



**OpenStack Labs**

## **Lab 04: Deploying an External Instance**

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## Introduction

In this lab, you will manage external networks, floating IP addresses, implement security, and launch an external instance.

## Objectives

- Manage external networks.
- Manage OpenStack routers.
- Manage floating IP addresses.
- Manage SSH key pairs and security groups.
- Launch and verify an external instance.

## Lab Settings

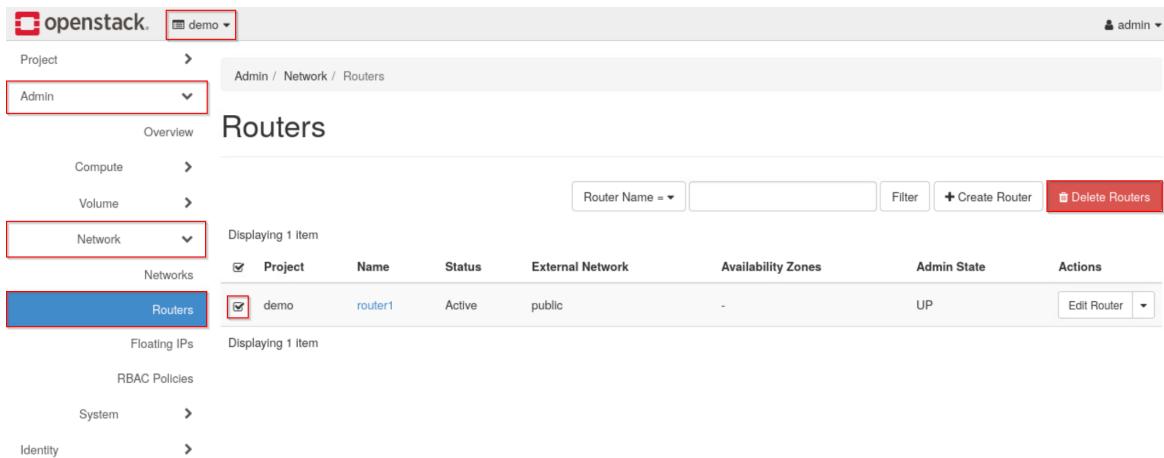
The information in the table below will be needed in order to complete the lab. The task sections below provide details on the use of this information.

Virtual Machine	IP Address	Account	Password
workstation	ens3: 192.168.1.20 ens4: 172.25.250.20	ubuntu	ubuntu
devstack	ens3: 192.168.1.21 ens4: 172.25.250.21	ubuntu	ubuntu

# 1 Managing External Networks

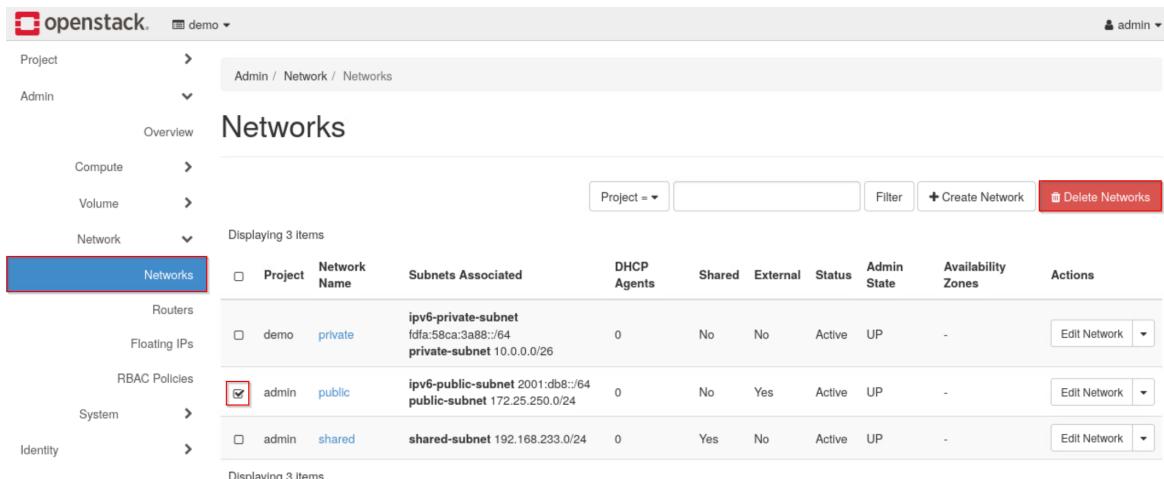
In this task, you will use the *Horizon Dashboard* and the **OpenStack Unified CLI** to create and configure an external network.

1. Open the web browser. Navigate to **192.168.1.20** and log in to the dashboard as **admin** with the password **secret**.
2. Switch to the **demo** project. Navigate to **Admin > Network > Routers**. Check the box in the same row as **router1**, then click **Delete Routers**.



Project	Name	Status	External Network	Availability Zones	Admin State	Actions
demo	router1	Active	public	-	UP	<a href="#">Edit Router</a>

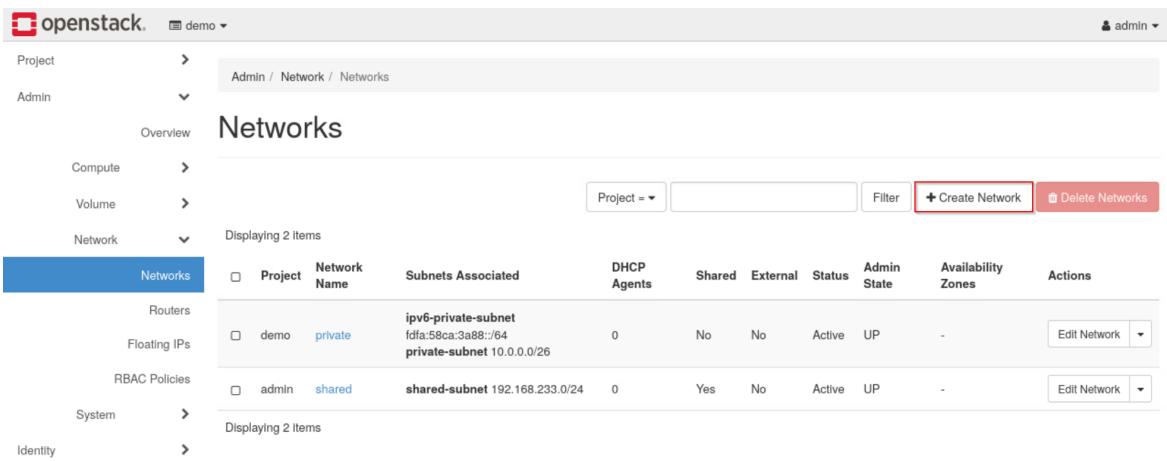
3. Now, navigate to **Networks**. Check the box in the same row as **public**, then click **Delete Networks**.



Project	Network Name	Subnets Associated	DHCP Agents	Shared	External	Status	Admin State	Availability Zones	Actions
demo	private	ipv6-private-subnet fd1a:58ca:3a88::/64 private-subnet 10.0.0.0/26	0	No	No	Active	UP	-	<a href="#">Edit Network</a>
admin	public	ipv6-public-subnet 2001:db8::/64 public-subnet 172.25.250.0/24	0	No	Yes	Active	UP	-	<a href="#">Edit Network</a>
admin	shared	shared-subnet 192.168.233.0/24	0	Yes	No	Active	UP	-	<a href="#">Edit Network</a>

4. Click **Create Network**.

## Lab 04: Deploying an External Instance



The screenshot shows the OpenStack Admin interface under the 'Network' tab. The left sidebar has sections for Project, Compute, Volume, Network, RBAC Policies, System, and Identity. The Network section is expanded, showing 'Overview', 'Routers', 'Floating IPs', and 'Displaying 2 Items'. The main content area is titled 'Networks' and displays a table with two rows. The columns are: Networks (checkbox), Project (dropdown), Network Name, Subnets Associated, DHCP Agents, Shared, External, Status, Admin State, Availability Zones, and Actions (Edit Network). The first row is for a 'private' network associated with project 'demo', and the second row is for a 'shared' network associated with project 'admin'.

Networks	Project	Network Name	Subnets Associated	DHCP Agents	Shared	External	Status	Admin State	Availability Zones	Actions
	demo	private	ipv6-private-subnet fdca:58ca:3a88::/64 private-subnet 10.0.0.0/26	0	No	No	Active	UP	-	<button>Edit Network</button>
	admin	shared	shared-subnet 192.168.233.0/24	0	Yes	No	Active	UP	-	<button>Edit Network</button>

- Enter **net1** in the *Network Name* field. Select **demo** in the *Project* dropdown. For *Provider Network Type*, select **Flat**. Enter **public** into the *Physical Network* field. Check the *Shared* and *External Network* check boxes, and ensure the *Create Subnet* check box is checked. Click **Next** to go to the *Subnet* tab.

