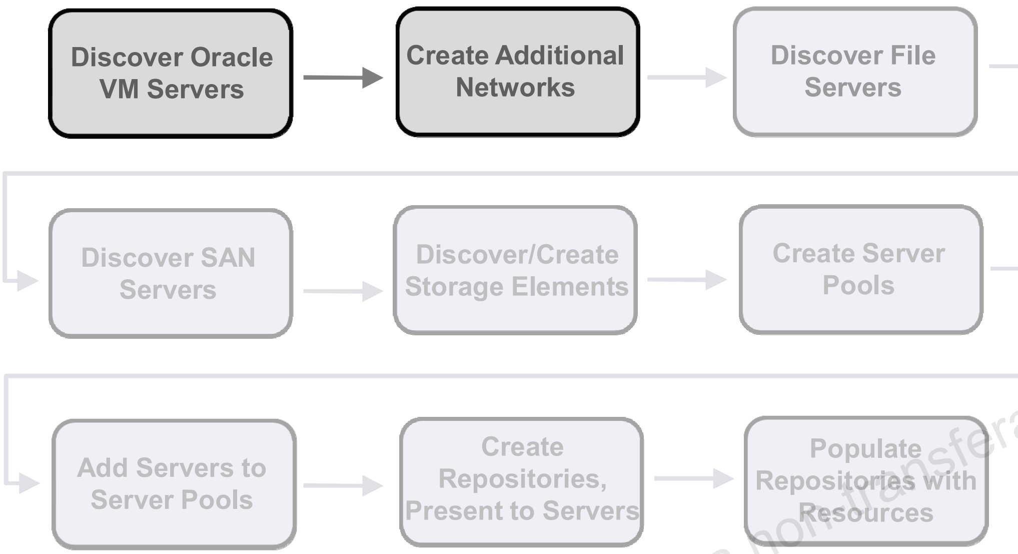


The first section of this lesson provides a high-level description of all the steps needed to prepare your Oracle VM environment for creating and deploying virtual machines.

The remaining sections present information about Oracle VM servers and networking in Oracle VM. These sections guide you through the steps to:

- Discover the Oracle VM servers that were already installed
- Become familiar with the role of the management network
- Create additional networks

# Initial Configuration Steps








When the networks and storage required for repositories and server pool file systems are in place, and the Oracle VM servers and the Oracle VM Manager are installed, start the configuration process.

Initial configuration consists of the nine steps listed in the slide. You perform these steps from the Oracle VM Manager. This lesson focuses on the first two steps:

- Discovering your Oracle VM servers
- Creating additional networks

The later lessons in the course cover the remaining configuration steps.

## Discovering Oracle VM Servers

- The Oracle VM server is a self-contained virtualization environment that is designed to provide a lightweight, secure platform to run virtual machines.
- When installed, the Oracle VM server:
  - Has one network port configured as a bonded interface
  - Listens for discovery events from the Oracle VM Manager
- Using the Oracle VM Manager UI or CLI, discover one or more Oracle VM servers by providing:
  - The host name or IP address of each server (or an address range)
  - The Oracle VM Agent password







Before you can configure and use an Oracle VM server, it must discovered by an Oracle VM Manager that can take ownership of this server.

During the installation of the Oracle VM Server for x86 software, you provided the network parameters for one of its network interfaces.

When you discover an Oracle VM server, you provide the Oracle VM Manager these network parameters (IP address or hostname) used during the installation of the Oracle VM server. This action automatically creates the first management network and determines the network on which the Oracle VM server resides. You discover Oracle VM servers using the Oracle VM Manager UI or CLI.

**Note:** You can also discover your Oracle VM servers by using the Oracle VM Web Services API (WS-API). You can find information about using the Oracle VM WS-API to manage and automate your Oracle VM environment in the *Oracle VM Web Services API Developer's Guide, Part Number E50253-03 or later.*

You must discover all Oracle VM servers that are to be part of your server pools.

The Oracle VM Agent password, which is specified during Oracle VM Server for x86 installation, must be identical for all Oracle VM servers in the same server pool that you discover in a single operation. The methods to change the Oracle VM Agent password are discussed in the lesson titled "Planning and Installation."

## Newly Discovered Oracle VM Servers

After discovery, the Oracle VM server is unassigned and owned by the current Oracle VM Manager.

**Oracle VM server information for ovm1**

| | |
|---|---|
| Host Name: ovm1.example.com | IP Address: 10.150.36.201 |
| Status: Running | Processor Speed (GHz): 2.79 |
| Processors: 4 | Memory (GiB): 8.0 |
| Ethernet Ports: 4 | Network Failover Groups: 1 |
| Maintenance Mode: Off<br>Inbound Migration Locked: No | CPU Compatibility Group:<br>Default_AMD_F15_M65 |
| Ownership: Owned by you | [Default_AMD_Family:15_Model:65] |
| Server Pool: Pool1 | Processor Type: X86_64 |
| Roles: Utility,Vm | Hypervisor Type: XEN |
| NTP Servers: 10.150.36.227 | Version: 3.4.1-1065 |

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During the discovery process, the Oracle VM Manager communicates directly with the target Oracle VM server and gathers basic information about the server: number and speed of processors, size of memory, number of network interfaces, and so forth.

If the Oracle VM server is connected to a storage area network (SAN), some connectivity information is also gathered, such as the number of Host Bus Adapters (HBAs) present on the server.

After you have discovered the Oracle VM servers, you can display this information by selecting an Oracle VM server in the "Unassigned Servers" folder in the navigation pane on the Servers and VMs tab. Select the Info perspective in the management (right) pane to display the information discovered about this server. This information is similar to the information shown in the slide, which shows only a subset of the available information.

After discovery, the Oracle VM server is unassigned but is owned by the Oracle VM Manager that initiated the discovery operation.

Newly discovered and owned Oracle VM servers cannot perform any virtual machine or active cluster operations until you add them to a server pool. However, they can be used to discover network file servers and SAN servers, and perform other functions that are unrelated to the management of virtual machines.

If a server is already owned by another Oracle VM Manager, you can discover the server but the step to take ownership fails. The only operation possible against an unowned Oracle VM server is to take ownership of the server or to delete it.

**Server Processor Compatibility Group**

The discovered servers are automatically added to a Server Processor Compatibility group. The first server discovered triggers the creation of the first Server Processor Compatibility group. A newly discovered server from the same processor family and with the same model number is added to the already existing Server Processor Compatibility group. A discovered server with a different processor family or model number triggers the creation of a new Server Processor Compatibility group.

**Oracle VM Server Roles**

When you discover one or more Oracle VM servers, each server acquires two roles automatically, as seen in the server information in the slide:

- **VM Server role:** This role enables an Oracle VM server to run virtual machines.
- **Utility Server role:** An Oracle VM server with the utility server role is favored to do operations other than hosting virtual machines. For example, if you trigger a template import operation or create a new repository, servers with the utility server role are favored to perform the operation.

You can use the Oracle VM Manager UI to remove roles from or add roles to any Oracle VM server to achieve your performance goals in your environment.

## Newly Discovered Oracle VM Servers: Functions

The Oracle VM servers discovered by the Oracle VM Manager can be used in the following ways:

- For operations related to the discovery and management of storage servers
- For input/output (I/O)-intensive operations, such as importing ISO files and templates into repositories
- To create new networks by using its network interfaces
- As the building block to create server pools



You need at least one discovered Oracle VM server to continue with the initial configuration of your Oracle VM environment. You can, of course, discover all your Oracle VM servers at this time.

Before creating server pools, you need storage elements to use as the server pool file system. Use a newly discovered Oracle VM server to discover file servers or SAN servers, which provide the storage elements to use as server pool file systems or repositories. Storage and server pool operations are covered in the lessons titled "Managing Storage" and "Server Pools and Repositories."

If your SAN storage arrays or file servers reside on a network other than the management network, you must create a new network to allow your Oracle VM servers to access this storage. These steps are discussed later in this lesson.

## Operations on Oracle VM Servers

After you have discovered an Oracle VM server, you can:

- Delete the Oracle VM server
- Rediscover the Oracle VM server
- Take or release ownership of the Oracle VM server
- Change the name and description of the Oracle VM server
- Add or remove a server role
- Configure the server Intelligent Platform Management Interface (IPMI)
- Place the Oracle VM server in maintenance mode
- Start, restart, stop, or kill the Oracle VM server
- Upgrade the Oracle VM server

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After discovering an Oracle VM server, even before adding it to a server pool, you can perform several actions on the newly discovered server:

- **Delete the Oracle VM server:** If the Oracle VM server is not part of a server pool, you can easily delete the server. When the server belongs to a server pool, the delete function triggers several operations to remove the Oracle VM server from the server pool before it can delete the server completely.
- **Rediscover the Oracle VM server:** If you make changes to your Oracle VM server, for example, if you add network interfaces or if you change its memory configuration, you can use the rediscover function to let the Oracle VM Manager know about these changes.
- **Release the ownership of the Oracle VM server:** When the Oracle VM server is discovered, the Oracle VM Manager automatically takes ownership of the server. You can release this ownership, which makes the server unavailable to your Oracle VM environment, although deleting the server is the preferred way to remove the server from the environment.
- **Edit the name and description of the Oracle VM server:** Using the Edit function, you can change the name and description of any Oracle VM server at any time. You can also add or delete a role for the server. Recall that, by default, an Oracle VM server acquires the Utility Server and VM Server roles when it is discovered.

- **Add a tag to the Oracle VM server:** You can use this tag with the Tag Filter function when sorting through a large number of servers. Before you can add a tag, you must create the tag by using the Tags function on the Tools and Resources tab. For example, you can create a tag that identifies Oracle VM servers with Fibre Channel (FC) HBAs and add this tag to each discovered server with FC HBAs. When compiling the list of Oracle VM servers with FC HBAs, just provide the tag you created in the Tag Filter field.
- **Configure the Oracle VM server Intelligent Platform Management Interface (IPMI):** This configuration step includes assigning network and access parameters to the IPMI interface, and varies greatly between server vendors. IPMI's role in Oracle VM server operations is discussed in the next slide.
- **Place the Oracle VM server in maintenance mode:** An Oracle VM server can be placed in maintenance mode to perform hardware or software maintenance. When an Oracle VM server is placed in maintenance mode, any virtual machines that are 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.
- **Start, restart, stop, or kill the Oracle VM server:** These operations can be performed with or without IPMI. The role of IPMI is discussed in the next slide.

  You cannot stop an Oracle VM server if virtual machines are running on the server.
- **Upgrade the Oracle VM server:** If you have a Yum repository configured for Oracle VM server updates, you can perform the updates from within the Oracle VM Manager UI. The upgrade process for Oracle VM servers is discussed in the lesson titled "Planning and Installation."

Some of the actions described in the preceding paragraphs have different effects if the Oracle VM server is part of a server pool. For example, when restarting an Oracle VM server that belongs to a clustered server pool, the server must rejoin the cluster. Cluster operations are discussed in the lesson titled "Server Pools and Repositories."

More actions are possible against Oracle VM servers when the servers are part of a server pool. These operations are covered in the lessons titled "Managing Storage" and "Server Pools and Repositories."

# Using IPMI to Change the Operational State of Oracle VM Servers

- IPMI is a computer interface for out-of-band management of physical hosts.
  - Configuring IPMI for your Oracle VM servers is optional.
- To configure IPMI, provide an IP address and user access information.
- When available, IPMI can be used to start or kill an Oracle VM server host.
- If IPMI is not available on your servers, configure Wake-on-LAN in the BIOS to allow start or kill operations.

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**Configure the Oracle VM Server IPMI**

Configuring the Management Controller for IPMI operations on the Oracle VM server is optional. With IPMI, you can start a server that has been powered down.

IPMI must be configured on the physical host on which you installed the Oracle VM Server for x86 software, before IPMI can be used by Oracle VM. After IPMI is configured on the physical hosts, you can enable IPMI operations on your Oracle VM servers.

To configure IPMI on an Oracle VM server by using the Oracle VM Manager UI, highlight the server on the Servers and VMs tab, and select the Edit function for the server. Provide the following information:

- IP address for the IPMI-capable service processor
- Username and password to access the service processor

If IPMI is not available for your Oracle VM servers, configure Wake-on-LAN (WOL) in the BIOS of your servers to allow start and restart operations.

**IPMI for Start, Restart, Stop, or Kill Operations on Oracle VM Servers**

If IPMI or WOL is not enabled on your Oracle VM server, the Oracle VM Manager Start and Kill operations on your Oracle VM servers do not work.

To stop an Oracle VM server, a system power off command is sent to the server. To restart an Oracle VM server, a system restart command is sent to the server. Therefore, the stop or restart actions do not require IPMI or WOL. However, if the stop operation is unsuccessful, you must use the Kill function, which uses IPMI.

## Quiz

When you use the Oracle VM Manager to discover an Oracle VM server that is running on a physical host with IPMI, the IPMI information for this server is retrieved automatically.

a. True

b. False



**Answer: b**

# Networking in Oracle VM

- The rest of this lesson addresses networking and creating networks for your Oracle VM environment.
- This section describes how networks are managed by using the Oracle VM Manager, and includes the following topics:
  – How the Oracle VM Manager uses networks
  – Network functions
  – The role of the management network
  – How to create additional networks

## Networks in the Oracle VM Environment

- A network in the Oracle VM Manager is a logical grouping of network interfaces, providing an abstraction of the underlying network configuration.
- The first network is created automatically when discovering the first Oracle VM server on that network.
- You can create additional networks to implement your network design based on your physical network configuration:
  - How many ports are available on each Oracle VM server?
  - Are there Virtual LANs (VLANs) in your network?
  - Do you want to achieve network isolation or boost performance?

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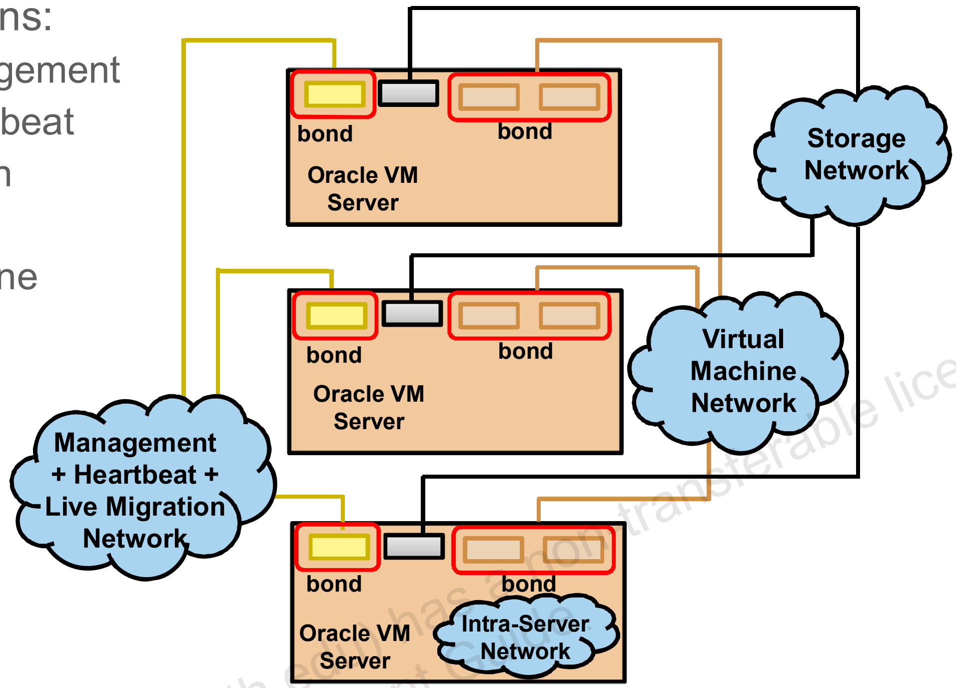
You create logical networks with the Oracle VM Manager to match your physical network configuration. There is no representation for these logical networks in the Oracle VM servers. The Oracle VM Manager uses networks to group interfaces for the purpose of configuring and activating the interfaces in the Oracle VM servers, for bookkeeping, and for providing an abstraction to the user.

The only network that the Oracle VM Manager can auto-detect is the management network. In a test environment, you can direct all traffic through the management network. However, if you have multiple ports on your Oracle VM servers, you can create networks for specific functions, in addition to the management network. Oracle VM supports network traffic over bonded interfaces, bridges, and virtual LANs (VLANs). Bonded interfaces, bridges, and VLANs are discussed later in this lesson.

## Networks and Network Functions

Network functions:

- Server Management
- Cluster Heartbeat
- Live Migration
- Storage
- Virtual machine
- Intra-Server

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You specify one or more network functions when creating your networks, to isolate different types of network traffic:

- **Server Management function:** This function is assigned automatically to the network that is created during the discovery phase. This type of network is used for communication between the Oracle VM Manager and all Oracle VM servers and between the Oracle VM servers.
  - An Oracle VM server can belong to only one server management network.
- **Live Migration function:** This type of network is used to migrate running virtual machines from one Oracle VM server to another server within a server pool.
- **Cluster Heartbeat function:** This type of network is used by each Oracle VM server (in a clustered pool) to send a heartbeat to indicate that it is alive.
- **Storage function:** This type of network is used to connect to Ethernet-based storage servers by using the iSCSI protocol, and to file servers that provide NFS shares.
- **Virtual Machine function:** This type of network enables virtual machines to communicate with other virtual machines and to access the corporate or other external networks.

- **Local network with the Virtual Machine function on a single server (also called intra-server network):** This feature creates a network on a single Oracle VM server. All virtual machines deployed on that server can communicate with each other over this network, without a physical link connecting to an external physical network. This type of network is useful for virtual machines that provide services to each other over the network.

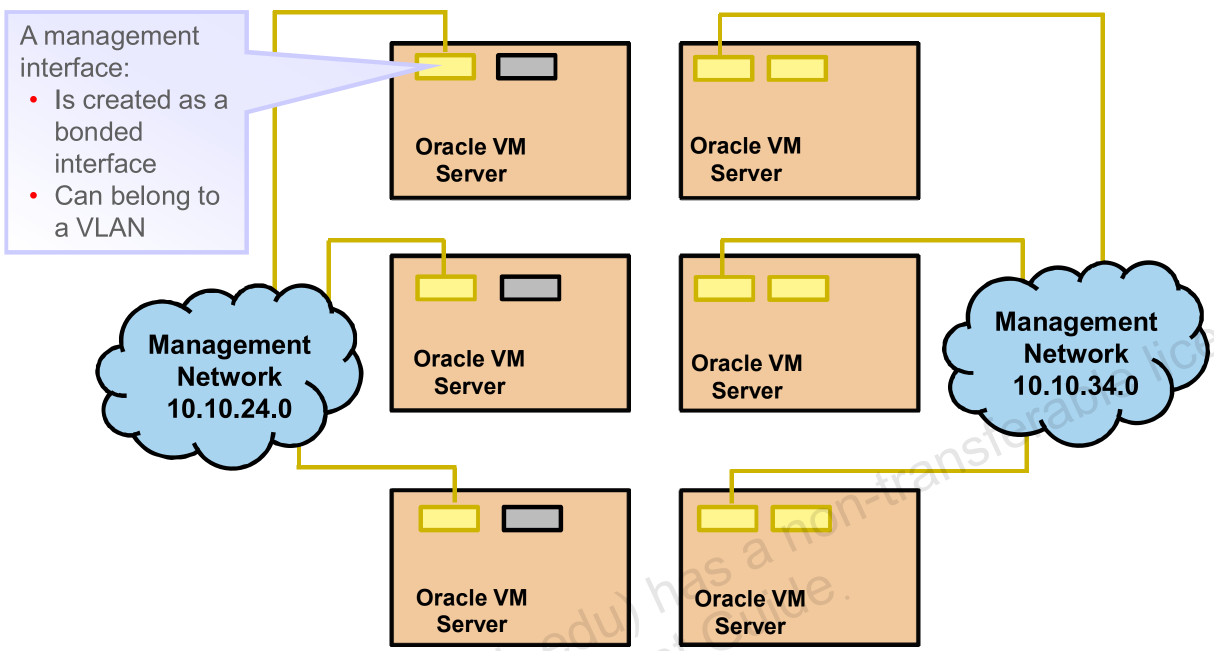
The diagram in the slide illustrates four networks for the Oracle VM environment:

1. The first network, built on the first bonded interface, is the management network, but also has the Heartbeat and Live Migrate functions.
2. The second network uses the second port on each Oracle VM server. This network has been created with the Storage function.
3. A third network, which is built by using the second bonded interface, is dedicated to virtual machine traffic.
4. A fourth network has been created as an intra-server network, and is valid for only one Oracle VM server.

When using the Oracle VM Manager UI, the network functions are called network channels. When you create or edit a network, you select one or more of the following network channels for your network: Server Management, Cluster Heartbeat, Live Migrate, Storage, or Virtual Machine.

When you create a network by using the Oracle VM Manager UI and select “Create a Network on a single server,” an intra-server type network is created, which acquires the Virtual Machine network channel automatically.

# Management Networks






When you discover the first Oracle VM server by using the discovery function, the first server management network is created. This network also includes the Live Migration and Cluster Heartbeat functions:

- When you discover additional servers on the same subnet, these servers are added to the existing management network.
- If you discover a server on a different subnet within the network, a new management network is created.

This situation is illustrated in the slide, where two management networks are automatically created during the discovery process. Each Oracle VM server has only one bonded interface in one management network.

## Management Interface on the Oracle VM Server

- The management port is created as a bonded interface during the Oracle VM Server for x86 installation.
- You can add a port to this bonded interface by using the Oracle VM Manager.
- The bonding mode is set to Active-Backup by default.
- If you specify a VLAN ID during the Oracle VM Server for x86 installation, a VLAN interface is automatically created on the management bond.

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**Bonding of the Management Interface**

The management port on each server, which is specified during the Oracle VM Server for x86 installation, is configured as a bonded interface and is added to the management network during the discovery process. Bonding is a Linux OS feature that provides a method for aggregating several ports into a single bonded interface to provide load balancing or redundancy. When you discover an Oracle VM server, the bonded interface is shown as containing a single port.

Because the management interface is already configured as a bonded interface, you can add one or more ports to this bond after the discovery step. You can also change the bonding mode. Bonding is discussed later in this lesson.

**VLAN Support for the Management Interface**

If you specified a VLAN for the management interface during the Oracle VM Server for x86 installation, a VLAN interface is automatically created on the management bonded port. You can examine this VLAN interface along with its associated bonded port when accessing your newly installed Oracle VM server.

## Creating Additional Networks

- When the management networks are in place, you can create additional networks to implement your network design.
- For each network created by using the Oracle VM Manager, you select one or more network channels and network resources.
- Oracle VM servers are unaware of these network constructs:
  - Creating a new network by using the Oracle VM Manager results in the configuration of network devices on the Oracle VM servers that are participating in the network.



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After you have discovered your Oracle VM servers, you can create additional networks, for example, a storage network. The Virtual Machine network channel (or function) can be added to the management network, although you might want to create one or more additional virtual machine networks that do not share the Virtual Machine function with other network functions.

When you create a new network, in addition to specifying a network channel, you select network resources such as ports, bonds, or VLAN interfaces.

Oracle VM servers are unaware of the logical networks that you create by using the Oracle VM Manager. These network objects are stored in the Oracle VM Manager database. Creating and managing network objects from the Oracle VM Manager results in the configuration or deletion of network devices on the Oracle VM servers that are participating in the network.

# Guidelines for Creating Networks

- Networks can be on dedicated or shared physical networks.
  - A network on a private segment is a good choice for a cluster heartbeat, which is sensitive to latency.
  - Live migration traffic is encrypted by using secure sockets layer (SSL) but can benefit from having its own network.
- Network configuration is independent of your server pool configuration.
  - Consider both components when creating networks.
  - Ensure that each Oracle VM server in a server pool has the same network configuration.

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All additional networks can be on either dedicated or shared physical networks, except for virtual machine networks with the intra-server network feature specified. Such networks are limited to a single Oracle VM server and operate only within the server.

A network on a private (dedicated) segment is a good choice for a Cluster Heartbeat network, because this type of network traffic is susceptible to latency and is limited to communication between the Oracle VM servers in a clustered server pool. However, this is not a requirement and the cluster heartbeat traffic can be safely configured on a shared network.

You can also create a separate network for the Live Migrate network channel. After the initial server discovery, the Live Migrate network channel is assigned to the Management network. Oracle VM encrypts migration traffic by 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.

Network configuration is independent of your server pool configuration, but both entities must be taken into account when designing your overall networking infrastructure. The Oracle VM Manager communicates with all the Oracle VM servers in the environment by using the management port, independently of how the Oracle VM servers are grouped to form server pools. Each Oracle VM server in a server pool must be able to communicate with all the other Oracle VM servers in the same pool.

The network configuration in your environment might be dependent on the network-based storage (NFS/iSCSI) that is available to specific server pools. The 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 the current network and storage setup, as well as anticipated growth. Each server in a server pool must have access to the same network resources, although the network configuration might differ. For example, one Oracle VM server might have a single Ethernet port participating in a network, whereas another Oracle VM server can participate in the same network with a bonded port.

If you want to protect your environment from loss of service due to failure of a single physical link, you can create bonded interfaces, which combine two or more interfaces to add redundancy, and optionally load balancing, to the bonded interface.

If you want to allow traffic from several LANs on a single port or bond, you can take advantage of the VLAN feature supported by Oracle VM.

To support network communication by the virtual machines deployed on Oracle VM servers, Oracle VM provides the bridging mode. When you create a network with the Virtual Machine function, a network bridge is automatically created on the selected interface.

Bonding, VLAN support, and bridges are discussed in the next section of this lesson.

# Building Blocks for Creating Networks

- The next section of this lesson provides you with information about the building blocks that are available to create additional networks:
  - Ports
  - Bonded interfaces
  - Bridges
  - VLAN interfaces
- The last section of this lesson provides you with rules for making changes to your newly configured network infrastructure.

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# Bonded Interfaces

- A network bond, or bonded interface, is the aggregation of two or more ports to add redundancy or to increase throughput.
- With Oracle VM Server for x86, the maximum number of ports in a bond is set to 256.
- Oracle VM supports three modes of network bonding:
  - Active-Passive
  - Dynamic Link Aggregation
  - Adaptive Load Balancing
- If you plan to use bonded interfaces when creating networks, configure the bonded interface first for each Oracle VM server.



Network bonding refers to the combination of network interfaces on one host for redundancy and/or increased throughput. Redundancy is the key factor: You want to protect your 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 might require configuration on your external switches.

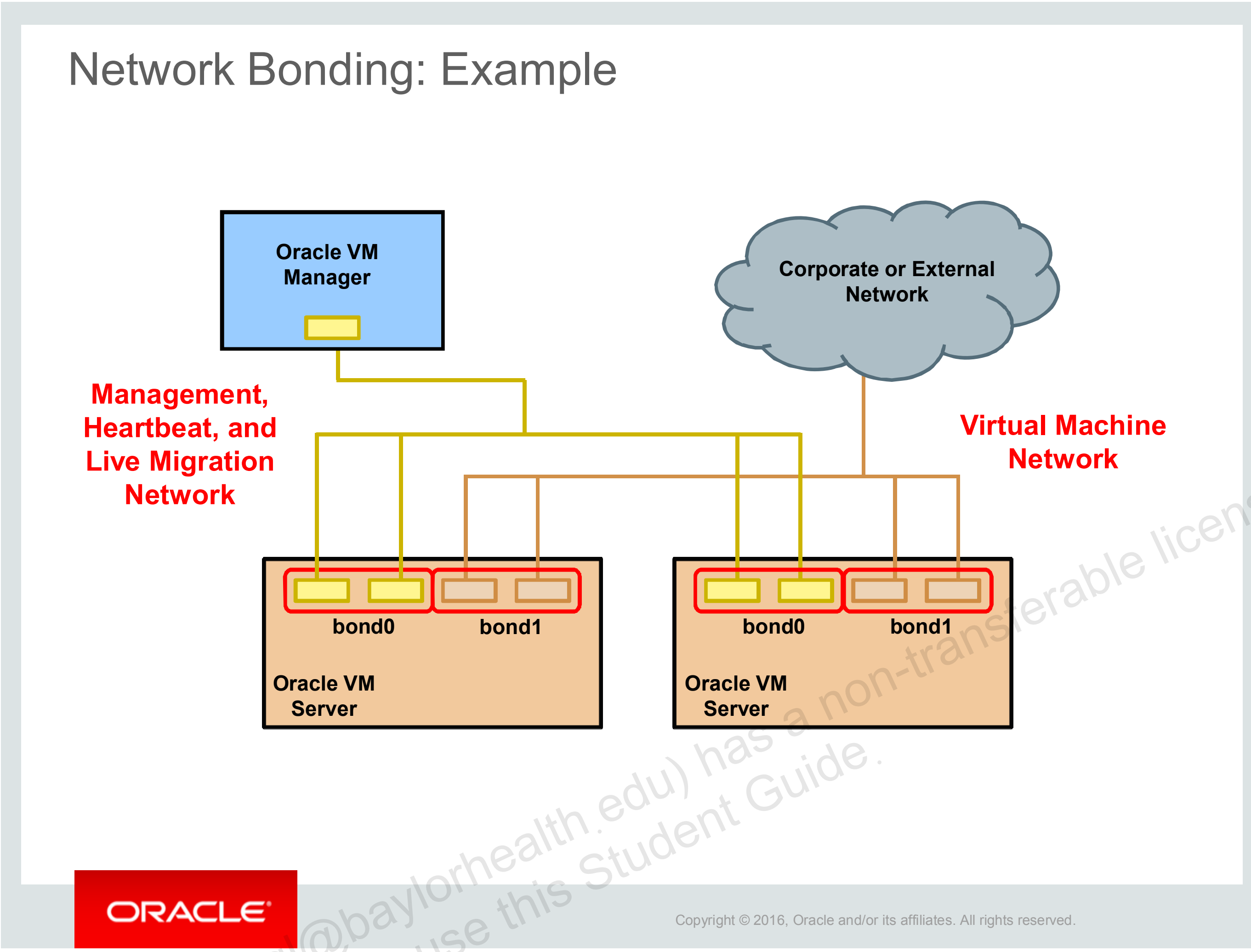
In Oracle VM, there are three modes of network bonding:

- **Active-Passive:** One Network Interface Card (NIC) is active, whereas the other NIC is standby. If the active NIC goes down, the other NIC becomes active.
- **Dynamic Link Aggregation:** All NICs act as one NIC and the network traffic flows through all interfaces concurrently, which results in higher throughput. With this mode, your network administrator must create Link Aggregation Control Protocol (LACP) bonding on the network switches.
- **Adaptive Load Balancing:** The network traffic is equally balanced over the NICs of the bond. This mode does not require any special configuration on the connected network switches. However, this mode does not support using VLAN with bridges. If you are using this mode for your bonded interfaces in any network, you cannot use VLANs if this network is configured with the Virtual Machine network channel.

**Note**

- Network channels were introduced earlier in this lesson. See the notes for the slide titled "Networks and Network Functions."
- With Oracle VM, the maximum number of ports in a bond is 256 and there is no limit to the number of bonds on an Oracle VM server.

As stated earlier, during the installation of Oracle VM Server for x86, the management interface (selected when prompted for the management port) is configured as a bonded interface. The bond is created with only one interface. You can add more interfaces to the existing bond device without affecting the configuration of the original interface.




The diagram in the slide shows an example where a second network interface is added to `bond0`, the network bond that was created during installation. The bonded interface now provides redundancy because the default bonding mode is set to active-passive by default for a management network. You can change the bonding mode for management bonds and you can add or remove ports from the management bond, but there must always be at least one port in the bonded interface. The bonded interface in a management network can also be connected to a VLAN. VLANs are discussed later in this lesson.

The diagram also illustrates the configuration of a second bonded interface, `bond1`, which can be used for other network usage, such as the Virtual Machine network channel. This second bond can use any of the supported network bonding modes, except for the limitation with the adaptive load balancing mode, as noted in the slide titled “Bonded Interfaces.”

When a bond is configured on any Oracle VM server, the bonded interface is specified as the MASTER device, and the Ethernet port that is part of the bonded interface is specified as the SLAVE.

This is reflected in the configuration file of your Oracle VM servers for Ethernet port, `eth0`, in `/etc/sysconfig/network-scripts`, which references `bond0` as the MASTER.

The configuration file for Ethernet port `eth0` points to `bond0` as MASTER:

```
# cat ifcfg-eth0
DEVICE="eth0"
BOOTPROTO=none
HWADDR="00:14:4F:9A:69:D6"
ONBOOT="yes"
MASTER=bond0
SLAVE=yes
```

The configuration file for bond `bond0`:

```
# cat ifcfg-bond0
DEVICE=bond0
BONDING_OPTS="mode=1 miimon=250 use_carrier=1 updelay=500
downdelay=500 primary_reselect=2 primary=eth0"
BOOTPROTO="static"
DNS1="152.68.154.3"
IPADDR="10.150.36.202"
NETMASK="255.255.254.0"
ONBOOT=yes
```

## Network Bridges

- Oracle VM uses bridges to allow all virtual machines to appear on the network as individual hosts.
- When you add the Virtual Machine function to a network, a bridge is automatically created on all Oracle VM servers that are participating in the network.
- A bridge acts as a Layer 2 switch that directs packets to:
  - Other virtual machines on this virtual switch
  - The Ethernet port or bond if the destination of the packets is outside the Oracle VM server
- The bridge and the Ethernet port or bond in the bridge's path do not require an IP address.





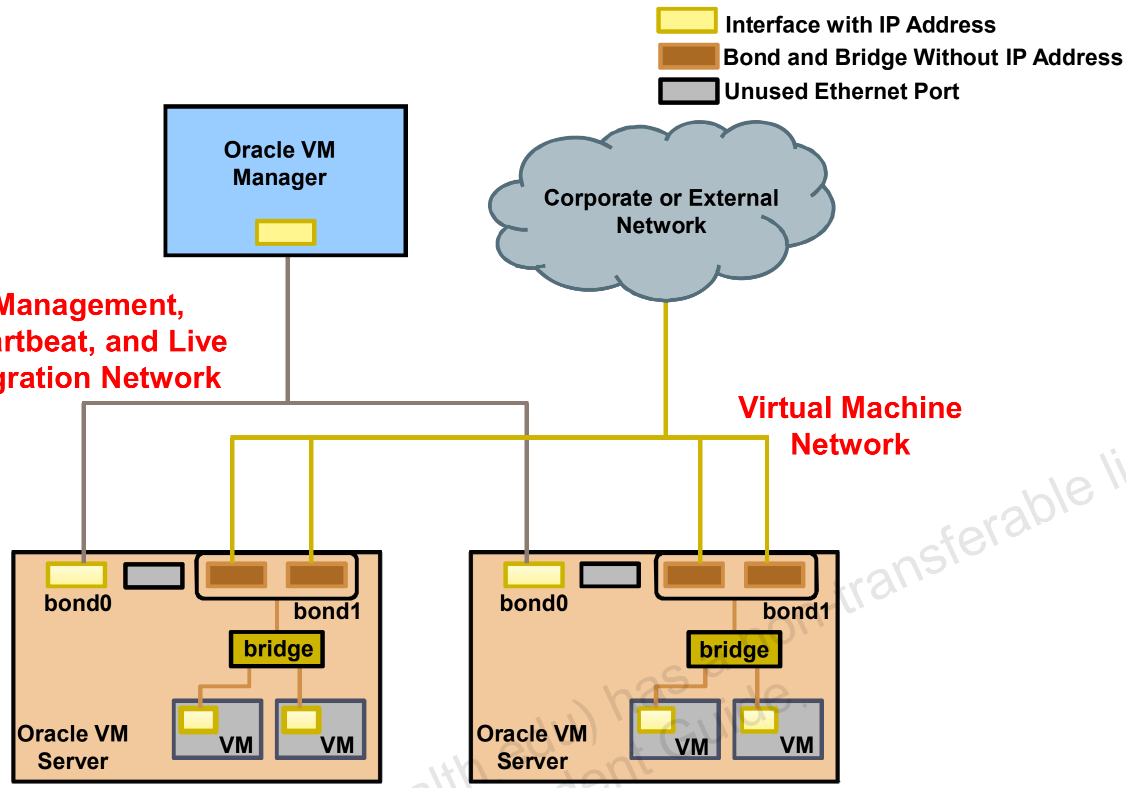


Bridges are used with Xen virtualization to allow virtual machines to communicate with the Oracle VM server (or dom0), with other virtual machines on the Oracle VM server, and with external networks. Creating a bridge is similar to creating a virtual switch in the Oracle VM server, to which all virtual machines on that server are connected.

When you create a network with the Virtual Machine network channel or add the Virtual Machine network channel to any existing network, a bridge is created for that network. The Virtual Machine network channel is the only function that, if selected when creating or updating a network, triggers the creation of a bridge on the specified interface for each Oracle VM server present in the network.

The packets that originate from the virtual machines that are running on the Oracle VM server flow directly to other virtual machines on the server or to an external network by using the bridge. For this reason, there is no need to assign an IP address to the bridge, or to the port or bond used by the bridge to move packets outside of the Oracle VM server. If there is a need for the Oracle VM server to communicate on this network, an IP address can be assigned to the bridge.

## Network Bridges: Example








The diagram in the slide illustrates the bridge concept:

- The management network is created when the first Oracle VM server is discovered.
- A second network is planned for virtual machine network traffic.
- Two ports (for example, eth2 and eth3) are selected on each server to be part of the second network.
- Before creating the second network, you create the bonded interface by using eth2 and eth3.
- You then create the network by selecting this bond and by specifying the Virtual Machine network channel.

During the network creation process, the Oracle VM Manager triggers configuration changes on the Oracle VM servers that result in the creation of a bridge, which is a network device to which all IP packets from the virtual machines are sent. The bridge acts as a virtual switch, and directs packets to other virtual machines that are running on the Oracle VM server or to the bond if the destination of the packets is outside the Oracle VM server where the virtual machine resides.

Although each virtual machine is usually assigned an IP address, either static or DHCP, there is no need to configure an IP address for the bridge.

When configuring your Virtual Machine network, if you specify an IP address, it is assigned to the bridge. However, you can omit this IP address assignment, and the bridge does not acquire an address. If you add the Virtual Machine function to a network that already has other functions, or if you create a network with multiple functions, including the Virtual Machine network channel, a bridge is created automatically and an IP address is assigned to the bridge.

Bridges are needed to allow virtual machines to access the network and, therefore, are created only for networks with the Virtual Machine function.

# Creating a Network with VLAN Support

- A virtual LAN or VLAN is essentially an independent logical network that operates with other VLANs over the same physical connection.
- Oracle VM supports multiple VLANs on the same network port or bond.
- Oracle VM implements this support by using VLAN interfaces.
- When you create VLAN interfaces, you specify:
  - A network interface on each Oracle VM server
  - The VLAN segments (as VLAN IDs) with anticipated traffic on the network interface
- When creating a network with VLAN support, specify a VLAN interface for each Oracle VM server.

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Oracle VM supports multiple virtual LANs (VLANs) on the same port or bond. Each VLAN is essentially an independent logical network that operates with other VLANs over the same physical connection.

Configuring VLAN support involves creating VLAN interfaces on the ports or bonds of your Oracle VM servers. For each port or bond, specify the VLAN IDs for the VLANS that are expected to operate on the same link. The VLAN ID provides a distinct VLAN identification and is used to segregate traffic among the different VLANs.

When a VLAN interface is configured, it functions exactly like a separate physical connection.

VLANs need to be configured in the physical switches before you can use them.

When creating a VLAN interface:

1. Select the port or bond of each Oracle VM server
2. Add the VLAN IDs for all the VLAN traffic that is expected on the port or bond specified in the first step

**Note:** Oracle VM supports traffic on the untagged VLAN, which is VLAN segment 1.

Creating VLAN interfaces results in new network interfaces being created on the Oracle VM servers.

After your VLAN interfaces are created, you can use these VLAN interfaces to create networks in the same way that you create networks by using ports or bonds.

## Oracle VM VLAN Terminology

- VLAN segment: A network segment that is a subset of a larger network and that supports VLAN tagging by using its assigned VLAN ID
- VLAN ID: A unique number between 2 and 4094 that is assigned to a VLAN segment and that is used to tag a packet within the VLAN segment
- VLAN interface: A network device on a host machine (including Oracle VM servers) that implements tagging and untagging of packets flowing through its interface

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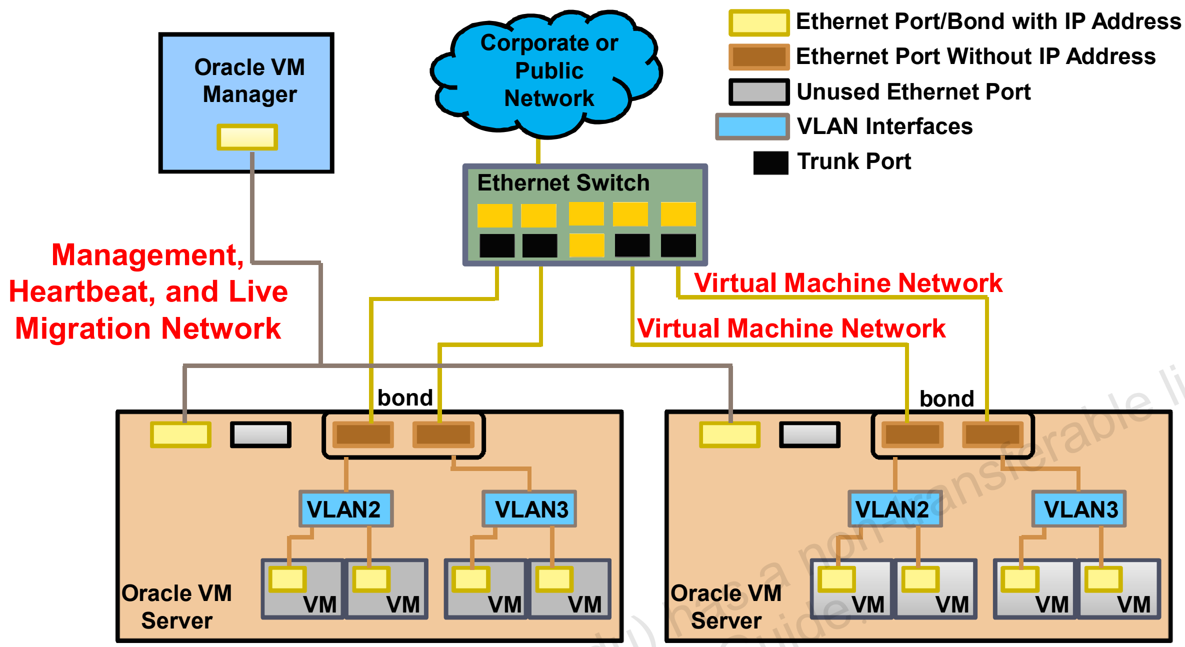
Each packet that is transmitted on a VLAN segment is tagged with the VLAN ID that is assigned to that segment.

The VLAN interface is responsible for tagging outgoing packets with the VLAN ID that is configured for that interface, and the packets are then routed to the actual port or bond to which the VLAN interface is attached. The VLAN interface is also responsible for removing the VLAN tag on the incoming VLAN packets.

By using VLAN interfaces, you can direct traffic from several VLANs onto a single port or bond on each Oracle VM server.

VLAN ID 1 is reserved for untagged network traffic.

# VLAN Interfaces: Example








The diagram in the slide extends the concept of VLANs and VLAN tagging.

VLAN tagging means adding a VLAN ID in the Ethernet packet header. When the tagged packet is transmitted to the external switch over a trunk port, this ID is used to determine where to direct the packet on the switch, possibly onto another switch, if the VLAN design spans several switches.

In the example in the slide, two VLAN interfaces were created on each Oracle VM server, for operations on two VLAN segments:

- The first VLAN segment uses VLAN ID 2.
- The second VLAN segment uses VLAN ID 3.

Creating VLAN interfaces from the Oracle VM Manager triggered the creation of two VLAN interfaces on each Oracle VM server, one VLAN interface for each VLAN ID. These VLAN interfaces are VLAN-capable devices, which tag network packets with the proper VLAN ID.

After creating the VLAN interfaces, two networks with the Virtual Machine function are created from the Oracle VM Manager and the VLAN interfaces that were created previously are selected when creating the networks. Creating these networks triggers the creation of a bridge for each network, on each Oracle VM server that is participating in these networks. These bridges are not shown in the diagram.

## Creating Networks with VLAN Support

- Plan your networks:
  - Which interface (port or bond) on each Oracle VM server will support the VLAN traffic?
  - Which VLAN segments will use this interface?
  - What is the network channel of each network that was created using a VLAN segment?
- Prepare your environment for VLAN support.
  - This is usually done by using switch trunking.
- From the Oracle VM Manager:
  - Create the VLAN interfaces
  - Create VLAN-capable networks

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**Preparing Your Environment for VLAN Support**

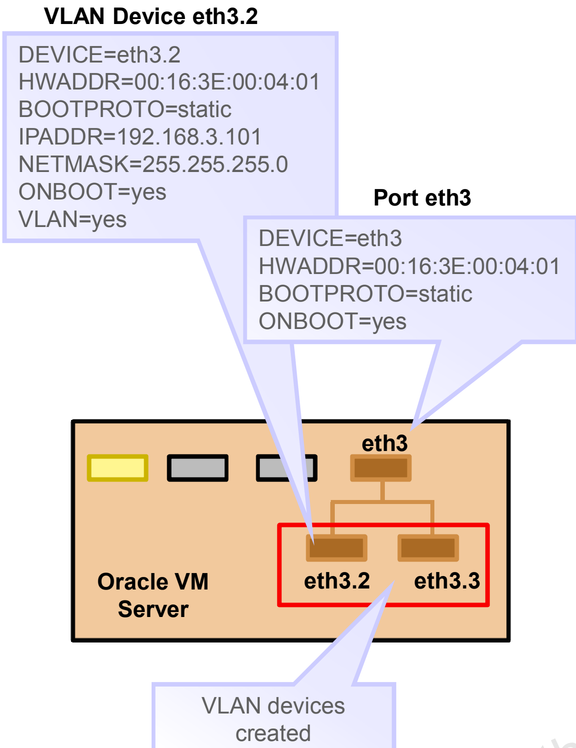
You must configure the VLANs needed to support your network design before you can create the VLAN interfaces and networks. This is usually accomplished by using switch trunking. Trunking involves configuring ports on the switch to allow network traffic from multiple VLANs on these ports, to make sure that packets are correctly transmitted to their final destination. Consult your switch vendor's documentation for information about trunking.

**Implementing VLAN-Capable Networks**

- **Create the VLAN interfaces:** You select a network interface for each Oracle VM server with anticipated VLAN traffic on that network interface. You specify VLAN IDs for all the anticipated VLAN segments. You can also assign an IP address for the VLAN interface on each Oracle VM server. If the network interface is a bond, create the bonded interface before creating the VLAN interfaces.
- **Create the VLAN-capable networks:** For each network, specify:
  - One of the VLAN interfaces that was created in the previous step
  - One or more network channels
  - Optional IP addresses if they were not specified during VLAN interface creation

These two steps are explained in detail in the next slides.

# Configuring VLAN Interfaces




- Create VLAN interfaces:
  - Select one or more Oracle VM servers.
  - Select a port or bond on each server.
  - Specify the VLAN IDs.
  - Optionally, configure an IP address for each VLAN interface.
- After you create the VLAN interfaces from the Oracle VM Manager, the VLAN interfaces show up on the Oracle VM servers.

