Red Hat Openshift Container Storage 3.11

Deployment Guide

Deploying Red Hat Openshift Container Storage 3.11

Last Updated: 2019-11-25

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Abstract

This guide describes the prerequisites and provides step-by-step instructions to deploy Red Hat Openshift Container Storage.

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PART I. PLANNING

CHAPTER 1. IDENTIFY YOUR WORKLOADS

This chapter provides a list of workloads that are supported with Red Hat Openshift Container Storage.

Persistent volumes backed by block storage is the recommended method for the following workloads:

- Jenkins
- ElasticSearch
- Prometheus

If using file storage for transactional workloads, turn off the performance translators as described in Chapter 11, *Setting up Custom Volume Options*.

CHAPTER 2. IDENTIFY YOUR USE CASE

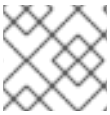
This chapter provides a brief introduction of the two use cases available in Containerized Red Hat Gluster Storage.

NOTE

Red Hat Openshift Container Storage does not support a simultaneous deployment of converged and independent mode with ansible workflow. Therefore, you must deploy either converged mode or independent mode: you cannot mix both modes during deployment.

Red Hat only supports Heketi inside OpenShift Container Platform in OCS.

2.1. CONVERGED MODE



NOTE

Converged mode was earlier called as Container-Native Storage.

This deployment delivers a hyper-converged solution, where the storage containers that host Red Hat Gluster Storage co-reside with the compute containers and serve out storage from the hosts that have local or direct attached storage to the compute containers. This solution integrates Red Hat Gluster Storage deployment and management with OpenShift services. As a result, persistent storage is delivered within an OpenShift pod that provides both compute and file storage.

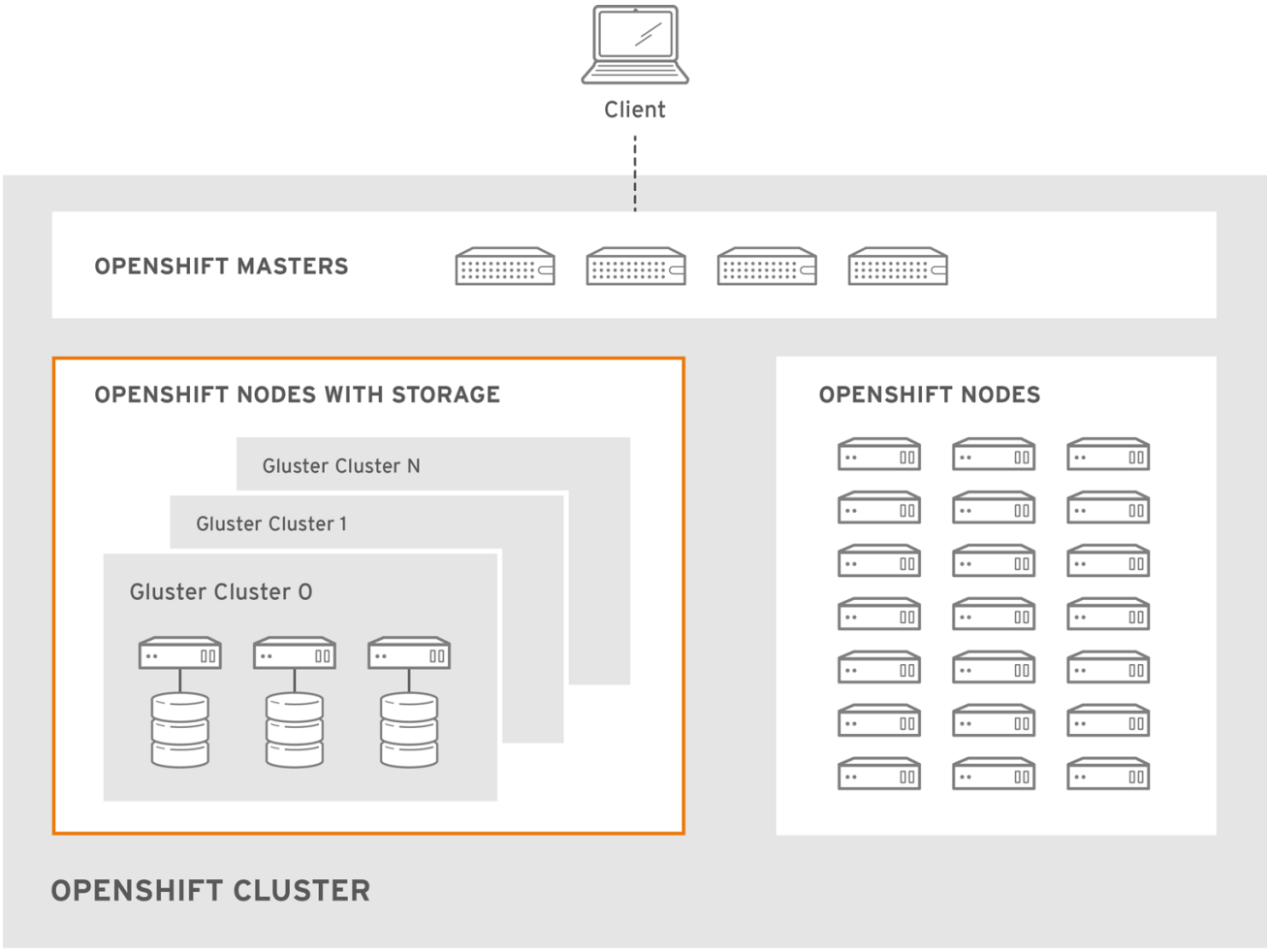
Converged Mode for OpenShift Container Platform is built around three key technologies:

- OpenShift provides the platform as a service (PaaS) infrastructure based on Kubernetes container management. Basic OpenShift architecture is built around multiple master systems where each system contains a set of nodes.
- Red Hat Gluster Storage provides the containerized distributed storage based on Red Hat Gluster Storage 3.5 container. Each Red Hat Gluster Storage volume is composed of a collection of bricks, where each brick is the combination of a node and an export directory.
- Heketi provides the Red Hat Gluster Storage volume life-cycle management. It creates the Red Hat Gluster Storage volumes dynamically and supports multiple Red Hat Gluster Storage clusters.

The following list provides the administrators a solution workflow. The administrators can:

- Create multiple persistent volumes (PV) and register these volumes with OpenShift.
- Developers then submit a persistent volume claim (PVC).
- A PV is identified and selected from a pool of available PVs and bound to the PVC.
- The OpenShift pod then uses the PV for persistent storage.

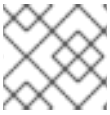
Figure 2.1. Architecture - Converged Mode for OpenShift Container Platform



NOTE

Red Hat Openshift Container Storage does not support a simultaneous deployment of converged and independent mode with ansible workflow. Therefore, you must deploy either converged mode or independent mode: you cannot mix both modes during deployment.

2.2. INDEPENDENT MODE



NOTE

Independent mode was earlier called Container-Ready Storage.

When Red Hat Gluster Storage is deployed as stand-alone storage, providing storage to containers, that is called independent mode. In this mode, the life cycle of the storage platform is maintained independently from the life cycle of the container platform.

When Red Hat Gluster Storage is deployed on top an OpenShift cluster, it is called converged mode.

Independent mode provides dynamically provisioned storage, statically provisioned storage, RWO support, and RWX support. Further, it provides full support for OpenShift Container Platform infrastructure services like logging, metrics, and registry services.

Being stand-alone of OpenShift Container Platform, the independent mode does have an advantage regarding providing additional Nagios Monitoring functionality to what is supported by OpenShift.

For users of persistent storage, the deployment modes are completely transparent. Administrators, however, will see a variation in how they set the system up, manage, and scale. In independent mode, storage is managed like Red Hat Gluster Storage.

Following are some of the key drivers of choosing independent mode of deployment:

- OpenShift Container Platform administrators might not want to manage storage. Independent mode separates storage management from container management.
- Leverage legacy storage (SAN, Arrays, Old filers): Storage arrays from traditional storage vendors often have either limited or no support for OpenShift. Independent mode allows you to leverage existing legacy storage for OpenShift Containers.
- Cost effective: In environments where costs related to new infrastructure is a challenge, you can repurpose existing storage arrays to back OpenShift under independent mode. Independent mode is perfect for situations where you can run Red Hat Gluster Storage inside a VM and serve out LUNs or disks from these storage arrays to OpenShift offering all the features that the OpenShift storage subsystem has to offer including dynamic provisioning. This is a very useful solution in those environments with potential infrastructure additions.

Independent mode may have Heketi, and other provisioners (components of independent mode) deployed on top of OpenShift Cluster nodes. Red Hat only supports Heketi inside OpenShift Container Platform in OCS. Heketi is a service endpoint for automated Red Hat Gluster Storage volume provisioning, where requests for allocation of Red Hat Gluster Storage volumes to back OpenShift PVs land from kubernetes. Heketi manages allocation and de-allocation of Red Hat Gluster Storage volumes dynamically.

NOTE

Red Hat Openshift Container Storage does not support a simultaneous deployment of converged and independent mode with ansible workflow. Therefore, you must deploy either converged mode or independent mode: you cannot mix both modes during deployment.

In independent mode, Heketi must have complete control of the Gluster cluster.

CHAPTER 3. VERIFY PREREQUISITES

This chapter provides the prerequisites that have to be verified before for the two different use cases available in Containerized Red Hat Gluster Storage before deployment.

3.1. CONVERGED MODE

3.1.1. Supported Versions

For supported versions of OpenShift Container Platform with Red Hat Gluster Storage Server and Container-Native Storage, please see https://access.redhat.com/articles/3403951.

CRI-O is supported as a Technology Preview. Information about CRI-O is available in the OpenShift Container Platform cri-o Runtime Guide (https://access.redhat.com/documentation/en-us/openshift_container_platform/3.11/html-single/cri-o_runtime/). For more information on Red Hat Technology Preview features support scope, see https://access.redhat.com/support/offerings/techpreview/.

3.1.2. Environment Requirements

The requirements for Red Hat Enterprise Linux Atomic Host, Red Hat OpenShift Container Platform, Red Hat Enterprise Linux, and Red Hat Gluster Storage are described in this section. A Red Hat Gluster Storage Container Native with OpenShift Container Platform environment consists of Red Hat OpenShift Container Platform installed on either Red Hat Enterprise Linux Atomic Host or Red Hat Enterprise Linux.

3.1.2.1. Installing Red Hat Openshift Container Storage with OpenShift Container Platform on Red Hat Enterprise Linux 7

This section describes the procedures to install Red Hat Gluster Storage Container Native with OpenShift Container Platform on Red Hat Enterprise Linux 7 based OpenShift Container Platform 3.11.

3.1.2.1.1. Setting up the Openshift Master as the Client

You can use the OpenShift Master as a client to execute the **oc** commands across the cluster when installing OpenShift. Generally, this is setup as a non-scheduled node in the cluster. This is the default configuration when using the OpenShift installer. You can also choose to install their client on their local machine to access the cluster remotely. For more information, see https://access.redhat.com/documentation/en-us/openshift_container_platform/3.11/html/cli_reference/cli-reference-get-started-cli#installing-the-cli.

Install heketi-client package

Execute the following commands to install **heketi-client** package.

```
# subscription-manager repos --enable=rh-gluster-3-client-for-rhel-7-server-rpms
```

```
# yum install heketi-client
```

3.1.2.2. OpenShift Container Platform Options

- Container logs by default are not configured to be rotated or limited to a max size by docker. A log file can grow so large that it fills up the disk space if the container runs for long enough and generate enough logs.

- To set log limits for containers on a host **--log-opt** can be configured with **max-size** and **max-file** so that a containers logs are rolled over when they reach a max limit and only a certain number of files are saved before being discarded.

```
# cat /etc/sysconfig/docker

OPTIONS='--insecure-registry=172.30.0.0/16 --selinux-enabled --log-opt max-size=50m --log-opt max-file=5'
```

NOTE

If the above options are not executed , once the logs get large the pod can be evicted.

3.1.3. Red Hat OpenShift Container Platform and Red Hat Openshift Container Storage Requirements

The following list provides the Red Hat OpenShift Container Platform and Red Hat Openshift Container Storage requirements:

- All OpenShift nodes on Red Hat Enterprise Linux systems must have **glusterfs-client** RPMs (glusterfs, glusterfs-client-xlators, glusterfs-libs, glusterfs-fuse) installed. You can verify if the RPMs are installed by running the following command:

```
# yum list glusterfs glusterfs-client-xlators glusterfs-libs glusterfs-fuse
```

NOTE

Ensure that the latest version of **glusterfs-client** RPMs are installed. The client RPMs must have the same version as the **gluster-rhgs-server** version. The **gluster-rhgs-server** version is based on the selected OCS version.

For more information on installing native client packages, see https://access.redhat.com/documentation/en-us/red_hat_gluster_storage/3.5/html-single/administration_guide/index#Installing_Native_Client

3.1.4. Deployment and Scaling Guidelines

To prevent potential deployment or scaling issues, review the following guidelines before deploying converged mode with OpenShift Container Platform.

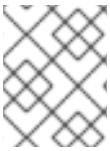
Ensure that the Trusted Storage Pool is appropriately sized and you have room for dynamic scaling on demand. This action ensures that you do not scale beyond the following maximum limits:

Sizing guidelines on converged mode

- **Persistent volumes backed by the file interface** For typical operations, size for 500-800 persistent volumes backed by files per three-node converged mode cluster. The maximum limit of supported persistent volumes backed by the file interface is 2000 persistent volumes per three-node cluster in a converged mode deployment. Considering that micro-services can

dynamically scale as per demand, it is recommended that the initial sizing keep sufficient headroom for the scaling. If additional scaling is needed, add a new three-node converged mode cluster to support additional persistent volumes
The default limit for file-based persistent volumes per trusted storage pool is set to 1000 and the maximum supported limit is 2000. For more information on steps needed to be performed to go beyond 1000+ default limit and max till 2000, see How to have more PV's beyond default limit in OCS?

- **Persistent volumes backed by block-based storage**: Size for a maximum of 300 persistent volumes per three-node converged mode cluster.
- **Persistent volumes backed by file and block** Size for 300-500 persistent volumes (backed by files) and 100-200 persistent volumes (backed by block). Do not exceed these maximum limits of file or block-backed persistent volumes or the combination of a maximum 1000 persistent volumes per three-node converged mode cluster.
- **Volume types**: 3-way distributed-replicated volumes and arbitrated volumes are the only supported volume types.
- **Minimum Red Hat Openshift Container Storage cluster size (4):**It is recommended to have a minimum of 4 nodes in the Red Hat Openshift Container Storage cluster to adequately meet high-availability requirements. Although 3 nodes are required to create a persistent volume claim, the failure of one node in a 3 node cluster prevents the persistent volume claim from being created. The fourth node provides high-availability and allows the persistent volume claim to be created even if a node fails.
- **Minimum requirements**: Each physical or virtual node that hosts a converged mode peer requires the following:
  - a minimum of 8 GB RAM and 30 MB per persistent volume
  - the same disk type
  - the heketidb utilises 2 GB distributed replica volume
  - a minimum of 2 physical core pair



NOTE

2 physical core pair translates to 4 vCPU for non hyper-threaded systems and 8 vCPU for hyper-threaded systems.

Deployment guidelines on converged mode

- In converged mode, you can install the Red Hat Openshift Container Storage nodes, Heketi, and all provisioner pods on OpenShift Container Platform Infrastructure nodes or OpenShift Container Platform Application nodes.
- Red Hat Gluster Storage Container Native with OpenShift Container Platform supports up to 14 snapshots per volume by default (**snap-max-hard-limit =14** in Heketi Template).
- The required kernel version is kernel-3.10.0-862.14.4.el7.x86_64 or higher. Verify the installed and running kernel versions by running the following command:

```
# rpm -q kernel
kernel-3.10.0-862.14.4.el7.x86_64
```

```
# uname -r
3.10.0-862.14.4.el7.x86_64
```

3.2. INDEPENDENT MODE

3.2.1. Supported Versions

For supported versions of OpenShift Container Platform with Red Hat Gluster Storage Server and Container-Native Storage, please see https://access.redhat.com/articles/3403951.

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Install heketi-client package

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3.2.2.2. OpenShift Container Platform Options

- Container logs by default are not configured to be rotated or limited to a max size by docker. A log file can grow so large that it fills up the disk space if the container runs for long enough and generate enough logs.

- To set log limits for containers on a host **--log-opt** can be configured with **max-size** and **max-file** so that a containers logs are rolled over when they reach a max limit and only a certain number of files are saved before being discarded.

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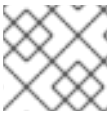

NOTE

If the above options are not executed , once the logs get large the pod can be evicted.

3.2.3. Red Hat OpenShift Container Platform and Red Hat Openshift Container Storage Requirements

The following list provides the Red Hat OpenShift Container Platform requirements:

- All OpenShift nodes on Red Hat Enterprise Linux systems must have glusterfs-client RPMs (glusterfs, glusterfs-client-xlators, glusterfs-libs, glusterfs-fuse) installed. You can verify if the RPMs are installed by running the following command:

```
# yum list glusterfs glusterfs-client-xlators glusterfs-libs glusterfs-fuse
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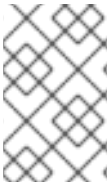


NOTE

Ensure that the latest version of **glusterfs-client** RPMs are installed. The client RPMs must have the same version as the **gluster-rhgs-server** version. The **gluster-rhgs-server** version is based on the selected OCS version.

For more information on installing native client packages, see https://access.redhat.com/documentation/en-us/red_hat_gluster_storage/3.5/html-single/administration_guide/index#Installing_Native_Client

3.2.4. Red Hat Gluster Storage Requirements

The following list provides the details regarding the Red Hat Gluster Storage requirements:

- Installation of Heketi packages must have valid subscriptions to Red Hat Gluster Storage Server repositories.

- Red Hat Gluster Storage installations must adhere to the requirements outlined in the Red Hat Gluster Storage Installation Guide.

- The versions of Red Hat Enterprise OpenShift and Red Hat Gluster Storage integrated must be compatible, according to the information in Section 3.1.1, “Supported Versions” section.

- A fully qualified domain name must be set for Red Hat Gluster Storage server node. Ensure that the correct DNS records exist and that the fully qualified domain name is resolvable via both forward and reverse DNS lookup.

- To access GlusterFS volumes, the mount.glusterfs command must be available on all schedulable nodes. For RPM-based systems, the glusterfs-fuse package must be installed:

```
# yum install glusterfs-fuse
```

This package comes installed on every RHEL system. However, it is recommended to update to the latest available version from Red Hat Gluster Storage. To do this, the following RPM repository must be enabled:

```
# subscription-manager repos --enable=rh-gluster-3-client-for-rhel-7-server-rpms
```

If glusterfs-fuse is already installed on the nodes, ensure that the latest version is installed:

```
# yum update glusterfs-fuse
```

IMPORTANT

Restrictions for using Snapshot

- After a snapshot is created, it must be accessed through the user-serviceable snapshots feature only. This can be used to copy the old versions of files into the required location.
  Reverting the volume to a snapshot state is not supported and should never be done as it might damage the consistency of the data.
- On a volume with snapshots, volume changing operations, such as volume expansion, must not be performed.

3.2.5. Deployment and Scaling Guidelines

To prevent potential deployment or scaling issues, review the following guidelines before deploying independent mode with OpenShift Container Platform.

Ensure that the Trusted Storage Pool is appropriately sized and you have room for dynamic scaling on demand. This action ensures that you do not scale beyond the following maximum limits:

Sizing guidelines on Independent mode

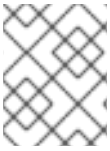
- **Persistent volumes backed by the file interface** For typical operations, size for 500-800 persistent volumes backed by files per three-node independent mode cluster. The maximum limit of supported persistent volumes backed by the file interface is 2000 persistent volumes per three-node cluster in an independent mode deployment. Considering that micro-services can dynamically scale as per demand, it is recommended that the initial sizing keep sufficient headroom for the scaling. If additional scaling is needed, add a new three-node independent mode cluster to support additional persistent volumes.

The default limit for file-based persistent volumes per trusted storage pool is set to 1000 and the maximum supported limit is 2000. For more information on steps needed to be performed to go beyond 1000+ default limit and max till 2000, see How to have more PV's beyond default limit in OCS?

- **Persistent volumes backed by block-based storage** Size for a maximum of 300 persistent volumes per three-node independent mode cluster.
- **Persistent volumes backed by file and block** Size for 300-500 persistent volumes (backed by

files) and 100-200 persistent volumes (backed by block). Do not exceed these maximum limits of file or block-backed persistent volumes or the combination of a maximum 1000 persistent volumes per three-node independent mode cluster.

- **Volume types**: 3-way distributed-replicated volumes and arbitrated volumes are the only supported volume types.
- **Minimum Red Hat Openshift Container Storage cluster size (4:)**It is recommended to have a minimum of 4 nodes in the Red Hat Openshift Container Storage cluster to adequately meet high-availability requirements. Although 3 nodes are required to create a persistent volume claim, the failure of one node in a 3 node cluster prevents the persistent volume claim from being created. The fourth node provides high-availability and allows the persistent volume claim to be created even if a node fails.
- **Minimum requirements**: Each physical or virtual node that hosts a Red Hat Gluster Storage independent mode peer requires the following:
  - a minimum of 8 GB RAM and 30 MB per persistent volume.
  - the same disk type.
  - the heketidb utilises 2 GB distributed replica volume.
  - a minimum of 2 physical core pair



NOTE

2 physical core pair translates to 4vCPU for non hyper-threaded systems and 8 vCPU for hyper-threaded systems.

Deployment guidelines on independent mode

- In independent mode, you can install Heketi and all provisioners pods on OpenShift Container Platform Infrastructure nodes or on OpenShift Container Platform Application nodes
- Red Hat Gluster Storage Container Native with OpenShift Container Platform supports up to 14 snapshots per volume by default (snap-max-hard-limit =14 in Heketi Template).
- The required kernel version is kernel-3.10.0-862.14.4.el7.x86_64 version or higher. Verify the installed and running kernel versions by running the following command:

```
# rpm -q kernel
kernel-3.10.0-862.14.4.el7.x86_64
```

```
# uname -r
3.10.0-862.14.4.el7.x86_64
```

PART II. DEPLOY

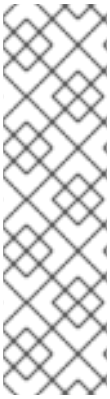
CHAPTER 4. DEPLOYING CONTAINERIZED STORAGE IN CONVERGED MODE

Before following the deployment workflow for your preferred solution, make sure to review Section 4.1, "Specify Advanced Installer Variables" to understand ansible variable and playbook recommendations and requirements.

To set up storage to containers on top of an OpenShift Cluster, select the workflow that meets your objectives.

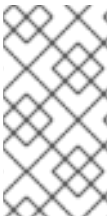
Table 4.1. Deployment Workflow

Deployment workflow	Registry	Metrics	Logging	Applications
Section 4.2, "Deploying Red Hat Openshift Container Storage in Converged Mode"				✔
Section 4.3, "Deploying Red Hat Openshift Container Storage in Converged Mode with Registry"	✔			
Section 4.4, "Deploying Red Hat Openshift Container Storage in Converged Mode with Logging and Metrics"		✔	✔	
Section 4.5, "Deploying Red Hat Openshift Container Storage in Converged mode for Applications with Registry, Logging, and Metrics"	✔	✔	✔	✔



NOTE

- Red Hat Openshift Container Storage does not support a simultaneous deployment of converged and independent mode with ansible workflow. Therefore, you must deploy either converged mode or independent mode: you cannot mix both modes during deployment.
- s3 is deployed manually and not through Ansible installer. For more information on manual deployment, see https://access.redhat.com/documentation/en-us/red_hat_openshift_container_storage/3.11/html-single/operations_guide/#S3_Object_Store



NOTE

New registry name **registry.redhat.io** is used throughout in this Guide.

However, if you have not migrated to the new **registry** yet then replace all occurrences of **registry.redhat.io** with **registry.access.redhat.com** where ever applicable.

4.1. SPECIFY ADVANCED INSTALLER VARIABLES

The cluster installation process as documented in https://access.redhat.com/documentation/en-us/openshift_container_platform/3.11/html-single/installing_clusters/#install-planning, can be used to install one or both the GlusterFS node groups:

- **glusterfs**: A general storage cluster for use by user applications.
- **glusterfs-registry**: A dedicated storage cluster for use by infrastructureapplications such as an integrated OpenShift Container Registry.

It is recommended to deploy both groups to avoid potential impacts on performance in I/O and volume creation. Both of these are defined in the inventory hosts file.

The definition of the clusters is done by including the relevant names in the `[OSEv3:children]` group, creating similarly named groups, and then populating the groups with the node information. The clusters can then be configured through a variety of variables in the **[OSEv3:vars]** group. **glusterfs** variables begin with **openshift_storage_glusterfs_** and **glusterfs-registry** variables begin with **openshift_storage_glusterfs_registry_**. A few other variables, such as **openshift_hosted_registry_storage_kind**, interact with the GlusterFS clusters.

It is recommended to specify image names and version tags for all containerized components.This is to prevent components such as the Red Hat Gluster Storage pods from upgrading after an outage, which might lead to a cluster of widely disparate software versions. The relevant variables are as follows:

- **openshift_storage_glusterfs_image**
- **openshift_storage_glusterfs_block_image**
- **openshift_storage_glusterfs_heketi_image**

The following are the recommended values for this release of Red Hat Openshift Container Storage

- **openshift_storage_glusterfs_image=registry.redhat.io/rhgs3/rhgs-server-rhel7:v3.11.4**
- **openshift_storage_glusterfs_block_image=registry.redhat.io/rhgs3/rhgs-gluster-block-prov-rhel7:v3.11.4**

- **openshift_storage_glusterfs_heketi_image=registry.redhat.io/rhgs3/rhgs-volmanager-rhel7:v3.11.4**
- **openshift_storage_glusterfs_s3_server_image=registry.redhat.io/rhgs3/rhgs-s3-server-rhel7:v3.11.4**

For a complete list of variables, see https://github.com/openshift/openshift-ansible/tree/release-3.11/roles/openshift_storage_glusterfs on GitHub.

Once the variables are configured, there are several playbooks available depending on the circumstances of the installation:

- The main playbook for cluster installations can be used to deploy the GlusterFS clusters in tandem with an initial installation of OpenShift Container Platform.
  - This includes deploying an integrated OpenShift Container Registry that uses GlusterFS storage.
- **/usr/share/ansible/openshift-ansible/playbooks/openshift-glusterfs/config.yml** can be used to deploy the clusters onto an existing OpenShift Container Platform installation.
- **/usr/share/ansible/openshift-ansible/playbooks/openshift-glusterfs/registry.yml** can be used to deploy the clusters onto an existing OpenShift Container Platform installation. In addition, this will deploy an integrated OpenShift Container Registry, which uses GlusterFS storage.

IMPORTANT

- There must not be a pre-existing registry in the OpenShift Container Platform cluster.

- **playbooks/openshift-glusterfs/uninstall.yml** can be used to remove existingclusters matching the configuration in the inventory hosts file. This is usefulfor cleaning up the Red Hat Openshift Container Storage environment in the case of a faileddeployment due to configuration errors.

NOTE

The GlusterFS playbooks are not guaranteed to be idempotent. Running the playbooks more than once for a given installation is currently not supported without deleting the entire GlusterFS installation (including disk data) and starting over.

4.2. DEPLOYING RED HAT OPENSHIFT CONTAINER STORAGE IN CONVERGED MODE

1. In your inventory file, include the following variables in the **[OSEv3:vars]** section, adjusting them as needed for your configuration:

```
[OSEv3:vars]
openshift_storage_glusterfs_namespace=app-storage
openshift_storage_glusterfs_storageclass=true
openshift_storage_glusterfs_storageclass_default=false
openshift_storage_glusterfs_block_deploy=true
openshift_storage_glusterfs_block_host_vol_create=true
```

```
openshift_storage_glusterfs_block_host_vol_size=100
openshift_storage_glusterfs_block_storageclass=true
openshift_storage_glusterfs_block_storageclass_default=false
```

1. In your inventory file, add **glusterfs** in the **[OSEv3:children]** section to enable the **[glusterfs]** group:

```
[OSEv3:children]
masters
etcd
nodes
glusterfs
```

2. Add a **[glusterfs]** section with entries for each storage node that will host the GlusterFS storage. For each node, set **glusterfs_devices** to a list of raw block devices that will be completely managed as part of a GlusterFS cluster.There must be at least one device listed. Each device must be bare, with no partitions or LVM PVs. Specifying the variable takes the form:

```
<hostname_or_ip> glusterfs_zone=<zone_number> glusterfs_devices='[ "
</path/to/device1/>", "</path/to/device2>", ... ]'
```

   For example:

```
[glusterfs]
node103.example.com glusterfs_zone=1 glusterfs_devices='["/dev/sdd"]'
node104.example.com glusterfs_zone=2 glusterfs_devices='["/dev/sdd"]'
node105.example.com glusterfs_zone=3 glusterfs_devices='["/dev/sdd"]'
```

3. Add the hosts listed under **[glusterfs]** to the **[nodes]** group:

```
[nodes]
...
node103.example.com openshift_node_group_name="node-config-infra"
node104.example.com openshift_node_group_name="node-config-infra"
node105.example.com openshift_node_group_name="node-config-infra"
```

4. The preceding steps detail options that need to be added to a larger, complete inventory file. To use the complete inventory file to deploy {gluster} provide the file path as an option to the following playbooks:

   a. For an initial OpenShift Container Platform installation:

```
ansible-playbook -i <path_to_inventory_file> /usr/share/ansible/openshift-
ansible/playbooks/prerequisites.yml

ansible-playbook -i <path_to_inventory_file> /usr/share/ansible/openshift-
ansible/playbooks/deploy_cluster.yml
```

   b. For a standalone installation onto an existing OpenShift Container Platform cluster:

```
ansible-playbook -i <path_to_inventory_file> /usr/share/ansible/openshift-
ansible/playbooks/openshift-glusterfs/config.yml
```

5. To verify the deployment see, Section 4.8, “Verify your Deployment” .

4.3. DEPLOYING RED HAT OPENSHIFT CONTAINER STORAGE IN CONVERGED MODE WITH REGISTRY

1. In your inventory file, include the following variables in the [OSEv3:vars] section, adjusting them as needed for your configuration:

```
openshift_storage_glusterfs_registry_namespace=app-storage
openshift_storage_glusterfs_registry_storageclass=true
openshift_storage_glusterfs_registry_storageclass_default=false
openshift_storage_glusterfs_registry_block_deploy=true
openshift_storage_glusterfs_registry_block_host_vol_create=true
openshift_storage_glusterfs_registry_block_host_vol_size=100
openshift_storage_glusterfs_registry_block_storageclass=true
openshift_storage_glusterfs_registry_block_storageclass_default=false
```

2. In your inventory file, set the following variable under **[OSEv3:vars]**:

```
[OSEv3:vars]
...
openshift_hosted_registry_storage_kind=glusterfs
openshift_hosted_registry_storage_volume_size=5Gi
openshift_hosted_registry_selector='node-role.kubernetes.io/infra=true'
```

3. Add **glusterfs_registry** in the **[OSEv3:children]** section to enable the `[glusterfs_registry]` group:

```
[OSEv3:children]
masters
etcd
nodes
glusterfs_registry
```

4. Add a **[glusterfs_registry]** section with entries for each storage node that will host the GlusterFS storage. For each node, set **glusterfs_devices** to a list of raw block devices that will be completely managed as part of a GlusterFS cluster. There must be at least one device listed. Each device must be bare, with no partitions or LVM PVs. Specifying the variable takes the form:

```
<hostname_or_ip> glusterfs_zone=<zone_number> glusterfs_devices='[ "
</path/to/device1/>", "</path/to/device2>", ... ]'
```

   For example:

```
[glusterfs_registry]
node106.example.com glusterfs_zone=1 glusterfs_devices='["/dev/sdd"]'
node107.example.com glusterfs_zone=2 glusterfs_devices='["/dev/sdd"]'
node108.example.com glusterfs_zone=3 glusterfs_devices='["/dev/sdd"]'
```

   - Add the hosts listed under **[glusterfs_registry]** to the **[nodes]** group:

```
[nodes]
...
node106.example.com openshift_node_group_name="node-config-compute"
```

```
node107.example.com openshift_node_group_name="node-config-compute"
node108.example.com openshift_node_group_name="node-config-compute"
```

5. The preceding steps detail options that need to be added to a larger, complete inventory file. To use the complete inventory file to deploy {gluster} provide the file path as an option to the following playbooks:

   a. For an initial OpenShift Container Platform installation:

   ```
   ansible-playbook -i <path_to_inventory_file> /usr/share/ansible/openshift-ansible/playbooks/prerequisites.yml

   ansible-playbook -i <path_to_inventory_file> /usr/share/ansible/openshift-ansible/playbooks/deploy_cluster.yml
   ```

   b. For a standalone installation onto an existing OpenShift Container Platform cluster:

   ```
   ansible-playbook -i <path_to_inventory_file> /usr/share/ansible/openshift-ansible/playbooks/openshift-glusterfs/config.yml
   ```

6. To verify the deployment see, Section 4.8, “Verify your Deployment” .

4.4. DEPLOYING RED HAT OPENSHIFT CONTAINER STORAGE IN CONVERGED MODE WITH LOGGING AND METRICS

1. In your inventory file, set the following variables under **[OSEv3:vars]**:

```
[OSEv3:vars]
...
openshift_metrics_install_metrics=true
openshift_metrics_cassandra_storage_type=pv
openshift_metrics_hawkular_nodeselector={"node-role.kubernetes.io/infra": "true"}
openshift_metrics_cassandra_nodeselector={"node-role.kubernetes.io/infra": "true"}
openshift_metrics_heapster_nodeselector={"node-role.kubernetes.io/infra": "true"}
openshift_metrics_storage_volume_size=20Gi
openshift_metrics_cassandra_pvc_storage_class_name="glusterfs-registry-block"

openshift_logging_install_logging=true
openshift_logging_es_pvc_dynamic=true
openshift_logging_storage_kind=dynamic
openshift_logging_kibana_nodeselector={"node-role.kubernetes.io/infra": "true"}
openshift_logging_curator_nodeselector={"node-role.kubernetes.io/infra": "true"}
openshift_logging_es_nodeselector={"node-role.kubernetes.io/infra": "true"}
openshift_logging_es_pvc_size=20Gi
openshift_logging_es_pvc_storage_class_name="glusterfs-registry-block"

openshift_storage_glusterfs_registry_namespace=infra-storage
openshift_storage_glusterfs_registry_storageclass=false
openshift_storage_glusterfs_registry_storageclass_default=false
openshift_storage_glusterfs_registry_block_deploy=true
openshift_storage_glusterfs_registry_block_host_vol_create=true
openshift_storage_glusterfs_registry_block_host_vol_size=100
openshift_storage_glusterfs_registry_block_storageclass=true
openshift_storage_glusterfs_registry_block_storageclass_default=false
```

NOTE

For more details about all the variables, see https://github.com/openshift/openshift-ansible/tree/release-3.11/roles/openshift_storage_glusterfs.

2. Add **glusterfs_registry** in the **[OSEv3:children]`section to enable the `[glusterfs_registry]** group:

```
[OSEv3:children]
masters
etcd
nodes
glusterfs_registry
```

3. Add a **[glusterfs_registry]** section with entries for each storage node thatwill host the GlusterFS storage. For each node, set **glusterfs_devices** to alist of raw block devices that will be completely managed as part of aGlusterFS cluster. There must be at least one device listed. Each device mustbe bare, with no partitions or LVM PVs. Specifying the variable takes the form:

```
<hostname_or_ip> glusterfs_zone=<zone_number> glusterfs_devices='[ "
</path/to/device1/>", "</path/to/device2>", ... ]'
```

For example:

```
[glusterfs_registry]
node106.example.com glusterfs_zone=1 glusterfs_devices='["/dev/sdd"]'
node107.example.com glusterfs_zone=2 glusterfs_devices='["/dev/sdd"]'
node108.example.com glusterfs_zone=3 glusterfs_devices='["/dev/sdd"]'
```

4. Add the hosts listed under **[glusterfs_registry]** to the **[nodes]** group:

```
[nodes]
...
node106.example.com openshift_node_group_name="node-config-compute"
node107.example.com openshift_node_group_name="node-config-compute"
node108.example.com openshift_node_group_name="node-config-compute"
```

1. The preceding steps detail options that need to be added to a larger, complete inventory file. To use the complete inventory file to deploy {gluster} provide the file path as an option to the following playbooks:

   a. For an initial OpenShift Container Platform installation:

   ```
   ansible-playbook -i <path_to_inventory_file> /usr/share/ansible/openshift-
   ansible/playbooks/prerequisites.yml

   ansible-playbook -i <path_to_inventory_file> /usr/share/ansible/openshift-
   ansible/playbooks/deploy_cluster.yml
   ```

   b. For a standalone installation onto an existing OpenShift Container Platform cluster:

   ```
   ansible-playbook -i <path_to_inventory_file> /usr/share/ansible/openshift-
   ansible/playbooks/openshift-glusterfs/config.yml
   ```

```
ansible-playbook -i <path_to_the_inventory_file> /usr/share/ansible/openshift-ansible/playbooks/openshift-logging/config.yml

ansible-playbook -i <path_to_the_inventory_file>  /usr/share/ansible/openshift-ansible/playbooks/openshift-metrics/config.yml
```

2. To verify the deployment see, Section 4.8, “Verify your Deployment” .

4.5. DEPLOYING RED HAT OPENSHIFT CONTAINER STORAGE IN CONVERGED MODE FOR APPLICATIONS WITH REGISTRY, LOGGING, AND METRICS

1. In your inventory file, set the following variables under **[OSEv3:vars]**:

```
[OSEv3:vars]
...
openshift_hosted_registry_selector='node-role.kubernetes.io/infra=true'
openshift_hosted_registry_storage_volume_size=5Gi
openshift_hosted_registry_storage_kind=glusterfs

[OSEv3:vars]
...
openshift_metrics_install_metrics=true
openshift_metrics_cassandra_storage_type=pv
openshift_metrics_hawkular_nodeselector={"node-role.kubernetes.io/infra": "true"}
openshift_metrics_cassandra_nodeselector={"node-role.kubernetes.io/infra": "true"}
openshift_metrics_heapster_nodeselector={"node-role.kubernetes.io/infra": "true"}
openshift_metrics_storage_volume_size=20Gi
openshift_metrics_cassandra_pvc_storage_class_name="glusterfs-registry-block"

openshift_logging_install_logging=true
openshift_logging_es_pvc_dynamic=true
openshift_logging_storage_kind=dynamic
openshift_logging_kibana_nodeselector={"node-role.kubernetes.io/infra": "true"}
openshift_logging_curator_nodeselector={"node-role.kubernetes.io/infra": "true"}
openshift_logging_es_nodeselector={"node-role.kubernetes.io/infra": "true"}
openshift_logging_es_pvc_size=20Gi
openshift_logging_es_pvc_storage_class_name="glusterfs-registry-block"

openshift_storage_glusterfs_namespace=app-storage
openshift_storage_glusterfs_storageclass=true
openshift_storage_glusterfs_storageclass_default=false
openshift_storage_glusterfs_block_deploy=false

openshift_storage_glusterfs_registry_namespace=infra-storage
openshift_storage_glusterfs_registry_storageclass=false
openshift_storage_glusterfs_registry_storageclass_default=false
openshift_storage_glusterfs_registry_block_deploy=true
openshift_storage_glusterfs_registry_block_host_vol_create=true
openshift_storage_glusterfs_registry_block_host_vol_size=100
openshift_storage_glusterfs_registry_block_storageclass=true
openshift_storage_glusterfs_registry_block_storageclass_default=false
```

NOTE

Ensure to set **openshift_storage_glusterfs_block_deploy=false** in this deployment scenario.

2. Add **glusterfs** and **glusterfs_registry** in the **[OSEv3:children]** section toenable the **[glusterfs]** and **[glusterfs_registry]** groups:

```
[OSEv3:children]
...
glusterfs
glusterfs_registry
```

3. Add **[glusterfs]** and **[glusterfs_registry]** sections with entries for eachstorage node that will host the GlusterFS storage. For each node, set`glusterfs_devices` to a list of raw block devices that will be completelymanaged as part of a GlusterFS cluster. There must be at least one devicelisted. Each device must be bare, with no partitions or LVM PVs. Specifying thevariable takes the form:

```
<hostname_or_ip> glusterfs_zone=<zone_number> glusterfs_devices='[ "
</path/to/device1/>", "</path/to/device2>", ... ]'
```

For example:

```
[glusterfs]
node103.example.com glusterfs_zone=1 glusterfs_devices='["/dev/sdd"]'
node104.example.com glusterfs_zone=2 glusterfs_devices='["/dev/sdd"]'
node105.example.com glusterfs_zone=3 glusterfs_devices='["/dev/sdd"]'

[glusterfs_registry]
node106.example.com glusterfs_zone=1 glusterfs_devices='["/dev/sdd"]'
node107.example.com glusterfs_zone=2 glusterfs_devices='["/dev/sdd"]'
node108.example.com glusterfs_zone=3 glusterfs_devices='["/dev/sdd"]'
```

4. Add the hosts listed under **[glusterfs]** and **[glusterfs_registry]** to the`[nodes]` group:

```
[nodes]
...
node103.example.com openshift_node_group_name="node-config-compute"
node104.example.com openshift_node_group_name="node-config-compute"
node105.example.com openshift_node_group_name="node-config-compute"
node106.example.com openshift_node_group_name="node-config-infra"
node107.example.com openshift_node_group_name="node-config-infra"
node108.example.com openshift_node_group_name="node-config-infra"
```

5. The preceding steps detail options that need to be added to a larger, complete inventory file. To use the complete inventory file to deploy {gluster} provide the file path as an option to the following playbooks:

   a. For an initial OpenShift Container Platform installation:

```
ansible-playbook -i <path_to_inventory_file> /usr/share/ansible/openshift-
ansible/playbooks/prerequisites.yml
```

```
ansible-playbook -i <path_to_inventory_file> /usr/share/ansible/openshift-
ansible/playbooks/deploy_cluster.yml
```

b. For a standalone installation onto an existing OpenShift Container Platform cluster:

```
ansible-playbook -i <path_to_inventory_file> /usr/share/ansible/openshift-
ansible/playbooks/openshift-glusterfs/config.yml

ansible-playbook -i <path_to_the_inventory_file> /usr/share/ansible/openshift-
ansible/playbooks/openshift-logging/config.yml

ansible-playbook -i <path_to_the_inventory_file>  /usr/share/ansible/openshift-
ansible/playbooks/openshift-metrics/config.yml
```

6. To verify the deployment see, Section 4.8, “Verify your Deployment” .

4.6. SINGLE OCS CLUSTER INSTALLATION

It is possible to support both general-application storage and infrastructure storage in a single OCS cluster. To do this, the inventory file options will change slightly for logging and metrics. This is because when there is only one cluster, the **gluster-block StorageClass** would be **glusterfs-storage-block**. The registry PV will be created on this single cluster if the second cluster,**[glusterfs_registry]** does not exist. For high availability, it is very important to have four nodes for this cluster. Special attention should be given to choosing the size for **openshift_storage_glusterfs_block_host_vol_size**. This is the hosting volume for gluster-block devices that will be created for logging and metrics. Make sure that the size can accommodate all these block volumes and have sufficient storage if another hosting volume must be created.