Create Network X

Network \*

Subnet

Subnet Details

Name

net1

Create a new network. In addition, a subnet associated with the network can be created in the following steps of this wizard.

Project \*

demo

Provider Network Type \* ⓘ

Flat

Physical Network \* ⓘ

public

 Enable Admin State ⓘ Shared External Network Create Subnet

Availability Zone Hints ⓘ

MTU ⓘ

Cancel

« Back

Next »

6. In the *Subnet* tab, enter **subnet1** in the *Subnet Name* field, and enter **172.25.250.0/24** in the *Network Address* field. Click **Next** to go to the *Subnet Details* tab.

## Create Network



Network \*

Subnet

Subnet Details

**Subnet Name**

subnet1

**Network Address Source**

Enter Network Address manually

Creates a subnet associated with the network. You need to enter a valid "Network Address" and "Gateway IP". If you did not enter the "Gateway IP", the first value of a network will be assigned by default. If you do not want gateway please check the "Disable Gateway" checkbox. Advanced configuration is available by clicking on the "Subnet Details" tab.

**Network Address ?**

172.25.250.0/24

**IP Version**

IPv4

**Gateway IP ?** Disable Gateway

7. In the *Subnet Details* tab, uncheck the *Enable DHCP* check box. Enter **172.25.250.5**, **172.25.250.100** in the *Allocation Pools* field. Click **Create** to create the network and subnet.

## Create Network

Network \* Subnet Subnet Details

**Enable DHCP**

Specify additional attributes for the subnet.

**Allocation Pools** ②  
172.25.250.5,172.25.250.100

**DNS Name Servers** ②

**Host Routes** ②

Cancel « Back **Create**

8. Log out of the *Horizon Dashboard* and close the web browser.
9. Open a terminal window and source the keystone credentials for the **admin** user.

```
ubuntu@workstation:~$ source ~/keystonerc-admin
```

```
ubuntu@workstation:~$ source ~/keystonerc-admin
ubuntu@workstation:~$ 
```

10. Delete the **subnet1** subnet.

```
ubuntu@workstation:~$ openstack subnet delete subnet1
```

```
ubuntu@workstation:~$ openstack subnet delete subnet1
ubuntu@workstation:~$ 
```

11. Delete the **net1** network.

```
ubuntu@workstation:~$ openstack network delete net1
```

```
ubuntu@workstation:~$ openstack network delete net1
ubuntu@workstation:~$
```

12. Create an external network named **external**. Set the network type to **flat** and the physical network to **public**. Set the network as shared and external.

```
ubuntu@workstation:~$ openstack network create external \
> --external --share \
> --provider-network-type flat \
> --provider-physical-network public
```

```
ubuntu@workstation:~$ openstack network create external \
> --external --share \
> --provider-network-type flat \
> --provider-physical-network public
+-----+-----+
| Field | Value |
+-----+-----+
| admin_state_up | UP |
| availability_zone_hints | |
| availability_zones | |
| created_at | 2023-11-16T17:38:08Z |
| description | |
| dns_domain | None |
| id | ccf7ae57-24bd-4ef7-add5-b6ceca28f2a6 |
| ipv4_address_scope | None |
| ipv6_address_scope | None |
| is_default | False |
| is_vlan_transparent | None |
| mtu | 1500 |
| name | external |
| port_security_enabled | True |
| project_id | c524eaead1f74d4f9141f71b280e0237 |
| provider:network_type | flat |
| provider:physical_network | public |
| provider:segmentation_id | None |
| qos_policy_id | None |
| revision_number | 1 |
| router:external | External |
| segments | None |
| shared | True |
| status | ACTIVE |
| subnets | |
| tags | |
| updated_at | 2023-11-16T17:38:08Z |
+-----+-----+
ubuntu@workstation:~$
```

**Tip**

When typing the command, make sure there is a space between **external** and the **\** character, and press **Enter** to get the **>** and continue typing the rest of the command.

13. Create a subnet named **subext** in the **external** network. Give the subnet a range of **172.25.250.60** to **172.25.250.80**. Disable DHCP services for the subnet and use the address **172.25.250.254** as the gateway as well as the DNS name server.

```
ubuntu@workstation:~$ openstack subnet create \
> --subnet-range 172.25.250.0/24 \
> --no-dhcp \
> --gateway 172.25.250.254 \
> --dns-nameserver 172.25.250.254 \
> --allocation-pool start=172.25.250.60,end=172.25.250.80 \
> --network external \
> subext
```

```
ubuntu@workstation:~$ openstack subnet create \
> --subnet-range 172.25.250.0/24 \
> --no-dhcp \
> --gateway 172.25.250.254 \
> --dns-nameserver 172.25.250.254 \
> --allocation-pool start=172.25.250.60,end=172.25.250.80 \
> --network external \
> subext
+-----+-----+
| Field | Value |
+-----+-----+
| allocation_pools | 172.25.250.60-172.25.250.80 |
| cidr | 172.25.250.0/24 |
| created_at | 2023-11-20T20:29:27Z |
| description | |
| dns_nameservers | 172.25.250.254 |
| enable_dhcp | False |
| gateway_ip | 172.25.250.254 |
| host_routes | |
| id | 3bb68218-3879-4f34-8f09-1d182db8227d |
| ip_version | 4 |
| ipv6_address_mode | None |
| ipv6_ra_mode | None |
| name | subext |
| network_id | d8e6f5bd-6c4e-47ab-9cc7-1d8c88b5961d |
| project_id | c524eaead1f74d4f9141f71b280e0237 |
| revision_number | 0 |
| segment_id | None |
| service_types | |
| subnetpool_id | None |
| tags | |
| updated_at | 2023-11-20T20:29:27Z |
+-----+
ubuntu@workstation:~$ █
```

14. Leave the terminal window open and continue to the next task.

## 2 Preparing OpenStack Routers to Deploy an Instance

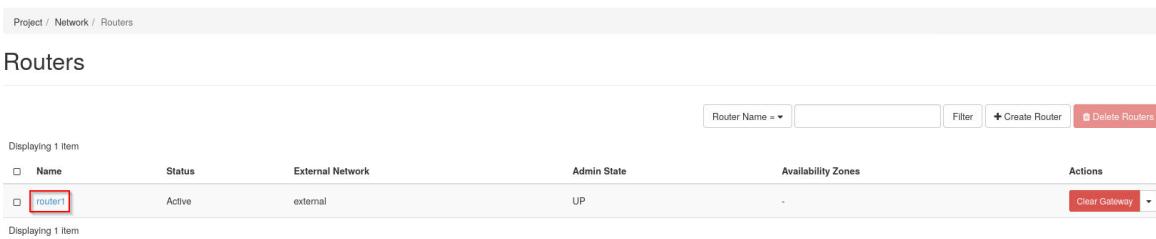
In this task, you will create and configure a router using the *Horizon Dashboard* and *OpenStack Unified CLI* and use command line tools to test the connectivity of the router.

1. Open the web browser and navigate to **192.168.1.20**. Log into the dashboard as **admin** with the password **secret**.
2. Switch to the **demo** project and navigate to **Project > Network > Routers**. Click **Create Router** to create a new router.

3. Enter **router1** in the *Router Name* field and select **external** in the *External Network* dropdown. Click **Create Router**.

Name	Description
Router Name	Creates a router with specified parameters.
Enable Admin State	<input checked="" type="checkbox"/>
External Network	Creates a router with specified parameters.
Enable SNAT	<input checked="" type="checkbox"/>
Availability Zone Hints	

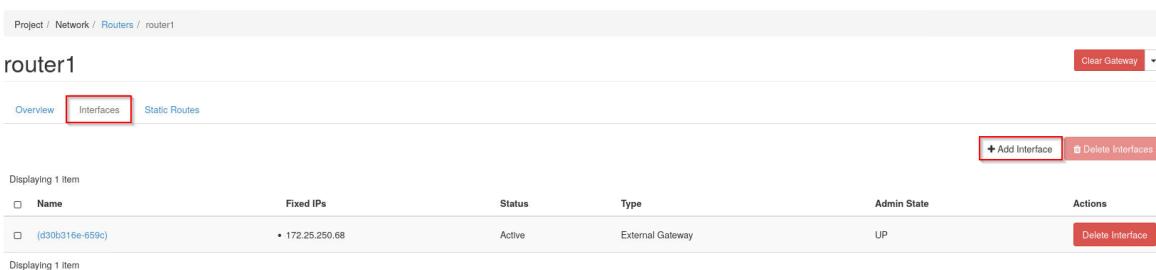
4. Click the router name, **router1**, to access its details.



