Multi-Tenancy for OpenStack and Lightbits: Implementation Framework

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Abstract:

In today's dynamic cloud landscape, multi-tenancy is the key to maximizing resource efficiency, ensuring tenant isolation, and optimizing operational costs. By integrating OpenStack's powerful cloud orchestration with Lightbits' high-performance, software-defined storage, organizations can unlock seamless scalability, ultra-low latency, and enterprise-grade data resiliency. This white paper provides a comprehensive framework for implementing multi-tenancy in an OpenStack-Lightbits environment—empowering businesses to deliver secure, efficient, and high-performance cloud services while maintaining full control over storage and compute resources.

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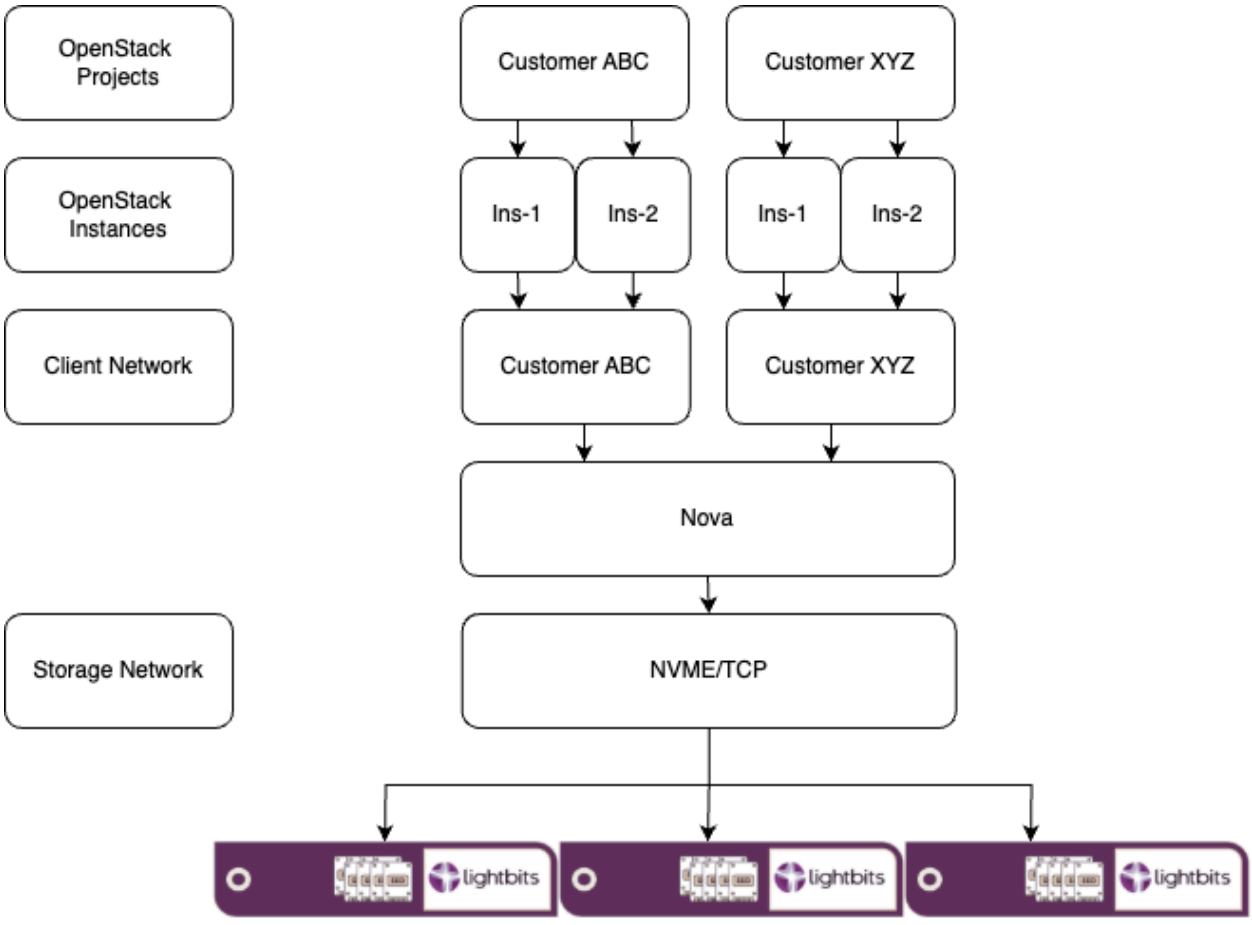
1. Introduction

This white paper provides a step-by-step guide to seamlessly integrating **Lightbits storage** with **OpenStack** in a multi-tenant environment. You'll learn how to **create a project in Lightbits**, configure secure access credentials, and set up the **Cinder driver in OpenStack** for optimal performance. We'll walk you through **creating a new OpenStack project**, assigning a **dedicated manager**, and configuring **volume types** to ensure isolated and efficient storage provisioning. Finally, you'll see how to **launch a new instance**, attach a **secure, high-performance volume**, and leverage OpenStack's **Virtio driver**—ensuring that the storage network remains invisible to the project manager, reinforcing security and tenant isolation.

To have an understanding of the environment layout the drawing below gives an overview of the infrastructure.



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2. Prerequisites

Before diving into seamless multi-tenancy with **OpenStack and Lightbits**, a solid foundation is essential. You'll need a **fully functional OpenStack deployment** with administrative access, ensuring smooth orchestration and resource management. A **Lightbits cluster** must be up and running, ready to deliver high-performance, software-defined storage to OpenStack services. Lastly, a **well-configured network** is critical—enabling secure, efficient communication between OpenStack components and LightOS for optimal performance and scalability. With these key prerequisites in place, you're set to unlock the full potential of multi-tenant cloud storage.

Furthermore there will be three variables we are going to work with, and please change those to what is suitable for your environment:

- Project = lightstack
- User = lightstack
- Network = lightstack

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3. Lightbits Project Setup

3.1 Create the project

The first step we do is to create a project in Lightbits. Login to your Lightbits cluster and list the existing project with the following command:

```
Unset
lbcli list projects
```

The result could be like:

```
Name    UUID                                    Description
default dc4c46e4-cb83-5df6-b84a-8beae38ac43c    This is default project description
acme    f26153be-e9a4-4808-9ab8-3d2e39db837d    This is for customer acme.
```

To create a new project:

```
Unset
lbcli --endpoint https://localhost:443 create project --name lightstack
--description "Project for Lightbits and OpenStack integration"
```

Output:

```
Name       UUID                                    Description
lightstack 2a019b44-e886-417a-85ea-8f0f030dba05    Project for Lightbits and OpenStack integration
```

3.2 Set the security for the project in Lightbits

To be able for OpenStack, via the Cinder driver, to communicate with Lightbits a credential needs to be created. This will create a JWT at the last step and that JWT is required with the configuration of the cinder.conf file in OpenStack. The first step we have to do is to create the keys. In this example we are using

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lightstack as our project name, please make sure that you change lightstack with your project name to generate the keys.

3.2.1 Create the rsa keys

```
Unset
mkdir -p ${HOME}/.lightstack_keys && ssh-keygen -t rsa -f
${HOME}/.lightstack_keys/lightstackkey -q -N "" -m PKCS8 && openssl rsa
-in ${HOME}/.lightstack_keys/lightstackkey -pubout -out
${HOME}/.lightstack_keys/lightstackkey.pem
```

The output will be like:

```
writing RSA key
```

Please verify that the keys have been created.

```
Unset
ls .lightstack_keys
```

It will show you three keys:

```
lightstackkey  lightstackkey.pem  lightstackkey.pub
```

(It should show you your project name instead of lightstack).

3.2.2 Create the credential

First list the credential for the project

```
Unset
lbcli list credentials --project-name lightstack
```

The output will show that now credential exists for this new project

```
ID     Type     Usage Kind  Size
```


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Create the credential

```
Unset
lbcli --endpoint https://localhost:443 create credential --id=cred1
--project-name lightstack --type rsa256pubkey
${HOME}/.lightstack_keys/lightstackkey.pem
```

Output created

```
ID      Type         Usage Kind  Size
cred1   RSA Public Key  User      625 B
```

3.3.3 Create the JWT

We now need to create the JWT

```
Unset
lbcli create jwt --key-id lightstack:cred1 --key
${HOME}/.lightstack_keys/lightstackkey --role lightstack:admin
--issuer=root@example.com --subject=tenant
```

Output

```
eyJhbGciOiJSUzI1NiIsImtpZCI6ImxpZ2h0c3RhY2s6Y3JlZDEiLCJ0eXAiOiJKV1QifQ.eyJzdWIiOiJ0ZW5
hbnQiLCJhdWQiOiJMaWdodE9TIiwiZXhwIjoxNzQzNTkzMjUzLCJuYmYiOjE3NDEwMDEyNTMsImlhd
CI6MTc0MTAwMTI1MywianRpIjoiYzNkZGY1ZjgtNmFkYi00ZTEwLTk5N2ItYjIxYjRlNWVmNmQ1Iiwic
m9sZXMiOlsicHJvZDphZG1pbiJdfQ.xnBEy1_LKWg_6pik5tULgcj7duQC6IP1ztRCSWATJ5bdmxkuWmb
JFsulSZKkF9Vac_k9EICJM2QNfKAGwRYLKrNSQ81fbUPaqUwpjuWigunTm_5esoCtn7bj5o_QXdXB0Dy
KCWFd1p66iNfQMJV-fuIq-oNPOfLtonYg-75T3f44HywZsnoGrF3btS5ZxM57-SF_4-IJVK1QbxpknMW
ClqjG5q_YQz4ikvbmNWas9kXo_Bbm2dsdbQt_b3eAP7O-v5yH5G6__6C8SUbYGRJ0OpfULadLWNea-E_
nKmhmXWMR-IJR7Y-5_jhRoNIPYlvQWDcNjndRi0ALV5Kh-XN26ib53gsPESCT1SEVF8nuClcg41HZCzS
jJDI4yBUn8MGK953sCJRur7VVmQq5y2nGVmvcp_NXxH0RqjRmNQW1L9mTAyMIJOBU2SSzVg7z7e2
GmjWdRK9a3F22-ew7d2ErFAOtNM5I9xszzBf2aYQOplWhbDCrqaIw5jYOeDLH73pI
```

3.3.4 Verification of the JWT

Now let us verify that the JWT we just created is working for the new project.

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```
Unset
export
lightstack=eyJhbGciOiJSUzI1NiIsImtpZCI6ImxpZ2h0c3RhY2s6Y3JlZDEiLCJ0eXAiO
iJKV1QifQ.eyJzdWIiOiJ0ZW5hbnQiLCJhdWQiOiJMaWdodE9TIiwiZXhwIjoxNzQzNTkzMj
UzLCJuYmYiOjE3NDEwMDEyNTMsImlhdCI6MTc0MTAwMTI1MywianRpIjoiYzNkZGY1ZjgtNm
FkYi00ZTEwLTk5N2ItYjIxYjRlNWVmNmQ1Iiwicm9sZXMiOlsicHJvZDphZG1pbiJdfQ.xnB
Ey1_LKWg_6pik5tULgcj7duQC6IP1ztRCSWATJ5bdmxkuWmbJFsulSZKkF9Vac_k9EICJM2Q
NfKAGwRYLKrNSQ81fbUPaqUwpjuWigunTm_5esoCtn7bj5o_QXdXB0DyKCWFd1p66iNfQMJV
-fuIq-oNPOfLtonYg-75T3f44HywZsnoGrF3btS5ZxM57-SF_4-lJVK1QbxpknMWClqjG5q_
YQz4ikvbmNWas9kXo_Bbm2dsdbQt_b3eAP7O-v5yH5G6__6C8SUbYGRJ0OpfULadLWNea-E_
nKmhmXWMR-lJR7Y-5_jhRoNIPYlvQWDcNjndRi0ALV5Kh-XN26ib53gsPESCT1SEVF8nuClc
g41HZCzSjJDl4yBUn8MGK953sCJRur7VVmQq5y2nGVmvcp_NXxH0RqjRmNQW1L9mTAyMlJOB
U2SSzVg7z7e2GmjWdRK9a3F22-ew7d2ErFAOtNM5I9xszzBf2aYQOplWhbDCrqaIw5jYOeDL
H73pI
```

Create a new volume

```
Unset
lbcli -J $lightstack create volume --name vol1 --project-name lightstack
--size 10GiB --replica-count 3 --acl ALLOW_ANY --compression true
```

Output

```
Name    UUID                    State    Protection State  NSID    Size    Replicas  Compression  ACL
Rebuild Progress
vol1    7bd3d1a4-1ab6-48ba-a61b-2b6e5debfcc7  Creating  Unknown       0     10 GiB  3      true
values:"ALLOW_ANY"
```

Delete the just created volume

```
Unset
lbcli -J $lightstack delete volume --name vol1 --project-name lightstack
```

And check that the volume has been deleted

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```
Unset
lbcli list volumes --project-name lightstack
```

Output

```
Name    UUID    State    Protection State    NSID    Size    Replicas    Compression    ACL    Rebuild Progress
```

We are now done for Lightbits, the next steps are in OpenStack

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4. Configure Cinder to Use Lightbits

To unlock the full potential of **Lightbits storage** in your **OpenStack environment**, the first step is configuring the **cinder.conf** file. By default, you'll find it in the /etc/cinder directory, but here's where things get exciting—**not all parameters need to be hardcoded**.