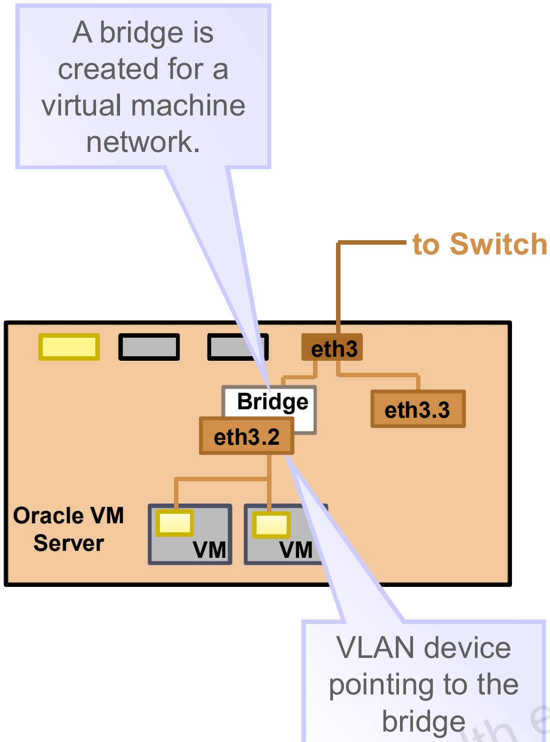




You create VLAN interfaces to direct traffic from several VLANs onto a single port or bond on each Oracle VM server. In the example in the slide, the eth3 interface is expected to carry traffic for VLAN with ID 2 and for VLAN with ID 3. You create VLAN interfaces by specifying the port on each server that is participating in the VLANs, and the two VLAN IDs, VLAN ID 2 and VLAN ID 3. You can assign IP addresses to the VLAN interfaces, depending on the type of network channel that you plan to specify when creating the networks by using these VLAN interfaces.

When you create VLAN interfaces from the Oracle VM Manager UI or the Oracle VM CLI, VLAN devices are created on the Oracle VM servers that you specified as part of the VLAN interface creation process. As shown in the diagram in the slide, these VLAN devices are network devices that point to the same MAC address as the network port specified when creating the VLAN interfaces.

# Creating a Network with a VLAN Interface




- Creating a network with a VLAN interface:
  - Specify a name for the network.
  - Select one or more network channels.
  - Select a VLAN interface for each Oracle VM server.
- For a network with the Virtual Machine channel, a bridge is created and the VLAN device connects to the bridge.

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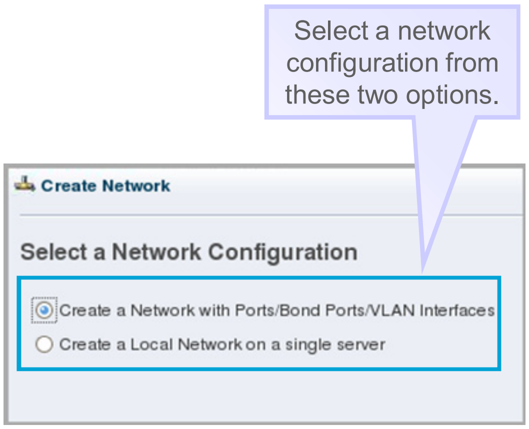
After the VLAN interfaces are created, you can create networks by using the newly created VLAN interfaces. In the example in the slide, a virtual machine network is created by specifying the VLAN interface for VLAN ID 2 for each Oracle VM server. For this new virtual machine network, a bridge is configured on each server that is participating in the network, and the VLAN device on each server connects to this bridge device. The bridge can be created without an IP address because this network is dedicated to virtual machine traffic. Outgoing network packets from the virtual machines deployed on the VLAN segment acquire a tag, which identifies the packets as belonging to a VLAN with VLAN ID 2.

# Creating Networks with the Oracle VM Manager UI




- Select the option to create a network with existing network devices or to create a local network on a single server.
- The creation screens in the Create Network Wizard depend on the selected network configuration.
- If you plan to use bonded interfaces or VLANs, create the VLAN interfaces and bonds before creating your networks.





The initial Oracle VM server discovery step configures the minimum network configuration (a network with the Server Management, Cluster Heartbeat, and Live Migrate network channels). This allows each Oracle VM server to set up its networking sufficiently to establish communication with the Oracle VM Manager. You perform additional network configuration by using the Oracle VM Manager.

**Creating a Network**

The information that you provide depends on the network configuration selected. If you choose to create a network with VLAN support, you must create the VLAN interfaces first.

When creating a network:

- You specify a name and one or more network channels
- Without VLAN support: Select the servers that are participating in the network and the port or bond on the selected servers, and optionally, assign IP information.
- With VLAN support: Select a VLAN interface on the selected servers, and optionally, assign IP information.

## Managing Networks with the Oracle VM Manager

- If you plan to use bonding, create the bonded interfaces before creating the VLAN interfaces and networks.
- Before making changes to a virtual machine network, stop all the virtual machines that are running on the Oracle VM servers in the network.
- All network configuration is persistent on the servers to allow high availability for the virtual machines to work even if the Oracle VM Manager is not available.
- If a network configuration operation fails, the Oracle VM Manager triggers a network discovery for each Oracle VM server that is participating in the failed operation.

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**Making Changes to Your Networking Environment**

You can make the following changes:

- Delete a network if it becomes obsolete.
- Remove a management network if there are no longer any Oracle VM servers that are participating in the network.
- Change the management interface.

  This action requires careful planning because the change might impact communication with the Oracle VM Manager and/or the server pool metadata, causing the Oracle VM servers to reboot.

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

After a network is created, you can add or remove network devices such as ports, bonds, or VLAN interfaces in that network.

- **Removing a network device:** Removing a network device leaves your Oracle VM servers and possibly the virtual machines without the ability to connect to the network. This operation is usually followed by adding one or more ports, bonds, or VLAN interfaces to the network.

To perform the change, launch “Edit Selected Network” and remove the port, bond, or VLAN interface for the Oracle VM servers that are involved in the change. This operation removes the selected network devices on the affected Oracle VM servers.

- **Modifying a port:** From the Servers and VMs tab, highlight the Oracle VM server in the navigation pane and select the Ethernet Ports perspective in the management pane. Select the port in the management pane and click Edit. You can change the address type (Static, Dynamic, or None), IP address, netmask, maximum transmission unit (MTU), and description.

  You cannot change information for a port that is part of a bonded interface.
- **Modifying a bond:** From the Servers and VMs tab, highlight the Oracle VM server in the navigation pane and select the Bond Ports perspective in the management pane. Select the bond from the list of bonds in the management pane and click Edit. You can change the bonding mode, address type (Static, Dynamic, or None), IP address, netmask, MTU, and description, and also add or remove ports from the bond.
- **Modifying a VLAN interface:** From the Networking tab, click the VLAN Interfaces subtab. In the navigation pane, select an Oracle VM server. The server’s VLAN interfaces appear in the navigation pane. Highlight a VLAN interface and click the “Edit Selected VLAN Interface” icon. You can edit the MTU setting, IP address assignment settings, and description.

**How the Oracle VM Manager Recovers from Failed Network Operations**

A single network operation can involve several Oracle VM servers and several networking configuration steps in each Oracle VM server. When a network operation fails, the Oracle VM Manager triggers a network discovery on each Oracle VM server that is participating in the network operation. The network discovery detects which commands completed successfully and the configuration changes resulting from these commands are reflected in the network information displayed with the Oracle VM Manager UI.

At this point, you must investigate the reason for the failed operation. You can then manually undo some of the configuration changes or choose to perform those that did not complete successfully.

## Quiz

Which Oracle VM Manager network channel is not valid?

a. Live Migrate
b. Virtual Machine
c. Storage
d. IPMI



**Answer: d**

## Summary

In this lesson, you should have learned how to:

- List the steps to prepare your environment for Oracle VM
- Discover your Oracle VM servers
- Manage your Oracle VM servers
- Discuss the role of networking in the Oracle VM environment
- List and describe the various network functions
- Explain the role of bridges and VLANs in the Oracle VM environment
- Create networks with or without VLANs
- Modify an existing network configuration

## Practice 3: Overview

In this practice, you perform the following tasks:

- Discover Oracle VM servers from the Oracle VM Manager.
- Create a Virtual Machine network.
- Create a Cluster Heartbeat network.
- Check bonds and bridges on the Oracle VM servers.
- Create a network with VLAN support.

4

# Managing Storage

# Objectives

After completing this lesson, you should be able to:

- Describe the types of storage
- Discuss the functions of storage in the Oracle VM environment
- Explain the Storage Connect framework
- Prepare external storage for use with Oracle VM
- List the initial tasks to configure Oracle VM storage
- Discover file servers and SAN servers
- Perform refresh operations
- Create NFS access groups and SAN access groups
- Create and clone physical disks
- Describe the added functionality that is available with storage arrays when using a vendor-specific plug-in

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## Lesson Overview

- The first topic of this lesson identifies the storage configuration steps to prepare your Oracle VM environment for virtual machine creation.
- The next few sections explain how storage is used in Oracle VM and what types of storage are supported.
- The rest of this lesson guides you through the steps to configure and use storage in Oracle VM.





In the lesson titled "Managing Servers and Networks," you learned how to manage your Oracle VM servers and how to create additional networks for your Oracle VM environment.

In this lesson, the following topics provide an overview of the concepts and tools to help you administer the external and local storage in your Oracle VM environment:

- Become familiar with the storage functions and storage types supported by Oracle VM.
- Learn about the Storage Connect framework.
- Prepare your external storage for use with Oracle VM.
- Perform the storage configuration steps by using the Oracle VM Manager.

## Storage Concepts

- Storage is a fundamental component within an Oracle VM installation.
- To understand how to configure and use storage, this section explores the following concepts:
  – What types of storage does Oracle VM support
  – How storage functions with Oracle VM
  – How Oracle VM accesses storage





Storage is a fundamental component within an Oracle VM installation. This section provides an overview of the storage infrastructure and how it is used within an Oracle VM environment. The concepts presented in this section lay the foundation for configuring and managing your storage.

Oracle VM can use several types of storage. This topic discusses the supported storage types and guidelines for their use. The next topic explores the storage functions, or for what purpose Oracle VM uses storage resources. These functions can be grouped into two main categories:

- Oracle VM clustering resources
- Oracle VM virtual machine resources

The final topic in this section explores how Oracle VM accesses and connects to storage resources. Oracle VM makes use of Oracle Storage Connect plug-ins to establish connectivity.

The following slides explore these topics in more detail.

## Storage Types

- Local storage is locally installed hard disks in your Oracle VM server.
- NFS is a commonly used file-based storage system.
- iSCSI is a storage area network based on the Ethernet protocol.
- Fibre Channel (FC) is a storage area network based on the Fibre Channel protocol.





Oracle VM supports access to several types of external storage:

- **Local storage:** Hard disks that are installed locally in your Oracle VM server
- **Network-attached storage (NAS):** Where data is transferred by using the NFS protocol, also by using a network infrastructure
- **iSCSI storage:** A storage area network based on the Ethernet protocol, where SCSI commands are transferred over a network infrastructure
- **Fibre Channel (FC) storage:** A storage area network based on the Fibre Channel protocol, where SCSI commands are transferred in frames over fiber optic links

When the Oracle VM storage infrastructure is in place, server pools can have access to multiple sources of storage, with repositories residing on NFS shares, or iSCSI or Fibre Channel LUNs. Virtual machines can have their configuration files residing on an NFS repository and their disks residing on virtual disks in repositories or raw physical disks, shared or not, created on iSCSI or FC LUNs.

The next four slides discuss guidelines for using these storage types.

# Storage Types: Local Storage

- Setting up local storage is straightforward because there is no additional hardware.
- You can never use local storage for a server pool file system.
- Storage repositories placed in local storage create an OCFS2 file system.







Here are some considerations for using local storage:

- Setting up local storage is straightforward because you do not need additional hardware for the disk subsystem.
- You can never use local storage for a server pool file system. Local storage is better suited for environments with minimal uptime requirements.
- Storage repositories placed in local storage create an OCFS2 file system. Starting with Oracle VM Release 3.4, features built into the OCFS2 file system enable live migrations of virtual machines with virtual disks on local storage. These live migrations help achieve nearly uninterrupted uptime. Also, storage repositories on a local disk must not contain any data or metadata. You must remove any pre-existing data before creating a storage repository.

## Storage Types: NFS Storage

- NFS storage is a file-based storage system that is suitable for the installation of Oracle VM storage repositories.
- NFS storage is slower for virtual disk I/O compared to a logical volume or a raw disk.
- You can use NFS storage to store server pool file systems for clustered server pools.



NFS storage is a commonly used file-based storage system for Oracle VM installations. Here are some considerations when using NFS storage.

NFS servers present mounted file systems to Oracle VM servers in the form of shares. Oracle VM servers mount these shared file systems as attached storage. Since mounting an NFS share can be done on any server in the network, it is possible to share NFS storage between servers of the same pool and across different server pools.

NFS storage is ideal for storing various categories of storage resources in storage repositories. These resources (files) actually reside in directories on remote systems.

Due to the nature of file-based storage, I/O performance is slower than block-based storage systems such as iSCSI and Fibre Channel SANs.

You can also use NFS storage to store server pool file systems for clustered server pools. When you discover NFS storage, you present the storage to all the servers in a server pool. This allows the servers to share the same resources. When combined with clustering, you achieve high availability in your environment.

## Storage Types: iSCSI and FC Storage

The following apply to both iSCSI and FC storage:

- 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.





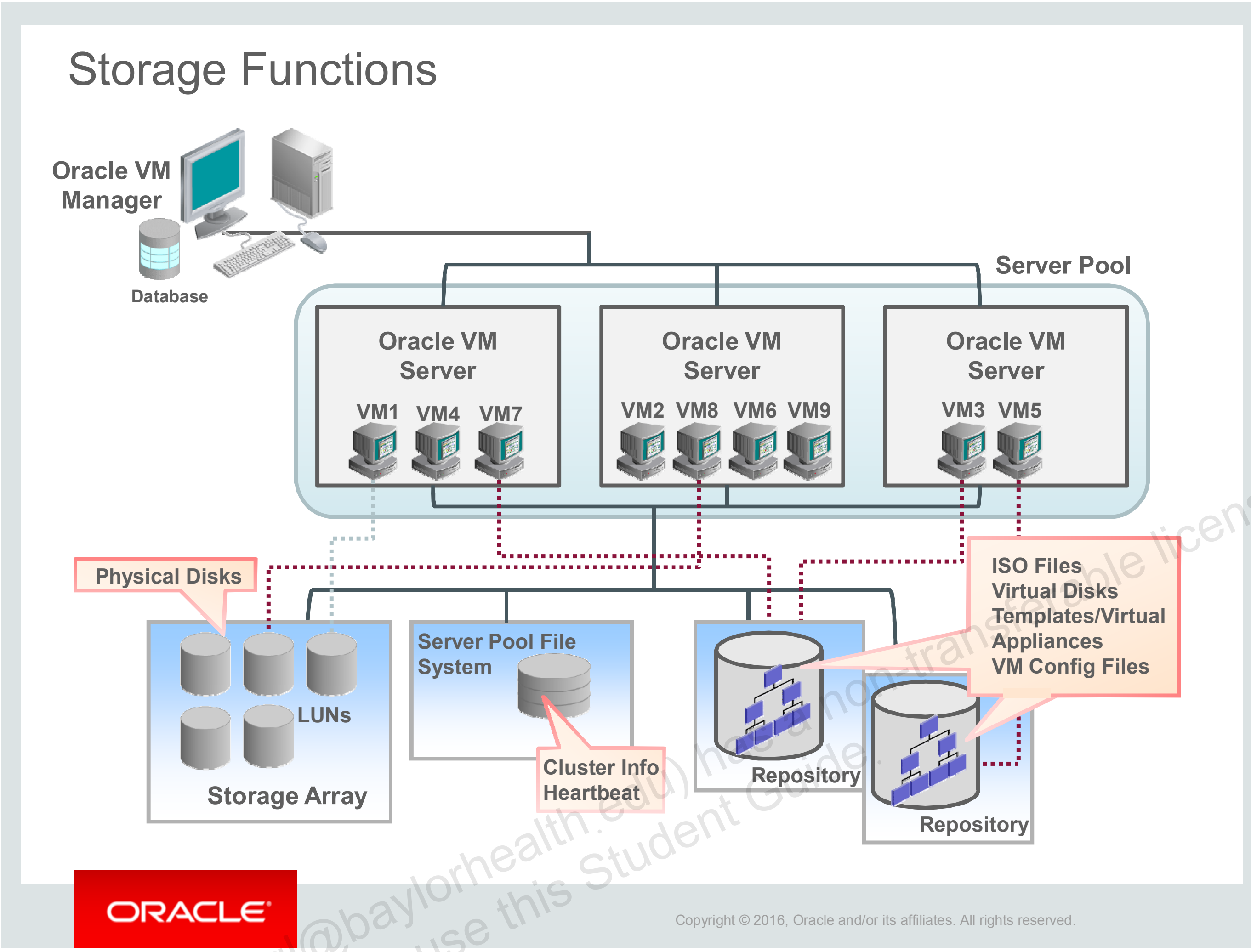
iSCSI works by transporting block-level data between an iSCSI initiator on a server and an iSCSI target on a storage device. Oracle VM connects to iSCSI SANs using configured network interfaces as iSCSI initiators. Here are some guidelines to follow when using iSCSI storage.

When discovered, unmanaged iSCSI and Fibre Channel storage is not allocated a name in the Oracle VM Manager. Use the ID allocated to the storage to reference unmanaged storage devices in the Oracle VM Manager GUI or the Oracle VM Manager CLI.

Set up access groups through the Oracle VM Manager to determine which LUNs are available to which Oracle VM Servers.

Because both iSCSI and FC SAN storage are attached to remote servers, they are well suited for cluster server pool configurations where high availability is desired.

Another aspect of iSCSI and FC SAN storage that makes it desirable is the performance characteristics, which are better than NFS storage.




Storage has several functions within Oracle VM. Oracle VM uses storage to:

- Store repositories that contain ISO files, templates, virtual appliances, virtual machine disks, and virtual machine configuration files
- Support clustering within a server pool by using a common file system that is accessible by all Oracle VM servers that participate in the cluster. This common file system is called server pool file system throughout this lesson.
- Store server pool information (in the server pool file system)
- Present physical volumes (or LUNs) to selected virtual machines. These virtual machines access the physical disks directly, without the need to create virtual disks in a repository.

It is highly desirable that all Oracle VM servers in a server pool have access to the same storage.

The diagram in the slide illustrates the ways storage is used in a typical server pool.

For virtual machine disks, Oracle VM offers you two choices:

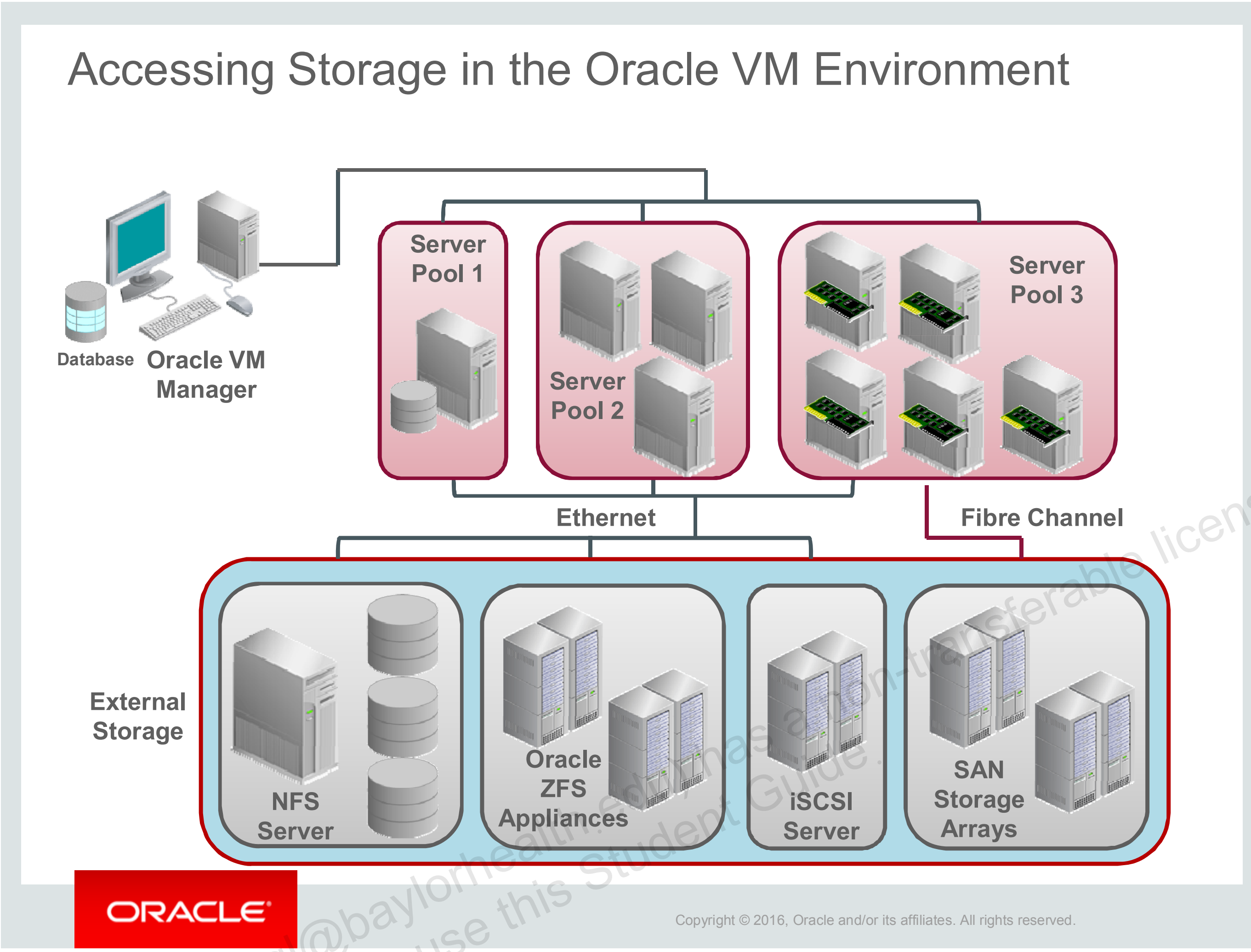
- **Virtual disks:** Disk image files in a file system
- **Raw physical disks:** LUNs accessed directly by the virtual machine

The physical disks that are shown as LUNs in the bottom-left area of the diagram illustrate how physical disks can be accessed directly by the virtual machines deployed within the server pool. Virtual disks, on the other hand, are created from the disk space that is available in repositories.

Physical disk and virtual disk access by virtual machines is shown as red dotted lines in the diagram in the slide. Virtual machine 1 (VM1) and virtual machine 8 (VM8) access a physical disk in the storage array. Virtual machine 3 (VM3), virtual machine 5 (VM5), and virtual machine 7 (VM7) access a virtual disk in a repository.

In addition to housing virtual disks for virtual machines, repositories store other virtual resources, including ISO files, templates, virtual appliances, and virtual machine configuration files. A server pool can have more than one repository.

The dedicated space required for each clustered server pool, called the server pool file system, can reside on a NAS export (NFS share) or an iSCSI or Fibre Channel LUN. Server pools and the server pool file systems are discussed in the lesson titled “Server Pools and Repositories.”




As shown in the diagram in the slide, Server Pool 1 and Server Pool 2 have access to the NFS and iSCSI storage, based on the physical configuration of the storage and network connections. Server Pool 3, alternatively, has access to both the Ethernet-based storage and the Fibre Channel SAN.

**Local Storage**

The diagram also shows an example of local storage: Server Pool 1 contains a single Oracle VM server. This server can use an unused internal drive as storage for a repository, as long as the drive does not have any partition or data on it.

### Accessing Fibre Channel Storage

The Oracle VM servers that access Fibre Channel storage require Host Bus Adapters (HBAs) to connect to the storage area network (SAN). In addition, some configuration might be necessary for multipathing. More information about this topic is available later in this lesson.

### Accessing Network-Attached Storage (NAS) and iSCSI LUNs

As discussed in the lesson titled "Managing Servers and Networks," the only network available to you, after the discovery process takes ownership of your Oracle VM servers, is the management network. You can create additional networks for the different network functions.

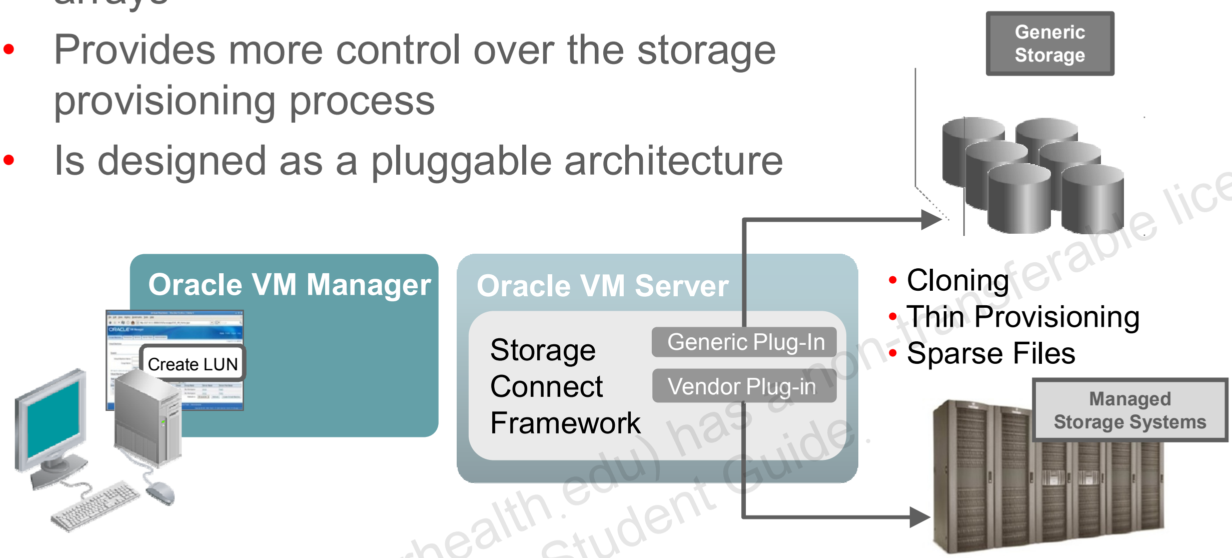
If your storage resides on a network other than the management network, you must create networks with the Storage network channel for the Oracle VM servers to access their storage. If your storage resides on the same network as the management network, you can add the Storage function to the management network, but it is not necessary to do so.

**Note:** The Oracle VM Manager does not check for the existence of a Storage network channel when managing storage. Creating a network with the Storage function is just a way to configure proper network devices on your Oracle VM servers, to allow them to access their storage.

**Note:** The Oracle VM Manager does not need to attach to the external storage. Every request for storage configuration issued by the Oracle VM Manager is sent directly to an Oracle VM server for execution, or is sent to the master Oracle VM server, which designates one of the Oracle VM servers in the server pool to execute the request.

## Storage Connect Framework

- Enables the administrator to manage storage arrays from the Oracle VM Manager
- Uses advanced features that are available from the storage arrays
- Provides more control over the storage provisioning process
- Is designed as a pluggable architecture








The Oracle VM Manager communicates with all storage through a set of plug-ins that is part of the Storage Connect framework. These plug-ins are not actually run from the Oracle VM Manager, but rather installed on some or all the Oracle VM servers.

The Storage Connect feature offers the following benefits:

- Integrates storage administration into the Oracle VM Manager to simplify and automate storage management
- With generic plug-ins, uses the Oracle VM server's built-in OS capabilities for SAN or NFS storage access
- With vendor plug-ins, leverages advanced vendor storage system capabilities such as:
  - Native storage services, such as LUN creation, deletion, expansion, or cloning
  - Improved storage utilization with thin provisioning

Cloning, thin provisioning (or thin cloning), and sparse files are defined later in this lesson.

## Storage Connect Generic and Vendor Plug-Ins

- Generic plug-ins:
  - Offer a limited set of standard storage operations
  - Do not interact directly with storage management
- Vendor plug-ins:
  - Offer a much larger set of operations
  - Provide access to the management interface in the storage array





Storage Connect plug-ins are split according to the functionality they offer. There are generic plug-ins and non-generic plug-ins, which are also referred to as vendor 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.
- Vendor-specific plug-ins include a much larger set of operations, which also includes direct, active interventions on the storage hardware: cloning, LUN creation, resize operation, and so on.

To execute generic storage plug-in operations, only an iSCSI access host or Fibre Channel connectivity is required. For iSCSI, this is typically a host name or an IP address and a port number. The non-generic plug-in operations require an additional admin host, with optional administrative username and password. This additional information enables the Oracle VM Manager to select an authorized Oracle VM server to perform the advanced configuration tasks on the storage subsystem.

## Preparing External Storage

- Create an additional network for access to your storage.
- Ensure that your storage infrastructure exposes writable NFS shares or LUNs to the Oracle VM servers connected to the storage networks.
- Test your configuration, including any failover component.
- Install non-generic plug-ins on the Oracle VM servers that are selected to access and manage the storage.
- Ensure that you leave some disk space available to create smaller storage entities, of at least 12 GB each, to use as server pool file systems.





As stated earlier in this lesson, the Oracle VM Manager distinguishes between file servers and SAN servers (storage arrays). Depending on your hardware and networking configuration, external storage can 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.

If you plan to access your storage by using generic plug-ins, you must create the storage elements on your storage hardware before you can discover and configure these storage elements by using the Oracle VM Manager. The servers or disk subsystems that offer the storage simply need to be reachable by the Oracle VM servers in the Oracle VM environment through a Fibre Channel or Ethernet network.

If you plan to use vendor plug-ins, you must install these plug-ins on the Oracle VM servers that access the storage. Vendor plug-ins are discussed later in this lesson.

## Preparing External Storage: FC Multipathing

- Oracle VM supports multipath I/O for Fibre Channel storage.
- Configuration for multipathing is vendor-specific.
  - The configuration steps are provided only as a guideline.
- Always test your multipathing configuration, including any failover components.







Oracle VM supports multipath I/O for FC storage, but the steps required to enable this feature depend on the storage hardware that is implemented. Consequently, the following steps are intended only as a guideline. Some steps may not be necessary. Refer to your SAN hardware documentation before attempting to configure multipathing in your Oracle VM environment.

**General Steps to Configuring Multipathing**

**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.

- Design and document the multipathing configuration that you intend to apply to the SAN hardware used in your Oracle VM environment.
- Make sure that the drivers for your HBAs are present. If not, install the drivers for the HBAs.
- Configure appropriate zoning on the Fibre Channel switches.

- Configure LUN masking on the storage arrays.
- Configure path optimization features (ALUA or similar) on your disk subsystem, if so instructed by your vendor's documentation.
- Check the fabric information about each Oracle VM server that has access to the SAN hardware. Use `multipath -ll` and related commands.
- Make necessary changes to the `/etc/multipath.conf` file on the Oracle VM servers.

  **Note:** The `/etc/multipath.conf` file in the Oracle VM server has been configured to support most vendors' hardware. Modify this file only if directed by your storage vendor.
- If you have made changes to `/etc/multipath.conf`, restart the multipath daemon (`multipathd`). You must keep the configuration parameter `user_friendly_names` set to `no` in the `/etc/multipath.conf` file.
- Check the fabric information again to verify the configuration.
- If instructed by the vendor's documentation, rebuild `initrd`.
- 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.

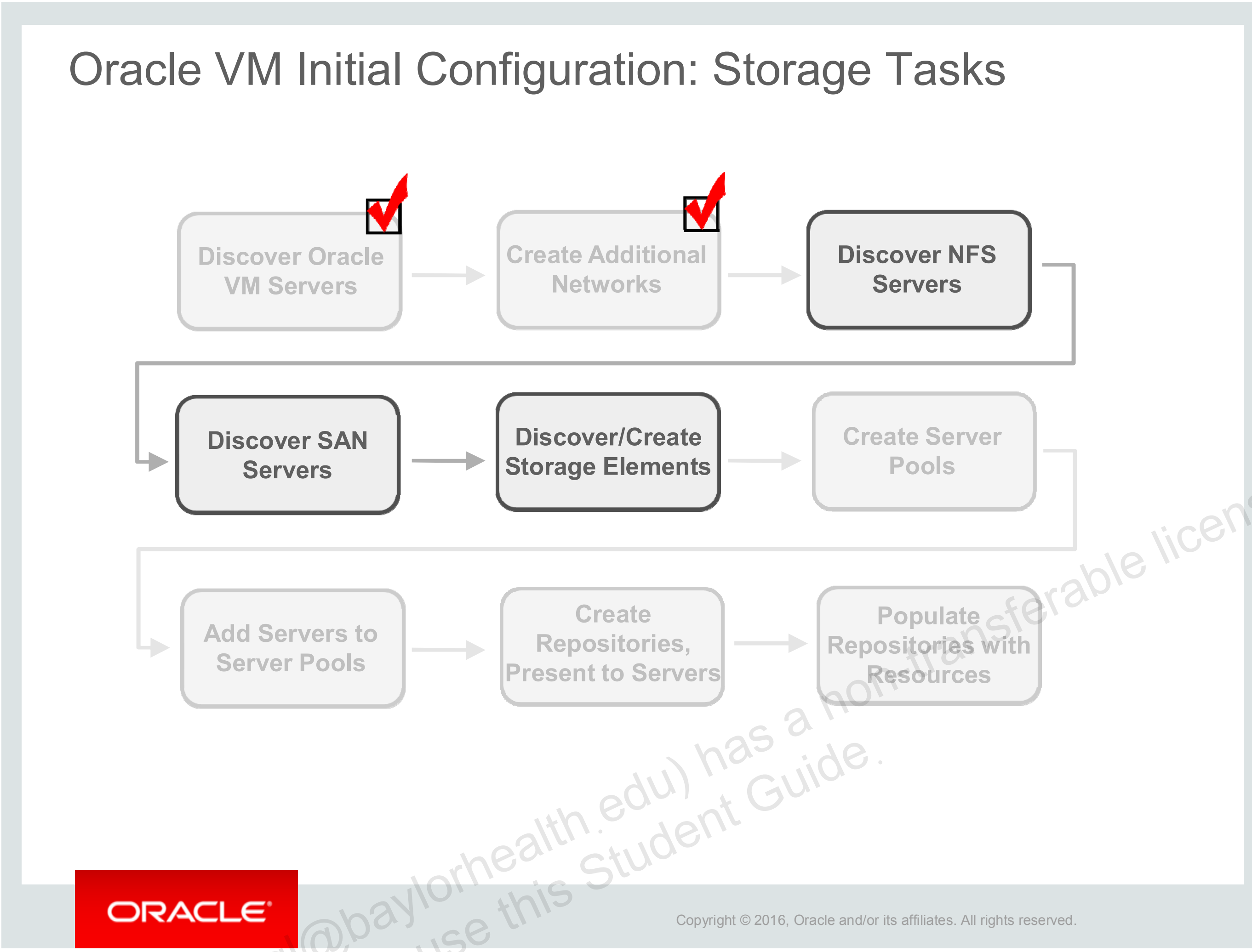
## Quiz

The Oracle VM Manager and all the Oracle VM servers in a server pool must be able to access the storage that is to be used for the server pool file systems, repositories, and optionally, the physical disks for virtual machines.

a. True
b. False



**Answer: b**




The steps that are specific to storage within the overall initial configuration tasks include:

- Discovering NFS servers
- Discovering SAN servers
- Discovering and creating storage elements

**Note:** For storage arrays that are managed with a vendor-specific plug-in, you can discover the storage elements, but you can also create new storage elements, if the plug-in offers this capability.

File servers offer file-based storage, which is usually associated with network-attached storage (NAS). Discovering a file server makes file-based storage from another physical server available to the environment. This type of storage can be set up quickly by exporting file systems as network shares.

SAN servers include iSCSI and Fibre Channel (FC) storage arrays. SAN servers offer block-based storage. Although another layer is normally added on top of the block-based storage, such as a file system or database management system, this type of storage is accessed at the block level, either by directly attaching it to one or more Oracle VM servers by using a Fibre Channel SAN or over the network by using the iSCSI protocol.

## Configuring Storage in Oracle VM

- The first section of this lesson presented information about storage in Oracle VM:
  - How storage is used in Oracle VM
  - How the Oracle VM Manager and Oracle VM servers communicate with storage within the Storage Connect framework
  - How to prepare storage for use with Oracle VM
- The rest of this lesson guides you through the steps to configure your storage by using the Oracle VM Manager UI.





The first part of this lesson provided you with an overview of how storage is used with Oracle VM. You learned about the Storage Connect framework and the plug-ins used to implement the Storage Connect architecture.

The next section in this lesson guides you through the steps to configure your storage by using the Oracle VM Manager UI. The section covers the following topics:

- Discovering file servers
- Discovering iSCSI and Fibre Channel storage arrays
- Distinguishing between managed and unmanaged storage arrays
- Using Access Groups
- Discovering and managing storage elements

## Storage Management with the Oracle VM Manager

- In the Oracle VM Manager, storage is represented by storage providers and their storage elements.
- There are three types of storage providers:
  - File Servers
    - NFS file servers
  - SAN Servers
    - Unmanaged iSCSI storage array
    - Unmanaged SAN storage array
    - Configured iSCSI or SAN storage arrays
  - Local storage on Oracle VM servers

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In the Oracle VM Manager, storage is organized under the following categories:

**File Servers**

Network Attached Storage—typically, NFS—is a commonly used file-based storage system that is very suitable for Oracle VM storage repositories. Recall that storage repositories contain various categories of resources such as templates, virtual disk images, DVD ISO files, and virtual machine configuration files.

With the Oracle VM Manager, you discover NFS storage by using the server IP or host name of the file server, and you typically present the same storage to all the servers in a server pool to allow them to share the same resources.

**SAN Servers**

In Oracle VM, block-based storage is represented by SAN servers.

The Oracle VM Manager separates SAN servers into two categories:

- Fibre Channel storage arrays
- iSCSI storage arrays

These categories of storage arrays are further broken down into unmanaged and managed (or configured) storage arrays.

All storage, either unmanaged or configured, is controlled through a set of plug-ins that is part of the Storage Connect framework (introduced earlier in this lesson).

The difference between unmanaged and configured storage is explained in the slide titled “Unmanaged and Managed SAN Servers” later in this lesson.

**Local Storage**

Local storage is a special type of storage, which consists of hard disks that are connected locally in your Oracle VM servers.

In a default installation, the Oracle VM server uses only a part of the installation disk. If there is enough space left on the installation disk, that space is converted into a physical disk that you can use to create a local repository for the Oracle VM server owning the disk. If additional local disks are available for storage, the unused local devices are detected as raw disks, and, as such, are treated in the same way as block-based storage. The choice is yours to use these additional local disks as disks for virtual machines or to create a storage repository on these disks. If you create a storage repository on a local disk, an OCFS2 file system is created on the disk.

# Configuring File Servers

- You configure file-based storage by using file server discovery in the Oracle VM Manager.
- File servers offer either uniform or non-uniform exports.
- The discovery process varies depending on whether the file server offers uniform or non-uniform exports.





Before attempting to discover a file server, make sure that your file server exposes writable file systems (for example, through an NFS share or a NetApp file server) to the Oracle VM servers in your target server pool.

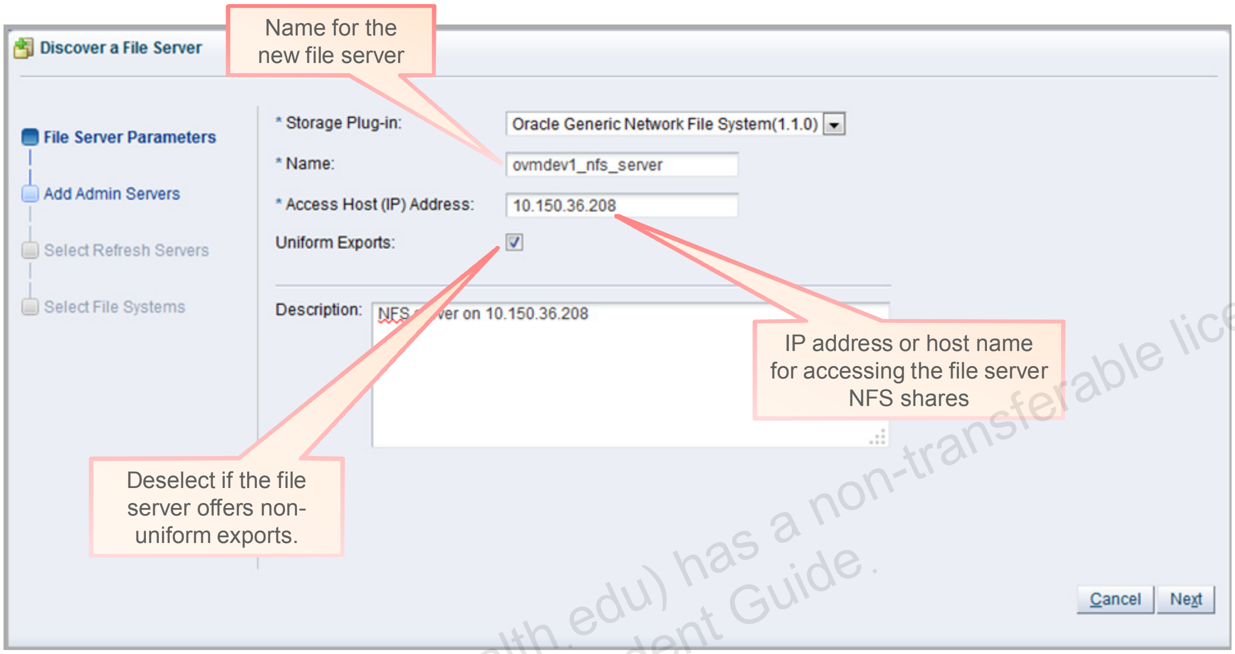
If a file server exports the same exports (or NFS shares) to all the Oracle VM servers in all the server pools in your Oracle VM environment, the file server is said to have uniform exports.

If a file server exports different exports to different server pools, the file server is said to have non-uniform exports.

The discovery process for a file server differs depending on whether the file server offers uniform or non-uniform exports.

To discover a file server, you launch the Discover File Server Wizard from the Storage tab of the Oracle VM Manager UI.

# Discovering a File Server: File Server Parameters

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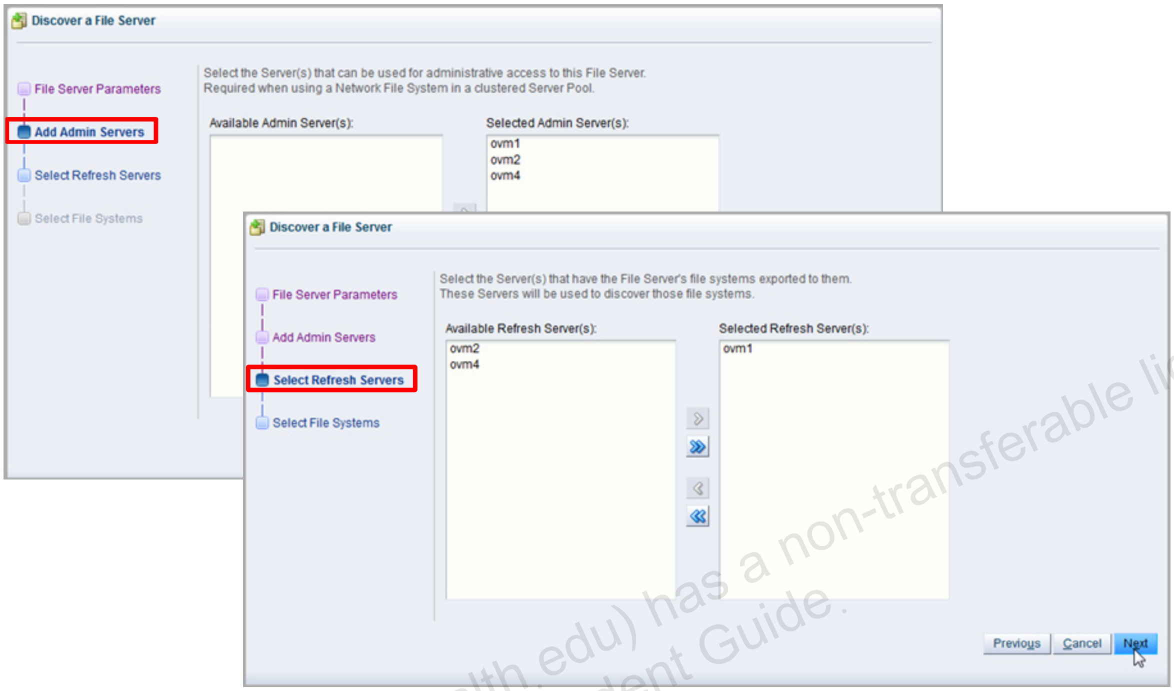
On the first screen of the Discover File Server Wizard, provide the following information to the wizard:

- **Storage Plug-in:** The storage plug-in corresponding to the type of file server (generic NFS or vendor-specific)
  - In the example in the slide, the generic NFS plug-in is used.
- **Name:** The name that you want to use to identify the file server
- **Access Host:** The host name or IP address of the server offering the file shares
- **Description:** Optional information that you would like to add about this file server
- **Uniform Exports (a check box that is selected by default):** You leave this check box selected if all the Oracle VM servers in all the server pools have access to the same NFS shares exported by this file server.

  If the file server is configured to offer different exports to different server pools, you deselect this check box *and* configure access groups after completing the discovery of the file server. Access groups are discussed later in this section.

# Discovering a File Server: Adding Admin and Refresh Servers










**File Server Discovery: Specifying Admin Servers**

In the next window, you specify the admin servers for your file server.

Admin servers are designated servers that can access a file server or storage array to perform an administrative function on the storage, such as extending a file system. You must specify admin servers when using a network file system in a clustered server pool.

Admin servers are also required when discovering most types of SAN servers.

**Note:** If you are working with a non-clustered server pool, you can skip this screen. The difference between a clustered and a non-clustered server pool is discussed in the lesson titled “Server Pools and Repositories.”

Generally, when adding admin servers to this screen, you include several Oracle VM servers that have access to the file server.

After specifying the admin servers, you click Next to move to the next screen.

**File Server Discovery: Specifying Refresh Servers**

In the next window in the file server discovery process, you specify refresh servers.

A refresh server is an Oracle VM server that is used to access all the exports (or NFS shares) that are made available by a file server.

## Specifying Refresh Servers

- Refresh servers are Oracle VM servers that can be dispatched to update information about the exports that are available on a file server.
- If your file server has non-uniform exports, include an Oracle VM server from each server pool in your list of refresh servers.
- If your file server has uniform exports, specify one Oracle VM server or leave the list empty.



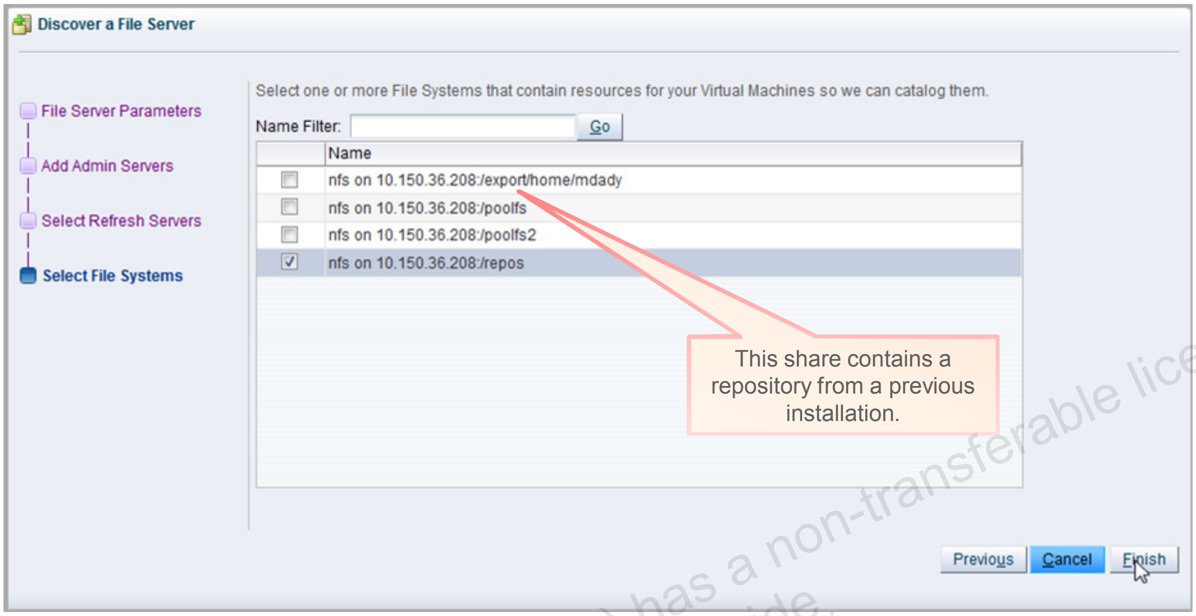
After the file server is configured, if you make changes to the configuration of your file server, you can use the file server refresh function to allow the Oracle VM Manager to update its information about the exports that are available from the file server.