The screenshot shows a table with the following columns: Name, Status, External Network, Admin State, Availability Zones, and Actions. There is one item listed:

Name	Status	External Network	Admin State	Availability Zones	Actions
router1	Active	external	UP	-	<a href="#">Clear Gateway</a>

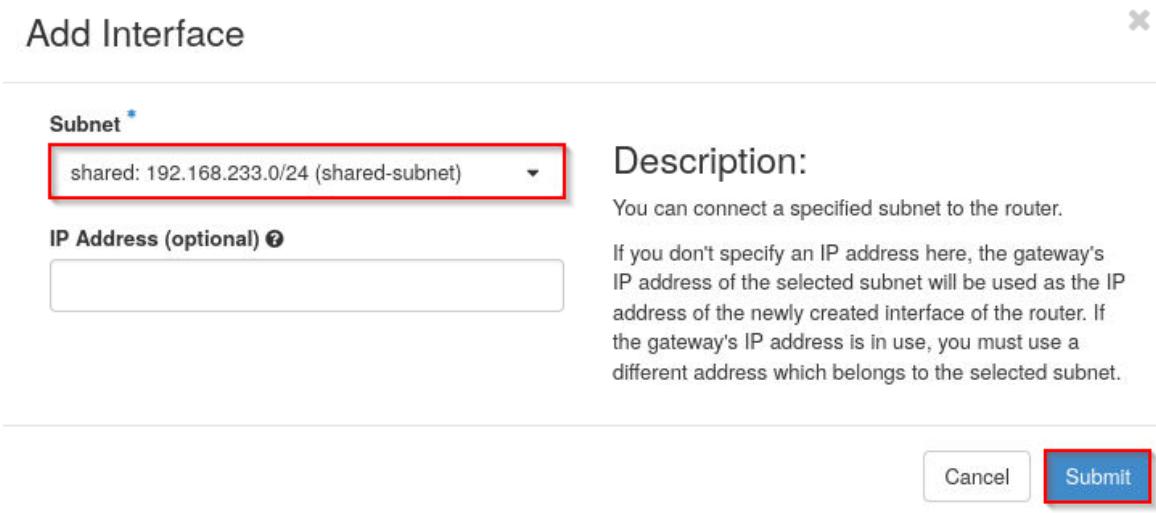
5. Click the **Interfaces** tab to manage the interfaces for the router. Click **Add Interface** to add a new interface.



The screenshot shows the 'Interfaces' tab selected. The table has the following columns: Name, Fixed IPs, Status, Type, Admin State, and Actions. One item is listed:

Name	Fixed IPs	Status	Type	Admin State	Actions
(d30b316e-659c)	172.25.250.68	Active	External Gateway	UP	<a href="#">Delete Interface</a>

6. Select **shared: 172.25.233.0/24 (shared-subnet)** from the *Subnet* dropdown and click **Submit** to add the interface.



**Add Interface**

**Subnet \***

shared: 192.168.233.0/24 (shared-subnet)

**Description:**

You can connect a specified subnet to the router.

If you don't specify an IP address here, the gateway's IP address of the selected subnet will be used as the IP address of the newly created interface of the router. If the gateway's IP address is in use, you must use a different address which belongs to the selected subnet.

**IP Address (optional) ?**

**Cancel** **Submit**

7. Log out of the dashboard and close the web browser.
8. Open a terminal window if one is not already open, and source the **admin** credentials.

```
ubuntu@workstation:~$ source ~/keystonerc-admin
```

```
ubuntu@workstation:~$ source ~/keystonerc-admin
ubuntu@workstation:~$ █
```

9. Show the details of **router1**. Copy the `subnet_id` from the `interfaces_info` row of the output.

```
ubuntu@workstation:~$ openstack router show router1
```

```
ubuntu@workstation:~$ openstack router show router1
+-----+-----+
| Field | Value |
+-----+-----+
| admin_state_up | UP
| availability_zone_hints | None
| availability_zones | None
| created_at | 2024-01-12T18:07:29Z
| description | None
| distributed | False
| external_gateway_info | {"network_id": "3eeb3caf-f410-408e-adf8-7d64ab0a57a", "enable_snat": true, "external_fixed_ips": [{"subnet_id": "6fd67391-02eb-47b8-9274-d8c9ef9a9d2", "ip_address": "172.25.250.71"}]}
| flavor_id | None
| has_dvr | None
| id | f51ad59c-9224-4feb-baa9-f691bcac2c45
| interfaces_info | [{"subnet_id": "85998680-f76d-4cba-887c-f4946a26e071", "ip_address": "192.168.233.1", "port_id": "a9le677c-6a01-4657-9c64-c930c9cf4ad0"}]
| name | router1
| project_id | a9le677c-6a01-4657-9c64-c930c9cf4ad0
| revision_number | 1
| routes | []
| status | ACTIVE
| tags | None
| updated_at | 2024-01-12T18:25:25Z
+-----+-----+
ubuntu@workstation:~$ █
```

### Tip

You can copy from the terminal to the clipboard the keyboard shortcut **Ctrl+Shift+C**.

10. Delete the interface in the **shared** subnet for the **router1** router using the command below. Substitute the subnet ID with the one you copied previously. Make sure not to include any characters besides numbers and hyphens.

```
ubuntu@workstation:~$ openstack router remove subnet router1 \
> 85998680-f76d-4cba-887c-f4946a26e071
```

```
ubuntu@workstation:~$ openstack router remove subnet router1 \
> 85998680-f76d-4cba-887c-f4946a26e071
ubuntu@workstation:~$ █
```

### Tip

You can paste from the clipboard into the terminal with the keyboard shortcut **Ctrl+Shift+V**.

11. Unset the **external** network as the gateway for the router.

```
ubuntu@workstation:~$ openstack router unset --external-gateway router1
```

```
ubuntu@workstation:~$ openstack router unset --external-gateway router1
ubuntu@workstation:~$ █
```

12. Delete the **router1** router.

```
ubuntu@workstation:~$ openstack router delete router1
```

```
ubuntu@workstation:~$ openstack router delete router1
ubuntu@workstation:~$ █
```

13. Create a router named **exercise-router**.

```
ubuntu@workstation:~$ openstack router create exercise-router
```

```
ubuntu@workstation:~$ openstack router create exercise-router
+-----+-----+
| Field          | Value
+-----+-----+
| admin_state_up | UP
| availability_zone_hints |
| availability_zones |
| created_at     | 2023-11-18T23:53:37Z
| description    |
| distributed    | False
| external_gateway_info | None
| flavor_id      | None
| ha             | False
| id             | 287b9ee8-ff5a-4402-ba09-e7b1b5063c90
| name           | exercise-router
| project_id     | c524eaead1f74d4f9141f71b280e0237
| revision_number| 1
| routes         |
| status          | ACTIVE
| tags            |
| updated_at     | 2023-11-18T23:53:37Z
+-----+
ubuntu@workstation:~$ █
```

14. Connect the router to the **shared-subnet** subnet.

```
ubuntu@workstation:~$ openstack router add subnet \
> exercise-router shared-subnet
```

```
ubuntu@workstation:~$ openstack router add subnet \
> exercise-router shared-subnet
ubuntu@workstation:~$ █
```

15. Set the **external** network as the gateway for the router.

```
ubuntu@workstation:~$ openstack router set \
> --external-gateway external \
> exercise-router
```

```
ubuntu@workstation:~$ openstack router set \
> --external-gateway external \
> exercise-router
ubuntu@workstation:~$
```

16. Show the details of the **exercise-router** router. Take note of the IP address listed in the *external\_gateway\_info* row, as you will ping this address in a later step to verify that the router can be reached.

```
ubuntu@workstation:~$ openstack router show exercise-router
```

```
ubuntu@workstation:~$ openstack router show exercise-router
+-----+-----+
| Field           | Value          |
+-----+-----+
| admin_state_up | UP             |
| availability_zone_hints |           |
| availability_zones |           |
| created_at     | 2023-11-21T22:19:55Z |
| description    |               |
| distributed    | False          |
| external_gateway_info | {"network_id": "f940f9bd-6695-427b-8598-09a12672e9cc", "enable_snat": true, "external_fixed_ips": [{"subnet_id": "ad188951-37cb-4f68-bf28-009bc5a396e7", "ip_address": "172.25.250.71"}]} |
| flavor_id      | None           |
| id             | 29bd2f8-7979-4c84-9bfe-a2fa781231a9 |
| interfaces_info | [{"subnet_id": "5c9345df-47ac-446a-a7e3-8e6821ff6f08", "ip_address": "192.168.233.1", "port_id": "f083dcacf-5647-456c-b969-9a566b9dde37"}] |
| name           | exercise-router |
| project_id     | c524eade1f74d4f9141f71b280e0237 |
| routes         | 3              |
| status          | ACTIVE         |
| tags           |               |
| updated_at     | 2023-11-21T22:54:27Z |
+-----+-----+
ubuntu@workstation:~$
```

