



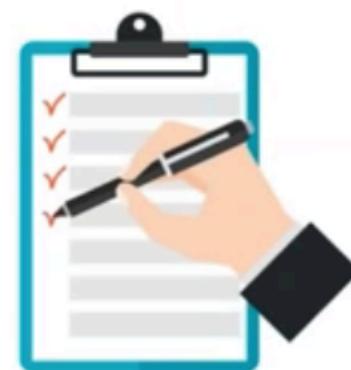
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What is OpenStack?

What to expect?

- ✓ Introduction to Cloud
- ✓ What is OpenStack
- ✓ OpenStack in Cloud
- ✓ Deployment Models
- ✓ OpenStack Architecture
- ✓ OpenStack Components
- ✓ Use Case



Introduction to Cloud



Introduction to Cloud

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Introduction to Cloud



- Cloud computing is a type of Internet-based computing that provides shared computer processing resources and data to computers and other devices on demand



IaaS

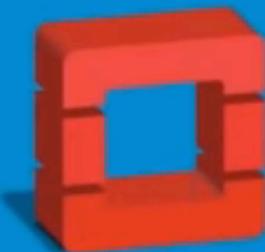


PaaS



SaaS

What is OpenStack?





What is OpenStack?

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- OpenStack is a set of **software tools** for building and managing cloud computing platforms for **public** and **private clouds**.
- OpenStack is managed by the **OpenStack Foundation**, a non-profit that oversees both development and community-building around the project.
- OpenStack is the future of **cloud computing** backed by some of the biggest companies.



Figure: Companies contributing to OpenStack



OpenStack in Cloud





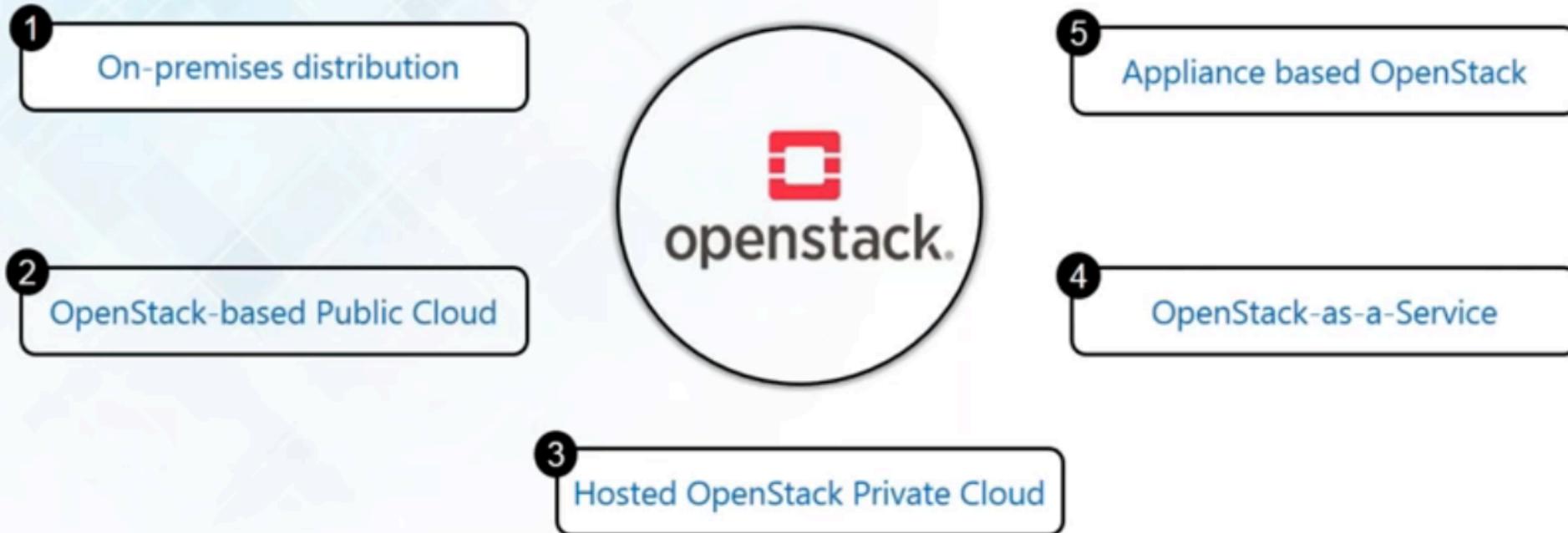
Deployment Models





Deployment Models

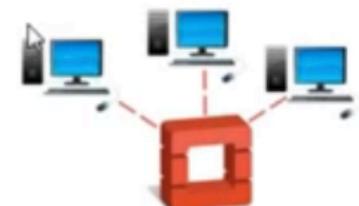
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On-premises distribution

edureka!

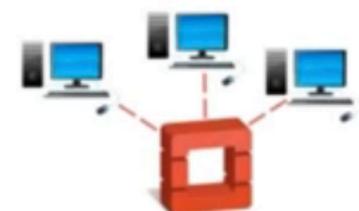


- In this model, a customer downloads and installs an OpenStack distribution within their internal network



OpenStack-based Public Cloud

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- A vendor provides a public cloud computing system based on the OpenStack project

Hosted OpenStack Private Cloud

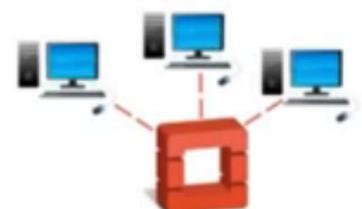


- A vendor hosts an OpenStack-based private cloud including the underlying hardware and the OpenStack software



OpenStack-as-a-Service

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- A vendor hosts OpenStack management software as a service and customers use the software service



Appliance based OpenStack

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- Nebula was a vendor that sold appliances that could be plugged into a network which spawned an OpenStack deployment.



