Microsoft

Red Hat Storage / GlusterFS ON AZURE

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LAB OBJECTIVES AND PRE-REQUISITES

This lab describes the steps necessary to deploy highly available GlusterFs (Red Hat Storage) environment on Azure using a basic two-node CENTOS 7 configuration. GlusterFS is the upstream project of Red Hat storage and is considered as a test bed incubator.

You don't need a Red Hat subscription to perform the lab instructions. But you will need a valid Azure account. Create your free azure account (https://azure.microsoft.com/en-us/free/) today.

If you are using Windows 10, you can install Bash shell on Ubuntu on Windows (http://www.windowscentral.com/how-install-bash-shell-command-line-windows-10). To install Azure CLI, download and install the latest Node.js and npm for Ubuntu: (https://nodejs.org/en/download/package-manager/#debian-and-ubuntu-based-linux-distributions). Then, follow the instructions (**Option-1**): https://azure.microsoft.com/en-us/documentation/articles/xplat-cli-install/

If you are using MAC or another windows version, install Azure CLI, following (**Option-2)**: https://azure.microsoft.com/en-us/documentation/articles/xplat-cli-install/

The Lab covers:

- GlusterFS Architecture Installation
- Creating Highly Available (Replicated) GlusterFS Volume on Azure
- Creating a distributed GlusterFS Volume on Azure
- Connect from Linux/Windows clients
- Extend GlusterFS Volumes without downtime
- Exploring the graphical console managing GlusterFS clusters

INTRODUCTION TO RED HAT STORAGE

Red Hat Gluster FS 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 storage demanding workloads. Deployment flexibility is a key strength of Red Hat Gluster FS Storage. GlusterFS can be deployed to virtual or physical servers in on-premises environments, private clouds, and public clouds. Microsoft and Red Hat have signed a partnership that includes support to run Red Hat Storage on Microsoft Azure.

Azure offers multiple cloud solutions either as infrastructure-as-a-service (IaaS) or platform-as-a-service (PaaS). For GlusterFS, we will leverage Azure IAAS capabilities to build logical containers (virtual machines) backed by software defined storage (Azure disks). Then, we will deploy and configure the shared filesystem bricks. Azure provides network services like DNS and DHCP, which makes managing the infrastructure like managing a physical deployment.

EXERCISE1: PLANNING THE DEPLOYMENT ON AZURE

Terminology:

- Gluster Storage server: The virtual machine which hosts the file system in which data will be stored.
- Gluster Storage client: The virtual machine which mounts the GlusterFS shared volumes.
- Brick: The brick is a disk partition with XFS file system that has been assigned to a Volume.
- GlusterFS Volume: The logical collection of bricks.

Lab configuration:

We will use Azure virtual machines to create a two nodes GlusterFS cluster. A Linux and Windows clients will be used to demonstrate mounting and consuming software defined storage exported by the GlusterFS cluster

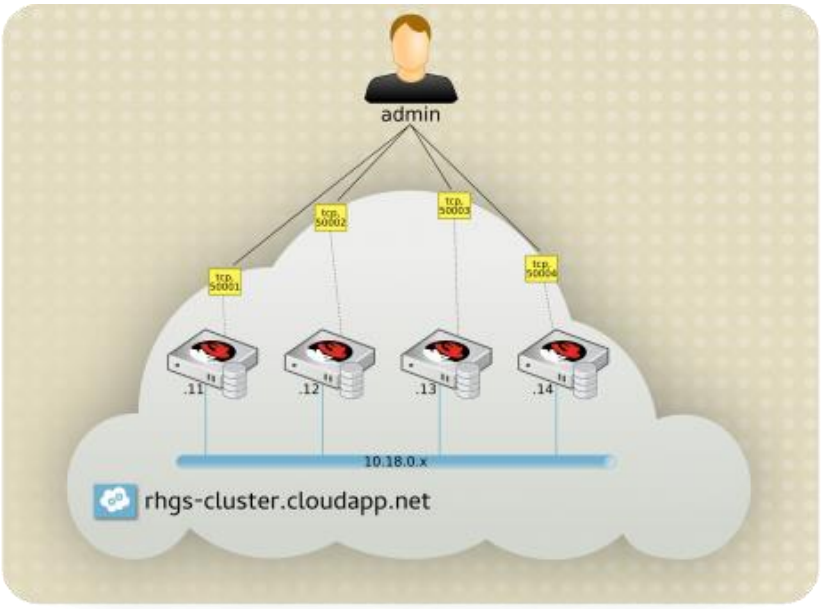


Fig1: GlusterFS simplified architecture

Servers	Node1	Node2
	CentOS 7.3+	CentOS 7.3+
Clients	Node3	Windows-client
	CentOS 7.3+	Windows Server 2008 x64

To add another layer of resiliency to our architecture, we will provision GlusterFS cluster nodes into an Azure availability set (https://docs.microsoft.com/en-us/azure/virtual-machines/virtual-machines-windows-infrastructure-availability-sets-guidelines#availability-sets).

An 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 an Azure datacenter. By using availability sets in the replication design, incidents within the Azure infrastructure cannot affect all members of a replica set simultaneously.

1. Start a *Bash* session and login to your Azure account

```
# azure login
```

2. Make sure the Azure CLI is using Resource Manager mode

```
# azure config mode arm
info:    Executing command config mode
info:    New mode is arm
info:    config mode command OK
```

3. Create an *ssh* keypair with a blank passphrase

```
# ssh-keygen
Generating public/private rsa key pair.
Enter file in which to save the key
(/home/azureuser/.ssh/id_rsa):
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in
/home/azureuser/.ssh/id_rsa.
Your public key has been saved in
/home/azureuser/.ssh/id_rsa.pub.
The key fingerprint is:
... output omitted ...
```

4. Create a new Azure resource group *glusterfsRG* in your preferred region

```
# azure group create glusterfsRG northeurope
info:    Executing command group create
+ Getting resource group glusterfsRG
+ Creating resource group glusterfsRG
info:    Created resource group glusterfsRG
data:    Id:                  /subscriptions/f3a5dfdb-
e853-42d9-b23c-752c896c0290/resourceGroups/ glusterfsRG
data:    Name:                glusterfsRG
data:    Location:            northeurope
data:    Provisioning State:  Succeeded
data:    Tags: null
data:
info:    group create command OK
```

5. Create a new availability set *glusteras*

```
# azure availset create glusterfsRG glusteras
northeurope
info:    Executing command availset create
+ Looking up the availability set "glusteras"
+ Creating availability set "glusteras"
info:    availset create command OK
```