17. SSH into the **devstack** virtual machine. Log in with the password **ubuntu**.

```
ubuntu@workstation:~$ ssh 192.168.1.20
```

```

ubuntu@workstation:~$ ssh 192.168.1.20
ubuntu@192.168.1.20's password:
Welcome to Ubuntu 22.04.3 LTS (GNU/Linux 5.15.0-1046-kvm x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

 * Strictly confined Kubernetes makes edge and IoT secure. Learn how MicroK8s
 just raised the bar for easy, resilient and secure K8s cluster deployment.

 https://ubuntu.com/engage/secure-kubernetes-at-the-edge

This system has been minimized by removing packages and content that are
not required on a system that users do not log into.

To restore this content, you can run the 'unminimize' command.

Expanded Security Maintenance for Applications is not enabled.

2 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: Fri Nov 17 00:56:21 2023 from 192.168.1.254
ubuntu@devstack:~$ █

```

18. Use the ping command on the IP address found from the openstack router show command to verify that the router can be reached.

```

ubuntu@devstack:~$ ping -c3 172.25.250.71

```

**Note**

The actual IP address may differ from this example.

```

ubuntu@devstack:~$ ping -c3 172.25.250.71
PING 172.25.250.71 (172.25.250.71) 56(84) bytes of data.
64 bytes from 172.25.250.71: icmp_seq=1 ttl=254 time=0.953 ms
64 bytes from 172.25.250.71: icmp_seq=2 ttl=254 time=0.599 ms
64 bytes from 172.25.250.71: icmp_seq=3 ttl=254 time=0.461 ms

--- 172.25.250.71 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2030ms
rtt min/avg/max/mdev = 0.461/0.671/0.953/0.207 ms
ubuntu@devstack:~$ █

```

19. Exit the SSH session.

```

ubuntu@workstation:~$ exit

```

```
ubuntu@devstack:~$ exit  
logout  
Connection to 192.168.1.20 closed.  
ubuntu@workstation:~$ ~█
```

20. Leave the terminal window open and continue to the next task.

### 3 Maintaining Floating IP Addresses

In this task, you will create a set of floating IP addresses and allocate them to an instance.

1. If a terminal window is not already open, open one and source the admin credentials from the `~/keystonerc-admin` file.
2. Create a new instance named `instance1`. Use the `ubuntu` image, `m1.small` flavor, and `shared` network.

```
ubuntu@workstation:~$ openstack server create \
> --image ubuntu \
> --flavor m1.small \
> --nic net-id=shared \
> --wait instance1
```

```
ubuntu@workstation:~$ openstack server create \
> --image ubuntu \
> --flavor m1.small \
> --nic net-id=shared \
> --wait instance1

+-----+-----+
| Field          | Value        |
+-----+-----+
| OS-DCF:diskConfig | MANUAL      |
| OS-EXT-AZ:availability_zone | nova       |
| OS-EXT-SRV-ATTR:host | devstack    |
| OS-EXT-SRV-ATTR:hypervisor_hostname | devstack   |
| OS-EXT-SRV-ATTR:instance_name | instance-00000006 |
| OS-EXT-STS:power_state | Running     |
| OS-EXT-STS:task_state | None        |
| OS-EXT-STS:vm_state | active      |
| OS-SRV-USG:launched_at | 2023-11-19T22:24:07.000000 |
| OS-SRV-USG:terminated_at | None        |
| accessIPv4 |           |
| accessIPv6 |           |
| addresses | shared=192.168.233.153 |
| adminPass | S8eek4bFqWHX |
| config_drive |           |
| created | 2023-11-19T22:23:49Z |
| flavor | m1.small (2) |
| hostId | 151e314f6e3cf8b4db0b1f6035cc4b68cb1e6c9aa97163a575f9f6c |
| id | 10602cea-bc68-43a0-8537-c9231adfb791 |
| image | ubuntu (10d986bd-8501-47be-b9d9-d72eab219920) |
| key_name | None        |
| name | instance1  |
| progress | 0           |
| project_id | c524eaead1f74d4f9141f71b280e0237 |
| properties |           |
| security_groups | name='default' |
| status | ACTIVE      |
| updated | 2023-11-19T22:24:08Z |
| user_id | b4bdeae0865449e1905fc5e639007753 |
| volumes_attached |           |
+-----+-----+
ubuntu@workstation:~$
```

3. Leave the terminal window open and open the web browser. Navigate to **192.168.1.20**. Log into the *Horizon Dashboard* as the **admin** user with the password **secret**.
4. Switch to the **demo** project. Navigate to **Project > Network > Floating IPs**. Click **Allocate IP to Project**.

The screenshot shows the OpenStack interface under the 'demo' project. The 'Network' section is selected, and the 'Floating IPs' tab is active. A red box highlights the 'Allocate IP To Project' button at the top right of the table header.

5. Ensure **external** is set as the *Pool*. Click **Allocate IP**.

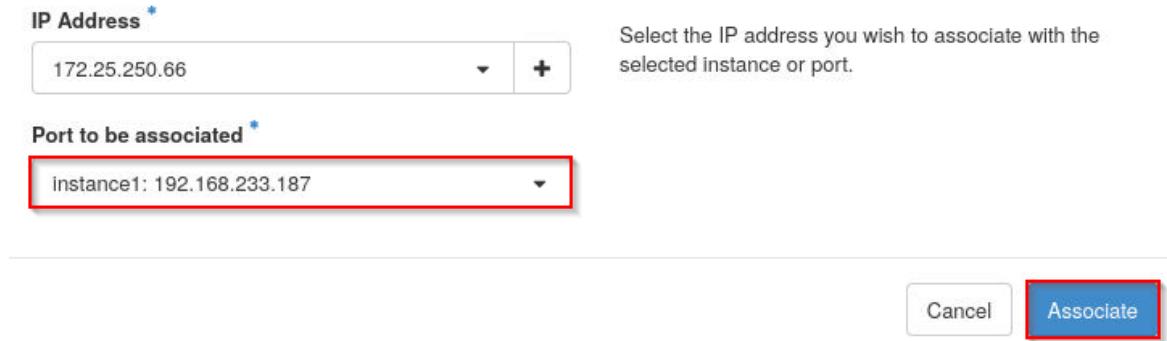
The screenshot shows the 'Allocate Floating IP' dialog. The 'Pool' dropdown is set to 'external'. The 'Allocate IP' button is highlighted with a red box.

6. Click **Associate** in the row of the floating IP address.

The screenshot shows the 'Floating IPs' page with one item listed. The 'Associate' button in the 'Actions' column for the first item is highlighted with a red box.

7. In the *Port to be associated* dropdown, select **instance1: 192.168.233.XYZ**. Click **Associate**.

## Manage Floating IP Associations



**IP Address \***  
172.25.250.66

**Port to be associated \***  
instance1: 192.168.233.187

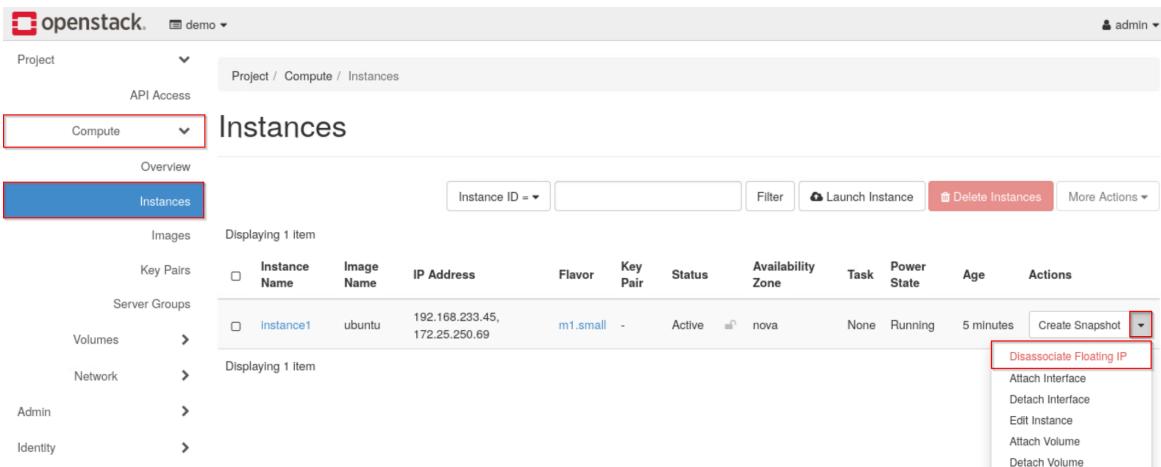
Select the IP address you wish to associate with the selected instance or port.

