OpenSDS Aruba POC Test Plan

June 2018

Revision: 0.6

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Document Revision History

Version	Date	Comments
0.1	6/12/2018	Initial revision.
0.2	6/15/2018	Added content to sections host-based replication, array-based replication, CLI guide, Cinder compatible APIs.
0.3	6/20/2018	Modified dates after reviewing it at OSS Summit Tokyo
0.4	6/26/2018	Add Dashboard section; Modify CLI section.
0.5	6/29/2018	Update Dashboard section and Installation section.
0.6	7/05/2018	Update the use cases of dashboard and replication with kubernetes

Related Documents

Author	Documents

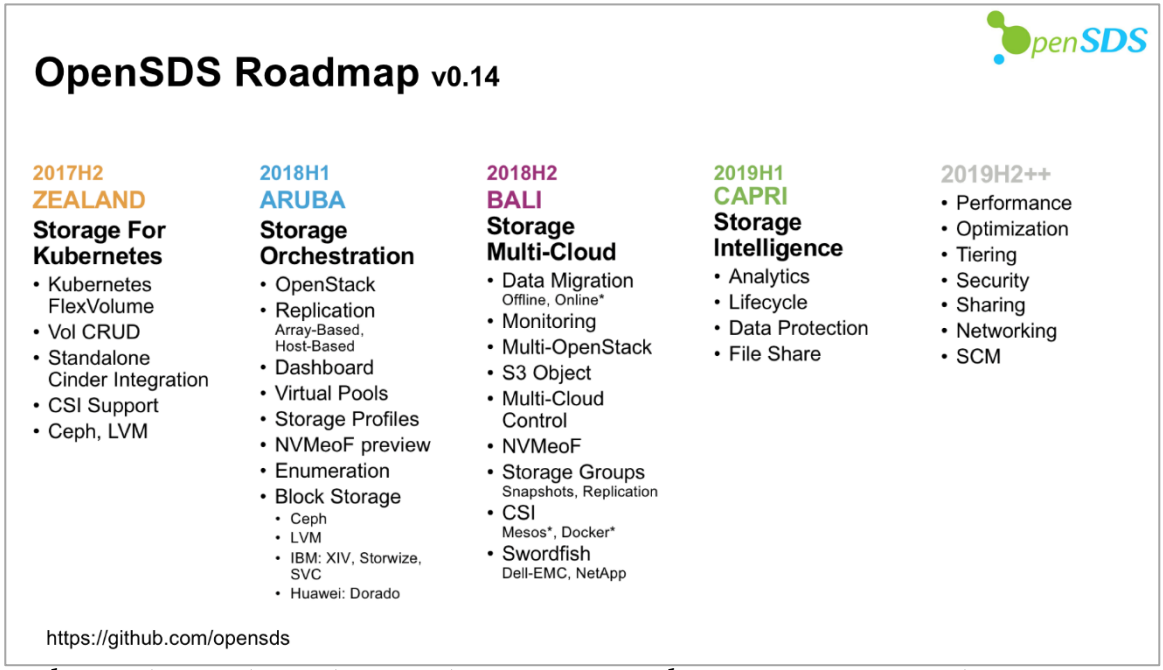
Table of Contents

1 Overview

OpenSDS Aruba will be released in the week of June 27, 2018. This document serves as the OpenSDS Aruba POC Test Plan. It covers the following topics:

1. Overall project scope and objectives
2. Test objectives and success criteria
3. Test resources required
4. Test schedule
5. Use cases
    a. OpenStack/Kubernetes/bare-metal/mixed environment provisioning
    b. Host and storage replication, and local and remote replication
    c. Test cases for each use case

1.1 Project Scope and Objectives



In the Zealand release, basic volume and snapshot CRUD functionalities were added and Kubernetes CSI/FlexVolume support was also added.

During the Aruba release, the focus has been on storage orchestration, building advanced automated storage and data services across traditional data centers, private and public clouds. Functionalities in this release include basic OpenStack integration, integrating with Keystone for identity service, array-based and host-based replication, and storage profiles design based on Swordfish. A deployment tool using Ansible is also available to install OpenSDS with Keystone and Dashboard.

1.2 POC Timeline

June 15: POC plan draft ready for EUAC review

June 20: Aruba release. POC plan approval.

July 1-31: POC testing

August 7: POC results/comments/testimonials

2 System requirements

2.1 Hardware

The hardware requirements are described in this section.

For array-based replication, two physical servers and two Dorado arrays are needed.

For host-based replication, two physical servers are needed.

For other tests described in this POC, one physical server or one VM can be used for basic testing.

2.2 Software

The software requirements are described in this section.

2.2.1 OS

Ubuntu 16.04.2 has been used during the testing and therefore should be used in this POC:

```
root@proxy:~# cat /etc/issue
Ubuntu 16.04.2 LTS \n \l
```

For host-based replication, required DRBD software is described in the relevant section later. Other required software is described in the installation section.

3 Features

Features to be tested include the following:

- Multitenancy using Keystone
- Create/delete volume
- Expand volume
- Create/delete snapshot
- Create volume from snapshot
- Create volume group
- Create/delete profile
- Array-based replication
- Host-based replication
- Use Cinder-compatible API in OpenStack

Supported storage backends include the following:

- LVM
- Ceph
- Dorado
- IBM storage via Cinder driver?
- Cinder stand alone with LVM
- Cinder in an OpenStack deployment with LVM

Supported protocols:

- iSCSI

- FC
- RBD

Testing environment includes the following:

- OpenSDS with Kubernetes
- OpenSDS with OpenStack (full OpenStack deployment or Cinder stand-alone)
- Hotpot only on bare-metal or a VM

4 Installation

In the section, how to install OpenSDS using Ansible playbook will be discussed. Section 4.1 is prerequisites for Installation. If you are testing OpenSDS with Kubernetes, read section *4.2 Kubernetes Local Cluster Deployment* first. Otherwise, go to section 4.3 directly. For OpenSDS with OpenStack, testing with Cinder stand-alone is part of the OpenSDS ansible installation in section 4.3, and testing with a separate Cinder deployment is discussed in section *5.3 OpenStack*.

4.1 Prerequisite

4.1.1 Packages

Install following packages:

```
apt-get install vim git curl wget make gcc zip
```

4.1.2 Golang

You can install golang by executing commands blow:

```
wget https://storage.googleapis.com/golang/go1.9.2.linux-amd64.tar.gz
tar -C /usr/local -xzf go1.9.2.linux-amd64.tar.gz
echo 'export PATH=$PATH:/usr/local/go/bin' >> /etc/profile
echo 'export GOPATH=$HOME/gopath' >> /etc/profile
source /etc/profile
```

Check golang version information:

```
root@proxy:~# go version
go version go1.9.2 linux/amd64
```

4.1.3 docker

Install docker:

```
wget
https://download.docker.com/linux/ubuntu/dists/xenial/pool/stable/amd64/doc
ker-ce_18.03.1~ce-0~ubuntu_amd64.deb
dpkg -i docker-ce_18.03.1~ce-0~ubuntu_amd64.deb
```

Version information:

```
root@proxy:~# docker version
Client:
  Version:      18.03.1-ce
  API version:  1.37
  Go version:   go1.9.5
  Git commit:   9ee9f40
  Built:        Thu Apr 26 07:17:20 2018
  OS/Arch:      linux/amd64
  Experimental: false
  Orchestrator: swarm

 Server:
  Engine:
   Version:      18.03.1-ce
   API version:  1.37 (minimum version 1.12)
   Go version:   go1.9.5
   Git commit:   9ee9f40
   Built:        Thu Apr 26 07:15:30 2018
   OS/Arch:      linux/amd64
   Experimental: false
```

4.2 Kubernetes Local Cluster Deployment

4.2.1 Install Etcd

You can install etcd by executing commands blow:

```
cd $HOME
wget https://github.com/coreos/etcd/releases/download/v3.3.0/etcd-v3.3.0-
linux-amd64.tar.gz
tar -xzf etcd-v3.3.0-linux-amd64.tar.gz
cd etcd-v3.3.0-linux-amd64
sudo cp -f etcd etcdctl /usr/local/bin/
```

4.2.2 kubernetes local cluster

You can start the latest k8s local cluster by executing commands blow:

```
cd $HOME
git clone https://github.com/kubernetes/kubernetes.git
cd $HOME/kubernetes
git checkout v1.10.0
make
echo alias kubectl='$HOME/kubernetes/cluster/kubectl.sh' >> /etc/profile
ALLOW_PRIVILEGED=true
FEATURE_GATES=CSIPersistentVolume=true,MountPropagation=true
```

```
RUNTIME_CONFIG="storage.k8s.io/v1alpha1=true" LOG_LEVEL=5 hack/local-up-cluster.sh
```

4.3 OpenSDS Deployment

In this section, the steps to deploy an OpenSDS local cluster are described.

4.3.1 Pre-config

First download some system packages:

```
apt-get install -y git curl wget
```

Then config `/etc/ssh/sshd_config` file and change one line:

```
PermitRootLogin yes
```

Next generate ssh-token:

```
ssh-keygen -t rsa

ssh-copy-id -i ~/.ssh/id_rsa.pub <ip_address> # IP address of the target machine of the installation
```

4.3.2 Download opensds-installer code

```
git clone https://github.com/opensds/opensds-installer.git

cd opensds-installer/ansible
```

4.3.3 Install ansible tool

To install ansible, run the commands below:

```
# This step is needed to upgrade ansible to version 2.4.2 which is required for the "include_tasks" ansible command.
chmod +x ./install_ansible.sh && ./install_ansible.sh
ansible --version # Ansible version 2.4.x is required.
```

4.3.4 Configure OpenSDS cluster variables

4.3.4.1 System environment

To integrate OpenSDS with cloud platform (for example k8s), modify `nbp_plugin_type` variable in `group_vars/common.yml`:

```
nbp_plugin_type: hotpot_only # hotpot_only is the default integration method. Other available options are 'csi' and 'flexvolume'.
```

Note: If 'csi' is the selected nbp_plugin_type, make sure section *4.2 Kubernetes Local Cluster Deployment* is followed before proceeding.

Change `opensds_endpoint` to the actual IP address:

```
opensds_endpoint: http://127.0.0.1:50040 # The IP (127.0.0.1) should be replaced with
the opensds actual endpoint IP
```

4.3.4.2 LVM

If lvm is chosen as the storage backend, there is no need to modify `group_vars/osdsdock.yml` because it is the default choice:

```
enabled_backend: lvm # Change it according to the chosen backend. Supported backends
include 'lvm', 'ceph', and 'cinder'
```

Change `tgtBindIp` variable in `group_vars/lvm/lvm.yaml` to your real host IP address:

```
tgtBindIp: 127.0.0.1 # change tgtBindIp to your real host ip, run 'ifconfig' to check
```

4.3.4.3 Ceph

If `ceph` is chosen as storage backend, modify `group_vars/osdsdock.yml`:

```
enabled_backend: ceph # Change it according to the chosen backend. Supported
backends include 'lvm', 'ceph', and 'cinder'.
```

Configure `group_vars/ceph/all.yml` with an example below:

```
ceph_origin: repository
ceph_repository: community
ceph_stable_release: luminous # Choose luminous as default version
public_network: "192.168.3.0/24" # Run 'ip -4 address' to check the ip address
cluster_network: "{{ public_network }}"
monitor_interface: eth1 # Change to the network interface on the target
machine
devices: # For ceph devices, append ONE or MULTIPLE devices like the example
below:
  - '/dev/sda' # Ensure this device exists and available if ceph is chosen
  #- '/dev/sdb'  # Ensure this device exists and available if ceph is chosen
osd_scenario: collocated
```

4.3.4.4 Cinder

If cinder is chosen as storage backend, modify group_vars/osdsdock.yml:

```
enabled_backend: cinder # Change it according to the chosen backend. Supported backends
include 'lvm', 'ceph', and 'cinder'

# Use block-box install cinder_standalone if true, see details in:
```

```
use_cinder_standalone: true
```

Configure the auth and pool options to access cinder in `group_vars/cinder/cinder.yaml`. Do not need to make additional configure changes if using cinder standalone.

4.3.5 Check if the hosts can be reached

```
ansible all -m ping -i local.hosts
```

4.3.6 Run opensds-ansible playbook to start deploy

```
ansible-playbook site.yml -i local.hosts
```

4.4 Test OpenSDS

4.4.1 Use OpenSDS CLI Tool

Configure OpenSDS CLI tool:

```
sudo cp /opt/opensds-linux-amd64/bin/osdsctl /usr/local/bin

export OPENSDS_ENDPOINT=http://{your_real_host_ip}:50040

export OPENSDS_AUTH_STRATEGY=keystone

source /opt/stack/devstack/openrc admin admin

osdsctl pool list # Check if the pool resource is available
```

Create a default profile:

```
osdsctl profile create '{"name": "default", "description": "default policy"}'
```

Create a volume:

```
osdsctl volume create 1 --name=test-001
```

List all volumes:

```
osdsctl volume list
```

Delete the volume:

```
osdsctl volume delete <your_volume_id>
```

4.4.2 Test CSI Plugin

After running the ansible deployment tool in "csi" mode, three CSI plugin pods can be found by `kubectl get pods` like below:

- csi-provisioner-opensdsplugin
- csi-attacher-opensdsplugin
- csi-nodeplugin-opensdsplugin

More design details about CSI can be found from CSI Volume Plugins in Kubernetes Design Doc.

To test the OpenSDS CSI plugin, create an example nginx application:

```
cd /opt/opensds-k8s-linux-amd64/ && kubectl create -f
csi/server/examples/kubernetes/nginx.yaml
```

This will create an OpenSDS volume and mount the volume at `/var/lib/www/html`.

Use the following command to inspect the nginx container to verify it.

```
docker exec -it <nginx container id> /bin/bash
```

Clean up example nginx application by the following commands:

```
kubectl delete -f csi/server/examples/kubernetes/nginx.yaml
```

4.4.3 OpenSDS Dashboard

OpenSDS UI dashboard is available at *`http://{your_host_ip}:8088`*, please login the dashboard using the default admin credentials: *`admin/opensds@123`*. Create tenant, user, and profiles as admin.

Logout of the dashboard as admin and login the dashboard again as a non-admin user to create volume, snapshot, expand volume, create volume from snapshot, create volume group.

4.5 Cleanup OpenSDS

4.5.1 Run opensds-ansible playbook to clean the environment

```
ansible-playbook clean.yml -i local.hosts
```

This should clean up hotpot as well as nbp (including the CSI plugin).

4.5.2 Run ceph-ansible playbook to clean ceph cluster if ceph is deployed

```
cd /opt/ceph-ansible

sudo ansible-playbook infrastructure-playbooks/purge-cluster.yml -i ceph.hosts
```

In addition, clean up the logical partition on the physical block device used by ceph, using the `fdisk` tool.

4.5.3 Remove ceph-ansible source code (optional)

```
sudo rm -rf /opt/ceph-ansible
```

4.6 Troubleshooting

4.6.1 Problem Starting CSI Plugin

If the CSI plugin cannot be started, check if OpenSDS endpoint IP is configured.

```
vi csi/server/deploy/kubernetes/csi-configmap-opensdsplugin.yaml
```

The IP (127.0.0.1) should be replaced with the opensds and identity actual endpoint IP.

```
kind: ConfigMap

apiVersion: v1

    metadata:

name: csi-configmap-opensdsplugin

    data:

    opensdsendpoint: http://127.0.0.1:50040

    osauthurl: http://127.0.0.1/identity
```

Manually create OpenSDS CSI pods:

```
kubectl create -f csi/server/deploy/kubernetes
```

After this, three pods can be found by `kubectl get pods` like below:

- csi-provisioner-opensdsplugin
- csi-attacher-opensdsplugin

- csi-nodeplugin-opensdsplugin

To test the OpenSDS CSI plugin, create an example nginx application:

```
kubectl create -f csi/server/examples/kubernetes/nginx.yaml
```

This will mount an OpenSDS volume into `/var/lib/www/html`.

Use the following command to inspect the nginx container to verify it.

```
docker exec -it <nginx container id> /bin/bash
```

Clean up example nginx application and opensds CSI pods by the following commands.

```
kubectl delete -f csi/server/examples/kubernetes/nginx.yaml

kubectl delete -f csi/server/deploy/kubernetes
```