OpenStack Architecture

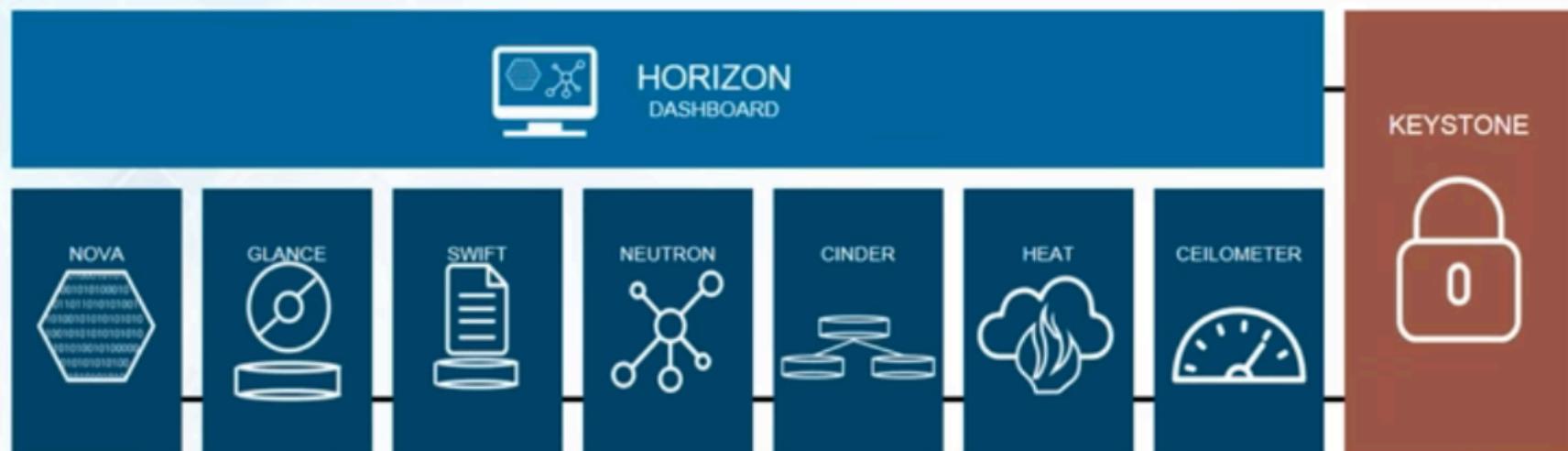




OpenStack Architecture

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OpenStack Architecture

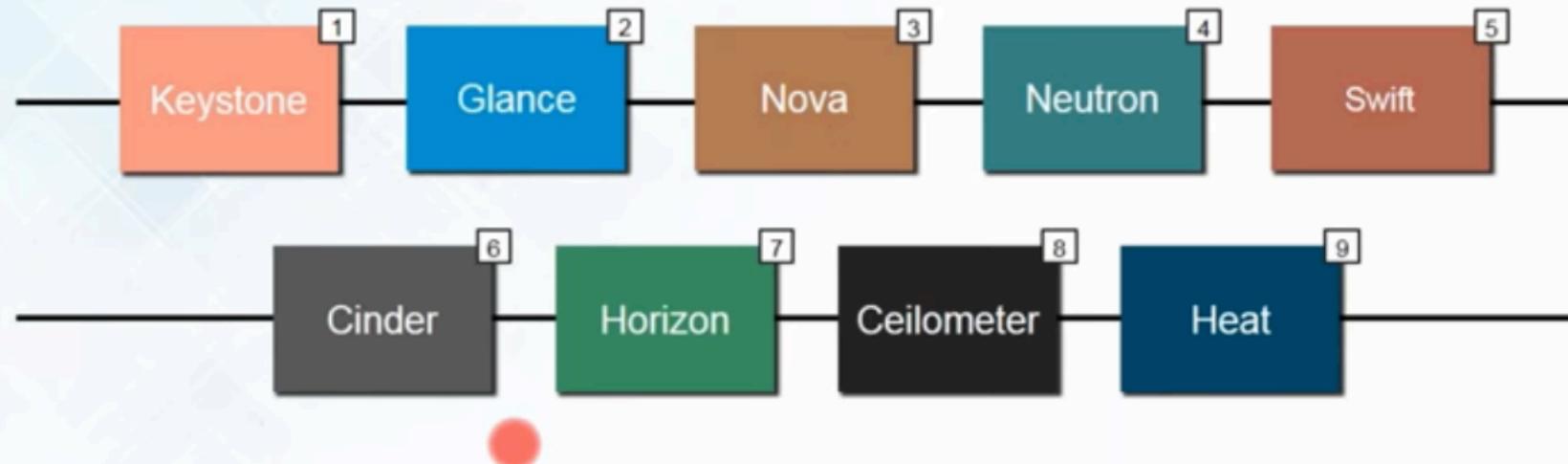




OpenStack Components

OpenStack Components

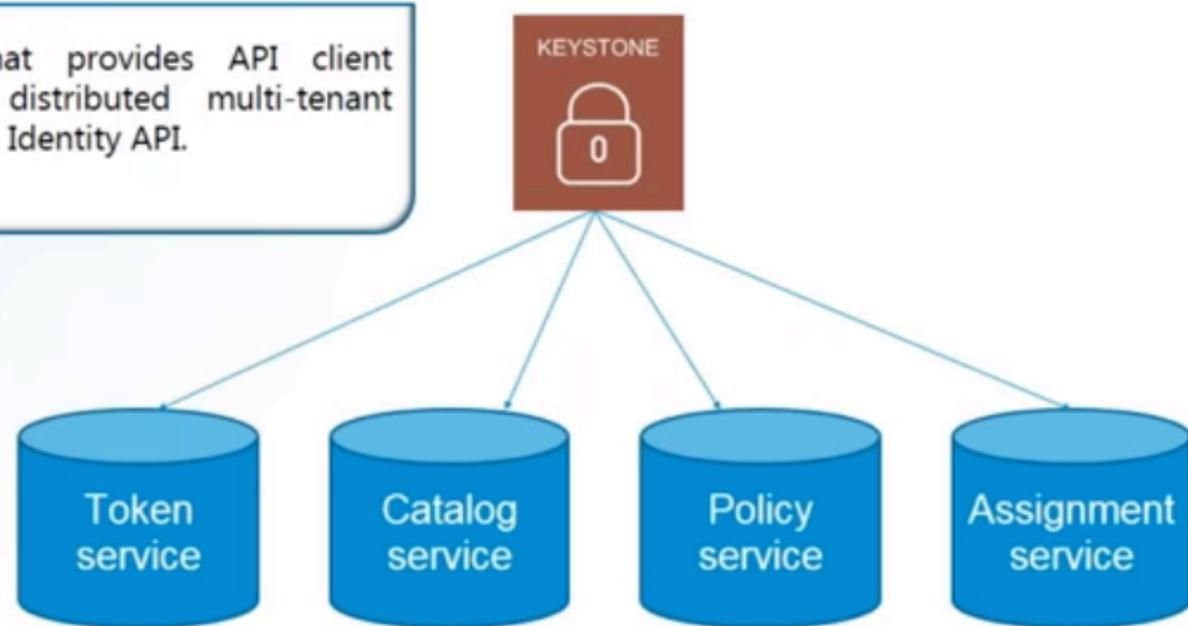