- If your file server has non-uniform exports, you must include an Oracle VM server from each server pool in your list of refresh servers, for each file system to be accessible by at least one Oracle VM server.

  **Note:** Recall that generally, all the Oracle VM servers in a server pool have access to the same storage.
- If your file server offers uniform exports, you can include a single Oracle VM server in the list of refresh servers, or leave the list empty, and the Oracle VM Manager chooses an Oracle VM server from the admin server list to perform the refresh operation.

At this point in the file server discovery wizard, what happens depends on whether the file server's exports are set to uniform or non-uniform.

# For Uniform Exports: Selecting File Systems








**For a File Server That Offers Uniform Exports**

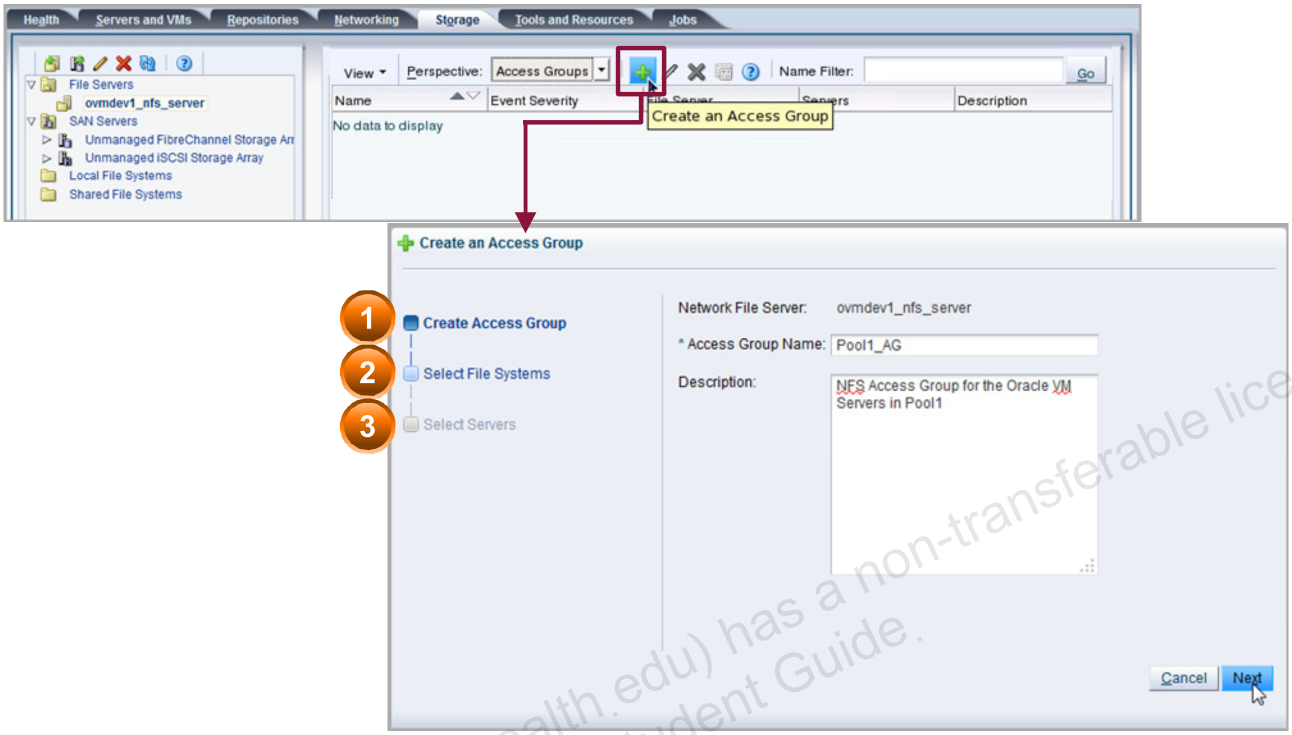
When you click Next after specifying the refresh servers, a refresh operation is triggered for the file server. When this operation is complete, the available file systems appear on the last screen of the Discover a File Server Wizard.

If you know that one of the listed file systems has a repository on it from a previous installation or configuration, you can select the file system with the repository on it.

At this point, you click Finish to trigger a refresh of the file systems that you selected in this step. If a repository exists on the selected file systems, it appears in the list of available repositories.

Your file server and its network file systems are now ready to be used either for storage repositories or as server pool file systems.

# For Non-Uniform Exports: Creating NFS Access Groups

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**For a File Server That Offers Non-Uniform Exports**

If your file server offers non-uniform exports, the discovery process for the file server ends with the selection of refresh servers. When exiting the Discover a File Server Wizard, you get the following message:

`“Please configure Access Groups for your File Server. Once they are properly configured, you can then select and refresh applicable File Systems, making their contents available for use.”`

At this point, you must configure the NFS access groups for your file server.

You create NFS access groups to ensure that each file system in a particular file server can be refreshed by at least one Oracle VM server.

**Launching the Access Group Wizard**

To launch the NFS Access Group Wizard, from the Storage tab view, select your file server in the navigation pane and select the NFS Access Groups perspective from the Perspective drop-down list in the management pane.

**Creating an NFS Access Group**

1. In the Create Access Group window, specify a name and an optional description for the access group.
2. In the Select File Systems window, select the file systems that reside on the file server.
3. In the Select Servers window, select the Oracle VM servers that can access the file systems specified in the previous window.

In each file server access group, every file system that you add to the access group must have been exported to every Oracle VM server present in the group.

An Oracle VM server can appear in more than one file server access group.

You can now trigger a file system refresh for every file system in your file server. If a repository is already present on the file system, this repository is discovered and appears in the list of repositories on the Repositories tab.

## Managing File Servers

- After discovering a file server, you can modify or refresh its configuration by:
  - Changing its name, description, and access host
  - Adding or removing the admin and refresh servers
  - Refreshing the file server
  - Adding, editing, or removing the NFS access groups
  - Refreshing a file system that belongs to the file server
- You can also display file server events, such as creation and removal, or acknowledge an event to clear the error associated with the event.

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After discovering a file server, you can change most of its configuration parameters but you cannot change the plug-in information.

You can also refresh the file server itself and/or refresh one or more file systems exported by the file server.

**Differences Between a File Server Refresh and a File System Refresh**

When you trigger a file server refresh, Oracle VM directs all the Oracle VM servers from the list of refresh servers to perform the refresh operation. Each Oracle VM server in the list accesses the file server to find all the exported file systems on the file server that have been made available to that Oracle VM server. This is why you must have, in your refresh server list, enough Oracle VM servers to detect all the file systems exported from the file server. However, you must also keep this list to a minimum set of servers to avoid long-running refresh operations.

You perform a file system refresh to detect existing virtual resources on the file system. When you trigger a file system refresh, Oracle VM locates the NFS access group to which the file system belongs, and directs one of the Oracle VM servers in the same NFS access group to perform the file system refresh.

## Configuring SAN Servers

- In the Oracle VM Manager, the iSCSI and Fibre Channel block-based storage arrays are configured as SAN servers.
- You bring the block-based storage into your Oracle VM environment by using the SAN server discovery process from the Oracle VM Manager.
- Some storage elements are discovered by the Oracle VM servers and reported by the Oracle VM Manager even before starting the discovery process for the iSCSI and Fibre Channel storage arrays.

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In the previous section, you learned how to bring your file-based storage into your Oracle VM environment. In this section, you perform the same task for your block-based storage.

**Note:** The local storage that is available on an Oracle VM server is discovered automatically.

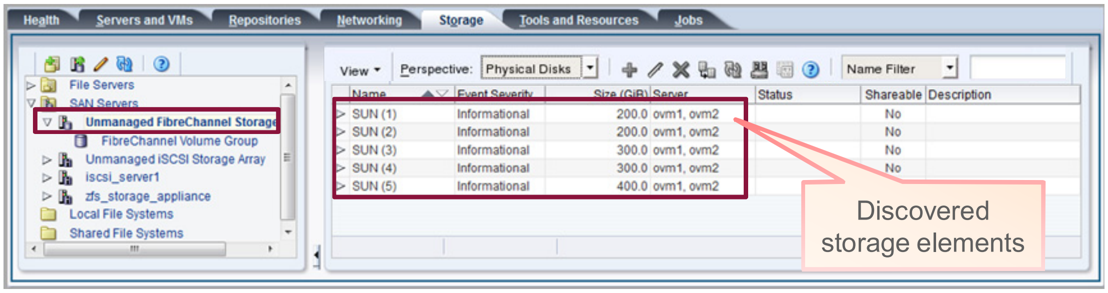
To configure your external block-based storage, either the iSCSI or Fibre Channel storage arrays, you use the Discover SAN Server Wizard from the Storage tab of your Oracle VM Manager UI.

Even before you start the discovery process for your block-based storage, some storage elements may have been discovered by your Oracle VM servers. These storage elements are reported by the Oracle VM Manager as unmanaged storage. The concept of unmanaged and managed storage arrays is discussed in the next two slides.

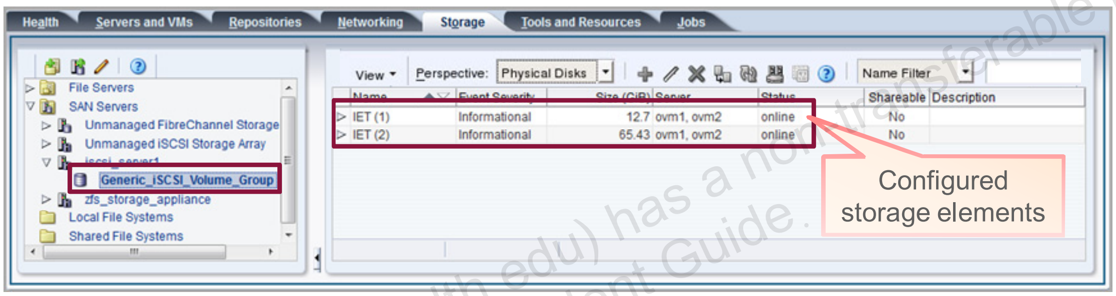
Throughout this discussion, the term SAN server is used to refer to the object tracked by the Oracle VM Manager. The SAN server can also be used to refer to a storage array when describing a disk subsystem that exposes storage LUNs.

# Unmanaged and Managed SAN Servers

- Unmanaged storage array:




- Managed (or named) storage array:

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### Unmanaged Storage

Unmanaged storage is storage that is automatically discovered by Oracle VM servers—for example, Fibre Channel connected storage—for which no particular management mechanism is available, or no appropriate management mechanism can be determined.

### Managed or Named Storage

Managed (or named) storage is storage that is accessible from Oracle VM servers, but you must configure the storage to discover the storage elements, whether it is managed by using a generic or vendor-specific Storage Connect plug-in.

The screenshots in the slide provide an example of unmanaged and named storage arrays.

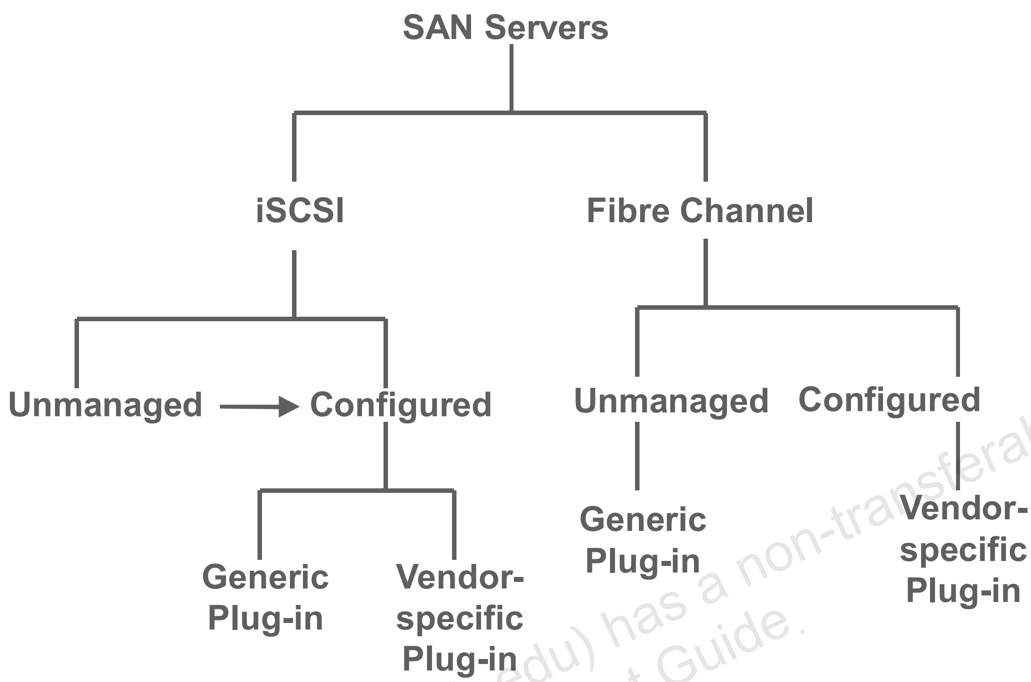
### Screenshot at the Top

Five Fibre Channel LUNs are accessible by the Oracle VM servers that are attached to a Fibre Channel SAN. No storage configuration is necessary to discover these LUNS: The LUNs are discovered when the Oracle VM servers are discovered. These LUNs, SUN(1) through SUN(5), are shown in the Physical Disks perspective when “Unmanaged FibreChannel Storage Array” or its associated “FibreChannel Volume Group” is selected.

**Screenshot at the Bottom**

The named storage array, `iscsi_server1`, has exposed two LUNs that are named IET (1) and IET (2). This storage array was configured from the Oracle VM Manager by using the SAN server discovery process and by specifying the plug-in as "Oracle Generic SCSI Plugin." After the discovery process is complete, you can view the LUNs from the Physical Disks perspective in the management pane, when selecting the SAN server or its associated volume group entity in the navigation pane.

## Unmanaged SAN Server Behavior





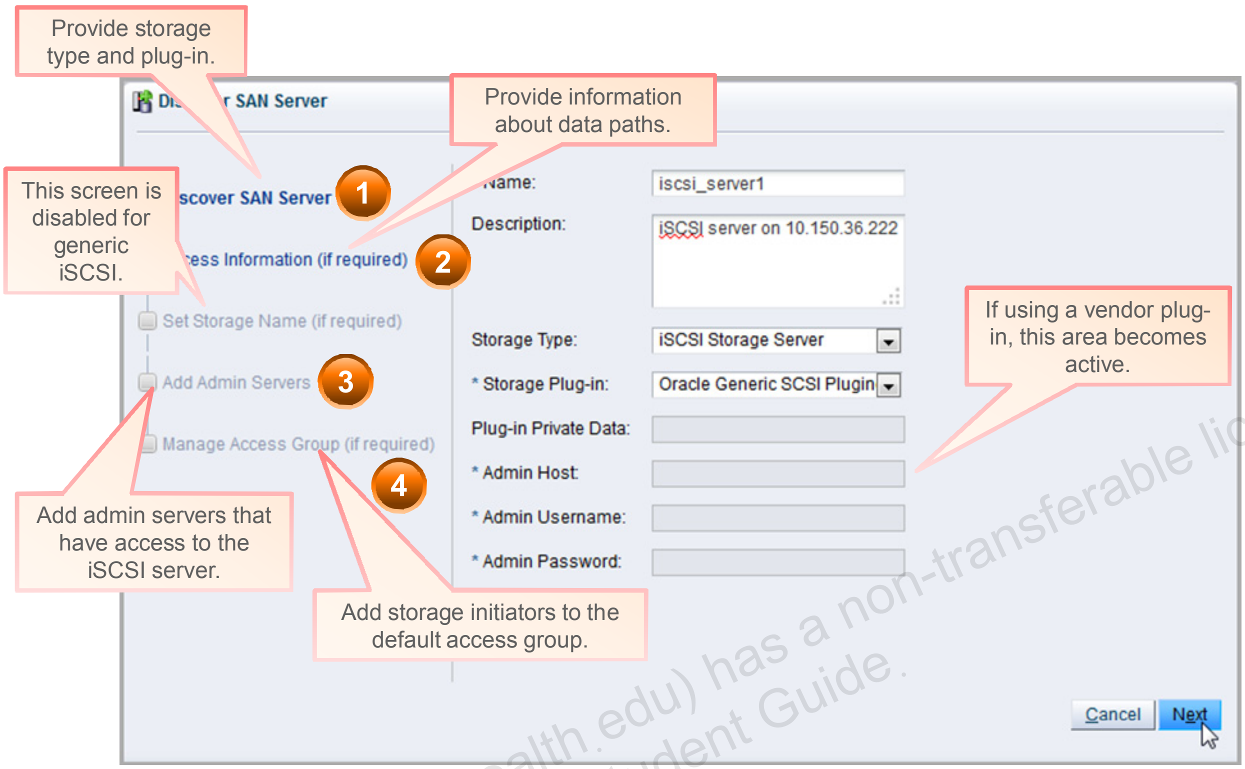



An unmanaged array behaves differently for iSCSI and Fibre Channel storage arrays.

For an iSCSI storage array, its status as unmanaged array is temporary, whether it is a generic storage array or a storage array for which a vendor-specific plug-in is available. When the iSCSI storage array is properly discovered, its storage elements migrate to the properly named and configured storage array.

For a Fibre Channel storage array, the situation is, however, different. Because generic Fibre Channel arrays are detected when the Oracle VM servers are connected to the SAN, there is no mechanism to place them under a separate storage array based on a specific access host. Consequently, generic Fibre Channel LUNs remain in the unmanaged Fibre Channel storage array container. For Fibre Channel storage arrays with a vendor-specific plug-in available, the discovery process and the associated configuration claim the LUNs in the unmanaged Fibre Channel storage array, and these LUNs migrate to the properly named and configured storage array.

# Discovering SAN Servers: A Generic iSCSI Example








For a generic iSCSI SAN server, the end-to-end procedure consists of four steps:

1. Identify the type of storage and the plug-in, including providing a name and a description.
2. Provide access information, which specifies the network data paths to the storage on the SAN server.
3. Add admin servers. Admin servers are Oracle VM servers that are guaranteed access to the storage array to perform administrative functions.
4. Add storage initiators to the default access group. The storage initiators represent the Oracle VM servers that have access to the storage elements offered by the iSCSI storage array. For a generic iSCSI server, there is only one default access group.

The configuration process is very similar for Fibre Channel storage arrays and iSCSI storage arrays, and for storage arrays that use generic or vendor plug-ins.

In the next slide, you examine the type of information that you need to provide when discovering a SAN server.

# Discovering SAN Server Information

| Discovery Information | iSCSI Generic | iSCSI Vendor Specific | Fibre Channel Vendor Specific |
|---|---|---|---|
| Name and description | Yes | Yes | Yes |
| Storage Type | iSCSI Storage Server | iSCSI Storage Server | FibreChannel Storage Server |
| Storage Plug-in | Oracle Generic SCSI Plugin | Vendor specific | Vendor specific |
| Plug-in Private Data | No | See vendor doc | See vendor doc |
| Access host and port | Yes | Yes | No |
| Access credentials/CHAP | Optional | Optional | No |
| Admin host with username/password | No | Yes | Yes |
| Admin Servers | Yes | Yes | Yes |
| Access Groups | Default only | Yes | Yes |

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There are four types of storage arrays:

- Generic iSCSI storage arrays
- Vendor-specific iSCSI storage arrays
- Generic (unmanaged) Fibre Channel storage arrays
- Vendor-specific Fibre Channel storage arrays

The information for generic Fibre Channel storage does not appear in the table in the slide because the storage elements for generic Fibre Channel storage arrays appear automatically without the need for configuration, as soon as the Oracle VM servers are connected to the SAN that exposes the storage elements.

The other three types of storage arrays require information during the discovery process. For all storage arrays, you must specify the storage type, the storage plug-in, and the admin servers.

Additional information is dependent on your selection for the storage type and storage plug-in:

- Generic iSCSI storage arrays
  - Provide the access information, which includes access host and access port. Optionally, specify whether the Challenge-Handshake Authentication Protocol (CHAP) is used.

- Vendor-specific iSCSI storage arrays
  - Provide plug-in private data, administration information, and access information.
  - The administration information includes the admin host and the admin username and password.
  - The access information includes the access host and access port. Depending on the configuration in your storage array, you might need an access username and password. Optionally, specify if CHAP is used or not.
- Vendor-specific Fibre Channel storage arrays
  - Provide plug-in private data and administration information.
  - You do not need access information for Fibre Channel storage arrays, because the storage elements exposed by these storage arrays are not accessed by using a network protocol.

**Storage Array Discovery Parameters**

- **Name:** The name you want to use to identify the storage array
- **Description:** Optional information that you would like to add about this storage array
- **Storage Type:** Fibre Channel Storage Server or iSCSI Storage Server
- **Storage Plug-in:** The storage plug-in corresponding to the type of storage array, which is a generic iSCSI, a vendor-specific iSCSI, or a Fibre Channel plug-in. The vendor-specific plug-in must be properly installed on the selected Oracle VM servers with access to the storage.
- **Plug-in Private Data:** An optional field that provides additional information for connecting to the management interface for a storage array with a vendor-specific plug-in. Consult your storage vendor documentation to find out the exact syntax for the plug-in private data.

  When registering a vendor-specific storage array, ensure that you double-check the information you entered in the Plug-in Private Data field. After the storage array is discovered, you can no longer modify this field. If you need to update the plug-in private data, you must unregister and rediscover the storage array.
- **Access Host:** For iSCSI storage arrays only: the host name or IP address of the server that is offering the storage elements

  You can add multiple access hosts to provide multiple paths to the iSCSI storage array.
- **Access Port:** For iSCSI storage arrays only. This is the port for the iSCSI protocol. The default is 3260.
- **CHAP and Associated Access Credentials:** For iSCSI storage arrays only. If CHAP* is enabled, provide a username and password.
- **Admin Host with Username and Password:** For the iSCSI storage that you can manage through the Oracle VM Manager by using a vendor plug-in, you must provide a username and password to access the administrative interface.
- **Admin Servers:** Similar to the discovery of file servers, you provide admin servers, which are Oracle VM servers with guaranteed access to the administrative interface for the storage array.
- ***CHAP Information:** CHAP is a form of authentication to protect network shares from malicious or accidental access. It requires configuration on the storage server side, whether the storage is presented as a generic storage array or by using a vendor-specific plug-in.

## Role of Access Groups

- You enable or restrict access to the physical disks in a storage array by adding or removing storage initiators in access groups.
- You configure access groups during the discovery process for each SAN server:
  - For storage arrays with a vendor-specific plug-in, you create one or more access groups to implement your storage access strategy.
  - For generic iSCSI storage arrays, you can edit the default access group that was created during the discovery process.
  - There is no access group for the unmanaged Fibre Channel storage array.
- After the discovery process, you can modify the access groups to reflect the changing access requirements for your storage.





Except for generic iSCSI and unmanaged Fibre Channel storage arrays, you can create one or more access groups to enable or restrict physical disk access. You create these access groups to match your storage resources and anticipated server pool design.

When you create an access group for a non-generic storage array, you include the storage initiators that are allowed to access the storage elements (LUNs) for the array. These storage initiators are the connections to the storage array from your Oracle VM servers, which act as clients for the storage services provided by the storage array:

- iSCSI storage initiators have names that follow the iSCSI Qualified Name format—for example, iqn.1988-12.com.oracle:147ee0ec2ed3.
- Fibre Channel storage initiators represent the HBA ports on the Oracle VM servers and are closely related to the HBA's path name for these ports on the servers.

For generic iSCSI storage arrays, a single access group is created during the discovery process. You can add and remove initiators from this access group. By default, all the LUNs exposed by the storage array are visible to all the initiators in the access group.

There is no access group for unmanaged Fibre Channel storage.

To make changes to the access groups for a SAN server, highlight the SAN server in the navigation pane and select the Access Groups perspective in the management pane. From the list of access groups, select the access group that you want to modify and click the Edit Access Group icon.

## Discovering Physical Disks

- Existing physical disks, which are the storage elements presented by your storage array, are discovered during the SAN server discovery process.
- For managed SAN servers, you can also create physical disks by using the Create Physical Disk function for your storage array.
- If you make changes to your storage arrays, you can trigger a refresh operation from the Oracle VM Manager.



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During the SAN server discovery process, a refresh operation is performed to gather information about the storage array. The scope of this operation differs for generic and vendor-specific plug-ins. For storage arrays that use a vendor-specific plug-in, information about the storage array is gathered by using the plug-in private data provided during the discovery process. For storage arrays that use a generic plug-in, the refresh operation attempts to discover the storage elements that were previously created on the storage array by the storage administrator. Consult your storage vendor documentation for information about the functionality and operations for the plug-in.

When the refresh operation is complete, the available storage elements on a storage array appear as physical disks in the management pane, when the Physical Disks perspective is selected for the appropriate storage array. If the storage elements do not appear, you can trigger a new refresh operation for the SAN server. However, it is possible that no physical disks are present for a storage array that is managed with a vendor-specific plug-in. In this case, you can create physical disks by using the Create Physical Disk function available with managed storage arrays. By using this function, you can create the physical disks that you need to provide storage for repositories, pool file systems, and virtual disks for virtual machines.

**Note:** The Create Physical Disk function is not available for the Unmanaged Fibre Channel Storage Array and all generic iSCSI storage arrays.

If you make changes to your storage arrays, you can trigger a refresh operation from the Oracle VM Manager. This is particularly important for generic-type storage arrays, because the Oracle VM Manager is unaware of the changes that you make to the storage elements in your storage array.

## Making Changes to Your Storage

- For each SAN server, you can:
  - Edit the SAN server (edit the access information, add or remove admin servers, and edit the access groups)
  - Refresh the SAN server when you make changes to its storage configuration
  - Create physical disks (vendor-managed only)
  - Delete the SAN server
- For each physical disk, you can:
  - Edit the physical disk
  - Refresh the physical disk
  - Display the Oracle VM servers that use the physical disk
  - Delete the physical disk
  - Clone the physical disk

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For each SAN server, you can:

- **Edit the SAN server:** You can change storage array settings such as the name, description, access host, and port. You can also add or remove admin servers and edit the access groups.
- **Refresh the SAN server:** This action triggers an update to the SAN server configuration. Refresh your SAN server when you make changes to the storage configuration by adding or removing storage elements.

  **Note:** If you make changes to the storage initiators (for example, by changing, adding, or removing HBAs on your Oracle VM servers), use the Oracle VM server Rediscover Server action to update the servers' configuration.
- **Create physical disks on the SAN Server:** This function is available only for vendor-managed storage arrays that allow this operation.

- **Delete the SAN server:** This action removes the selected storage array from your Oracle VM environment. Before you can remove a storage array, you must perform the following tasks:
  - Delete or release ownership of any repositories created on the LUNs in the storage array.
  - For a LUN that is used as a server pool file system, delete the server pool.

  Repositories and server pools are discussed in the lesson titled "Server Pools and Repositories."

For each physical disk, you can:

- **Edit the physical disk:** You can edit the name and description, or make the physical disk shareable. For the physical disks on a managed storage array, you can also resize the physical disk if the storage array allows the operation.
- **Delete the physical disk:** You can remove the selected physical disk from the environment. Note that for a generic storage array, deleting a physical disk in the storage array temporarily deletes it from the Oracle VM environment. To permanently remove the physical disk, you must also remove the LUN by using the storage array administrative tool.
- **Clone the physical disk:** You can create a clone of the physical disk.
- **Refresh the physical disk:** If you have made a change to a physical disk, for example, if you increased the size of a physical disk, use the refresh function to force the Oracle VM Manager to detect the change.

Physical disk cloning is covered in the next section.

# Physical Disk Cloning

- The next section of this lesson discusses physical disk cloning.
- Physical disk cloning includes the following topics:
  - Cloning terminology
  - How to clone physical disks with the Oracle VM Manager
- Oracle VM also supports:
  - Virtual disk cloning
  - Virtual machine and template cloning

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As part of managing your storage with the Oracle VM Manager, you can use the disk cloning feature to create new disks from existing physical disks.

Oracle VM also supports:

- Cloning of virtual disks, which is discussed in the lesson titled “Server Pools and Repositories”
- Cloning of virtual machines and templates, which is discussed in the lesson titled “Managing Virtual Machines”

This lesson only discusses physical disk cloning.

Before jumping into the steps to set up physical disk cloning, you learn about some cloning terminology. You then learn how to create new disks from your existing physical disks by using the Oracle VM Manager.

## Cloning Terminology

- Cloning
  - Cloning a physical disk is the process of copying the contents of that physical disk to another physical disk or to a virtual disk.
- Sparse and non-sparse copy
  - A sparse file or disk refers to a file or disk with holes (blocks with no valid data).
    - When using a sparse copy, these holes are not allocated except when written to.
    - When using a non-sparse copy, all blocks are written, including the empty blocks.
- Thin cloning
  - This type of copy allocates only a portion of the disk size. As data is written to the disk, more space is allocated.

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Physical disk cloning is a copy operation from a source physical disk to a target physical disk or to a virtual disk in a repository.

After the copy operation:

- If the target for the cloning operation is another physical disk, this physical disk is identical to the source disk.
- If the target is a virtual disk, it appears as a file that is a disk image of the source disk.

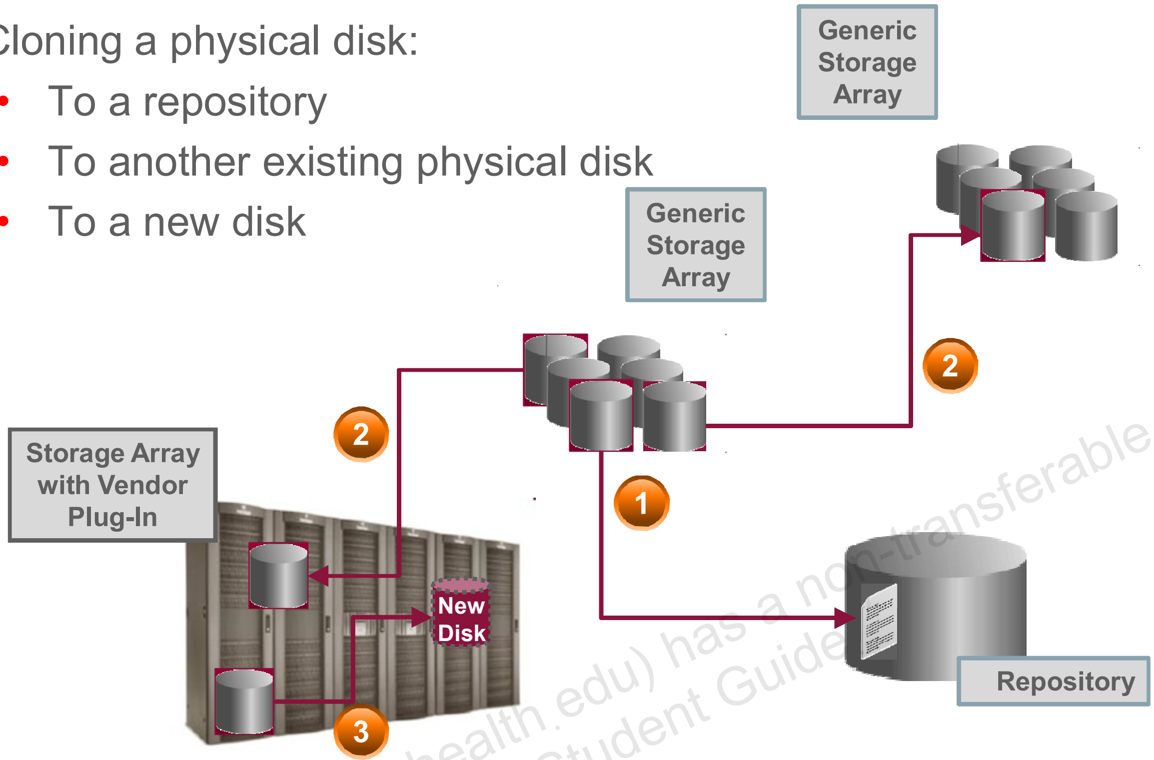
Cloning a physical disk:

- **Using a non-sparse copy:** Every block is copied, whether it contains data or is empty.
- **Using a sparse copy:** Empty areas of the disk are not allocated. Reading this area gets all zeros. Writing to this area causes space to be allocated to the area.
- **Using thin copy:** Only a small portion of the clone is allocated. As data is written to the target disk, more space is allocated. Thin cloning for a physical disk is supported only within storage arrays that have a vendor plug-in available.

**Note:** Thin cloning is also supported for virtual disk cloning operations if the source and target virtual disks reside in the same OCFS2-formatted repository. Virtual disk cloning is discussed in the lesson titled “Server Pools and Repositories.”

# Cloning Physical Disks with Oracle VM

Cloning a physical disk:
- To a repository
- To another existing physical disk
- To a new disk

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You can clone a physical disk by using a sparse copy, a non-sparse copy, or a thin clone, depending on the clone target.

- If the target for the cloning is a repository, as shown by the path for case 1 in the slide:
  - The cloning operation triggers a copy operation from the physical disk to the repository
  - The copy operation creates a virtual disk, as a disk image file in the repository. You can select either the sparse or non-sparse copy for the clone operation.
  - The operation is carried out by an Oracle VM server, selected by the Oracle VM Manager
- If the target for the cloning is a storage array and:
  - If the storage array where the source physical disk resides is not the same as the target storage array specified for the cloning operation, or the source storage array uses a generic plug-in, as shown by the paths for case 2 in the slide:
    - The physical disk cloning results in a copy operation from the source array to an existing physical disk on the target storage array, using sparse or non-sparse copy
    - The operation is carried out by an Oracle VM server, selected by the Oracle VM Manager

- If the storage array for the source physical disk and the target physical disk are the same and the storage array is managed by using a vendor-specific plug-in, as shown by the path for case 3 in the slide:
  - The cloning operation can use thin cloning if the vendor-specific plug-in supports it
  - The cloning operation creates a new physical disk
  - The cloning operation takes place in the storage array and is not carried out by an Oracle VM server

The disks with the solid outline represent entities that existed before the cloning operation.

The disk with the dashed outline represents an entity that is created as part of the cloning operation.

# Vendor-Managed Storage Case Study Using the Oracle ZFS Storage Appliance

- The last section of this lesson describes the storage configuration process by using the Oracle ZFS Storage Appliance.
- This section includes the following topics:
  - Installing the components of the Storage Connect plug-in for the Oracle ZFS Storage Appliance
  - Configuration steps that take place in the Oracle ZFS Storage Appliance
  - Configuration steps that take place in the Oracle VM Manager
  - Creating physical disks in the Oracle ZFS Storage Appliance
  - Cloning physical disks in the Oracle ZFS Storage Appliance





The previous sections in this lesson provided you with the information and the tools to configure and manage your storage with the Oracle VM Manager.

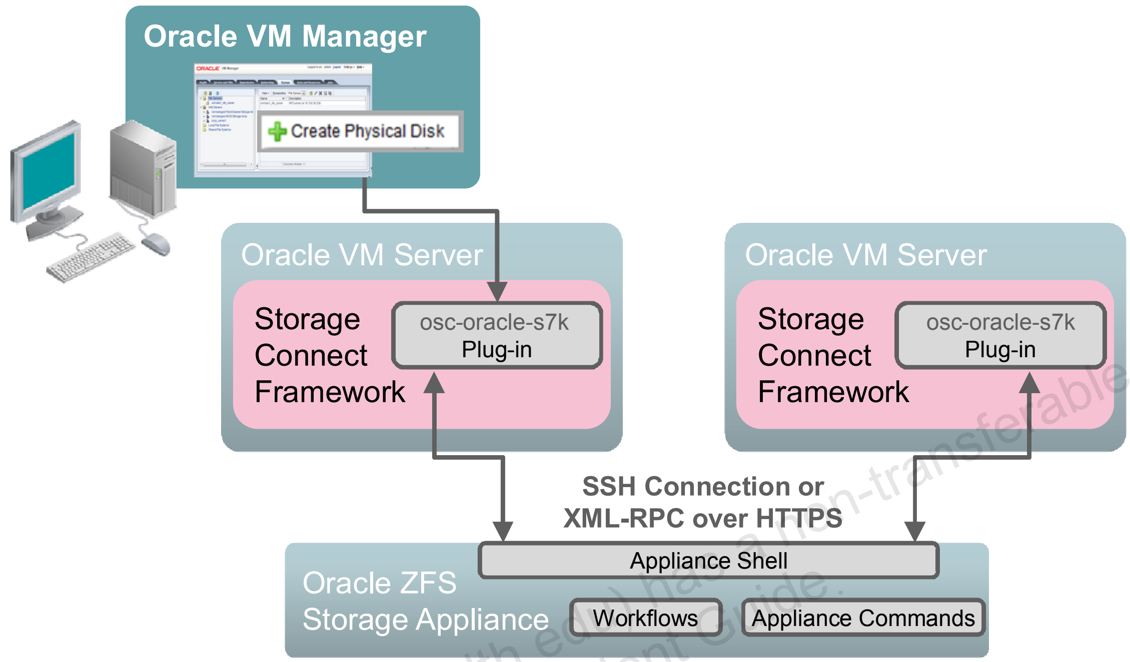
You learned to:

- Discover file servers and storage arrays (SAN servers)
- Manage storage arrays and their storage elements (physical disks)
- Clone physical disks in the storage arrays

You also learned that the file servers and storage arrays that are managed by using a vendor plug-in offer features that are not available to storage systems managed by using a generic plug-in.

The last section of this lesson presents a case study on the use of the Oracle ZFS Storage Appliance. This case study illustrates the advanced features that are available through the use of the Oracle ZFS Storage Appliance SCSI plug-in. These features are similar to the features offered by other storage vendors.

# Oracle ZFS Storage Appliance Storage Connect Components










The Storage Connect framework provides storage abstraction to simplify the management of storage with Oracle VM and to enable storage vendors to develop their own bridge between Oracle VM and their storage subsystem.

Although a storage administrator is still needed to maintain the storage subsystem, the Oracle VM administrator is shielded from day-to-day storage operations, and is presented with a set of operations against the storage subsystem that makes sense within the Oracle VM context. The storage administrator is responsible for what storage is accessed and by whom, and how much of that storage can be used by the Oracle VM environment.

The diagram in the slide illustrates the flow of information between the Storage Connect plug-in in the Oracle VM servers and the Oracle ZFS Storage Appliance.

- The Oracle ZFS Storage Appliance plug-in installed in the Oracle VM servers. This plug-in manages storage that is consumed through the iSCSI or FC protocol for data path connectivity to the target appliances.
- Management requests from the plug-in in the Oracle VM servers are sent through SSH requests or XML-RPC calls.

- The Oracle ZFS Storage Appliance shell handles requests, which are requests to execute a stored workflow or to run commands that are understood by the appliance shell.

**Note:** Workflows are stored scripts in the Oracle ZFS Storage Appliance. You can trigger the execution of a workflow directly or you can set up an alert or timer event to trigger its execution.

The Oracle ZFS Storage Appliance plug-in is called the `osc-oracle-s7k` plug-in in the diagram in the slide, a name resembling the package name for the plug-in as installed in the Oracle VM servers.

**Note:** The Oracle ZFS Storage Appliance plug-in supports both iSCSI and Fibre Channel (FC) protocols. At this time, it is not possible to use both iSCSI and FC protocols simultaneously on the same Oracle ZFS Storage Appliance.

## Using the Oracle ZFS Storage Appliance for iSCSI Operations with Oracle VM

- Install the Oracle ZFS Storage Appliance plug-in on the Oracle VM servers.
- On the Oracle ZFS Storage Appliance:
  – Create a local user and a role for Oracle VM
  – Configure an iSCSI target and a target group for Oracle VM
  – Create storage elements in the Oracle ZFS Storage Appliance for repositories, server pool file systems, and raw disks (optional)
- From the Oracle VM Manager:
  – Discover the Oracle ZFS Storage Appliance as a SAN server
  – Create an access group and add storage initiators to the access group
  – Create physical disks from the Oracle VM Manager (optional)

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The process to integrate the Oracle ZFS Storage Appliance in your Oracle VM environment includes several steps that are common to most storage vendors that offer a Storage Connect plug-in:

- Install the Storage Connect plug-in on the Oracle VM servers that access the storage that is available in the storage array. Note, however, that the storage management requests may originate from the Oracle VM Manager, which sends the requests to an Oracle VM server. The Oracle VM server communicates with the storage array by using the installed plug-in to execute the request.
- Discover the storage array for Oracle VM use. The discovery steps are different for each storage vendor and include some configuration tasks to enable or restrict access to pools of storage for Oracle VM usage.
- If you create LUNs directly on the storage array, these LUNs are discovered as physical disks during the SAN server discovery process. After the discovery, you can also create additional physical disks to provision your Oracle VM environment.

The steps in this section apply only to iSCSI operations. The steps to implement FC connectivity to the Oracle ZFS Storage Appliance are very similar.

The rest of this lesson describes these steps.

Only the steps that are performed on the Oracle VM servers or the Oracle VM Manager are described in some detail. The steps relating to the Oracle ZFS Storage Appliance are shown only when they relate to the configuration information that is required from the Oracle VM Manager—for example, the information that is entered in the Plug-in Private Data field during SAN server discovery.

For more information about the steps to perform on the Oracle ZFS Storage Appliance, refer to the Readme file and the *Oracle Storage Connect Plug-in for Oracle ZFS Storage Appliance Administration Guide*, which is available with the plug-in package.

# Installing the Oracle ZFS Storage Appliance Plug-In

- Download the plug-in package from OTN and extract the package components.
- Install the plug-in on each Oracle VM server with access to the Oracle ZFS Storage Appliance:

```
# rpm -ivh osc-oracle-s7k-1.0.3-96.el6.noarch.rpm
```

- If the Oracle VM servers are already known to your Oracle VM Manager, rediscover the Oracle VM servers.





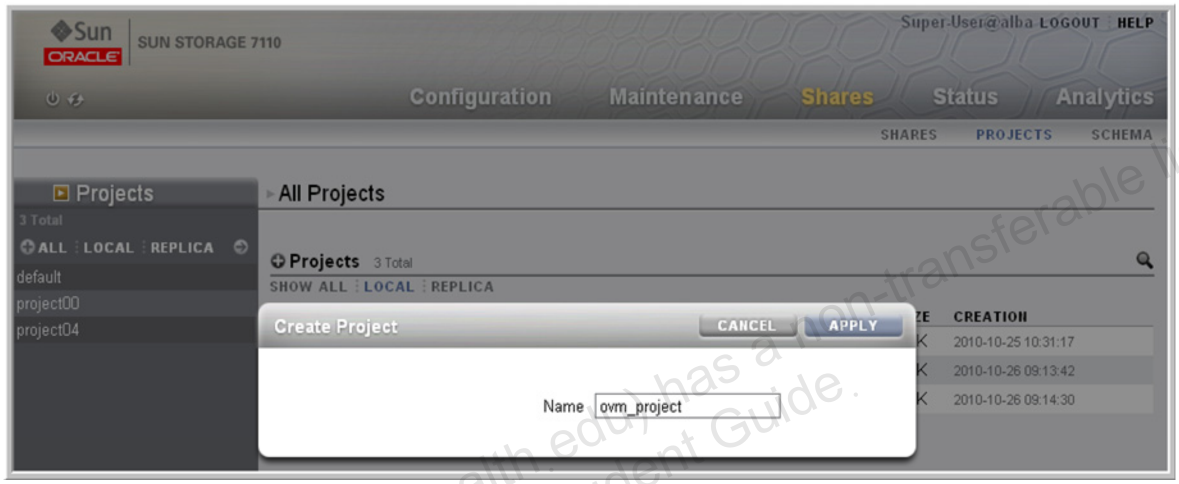


Before installing the plug-in, review the requirements for using the Oracle ZFS Storage Appliance plug-in. These requirements are listed in the *Oracle Storage Connect Plug-in for Sun ZFS Storage Appliance Administration Guide*. This document is available in the zip file that you download from Oracle Technology Network (http://www.oracle.com/technetwork/server-storage/sun-unified-storage/downloads/zfssa-plugins-1489830.html).

You can rediscover an Oracle VM server any time, whether it is unassigned, discovered, or part of an active server pool and running virtual machines.

# Creating an Oracle VM Project on the Oracle ZFS Storage Appliance

- Log in to the appliance.
- Navigate to Shares > Projects.
- Click “+” to add a project.





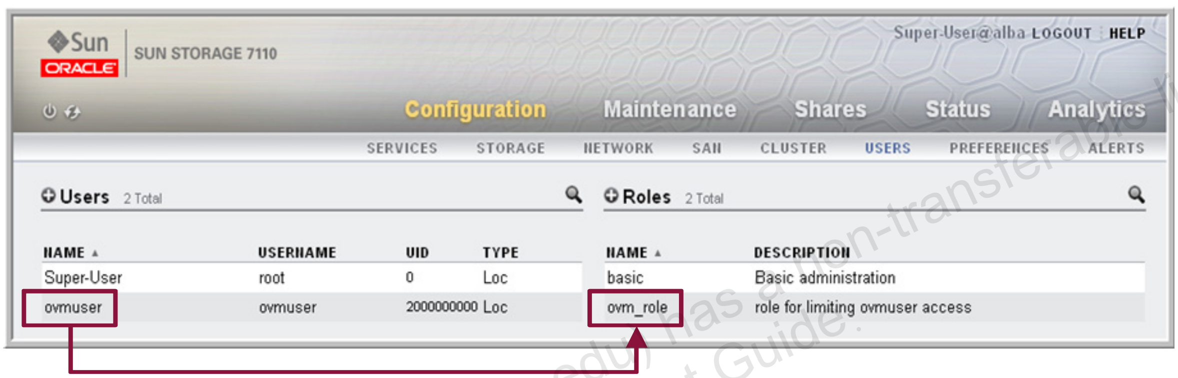

With the Oracle ZFS Storage Appliance, you can group related LUNs under a project. These projects become Oracle VM Groups after the Oracle ZFS Storage Appliance is discovered as a SAN server.

In the example in the slide, only one project is created for exclusive use by Oracle VM. This project co-exists with other projects already configured on the Oracle ZFS Storage Appliance.

A project is associated with an existing pool on the storage appliance and determines what storage is available to the project.

# Creating a Role and a User for Oracle VM on the Oracle ZFS Storage Appliance

1. Add a role (for example, `ovm_role`) by navigating to Configuration > Users, and clicking "+" next to Roles.
2. Add a user (for example, `ovmuser`) by clicking "+" next to Users, and assign the previously created role to this user.






The Oracle ZFS Storage Appliance can be used by multiple users. However, it is recommended that you create a dedicated user for Oracle VM.

To limit access for a dedicated user to selected storage pools and projects, perform the following configuration steps on the Oracle ZFS Storage Appliance:

- Create a role.
- Define authorizations for this role.
- Create a user.
- Assign the previously defined role to this user.

You can use the Oracle ZFS Storage Appliance browser user interface (BUI) or the command-line interface (CLI) to perform the configuration tasks.

# Creating an iSCSI Target and a Target Group on the Oracle ZFS Storage Appliance

- Create a target (for example, `OVM-iSCSI-Target`) by navigating to Configuration > SAN > Targets, and clicking “+” next to iSCSI Targets.
- Create a new target group by dragging the target to iSCSI Target Groups and renaming it OVM-iSCSI.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You create an iSCSI target and a target group on the Oracle ZFS Storage Appliance. The iSCSI target and target group are used by the Oracle ZFS Storage Appliance Storage Connect plug-in when provisioning storage entities (LUNs) through the Oracle VM Manager.

