

ViPR CONTROLLER 2.2 - CINDER INTEGRATION



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Introduction

Business Challenge

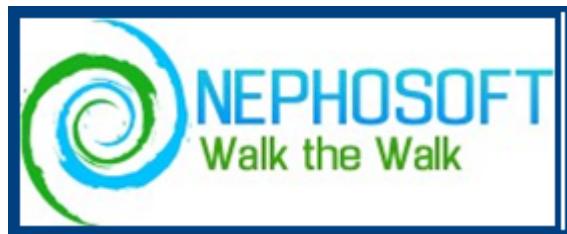
Neophosoft

Nephosoft is a multi-national software company that has expanded from a niche market of developing manufacturing and logistics Integration software to an enterprise application hosting firm. Nephosoft is actively partnering with cloud solutions firms in the private cloud market but is looking to expand offerings to meet expansion needs of SMB clients.

Nephosoft has installed EMC ViPR Controller 2.2 to manage its VNX and VMAX arrays. However, due to a recent acquisition, Nephosoft finds that it must add a third-party array to its ViPR Controller infrastructure.

You can extend ViPR Controller's management abilities by using OpenStack Cinder as a third-party storage provider. In this scenario, often called "Southbound" integration, ViPR Controller acts as a front-end to Cinder while maintaining its single-pane-of-glass consistent interface across the third-party and natively supported arrays.

This lab will demonstrate how ViPR Controller's native array support can be extended by using the Openstack Cinder component stack.



Solution

Extend ViPR Controller array support using Openstack Cinder

Neophosoft's IT department uses Openstack Cinder as a provider to EMC ViPR Controller 2.2 for basic management of third-party arrays.

This solution provides the following:

- **Consistent user interface:** Once Neophosoft's administrators have become comfortable with ViPR Controller's user interface, they do not need to learn another set of procedures for allocating and managing storage via the Cinder stack.
- **Wide variety of array support:** ViPR Controller can provide basic management for any array supported by Cinder.
- **Scaleable and modular:** Cinder / Openstack is open-source, so its framework offers customizable implementation options at low cost.

Key Components

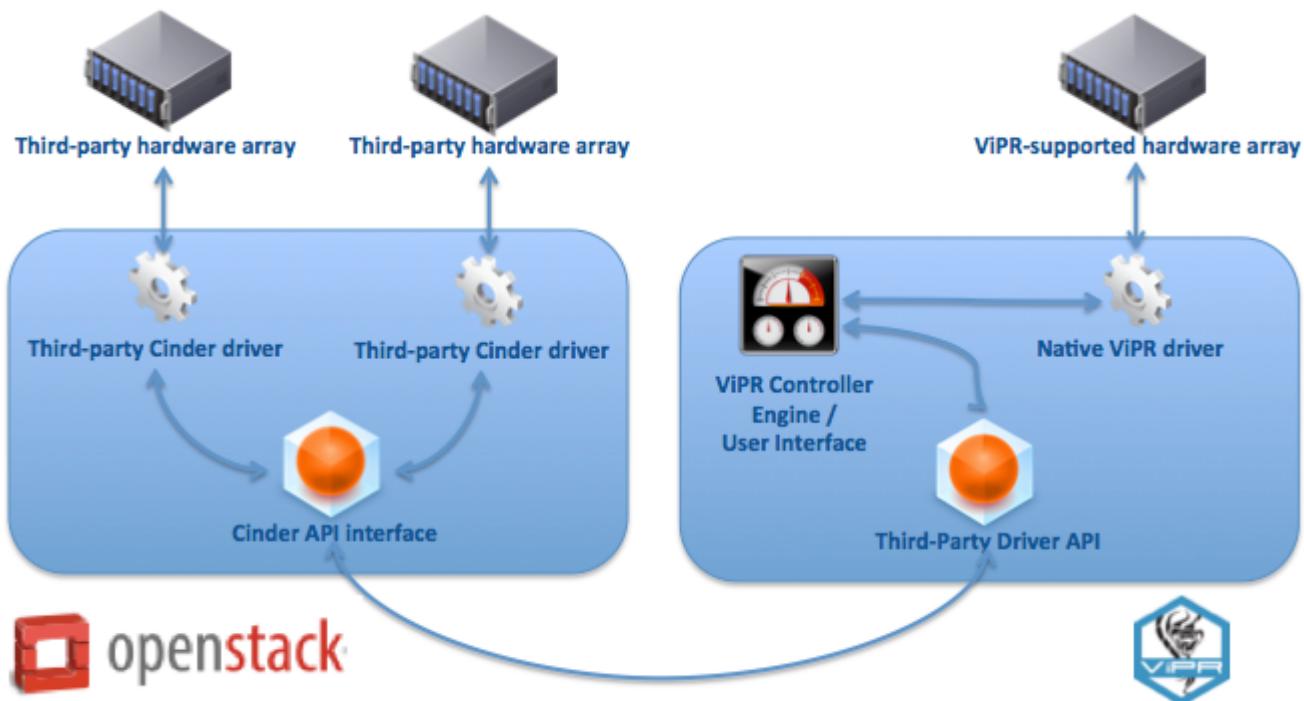
EMC ViPR Controller and OpenStack Cinder

What are EMC ViPR and OpenStack Cinder?

EMC® ViPR® is software-defined storage to manage and automate all storage resources for traditional and next-generation cloud storage platforms. EMC ViPR Controller is storage automation software that centralizes and transforms storage into a simple, extensible, and open platform. It abstracts and pools resources to deliver automated, policy-driven storage services on demand through a self-service catalog – reducing time, cost, and risk.

OpenStack is an open-source cloud based computing solution which aims to provide a modular framework for host virtualization, networking, storage, and other platform services. The block storage component of OpenStack is named "Cinder", and it's designed to virtualize pools of block storage devices and provide an API to request and consume those resources without requiring any knowledge of where their storage is actually deployed or on what type of device. Cinder drivers are available for a wide variety of block storage arrays.

Using ViPR Controller with Openstack Cinder, you can provide basic provisioning and management services to third-party as well as natively-supported arrays.



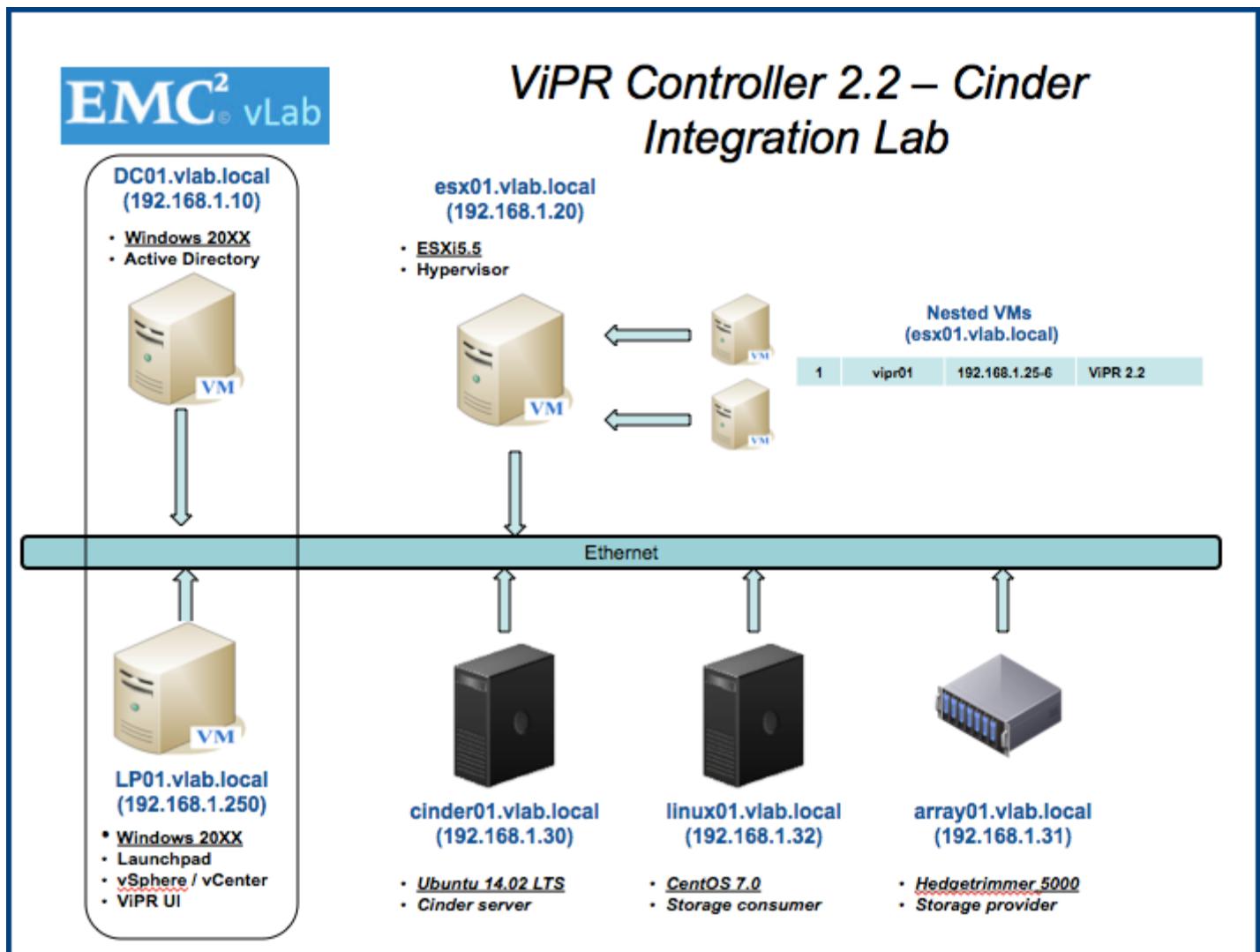
Lab Overview

Lab Environment

The environment for this lab includes the following:

- 1 Linux host acting as a Cinder provider
- 1 Linux host acting as a storage consumer
- 1 Hedgetrimmer 5000 virtual array (to be controlled by Cinder)
- 1 ESXi host containing the ViPR Controller 2.2 instance

The remaining hosts are for infrastructure purposes and not directly used in the lab.



Lab Scenario

What will you do in this lab?

You are the Storage Administrator for Neophosoft, which uses ViPR Controller 2.2 in its storage infrastructure. You and your assistants have become familiar with the ViPR Controller interface, and you currently use ViPR Controller to manage all of your installed storage. Your team has also installed and configured a host with OpenStack Cinder (Juno release) but has not yet set up any storage components.

Recently, Neophosoft acquired a company that uses a Hedgetrimmer 5000 ("HT5k") iSCSI-connected array with 20 GB of block-level storage. Although ViPR Controller does not support the HT5k, you've learned that Hedgetrimmer offers an array driver for OpenStack's Cinder component. You want to use ViPR Controller so that your team doesn't have to learn a new interface and so you plan to use Cinder to present the HT5k as a third-party array to ViPR Controller.

In this Lab, you will:

- Configure Cinder to present the HT5k block storage to ViPR Controller
- Configure ViPR Controller to use the Cinder instance as a storage provider
- Use ViPR Controller to create a virtual array and pool from the Cinder storage
- Create, present, and verify the HT5k block storage for a Linux host
- Create a full copy (clone) of the block volume
- Examine and expand the Cinder volume quota limits

Along the way, you will troubleshoot and fix a few issues commonly encountered during Cinder integration. The following Labs will guide you through the process of configuring and verifying the Cinder - ViPR Controller environment.

Labs

What do you need to know in order to complete this lab?

The basic infrastructure of the host environment has already been set up for you. However, you must complete the labs in sequence to correctly configure your storage.

All passwords in the lab have been set to "Password123!". This lab includes the following exercises:

- **Lab 1:** Set up the HT5k array within Cinder
 - Install the HT5k driver
 - Configure the Cinder components
 - Verify array - Cinder operations
- **Lab 2:** Install the Cinder provider in ViPR Controller
 - Configure the physical environment within ViPR Controller
 - Create a virtual array and virtual pool from the HT5k storage
- **Lab 3:** Explore third-party operations within ViPR Controller
 - Export a block volume to the target host and verify operation
 - Create a clone of an HT5k volume
 - Examine Cinder volume quota limitations
 - Remove volumes from the target host

Lab 1 - Set up OpenStack Cinder

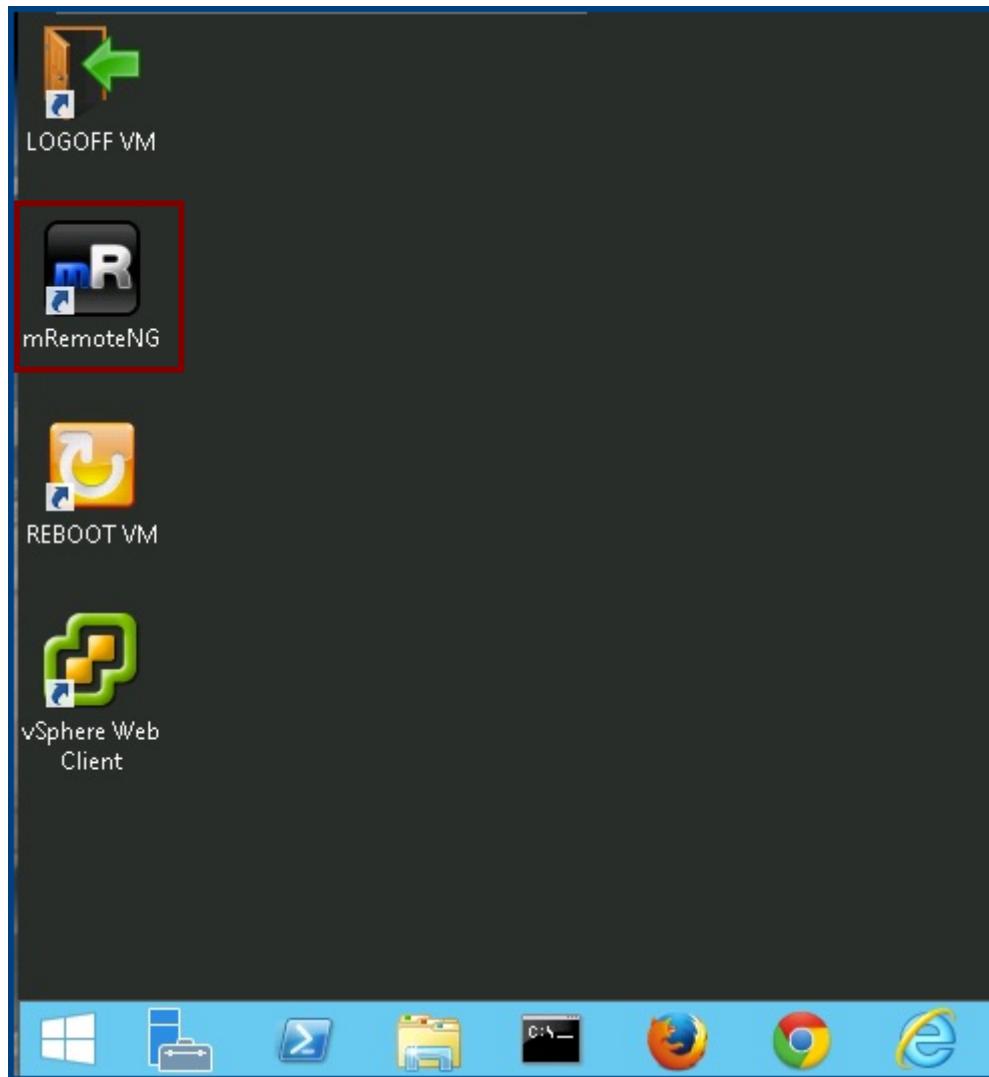
Lab 1 - Set up OpenStack Cinder

OpenStack's Cinder component must be configured before presenting storage to ViPR Controller. In this lab you will install and configure the Hedgetrimmer 5000 array driver. Cinder has already been installed for you but no storage is assigned. Your goals:

- Install the HedgeTrimmer 5000 (HT5k) driver set into Cinder
- Modify cinder.conf and set up the Cinder linkages to the driver backend
- Create and delete a test volume to verify Cinder operations

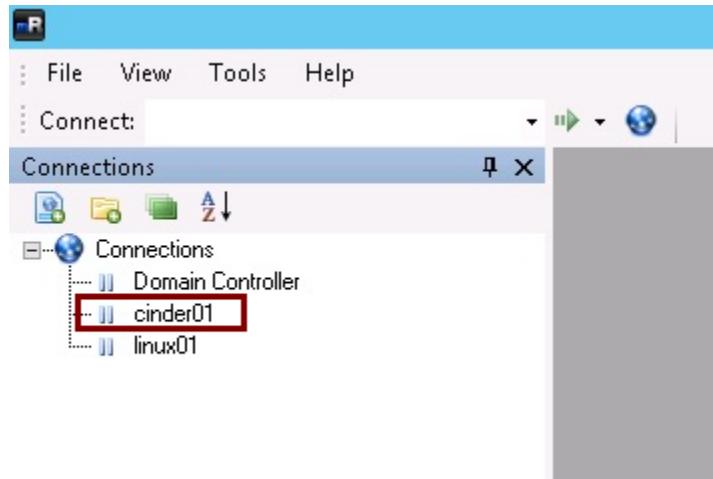
Step 1: Install the HT5k driver

Double-click the mRemoteNG icon on your desktop. mRemoteNG will open.



