



# SSCloud Introduction

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## Intorduction

SSCloud is an IaaS services based on OpenStack. The purpose of SSScloud is similar to Amazon EC2, to provide a virtual machine leasing service. User can easily get a virtual machine online in five minutes.

## Software Stack and System Architecture

Currently, SSScloud is using **OpenStack Liberty**. To provide high available service, SSScloud enable HAProxy and other HA mechanism.

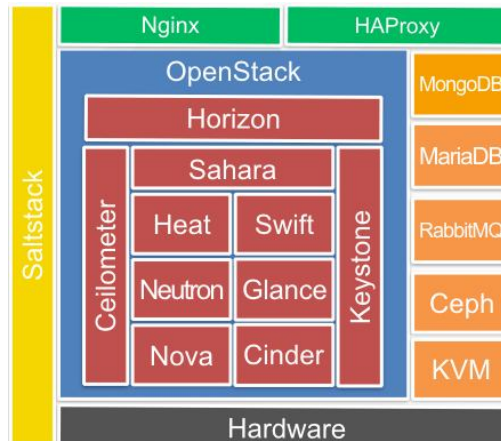


Figure 1 Software Stack

Our system architecture as following:

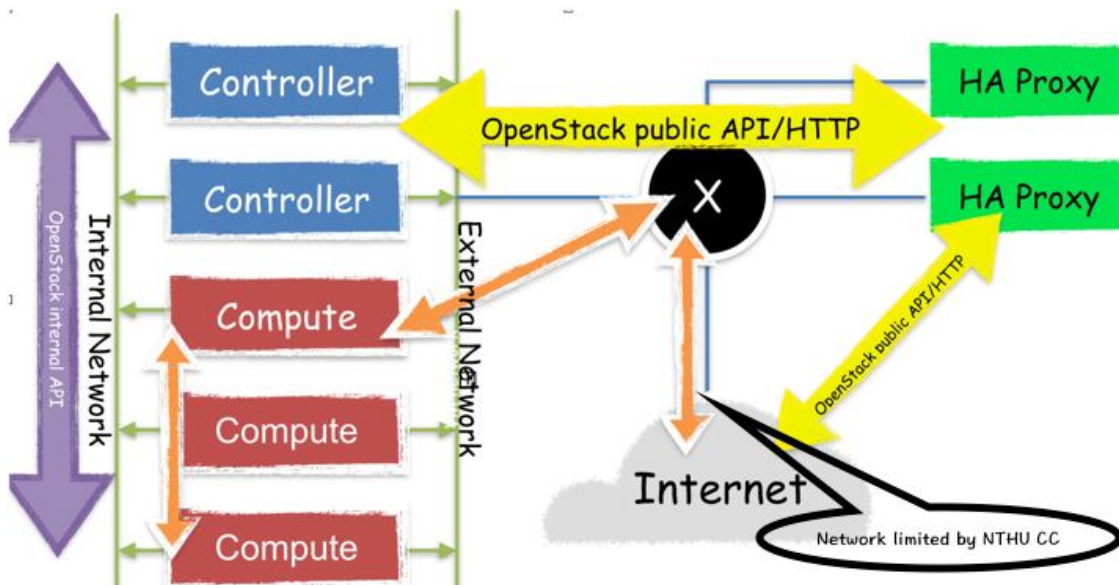


Figure 2 System Architecture

There is two different physical network:

- External network provides network traffic for instance to Internet or access from Internet to instance. This network is setup with GB Ethernet network.
- Internal network provides instances communication, OpenStack internal API, and data network. This network is setup with Infiniband network.

## Features

- Self-service web portal for VM provisioning and management.

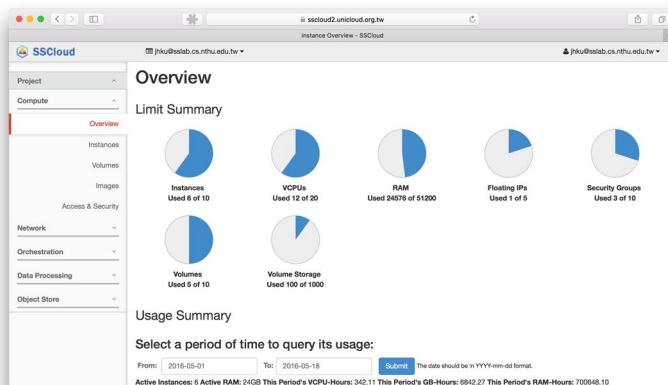


Figure 3 Overview

- Flexible virtual network configuration.

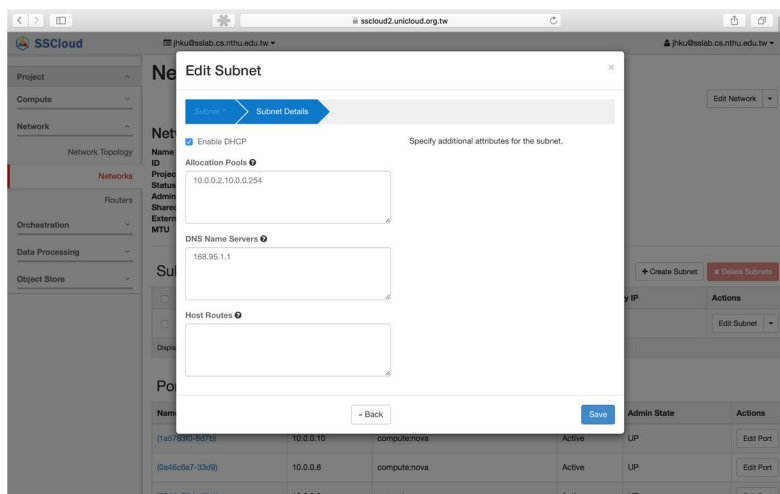
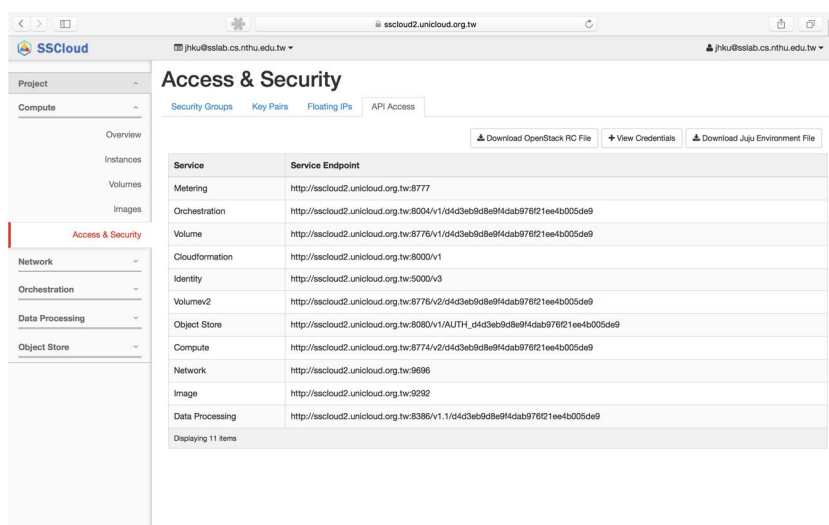


Figure 4 Edit Subnet

- Provide programmable REST APIs that comply with AWS.



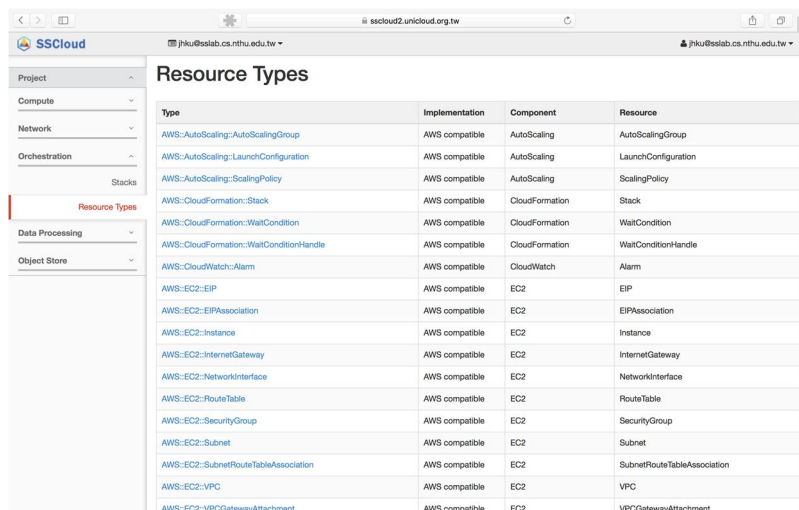
The screenshot shows the 'Access & Security' page of the SSSCloud web portal. It has tabs for 'Security Groups', 'Key Pairs', 'Floating IPs', and 'API Access'. The 'API Access' tab is active, displaying a table of REST API endpoints. The table has two columns: 'Service' and 'Service Endpoint'. Below the table are links for 'Download OpenStack RC File', 'View Credentials', and 'Download Juju Environment File'.

