



LAB 4

Infrastructure-as-a-Service with DevStack (OpenStack)

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- Note: screenshots need to be clear and good-looking; submissions must be in PDF format.

1. OpenStack overview

- Please take a visit to the OpenStack [home page](#)
- OpenStack installation on Ubuntu [guide](#)
- DevStack installation [guide](#)

2. Setup DevStack on VirtualBox

Deploying OpenStack could be challenging for beginners. DevStack is a set of scripts and utilities to quickly bring up a complete OpenStack environment based on the latest versions of everything from git master. It is used interactively as a development environment and as the basis for much of the OpenStack project's functional testing.

The source of DevStack is available at <https://opendev.org/openstack/devstack>.

2.1. Ubuntu installation

- Create a virtual machine using VirtualBox/VMWare.
 - Name: DevStack; Type: Linux; Version: Ubuntu 22.04 (64bit)
 - Memory: 8G; Processors: 4 CPUs (add more if possible)
 - Hard disk: 50G

Summary

The following table summarizes the configuration you have chosen for the new virtual machine. When you are happy with the configuration press Finish to create the virtual machine. Alternatively you can go back and modify the configuration.



Machine Name and OS Type

Machine Name	DevStack
Machine Folder	C:/Users/lambo/VirtualBox VMs/DevStack
ISO Image	
Guest OS Type	Oracle Linux (64-bit)



Hardware

Base Memory	9216
Processor(s)	5
EFI Enable	false



Disk

Disk Size	60.00 GB
Pre-allocate Full Size	false

VM's information

- Network: create 2 adapters for the VM
 - Both are attached to a bridged adapter;
 - Advanced → Promiscuous mod: Allow All

The screenshot shows the 'Network' settings for 'Adapter 1'. The 'Enable Network Adapter' checkbox is checked. The 'Attached to' dropdown is set to 'Bridged Adapter'. The 'Name' dropdown is set to 'Realtek PCIe GbE Family Controller'. The 'Advanced' section is expanded, showing 'Adapter Type' as 'Intel PRO/1000 MT Desktop (82540EM)', 'Promiscuous Mode' as 'Allow All', and 'MAC Address' as '08002733E115'. The 'Cable Connected' checkbox is also checked.

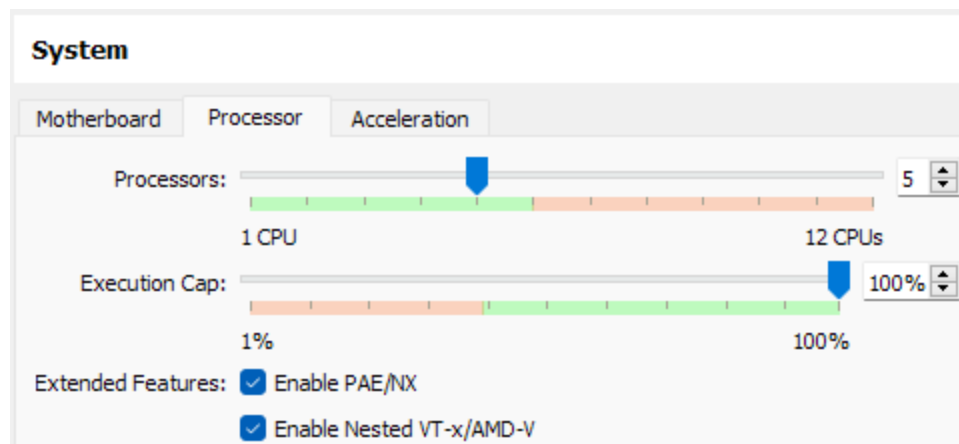
Network 1st adapter

The screenshot shows the 'Network' settings for 'Adapter 2'. The 'Enable Network Adapter' checkbox is checked. The 'Attached to' dropdown is set to 'Bridged Adapter'. The 'Name' dropdown is set to 'Realtek PCIe GbE Family Controller'. The 'Advanced' section is expanded, showing 'Adapter Type' as 'Intel PRO/1000 MT Desktop (82540EM)', 'Promiscuous Mode' as 'Allow All', and 'MAC Address' as '0800273A63AC'. The 'Cable Connected' checkbox is also checked.

Network 2nd adapter

- Enable PAE/NX and Enable Nested VT-x/AMD-v (Setting/System/Processor). If the option is grey out, entering the following command

```
$ VBoxManage modifyvm "vm name" --nested-hw-virt on
```



Enable PAE/NX and Enable Nested VT-x/AMD-v

- Install [Ubuntu server 22.04 LTS](https://ubuntu.com/server/docs/ubuntu-server-22-04-lts) as the OS of the VM. (take a screenshot after finishing the installation)

```
DevStack [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
* Management: https://landscape.canonical.com
* Support: https://ubuntu.com/pro

System information as of Wed Mar 20 07:09:07 AM UTC 2024

System load: 0.23291015625
Usage of /: 24.3% of 28.37GB
Memory usage: 2%
Swap usage: 0%
Processes: 143
Users logged in: 0
IPv4 address for enp0s3: 192.168.1.105
IPv6 address for enp0s3: 2402:800:6390:b03f:a00:27ff:fec6:b563
IPv4 address for enp0s8: 192.168.1.106
IPv6 address for enp0s8: 2402:800:6390:b03f:a00:27ff:fe19:9f88

Expanded Security Maintenance for Applications is not enabled.

11 updates can be applied immediately.
To see these additional updates run: apt list --upgradable
```

Finish installing the Ubuntu server 22.04 LTS

- SSH to the VM and update it OS:
\$ sudo apt update && sudo apt upgrade -y

```
2. 192.168.1.105
Memory usage:          2%
Swap usage:            0%
Processes:             143
Users logged in:       0
IPv4 address for enp0s3: 192.168.1.105
IPv6 address for enp0s3: 2402:800:6390:b03f:a00:27ff:fec6:b563
IPv4 address for enp0s8: 192.168.1.106
IPv6 address for enp0s8: 2402:800:6390:b03f:a00:27ff:fe19:9f88

Expanded Security Maintenance for Applications is not enabled.

11 updates can be applied immediately.
To see these additional updates run: apt list --upgradable

Enable ESM Apps to receive additional future security updates.
See https://ubuntu.com/esm or run: sudo pro status

Last login: Wed Mar 20 07:09:08 2024
/usr/bin/xauth:  file /home/b2111933/.Xauthority does not exist
To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

b2111933@b2111933:~$
```

SSH to the VM

```
2. 192.168.1.105
b2111933@b2111933:~$ sudo apt update && sudo apt upgrade -y
[sudo] password for b2111933:
Hit:1 http://vn.archive.ubuntu.com/ubuntu jammy InRelease
Hit:2 http://vn.archive.ubuntu.com/ubuntu jammy-updates InRelease
Hit:3 http://vn.archive.ubuntu.com/ubuntu jammy-backports InRelease
Hit:4 http://security.ubuntu.com/ubuntu jammy-security InRelease
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
10 packages can be upgraded. Run 'apt list --upgradable' to see them.
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
Calculating upgrade... Done
The following NEW packages will be installed:
  ubuntu-pro-client
The following packages will be upgraded:
  cloud-init dpkg libgpgme11 libldap-2.5-0 libldap-common python3-updat
  ubuntu-advantage-tools ubuntu-pro-client-l10n update-manager-core
10 upgraded, 1 newly installed, 0 to remove and 0 not upgraded.
Need to get 2,905 kB of archives.
After this operation, 98.3 kB of additional disk space will be used.
```