```
[OSEv3:children]
...
nodes
glusterfs

[OSEv3:vars]
...
# registry
...

# logging
openshift_logging_install_logging=true
...
openshift_logging_es_pvc_storage_class_name='glusterfs-storage-block'
...

# metrics
openshift_metrics_install_metrics=true
...
openshift_metrics_cassandra_pvc_storage_class_name='glusterfs-storage-block'
...

# glusterfs_registry_storage
openshift_hosted_registry_storage_kind=glusterfs
openshift_hosted_registry_storage_volume_size=20Gi
openshift_hosted_registry_selector="node-role.kubernetes.io/infra=true"
```

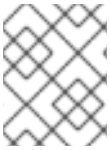
```
# OCS storage cluster for applications
openshift_storage_glusterfs_namespace=app-storage
openshift_storage_glusterfs_storageclass=true
openshift_storage_glusterfs_storageclass_default=false
openshift_storage_glusterfs_block_deploy=true
openshift_storage_glusterfs_block_host_vol_create=true
openshift_storage_glusterfs_block_host_vol_size=100
openshift_storage_glusterfs_block_storageclass=true
openshift_storage_glusterfs_block_storageclass_default=false
...

[nodes]
…
ose-app-node01.ocpgluster.com openshift_node_group_name="node-config-compute"
ose-app-node02.ocpgluster.com openshift_node_group_name="node-config-compute"
ose-app-node03.ocpgluster.com openshift_node_group_name="node-config-compute"
ose-app-node04.ocpgluster.com openshift_node_group_name="node-config-compute"

[glusterfs]
ose-app-node01.ocpgluster.com glusterfs_zone=1 glusterfs_devices='[ "/dev/xvdf" ]'
ose-app-node02.ocpgluster.com glusterfs_zone=2 glusterfs_devices='[ "/dev/xvdf" ]'
ose-app-node03.ocpgluster.com glusterfs_zone=3 glusterfs_devices='[ "/dev/xvdf" ]'
ose-app-node04.ocpgluster.com glusterfs_zone=1 glusterfs_devices='[ "/dev/xvdf" ]'
```

4.7. CONFIGURE HEKETI TO PLACE BRICKS ACROSS ZONES

Heketi uses node zones as a hint for brick placement. To force Heketi to strictly place replica bricks in different zones, "strict zone checking" feature of Heketi has to be enabled. When this feature is enabled, a volume is created successfully only if each brick set is spread across sufficiently many zones.



NOTE

Ensure that the OCS nodes are labeled with the correct zones before configuring StorageClass to use heketi's strict zoning.

You can configure this feature by adding the "volumeoptions" field with the desired setting in the parameters section of the StorageClass. For example:

```
volumeoptions: "user.heketi.zone-checking strict"
```

OR

```
volumeoptions: "user.heketi.zone-checking none"
```

The settings are as follows:

strict

Requires at least 3 nodes to be present in different zones (assuming replica 3).

none

Previous (and current default) behavior

A sample StorageClass file with "strict zone checking" feature configured is shown below:

```
# cat glusterfs-storageclass.yaml

apiVersion: storage.k8s.io/v1
kind: StorageClass
metadata:
  name: gluster-container
provisioner: kubernetes.io/glusterfs
reclaimPolicy: Delete
parameters:
  resturl: "http://heketi-storage-project.cloudapps.mystorage.com"
  restuser: "admin"
  volumetype: "replicate:3"
  clusterid: "630372ccdc720a92c681fb928f27b53f"
  secretNamespace: "default"
  secretName: "heketi-secret"
  volumeoptions: "user.heketi.zone-checking strict"
  volumenameprefix: "test-vol"
allowVolumeExpansion: true
```

4.8. VERIFY YOUR DEPLOYMENT

Execute the following steps to verify the deployment.

1. Installation Verification for converged mode

   a. Examine the installation for the app-storage namespace by running the following commands This can be done from an OCP master node or the ansible deploy host that has the OC CLI installed.

```
# switch to the app-storage namespace
oc project app-storage
# get the list of pods here (3 gluster pods +1 heketi pod + 1 gluster block provisioner pod)
oc get pods
NAME                                          READY     STATUS    RESTARTS   AGE
glusterblock-storage-provisioner-dc-1-mphfp   1/1       Running   0          1h
glusterfs-storage-6tlzx                       1/1       Running   0          1h
glusterfs-storage-lksps                       1/1       Running   0          1h
glusterfs-storage-nf7qk                       1/1       Running   0          1h
glusterfs-storage-tcnd8                       1/1       Running   0          1h
heketi-storage-1-5m6cl                        1/1       Running   0          1h
```

   b. Examine the installation for the infra-storage namespace by running the following commands This can be done from an OCP master node or the ansible deploy host that has the OC CLI installed.

```
# switch to the infra-storage namespace
oc project infra-storage
# list the pods here (3 gluster pods, 1 heketi pod and 1 glusterblock-provisioner pod)
oc get pods
NAME                                          READY   STATUS      RESTARTS      AGE
glusterblock-registry-provisioner-dc-1-28sfc 1/1   Running     0             1h
glusterfs-registry-cjp49                      1/1   Running     0             1h
glusterfs-registry-lhgjj                      1/1   Running     0             1h
glusterfs-registry-v4vqx                      1/1   Running     0             1h
heketi-registry-5-lht6s                       1/1   Running     0             1h
```

c. Check the existence of the registry PVC backed by OCP infrastructure Red Hat Openshift Container Storage. This volume was statically provisioned by openshift-ansible deployment.

```
oc get pvc -n default
NAME                STATUS    VOLUME                                     CAPACITY
ACCESSMODES    STORAGECLASS          AGE
registry-claim      Bound     pvc-7ca4c8de-10ca-11e8-84d3-069df2c4f284   25Gi
RWX                          1h
```

Check the registry DeploymentConfig to verify it's using this glusterfs volume.

```
oc describe dc/docker-registry -n default | grep -A3 Volumes
  Volumes:
  registry-storage:
  Type: PersistentVolumeClaim (a reference to a PersistentVolumeClaim in the same
namespace)
  ClaimName: registry-claim
```

2. Storage Provisioning Verification for Converged Mode

a. The Storage Class resources can be used to create new PV claims for verification of the RHOCS deployment. Validate PV provisioning using the following OCP Storage Class created during the RHOCS deployment:

- Use the glusterfs-storage-block OCP Storage Class resource to create new PV claims if you deployed RHOCS using Section 4.2, "Deploying Red Hat Openshift Container Storage in Converged Mode".
- Use the glusterfs-registry-block OCP Storage Class resource to create new PV claims if you deployed RHOCS using one of the following workflows:
  - Section 4.3, "Deploying Red Hat Openshift Container Storage in Converged Mode with Registry"
  - Section 4.4, "Deploying Red Hat Openshift Container Storage in Converged Mode with Logging and Metrics"
  - Section 4.5, "Deploying Red Hat Openshift Container Storage in Converged mode for Applications with Registry, Logging, and Metrics"

```
# oc get storageclass

NAME                          TYPE
glusterfs-storage               kubernetes.io/glusterfs
Glusterfs-storage-block         gluster.org/glusterblock
$ cat pvc-file.yaml
kind: PersistentVolumeClaim
apiVersion: v1
spec:
  name: rhocs-file-claim1
  annotations:
    storageClassName: glusterfs-storage-block
spec:
  accessModes:
    - ReadWriteMany
```

```
  resources:
    requests:
storage: 5Gi
```

```
# cat pvc-block.yaml
kind: PersistentVolumeClaim
apiVersion: v1
spec:
  name: rhocs-block-claim1
  annotations:
    storageClassName: glusterfs-storage-block
spec:
  accessModes:
    - ReadWriteOnce
  resources:
    requests:
      storage: 5Gi
```

```
# oc create -f pvc-file.yaml
# oc create -f pvc-block.yaml
```

Validate that the two PVCs and respective PVs are created correctly:

```
# oc get pvc
```

3. Using the heketi-client for Verification

   a. The heketi-client package needs to be installed on the ansible deploy host or on a OCP master. Once it is installed two new files should be created to easily export the required environment variables to run the heketi-client commands (or heketi-cli). The content of each file as well as useful heketi-cli commands are detailed here.
   Create a new file (e.g. "heketi-exports-app") with the following contents:

```
export HEKETI_POD=$(oc get pods -l glusterfs=heketi-storage-pod -n app-storage -o
jsonpath="{.items[0].metadata.name}")
export HEKETI_CLI_SERVER=http://$(oc get route/heketi-storage -n app-storage -o
jsonpath='{.spec.host}')
export HEKETI_CLI_KEY=$(oc get pod/$HEKETI_POD -n app-storage -o
jsonpath='{.spec.containers[0].env[?(@.name=="HEKETI_ADMIN_KEY")].value}')
export HEKETI_ADMIN_KEY_SECRET=$(echo -n ${HEKETI_CLI_KEY} | base64)
export HEKETI_CLI_USER=admin
```

   Source the file to create the HEKETI app-storage environment variables:

```
source heketi-exports-app
# see if heketi is alive
curl -w '\n' ${HEKETI_CLI_SERVER}/hello
Hello from Heketi
# ask heketi about the cluster it knows about
heketi-cli cluster list
Clusters:
Id:56ed234a384cef7dbef6c4aa106d4477 [file][block]
# ask heketi about the topology of the RHOCS cluster for apps
heketi-cli topology info
```

```
# ask heketi about the volumes already created (one for the heketi db should exist after
the OCP initial installation)
heketi-cli volume list
Id:d71a4cbea22af3453615a9020f261b5c Cluster:56ed234a384cef7dbef6c4aa106d4477
Name:heketidbstorage
```

Create a new file (e.g. "heketi-exports-infra") with the following contents:

```
export HEKETI_POD=$(oc get pods -l glusterfs=heketi-registry-pod -n infra-storage -o
jsonpath="{.items[0].metadata.name}")
export HEKETI_CLI_SERVER=http://$(oc get route/heketi-registry -n infra-storage -o
jsonpath='{.spec.host}')
export HEKETI_CLI_USER=admin
export HEKETI_CLI_KEY=$(oc get pod/$HEKETI_POD -n infra-storage -o
jsonpath='{.spec.containers[0].env[?(@.name=="HEKETI_ADMIN_KEY")].value}')
export HEKETI_ADMIN_KEY_SECRET=$(echo -n ${HEKETI_CLI_KEY} | base64)
```

Source the file to create the HEKETI infra-storage environment variables:

```
source heketi-exports-infra
# see if heketi is alive
curl -w '\n' ${HEKETI_CLI_SERVER}/hello
Hello from Heketi
# ask heketi about the cluster it knows about (the RHOCS cluster for infrastructure)
heketi-cli cluster list
Clusters:
Id:baf91b261cbca2bb4b62caece63f60d0 [file][block]
# ask heketi about the volumes already created
heketi-cli volume list
Id:77baed02f79f4518326d8cc1db6c7af8 Cluster:baf91b261cbca2bb4b62caece63f60d0
Name:heketidbstorage
```

4.9. CREATING AN ARBITER VOLUME (OPTIONAL)

Arbiter volume supports all persistent volume types with better consistency and less disk space requirements. An arbitrated replicated volume, or arbiter volume, is a three-way replicated volume where every third brick is a special type of brick called an arbiter. Arbiter bricks do not store file data; they only store file names, structure, and metadata. The arbiter uses client quorum to compare this metadata with the metadata of the other nodes to ensure consistency in the volume and prevent split-brain conditions.

Advantages of arbitrated replicated volumes:

- Better consistency: When an arbiter is configured, arbitration logic uses client-side quorum in auto mode to prevent file operations that would lead to split-brain conditions.
- Less disk space required: Because an arbiter brick only stores file names and metadata, an arbiter brick can be much smaller than the other bricks in the volume.

For more information about Arbitrated Replicated Volumes, see https://access.redhat.com/documentation/en-us/red_hat_gluster_storage/3.5/html-single/administration_guide/index#Creating_Arbitrated_Replicated_Volumes

Before creating the arbiter volume, make sure heketi-client packages are installed.

■

```
# subscription-manager repos --enable=rh-gluster-3-for-rhel-7-server-rpms
```

```
# yum install heketi-client
```

If you want to upgrade your already existing Heketi server, then see, https://access.redhat.com/documentation/en-us/red_hat_openshift_container_storage/3.11/html-single/deployment_guide/index#upgrade_heketi_rhgs

4.9.1. Creating an Arbiter Volume

Arbiter volume can be created using the Heketi CLI or by updating the storageclass file.

4.9.1.1. Creating an Arbiter Volume using Heketi CLI

To create an Arbiter volume using the Heketi CLI one must request a replica 3 volume as well as provide the Heketi-specific volume option “user.heketi.arbiter true” that will instruct the system to create the Arbiter variant of replica 3.

For example:

```
# heketi-cli volume create --size=4 --gluster-volume-options='user.heketi.arbiter true'
```

4.9.1.2. Creating an Arbiter Volume using the Storageclass file

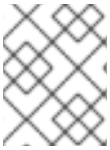
To create an arbiter volume using the storageclass file ensure to include the following two parameters in the storageclass file:

- user.heketi.arbiter true
- (Optional) user.heketi.average-file-size 1024

Following is a sample storageclass file:

```
# cat glusterfs-storageclass.yaml
apiVersion: storage.k8s.io/v1
kind: StorageClass
metadata:
  name: gluster-container
provisioner: kubernetes.io/glusterfs
parameters:
  resturl: "http://heketi-storage-project.cloudapps.mystorage.com"
  restuser: "admin"
  volumetype: "replicate:3"
  clusterid: "630372ccdc720a92c681fb928f27b53f,796e6db1981f369ea0340913eeea4c9a"
  secretNamespace: "default"
  secretName: "heketi-secret"
  volumeoptions: "user.heketi.arbiter true,user.heketi.average-file-size 1024"
  volumenameprefix: "test-vol"
spec:
  persistentVolumeReclaimPolicy: Retain
  accessModes:
    - ReadWriteOnce
```

```
resources:
  requests:
storage: 5Gi
```



NOTE

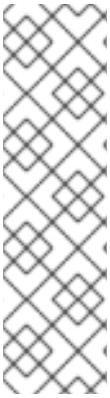
For information about managing arbiter volumes see, Chapter 10, *Managing Arbitrated Replicated Volumes*

CHAPTER 5. DEPLOYING CONTAINER STORAGE IN INDEPENDENT MODE

Before following the deployment workflow for your preferred solution, make sure to complete] and review xref:chap-Documentation-Red_Hat_Gluster_Storage_Container_Native_with_OpenShift_Platform-Specify_variables_CRS[to understand ansible variable and playbook recommendations and requirements.To set up storage to containers as a stand-alone Red Hat Gluster Storage cluster, select the workflow that meets your objectives.

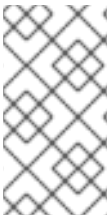
Table 5.1. Deployment Workflow

Deployment workflow	Registry	Metrics	Logging	Applications
Section 5.3, "Deploying Red Hat Openshift Container Storage in Independent Mode"				✔
Section 5.4, "Deploying Red Hat Openshift Container Storage in Independent mode for Applications with Registry, Logging, and Metrics"	✔	✔	✔	✔



NOTE

- Red Hat Openshift Container Storage does not support a simultaneous deployment of converged and independent mode with ansible workflow. Therefore, you must deploy either converged mode or independent mode: you cannot mix both modes during deployment.
- s3 is deployed manually and not through Ansible installer. For more information on manual deployment, see https://access.redhat.com/documentation/en-us/red_hat_openshift_container_storage/3.11/html-single/operations_guide/#S3_Object_Store



NOTE

New registry name **registry.redhat.io** is used throughout in this Guide.

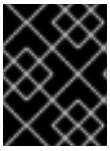
However, if you have not migrated to the new **registry** yet then replace all occurrences of **registry.redhat.io** with **registry.access.redhat.com** where ever applicable.

5.1. SETTING UP A RHGS CLUSTER

In an independent mode set-up a dedicated Red Hat Gluster Storage cluster is available external to the OpenShift Container Platform. The storage is provisioned from the Red Hat Gluster Storage cluster.

5.1.1. Installing Red Hat Gluster Storage Server on Red Hat Enterprise Linux (Layered Install)

Layered install involves installing Red Hat Gluster Storage over Red Hat Enterprise Linux.



IMPORTANT

It is recommended to create a separate **/var** partition that is large enough (50GB - 100GB) for log files, geo-replication related miscellaneous files, and other files.

1. Perform a base install of Red Hat Enterprise Linux 7 Server
   Independent mode is supported only on Red Hat Enterprise Linux 7.

2. Register the System with Subscription Manager
   Run the following command and enter your Red Hat Network username and password to register the system with the Red Hat Network:

   ```
   # subscription-manager register
   ```

3. Identify Available Entitlement Pools
   Run the following commands to find entitlement pools containing the repositories required to install Red Hat Gluster Storage:

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

4. Attach Entitlement Pools to the System
   Use the pool identifiers located in the previous step to attach the **Red Hat Enterprise Linux Server** and **Red Hat Gluster Storage** entitlements to the system. Run the following command to attach the entitlements:

   ```
   # subscription-manager attach --pool=[POOLID]
   ```

   For example:

   ```
   # subscription-manager attach --pool=8a85f9814999f69101499c05aa706e47
   ```

5. Enable the Required Channels
   Run the following commands to enable the repositories required to install Red Hat Gluster Storage 3.5 on Red Hat Enterprise Linux 7.7

   ```
   # subscription-manager repos --enable=rhel-7-server-rpms
   # subscription-manager repos --enable=rh-gluster-3-for-rhel-7-server-rpms
   # subscription-manager repos --enable=rhel-7-server-extras-rpms
   ```

6. Verify if the Channels are Enabled
   Run the following command to verify if the channels are enabled:

   ```
   # yum repolist
   ```

7. Update all packages

Ensure that all packages are up to date by running the following command.

+

```
# yum update
```

1. Kernel Version Requirement
   Independent mode requires the kernel-3.10.0-862.14.4.el7.x86_64 version or higher to be used on the system. Verify the installed and running kernel versions by running the following command:

   ```
   # rpm -q kernel
   kernel-3.10.0-862.14.4.el7.x86_64
   ```

   ```
   # uname -r
   3.10.0-862.14.4.el7.x86_64
   ```

   IMPORTANT

   If any kernel packages are updated, reboot the system with the following command.

   +

   ```
   # shutdown -r now
   ```

2. Install Red Hat Gluster Storage
   Run the following command to install Red Hat Gluster Storage:

   ```
   # yum install redhat-storage-server
   ```

3. To enable gluster-block execute the following command:

   ```
   # yum install gluster-block
   ```

4. Reboot
   Reboot the system.

5.1.2. Configuring Port Access

This section provides information about the ports that must be open for the independent mode.

Red Hat Gluster Storage Server uses the listed ports. You must ensure that the firewall settings do not prevent access to these ports.

Execute the following commands to open the required ports for both runtime and permanent configurations on all Red Hat Gluster Storage nodes:

```
# firewall-cmd --zone=zone_name --add-port=24010/tcp --add-port=3260/tcp --add-port=111/tcp --
add-port=22/tcp --add-port=24007/tcp --add-port=24008/tcp --add-port=49152-49664/tcp
```

```
# firewall-cmd --zone=zone_name --add-port=24010/tcp --add-port=3260/tcp --add-port=111/tcp --
add-port=22/tcp --add-port=24007/tcp --add-port=24008/tcp --add-port=49152-49664/tcp --
permanent
```

NOTE

- Port 24010 and 3260 are for gluster-blockd and iSCSI targets respectively.
- The port range starting at 49664 defines the range of ports that can be used by GlusterFS for communication to its volume bricks. In the above example the total number of bricks allowed is 512. Configure the port range based on the maximum number of bricks that could be hosted on each node.

5.1.3. Enabling Kernel Modules

Execute the following commands to enable kernel modules:

1. You must ensure that the **dm_thin_pool** and **target_core_user** modules are loaded in the Red Hat Gluster Storage nodes.

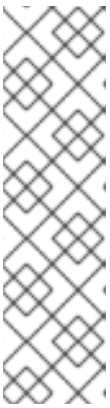
   ```
   # modprobe target_core_user
   ```

   ```
   # modprobe dm_thin_pool
   ```

   Execute the following command to verify if the modules are loaded:

   ```
   # lsmod | grep dm_thin_pool
   ```

   ```
   # lsmod | grep target_core_user
   ```

   NOTE

   To ensure these operations are persisted across reboots, create the following files and update each file with the content as mentioned:

   ```
   # cat /etc/modules-load.d/dm_thin_pool.conf
   dm_thin_pool
   ```

   ```
   # cat /etc/modules-load.d/target_core_user.conf
   target_core_user
   ```

2. You must ensure that the **dm_multipath** module is loaded on all OpenShift Container Platform nodes.

   ```
   # modprobe dm_multipath
   ```

   Execute the following command to verify if the modules are loaded:

   ```
   # lsmod | grep dm_multipath
   ```

NOTE

To ensure these operations are persisted across reboots, create the following file and update it with the content as mentioned:

```
# cat /etc/modules-load.d/dm_multipath.conf
dm_multipath
```

5.1.4. Starting and Enabling Services

Execute the following commands to start **glusterd** and **gluster-blockd**:

```
# systemctl start sshd
```

```
# systemctl enable sshd
```

```
# systemctl start glusterd
```

```
# systemctl enable glusterd
```

```
# systemctl start gluster-blockd
```

```
# systemctl enable gluster-blockd
```

5.1.5. Creating 2 TB (or more) Block Volume

To create 2 TB or more (a maximum of 2.5 TB) of block volume in independent mode, the **GB_CLI_TIME** parameter has to be configured as follows:

- Edit the **/etc/sysconfig/gluster-blockd** configuration file. Uncomment the **GB_CLI_TIME** parameter and update the parameter value as **900**.

5.2. SPECIFY ADVANCED INSTALLER VARIABLES

The cluster installation process as documented in https://access.redhat.com/documentation/en-us/openshift_container_platform/3.11/html-single/installing_clusters/#install-planning, can be used to install one or both the GlusterFS node groups:

- **glusterfs**: A general storage cluster for use by user applications.
- **glusterfs-registry**: A dedicated storage cluster for use by infrastructureapplications such as an integrated OpenShift Container Registry.

It is recommended to deploy both groups to avoid potential impacts onperformance in I/O and volume creation. Both of these are defined in theinventory hosts file.

The definition of the clusters is done by including the relevant names in the`[OSEv3:children]` group, creating similarly named groups, and then populating the groups with the node information. The clusters can then be configured through a variety of variables in the **[OSEv3:vars]** group. **glusterfs** variables begin with **openshift_storage_glusterfs_** and **glusterfs-registry** variables begin with **openshift_storage_glusterfs_registry_**. A few other variables, such as **openshift_hosted_registry_storage_kind**, interact with the GlusterFS clusters.

It is recommended to specify version tags for all containerized components.This is primarily to prevent components from upgrading after an outage, which might lead to a cluster of widely disparate software versions. The relevant variables are:

- **openshift_storage_glusterfs_image**
- **openshift_storage_glusterfs_block_image**
- **openshift_storage_glusterfs_heketi_image**

NOTE

The image variables for gluster-block is necessary only if the corresponding deployment variables (the variables ending in **_block_deploy**) is true.

The recommended values for this release of Red Hat Openshift Container Storage are as follows:

- **openshift_storage_glusterfs_image=registry.redhat.io/rhgs3/rhgs-server-rhel7:v3.11.4**
- **openshift_storage_glusterfs_block_image=registry.redhat.io/rhgs3/rhgs-gluster-block-prov-rhel7:v3.11.4**
- **openshift_storage_glusterfs_heketi_image=registry.redhat.io/rhgs3/rhgs-volmanager-rhel7:v3.11.4**
- **openshift_storage_glusterfs_s3_server_image=registry.redhat.io/rhgs3/rhgs-s3-server-rhel7:v3.11.4**

For a complete list of variables, see https://github.com/openshift/openshift-ansible/tree/release-3.11/roles/openshift_storage_glusterfs on GitHub.

Once the variables are configured, there are several playbooks available depending on the circumstances of the installation:

- The main playbook for cluster installations can be used to deploy theGlusterFS clusters in tandem with an initial installation of OpenShift Container Platform.
- This includes deploying an integrated OpenShift Container Registry thatuses GlusterFS storage.
- **/usr/share/ansible/openshift-ansible/playbooks/openshift-glusterfs/config.yml** can be used to deploy the clusters onto an existing OpenShift Container Platform installation.
- **/usr/share/ansible/openshift-ansible/playbooks/openshift-glusterfs/registry.yml** can be used to deploy the clusters onto an existing OpenShift Container Platform installation. In addition, this deploys an integrated OpenShift Container Registry, which uses GlusterFS storage.

IMPORTANT

The OpenShift Container Platform cluster must not contain a pre-existing registry.

- **playbooks/openshift-glusterfs/uninstall.yml** can be used to remove existingclusters matching the configuration in the inventory hosts file. This is usefulfor cleaning up the Red Hat OpenShift Container Storage environment in case of a faileddeployment due to configuration errors.

NOTE

The GlusterFS playbooks are not guaranteed to be idempotent. Running the playbooks more than once for a given installation is not supported without deleting the entire GlusterFS installation (including disk data) and starting over.

5.3. DEPLOYING RED HAT OPENSHIFT CONTAINER STORAGE IN INDEPENDENT MODE

1. In your inventory file, add **glusterfs** in the **[OSEv3:children]** section to enable the **[glusterfs]** group:

```
[OSEv3:children]
masters
etcd
nodes
glusterfs
```

2. Include the following variables in the **[OSEv3:vars]** section, adjusting them as needed for your configuration:

```
[OSEv3:vars]
...
openshift_storage_glusterfs_namespace=app-storage
openshift_storage_glusterfs_storageclass=true
openshift_storage_glusterfs_storageclass_default=false
openshift_storage_glusterfs_block_deploy=true
openshift_storage_glusterfs_block_host_vol_create=true
openshift_storage_glusterfs_block_host_vol_size=100
openshift_storage_glusterfs_block_storageclass=true
openshift_storage_glusterfs_block_storageclass_default=false
openshift_storage_glusterfs_is_native=false
openshift_storage_glusterfs_heketi_is_native=true
openshift_storage_glusterfs_heketi_executor=ssh
openshift_storage_glusterfs_heketi_ssh_port=22
openshift_storage_glusterfs_heketi_ssh_user=root
openshift_storage_glusterfs_heketi_ssh_sudo=false
openshift_storage_glusterfs_heketi_ssh_keyfile="/root/.ssh/id_rsa"
```

1. Add a **[glusterfs]** section with entries for each storage node that will hostthe GlusterFS storage. For each node, set **glusterfs_devices** to a list of rawblock devices that will be completely managed as part of a GlusterFS cluster.There must be at least one device listed. Each device must be bare, with nopartitions or LVM PVs. Also, set **glusterfs_ip** to the IP address of the node.Specifying the variable takes the form:

```
<hostname_or_ip> glusterfs_zone=<zone_number> glusterfs_ip=<ip_address>
glusterfs_devices='[ "</path/to/device1/>", "</path/to/device2>", ... ]'
```

For example:

```
[glusterfs]
gluster1.example.com glusterfs_zone=1 glusterfs_ip=192.168.10.11 glusterfs_devices='[
"/dev/xvdc", "/dev/xvdd" ]'
gluster2.example.com glusterfs_zone=2 glusterfs_ip=192.168.10.12 glusterfs_devices='[
"/dev/xvdc", "/dev/xvdd" ]'
gluster3.example.com glusterfs_zone=3 glusterfs_ip=192.168.10.13 glusterfs_devices='[
"/dev/xvdc", "/dev/xvdd" ]'
```

2. The preceding steps detail options that need to be added to a larger, complete inventory file. To use the complete inventory file to deploy {gluster} provide the file path as an option to the following playbooks:

   - For an initial OpenShift Container Platform installation:

     ```
     ansible-playbook -i <path_to_inventory_file> /usr/share/ansible/openshift-
     ansible/playbooks/prerequisites.yml

     ansible-playbook -i <path_to_inventory_file> /usr/share/ansible/openshift-
     ansible/playbooks/deploy_cluster.yml
     ```

   - For a standalone installation onto an existing OpenShift Container Platform cluster:

     ```
     ansible-playbook -i <path_to_inventory_file> /usr/share/ansible/openshift-
     ansible/playbooks/openshift-glusterfs/config.yml
     ```

3. Brick multiplexing is a feature that allows adding multiple bricks into one process. This reduces resource consumption and allows us to run more bricks than before with the same memory consumption. Execute the following commands on one of the Red Hat Gluster Storage nodes on each cluster to enable brick-multiplexing:

   a. Execute the following command to enable brick multiplexing:

      ```
      # gluster vol set all cluster.brick-multiplex on
      ```

      For example:

      ```
      # gluster vol set all cluster.brick-multiplex on
      Brick-multiplexing is supported only for container workloads (CNS/CRS). Also it is
      advised to make sure that either all volumes are in stopped state or no bricks are running
      before this option is modified.Do you still want to continue? (y/n) y
      volume set: success
      ```

   b. Restart the heketidb volumes:

      ```
      # gluster vol stop heketidbstorage
      Stopping volume will make its data inaccessible. Do you want to continue? (y/n) y
      volume stop: heketidbstorage: success
      ```

      ```
      # gluster vol start heketidbstorage
      volume start: heketidbstorage: success
      ```

5.4. DEPLOYING RED HAT OPENSHIFT CONTAINER STORAGE IN INDEPENDENT MODE FOR APPLICATIONS WITH REGISTRY, LOGGING, AND METRICS

1. In your inventory file, set the following variables under **[OSEv3:vars]**:

```
[OSEv3:vars]
...
openshift_hosted_registry_selector='node-role.kubernetes.io/infra=true'
openshift_hosted_registry_storage_volume_size=5Gi
openshift_hosted_registry_storage_kind=glusterfs

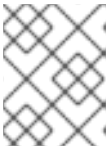
openshift_metrics_install_metrics=true
openshift_metrics_cassandra_storage_type=pv
openshift_metrics_hawkular_nodeselector={"node-role.kubernetes.io/infra": "true"}
openshift_metrics_cassandra_nodeselector={"node-role.kubernetes.io/infra": "true"}
openshift_metrics_heapster_nodeselector={"node-role.kubernetes.io/infra": "true"}
openshift_metrics_storage_volume_size=20Gi
openshift_metrics_cassandra_pvc_storage_class_name="glusterfs-registry-block"

openshift_logging_install_logging=true
openshift_logging_es_pvc_dynamic=true
openshift_logging_storage_kind=dynamic
openshift_logging_kibana_nodeselector={"node-role.kubernetes.io/infra": "true"}
openshift_logging_curator_nodeselector={"node-role.kubernetes.io/infra": "true"}
openshift_logging_es_nodeselector={"node-role.kubernetes.io/infra": "true"}
openshift_logging_es_pvc_size=20Gi
openshift_logging_es_pvc_storage_class_name="glusterfs-registry-block"

openshift_storage_glusterfs_namespace=app-storage
openshift_storage_glusterfs_storageclass=true
openshift_storage_glusterfs_storageclass_default=false
openshift_storage_glusterfs_block_deploy=false
openshift_storage_glusterfs_is_native=false
openshift_storage_glusterfs_heketi_is_native=true
openshift_storage_glusterfs_heketi_executor=ssh
openshift_storage_glusterfs_heketi_ssh_port=22
openshift_storage_glusterfs_heketi_ssh_user=root
openshift_storage_glusterfs_heketi_ssh_sudo=false
openshift_storage_glusterfs_heketi_ssh_keyfile="/root/.ssh/id_rsa"


openshift_storage_glusterfs_registry_namespace=infra-storage
openshift_storage_glusterfs_registry_storageclass=false
openshift_storage_glusterfs_registry_storageclass_default=false
openshift_storage_glusterfs_registry_block_deploy=true
openshift_storage_glusterfs_registry_block_host_vol_create=true
openshift_storage_glusterfs_registry_block_host_vol_size=100
openshift_storage_glusterfs_registry_block_storageclass=true
openshift_storage_glusterfs_registry_block_storageclass_default=false
openshift_storage_glusterfs_registry_is_native=false
openshift_storage_glusterfs_registry_heketi_is_native=true
openshift_storage_glusterfs_registry_heketi_executor=ssh
openshift_storage_glusterfs_registry_heketi_ssh_port=22
```

```
openshift_storage_glusterfs_registry_heketi_ssh_user=root
openshift_storage_glusterfs_registry_heketi_ssh_sudo=false
openshift_storage_glusterfs_registry_heketi_ssh_keyfile="/root/.ssh/id_rsa"
```



NOTE

Ensure to set **openshift_storage_glusterfs_block_deploy=false** in this deployment scenario.

2. Add **glusterfs** and **glusterfs_registry** in the **[OSEv3:children]** section to enable the **[glusterfs]** and **[glusterfs_registry]** groups:

```
[OSEv3:children]
...
glusterfs
glusterfs_registry
```

3. Add **[glusterfs]** and **[glusterfs_registry]** sections with entries for eachstorage node that will host the GlusterFS storage. For each node, set`glusterfs_devices` to a list of raw block devices that will be completelymanaged as part of a GlusterFS cluster. There must be at least one devicelisted. Each device must be bare, with no partitions or LVM PVs. Specifying thevariable takes the form:

```
<hostname_or_ip> glusterfs_zone=<zone_number> glusterfs_ip=<ip_address>
glusterfs_devices='[ "</path/to/device1/>", "</path/to/device2>", ... ]'
```

For example:

```
[glusterfs]
node11.example.com glusterfs_zone=1 glusterfs_ip=192.168.10.11
glusterfs_devices='["/dev/xvdc", "/dev/xvdd" ]'
node12.example.com glusterfs_zone=2 glusterfs_ip=192.168.10.12
glusterfs_devices='["/dev/xvdc", "/dev/xvdd" ]'
node13.example.com glusterfs_zone=3 glusterfs_ip=192.168.10.13
glusterfs_devices='["/dev/xvdc", "/dev/xvdd" ]'

[glusterfs_registry]
node15.example.com glusterfs_zone=1 glusterfs_ip=192.168.10.15
glusterfs_devices='["/dev/xvdc", "/dev/xvdd" ]'
node16.example.com glusterfs_zone=2 glusterfs_ip=192.168.10.16
glusterfs_devices='["/dev/xvdc", "/dev/xvdd" ]'
node17.example.com glusterfs_zone=3 glusterfs_ip=192.168.10.17
glusterfs_devices='["/dev/xvdc", "/dev/xvdd" ]'
```

4. The preceding steps detail options that need to be added to a larger, complete inventory file. To use the complete inventory file to deploy {gluster} provide the file path as an option to the following playbooks:

   - For an initial OpenShift Container Platform installation:

     ```
     ansible-playbook -i <path_to_inventory_file> /usr/share/ansible/openshift-
     ansible/playbooks/prerequisites.yml
     ```

```
ansible-playbook -i <path_to_inventory_file> /usr/share/ansible/openshift-
ansible/playbooks/deploy_cluster.yml
```

- For a standalone installation onto an existing OpenShift Container Platform cluster:

```
ansible-playbook -i <path_to_inventory_file> /usr/share/ansible/openshift-
ansible/playbooks/openshift-glusterfs/config.yml

ansible-playbook -i <path_to_the_inventory_file> /usr/share/ansible/openshift-
ansible/playbooks/openshift-logging/config.yml

ansible-playbook -i <path_to_the_inventory_file>  /usr/share/ansible/openshift-
ansible/playbooks/openshift-metrics/config.yml
```

5. To verify the deployment see, Section 5.7, “Verify your Deployment”.

5.5. SINGLE OCS CLUSTER INSTALLATION

It is possible to support both general-application storage and infrastructure storage in a single OCS cluster. To do this, the inventory file options will change slightly for logging and metrics. This is because when there is only one cluster, the **gluster-block StorageClass** would be **glusterfs-storage-block**. The registry PV will be created on this single cluster if the second cluster,**[glusterfs_registry]** does not exist. For high availability, it is very important to have four nodes for this cluster. Special attention should be given to choosing the size for **openshift_storage_glusterfs_block_host_vol_size**. This is the hosting volume for gluster-block devices that will be created for logging and metrics. Make sure that the size can accommodate all these block volumes and have sufficient storage if another hosting volume must be created.