The following gives a flow of all the components in OpenStack that we will discuss in the coming slides:

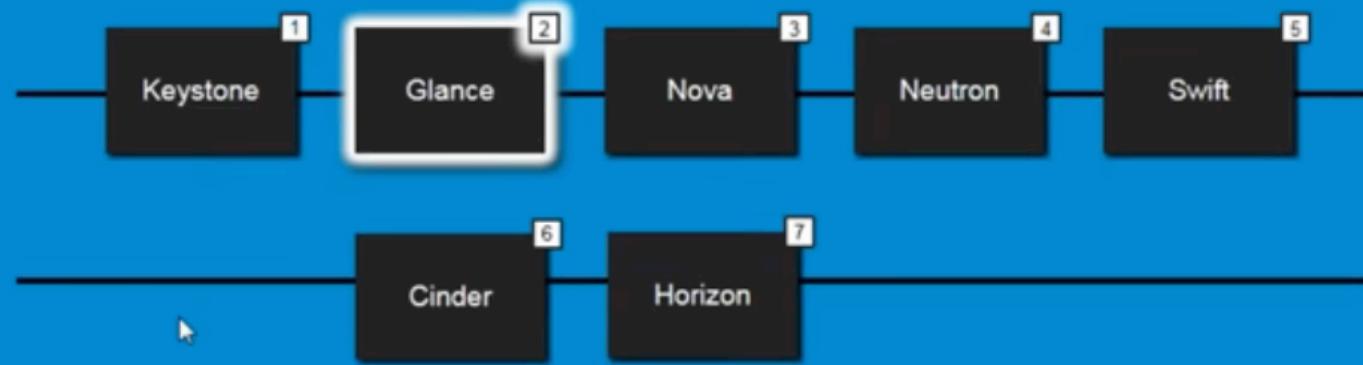




Keystone

- Keystone is an OpenStack service that provides API client authentication, service discovery and distributed multi-tenant authorization by implementing OpenStack's Identity API.

