



## Red Hat Virtualization 4.4

### Installing Red Hat Virtualization as a standalone Manager with local databases

ALTERNATIVE method – Installing the Red Hat Virtualization Manager and its  
databases on the same server



## Red Hat Virtualization 4.4 Installing Red Hat Virtualization as a standalone Manager with local databases

---

ALTERNATIVE method – Installing the Red Hat Virtualization Manager and its databases on the same server

Red Hat Virtualization Documentation Team  
Red Hat Customer Content Services  
rhev-docs@redhat.com

## Legal Notice

Copyright © 2021 Red Hat, Inc.

The text of and illustrations in this document are licensed by Red Hat under a Creative Commons Attribution–Share Alike 3.0 Unported license ("CC-BY-SA"). An explanation of CC-BY-SA is available at

<http://creativecommons.org/licenses/by-sa/3.0/>

. In accordance with CC-BY-SA, if you distribute this document or an adaptation of it, you must provide the URL for the original version.

Red Hat, as the licensor of this document, waives the right to enforce, and agrees not to assert, Section 4d of CC-BY-SA to the fullest extent permitted by applicable law.

Red Hat, Red Hat Enterprise Linux, the Shadowman logo, the Red Hat logo, JBoss, OpenShift, Fedora, the Infinity logo, and RHCE are trademarks of Red Hat, Inc., registered in the United States and other countries.

Linux<sup>®</sup> is the registered trademark of Linus Torvalds in the United States and other countries.

Java<sup>®</sup> is a registered trademark of Oracle and/or its affiliates.

XFS<sup>®</sup> is a trademark of Silicon Graphics International Corp. or its subsidiaries in the United States and/or other countries.

MySQL<sup>®</sup> is a registered trademark of MySQL AB in the United States, the European Union and other countries.

Node.js<sup>®</sup> is an official trademark of Joyent. Red Hat is not formally related to or endorsed by the official Joyent Node.js open source or commercial project.

The OpenStack<sup>®</sup> Word Mark and OpenStack logo are either registered trademarks/service marks or trademarks/service marks of the OpenStack Foundation, in the United States and other countries and are used with the OpenStack Foundation's permission. We are not affiliated with, endorsed or sponsored by the OpenStack Foundation, or the OpenStack community.

All other trademarks are the property of their respective owners.

## Abstract

This document describes how to install a standalone Manager environment – where the Red Hat Virtualization Manager is installed on either a physical server or a virtual machine hosted in another environment – with the Manager database and the Data Warehouse service and database installed on the same machine as the Manager. If this is not the configuration you want to use, see the other Installation Options in the Product Guide.

## Table of Contents

<b>PREFACE</b> .....	<b>4</b>
STANDALONE MANAGER ARCHITECTURE .....	4
<b>MAKING OPEN SOURCE MORE INCLUSIVE</b> .....	<b>6</b>
<b>CHAPTER 1. INSTALLATION OVERVIEW</b> .....	<b>7</b>
<b>CHAPTER 2. REQUIREMENTS</b> .....	<b>8</b>
2.1. RED HAT VIRTUALIZATION MANAGER REQUIREMENTS .....	8
2.1.1. Hardware Requirements .....	8
2.1.2. Browser Requirements .....	8
2.1.3. Client Requirements .....	9
2.1.4. Operating System Requirements .....	9
2.2. HOST REQUIREMENTS .....	10
2.2.1. CPU Requirements .....	10
2.2.1.1. Checking if a Processor Supports the Required Flags .....	11
2.2.2. Memory Requirements .....	11
2.2.3. Storage Requirements .....	11
2.2.4. PCI Device Requirements .....	12
2.2.5. Device Assignment Requirements .....	12
2.2.6. vGPU Requirements .....	13
2.3. NETWORKING REQUIREMENTS .....	13
2.3.1. General requirements .....	13
2.3.2. Firewall Requirements for DNS, NTP, and IPMI Fencing .....	13
2.3.3. Red Hat Virtualization Manager Firewall Requirements .....	14
2.3.4. Host Firewall Requirements .....	17
2.3.5. Database Server Firewall Requirements .....	21
<b>CHAPTER 3. INSTALLING THE RED HAT VIRTUALIZATION MANAGER</b> .....	<b>23</b>
3.1. PREPARING THE RED HAT VIRTUALIZATION MANAGER MACHINE .....	23
3.2. ENABLING THE RED HAT VIRTUALIZATION MANAGER REPOSITORIES .....	23
3.3. INSTALLING AND CONFIGURING THE RED HAT VIRTUALIZATION MANAGER .....	24
3.4. CONNECTING TO THE ADMINISTRATION PORTAL .....	30
<b>CHAPTER 4. INSTALLING HOSTS FOR RED HAT VIRTUALIZATION</b> .....	<b>32</b>
4.1. RED HAT VIRTUALIZATION HOSTS .....	32
4.1.1. Installing Red Hat Virtualization Hosts .....	32
4.1.2. Enabling the Red Hat Virtualization Host Repository .....	34
4.1.3. Advanced Installation .....	35
4.1.3.1. Custom Partitioning .....	35
4.1.3.2. Automating Red Hat Virtualization Host deployment .....	36
4.1.3.2.1. Preparing the installation environment .....	37
4.1.3.2.2. Configuring the PXE server and the boot loader .....	37
4.1.3.2.3. Creating and running a Kickstart file .....	38
4.2. RED HAT ENTERPRISE LINUX HOSTS .....	41
4.2.1. Installing Red Hat Enterprise Linux hosts .....	41
4.2.2. Enabling the Red Hat Enterprise Linux host Repositories .....	41
4.2.3. Installing Cockpit on Red Hat Enterprise Linux hosts .....	43
4.3. RECOMMENDED PRACTICES FOR CONFIGURING HOST NETWORKS .....	43
4.4. ADDING STANDARD HOSTS TO THE RED HAT VIRTUALIZATION MANAGER .....	44
<b>CHAPTER 5. PREPARING STORAGE FOR RED HAT VIRTUALIZATION</b> .....	<b>46</b>
5.1. PREPARING NFS STORAGE .....	46

---

5.2. PREPARING ISCSI STORAGE	48
5.3. PREPARING FCP STORAGE	48
5.4. PREPARING POSIX-COMPLIANT FILE SYSTEM STORAGE	49
5.5. PREPARING LOCAL STORAGE	50
5.6. PREPARING RED HAT GLUSTER STORAGE	50
5.7. CUSTOMIZING MULTIPATH CONFIGURATIONS FOR SAN VENDORS	51
5.8. RECOMMENDED SETTINGS FOR MULTIPATH.CONF	52
<b>CHAPTER 6. ADDING STORAGE FOR RED HAT VIRTUALIZATION</b>	<b>54</b>
6.1. ADDING NFS STORAGE	54
6.2. ADDING ISCSI STORAGE	55
6.3. ADDING FCP STORAGE	57
6.4. ADDING POSIX-COMPLIANT FILE SYSTEM STORAGE	58
6.5. ADDING LOCAL STORAGE	59
6.6. ADDING RED HAT GLUSTER STORAGE	59
<b>APPENDIX A. CONFIGURING A LOCAL REPOSITORY FOR OFFLINE RED HAT VIRTUALIZATION MANAGER INSTALLATION</b>	<b>60</b>
Enabling the Red Hat Virtualization Manager Repositories	60
Configuring the Offline Repository	61
<b>APPENDIX B. PREPARING A LOCAL MANUALLY CONFIGURED POSTGRESQL DATABASE</b>	<b>64</b>
Enabling the Red Hat Virtualization Manager Repositories	64
Initializing the PostgreSQL Database	65
<b>APPENDIX C. SETTING UP CINDERLIB</b>	<b>67</b>
<b>APPENDIX D. CONFIGURING A HOST FOR PCI PASSTHROUGH</b>	<b>69</b>
<b>APPENDIX E. REMOVING THE STANDALONE RED HAT VIRTUALIZATION MANAGER</b>	<b>71</b>



## PREFACE

Standalone Manager installation is manual and customizable. You must install a Red Hat Enterprise Linux machine, then run the configuration script (**engine-setup**) and provide information about how you want to configure the Red Hat Virtualization Manager. Add hosts and storage after the Manager is running. At least two hosts are required for virtual machine high availability.

In a local database environment, the Manager database and Data Warehouse database can be created automatically by the Manager configuration script. Alternatively, you can create these databases manually on the Manager machine before running **engine-setup**.

See the [Planning and Prerequisites Guide](#) for information on environment options and recommended configuration.

**Table 1. Red Hat Virtualization Key Components**

Component Name	Description
Red Hat Virtualization Manager	A service that provides a graphical user interface and a REST API to manage the resources in the environment. The Manager is installed on a physical or virtual machine running Red Hat Enterprise Linux.
Hosts	Red Hat Enterprise Linux hosts (RHEL hosts) and Red Hat Virtualization Hosts (image-based hypervisors) are the two supported types of host. Hosts use Kernel-based Virtual Machine (KVM) technology and provide resources used to run virtual machines.
Shared Storage	A storage service is used to store the data associated with virtual machines.
Data Warehouse	A service that collects configuration information and statistical data from the Manager.

## STANDALONE MANAGER ARCHITECTURE

The Red Hat Virtualization Manager runs on a physical server, or a virtual machine hosted in a separate virtualization environment. A standalone Manager is easier to deploy and manage, but requires an additional physical server. The Manager is only highly available when managed externally with a product such as Red Hat's High Availability Add-On.

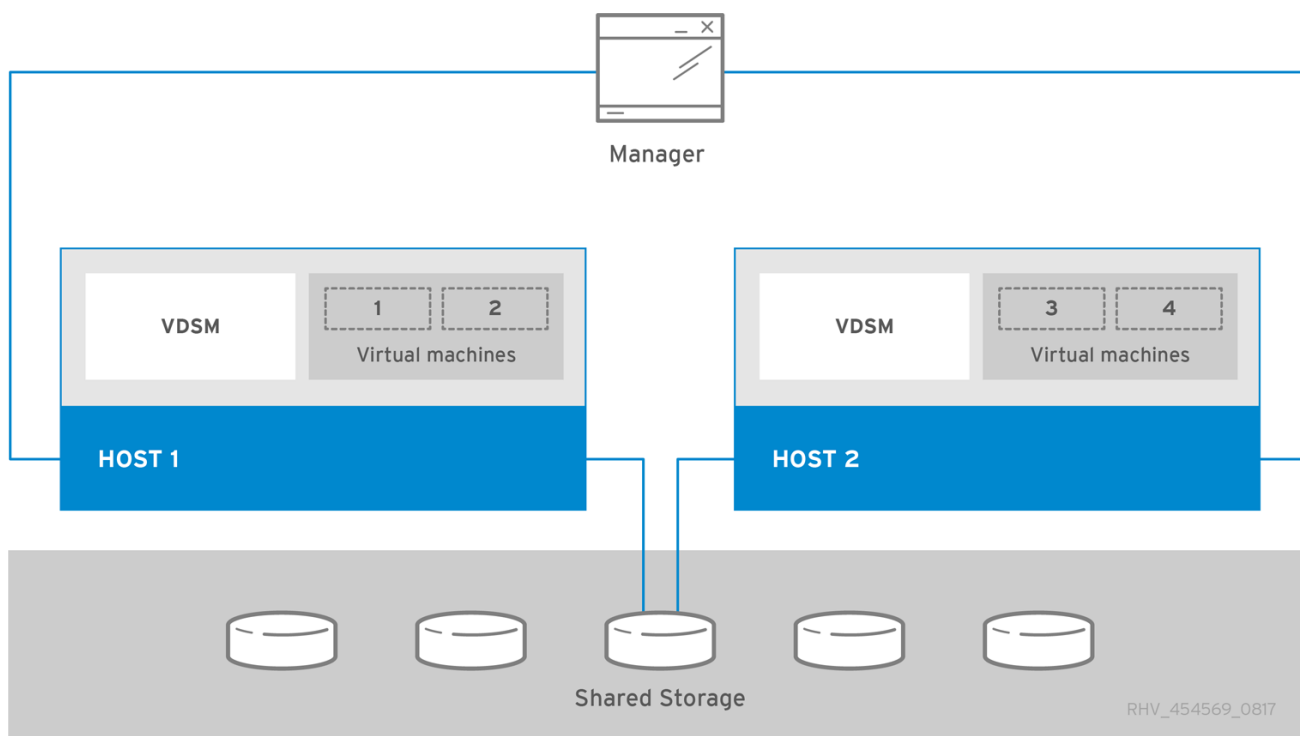
The minimum setup for a standalone Manager environment includes:

- One Red Hat Virtualization Manager machine. The Manager is typically deployed on a physical server. However, it can also be deployed on a virtual machine, as long as that virtual machine is hosted in a separate environment. The Manager must run on Red Hat Enterprise Linux 8.
- A minimum of two hosts for virtual machine high availability. You can use Red Hat Enterprise Linux hosts or Red Hat Virtualization Hosts (RHVH). VDSM (the host agent) runs on all hosts to facilitate communication with the Red Hat Virtualization Manager.



- One storage service, which can be hosted locally or on a remote server, depending on the storage type used. The storage service must be accessible to all hosts.

Figure 1. Standalone Manager Red Hat Virtualization Architecture



## MAKING OPEN SOURCE MORE INCLUSIVE

Red Hat is committed to replacing problematic language in our code, documentation, and web properties. Because of the enormity of this endeavor, these changes are being updated gradually and where possible. For more details, see [our CTO Chris Wright's message](#).

# CHAPTER 1. INSTALLATION OVERVIEW

Installing a standalone Manager environment with local databases involves the following steps:

1. Install and configure the Red Hat Virtualization Manager:
  - a. Install a Red Hat Enterprise Linux machine for the Manager.
  - b. Register the Manager machine with the Content Delivery Network and enable the Red Hat Virtualization Manager repositories.
  - c. Install and Configure the Red Hat Virtualization Manager using **engine-setup**.
  - d. Connect to the Administration Portal to add hosts and storage domains.
2. Install hosts to run virtual machines on:
  - a. Use either host type, or both:
    - Red Hat Virtualization Host
    - Red Hat Enterprise Linux
  - b. Add the hosts to the Manager.
3. Prepare storage to use for storage domains. You can use one of the following storage types:
  - NFS
  - iSCSI
  - Fibre Channel (FCP)
  - POSIX-compliant file system
  - Local storage
  - Red Hat Gluster Storage
4. Add storage domains to the Manager.



## IMPORTANT

Keep the environment up to date. See <https://access.redhat.com/articles/2974891> for more information. Since bug fixes for known issues are frequently released, use scheduled tasks to update the hosts and the Manager.