Service	Service Endpoint
Metering	http://sscloud2.unicond.org.tw:8777
Orchestration	http://sscloud2.unicond.org.tw:8004/v1/04d3eb9d8e9f4dab97821ee4b005de9
Volume	http://sscloud2.unicond.org.tw:8776/v1/04d3eb9d8e9f4dab97821ee4b005de9
Cloudformation	http://sscloud2.unicond.org.tw:8000/v1
Identity	http://sscloud2.unicond.org.tw:5000/v3
Volume2	http://sscloud2.unicond.org.tw:8776/v2/04d3eb9d8e9f4dab97821ee4b005de9
Object Store	http://sscloud2.unicond.org.tw:8080/v1/AUTH_04d3eb9d8e9f4dab97821ee4b005de9
Compute	http://sscloud2.unicond.org.tw:8774/v2/04d3eb9d8e9f4dab97821ee4b005de9
Network	http://sscloud2.unicond.org.tw:9696
Image	http://sscloud2.unicond.org.tw:9292
Data Processing	http://sscloud2.unicond.org.tw:8386/v1.1/04d3eb9d8e9f4dab97821ee4b005de9

Displaying 11 items

Figure 5 API Access

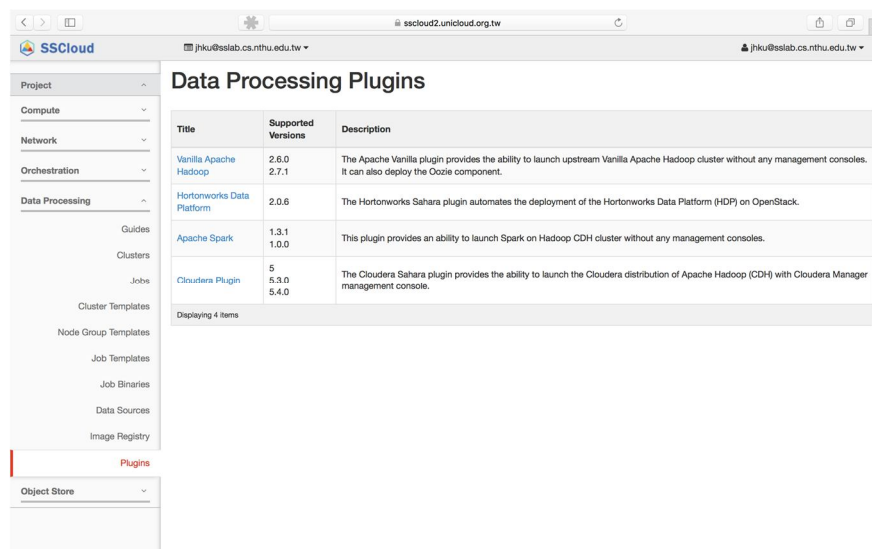
- A human- and machine-accessible service for managing the entire lifecycle of infrastructure and applications.



Type	Implementation	Component	Resource
AWS::AutoScaling::AutoScalingGroup	AWS compatible	AutoScaling	AutoScalingGroup
AWS::AutoScaling::LaunchConfiguration	AWS compatible	AutoScaling	LaunchConfiguration
AWS::AutoScaling::ScalingPolicy	AWS compatible	AutoScaling	ScalingPolicy
AWS::CloudFormation::Stack	AWS compatible	CloudFormation	Stack
AWS::CloudFormation::WaitCondition	AWS compatible	CloudFormation	WaitCondition
AWS::CloudFormation::WaitConditionHandle	AWS compatible	CloudFormation	WaitConditionHandle
AWS::CloudWatch::Alarm	AWS compatible	CloudWatch	Alarm
AWS::EC2::EIP	AWS compatible	EC2	EIP
AWS::EC2::EIPAssociation	AWS compatible	EC2	EIPAssociation
AWS::EC2::Instance	AWS compatible	EC2	Instance
AWS::EC2::InternetGateway	AWS compatible	EC2	InternetGateway
AWS::EC2::NetworkInterface	AWS compatible	EC2	NetworkInterface
AWS::EC2::RouteTable	AWS compatible	EC2	RouteTable
AWS::EC2::SecurityGroup	AWS compatible	EC2	SecurityGroup
AWS::EC2::Subnet	AWS compatible	EC2	Subnet
AWS::EC2::SubnetRouteTableAssociation	AWS compatible	EC2	SubnetRouteTableAssociation
AWS::EC2::VPC	AWS compatible	EC2	VPC
AWS::EC2::VPCGatewayAttachment	AWS compatible	EC2	VPCGatewayAttachment

Figure 6 Resource Types

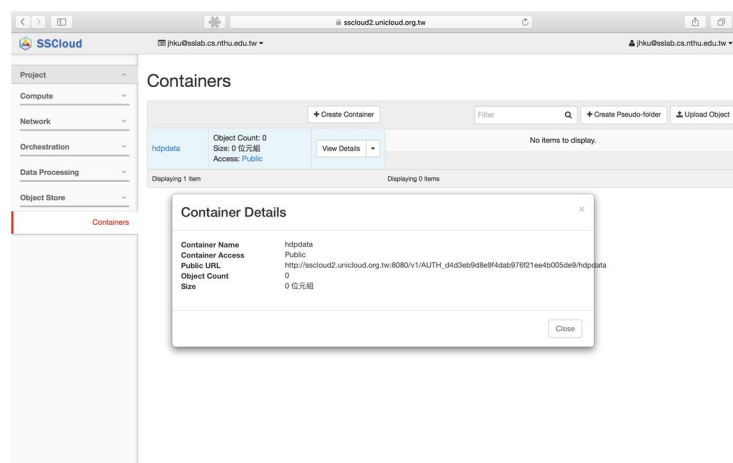
- A simple means to provision a data-intensive application cluster (Hadoop or Spark).



Title	Supported Versions	Description
Vanilla Apache Hadoop	2.6.0 2.7.1	The Apache Vanilla plugin provides the ability to launch upstream Vanilla Apache Hadoop cluster without any management consoles. It can also deploy the Oozie component.
Hortonworks Data Platform	2.0.6	The Hortonworks Sahara plugin automates the deployment of the Hortonworks Data Platform (HDP) on OpenStack.
Apache Spark	1.3.1 1.0.0	This plugin provides an ability to launch Spark on Hadoop CDH cluster without any management consoles.
Cloudera Plugin	5 5.3.0 5.4.0	The Cloudera Sahara plugin provides the ability to launch the Cloudera distribution of Apache Hadoop (CDH) with Cloudera Manager management console.

Figure 7 Sahara plugin list

- Cloud storage for user to store and retrieve lots of data with a simple API.



Container Name	Container Access	Public URL	Object Count	Size
hdpdata	Public	http://sscloud2.unicond.org.tw:8080/v1/AUTH_1443e6b98e9f4dab97621e442055e9/hdpdata	0	0 位元組