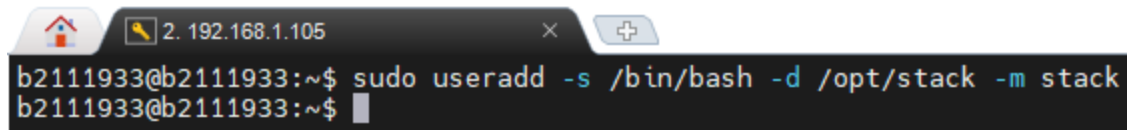
Update the OS

2.2. DevStack installation

2.2.1. Add Stack User

- DevStack should be run as a non-root user with sudo enabled. We should create a separate stack user to run DevStack with

```
$ sudo useradd -s /bin/bash -d /opt/stack -m stack
```

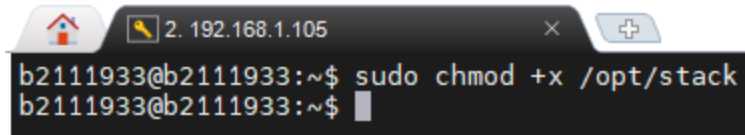


A terminal window with a dark background and light text. The title bar shows a home icon, a signal strength icon, the IP address 2.192.168.1.105, and window control buttons. The terminal shows the command `sudo useradd -s /bin/bash -d /opt/stack -m stack` being executed. The prompt is `b2111933@b2111933:~$`.

Add Stack User

- Ensure the home directory for the stack user has executable permission for all

```
$ sudo chmod +x /opt/stack
```



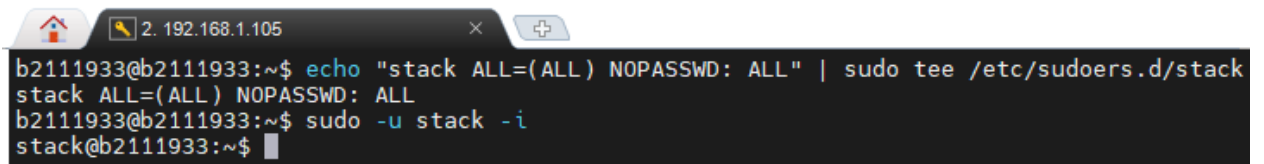
A terminal window with a dark background and light text. The title bar shows a home icon, a signal strength icon, the IP address 2.192.168.1.105, and window control buttons. The terminal shows the command `sudo chmod +x /opt/stack` being executed. The prompt is `b2111933@b2111933:~$`.

Now the stack user has executable permission for all

- Since this user will be making many changes to your system, it should have sudo privileges:

```
$ echo "stack ALL=(ALL) NOPASSWD: ALL" | sudo tee /etc/sudoers.d/stack
```

```
$ sudo -u stack -i
```



A terminal window with a dark background and light text. The title bar shows a home icon, a signal strength icon, the IP address 2.192.168.1.105, and window control buttons. The terminal shows two commands: `echo "stack ALL=(ALL) NOPASSWD: ALL" | sudo tee /etc/sudoers.d/stack` and `sudo -u stack -i`. The prompt changes from `b2111933@b2111933:~$` to `stack@b2111933:~$`.

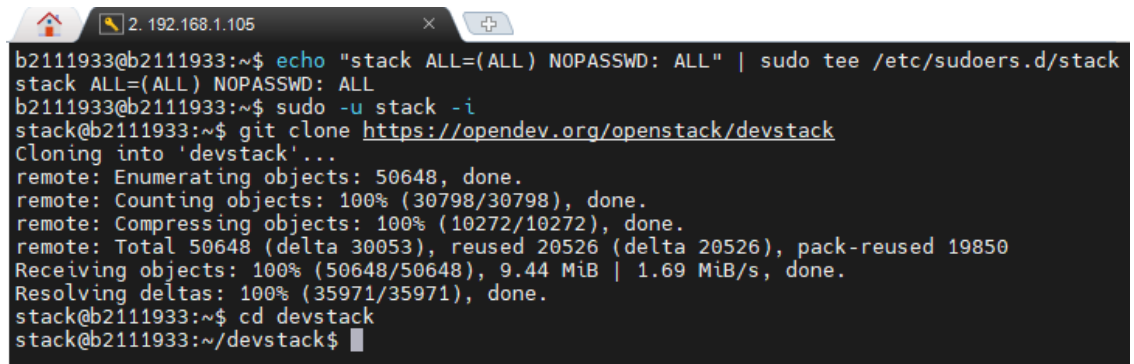
Now the stack user has the sudo privileges

2.2.2. Download DevStack

- The DevStack repo contains a script that installs OpenStack and templates for configuration files.

```
$ git clone https://opendev.org/openstack/devstack
```

```
$ cd devstack
```



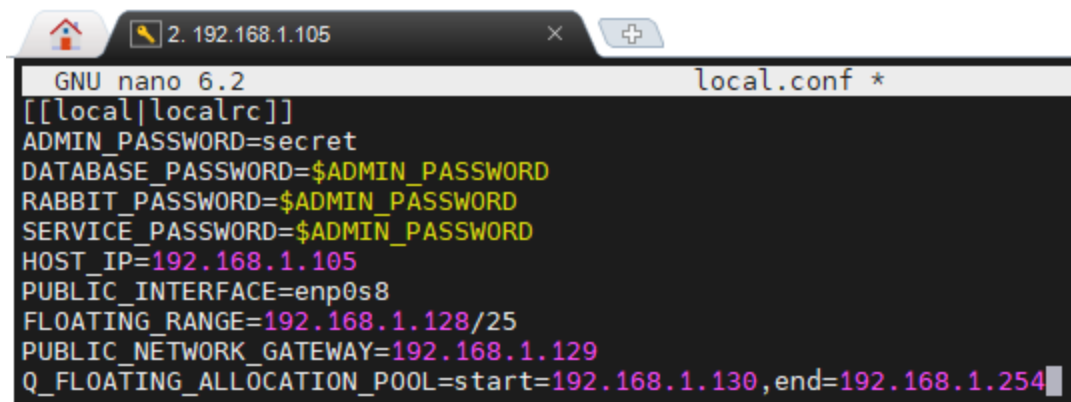
```
b2111933@b2111933:~$ echo "stack ALL=(ALL) NOPASSWD: ALL" | sudo tee /etc/sudoers.d/stack
stack ALL=(ALL) NOPASSWD: ALL
b2111933@b2111933:~$ sudo -u stack -i
stack@b2111933:~$ git clone https://opendev.org/openstack/devstack
Cloning into 'devstack'...
remote: Enumerating objects: 50648, done.
remote: Counting objects: 100% (30798/30798), done.
remote: Compressing objects: 100% (10272/10272), done.
remote: Total 50648 (delta 30053), reused 20526 (delta 20526), pack-reused 19850
Receiving objects: 100% (50648/50648), 9.44 MiB | 1.69 MiB/s, done.
Resolving deltas: 100% (35971/35971), done.
stack@b2111933:~$ cd devstack
stack@b2111933:~/devstack$
```