**Creating an iSCSI Target**

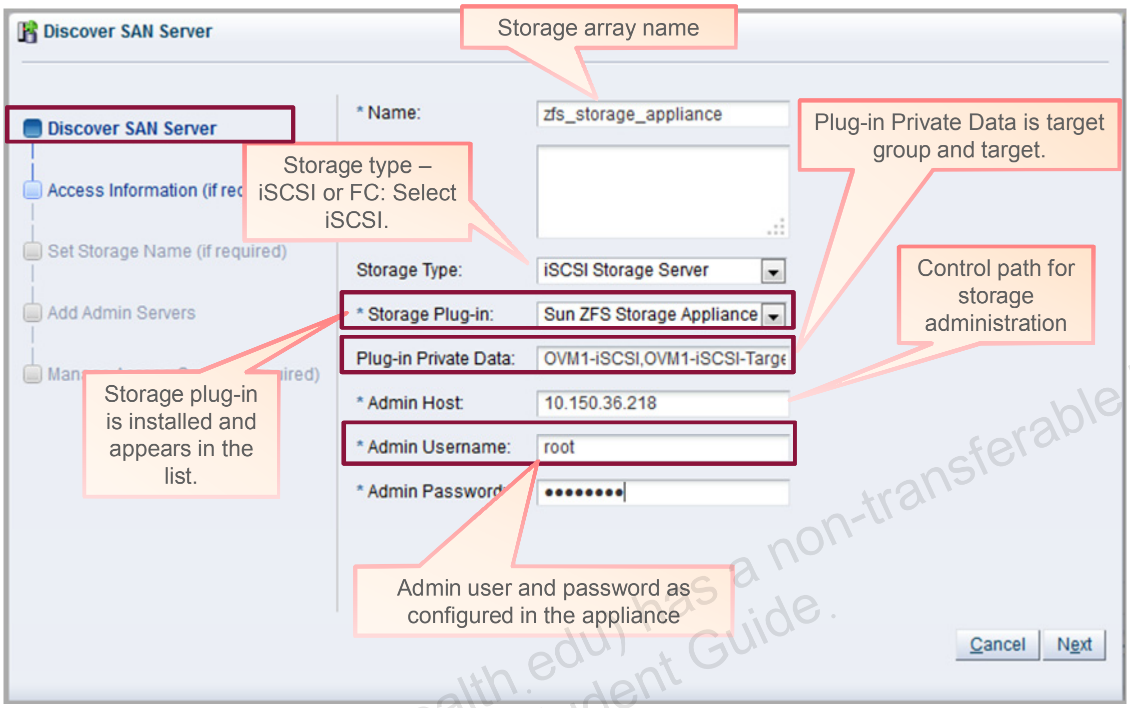
To create a target from the appliance’s BUI, access the Configuration > SAN screen, and click the plus sign (+) next to iSCSI Targets. On the pop-up screen, give your target a name. In this case study, the iSCSI target name is `OVM-iSCSI-Target`.

**Creating an iSCSI Target Group**

To create a target group, drag the newly created iSCSI target to the iSCSI Target Groups area. This step automatically creates an iSCSI target group named “target-#”. Edit this newly created iSCSI target group and rename it by using a meaningful name. In this case study, the iSCSI target group is renamed as `OVM-iSCSI`.

The target `OVM-iSCSI-Target` and the target group `OVM-iSCSI` are used as input when discovering the Oracle ZFS Storage Appliance as a SAN server with the Oracle VM Manager.

# Discovering the Oracle ZFS Storage Appliance: Discover a SAN Server







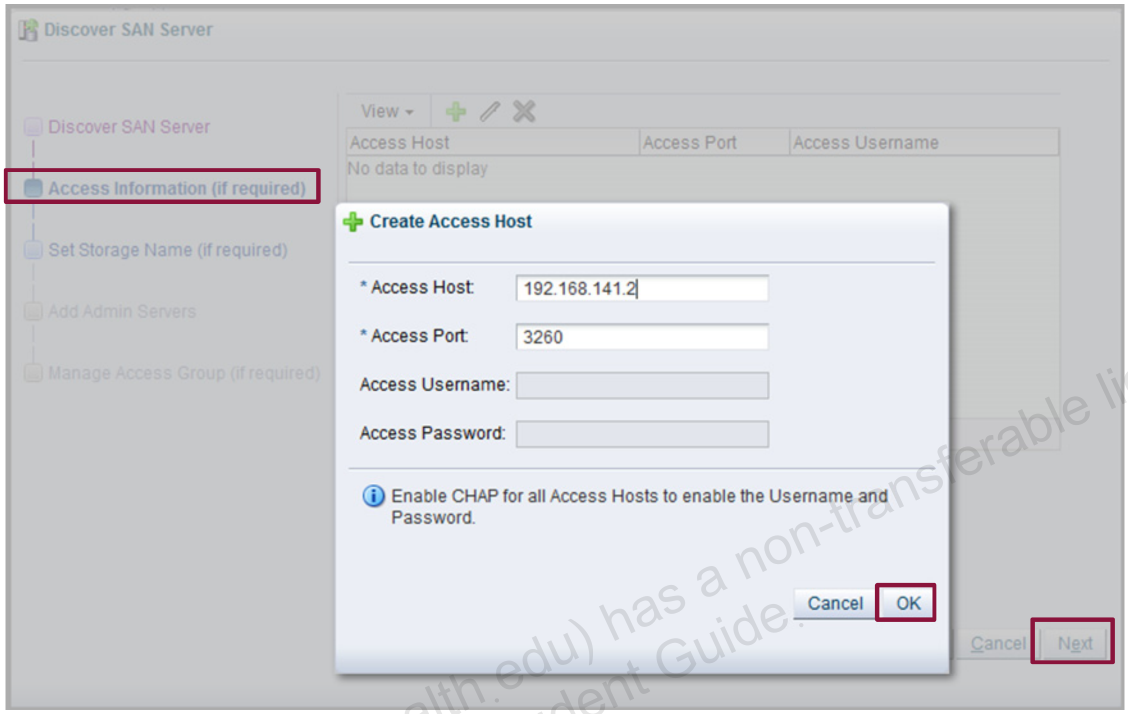



Discovering your Oracle ZFS Storage Appliance makes it available to your Oracle VM environment.

For the discovery process, you supply the following parameters:

- **Name:** A storage array name
- **Description:** An optional description
- **Storage Type:** You can select iSCSI or FC Storage Server. In this example, iSCSI is used.
- **Storage Plug-In:** Select the Sun ZFS Storage Appliance SCSI plug-in. The plug-in appears in the drop-down list if it is installed on your Oracle VM servers.
- **Plug-in Private Data:** This is the target group and the target that you previously created on the Oracle ZFS Storage Appliance for Oracle VM use. Enter the target group first, followed by the target, separated by a comma. Do not use spaces between the target group name and target name.
- **Admin Host:** This is the IP address or host name for the control path to the Oracle ZFS Storage Appliance.
- **Admin Username and Admin Password:** Enter the username and password for an administrator of the Oracle ZFS Storage Appliance. In this example, this is the `root` user.

# Discovering the Oracle ZFS Storage Appliance: Access Information

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On the Access Information screen, you configure the data path access to your Oracle ZFS Storage Appliance.

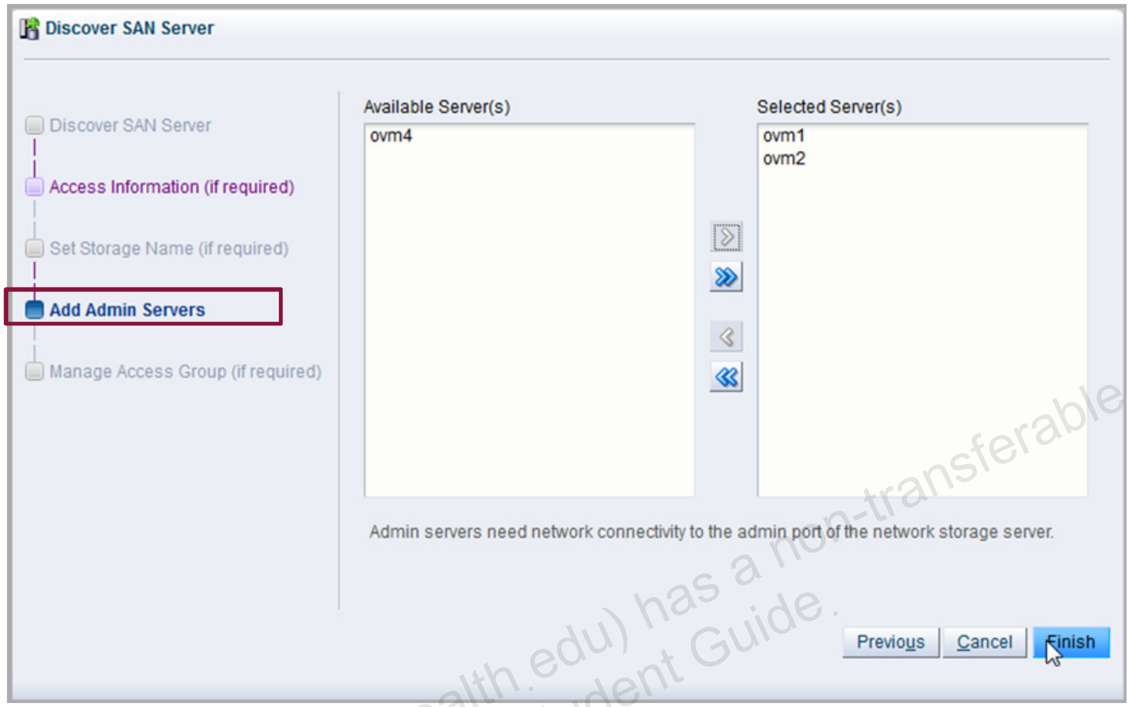
Access information includes:

- **Access Host:** This is the IP address or the host name of the data path to the Oracle ZFS Storage Appliance.

  Observe that the IP address for the data access host is on a different network than the network specified for the admin host in the previous slide.
- **Access Port:** In most cases, you accept the default.
- **Use Chap:** Select this check box if you plan to use CHAP. If using CHAP, your Oracle ZFS Storage Appliance must have been configured to support it.

After supplying the information on the Create Access Host window, click OK to return to the Access Information window. Click Next to proceed to the “Add Admin Servers” screen. The Set Storage Name screen is disabled for this particular type of SAN server.

# Discovering the Oracle ZFS Storage Appliance: Add Admin Servers

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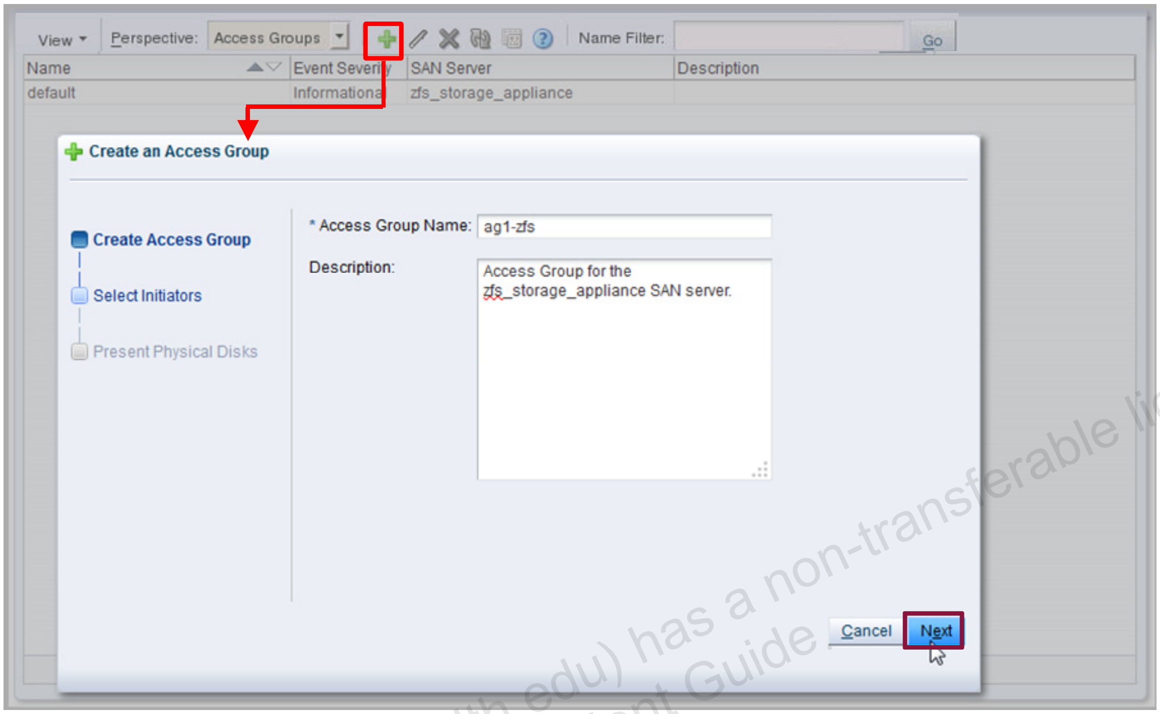
On the “Add Admin Servers” screen, add the Oracle VM servers with access to the Oracle ZFS Storage Appliance. This is also the list of all Oracle VM servers where you installed the Oracle ZFS Storage Appliance plug-in.

Click Finish to complete the configuration of your Oracle ZFS Storage Appliance as a SAN server.

**What Happens Next?**

When you click the Finish button, the new SAN server is added to your Oracle VM environment and the physical disks that are already present on the Oracle ZFS Storage Appliance appear in the list of physical disks for the new SAN server. However, these physical disks are not accessible to your Oracle VM servers until you specify the storage initiators that have access to these physical disks. You perform this last step of the configuration process by creating an access group. This step is discussed in the next slide.

## Adding Access Group: Create Step






The physical disks that you created on the Oracle ZFS Storage Appliance are not available for use until you present these disks to an access group.

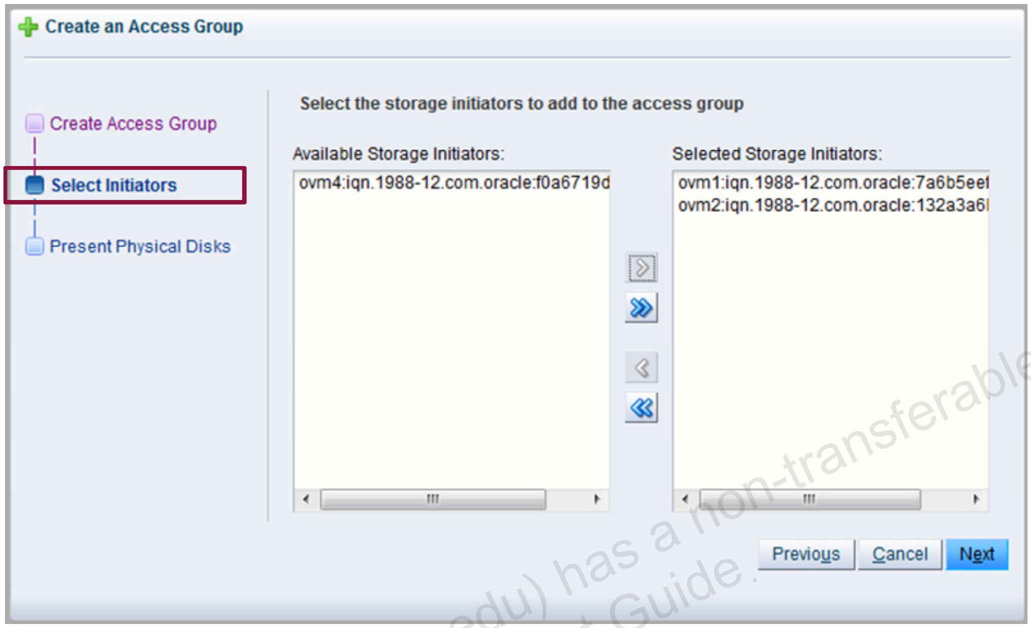
To create an access group, highlight your new SAN server in the navigation pane and select Access Groups from the Perspective drop-down list. From the Access Groups perspective, click the Create Access Group icon on the toolbar. The Create an Access Group window appears, as shown in the slide.

**Note:** You create one or more access groups to implement your storage access rules.

Generally, you want to create an access group for each server pool. For each access group, you select the storage initiators that represent the Oracle VM servers in a single pool.

On the first screen of the "Create an Access Group" Wizard, specify a name and a description for your new access group. Click Next to continue.

# Creating Access Group: Select Initiators

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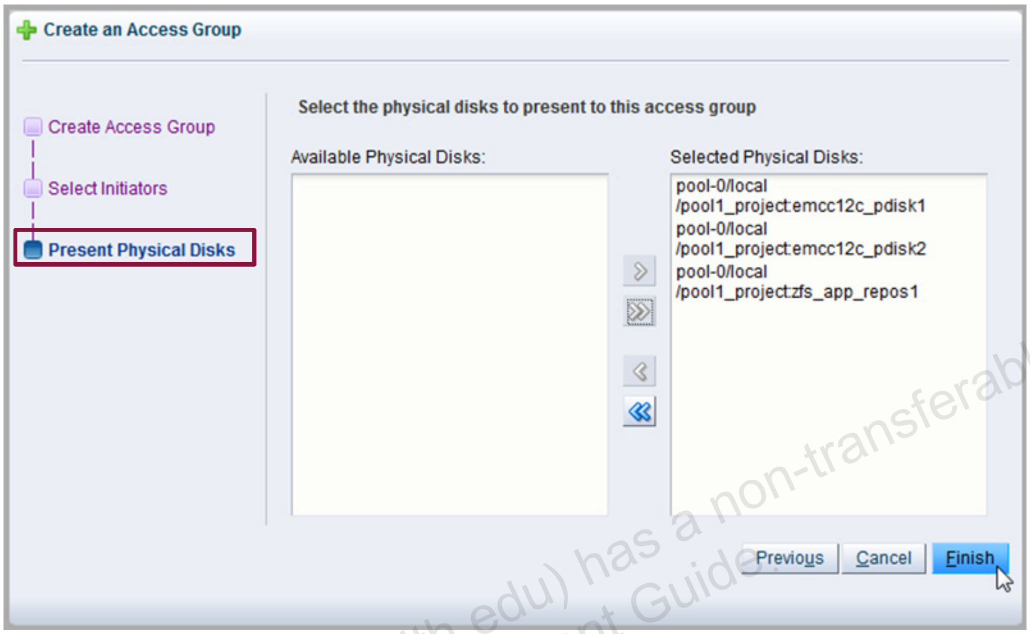
For each access group that you create, add the initiators that are allowed to access the storage. The initiators represent the Oracle VM servers that are allowed to use a subset of the physical disks.

In the example in the slide, Oracle VM servers `ovm1` and `ovm2` belong to the same server pool.

In the next step, you select the physical disks that the Oracle VM servers are allowed to access.

# Creating Access Group: Present Physical Disks







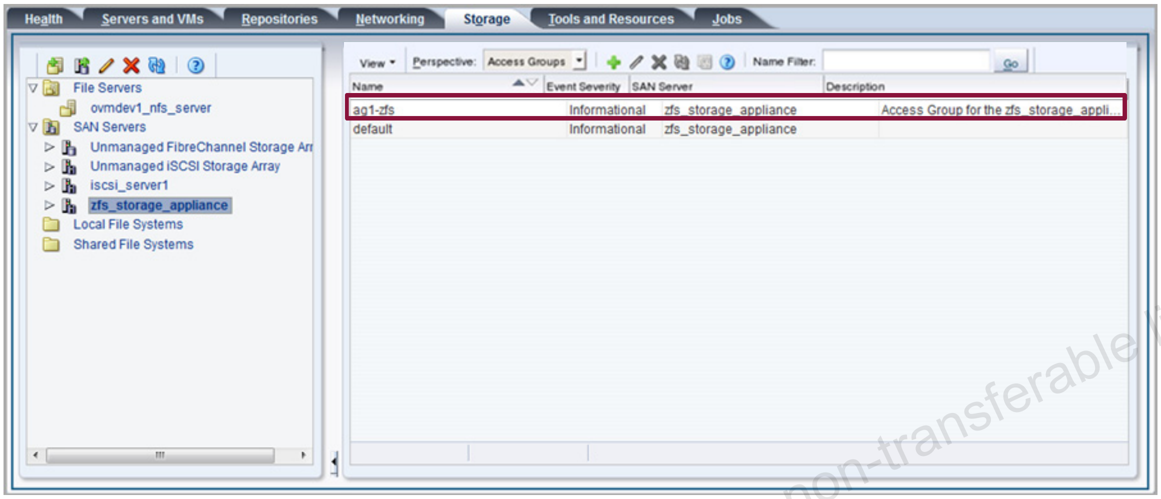

On this screen, you select the physical disks that can be acted upon by the initiators (Oracle VM servers) that were chosen in the previous step.

It is possible that no physical disk appears in the Available Physical Disks pane. Recall that with this type of SAN server, you can create physical disks directly from the Oracle VM Manager. Creating physical disks is discussed later in this lesson.

After selecting the physical disks, click Finish. You are returned to the storage view.

At this point, you have finished the configuration of your Oracle ZFS Storage Appliance in your Oracle VM environment. You can, however, modify, add, or remove access groups to reflect your storage needs. Managing access groups is discussed in the next slide.

# Managing Access Groups









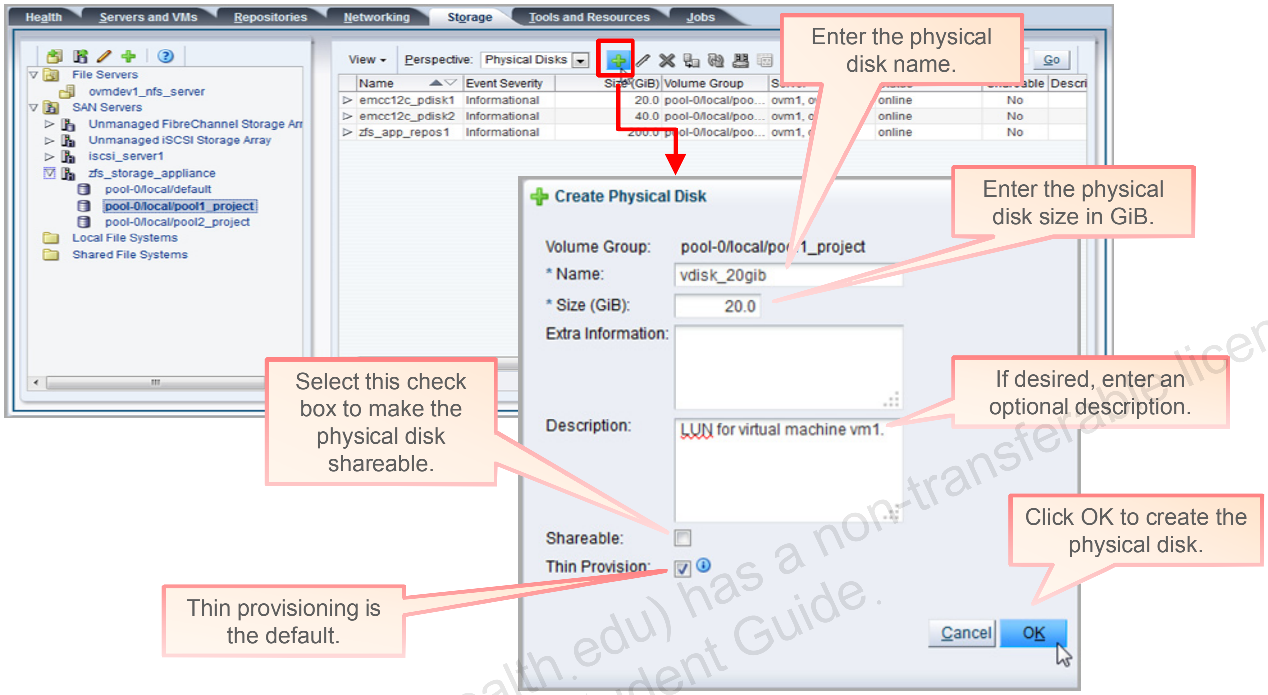

When you complete the steps to create an access group, you are returned to the last view on the Storage tab. The new access group is displayed in the list of access groups available for this SAN server.

If you presented physical disks to initiators as part of creating your access group, these physical disks are now ready for use.

At this point, you can create additional access groups depending on the storage design in your Oracle ZFS Storage Appliance. You can also use the “Edit Access Group” action to make changes to an existing access group, or use the “Delete Access Group” action if the access group is no longer needed. However, you must un-present physical disks to initiators before you can delete an access group.

If no physical disks were presented as part of creating the access group, you can now create the physical disks and present them to your Oracle VM servers by editing the appropriate access group. The next slides describe these operations.

# Creating Physical Disks in the Oracle ZFS Storage Appliance by Using the Oracle VM Manager

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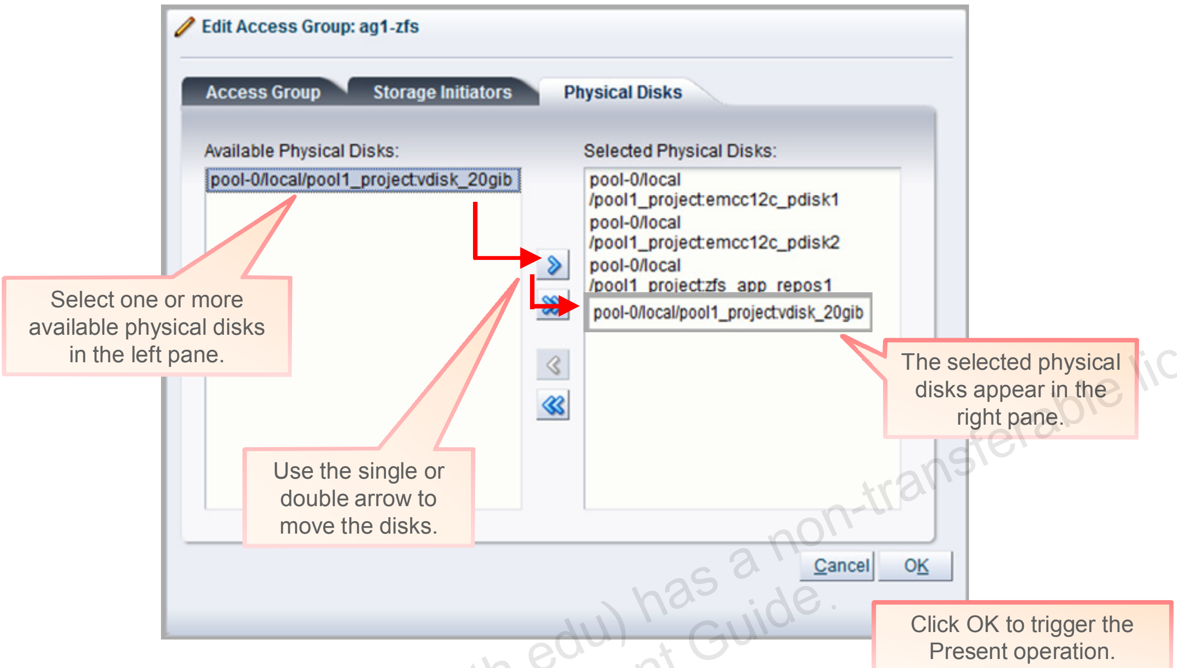
You can create physical disks immediately after discovering your new Oracle ZFS Storage Appliance.

To create a physical disk by using the Oracle VM Manager UI, perform the following steps:

1. Select a volume group from the list of volume groups for the Oracle ZFS Storage Appliance.

   **Note:** For the Oracle ZFS Storage Appliance, a volume group in the Oracle VM Manager corresponds to a project in the appliance. During the discovery process, Oracle VM obtains a list of all the projects that are available on the Oracle ZFS Appliance, including any project that was configured for Oracle VM's exclusive use. There is currently no mechanism to hide the projects that are not meant for use by Oracle VM.
2. Select the Physical Disks perspective in the management pane.
3. On the Create Physical Disk screen, enter a name and size (in GiB [gibibytes]) for the disk.
4. If you intend to share this physical disk between virtual machines, select the Shareable check box.
5. The Thin Provision check box is selected by default. You can deselect it if you want to allocate all storage blocks up front, rather than using on-demand allocation.
6. Click OK to trigger the creation of the physical disk.

# Presenting Physical Disks to the Access Group from the Oracle VM Manager








After creating the physical disks, you must present them to the Oracle VM servers that need access to them. You perform this task by editing the access group that contains the appropriate Oracle VM servers.

To present the physical disks, do the following:

1. Select the Oracle ZFS Storage Appliance by selecting its name in the navigation pane.
2. Highlight the access group from the Access Groups perspective.
3. Click the Edit Access Group icon.

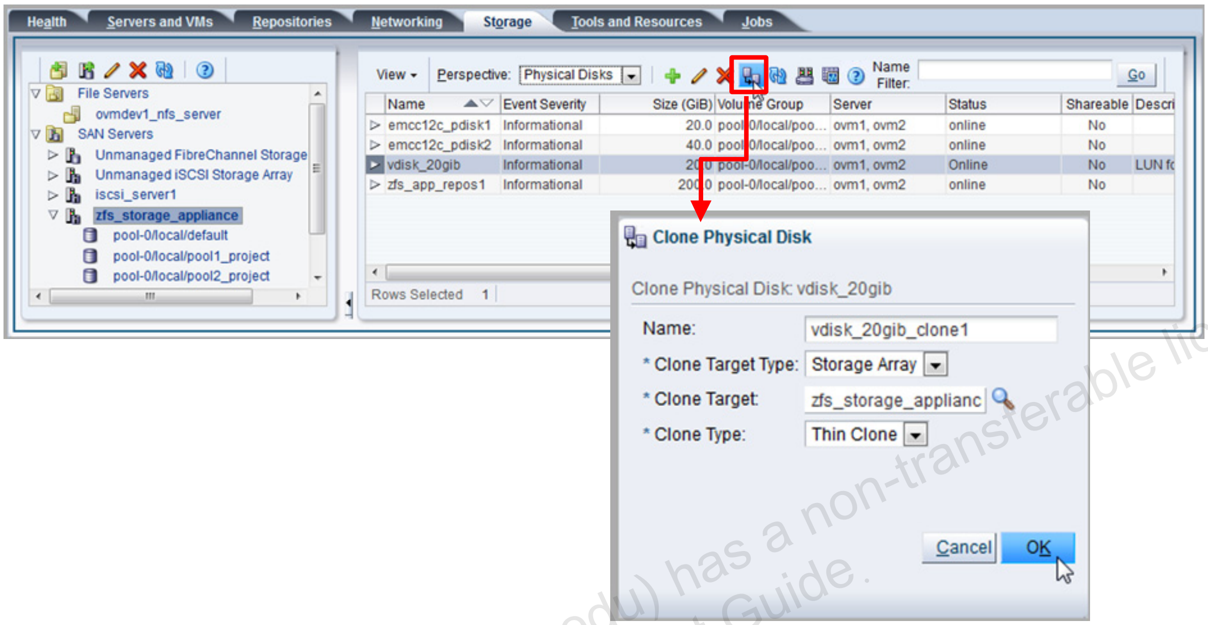
The screenshot in the slide illustrates the result of these actions.

To present the physical disks, do the following:

1. Select one or more disks in the “Available Physical Disks” pane.
2. Using the single or double arrow, move the highlighted physical disks to the “Selected Physical Disks” pane.
3. Click the OK button to complete the operation.

Your physical disks are now available for use.

## Cloning Physical Disks in the Oracle ZFS Storage Appliance by Using the Oracle VM Manager

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The last operation that is shown as part of this case study is the disk cloning operation. To launch this operation, perform the following steps:

1. Select the volume group (project) under the Oracle ZFS Appliance SAN server in the navigation pane.
2. From the Physical Disks perspective, highlight the disk that you want to clone.
3. Click the Clone Physical Disk icon or right-click and select "Clone Physical Disk" from the shortcut menu. In this case study, the selected physical disk is named `vdisk_20gib`.

The Clone Physical Disk screen appears (shown in the slide).

**Note:** To take advantage of the thin provisioning feature offered by the Oracle ZFS Storage Appliance, you must clone the physical disk to a new physical disk on the same storage appliance.

To create a clone on the same Oracle ZFS Storage Appliance, perform the following steps:

1. Enter a name for the new clone.
2. Select Storage Array from the Clone Target Type drop-down list.
3. Because you selected Storage Array as the clone target type, you can search for the storage array on which to create the clone. In this example, select the Oracle VM Manager name that is associated with the Oracle ZFS Storage Appliance.
4. Select the Clone type. The only choice is "Thin Clone" as shown in the slide.
5. Click OK to trigger the cloning operation.

A new physical disk named `vdisk_20gib_clone1` is created, and now appears under the same volume group as the source physical disk that was used for the cloning operation.

If you want to change the characteristics for the new clone, select the clone and click the Edit Physical Disk icon on the toolbar from the Physical Disks perspective. On the Edit Physical Disk screen, you can change the name, specify a new size, change the description, and make the physical disk shareable. Click OK to complete the operation.

## Quiz

Identify the information items that are required when discovering an iSCSI storage array that uses the Oracle generic SCSI plug-in.

a. Access host
b. Admin host
c. Storage plug-in name
d. Plug-in private data



**Answer: a, c**

## Summary

In this lesson, you should have learned how to:

- Describe how storage is used in the Oracle VM environment
- List the types of storage
- Explain how the Storage Connect framework fits into Oracle VM
- Prepare external storage for use with Oracle VM
- Discover file servers and SAN servers
- Perform refresh operations
- Create NFS access groups and SAN access groups
- Create and clone physical disks
- Describe the added functionality that is available with the vendor-specific plug-ins when using the Oracle ZFS Storage Appliance

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# Practice 4: Overview

In this practice, you perform the following tasks:

- Verify the NFS storage on your lab machine.
- Discover the generic NFS file server from the Oracle VM Manager.
- Verify the presence of iSCSI targets and LUNs on your lab machine.
- Discover the iSCSI generic storage array.
- Explore available operations on physical disks.
- Install the Oracle ZFS Storage Appliance plug-in.

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5

# Server Pools and Repositories

# Objectives

After completing this lesson, you should be able to:

- Describe the role of server pools and server pool file systems
- List the features of a clustered server pool
- Describe the role of Oracle Cluster File System 2 (OCFS2) in the server pool cluster
- Prepare for server pool deployment
- Create and manage server pools
- Describe the function and structure of Oracle VM repositories
- Create repositories and add resources to the repositories
- Manage repositories and their resources

# Lesson Overview

- The first section of this lesson covers the following topics on server pools:
  - Server pool functions and features
  - Clustered server pools and the role of OCFS2 in the cluster
  - Non-clustered server pools
  - Creating and managing server pools
  - Server pool policies
- The last section covers the following topics on repositories:
  - Repository structure
  - Creating repositories
  - Adding resources to repositories
  - Managing repositories

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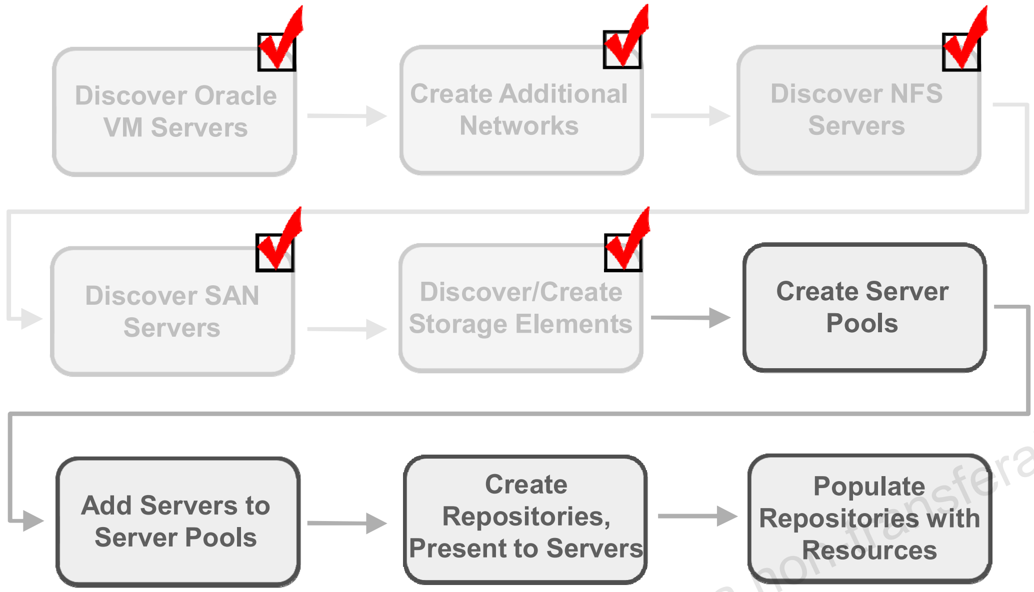
In the lesson titled "Managing Storage," you learned about managing storage in your Oracle VM environment for storing resources and creating physical disks to be used by your virtual machines.

In this lesson, you learn how to create and manage server pools and repositories. By using repositories and server pools, and managing the virtual machine resources contained within them, you build a highly available environment for your virtual machines.

The lesson is divided into two sections. The first section covers the key concepts and tasks associated with server pools. The last section covers repositories.

# Oracle VM Initial Configuration: Server Pool and Repository Tasks






The flow diagram in the slide shows the tasks associated with creating and configuring server pools and repositories, starting with creating server pools.

After creating server pools, you create repositories and populate them with the resources that are needed for creating virtual machines: ISO files, templates, virtual appliances, and virtual disks.

You can change the order of execution for the configuration tasks shown in the slide depending on the type of storage you use for repositories. These variances are discussed in the sections titled “Server Pools and Repositories” and “Creating Storage Repositories” later in this lesson.

After creating server pools and repositories and populating the repositories with resources, you are ready to create virtual machines. Creating virtual machines is explained in the lesson titled “Managing Virtual Machines.”

## Server Pools and Repositories

- After you configure your storage, you create server pools and repositories.
- A server pool is a collection of physical and virtual resources to host virtual machines.
- A repository is logical storage space that is made available to the Oracle VM servers in a server pool.
- The order for creating repositories and server pools is important:
  - NFS type repositories are created independently of any server pool.
  - Repositories on iSCSI or FC storage elements are created for a specific server pool.

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After you have prepared and configured your external storage, the Oracle VM Manager is fully aware of the underlying physical storage providers that are available to create server pools and storage repositories.

A storage repository is logical storage space (essentially a file system on top of physical storage hardware) that is made available to the Oracle VM servers in a server pool. You use the Oracle VM Manager to create and manage the resources in your storage repositories. These resources include ISO files, templates, virtual appliances, virtual disks, and virtual machine configuration files.

**Server Pool and Repository Facts**

- All the Oracle VM servers in a server pool must have access to the same storage resources. This is a requirement of high availability (HA) for the virtual machines that are running on the Oracle VM servers in a server pool.
- However, you can create repositories on disks that are available locally from a single Oracle VM server. Resources in repositories that are created on local storage are not available to any Oracle VM server other than the server owning the local storage. Additionally, there is no HA for virtual machines whose resources reside on these local repositories.

- The Oracle VM servers in a server pool can access more than one repository, but a repository can belong to only one server pool, except the repositories created on NFS file shares. NFS storage repositories can be shared by multiple server pools.

Server pools are discussed next, followed by additional information about repositories. After creating server pools and repositories, and populating the repositories with the required resources, you are ready to create virtual machines.

## Server Pool: Overview

- A server pool consists of one or more Oracle VM servers.
- Each Oracle VM server in the server pool shares the same network and storage configuration.
- A server pool is scalable.
  - You can expand the server pool by adding more Oracle VM servers and more repositories.
- A server pool can be clustered or unclustered.



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A server pool consists of one or more Oracle VM servers that are grouped together and represents a logical view of the resources available to the virtual machines that are running on the servers. The server pool also acts as an HA group, as well as a live migration group.

All the Oracle VM servers in a server pool participate in the same networks, and have access to the same storage resources. If you decide to have a slightly different network or storage configuration for one or more Oracle VM servers in your server pools, be aware that these deviations can affect the functionality of your server pools.

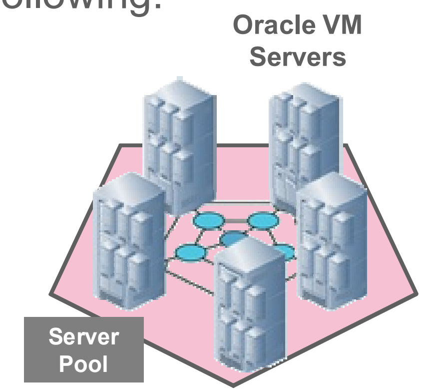
A server pool is scalable. If you find that a server pool does not have sufficient resources (such as CPU or memory) to run the virtual machines, you can expand the server pool by adding more Oracle VM servers. You can add up to 32 Oracle VM servers in a clustered server pool and 64 Oracle VM servers in a non-clustered server pool. You can obtain the latest information about the configuration limits for server pools by consulting the *Oracle VM Release Notes*, Part Number E50246-03 or later.

Oracle VM's deployment architecture uses server pools, with shared access to storage across the 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.

# Server Pool Functions

Each server pool can act as the following:

- Resource group
- HA group
- Live migration group
- Policy group










The server pool is the most important unit in Oracle VM.

**Server Pool as a Resource Group**

As the Oracle VM administrator, you assign resources to each server pool. These resources include repositories and storage elements within storage arrays, which are accessible by all the Oracle VM servers in the server pool. You also create a network infrastructure by configuring networks from the Oracle VM Manager, which triggers the creation of network devices on the Oracle VM servers. You assign these resources and configure networks so that all the Oracle VM servers in the server pool share the same storage and networking profile. This is important for all the functions of the server pool, which are described in the following paragraphs.

**Server Pool as an HA Group**

The server pool unit provides HA to the virtual machines deployed to that server pool. The HA feature is implemented by Oracle VM and the clustering capabilities of the repositories shared by the Oracle VM servers in the server pool. In this lesson, you learn how clustered pools provide shared access to the resources in the server pool. In the lesson titled “Managing Virtual Machines,” you learn how to build virtual machines that take advantage of the HA feature of the server pools.

### Live Migration Group

Live migration is a feature used by the server pool to provide added functionality to the virtual machines running in the server pool. With live migration, you can move running virtual machines from one Oracle VM server to another Oracle VM server within a server pool, without service interruption to the virtual machine. The live migration feature is used when the Oracle VM servers in the server pool must be put offline for maintenance purposes, and is essential to the implementation of server pool policies (which are discussed next).

### Policy Group

Using the Oracle VM Manager, you can set a policy for each server pool. The goal of these policies is to balance Oracle VM server usage in a server pool, to provide consistent resources to the running virtual machines in the server pool, or to minimize power consumption in the server pool. Server pool polices are discussed later in this lesson.

## Server Pool Clusters

- When creating a server pool, you choose whether the server pool is clustered or not.
- The cluster option offers the following features:
  - Shared access to the pool resources residing in the OCFS2 file systems
    - OCFS2 enables multiple nodes to access the same disk at the same time.
  - HA for the virtual machines running in the server pool
- The cluster features are provided by:
  - The capabilities of OCFS2, which is a cluster file system for Linux
  - The HA functionality in Oracle VM







Oracle VM works in concert with Oracle OCFS2 to provide shared access to the server pool resources that reside in the OCFS2 file systems. This shared access feature is crucial in the implementation of HA for the virtual machines that are running on the Oracle VM servers that belong to a server pool with clustering enabled.

OCFS2 ensures that the Oracle VM servers that belong to the same server pool access and modify the resources in the shared repositories in a controlled manner.

When a virtual machine is configured with the HA option, if the Oracle VM server on which the virtual machine is running fails, Oracle VM restarts the virtual machine on another Oracle VM server in the server pool. For the virtual machine to restart successfully, all the Oracle VM servers in the server pool must access the same resources, and the access to these shared resources must proceed in a controlled manner.

OCFS2, which is a cluster file system for Linux, is the underlying technology that controls access to the shared resources in the cluster.

## Components of OCFS2

- The OCFS2 software includes:
  - The core file system, which offers the standard file system interfaces
  - The O2CB cluster stack, which supports the shared disk cluster feature
- The shared disk cluster feature includes the following:
  - A disk heartbeat to detect live Oracle VM servers
  - A network heartbeat for communication between the servers (or nodes)
  - A Distributed Lock Manager (DLM), which allows shared disk resources to be locked and released by the servers in the cluster

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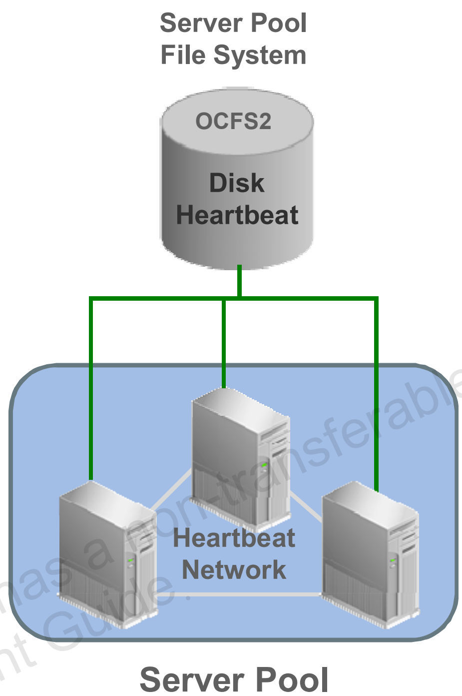
The OCFS2 software includes the core file system, which offers the standard file system interfaces and behavioral semantics, and also includes a component that supports the shared disk cluster feature.

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:** The disk heartbeat is written to a file system, which is accessible by all the Oracle VM servers in the clustered server pool. This common file system is called the server pool file system and is discussed next.
- **A network heartbeat for communication between the nodes:** There is also a heartbeat network, which can be shared with the management network, or can use its own dedicated network. For more information about the heartbeat network, see the lesson titled “Managing Servers and Networks.”
- **A Distributed Lock Manager (DLM):** DLM allows shared disk resources to be locked and released by the servers in the cluster. DLM is discussed later in this lesson.

## Building a Clustered Server Pool with OCFS2

- Each clustered server pool requires one server pool file system.
- Reserve an NFS share, or an iSCSI or FC storage element, with at least 12 GB to use as the server pool file system.
- The server pool file system is formatted as an OCFS2 file system when the server pool is created.
- Create a separate heartbeat network if desired.








### Clustered Server Pool

A clustered server pool uses the OCFS2 cluster file system to implement its clustering functionality. The OCFS2 cluster file system refers to the participating members of the cluster as nodes. With Oracle VM, these nodes are the Oracle VM servers that are members of the server pool.

The elements of the clustered server pool are illustrated in the diagram in the slide.

### Server Pool File System

When you create a server pool, you provide a shared storage element with at least 12 GB of space, which can be an NFS share or an iSCSI/FC storage element.

This storage area must be accessible by all the Oracle VM servers that you expect to add to the server pool.

During server pool creation, the Oracle VM Manager designates one Oracle VM to format this shared storage area as an OCFS2 file system. This occurs when the shared storage is an NFS or an iSCSI/FC storage element.

### Disk Heartbeat

The disk heartbeat feature uses a file in the hidden region of the server pool file system. Each pool member writes to its own block in this region every two seconds, indicating that it is alive. It also reads the region to maintain a map of live nodes.

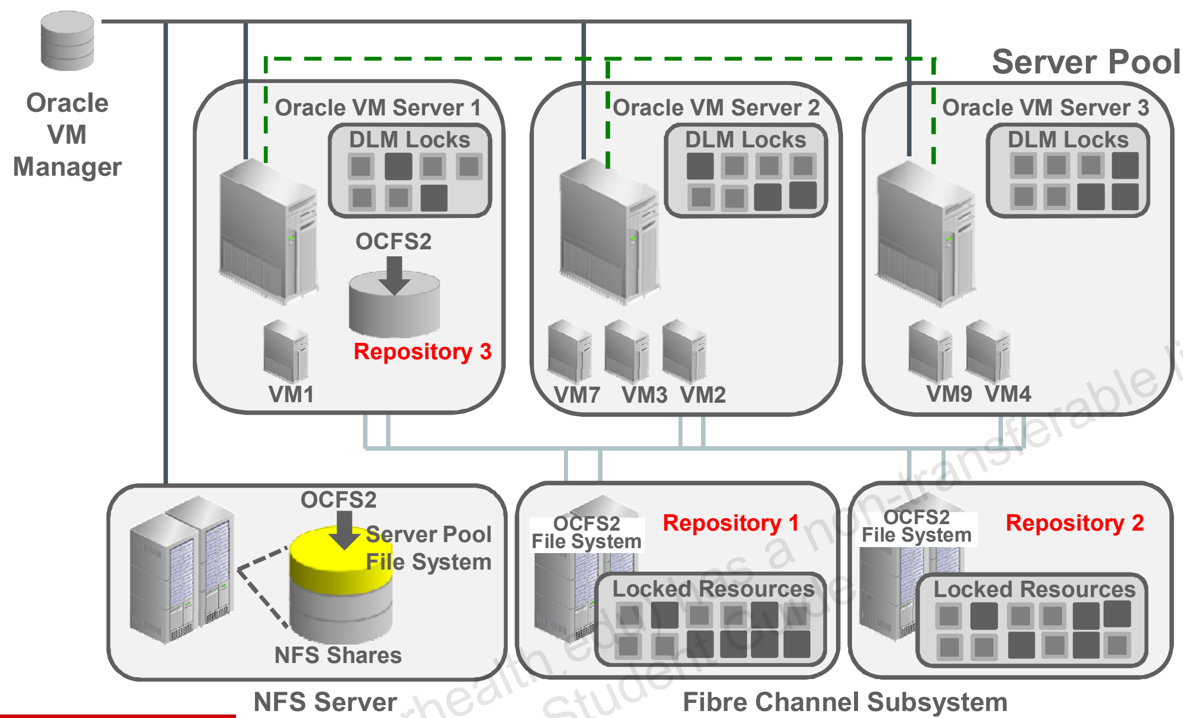
### Heartbeat Network

The Oracle VM servers that are added to the server pool communicate over the network by using a TCP port, which defaults to 7777.

