Deploying Red Hat Hyperconverged Infrastructure for Virtualization

Instructions for deploying Red Hat Hyperconverged Infrastructure for Virtualization
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**Abstract**

This document outlines how to deploy Red Hat Hyperconverged Infrastructure for Virtualization (RHHI for Virtualization) across three physical machines, using Red Hat Gluster Storage 3.4 and Red Hat Virtualization 4.3. This creates a discrete cluster for use in remote office branch office (ROBO) environments, where a remote office synchronizes data to a central data center on a regular basis, but can remain fully functional if connectivity to the central data center is lost.
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PART I. PLAN
CHAPTER 1. ARCHITECTURE

Red Hat Hyperconverged Infrastructure for Virtualization (RHHI for Virtualization) combines compute, storage, networking, and management capabilities in one deployment.

RHII for Virtualization is deployed across three physical machines to create a discrete cluster or pod using Red Hat Gluster Storage 3.4 and Red Hat Virtualization 4.3.

The dominant use case for this deployment is in remote office branch office (ROBO) environments, where a remote office synchronizes data to a central data center on a regular basis, but does not require connectivity to the central data center to function.

The following diagram shows the basic architecture of a single cluster.

1.1. UNDERSTANDING VDO

As of Red Hat Hyperconverged Infrastructure for Virtualization 1.6, you can configure a Virtual Data Optimizer (VDO) layer to provide data reduction and deduplication for your storage.

VDO is supported only when enabled on new installations at deployment time, and cannot be enabled on deployments upgraded from earlier versions of RHHI for Virtualization.
VDO performs following types of data reduction to reduce the space required by data.

**Deduplication**

Eliminates zero and duplicate data blocks. VDO finds duplicated data using the UDS (Universal Deduplication Service) Kernel Module. Instead of writing the duplicated data, VDO records it as a reference to the original block. The logical block address is mapped to the physical block address by VDO.

**Compression**

Reduces the size of the data by packing non-duplicate blocks together into fixed length (4 KB) blocks before writing to disk. This helps to speed up the performance for reading data from storage. At best, data can be reduced to 15% of its original size.

Because reducing data has additional processing costs, enabling compression and deduplication reduces write performance. As a result, VDO is not recommended for performance sensitive workloads. Red Hat strongly recommends that you test and verify that your workload achieves the required level of performance with VDO enabled before deploying VDO in production.
Visit the RHFI for Virtualization Sizing Tool, enter your deployment requirements and click Solve to receive an example configuration with suggested nodes, memory, and resource commitments for your deployment.
CHAPTER 3. SUPPORT REQUIREMENTS

Review this section to ensure that your planned deployment meets the requirements for support by Red Hat.

3.1. OPERATING SYSTEM

Red Hat Hyperconverged Infrastructure for Virtualization (RHHI for Virtualization) uses Red Hat Virtualization Host 4.3 as a base for all other configuration. Red Hat Enterprise Linux hosts are not supported.

The following table shows the supported versions of each product to use for a supported RHHI for Virtualization deployment.

<table>
<thead>
<tr>
<th>RHHI version</th>
<th>RHGS version</th>
<th>RHV version</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>3.2</td>
<td>4.1.0 to 4.1.7</td>
</tr>
<tr>
<td>1.1</td>
<td>3.3.1</td>
<td>4.1.8 to 4.2.0</td>
</tr>
<tr>
<td>1.5</td>
<td>3.4 Batch 1 Update</td>
<td>4.2.7</td>
</tr>
<tr>
<td>1.5.1</td>
<td>3.4 Batch 2 Update</td>
<td>4.2.8</td>
</tr>
<tr>
<td>1.6</td>
<td>3.4 Batch 4 Update</td>
<td>4.3 to current</td>
</tr>
</tbody>
</table>

See Requirements in the Red Hat Virtualization Planning and Prerequisites Guide for details on requirements of Red Hat Virtualization.

3.2. PHYSICAL MACHINES

Red Hat Hyperconverged Infrastructure for Virtualization (RHHI for Virtualization) requires at least 3 physical machines. Scaling to 6, 9, or 12 physical machines is also supported; see Scaling for more detailed requirements.

Each physical machine must have the following capabilities:

- at least 2 NICs (Network Interface Controllers) per physical machine, for separation of data and management traffic (see Section 3.5, "Networking" for details)

- for small deployments:
  - at least 12 cores
  - at least 64GB RAM
  - at most 48TB storage

- for medium deployments:
  - at least 12 cores
- at least 128GB RAM
- at most 64TB storage

- for large deployments:
  - at least 16 cores
  - at least 256GB RAM
  - at most 80TB storage

### 3.3. VIRTUAL MACHINES

The number of virtual machines that you are able to run on your hyperconverged deployment depends greatly on what those virtual machines do, and what load they are under. Test your workload’s CPU, memory, and throughput requirements and provision your hyperconverged environment accordingly.

See [Virtualization limits for Red Hat Virtualization](#) for information about maximum numbers of virtual machines and virtual CPUs, and use the [RHHI for Virtualization Sizing Tool](#) for assistance planning your deployment.

### 3.4. HOSTED ENGINE VIRTUAL MACHINE

The Hosted Engine virtual machine requires at least the following:

- 1 dual core CPU (1 quad core or multiple dual core CPUs recommended)
- 4GB RAM that is not shared with other processes (16GB recommended)
- 25GB of local, writable disk space (50GB recommended)
- 1 NIC with at least 1Gbps bandwidth

For more information, see [Requirements](#) in the Red Hat Virtualization 4.3 Planning and Prerequisites Guide.

### 3.5. NETWORKING

Fully-qualified domain names that are forward and reverse resolvable by DNS are required for all hyperconverged hosts and for the Hosted Engine virtual machine that provides Red Hat Virtualization Manager.

IPv6 is supported as a Technology Preview in IPv6-only environments (including DNS and gateway addresses). Environments with both IPv4 and IPv6 addresses are not supported.

**IMPORTANT**

Technology Preview features are provided with a limited support scope, as detailed on the Customer Portal: [Technology Preview Features Support Scope](#).

Client storage traffic and management traffic in the cluster must use separate networks: a **front-end management network** and a **back-end storage network**.
Each node requires two Ethernet ports, one for each network. This ensures optimal performance. For high availability, place each network on a separate network switch. For improved fault tolerance, provide a separate power supply for each switch.

