

Lab 2: Persistent Storage: Swift and Cinder

In this lab you will gain familiarity in accessing persistent storage in OpenStack through both Horizon and the cli. The projects you will explore are the two core OpenStack Persistent Storage components: Object Storage (Swift) and Block Storage (Cinder).

Section 1: Swift - OpenStack Object Store

In this section you will investigate the principal interaction models with Swift. The process of leveraging the programmatic interfaces directly will be explored in lab 3. You will look at the creation and management of objects in the Swift environment, and discover some of the differences between the Horizon UI and the Swift CLI.

Exercise 1: Swift “Object” panel in Horizon

When configured as part of an OpenStack environment, Swift uses the same credentials as the rest of the system, so logging in via Horizon to access Swift is no different than when accessing any other Horizon-enabled OpenStack component.

One difference between a standalone swift environment and Swift with Keystone is that the “account” in Swift is actually tied directly to the tenant. In addition, while most Horizon interfaces are tied to one region or another, in a multi-node swift environment, it doesn’t matter what region you connect with, as the replication model in Swift will allow the same operations, and the same data to exist in multiple regions.

Follow along and explore the Horizon integration with Swift. Can you identify the elements of Swift that are not directly available through Horizon?

Container Creation Page:

After successful login, a user must first create a container before uploading objects. In the CLI section we’ll see that you can in fact create containers at the same time as a data upload request.

The screenshot shows the OpenStack Horizon interface for the 'rstarmer-training' project. The 'Containers' section is active, displaying a table of existing containers. A red circle highlights the '+ Create Container' button. The table lists five containers with their respective object counts, sizes, and access levels.

Container Name	Object Count	Size	Access	View Details
images	1	0 bytes	Private	View Details
images_segments	17	16.2 MB	Private	View Details
public_images	1	16.2 MB	Public	View Details
test_container1	1	6.8 KB	Private	View Details
volumebackups	411	280.5 MB	Private	View Details

After navigating to the Project->Object Store->Containers section of Horizon, users can create a new container or modify an old one through the 'View Details' dropdown. On creation, you can select either Private or Public type of Container, and you can change between those states later. Public containers are available to any user without additional authentication restrictions, but the actual public path (not the originating tenants account and created container) needs to be released to those who would need access.

The 'Create Container' dialog box is shown. It has a 'Container Name' field with the value 'TWC_Lab' and a 'Container Access' dropdown menu set to 'Private'. A 'Description' section provides information about containers, stating they are storage compartments for organizing data. A note at the bottom explains that public containers allow anyone with the public URL to access objects. The dialog has 'Cancel' and 'Create Container' buttons at the bottom right.

Create Container

Container Name *
TWC_Lab

Container Access *
Private

Description:
A container is a storage compartment for your data and provides a way for you to organize your data. You can think of a container as a folder in Windows ® or a directory in UNIX ®. The primary difference between a container and these other file system concepts is that containers cannot be nested. You can, however, create an unlimited number of containers within your account. Data must be stored in a container so you must have at least one container defined in your account prior to uploading data.

Note: A Public Container will allow anyone with the Public URL to gain access to your objects in the container.

Cancel Create Container

List all Containers:

Once the container is created, the user can see the updated list of containers. Modifications can be made via the “view details” sub-menu. Take a look at the modifications you are able to make through Horizon. Note that in this view the container(s) are present, but none have been selected, so there are no Objects being displayed.

The screenshot shows the OpenStack Horizon interface for the 'Containers' section. The left sidebar contains a navigation menu with the following items: Project, Compute, Network, Object Store, Containers (highlighted), Orchestration, and Identity. The main content area is titled 'Containers' and features a table of containers. The table has columns for the container name, object count, size, access, and a 'View Details' button. The containers listed are:

Container Name	Object Count	Size	Access	Action
TWC_Lab	0	0 bytes	Private	View Details
images	1	0 bytes	Private	View Details
images_segments	17	16.2 MB	Private	View Details
public_images	1	16.2 MB	Public	View Details
test_container1	1	6.8 KB	Private	View Details
volumebackups	411	280.5 MB	Private	View Details

Below the table, it says 'Displaying 6 items'. To the right of the table, there is a search bar and buttons for '+ Create Container', '+ Create Pseudo-folder', and 'Upload Object'. The right pane shows 'No items to display.'

