

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.





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



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

 default
 dc4c46e4-cb83-5df6-b84a-8beae38ac43c

 acme
 f26153be-e9a4-4808-9ab8-3d2e39db837d

Description This is default project description 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 lightstack 2a019b44-e886-417a-85ea-8f0f030dba05 Description 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



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



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

eyJhbGciOiJSUzI1NilsImtpZCI6ImxpZ2h0c3RhY2s6Y3JIZDEiLCJ0eXAiOiJKV1QifQ.eyJzdWIiOiJ0ZW5 hbnQiLCJhdWQiOiJMaWdodE9TliwiZXhwIjoxNzQzNTkzMjUzLCJuYmYiOjE3NDEwMDEyNTMsImlhd CI6MTc0MTAwMTI1MywianRpIjoiYzNkZGY1ZjgtNmFkYi00ZTEwLTk5N2ItYjIxYjRINWVmNmQ1liwic 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_jhRoNIPYIvQWDcNjndRi0ALV5Kh-XN26ib53gsPESCT1SEVF8nuClcg41HZCzS jJDI4yBUn8MGK953sCJRur7VVmQq5y2nGVmvcp_NXxH0RqjRmNQW1L9mTAyMIJOBU2SSzVg7z7e2 GmjWdRK9a3F22-ew7d2ErFAOtNM5I9xszzBf2aYQOpIWhbDCrqalw5jYOeDLH73pI

3.3.4 Verification of the JWT

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



Unset

export

lightstack=eyJhbGci0iJSUzI1NiIsImtpZCI6ImxpZ2h0c3RhY2s6Y3JlZDEiLCJ0eXAi0 iJKV1QifQ.eyJzdWIi0iJ0ZW5hbnQiLCJhdWQi0iJMaWdodE9TIiwiZXhwIjoxNzQzNTkzMj UzLCJuYmYi0jE3NDEwMDEyNTMsImlhdCI6MTc0MTAwMTI1MywianRpIjoiYzNkZGY1ZjgtNm FkYi00ZTEwLTk5N2ItYjIxYjR1NWVmNmQ1Iiwicm9sZXMi0lsicHJvZDphZG1pbiJdfQ.xnB Ey1_LKWg_6pik5tULgcj7duQC6IP1ztRCSWATJ5bdmxkuWmbJFsulSZKkF9Vac_k9EICJM2Q NfKAGwRYLKrNSQ81fbUPaqUwpjuWigunTm_5esoCtn7bj5o_QXdXB0DyKCWFd1p66iNfQMJV -fuIq-oNP0fLtonYg-75T3f44HywZsnoGrF3btS5ZxM57-SF_4-1JVK1QbxpknMWClqjG5q_ YQz4ikvbmNWas9kXo_Bbm2dsdbQt_b3eAP70-v5yH5G6__6C8SUbYGRJ00pfULadLWNea-E_ nKmhmXWMR-1JR7Y-5_jhRoNIPY1vQWDcNjndRi0ALV5Kh-XN26ib53gsPESCT1SEVF8nuClc g41HZCzSjJD14yBUn8MGK953sCJRur7VVmQq5y2nGVmvcp_NXxH0RqjRmNQW1L9mTAyM1J0B U2SSzVg7z7e2GmjWdRK9a3F22-ew7d2ErFA0tNM5I9xszzBf2aYQ0p1WhbDCrqaIw5jY0eDL 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

NameUUIDStateProtection StateNSIDSizeReplicasCompressionACLRebuild Progressvol17bd3d1a4-1ab6-48ba-a61b-2b6e5debfcc7CreatingUnknown010 GiB3truevalues:"ALLOW_ANY"VVV

Delete the just created volume

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

And check that the volume has been deleted



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



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 \rightarrow 3 replicas for maximum redundancy

V Silver \rightarrow 2 replicas for balanced performance

Bronze \rightarrow **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>
```



```
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 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
```



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 domain_id enabled id is_domain name options parent_id tags	Lightstack Project default True 16071c2a13694fd1ae300d21d4efddbe False lightstack {} default []

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
```



Output

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



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

+	++	F
Field	Value	
+ description id is_public name properties	+	-
+	кепи_пате- пунскаск +	 +

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:



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
```

+ Field +	Value
 admin_state_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



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
```

+	+
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
++	



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

+	+ Name	⊦+ Status
+	+ cirros-0.6.3-x86_64-disk +	++ active ++

To check your flavors, the command is as follows:

Unset openstack flavor list

++	+	+4	+4	4	+
ID Name	RAM	Disk	Ephemeral	VCPUs	Is Public
++	+	F7			+
1 m1.tiny	512	1	0	1	Irue
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



d4 ds4G	4096 2	20 0	0	4 True
++	++	+	+	++

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

Unset

openstack security group list

Output

ID Name Description Project Tags +	+	+	+	+	++
1 3ec825e1-c434-401c-9fba-cce623ab9c00 default Default security group 2276907c048c47a6b8cf952d6d613950 []	ID	Name	Description	Project	Tags
+++++++	+	default +	Default security group	+ 2276907c048c47a6b8cf952d6d61; +	3950 []

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
```

+	++
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



OS-EXT-STS:task_state	scheduling
OS-SRV-USG:launched at	None
OS-SRV-USG:terminated at	None
accessIPv4	l 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', locatio	n=, 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:

Unset

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



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

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



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:

Create Project		×
Project Information *	Project Members Project Groups	
Domain ID	default	
Domain Name	Default	
Name *	lightstack	
Description	Multi-tenancy project between OpenStack and Lightbits	
Enabled		
	Cancel Create Proj	ect

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



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:

Create User	×
Jomain ID	Description
default	Description:
Domain Name	Create a new user and set related properties including the Primary Project and Role.
Default	
Jser Name *	
lightstack	
Description	
Manager for the project lightstack	
Email	
Password *	
····· 🔤 🏾	
Confirm Password *	
Primary Project	
lightstack - +	
Role	
manager •	
☑ Enabled	
□ Lock password	
	Canad
	Create User

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".



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:

Create Volume Type

lightstack-Gold	Description:	
Description	Volume type is a type or label that can be selected at volume creation time in OpenStack. It usually maps to a	
The volume type has 3 copies and compression enabled.	set of capabilities of the storage back-end driver to be used for this volume. Examples: "Performance", "SSD" "Backup", etc. This is equivalent to the openstack volume type create command. Once the volume type gets created, click the "View Extra Specs" button	
	set up extra specs key-value pair(s) for that volume type	

Cancel Create Volume Type

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".

×



Create Volume Type Extra Spec

Key *		
compression	Description:	
Value *	Create a new "extra spec" key-value pair for a volume type.	
<is> True</is>		
	Cancel	

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

Admin / Volume / Volume Types /		
Volume Type: lightstack-Gold		
Volume Type Extra Specs		
		+ Create Delete Extra Specs
Displaying 1 item		
СКеу	Value	Actions
compression	<is> True</is>	Edit 👻
Displaying 1 item		

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:

×



Admin / Volume / Volume Types /

Volume Type: lightstack-Gold

Volume Type Extra Specs

		+ Create Delete Extra Specs
Displaying 4 items		
🗆 Кеу	Value	Actions
compression	<is> True</is>	Edit 👻
lightos:num_replicas	3	Edit 👻
lightos:project_name	lightstack	Edit 💌
volume_backend_name	lightstack	Edit 👻
Displaying 4 items		

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

Admin / Volume / Volume Types /		
Volume Type: lightstack-Silver		
Volume Type Extra Specs		
		+ Create Delete Extra Specs
Displaying 4 items		
СКеу	Value	Actions
compression	<is> True</is>	Edit 👻
lightos:num_replicas	2	Edit -
lightos:project_name	lightstack	Edit -
volume_backend_name	lightstack	Edit 👻

And for lightstack-Bronze it will look like:

Admin / Volume / Volume Types /		
Volume Type: lightstack-Bronze		
Volume Type Extra Specs		
		+ Create Delete Extra Specs
Displaying 4 items		
СКеу	Value	Actions
C compression		
	<is> False</is>	Edit 👻
Ightos.num_replicas	<is> False</is>	Edit -
Ightos:rum_replicas Ightos:project_name	<is>False 1 lightstack</is>	Edit • Edit • Edit •
Iightos:project_name volume_backend_name	<is>False 1 Ightstack Iightstack</is>	Edit • Edit • Edit • Edit •

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".