**Front-end management network**
- Used by Red Hat Virtualization and virtual machines.
- Requires at least one 1Gbps Ethernet connection.
- IP addresses assigned to this network must be on the same subnet as each other, and on a different subnet to the back-end storage network.
- IP addresses on this network can be selected by the administrator.

**Back-end storage network**
- Used by storage and migration traffic between hyperconverged nodes.
- Requires at least one 10Gbps Ethernet connection.
- Requires maximum latency of 5 milliseconds between peers.

Network fencing devices that use Intelligent Platform Management Interfaces (IPMI) require a separate network.

If you want to use DHCP network configuration for the Hosted Engine virtual machine, then you must have a DHCP server configured prior to configuring Red Hat Hyperconverged Infrastructure for Virtualization.

**If you want to configure disaster recovery** by using geo-replication to store copies of data:
- Configure a reliable time source.
- Do not use IPv6 addresses.

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**WARNING**

Bug 1688239 currently prevents IPv6 based geo-replication from working correctly. Do not use IPv6 addresses if you require disaster recovery functionality using geo-replication.

---

**Before you begin the deployment process**, determine the following details:
- IP address for a gateway to the hyperconverged host. This address must respond to ping requests.
- IP address of the front-end management network.
- Fully-qualified domain name (FQDN) for the Hosted Engine virtual machine.
• MAC address that resolves to the static FQDN and IP address of the Hosted Engine.

3.6. STORAGE

A hyperconverged host stores configuration, logs and kernel dumps, and uses its storage as swap space. This section lists the minimum directory sizes for hyperconverged hosts. Red Hat recommends using the default allocations, which use more storage space than these minimums.

- / (root) - 6GB
- /home - 1GB
- /tmp - 1GB
- /boot - 1GB
- /var - 15GB
- /var/crash - 10GB
- /var/log - 8GB

IMPORTANT

Red Hat recommends increasing the size of /var/log to at least 15GB to provide sufficient space for the additional logging requirements of Red Hat Gluster Storage.

Follow the instructions in Growing a logical volume using the Web Console to increase the size of this partition after installing the operating system.

- /var/log/audit - 2GB
- swap - 1GB (see Recommended swap size for details)
- 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 - 55GB

3.6.1. Disks

Red Hat recommends Solid State Disks (SSDs) for best performance. If you use Hard Drive Disks (HDDs), you should also configure a smaller, faster SSD as an LVM cache volume.

4K native devices are not supported with Red Hat Hyperconverged Infrastructure for Virtualization, as Red Hat Virtualization requires 512 byte emulation (512e) support.

3.6.2. RAID

RAID5 and RAID6 configurations are supported. However, RAID configuration limits depend on the technology in use.

- SAS/SATA 7k disks are supported with RAID6 (at most 10+2)
SAS 10k and 15k disks are supported with the following:
  - RAID5 (at most 7+1)
  - RAID6 (at most 10+2)

RAID cards must use flash backed write cache.

Red Hat further recommends providing at least one hot spare drive local to each server.

### 3.6.3. JBOD

As of Red Hat Hyperconverged Infrastructure for Virtualization 1.6, JBOD configurations are fully supported and no longer require architecture review.

### 3.6.4. Logical volumes

The logical volumes that comprise the **engine** gluster volume must be thick provisioned. This protects the Hosted Engine from out of space conditions, disruptive volume configuration changes, I/O overhead, and migration activity.

The logical volumes that comprise the **vmstore** and optional **data** gluster volumes must be thin provisioned. This allows greater flexibility in underlying volume configuration. If your thin provisioned volumes are on Hard Drive Disks (HDDs), configure a smaller, faster Solid State Disk (SSD) as an lvmcache for improved performance.

### 3.6.5. Red Hat Gluster Storage volumes

Red Hat Hyperconverged Infrastructure for Virtualization is expected to have 3–4 Red Hat Gluster Storage volumes.

- 1 **engine** volume for the Hosted Engine
- 1 **vmstore** volume for virtual machine operating system disk images
- 1 optional **data** volume for other virtual machine disk images
- 1 **shared_storage** volume for geo-replication metadata

Separate **vmstore** and **data** volumes are recommended to minimize backup storage requirements. Storing virtual machine data separate from operating system images means that only the **data** volume needs to be backed up when storage space is at a premium, since operating system images on the **vmstore** volume can be more easily rebuilt.

A Red Hat Hyperconverged Infrastructure for Virtualization deployment can contain at most 1 geo-replicated volume.

### 3.6.6. Volume types

Red Hat Hyperconverged Infrastructure for Virtualization (RHHI for Virtualization) supports only the following volume types at deployment time:

- **Replicated volumes** (3 copies of the same data on 3 bricks, across 3 nodes). These volumes can be expanded into distributed-replicated volumes after deployment.
• **Arbitrated replicated volumes** (2 full copies of the same data on 2 bricks and 1 arbiter brick that contains metadata, across three nodes). These volumes can be expanded into arbitrated distributed-replicated volumes after deployment.

• **Distributed volumes** (1 copy of the data, no replication to other bricks).

Note that arbiter bricks store only file names, structure, and metadata. This means that a three-way arbitrated replicated volume requires about 75% of the storage space that a three-way replicated volume would require to achieve the same level of consistency. However, because the arbiter brick stores only metadata, a three-way arbitrated replicated volume only provides the availability of a two-way replicated volume.

For more information on laying out arbitrated replicated volumes, see *Creating multiple arbitrated replicated volumes across fewer total nodes* in the Red Hat Gluster Storage *Administration Guide*.

### 3.7. VIRTUAL DATA OPTIMIZER (VDO)

A Virtual Data Optimizer (VDO) layer is supported as of Red Hat Hyperconverged Infrastructure for Virtualization 1.6.

VDO support is limited to new deployments only; do not attempt to add a VDO layer to an existing deployment.

### 3.8. SCALING

Initial deployments of Red Hat Hyperconverged Infrastructure for Virtualization are either 1 node or 3 nodes.

1 node deployments cannot be scaled.