Log into the host

Within mRemoteNG, double-click the cinder01 entry. A console window to the Cinder host opens and automatically logs you in as root:



Install the driver package

Run `ls` (that's lowercase "LS") and note the HT5k driver package. Install the package by running `tar -zvxf hedgetrimmer_5k.tar.gz -C /usr/lib/python2.7/dist-packages/cinder/volume/drivers`, then verify installation with `ls /usr/lib/python2.7/dist-packages/cinder/volume/drivers`. You should see "ht.py" and "ht.pyc" in the listing.

```
root@cinder01:~# ls
hedgetrimmer_5k.tar.gz
root@cinder01:~# tar -zvxf hedgetrimmer_5k.tar.gz -C /usr/lib/python2.7/dist-packages/cinder/volume/drivers
ht.py
ht.pyc
root@cinder01:~# ls /usr/lib/python2.7/dist-packages/cinder/volume/drivers
block_device.py      eqlx.pyc          glusterfs.py    __init__.py  nimble.py   remotefs.pyc  solidfire.py
block_device.pyc     fujitsu_eternus_dx_common.py  glusterfs.pyc  __init__.pyc nimble.pyc  san          solidfire.pyc
coraid.py           fujitsu_eternus_dx_common.pyc  hds          lvm.py       prophetstor  scalability.py  vmware
coraid.pyc          fujitsu_eternus_dx_fc.py    hitachi     lvm.pyc     pure.py     scalability.pyc windows
datera.py           fujitsu_eternus_dx_fc.pyc   ht.py        netapp     pure.pyc    sheepdog.py  zadarapy
datera.pyc          fujitsu_eternus_dx_iscsi.py  ht.pyc      nexenta    rbd.py     sheepdog.pyc zadarapy
emc                fujitsu_eternus_dx_iscsi.pyc huawei     nfs.py     rbd.pyc    smbfs.py    zfssa
eqlx.py            fusionio               ibm         nfs.pyc    remotefs.py  smbfs.pyc
root@cinder01:~#
```

Step 2: Configure the Cinder components

Your next task involves modifying Cinder's configuration file. If you'd prefer not to do this manually, then execute the following command in the Cinder terminal:

```
cp -v ./cinder-master.conf /etc/cinder/cinder.conf
```

This command copies a pre-configured Cinder configuration file for you. The output should resemble the screen below. If all looks good, skip the next commands and continue to **Step 3**.

```
root@cinder01:~# cp -v ./cinder-master.conf /etc/cinder/cinder.conf  
'./cinder-master.conf' -> '/etc/cinder/cinder.conf'  
root@cinder01:~#
```

Begin editing the Cinder configuration

Run vi /etc/cinder/cinder.conf to edit Cinder's configuration file. Once the editor opens, type :18 and press Enter to move your cursor just above the [database] section. Your screen should look like this:

```
[DEFAULT]
rootwrap_config = /etc/cinder/rootwrap.conf
api_paste_config = /etc/cinder/api-paste.ini
iscsi_helper = tgtadm
volume_name_template = volume-%s
volume_group = cinder-volumes
verbose = True
auth_strategy = keystone
state_path = /var/lib/cinder
lock_path = /var/lock/cinder
volumes_dir = /var/lib/cinder/volumes

rpc_backend = rabbit
rabbit_host = controller
rabbit_password = rbpas
my_ip = 192.168.1.30
rpc_response_timeout=300
█
[database]
connection = mysql://cinder:cdpass@localhost/cinder

[keystone_authtoken]
auth_uri = http://192.168.1.30:5000/v2.0
identity_uri = http://192.168.1.30:35357
auth_host = 192.168.1.30
auth_protocol = http
auth_port = 35357
admin_user = cinder
admin_tenant_name = service
admin_password = cdpass

~
~
~
~
```

Set the backend

To inform Cinder which storage back ends are available, press **i** (putting vi in insert mode). Press **Enter** twice (adding two blank lines). Use the arrow keys to put your cursor on the middle blank line, then type **enabled_backends = hedgetrimmer** as below:

```
rabbit_password = rbpass
my_ip = 192.168.1.30
rpc_response_timeout=300

enabled_backends = hedgetrimmer

[database]
connection = mysql://cinder:cdpass@localhost/cinder

[keystone_auth_token]
```

Define the array

While still in insert mode, use the arrow keys to position the cursor at the end of the file. Once there, press **Enter** to add a blank line, then define the hedgetrimmer array's characteristics to Cinder by adding the following information (all case-sensitive, note the upper-case ISCSI on line 2):

```
[hedgetrimmer]

volume_driver = cinder.volume.drivers.ht.HtISCSIDriver

volume_backend_name=hedgetrimmer

vol_type = default

vol_group = ht5k-volumes

server_ip = 192.168.1.31

management_port = 80

storage_port = iscsi

array_login = admin

array_password = Password123!
```

If you copy and paste, be careful not to grab anything past the trailing ! - extraneous characters can stop Cinder from starting. Check your typing against the figure below. When complete, press ESC, then :wq! to save and exit vi.

```
admin_user = cinder
admin_tenant_name = service
admin_password = cdpass

[hedgetrimmer]
volume_driver = cinder.volume.drivers.ht.HtISCSIDriver
volume_backend_name=hedgetrimmer
vol_type = default
vol_group = ht5k-volumes
server_ip = 10.247.139.206
management_port = 80
storage_port = iscsi
array_login = admin
array_password = Password123 !
```

Step 3: Verify Cinder operations with the array

Build a Cinder database entry for your new array and associate it with the back-end drivers using the following commands:

- **cinder type-create hedgetrimmer** (creates the driver link within Cinder)
- **cinder type-key hedgetrimmer set volume_backend_name=hedgetrimmer** (match the volume_backend_name entry in cinder.conf; produces no output)
- **cinder extra-specs-list** (display the relationships)

The output should resemble the figure below, although the ID field will be different:

```
root@cinder01:~# cinder type-create hedgetrimmer
+-----+-----+
|       ID      |     Name    |
+-----+-----+
| ae47066f-cd79-4dff-a9cd-122791234bef | hedgetrimmer |
+-----+-----+
root@cinder01:~# cinder type-key hedgetrimmer set volume_backend_name=hedgetrimmer
root@cinder01:~# cinder extra-specs-list
+-----+-----+-----+
|       ID      |     Name    | extra_specs          |
+-----+-----+-----+
| ae47066f-cd79-4dff-a9cd-122791234bef | hedgetrimmer | {u'volume_backend_name': u'hedgetrimmer'} |
+-----+-----+-----+
root@cinder01:~#
```

Restart services

Restart the Cinder services using service cinder-api restart, service cinder-scheduler restart, and service cinder-volume restart (your process IDs will be different):

```
root@cinder01:~# service cinder-api restart
cinder-api stop/waiting
cinder-api start/running, process 4748
root@cinder01:~# service cinder-scheduler restart
cinder-scheduler stop/waiting
cinder-scheduler start/running, process 4771
root@cinder01:~# service cinder-volume restart
cinder-volume stop/waiting
cinder-volume start/running, process 4793
root@cinder01:~#
```

Check the driver startup

Use tail -20 /var/log/cinder/cinder-volume.log to determine if your driver started. You should see an error, and a hint as to what the problem is:

```
root@cinder01:~# tail -20 /var/log/cinder/cinder-volume.log
2015-05-29 13:10:31.071 4793 INFO cinder.openstack.common.service [-] Caught SIGTERM, stopping children
2015-05-29 13:10:31.072 4793 INFO cinder.openstack.common.service [-] Waiting on 1 children to exit
2015-05-29 13:10:31.075 4793 INFO cinder.openstack.common.service [-] Child 4799 exited with status 1
2015-05-29 13:10:31.554 4924 INFO cinder.openstack.common.service [-] Starting 1 workers
2015-05-29 13:10:31.556 4924 INFO cinder.openstack.common.service [-] Started child 4930
2015-05-29 13:10:31.560 4930 INFO cinder.service [-] Starting cinder-volume node (version 2014.2.2)
2015-05-29 13:10:31.562 4930 INFO cinder.volume.manager [req-4ec39a1a-cc07-4e0e-bbe9-e29413fc644f -----] Starting volume driver HtISCSIDriver (3.0.0)
2015-05-29 13:10:31.858 4930 ERROR cinder.volume.manager [req-4ec39a1a-cc07-4e0e-bbe9-e29413fc644f -----] Error encountered during initialization of driver: HtISCSIDriver
2015-05-29 13:10:31.859 4930 ERROR cinder.volume.manager [req-4ec39a1a-cc07-4e0e-bbe9-e29413fc644f -----] Bad or unexpected response from the storage volume backend API: HT5k login account 'admin' failed, try 'root'
2015-05-29 13:10:31.859 4930 TRACE cinder.volume.manager Traceback (most recent call last):
2015-05-29 13:10:31.859 4930 TRACE cinder.volume.manager   File "/usr/lib/python2.7/dist-packages/cinder/volume/manager.py", line 251, in init_host
2015-05-29 13:10:31.859 4930 TRACE cinder.volume.manager       self.driver.check_for_setup_error()
2015-05-29 13:10:31.859 4930 TRACE cinder.volume.manager   File "/usr/lib/python2.7/dist-packages/osprofiler/profiler.py", line 105, in wrapper
2015-05-29 13:10:31.859 4930 TRACE cinder.volume.manager       return f(*args, **kwargs)
2015-05-29 13:10:31.859 4930 TRACE cinder.volume.manager   File "/usr/lib/python2.7/dist-packages/cinder/volume/drivers/ht.py", line 174, in check_for_setup_error
2015-05-29 13:10:31.859 4930 TRACE cinder.volume.manager       raise exception.VolumeBackendAPIException(data=message)
2015-05-29 13:10:31.859 4930 TRACE cinder.volume.manager VolumeBackendAPIException: Bad or unexpected response from the storage volume backend API: HT5k login account 'admin' failed, try 'root'
2015-05-29 13:10:31.859 4930 TRACE cinder.volume.manager
2015-05-29 13:10:32.245 4930 INFO oslo.messaging._drivers.impl_rabbit [-] Connecting to AMQP server on controller:5672
2015-05-29 13:10:32.263 4930 INFO oslo.messaging._drivers.impl_rabbit [-] Connected to AMQP server on controller:5672
root@cinder01:~#
```

Edit the configuration

Run `vi /etc/cinder/cinder.conf` to edit Cinder's configuration file. Once the editor opens, type `/array_login` and press `Enter` to move your cursor to the `array_login` entry. Use your arrow keys to cursor to "admin", then press `i` for insert mode. Replace "admin" with "root", then press `ESC`, then `:wq!` to save and exit vi. The finished product should look like:

```
admin_tenant_name = service
admin_password = cdpass

[hedgetrimmer]
volume_driver = cinder.volume.drivers.ht.HtISCSIDriver
volume_backend_name=hedgetrimmer
vol_type = default
vol_group = ht5k-volumes
server_ip = 192.168.1.31
management_port = 80
storage_port = iscsi
array_login = root
array_password = Password123!
~
```

Restart services and verify startup

Restart the Cinder services using service cinder-api restart, service cinder-scheduler restart, and service cinder-volume restart (your process IDs will change). Then, use tail -20 /var/log/cinder/cinder-volume.log to verify that the driver has started. Note that the HT5k driver emits messages displaying the cinder.conf entries, but not all drivers do so. The lack of tracebacks or error messages indicates a successful startup:

```
root@cinder01:~# service cinder-api restart
cinder-api stop/waiting
cinder-api start/running, process 5075
root@cinder01:~# service cinder-scheduler restart
cinder-scheduler stop/waiting
cinder-scheduler start/running, process 5096
root@cinder01:~# service cinder-volume restart
cinder-volume stop/waiting
cinder-volume start/running, process 5118
root@cinder01:~# tail -20 /var/log/cinder/cinder-volume.log
2015-05-29 13:18:56.538 4930 INFO cinder.openstack.common.service [-] Child caught SIGTERM, exiting
2015-05-29 13:18:56.540 4924 INFO cinder.openstack.common.service [-] Caught SIGTERM, stopping children
2015-05-29 13:18:56.541 4924 INFO cinder.openstack.common.service [-] Waiting on 1 children to exit
2015-05-29 13:18:56.546 4924 INFO cinder.openstack.common.service [-] Child 4930 exited with status 1
2015-05-29 13:18:57.038 5118 INFO cinder.openstack.common.service [-] Starting 1 workers
2015-05-29 13:18:57.040 5118 INFO cinder.openstack.common.service [-] Started child 5126
2015-05-29 13:18:57.044 5126 INFO cinder.service [-] Starting cinder-volume node (version 2014.2.2)
2015-05-29 13:18:57.045 5126 INFO cinder.volume.manager [req-686393ac-fee3-4a7d-ade0-8637a0193628 - - - - -] Starting volume driver HtISCSIDriver (3.0.0)
2015-05-29 13:18:57.321 5126 INFO cinder.volume.drivers.ht [req-686393ac-fee3-4a7d-ade0-8637a0193628 - - - - -] HT5k server IP: 192.168.1.31
2015-05-29 13:18:57.322 5126 INFO cinder.volume.drivers.ht [req-686393ac-fee3-4a7d-ade0-8637a0193628 - - - - -] HT5k management port: 80
2015-05-29 13:18:57.323 5126 INFO cinder.volume.drivers.ht [req-686393ac-fee3-4a7d-ade0-8637a0193628 - - - - -] HT5k login account: root
2015-05-29 13:18:57.323 5126 INFO cinder.volume.drivers.ht [req-686393ac-fee3-4a7d-ade0-8637a0193628 - - - - -] HT5k login password: Password123!
2015-05-29 13:18:57.324 5126 INFO cinder.volume.drivers.ht [req-686393ac-fee3-4a7d-ade0-8637a0193628 - - - - -] HT5k storage port: iscsi
2015-05-29 13:18:57.324 5126 INFO cinder.volume.drivers.ht [req-686393ac-fee3-4a7d-ade0-8637a0193628 - - - - -] HT5k volume group: ht5k-volumes
2015-05-29 13:18:57.325 5126 INFO cinder.volume.drivers.ht [req-686393ac-fee3-4a7d-ade0-8637a0193628 - - - - -] HT5k volume type: default
2015-05-29 13:18:57.776 5126 INFO cinder.volume.manager [req-686393ac-fee3-4a7d-ade0-8637a0193628 - - - - -] Updating volume status
2015-05-29 13:18:57.865 5126 INFO oslo.messaging._drivers.impl_rabbit [req-686393ac-fee3-4a7d-ade0-8637a0193628 - - - - -] Connecting to AMQP server on controller:5672
2015-05-29 13:18:57.880 5126 INFO oslo.messaging._drivers.impl_rabbit [req-686393ac-fee3-4a7d-ade0-8637a0193628 - - - - -] Connected to AMQP server on controller:5672
2015-05-29 13:18:57.891 5126 INFO oslo.messaging._drivers.impl_rabbit [-] Connecting to AMQP server on controller:5672
2015-05-29 13:18:57.902 5126 INFO oslo.messaging._drivers.impl_rabbit [-] Connected to AMQP server on controller:5672
root@cinder01:~#
```