```
[OSEv3:children]
...
nodes
glusterfs

[OSEv3:vars]
...
# registry
...

# logging
openshift_logging_install_logging=true
...
openshift_logging_es_pvc_storage_class_name='glusterfs-storage-block'
...

# metrics
openshift_metrics_install_metrics=true
...
openshift_metrics_cassandra_pvc_storage_class_name='glusterfs-storage-block'
...

# glusterfs_registry_storage
openshift_hosted_registry_storage_kind=glusterfs
openshift_hosted_registry_storage_volume_size=20Gi
openshift_hosted_registry_selector="node-role.kubernetes.io/infra=true"
```

```
# OCS storage cluster for applications
openshift_storage_glusterfs_namespace=app-storage
openshift_storage_glusterfs_storageclass=true
openshift_storage_glusterfs_storageclass_default=false
openshift_storage_glusterfs_block_deploy=true
openshift_storage_glusterfs_block_host_vol_create=true
openshift_storage_glusterfs_block_host_vol_size=100
openshift_storage_glusterfs_block_storageclass=true
openshift_storage_glusterfs_block_storageclass_default=false
openshift_storage_glusterfs_is_native=false
openshift_storage_glusterfs_heketi_is_native=true
openshift_storage_glusterfs_heketi_executor=ssh
openshift_storage_glusterfs_heketi_ssh_port=22
openshift_storage_glusterfs_heketi_ssh_user=root
openshift_storage_glusterfs_heketi_ssh_sudo=false
openshift_storage_glusterfs_heketi_ssh_keyfile="/root/.ssh/id_rsa"
...

[nodes]
…
ose-app-node01.ocpgluster.com openshift_node_group_name="node-config-compute"
ose-app-node02.ocpgluster.com openshift_node_group_name="node-config-compute"
ose-app-node03.ocpgluster.com openshift_node_group_name="node-config-compute"
ose-app-node04.ocpgluster.com openshift_node_group_name="node-config-compute"

[glusterfs]
ose-app-node01.ocpgluster.com glusterfs_zone=1 glusterfs_devices='["/dev/sdd"]'
glusterfs_ip=192.168.0.11
ose-app-node02.ocpgluster.com glusterfs_zone=2 glusterfs_devices='["/dev/sdd"]'
glusterfs_ip=192.168.0.12
ose-app-node03.ocpgluster.com glusterfs_zone=3 glusterfs_devices='["/dev/sdd"]'
glusterfs_ip=192.168.0.13
ose-app-node04.ocpgluster.com glusterfs_zone=1 glusterfs_devices='["/dev/sdd"]'
glusterfs_ip=192.168.0.14
```

5.6. CONFIGURE HEKETI TO PLACE BRICKS ACROSS ZONES

Heketi uses node zones as a hint for brick placement. To force Heketi to strictly place replica bricks in different zones, "strict zone checking" feature of Heketi has to be enabled. When this feature is enabled, a volume is created successfully only if each brick set is spread across sufficiently many zones.

NOTE

Ensure that the OCS nodes are labeled with the correct zones before configuring StorageClass to use heketi's strict zoning.

You can configure this feature by adding the "volumeoptions" field with the desired setting in the parameters section of the StorageClass. For example:

```
volumeoptions: "user.heketi.zone-checking strict"
```

OR

```
volumeoptions: "user.heketi.zone-checking none"
```

The settings are as follows:

strict

Requires at least 3 nodes to be present in different zones (assuming replica 3).

none

Previous (and current default) behavior

A sample StorageClass file with "strict zone checking" feature configured is shown below:

```
# cat glusterfs-storageclass.yaml

apiVersion: storage.k8s.io/v1
kind: StorageClass
metadata:
  name: gluster-container
provisioner: kubernetes.io/glusterfs
reclaimPolicy: Delete
parameters:
  resturl: "http://heketi-storage-project.cloudapps.mystorage.com"
  restuser: "admin"
  volumetype: "replicate:3"
  clusterid: "630372ccdc720a92c681fb928f27b53f"
  secretNamespace: "default"
  secretName: "heketi-secret"
  volumeoptions: "user.heketi.zone-checking strict"
  volumenameprefix: "test-vol"
allowVolumeExpansion: true
```

5.7. VERIFY YOUR DEPLOYMENT

Execute the following steps to verify the deployment.

1. Installation Verification for Independent mode

    a. Examine the installation for the app-storage namespace by running the following commands:

    ```
    # switch to the app-storage namespace
    oc project app-storage

    # get the list of pods here (1 heketi pod)
    oc get pods
    NAME                 READY        STATUS        RESTARTS        AGE

    heketi-storage-1-v5skm  1/1          Running        0               1h
    ```

    b. Examine the installation for the infra-storage namespace by running the following commands This can be done from an OCP master node or the ansible deploy host that has the OC CLI installed.

    ```
    # switch to the infra-storage namespace
    ```

```
oc project infra-storage

# list the pods here (1 heketi pod and 1 glusterblock-provisioner pod)
oc get pods
NAME                                          READY   STATUS      RESTARTS      AGE
glusterblock-registry-provisioner-dc-1-28sfc        1/1   Running     0             1h
heketi-registry-5-lht6s                             1/1   Running     0             1h
```

- Check the existence of the registry PVC backed by OCP infrastructure Red Hat Openshift Container Storage. This volume was statically provisioned by openshift-ansible deployment.

```
oc get pvc -n default
NAME                STATUS      VOLUME                                     CAPACITY
ACCESSMODES      STORAGECLASS              AGE
registry-claim           Bound       pvc-7ca4c8de-10ca-11e8-84d3-069df2c4f284   25Gi
RWX                                    1h
```

Check the registry DeploymentConfig to verify it's using this glusterfs volume.

```
oc describe dc/docker-registry -n default | grep -A3 Volumes
    Volumes:
    registry-storage:
    Type: PersistentVolumeClaim (a reference to a PersistentVolumeClaim in the
same namespace)
    ClaimName: registry-claim
```

2. Storage Provisioning Verification for Independent Mode

a. Validate PV provisioning using the glusterfs and glusterblock OCP Storage Class created during the OCP deployment. The two Storage Class resources, glusterfs-storage and glusterfs-storage-block, can be used to create new PV claims for verification of the Red Hat Openshift Container Storage deployment. The new PVC using the glusterfs-storage storageclass will be using storage available to gluster pods in app-storage project.

```
# oc get storageclass

NAME                            TYPE
glusterfs-storage                 kubernetes.io/glusterfs
Glusterfs-storage-block             gluster.org/glusterblock
$ cat pvc-file.yaml
kind: PersistentVolumeClaim
apiVersion: v1
spec:
  name: rhocs-file-claim1
  annotations:
  storageClassName: glusterfs-storage-block
spec:
  accessModes:
    - ReadWriteMany
  resources:
    requests:
storage: 5Gi
```

```
# cat pvc-block.yaml
```

```
kind: PersistentVolumeClaim
apiVersion: v1
spec:
  name: rhocs-block-claim1
  annotations:
  storageClassName: glusterfs-storage-block
spec:
  accessModes:
    - ReadWriteOnce
  resources:
    requests:
      storage: 5Gi
```

```
# oc create -f pvc-file.yaml
# oc create -f pvc-block.yaml
+
```

Validate that the two PVCs and respective PVs are created correctly:

```
# oc get pvc
```

3. Using the heketi-client for Verification

   a. The heketi-client package needs to be installed on the ansible deploy host or on a OCP master. Once it is installed two new files should be created to easily export the required environment variables to run the heketi-client commands (or heketi-cli). The content of each file as well as useful heketi-cli commands are detailed here.
   Create a new file (e.g. "heketi-exports-app") with the following contents:

```
export HEKETI_POD=$(oc get pods -l glusterfs=heketi-storage-pod -n app-storage -o
jsonpath="{.items[0].metadata.name}")
export HEKETI_CLI_SERVER=http://$(oc get route/heketi-storage -n app-storage -o
jsonpath='{.spec.host}')
export HEKETI_CLI_KEY=$(oc get pod/$HEKETI_POD -n app-storage -o
jsonpath='{.spec.containers[0].env[?(@.name=="HEKETI_ADMIN_KEY")].value}')
export HEKETI_ADMIN_KEY_SECRET=$(echo -n ${HEKETI_CLI_KEY} | base64)
export HEKETI_CLI_USER=admin
```

   Source the file to create the HEKETI app-storage environment variables:

```
source heketi-exports-app
# see if heketi is alive
curl -w '\n' ${HEKETI_CLI_SERVER}/hello
Hello from Heketi
# ask heketi about the cluster it knows about
heketi-cli cluster list
Clusters:
Id:56ed234a384cef7dbef6c4aa106d4477 [file][block]
# ask heketi about the topology of the RHOCS cluster for apps
heketi-cli topology info
# ask heketi about the volumes already created (one for the heketi db should exist after
the OCP initial installation)
```

```
heketi-cli volume list
Id:d71a4cbea22af3453615a9020f261b5c Cluster:56ed234a384cef7dbef6c4aa106d4477
Name:heketidbstorage
```

Create a new file (e.g. "heketi-exports-infra") with the following contents:

```
export HEKETI_POD=$(oc get pods -l glusterfs=heketi-registry-pod -n infra-storage -o
jsonpath="{.items[0].metadata.name}")
export HEKETI_CLI_SERVER=http://$(oc get route/heketi-registry -n infra-storage -o
jsonpath='{.spec.host}')
export HEKETI_CLI_USER=admin
export HEKETI_CLI_KEY=$(oc get pod/$HEKETI_POD -n infra-storage -o
jsonpath='{.spec.containers[0].env[?(@.name=="HEKETI_ADMIN_KEY")].value}')
export HEKETI_ADMIN_KEY_SECRET=$(echo -n ${HEKETI_CLI_KEY} | base64)
```

Source the file to create the HEKETI infra-storage environment variables:

```
source heketi-exports-infra
# see if heketi is alive
curl -w '\n' ${HEKETI_CLI_SERVER}/hello
Hello from Heketi
# ask heketi about the cluster it knows about (the RHOCS cluster for infrastructure)
heketi-cli cluster list
Clusters:
Id:baf91b261cbca2bb4b62caece63f60d0 [file][block]
# ask heketi about the volumes already created
heketi-cli volume list
Id:77baed02f79f4518326d8cc1db6c7af8 Cluster:baf91b261cbca2bb4b62caece63f60d0
Name:heketidbstorage
```

5.8. CREATING AN ARBITER VOLUME (OPTIONAL)

Arbiter volume supports all persistent volume types with better consistency and less disk space requirements. An arbitrated replicated volume, or arbiter volume, is a three-way replicated volume where every third brick is a special type of brick called an arbiter. Arbiter bricks do not store file data; they only store file names, structure, and metadata. The arbiter uses client quorum to compare this metadata with the metadata of the other nodes to ensure consistency in the volume and prevent split-brain conditions.

Advantages of arbitrated replicated volumes:

- Better consistency: When an arbiter is configured, arbitration logic uses client-side quorum in auto mode to prevent file operations that would lead to split-brain conditions.
- Less disk space required: Because an arbiter brick only stores file names and metadata, an arbiter brick can be much smaller than the other bricks in the volume.

For more information about Arbitrated Replicated Volumes, see https://access.redhat.com/documentation/en-us/red_hat_gluster_storage/3.5/html-single/administration_guide/index#Creating_Arbitrated_Replicated_Volumes

Before creating the arbiter volume, make sure heketi-client packages are installed.

```
# subscription-manager repos --enable=rh-gluster-3-for-rhel-7-server-rpms
```

```
# yum install heketi-client
```

If you want to upgrade your already existing Heketi server, then see, https://access.redhat.com/documentation/en-us/red_hat_openshift_container_storage/3.11/html-single/deployment_guide/index#upgrade_heketi_rhgs.

5.8.1. Creating an Arbiter Volume

Arbiter volume can be created using the Heketi CLI or by updating the storageclass file.

5.8.1.1. Creating an Arbiter Volume using Heketi CLI

To create an Arbiter volume using the Heketi CLI one must request a replica 3 volume as well as provide the Heketi-specific volume option “user.heketi.arbiter true” that will instruct the system to create the Arbiter variant of replica 3.

For example:

```
# heketi-cli volume create --size=4 --gluster-volume-options='user.heketi.arbiter true'
```

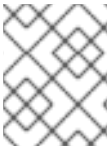
5.8.1.2. Creating an Arbiter Volume using the Storageclass file

To create an arbiter volume using the storageclass file ensure to include the following two parameters in the storageclass file:

- user.heketi.arbiter true
- (Optional) user.heketi.average-file-size 1024

Following is a sample storageclass file:

```
# cat glusterfs-storageclass.yaml
apiVersion: storage.k8s.io/v1
kind: StorageClass
metadata:
  name: gluster-container
provisioner: kubernetes.io/glusterfs
parameters:
  resturl: "http://heketi-storage-project.cloudapps.mystorage.com"
  restuser: "admin"
  volumetype: "replicate:3"
  clusterid: "630372ccdc720a92c681fb928f27b53f,796e6db1981f369ea0340913eeea4c9a"
  secretNamespace: "default"
  secretName: "heketi-secret"
  volumeoptions: "user.heketi.arbiter true,user.heketi.average-file-size 1024"
  volumenameprefix: "test-vol"
spec:
  persistentVolumeReclaimPolicy: Retain
  accessModes:
    - ReadWriteOnce
  resources:
    requests:
storage: 5Gi
```



NOTE

For information about managing arbiter volumes see, Chapter 10, *Managing Arbitrated Replicated Volumes*

PART III. UPGRADE

CHAPTER 6. UPGRADING YOUR RED HAT OPENSHIFT CONTAINER STORAGE IN CONVERGED MODE

This chapter describes the procedure to upgrade your environment from Container Storage in Converged Mode 3.10 to Red Hat Openshift Container Storage in Converged Mode 3.11.

NOTE

New registry name **registry.redhat.io** is used throughout in this Guide.

However, if you have not migrated to the new **registry** yet then replace all occurrences of **registry.redhat.io** with **registry.access.redhat.com** where ever applicable.

NOTE

Follow the same upgrade procedure to upgrade your environment from Red Hat Openshift Container Storage in Converged Mode 3.11.0 and above to Red Hat Openshift Container Storage in Converged Mode 3.11.4. Ensure that the correct image and version numbers are configured before you start the upgrade process.

The valid images for Red Hat Openshift Container Storage 3.11.4 are:

- registry.redhat.io/rhgs3/rhgs-server-rhel7:v3.11.4
- registry.redhat.io/rhgs3/rhgs-volmanager-rhel7:v3.11.4
- registry.redhat.io/rhgs3/rhgs-gluster-block-prov-rhel7:v3.11.4
- registry.redhat.io/rhgs3/rhgs-s3-server-rhel7:v3.11.4

6.1. UPGRADING THE PODS IN THE GLUSTERFS GROUP

The following sections provide steps to upgrade your Glusterfs pods.

6.1.1. Prerequisites

Ensure the following prerequisites are met:

- Section 3.1.3, “Red Hat OpenShift Container Platform and Red Hat Openshift Container Storage Requirements”
- Ensure to have the supported versions of OpenShift Container Platform with Red Hat Gluster Storage Server and Red Hat Openshift Container Storage. For more information on supported versions, see Section 3.1.1, “Supported Versions”
- Ensure to run the following command to get the latest versions of Ansible templates.

```
# yum update openshift-ansible
```

NOTE

For deployments using cns-deploy tool, the templates are available in the following location:

- gluster template - /usr/share/heketi/templates/glusterfs-template.yaml
- heketi template - /usr/share/heketi/templates/heketi-template.yaml
- glusterblock-provisioner template - /usr/share/heketi/templates/glusterblock-provisioner.yaml

For deployments using ansible playbook the templates are available in the following location:

- gluster template - /usr/share/ansible/openshift-ansible/roles/openshift_storage_glusterfs/files/glusterfs-template.yml
- heketi template - /usr/share/ansible/openshift-ansible/roles/openshift_storage_glusterfs/files/heketi-template.yml
- glusterblock-provisioner template - /usr/share/ansible/openshift-ansible/roles/openshift_storage_glusterfs/files/glusterblock-provisioner.yml

6.1.2. Restoring original label values for /dev/log

NOTE

Follow this procedure only if you are upgrading your environment from Red Hat Container Native Storage 3.9 to Red Hat Openshift Container Storage 3.11.4.

Skip this procedure if you are upgrading your environment from Red Hat Openshift Container Storage 3.10 and above to Red Hat Openshift Container Storage 3.11.4.

To restore the original selinux label, execute the following commands:

1. Create a directory and soft links on all nodes that run gluster pods:

```
# mkdir /srv/<directory_name>
# cd /srv/<directory_name>/   # same dir as above
# ln -sf /dev/null systemd-tmpfiles-setup-dev.service
# ln -sf /dev/null systemd-journald.service
# ln -sf /dev/null systemd-journald.socket
```

2. Edit the daemonset that creates the glusterfs pods on the node which has oc client:

```
# oc edit daemonset <daemonset_name>
```

Under volumeMounts section add a mapping for the volume:

```
- mountPath: /usr/lib/systemd/system/systemd-journald.service
  name: systemd-journald-service
- mountPath: /usr/lib/systemd/system/systemd-journald.socket
```

```
  name: systemd-journald-socket
- mountPath: /usr/lib/systemd/system/systemd-tmpfiles-setup-dev.service
name: systemd-tmpfiles-setup-dev-service
```

Under volumes section add a new host path for each service listed:

NOTE

The path mentioned in here should be the same as mentioned in Step 1.

```
- hostPath:
   path: /srv/<directory_name>/systemd-journald.socket
   type: ""
  name: systemd-journald-socket
- hostPath:
   path: /srv/<directory_name>/systemd-journald.service
   type: ""
  name: systemd-journald-service
- hostPath:
   path: /srv/<directory_name>/systemd-tmpfiles-setup-dev.service
   type: ""
name: systemd-tmpfiles-setup-dev-service
```

3. Run the following command on all nodes that run gluster pods. This will reset the label:

```
# restorecon /dev/log
```

- Execute the following command to check the status of self heal for all volumes:

```
# oc rsh <gluster_pod_name>
# for each_volume in gluster volume list; do gluster volume heal $each_volume info ; done  | grep
"Number of entries: [^0]$"
```

Wait for self-heal to complete.

1. Execute the following command and ensure that the bricks are not more than 90% full:

```
# df -kh | grep -v ^Filesystem | awk '{if($5>"90%") print $0}'
```

2. Execute the following command on any one of the gluster pods to set the maximum number of bricks (250) that can run on a single instance of **glusterfsd** process:

```
# gluster volume set all cluster.max-bricks-per-process 250
```

a. Execute the following command on any one of the gluster pods to ensure that the option is set correctly:

```
# gluster volume get all cluster.max-bricks-per-process
```

For example:

```
# gluster volume get all cluster.max-bricks-per-process
cluster.max-bricks-per-process 250
```

-

3. Execute the following command on the node which has oc client to delete the gluster pod:

```
# oc delete pod <gluster_pod_name>
```

4. To verify if the pod is ready, execute the following command:

```
# oc get pods -l glusterfs=storage-pod
```

5. Login to the node hosting the pod and check the selinux label of /dev/log

```
# ls -lZ /dev/log
```

The output should show devlog_t label

For example:

```
#  ls -lZ /dev/log
srw-rw-rw-. root root system_u:object_r:devlog_t:s0    /dev/log
```

Exit the node.

6. In the gluster pod, check if the label value is devlog_t:

```
# oc rsh <gluster_pod_name>
# ls -lZ /dev/log
```

For example:

```
#  ls -lZ /dev/log
srw-rw-rw-. root root system_u:object_r:devlog_t:s0    /dev/log
```

7. Perform steps 4 to 9 for other pods.

6.1.3. Upgrading if existing version deployed by using cns-deploy

6.1.3.1. Upgrading cns-deploy and Heketi Server

The following commands must be executed on the client machine.

1. Execute the following command to update the heketi client and cns-deploy packages:

```
# yum update cns-deploy -y
# yum update heketi-client -y
```

2. Backup the Heketi database file

```
# heketi-cli db dump > heketi-db-dump-$(date -I).json
```

- Execute the following command to get the current HEKETI_ADMIN_KEY.
  The OCS admin can choose to set any phrase for user key as long as it is not used by their infrastructure. It is not used by any of the OCS default installed resources.

```
oc get secret <heketi-admin-secret> -o jsonpath='{.data.key}'|base64 -d;echo
```

3. Execute the following command to delete the heketi template.

```
# oc delete templates heketi
```

4. Execute the following command to install the heketi template.

```
oc create -f /usr/share/heketi/templates/heketi-template.yaml
template "heketi" created
```

5. Execute the following command to grant the heketi Service Account the necessary privileges.

```
# oc policy add-role-to-user edit system:serviceaccount:<project_name>:heketi-service-account
# oc adm policy add-scc-to-user privileged -z heketi-service-account
```

For example,

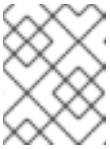
```
# oc policy add-role-to-user edit system:serviceaccount:storage-project:heketi-service-account
# oc adm policy add-scc-to-user privileged -z heketi-service-account
```

6. Execute the following command to generate a new heketi configuration file.

```
# sed -e "s/\${HEKETI_EXECUTOR}/kubernetes/" -e
"s#\${HEKETI_FSTAB}#/var/lib/heketi/fstab#" -e "s/\${SSH_PORT}/22/" -e
"s/\${SSH_USER}/root/" -e "s/\${SSH_SUDO}/false/" -e
"s/\${BLOCK_HOST_CREATE}/true/" -e "s/\${BLOCK_HOST_SIZE}/500/"
"/usr/share/heketi/templates/heketi.json.template" > heketi.json
```

- The **BLOCK_HOST_SIZE** parameter controls the size (in GB) of the automatically created Red Hat Gluster Storage volumes hosting the gluster-block volumes (For more information, see https://access.redhat.com/documentation/en-us/red_hat_openshift_container_storage/3.11/html-single/operations_guide/index#Block_Storage). This default configuration will dynamically create block-hosting volumes of 500GB in size as more space is required.

- Alternatively, copy the file **/usr/share/heketi/templates/heketi.json.template** to **heketi.json** in the current directory and edit the new file directly, replacing each "**${VARIABLE}**" string with the required parameter.

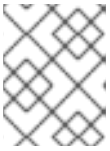


NOTE

JSON formatting is strictly required (e.g. no trailing spaces, booleans in all lowercase).

7. Execute the following command to create a secret to hold the configuration file.

```
# oc create secret generic <heketi-config-secret> --from-file=heketi.json
```



NOTE

If the **heketi-config-secret** file already exists, then delete the file and run the following command.

8. Execute the following command to delete the deployment configuration, service, and route for heketi:

```
# oc delete deploymentconfig,service,route heketi
```

NOTE

The names of these parameters can be referenced from output of the following command:

```
# oc get all | grep heketi
```

9. Execute the following command to edit the heketi template. Edit the HEKETI_USER_KEY and HEKETI_ADMIN_KEY parameters.

```
# oc edit template heketi
parameters:
- description: Set secret for those creating volumes as type user
  displayName: Heketi User Secret
  name: HEKETI_USER_KEY
  value: <heketiuserkey>
- description: Set secret for administration of the Heketi service as user admin
  displayName: Heketi Administrator Secret
  name: HEKETI_ADMIN_KEY
  value: <adminkey>
- description: Set the executor type, kubernetes or ssh
  displayName: heketi executor type
  name: HEKETI_EXECUTOR
  value: kubernetes
- description: Set the hostname for the route URL
  displayName: heketi route name
  name: HEKETI_ROUTE
  value: heketi-storage
- displayName: heketi container image name
  name: IMAGE_NAME
  required: true
  value: registry.redhat.io/rhgs3/rhgs-volmanager-rhel7
- displayName: heketi container image version
  name: IMAGE_VERSION
  required: true
  value: v3.11.4
- description: A unique name to identify this heketi service, useful for running
    multiple heketi instances
  displayName: GlusterFS cluster name
  name: CLUSTER_NAME
value: storage
```

10. Execute the following command to deploy the Heketi service, route, and deployment configuration which will be used to create persistent volumes for OpenShift:

```
# oc process heketi | oc create -f -

 service "heketi" created
 route "heketi" created
deploymentconfig "heketi" created
```

NOTE

It is recommended that the **heketidbstorage** volume be tuned for db workloads. Newly installed Openshift Container Storage deployments tune the heketidbstorage volume automatically. For older deployments, follow the KCS article Planning to run containerized DB or nosql workloads on Openshift Container Storage? and perform the volume set operation for the volume **heketidbstorage**.

11. Execute the following command to verify that the containers are running:

```
# oc get pods
```

For example:

```
# oc get pods
 NAME                          READY     STATUS    RESTARTS   AGE
 glusterfs-0h68l               1/1       Running   0          3d
 glusterfs-0vcf3               1/1       Running   0          3d
 glusterfs-gr9gh               1/1       Running   0          3d
 heketi-1-zpw4d                1/1       Running   0          3h
 storage-project-router-2-db2wl  1/1       Running   0          4d
```

6.1.3.2. Upgrading the Red Hat Gluster Storage Pods

The following commands must be executed on the client machine.

Following are the steps for updating a DaemonSet for glusterfs:

1. Execute the following steps to stop the Heketi pod to prevent it from accepting any new request for volume creation or volume deletion:

   a. Execute the following command to access your project:

   ```
   # oc project <project_name>
   ```

   For example:

   ```
   # oc project storage-project
   ```

   b. Execute the following command to get the **DeploymentConfig**:

   ```
   # oc get ds
   ```

c. Execute the following command to set heketi server to accept requests only from the local-client:

```
# heketi-cli server mode set local-client
```

d. Wait for the ongoing operations to complete and execute the following command to monitor if there are any ongoing operations:

```
# heketi-cli server operations info
```

e. Execute the following command to reduce the replica count from 1 to 0. This brings down the Heketi pod:

```
# oc scale dc <heketi_dc> --replicas=0
```

f. Execute the following command to verify that the heketi pod is no longer present:

```
# oc get pods
```

1. Execute the following command to find the DaemonSet name for gluster

```
# oc get ds
```

2. Execute the following command to delete the DaemonSet:

```
# oc delete ds <ds-name> --cascade=false
```

Using **--cascade=false** option while deleting the old DaemonSet does not delete the gluster pods but deletes only the DaemonSet. After deleting the old DaemonSet, you must load the new one. When you manually delete the old pods, the new pods which are created will have the configurations of the new DaemonSet.

For example,

```
# oc delete ds glusterfs --cascade=false
daemonset "glusterfs" deleted
```

3. Execute the following commands to verify all the old pods are up:

```
# oc get pods
```

For example,

```
# oc get pods
 NAME                          READY     STATUS    RESTARTS   AGE
 glusterfs-0h68l               1/1       Running   0          3d
 glusterfs-0vcf3               1/1       Running   0          3d
 glusterfs-gr9gh               1/1       Running   0          3d
 storage-project-router-2-db2wl  1/1       Running   0          4d
```

4. Execute the following command to delete the old glusterfs template.

```
# oc delete templates glusterfs
```

For example,

```
# oc delete templates glusterfs
template “glusterfs” deleted
```

5. Execute the following command to register new glusterfs template.

```
# oc create -f /usr/share/heketi/templates/glusterfs-template.yaml
```

For example,

```
# oc create -f /usr/share/heketi/templates/glusterfs-template.yaml
 template “glusterfs” created
```

6. Label all the OpenShift Container Platform nodes that has the Red Hat Gluster Storage pods:

   a. Check if the nodes are labelled using the following command:

   ```
   # oc get nodes --show-labels
   ```

   If the Red Hat Gluster Storage nodes do not have the **storagenode=glusterfs** label, then label the nodes as shown in step ii.

   b. Label all the OpenShift Container Platform nodes that has the Red Hat Gluster Storage pods:

   ```
   # oc label nodes <node name> storagenode=glusterfs
   ```

7. Execute the following commands to create the gluster DaemonSet:

```
# oc process glusterfs | oc create -f -
```

For example,

```
# oc process glusterfs | oc create -f -
Deamonset “glusterfs” created
```

8. Execute the following command to identify the old gluster pods that needs to be deleted:

```
# oc get pods
```

For example,

```
# oc get pods
 NAME                          READY     STATUS    RESTARTS   AGE
 glusterfs-0h68l               1/1       Running   0          3d
 glusterfs-0vcf3               1/1       Running   0          3d
 glusterfs-gr9gh               1/1       Running   0          3d
 storage-project-router-2-db2wl  1/1       Running   0          4d
```

9. Execute the following command and ensure that the bricks are not more than 90% full:

```
# df -kh | grep -v ^Filesystem | awk '{if($5>"90%") print $0}'
```

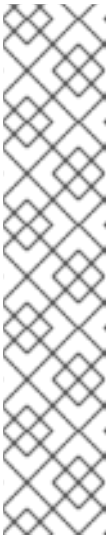
10. Execute the following command to delete the old gluster pods. **Gluster pods should follow rolling upgrade. Hence, you must ensure that the new pod is running before deleting the next old gluster pod. We support OnDelete Strategy DaemonSet update strategy**. With **OnDelete Strategy** update strategy, after you update a DaemonSet template, new DaemonSet pods will only be created when you manually delete old DaemonSet pods.

    a. To delete the old gluster pods, execute the following command:

    ```
    # oc delete pod <gluster_pod>
    ```

    For example,

    ```
    # oc delete pod glusterfs-0vcf3
    pod  “glusterfs-0vcf3” deleted
    ```

    NOTE

    Before deleting the next pod, self heal check has to be made:

    1. Run the following command to access shell on gluster pod:

    ```
    # oc rsh <gluster_pod_name>
    ```

    2. Run the following command to check the self-heal status of all the volumes:

    ```
    for each_volume in gluster volume list;
      do gluster volume heal $each_volume info ;
    done | grep "Number of entries: [^0]$"
    ```

    b. The delete pod command will terminate the old pod and create a new pod. Run **# oc get pods -w** and check the **Age** of the pod and **READY** status should be 1/1. The following is the example output showing the status progression from termination to creation of the pod.

    ```
    # oc get pods -w
      NAME                    READY     STATUS        RESTARTS   AGE
      glusterfs-0vcf3           1/1       Terminating   0          3d
    …
    ```

11. Execute the following command to verify that the pods are running:

```
# oc get pods
```

For example,

```
# oc get pods
 NAME                    READY     STATUS    RESTARTS   AGE
 glusterfs-j241c           1/1       Running   0          4m
```

```
glusterfs-pqfs6                 1/1       Running   0          7m
glusterfs-wrn6n                 1/1       Running   0          12m
storage-project-router-2-db2wl  1/1       Running   0          4d
```

12. Execute the following command to verify if you have upgraded the pod to the latest version:

```
# oc rsh <gluster_pod_name> glusterd --version
```

For example:

```
 # oc rsh glusterfs-4cpcc glusterd --version
glusterfs 6.0
```

13. Check the Red Hat Gluster Storage op-version by executing the following command on one of the gluster pods.

```
# gluster vol get all cluster.op-version
```

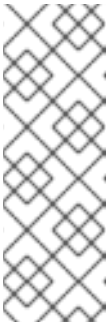
14. Set the cluster.op-version to 70000 on any one of the pods:

IMPORTANT

Ensure all the gluster pods are updated before changing the cluster.op-version.

```
# gluster --timeout=3600 volume set all cluster.op-version 70000
```

- Execute the following steps to enable server.tcp-user-timeout on all volumes.



NOTE

The "server.tcp-user-timeout" option specifies the maximum amount of the time (in seconds) the transmitted data from the application can remain unacknowledged from the brick.

It is used to detect force disconnections and dead connections (if a node dies unexpectedly, a firewall is activated, etc.,) early and make it possible for applications to reduce the overall failover time.

a. List the glusterfs pod using the following command:

```
# oc get pods
```

For example:

```
# oc get pods
  NAME                          READY     STATUS    RESTARTS   AGE
  glusterfs-0h68l               1/1       Running   0          3d
  glusterfs-0vcf3               1/1       Running   0          3d
  glusterfs-gr9gh               1/1       Running   0          3d
storage-project-router-2-db2wl  1/1       Running   0          4d
```

b. Remote shell into one of the glusterfs pods. For example:

```
# oc rsh glusterfs-0vcf3
```

c. Execute the following command:

```
# for eachVolume in gluster volume list; do echo $eachVolume; gluster volume set
$eachVolume server.tcp-user-timeout 42 ; done
```

For example:

```
# for eachVolume in gluster volume list; do echo $eachVolume; gluster volume set
$eachVolume server.tcp-user-timeout 42 ; done
  volume1
  volume set: success
  volume2
volume set: success
```

15. If a gluster-block-provisoner-pod already exists then delete it by executing the following commands:

```
# oc delete dc glusterblock-provisioner-dc
```

For example:

```
# oc delete dc glusterblock-storage-provisioner-dc
```

16. Delete the following resources from the old pod:

```
# oc delete clusterroles.authorization.openshift.io glusterblock-provisioner-runner
# oc delete serviceaccounts glusterblock-provisioner
serviceaccount "glusterblock-provisioner" deleted
# oc delete clusterrolebindings.authorization.openshift.io glusterblock-provisioner
```

17. Execute the following commands to deploy the gluster-block provisioner:

```
# sed -e 's/\\\${NAMESPACE}/<NAMESPACE>/' /usr/share/heketi/templates/glusterblock-
provisioner.yaml | oc create -f -
```

```
# oc adm policy add-cluster-role-to-user glusterblock-provisioner-runner
system:serviceaccount:<NAMESPACE>:glusterblock-provisioner
```

For example:

```
# sed -e 's/\\\${NAMESPACE}/storage-project/' /usr/share/heketi/templates/glusterblock-
provisioner.yaml | oc create -f -
```

```
# oc adm policy add-cluster-role-to-user glusterblock-provisioner-runner
system:serviceaccount:storage-project:glusterblock-provisioner
```

18. Brick multiplexing is a feature that allows adding multiple bricks into one process. This reduces resource consumption and allows us to run more bricks than before with the same memory consumption. It is enabled by default from Container-Native Storage 3.6. During an upgrade

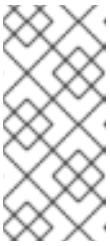
from Container-Native Storage 3.10 to Red Hat Openshift Container Storage 3.11, to turn brick multiplexing on, execute the following commands:

a. To exec into the Gluster pod, execute the following command and rsh into any of the gluster pods:

```
# oc rsh <gluster_pod_name>
```

b. Verify if brick multiplexing is enabled. If it is disabled, then execute the following command to enable brick multiplexing:

```
# gluster volume set all cluster.brick-multiplex on
```



NOTE

You can check the brick multiplex status by executing the following command:

```
# gluster v get all all
```

For example:

```
# oc rsh glusterfs-770ql

 sh-4.2# gluster volume set all cluster.brick-multiplex on
 Brick-multiplexing is supported only for container workloads (Independent/Converged).
Also it is advised to make sure that either all volumes are in stopped state or no bricks
are running before this option is modified.Do you still want to continue? (y/n) y
volume set: success
```

c. List all the volumes in the trusted storage pool. This step is only required if the volume set operation is performed:
For example:

```
# gluster volume list

 heketidbstorage
 vol_194049d2565d2a4ad78ef0483e04711e
 ...
 ...
```

Restart all the volumes. This step is only required if the volume set operation is performed along with the previous step:

```
# gluster vol stop <VOLNAME>
# gluster vol start <VOLNAME>
```

19. Support for S3 compatible Object Store in Red Hat Openshift Container Storage is under technology preview. To enable S3 compatible object store, see https://access.redhat.com/documentation/en-us/red_hat_openshift_container_storage/3.11/html/operations_guide/s3_object_store.

NOTE

- If you have glusterfs registry pods, then proceed with the steps listed in Section 6.2, "Upgrading the pods in the glusterfs registry group" to upgrade heketi and glusterfs registry pods.
- If you do not have glusterfs registry pods, then proceed with the steps listed in] to bring back your heketi pod and then proceed with the steps listed in xref:chap-upgrade_client_common[to upgrade the client on Red Hat Openshift Container Platform Nodes.

6.1.4. Upgrading if existing version deployed by using Ansible

6.1.4.1. Upgrading Heketi Server

The following commands must be executed on the client machine.

1. Execute the following command to update the heketi client packages:

```
# yum update heketi-client -y
```

2. Backup the Heketi database file

```
# heketi-cli db dump > heketi-db-dump-$(date -I).json
```

3. Execute the following command to get the current HEKETI_ADMIN_KEY.
The OCS admin can choose to set any phrase for user key as long as it is not used by their infrastructure. It is not used by any of the OCS default installed resources.