## CHAPTER 2. REQUIREMENTS

### 2.1. RED HAT VIRTUALIZATION MANAGER REQUIREMENTS

#### 2.1.1. Hardware Requirements

The minimum and recommended hardware requirements outlined here are based on a typical small to medium-sized installation. The exact requirements vary between deployments based on sizing and load.

Hardware certification for Red Hat Virtualization is covered by the hardware certification for Red Hat Enterprise Linux. For more information, see <https://access.redhat.com/solutions/725243>. To confirm whether specific hardware items are certified for use with Red Hat Enterprise Linux, see <https://access.redhat.com/ecosystem/#certifiedHardware>.

**Table 2.1. Red Hat Virtualization Manager Hardware Requirements**

Resource	Minimum	Recommended
CPU	A dual core x86_64 CPU.	A quad core x86_64 CPU or multiple dual core x86_64 CPUs.
Memory	4 GB of available system RAM if Data Warehouse is not installed and if memory is not being consumed by existing processes.	16 GB of system RAM.
Hard Disk	25 GB of locally accessible, writable disk space.	50 GB of locally accessible, writable disk space.  You can use the <a href="#">RHV Manager History Database Size Calculator</a> to calculate the appropriate disk space for the Manager history database size.
Network Interface	1 Network Interface Card (NIC) with bandwidth of at least 1 Gbps.	1 Network Interface Card (NIC) with bandwidth of at least 1 Gbps.

#### 2.1.2. Browser Requirements

The following browser versions and operating systems can be used to access the Administration Portal and the VM Portal.

Browser support is divided into tiers:

- Tier 1: Browser and operating system combinations that are fully tested and fully 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. Limited support is provided for this tier. 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.

**Table 2.2. Browser Requirements**

Support Tier	Operating System Family	Browser
Tier 1	Red Hat Enterprise Linux	Mozilla Firefox Extended Support Release (ESR) version
	Any	Most recent version of Google Chrome, Mozilla Firefox, or Microsoft Edge
Tier 2		
Tier 3	Any	Earlier versions of Google Chrome or Mozilla Firefox
	Any	Other browsers

### 2.1.3. Client Requirements

Virtual machine consoles can only be accessed using supported Remote Viewer (**virt-viewer**) clients on Red Hat Enterprise Linux and Windows. To install **virt-viewer**, see [Installing Supporting Components on Client Machines](#) in the *Virtual Machine Management Guide*. Installing **virt-viewer** requires Administrator privileges.

You can access virtual machine consoles using the SPICE, VNC, or RDP (Windows only) protocols. You can install the QXLDDOD graphical driver in the guest operating system to improve the functionality of SPICE. SPICE currently supports a maximum resolution of 2560x1600 pixels.

#### Client Operating System SPICE Support

Supported QXLDDOD drivers are available on Red Hat Enterprise Linux 7.2 and later, and Windows 10.



#### NOTE

SPICE may work with Windows 8 or 8.1 using QXLDDOD drivers, but it is neither certified nor tested.

### 2.1.4. Operating System Requirements

The Red Hat Virtualization Manager must be installed on a base installation of Red Hat Enterprise Linux 8 that has been updated to the latest minor release.

Do not install any additional packages after the base installation, as they may cause dependency issues when attempting to install the packages required by the Manager.

Do not enable additional repositories other than those required for the Manager installation.

## 2.2. HOST REQUIREMENTS

Hardware certification for Red Hat Virtualization is covered by the hardware certification for Red Hat Enterprise Linux. For more information, see <https://access.redhat.com/solutions/725243>. To confirm whether specific hardware items are certified for use with Red Hat Enterprise Linux, see <https://access.redhat.com/ecosystem/#certifiedHardware>.

For more information on the requirements and limitations that apply to guests see <https://access.redhat.com/articles/rhel-limits> and <https://access.redhat.com/articles/906543>.

### 2.2.1. CPU Requirements

All CPUs must have support for the Intel® 64 or AMD64 CPU extensions, and the AMD-V™ or Intel VT® hardware virtualization extensions enabled. Support for the No eXecute flag (NX) is also required.

The following CPU models are supported:

- AMD
  - Opteron G4
  - Opteron G5
  - EPYC
- Intel
  - Nehalem
  - Westmere
  - SandyBridge
  - IvyBridge
  - Haswell
  - Broadwell
  - Skylake Client
  - Skylake Server
  - Cascadelake Server
- IBM
  - POWER8
  - POWER9

For each CPU model with security updates, the **CPU Type** lists a basic type and a secure type. For example:

- **Intel Cascadelake Server Family**
- **Secure Intel Cascadelake Server Family**

The Secure CPU type contains the latest updates. For details, see [BZ#1731395](#)

### 2.2.1.1. Checking if a Processor Supports the Required Flags

You must enable virtualization in the BIOS. Power off and reboot the host after this change to ensure that the change is applied.

1. At the Red Hat Enterprise Linux or Red Hat Virtualization Host boot screen, press any key and select the **Boot** or **Boot with serial console** entry from the list.
2. Press **Tab** to edit the kernel parameters for the selected option.
3. Ensure there is a space after the last kernel parameter listed, and append the parameter **rescue**.
4. Press **Enter** to boot into rescue mode.
5. At the prompt, determine that your processor has the required extensions and that they are enabled by running this command:

```
# grep -E 'svm|vmx' /proc/cpuinfo | grep nx
```

If any output is shown, the processor is hardware virtualization capable. If no output is shown, your processor may still support hardware virtualization; in some circumstances manufacturers disable the virtualization extensions in the BIOS. If you believe this to be the case, consult the system's BIOS and the motherboard manual provided by the manufacturer.

### 2.2.2. Memory Requirements

The minimum required RAM is 2 GB. The maximum supported RAM per VM in Red Hat Virtualization Host is 4 TB.

However, the amount of RAM required varies depending on guest operating system requirements, guest application requirements, and guest memory activity and usage. KVM can also overcommit physical RAM for virtualized guests, allowing you to provision guests with RAM requirements greater than what is physically present, on the assumption that the guests are not all working concurrently at peak load. KVM does this by only allocating RAM for guests as required and shifting underutilized guests into swap.

### 2.2.3. Storage Requirements

Hosts require storage to store configuration, logs, kernel dumps, and for use as swap space. Storage can be local or network-based. Red Hat Virtualization Host (RHVH) can boot with one, some, or all of its default allocations in network storage. Booting from network storage can result in a freeze if there is a network disconnect. Adding a drop-in multipath configuration file can help address losses in network connectivity. If RHVH boots from SAN storage and loses connectivity, the files become read-only until network connectivity restores. Using network storage might result in a performance downgrade.

The minimum storage requirements of RHVH are documented in this section. The storage requirements for Red Hat Enterprise Linux hosts vary based on the amount of disk space used by their existing configuration but are expected to be greater than those of RHVH.

The minimum storage requirements for host installation are listed below. However, use the default allocations, which use more storage space.

- / (root) - 6 GB

- /home - 1 GB
- /tmp - 1 GB
- /boot - 1 GB
- /var - 15 GB
- /var/crash - 10 GB
- /var/log - 8 GB
- /var/log/audit - 2 GB
- swap - 1 GB (for the recommended swap size, see <https://access.redhat.com/solutions/15244>)
- Anaconda reserves 20% of the thin pool size within the volume group for future metadata expansion. This is to prevent an out-of-the-box configuration from running out of space under normal usage conditions. Overprovisioning of thin pools during installation is also not supported.
- **Minimum Total - 64 GiB**

If you are also installing the RHV-M Appliance for self-hosted engine installation, **/var/tmp** must be at least 5 GB.

If you plan to use memory overcommitment, add enough swap space to provide virtual memory for all of virtual machines. See [Memory Optimization](#).

## 2.2.4. PCI Device Requirements

Hosts must have at least one network interface with a minimum bandwidth of 1 Gbps. Each host should have two network interfaces, with one dedicated to supporting network-intensive activities, such as virtual machine migration. The performance of such operations is limited by the bandwidth available.

For information about how to use PCI Express and conventional PCI devices with Intel Q35-based virtual machines, see [Using PCI Express and Conventional PCI Devices with the Q35 Virtual Machine](#).

## 2.2.5. Device Assignment Requirements

If you plan to implement device assignment and PCI passthrough so that a virtual machine can use a specific PCIe device from a host, ensure the following requirements are met:

- CPU must support IOMMU (for example, VT-d or AMD-Vi). IBM POWER8 supports IOMMU by default.
- Firmware must support IOMMU.
- CPU root ports used must support ACS or ACS-equivalent capability.
- PCIe devices must support ACS or ACS-equivalent capability.
- All PCIe switches and bridges between the PCIe device and the root port should support ACS. For example, if a switch does not support ACS, all devices behind that switch share the same IOMMU group, and can only be assigned to the same virtual machine.
- For GPU support, Red Hat Enterprise Linux 8 supports PCI device assignment of PCIe-based NVIDIA K-Series Quadro (model 2000 series or higher), GRID, and Tesla as non-VGA graphics



devices. Currently up to two GPUs may be attached to a virtual machine in addition to one of the standard, emulated VGA interfaces. The emulated VGA is used for pre-boot and installation and the NVIDIA GPU takes over when the NVIDIA graphics drivers are loaded. Note that the NVIDIA Quadro 2000 is not supported, nor is the Quadro K420 card.

Check vendor specification and datasheets to confirm that your hardware meets these requirements. The **lspci -v** command can be used to print information for PCI devices already installed on a system.

### 2.2.6. vGPU Requirements

A host must meet the following requirements in order for virtual machines on that host to use a vGPU:

- vGPU-compatible GPU
- GPU-enabled host kernel
- Installed GPU with correct drivers
- Predefined **mdev\_type** set to correspond with one of the mdev types supported by the device
- vGPU-capable drivers installed on each host in the cluster
- vGPU-supported virtual machine operating system with vGPU drivers installed

## 2.3. NETWORKING REQUIREMENTS

### 2.3.1. General requirements

Red Hat Virtualization requires IPv6 to remain enabled on the physical or virtual machine running the Manager. [Do not disable IPv6](#) on the Manager machine, even if your systems do not use it.

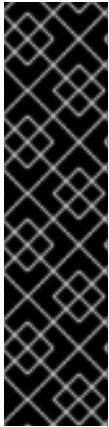
### 2.3.2. Firewall Requirements for DNS, NTP, and IPMI Fencing

The firewall requirements for all of the following topics are special cases that require individual consideration.

#### DNS and NTP

Red Hat Virtualization does not create a DNS or NTP server, so the firewall does not need to have open ports for incoming traffic.

By default, Red Hat Enterprise Linux allows outbound traffic to DNS and NTP on any destination address. If you disable outgoing traffic, define exceptions for requests that are sent to DNS and NTP servers.



## IMPORTANT

- The Red Hat Virtualization Manager and all hosts (Red Hat Virtualization Host and Red Hat Enterprise Linux host) must have a fully qualified domain name and full, perfectly-aligned forward and reverse name resolution.
- Running a DNS service as a virtual machine in the Red Hat Virtualization environment is not supported. All DNS services the Red Hat Virtualization environment uses must be hosted outside of the environment.
- Use DNS instead of the **/etc/hosts** file for name resolution. Using a hosts file typically requires more work and has a greater chance for errors.

### IPMI and Other Fencing Mechanisms (optional)

For IPMI (Intelligent Platform Management Interface) and other fencing mechanisms, the firewall does not need to have open ports for incoming traffic.

By default, Red Hat Enterprise Linux allows outbound IPMI traffic to ports on any destination address. If you disable outgoing traffic, make exceptions for requests being sent to your IPMI or fencing servers.

Each Red Hat Virtualization Host and Red Hat Enterprise Linux host in the cluster must be able to connect to the fencing devices of all other hosts in the cluster. If the cluster hosts are experiencing an error (network error, storage error...) and cannot function as hosts, they must be able to connect to other hosts in the data center.

The specific port number depends on the type of the fence agent you are using and how it is configured.

The firewall requirement tables in the following sections do not represent this option.

### 2.3.3. Red Hat Virtualization Manager Firewall Requirements

The Red Hat Virtualization Manager requires that a number of ports be opened to allow network traffic through the system's firewall.

The **engine-setup** script can configure the firewall automatically.

The firewall configuration documented here assumes a default configuration.



## NOTE

A diagram of these firewall requirements is available at <https://access.redhat.com/articles/3932211>. You can use the IDs in the table to look up connections in the diagram.

**Table 2.3. Red Hat Virtualization Manager Firewall Requirements**

ID	Port(s)	Protocol	Source	Destination	Purpose	Encrypted by default
M1	-	ICMP	Red Hat Virtualization Hosts Red Hat Enterprise Linux hosts	Red Hat Virtualization Manager	Optional. May help in diagnosis.	No

ID	Port(s)	Protocol	Source	Destination	Purpose	Encrypted by default
M2	22	TCP	System(s) used for maintenance of the Manager including backend configuration, and software upgrades.	Red Hat Virtualization Manager	Secure Shell (SSH) access.  Optional.	Yes
M3	2222	TCP	Clients accessing virtual machine serial consoles.	Red Hat Virtualization Manager	Secure Shell (SSH) access to enable connection to virtual machine serial consoles.	Yes
M4	80, 443	TCP	Administration Portal clients  VM Portal clients  Red Hat Virtualization Hosts  Red Hat Enterprise Linux hosts  REST API clients	Red Hat Virtualization Manager	Provides HTTP (port 80, not encrypted) and HTTPS (port 443, encrypted) access to the Manager. HTTP redirects connections to HTTPS.	Yes
M5	6100	TCP	Administration Portal clients  VM Portal clients	Red Hat Virtualization Manager	Provides websocket proxy access for a web-based console client, <b>noVNC</b> , when the websocket proxy is running on the Manager.	No

ID	Port(s)	Protocol	Source	Destination	Purpose	Encrypted by default
M6	7410	UDP	Red Hat Virtualization Hosts  Red Hat Enterprise Linux hosts	Red Hat Virtualization Manager	If Kdump is enabled on the hosts, open this port for the fence_kdump listener on the Manager. See <a href="#">fence_kdump Advanced Configuration</a> . <b>fence_kdump</b> doesn't provide a way to encrypt the connection. However, you can manually configure this port to block access from hosts that are not eligible.	No
M7	54323	TCP	Administration Portal clients	Red Hat Virtualization Manager (ImageIO Proxy server)	Required for communication with the ImageIO Proxy ( <b>ovirt-imageio-proxy</b> ).	Yes
M8	6442	TCP	Red Hat Virtualization Hosts  Red Hat Enterprise Linux hosts	Open Virtual Network (OVN) southbound database	Connect to Open Virtual Network (OVN) database	Yes
M9	9696	TCP	Clients of external network provider for OVN	External network provider for OVN	OpenStack Networking API	Yes, with configuration generated by engine-setup.
M10	35357	TCP	Clients of external network provider for OVN	External network provider for OVN	OpenStack Identity API	Yes, with configuration generated by engine-setup.