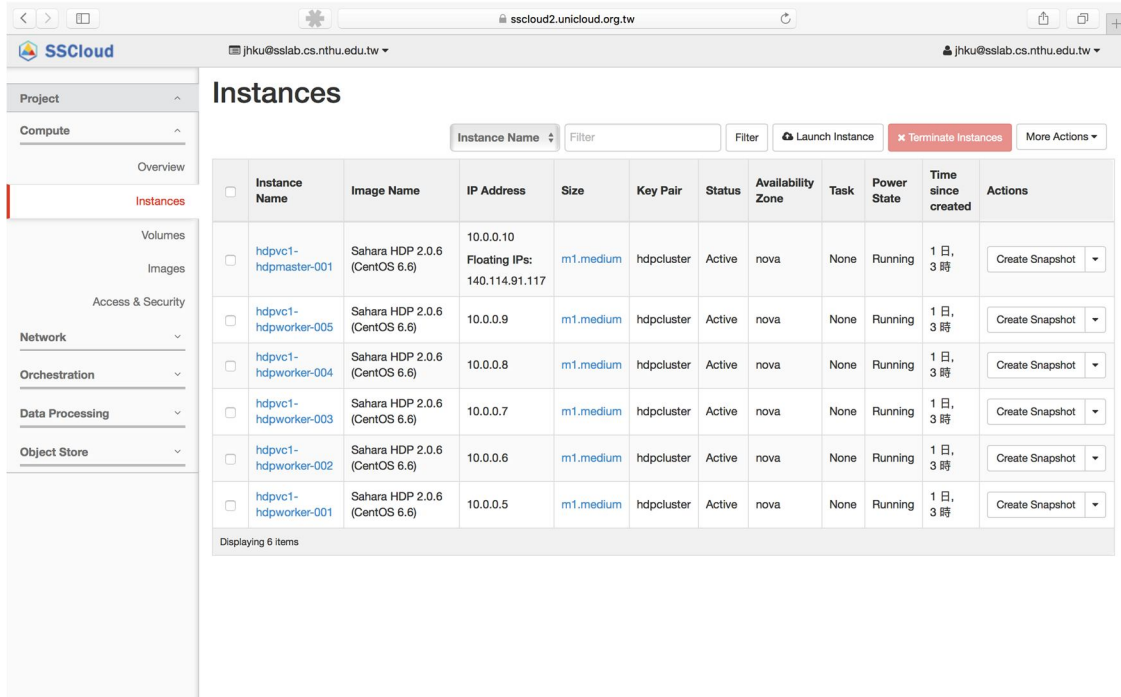
Figure 8 Swift Container

## Services

SSCloud provide 7 main service: compute, image, network, ... , object storage.

## Compute

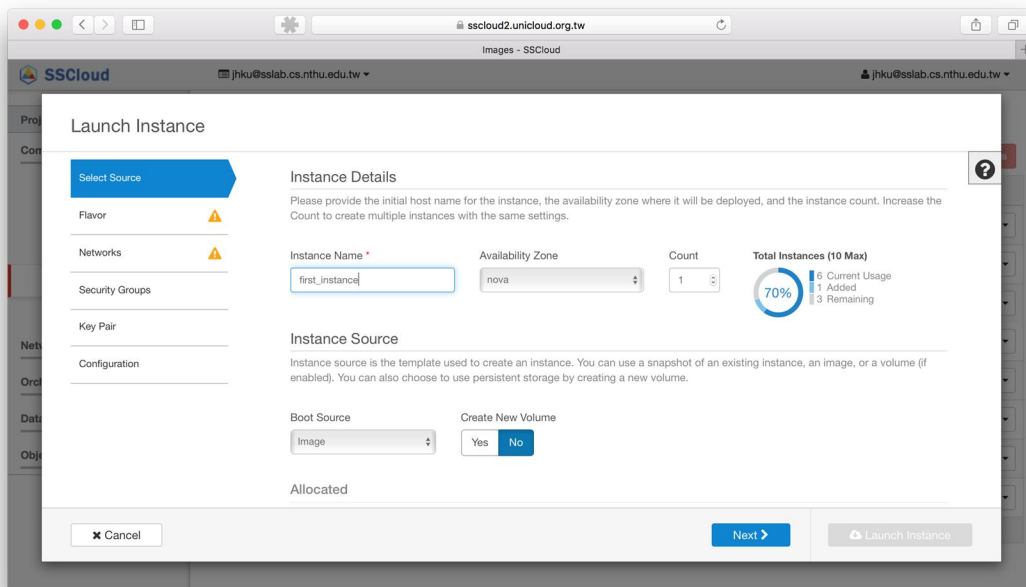
**Compute service** provide function to manage virtual machine (instances).



Instance Name	Image Name	IP Address	Size	Key Pair	Status	Availability Zone	Task	Power State	Time since created	Actions
hdpvc1-hdpmaster-001	Sahara HDP 2.0.6 (CentOS 6.6)	10.0.0.10 Floating IPs: 140.114.91.117	m1.medium	hdpcluster	Active	nova	None	Running	1 日, 3 時	Create Snapshot
hdpvc1-hdpworker-005	Sahara HDP 2.0.6 (CentOS 6.6)	10.0.0.9	m1.medium	hdpcluster	Active	nova	None	Running	1 日, 3 時	Create Snapshot
hdpvc1-hdpworker-004	Sahara HDP 2.0.6 (CentOS 6.6)	10.0.0.8	m1.medium	hdpcluster	Active	nova	None	Running	1 日, 3 時	Create Snapshot
hdpvc1-hdpworker-003	Sahara HDP 2.0.6 (CentOS 6.6)	10.0.0.7	m1.medium	hdpcluster	Active	nova	None	Running	1 日, 3 時	Create Snapshot
hdpvc1-hdpworker-002	Sahara HDP 2.0.6 (CentOS 6.6)	10.0.0.6	m1.medium	hdpcluster	Active	nova	None	Running	1 日, 3 時	Create Snapshot
hdpvc1-hdpworker-001	Sahara HDP 2.0.6 (CentOS 6.6)	10.0.0.5	m1.medium	hdpcluster	Active	nova	None	Running	1 日, 3 時	Create Snapshot

Figure 9 Instance List

User can launch instances via web portal or REST APIs.



Launch Instance

Select Source

Flavor

Networks

Security Groups

Key Pair

Configuration

Instance Details

Please provide the initial host name for the instance, the availability zone where it will be deployed, and the instance count. Increase the Count to create multiple instances with the same settings.

Instance Name \* first\_instance

Availability Zone nova

Count 1

Total Instances (10 Max)

6 Current Usage

1 Added

3 Remaining

70%

Instance Source

Instance source is the template used to create an instance. You can use a snapshot of an existing instance, an image, or a volume (if enabled). You can also choose to use persistent storage by creating a new volume.

Boot Source Image

Create New Volume

Yes No

Allocated

Cancel Next Launch Instance

Figure 10 Create Instance

To access instances, there is two way:

1. Access via Web Console after user login to dashboard.

### Instance Console



Figure 11 Web Console

2. Access via SSH with floating IP and SSH key

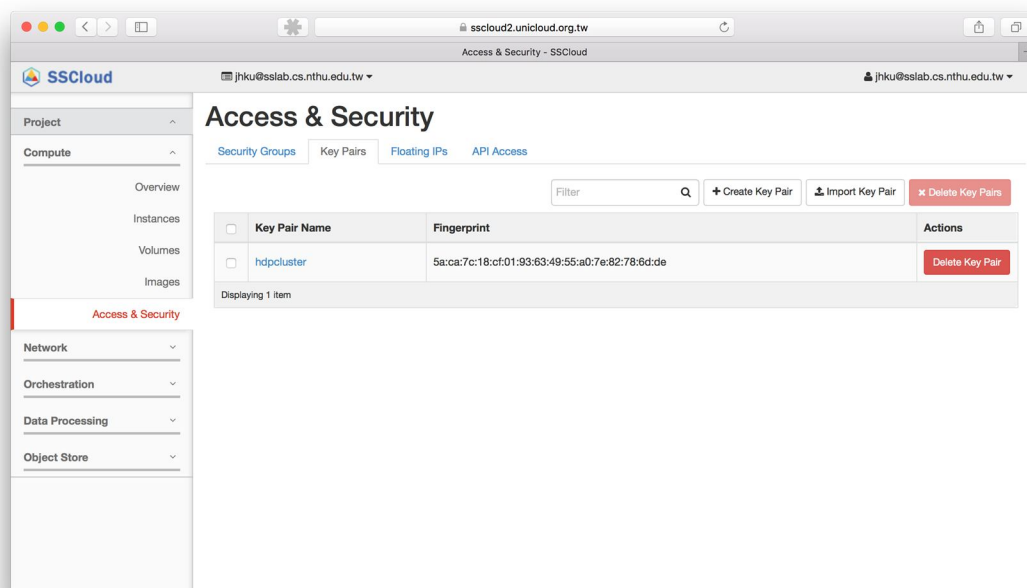


Figure 12 SSH Key

## Image

Image service provide operating system for user to create instance.