3 node deployments can be scaled to 6, 9, or 12 nodes using one of the following methods:

1. Add new hyperconverged nodes to the cluster, in sets of three, up to the maximum of 12 hyperconverged nodes.

2. Create new Gluster volumes using new disks on new or existing nodes.

3. Expand existing Gluster volumes to span 6, 9, or 12 nodes using new disks on new or existing nodes.

You cannot create a volume that spans more than 3 nodes at creation time; you must create a 3-node volume first and then expand it across more nodes as necessary.

### 3.9. EXISTING RED HAT GLUSTER STORAGE CONFIGURATIONS

Red Hat Hyperconverged Infrastructure for Virtualization is supported only when deployed as specified in this document. Existing Red Hat Gluster Storage configurations cannot be used in a hyperconverged configuration. If you want to use an existing Red Hat Gluster Storage configuration, refer to the traditional configuration documented in *Configuring Red Hat Virtualization with Red Hat Gluster Storage*.

### 3.10. DISASTER RECOVERY

Red Hat strongly recommends configuring a disaster recovery solution. For details on configuring geo-

**WARNING**

Bug 1688239 currently prevents IPv6 based geo-replication from working correctly. Do not use IPv6 addresses if you require disaster recovery functionality using geo-replication.

### 3.10.1. Prerequisites for geo-replication

Be aware of the following requirements and limitations when configuring geo-replication:

**One geo-replicated volume only**

Red Hat Hyperconverged Infrastructure for Virtualization (RHVI for Virtualization) supports only one geo-replicated volume. Red Hat recommends backing up the volume that stores the data of your virtual machines, as this is usually contains the most valuable data.

**Two different managers required**

The source and destination volumes for geo-replication must be managed by different instances of Red Hat Virtualization Manager.

### 3.10.2. Prerequisites for failover and failback configuration

**Versions must match between environments**

Ensure that the primary and secondary environments have the same version of Red Hat Virtualization Manager, with identical data center compatibility versions, cluster compatibility versions, and PostgreSQL versions.

**No virtual machine disks in the hosted engine storage domain**

The storage domain used by the hosted engine virtual machine is not failed over, so any virtual machine disks in this storage domain will be lost.

**Execute Ansible playbooks manually from a separate master node**

Generate and execute Ansible playbooks manually from a separate machine that acts as an Ansible master node.

### 3.11. ADDITIONAL REQUIREMENTS FOR SINGLE NODE DEPLOYMENTS

Red Hat Hyperconverged Infrastructure for Virtualization is supported for deployment on a single node provided that all Support Requirements are met, with the following additions and exceptions.

A single node deployment requires a physical machine with:

- 1 Network Interface Controller
- at least 12 cores
- at least 64GB RAM
- at most 48TB storage

Single node deployments cannot be scaled, and are not highly available.
CHAPTER 4. RECOMMENDATIONS

The configuration described in this section is not required, but may improve the stability or performance of your deployment.

4.1. GENERAL RECOMMENDATIONS

- Take a full backup as soon as deployment is complete, and store the backup in a separate location. Take regular backups thereafter. See Configuring backup and recovery options for details.

- Avoid running any service that your deployment depends on as a virtual machine in the same RHHI for Virtualization environment. If you must run a required service in the same deployment, carefully plan your deployment to minimize the downtime of the virtual machine running the required service.

- Ensure that hyperconverged hosts have sufficient entropy. Failures can occur when the value in `/proc/sys/kernel/random/entropy_avail` is less than 200. To increase entropy, install the `rng-tools` package and follow the steps in https://access.redhat.com/solutions/1395493.

- Document your environment so that everyone who works with it is aware of its current state and required procedures.

4.2. SECURITY RECOMMENDATIONS

- Do not disable any security features (such as HTTPS, SELinux, and the firewall) on the hosts or virtual machines.

- Register all hosts and Red Hat Enterprise Linux virtual machines to either the Red Hat Content Delivery Network or Red Hat Satellite in order to receive the latest security updates and errata.

- Create individual administrator accounts, instead of allowing many people to use the default admin account, for proper activity tracking.

- Limit access to the hosts and create separate logins. Do not create a single root login for everyone to use. See Managing Users and Groups in the Red Hat Enterprise Linux 7 System Administrator’s Guide.

- Do not create untrusted users on hosts.

- Avoid installing additional packages such as analyzers, compilers, or other components that add unnecessary security risk.

4.3. HOST RECOMMENDATIONS

- Standardize the hosts in the same cluster. This includes having consistent hardware models and firmware versions. Mixing different server hardware within the same cluster can result in inconsistent performance from host to host.

- Configure fencing devices at deployment time. Fencing devices are required for high availability.

- Use separate hardware switches for fencing traffic. If monitoring and fencing go over the same switch, that switch becomes a single point of failure for high availability.
4.4. NETWORKING RECOMMENDATIONS

- Bond network interfaces, especially on production hosts. Bonding improves the overall availability of service, as well as network bandwidth. See Network Bonding in the Administration Guide.

- For optimal performance and simplified troubleshooting, use VLANs to separate different traffic types and make the best use of 10 GbE or 40 GbE networks.

- If the underlying switches support jumbo frames, set the MTU to the maximum size (for example, 9000) that the underlying switches support. This setting enables optimal throughput, with higher bandwidth and reduced CPU usage, for most applications. The default MTU is determined by the minimum size supported by the underlying switches. If you have LLDP enabled, you can see the MTU supported by the peer of each host in the NIC’s tool tip in the Setup Host Networks window.

- 1 GbE networks should only be used for management traffic. Use 10 GbE or 40 GbE for virtual machines and Ethernet-based storage.

- If additional physical interfaces are added to a host for storage use, uncheck VM network so that the VLAN is assigned directly to the physical interface.

4.4.1. Recommended practices for configuring host networks

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

Red Hat recommends the following practices for configuring a host network:

- Configure the network with the Web Console. 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. Networking teaming is not supported.

- 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):

```bash
# 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):

```bash
# 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.

**IMPORTANT**

When creating a management bridge that uses a static IPv6 address, disable network manager control in its interface configuration (ifcfg) file before adding a host. See https://access.redhat.com/solutions/3981311 for more information.