ID	Port(s)	Protocol	Source	Destination	Purpose	Encrypted by default
M11	53	TCP, UDP	Red Hat Virtualization Manager	DNS Server	DNS lookup requests from ports above 1023 to port 53, and responses. Open by default.	No
M12	123	UDP	Red Hat Virtualization Manager	NTP Server	NTP requests from ports above 1023 to port 123, and responses. Open by default.	No



#### NOTE

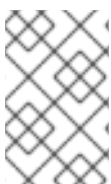
- A port for the OVN northbound database (6641) is not listed because, in the default configuration, the only client for the OVN northbound database (6641) is **ovirt-provider-ovn**. Because they both run on the same host, their communication is not visible to the network.
- By default, Red Hat Enterprise Linux allows outbound traffic to DNS and NTP on any destination address. If you disable outgoing traffic, make exceptions for the Manager to send requests to DNS and NTP servers. Other nodes may also require DNS and NTP. In that case, consult the requirements for those nodes and configure the firewall accordingly.

### 2.3.4. Host Firewall Requirements

Red Hat Enterprise Linux hosts and Red Hat Virtualization Hosts (RHVH) require a number of ports to be opened to allow network traffic through the system's firewall. The firewall rules are automatically configured by default when adding a new host to the Manager, overwriting any pre-existing firewall configuration.

To disable automatic firewall configuration when adding a new host, clear the **Automatically configure host firewall** check box under **Advanced Parameters**.

To customize the host firewall rules, see <https://access.redhat.com/solutions/2772331>.



#### NOTE

A diagram of these firewall requirements is available at <https://access.redhat.com/articles/3932211>. You can use the IDs in the table to look up connections in the diagram.

**Table 2.4. Virtualization Host Firewall Requirements**

ID	Port(s)	Protocol	Source	Destination	Purpose	Encrypted by default
----	---------	----------	--------	-------------	---------	----------------------

ID	Port(s)	Protocol	Source	Destination	Purpose	Encrypted by default
H1	22	TCP	Red Hat Virtualization Manager	Red Hat Virtualization Hosts Red Hat Enterprise Linux hosts	Secure Shell (SSH) access. Optional.	Yes
H2	2223	TCP	Red Hat Virtualization Manager	Red Hat Virtualization Hosts Red Hat Enterprise Linux hosts	Secure Shell (SSH) access to enable connection to virtual machine serial consoles.	Yes
H3	161	UDP	Red Hat Virtualization Hosts Red Hat Enterprise Linux hosts	Red Hat Virtualization Manager	Simple network management protocol (SNMP). Only required if you want Simple Network Management Protocol traps sent from the host to one or more external SNMP managers. Optional.	No
H4	111	TCP	NFS storage server	Red Hat Virtualization Hosts Red Hat Enterprise Linux hosts	NFS connections. Optional.	No

ID	Port(s)	Protocol	Source	Destination	Purpose	Encrypted by default
H5	5900 - 6923	TCP	Administrati on Portal clients  VM Portal clients	Red Hat Virtualizatio n Hosts  Red Hat Enterprise Linux hosts	Remote guest console access via VNC and SPICE. These ports must be open to facilitate client access to virtual machines.	Yes (optional)
H6	5989	TCP, UDP	Common Information Model Object Manager (CIMOM)	Red Hat Virtualizatio n Hosts  Red Hat Enterprise Linux hosts	Used by Common Information Model Object Managers (CIMOM) to monitor virtual machines running on the host. Only required if you want to use a CIMOM to monitor the virtual machines in your virtualizatio n environmen t.  Optional.	No
H7	9090	TCP	Red Hat Virtualizatio n Manager  Client machines	Red Hat Virtualizatio n Hosts  Red Hat Enterprise Linux hosts	Required to access the Cockpit web interface, if installed.	Yes

ID	Port(s)	Protocol	Source	Destination	Purpose	Encrypted by default
H8	16514	TCP	Red Hat Virtualization Hosts Red Hat Enterprise Linux hosts	Red Hat Virtualization Hosts Red Hat Enterprise Linux hosts	Virtual machine migration using <b>libvirt</b> .	Yes
H9	49152 - 49215	TCP	Red Hat Virtualization Hosts Red Hat Enterprise Linux hosts	Red Hat Virtualization Hosts Red Hat Enterprise Linux hosts	Virtual machine migration and fencing using VDSM. These ports must be open to facilitate both automated and manual migration of virtual machines.	Yes. Depending on agent for fencing, migration is done through libvirt.
H10	54321	TCP	Red Hat Virtualization Manager Red Hat Virtualization Hosts Red Hat Enterprise Linux hosts	Red Hat Virtualization Hosts Red Hat Enterprise Linux hosts	VDSM communications with the Manager and other virtualization hosts.	Yes
H11	54322	TCP	Red Hat Virtualization Manager (ImageIO Proxy server)	Red Hat Virtualization Hosts Red Hat Enterprise Linux hosts	Required for communication with the ImageIO daemon ( <b>ovirt-imageio-daemon</b> ).	Yes



ID	Port(s)	Protocol	Source	Destination	Purpose	Encrypted by default
H12	6081	UDP	Red Hat Virtualization Hosts Red Hat Enterprise Linux hosts	Red Hat Virtualization Hosts Red Hat Enterprise Linux hosts	Required, when Open Virtual Network (OVN) is used as a network provider, to allow OVN to create tunnels between hosts.	No
H13	53	TCP, UDP	Red Hat Virtualization Hosts Red Hat Enterprise Linux hosts	DNS Server	DNS lookup requests from ports above 1023 to port 53, and responses. This port is required and open by default.	No



#### NOTE

By default, Red Hat Enterprise Linux allows outbound traffic to DNS and NTP on any destination address. If you disable outgoing traffic, make exceptions for the Red Hat Virtualization Hosts

Red Hat Enterprise Linux hosts to send requests to DNS and NTP servers. Other nodes may also require DNS and NTP. In that case, consult the requirements for those nodes and configure the firewall accordingly.

### 2.3.5. Database Server Firewall Requirements

Red Hat Virtualization supports the use of a remote database server for the Manager database (**engine**) and the Data Warehouse database (**ovirt-engine-history**). If you plan to use a remote database server, it must allow connections from the Manager and the Data Warehouse service (which can be separate from the Manager).

Similarly, if you plan to access a local or remote Data Warehouse database from an external system, the database must allow connections from that system.

**IMPORTANT**

Accessing the Manager database from external systems is not supported.

**NOTE**

A diagram of these firewall requirements is available at <https://access.redhat.com/articles/3932211>. You can use the IDs in the table to look up connections in the diagram.

**Table 2.5. Database Server Firewall Requirements**

ID	Port(s)	Protocol	Source	Destination	Purpose	Encrypted by default
D1	5432	TCP, UDP	Red Hat Virtualization Manager  Data Warehouse service	Manager ( <b>engine</b> ) database server  Data Warehouse ( <b>ovirt-engine-history</b> ) database server	Default port for PostgreSQL database connections.	No, but can be enabled.
D2	5432	TCP, UDP	External systems	Data Warehouse ( <b>ovirt-engine-history</b> ) database server	Default port for PostgreSQL database connections.	Disabled by default. No, but can be enabled.

## CHAPTER 3. INSTALLING THE RED HAT VIRTUALIZATION MANAGER

Installing the Red Hat Virtualization Manager involves the following steps:

1. [Preparing the Red Hat Virtualization Manager Machine](#)
2. [Enabling the Red Hat Virtualization Manager Repositories](#)
3. [Installing and Configuring the Red Hat Virtualization Manager](#)
4. [Connecting to the Administration Portal](#)

### 3.1. PREPARING THE RED HAT VIRTUALIZATION MANAGER MACHINE

The Red Hat Virtualization Manager must run on Red Hat Enterprise Linux 8. For detailed installation instructions, see [Performing a standard RHEL installation](#).

This machine must meet the minimum [Manager hardware requirements](#).

To install the Red Hat Virtualization Manager on a system that does not have access to the Content Delivery Network, see [Appendix A, Configuring a Local Repository for Offline Red Hat Virtualization Manager Installation](#) before configuring the Manager.

By default, the Red Hat Virtualization Manager's configuration script, **engine-setup**, creates and configures the Manager database and Data Warehouse database automatically on the Manager machine. To set up either database, or both, manually, see [Appendix B, Preparing a Local Manually Configured PostgreSQL Database](#) before configuring the Manager.

### 3.2. ENABLING THE RED HAT VIRTUALIZATION MANAGER REPOSITORIES

You need to log in and register the Manager machine with Red Hat Subscription Manager, attach the **Red Hat Virtualization Manager** subscription, and enable the Manager repositories.

#### Procedure

1. Register your system with the Content Delivery Network, entering your Customer Portal user name and password when prompted:

```
# subscription-manager register
```



#### NOTE

If you are using an IPv6 network, use an IPv6 transition mechanism to access the Content Delivery Network and subscription manager.

2. Find the **Red Hat Virtualization Manager** subscription pool and record the pool ID:

```
# subscription-manager list --available
```

3. Use the pool ID to attach the subscription to the system:

```
# subscription-manager attach --pool=pool_id
```



#### NOTE

To view currently attached subscriptions:

```
# subscription-manager list --consumed
```

To list all enabled repositories:

```
# dnf repolist
```

4. Configure the repositories:

```
# subscription-manager repos \
  --disable='*' \
  --enable=rhel-8-for-x86_64-baseos-rpms \
  --enable=rhel-8-for-x86_64-appstream-rpms \
  --enable=rhv-4.4-manager-for-rhel-8-x86_64-rpms \
  --enable=fast-datapath-for-rhel-8-x86_64-rpms \
  --enable=jb-eap-7.3-for-rhel-8-x86_64-rpms
```

5. Enable the **pki-deps** module.

```
# dnf module -y enable pki-deps
```

6. Enable version 12 of the **postgresql** module.

```
# dnf module -y enable postgresql:12
```

7. Synchronize installed packages to update them to the latest available versions.

```
# dnf distro-sync --nobest
```

#### Additional resources

For information on modules and module streams, see the following sections in *Installing, managing, and removing user-space components*

- [Module streams](#)
- [Selecting a stream before installation of packages](#)
- [Resetting module streams](#)
- [Switching to a later stream](#)

## 3.3. INSTALLING AND CONFIGURING THE RED HAT VIRTUALIZATION MANAGER

Install the package and dependencies for the Red Hat Virtualization Manager, and configure it using the **engine-setup** command. The script asks you a series of questions and, after you provide the required values for all questions, applies that configuration and starts the **ovirt-engine** service.



### IMPORTANT

The **engine-setup** command guides you through several distinct configuration stages, each comprising several steps that require user input. Suggested configuration defaults are provided in square brackets; if the suggested value is acceptable for a given step, press **Enter** to accept that value.

You can run **engine-setup --accept-defaults** to automatically accept all questions that have default answers. This option should be used with caution and only if you are familiar with **engine-setup**.

### Procedure

1. Ensure all packages are up to date:

```
# dnf upgrade --nobest
```



### NOTE

Reboot the machine if any kernel-related packages were updated.

2. Install the **rhvm** package and dependencies.

```
# dnf install rhvm
```

3. Run the **engine-setup** command to begin configuring the Red Hat Virtualization Manager:

```
# engine-setup
```

4. Optional: Type **Yes** and press **Enter** to set up Cinderlib integration on this machine:

```
Set up Cinderlib integration
(Currently in tech preview)
(Yes, No) [No]:
```

For instructions on setting up Cinderlib, see [Setting up Cinderlib](#).



### IMPORTANT

Cinderlib is a Technology Preview feature only. Technology Preview features are not supported with Red Hat production service level agreements (SLAs), might not be functionally complete, and Red Hat does not recommend to use them for production. These features provide early access to upcoming product features, enabling customers to test functionality and provide feedback during the development process.

For more information on Red Hat Technology Preview features support scope, see <https://access.redhat.com/support/offerings/techpreview/>.

- Press **Enter** to configure the Manager on this machine:

Configure Engine on this host (Yes, No) [Yes]:

- Optional: Install Open Virtual Network (OVN). Selecting **Yes** installs an OVN server on the Manager machine and adds it to Red Hat Virtualization as an external network provider. This action also configures the Default cluster to use OVN as its default network provider.



### IMPORTANT

Also see the "Next steps" in [Adding Open Virtual Network \(OVN\) as an External Network Provider](#) in the *Administration Guide*.

Configuring ovirt-provider-ovn also sets the Default cluster's default network provider to ovirt-provider-ovn.

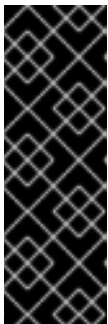
Non-Default clusters may be configured with an OVN after installation.

Configure ovirt-provider-ovn (Yes, No) [Yes]:

For more information on using OVN networks in Red Hat Virtualization, see [Adding Open Virtual Network \(OVN\) as an External Network Provider](#) in the *Administration Guide*.

- Optional: Allow **engine-setup** to configure a WebSocket Proxy server for allowing users to connect to virtual machines through the **noVNC** console:

Configure WebSocket Proxy on this machine? (Yes, No) [Yes]:



### IMPORTANT

The WebSocket Proxy and noVNC are Technology Preview features only. Technology Preview features are not supported with Red Hat production service-level agreements (SLAs) and might not be functionally complete, and Red Hat does not recommend using them for production. These features provide early access to upcoming product features, enabling customers to test functionality and provide feedback during the development process. For more information see [Red Hat Technology Preview Features Support Scope](#).

- Choose whether to configure Data Warehouse on this machine.

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]:



### IMPORTANT

Red Hat only supports installing the Data Warehouse database, the Data Warehouse service, and Grafana all on the same machine as each other.

- Press **Enter** to configure Grafana on the Manager:

Configure Grafana on this host (Yes, No) [Yes]:

10. Optional: Allow access to a virtual machine's serial console from the command line.

Configure VM Console Proxy on this host (Yes, No) [Yes]:

Additional configuration is required on the client machine to use this feature. See [Opening a Serial Console to a Virtual Machine](#) in the *Virtual Machine Management Guide*.

11. Press **Enter** to accept the automatically detected host name, or enter an alternative host name and press **Enter**. Note that the automatically detected host name may be incorrect if you are using virtual hosts.

Host fully qualified DNS name of this server [*autodetected host name*]:

12. The **engine-setup** command checks your firewall configuration and offers to open the ports used by the Manager for external communication, such as ports 80 and 443. If you do not allow **engine-setup** to modify your firewall configuration, you must manually open the ports used by the Manager. **firewalld** is configured as the firewall manager.