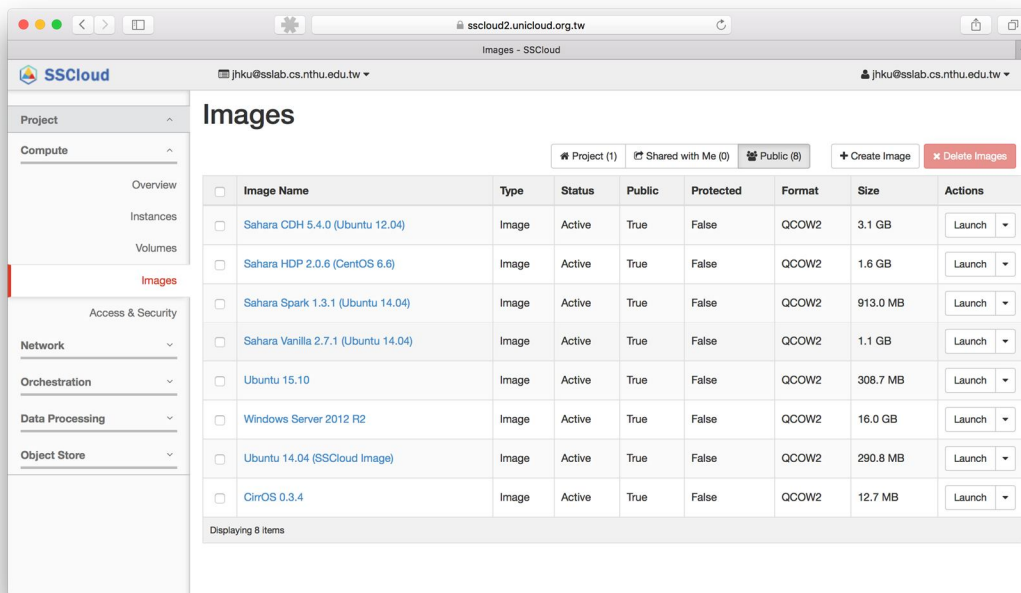


Figure 13 Image List

User can upload own private image or download image from Internet to SSCloud.

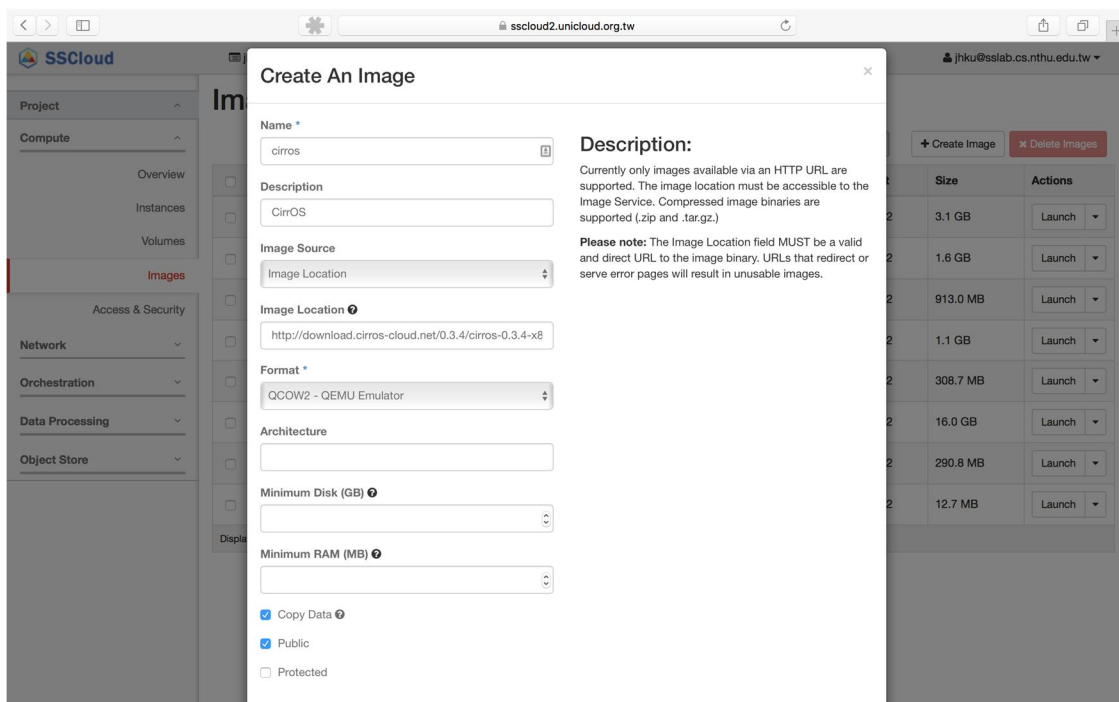


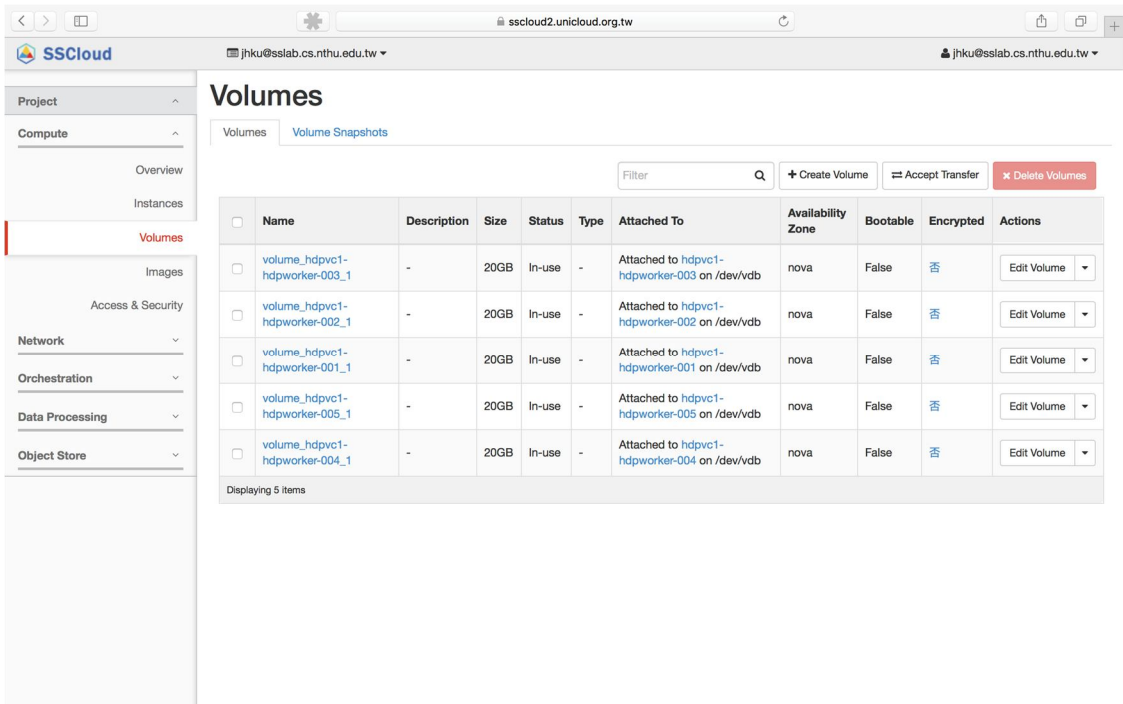
Figure 14 Upload Custom Image

SSCloud support format of image include: **qcow2**(recommends), raw, aki, ami, vmdk, vdi, vhd, ... etc.



## Volume

**Volume service** provide block storage for instance. User can create and attach a large storage to instance.



The screenshot shows the 'Volumes' section of the SSCloud interface. On the left is a sidebar with navigation options: Project, Compute, Overview, Instances, Volumes (selected), Images, Access & Security, Network, Orchestration, Data Processing, and Object Store. The main area displays a table of volumes with columns: Name, Description, Size, Status, Type, Attached To, Availability Zone, Bootable, Encrypted, and Actions. There are five volumes listed, all 20GB and in 'In-use' status, attached to various hdpvc1-hdpworker instances. Each volume has an 'Edit Volume' button in the Actions column. Above the table are buttons for '+ Create Volume', 'Accept Transfer', and 'Delete Volumes'. A search filter is also present.

	Name	Description	Size	Status	Type	Attached To	Availability Zone	Bootable	Encrypted	Actions
<input type="checkbox"/>	volume_hdpvc1-hdpworker-003_1	-	20GB	In-use	-	Attached to hdpvc1-hdpworker-003 on /dev/vdb	nova	False	否	Edit Volume
<input type="checkbox"/>	volume_hdpvc1-hdpworker-002_1	-	20GB	In-use	-	Attached to hdpvc1-hdpworker-002 on /dev/vdb	nova	False	否	Edit Volume
<input type="checkbox"/>	volume_hdpvc1-hdpworker-001_1	-	20GB	In-use	-	Attached to hdpvc1-hdpworker-001 on /dev/vdb	nova	False	否	Edit Volume
<input type="checkbox"/>	volume_hdpvc1-hdpworker-005_1	-	20GB	In-use	-	Attached to hdpvc1-hdpworker-005 on /dev/vdb	nova	False	否	Edit Volume
<input type="checkbox"/>	volume_hdpvc1-hdpworker-004_1	-	20GB	In-use	-	Attached to hdpvc1-hdpworker-004 on /dev/vdb	nova	False	否	Edit Volume

Displaying 5 items

Figure 15 Volume List

The data stored in block storage will not be removed even instance has been deleted. And it can be re-use in another instance.