### 4.5. SELF-HOSTED ENGINE RECOMMENDATIONS

- Create a separate data center and cluster for the Red Hat Virtualization Manager and other infrastructure-level services, if the environment is large enough to allow it. Although the Manager virtual machine can run on hosts in a regular cluster, separation from production virtual machines helps facilitate backup schedules, performance, availability, and security.

- A storage domain dedicated to the Manager virtual machine is created during self-hosted engine deployment. Do not use this storage domain for any other virtual machines.

- All self-hosted engine nodes should have an equal CPU family so that the Manager virtual machine can safely migrate between them. If you intend to have various families, begin the installation with the lowest one.

- If the Manager virtual machine shuts down or needs to be migrated, there must be enough memory on a self-hosted engine node for the Manager virtual machine to restart on or migrate to it.
CHAPTER 5. DEPLOYMENT WORKFLOW

The workflow for deploying Red Hat Hyperconverged Infrastructure for Virtualization (RHHI for Virtualization) is as follows:

1. Verify that your planned deployment meets support requirements: Chapter 3, Support requirements.

2. Install the physical machines that will act as hyperconverged hosts: Section 5.1, "Install host physical machines".

3. Configure key-based SSH authentication without a password to enable automated configuration of the hosts: Chapter 6, Configure Public Key based SSH Authentication without a password.


5. Deploy the Hosted Engine using the Web Console: Chapter 8, Deploy the Hosted Engine using the Web Console.

6. Configure the Red Hat Gluster Storage nodes using the Administration Portal: Log in to the Administration Portal to complete configuration.

5.1. INSTALL HOST PHYSICAL MACHINES

Your physical machines need an operating system and access to the appropriate software repositories in order to be used as hyperconverged hosts.

1. Install Red Hat Virtualization Host on each physical machine.

2. Enable the Red Hat Virtualization Host software repository on each physical machine.

5.1.1. Installing Red Hat Virtualization Host

Red Hat Virtualization Host is a minimal operating system designed for setting up a physical machine that acts as a hypervisor in Red Hat Virtualization, or a hyperconverged host in Red Hat Hyperconverged Infrastructure.

Prerequisites

- Ensure that your physical machine meets the requirements outlined in Physical machines.

Procedure

1. Download the Red Hat Virtualization Host ISO image from the Customer Portal:
   b. Click Downloads in the menu bar.
   c. Click Red Hat Virtualization. Scroll up and click Download Latest to access the product download page.
   d. Go to Hypervisor Image for RHV 4.3 and and click Download Now.
e. Create a bootable media device. See Making Media in the Red Hat Enterprise Linux Installation Guide for more information.

2. Start the machine on which you are installing Red Hat Virtualization Host, and boot from the prepared installation media.

3. From the boot menu, select Install RHVH 4.3 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.

4. Select a language, and click Continue.

5. Select a time zone from the Date & Time screen and click Done.

   IMPORTANT
   Red Hat recommends using Coordinated Universal Time (UTC) on all hosts. This helps ensure that data collection and connectivity are not impacted by variation in local time, such as during daylight savings time.

6. Select a keyboard layout from the Keyboard screen and click Done.

7. Specify the installation location from the Installation Destination screen.

   IMPORTANT
   - Red Hat strongly recommends using the Automatically configure partitioning option.
   - All disks are selected by default, so deselect disks that you do not want to use as installation locations.
   - At-rest encryption is not supported. Do not enable encryption.
   - Red Hat recommends increasing the size of /var/log to at least 15GB to provide sufficient space for the additional logging requirements of Red Hat Gluster Storage. Follow the instructions in Growing a logical volume using the Web Console to increase the size of this partition after installing the operating system.

   Click Done.

8. Select the Ethernet network from the Network & Host Name screen.

   a. Click Configure... → General and select the Automatically connect to this network when it is available check box.

10. Click **Begin Installation**.

11. Set a root password and, optionally, create an additional user while Red Hat Virtualization Host installs.

![WARNING]

Red Hat strongly recommends not creating untrusted users on Red Hat Virtualization Host, as this can lead to exploitation of local security vulnerabilities.

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

**NOTE**

When Red Hat Virtualization Host 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. The service is enabled by default.

### 5.1.2. Enabling software repositories

1. Log in to the Web Console.
   Use the management FQDN and port **9090**, for example, **https://server1.example.com:9090/**.

2. Navigate to **Subscriptions**, click **Register System**, 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 7** repository to allow later updates to the Red Hat Virtualization Host:

   ```
   # subscription-manager repos --enable=rhel-7-server-rhvh-4-rpms
   ```
CHAPTER 6. CONFIGURE PUBLIC KEY BASED SSH AUTHENTICATION WITHOUT A PASSWORD

Configure public key based SSH authentication without a password for the root user on the first hyperconverged host to all hosts, including itself. Do this for all storage and management interfaces, and for both IP addresses and FQDNs.

6.1. ADDING KNOWN HOSTS TO THE FIRST HOST

When you use SSH to log in to a host from a system that is not already known to the host, you are prompted to add that system as a known host.

1. Log in to the first hyperconverged host as the root user.

2. Perform the following steps for each host in the cluster, including the first host.
   a. Use SSH to log in to a host as the root user.
      
      [root@server1]# ssh root@server1.example.com
   b. Enter yes to continue connecting.
      
      [root@server1]# ssh root@server2.example.com
      The authenticity of host 'server2.example.com (192.51.100.28)' can't be established. ECDSA key fingerprint is SHA256:Td8KqgVIPXdTlasdf2xRwn3/asdBasdpnaGM. Are you sure you want to continue connecting (yes/no)?
      Are you sure you want to continue connecting (yes/no)? yes
      Warning: Permanently added '192.51.100.28' (ECDSA) to the list of known hosts.
   c. Enter the password for the root user on the target host to complete the login process.
      
      root@server2.example.com's password: **************
      Last login: Mon May 27 10:04:49 2019
      [root@server2]#
   d. Log out of the host.
      
      [root@server2]# exit
      [root@server1]#

   NOTE

When you log out of the SSH session from the first host to itself, the user and server in the command line prompt stay the same; it is only the session that changes.

   [root@server1]# exit
   [root@server1]#
6.2. GENERATING SSH KEY PAIRS WITHOUT A PASSWORD

Generating a public/private key pair lets you use key-based SSH authentication. Generating a key pair that does not use a password makes it simpler to use Ansible to automate deployment and configuration processes.