Create Objects:

On uploading an object, note that the Object Name and filename do not need to match, and often they don't.

Upload Object To Container: TWC_Lab

File

Choose File IMG_0576.jpg

Object Name ⓘ

TWC_Object1

Description:

Object: An object is the basic storage entity that represents a file you store in the OpenStack Object Storage system. When you upload data to OpenStack Object Storage, the data is stored as-is (no compression or encryption) and consists of a location (container), the object's name, and any metadata consisting of key/value pairs.

Pseudo-folder: Within a container you can group your objects into pseudo-folders, which behave similarly to folders in your desktop operating system, with the exception that they are virtual collections defined by a common prefix on the object's name. A slash (/) character is used as the delimiter for pseudo-folders in the Object Store.

Cancel

Upload Object

List all Objects in a Container:

Now that an object has been uploaded, you can select a specific container to get the current list of object(s) in the panel on the right of the Swift dashboard.

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Project

Compute

Network

Object Store

Containers

Orchestration

Identity

Containers

+ Create Container

Filter

+ Create Pseudo-folder

Upload Object

Delete Objects

TWC_Lab	Object Count: 1 Size: 2.5 MB Access: Private	View Details	<input type="checkbox"/>	TWC_Object1	2.5 MB	Download
images	Object Count: 1 Size: 0 bytes Access: Private	View Details				
images_segments	Object Count: 17 Size: 16.2 MB Access: Private	View Details				
public_images	Object Count: 1 Size: 16.2 MB Access: Public	View Details				
test_container1	Object Count: 1 Size: 6.8 KB Access: Private	View Details				
volumebackups	Object Count: 411 Size: 280.5 MB Access: Private	View Details				

Displaying 6 items

Displaying 1 item

Create folder (pseudo-folder) inside Container:

It is possible to provide further “hierarchy”, though logical, to objects imported. This is especially useful if there is a high likelihood of name collision for content you would want to store in a single container.

Creation of pseudo-folders simply requires you to provide a name for the folder after selecting the create button. The nesting of folders can go arbitrarily deep, though it's usually just a single extra level of depth needed beyond a container. You will need to select the pseudo-folder you want to use prior to uploading an object you would like to store in that folder.

The screenshot shows the OpenStack dashboard interface. The left sidebar contains navigation links: Project, Compute, Network, Object Store, Containers (highlighted), Orchestration, and Identity. The main content area is titled 'Containers'. It features a table with two columns: 'Containers' and 'Pseudo-folders'. The 'Containers' column lists several containers with their object counts, sizes, and access levels. The 'Pseudo-folders' column lists pseudo-folders, including 'TWC_Lab_Pseudo-folder' and 'TWC_Object1'. The 'TWC_Lab_Pseudo-folder' is highlighted, and its details are shown on the right, including a 'Download' button. The interface also includes buttons for 'Create Container', 'Create Pseudo-folder', 'Upload Object', and 'Delete Objects'.

Containers	Object Count	Size	Access	View Details
TWC_Lab	2	2.5 MB	Private	View Details
images	1	0 bytes	Private	View Details
images_segments	17	16.2 MB	Private	View Details
public_images	1	16.2 MB	Public	View Details
test_container1	1	6.8 KB	Private	View Details
volumebackups	411	280.5 MB	Private	View Details

Pseudo-folders	Object Count	Size	Access	View Details
TWC_Lab_Pseudo-folder				View Details
TWC_Object1		2.5 MB		View Details

Download or Delete:

Files can be downloaded or deleted via the 'Download' drop down from the list of all folders and files. Note that containers and pseudo-folders must be empty before deletion.