User also can use volume as main disk for instance if user want a large space in root disk. **But data will be removed when instance has been deleted by user.**

## Network

**Network service** allow users who like to have their own virtual LANs to manage the network.

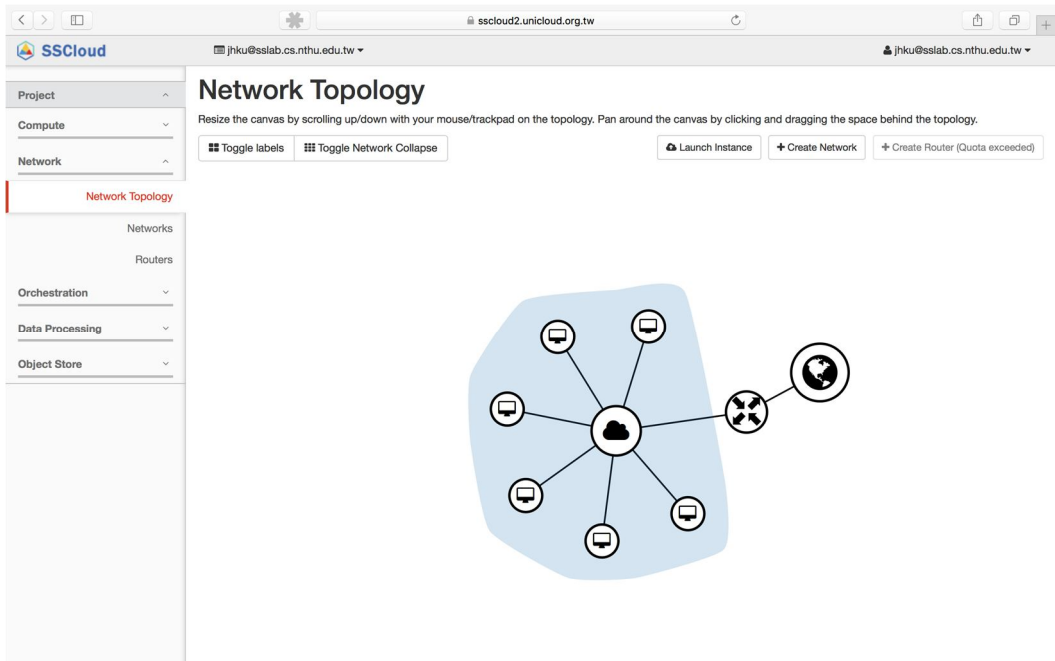


Figure 16 Network Topology

There has firewall function provide by **Security Groups** which can protect instance, Users can limit the access of instance by manage the rule of security groups.

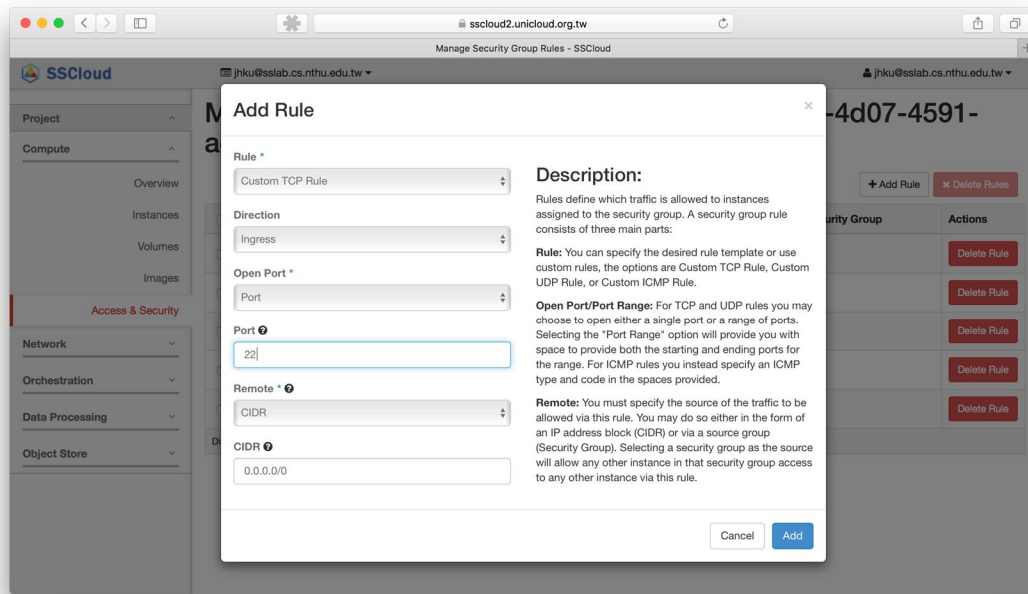


Figure 17 Add Rule for Security Group

## Orchestration

**Orchestration service** is a human- and machine-accessible service for managing the entire lifecycle of infrastructure and applications.

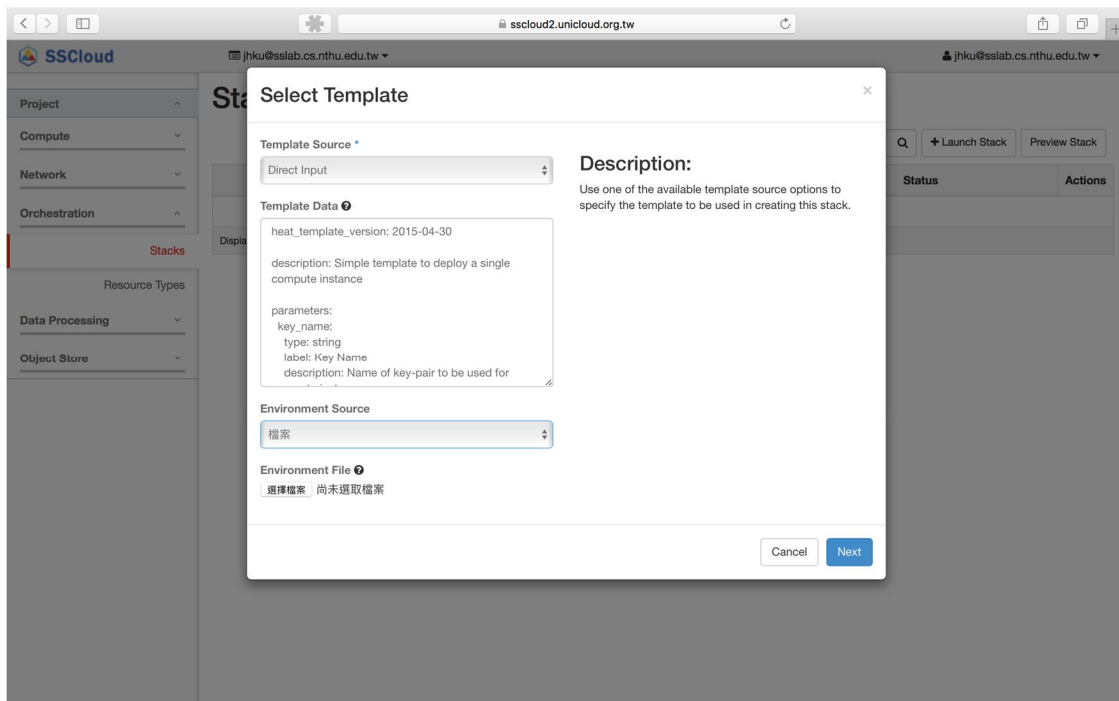


Figure 18 Resource types of Orchestration

## Data Processing

**Data Processing Service** provide a simple means to provision a data-intensive application cluster (Hadoop or Spark).

SSCloud provide four different types cluster:

Title(Plugin name)	Supported Versions	Description
<b>Vanilla Apache Hadoop</b>	<ul style="list-style-type: none"> <li>● 2.6.0</li> <li>● 2.7.1</li> </ul>	The Apache Vanilla plugin provides the ability to launch upstream Vanilla Apache Hadoop cluster without any management consoles. It can also deploy the Oozie component.
<b>Hortonworks Data Platform</b>	<ul style="list-style-type: none"> <li>● 2.0.6</li> </ul>	The Hortonworks Sahara plugin automates the deployment of the Hortonworks Data Platform (HDP) on OpenStack.
<b>Apache Spark</b>	<ul style="list-style-type: none"> <li>● 1.0.1</li> <li>● 1.3.0</li> </ul>	This plugin provides an ability to launch Spark on Hadoop CDH cluster without any management consoles.
<b>Cloudera Plugin</b>	<ul style="list-style-type: none"> <li>● 5</li> <li>● 5.3.0</li> <li>● 5.4.0</li> </ul>	The Cloudera Sahara plugin provides the ability to launch the Cloudera distribution of Apache Hadoop (CDH) with Cloudera Manager management console.