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]:

If you choose to automatically configure the firewall, and no firewall managers are active, you are prompted to select your chosen firewall manager from a list of supported options. Type the name of the firewall manager and press **Enter**. This applies even in cases where only one option is listed.

13. Specify whether to configure the Data Warehouse database on this machine, or on another machine:

Where is the DWH database located? (Local, Remote) [Local]:

- If you select **Local**, the **engine-setup** script can configure your database automatically (including adding a user and a database), or it can connect to a preconfigured local database:

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]:

- If you select **Automatic** by pressing **Enter**, no further action is required here.
- If you select **Manual**, input the following values for the manually configured local database:

DWH database secured connection (Yes, No) [No]:

DWH database name [ovirt\_engine\_history]:

DWH database user [ovirt\_engine\_history]:

DWH database password:

**NOTE**

**engine-setup** requests these values after the Manager database is configured in the next step.

- If you select **Remote** (for example, if you are installing the Data Warehouse service on the Manager machine, but have configured a remote Data Warehouse database), input the following values for the remote database server:

DWH database host [localhost]:  
 DWH database port [5432]:  
 DWH database secured connection (Yes, No) [No]:  
 DWH database name [ovirt\_engine\_history]:  
 DWH database user [ovirt\_engine\_history]:  
 DWH database password:

**NOTE**

**engine-setup** requests these values after the Manager database is configured in the next step.

- If you select **Remote**, you are prompted to enter the username and password for the Grafana database user:

Grafana database user [ovirt\_engine\_history\_grafana]:  
 Grafana database password:

14. Specify whether to configure the Manager database on this machine, or on another machine:

Where is the Engine database located? (Local, Remote) [Local]:

- If you select **Local**, the **engine-setup** command can configure your database automatically (including adding a user and a database), or it can connect to a preconfigured local database:

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]:

- If you select **Automatic** by pressing **Enter**, no further action is required here.
- If you select **Manual**, input the following values for the manually configured local database:

Engine database secured connection (Yes, No) [No]:  
 Engine database name [engine]:  
 Engine database user [engine]:  
 Engine database password:

15. Set a password for the automatically created administrative user of the Red Hat Virtualization Manager:



Engine admin password:  
Confirm engine admin password:

16. Select **Gluster**, **Virt**, or **Both**:

Application mode (Both, Virt, Gluster) [Both]:

**Both** offers the greatest flexibility. In most cases, select **Both**. **Virt** allows you to run virtual machines in the environment; **Gluster** only allows you to manage GlusterFS from the Administration Portal.

17. If you installed the OVN provider, you can choose to use the default credentials, or specify an alternative.

Use default credentials (admin@internal) for ovirt-provider-ovn (Yes, No) [Yes]:  
oVirt OVN provider user[admin@internal]:  
oVirt OVN provider password:

18. Set the default value for the **wipe\_after\_delete** flag, which wipes the blocks of a virtual disk when the disk is deleted.

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

19. The Manager uses certificates to communicate securely with its hosts. This certificate can also optionally be used to secure HTTPS communications with the Manager. Provide the organization name for the certificate:

Organization name for certificate [*autodetected domain-based name*]:

20. Optionally allow **engine-setup** to make the landing page of the Manager the default page presented by the Apache web server:

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 web page of the server? (Yes, No) [Yes]:

21. By default, external SSL (HTTPS) communication with the Manager is secured with the self-signed certificate created earlier in the configuration to securely communicate with hosts. Alternatively, choose another certificate for external HTTPS connections; this does not affect how the Manager communicates with hosts:

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]:

22. You can specify a unique password for the Grafana admin user, or use same one as the Manager admin password:

Use Engine admin password as initial Grafana admin password (Yes, No) [Yes]:

23. Choose how long Data Warehouse will retain collected data:

Please choose Data Warehouse sampling scale:

- (1) Basic
- (2) Full
- (1, 2)[1]:

**Full** uses the default values for the data storage settings listed in the [Data Warehouse Guide](#) (recommended when Data Warehouse is installed on a remote server).

**Basic** reduces the values of **DWH\_TABLES\_KEEP\_HOURLY** to **720** and **DWH\_TABLES\_KEEP\_DAILY** to **0**, easing the load on the Manager machine. Use **Basic** when the Manager and Data Warehouse are installed on the same machine.

24. Review the installation settings, and press **Enter** to accept the values and proceed with the installation:

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

When your environment has been configured, **engine-setup** displays details about how to access your environment. If you chose to manually configure the firewall, **engine-setup** provides a custom list of ports that need to be opened, based on the options selected during setup. **engine-setup** also saves your answers to a file that can be used to reconfigure the Manager using the same values, and outputs the location of the log file for the Red Hat Virtualization Manager configuration process.

25. If you intend to link your Red Hat Virtualization environment with a directory server, configure the date and time to synchronize with the system clock used by the directory server to avoid unexpected account expiry issues. See [Synchronizing the System Clock with a Remote Server](#) in the *Red Hat Enterprise Linux System Administrator's Guide* for more information.
26. Install the certificate authority according to the instructions provided by your browser. You can get the certificate authority's certificate by navigating to **http://*manager-fqdn*/ovirt-engine/services/pki-resource?resource=ca-certificate&format=X509-PEM-CA**, replacing *manager-fqdn* with the FQDN that you provided during the installation.

Log in to the Administration Portal, where you can add hosts and storage to the environment:

### 3.4. CONNECTING TO THE ADMINISTRATION PORTAL

Access the Administration Portal using a web browser.

1. In a web browser, navigate to **https://*manager-fqdn*/ovirt-engine**, replacing *manager-fqdn* with the FQDN that you provided during installation.



#### NOTE

You can access the Administration Portal using alternate host names or IP addresses. To do so, you need to add a configuration file under **/etc/ovirt-engine/engine.conf.d/**. For example:

```
# vi /etc/ovirt-engine/engine.conf.d/99-custom-ss0-setup.conf
SSO_ALTERNATE_ENGINE_FQDNS="alias1.example.com
alias2.example.com"
```

The list of alternate host names needs to be separated by spaces. You can also add the IP address of the Manager to the list, but using IP addresses instead of DNS-resolvable host names is not recommended.

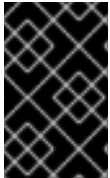
2. Click **Administration Portal**. An SSO login page displays. SSO login enables you to log in to the Administration and VM Portal at the same time.
3. Enter your **User Name** and **Password**. If you are logging in for the first time, use the user name **admin** along with the password that you specified during installation.
4. Select the **Domain** to authenticate against. If you are logging in using the internal **admin** user name, select the **internal** domain.
5. Click **Log In**.
6. You can view the Administration Portal in multiple languages. The default selection is chosen based on the locale settings of your web browser. If you want to view the Administration Portal in a language other than the default, select your preferred language from the drop-down list on the welcome page.

To log out of the Red Hat Virtualization Administration Portal, click your user name in the header bar and click **Sign Out**. You are logged out of all portals and the Manager welcome screen displays.

## CHAPTER 4. INSTALLING HOSTS FOR RED HAT VIRTUALIZATION

Red Hat Virtualization supports two types of hosts: [Red Hat Virtualization Hosts \(RHVH\)](#) and [Red Hat Enterprise Linux hosts](#). Depending on your environment, you may want to use one type only, or both. At least two hosts are required for features such as migration and high availability.

See [Section 4.3, “Recommended Practices for Configuring Host Networks”](#) for networking information.



### IMPORTANT

SELinux is in enforcing mode upon installation. To verify, run **getenforce**. SELinux must be in enforcing mode on all hosts and Managers for your Red Hat Virtualization environment to be supported.

Table 4.1. Host Types

Host Type	Other Names	Description
Red Hat Virtualization Host	RHVH, thin host	This is a minimal operating system based on Red Hat Enterprise Linux. It is distributed as an ISO file from the Customer Portal and contains only the packages required for the machine to act as a host.
Red Hat Enterprise Linux host	RHEL host, thick host	Red Hat Enterprise Linux systems with the appropriate subscriptions attached can be used as hosts.

### Host Compatibility

When you create a new data center, you can set the compatibility version. Select the compatibility version that suits all the hosts in the data center. Once set, version regression is not allowed. For a fresh Red Hat Virtualization installation, the latest compatibility version is set in the default data center and default cluster; to use an earlier compatibility version, you must create additional data centers and clusters. For more information about compatibility versions see *Red Hat Virtualization Manager Compatibility* in [Red Hat Virtualization Life Cycle](#).

## 4.1. RED HAT VIRTUALIZATION HOSTS

### 4.1.1. Installing Red Hat Virtualization Hosts

Red Hat Virtualization Host (RHVH) is a minimal operating system based on Red Hat Enterprise Linux that is designed to provide a simple method for setting up a physical machine to act as a hypervisor in a Red Hat Virtualization environment. The minimal operating system contains only the packages required for the machine to act as a hypervisor, and features a Cockpit web interface for monitoring the host and performing administrative tasks. See <http://cockpit-project.org/running.html> for the minimum browser requirements.

RHVH supports NIST 800-53 partitioning requirements to improve security. RHVH uses a NIST 800-53 partition layout by default.

The host must meet the minimum [host requirements](#).



### WARNING

When installing or reinstalling the host's operating system, Red Hat strongly recommends that you first detach any existing non-OS storage that is attached to the host to avoid accidental initialization of these disks, and with that, potential data loss.

### Procedure

1. Go to the [Get Started with Red Hat Virtualization](#) on the Red Hat Customer Portal and log in.
2. Click **Download Latest** to access the product download page.
3. Choose the appropriate **Hypervisor Image for RHV** from the list and click **Download Now**.
4. Start the machine on which you are installing RHVH, booting from the prepared installation media.
5. From the boot menu, select **Install RHVH 4.4** and press **Enter**.



### NOTE

You can also press the **Tab** key to edit the kernel parameters. Kernel parameters must be separated by a space, and you can boot the system using the specified kernel parameters by pressing the **Enter** key. Press the **Esc** key to clear any changes to the kernel parameters and return to the boot menu.

6. Select a language, and click **Continue**.
7. Select a keyboard layout from the **Keyboard Layout** screen and click **Done**.
8. Select the device on which to install RHVH from the **Installation Destination** screen. Optionally, enable encryption. Click **Done**.



### IMPORTANT

Use the **Automatically configure partitioning** option.

9. Select a time zone from the **Time & Date** screen and click **Done**.
10. Select a network from the **Network & Host Name** screen and click **Configure...** to configure the connection details.

**NOTE**

To use the connection every time the system boots, select the **Connect automatically with priority** check box. For more information, see [Configuring network and host name options](#) in the *Red Hat Enterprise Linux 8 Installation Guide*.

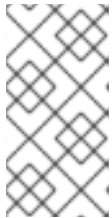
Enter a host name in the **Host Name** field, and click **Done**.

11. Optionally configure **Language Support**, **Security Policy**, and **Kdump**. See [Customizing your RHEL installation using the GUI](#) in *Performing a standard RHEL installation* for Red Hat Enterprise Linux 8 for more information on each of the sections in the **Installation Summary** screen.
12. Click **Begin Installation**.
13. Set a root password and, optionally, create an additional user while RHVH installs.

**WARNING**

Do not create untrusted users on RHVH, as this can lead to exploitation of local security vulnerabilities.

14. Click **Reboot** to complete the installation.

**NOTE**

When RHVH restarts, **nodectl check** performs a health check on the host and displays the result when you log in on the command line. The message **node status: OK** or **node status: DEGRADED** indicates the health status. Run **nodectl check** to get more information.

## 4.1.2. Enabling the Red Hat Virtualization Host Repository

Register the system to receive updates. Red Hat Virtualization Host only requires one repository. This section provides instructions for registering RHVH with the [Content Delivery Network](#), or with [Red Hat Satellite 6](#).

### Registering RHVH with the Content Delivery Network

1. Log in to the Cockpit web interface at **https://HostFQDNorIP:9090**.
2. Navigate to **Subscriptions**, click **Register**, and enter your Customer Portal user name and password. The **Red Hat Virtualization Host** subscription is automatically attached to the system.
3. Click **Terminal**.
4. Enable the **Red Hat Virtualization Host 8** repository to allow later updates to the Red Hat Virtualization Host:

```
# subscription-manager repos --enable=rhvh-4-for-rhel-8-x86_64-rpms
```

## Registering RHVH with Red Hat Satellite 6

1. Log in to the Cockpit web interface at **`https://HostFQDNorIP:9090`**.
2. Click **Terminal**.
3. Register RHVH with Red Hat Satellite 6:

```
# rpm -Uvh http://satellite.example.com/pub/katello-ca-consumer-latest.noarch.rpm
# subscription-manager register --org="org_id"
# subscription-manager list --available
# subscription-manager attach --pool=pool_id
# subscription-manager repos \
  --disable='*' \
  --enable=rhvh-4-for-rhel-8-x86_64-rpms
```



### NOTE

You can also configure virtual machine subscriptions in Red Hat Satellite using `virt-who`. See [Using virt-who to manage host-based subscriptions](#) .

## 4.1.3. Advanced Installation

### 4.1.3.1. Custom Partitioning

Custom partitioning on Red Hat Virtualization Host (RHVH) is not recommended. Use the **Automatically configure partitioning** option in the **Installation Destination** window.

If your installation requires custom partitioning, select the **I will configure partitioning** option during the installation, and note that the following restrictions apply:

- Ensure the default **LVM Thin Provisioning** option is selected in the **Manual Partitioning** window.
- The following directories are required and must be on thin provisioned logical volumes:
  - `root (/)`
  - `/home`
  - `/tmp`
  - `/var`
  - `/var/crash`
  - `/var/log`
  - `/var/log/audit`



## IMPORTANT

Do not create a separate partition for **/usr**. Doing so will cause the installation to fail.

**/usr** must be on a logical volume that is able to change versions along with RHVH, and therefore should be left on root (**/**).

For information about the required storage sizes for each partition, see [Section 2.2.3, “Storage Requirements”](#).

- The **/boot** directory should be defined as a standard partition.
- The **/var** directory must be on a separate volume or disk.
- Only XFS or Ext4 file systems are supported.