Containers

+ Create Container		Filter	+ Create Pseudo-folder	Upload Object	Objects
Bob_Snivley	Object Count: 5 Size: 6.7 MB Access: Private	View Details	<input type="checkbox"/>	Snively_Fiendish	pseudo-folder Delete Object
images	Object Count: 1 Size: 0 bytes Access: Private	View Details	<input type="checkbox"/>	Widget_Borgney	pseudo-folder Delete Object
images_segments	Object Count: 17 Size: 16.2 MB Access: Private	View Details	<input type="checkbox"/>	IMG_0576.jpg	2.5 MB Download
public_images	Object Count: 1 Size: 16.2 MB Access: Public	View Details	<input type="checkbox"/>	IMG_0579.jpg	1.7 MB Edit Copy View Details Delete Object
test_container1	Object Count: 1 Size: 6.8 KB Access: Private	View Details			

Exercise 2 Accessing Swift from the CLI

Prerequisites

Swift CLI

The Python based Swift Command Line Client (python-swiftclient) provides remote access to Swift Storage. You should have already installed this client in Lab 1.

Source your Credentials

If you have not already, source your openrc file to set your environment variables.

Verify your Installation

Once authentication parameters are configured, run

```
$ swift --help
```

to verify this service is working and to see a complete listing of available commands.

Exercise 2.1: Create a container and upload/download a file:

a. Create a container

Create a container and add an object requires passing both the container name and the filename simultaneously.

For example, to create a container called “test_contianer” upload a file called “test_file.txt” type, create a sample file to upload:

```
$ echo "Sample Data" > test_file.txt
```

Use “swift upload” command to upload your file:

Command Format:

```
$ swift upload [ContainerName] [FilePath]
```

Example:

```
$ swift upload test_container test_file.txt
```

Note: If you include the full path to the file (as in /tmp/test_file.txt), you will automatically have a /tmp pseudo folder created under the ContainerName. Normally one would upload from the current directory.

b. List all your Containers:

To list all the containers for an account, use “swift list” with no options or arguments.

```
$ swift list
```

Example Output:

```
test_container
```

c. List all objects of a container:

The swift list command will also display the contents of containers and accounts that are passed to it.

Command Format:

```
$ swift list [ContainerName]
```

Example input

```
$ swift list test_container
```

Example output

```
test_file.txt
```

d. Download object from a container:

To download an object from container:

Format:

```
$ swift download [ContainerName] [ObjectName]
```

Example:

```
$ swift list test_container test_file.txt
```

Example output:

```
test_file.txt [auth 0.372s, headers 0.465s, total 0.465s, 0.000 MB/s]
```

e. Get Temporary URL:

User can obtain a temporary URL with “swift-temp-url.”

Format:

```
$ swift tempurl [method] [seconds] [path] [key]
```

Where:

[method] is the method to allow; GET for example.

[seconds] are the number of seconds from command execution to allow requests.

[path] is the full path to the resource. For example: /v1/AUTH_account/c/o

[key] is the X-Account-Meta-Temp-URL-Key for the account.

Note: [path] includes your container “account” which is in the form either of “AUTH_...” or “KEY_...” depending on whether you’re on OpenStack Swift or on SwiftStack. You can determine which value your system is using with:

```
$ swift stat
```

Example output (partial):

```
Account: KEY_7779a8fa71df44619f71d4fdb273ee04
Containers: 4
Objects: 24
Bytes: 34030460
Meta Temp-Url-Key: secret
... : ...
```

The default is called “secret.” Create a unique Temp-URL-Key for your account:

```
$ swift post -m "Temp-URL-Key:my_own_secret"
```

Now your default key is called: my_own_secret or whatever you chose as your secret. It is not the ‘Meta Temp-Url-Key’ part and you can see that it was set appropriately if you again run:

```
$ swift stat
```

Now to get a temporary url:

```
$ swift tempurl GET 300 /v1/KEY_[TenantID]/[ContName]/[ObjectName] my_own_secret
```


Example Output:

```
/v1/KEY_[TenantID]/[ContName]/[ObjectName]?temp_url_sig=[12345abcd]&temp_url_expires=[12345]
```