Cancel **Associate**

### Note

The actual value of the floating IP address may differ.

8. Navigate to **Compute > Instances**. Click the arrow next to the **Create Snapshot** in the same as **instance1**. Select **Disassociate Floating IP** to detach the floating IP from the instance.



Project / Compute / Instances

Compute

Instances

Instance Name	Image Name	IP Address	Flavor	Key Pair	Status	Availability Zone	Task	Power State	Age	Actions
Instance1	ubuntu	192.168.233.45, 172.25.250.69	m1.small	-	Active	nova	None	Running	5 minutes	<b>Create Snapshot</b>

Disassociate Floating IP

Attach Interface  
Detach Interface  
Edit Instance  
Attach Volume  
Detach Volume

9. Check the *Release Floating IP* box and click **Disassociate**.

## Disassociate floating IP

### Disassociate Floating IP

Floating IP \*

172.25.250.69

Release Floating IP

Description:

Select the floating IP to be disassociated from the instance.

**Release Floating IP**

If checked, the selected floating IP will be released at the same time.

Cancel Disassociate

10. Log out of the *Horizon Dashboard* and close the web browser.
11. From the terminal, create the floating IP **172.25.250.66** in the **external** network.

```
ubuntu@workstation:~$ openstack floating ip create \
> --floating-ip-address 172.25.250.66 \
> external
```

```
ubuntu@workstation:~$ openstack floating ip create \
> --floating-ip-address 172.25.250.66 \
> external
+-----+-----+
| Field | Value |
+-----+-----+
| created_at | 2023-11-20T21:53:23Z
| description | None
| fixed_ip_address | 172.25.250.66
| floating_ip_address | 172.25.250.66
| floating_network_id | d8e6f5bd-6c4e-47ab-9cc7-1d8c88b5961d
| id | 7bfda980-77b3-4348-9303-981b2c731529
| name | 172.25.250.66
| port_id | None
| project_id | c524eaead1f74d4f9141f71b280e0237
| qos_policy_id | None
| revision_number | 0
| router_id | None
| status | DOWN
| subnet_id | None
| updated_at | 2023-11-20T21:53:23Z
+-----+
ubuntu@workstation:~$
```

### Tip

If an *HttpException: Conflict* error appears, this indicates that a floating IP from a previous step in this section was not released. If this is the case, either go back to

the *Horizon Dashboard* and release the floating IP address or use the next available floating IP address.

12. From the floating IP pool in the **external** network, create a floating IP.

```
ubuntu@workstation:~$ openstack floating ip create external
```

```
ubuntu@workstation:~$ openstack floating ip create external
+-----+-----+
| Field          | Value
+-----+-----+
| created_at     | 2024-01-12T18:48:37Z
| description    |
| fixed_ip_address | None
| floating_ip_address | 172.25.250.75
| floating_network_id | 3eeb3caf-f410-408e-adf8-7d64ab0a857a
| id             | 3975289d-1fc1-43cc-aa73-2bdea0c5ae03
| name           | 172.25.250.75
| port_id        | None
| project_id     | a96f441f305f48d4a2be02606b29faa8
| qos_policy_id  | None
| revision_number | 0
| router_id      | None
| status          | DOWN
| subnet_id       | None
| updated_at      | 2024-01-12T18:48:37Z
+-----+
ubuntu@workstation:~$
```

13. Allocate a second floating IP using the same command.

```
ubuntu@workstation:~$ openstack floating ip create external
```

```
ubuntu@workstation:~$ openstack floating ip create external
+-----+-----+
| Field | Value |
+-----+-----+
| created_at | 2024-01-12T18:48:56Z |
| description | None |
| fixed_ip_address | 172.25.250.65 |
| floating_ip_address | 3eeb3caf-f410-408e-adf8-7d64ab0a857a |
| floating_network_id | 0fc02336-ebba-442e-bbc1-35482ee53631 |
| id | 172.25.250.65 |
| name | None |
| port_id | a96f441f305f48d4a2be02606b29faa8 |
| project_id | None |
| qos_policy_id | 0 |
| revision_number | None |
| router_id | DOWN |
| subnet_id | None |
| updated_at | 2024-01-12T18:48:56Z |
+-----+-----+
ubuntu@workstation:~$
```

14. Allocate a third floating IP.

```
ubuntu@workstation:~$ openstack floating ip create external
```

```
ubuntu@workstation:~$ openstack floating ip create external
+-----+-----+
| Field | Value |
+-----+-----+
| created_at | 2024-01-12T18:49:16Z |
| description | None |
| fixed_ip_address | 172.25.250.74 |
| floating_ip_address | 3eeb3caf-f410-408e-adf8-7d64ab0a857a |
| floating_network_id | 6671e8bf-11bb-4f06-83d4-fe44420b533c |
| id | 172.25.250.74 |
| name | None |
| port_id | a96f441f305f48d4a2be02606b29faa8 |
| project_id | None |
| qos_policy_id | 0 |
| revision_number | None |
| router_id | DOWN |
| subnet_id | None |
| updated_at | 2024-01-12T18:49:16Z |
+-----+-----+
ubuntu@workstation:~$
```

15. Associate the third floating IP with **instance1**.

```
ubuntu@workstation:~$ openstack server add \  
> floating ip instance1 172.25.250.74
```

```
ubuntu@workstation:~$ openstack server add \  
> floating ip instance1 172.25.250.74  
ubuntu@workstation:~$ █
```

**Note**

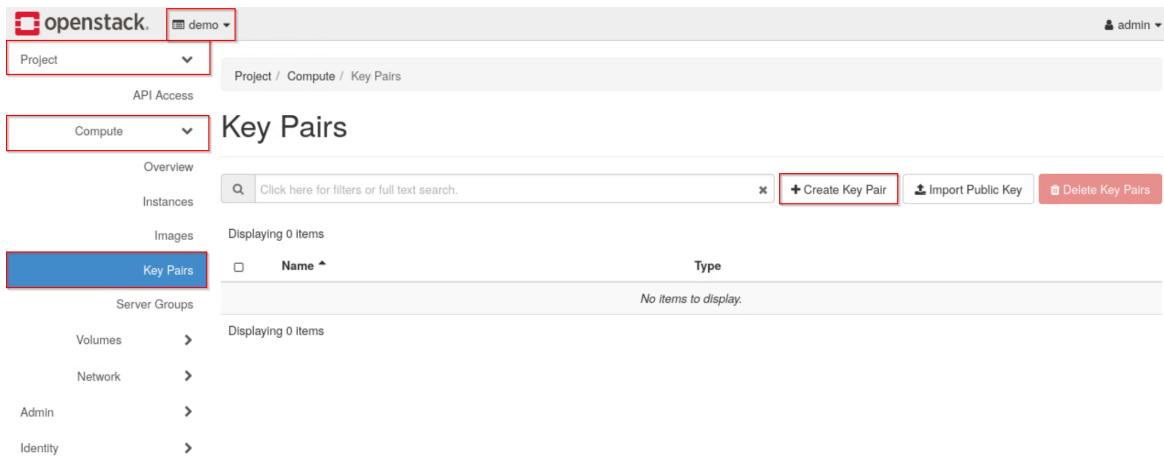
The actual floating IP may differ. Use the floating IP address generated from your output from the previous step.

16. Leave the terminal window open and continue to the next task.

## 4 Implementing Security

In this task, you will use the *Horizon Dashboard* and *OpenStack Unified CLI* to manage SSH key pairs and security groups for OpenStack instances.

1. Open the web browser and navigate to **192.168.1.20**. Log into the dashboard as **admin** with the password **secret**.
2. Switch to the **demo** project and navigate to **Project > Compute > Key Pairs**. Click **Create Key Pair** to create a new key pair.



3. Enter **keypair1** in the *Key Pair Name* field, and select **SSH Key** in the *Key Type* dropdown. Click **Create Key Pair**. This will create the key pair and download it to the **~/Downloads** directory.



4. Navigate to **Network > Security Groups** and click **Create Security Group**.

The screenshot shows the OpenStack interface under the 'demo' project. The left sidebar has 'Network' selected. In the main content area, it says 'Displaying 1 Item' and lists a single security group named 'default'. There is a 'Create Security Group' button at the top right.

5. Enter **secgroup1** into the *Name* field and click **Create Security Group**.

**Name \***  
secgroup1

**Description**

**Description:**  
Security groups are sets of IP filter rules that are applied to network interfaces of a VM. After the security group is created, you can add rules to the security group.