Clone the DevStack repository

2.2.3. Create a local.conf

- Create a local.conf file with four passwords preset at the root of the DevStack git repo.

```
$ nano local.conf
[[local|localrc]]
ADMIN_PASSWORD=secret
DATABASE_PASSWORD=$ADMIN_PASSWORD
RABBIT_PASSWORD=$ADMIN_PASSWORD
SERVICE_PASSWORD=$ADMIN_PASSWORD
HOST_IP=<DevStack IP>
PUBLIC_INTERFACE=enp0s8
FLOATING_RANGE=<Network Address>
PUBLIC_NETWORK_GATEWAY=<Gateway Address>
Q_FLOATING_ALLOCATION_POOL=start=<Start of floating
IP>,end=<End of floating IP>
```



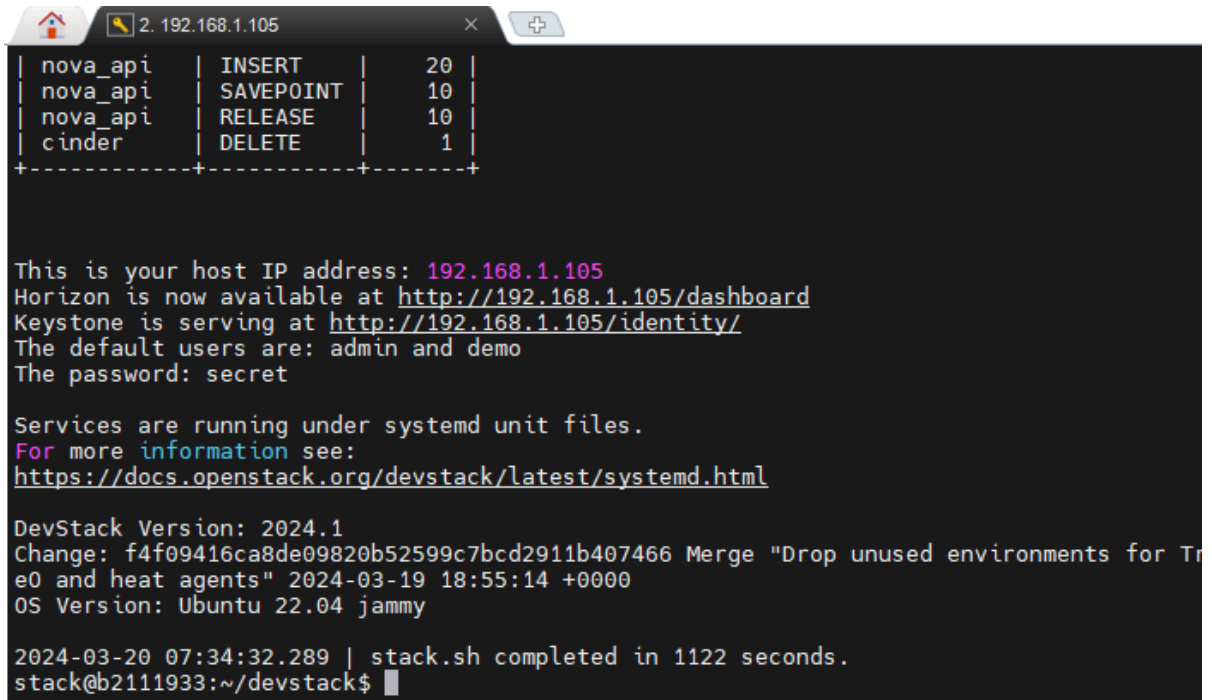
```
GNU nano 6.2 local.conf *
[[local|localrc]]
ADMIN_PASSWORD=secret
DATABASE_PASSWORD=$ADMIN_PASSWORD
RABBIT_PASSWORD=$ADMIN_PASSWORD
SERVICE_PASSWORD=$ADMIN_PASSWORD
HOST_IP=192.168.1.105
PUBLIC_INTERFACE=enp0s8
FLOATING_RANGE=192.168.1.128/25
PUBLIC_NETWORK_GATEWAY=192.168.1.129
Q_FLOATING_ALLOCATION_POOL=start=192.168.1.130,end=192.168.1.254
```

Create a local.conf file

2.2.4. Start the install

```
$ ./stack.sh
```

- This will take 15 - 30 minutes, depending on your internet connection speed. Many git trees and packages will be installed during this process. DevStack will have installed Keystone, Glance, Nova, Placement, Cinder, Neutron, and Horizon



```
| nova_api | INSERT | 20 |
| nova_api | SAVEPOINT | 10 |
| nova_api | RELEASE | 10 |
| cinder | DELETE | 1 |
+-----+-----+-----+

This is your host IP address: 192.168.1.105
Horizon is now available at http://192.168.1.105/dashboard
Keystone is serving at http://192.168.1.105/identity/
The default users are: admin and demo
The password: secret

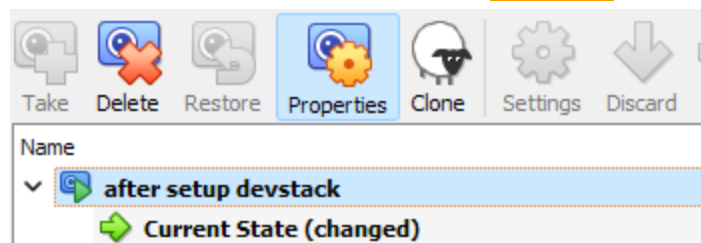
Services are running under systemd unit files.
For more information see:
https://docs.openstack.org/devstack/latest/systemd.html

DevStack Version: 2024.1
Change: f4f09416ca8de09820b52599c7bcd2911b407466 Merge "Drop unused environments for Tr
e0 and heat agents" 2024-03-19 18:55:14 +0000
OS Version: Ubuntu 22.04 jammy

2024-03-20 07:34:32.289 | stack.sh completed in 1122 seconds.
stack@b2111933:~/devstack$
```

Install complete

- Take a snapshot of the Devstack VM **right after** the installation finishes.