Each Oracle VM server sends regular keep-alive packages over the network to each Oracle VM server in the cluster to validate whether the servers are alive.

This intra-cluster node communication uses the network with the Cluster Heartbeat network channel. By default, this is the server management network. You can, however, create a separate network for this function. Ensure that the firewall on each Oracle VM server in the cluster allows network traffic on the heartbeat network. By default, the firewall is disabled on the Oracle VM servers after installation.

## Server Pool Cluster with Shared Resources and Distributed Lock Management








The diagram in the slide illustrates the components of a clustered server pool, the disk and network heartbeats, and the use of the DLM feature to lock resources across the cluster.

**Repositories**

The shared resources in the server pool are stored in a repository. In a clustered server pool, repositories reside on external storage elements that are formatted as OCFS2 file systems when the repositories are created. NFS-based repositories are an exception, and this type of repository is not formatted as an OCFS2 file system.

With OCFS2, the resources in the repositories—for example, virtual machine configuration files, virtual disks, ISO files, templates, and virtual appliances—can be shared safely across the server pool.

The diagram in the slide shows two repositories, Repository 1 and Repository 2, created on Fibre Channel storage elements.

There is also a local repository, Repository 3, for the exclusive use of one of the Oracle VM servers in the server pool.

### Server Pool File System

The server pool file system associated with this server pool is shown in the diagram, to the left of the repositories. The server pool file system 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.

### Virtual Machines

The diagram also shows several running virtual machines, with resources in the shared Repository 1 and Repository 2.

### Heartbeat Network

The heartbeat network is shown (green, dash-line) as a dedicated network link between all the Oracle VM servers in the server pool.

### Distributed Lock Manager

As virtual machines are created, started, stopped, or migrated, the Oracle VM servers lock the resources they need in the shared repositories. Each Oracle VM server ends up managing a subset of all the locked resources in the server pool. A resource can have several locks against it.

An exclusive lock is requested when a write is anticipated 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.

If an Oracle VM server fails, its locks are recovered by the other Oracle VM servers in the cluster, and the virtual machines that are 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.

### Cluster Timeout

OCFS2 uses a timeout value for the disk and network heartbeats. If an Oracle VM server node cannot send a heartbeat within the timeout values, the server can be forcibly removed from the cluster.

You can change the timeout value for the cluster when you create a clustered server pool. The default value is 120 seconds. You can set this value between 12 and 300 seconds. The disk heartbeat timeout value is derived from this cluster timeout value. All timeout values are listed in the `/etc/sysconfig/o2cb` file on each server.

If you want to change the timeout value after the clustered server pool has been created and the servers have been added to the server pool, you must make the change manually. Contact Oracle Support to make this change. Be careful when setting the cluster timeout value because this setting can negatively impact your cluster operations.

## OCFS2 Features

- Shared file system support
  - With distributed lock management
- Posix-compliant file system
  - Support for the usual file system behavior
- Reflink feature
  - Ability to create multiple writable snapshots of regular files
- Sparse file support
  - Skipping allocation for “holes” in a file enabled
  - Space allocated only when it is written to
- Inline-data support
  - Ability to store small files and directories in the inode block
  - Also called data-in-inode

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Oracle VM uses several features of the OCFS2 file systems. The list of OCFS2 features in the slide is only a subset of the features offered by OCFS2.

Some of these features exist in other types of file systems as well. For example, the sparse file support is available in most UNIX operating systems.

**Reflink Feature**

Oracle VM uses the reflink feature to provide the thin cloning feature for cloning virtual disks. Virtual disk cloning is discussed later in this lesson.

**Data-in-inode**

You might observe that creating a new virtual machine does not use any additional space in a repository. Even if the virtual machine’s disks reside on iSCSI or FC storage elements, creating a virtual machine causes a configuration file to be created in the target repository. A typical virtual machine configuration file is small and may be stored in the inode, which means that the size of the repository does not change with the addition of this configuration file. This feature is appropriately called data-in-inode, or inline-data support.

# OCFS2 Cluster Services

- Starting the cluster activates several services and processes on each of the Oracle VM servers in the cluster.
- The following are the most important services and processes:
  - `o2cb` service, which is central to the cluster operations
  - `ocfs2` service, which is responsible for the file system operations
  - `o2net` process, which creates the intra-cluster node communication channels
  - `ocfs2_dlm` and other DLM-related processes, which are part of the DLM
- Do not manually start or stop the cluster services:
  - Manually configuring or operating the cluster can lead to cluster failure.



You can use the display commands on your Oracle VM servers to see the processes, files, and services that are activated or created by Oracle VM, and also controlled by Oracle VM.

**Warning:** Do not manually modify the cluster configuration files, or start and stop the cluster services. The Oracle VM Manager automatically starts the cluster on the Oracle VM servers that belong to a clustered server pool. Manually configuring or operating the cluster can lead to cluster failure.

## Server Pool Deployment Planning

- Develop workload profiles for the applications that you plan to run on the virtual machines that are to be deployed in each server pool.
- Calculate how much aggregate CPU and memory capacity is needed to support normal and peak workloads.
- Decide if a few larger servers, or a greater number of smaller servers, would best fit your environment.
- Incorporate the live migration feature to ensure high availability during unplanned outages.
- Consider storage topologies and networking infrastructure along with server pool architecture.

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A large number of considerations exist when planning your Oracle VM server pool design.

There are also some significant similarities between server pool planning and physical server planning with regard to node (physical server) size versus overall server pool size. For example, in some cases, it is better to have relatively fewer but larger servers in a server pool. In other cases, a greater number of relatively small servers or blades could be a better fit. Both deployments can provide the same aggregate CPU, memory, storage, and bandwidth, but the implications of the deployment in a pool can be different.

Plan for enough excess capacity in aggregate across the pool to support running all VMs to an appropriate service level, even when one or more servers in the pool are out of service.

Plan extra capacity to support guest HA/auto-restart. There should be sufficient capacity to support hosting additional virtual machines on fewer machines in the event that one (or more) of the Oracle VM servers fail and their virtual machines end up being restarted on the remaining healthy servers, even if only temporarily.

Plan for extra capacity to support live migration of virtual machines during planned events or to better load-balance virtual machine loads when using Distributed Resource Scheduling (DRS). DRS is discussed later in this lesson.

**Creating Workload Profiles**

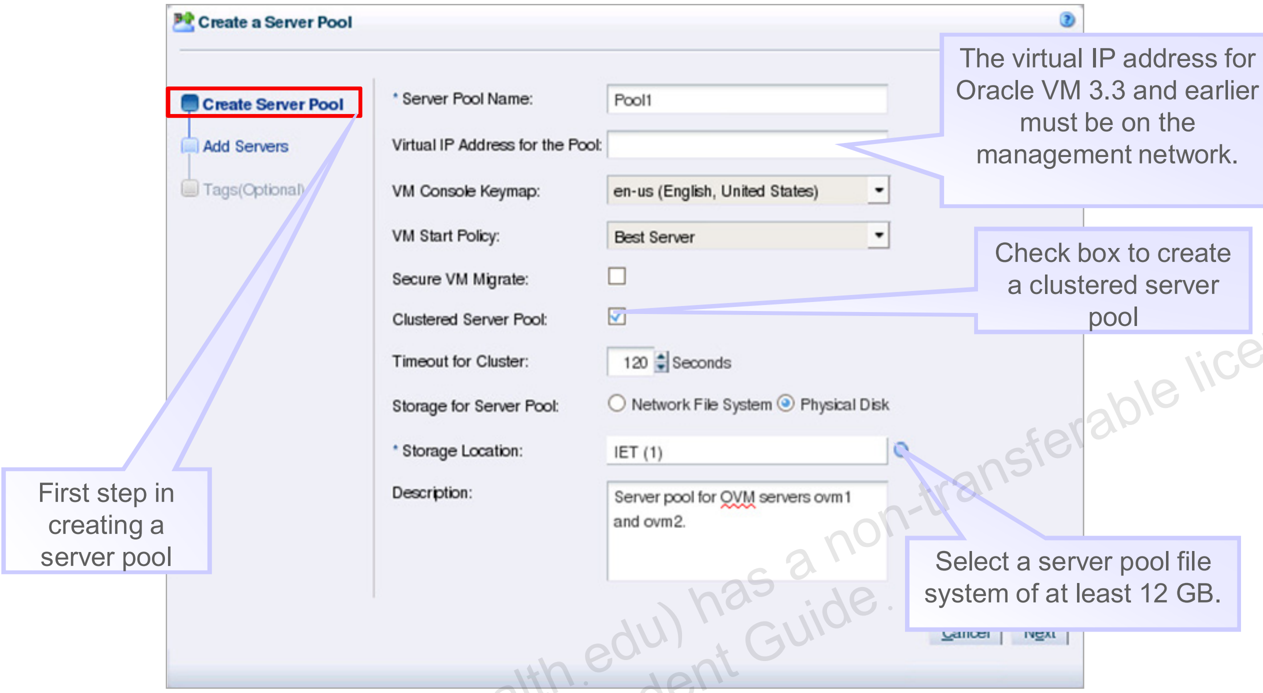
You create a workload profile to capture the load characteristics for a selected group of virtual machines. The load characteristics track CPU, memory, and network usage over a time period, including the variations over that time period.

Is the workload flat and stable or variable with peaks? Some virtual machines have relatively low utilization, and are very flat and stable with minimal peaks. These types of virtual machines can often be very tightly consolidated, with a large number of virtual machines per Oracle VM server. Because they are very predictable, they require little excess capacity to accommodate unexpected peaks.

Other workloads have peaks, but the peaks are predictable in both timing and magnitude. For instance, some virtual machines can contain applications that always peak at the end of the week or month. If you can consolidate these virtual machines with other virtual machines that peak at different times, you can maximize the number of virtual machines per Oracle VM server and per server pool.

The worst case scenario is when the virtual machines are highly variable in load and timing. In this situation, you are likely to need a lot of extra headroom on the Oracle VM servers, making it possible to have fewer virtual machines per Oracle VM server and server pool.

# Creating a Clustered Server Pool with the Oracle VM Manager UI

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**Creating a Server Pool with the Oracle VM Manager UI**

When you create a server pool, you specify the following:

- A server pool name and description
- A virtual IP address
- A VM Console Keymap
- A VM Start Policy
- Whether to use Secure VM Migration
- Whether to activate the cluster
- A value for the cluster timeout
- A server pool file system for the global heartbeat and other cluster information

**Selecting a Virtual IP Address**

For environments running Oracle VM 3.3 and earlier, a virtual IP address is a required parameter of server pool configuration for both clustered and non-clustered pools. The concept of a virtual IP has been removed from Oracle VM 3.4, but the field is still active because the Oracle VM Manager can see Oracle VM servers and their server pools from a previous release.

### Activating the Cluster

If you select the Clustered Server Pool check box, the server pool is created as a cluster. The cluster itself is not immediately activated. This step occurs when you add the Oracle VM servers initially to the server pool.

### Selecting a Keymap

You select the keymap for your particular country and language. The keymap is the key mapping to use in the console for all virtual machines in the server pool.

### Enabling Secure VM Migration

If you select the Secure VM Migrate check box, the network traffic that is generated by migrating virtual machines is encrypted.

### Selecting a VM Start Policy

The VM Start Policy has two options:

- **Start on best server:** With this option, Oracle VM starts a virtual machine on the server with the most resources available, as determined by using the same algorithms as DRS and Dynamic Power Management (DPM).
- **Start on current server:** With this option, Oracle VM starts a virtual machine on the server to which the virtual machine has been assigned.

### Accepting or Adjusting the Timeout for Cluster

In most cases, you accept the default value of 120 seconds for the cluster heartbeat timeout. The cluster heartbeat timeout was discussed earlier in this lesson. You can choose a value between 12 and 300 seconds.

### Searching for the Storage to Use as Server Pool File System

If you select the check box to create a clustered server pool, you must specify a storage element to act as the server pool file system. You can choose an NFS file system or a physical disk. A physical disk is also referred to as a logical unit number (LUN).

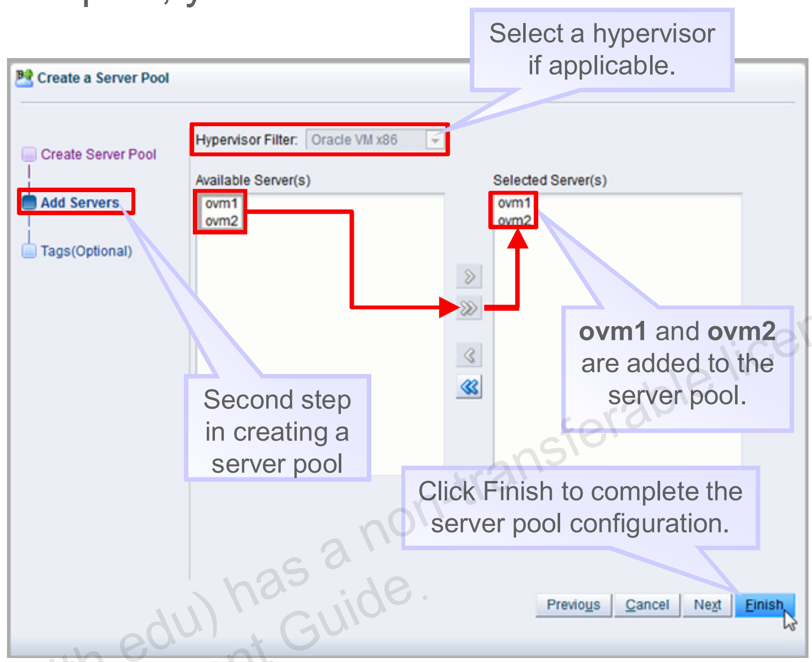
Using the search facility, locate and select the storage element. The file system or physical disk that you select appears in the Storage Location field.

### Triggering the Creation of the Server Pool

After you make selections on the first screen of the “Create a Server Pool” Wizard, click the Next button. This action triggers the creation of the server pool. After this operation completes, you are presented with the “Add Servers” screen. This screen is described next.

## Adding Oracle VM Servers to a Server Pool

- After you create a server pool, you add Oracle VM servers to the new server pool.
- Only unassigned Oracle VM servers are listed in the Available Server(s) pane.
- The Hypervisor Filter is disabled if the Oracle VM servers are all of the same type.






After the step to create the server pool completes, you add Oracle VM servers to the new server pool. You must first discover the Oracle VM servers before you can add them to a server pool. From the Oracle VM Manager UI, you can view the list of Oracle VM servers that have been discovered and can now be added to the server pools. They are listed under the "Unassigned Servers" folder, which is visible in the navigation pane from the Servers and VMs tab.

The screenshot in the slide shows an example of adding the Oracle VM servers, `ovm1` and `ovm2`, to the new server pool.

**Selecting the Hypervisor Type**

Recall that the hypervisor is responsible for allocating resources to virtual machines.

The Hypervisor Filter has two options:

- **OVM VM x86:** Select this option if the servers in your server pool are running Oracle VM Server for x86.
- **OVM VM SPARC:** Select this option if the servers in your server pool are running Oracle VM Server for SPARC.

Oracle VM does not support a mix of Oracle VM Server for x86 and Oracle VM Server for SPARC in the same server pool.

Optionally, you can proceed to the Tags window, where you can select one or more tags that you created previously. You use these tags to identify and locate the server pool and to group it with other objects within the Oracle VM Manager.

After making your Oracle VM server selection, click Finish to complete the server pool configuration.

## Cluster Creation

When Oracle VM servers are added, Oracle VM performs the following steps:

1. Creates the cluster configuration file and the cluster timeout file
2. Pushes the configuration files to all the Oracle VM servers in the server pool
3. Starts the cluster

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When you add Oracle VM servers to the server pool, several events occur on the Oracle VM servers:

- The cluster configuration is modified to reflect the additions of all Oracle VM servers to the server pool.
- Oracle VM pushes the configuration files to all the Oracle VM servers that are now members of the server pool.
- The cluster status changes from “heart beating” to “DLM ready” on each Oracle VM server.

# Oracle VM Cluster Configuration

The cluster configuration file, `cluster.conf`, is located in `/etc/ocfs2/` on each Oracle VM server in the server pool.

```
node:                               node:
   name = ovm1                         name = ovm3
   cluster = ba5aa4da864b2335          cluster = ba5aa4da864b2335
   number = 0                          number = 1
   ip_address = 192.168.131.201      ip_address = 192.168.131.203
   ip_port = 7777                      ip_port = 7777
cluster:
   name = ba5aa4da864b2335
   heartbeat_mode = global
    node_count = 2
heartbeat:
   cluster = ba5aa4da864b2335
   region = 0004FB00000500009D4CAAE1260ED8E7
```

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The `cluster.conf` file contains the following information:

- The cluster ID (as the `cluster` value in the `cluster.conf` file)
- The number of nodes (or Oracle VM servers) in the cluster
- For each Oracle VM server:
  - The Oracle VM server name
  - Its position in the cluster (0, 1, 2, up to 31)
  - The IP address on the heartbeat network
  - The TCP port that is used for communication between the Oracle VM servers. The default is 7777.
- The heartbeat region, which is also the ID for the server pool file system, as seen from a listing of file systems in the Oracle VM environment

**Note:** The node stanzas appear one after the other in the `cluster.conf` file. The stanzas have been rearranged in the slide to fit in the space available.

The `cluster.conf` file is created automatically. Do not modify this file, except if you change the heartbeat network after the clustered server pool has been created.

If you decide to use a different network for the heartbeat, contact Oracle Support. You can also find information about this procedure at My Oracle Support, Doc ID 1504140.1.

# Non-Clustered Server Pools

- The Oracle VM servers in a non-clustered server pool can access only the repositories that are created on NFS shares or local storage.
- Non-clustered server pools do not require a server pool file system.
- The features that are supported or not supported for non-clustered server pools are as follows:
  - Live migration is supported.
  - HA for virtual machines is not supported.
  - Repositories on an iSCSI/FC storage element are not supported.

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Non-clustered server pools have access only to repositories built on NFS shares or local storage. Recall that NFS repositories can be shared across server pools, so you can have a situation where an NFS-type repository is shared between a clustered and a non-clustered server pool.

If you want to create a repository on an iSCSI or FC storage element, you must create a clustered server pool.

You can choose to create a non-clustered server pool if you are building a server pool with a single Oracle VM server or if the cluster's HA functionality is not needed in the server pool. A non-clustered server pool does not support HA for the virtual machines deployed on its Oracle VM servers. If an Oracle VM server fails in this type of server pool, the virtual machines on the server must be restarted manually on another Oracle VM server in the server pool.

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

On the first screen of the Create a Server Pool Wizard, when creating a non-clustered server pool, you provide information that is similar to what is required for creating a clustered server pool, except the following:

- Do not select the Clustered Server Pool check box.
- The Timeout for Cluster increment/decrement check box is disabled.
- The option buttons for Storage for Server Pool are disabled.

On the second screen, Add Servers, you select the unassigned Oracle VM servers that you want to include in your non-clustered server pool. Note that for a non-clustered server pool, the Hypervisor Filter drop-down list is active on the wizard’s second screen and you must specify the hypervisor type for the Oracle VM servers that you are adding to the non-clustered server pool.

Converting a non-clustered pool to a clustered pool is not supported.

## Managing Server Pools

After creating a server pool, you can perform the following actions:

- Adding Oracle VM servers to or removing Oracle VM servers from the server pool
- Making changes to the configuration of the server pool
- Changing the Oracle VM Agent password on all Oracle VM servers in the server pool
- Creating server pool policies
- Creating anti-affinity groups
- Deleting the server pool





After creating a server pool and adding Oracle VM servers to the server pool, you can add additional Oracle VM servers when you need to increase the CPU and memory capacity for your server pool.

**Adding an Oracle VM Server to a Server Pool**

Before adding Oracle VM servers to a server pool, make sure that the Oracle VM servers to be added have the same network configuration as the Oracle VM servers that are already members of the server pool. This might require editing existing networks, and adding network ports or bonds for the new Oracle VM servers. Similarly, ensure that the Oracle VM servers to be added to the server pool have the same access to the server pool storage resources.

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

**Removing an Oracle VM Server from a Server Pool**

Before removing an Oracle VM server from a server pool, migrate all running virtual machines to other Oracle VM servers in the server pool or, for virtual machines that are in stopped state, migrate them to the server pool itself rather than to a specific Oracle VM server.

When you remove an Oracle VM server from a server pool, several actions are triggered automatically:

- Repositories that are currently presented to the Oracle VM server are unpresented.
- The Oracle VM server is removed from the server pool.
- The cluster configuration is updated on the remaining Oracle VM servers in the server pool.

After removing an Oracle VM server from a server pool, the Oracle VM server now appears in the Unassigned Servers folder in the Oracle VM Manager UI. You can delete the Oracle VM server from the Oracle VM environment or add it to another server pool.

**Editing Server Pool Policies**

You can configure one of two types of server pool policies:

- DRS to optimize virtual machine resource utilization
- DPM to minimize power consumption

Server pool policies are discussed later in this lesson.

**Creating Anti-Affinity Groups**

An anti-affinity group applies to all Oracle VM servers in a server pool.

Anti-affinity groups are discussed later in this lesson.

**Deleting a Server Pool**

Remove all Oracle VM servers in the server pool by using the guidelines in the preceding paragraphs. You need at least one Oracle VM server left in the pool. You also must delete or release ownership of all repositories before removing the last Oracle VM server from the cluster.

You can then remove the last Oracle VM server in the server pool. You can now delete the server pool.

# Making Changes to a Server Pool

- Edit the server pool to:
  - Change its name and description
  - Change the VM Start Policy setting
  - Change the VM Console Keymap setting
  - Select or deselect Secure VM Migrate
  - Override the Global Server Update Group
- Change the OVS Agent password for all Oracle VM servers in the pool.

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**Editing a Server Pool**

To edit a server pool from the Oracle VM Manager UI, highlight the server pool, right-click, and select Edit. Make the changes and click OK to complete the operation.

You can make the following changes:

- Change the server pool name and its description.
- Select a new keymap: The keymap is the key mapping to use in the consoles for all virtual machines in the server pool. You can choose from a list of languages and countries.
- Select a new VM Start policy: The selections are Best Server and Current Server.
- Select or deselect "Secure VM Migration." If you select the option to secure the migration of virtual machines, the migration traffic between Oracle VM servers is encrypted.
- Override the Global Server Update Group: You can specify Yum update repositories that are used to update all the Oracle VM servers in all your server pools (global). If you want to specify Yum repositories at the server pool level, you must select this override check box.

After creating a server pool, you cannot change the timeout value for the cluster using the Edit Server Pool Wizard.

**Changing the OVS Agent Password for All Oracle VM Servers in the Server Pool**

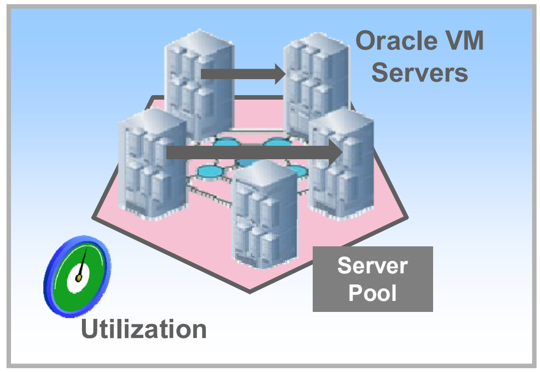
This option is accessed from:

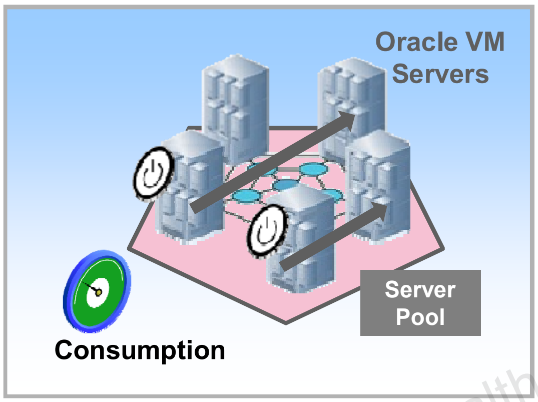
- The Server Pool shortcut menu
- The Server Pools perspective, as an icon on the toolbar of the management pane

Use this option to change the Oracle VM Agent password that is used by all the Oracle VM servers in the selected server pool. Note that the Oracle VM Agent password is used only when taking ownership of an Oracle VM server during the Oracle VM server discovery process. After the Oracle VM server is owned by the Oracle VM Manager, the Oracle VM Manager and the Oracle VM server use certificate-based authentication for communication.

# Server Pool Policies

Distributed Resource Scheduling (DRS) for Capacity Management




Dynamic Power Management (DPM) to Minimize Power Consumption





**DRS**

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 exceeds a specified CPU threshold for a specified period of time. DRS continuously samples performance data from every Oracle VM server and virtual machine.

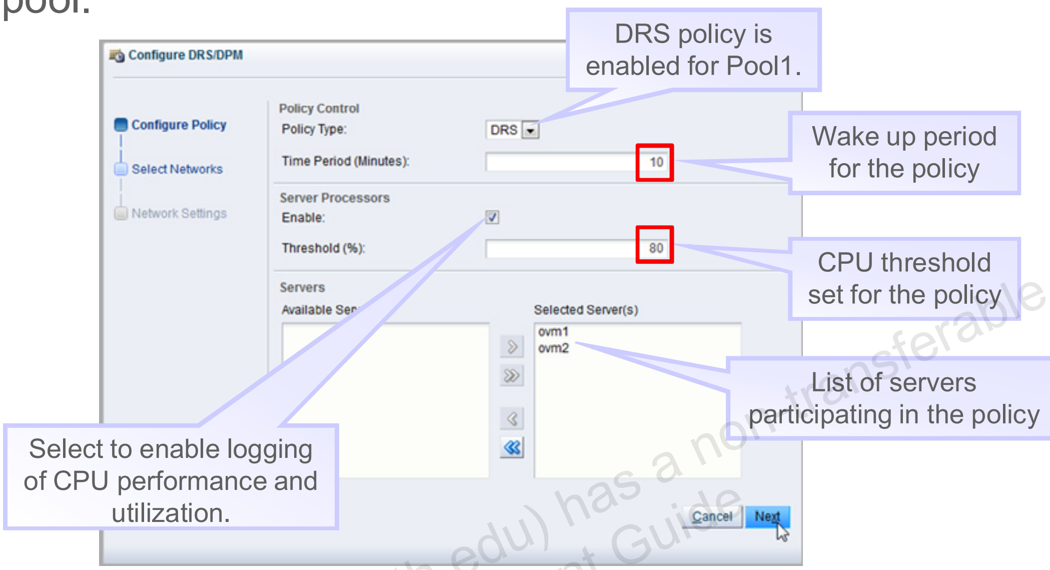
**DPM**

You use DPM when there are periods of relatively 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.

**Note:** You can choose to enable DRS or DPM, or neither. You cannot set both DRS and DPM to be active at the same time.

# DRS: CPU Component

DRS migrates running virtual machines from highly utilized Oracle VM servers based on parameters set in the DRS policy for the server pool.




**General DRS Parameters and Settings for the CPU Component**

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The movement of virtual machines is policy driven. When a threshold is reached, either for CPU usage or network activity, the Oracle VM Manager requests live migration for a running virtual machine from one Oracle VM server to another, without down time. The Oracle VM Manager enables you to specify a DRS threshold for CPU and networking usage for each server pool, and to choose which Oracle VM servers participate in the policy.

**To configure the DRS policy and its CPU component:**

Under Policy Control, specify the following options:

- The policy type:
  - DRS (Distributed Resource Scheduling)
  - DPM (Dynamic Power Management)
  - Off (no policy)
- The time period in minutes (default is 10 minutes; specify a value between 2 and 60)
  - The time period for the policy job to run. If you specify 5 minutes, the policy wakes up every 5 minutes and checks thresholds and calculates utilization.

Under Server Processors, specify the following options:

- The Enable check box
  - Set whether to enable or disable logging of CPU performance and utilization.

- Threshold (%): Less or equal to 99
  - The maximum amount of CPU percentage usage allowed before the policy must be enacted

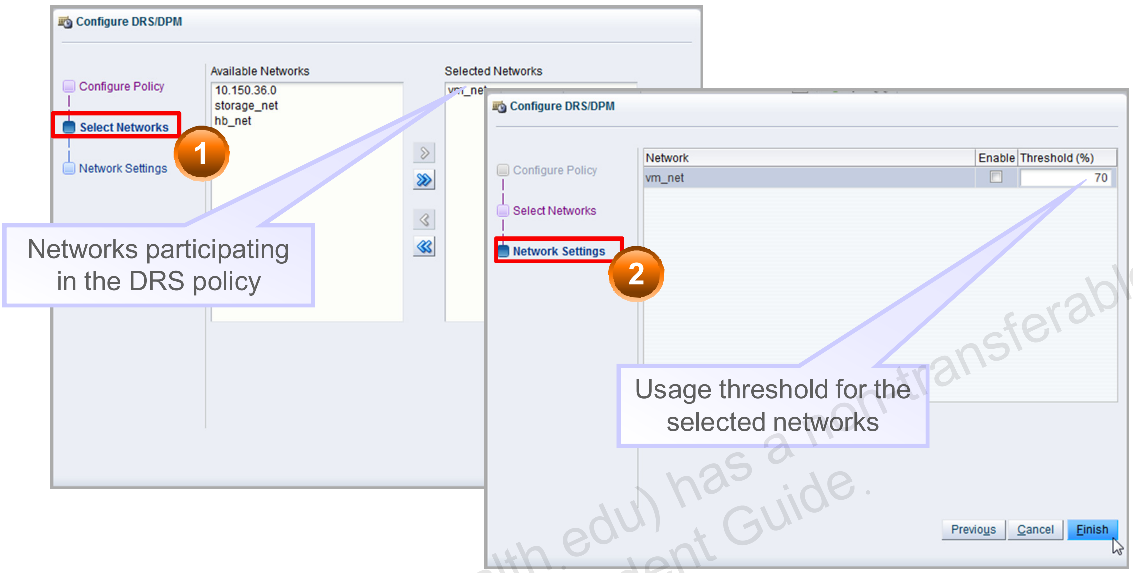
Under Servers, specify the following:

- Select the Oracle VM servers for which the policy is enabled.

Click Next to configure the networking aspect of your DRS policy.

## DRS: Networking Component

You set the networking component of your DRS policy by using two screens:




**Settings for the Networking Component of DRS**





On the second and third screens of the Configure DRS/DPM Wizard, you continue configuring the DRS policy (as shown in the screenshots in the slide) for the networking component of the policy.

If enabled for one or more networks, the policy tracks network usage and moves virtual machines to other servers when utilization thresholds are reached.

**To configure settings for the networking component:**

On the Select Networks screen:

- Select the networks that should participate in this policy

On the Network Settings screen:

- For each network in the policy:
  - Select whether to monitor network utilization for this network
  - Select the threshold (99 or less) of network utilization allowed before the policy is enacted

Configuring a DPM policy follows the same flow, except that the goal of a DPM policy is to migrate virtual machines from Oracle VM servers with low CPU usage and/or low networking activity, to consolidate virtual machine activity on fewer Oracle VM servers.

## How DRS and DPM Work

- The DRS policy wakes up at the intervals specified by the Time Period you set for the policy.
- When the policy wakes up, it performs the following steps:
  - Checks the thresholds set in the policy
  - Calculates average utilization over the time period
- If utilization exceeds the specified thresholds, the policy:
  - Performs a fit factor calculation based on statistics gathered for the virtual machines marked for migration, and for the Oracle VM servers selected as destination
  - Migrates the running virtual machines to the selected Oracle VM server, without down time, if a good fit is found
- DPM works like DRS, but its goal is to reduce power consumption.

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When the DRS policy wakes up, it checks the utilization thresholds for the CPU and/or networks, depending on the settings in the DRS policy.

The policy does not check only the current utilization values, but also gathers statistics for CPU and/or network utilization over a sampling time. If these thresholds have been reached, the policy calculates a fit factor to determine which virtual machines to migrate, and to which Oracle VM servers. The policy uses the collected statistics to calculate this fit factor. If a suitable Oracle VM server is found, virtual machines from the highly utilized server are migrated by using live migration. The virtual machines are not affected by this migration.

**Note:** If you want to enable the DRS policy, plan on using a dedicated Live Migration network to ensure that the migration operations do not skew network utilization statistics.

DPM works very much like DRS, but instead of checking for over-threshold conditions, Oracle VM checks for under-threshold conditions, because the goal of DPM is to free under-utilized Oracle VM servers to minimize power consumption.

## Anti-Affinity Groups

- In an anti-affinity group, you specify virtual machines that must not run on the same Oracle VM server.
- With anti-affinity groups, you can:
  - Build redundancy for an application
  - Achieve load balancing for a specific application
- An anti-affinity group applies to all the Oracle VM servers in a server pool.
- You cannot add a virtual machine to an anti-affinity group if that virtual machine is running on the same Oracle VM server as another virtual machine that is already part of the anti-affinity group.





Anti-affinity groups specify virtual machines that must never run on the same Oracle VM server.

The anti-affinity feature for server pools provides the flexibility to place virtual machines on different servers, and ensures that this placement remains active across restarts, failures, and other operational events.

For example, an application might require that two virtual machines do not reside on the same Oracle VM server for performance reasons. Or, virtual machines might be placed on different Oracle VM servers to ensure HA for the application that is running on these virtual machines.

During a live migration event, a virtual machine does not migrate to an Oracle VM server if this move violates an anti-affinity group setting. The same applies to maintenance mode, because putting an Oracle VM server in maintenance mode triggers migration events. However, if you have an HA event and there is only one available Oracle VM server on which to restart the virtual machine, the virtual machine restarts on that Oracle VM server even if doing so violates an anti-affinity rule.

Anti-affinity groups are a feature of server pools. When creating an anti-affinity group from the Oracle VM Manager UI, select the target server pool in the navigation pane on the Servers and VMs tab. Select the Anti-Affinity Group perspective in the management pane. Click the "Create New Anti-Affinity Group" icon to launch the wizard.

You can edit or delete an existing anti-affinity group.

# Quiz

Identify three elements that are part of an Oracle VM clustered server pool.

a. A disk heartbeat
b. A network heartbeat
c. A server pool file system
d. A standby Oracle VM server

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**Answer: a, b, c**

# Oracle VM Repositories

- The first section of this lesson described the features of server pools: clustered and non-clustered.
- OCFS2 was discussed as a key element of the clustering architecture of Oracle VM.
- You have learned how to create and manage server pools.
- The next section of this lesson is dedicated to repositories, and includes the following topics:
  - Repository structure
  - Creation of repositories
  - Addition of resources to repositories
  - Management of repositories

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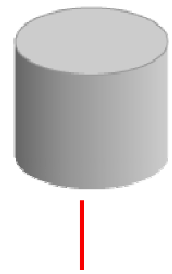
# Storage Repositories

- Repositories can be created on:
  - NFS shares
  - iSCSI or FC storage elements
  - Local storage
- All repositories, regardless of their underlying storage, share the same structure.



```
/OVS/Repositories/<Repository ID>/
    .ovsrepo
    Assemblies/
    ISOs/
    Templates/
    VirtualDisks/
    VirtualMachines/
```





A repository is a logical disk space that is made available through a file system created on a storage element. This storage element can be a network share that is accessed by using the NFS protocol or a physical disk that is accessed by using the iSCSI or the Fibre Channel protocol.

- **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 Oracle VM server acts as the worker component that performs the instructions given through the 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 that it uses. Consequently, a server pool must exist with clustering enabled, and at least one server must be present in the clustered pool.
- **Repository on local storage:** You can create a repository on an unused Oracle VM server disk. You can create repositories on local disks for clustered or non-clustered server pools.

It is a best practice to create repositories that do not exceed 8 TB in size.

A repository is used to store resources for creating virtual machines or to store components of virtual machines.

These resources include:

- ISO files
- Templates
- Assemblies (This is the location of virtual appliances.)
- The configuration files for virtual machines
- The virtual disks for virtual machines

**ISO Files**

An ISO file is a disk image of the contents of a CD or DVD. You can then use the ISO file instead of the CD or DVD.

**Templates**

An Oracle VM template is a virtual machine containing Oracle or other software that is prebuilt, preinstalled, preconfigured, and ready to use. Oracle VM templates of many key Oracle products are available for download, including Oracle Linux, Oracle Solaris, Oracle Database, Fusion Middleware, and many more.

Templates are brought into a repository by using an import operation. Importing a template or assembly is covered later in this lesson.

**Virtual Appliances**

A virtual appliance is an infrastructure template containing a configuration of multiple virtual machines with their virtual disks, and the interconnectivity between them. You can create virtual appliances as a set of `.ovf` (Open Virtualization Format) and `.img` (disk image) files, or all these files can be contained in a single `.ova` (Open Virtualization Format Archive) file. The term virtual appliances replaces the term assembly in both the GUI and the CLI. However, the change does not apply to the Assemblies directory.

**Virtual Machine Configuration Files**

Each virtual machine deployed to Oracle VM contains a configuration file, which contains information about its virtual disks or physical disks, its virtual network interface cards (VNICs), the boot loader (hardware virtual machine [HVM] or paravirtualized machine [PVM]), and other type of information. The contents of a virtual machine configuration file are discussed later in this lesson. Because a template is considered a type of virtual machine, its configuration files are stored in the Templates directory of the repository where the template was imported.

**Virtual Disks**

A virtual disk is a file disk image that represents a single disk for a virtual machine. A virtual machine can have several virtual disks in its configuration. The file-based disk images are mounted as loop devices when the virtual machine is started. Because templates are considered a type of virtual machine, their virtual disks also appear in the virtual disks directory.

**The `.ovsrepo` File**

In addition to the directories used to store repository resources, each repository contains a file called `.ovsrepo`. This file contains metadata for its repository, including the UUID of the Oracle VM Manager that owns the repository.

## Creating Storage Repositories

- To create a repository with the Oracle VM Manager UI, navigate to the Repositories tab and click the Create icon.
- NFS-based repositories can be shared among server pools:
  - No need to specify a server pool
- If you are using a physical disk for your new repository, you must also specify a server pool:
  - For a clustered pool, you can select any available physical disk.
  - For a non-clustered server pool, you can select only a physical disk in local storage.
- For repositories on a physical disk, an OCFS2 file system is created on the disk.

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**Create a Repository**

**Note:** If you intend to create a repository on a network file system, refresh the file system before you select it to house your new repository.

**Note:** When you create a repository on a shared disk, an OCFS2 file system is created on the shared disk. This does not apply to repositories created on NFS shares.

To create a repository, navigate to the Repositories tab from the Oracle VM Manager UI, and click "Create New Repository" on the toolbar.

In the Create Repository window, specify the following:

- A name for the repository
- The repository location:
  - A Network File Server if the location is an NFS share
  - A Physical Disk if the location is an iSCSI or FC LUN, or an unused local disk for any Oracle VM server
- If you select Network File Server, you then select a Network File System by using the Search function. You can optionally select a Share Path as a directory path if the repository is to be created in a subdirectory on the selected network file system.

- If you select a Physical Disk, you select a LUN by using the Search function.

  You also must select a server pool because building a repository on a physical disk requires that you specify a server pool:
  - If you select a clustered server pool, you can select any available physical disk.
  - If you select a non-clustered server pool, select a physical disk in a local storage array only.
- You can optionally add a description for your new repository.
- Click Next to trigger the creation of the new repository.

If the repository is created on a physical disk, Oracle VM directs an Oracle VM server to create an OCFS2 file system on the disk and to create the repository directory structure in the file system.

If the repository is created on an NFS share, Oracle VM directs an Oracle VM server to create the repository structure on the share without creating an OCFS2 file system on the share. If the NFS-based repository is shared among Oracle VM servers, NFS semantics are used.

After the repository is created, the second screen of the wizard appears. On this screen, you select the Oracle VM servers or server pools that can access the repository. This topic is discussed in the next slide.

## Presenting Repositories to Oracle VM Servers

- The last step for creating a repository is to present the repository to the Oracle VM servers.
- For a repository that is built on a physical disk, present the repository to all the Oracle VM servers in the server pool specified when creating the repository.
- For a repository built on an NFS share, present the repository to any Oracle VM server with access to the NFS share.
- Presenting a repository to an Oracle VM server triggers a mount operation on the server.
  - The repository can now be accessed as a file system.

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At the completion of the first step in creating a storage repository, the storage repository is built on the storage element selected: a physical disk, an NFS share, or the local disk of an Oracle VM server. The last step is to make this repository available to your Oracle VM servers before it can be used.

Typically, you present the storage repository to all the Oracle VM servers in a server pool. However, if you want to set up the storage differently, the Oracle VM Manager enables you to present a repository to a selection of Oracle VM servers instead of all the servers in the server pool.

If your repository is NFS based, you can present it to the Oracle VM servers in different server pools, as long as these Oracle VM servers have access to the NFS share.

You present a repository as the second step of the wizard when creating the repository. You have the choice of presenting the repository:

- To individual Oracle VM servers by selecting the servers from the list of available servers
- To all the Oracle VM servers in a server pool by selecting a server pool from the list of available server pools

You control this selection by using an option button in the wizard.

After completing the creation of a repository, you can do the following:

- Present or unpresent the repository to the Oracle VM servers or server pools at any time: Navigate to the Repositories tab, select the repository, and click “Present/Unpresent Selected Repository” on the toolbar.
- Release ownership for the repository by selecting the edit function for the repository and selecting the Release Ownership check box.

Presenting the storage repository to an Oracle VM server is the equivalent of mounting a file system. When you present a repository to the Oracle VM servers in your server pool, the file system is mounted by the `root` user on each Oracle VM server. This is an essential factor for HA operations in your Oracle VM environment.

# Creating Repository Exports for OCFS2-Based Repositories

- When you create a repository export, you configure NFS access to this repository from external hosts.
- Repository exports are created for one or more Oracle VM servers with access to the repository.
- You use this feature to enable third-party applications to perform a backup of the contents for a storage repository.
- To connect to the repository from the backup application by using NFS, you specify:
  - The full path to the repository
  - The IP address of the Oracle VM server with the configured repository export

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After creating an OCFS2-type repository, you can make the repository NFS-accessible from external hosts by configuring a repository export. The repository export feature enables you to back up the contents of a repository by using your site backup application. This feature is available for all OCFS2-based repositories, whether they reside on iSCSI/FC physical disks or on local storage. The feature is not available, and not needed, for NFS-based repositories.

When configuring a repository export, you first select an Oracle VM server with access to the repository. This is any Oracle VM server that has been presented to the repository. Generally, you select only one Oracle VM server to export the repository, but you are not limited to one server.

**Creating a Repository Export by Using the Oracle VM Manager UI**

1. In the navigation pane, select an Oracle VM server with access to the repository.
2. In the management pane, select the Repository Exports perspective.
3. Click the Create Repository Export icon.
4. In the Create Repository Export window, enter the IP address or host name for the client host (the host that is meant to access the repository as an NFS share).
5. Select the repository to export.
6. Specify options for the export operation (for example, `async` and `no_root_squash`).

## Backing Up the Repository Export from an External Host

1. Verify that you can access the repository by using NFS on the remote host.
2. Create a mount point for the repository on your external host.
3. Mount the repository as an NFS share.
4. Access and back up the NFS share by using a backup application.





The steps to access the repository remotely as an NFS share are as follows:

1. Verify that you can access the repository by using NFS.
   For example, from a host called `backup`, use the `showmount` command with the IP address of the Oracle VM server for which the repository export is configured.
   ```
   backup# showmount -e 192.0.2.101
   Export list for 192.0.2.101:
   /OVS/Repositories/0004fb0000030000120bb3d570106cc5 192.0.2.1
   ```
2. Create a mount point for the repository on your external host.
   ```
   backup# mkdir /mnt_repos
   ```
3. Mount the repository.
   ```
   backup# mount \
   192.0.2.101:/OVS/Repositories/0004fb0000030000120bb3d570106cc5 \
   /mnt_repos
   ```
4. You can now access the repository's contents at `/mnt_repos` from your backup application.

## Adding Resources to Repositories

- Use the import function to add templates, virtual appliances, and ISO files.
  - You use ISO files to create virtual machines from installation media.
  - With templates and virtual appliances, you quickly get virtual machines up and running with minimal intervention.
- Create or import virtual disks for existing or future virtual machines.
- Import an existing virtual machine.





You can perform this step before creating a server pool if your repository is located on an NFS share. However, you must present the repository to at least one Oracle VM server before attempting to populate your repository.

As discussed in the lesson titled “Planning and Installation,” the appropriate HTTP or FTP infrastructure must be in place before attempting to import resources in the repository.

**Importing Virtual Appliances, Templates, ISO Files, and Virtual Disks**

To import virtual appliances into the repository, select the target repository in the navigation pane on the Repositories tab, select the Assemblies folder, and use the Import button that is available in the management pane. Similarly, to import ISO files, templates, or virtual disks, select the corresponding folder for the repository in the navigation pane, and use the Import button in the management pane.

**Creating a New Virtual Disk**

To create a new virtual disk, select the Virtual Disks folder under the target repository and click the Create Virtual Disk icon in the management pane.

Select a name for your virtual disk, enter a size in GiB, and optionally, provide a description.

You can also specify whether the virtual disk can be shared by multiple virtual machines by selecting the Shareable check box. Shareable virtual disks have read/write privileges for all virtual machines that access the virtual disk, and you must use them with caution.

Lastly, you can specify the allocation type to be used when creating the virtual disk: sparse or non-sparse allocation. With sparse allocation, the file system can postpone allocating space until the disk is written to.

**Importing a Virtual Machine**

You can import a virtual machine by using the Oracle VM Manager and have the virtual machine deployed to a server pool, or placed in the Unassigned Virtual Machines folder if you do not want to deploy it.

A virtual machine is composed of a virtual machine configuration file and one or more virtual disks. The virtual machine elements must be located on an FTP or a web server, either as separate files or compressed into a single archive file (for example, a `.tgz` or `.zip` file).

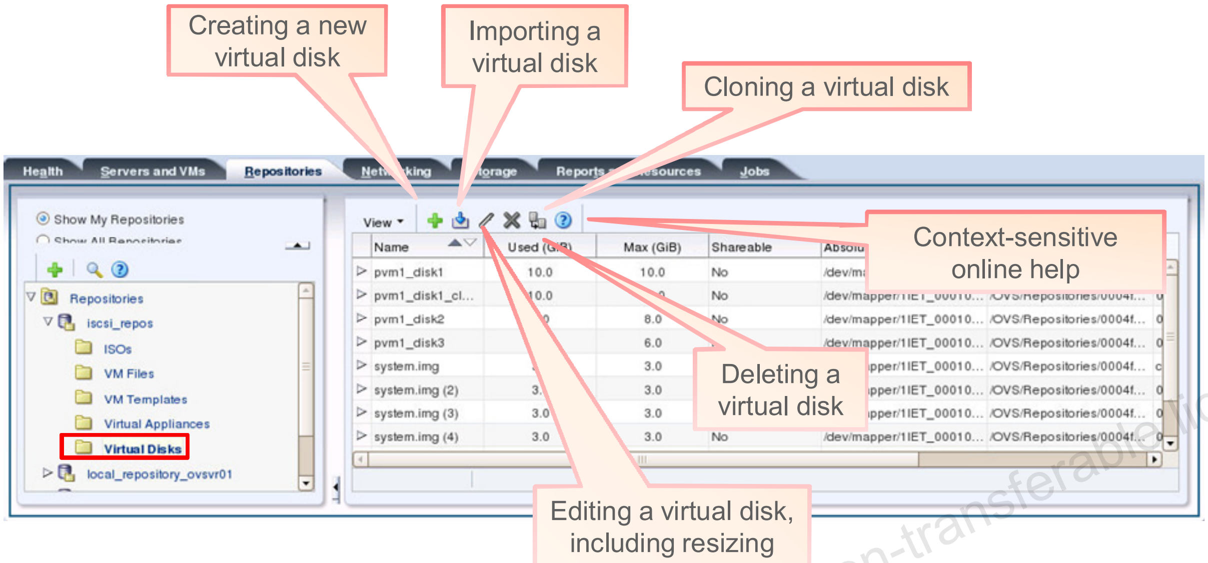
To import a virtual machine, you select one of the following from the Servers and VMs tab:

- The Server Pools folder in the navigation tree, and a specific server pool in the management pane
- A specific server pool in the navigation tree
- The Unassigned Virtual Machines folder in the navigation tree

Depending on your selection, you find the Import Virtual Machine function as a selection in the shortcut menu or as an icon in the management pane.