Instead, leverage **Extra Specs** in volume types for greater flexibility. This allows you to offer **customized SLAs** using a **single storage backend**. Imagine providing tiered storage options effortlessly:

✅ **Gold** → **3 replicas** for maximum redundancy

Silver → **2 replicas** for balanced performance

✅ **Bronze** → **1 replica** for cost efficiency

All powered by the same backend—without cluttering your **cinder.conf** file. Simply configure the backend once and define volume types with the following **Extra Specs**:

- **compression**: <is> True or <is> False

  lightos:num_replicas: 1 | 2 | 3

  lightos:project_name: *(Best practice: Align with the Lightbits project naming convention)*

- **volume_backend_name**: *(As defined in cinder.conf)*

By embracing this approach, you gain **agility, scalability, and control**—ensuring that each tenant gets exactly what they need without unnecessary complexity.

4.1 Modify the cinder.conf File:

4.1.1 Adding the lightstack backend

Locate the cinder.conf configuration file on the OpenStack controller node. Edit the file with vi, vim or nano (whatever you prefer). Go to the end of the file and copy the text below in the file.

```
Unset
[lightstack]
volume_driver = cinder.volume.drivers.lightos.LightOSVolumeDriver
volume_backend_name = lightstack
lightos_api_address = <TARGET_ACCESS_IPS>
```


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```
lightos_api_port = 443
lightos_jwt = <lightstack>
lightos_api_service_timeout = 30
```

- Replace 192.168.1.41,192.168.1.42, 192.168.1.43 with the IP addresses of your Lightbits API endpoints.
- Set <lightstack> to the JSON Web Token obtained from Lightbits, when you created the token.

4.1.2 Enable the Backend:

In the [DEFAULT] section, append 'lightos' to the enabled_backends list:

```
Unset
enabled_backends = <existing ones>,lightstack
```

Please restart the cinder services

```
Unset
sudo systemctl restart openstack-cinder-api
sudo systemctl restart openstack-cinder-scheduler
sudo systemctl restart openstack-cinder-volume
```


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5. OpenStack Project Configuration - CLI

In this chapter the guidelines are taking you through the cli from OpenStack.

5.1 Create a New Project

Go to the OpenShift Cluster Master and login as administrator on the cli to manage the openstack environment. To create a new project, please type the following command:

```
Unset
openstack project create --description "Lightstack Project" lightstack
```

Output

```
+-------------+----------------------------------------------------+
| Field       | Value                                              |
+-------------+----------------------------------------------------+
| description| Lightstack Project                                  |
| domain_id   | default                                            |
| enabled     | True                                               |
| id          | 16071c2a13694fd1ae300d21d4efddbe |
| is_domain   | False                                              |
| name        | lightstack                                         |
| options     | {}                                                 |
| parent_id   | default                                            |
| tags        | []                                                 |
+-------------+----------------------------------------------------+
```

5.1.1 Create a new user for the project

First, create a user within the lightstack project. You can assign the manager role to this user, which will allow them to manage all services within the project.

```
Unset
openstack user create --domain default --project lightstack --password
<user_password> lightstack
```


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Output

```
+-------------------------+--------------------------------------------------+
| Field                   | Value                                            |
+-------------------------+--------------------------------------------------+
| default_project_id      | 16071c2a13694fd1ae300d21d4efddbe |
| domain_id               | default                                          |
| email                   | None                                             |
| enabled                 | True                                             |
| id                      | 681b4bc3ad8f4609b81a4157ba3ec31b |
| name                    | lightstack                                       |
| description             | None                                             |
| password_expires_at | None                                             |
+-------------------------+--------------------------------------------------+
```

Assign the manager role to the new user

```
Unset
openstack role add --project lightstack --user lightstack manager
```

There is no output provided for the above command.

Please also make sure that the admin of OpenStack also has access to the new project

```
Unset
openstack role add --project lightstack --user admin admin
```

There is no output provided for the above command.

5.2 Volume Type Management

For the Volume Type we will create three types and they will be accordingly:

- lightstack Gold, 3 copies and with compression enabled
- lightstack Silver, 2 copies and with compression enabled
- lightstack Bronze, 1 copy and compression disabled

All the volume types will be Non-public and will be assigned to the project specifically.

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5.2.1 Create the volume types

For lightstack-Gold

```
Unset
openstack volume type create --property compression='<is> True'
--property lightos:num_replicas=3 --property
lightos:project_name=lightstack --property
volume_backend_name=lightstack --private lightstack-Gold
```

Output

```
+-------------+-----------------------------------------------------------------------------------------------------------------+
| Field       | Value                                                                                                           |
+-------------+-----------------------------------------------------------------------------------------------------------------+
| description | None                                                                                                            |
| id          | fffb35eb-2b42-4c16-a5f7-aa093bd4e20d                                                                            |
| is_public   | False                                                                                                           |
| name        | lightstack_Gold                                                                                                 |
| properties  | compression='<is> True', lightos:num_replicas='3', lightos:project_name='lightstack',
volume_backend_name='lightstack'                                                                                        |
+-------------+-----------------------------------------------------------------------------------------------------------------+
```

5.3 Create a new Network

A new network needs to be created for this new project. The steps are the following:

- Create the new network
- Create a subnet for the new network
- Verify the network and subnet settings
- Assign the network to the correct project

5.3.1 Create the network

OpenStack networks are owned by projects, we need to retrieve the project id for project lightstack
The command to fetch the project id is as follows:

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```
Unset
openstack project show lightstack -c id -f value
```

Output

```
2276907c048c47a6b8cf952d6d613950
```

The command to create the new network is as follows:

```
Unset
openstack network create lightstack --internal --project
2276907c048c47a6b8cf952d6d613950
```

Output

```
+-----------------------------+------------------------------------------------------+
| Field                       | Value                                                |
+-----------------------------+------------------------------------------------------+
| admin_state_up              | UP                                                   |
| availability_zone_hints     |                                                      |
| availability_zones          |                                                      |
| created_at                  | 2025-03-04T11:12:29Z                                 |
| description                 |                                                      |
| dns_domain                  | None                                                 |
| id                          | 2319e175-a98d-4240-827b-cf5e0684ca5d                 |
| ipv4_address_scope          | None                                                 |
| ipv6_address_scope          | None                                                 |
| is_default                  | None                                                 |
| is_vlan_transparent         | None                                                 |
| mtu                         | 1442                                                 |
| name                        | lightstack                                           |
| port_security_enabled       | True                                                 |
| project_id                  | 2276907c048c47a6b8cf952d6d613950                     |
| provider:network_type       | geneve                                               |
| provider:physical_network   | None                                                 |
| provider:segmentation_id    | 4089                                                 |
| qos_policy_id               | None                                                 |
| revision_number             | 1                                                    |
| router:external             | Internal                                             |
| segments                    | None                                                 |
| shared                      | False                                                |
| status                      | ACTIVE                                               |
| subnets                     |                                                      |
| tags                        |                                                      |
| updated_at                  | 2025-03-04T11:12:30Z                                 |
+-----------------------------+------------------------------------------------------+
```


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5.3.2 Create the subnet

The command to create the new subnet is as follows:

```
Unset
openstack subnet create lightstack-subnet \
--network lightstack \
--subnet-range 192.168.10.0/24 \
--dns-nameserver 8.8.8.8 \
--project 2276907c048c47a6b8cf952d6d613950
```

Output

```
+-------------------------+------------------------------------------------------+
| Field                   | Value                                                |
+-------------------------+------------------------------------------------------+
| allocation_pools        | 192.168.10.2-192.168.10.254                          |
| cidr                    | 192.168.10.0/24                                      |
| created_at              | 2025-03-04T11:31:23Z                                 |
| description             |                                                      |
| dns_nameservers         | 8.8.8.8                                              |
| dns_publish_fixed_ip    | None                                                 |
| enable_dhcp             | True                                                 |
| gateway_ip              | 192.168.10.1                                         |
| host_routes             |                                                      |
| id                      | c2ad4eee-7654-46a4-92f1-9dd6fe7c8dfa                 |
| ip_version              | 4                                                    |
| ipv6_address_mode       | None                                                 |
| ipv6_ra_mode            | None                                                 |
| name                    | lightstack-subnet                                    |
| network_id              | 2319e175-a98d-4240-827b-cf5e0684ca5d                 |
| project_id              | 2276907c048c47a6b8cf952d6d613950                     |
| revision_number         | 0                                                    |
| router:external         | False                                                |
| segment_id              | None                                                 |
| service_types           |                                                      |
| subnetpool_id           | None                                                 |
| tags                    |                                                      |
| updated_at              | 2025-03-04T11:31:23Z                                 |
+-------------------------+------------------------------------------------------+
```


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5.4 Create a New Instance

To create a new instance you need to have your image, flavor and your security group.
To check your images, the command is as follows:

```
Unset
openstack image list
```

Output

```
+--------------------------------------------------+------------------------------+--------+
| ID                                               | Name                         | Status |
+--------------------------------------------------+------------------------------+--------+
| a7f01c93-a3e1-4be0-962f-2dac6ef2e34b | cirros-0.6.3-x86_64-disk | active |
+--------------------------------------------------+------------------------------+--------+
```

To check your flavors, the command is as follows:

```
Unset
openstack flavor list
```

Output

```
+---+----------------+---------+------+-------------+---------+-----------+
| ID | Name          |  RAM    | Disk | Ephemeral | VCPUs | Is Public |
+---+----------------+---------+------+-------------+---------+-----------+
| 1   | m1.tiny       |  512    |  1    |            0 |        1 | True      |
| 2   | m1.small      | 2048  |  20   |            0 |        1 | True      |
| 3   | m1.medium | 4096  |  40   |            0 |        2 | True      |
| 4   | m1.large      | 8192  |  80   |            0 |        4 | True      |
| 42 | m1.nano       |  192    |  1    |            0 |        1 | True      |
| 5   | m1.xlarge    | 16384 |  160  |            0 |        8 | True      |
| 84 | m1.micro     |  256    |  1    |            0 |        1 | True      |
| c1 | cirros256    |  256    |  1    |            0 |        1 | True      |
| d1 | ds512M       |  512    |  5    |            0 |        1 | True      |
| d2 | ds1G         | 1024  |  10   |            0 |        1 | True      |
| d3 | ds2G         | 2048  |  10   |            0 |        2 | True      |
```


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```
| d4 | ds4G          | 4096  |  20   |            0 |          4 | True      |
+---+---------------+---------+------+--------------+----------+-----------+
```

To check your security groups, the command is as follows:

```
Unset
openstack security group list
```

Output

```
+--------------------------------------------------+---------+---------------------------+-----------------------------------------------+------+
| ID                                               | Name    | Description               | Project                                       | Tags |
+--------------------------------------------------+---------+---------------------------+-----------------------------------------------+------+
| 3ec825e1-c434-401c-9fba-cce623ab9c00 | default | Default security group | 2276907c048c47a6b8cf952d6d613950 | []   |
+--------------------------------------------------+---------+---------------------------+-----------------------------------------------+------+
```

The command to create a new instance is as follows:

```
Unset
openstack server create \
  --image cirros-0.6.3-x86_64-disk \
  --flavor cirros256\
  --network lightstack \
  --security-group default \
  lightstack-instance
```

Output