### Configuring Manual Partitioning in a Kickstart File

The following example demonstrates how to configure manual partitioning in a Kickstart file.

```
clearpart --all
part /boot --fstype xfs --size=1000 --ondisk=sda
part pv.01 --size=42000 --grow
volgroup HostVG pv.01 --reserved-percent=20
logvol swap --vgname=HostVG --name=swap --fstype=swap --recommended
logvol none --vgname=HostVG --name=HostPool --thinpool --size=40000 --grow
logvol / --vgname=HostVG --name=root --thin --fstype=ext4 --poolname=HostPool --
fsoptions="defaults,discard" --size=6000 --grow
logvol /var --vgname=HostVG --name=var --thin --fstype=ext4 --poolname=HostPool --
fsoptions="defaults,discard" --size=15000
logvol /var/crash --vgname=HostVG --name=var_crash --thin --fstype=ext4 --poolname=HostPool --
fsoptions="defaults,discard" --size=10000
logvol /var/log --vgname=HostVG --name=var_log --thin --fstype=ext4 --poolname=HostPool --
fsoptions="defaults,discard" --size=8000
logvol /var/log/audit --vgname=HostVG --name=var_audit --thin --fstype=ext4 --poolname=HostPool --
fsoptions="defaults,discard" --size=2000
logvol /home --vgname=HostVG --name=home --thin --fstype=ext4 --poolname=HostPool --
fsoptions="defaults,discard" --size=1000
logvol /tmp --vgname=HostVG --name=tmp --thin --fstype=ext4 --poolname=HostPool --
fsoptions="defaults,discard" --size=1000
```



## NOTE

If you use **logvol --thinpool --grow**, you must also include **volgroup --reserved-space** or **volgroup --reserved-percent** to reserve space in the volume group for the thin pool to grow.

### 4.1.3.2. Automating Red Hat Virtualization Host deployment

You can install Red Hat Virtualization Host (RHVH) without a physical media device by booting from a PXE server over the network with a Kickstart file that contains the answers to the installation questions.



**WARNING**

When installing or reinstalling the host's operating system, Red Hat strongly recommends that you first detach any existing non-OS storage that is attached to the host to avoid accidental initialization of these disks, and with that, potential data loss.

General instructions for installing from a PXE server with a Kickstart file are available in the [Red Hat Enterprise Linux Installation Guide](#), as RHVH is installed in much the same way as Red Hat Enterprise Linux. RHVH-specific instructions, with examples for deploying RHVH with Red Hat Satellite, are described below.

The automated RHVH deployment has 3 stages:

- [Section 4.1.3.2.1, "Preparing the installation environment"](#)
- [Section 4.1.3.2.2, "Configuring the PXE server and the boot loader"](#)
- [Section 4.1.3.2.3, "Creating and running a Kickstart file"](#)

**4.1.3.2.1. Preparing the installation environment**

1. Go to the [Get Started with Red Hat Virtualization](#) on the Red Hat Customer Portal and log in.
2. Click **Download Latest** to access the product download page.
3. Choose the appropriate **Hypervisor Image for RHV** from the list and click **Download Now**.
4. Make the RHVH ISO image available over the network. See [Installation Source on a Network](#) in the *Red Hat Enterprise Linux Installation Guide*.
5. Extract the **squashfs.img** hypervisor image file from the RHVH ISO:

```
# mount -o loop /path/to/RHVH-ISO/mnt/rhvh
# cp /mnt/rhvh/Packages/redhat-virtualization-host-image-update* /tmp
# cd /tmp
# rpm2cpio redhat-virtualization-host-image-update* | cpio -idmv
```

**NOTE**

This **squashfs.img** file, located in the **/tmp/usr/share/redhat-virtualization-host/image/** directory, is called **redhat-virtualization-host-version\_number\_version.squashfs.img**. It contains the hypervisor image for installation on the physical machine. It should not be confused with the **/LiveOS/squashfs.img** file, which is used by the Anaconda **inst.stage2** option.

**4.1.3.2.2. Configuring the PXE server and the boot loader**

1. Configure the PXE server. See [Preparing for a Network Installation](#) in the *Red Hat Enterprise Linux Installation Guide*.

- Copy the RHVH boot images to the **/tftpboot** directory:

```
# cp mnt/rhvh/images/pxeboot/{vmlinuz,initrd.img} /var/lib/tftpboot/pxelinux/
```

- Create a **rhvh** label specifying the RHVH boot images in the boot loader configuration:

```
LABEL rhvh
MENU LABEL Install Red Hat Virtualization Host
KERNEL /var/lib/tftpboot/pxelinux/vmlinuz
APPEND initrd=/var/lib/tftpboot/pxelinux/initrd.img inst.stage2=URL/to/RHVH-ISO
```

### RHVH Boot loader configuration example for Red Hat Satellite

If you are using information from Red Hat Satellite to provision the host, you must create a global or host group level parameter called **rhvh\_image** and populate it with the directory URL where the ISO is mounted or extracted:

```
< %#
kind: PXELinux
name: RHVH PXELinux
%>
# Created for booting new hosts
#

DEFAULT rhvh

LABEL rhvh
KERNEL < %= @kernel %>
APPEND initrd=< %= @initrd %> inst.ks=< %= foreman_url("provision") %> inst.stage2=< %=
@host.params["rhvh_image"] %> intel_iommu=on console=tty0 console=ttyS1,115200n8
ssh_pwauth=1 local_boot_trigger=< %= foreman_url("built") %>
IPAPPEND 2
```

- Make the content of the RHVH ISO locally available and export it to the network, for example, using an HTTPD server:

```
# cp -a /mnt/rhvh/ /var/www/html/rhvh-install
# curl URL/to/RHVH-ISO/rhvh-install
```

#### 4.1.3.2.3. Creating and running a Kickstart file

- Create a Kickstart file and make it available over the network. See [Kickstart Installations](#) in the *Red Hat Enterprise Linux Installation Guide*.
- Ensure that the Kickstart file meets the following RHV-specific requirements:
  - The **%packages** section is not required for RHVH. Instead, use the **liveimg** option and specify the **redhat-virtualization-host-version\_number\_version.squashfs.img** file from the RHVH ISO image:

```
liveimg --url=example.com/tmp/usr/share/redhat-virtualization-host/image/redhat-
virtualization-host-version_number_version.squashfs.img
```

- Autopartitioning is highly recommended, but use caution: ensure that the local disk is

detected first, include the **ignoredisk** command, and specify the local disk to ignore, such as **sda**. To ensure that a particular drive is used, Red Hat recommends using **ignoredisk --only-use=/dev/disk/<path>** or **ignoredisk --only-use=/dev/disk/<ID>**:

```
autopart --type=thinp
ignoredisk --only-use=sda
ignoredisk --only-use=/dev/disk/<path>
ignoredisk --only-use=/dev/disk/<ID>
```



## NOTE

Autopartitioning requires thin provisioning.

The **--no-home** option does not work in RHVH because **/home** is a required directory.

If your installation requires manual partitioning, see [Section 4.1.3.1, “Custom Partitioning”](#) for a list of limitations that apply to partitions and an example of manual partitioning in a Kickstart file.

- A **%post** section that calls the **nodectl init** command is required:

```
%post
nodectl init
%end
```

## Kickstart example for deploying RHVH on its own

This Kickstart example shows you how to deploy RHVH. You can include additional commands and options as required.



## WARNING

This example assumes that all disks are empty and can be initialized. If you have attached disks with data, either remove them or add them to the **ignoredisks** property.

```
liveimg --url=http://FQDN/tmp/usr/share/redhat-virtualization-host/image/redhat-
virtualization-host-version_number_version.squashfs.img
clearpart --all
autopart --type=thinp
rootpw --plaintext ovirt
timezone --utc America/Phoenix
zerombr
text

reboot
```

```
%post --erroronfail
nodedctl init
%end
```

## Kickstart example for deploying RHVH with registration and network configuration from Satellite

This Kickstart example uses information from Red Hat Satellite to configure the host network and register the host to the Satellite server. You must create a global or host group level parameter called **rhvh\_image** and populate it with the directory URL to the **squashfs.img** file. **ntp\_server1** is also a global or host group level variable.



### WARNING

This example assumes that all disks are empty and can be initialized. If you have attached disks with data, either remove them or add them to the **ignoredisks** property.

```
<%=#
kind: provision
name: RHVH Kickstart default
oses:
- RHVH
%>
install
liveimg --url=<%= @host.params['rhvh_image'] %>squashfs.img

network --bootproto static --ip=<%= @host.ip %> --netmask=<%= @host.subnet.mask
%> --gateway=<%= @host.subnet.gateway %> --nameserver=<%=
@host.subnet.dns_primary %> --hostname <%= @host.name %>

zerombr
clearpart --all
autopart --type=thinp

rootpw --iscrypted <%= root_pass %>

# installation answers
lang en_US.UTF-8
timezone <%= @host.params['time-zone'] || 'UTC' %>
keyboard us
firewall --service=ssh
services --enabled=sshd

text
reboot

%post --log=/root/ks.post.log --erroronfail
nodedctl init
<%= snippet 'subscription_manager_registration' %>
<%= snippet 'kickstart_networking_setup' %>
```

```

/usr/sbin/ntpdate -sub <%= @host.params['ntp_server1'] || '0.fedora.pool.ntp.org' %>
/usr/sbin/hwclock --systohc

/usr/bin/curl <%= foreman_url('built') %>

sync
systemctl reboot
%end

```

3. Add the Kickstart file location to the boot loader configuration file on the PXE server:

```

APPEND initrd=/var/tftpboot/pxelinux/initrd.img inst.stage2=URL/to/RHVH-ISO
inst.ks=URL/to/RHVH-ks.cfg

```

4. Install RHVH following the instructions in [Booting from the Network Using PXE](#) in the *Red Hat Enterprise Linux Installation Guide*.

## 4.2. RED HAT ENTERPRISE LINUX HOSTS

### 4.2.1. Installing Red Hat Enterprise Linux hosts

A Red Hat Enterprise Linux host is based on a standard basic installation of Red Hat Enterprise Linux 8 on a physical server, with the **Red Hat Enterprise Linux Server** and **Red Hat Virtualization** subscriptions attached.

For detailed installation instructions, see the [Performing a standard RHEL installation](#).

The host must meet the minimum [host requirements](#).



#### WARNING

When installing or reinstalling the host's operating system, Red Hat strongly recommends that you first detach any existing non-OS storage that is attached to the host to avoid accidental initialization of these disks, and with that, potential data loss.



#### IMPORTANT

Virtualization must be enabled in your host's BIOS settings. For information on changing your host's BIOS settings, refer to your host's hardware documentation.



#### IMPORTANT

Do not install third-party watchdogs on Red Hat Enterprise Linux hosts. They can interfere with the watchdog daemon provided by VDSM.

### 4.2.2. Enabling the Red Hat Enterprise Linux host Repositories

To use a Red Hat Enterprise Linux machine as a host, you must register the system with the Content Delivery Network, attach the **Red Hat Enterprise Linux Server** and **Red Hat Virtualization** subscriptions, and enable the host repositories.

## Procedure

1. Register your system with the Content Delivery Network, entering your Customer Portal user name and password when prompted:

```
# subscription-manager register
```

2. Find the **Red Hat Enterprise Linux Server** and **Red Hat Virtualization** subscription pools and record the pool IDs:

```
# subscription-manager list --available
```

3. Use the pool IDs to attach the subscriptions to the system:

```
# subscription-manager attach --pool=poolid
```



### NOTE

To view currently attached subscriptions:

```
# subscription-manager list --consumed
```

To list all enabled repositories:

```
# dnf repolist
```

4. Configure the repositories:

```
# subscription-manager repos \
  --disable='*' \
  --enable=rhel-8-for-x86_64-baseos-rpms \
  --enable=rhel-8-for-x86_64-appstream-rpms \
  --enable=rhv-4-mgmt-agent-for-rhel-8-x86_64-rpms \
  --enable=fast-datapath-for-rhel-8-x86_64-rpms \
  --enable=advanced-virt-for-rhel-8-x86_64-rpms
```

For Red Hat Enterprise Linux 8 hosts, little endian, on IBM POWER8 or IBM POWER9 hardware:

```
# subscription-manager repos \
  --disable='*' \
  --enable=rhv-4-mgmt-agent-for-rhel-8-ppc64le-rpms \
  --enable=rhv-4-tools-for-rhel-8-ppc64le-rpms \
  --enable=advanced-virt-for-rhel-8-ppc64le-rpms \
  --enable=rhel-8-for-ppc64le-appstream-rpms \
  --enable=rhel-8-for-ppc64le-baseos-rpms \
```

5. Ensure that all packages currently installed are up to date:

```
# dnf upgrade --nobest
```

6. Reboot the machine.

### 4.2.3. Installing Cockpit on Red Hat Enterprise Linux hosts

You can install Cockpit for monitoring the host's resources and performing administrative tasks.

#### Procedure

1. Install the dashboard packages:

```
# dnf install cockpit-ovirt-dashboard
```

2. Enable and start the **cockpit.socket** service:

```
# systemctl enable cockpit.socket
# systemctl start cockpit.socket
```

3. Check if Cockpit is an active service in the firewall:

```
# firewall-cmd --list-services
```

You should see **cockpit** listed. If it is not, enter the following with root permissions to add **cockpit** as a service to your firewall:

```
# firewall-cmd --permanent --add-service=cockpit
```

The **--permanent** option keeps the **cockpit** service active after rebooting.

You can log in to the Cockpit web interface at **https://HostFQDNorIP:9090**.

## 4.3. RECOMMENDED PRACTICES FOR CONFIGURING HOST NETWORKS



### IMPORTANT

Always use the RHV Manager to modify the network configuration of hosts in your clusters. Otherwise, you might create an unsupported configuration. For details, see [Network Manager Stateful Configuration \(nmstate\)](#).

If your network environment is complex, you may need to configure a host network manually before adding the host to the Red Hat Virtualization Manager.

Consider the following practices for configuring a host network:

- Configure the network with Cockpit. Alternatively, you can use **nmtui** or **nmcli**.
- If a network is not required for a self-hosted engine deployment or for adding a host to the Manager, configure the network in the Administration Portal after adding the host to the Manager. See [Creating a New Logical Network in a Data Center or Cluster](#).