Edit Volume Type Access		×
Member admin lightstack demo invisible_to_admin service alt_demo acme	Select the projects where the volume types will be used. If no projects are selected, then volume type w be only visible by users with the admin role.	îΠ
	Cancel Sa	ive

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.

Create Volume		3
olume Name	Descriptions	
	Description:	
Description	Volumes are block devi instances.	ces that can be attached to
	Volume Type	Description:
	lvmdriver-1	
	// No description available	e.
olume Source	Volume Limit	s
No source, empty volume	▼ Total Gibibytes	0 of 100 GiB Use
VDe		
lvmdriver-1	Number of Volumes	0 of 10 Use
lightstack-Bronze		
lightstack-Silver		
lightstack-Gold		
lvmdriver-1		
DEFAULT		
iroup 🕖		
No group	•	



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:

Create Network		×
Network * Subnet Subnet Details		
Name		Create a new network. In addition, a subnet associated
lightstack	••••	with the network can be created in the following steps of this wizard
Project *		
lightstack	•	
Provider Network Type * 🛛		
Local	•	
☑ Enable Admin State		
□ Shared		
External Network		
☑ Create Subnet		
Availability Zone Hints @		
MTU @		
	▲ ▼	
		Cancel « Back Next »



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

Create Network	×
Network * Subnet Subnet Details	
Subnet Name	Creates a subnet associated with the network. You need
lightstack-subnet	to enter a valid "Network Address" and "Gateway IP". If
Network Address Source	network will be assigned by default. If you do not want ateway please check the "Disable Gateway" checkbox.
Enter Network Address manually	Advanced configuration is available by clicking on the
Network Address 🕢	"Subnet Details" tab.
172.168.168.0/16	
IP Version	
IPv4	•
Gateway IP 🕖	
Disable Gateway	
	Cancel « Back Next »

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



Create Network	×
Network * Subnet Subnet Details	
☑ Enable DHCP	Specify additional attributes for the subnet.
Allocation Pools 🛛	
DNS Name Servers Ø	
Host Routes @	
	Cancel « Back Create

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:

0	Project	Network Name Subnets Associated		DHCP Agents Shared		ared External St		Admin State	Availability Zones
0	lightstack	lightstack	lightstack-subnet 172.168.0.0/16	0	No	No	Active	True	-



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:

Details	Please provide the initial hostname for the instance, the availability zo count. Increase the Count to create multiple instances with the same	one where it settings.	will be deployed, and the instance
Source *	Project Name		Total Instances
Flavour *	lightstack		(10 Max)
	Instance Name *		10%
Networks *	Server-1		
Network Ports	Description		0 Current Usage
Security Groups	The first server to be deployed		9 Remaining
Key Pair	Availability Zone		
Configuration	nova	~	
Server Groups	Count *		
Scheduler Hints	1		
Metadata			

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



Launch Instance								×			
Details	Instance source is th (image snapshot), a creating a new volur	he template used volume or a volu me.	d to create an instance ume snapshot (if enab	e. Yo oled).	ou can use ar . You can als	n image, a snap o choose to use	shot of an instar e persistent stora	age by			
Source *	Select Boot Source	e									
Flavour *	Image		~		Yes No						
Networks *	Volume Size (GB) *				Delete Volume on Instance Delete						
Network Ports	1				Yes No	D					
Security Groups	Allocated										
Key Pair	Displaying 0 items										
Configuration	Name	Updated	Size		Forma	t	Visibility				
	Select an item from Available items below										
Server Groups	Displaying 0 items										
Scheduler Hints	✓ Available ①)						Select one			
Metadata	O Click here fo	r filters or full to	vt saarch					~			
			ti Souron.					^			
	Displaying 1 item										
	Name		Updated		Size	Format	Visibility				
	> cirros-0.6.3-x86	6_64-disk	11/4/24 4:02 PM		20.69 MB	QCOW2	Public	•			
	Displaying 1 item										
X Cancel					<	Back Next	Cauno	h Instance			

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:



Launch Instance						×						
Details	Instance source is the template used to create an instance. You can use an image, a snapshot of an instance (image snapshot), a volume or a volume snapshot (if enabled). You can also choose to use persistent storage by creating a new volume.											
Source	Select Boot Source		Create New Volume									