6. Create a new Linux CentOS virtual machines and replace CHANGEME by any random string, to insure uniqueness. The following second command creates a new vm named *node1* in the availability set *glusteras* with a virtual network name *gluster-vnet*, a subnet name *gluster-snet*, a network card name *nic-node1*, a virtual address network prefix *10.0.0.0/16*, a virtual network subnet address prefix *10.0.1.0/24*, a public IP name *node1-pub*, and a public IP domain name *node1glusterXXX*. The username *azureuser* and the public key *id_rsa.pub* will be used to login to the newly created node. Start, by exploring the various options available with the vm creation command, then create the node.

```
# azure vm create --help


# azure vm create glusterfsRG node1 northeurope -F
gluster-vnet -j gluster-snet -f nic-node1 -P 10.0.0.0/16
-k 10.0.1.0/24 -i node1-pub -w node1gluster CHANGEME -y
Linux -Q OpenLogic:CentOS:7.2:latest -u azureuser -M
.ssh/id_rsa.pub -r glusteras
```

7. Create similar virtual machine *node2* in the same vnet/subnet as *node1*. Replace CHANGEME by the same random string, you used in the previous command.

```
# azure vm create glusterfsRG node2 northeurope -F
gluster-vnet -j gluster-snet -f nic-node2 -i node2-pub -
w node2gluster CHANGEME -y Linux -Q
OpenLogic:CentOS:7.2:latest -u azureuser -M
.ssh/id_rsa.pub -r glusteras
```

8. Show the two, previously, provisioned nodes

```
# azure vm list glusterfsRG | grep node
```

```
# azure vm show glusterfsRG node1
```

9. Note the public IP addresses of your newly created vms

```
# azure vm list-ip-address | grep GLUSTERFSRG
data:    GLUSTERFSRG        node1          52.149.219.230
data:    GLUSTERFSRG        node2          52.154.143.136
```

10. Ssh to the node1 using the private key you created in step-3 and make sure to install any available updates.

```
# ssh -i .ssh/id_rsa azureuser@NODE1-PubIP

[node1]# sudo yum update -y
```

11. Create a new yum repository */etc/yum.repos.d/glusterfs-epel.repo* and add the following:

```
[glusterfs-epel]
name=GlusterFS is a clustered file-system capable of
scaling to several petabytes.
baseurl=http://buildlogs.centos.org/centos/7/storage/x86
_64/gluster-3.8/
enabled=1
skip_if_unavailable=1
gpgcheck=0
```

12. Install the latest *EPEL* repository from *fedoraproject.org* to resolve all dependencies needed later-on:

```
[node1]# sudo yum -y install
http://dl.fedoraproject.org/pub/epel/epel-release-
latest-7.noarch.rpm
```

13. Make sure both repositories are enabled by default:

```
[node1]# sudo yum repolist
... output omitted ...
repo id            repo name                    status
base/7/x86_64      CentOS-7 - Base               9,007
epel/x86_64        Extra Packages for Enterprise Linux 7
- x86_64                        10,765
extras/7/x86_64    CentOS-7 - Extras              393
glusterfs-epel     GlusterFS is a clustered file-system
capable of scaling to several p    162
openlogic/7/x86_64 CentOS-7 - openlogic packages for
x86_64                                    48
updates/7/x86_64   CentOS-7 - Updates          2,560
repolist: 22,935
```

14. Install *GlusterFS* Server and *Samba* packages

```
[node1]# sudo yum install glusterfs-server samba -y
```

EXERCISE2: CREATING THE BRICKS

In the next steps, we will add two new disks to each GlusterFS cluster node. To create a big backend storage pool. We will stripe the disks into a RAID0 array. That configuration, potentially allows higher IOPS.

For simplicity reasons, we will use disks with 10Gb capacity, only. The array on each node will then be used to create two GlusterFS bricks. The bricks will be used to create the GlusterFS volumes.

1. Exit from *node1* and attach 2 x 10 GB data disks to *node1* and *node2*

```
[node1]# exit

# for n in {1..2}; do azure vm disk attach-new
glusterfsRG node1 10; done

# for n in {1..2}; do azure vm disk attach-new
glusterfsRG node2 10; done
```

2. Login to node1, again and list the system's partition table and make sure you have 2 new disks (*/dev/sdc* and */dev/sdd*)

```
# ssh -i .ssh/id_rsa azureuser@NODE1-PubIP

[node1]# sudo fdisk -l

... output omitted ...

Device Boot  Start   End      Blocks     Id  System

/dev/sda1 *  2048    62914559 31456256   83  Linux

... output omitted ...

/dev/sdb1    128     14678015 7338944    83  Linux

... output omitted ...

Disk /dev/sdc: 10.7 GB, 10737418240 bytes, 20971520
sectors

... output omitted ...

Disk /dev/sdd: 10.7 GB, 10737418240 bytes, 20971520
sectors
```

3. Combine the virtual disks with *mdadm* to allow the LUN to deliver IOPS beyond that of a single virtual disk. Use *mdadm* to combine disks to form a larger RAID0 disk.

```
[node1] # sudo mdadm --create md0 --level=0 --
chunk=256K --raid-devices=2 /dev/sdc /dev/sdd

mdadm: Defaulting to version 1.2 metadata
```

```
mdadm: array /dev/md/md0 started.
```

```
[node1]# sudo mdadm --examine --scan | sudo tee /etc/mdadm.conf
ARRAY /dev/md/md0  metadata=1.2 UUID=f92d3a2d:2c14157b:5bc8ef77:27ca57b7 name=node1:md0
```

4. Create the file system (2 *bricks*) that will be used to create the *Glusterfs* volume

```
[node1]# sudo pvcreate --dataalignment 1024K /dev/md/md0
  Physical volume "/dev/md/md0" successfully created

[node1]# sudo vgcreate --physicalextentsize 256K glustervg-data /dev/md/md0
  Volume group "glustervg-data" successfully created

[node1]# sudo vgs
  VG            #PV #LV #SN Attr   VSize  VFree
  glustervg-data   1   2   0 wz--n- 19.98g 9.98g

[node1]# for n in {1..2}; do sudo lvcreate -L 5G -n brick$n glustervg-data; done
  Logical volume "brick1" created.
  Logical volume "brick2" created.

[node1]# sudo lvs
  LV     VG            Attr       LSize Pool Origin Data%  Meta%  Move Log Cpy%Sync Convert
  brick1 glustervg-data -wi-ao---- 5.00g
  brick2 glustervg-data -wi-ao---- 5.00g
```

5. Format the bricks with *XFS* file system:

```
[node1]# for n in {1..2}; do sudo mkfs.xfs
/dev/glustervg-data/brick$n; done
```