- Use the following naming conventions:
  - VLAN devices: ***VLAN\_NAME\_TYPE\_RAW\_PLUS\_VID\_NO\_PAD***
  - VLAN interfaces: ***physical\_device.VLAN\_ID*** (for example, ***eth0.23***, ***eth1.128***, ***enp3s0.50***)
  - Bond interfaces: ***bondnumber*** (for example, ***bond0***, ***bond1***)
  - VLANs on bond interfaces: ***bondnumber.VLAN\_ID*** (for example, ***bond0.50***, ***bond1.128***)
- Use [network bonding](#). Network teaming is not supported in Red Hat Virtualization and will cause errors if the host is used to deploy a self-hosted engine or added to the Manager.
- Use recommended bonding modes:
  - If the ***ovirtmgmt*** network is not used by virtual machines, the network may use any supported bonding mode.
  - If the ***ovirtmgmt*** network is used by virtual machines, see [Which bonding modes work when used with a bridge that virtual machine guests or containers connect to?](#)
  - Red Hat Virtualization's default bonding mode is **(Mode 4) Dynamic Link Aggregation**. If your switch does not support Link Aggregation Control Protocol (LACP), use **(Mode 1) Active-Backup**. See [Bonding Modes](#) for details.
- Configure a VLAN on a physical NIC as in the following example (although ***nmcli*** is used, you can use any tool):

```
# nmcli connection add type vlan con-name vlan50 ifname eth0.50 dev eth0 id 50
# nmcli con mod vlan50 +ipv4.dns 8.8.8.8 +ipv4.addresses 123.123.0.1/24 +ipv4.gateway 123.123.0.254
```

- Configure a VLAN on a bond as in the following example (although ***nmcli*** is used, you can use any tool):

```
# nmcli connection add type bond con-name bond0 ifname bond0 bond.options "mode=active-backup,miimon=100" ipv4.method disabled ipv6.method ignore
# nmcli connection add type ethernet con-name eth0 ifname eth0 master bond0 slave-type bond
# nmcli connection add type ethernet con-name eth1 ifname eth1 master bond0 slave-type bond
# nmcli connection add type vlan con-name vlan50 ifname bond0.50 dev bond0 id 50
# nmcli con mod vlan50 +ipv4.dns 8.8.8.8 +ipv4.addresses 123.123.0.1/24 +ipv4.gateway 123.123.0.254
```

- Do not disable ***firewalld***.
- Customize the firewall rules in the Administration Portal after adding the host to the Manager. See [Configuring Host Firewall Rules](#).

## 4.4. ADDING STANDARD HOSTS TO THE RED HAT VIRTUALIZATION MANAGER



**IMPORTANT**

Always use the RHV Manager to modify the network configuration of hosts in your clusters. Otherwise, you might create an unsupported configuration. For details, see [Network Manager Stateful Configuration \(nmstate\)](#).


Adding a host to your Red Hat Virtualization environment can take some time, as the following steps are completed by the platform: virtualization checks, installation of packages, and creation of a bridge.

**IMPORTANT**

OVS clusters cannot contain RHEL 8 hosts. Due to a known issue, RHEL 8 hosts do not work in clusters whose **Switch Type** is **OVS**. For details, see [BZ#1809116](#) and [Open vSwitch and OpenFlow support for RHV](#).

**Procedure**

1. From the Administration Portal, click **Compute** → **Hosts**.
2. Click **New**.
3. Use the drop-down list to select the **Data Center** and **Host Cluster** for the new host.
4. Enter the **Name** and the **Address** of the new host. The standard SSH port, port 22, is auto-filled in the **SSH Port** field.
5. Select an authentication method to use for the Manager to access the host.
  - Enter the root user's password to use password authentication.
  - Alternatively, copy the key displayed in the **SSH PublicKey** field to `/root/.ssh/authorized_keys` on the host to use public key authentication.
6. Optionally, click the **Advanced Parameters** button to change the following advanced host settings:
  - Disable automatic firewall configuration.
  - Add a host SSH fingerprint to increase security. You can add it manually, or fetch it automatically.
7. Optionally configure power management, where the host has a supported power management card. For information on power management configuration, see [Host Power Management Settings Explained](#) in the *Administration Guide*.
8. Click **OK**.

The new host displays in the list of hosts with a status of **Installing**, and you can view the progress of the installation in the **Events** section of the **Notification Drawer** (). After a brief delay the host status changes to **Up**.

## CHAPTER 5. PREPARING STORAGE FOR RED HAT VIRTUALIZATION

You need to prepare storage to be used for storage domains in the new environment. A Red Hat Virtualization environment must have at least one data storage domain, but adding more is recommended.



### WARNING

When installing or reinstalling the host's operating system, Red Hat strongly recommends that you first detach any existing non-OS storage that is attached to the host to avoid accidental initialization of these disks, and with that, potential data loss.

A data domain holds the virtual hard disks and OVF files of all the virtual machines and templates in a data center, and cannot be shared across data centers while active (but can be migrated between data centers). Data domains of multiple storage types can be added to the same data center, provided they are all shared, rather than local, domains.

You can use one of the following storage types:

- [NFS](#)
- [iSCSI](#)
- [Fibre Channel \(FCP\)](#)
- [POSIX-compliant file system](#)
- [Local storage](#)
- [Red Hat Gluster Storage](#)

### 5.1. PREPARING NFS STORAGE

Set up NFS shares on your file storage or remote server to serve as storage domains on Red Hat Enterprise Virtualization Host systems. After exporting the shares on the remote storage and configuring them in the Red Hat Virtualization Manager, the shares will be automatically imported on the Red Hat Virtualization hosts.

For information on setting up, configuring, mounting and exporting NFS, see [Managing file systems](#) for Red Hat Enterprise Linux 8.

Specific system user accounts and system user groups are required by Red Hat Virtualization so the Manager can store data in the storage domains represented by the exported directories. The following procedure sets the permissions for one directory. You must repeat the **chown** and **chmod** steps for all of the directories you intend to use as storage domains in Red Hat Virtualization.

#### Prerequisites

1. Install the NFS **utils** package.

```
# dnf install nfs-utils -y
```

2. To check the enabled versions:

```
# cat /proc/fs/nfsd/versions
```

3. Enable the following services:

```
# systemctl enable nfs-server  
# systemctl enable rpcbind
```

## Procedure

1. Create the group **kvm**:

```
# groupadd kvm -g 36
```

2. Create the user **vds**m in the group **kvm**:

```
# useradd vds -u 36 -g kvm
```

3. Create the **storage** directory and modify the access rights.

```
# mkdir /storage  
# chmod 0755 /storage  
# chown 36:36 /storage/
```

4. Add the **storage** directory to **/etc/exports** with the relevant permissions.

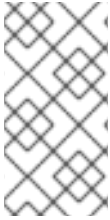
```
# vi /etc/exports  
# cat /etc/exports  
/storage *(rw)
```

5. Restart the following services:

```
# systemctl restart rpcbind  
# systemctl restart nfs-server
```

6. To see which export are available for a specific IP address:

```
# exportfs  
/nfs_server/srv  
10.46.11.3/24  
/nfs_server <world>
```

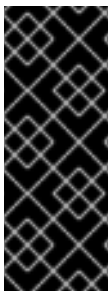
**NOTE**

If changes in `/etc/exports` have been made after starting the services, the `exportfs -ra` command can be used to reload the changes. After performing all the above stages, the exports directory should be ready and can be tested on a different host to check that it is usable.

## 5.2. PREPARING ISCSI STORAGE

Red Hat Virtualization supports iSCSI storage, which is a storage domain created from a volume group made up of LUNs. Volume groups and LUNs cannot be attached to more than one storage domain at a time.

For information on setting up and configuring iSCSI storage, see [Getting started with iSCSI](#) in *Managing storage devices* for Red Hat Enterprise Linux 8.

**IMPORTANT**

If you are using block storage and intend to deploy virtual machines on raw devices or direct LUNs and manage them with the Logical Volume Manager (LVM), you must create a filter to hide guest logical volumes. This will prevent guest logical volumes from being activated when the host is booted, a situation that could lead to stale logical volumes and cause data corruption. Use the `vdsm-tool config-lvm-filter` command to create filters for the LVM. See [Creating an LVM filter](#)

**IMPORTANT**

Red Hat Virtualization currently does not support block storage with a block size of 4K. You must configure block storage in legacy (512b block) mode.

**IMPORTANT**

If your host is booting from SAN storage and loses connectivity to the storage, the storage file systems become read-only and remain in this state after connectivity is restored.

To prevent this situation, add a drop-in multipath configuration file on the root file system of the SAN for the boot LUN to ensure that it is queued when there is a connection:

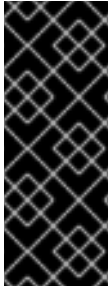
```
# cat /etc/multipath/conf.d/host.conf
multipaths {
  multipath {
    wwid boot_LUN_wwid
    no_path_retry queue
  }
}
```

## 5.3. PREPARING FCP STORAGE

Red Hat Virtualization supports SAN storage by creating a storage domain from a volume group made of pre-existing LUNs. Neither volume groups nor LUNs can be attached to more than one storage domain at a time.

Red Hat Virtualization system administrators need a working knowledge of Storage Area Networks (SAN) concepts. SAN usually uses Fibre Channel Protocol (FCP) for traffic between hosts and shared external storage. For this reason, SAN may occasionally be referred to as FCP storage.

For information on setting up and configuring FCP or multipathing on Red Hat Enterprise Linux, see the [Storage Administration Guide](#) and [DM Multipath Guide](#).



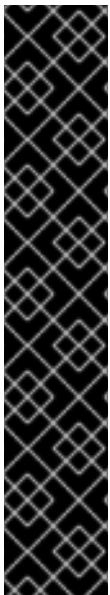
### IMPORTANT

If you are using block storage and intend to deploy virtual machines on raw devices or direct LUNs and manage them with the Logical Volume Manager (LVM), you must create a filter to hide guest logical volumes. This will prevent guest logical volumes from being activated when the host is booted, a situation that could lead to stale logical volumes and cause data corruption. Use the **vdsm-tool config-lvm-filter** command to create filters for the LVM. See [Creating an LVM filter](#)



### IMPORTANT

Red Hat Virtualization currently does not support block storage with a block size of 4K. You must configure block storage in legacy (512b block) mode.



### IMPORTANT

If your host is booting from SAN storage and loses connectivity to the storage, the storage file systems become read-only and remain in this state after connectivity is restored.

To prevent this situation, add a drop-in multipath configuration file on the root file system of the SAN for the boot LUN to ensure that it is queued when there is a connection:

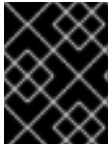
```
# cat /etc/multipath/conf.d/host.conf
multipaths {
  multipath {
    wwid boot_LUN_wwid
    no_path_retry queue
  }
}
```

## 5.4. PREPARING POSIX-COMPLIANT FILE SYSTEM STORAGE

POSIX file system support allows you to mount file systems using the same mount options that you would normally use when mounting them manually from the command line. This functionality is intended to allow access to storage not exposed using NFS, iSCSI, or FCP.

Any POSIX-compliant file system used as a storage domain in Red Hat Virtualization must be a clustered file system, such as Global File System 2 (GFS2), and must support sparse files and direct I/O. The Common Internet File System (CIFS), for example, does not support direct I/O, making it incompatible with Red Hat Virtualization.

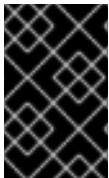
For information on setting up and configuring POSIX-compliant file system storage, see [Red Hat Enterprise Linux Global File System 2](#).

**IMPORTANT**

Do **not** mount NFS storage by creating a POSIX-compliant file system storage domain. Always create an NFS storage domain instead.

## 5.5. PREPARING LOCAL STORAGE

A local storage domain can be set up on a host. When you set up a host to use local storage, the host is automatically added to a new data center and cluster that no other hosts can be added to. Multiple-host clusters require that all hosts have access to all storage domains, which is not possible with local storage. Virtual machines created in a single-host cluster cannot be migrated, fenced, or scheduled.

**IMPORTANT**

On Red Hat Virtualization Host (RHVH), local storage should always be defined on a file system that is separate from / (root). Use a separate logical volume or disk, to prevent possible loss of data during upgrades.

### Preparing Local Storage for Red Hat Enterprise Linux hosts

1. On the host, create the directory to be used for the local storage:

```
# mkdir -p /data/images
```

2. Ensure that the directory has permissions allowing read/write access to the **vdsm** user (UID 36) and **kvm** group (GID 36):

```
# chown 36:36 /data /data/images
# chmod 0755 /data /data/images
```

### Preparing Local Storage for Red Hat Virtualization Hosts

Create the local storage on a logical volume:

1. Create a local storage directory:

```
# mkdir /data
# lvcreate -L $SIZE rhvh -n data
# mkfs.ext4 /dev/mapper/rhvh-data
# echo "/dev/mapper/rhvh-data /data ext4 defaults,discard 1 2" >> /etc/fstab
# mount /data
```

2. Mount the new local storage, and then modify the permissions and ownership:

```
# mount -a
# chown 36:36 /data /rhvh-data
# chmod 0755 /data /rhvh-data
```

## 5.6. PREPARING RED HAT GLUSTER STORAGE

For information on setting up and configuring Red Hat Gluster Storage, see the [Red Hat Gluster Storage Installation Guide](#).

For the Red Hat Gluster Storage versions that are supported with Red Hat Virtualization, see <https://access.redhat.com/articles/2356261>.

## 5.7. CUSTOMIZING MULTIPATH CONFIGURATIONS FOR SAN VENDORS

If your RHV environment is configured to use multipath connections with SANs, you can customize the multipath configuration settings to meet requirements specified by your storage vendor. These customizations can override both the default settings and settings that are specified in **/etc/multipath.conf**.

To override the multipath settings, do not customize **/etc/multipath.conf**. Because VDSM owns **/etc/multipath.conf**, installing or upgrading VDSM or Red Hat Virtualization can overwrite this file including any customizations it contains. This overwriting can cause severe storage failures.

Instead, you create a file in the **/etc/multipath/conf.d/user.conf** directory that contains the settings you want to customize or override.

VDSM executes the files in **/etc/multipath/conf.d/user.conf** in alphabetical order. So, to control the order of execution, you begin the filename with a number that makes it come last. For example, **/etc/multipath/conf.d/user.conf/90-myfile.conf**.

To avoid causing severe storage failures, follow these guidelines:

- Do not modify **/etc/multipath.conf**. If the file contains user modifications, and the file is overwritten, it can cause unexpected storage problems.
- Do not override the **user\_friendly\_names** and **find\_multipaths** settings. For details, see [Section 5.8, “Recommended Settings for Multipath.conf”](#).
- Avoid overriding the **no\_path\_retry** and **polling\_interval** settings unless a storage vendor specifically requires you to do so. For details, see [Section 5.8, “Recommended Settings for Multipath.conf”](#).



### WARNING

Not following these guidelines can cause catastrophic storage errors.

### Prerequisites

- VDSM is configured to use the multipath module. To verify this, enter:

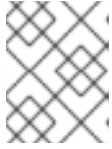
```
# vdsmd --is-configured --module multipath
```

### Procedure

1. Create a new configuration file in the **/etc/multipath/conf.d/user.conf** directory.

2. Copy the individual setting you want to override from **/etc/multipath.conf** to the new configuration file in **/etc/multipath/conf.d/user.conf**. Remove any comment marks, edit the setting values, and save your changes.
3. Apply the new configuration settings by entering:

```
# systemctl reload multipathd
```



#### NOTE

Do not restart the multipathd service. Doing so generates errors in the VDSM logs.