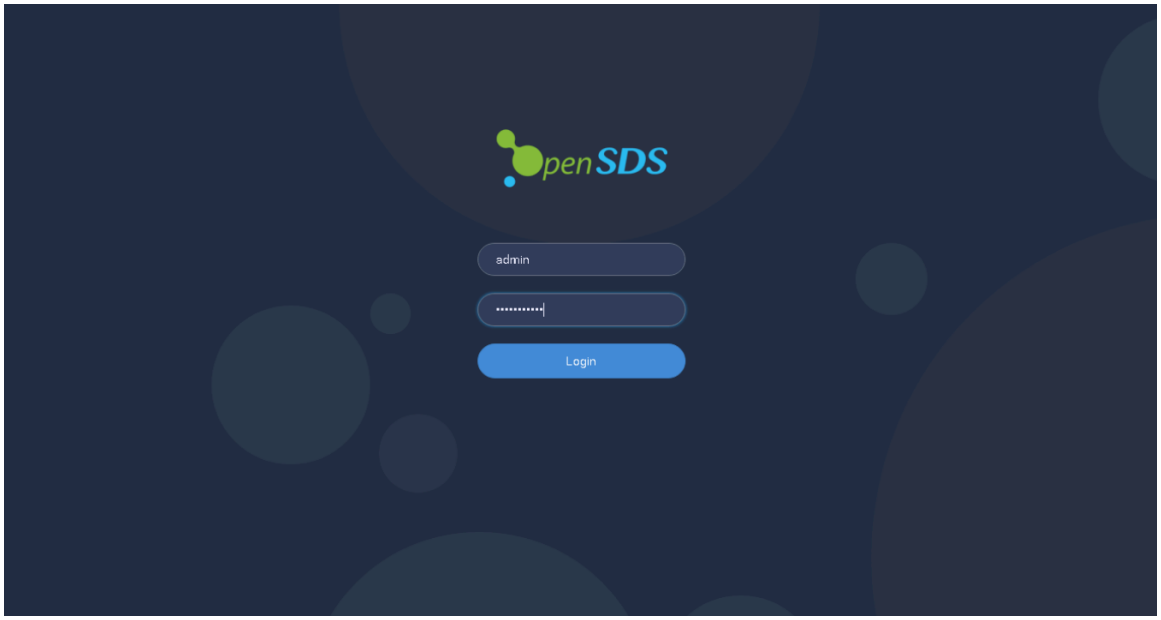
5 Use Cases

5.1 Dashboard

5.1.1 Administrator configuration

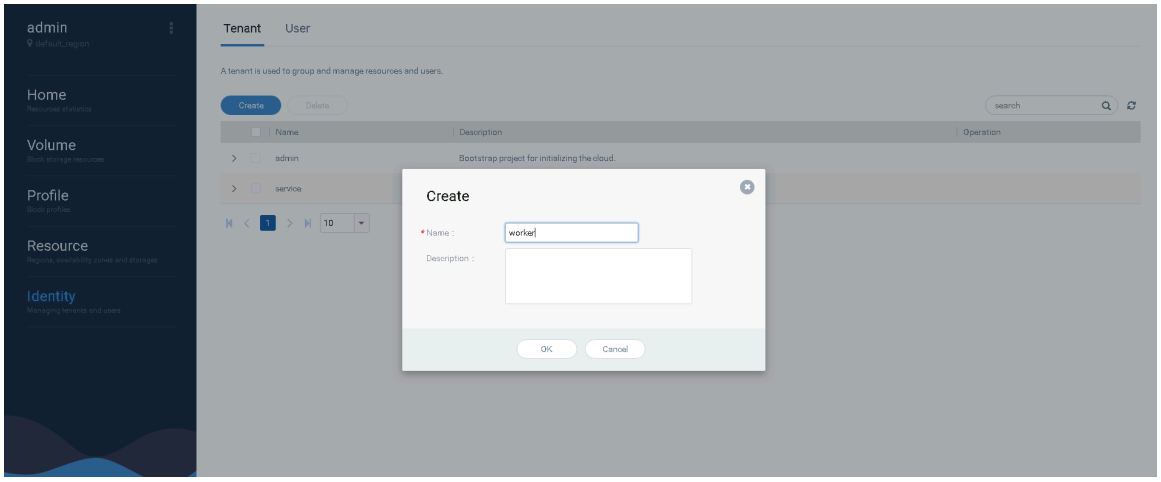
5.1.1.1 Login

Log into dashboard as admin. Password is opensds@123



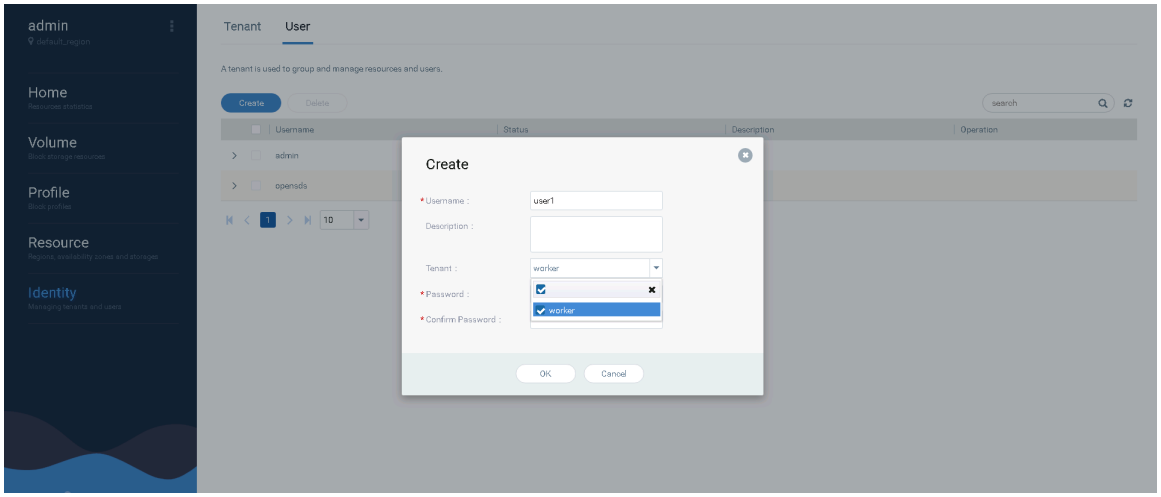
5.1.1.2 Create tenant

Go to the tab: Identity/Tenant, click "Create" button and input the necessary information, then submit the request.



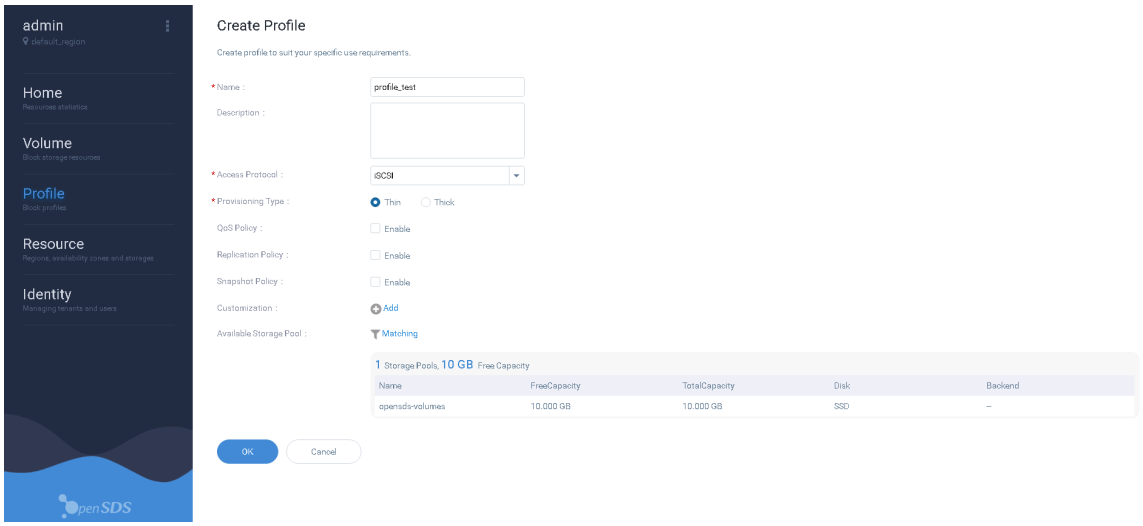
5.1.1.3 Create user

Go to the tab: Identity/User, click "Create" button and input the necessary information, then submit the request. Notes: On the page of creation, you can specify tenants that the user belongs to.



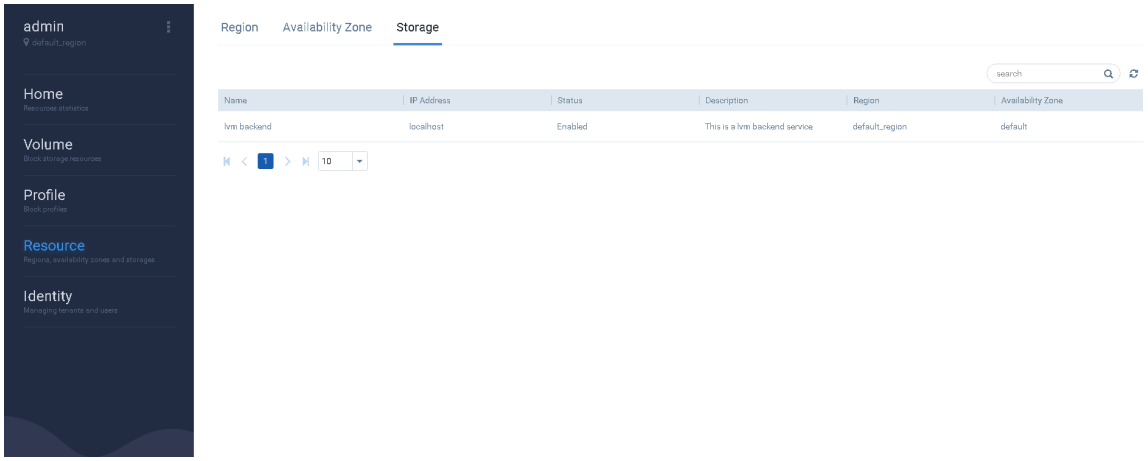
5.1.1.4 Create profile

Go to the tab: Profile, click “Create” button and input the necessary information, then submit the request.



5.1.1.5 View resources

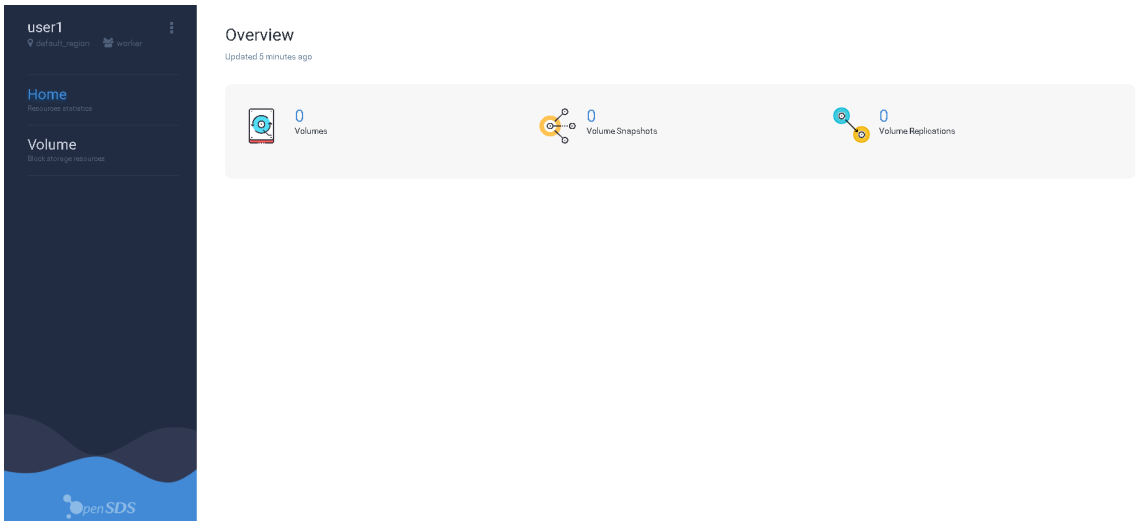
Go to Resource tab, check Availability Zone, Region and Storage resources.



5.1.2 Tenant provision volume

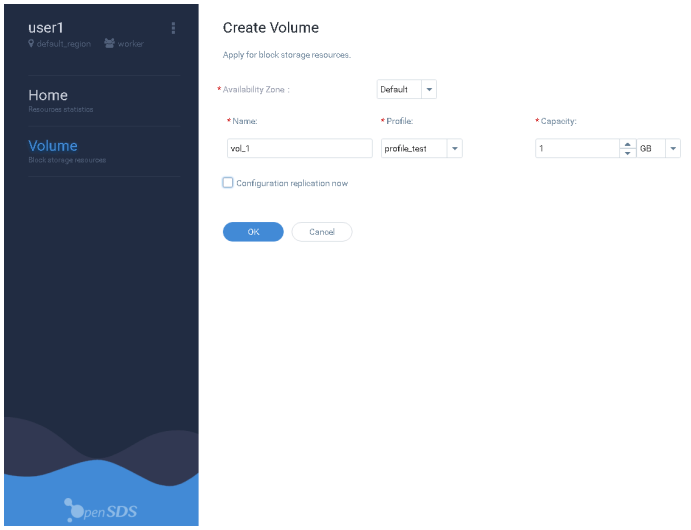
5.1.2.1 Overview

Log into dashboard as user(user1). The home page shows statistics of volumes, snapshots and replications.



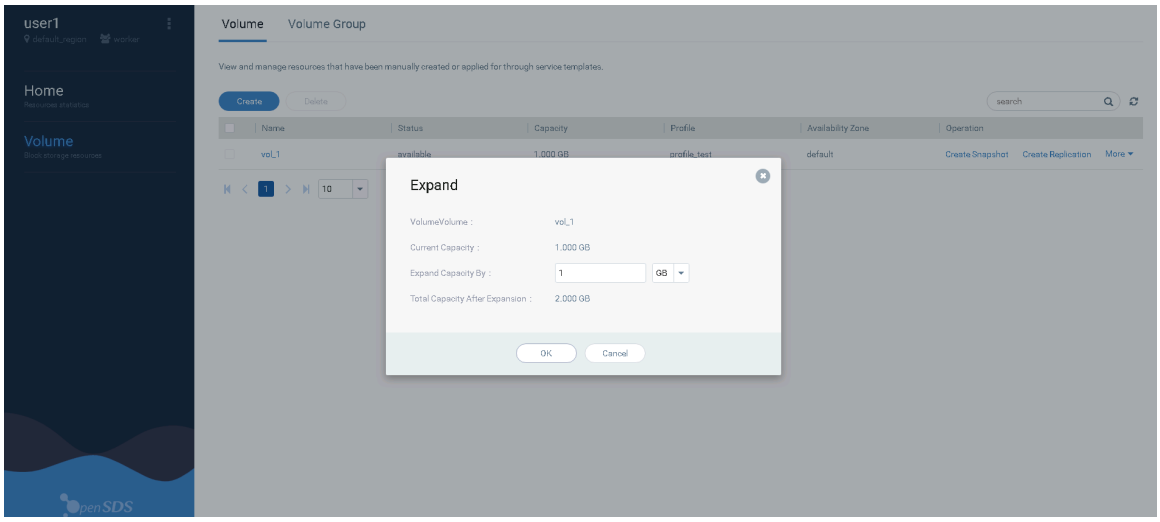
5.1.2.2 Create volume

Go to the tab: Volume/Volume, click “Create” button and input the necessary information, such as name, size, profile, etc., then submit the request.



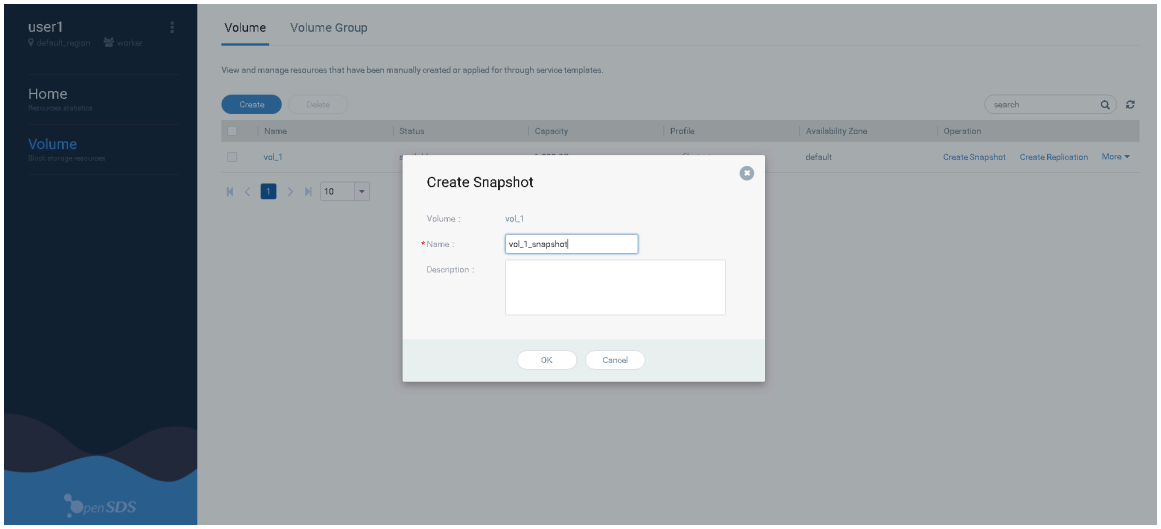
5.1.2.3 Expand volume size

Go to the tab: Volume/Volume, Select a volume and click “More/Expand” button to extend the volume size.



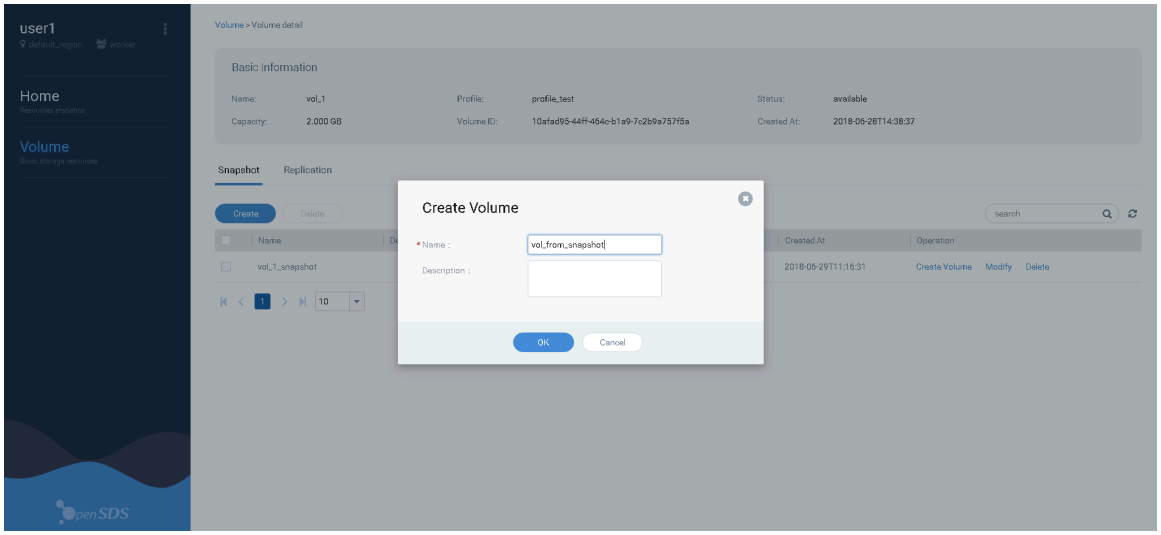
5.1.2.4 Create volume snapshot

Go to the tab: Volume/Volume, Select a volume and click “Create Snapshot” button to create volume snapshot.



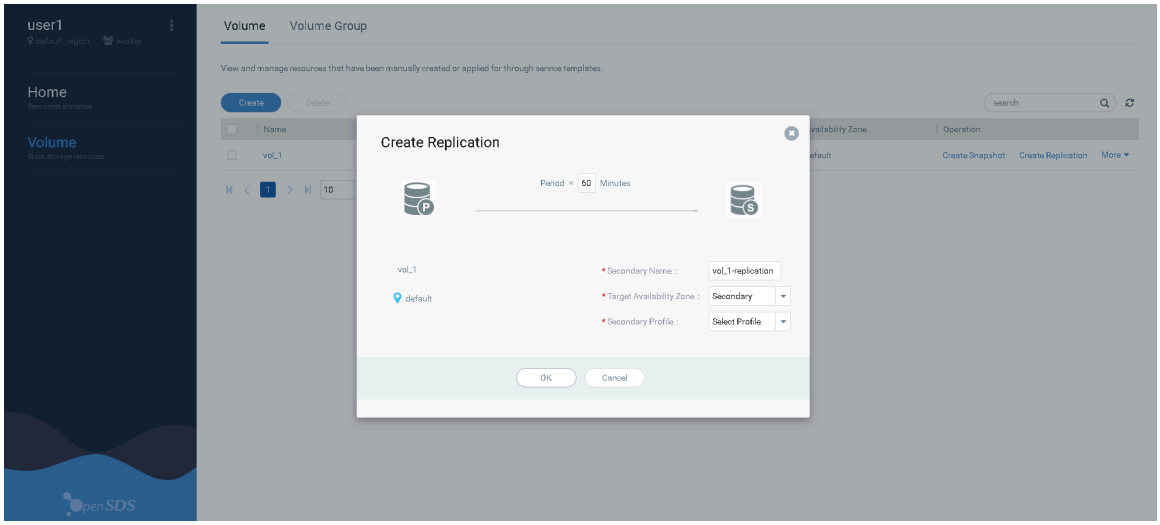
5.1.2.5 Create volume from snapshot

Go to the tab: Volume/Volume, Select a volume and click volume name to enter the volume detail page. Select a snapshot and click “Create volume” button to create volume.