Create a volume

To verify that the driver can in fact control the array, run `cinder list` (note the empty output) and then `cinder create --display_name=test-vol --volume_type=hedgetrimmer 5` (to create a 5 GB hedgetrimmer volume). Running `cinder list` again should show the volume with an available status.

```
root@cinder01:~# cinder list
+---+-----+-----+-----+-----+-----+
| ID | Status | Display Name | Size | Volume Type | Bootable | Attached to |
+---+-----+-----+-----+-----+-----+
+---+-----+-----+-----+-----+-----+
root@cinder01:~# cinder create --display_name=test-vol --volume_type=hedgetrimmer 5
+-----+
| Property | Value |
+-----+
| attachments | [] |
| availability_zone | nova |
| bootable | false |
| created_at | 2015-05-29T17:55:21.207372 |
| display_description | None |
| display_name | test-vol |
| encrypted | False |
| id | 6a243ba9-78cb-411b-b1bb-3610a357f75d |
| metadata | {} |
| size | 5 |
| snapshot id | None |
| source_valid | None |
| status | creating |
| volume_type | hedgetrimmer |
+-----+
root@cinder01:~# cinder list
+-----+-----+-----+-----+-----+-----+
| ID | Status | Display Name | Size | Volume Type | Bootable | Attached to |
+-----+-----+-----+-----+-----+-----+
| 6a243ba9-78cb-411b-b1bb-3610a357f75d | available | test-vol | 5 | hedgetrimmer | false | |
+-----+-----+-----+-----+-----+-----+
root@cinder01:~#
```

Delete a volume

Delete the volume by running `cinder delete your-id` (where `your-id` is the ID field from the `cinder list` command). Wait 2-3 minutes, then re-run `cinder list` to ensure that the volume was deleted. If `cinder list` shows the volume in 'deleting' status, wait and try the `cinder list` command again.

```
root@cinder01:~# cinder list
+-----+-----+-----+-----+-----+-----+
|       ID      | Status | Display Name | Size | Volume Type | Bootable | Attached to |
+-----+-----+-----+-----+-----+-----+
| 6a243ba9-78cb-411b-b1bb-3610a357f75d | available | test-vol   | 5   | hddgetrimmer | false    |           |
+-----+-----+-----+-----+-----+-----+
root@cinder01:~# cinder delete 6a243ba9-78cb-411b-b1bb-3610a357f75d
root@cinder01:~# cinder list
+-----+-----+-----+-----+-----+
| ID | Status | Display Name | Size | Volume Type | Bootable | Attached to |
+-----+-----+-----+-----+-----+
+-----+-----+-----+-----+
root@cinder01:~#
```

Lab 2 - Configure ViPR Controller for third-party storage

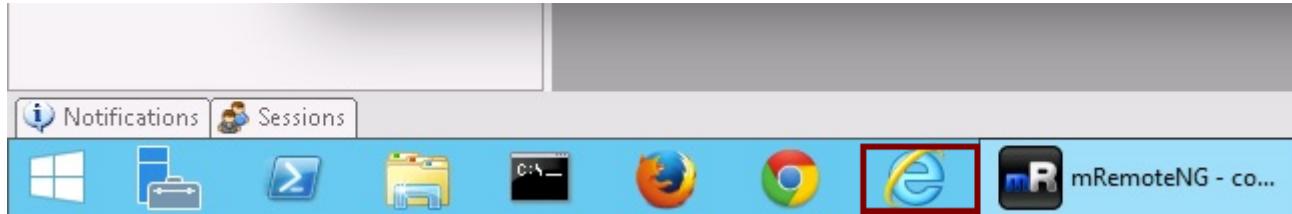
Lab 2 - Configure ViPR Controller for third-party storage

Once Cinder operations are confirmed, you can introduce it to ViPR Controller. You will use the Cinder instance you configured in the previous lab to present the Hedgetrimmer 5000 array to ViPR Controller. Your ViPR Controller instance has already been installed and licensed, but no configuration has been performed. Your goals:

- Teach ViPR Controller about the components of your physical environment (arrays, hosts, and networks)
- Build a virtual environment within ViPR Controller (virtual array and virtual storage pool)

Step 1: Build the physical environment within ViPR Controller

From your Windows session, open Internet Explorer.



Open ViPR Controller

Click the **ViPR Login** shortcut, then click **Continue to this website (not recommended)**.

The screenshot shows a web browser window with the following details:

- Address Bar:** https://192.168.1.25:4443/formlogin?service
- Message:** Certificate Error: Navigation...
- Links:**
 - ViPR Login** (highlighted with a red border)
 - Click here to close this webpage.**
 - Continue to this website (not recommended).** (highlighted with a red border)
 - More information**

Content Area:

There is a problem with this website's security certificate.

The security certificate presented by this website was not issued by a trusted certificate authority.
The security certificate presented by this website was issued for a different website's address.

Security certificate problems may indicate an attempt to fool you or intercept any data you send to the server.

We recommend that you close this webpage and do not continue to this website.

Click here to close this webpage.

Continue to this website (not recommended).

More information

Log in to ViPR Controller

At the login screen, enter "root" and "Password123!". Click Login, and on the next screen, click Continue to this website (not recommended).

The image shows a login interface with a light gray background. At the top center, the word "Login" is displayed in a large, bold, black font. Below it is a form divided into two horizontal sections by a thin blue line. The top section is a white input field containing the text "root". The bottom section is a white input field containing the text "Password123!" followed by a cursor. Both the "root" and "Password123!" fields are enclosed in a red rectangular border. To the right of the "Password123!" field is a small, faint icon of a person. Below the input fields is a "Remember me" checkbox followed by the text "Remember me". At the bottom of the form is a large, solid blue button with the word "Login" in white. At the very bottom of the page, centered, is the copyright notice "© 2014 EMC Corporation. All Rights Reserved.".

Prepare to add a host

Start by adding the Linux host which will consume the array storage. At the main ("Dashboard") screen, click on Hosts.

The screenshot shows the EMC ViPR Dashboard interface. On the left, there is a vertical sidebar with icons for Home, Storage Systems, Storage Providers, Data Protection Systems, Fabric Managers, Networks, Compute Images, Vblock Compute Systems, Hosts (which is highlighted with a red box), Clusters, and VMware vCenters. The main content area has three main sections: 'Arrays Capacity' (Block: 0, File: 0, Free Block/File: 0), 'Physical Assets' (Storage Systems, Storage Providers, Data Protection Systems, Fabric Managers, Networks, Compute Images, Vblock Compute Systems, Hosts, Clusters, VMware vCenters), and 'Version and Licenses' (Controller: vipr-2.2.1.0.1109, Licenses: ViPR Controller). The 'Hosts' link in the sidebar and the 'Hosts' section in the main content area are both highlighted with red boxes.

Add a host

At the Hosts screen, click Add.

The screenshot shows the EMC ViPR interface with the title "EMC ViPR" at the top. On the left is a vertical navigation bar with icons for Hosts (selected), Storage, Cloud, and Applications. The main area is titled "Hosts" and displays a table with columns: Name, Host, and Operating System. A message "No results" is shown below the table. At the bottom are buttons for "First", "Last", "0 entries selected", "+ Add" (which is highlighted with a red box), "Delete", "Rediscover", and "Detach Storage".

Specify host parameters

When the Add Host screen appears, fill in the following values:

Operating System: Linux

Name: linux01

Host: 192.168.1.32

Port: 22

Discoverable: checked

Username: root

Password: Password123!

When all fields are complete, click **Save**. Leave the **Validate Connection on Save** box checked.

EMC ViPR

Hosts / Add Host



Add Host

Enter the information needed to connect to a host.

Operating System: *Name: *Host: *

Enter the fully qualified domain name or IP address of the host.

Port: *

SSH Connection Port. Default: 22

Discoverable: *

Automatically discover information from the host about IP Interfaces and Initiators

Username: *Password: *Confirm Password: * Save Cancel Validate Connection on Save

Verify host addition

Your host should appear in the Hosts listing with a green checkbox in the status field. Click on the System icon, then Dashboard, to return to the Dashboard:

The screenshot shows the EMC ViPR interface with the title "EMC ViPR". In the top right corner, there are icons for notifications (0), help, and user authentication (root). The main content area is titled "Hosts" and displays a table of hosts. A success message "Host 'linux01' saved successfully." is shown in a green bar at the top. The table has columns: Name, Host, Operating System, Discoverable, Status, and Edit. One entry is listed: "linux01" with IP 192.168.1.32, OS Linux, discoverable checked, status green (checked), and initiators checked. Below the table are buttons for "+ Add", "Delete", "Rediscover", and "Detach Storage". The bottom right of the table area says "Showing 1 to 1 of 1 entries". On the left sidebar, there are icons for Hosts, Storage, Compute, Networks, and Security.

Prepare to add a provider

Next, you will add the OpenStack Cinder provider. At the Dashboard, click on **Storage Providers**:

The screenshot shows the EMC ViPR Dashboard. On the left, there is a vertical sidebar with icons for Home, Hosts, Storage, Compute, Networks, and Security. The "Home" icon is highlighted with a blue arrow pointing to it. The main content area has two sections: "Arrays Capacity" on the left and "Physical Assets" on the right. Under "Arrays Capacity", there are counts for Block (0), File (0), and Free Block/File (0). Under "Physical Assets", there are links for Storage Systems, Storage Providers (which is highlighted with a red box), Data Protection Systems, Fabric Managers, Networks, Compute Images, Vblock Compute Systems, Hosts (with a count of 1), and Clusters. The "Hosts" link has a small circular badge with the number 1.

Add a provider

At the Storage Providers screen, click Add:

The screenshot shows the EMC ViPR interface with the title "Storage Providers". On the left is a vertical sidebar with icons for Clock, Host, Cloud, and Book. The main area displays a table with one column labeled "Name" and another labeled "Host". A header row indicates "No results" and shows sorting options for "Name" and "Host". Below the table are navigation buttons for "First", "Last", and "Previous/Next". A message "0 entries selected" is displayed. At the bottom are three buttons: a green "+ Add" button, a red "Delete" button, and a blue "Rediscover" button. The "+ Add" button is highlighted with a red border.

Specify provider parameters

When the Add Host screen appears, fill in the following values:

Name: cinder01
Type: Third-party block
Host: 192.168.1.30
Use SSL: unchecked
Username: root
Password: Password123!

When all fields are complete, click **Save**. Leave the **Validate Connection on Save** box checked.

The screenshot shows the EMC ViPR interface with a blue header bar. On the left is a vertical sidebar with icons for clock, storage, books, databases, users, locks, and settings. The main area has a blue header "Add Storage Provider". Below it is a sub-header "Enter the information needed to connect to a Storage Provider". The form fields are as follows:

Name:	cinder01	*
Type:	Third-party block	*
Host:	192.168.1.30	*
Enter the fully qualified domain name or IP address of the host.		
Use SSL:	<input type="checkbox"/>	
Port:	22	*
User:	root	*
Password:	*****	*
Confirm Password:	*****	*

At the bottom are two buttons: a blue "Save" button with a checkmark and a white "Cancel" button with a trash icon.

Verify provider addition

Your Cinder host should appear in the Storage Providers listing with a green checkbox in the status field. Click on the top icon to return to the Dashboard:

The screenshot shows the EMC ViPR interface with the title 'EMC ViPR'. In the top right corner, there are icons for notifications (0), help, and user authentication (root). The main content area is titled 'Storage Providers'. A message bar at the top says 'Saved 'cinder01''. Below it is a table with the following data:

Name	Host	Type	Status	Actions
cinder01	192.168.1.30	Third-party block	<input checked="" type="checkbox"/>	

Below the table, there are navigation buttons for 'First', 'Last', and page number '1'. A search bar says 'Showing 1 to 1 of 1 entries'. At the bottom of the table are buttons for '+ Add', 'Delete', and 'Rediscover'.

Verify storage system

Note that a Storage System is now present along with your Storage Provider. Click on **Storage Systems** to view the details:

The screenshot shows the EMC ViPR dashboard. On the left, there is a vertical sidebar with icons for Home, Storage Systems, Storage Providers, Data Protection Systems, Fabric Managers, Networks, Compute Images, Vblock Compute Systems, and Hosts. The 'Storage Systems' icon is highlighted with a red box. The main content area has two sections: 'Arrays Capacity' and 'Physical Assets'.

Arrays Capacity

- Block: 0
- File: 0
- Free Block/File: 0

Physical Assets

- Storage Systems** (1)
- Storage Providers (1)
- Data Protection Systems
- Fabric Managers
- Networks
- Compute Images
- Vblock Compute Systems
- Hosts (1)

View provider identifier

When the "third-party block" (Cinder) host was discovered, ViPR polled the provider and found the Hedgetrimmer array you configured earlier. Click on Ports:

Name	Registered	Host	Type	Status	Edit
hedgetrimmer_HtISCSIDriver+10056777502	✓	192.168.1.30	Third-party block	✓	Pools Ports

First ← 1 → Last 0 entries selected Showing 1 to 1 of 1 entries

[+ Add](#) [Delete](#) [Rediscover](#) [+ Register](#) [- Deregister](#)

View storage ports

Note that OpenStack is handling the connectivity via iSCSI (IP). Click the drop-down for **Storage Ports**, and select **Storage Pools**:

Name	Registered	Group	Identifier
DEFAULT	✓	Cinder-PortGroup	OPENSTACK+10056777502+PORT+DEFAULT

First ← 1 → Last 0 entries selected

[+ Add](#) [✓ Register](#) [✗ Deregister](#)

View storage pools

Cinder presents Hedgetrimmer storage properly, but ViPR cannot determine the actual amount, so the display defaults to 1 TB. Click back to the Dashboard:

The screenshot shows the EMC ViPR interface. The top navigation bar includes the EMC logo, user status (0 notifications), Help, and a dropdown for the current user ('root'). Below the header, the breadcrumb path is 'Storage Systems / hedgetrimmer_HtISCSIDriver+10056777502 / Storage Pools'. The main content area is titled 'Storage Pools' and displays a table with one entry: 'hedgetrimmer' (Thin). The table columns are Name, Registered, Resource Types, Drive Types, Free, Subscribed, and Total. The 'Total' column shows 1024 GB. A search bar is at the top right. At the bottom left are 'Register' and 'Deregister' buttons. The sidebar on the left has icons for Home, Storage Systems, Storage Providers, Data Protection Systems, Fabric Managers, Networks (which is highlighted with a red box), Compute Images, Vblock Compute Systems, Hosts, Clusters, and VMware vCenters.

Prepare to create a network

For your final step in the physical setup, create a network to tie the host and array together. Click on **Networks**:

The screenshot shows the EMC ViPR Dashboard. The left sidebar includes icons for Home, Storage Capacity (highlighted with a red box), Physical Assets, Version and License, System Health, and a gear icon for Settings. The main content area is divided into several sections: 'Arrays Capacity' (Block: 0, File: 0, Free Block/File: 1.0 TB), 'Physical Assets' (Storage Systems: 1, Storage Providers: 1, Data Protection Systems, Fabric Managers, Networks (highlighted with a red box), Compute Images, Vblock Compute Systems, Hosts: 1, Clusters, VMware vCenters), 'Version and License' (Controller: vipr-2.2.1.0.1109, Licenses: ViPR Controller, Licensed), and 'System Health' (Controller Status: Stable, Controller Environment: vipr1, Last Updated: a few seconds ago).

Add a network

At the Networks screen, click Add IP Network:

The screenshot shows the EMC ViPR interface with the title "EMC ViPR" at the top. On the left, there is a vertical sidebar with four icons: a clock, a server rack, a cloud, and an open book. The "server rack" icon is highlighted with a blue arrow pointing to it. The main area is titled "Networks". It features a table header with columns for "Name", "Registered", and "Type". Below the header, it says "No results" and shows navigation buttons for "First", "Last", and "0 entries selected". At the bottom, there are four buttons: a green "+ Add IP Network" button with a red border, a red "Delete" button, a white "Register" button with a checkmark, and a white "Deregister" button with a cross.