And try to download it either in a browser, take the output from above and concatenate it with the Swift endpoint (e.g. <https://chrcnc-api.os.cloud.twc.net>) all on one line:

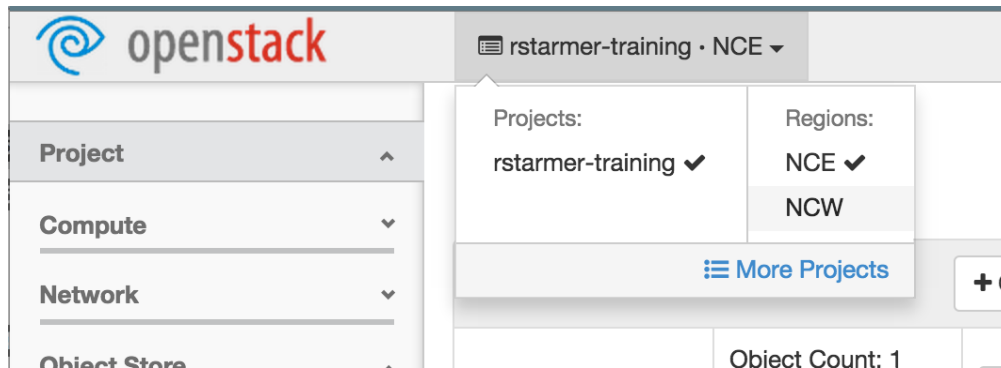
```
wget "https://chrcnc-api.os.cloud.twc.net/v1/KEY_[TenantID]/[ContName]/\[ObjectName]?temp_url_sig=[12345abcd]&temp_url_expires=[12345]"
```

Note, that on the command line you must put the full URL in “” or the & in the URL will be interpreted by the command line!

You can also just paste the full url into a browser window (and then you don’t need the “”)

Exercise 2.2 Now for something duplicate… Regions

You have two regions available to deploy applications into, NCE and NCW. By default, swift objects will be loaded into the swift cluster in the region that is either set in Horizon (if you are using the UI), or in your openrc.sh script (or equivalent) from the command line. If you want to point at NCW instead of NCE (which appears to be the default), in Horizon, you toggle the location in the pulldown at the top of the screen:



In the openrc.sh script, the differences are both in the AUTH_URL and in the REGION:

```
$ diff nce.sh ncw.sh
```

```
33c33
< export OS_REGION_NAME="NCE"
---
> export OS_REGION_NAME="NCW"
```

If you configure two scripts, one for each region, you can then easily switch back and forth between them as needed. Since your password doesn’t change, and it’s never a good idea to store your password in a file, you might actually create three scripts:

- 1) A script to configure the base parameters, and to ask you for your password (to store it as an environment variable).
- 2) A script to set NCE region and Auth
- 3) A script to set NCW region and Auth

The easiest approach to this is to copy the Horizon provided `openrc.sh` to something like `default-openrc.sh` (perhaps with NCE credentials), and then create the following two files:

```
cat > nce.sh <<EOF
#!/bin/bash
export OS_REGION_NAME="NCE"
EOF
```

```
cat > ncw.sh <<EOF
#!/bin/bash
export OS_REGION_NAME="NCW"
EOF
```

Now, you can upload an object into NCE, and see it magically appear in NCW:

```
source {project-name}-openrc.sh
source nce.sh
swift upload test_container_1 test_file.txt
swift list test_container_1

source ncw.sh
mv test_file.txt test_file.txt.orig
swift list test_container_1
swift download test_container_1 test_file.txt
diff test_file.txt.orig test_file.txt
```

Note, generating temporary URLs will work with this switch as well, as the hostname portion of the URL is not part of the tokenized verification of authorization, so you can redirect your application user to the “closer” location to download their data, or provide a backup in case the initial path fails.

Exercise 2.3 And let’s not forget Expiration!