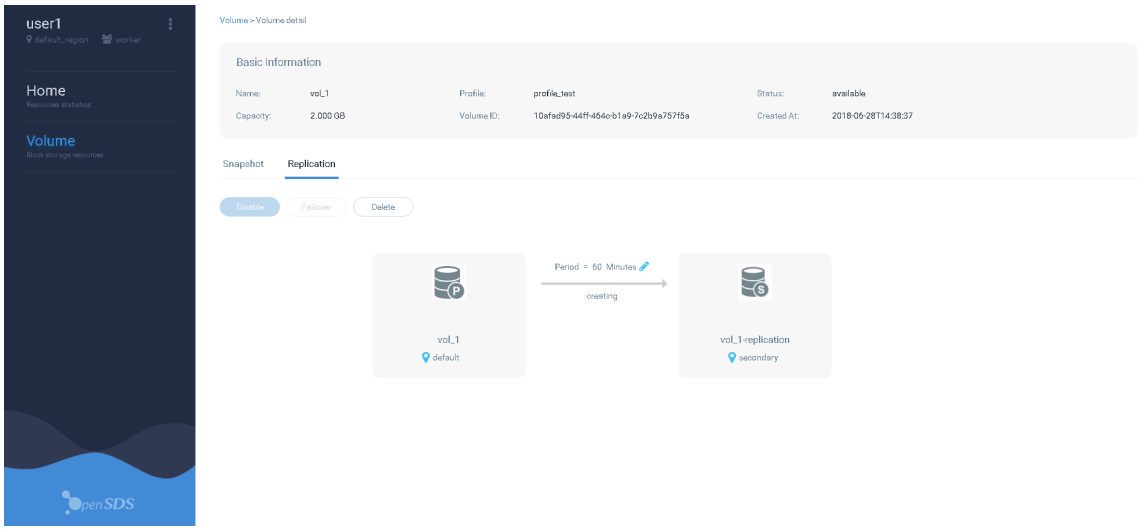
5.1.2.6 Create volume replication

Go to the tab: Volume/Volume, Select a volume and click “Create Replication” button to create replication. Input the secondary volume name, availability zone, profile, then submit the request. Note: To configure a storage backend with replication capabilities, see the section 5.4 *Array-based Replication using Dorado.*



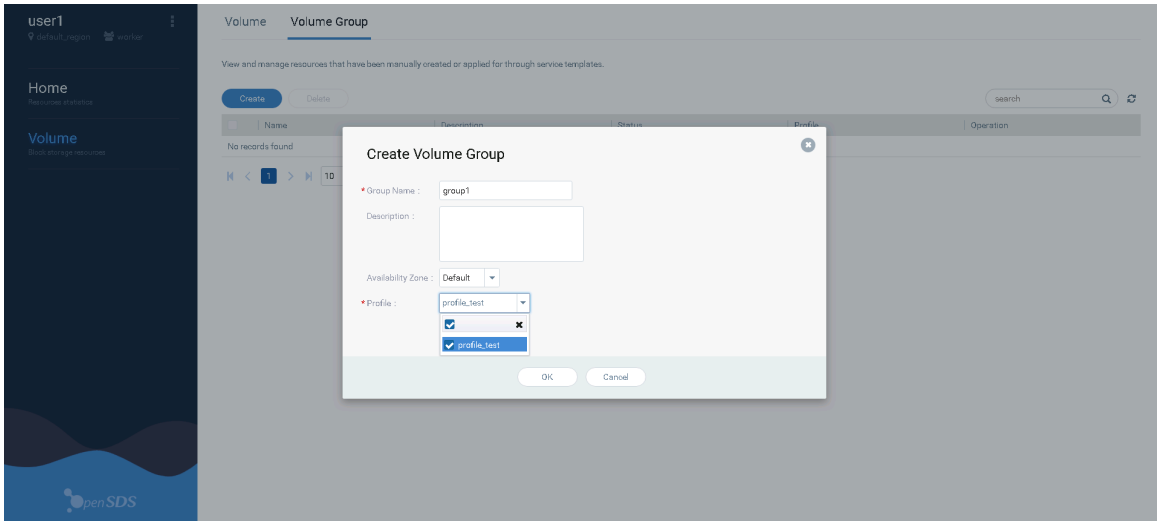
5.1.2.7 Disable/Enable/Failover volume replication

Go to the tab: Volume/Volume, Select the protected volume and click volume name to enter the volume detail page. In replication tab page, click "Disable/Enable/Failover" button to control replication.



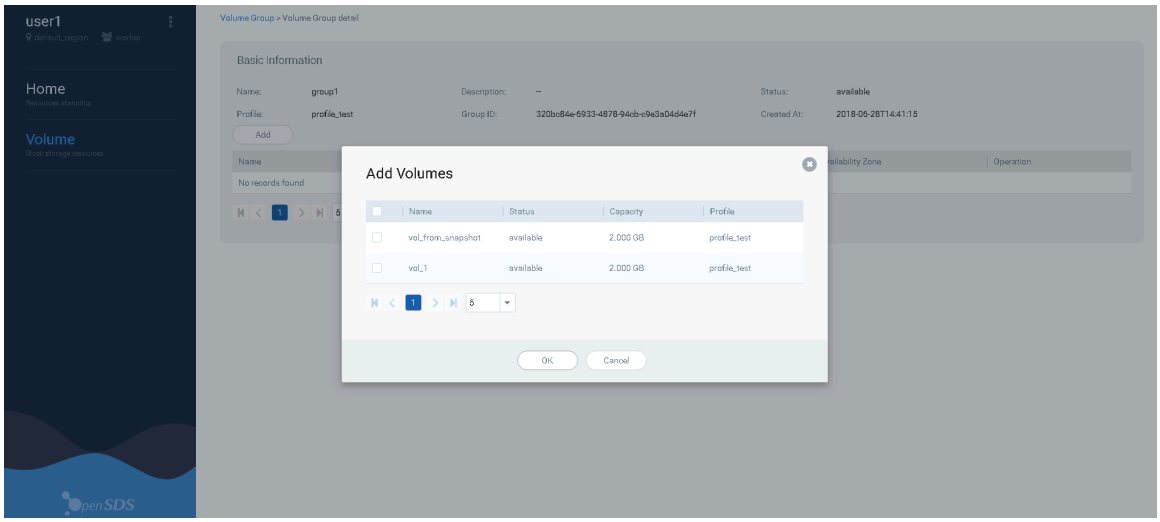
5.1.2.8 Create volume group

Go to the tab: Volume/Volume Group, click "Create" button to create volume group.



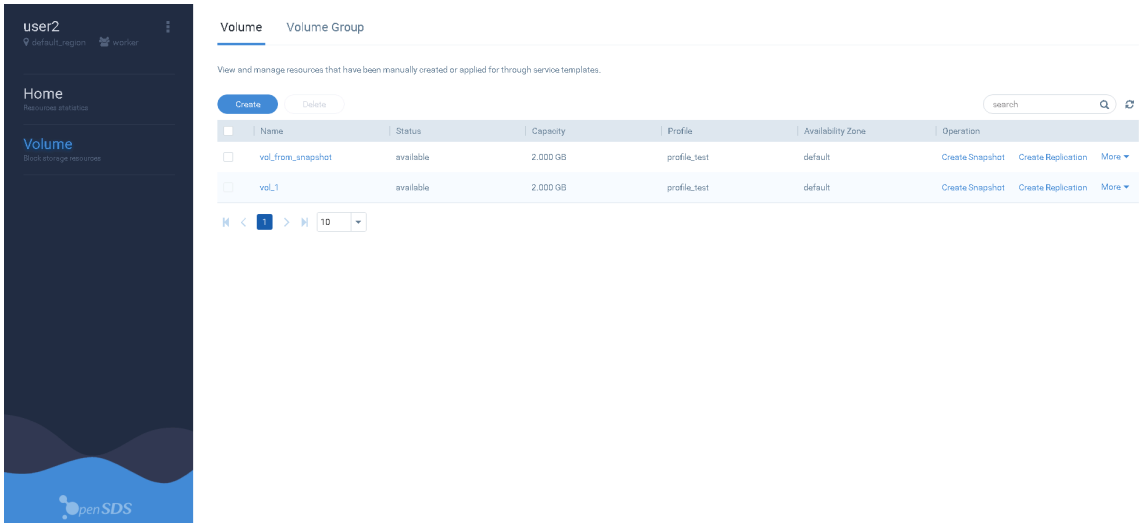
5.1.2.9 Add volumes into group

Go to the tab: Volume/Volume Group, select a volume group and go into the volume group detail page. Click “Add” button to add volumes into volume group.

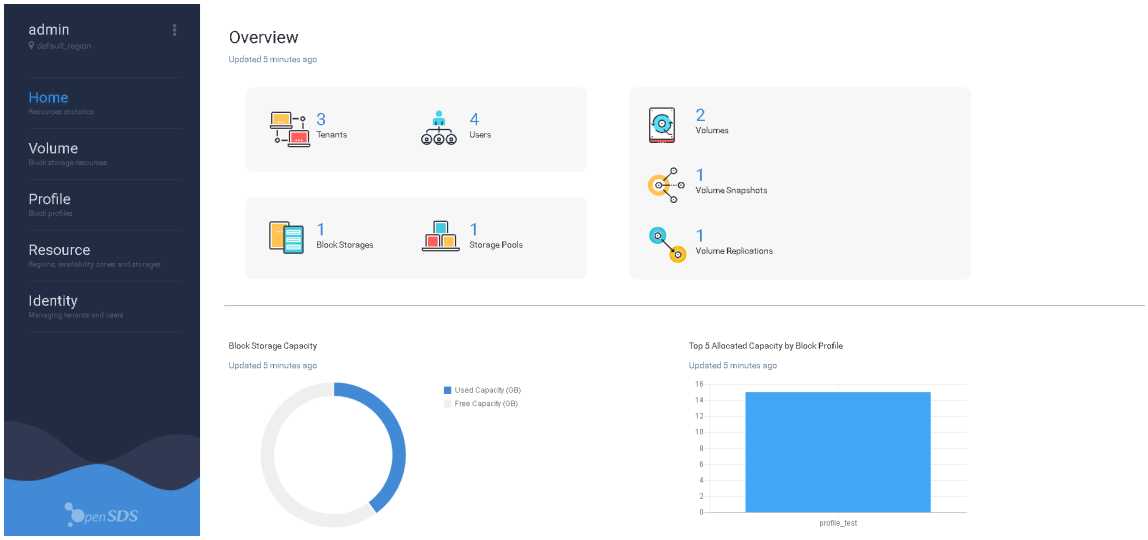


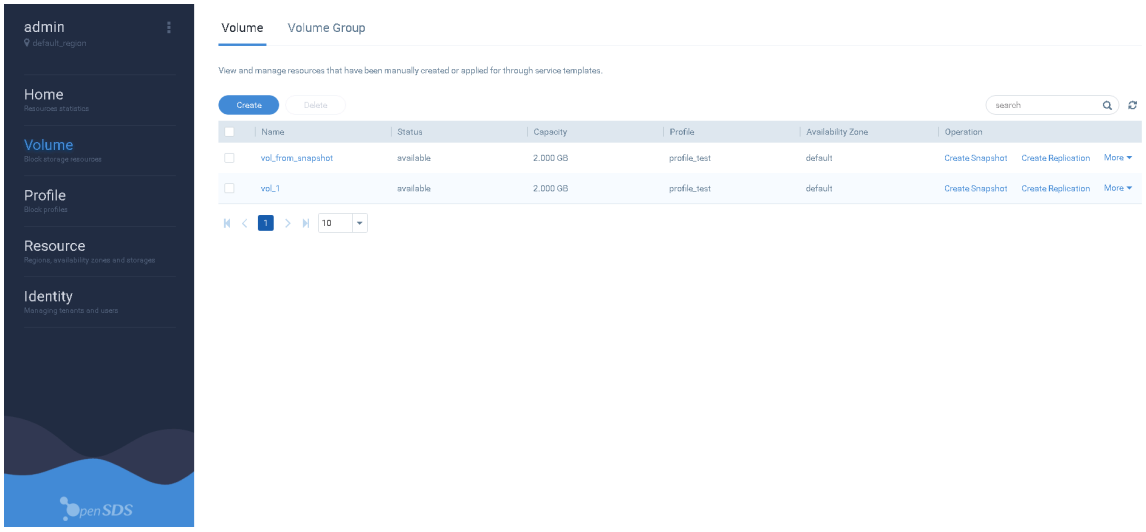
5.1.2.10 Tenant isolation

Log out and log in as user2 and verify that user2 can view volumes created by user1.



Log out and log in as administrator(admin) and can manage the volumes of all tenants.





5.2 Kubernetes

Kubernetes cluster runs on baremetal or VM using OpenSDS to provision storage, using the following drivers:

- Native LVM driver
- Native Ceph driver
- Native Dorado driver
- Cinder driver with Cinder stand-alone (LVM by default)

Refer to the *Installation* section to see how to use the OpenSDS CSI plugin to provision storage for Kubernetes.

5.3 OpenStack

There are two ways for OpenSDS to integrate with OpenStack.

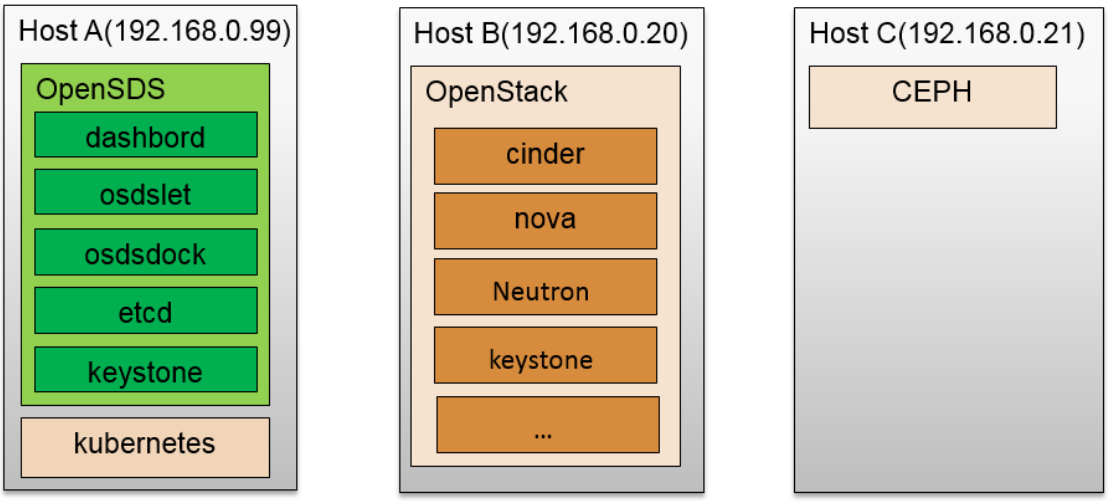
- OpenSDS provisions storage through the southbound Cinder driver. Cinder can be Cinder stand-alone or part of an OpenStack deployment. See the Installation section on how to install OpenSDS to test with Cinder driver.
- OpenSDS provisions storage in an OpenStack deployment through the Cinder compatible API. It can be southbound native driver or Cinder driver below OpenSDS in this case.

5.3.1 Use OpenSDS to Manage Cinder Drivers

As the backend of OpenSDS, Cinder supports many kinds of storage. Therefore, OpenSDS can manage other storage with the help of cinder. But the installer of OpenSDS only supports Cinder with LVM. In order to manage storage supported in Cinder, you need to configure Cinder backend manually. This section will show you an example using ceph as the cinder backend.

5.3.1.1 Prepare

A recommend deployment would be like the graph blow. We need three hosts for this testing, say Host A (IP: 192.168.0.99), Host B (IP: 192.168.0.20) and Host C (IP: 192.168.0.21). Note: the keystone in Host A is used for OpenSDS authentication and the keystone in Host B is use for OpenStack authentication, there is no any relationship between them.



5.3.1.2 Install OpenStack using devstack

You can reference this document https://docs.openstack.org/devstack/latest/

5.3.1.3 Install ceph using ansible

You can reference this document http://docs.ceph.com/ceph-ansible/master/

Install Kubernetes using local cluster

```
# /etc/opensds/opensds.conf
[keystone_authtoken]
memcached_servers = localhost:11211
signing_dir = /var/cache/cinder
cafile = /opt/stack/data/ca-bundle.pem
project_domain_name = Default
project_name = service
user_domain_name = Default
password = opensds@123
username = opensds
auth_url = http://192.168.0.99/identity
auth_type = password

[cinder]
name = cinder
description = Cinder Test
driver_name = cinder
config_path = /etc/opensds/driver/cinder.yaml

[osdslet]
api_endpoint = 0.0.0.0:50040
graceful = True
log_file = /var/log/opensds/osdslet.log
socket_order = inc
auth_strategy = keystone

[osdsdock]
api_endpoint = 192.168.0.99:50050
```

5.3.1.4 Configuration

5.3.1.4.1 OpenSDS

There are two configurations we need to config for OpenSDS:

- /etc/opensds/opensds.conf
- /etc/opensds/driver/cinder.yaml

An example would be like this:

1. /etc/opensds/opensds.conf
2. /etc/opends/driver/cinder.conf

```
# /etc/opensds/driver/opensds.conf
authOptions:
  endpoint: "http://192.168.0.20/identity"
  domainName: "Default"
  username: "admin"
  password: "admin"
  tenantName: "admin"
pool:
  ecs-351b@ceph#ceph:
    storageType: block
    availabilityZone: default
    extras:
      dataStorage:
        provisioningPolicy: Thin
        isSpaceEfficient: false
      ioConnectivity:
        accessProtocol: iscsi
        maxIOPS: 7000000
        maxBWS: 600
      advanced:
        diskType: SSD
        latency: 3ms
```

Then you can restart the OPenSDS manually.

5.3.1.4.2 Set ceph as backend of Cinder

Operation in Node C:

1. Create pool in ceph

ceph osd pool create rbd 64

2. Copy the ceph.conf to the Host B which contains cinder-volume server.

ssh {your-openstack-server} sudo tee /etc/ceph/ceph.conf </etc/ceph/ceph.conf

3. Set the cinder authentication in ceph.

ceph auth get-or-create client.cinder mon 'allow r' osd 'allow class-read object_prefix rbd_children, allow rwx pool=volumes, allow rwx pool=vms, allow rwx pool=images'

4. Generate the authentication file and copy it to Host B.

ceph auth get-or-create client.cinder | ssh {your-volume-server} sudo tee /etc/ceph/ceph.client.cinder.keyring

ssh {your-cinder-volume-server} sudo chown stack:stack /etc/ceph/ceph.client.cinder.keyring

Operation in Node B:

1. Intall python-rbd and ceph-common which is needed for cinder ceph backend.

sudo apt-get install python-rbd

sudo apt-get install ceph-common

2. Modified the cinder configuration file /etc/cinder/cinder.conf in Node B:

```
[DEFAULT]
...
default_volume_type = ceph
enabled_backends = ceph
...
[ceph]
volume_driver = cinder.volume.drivers.rbd.RBDDriver
volume_backend_name = rbd
rbd_pool = volumes
rbd_ceph_conf = /etc/ceph/ceph.conf
rbd_flatten_volume_from_snapshot = false
rbd_max_clone_depth = 5
rbd_store_chunk_size = 4
rados_connect_timeout = -1
glance_api_version = 2
```

3. Restart cinder-volume server

sudo systemctl restart devstack@c-vol.service

4. delete default volume type

cinder type-delete 1fd30cdc-63d0-4b1d-9e88-3b7b58f05d73

5.3.1.5 Testing

Create volume

```
root@ecs-1201:/etc/opensds/driver# osdsctl volume create 1 -n cinder-ceph-test
+------------------+--------------------------------------+
| Property         | Value                                |
+------------------+--------------------------------------+
| Id               | 6bdcbbc6-20f7-49d6-99fb-aa5ebe4c8e19 |
| CreatedAt        | 2018-07-05T12:08:33                  |
| UpdatedAt        |                                      |
| Name             | cinder-ceph-test                     |
| Description      |                                      |
| GroupId          |                                      |
| Size             | 1                                    |
| AvailabilityZone | default                              |
| Status           | creating                             |
| PoolId           |                                      |
| ProfileId        |                                      |
| Metadata         | map[]                                |
+------------------+--------------------------------------+
root@ecs-1201:/etc/opensds/driver# osdsctl volume list
+--------------------------------------+-----------------+-------------+---------+------+------------------+-----------+--------------------------------------+--------------------------------------+
| Id                                   | Name            | Description | GroupId | Size | AvailabilityZone | Status    | PoolId                               | ProfileId                            |
+--------------------------------------+-----------------+-------------+---------+------+------------------+-----------+--------------------------------------+--------------------------------------+
| 6bdcbbc6-20f7-49d6-99fb-aa5ebe4c8e19 | cinder-ceph-test |             |         | 1    | default          | available | c8eafeb0-3077-5979-8d23-532ed316cd24 | 76a3c0c9-6b89-43db-9a76-0f35c13d00d2 |
+--------------------------------------+-----------------+-------------+---------+------+------------------+-----------+--------------------------------------+--------------------------------------+
```

```
root@ecs-351b:~# cinder list
+--------------------------------------+-----------+------------------+------+-------------+----------+-------------+
| ID                                   | Status    | Name             | Size | Volume Type | Bootable | Attached to |
+--------------------------------------+-----------+------------------+------+-------------+----------+-------------+
| a225400e-1c3a-4c61-a81c-08d524dee5bc | available | cinder-ceph-test | 1    | -           | false    |             |
+--------------------------------------+-----------+------------------+------+-------------+----------+-------------+
root@ecs-351b:~# rbd list
volume-a225400e-1c3a-4c61-a81c-08d524dee5bc
root@ecs-351b:~#
```

5.3.2 OpenSDS with Cinder Compatible API

Cinder Compatible API adapter is not built in as part of the ansible deployment tool. Follow the following instruction to install it.

