



# Red Hat Gluster Storage 3.5

## Deployment Guide for Public Cloud

Deploying Red Hat Gluster Storage on Public Cloud



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Red Hat Gluster Storage Documentation Team

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## Abstract

This guide provides instructions on how to deploy Red Hat Gluster Storage on a Public Cloud. Making open source more inclusive Red Hat is committed to replacing problematic language in our code, documentation, and web properties. We are beginning with these four terms: master, slave, blacklist, and whitelist. Because of the enormity of this endeavor, these changes will be implemented gradually over several upcoming releases. For more details, see our CTO Chris Wright's message

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# CHAPTER 1. RED HAT STORAGE ON PUBLIC CLOUD

Red Hat Gluster Storage for Public Cloud packages `glusterFS` for deploying scalable NAS in the public cloud. This powerful storage server provides all the features of On-Premise deployment, within a highly available, scalable, virtualized, and centrally managed pool of NAS storage hosted off-premise.

Additionally, Red Hat Gluster Storage can be deployed in the public cloud using Red Hat Gluster Storage for Public Cloud, for example, within the Amazon Web Services (AWS) cloud. It delivers all the features and functionality possible in a private cloud or datacenter to the public cloud by providing massively scalable and high available NAS in the cloud.

The POSIX compatible `glusterFS` servers, which use XFS file system format to store data on disks, can be accessed using industry-standard access protocols including Network File System (NFS) and Server Message Block (SMB) (also known as CIFS).

## 1.1. ABOUT GLUSTERFS

*glusterFS* aggregates various storage servers over network interconnects into one large parallel network file system. Based on a stackable user space design, it delivers exceptional performance for diverse workloads and is a key building block of Red Hat Gluster Storage.

## 1.2. PREREQUISITES

Red Hat has established the generic and use-case specific criteria for Red Hat Gluster Storage compatibility of specific servers.

As a prerequisite to ensure supportability of production deployments, source the instance type for running Red Hat Gluster Storage for Cloud Deployments based on the criteria as specified in <https://access.redhat.com/articles/66206#CE>.

## CHAPTER 2. ACCESSING RED HAT GLUSTER STORAGE USING AMAZON WEB SERVICES

Red Hat Gluster Storage for Public Cloud packages glusterFS as an Amazon Machine Image (AMI) for deploying scalable network attached storage (NAS) in the Amazon Web Services (AWS) public cloud. This storage server provides a highly available, scalable, virtualized, and centrally managed pool of storage for Amazon users. Red Hat Gluster Storage for Public Cloud provides highly available storage within AWS. Synchronous n-way replication across AWS Availability Zones provides high availability within an AWS region. Asynchronous geo-replication provides continuous data replication to ensure high availability across the AWS regions. The glusterFS global namespace capability aggregates disk and memory resources into a unified storage volume that is abstracted from the physical hardware.

The following diagram illustrates AWS integration with Red Hat Gluster Storage:

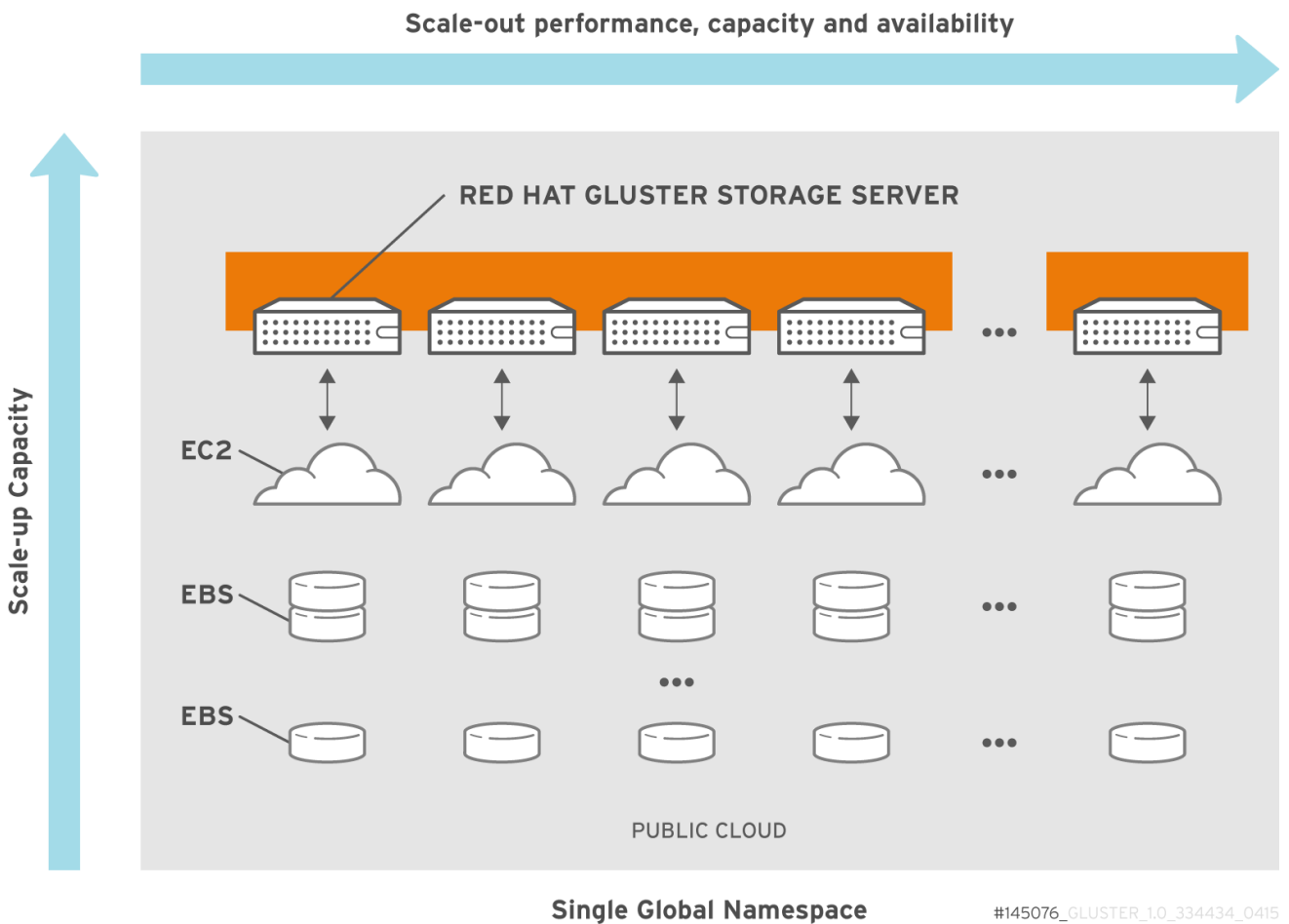


Figure 2.1. Amazon Web Services integration architecture



### IMPORTANT

The following features are not supported on Amazon Web Services:

- NFS and CIFS High Availability
- Red Hat Gluster Storage Web Administration

### 2.1. ACCESSING RED HAT GLUSTER STORAGE AS AN AMAZON MACHINE IMAGE



For information on obtaining access to Red Hat Gluster Storage as an Amazon Machine Image (AMI), see the following resources:

- <https://access.redhat.com/knowledge/articles/145693>
- <https://access.redhat.com/solutions/314993>

## 2.2. PREREQUISITES

- Minimum required number of nodes is 3.
- For compatible physical server, virtual server and client OS platforms, refer <https://access.redhat.com/articles/66206>.

## 2.3. LAUNCHING RED HAT GLUSTER STORAGE INSTANCES

This section describes how to launch Red Hat Gluster Storage instances on Amazon Web Services.

The supported configuration for three-way replication is up to 24 Amazon Elastic Block Store (EBS) volumes of equal size.

**Table 2.1. Supported Configuration on Amazon Web Services**

EBS Volume Type	Minimum Number of Volumes per Instance	Maximum Number of Volumes per Instance	EBS Volume Capacity Range
Magnetic	1	24	1 GiB - 1 TiB
General purpose SSD	1	24	1 GiB - 16 TiB
PIOPS SSD	1	24	4 GiB - 16 TiB
Optimized HDD (ST1)	1	24	500 GiB - 16 TiB
Cold HDD (SC1)	1	24	500 GiB - 16 TiB

- Creation of Red Hat Gluster Storage volume snapshots is supported on magnetic, general purpose SSD and PIOPS EBS volumes. You can also browse the snapshot content using USS. For information on managing Red Hat Gluster Storage volume snapshots see chapter *Managing Snapshots* in the *Red Hat Gluster Storage Administration Guide*

- 



### WARNING

Tiering is considered deprecated as of Red Hat Gluster Storage 3.5. Red Hat no longer recommends its use and does not support tiering in new deployments and existing deployments that upgrade to Red Hat Gluster Storage 3.5.3.

**WARNING**

Gluster-NFS is considered deprecated as of Red Hat Gluster Storage 3.5. Red Hat no longer recommends the use of Gluster-NFS and does not support its use in new deployments and existing deployments that upgrade to Red Hat Gluster Storage 3.5.3.

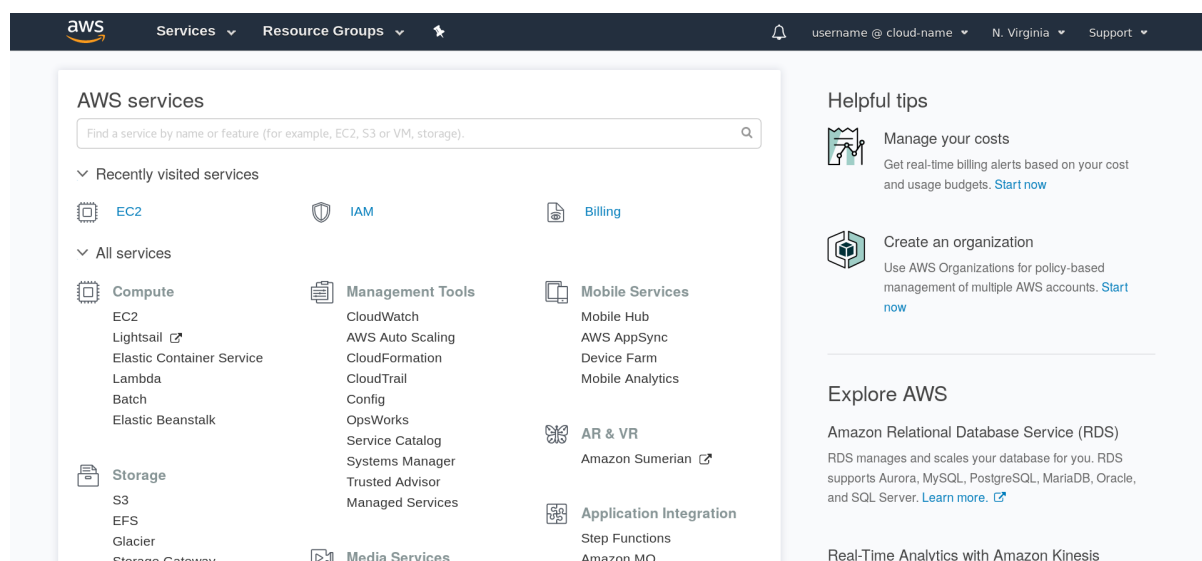
**WARNING**

Using RDMA as a transport protocol is considered deprecated in Red Hat Gluster Storage 3.5. Red Hat no longer recommends its use and does not support it on new deployments and existing deployments that upgrade to Red Hat Gluster Storage 3.5.3.

Amazon Web Service environment supports the Red Hat Gluster Storage tiering feature. You can attach bricks created out of PIOPS or general purpose SSD volumes as hot tier to an existing or new Red Hat Gluster Storage volume created out of magnetic EBS volumes. For information on creation of tiered volumes see chapter *Managing Tiering* in the *Red Hat Gluster Storage Administration Guide*

**To launch the Red Hat Gluster Storage Instance**

1. Navigate to the Amazon Web Services home page at <http://aws.amazon.com>.
2. Log in to Amazon Web Services. The **AWS Management Console** screen displays.



3. Click the **EC2** option. The **EC2 Management Console** displays.

The screenshot shows the AWS Management Console 'Resources' page. The main content area displays a summary of EC2 resources in the US East (N. Virginia) region, including 8 Running Instances, 0 Dedicated Hosts, 142 Volumes, 83 Key Pairs, 0 Placement Groups, 9 Elastic IPs, 51 Snapshots, 0 Load Balancers, and 187 Security Groups. A 'Launch Instance' button is prominently displayed. The right sidebar contains 'Account Attributes' and 'Additional Information' sections with various links.

- Click **Launch Instance**. The **Step 1: Choose an Amazon Machine Image (AMI)** screen is displayed.

The screenshot shows the 'Step 1: Choose an Amazon Machine Image (AMI)' screen. The page displays a list of AMIs under the 'Quick Start' section. Two AMIs are visible: 'Amazon Linux AMI 2017.09.1 (HVM), SSD Volume Type' and 'Amazon Linux 2 LTS Candidate AMI 2017.12.0 (HVM), SSD Volume Type'. The 'My AMIs' tab is selected in the left sidebar.

- Click **My AMIs** and select the **Shared with me** checkbox.

The screenshot shows the 'Step 1: Choose an Amazon Machine Image (AMI)' screen. The page displays a list of AMIs under the 'My AMIs' section. The 'Ownership' filter is set to 'Shared with me'. A search bar is visible at the top of the AMI list.

- Search for the required AMI, and click **Select** corresponding to the AMI. The **Step 2: Choose an Instance Type** screen displays.

**Step 2: Choose an Instance Type**

Amazon EC2 provides a wide selection of instance types optimized to fit different use cases. Instances are virtual servers that can run applications. They have varying combinations of CPU, memory, storage, and networking capacity, and give you the flexibility to choose the appropriate mix of resources for your applications. [Learn more](#) about instance types and how they can meet your computing needs.

Filter by: **All Instance types** **Current generation** [Show/Hide Columns](#)

Currently selected: t2.micro (Variable ECUs, 1 vCPUs, 2.5 GHz, Intel Xeon Family, 1 GiB memory, EBS only)

	Family	Type	vCPUs	Memory (GiB)	Instance Storage (GB)	EBS-Optimized Available	Network Performance	IPv6 Support
<input type="radio"/>	General purpose	t2.nano	1	0.5	EBS only	-	Low to Moderate	Yes
<input checked="" type="radio"/>	General purpose	t2.micro <small>Free tier eligible</small>	1	1	EBS only	-	Low to Moderate	Yes
<input type="radio"/>	General purpose	t2.small	1	2	EBS only	-	Low to Moderate	Yes

[Cancel](#) [Previous](#) [Review and Launch](#) [Next: Configure Instance Details](#)

- Look for the required type of instance, and select it using the radio button corresponding to the instance type.
- Click **Next: Configure Instance Details**. The **Step 3: Configure Instance Details** screen displays.

**Step 3: Configure Instance Details**

Configure the instance to suit your requirements. You can launch multiple instances from the same AMI, request Spot instances to take advantage of the lower pricing, assign an access management role to the instance, and more.

Number of instances:  [Launch into Auto Scaling Group](#)

Purchasing option:  Request Spot instances

Network:  [Create new VPC](#)

Subnet:  [Create new subnet](#)  
206 IP Addresses available

Auto-assign Public IP:

IAM role:  [Create new IAM role](#)

Shutdown behavior:

[Cancel](#) [Previous](#) [Review and Launch](#) [Next: Add Storage](#)

- Specify the configuration for your instance or continue with the default settings, and click **Next: Add Storage**. The **Step 4: Add Storage** screen displays.

**Step 4: Add Storage**

Your instance will be launched with the following storage device settings. You can attach additional EBS volumes and instance store volumes to your instance, or edit the settings of the root volume. You can also attach additional EBS volumes after launching an instance, but not instance store volumes. [Learn more](#) about storage options in Amazon EC2.

Volume Type	Device	Snapshot	Size (GiB)	Volume Type	IOPS	Throughput (MB/s)	Delete on Termination	Encrypted
Root	/dev/sda1	snap-ba40cac8	10	General Purpose SSD (GP2)	100 / 3000	N/A	<input checked="" type="checkbox"/>	Not Encrypted

[Add New Volume](#)

Free tier eligible customers can get up to 30 GB of EBS General Purpose (SSD) or Magnetic storage. [Learn more](#) about free usage tier eligibility and usage restrictions.

[Cancel](#) [Previous](#) [Review and Launch](#) [Next: Add Tags](#)

- In the **Step 4: Add Storage** screen, specify the storage details, and click **Next: Add Tags**. The **Step 5: Add Tags** screen displays.

**Step 5: Add Tags**

A tag consists of a case-sensitive key-value pair. For example, you could define a tag with key = Name and value = Webserver. A copy of a tag can be applied to volumes, instances or both. Tags will be applied to all instances and volumes. [Learn more](#) about tagging your Amazon EC2 resources.

Key	Value	Instances	Volumes
This resource currently has no tags			

Choose the [Add tag](#) button or [click to add a Name tag](#).  
Make sure your [IAM policy](#) includes permissions to create tags.

[Add Tag](#) (Up to 50 tags maximum)

[Cancel](#) [Previous](#) [Review and Launch](#) [Next: Configure Security Group](#)

- Click **Add** and enter the required information in the **Value** field for each tag.



## IMPORTANT

Adding the **Name** tag is required. To add the **Name** tag, click **click to add a Name tag**. You can use this name later to verify that the instance is operating correctly.

- Click **Next: Configure Security Group**. The **Step 6: Configure Security Group** screen displays.

**Step 6: Configure Security Group**

A security group is a set of firewall rules that control the traffic for your instance. On this page, you can add rules to allow specific traffic to reach your instance. For example, if you want to set up a web server and allow Internet traffic to reach your instance, add rules that allow unrestricted access to the HTTP and HTTPS ports. You can create a new security group or select from an existing one below. [Learn more](#) about Amazon EC2 security groups.

Assign a security group:  Create a new security group  
 Select an existing security group

Security group name:   
 Description:

Type	Protocol	Port Range	Source	Description
SSH	TCP	22	Custom 0.0.0.0/0	e.g. SSH for Admin Desktop

[Add Rule](#)

**Warning**

[Cancel](#) [Previous](#) [Review and Launch](#)

13. Create a new security group or select an existing security group.
14. Ensure to open the following TCP port numbers in the new or selected security group:
  - 22 to allow ssh access to the instance created
15. Click **Review and Launch**. The **Step 7: Review Instance Launch** screen displays.

**Step 7: Review Instance Launch**

Please review your instance launch details. You can go back to edit changes for each section. Click **Launch** to assign a key pair to your instance and complete the launch process.

▼ AMI Details [Edit AMI](#)

**RHEL-7.2\_HVM\_GA-20151112-x86\_64-1-Access2-GP2 - ami-2a532b40**  
 Provided by Red Hat, Inc.  
 Root Device Type: ebs Virtualization type: hvm

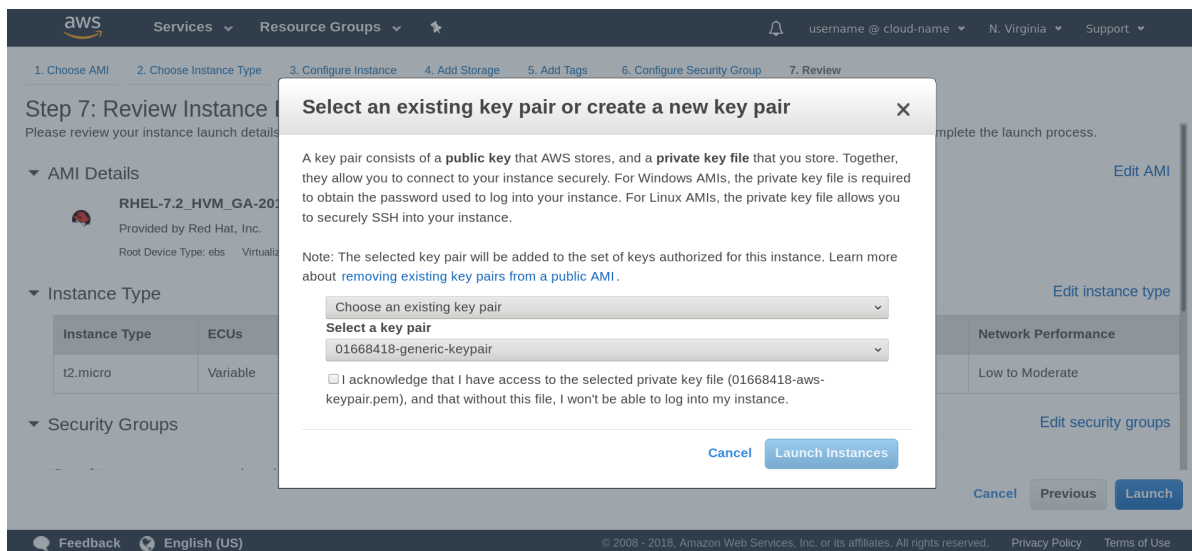
▼ Instance Type [Edit instance type](#)

Instance Type	ECUs	vCPUs	Memory (GiB)	Instance Storage (GB)	EBS-Optimized Available	Network Performance
t2.micro	Variable	1	1	EBS only	-	Low to Moderate

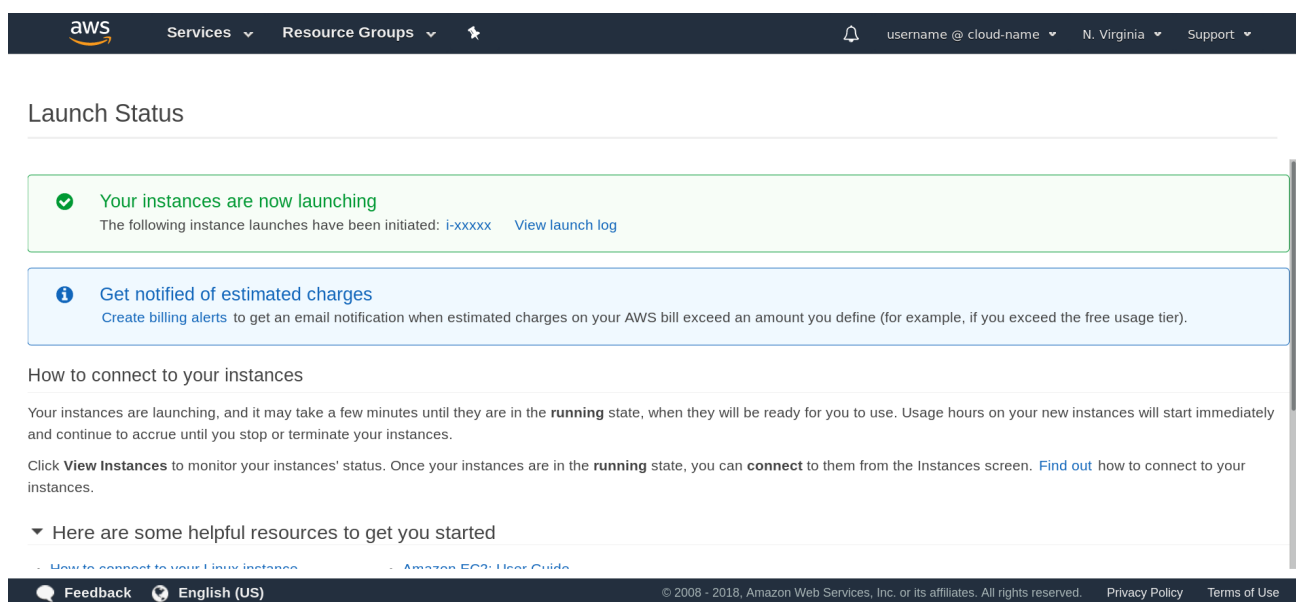
▼ Security Groups [Edit security groups](#)

[Cancel](#) [Previous](#) [Launch](#)

16. Review and edit the required settings, and click **Launch**.
17. Choose an existing key pair or create a new key pair, and click **Launch Instances**.