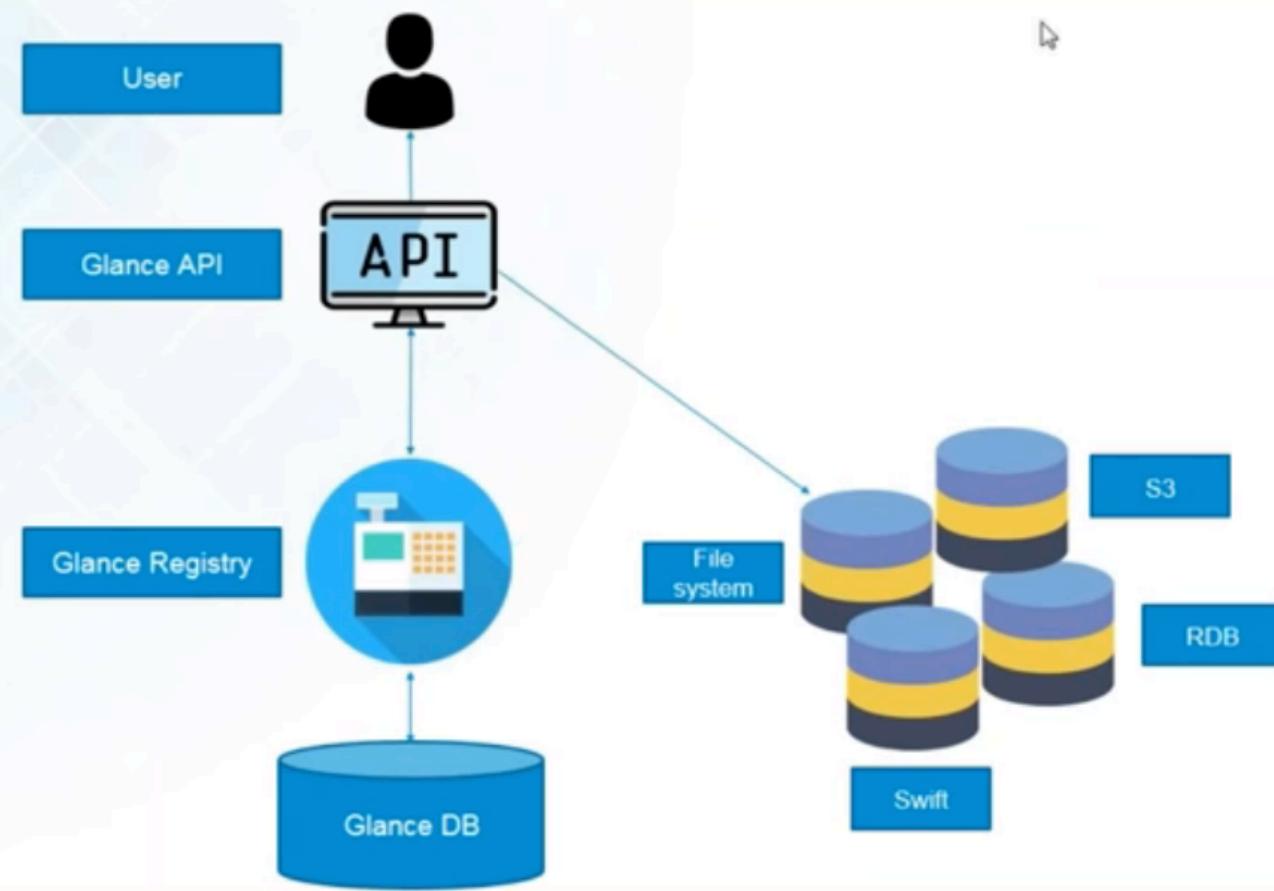


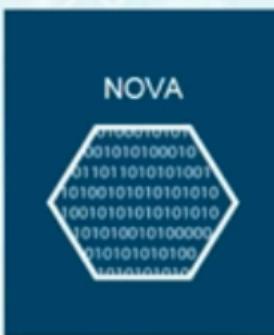




Glance Architecture

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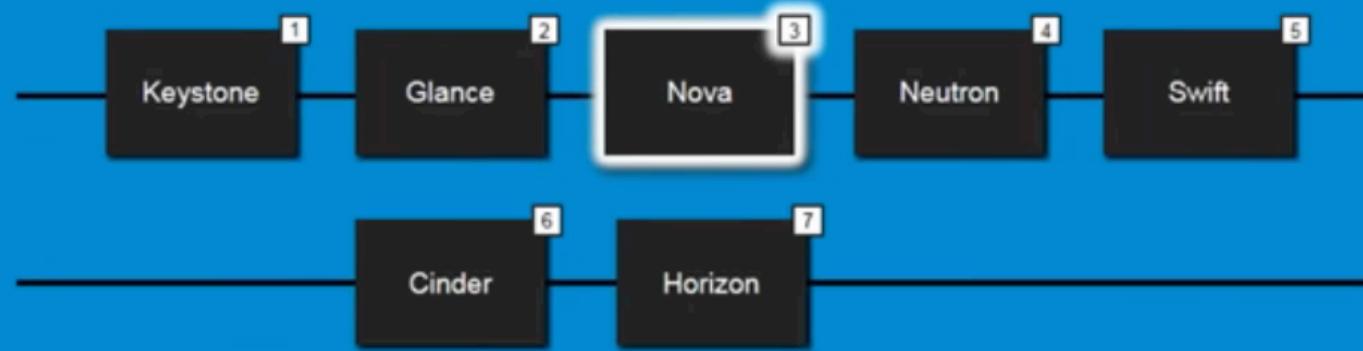


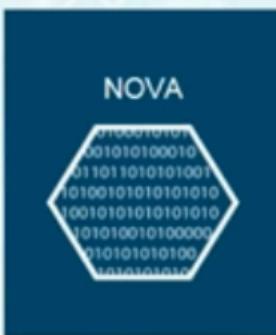


- ❑ Nova is an OpenStack project designed to provide power massively scalable, on demand, self service access to compute resources.
 - ❑ It is fault tolerant, recoverable and provides API-compatibility with systems like Amazon EC2.
 - ❑ It is built on a messaging architecture and all of its components can typically be run on several servers.