**Create Security Group**

6. After creating the security group, you should land on the page containing the rules for the security group. If not, click **Manage Rules** in the same column as **secgroup1** on the **Security Groups** page to get there. Click **Add Rule** to add a new rule in the security group.

Project / Network / Security Groups / Manage Security Group Rule...

Manage Security Group Rules: secgroup1 (287ccaa3-61ad-447d-8f6e-0f81d14c67dd)

+ Add Rule Delete Rules

Direction	Ether Type	IP Protocol	Port Range	Remote IP Prefix	Remote Security Group	Description	Actions
Egress	IPv4	Any	Any	0.0.0.0/0	-	-	Delete Rule
Egress	IPv6	Any	Any	::/0	-	-	Delete Rule

7. Select **All ICMP** from the *Rule* dropdown and click **Add**. This will allow ICMP traffic, namely the ping command, to reach instances in this security group.

## Add Rule



**Rule \***

All ICMP

**Description** ⓘ

**Direction**

Ingress

**Remote \*** ⓘ

CIDR

**CIDR \*** ⓘ

0.0.0.0/0

### Description:

Rules define which traffic is allowed to instances assigned to the security group. A security group rule consists of three main parts:

**Rule:** You can specify the desired rule template or use custom rules, the options are Custom TCP Rule, Custom UDP Rule, or Custom ICMP Rule.

**Open Port/Port Range:** For TCP and UDP rules you may choose to open either a single port or a range of ports. Selecting the "Port Range" option will provide you with space to provide both the starting and ending ports for the range. For ICMP rules you instead specify an ICMP type and code in the spaces provided.

**Remote:** You must specify the source of the traffic to be allowed via this rule. You may do so either in the form of an IP address block (CIDR) or via a source group (Security Group). Selecting a security group as the source will allow any other instance in that security group access to any other instance via this rule.

Cancel

Add

8. Log out of the *Horizon Dashboard* and close the web browser.
9. If a terminal window is not already open, open one and source the **admin** credentials from the `~/keystonerc-admin` file.
10. Delete the private key located at `~/Downloads/keypair1.pem`.

```
ubuntu@workstation:~$ rm -f ~/Downloads/keypair1.pem
```

```
ubuntu@workstation:~$ rm -f ~/Downloads/keypair1.pem
ubuntu@workstation:~$
```

11. Delete the **keypair1** key pair.

```
ubuntu@workstation:~$ openstack keypair delete keypair1
```

```
ubuntu@workstation:~$ openstack keypair delete keypair1
ubuntu@workstation:~$
```

12. List the rules in the **secgroup1** security group.

```
ubuntu@workstation:~$ openstack security group rule \
> list secgroup1
```

```
ubuntu@workstation:~$ openstack security group rule \
> list secgroup1
+-----+-----+-----+-----+
| ID      | IP Protocol | IP Range | Port Range | Remote Security Group |
+-----+-----+-----+-----+
| 3027b819-ceaf-43e9-a556-9f4b622d6806 | None       | None     |            | None
| 7070ffa9-0746-4ac1-a504-99356ebdf2cf | None       | None     |            | None
| c92f0fdb-65b0-49ba-ae54-e9ec13ac98c1 | icmp      | 0.0.0.0/0 |            | None
+-----+-----+-----+-----+
ubuntu@workstation:~$ █
```

13. Use the *ID* for the ICMP rule to delete that rule.

```
ubuntu@workstation:~$ openstack security group rule \
> delete c92f0fdb-65b0-ae54-e9ec13ac98c1
```

```
ubuntu@workstation:~$ openstack security group rule delete c92f0fdb-65b0-49ba-ae54-e9ec13ac98c1
ubuntu@workstation:~$ █
```

#### Note

The actual ID value may differ.

14. Delete the **secgroup1** security group.

```
ubuntu@workstation:~$ openstack security group \
> delete secgroup1
```

```
ubuntu@workstation:~$ openstack security group \
> delete secgroup1
ubuntu@workstation:~$ █
```

15. Create the key pair **dev-keypair** and save the private key to the file **~/Downloads/dev-keypair.pem**.

```
ubuntu@workstation:~$ openstack keypair create \
> dev-keypair > ~/Downloads/dev-keypair.pem
```

```
ubuntu@workstation:~$ openstack keypair create \
> dev-keypair > ~/Downloads/dev-keypair.pem
ubuntu@workstation:~$ █
```

16. the `chmod` command with a mode of **600** to make it so that the **ubuntu** user has read/write permissions on the file, and groups and other users have no permissions to the file.

```
ubuntu@workstation:~$ chmod 600 ~/Downloads/dev-keypair.pem
```

```
ubuntu@workstation:~$ chmod 600 ~/Downloads/dev-keypair.pem
ubuntu@workstation:~$ █
```

17. Create the **dev-secgroup** security group.

```
ubuntu@workstation:~$ openstack security group \
> create dev-secgroup
```

```
ubuntu@workstation:~$ openstack security group \
> create dev-secgroup
+-----+
| Field           | Value
+-----+
| created_at     | 2023-11-21T20:31:33Z
| description    | dev-secgroup
| id             | aa3d7521-489d-4270-be5a-f33c4b3celef
| name           | dev-secgroup
| project_id    | 0524e0ead1f74d4f9141f71b280e0237
| revision_number | 1
| rules          | created at='2023-11-21T20:31:33Z', direction='egress', ethertype='IPv4', id='1245145b-c368-4f25-8462-3d0b5911524b', standard_attr_id='72', updated at='2023-11-21T20:31:33Z'
|                 | created at='2023-11-21T20:31:33Z', direction='egress', ethertype='IPv6', id='72d05a33-7763-424b-a3ea-5d4271850157', standard_attr_id='71', updated at='2023-11-21T20:31:33Z'
| updated_at     | 2023-11-21T20:31:33Z
+-----+
ubuntu@workstation:~$ █
```

18. Add a security rule in the **dev-secgroup** security group to allow remote ICMP traffic.

```
ubuntu@workstation:~$ openstack security group \
> rule create \
> --protocol icmp \
> dev-secgroup
```

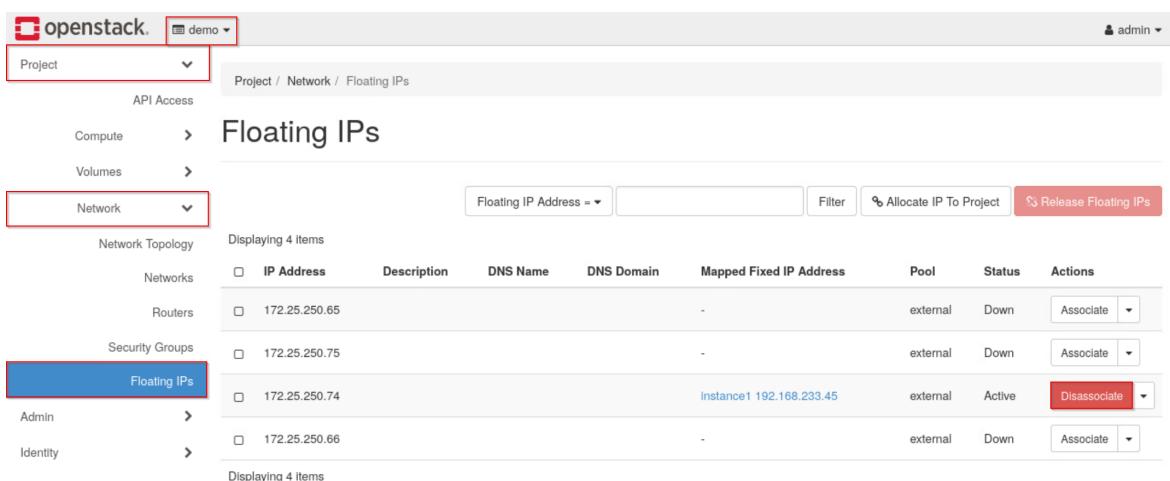
```
ubuntu@workstation:~$ openstack security group \
> rule create \
> --protocol icmp \
> dev-secgroup
+-----+-----+
| Field | Value |
+-----+-----+
| created_at | 2023-11-21T20:35:44Z |
| description | |
| direction | ingress |
| ether_type | IPv4 |
| id | fc550acd-9f63-4e78-9c58-2f49d5b3536e |
| name | None |
| port_range_max | None |
| port_range_min | None |
| project_id | c524eaead1f74d4f9141f71b280e0237 |
| protocol | icmp |
| remote_group_id | None |
| remote_ip_prefix | 0.0.0.0/0 |
| revision_number | 0 |
| security_group_id | aa3d7521-489d-4270-be5a-f33c4b3ce1ef |
| updated_at | 2023-11-21T20:35:44Z |
+-----+
ubuntu@workstation:~$ █
```