Table 1 SSCloud support Sahara plugin

User can define the template of master node or work node.

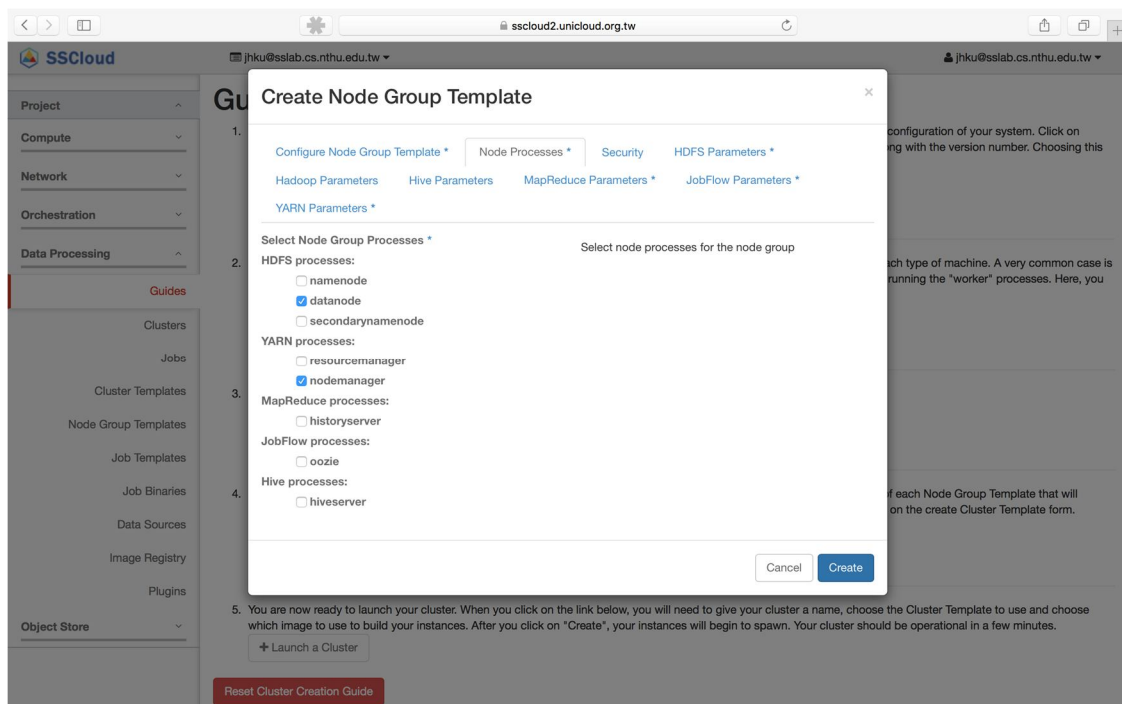


Figure 19 Sahara Node Template

And group those node templates become a cluster template.

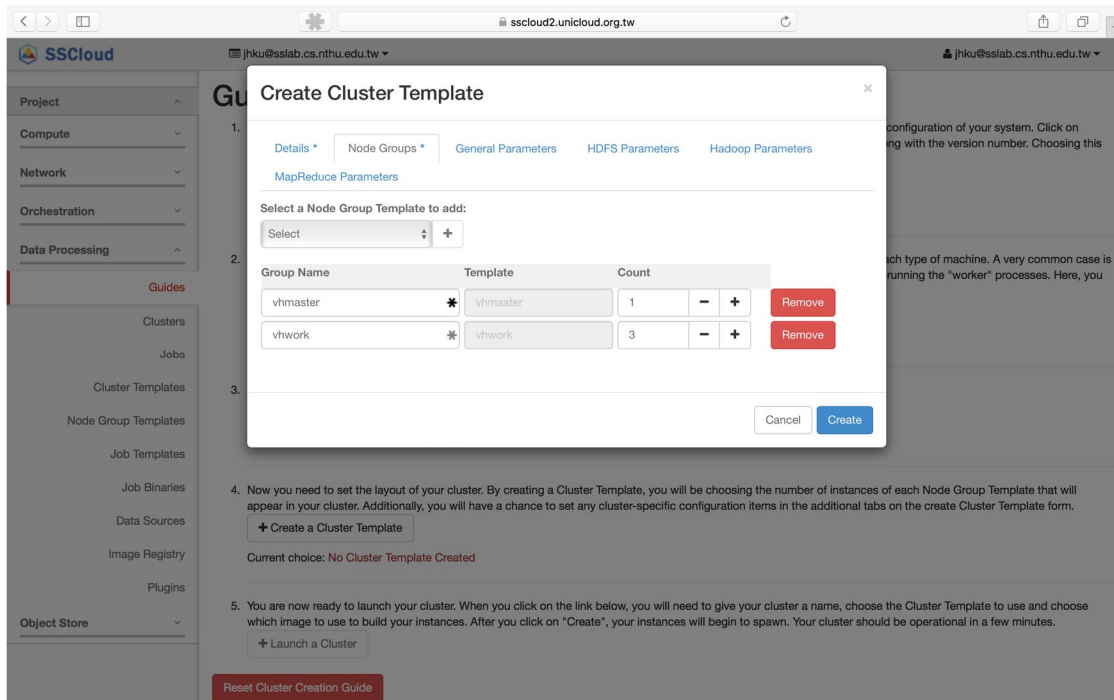


Figure 20 Sahara Cluster Template

There has a guide program provide user can easily create cluster following step by step.

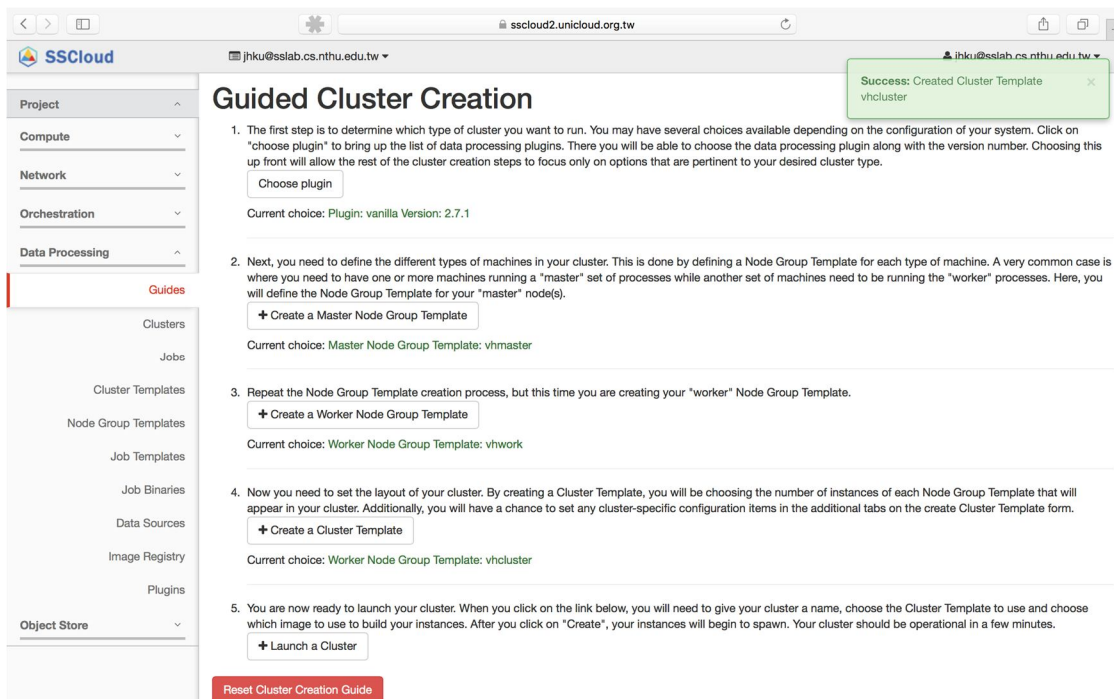
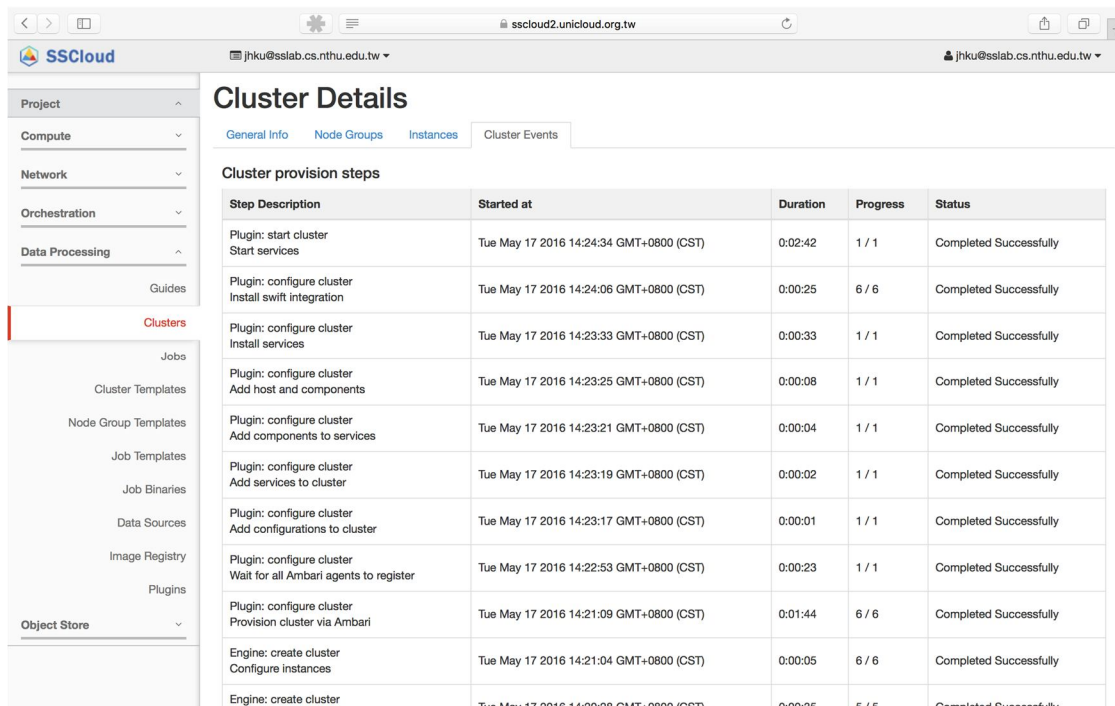