Compute Zone

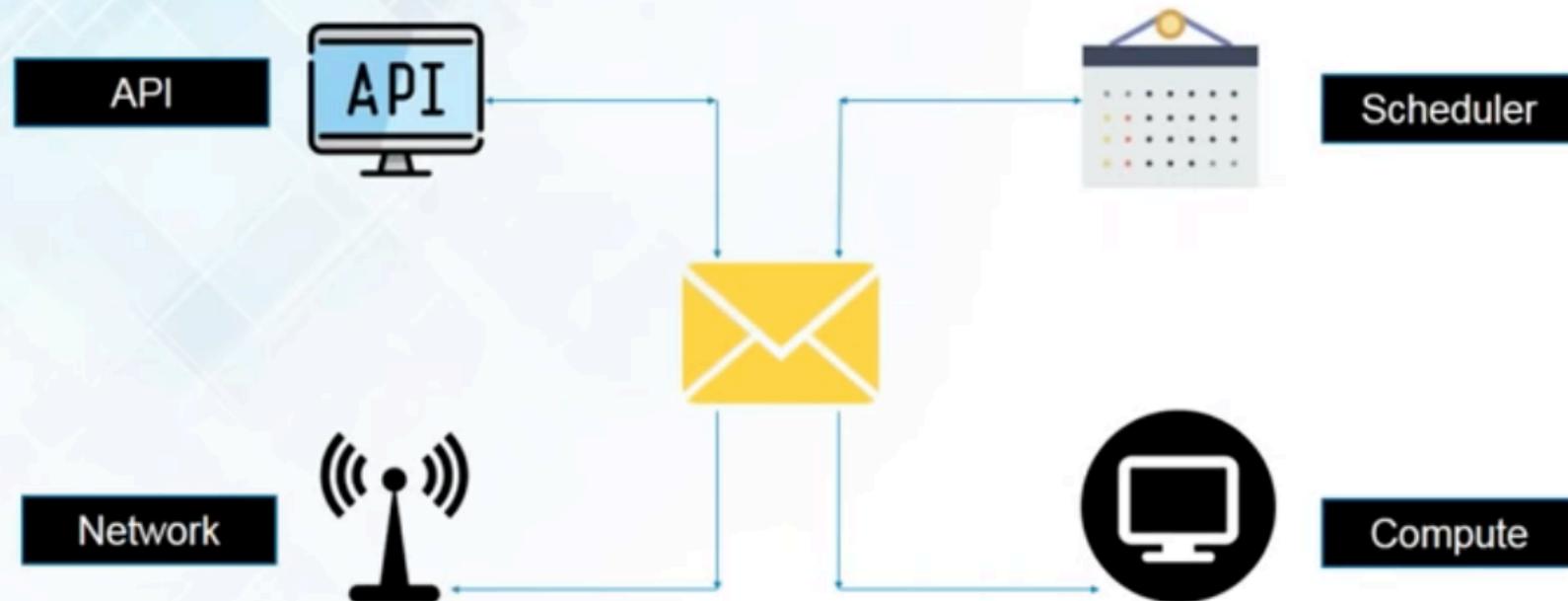


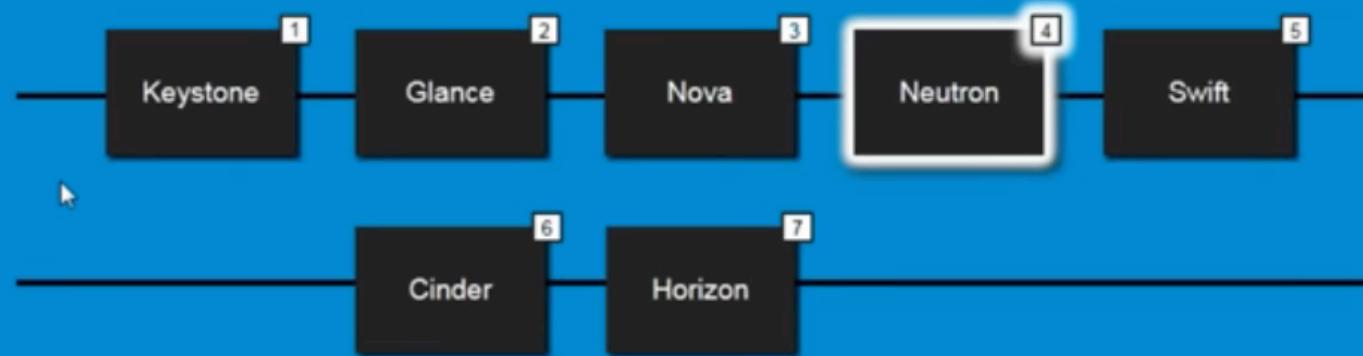


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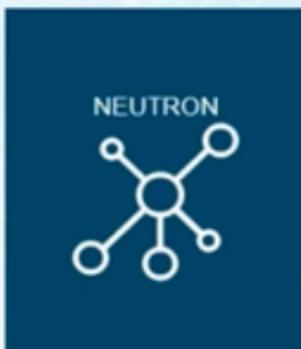