```
+-------------------------------------------------+-------------------------------------------------------------------------------------------+
| Field                                           | Value                                                                                     |
+-------------------------------------------------+-------------------------------------------------------------------------------------------+
| OS-DCF:diskConfig                               | MANUAL                                                                                    |
| OS-EXT-AZ:availability_zone                     | None                                                                                      |
|OS-EXT-SRV-ATTR:host                             | None                                                                                      |
| OS-EXT-SRV-ATTR:hostname                        | lightstack-instance                                                                       |
| OS-EXT-SRV-ATTR:hypervisor_hostname             | None                                                                                      |
| OS-EXT-SRV-ATTR:instance_name                   | None                                                                                      |
| OS-EXT-SRV-ATTR:kernel_id                       | None                                                                                      |
| OS-EXT-SRV-ATTR:launch_index                    | None                                                                                      |
| OS-EXT-SRV-ATTR:ramdisk_id                      | None                                                                                      |
| OS-EXT-SRV-ATTR:reservation_id                  | None                                                                                      |
| OS-EXT-SRV-ATTR:root_device_name                | None                                                                                      |
| OS-EXT-SRV-ATTR:user_data                       | None                                                                                      |
| OS-EXT-STS:power_state                          | N/A                                                                                       |
```


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```
| OS-EXT-STS:task_state            | scheduling                                   |
| OS-EXT-STS:vm_state              | building                                     |
| OS-SRV-USG:launched_at           | None                                         |
| OS-SRV-USG:terminated_at         | None                                         |
| accessIPv4                       | None                                         |
| accessIPv6                       | None                                         |
| addresses                        | N/A                                          |
| adminPass                        | N6GqYtcvX4zU                                 |
| config_drive                     | None                                         |
| created                          | 2025-03-04T12:55:45Z                         |
| description                      | None                                         |
| flavor                           | description=, disk='1', ephemeral='0', extra_specs.hw_rng:allowed='True', id='cirros256',
is_disabled=,     ||| is_public='True', location=, name='cirros256', original_name='cirros256', ram='256', rxtx_factor=, swap='0', |
|    | vcpus='1'                                                                      |
| hostId                           | None                                         |
| host_status                      | None                                         |
| id                               | 542eaa09-aca7-4a39-a28f-678523f70fdf         |
| image                            | cirros-0.6.3-x86_64-disk (a7f01c93-a3e1-4be0-962f-2dac6ef2e34b) |
| key_name                         | None                                         |
| locked                           | None                                         |
| locked_reason                    | None                                         |
| name                             | lightstack-instance                          |
| pinned_availability_zone         | None                                         |
| progress                         | None                                         |
| project_id                       | 2276907c048c47a6b8cf952d6d613950             |
| properties                       | None                                         |
| security_groups                  | name='3ec825e1-c434-401c-9fba-cce623ab9c00'  |
| server_groups                    | None                                         |
| status                           | BUILD                                        |
| tags                             |                                              |
| trusted_image_certificates       | None                                         |
| updated                          | 2025-03-04T12:55:45Z                         |
| user_id                          | 4ee401a30da444e283b5133f9f0be6f9             |
| volumes_attached                 |                                              |
+----------------------------------+----------------------------------------------+
```

5.5 Create a new Volume

The command to create a new volume is as follows:

```
openstack volume create --size 20 --type lightstack-Gold Vol1
```


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Output

```
+------------------------+------------------------------------------------------+
| Field                  | Value                                                |
+------------------------+------------------------------------------------------+
| attachments            | []                                                   |
| availability_zone      | nova                                                 |
| bootable               | false                                                |
| consistencygroup_id | None                                                   |
| created_at             | 2025-03-04T15:36:40.865787                           |
| description            | None                                                 |
| encrypted              | False                                                |
| id                     | f3168eda-5897-45b3-b060-369adbda8efa |
| multiattach            | False                                                |
| name                   | Vol1                                                 |
| properties             |                                                      |
| replication_status     | None                                                 |
| size                   | 20                                                   |
| snapshot_id            | None                                                 |
| source_volid           | None                                                 |
| status                 | creating                                             |
| type                   | lightstack-Gold                                      |
| updated_at             | None                                                 |
| user_id                | 4ee401a30da444e283b5133f9f0be6f9                     |
+------------------------+------------------------------------------------------+
```

The next step is to attach the volume to the instance. The command is as follows:

```
Unset
openstack server add volume lightstack-instance Vol1
```

Output

```
+-----------------------------+------------------------------------------------------+
| Field                       | Value                                                |
+-----------------------------+------------------------------------------------------+
| ID                          | f3168eda-5897-45b3-b060-369adbda8efa |
| Server ID                   | 542eaa09-aca7-4a39-a28f-678523f70fd    |
| Volume ID                   | f3168eda-5897-45b3-b060-369adbda8efa |
| Device                      | /dev/vdb                                             |
| Tag                         | None                                                 |
| Delete On Termination | False                                                |
+-----------------------------+------------------------------------------------------+
```


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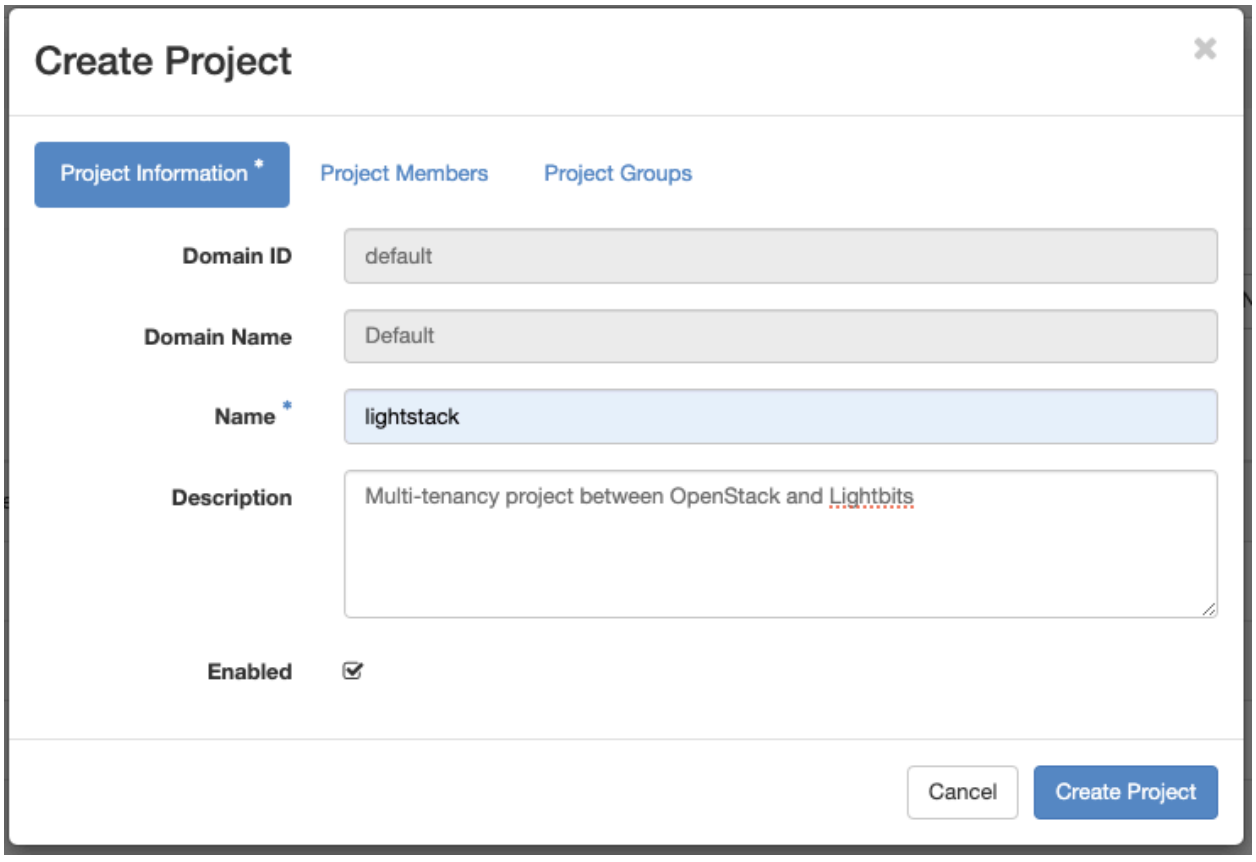
6. OpenStack Project Configuration - Horizon

In this chapter the guidelines are taking you through Horizon from OpenStack.

6.1 Create a new project

To create a new project in Horizon, login as the administrator in Horizon. Click on the left menu bar on Identity and then on Projects. On the right side click on the button "+ Create Project". The following screen appears:



Fill in the fields Name and the Description, leave everything else as is and click on the button "Create Project".

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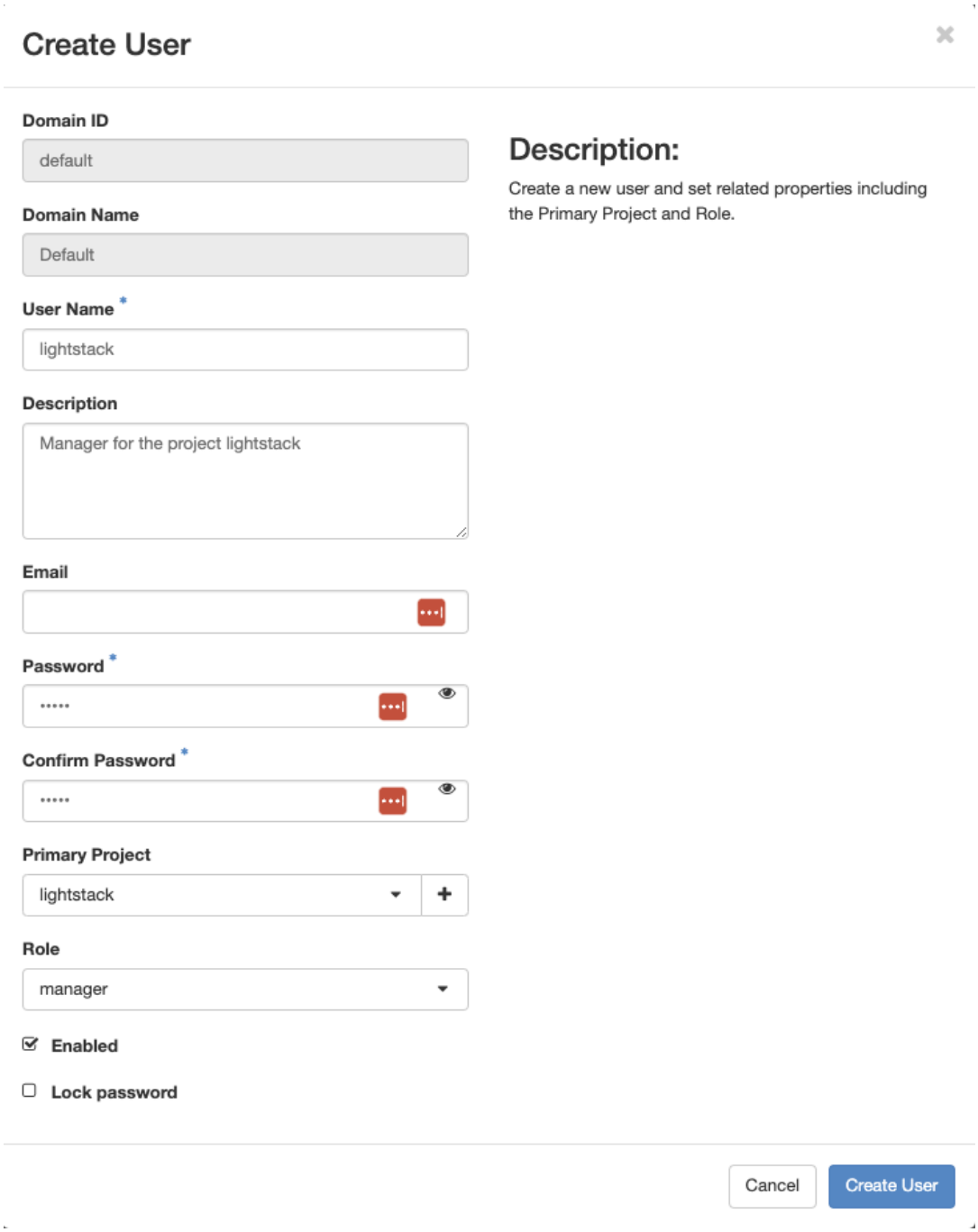
The next step is to create a user and add that user as the manager for the new project. To create a new user in Horizon, login as the administrator in Horizon. Click on the left menu bar on Identity and then on users. On the right side click on the button "+ Create User". The following screen appears:



Please fill in the fields as the example above, please make sure you use your project name as well, and click on the button “Create User".