The **Launch Status** screen is displayed indicating that the instance is launching.

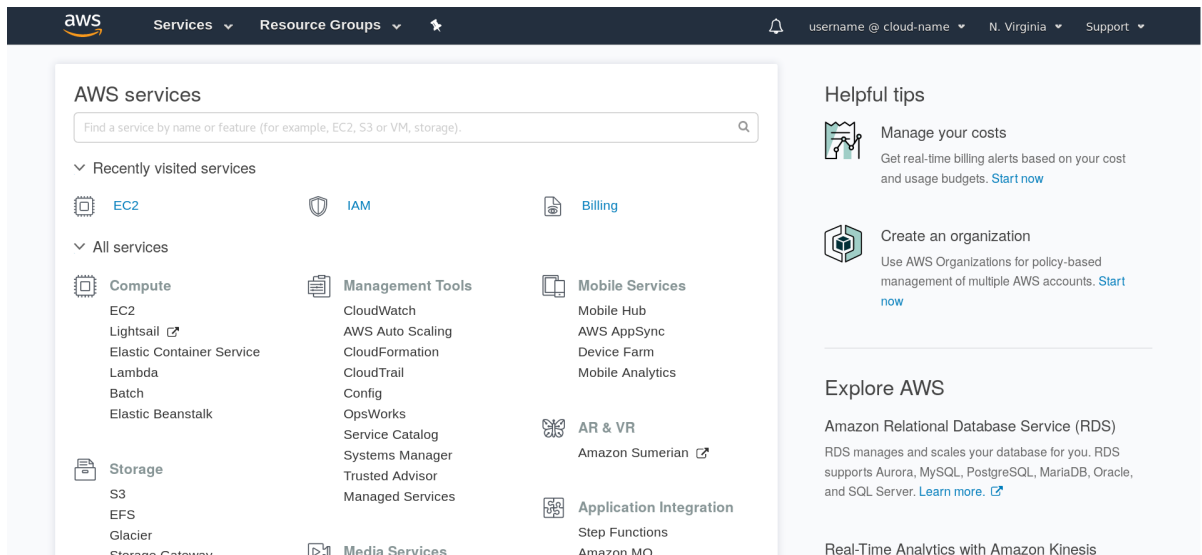


## 2.4. VERIFYING THAT RED HAT GLUSTER STORAGE INSTANCE IS RUNNING

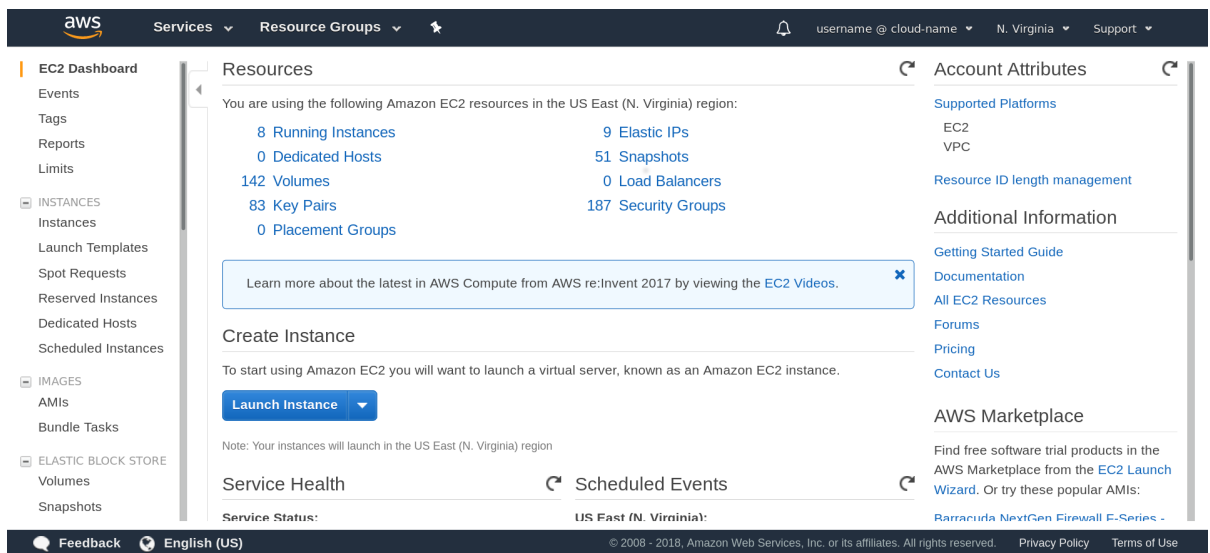
You can verify that the Red Hat Gluster Storage instance is running by performing a remote login to the Red Hat Gluster Storage instance and issuing a command.

**To verify that the Red Hat Gluster Storage instance is running:**

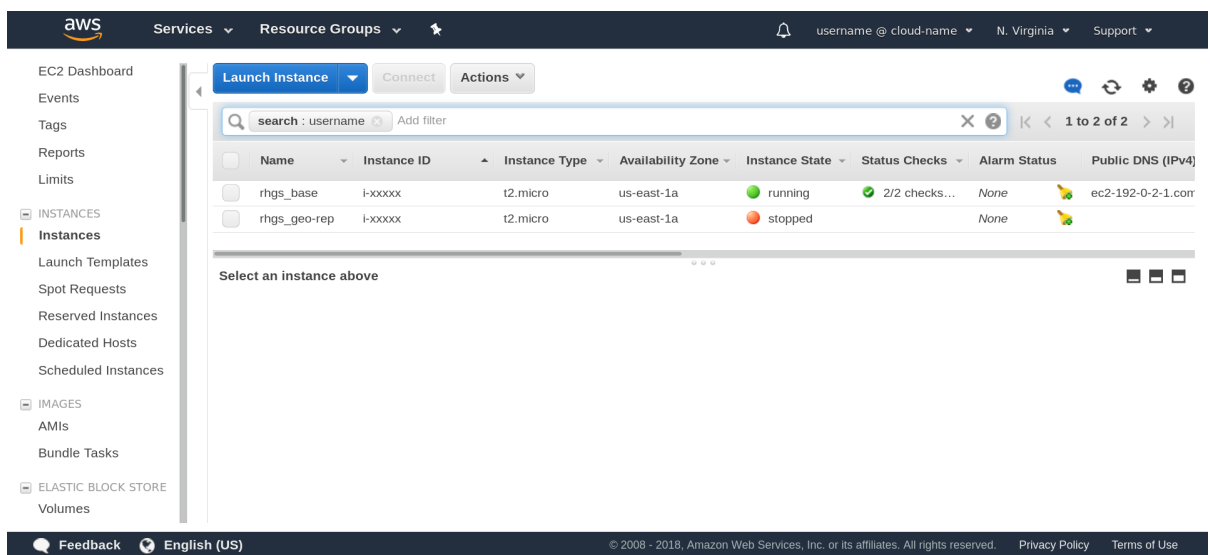
1. Navigate to <http://aws.amazon.com>.
2. Log in to Amazon Web Services. The **AWS Management Console** screen displays.



3. Click the **EC2** option. The **EC2 Management Console** displays.



4. In the **Instances** section click the **Instances** link. The screen displays your current instances.



5. Check the **Instance State** column and verify that the instance is running. A yellow circle indicates a pending status while a green circle indicates that the instance is running.



Select the instance and verify the details displayed in the **Description** tab.

The screenshot shows the AWS Management Console interface. On the left, there is a navigation menu with categories like EC2 Dashboard, Events, Tags, Reports, Limits, INSTANCES, INSTANCES (highlighted), Launch Templates, Spot Requests, Reserved Instances, Dedicated Hosts, Scheduled Instances, IMAGES, AMIs, Bundle Tasks, and ELASTIC BLOCK STORE. The main content area displays a table of EC2 instances. Two instances are listed: 'rhgs\_base' (running) and 'rhgs\_geo-rep' (stopped). Below the table, the details for the selected 'rhgs\_base' instance are shown in the 'Description' tab. The details include Instance ID (i-xxxxx), Instance state (running), Instance type (t2.micro), Availability zone (us-east-1a), Security groups (launch-wizard-122), and Public DNS (ec2-192-0-2-1.compute-1.amazonaws.com). Other fields like Elastic IPs, Private DNS, Private IPs, and VPC ID are also visible.

- Use the domain name in the Public DNS field to remotely log in to the Red Hat Amazon Machine Image instance by using the following commands:

```
# ssh -i Key_Pair_File Public_DNS
# sudo su
```



#### NOTE

You must use the key pair that was selected or created when launching the instance.

For example, the key pair file name is **rhs-aws.pem**, and the **Public DNS** is **ec2-user@ec2-23-20-52-123.compute-1.amazonaws.com**:

```
# ssh -i rhs-aws.pem ec2-user@ec2-23-20-52-123.compute-1.amazonaws.com
# sudo su
```

- Verify that the **glusterd** daemon is running on the instance using the following command:

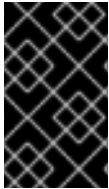
```
# service glusterd status
```



#### NOTE

Samba and NFS-Ganesha channels are disabled by default. To use standalone Samba and NFS-Ganesha:

- For enabling and installing the Red Hat Gluster Storage Samba repository, see *Deploying Samba on Red Hat Gluster Storage* in [Red Hat Gluster Storage 3.5 Installation Guide](#).
- For enabling and installing the Red Hat Gluster Storage NFS-Ganesha repository, see *Deploying NFS-Ganesha on Red Hat Gluster Storage* in [Red Hat Gluster Storage 3.5 Installation Guide](#).

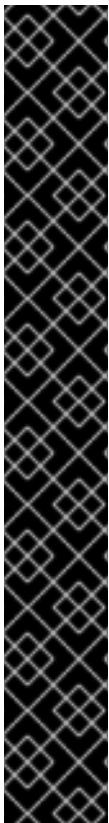


## IMPORTANT

Before using **yum update** to update the Amazon EC2 Red Hat Gluster Storage AMI, follow the steps listed in the Knowledgebase article at <https://access.redhat.com/solutions/1556793>

## 2.5. PROVISIONING STORAGE

Amazon Elastic Block Storage (EBS) is designed specifically for use with Amazon EC2 instances. Amazon EBS provides storage that works like a raw, unformatted, external block device. This section provides step-by-step instructions to provision storage for creating bricks in form of logical volumes. These bricks can be used to create different types of volumes like Gluster arbitrated replicated volumes, and Gluster three-way replicated volumes.



## IMPORTANT

- Starting with Red Hat Gluster Storage 3.4, Red Hat does not recommend the aggregation of multiple EBS volumes when they are consumed by a Red Hat Gluster Storage instance. Follow the steps provided in this chapter to configure Red Hat Gluster Storage in an AWS environment.
- The supported configuration for a Red Hat Gluster Storage EC2 instance is up to 24 Amazon EBS volumes.
- If you are provisioning storage for three-way replicated volumes or arbitrated volumes, you must create each replica set of a volume in three different zones. With this configuration, there will be no impact on the data availability even if two availability zones are unavailable. Client-side quorum is enabled by default and hence unavailability of two zones would make the access read-only.
- External snapshots, such as snapshots of a virtual machine or an instance where Red Hat Gluster Storage Server is installed as a guest operating system, and Fibre Channel or iSCSI SAN snapshots, are not supported.
- If you want to create arbitrated replicated volumes or three-way replicated volumes, you must use **EBS** volume type comprising general purpose SSD or PIOPS SSD.

1. Create a physical volume (PV) by using the following command:

```
# pvcreate device
```

For example:

```
# pvcreate /dev/xvdd  
Physical volume "/dev/xvdd" successfully created.
```

**NOTE**

- `/dev/xvdd` is a storage device. This command has to be executed on all the disks if there are multiple volumes. For example:

```
# pvcreate /dev/xvdd /dev/xvde /dev/xvdf...
```

- The device name and the alignment value will vary based on the device you are using.

2. Create a Volume Group (VG) from the PV using the following command:

```
# vgcreate volume_group device
```

For example:

```
# vgcreate rhs_vg /dev/xvdd
Volume group "rhs_vg" successfully created
```

**NOTE**

`/dev/xvdd` is a storage device. If you have multiple devices, create multiple VGs.

3. Create a thin pool of the maximum possible size or the pool size of 0.5% of the EBS volume size:

```
# lvcreate --thinpool VOLGROUP/POOLNAME -l 100%FREE --chunksize chunk_size --
poolmetadatasize metadata_pool_size --zero n
```

The maximum possible size for a metadata LV is 16 GiB. Red Hat Gluster Storage recommends creating the metadata device of the maximum supported size. You can allocate less than the maximum if space is a concern, but in this case you should allocate a minimum of 0.5% of the pool size.

**Example 1**

To create a thin pool with the maximum possible metadata device size of the maximum possible size for your device:

```
# lvcreate --thinpool rhs_vg/rhs_pool -l 100%FREE --chunksize 256K --poolmetadatasize 16g
--zero n
Using default stripesize 64.00 KiB.
Logical volume "rhs_pool" created.
```

**Example 2**

To create 0.5% pool metadata size of the EBS volume of size of 20 GiB.

```
# lvcreate --thinpool rhs_vg1/rhs_pool1 -l 100%FREE --chunksize 256K --poolmetadatasize
0.1g --zero n
Using default stripesize 64.00 KiB.
Rounding up size to full physical extent 104.00 MiB
```

- Execute **lvs** command to get the maximum available device space in the EBS volume. You can use the **LSize** size listed in this command while creating logical volume. This is to ensure that the entire EBS volume is used and no space is wasted.

```
# lvs rhs_vg
LV      VG      Attr      LSize Pool Origin Data% Meta% Move Log Cpy%Sync Convert
rhs_pool rhs_vg twi-a-t--- 1.97t  0.00  0.02
```

- Create a logical volume using the **LSize** obtained in the previous command to consume the entire thin pool into a single LV or you can create multiple LVs from a single thin pool.

```
# lvcreate -V lv_size -T VOLGROUP/POOLNAME -n lv_name
```

### Example 1

Create a single LV using **LSize** obtained in the previous command to consume entire thin pool into a single LV:

```
# lvcreate -V 1.96T -T rhs_vg/rhs_pool -n rhs_lv
Using default stripesize 64.00 KiB.
Rounding up size to full physical extent 1.96 TiB
Logical volume "rhs_lv" created.
```

For thin pool auto extension activation/`thin_pool_autoextend_threshold` should be below 100.

### Example 2

Create multiple LVs from the single thin pool. This example creates two LVs of size 2G from the thin pool `rhs_pool1`.

```
# lvcreate -V 2G -T rhs_vg1/rhs_pool1 -n rhs_lv
Using default stripesize 64.00 KiB.
Logical volume "rhs_lv" created.

# lvcreate -V 2G -T rhs_vg1/rhs_pool1 -n rhs_lv1
Using default stripesize 64.00 KiB.
Logical volume "rhs_lv1" created.
```

- Format the logical volume using the following command:

```
# mkfs.xfs -i size=512 -n size=8192 /VOLGROUP/POOLNAME/
```

For example, to format **/dev/rhgs\_vg/rhgs\_lv::**

```
# mkfs.xfs -i size=512 -n size=8192 /dev/rhgs_vg/rhgs_lv
```

- Create a mount point and mount the logical device using the following commands:

```
# mkdir File Mount Path
# mount -t xfs -o inode64,noatime Logical Volume Path File Mount Path
```

For example:

```
# mkdir /export/mountlv  
# mount -t xfs -o inode64,noatime /dev/rhgs_vg/rhgs_lv /export/mountlv
```

8. Mount the file system automatically by adding the following line in the **/etc/fstab**:

```
# Logical Volume Path File Mount Path xfs rw,inode64,noatime,nouuid 0 0
```

For example:

```
# /dev/rhgs_vg/rhgs_lv /export/mountlv xfs rw,inode64,noatime,nouuid 0 0
```

After adding the EBS volumes, you can use the mount points as bricks to be a part of existing or new volumes. For more information on creating arbitrated replicated volumes, and three-way replicated volumes, see chapter *Red Hat Gluster Storage Volumes* in the *Red Hat Gluster Storage Administration Guide*.

## 2.6. STOPPING AND RESTARTING THE RED HAT GLUSTER STORAGE INSTANCE



### IMPORTANT

When you stop and restart a Red Hat Gluster Storage instance, Amazon Web Services assigns the instance a new IP address and hostname. This results in the instance losing its association with the virtual hardware, causing disruptions to the trusted storage pool. To prevent errors, add the restarted Red Hat Gluster Storage instance to the trusted storage pool. See section *Adding Servers to the Trusted Storage Pool* in the *Red Hat Gluster Storage Administration Guide*.

Rebooting the Red Hat Gluster Storage instance preserves the IP address and hostname and does not lose its association with the virtual hardware. This does not cause any disruptions to the trusted storage pool.

## CHAPTER 3. ACCESSING RED HAT GLUSTER STORAGE USING MICROSOFT AZURE

Red Hat Gluster Storage is designed to provide a flexible file services layer for users and applications in a way that can be easily scaled to adjust to your workloads. Deployment flexibility is a key strength of Red Hat Gluster Storage. Gluster can be deployed to virtual or physical servers in on-premise environments, private clouds, and public clouds, including Microsoft Azure.

### Integration Architecture

The architecture of Microsoft Azure itself shapes the way solutions are designed. Microsoft Azure offers a cloud service that can function either as a platform-as-a-service (PaaS) or infrastructure-as-a-service (IaaS) environment. For Gluster Storage, the cloud service should be an IaaS layer that provides a logical container to deploy virtual instances to. Within the IaaS container, Microsoft Azure provides network services like DNS and DHCP, which makes managing the virtual instances similar to managing a physical deployment.

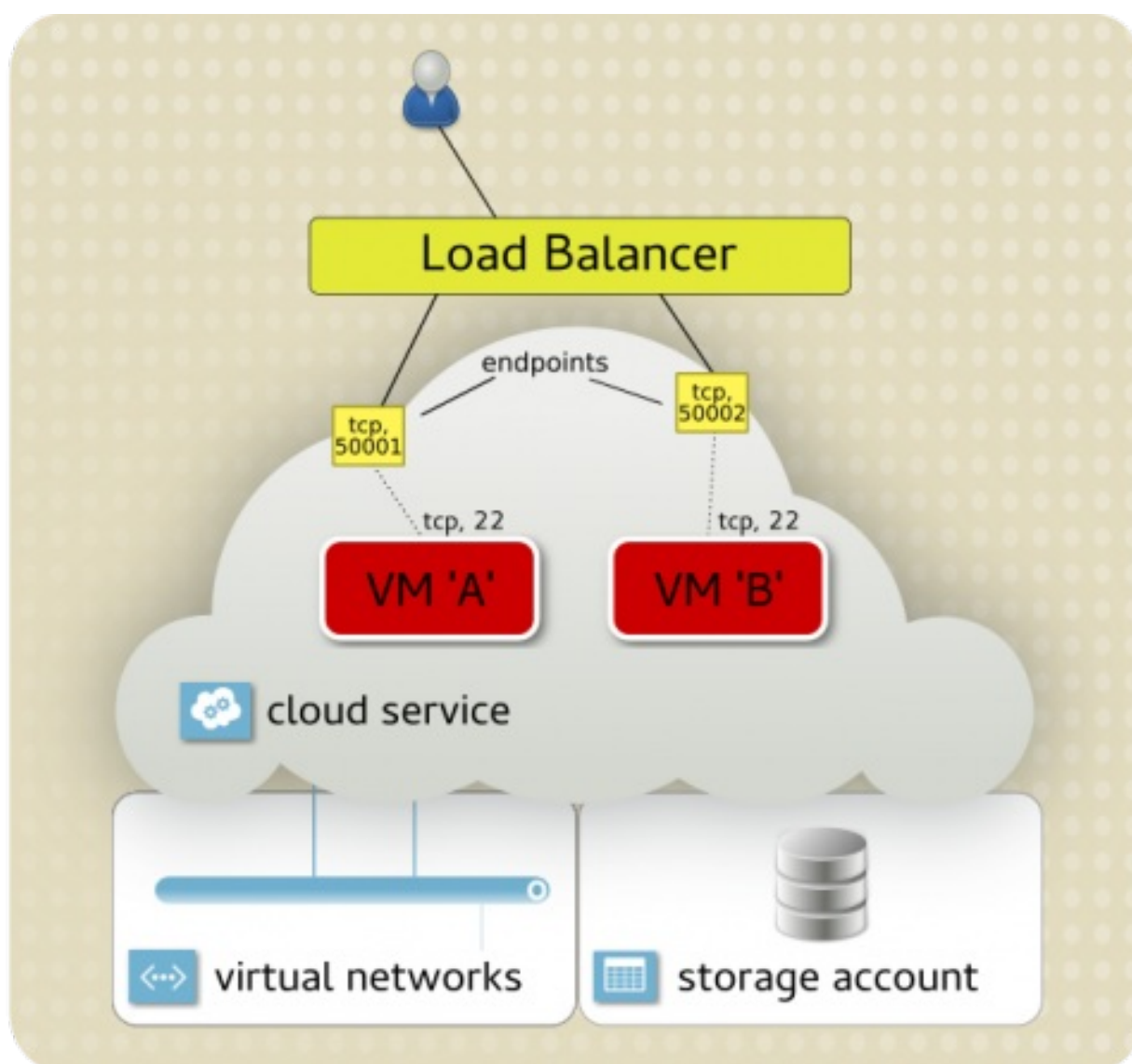


Figure 3.1. integration Architecture

A cloud service is defined by a name, which is a prefix applied to the **cloudapp.net** domain. Access to instances inside the cloud service is done by specifying the cloud service name and TCP port (endpoint). Most typically, this is SSH access. For example, you may have 30 virtual instances running inside a cloud

service, so accessing them individually is done by exposing a different endpoint for each instance: **50,001** links to port 22 on instance A, and **50,002** links to port 22 on instance B.