5.3.2.1 Installation

1. The Cinder Compatible API only supports cinder's current Api(v3). You can use devstack to install cinder when testing, but in order to use cinder's current Api(v3), branch for devstack must be stable/queens.

2. When devstack is installed, kill all cinder processes.

3. Run the "source /opt/stack/devstack/openrc admin admin" command to execute the openstack's cli command.

4. Run the "openstack endpoint list" command to view the cinder endpoint.

5. Run the command "export CINDER_ENDPOINT=http://10.10.10.10:8776/v3". The actual value of CINDER_ENDPOINT is determined by the previous step.

6. Run the command export OPENSDS_ENDPOINT=http://127.0.0.1:50040.

7. Download the opensds source (https://github.com/opensds/opensds.git) and install opensds.

8. Run the command "go build -o ./build/out/bin/cindercompatibleapi github.com/opensds/opensds/contrib/cindercompatibleapi".

9. Execute the command "./build/out/bin/cindercompatibleapi".

10. Execute some cinder cli commands to see if the result is correct. For example, if you execute the command "cinder type-list", the results will show the profile of opensds.

5.3.2.2 Volume Types

5.3.2.2.1 List all volume types (default policy)

cinder type-list

```
root@openstack:~# cinder type-list
+--------------------------------------+---------+----------------+-----------+
| ID                                   | Name    | Description    | Is_Public |
+--------------------------------------+---------+----------------+-----------+
| 02e50100-e2b5-499e-a938-9b2a5f079c9c | default | default policy | True      |
+--------------------------------------+---------+----------------+-----------+
```

```
2018/05/07 09:31:31.659 [D] 192.168.56.104 - - [07/May/2018 09:31:31] "GET /v3/28e79796cfd84db294a756b90b8d845f/types?is_public=None HTTP/1.1 200 0" 0.003206 python-cinderclient
```

5.3.2.2.2 Delete a volume type

cinder type-delete

```
root@openstack:~# cinder type-list
+--------------------------------------+---------+----------------+-----------+
| ID                                   | Name    | Description    | Is_Public |
+--------------------------------------+---------+----------------+-----------+
| 02e50100-e2b5-499e-a938-9b2a5f079c9c | default | default policy | True      |
+--------------------------------------+---------+----------------+-----------+
root@openstack:~#
root@openstack:~# cinder type-delete 02e50100-e2b5-499e-a938-9b2a5f079c9c
Request to delete volume type 02e50100-e2b5-499e-a938-9b2a5f079c9c has been accepted.
```

```
2018/05/07 09:34:45.736 [D] 192.168.56.104 - - [07/May/2018 09:34:45] "DELETE /v3/28e79796cfd84db294a756b90b8d845f/types/02e50100-e2b5-499e-a938-9b2a5f079c9c HTTP/1.1 200 0" 0.003395 python-cinderclient
```

5.3.2.2.3 List all volume types(0)

cinder type-list

```
root@openstack:~# cinder type-list
+----+------+-------------+-----------+
| ID | Name | Description | Is_Public |
+----+------+-------------+-----------+
+----+------+-------------+-----------+
```

```
2018/05/07 09:37:28.842 [D] 192.168.56.104 - - [07/May/2018 09:37:28] "GET /v3/28e79796cfd84db294a756b90b8d845f/types?is_public=None HTTP/1.1 200 0" 0.002610 python-cinderclient
```

5.3.2.2.4 Create a volume type

cinder type-create type00 --description test_type_00

```
root@openstack:~# cinder type-create type00 --description test_type_00
+--------------------------------------+--------+-------------+-----------+
| ID                                   | Name   | Description | Is_Public |
+--------------------------------------+--------+-------------+-----------+
| 7abff35e-0cbb-4c48-8bab-4fe7c3286792 | type00 | test_type_00 | True      |
+--------------------------------------+--------+-------------+-----------+
root@openstack:~#
```

```
2018/05/07 09:38:10.901 [D] 192.168.56.104 - - [07/May/2018 09:38:10] "POST /v3/28e79796cfd84db294a756b90b8d845f/types HTTP/1.1 200 0" 0.002892 python-cinderclient
```

5.3.2.2.5 Show volume type detail

cinder type-show Id

```
root@openstack:~# cinder type-show 7abff35e-0cbb-4c48-8bab-4fe7c3286792
+-------------+--------------------------------------+
| Property    | Value                                |
+-------------+--------------------------------------+
| description | test_type_00                         |
| extra_specs | None                                 |
| id          | 7abff35e-0cbb-4c48-8bab-4fe7c3286792 |
| is_public   | True                                 |
| name        | type00                               |
+-------------+--------------------------------------+
```

```
2018/05/07 09:39:45.513 [D] 192.168.56.104 - - [07/May/2018 09:39:45] "GET /v3/28e79796cfd84db294a756b90b8d845f/types/7abff35e-0cbb-4c48-8bab-4fe7c3286792 HTTP/1.1 200 0" 0.002401 python-cinderclient
```

5.3.2.2.6 Create a volume type（2nd）

cinder type-create type01 --description test_type_01

```
root@openstack:~# cinder type-create type01 --description test_type_01
+--------------------------------------+--------+-------------+-----------+
| ID                                   | Name   | Description | Is_Public |
+--------------------------------------+--------+-------------+-----------+
| 8ddce5f5-03a1-4397-9d82-5e002a2742cd | type01 | test_type_01 | True      |
+--------------------------------------+--------+-------------+-----------+
```

```
2018/05/07 09:41:48.712 [D] 192.168.56.104 - - [07/May/2018 09:41:48] "POST /v3/28e79796cfd84db294a756b90b8d845f/types HTTP/1.1 200 0" 0.003471 python-cinderclient
```

5.3.2.2.7 List all volume types (2)

cinder type-list

```
root@openstack:~# cinder type-list
+--------------------------------------+--------+--------------+-----------+
| ID                                   | Name   | Description  | Is_Public |
+--------------------------------------+--------+--------------+-----------+
| 7abff35e-0cbb-4c48-8bab-4fe7c3286792 | type00 | test_type_00 | True      |
| 8ddce5f5-03a1-4397-9d82-5e002a2742cd | type01 | test_type_01 | True      |
+--------------------------------------+--------+--------------+-----------+
```

```
2018/05/07 09:42:42.333 [D] 192.168.56.104 - - [07/May/2018 09:42:42] "GET /v3/28e79796cfd84db294a756b90b8d845f/types?is_public=None HTTP/1.1 200 0" 0.003555 python-cinderclient
```

5.3.2.2.8 Update an encryption type

cinder type-update 7abff35e-0cbb-4c48-8bab-4fe7c3286792 --name type0 --description test_type_0 --is-public true

```
root@openstack:~# cinder type-update 7abff35e-0cbb-4c48-8bab-4fe7c3286792 --name type0 --description test_type_0 --is-public true
+--------------------------------------+-------+-------------+-----------+
| ID                                   | Name  | Description | Is_Public |
+--------------------------------------+-------+-------------+-----------+
| 7abff35e-0cbb-4c48-8bab-4fe7c3286792 | type0 | test_type_0 | True      |
+--------------------------------------+-------+-------------+-----------+
```

```
2018/05/07 09:47:33.650 [D] 192.168.56.104 - - [07/May/2018 09:47:33] "PUT /v3/28e79796cfd84db294a756b90b8d845f/types/7abff35e-0cbb-4c48-8bab-4fe7c3286792 HTTP/1.1 200 0" 0.003619 python-cinderclient
```

If is-public is not set, false is the default which is not supported by opensds:

```
root@openstack:~# cinder type-update 7abff35e-0cbb-4c48-8bab-4fe7c3286792 --name type0 --description test_type_0
ERROR: Update a volume type failed: OpenSDS does not support is_public = false (HTTP 400)
```

```
E0507 09:46:35.930152   22851 volumetype.go:64] Update a volume type failed: OpenSDS does not support is_public = false
2018/05/07 09:46:35.930 [D] 192.168.56.104 - - [07/May/2018 09:46:35] "PUT /v3/28e79796cfd84db294a756b90b8d845f/types/7abff35e-0cbb-4c48-8bab-4fe7c3286792 HTTP/1.1 400 0" 0.000870 python-cinderclient
```

5.3.2.2.9 Lists current volume types and extra specs.

cinder extra-specs-list

```
root@openstack:~# cinder type-list
+--------------------------------------+--------+--------------+-----------+
| ID                                   | Name   | Description  | Is_Public |
+--------------------------------------+--------+--------------+-----------+
| 7abff35e-0cbb-4c48-8bab-4fe7c3286792 | type0  | test_type_0  | True      |
| 8ddce5f5-03a1-4397-9d82-5e002a2742cd | type01 | test_type_01 | True      |
+--------------------------------------+--------+--------------+-----------+
root@openstack:~# cinder extra-specs-list
+--------------------------------------+--------+-------------+
| ID                                   | Name   | extra_specs |
+--------------------------------------+--------+-------------+
| 7abff35e-0cbb-4c48-8bab-4fe7c3286792 | type0  | -           |
| 8ddce5f5-03a1-4397-9d82-5e002a2742cd | type01 | -           |
+--------------------------------------+--------+-------------+
```

```
2018/05/07 09:57:14.497 [D] 192.168.56.104 - - [07/May/2018 09:57:14] "GET /v3/28e79796cfd84db294a756b90b8d845f/types?is_public=None HTTP/1.1 200 0" 0.002168 python-cinderclient
2018/05/07 09:57:40.984 [D] 192.168.56.104 - - [07/May/2018 09:57:40] "GET /v3/28e79796cfd84db294a756b90b8d845f/types?is_public=None HTTP/1.1 200 0" 0.002751 python-cinderclient
```

5.3.2.2.10 Create or update extra specs for volume type

cinder type-key 7abff35e-0cbb-4c48-8bab-4fe7c3286792 set key1=value1

```
root@openstack:~# cinder type-key 7abff35e-0cbb-4c48-8bab-4fe7c3286792 set key1=value1
root@openstack:~# cinder extra-specs-list
+--------------------------------------+--------+--------------------+
| ID                                   | Name   | extra_specs        |
+--------------------------------------+--------+--------------------+
| 7abff35e-0cbb-4c48-8bab-4fe7c3286792 | type0  | {'key1': 'value1'} |
| 8ddce5f5-03a1-4397-9d82-5e002a2742cd | type01 | -                  |
+--------------------------------------+--------+--------------------+
```

```
2018/05/07 10:09:53.361 [D] 192.168.56.104 - - [07/May/2018 10:09:53] "POST /v3/28e79796cfd84db294a756b90b8d845f/types/7abff35e-0cbb-4c48-8bab-4fe7c3286792/extra_specs HTTP/1.1 200 0" 0.003180 python-cinderclient
```

5.3.2.2.11 Delete extra specification for volume type

cinder type-key 7abff35e-0cbb-4c48-8bab-4fe7c3286792 unset key1

```
root@openstack:~# cinder extra-specs-list
+--------------------------------------+--------+--------------------+
| ID                                   | Name   | extra_specs        |
+--------------------------------------+--------+--------------------+
| 7abff35e-0cbb-4c48-8bab-4fe7c3286792 | type0  | {'key1': 'value1'} |
| 8ddce5f5-03a1-4397-9d82-5e002a2742cd | type01 | -                  |
+--------------------------------------+--------+--------------------+
root@openstack:~# cinder type-key 7abff35e-0cbb-4c48-8bab-4fe7c3286792 unset key1
root@openstack:~# cinder extra-specs-list
+--------------------------------------+--------+-------------+
| ID                                   | Name   | extra_specs |
+--------------------------------------+--------+-------------+
| 7abff35e-0cbb-4c48-8bab-4fe7c3286792 | type0  | -           |
| 8ddce5f5-03a1-4397-9d82-5e002a2742cd | type01 | -           |
+--------------------------------------+--------+-------------+
```

```
2018/05/07 10:14:44.458 [D] 192.168.56.104 - - [07/May/2018 10:14:44] "DELETE /v3/28e79796cfd84db294a756b90b8d845f/types/7abff35e-0cbb-4c48-8bab-4fe7c3286792/extra_specs/key1 HTTP/1.1 200 0" 0.002390 python-cinderclient
```

5.3.2.3 Volumes

5.3.2.3.1 List accessible volumes with details (0)

cinder list

```
root@openstack:~# cinder list
+----+--------+------+------+-------------+----------+-------------+
| ID | Status | Name | Size | Volume Type | Bootable | Attached to |
+----+--------+------+------+-------------+----------+-------------+
+----+--------+------+------+-------------+----------+-------------+
root@openstack:~#
```

5.3.2.3.2 Create a volume (1st)

cinder create 1 --name volume00

```
root@openstack:~# cinder create 1 --name volume00
+--------------------+--------------------------------------+
| Property           | Value                                |
+--------------------+--------------------------------------+
| attachments        | []                                   |
| availability_zone  | default                              |
| created_at         | 2018-05-07T10:44:55                  |
| description        |                                      |
| id                 | de54b33f-8d66-45b6-887c-0c9acfe56dc7 |
| metadata           | {}                                   |
| name               | volume00                             |
| size               | 1                                    |
| status             | creating                             |
| updated_at         |                                      |
| user_id            |                                      |
+--------------------+--------------------------------------+
```

```
2018/05/07 10:44:55.174 [D] 192.168.56.104 - - [07/May/2018 10:44:55] "POST /v3/28e79796cfd84db294a756b90b8d845f/volumes HTTP/1.1 202 0" 0.004293 python-cinderclient
2018/05/07 10:44:55.178 [D] 192.168.56.104 - - [07/May/2018 10:44:55] "GET /v3/28e79796cfd84db294a756b90b8d845f/volumes/de54b33f-8d66-45b6-887c-0c9acfe56dc7 HTTP/1.1 200 0" 0.001601 python-cinderclient
```

5.3.2.3.3 List accessible volumes with details (1)

cinder list

```
root@openstack:~# cinder list
+--------------------------------------+----------+----------+------+-------------+
| ID                                   | Status   | Name     | Size | Attached to |
+--------------------------------------+----------+----------+------+-------------+
| de54b33f-8d66-45b6-887c-0c9acfe56dc7 | creating | volume00 | 1    |             |
+--------------------------------------+----------+----------+------+-------------+
root@openstack:~#
```

```
2018/05/07 10:46:07.854 [D] 192.168.56.104 - - [07/May/2018 10:46:07] "GET /v3/28e79796cfd84db294a756b90b8d845f/volumes/detail HTTP/1.1 200 0" 0.002999 python-cinderclient
```

5.3.2.3.4 Show a volume's details

cinder show <volume uuid>

5.3.2.3.5 Delete a volume

cinder delete <volume uuid>

5.3.2.4 Snapshots

5.3.2.4.1 Create a snapshot

cinder snapshot-create <volume uuid>

5.3.2.4.2 List snapshots and details

cinder snapshot-list

```
root@ubuntu:~/gopath/src/github.com/opensds/opensds# cinder snapshot-list
+--------------------------------------+--------------------------------------+-----------+----------+------+---------+
| ID                                   | Volume ID                            | Status    | Name     | Size | User ID |
+--------------------------------------+--------------------------------------+-----------+----------+------+---------+
| b94acf3a-59cc-4117-8f94-7615eb9360e4 | 3c51e853-51dc-4cfd-b795-8bc9b57a0b79 | available | snap-001 | 1    |         |
+--------------------------------------+--------------------------------------+-----------+----------+------+---------+
root@ubuntu:~/gopath/src/github.com/opensds/opensds#
```

5.3.2.4.3 Show a snapshot's details

cinder snapshot-show <snapshot uuid>

5.3.2.4.4 Delete a snapshot

cinder snapshot-delete <snapshot uuid>

5.3.2.5 Attachments

5.3.2.5.1 Create attachment

cinder attachment-create

cinder results:

```
root@ubuntu:~/cinder_data_dir/cinder/contrib/block-box# cinder attachment-create ec555584-83a0-4aef-809b-a2d2ef4c5ac5 8149b0b3-fa8c-4a13-b54e-8251f5778807
+-------------+--------------------------------------+
| Property    | Value                                |
+-------------+--------------------------------------+
| attach_mode | None                                 |
| attached_at |                                      |
| detached_at |                                      |
| id          | f7a84c08-5943-4d23-a89b-b056042a3506 |
| instance    | 8149b0b3-fa8c-4a13-b54e-8251f5778807 |
| status      | reserved                             |
| volume_id   | ec555584-83a0-4aef-809b-a2d2ef4c5ac5 |
+-------------+--------------------------------------+
root@ubuntu:~/cinder_data_dir/cinder/contrib/block-box#
```

Cinder compatible API results:

```
root@ubuntu:~/gopath/src/github.com/opensds/opensds# cinder attachment-create babaed1a-2e9d-4b61-9631-0e9242c76c0f babaed1a-2e9d-4b61-9631-0e9242c76c0f
+-----------+--------------------------------------+
| Property  | Value                                |
+-----------+--------------------------------------+
| id        | fd32832d-5d91-4f9e-b0c2-2b2ecc424166 |
| instance  | babaed1a-2e9d-4b61-9631-0e9242c76c0f |
| status    | creating                             |
| volume_id | babaed1a-2e9d-4b61-9631-0e9242c76c0f |
+-----------+--------------------------------------+
+----------+------------------------------+
| Property | Value                        |
+----------+------------------------------+
| data     | {u'attachment': u'attachment'} |
+----------+------------------------------+
```

5.3.2.5.2 Show attachment

Cinder attachment-show

cinder results：

```
root@ubuntu:~/cinder_data_dir/cinder/contrib/block-box# cinder attachment-show f7a84c08-5943-4d23-a89b-b056042a3506
+-------------+--------------------------------------+
| Property    | Value                                |
+-------------+--------------------------------------+
| attach_mode | None                                 |
| attached_at |                                      |
| detached_at |                                      |
| id          | f7a84c08-5943-4d23-a89b-b056042a3506 |
| instance    | 8149b0b3-fa8c-4a13-b54e-8251f5778807 |
| status      | reserved                             |
| volume_id   | ec555584-83a0-4aef-809b-a2d2ef4c5ac5 |
+-------------+--------------------------------------+
```