A feature of Swift that can also be very useful is to upload an image with an expiration date, or a Time-To-Live. This is accomplished on the CLI with the same `swift upload` command as before, with the addition of passing an additional header. The following will upload a file to SWIFT and will delete it 5 minutes later (300 seconds):

```
swift upload [CONTAINER] [FILE] --header X-Delete-After:300
```

You can also use the X-Delete-At header, which takes the Unix Epoch time for deletion. In bash, you should be able to get the epoch version of a date with the following (for example 16:15-27-Feb-15):

```
date -j -f "%H:%M-%d-%B-%y" 16:15-27-FEB-15 +%s
1425078910
```

Which you can then use as:

```
swift upload [CONTAINER] [FILE] --header X-Delete-At:1425078910
```

If you check either after the TTL expires, or after the date/time specified as an Epoch, you should no longer see your object!

What if we combine both expiration and a private token enabled container, and script up a little test?

```
#!/bin/bash
#swift_temp.sh
cat >> class_test_file.txt <<EOF
This is a simple test file for Swift to validate
that ${OS_USERNAME} was able to grab a document
from a temporary URL.
EOF
swift upload lab_container class_test_file.txt --header X-Delete-After:60
swift post -m "Temp-URL-Key:my_own_secret"
temp_url=`swift tempurl GET 100
/v1/KEY_${OS_TENANT_ID}/lab_container/class_test_file.txt my_own_secret`
wget -O - "https://chrcnc-api.os.cloud.twc.net${temp_url}"
rm class_test_file.txt
echo ""
echo "sleeping for 45 seconds"
sleep 45
echo "first test"
swift list lab_container
wget -O - "https://chrcnc-api.os.cloud.twc.net${temp_url}"
echo "sleeping for another 45 seconds, container should be empty"
sleep 45
swift list lab_container
wget -O - "https://chrcnc-api.os.cloud.twc.net${temp_url}"
exit 0
```

And If I wanted to create a public container?

Make a read only container public:

```
swift upload new-container test_file.txt
swift post new-container -r '.r:*,.rlistings'
```

And then perhaps find the public url:

```
swift stat -v new-container | grep 'URL:'
```

Section 3: Cinder: OpenStack Block Storage

In this Lab Exercise, you will create a Cinder storage volume and attach it to a VM using the CLI. Using the Horizon UI is left as an exercise for the you and it should be straightforward after completing this lab.

In this lab you will also look at creating a snapshot of this instance and turning the snapshot into a new image for re-deployment.

Exercise 3.1 Access Cinder from the CLI

Prerequisites

Cinder CLI

The Python based Cinder Command Line Client (python-cinderclient) provides remote access to Cinder storage. You should have already installed this client in Lab 1.

Source your Credentials

If you have not already, source your openrc file to set your environment variables.

Verify Service

Once authentication parameters are configured, run

```
$ cinder list
```

to verify this service is working and to see a complete listing of available commands.

a. Create a volume:

Now you are ready to create a new volume using “cinder create”

Command Format:

```
$ cinder create --display-name [Volume_Name] [Required_Size_of_Volume_in_GB]
```

Example:

```
$ cinder create --display-name "MyVolume" 10
```

Use “cinder help create” to see the full syntax of the command as well as optional switches you can use.

Example Output:

Property	Value
attachments	[]
availability_zone	nova
bootable	false
created_at	2015-01-30T18:07:15.277023
display_description	None
display_name	"MyVolume"
encrypted	False
id	ab88d5c7-da0a-4c9e-a759-6ccc0b395907
metadata	{}
size	2
snapshot_id	None
source_volid	None
status	creating
volume_type	None

b. List all Volumes:

Now when executing “cinder list” the new volume should be displayed:

```
$ cinder list
```

ID	Status	Display Name	Size	Volume Type	Bootable	Attached to
ab88d5c7-...95907	available	"MyVolume"	2	None	false	

c. Create bootable volume from Glance Image:

A volume is a detachable block storage device, similar to a USB hard drive. By default a volume can only be attached to one instance. A bootable volume can be created with any image and by using that volume only one instance can be launched.