A virtual network allows greater control and connectivity for instances inside a cloud service. Virtual networks can be configured to function purely within the Microsoft Azure infrastructure or can be used to connect on-premise networks to cloud services through site-to-site VPN connections.

The last key architectural element is the storage account. A storage account provides access to storage services within Microsoft Azure. The account provides a unique namespace for data and supports a number of access protocols, including blob, table, queue, and file. Data can be stored physically either on SSD (premium) or HDD (standard).

The workflow described in this chapter creates Red Hat Gluster Storage cluster.

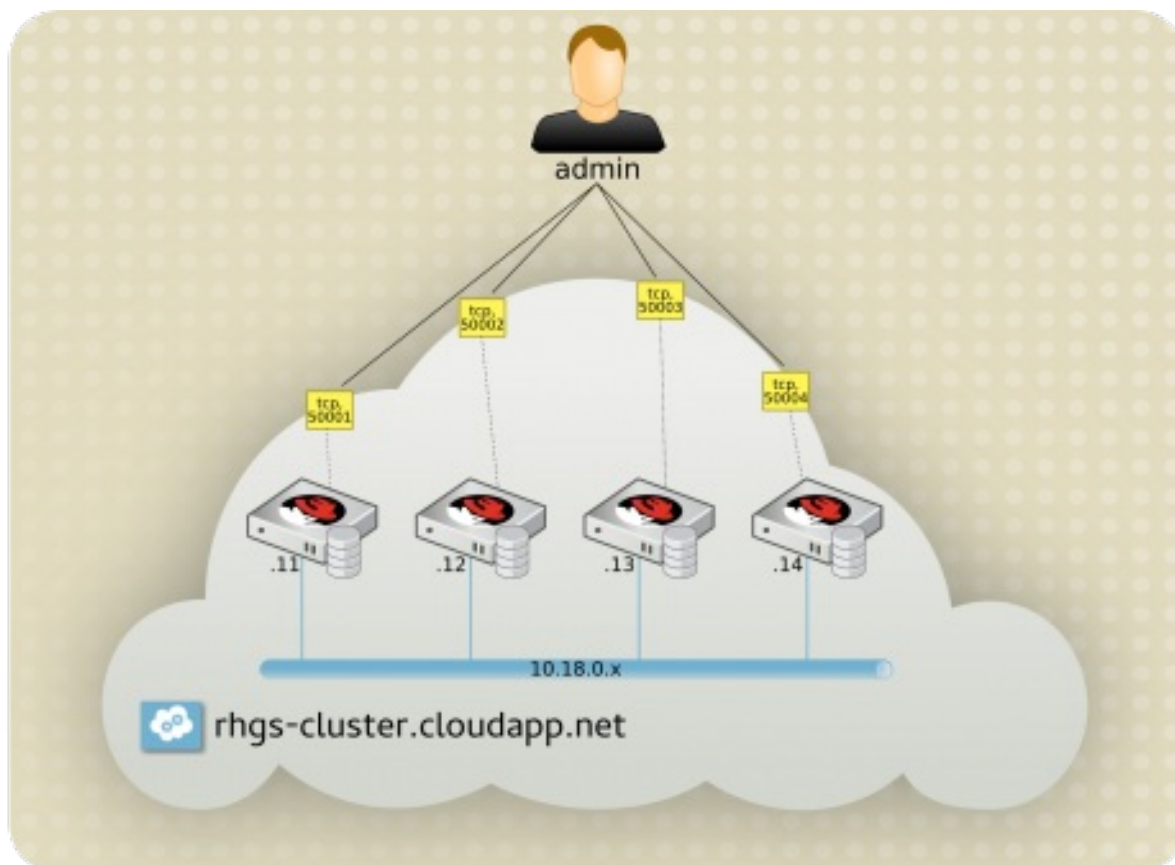


Figure 3.2. Microsoft Azure and Red Hat Gluster Storage workflow



### IMPORTANT

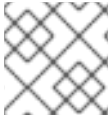
The following features of Red Hat Gluster Storage Server are not supported on Microsoft Azure:

- Red Hat Gluster Storage Console and Nagios Monitoring
- NFS-Ganesha and CIFS High Availability

## 3.1. IMAGE PROFILE AND SIZING

Microsoft Azure offers various virtual machine configurations to choose from, based on the projected workload. The example configuration assumes a Standard Tier/A2 instance.

As a guide, the tasks performed within this chapter are based on the Standard Tier/A2 instance size:



## NOTE

A minimum of two cores is required for each instance of Red Hat Gluster Storage.

In addition to the operating system disk, Microsoft Azure also allocates every instance a resource disk. This is a non-persistent (ephemeral) disk, provided at runtime to the instance from the local storage on the physical host the instance is running on. The resource disk is visible at `/mnt/resource` and is configured by the Windows Azure Linux Agent to provide swap space and temporary storage for applications.

For each instance type, the Microsoft Azure portal shows a clear indication of the CPU core count and RAM, but it does not show the number of configurable disks that each instance supports. The number of configurable data disks ranges between 1 and 32, dependent upon the instance type.

Since Red Hat Gluster Storage is a storage platform, there are some additional planning considerations when sizing instances:

- A virtual disk has a maximum size of 1023 GB. Larger disk sizes can be accommodated by aggregating multiple 1023 GB disks together.
- Once a disk has been defined, its size cannot be changed easily. Because capacity costs in Microsoft Azure Standard Storage are based on use, not allocated space, it is recommended that all disks assigned to a Red Hat Gluster Storage node are 1023 GB.
- Although attributes like CPU, RAM, and disk count can be easily changed after an instance is created, networking characteristics cannot. When planning your configuration, consider the network topology and connectivity you need before the instance are created. Microsoft Azure instance supports multiple network cards and multiple virtual networks, but these types of advanced networking features are only configurable using the Windows Powershell.

## 3.2. PREREQUISITES

- Install the Microsoft Azure CLI based on the instructions listed at <https://access.redhat.com/articles/uploading-rhel-image-to-azure#install-the-azure-cross-platform-cli-on-your-azure-administration-server-6>.
- Migrate your subscriptions from Red Hat to Microsoft Azure based on the instructions listed at <https://access.redhat.com/articles/migrating-to-red-hat-cloud-access>.
- Minimum required number of nodes is 3.
- For compatible physical server, virtual server and client OS platforms , refer <https://access.redhat.com/articles/66206>.

It is also possible to manage Gluster Storage using the Windows Powershell environment based on the instructions at: <https://azure.microsoft.com/en-in/documentation/articles/powershell-install-configure>. But that is not listed in this chapter. All of the procedures here will use the Microsoft Azure CLI.

## 3.3. PLANNING GUIDELINES



The following are the guidelines for setting up Red Hat Gluster Storage on Microsoft Azure.

- Designate a management server for interaction and control with Microsoft Azure services. For simple Gluster Storage deployments (single site, single NIC), the management platform can be a Linux server/workstation. For more complex deployments, a Windows desktop with Powershell is recommended.
- Build custom images based on Red Hat Enterprise Linux 7 with the Hyper-V drivers included within the `initramfs` file. **Instances will fail to start if these drivers are not present.**
- Use a virtual network for your Red Hat Gluster Storage nodes.
- For geo-replication, deploy a common `/etc/hosts` file to all nodes or use a shared DNS server.
- Pricing for standard storage is based on used capacity. It therefore makes sense to use the maximum size for data disks (1023 GB) and allocate as many as the instance supports at install time to minimize future administration overheads.
- If NFS is the preferred way to connect to the Gluster Storage nodes, consider using a **D** series instance that has a more modern CPU with a higher clock speed.
- Use availability sets to group Gluster Storage nodes within a replication set together to enhance availability.
- Use **mdadm** to combine disks to form a larger disk.
- Use fewer, larger virtual machines to deliver the highest capacity.
- For highly available data access, use a replicated GlusterFS volume with the native **glusterfs** client.
- Use a non-default SSH port for public access to the SSH services running on each of the Gluster Storage nodes (that is, use `--ssh` with `vm create`).

## 3.4. SETTING UP RED HAT GLUSTER STORAGE IN MICROSOFT AZURE IN ARM MODE

This section provides step-by-step instructions to set up Red Hat Gluster Storage in Microsoft Azure in the Azure Resource Manager mode.



### NOTE

There are two deployment modes in Microsoft Azure: Azure Service Management (ASM) mode (sometimes referred to as Azure Classic) and Azure Resource Manager (ARM) mode. The procedure in this section uses ARM mode and ARM cross-platform command-line interface (Xplat-CLI) commands to deploy a Red Hat Gluster Storage into Microsoft Azure. The Xplat-CLI commands differ slightly between these two deployment modes. If you want to set up the Red Hat Gluster Storage in Microsoft Azure using Azure Service Management (ASM) mode, refer to [Section 3.6, "Appendix - Setting up Red Hat Gluster Storage in Microsoft Azure in ASM Mode"](#).

### 3.4.1. Obtaining Red Hat Gluster Storage for Microsoft Azure

To download the Red Hat Gluster Storage Server files using a Red Hat Subscription or a Red Hat Evaluation Subscription:

1. Visit the Red Hat Customer Service Portal at <https://access.redhat.com/login> and enter your user name and password to log in.
2. Click **Downloads** to visit the **Software & Download Center**.
3. In the Red Hat Gluster Storage Server area, click **Download Software** to download the latest version of the **VHD** image.
4. Navigate to the directory where the file was downloaded and execute the **sha256sum** command on the file.

For example,

```
$ sha256sum rhgs-azure-3.5-rhel-7-x86_64.tar.gz
2d083222d6a3c531fa2fbbd21c9ea5b2c965d3b8f06eb8 ff3b2b0efce173325d rhgs-azure-
3.5-rhel-7-x86_64.tar.gz
```

The value generated by the **sha256sum** utility must match the value displayed on the Red Hat Customer Portal for the file. If they are not the same, your download is either incomplete or corrupt, and you will need to download the file again. If the checksum is not successfully validated after several attempted downloads, contact Red Hat Support for assistance.

5. Unzip the downloaded file **rhgs-azure-[version].zip** to extract the archive contents.

For example,

```
# tar -xvzf rhgs-azure-3.5-rhel-7-x86_64.tar.gz
```

### 3.4.2. Setting Up New Resources in Microsoft Azure

You must install the Azure cross-platform command-line interface (Xplat-CLI) before setting up new resources in Microsoft Azure. The steps to install the Azure Xplat-CLI and set up new resources in Microsoft Azure are provided at <https://access.redhat.com/articles/2706961#install-the-azure-cross-platform-cli-2>

Before you can upload the Microsoft Azure VHD, you need to have resources for the VM created in Microsoft Azure. All of the following steps are completed from your Microsoft Azure Administration Server.

1. Create a resource group.

```
# azure group create -l [azure-region] -n [resource-group]
```

For example,

```
# azure group create -l eastus -n rhgsarm
info: Executing command group create
+ Getting resource group rhgsarm
+ Creating resource group rhgsarm
info: Created resource group rhgsarm
data: Id: /subscriptions/2586c64b-38b4-4527-a140-012d49dfc02c/resourceGroups/rhgsarm
data: Name: rhgsarm
data: Location: eastus
data: Provisioning State: Succeeded
```

```
data: Tags: null
data:
info: group create command OK
```

2. Create a storage account. The following command sets up a few details that allow you to identify the replication option you want to use. Refer to Microsoft's *Account Replication Options* article at <https://azure.microsoft.com/en-us/documentation/articles/storage-redundancy/>

```
# azure storage account create --sku-name [LRS, ZRS, GRS, RA-GRS] --kind [Storage,
Blob Storage] -l [azure-region] -g [resource-group] [account-name]
```

For example,

```
# azure storage account create --sku-name LRS --kind Storage -l eastus -g rhgsarm
rhgsstorage
info: Executing command storage account create
+ Checking availability of the storage account name
+ Creating storage account
info: storage account create command OK
```

3. Get the storage account keys to use in the next step.

```
# azure storage account keys list -g [resource-group] [account-name]
```

For example,

```
# azure storage account keys list -g rhgsarm rhgsstorage
info: Executing command storage account keys list
+ Getting storage account keys
data: Name Key Permissions
data: -----
data: key1
ba8zt8LSUznaGX92DV1zWhj3ikrplQEsZXxmNQcd194JaD/NgSwueVVmPfAjOMptpu3fDR/7ol
T2smo/9ZON+w== Full
data: key2
5r+wVkfzb8S6oBpZCo9vQSuVhyNLuaOcfpOR048zWnRr8kAsTs7Vp72C/ldWGGQE9liKrFXx
PaDb5GosaA3Zeg== Full
info: storage account keys list command OK
```

Microsoft Azure generates two keys, both of which allow access to your storage container. Microsoft Azure generates two keys for key regeneration purposes. During regeneration, you use one key for secure access, while Microsoft Azure regenerates and creates a new key. Once there is a new key, you switch to that key and regenerate the other key the next time, and so forth. This is like changing your password for your Microsoft Azure storage container. You should do this periodically, but do not do it now because you just created the two keys. For information on keys and key regeneration, refer to Microsoft's *Storage Connection Strings* article at <https://azure.microsoft.com/en-us/documentation/articles/storage-configure-connection-string/>.

4. Export the key. Copy the key1 string created in the previous step and paste it in the AccountKey= file.

```
# export
AZURE_STORAGE_CONNECTION_STRING="DefaultEndpointsProtocol=https;AccountName=[account-name];AccountKey=[storage-account-key]"
```

For example,

```
# export
AZURE_STORAGE_CONNECTION_STRING="DefaultEndpointsProtocol=https;AccountName=rhgsstorage;AccountKey=ba8zt8LSUznaGX92DV1zWhj3ikrplQEsZXmNQcd194JaD/NgSwueVVmPfAjOMptpu3fDR/7olT2smo/9ZON+w=="
```

5. Create the storage container.

```
# azure storage container create [container-name]
```

For example,

```
# azure storage container create rhgscontainer
info: Executing command storage container create
+ Creating storage container rhgscontainer
+ Getting storage container information
data: {
  data: name: 'rhgscontainer',
  data: metadata: {},
  data: etag: '"0x8D44F1EAD8604B4"',
  data: lastModified: 'Tue, 07 Feb 2017 06:00:54 GMT',
  data: lease: { status: 'unlocked', state: 'available' },
  data: requestId: '124a5521-0001-007a-3507-81b138000000',
  data: publicAccessLevel: 'Off'
  data: }
info: storage container create command OK
```

6. Create the Microsoft Azure virtual network.

```
# azure network vnet create -g [resource-group] -l [azure-region] -a [CIDR-address-prefix-vnet] [vnet-name]
```

For example,

```
# azure network vnet create -g rhgsarm -l eastus -a 10.0.0.0/8 rhgsvnet1
info: Executing command network vnet create
+ Looking up the virtual network "rhgsvnet1"
+ Creating virtual network "rhgsvnet1"
data: Id :
/subscriptions/2586c64b-38b4-4527-a140-012d49dfc02c/resourceGroups/rhgsarm/providers/Microsoft.Network/virtualNetworks/rhgsvnet1

data: Name : rhgsvnet1
data: Type : Microsoft.Network/virtualNetworks
data: Location : eastus
data: Provisioning state : Succeeded
```

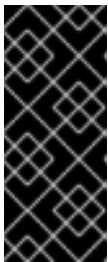
```
data: Address prefixes:
data: 10.0.0.0/8
info: network vnet create command OK
```

7. Create the subnet for the Microsoft Azure virtual network.

```
# azure network vnet subnet create -g [resource-group] -e [vnet-name] -a [CIDR-address-
prefix-subnet] [subnet-name]
```

For example,

```
# azure network vnet subnet create -g rhgsarm -e rhgsvnet1 -a 10.0.1.0/24 rhgssubnet1
info: Executing command network vnet subnet create
+ Looking up the virtual network "rhgsvnet1"
+ Looking up the subnet "rhgssubnet1"
+ Creating subnet "rhgssubnet1"
data: Id : /subscriptions/2586c64b-38b4-4527-a140-
012d49dfc02c/resourceGroups/rhgsarm/providers/Microsoft.Network/virtualNetworks/rhgsvnet1
/subnets/rhgssubnet1
data: Name : rhgssubnet1
data: Provisioning state : Succeeded
data: Address prefix : 10.0.1.0/24
info: network vnet subnet create command OK
```



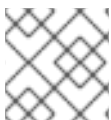
### IMPORTANT

The storage connection key persists through the following procedure if you do not shut down your machine. If you shut down prior to completing the procedure, you need to pass your key (`-k "[storage-account-key]"`) in the following commands. You can add your keys to a configuration file to load them each time your machine boots

### 3.4.3. Uploading the Disk Image to Microsoft Azure

The disk image can be uploaded and used as a template for creating Gluster Storage nodes. To upload the image to Microsoft Azure, navigate to the directory where the VHD image is stored and run the following command:

```
# azure storage blob upload -t page -a [account-name] --container [container-name] -b [azure-image-
name].vhd [path to image-name].vhd
```



### NOTE

This could take some time, depending on how fast your upload speeds are.

For example,

```
# azure storage blob upload -t page -a rhgsstorage --container rhgscontainer -b rhgsimage72.vhd
rhgs-azure-cluster.vhd
info: Executing command storage blob upload
+ Checking blob rhgsimage72.vhd in container rhgscontainer
+ Uploading rhgs-azure-cluster.vhd to blob rhgsimage72.vhd in container rhgscontainer
```

```
+ Getting storage blob information
data: Property      Value
data: -----
data: container     rhgscontainer
data: name           rhgsimage72.vhd
data: blobType       PageBlob
data: contentLength  21475885568
data: contentType   application/octet-stream
data: contentMD5    G965mhnwQtBZVI6oRW3tpw==
info: storage blob upload command OK
```

### 3.4.4. Deploy the Gluster Storage Instances

Individual Gluster Storage instances in Microsoft Azure can be configured into a cluster. You must first create the instances from the prepared image and then attach the data disks.

When creating the instances, you can use the following two methods of authentication to access the instance.

- Authenticate using SSH keys
  - Authenticate using password
1. Create the Red Hat Gluster Storage VM.



#### NOTE

The vnic-name, public-ip-name, and public-ip-domain-name are created when you run this command. Enter the names you want to use, and they will be created when the command runs. Copy and paste the image URL from the previous step for the -Q option. The -G option generates ssh keys. Note the path to the key-pem file in the resulting displayed details. You need the path to this file to ssh in to your Azure VM.



#### IMPORTANT

Microsoft Azure virtual machine names can contain letters, digits, a period, and a hyphen. The name cannot start or end with a hyphen, cannot be composed entirely of numbers, or be longer than 512 characters. Refer to Microsoft's *Recommended naming conventions for Azure resources* article for additional details <https://docs.microsoft.com/en-us/azure/guidance/guidance-naming-conventions>.

#### Authenticate using SSH keys

1. Enter the following command to create the Red Hat Gluster Storage instance and authenticate using SSH keys

```
azure vm create -g [resource-group] -l [azure-region] -f [vnic-name] -y [os-type] -Q
[image-url] -G -z [vm-size] -i [public-ip-name] -o [storage-account-name] -R [storage-
container-name] -m [public-ip-allocation-method] -w [public-ip-domain-name] -t [public-ip-
idletimeout] -F [vnet-name] -j [vnet-subnet-name] -u [admin-name] -n [virtual-machine-
name]
```

For example,

```
# azure vm create -g rhgsarm -l eastus -f rhgsimage72vnic -y Linux -Q
https://rhgsstorage.blob.core.windows.net:443/rhgscontainer/rhgsimage72.vhd -G -z
Standard_A2 -i rhgs72_pub -o rhgsstorage -R rhgscontainer -m dynamic -w rhgs72 -t 10
-F rhgsvnet1 -j rhgssubnet1 -u clouduser -n rhgs72
info: Executing command vm create
+ Looking up the VM "rhgs72"
info: You can use /root/.azure/ssh/rhgs72-key.pem private key for SSH authentication.
info: Verifying the public key SSH file: /root/.azure/ssh/rhgs72-cert.pem
info: Using the VM Size "Standard_A2"
info: The [OS, Data] Disk or image configuration requires storage account
+ Looking up the storage account rhgsstorage info: Using
"https://rhgsstorage.blob.core.windows.net:443/rhgscontainer/rhgsimage72.vhd" as the
user image.
+ Looking up the NIC "rhgsimage72vnic" info: Found an existing
NIC "rhgsimage"
info: Found an IP configuration with virtual network subnet id "/subscriptions/2586c64b-
38b4-4527-a140-
012d49dfc02c/resourceGroups/rhgsarm/providers/Microsoft.Network/virtualNetworks/rhgsv
net1/subnets/rhgssubnet1" in the NIC "rhgsimage72vnic"
info: This NIC IP configuration is already configured with the provided public ip
"rhgs72_pub"
info: The storage URI 'https://rhgsstorage.blob.core.windows.net/' will be used for boot
diagnostics settings, and it can be overwritten by the parameter input of '--boot-
diagnostics-storage-uri'.
+ Creating VM "rhgs72"
info: vm create command OK
```

2. Start an SSH session and connect to the running VM using your administrator name and the public key file.

```
# ssh -i [path-to-key-pem] [admin-name@public-ip-address]
```

For example,

```
# ssh -i /root/.azure/ssh/rhgs72-key.pem clouduser@rhgs72.east.cloudapp.azure.com
```

### Authenticate using password

1. Enter the following command to create the Red Hat Gluster Storage instance and authenticate using password. You must enter the password when prompted.

```
# azure vm create -g [resource-group] -l [azure-region] -f [vnic-name] -y [os-type] -Q
[image-url] -z [vm-size] -i [public-ip-name] -o [storage-account-name] -R [storage-
container-name] -m [public-ip-allocation-method] -w [public-ip-domain-name] -t [public-ip-
idletimeout] -F [vnet-name] -j [vnet-
subnet-name] -u [admin-name] -n [virtual-machine-name]
```

For example,

```
# azure vm create -g rhgsarm732 -l eastus -f rhgs732vnic -y Linux -Q
https://rhgsstorage732.blob.core.windows.net/rhgscontainer732/rhgsimage732.vhd -z
Standard_A2 -i rhgs732_pub -o rhgsstorage732 -R rhgscontainer732 -m dynamic -w
```

```

rhgs7322 -t 10 -F rhgsvnet732 -j rhgssubnet732 -u clouduser -n rhgs732-2
info: Executing command vm create
+ Looking up the VM "rhgs732-2"
Enter password for clouduser: *****
Confirm password: *****
info: Using the VM Size "Standard_A2"
info: The [OS, Data] Disk or image configuration requires storage account
+ Looking up the storage account rhgsstorage732
info: Using
"https://rhgsstorage732.blob.core.windows.net/rhgscontainer732/rhgsimage732.vhd" as
the user image.
+ Looking up the NIC "rhgs732vnic"
info: Found an existing NIC "rhgs732vnic"
info: Found an IP configuration with virtual network subnet id "/subscriptions/2586c64b-
38b4-4527-a140-
012d49dfc02c/resourceGroups/rhgsarm732/providers/Microsoft.Network/virtualNetworks/r
hgsvnet732/subnets/rhgssubnet732" in the NIC "rhgs732vnic"
info: This NIC IP configuration is already configured with the provided public ip
"rhgs732_pub"
info: The storage URI 'https://rhgsstorage732.blob.core.windows.net/' will be used for
boot diagnostics settings, and it can be overwritten by the parameter input of '--boot-
diagnostics-storage-uri'.
+i reating VM "rhgs732-2"
info: vm create command OK