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6.2 Volume Type Management

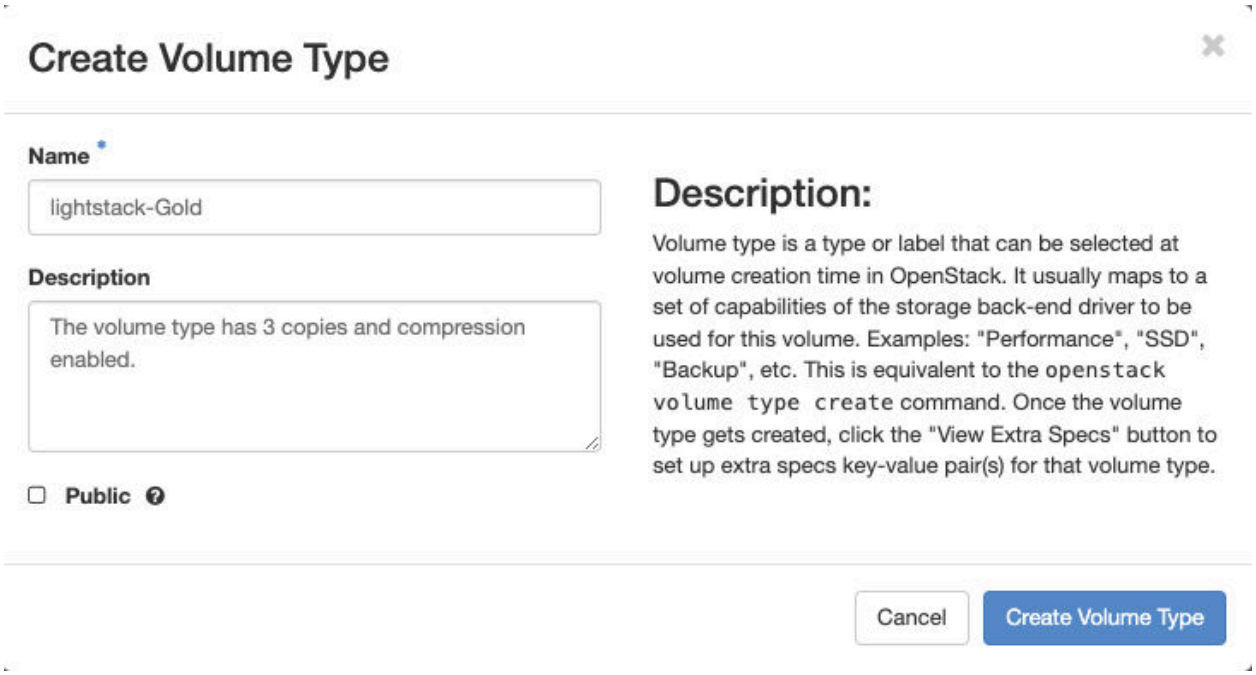
For the Volume Type we will create three types and they will be accordingly:

- lightstack Gold, 3 copies and with compression enabled
- lightstack Silver, 2 copies and with compression enabled
- lightstack Bronze, 1 copy and compression disabled

All the volume types will be Non-public and will be assigned to the project specifically.

6.2.1 Create the volume types

From the left menu bar please select Admin->Volumes->Volume Types and click on the button “+Create Volume Type” located on the right side of the screen. The following screen appears:



Please fill in the name of the volume type and the description, also make sure that Public is ticked off, and click on the button “Create Volume Type".

Once the volume type has been created on the right side of the screen you can select an action called “View Extra Specs”. Click on it and on the following screen click on the button "Create". On this screen we can add the first “Extra Specs".

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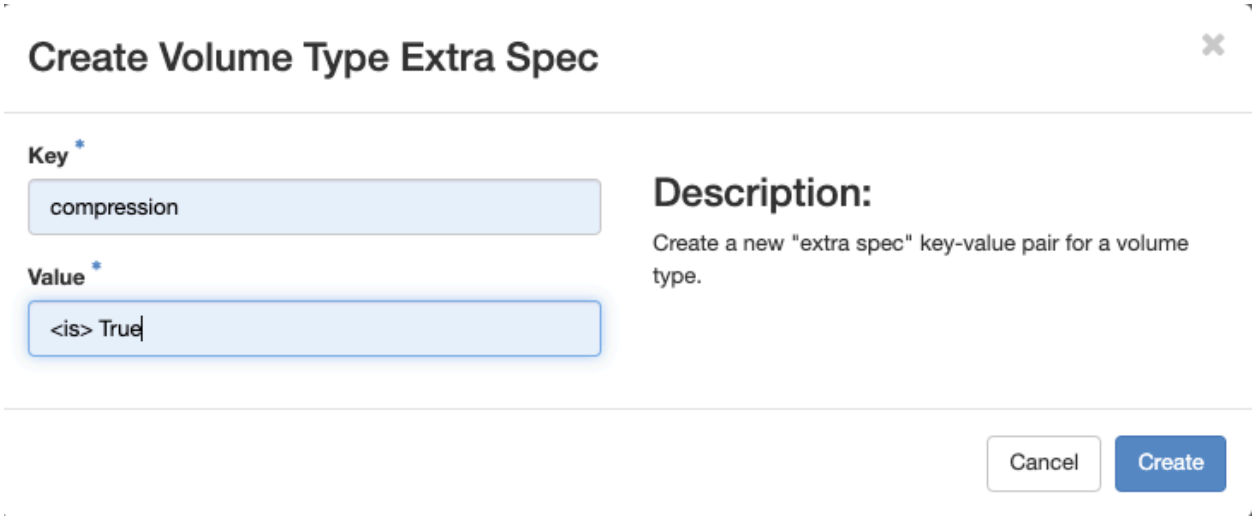
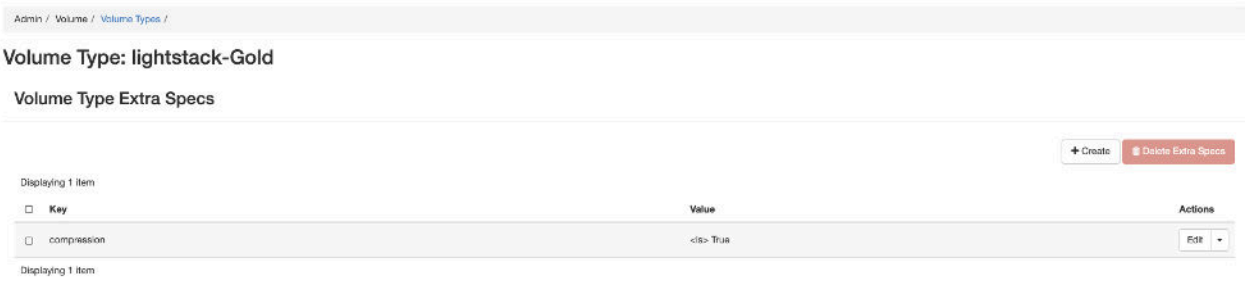


This example above enables compression. Click on the button "Create" and the following screen will appear:



To add another “Extra Specs” clik on the button “+ Create". The same screen appears as in the first added Extra Spec. The following “Extra Specs” will need to be added:

Name	Value
lightos:num_replicas	3
lightos:project_name	lightstack
volume_backend_name	lightstack

Once done, then the “Extra Specs” screen will look as follows:

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Do the same for lightstack-Silver and lightstack-Bronze. ”The Extra Specs” screen for lightstack-Silver will look like:

And for lightstack-Bronze it will look like:

The last step is to assign the Volume Types to the correct project. From the left menu bar Admin->Volume->Volume Type. Look at the right side of the screen and click on the action “Edit Access”. Please click on the project lightstack and click on "Save”.

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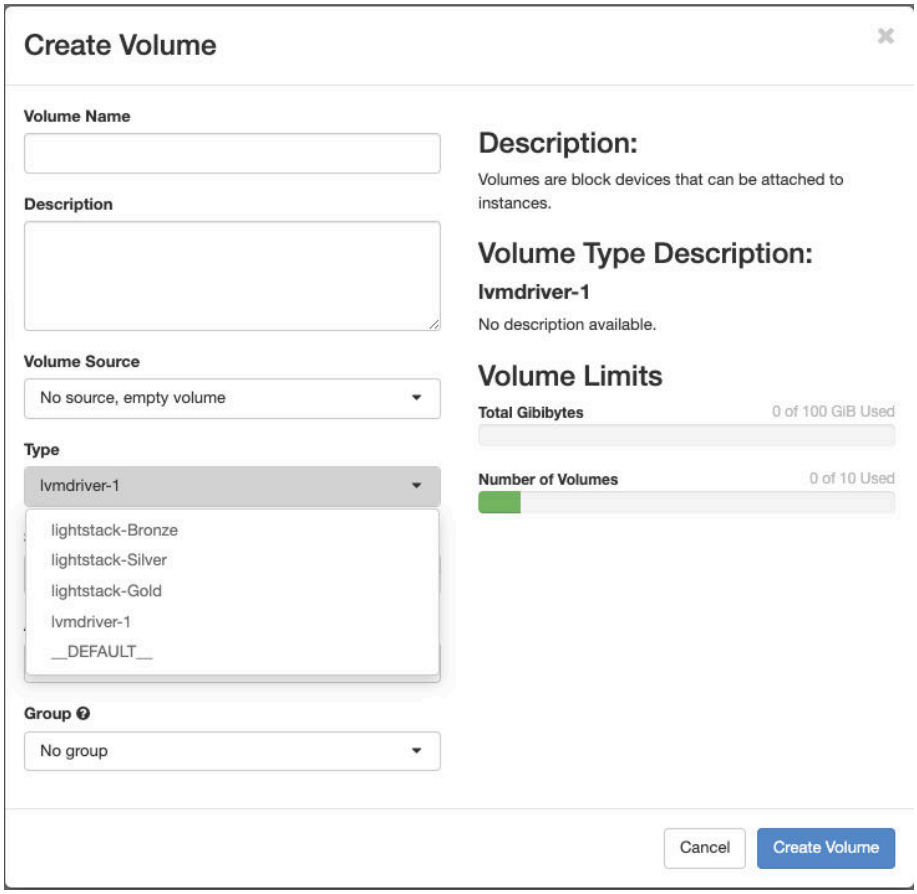
Please make sure to do this for all three Volume Types.

To verify please log out as administrator and login the project lightstack with the created user. Once logged, from the left menu bar go to Volumes->Volume. Click on the button called “+ Create Volume” and the following screen will appear. Click on the dropdown box for Type and you will see the Volume Types you just created.



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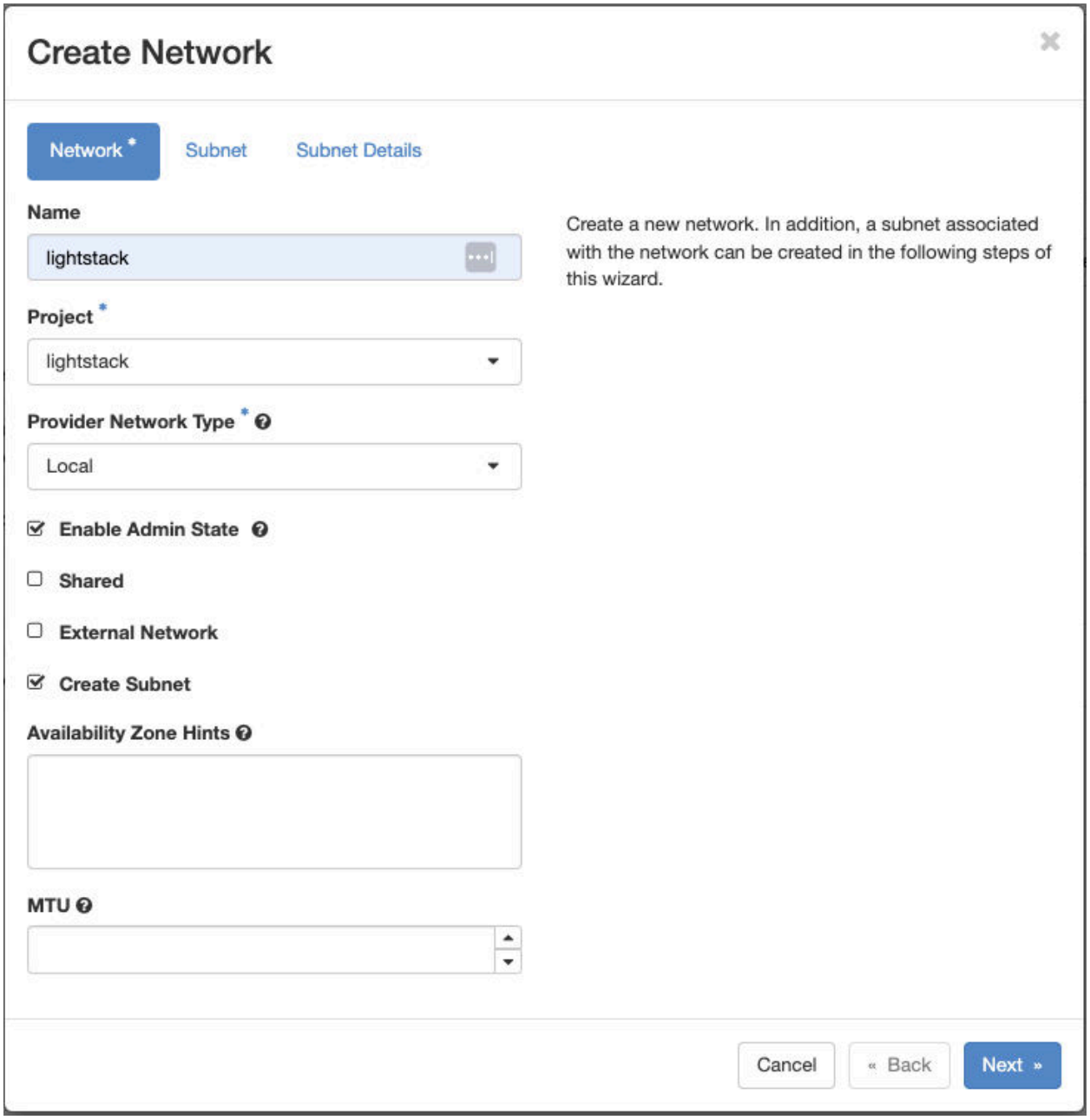
6.3 Create a new Network