6. Create mount points and mount XFS bricks:

```
[node1]# sudo mkdir -p /bricks/brick{1,2}


[node1]# for n in {1..2}; do sudo mount /dev/glustervg-
data/brick$n /bricks/brick$n; done
```

7. Add the following lines to */etc/fstab*:

```
[node1]# sudo -s


[node1]# echo '/dev/glustervg-data/brick1
/bricks/brick1    xfs     defaults    0 0' >> /etc/fstab


[node1]# echo '/dev/glustervg-data/brick2
/bricks/brick2    xfs     defaults    0 0' >> /etc/fstab


[node1]# exit
```

8. Mount the created bricks and make sure they show as new file systems

```
[node1]# sudo mount -a


[node1]# sudo df -h
... output omitted ...
/dev/mapper/glustervg--data-brick1  5.0G   33M  5.0G
1% /bricks/brick1
/dev/mapper/glustervg--data-brick2  5.0G   33M  5.0G
1% /bricks/brick2
```

EXERCISE3: CONFIGURING STORAGE POOL

In this section, we will enable the *GlusterFS* cluster on *node1* and *node2*

1. Start *glusterd* service on *node1*:

```
[node1]# sudo systemctl enable glusterd
Created symlink from /etc/systemd/system/multi-
user.target.wants/glusterd.service to
/usr/lib/systemd/system/glusterd.service.

[node1]# sudo systemctl start glusterd
```

2. To avoid, repeating the same steps to prepare *node2* we will provide you with a ready to use bash script that automates the same previous commands we run on *node1* to be executed on *node2*. Start by logging to *node2* (you can find the public IP address from step-9 Exercice-1), escalate to *root* privileges. Then copy, explore and execute the "*prepare-gluster-node.sh*".

```
# ssh -i .ssh/id_rsa azureuser@NODE2-PubIP

[node2]# sudo -s

[node2]# wget https://raw.githubusercontent.com/Microsoft-
OpenSource-Labs/glusterfs-azure-lab/master/prepare-gluster-
node.sh

[node2]# less prepare-gluster-node.sh

[node2]# chmod +x prepare-gluster-node.sh

[node2]# ./prepare-gluster-node.sh

[node2]# exit
```

3. Use *gluster* command to connect the two nodes and create a Trusted Pool (Storage Cluster). You don't have to run the same command on the other node

```
[node2]# sudo gluster peer probe node1
peer probe: success.
```

4. Verify the cluster peer:

```
[node2]# sudo gluster peer status
Number of Peers: 1

Hostname: node1
Uuid: 17de2959-20f5-4107-a33a-3b169ee8adbf
State: Peer in Cluster (Connected)
```

EXERCISE4: HIGH AVAILABILITY GLUSTERFS VOLUMES

Once the bricks are in place, a *GlusterFS* volume can be created; the volume combines the capacity from each node. GlusterFS Volume works with Gluster File System which is a logical collection of XFS bricks. The following table shows dependencies between volume types and sizes, assuming 1G bricks:

GlusterFS Volume types	Volume space
Distributed (for maximum space)	1G + 1G = 2G
Replicated (for high availability)	1G + 1G = 1G
Striped (for large files)	1G + 1G = 2G
Distributed and Replicated	(1G+1G) + (1G+1G) = 2G
Distributed and Striped	(1G+1G) + (1G+1G) = 4G
Distributed, Replicated and Stripped	[(1G+1G)+(1G+1G)] + [(1G+1G)+(1G+1G)] = 4G

Table: GlusterFS volume types

The two most common volume types are *distributed* and *distributed-replicated*. A distributed volume has no fault-tolerance but has the maximum capacity. A distributed-replicated volume has node-level fault-tolerance but has reduced capacity. In the next section, we will configure two *GlusterFS volumes*, replicated *glustervol1* and distributed, *glustervol2*.

1. First, create two sub-directories mount points, */bricks/brick1/repvol* and */bricks/brick1/disvol* on both *node1* and *node2*

```
[node2]# sudo mkdir /bricks/brick1/repvol
/bricks/brick2/distvol


[node2]# exit && ssh -i .ssh/id_rsa azureuser@NODE1-
PubIP
```

```
[node1]# sudo mkdir /bricks/brick1/repvol
/bricks/brick2/distvol


[node1]# exit && ssh -i .ssh/id_rsa azureuser@NODE2-
PubIP
```

2. Use the */bricks/brick1* XFS partition on both nodes to create a highly available replicated volume, *glustervol1*. You don't have to run the same command on *node1*:

```
[node2]# sudo gluster volume create glustervol1 replica
2 transport tcp node1:/bricks/brick1/repvol
node2:/bricks/brick1/repvol
volume create: glustervol1: success: please start the
volume to access data


[node2]# sudo gluster volume start glustervol1
volume start: glustervol1: success
```

3. Use the */bricks/brick2* XFS partition on both nodes to create a big distributed volume, *glustervol2*. You don't have to run the same command on *node2*:

```
[node2]# sudo gluster volume create glustervol2
transport tcp node1:/bricks/brick2/distvol
node2:/bricks/brick2/distvol
volume create: glustervol2: success: please start the
volume to access data


[node2]# sudo gluster volume start glustervol2
volume start: glustervol1: success
```

4. Verify the newly created GlusterFS Volumes:

```
[node2]# sudo gluster volume info all
Volume Name: glustervol1
Type: Replicate
```

```
Volume ID: 6ce0b2e0-696a-4deb-8f3a-6b11dfd5ad85
Status: Started
Snapshot Count: 0
Number of Bricks: 1 x 2 = 2
Transport-type: tcp
Bricks:
Brick1: node1:/bricks/brick1/repvol
Brick2: node2:/bricks/brick1/repvol
Options Reconfigured:
transport.address-family: inet
performance.readdir-ahead: on
nfs.disable: on

Volume Name: glustervol2
Type: Distribute
Volume ID: 9b96e301-9aa7-47fc-a387-65c61e7d2bb6
Status: Started
Snapshot Count: 0
Number of Bricks: 2
Transport-type: tcp
Bricks:
Brick1: node1:/bricks/brick2/distvol
Brick2: node2:/bricks/brick2/distvol
Options Reconfigured:
transport.address-family: inet
performance.readdir-ahead: on
nfs.disable: on
```

The following diagram, explain the logical architecture of the implemented solution, so far.