### Verification steps

Test the new configuration performs as expected on a non-production cluster in a variety of failure scenarios. For example, disable all of the storage connections. Then enable one connection at a time and verify that doing so makes the storage domain reachable.

### Additional resources

- [Red Hat Enterprise Linux DM Multipath](#)
- [Configuring iSCSI Multipathing](#)
- [How do I customize /etc/multipath.conf on my RHVH hypervisors? What values must not change and why?](#)

## 5.8. RECOMMENDED SETTINGS FOR MULTIPATH.CONF

Do not override the following settings:

### **user\_friendly\_names no**

Device names must be consistent across all hypervisors. For example, **/dev/mapper/{WWID}**. The default value of this setting, **no**, prevents the assignment of arbitrary and inconsistent device names such as **/dev/mapper/mpath{N}** on various hypervisors, which can lead to unpredictable system behavior.



#### WARNING

Do not change this setting to **user\_friendly\_names yes**. User-friendly names are likely to cause unpredictable system behavior or failures, and are not supported.

### **find\_multipaths no**



This setting controls whether RHVH tries to access devices through multipath only if more than one path is available. The current value, **no**, allows RHV to access devices through multipath even if only one path is available.

**WARNING**

Do not override this setting.

Avoid overriding the following settings unless required by the storage system vendor:

**no\_path\_retry 4**

This setting controls the number of polling attempts to retry when no paths are available. Before RHV version 4.2, the value of **no\_path\_retry** was **fail** because QEMU had trouble with the I/O queuing when no paths were available. The **fail** value made it fail quickly and paused the virtual machine. RHV version 4.2 changed this value to **4** so when multipathd detects the last path has failed, it checks all of the paths four more times. Assuming the default 5-second polling interval, checking the paths takes 20 seconds. If no path is up, multipathd tells the kernel to stop queuing and fails all outstanding and future I/O until a path is restored. When a path is restored, the 20-second delay is reset for the next time all paths fail. For more details, see [the commit that changed this setting](#).

**polling\_interval 5**

This setting determines the number of seconds between polling attempts to detect whether a path is open or has failed. Unless the vendor provides a clear reason for increasing the value, keep the VDSM-generated default so the system responds to path failures sooner.

## CHAPTER 6. ADDING STORAGE FOR RED HAT VIRTUALIZATION

Add storage as data domains in the new environment. A Red Hat Virtualization environment must have at least one data domain, but adding more is recommended.

Add the storage you prepared earlier:

- [NFS](#)
- [iSCSI](#)
- [Fibre Channel \(FCP\)](#)
- [POSIX-compliant file system](#)
- [Local storage](#)
- [Red Hat Gluster Storage](#)

### 6.1. ADDING NFS STORAGE

This procedure shows you how to attach existing NFS storage to your Red Hat Virtualization environment as a data domain.

If you require an ISO or export domain, use this procedure, but select **ISO** or **Export** from the **Domain Function** list.

#### Procedure

1. In the Administration Portal, click **Storage** → **Domains**.
2. Click **New Domain**.
3. Enter a **Name** for the storage domain.
4. Accept the default values for the **Data Center**, **Domain Function**, **Storage Type**, **Format**, and **Host** lists.
5. Enter the **Export Path** to be used for the storage domain. The export path should be in the format of `123.123.0.10:/data` (for IPv4), `[2001:0:0:0:0:0:5db1]:/data` (for IPv6), or `domain.example.com:/data`.
6. Optionally, you can configure the advanced parameters:
  - a. Click **Advanced Parameters**.
  - b. Enter a percentage value into the **Warning Low Space Indicator** field. If the free space available on the storage domain is below this percentage, warning messages are displayed to the user and logged.
  - c. Enter a GB value into the **Critical Space Action Blocker** field. If the free space available on the storage domain is below this value, error messages are displayed to the user and logged, and any new action that consumes space, even temporarily, will be blocked.

- d. Select the **Wipe After Delete** check box to enable the wipe after delete option. This option can be edited after the domain is created, but doing so will not change the wipe after delete property of disks that already exist.
7. Click **OK**.

The new NFS data domain has a status of **Locked** until the disk is prepared. The data domain is then automatically attached to the data center.

## 6.2. ADDING ISCSI STORAGE

This procedure shows you how to attach existing iSCSI storage to your Red Hat Virtualization environment as a data domain.

### Procedure

1. Click **Storage → Domains**.
2. Click **New Domain**.
3. Enter the **Name** of the new storage domain.
4. Select a **Data Center** from the drop-down list.
5. Select **Data** as the **Domain Function** and **iSCSI** as the **Storage Type**.
6. Select an active host as the **Host**.



### IMPORTANT

Communication to the storage domain is from the selected host and not directly from the Manager. Therefore, all hosts must have access to the storage device before the storage domain can be configured.

7. The Manager can map iSCSI targets to LUNs or LUNs to iSCSI targets. The **New Domain** window automatically displays known targets with unused LUNs when the iSCSI storage type is selected. If the target that you are using to add storage does not appear, you can use target discovery to find it; otherwise proceed to the next step.
  - a. Click **Discover Targets** to enable target discovery options. When targets have been discovered and logged in to, the **New Domain** window automatically displays targets with LUNs unused by the environment.



### NOTE

LUNs used externally for the environment are also displayed.

You can use the **Discover Targets** options to add LUNs on many targets or multiple paths to the same LUNs.

**IMPORTANT**

If you use the REST API method **iscsidiscover** to discover the iscsi targets, you can use an FQDN or an IP address, but you must use the iscsi details from the discovered targets results to log in using the REST API method **iscsilogin**. See [iscsidiscover](#) in the *REST API Guide* for more information.

- b. Enter the FQDN or IP address of the iSCSI host in the **Address** field.
- c. Enter the port with which to connect to the host when browsing for targets in the **Port** field. The default is **3260**.
- d. If CHAP is used to secure the storage, select the **User Authentication** check box. Enter the **CHAP user name** and **CHAP password**.

**NOTE**

You can define credentials for an iSCSI target for a specific host with the REST API. See [StorageServerConnectionExtensions: add](#) in the *REST API Guide* for more information.

- e. Click **Discover**.
- f. Select one or more targets from the discovery results and click **Login** for one target or **Login All** for multiple targets.

**IMPORTANT**

If more than one path access is required, you must discover and log in to the target through all the required paths. Modifying a storage domain to add additional paths is currently not supported.

**IMPORTANT**

When using the REST API **iscsilogin** method to log in, you must use the iscsi details from the discovered targets results in the **iscsidiscover** method. See [iscsilogin](#) in the *REST API Guide* for more information.

8. Click the **+** button next to the desired target. This expands the entry and displays all unused LUNs attached to the target.
9. Select the check box for each LUN that you are using to create the storage domain.
10. Optionally, you can configure the advanced parameters:
  - a. Click **Advanced Parameters**.
  - b. Enter a percentage value into the **Warning Low Space Indicator** field. If the free space available on the storage domain is below this percentage, warning messages are displayed to the user and logged.
  - c. Enter a GB value into the **Critical Space Action Blocker** field. If the free space available on the storage domain is below this value, error messages are displayed to the user and logged, and any new action that consumes space, even temporarily, will be blocked.

- d. Select the **Wipe After Delete** check box to enable the wipe after delete option. This option can be edited after the domain is created, but doing so will not change the wipe after delete property of disks that already exist.
- e. Select the **Discard After Delete** check box to enable the discard after delete option. This option can be edited after the domain is created. This option is only available to block storage domains.

11. Click **OK**.

If you have configured multiple storage connection paths to the same target, follow the procedure in [Configuring iSCSI Multipathing](#) to complete iSCSI bonding.

If you want to migrate your current storage network to an iSCSI bond, see [Migrating a Logical Network to an iSCSI Bond](#).

## 6.3. ADDING FCP STORAGE

This procedure shows you how to attach existing FCP storage to your Red Hat Virtualization environment as a data domain.

### Procedure

1. Click **Storage → Domains**.
2. Click **New Domain**.
3. Enter the **Name** of the storage domain.
4. Select an FCP **Data Center** from the drop-down list.  
If you do not yet have an appropriate FCP data center, select **(none)**.
5. Select the **Domain Function** and the **Storage Type** from the drop-down lists. The storage domain types that are not compatible with the chosen data center are not available.
6. Select an active host in the **Host** field. If this is not the first data domain in a data center, you must select the data center's SPM host.



### IMPORTANT

All communication to the storage domain is through the selected host and not directly from the Red Hat Virtualization Manager. At least one active host must exist in the system and be attached to the chosen data center. All hosts must have access to the storage device before the storage domain can be configured.

7. The **New Domain** window automatically displays known targets with unused LUNs when **Fibre Channel** is selected as the storage type. Select the **LUN ID** check box to select all of the available LUNs.
8. Optionally, you can configure the advanced parameters.
  - a. Click **Advanced Parameters**.

- b. Enter a percentage value into the **Warning Low Space Indicator** field. If the free space available on the storage domain is below this percentage, warning messages are displayed to the user and logged.
  - c. Enter a GB value into the **Critical Space Action Blocker** field. If the free space available on the storage domain is below this value, error messages are displayed to the user and logged, and any new action that consumes space, even temporarily, will be blocked.
  - d. Select the **Wipe After Delete** check box to enable the wipe after delete option. This option can be edited after the domain is created, but doing so will not change the wipe after delete property of disks that already exist.
  - e. Select the **Discard After Delete** check box to enable the discard after delete option. This option can be edited after the domain is created. This option is only available to block storage domains.
9. Click **OK**.

The new FCP data domain remains in a **Locked** status while it is being prepared for use. When ready, it is automatically attached to the data center.

## 6.4. ADDING POSIX-COMPLIANT FILE SYSTEM STORAGE

This procedure shows you how to attach existing POSIX-compliant file system storage to your Red Hat Virtualization environment as a data domain.

### Procedure

1. Click **Storage → Domains**.
2. Click **New Domain**.
3. Enter the **Name** for the storage domain.
4. Select the **Data Center** to be associated with the storage domain. The data center selected must be of type **POSIX (POSIX compliant FS)**. Alternatively, select **(none)**.
5. Select **Data** from the **Domain Function** drop-down list, and **POSIX compliant FS** from the **Storage Type** drop-down list.  
If applicable, select the **Format** from the drop-down menu.
6. Select a host from the **Host** drop-down list.
7. Enter the **Path** to the POSIX file system, as you would normally provide it to the **mount** command.
8. Enter the **VFS Type**, as you would normally provide it to the **mount** command using the **-t** argument. See **man mount** for a list of valid VFS types.
9. Enter additional **Mount Options**, as you would normally provide them to the **mount** command using the **-o** argument. The mount options should be provided in a comma-separated list. See **man mount** for a list of valid mount options.
10. Optionally, you can configure the advanced parameters.
  - a. Click **Advanced Parameters**.

- b. Enter a percentage value in the **Warning Low Space Indicator** field. If the free space available on the storage domain is below this percentage, warning messages are displayed to the user and logged.
  - c. Enter a GB value in the **Critical Space Action Blocker** field. If the free space available on the storage domain is below this value, error messages are displayed to the user and logged, and any new action that consumes space, even temporarily, will be blocked.
  - d. Select the **Wipe After Delete** check box to enable the wipe after delete option. This option can be edited after the domain is created, but doing so will not change the wipe after delete property of disks that already exist.
11. Click **OK**.

## 6.5. ADDING LOCAL STORAGE

Adding local storage to a host places the host in a new data center and cluster. The local storage configuration window combines the creation of a data center, a cluster, and storage into a single process.

### Procedure

1. Click **Compute** → **Hosts** and select the host.
2. Click **Management** → **Maintenance** and **OK**.
3. Click **Management** → **Configure Local Storage**.
4. Click the **Edit** buttons next to the **Data Center**, **Cluster**, and **Storage** fields to configure and name the local storage domain.
5. Set the path to your local storage in the text entry field.
6. If applicable, click the **Optimization** tab to configure the memory optimization policy for the new local storage cluster.
7. Click **OK**.

Your host comes online in a data center of its own.

## 6.6. ADDING RED HAT GLUSTER STORAGE

To use Red Hat Gluster Storage with Red Hat Virtualization, see [Configuring Red Hat Virtualization with Red Hat Gluster Storage](#).

For the Red Hat Gluster Storage versions that are supported with Red Hat Virtualization, see <https://access.redhat.com/articles/2356261>.

# APPENDIX A. CONFIGURING A LOCAL REPOSITORY FOR OFFLINE RED HAT VIRTUALIZATION MANAGER INSTALLATION

To install Red Hat Virtualization Manager on a system that does not have a direct connection to the Content Delivery Network, download the required packages on a system that has internet access, then create a repository that can be shared with the offline Manager machine. The system hosting the repository must be connected to the same network as the client systems where the packages are to be installed.

## Prerequisites

- A Red Hat Enterprise Linux 8 Server installed on a system that has access to the Content Delivery Network. This system downloads all the required packages, and distributes them to your offline systems.
- A large amount of free disk space available. This procedure downloads a large number of packages, and requires up to 50GB of free disk space.

Begin by enabling the Red Hat Virtualization Manager repositories on the online system:

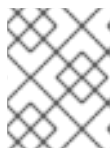
## Enabling the Red Hat Virtualization Manager Repositories

You need to log in and register the online machine with Red Hat Subscription Manager, attach the **Red Hat Virtualization Manager** subscription, and enable the Manager repositories.

## Procedure

1. Register your system with the Content Delivery Network, entering your Customer Portal user name and password when prompted:

```
# subscription-manager register
```



### NOTE

If you are using an IPv6 network, use an IPv6 transition mechanism to access the Content Delivery Network and subscription manager.