Compute Zone

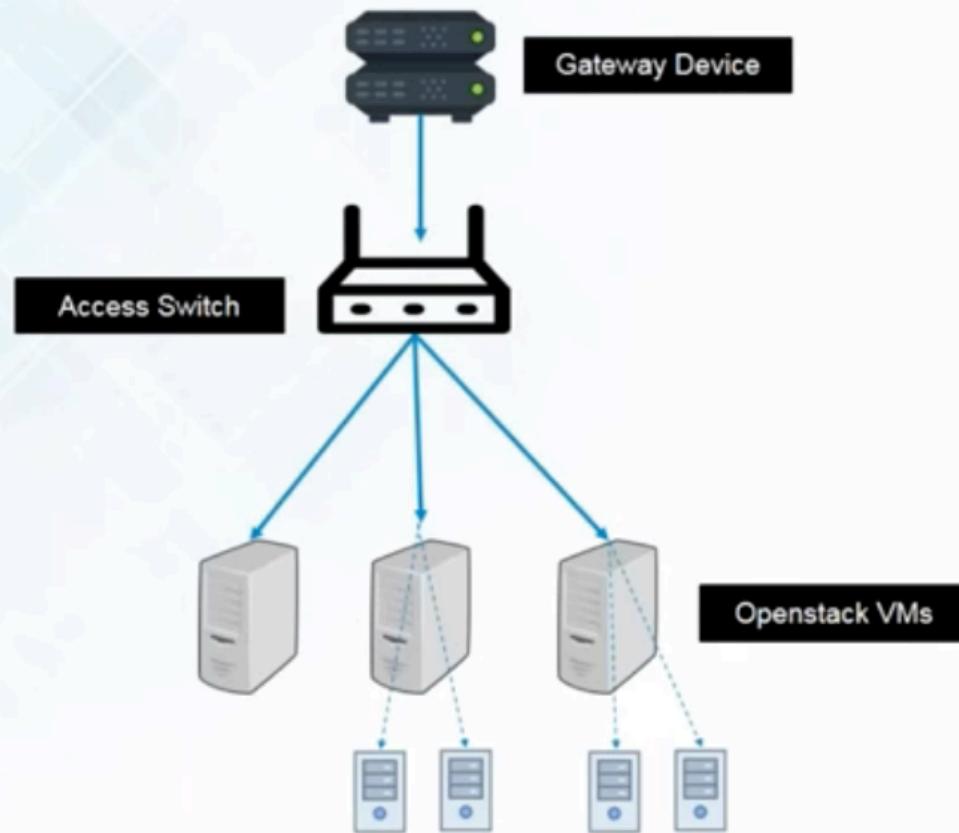




Neutron



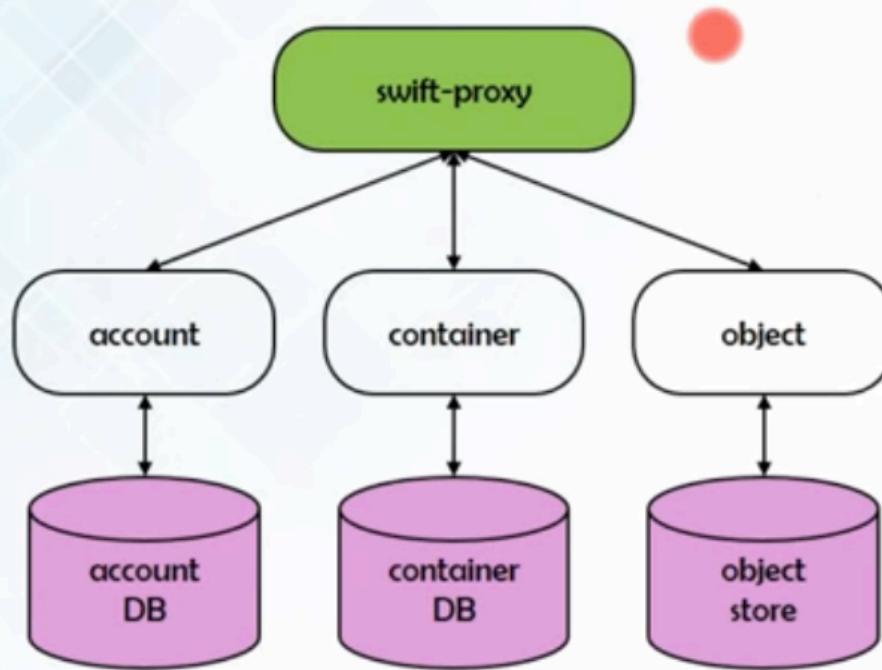
- ❑ Neutron is a networking project focused on delivering Networking-as-a-Service (NaaS) in virtual compute environments.
- ❑ Neutron has replaced the original networking application program interface (API) called Quantum in OpenStack.
- ❑ Neutron is designed to address deficiencies in "baked-in" networking technology found in cloud environments.