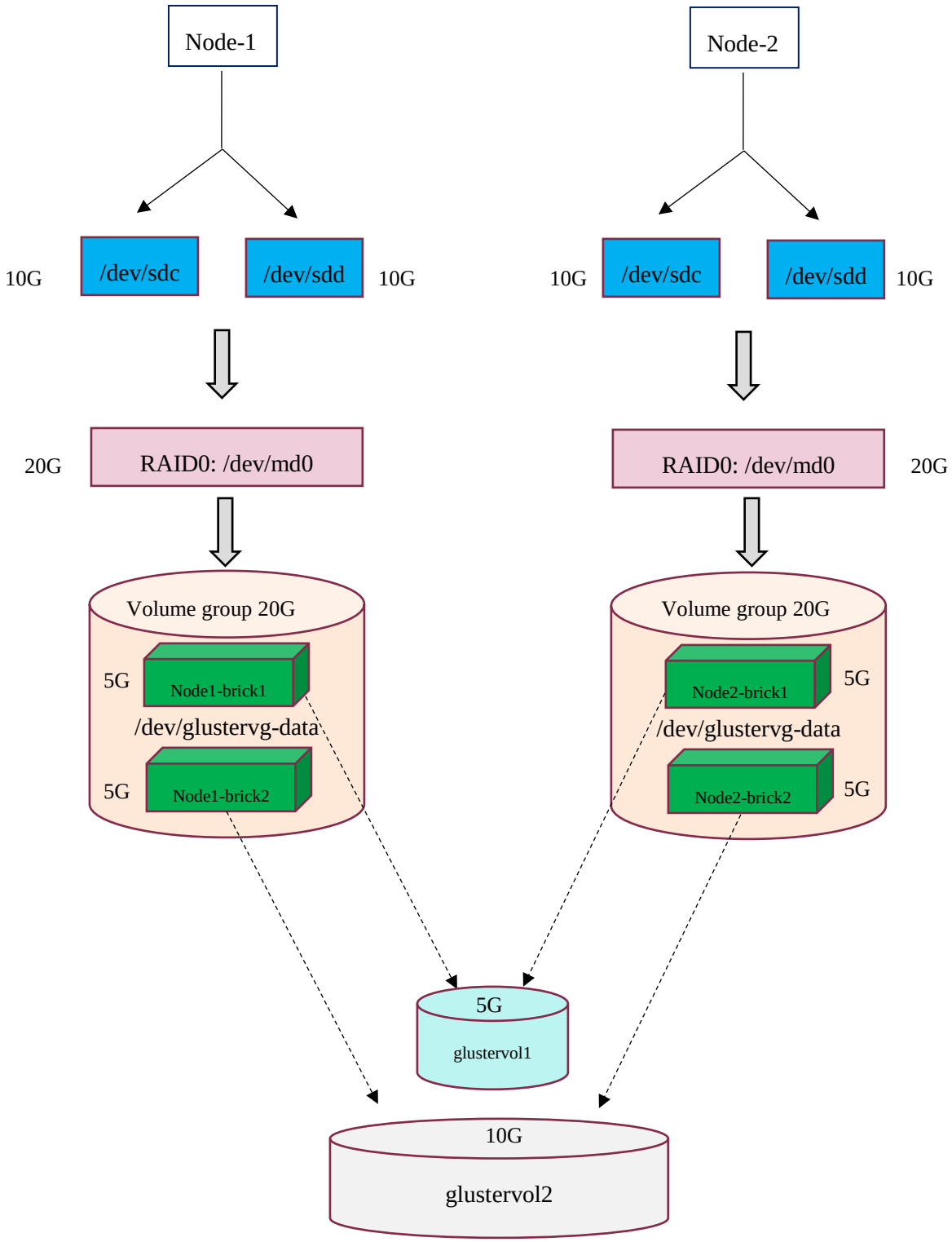


Fig1: Logical architecture

EXERCISE5: GLUSTERFS CLIENTS CONFIGURATION

Now that we have created the type GlusterFS volumes, we need to verify that the exported storage could be mounted by various operating systems. In a typical use case, we could have a cluster of multiple VMs sharing the exported storage as illustrated by the following figure. For instance, the cluster could be created by Azure scale sets. With such architecture, Red Hat storage / GlusterFS will provide highly available, persistent, elastic storage to be shared among the nodes.

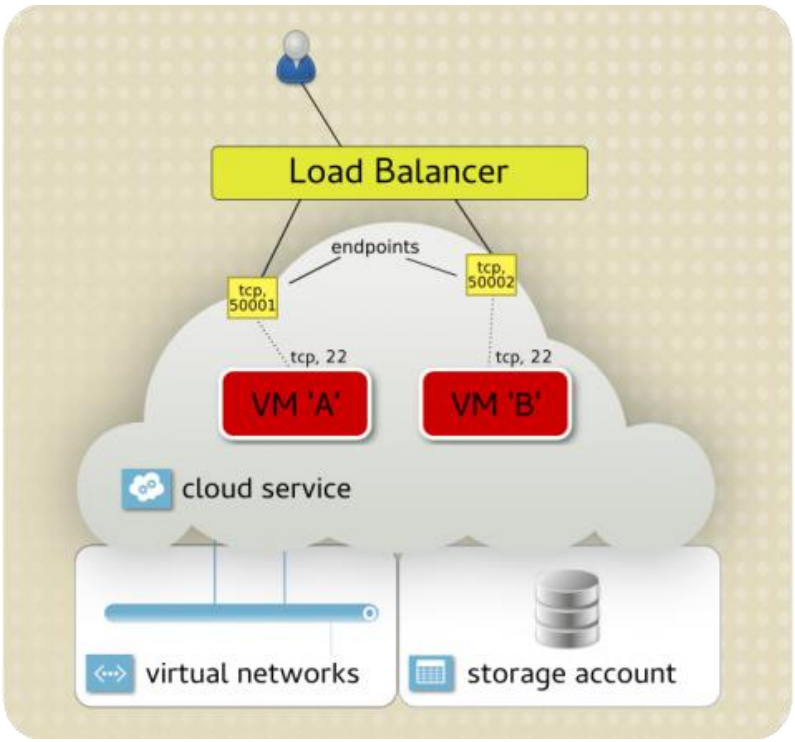


Fig2: GlusterFs as a backend to compute cluster

GlusterFS could be mounted on Linux systems using the native *glusterfs* client, or as an *NFS* or *samba* share. On windows, the filesystem could be exported with *samba* service and mounted as CIFS.

For simplicity reasons, we will deploy single Linux and Windows VMs. Then we will mount the created volumes on each of them.