Cinder compatible API results：

```
root@ubuntu:~/gopath/src/github.com/opensds/opensds# cinder attachment-show fd32832d-5d91-4f9e-b0c2-2b2ecc424166
+-----------+--------------------------------------+
| Property  | Value                                |
+-----------+--------------------------------------+
| id        | fd32832d-5d91-4f9e-b0c2-2b2ecc424166 |
| instance  | babaed1a-2e9d-4b61-9631-0e9242c76c0f |
| status    | error                                |
| volume_id | babaed1a-2e9d-4b61-9631-0e9242c76c0f |
+-----------+--------------------------------------+
+----------+-------------------------------+
| Property | Value                         |
+----------+-------------------------------+
| data     | {u'attachment': u'attachment'} |
+----------+-------------------------------+
```

5.3.2.5.3 List attachment

cinder attachment-list

cinder results：

```
root@ubuntu:~/cinder_data_dir/cinder/contrib/block-box# cinder attachment-list
+--------------------------------------+--------------------------------------+----------+-----------+
| ID                                   | Volume ID                            | Status   | Server ID |
+--------------------------------------+--------------------------------------+----------+-----------+
| 8fa3413f-07dc-48f5-a7b2-fdbea19ded1c | c64a4d98-c194-4c75-a37b-05722c7ee349 | reserved |           |
| f7a84c08-5943-4d23-a89b-b056042a3506 | ec555584-83a0-4aef-809b-a2d2ef4c5ac5 | reserved |           |
+--------------------------------------+--------------------------------------+----------+-----------+
```

Cinder compatible API results：

```
root@ubuntu:~/gopath/src/github.com/opensds/opensds# cinder attachment-list
+--------------------------------------+--------------------------------------+--------+-----------+
| ID                                   | Volume ID                            | Status | Server ID |
+--------------------------------------+--------------------------------------+--------+-----------+
| 95d4e9f5-88db-4015-9467-1ed0045b6469 | 3c51e853-51dc-4cfd-b795-8bc9b57a0b79 | error  |           |
| caa2a055-a9c2-43e0-96d4-391398f7c8b4 | bb04ad9a-75bd-40a4-ac5e-3c92a7e66956 | error  |           |
+--------------------------------------+--------------------------------------+--------+-----------+
```

5.3.2.5.4 Update attachment

cinder attachment-update

Cinder compatible API results：

```
root@ubuntu:~/gopath/src/github.com/opensds/opensds# cinder attachment-update fd32832d-5d91-4f9e-b0c2-2b2ecc424166 --ip 127.0.0.1
+-----------+-----------------------------------+
| Property  | Value                             |
+-----------+-----------------------------------+
| id        | fd32832d-5d91-4f9e-b0c2-2b2ecc424166 |
| instance  | babaed1a-2e9d-4b61-9631-0e9242c76c0f |
| status    | error                             |
| volume_id | babaed1a-2e9d-4b61-9631-0e9242c76c0f |
+-----------+-----------------------------------+
+----------+------------------------------+
| Property | Value                        |
+----------+------------------------------+
| data     | {u'attachment': u'attachment'} |
+----------+------------------------------+
root@ubuntu:~/gopath/src/github.com/opensds/opensds# osdsctl volume attachment show fd32832d-5d91-4f9e-b0c2-2b2ecc424166
WARNING: Not found Env OPENSDS_AUTH_STRATEGY, use default(noauth)
+----------------+-----------------------------------+
| Property       | Value                             |
+----------------+-----------------------------------+
| Id             | fd32832d-5d91-4f9e-b0c2-2b2ecc424166 |
| CreatedAt      | 2018-04-24T10:41:28               |
| UpdatedAt      | 2018-04-24T10:54:56               |
| TenantId       | ef305038-cd12-4f3b-90bd-0612f83e14ee |
| UserId         |                                   |
| VolumeId       | babaed1a-2e9d-4b61-9631-0e9242c76c0f |
| Mountpoint     |                                   |
| Status         | error                             |
| HostInfo       | {                                 |
|                |  "platform": "x86_64",            |
|                |  "osType": "linux2",              |
|                |  "ip": "127.0.0.1"                |
|                | }                                 |
| ConnectionInfo | {                                 |
|                |  "data": {                        |
|                |   "attachment": "attachment"      |
|                |  },                               |
|                |  "additionalProperties": {        |
|                |   "attachment": "attachment"      |
|                |  }                                |
|                | }                                 |
+----------------+-----------------------------------+
```

5.3.2.5.5 Delete attachment

cinder attachment-delete

cinder results：

```
root@ubuntu:~/cinder_data_dir/cinder/contrib/block-box# cinder attachment-list
+--------------------------------------+--------------------------------------+----------+-----------+
| ID                                   | Volume ID                            | Status   | Server ID |
+--------------------------------------+--------------------------------------+----------+-----------+
| 8fa3413f-07dc-48f5-a7b2-fdbea19ded1c | c64a4d98-c194-4c75-a37b-05722c7ee349 | reserved |           |
| f7a84c08-5943-4d23-a89b-b056042a3506 | ec555584-83a0-4aef-809b-a2d2ef4c5ac5 | reserved |           |
+--------------------------------------+--------------------------------------+----------+-----------+
root@ubuntu:~/cinder_data_dir/cinder/contrib/block-box#
root@ubuntu:~/cinder_data_dir/cinder/contrib/block-box# cinder attachment-delete 8fa3413f-07dc-48f5-a7b2-fdbea19ded1c
root@ubuntu:~/cinder_data_dir/cinder/contrib/block-box# cinder attachment-list
+--------------------------------------+--------------------------------------+----------+-----------+
| ID                                   | Volume ID                            | Status   | Server ID |
+--------------------------------------+--------------------------------------+----------+-----------+
| f7a84c08-5943-4d23-a89b-b056042a3506 | ec555584-83a0-4aef-809b-a2d2ef4c5ac5 | reserved |           |
+--------------------------------------+--------------------------------------+----------+-----------+
```

Cinder compatible API results：

```
root@ubuntu:~/gopath/src/github.com/opensds/opensds# cinder attachment-list
+--------------------------------------+--------------------------------------+--------+-----------+
| ID                                   | Volume ID                            | Status | Server ID |
+--------------------------------------+--------------------------------------+--------+-----------+
| 95d4e9f5-88db-4015-9467-1ed0045b6469 | 3c51e853-51dc-4cfd-b795-8bc9b57a0b79 | error  |           |
| caa2a055-a9c2-43e0-96d4-391398f7c8b4 | bb04ad9a-75bd-40a4-ac5e-3c92a7e66956 | error  |           |
+--------------------------------------+--------------------------------------+--------+-----------+
root@ubuntu:~/gopath/src/github.com/opensds/opensds# cinder attachment-delete 95d4e9f5-88db-4015-9467-1ed0045b6469
root@ubuntu:~/gopath/src/github.com/opensds/opensds# cinder attachment-list
+--------------------------------------+--------------------------------------+--------+-----------+
| ID                                   | Volume ID                            | Status | Server ID |
+--------------------------------------+--------------------------------------+--------+-----------+
| caa2a055-a9c2-43e0-96d4-391398f7c8b4 | bb04ad9a-75bd-40a4-ac5e-3c92a7e66956 | error  |           |
+--------------------------------------+--------------------------------------+--------+-----------+
```

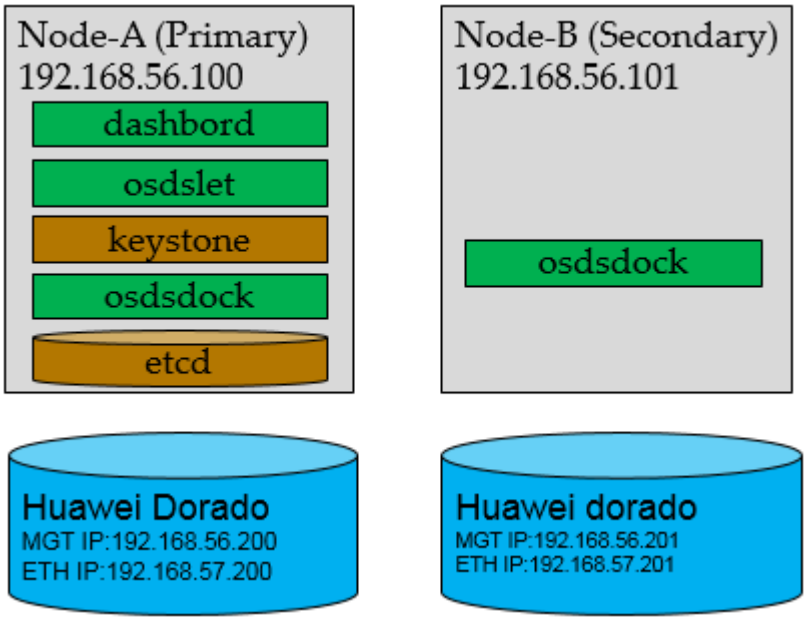
5.4 Array-based Replication using Dorado

5.4.1 Without Kubernetes

Test using Dashboard and CLI

5.4.1.1 Configuration

In array-based replication scenario, we need to depoly opensds in two nodes. Node A includes dashboard, keystone, osdslet, osdsdock(provisioner) and etcd. For simplifying the testing scenario, node B includes just only includes osdsdock.



NOTE: MGT IP means management ip, ETH IP is used for iscsi.

There are two configurations we need to config:

- /etc/opensds/opensds.conf
- /etc/opensds/driver/dorado.yaml

An example in Node A (192.168.56.100) would be like this:

1. /etc/opensds/opensds.conf

```
[keystone_authtoken]
memcached_servers = 8.46.186.191:11211
signing_dir = /var/cache/opensds
cafile = /opt/stack/data/ca-bundle.pem
auth_uri = http://8.46.186.191/identity
project_domain_name = Default
project_name = service
user_domain_name = Default
password = opensds@123
username = opensds
auth_url = http://8.46.186.191/identity
auth_type = password

[osdslet]
api_endpoint = 0.0.0.0:50040
graceful = True
log_file = /var/log/opensds/osdslet.log
socket_order = inc
auth_strategy = keystone

[osdsdock]
api_endpoint = 192.168.56.100:50050
log_file = /var/log/opensds/osdsdock.log
# Specify which backends should be enabled, sample,ceph,cinder,lvm and so on.
enabled_backends = huawei_dorado

[database]
endpoint = 192.168.56.100:62379,192.168.56.100:62380
driver = etcd

[huawei_dorado]
name = huawei_dorado
description = Huawei OceanStor Dorado
driver_name = huawei_dorado
config_path = /etc/opensds/driver/dorado.yaml
support_replication = true
```

2. /etc/opensds/driver/dorado.yaml

```
authOptions:
  endpoints: "https://192.168.56.200:8088/deviceManager/rest"
  username: "opensds"
  password: "opensds@123"
  insecure: true
replication:
  remoteAuthOptions:
    endpoints: "https://192.168.56.201:8088/deviceManager/rest"
    username: "opensds"
    password: "opensds@123"
    insecure: true
pool:
  StoragePool001:
    diskType: SSD
    AZ: default
    accessProtocol: iscsi
    thinProvisioned: true
    compressed: true
    advanced:
      deduped: true

targetIp: 192.168.57.200
```

Then you can start opensds servers.

Start etcd server:

etcd --advertise-client-urls http://192.168.56.100:2379 --listen-client-urls http://192.168.56.100:2379 --listen-peer-urls http://127.0.0.1:2380

Start up osdslet:

osdslet --logtostderr -v 8

Start up osdsdock(provisioner):

osdsdock --logtostderr -v 8

An example in Node B(192.168.56.101) would be like this:

1. /etc/opensds/opensds.conf

```
[osdsdock]
api_endpoint = 192.168.56.101:50050
log_file = /var/log/opensds/osdsdock.log
# Specify which backends should be enabled, sample,ceph,cinder,lvm and so on.
enabled_backends = huawei_dorado

[database]
endpoint = 192.168.56.100:62379,192.168.56.100:62380
driver = etcd

[huawei_dorado]
name = huawei_dorado_remote
description = Huawei OceanStor Dorado Remote array
driver_name = huawei_dorado
config_path = /etc/opensds/driver/dorado.yaml
support_replication = true
```

2. /etc/opensds/driver/dorado.yaml

```
authOptions:
  endpoints: "https://192.168.56.201:8088/deviceManager/rest"
  username: "opensds"
  password: "opensds@123"
  insecure: true
replication:
  remoteAuthOptions:
    endpoints: "https://192.168.56.200/deviceManager/rest"
    username: "opensds"
    password: "opensds@123"
    insecure: true

pool:
  StoragePool_210038bc0177ae4f:
    diskType: SSD
    availabilityZone: secondary
    accessProtocol: iscsi
    thinProvisioned: true
    compressed: true
    advanced:
      deduped: true
targetIp: 192.168.57.201
```

In node B you just should only start up osdsdock(provisioner).

Start up osdsdock(provisioner):

```
osdsdock --logtostderr -v 8
```

5.4.1.2 Testing

Here is the usage of replication CLI.

1. Create replication.

Usage:

osdsctl replication create <primary volume id> <secondary volume id> [flags]

Flags:

-d, --description string the description of created replication

-h, --help help for create

-n, --name string the name of created replication

-p, --primary_driver_data string the primary replication driver data of created replication

-m, --replication_model string the replication mode of created replication, value can be sync/async

-t, --replication_period int the replication period of created replication, the value must greater than 0 (default 120)

-s, --secondary_driver_data string the secondary replication driver data of created replication

2. List replication.

Usage:

osdsctl replication list [flags]

Flags:

-h, --help help for list

Global Flags:

--debug shows debugging output.

3. Show a replication

Usage:

osdsctl replication show <replication id> [flags]

Flags:

-h, --help help for show

Global Flags:

--debug shows debugging output.

4. Enable replication.

Usage:

osdsctl replication enable <replication id> [flags]

Flags:

-h, --help help for enable

Global Flags:

--debug shows debugging output.

5.disable replication

Usage:

osdsctl replication disable <replication id> [flags]

Flags:

-h, --help help for disable

Global Flags:

--debug shows debugging output.

6. Failover replication

Usage:

osdsctl replication failover <replication id> [flags]

Flags:

-a, --allow_attached_volume whether allow attached volume when failing over replication

-h, --help help for failover

-s, --secondary_backend_id string the secondary backend id of failoverr replication

Global Flags:

--debug shows debugging output.

7. delete replication

Usage:

osdsctl replication delete <replication id> [flags]

Flags:

-h, --help help for delete

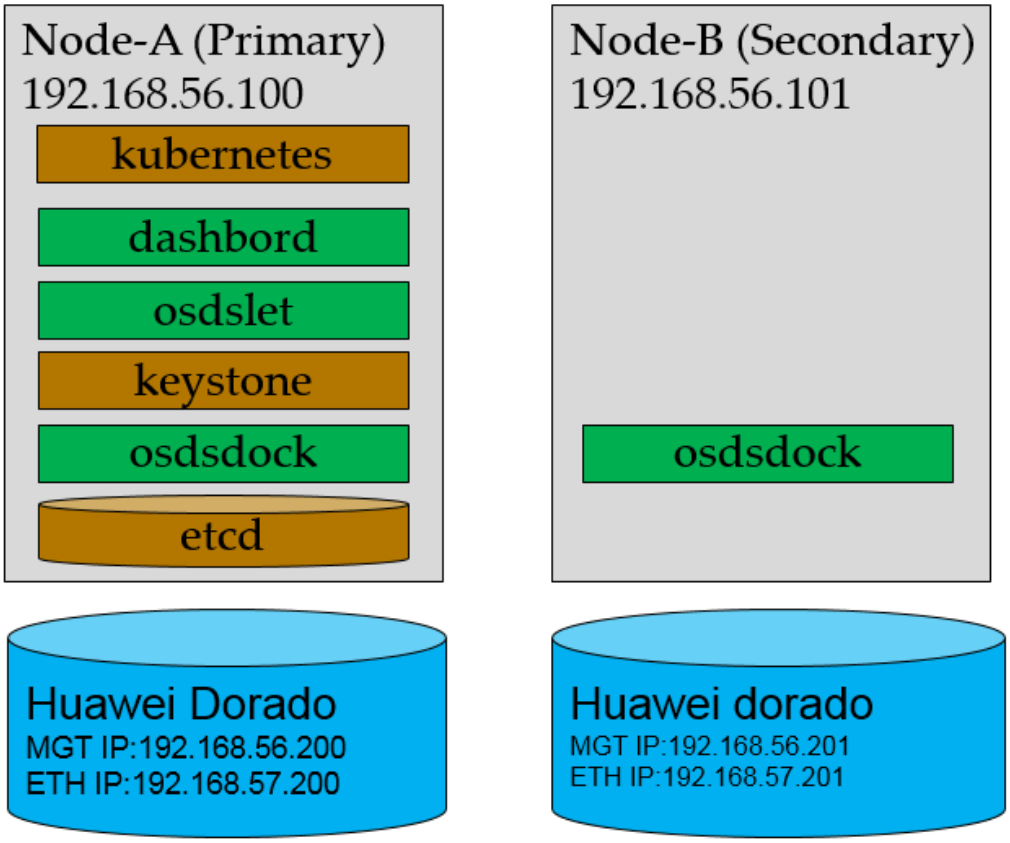
Global Flags:

--debug shows debugging output.

5.4.2 With Kubernetes

5.4.2.1 Configuration

OpenSDS provide storage to kubernetes using CSI plugin. OpenSDS replication feature also works in kubernetes, when an application pod crashes and the replication status is failedOver, the OpenSDS CSI plugin will switch to the secondary volume automatically. This is totally invisible for users. A simplest testing deployment would be like blow.



NOTE: MGT IP means management ip, ETH IP is used for iscsi.

There are two configurations we need to config:

- /etc/opensds/opensds.conf
- /etc/opensds/driver/dorado.yaml

An example in Node A (192.168.56.100) would be like this:

1. /etc/opensds/opensds.conf

```
[keystone_authtoken]
memcached_servers = 8.46.186.191:11211
signing_dir = /var/cache/opensds
cafile = /opt/stack/data/ca-bundle.pem
auth_uri = http://8.46.186.191/identity
project_domain_name = Default
project_name = service
user_domain_name = Default
password = opensds@123
username = opensds
auth_url = http://8.46.186.191/identity
auth_type = password

[osdslet]
api_endpoint = 0.0.0.0:50040
graceful = True
log_file = /var/log/opensds/osdslet.log
socket_order = inc
auth_strategy = keystone

[osdsdock]
api_endpoint = 192.168.56.100:50050
log_file = /var/log/opensds/osdsdock.log
# Specify which backends should be enabled, sample,ceph,cinder,lvm and so on.
enabled_backends = huawei_dorado

[database]
endpoint = 192.168.56.100:62379,192.168.56.100:62380
driver = etcd

[huawei_dorado]
name = huawei_dorado
description = Huawei OceanStor Dorado
driver_name = huawei_dorado
config_path = /etc/opensds/driver/dorado.yaml
support_replication = true
```

2. /etc/opensds/driver/dorado.yaml

```
authOptions:
  endpoints: "https://192.168.56.200:8088/deviceManager/rest"
  username: "opensds"
  password: "opensds@123"
  insecure: true
replication:
  remoteAuthOptions:
    endpoints: "https://192.168.56.201:8088/deviceManager/rest"
    username: "opensds"
    password: "opensds@123"
    insecure: true
pool:
  StoragePool001:
    diskType: SSD
    AZ: default
    accessProtocol: iscsi
    thinProvisioned: true
    compressed: true
    advanced:
      deduped: true

targetIp: 192.168.57.200
```

Then you can start opensds servers.