Figure 21 Sahara Guides

While building cluster, user can view the event of cluster



Step Description	Started at	Duration	Progress	Status
Plugin: start cluster Start services	Tue May 17 2016 14:24:34 GMT+0800 (CST)	0:02:42	1 / 1	Completed Successfully
Plugin: configure cluster Install swift integration	Tue May 17 2016 14:24:06 GMT+0800 (CST)	0:00:25	6 / 6	Completed Successfully
Plugin: configure cluster Install services	Tue May 17 2016 14:23:33 GMT+0800 (CST)	0:00:33	1 / 1	Completed Successfully
Plugin: configure cluster Add host and components	Tue May 17 2016 14:23:25 GMT+0800 (CST)	0:00:08	1 / 1	Completed Successfully
Plugin: configure cluster Add components to services	Tue May 17 2016 14:23:21 GMT+0800 (CST)	0:00:04	1 / 1	Completed Successfully
Plugin: configure cluster Add services to cluster	Tue May 17 2016 14:23:19 GMT+0800 (CST)	0:00:02	1 / 1	Completed Successfully
Plugin: configure cluster Add configurations to cluster	Tue May 17 2016 14:23:17 GMT+0800 (CST)	0:00:01	1 / 1	Completed Successfully
Plugin: configure cluster Wait for all Ambari agents to register	Tue May 17 2016 14:22:53 GMT+0800 (CST)	0:00:23	1 / 1	Completed Successfully
Plugin: configure cluster Provision cluster via Ambari	Tue May 17 2016 14:21:09 GMT+0800 (CST)	0:01:44	6 / 6	Completed Successfully
Engine: create cluster Configure instances	Tue May 17 2016 14:21:04 GMT+0800 (CST)	0:00:05	6 / 6	Completed Successfully
Engine: create cluster	Tue May 17 2016 14:20:28 GMT+0800 (CST)	0:00:35	6 / 6	Completed Successfully

Figure 22 Sahara Cluster Event

User also can use data processing service with job-oriented.