```
# oc get secret heketi-storage-admin-secret -o jsonpath='{.data.key}'|base64 -d;echo
```

4. Execute the following command to delete the heketi template.

```
# oc delete templates heketi
```

5. Execute the following command to install the heketi template.

```
# oc create -f /usr/share/ansible/openshift-
ansible/roles/openshift_storage_glusterfs/files/heketi-template.yml
template "heketi" created
```

6. Execute the following step to edit the template:

```
# oc get templates
NAME     DESCRIPTION       PARAMETERS  OBJECTS
glusterblock-provisioner  glusterblock provisioner   3 (2 blank) 4
    template
glusterfs    GlusterFS DaemonSet       5 (1 blank) 1
    template
heketi     Heketi service deployment  7 (3 blank) 3
template
```

If the existing template has IMAGE_NAME and IMAGE_VERSION as two parameters, then edit the template to change the HEKETI_USER_KEY, HEKETI_ADMIN_KEY, HEKETI_ROUTE, IMAGE_NAME, IMAGE_VERSION, and CLUSTER_NAME as shown in the example below.

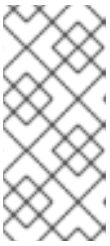
```
# oc edit template heketi
parameters:
  - description: Set secret for those creating volumes as type user
  displayName: Heketi User Secret
  name: HEKETI_USER_KEY
  value: <heketiuserkey>
  - description: Set secret for administration of the Heketi service as user admin
  displayName: Heketi Administrator Secret
  name: HEKETI_ADMIN_KEY
  value: <adminkey>
  - description: Set the executor type, kubernetes or ssh
  displayName: heketi executor type
  name: HEKETI_EXECUTOR
  value: kubernetes
  - description: Set the hostname for the route URL
  displayName: heketi route name
  name: HEKETI_ROUTE
  value: heketi-storage
  - displayName: heketi container image name
  name: IMAGE_NAME
  required: true
  value: registry.redhat.io/rhgs3/rhgs-volmanager-rhel7
  - displayName: heketi container image version
  name: IMAGE_VERSION
  required: true
  value: v3.11.4
  - description: A unique name to identify this heketi service, useful for running
  multiple heketi instances
  displayName: GlusterFS cluster name
  name: CLUSTER_NAME
  value: storage
```

If the template has only IMAGE_NAME, then edit the template to change the HEKETI_USER_KEY, HEKETI_ADMIN_KEY, HEKETI_ROUTE, IMAGE_NAME and CLUSTER_NAME as shown in the example below.

```
# oc edit template heketi
parameters:
- description: Set secret for those creating volumes as type user
  displayName: Heketi User Secret
  name: HEKETI_USER_KEY
  value: <heketiuserkey>
- description: Set secret for administration of the Heketi service as user admin
  displayName: Heketi Administrator Secret
  name: HEKETI_ADMIN_KEY
  value: <adminkey>
- description: Set the executor type, kubernetes or ssh
  displayName: heketi executor type
  name: HEKETI_EXECUTOR
  value: kubernetes
- description: Set the hostname for the route URL
  displayName: heketi route name
```

```
  name: HEKETI_ROUTE
  value: heketi-storage
- displayName: heketi container image name
  name: IMAGE_NAME
  required: true
  value: registry.redhat.io/rhgs3/rhgs-volmanager-rhel7:v3.11.4
- description: A unique name to identify this heketi service, useful for running
    multiple heketi instances
  displayName: GlusterFS cluster name
  name: CLUSTER_NAME
value: storage
```

7. Execute the following command to delete the deployment configuration, service, and route for heketi:



NOTE

The names of these parameters can be referenced from output of the following command:

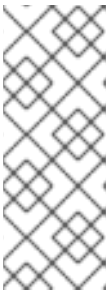
```
# oc get all | grep heketi
```

```
# oc delete deploymentconfig,service,route heketi-storage
```

8. Execute the following command to deploy the Heketi service, route, and deployment configuration which will be used to create persistent volumes for OpenShift:

```
# oc process heketi | oc create -f -

service "heketi" created
route "heketi" created
deploymentconfig "heketi" created
```



NOTE

It is recommended that the **heketidbstorage** volume be tuned for db workloads. Newly installed Openshift Container Storage deployments tune the heketidbstorage volume automatically. For older deployments, follow the KCS article Planning to run containerized DB or nosql workloads on Openshift Container Storage? and perform the volume set operation for the volume **heketidbstorage**.

9. Execute the following command to verify that the containers are running:

```
# oc get pods
```

For example:

```
# oc get pods
 NAME                READY    STATUS    RESTARTS   AGE
 glusterfs-0h68l     1/1      Running   0          3d
 glusterfs-0vcf3     1/1      Running   0          3d
```

```
glusterfs-gr9gh                 1/1       Running   0          3d
heketi-1-zpw4d                  1/1       Running   0          3h
storage-project-router-2-db2wl  1/1       Running   0          4d
```

6.1.4.2. Upgrading the Red Hat Gluster Storage Pods

The following commands must be executed on the client machine.

Following are the steps for updating a DaemonSet for glusterfs:

1. Execute the following steps to stop the Heketi pod to prevent it from accepting any new request for volume creation or volume deletion:

   a. Execute the following command to access your project:

   ```
   # oc project <project_name>
   ```

   For example:

   ```
   # oc project storage-project
   ```

   b. Execute the following command to get the **DeploymentConfig**:

   ```
   # oc get dc
   ```

   c. Execute the following command to set heketi server to accept requests only from the local-client:

   ```
   # heketi-cli server mode set local-client
   ```

   d. Wait for the ongoing operations to complete and execute the following command to monitor if there are any ongoing operations:

   ```
   # heketi-cli server operations info
   ```

   e. Execute the following command to reduce the replica count from 1 to 0. This brings down the Heketi pod:

   ```
   # oc scale dc <heketi_dc> --replicas=0
   ```

   f. Execute the following command to verify that the heketi pod is no longer present:

   ```
   # oc get pods
   ```

2. Execute the following command to find the DaemonSet name for gluster

   ```
   # oc get ds
   ```

3. Execute the following command to delete the DaemonSet:

   ```
   # oc delete ds <ds-name> --cascade=false
   ```

Using **--cascade=false** option while deleting the old DaemonSet does not delete the gluster pods but deletes only the DaemonSet. After deleting the old DaemonSet, you must load the new one. When you manually delete the old pods, the new pods which are created will have the configurations of the new DaemonSet.

For example,

```
# oc delete ds glusterfs-storage --cascade=false
daemonset "glusterfs-storage" deleted
```

4. Execute the following commands to verify all the old pods are up:

```
# oc get pods
```

For example,

```
# oc get pods
NAME                           READY     STATUS    RESTARTS   AGE
glusterfs-0h68l                1/1       Running   0          3d
glusterfs-0vcf3                1/1       Running   0          3d
glusterfs-gr9gh                1/1       Running   0          3d
storage-project-router-2-db2wl   1/1       Running   0          4d
```

5. Execute the following command to delete the old glusterfs template.

```
# oc delete templates glusterfs
```

6. Execute the following command to register new glusterfs template.

```
# oc create -f /usr/share/ansible/openshift-
ansible/roles/openshift_storage_glusterfs/files/glusterfs-template.yml
template "glusterfs" created
```

7. Execute the following command to edit the old glusterfs template.

```
# oc get templates
NAME     DESCRIPTION       PARAMETERS  OBJECTS
glusterblock-provisioner  glusterblock provisioner   3 (2 blank) 4
        template
glusterfs    GlusterFS DaemonSet       5 (1 blank) 1
        template
heketi     Heketi service deployment  7 (3 blank) 3
template
```

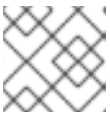
If the template has IMAGE_NAME and IMAGE_VERSION as two separate parameters, then update the glusterfs template as following. For example:

```
# oc edit template glusterfs
- displayName: GlusterFS container image name
  name: IMAGE_NAME
  required: true
  value: registry.redhat.io/rhgs3/rhgs-server-rhel7
- displayName: GlusterFS container image version
```

```
    name: IMAGE_VERSION
    required: true
    value: v3.11.4
- description: A unique name to identify which heketi service manages this cluster, useful for
running
      multiple heketi instances
  displayName: GlusterFS cluster name
  name: CLUSTER_NAME
  value: storage
```

If the template has only IMAGE_NAME as a parameter, then update the glusterfs template as following. For example:

```
# oc edit template glusterfs
- displayName: GlusterFS container image name
  name: IMAGE_NAME
  required: true
  value: registry.redhat.io/rhgs3/rhgs-server-rhel7:v3.11.4
- description: A unique name to identify which heketi service manages this cluster, useful for
running
      multiple heketi instances
  displayName: GlusterFS cluster name
  name: CLUSTER_NAME
value: storage
```



NOTE

Ensure that the CLUSTER_NAME variable is set to the correct value

8. Label all the OpenShift Container Platform nodes that has the Red Hat Gluster Storage pods:

   a. Check if the nodes are labelled using the following command:

      ```
      # oc get nodes --show-labels
      ```

      If the Red Hat Gluster Storage nodes do not have the **glusterfs=storage-host** label, then label the nodes as shown in step ii.

   b. Label all the OpenShift Container Platform nodes that has the Red Hat Gluster Storage pods:

      ```
      # oc label nodes <node name> glusterfs=storage-host
      ```

9. Execute the following commands to create the gluster DaemonSet:

   ```
   # oc process glusterfs | oc create -f -
   ```

   For example,

   ```
   # oc process glusterfs | oc create -f -
   Deamonset “glusterfs” created
   ```

   - Execute the following command to identify the old gluster pods that needs to be deleted:

     -

```
# oc get pods
```

For example,

```
# oc get pods
NAME                                READY     STATUS    RESTARTS   AGE
glusterfs-0h68l                     1/1       Running   0          3d
glusterfs-0vcf3                     1/1       Running   0          3d
glusterfs-gr9gh                     1/1       Running   0          3d
storage-project-router-2-db2wl      1/1       Running   0          4d
```

10. Execute the following command and ensure that the bricks are not more than 90% full:

```
# df -kh | grep -v ^Filesystem | awk '{if($5>"90%") print $0}'
```

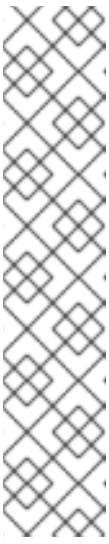
11. Execute the following command to delete the old gluster pods. **Gluster pods should follow rolling upgrade. Hence, you must ensure that the new pod is running before deleting the next old gluster pod. We support OnDelete Strategy DaemonSet update strategy**. With **OnDelete Strategy** update strategy, after you update a DaemonSet template, new DaemonSet pods will only be created when you manually delete old DaemonSet pods.

    a. To delete the old gluster pods, execute the following command:

```
# oc delete pod <gluster_pod>
```

    For example,

```
# oc delete pod glusterfs-0vcf3
pod  “glusterfs-0vcf3” deleted
```



NOTE

Before deleting the next pod, self heal check has to be made:

1. Run the following command to access shell on gluster pod:

```
# oc rsh <gluster_pod_name>
```

2. Run the following command to check the self-heal status of all the volumes:

```
for each_volume in gluster volume list;
    do gluster volume heal $each_volume info ;
done | grep "Number of entries: [^0]$"
```

    b. The delete pod command will terminate the old pod and create a new pod. Run **# oc get pods -w** and check the **Age** of the pod and **READY** status should be 1/1. The following is the example output showing the status progression from termination to creation of the pod.

```
# oc get pods -w
NAME                                READY     STATUS        RESTARTS   AGE
glusterfs-0vcf3                     1/1       Terminating   0          3d
```

```
...
```

12. Execute the following command to verify that the pods are running:

```
# oc get pods
```

For example,

```
# oc get pods
NAME                           READY     STATUS    RESTARTS   AGE
glusterfs-j241c                1/1       Running   0          4m
glusterfs-pqfs6                1/1       Running   0          7m
glusterfs-wrn6n                1/1       Running   0          12m
storage-project-router-2-db2wl   1/1       Running   0          4d
```

13. Execute the following command to verify if you have upgraded the pod to the latest version:

```
# oc rsh <gluster_pod_name> glusterd --version
```

For example:

```
# oc rsh glusterfs-4cpcc glusterd --version
glusterfs 6.0
```

14. Check the Red Hat Gluster Storage op-version by executing the following command on one of the gluster pods.

```
# gluster vol get all cluster.op-version
```

15. Set the cluster.op-version to 70000 on any one of the pods:

NOTE

Ensure all the gluster pods are updated before changing the cluster.op-version.

```
# gluster --timeout=3600 volume set all cluster.op-version 70000
```

16. Execute the following steps to enable server.tcp-user-timeout on all volumes.

NOTE

The "server.tcp-user-timeout" option specifies the maximum amount of the time (in seconds) the transmitted data from the application can remain unacknowledged from the brick.

It is used to detect force disconnections and dead connections (if a node dies unexpectedly, a firewall is activated, etc.,) early and make it possible for applications to reduce the overall failover time.

a. List the glusterfs pod using the following command:

```
# oc get pods
```

For example:

```
# oc get pods
  NAME                          READY     STATUS    RESTARTS   AGE
  glusterfs-0h68l               1/1       Running   0          3d
  glusterfs-0vcf3               1/1       Running   0          3d
  glusterfs-gr9gh               1/1       Running   0          3d
storage-project-router-2-db2wl  1/1       Running   0          4d
```

b. Remote shell into one of the glusterfs pods. For example:

```
# oc rsh glusterfs-0vcf3
```

c. Execute the following command:

```
# for eachVolume in gluster volume list; do echo $eachVolume; gluster volume set
$eachVolume server.tcp-user-timeout 42 ; done
```

For example:

```
# for eachVolume in gluster volume list; do echo $eachVolume; gluster volume set
$eachVolume server.tcp-user-timeout 42 ; done
  volume1
  volume set: success
  volume2
volume set: success
```

17. If a gluster-block-provisoner-pod already exists then delete it by executing the following commands:

```
# oc delete dc glusterblock-provisioner-dc
```

For example:

```
# oc delete dc glusterblock-storage-provisioner-dc
```

18. Execute the following command to delete the old glusterblock provisioner template.

```
# oc delete templates glusterblock-provisioner
```

19. Execute the following command to register new glusterblock provisioner template, see Templates. Copy and paste to **new-block-prov.yaml**. For example,

```
# oc create -f new-block-prov.yaml
template.template.openshift.io/glusterblock-provisioner created
```

20. Depending on the OCP version, edit the glusterblock-provisioner template to change the IMAGE_NAME, IMAGE_VERSION and NAMESPACE.

```
# oc get templates
```

```
NAME     DESCRIPTION       PARAMETERS  OBJECTS
glusterblock-provisioner  glusterblock provisioner   3 (2 blank) 4
        template
glusterfs    GlusterFS DaemonSet       5 (1 blank) 1
        template
heketi     Heketi service deployment  7 (3 blank) 3
template
```

If the template has IMAGE_NAME and IMAGE_VERSION as two separate parameters, then update the glusterblock-provisioner template as following. For example:

```
# oc edit template glusterblock-provisioner
- displayName: glusterblock provisioner container image name
name: IMAGE_NAME
required: true
value: registry.redhat.io/rhgs3/rhgs-gluster-block-prov-rhel7
- displayName: glusterblock provisioner container image version
name: IMAGE_VERSION
required: true
value: v3.11.4
- description: The namespace in which these resources are being created
displayName: glusterblock provisioner namespace
name: NAMESPACE
required: true
value: glusterfs
- description: A unique name to identify which heketi service manages this cluster,
  useful for running multiple heketi instances
displayName: GlusterFS cluster name
name: CLUSTER_NAME
value: storage
```

If the template has only IMAGE_NAME as a parameter, then update the glusterblock-provisioner template as following. For example:

```
# oc edit template glusterblock-provisioner
- displayName: glusterblock provisioner container image name
name: IMAGE_NAME
required: true
value: registry.redhat.io/rhgs3/rhgs-gluster-block-prov-rhel7:v3.11.4
- description: The namespace in which these resources are being created
displayName: glusterblock provisioner namespace
name: NAMESPACE
required: true
value: glusterfs
- description: A unique name to identify which heketi service manages this cluster,
        useful for running multiple heketi instances
displayName: GlusterFS cluster name
name: CLUSTER_NAME
value: storage
```

21. Delete the following resources from the old pod

```
# oc delete clusterroles.authorization.openshift.io glusterblock-provisioner-runner
# oc delete serviceaccounts glusterblock-storage-provisioner
# oc delete clusterrolebindings.authorization.openshift.io glusterblock-storage-provisioner
```

22. Before running oc process determine the correct **provisioner** name. If there are more than one **gluster block provisioner** running in your cluster the names must differ from all other **provisioners**.
For example,

    - If there are 2 or more provisioner the name should be **gluster.org/glusterblock-<namespace>** where, namespace is replaced by the namespace that the provisioner is deployed in.

    - If there is only one provisioner, installed prior to 3.11.4, **gluster.org/glusterblock** is sufficent. If the name currently in use already has a unique namespace suffix, reuse the existing name.

23. After editing the template, execute the following command to create the deployment configuration:

    ```
    # oc process -p PROVISIONER_NAME=<provisioner-name> glusterblock-provisioner -o yaml | oc create -f -
    ```

    For example:

    ```
    # oc process -p PROVISIONER_NAME=gluster.org/glusterblock-app-storage glusterblock-provisioner -o yaml | oc create -f -
    clusterrole.authorization.openshift.io/glusterblock-provisioner-runner created
    serviceaccount/glusterblock-storage-provisioner created
    clusterrolebinding.authorization.openshift.io/glusterblock-storage-provisioner created
    deploymentconfig.apps.openshift.io/glusterblock-storage-provisioner-dc created
    ```

24. Brick multiplexing is a feature that allows adding multiple bricks into one process. This reduces resource consumption and allows us to run more bricks than before with the same memory consumption. It is enabled by default from Container-Native Storage 3.6. During an upgrade from Container-Native Storage 3.10 to Red Hat Openshift Container Storage 3.11, to turn brick multiplexing on, execute the following commands:

    a. To exec into the Gluster pod, execute the following command and rsh into any of the gluster pods:

    ```
    # oc rsh <gluster_pod_name>
    ```

    b. Verify if brick multiplexing is enabled. If it is disabled, then execute the following command to enable brick multiplexing:

    ```
    # gluster volume set all cluster.brick-multiplex on
    ```

    NOTE

    You can check the brick multiplex status by executing the following command:

    ```
    # gluster v get all all
    ```

    For example:

    ```
    # oc rsh glusterfs-770ql
    ```

```
sh-4.2# gluster volume set all cluster.brick-multiplex on
Brick-multiplexing is supported only for container workloads (Independent/Converged).
Also it is advised to make sure that either all volumes are in stopped state or no bricks
are running before this option is modified.Do you still want to continue? (y/n) y
volume set: success
```

c. List all the volumes in the trusted storage pool. This step is only required if the volume set operation is performed:
For example:

```
# gluster volume list

heketidbstorage
vol_194049d2565d2a4ad78ef0483e04711e
...
...
```

Restart all the volumes. This step is only required if the volume set operation is performed along with the previous step:

```
# gluster vol stop <VOLNAME>
# gluster vol start <VOLNAME>
```

25. Support for S3 compatible Object Store in Red Hat Openshift Container Storage is under technology preview. To enable S3 compatible object store, see https://access.redhat.com/documentation/en-us/red_hat_openshift_container_storage/3.11/html/operations_guide/s3_object_store.

NOTE

- If you have glusterfs registry pods, then proceed with the steps listed in Section 6.2, “Upgrading the pods in the glusterfs registry group” to upgrade heketi and glusterfs registry pods.
- If you do not have glusterfs registry pods, then proceed with the steps listed in] to bring back your heketi pod and then proceed with the steps listed in xref:chap-upgrade_client_common[to upgrade the client on Red Hat Openshift Container Platform Nodes.

26. All storage classes that use gluster block volume provisioning must match exactly to one of the provisioner names in the cluster. To check the list of storage classes that refer to a **block provisioner**, in a given **namespace**, run the following command:

```
# oc get sc -o custom-
columns=NAME:.metadata.name,PROV:.provisioner,RSNS:.parameters.restsecretnamespace
| grep 'gluster.org/glusterblock' | grep <namespace>
```

Example:

```
# oc get sc -o custom-
columns=NAME:.metadata.name,PROV:.provisioner,RSNS:.parameters.restsecretnamespace
| grep 'gluster.org/glusterblock' | grep app-storage
glusterfs-storage-block   gluster.org/glusterblock-app-storage   app-storage
```

Check each storage class **provisioner name**, if it does not match the **block provisioner name** configured for that **namespace** it must be updated. If the **block provisioner** name already matches the **configured provisioner** name, nothing else needs to be done. Use the list generated above and include all storage class names where the provionser name must be updated.
For every storage class in this list do the following:

```
# oc get sc -o yaml <storageclass> > storageclass-to-edit.yaml
# oc delete sc <storageclass>
# sed 's,gluster.org/glusterblock$,gluster.org/glusterblock-<namespace>,' storageclass-to-edit.yaml | oc create -f -
```

Example:

```
# oc get sc -o yaml gluster-storage-block > storageclass-to-edit.yaml
# oc delete sc gluster-storage-block
# sed 's,gluster.org/glusterblock$,gluster.org/glusterblock-app-storage,' storageclass-to-edit.yaml | oc create -f -
```

6.2. UPGRADING THE PODS IN THE GLUSTERFS REGISTRY GROUP

The following sections provide steps to upgrade your glusterfs registry pods.

6.2.1. Prerequisites

Ensure the following prerequisites are met:

- Section 3.1.3, “Red Hat OpenShift Container Platform and Red Hat Openshift Container Storage Requirements”
- Ensure to have the supported versions of OpenShift Container Platform with Red Hat Gluster Storage Server and Red Hat Openshift Container Storage. For more information on supported versions, see Section 3.1.1, “Supported Versions”
- Ensure to run the following command to get the latest versions of Ansible templates.

```
# yum update openshift-ansible
```

NOTE

For deployments using cns-deploy tool, the templates are available in the following location:

- gluster template - /usr/share/heketi/templates/glusterfs-template.yaml
- heketi template - /usr/share/heketi/templates/heketi-template.yaml
- glusterblock-provisioner template - /usr/share/heketi/templates/glusterblock-provisioner.yaml

For deployments using ansible playbook the templates are available in the following location:

- gluster template - /usr/share/ansible/openshift-ansible/roles/openshift_storage_glusterfs/files/glusterfs-template.yml
- heketi template - /usr/share/ansible/openshift-ansible/roles/openshift_storage_glusterfs/files/heketi-template.yml
- glusterblock-provisioner template - /usr/share/ansible/openshift-ansible/roles/openshift_storage_glusterfs/files/glusterblock-provisioner.yml

6.2.2. Restoring original label values for /dev/log

NOTE

Follow this procedure only if you are upgrading your environment from Red Hat Container Native Storage 3.9 to Red Hat Openshift Container Storage 3.11.4.

Skip this procedure if you are upgrading your environment from Red Hat Openshift Container Storage 3.10 and above to Red Hat Openshift Container Storage 3.11.4.

To restore the original selinux label, execute the following commands:

1. Create a directory and soft links on all nodes that run gluster pods:

```
# mkdir /srv/<directory_name>
# cd /srv/<directory_name>/   # same dir as above
# ln -sf /dev/null systemd-tmpfiles-setup-dev.service
# ln -sf /dev/null systemd-journald.service
# ln -sf /dev/null systemd-journald.socket
```

2. Edit the daemonset that creates the glusterfs pods on the node which has oc client:

```
# oc edit daemonset <daemonset_name>
```

Under volumeMounts section add a mapping for the volume:

```
- mountPath: /usr/lib/systemd/system/systemd-journald.service
  name: systemd-journald-service
- mountPath: /usr/lib/systemd/system/systemd-journald.socket
```

```
  name: systemd-journald-socket
- mountPath: /usr/lib/systemd/system/systemd-tmpfiles-setup-dev.service
name: systemd-tmpfiles-setup-dev-service
```

Under volumes section add a new host path for each service listed:

NOTE

The path mentioned in here should be the same as mentioned in Step 1.

```
- hostPath:
   path: /srv/<directory_name>/systemd-journald.socket
   type: ""
  name: systemd-journald-socket
- hostPath:
   path: /srv/<directory_name>/systemd-journald.service
   type: ""
  name: systemd-journald-service
- hostPath:
   path: /srv/<directory_name>/systemd-tmpfiles-setup-dev.service
   type: ""
name: systemd-tmpfiles-setup-dev-service
```

3. Run the following command on all nodes that run gluster pods. This will reset the label:

```
# restorecon /dev/log
```

4. Execute the following command to check the status of self heal for all volumes:

```
# oc rsh <gluster_pod_name>
# for each_volume in gluster volume list; do gluster volume heal $each_volume info ; done  |
grep  "Number of entries: [^0]$"
```

Wait for self-heal to complete.

5. Execute the following command and ensure that the bricks are not more than 90% full:

```
# df -kh | grep -v ^Filesystem | awk '{if($5>"90%") print $0}'
```

6. Execute the following command on any one of the gluster pods to set the maximum number of bricks (250) that can run on a single instance of **glusterfsd** process:

```
# gluster volume set all cluster.max-bricks-per-process 250
```

   a. Execute the following command on any one of the gluster pods to ensure that the option is set correctly:

```
# gluster volume get all cluster.max-bricks-per-process
```

   For example:

```
# gluster volume get all cluster.max-bricks-per-process
cluster.max-bricks-per-process 250
```

-

7. Execute the following command on the node which has oc client to delete the gluster pod:

```
# oc delete pod <gluster_pod_name>
```

8. To verify if the pod is ready, execute the following command:

```
# oc get pods -l glusterfs=registry-pod
```

9. Login to the node hosting the pod and check the selinux label of /dev/log

```
# ls -lZ /dev/log
```

The output should show devlog_t label

For example:

```
#  ls -lZ /dev/log
srw-rw-rw-. root root system_u:object_r:devlog_t:s0    /dev/log
```

Exit the node.

10. In the gluster pod, check if the label value is devlog_t:

```
# oc rsh <gluster_pod_name>
# ls -lZ /dev/log
```

For example:

```
#  ls -lZ /dev/log
srw-rw-rw-. root root system_u:object_r:devlog_t:s0    /dev/log
```

11. Perform steps 4 to 9 for other pods.

6.2.3. Upgrading if existing version deployed by using cns-deploy

6.2.3.1. Upgrading cns-deploy and Heketi Server

The following commands must be executed on the client machine.

1. Execute the following command to update the heketi client and cns-deploy packages:

```
# yum update cns-deploy -y
# yum update heketi-client -y
```

2. Backup the Heketi registry database file

```
# heketi-cli db dump > heketi-db-dump-$(date -I).json
```

3. Execute the following command to delete the heketi template.

```
# oc delete templates heketi
```

4. Execute the following command to get the current HEKETI_ADMIN_KEY.
The OCS admin can choose to set any phrase for user key as long as it is not used by their infrastructure. It is not used by any of the OCS default installed resources.

```
# oc get secret <heketi-admin-secret-name> -o jsonpath='{.data.key}'|base64 -d;echo
```

5. Execute the following command to install the heketi template.

```
# oc create -f /usr/share/heketi/templates/heketi-template.yaml
template "heketi" created
```

6. Execute the following command to grant the heketi Service Account the necessary privileges.

```
# oc policy add-role-to-user edit system:serviceaccount:<project_name>:heketi-service-account
# oc adm policy add-scc-to-user privileged -z heketi-service-account
```

For example,

```
# oc policy add-role-to-user edit system:serviceaccount:storage-project:heketi-service-account
# oc adm policy add-scc-to-user privileged -z heketi-service-account
```

NOTE

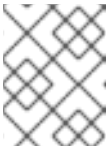
The service account used in heketi pod needs to be privileged because Heketi/rhgs-volmanager pod mounts the heketidb storage Gluster volume as a "glusterfs" volume type and not as a PersistentVolume (PV).
As per the security-context-constraints regulations in OpenShift, ability to mount volumes which are not of the type configMap, downwardAPI, emptyDir, hostPath, nfs, persistentVolumeClaim, secret is granted only to accounts with privileged Security Context Constraint (SCC).

7. Execute the following command to generate a new heketi configuration file.

```
# sed -e "s/\${HEKETI_EXECUTOR}/kubernetes/" -e
"s#\${HEKETI_FSTAB}#/var/lib/heketi/fstab#" -e "s/\${SSH_PORT}/22/" -e
"s/\${SSH_USER}/root/" -e "s/\${SSH_SUDO}/false/" -e
"s/\${BLOCK_HOST_CREATE}/true/" -e "s/\${BLOCK_HOST_SIZE}/500/"
"/usr/share/heketi/templates/heketi.json.template" > heketi.json
```

- The **BLOCK_HOST_SIZE** parameter controls the size (in GB) of the automatically created Red Hat Gluster Storage volumes hosting the gluster-block volumes (For more information, see https://access.redhat.com/documentation/en-us/red_hat_openshift_container_storage/3.11/html-single/operations_guide/index#Block_Storage). This default configuration will dynamically create block-hosting volumes of 500GB in size as more space is required.

- Alternatively, copy the file **/usr/share/heketi/templates/heketi.json.template** to **heketi.json** in the current directory and edit the new file directly, replacing each "**${VARIABLE}**" string with the required parameter.

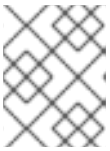


NOTE

JSON formatting is strictly required (e.g. no trailing spaces, booleans in all lowercase).

8. Execute the following command to create a secret to hold the configuration file.

```
# oc create secret generic <heketi-registry-config-secret> --from-file=heketi.json
```



NOTE

If the **heketi-registry-config-secret** file already exists, then delete the file and run the following command.

9. Execute the following command to delete the deployment configuration, service, and route for heketi:

```
# oc delete deploymentconfig,service,route heketi-registry
```

10. Execute the following command to edit the heketi template. Edit the HEKETI_USER_KEY and HEKETI_ADMIN_KEY parameters.

```
# oc edit template heketi
parameters:
- description: Set secret for those creating volumes as type user
  displayName: Heketi User Secret
  name: HEKETI_USER_KEY
  value: <heketiuserkey>
- description: Set secret for administration of the Heketi service as user admin
  displayName: Heketi Administrator Secret
  name: HEKETI_ADMIN_KEY
  value: <adminkey>
- description: Set the executor type, kubernetes or ssh
  displayName: heketi executor type
  name: HEKETI_EXECUTOR
  value: kubernetes
- description: Set the hostname for the route URL
  displayName: heketi route name
  name: HEKETI_ROUTE
  value: heketi-storage
- displayName: heketi container image name
  name: IMAGE_NAME
  required: true
  value: registry.redhat.io/rhgs3/rhgs-volmanager-rhel7
- displayName: heketi container image version
  name: IMAGE_VERSION
  required: true
  value: v3.11.4
- description: A unique name to identify this heketi service, useful for running
    multiple heketi instances
  displayName: GlusterFS cluster name
  name: CLUSTER_NAME
value: storage
```

11. Execute the following command to deploy the Heketi service, route, and deployment configuration which will be used to create persistent volumes for OpenShift:

```
# oc process heketi | oc create -f -

service "heketi-registry" created
route "heketi-registry" created
deploymentconfig-registry "heketi" created
```

NOTE

It is recommended that the **heketidbstorage** volume be tuned for db workloads. Newly installed Openshift Container Storage deployments tune the heketidbstorage volume automatically. For older deployments, follow the KCS article Planning to run containerized DB or nosql workloads on Openshift Container Storage? and perform the volume set operation for the volume **heketidbstorage**.

12. Execute the following command to verify that the containers are running:

```
# oc get pods
```

For example:

```
# oc get pods
NAME                                          READY     STATUS    RESTARTS   AGE
glusterblock-registry-provisioner-dc-1-lm7ht  1/1       Running   81         14d
glusterfs-registry-l25b9                      1/1       Running   10         14d
glusterfs-registry-vl6qs                      1/1       Running   10         14d
glusterfs-registry-zhxwg                      1/1       Running   10         14d
heketi-registry-1-54bwf                       1/1       Running   10         14d
```

6.2.3.2. Upgrading the Red Hat Gluster Storage Registry Pods

The following commands must be executed on the client machine. .

Following are the steps for updating a DaemonSet for glusterfs:

1. Execute the following steps to stop the Heketi pod to prevent it from accepting any new request for volume creation or volume deletion:

   a. Execute the following command to access your project:

   ```
   # oc project <project_name>
   ```

   For example:

   ```
   # oc project storage-project
   ```

   b. Execute the following command to get the **DeploymentConfig**:

   ```
   # oc get ds
   ```

c. Execute the following command to set heketi server to accept requests only from the local-client:

```
# heketi-cli server mode set local-client
```

d. Wait for the ongoing operations to complete and execute the following command to monitor if there are any ongoing operations:

```
# heketi-cli server operations info
```

e. Execute the following command to reduce the replica count from 1 to 0. This brings down the Heketi pod:

```
# oc scale dc <heketi_dc> --replicas=0
```

f. Execute the following command to verify that the heketi pod is no longer present:

```
# oc get pods
```

2. Execute the following command to find the DaemonSet name for gluster

```
# oc get ds
```

3. Execute the following command to delete the DaemonSet:

```
# oc delete ds <ds-name> --cascade=false
```

Using **--cascade=false** option while deleting the old DaemonSet does not delete the glusterfs_registry pods but deletes only the DaemonSet. After deleting the old DaemonSet, you must load the new one. When you manually delete the old pods, the new pods which are created will have the configurations of the new DaemonSet.

For example,

```
# oc delete ds glusterfs-registry --cascade=false
daemonset "glusterfs-registry" deleted
```

4. Execute the following commands to verify all the old pods are up:

```
# oc get pods
```

For example,

```
# oc get pods
NAME                                          READY     STATUS    RESTARTS   AGE
glusterblock-registry-provisioner-dc-1-nvnhc   1/1       Running   1          7d
glusterfs-registry-4cpcc                       1/1       Running   0          7d
glusterfs-registry-9xj78                       1/1       Running   0          7d
glusterfs-registry-b9p5j                       1/1       Running   0          7d
```

5. Execute the following command to delete the old glusterfs template.

```
# oc delete templates glusterfs
```

For example,

```
# oc delete templates glusterfs
template “glusterfs” deleted
```

6. Label all the OpenShift Container Platform nodes that has the Red Hat Gluster Storage pods:

   a. Check if the nodes are labelled using the following command:

   ```
   # oc get nodes --show-labels
   ```

   If the Red Hat Gluster Storage nodes do not have the **glusterfs=registry-host** label, then label the nodes as shown in step ii.

   b. Label all the OpenShift Container Platform nodes that has the Red Hat Gluster Storage pods:

   ```
   # oc label nodes <node name> glusterfs=registry-host
   ```

7. Execute the following command to register new glusterfs template.

```
# oc create -f /usr/share/heketi/templates/glusterfs-template.yaml
```

For example,

```
# oc create -f /usr/share/heketi/templates/glusterfs-template.yaml
template “glusterfs” created
```

8. Execute the following commands to create the gluster DaemonSet:

```
# oc process glusterfs | oc create -f -
```

For example,

```
# oc process glusterfs | oc create -f -
Deamonset “glusterfs” created
```

9. Execute the following command to identify the old glusterfs_registry pods that needs to be deleted:

```
# oc get pods
```

For example,

```
# oc get pods
NAME                                          READY     STATUS    RESTARTS   AGE
glusterblock-registry-provisioner-dc-1-nvnhc  1/1       Running   1          7d
glusterfs-registry-4cpcc                      1/1       Running   0          7d
glusterfs-registry-9xj78                      1/1       Running   0          7d
glusterfs-registry-b9p5j                      1/1       Running   0          7d
```

10. Execute the following command and ensure that the bricks are not more than 90% full:

```
# df -kh | grep -v ^Filesystem | awk '{if($5>"90%") print $0}'
```

11. Execute the following command to delete the old glusterfs-registry pods. **glusterfs-registry pods should follow rolling upgrade. Hence, you must ensure that the new pod is running before deleting the next old glusterfs-registry pods. We support OnDelete Strategy DaemonSet update strategy**. With **OnDelete Strategy** update strategy, after you update a DaemonSet template, new DaemonSet pods will only be created when you manually delete old DaemonSet pods.

    a. To delete the old glusterfs-registry pods, execute the following command:

    ```
    # oc delete pod <gluster_pod>
    ```

    For example,

    ```
    # oc delete pod glusterfs-0vcf3
    pod  “glusterfs-0vcf3” deleted
    ```

    NOTE

    Before deleting the next pod, self heal check has to be made:

    1. Run the following command to access shell on glusterfs-registry pods:

    ```
    # oc rsh <gluster_pod_name>
    ```

    2. Run the following command to check the self-heal status of all the volumes: :

    ```
    # for each_volume in gluster volume list; do gluster volume heal
    $each_volume info ; done | grep "Number of entries: [^0]$"
    ```

    b. The delete pod command will terminate the old pod and create a new pod. Run **# oc get pods -w** and check the **Age** of the pod and **READY** status should be 1/1. The following is the example output showing the status progression from termination to creation of the pod.

    ```
    # oc get pods -w
    NAME                    READY     STATUS        RESTARTS   AGE
    glusterfs-0vcf3             1/1       Terminating   0          3d
    …
    ```

12. Execute the following command to verify that the pods are running:

```
# oc get pods
```

For example,

```
# oc get pods
NAME                                    READY     STATUS    RESTARTS   AGE
glusterblock-registry-provisioner-dc-1-nvnhc   1/1       Running   1          7d
```

```
glusterfs-registry-4cpcc                1/1       Running   0          7d
glusterfs-registry-9xj78                1/1       Running   0          7d
glusterfs-registry-b9p5j                1/1       Running   0          7d
```

- Execute the following commands to verify if you have upgraded the pod to the latest version:

```
# oc rsh <gluster_registry_pod_name> glusterd --version
```

For example:

```
 # oc rsh glusterfs-registry-4cpcc glusterd --version
glusterfs 6.0
```

```
# rpm -qa|grep gluster
```

13. Check the Red Hat Gluster Storage op-version by executing the following command on one of the glusterfs-registry pods.

```
# gluster vol get all cluster.op-version
```

14. Set the cluster.op-version to 70000 on any one of the pods:

NOTE

Ensure all the glusterfs-registry pods are updated before changing the cluster.op-version.