Start etcd server:

etcd --advertise-client-urls http://192.168.56.100:2379 --listen-client-urls http://192.168.56.100:2379 --listen-peer-urls http://127.0.0.1:2380

Start up osdslet:

osdslet --logtostderr -v 8

Start up osdsdock(provisioner):

osdsdock --logtostderr -v 8

An example in Node B(192.168.56.101) would be like this:

1. /etc/opensds/opensds.conf

```
[osdsdock]
api_endpoint = 192.168.56.101:50050
log_file = /var/log/opensds/osdsdock.log
# Specify which backends should be enabled, sample,ceph,cinder,lvm and so on.
enabled_backends = huawei_dorado

[database]
endpoint = 192.168.56.100:62379,192.168.56.100:62380
driver = etcd

[huawei_dorado]
name = huawei_dorado_remote
description = Huawei OceanStor Dorado Remote array
driver_name = huawei_dorado
config_path = /etc/opensds/driver/dorado.yaml
support_replication = true
```

2. /etc/opensds/driver/dorado.yaml

```
authOptions:
  endpoints: "https://192.168.56.201:8088/deviceManager/rest"
  username: "opensds"
  password: "opensds@123"
  insecure: true
replication:
  remoteAuthOptions:
    endpoints: "https://192.168.56.200/deviceManager/rest"
    username: "opensds"
    password: "opensds@123"
    insecure: true

pool:
  StoragePool_210038bc0177ae4f:
    diskType: SSD
    availabilityZone: secondary
    accessProtocol: iscsi
    thinProvisioned: true
    compressed: true
    advanced:
      deduped: true
targetIp: 192.168.57.201
```

In node B you just should only start up osdsdock(provisioner).

Start up osdsdock(provisioner):

```
osdsdock --logtostderr -v 8
```

Startup kubernetes local cluster in Node A.If you get information like blow, your kubernetes local_cluster startup successfully.

```
Local Kubernetes cluster is running. Press Ctrl-C to shut it down.

Logs:
  /tmp/kube-apiserver.log
  /tmp/kube-controller-manager.log

  /tmp/kube-proxy.log
  /tmp/kube-scheduler.log
  /tmp/kubelet.log

To start using your cluster, you can open up another terminal/tab and run:

  export KUBECONFIG=/var/run/kubernetes/admin.kubeconfig
  cluster/kubectl.sh

Alternatively, you can write to the default kubeconfig:

  export KUBERNETES_PROVIDER=local

  cluster/kubectl.sh config set-cluster local --server=https://localhost:6443 --certificate-authority=/var/run/kubernetes/server-ca.crt
  cluster/kubectl.sh config set-credentials myself --client-key=/var/run/kubernetes/client-admin.key --client-certificate=/var/run/kubernetes/client-admin.crt
  cluster/kubectl.sh config set-context local --cluster=local --user=myself
  cluster/kubectl.sh config use-context local
  cluster/kubectl.sh
```

5.4.2.2 Testing steps

1. Run command **kubectl get pod** to confirm the OpenSDS CSI plugin server is up. There will be 3 pods.

```
root@opensds:~/gopath/src/github.com/opensds/nbp/csi/server/deploy/kubernetes# kubectl get pod
NAME                                READY     STATUS    RESTARTS   AGE
csi-attacher-opensdsplugin-0        2/2       Running   0          2s
csi-nodeplugin-opensdsplugin-fdsk5  2/2       Running   0          2s
csi-provisioner-opensdsplugin-0     2/2       Running   0          2s
root@opensds:~/gopath/src/github.com/opensds/nbp/csi/server/deploy/kubernetes#
```

2. Add the configuration item **enableReplication**: "true" at parameters section to enable the replication feature.

```
# sc_pvc.yaml
# This YAML file contains StorageClass and PVC
# which are necessary to run nginx with csi opensds driver.

apiVersion: storage.k8s.io/v1
kind: StorageClass
metadata:
  name: csi-sc-opensdsplugin
provisioner: csi-opensdsplugin
parameters:
  enableReplication: "true"
---
apiVersion: v1
kind: PersistentVolumeClaim
metadata:
  name: csi-pvc-opensdsplugin
spec:
  accessModes:
  - ReadWriteOnce
  resources:
    requests:
      storage: 1Gi
  storageClassName: csi-sc-opensdsplugin
```

3. Create StorageClss and PVC.

```
root@opensds:~/gopath/src/github.com/opensds/nbp/csi/server/examples/kubernetes# kubectl create -f sc_pvc.yaml
storageclass.storage.k8s.io "csi-sc-opensdsplugin" created
persistentvolumeclaim "csi-pvc-opensdsplugin" created
root@opensds:~/gopath/src/github.com/opensds/nbp/csi/server/examples/kubernetes# kubectl get sc
NAME                  PROVISIONER               AGE
csi-sc-opensdsplugin  csi-opensdsplugin         9s
standard (default)    kubernetes.io/host-path   1h
root@opensds:~/gopath/src/github.com/opensds/nbp/csi/server/examples/kubernetes# kubectl get pvc
NAME                   STATUS    VOLUME                                     CAPACITY   ACCESS MODES   STORAGECLASS          AGE
csi-pvc-opensdsplugin  Bound     pvc-ce0baf87-7ee6-11e8-b500-000c29bcba39   1Gi        RWO            csi-sc-opensdsplugin  31s
root@opensds:~/gopath/src/github.com/opensds/nbp/csi/server/examples/kubernetes# kubectl get pv
NAME                                       CAPACITY   ACCESS MODES   RECLAIM POLICY   STATUS    CLAIM                         STORAGECLASS          REASON    AGE
pvc-ce0baf87-7ee6-11e8-b500-000c29bcba39   1Gi        RWO            Delete           Bound     default/csi-pvc-opensdsplugin  csi-sc-opensdsplugin            22s
root@opensds:~/gopath/src/github.com/opensds/nbp/csi/server/examples/kubernetes#
```

You will find two volumes and a replication in OpenSDS.

```
root@opensds:~/gopath/src/github.com/opensds/opensds# osdsctl volume list
+--------------------------------------+--------------------------------------------------+-------------+---------+------+------------------+-----------+--------------------------------------+--------------------------------------+
| Id                                   | Name                                             | Description | GroupId | Size | AvailabilityZone | Status    | PoolId                               | ProfileId                            |
+--------------------------------------+--------------------------------------------------+-------------+---------+------+------------------+-----------+--------------------------------------+--------------------------------------+
| 662a5727-99b7-4b17-ba48-148ea8a0559c | pvc-ce0baf87-7ee6-11e8-b500-000c29bcba39         |             |         | 1    | default          | available | 382147f3-72ea-566d-ab99-407d8e9ab351 | 612cfd0c-0a0f-47f9-a03f-8d2c1ee926ba |
| 62bb24bf-edbb-47dc-9a77-ecfd9cb61c23 | secondary-pvc-ce0baf87-7ee6-11e8-b500-000c29bcba39 |             |         | 1    | secondary        | available | 27e8a520-335b-5d34-9634-399ae15ceeb8 | 612cfd0c-0a0f-47f9-a03f-8d2c1ee926ba |
+--------------------------------------+--------------------------------------------------+-------------+---------+------+------------------+-----------+--------------------------------------+--------------------------------------+
root@opensds:~/gopath/src/github.com/opensds/opensds# osdsctl replication list
+--------------------------------------+--------------------------------------+-------------+--------------------------------------+--------------------------------------+------------------+-----------------+-----------------+
| Id                                   | Name                                 | Description | PrimaryVolumeId                      | SecondaryVolumeId                    | AvailabilityZone | ReplicationStatus | ReplicationMode |
+--------------------------------------+--------------------------------------+-------------+--------------------------------------+--------------------------------------+------------------+-----------------+-----------------+
| 22674284-df5c-407a-831b-ded83b90b3eb | pvc-ce0baf87-7ee6-11e8-b500-000c29bcba39 |             | 662a5727-99b7-4b17-ba48-148ea8a0559c | 62bb24bf-edbb-47dc-9a77-ecfd9cb61c23 |                  | enabled           | sync            |
+--------------------------------------+--------------------------------------+-------------+--------------------------------------+--------------------------------------+------------------+-----------------+-----------------+
```

4. Start up the nginx application pod.

```yaml
# nginx.yaml
# This YAML file contains nginx
apiVersion: v1
kind: Pod
metadata:
  name: nginx
spec:
  containers:
  - image: nginx
    imagePullPolicy: IfNotPresent
    name: nginx
    ports:
    - containerPort: 80
      protocol: TCP
    volumeMounts:
      - mountPath: /var/lib/www/html
        name: csi-data-opensdsplugin
  volumes:
  - name: csi-data-opensdsplugin
    persistentVolumeClaim:
      claimName: csi-pvc-opensdsplugin
      readOnly: false
```

```
root@opensds:~# kubectl get pod
NAME                                READY     STATUS    RESTARTS   AGE
csi-attacher-opensdsplugin-0        2/2       Running   0          1h
csi-nodeplugin-opensdsplugin-fdsk5  2/2       Running   6          1h
csi-provisioner-opensdsplugin-0     2/2       Running   0          1h
nginx                               1/1       Running   0          27m
root@opensds:~# lsblk
NAME                  MAJ:MIN RM   SIZE RO TYPE MOUNTPOINT
fd0                     2:0    1     4K  0 disk
sda                     8:0    0   120G  0 disk
├─sda1                  8:1    0   487M  0 part /boot
├─sda2                  8:2    0     1K  0 part
└─sda5                  8:5    0 119.5G  0 part
  ├─opensds--vg-root  252:0    0 103.5G  0 lvm  /
  └─opensds--vg-swap_1 252:1   0    16G  0 lvm  [SWAP]
sdb                     8:16   0     1G  0 disk /var/lib/kubelet/pods/8c96ed3e-7ee7-11e8-b500-000c29bcba39/volumes/kubernetes.io~csi/pvc-ce0baf87-7ee6-11e8-b500-000c29bcba39/mount
sr0                    11:0    1  1024M  0 rom
```

5. Set the replication failed over.

```
root@opensds:~/gopath/src/github.com/opensds/opensds# osdsctl replication list
+--------------------------------------+--------------------------------------+-------------+--------------------------------------+--------------------------------------+------------------+-------------------+-----------------+
| Id                                   | Name                                 | Description | PrimaryVolumeId                      | SecondaryVolumeId                    | AvailabilityZone | ReplicationStatus | ReplicationMode |
+--------------------------------------+--------------------------------------+-------------+--------------------------------------+--------------------------------------+------------------+-------------------+-----------------+
| 22674284-df5c-407a-831b-ded83b90b3eb | pvc-ce0baf87-7ee6-11e8-b500-000c29bcba39 |             | 662a5727-99b7-4b17-ba48-148ea8a0559c | 62bb24bf-edbb-47dc-9a77-ecfd9cb61c23 |                  | enabled           | sync            |
+--------------------------------------+--------------------------------------+-------------+--------------------------------------+--------------------------------------+------------------+-------------------+-----------------+
root@opensds:~/gopath/src/github.com/opensds/opensds# osdsctl replication failover 22674284-df5c-407a-831b-ded83b90b3eb
root@opensds:~/gopath/src/github.com/opensds/opensds# osdsctl replication list
+--------------------------------------+--------------------------------------+-------------+--------------------------------------+--------------------------------------+------------------+-------------------+-----------------+
| Id                                   | Name                                 | Description | PrimaryVolumeId                      | SecondaryVolumeId                    | AvailabilityZone | ReplicationStatus | ReplicationMode |
+--------------------------------------+--------------------------------------+-------------+--------------------------------------+--------------------------------------+------------------+-------------------+-----------------+
| 22674284-df5c-407a-831b-ded83b90b3eb | pvc-ce0baf87-7ee6-11e8-b500-000c29bcba39 |             | 662a5727-99b7-4b17-ba48-148ea8a0559c | 62bb24bf-edbb-47dc-9a77-ecfd9cb61c23 |                  | failed_over       | sync            |
+--------------------------------------+--------------------------------------+-------------+--------------------------------------+--------------------------------------+------------------+-------------------+-----------------+
```

6. Restart the nginx, you will find the storage which is used by nginx is switch to secondary.

```
root@opensds:~/gopath/src/github.com/opensds/nbp/csi/server/examples/kubernetes# kubectl get pod
NAME                                 READY     STATUS    RESTARTS   AGE
csi-attacher-opensdsplugin-0         2/2       Running   0          1h
csi-nodeplugin-opensdsplugin-fdsk5   2/2       Running   6          1h
csi-provisioner-opensdsplugin-0      2/2       Running   0          1h
root@opensds:~/gopath/src/github.com/opensds/nbp/csi/server/examples/kubernetes# kubectl create -f nginx.yaml
pod "nginx" created
root@opensds:~/gopath/src/github.com/opensds/nbp/csi/server/examples/kubernetes# kubectl get pod
NAME                                 READY     STATUS    RESTARTS   AGE
csi-attacher-opensdsplugin-0         2/2       Running   0          1h
csi-nodeplugin-opensdsplugin-fdsk5   2/2       Running   6          1h
csi-provisioner-opensdsplugin-0      2/2       Running   0          1h
nginx                                1/1       Running   0          3m
root@opensds:~/gopath/src/github.com/opensds/nbp/csi/server/examples/kubernetes# lsblk
NAME                  MAJ:MIN RM   SIZE RO TYPE MOUNTPOINT
fd0                     2:0    1     4K  0 disk
sda                     8:0    0   120G  0 disk
├─sda1                  8:1    0   487M  0 part /boot
├─sda2                  8:2    0     1K  0 part
└─sda5                  8:5    0 119.5G  0 part
  ├─opensds--vg-root   252:0    0 103.5G  0 lvm  /
  └─opensds--vg-swap_1 252:1    0    16G  0 lvm  [SWAP]
sdb                     8:16   0     1G  0 disk /var/lib/kubelet/pods/422ec993-7eec-11e8-b500-000c29bcba39/volumes/kubernetes.io~csi/pvc-ce0baf87-7ee6-11e8-b500-000c29bcba39/mount
sr0                    11:0    1  1024M  0 rom
root@opensds:~/gopath/src/github.com/opensds/nbp/csi/server/examples/kubernetes#
```

5.5 Host-based Replication using DRBD

5.5.1 Prepare

We need to prepare two hosts for this test, say HostA(IP: 192.168.0.131) and HostB(IP: 192.168.0.66). And before we start, please make sure the OpenSDS is already installed on both hosts. And copy *etcdctl, etcd, osdslet, osdsdock, osdsctl* to */opt/opensds/bin/*.

5.5.2 Install DRBD

Install DRBD as the following steps on both hosts:

- *sudo add-apt-repository ppa:linbit/linbit-drbd9-stack*
- *sudo apt-get update*
- *sudoapt-get install drbd-utils python-drbdmanage drbd-dkms*

5.5.3 Configuration

Before do configuration, please stop opensds service first. That is find out the process id of etcd, osdslet and osdsdock, and kill them.

Modify */etc/opensds/opensds.conf*:

- Add *host_based_replication_driver* for the *osdsdock* part on both hosts

- Change *endpoint* of *database* on hostB to the same as HostA.

Here is the example:

```
[lvm]
name = lvm
description = LVM Test
driver_name = lvm
config_path = /etc/opensds/driver/lvm.yaml

[osdslet]
api_endpoint = 0.0.0.0:50040
graceful = True
log_file = /var/log/opensds/osdslet.log
socket_order = inc
auth_strategy = noauth

[osdsdock]
api_endpoint = 192.168.0.131:50050
log_file = /var/log/opensds/osdsdock.log
#  Specify which backends should be enabled, sample,ceph,cinder,lvm and so on.
enabled_backends = lvm
host_based_replication_driver = drbd

[database]
endpoint = 192.168.0.131:62379,192.168.0.131:62380
driver = etcd
```

Add a new configuration file */etc/opensds/attacher.conf* on both hosts, here is an example:

```
[osdsdock]
api_endpoint = 192.168.0.131:50051
log_file = /var/log/opensds/osdsdock.log
bind_ip = 192.168.0.131
dock_type = attacher

[database]
endpoint = 192.168.0.131:62379,192.168.0.131:62380
driver = etcd
```

Note: both hosts have the same *endpoint* of *database*, but *api_endpoint* and *bind_ip* of *osdsdock* should be the host ip respectively.

Add a new configuration file */etc/opensds/drbd.yaml* on both hosts, the content is:

```
# Minumum and Maximum TCP/IP ports used for DRBD replication
PortMin: 7000
PortMax: 8000

# Exactly two hosts between resources are replicated.
# Never ever change the Node-ID associated with a Host(name)
Hosts:
  - Hostname: ecs-37cc
    IP: 192.168.0.66
    Node-ID: 1

  - Hostname: ecs-32bc
    IP: 192.168.0.131
    Node-ID: 0
```

Note: *Hostname* and *IP* should be the real value of each hosts.