In our first lab we used `nova image-list` to determine which disc images were available. Run this command again and then run the OpenStack Image Service equivalent:

```
$ glance image-list
```

Take a moment to look at the differences in the information provided by both commands and then make a note of the ID for the Ubuntu-Server-LTS14.04 image to incorporate into the volume you are about to create.

To create a bootable volume:

Command Format:

```
$ cinder create --image-id [Glance_Image_ID] --display-name [Volume_Name] [Size]
```

Example Input:

```
$ cinder create --image-id 3bbddb4b-9115-4da4-b198-aac18e3d7104 --display-name "BootVolume" 20
```

Example Result

Property	Value
attachments	[]
availability_zone	nova
bootable	true
created_at	2015-01-30T18:10:35.714785
display_description	None
display_name	BootVolume
encrypted	False
id	c505fd02-b0c4-4413-b78a-faaa4b5a3f57
image_id	3bbddb4b-9115-4da4-b198-aac18e3d7104
metadata	{}
size	1
snapshot_id	None
source_volid	None
status	creating
volume_type	None

The volume will need to be detached from any instances in order to either snapshot it or create a backup.

d. Create backup of a volume:

This makes a backup of the data on the volume and places it in Object Storage. The backup can then be restored to a new Volume. If you only have 1GB of data on a 2GB Volume, your backup will only be ~1GB, but the volume will still be considered as a 2GB file

Command format to backup a volume:

```
$ cinder backup-create [volume_id]
```

e. Restore Volume Backup:

Find the backup id:

```
$cinder backup-list
```

Restore from a volume backup:

```
$ cinder backup-restore [backup_id]
```

f. Delete Volume Backup:

Command format to delete backup:

```
$ cinder backup-delete [backup_id]
```

Snapshot:

Two things to keep in mind when doing snapshots:

1. It is recommended that the volume be detached and be in '**available**' status in order for you to take a snapshot. You will receive an error if you try to snapshot a volume that's in-use, but you can use the `--force True` flag if you really need to execute the snapshot.
2. You must keep the original volume for the snapshot to function properly. If the original volume is deleted then the snapshot will become unusable.

Create snapshot of a volume:

Snapshots end up in the volume list marked as snapshots, and with CEPH backed volumes, they are COW point in time markers against the base deployed volume. New volumes can then be created based on the snapshot. A 2GB volume will have a 2GB snapshot even only 1GB worth of its space is consumed.

To create snapshot of a volume:

```
$ cinder snapshot-create <Volume_ID>
```

Property	Value
created_at	2015-01-30T18:14:58.461270
display_description	None
display_name	None
id	4a647cda-346b-43d2-8215-b69cdd39ac90
metadata	{}
size	2
status	creating
volume_id	ab88d5c7-da0a-4c9e-a759-6ccc0b395907

Create volume from Snapshot:

Create a new volume using the base command without setting the variables.

```
$ cinder create --snapshot-id 4a647cda-346b-43d2-8215-b69cdd39ac90 20
```

Property	Value
attachments	[]
availability_zone	nova
bootable	false
created_at	2015-01-30T18:18:18.175236
display_description	None
display_name	None
encrypted	False
id	49999974-bf7d-49a2-b276-c6f35a67c914
metadata	{}
size	20
snapshot_id	4a647cda-346b-43d2-8215-b69cdd39ac90
source_volid	None
status	creating
volume_type	None

Attach and Format a Volume:

Log into your instance, and format the volume (the first volume beyond the root disk is called /dev/vdb unless you specifically called it something else when it was attached).

```
$ mkfs.ext4 /dev/vdb
```

And then mount int:

```
$ mount /dev/vdb /mnt
```

Delete Volume:

Delete a volume using this command: “cinder delete”

```
$ cinder delete <volume_id>
```

What happens if you delete a volume that is attached to an instance?
What happens if you detach an attached volume?

Section 4: Access Cinder from Horizon

Exercise 4.1

Now logon to the portal and try to replicate the tasks you just completed through the CLI in Horizon. Are there any tasks you are not able to replicate? Do you find the CLI or dashboard easier to complete tasks with? What if you had to do this tasks repeatedly would you go with dashboard or CLI?