```
# gluster volume set all cluster.op-version 70000
```

15. Execute the following steps to enable server.tcp-user-timeout on all volumes.

NOTE

The "server.tcp-user-timeout" option specifies the maximum amount of the time (in seconds) the transmitted data from the application can remain unacknowledged from the brick.

It is used to detect force disconnections and dead connections (if a node dies unexpectedly, a firewall is activated, etc.,) early and make it possible for applications to reduce the overall failover time.

a. List the glusterfs pod using the following command:

```
# oc get pods
```

For example:

```
# oc get pods
NAME                                          READY     STATUS    RESTARTS   AGE
glusterblock-registry-provisioner-dc-1-nvnhc  1/1       Running   1          7d
```

```
glusterfs-registry-4cpcc          1/1     Running   0          7d
glusterfs-registry-9xj78          1/1     Running   0          7d
glusterfs-registry-b9p5j          1/1     Running   0          7d
```

b. Remote shell into one of the glusterfs-registry pods. For example:

```
# oc rsh glusterfs-registry-g6vd9
```

c. Execute the following command:

```
# for eachVolume in gluster volume list; do echo $eachVolume; gluster volume set
$eachVolume server.tcp-user-timeout 42 ; done
```

For example:

```
# for eachVolume in gluster volume list; do echo $eachVolume; gluster volume set
$eachVolume server.tcp-user-timeout 42 ; done
volume1
volume set: success
volume2
volume set: success
```

16. If a gluster-block-registry-provisoner-pod already exists then delete it by executing the following commands:

```
# oc delete dc <gluster-block-registry-dc>
```

For example:

```
# oc delete dc glusterblock-registry-provisioner-dc
```

17. Delete the following resources from the old pod

```
# oc delete clusterroles.authorization.openshift.io glusterblock-provisioner-runner
# oc delete serviceaccounts glusterblock-provisioner
serviceaccount "glusterblock-provisioner" deleted
# oc delete clusterrolebindings.authorization.openshift.io glusterblock-provisioner
```

18. Execute the following commands to deploy the gluster-block provisioner:

```
# sed -e 's/\\\${NAMESPACE}/<NAMESPACE>/' /usr/share/heketi/templates/glusterblock-
provisioner.yaml | oc create -f -
```

```
# oc adm policy add-cluster-role-to-user glusterblock-provisioner-runner
system:serviceaccount:<NAMESPACE>:glusterblock-provisioner
```

For example:

```
# sed -e 's/\\\${NAMESPACE}/storage-project/' /usr/share/heketi/templates/glusterblock-
provisioner.yaml | oc create -f -
```

```
# oc adm policy add-cluster-role-to-user glusterblock-provisioner-runner
system:serviceaccount:storage-project:glusterblock-provisioner
```

19. Brick multiplexing is a feature that allows adding multiple bricks into one process. This reduces resource consumption and allows us to run more bricks than before with the same memory consumption. It is enabled by default from Container-Native Storage 3.6. During an upgrade from Container-Native Storage 3.10 to Red Hat Openshift Container Storage 3.11, to turn brick multiplexing on, execute the following commands:

    a. To exec into the Gluster pod, execute the following command and rsh into any of the glusterfs_registry pods:

    ```
    # oc rsh <gluster_pod_name>
    ```

    b. Verify if brick multiplexing is enabled. If it is disabled, then execute the following command to enable brick multiplexing:

    ```
    # gluster volume set all cluster.brick-multiplex on
    ```

    NOTE

    You can check the brick multiplex status by executing the following command:

    ```
    # gluster v get all all
    ```

    For example:

    ```
    # oc rsh glusterfs-registry-g6vd9

    sh-4.2# gluster volume set all cluster.brick-multiplex on
    Brick-multiplexing is supported only for container workloads (Independent/Converged).
    Also it is advised to make sure that either all volumes are in stopped state or no bricks
    are running before this option is modified.Do you still want to continue? (y/n) y
    volume set: success
    ```

    c. List all the volumes in the trusted storage pool. This step is only required if the volume set operation is performed:
    For example:

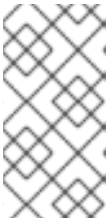
    ```
    # gluster volume list

    heketidbstorage
    vol_194049d2565d2a4ad78ef0483e04711e
    ...
    ...
    ```

    Restart all the volumes. This step is only required if the volume set operation is performed along with the previous step:

    ```
    # gluster vol stop <VOLNAME>
    # gluster vol start <VOLNAME>
    ```

20. Support for S3 compatible Object Store in Red Hat Openshift Container Storage is under technology preview. To enable S3 compatible object store, see https://access.redhat.com/documentation/en-us/red_hat_openshift_container_storage/3.11/html/operations_guide/s3_object_store.



NOTE

After upgrading the glusterfs registry pods, proceed with the steps listed in] to bring back your heketi pod and then proceed with the steps listed in xref:chap-upgrade_client_common[to upgrade the client on Red Hat Openshift Container Platform Nodes.

6.2.4. Upgrading if existing version deployed by using Ansible

6.2.4.1. Upgrading Heketi Server

The following commands must be executed on the client machine.

NOTE

"yum update cns-deploy -y" is not required to be executed if OCS 3.10 was deployed via Ansible.

1. Backup the Heketi registry database file

```
# heketi-cli db dump > heketi-db-dump-$(date -I).json
```

2. Execute the following command to get the current HEKETI_ADMIN_KEY.
The OCS admin can choose to set any phrase for user key as long as it is not used by their infrastructure. It is not used by any of the OCS default installed resources.

```
# oc get secret heketi-registry-admin-secret -o jsonpath='{.data.key}'|base64 -d;echo
```

3. Execute the following step to edit the template:
If the existing template has IMAGE_NAME, then edit the template to change the HEKETI_USER_KEY, HEKETI_ADMIN_KEY, HEKETI_ROUTE, IMAGE_NAME, and CLUSTER_NAME as shown in the example below.

```
# oc edit template heketi
parameters:
- description: Set secret for those creating volumes as type user
  displayName: Heketi User Secret
  name: HEKETI_USER_KEY
  value: <heketiuserkey>
- description: Set secret for administration of the Heketi service as user admin
  displayName: Heketi Administrator Secret
  name: HEKETI_ADMIN_KEY
  value: <adminkey>
- description: Set the executor type, kubernetes or ssh
  displayName: heketi executor type
  name: HEKETI_EXECUTOR
  value: kubernetes
- description: Set the hostname for the route URL
```

```
    displayName: heketi route name
    name: HEKETI_ROUTE
    value: heketi-registry
  - displayName: heketi container image name
    name: IMAGE_NAME
    required: true
    value: registry.redhat.io/rhgs3/rhgs-volmanager-rhel7:v3.11.4
  - description: A unique name to identify this heketi service, useful for running
    multiple heketi instances
    displayName: GlusterFS cluster name
    name: CLUSTER_NAME
    value: registry
```

If the existing template has IMAGE_NAME and IMAGE_VERSION as two parameters, then edit the template to change the HEKETI_USER_KEY, HEKETI_ADMIN_KEY, HEKETI_ROUTE, IMAGE_NAME, IMAGE_VERSION, and CLUSTER_NAME as shown in the example below.

```
# oc edit template heketi
parameters:
- description: Set secret for those creating volumes as type user
  displayName: Heketi User Secret
  name: HEKETI_USER_KEY
  value: <heketiuserkey>
- description: Set secret for administration of the Heketi service as user admin
  displayName: Heketi Administrator Secret
  name: HEKETI_ADMIN_KEY
  value: <adminkey>
- description: Set the executor type, kubernetes or ssh
  displayName: heketi executor type
  name: HEKETI_EXECUTOR
  value: kubernetes
- description: Set the hostname for the route URL
  displayName: heketi route name
  name: HEKETI_ROUTE
  value: heketi-registry
- displayName: heketi container image name
  name: IMAGE_NAME
  required: true
  value: registry.redhat.io/rhgs3/rhgs-volmanager-rhel7
- displayName: heketi container image version
  name: IMAGE_VERSION
  required: true
  value: v3.11.4
- description: A unique name to identify this heketi service, useful for running multiple heketi
instances
  displayName: GlusterFS-registry cluster name
  name: CLUSTER_NAME
  value: registry
```

4. Execute the following command to delete the deployment configuration, service, and route for heketi:

```
# oc delete deploymentconfig,service,route heketi-registry
```

5. Execute the following command to deploy the Heketi service, route, and deployment configuration which will be used to create persistent volumes for OpenShift:

```
# oc process heketi | oc create -f -

service "heketi-registry" created
route "heketi-registry" created
deploymentconfig-registry "heketi" created
```

NOTE

It is recommended that the **heketidbstorage** volume be tuned for db workloads. Newly installed Openshift Container Storage deployments tune the heketidbstorage volume automatically. For older deployments, follow the KCS article Planning to run containerized DB or nosql workloads on Openshift Container Storage? and perform the volume set operation for the volume **heketidbstorage**.

6. Execute the following command to verify that the containers are running:

```
# oc get pods
```

For example:

```
# oc get pods
NAME                                          READY     STATUS    RESTARTS   AGE
glusterblock-registry-provisioner-dc-1-lm7ht  1/1       Running   81         14d
glusterfs-registry-l25b9                      1/1       Running   10         14d
glusterfs-registry-vl6qs                      1/1       Running   10         14d
glusterfs-registry-zhxwg                      1/1       Running   10         14d
heketi-registry-1-54bwf                       1/1       Running   10         14d
```

6.2.4.2. Upgrading the Red Hat Gluster Storage Registry Pods

The following commands must be executed on the client machine.

Following are the steps for updating a DaemonSet for glusterfs:

1. Execute the following steps to stop the Heketi pod to prevent it from accepting any new request for volume creation or volume deletion:

   a. Execute the following command to access your project:

   ```
   # oc project <project_name>
   ```

   For example:

   ```
   # oc project storage-project
   ```

   b. Execute the following command to get the **DeploymentConfig**:

   ```
   # oc get dc
   ```

c. Execute the following command to set heketi server to accept requests only from the local-client:

```
# heketi-cli server mode set local-client
```

d. Wait for the ongoing operations to complete and execute the following command to monitor if there are any ongoing operations:

```
# heketi-cli server operations info
```

e. Execute the following command to reduce the replica count from 1 to 0. This brings down the Heketi pod:

```
# oc scale dc <heketi_dc> --replicas=0
```

f. Execute the following command to verify that the heketi pod is no longer present:

```
# oc get pods
```

2. Execute the following command to find the DaemonSet name for gluster

```
# oc get ds
```

3. Execute the following command to delete the DaemonSet:

```
# oc delete ds <ds-name> --cascade=false
```

Using **--cascade=false** option while deleting the old DaemonSet does not delete the glusterfs_registry pods but deletes only the DaemonSet. After deleting the old DaemonSet, you must load the new one. When you manually delete the old pods, the new pods which are created will have the configurations of the new DaemonSet.

For example,

```
# oc delete ds glusterfs-registry --cascade=false
daemonset "glusterfs-registry" deleted
```

4. Execute the following commands to verify all the old pods are up:

```
# oc get pods
```

For example,

```
# oc get pods
NAME                                          READY     STATUS    RESTARTS   AGE
glusterblock-registry-provisioner-dc-1-nvnhc   1/1       Running   1          7d
glusterfs-registry-4cpcc                       1/1       Running   0          7d
glusterfs-registry-9xj78                       1/1       Running   0          7d
glusterfs-registry-b9p5j                       1/1       Running   0          7d
```

5. Execute the following command to delete the old glusterfs template.

```
# oc delete templates glusterfs
```

6. Execute the following command to register new glusterfs template.

```
# oc create -f /usr/share/ansible/openshift-
ansible/roles/openshift_storage_glusterfs/files/glusterfs-template.yml
template "glusterfs" created
```

7. Execute the following command to edit the old glusterfs template.
   If the template has IMAGE_NAME, then update the glusterfs template as following. For example:

```
# oc edit template glusterfs

- description: Labels which define the daemonset node selector. Must contain at least
    one label of the format \'glusterfs=<CLUSTER_NAME>-host\'
  displayName: Daemonset Node Labels
  name: NODE_LABELS
  value: '{ "glusterfs": "registry-host" }'
- displayName: GlusterFS container image name
  name: IMAGE_NAME
  required: true
  value: registry.redhat.io/rhgs3/rhgs-server-rhel7:v3.11.4
- description: A unique name to identify which heketi service manages this cluster,
    useful for running multiple heketi instances
  displayName: GlusterFS cluster name
  name: CLUSTER_NAME
  value: registry
```

   If the template has IMAGE_NAME and IMAGE_VERSION as two separate parameters, then update the glusterfs template as following. For example:

```
# oc edit template glusterfs
- description: Labels which define the daemonset node selector. Must contain at least one
label of the format \'glusterfs=<CLUSTER_NAME>-host\'
displayName: Daemonset Node Labels
name: NODE_LABELS
value: '{ "glusterfs": "registry-host" }'
- displayName: GlusterFS container image name
name: IMAGE_NAME
required: true
value: registry.redhat.io/rhgs3/rhgs-server-rhel7
- description: A unique name to identify which heketi service manages this cluster,
useful for running multiple heketi instances
- displayName: GlusterFS container image version
name: IMAGE_VERSION
required: true
value: v3.11.4
- displayName: GlusterFS cluster name
name: CLUSTER_NAME
value: registry
```

NOTE

Ensure that the CLUSTER_NAME variable is set to the correct value

8. Label all the OpenShift Container Platform nodes that has the Red Hat Gluster Storage pods:

   a. Check if the nodes are labelled using the following command:

   ```
   # oc get nodes --show-labels
   ```

   If the Red Hat Gluster Storage nodes do not have the **glusterfs=registry-host** label, then label the nodes as shown in step ii.

   b. Label all the OpenShift Container Platform nodes that has the Red Hat Gluster Storage pods:

   ```
   # oc label nodes <node name> glusterfs=registry-host
   ```

9. Execute the following commands to create the gluster DaemonSet:

   ```
   # oc process glusterfs | oc create -f -
   ```

   For example,

   ```
   # oc process glusterfs | oc create -f -
   Deamonset “glusterfs-registry” created
   ```

10. Execute the following command to identify the old glusterfs_registry pods that needs to be deleted:

    ```
    # oc get pods
    ```

    For example,

    ```
    # oc get pods
    NAME                                          READY     STATUS    RESTARTS   AGE
    glusterblock-registry-provisioner-dc-1-nvnhc   1/1       Running   1          7d
    glusterfs-registry-4cpcc                       1/1       Running   0          7d
    glusterfs-registry-9xj78                       1/1       Running   0          7d
    glusterfs-registry-b9p5j                       1/1       Running   0          7d
    ```

11. Execute the following command and ensure that the bricks are not more than 90% full:

    ```
    # df -kh | grep -v ^Filesystem | awk '{if($5>"90%") print $0}'
    ```

12. Execute the following command to delete the old glusterfs-registry pods. **glusterfs-registry pods should follow rolling upgrade. Hence, you must ensure that the new pod is running before deleting the next old glusterfs-registry pods. We support OnDelete Strategy DaemonSet update strategy**. With **OnDelete Strategy** update strategy, after you update a DaemonSet template, new DaemonSet pods will only be created when you manually delete old DaemonSet pods.

    a. To delete the old glusterfs-registry pods, execute the following command:

    -

```
# oc delete pod <gluster_pod>
```

For example,

```
# oc delete pod glusterfs-registry-4cpcc
pod “glusterfs-registry-4cpcc” deleted
```

NOTE

Before deleting the next pod, self heal check has to be made:

1. Run the following command to access shell on glusterfs-registry pods:

```
# oc rsh <gluster_pod_name>
```

2. Run the following command to check the self-heal status of all the volumes: :

```
# for each_volume in gluster volume list; do gluster volume heal
$each_volume info ; done | grep "Number of entries: [^0]$"
```

b. The delete pod command will terminate the old pod and create a new pod. Run **# oc get pods -w** and check the **Age** of the pod and **READY** status should be 1/1. The following is the example output showing the status progression from termination to creation of the pod.

```
# oc get pods -w
NAME                        READY    STATUS        RESTARTS   AGE
glusterfs-registry-4cpcc              1/1       Terminating   0         3d
…
```

13. Execute the following command to verify that the pods are running:

```
# oc get pods
```

For example,

```
# oc get pods
NAME                                      READY     STATUS    RESTARTS   AGE
glusterblock-registry-provisioner-dc-1-nvnhc   1/1       Running   1         7d
glusterfs-registry-abmqa                    1/1       Running   0         01m
glusterfs-registry-9xj78                   1/1       Running   0         7d
glusterfs-registry-b9p5j                   1/1       Running   0         7d
```

14. Execute the following commands to verify if you have upgraded the pod to the latest version:

```
# oc rsh <gluster_registry_pod_name> glusterd --version
```

For example:

```
# oc rsh glusterfs-registry-abmqa glusterd --version
glusterfs 6.0
```

-

```
# rpm -qa|grep gluster
```

15. Check the Red Hat Gluster Storage op-version by executing the following command on one of the glusterfs-registry pods.

```
# gluster vol get all cluster.op-version
```

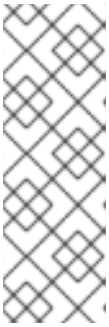
16. Set the cluster.op-version to 70000 on any one of the pods:

NOTE

Ensure all the glusterfs-registry pods are updated before changing the cluster.op-version.

```
# gluster volume set all cluster.op-version 70000
```

17. Execute the following steps to enable server.tcp-user-timeout on all volumes.



NOTE

The "server.tcp-user-timeout" option specifies the maximum amount of the time (in seconds) the transmitted data from the application can remain unacknowledged from the brick.

It is used to detect force disconnections and dead connections (if a node dies unexpectedly, a firewall is activated, etc.,) early and make it possible for applications to reduce the overall failover time.

a. List the glusterfs pod using the following command:

```
# oc get pods
```

For example:

```
# oc get pods
NAME                                          READY     STATUS    RESTARTS   AGE
glusterblock-registry-provisioner-dc-1-nvnhc  1/1       Running   1          7d
glusterfs-registry-3cpqt                      1/1       Running   0          01m
glusterfs-registry-4xj33                      1/1       Running   0          10m
glusterfs-registry-l9p2p                      1/1       Running   0          20m
```

b. Remote shell into one of the glusterfs-registry pods. For example:

```
# oc rsh glusterfs-registry-g6vd9
```

c. Execute the following command:

```
# for eachVolume in gluster volume list; do echo $eachVolume; gluster volume set
$eachVolume server.tcp-user-timeout 42 ; done
```

For example:

```
-
```

```
# for eachVolume in gluster volume list; do echo $eachVolume; gluster volume set
$eachVolume server.tcp-user-timeout 42 ; done
volume1
volume set: success
volume2
volume set: success
```

18. If a gluster-block-registry-provisoner-pod already exists then delete it by executing the following commands:

```
# oc delete dc <gluster-block-registry-dc>
```

For example:

```
# oc delete dc glusterblock-registry-provisioner-dc
```

19. Execute the following command to delete the old glusterblock provisioner template.

```
# oc delete templates glusterblock-provisioner
```

20. Execute the following command to register new glusterblock provisioner template, see Templates. Copy and paste to **new-block-prov.yaml**.
For example,

```
# oc create -f new-block-prov.yaml
template.template.openshift.io/glusterblock-provisioner created
```

21. Depending on the OCP version, edit the glusterblock-provisioner template to change the IMAGE_NAME and NAMESPACE.

```
# oc edit template glusterblock-provisioner
- displayName: glusterblock provisioner container image name
  name: IMAGE_NAME
  required: true
  value: registry.redhat.io/rhgs3/rhgs-gluster-block-prov-rhel7:v3.11.4
- description: The namespace in which these resources are being created
  displayName: glusterblock provisioner namespace
  name: NAMESPACE
  required: true
  value: glusterfs-registry
- description: A unique name to identify which heketi service manages this cluster, useful for
running multiple heketi instances
  displayName: GlusterFS cluster name
  name: CLUSTER_NAME
  value: registry
```

- If the template has IMAGE_NAME and IMAGE_VERSION as two separate parameters, then update the glusterblock-provisioner template as following.
For example:

```
# oc edit template glusterblock-provisioner

- displayName: glusterblock provisioner container image name
  name: IMAGE_NAME
```

```
    required: true
    value: registry.redhat.io/rhgs3/rhgs-gluster-block-prov-rhel7
  - displayName: glusterblock provisioner container image version
    name: IMAGE_VERSION
    required: true
    value: v3.11.4
  - description: The namespace in which these resources are being created
    displayName: glusterblock provisioner namespace
    name: NAMESPACE
    required: true
    value: glusterfs-registry
  - description: A unique name to identify which heketi service manages this cluster,
    useful for running multiple heketi instances
    displayName: GlusterFS cluster name
    name: CLUSTER_NAME
    value: registry
```

22. Delete the following resources from the old pod

```
# oc delete clusterroles.authorization.openshift.io glusterblock-provisioner-runner
# oc delete serviceaccounts glusterblock-registry-provisioner
# oc delete clusterrolebindings.authorization.openshift.io glusterblock-registry-provisioner
```

23. Before running oc process determine the correct **provisioner** name. If there are more than one **gluster block provisioner** running in your cluster the names must differ from all other **provisioners**.
For example,

    - If there are 2 or more provisioners the name should be **gluster.org/glusterblock-<namespace>** where, namespace is replaced by the namespace that the provisioner is deployed in.

    - If there is only one provisioner, installed prior to 3.11.4, **gluster.org/glusterblock** is sufficent. If the name currently in use already has a unique namespace suffix, reuse the existing name.

24. After editing the template, execute the following command to create the deployment configuration:

```
# oc process -p PROVISIONER_NAME=<provisioner-name> glusterblock-provisioner -o
yaml | oc create -f -
```

    For example:

```
 # oc process -p PROVISIONER_NAME=gluster.org/glusterblock-infra-storage glusterblock-
provisioner -o yaml | oc create -f -
  clusterrole.authorization.openshift.io/glusterblock-provisioner-runner created
  serviceaccount/glusterblock-registry-provisioner created
  clusterrolebinding.authorization.openshift.io/glusterblock-registry-provisioner created
  deploymentconfig.apps.openshift.io/glusterblock-registry-provisioner-dc created
```

25. Brick multiplexing is a feature that allows adding multiple bricks into one process. This reduces resource consumption and allows us to run more bricks than before with the same memory consumption. It is enabled by default from Container-Native Storage 3.6. During an upgrade from Container-Native Storage 3.10 to Red Hat Openshift Container Storage 3.11, to turn brick multiplexing on, execute the following commands:

a. To exec into the Gluster pod, execute the following command and rsh into any of the glusterfs_registry pods:

```
# oc rsh <gluster_pod_name>
```

b. Verify if brick multiplexing is enabled. If it is disabled, then execute the following command to enable brick multiplexing:

```
# gluster volume set all cluster.brick-multiplex on
```

NOTE

You can check the brick multiplex status by executing the following command:

```
# gluster v get all all
```

For example:

```
# oc rsh glusterfs-registry-g6vd9

sh-4.2# gluster volume set all cluster.brick-multiplex on
Brick-multiplexing is supported only for container workloads (Independent/Converged).
Also it is advised to make sure that either all volumes are in stopped state or no bricks
are running before this option is modified.Do you still want to continue? (y/n) y
volume set: success
```

c. List all the volumes in the trusted storage pool. This step is only required if the volume set operation is performed:
For example:

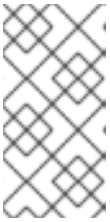
```
# gluster volume list

heketidbstorage
vol_194049d2565d2a4ad78ef0483e04711e
...
...
```

Restart all the volumes. This step is only required if the volume set operation is performed along with the previous step:

```
# gluster vol stop <VOLNAME>
# gluster vol start <VOLNAME>
```

26. Support for S3 compatible Object Store in Red Hat Openshift Container Storage is under technology preview. To enable S3 compatible object store, see https://access.redhat.com/documentation/en-us/red_hat_openshift_container_storage/3.11/html/operations_guide/s3_object_store.



NOTE

After upgrading the glusterfs registry pods, proceed with the steps listed in] to bring back your heketi pod and then proceed with the steps listed in xref:chap-upgrade_client_common[to upgrade the client on Red Hat Openshift Container Platform Nodes.

27. All storage classes that use gluster block volume provisioning must match exactly to one of the provisioner names in the cluster. To check the list of storage classes that refer to a **block provisioner**, in a given **namespace**, run the following command:

```
# oc get sc -o custom-
columns=NAME:.metadata.name,PROV:.provisioner,RSNS:.parameters.restsecretnamespace
| grep 'gluster.org/glusterblock' | grep <namespace>
```

Example:

```
# oc get sc -o custom-
columns=NAME:.metadata.name,PROV:.provisioner,RSNS:.parameters.restsecretnamespace
| grep 'gluster.org/glusterblock' | grep infra-storage
  glusterfs-registry-block   gluster.org/glusterblock              infra-storage
```

Check each storage class **provisioner name**, if it does not match the **block provisioner name** configured for that **namespace** it must be updated. If the **block provisioner** name already matches the **configured provisioner** name, nothing else needs to be done. Use the list generated above and include all storage class names where the provionser name must be updated.
For every storage class in this list do the following:

```
# oc get sc  -o yaml <storageclass>  > storageclass-to-edit.yaml
# oc delete sc  <storageclass>
# sed 's,gluster.org/glusterblock$,gluster.org/glusterblock-<namespace>,' storageclass-to-
edit.yaml | oc create -f -
```

Example:

```
# oc get sc -o yaml glusterfs-registry-block > storageclass-to-edit.yaml
# oc delete sc glusterfs-registry-block
storageclass.storage.k8s.io "glusterfs-registry-block" deleted
# sed 's,gluster.org/glusterblock$,gluster.org/glusterblock-infra-storage,' storageclass-to-
edit.yaml | oc create -f -
storageclass.storage.k8s.io/glusterfs-registry-block created
```

6.3. STARTING THE HEKETI PODS

Execute the following commands on the client machine for both glusterfs and registry namespace.

1. Execute the following command to navigate to the project where the Heketi pods are running:

```
# oc project <project_name>
```

For example for glusterfs namespace:

```
# oc project glusterfs
```

For example for registry namespace:

```
# oc project glusterfs-registry
```

2. Execute the following command to get the **DeploymentConfig**:

```
# oc get dc
```

For example, on a glusterfs-registry project:

```
# oc get dc
NAME                                REVISION   DESIRED   CURRENT   TRIGGERED BY
glusterblock-registry-provisioner-dc   1         1         1         config
heketi-registry                     1         1         1         config
```

For example, on a glusterfs project:

```
# oc get dc
NAME                                REVISION   DESIRED   CURRENT   TRIGGERED BY
glusterblock-storage-provisioner-dc   1         1         1         config
heketi-storage                      1         1         1         config
```

3. Execute the following command to increase the replica count from 0 to 1. This brings back the Heketi pod:

```
# oc scale dc <heketi_dc> --replicas=1
```

4. Execute the following command to verify that the heketi pod is present in both glusterfs and glusterfs-registry namespace:

```
# oc get pods
```

For example for glusterfs:

```
# oc get pods
glusterblock-storage-provisioner-dc-1-fc8sc   1/1       Running       0          3d
glusterfs-storage-bd6kv                       1/1       Running       0          2h
glusterfs-storage-vhpcw                       1/1       Running       1          1d
glusterfs-storage-z6nkk                       1/1       Running       0          1d
heketi-storage-1-6sccl                        1/1       Running       0          2h
```

For example for registry pods:

```
# oc get pods
NAME                                          READY     STATUS    RESTARTS   AGE
glusterblock-registry-provisioner-dc-1-c59rn   1/1       Running   0          2d
glusterfs-registry-987g6                      1/1       Running   4          2m
glusterfs-registry-sd7z4                      1/1       Running   4          2m
```

```
glusterfs-registry-tlzfb                1/1       Running   4          2m

heketi-registry-1-qktss                 1/1       Running   0          1d
```

6.4. UPGRADING THE CLIENT ON RED HAT OPENSHIFT CONTAINER PLATFORM NODES

Execute the following commands on each of the nodes:

1. To drain the pod, execute the following command on the master node (or any node with cluster-admin access):

```
# oc adm drain <node_name> --ignore-daemonsets
```

2. To check if all the pods are drained, execute the following command on the master node (or any node with cluster-admin access) :

```
# oc get pods --all-namespaces --field-selector=spec.nodeName=<node_name>
```

3. Execute the following command to upgrade the client node to the latest glusterfs-fuse version:

```
# yum update glusterfs-fuse
```

4. To enable node for pod scheduling execute the following command on the master node (or any node with cluster-admin access):

```
# oc adm manage-node --schedulable=true <node_name>
```

5. Create and add the following content to the multipath.conf file:

NOTE

Make sure that the changes to multipath.conf and reloading of multipathd are done only after all the server nodes are upgraded.

```
# cat >> /etc/multipath.conf <<EOF
# LIO iSCSI
devices {
  device {
    vendor "LIO-ORG"
    user_friendly_names "yes" # names like mpatha
    path_grouping_policy "failover" # one path per group
    hardware_handler "1 alua"
    path_selector "round-robin 0"
    failback immediate
    path_checker "tur"
    prio "alua"
    no_path_retry 120
    rr_weight "uniform"
  }
}
EOF
```

6. Execute the following commands to start multipath daemon and [re]load the multipath configuration:

```
# systemctl start multipathd
```

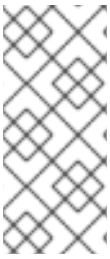
```
# systemctl reload multipathd
```

CHAPTER 7. UPGRADING USING THE PLAYBOOK

NOTE

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/.



NOTE

The upgrade playbook does not fail or give any warning if the application pods running on the cluster fails and enters into an error state while running the Openshift Container Storage upgrade. Hence, the cluster administrator needs to check the health of the cluster and all the pods and nodes in the cluster while running the Openshift container Storage upgrade playbook.

IMPORTANT

- The upgrade playbook is to be used only while upgrading to the latest available OpenShift Container Storage bits.

Playbook: upgrade.yml

This playbook is intended to upgrade the **GlusterFS** related resources on an existing OpenShift cluster. This is applicable only for **GlusterFS** resources that were deployed using the **config.yml** playbook in the converged mode.
This playbook is in tech-preview and needs to be acknowledged using the variable **openshift_storage_gluster_update_techpreview=true**.
The same inventory from install should be reused after updating the following variables to the desired version:

- **openshift_storage_glusterfs_image**
- **openshift_storage_glusterfs_heketi_image**
- **openshift_storage_glusterfs_block_image**
- **openshift_storage_glusterfs_fuse_version**

7.1. PARAMETERS OF UPGRADE PLAYBOOK

- **openshift_storage_glusterfs_health_timeout=10**: This variable limits the number of cluster health check retries. The variable value should be multiple of 10, 10 means one retry, 20 means 2 retries and this value should not be less than 10. By default value of this var is 30, so do not specify anything and the playbook will do 3 retries.
- **openshift_storage_gluster_update_techpreview=true**: The playbook is in tech preview. Set this variable to true for using upgrade playbook.

- **openshift_storage_glusterfs_fuse_version=<version>**: To upgrade nodes to specific client packages we need to mention the version of which you want to upgrade.
  example,

```
openshift_storage_glusterfs_fuse_version=-3.12.2-18.el7
```

- **openshift_storage_glusterfs_check_brick_size_health=false**: When the playbook is executing it checks for the brick capacity and while checking brick capacity we need to exclude some bricks from checking, these bricks are the bricks that are part of block hosting volume. For that purpose, we need to set the above variable to false in the inventory file.

CHAPTER 8. UPGRADING YOUR RED HAT OPENSHIFT CONTAINER STORAGE IN INDEPENDENT MODE

This chapter describes the procedures to follow to upgrade your independent mode environment.

NOTE

New registry name **registry.redhat.io** is used throughout in this Guide.

However, if you have not migrated to the new **registry** yet then replace all occurrences of **registry.redhat.io** with **registry.access.redhat.com** where ever applicable.

NOTE

Follow the same upgrade procedure to upgrade your environment from Red Hat Openshift Container Storage in Independent Mode 3.11.0 and above to Red Hat Openshift Container Storage in Independent Mode 3.11.4. Ensure that the correct image and version numbers are configured before you start the upgrade process.

The valid images for Red Hat Openshift Container Storage 3.11.4 are:

- registry.redhat.io/rhgs3/rhgs-server-rhel7:v3.11.4
- registry.redhat.io/rhgs3/rhgs-volmanager-rhel7:v3.11.4
- registry.redhat.io/rhgs3/rhgs-gluster-block-prov-rhel7:v3.11.4
- registry.redhat.io/rhgs3/rhgs-s3-server-rhel7:v3.11.4

8.1. PREREQUISITES

Ensure the following prerequisites are met:

- Section 3.1.3, “Red Hat OpenShift Container Platform and Red Hat Openshift Container Storage Requirements”
- Configuring Port Access: https://access.redhat.com/documentation/en-us/red_hat_openshift_container_storage/3.11/html-single/deployment_guide/#CRS_port_access
- Enabling Kernel Modules: https://access.redhat.com/documentation/en-us/red_hat_openshift_container_storage/3.11/html-single/deployment_guide/#CRS_enable_kernel
- Starting and Enabling Services: https://access.redhat.com/documentation/en-us/red_hat_openshift_container_storage/3.11/html-single/deployment_guide/#Start_enable_service
- Ensure to have the supported versions of OpenShift Container Platform with Red Hat Gluster Storage Server and Red Hat Openshift Container Storage. For more information on supported versions, see Section 3.1.1, “Supported Versions”
- If Heketi is running as a standalone service in one of the Red Hat Gluster Storage nodes, then ensure to open the port for Heketi. By default the port number for Heketi is 8080. To open this port execute the following command on the node where Heketi is running:

```
# firewall-cmd --zone=zone_name --add-port=8080/tcp
# firewall-cmd --zone=zone_name --add-port=8080/tcp --permanent
```

If Heketi is configured to listen on a different port, then change the port number in the command accordingly.

- Ensure that brick multiplexing is enabled. Brick multiplex status can be checked by using the following command:

```
# gluster v get all all
```

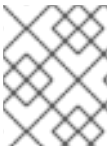
8.2. UPGRADING NODES AND PODS IN GLUSTERFS GROUP

Follow the steps in the sections ahead to upgrade your independent mode Setup.

8.2.1. Upgrading the Red Hat Gluster Storage Cluster

To upgrade the Red Hat Gluster Storage cluster, see In-Service Software Upgrade.

8.2.2. Upgrading/Migration of Heketi in RHGS node



NOTE

If Heketi is in an Openshift node, then skip this section and see Section 8.2.4.1, "Upgrading Heketi in Openshift node" instead.

IMPORTANT

- In OCS 3.11, upgrade of Heketi in RHGS node is not supported. Hence, you have to migrate heketi to a new heketi pod.
- Ensure to migrate to the supported heketi deployment now, as there might not be a migration path in the future versions.
- Ensure that cns-deploy rpm is installed in the master node. This provides template files necessary to setup heketi pod.

```
# subscription-manager repos --enable=rh-gluster-3-for-rhel-7-server-rpms
```

```
# yum install cns-deploy
```

1. Use the newly created containerized Red Hat Gluster Storage project on the master node:

```
# oc project <project-name>
```

For example:

```
# oc project gluster
```

2. Execute the following command on the master node to create the service account:

```
# oc create -f /usr/share/heketi/templates/heketi-service-account.yaml
serviceaccount/heketi-service-account created
```

3. Execute the following command on the master node to install the heketi template:

```
# oc create -f /usr/share/heketi/templates/heketi-template.yaml
template.template.openshift.io/heketi created
```

4. Verify if the templates are created

```
# oc get templates

NAME          DESCRIPTION                        PARAMETERS    OBJECTS
heketi        Heketi service deployment template   5 (3 blank)   3
```

5. Execute the following command on the master node to grant the heketi Service Account the necessary privileges:

```
# oc policy add-role-to-user edit system:serviceaccount:gluster:heketi-service-account
role "edit" added: "system:serviceaccount:gluster:heketi-service-account"
```

```
# oc adm policy add-scc-to-user privileged -z heketi-service-account
scc "privileged" added to: ["system:serviceaccount:gluster:heketi-service-account"]
```

6. On the RHGS node, where heketi is running, execute the following commands:

   a. Create the heketidbstorage volume:

   ```
   # heketi-cli volume create --size=2 --name=heketidbstorage
   ```

   b. Mount the volume:

   ```
   # mount  -t glusterfs 192.168.11.192:heketidbstorage /mnt/
   ```

   where 192.168.11.192 is one of the RHGS node.

   c. Stop the heketi service:

   ```
   # systemctl stop heketi
   ```

   d. Disable the heketi service:

   ```
   # systemctl disable heketi
   ```

   e. Copy the heketi db to the heketidbstorage volume:

   ```
   # cp /var/lib/heketi/heketi.db /mnt/
   ```

   f. Unmount the volume:

   ```
   # umount /mnt
   ```

g. Copy the following files from the heketi node to the master node:

```
# scp   /etc/heketi/heketi.json  topology.json   /etc/heketi/heketi_key
OCP_master_node:/root/
```

where OCP_master_node is the hostname of the master node.

7. On the master node, set the environment variables for the following three files that were copied from the heketi node. Add the following lines to ~/.bashrc file and run the bash command to apply and save the changes:

```
export SSH_KEYFILE=heketi_key
export TOPOLOGY=topology.json
export HEKETI_CONFIG=heketi.json
```

NOTE

If you have changed the value for "keyfile" in /etc/heketi/heketi.json to a different value, change here accordingly.

8. Execute the following command to create a secret to hold the configuration file:

```
# oc create secret generic heketi-config-secret --from-file=${SSH_KEYFILE} --from-
file=${HEKETI_CONFIG} --from-file=${TOPOLOGY}

secret/heketi-config-secret created
```

9. Execute the following command to label the secret:

```
# oc label --overwrite secret heketi-config-secret glusterfs=heketi-config-secret
heketi=config-secret

secret/heketi-config-secret labeled
```

10. Get the IP addresses of all the glusterfs nodes, from the heketi-gluster-endpoints.ymlfile. For example:

```
# cat heketi-gluster-endpoints.yaml
apiVersion: v1
kind: Endpoints
metadata:
  name: heketi-storage-endpoints
subsets:
- addresses:
  - ip: 192.168.11.208
  ports:
  - port: 1
- addresses:
  - ip: 192.168.11.176
  ports:
  - port: 1
- addresses:
```

```
  - ip: 192.168.11.192
  ports:
  - port: 1
```

In the above example, 192.168.11.208, 192.168.11.176, 192.168.11.192 are the glusterfs nodes.

11. Execute the following command to create the endpoints:

```
# oc create -f ./heketi-gluster-endpoints.yaml
```

```
# cat heketi-gluster-service.yaml
apiVersion: v1
kind: Service
metadata:
  name: heketi-storage-endpoints
spec:
  ports:
  - port: 1
```

12. Execute the following command to create the service:

```
# oc create -f ./heketi-gluster-service.yaml
```

13. Execute the following command to deploy the Heketi service, route, and deployment configuration which will be used to create persistent volumes for OpenShift:

```
# oc process heketi | oc create -f -
service/heketi created
route.route.openshift.io/heketi created
deploymentconfig.apps.openshift.io/heketi created
```

NOTE

It is recommended that the **heketidbstorage** volume be tuned for db workloads. Newly installed Openshift Container Storage deployments tune the heketidbstorage volume automatically. For older deployments, follow the KCS article Planning to run containerized DB or nosql workloads on Openshift Container Storage? and perform the volume set operation for the volume **heketidbstorage**.

14. To verify if Heketi is migrated execute the following command on the master node:

```
# oc rsh po/<heketi-pod-name>
```

For example:

```
# oc rsh po/heketi-1-p65c6
```

15. Execute the following command to check the cluster IDs

```
# heketi-cli cluster list
```

From the output verify if the cluster ID matches with the old cluster.

8.2.3. Upgrading if existing version deployed using cns-deploy

8.2.3.1. Upgrading Heketi in Openshift node

The following commands must be executed on the client machine.

1. Execute the following command to update the heketi client and cns-deploy packages:

```
# yum update cns-deploy -y
# yum update heketi-client -y
```

2. Backup the Heketi database file

```
# heketi-cli db dump > heketi-db-dump-$(date -I).json
```

3. Execute the following command to get the current HEKETI_ADMIN_KEY.
The OCS admin can choose to set any phrase for user key as long as it is not used by their infrastructure. It is not used by any of the OCS default installed resources.