```

2. Start an SSH session and connect to the running VM using your administrator name and the password used while creating the instance.

```
# ssh [admin-name@public-ip-address]
```

For example,

```
# ssh clouduser@rhgs72.east.cloudapp.azure.com
```

2. Add a data disk to your newly created virtual machine.

```
# azure vm disk attach-new resource-group vm-name size-in-gb
```

For example,

```

# azure vm disk attach-new rhgsarm rhgs72 1023
info: Executing command vm disk attach-new
+ Looking up the VM "rhgs72"
info: New data disk location:
https://rhgsstorage.blob.core.windows.net/rhgscontainer/rhgs72-20170220-121452858.vhd
+ Updating VM "rhgs72"
info: vm disk attach-new command OK

```

3. Perform the above steps of creating instances and attaching disks for all the instances.
4. Confirm that the instances have been properly created:

```
# azure vm list -g [resource group]
```

-



For example,

```
# azure vm list rhgsarm
info: Executing command vm list
+ Getting virtual machines
data: ResourceGroupName Name ProvisioningState PowerState Location Size
data: -----
data: rhgsarm rhgs72 Succeeded VM deallocated eastus Standard_A2
data: rhgsarm rhgs72-1 Succeeded VM deallocated eastus Standard_A2
info: vm list command OK

# azure vm show -g rhgsarm rhgs72
info: Executing command vm show
+ Looking up the VM "rhgs72"
+ Looking up the NIC "rhgsimage72vnic"
+ Looking up the public ip "rhgs72_pub"
Id :/subscriptions/2586c64b-38b4-4527-a140-012d49dfc02c/resourceGroups/rhgsarm/providers/Microsoft.Compute/virtualMachines/rhgs72d
ata: ProvisioningState :Succeeded
data: Name :rhgs72
data: Location :eastus
data: Type :Microsoft.Compute/virtualMachines data:
data: Hardware Profile:
data: Size :Standard_A2
data:
data: Storage Profile:
data:
data: OS Disk:
data: OSType :Linux
data: Name :clib438d5640249ac7c-os-1486533879443
data: Caching :ReadWrite
data: CreateOption :FromImage
data: Vhd:
data: Uri
:https://rhgsstorage.blob.core.windows.net/rhgscontainer/clib438d5640249ac7c-os-1486533879443.vhd
data:
data: OS Profile:
data: Computer Name :rhgs72
data: User Name :clouduser
data: Secrets :[]
data: Linux Configuration:
data: Disable Password Auth :true
data:
data: Network Profile:
data: Network Interfaces:
data: Network Interface #1:
data: Primary :true
data: MAC Address :00-0D-3A-13-36-A0
data: Provisioning State :Succeeded
data: Name :rhgsimage72vnic
data: Location :eastus
data: Public IP address :40.121.209.95
data: FQDN :rhgs72.eastus.cloudapp.azure.com
data:
```

```

data: Diagnostics Profile:
data: BootDiagnostics Enabled :true
data: BootDiagnostics StorageUri:https://rhgsstorage.blob.core.windows.net/
data:
data: Diagnostics Instance View:
info: vm show command OK

```

- A Microsoft Azure availability set provides a level of fault tolerance to the instances it holds, protecting against system failure or planned outages. This is achieved by ensuring instances within the same availability set are deployed across the different fault and upgrade domains within a Microsoft Azure datacenter.
- When Gluster Storage replicates data between bricks, associate the replica sets to a specific availability set. By using availability sets in the replication design, incidents within the Microsoft Azure infrastructure cannot affect all members of a replica set simultaneously.

### 3.5. CONFIGURE THE GLUSTER STORAGE CLUSTER

Configure these instances to form a trusted storage pool (cluster).



#### NOTE

If you are using Red Hat Enterprise Linux 7 machines, log in to the Azure portal and reset the password for the VMs and also restart the VMs. On Red Hat Enterprise Linux 6 machines, password reset is not required.

1. Log into each node using the keys or with password.

```

# ssh -i [path-to-key-pem] [admin-name@public-ip-address]
or
# ssh [admin-name@public-ip-address]

```

For example,

```

# ssh -i /root/.azure/ssh/rhgs72-key.pem clouduser@rhgs72.east.cloudapp.azure.com
or
# ssh clouduser@rhgs72.east.cloudapp.azure.com

```

2. Register each node to Red Hat Network using the **subscription-manager** command, and attach the relevant Red Hat Storage subscriptions.

For information on subscribing to the Red Hat Gluster Storage 3.5 channels, see the *Installing Red Hat Gluster Storage* chapter in the [Red Hat Gluster Storage 3.5 Installation Guide](#).

3. Update each node to ensure the latest enhancements and patches are in place.

```

# yum update

```

4. Follow the instructions in the *Adding Servers to the Trusted Storage Pool* chapter in the *Red Hat Gluster Storage Administration Guide* to create the trusted storage pool.

## 3.6. APPENDIX - SETTING UP RED HAT GLUSTER STORAGE IN MICROSOFT AZURE IN ASM MODE

This section provides step-by-step instructions to set up Red Hat Gluster Storage in Microsoft Azure.

### 3.6.1. Obtaining Red Hat Gluster Storage for Microsoft Azure

To download the Red Hat Gluster Storage Server files using a Red Hat Subscription or a Red Hat Evaluation Subscription:

1. Visit the Red Hat Customer Service Portal at <https://access.redhat.com/login> and enter your user name and password to log in.
2. Click **Downloads** to visit the **Software & Download Center**.
3. In the Red Hat Gluster Storage Server area, click **Download Software** to download the latest version of the **VHD** image.
4. Navigate to the directory where the file was downloaded and execute the **sha256sum** command on the file.

For example,

```
$ sha256sum rhgs-azure-3.5-rhel-7-x86_64.tar.gz
2d083222d6a3c531fa2fbbd21c9ea5b2c965d3b8f06eb8ff3b2b0efce173325d rhgs-azure-3.5-
rhel-7-x86_64.tar.gz
```

The value generated by the **sha256sum** utility must match the value displayed on the Red Hat Customer Portal for the file. If they are not the same, your download is either incomplete or corrupt, and you will need to download the file again. If the checksum is not successfully validated after several attempted downloads, contact Red Hat Support for assistance.

5. Unzip the downloaded file **rhgs-azure-[version].zip** to extract the archive contents.

For example,

```
# tar -xvzf rhgs-azure-3.5-rhel-7-x86_64.tar.gz
```

### 3.6.2. Define the Network Topology

By default, deploying an instance into a cloud service will pick up a dynamically assigned, internal IP address. This address may change and vary from site to site. For some configurations, consider defining one or more virtual networks within your account for instances to connect to. That establishes a networking configuration similar to an on-premise environment.

To create a simple network:

1. Create the cloud service for the Gluster Storage nodes.

```
# azure service create --serviceName service_name --location location
```

For example,

```
# azure service create --serviceName rhgs313-cluster --location "East US"
info: Executing command service create
+ Creating cloud service
data: Cloud service name rhgs313-cluster
info: service create command OK
```

**cloudapp.net** will be appended to the service name, and the full service name will be exposed directly to the Internet. In this case, **rhgs313-cluster.cloudapp.net**.

2. Create a virtual network for the Gluster Storage nodes to connect to. In this example, the network is created within the East US location.

```
# azure network vnet create --vnet "rhgs313-vnet" --location "East US" --address-space
10.18.0.0 --cidr 16
info: Executing command network vnet create
info: Using default subnet start IP: 10.18.0.0
info: Using default subnet cidr: 19
+ Looking up network configuration
+ Looking up locations
+ Setting network configuration
info: network vnet create command OK
```

This defines a network within a single region.

Features like geo-replication within Gluster Storage require a vnet-to-vnet configuration. A vnet-to-vnet configuration connects virtual networks through VPN gateways. Each virtual network can be within the same region or across regions to address disaster recovery scenarios. Joining VPNs together requires a shared key, and it is not possible to pass a shared key through the Microsoft Azure CLI. To define a vnet-to-vnet configuration, use the Windows Powershell or use the Microsoft Azure REST API.

### 3.6.3. Upload the Disk Image to Microsoft Azure

The disk image can be uploaded and used as a template for creating Gluster Storage nodes.



#### NOTE

Microsoft Azure commands must be issued from the local account configured to use the xplat-cli.

To upload the image to Microsoft Azure, navigate to the directory where the VHD image is stored and run the following command:

```
# azure vm image create image_name --location location --os linux VHD_image_name
```

For example,

```
# azure vm image create rhgs-3.1.3 --location "East US" --os linux rhgs313.vhd
info: Executing command vm image create
+ Retrieving storage accounts
info: VHD size : 20 GB
info: Uploading 20973568.5 KB
```

```
Requested:100.0% Completed:100.0% Running: 0 Time: 7m50s Speed: 3876 KB/s
info: https://bauderhel7.blob.core.windows.net/vm-images/rhgs313.vhd was uploaded successfully
info: vm image create command OK
```

Once complete, confirm the image is available:

```
# azure vm image list | awk '$3 == "User" {print $2;}'
```



## NOTE

The output of an instance image list will show public images as well as images specific to your account (User), so **awk** is used to display only the images added under the Microsoft Azure account.

### 3.6.4. Deploy the Gluster Storage Instances

Individual Gluster Storage instances in Microsoft Azure can be configured into a cluster. You must first create the instances from the prepared image and then attach the data disks.

1. To create instances from the prepared image

```
# azure vm create --vm-name vm_name --availability-set name_of_the_availability_set --vm-size size --virtual-network-name vnet_name --ssh port_number --connect cluster_name username_and_password
```

For example,

```
# azure vm create --vm-name rhgs313-1 --availability-set AS1 -S 10.18.0.11 --vm-size Medium --virtual-network-name rhgs313-vnet --ssh 50001 --connect rhgs313-cluster rhgs-3.1.3 rhgsuser 'AzureAdm1n!'
info: Executing command vm create
+ Looking up image rhgs-313
+ Looking up virtual network
+ Looking up cloud service
+ Getting cloud service properties
+ Looking up deployment
+ Creating VM
info: OK
info: vm create command OK
```

2. Adding 1023 GB data disk to each of the instances.

```
# azure vm disk attach-new VM_name 1023
```

For example

```
# azure vm disk attach-new rhgs313-1 1023
info: Executing command vm disk attach-new
+ Getting virtual machines
+ Adding Data-Disk
info: vm disk attach-new command OK
```

3. Perform the above steps of creating instances and attaching disks for all the instances

4. Confirm that the instances have been properly created:

```
# azure vm list
# azure vm show vm-name
```

- A Microsoft Azure availability set provides a level of fault tolerance to the instances it holds, protecting against system failure or planned outages. This is achieved by ensuring instances within the same availability set are deployed across different fault and upgrade domains within a Microsoft Azure datacenter.
- When Gluster Storage replicates data between bricks, associate the replica sets to a specific availability set. By using availability sets in the replication design, incidents within the Microsoft Azure infrastructure cannot affect all members of a replica set simultaneously.
- Each instance is assigned a static IP (**-S**) within the **rhgs--** virtual network and an endpoint added to the cloud service to allow SSH access (**--ssh port**).
- There are single quotation marks (') around the password to prevent bash interpretation issues.

### Example

Following is the example for creating four instances from the prepared image.

- They are named **rhgs31-n**.
- Their IP address are 10.18.0.11 to 10.18.0.14.

As the instances are created (**azure vm create**), they can be added to the same availability set ( **--availability-set**).

```
for i in 1 2 3 4; do as=$((i/3)); azure vm create --vm-name rhgs31-$i --availability-set AS$as -S
10.18.0.1$i --vm-size Medium --virtual-network-name rhgs-vnet --ssh 5000$i --connect rhgs-cluster
rhgs3.1 rhgsuser 'AzureAdm1n!'; done
```

Add four 1023 GB data disks to each of the instances.

```
for node in 1 2 3 4; do for disk in 1 2 3 4; do azure vm disk attach-new rhgs31-$node 1023; done ;
done
```

Confirm that the instances have been properly created:

```
# azure vm list
# azure vm show vm-name
```



### NOTE

This example uses static IP addresses, but this is not required. If you're creating a single Gluster Storage cluster and do not need features like geo-replication, it is possible to use the dynamic IPs automatically assigned by Microsoft Azure. The only important thing is that the Gluster Storage cluster is defined by name.

### 3.6.5. Configure the Gluster Storage Cluster

Configure these instances to form a trusted storage pool (cluster).

**NOTE**

If you are using Red Hat Enterprise Linux 7 machines, log in to the Microsoft Azure portal and reset the password for the VMs and also restart the VMs. On Red Hat Enterprise Linux 6 machines, password reset is not required.

1. Log into each node.

```
# ssh rhgsuser@rhgs313-cluster.cloudapp.net -p 50001
```

2. Register each node to Red Hat Network using the **subscription-manager** command, and attach the relevant Red Hat Storage subscriptions.

For information on subscribing to the Red Hat Gluster Storage 3.5 channels, see the *Installing Red Hat Gluster Storage* chapter in the [Red Hat Gluster Storage 3.5 Installation Guide](#).

3. Update each node to ensure the latest enhancements and patches are in place.

```
# yum update
```

4. Follow the instructions in the *Adding Servers to the Trusted Storage Pool* chapter in the *Red Hat Gluster Storage Administration Guide* to create the trusted storage pool.

### 3.7. APPENDIX - CREATING A CUSTOM DISK IMAGE FROM ISO

Instances within Microsoft Azure are created from disk images. Gluster Storage requires a custom image, rather than one of the default Microsoft Azure-supplied images. Building custom virtual machine images is typically done with Hyper-V, but custom images for Microsoft Azure can also be built using native Linux tools.

The overall process to configure a custom image takes about 30 minutes.

1. Download the latest ISO for Gluster Storage from here: [https://access.redhat.com/downloads/content/186/ver=3.1/rhel---7/3.1/x86\\_64/product-software](https://access.redhat.com/downloads/content/186/ver=3.1/rhel---7/3.1/x86_64/product-software)
2. Using **virt-manager**, create a qcow2 image with two cores, 4 GB RAM, 20 GB virtio HDD, and a single NIC.
3. Boot the instance from the ISO image and complete the installation of Gluster Storage. Do not allocate swap space since the Windows Azure agent sets up an ephemeral disk at runtime for swap space.
4. Reboot the instance and log in.
5. Set a generic hostname.

On Red Hat Enterprise Linux 7:

```
# hostnamectl set-hostname localhost.localdomain
```

On Red Hat Enterprise Linux 6:

```
# vim /etc/sysconfig/network
```

```
NETWORKING=yes
HOSTNAME=localhost.localdomain
```

- Confirm that DHCP is configured in **/etc/sysconfig/network-scripts/ifcfg-eth0**.

```
DEVICE=eth0
ONBOOT=yes
BOOTPROTO=dhcp
IPV6INIT=no
TYPE=Ethernet
USERCTL=no
PEERDNS=yes
```

- Update the udev rules to avoid conflicts with Microsoft Azure and Hyper-V.

```
# rm -f /etc/udev/rules.d/70-persistent-net.rules
# rm -f /lib/udev/rules.d/75-persistent-net-generator.rules
```

- On Red Hat Enterprise Linux 7, apply the default firewall rules for Gluster Storage. These rulesets are used for inter-node communication, the GlusterFS client, and NFS.

```
# firewall-cmd --zone=public --add-service=glusterfs --permanent
# firewall-cmd --zone=public --add-service=nfs --add-service=rpc-bind --permanent
```

- Register the virtual machine.

```
# subscription-manager register --auto-attach
# subscription-manager repos --disable=*
```

- Enable the Extras and Gluster Storage repositories. This is either rhel-6- or rhel-7-.

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

- Update the system and install the Microsoft Azure Linux agent.

```
# yum update -y
# yum -y install WALinuxAgent
```

- Disable any swap space defined during the Gluster Storage installation. This is required on Red Hat Enterprise Linux 7. Microsoft Azure allocates ephemeral storage at runtime, which is used for swap, so swap space does not need to be explicitly defined.

```
# swapoff -v /dev/rhgs/swap
# sed -i '/*.* swap/d' /etc/fstab
```

On Red Hat Enterprise Linux 6, the installer enables disk configuration to be changed, so the swap is not defined. However, if a logical volume was created, then remove the configuration as on RHEL 7.

- Red Hat Enterprise Linux 7 only** A Linux virtual machine running in Azure requires the



hv\_storvsc and hv\_vmbus drivers within the initramfs image. The Red Hat Enterprise Linux 6 installer includes these drivers automatically, but under Red Hat Enterprise Linux 7, the installer only adds these drivers if Hyper-V devices are detected at installation time. When building a virtual machine image using virt-manager, add these Hyper-V drivers manually.

1. Add the following content to **/etc/dracut.conf**.
2. Regenerate **initramfs**.

```
# dracut -f -v
```

14. Update the kernel boot settings.

On Red Hat Enterprise Linux 7:

1. Set the GRUB\_CMDLINE\_LINUX variable in **/etc/default/grub**.

```
``rd.lvm.lv=rhgs/root console=ttyS0 earlyprintk=ttyS0 rootdelay=300
```

2. Refresh the grub2 configuration.

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

3. Remove the rhqb, quiet, or crashkernel=auto parameters.

On Red Hat Enterprise Linux 6:

1. Update the kernel boot line in **/boot/grub/menu.lst**:

```
console=ttyS0 earlyprintk=ttyS0 rootdelay=300 numa=off
```

2. Remove the rhqb, quiet, or crashkernel=auto parameters.

15. Enable the Windows Azure agent to start at boot.

- On Red Hat Enterprise Linux 7:

```
# systemctl enable waagent
```

- On Red Hat Enterprise Linux 6:

```
# chkconfig waagent on
```

16. Unregister the virtual machine using Red Hat Subscription Manager.

```
# subscription-manager unregister
```

17. De-provision the instance to remove the local settings; this allows the instance to be used as a disk image within Microsoft Azure.

```
# yum clean all
# waagent -force -deprovision
```

```
# export HISTSIZE=0  
# poweroff
```

18. Dump the XML of the instance to find the filename of the virtual disk that was created, and convert it to a Microsoft Azure compatible VHD file. In this example, the instance was initially created using the **qcow2** disk format.

```
# virsh dumpxml image-name  
# qemu-img convert -f qcow2 -O vpc -o subformat=fixed -O vpc rhgs313.qcow2 rhgs313.vhd
```

## 3.8. APPENDIX - PERFORMANCE CATEGORIZATION

There are a number of infrastructure and architectural factors that determine the potential performance that Red Hat Gluster Storage within Microsoft Azure can deliver.

### 3.8.1. Storage Type

Microsoft Azure offers two classes of physical storage: standard and premium. Standard storage is backed by hard disk drives, whereas premium storage is delivered by solid state drives. These classes of storage provide an IOPS target of 500 IOPS and 5,000 IOPS per disk, respectively.

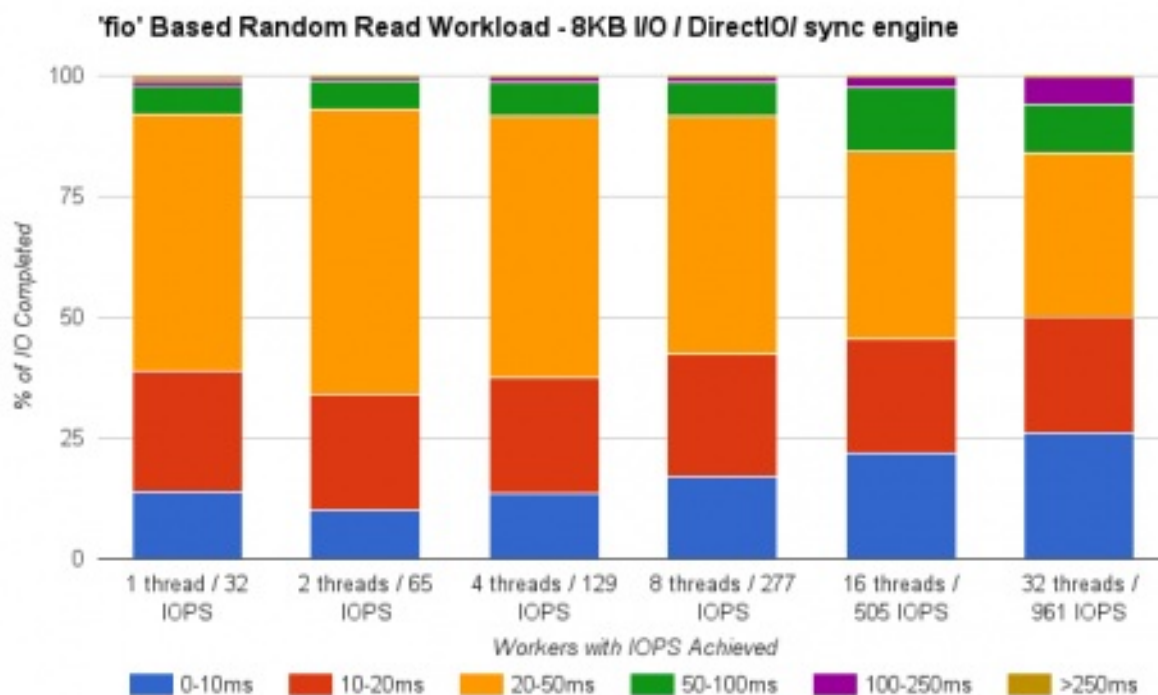
A more general consideration is how the data are protected. By default, Microsoft Azure protects the data by synchronously storing three copies of data in separate failure domains, and then asynchronously places another three copies of the data in a secondary datacenter (a default GRS replication scheme).

### 3.8.2. Bandwidth

A simple test was performed using **iperf** to determine the upper limit between the client and Red Hat Gluster Storage node. This testing showed that a single network interface can be expected to deliver between 600 - 700 Mbit.

### 3.8.3. Disk Latencies

Four disks were attached to a Standard Tier/A2 instance and aggregated to form a RAID0 set using the **mdadm** tool. The LUN was then configured using recommended best practices, based on LVM, dm-thin, and the XFS file system. The **fiio** tool was then used to reveal the random read profile of the underlying disks at increasing levels of concurrency.