Complete network creation

Name your network iSCSI_network, then click Done:

The screenshot shows a modal dialog box titled "Create IP Network". The instruction "Enter the name of the IP network. Once the network is created its ports may be edited." is displayed. A text input field contains the name "iSCSI_network". At the bottom right, there are two buttons: a blue "Done" button with a checkmark and a white "Cancel" button with a trash can icon. The "Done" button has a red border.

Add array ports to the network

Click the Add drop-down and select Add Array Ports:

IP Ports

Ports assigned to this network

Identifier	Alias	IP Address
Add Ports		
Add Host Ports		
Add Array Ports		0 entries selected

+ Add **- Remove**

Select array port to add

Your OpenStack provider and Hedgetrimmer port appear. Check the box, then click Add:

Add Array Ports

Search...

Identifier	Alias	IP Address	Name	Storage System	Discovered
<input checked="" type="checkbox"/> OPENSTACK+10056777502+PORT+DEFAULT			DEFAULT	hedgetrimmer_HtISCSIDriver+10056777502	

First ← 1 → Last 1 entries selected Showing 1 to 1 of 1 entries

+ Add **Cancel**

Add host ports to the network

Click the Add drop-down and select Add Host Ports:

IP Ports

Ports assigned to this network

Identifier	Alias	IP Address
Add Ports		
Add Host Ports		
Add Array Ports		

+ Add **- Remove**

0 entries selected

Select host port to add

Your Linux host port appears. Check the box, then click Add:

Add Host Ports

Identifier	Alias	IP Address	Name	Host	Dis
<input checked="" type="checkbox"/> iqn.1994-05.com.redhat:5488bd760d7			iqn.1994-05.com.redhat:5488bd760d7	192.168.1.32	

First ← 1 → Last 1 entries selected Showing 1 to 1

+ Add

Verify and save network configuration

The IP network should now contain the host and array. Click **Save**, then return to the **Dashboard**:

The screenshot shows the EMC ViPR interface for editing an IP network. The left sidebar has icons for Networks, Hosts, Storage, and Security. The main header says "Edit IP Network". The "Name:" field contains "SCSI_network". The "Virtual Arrays:" field is empty. Below the fields are "Save" and "Cancel" buttons, with "Save" being highlighted with a red box. The "IP Ports" section shows two entries: "iqn.1994-05.com.redhat:5488bd760d7" and "OPENSTACK+10056777502+PORT+DEFAULT". A search bar and pagination controls are also visible.

Identifier	Alias	IP Address	Name	Storage System	Host	Disc
iqn.1994-05.com.redhat:5488bd760d7			iqn.1994-05.com.redhat:5488bd760d7		192.168.1.32	
OPENSTACK+10056777502+PORT+DEFAULT			DEFAULT	hedgetrimmer_HtISCSI	hedge	trimmer+10056777502

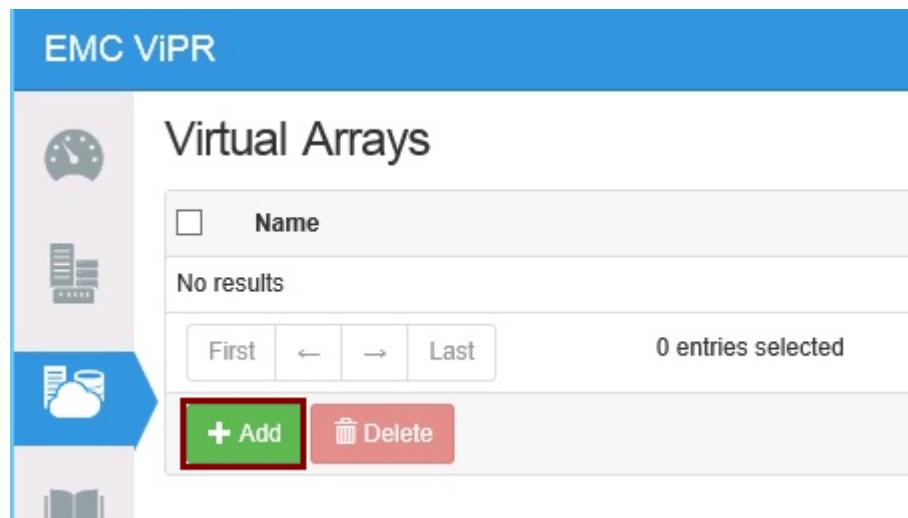
Step 2: Create a virtual array and virtual pool

From the Dashboard, select Virtual Arrays.



Prepare to add virtual array

Click Add.



Name the virtual array

Provide a name for the virtual array; this lab uses vArray1 as an example. Click Save.

Create Virtual Array

Enter the name for the new Virtual Array. After the virtual array is created, connections can be made to the desired storage

Name: 1

X *

2

Save

Cancel

Check array name

In the Edit Virtual Array box, note that SAN Zoning is set to Automatic and that the array name is filled in. At the bottom of the box, click Add Storage System.

Saved 'vArray1'

Name: X

SAN Zoning: ▼

Automatic: to allow ViPR to automatically create the required zones in the SAN fabric when a provisioning request is made in this virtual array.
Manual: to configure the zones outside of ViPR.

Tenant Access

Controls which tenants have access to the virtual array (default all)

Grant Access to Tenants:

Save Cancel

Block and File Storage

A Virtual Array aggregates the management of storage capacity (pools) and connectivity (ports). Storage Pools and Ports can be directly assigned to the Virtual Array, or implicitly assigned via Network connectivity.

Networks	0
Storage Ports	0
Storage Pools	0

+ Add Storage System

➤ Associated Storage Systems

➤ Associated Virtual Pools

Add storage system to array

The Add Storage System dialog displays. Select the **hedgetrimmer_HtISCSIDriver** entry, which is the representation of your HT5k array, then click **Add**.

Add Storage System

The screenshot shows a table with the following columns: Name, Type, and Status. There is one entry listed:

Name	Type	Status
hedgetrimmer_HtISCSIDriver+10056777502	Third-party block	<input checked="" type="checkbox"/>

Below the table, there are navigation buttons (First, Previous, Next, Last), a count of "1 entries selected", and a status message "Showing 1 to 1 of 1 entries". At the bottom right are three buttons: "2" (highlighted with a blue circle), "+ Add" (highlighted with a red box), and "Cancel".

Verify storage system association

Note that networks, storage pools, and storage ports are automatically discovered. Expand the Associated Storage Systems area by clicking the **>** and note that the HT5k entry is associated with a type of "Third-party block". Click **Save**.

Tenant Access

Controls which tenants have access to the virtual array (default all)

The screenshot shows two main sections: "Block and File Storage" and "Associated Storage Systems".

Block and File Storage (Left):

- A Virtual Array aggregates the management of storage capacity (pools) and connectivity (ports). Storage Pools and Ports can be directly assigned to the Virtual Array, or implicitly assigned via Network connectivity.
- Networks**: 1 entry
- Storage Ports**: 1 entry
- Storage Pools**: 1 entry
- + Add Storage System**

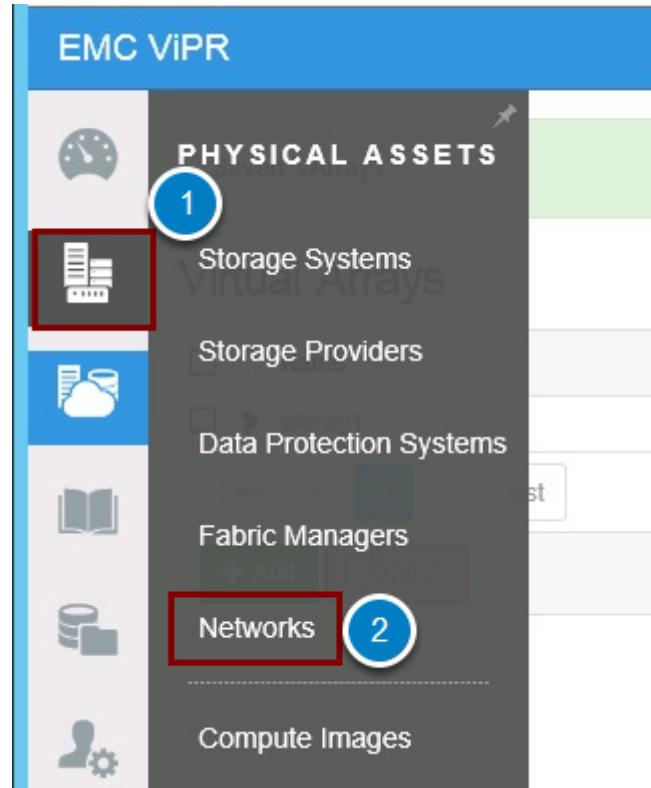
Associated Storage Systems (Right):

- Associated Storage Systems** (1 entry):
 - hedgetrimmer_HtISCSIDriver+10056777502 (Third-party block)
- Associated Virtual Pools**

At the top of the "Associated Storage Systems" section, there is a "Save" button highlighted with a red box and a "2" circled in blue.

Prepare to assign array to network

Your virtual array is complete. Assign it to a network by clicking the second icon on the left-hand bar (**Physical Assets**) and then selecting **Networks**.



Select the network entry

The Networks screen displays. Double-click your network entry.

The screenshot shows the EMC ViPR interface with the title "EMC ViPR" at the top. On the left, there is a vertical sidebar with four icons: a clock, a server tower, a cloud, and a book. The second icon (server tower) is highlighted with a blue arrow pointing to it. The main area is titled "Networks". A table lists one entry:

Name	Registered	Type
iSCSI_network	✓	IP

Below the table, there are navigation buttons for "First", "←", "1", "→", and "Last", and a message "0 entries selected". At the bottom, there are four buttons: "+ Add IP Network" (green), "Delete" (red), "Register" (grey with a checkmark), and "Deregister" (grey with a cross).

Associate array with network

On the Edit IP Network screen, you will see your virtual array listed. Associate it with the network by selecting the check box next to its name, then click Save.

The screenshot shows the 'Edit IP Network' interface. At the top left is a navigation bar with five icons. The title 'Edit IP Network' is centered above a subtitle 'Enter the information needed to change the network'. Below this is a form with two sections. The first section, labeled 'Virtual Arrays:', contains a list box with one item, 'vArray1', which has a checked checkbox next to it. A blue circle with the number '1' is overlaid on this list box. The second section contains two buttons: a blue 'Save' button with a checkmark icon, which is highlighted with a red box, and a white 'Cancel' button with a trash can icon. A blue circle with the number '2' is overlaid on the 'Save' button.

IP Ports

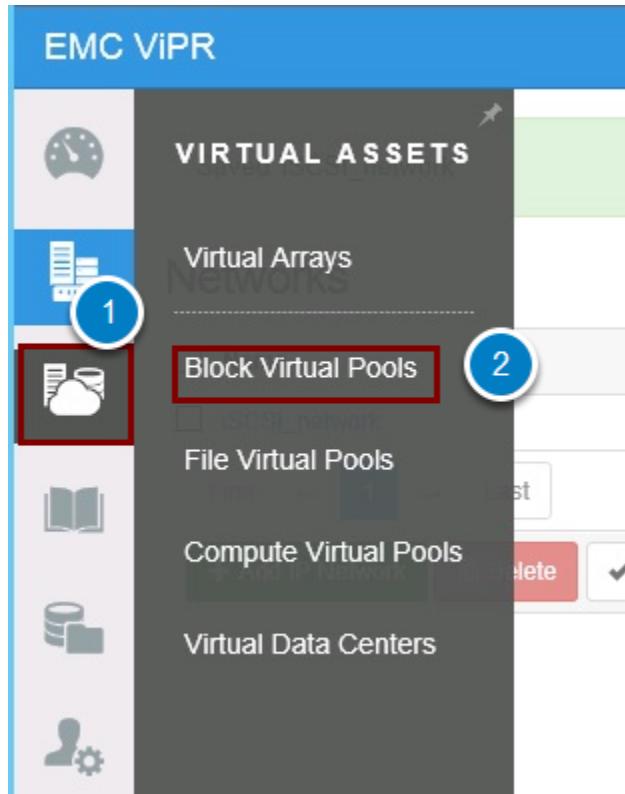
Ports assigned to this network

Identifier	Alias	IP Address	Name	Storage System
iqn.1994-05.com.redhat:5488bd760d7			iqn.1994-05.com.redhat:5488bd760d7	
OPENSTACK+10056777502+PORT+DEFAULT			DEFAULT	hedgetrimmer_1

First ← 1 → Last 0 entries selected

Prepare to create a virtual pool

Create a virtual pool. Start by clicking the third icon in the left-hand bar (Virtual Assets) and then Block Virtual Pools.



Add a virtual pool

The Block Virtual Pools screen displays. Click Add.

The screenshot shows the EMC ViPR interface for managing Block Virtual Pools. The title bar reads "EMC ViPR". On the left, there is a vertical sidebar with icons for Home, Storage, Network, Compute, and a Cloud icon with an arrow pointing right. The main content area is titled "Block Virtual Pools". It features a search bar with "Name" and "Description" fields, a message "No results", and navigation buttons for "First", "Previous", "Next", and "Last". Below these are three buttons: a green "+ Add" button, a red "Delete" button, and a white "Duplicate" button. The "+ Add" button is highlighted with a red border, indicating it is the active or intended action.

Set basic virtual pool parameters

In the Edit Block Virtual Pool screen, add a name ("vPool 1", for example) and a description ("HT5k storage"). Click the box next to your virtual array.



Edit Block Virtual Pool

Edit an existing block virtual pool.

Name:

vPool 1

1

*

Description:

HT5k storage

2

*

Virtual Arrays:

vArray1

3

A Virtual Pool must be associated with one or more Virtual Arrays before the options for other available criteria can be determined.

Enable Quota:

➤ Hardware

➤ SAN Multi Path

Specify hardware options for the virtual pool

Expand the ▾ next to the Hardware entry. Select iSCSI as the protocol, leave all other entries alone. Note that an advisory box stating "No matching storage pools" appears; this is normal.

 **Hardware**

Provisioning Type: *

Protocols: iSCSI *

Matching storage pools will be limited to those that can support all selected protocols

Drive Type: *

System Type: *

Thin Volume Preallocation: %

Multi-Volume Consistency:
If selected, resources provisioned from this pool will support the use of consistency groups

Expandable:
If selected, resources provisioned from this pool will support expansion.

Specify path parameters for the virtual pool

ViPR cannot determine how many paths Cinder has to a back-end array, so the maximum paths must be set to 1 for pool discovery. Expand the SAN Multi Path entry and change Maximum Paths to "1". You will now see an advisory that one storage pool matches your specifications.

SAN Multi Path

Minimum Paths: <input type="text" value="1"/>	Minimum number of total paths from the host to storage array
Maximum Paths: <input type="text" value="1"/>	Maximum number of total paths from the host to storage array
Paths Per Initiator: <input type="text" value="1"/>	Number of paths per host initiator

Verify pool assignment

Expand the Storage Pools entry. Note that your HT5k array storage is now visible and is associated with your virtual pool. Click Save. You now have created a virtual array and pool.

Storage Pools 1

Pool Assignment: <input type="text" value="Automatic"/>	Choosing manual pool assignment allows selection of a subset of the storage pools matching the criteria
---	---

Name	Storage System	Provisioning	Drive Types	Free	Subscribed	Total
hedgetrimmer	hedgetrimmer_HtISCSIDriver+10056777502	Thin		1024 GB	0 GB	1024 GB

Showing 1 to 1 of 1 entries

Lab 3 - Explore third-party operations within ViPR Controller

Lab 3 - Explore third-party operations within ViPR Controller

Your HT5k now has a virtual representation within ViPR Controller. Next you will look at some of the basic operations ViPR can perform using that array. Your goals:

- Verify that your host does not see any external devices
- Provision basic block storage to your host and verify that it's properly seen
- Clone the block storage you created and provision it to the same host
- Delete the block storage and clone
- Investigate Cinder quota limits and their effect on provisioning

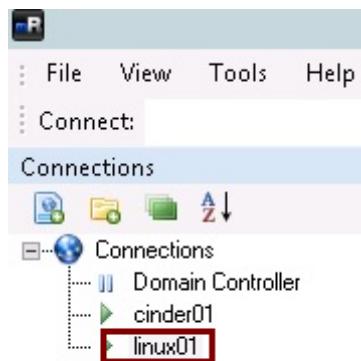
Step 1: Verify storage at target host

Click back to the mRemoteNG session on your Windows taskbar.