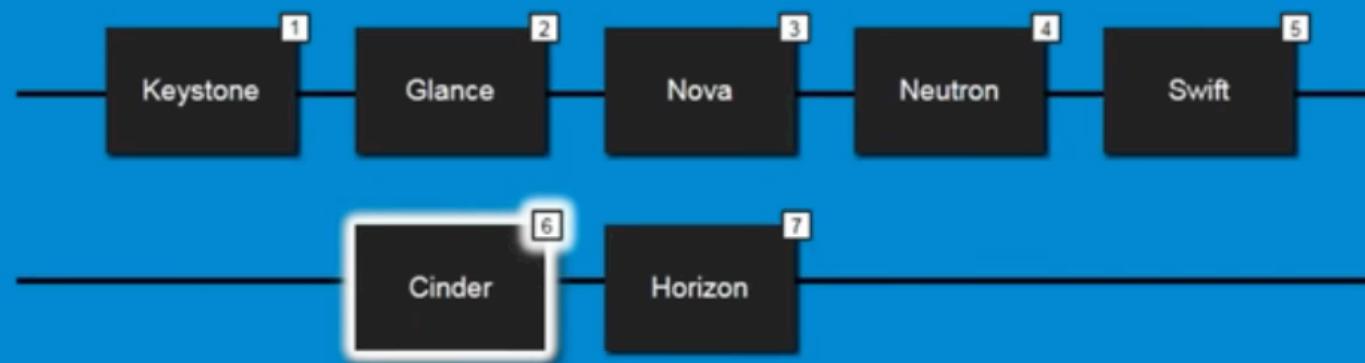


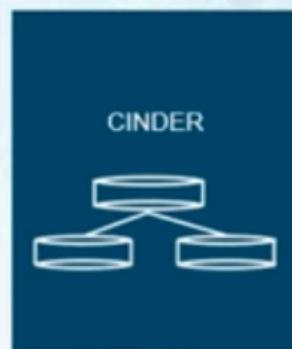


Swift Architecture

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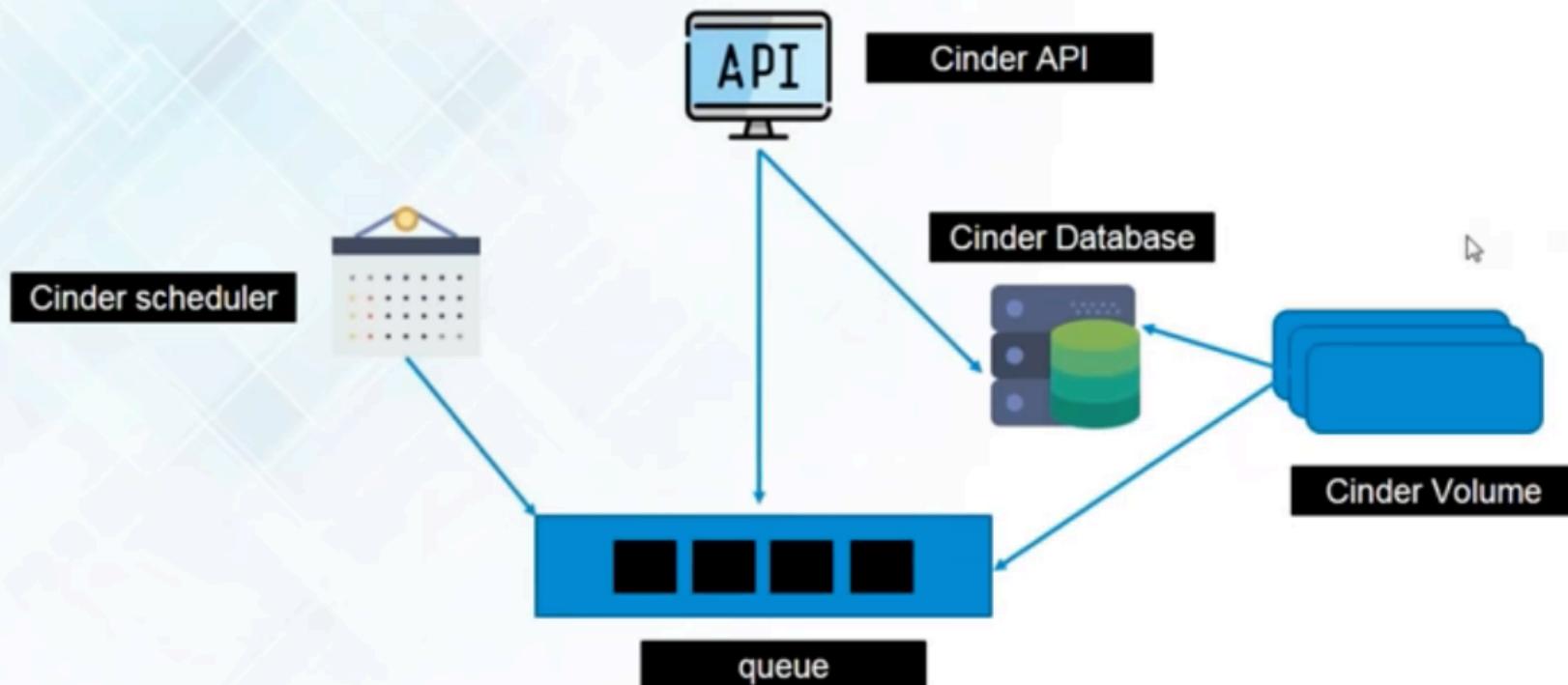