From the left menu bar please select Admin->Networks->Network. On the right side of the screen please click on the button “+ Create Network". The following screen will appear:



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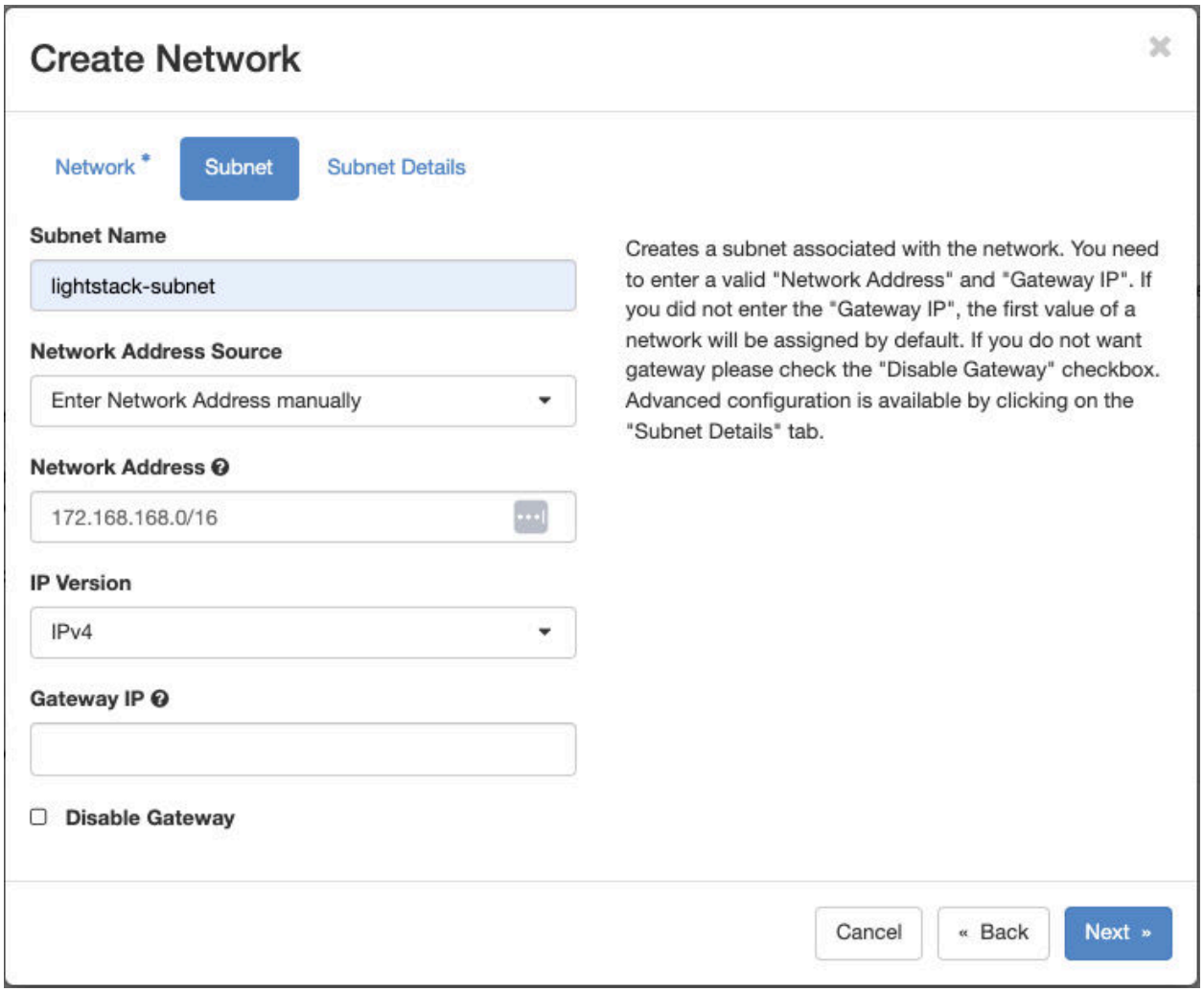
Please select the network type as is fit for your environment and click on the button “Next". The following screen will appear:



Please adjust to what you have in your network environment. And click on the button “Next". The following screen will appear:

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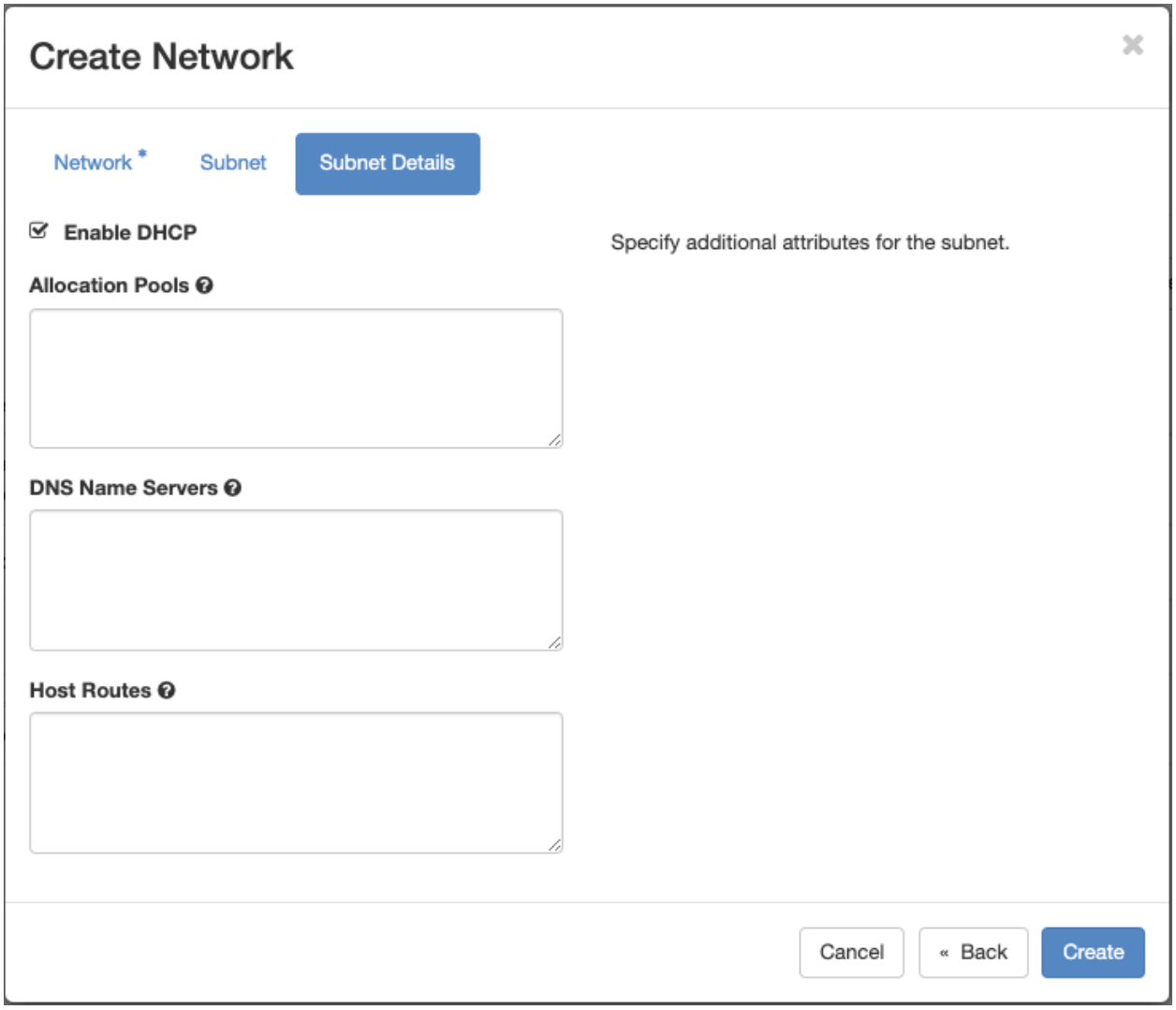

Please fill in the details as is required for your network environment. Per this example we simply use DHCP. Please click on the button “Create". And the Network has been created:

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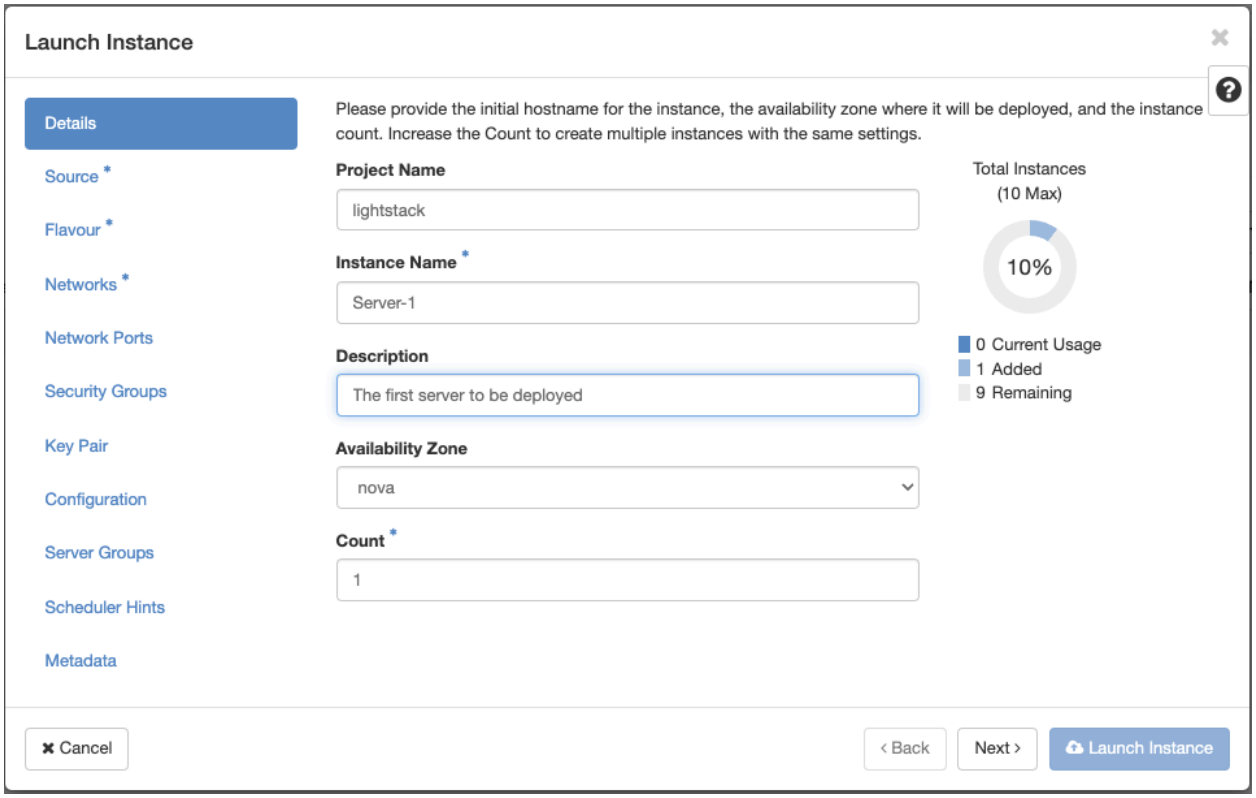
6.4 Create a new Instance