**Figure 3.3. Disk Latencies**

This benchmark does not produce a definitive result, but it indicates the potential I/O profile of the underlying storage.

#### Observations

- Typical latencies are in the 20 - 50 ms range.
- Attaining higher IOPS requires a multi-threaded workload; that is, one thread=32 IOPS, 32 threads = 961 IOPS.
- Combining the virtual drives with **mdadm** allows the LUN to deliver IOPS beyond that of a single virtual disk.

#### 3.8.4. GlusterFS

The performance tests for Gluster Storage are only indicative and illustrate the expected performance from a similar environment. For the purposes of benchmarking, the smallfile tool has been used to simulate multiple concurrent file creations that are typical of user environments.

The create workload creates a series of 10 MB files within a nested directory hierarchy, exercising metadata operations as well as file creation and throughput.

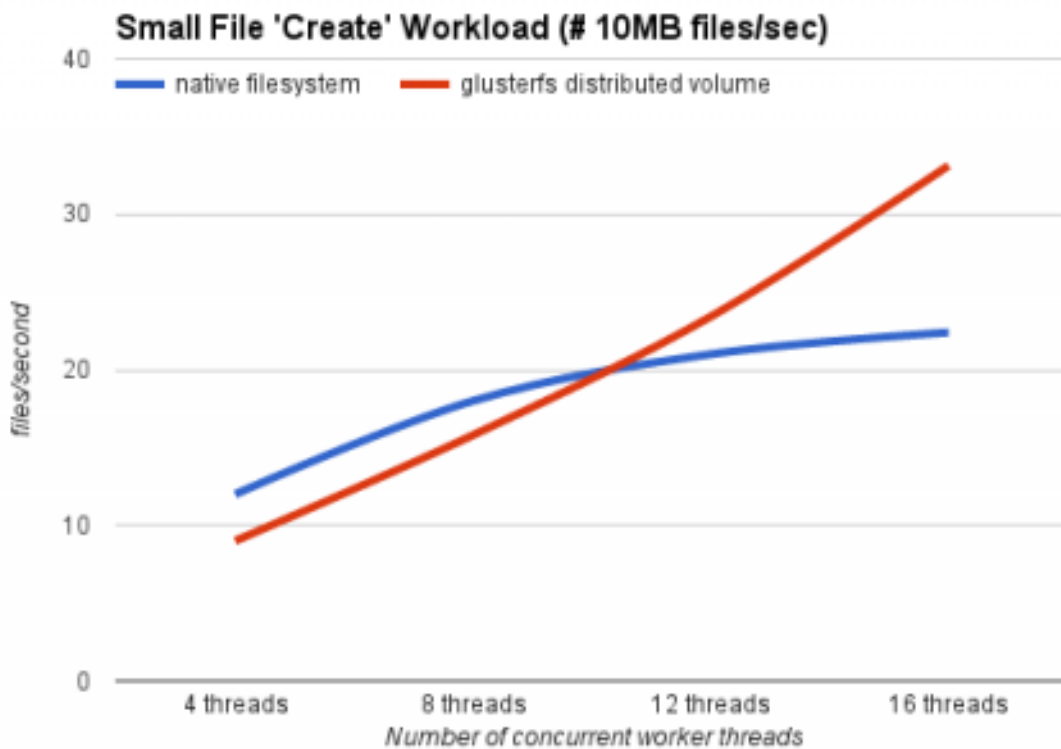
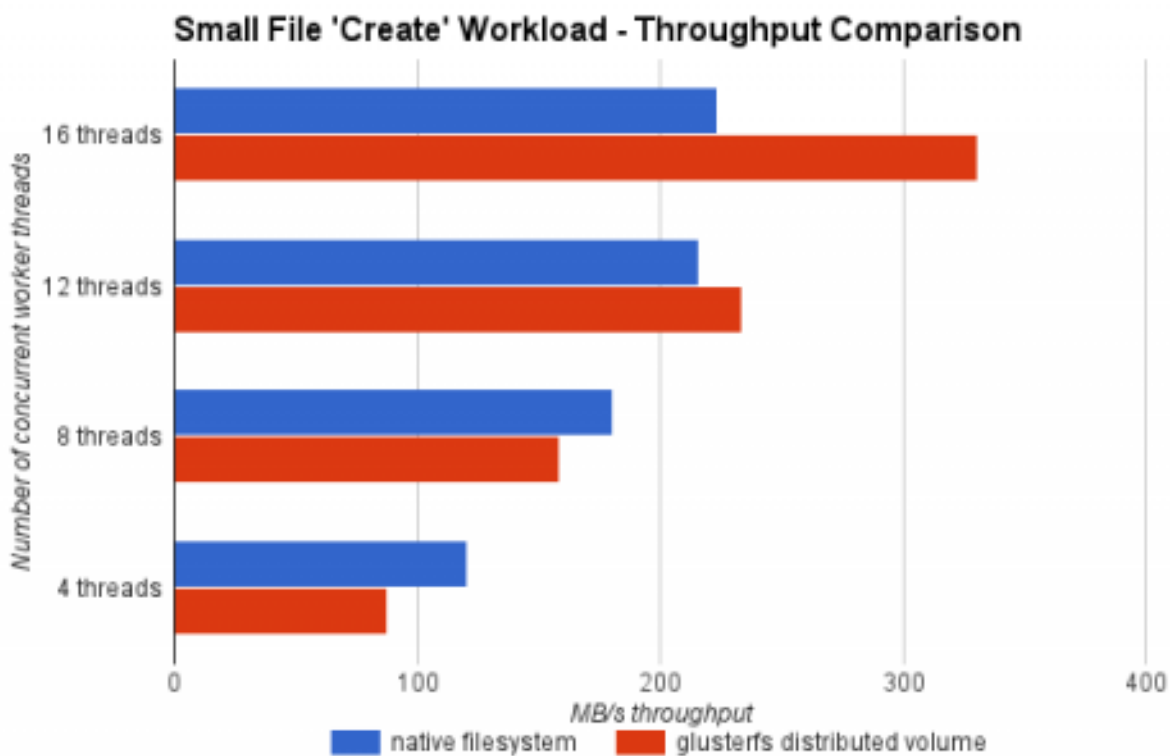


Figure 3.4. Gluster Performance: Small File "Create" Workload



Observations:

- Although the native file system starts well, a performance cross-over occurs between 8 - 12 threads, with the native file system fading and the GlusterFS volume continuing to scale.
- The throughput of the GlusterFS volume scales linearly with the increase in client workload.
- At higher concurrency, the GlusterFS volume outperforms the local file system by up to 47%.

- During high concurrency, the native file system slows down under load. Examining the disk subsystems statistics during the test run revealed the issue was increased I/O wait times (70 - 90%).

## CHAPTER 4. USING RED HAT GLUSTER STORAGE IN THE GOOGLE CLOUD PLATFORM

Red Hat Gluster Storage provides support to the data needs of cloud-scale applications on Google Cloud Platform (GCP). Red Hat Gluster Storage provides software-defined file storage solution to run on GCP so that customer's applications can use traditional file interfaces with scale-out flexibility and performance.

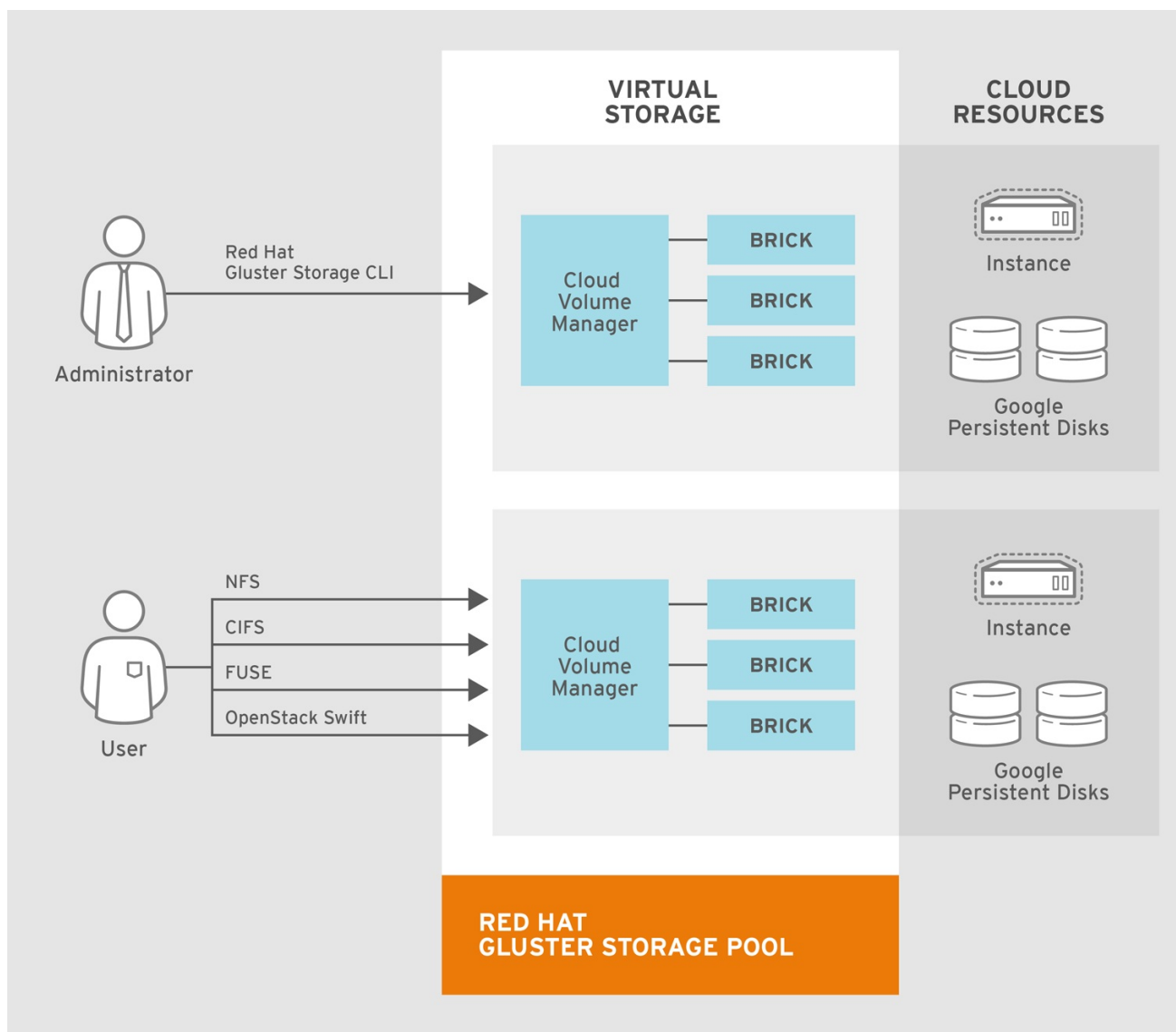
At the core of the Red Hat Gluster Storage design is a completely new method of architecting storage. The result is a system that has immense scalability, is highly resilient, and offers extraordinary performance.

### Google Cloud Platform Overview

The Google Cloud Platform is Google's public cloud offering, which provides many services to run a fully integrated cloud-based environment. The Google Compute Engine is what drives and manages the virtual machine environment. **This chapter is based on this virtual machine infrastructure** This virtual framework provides networking, storage, and virtual machines to scale out the Red Hat Gluster Storage environment to meet the demands of the specified workload.

For more information on Google Cloud Platform, see <https://cloud.google.com>, and for information on the Google Compute Engine, see <https://cloud.google.com/compute/docs>.

The following diagram illustrates Google Cloud Platform integration with Red Hat Gluster Storage.



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**Figure 4.1. Integration Architecture**

For more information on Red Hat Gluster Storage architecture, concepts, and implementation, see *Red Hat Gluster Storage Administration Guide*.

**This chapter describes the steps necessary to deploy a Red Hat Gluster Storage environment to Google Cloud Platform using 10 x 2 Distribute-Replicate volume.**

## 4.1. PLANNING YOUR DEPLOYMENT

This chapter models a 100 TB distributed and replicated file system space. The application server model, which is a Red Hat Gluster Storage client, includes 10 virtual machine instances running a streaming video capture and retrieval simulation. This simulation provides a mixed workload representative of I/O patterns that may be common among other common use cases where a distributed storage system may be most suitable.

While this scale allows us to model a high-end simulation of storage capacity and intensity of client activity, a minimum viable implementation may be achieved at a significantly smaller scale. As the model is scaled down your individual requirements and use cases are considered, certain fundamental approaches of this architecture should be taken into account, such as instance sizing, synchronous replication across zones, careful isolation of failure domains, and asynchronous replication to a remote geographical site.

## Maximum Persistent Disk Size

The original test build was limited by the maximum per-VM persistent disk size of 10 TB. Google has since increased that limit to 64 TB. Red Hat will support persistent disks per VM up to Google's current maximum size of 64 TB. (Note that 64 TB is both a per-disk and a per-VM maximum, so the actual data disk maximum will be 64 TB minus the operating system disk size.)

Other real-world use cases may involve significantly more client connections than represented in this chapter. While the particular study performed here was limited in client scale due to a focus on server and storage scale, some basic throughput tests showed the linear scale capabilities of the storage system. As always, your own design should be tuned to your particular use case and tested for performance and scale limitations.

### 4.1.1. Environment

The scale target is roughly 100 TB of usable storage, with 2-way synchronous replication between zones in the primary pool, and additionally remote asynchronous geo-replication to a secondary pool in another region for disaster recovery. As of this writing, the current maximum size of a Google Compute Engine persistent disk is 10 TB, therefore our design requires 20 bricks for the primary pool and 10 bricks for the secondary pool. The secondary pool will have single data copies which are not synchronously replicated.

Note that there is also currently a per-VM limit of 10 TB of persistent disk, so the actual data disk will be configured at 10,220 GB in order to account for the 20 GB root volume persistent disk.

All nodes will use a Red Hat Gluster Storage 3.5 on Red Hat Enterprise Linux 7.7 image that will be manually created and configured with a local virtualization system, that is KVM. Red Hat Gluster Storage replica peers in the local region are placed in separate zones within each region. This allows our synchronous replica copies to be highly available in the case of a zone outage.

The Red Hat Gluster Storage server nodes are built as **n1-highmem-4** machine types. This machine type is the minimally viable configuration based on the published resource requirements for Red Hat Gluster Storage. Some concession has been made for the minimum memory size based on expected cloud use cases. The **n1-highmem-8** machine type may be a more appropriate match, depending on your application and specific needs.

### 4.1.2. Prerequisites

- Google account
- Google Cloud SDK. The Google Cloud SDK contains tools and libraries that enable you to easily create and manage resources on Google Cloud Platform. It will be used later to facilitate the creation of the multiple Red Hat Gluster Storage instances. For instructions to set up and install the Google Cloud SDK, see <https://cloud.google.com/sdk>.
- Subscription to access the Red Hat Gluster Storage software channels. For information on subscribing to the Red Hat Gluster Storage 3.5 channels, refer to the *Installing Red Hat Gluster Storage* chapter in the [Red Hat Gluster Storage 3.5 Installation Guide](#).
- Minimum required number of nodes is 3.
- For compatible physical server, virtual server and client OS platforms, refer <https://access.redhat.com/articles/66206>.

### 4.1.3. Primary Storage Pool Configuration

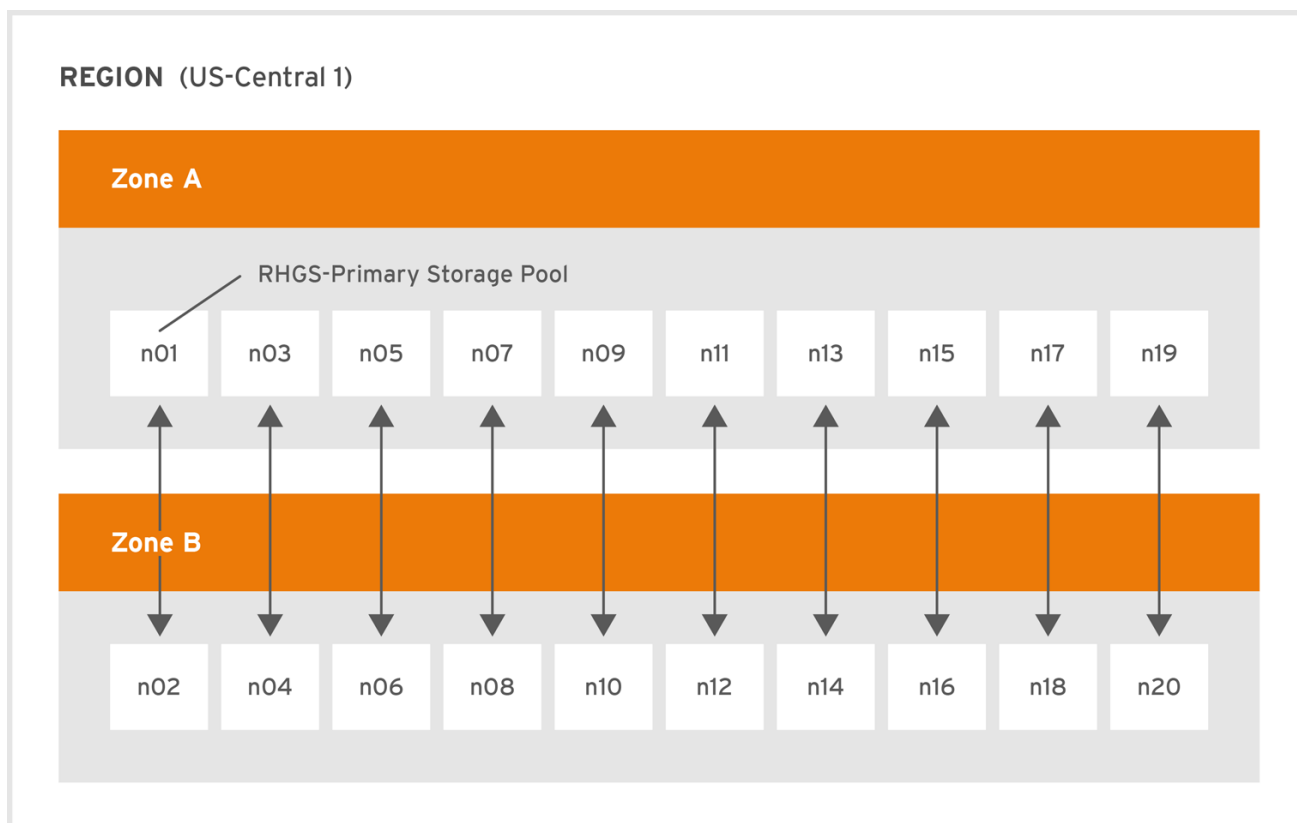


- Red Hat Gluster Storage configured in a 10 x 2 Distribute-Replicate volume
- 20 x n1-highmem-4 instances:

Resource	Specification
vCPU	4
Memory	26 GB
Boot Disk	20 GB standard persistent disk
Data Disk	10,220 GB standard persistent disk. The maximum persistent disk allocation for a single instance is 10 TB. Therefore the maximum size of our data disk is necessarily 10 TB minus the 20 GB size of the boot disk, or 10,220 GB.
Image	Custom Red Hat Gluster Storage 3.5 on Red Hat Enterprise Linux 7.7

- VM zone allocation:

Each Gluster synchronous replica pair is placed across zones in order to limit the impact of a zone failure. A single zone failure will not result in a loss of data access. Note that the setting synchronous replica pairs is a function of the order the bricks defined in the **gluster volume create** command.



GLUSTER\_389871\_0216

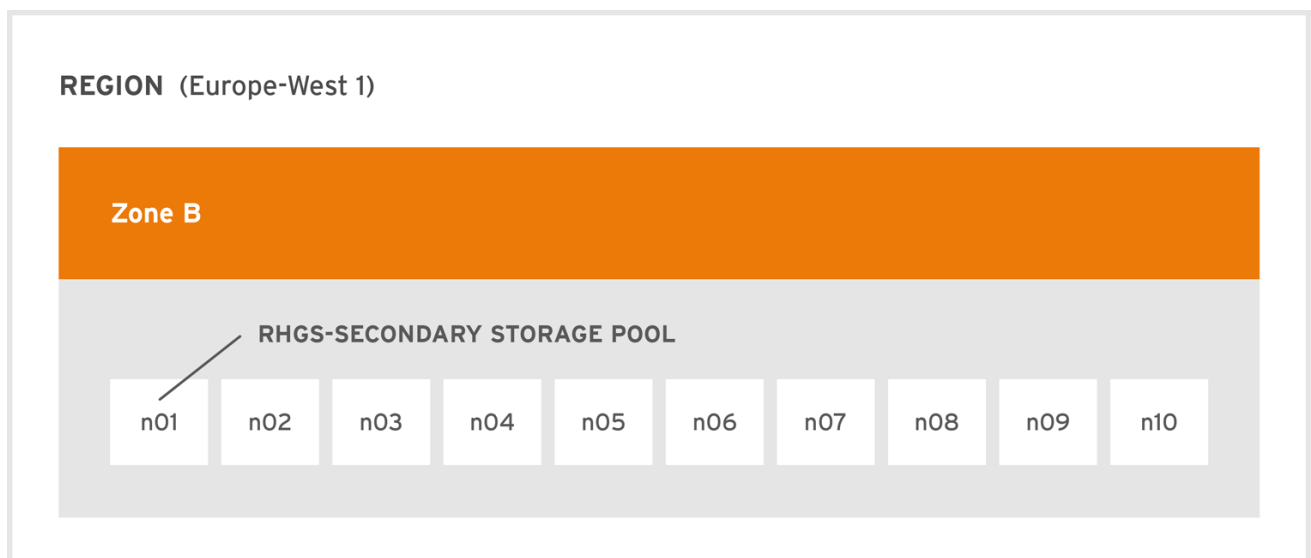
#### 4.1.4. Secondary Storage Pool Configuration

- Gluster configured in a 10 x 1 Distribute volume
- 10 x n1-highmem-4 instances:

Resource	Specification
vCPU	4
Memory	24 GB
Boot Disk	20 GB standard persistent disk
Data Disk	10,220 GB standard persistent disk
Image	Custom Red Hat Gluster Storage 3.5 on Red Hat Enterprise Linux 7.7

- VM zone allocation:

The secondary storage pool as designed as a receiver of asynchronous replication, via geo-replication, in a remote region for disaster recovery. To limit the cost of this protective layer, this storage pool is not synchronously replicated within its local region and a distribute-only gluster volume is used. In order to limit the potential impact of an outage, all nodes in this region are placed in the same zone.