Access from Linux via GlusterFS Native Client

1. Exit *node2* and provision a Linux CentOS vm, *node3*. Replace CHANGEME by the one you used in the previous exercises.

```
[node2]# exit


# azure vm create glusterfsRG node3 northeurope -F
gluster-vnet -j gluster-snet -f nic-node3 -i node3-pub -
w node3gluster CHANGEME -y Linux -Q
OpenLogic:CentOS:7.2:latest -u azureuser -M
.ssh/id_rsa.pub
```

2. Ssh into node3 and install glusterfs native client tools and some additional packages. All required packages are available by default in the CentOS 7 Base repository.

```
# azure vm list-ip-address | grep node3


# ssh -i .ssh/id_rsa azureuser@NODE3-PubIP
[node3]# sudo yum install glusterfs-fuse attr nfs-utils
httpd -y
```

3. From the azure portal, find node3 and associate *nic-node3* with a network security group that opens port 80 to the world.
4. Create a mount point and mount GlusterFS Volumes on node 3:

```
[node3]# sudo mkdir -p /shared/big


[node3]# sudo mount -t glusterfs node1:/glustervol1
/var/www/html


[node3]# sudo mount -t glusterfs node1:/glustervol2
/shared/big
```

5. Report the size of the shared file systems and explain the difference:

```
[node3]# sudo df -h /var/www/html/ /shared/big
node1:/glustervol1  5.0G   33M  5.0G   1% /var/www/html
```

```
node1:/glustervol2    10G    66M    10G    1% /shared/big
```

6. Start Apache on *node3*

```
[node3]# sudo systemctl start httpd && exit
```

7. Point your web browser to the public IP of *node3* or use *curl* on another bash session in your local machine to confirm that the website on node3 is active. If curl is not installed, you can install with "*sudo yum install curl -y*"

```
# curl http:// NODE3-PubIP
```

8. Copy some content to the shared volume

```
# ssh -i .ssh/id_rsa azureuser@NODE3-PubIP

[node3]# sudo cp /etc/passwd /shared/big && exit
```

9. Stop *node1*. Is the website still available? Can you list the contents of /share/big? Can you copy in some new contents? Can you explain what happened?

```
# azure vm stop glusterfsRG node1

# curl://http:node3(pubIP)

# ssh -i .ssh/id_rsa azureuser@NODE3-PubIP

[node3]# sudo ls /shared/big

[node3]# sudo cp /etc/shadow /shared/big/
cp: cannot create regular file '/shared/big/shadow':
Transport endpoint is not connected
```

```
[node3]# exit
```

10. Start node1 and wait for few seconds. Repeat the previous steps. Can you explain what just happened?

```
# azure vm start glusterfsRG node1

# curl://http:node3(pubIP)

# ssh -i .ssh/id_rsa azureuser@NODE3-PubIP

[node3]# sudo cp /etc/shadow /shared/big/

[node3]# ls -l /shared/big/
total 3
-rw-r--r--. 1 root root 1573 Dec 28 17:15 passwd
----------. 1 root root  736 Dec 28 17:22 shadow
```

11. Stop *Apache* and unmount the shared file system.

```
[node3]# sudo systemctl stop httpd

[node3]# sudo umount /shared/big /var/www/html && exit
```

Access from Linux via GlusterFS via NFS

NB: GlusterFS NFS server only supports version 3 of NFS protocol.

12. Enable NFS access to glustervol2 and verify the volumes configuration.

```
# ssh -i .ssh/id_rsa azureuser@NODE1-PubIP

[node1]# sudo gluster volume set glustervol2 nfs.disable
off

[node2]# sudo gluster volume status
```

```
Status of volume: glustervol1
Gluster process         TCP Port  RDMA Port  Online  Pid
------------------------------------------------------------
Brick node1:/bricks/brick1/repvol 49154 0      Y    1120
Brick node2:/bricks/brick1/repvol 49156 0      Y    1108
NFS Server on localhost           2049  0      Y    1097
Self-heal Daemon on localhost     N/A   N/A    Y    1106
NFS Server on node1               2049  0      Y    1105
Self-heal Daemon on node1         N/A   N/A    Y    1111

Task Status of Volume glustervol1
------------------------------------------------------------
There are no active volume tasks

Status of volume: glustervol2
Gluster process         TCP Port  RDMA Port  Online  Pid
------------------------------------------------------------
Brick node1:/bricks/brick2/distvol 49155  0    Y    1127
Brick node2:/bricks/brick2/distvol 49157  0    Y    1120
NFS Server on localhost            2049   0    Y    1097
NFS Server on node1                2049   0    Y    1105

Task Status of Volume glustervol2
------------------------------------------------------------
There are no active volume tasks
```

13. Add the following line to */etc/nfsmount.conf* on both *node1* and *node2*. It is recommended to reboot all glusterfs nodes (*node1* and *node2*) before continuing.

```
[node1]# sudo -s

[node1]# echo "Defaultvers=3" >> /etc/nfsmount.conf

[node1]# reboot && exit
```

```
# ssh -i .ssh/id_rsa azureuser@NODE2-PubIP

[node2]# sudo -s

[node2]# echo "Defaultvers=3" >> /etc/nfsmount.conf

[node2]# reboot && exit
```

14. Wait for a minute until *node1* and *node2* are up again, then mount GlusterFS Volumes via NFS:

```
# ssh -i .ssh/id_rsa azureuser@NODE3-PubIP

[node3]# sudo mount -t nfs node1:/glustervol2
/shared/big

[node3]# sudo mount

[node3]# sudo df -h
```

15. (optional) To persist the mount at boot, append the following line to */etc/fstab* on node3:

```
[node3]# sudo -s

[node3]# echo 'node1:/glustervol1  /var/www/html  xfs
defaults,_netdev,inode64,nobarrier,noatime,nouuid 0 2'
>> /etc/fstab
node1:/glustervol2    /mnt  nfs   defaults,_netdev  0  0
```

Access from Windows/Linux machines via CIFS

16. Install/update the *samba* required packages on both cluster nodes and start/enable Samba services:

PS: *node2* was pre-configured by the script *prepare-gluster-node.sh*

```
[node3]# exit && exit

# ssh -i .ssh/id_rsa azureuser@NODE1-PubIP

[node1]# sudo yum install samba samba-client samba-
common samba-vfs-glusterfs -y

[node1]# sudo systemctl start smb.service

[node1]# sudo systemctl enable smb.service

[node1]# sudo systemctl start nmb.service

[node1]# sudo systemctl enable nmb.service
```

Once a new GlusterFS Volume is created/started, it is added to the Samba configuration file, automatically as *gluster-<Volume_name>* file share.