On the Import Virtual Machine screen, you choose the repository where the elements of your virtual machine are to be stored. The list of available repositories depends on your previous selection: a specific server pool or the Unassigned Virtual Machines folder. For example, if you selected a server pool, you have the option of saving the virtual machine elements to any storage repository that is presented to at least one Oracle VM server in the server pool.

# Managing Virtual Disks in Repositories




**Operations on Virtual Disks**

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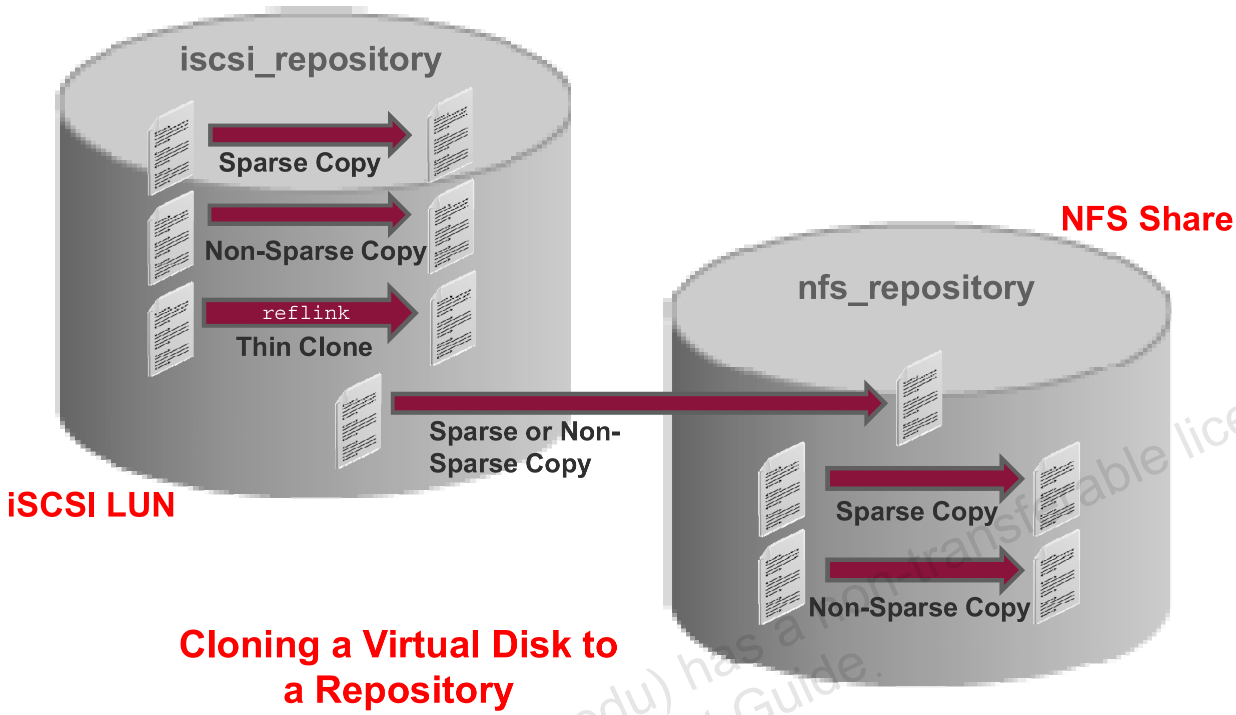
In the previous slide, you learned that you can create virtual disks in and import virtual disks to a repository.

After you add virtual disks, either by creating or importing them, you can perform the following operations on the virtual disks:

- **Edit the virtual disk:** You can change the disk's name and its size, and make the virtual disk shareable by other virtual machines. If you are resizing the virtual disk, ensure that the virtual machine's operating system can support this operation.
- **Clone the virtual disk:** This action creates an identical copy of the virtual disk. Cloning a virtual disk is discussed next.
- Delete the virtual disk.

## Cloning a Virtual Disk








Recall that when cloning physical disks, thin cloning can be used if the vendor-specific plug-in supports it. When cloning physical disks with generic plug-ins, the target physical disk must already exist.

When cloning virtual disks, you have a choice of targets for the cloning operation:

1. To the same repository or to another repository
2. To a physical disk in a generic or vendor-managed storage array

This slide discusses case 1. Case 2 is discussed in the next slide.

When cloning a virtual disk to a repository, the target virtual disk is always created by the cloning operation. Virtual disks are stored as files in the repository; therefore, the cloning operation results in a file copy operation. The cloning modes that are available for the cloning operation depend on the type of repository.

**Cloning in NFS-Based Repositories**

When cloning a virtual disk to a new virtual disk in the same NFS-based repository or to another repository of any type, you can choose to clone the virtual disk by using a sparse or non-sparse copy.

- A sparse copy does not allocate the “holes” or unused areas in the file.
- A non-sparse copy operation copies all blocks, including the empty blocks.

The diagram in the slide shows two cloning operations in the NFS-based repository. One cloning operation uses a sparse copy and the other operation uses a non-sparse copy. Both cloning operations result in the creation of a new virtual disk in the NFS repository.

**Cloning in LUN-Based Repositories**

Sparse or non-sparse copy modes are also available for the cloning operations within the same LUN-based repository.

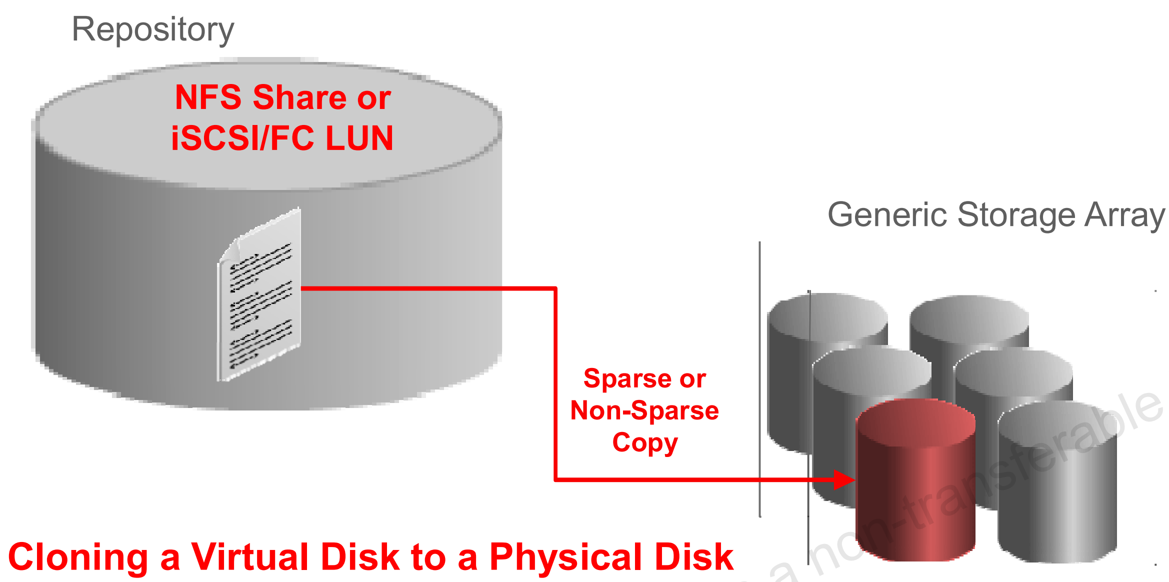
You can also choose to create a thin clone, but this selection is valid only when the target repository is the same as the source repository. The thin cloning feature is provided by the reflink feature of the OCFS2 file system.

The reflink feature is discussed in the lesson titled “Managing Storage.”

**Cross-Repository Cloning**

When cloning a virtual disk from one repository to another repository, thin cloning is not supported regardless of the type of repository involved. This situation is illustrated in the diagram in the slide where a virtual disk in the iSCSI-based repository is cloned to a new virtual disk in the NFS-type repository. When cloning across repositories, you can select only a sparse or non-sparse copy for the cloning operation.

# Cloning a Virtual Disk







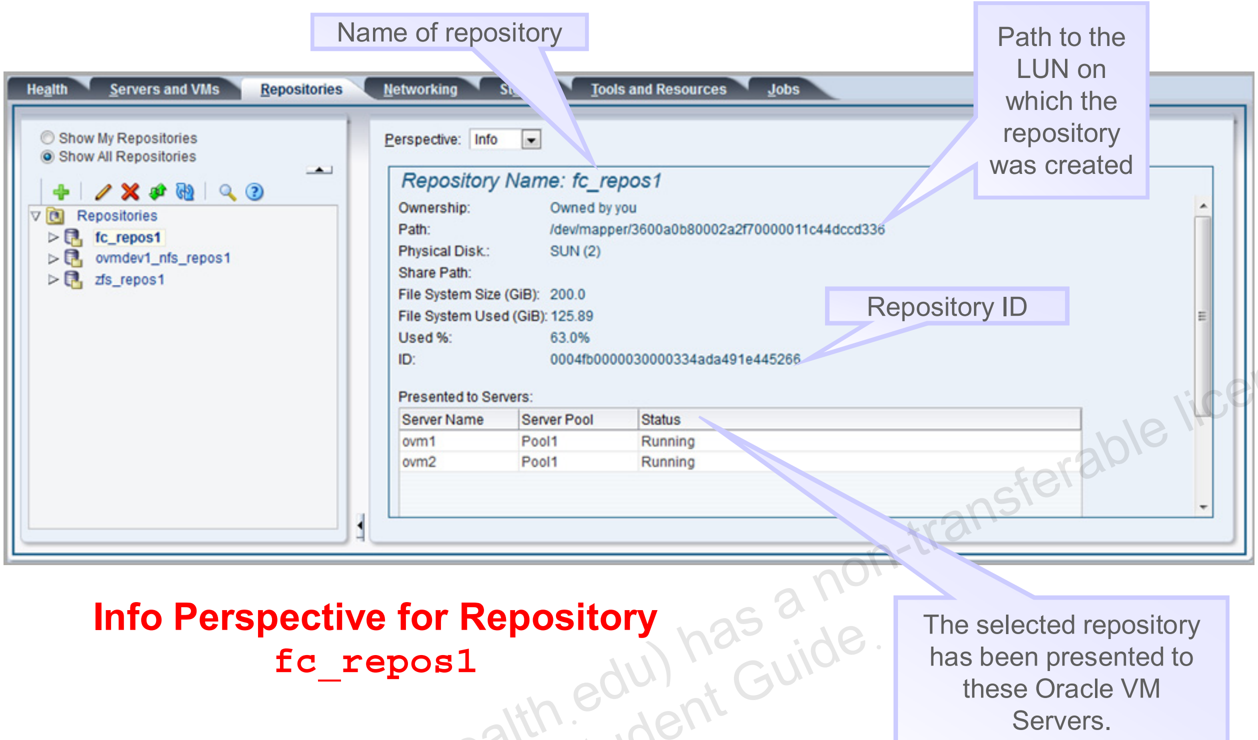

This slide discusses the case where a virtual disk, in any type of repository, is cloned to a physical disk, which resides in a generic storage array or in a storage array that is managed with a vendor plug-in.

When cloning a virtual disk to a physical disk, the target physical disk must already exist, whether it exists in a generic or vendor-managed storage array.

For the cloning operation, you select the option to trigger a sparse or non-sparse copy.

The cloning of a virtual disk to an already existing physical disk is illustrated in the diagram in the slide. In this example, the target disk is located in a storage array that is managed with a generic plug-in. The target disk must be the same size as or bigger than the source virtual disk.

# Obtaining Information About a Repository




**Info Perspective for Repository**
**`fc_repos1`**

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To display information about a particular repository, click the Repositories tab, highlight the repository in the navigation pane, and select the Info perspective in the management pane. In this view, in addition to the Oracle VM servers that are presented to the repository, you can examine the size of the repository in GiB, its usage level, and the ID for the repository.

With this ID, you can locate the mounted repository when you are logged in to any Oracle VM server with access to the repository. For example, ID `0004fb0000030000334ada491e445266` is displayed in the Oracle VM Manager UI for the `fc_repos1` repository. By using this ID, you can quickly find and access the directories for this repository on Oracle VM server `ovm1` or `ovm2` by executing the `df` command from the server:

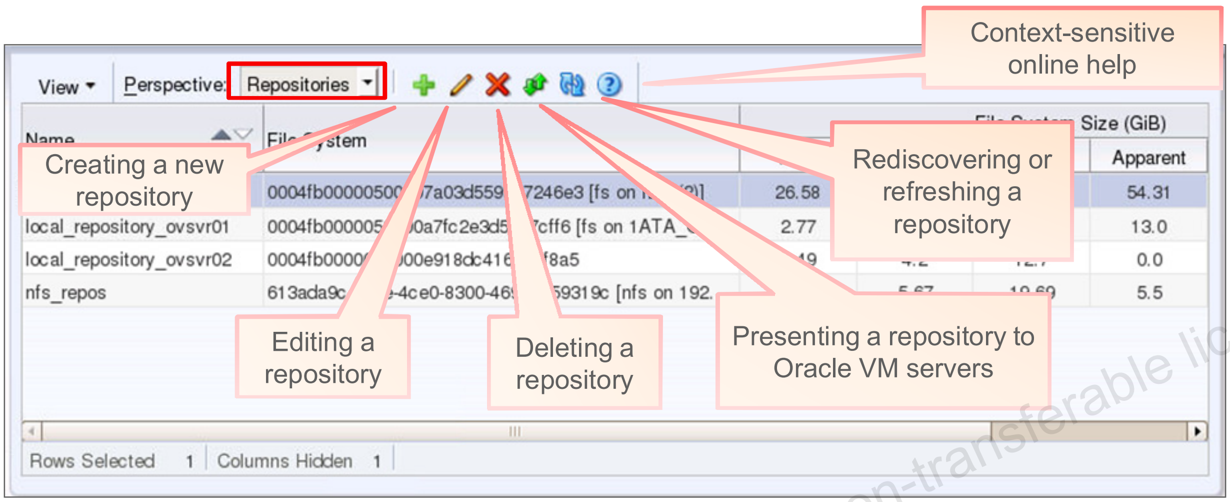
```
[root@ovm1 ~]# df -h
Filesystem                        Size  Used Avail Use% Mounted on
/dev/sdf2                          50G  1.2G   46G   3% /
tmpfs                             420M   16K  420M   1% /dev/shm
/dev/sdf1                         477M   46M  402M  11% /boot
none                              420M   40K  420M   1% /var/lib/xenstored
/dev/mapper/1IET_00010001          13G  369M   13G   3%
                               /poolfsmnt/0004fb0000050000e3f61cdb72412e85
```

```
/dev/mapper/3600a0b80002a2f70000011c44dccd336
     200G  126G   75G  63%
/OVS/Repositories/0004fb0000030000334ada491e445266
10.150.36.208:/repos
      50G  4.2G   45G   9%
/OVS/Repositories/0004fb0000030000bea81983761e4f65
/dev/mapper/3600144f0bf442eca000051d712ed000f
     200G   65G  136G  33%
/OVS/Repositories/0004fb0000030000ab8a00cda23aa474
[root@ovm1 ~]#
```

The mounted repository that corresponds to ID `0004fb0000030000334ada491e445266` is shown in bold.

# Managing Repositories

**Operations on Repositories**










On the Repositories tab, you perform most operations on repositories by highlighting the Repositories folder in the navigation pane and highlighting a repository in the management pane. The operations that are allowed on the repository are active on the toolbar.

**Creating a New Repository**

This topic was discussed earlier in this lesson. In summary, you can create repositories on NFS shares, iSCSI or FC LUNs, or local disks of Oracle VM servers.

**Editing a Repository**

You can change the name and description of a repository and release ownership. You can also present the repository to or unpresent it from server pools or individual Oracle VM servers.

**Deleting a Repository**

Before you can delete a repository, you must delete its contents. When the repository is empty, you can delete the directory. The delete operation also deletes the file system that contained the repository.

If you want to remove a repository from a server pool without deleting its contents, edit the repository and select the Release Ownership check box. By releasing the ownership of a repository, you can transfer ownership of the repository to another server pool.

### Presenting a Repository to or Unpresenting It from Oracle VM Servers or Server Pools

This operation is available from the Edit function or as a separate function that is selectable on the toolbar. When you add a new Oracle VM server to a server pool, you must also add this Oracle VM server as an initiator to all the access groups that are active for the storage accessible to the server pool, and finally present all the active repositories to the new server in the server pool.

### Refreshing the Contents of the Repository

During the refresh operation, any detected changes are reflected in the various locations (Assemblies directory, ISOs directory, and so on) in the storage repository.

This operation is useful in the following situations:

1. If you have made changes to your repository directly, without using the Oracle VM Manager UI or the Oracle VM CLI
2. If you have taken ownership of an existing repository
3. If you have reinstalled your Oracle VM Manager and you want to rediscover repositories that were created with the earlier instance of the Oracle VM Manager

For Case 3, you must use the same UUID for the Oracle VM Manager during the reinstallation process to rediscover the storage repositories that were available with the previous installation. The UUID for the Oracle VM Manager is discussed in the lesson titled “Planning and Installation.”

### Displaying Events for a Repository

Display events for a repository by highlighting the repository in the navigation pane and selecting the Events perspective in the management pane.

## Quiz

Which three locations are supported to house a repository?

a. An NFS share
b. The server pool file system
c. An iSCSI LUN
d. An unused internal disk in any Oracle VM server
e. A virtual disk



**Answer: a, c, d**

## Summary

In this lesson, you should have learned how to:

- Describe the role of server pools and server pool file systems
- List the features of a clustered server pool
- Describe the role of OCFS2 in the server pool cluster
- Prepare for server pool deployment
- Create and manage server pools
- Describe the function and structure of Oracle VM repositories
- Create repositories and add resources to the repositories
- Manage repositories and their resources

## Practice 5: Overview

This practice covers the following topics:

- Refreshing the rediscovered NFS repository
- Creating a clustered server pool
- Creating an iSCSI repository
- Importing resources into the repository
- Move a template between repositories
- Performing disk and cloning operations for resources in the repository
- Creating repositories on local storage
- Optionally, configure a repository export

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6

# Managing Virtual Machines

# Objectives

After completing this lesson, you should be able to:

- Describe virtual machine components
- List the steps to prepare for virtual machine creation
- Discuss the various ways to create virtual machines
- Perform the steps to create virtual machines
- Install a guest operating system (OS) within a virtual machine
- Discuss the use of templates and virtual appliances
- Use cloning and clone customizers to create additional virtual entities
- Access and manage virtual machines

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## Lesson Overview

- This lesson is about creating, accessing, and cloning virtual machines.
- In the first section, you learn about what you need to create virtual machines, and the various ways to create these virtual machines.
- You then step through the creation of a virtual machine by using the installation media.
- Other creation methods are also discussed: over-the-network installations and Kickstart installation.
- The rest of this lesson addresses cloning and managing virtual machines.

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In the previous lessons, you learned how to manage networks, storage, server pools, and repositories in your Oracle VM environment. Your next step is to create virtual machines.

In preparation for creating virtual machines:

- You are introduced to the concepts and you review terminology related to virtual machines
- You review the disk storage options for virtual machines
- You learn how to create virtual network interfaces for your virtual machines

You are then guided through the steps to create a virtual machine with installation media.

Other installation methods are also discussed:

- Using installation media that is available over the network
- Using Kickstart with PreBoot Execution Environment (PXE) boot
- Using the P2V utility, which allows you to convert a physical host into a virtual host

The next section of this lesson addresses cloning virtual machines and templates to create new virtual machines and templates.

The last section covers the virtual machine life cycle, management, and high availability.

## Review: Virtual Machine Terminology

- **Domain:** A configurable set of resources, including memory, virtual CPUs, network devices, and disk devices, in which a virtual machine runs
- **Virtual machine:** An isolated virtual environment that provides an operating environment for a guest operating system
- **Guest:** A guest operating system that runs within a domain in an Oracle VM server
- **Dom0:** The management domain with privileged access to the hardware and device drivers

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The terms that are defined in the slide appear in many different contexts and a clear understanding of these terms is useful, not only for creating virtual machines with Oracle VM but also to deal with all aspects of server virtualization.

**Domain**

A domain is a Xen concept, although the term is used with other virtualization platforms. It refers to a set of resources in which a virtual machine runs.

**Virtual Machine**

A virtual machine is:

- An isolated virtual environment that provides an operating environment for a guest operating system
- A persistent entity that resides on storage, but when started, runs in a domain

Oracle VM uses the term virtual machine for a virtual environment that is running on an Oracle VM server. A running virtual machine is seen as a domain by the Xen hypervisor.

### Guest

A guest is an instance of an operating system that is running in a virtual machine. Often, guest and virtual machine are used interchangeably. However, with Oracle VM, you can choose to switch the operating system in your virtual machine, in which case, the guest would be different.

### Dom0

Dom0 refers to domain 0, which is a privileged domain that serves as an administrative domain to the Xen hypervisor. Although the Xen hypervisor is responsible for allocating resources to domains, dom0 has access to most physical devices, because it controls the device drivers to these physical devices.

Dom0 is the first domain to be launched when the Oracle VM server boots. Other domains are launched from dom0.

## Review: Virtual Machine Terminology

- **Xen hypervisor:** The Xen hypervisor is a small, lightweight virtual machine monitor. It controls the most basic resources of the host machine.
- **DomU:** This is an unprivileged domain with no direct access to the hardware or device drivers.
- **PV (paravirtualized) machine or PVM:** The modified kernel of the PVM is virtualization-aware, which offers performance benefits.
- **HV (hardware-virtualized) machine or HVM:** The HVM depends on the virtualization platform for its hardware operations. It can run unmodified.
- **HVM with PV drivers:** An HVM with the addition of paravirtualized drivers provides increased performance.

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### Xen Hypervisor

The Xen hypervisor is a small, lightweight virtual machine monitor, which executes multiple virtual machines on one physical system. It controls the most basic resources of the system, including CPU and memory usage, privilege checks, and hardware interrupts. The hypervisor uses the services of dom0 for administering the unprivileged domains. This allows the hypervisor to remain small.

### DomU

This is any unprivileged domain with no direct access to the hardware. When a virtual machine starts, it is assigned a domain ID, starting with ID 1. Resources are allocated to the unprivileged domain, and, therefore, to the virtual machine that runs in the domain. A domain is removed when the virtual machine in it is stopped. Alternatively, the virtual machine is not removed, and its components still exist in a repository and/or physical disks.

### PV Machine (PVM)

A paravirtualized machine is a virtual machine that is running a guest with a modified kernel. The kernel is aware that it is running on a hypervisor, and not on bare metal. As a result, I/O operations are handled more efficiently. Oracle VM supports PV kernels for Oracle Linux and Red Hat Enterprise Linux.

For a complete list of paravirtualized and supported guest operating systems, consult the Oracle VM release notes for your version of Oracle VM.

**HV Machine (HVM)**

A hardware-virtualized machine is a guest that depends on the virtualization platform (Xen hypervisor and dom0) to provide emulation for its hardware functions. The HV machine is unaware that it is running in a virtual environment and, therefore, can run unmodified. Unmodified operating systems such as Linux and Windows can run as HV machines.

**HVM with PV Drivers**

You can install paravirtualized drivers in supported guest operating systems to increase the performance of network and block I/O operations.

## Creating Virtual Machines

- Using the installation media:
  - For example, use the ISO file for Oracle Linux 6 Update 5.
- Installing over a network, with or without PXE:
  - Your virtual machine obtains an IP address and the required configuration and installation files from a network location.
- Using cloning, with templates and virtual appliances
- Using import and other utilities:
  - Importing a virtual machine
  - Importing an existing virtual disk
  - P2V







**Using Installation Media**

If your virtual machine is an HVM guest, you can boot from an ISO image and install the operating system as you would on a physical machine.

If your virtual machine is hosting a PVM guest, you cannot use the ISO file directly, but can specify an exploded ISO file in a network location that is accessible by the virtual machine. Details of this process are discussed later in this lesson.

**Using Cloning with Templates and Virtual Appliances**

You can also create virtual machines from templates and virtual appliances. Templates and virtual appliances are first imported into repositories. After they are stored in repositories, you use cloning to create virtual machines or other templates in the following ways:

- By creating virtual machines or other templates based directly on the available templates
- By creating templates from virtual appliances, and then cloning virtual machines by using these templates
- By customizing the cloning process and creating new virtual machines based on this customization

There is more information about cloning and customizing the cloning process later in this lesson.

You can also create a virtual machine from an existing virtual machine that was created by using another virtualization platform. You do this by converting this virtual machine to a virtual machine appliance (`.ova` format) and importing the virtual machine appliance into a repository as a virtual appliance. Then, you create a template from this virtual appliance. After the template is created, use this template to create virtual machines (and possibly other templates).

**By Importing a Virtual Disk**

You can create a new virtual machine by using one or more virtual disks that contain a guest operating system:

1. Import the existing Oracle VM virtual disk images (raw disks) that reside in a network location that is accessible via HTTP, HTTPS, or FTP.
2. Create a virtual machine and include these virtual disks as part of the virtual machine's configuration.

**By Importing a Virtual Machine**

Similar to importing a virtual disk, you can import a virtual machine by using HTTP, HTTPS, or FTP. The files that make up the virtual machine can be imported as separate files or compressed into a single archive (for example, a `.tgz` or `.zip` file).

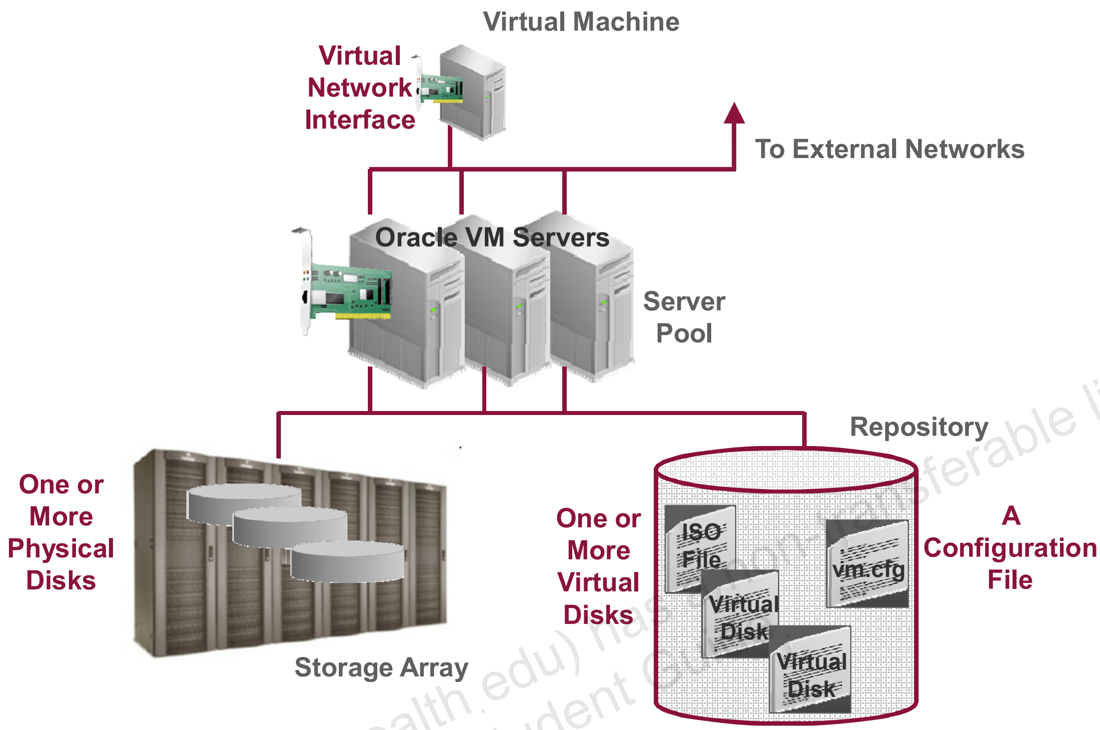
When importing the virtual machine, you specify a target repository and optional proxy information if your environment requires a proxy setting.

**Using a Physical Machine**

You can create a new virtual machine by converting a physical Linux or Windows computer into a virtual machine by using the Physical to Virtual (P2V) utility.

The P2V utility is documented in the chapter titled "Converting Hosts" in the *Oracle VM Administrator's Guide*, Part Number E50251-03 or later.

## Virtual Machine Components

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The diagram in the slide shows a virtual machine with the following components:

- Virtual disks residing in a repository, including an ISO file for operating system installation or further package installation
- A virtual machine configuration file (`vm.cfg`) residing in the same repository
- Additional physical disks located in a storage array
- A VNIC mapped to a real network interface on the Oracle VM server where the virtual machine is running

  **Note:** The VNIC is specified in the virtual machine configuration file.

Before creating a new virtual machine, make sure that the following resources are available and accessible:

- A server pool with at least one Oracle VM server to run the virtual machine
- Access to one or more repositories
- An ISO file if you are installing the guest OS in the virtual machine from installation media

- Virtual disks and/or physical disks where the guest’s operating system, applications, and data will reside
- One or more virtual network interfaces to allow the virtual machine to communicate with other virtual machines and/or the outside world

**Note:** In the diagram, the configuration file and the virtual disks are located in the same repository, but when creating a virtual machine, you are prompted for the repository where the configuration file is to be stored. This location can be different from the location of the virtual disks.

In the following slides, after reviewing storage concepts, you learn how to create virtual disks and VNICs in preparation for creating a virtual machine.

## Review: Disk Storage for Virtual Machines

- A virtual machine's operating system, applications, and data reside on one of the following storage entities:
  - Virtual disks, including shared virtual disks
  - Physical disks, including shared physical disks
- Virtual disks (shared or not) are stored as disk image files in a repository.
- Physical disks are volumes (also called LUNs) that reside in the storage arrays that are configured to your Oracle VM environment.
- Unused internal disks or disk space in your Oracle VM servers are also seen as physical disks in Oracle VM.



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A virtual machine needs at least one disk from which to boot and to run the operating system.

**Virtual Disks**

Virtual disks are represented as files (for example, `vm_disk1.img`). These files are stored in repositories in the `VirtualDisks` directory. The directories present in each repository are listed in the lesson titled "Server Pools and Repositories." For a highly available virtual machine, its disks must be accessible by all the Oracle VM servers in the server pool. High availability for a virtual machine is discussed later in this lesson.

You create virtual disks before creating your virtual machines or during the creation process. To create a virtual disk by using the Oracle VM Manager UI, highlight the Virtual Disks folder for a repository from the Repositories tab and click the Create Virtual Disk icon in the management pane. During creation, you can specify whether the virtual disk is shared. If you have already created one or more virtual disks, you select these disks when creating the virtual machine. If no virtual disk is available, you are given the opportunity to create one or more virtual disks for your virtual machine from within the Create Virtual Machine Wizard.

### Physical Disks

Physical disks are storage volumes (or LUNs) that reside in storage arrays. These storage arrays make these physical disks available through either the iSCSI or Fibre Channel protocol. To access these physical disks and to use them as disks for virtual machines, you discover the storage arrays and their storage elements. This process is discussed in the lesson titled "Managing Storage."

Physical disks in Oracle VM also include unused internal disks and unused space on the installation disk in your Oracle VM servers. These physical disks become part of a special volume group called Local Storage Volume Group.

After the virtual machine creation process, all its virtual disks that reside in repositories and all its physical disks that are in storage arrays are listed in the virtual machine's configuration file.

## Virtual Machine Networking

- The Virtual NICs tool reserves MAC addresses, which are dynamically assigned to VNICs as they are created for use by virtual machines.
- When creating a virtual machine, you add one or more VNICs for virtual machine communication.
- You define a range of MAC addresses, and you specify an initial MAC address.
- VNICs are automatically related to a network bridge on the hosting Oracle VM Server.

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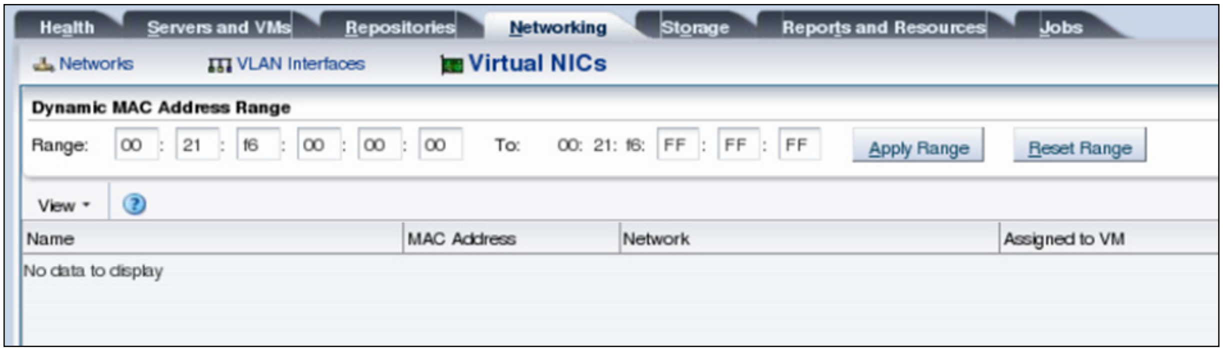
The Virtual NICs tool is a feature of the Oracle VM Manager. With the tool, you can reserve a range of MAC addresses to assign to the VNICs that you define for your virtual machines.

When you create a virtual machine, you can add one or more VNICs to allow your virtual machine to communicate with other virtual machines or with external networks. These VNICs exist as objects in the Oracle VM Manager database after they are created and they appear as entries in the virtual machine configuration file, `vm.cfg`.

When you add a VNIC as part of the virtual machine creation process, you can choose to assign a MAC address dynamically from the range that you defined from the Virtual NICs tool or you can manually specify a MAC address.

When the virtual machine is started, each VNIC is activated and linked to a network bridge on the Oracle VM server where it is running. For each VNIC, a corresponding network interface is configured in the virtual machine OS and this interface is used in the same manner as a physical NIC would be in a physical machine.

# Using the Virtual NICs Tool




- Access the Virtual NICs Tool on the Networking tab.
- Reserve a range of MAC addresses. First, you specify an initial MAC address.
  - The first three octets are already preset, followed by zeros:
    **00:21:f6**:00:00:00
  - Specify the last three octets for the ending MAC address in the range.

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**Using the Virtual NICs Tool**

You access the Virtual NICs tool on the Networking tab.

When using the Virtual NICs tool to reserve MAC addresses, the first three octets of the starting address are already set. These octets are assigned to Oracle Corporation and Oracle recommends not changing them.

**Specifying the Dynamic MAC Address Range**

- Specify the initial MAC address range by entering a value for the next three octets, or accept the default octets.
- Specify the last three octets for the ending MAC address in the range.

The range of MAC addresses is stored in the Oracle VM Manager database and the MAC addresses from this range are available to assign dynamically to VNICs when you add them to your virtual machines.

You can modify the range of reserved MAC addresses from the Virtual NICs tool and you can also specify an unused MAC address for a VNIC when you add the VNIC to your virtual machine's configuration. Changing the MAC address range does not affect the already allocated MAC addresses for existing VNICs.

**Note:** If you run more than one Oracle VM Manager instance, you must not have overlapping MAC address ranges. If you assign a MAC address that is already in the Oracle VM Manager database, an error message is displayed. However, no message is displayed if the MAC address is used outside of your Oracle VM environment.

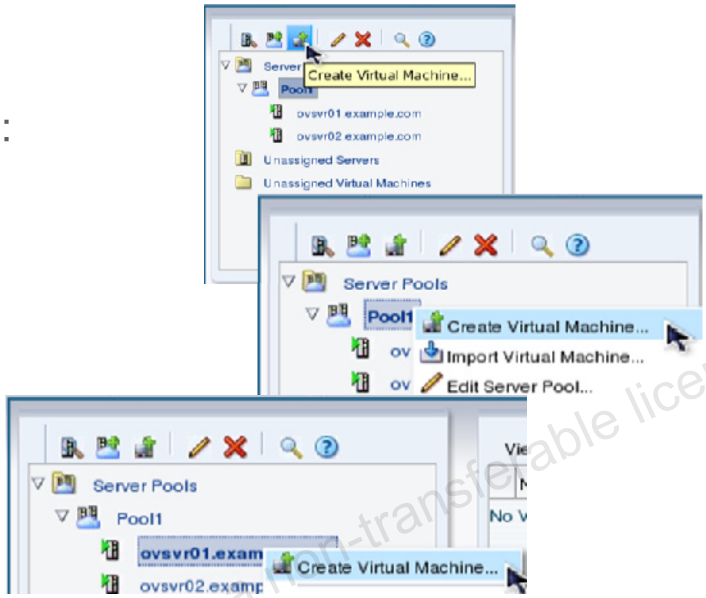
After you reserve a range of MAC addresses, you can return to the Virtual NICs tool and display the list of used MAC addresses. For each MAC address in use, the list shows:

- The MAC address that is assigned to the configured VNIC
- The network that is assigned to the associated VNIC
- The virtual machine to which the MAC address is assigned

## Creating a Virtual Machine

Multiple options for launching the Create Virtual Machine Wizard in the navigation pane:

- Toolbar icons
- Shortcut menu for any server pool in the navigation tree
- Shortcut menu for any Oracle VM server in the navigation tree







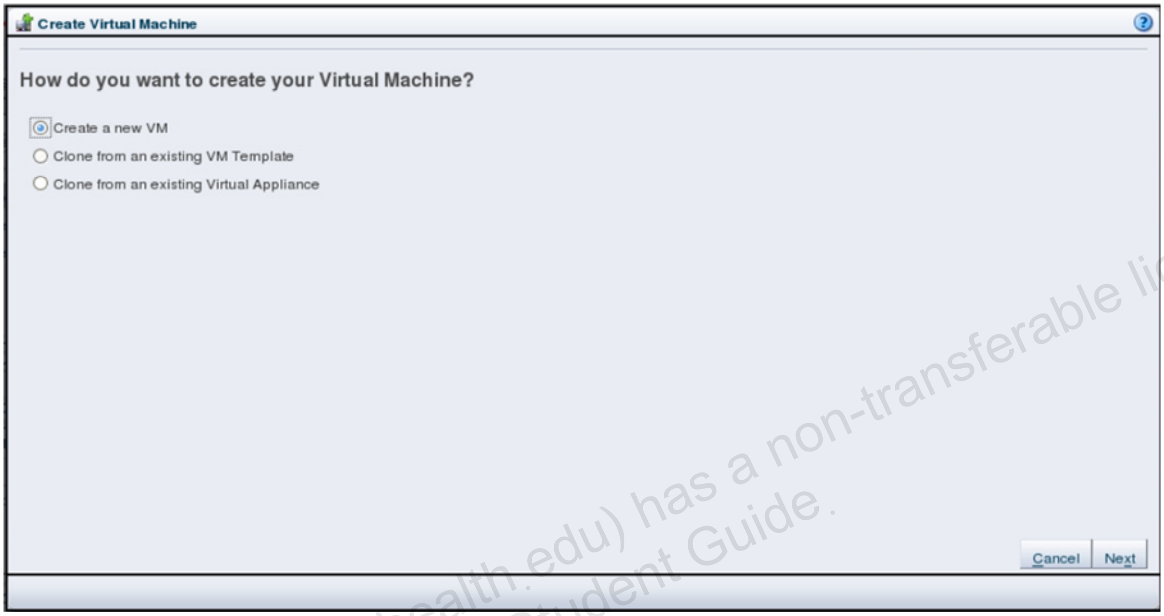



To create a virtual machine, you launch the Create Virtual Machine Wizard. You have several choices on how to launch the wizard from the Oracle VM Manager UI. For example, on the Servers and VMs tab, select Create Virtual Machine:

- On the toolbar in the navigation pane
- From the shortcut menu for any server pool in the navigation tree
- From the shortcut menu for any Oracle VM server in the navigation tree

# The Virtual Machine Wizard

- First screen of the Create Virtual Machine Wizard
- How do you want to create?





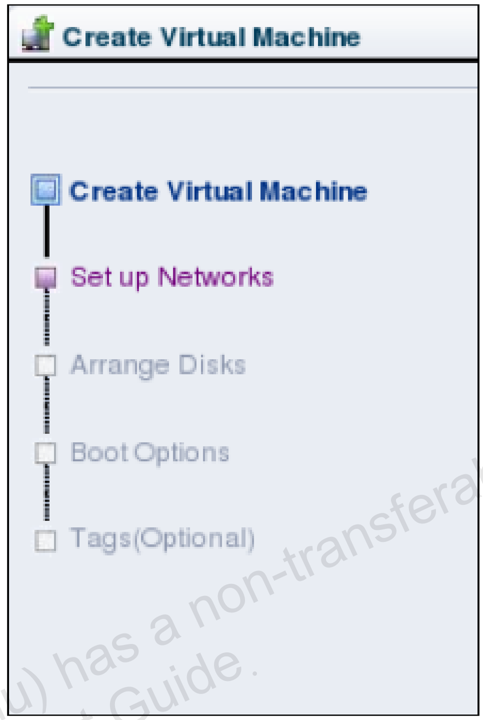

On the first screen of the Create Virtual Machine Wizard, you select the option to create a virtual machine from the beginning, or by using cloning from a VM template or virtual appliance. This section covers how to create a virtual machine from the beginning, that is, by specifying all the components and configuration choices for the new virtual machine. Creating a new virtual machine by using cloning is discussed later in this lesson.

To advance to the next screen and start the creation of your new virtual machine, select the "Create a new VM" option button and click Next.

## Steps to Create a Virtual Machine

Enter information on the following screens:

1. Create Virtual Machine
2. Set up Networks
3. Arrange Disks
4. Boot Options
5. Tags (Optional)







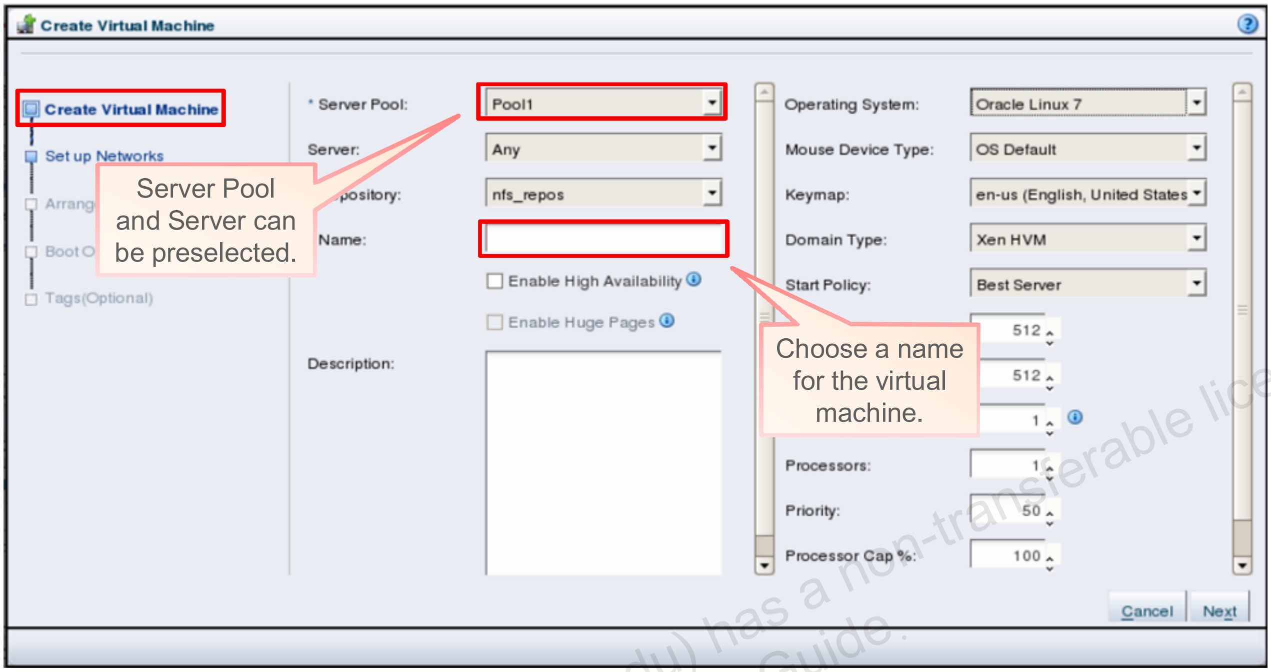



The wizard presents five screens (the Tags screen is optional) to step you through the creation of your new virtual machine:

1. **Create Virtual Machine:** On this screen, enter information about the virtual machine. This information includes a name for the virtual machine, its domain type, OS, memory, and more.
2. **Set up Networks:** On this screen, you create VNICs and associate them with a network.
3. **Arrange Disks:** On this screen, you select the virtual or physical disks, and the ISO files that are to be part of your virtual machine disk configuration. You also specify the disk order. From this screen, you can create one or more virtual disks. This creation step is optional.
4. **Boot Options:** On this screen, you select the boot devices and their order. You can also specify a PXE boot option. A PXE type boot is required if you are installing a PV machine from a mounted ISO file that is available over the network.
5. **Tags:** On this screen, you select one or more existing tags for the new virtual machine. By tagging this virtual machine, you can group it with other objects according to your own selection criteria.

More information about the parameters and selections that are available when creating a virtual machine is provided in the following slides, which walk you through an example of creating a virtual machine.

# Example: Creating a Virtual Machine Using the Installation Media




**Create a Virtual Machine**

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This slide and the next slides present an example of creating a virtual machine by using an ISO file. However, you can create a virtual machine from the beginning without an installation from installation media. For example, if you import a virtual disk that contains a complete bootable OS, you can create a virtual machine to include the virtual disk and boot the virtual machine immediately after creating it.

The rest of this slide describes some of the parameters that appear on the Create Virtual Machine screen. For a complete list and description of these parameters, see the topic titled "Create Virtual Machine" in the *Oracle VM Manager User's Guide*, Part Number E50250-03 or later.