Now that the network has been created, please login with the user for the project lightstack. From the left menu bar please select Compute->Instances. Click on the far right button “Launch Instance". And the following screen will appear:



Please fill in the field and click on the button “Next". The following screen will appear:

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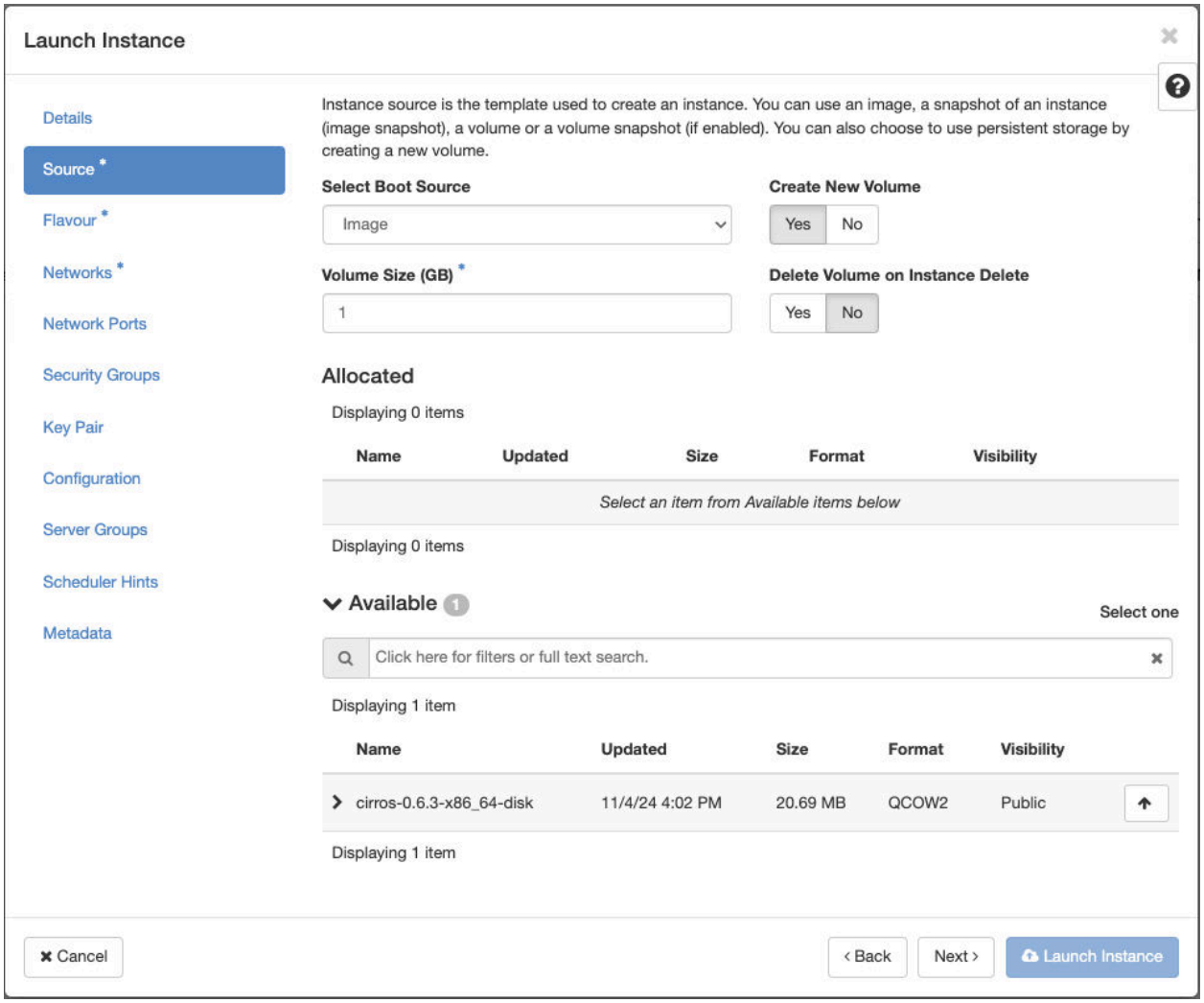

Select the source, in this case only cirros-0.6.3-x86_64-disk. Click on the up arrow on the right, and the screen will look like this:

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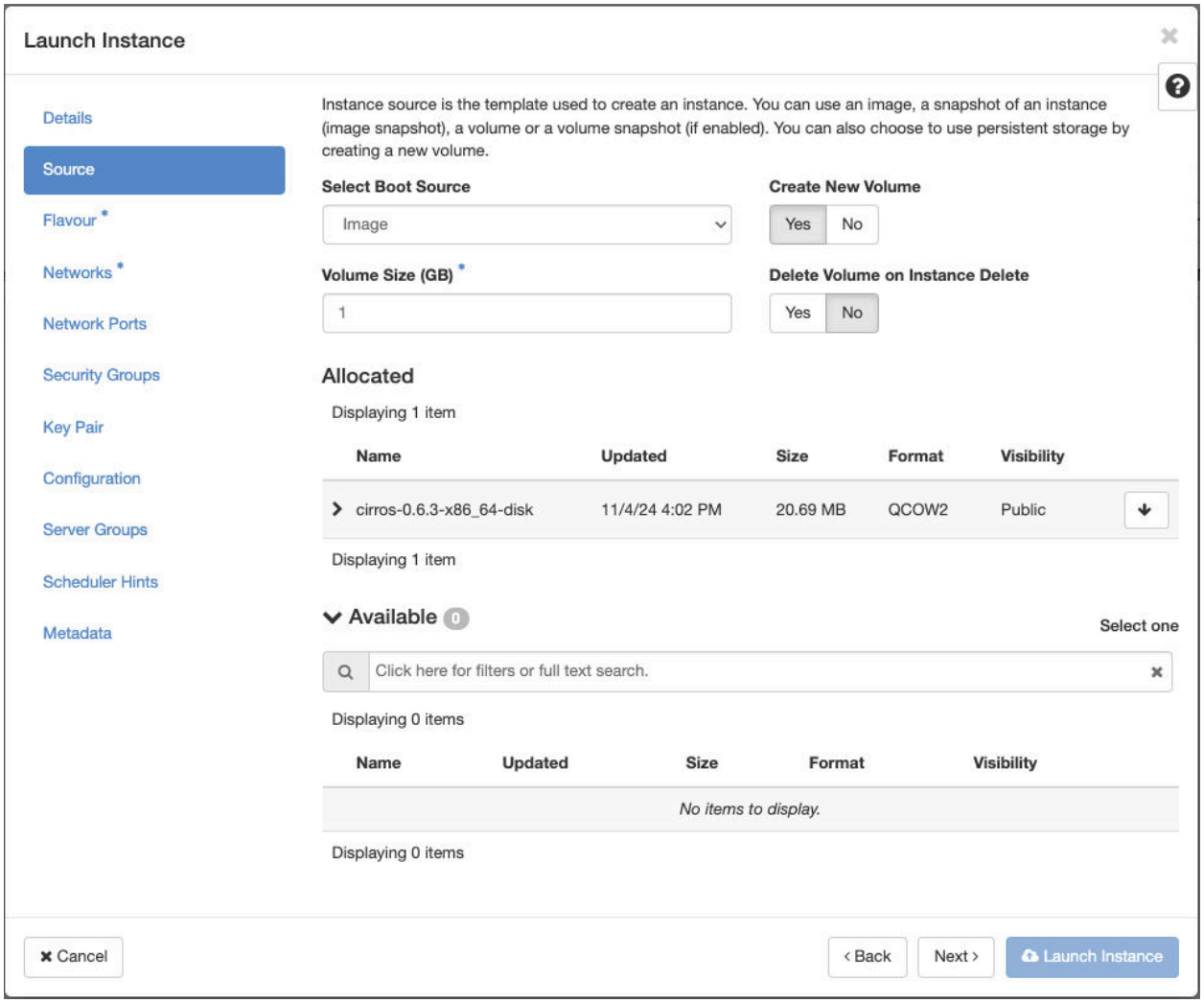

Click on the button Next and the following screen will appear:

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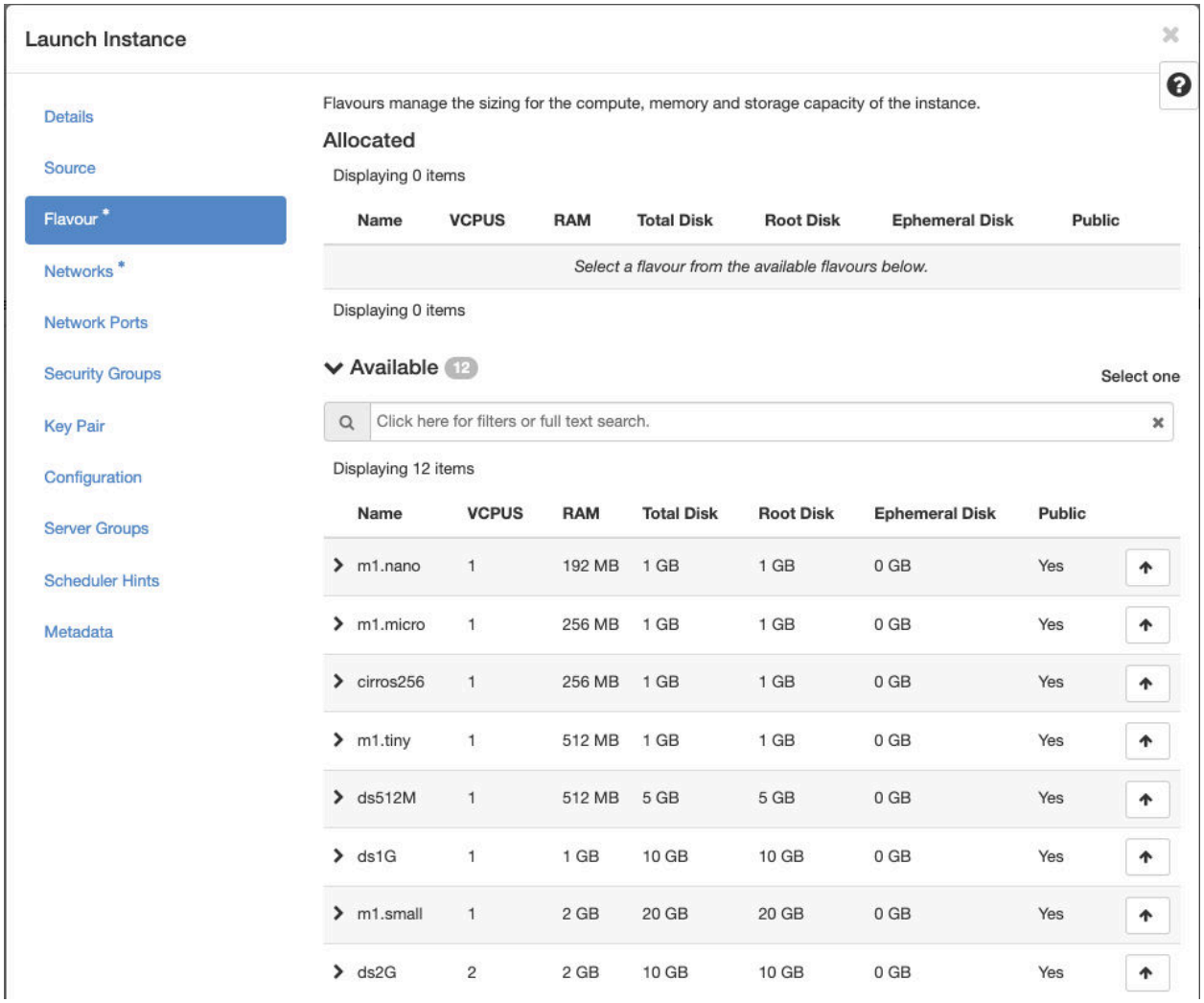

In this case we selected the cirros256 with the up arrow on the right site. The screen will look like this:

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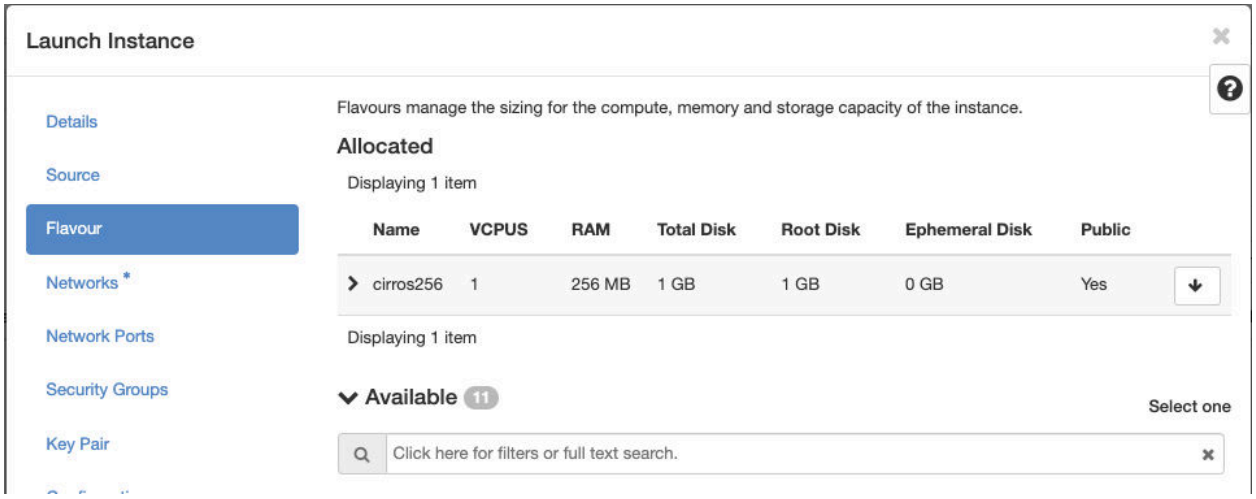
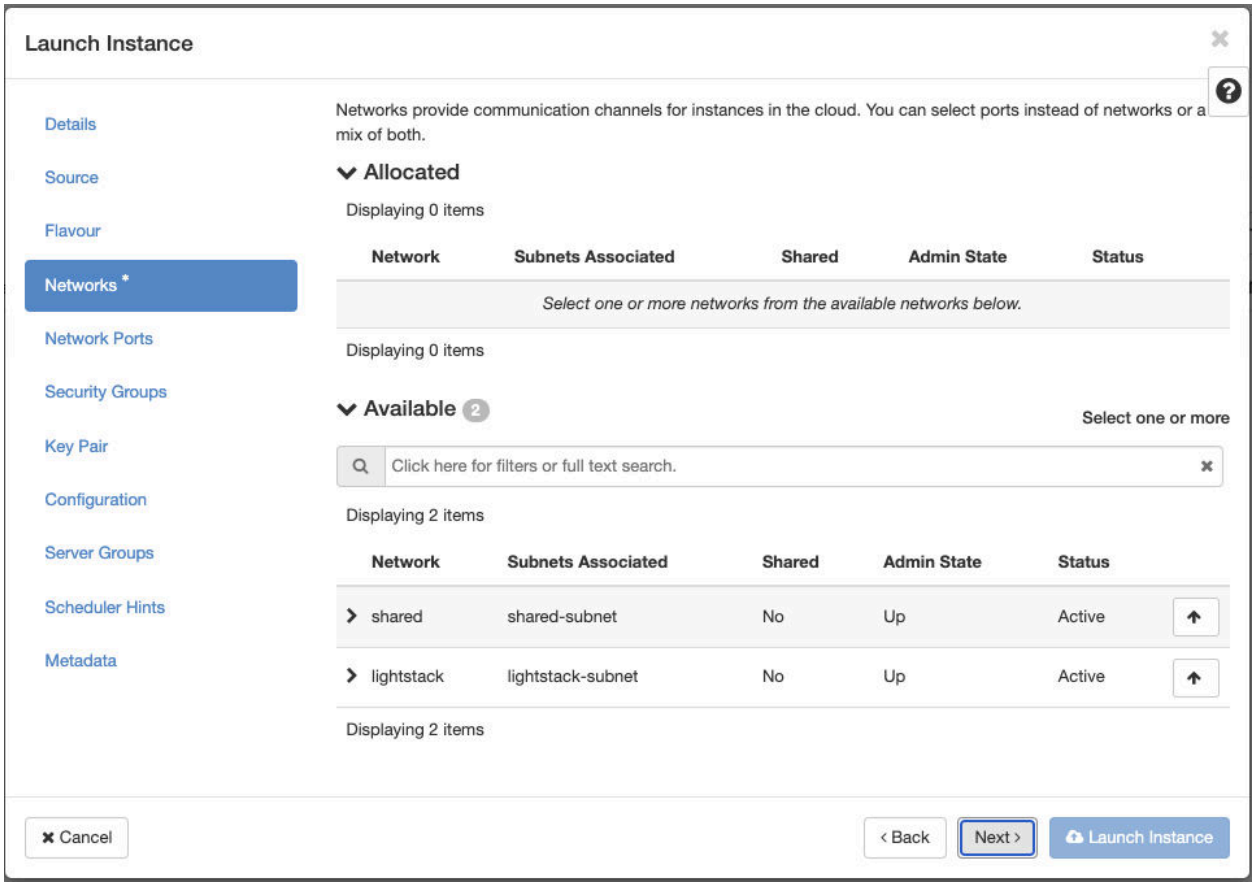


Click on the button "Next" and the following screen will appear:



Click on the up arrow on the right site for the lightstack network. The screen will be updated like this:

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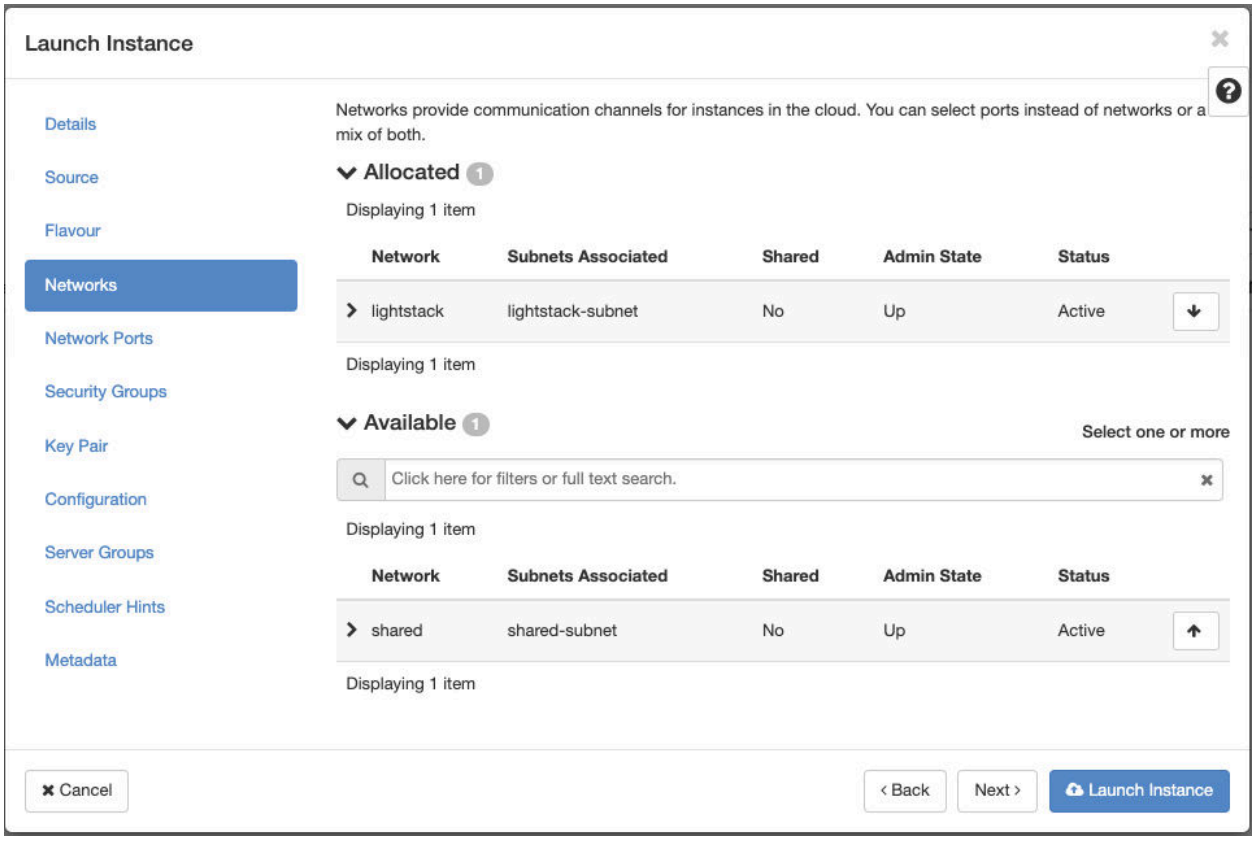

The other screens are not required for this white paper purpose. Please click on the button “Launch Instance". The instance has been created:

6.5 Create a New Volume

Now that we have created the instance, it is time to create a volume and attach that volume to this new instance. Before we created and attached the new volume, the current situation is as follows:

```
$ lsblk
NAME    MAJ:MIN RM  SIZE RO TYPE MOUNTPOINTS
vda     252:0    0    1G  0 disk
|-vda1  252:1    0 1015M  0 part /
`-vda15 252:15   0    8M  0 part
$ _
```


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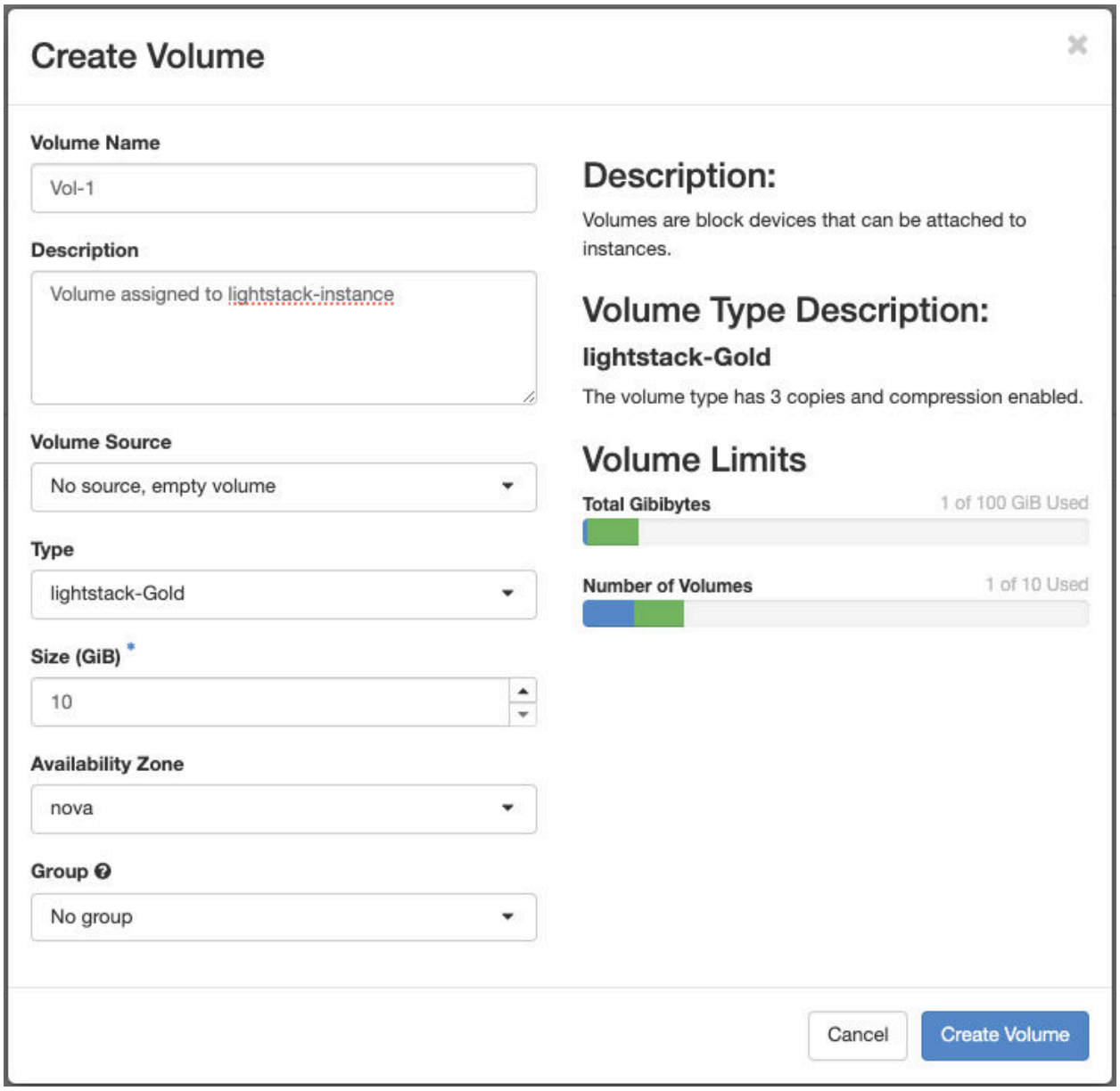
From the left menu select Volumes->Volumes. On the right side click on the button “+Create Volume” and the following screen will appear.