17. Find the GlusterFS shares in */etc/samba/smb.conf*

```
[node1]# sudo cat /etc/samba/smb.conf
... output omitted ...
 [gluster-glustervol1]
comment = For samba share of volume glustervol1
vfs objects = glusterfs
glusterfs:volume = glustervol1
glusterfs:logfile = /var/log/samba/glusterfs-
glustervol1.%M.log
glusterfs:loglevel = 7
path = /
read only = no
guest ok = yes

[gluster-glustervol2]
comment = For samba share of volume glustervol2
vfs objects = glusterfs
```

```
glusterfs:volume = glustervol2
glusterfs:logfile = /var/log/samba/glusterfs-
glustervol2.%M.log
glusterfs:loglevel = 7
path = /
read only = no
guest ok = yes

[node1]# sudo -s
```

18. Use your preferred text editor to add a new parameter kernel **share modes = No** to the GlusterFS samba configuration on both *node1* and *node2*.

```
[gluster-glustervol2]
kernel share modes = No
```

19. Prepare the *glustervol2* GlusterFS Volume for Samba:

```
[node1]# sudo gluster volume set glustervol2 stat-
prefetch off
volume set: success

[node1]# sudo gluster volume set glustervol2
server.allow-insecure on
volume set: success

[node1]# sudo gluster volume set glustervol2
storage.batch-fsync-mode sudo lazy-open 0
volume set: success
```

20. Use your preferred editor to add the following line to */etc/glusterfs/glusterd.vol* before the line *#end-volume*, on *node1* and *node2*:

```
option rpc-auth-allow-insecure on
```

21. Restart *glusterfs* service:

```
[node1]# sudo systemctl restart glusterd
```

22. Add a new samba user on *node1*:

```
[node1]# sudo adduser sambauser

[node1]# sudo smbpasswd -a sambauser
New SMB password:
Retype new SMB password:
Added user sambauser.
```

23. Restart Samba and turn SELinux to permissive mode:

```
[node1]# sudo systemctl restart smb.service

[node1]# sudo systemctl restart nmb.service

[node1]# sudo setenforce 0 && exit
```

24. Exit from node1, ssh to node2 and repeat steps 20, 21, 22 and 23.
25. On *node3*, mount GlusterFS Volume via CIFS (Samba) and verify the file system:

```
# ssh -i .ssh/id_rsa azureuser@NODE3-PubIP

[node3]# yum install cifs-utils -y

[node3]# mount -t cifs \\\\node1\\gluster-glustervol2
/mnt/ -o user=sambauser

[node3]# sudo mount
\\10.0.1.5\gluster-glustervol2 on /share/big type cifs
(rw,relatime,vers=1.0,cache=strict,username=sambauser,do
main=NODE1,uid=0,noforceuid,gid=0,noforcegid,addr=10.0.1
.4,unix,posixpaths,serverino,acl,rsize=1048576,wsize=655
36,actimeo=1)
```

```
[node3]# sudo df -h /mnt && exit
Filesystem                Size Used Avail Use% Mounted on
\\node1\gluster-glustervol2 10G   66M   10G   1% /mnt
```

26. Use Azure portal to create a new Windows 2008 VM, in the same resource group *glusterfsRG*
27. Mount *glustervol2* on Windows:

```
c:\>net use Z: \\node1\gluster-glustervol2
/user:sambauser
The command completed successfully.
```

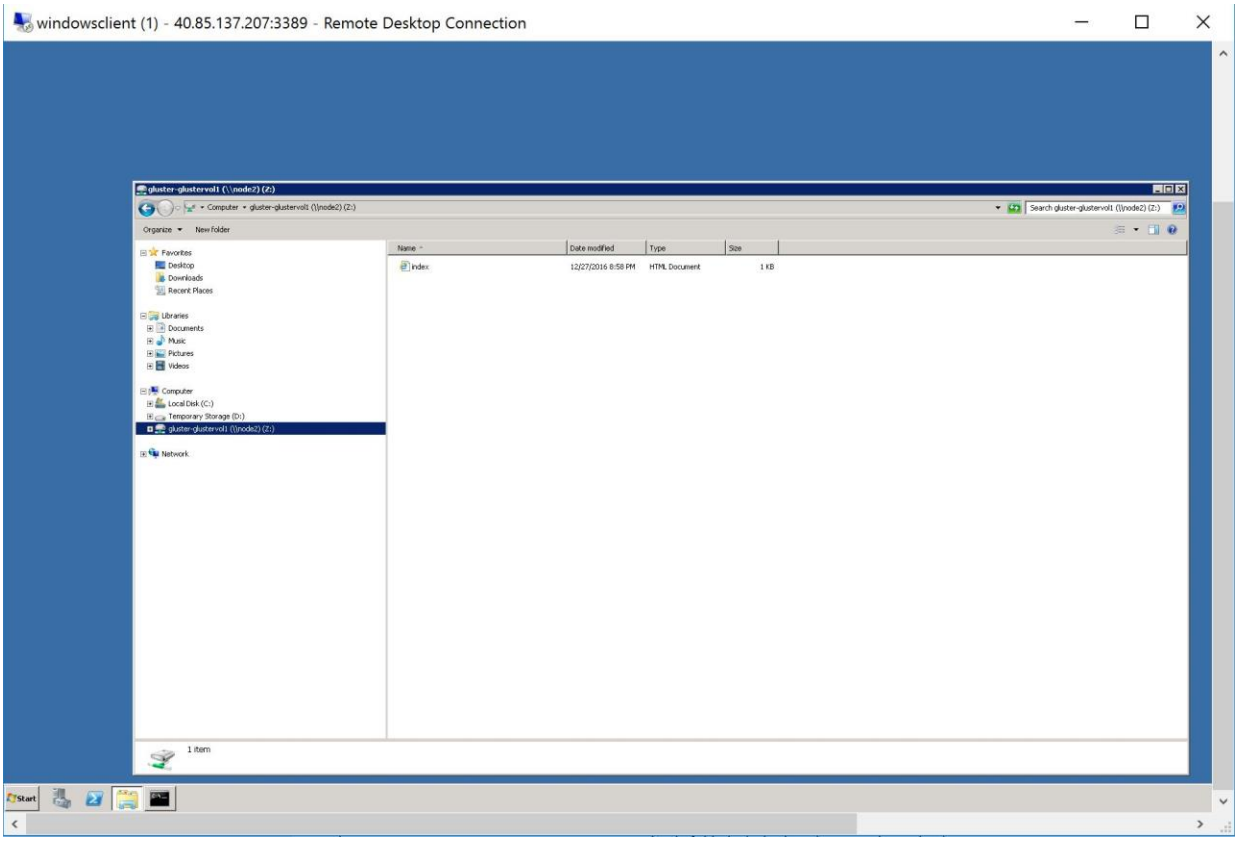


Fig3: Adding glusterfs share from windows client

EXERCISE6: EXTEND GLUSTERFS SYSTEM WITHOUT DOWNTIME

GlusterFS offers the option to extend the shared filesystem without down time. To do so, we need to add a number of bricks that is a multiple of the replica or stripe count. For example, to expand a distributed replicated volume with a replica count of 2, we need to add bricks in multiples of 2.