Flavour *	Image	~	Yes No									
Networks *	Volume Size (GB) *		Delete Volume on Instance Delete									
Network Ports	1		Yes No]								
Security Groups	Allocated	Allocated										
Key Pair	Displaying 1 item											
Configuration	Name	Updated	Size	Format	Visibility							
Server Groups	> cirros-0.6.3-x86_64-disk	11/4/24 4:02 PM	20.69 MB	QCOW2	Public	•						
Scheduler Hints	Displaying 1 item	Displaying 1 item										
Metadata	✓ Available											
	Q Click here for filters or full tex	kt search.				×						
	Displaying 0 items											
	Name Updated	Size	Format	v	/isibility							
		No items t	o display.									
	Displaying 0 items											
X Cancel			< Ba	ck Next >	▲ Launch In	stance						

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



ource	Flavours manaç Allocated Displaying 0 it	ge the sizing fo ems	or the compu	te, memory and	1 storage capacit	y of the instance.		
lavour *	Name	VCPUS	RAM	Total Disk	Root Disk	Ephemeral Disk	Public	D
letworks *			Select	a flavour from ti	he available flavo	urs below.		
letwork Ports	Displaying 0 it	ems						
ecurity Groups	✓ Available	9 12					S	elec
ey Pair	Q Click he	re for filters or	full text sea	rch.				
onfiguration	Displaying 12	items						
erver Groups	Name	VCPUS	RAM	Total Disk	Root Disk	Ephemeral Disk	Public	
cheduler Hints	> m1.nano	1	192 MB	1 GB	1 GB	0 GB	Yes	
letadata	> m1.micro	1	256 MB	1 GB	1 GB	0 GB	Yes	
	> cirros256	1	256 MB	1 GB	1 GB	0 GB	Yes	
	> m1.tiny	1	512 MB	1 GB	1 GB	0 GB	Yes	
	> ds512M	1	512 MB	5 GB	5 GB	0 GB	Yes	
	> ds1G	1	1 GB	10 GB	10 GB	0 GB	Yes	
	> m1.small	1	2 GB	20 GB	20 GB	0 GB	Yes	

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



Launch Instance								×		
Details Source	Flavours mana Allocated Displaying 1 i	Flavours manage the sizing for the compute, memory and storage capacity of the instance. Allocated Displaying 1 item								
Flavour	Name	VCPUS	RAM	Total Disk	Root Disk	Ephemeral Disk	Public			
Networks *	> cirros256	1	256 MB	1 GB	1 GB	0 GB	Yes	↓		
Network Ports	Network Ports Displaying 1 item									
Security Groups	ecurity Groups VAvailable 11 Se									
Key Pair Q Click here for filters or full text search.										

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

Detelle	Networks provide of	communication channels for ins	tances in the cloud.	You can select ports ir	nstead of networ	ks or a
Details	mix of both.					
Source	✓ Allocated					
Flavour	Displaying 0 items	S				
Notworks *	Network	Subnets Associated	Shared	Admin State	Status	
Networks		Select one or more net	tworks from the avai	ilable networks below.		
Network Ports	Displaying 0 items	5				
Security Groups	✓ Available 2				Select on	e or more
Key Pair	Q Click here fe	or filters or full text search.				×
Configuration	Displaying 2 items	5				
Server Groups	Network	Subnets Associated	Shared	Admin State	Status	
Scheduler Hints	> shared	shared-subnet	No	Up	Active	•
Metadata	> lightstack	lightstack-subnet	No	Up	Active	•
	Displaying 2 items	5				
× Cancel				< Back Next >	Launch I	nstance

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



Details	Networks provide	communication channels for ins	stances in the cloue	d. You can select ports	instead of networks	s or a		
Source	✓ Allocated	D						
Flavour	Network	Subnets Associated	Shared	Admin State	Status			
Networks	> lightstack	lightstack-subnet	No	Up	Active	•		
Network Ports	Displaying 1 item	1						
Security Groups	✓ Available	0			Select one	or more		
Configuration	Q Click here f	Q Click here for filters or full text search.						
Server Groups	Displaying 1 item							
Scheduler Hints	Network	Subnets Associated	Shared	Admin State	Status			
Metadata	Displaving 1 item	snared-subnet	NO	Ορ	Active	т		
	,							
				(Back Next)		tanco		

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

	Instance Name	Image Name	IP Address	Flavor	Key Pair	Status		Availability Zone	Task	Power State	Age	Actions
0	Server-1	-	172.168.1.23	cirros256	-	Active	шî	nova	None	Running	0 minutes	Create Snapshot 👻
Dis	playing 1 item											

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	ТЧРЕ	MOUNTPOINTS
vda	252:0	0	1 G	0	disk	
l-vda1	252:1	0	1015M	0	part	1
`-vda15	252:15	0	8M	0	part	
\$_						



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

Create Volume	×
Volume Name	
Vol-1	Description:
Description	Volumes are block devices that can be attached to instances.