Log into the target host

Start a terminal session to your storage consumer host by double-clicking the linux01 entry in the Connections area (leave your Cinder terminal session open).



Verify existing storage

Display the existing storage by running `fdisk -l | grep -i sd` (that's `fdisk` dash "L" piped to `grep` minus I `sd`). Note that `/dev/sda` is the only disk present - `sda1` and `sda2` are partitions on device `/dev/sda`.

```
Using username "root".
Last login: Wed Jun  3 07:41:40 2015 from 1p01.vlab.local
[root@linux01 ~]# fdisk -l | grep -i sd
Disk /dev/sda: 8589 MB, 8589934592 bytes, 16777216 sectors
 /dev/sda1      *        2048     1026047      512000    83  Linux
 /dev/sda2          1026048     16777215    7875584    8e  Linux LVM
[root@linux01 ~]#
```

Step 2: Provision block storage to the host

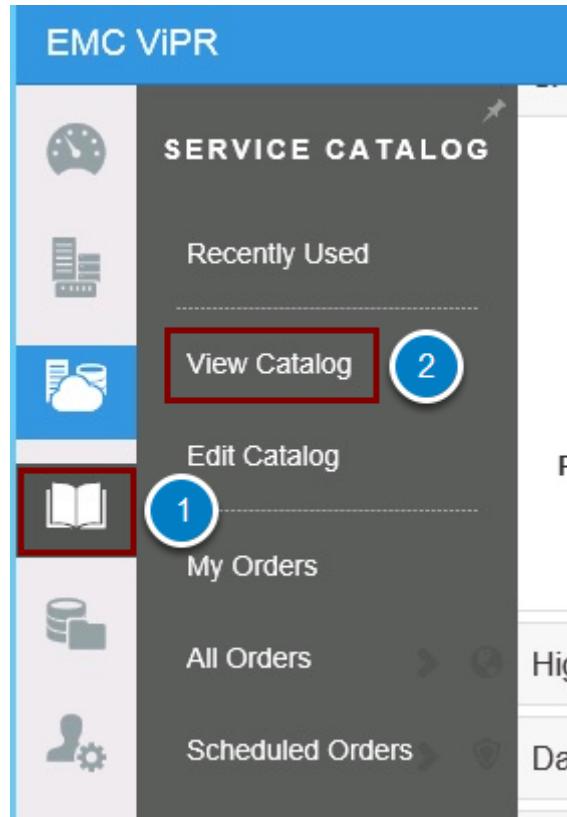
Although ViPR Controller allows creation, format, and mount of host devices in a single step, it also provides you with the flexibility to separate the tasks out if desired. You will create and export devices in this lab (you may optionally format and mount them if desired, but those operations are not covered).

Return to ViPR Controller by clicking the Internet Explorer icon on the Windows taskbar.



Prepare to provision storage

In the left-hand taskbar, click the fourth icon (Service Catalog), then View Catalog.



Specify the operation

Select Block Storage Services.

The screenshot shows the EMC ViPR Service Catalog interface. On the left, there is a vertical sidebar with icons for different service categories: a clock (Time), a server (Storage), a cloud (Cloud), a book (Documentation/Config), a database (File Protection), and a person (User). The 'File Protection Services' icon is highlighted with a blue arrow pointing towards it. The main area is titled 'Service Catalog' and contains four service categories:

- Block Storage Services**: Block storage services for fibre channel and iSCSI. This option is highlighted with a red border.
- Block Protection Services**: Protection services for block storage.
- File Protection Services**: Protection services for network attached storage.
- Block Services for Linux**: Block storage services for Linux.

Each service category has a corresponding icon: a server for Block Storage Services, two cylinders for Block Protection Services, a folder with a shield for File Protection Services, and a penguin for Block Services for Linux.

Prepare to create a volume

Select Create Block Volume for a Host.

EMC ViPR

Service Catalog / Block Storage Services

The EMC ViPR Service Catalog interface displays four main options under the Block Storage Services category:

- Create Block Volume for a Host**: This option is highlighted with a red border. It features a icon of two servers and a green plus sign, with the text "Create Block Volume and export it for a Host".
- Remove Volume by Host**: This option features a icon of two servers and a red minus sign, with the text "Removes an unmounted Block Volume assigned to a Host from all of its Exports and deletes the Volume. The Volume will no longer be available from any Host".
- Remove Block Volumes**: This option features a icon of a single server and a red minus sign, with the text "Remove Block Volumes and related exports".
- Expand Block Volume**: This option features a icon of two servers with a blue arrow pointing right, with the text "Expand storage on a Block Volume".

A vertical sidebar on the left contains icons for Monitoring, Configuration, and User Management, with the Configuration icon currently selected.

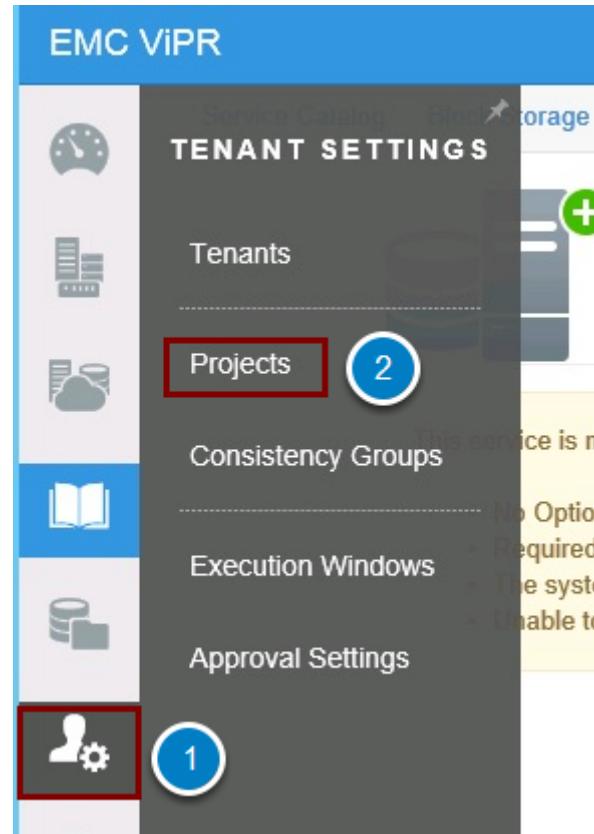
Problem!

Note that you see an error box. This occurs because you have not created a project yet within ViPR Controller.

The screenshot shows the EMC ViPR Service Catalog interface. The left sidebar has icons for Home, Projects, Hosts, Networks, Storage, and Logs, with the Storage icon highlighted by a blue arrow. The main navigation bar shows 'Service Catalog / Block Storage Services / Create Block Volume for a Host'. Below this is a large icon of two stacked cylinders with a green plus sign. The title 'Create Block Volume for a Host' is displayed, followed by the subtitle 'Create Block Volume and export it for a Host'. A yellow callout box contains the message: 'This service is missing required data. This could be caused by:' followed by a bulleted list: '• No Options available for field: Project', '• Required assets (Host, Switches, Storage Arrays) are not defined or you do not have permission.', '• The system is busy discovering assets (Host, Switches, Storage Arrays).', and '• Unable to connect to a ViPR backend server.' At the bottom, there are dropdown menus for 'Storage Type' (set to 'Exclusive') and 'Exclusive'.

Prepare to create a project

In the left-hand taskbar, click the sixth icon (Tenant Settings), then Projects.



Add a project

In the Projects screen, click on Add.

The screenshot shows the EMC ViPR interface with a blue header bar. Below it, a sidebar on the left contains icons for a clock, a server, and a cloud. The main area is titled "Projects". It features a search bar with the placeholder "Name" and a checkbox. Below the search bar, a message says "No results". At the bottom, there are navigation buttons for "First", "←", "→", and "Last", and a status message "0 entries selected". At the very bottom are two buttons: a green "+ Add" button and a red "Delete" button.

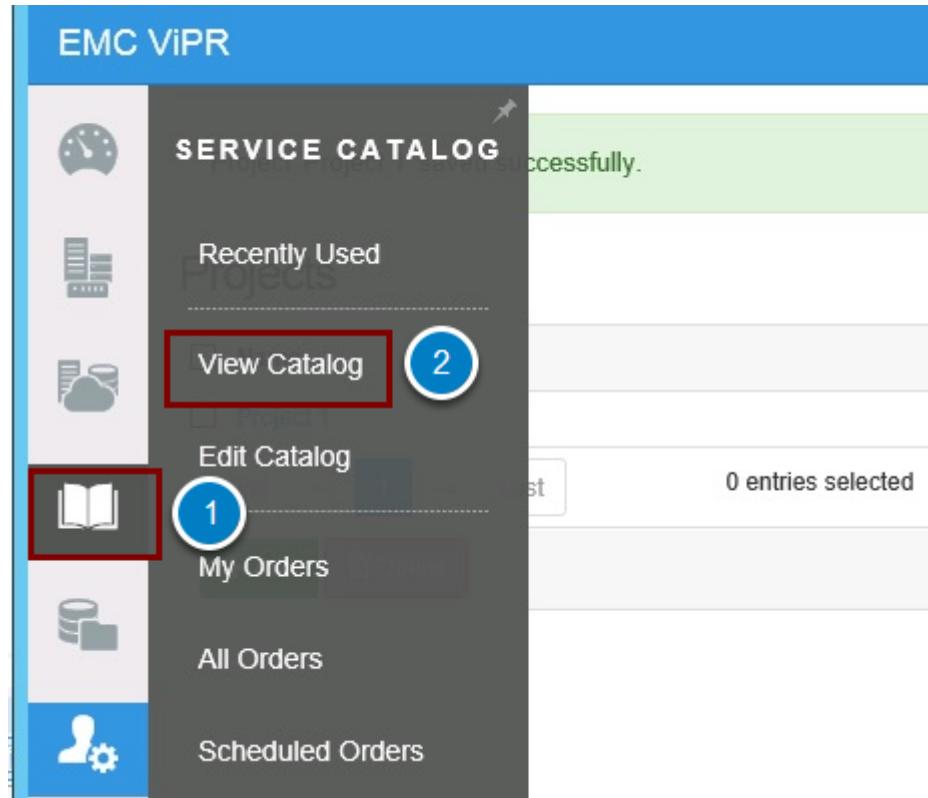
Name and create a project

Enter a name for your project ("Project 1") and click Save.

The screenshot shows the EMC ViPR interface with a blue header bar. A vertical sidebar on the left has icons for a clock, a server, a cloud, a book, a database, and a user. The main area is titled "Create Project". It has a "Name:" field containing "Project 1" (marked with a red box and circled with a blue number 1). Below it is a "Enable Quota:" checkbox. Under "Access Control List", it says "Controls fine-grained access to the resource." There is a table with columns "Name", "Type", and "Access". At the bottom, there is a "Save" button (circled with a blue number 2) and a "Cancel" button.

Prepare to provision storage

Return to the Service Catalog using the left-hand taskbar.



Specify the operation

Select Block Storage Services.

The screenshot shows the EMC ViPR Service Catalog interface. On the left is a vertical navigation bar with icons for Home, Block, File, Protection, and Linux services. A blue arrow points from the Block icon towards the Block Storage Services section. The main area is titled "Service Catalog" and contains four service categories:

- Block Storage Services** (highlighted with a red border): Described as "Block storage services for fibre channel and iSCSI". It features an icon of a server tower.
- Block Protection Services**: Described as "Protection services for block". It features an icon of a database with a shield.
- File Protection Services**: Described as "Protection services for network attached storage". It features an icon of a folder with a shield.
- Block Services for Linux**: Described as "Block storage services for L". It features an icon of the Linux penguin logo.

Prepare to create a volume

Select Create Block Volume for a Host.

The screenshot shows the EMC ViPR Service Catalog interface. On the left, there is a vertical sidebar with icons for Monitoring, Storage, Compute, Network, and Configuration. The 'Storage' icon is highlighted with a blue arrow pointing to it. The main area has a header 'Service Catalog / Block Storage Services'. Below the header, there are four service cards:

- Create Block Volume for a Host** (highlighted with a red box):
 - Create Block Volume and export it for a Host
- Remove Volume by Host**:
 - Removes an unmounted Block Volume assigned to a Host from all of its Exports and deletes the Volume. The Volume will no longer be available from any Host.
- Remove Block Volumes**:
 - Remove Block Volumes and related exports.
- Expand Block Volume**:
 - Expand storage on a Block Volume

Specify volume parameters

Most of the values needed for the Create Block Volume for a Host screen are already filled in with the correct values based on the array and pool characteristics, since you only have one host, array, and pool defined. Add a name for the volume ("HT5k vol 1") and use a 1 GB volume size, then click Order.

The screenshot shows the EMC ViPR interface with the following details:

- Service Catalog / Block Storage Services / Create Block Volume for a Host**
- Create Block Volume for a Host** (Icon: two cylinders with a plus sign)
- Create Block Volume and export it for a Host**
- Storage Type:** Exclusive
- Host/Cluster:** linux01
- Virtual Array:** vArray1
- Virtual Pool:** vPool 1
- Project:** Project 1
- Name:** HT5k vol 1 (highlighted with a red box, circled with number 1)
- User assigned description of the volume**
- Number Of Volumes:** 1
- Size (GB):** 1 (highlighted with a red box, circled with number 2)
- Advanced** (button with a right arrow)
- Order** (blue button, circled with number 3)
- Cancel** (white button)

Create the volume

ViPR Controller will now create the block volume and export it to your host. Successful completion looks like the screen below.

The screenshot shows the EMC ViPR interface with the title "Create Block Volume for a Host". The left sidebar has a blue arrow pointing right over icons for Service Catalog, Block Storage Services, Compute Services, Network Services, and Storage Services. The main content area displays the following details:

Order Number:	1	Storage Type:	Exclusive
Date Submitted:	Jun 3rd 2015, 8:21:00 am	Host/Cluster:	linux01
Submitted By:	root	Virtual Array:	vArray1
Status:	✓ Order Successfully Fulfilled	Virtual Pool:	vPool 1
Execution Time:	32 seconds	Project:	Project 1
Precheck Steps:	1 / 4	Name:	HT5k vol 1
Execution Steps:	4 / 4	Number Of Volumes:	1
		Size (GB):	1
		Consistency Group:	
		HLU:	-1
		Resubmit:	Order

Affected Resources

Block Export: urn:storageos:ExportGroup:aecc422c-50c4-41b9-ac6a-9da259195819:vdc1
 Name: 192.168.1.32
 Virtual Array: vArray1

Return to the target host

Click back to the mRemoteNG session on your Windows taskbar.