1. Show the volume parameters before the extension:

```
# ssh -i .ssh/id_rsa azureuser@NODE1-PubIP

[node1]# sudo gluster volume info all
Volume Name: glustervol1
Type: Replicate
Volume ID: bf14d223-f8b7-43b3-8c6f-2cfc6cb40c93
Status: Started
Snapshot Count: 0
Number of Bricks: 1 x 2 = 2
Transport-type: tcp
Bricks:
Brick1: gluster1.example.com:/bricks/brick1/repvol
Brick2: gluster2.example.com:/bricks/brick1/repvol
... output omitted ...
```

2. Now, we will leverage the free capacity in the volume group *glusterfsvg* from each node to create an additional brick *brick3* on *node1* and another one on *node2*.

```
[node1]# sudo lvcreate -L 5G -n brick3 glustervg-data

[node1]# sudo mkfs.xfs /dev/glustervg-data/brick3

[node1]# sudo mkdir /bricks/brick3

[node1]# sudo mount /dev/glustervg-data/brick3
/bricks/brick3/
```

```
[node1]# sudo -s


[node1]# echo '/dev/glustervg-data/brick3
/bricks/brick3    xfs     defaults' >> /etc/fstab


[node1]# mount |grep brick3
/dev/mapper/vg_gluster-brick3 on /bricks/brick3 type xfs
(rw,relatime,seclabel,attr2,inode64,noquota)
```

3. Create a necessary the sub-directory mount point */bricks/brick3/distrepvol*.

```
[node1]# mkdir /bricks/brick3/distrepvol
```

4. Exit *node1*, ssh to *node2* and repeat the steps 2 and 3.
5. Use the two XFS bricks, newly created, to extend the GlusterFS Volume without any downtime:

```
[node1]# gluster volume add-brick glustervol1
node1:/bricks/brick3/distrepvol
node2:/bricks/brick3/distrepvol force
volume add-brick: success
```

6. Verify the Volume:

```
[node1]# gluster volume info glustervol1
Volume Name: glustervol1
Type: Distributed-Replicate
Volume ID: bf14d223-f8b7-43b3-8c6f-2cfc6cb40c93
Status: Started
Snapshot Count: 0
Number of Bricks: 2 x 2 = 4
Transport-type: tcp
Bricks:
Brick1: node1:/bricks/brick1/repvol
Brick2: node2:/bricks/brick1/repvol
```

```
Brick3: node1:/bricks/brick3/distrepvol
Brick4: node2:/bricks/brick3/distrepvol
Options Reconfigured:
transport.address-family: inet
performance.readdir-ahead: on
nfs.disable: off
```

```
# ssh -i .ssh/id_rsa azureuser@NODE3-PubIP


[node3]# sudo mount -t glusterfs node1:/glustervol1
/var/www/html


[node3] df -h /var/www/html
Filesystem            Size  Used Avail Use% Mounted on
node1:/glustervol1    10G   66M   10G   1% /var/www/html
```

Now the Volume is extended with two bricks and became **Distributed-Replicate**.

EXERCISE8: INSTALLING THE GRAPHICAL CONSOLE

The *oVirt* upstream project, provides a graphical management console that can be used to manage the GlusterFS cluster. Let's install it and explore it.

1. Subscribe the server to the *oVirt* project repository and install *ovirt-engine* by running

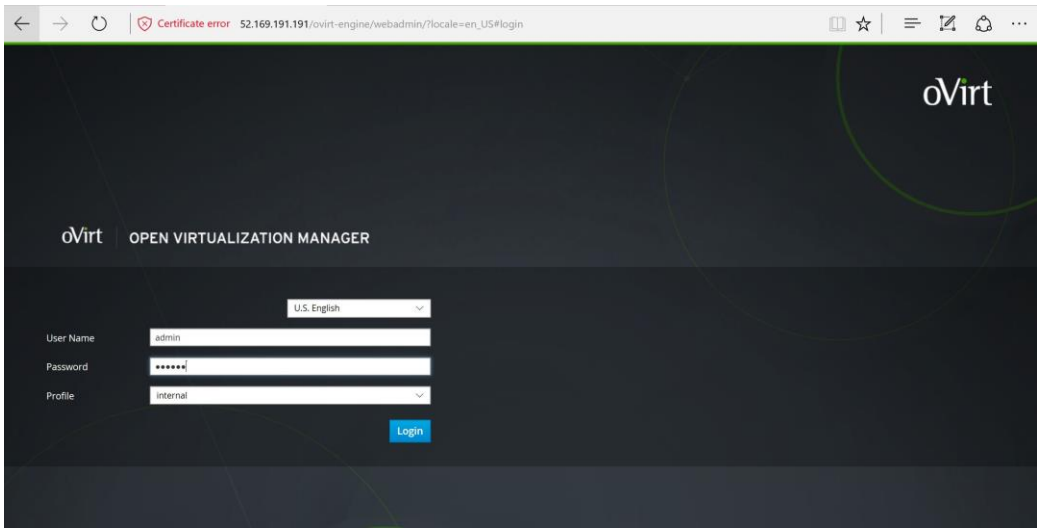
```
[node3]# sudo yum install
http://resources.ovirt.org/pub/yum-repo/ovirt-
release36.rpm -y


[node3]# sudo yum install ovirt-engine -y
```

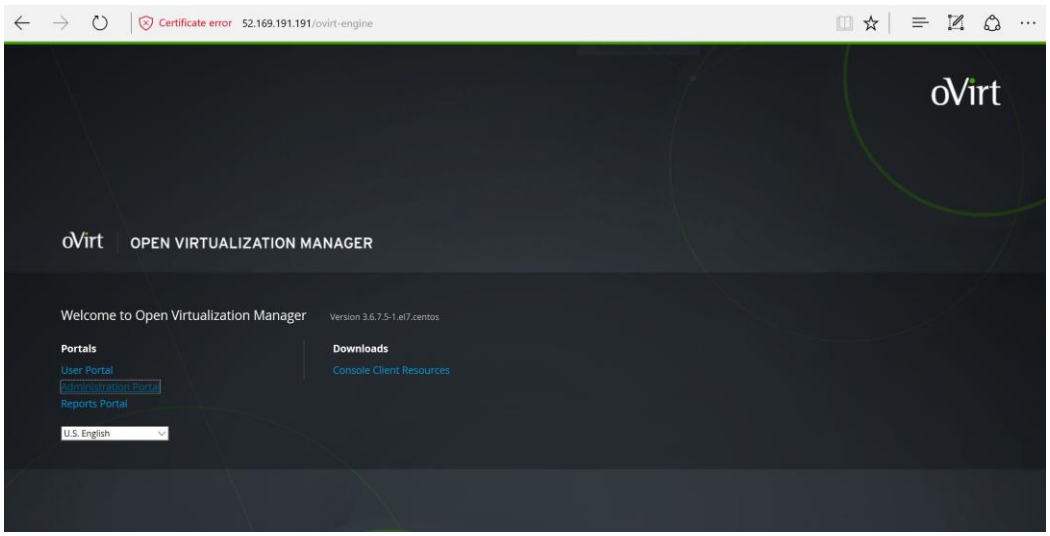
2. Once the installation is completed, set up *ovirt* with *gluster*. The installer will take you through a series of interactive questions. Accept the default values. But don't setup the firewall. When prompted for the application mode, choose *Gluster*. Ignore the warning about the RAM resources.