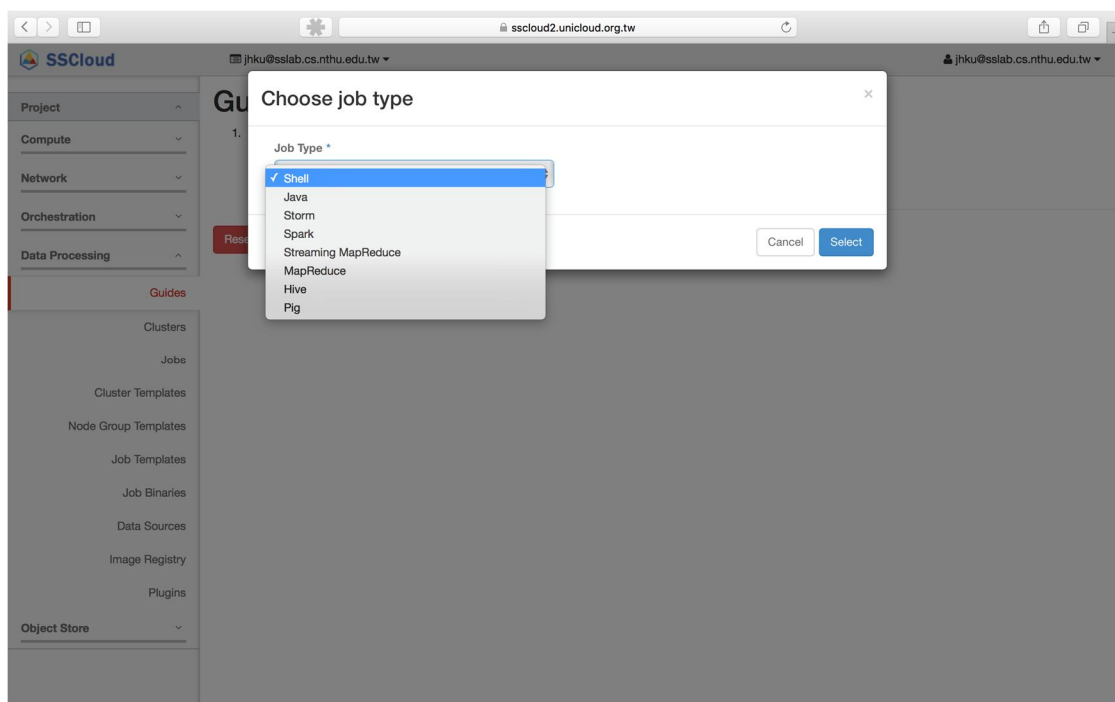


Figure 23 Sahara Job Template

## Object Storage

**Object Storage Service** offer cloud storage for user to store and retrieve lots of data with a simple API.

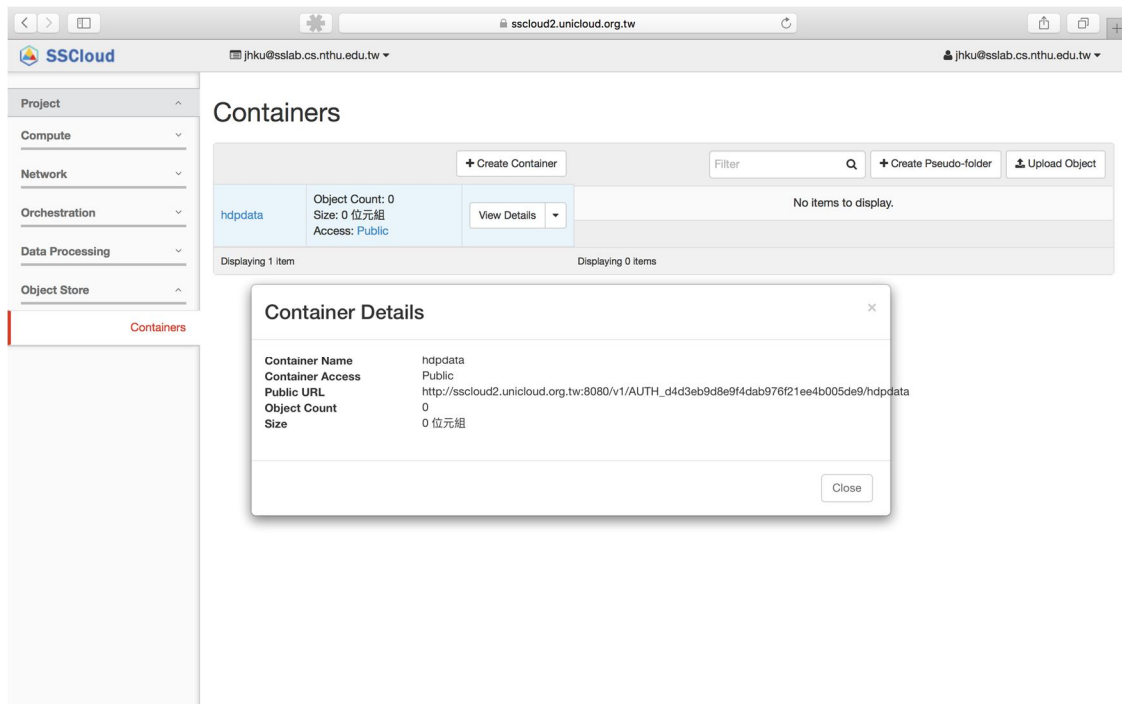


Figure 24 Swift Container

This service is also can provide data source for cluster in Data Processing Service.

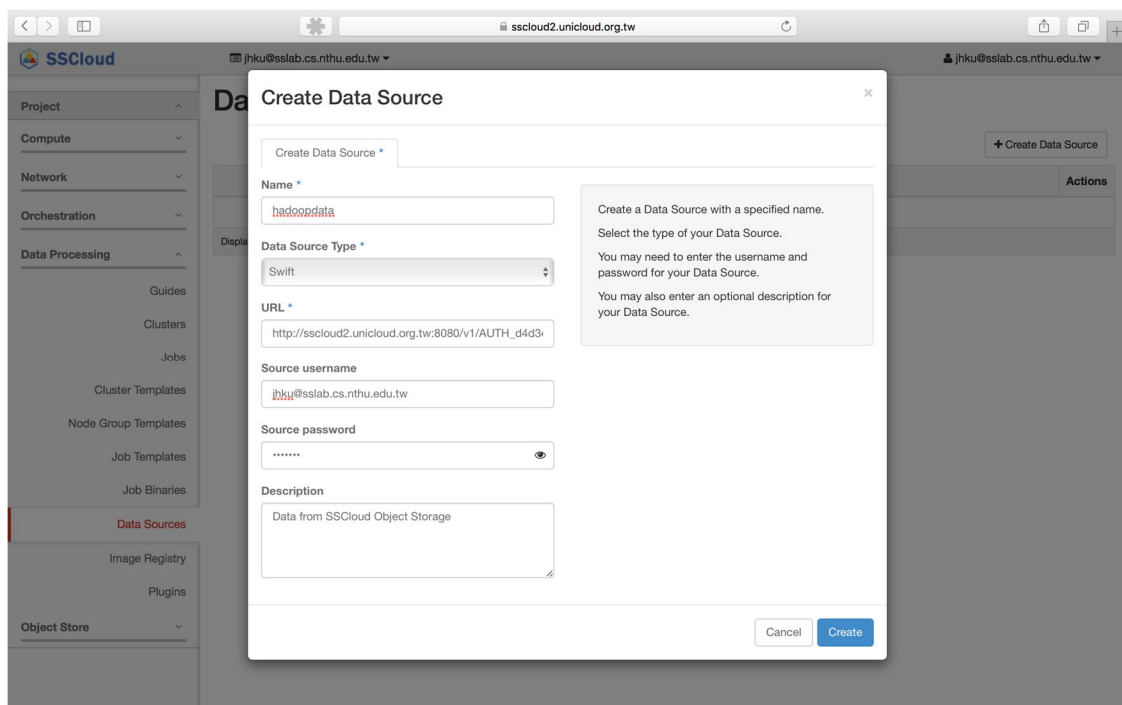


Figure 25 Sahara Data Source

# Performance

## Network performance

- Benchmark software: **Iperf** (version 2.0.5)
- Transfer size: 10 GBytes

Senario	Time	Bandwidth
VM to VM	70.13 sec	1.23 Gbits/sec
VM to Internet	15.6 min	92.92 Mbits/sec
Internet to VM	16.8 min	85.3 Mbits/sec

Table 2 Network Benchmark

There has network bandwidth limited by NTHU Computer and Communication Center, current limit is 100Mbits/sec.

## Storage performance

Test target:

- Ephemeral storage (CephFS)
- Block storage (Ceph RBD)

### Method 1

- Benchmark software: **Linux DD command**
- Test size: **10 GB** (*parameters: bs=4k, count=2560000, EXT4*)

Item	Ephemeral storage	Block storage
Time	70.7 sec	172.8 sec
Bandwidth	148 MB/s	60.9 MB/s

Table 3 Storage Bechmark (1)

### Method 2

- Benchmark software: **FIO** (test IOPS)
- Read/Write block size: 128k

Item	Ephemeral storage	Block storage
Read (IOPS)	5857	1510
Write (IOPS)	2962	364

Table 4 Storage Benchmark (2)



## Resources and Quota

### Hardware Resources

There is 16 nodes provide SSCloud service, the hardware resource of each node:

Item	Resource
<b>CPU</b>	Intel(R) Xeon(R) CPU X5670 2.93GHz * 24 cores
<b>Memory</b>	96GB
<b>Network</b>	GB Ethernet * 1, Infiniband *1

Table 5 Hardware Resource

The storage of SSCloud is SSD-HDD hybrid, provide by Ceph Storage System.

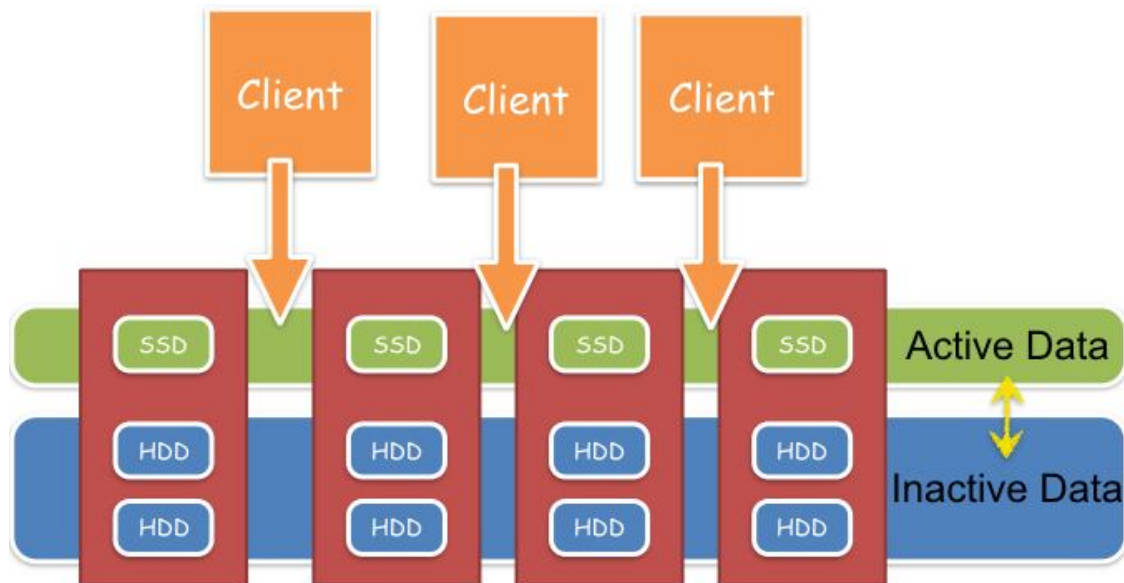


Figure 26 SSCloud Hybrid Storage

### User Quota

Item	Education User	Enterprise User
<b>CPU cores</b>	20	120
<b>Memory</b>	10 GB	240 GB
<b>Instances</b>	10	No limited
<b>Data storage</b>	1 TB	5TB
<b>Public IP</b>	0	1

Table 6 User Quota

## How to access SSCloud

There three ways to access SSCloud:

1. Web dashboard (<https://sscloud2.unicloud.org.tw>)
2. REST APIs
3. OpenStack client program ([https://wiki.openstack.org/wiki/OpenStackClients#OpenStack\\_Clients](https://wiki.openstack.org/wiki/OpenStackClients#OpenStack_Clients))

Web dashboard is recommended for normal user. But user also can access REST APIs or using OpenStack client program for programming or command line job.