Leave the volume source at “No source, empty volume” and from the Type we just selected the lightstack-Gold, which provides 3x replicas and compression. The Size is 10GiB. Next thing is to click on the button “Create Volume".

And the volume has been created:

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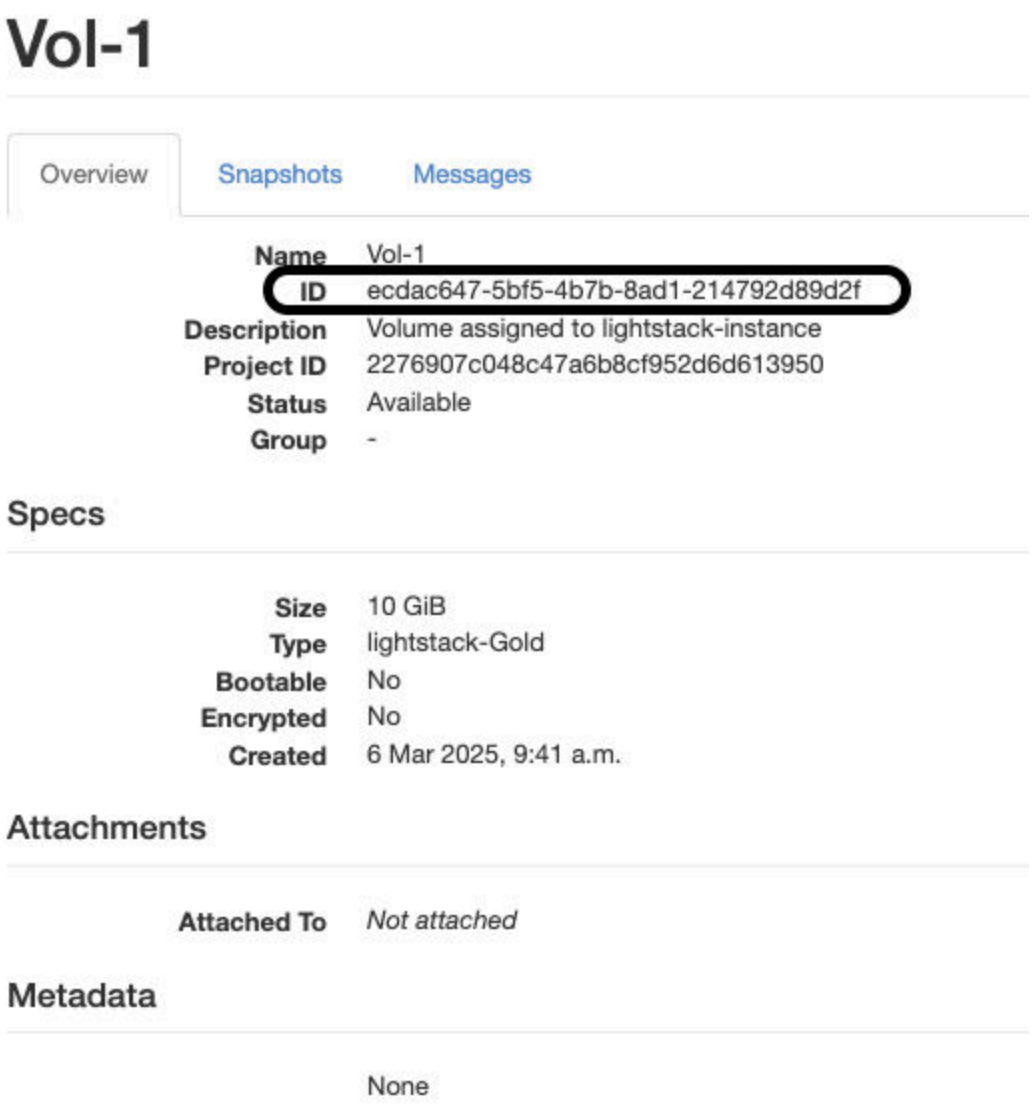
Click on the Vol-1 and look at the details of the volume. The following screen appears:



Although the volume was called Vol-1, the ID has been sent to Lightbits. In this way multi-tenants can create the same volume name, but it will have its own ID on Lightbits.

To validate whether the volumes exists on Lightbits, here is a screenshot from Photon (UI for Lightbits).

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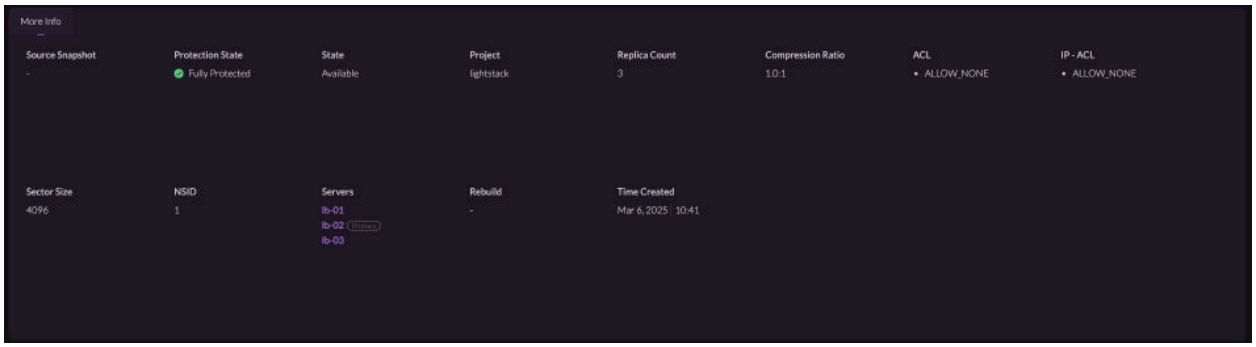
The volume id is the same, ecdac647-5bf5-4b7b-8ad1-214792d89d2f, the capacity is 10GiB, the Replica Count is 3 and the compression is active.

When clicked on the volume to get more details, it shows that the ACL and the IP-ACL have not been set. That means that no client has access to the volume yet. Another thing to notice is that the server lb-02 has become the primary server for this volume.



Now the volume can be attached to the instance lightstack-instance. From the left menu-bar in OpenStack go to Volumes->Volumes. On the row for Vol-1 on the right site there is an Actions dropdown box. From that dropdown box, select “Manage Attachment” and the following screen appears:

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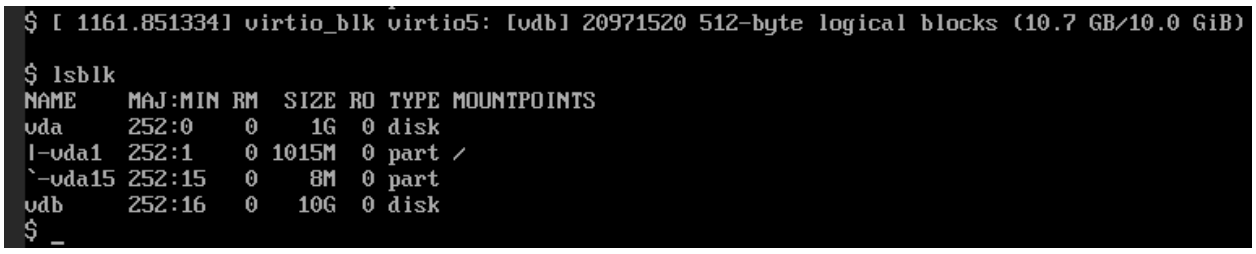
Select the instance Server-1 and click on “Attach Volume".

The volume has been attached to Server-1 as /dev/vdb. Check on the Server-1 show the following disks. From the left menu bar select Compute->Instances. Click on the instance Server-1 and click on Console. Run the command lsblk and the disk shows up as vdb with 10G as space allocation.



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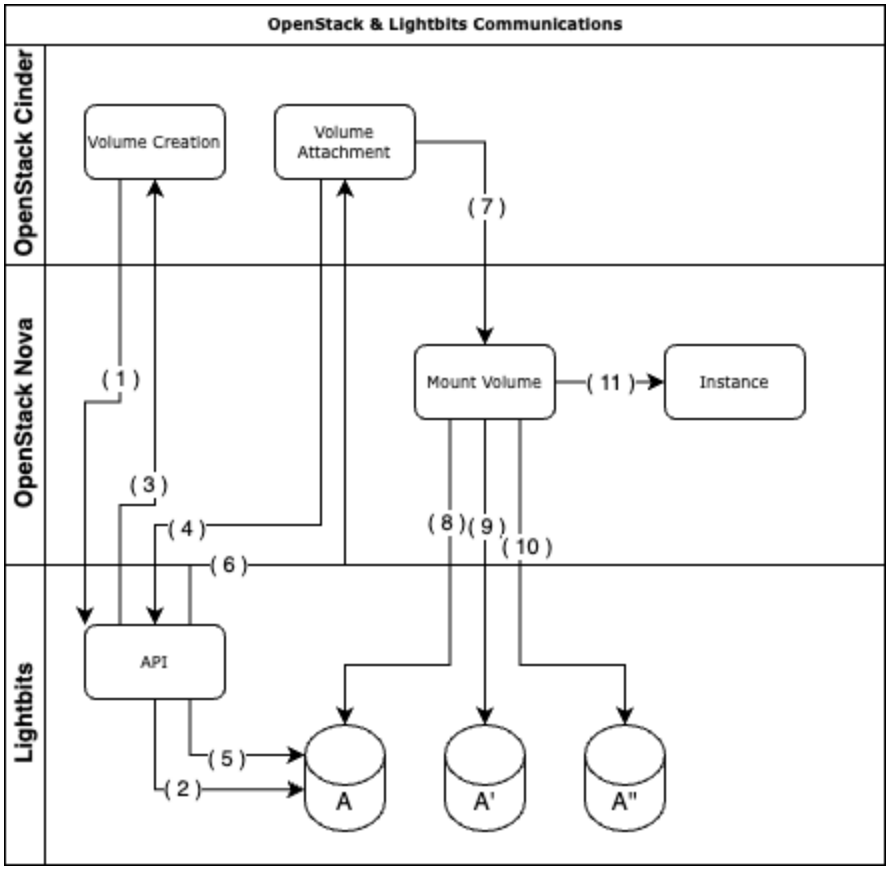
7. Process Structure Diagram

To understand the communication between OpenStack Master, Cinder, Lightbits and Nova the following overview has been created:



1. OpenStack creates a volume by communicating to the Lightbits API
2. Lightbits creates the volume and also the replicas
3. Lightbits confirms to Cinder that the volume has been created
4. OpenStack Attached the volume and provides the hostnqn and IP addresses to the Lightbits API
5. Lightbits API sets the hostnqn on the ACL and the IP addresses on the IP-ACL
6. Lightbits confirms that the command has been processed
7. OpenStack inform the Nova server that the volume can be mounted
8. The Nova server connects to the primary volume through the optimized path
9. The Nova server connects to the A' as inactive path
10. The Nova server connects to the A'' as inactive path
11. The Nova server informs the instance that a new volume has been provided and the instance has access to the volume

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8. Conclusion

Seamless, Secure, and Scalable: The Future of OpenStack Storage with VirtIO and Lightbits

In the world of cloud infrastructure, agility, security, and simplicity define the difference between a good deployment and a great one. Imagine a world where OpenStack tenants enjoy seamless, high-performance storage without ever seeing the complexity underneath—no exposed networks, no API risks, no additional VLAN headaches. That's the power of Lightbits combined with OpenStack and VirtIO.

By leveraging the VirtIO driver, OpenStack instances connect effortlessly to Lightbits volumes, ensuring that tenants get the storage they need without ever seeing—or managing—the storage network. Unlike traditional approaches that expose IP addresses, JWTs, or network elements, this setup keeps the storage infrastructure completely invisible to the tenant. The result? A dramatically reduced attack surface and enhanced security with no risk of unauthorized API calls or storage manipulations.

Beyond security, this solution eliminates operational complexity. No special VLANs are required, simplifying network configuration while maintaining performance and reliability at scale. This is cloud storage the way it was meant to be—fast, secure, and hassle-free.

With VirtIO and Lightbits, OpenStack operators can finally deliver the perfect balance of security, efficiency, and performance. No compromises. No unnecessary exposure. Just seamless, high-performance storage that works—out of sight, but never out of mind.

To learn more about Lightbits Labs, visit https://www.lightbitslabs.com.

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