Procedure

1. Log in to the first hyperconverged host as the root user.

2. Generate an SSH key that does not use a password.
   a. Start the key generation process.
      
      ```
      # ssh-keygen -t rsa
      Generating public/private rsa key pair.
      ```
   
   b. Enter a location for the key.
      The default location, shown in parentheses, is used if no other input is provided.
      
      ```
      Enter file in which to save the key (/home/username/.ssh/id_rsa): <location>/<keyname>
      ```
   
   c. Specify and confirm an empty passphrase by pressing Enter twice.
      
      ```
      Enter passphrase (empty for no passphrase): 
      Enter same passphrase again: 
      ```
      
      The private key is saved in `<location>/<keyname>`. The public key is saved in `<location>/<keyname>.pub`.

      Your identification has been saved in `<location>/<keyname>`.
      Your public key has been saved in `<location>/<keyname>.pub`.
      The key fingerprint is SHA256:8BhZageKrLXM99z5f/AM9aPo/KAUd8ZZFPcPFWqK6+Mroot@server1.example.com
      The key’s randomart image is:
      ++--[ECDSA 256]--++
      | . . . +=|
      | . . = 0.0|
      | + . * 0...|
      | = . * + ++|
      | . + .. So o * .|
      | . . . + = ..|
      | 0 00 ..= ..|
      | 000++ +|
      | .E+++00 |
      ++--[SHA256]-----+
6.3. COPYING SSH KEYS

To access a host using your private key, that host needs a copy of your public key.

Prerequisites

- Generate a public/private key pair.
- SSH access from the root user on the host to all storage and management interfaces on the same host, using both IP addresses and FQDNs.

Procedure

1. Log in to the first host as the root user.

2. Copy your public key to the host that you want to access.

   # ssh-copy-id -i <location>/<keyname>.pub <user>@<hostname>

   Enter the password for <user>@<hostname> if prompted.

   WARNING

   Make sure that you use the file that ends in .pub. Never share your private key. Possession of your private key allows someone else to impersonate you on any system that has your public key.
CHAPTER 7. CONFIGURE RED HAT GLUSTER STORAGE FOR HOSTED ENGINE USING THE WEB CONSOLE

IMPORTANT

Ensure that disks specified as part of this deployment process do not have any partitions or labels.

1. Log into the Web Console
   Browse to the Web Console management interface of the first hyperconverged host, for example, https://node1.example.com:9090/, and log in with the credentials you created in Section 5.1, “Install host physical machines”.

2. Start the deployment wizard
   a. Click Virtualization → Hosted Engine and click Start underneath Hyperconverged.

      ![Virtualization Setup](image)

      The Gluster Configuration window opens.

   b. Click the Run Gluster Wizard button.

      ![Gluster Configuration](image)

      The Gluster Deployment window opens in 3 node mode.

3. Specify hyperconverged hosts
Specify the back-end Additional Hosts on the storage network (not the management network) of the three hyperconverged hosts. The hyperconverged host that can SSH using key pairs should be listed first, as it is the host that will run deployment tasks and the hosted engine.

**NOTE**

If you plan to create an arbitrated replicated volume, ensure that you specify the host with the arbiter brick as Host3 on this screen.

Click Next.

4. **Specify additional hosts**
   For multi-node deployments, add the front-end Additional Hosts or IP addresses of the other two hyperconverged hosts to have them automatically added to Red Hat Virtualization Manager when deployment is complete.
Important

**Bug 1688269** means that hosts with IPv6 addresses are not automatically added to Red Hat Virtualization Manager when deployment is complete. You can add them after deployment by following Add additional hyperconverged hosts to the hosted engine.

5. **Specify volumes**
   Specify the volumes to create.

   ![Gluster Deployment](image)

   **Name**
   Specify the name of the volume to be created.

   **Volume Type**
   Specify a **Replicate** volume type. Only replicated volumes are supported for this release.

   **Arbiter**
   Specify whether to create the volume with an arbiter brick. If this box is checked, the third disk stores only metadata.

   **Brick Dirs**
   The directory that contains this volume's bricks.

   The default values are correct for most installations.

6. **Specify bricks**
   Enter details of the bricks to be created. Use the **Select host** drop-down menu to change the host being configured.
RAID

Specify the RAID configuration to use. This should match the RAID configuration of your host. Supported values are `raid5`, `raid6`, and `jbod`. Setting this option ensures that your storage is correctly tuned for your RAID configuration.

Stripe Size

Specify the RAID stripe size in KB. Do not enter units, only the number. This can be ignored for `jbod` configurations.

Disk Count

Specify the number of data disks in a RAID volume. This can be ignored for `jbod` configurations.

LV Name

The name of the logical volume to be created. This is pre-filled with the name that you
The name of the logical volume to be created. This is pre-filled with the name that you specified on the previous page of the wizard.

**Device**

Specify the raw device you want to use. Red Hat recommends an unpartitioned device.

a. **With multipath devices**
   If the environment has multipath devices for the Gluster deployment from the cockpit, use multipath WWIDs.
   For example:
   ```
   /dev/mapper/3600508b1001caab032303683327a6a2e
   instead of /dev/sdb
   ```

b. **Without the multipath devices**
   If there are no multipath devices in the environment. Blacklist these devices.

   **NOTE**
   **Blacklist**: Listing of specific devices that will not be considered for multipath.
   There are different ways to blacklist the device. For more information, refer to RHEL 7 DM Multipath, chapter 4.2.

   - To blacklist the device /dev/sdb
     i. Create a directory: /etc/multipath/conf.d/
     ii. Create a file under this directory with the following content: blacklist {
         devnodes "<device>"
       }
     For example:
     ```
     [root@ ~]# cat /etc/multipath/conf.d/99-custom-multipath.conf
     blacklist {
         devnodes "sdb"
     }
     ```

   **IMPORTANT**
   Local disks should not have multipath names. Use **lsblk** command to check for multipath names.
   
   If there are multipath names on the disks, after blacklisting the disks, reboot the hosts.

**Size**

Specify the size of the logical volume to create in GB. Do not enter units, only the number. This number should be the same for all bricks in a replicated set. Arbiter bricks can be smaller than other bricks in their replication set.