19. Add another security rule to allow remote connection using SSH on the default port 22.

```
ubuntu@workstation:~$ openstack security group \
> rule create \
> --protocol tcp \
> --dst-port 22 \
> dev-secgroup
```

```
ubuntu@workstation:~$ openstack security group \
> rule create \
> --protocol tcp \
> --dst-port 22 \
> dev-secgroup
+-----+
| Field          | Value
+-----+
| created_at    | 2023-11-21T20:36:26Z
| description    | ingress
| direction      | ingress
| ether_type     | IPv4
| id             | f9f6da93-31ef-4d43-8ec0-840b1cf79991
| name           | None
| port_range_max| 22
| port_range_min| 22
| project_id     | c524eaead1f74d4f9141f71b280e0237
| protocol       | tcp
| remote_group_id| None
| remote_ip_prefix| 0.0.0.0/0
| revision_number| 0
| security_group_id| aa3d7521-489d-4270-be5a-f33c4b3ce1ef
| updated_at     | 2023-11-21T20:36:26Z
+-----+
ubuntu@workstation:~$ █
```

20. Open the web browser and navigate to **192.168.1.20**. Log into the dashboard as **admin** with the password **secret**.
21. Navigate to **Project > Floating IPs**. Disassociate the floating IP assigned to **instance1**.



IP Address	Description	DNS Name	DNS Domain	Mapped Fixed IP Address	Pool	Status	Actions
172.25.250.65				-	external	Down	<button>Associate</button>
172.25.250.75				-	external	Down	<button>Associate</button>
172.25.250.74				instance1 192.168.233.45	external	Active	<button>Disassociate</button>
172.25.250.66				-	external	Down	<button>Associate</button>

22. Click **Disassociate** to confirm the disassociation.

## Confirm Disassociate

You have selected: "172.25.250.64". Please confirm your selection.

[Cancel](#) [Disassociate](#)

23. Select all checkboxes and click **Release Floating IPs** to release all the floating IP addresses.

IP Address	Description	DNS Name	DNS Domain	Mapped Fixed IP Address	Pool	Status	Actions
172.25.250.64				-	external	Down	<a href="#">Associate</a>
172.25.250.77				-	external	Down	<a href="#">Associate</a>
172.25.250.66				-	external	Down	<a href="#">Associate</a>
172.25.250.61				-	external	Down	<a href="#">Associate</a>

24. Click **Release Floating IPs** to confirm the release of the all the floating IP addresses.

## Confirm Release Floating IPs

You have selected: "172.25.250.64", "172.25.250.77", "172.25.250.66", "172.25.250.61". Please confirm your selection.  
Once a floating IP is released, there is no guarantee the same IP can be allocated again.

[Cancel](#) [Release Floating IPs](#)

25. Navigate to the **Routers** tab. Click the **Clear Gateway** associated with **exercise-router** to remove its interface on the **external** network.

Name	Status	External Network	Admin State	Availability Zones	Actions
exercise-router	Active	external	UP	-	<a href="#">Clear Gateway</a>

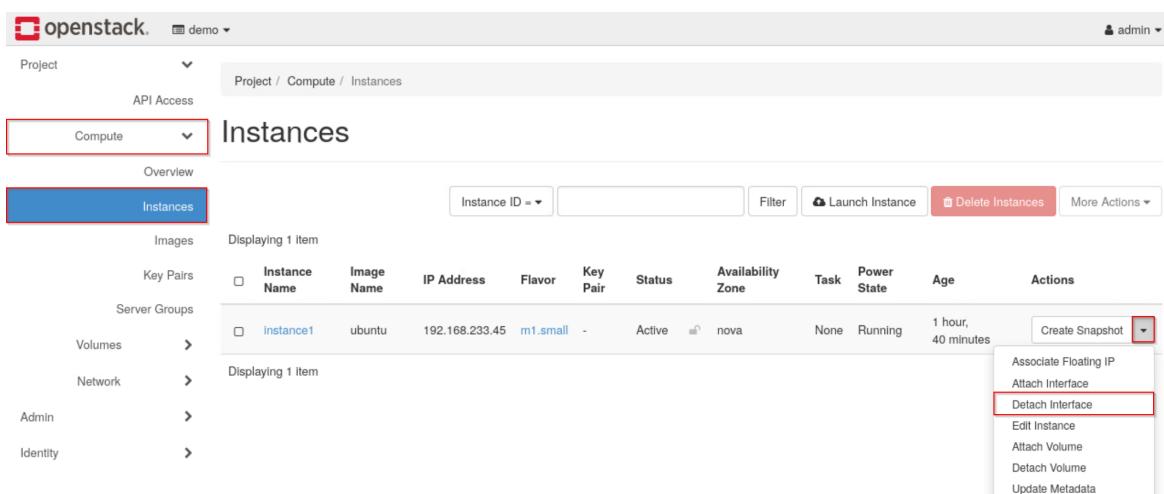
26. Click **Clear Gateway** to confirm the clearing of the gateway.

## Confirm Clear Gateway

You have selected: "exercise-router". Please confirm your selection. You may reset the gateway later by using the set gateway action, but the gateway IP may change.

[Cancel](#) [Clear Gateway](#)

27. Navigate to **Compute > Instances**. In the row for the **instance1** instance, click the dropdown next to the **Create Snapshot** button, then click **Detach Interface**.



The screenshot shows the OpenStack Compute Instances page. The 'Instances' tab is selected. A table displays one item: 'Instance1' (ubuntu, 192.168.233.45, m1.small, Active, nova). To the right of the table, a context menu is open over the 'Create Snapshot' button. The menu options are: Associate Floating IP, Attach Interface, Detach Interface (which is highlighted with a red box), Edit Instance, Attach Volume, Detach Volume, and Update Metadata.

28. In the **Detach Interface** window, select **192.168.233.XYZ** and click **Detach Interface**.

## Detach Interface

**Port \***

**Description:**

Select the port to detach.

[Cancel](#) [Detach Interface](#)

29. Click the checkbox next to **instance1**, then click **Delete Instances**.

Project / Compute / Instances

## Instances

Instance ID =  Filter More Actions ▾

Displaying 1 item

Instance Name	Image Name	IP Address	Flavor	Key Pair	Status	Availability Zone	Task	Power State	Age	Actions
<input checked="" type="checkbox"/> instance1	ubuntu	192.168.233.45	m1.small	-	Active	nova	None	Running	1 hour, 46 minutes	▾

Displaying 1 item

30. Click **Delete Instances** to confirm the deletion of **instance1**.

### Confirm Delete Instances

You have selected: "instance1". Please confirm your selection. Deleted instances are not recoverable.

31. Close the web browser and continue to the next task.

## 5 Launching an External Instance

In this task, you will launch an external instance.

1. If a terminal window is not already open, open one and source the admin credentials from the `~/keystonerc-admin` file.
2. List all instances in the project. The list should be empty.

```
ubuntu@workstation:~$ openstack server list
```

```
ubuntu@workstation:~$ openstack server list

ubuntu@workstation:~$ █
```

3. Launch an instance named `instance-external` using the `ubuntu` image, the `m1.small` flavor, the `dev-keypair` key pair, the `shared` network, and the `dev-secgroup` security group.

```
ubuntu@workstation:~$ openstack server create \
> --image ubuntu \
> --flavor m1.small \
> --key-name dev-keypair \
> --nic net-id=shared \
> --security-group dev-secgroup \
> --wait instance-external
```

```
ubuntu@workstation:~$ openstack server create \
> --image ubuntu \
> --flavor m1.small \
> --key-name dev-keypair \
> --nic net-id=shared \
> --security-group dev-secgroup \
> --wait instance-external

+-----+-----+
| Field | Value |
+-----+-----+
| OS-DCF:diskConfig | MANUAL |
| OS-EXT-AZ:availability_zone | nova |
| OS-EXT-SRV-ATTR:host | devstack |
| OS-EXT-SRV-ATTR:hypervisor_hostname | devstack |
| OS-EXT-SRV-ATTR:instance_name | instance-00000007 |
| OS-EXT-STS:power_state | Running |
| OS-EXT-STS:task_state | None |
| OS-EXT-STS:vm_state | active |
| OS-SRV-USG:launched_at | 2023-11-21T21:43:30.000000 |
| OS-SRV-USG:terminated_at | None |
| accessIPv4 | |
| accessIPv6 | |
| addresses | shared=192.168.233.172 |
| adminPass | UDYpHip6pDGy |
| config_drive | |
| created | 2023-11-21T21:43:27Z |
| flavor | m1.small (2) |
| hostId | 151e314f6e3cfc8b4db0b1f6035cc4b68cb1e6c9aa97163a575f9f6c |
| id | 542a4800-5285-4523-8239-c94f77f76203 |
| image | ubuntu (10d986bd-8501-47be-b9d9-d72eab219920) |
| key_name | dev-keypair |
| name | instance-external |
| progress | 0 |
| project_id | c524eae1f74d4f9141f71b280e0237 |
| properties | |
| security_groups | name='dev-secgroup' |
| status | ACTIVE |
| updated | 2023-11-21T21:43:31Z |
| user_id | b4bdeae0865449e1905fc5e639007753 |
| volumes_attached | |
+-----+-----+
ubuntu@workstation:~$
```