```
oc get secret <heketi-admin-secret-name> -o jsonpath='{.data.key}'|base64 -d;echo
```

Where <heketi-admin-secret-name> is the name of the heketi admin secret created by the user.

4. Execute the following command to delete the heketi template.

```
# oc delete templates heketi
```

5. Execute the following command to install the heketi template.

```
# oc create -f /usr/share/heketi/templates/heketi-template.yaml
template "heketi" created
```

- Execute the following command to grant the heketi Service Account the necessary privileges.

```
# oc policy add-role-to-user edit system:serviceaccount: <project_name>:heketi-service-account
# oc adm policy add-scc-to-user privileged -z heketi-service-account
```

For example,

```
# oc policy add-role-to-user edit system:serviceaccount:storage-project:heketi-service-account
# oc adm policy add-scc-to-user privileged -z heketi-service-account
```

NOTE

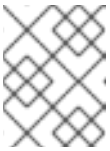
The service account used in heketi pod needs to be privileged because Heketi/rhgs-volmanager pod mounts the heketidb storage Gluster volume as a "glusterfs" volume type and not as a PersistentVolume (PV).
As per the security-context-constraints regulations in OpenShift, ability to mount volumes which are not of the type configMap, downwardAPI, emptyDir, hostPath, nfs, persistentVolumeClaim, secret is granted only to accounts with privileged Security Context Constraint (SCC).

6. Execute the following command to generate a new heketi configuration file.

```
# sed -e "s/\${HEKETI_EXECUTOR}/ssh/" -e "s#\${HEKETI_FSTAB}#/etc/fstab#" -e
"s/\${SSH_PORT}/22/" -e "s/\${SSH_USER}/root/" -e "s/\${SSH_SUDO}/false/" -e
"s/\${BLOCK_HOST_CREATE}/true/" -e "s/\${BLOCK_HOST_SIZE}/500/"
"/usr/share/heketi/templates/heketi.json.template" > heketi.json
```

- The **BLOCK_HOST_SIZE** parameter controls the size (in GB) of the automatically created Red Hat Gluster Storage volumes hosting the gluster-block volumes (For more information, see https://access.redhat.com/documentation/en-us/red_hat_openshift_container_storage/3.11/html-single/operations_guide/#Block_Storage). This default configuration will dynamically create block-hosting volumes of 500GB in size as more space is required.

- Alternatively, copy the file **/usr/share/heketi/templates/heketi.json.template** to **heketi.json** in the current directory and edit the new file directly, replacing each "**${VARIABLE}**" string with the required parameter.



NOTE

JSON formatting is strictly required (e.g. no trailing spaces, booleans in all lowercase).

7. Execute the following command to create a secret to hold the configuration file.

```
# oc create secret generic heketi-config-secret --from-file=private_key=${SSH_KEYFILE} --
from-file=./heketi.json
```

NOTE

If the **heketi-config-secret** file already exists, then delete the file and run the following command.

8. Execute the following command to delete the deployment configuration, service, and route for heketi:

```
# oc delete deploymentconfig,service,route heketi
```

9. Execute the following command to edit the heketi template. Edit the HEKETI_USER_KEY, HEKETI_ADMIN_KEY, and HEKETI_EXECUTOR parameters.

```
# oc edit template heketi
parameters:
```

```
  - description: Set secret for those creating volumes as type user
    displayName: Heketi User Secret
    name: HEKETI_USER_KEY
    value: <heketiuserkey>
  - description: Set secret for administration of the Heketi service as user admin
    displayName: Heketi Administrator Secret
    name: HEKETI_ADMIN_KEY
    value: <adminkey>
  - description: Set the executor type, kubernetes or ssh
    displayName: heketi executor type
    name: HEKETI_EXECUTOR
    value: ssh
  - description: Set the fstab path, file that is populated with bricks that heketi creates
    displayName: heketi fstab path
    name: HEKETI_FSTAB
    value: /etc/fstab
  - description: Set the hostname for the route URL
      displayName: heketi route name
      name: HEKETI_ROUTE
      value: heketi-storage
    - displayName: heketi container image name
      name: IMAGE_NAME
      required: true
      value: registry.redhat.io/rhgs3/rhgs-volmanager-rhel7:v3.11.4
    - description: A unique name to identify this heketi service, useful for running multiple
        heketi instances
      displayName: GlusterFS cluster name
      name: CLUSTER_NAME
value: storage
```

10. Execute the following command to deploy the Heketi service, route, and deployment configuration which will be used to create persistent volumes for OpenShift:

```
# oc process heketi | oc create -f -

service "heketi" created
route "heketi" created
deploymentconfig "heketi" created
```

NOTE

It is recommended that the **heketidbstorage** volume be tuned for db workloads. Newly installed Openshift Container Storage deployments tune the heketidbstorage volume automatically. For older deployments, follow the KCS article Planning to run containerized DB or nosql workloads on Openshift Container Storage? and perform the volume set operation for the volume **heketidbstorage**.

11. Execute the following command to verify that the containers are running:

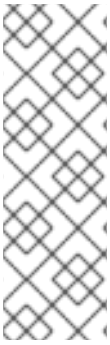
```
# oc get pods
```

For example:

```
# oc get pods
  NAME                                READY     STATUS    RESTARTS   AGE
  glusterfs-0h68l                     1/1       Running   0          3d
  glusterfs-0vcf3                     1/1       Running   0          3d
  glusterfs-gr9gh                     1/1       Running   0          3d
  heketi-1-zpw4d                      1/1       Running   0          3h
  storage-project-router-2-db2wl      1/1       Running   0          4d
```

8.2.3.2. Upgrading Gluster Block

Execute the following steps to upgrade gluster block.



NOTE

The recommended Red Hat Enterprise Linux (RHEL) version for block storage is RHEL-7.5.4. Please ensure that your kernel version matches with 3.10.0-862.14.4.el7.x86_64. To verify execute:

```
# uname -r
```

Reboot the node for the latest kernel update to take effect.

1. Execute the following command to upgrade the gluster block:

   ```
   # yum update gluster-block
   ```

2. Enable and start the gluster block service:

   ```
   # systemctl enable gluster-blockd
   # systemctl start gluster-blockd
   ```

3. To use gluster block, add the following two parameters to the **glusterfs** section in the heketi configuration file at /etc/heketi/heketi.JSON:

   ```
   auto_create_block_hosting_volume
   block_hosting_volume_size
   ```

   Where:

   auto_create_block_hosting_volume: Creates Block Hosting volumes automatically if not found or if the existing volume is exhausted. To enable this, set the value to **true**.

   block_hosting_volume_size: New block hosting volume will be created in the size mentioned. This is considered only if auto_create_block_hosting_volume is set to true. Recommended size is 500G.

   For example:

   ```
   .....
     .....
    "glusterfs" : {
        "executor" : "ssh",
   ```

```
    "db" : "/var/lib/heketi/heketi.db",

    "sshexec" : {
    "rebalance_on_expansion": true,
    "keyfile" : "/etc/heketi/private_key"
    },

    "auto_create_block_hosting_volume": true,

    "block_hosting_volume_size": 500G
  },
  .....
.....
```

4. Restart the Heketi service:

```
# systemctl restart heketi
```

NOTE

This step is not applicable if heketi is running as a pod in the Openshift cluster.

5. If a gluster-block-provisoner-pod already exists then delete it by executing the following commands:

```
# oc delete dc <gluster-block-dc>
```

For example:

```
# oc delete dc glusterblock-provisioner-dc
```

6. Delete the following resources from the old pod
If you have glusterfs pods:

```
# oc delete clusterroles.authorization.openshift.io glusterblock-provisioner-runner
```

```
# oc delete serviceaccounts glusterblock-provisioner
serviceaccount "glusterblock-provisioner" deleted
# oc delete clusterrolebindings.authorization.openshift.io glusterblock-provisioner
```

If you have registry pods:

```
# oc delete clusterroles.authorization.openshift.io glusterblock-provisioner-runner
```

```
# oc delete serviceaccounts glusterblock-provisioner
serviceaccount "glusterblock-provisioner" deleted
# oc delete clusterrolebindings.authorization.openshift.io glusterblock-provisioner
```

7. Execute the following commands to deploy the gluster-block provisioner:

```
# sed -e 's/\\\${NAMESPACE}/<NAMESPACE>/' /usr/share/heketi/templates/glusterblock-
provisioner.yaml | oc create -f -
```

```
# oc adm policy add-cluster-role-to-user glusterblock-provisioner-runner
system:serviceaccount:<NAMESPACE>:glusterblock-provisioner
```

For example:

```
# sed -e 's/\\\${NAMESPACE}/storage-project/' /usr/share/heketi/templates/glusterblock-
provisioner.yaml | oc create -f -
```

```
# oc adm policy add-cluster-role-to-user glusterblock-provisioner-runner
system:serviceaccount:storage-project:glusterblock-provisioner
```

8.2.4. Upgrading if existing version deployed using Ansible

8.2.4.1. Upgrading Heketi in Openshift node

The following commands must be executed on the client machine.

1. Execute the following command to update the heketi client:

```
# yum update heketi-client -y
```

2. Backup the Heketi database file:

```
# heketi-cli db dump > heketi-db-dump-$(date -I).json
```

3. Execute the following command to get the current HEKETI_ADMIN_KEY:
The OCS administrator can choose to set any phrase for user key as long as it is not used by their infrastructure. It is not used by any of the OCS default installed resources.

```
oc get secret heketi-storage-admin-secret -o jsonpath='{.data.key}'|base64 -d;echo
```

4. Execute the following command to delete the heketi template.

```
 # oc delete templates heketi
```

5. Execute the following command to install the heketi template.

```
# oc create -f /usr/share/ansible/openshift-
ansible/roles/openshift_storage_glusterfs/files/heketi-template.yml
template "heketi" created
```

6. Execute the following step to edit the template:

```
# oc get templates
  NAME     DESCRIPTION       PARAMETERS  OBJECTS
  glusterblock-provisioner  glusterblock provisioner   3 (2 blank) 4
      template
  glusterfs    GlusterFS DaemonSet       5 (1 blank) 1
```

```
        template
   heketi     Heketi service deployment  7 (3 blank) 3
template
```

If the existing template has IMAGE_NAME and IMAGE_VERSION as two parameters, then edit the template to change the HEKETI_USER_KEY, HEKETI_ADMIN_KEY, HEKETI_EXECUTOR, HEKETI_FSTAB, HEKETI_ROUTE, IMAGE_NAME, IMAGE_VERSION and CLUSTER_NAME as shown in the example below.

```
# oc edit template heketi
parameters:
- description: Set secret for those creating volumes as type user
  displayName: Heketi User Secret
  name: HEKETI_USER_KEY
  value: <heketiuserkey>
- description: Set secret for administration of the Heketi service as user admin
  displayName: Heketi Administrator Secret
  name: HEKETI_ADMIN_KEY
  value: <adminkey>
- description: Set the executor type, kubernetes or ssh
  displayName: heketi executor type
  name: HEKETI_EXECUTOR
  value: ssh
- description: Set the fstab path, file that is populated with bricks that heketi creates
  displayName: heketi fstab path
  name: HEKETI_FSTAB
  value: /etc/fstab
- description: Set the hostname for the route URL
  displayName: heketi route name
  name: HEKETI_ROUTE
  value: heketi-storage
- displayName: heketi container image name
  name: IMAGE_NAME
  required: true
  value: registry.redhat.io/rhgs3/rhgs-volmanager-rhel7
- displayName: heketi container image version
  name: IMAGE_VERSION
  required: true
  value: v3.11.4
- description: A unique name to identify this heketi service, useful for running multiple heketi
instances
  displayName: GlusterFS cluster name
  name: CLUSTER_NAME
value: storage
```

If the template has only IMAGE_NAME, then edit the template to change the HEKETI_USER_KEY, HEKETI_ADMIN_KEY, HEKETI_EXECUTOR, HEKETI_FSTAB, HEKETI_ROUTE, IMAGE_NAME, and CLUSTER_NAME as shown in the example below.

```
parameters:
  - description: Set secret for those creating volumes as type user
    displayName: Heketi User Secret
    name: HEKETI_USER_KEY
    value: <heketiuserkey>
  - description: Set secret for administration of the Heketi service as user admin
```

```
    displayName: Heketi Administrator Secret
    name: HEKETI_ADMIN_KEY
    value: <adminkey>
  - description: Set the executor type, kubernetes or ssh
    displayName: heketi executor type
    name: HEKETI_EXECUTOR
    value: ssh
  - description: Set the fstab path, file that is populated with bricks that heketi creates
    displayName: heketi fstab path
    name: HEKETI_FSTAB
    value: /etc/fstab
  - description: Set the hostname for the route URL
    displayName: heketi route name
    name: HEKETI_ROUTE
    value: heketi-storage
  - displayName: heketi container image name
    name: IMAGE_NAME
    required: true
    value: registry.redhat.io/rhgs3/rhgs-volmanager-rhel7:v3.11.4
  - description: A unique name to identify this heketi service, useful for running multiple heketi
instances
    displayName: GlusterFS cluster name
    name: CLUSTER_NAME
    value: storage
```

7. Execute the following command to delete the deployment configuration, service, and route for heketi:

```
# oc delete deploymentconfig,service,route heketi-storage
```

8. Execute the following command to deploy the Heketi service, route, and deploymentconfig which will be used to create persistent volumes for OpenShift:

```
# oc process heketi | oc create -f -
service "heketi" created
route "heketi" created
deploymentconfig "heketi" created
```

NOTE

It is recommended that the **heketidbstorage** volume be tuned for db workloads. Newly installed Openshift Container Storage deployments tune the heketidbstorage volume automatically. For older deployments, follow the KCS article Planning to run containerized DB or nosql workloads on Openshift Container Storage? and perform the volume set operation for the volume **heketidbstorage**.

9. Execute the following command to verify that the containers are running:

```
# oc get pods
```

For example:

```
# oc get pods
```

```
NAME                          READY  STATUS  RESTARTS AGE
glusterfs-registry-0h68l        1/1   Running   0      3d
glusterfs-registry-0vcf3        1/1   Running   0      3d
glusterfs-registry-gr9gh        1/1   Running   0      3d
heketi-registry-1-zpw4d          1/1   Running   0      3h
storage-project-router-2-db2wl    1/1   Running   0      4d
```

8.2.4.2. Upgrading Gluster Block if Deployed by Using Ansible

Execute the following steps to upgrade gluster block.

NOTE

The recommended Red Hat Enterprise Linux (RHEL) version for block storage is RHEL-7.5.4. Please ensure that your kernel version matches with 3.10.0-862.14.4.el7.x86_64. To verify execute:

```
# uname -r
```

Reboot the node for the latest kernel update to take effect.

1. Execute the following command to upgrade the gluster block:

```
# yum update gluster-block
```

2. Enable and start the gluster block service:

```
# systemctl enable gluster-blockd
# systemctl start gluster-blockd
```

3. Execute the following command to update the heketi client

```
# yum update heketi-client -y
```

4. Restart the Heketi service:

```
# systemctl restart heketi
```

NOTE

This step is not applicable if heketi is running as a pod in the Openshift cluster.

5. Execute the following command to delete the old glusterblock provisioner template.

```
# oc delete templates glusterblock-provisioner
```

6. Execute the following command to register new glusterblock provisioner template, see Templates. Copy and paste to **new-block-prov.yaml**. For example,

```
# oc create -f new-block-prov.yaml
template.template.openshift.io/glusterblock-provisioner created
```

7. If a gluster-block-provisoner-pod already exists then delete it by executing the following commands.
   For glusterfs namespace:

```
# oc delete dc glusterblock-storage-provisioner-dc
```

   For glusterfs-registry namespace:

```
oc delete dc glusterblock-registry-provisioner-dc
```

8. Edit the glusterblock-provisioner template to change the IMAGE_NAME, IMAGE_VERSION and NAMESPACE.

```
# oc get templates
NAME     DESCRIPTION                 PARAMETERS OBJECTS
glusterblock-provisioner  glusterblock provisioner template    3 (2 blank) 4
glusterfs    GlusterFS DaemonSet template         5 (1 blank) 1
heketi  Heketi service deployment template   7 (3 blank)3
```

   If the template has IMAGE_NAME and IMAGE_VERSION as two separate parameters, then update the glusterblock-provisioner template as following. For example:

```
# oc edit template glusterblock-provisioner
- displayName: glusterblock provisioner container image name
  name: IMAGE_NAME
  required: true
  value: registry.redhat.io/rhgs3/rhgs-volmanager-rhel7
- displayName: glusterblock provisioner container image version
  name: IMAGE_VERSION
  required: true
  value: v3.11.4
- description: The namespace in which these resources are being created
  displayName: glusterblock provisioner namespace
  name: NAMESPACE
  required: true
  value: glusterfs
- description: A unique name to identify which heketi service manages this cluster, useful for
running multiple heketi instances
  displayName: GlusterFS cluster name
  name: CLUSTER_NAME
value: storage
```

   If the template has only IMAGE_NAME as a parameter, then update the glusterblock-provisioner template as following. For example:

```
# oc edit template glusterblock-provisioner
- displayName: glusterblock provisioner container image name
  name: IMAGE_NAME
  required: true
  value: rhgs3/rhgs-gluster-block-prov-rhel7:v3.11.4
- description: The namespace in which these resources are being created
  displayName: glusterblock provisioner namespace
  name: NAMESPACE
  required: true
```

```
    value: glusterfs
  - description: A unique name to identify which heketi service manages this cluster, useful for
  running multiple heketi instances
    displayName: GlusterFS cluster name
    name: CLUSTER_NAME
  value: storage
```

9. Delete the following resources from the old pod.
   If you have glusterfs pods:

```
# oc delete clusterroles.authorization.openshift.io glusterblock-provisioner-runner
```

```
# oc delete serviceaccounts glusterblock-storage-provisioner
# oc delete clusterrolebindings.authorization.openshift.io glusterblock-storage-provisioner
```

   If you have registry pods:

```
# oc delete clusterroles.authorization.openshift.io glusterblock-provisioner-runner
```

```
# oc delete serviceaccounts glusterblock-registry-provisioner
# oc delete clusterrolebindings.authorization.openshift.io glusterblock-registry-provisioner
```

10. Before running oc process determine the correct **provisioner** name. If there are more than one **gluster block provisioner** running in your cluster the names must differ from all other **provisioners**.
    For example,

    - If there are 2 or more provisioners the name should be **gluster.org/glusterblock-<namespace>** where, namespace is replaced by the namespace that the provisioner is deployed in.

    - If there is only one provisioner, installed prior to 3.11.4, **gluster.org/glusterblock** is sufficent. If the name currently in use already has a unique namespace suffix, reuse the existing name.

11. After editing the template, execute the following command to create the deployment configuration:

```
# oc process -p PROVISIONER_NAME=<provisioner-name> glusterblock-provisioner -o
yaml | oc create -f -
```

    For example:

```
 # oc process -p PROVISIONER_NAME=gluster.org/glusterblock-app-storage glusterblock-
provisioner -o yaml | oc create -f -
 clusterrole.authorization.openshift.io/glusterblock-provisioner-runner created
 serviceaccount/glusterblock-storage-provisioner created
 clusterrolebinding.authorization.openshift.io/glusterblock-storage-provisioner created
 deploymentconfig.apps.openshift.io/glusterblock-storage-provisioner-dc created
```

12. All storage classes that use gluster block volume provisioning must match exactly to one of the provisioner names in the cluster. To check the list of storage classes that refer to a **block provisioner**, in a given **namespace**, run the following command:

```
# oc get sc -o custom-
columns=NAME:.metadata.name,PROV:.provisioner,RSNS:.parameters.restsecretnamespace
| grep 'gluster.org/glusterblock' | grep <namespace>
```

Example:

```
# oc get sc -o custom-
columns=NAME:.metadata.name,PROV:.provisioner,RSNS:.parameters.restsecretnamespace
| grep 'gluster.org/glusterblock' | grep app-storage
glusterfs-storage-block   gluster.org/glusterblock-app-storage   app-storage
```

Check each storage class **provisioner name**, if it does not match the **block provisioner name** configured for that **namespace** it must be updated. If the **block provisioner** name already matches the **configured provisioner** name, nothing else needs to be done. Use the list generated above and include all storage class names where the provionser name must be updated.
For every storage class in this list do the following:

```
# oc get sc  -o yaml <storageclass>  > storageclass-to-edit.yaml
# oc delete sc  <storageclass>
# sed 's,gluster.org/glusterblock$,gluster.org/glusterblock-<namespace>,' storageclass-to-
edit.yaml | oc create -f -
```

Example:

```
# oc get sc  -o yaml gluster-storage-block  > storageclass-to-edit.yaml
# oc delete sc  gluster-storage-block
# sed 's,gluster.org/glusterblock$,gluster.org/glusterblock-app-storage,' storageclass-to-
edit.yaml | oc create -f -
```

8.2.5. Enabling S3 Compatible Object store

Support for S3 compatible Object Store is under technology preview. To enable S3 compatible object store, see https://access.redhat.com/documentation/en-us/red_hat_openshift_container_storage/3.11/html-single/operations_guide/#S3_Object_Store.

NOTE

If you have gluster nodes and heketi pods in glusterfs registry namespace, then follow the steps in section Section 8.3, “Upgrading nodes and pods in glusterfs registry group” .

8.3. UPGRADING NODES AND PODS IN GLUSTERFS REGISTRY GROUP

Follow the steps in the sections to upgrade your gluster nodes and heketi pods in glusterfs registry namespace.

8.3.1. Upgrading the Red Hat Gluster Storage Registry Cluster

To upgrade the Red Hat Gluster Storage cluster, see In-Service Software Upgrade.

8.3.1.1. Upgrading Heketi Registry pod

NOTE

If Heketi is not in an Openshift node, then you have to migrate Heketi in RHGS node to Openshift node. For more information on how to migrate, refer Section 8.2.2, "Upgrading/Migration of Heketi in RHGS node".

To upgrade the Heketi registry pods, perform the following steps:

The following commands must be executed on the client machine.

1. Execute the following command to update the heketi client:

```
# yum update heketi-client -y
```

2. Backup the Heketi registry database file:

```
# heketi-cli db dump > heketi-db-dump-$(date -I).json
```

3. Execute the following command to get the current HEKETI_ADMIN_KEY:
The OCS administrator can choose to set any phrase for user key as long as it is not used by their infrastructure. It is not used by any of the OCS default installed resources.

```
# oc get secret heketi-registry-admin-secret -o jsonpath='{.data.key}'|base64 -d;echo
```

4. Execute the following command to delete the heketi template.

```
# oc delete templates heketi
```

5. Execute the following command to install the heketi template.

```
# oc create -f /usr/share/ansible/openshift-
ansible/roles/openshift_storage_glusterfs/files/heketi-template.yml
template "heketi" created
```

- Execute the following step to edit the template:

```
# oc get templates
NAME        DESCRIPTION             PARAMETERS OBJECTS
glusterblock-  glusterblock provisioner  3 (2 blank) 4
provisioner    template
heketi         Heketi service deployment 7 (3 blank) 3
template
```

If the existing template has IMAGE_NAME and IMAGE_VERSION as two parameters, then edit the template to change the HEKETI_USER_KEY, HEKETI_ADMIN_KEY, HEKETI_EXECUTOR, HEKETI_FSTAB, HEKETI_ROUTE, IMAGE_NAME, IMAGE_VERSION and CLUSTER_NAME as shown in the following example:

```
# oc edit template heketi
parameters:
- description: Set secret for those creating volumes as type user
  displayName: Heketi User Secret
  name: HEKETI_USER_KEY
```

```
    value: heketiuserkey
  - description: Set secret for administration of the Heketi service as
    user admin
    displayName: Heketi Administrator Secret
    name: HEKETI_ADMIN_KEY
    value: adminkey
  - description: Set the executor type, kubernetes or ssh
    displayName: heketi executor type
    name: HEKETI_EXECUTOR
    value: ssh
  - description: Set the fstab path, file that is populated with bricks
    that heketi creates
    displayName: heketi fstab path
    name: HEKETI_FSTAB
    value: /etc/fstab
  - description: Set the hostname for the route URL
    displayName: heketi route name
    name: HEKETI_ROUTE
    value: heketi-registry
  - displayName: heketi container image name
    name: IMAGE_NAME
    required: true
    value: registry.redhat.io/rhgs3/rhgs-volmanager-rhel7
  - displayName: heketi container image version
    name: IMAGE_VERSION
    required: true
    value: v3.11.4
  - description: A unique name to identify this heketi service, useful
    for running multiple heketi instances
    displayName: GlusterFS cluster name
    name: CLUSTER_NAME
  value: registry
```

If the template has only IMAGE_NAME, then edit the template to change the HEKETI_USER_KEY, HEKETI_ADMIN_KEY, HEKETI_EXECUTOR, HEKETI_FSTAB, HEKETI_ROUTE, IMAGE_NAME, and CLUSTER_NAME as shown in the following example:

```
parameters:
  - description: Set secret for those creating volumes as type user
    displayName: Heketi User Secret
    name: HEKETI_USER_KEY
    value: heketiuserkey
  - description: Set secret for administration of the Heketi service as
    user admin
    displayName: Heketi Administrator Secret
    name: HEKETI_ADMIN_KEY
    value: adminkey
  - description: Set the executor type, kubernetes or ssh
    displayName: heketi executor type
    name: HEKETI_EXECUTOR
    value: ssh
  - description: Set the fstab path, file that is populated with bricks that heketi creates
    displayName: heketi fstab path
    name: HEKETI_FSTAB
    value: /etc/fstab
  - description: Set the hostname for the route URL
```

```
    displayName: heketi route name
    name: HEKETI_ROUTE
    value: heketi-registry
  - displayName: heketi container image name
    name: IMAGE_NAME
    required: true
    value: registry.redhat.io/rhgs3/rhgs-volmanager-rhel7:v3.11.4
  - description: A unique name to identify this heketi service, useful for running multiple
heketi instances
    displayName: GlusterFS cluster name
    name: CLUSTER_NAME
value: registry
```

6. Execute the following command to delete the deployment configuration, service, and route for heketi:

```
# oc delete deploymentconfig,service,route heketi-registry
```

7. Execute the following command to deploy the Heketi service, route, and deploymentconfig which will be used to create persistent volumes for OpenShift:

```
# oc process heketi | oc create -f -
service "heketi-registry" created route "heketi-registry" created deploymentconfig "heketi-
registry" created
```

NOTE

It is recommended that the **heketidbstorage** volume be tuned for db workloads. Newly installed Openshift Container Storage deployments tune the heketidbstorage volume automatically. For older deployments, follow the KCS article Planning to run containerized DB or nosql workloads on Openshift Container Storage? and perform the volume set operation for the volume **heketidbstorage**.

8. Execute the following command to verify that the containers are running:

```
# oc get pods
```

For example:

```
# oc get pods
NAME                          READY  STATUS  RESTARTS AGE
heketi-registry-1-zpw4d           1/1   Running   0      3h
glusterblock-registry-provisioner- 1/1   Running   0      21h
dc-1-c59rn
```

8.3.2. Upgrading glusterblock-provisioner Pod

To upgrade the glusterblock-provisioner pods, perform the following steps:

1. Execute the following command to delete the old glusterblock provisioner template.

```
# oc delete templates glusterblock-provisioner
```

2. Execute the following command to register new glusterblock provisioner template.

```
# oc create -f /usr/share/ansible/openshift-
ansible/roles/openshift_storage_glusterfs/files/glusterblock-provisioner.yml
template "glusterblock-provisioner" created
```

3. If a glusterblock-provisoner pod already exists then delete it by executing the following commands:

```
# oc delete dc <gluster-block-registry-dc>
```

For example:

```
# oc delete dc glusterblock-registry-provisioner-dc
```

4. Edit the glusterblock-provisioner template to change the IMAGE_NAME, IMAGE_VERSION, and NAMESPACE.

```
# oc get templates
NAME          DESCRIPTION           PARAMETERS  OBJECTS
glusterblock-  glusterblock          3 (2 blank)   4
provisioner    provisioner template
heketi        Heketi service        7 (3 blank)   3
deployment template
```

If the template has IMAGE_NAME and IMAGE_VERSION as two separate parameters, then update the glusterblock-provisioner template as follows:

```
oc edit template glusterblock-provisioner
  - displayName: glusterblock provisioner container image name
    name: IMAGE_NAME
    required: true
    value: registry.redhat.io/rhgs3/rhgs-volmanager-rhel7
  - displayName: glusterblock provisioner container image version
    name: IMAGE_VERSION
    required: true
    value: v3.11.4
  - description: The namespace in which these resources are being created
    displayName: glusterblock provisioner namespace
    name: NAMESPACE
    required: true
    value: glusterfs-registry
  - description: A unique name to identify which heketi service manages this cluster, useful for
running multiple heketi instances
    displayName: GlusterFS cluster name
    name: CLUSTER_NAME
value: registry
```

If the template has only IMAGE_NAME as a parameter, then update the glusterblock-provisioner template as follows:

```
# oc edit template glusterblock-provisioner
  - displayName: glusterblock provisioner container image name
    name: IMAGE_NAME
```

```
    required: true
    value: rhgs3/rhgs-gluster-block-prov-rhel7:v3.11.4
  - description: The namespace in which these resources are being created
  - displayName: glusterblock provisioner namespace
    name: NAMESPACE
    required: true
    value: glusterfs-registry
  - description: A unique name to identify which heketi service manages this cluster, useful for
running multiple heketi instances
    displayName: GlusterFS cluster name
    name: CLUSTER_NAME
value: registry
```

5. Delete the following resources from the old pod:

```
# oc delete clusterroles.authorization.openshift.io glusterblock-provisioner-runner
# oc delete serviceaccounts glusterblock-registry-provisioner
# oc delete clusterrolebindings.authorization.openshift.io glusterblock-registry-provisioner
```

6. Execute the following command to create a glusterblock-provisioner:

```
# oc process <gluster_block_provisioner_template> | oc create -f -
```

8.3.3. Upgrading Gluster Block

To upgrade the gluster block, perform the following steps:

1. Execute the following command to upgrade the gluster block:

```
# yum update gluster-block
```

- Enable and start the gluster block service:

```
# systemctl enable gluster-blockd
# systemctl start gluster-blockd
```

8.4. UPGRADING THE CLIENT ON RED HAT OPENSHIFT CONTAINER PLATFORM NODES

Execute the following commands on each of the nodes:

1. To drain the pod, execute the following command on the master node (or any node with cluster-admin access):

```
# oc adm drain <node_name> --ignore-daemonsets
```

2. To check if all the pods are drained, execute the following command on the master node (or any node with cluster-admin access):

```
# oc get pods --all-namespaces --field-selector=spec.nodeName=<node_name>
```

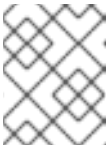
3. Execute the following command on the node to upgrade the client on the node:

```
# yum update glusterfs-client
```

4. To enable node for pod scheduling execute the following command on the master node (or any node with cluster-admin access):

```
# oc adm manage-node --schedulable=true <node_name>
```

- Create and add the following content to the multipath.conf file:



NOTE

Make sure that the changes to multipath.conf and reloading of multipathd are done only after all the server nodes are upgraded.

```
# cat >> /etc/multipath.conf <<EOF
# LIO iSCSI
devices {
  device {
    vendor "LIO-ORG"
    user_friendly_names "yes" # names like mpatha
    path_grouping_policy "failover" # one path per group
    hardware_handler "1 alua"
    path_selector "round-robin 0"
    failback immediate
    path_checker "tur"
    prio "alua"
    no_path_retry 120
  }
}
EOF
```

5. Execute the following commands to start multipath daemon and [re]load the multipath configuration:

```
# systemctl start multipathd
```

```
# systemctl reload multipathd
```

PART IV. UNINSTALLING

CHAPTER 9. UNINSTALL RED HAT OPENSHIFT CONTAINER STORAGE

For Red Hat Openshift Container Storage, the OpenShift Container Platform Advanced Installer comes with a playbook to uninstall all resources and artifacts from the cluster. To use it,provide the original inventory file that was used to install the target instanceof Red Hat Openshift Container Storage and run the following playbook:

WARNING

This procedure will destroy data. Proceed with caution.