GLUSTER\_389871\_0216

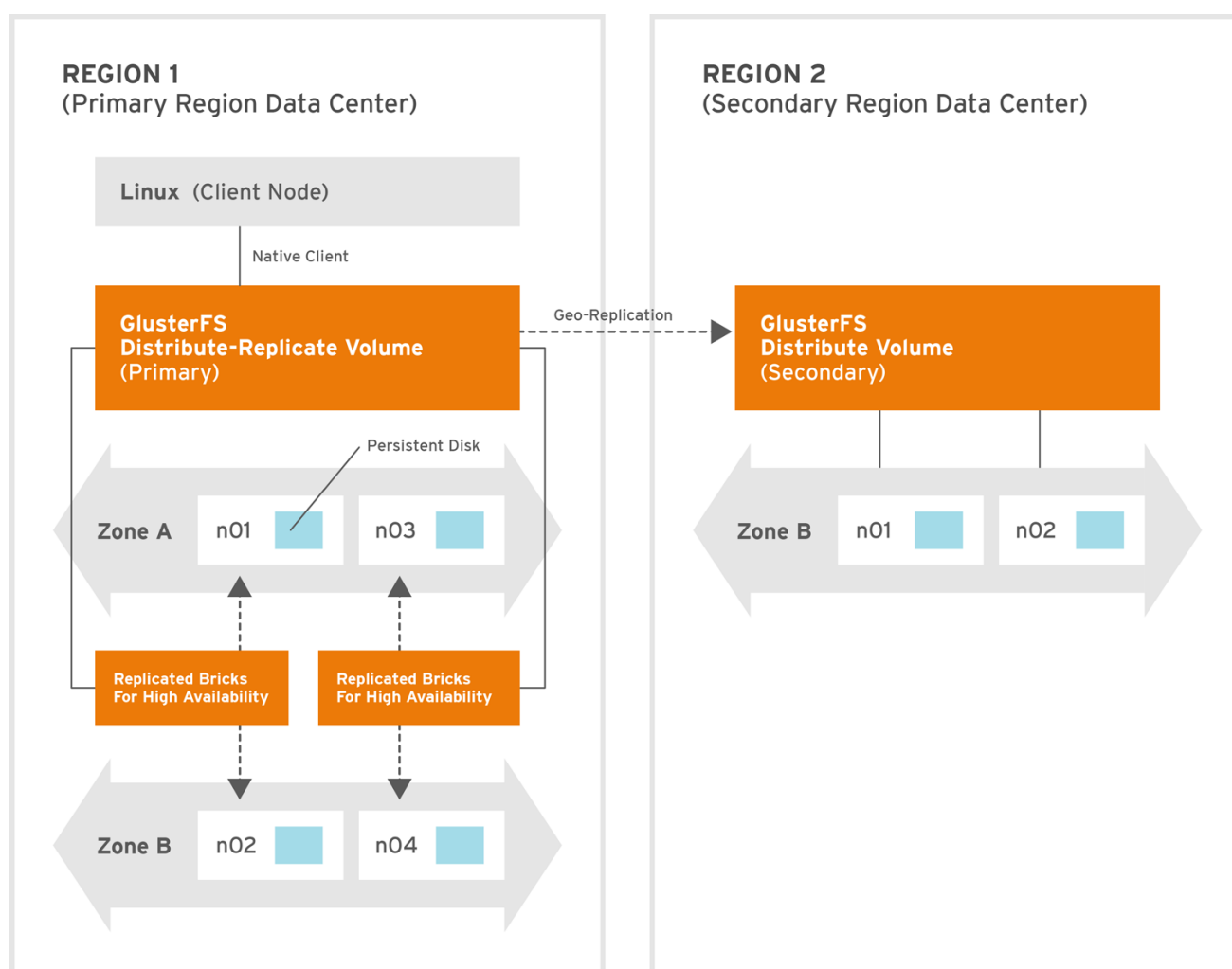
#### 4.1.5. Client Configuration

Client VMs have been distributed as evenly as possible across the US-CENTRAL1 region, zones A and B.

- 10 x n1-standard-2 instances:

Resource	Specification
vCPU	2
Memory	7.5 GB
Boot Disk	10 GB standard persistent disk
Image	Custom Red Hat Gluster Storage 3.5 on Red Hat Enterprise Linux 7.7

### 4.1.6. Trusted Pool Topology



GLUSTER\_389871\_0216

### 4.1.7. Obtaining Red Hat Gluster Storage for Google Cloud Platform

To download the Red Hat Gluster Storage Server files using a Red Hat Subscription or a Red Hat Evaluation Subscription:

1. Visit the Red Hat Customer Service Portal at <https://access.redhat.com/login> and enter your user name and password to log in.
2. Click **Downloads** to visit the **Software & Download Center**.

- In the Red Hat Gluster Storage Server area, click **Download Software** to download the latest version of the **qcow2** image.

## 4.2. SETTING UP GOOGLE COMPUTE ENGINE

To set up Google Compute engine, perform the following steps:

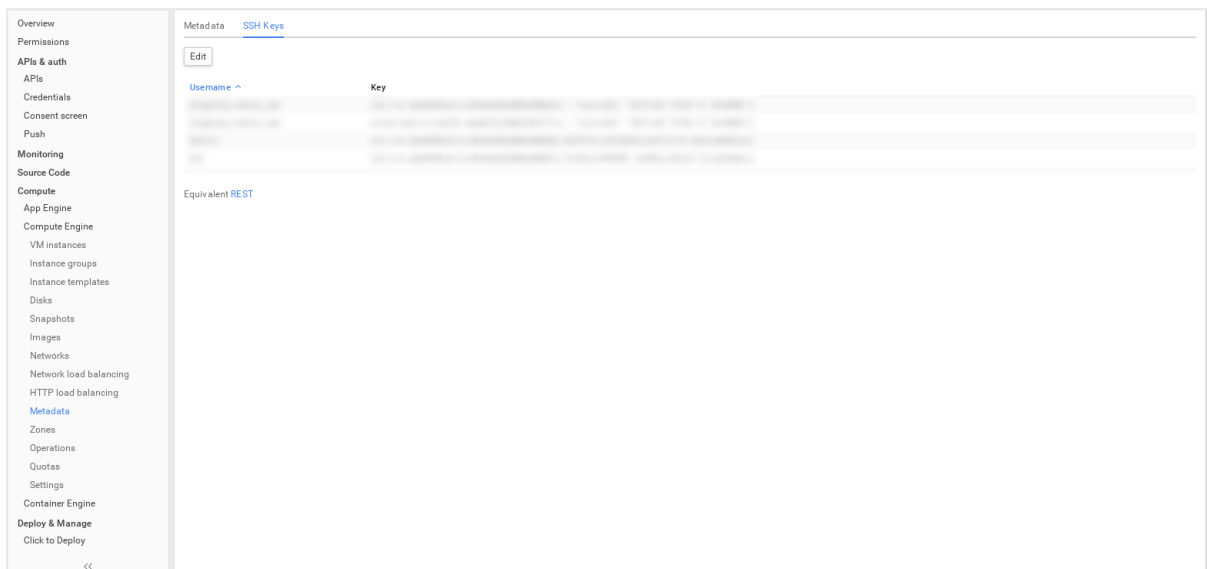
### 4.2.1. SSH Keys

SSH keys must be generated and registered with the Google Compute Engine project to connect via standard SSH. You can SSH directly to the instance public IP addresses after it is generated.

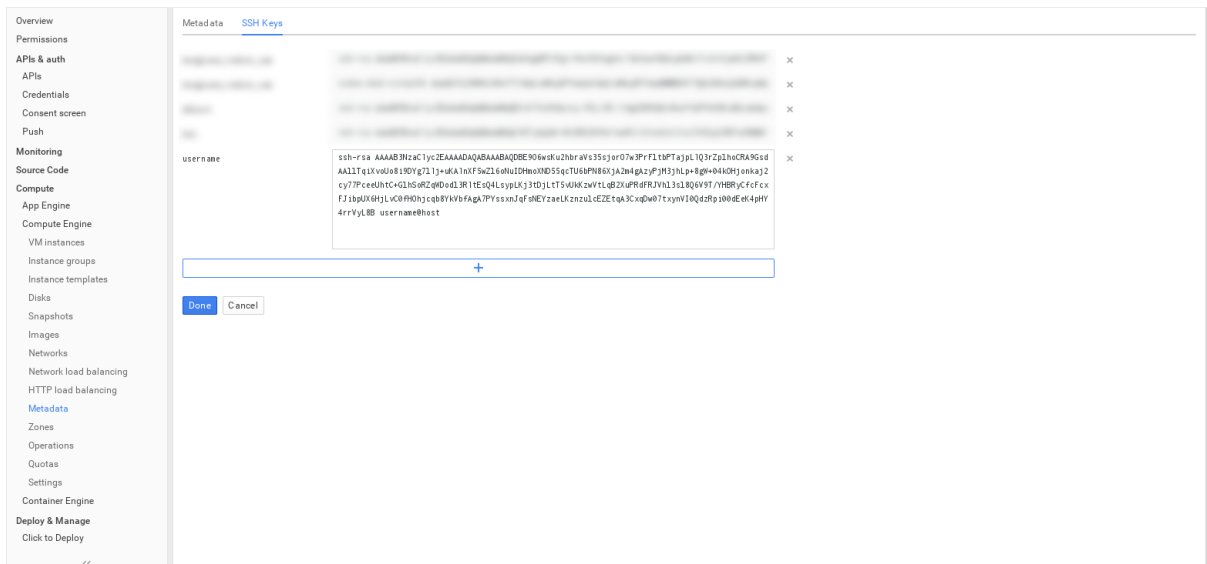
- Generate an SSH key pair for use with Google Compute Engine using the following command:

```
# ssh-keygen -t rsa -f ~/.ssh/google_compute_engine
```

- In the Google Developers Console, click **Computer > Compute Engine > Metadata > SSH Keys > Edit**.



- Enter the output generated from `~/.ssh/google_compute_engine.pub` file, and click **Save**.



- To enable SSH agent to use this identity file for each new local console session, run the following command on the console:

```
# ssh-add ~/.ssh/google_compute_engine
```

- Adding the below line to your `~/.ssh/config` file helps you automate this command.

```
IdentityFile ~/.ssh/google_compute_engine
```

- You can now connect via standard SSH to the new VM instances created in your Google Compute Engine project.

```
# ssh -i ~/.ssh/google_compute_engine <username>@<instance_external_ip>
```

The `gcloud compute config-ssh` command from the Google Cloud SDK populates your `~/.ssh/config` file with aliases that allows simple SSH connections by instance name.

### 4.2.2. Setting up Quota

The minimum persistent disk quotas listed below are required for this deployment. It may be necessary to request a quota increase from Google.

- Local region (see US-CENTRAL1 illustration in [Section 4.1.3, "Primary Storage Pool Configuration"](#))
  - Total persistent disk reserved (GB)  $\geq$  206,000
  - CPUs  $\geq$  100
- Remote region (see EUROPE-WEST1 illustration in [Section 4.1.4, "Secondary Storage Pool Configuration"](#))
  - Total persistent disk reserved (GB)  $\geq$  103,000
  - CPUs  $\geq$  40

## 4.3. CONVERTING QCOW2 TO .RAW FORMAT

Convert the downloaded **qcow2** image to **.raw** format using the following command:

```
# qemu-img convert image_name disk.raw
```

For example:

```
# qemu-img convert RHGS-3.5.0.x86_64.qcow2 disk.raw
```

## 4.4. PACKAGING THE IMAGE FOR GOOGLE COMPUTE ENGINE

Create a gzip sparse tar archive to package the image for Google Compute Engine, using the following command:

```
# tar -czSf disk.raw.tar.gz disk.raw
```

## 4.5. UPLOADING THE IMAGE INTO GOOGLE CLOUD STORAGE

You must log in using **gcloud auth login** command before uploading the image to the Google cloud. Running the command will open a browser and prompts for google account credentials. The PROJECT\_ID is set by default and follow the subsequent CLI instructions and make changes if required.

Use Google's **gsutil** command to create the storage bucket and upload the image.

```
# gsutil mb gs://rhgs_image_upload
# gsutil cp disk.raw.tar.gz gs://rhgs_image_upload
```

## 4.6. IMPORTING THE IMAGE INTO GOOGLE COMPUTE ENGINE

Use the following command to import the image to Google Compute Engine:

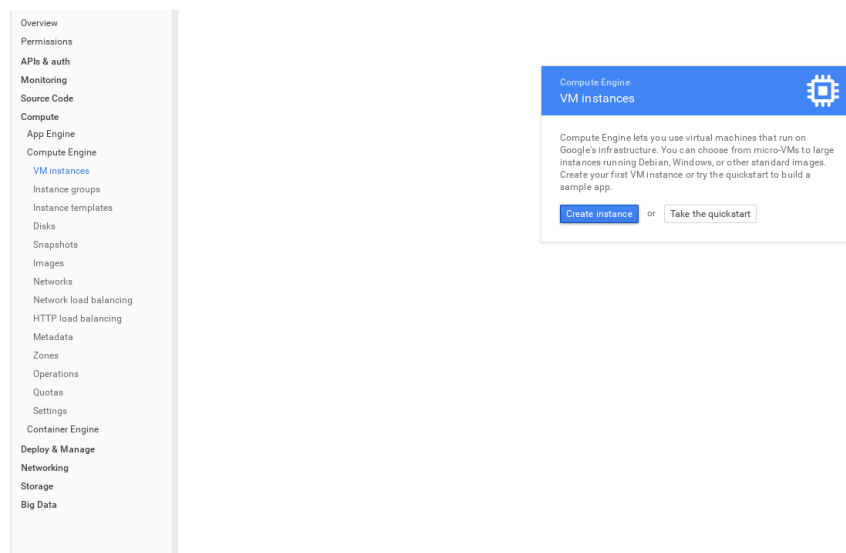
```
# gcloud compute images create rhgs31 --source-uri gs://rhgs_image_upload/disk.raw.tar.gz
```

For information on using the saved image, see

[https://cloud.google.com/compute/docs/images/create-delete-deprecate-private-images#use\\_saved\\_image](https://cloud.google.com/compute/docs/images/create-delete-deprecate-private-images#use_saved_image).

## 4.7. CREATING A VM INSTANCE TO CONFIGURE THE DISKS FOR RED HAT GLUSTER STORAGE INSTANCES

1. In the Google Developers Console, click **Compute > Compute Engine > VM instances > Create Instance**.



The **Create Instance** window is displayed.

The screenshot shows the 'Create a new instance' configuration page in the Google Cloud Platform console. The left sidebar contains navigation options such as Home, Permissions, APIs & auth, Monitoring, Source Code, Cloud Launcher, Deployments, Compute, App Engine, Compute Engine, VM instances (highlighted), Instance groups, Instance templates, Disks, Snapshots, Images, Networks, Network load balancing, HTTP load balancing, Metadata, Health checks, Zones, Operations, Quotas, Settings, Container Engine, Networking, Storage, and Big Data. The main content area is titled 'Create a new instance' and includes the following configuration options:

- Name:** rhg-primary-n1
- Zone:** us-central1-a
- Machine type:** n1-highmem-4 (4 vCPUs, 26 GB Memory)
- Boot disk:** New 20 GB standard persistent disk (Image: rhgs31)
- Firewall:** Add tags and firewall rules to allow specific network traffic from the Internet. Options:  Allow HTTP traffic,  Allow HTTPS traffic.
- Project access:**  Allow API access to all Google Cloud services in the same project. [Learn more](#)
- Management, disk, networking, access & security options:** (Expanded)

At the bottom of the page, there is a note: 'You will be billed for this instance. [Learn more](#)'. Below this note are 'Create' and 'Cancel' buttons. At the very bottom, it says 'Equivalent [REST](#) or [command line](#)'.

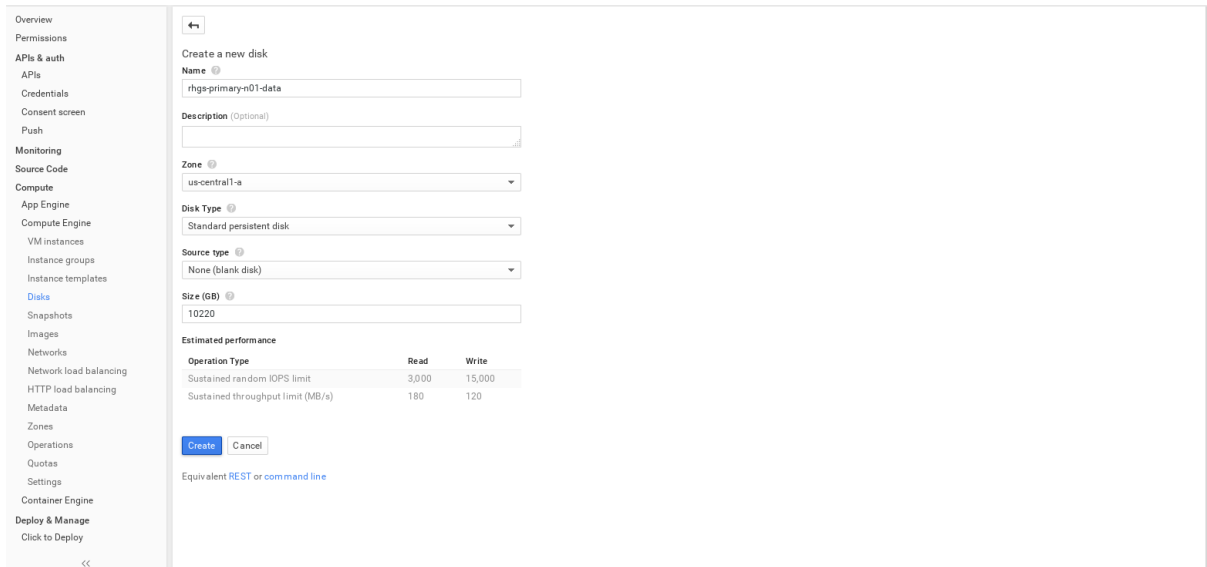
2. Enter the following in the **Create a new instance** window and click **Create**.

- Name: rhgs-primary-n01
- Zone: us-central1-a
- Machine type: n1-highmem-4 (4 vCPUs, 26 GB memory)
- Boot disk: New 20 GB standard persistent disk
- Image: rhgs31 (our uploaded image file)

## 4.8. CREATING THE INITIAL DATA DISK

Create a 10,220 GB standard persistent disk for the rhgs-primary-n01 VM instance in the same zone as the instance.

1. In the Google Developers Console, click **Compute > Compute Engine > Disks > New disk**.

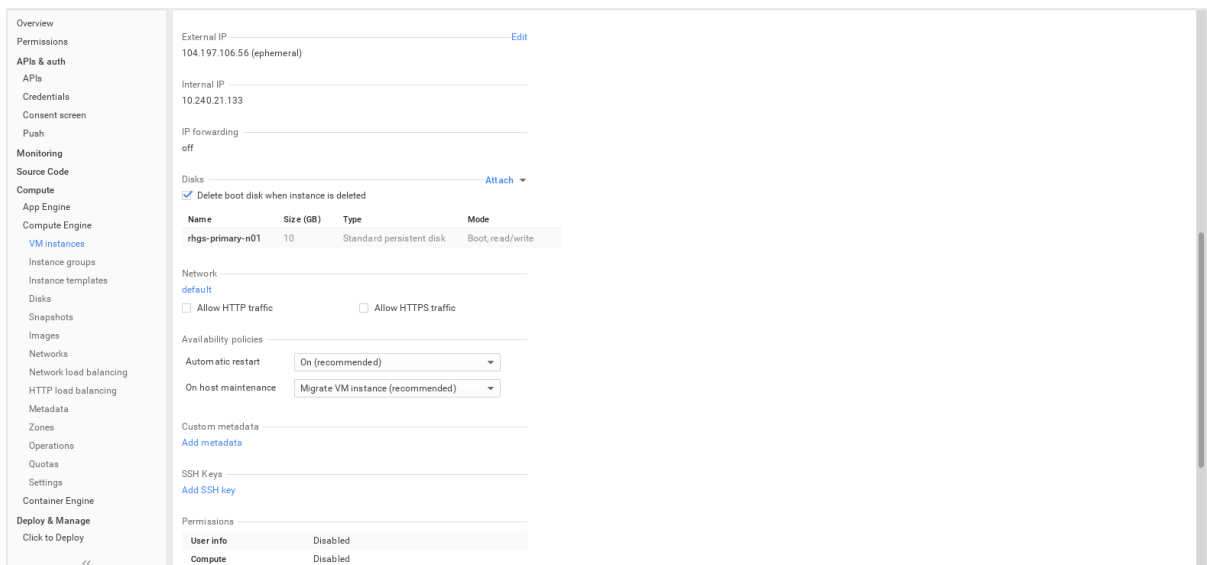


2. Enter the following in the **New Disk** window and click **Create**.

- Name: rhgs-primary-n01-data
- Zone: us-central1-a
- Disk Type: Standard persistent disk
- Source Type: None (blank disk)
- Size (GB): 10220

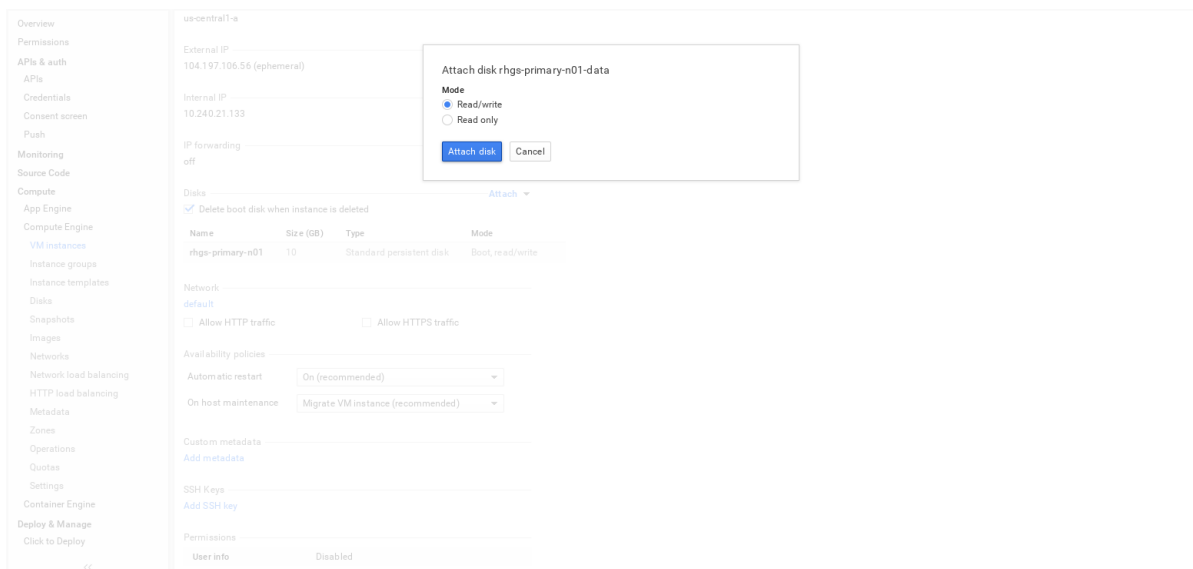
## 4.9. ATTACHING AND CONFIGURING THE DATA DISK

1. From the Google Developers Console, click **Compute > Compute Engine > VM instances > rhgs-primary-n01 > Attach > rhgs-primary-n01-data**.