Take a snapshot

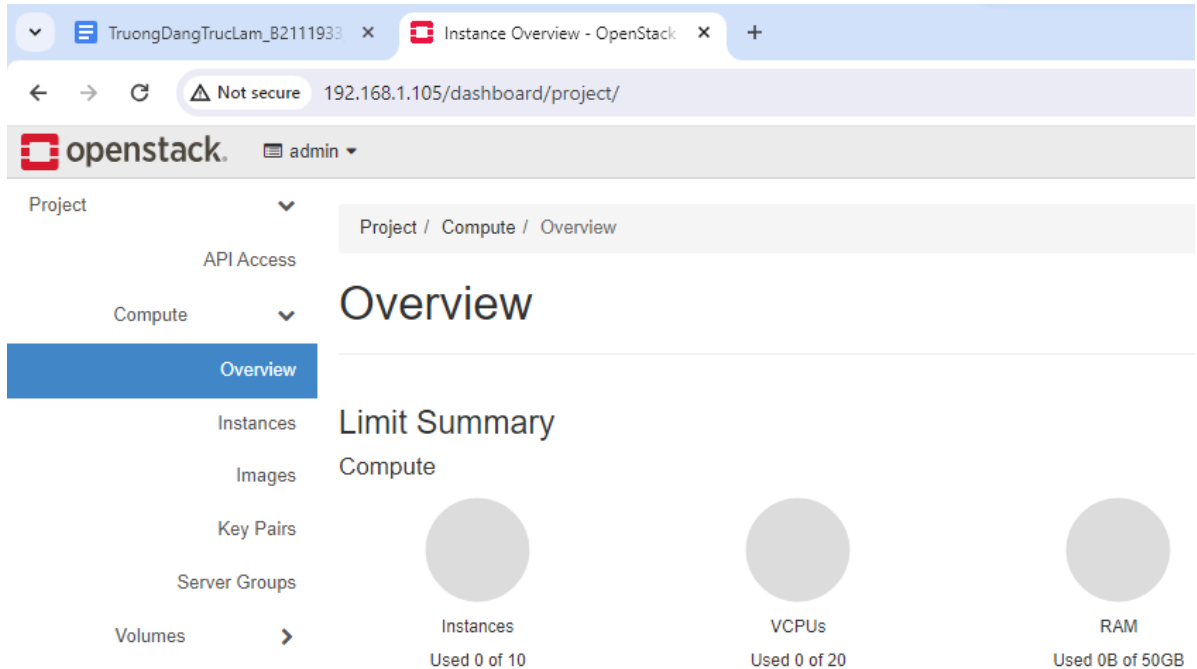
- You can access Horizon to experience the web interface to OpenStack and manage VMs, networks, volumes, and images from http://YOUR_VM_IP.

3. Using OpenStack services via Horizon

- Horizon provides a dashboard for using OpenStack. On your computer, use this URL to access the GUI:

http://YOUR_VM_IP

- Log on to OpenStack using the credential “admin/secret”
(take a screenshot)



Using OpenStack services via Horizon

3.1. Creating Projects and Users

Using Horizon dashboard to create:

- Create a project:
 - Name: <CloudComputing_Your student ID>

A screenshot of the 'Create Project' form in the OpenStack Horizon dashboard. The form has a title bar with 'Create Project' and a close button. Below the title bar are three tabs: 'Project Information *', 'Project Members', and 'Project Groups'. The 'Project Information *' tab is active and contains three input fields: 'Domain ID' with the value 'default', 'Domain Name' with the value 'Default', and 'Name *' with the value 'CloudComputing_B2111933'.

Create a project

Identity / [Projects](#) / CloudComputing_B2111933

CloudComputing_B2111933

Overview

[Users](#)

[Groups](#)

Name	CloudComputing_B2111933
ID	ae0b8fadca55432abfca6851ac558200
Domain Name	Default
Domain ID	default
Enabled	Yes
Description	-

Project information

- Create a user:
 - User Name: <Your student ID>
 - Password: <Your password>
 - Primary Project: <CloudComputing_Your student ID>
 - Role: admin

Create User

Domain ID

default

Domain Name

Default

User Name *


B2111933

Description:

Create a new user and :
Primary Project and Rol

Filling user information

Confirm Password ^{*}

..... 

Primary Project

CloudComputing_B2111933 ▼ +

Role

admin ▼

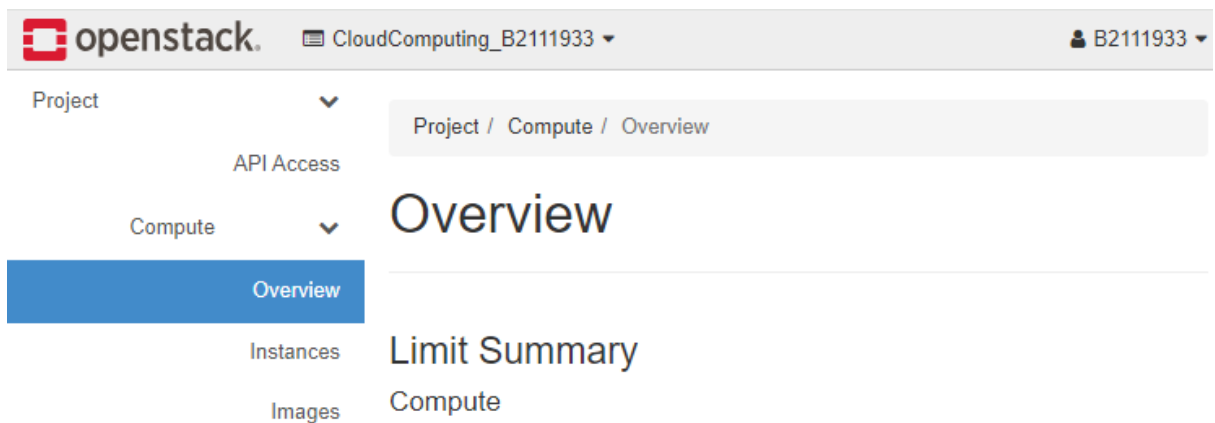
☒ Enabled

☐ Lock password

Cancel Create User

Create user B2111933 as the admin of project CCloudComputing_B2111933

- Log out from OpenStack then log on again with the user <Your student ID> (take a screenshot)



Login again user B2111933

3.2. Creating Images

- Download the [Cirros image](#), then create an image
 - Image Name: Cirros
 - Format: QCOW2

Image Details

Specify an image to upload to the Image Service.

Image Name

Cirros

Image Description

Image Source

File*

Choose File

cirros-0.6.2-x86_64-disk.img

Format*

QCOW2 - QEMU Emulator

Create an image with Cirros

- Download the [Ubuntu 22.04 cloud image](#), then create the second image
 - Image Name: Ubuntu 22.04
 - Format: QCOW2

Images

Click here for filters or full text search.

✕

+ Create Image

Delete Images

Displaying 3 items

<input type="checkbox"/>	Owner	Name ^	Type	Status	Visibility	Protected	Disk Format	Size	
<input type="checkbox"/>	> CloudComputing_B2111933	Cirros	Image	Active	Shared	No	QCOW2	20.44 MB	Launch ▾
<input type="checkbox"/>	> admin	cirros-0.6.2-x86_64-disk	Image	Active	Public	No	QCOW2	20.44 MB	Launch ▾
<input type="checkbox"/>	> CloudComputing_B2111933	Ubuntu 22.04	Image	Active	Shared	No	QCOW2	618.00 MB	Launch ▾

Displaying 3 items

The images

3.3. Create Networks, Routers, Security Groups, and Floating IP allocation

- Create a Network:
 - Network Name: "VM_Network"
 - Subnet Name: "VM_Network_Subnet"

- Network Address: 10.0.1.0/24
- Gateway IP: 10.0.1.1
- Enable DHCP
- Allocation Pools: 10.0.1.100,10.0.1.254
- DNS Name Servers: 8.8.8.8

NetworkSubnetSubnet Details

Network Name

VM_Network

☒ Enable Admin State ?