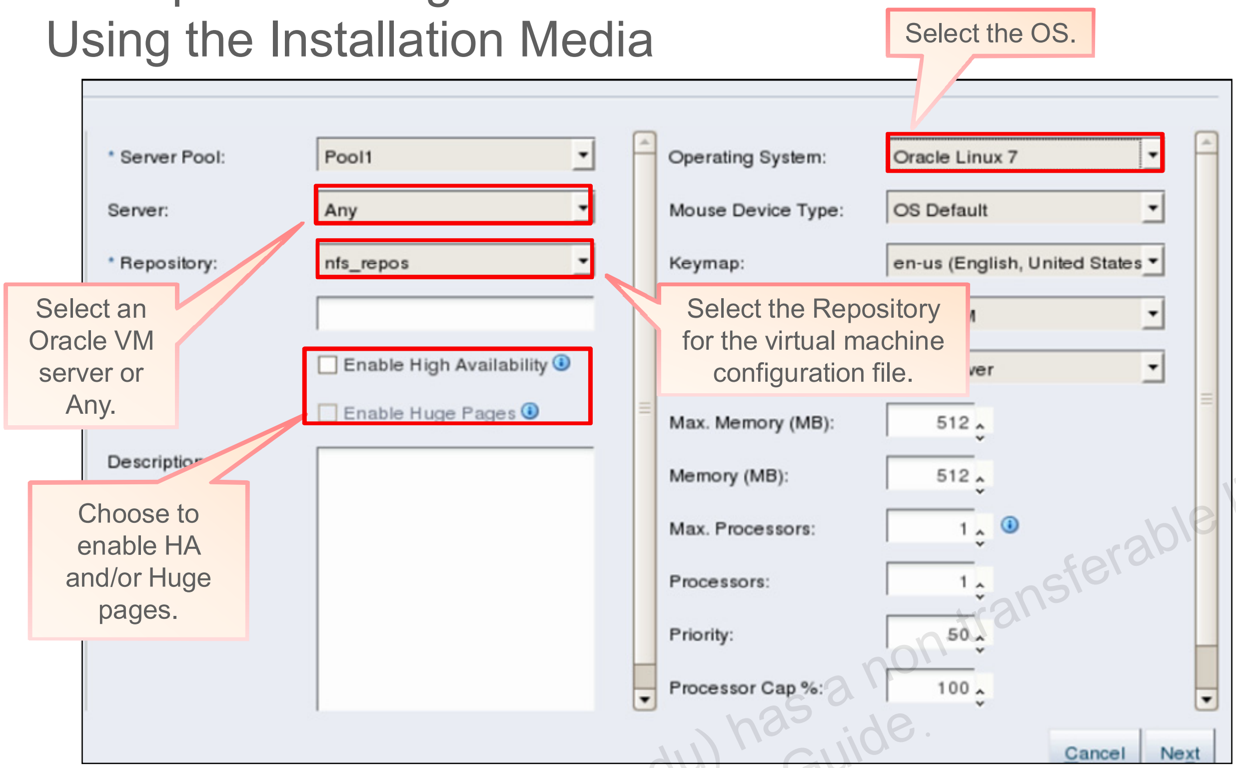
### Description of Parameters

If you choose "Create Virtual Machine" from the shortcut menu of any server pool, the Server Pool field is prefilled on the Create Virtual Machine screen.

Similarly, if you choose "Create Virtual Machine" from the shortcut menu of any Oracle VM server, the Server Pool and Server fields are prefilled on the Create Virtual Machine screen.

If you click the Create Virtual Machine icon on the toolbar of the navigation pane on the Servers and VMs tab, you must select the server pool and the Oracle VM server where the virtual machine is to be deployed.

# Example: Creating a Virtual Machine Using the Installation Media




**Create a Virtual Machine**

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After you select a server pool, you can select any Oracle VM server in the server pool. Select Any if you do not have a preference.

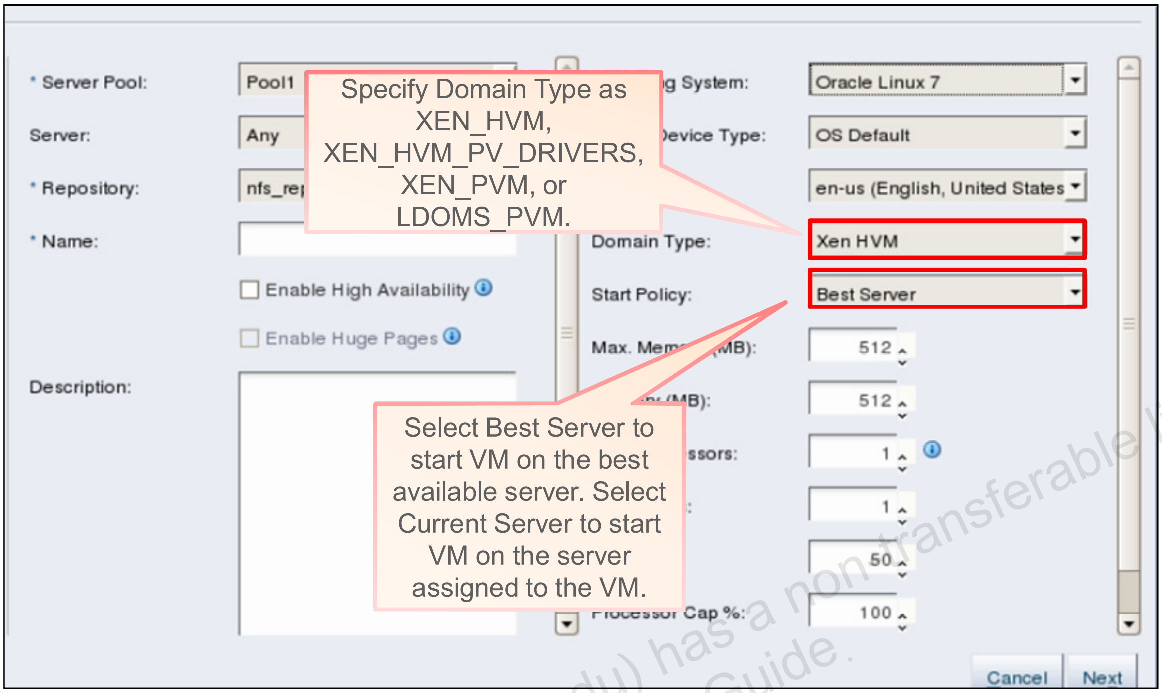
You select a **repository** in which to create the virtual machine configuration file. The list of available repositories depends on your server pool choice. You give your new virtual machine a name and an optional description.

If you select **Enable High Availability** for your virtual machine, and if the Oracle VM server on which it is running fails or shuts down, the virtual machine is restarted on another available server in the server pool. You must enable high availability for both the server pool and the virtual machine. You can set this option later.

You can select **Enable Huge Pages** for a PVM if you enable this support in the guest operating system. Changing this parameter requires that you stop the virtual machine. The option is not active for an HVM or HVM with PV drivers because Huge Pages is the default for these types of virtual machines.

The **Operating System** options include various releases of Microsoft Windows, Oracle Linux, Red Hat Enterprise Linux, Oracle Solaris, and several other generic choices.

# Example: Creating a Virtual Machine Using the Installation Media




**Create a Virtual Machine**

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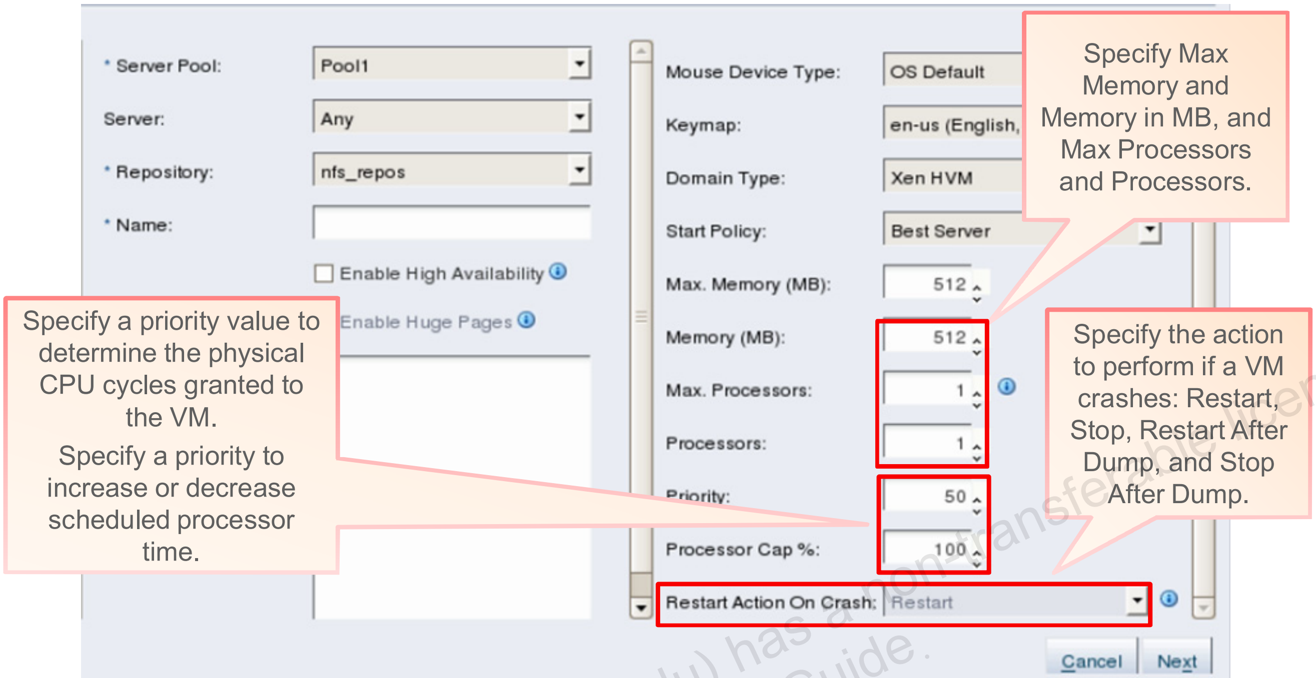
**Domain Type** reflects the type of virtualization support by the guest that is running in the virtual machine. Allowed choices include:

- **XEN_HVM or hardware virtualization:** This means that the virtual machine's guest is fully virtualized.
- **XEN_HVM_PV_DRIVERS:** This is similar to HVM, but with additional paravirtualized drivers for improved performance of the virtual machine. Paravirtualized drivers are discussed again later in this lesson.
- **XEN_PVM:** In a paravirtualized guest, the kernel is aware that it is running in a virtualized environment and is, therefore, optimized for this type of environment.
- **LDOMS_PVM:** Select if the servers in the server pool use Oracle VM Server for SPARC instead of Oracle VM Server for x86.
- **Unknown:** Select if you do not know the domain type.

The **Start Policy** is used to determine the Oracle VM server on which to start the virtual machine. If you select "Best Server," the virtual machine is started on the best available server, which is determined by using the same algorithm as used by DRS/DPM. "Current Server" starts the virtual machine on the Oracle VM server that is assigned to the virtual machine. You can also select where to start the virtual machine based on the start policy defined for the server pool.

# Example: Creating a Virtual Machine Using the Installation Media




**Create a Virtual Machine**



**Maximum Memory and Memory** size are entered in MB. You enter a number between 256 and 2000000. This is the maximum amount of memory that can be allocated to the virtual machine.

When specifying this value, you must stay within the limits imposed by your virtual machine's guest OS and domain type. The maximum memory size depends on whether the virtual machine contains a 32-bit or a 64-bit guest. The maximum size ranges from 64 GB (32-bit guests) through 2 TB (64-bit guests). For a list of the maximum RAM supported for virtual guests, see the topic titled "Configuration Limits" in *Oracle VM Release Notes*, Part Number E50246-03 or later.

The memory size is the current memory allocation. It is the memory size allocated when starting the virtual machine. You can change the memory size for a PVM while the virtual machine is running, but you cannot exceed the maximum memory size. For an HVM or HVM with PV drivers, the memory size must equal the maximum memory size and a change to the memory size requires the virtual machine to be stopped.

The number of **processors** is expressed in the number of physical CPU cores. You can change this value up to the value of **Max. Processors** while the virtual machine is running. When setting the number of processors and maximum processors, you are also limited by the resources available on the Oracle VM server that is selected to run the virtual machine.

The maximum number of processors depends on the domain type, as follows:

- PVM: 256
- HVM: 128
- PVHVM: 128; or 32 if using Oracle VM Paravirtual Drivers for Microsoft Windows

The **Priority** parameter determines the physical CPU cycles that are granted to the virtual machine. A higher priority means that more CPU cycles are granted. Specify a priority between 10 and 100. This option is ignored if you are using a SPARC hypervisor.

The **Processor Cap** parameter increases or decreases the percentage of scheduled time granted to the virtual machine. You specify a priority between 10 and 100. Use this parameter to keep low-priority virtual machines from consuming too many CPU cycles on an Oracle VM server.

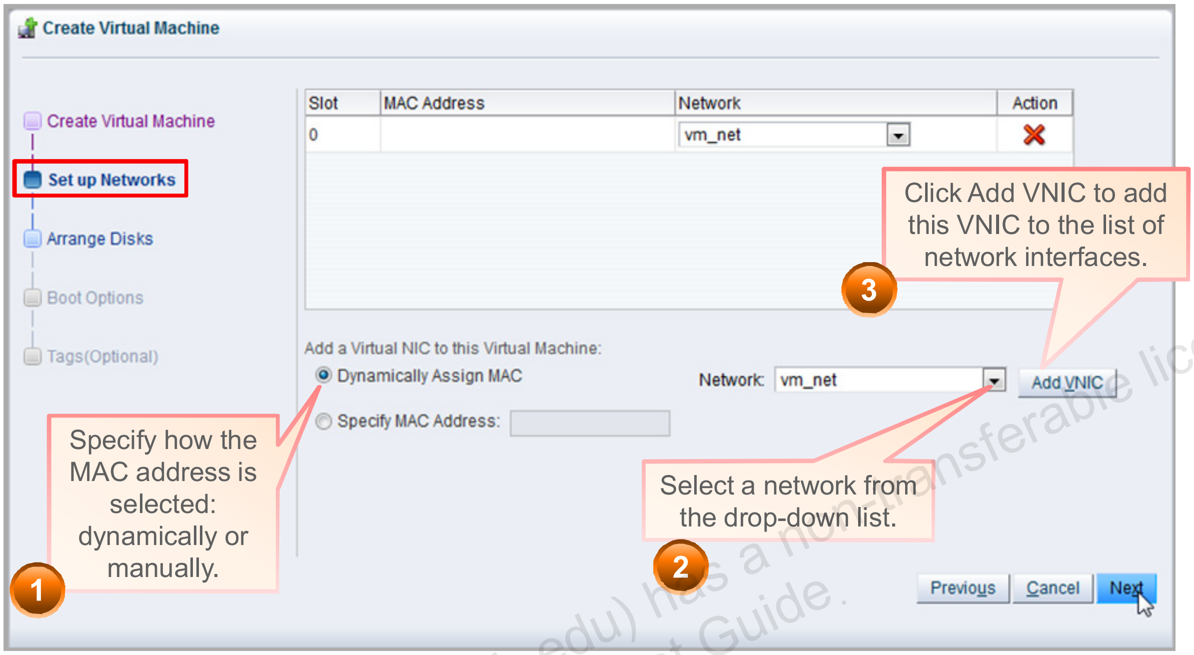
**Note:** Because Xen is responsible for scheduling CPU and memory access for virtual machines, the Priority and Processor Cap parameters are passed to Xen to control the allocation of these resources.

The **Restart Action on Crash** parameter specifies the action to perform if the virtual machine crashes. The actions available are as follows:

- The Restart parameter restarts the virtual machine.
- The Restart After Dump parameter restarts the virtual machine operating system after first creating a core dump file for the virtual machine.
- The Stop After Dump parameter stops the virtual machine after first creating a core dump file for the virtual machine. If Enable High Availability is selected, this option is not available.

**Note:** Core dump files are saved to `/var/xen/dump` on the Oracle VM server where the virtual machine is hosted. Each core dump file is named uniquely so that files are not overwritten.

# Example: Creating a Virtual Machine Using the Installation Media




**Set Up Networking**

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### Setting Up Networking

The second screen of the Create Virtual Machine Wizard configures network access for your virtual machine.

As shown in the screenshot in the slide, you perform the following steps to add one or more VNICs to your virtual machine:

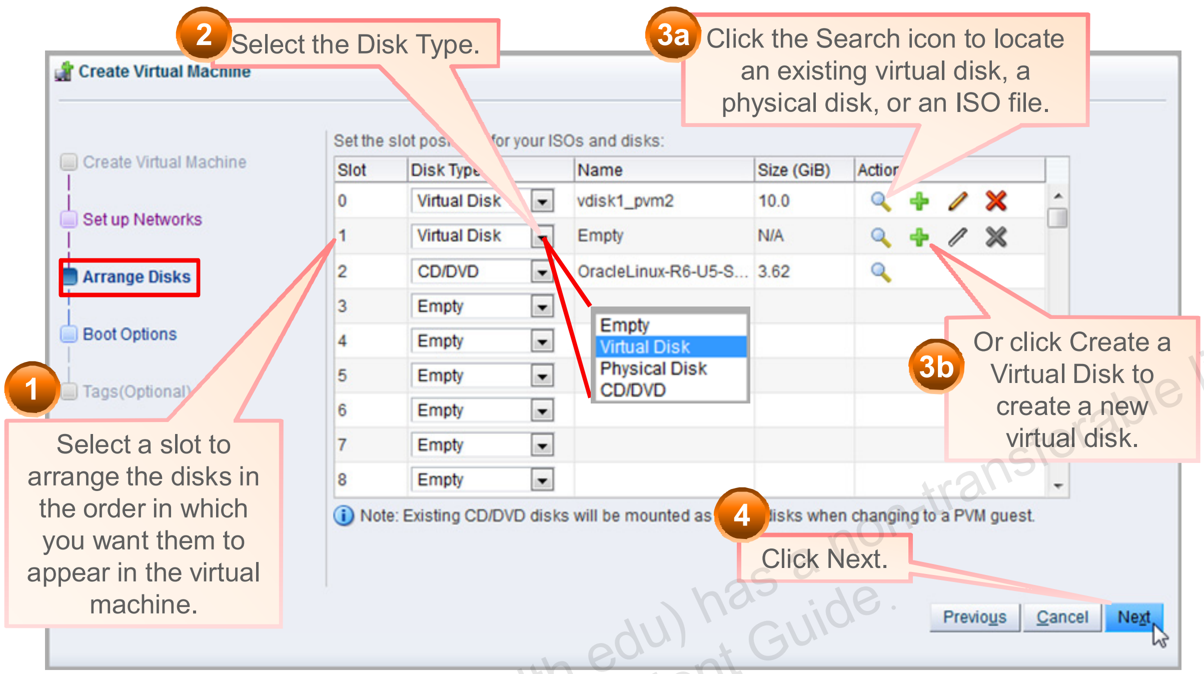
1. Assign a MAC address to the VNIC, either dynamically from the range of reserved MAC addresses or manually, by specifying a MAC address.
2. Select a network for the VNIC. The Network drop-down menu lists all the available networks created with the Virtual Machine network channel.
3. Click the Add VNIC button to add the VNIC to the list of network interfaces for the virtual machine.

You repeat this sequence for each VNIC that you want to add to this virtual machine.

You can change the network selection for a particular VNIC by selecting a new network from the Network drop-down list.

Click Next for the next screen.

# Example: Creating a Virtual Machine Using the Installation Media




**Arrange Disks**



On this screen, you select the virtual disks, ISO files, and physical disks to make them available to your virtual machine.

The screenshot in the slide shows the steps for selecting storage for your virtual machine:

1. Select a disk slot.
2. Select the Disk Type from the drop-down list as shown in step 2 in the slide: For example, for an HV machine that you plan to build by using installation media, select CD/DVD from the list. In the example in the slide, Virtual Disk is selected for slots 0 and 1.
3. On the Actions toolbar, click the Search icon to locate an existing virtual disk, a physical disk, or an ISO file. This is step 3a in the slide. The ISO files that appear in the selection list have been previously imported into a repository.

   Or

   Click the Create a Virtual Disk icon to create a new virtual disk. This is step 3b in the slide. After it is created, the virtual disk appears in the current slot.

**Set Up Disk Order**

When you add storage to your virtual machine, you order the disks as you want them to be seen by the boot and/or installation process.

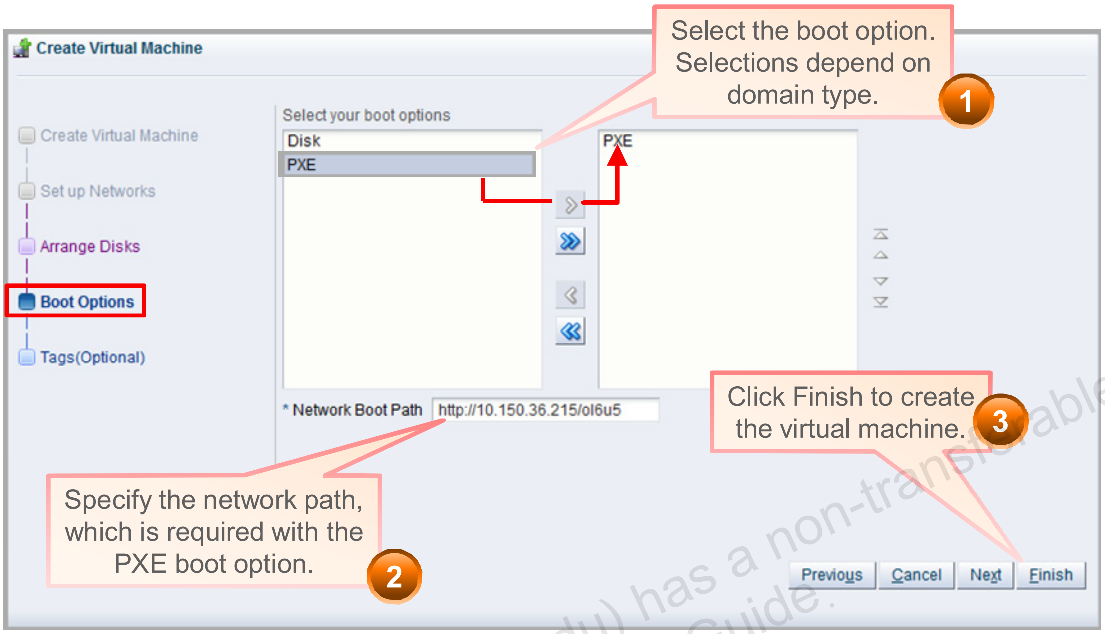
Disks are arranged in slots, with up to four slots for an HVM guest, including CD/DVD files. A PVM can have up to 104 disks. An HVM guest with PV drivers can have up to 107 disks.

The disk with the boot partition must be the first disk listed.

To move a disk or CD/DVD file, you first must empty the slot where the disk resides. To empty the slot, select Empty from the Disk Type drop-down list. The possible selections are shown in the smaller screenshot in the slide. Next, select the slot where you want to move the disk and switch disks. You might have to repeat this operation several times if you want to reposition all the disks in new slot positions.

When you are satisfied with the order, click Next to continue, as shown in step 4 in the slide.

# Example: Creating a Virtual Machine Using the Installation Media




**Boot Options for a PVM**





### Boot Options

On the Boot Options screen, which is the last screen of the wizard, select the boot order for the various boot options: Disk, CDROM, and PXE. The available selections depend on the domain type for the virtual machine.

For an HVM, the following options are available:

- Disk
- PXE
- CDROM

For a PVM, the following options are available:

- Disk
- PXE

For an initial installation of an HV machine by using a local ISO file, choose CDROM. You can also include Disk in the Boot Order, either before or after CDROM. Set Disk first only if the virtual disks of your virtual machine do not contain valid data.

For an initial installation of a PV machine by using a remotely mounted ISO file, select PXE as the boot option, and in the “Network Boot Path” field, enter the location of the mounted ISO file from which to boot the virtual machine.

Click Finish to trigger the creation of the virtual machine.

You can modify the boot order list after the installation. For example, after the installation, stop the virtual machine and update your virtual machine by using Edit Virtual Machine to remove CDROM from the Boot Order.

Removing CDROM from the Boot Order does not remove it from the disk configuration of the virtual machine. You still can access the ISO file to install additional packages as long as you do not remove it from the storage configuration of your virtual machine. See the “Arrange Disks” screen that was shown earlier in this lesson.

## Examining the Configuration Information for Virtual Machines

After creating your virtual machine, you can examine its components and the configuration information by using several methods:

1. In the Oracle Manager UI, use the information tabs for the virtual machine.
2. In the Oracle VM Manager UI, highlight the virtual machine and click the “Display VM Config File Content” icon.
3. Access a suitable Oracle VM server and display the `vm.cfg` file for the virtual machine.
4. Use the Oracle VM CLI.

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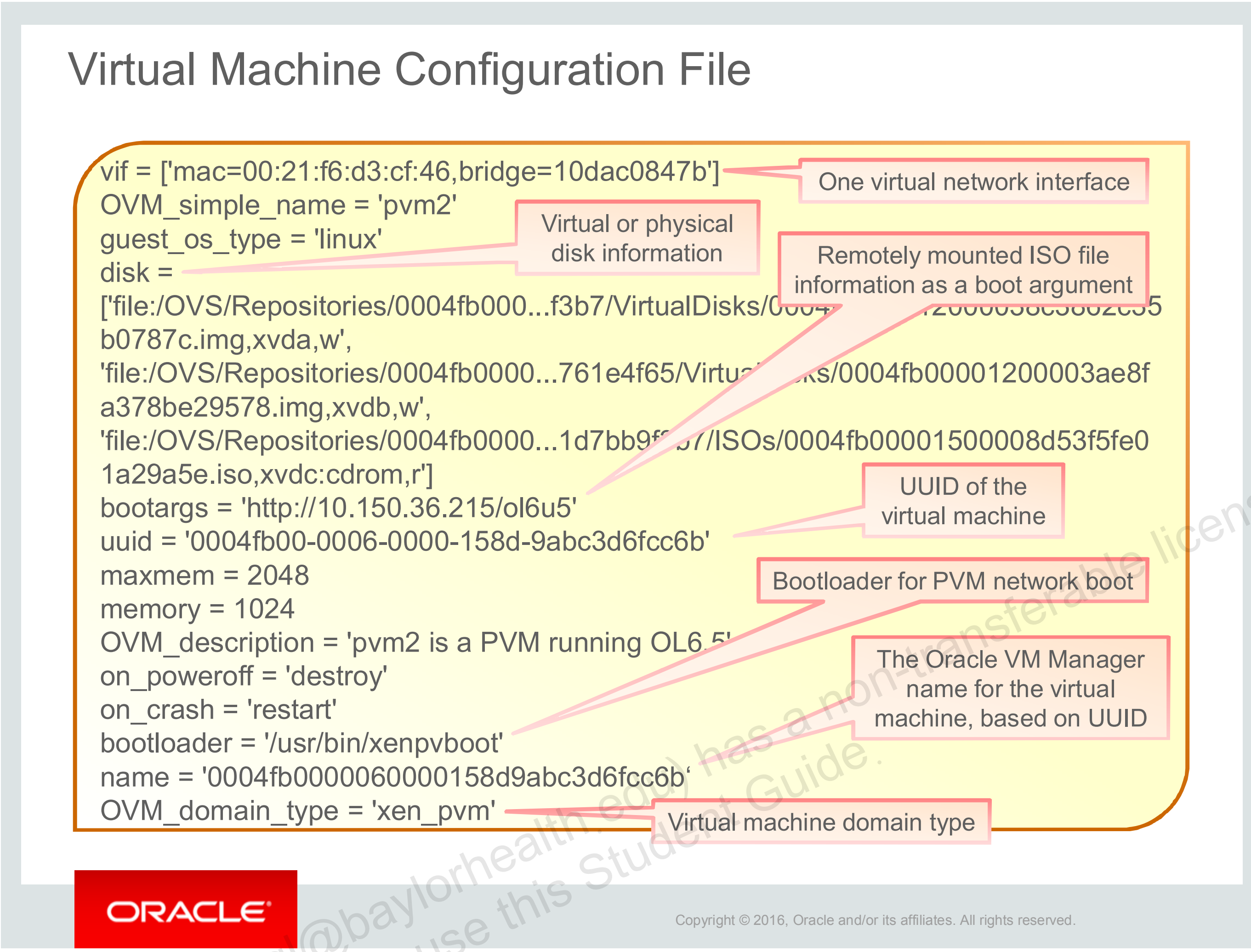
After creating your virtual machine, you can examine its configuration in several ways:

1. In the Oracle VM Manager UI, click the Servers and VMs tab. Highlight either a server pool or a specific Oracle VM server in the navigation tree. In the management pane, select the Virtual Machines perspective. A list of virtual machines is displayed.

   Click the Expand button next to your virtual machine to expose three tabs: Configuration, Networks, and Disks. From these tabs, you can examine but cannot change the configuration of your virtual machine.
2. In the management pane that displays the list of virtual machines, highlight your virtual machine and click the “Display VM Config File Content” icon on the toolbar. A window appears and the virtual machine `vm.cfg` file is displayed in the window.
3. You can also access the `vm.cfg` file directly from an Oracle VM server that has access to the repository where the `vm.cfg` file is stored. This method is described in the next slide.
4. Finally, you can obtain information about your virtual machine by using the Oracle VM CLI. You use this method in a practice for this lesson.




After you create a virtual machine, it has several components, including a configuration file called `vm.cfg`. An extract from a configuration file for a paravirtualized machine is displayed in the slide, with callouts identifying important file entries. Several lines have been removed from the configuration file that is shown in the slide.

The important information in the `vm.cfg` file includes:

- The domain type and `bootargs`, which determine the `bootloader`

  **Note:** The virtual machine is currently set to boot from the network. After installation, you change the boot option to disk and the boot loader changes to `'/usr/bin/pygrub'`.
- The disk section, which lists the disk images and physical disks for the virtual machine
- The `vif` or virtual interface section, which lists the MAC addresses for the defined VNICs, as well as the bridges used for the virtual machine networks. The bridge concept is covered in the lesson "Managing Servers and Networks."

For reference, the next slide shows the complete listing of a `vm.cfg` file.

The complete `vm.cfg` file is listed as follows:

```
vif = ['mac=00:21:f6:d3:cf:46,bridge=10dac0847b']
OVM_simple_name = 'pvm2'
guest_os_type = 'linux'
disk =
['file:/OVS/Repositories/0004fb00000300001456c61d7bb9f3b7/VirtualDisks
/0004fb000012000038c3862c35b0787c.img,xvda,w',
'file:/OVS/Repositories/0004fb0000030000bea81983761e4f65/VirtualDisks/
0004fb00001200003ae8fa378be29578.img,xvdb,w',
'file:/OVS/Repositories/0004fb00000300001456c61d7bb9f3b7/ISOs/0004fb00
001500008d53f5fe01a29a5e.iso,xvdc:cdrom,r']
bootargs = 'http://10.150.36.215/ol6u5'
uuid = '0004fb00-0006-0000-158d-9abc3d6fcc6b'
on_reboot = 'restart'
cpu_weight = 27500
OVM_os_type = 'Oracle Linux 6'
cpu_cap = 0
maxvcpus = 2
OVM_high_availability = False
maxmem = 2048
memory = 1024
OVM_description = 'pvm2 is a PVM running OL6.5'
on_poweroff = 'destroy'
on_crash = 'restart'
bootloader = '/usr/bin/xenpvboot'
name = '0004fb0000060000158d9abc3d6fcc6b'
usbdevice = 'tablet'
vfb = ['type=vnc,vncunused=1,vnclisten=127.0.0.1,keymap=en-us']
vcpus = 1
OVM_cpu_compat_group = ''
OVM_domain_type = 'xen_pvm'
```

# Viewing Information on Virtual or Physical Disks

- The virtual machine configuration file lists available disks as:
  - `/dev/mapper` paths for physical disks
  - `/OVS/Repositories` paths for virtual disks or ISO files
- The label for physical disks is `phy`.
  - Example: `['phy:/dev/mapper/../.. ']`
- The label for virtual disks is `file`.
  - Example: `['file:/OVS/Repositories/../.. ']`
- Specify additional options:
  - `r` for read-only disk
  - `w` for writeable disk
  - `!` for shareable disk

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**Virtual or Physical Disks**

The disks that are available to the virtual machine are listed in the virtual machine configuration file as:

- `/dev/mapper` paths for physical disks
- `/OVS/Repositories` paths for virtual disks or ISO files

The label for physical disks is `phy` and the label for virtual disk images is `file`.

A read-only disk is specified with the “`r`” option and a writeable disk with the “`w`” option.

A shareable disk is specified with the “`!`” option.

## Locating the Virtual Machine Configuration File

- The file name of the virtual machine configuration file is `vm.cfg`.
- It is stored in the repository selected during the creation of the virtual machine.
- Path to the file is `/OVS/Repositories/<Repository UUID>/VirtualMachines/<Virtual Machine UUID>`.
- You can find the Virtual Machine UUID in the following locations:
  – The Virtual Machines perspective in the Oracle VM Manager UI by selecting a virtual machine
  – The Configuration tab by clicking the expand button next to the machine name
  – The configuration file

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**Locating the Configuration File**

The `vm.cfg` configuration file for all virtual machines is stored in the repository that is selected during virtual machine creation. The path to this file is `/OVS/Repositories/<Repository UUID>/VirtualMachines/<Virtual Machine UUID>`.

**Finding the Virtual Machine's UUID**

You also need to find the virtual machine's universally unique identifier (UUID) by selecting the virtual machine from the Virtual Machines perspective in the Oracle VM Manager UI, and by looking for the UUID information on the Configuration tab that is exposed by clicking the Expand button to the left of the virtual machine name. In the extract from `vm.cfg` that is shown in the previous slide, the virtual machine UUID is `0004fb0000060000158d9abc3d6fcc6b`.

# Locating the Virtual Machine Configuration File in an Oracle VM Server

- Find the name of the repository on the Configuration tab.
- Find the repository UUID of the virtual machine:
  - Execute the `df -h` command from a server presented to this repository. For example:

```
Filesystem                    Size   Used   Avail  Use%
   Mounted on
   192.0.2.1:/nfsrepos1   20G    3.8G   15G    21%
   /OVS/Repositories/0004fb000003000033 4ada491e44
   5266
```

- Match the UUID of the repository to a repository path from the output of the `df -h` command. For example:

```
# ls
   /OVS/Repositories/0004fb0000030000334ada491e44
   5266/VirtualMachines/0004fb0000030000334ada491
   e445266/vm.cfg
```

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**Locating the Virtual Machine's Configuration File in an Oracle VM Server**

To find the `vm.cfg` file in an Oracle VM server with access to the repository:

- Find the name of the repository where the virtual machine's configuration file is stored on the Configuration tab for the virtual machine. This is also where you found the UUID information for the virtual machine.
- Find the repository UUID by locating the repository in the navigation tree on the Repositories tab in the Oracle VM Manager UI, and noting the UUID of the repository from the Info perspective.
- Log in to one of the Oracle VM servers presented to this repository and execute the `df -h` command (extract as follows):

```
/dev/mapper/3600a0b80002a2f70000011c44dccd336   200G   126G   75G   63%
     /OVS/Repositories/0004fb0000030000334ada491e445266
```

- Match the UUID of the repository to a repository path in the output of the `df -h` command. In this example, the UUID for the repository is **`0004fb0000030000334ada491e445266`**.

# Starting and Accessing the Virtual Machine

- To start the virtual machine, locate the virtual machine from the Virtual Machines perspective in the Oracle VM Manager UI and select Start on the toolbar.
- When it is started, the virtual machine boots by using the boot device that is specified in its configuration file.
  - A job is triggered when a virtual machine is started.
- You access the console in the same way that you started the virtual machine:
  - Select the virtual machine and click Launch Console on the toolbar.

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Connect to a virtual machine by using its console. The console is the remote control system of Oracle VM, and enables you to work and interact with your virtual machines.

You can choose from two types of console access: a VNC type console and a serial console. For virtual machines that are running on servers built with Oracle VM Server for x86, you can select either type of console to control your virtual machine. Virtual machines that are running on servers built with Oracle VM Server for SPARC can be accessed only by using the serial console feature.

**VNC and Serial Console Access**

The VNC and serial console programs use HTML5 Canvas and WebSockets. Your browser must properly support HTML5 to use the console facility. The list of supported web browsers is provided in the section titled “Web Browser Requirements” in the *Oracle VM Manager User’s Guide*, Part Number E50250-03 or later.

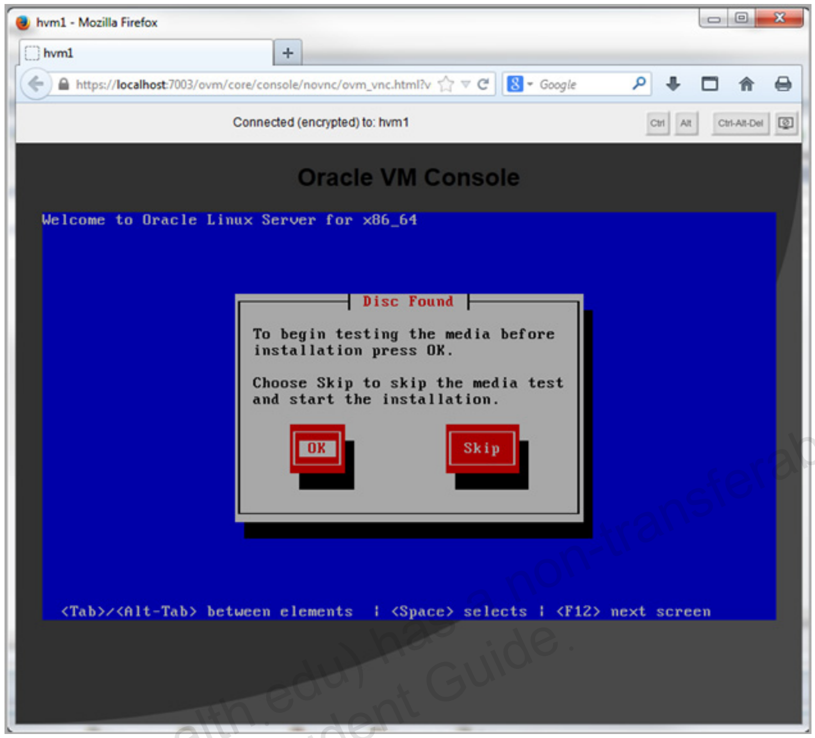
This package installs the noVNC client for VNC type console access and the jsTerm terminal emulator for serial console access. You can find information about noVNC at this site: http://kanaka.github.io/noVNC.

**Serial Console Access**

If you chose to use the serial console to access your virtual machines, you must make sure that the guest operating system that is running in the virtual machine supports serial console access. For example, you might have to add a `console` parameter to the `kernel` statement in the `grub.conf` file of your Oracle Linux virtual machine.

# Installing the Operating System in the Guest

**HVM With or Without PV Drivers: Installing from an ISO File**

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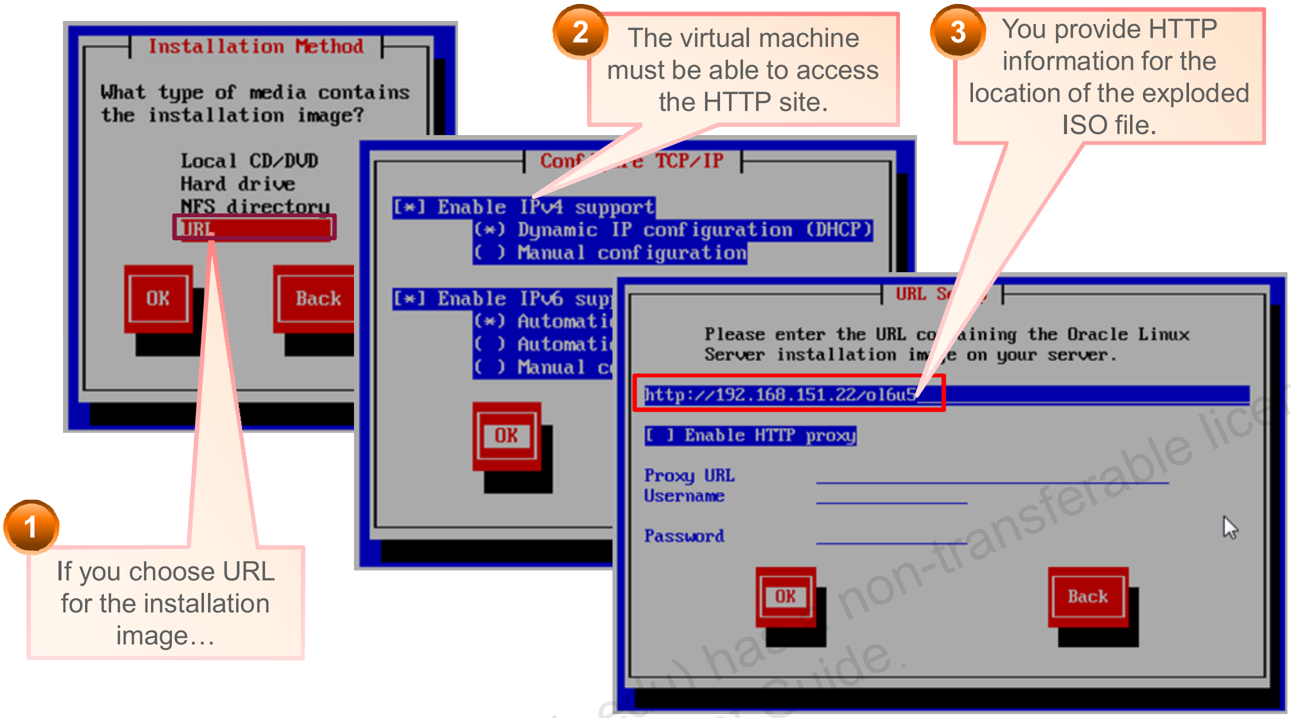
You install the operating system in the HV machine as you would in a physical host. The screenshot in the slide illustrates the case of installing from an ISO file that is added as a local disk to the virtual machine. The virtual machine uses the ISO file as it would a CD inserted in a local CD/DVD drive. This is supported only for HV machines and HV machines with PV drivers.

# Installing the Operating System in the Guest




PVM: Installing from a Network Location







For PV machines, if you want to boot the virtual machine from installation media, the ISO file must be accessed remotely. This is because PV guests do not have an emulated BIOS to allow booting from a local virtual CD/DVD device. In this case, the ISO file can be made available by mounting it as a loop device, in a remote location over the network.

To mount an ISO file as a loop device, use the `mount` command with the `loop` parameter; for example:

```
# mount -o loop,ro OracleLinux-R6-U5-x86_64-dvd.iso /mnt
```

After mounting the ISO file, make the ISO file available over the network and offer this exploded ISO file by using FTP, HTTP, or NFS.

**Note:** You can also copy the content of the exploded ISO file to a permanent directory and make this directory available remotely by using FTP, HTTP, or NFS.

When you start the PVM, the installation process prompts you for information about the installation media. If you select NFS or URL, you are prompted for the location of the mounted ISO file over the network. With the URL selection, you can specify an FTP or HTTP location.

The screenshots in the slide show three screens as part of this process:

Step 1

- Choose a Language and Keyboard Type.
- Choose an Installation Method (Local CD/DVD, Hard drive, NFS directory, and URL, which includes FTP and HTTP).

Step 2

- Configure TCP/IP (dynamic or static IP assignment, IPv6 support) for the virtual machine.

  This step configures `eth0` on the virtual machine. The network configuration allows the virtual machine to reach the location where the exploded ISO file resides. In step 2 in the slide, DHCP is used to configure `eth0`.

Step 3

- Provide information to reach the website if you chose HTTP as the Installation Method.

  Provide the web server host name or IP address, and the directory where to find the exploded ISO file. In step 3 in the slide, the website name is `192.168.151.22` and the directory is `ol6u5`.

At this point, the installation for PV machines proceeds as usual.

At the end of the installation process, stop the virtual machine, remove PXE from the Boot Options screen for the PV machine, add Disk (which is the default), and start the virtual machine again to complete the configuration of your virtual machine.

**Dom0 Network Requirement when Booting a PVM from the Network**

When a paravirtualized (PV) machine boots for the first time, in preparation for an installation over the network, the boot loader, `xenpvboot`, retrieves the boot files (the kernel image, `vmlinuz`, and the initial ramdisk, `initrd`), by looking into the default directory from the location specified in the Network Boot Path. For example, if you enter `http://10.150.36.215/ol6u5` in the "Network Boot Path" field of the Boot Options screen, the boot loader attempts to retrieve the boot files from that location.

Because dom0 (and not the virtual machine) is responsible for booting the PV machine over the network, make sure that dom0 (the Oracle VM server where the virtual machine is located) can access the boot files at the network location specified in "Network Boot Path."

## Using Kickstart to Create Virtual Machines

- Using Kickstart to create an HVM is similar to using Kickstart to install a physical machine.
- Using Kickstart to create a PVM is a combination of network booting and Kickstart installation:
  - The PVM is first booted by using network-accessible, Xen-aware boot files.
  - The Kickstart installation then proceeds.
- When you create a virtual machine to be installed with Kickstart:
  - Specify PXE as a boot option for an HVM
  - Specify PXE as a boot option for a PVM and provide the network location for the boot files, boot parameters, and the Kickstart information

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**What Is a Kickstart Installation?**

Kickstart is an unattended installation technique for Linux hosts. The target machine is started and it obtains an IP address by broadcasting its MAC address on the subnet. It then obtains the booting and configuration information from the network, and proceeds with the installation.

The Kickstart infrastructure usually requires DHCP and PXE servers, a TFTP server, and possibly, an HTTP server. You must set up the Kickstart environment and create the PXE and Kickstart configuration files before attempting a Kickstart installation.

**Kickstart for an HV Guest**

Installing a Linux guest operating system into an HV machine by using Kickstart is similar to using Kickstart to install a physical machine.

To Kickstart an HV machine:

- Specify HVM or HVM with PV drivers as the Domain type in the virtual machine
- Specify PXE on the Boot Order screen
- Create the infrastructure for the Kickstart installation. This can include a DHCP server, a TFTP server, an HTTP server, and the PXE and Kickstart configuration files.
- Make sure that the network configuration in your Oracle VM environment supports the Kickstart installation

### Kickstart for a PV Guest

The process for using Kickstart to install a Linux operating system in a PV machine is a combination of virtual machine network booting and Kickstart installation.

To Kickstart a PV machine:

- Specify PVM as the Domain type in the virtual machine
- Specify PXE on the Boot Order screen
- In the Network Boot Path of the Boot Order screen, specify the location of the Xen-aware boot files and specify the Kickstart information; for example:

  ```
  --kernel olxen/vmlinuz --ramdisk olxen/initrd.img --
  args="ksdevice=eth0 console=tty0 load_ramdisk=1 network
  ks=http://192.168.151.22/pvm4-ks.cfg" http://192.168.151.22
  ```
- Create the infrastructure for the Kickstart installation. This can include a DHCP server, an HTTP server, and a Kickstart configuration file. A TFTP server is not required.
- Make sure that the network configuration in your Oracle VM environment supports the network boot and the Kickstart installation

## Quiz

With the Virtual NICs tool, you can:

a. Create network bridges for virtual machine networks
b. Reserve VLAN IDs for creating VLAN interfaces
c. Reserve MAC addresses for your virtual machines' VNICs
d. Assign VNICs to existing networks





**Answer: c**

## Templates, Virtual Appliances, and Cloning

- The first section of this lesson described:
  - The components of a virtual machine
  - The prerequisites for creating a virtual machine
  - The steps to create a virtual machine
  - An example of creating a virtual machine by using installation media
- The next section presents a more automated and more flexible way to create virtual machines: *cloning*.
  - It includes the following topics:
    - Creating virtual machines from templates and virtual appliances
    - Simple cloning
    - Advanced cloning and clone customizers

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This lesson is about creating virtual machines.

The first section of this lesson provided you with:

- Information about virtual machine components
- The steps to prepare for virtual machine creation

  These preparatory steps include creating virtual or physical disks for your future virtual machines, as well as reserving MAC addresses to include in your future virtual machines configuration.
- The steps to create virtual machines from installation media, for both HV and PV machines
- Guidelines for creating virtual machines by using Kickstart

The following section introduces more automated, efficient, and quicker methods of creating virtual machines. This section includes the following methods:

- Creating virtual machines from templates and virtual appliances, or from other virtual machines by using cloning
- Cloning by using the Oracle VM Manager UI
- Advanced cloning and clone customizers

## Creating Virtual Machines from Templates and Virtual Appliances

- Templates are preconfigured virtual machines that contain one or more virtual disks and configuration information.
- Virtual appliances are similar to templates, but they contain multiple virtual machines, which are prebuilt to deliver multitier enterprise applications.
- Use the import function to make the templates and virtual appliances available to the Oracle VM Manager.
- Use the Export VM to Virtual Appliance function to export a virtual machine as a virtual appliance.
- Use cloning to create one or more virtual machines from the templates or virtual appliances.

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In addition to installing virtual machines from installation media, you can use templates to create virtual machines.

**Template**

A template is a virtual machine that contains a guest OS, such as Oracle Linux, and, optionally, other software that is ready to be deployed. The guest OS of the virtual machine in the template has already been installed and configured, and is packaged as a compressed TAR file.

**Virtual Appliance**

A virtual appliance is similar to a template, except that it contains a group of prebuilt virtual machines that are meant to run together to deliver a fully functioning, multitier application environment. An example of such an environment could contain a web server, an application server, and a database server that are packaged together as a virtual appliance. When a virtual appliance is deployed, the components can be configured automatically.