```
ansible-playbook -i <path_to_inventory_file> /usr/share/ansible/openshift-
ansible/playbooks/openshift-glusterfs/uninstall.yml
```

In addition, the playbook supports the use of a variable called`openshift_storage_glusterfs_wipe` which, when enabled, will destroy any data onthe block devices that were used for Red Hat Gluster Storage backend storage. For more information about the settings/variables that will be destroyed, see Appendix B, *Settings that are destroyed when using uninstall playbook* . It is recommended to use this variable in the following format:

```
ansible-playbook -i <path_to_inventory_file> -e "openshift_storage_glusterfs_wipe=true"
/usr/share/ansible/openshift-ansible/playbooks/openshift-glusterfs/uninstall.yml
```

NOTE

If gluster-block is uninstalled, ensure that the entries corresponding to gluster-block in /etc/target/saveconfig.json is removed. It is possible that the configuration file may contain entries other than gluster-block and hence it is required to remove the the gluster-block entries manually.

PART V. WORKLOADS

CHAPTER 10. MANAGING ARBITRATED REPLICATED VOLUMES

10.1. MANAGING ARBITER BRICK SIZE

A standard replica 3 volume has the same sized bricks in each set, however, an arbiter volume will have one brick in the brick set that can be smaller than the data bricks.

In order to better optimize the sizing of the Arbiter brick, Heketi allows the user to provide an average file size value that is used to calculate the final size of the Arbiter brick. This is done using the volume option “user.heketi.average-file-size NUM” where NUM is an integer value in KiB. By default Heketi uses a value of 64KiB.

To create an arbiter volume with a custom average file size using the heketi-cli command line tool the volume options "user.heketi.arbiter true" and "user.heketi.average-file-size 1024" must be provided.

For example:

```
# heketi-cli volume create --size=4 --gluster-volume-options='user.heketi.arbiter
true,user.heketi.average-file-size 1024'
```

10.2. MANAGING ARBITER BRICK PLACEMENT

To accomplish the task of controlling where arbiter bricks are placed, Heketi uses specific node and device tags. For the Arbiter feature, the tag "arbiter" can be applied to a node or device with the values of "supported", "required", or "disabled".

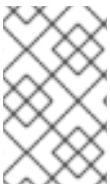
where:

- supported: both arbiter bricks and data bricks are allowed.
- required: only arbiter bricks are allowed, data bricks are rejected.
- disabled: only data bricks are allowed, arbiter bricks are rejected.

Based on your use case, you can set tags on a node or a device.

For example, to use arbiter in order to split nodes such that arbiter nodes can act as dedicated "tiebreakers" between the nodes that host data, you can set a tag on the node.

The following example shows how to set tags on a device. The nodes have heterogeneous device types and you want to set a particular space saving pattern: one node with a small nvme device and two (or more) nodes with larger SSDs. To do this, set a tag on the device by identifying the small device as d1 (arbiter:required) and the larger devices as d2 and d3 (arbiter:disabled).



NOTE

A device without an explicit tag will automatically inherit the arbiter tag value from the node it is connected to. An explicit tag on the device always has priority over the node’s tag.

10.2.1. Setting Tags with the Heketi CLI

To set tags on nodes and device via the heketi-cli command line tool, execute the following commands:

Node

```
# heketi-cli node settags <node id> arbiter:<tag>
```

For example:

```
# heketi-cli node settags e2a792a43ca9a6bac4b9bfa792e89347 arbiter:disabled
```

Device

```
# heketi-cli device settags <device id> arbiter:<tag>
```

For example:

```
# heketi-cli device settags 167fe2831ad0a91f7173dac79172f8d7 arbiter:required
```

10.2.2. Removing Tags using Heketi CLI

If you want to remove the arbiter tags, then execute the following commands:

Node

```
# heketi-cli node rmtags <node id> arbiter
```

For example:

```
# heketi-cli node rmtags e2a792a43ca9a6bac4b9bfa792e89347 arbiter
```

Device

```
# heketi-cli device rmtags <device id> arbiter
```

For example:

```
# heketi-cli device rmtags 167fe2831ad0a91f7173dac79172f8d7 arbiter
```

10.2.3. Viewing Tags with the Heketi CLI

To view the tags, execute the following commands. If the node or device has any tags it will be displayed in a list below the heading "Tags":

Node

```
# heketi-cli node info <node id>
```

For example:

```
# heketi-cli node info e2a792a43ca9a6bac4b9bfa792e89347
Node Id: e2a792a43ca9a6bac4b9bfa792e89347
```

```
State: online
Cluster Id: ddb14817873c13c5bb42a5c04969daf9
Zone: 1
Management Hostname: 10.0.0.1
Storage Hostname: 10.0.0.1
Tags:
  arbiter: disabled
  test: demonstration
Devices:
Id:0b39f89c0677e8c0b796caf00204e726   Name:/dev/vdb          State:online    Size (GiB):500
Used (GiB):0      Free (GiB):500    Bricks:0
Id:167fe2831ad0a91f7173dac79172f8d7   Name:/dev/vdg          State:online    Size (GiB):500
Used (GiB):0      Free (GiB):500    Bricks:0
```

Device

```
# heketi-cli device info <device id>
```

For example:

```
# heketi-cli device info 167fe2831ad0a91f7173dac79172f8d7
Device Id: 167fe2831ad0a91f7173dac79172f8d7
Name: /dev/vdg
State: online
Size (GiB): 500
Used (GiB): 0
Free (GiB): 500
Tags:
  arbiter: required
  foobar: magic
Bricks:
```

10.3. CREATING PERSISTENT VOLUMES

For more information about creating persistent volumes, see https://access.redhat.com/documentation/en-us/red_hat_openshift_container_storage/3.11/html-single/operations_guide/#chap-Documentation-Red_Hat_Gluster_Storage_Container_Native_with_OpenShift_Platform-OpenShift_Creating_Persistent_Volumes-Dynamic_Prov

IMPORTANT

In the Storage Class file ensure to add "user.heketi.arbiter true" under the volumeoptions parameter to create Arbiter volumes.

For example:

```
apiVersion: storage.k8s.io/v1
kind: StorageClass
metadata:
  name: gluster-container
provisioner: kubernetes.io/glusterfs
parameters:
  resturl: "http://heketi-storage-project.cloudapps.mystorage.com"
  restuser: "admin"
  volumetype: "replicate:3"
  clusterid:
"630372ccdc720a92c681fb928f27b53f,796e6db1981f369ea0340913eeea4c9a"
  secretNamespace: "default"
  secretName: "heketi-secret"
  volumeoptions: "user.heketi.arbiter true"
  volumenameprefix: "test-vol"
allowVolumeExpansion: "true"
```

CHAPTER 11. SETTING UP CUSTOM VOLUME OPTIONS

To set up shared persistent volumes, execute the following commands in one of the Red Hat Openshift Container Storage pod:

1. For static provisioning: Execute the following commands to set the volume options:

```
# gluster volume set VOLUME performance.open-behind off
# gluster volume set VOLUME performance.write-behind off
# gluster volume set VOLUME performance.stat-prefetch off
# gluster volume set VOLUME  performance.quick-read off
# gluster volume set VOLUME performance.strict-o-direct on
# gluster volume set VOLUME  performance.read-ahead off
# gluster volume set VOLUME performance.io-cache off
# gluster volume set VOLUME performance.readdir-ahead off
```

2. To verify, execute the following command:

```
# gluster volume get VOLUME all  | grep <performance translator>
```

   For example:

```
# gluster volume get VOLUME all  | egrep "performance.stat-prefetch | performance.write-behind | performance.open-behind | performance.quick-read | performance.strict-o-direct | performance.read-ahead | performance.io-cache | performance.readdir-ahead"
```

3. For dynamic provisioning, the volume options can be listed under "parameter" in the storage class file. For example:

```
parameters:
  resturl: http://heketi-storage-glusterfs.router.default.svc.cluster.local
  restuser: admin
  secretName: heketi-storage-admin-secret
  secretNamespace: glusterfs
  volumeoptions: performance.stat-prefetch off performance.write-behind off
performance.open-behind off performance.quick-read off performance.strict-o-direct on
performance.read-ahead off performance.io-cache off performance.readdir-ahead off
```

For more information on registering a storage class for file storage see https://access.redhat.com/documentation/en-us/red_hat_openshift_container_storage/3.11/html-single/operations_guide/#chap-Documentation-Red_Hat_Gluster_Storage_Container_Native_with_OpenShift_Platform-OpenShift_Creating_Persistent_Volumes-Dynamic_Prov

For more information on registering a storage class for block storage see https://access.redhat.com/documentation/en-us/red_hat_openshift_container_storage/3.11/html-single/operations_guide/#Block_dynamic_prov_vol

PART VI. APPENDIX

APPENDIX A. OPTIONAL DEPLOYMENT METHOD (WITH CNS-DEPLOY)

Following sections provides an optional method to deploy Red Hat Openshift Container Storage using cns-deploy.

NOTE

CNS-deploy is deprecated and will not be supported in future Openshift Container Storage versions for new deployments.

A.1. SETTING UP CONVERGED MODE

The converged mode environment addresses the use-case where applications require both shared storage and the flexibility of a converged infrastructure with compute and storage instances being scheduled and run from the same set of hardware.

A.1.1. Configuring Port Access

- On each of the OpenShift nodes that will host the Red Hat Gluster Storage container, add the following rules to **/etc/sysconfig/iptables** in order to open the required ports:

```
-A OS_FIREWALL_ALLOW -p tcp -m state --state NEW -m tcp --dport 24007 -j ACCEPT
-A OS_FIREWALL_ALLOW -p tcp -m state --state NEW -m tcp --dport 24008 -j ACCEPT
-A OS_FIREWALL_ALLOW -p tcp -m state --state NEW -m tcp --dport 2222 -j ACCEPT
-A OS_FIREWALL_ALLOW -p tcp -m state --state NEW -m multiport --dports 49152:49664 -j
ACCEPT
-A OS_FIREWALL_ALLOW -p tcp -m state --state NEW -m tcp --dport 24010 -j ACCEPT
-A OS_FIREWALL_ALLOW -p tcp -m state --state NEW -m tcp --dport 3260 -j ACCEPT
-A OS_FIREWALL_ALLOW -p tcp -m state --state NEW -m tcp --dport 111 -j ACCEPT
```

NOTE

- Port 24010 and 3260 are for gluster-blockd and iSCSI targets respectively.
- The port range starting at 49664 defines the range of ports that can be used by GlusterFS for communication to its volume bricks. In the above example the total number of bricks allowed is 512. Configure the port range based on the maximum number of bricks that could be hosted on each node.

For more information about Red Hat Gluster Storage Server ports, see https://access.redhat.com/documentation/en-us/red_hat_gluster_storage/3.5/html/administration_guide/chap-getting_started.

- Execute the following command to reload the iptables:

```
# systemctl reload iptables
```

- Execute the following command on each node to verify if the iptables are updated:

```
# iptables -L
```

A.1.2. Enabling Kernel Modules

Before running the **cns-deploy** tool, you must ensure that the **dm_thin_pool**, **dm_multipath**, and **target_core_user** modules are loaded in the OpenShift Container Platform node. Execute the following commands only on Gluster nodes to verify if the modules are loaded:

```
# lsmod | grep dm_thin_pool
```

```
# lsmod | grep dm_multipath
```

```
# lsmod | grep target_core_user
```

If the modules are not loaded, then execute the following command to load the modules:

```
# modprobe dm_thin_pool
```

```
# modprobe dm_multipath
```

```
# modprobe target_core_user
```

NOTE

To ensure these operations are persisted across reboots, create the following files and update each with the content as mentioned:

```
# cat /etc/modules-load.d/dm_thin_pool.conf
dm_thin_pool
```

```
# cat /etc/modules-load.d/dm_multipath.conf
dm_multipath
```

```
# cat /etc/modules-load.d/target_core_user.conf
target_core_user
```

A.1.3. Starting and Enabling Services

Execute the following commands to enable and run rpcbind on all the nodes hosting the gluster pod:

```
# systemctl add-wants multi-user rpcbind.service
# systemctl enable rpcbind.service
# systemctl start rpcbind.service
```

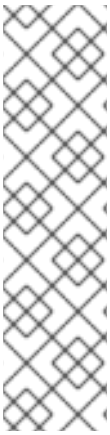
Execute the following command to check the status of rpcbind

```
# systemctl status rpcbind

rpcbind.service - RPC bind service
   Loaded: loaded (/usr/lib/systemd/system/rpcbind.service; enabled; vendor preset: enabled)
   Active: active (running) since Wed 2017-08-30 21:24:21 IST; 1 day 13h ago
```

```
Main PID: 9945 (rpcbind)
  CGroup: /system.slice/rpcbind.service
└─9945 /sbin/rpcbind -w
```

Next Step: Proceed to Section A.3, "Setting up the Environment" to prepare the environment for Red Hat Gluster Storage Container Converged in OpenShift.



NOTE

To remove an installation of Red Hat Openshift Container Storage done using cns-deploy, run the **cns-deploy --abort** command. Use the **-g** option if Gluster is containerized.

When the pods are deleted, not all Gluster states are removed from the node. Therefore, you must also run **rm -rf /var/lib/heketi /etc/glusterfs /var/lib/glusterd /var/log/glusterfs** command on every node that was running a Gluster pod and also run **wipefs -a <device>** for every storage device that was consumed by Heketi. This erases all the remaining Gluster states from each node. You must be an administrator to run the device wiping command

A.2. SETTING UP INDEPENDENT MODE

In an independent mode set-up, a dedicated Red Hat Gluster Storage cluster is available external to the OpenShift Container Platform. The storage is provisioned from the Red Hat Gluster Storage cluster.

A.2.1. Installing Red Hat Gluster Storage Server on Red Hat Enterprise Linux (Layered Install)

Layered install involves installing Red Hat Gluster Storage over Red Hat Enterprise Linux.

IMPORTANT

It is recommended to create a separate **/var** partition that is large enough (50GB - 100GB) for log files, geo-replication related miscellaneous files, and other files.

1. Perform a base install of Red Hat Enterprise Linux 7 Server
   Independent mode is supported only on Red Hat Enterprise Linux 7.

2. Register the System with Subscription Manager
   Run the following command and enter your Red Hat Network username and password to register the system with the Red Hat Network:

   ```
   # subscription-manager register
   ```

3. Identify Available Entitlement Pools
   Run the following commands to find entitlement pools containing the repositories required to install Red Hat Gluster Storage:

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

4. Attach Entitlement Pools to the System

Use the pool identifiers located in the previous step to attach the **Red Hat Enterprise Linux Server** and **Red Hat Gluster Storage** entitlements to the system. Run the following command to attach the entitlements:

```
# subscription-manager attach --pool=[POOLID]
```

For example:

```
# subscription-manager attach --pool=8a85f9814999f69101499c05aa706e47
```

5. Enable the Required Channels
For Red Hat Gluster Storage 3.5 on Red Hat Enterprise Linux 7.7

Run the following commands to enable the repositories required to install Red Hat Gluster Storage

```
# subscription-manager repos --enable=rhel-7-server-rpms
# subscription-manager repos --enable=rh-gluster-3-for-rhel-7-server-rpms
```

6. Verify if the Channels are Enabled
Run the following command to verify if the channels are enabled:

```
# yum repolist
```

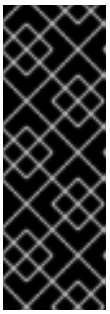
7. Update all packages
Ensure that all packages are up to date by running the following command.

```
# yum update
```

8. Kernel Version Requirement
Independent mode requires the kernel-3.10.0-862.14.4.el7.x86_64 version or higher to be used on the system. Verify the installed and running kernel versions by running the following command:

```
# rpm -q kernel
kernel-3.10.0-862.14.4.el7.x86_64
```

```
# uname -r
3.10.0-862.14.4.el7.x86_64
```



IMPORTANT

If any kernel packages are updated, reboot the system with the following command.

+

```
# shutdown -r now
```

9. Install Red Hat Gluster Storage
Run the following command to install Red Hat Gluster Storage:

```
# yum install redhat-storage-server
```

a. To enable gluster-block execute the following command:

```
# yum install gluster-block
```

1. Reboot
   Reboot the system.

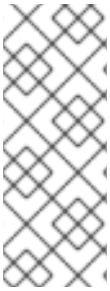
A.2.2. Configuring Port Access

This section provides information about the ports that must be open for the independent mode.

Red Hat Gluster Storage Server uses the listed ports. You must ensure that the firewall settings do not prevent access to these ports.

Execute the following commands to open the required ports for both runtime and permanent configurations on all Red Hat Gluster Storage nodes:

```
# firewall-cmd --zone=zone_name --add-port=24010/tcp --add-port=3260/tcp --add-port=111/tcp --add-port=22/tcp --add-port=24007/tcp --add-port=24008/tcp --add-port=49152-49664/tcp
# firewall-cmd --zone=zone_name --add-port=24010/tcp --add-port=3260/tcp --add-port=111/tcp --add-port=22/tcp --add-port=24007/tcp --add-port=24008/tcp --add-port=49152-49664/tcp --permanent
```



NOTE

- Port 24010 and 3260 are for gluster-blockd and iSCSI targets respectively.
- The port range starting at 49664 defines the range of ports that can be used by GlusterFS for communication to its volume bricks. In the above example, the total number of bricks allowed is 512. Configure the port range based on the maximum number of bricks that could be hosted on each node.

A.2.3. Enabling Kernel Modules

Execute the following commands to enable kernel modules:

1. You must ensure that the **dm_thin_pool** and **target_core_user** modules are loaded in the Red Hat Gluster Storage nodes.

   ```
   # modprobe target_core_user
   ```

   ```
   # modprobe dm_thin_pool
   ```

   Execute the following command to verify if the modules are loaded:

   ```
   # lsmod | grep dm_thin_pool
   ```

   ```
   # lsmod | grep target_core_user
   ```

NOTE

To ensure these operations are persisted across reboots, create the following files and update each file with the content as mentioned:

```
# cat /etc/modules-load.d/dm_thin_pool.conf
dm_thin_pool
```

```
# cat /etc/modules-load.d/target_core_user.conf
target_core_user
```

2. You must ensure that the **dm_multipath** module is loaded on all OpenShift Container Platform nodes.

```
# modprobe dm_multipath
```

Execute the following command to verify if the modules are loaded:

```
# lsmod | grep dm_multipath
```

NOTE

To ensure these operations are persisted across reboots, create the following file and update it with the content as mentioned:

```
# cat /etc/modules-load.d/dm_multipath.conf
dm_multipath
```

A.2.4. Starting and Enabling Services

Execute the following commands to start glusterd and gluster-blockd:

```
# systemctl start sshd
```

```
# systemctl enable sshd
```

```
# systemctl start glusterd
```

```
# systemctl enable glusterd
```

```
# systemctl start gluster-blockd
```

```
# systemctl enable gluster-blockd
```

Next Step: Proceed to Section A.3, “Setting up the Environment” to prepare the environment for Red Hat Gluster Storage Container Converged in OpenShift.

A.3. SETTING UP THE ENVIRONMENT

This chapter outlines the details for setting up the environment for Red Hat Openshift Container Platform.

A.3.1. Preparing the Red Hat OpenShift Container Platform Cluster

Execute the following steps to prepare the Red Hat OpenShift Container Platform cluster:

1. On the master or client, execute the following command to login as the cluster admin user:

```
# oc login
```

For example:

```
# oc login
Authentication required for https://dhcp46-24.lab.eng.blr.redhat.com:8443 (openshift)
Username: test
Password:
Login successful.

You have access to the following projects and can switch between them with 'oc project
<project_name>':

  * default
    kube-system
    logging
    management-infra
    openshift
    openshift-infra


Using project "default".
```

2. On the master or client, execute the following command to create a project, which will contain all the containerized Red Hat Gluster Storage services:

```
# oc new-project <project_name>
```

For example:

```
# oc new-project storage-project

Now using project "storage-project" on server "https://master.example.com:8443"
```

3. After the project is created, execute the following command on the master node to enable the deployment of the privileged containers as Red Hat Gluster Storage container can only run in the privileged mode.

```
# oc  adm policy add-scc-to-user privileged -z default
```

4. Execute the following steps on the master to set up the router:

NOTE

If a router already exists, proceed to Step 5. To verify if the router is already deployed, execute the following command:

```
# oc get dc --all-namespaces
```

To list all routers in all namespaces execute the following command:

```
# oc get dc --all-namespaces --selector=router=router
NAMESPACE   NAME     REVISION   DESIRED   CURRENT   TRIGGERED
BY
default     router   31         5         5         config
```

a. Execute the following command to enable the deployment of the router:

```
# oc adm policy add-scc-to-user privileged -z router
```

b. Execute the following command to deploy the router:

```
# oc adm router storage-project-router --replicas=1
```

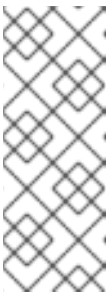
c. Edit the subdomain name in the config.yaml file located at **/etc/origin/master/master-config.yaml**.
For example:

```
subdomain: "cloudapps.mystorage.com"
```

For more information, see https://access.redhat.com/documentation/en-us/openshift_container_platform/3.11/html-single/configuring_clusters/#customizing-the-default-routing-subdomain.

d. For OpenShift Container Platform 3.7 and 3.9 execute the following command to restart the services:

```
# systemctl restart atomic-openshift-master-api atomic-openshift-master-controllers
```



NOTE

If the router setup fails, use the port forward method as described in https://access.redhat.com/documentation/en-us/red_hat_openshift_container_storage/3.11/html-single/operations_guide/#chap-Documentation-Red_Hat_Gluster_Storage_Container_Native_with_OpenShift_Platform-Port_Fwding.

For more information regarding router setup, see https://access.redhat.com/documentation/en-us/openshift_container_platform/3.11/html/configuring_clusters/setting-up-a-router

5. Execute the following command to verify if the router is running:

```
# oc get dc <_router_name_>
```

For example:

```
# oc get dc storage-project-router
NAME                    REVISION   DESIRED   CURRENT   TRIGGERED BY
storage-project-router   1          1         1         config
```

NOTE

Ensure you do not edit the */etc/dnsmasq.conf *file until the router has started.

1. After the router is running, the client has to be setup to access the services in the OpenShift cluster. Execute the following steps on the client to set up the DNS.

   a. Execute the following command to find the IP address of the router:

   ```
   # oc get pods -o wide --all-namespaces | grep router
   storage-project storage-project-router-1-cm874        1/1       Running   119d
   10.70.43.132   dhcp43-132.lab.eng.blr.redhat.com
   ```

   b. Edit the /etc/dnsmasq.conf file and add the following line to the file:

   ```
   address=/.cloudapps.mystorage.com/<Router_IP_Address>
   ```

   where, *Router_IP_Address* is the IP address of the node where the router is running.

   c. Restart the **dnsmasq** service by executing the following command:

   ```
   # systemctl restart dnsmasq
   ```

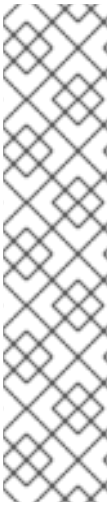
   d. Edit /etc/resolv.conf and add the following line:

   ```
   nameserver 127.0.0.1
   ```

For more information regarding setting up the DNS, see https://access.redhat.com/documentation/en-us/openshift_container_platform/3.11/html/installing_clusters/install-config-install-prerequisites#prereq-dns.

A.3.2. Deploying Containerized Red Hat Gluster Storage Solutions

The following section covers deployment of the converged mode pods, independent mode pods, and using the *cns-deploy *tool.



NOTE

- It is recommended that a separate cluster for OpenShift Container Platform infrastructure workload (registry, logging and metrics) and application pod storage. Hence, if you have more than 6 nodes ensure you create multiple clusters with a minimum of 3 nodes each. The infrastructure cluster should belong to the **default** project namespace.

- If you want to enable encryption on Red Hat Openshift Container Storage setup, see https://access.redhat.com/documentation/en-us/red_hat_openshift_container_storage/3.11/html-single/operations_guide/#chap-Documentation-Red_Hat_Gluster_Storage_Container_Native_with_OpenShift_Platform-Enabling_Encryption before proceeding with the following steps.

1. You must first provide a topology file for heketi which describes the topology of the Red Hat Gluster Storage nodes and their attached storage devices. A sample, formatted topology file (topology-sample.json) is installed with the 'heketi-client' package in the /usr/share/heketi/ directory.

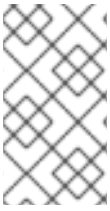
```
{
    "clusters": [
        {
            "nodes": [
                {
                    "node": {
                        "hostnames": {
                            "manage": [
                                "node1.example.com"
                            ],
                            "storage": [
                                "192.168.68.3"
                            ]
                        },
                        "zone": 1
                    },
                    "devices": [
                        "/dev/sdb",
                        "/dev/sdc",
                        "/dev/sdd",
                        "/dev/sde",
                        "/dev/sdf",
                        "/dev/sdg",
                        "/dev/sdh",
                        "/dev/sdi"
                    ]
                },
                {
                    "node": {
                        "hostnames": {
                            "manage": [
                                "node2.example.com"
                            ],
                            "storage": [
                                "192.168.68.2"
                            ]
```

```
                    },
                    "zone": 2
                },
                "devices": [
                    "/dev/sdb",
                    "/dev/sdc",
                    "/dev/sdd",
                    "/dev/sde",
                    "/dev/sdf",
                    "/dev/sdg",
                    "/dev/sdh",
                    "/dev/sdi"
                ]
            },
.......
.......
```

where, ** clusters: Array of clusters.

+ Each element on the array is a map which describes the cluster as follows.

- nodes: Array of OpenShift nodes that will host the Red Hat Gluster Storage container
  Each element on the array is a map which describes the node as follows
- node: It is a map of the following elements:
  - zone: The value represents the zone number that the node belongs to; the zone number is used by heketi for choosing optimum position of bricks by having replicas of bricks in different zones. Hence zone number is similar to a failure domain.
  - hostnames: It is a map which lists the manage and storage addresses
    - manage: It is the hostname/IP Address that is used by Heketi to communicate with the node
    - storage: It is the IP address that is used by other OpenShift nodes to communicate with the node. Storage data traffic will use the interface attached to this IP. This must be the IP address and not the hostname because, in an OpenShift environment, Heketi considers this to be the endpoint too.
- devices: Name of each disk to be added

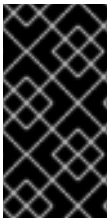


NOTE

Copy the topology file from the default location to your location and then edit it:

```
# cp /usr/share/heketi/topology-sample.json /<_Path_>/topology.json
```

Edit the topology file based on the Red Hat Gluster Storage pod hostname under the **node.hostnames.manage** section and **node.hostnames.storage** section with the IP address. For simplicity, the /usr/share/heketi/topology-sample.json file only sets up 4 nodes with 8 drives each.



IMPORTANT

Heketi stores its database on a Red Hat Gluster Storage volume. In cases where the volume is down, the Heketi service does not respond due to the unavailability of the volume served by a disabled trusted storage pool.To resolve this issue, restart the trusted storage pool which contains the Heketi volume.

A.3.3. Deploying Converged Mode

Execute the following commands to deploy converged mode:

1. Execute the following command on the client to deploy the heketi and Red Hat Gluster Storage pods:

```
# cns-deploy -v -n <namespace> -g --admin-key <admin-key> --user-key <user-key>
topology.json
```

NOTE

- From Container-Native Storage 3.6, support for S3 compatible Object Store in Red Hat Openshift Container Storage is under technology preview. To deploy S3 compatible object store in Red Hat Openshift Container Storage see substep i below.
- In the above command, the value for **admin-key** is the secret string for heketi admin user. The heketi administrator will have access toall APIs and commands. Default is to use no secret.
- The **BLOCK_HOST_SIZE** parameter in cns-deploy controls the size (in GB) of the automatically created Red Hat Gluster Storage volumes hosting the gluster-block volumes. This default configuration will dynamically create block-hosting volumes of 500GB in size when more space is required. If you want to change this value then use --block-host in cns-deploy. For example:

```
# cns-deploy -v -n storage-project -g --admin-key secret --user-key
mysecret --block-host 1000 topology.json
```

For example:

```
# cns-deploy -v -n storage-project -g --admin-key secret --user-key mysecret topology.json

Welcome to the deployment tool for GlusterFS on Kubernetes and OpenShift.

Before getting started, this script has some requirements of the execution
environment and of the container platform that you should verify.

The client machine that will run this script must have:
 * Administrative access to an existing Kubernetes or OpenShift cluster
 * Access to a python interpreter 'python'

Each of the nodes that will host GlusterFS must also have appropriate firewall
rules for the required GlusterFS ports:
 * 111   - rpcbind (for glusterblock)
 * 2222  - sshd (if running GlusterFS in a pod)
```

```
 * 3260  - iSCSI targets (for glusterblock)
 * 24010 - glusterblockd
 * 24007 - GlusterFS Management
 * 24008 - GlusterFS RDMA
 * 49152 to 49251 - Each brick for every volume on the host requires its own
   port. For every new brick, one new port will be used starting at 49152. We
   recommend a default range of 49152-49251 on each host, though you can adjust
   this to fit your needs.

The following kernel modules must be loaded:
 * dm_snapshot
 * dm_mirror
 * dm_thin_pool
 * dm_multipath
 * target_core_user

For systems with SELinux, the following settings need to be considered:
 * virt_sandbox_use_fusefs should be enabled on each node to allow writing to
   remote GlusterFS volumes

In addition, for an OpenShift deployment you must:
 * Have 'cluster_admin' role on the administrative account doing the deployment
 * Add the 'default' and 'router' Service Accounts to the 'privileged' SCC
 * Have a router deployed that is configured to allow apps to access services
   running in the cluster

Do you wish to proceed with deployment?

[Y]es, [N]o? [Default: Y]: Y
Using OpenShift CLI.
Using namespace "storage-project".
Checking for pre-existing resources...
  GlusterFS pods ... not found.
  deploy-heketi pod ... not found.
  heketi pod ... not found.
  glusterblock-provisioner pod ... not found.
  gluster-s3 pod ... not found.
Creating initial resources ... template "deploy-heketi" created
serviceaccount "heketi-service-account" created
template "heketi" created
template "glusterfs" created
role "edit" added: "system:serviceaccount:storage-project:heketi-service-account"
OK
node "ip-172-18-5-29.ec2.internal" labeled
node "ip-172-18-8-205.ec2.internal" labeled
node "ip-172-18-6-100.ec2.internal" labeled
daemonset "glusterfs" created
Waiting for GlusterFS pods to start ... OK
secret "heketi-config-secret" created
secret "heketi-config-secret" labeled
service "deploy-heketi" created
route "deploy-heketi" created
deploymentconfig "deploy-heketi" created
Waiting for deploy-heketi pod to start ... OK
Creating cluster ... ID: 30cd12e60f860fce21e7e7457d07db36
Allowing file volumes on cluster.
```

```
Allowing block volumes on cluster.
Creating node ip-172-18-5-29.ec2.internal ... ID: 4077242c76e5f477a27c5c47247cb348
Adding device /dev/xvdc ... OK
Creating node ip-172-18-8-205.ec2.internal ... ID: dda0e7d568d7b2f76a7e7491cfc26dd3
Adding device /dev/xvdc ... OK
Creating node ip-172-18-6-100.ec2.internal ... ID: 30a1795ca515c85dca32b09be7a68733
Adding device /dev/xvdc ... OK
heketi topology loaded.
Saving /tmp/heketi-storage.json
secret "heketi-storage-secret" created
endpoints "heketi-storage-endpoints" created
service "heketi-storage-endpoints" created
job "heketi-storage-copy-job" created
service "heketi-storage-endpoints" labeled
deploymentconfig "deploy-heketi" deleted
route "deploy-heketi" deleted
service "deploy-heketi" deleted
job "heketi-storage-copy-job" deleted
pod "deploy-heketi-1-frjpt" deleted
secret "heketi-storage-secret" deleted
template "deploy-heketi" deleted
service "heketi" created
route "heketi" created
deploymentconfig "heketi" created
Waiting for heketi pod to start ... OK

heketi is now running and accessible via http://heketi-storage-
project.cloudapps.mystorage.com . To run
administrative commands you can install 'heketi-cli' and use it as follows:

  # heketi-cli -s http://heketi-storage-project.cloudapps.mystorage.com --user admin --secret
'<ADMIN_KEY>' cluster list

You can find it at https://github.com/heketi/heketi/releases . Alternatively,
use it from within the heketi pod:

  # /bin/oc -n storage-project exec -it <HEKETI_POD> -- heketi-cli -s http://localhost:8080 --
user admin --secret '<ADMIN_KEY>' cluster list

For dynamic provisioning, create a StorageClass similar to this:

---
apiVersion: storage.k8s.io/v1
kind: StorageClass
metadata:
  name: glusterfs-storage
provisioner: kubernetes.io/glusterfs
parameters:
  resturl: "http://heketi-storage-project.cloudapps.mystorage.com"

Ready to create and provide GlusterFS volumes.
clusterrole "glusterblock-provisioner-runner" created
serviceaccount "glusterblock-provisioner" created
clusterrolebinding "glusterblock-provisioner" created
deploymentconfig "glusterblock-provisioner-dc" created
Waiting for glusterblock-provisioner pod to start ... OK
```

```
Ready to create and provide Gluster block volumes.

Deployment complete!
```

NOTE

For more information on the cns-deploy commands, refer to the man page of cns-deploy.

+

```
# cns-deploy --help
```

a. To deploy S3 compatible object store along with Heketi and Red Hat Gluster Storage pods, execute the following command:

```
#  cns-deploy /opt/topology.json --deploy-gluster  --namespace <namespace> --yes --admin-key <admin-key>  --user-key <user-key> --log-file=<path/to/logfile> --object-account <object account name> --object-user <object user name>  --object-password <object user password> --verbose
```

object-account, **object-user**, and **object-password** are required credentials for deploying the gluster-s3 container.If any of these are missing, gluster-s3 container deployment will be skipped.

object-sc and **object-capacity** are optional parameters. Where, **object-sc** is used to specify a pre-existing StorageClass to use to create Red Hat Gluster Storage volumes to back the object store and **object-capacity** is the total capacity of the Red Hat Gluster Storage volume which will store the object data.

For example:

```
#  cns-deploy /opt/topology.json --deploy-gluster --namespace storage-project --yes --admin-key secret --user-key mysecret --log-file=/var/log/cns-deploy/444-cns-deploy.log --object-account testvolume --object-user adminuser --object-password itsmine --verbose
Using OpenShift CLI.

Checking status of namespace matching 'storage-project':
storage-project   Active    56m
Using namespace "storage-project".
Checking for pre-existing resources...
  GlusterFS pods ...
Checking status of pods matching '--selector=glusterfs=pod':
No resources found.
Timed out waiting for pods matching '--selector=glusterfs=pod'.
not found.
  deploy-heketi pod ...
Checking status of pods matching '--selector=deploy-heketi=pod':
No resources found.
Timed out waiting for pods matching '--selector=deploy-heketi=pod'.
not found.
  heketi pod ...
Checking status of pods matching '--selector=heketi=pod':
```

```
No resources found.
Timed out waiting for pods matching '--selector=heketi=pod'.
not found.
  glusterblock-provisioner pod ...
Checking status of pods matching '--selector=glusterfs=block-provisioner-pod':
No resources found.
Timed out waiting for pods matching '--selector=glusterfs=block-provisioner-pod'.
not found.
  gluster-s3 pod ...
Checking status of pods matching '--selector=glusterfs=s3-pod':
No resources found.
Timed out waiting for pods matching '--selector=glusterfs=s3-pod'.
not found.
Creating initial resources ... /usr/bin/oc -n storage-project create -f
/usr/share/heketi/templates/deploy-heketi-template.yaml 2>&1
template "deploy-heketi" created
/usr/bin/oc -n storage-project create -f /usr/share/heketi/templates/heketi-service-
account.yaml 2>&1
serviceaccount "heketi-service-account" created
/usr/bin/oc -n storage-project create -f /usr/share/heketi/templates/heketi-template.yaml
2>&1
template "heketi" created
/usr/bin/oc -n storage-project create -f /usr/share/heketi/templates/glusterfs-
template.yaml 2>&1
template "glusterfs" created
/usr/bin/oc -n storage-project policy add-role-to-user edit system:serviceaccount:storage-
project:heketi-service-account 2>&1
role "edit" added: "system:serviceaccount:storage-project:heketi-service-account"
/usr/bin/oc -n storage-project adm policy add-scc-to-user privileged -z heketi-service-
account
OK
Marking 'dhcp46-122.lab.eng.blr.redhat.com' as a GlusterFS node.
/usr/bin/oc -n storage-project label nodes dhcp46-122.lab.eng.blr.redhat.com
storagenode=glusterfs 2>&1
node "dhcp46-122.lab.eng.blr.redhat.com" labeled
Marking 'dhcp46-9.lab.eng.blr.redhat.com' as a GlusterFS node.
/usr/bin/oc -n storage-project label nodes dhcp46-9.lab.eng.blr.redhat.com
storagenode=glusterfs 2>&1
node "dhcp46-9.lab.eng.blr.redhat.com" labeled
Marking 'dhcp46-134.lab.eng.blr.redhat.com' as a GlusterFS node.
/usr/bin/oc -n storage-project label nodes dhcp46-134.lab.eng.blr.redhat.com
storagenode=glusterfs 2>&1
node "dhcp46-134.lab.eng.blr.redhat.com" labeled
Deploying GlusterFS pods.
/usr/bin/oc -n storage-project process -p NODE_LABEL=glusterfs glusterfs | /usr/bin/oc -
n storage-project create -f - 2>&1
daemonset "glusterfs" created
Waiting for GlusterFS pods to start ...
Checking status of pods matching '--selector=glusterfs=pod':
glusterfs-6fj2v   1/1       Running   0         52s
glusterfs-ck40f   1/1       Running   0         52s
glusterfs-kbtz4   1/1       Running   0         52s
OK
/usr/bin/oc -n storage-project create secret generic heketi-config-secret --from-
file=private_key=/dev/null --from-file=./heketi.json --from-
file=topology.json=/opt/topology.json
```

```
secret "heketi-config-secret" created
/usr/bin/oc -n storage-project label --overwrite secret heketi-config-secret
glusterfs=heketi-config-secret heketi=config-secret
secret "heketi-config-secret" labeled
/usr/bin/oc -n storage-project process -p HEKETI_EXECUTOR=kubernetes -p
HEKETI_FSTAB=/var/lib/heketi/fstab -p HEKETI_ADMIN_KEY= -p
HEKETI_USER_KEY= deploy-heketi | /usr/bin/oc -n storage-project create -f - 2>&1
service "deploy-heketi" created
route "deploy-heketi" created
deploymentconfig "deploy-heketi" created
Waiting for deploy-heketi pod to start ...
Checking status of pods matching '--selector=deploy-heketi=pod':
deploy-heketi-1-hf9rn   1/1       Running   0         2m
OK
Determining heketi service URL ... OK
/usr/bin/oc -n storage-project exec -it deploy-heketi-1-hf9rn -- heketi-cli -s
http://localhost:8080 --user admin --secret '' topology load --
json=/etc/heketi/topology.json 2>&1
Creating cluster ... ID: 252509038eb8568162ec5920c12bc243
Allowing file volumes on cluster.
Allowing block volumes on cluster.
Creating node dhcp46-122.lab.eng.blr.redhat.com ... ID:
73ad287ae1ef231f8a0db46422367c9a
Adding device /dev/sdd ... OK
Adding device /dev/sde ... OK
Adding device /dev/sdf ... OK
Creating node dhcp46-9.lab.eng.blr.redhat.com ... ID:
0da1b20daaad2d5c57dbfc4f6ab78001
Adding device /dev/sdd ... OK
Adding device /dev/sde ... OK
Adding device /dev/sdf ... OK
Creating node dhcp46-134.lab.eng.blr.redhat.com ... ID:
4b3b62fc0efd298dedbcdacf0b498e65
Adding device /dev/sdd ... OK
Adding device /dev/sde ... OK
Adding device /dev/sdf ... OK
heketi topology loaded.
/usr/bin/oc -n storage-project exec -it deploy-heketi-1-hf9rn -- heketi-cli -s
http://localhost:8080 --user admin --secret '' setup-openshift-heketi-storage --
listfile=/tmp/heketi-storage.json --image rhgs3/rhgs-volmanager-rhel7:3.3.0-17 2>&1
Saving /tmp/heketi-storage.json
/usr/bin/oc -n storage-project exec -it deploy-heketi-1-hf9rn -- cat /tmp/heketi-
storage.json | /usr/bin/oc -n storage-project create -f - 2>&1
secret "heketi-storage-secret" created
endpoints "heketi-storage-endpoints" created
service "heketi-storage-endpoints" created
job "heketi-storage-copy-job" created

Checking status of pods matching '--selector=job-name=heketi-storage-copy-job':
heketi-storage-copy-job-87v6n   0/1       Completed   0         7s
/usr/bin/oc -n storage-project label --overwrite svc heketi-storage-endpoints
glusterfs=heketi-storage-endpoints heketi=storage-endpoints
service "heketi-storage-endpoints" labeled
/usr/bin/oc -n storage-project delete all,service,jobs,deployment,secret --
selector="deploy-heketi" 2>&1
deploymentconfig "deploy-heketi" deleted
```

```
route "deploy-heketi" deleted
service "deploy-heketi" deleted
job "heketi-storage-copy-job" deleted
pod "deploy-heketi-1-hf9rn" deleted
secret "heketi-storage-secret" deleted
/usr/bin/oc -n storage-project delete dc,route,template --selector="deploy-heketi" 2>&1
template "deploy-heketi" deleted
/usr/bin/oc -n storage-project process -p HEKETI_EXECUTOR=kubernetes -p
HEKETI_FSTAB=/var/lib/heketi/fstab -p HEKETI_ADMIN_KEY= -p
HEKETI_USER_KEY= heketi | /usr/bin/oc -n storage-project create -f - 2>&1
service "heketi" created
route "heketi" created
deploymentconfig "heketi" created
Waiting for heketi pod to start ...
Checking status of pods matching '--selector=heketi=pod':
heketi-1-zzblp   1/1       Running   0         31s
OK
Determining heketi service URL ... OK

heketi is now running and accessible via http://heketi-storage-
project.cloudapps.mystorage.com . To run
administrative commands you can install 'heketi-cli' and use it as follows:

  # heketi-cli -s http://heketi-storage-project.cloudapps.mystorage.com --user admin --
secret '<ADMIN_KEY>' cluster list

You can find it at https://github.com/heketi/heketi/releases . Alternatively,
use it from within the heketi pod:

  # /usr/bin/oc -n storage-project exec -it <HEKETI_POD> -- heketi-cli -s
http://localhost:8080 --user admin --secret '<ADMIN_KEY>' cluster list

For dynamic provisioning, create a StorageClass similar to this:

---
apiVersion: storage.k8s.io/v1
kind: StorageClass
metadata:
  name: glusterfs-storage
provisioner: kubernetes.io/glusterfs
parameters:
  resturl: "http://heketi-storage-project.cloudapps.mystorage.com"

Ready to create and provide GlusterFS volumes.
sed -e 's/\${NAMESPACE}/storage-project/' /usr/share/heketi/templates/glusterblock-
provisioner.yaml | /usr/bin/oc -n storage-project create -f - 2>&1
clusterrole "glusterblock-provisioner-runner" created
serviceaccount "glusterblock-provisioner" created
clusterrolebinding "glusterblock-provisioner" created
deploymentconfig "glusterblock-provisioner-dc" created
Waiting for glusterblock-provisioner pod to start ...
Checking status of pods matching '--selector=glusterfs=block-provisioner-pod':
glusterblock-provisioner-dc-1-xm6bv   1/1       Running   0         6s
OK
Ready to create and provide Gluster block volumes.
/usr/bin/oc -n storage-project create secret generic heketi-storage-project-admin-secret -
```

```
-from-literal=key= --type=kubernetes.io/glusterfs
secret "heketi-storage-project-admin-secret" created
/usr/bin/oc -n storage-project label --overwrite secret heketi-storage-project-admin-secret
glusterfs=s3-heketi-storage-project-admin-secret gluster-s3=heketi-storage-project-
admin-secret
secret "heketi-storage-project-admin-secret" labeled
sed -e 's/\${STORAGE_CLASS}/glusterfs-for-s3/' -e 's/\${HEKETI_URL}/heketi-storage-
project.cloudapps.mystorage.com/' -e 's/\${NAMESPACE}/storage-project/'
/usr/share/heketi/templates/gluster-s3-storageclass.yaml | /usr/bin/oc -n storage-project
create -f - 2>&1
storageclass "glusterfs-for-s3" created
sed -e 's/\${STORAGE_CLASS}/glusterfs-for-s3/' -e 's/\${VOLUME_CAPACITY}/2Gi/'
/usr/share/heketi/templates/gluster-s3-pvcs.yaml | /usr/bin/oc -n storage-project create -f
- 2>&1
persistentvolumeclaim "gluster-s3-claim" created
persistentvolumeclaim "gluster-s3-meta-claim" created

Checking status of persistentvolumeclaims matching '--selector=glusterfs in (s3-pvc, s3-
meta-pvc)':
gluster-s3-claim       Bound     pvc-35b6c1f0-9c65-11e7-9c8c-005056b3ded1   2Gi
RWX       glusterfs-for-s3   18s
gluster-s3-meta-claim   Bound     pvc-35b86e7a-9c65-11e7-9c8c-005056b3ded1   1Gi
RWX       glusterfs-for-s3   18s
/usr/bin/oc -n storage-project create -f /usr/share/heketi/templates/gluster-s3-
template.yaml 2>&1
template "gluster-s3" created
/usr/bin/oc -n storage-project process -p S3_ACCOUNT=testvolume -p
S3_USER=adminuser -p S3_PASSWORD=itsmine gluster-s3 | /usr/bin/oc -n storage-
project create -f - 2>&1
service "gluster-s3-service" created
route "gluster-s3-route" created
deploymentconfig "gluster-s3-dc" created
Waiting for gluster-s3 pod to start ...
Checking status of pods matching '--selector=glusterfs=s3-pod':
gluster-s3-dc-1-x3x4q   1/1       Running   0         6s
OK
Ready to create and provide Gluster object volumes.