Modify */etc/opensds/driver/lvm.yaml* on hostB, change *availabilityZone* to a new value. Here is an example:

```
tgtBindIp: 192.168.0.66
```

```
tgtConfDir: /etc/tgt/conf.d
pool:
  opensds-volumes-default:
    diskType: NL-SAS
    availabilityZone: secondary
    extras:
      dataStorage:
        provisioningPolicy: Thin
        isSpaceEfficient: false
      ioConnectivity:
        accessProtocol: iscsi
        maxIOPS: 7000000
        maxBWS: 600
      advanced:
        diskType: SSD
        latency: 5ms
```

5.5.4 **Create Replication**

Start services on HostA:

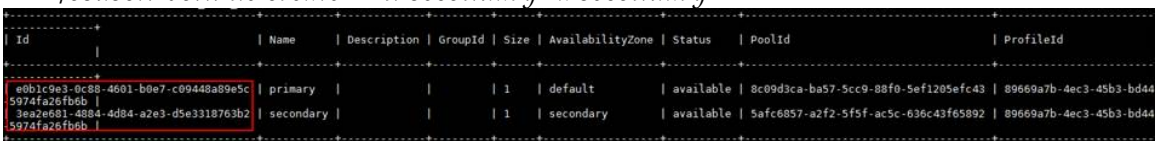
- *cd /opt/opensds/bin*
- *./etcd --advertise-client-urls http://192.168.0.131:62379 --listen-client-urls http://192.168.0.131:62379 --listen-peer-urls http://192.168.0.131:62380 --data-dir /opt/opensds/etcd/data >> /var/log/opensds/etcd.log 2>&1 &*
- *./osdslet &*
- *./osdsdock &*
- *./osdsdock --config-file /etc/opensds/attacher.conf &*

Start services on HostB:

- *./osdslet &*
- *./osdsdock &*
- *./osdsdock --config-file /etc/opensds/attacher.conf &*

Create volumes (run them on HostA or hostB):

- *./osdsctl volume create 1 -n primary*
- *./osdsctl volume create 1 -n secondary -a secondary*



```
+--------------------------------------+-----------+-------------+---------+------+------------------+-----------+--------------------------------------+--------------------------------------+
| Id                                   | Name      | Description | GroupId | Size | AvailabilityZone | Status    | PoolId                               | ProfileId                            |
+--------------------------------------+-----------+-------------+---------+------+------------------+-----------+--------------------------------------+--------------------------------------+
| e0b1c9e3-0c88-4601-b0e7-c09448a89e5c | primary   |             |         | 1    | default          | available | 8c09d3ca-ba57-5cc9-88f0-5ef1205efc43 | 89669a7b-4ec3-45b3-bd44-5974fa26fb6b |
| 3ea2e681-4884-4d84-a2e3-d5e3318763b2 | secondary |             |         | 1    | secondary        | available | 5afc6857-a2f2-5f5f-ac5c-636c43f65892 | 89669a7b-4ec3-45b3-bd44-5974fa26fb6b |
+--------------------------------------+-----------+-------------+---------+------+------------------+-----------+--------------------------------------+--------------------------------------+
```

Create replication:

- *./osdsctl replication create e0b1c9e3-0c88-4601-b0e7-c09448a89e5c 3ea2e681-4884-4d84-a2e3-d5e3318763b2*

```
root@ecs-32bc:/opt/opensds/bin# ./osdsctl replication create e0b1c9e3-0c88-4601-b0e7-c09448a89e5c 3ea2e681-4884-4d84-a2e3-d5e3318763b2
WARNING: Not found Env OPENSDS_AUTH_STRATEGY, use default(noauth)
&{0xc420750e90 0xc420750e98 0xc42012a5a0}
&{0xc42021df50 attacher    192.168.0.131:50051 ecs-32bc  map[OsType:linux Platform:amd64 HostIp:192.168.0.131 Initiator:iqn.1993-08.org.debian:01:42e1a22343c]}
&{0xc420750ce0 0xc420750cf0 0xc4208741e0}
&{0xc4207e9260 attacher    192.168.0.66:50051 ecs-37cc  map[HostIp:192.168.0.66 Initiator:iqn.1993-08.org.debian:01:42e1a22343c OsType:linux Platform:amd64]}
2018/06/08 11:48:07.996 [D] ::1 - - [08/Jun/2018 11:48:04] "POST /v1beta/ef305038-cd12-4f3b-90bd-0612f83e14ee/block/replications HTTP/1.1 202 0" 3.465986  beegoServer

+--------------------------------+------------------------------------------------------------
| Property                       | Value
+--------------------------------+------------------------------------------------------------
| Id                             | 1badf257-a3ad-459a-bcd7-c9506aed43cb
| CreatedAt                      | 2018-06-08T11:48:04
| UpdatedAt                      |
| Name                           |
| Description                    |
| PrimaryVolumeId                | e0b1c9e3-0c88-4601-b0e7-c09448a89e5c
| SecondaryVolumeId              | 3ea2e681-4884-4d84-a2e3-d5e3318763b2
| AvailabilityZone               |
| PrimaryReplicationDriverData   | {
|                                |  "AttachmentId": "d4a38c28-5a80-4b52-858d-f195bf7b173b",
|                                |  "HostIp": "192.168.0.131",
|                                |  "HostName": "ecs-32bc",
|                                |  "Mountpoint": "/dev/disk/by-path/ip-192.168.0.131:3260-iscsi-iqn.2017-10.io.opensds:e0b1c9e3-0c88-4601-b0e7-c09448a89e5c-lun-1",
|                                |  "e0b1c9e3-0c88-4601-b0e7-c09448a89e5c-drbd-minor": "1",
|                                |  "e0b1c9e3-0c88-4601-b0e7-c09448a89e5c-drbd-port": "7000",
|                                |  "lvPath": "/dev/opensds-volumes-default/volume-e0b1c9e3-0c88-4601-b0e7-c09448a89e5c"
|                                | }
| SecondaryReplicationDriverData | {
|                                |  "3ea2e681-4884-4d84-a2e3-d5e3318763b2-drbd-minor": "1",
|                                |  "3ea2e681-4884-4d84-a2e3-d5e3318763b2-drbd-port": "7000",
|                                |  "AttachmentId": "9440aeec-57b7-493f-85bd-8c8af6058e0a",
|                                |  "HostIp": "192.168.0.66",
|                                |  "HostName": "ecs-37cc",
|                                |  "Mountpoint": "/dev/disk/by-path/ip-192.168.0.66:3260-iscsi-iqn.2017-10.io.opensds:3ea2e681-4884-4d84-a2e3-d5e3318763b2-lun-1",
|                                |  "lvPath": "/dev/opensds-volumes-default/volume-3ea2e681-4884-4d84-a2e3-d5e3318763b2"
|                                | }
| ReplicationStatus              | enabled
| ReplicationMode                | sync
| ReplicationPeriod              | 0
| ProfileId                      |
+--------------------------------+------------------------------------------------------------
```

5.5.5 **Check result**

See the block device.

```
root@ecs-32bc:/opt/opensds/bin# lsblk
NAME                                                                MAJ:MIN RM   SIZE RO TYPE MOUNTPOINT
sda                                                                   8:0    0     1G  0 disk
xvda                                                                202:0    0    60G  0 disk
└─xvda1                                                             202:1    0    60G  0 part /
loop0                                                                 7:0    0    20G  0 loop
└─opensds--volumes--default-volume--e0b1c9e3--0c88--4601--b0e7--c09448a89e5c 252:0    0     1G  0 lvm
  └─drbd1                                                           147:1    0 1023.8M  1 disk
```

Create some data on HostA.

- *mkfs.ext4 /dev/drbd1*
- *mount /dev/drbd1 ./reptest/*
- *touch test*
- *dd if=/dev/zero of=./2 bs=1M count=500*
- *touch test*
- ……

Check the synchronous status on both hosts.

```
root@ecs-32bc:/opt/opensds/bin# drbdsetup status
1badf257-a3ad-459a-bcd7-c9506aed43cb role:Primary
  disk:UpToDate
  ecs-37cc role:Secondary
    peer-disk:UpToDate
```

Check if the data is updated on HostB.

- umount on HostA
- mount on HostB
- Check data on HostB, and you can see the data is updated.

```
root@ecs-37cc:/home/reptest# ll
total 512044
drwxr-xr-x 3 root root      4096 Jun  8 11:56 ./
drwxr-xr-x 4 root root      4096 Jun  8 11:54 ../
-rw-r--r-- 1 root root 524288000 Jun  8 13:39 2
-rw-r--r-- 1 root root        29 Jun  8 11:56 3
-rw-r--r-- 1 root root        29 Jun  8 11:56 4
-rw-r--r-- 1 root root        29 Jun  8 11:56 5
drwx------ 2 root root     16384 Jun  8 11:51 lost+found/
-rw-r--r-- 1 root root        29 Jun  8 11:51 test
root@ecs-37cc:/home/reptest#
```

6 OpenSDS CLI Guide

6.1 List Docks

Use the following command to display the docks information.

```
osdsctl dock list
```

Sample results are as follows:

```
root@ecs-fe68:~/gopath/src/github.com/opensds/opensds# osdsctl dock list
+--------------------------------------+------+-------------+---------------------+------------+
| Id                                   | Name | Description | Endpoint            | DriverName |
+--------------------------------------+------+-------------+---------------------+------------+
| 410203b0-3bcd-5239-b9c2-3cd63d8fbdfd | lvm  | LVM Test    | 192.168.0.172:50050 | lvm        |
+--------------------------------------+------+-------------+---------------------+------------+
```

Display specific results by filter parameters. Filter parameters can be displayed by the following command.

```
osdsctl dock list -h
```

Results are as follows:

```
root@ecs-fe68:~/gopath/src/github.com/opensds/opensds# osdsctl dock list -h
get all dock resources

Usage:
  osdsctl dock list [flags]

Flags:
      --description string   list docks by description
      --driverName string    list docks by driver name
      --endpoint string      list docks by endpoint
  -h, --help                 help for list
      --id string            list docks by id
      --limit string         the number of ertries displayed per page (default "50")
      --name string          list docks by name
      --offset string        all requested data offsets (default "0")
      --sortDir string       the sort direction of all requested data. supports asc or desc(default) (default "desc")
      --sortKey string       the sort key of all requested data. supports id(default), name, status, endpoint, drivername, description (default "id")
      --status string        list docks by status
      --storageType string   list docks by storage type

Global Flags:
      --debug   shows debugging output.
root@ecs-fe68:~/gopath/src/github.com/opensds/opensds#
```

Example:

```
root@ecs-fe68:~/gopath/src/github.com/opensds/opensds# osdsctl  dock list
+--------------------------------------+------+-------------+---------------------+------------+
| Id                                   | Name | Description | Endpoint            | DriverName |
+--------------------------------------+------+-------------+---------------------+------------+
| 410203b0-3bcd-5239-b9c2-3cd63d8fbdfd | lvm  | LVM Test    | 192.168.0.172:50050 | lvm        |
+--------------------------------------+------+-------------+---------------------+------------+
root@ecs-fe68:~/gopath/src/github.com/opensds/opensds# osdsctl  dock list --name test
+----+------+-------------+----------+------------+------------+
| Id | Name | Description | Endpoint | DriverName | Parameters |
+----+------+-------------+----------+------------+------------+
+----+------+-------------+----------+------------+------------+
root@ecs-fe68:~/gopath/src/github.com/opensds/opensds# osdsctl  dock list --name lvm
+--------------------------------------+------+-------------+---------------------+------------+
| Id                                   | Name | Description | Endpoint            | DriverName |
+--------------------------------------+------+-------------+---------------------+------------+
| 410203b0-3bcd-5239-b9c2-3cd63d8fbdfd | lvm  | LVM Test    | 192.168.0.172:50050 | lvm        |
+--------------------------------------+------+-------------+---------------------+------------+
root@ecs-fe68:~/gopath/src/github.com/opensds/opensds#
```

6.2 List Pools

Use the following command to display the pools information.

```
osdsctl pool list
```

Sample results are as follows:

```
root@ecs-fe68:~/gopath/src/github.com/opensds/opensds# osdsctl pool list
+--------------------------------------+-------------------------+-------------+--------+------------------+---------------+--------------+
| Id                                   | Name                    | Description | Status | AvailabilityZone | TotalCapacity | FreeCapacity |
+--------------------------------------+-------------------------+-------------+--------+------------------+---------------+--------------+
| 83272ab1-d97e-5706-b299-8928f8847477 | opensds-volumes-default |             |        | default          | 20            | 20           |
+--------------------------------------+-------------------------+-------------+--------+------------------+---------------+--------------+
root@ecs-fe68:~/gopath/src/github.com/opensds/opensds#
```

Display specific results by filter parameters. Filter parameters can be displayed by the following command.

```
osdsctl pool list -h
```

Results are as follows:

```
root@ecs-fe68:~/gopath/src/github.com/opensds/opensds# osdsctl pool list -h
get all pool resources

Usage:
  osdsctl pool list [flags]

Flags:
      --availabilityZone string   list pools by availability zone
      --description string        list pools by description
      --dockId string             list pools by dock id
  -h, --help                      help for list
      --id string                 list pools by id
      --limit string              the number of ertries displayed per page (default "50")
      --name string               list pools by name
      --offset string             all requested data offsets (default "0")
      --sortDir string            the sort direction of all requested data. supports asc or desc(default) (default "desc")
      --sortKey string            the sort key of all requested data. supports id(default), name, status, availabilityzone, dock id, description (default "id")
      --status string             list pools by status
      --storageType string        list pools by storage type

Global Flags:
      --debug   shows debugging output.
root@ecs-fe68:~/gopath/src/github.com/opensds/opensds#
```

Example:

```
root@ecs-fe68:~/gopath/src/github.com/opensds/opensds# osdsctl pool list
+--------------------------------------+--------------------------+-------------+--------+------------------+---------------+--------------+
| Id                                   | Name                     | Description | Status | AvailabilityZone | TotalCapacity | FreeCapacity |
+--------------------------------------+--------------------------+-------------+--------+------------------+---------------+--------------+
| 83272ab1-d97e-5706-b299-8928f8847477 | opensds-volumes-default  |             |        | default          | 20            | 20           |
+--------------------------------------+--------------------------+-------------+--------+------------------+---------------+--------------+
root@ecs-fe68:~/gopath/src/github.com/opensds/opensds# osdsctl pool list --limit 3
+--------------------------------------+--------------------------+-------------+--------+------------------+---------------+--------------+
| Id                                   | Name                     | Description | Status | AvailabilityZone | TotalCapacity | FreeCapacity |
+--------------------------------------+--------------------------+-------------+--------+------------------+---------------+--------------+
| 83272ab1-d97e-5706-b299-8928f8847477 | opensds-volumes-default  |             |        | default          | 20            | 20           |
+--------------------------------------+--------------------------+-------------+--------+------------------+---------------+--------------+
root@ecs-fe68:~/gopath/src/github.com/opensds/opensds#
```

6.3 Create/Delete Profile

Use the following command to create profile.

```
osdsctl profile create *
```

Example:

```
root@ecs-fe68:~/gopath/src/github.com/opensds/opensds# osdsctl profile create '{"name":"default","description":"default policy"}'
+-------------+----------------------------------+
| Property    | Value                            |
+-------------+----------------------------------+
| Id          | 879a434d-a679-44b1-8265-4ba2cff0165d |
| CreatedAt   | 2018-06-16T19:14:22              |
| UpdatedAt   |                                  |
| Name        | default                          |
| Description | default policy                   |
| Extras      | null                             |
+-------------+----------------------------------+
root@ecs-fe68:~/gopath/src/github.com/opensds/opensds# osdsctl profile list
+--------------------------------------+---------+----------------+
| Id                                   | Name    | Description    |
+--------------------------------------+---------+----------------+
| dde9554b-ca62-4989-9d6b-a23997883ce1 | default | default policy |
| 879a434d-a679-44b1-8265-4ba2cff0165d | default | default policy |
+--------------------------------------+---------+----------------+
root@ecs-fe68:~/gopath/src/github.com/opensds/opensds#
```

Use the following command to delete profile.

```
osdsctl profile delete *
```

Example:

```
root@ecs-fe68:~/gopath/src/github.com/opensds/opensds# osdsctl profile delete 879a434d-a679-44b1-8265-4ba2cff0165d
root@ecs-fe68:~/gopath/src/github.com/opensds/opensds# osdsctl profile list
+--------------------------------------+---------+----------------+
| Id                                   | Name    | Description    |
+--------------------------------------+---------+----------------+
| dde9554b-ca62-4989-9d6b-a23997883ce1 | default | default policy |
+--------------------------------------+---------+----------------+
root@ecs-fe68:~/gopath/src/github.com/opensds/opensds#
```

6.4 Create/Delete/Get/List Volume(s)

Use the following command to create volume.

```
osdsctl volume create 3
```

Example:

```
root@ecs-fe68:~/gopath/src/github.com/opensds/opensds# osdsctl volume create 3
+------------------+--------------------------------------+
| Property         | Value                                |
+------------------+--------------------------------------+
| Id               | 2e5b76a3-8464-4fc8-9138-fda196c8d019 |
| CreatedAt        | 2018-06-16T18:24:30                  |
| UpdatedAt        |                                      |
| Name             |                                      |
| Description      |                                      |
| GroupId          |                                      |
| Size             | 3                                    |
| AvailabilityZone | default                              |
| Status           | creating                             |
| PoolId           |                                      |
| ProfileId        |                                      |
| Metadata         | map[]                                |
+------------------+--------------------------------------+
root@ecs-fe68:~/gopath/src/github.com/opensds/opensds#
```

Use the following command to display the volume details.

```
osdsctl volume show *
```

Example:

```
root@ecs-fe68:~/gopath/src/github.com/opensds/opensds# osdsctl volume show 2e5b76a3-8464-4fc8-9138-fda196c8d019
+------------------+-----------------------------------------------------------------------------------------+
| Property         | Value                                                                                   |
+------------------+-----------------------------------------------------------------------------------------+
| Id               | 2e5b76a3-8464-4fc8-9138-fda196c8d019                                                    |
| CreatedAt        | 2018-06-16T18:24:30                                                                     |
| UpdatedAt        | 2018-06-16T18:24:31                                                                     |
| Name             |                                                                                         |
| Description      |                                                                                         |
| GroupId          |                                                                                         |
| Size             | 3                                                                                       |
| AvailabilityZone | default                                                                                 |
| Status           | available                                                                               |
| PoolId           | 83272ab1-d97e-5706-b299-8928f8847477                                                    |
| ProfileId        | 65f1c4ce-cf4b-4a86-91f2-c9b40edbea4a                                                    |
| Metadata         | map[lvPath:/dev/opensds-volumes-default/volume-2e5b76a3-8464-4fc8-9138-fda196c8d019]    |
| SnapshotId       |                                                                                         |
+------------------+-----------------------------------------------------------------------------------------+
root@ecs-fe68:~/gopath/src/github.com/opensds/opensds#
```

Use the following command to delete the volume.

```
osdsctl volume delete *
```

Example:

```
root@ecs-fe68:~/gopath/src/github.com/opensds/opensds# osdsctl volume delete 2e5b76a3-8464-4fc8-9138-fda196c8d019
root@ecs-fe68:~/gopath/src/github.com/opensds/opensds# osdsctl volume show 2e5b76a3-8464-4fc8-9138-fda196c8d019
ERROR: Get volume failed: specified volume(2e5b76a3-8464-4fc8-9138-fda196c8d019) can't find
root@ecs-fe68:~/gopath/src/github.com/opensds/opensds#
```

Display specific results by filter parameters. Filter parameters can be displayed by the following command.

```
osdsctl volume list -h
```

Results are as follows:

```
root@ecs-fe68:~/gopath/src/github.com/opensds/opensds# osdsctl volume list -h
list all volumes in the cluster

Usage:
  osdsctl volume list [flags]

Flags:
      --availabilityZone string   list volume by availability zone
      --description string        list volume by description
      --groupId string            list volume by volume group id
  -h, --help                      help for list
      --id string                 list volume by id
      --limit string              the number of etries displayed per page (default "50")
      --name string               list volume by name
      --offset string             all requested data offsets (default "0")
      --poolId string             list volume by poolId
      --profileId string          list volume by profile id
      --sortDir string            the sort direction of all requested data. supports asc or desc(default) (default "desc")
      --sortKey string            the sort key of all requested data. supports id(default), name, status, availabilityzone, profileid, tenantid, size, poolid, description (default "id")
      --status string             list volume by status
      --tenantId string           list volume by tenantId
      --userId string             list volume by storage userId

Global Flags:
      --debug           shows debugging output.
  -p, --profile string  the name of profile configured by admin
root@ecs-fe68:~/gopath/src/github.com/opensds/opensds#
```

Example:

```
root@ecs-fe68:~/gopath/src/github.com/opensds/opensds# osdsctl volume list
+--------------------------------------+------+-------------+---------+------+------------------+-----------+--------------------------------------+--------------------------------------+
| Id                                   | Name | Description | GroupId | Size | AvailabilityZone | Status    | PoolId                               | ProfileId                            |
+--------------------------------------+------+-------------+---------+------+------------------+-----------+--------------------------------------+--------------------------------------+
| e30867c4-8e46-4661-a119-9d9432c421e6 |      |             |         | 1    | default          | available | 273d3ce3-7728-51e1-b32d-446d33a015d6 | dde9554b-ca62-4989-9d6b-a23997883ce1 |
| 93c1cae1-7512-4d7c-81c1-60c423569f35 |      |             |         | 3    | default          | available | 273d3ce3-7728-51e1-b32d-446d33a015d6 | dde9554b-ca62-4989-9d6b-a23997883ce1 |
| 911803b4-2f47-420b-9b3a-f8062f211299 |      |             |         | 2    | default          | available | 273d3ce3-7728-51e1-b32d-446d33a015d6 | dde9554b-ca62-4989-9d6b-a23997883ce1 |
| 8bd82aab-76ee-426f-a09c-e96b4559229a |      |             |         | 4    | default          | available | 273d3ce3-7728-51e1-b32d-446d33a015d6 | dde9554b-ca62-4989-9d6b-a23997883ce1 |
| 490b9396-d020-4ac8-bc68-f93229c6a67a |      |             |         | 1    | default          | available | 273d3ce3-7728-51e1-b32d-446d33a015d6 | dde9554b-ca62-4989-9d6b-a23997883ce1 |
+--------------------------------------+------+-------------+---------+------+------------------+-----------+--------------------------------------+--------------------------------------+
root@ecs-fe68:~/gopath/src/github.com/opensds/opensds# osdsctl volume list --sortKey size --sortDir asc --limit 3 --offset 1
+--------------------------------------+------+-------------+---------+------+------------------+-----------+--------------------------------------+--------------------------------------+
| Id                                   | Name | Description | GroupId | Size | AvailabilityZone | Status    | PoolId                               | ProfileId                            |
+--------------------------------------+------+-------------+---------+------+------------------+-----------+--------------------------------------+--------------------------------------+
| e30867c4-8e46-4661-a119-9d9432c421e6 |      |             |         | 1    | default          | available | 273d3ce3-7728-51e1-b32d-446d33a015d6 | dde9554b-ca62-4989-9d6b-a23997883ce1 |
| 911803b4-2f47-420b-9b3a-f8062f211299 |      |             |         | 2    | default          | available | 273d3ce3-7728-51e1-b32d-446d33a015d6 | dde9554b-ca62-4989-9d6b-a23997883ce1 |
| 93c1cae1-7512-4d7c-81c1-60c423569f35 |      |             |         | 3    | default          | available | 273d3ce3-7728-51e1-b32d-446d33a015d6 | dde9554b-ca62-4989-9d6b-a23997883ce1 |
+--------------------------------------+------+-------------+---------+------+------------------+-----------+--------------------------------------+--------------------------------------+
root@ecs-fe68:~/gopath/src/github.com/opensds/opensds#
```