☐ Shared

☒ Create Subnet

Subnet Name

VM_Network_Subnet

Network Address Source

Enter Network Address manually

Network Address ?

10.0.1.0/24

IP Version

IPv4

Gateway IP ?

10.0.1.1

Create a new network with the network wizard.

Create a new network to enter your network gateway address "Subnet"

Network information

☒ **Enable DHCP**

Specify :

Allocation Pools ?

10.0.1.100,10.0.1.254

DNS Name Servers ?

8.8.8.8

Network information

- Create a router to connect VM_Network to Public_Network
 - Router Name: VM_Network_Router
 - External Network: public
 - On the router, choose the “Add interface” function to connect “VM_Network” to the router

Create Router

Router Name

VM_Network_Router

☒ **Enable Admin State** ?

External Network

public

☒ **Enable SNAT**

Description

Creates a route

Enable SNAT \
network is set.

Create router

Add Interface

Subnet *

VM_Network: 10.0.1.0/24 (VM_Network_Subn... ▼

IP Address (optional) ?

Desc

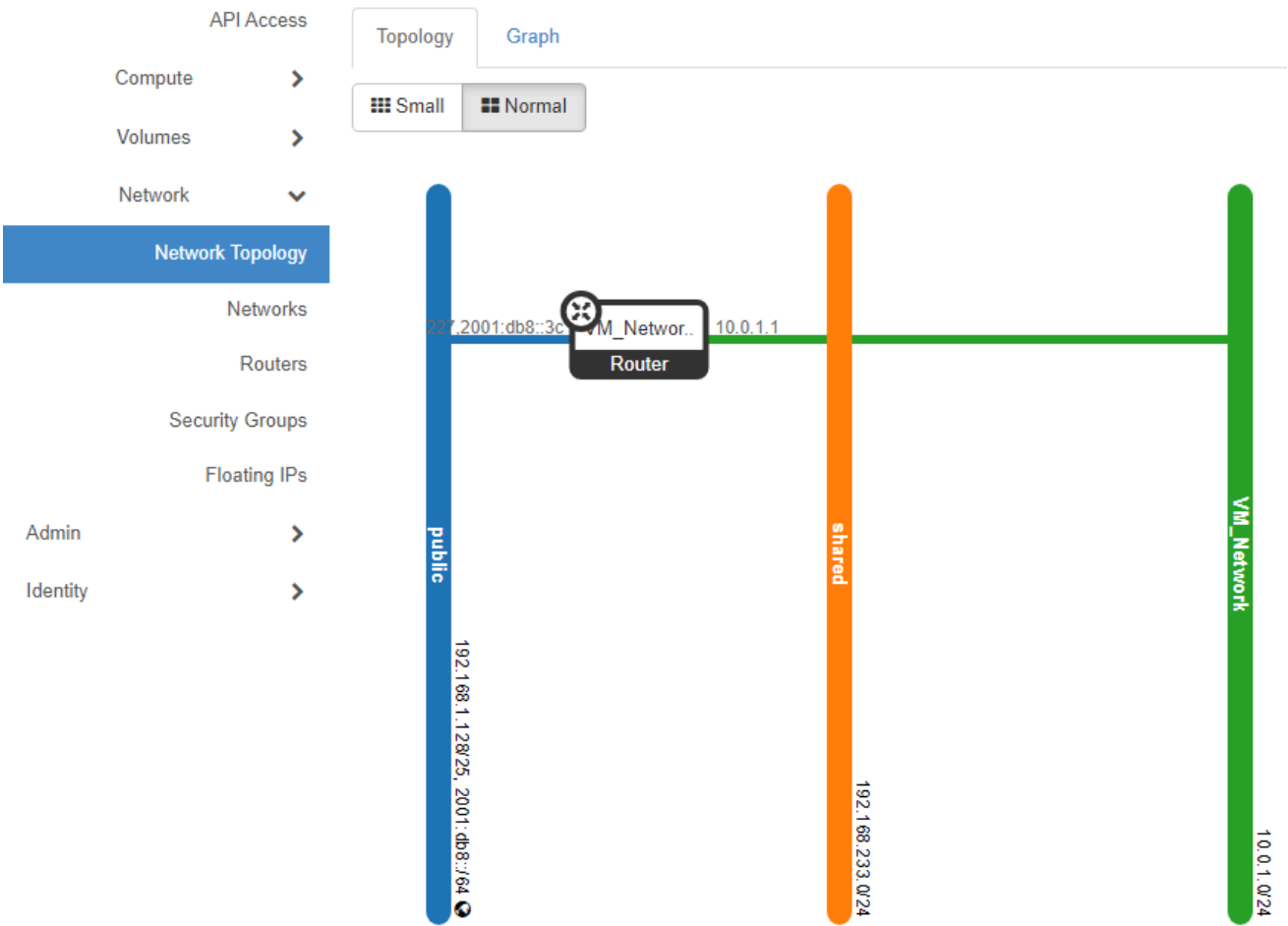
You can i

If you do

IP addre

Add Interface

(take a screenshot of network topology)



The network topology

- Create a security group
 - Name: VM_Security_Group
 - Add Ingress Rule that allows: ICMP, SSH, HTTP, HTTPS

Manage Security Group Rules: VM_Security_Group (e8089207-f705-4c23-afbc-0ecd51c7fab8)

Displaying 6 items

<input type="checkbox"/>	Direction	Ether Type	IP Protocol	Port Range	Remote IP Prefix	Remote Security Group
<input type="checkbox"/>	Egress	IPv4	Any	Any	0.0.0.0/0	-
<input type="checkbox"/>	Egress	IPv6	Any	Any	::/0	-
<input type="checkbox"/>	Ingress	IPv4	ICMP	Any	0.0.0.0/0	-
<input type="checkbox"/>	Ingress	IPv4	TCP	22 (SSH)	0.0.0.0/0	-
<input type="checkbox"/>	Ingress	IPv4	TCP	80 (HTTP)	0.0.0.0/0	-
<input type="checkbox"/>	Ingress	IPv4	TCP	443 (HTTPS)	0.0.0.0/0	-

Displaying 6 items

Create a security group with Ingress Rules that allow: ICMP, SSH, HTTP, HTTPS

- Allocate 3 Floating IPs for the project <CloudComputing_Your student ID>

Floating IP Address = ▼

Filter

Allocate IP To Project

Release Floating IPs

Displaying 3 items

<input type="checkbox"/>	IP Address	Description	DNS Name	DNS Domain	Mapped Fixed IP Address	Pool	Status	Actions
<input type="checkbox"/>	192.168.1.228				-	public	Down	Associate ▼
<input type="checkbox"/>	192.168.1.155				-	public	Down	Associate ▼
<input type="checkbox"/>	192.168.1.180				-	public	Down	Associate ▼

Displaying 3 items

Allocate 3 Floating IPs for the project <CloudComputing_Your student ID>

3.4. Create instances (VMs):

3.4.1. Cirros VM

- Instance name: <Your student ID>_Cirros
- Source: CirrOS; Select boot source: image; Create new Volume: No
- Flavor: m1.tiny
- Security group: VM_Security_Group
- Networks: VM_Network
- Access the VM using the web console. Then log in to the VM using "cirros/gocubsgo" credentials, and execute the "sudo ping google.com -c 3 ; uname -a" command.