- Set the **external** network as the gateway for the **exercise-router** router.

```
ubuntu@workstation:~$ openstack router set \
> --external-gateway external \
> exercise-router
```

```
ubuntu@workstation:~$ openstack router set \
> --external-gateway external \
> exercise-router
ubuntu@workstation:~$
```

- Create a floating IP address for the project.

```
ubuntu@workstation:~$ openstack floating ip create external
```

ubuntu@workstation:~\$ openstack floating ip create external	
Field	Value
created_at	2023-11-21T22:54:54Z
description	
fixed_ip_address	None
floating_ip_address	172.25.250.66
floating_network_id	f940f9bd-6695-427b-8598-09a12672e9cc
id	d5c7805e-ed24-48de-afaf-37a3b41b0786
name	172.25.250.66
port_id	None
project_id	c524eaead1f74d4f9141f71b280e0237
qos_policy_id	None
revision_number	0
router_id	None
status	DOWN
subnet_id	None
updated_at	2023-11-21T22:54:54Z

6. Create a second floating IP address for the project.

```
ubuntu@workstation:~$ openstack floating ip create external
```

ubuntu@workstation:~\$ openstack floating ip create external	
Field	Value
created_at	2023-11-21T22:54:58Z
description	
fixed_ip_address	None
floating_ip_address	172.25.250.70
floating_network_id	f940f9bd-6695-427b-8598-09a12672e9cc
id	2a46cabb-57c4-403f-8937-587418f2a4e1
name	172.25.250.70
port_id	None
project_id	c524eaead1f74d4f9141f71b280e0237
qos_policy_id	None
revision_number	0
router_id	None
status	DOWN
subnet_id	None
updated_at	2023-11-21T22:54:58Z

7. Create a third floating IP address for the project.

```
ubuntu@workstation:~$ openstack floating ip create external
```

```
ubuntu@workstation:~$ openstack floating ip create external
+-----+-----+
| Field | Value |
+-----+-----+
| created_at | 2023-11-21T22:55:00Z |
| description | |
| fixed_ip_address | None |
| floating_ip_address | 172.25.250.74 |
| floating_network_id | f940f9bd-6695-427b-8598-09a12672e9cc |
| id | 49152876-3b61-40ab-9b24-1f0b67df3f7b |
| name | 172.25.250.74 |
| port_id | None |
| project_id | c524eaead1f74d4f9141f71b280e0237 |
| qos_policy_id | None |
| revision_number | 0 |
| router_id | None |
| status | DOWN |
| subnet_id | None |
| updated_at | 2023-11-21T22:55:00Z |
+-----+
ubuntu@workstation:~$
```

- Associate the third floating IP address with the **instance-external** instance.

```
ubuntu@workstation:~$ openstack server add floating ip \
> instance-external 172.25.250.74
```

```
ubuntu@workstation:~$ openstack server add floating ip \
> instance-external 172.25.250.74
ubuntu@workstation:~$
```

**Note**

Be sure to use the floating IP address that matches your output as they may differ slightly from this example.

- Verify that the instance was assigned the floating IP address.

```
ubuntu@workstation:~$ openstack server list \
> -c Name \
> -c Networks
```

```
ubuntu@workstation:~$ openstack server list \
> -c Name \
> -c Networks
+-----+-----+
| Name | Networks |
+-----+-----+
| instance-external | shared=192.168.233.208, 172.25.250.74 |
+-----+-----+
ubuntu@workstation:~$ █
```

**Tip**

For commands that output tables, you can pull out only the columns you want by using the `-c` option followed by the column name. This option can be chained as in the command above to list multiple columns.

10. Leave the terminal window open and continue to the next task.

## 6 Verifying an External Instance

In this task, you will verify the functionality of an external instance by using the ssh and ping commands to test the external network.

1. If a terminal window is not already open, open one and source the admin credentials from the `~/keystonerc-admin` file.
2. Use the `scp` command to send the `dev-keypair` key pair to the `devstack` machine over the SSH protocol.

```
ubuntu@workstation:~$ scp ~/Downloads/dev-keypair.pem \
> ubuntu@192.168.1.20:~/dev-keypair.pem
```

```
ubuntu@workstation:~$ scp ~/Downloads/dev-keypair.pem \
> ubuntu@192.168.1.20:~/dev-keypair.pem
ubuntu@192.168.1.20's password:
dev-keypair.pem                                              100% 1680      4.8MB/s   00:00
ubuntu@workstation:~$ █
```

3. SSH into the `devstack` machine.

```
ubuntu@workstation:~$ ssh 192.168.1.20
```

```
ubuntu@workstation:~$ ssh 192.168.1.20
ubuntu@192.168.1.20's password:
Welcome to Ubuntu 22.04.3 LTS (GNU/Linux 5.15.0-1046-kvm x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

 * Strictly confined Kubernetes makes edge and IoT secure. Learn how MicroK8s
 just raised the bar for easy, resilient and secure K8s cluster deployment.

 https://ubuntu.com/engage/secure-kubernetes-at-the-edge

This system has been minimized by removing packages and content that are
not required on a system that users do not log into.

To restore this content, you can run the 'unminimize' command.

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 list of available updates is more than a week old.
To check for new updates run: sudo apt update
Last login: Tue Nov 21 22:27:04 2023 from 192.168.1.254
ubuntu@devstack:~$ █
```

4. Ping the **external-instance** instance using the floating IP that was assigned to it in the previous task.

```
ubuntu@devstack:~$ ping -c3 172.25.250.74
```

```
ubuntu@devstack:~$ ping -c3 172.25.250.74
PING 172.25.250.74 (172.25.250.74) 56(84) bytes of data.
64 bytes from 172.25.250.74: icmp_seq=1 ttl=63 time=2.31 ms
64 bytes from 172.25.250.74: icmp_seq=2 ttl=63 time=0.962 ms
64 bytes from 172.25.250.74: icmp_seq=3 ttl=63 time=0.820 ms

--- 172.25.250.74 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2002ms
rtt min/avg/max/mdev = 0.820/1.362/2.306/0.669 ms
ubuntu@devstack:~$ █
```

5. SSH into the **instance-external** instance, using the **dev-keypair.pem** file to authenticate.

```
ubuntu@devstack:~$ ssh -i ~/dev-keypair.pem \
> 172.25.250.74
```

```

ubuntu@devstack:~$ ssh -i ~/dev-keypair.pem \
> 172.25.250.74
The authenticity of host '172.25.250.74 (172.25.250.74)' can't be established.
ED25519 key fingerprint is SHA256:hNu/n5EEiloTiEqNJRi3pRoGhzyV9p9SaPGCwgFw4ZY.
This key is not known by any other names
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '172.25.250.74' (ED25519) to the list of known hosts.
Welcome to Ubuntu 22.04.3 LTS (GNU/Linux 5.15.0-87-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

System information as of Tue Nov 21 23:21:42 UTC 2023

System load:  0.15380859375   Processes:          85
Usage of /:   7.3% of 19.20GB  Users logged in:    0
Memory usage: 8%                  IPv4 address for ens3: 192.168.233.208
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 list of available updates is more than a week old.
To check for new updates run: sudo apt update

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.

To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

ubuntu@instance-external:~$ 

```

### Note

It may take a few minutes for the instance to be fully booted and ready to accept SSH connections.

- Ping the DHCP server.

```

ubuntu@instance-external:~$ ping -c3 192.168.233.2

```

```
ubuntu@instance-external:~$ ping -c3 192.168.233.2
PING 192.168.233.2 (192.168.233.2) 56(84) bytes of data.
64 bytes from 192.168.233.2: icmp_seq=1 ttl=64 time=10.6 ms
64 bytes from 192.168.233.2: icmp_seq=2 ttl=64 time=2.06 ms
64 bytes from 192.168.233.2: icmp_seq=3 ttl=64 time=1.33 ms

--- 192.168.233.2 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2005ms
rtt min/avg/max/mdev = 1.329/4.667/10.618/4.218 ms
ubuntu@instance-external:~$ █
```

7. The lab is now complete.