6.5 Create/Delete/Get/List Snapshot(s)

Use the following command to create snapshot.

```
osdsctl volume snapshot create *
```

Example:

```
root@ecs-fe68:~/gopath/src/github.com/opensds/opensds# osdsctl volume snapshot create fba2d85f-f5c7-451e-9f98-b78cd7287047
+-------------+--------------------------------------+
| Property    | Value                                |
+-------------+--------------------------------------+
| Id          | 12750418-a1d5-4aca-8ad4-982418162b8f |
| CreatedAt   | 2018-06-16T18:29:50                  |
| UpdatedAt   |                                      |
| Name        |                                      |
| Description |                                      |
| Size        | 2                                    |
| Status      | creating                             |
| VolumeId    | fba2d85f-f5c7-451e-9f98-b78cd7287047 |
+-------------+--------------------------------------+
```

Use the following command to display snapshot details.

```
osdsctl volume snapshot show *
```

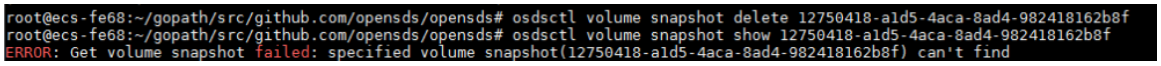
Example:

```
root@ecs-fe68:~/gopath/src/github.com/opensds/opensds# osdsctl volume snapshot show 12750418-a1d5-4aca-8ad4-982418162b8f
+-------------+--------------------------------------+
| Property    | Value                                |
+-------------+--------------------------------------+
| Id          | 12750418-a1d5-4aca-8ad4-982418162b8f |
| CreatedAt   | 2018-06-16T18:29:50                  |
| UpdatedAt   | 2018-06-16T18:29:50                  |
| Name        |                                      |
| Description |                                      |
| Size        | 2                                    |
| Status      | available                            |
| VolumeId    | fba2d85f-f5c7-451e-9f98-b78cd7287047 |
+-------------+--------------------------------------+
```

Use the following command to delete snapshot.

```
osdsctl volume snapshot delete *
```

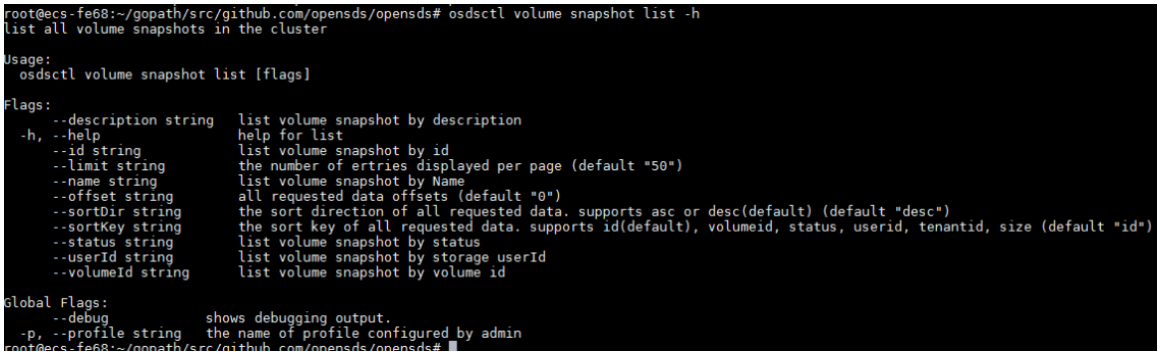
Example:



Display specific results by filter parameters. Filter parameters can be displayed by the following command.

```
osdsctl volume snapshot list -h
```

Results are as follows:



6.6 Create Volume from Snapshot

Use the following command to create volume from snapshot.

```
osdsctl volume create 1 –s *
```

Example:

```
root@ecs-fe68:~/gopath/src/github.com/opensds/opensds# osdsctl volume snapshot list
+--------------------------------------+------+-------------+------+-----------+--------------------------------------+
| Id                                   | Name | Description | Size | Status    | VolumeId                             |
+--------------------------------------+------+-------------+------+-----------+--------------------------------------+
| e405cf80-4679-4b12-91be-11f0282031eb |      |             | 2    | available | fba2d85f-f5c7-451e-9f98-b78cd7287047 |
+--------------------------------------+------+-------------+------+-----------+--------------------------------------+
root@ecs-fe68:~/gopath/src/github.com/opensds/opensds# osdsctl volume create 2 -s e405cf80-4679-4b12-91be-11f0282031eb
+------------------+--------------------------------------+
| Property         | Value                                |
+------------------+--------------------------------------+
| Id               | 003695ae-f90a-45a6-a906-3ea6514b0ca2 |
| CreatedAt        | 2018-06-16T18:34:55                  |
| UpdatedAt        |                                      |
| Name             |                                      |
| Description      |                                      |
| GroupId          |                                      |
| Size             | 2                                    |
| AvailabilityZone | default                              |
| Status           | creating                             |
| PoolId           |                                      |
| ProfileId        |                                      |
| Metadata         | map[]                                |
+------------------+--------------------------------------+
root@ecs-fe68:~/gopath/src/github.com/opensds/opensds# osdsctl volume show 003695ae-f90a-45a6-a906-3ea6514b0ca2
+------------------+-----------------------------------------------------------------------------------------+
| Property         | Value                                                                                   |
+------------------+-----------------------------------------------------------------------------------------+
| Id               | 003695ae-f90a-45a6-a906-3ea6514b0ca2                                                    |
| CreatedAt        | 2018-06-16T18:34:55                                                                     |
| UpdatedAt        | 2018-06-16T18:35:07                                                                     |
| Name             |                                                                                         |
| Description      |                                                                                         |
| GroupId          |                                                                                         |
| Size             | 2                                                                                       |
| AvailabilityZone | default                                                                                 |
| Status           | available                                                                               |
| PoolId           | 83272ab1-d97e-5706-b299-8928f8847477                                                    |
| ProfileId        | 65f1c4ce-cf4b-4a86-91f2-c9b40edbea4a                                                    |
| Metadata         | map[lvPath:/dev/opensds-volumes-default/volume-003695ae-f90a-45a6-a906-3ea6514b0ca2]    |
| SnapshotId       | e405cf80-4679-4b12-91be-11f0282031eb                                                    |
+------------------+-----------------------------------------------------------------------------------------+
root@ecs-fe68:~/gopath/src/github.com/opensds/opensds#
```

6.7 Expand Volume

Use the following command to expand volume size.

```
osdsctl volume extend * *
```

Example:

```
root@ecs-fe68:~/gopath/src/github.com/opensds/opensds# osdsctl volume extend 11a357e4-03c8-4e72-bc76-fce868ed2d10 2
+------------------+--------------------------------------------------------------------------------------+
| Property         | Value                                                                                |
+------------------+--------------------------------------------------------------------------------------+
| Id               | 11a357e4-03c8-4e72-bc76-fce868ed2d10                                                 |
| CreatedAt        | 2018-06-16T18:37:18                                                                  |
| UpdatedAt        | 2018-06-16T18:37:39                                                                  |
| Name             |                                                                                      |
| Description      |                                                                                      |
| GroupId          |                                                                                      |
| Size             | 1                                                                                    |
| AvailabilityZone | default                                                                              |
| Status           | extending                                                                            |
| PoolId           | 83272ab1-d97e-5706-b299-8928f8847477                                                 |
| ProfileId        | 65f1c4ce-cf4b-4a86-91f2-c9b40edbea4a                                                 |
| Metadata         | map[lvPath:/dev/opensds-volumes-default/volume-11a357e4-03c8-4e72-bc76-fce868ed2d10] |
+------------------+--------------------------------------------------------------------------------------+
root@ecs-fe68:~/gopath/src/github.com/opensds/opensds# osdsctl volume show 11a357e4-03c8-4e72-bc76-fce868ed2d10
+------------------+--------------------------------------------------------------------------------------+
| Property         | Value                                                                                |
+------------------+--------------------------------------------------------------------------------------+
| Id               | 11a357e4-03c8-4e72-bc76-fce868ed2d10                                                 |
| CreatedAt        | 2018-06-16T18:37:18                                                                  |
| UpdatedAt        | 2018-06-16T18:37:39                                                                  |
| Name             |                                                                                      |
| Description      |                                                                                      |
| GroupId          |                                                                                      |
| Size             | 2                                                                                    |
| AvailabilityZone | default                                                                              |
| Status           | available                                                                            |
| PoolId           | 83272ab1-d97e-5706-b299-8928f8847477                                                 |
| ProfileId        | 65f1c4ce-cf4b-4a86-91f2-c9b40edbea4a                                                 |
| Metadata         | map[lvPath:/dev/opensds-volumes-default/volume-11a357e4-03c8-4e72-bc76-fce868ed2d10] |
| SnapshotId       |                                                                                      |
+------------------+--------------------------------------------------------------------------------------+
root@ecs-fe68:~/gopath/src/github.com/opensds/opensds#
```

6.8 Create/Update/Delete/Get/List Volume Groups

Use the following command to create volume group.

```
osdsctl volume group create --profiles *
```

Example:

```
root@ecs-fe68:~/gopath/src/github.com/opensds/opensds# osdsctl volume group create --profiles dde9554b-ca62-4989-9d6b-a23997883ce1
+------------------+--------------------------------------+
| Property         | Value                                |
+------------------+--------------------------------------+
| Id               | a74480d9-9607-488b-9dd6-8b2a96d2b85c |
| CreatedAt        |                                      |
| UpdatedAt        |                                      |
| Name             |                                      |
| Status           | creating                             |
| Description      |                                      |
| Profiles         | [dde9554b-ca62-4989-9d6b-a23997883ce1] |
| AvailabilityZone | default                              |
| PoolId           |                                      |
+------------------+--------------------------------------+
```

Use the following command to update volume group.

```
osdsctl volume group update groupId -a “volumeId1, volumeId2” *
```

```
root@ecs-f386-0001:~/gopath/src/github.com/opensds/opensds# osdsctl volume group update 5883411b-1e29-47e5-bda9-1a1091ac32cb -a *9d4007a5-4a99-45f9-a4dc-179590a751ee,2a05eaf1-dcf0-4f49-a62f-26ea8dcfd65
1*
+------------------+--------------------------------------+
| Property         | Value                                |
+------------------+--------------------------------------+
| Id               | 5883411b-1e29-47e5-bda9-1a1091ac32cb |
| CreatedAt        | 2018-07-04T18:03:43                  |
| UpdatedAt        | 2018-07-04T18:04:36                  |
| Name             |                                      |
| Status           | updating                             |
| Description      |                                      |
| Profiles         | [c9adca4e-81c3-4190-b3dc-4471c8255c06] |
| AvailabilityZone | default                              |
| PoolId           | 5f595c2b-3891-5983-8c34-8aa258f7a86b |
+------------------+--------------------------------------+
```

Use the following command to show volume group.

```
osdsctl volume group show *
```

Example:

```
root@ecs-fe68:~/gopath/src/github.com/opensds/opensds# osdsctl volume group show a74480d9-9607-488b-9dd6-8b2a96d2b85c
+------------------+--------------------------------------+
| Property         | Value                                |
+------------------+--------------------------------------+
| Id               | a74480d9-9607-488b-9dd6-8b2a96d2b85c |
| CreatedAt        | 2018-06-16T18:56:33                  |
| UpdatedAt        |                                      |
| Name             |                                      |
| Status           | available                            |
| Description      |                                      |
| Profiles         | [dde9554b-ca62-4989-9d6b-a23997883ce1] |
| AvailabilityZone | default                              |
| PoolId           | 273d3ce3-7728-51e1-b32d-446d33a015d6 |
+------------------+--------------------------------------+
root@ecs-fe68:~/gopath/src/github.com/opensds/opensds#
```

Display specific results by filter parameters. Filter parameters can be displayed by the following command.

```
osdsctl volume group list -h
```

Results are as follows:

```
root@ecs-fe68:~/gopath/src/github.com/opensds/opensds# osdsctl volume group list -h
List all volume groups in the cluster

Usage:
  osdsctl volume group list [flags]

Flags:
      --availabilityZone string   list volume group by availability zone
      --description string        list volume group by description
  -h, --help                      help for list
      --id string                 list volume group by id
      --limit string              the number of etries displayed per page (default "50")
      --name string               list volume group by Name
      --offset string             all requested data offsets (default "0")
      --poolId string             list volume group by pool id
      --sortDir string            the sort direction of all requested data. supports asc or desc(default) (default "desc")
      --sortKey string            the sort key of all requested data. supports id(default), name, status, availability zone, tenantid, pool id (defa
ult "id")
      --status string             list volume group by status
      --tenantId string           list volume group by tenantId
      --userId string             list volume group by storage userId

Global Flags:
      --debug           shows debugging output.
  -p, --profile string   the name of profile configured by admin
root@ecs-fe68:~/gopath/src/github.com/opensds/opensds#
```

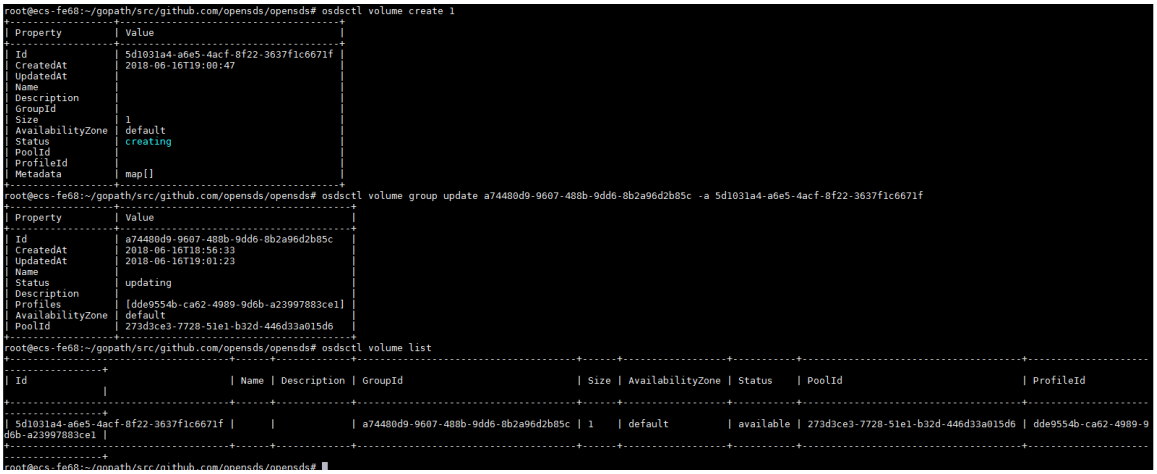
Example:

```
root@ecs-fe68:~/gopath/src/github.com/opensds/opensds# osdsctl volume group list
+--------------------------------------+------+-----------+-------------+--------------------------------------+------------------+--------------------------------------+
| Id                                   | Name | Status    | Description | Profiles                             | AvailabilityZone | PoolId                               |
+--------------------------------------+------+-----------+-------------+--------------------------------------+------------------+--------------------------------------+
| a74480d9-9607-488b-9dd6-8b2a96d2b85c |      | available |             | [dde9554b-ca62-4989-9d6b-a23997883ce1] | default          | 273d3ce3-7728-51e1-b32d-446d33a015d6 |
+--------------------------------------+------+-----------+-------------+--------------------------------------+------------------+--------------------------------------+
root@ecs-fe68:~/gopath/src/github.com/opensds/opensds# osdsctl volume group list --poolId 273d3ce3-7728-51e1-b32d-446d33a015d6
+--------------------------------------+------+-----------+-------------+--------------------------------------+------------------+--------------------------------------+
| Id                                   | Name | Status    | Description | Profiles                             | AvailabilityZone | PoolId                               |
+--------------------------------------+------+-----------+-------------+--------------------------------------+------------------+--------------------------------------+
| a74480d9-9607-488b-9dd6-8b2a96d2b85c |      | available |             | [dde9554b-ca62-4989-9d6b-a23997883ce1] | default          | 273d3ce3-7728-51e1-b32d-446d33a015d6 |
+--------------------------------------+------+-----------+-------------+--------------------------------------+------------------+--------------------------------------+
root@ecs-fe68:~/gopath/src/github.com/opensds/opensds#
```

Use the following command to update volume group.

```
osdsctl volume group update *
```

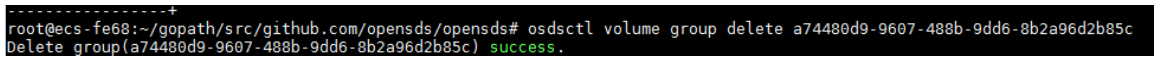
Example:



Use the following command to delete volume group.

```
osdsctl volume group delete *
```

Example:



6.9 Replication

Here is the usage of replication CLI.

1. Create replication.

Usage:

osdsctl replication create <primary volume id> <secondary volume id> [flags]

Flags:

-d, --description string the description of created replication

-h, --help help for create

-n, --name string the name of created replication

-p, --primary_driver_data string the primary replication driver data of created replication

-m, --replication_model string the replication mode of created replication, value can be sync/async

-t, --replication_period int the replication period of created replication, the value must greater than 0 (default 120)

-s, --secondary_driver_data string the secondary replication driver data of created replication

2. List replication.

Usage:

osdsctl replication list [flags]

Flags:

-h, --help help for list

Global Flags:

--debug shows debugging output.

3. Show a replication

Usage:

osdsctl replication show <replication id> [flags]

Flags:

-h, --help help for show

Global Flags:

--debug shows debugging output.

4. Enable replication.

Usage:

osdsctl replication enable <replication id> [flags]

Flags:

-h, --help help for enable

Global Flags:

--debug shows debugging output.

5.disable replication

Usage:

osdsctl replication disable <replication id> [flags]

Flags:

-h, --help help for disable

Global Flags:

--debug shows debugging output.

6. Failover replication

Usage:

osdsctl replication failover <replication id> [flags]

Flags:

-a, --allow_attached_volume whether allow attached volume when failing over replication

-h, --help help for failover

-s, --secondary_backend_id string the secondary backend id of failoverr replication

Global Flags:

--debug shows debugging output.

7. delete replication

Usage:

osdsctl replication delete <replication id> [flags]

Flags:

-h, --help help for delete

Global Flags:

--debug shows debugging output.