2. Choose the mode as **Read/write**.





3. Connect to the rhgs-primary-n01 instance via SSH, and configure the data disk:

```
# ssh username@instance_external_ip
```

4. Confirm the data disk is visible as /dev/sdb:

```
# fdisk -l /dev/sdb
```

```
Disk /dev/sdb: 10984.4 GB, 10984378859520 bytes
255 heads, 63 sectors/track, 1335441 cylinders
Units = cylinders of 16065 * 512 = 8225280 bytes
Sector size (logical/physical): 512 bytes / 4096 bytes
I/O size (minimum/optimal): 4096 bytes / 4096 bytes
Disk identifier: 0x00000000
```

5. Configure LVM, format the filesystem, and mount the data disk:

The script below can be used to complete this process per documented recommendations.



### WARNING

This script assumes a large enough block device to accommodate the maximum supported metadata LV size of 16 GB for LVM thin provisioning needed for snapshots. You should understand what each step in the script is doing before using it.

```
#!/bin/bash
pvcreate /dev/sdb
vgcreate rhgs_vg /dev/sdb
# Create metadata LV with the maximum supported size of 16GB
lvcreate -L 16777216K --name rhgs_pool_meta rhgs_vg
# Create data LV with the remainder of the VG space
```

```
lvcreate -l 100%FREE --name rhgs_pool rhgs_vg
# The lvconvert command below required 4096 free extents, so reduce the LV
lvreduce -f -l 4096 /dev/rhgs_vg/rhgs_pool
# Convert our LVs to a thin pool
lvconvert --yes --thinpool rhgs_vg/rhgs_pool --poolmetadata rhgs_vg/rhgs_pool_meta
# Disable zeroing of thin pool chunks for performance boost
lvchange --zero n rhgs_vg/rhgs_pool
# The -V flag for lvcreate does not allow a '100%FREE' option like -l does.
# So we'll get the size of rhgs_pool from lvs for maximum efficiency
LVSIZE=$(lvs --units g | grep rhgs_pool | awk '{print $4}' | awk -F. '{print $1}')
# Create the thin LV for the bricks
lvcreate -V ${LVSIZE}G -T rhgs_vg/rhgs_pool -n rhgs_lv
# Create the XFS filesystem with 512B inode size and 8KB directory block size
# This step may take a while...
mkfs.xfs -f -i size=512 -n size=8192 -L rhgs_lv /dev/rhgs_vg/rhgs_lv
# Create mountpoint and fstab entry
mkdir -p /rhgs/bricks
echo "LABEL=rhgs_lv /rhgs/bricks xfs rw,inode64,noatime,nouuid 1 2" >> /etc/fstab
mount /rhgs/bricks
df -h /rhgs/bricks
```

## 4.10. DETACHING THE DISKS FOR THE IMAGE CREATION PROCESS

Now that the disks have been set up, they must be detached from the VM instances so that they can be used for the next step. The VM instance is deleted in the process.

- In the Google Developers Console, click **Compute > Compute Engine > VM instances > rhgs-primary-n01**.

← SSH ⋮ Reset Stop Clone Delete

✓ rhgs-primary-n01

CPU utilization ▾

1 hour 6 hours 12 hours 1 day 2 days 4 days 7 days 14 days 30 days

CPU

% CPU

5  
4  
3  
2  
1

Aug 4, 12:30 PM Aug 4, 12:45 PM Aug 4, 1:00 PM Aug 4, 1:15 PM Aug 4, 1:26 PM

CPU: 4.308

**Tags**  
glusterfs-deployed-from-google-developer-console  
Edit

**Machine type**  
n1-highmem-4 (4 vCPUs, 26 GB memory)

**CPU platform**  
Intel Sandy Bridge

**Zone**  
us-central1-a

**External IP**  
130.211.127.252 (ephemeral)  
Edit

**Internal IP**  
10.240.214.249

**IP forwarding**  
off

**Boot disk and local disks**

Name	Size (GB)	Type	Mode
rhgs-primary-n01	10	Standard persistent disk	Boot, read/write

Delete boot disk when instance is deleted  
Save Cancel

**Additional disks** ⓘ (Optional)

Name	Mode	When deleting instance
rhgs-primary-data-disk-n01	Read/write	Keep disk

+ Add item

Save Cancel

**Network**  
default

Allow HTTP traffic  
 Allow HTTPS traffic

Scroll down to the **Disks** section (there should be one for the boot disk and one for the additional disks). Ensure that the checkbox **delete boot disk when instance is deleted** is unchecked and the option for **When deleting instance** is selected the additional disk shows **Keep disk**.

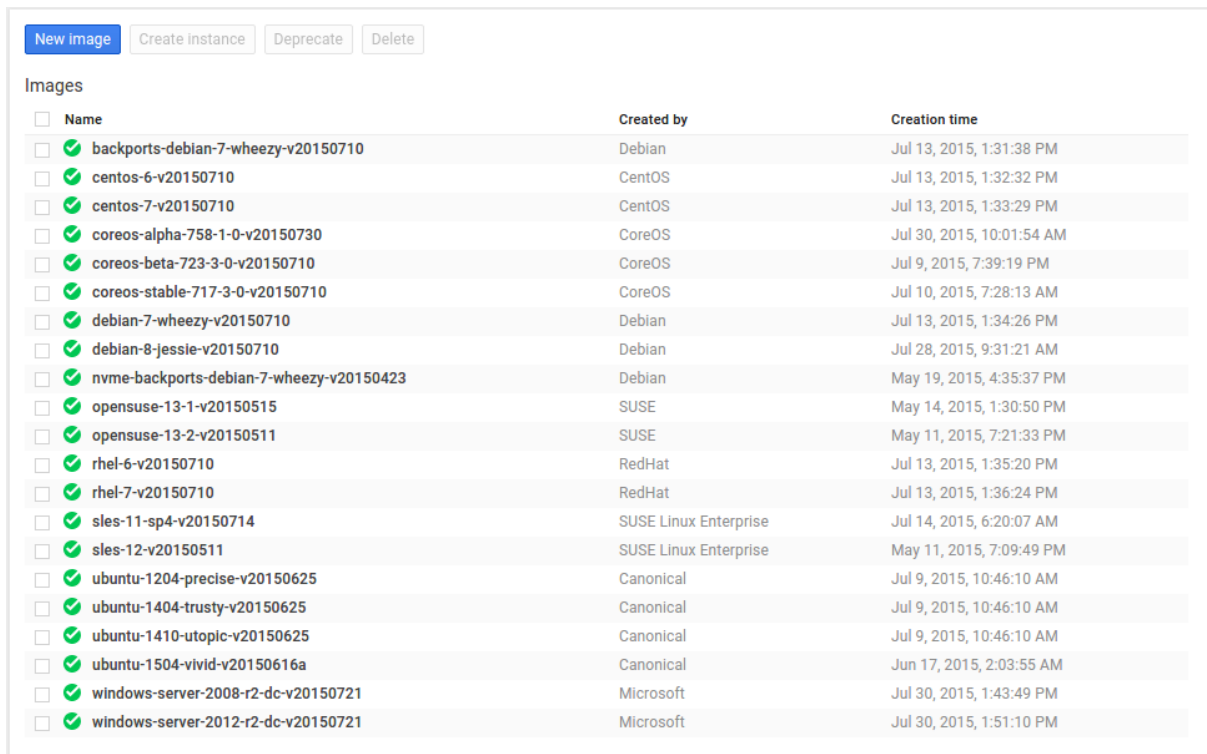
Now, click **Delete** on the top to delete the VM instance.

## 4.11. CREATING MULTIPLE RED HAT GLUSTER STORAGE INSTANCES USING IMAGES

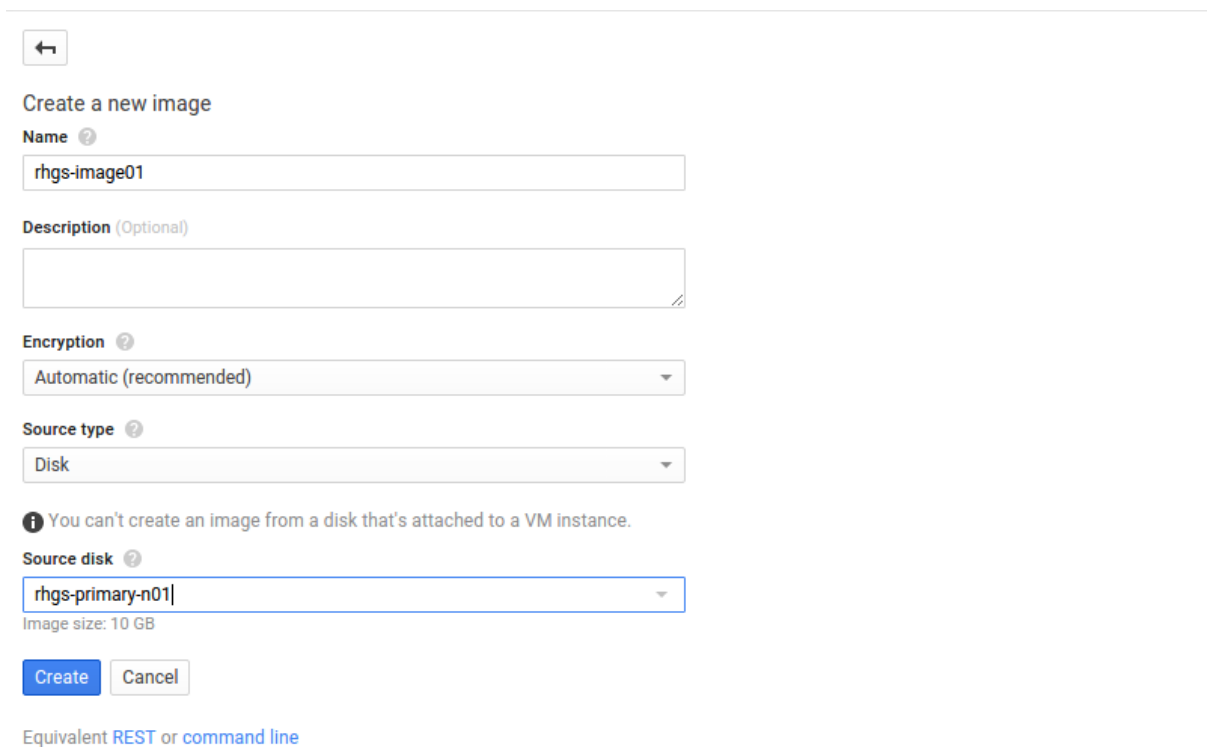
In this chapter, we are using 20 VM instances in the local region, US-CENTRAL1, and 10 VM instances in the remote region, EUROPE-WEST1.

## 1. Creating an image of the rhgs-primary-n01 as Root persistent disk.

In the Google Developers Console, click **Compute > Compute Engine > Images > New image**



The **Create a new image** window is displayed.



Enter the following in **Create a new image** window and click **Create**.

- Name: rhgs-image01
- Source disk: rhgs-primary-n01

2. Creating an image of the rhgs-primary-n01-data as Data persistent disk.

In the Google Developers Console, click **Compute > Compute Engine > Images > New image**

Enter the following in **Create a new image** window and click **Create** .

- Name: rhgs-data-image01
- Source disk: rhgs-primary-n01-data

## 4.12. USING GOOGLE CLOUD DEPLOYMENT MANAGER TO DEPLOY MULTIPLE INSTANCES

Using the google cloud deployment manager facilitates creation of multiple RGHS instances.

1. Log in and authenticate to Google Cloud by following the steps listed at <https://cloud.google.com/sdk/gcloud/#gcloud.auth>.
2. Copy the configuration contents in the [Section 4.16, "Appendix: Configuration files for Red Hat Gluster Storage Deployment"](#).
3. Run the following gcloud command:

```
# gcloud deployment-manager deployments create rghs --config glusterfs-config.yaml
```

## 4.13. CONFIGURING RED HAT GLUSTER STORAGE

### 4.13.1. Peer the Nodes

From rhgs-primary-n01, peer nodes rhgs-primary-n{02..20}:

```
# for i in {02..20};
do gluster peer probe rhgs-primary-n${i};
done
```

From rhgs-primary-n02, re-peer node rhgs-primary-n01:

Note the problem. This step is done in order to clean up the initial peering process which leaves rhgs-primary-n01 defined by its IP address in the other peers Gluster trusted pool configuration files. This is important because the IP addresses are ephemeral:

```
# gluster peer status | grep Hostname | grep -v rhgs
Hostname: 10.240.21.133
```

And correct it:

```
# gluster peer probe rhgs-primary-n01
peer probe: success.
# gluster peer status | grep Hostname | grep n01
Hostname: rhgs-primary-n01
```

From rhgs--n01, peer nodes rhgs-secondary-n{02..10}:

■

```
# for i in {02..10};
do gluster peer probe rhgs-secondary-n${i};
done
```

From rhgs-secondary-n02, peer node rhgs-secondary-n01:

```
# gluster peer probe rhgs-secondary-n01
```

### 4.13.2. Creating Distribute-Replicate Volumes



#### WARNING

Support for two-way replication is planned for deprecation and removal in future versions of Red Hat Gluster Storage. This will affect both replicated and distributed-replicated volumes.

Support is being removed because two-way replication does not provide adequate protection from split-brain conditions. While a dummy node can be used as an interim solution for this problem, Red Hat recommends that all volumes that currently use two-way replication are migrated to use either arbitrated replication or three-way replication.

Instructions for migrating a two-way replicated volume to an arbitrated replicated volume are available in [Converting to an Arbitrated Volume](#).

Information about three-way replication is available in [Creating Three-way Replicated Volumes](#) and [Creating Three-way Distributed Replicated Volumes](#).

On the primary trusted pool, create a 10x2 Distribute-Replicate volume, ensuring that bricks are paired appropriately with their replica peers as defined in [Section 4.1.3, "Primary Storage Pool Configuration"](#).

```
# gluster volume create myvol replica 2 \
rhgs-primary-n01:/rhgs/bricks/myvol rhgs-primary-n02:/rhgs/bricks/myvol \
rhgs-primary-n03:/rhgs/bricks/myvol rhgs-primary-n04:/rhgs/bricks/myvol \
rhgs-primary-n05:/rhgs/bricks/myvol rhgs-primary-n06:/rhgs/bricks/myvol \
rhgs-primary-n07:/rhgs/bricks/myvol rhgs-primary-n08:/rhgs/bricks/myvol \
rhgs-primary-n09:/rhgs/bricks/myvol rhgs-primary-n10:/rhgs/bricks/myvol \
rhgs-primary-n11:/rhgs/bricks/myvol rhgs-primary-n12:/rhgs/bricks/myvol \
rhgs-primary-n13:/rhgs/bricks/myvol rhgs-primary-n14:/rhgs/bricks/myvol \
rhgs-primary-n15:/rhgs/bricks/myvol rhgs-primary-n16:/rhgs/bricks/myvol \
rhgs-primary-n17:/rhgs/bricks/myvol rhgs-primary-n18:/rhgs/bricks/myvol \
rhgs-primary-n19:/rhgs/bricks/myvol rhgs-primary-n20:/rhgs/bricks/myvol
volume create: myvol: success: please start the volume to access data
```

```
# gluster volume start myvol
volume start: myvol: success
```

```
# gluster volume info myvol
Volume Name: myvol
```

```

Type: Distributed-Replicate
Volume ID: f093e120-b291-4362-a859-8d2d4dd87f3a
Status: Started
Snap Volume: no
Number of Bricks: 10 x 2 = 20
Transport-type: tcp
Bricks:
Brick1: rhgs-primary-n01:/rhgs/bricks/myvol
Brick2: rhgs-primary-n02:/rhgs/bricks/myvol
Brick3: rhgs-primary-n03:/rhgs/bricks/myvol
Brick4: rhgs-primary-n04:/rhgs/bricks/myvol
Brick5: rhgs-primary-n05:/rhgs/bricks/myvol
Brick6: rhgs-primary-n06:/rhgs/bricks/myvol
Brick7: rhgs-primary-n07:/rhgs/bricks/myvol
Brick8: rhgs-primary-n08:/rhgs/bricks/myvol
Brick9: rhgs-primary-n09:/rhgs/bricks/myvol
Brick10: rhgs-primary-n10:/rhgs/bricks/myvol
Brick11: rhgs-primary-n11:/rhgs/bricks/myvol
Brick12: rhgs-primary-n12:/rhgs/bricks/myvol
Brick13: rhgs-primary-n13:/rhgs/bricks/myvol
Brick14: rhgs-primary-n14:/rhgs/bricks/myvol
Brick15: rhgs-primary-n15:/rhgs/bricks/myvol
Brick16: rhgs-primary-n16:/rhgs/bricks/myvol
Brick17: rhgs-primary-n17:/rhgs/bricks/myvol
Brick18: rhgs-primary-n18:/rhgs/bricks/myvol
Brick19: rhgs-primary-n19:/rhgs/bricks/myvol
Brick20: rhgs-primary-n20:/rhgs/bricks/myvol
Options Reconfigured:
performance.readdir-ahead: on
auto-delete: disable
snap-max-soft-limit: 90
snap-max-hard-limit: 256

```

The resulting Gluster volume topology is:

```

Distribute set
|
+-- Replica set 0
| |
| +-- Brick 0: rhgs-primary-n01:/rhgs/bricks/myvol
| |
| +-- Brick 1: rhgs-primary-n02:/rhgs/bricks/myvol
|
+-- Replica set 1
| |
| +-- Brick 0: rhgs-primary-n03:/rhgs/bricks/myvol
| |
| +-- Brick 1: rhgs-primary-n04:/rhgs/bricks/myvol
|
+-- Replica set 2
| |
| +-- Brick 0: rhgs-primary-n05:/rhgs/bricks/myvol
| |
| +-- Brick 1: rhgs-primary-n06:/rhgs/bricks/myvol
|
+-- Replica set 3

```

```

| |
| +-- Brick 0: rhgs-primary-n07:/rhgs/bricks/myvol
| |
| +-- Brick 1: rhgs-primary-n08:/rhgs/bricks/myvol
|
+-- Replica set 4
| |
| +-- Brick 0: rhgs-primary-n09:/rhgs/bricks/myvol
| |
| +-- Brick 1: rhgs-primary-n10:/rhgs/bricks/myvol
|
+-- Replica set 5
| |
| +-- Brick 0: rhgs-primary-n11:/rhgs/bricks/myvol
| |
| +-- Brick 1: rhgs-primary-n12:/rhgs/bricks/myvol
|
+-- Replica set 6
| |
| +-- Brick 0: rhgs-primary-n13:/rhgs/bricks/myvol
| |
| +-- Brick 1: rhgs-primary-n14:/rhgs/bricks/myvol
|
+-- Replica set 7
| |
| +-- Brick 0: rhgs-primary-n15:/rhgs/bricks/myvol
| |
| +-- Brick 1: rhgs-primary-n16:/rhgs/bricks/myvol
|
+-- Replica set 8
| |
| +-- Brick 0: rhgs-primary-n17:/rhgs/bricks/myvol
| |
| +-- Brick 1: rhgs-primary-n18:/rhgs/bricks/myvol
|
+-- Replica set 9
|
| +-- Brick 0: rhgs-primary-n19:/rhgs/bricks/myvol
|
| +-- Brick 1: rhgs-primary-n20:/rhgs/bricks/myvol

```

On the secondary trusted pool, create a 10-brick Distribute volume:

```

# gluster volume create myvol-slave \
rhgs-secondary-n01:/rhgs/bricks/myvol-slave \
rhgs-secondary-n02:/rhgs/bricks/myvol-slave \
rhgs-secondary-n03:/rhgs/bricks/myvol-slave \
rhgs-secondary-n04:/rhgs/bricks/myvol-slave \
rhgs-secondary-n05:/rhgs/bricks/myvol-slave \
rhgs-secondary-n06:/rhgs/bricks/myvol-slave \
rhgs-secondary-n07:/rhgs/bricks/myvol-slave \
rhgs-secondary-n08:/rhgs/bricks/myvol-slave \
rhgs-secondary-n09:/rhgs/bricks/myvol-slave \
rhgs-secondary-n10:/rhgs/bricks/myvol-slave
volume create: myvol-slave: success: please start the volume to access data

```



```
# gluster volume start myvol-slave
volume start: myvol-slave: success

# gluster volume info myvol-slave
Volume Name: myvol-slave
Type: Distribute
Volume ID: 64295b00-ac19-436c-9aac-6069e0a5b8cf
Status: Started
Snap Volume: no
Number of Bricks: 10
Transport-type: tcp
Bricks:
Brick1: rhgs-secondary-n01:/rhgs/bricks/myvol-slave
Brick2: rhgs-secondary-n02:/rhgs/bricks/myvol-slave
Brick3: rhgs-secondary-n03:/rhgs/bricks/myvol-slave
Brick4: rhgs-secondary-n04:/rhgs/bricks/myvol-slave
Brick5: rhgs-secondary-n05:/rhgs/bricks/myvol-slave
Brick6: rhgs-secondary-n06:/rhgs/bricks/myvol-slave
Brick7: rhgs-secondary-n07:/rhgs/bricks/myvol-slave
Brick8: rhgs-secondary-n08:/rhgs/bricks/myvol-slave
Brick9: rhgs-secondary-n09:/rhgs/bricks/myvol-slave
Brick10: rhgs-secondary-n10:/rhgs/bricks/myvol-slave
Options Reconfigured:
performance.readdir-ahead: on
snap-max-hard-limit: 256
snap-max-soft-limit: 90
auto-delete: disable
```

The resulting Gluster volume topology is:

```
Distribute set
|
+-- Brick 0: rhgs-secondary-n01:/rhgs/bricks/myvol-slave
|
+-- Brick 1: rhgs-secondary-n02:/rhgs/bricks/myvol-slave
|
+-- Brick 2: rhgs-secondary-n03:/rhgs/bricks/myvol-slave
|
+-- Brick 3: rhgs-secondary-n04:/rhgs/bricks/myvol-slave
|
+-- Brick 4: rhgs-secondary-n05:/rhgs/bricks/myvol-slave
|
+-- Brick 5: rhgs-secondary-n06:/rhgs/bricks/myvol-slave
|
+-- Brick 6: rhgs-secondary-n07:/rhgs/bricks/myvol-slave
|
+-- Brick 7: rhgs-secondary-n08:/rhgs/bricks/myvol-slave
|
+-- Brick 8: rhgs-secondary-n09:/rhgs/bricks/myvol-slave
|
+-- Brick 9: rhgs-secondary-n10:/rhgs/bricks/myvol-slave
```

### 4.13.3. Setting up Geo-Replication from the Primary to the Secondary Region

From a primary region node, establish geo-replication from the local **myvol** volume to the remote region **myvol-slave** volume.