Check for new storage

Use your up-arrow, then Enter, to re-run the previous fdisk command. Note that no new storage is displayed, because the iSCSI initiator does not yet know about your provisioning.

```
Using username "root".
Last login: Wed Jun  3 07:41:40 2015 from lp01.vlab.local
[root@linux01 ~]# fdisk -l | grep -i sd
Disk /dev/sda: 8589 MB, 8589934592 bytes, 16777216 sectors
/dev/sda1      *     2048    1026047    512000    83  Linux
/dev/sda2        1026048   16777215   7875584    8e  Linux LVM
[root@linux01 ~]# fdisk -l | grep -i sd
Disk /dev/sda: 8589 MB, 8589934592 bytes, 16777216 sectors
/dev/sda1      *     2048    1026047    512000    83  Linux
/dev/sda2        1026048   16777215   7875584    8e  Linux LVM
[root@linux01 ~]#
```

Perform an iSCSI discovery

Perform an iSCSI discovery of the HT5k array with the **iscsiadm -m discovery -t st -p 192.168.1.31** command. The parameters are -m (mode discovery) -t st (-type Send Targets) and -p (Portal). Note the IQN of "openstack", but the GUID at the end of the IQN may not match yours.

```
[root@linux01 ~]# iscsiadm -m discovery -t st -p 192.168.1.31
192.168.1.31:3260,1 iqn.2010-10.org.openstack:volume-a4019792-2aeb-40e8-a571-6dadf7da6ada
[root@linux01 ~]#
```

Perform an iSCSI login

Log into the ports discovered with the **iscsiadm -m node -L all** command. The parameters are -m (mode node) and -L all (login all ports). Your output should be similar to the following:

```
[root@linux01 ~]# iscsiadm -m node -L all
Logging in to [iface: default, target: iqn.2010-10.org.openstack:volume-a4019792-2aeb-40e8-a571-6dadf7da6ada, portal: 192.168.1.31,3260] (multiple)
Login to [iface: default, target: iqn.2010-10.org.openstack:volume-a4019792-2aeb-40e8-a571-6dadf7da6ada, portal: 192.168.1.31,3260] successful.
[root@linux01 ~]#
```

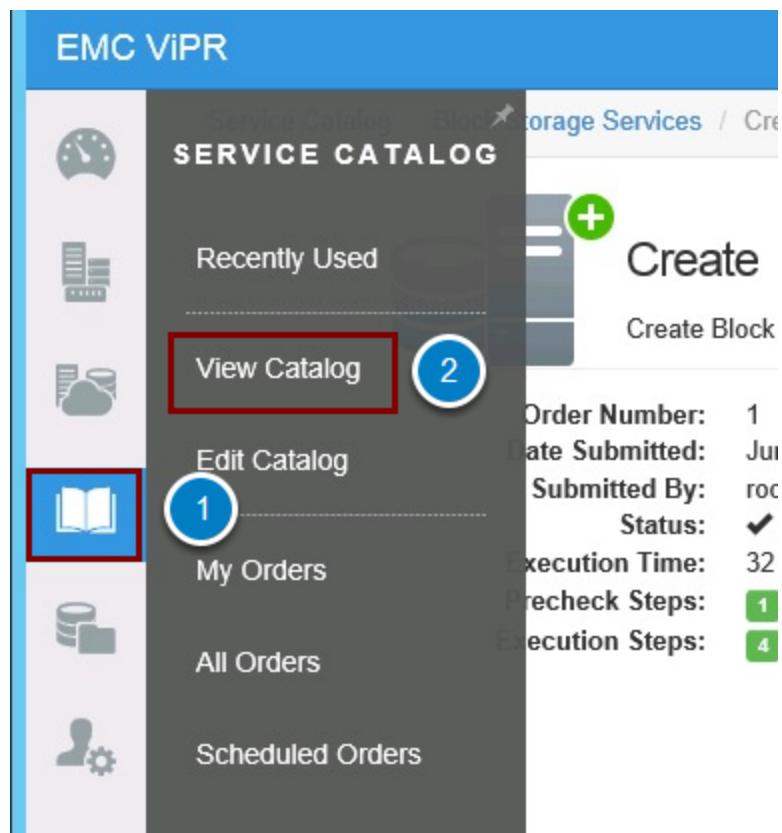
Verify storage device

Using your up-arrow (or by retyping) re-run the `fdisk -l | grep -i sd` command. Note that a new device, `/dev/sdb`, is now present. This 1 GB disk is the one you created in ViPR Controller and resides on your HT5k array.

```
[root@linux01 ~]# fdisk -l | grep -i sd
Disk /dev/sda: 8589 MB, 8589934592 bytes, 16777216 sectors
 /dev/sda1      *     2048    1026047    512000   83  Linux
 /dev/sda2        1026048    16777215    7875584   8e  Linux LVM
Disk /dev/sdb: 1073 MB, 1073741824 bytes, 2097152 sectors
[root@linux01 ~]#
```

Step 3: Clone the block volume

Using the Windows taskbar, return to Internet Explorer. In the left-hand toolbar, select the fourth icon (Service Catalog), then View Catalog.



Prepare to clone a volume

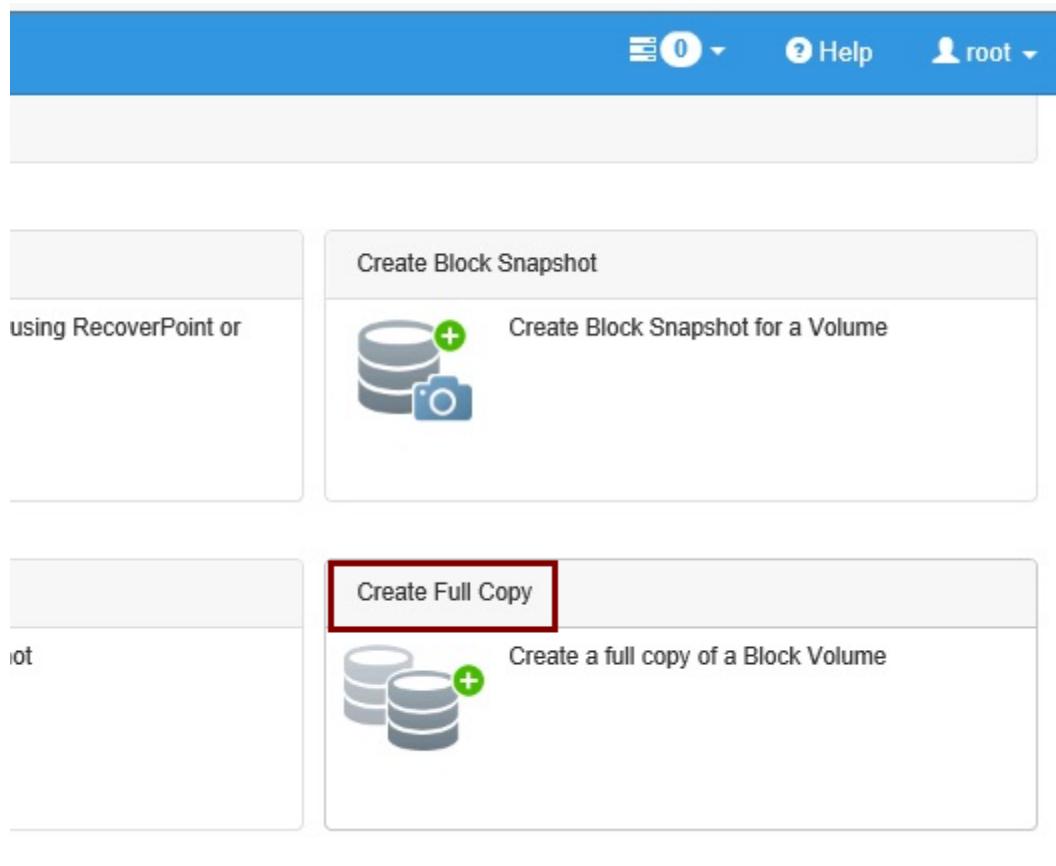
Select Block Protection Services.

The screenshot shows the EMC ViPR Service Catalog interface. On the left, there is a vertical navigation bar with icons for Home, Service Catalog, Block Storage Services, File Protection Services, and Block Services for Linux. The 'Service Catalog' icon is highlighted with a blue arrow pointing to it. The main area displays four service categories:

- Block Storage Services**: Block storage services for fibre channel and iSCSI. It features a server icon.
- Block Protection Services**: Protection services for block storage. It features a cylinder and shield icon. This option is highlighted with a red box.
- File Protection Services**: Protection services for network attached storage. It features a folder and shield icon.
- Block Services for Linux**: Block storage services for Linux hosts. It features a Linux penguin icon.

Specify the operation

Select Create Full Copy.



Specify clone parameters

As you have only one project and one volume, the first two fields are pre-filled. Provide a name ("Clone Copy") and enter 1 in the Number of Copies field, then click Order.

The screenshot shows the "Create Full Copy" interface. It includes a icon of two cylinders with a plus sign, a title "Create Full Copy", and a subtitle "Create a full copy of a Block Volume". The form has the following fields:

- Project:** Project 1 (dropdown)
- Volume:** HT5k vol 1 [1.00 GB] (dropdown)
- Name:** Clone Copy (input field highlighted with a red border and circled with a blue number 1)
- User assigned description of the copy** (text placeholder below the Name field)
- Number of Copies:** 1 (input field circled with a red border and circled with a blue number 2)
- Order** (button highlighted with a red border and circled with a blue number 3)
- Cancel** (button)

Create the clone

ViPR Controller creates an independent copy of your HT5k volume using the OpenStack Cinder API. Successful completion looks like the following:



Create Full Copy

Create a full copy of a Block Volume

Order Number: 2
Date Submitted: Jun 10th 2015, 7:43:59 am
Submitted By: root
Status: ✓ Order Successfully Fulfilled
Execution Time: 21 seconds
Precheck Steps:
Execution Steps:

Project: Project 1
Volume: HT5k vol 1
Name: Clone Copy
Number of Copies: 1
Resubmit: [Order](#)

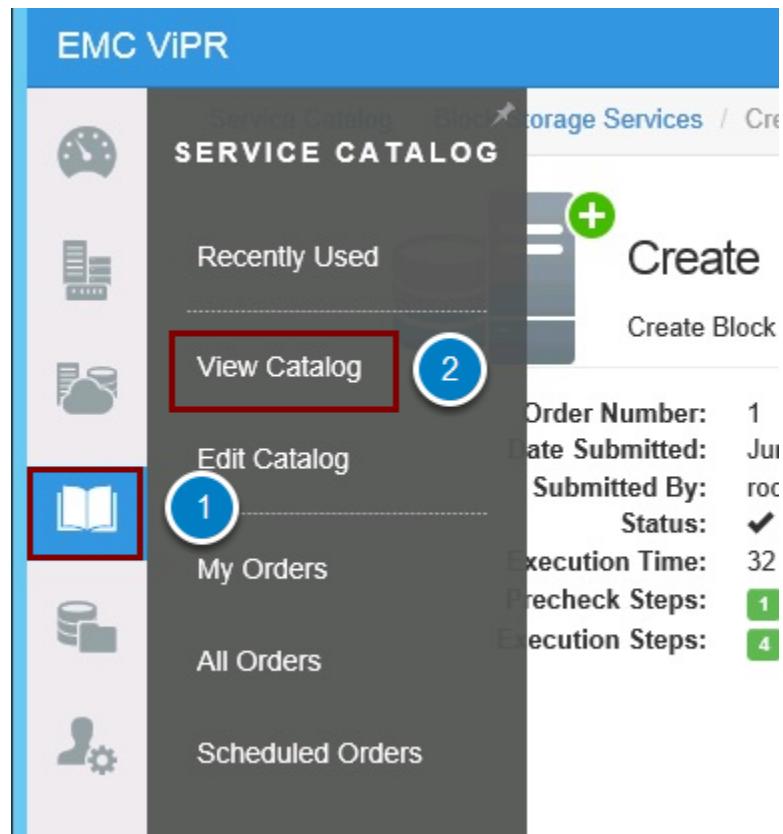
Affected Resources



Volume: urn:storageos:Volume:2196e3ab-5b90-4d70-bdad-30032c70ff30:vdc1
Name: [Clone Copy](#)
WWN: 438013EB18A940B6B7234668C0979356
Size: 1.00 GB Provisioned / 1.00 GB Requested
Virtual Array: vArray1
Virtual Pool: vPool 1

Prepare to export the clone volume

Although you have created a clone, your host will not be able to connect to it until you export the volume. Using the Windows taskbar, return to Internet Explorer. In the left-hand taskbar, select the fourth icon (Service Catalog), then View Catalog.



Specify the operation

Select Block Storage Services.

The screenshot shows the EMC ViPR Service Catalog interface. On the left, there is a vertical sidebar with icons for different service categories: a clock (top), a server (second), a cloud (third), a book (highlighted in blue, fourth), a database (fifth), and a user (sixth). The main area is titled "Service Catalog". It contains four service categories:

- Block Storage Services**: This category is highlighted with a red border. It includes a server icon and the text "Block storage services for fibre channel and iSCSI".
- Block Protection Services**: This category includes a database icon with a shield and the text "Protection services for block".
- File Protection Services**: This category includes a folder icon with a shield and the text "Protection services for network attached storage".
- Block Services for Linux**: This category includes a Linux penguin icon and the text "Block storage services for L".

Export the clone volume

Select Export Volume to a Host.

Remove Volume by Host



Removes an unmounted Block Volume assigned to a Host from all of its Exports and deletes the Volume. The Volume will no longer be available from any Host.

Create Block Volume



Create a Block Volume

Expand Block Volume



Expand storage on a Block Volume

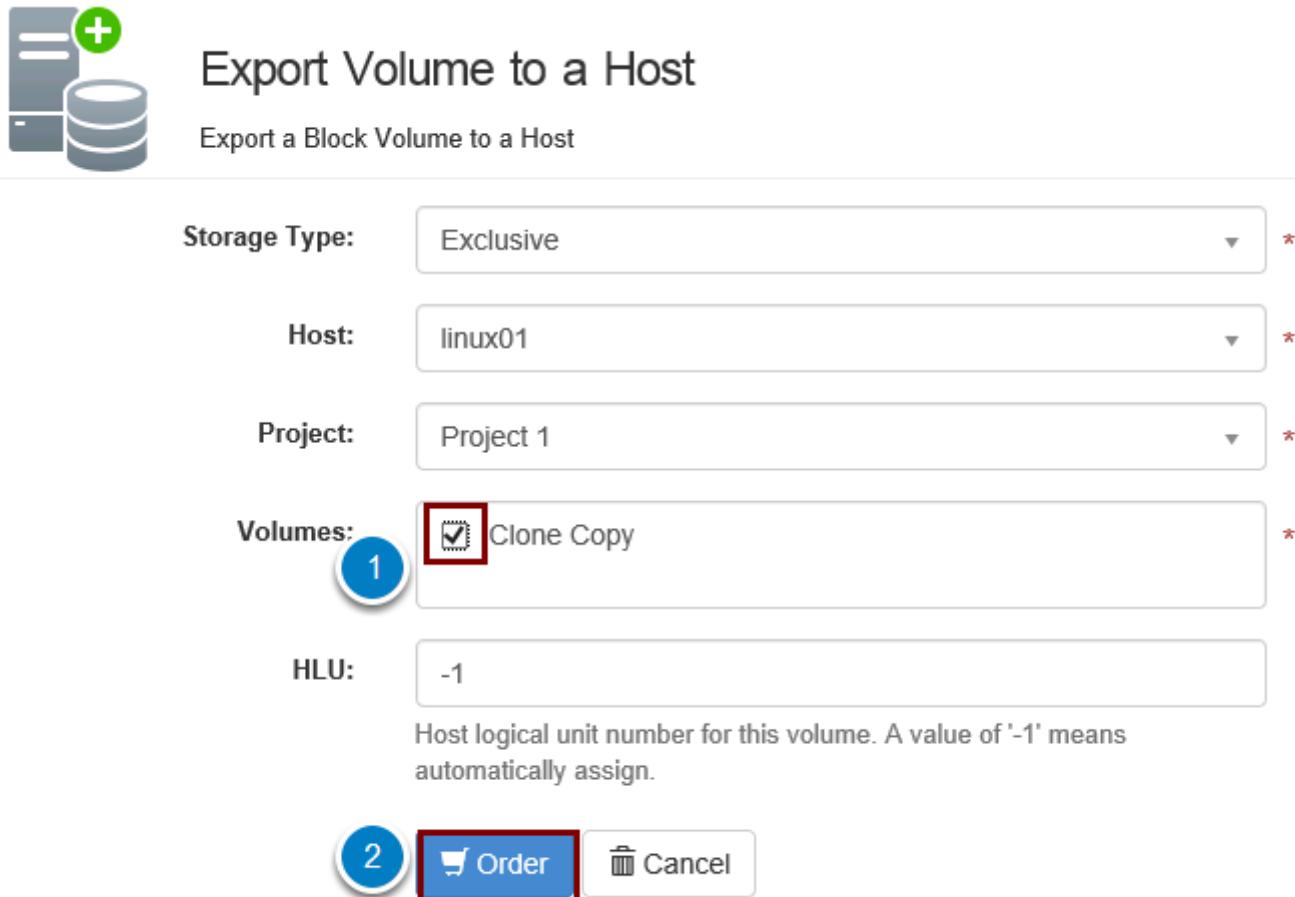
Export Volume to a Host



Export a Block Volume to a Host

Specify the export parameters

The first three fields are pre-populated as there is only one host and one project. Check the box by the Clone Copy volume, leave the HLU at -1, and select Order.