(take a screenshot)

Project / Compute / [Instances](#) / B2111933_Cirros

B2111933_Cirros

[Overview](#) [Interfaces](#) [Log](#) [Console](#) [Action Log](#)

Instance Console

If console is not responding to keyboard input: click the grey status bar below. [Click here to show only console](#)
To exit the fullscreen mode, click the browser's back button.

```
Connected to QEMU (instance-00000001)
$ sudo ping -c 3 google.com
PING 142.251.220.110 (142.251.220.110) 56(84) bytes of data.
64 bytes from hkg07s52-in-f14.1e100.net (142.251.220.110): icmp_seq=1 ttl=113 time=33.0 ms
64 bytes from hkg07s52-in-f14.1e100.net (142.251.220.110): icmp_seq=2 ttl=113 time=32.5 ms
64 bytes from hkg07s52-in-f14.1e100.net (142.251.220.110): icmp_seq=3 ttl=113 time=32.5 ms
--- 142.251.220.110 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2006ms
rtt min/avg/max/mdev = 32.452/32.628/32.961/0.235 ms
$ uname -a
Linux b2111933-cirros 5.15.0-71-generic #78-Ubuntu SMP Tue Apr 18 09:00:29 UTC 2023 x86_64 GNU/Linux
$
```

The Cirros VM

3.4.2. Ubuntu VM

- Instance name: <Your student ID>_Ubuntu
- Source: Ubuntu 22.04; Select boot source: image; Create new Volume: No
- Flavor: ds1G
- Security group: VM_Security_Group
- Networks: VM_Network
- Key pair: Create a new key pair,
 - Key Pair Name: <Your student ID>_Ubuntu_Key

- Key Type: SSH Key
- Copy the private key to the file <Your student ID>_Ubuntu_Key.pem

A key pair allows you to SSH into your newly created instance. You may select an existing key pair, import a key pair, or generate a new key pair.

+ Create Key Pair

Import Key Pair

Allocated

Displaying 1 item

Name	Type	
> B2111933_Ubuntu_Key	ssh	↓

Displaying 1 item

▼ Available 0

Select one



Click here for filters or full text search.



Create Key Pair

- Configuration/Customization Script:

```
#cloud-config
password: mypasswd
chpasswd: { expire: False }
ssh_pwauth: True
```

You can customize your instance after it has launched using the options available here, analogous to "User Data" in other systems.

Load Customization Script from a file

Choose File

No file chosen

Customization Script (Modified)

```
#cloud-config
password: mypasswd
chpasswd: { expire: False }
ssh_pwauth: True
```

Configuration/Customization Script

- Launch your VM, then assign it a floating IP.

Manage Floating IP Associations ✕

IP Address *

192.168.1.228



Select the IP address you wish to associate with the selected instance or port.

Port to be associated *

B2111933_Ubuntu: 10.0.1.224



Cancel

Associate

Assign to Ubuntu VM a floating IP

- SSH to your VM using an SSH client (MobaXterm)
 - Remote host: VM floating IP
 - Username: ubuntu
 - Using the <Your student ID>_Ubuntu_Key.pem file as private key file

```
6. 192.168.1.228 (ubuntu)
Usage of /: 14.7% of 9.51GB    Users logged in: 0
Memory usage: 10%           IPv4 address for ens3: 10.0.1.220
Swap usage: 0%

Expanded Security Maintenance for Applications is not enabled.
0 updates can be applied immediately.

Enable ESM Apps to receive additional future security updates.
See https://ubuntu.com/esm or run: sudo pro status

The programs included with the Ubuntu system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

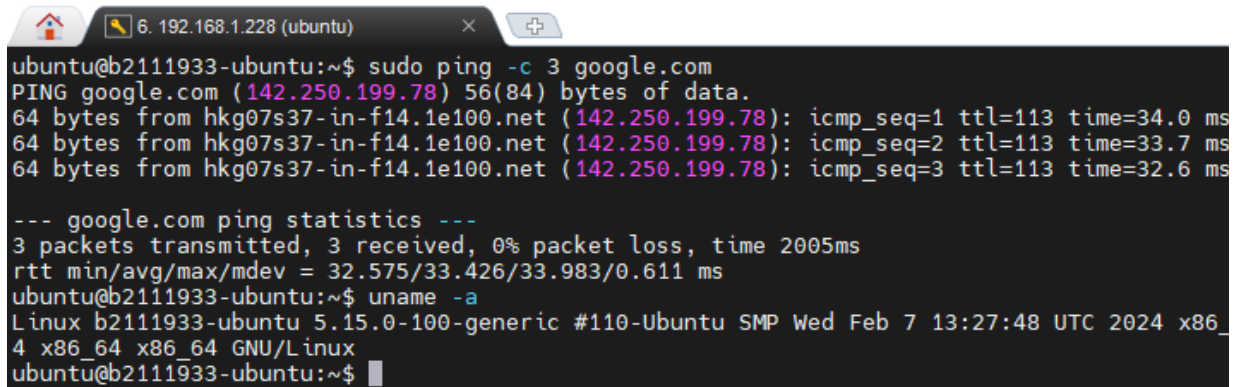
Ubuntu comes with ABSOLUTELY NO WARRANTY, to the extent permitted by
applicable law.

/usr/bin/xauth: file /home/ubuntu/.Xauthority does not exist
To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

ubuntu@b2111933-ubuntu:~$
```

SSH to Ubuntu VM using MobaXterm

- Execute "sudo ping google.com -c 3 ; uname -a" command.
(take a screenshot)



```
ubuntu@b2111933-ubuntu:~$ sudo ping -c 3 google.com
PING google.com (142.250.199.78) 56(84) bytes of data:
64 bytes from hkg07s37-in-f14.1e100.net (142.250.199.78): icmp_seq=1 ttl=113 time=34.0 ms
64 bytes from hkg07s37-in-f14.1e100.net (142.250.199.78): icmp_seq=2 ttl=113 time=33.7 ms
64 bytes from hkg07s37-in-f14.1e100.net (142.250.199.78): icmp_seq=3 ttl=113 time=32.6 ms

--- google.com ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2005ms
rtt min/avg/max/mdev = 32.575/33.426/33.983/0.611 ms
ubuntu@b2111933-ubuntu:~$ uname -a
Linux b2111933-ubuntu 5.15.0-100-generic #110-Ubuntu SMP Wed Feb 7 13:27:48 UTC 2024 x86_
4 x86_64 x86_64 GNU/Linux
ubuntu@b2111933-ubuntu:~$
```

Test connectivity

- Execute "sudo ping <Cirros VM IP>" command.
(take a screenshot)