1. As a prerequisite, all secondary/slave side nodes must allow root user login via SSH. The below commands should be run on all of nodes `rhgs-secondary-n{01..10}`.

```
# sed -i s/PermitRootLogin\ no/PermitRootLogin\ yes/ \
/etc/ssh/sshd_config
# service sshd restart
```

2. Create an SSH key pair for the root user on `rhgs-primary-n01`, and copy the contents of the public key:

```
# ssh-keygen
# cat ~root/.ssh/id_rsa.pub
ssh-rsa
AAAAB3NzaC1yc2EAAAABIwAAAQEAmzZdIR+pEI16LqH0kbGQfA7sTe1iWHhV/x+5zVDb91
Z+gzMVdBTBaLyugeoBlxzOeFFnc/7a9TwNSr7YWt/yKZxh+lnqq
/9xcWtONUrfvLH4TEWu4dIRwCvXGsdv23IQK0YabaY9hqzshscFtSnQTmzT13LPc9drH+k7IH
Bu4KjA4igDvX/j41or0weneg1vcqAP9vRyh4xXgtocqBiAqJegBZ5O
/QO1ynyJBysp7tIHF7HZuh3sFCxtqEPPsJkVJDiQZ/NqTr3hAqDzmn4USOX3FbSOvomlWa8W
e6tGb9nfUH6vBQGyKbWk4YOzm6E5oTzuRBGA1vCPmwpwR/cw==
root@rhgs-primary-n01
```

3. On `rhgs-secondary-n01`, add the SSH public key from `rhgs-primary-n01` to the root user's `authorized_keys` file:

```
# echo "ssh-rsa
AAAAB3NzaC1yc2EAAAABIwAAAQEAmzZdIR+pEI16LqH0kbGQfA7sTe1iWHhV/x+5zVDb91
Z+gzMVdBTBaLyugeoBlxzOeFFnc/7a9TwNSr7YWt
/yKZxh+lnqq/79xcWtONUrfvLH4TEWu4dIRwCvXGsdv23IQK0YabaY9hqzshscFtSnQTmzT13L
Pc9drH+k7IHBu4KjA4igDvX
j41or0weneg1vcqAP9vRyh4xXgtocqBiAqJegBZ5O/QO1ynyJBysp7tIHF7HZuh3sFCxtqEPPsJk
VJDiQZ
/NqTr3hAqDzmn4USOX3FbSOvomlWa8We6tGb9nfUH6vBQGyKbWk4YOzm6E5oTzuRBGA1
vCPmwpwR/cw== root@rhgs-primary-n01" | sudo tee ~root/.ssh
/authorized_keys > /dev/null
```



#### NOTE

The above SSH public key is for illustration purposes only. Use the key from your own **id\_rsa.pub** file on `rhgs-primary-n01`.

At this point, the root user on `rhgs-primary-n01` should have passwordless SSH access to `rhgs-secondary-n01`. This is a prerequisite for setting up geo-replication.

1. Create a common pem pub file on `rhgs-primary-n01`:



#### NOTE

This must be done on the node where passwordless SSH to the secondary node was configured.

```
# gluster system:: execute gsec_create
```

2. Create the geo-replication session from the primary site to the secondary site. The push-pem option is needed to perform the necessary pem-file setup on the slave nodes.

```
# gluster volume geo-replication myvol \
rhgs-secondary-n01::myvol-slave create push-pem
```

```
# gluster volume geo-replication myvol \
rhgs-secondary-n01::myvol-slave start
```

3. Verify the geo-replication status. After a few minutes, the initialization stage should complete, and each connection should show Active or Passive for its status.

```
# gluster volume geo-replication myvol rhgs-secondary-n01::myvol-slave status
MASTER NODE      MASTER VOL  MASTER BRICK      SLAVE USER  SLAVE
STATUS   CHECKPOINT STATUS  CRAWL STATUS
-----
rhgs-primary-n01 myvol      /rhgs/bricks/myvol root      rhgs-secondary-n10::myvol-
slave Active N/A      Changelog Crawl
rhgs-primary-n18 myvol      /rhgs/bricks/myvol root      rhgs-secondary-n05::myvol-
slave Passive N/A      N/A
rhgs-primary-n06 myvol      /rhgs/bricks/myvol root      rhgs-secondary-n07::myvol-
slave Passive N/A      N/A
rhgs-primary-n02 myvol      /rhgs/bricks/myvol root      rhgs-secondary-n02::myvol-
slave Passive N/A      N/A
rhgs-primary-n10 myvol      /rhgs/bricks/myvol root      rhgs-secondary-n09::myvol-
slave Passive N/A      N/A
rhgs-primary-n14 myvol      /rhgs/bricks/myvol root      rhgs-secondary-n01::myvol-
slave Passive N/A      N/A
rhgs-primary-n03 myvol      /rhgs/bricks/myvol root      rhgs-secondary-n03::myvol-
slave Active N/A      Changelog Crawl
rhgs-primary-n09 myvol      /rhgs/bricks/myvol root      rhgs-secondary-n08::myvol-
slave Active N/A      Changelog Crawl
rhgs-primary-n11 myvol      /rhgs/bricks/myvol root      rhgs-secondary-n10::myvol-
slave Active N/A      Changelog Crawl
rhgs-primary-n13 myvol      /rhgs/bricks/myvol root      rhgs-secondary-n03::myvol-
slave Active N/A      Changelog Crawl
rhgs-primary-n19 myvol      /rhgs/bricks/myvol root      rhgs-secondary-n08::myvol-
slave Active N/A      Changelog Crawl
rhgs-primary-n17 myvol      /rhgs/bricks/myvol root      rhgs-secondary-n04::myvol-
slave Active N/A      Changelog Crawl
rhgs-primary-n05 myvol      /rhgs/bricks/myvol root      rhgs-secondary-n06::myvol-
slave Active N/A      Changelog Crawl
rhgs-primary-n15 myvol      /rhgs/bricks/myvol root      rhgs-secondary-n06::myvol-
slave Active N/A      Changelog Crawl
rhgs-primary-n16 myvol      /rhgs/bricks/myvol root      rhgs-secondary-n07::myvol-
slave Passive N/A      N/A
rhgs-primary-n07 myvol      /rhgs/bricks/myvol root      rhgs-secondary-n04::myvol-
slave Active N/A      Changelog Crawl
rhgs-primary-n20 myvol      /rhgs/bricks/myvol root      rhgs-secondary-n09::myvol-
slave Passive N/A      N/A
rhgs-primary-n12 myvol      /rhgs/bricks/myvol root      rhgs-secondary-n02::myvol-
```

slave	Passive	N/A	N/A		
rhgs-primary-n04	myvol	/rhgs/bricks/myvol	root	rhgs-secondary-n01::myvol-	
slave	Passive	N/A	N/A		
rhgs-primary-n08	myvol	/rhgs/bricks/myvol	root	rhgs-secondary-n05::myvol-	
slave	Passive	N/A	N/A		

At this point, the 100 TB Gluster volume is fully ready for use, with cross-zone synchronous data replication on the primary side and remote asynchronous data replication to a read-only volume on the secondary side located in a separate region.

## 4.14. SETTING UP CLIENTS TO ACCESS DATA

- **NFS and SMB clients**

The NFS and SMB protocols are available for use, but due to limitations in the network configuration these protocols cannot be made highly available with CTDB or Pacemaker as would be normally recommended.

### Prerequisites

You must ensure to register and subscribe your system before installing Native Client. Instructions for registering the system, is available, refer to the *Creating Access to Volumes* chapter in the *Red Hat Gluster Storage Administration Guide*.

### 4.14.1. Installing Native Client

Run the following command to install the native client:

```
# yum -y install glusterfs-fuse attr
```

### 4.14.2. Mounting Red Hat Gluster Storage Volumes

After installing Native Client, the Red Hat Gluster Storage volumes must be mounted to access data. Mount the myvol Gluster volume to the local directory /rhgs/client/myvol:

```
# mkdir -p /rhgs/client/myvol
```

```
# sh -c 'echo "rhgs-primary-n01:myvol /rhgs/client/myvol \
glusterfs defaults 0 0" >> /etc/fstab'
```

### 4.14.3. Testing Mounted Volumes

Test the mounted volume by running the following command:

```
# mount /rhgs/client/myvol'
```

## 4.15. APPENDIX - BUILDING RED HAT GLUSTER STORAGE COMPUTE ENGINE IMAGE FROM SCRATCH

It is possible to deploy an existing Red Hat Enterprise Linux public image and perform a layered install of Red Hat Gluster Storage. This creates an effective "double charge" for each Red Hat Enterprise Linux instance.

**NOTE**

Google Compute Engine charges a premium fee for using a public Red Hat Enterprise Linux image for instances in order to cover the expense of the Red Hat subscription.

When deploying a layered install, you must re-register the instances with Red Hat Subscription Manager, thus consuming a Red Hat Enterprise Linux entitlement that you have paid for separately. After registering with Subscription Manager, however, Google Compute Engine will continue to charge the premium fee for the instances.

To avoid this, we will build a custom image, which will not be subject to the Google Compute Engine premium fee. For information on building a custom image from scratch, see <https://cloud.google.com/compute/docs/tutorials/building-images>.

**4.15.1. Installing Red Hat Gluster Storage from the ISO to a RAW Disk Image File**

Using your local virtualization manager, create a virtual machine with a RAW format sparse flat-file backing the system disk. The suggested minimum disk size for the Red Hat Gluster Storage 3.4 (and later) system disk is 20 GB and the maximum disk size for import into Google Compute Engine is 100 GB. Google Compute Engine additionally requires the disk size be in whole GB increments, that is, 20 GB or 21 GB, but not 20.5 GB. The RAW disk file should have the `disk.raw` file name. The `disk.raw` file must include an MS-DOS (MBR) partition table.

For example, run the following **dd** command to create a 20 GB sparse file to serve as the RAW disk image:

```
# dd if=/dev/zero of=disk.raw bs=1 count=0 seek=20G
```

Refer to the Google Compute Engine Hardware Manifest guide at <https://cloud.google.com/compute/docs/tutorials/building-images#hardwaremanifest> to ensure your virtual machine image is compatible with the Google Compute Engine platform.

**NOTE**

The steps below assumes KVM/QEMU as your local virtualization platform.

Attach the Red Hat Gluster Storage ISO, available from the Red Hat Customer Portal, as a bootable CD-ROM device to the image. Boot the VM to the ISO, and perform the installation of Red Hat Gluster Storage according to the instructions available in the [Red Hat Gluster Storage 3.5 Installation Guide](#).

**4.15.2. Enabling and Starting the Network Interface**

To enable and start the network interface:

- Enable the default `eth0` network interface at boot time:

```
# sed -i s/ONBOOT=no/ONBOOT=yes/ /etc/sysconfig/network-scripts/ifcfg-eth0
```

- Start the `eth0` network interface:

```
# ifup eth0
```

### 4.15.3. Subscribing to the Red Hat Gluster Storage Server Channels

You must register the system and enable the required channels for Red Hat Gluster Storage. For information on subscribing and connecting to the appropriate pool and repositories, refer to the *Installing Red Hat Gluster Storage* chapter in the [Red Hat Gluster Storage 3.5 Installation Guide](#) . .

### 4.15.4. Updating your System

Update your systems using the following command:

```
# yum -y update
```

### 4.15.5. Tuning and Miscellaneous Configuration

Set the tuned profile to **rhgs-sequential-io** using the following command:

```
# tuned-adm profile rhgs-sequential-io
```



#### NOTE

The **rhgs-sequential-io** profile is appropriate for this environment, but the **rhgs-random-io** profile may be more appropriate for different workloads.

Disable SELinux:

```
# setenforce 0
```

If SELinux support is required, refer to the *Enabling SELinux* chapter in the [Red Hat Gluster Storage 3.5 Installation Guide](#).

### 4.15.6. Customizing the Virtual Machine for Google Compute Engine

The Google Compute Engine's "Build a Compute Engine Image from Scratch" documentation includes specific instructions for configuring the kernel, network, packages, SSH, and security of the virtual machine. It is recommended that you reference this documentation directly for updated information to ensure compatibility of your image with Google Compute Engine.

Power off the instance to apply all changes and prepare the image import:

```
# init 0
```

## 4.16. APPENDIX: CONFIGURATION FILES FOR RED HAT GLUSTER STORAGE DEPLOYMENT

Filename: `glusterfs-config.yaml`

```
# Copyright 2015 Google Inc. All Rights Reserved.  
#  
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# you may not use this file except in compliance with the License.
```

```

# You may obtain a copy of the License at
#
# http://www.apache.org/licenses/LICENSE-2.0
#
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# distributed under the License is distributed on an "AS IS" BASIS,
# WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
# See the License for the specific language governing permissions and
# limitations under the License.

#
# glusterfs-config.yaml
#
# The Gluster FS deployment consists of a primary pool and a secondary pool
# of resources, each on a separate zone.
#

imports:
  - path: gluster_instance.jinja
  - path: path_utils.jinja
resources:
  - name: gluster_instance
    type: gluster_instance.jinja
    properties:
      namePrefix: rhgs
      numPrimaryReplicas: 10
      primaryZone: us-central1-a
      secondaryZone: us-central1-b
      numSecondaryReplicas: 10
      backupZone: europe-west1-b
      sourceImage: global/images/rhgs-image01
      dataSourceImage: global/images/rhgs-data-image01
      machineType: n1-highmem-4
      network: default
      bootDiskType: pd-standard
      dataDiskType: pd-standard
      dataDiskSizeGb: 10230

```

#### Filename: gluster\_instance.jinja

```

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#
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# distributed under the License is distributed on an "AS IS" BASIS,
# WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
# See the License for the specific language governing permissions and
# limitations under the License.

# GlusterFs configuration variables
#

```

```

# Required Cloud resource input parameters:
# * numPrimaryReplicas - number of instances to create in the primary zone
# * numSecondaryReplicas - number of instances to create in the secondary zone
# * namePrefix - hostname prefix
# The instance number (0 based) will be appended ("-n<#><#>")
# * primaryZone - Compute Engine zone for the instance (short name)
# * secondaryZone - Compute Engine zone for the instance (short name)
# * network - Compute Engine network for the instance (full URI)
# * image - Compute Engine image for the instance (full URI)
# * machineType - Compute Engine machine type for the instance (full URI)
# * bootDiskType - Compute Engine boot disk type for the instance (full URI)
# * dataDiskType: Compute Engine data disk type for the instance (full URI)
# * dataDiskSizeGb: Data disk size in Gigabytes

{% import 'path_utils.jinja' as path_utils with context %}

# Grab the config properties
{% set numPrimaryReplicas = properties["numPrimaryReplicas"] + 1%}
{% set numSecondaryReplicas = properties["numSecondaryReplicas"] + 1 %}
{% set image = properties["image"] %}

# Macros and variables dealing with naming
{% set prefix = properties["namePrefix"] %}

{% macro hostname(prefix, id) -%}
{{ "%s-n%02d"|format(prefix, id) }}
{%- endmacro %}

{% macro diskname(prefix, id) -%}
{{ "%s-data-disk-n%02d"|format(prefix, id) }}
{%- endmacro %}

# Expand resource input parameters into full URLs
{% set network = path_utils.networkPath(properties["network"]) %}
{% set primaryZone = properties["primaryZone"] %}
{% set bootDiskType = path_utils.diskTypePath(
    primaryZone, properties["bootDiskType"]) %}
{% set dataDiskType = path_utils.diskTypePath(
    primaryZone, properties["dataDiskType"]) %}
{% set machineType = path_utils.machineTypePath(
    primaryZone, properties["machineType"]) %}

resources:
# Add clone instances in the local Zone
{% for n_suffix in range(1, numPrimaryReplicas) %}

    {% set namePrefix = prefix + '-primary' %}

- type: compute.v1.disk
  name: {{ diskname(namePrefix, n_suffix) }}
  properties:

    zone: {{ primaryZone }}
    type: {{ dataDiskType }}
    sizeGb: {{ properties["dataDiskSizeGb"] }}
    sourceImage: {{ properties["dataSourceImage"] }}

```



```

- type: compute.v1.instance
name: {{ hostname(namePrefix, n_suffix) }}
properties:
  zone: {{ primaryZone }}
  machineType: {{ machineType }}

  disks:
    # Request boot disk creation (mark for autodelete)
    - deviceName: boot
      type: PERSISTENT
      boot: true
      autoDelete: true
      initializeParams:
        sourceImage: {{ properties["sourceImage"] }}
        diskType: {{ bootDiskType }}
        diskSizeGb: 10

    # Attach the existing data disk (mark for autodelete)
    - deviceName: {{ diskname(namePrefix, n_suffix) }}
      source: $(ref.{{ diskname(namePrefix, n_suffix) }}.selfLink)
      autoDelete: true
      type: PERSISTENT

  networkInterfaces:
    - network: {{ network }}
      accessConfigs:
        - name: External NAT
          type: ONE_TO_ONE_NAT

  tags:
    items:
      - "glusterfs-deployed-from-google-developer-console"

{% endfor %}

# Setup in-region replicas
{% set network = path_utils.networkPath(properties["network"]) %}
{% set secondaryZone = properties["secondaryZone"] %}
{% set bootDiskType = path_utils.diskTypePath(
  secondaryZone, properties["bootDiskType"]) %}
{% set dataDiskType = path_utils.diskTypePath(
  secondaryZone, properties["dataDiskType"]) %}
{% set machineType = path_utils.machineTypePath(
  secondaryZone, properties["machineType"]) %}
{% for n_suffix in range(1, numPrimaryReplicas) %}

  {% set namePrefix = prefix + '-secondary' %}

- type: compute.v1.disk
name: {{ diskname(namePrefix, n_suffix) }}
properties:
  zone: {{ secondaryZone }}
  type: {{ dataDiskType }}
  sizeGb: {{ properties["dataDiskSizeGb"] }}
  sourceImage: {{ properties["dataSourceImage"] }}

```

```

- type: compute.v1.instance
name: {{ hostname(namePrefix, n_suffix) }}
properties:
  zone: {{ secondaryZone }}
  machineType: {{ machineType }}

  disks:
  # Request boot disk creation (mark for autodelete)
  - deviceName: boot
    type: PERSISTENT
    boot: true
    autoDelete: true
    initializeParams:
      sourceImage: {{ properties["sourceImage"] }}
      diskType: {{ bootDiskType }}
      diskSizeGb: 10

  # Attach the existing data disk (mark for autodelete)
  - deviceName: {{ diskname(namePrefix, n_suffix) }}
    source: $(ref.{{ diskname(namePrefix, n_suffix) }}.selfLink)
    autoDelete: true
    type: PERSISTENT

  networkInterfaces:
  - network: {{ network }}
    accessConfigs:
    - name: External NAT
      type: ONE_TO_ONE_NAT

  tags:
  items:
  - "glusterfs-deployed-from-google-developer-console"

{% endfor %}

# Add clone instances in the remote Zone
{% set backupZone = properties["backupZone"] %}
{% set bootDiskType = path_utils.diskTypePath(
  backupZone, properties["bootDiskType"]) %}
{% set dataDiskType = path_utils.diskTypePath(
  backupZone, properties["dataDiskType"]) %}
{% set machineType = path_utils.machineTypePath(
  backupZone, properties["machineType"]) %}
{% for n_suffix in range(1, numSecondaryReplicas) %}
  {% set namePrefix = prefix + '-backup' %}

- type: compute.v1.disk
name: {{ diskname(namePrefix, n_suffix) }}
properties:
  zone: {{ backupZone }}
  type: {{ dataDiskType }}
  sizeGb: {{ properties["dataDiskSizeGb"] }}
# sourceImage: {{ properties["dataSourceImage"] }}

```

```

- type: compute.v1.instance
name: {{ hostname(namePrefix, n_suffix) }}
properties:
  zone: {{ backupZone }}
  machineType: {{ machineType }}

disks:
# Request boot disk creation (mark for autodelete)
- deviceName: boot
  type: PERSISTENT
  boot: true
  autoDelete: true
  initializeParams:
    sourceImage: {{ properties["sourceImage"] }}
    diskType: {{ bootDiskType }}
    diskSizeGb: 10

# Attach the existing data disk (mark for autodelete)
- deviceName: {{ diskname(namePrefix, n_suffix) }}
  source: $(ref.{{ diskname(namePrefix, n_suffix) }}.selfLink)
  autoDelete: true
  type: PERSISTENT

networkInterfaces:
- network: {{ network }}
  accessConfigs:
  - name: External NAT
    type: ONE_TO_ONE_NAT

tags:
  items:
  - "glusterfs-deployed-from-google-developer-console"

{% endfor %}

```

Filename: path\_utils.jinja

```

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# distributed under the License is distributed on an "AS IS" BASIS,
# WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
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# limitations under the License.

# path_utils.jinja
#
# Jinja macros for expanding short resource names into full paths
# Must have reference to the global env object, so when including this file,
# use the jinja import "with context" option.

```

```
{% macro projectPrefix() -%}
{{ "https://www.googleapis.com/compute/v1/projects/%s"|format(env["project"]) }}
{%- endmacro %}

{% macro imagePath(image) -%}
{% if image.startswith("https://") -%}
{{ image }}
{% elif image.startswith("debian-") -%}
{{ "https://www.googleapis.com/compute/v1/projects/debian-cloud/global/images/" + image }}
{% elif image.startswith("windows-") -%}
{{ "https://www.googleapis.com/compute/v1/projects/windows-cloud/global/images/" + image }}
{% endif -%}
{%- endmacro %}

{% macro machineTypePath(zone, machineType) -%}
{% if machineType.startswith("https://") -%}
{{ machineType }}
{% else -%}
{{ "%s/zones/%s/machineTypes/%s"|format(projectPrefix(), zone, machineType) }}
{% endif -%}
{%- endmacro %}

{% macro networkPath(network) -%}
{% if network.startswith("https://") -%}
{{ network }}
{% else -%}
{{ "%s/global/networks/%s"|format(projectPrefix(), network) }}
{% endif -%}
{%- endmacro %}

{% macro diskTypePath(zone, diskType) -%}
{% if diskType.startswith("https://") -%}
{{ diskType }}
{% else -%}
{{ "%s/zones/%s/diskTypes/%s"|format(projectPrefix(), zone, diskType) }}
{% endif -%}
{%- endmacro %}
```

## APPENDIX A. REVISION HISTORY

Revision 3.5-0

Wed Oct 30 2019

Red Hat Gluster Storage  
Documentation Team

Updated documentation for Red Hat Gluster Storage 3.5