The screenshot shows the 'Export Volume to a Host' interface. At the top left is a icon of a server and database with a green plus sign. The title 'Export Volume to a Host' is centered above the sub-tittle 'Export a Block Volume to a Host'. Below are five input fields:

- Storage Type:** Exclusive (dropdown menu)
- Host:** linux01 (dropdown menu)
- Project:** Project 1 (dropdown menu)
- Volumes:** A list box containing '1' (highlighted with a blue circle) and 'Clone Copy' (with a checked checkbox).
- HLU:** -1 (text input field)

A note below the HLU field states: 'Host logical unit number for this volume. A value of '-1' means automatically assign.' At the bottom are two buttons: 'Order' (highlighted with a red box) and 'Cancel'.

Create the export

ViPR Controller now creates the export for you. Successful completion looks like the following:



Export Volume to a Host

Export a Block Volume to a Host

Order Number: 3
Date Submitted: Jun 10th 2015, 7:46:55 am
Submitted By: root
Status: ✓ Order Successfully Fulfilled
Execution Time: 11 seconds
Precheck Steps: 1
Execution Steps: 3 4 5 6

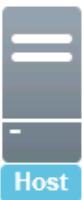
Storage Type: Exclusive
Host: linux01
Project: Project 1
Volumes: Clone Copy
HLU: -1
Resubmit: [Order](#)

Affected Resources



Block Export: urn:storageos:ExportGroup:da50c66a-504a-4b66-87af-3c7960f78e3e:vdc1
Name: [192.168.1.32](#)
Virtual Array: vArray1

[Block Export](#)



Host: urn:storageos:Host:2a4e1ee1-48ed-4a38-b8b1-3f46b419bd72:vdc1
Name: [linux01](#)
Host Name: 192.168.1.32
Operating System: Linux

[Host](#)

Return to the target host

Click back to the mRemoteNG session on your Windows taskbar.



Verify storage devices

Use your up-arrow, then Enter, to re-run the previous fdisk command. Note that no new storage is displayed, because the iSCSI initiator does not yet know about the cloned device.

```
[root@linux01 ~]# fdisk -l | grep -i sd
Disk /dev/sda: 8589 MB, 8589934592 bytes, 16777216 sectors
 /dev/sda1      *     2048    1026047    512000    83  Linux
 /dev/sda2        1026048   16777215    7875584    8e  Linux LVM
Disk /dev/sdb: 1073 MB, 1073741824 bytes, 2097152 sectors
[root@linux01 ~]#
```

Perform an iSCSI login and discovery

Cinder presents the clone on a new target, so you need to log in again. Run `iscsiadm -m discovery -t st -p 192.168.1.31` to rediscover the targets, then `iscsiadm -m node -L all` to log in. Next, run the `fdisk -l | grep -i sd` command and note that a new disk has appeared at `/dev/sdc`; this is the clone device.

```
[root@linux01 ~]# iscsiadm -m discovery -t st -p 192.168.1.31
192.168.1.31:3260,1 iqn.2010-10.org.openstack:volume-a4019792-2aeb-40e8-a571-6dadf7da6ada
192.168.1.31:3260,1 iqn.2010-10.org.openstack:volume-b7be4838-f9a2-4911-bc9a-163dec8f8ec8
192.168.1.31:3260,1 iqn.2010-10.org.openstack:volume-74f37529-144d-43b6-9b1c-0a4d2d12adff
[root@linux01 ~]# iscsiadm -m node -L all
Logging in to [iface: default, target: iqn.2010-10.org.openstack:volume-74f37529-144d-43b6-9b1c-0a4d2d12adff, portal: 192.168.1.31,3260] (multiple)
Login to [iface: default, target: iqn.2010-10.org.openstack:volume-74f37529-144d-43b6-9b1c-0a4d2d12adff, portal: 192.168.1.31,3260] successful.
[root@linux01 ~]# fdisk -l | grep -i sd
Disk /dev/sda: 8589 MB, 8589934592 bytes, 16777216 sectors
 /dev/sda1      *     2048    1026047    512000    83  Linux
 /dev/sda2        1026048   16777215    7875584    8e  Linux LVM
Disk /dev/sdb: 1073 MB, 1073741824 bytes, 2097152 sectors
Disk /dev/sdc: 1073 MB, 1073741824 bytes, 2097152 sectors
[root@linux01 ~]#
```

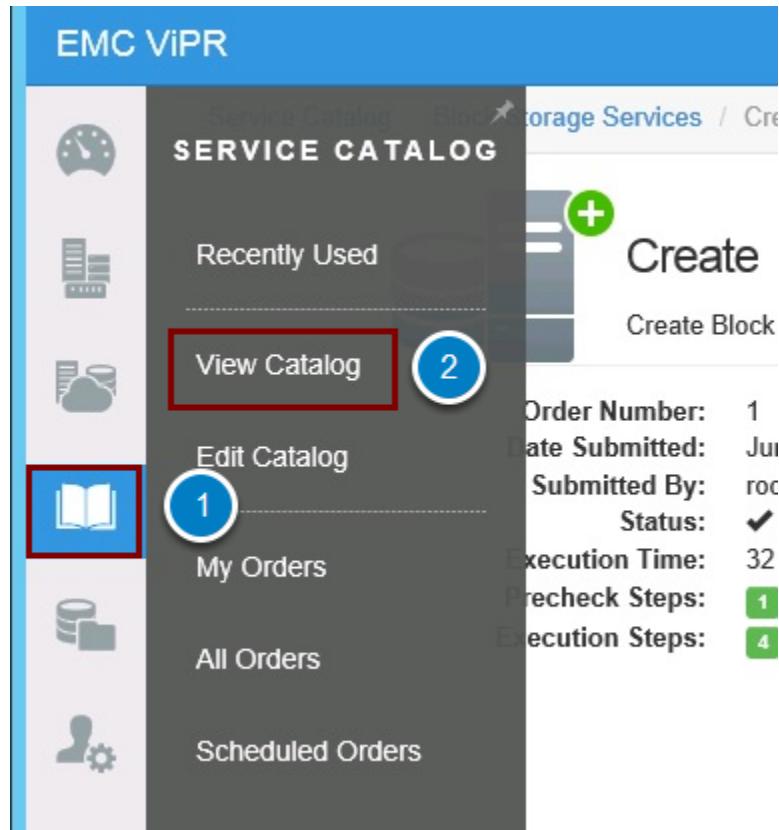
Step 4: Remove devices from Cinder

Some Linux hosts may hang if devices are removed while the iSCSI service is active. Stop iSCSI with service iscsi stop.

```
[root@linux01 ~]# service iscsi stop  
Redirecting to /bin/systemctl stop  iscsi.service  
[root@linux01 ~]# [green]
```

Return to ViPR Controller

Using the Windows taskbar, return to Internet Explorer. In the left-hand toolbar, select the fourth icon (Service Catalog), then View Catalog.



Prepare to remove devices

Select Block Storage Services.

The screenshot shows the EMC ViPR Service Catalog interface. On the left is a vertical sidebar with icons for Monitoring, Configuration, Protection, and Services. The 'Services' icon is highlighted with a blue arrow pointing to it. The main area is titled 'Service Catalog' and contains four service categories:

- Block Storage Services**: This category is selected, indicated by a red border around its icon and title. It includes a server icon and the text "Block storage services for fibre channel and iSCSI".
- Block Protection Services**: This category includes a database and shield icon and the text "Protection services for block".
- File Protection Services**: This category includes a folder and shield icon and the text "Protection services for network attached storage".
- Block Services for Linux**: This category includes a Linux penguin icon and the text "Block storage services for L".

Specify the operation

Select Remove Volume by Host.

EMC ViPR

Service Catalog / Block Storage Services

The screenshot shows the EMC ViPR Service Catalog interface. On the left is a vertical sidebar with icons for Home, Overview, Block, File, Network, Compute, and Settings. The 'Block' icon is highlighted with a blue arrow pointing to it. The main area shows a 'Service Catalog / Block Storage Services' header. Below this are four service cards:

- Create Block Volume for a Host**: A card with a green plus sign icon and the text "Create Block Volume and export it for a Host".
- Remove Volume by Host**: A card with a red minus sign icon and the text "Removes an unmounted Block Volume assigned to a Host from all of its Exports and deletes the Volume. The Volume will no longer be available from any Host." This card is highlighted with a red border.
- Remove Block Volumes**: A card with a red minus sign icon and the text "Remove Block Volumes and related exports."
- Expand Block Volume**: A card with a blue circular arrow icon and the text "Expand storage on a Block Volume".

Select volumes to remove

Using the **Volumes** window, check both the master and clone volumes you created. Leave the deletion type as Full, and click **Order**.

Remove Volume by Host

Removes an unmounted Block Volume assigned to a Host from all of its Exports and deletes the Volume. The Volume any Host.

The screenshot shows a user interface for removing volumes. It includes fields for 'Host' (set to 'linux01'), a list of 'Volumes' (labeled '1') with two checked items ('Clone Copy [1.00 GB]' and 'HT5k vol 1 [1.00 GB]'), and a 'Deletion Type' set to 'Full'. At the bottom, there are two buttons: 'Order' (highlighted with a red border) and 'Cancel'.

Host: linux01

Volumes: 1

Deletion Type: Full

Order Cancel

Remove the volumes

ViPR Controller will deactivate the volumes and then delete them using the Cinder APIs. Successful completion looks like this:

Remove Volume by Host

Removes an unmounted Block Volume assigned to a Host from all of its Exports and deletes the Volume. The Volume will no longer be associated with any Host.

Order Number:	4	Host:	linux01
Date Submitted:	Jun 10th 2015, 12:38:49 pm	Volumes:	Clone Copy HT5k vol 1
Submitted By:	root	Deletion Type:	Full
Status:	✓ Order Successfully Fulfilled	Resubmit:	Order
Execution Time:	43 seconds		
Precheck Steps:	<div style="display: flex; align-items: center;"><div style="width: 20px; height: 10px; background-color: #2e6b2e; margin-right: 5px;"></div><div style="width: 10px; height: 10px; background-color: #2e6b2e; margin-right: 5px;"></div><div style="width: 10px; height: 10px; background-color: #2e6b2e; margin-right: 5px;"></div></div>		
Execution Steps:	<div style="display: flex; align-items: center;"><div style="width: 14px; height: 10px; background-color: #2e6b2e; margin-right: 5px;"></div><div style="width: 10px; height: 10px; background-color: #2e6b2e; margin-right: 5px;"></div><div style="width: 10px; height: 10px; background-color: #2e6b2e; margin-right: 5px;"></div><div style="width: 10px; height: 10px; background-color: #2e6b2e; margin-right: 5px;"></div></div>		

Affected Resources



Block Export: urn:storageos:ExportGroup:d16fc3e1-51c4-415a-9dea-01aebc614386:vdc1
 Name: 192.168.1.32 (Deactivated)
 Virtual Array: vArray1

Block Export

Confirm volume removal

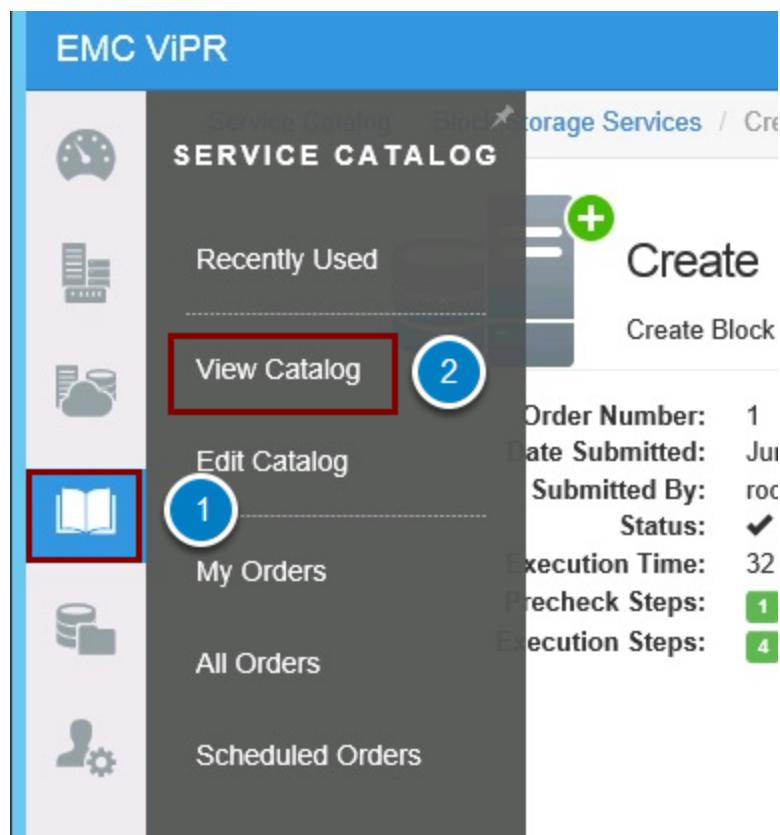
To confirm that the volumes are deleted, click back to mRemoteNG on the Windows taskbar, then run `service iscsi start`, then `fdisk -l | grep -i sd`. The system may pause for 30 or so seconds (while cleaning up the old iSCSI info) but afterwards, note that the local device (`/dev/sda`) is again the only one present.

```
[root@linux01 ~]# service iscsi start
Redirecting to /bin/systemctl start  iscsi.service
[root@linux01 ~]# fdisk -l | grep -i sd
Disk /dev/sda: 8589 MB, 8589934592 bytes, 16777216 sectors
 /dev/sda1      *     2048    1026047    512000   83  Linux
 /dev/sda2        1026048    16777215    7875584   8e  Linux LVM
[root@linux01 ~]#
```

Step 5: Explore Cinder quota limits

Cinder imposes quota limits on its tenants, and those may be too low for some installations. ViPR Controller has no knowledge of the quota restrictions and cannot prevent a user from exceeding Cinder quotas when ordering volumes from the Service Catalog.

In this exercise you will see what happens when you exceed the quota limits. To start, using the Windows taskbar, return to Internet Explorer. In the left-hand taskbar, select the fourth icon (Service Catalog), then **View Catalog**.



Prepare to create volumes

Select Block Storage Services.

The screenshot shows the EMC ViPR Service Catalog interface. On the left is a vertical navigation bar with icons for Home, Block Storage, File Protection, and Block Services for Linux. A blue arrow points from the Home icon towards the Block Storage icon. The main area is titled "Service Catalog" and contains four service categories:

- Block Storage Services**: This category is highlighted with a red border. It features an icon of a server tower and a brief description: "Block storage services for fibre channel and iSCSI".
- Block Protection Services**: This category features an icon of a database with a shield and a brief description: "Protection services for block".
- File Protection Services**: This category features an icon of a folder with a shield and a brief description: "Protection services for network attached storage".
- Block Services for Linux**: This category features an icon of the Linux penguin logo and a brief description: "Block storage services for L".

Specify the operation

Select Create Block Volume for a Host.

EMC ViPR

Service Catalog / Block Storage Services

The EMC ViPR Service Catalog interface displays four operations under the Block Storage Services category:

- Create Block Volume for a Host**: A red box highlights this option. It includes a green plus icon and a server icon with two disks. Description: Create Block Volume and export it for a Host.
- Remove Volume by Host**: Includes a red minus icon and a server icon with two disks. Description: Removes an unmounted Block Volume assigned to a Host from all of its Exports and deletes the Volume. The Volume will no longer be available from any Host.
- Remove Block Volumes**: Includes a red minus icon and a single disk icon. Description: Remove Block Volumes and related exports.
- Expand Block Volume**: Includes a blue right-pointing arrow icon and a server icon with two disks. Description: Expand storage on a Block Volume.

A vertical sidebar on the left contains icons for Monitoring, Storage, Cloud, Configuration, and User.

Specify the volumes to create

Most of the values needed for the Create Block Volume for a Host screen are already filled in with the correct values based on the array and pool characteristics, since you only have one host, array, and pool defined. **Name the new volumes "Small volumes"** (the name is significant for proper execution of the lab, so do not change it) and use a 1 GB volume size, and create 12 volumes. Click Order.

Create Block Volume for a Host

Create Block Volume and export it for a Host

Storage Type: Exclusive

Host/Cluster: linux01

Virtual Array: vArray1

Virtual Pool: vPool 1

Project: Project 1

Name: Small volumes 1

User assigned description of the volume

Number Of Volumes: 12 2

Size (GB): 1 3

Advanced

4 Order Cancel

Problem!