**Mount Point**
The mount point for the logical volume. This is pre-filled with the brick directory that you specified on the previous page of the wizard.

**Thinp**

This option is enabled and volumes are thinly provisioned by default, except for the **engine** volume, which must be thickly provisioned.

**Enable Dedupe & Compression**

Specify whether to provision the volume using VDO for compression and deduplication at deployment time.

**Logical Size (GB)**

Specify the logical size of the VDO volume. This can be up to 10 times the size of the physical volume, with an absolute maximum logical size of 4 PB.

**Configure LV Cache**

Optionally, check this checkbox to configure a small, fast SSD device as a logical volume cache for a larger, slower logical volume. Add the device path to the **SSD** field, the size to the **LV Size (GB)** field, and set the **Cache Mode** used by the device.

---

**WARNING**

To avoid data loss when using write-back mode, Red Hat recommends using two separate SSD/NVMe devices. Configuring the two devices in a RAID-1 configuration (via software or hardware), significantly reduces the potential of data loss from lost writes.

For further information about lvmcache configuration, see Red Hat Enterprise Linux 7 LVM Administration.

---

7. Review and edit configuration
a. Click **Edit** to begin editing the generated deployment configuration file. Make any changes required and click **Save**.

b. **Review the configuration file**
   If all configuration details are correct, click **Deploy**.

8. **Wait for deployment to complete**
   You can watch the progress of the deployment in the text field.

   The window displays **Successfully deployed gluster** when complete.
Click **Continue to Hosted Engine Deployment** and continue the deployment process with the instructions in Chapter 8, *Deploy the Hosted Engine using the Web Console*.

**IMPORTANT**

If deployment fails, click **Clean up** to remove any potentially incorrect changes to the system.

When cleanup is complete, click **Redeploy**. This returns you to the *Review and edit configuration* tab so that you can correct any issues in the generated configuration file before reattempting deployment.
CHAPTER 8. DEPLOY THE HOSTED ENGINE USING THE WEB CONSOLE

This section shows you how to deploy the Hosted Engine using the Web Console. Following this process results in Red Hat Virtualization Manager running as a virtual machine on the first physical machine in your deployment. It also configures a Default cluster comprised of the three physical machines, and enables Red Hat Gluster Storage functionality and the virtual-host tuned performance profile for each machine in the cluster.

Prerequisites

- Configure Red Hat Gluster Storage for Hosted Engine using the Web Console
- Gather the information you need for Hosted Engine deployment
  Have the following information ready before you start the deployment process.
  - IP address for a pingable gateway to the hyperconverged host
  - IP address of the front-end management network
  - Fully-qualified domain name (FQDN) for the Hosted Engine virtual machine
  - MAC address that resolves to the static FQDN and IP address of the Hosted Engine

Procedure

1. Open the Hosted Engine Deployment wizard
   If you continued directly from the end of Configure Red Hat Gluster Storage for Hosted Engine using the Web Console, the wizard is already open.
   
   Otherwise:
   
   a. Click Virtualization → Hosted Engine.
   
   b. Click Start underneath Hyperconverged.
   
   c. Click Use existing configuration.

   **IMPORTANT**

   If the previous deployment attempt failed, click Clean up instead of Use existing configuration to discard the previous attempt and start from scratch.

2. Specify virtual machine details
a. Enter the following details and click Validate for FQDN fields.

**Engine VM FQDN**

The fully qualified domain name to be used for the Hosted Engine virtual machine, for example, engine.example.com.

**MAC Address**

The MAC address associated with the Engine VM FQDN.

**IMPORTANT**

The pre-populated MAC address must be replaced.

**Root password**

The root password to be used for the Hosted Engine virtual machine.

b. Click Next. Your FQDNs are validated before the next screen appears.

3. Specify virtualization management details

   a. Enter the password to be used by the admin account in the Administration Portal. You can also specify notification behavior here.
b. Click **Next**.

4. **Review virtual machine configuration**

   a. Ensure that the details listed on this tab are correct. Click **Back** to correct any incorrect information.
b. Click **Prepare VM**.

c. Wait for virtual machine preparation to complete.
If preparation does not occur successfully, see Viewing Hosted Engine deployment errors.

d. Click Next.

5. **Specify storage for the Hosted Engine virtual machine**

   a. Specify the primary host and the location of the **engine** volume.

   b. Ensure that the **Mount Options** field is populated correctly.

      - Ensure that `backup-volfile-servers=<host2-ip-address>:<host3-ip-address>`, with the appropriate IP addresses inserted in place of `<host2-ip-address>` and `<host3-ip-address>`.

      - If your environment uses IPv6 addresses, ensure that you add the `xlator-option=transport.address-family=inet6` option after the `backup-volfile-servers` value, like so:

        ```
        backup-volfile-servers=<host2-ip-address>:<host3-ip-address>,xlator-option=transport.address-family=inet6
        ```
c. Click **Next**.

6. **Finalize Hosted Engine deployment**

   a. Review your deployment details and verify that they are correct.

**NOTE**

The responses you provided during configuration are saved to an answer file to help you reinstall the hosted engine if necessary. The answer file is created at `/etc/ovirt-hosted-engine/answers.conf` by default. This file should not be modified manually without assistance from Red Hat Support.
Please review the configuration. Once you click the 'Finish Deployment' button, the management VM will be transferred to the configured storage and the configuration of your hosted engine cluster will be finalized. You will be able to use your hosted engine once this step finishes.

- **Storage**
  - **Storage Type**: clusters
  - **Storage Domain Connection**: node1.example.com:engine
  - **Mount Options**: backup=volfile-servers=node2.example.com,node3.example.com
  - **Disk Size (GiB)**: 58

b. Click **Finish Deployment**.

7. **Wait for deployment to complete**
   This takes up to 30 minutes.

   The window displays the following when complete.
If deployment does not complete successfully, see Viewing Hosted Engine deployment errors.

Click Close.