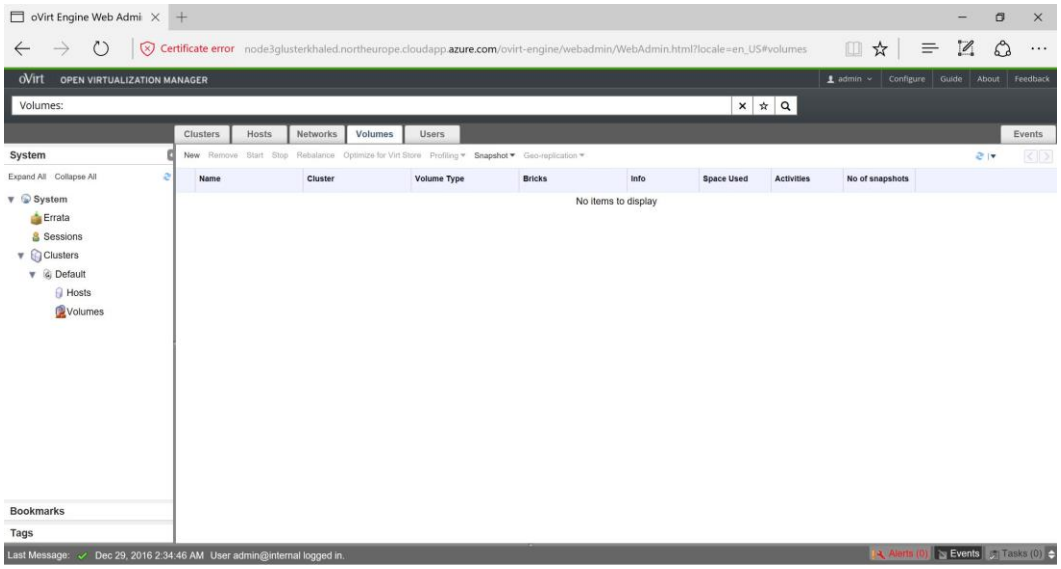
```
[node3]# sudo engine-setup
……
    --== CONFIGURATION PREVIEW ==--

          Application mode                    : gluster
          Default SAN wipe after delete       : False
          Update Firewall                     : False
          Host FQDN                           : node3
          Engine database secured connection  : False
          Engine database host                : localhost
          Engine database user name           : engine
          Engine database name                : engine
          Engine database port                : 5432
          Engine database host name validation   : False
          Engine installation                    : True
          PKI organization                       : Test
          Configure local Engine database        : True
          Set application as default page        : True
```

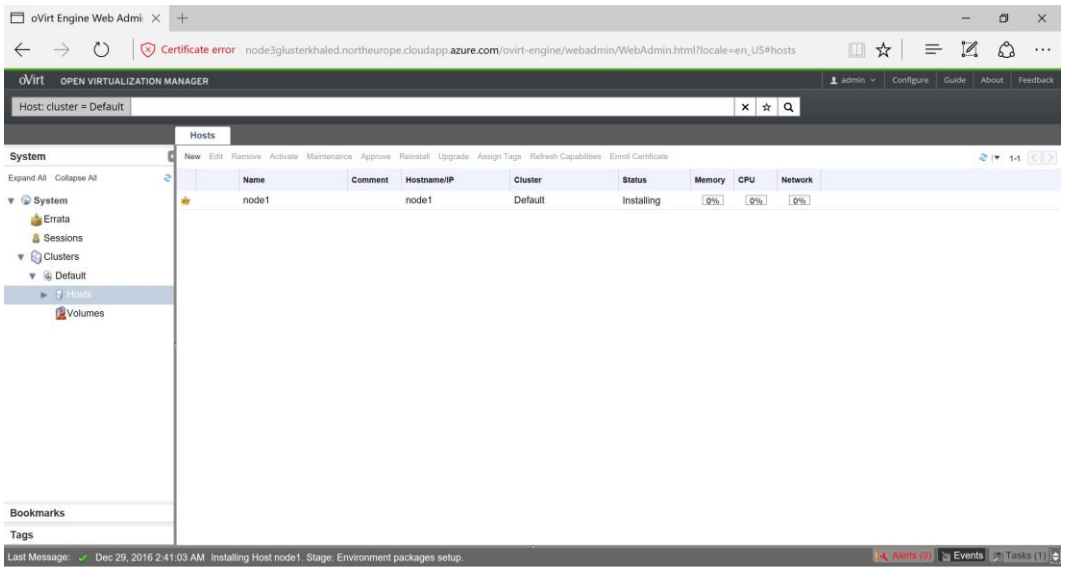
```
          Configure Apache SSL                    : True
          Configure VMConsole Proxy               : True
          Engine Host FQDN                        : node3
          Configure WebSocket Proxy               : True
```

3. Now, from your local graphical environment, browse through the following URL “https://<node3-ip>/ovirt-engine. Accept the self-signed certificate. Provide the user name *admin* and the password you chose at setup.
4. Explore features like adding new/ importing existing cluster, creating/deleting volumes, adding/deleting bricks, set/reset volume options, optimize volume for virt store, Rebalance, remove brick features.









5. Well done! Now that you have accomplished all the required steps in this lab, you deserve a treat ☺

```
[node3]# sudo yum install sl -y

[node3]# sl
```

REFERENCES

USEFUL LINKS

https://access.redhat.com/documentation/en/red-hat-storage/

https://access.redhat.com/articles/using-gluster-with-azure

https://wiki.centos.org/HowTos/GlusterFSonCentOS

MICROSOFT AND RED HAT PARTNERSHIP

http://openness.microsoft.com/2016/04/15/microsoft-red-hat-partnership-accelerating-partner-opportunities/

https://www.redhat.com/en/microsoft