The default quota settings only allow 10 volumes by default per Cinder tenant (not related to ViPR tenants) and so when you attempt to provision 12, even though there is sufficient disk space, Cinder fails due to the quota violation. ViPR Controller therefore rolls back the entire operation.

The failure will take a few minutes to show up; do not proceed until you see a screen similar to that below.

The screenshot shows a 'Create Block Volume for a Host' dialog. On the left, there's a icon of two servers with a green plus sign. The main title is 'Create Block Volume for a Host'. Below it, a sub-instruction says 'Create Block Volume and export it for a Host'. The form fields are as follows:

Order Number:	5	Storage Type:	Exclusive
Date Submitted:	Jun 10th 2015, 12:47:31 pm	Host/Cluster:	linux01
Submitted By:	root	Virtual Array:	vArray1
Status:	✗ Error Occurred Processing Order	Virtual Pool:	vPool 1
Execution Time:	2 minutes	Project:	Project 1
Precheck Steps:	1 green, 1 green	Name:	Small volumes
Execution Steps:	1 red, 1 red	Number Of Volumes:	12
		Size (GB):	1
		Consistency Group:	
		HLU:	-1
		Resubmit:	<button>Order</button>

A red box highlights the 'Status' field, which shows '✗ Error Occurred Processing Order'. Below the form, a large red box contains the error log output:

```

12 Error occurred
Error 12000: An error occurred while executing the job. Volume creation failed for the reason : {"overLimit": {"message": "VolumeLimitExceeded: Maximum number of volumes allowed (10) exceeded", "code": 413}}; Rollback error: Volume does not exist or is already deleted
Error 12000: An error occurred while executing the job. Volume creation failed for the reason : {"overLimit": {"message": "VolumeLimitExceeded: Maximum number of volumes allowed (10) exceeded", "code": 413}}; Rollback error: Volume does not exist or is already deleted
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Error 12000: An error occurred while executing the job. Volume creation failed for the reason : {"overLimit": {"message": "VolumeLimitExceeded: Maximum number of volumes allowed (10) exceeded", "code": 413}}; Rollback error: Volume does not exist or is already deleted

```

Obtain the Cinder tenant ID

To correct the issue, you'll need to increase the quota limit for the service tenant in Cinder. Click back to the mRemoteNG session on your Windows taskbar, then select the **cinder01** tab at the top. You'll first need to obtain your tenant's ID so that you can see the current quota. Use the **keystone tenant-list** command to display the current tenants (your IDs may vary from the ones shown below):

```
root@cinder01:~# keystone tenant-list
+-----+-----+-----+
|      id          |  name   | enabled |
+-----+-----+-----+
| a4fef1f6e9344406928db2121a5d1fa6 | admin   | True    |
| e9e5c5fda7114a8db20e25c1a0ede831 | service | True    |
+-----+-----+-----+
root@cinder01:~#
```

Display the current quota

Use your mouse to highlight the ID next to "service". On the command line, type **cinder quota-show** (note the space afterwards) and right-click your mouse to paste the ID, then press **Enter**. Note the volumes limit is set to 10, so when you attempted to create 12 volumes you exceeded the quota.

```
root@cinder01:~# keystone tenant-list
+-----+-----+-----+
|      id          |  name   | enabled |
+-----+-----+-----+
| a4fef1f6e9344406928db2121a5d1fa6 | admin   | True    |
| e9e5c5fda7114a8db20e25c1a0ede831 | service | True    |
+-----+-----+
root@cinder01:~# cinder quota-show e9e5c5fda7114a8db20e25c1a0ede831
+-----+-----+
|      Property     | Value  |
+-----+-----+
|      gigabytes    | 1000   |
|      gigabytes_hedgetrimmer | -1    |
|      snapshots     | 10    |
|      snapshots_hedgetrimmer | -1    |
|      volumes       | 10    |
|      volumes_hedgetrimmer | -1    |
+-----+-----+
root@cinder01:~#
```

Change the quota

Use up-arrow to recall the previous command and change `cinder quota-show <id>` to `cinder quota-delete <id>`, then press Enter. The command produces no output. Then, once again using command recall, change the command to read `cinder quota-update --volumes 50 <id>` (note the double dash before 50) and press Enter. Your volume limit is now set to 50.

```
root@cinder01:~# cinder quota-delete e9e5c5fda7114a8db20e25c1a0ede831
root@cinder01:~# cinder quota-update --volumes 50 e9e5c5fda7114a8db20e25c1a0ede831
+-----+-----+
|       Property      | Value |
+-----+-----+
|   gigabytes        |  1000 |
| gigabytes_hedgetrimmer | -1   |
|   snapshots        |   10  |
| snapshots_hedgetrimmer | -1   |
|   volumes          |   50  |
| volumes_hedgetrimmer | -1   |
+-----+-----+
```

Restart Cinder services

Restart the Cinder services using service `cinder-api restart`, service `cinder-scheduler restart`, and service `cinder-volume restart`.

```
root@cinder01:~# service cinder-api restart
cinder-api stop/waiting
cinder-api start/running, process 7515
root@cinder01:~# service cinder-scheduler restart
cinder-scheduler stop/waiting
cinder-scheduler start/running, process 7538
root@cinder01:~# service cinder-volume restart
cinder-volume stop/waiting
cinder-volume start/running, process 7561
root@cinder01:~#
```

Resubmit the failed order

Using the Windows taskbar, return to Internet Explorer. The failed order should still be on your screen (if not, find it by clicking **Service Catalog**, then **My Orders** in the left-hand taskbar, then click on the top order). Click on **Order** to resubmit the order.

Create Block Volume for a Host

Create Block Volume and export it for a Host

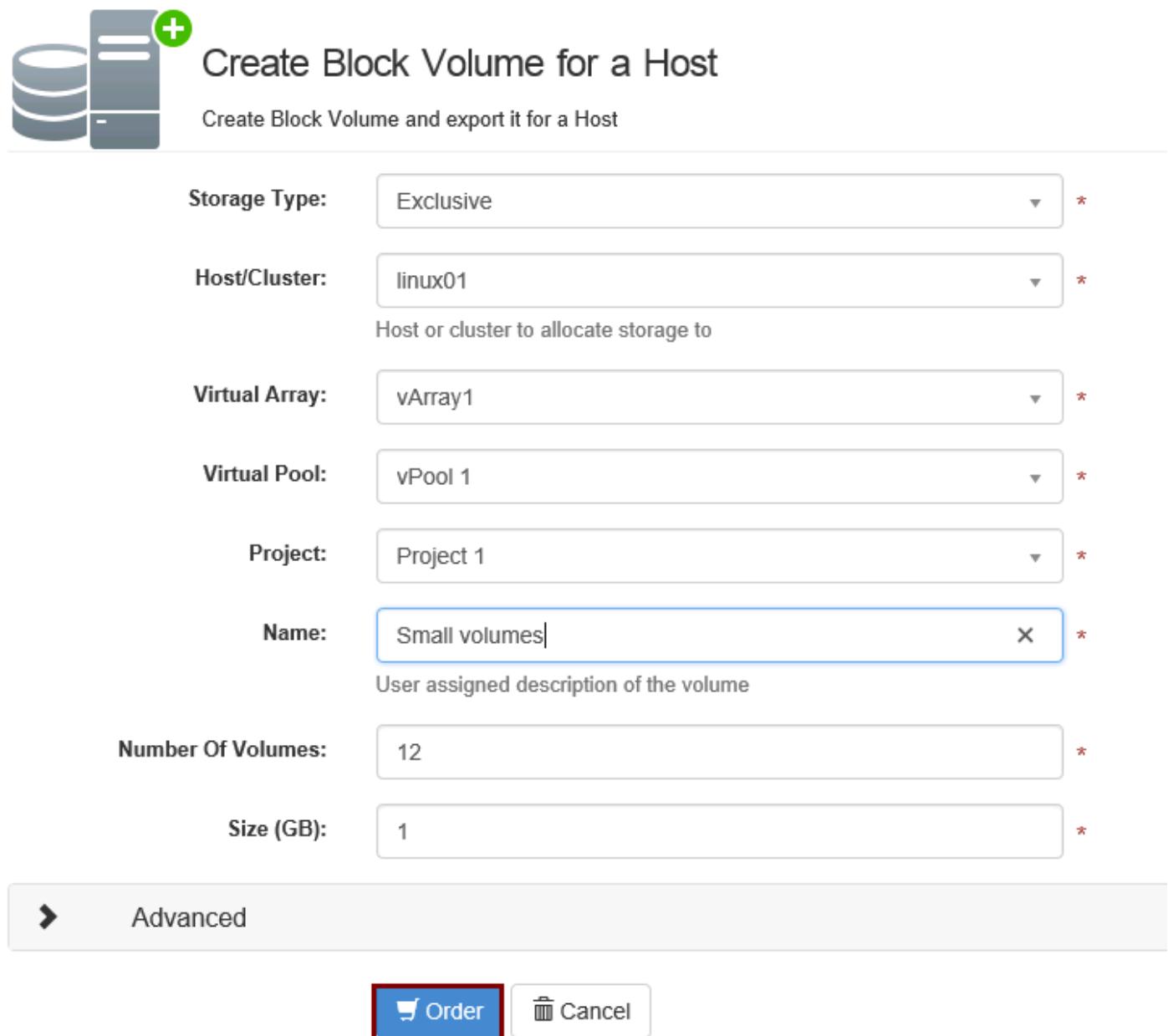
Order Number:	4	Storage Type:	Exclusive
Date Submitted:	Jun 5th 2015, 9:26:46 am	Host/Cluster:	linux01
Submitted By:	root	Virtual Array:	vArray1
Status:	✗ Error Occurred Processing Order	Virtual Pool:	vPool 1
Execution Time:	2 minutes	Project:	Project 1
Precheck Steps:	2 completed	Name:	Small volumes
Execution Steps:	1 completed, 1 failed	Number Of Volumes:	12
		Size (GB):	1
		Consistency Group:	
		HLU:	-1
		Resubmit:	Order

12 Error occurred

Error 41003: "Cinder volume creation failed". Volume creation failed for the reason : {"overLimit": {"message": "VolumeLimitExceeded: Maximum number of volumes allowed (10) exceeded", "code": 413}}; Rollback error: Volume does not exist or is already deleted
Error 41003: "Cinder volume creation failed". Volume creation failed for the reason : {"overLimit": {"message": "VolumeLimitExceeded: Maximum number of volumes allowed (10) exceeded", "code": 413}}; Rollback error: Volume does not exist or is already deleted
Error 41003: "Cinder volume creation failed". Volume creation failed for the reason : {"overLimit": {"message": "VolumeLimitExceeded: Maximum number of volumes allowed (10) exceeded", "code": 413}}; Rollback error: Volume does not exist or is already deleted
Error 41003: "Cinder volume creation failed". Volume creation failed for the reason : {"overLimit": {"message": "VolumeLimitExceeded: Maximum number of volumes allowed (10) exceeded", "code": 413}}; Rollback error: Volume does not exist or is already deleted
Error 41003: "Cinder volume creation failed". Volume creation failed for the reason : {"overLimit": {"message": "VolumeLimitExceeded: Maximum number of volumes allowed (10) exceeded", "code": 413}}; Rollback error: Volume does not exist or is already deleted
Error 41003: "Cinder volume creation failed". Volume creation failed for the reason : {"overLimit": {"message": "VolumeLimitExceeded: Maximum number of volumes allowed (10) exceeded", "code": 413}}; Rollback error: Volume does not exist or is already deleted

Start the order

No changes are needed, so just click Order.



The screenshot shows a configuration interface for creating a block volume. At the top, there's a icon of two servers with a green plus sign, followed by the title "Create Block Volume for a Host" and a subtitle "Create Block Volume and export it for a Host". Below the title are several input fields:

- Storage Type:** Exclusive (dropdown)
- Host/Cluster:** linux01 (dropdown)
Host or cluster to allocate storage to
- Virtual Array:** vArray1 (dropdown)
- Virtual Pool:** vPool 1 (dropdown)
- Project:** Project 1 (dropdown)
- Name:** Small volumes (text input, highlighted with a blue border and an 'X' button)
- Number Of Volumes:** 12 (text input)
- Size (GB):** 1 (text input)

At the bottom left is a "Advanced" button with a right-pointing arrow. At the bottom right are two buttons: a red-bordered "Order" button with a shopping cart icon and a "Cancel" button with a trash can icon.

Observe the resubmission results

The operation will take several minutes to execute. Note that with the increased quota, Cinder can provide the volumes requested., so the ViPR operation succeeds. Completion looks like the screenshot below:

The screenshot shows the 'Create Block Volume for a Host' interface. On the left, there's a icon of two servers with a plus sign. The main title is 'Create Block Volume for a Host' with the subtitle 'Create Block Volume and export it for a Host'. Below the title, there are two columns of configuration details:

Order Number:	7	Storage Type:	Exclusive
Date Submitted:	Jun 10th 2015, 8:03:41 am	Host/Cluster:	linux01
Submitted By:	root	Virtual Array:	vArray1
Status:	✓ Order Successfully Fulfilled	Virtual Pool:	vPool 1
Execution Time:	2 minutes	Project:	Project 1
Precheck Steps:	1 / 2	Name:	Small volumes
Execution Steps:	15 / 16	Number Of Volumes:	12
		Size (GB):	1
		Consistency Group:	
		HLU:	-1
		Resubmit:	Order

Affected Resources

The screenshot shows the 'Affected Resources' section. It features a large blue arrow pointing right, indicating the flow of the process. Below the arrow, there's a button labeled 'Block Export'. To the right, the details of the successful block export are listed:

Block Export: urn:storageos:ExportGroup:da50c66a-504a-4b66-87af-3c7960f78e3e:vdc1
Name: 192.168.1.32
Virtual Array: vArray1

Reacquire and verify the iSCSI devices

Using the Windows taskbar, click back to mRemoteNG and select the **linux01** host tab. As before, you need to run **iscsiadm -m discovery -t st -p 192.168.1.31** to rediscover the targets. You may see messages regarding to record removal; these relate to the devices previously deleted and can be ignored. Next, run **iscsiadm -m node -L all** to log in to the targets. Running the **fdisk -l | grep -i sd** command confirms that the new devices are present.

```
[root@linux01 ~]# fdisk -l | grep -i sd
Disk /dev/sda: 8589 MB, 8589934592 bytes, 16777216 sectors
/dev/sda1      *     2048    1026047    512000  83  Linux
/dev/sda2          1026048   16777215   7875584  8e  Linux LVM
Disk /dev/sdb: 1073 MB, 1073741824 bytes, 2097152 sectors
Disk /dev/sdc: 1073 MB, 1073741824 bytes, 2097152 sectors
Disk /dev/sdd: 1073 MB, 1073741824 bytes, 2097152 sectors
Disk /dev/sde: 1073 MB, 1073741824 bytes, 2097152 sectors
Disk /dev/sdf: 1073 MB, 1073741824 bytes, 2097152 sectors
Disk /dev/sdg: 1073 MB, 1073741824 bytes, 2097152 sectors
Disk /dev/sdh: 1073 MB, 1073741824 bytes, 2097152 sectors
Disk /dev/sdi: 1073 MB, 1073741824 bytes, 2097152 sectors
Disk /dev/sdj: 1073 MB, 1073741824 bytes, 2097152 sectors
Disk /dev/sdk: 1073 MB, 1073741824 bytes, 2097152 sectors
[root@linux01 ~]#
```

Conclusion

Conclusion

Congratulations! Time to put your feet up and relax for a while.

As Neophosoft's Storage Administrator, you've successfully demonstrated how ViPR Controller can provide basic management functions to any array that OpenStack Cinder supports. Neophosoft can now use its Hedgetrimmer 5000 arrays while maintaining the ease of use and single-pane of glass interface functionality from ViPR Controller, and you can redefine and transform your existing storage infrastructure into a simple, extensible and open software-defined platform that can deliver fully automated storage to your users and applications.

Oh, one more thing. If you're curious, the Hedgetrimmer 5000 array is really a custom-built Cinder driver based on an LVM back end. A second IP address was bound to the Cinder host so that the "array" volumes would appear to be coming from a separate machine; in fact, they're logical volumes on the Cinder server. The driver was developed specifically to meet the needs of this vLab and is neither fully debugged nor intended for release.