B2111933_Cirros

Create Snapshot

Overview

Interfaces

Log

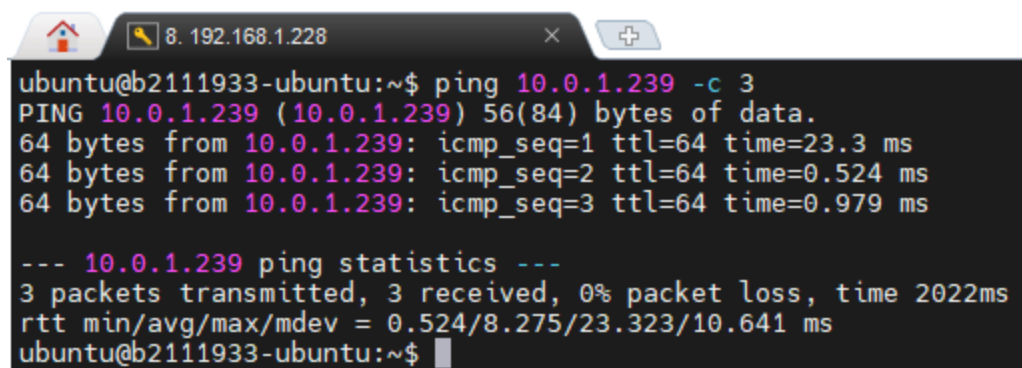
Console

Action Log

Displaying 1 item

Name	Network	Fixed IPs	MAC Address	Status	Admin State	Actions
(f9f8c15a-4212)	VM_Network	10.0.1.239	fa:16:3e:4e:d8:32	Active	UP	Edit Security Groups

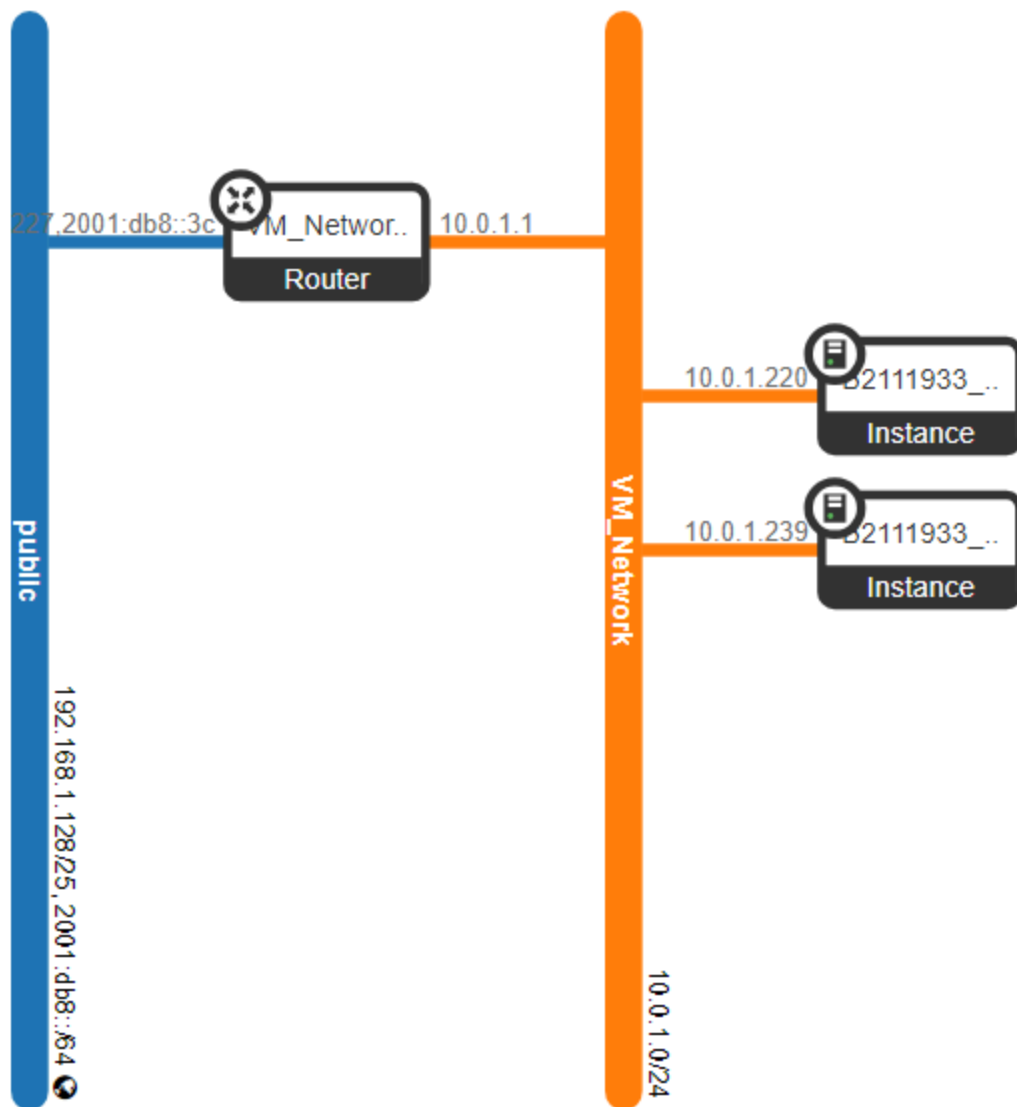
This is Network Interfaces of Cirros, including IP address **10.0.1.239**



```
ubuntu@b2111933-ubuntu:~$ ping 10.0.1.239 -c 3
PING 10.0.1.239 (10.0.1.239) 56(84) bytes of data:
64 bytes from 10.0.1.239: icmp_seq=1 ttl=64 time=23.3 ms
64 bytes from 10.0.1.239: icmp_seq=2 ttl=64 time=0.524 ms
64 bytes from 10.0.1.239: icmp_seq=3 ttl=64 time=0.979 ms

--- 10.0.1.239 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2022ms
rtt min/avg/max/mdev = 0.524/8.275/23.323/10.641 ms
ubuntu@b2111933-ubuntu:~$
```

Test connectivity with the **Cirros VM**



Check the result (deleted the **shared** subnet)

4. Using OpenStack services via CLI and API

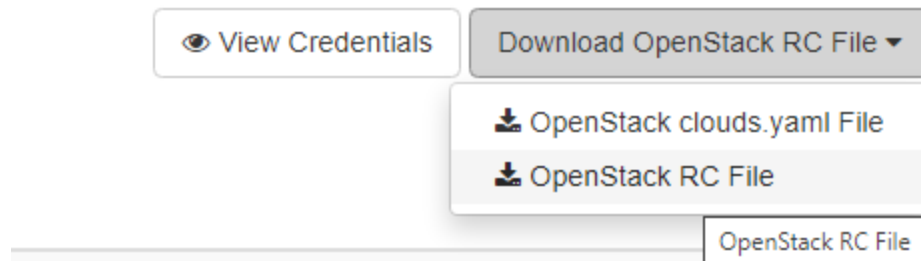
- SSH to the DevStack VM
- Install the OpenStack client

```
$ pip install python-openstackclient
```

```
7. 192.168.1.105
b2111933@b2111933:~$ pip install python-openstackclient
Defaulting to user installation because normal site-packages is not writeable
Collecting python-openstackclient
  Downloading python_openstackclient-6.6.0-py3-none-any.whl (1.1 MB)
    1.1/1.1 MB 4.8 MB/s eta 0s
Collecting iso8601>=0.1.11
  Downloading iso8601-2.1.0-py3-none-any.whl (7.5 kB)
```