8. **Verify hosted engine deployment**
Browse to the Administration Portal (for example, http://engine.example.com/ovirt-engine) and verify that you can log in using the administrative credentials you configured earlier. Click **Dashboard** and look for your hosts, storage domains, and virtual machines.
Next steps

- Log in to the Administration Portal to complete configuration.
CHAPTER 9. CONFIGURE RED HAT GLUSTER STORAGE AS A RED HAT VIRTUALIZATION STORAGE DOMAIN

9.1. CREATE THE LOGICAL NETWORK FOR GLUSTER TRAFFIC

1. Log in to the Administration Portal
   Browse to the Administration Portal (for example, http://engine.example.com/ovirt-engine) and log in using the administrative credentials you configured in Chapter 8, Deploy the Hosted Engine using the Web Console.

2. Create a logical network for gluster traffic
   a. Click Network → Networks and then click New. The New Logical Network wizard appears.
   b. On the General tab of the wizard, provide a Name for the new logical network, and uncheck the VM Network checkbox.
   c. On the Cluster tab of the wizard, uncheck the Required checkbox.
   d. Click OK to create the new logical network.

3. Enable the new logical network for gluster
   a. Click the Network → Networks and select the new logical network.
   b. Click the Clusters subtab and then click Manage Network. The Manage Network dialogue appears.
   c. In the Manage Network dialogue, check the Migration Network and Gluster Network checkboxes.
   d. Click OK to save.

4. Attach the gluster network to the host
   a. Click Compute → Hosts and select the host.
   b. Click the Network Interfaces subtab and then click Setup Host Networks. The Setup Host Networks window opens.
   c. Drag and drop the newly created network to the correct interface.
   d. Ensure that the Verify connectivity between Host and Engine checkbox is checked.
   e. Ensure that the Save network configuration checkbox is checked.
   f. Click OK to save.

5. Verify the health of the network
   Click the Network Interfaces tab and check the state of the host’s network. If the network interface enters an “Out of sync” state or does not have an IP Address, click Management → Refresh Capabilities.

9.2. CONFIGURE ADDITIONAL HYPERCONVERGED HOSTS
If your environment uses IPv6 addresses, or if you did not specify additional hyperconverged hosts as part of Configure Red Hat Gluster Storage for Hosted Engine using the Web Console, follow these steps in the Administration Portal for each of the other hyperconverged hosts.

a. Click **Compute → Hosts** and then click **New** to open the **New Host** window.

b. Provide the **Name**, **Hostname**, and **Password** for the host that you want to manage.

c. Under **Advanced Parameters**, uncheck the **Automatically configure host firewall** checkbox, as firewall rules are already configured by the deployment process.

d. In the **Hosted Engine** tab of the **New Host** dialog, set the value of **Choose hosted engine deployment action** to **Deploy**. This ensures that the hosted engine can run on the new host.

e. Click **OK**.

1. Attach the gluster network to all remaining hosts

f. Click the name of the newly added host to go to the host page.

g. Click the **Network Interfaces** subtab and then click **Setup Host Networks**.

h. Drag and drop the newly created network to the correct interface.

i. Ensure that the **Verify connectivity** checkbox is checked.

j. Ensure that the **Save network configuration** checkbox is checked.

k. Click **OK** to save.

1. In the **General** subtab for this host, verify that the value of **Hosted Engine HA** is **Active**, with a positive integer as a score.

**IMPORTANT**

If **Score** is listed as **N/A**, you may have forgotten to select the **deploy** action for **Choose hosted engine deployment action**. Follow the steps in Reinstalling a hyperconverged host in Maintaining Red Hat Hyperconverged Infrastructure for Virtualization to reinstall the host with the **deploy** action.

2. Verify the health of the network

   Click the **Network Interfaces** tab and check the state of the host’s network. If the network interface enters an “Out of sync” state or does not have an IP Address, click **Management → Refresh Capabilities**.

See the Red Hat Virtualization 4.3 Self-Hosted Engine Guide for further details:
PART III. VERIFY
CHAPTER 10. VERIFY YOUR DEPLOYMENT

After deployment is complete, verify that your deployment has completed successfully.


   Administration Console Login

   ![Administration Console Login]

2. Log in using the administrative credentials added during hosted engine deployment. When login is successful, the Dashboard appears.

   Administration Console Dashboard

   ![Administration Console Dashboard]
3. Verify that your cluster is available.

**Administration Console Dashboard - Clusters**

4. Verify that at least one host is available.
   If you provided additional host details during Hosted Engine deployment, 3 hosts are visible here, as shown.

**Administration Console Dashboard - Hosts**

a. Click **Compute → Hosts**.

b. Verify that all hosts are listed with a **Status** of **Up**.

**Administration Console - Hosts**
5. Verify that all storage domains are available.
   
a. Click Storage → Domains.
   
b. Verify that the Active icon is shown in the first column.

Administration Console – Storage Domains
CHAPTER 11. POST-DEPLOYMENT CONFIGURATION SUGGESTIONS

Depending on your requirements, you may want to perform some additional configuration on your newly deployed Red Hat Hyperconverged Infrastructure for Virtualization. This section contains suggested next steps for additional configuration.

Details on these processes are available in *Maintaining Red Hat Hyperconverged Infrastructure for Virtualization*.

11.1. CONFIGURE FENCING FOR HIGH AVAILABILITY

Fencing allows a cluster to enforce performance and availability policies and react to unexpected host failures by automatically rebooting hyperconverged hosts.

See [Configure High Availability using fencing policies](#) for further information.

11.2. CONFIGURE BACKUP AND RECOVERY OPTIONS

Red Hat recommends configuring at least basic disaster recovery capabilities on all production deployments.

See [Configuring backup and recovery options](#) in *Maintaining Red Hat Hyperconverged Infrastructure for Virtualization* for more information.
CHAPTER 12. LOG FILE LOCATIONS

During the deployment process, progress information is displayed in the web browser. This information is also stored on the local file system so that the information logged can be archived or reviewed at a later date, for example, if the web browser stops responding or is closed before the information has been reviewed.

The log file for the Web Console based deployment process (documented in Chapter 7, Configure Red Hat Gluster Storage for Hosted Engine using the Web Console) is stored in the /var/log/ansible.log file by default.

The log files for the Hosted Engine setup portion of the deployment process (documented in Chapter 8, Deploy the Hosted Engine using the Web Console) are stored in the /var/log/ovirt-hosted-engine-setup directory, with file names of the form ovirt-hosted-engine-setup-<date>.log.
13.1. FAILED TO DEPLOY STORAGE

If an error occurs during storage deployment, the deployment process halts and **Deployment failed** is displayed.