Deployment complete!
```

2. Execute the following command to let the client communicate with the container:

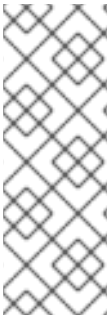
```
# export  HEKETI_CLI_SERVER=http://heketi-<project_name>.<sub_domain_name>
```

For example:

```
# export  HEKETI_CLI_SERVER=http://heketi-storage-project.cloudapps.mystorage.com
```

To verify if Heketi is loaded with the topology execute the following command:

```
# heketi-cli topology info
```



NOTE

The cns-deploy tool does not support scaling up of the cluster. To manually scale-up the cluster, see link:https://access.redhat.com/documentation/en-us/red_hat_openshift_container_storage/3.11/html-single/operations_guide/#chap-Documentation-Red_Hat_Gluster_Storage_Container_Native_with_OpenShift_Platform-Managing_Clusters[]

Next step: If you are installing the independent mode 3.11, proceed to https://access.redhat.com/documentation/en-us/red_hat_openshift_container_storage/3.11/html-single/operations_guide/#chap-Documentation-Red_Hat_Gluster_Storage_Container_Native_with_OpenShift_Platform-Updating_Registry.

A.3.3.1. Deploying Independent Mode

Execute the following commands to deploy Red Hat Openshift Container Storage in Independent mode:

1. To set a passwordless SSH to all Red Hat Gluster Storage nodes, execute the following command on the client for each of the Red Hat Gluster Storage node:

```
# ssh-copy-id -i /root/.ssh/id_rsa root@<hostname>
```

2. Execute the following command on the client to deploy heketi pod and to create a cluster of Red Hat Gluster Storage nodes:

```
# cns-deploy -v -n <namespace> -g --admin-key <admin-key> --user-key <user-key>
topology.json
```

NOTE

- Support for S3 compatible Object Store is under technology preview. To deploy S3 compatible object store see substep i below.
- In the above command, the value for **admin-key** is the secret string for heketi admin user. The heketi administrator will have access toall APIs and commands. Default is to use no secret.
- The **BLOCK_HOST_SIZE** parameter in cns-deploy controls the size (in GB) of the automatically created Red Hat Gluster Storage volumes hosting the gluster-block volumes. This default configuration will dynamically create block-hosting volumes of 500GB in size when more space is required. If you want to change this value then use --block-host in cns-deploy. For example:

```
# cns-deploy -v -n storage-project -g --admin-key secret --user-key
mysecret --block-host 1000 topology.json
```

For example:

```
# cns-deploy -v -n storage-project -g --admin-key secret -s /root/.ssh/id_rsa --user-key
mysecret topology.json
Welcome to the deployment tool for GlusterFS on Kubernetes and OpenShift.
```

```
Before getting started, this script has some requirements of the execution
environment and of the container platform that you should verify.

The client machine that will run this script must have:
 * Administrative access to an existing Kubernetes or OpenShift cluster
 * Access to a python interpreter 'python'

Each of the nodes that will host GlusterFS must also have appropriate firewall
rules for the required GlusterFS ports:
 * 2222  - sshd (if running GlusterFS in a pod)
 * 24007 - GlusterFS Management
 * 24008 - GlusterFS RDMA
 * 49152 to 49251 - Each brick for every volume on the host requires its own
   port. For every new brick, one new port will be used starting at 49152. We
   recommend a default range of 49152-49251 on each host, though you can adjust
   this to fit your needs.

The following kernel modules must be loaded:
 * dm_snapshot
 * dm_mirror
 * dm_thin_pool

For systems with SELinux, the following settings need to be considered:
 * virt_sandbox_use_fusefs should be enabled on each node to allow writing to
   remote GlusterFS volumes

In addition, for an OpenShift deployment you must:
 * Have 'cluster_admin' role on the administrative account doing the deployment
 * Add the 'default' and 'router' Service Accounts to the 'privileged' SCC
 * Have a router deployed that is configured to allow apps to access services
   running in the cluster

Do you wish to proceed with deployment?

[Y]es, [N]o? [Default: Y]: y
Using OpenShift CLI.
Using namespace "storage-project".
Checking for pre-existing resources...
  GlusterFS pods ... not found.
  deploy-heketi pod ... not found.
  heketi pod ... not found.
Creating initial resources ... template "deploy-heketi" created
serviceaccount "heketi-service-account" created
template "heketi" created
role "edit" added: "system:serviceaccount:storage-project:heketi-service-account"
OK
secret "heketi-config-secret" created
secret "heketi-config-secret" labeled
service "deploy-heketi" created
route "deploy-heketi" created
deploymentconfig "deploy-heketi" created
Waiting for deploy-heketi pod to start ... OK
Creating cluster ... ID: 60bf06636eb4eb81d4e9be4b04cfce92
Allowing file volumes on cluster.
Allowing block volumes on cluster.
Creating node dhcp47-104.lab.eng.blr.redhat.com ... ID:
```

```
eadc66f9d03563bcfc3db3fe636c34be
Adding device /dev/sdd ... OK
Adding device /dev/sde ... OK
Adding device /dev/sdf ... OK
Creating node dhcp47-83.lab.eng.blr.redhat.com ... ID: 178684b0a0425f51b8f1a032982ffe4d
Adding device /dev/sdd ... OK
Adding device /dev/sde ... OK
Adding device /dev/sdf ... OK
Creating node dhcp46-152.lab.eng.blr.redhat.com ... ID:
08cd7034ef7ac66499dc040d93cf4a93
Adding device /dev/sdd ... OK
Adding device /dev/sde ... OK
Adding device /dev/sdf ... OK
heketi topology loaded.
Saving /tmp/heketi-storage.json
secret "heketi-storage-secret" created
endpoints "heketi-storage-endpoints" created
service "heketi-storage-endpoints" created
job "heketi-storage-copy-job" created
service "heketi-storage-endpoints" labeled
deploymentconfig "deploy-heketi" deleted
route "deploy-heketi" deleted
service "deploy-heketi" deleted
job "heketi-storage-copy-job" deleted
pod "deploy-heketi-1-30c06" deleted
secret "heketi-storage-secret" deleted
template "deploy-heketi" deleted
service "heketi" created
route "heketi" created
deploymentconfig "heketi" created
Waiting for heketi pod to start ... OK

heketi is now running and accessible via http://heketi-storage-
project.cloudapps.mystorage.com . To run
administrative commands you can install 'heketi-cli' and use it as follows:

  # heketi-cli -s http://heketi-storage-project.cloudapps.mystorage.com --user admin --secret
'<ADMIN_KEY>' cluster list

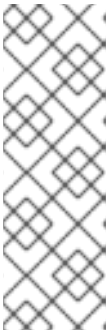
You can find it at https://github.com/heketi/heketi/releases . Alternatively,
use it from within the heketi pod:

  # /usr/bin/oc -n storage-project exec -it <HEKETI_POD> -- heketi-cli -s http://localhost:8080
--user admin --secret '<ADMIN_KEY>' cluster list

For dynamic provisioning, create a StorageClass similar to this:

---
apiVersion: storage.k8s.io/v1
kind: StorageClass
metadata:
  name: glusterfs-storage
provisioner: kubernetes.io/glusterfs
parameters:
  resturl: "http://heketi-storage-project.cloudapps.mystorage.com"
```

```
Deployment complete!
```



NOTE

For more information on the cns-deploy commands, refer to the man page of the cns-deploy.

+

```
# cns-deploy --help
```

a. To deploy S3 compatible object store along with Heketi and Red Hat Gluster Storage pods, execute the following command:

```
#  cns-deploy /opt/topology.json --deploy-gluster --namespace <namespace> --admin-key <admin-key> --user-key <user-key> --yes --log-file=<path/to/logfile> --object-account <object account name> --object-user <object user name>  --object-password <object user password> --verbose
```

object-account, **object-user**, and **object-password** are required credentials for deploying the gluster-s3 container.If any of these are missing, gluster-s3 container deployment will be skipped.

object-sc and **object-capacity** are optional parameters. Where, **object-sc** is used to specify a pre-existing StorageClass to use to create Red Hat Gluster Storage volumes to back the object store and **object-capacity** is the total capacity of the Red Hat Gluster Storage volume which will store the object data.

For example:

```
#  cns-deploy /opt/topology.json --deploy-gluster  --namespace storage-project --admin-key secret --user-key mysecret --yes --log-file=/var/log/cns-deploy/444-cns-deploy.log --object-account testvolume --object-user adminuser --object-password itsmine --verbose
Using OpenShift CLI.

Checking status of namespace matching 'storage-project':
storage-project   Active    56m
Using namespace "storage-project".
Checking for pre-existing resources...
  GlusterFS pods ...
Checking status of pods matching '--selector=glusterfs=pod':
No resources found.
Timed out waiting for pods matching '--selector=glusterfs=pod'.
not found.
  deploy-heketi pod ...
Checking status of pods matching '--selector=deploy-heketi=pod':
No resources found.
Timed out waiting for pods matching '--selector=deploy-heketi=pod'.
not found.
  heketi pod ...
Checking status of pods matching '--selector=heketi=pod':
```

```
No resources found.
Timed out waiting for pods matching '--selector=heketi=pod'.
not found.
  glusterblock-provisioner pod ...
Checking status of pods matching '--selector=glusterfs=block-provisioner-pod':
No resources found.
Timed out waiting for pods matching '--selector=glusterfs=block-provisioner-pod'.
not found.
  gluster-s3 pod ...
Checking status of pods matching '--selector=glusterfs=s3-pod':
No resources found.
Timed out waiting for pods matching '--selector=glusterfs=s3-pod'.
not found.
Creating initial resources ... /usr/bin/oc -n storage-project create -f
/usr/share/heketi/templates/deploy-heketi-template.yaml 2>&1
template "deploy-heketi" created
/usr/bin/oc -n storage-project create -f /usr/share/heketi/templates/heketi-service-
account.yaml 2>&1
serviceaccount "heketi-service-account" created
/usr/bin/oc -n storage-project create -f /usr/share/heketi/templates/heketi-template.yaml
2>&1
template "heketi" created
/usr/bin/oc -n storage-project create -f /usr/share/heketi/templates/glusterfs-
template.yaml 2>&1
template "glusterfs" created
/usr/bin/oc -n storage-project policy add-role-to-user edit system:serviceaccount:storage-
project:heketi-service-account 2>&1
role "edit" added: "system:serviceaccount:storage-project:heketi-service-account"
/usr/bin/oc -n storage-project adm policy add-scc-to-user privileged -z heketi-service-
account
OK
Marking 'dhcp46-122.lab.eng.blr.redhat.com' as a GlusterFS node.
/usr/bin/oc -n storage-project label nodes dhcp46-122.lab.eng.blr.redhat.com
storagenode=glusterfs 2>&1
node "dhcp46-122.lab.eng.blr.redhat.com" labeled
Marking 'dhcp46-9.lab.eng.blr.redhat.com' as a GlusterFS node.
/usr/bin/oc -n storage-project label nodes dhcp46-9.lab.eng.blr.redhat.com
storagenode=glusterfs 2>&1
node "dhcp46-9.lab.eng.blr.redhat.com" labeled
Marking 'dhcp46-134.lab.eng.blr.redhat.com' as a GlusterFS node.
/usr/bin/oc -n storage-project label nodes dhcp46-134.lab.eng.blr.redhat.com
storagenode=glusterfs 2>&1
node "dhcp46-134.lab.eng.blr.redhat.com" labeled
Deploying GlusterFS pods.
/usr/bin/oc -n storage-project process -p NODE_LABEL=glusterfs glusterfs | /usr/bin/oc -
n storage-project create -f - 2>&1
daemonset "glusterfs" created
Waiting for GlusterFS pods to start ...
Checking status of pods matching '--selector=glusterfs=pod':
glusterfs-6fj2v   1/1       Running   0         52s
glusterfs-ck40f   1/1       Running   0         52s
glusterfs-kbtz4   1/1       Running   0         52s
OK
/usr/bin/oc -n storage-project create secret generic heketi-config-secret --from-
file=private_key=/dev/null --from-file=./heketi.json --from-
file=topology.json=/opt/topology.json
```

```
secret "heketi-config-secret" created
/usr/bin/oc -n storage-project label --overwrite secret heketi-config-secret
glusterfs=heketi-config-secret heketi=config-secret
secret "heketi-config-secret" labeled
/usr/bin/oc -n storage-project process -p HEKETI_EXECUTOR=kubernetes -p
HEKETI_FSTAB=/var/lib/heketi/fstab -p HEKETI_ADMIN_KEY= -p
HEKETI_USER_KEY= deploy-heketi | /usr/bin/oc -n storage-project create -f - 2>&1
service "deploy-heketi" created
route "deploy-heketi" created
deploymentconfig "deploy-heketi" created
Waiting for deploy-heketi pod to start ...
Checking status of pods matching '--selector=deploy-heketi=pod':
deploy-heketi-1-hf9rn   1/1       Running   0         2m
OK
Determining heketi service URL ... OK
/usr/bin/oc -n storage-project exec -it deploy-heketi-1-hf9rn -- heketi-cli -s
http://localhost:8080 --user admin --secret '' topology load --
json=/etc/heketi/topology.json 2>&1
Creating cluster ... ID: 252509038eb8568162ec5920c12bc243
Allowing file volumes on cluster.
Allowing block volumes on cluster.
Creating node dhcp46-122.lab.eng.blr.redhat.com ... ID:
73ad287ae1ef231f8a0db46422367c9a
Adding device /dev/sdd ... OK
Adding device /dev/sde ... OK
Adding device /dev/sdf ... OK
Creating node dhcp46-9.lab.eng.blr.redhat.com ... ID:
0da1b20daaad2d5c57dbfc4f6ab78001
Adding device /dev/sdd ... OK
Adding device /dev/sde ... OK
Adding device /dev/sdf ... OK
Creating node dhcp46-134.lab.eng.blr.redhat.com ... ID:
4b3b62fc0efd298dedbcdacf0b498e65
Adding device /dev/sdd ... OK
Adding device /dev/sde ... OK
Adding device /dev/sdf ... OK
heketi topology loaded.
/usr/bin/oc -n storage-project exec -it deploy-heketi-1-hf9rn -- heketi-cli -s
http://localhost:8080 --user admin --secret '' setup-openshift-heketi-storage --
listfile=/tmp/heketi-storage.json --image rhgs3/rhgs-volmanager-rhel7:3.3.0-17 2>&1
Saving /tmp/heketi-storage.json
/usr/bin/oc -n storage-project exec -it deploy-heketi-1-hf9rn -- cat /tmp/heketi-
storage.json | /usr/bin/oc -n storage-project create -f - 2>&1
secret "heketi-storage-secret" created
endpoints "heketi-storage-endpoints" created
service "heketi-storage-endpoints" created
job "heketi-storage-copy-job" created

Checking status of pods matching '--selector=job-name=heketi-storage-copy-job':
heketi-storage-copy-job-87v6n   0/1       Completed   0         7s
/usr/bin/oc -n storage-project label --overwrite svc heketi-storage-endpoints
glusterfs=heketi-storage-endpoints heketi=storage-endpoints
service "heketi-storage-endpoints" labeled
/usr/bin/oc -n storage-project delete all,service,jobs,deployment,secret --
selector="deploy-heketi" 2>&1
deploymentconfig "deploy-heketi" deleted
```

```
route "deploy-heketi" deleted
service "deploy-heketi" deleted
job "heketi-storage-copy-job" deleted
pod "deploy-heketi-1-hf9rn" deleted
secret "heketi-storage-secret" deleted
/usr/bin/oc -n storage-project delete dc,route,template --selector="deploy-heketi" 2>&1
template "deploy-heketi" deleted
/usr/bin/oc -n storage-project process -p HEKETI_EXECUTOR=kubernetes -p
HEKETI_FSTAB=/var/lib/heketi/fstab -p HEKETI_ADMIN_KEY= -p
HEKETI_USER_KEY= heketi | /usr/bin/oc -n storage-project create -f - 2>&1
service "heketi" created
route "heketi" created
deploymentconfig "heketi" created
Waiting for heketi pod to start ...
Checking status of pods matching '--selector=heketi=pod':
heketi-1-zzblp   1/1       Running   0         31s
OK
Determining heketi service URL ... OK

heketi is now running and accessible via http://heketi-storage-
project.cloudapps.mystorage.com . To run
administrative commands you can install 'heketi-cli' and use it as follows:

  # heketi-cli -s http://heketi-storage-project.cloudapps.mystorage.com --user admin --
secret '<ADMIN_KEY>' cluster list

You can find it at https://github.com/heketi/heketi/releases . Alternatively,
use it from within the heketi pod:

  # /usr/bin/oc -n storage-project exec -it <HEKETI_POD> -- heketi-cli -s
http://localhost:8080 --user admin --secret '<ADMIN_KEY>' cluster list

For dynamic provisioning, create a StorageClass similar to this:

---
apiVersion: storage.k8s.io/v1
kind: StorageClass
metadata:
  name: glusterfs-storage
provisioner: kubernetes.io/glusterfs
parameters:
  resturl: "http://heketi-storage-project.cloudapps.mystorage.com"

Ready to create and provide GlusterFS volumes.
sed -e 's/\${NAMESPACE}/storage-project/' /usr/share/heketi/templates/glusterblock-
provisioner.yaml | /usr/bin/oc -n storage-project create -f - 2>&1
clusterrole "glusterblock-provisioner-runner" created
serviceaccount "glusterblock-provisioner" created
clusterrolebinding "glusterblock-provisioner" created
deploymentconfig "glusterblock-provisioner-dc" created
Waiting for glusterblock-provisioner pod to start ...
Checking status of pods matching '--selector=glusterfs=block-provisioner-pod':
glusterblock-provisioner-dc-1-xm6bv   1/1       Running   0         6s
OK
Ready to create and provide Gluster block volumes.
/usr/bin/oc -n storage-project create secret generic heketi-storage-project-admin-secret -
```

```
-from-literal=key= --type=kubernetes.io/glusterfs
secret "heketi-storage-project-admin-secret" created
/usr/bin/oc -n storage-project label --overwrite secret heketi-storage-project-admin-secret
glusterfs=s3-heketi-storage-project-admin-secret gluster-s3=heketi-storage-project-
admin-secret
secret "heketi-storage-project-admin-secret" labeled
sed -e 's/\${STORAGE_CLASS}/glusterfs-for-s3/' -e 's/\${HEKETI_URL}/heketi-storage-
project.cloudapps.mystorage.com/' -e 's/\${NAMESPACE}/storage-project/'
/usr/share/heketi/templates/gluster-s3-storageclass.yaml | /usr/bin/oc -n storage-project
create -f - 2>&1
storageclass "glusterfs-for-s3" created
sed -e 's/\${STORAGE_CLASS}/glusterfs-for-s3/' -e 's/\${VOLUME_CAPACITY}/2Gi/'
/usr/share/heketi/templates/gluster-s3-pvcs.yaml | /usr/bin/oc -n storage-project create -f
- 2>&1
persistentvolumeclaim "gluster-s3-claim" created
persistentvolumeclaim "gluster-s3-meta-claim" created

Checking status of persistentvolumeclaims matching '--selector=glusterfs in (s3-pvc, s3-
meta-pvc)':
gluster-s3-claim       Bound     pvc-35b6c1f0-9c65-11e7-9c8c-005056b3ded1   2Gi
RWX       glusterfs-for-s3   18s
gluster-s3-meta-claim   Bound     pvc-35b86e7a-9c65-11e7-9c8c-005056b3ded1   1Gi
RWX       glusterfs-for-s3   18s
/usr/bin/oc -n storage-project create -f /usr/share/heketi/templates/gluster-s3-
template.yaml 2>&1
template "gluster-s3" created
/usr/bin/oc -n storage-project process -p S3_ACCOUNT=testvolume -p
S3_USER=adminuser -p S3_PASSWORD=itsmine gluster-s3 | /usr/bin/oc -n storage-
project create -f - 2>&1
service "gluster-s3-service" created
route "gluster-s3-route" created
deploymentconfig "gluster-s3-dc" created
Waiting for gluster-s3 pod to start ...
Checking status of pods matching '--selector=glusterfs=s3-pod':
gluster-s3-dc-1-x3x4q   1/1       Running   0         6s
OK
Ready to create and provide Gluster object volumes.

Deployment complete!
```

3. Brick multiplexing is a feature that allows adding multiple bricks into one process. This reduces resource consumption and allows us to run more bricks than before with the same memory consumption. Execute the following commands on one of the Red Hat Gluster Storage nodes on each cluster to enable brick-multiplexing:

   a. Execute the following command to enable brick multiplexing:

   ```
   # gluster vol set all cluster.brick-multiplex on
   ```

   For example:

   ```
   # gluster vol set all cluster.brick-multiplex on
   Brick-multiplexing is supported only for container workloads (CNS/CRS). Also it is
   advised to make sure that either all volumes are in stopped state or no bricks are running
   before this option is modified.Do you still want to continue? (y/n) y
   volume set: success
   ```

b. Restart the heketidb volumes:

```
# gluster vol stop heketidbstorage
Stopping volume will make its data inaccessible. Do you want to continue? (y/n) y
volume stop: heketidbstorage: success
```

```
# gluster vol start heketidbstorage
volume start: heketidbstorage: success
```

4. Execute the following command to let the client communicate with the container:

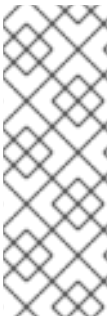
```
# export  HEKETI_CLI_SERVER=http://heketi-<project_name>.<sub_domain_name>
```

For example:

```
# export  HEKETI_CLI_SERVER=http://heketi-storage-project.cloudapps.mystorage.com
```

To verify if Heketi is loaded with the topology execute the following command:

```
# heketi-cli topology info
```



NOTE

The cns-deploy tool does not support scaling up of the cluster. To manually scale-up the cluster, see link:https://access.redhat.com/documentation/en-us/red_hat_openshift_container_storage/3.11/html-single/operations_guide/#chap-Documentation-Red_Hat_Gluster_Storage_Container_Native_with_OpenShift_Platform-Managing_Clusters[].

Next step: If you are installing converged mode, proceed to https://access.redhat.com/documentation/en-us/red_hat_openshift_container_storage/3.11/html-single/operations_guide/#chap-Documentation-Red_Hat_Gluster_Storage_Container_Native_with_OpenShift_Platform-Updating_Registry.

APPENDIX B. SETTINGS THAT ARE DESTROYED WHEN USING UNINSTALL PLAYBOOK

When running the uninstall.yml playbook the following two files are called:

- glusterfs_config_facts.yml
- glusterfs_registry_facts.yml

When the following command is executed then the data/resources/content/settings related to glusterfs_config_facts.yml and glusterfs_registry_facts.yml is destroyed.

```
ansible-playbook -i <path_to_inventory_file> -e "openshift_storage_glusterfs_wipe=true"
/usr/share/ansible/openshift-ansible/playbooks/openshift-glusterfs/uninstall.yml
```

glusterfs_config_facts.yml variables:

```
    glusterfs_timeout: "{{ openshift_storage_glusterfs_timeout }}"
    glusterfs_namespace: "{{ openshift_storage_glusterfs_namespace }}"
    glusterfs_is_native: "{{ openshift_storage_glusterfs_is_native | bool }}"
    glusterfs_name: "{{ openshift_storage_glusterfs_name }}"
    # map_from_pairs is a custom filter plugin in role lib_utils
    glusterfs_nodeselector: "{{ openshift_storage_glusterfs_nodeselector | default(['storagenode',
openshift_storage_glusterfs_name] | join('=')) | map_from_pairs }}"
    glusterfs_use_default_selector: "{{ openshift_storage_glusterfs_use_default_selector }}"
    glusterfs_storageclass: "{{ openshift_storage_glusterfs_storageclass }}"
    glusterfs_storageclass_default: "{{ openshift_storage_glusterfs_storageclass_default | bool }}"
    glusterfs_image: "{{ openshift_storage_glusterfs_image }}"
    glusterfs_block_deploy: "{{ openshift_storage_glusterfs_block_deploy | bool }}"
    glusterfs_block_image: "{{ openshift_storage_glusterfs_block_image }}"
    glusterfs_block_host_vol_create: "{{ openshift_storage_glusterfs_block_host_vol_create }}"
    glusterfs_block_host_vol_size: "{{ openshift_storage_glusterfs_block_host_vol_size }}"
    glusterfs_block_host_vol_max: "{{ openshift_storage_glusterfs_block_host_vol_max }}"
    glusterfs_block_storageclass: "{{ openshift_storage_glusterfs_block_storageclass | bool }}"
    glusterfs_block_storageclass_default: "{{ openshift_storage_glusterfs_block_storageclass_default |
bool }}"
    glusterfs_s3_deploy: "{{ openshift_storage_glusterfs_s3_deploy | bool }}"
    glusterfs_s3_image: "{{ openshift_storage_glusterfs_s3_image }}"
    glusterfs_s3_account: "{{ openshift_storage_glusterfs_s3_account }}"
    glusterfs_s3_user: "{{ openshift_storage_glusterfs_s3_user }}"
    glusterfs_s3_password: "{{ openshift_storage_glusterfs_s3_password }}"
    glusterfs_s3_pvc: "{{ openshift_storage_glusterfs_s3_pvc }}"
    glusterfs_s3_pvc_size: "{{ openshift_storage_glusterfs_s3_pvc_size }}"
    glusterfs_s3_meta_pvc: "{{ openshift_storage_glusterfs_s3_meta_pvc }}"
    glusterfs_s3_meta_pvc_size: "{{ openshift_storage_glusterfs_s3_meta_pvc_size }}"
    glusterfs_wipe: "{{ openshift_storage_glusterfs_wipe | bool }}"
    glusterfs_heketi_is_native: "{{ openshift_storage_glusterfs_heketi_is_native | bool }}"
    glusterfs_heketi_is_missing: "{{ openshift_storage_glusterfs_heketi_is_missing | bool }}"
    glusterfs_heketi_deploy_is_missing: "{{ openshift_storage_glusterfs_heketi_deploy_is_missing |
bool }}"
    glusterfs_heketi_cli: "{{ openshift_storage_glusterfs_heketi_cli }}"
    glusterfs_heketi_image: "{{ openshift_storage_glusterfs_heketi_image }}"
    glusterfs_heketi_admin_key: "{{ openshift_storage_glusterfs_heketi_admin_key }}"
    glusterfs_heketi_user_key: "{{ openshift_storage_glusterfs_heketi_user_key }}"
    glusterfs_heketi_topology_load: "{{ openshift_storage_glusterfs_heketi_topology_load | bool }}"
```

```
    glusterfs_heketi_wipe: "{{ openshift_storage_glusterfs_heketi_wipe | bool }}"
    glusterfs_heketi_url: "{{ openshift_storage_glusterfs_heketi_url }}"
    glusterfs_heketi_port: "{{ openshift_storage_glusterfs_heketi_port }}"
    glusterfs_heketi_executor: "{{ openshift_storage_glusterfs_heketi_executor }}"
    glusterfs_heketi_ssh_port: "{{ openshift_storage_glusterfs_heketi_ssh_port }}"
    glusterfs_heketi_ssh_user: "{{ openshift_storage_glusterfs_heketi_ssh_user }}"
    glusterfs_heketi_ssh_sudo: "{{ openshift_storage_glusterfs_heketi_ssh_sudo | bool }}"
    glusterfs_heketi_ssh_keyfile: "{{ openshift_storage_glusterfs_heketi_ssh_keyfile }}"
    glusterfs_heketi_fstab: "{{ openshift_storage_glusterfs_heketi_fstab }}"
    glusterfs_nodes: "{{ groups.glusterfs | default([]) }}"
```

glusterfs_registry_facts.yml variables:

```
    glusterfs_timeout: "{{ openshift_storage_glusterfs_registry_timeout }}"
    glusterfs_namespace: "{{ openshift_storage_glusterfs_registry_namespace }}"
    glusterfs_is_native: "{{ openshift_storage_glusterfs_registry_is_native | bool }}"
    glusterfs_name: "{{ openshift_storage_glusterfs_registry_name }}"
    # map_from_pairs is a custom filter plugin in role lib_utils
    glusterfs_nodeselector: "{{ openshift_storage_glusterfs_registry_nodeselector |
default(['storagenode', openshift_storage_glusterfs_registry_name] | join('=')) | map_from_pairs }}"
    glusterfs_use_default_selector: "{{ openshift_storage_glusterfs_registry_use_default_selector }}"
    glusterfs_storageclass: "{{ openshift_storage_glusterfs_registry_storageclass }}"
    glusterfs_storageclass_default: "{{ openshift_storage_glusterfs_registry_storageclass_default |
bool }}"
    glusterfs_image: "{{ openshift_storage_glusterfs_registry_image }}"
    glusterfs_block_deploy: "{{ openshift_storage_glusterfs_registry_block_deploy | bool }}"
    glusterfs_block_image: "{{ openshift_storage_glusterfs_registry_block_image }}"
    glusterfs_block_host_vol_create: "{{ openshift_storage_glusterfs_registry_block_host_vol_create
}}"
    glusterfs_block_host_vol_size: "{{ openshift_storage_glusterfs_registry_block_host_vol_size }}"
    glusterfs_block_host_vol_max: "{{ openshift_storage_glusterfs_registry_block_host_vol_max }}"
    glusterfs_block_storageclass: "{{ openshift_storage_glusterfs_registry_block_storageclass | bool
}}"
    glusterfs_block_storageclass_default: "{{
openshift_storage_glusterfs_registry_block_storageclass_default | bool }}"
    glusterfs_s3_deploy: "{{ openshift_storage_glusterfs_registry_s3_deploy | bool }}"
    glusterfs_s3_image: "{{ openshift_storage_glusterfs_registry_s3_image }}"
    glusterfs_s3_account: "{{ openshift_storage_glusterfs_registry_s3_account }}"
    glusterfs_s3_user: "{{ openshift_storage_glusterfs_registry_s3_user }}"
    glusterfs_s3_password: "{{ openshift_storage_glusterfs_registry_s3_password }}"
    glusterfs_s3_pvc: "{{ openshift_storage_glusterfs_registry_s3_pvc }}"
    glusterfs_s3_pvc_size: "{{ openshift_storage_glusterfs_registry_s3_pvc_size }}"
    glusterfs_s3_meta_pvc: "{{ openshift_storage_glusterfs_registry_s3_meta_pvc }}"
    glusterfs_s3_meta_pvc_size: "{{ openshift_storage_glusterfs_registry_s3_meta_pvc_size }}"
    glusterfs_wipe: "{{ openshift_storage_glusterfs_registry_wipe | bool }}"
    glusterfs_heketi_is_native: "{{ openshift_storage_glusterfs_registry_heketi_is_native | bool }}"
    glusterfs_heketi_is_missing: "{{ openshift_storage_glusterfs_registry_heketi_is_missing | bool }}"
    glusterfs_heketi_deploy_is_missing: "{{
openshift_storage_glusterfs_registry_heketi_deploy_is_missing | bool }}"
    glusterfs_heketi_cli: "{{ openshift_storage_glusterfs_registry_heketi_cli }}"
    glusterfs_heketi_image: "{{ openshift_storage_glusterfs_registry_heketi_image }}"
    glusterfs_heketi_admin_key: "{{ openshift_storage_glusterfs_registry_heketi_admin_key }}"
    glusterfs_heketi_user_key: "{{ openshift_storage_glusterfs_registry_heketi_user_key }}"
    glusterfs_heketi_topology_load: "{{ openshift_storage_glusterfs_registry_heketi_topology_load |
bool }}"
    glusterfs_heketi_wipe: "{{ openshift_storage_glusterfs_registry_heketi_wipe | bool }}"
```

```
    glusterfs_heketi_url: "{{ openshift_storage_glusterfs_registry_heketi_url }}"
    glusterfs_heketi_port: "{{ openshift_storage_glusterfs_registry_heketi_port }}"
    glusterfs_heketi_executor: "{{ openshift_storage_glusterfs_registry_heketi_executor }}"
    glusterfs_heketi_ssh_port: "{{ openshift_storage_glusterfs_registry_heketi_ssh_port }}"
    glusterfs_heketi_ssh_user: "{{ openshift_storage_glusterfs_registry_heketi_ssh_user }}"
    glusterfs_heketi_ssh_sudo: "{{ openshift_storage_glusterfs_registry_heketi_ssh_sudo | bool }}"
    glusterfs_heketi_ssh_keyfile: "{{ openshift_storage_glusterfs_registry_heketi_ssh_keyfile }}"
    glusterfs_heketi_fstab: "{{ openshift_storage_glusterfs_registry_heketi_fstab }}"
    glusterfs_nodes: "{% if groups.glusterfs_registry is defined and groups['glusterfs_registry'] | length
> 0 %}{% set nodes = groups.glusterfs_registry %}{% elif 'groups.glusterfs' is defined and
groups['glusterfs'] | length > 0 %}{% set nodes = groups.glusterfs %}{% else %}{% set nodes = '[]' %}
{% endif %}{{ nodes }}"
```

APPENDIX C. TEMPLATES

C.1. Glusterblock Provisioner Template

This section provides **Glusterblock Provisioner Template**.

```
---
kind: Template
apiVersion: v1
metadata:
  name: glusterblock-provisioner
  labels:
    glusterfs: block-template
    glusterblock: template
  annotations:
    description: glusterblock provisioner template
    tags: glusterfs
objects:
- kind: ClusterRole
  apiVersion: v1
  metadata:
    name: glusterblock-provisioner-runner
    labels:
      glusterfs: block-provisioner-runner-clusterrole
      glusterblock: provisioner-runner-clusterrole
  rules:
    - apiGroups: [""]
      resources: ["persistentvolumes"]
      verbs: ["get", "list", "watch", "create", "delete"]
    - apiGroups: [""]
      resources: ["persistentvolumeclaims"]
      verbs: ["get", "list", "watch", "update"]
    - apiGroups: ["storage.k8s.io"]
      resources: ["storageclasses"]
      verbs: ["get", "list", "watch"]
    - apiGroups: [""]
      resources: ["events"]
      verbs: ["list", "watch", "create", "update", "patch"]
    - apiGroups: [""]
      resources: ["services"]
      verbs: ["get"]
    - apiGroups: [""]
      resources: ["secrets"]
      verbs: ["get", "create", "delete"]
    - apiGroups: [""]
      resources: ["routes"]
      verbs: ["get", "list"]
    - apiGroups: [""]
      resources: ["endpoints"]
      verbs: ["get", "list", "watch", "create", "update", "patch"]
- apiVersion: v1
  kind: ServiceAccount
  metadata:
    name: glusterblock-${CLUSTER_NAME}-provisioner
    labels:
```

```
      glusterfs: block-${CLUSTER_NAME}-provisioner-sa
      glusterblock: ${CLUSTER_NAME}-provisioner-sa
- apiVersion: v1
  kind: ClusterRoleBinding
  metadata:
    name: glusterblock-${CLUSTER_NAME}-provisioner
  roleRef:
    name: glusterblock-provisioner-runner
  subjects:
  - kind: ServiceAccount
    name: glusterblock-${CLUSTER_NAME}-provisioner
    namespace: ${NAMESPACE}
- kind: DeploymentConfig
  apiVersion: v1
  metadata:
    name: glusterblock-${CLUSTER_NAME}-provisioner-dc
    labels:
      glusterfs: block-${CLUSTER_NAME}-provisioner-dc
      glusterblock: ${CLUSTER_NAME}-provisioner-dc
    annotations:
      description: Defines how to deploy the glusterblock provisioner pod.
  spec:
    replicas: 1
    selector:
      glusterfs: block-${CLUSTER_NAME}-provisioner-pod
    triggers:
    - type: ConfigChange
    strategy:
      type: Recreate
    template:
      metadata:
        name: glusterblock-provisioner
        labels:
          glusterfs: block-${CLUSTER_NAME}-provisioner-pod
      spec:
        serviceAccountName: glusterblock-${CLUSTER_NAME}-provisioner
        containers:
        - name: glusterblock-provisioner
          image: ${IMAGE_NAME}
          imagePullPolicy: IfNotPresent
          env:
          - name: PROVISIONER_NAME
            value: ${PROVISIONER_NAME}
parameters:
- name: IMAGE_NAME
  displayName: glusterblock provisioner container image name
  required: True
- name: NAMESPACE
  displayName: glusterblock provisioner namespace
  description: The namespace in which these resources are being created
  required: True
- name: CLUSTER_NAME
  displayName: GlusterFS cluster name
  description: A unique name to identify which heketi service manages this cluster, useful for running
multiple heketi instances
  value: storage
```

```
- name: PROVISIONER_NAME
  displayName: glusterblock provisioner name
  description: A name to uniquely identify the provisioner in an environment with multiple glusterblock
provisioners
  required: True
```