Volume assigned to lightstack-instance	Volume Type Description:
	lightstack-Gold
	The volume type has 3 copies and compression enabled.
Volume Source	Volume Limits
No source, empty volume	Total Gibibutes
Time	
	Number of Volumes 1 of 10 Used
IIghtstack-Gold	
Size (GiB) [*]	
10	
Availability Zone	
nova 👻	
Group 😡	
No group 👻	
	Cancel Create Volume

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:



Disp	playing 2 items										
0	Name	Description	Size	Status	Group	Туре	Attached To	Availability Zone	Bootable	Encrypted	Actions
0	Vol-1	Volume assigned to lightstack-instance	10GiB	Available	-	lightstack-Gold	-	nova	No	No	Edit Volume 💌
	114c5006-24b4-445e-a8fe-43ad9f7c91b1		1GiB	In-use	-	lvmdriver-1	/dev/vda on Server-1	nova	Yes	No	Edit Volume 💌

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

Vol-1		
Overview	Snapshots	Messages
	Name	Vol-1
	Description Project ID Status Group	Volume assigned to lightstack-instance 2276907c048c47a6b8cf952d6d613950 Available
Specs		
	Size Type Bootable Encrypted Created	10 GiB lightstack-Gold No 6 Mar 2025, 9:41 a.m.
Attachme	nts	
	Attached To	Not attached
Metadata		
		None

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).



🗐 lb-cluster1	Showing data from IOPS (M) 25 20 1.5	n Mar 6, 2025 09:46 to	Mar 6, 2025 10:4	ا ہ	BW (GiB/sec) 10 8 6	~~~~~	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	MMM	Total C Average Latency (µs) 400 300 200	Read 🛛 Write	Past: Hour	Day Week	Custom
	1.0 0.5 0.0 09:50												
# UUID: c690eff6-c20c-5d64-ac57-054d6 🗐	250 200		Pre	diction >									
Servers Volumes Snapshots Projects	Events												
1 Volume(s)								Statuses	\checkmark Servers \checkmark	Projects 🗸 🔅			
Volume Name 🗢	Status	Project		Size (GiB) 🗧	Capacity		Replica Count 🗧	Compressio	in 🗧 Servers			Rebuik	
volume-ecdac647-5bf5-4b7b-8ad1-214792d89d2f	Healthy	lightstack							1 lb-01, lb-02	2, Ib-03			

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 Ib-02 has become the primary server for this volume.

More Info									
Source Snapshot -	Protection State Fully Protected	State Available	Project lightstack	Replica Count 3	Compression Ratio 1.0:1	ACL IP-ACL ALLOW_NONE ALLOW_NONE			
Sector Size 4096	NSID 1	Servers Ib-01 Ib-02 (Transy) Ib-03	Rebuild -	Time Created Mar 6, 2025 10:41					

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:



Manage Volume Attachments										
Instance	Device	Actions								
	No items to di	isplay.								
Attach To Instance										
Select an instance			*							
Select an instance										
Server-1 (aebca773-84e5-4600-97	70e-0e468482f1f2)	Gancer								

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

Dis	playing 2 items										
	Name	Description	Size	Status	Group	Туре	Attached To	Availability Zone	Bootable	Encrypted	Actions
	Vol-1	Volume assigned to lightstack-instance	10GiB	In-use	-	lightstack-Gold	/dev/vdb on Server-1	nova	No	No	Edit Volume 💌
	114c5006-24b4-445e-a8fe-43ad9f7c91b1		1GiB	In-use	-	lvmdriver-1	/dev/vda on Server-1	nova	Yes	No	Edit 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 Isblk and the disk shows up as vdb with 10G as space allocation.

\$ [116:	1.851334] V	irtio_l	blk	virt	io5:	[vdb]	20971520	512-byte	logical	blocks	(10.7	GB∕10.0	GiB)
\$ lsblk														
NAME	MAJ:MIN	RM	SIZE	RO	TYPE	MOUN	TPO IN	IS						
uda	252:0	0	1 G	0	disk									
l-uda1	252:1	0	1015M	0	part	/								
`-vda15	252:15	0	8M	0	part									
udb	252:16	0	10G	0	disk									
\$_														



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 hostngn 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



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.



About Lightbits Labs

Lightbits Labs® (Lightbits) invented the NVMe over TCP protocol and offers best-of-breed software-defined block storage that enables data center infrastructure modernization for organizations building a private or public cloud. Built from the ground up for low consistent latency, scalability, resiliency, and cost-efficiency, Lightbits software delivers the best price/performance for real-time analytics, transactional, and AI/ML workloads. Lightbits Labs is backed by enterprise technology leaders [Cisco Investments, Dell Technologies Capital, Intel Capital, Lenovo, and Micron] and is on a mission to deliver the fastest and most cost-efficient data storage for performance-sensitive workloads at scale.

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