You must import templates (and virtual appliances) into a repository before they can be deployed.

### Export Virtual Appliance

The Export Virtual Appliance feature allows you to export a virtual machine as a virtual appliance in OVA format, which makes it easier to move a virtual machine between different virtualization platforms. For example, you can move virtual machines between VirtualBox and Oracle Virtual VM Server for x86.

### Creating and Importing a Template

Download templates from the Oracle Software Delivery Cloud. You can also clone an existing virtual machine or template to create a new template. Cloning is discussed later in this lesson. Finally, you can use the P2V utility to capture a physical machine into an Oracle VM template.

When you import a template, the configuration file is extracted and stored in the repository's `Templates` directory and the template's disk images are extracted to the repository's `VirtualDisks` directory.

**Note:** The Oracle VM Manager operates on templates and virtual machines in a similar way.

### Cloning

Cloning a virtual machine or template enables you to create virtual machines and templates based on the original virtual machine or template.

Cloning is discussed later in this lesson.

## Managing Virtual Appliances

- A virtual appliance contains a set of configuration files in Open Virtualization Format (`.ovf`) and one or more disk images.
- Import virtual appliances into the Oracle VM Manager as a single `.ova` file or import the virtual appliance's components.
  - The unpacked elements of the virtual appliance are stored in a subdirectory of the `Assemblies` directory in the selected repository.
- After the import operation, create a template from any virtual machine that is present in the virtual appliance.
  - Use cloning with the resulting template to create virtual machines.





**Importing a Virtual Appliance**

A virtual appliance consists of an `.ova` descriptive file (Open Virtualization Archive) and one or more disk image files. The OVA file contains a compressed and installable version of a virtual machine. The virtual appliance can also contain a manifest (`.mf`) file. These files are often bundled into a single `.ova` file that you can import directly into your Oracle VM environment. During the import operation, the virtual appliance package is uncompressed and its files are extracted.

You can, however, import the `.ova` file and the disk image files separately by performing the following steps:

1. Import all the virtual disk files by using the virtual disk import function.

   Place all the disk files in a download location and make them accessible by using one of these protocols: HTTP, HTTPS, or FTP. Make sure that the location is accessible to your Oracle VM servers. On the Repositories tab, select the repository to which you want to import the disk files, select the Virtual Disks folder, and click Import in the management pane for each disk file to import. Specify the location for the import operation.

2. Import the descriptive file by using the virtual appliance import function.

   Place the `.ova` descriptive file in a download location and make it accessible from your Oracle VM Manager host computer by using any of these protocols: HTTP, HTTPS, or FTP.

   In the navigation tree, select the Virtual Appliances folder of the repository where the disk images were imported, click Import in the management pane, and specify the location for the descriptive file.

When a virtual appliance is imported, a new directory is created for it in the `Assemblies` directory in the repository's file system, and all the extracted files are stored in the virtual appliance's new directory.

From the Oracle VM Manager UI, the newly imported virtual appliance now appears in the list of virtual appliances for the repository. You can list the virtual machines contained in the virtual appliance by locating the virtual appliance in the management pane and clicking the Expand button. The list of virtual machines appears in the "Virtual Appliance Virtual Machines" pane.

For more information about how to create virtual appliances, consult the Oracle Virtual Assembly Builder documentation, which is available at http://www.oracle.com/technetwork/middleware/ovab/documentation/index.html.

After the virtual appliance is available to the Oracle VM Manager, you can create templates from the virtual appliance. If the virtual appliance contains several virtual machines, you can create a template for any of the virtual machines in the virtual appliance.

After creating templates from the virtual appliance, you use cloning to create one or more virtual machines from any of the templates.

Cloning is discussed in the next slide.

## Creating New Virtual Machines with Cloning

- With cloning, you create a virtual machine or template based on an existing virtual machine or template.
- Cloning enables you to create virtual machines with similar characteristics.
  - Cold cloning: A clone created from a stopped virtual machine
  - Hot cloning: A clone created from a running virtual machine
- When cloning, you can:
  - Clone a virtual machine or template with the same configuration as the original (simple cloning)
  - Clone a virtual machine or template with different network and/or storage mappings (advanced cloning)







Cloning is a convenient technique that is used in many virtualization environments, including desktop and server virtualization. It enables you to create groups of desktops or servers that meet similar requirements. For example, a server that is running an application might require a specific disk or network configuration. After you have created and customized your virtual machine, you use cloning to create similar virtual machines, with virtual disks of the same size and content, and with a network configuration that is identical to that of the source virtual machine.

Oracle VM extends the usefulness of cloning by making the cloning process very flexible.

You can clone from:

- A virtual machine, to create a new virtual machine
- A virtual machine, to create a new template
- A template, to create a new virtual machine
- A template, to create a new template

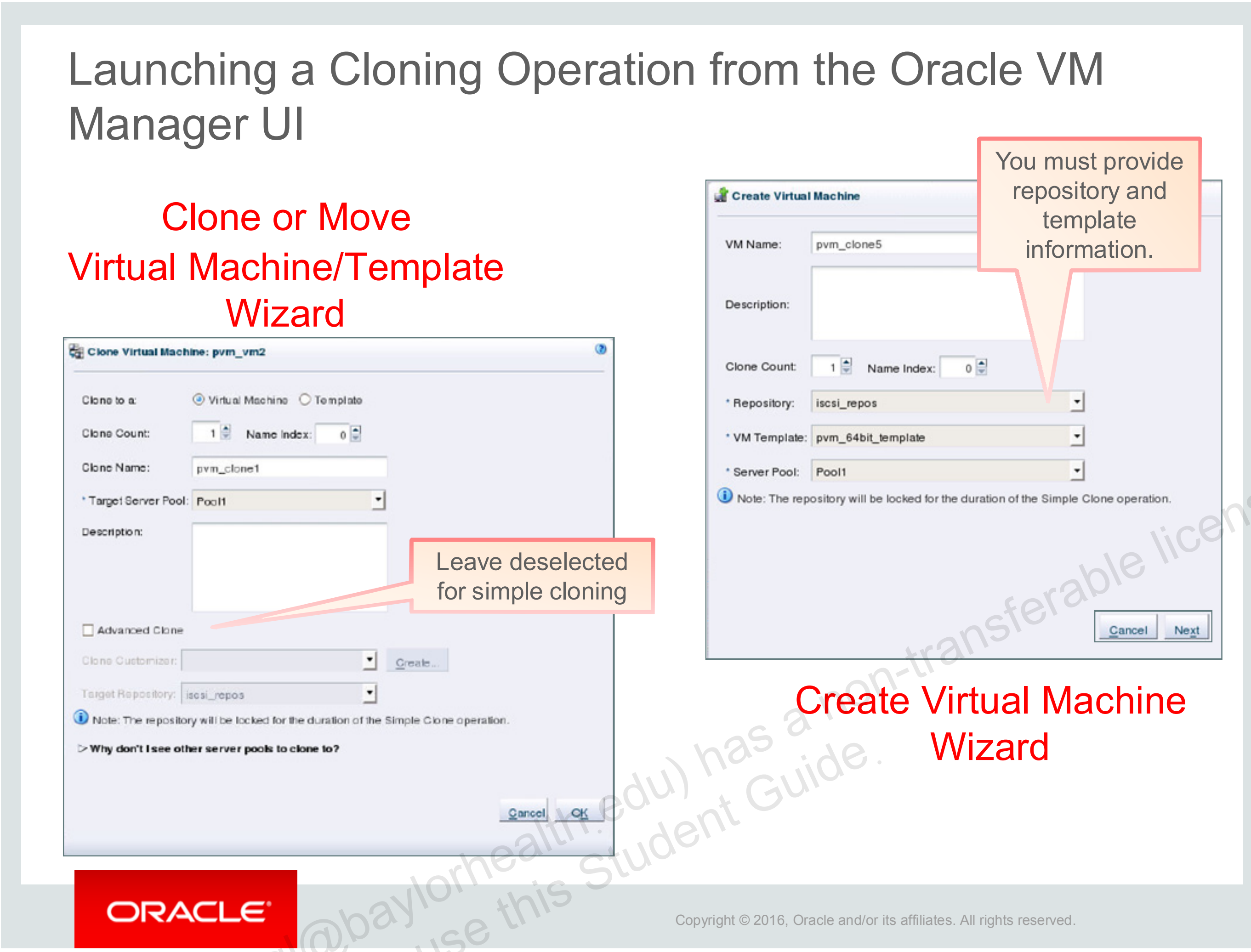
Virtual appliances contain one or more virtual machines, and any of these virtual machines can be used in the cloning process by first creating a template from any of these virtual machines.

Depending on the status of the virtual machine you select for a cloning operation, you are creating a cold or a hot clone.

- **Cold Clone:** A cold clone is a clone that is created from a stopped virtual machine. A cold clone performs a clone of a virtual machine with a safe and consistent virtual disk status. This is useful for creating a virtual machine or template from the original virtual machine.
- **Hot Clone:** A hot clone is created from a running virtual machine. A hot clone creates a clone with inconsistent disk status. Use hot cloning only as a snapshot or backup of a virtual machine, perhaps on a virtual machine that requires 100% uptime and cannot be shut down. If you want to use a hot-cloned virtual machine, first repair any virtual disks by using a disk repair utility such as `fsck`. Do not use hot cloning for virtual machines that are running an Oracle Database. Instead, use an Oracle Database backup strategy, such as the `rman` utility.
  - Currently, hot cloning is supported only for virtual machines with virtual disks in OCFS2 repositories or with physical disks in a storage array that is managed with a vendor-specific plug-in that supports dynamic provisioning of disks.

**Clone Customizers**

Oracle VM also enables you to specify variations when using cloning. Instead of a simple cloning operation by using a source (for example, a virtual machine) to create an identical copy of the source in the same location, you can specify a different configuration to be used during the cloning process. This is the advanced cloning feature that is achieved by using clone customizers.




You can start a cloning operation in the following ways:

- By selecting a virtual machine and clicking “Clone Virtual Machine”
- By selecting a template and clicking “Clone Template”
- By launching the Create Virtual Machine Wizard and selecting the “Clone from an existing VM Template” option button

**Cloning from the Clone Virtual Machine or Clone Template Wizards**

A cloning operation that is launched from the “Clone Virtual Machine” or “Clone Template” wizards knows the template or virtual machine to use as the source for the cloning because the operation is launched after selecting the source virtual machine or template. This selection is shown in the screenshot on the left in the slide.

Cloning with this wizard gives you the choice of performing a simple cloning operation, or using customization by selecting the Advanced Clone check box.

### Cloning from the Create Virtual Machine Wizard

When launching a cloning operation from the Create Virtual Machine Wizard, you must specify the source template and its repository. You cannot specify a virtual machine as the source for the cloning operation. This selection is shown in the screenshot on the right in the slide.

A cloning operation that is launched from the Create Virtual Machine Wizard is always a simple cloning operation, without customization.

Cloning customization is discussed later in this section.

# Launching a Cloning Operation from the Oracle VM Manager CLI

- From the CLI:
  - Use the `clone vm` *`instance`* command, where instance is either the name or ID of a virtual machine or template.
  - Specify the destination type as either a virtual machine or a template.
  - Specify the server pool where the virtual machine or template is to be deployed.
  - Specify a clone customizer and a target repository for the `vm.cfg` file if you are using advanced cloning.
- Example: Simple cloning of a template to a virtual machine

```
OVM> clone Vm name=MyTemplate destType=Vm
  destName=MyNewVM serverPool=MyServerPool
```

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Note in the example in the slide that the command `clone Vm` is used to clone a template or a virtual machine because Oracle VM manipulates templates and virtual machines in the same way.

Simple and advanced cloning are discussed later in this lesson.

## Cloning Considerations

- When cloning from an NFS type repository, you can create the clone in any server pool that is presented to this repository.
- When cloning from an OCFS2 type repository, the clone must be created within the current server pool, although the target repository can be different.
- When cloning within the same OCFS2 type repository, thin cloning is the default.





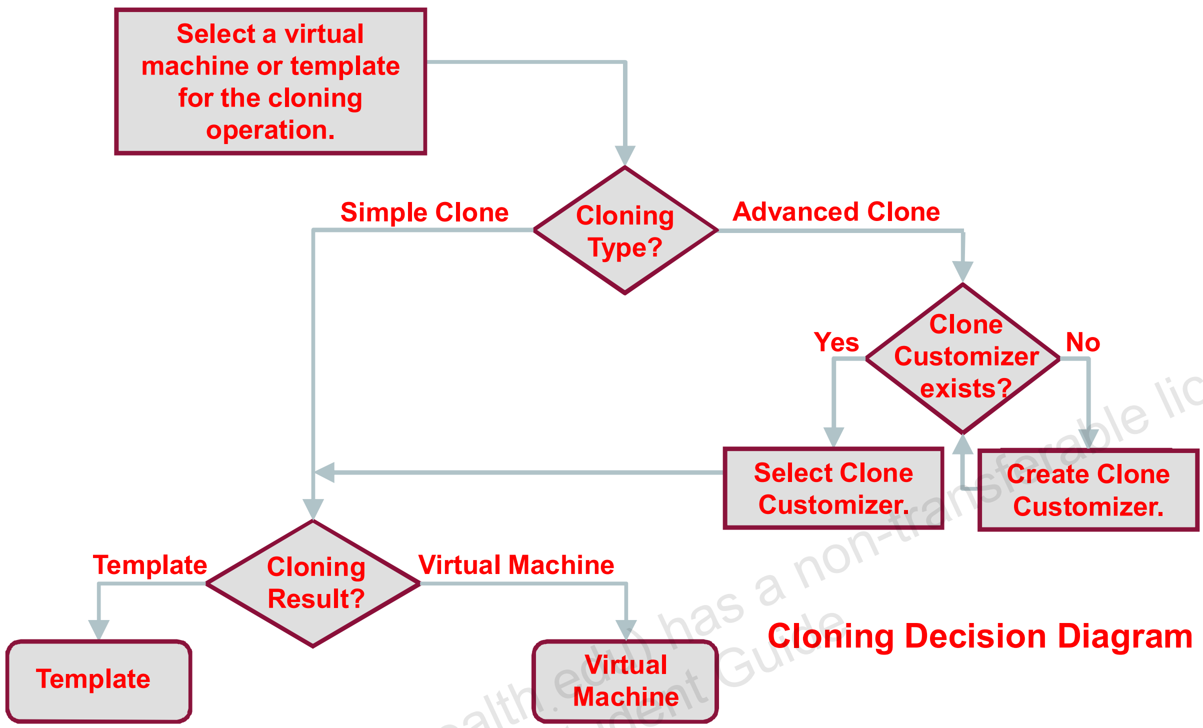




If the source virtual machine or template for the cloning operation resides in an NFS repository and this repository is presented to multiple server pools, you can select any of the server pools as the destination for the clone. This is true for cloning operations that are launched from the Oracle VM Manager UI or the Oracle VM CLI and for simple or advanced cloning.

If the source object for the cloning operation (virtual machine or template) resides in an OCFS2 repository, thin cloning is used when the source and target repositories are the same, which is always the case with a simple cloning operation.

## Simple and Advanced Cloning








The diagram in the slide illustrates the cloning process in the Oracle VM Manager UI.

If you do not select the Advanced Clone check box in the wizard (see the screenshot on the left in the slide titled “Launching a Cloning Operation from the Oracle VM Manager UI”), the information that you must provide is:

- Clone to a virtual machine or to a template (option button)
- Clone count: How many clones do you want to create with this operation?
- The clone name and name index: The index is used as a suffix to create each clone’s name.
- The target server pool
- An optional description

If you select the Advanced Clone check box, you must also specify:

- A clone customizer
- A target repository for the clone configuration file

A clone customizer is always associated with a virtual machine or template.

If no clone customizer is available for the source virtual machine or template, you can launch the clone customizer wizard, which guides you through a set of screens to create a new clone customizer. You are then looped back to the initial cloning screen, and you can select the clone customizer that you just created.

## Creating a Clone Customizer

- You can create a clone customizer:
  - From the cloning wizard
  - From the clone customizer wizard
- For each clone customizer, specify the following information:
  - Enter a name and description for the clone customizer.
  - For each disk in the source virtual machine or template, select a target type (Repository, Physical Disk, Storage Array), or deselect the source disk.
  - For each target type, select the target Repository, Physical Disk, or Storage Array.
  - For each disk, select the Clone Type (Sparse Copy, Non-Sparse Copy, Thin Clone).
  - For each VNIC, select a target network or deselect the VNIC.

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In the previous slide, you learned that you can create a clone customizer from within the cloning wizard. You can also add, edit, and delete clone customizers by using the “Manage Clone Customizer” Wizard. You access this wizard by selecting a virtual machine or template and clicking the “Manage Clone Customizer” icon on the toolbar, or selecting the wizard from the shortcut menu for the virtual machine or template.

When you create or edit a clone customizer:

- You specify the storage and network mappings for the clones to be created by using the new or edited clone customizer
- You create these mappings for the resources that are available in the virtual machine or template for which you are creating or editing the clone customizer

For example, if you are creating a clone customizer for a virtual machine that has the following resources:

- One virtual disk in a repository
- One physical disk in a storage array that is managed with a vendor plug-in
- Two VNICs

For each resource, you select where the same resource is to be created during the cloning process.

Using the preceding example, you might:

- Select a different repository for the virtual disk
- Select the same storage array for the physical disk to take advantage of thin cloning
- Select the same target network for the first VNIC
- Select a different target network for the second VNIC

You can also omit a storage or network mapping. For example, you can map only one VNIC even if the original virtual machine configuration contains two VNICs.

Also note that if the virtual machine for which you are creating a clone customizer is in the running state, and you are creating this clone customizer within the cloning wizard, the cloning customizer creation step succeeds, but the actual cloning operation can fail. In this case, stop the virtual machine before attempting to clone it.

**Note:** A clone customizer is an Oracle VM Manager object and as such does not have a representation in the storage repositories.

## Cloning Storage: Storage Mapping Clone Type

- When creating a storage mapping for a clone customizer, you specify the following:
  - Clone Target Type (Repository, Physical Disk)
  - Clone Type (Sparse Copy, Non-Sparse Copy, Thin Copy)
- Your selection for Clone Type depends on the current location for the disk and the Clone Target Type.
- Examples:
  - OCFS2-type repository to same repository: Select Thin Copy.
  - Repository to physical disk: Select Sparse or Non-Sparse Copy.
  - Physical disk to physical disk in a managed storage array: Select Thin Copy.

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When creating a clone customizer, you can map each disk in the source template or virtual machine to a repository, to a physical disk, or, for a disk that is residing in a managed storage array, to a new disk in the same managed storage array.

**Clone Type**

The Clone Type selection, which is the mode for the copy operation, includes Sparse, Non-Sparse, and Thin Clone. The definitions for the type of copy operation are the same as the copy definitions that were discussed for virtual and physical disk cloning in the lesson titled “Managing Storage.”

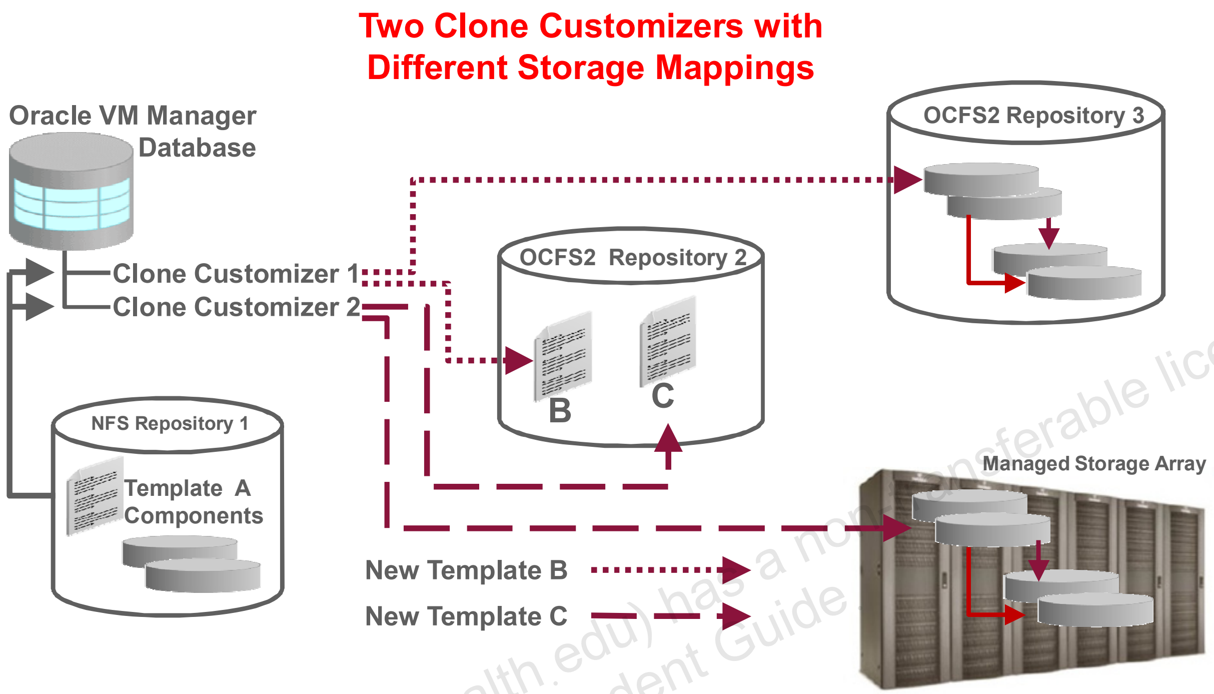
The selection for the clone type in your clone customizers also depends on the source and the target disk.

When cloning a disk:

- From an OCFS2-type repository to the same repository, you can use all three methods
- From an NFS-type repository to the same repository, or from any repository to a different repository, Sparse Copy and Non-Sparse Copy are supported

- From a repository to a physical disk, Sparse Copy and Non-Sparse Copy are supported
- From a physical disk in a generic storage array to another existing physical disk, Sparse Copy and Non-Sparse Copy are supported
- From a physical disk in a vendor-managed storage array to a new disk that is created dynamically in the same vendor-managed array, thin cloning is automatically selected if supported by the vendor

# Clone Customizers: A Scenario






The diagram in the slide illustrates a cloning scenario where Template A in Repository 1 is cloned to create two new templates, Template B and Template C. During the cloning operation, two different clone customizers are used to clone Template A, which results in cloning to two different storage locations by using different storage mappings in the clone customizers. In this scenario, the network configuration remains the same; that is, the network mappings in the clone customizers are configured to match those of the source Template A.

Why create two new templates by using clone customizers rather than clone virtual machines directly from Template A?

If you want to take advantage of the thin cloning capabilities that are available with OCFS2 type repositories and with many vendor-managed storage arrays, you must clone the storage from within the same repository or the same vendor-managed storage array.

Source Template A's components, which include a configuration file and two virtual disks, reside in an NFS repository that does not support thin cloning. The goal is therefore to create templates to an appropriate storage location, to allow future thin cloning. The new Template B and Template C, which are cloned by using clone customizers 1 and 2, have their configuration files in the same repository, Repository 2, but the disks for the new Template B are cloned as virtual disks into Repository 3, and as physical disks into the managed storage array for the new Template C.

After Template B and Template C are created, you can clone these templates by using simple or advanced cloning and take advantage of thin cloning. This additional cloning is shown in the diagram in the slide as solid arrows in Repository 3 and in the managed storage array.

You can achieve many different results with clone customizers. For example:

- Move cloning from slow NFS repositories to faster repositories that can also support thin cloning.
- Spread out the creation of virtual machine storage over different repositories while keeping all the configuration files in the same repository. For example, the repository that contains the configuration files could be placed on a slower NFS share, whereas the virtual disks could be created in repositories on a SAN.

## Cloning Operations: Summary

- If the source for the cloning operation is a virtual machine and hot cloning is not supported, stop the virtual machine.
- When cloning within an OCFS2 repository or within a managed storage array, use thin cloning.
- When cloning between repositories or to physical disks, the cloning process uses a copy operation (sparse or non-sparse).
- If a clone customizer uses an existing physical disk as the target of a disk copy, update the target physical disk before reusing the customizer.
- You can edit your new clone to supply missing configuration elements.

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Hot cloning is supported only for cloning operations by using thin cloning.

The VNICs for the clones are assigned new MAC addresses automatically.

The newly cloned virtual machine is assigned to an Oracle VM server in the target pool at the completion of the cloning process.

If your new cloned virtual machine was created with incomplete mappings, you can edit the virtual machine before you start it. For example, if you did not provide a network mapping for your virtual machine, edit your new clone to provide the missing networking information.

# Managing Virtual Machines

- In the previous section of this lesson, you learned how to create virtual machines.
- The rest of this lesson addresses the management of virtual machines, and includes the following topics:
  - Virtual machine life cycle
  - Actions on virtual machines
  - High availability for virtual machines





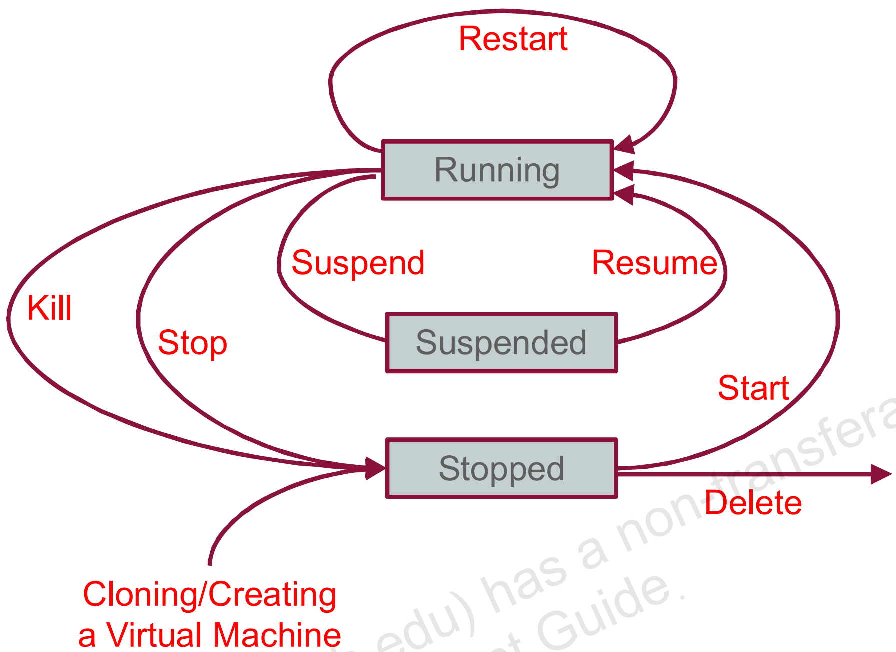
In the previous sections of this lesson, you learned how to prepare your Oracle VM environment for creating virtual machines and you stepped through the creation of virtual machines by using different methods, including cloning.

The rest of this lesson addresses virtual machine management. You learn how virtual machines cycle through different states and how to control these states by using the Oracle VM Manager.

The last topic of this lesson shows you:

- The conditions that must be met for virtual machines to be highly available
- How high availability works

## Virtual Machine Life Cycle

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When you first create a virtual machine by using the Create Virtual Machine Wizard or through cloning, the virtual machine is in a stopped state. You can start the virtual machine when the creation or cloning operation has completed.

From its running state, a virtual machine can be stopped, killed, restarted, suspended, migrated, and cloned.

To perform an action on a virtual machine by using the Oracle VM Manager UI, select the virtual machine and right-click to display the list of the available actions from the shortcut menu. Or, select the virtual machine and choose an operation on the toolbar.

If a virtual machine is locked, you cannot perform any of the actions listed for the virtual machine. You must wait for the lock to be released or abort the job that holds the lock.

**Starting or Restarting a Virtual Machine**

After creating a virtual machine, you can start it. You might need to stop and edit the virtual machine to modify the boot order under Boot Options, and remove the PXE or CDROM selection to avoid restarting the installation when the virtual machine reboots after completing its installation.

You cannot start a virtual machine if there are not enough resources on the Oracle VM server that is hosting the virtual machine. If the start policy for the virtual machine is set as “Start on best server,” the virtual machine starts on another Oracle VM server. If the start policy is set as “Start on current server,” an error message indicates the resource that is below the threshold: Memory or CPU. In this situation, you can stop some non-essential virtual machines or migrate the virtual machine to a server with available resources.

**Stopping or Killing a Virtual Machine**

To stop a virtual machine, select Stop from the virtual machine’s shortcut menu. If the stop operation is not progressing, you can use the Kill action to force the virtual machine to stop its operation, but first, you must abort the stop operation.

You can also stop the virtual machine by using the `shutdown` command from within the guest operating system of the virtual machine. If the virtual machine is enabled for high availability, it restarts automatically if it is shut down by using the OS `shutdown` command. In this case, use the Oracle VM Manager Stop action to keep the virtual machine from restarting.

**Suspending and Resuming a Virtual Machine**

Suspending a virtual machine is similar to putting a computer in sleep mode. The current state of the operating system and the application data are saved before the machine is put in suspended mode. When you resume operations for the virtual machine, the operating system and applications continue from the saved state. The virtual machine’s resources are not released on the Oracle VM server where it is located when in the suspended state. If you want to release these resources, stop the virtual machine.

**Deleting a Virtual Machine**

You can delete a virtual machine if it is in a stopped state or in the “In Error” state.

## More Actions on Virtual Machines

In addition to actions that affect the state of a virtual machine, you can perform the following actions:

- Connecting to a virtual machine
- Moving a virtual machine
- Migrating or live migrating a virtual machine
- Editing a virtual machine
- Installing paravirtualized drivers for an HV machine

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**Connecting to a Virtual Machine**

After starting a virtual machine, you can connect to it. To connect to your virtual machine, select Launch Console (VNC-type connection) from the context menu for the virtual machine. Although you can launch another VNC console session to your virtual machine, only one console can be active at a time. You can take control of the console from your second console window by clicking OK when prompted with this message: "Do you want to take over the connection from user admin?"

You can also use the serial console feature to access a virtual machine.

Refer to the lesson titled "Planning and Installation" for information about how to prepare your client computer or your Oracle VM Manager host for console operations.

**Moving a Virtual Machine**

You can move a virtual machine's storage elements and configuration file by using the Clone or Move Virtual Machine Wizard. You can use the same process to move a template.

This type of move operation involves only moving a virtual machine's storage components. It is not used to move a virtual machine between Oracle VM servers. Moving a virtual machine to another Oracle VM server in the same server pool is called migration. This type of operation is discussed next.

You saw the clone option on the Clone Virtual Machine Wizard screen in the slide titled “Launching a Cloning Operation from the Oracle VM Manager UI.” A move operation allows various elements of the virtual machine to be moved to different presented repositories. The virtual machine’s configuration file can be in one repository while its virtual disks can reside in other repositories. A move operation supports moving one or more of these elements from their source repositories to any desired target repositories. They do not all have to go to the same target repository. You specify where to move these elements using a "clone customizer."

To perform the move operation, you specify:

- A clone customizer (you can create one from this location if necessary)
- A repository, where the cloned configuration file is to be created

In the clone customizer wizard, you can relocate every storage element for the virtual machine (or template) that you are moving. The clone customizer also includes a mapping for the network elements of the virtual machine (or template) to move, but those mappings, if you create them, are ignored during the move operation.

There is no difference between moving a virtual machine and moving a template. The move operation is launched by clicking the move icon either for a virtual machine or for a template.

**Note:** Generally, you move a virtual machine (or template) between repositories that are presented to the same server pool; that is, the server pool where the virtual machine to be moved currently resides. To move a virtual machine between server pools, you must move the virtual machine’s storage components between NFS-based repositories, and the source and destination server pools in the move operation must be presented to the same NFS-based repositories.

**Migrating or Live Migrating a Virtual Machine**

This topic is discussed in the next several slides.

**Editing a Virtual Machine**

You can edit a virtual machine at any time, but a running virtual machine allows only certain types of edit:

- You can change the name of the virtual machine, its description, the size of memory, up to maximum memory, the number of processors, up to the maximum number of processors, priority, and processor cap. These parameters appear on the first screen that is displayed when you create or edit a virtual machine.
- You can add a disk to or remove a disk from the virtual machine’s disk configuration.
- You can also add a VNIC (hot add).
- You can change the boot device but this change does not take effect until the virtual machine is stopped and restarted.

**Installing Paravirtualized Drivers for an HV Machine**

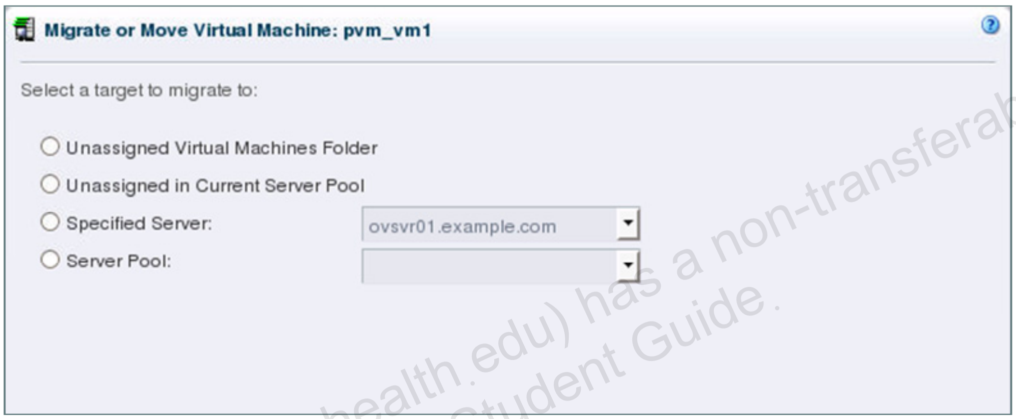
Paravirtualized drivers increase the throughput of I/O and network operations in the guest operating systems that are running on Oracle VM server hosts.

The current releases of Oracle Linux and Red Hat Enterprise Linux already contain the necessary paravirtualized drivers.

For help with installing paravirtualized drivers in Microsoft Windows releases, consult the *Oracle VM Paravirtual Drivers Installation Guide for Microsoft Windows*, Part Number E50255-03 or later.

# Migrating a Stopped Virtual Machine

- With a cold migration operation, you have four destinations to choose from:
  - The Unassigned Virtual Machines folder
  - Unassigned in the current server pool
  - To a specified Oracle VM server
  - To a specified server pool










Cold migration is the process of migrating a stopped virtual machine. With cold migration, you have four available destinations to choose from when moving a virtual machine.

- **Unassigned Virtual Machines folder:** You can remove a virtual machine from the server pool and move it to the Unassigned Virtual Machines folder.
- **Unassigned in Current Server Pool:** You can move the virtual machine to the server pool level. When you move a virtual machine to the server pool level, you remove the virtual machine from its current Oracle VM server, but the virtual machine remains in the server pool.
- **Specified Server:** You can move a virtual machine to Oracle VM servers in other server pools that share the same repository. This type of cross-server pool migration is supported only for virtual machines with resources in NFS repositories.
- **Server Pool:** You can move a virtual machine to another server pool. When you migrate a virtual machine to another server pool, the virtual machine is not deployed to a particular Oracle VM server until you start the virtual machine.

### Unassigned Virtual Machines Folder

The Unassigned Virtual Machines folder, which is a location for storing non-running virtual machines, works like an offline pool. You can migrate a non-running virtual machine to this location.

If you perform migration of a non-running virtual machine by using the Oracle VM CLI, you can direct the virtual machine to the Unassigned Virtual Machines folder by omitting the specification of a destination Oracle VM server or destination server pool in the migrate vm command.

Virtual machines in the Unassigned Virtual Machines folder can be migrated, cloned, edited, or deleted, as long as they are not locked by an ongoing operation.

You can migrate one or more virtual machines at a time. When migrating multiple virtual machines, the migrations are performed serially and not concurrently.

## Migrating a Running Virtual Machine

- Live migration moves a running virtual machine to another Oracle VM server.
- For a live migration to begin:
  - Oracle VM servers must be in the same server processor compatibility group pool.
  - Target servers must have adequate CPU, memory, and storage resources.
  - Oracle VM servers must run the same version of Oracle VM.







**Live Migration**

Live migration is the process of moving a running virtual machine from one Oracle VM server to another Oracle VM server in the same server pool.

For live migration to occur, the Oracle VM Manager must find a target Oracle VM server of the same make and model as the source server. The target server must have enough CPU, memory, and storage resources to allow migration to begin.

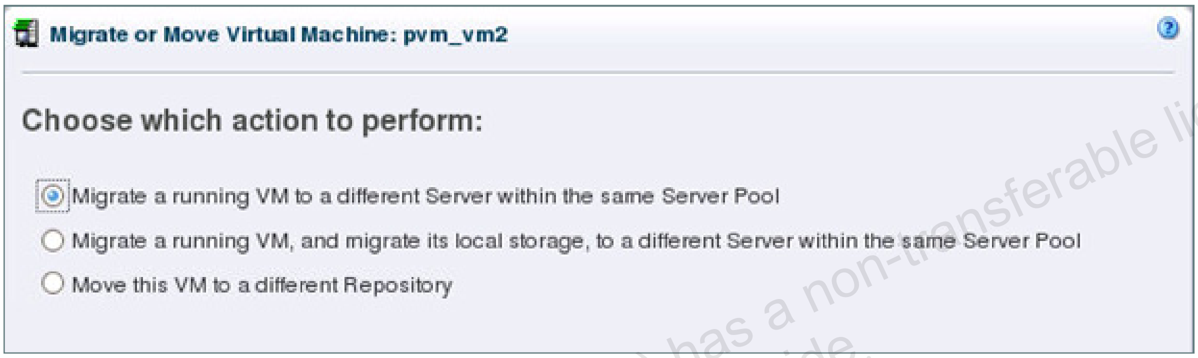
If you have created server processor compatibility groups to further refine the attributes for a particular group of Oracle VM servers, live migration is not allowed between servers in different server processor compatibility groups. Server processor compatibility groups were introduced in the lesson titled "Managing Servers and Networks."

Also, your source and target Oracle VM servers must be running the same version of Oracle VM software. Live migration does not support mixed version server pools. The Oracle VM Manager creates a mixed version server pool when upgrading a server in the pool. For live migration to work, each server must run the same version of Xen. For example, an Oracle VM 3.4 server uses a different Xen version than an Oracle VM 3.3 server.

You have two main approaches for migrating running virtual machines. The next few slides discuss these approaches.

# Live Migration Approaches

- There are two main approaches to live migration:
  - Migrate a running VM to a different Server within the same Server Pool
  - Migrate a running VM, and migrate its local storage, to a different Server within the same Server Pool






There are two main approaches to choose from when performing a live migration. One scenario is often referred to as a memory only migration. This type of migration only copies the RAM and processor states of the virtual machines. The migrating virtual machine expects its virtual disks and configuration to be consistent, with the same device names, IDs, and configuration as they were before being migrated.

In this scenario, you can migrate a running virtual machine from one server to another only if its storage can be accessed by both the source and target servers. This is the type of live migration you run when you select the first option in the Migrate or Move Virtual Machine Wizard.

The next scenario is referred to as a storage live migration, which is the second choice in the Migrate or Move Virtual Machine Wizard. This type of migration not only migrates the running virtual machine to a different server but also moves its configuration and local storage.

In this scenario, you can move a virtual machine's virtual disks only if the virtual disks originate from a local repository that is on a non-clustered OCFS2 file system and the target system also has a local repository that is on a non-clustered OCFS2 file system.

# Performing a Memory Only Migration

- Migrates a virtual machine to a different server within a server pool that uses a shared repository
- Select a server from the drop-down list.








**Migrating a running VM to a different Server within the same Server Pool**

This option changes the server where the virtual machine runs. The destination server must be within the same server pool as the source server. The target server must be able to access the virtual machine configuration and storage for this type of migration. Select this option when you want to migrate virtual machines between servers within a server pool that use a shared repository.

The Specified Server option button is the only enabled choice. Select the target server from the Specified Server drop-down list.

The other options like migrating to either the Unassigned Virtual Machines Folder or to Unassigned in Current Server Pool do not apply because you are migrating a running virtual machine.

You cannot live migrate running virtual machines to any other server pool because the option you selected only migrates virtual machines to an Oracle VM server within the same server pool.

## Performing a Storage Live Migration

- Migrates a virtual machine to a different server within a server pool, and moves its local and configuration file
- Select a server from the drop-down list.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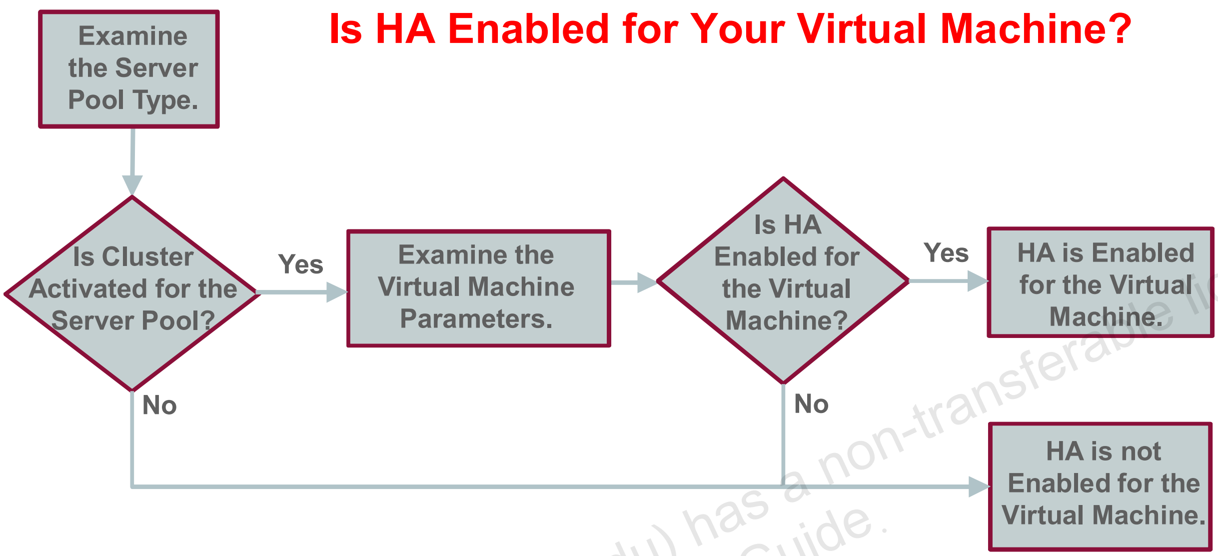
**Migrate a running VM, and migrate its local storage, to a different Server within the same Server Pool**

This option changes the server where the virtual machine runs and moves its local storage. You can choose this option to migrate virtual machines between servers within the same server pool when the following conditions are true:

- At least one virtual disk resides in a repository that is local to the source server.
- The target repository is local to the target server.

# Enabling High Availability for Virtual Machines






At the virtual machine level, Oracle VM offers basic restart capabilities for the virtual machine:

- When you create a virtual machine, the default setting in the virtual machine configuration file is to restart the virtual machine if it crashes. The setting in the `vm.cfg` file is `on_crash = 'restart'`.

Oracle VM also offers the high availability (HA) functionality within a server pool to ensure uninterrupted availability of a virtual machine in the event of failure of the Oracle VM server on which the virtual machine is running.

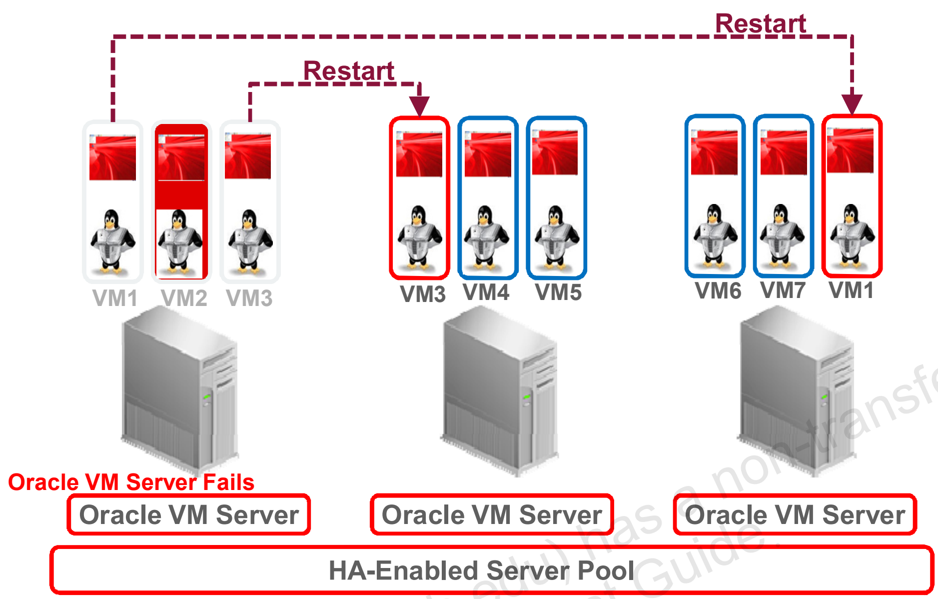
To enable HA:

- **Enable HA on a server pool:** To automatically configure the server pool cluster and enable HA in a server pool, select the Clustered Server Pool check box when you create the server pool.
- **Enable HA on a virtual machine:** To enable HA on a virtual machine, select the Enable High Availability check box when you create or edit a virtual machine.

As shown in the diagram in the slide, if you enable HA at the server pool level by activating the cluster and at the virtual machine level, HA is in effect for the virtual machine.

# HA and Oracle VM Server Failure

## HA Activity when an Oracle VM Server Fails








**An Oracle VM Server Is Stopped**

You cannot stop an Oracle VM server from the Oracle VM Manager UI if it has running virtual machines on it. If you stop an Oracle VM server from its OS, the running, HA-enabled virtual machines restart on another available Oracle VM server. If there are no available Oracle VM servers, or if all the Oracle VM servers in the server pool are at full capacity and cannot run additional virtual machines, the virtual machines are stopped and are restarted when an Oracle VM server becomes available.

**An Oracle VM Server Is Put into Maintenance**

If an Oracle VM server is put in maintenance mode, all the running virtual machines on that server are migrated, regardless of their HA status. Anti-affinity rules are taken into account when migrating the virtual machines. Do not put all the Oracle VM servers in the same server pool in maintenance mode at the same time because the virtual machines are not migrated if there are no available Oracle VM servers for the migration operation. The virtual machines remain in the running state.

**An Oracle VM Server Fails**

If an Oracle VM server fails, all highly available, 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 with high availability enabled are restarted when an Oracle VM server becomes available.

### HA and Anti-Affinity Groups

When restarting HA-enabled virtual machines, Oracle VM takes into account the existing anti-affinity rules established by the anti-affinity groups. However, if an Oracle VM server fails and the only other Oracle VM server in the server pool has a running virtual machine that is part of the same anti-affinity group as the HA-enabled virtual machine on the failing Oracle VM server, the HA-enabled virtual machine restarts on the available Oracle VM server, overriding the anti-affinity rule.

**Note:** If you enable HA for a virtual machine, the virtual machine restarts if it is shut down from within its guest operating system. To stop an HA-enabled virtual machine, use the Oracle VM Manager.

## Quiz

Which three cloning processes are valid?

a. From a virtual machine to a new virtual machine
b. From a virtual machine to a new template
c. From a virtual machine to a virtual appliance
d. From a template to a virtual machine

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**Answer: a, b, d**

# Summary

In this lesson, you should have learned how to:

- Describe virtual machine components
- List the steps to prepare for virtual machine creation
- Discuss the various ways to create virtual machines
- Perform the steps to create virtual machines
- Install a guest OS within a virtual machine
- Discuss the use of templates and virtual appliances
- Use cloning and clone customizers to create additional virtual entities
- Access and manage virtual machines

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## Practice 6: Overview

This practice covers the following topics:

- Reserving MAC addresses for the VNICs of your future virtual machines
- Preparing your HTTP server for installing a guest OS in a virtual machine
- Creating a paravirtualized virtual machine, starting it, and accessing your new virtual machine
- Installing Oracle Linux as the guest OS in the virtual machine
- Cloning a template into a new virtual machine
- Creating a clone customizer and using it for cloning operations
- Migrating virtual machines
- Exercising the high availability (HA) and anti-affinity features
- Viewing VNIC usage from the Oracle VM Manager UI

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