Install the OpenStack client

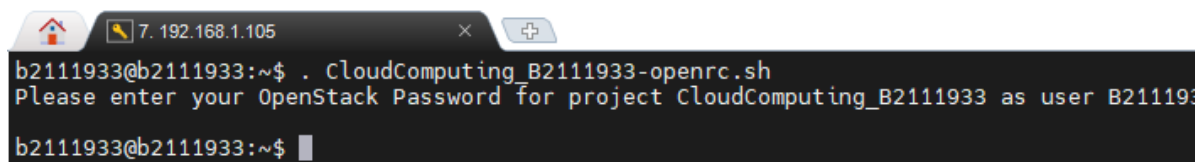
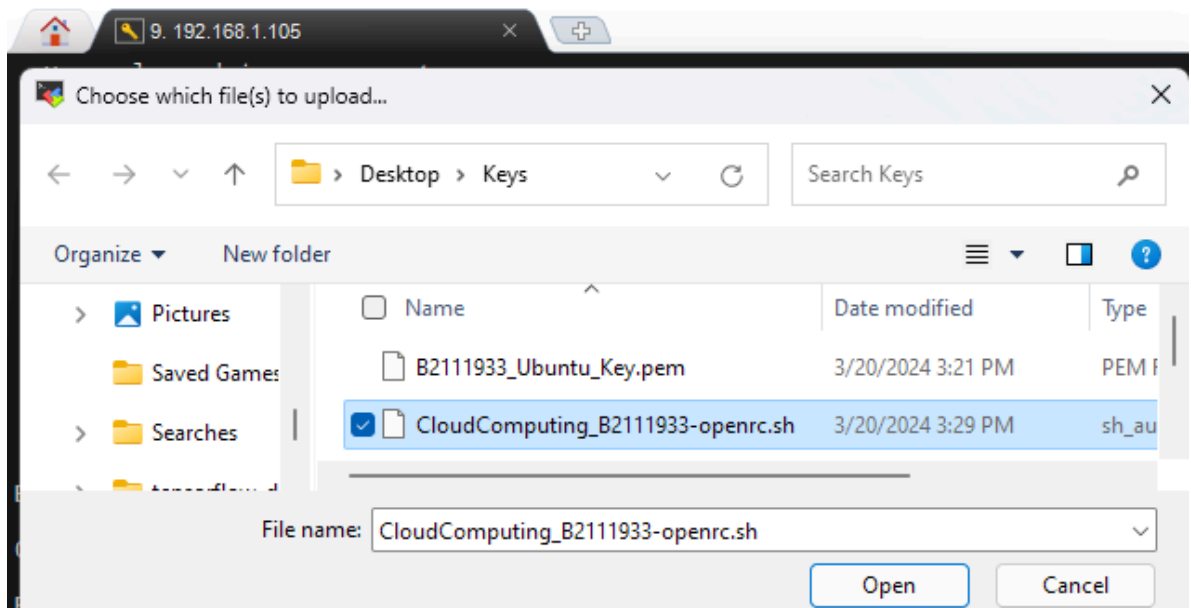
- On Horizon dashboard -> API Access -> Download OpenStack RC File, download OpenStack RC file (CloudComputing_<Your student ID>-openrc.sh)



Download OpenStack RC File

- Copy the file to the computer from which you want to run OpenStack commands, then source the file

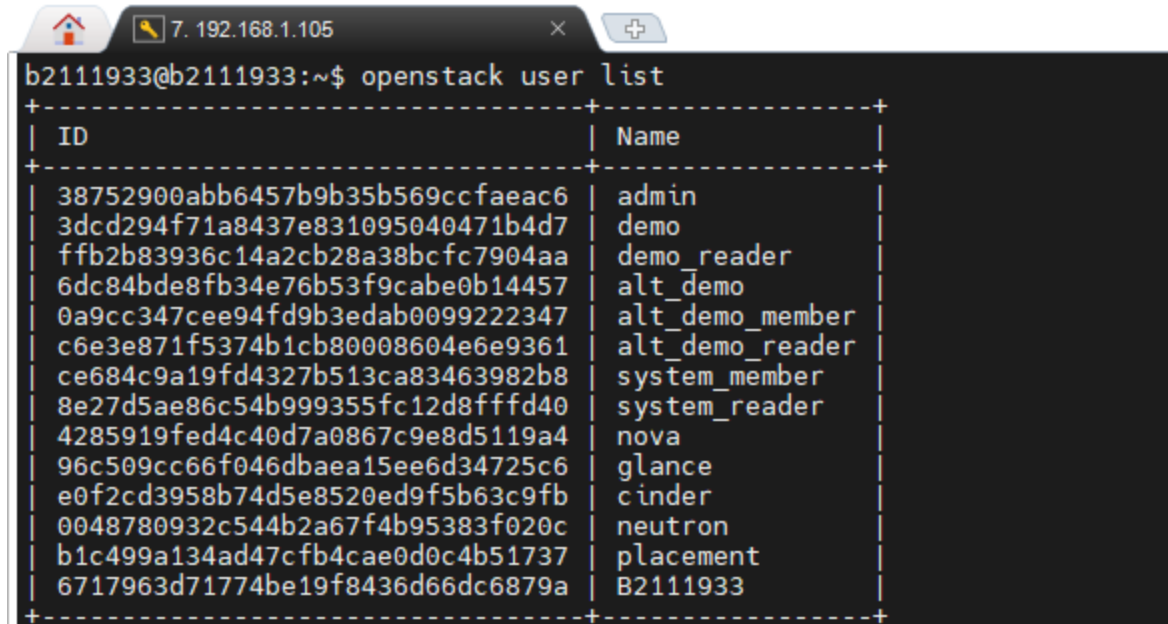
```
$ . CloudComputing_<Your student ID>-openrc.sh
```



Copy the file from physical machine, then source the file

- Now we can use [CLIs](#) to manage OpenStack. For example, list all users:

```
$ openstack user list
```



```
b2111933@b2111933:~$ openstack user list
```

ID	Name
38752900abb6457b9b35b569ccfaeac6	admin
3dcd294f71a8437e831095040471b4d7	demo
ffb2b83936c14a2cb28a38bcfc7904aa	demo_reader
6dc84bde8fb34e76b53f9cabe0b14457	alt_demo
0a9cc347cee94fd9b3edab0099222347	alt_demo_member
c6e3e871f5374b1cb80008604e6e9361	alt_demo_reader
ce684c9a19fd4327b513ca83463982b8	system_member
8e27d5ae86c54b999355fc12d8fffd40	system_reader
4285919fed4c40d7a0867c9e8d5119a4	nova
96c509cc66f046dbaea15ee6d34725c6	glance
e0f2cd3958b74d5e8520ed9f5b63c9fb	cinder
0048780932c544b2a67f4b95383f020c	neutron
b1c499a134ad47cfb4cae0d0c4b51737	placement
6717963d71774be19f8436d66dc6879a	B2111933

List all users on the server

- We can also manage OpenStack by using its [REST API](#).

---END---