**Deploying storage failed**

- Review the Web Console output for error information.
- Click **Clean up** to remove any potentially incorrect changes to the system.
- Click **Redeploy** and correct any entered values that may have caused errors. If you need help resolving errors, contact Red Hat Support with details.
- Return to **storage deployment** to try again.

13.2. FAILED TO PREPARE VIRTUAL MACHINE

If an error occurs while preparing the virtual machine in Hosted Engine deployment, deployment pauses, and you see a screen similar to the following:

**Preparing virtual machine failed**
Review the Web Console output for error information.

Click **Clean up** to remove any potentially incorrect changes to the system.

Click **Redeploy** and correct any entered values that may have caused errors. If you need help resolving errors, contact Red Hat Support with details.

Ensure that the `rhvm-appliance` package is available on all hosts.

```
# yum install rhvm-appliance
```

Return to **Hosted Engine deployment** to try again.

If you closed the deployment wizard while you resolved errors, you can select **Use existing configuration** when you retry the deployment process.

### 13.3. FAILED TO DEPLOY HOSTED ENGINE

If an error occurs during hosted engine deployment, deployment pauses, and **Deployment failed** is displayed.

**Hosted engine deployment failed**
Review the Web Console output for error information.

Remove the contents of the **engine** volume.

a. Mount the **engine** volume.

   ```bash
   # mount -t glusterfs <server1>:/engine /mnt/test
   ```

b. Remove the contents of the volume.

   ```bash
   # rm -rf /mnt/test/*
   ```

c. Unmount the **engine** volume.

   ```bash
   # umount /mnt/test
   ```

Click **Clean up** to remove any potentially incorrect changes to the system.

Click **Redeploy** and correct any entered values that may have caused errors. If you need help resolving errors, contact Red Hat Support with details.

Return to **Hosted Engine deployment** to try again. If you closed the deployment wizard while you resolved errors, you can select **Use existing configuration** when you retry the deployment process.
PART VI. REFERENCE MATERIAL
A.1. VIRTUALIZATION TERMS

Administration Portal
A web user interface provided by Red Hat Virtualization Manager, based on the oVirt engine web user interface. It allows administrators to manage and monitor cluster resources like networks, storage domains, and virtual machine templates.

Hosted Engine
The instance of Red Hat Virtualization Manager that manages RHHI for Virtualization.

Hosted Engine virtual machine
The virtual machine that acts as Red Hat Virtualization Manager. The Hosted Engine virtual machine runs on a virtualization host that is managed by the instance of Red Hat Virtualization Manager that is running on the Hosted Engine virtual machine.

Manager node
A virtualization host that runs Red Hat Virtualization Manager directly, rather than running it in a Hosted Engine virtual machine.

Red Hat Enterprise Linux host
A physical machine installed with Red Hat Enterprise Linux plus additional packages to provide the same capabilities as a Red Hat Virtualization host. This type of host is not supported for use with RHHI for Virtualization.

Red Hat Virtualization
An operating system and management interface for virtualizing resources, processes, and applications for Linux and Microsoft Windows workloads.

Red Hat Virtualization host
A physical machine installed with Red Hat Virtualization that provides the physical resources to support the virtualization of resources, processes, and applications for Linux and Microsoft Windows workloads. This is the only type of host supported with RHHI for Virtualization.

Red Hat Virtualization Manager
A server that runs the management and monitoring capabilities of Red Hat Virtualization.

Self-Hosted Engine node
A virtualization host that contains the Hosted Engine virtual machine. All hosts in a RHHI for Virtualization deployment are capable of becoming Self-Hosted Engine nodes, but there is only one Self-Hosted Engine node at a time.

storage domain
A named collection of images, templates, snapshots, and metadata. A storage domain can be comprised of block devices or file systems. Storage domains are attached to data centers in order to provide access to the collection of images, templates, and so on to hosts in the data center.

virtualization host
A physical machine with the ability to virtualize physical resources, processes, and applications for client access.

VM Portal
A web user interface provided by Red Hat Virtualization Manager. It allows users to manage and monitor virtual machines.

A.2. STORAGE TERMS
brick
An exported directory on a server in a trusted storage pool.

cache logical volume
A small, fast logical volume used to improve the performance of a large, slow logical volume.

geo-replication
One way asynchronous replication of data from a source Gluster volume to a target volume. Geo-replication works across local and wide area networks as well as the Internet. The target volume can be a Gluster volume in a different trusted storage pool, or another type of storage.

gluster volume
A logical group of bricks that can be configured to distribute, replicate, or disperse data according to workload requirements.

logical volume management (LVM)
A method of combining physical disks into larger virtual partitions. Physical volumes are placed in volume groups to form a pool of storage that can be divided into logical volumes as needed.

Red Hat Gluster Storage
An operating system based on Red Hat Enterprise Linux with additional packages that provide support for distributed, software-defined storage.

source volume
The Gluster volume that data is being copied from during geo-replication.

storage host
A physical machine that provides storage for client access.

target volume
The Gluster volume or other storage volume that data is being copied to during geo-replication.

thin provisioning
Provisioning storage such that only the space that is required is allocated at creation time, with further space being allocated dynamically according to need over time.

thick provisioning
Provisioning storage such that all space is allocated at creation time, regardless of whether that space is required immediately.

trusted storage pool
A group of Red Hat Gluster Storage servers that recognise each other as trusted peers.

A.3. HYPERCONVERGED INFRASTRUCTURE TERMS

Red Hat Hyperconverged Infrastructure (RHFI) for Virtualization
RHFI for Virtualization is a single product that provides both virtual compute and virtual storage resources. Red Hat Virtualization and Red Hat Gluster Storage are installed in a converged configuration, where the services of both products are available on each physical machine in a cluster.

hyperconverged host
A physical machine that provides physical storage, which is virtualized and consumed by virtualized processes and applications run on the same host. All hosts installed with RHFI for Virtualization are hyperconverged hosts.

Web Console
The web user interface for deploying, managing, and monitoring RHFI for Virtualization. The Web Console is provided by the the Web Console service and plugins for Red Hat Virtualization Manager.