2. Find the **Red Hat Virtualization Manager** subscription pool and record the pool ID:

```
# subscription-manager list --available
```

3. Use the pool ID to attach the subscription to the system:

```
# subscription-manager attach --pool=pool_id
```



**NOTE**

To view currently attached subscriptions:

```
# subscription-manager list --consumed
```

To list all enabled repositories:

```
# dnf repolist
```

4. Configure the repositories:

```
# subscription-manager repos \
  --disable='*' \
  --enable=rhel-8-for-x86_64-baseos-rpms \
  --enable=rhel-8-for-x86_64-appstream-rpms \
  --enable=rhv-4.4-manager-for-rhel-8-x86_64-rpms \
  --enable=fast-datapath-for-rhel-8-x86_64-rpms \
  --enable=jb-eap-7.3-for-rhel-8-x86_64-rpms
```

5. Enable the **pki-deps** module.

```
# dnf module -y enable pki-deps
```

6. Enable version 12 of the **postgresql** module.

```
# dnf module -y enable postgresql:12
```

7. Synchronize installed packages to update them to the latest available versions.

```
# dnf distro-sync --nobest
```

**Additional resources**

For information on modules and module streams, see the following sections in *Installing, managing, and removing user-space components*

- [Module streams](#)
- [Selecting a stream before installation of packages](#)
- [Resetting module streams](#)
- [Switching to a later stream](#)

**Configuring the Offline Repository**

1. Servers that are not connected to the Internet can access software repositories on other systems using File Transfer Protocol (FTP). To create the FTP repository, install and configure **vsftpd** on the intended Manager machine:

- a. Install the **vsftpd** package:

```
# dnf install vsftpd
```

- b. Enable ftp access for an anonymous user to have access to rpm files from the intended Manager machine, and to keep it secure, disable write on ftp server. Edit the `/etc/vsftpd/vsftpd.conf` file and change the values for **anonymous\_enable** and **write\_enable** as follows:

```
anonymous_enable=YES
write_enable=NO
```

- c. Start the **vsftpd** service, and ensure the service starts on boot:

```
# systemctl start vsftpd.service
# systemctl enable vsftpd.service
```

- d. Create a firewall rule to allow FTP service and reload the **firewalld** service to apply changes:

```
# firewall-cmd --permanent --add-service=ftp
# firewall-cmd --reload
```

- e. Red Hat Enterprise Linux 8 enforces SELinux by default, so configure SELinux to allow FTP access:

```
# setsebool -P allow_ftp_full_access=1
```

- f. Create a sub-directory inside the `/var/ftp/pub/` directory, where the downloaded packages are made available:

```
# mkdir /var/ftp/pub/rhvrepo
```

2. Download packages from all configured software repositories to the **rhvrepo** directory. This includes repositories for all Content Delivery Network subscription pools attached to the system, and any locally configured repositories:

```
# reposync -p /var/ftp/pub/rhvrepo --download-metadata
```

This command downloads a large number of packages and their metadata, and takes a long time to complete.

3. Create a repository file, and copy it to the `/etc/yum.repos.d/` directory on the intended Manager machine.

You can create the configuration file manually or with a script. Run the script below on the machine hosting the repository, replacing `ADDRESS` in the **baseurl** with the IP address or FQDN of the machine hosting the repository:

```
#!/bin/sh

REPOFILE="/etc/yum.repos.d/rhev.repo"
echo -e "" > $REPOFILE

for DIR in $(find /var/ftp/pub/rhvrepo -maxdepth 1 -mindepth 1 -type d);
do
  echo -e "[$(basename $DIR)]" >> $REPOFILE
  echo -e "name=$(basename $DIR)" >> $REPOFILE
  echo -e "baseurl=ftp://__ADDRESS__/pub/rhvrepo/'$(basename $DIR)'" >> $REPOFILE
done
```

```
echo -e "enabled=1" >> $REPOFILE  
echo -e "gpgcheck=0" >> $REPOFILE  
echo -e "\n" >> $REPOFILE  
done
```

Return to [Section 3.3, "Installing and Configuring the Red Hat Virtualization Manager"](#) . Packages are installed from the local repository, instead of from the Content Delivery Network.

## Troubleshooting

When running `reposync`, the following error message appears

**No available modular metadata for modular package "package\_name\_from\_module" it cannot be installed on the system**

### Solution

Ensure you have **yum-utils-4.0.8-3.el8.noarch** or higher installed so `reposync` correctly downloads all the packages. For more information, see [Create a local repo with Red Hat Enterprise Linux 8](#) .

## APPENDIX B. PREPARING A LOCAL MANUALLY CONFIGURED POSTGRESQL DATABASE

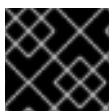
Use this procedure to set up the Manager database. Set up this database before you configure the Manager; you must supply the database credentials during **engine-setup**.



### NOTE

The **engine-setup** and **engine-backup --mode=restore** commands only support system error messages in the **en\_US.UTF8** locale, even if the system locale is different.

The locale settings in the **postgresql.conf** file must be set to **en\_US.UTF8**.



### IMPORTANT

The database name must contain only numbers, underscores, and lowercase letters.

### Enabling the Red Hat Virtualization Manager Repositories

You need to log in and register the Manager machine with Red Hat Subscription Manager, attach the **Red Hat Virtualization Manager** subscription, and enable the Manager repositories.

#### Procedure

1. Register your system with the Content Delivery Network, entering your Customer Portal user name and password when prompted:

```
# subscription-manager register
```



### NOTE

If you are using an IPv6 network, use an IPv6 transition mechanism to access the Content Delivery Network and subscription manager.

2. Find the **Red Hat Virtualization Manager** subscription pool and record the pool ID:

```
# subscription-manager list --available
```

3. Use the pool ID to attach the subscription to the system:

```
# subscription-manager attach --pool=pool_id
```



### NOTE

To view currently attached subscriptions:

```
# subscription-manager list --consumed
```

To list all enabled repositories:

```
# dnf repolist
```

4. Configure the repositories:

```
# subscription-manager repos \
--disable='*' \
--enable=rhel-8-for-x86_64-baseos-rpms \
--enable=rhel-8-for-x86_64-appstream-rpms \
--enable=rhv-4.4-manager-for-rhel-8-x86_64-rpms
```

5. Enable version 12 of the **postgresql** module.

```
# dnf module -y enable postgresql:12
```

6. Synchronize installed packages to update them to the latest available versions.

```
# dnf distro-sync --nobest
```

### Additional resources

For information on modules and module streams, see the following sections in *Installing, managing, and removing user-space components*

- [Module streams](#)
- [Selecting a stream before installation of packages](#)
- [Resetting module streams](#)
- [Switching to a later stream](#)

## Initializing the PostgreSQL Database

1. Install the PostgreSQL server package:

```
# dnf install postgresql-server postgresql-contrib
```

2. Initialize the PostgreSQL database instance:

```
# postgresql-setup --initdb
```

3. Start the **postgresql** service, and ensure that this service starts on boot:

```
# systemctl enable postgresql
# systemctl start postgresql
```

4. Connect to the **psql** command line interface as the **postgres** user:

```
# su - postgres -c psql
```

5. Create a default user. The Manager's default user is **engine** and Data Warehouse's default user is **ovirt\_engine\_history**:

```
postgres=# create role user_name with login encrypted password 'password';
```

6. Create a database. The Manager's default database name is **engine** and Data Warehouse's default database name is **ovirt\_engine\_history**:

```
postgres=# create database database_name owner user_name template template0
encoding 'UTF8' lc_collate 'en_US.UTF-8' lc_ctype 'en_US.UTF-8';
```

7. Connect to the new database:

```
postgres=# \c database_name
```

8. Add the **uuid-osspl** extension:

```
database_name=# CREATE EXTENSION "uuid-osspl";
```

9. Add the **plpgsql** language if it does not exist:

```
database_name=# CREATE LANGUAGE plpgsql;
```

10. Quit the **psql** interface:

```
database_name=# \q
```

11. Edit the **/var/lib/pgsql/data/pg\_hba.conf** file to enable md5 client authentication, so the engine can access the database locally. Add the following line immediately below the line that starts with **local** at the bottom of the file:

```
host database_name user_name 0.0.0.0/0 md5
host database_name user_name ::0/0 md5
```

12. Update the PostgreSQL server's configuration. Edit the **/var/lib/pgsql/data/postgresql.conf** file and add the following lines to the bottom of the file:

```
autovacuum_vacuum_scale_factor=0.01
autovacuum_analyze_scale_factor=0.075
autovacuum_max_workers=6
maintenance_work_mem=65536
max_connections=150
work_mem=8192
```

13. Restart the **postgresql** service:

```
# systemctl restart postgresql
```

14. Optionally, set up SSL to secure database connections using the instructions at <http://www.postgresql.org/docs/12/static/ssl-tcp.html#SSL-FILE-USAGE>.

Return to [Section 3.3, "Installing and Configuring the Red Hat Virtualization Manager"](#), and answer **Local** and **Manual** when asked about the database.

## APPENDIX C. SETTING UP CINDERLIB



### IMPORTANT

Cinderlib is a Technology Preview feature only. Technology Preview features are not supported with Red Hat production service level agreements (SLAs), might not be functionally complete, and Red Hat does not recommend to use them for production. These features provide early access to upcoming product features, enabling customers to test functionality and provide feedback during the development process.

For more information on Red Hat Technology Preview features support scope, see <https://access.redhat.com/support/offerings/techpreview/>.

### Setting up Cinderlib on the Manager

1. Enable the **openstack-cinderlib** repositories on Red Hat Enterprise Linux:

```
# subscription-manager repos --enable=openstack-16.1-cinderlib-for-rhel-8-x86_64-rpms
```

2. Install the **OpenStack Cinderlib** package:

```
# dnf install -y python3-cinderlib
```

3. In the Red Hat Virtualization Manager, enable managed block domain support:

```
# engine-config -s ManagedBlockDomainSupported=true
```

4. Restart the Manager to save the new configuration:

```
# systemctl restart ovirt-engine
```

### Setting up Cinderlib on the host

1. Enable the **openstack-cinderlib** repositories on Red Hat Enterprise Linux:

```
# subscription-manager repos --enable=openstack-16.1-cinderlib-for-rhel-8-x86_64-rpms
```

2. Install the Python **brick** package:

```
# yum install -y python3-os-brick
```

3. Restart the VDSM on the host to save the new configuration:

```
# systemctl restart vdsm
```

### Using Cinderlib with a ceph driver

If you are using Cinderlib together with a ceph driver:

1. Enable the following repositories on Red Hat Enterprise Linux:

```
# subscription-manager repos --enable=rhceph-4-osd-for-rhel-8-x86_64-rpms \  
--enable=rhceph-4-mon-for-rhel-8-x86_64-rpms \  
--enable=rhceph-4-tools-for-rhel-8-x86_64-rpms
```

2. Run the following command on the Manager and on the hosts:

```
# yum install -y ceph-common
```



## APPENDIX D. CONFIGURING A HOST FOR PCI PASSTHROUGH



### NOTE

This is one in a series of topics that show how to set up and configure SR-IOV on Red Hat Virtualization. For more information, see [Setting Up and Configuring SR-IOV](#)

Enabling PCI passthrough allows a virtual machine to use a host device as if the device were directly attached to the virtual machine. To enable the PCI passthrough function, you must enable virtualization extensions and the IOMMU function. The following procedure requires you to reboot the host. If the host is attached to the Manager already, ensure you place the host into maintenance mode first.

### Prerequisites

- Ensure that the host hardware meets the requirements for PCI device passthrough and assignment. See [PCI Device Requirements](#) for more information.

### Configuring a Host for PCI Passthrough

1. Enable the virtualization extension and IOMMU extension in the BIOS. See [Enabling Intel VT-x and AMD-V virtualization hardware extensions in BIOS](#) in the *Red Hat Enterprise Linux Virtualization Deployment and Administration Guide* for more information.
2. Enable the IOMMU flag in the kernel by selecting the **Hostdev Passthrough & SR-IOV** check box when adding the host to the Manager or by editing the **grub** configuration file manually.
  - To enable the IOMMU flag from the Administration Portal, see [Adding Standard Hosts to the Red Hat Virtualization Manager](#) and [Kernel Settings Explained](#).
  - To edit the **grub** configuration file manually, see [Enabling IOMMU Manually](#).
3. For GPU passthrough, you need to run additional configuration steps on both the host and the guest system. See [GPU device passthrough: Assigning a host GPU to a single virtual machine](#) in *Setting up an NVIDIA GPU for a virtual machine in Red Hat Virtualization* for more information.

### Enabling IOMMU Manually

1. Enable IOMMU by editing the grub configuration file.



### NOTE

If you are using IBM POWER8 hardware, skip this step as IOMMU is enabled by default.

- For Intel, boot the machine, and append **intel\_iommu=on** to the end of the **GRUB\_CMDLINE\_LINUX** line in the **grub** configuration file.

```
# vi /etc/default/grub
...
GRUB_CMDLINE_LINUX="nofb splash=quiet console=tty0 ... intel_iommu=on
...
```

- For AMD, boot the machine, and append **amd\_iommu=on** to the end of the **GRUB\_CMDLINE\_LINUX** line in the **grub** configuration file.

```
# vi /etc/default/grub
...
GRUB_CMDLINE_LINUX="nofb splash=quiet console=tty0 ... amd_iommu=on
...
```



#### NOTE

If **intel\_iommu=on** or **amd\_iommu=on** works, you can try adding **iommu=pt** or **amd\_iommu=pt**. The **pt** option only enables IOMMU for devices used in passthrough and provides better host performance. However, the option might not be supported on all hardware. Revert to previous option if the **pt** option doesn't work for your host.

If the passthrough fails because the hardware does not support interrupt remapping, you can consider enabling the **allow\_unsafe\_interrupts** option if the virtual machines are trusted. The **allow\_unsafe\_interrupts** is not enabled by default because enabling it potentially exposes the host to MSI attacks from virtual machines. To enable the option:

```
# vi /etc/modprobe.d
options vfio_iommu_type1 allow_unsafe_interrupts=1
```

2. Refresh the **grub.cfg** file and reboot the host for these changes to take effect:

```
# grub2-mkconfig -o /boot/grub2/grub.cfg
```

```
# reboot
```

To enable SR-IOV and assign dedicated virtual NICs to virtual machines, see <https://access.redhat.com/articles/2335291>.

## APPENDIX E. REMOVING THE STANDALONE RED HAT VIRTUALIZATION MANAGER

The **engine-cleanup** command removes all components of the Red Hat Virtualization Manager and automatically backs up the following:

- the Grafana database, in **/var/lib/grafana/**
- the Manager database in **/var/lib/ovirt-engine/backups/**
- a compressed archive of the PKI keys and configuration in **/var/lib/ovirt-engine/backups/**

Backup file names include the date and time.



### WARNING

You should use this procedure only on a standalone installation of the Red Hat Virtualization Manager.

### Procedure

1. Run the following command on the Manager machine:

```
# engine-cleanup
```

2. The Manager service must be stopped before proceeding. You are prompted to confirm. Enter **OK** to proceed:

```
During execution engine service will be stopped (OK, Cancel) [OK]:
```

3. You are prompted to confirm that you want to remove all Manager components. Enter **OK** to remove all components, or **Cancel** to exit **engine-cleanup**:

```
All the installed ovirt components are about to be removed, data will be lost (OK, Cancel) [Cancel]: OK
```

**engine-cleanup** details the components that are removed, and the location of backup files.

4. Remove the Red Hat Virtualization packages:

```
# dnf remove rhvm* vdsm-bootstrap
```