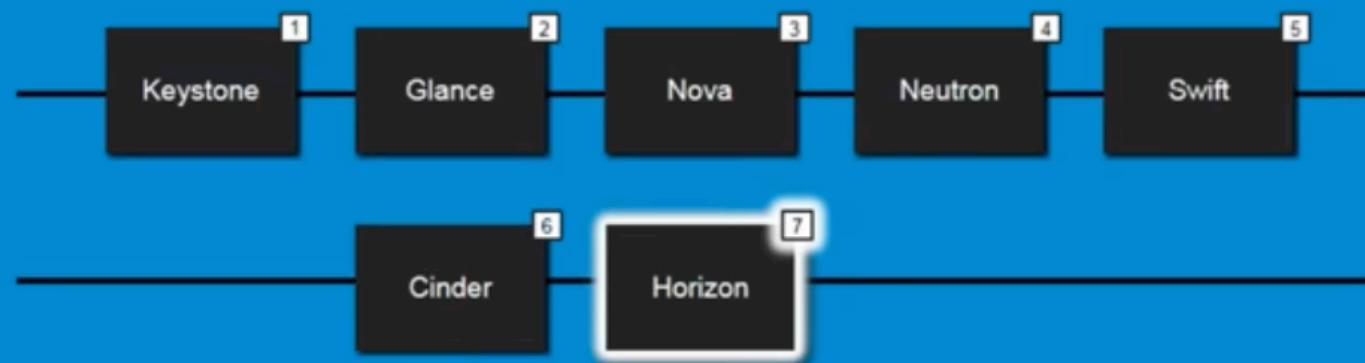
- Cinder is OpenStack's **Block Storage Service** and provides persistent block storage resources that OpenStack Compute instances can consume.
- This includes **secondary attached storage** similar to the Amazon Elastic Block Storage (EBS) offering.
- In addition, you can **write images** to a **Block Storage** device to use as a **bootable persistent instance**.



Cinder Architecture

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Horizon

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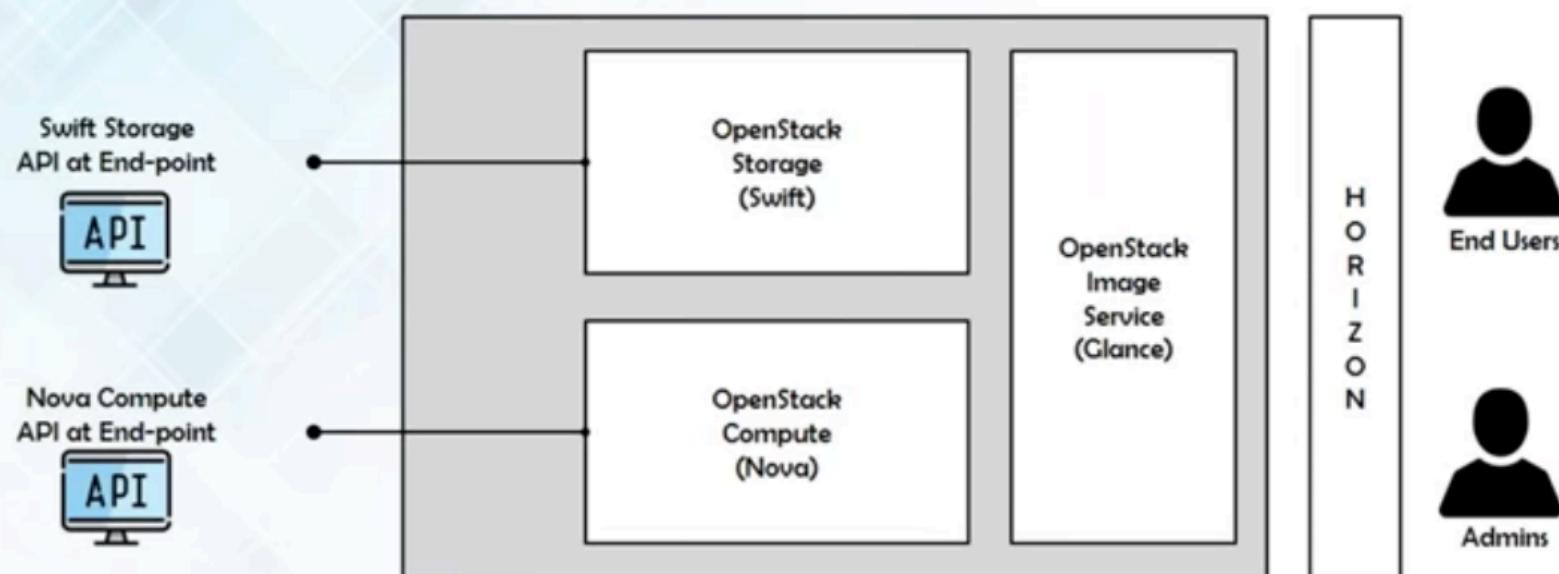
- ❑ Horizon is the OpenStack's **Dashboard** which provides a **web based user interface** to OpenStack services including Nova, Swift, Keystone, etc.
- ❑ It allows users and administrators of the environment to **interact with** and **manage** the various **functional components** without having to install any local client tools other than a web browser.





Horizon Architecture

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Login - OpenStack Dash... 

Secure | https://x86.trystack.org/dashboard/auth/login/?next=/dashboard/

FAQ: use before you ask on
Facebook:
[TryStack FAQ](#)

Use this video to get started:
<http://youtu.be/z-M5Vt4-HYg>
#trystack on freenode

 Login with Facebook

- OR -

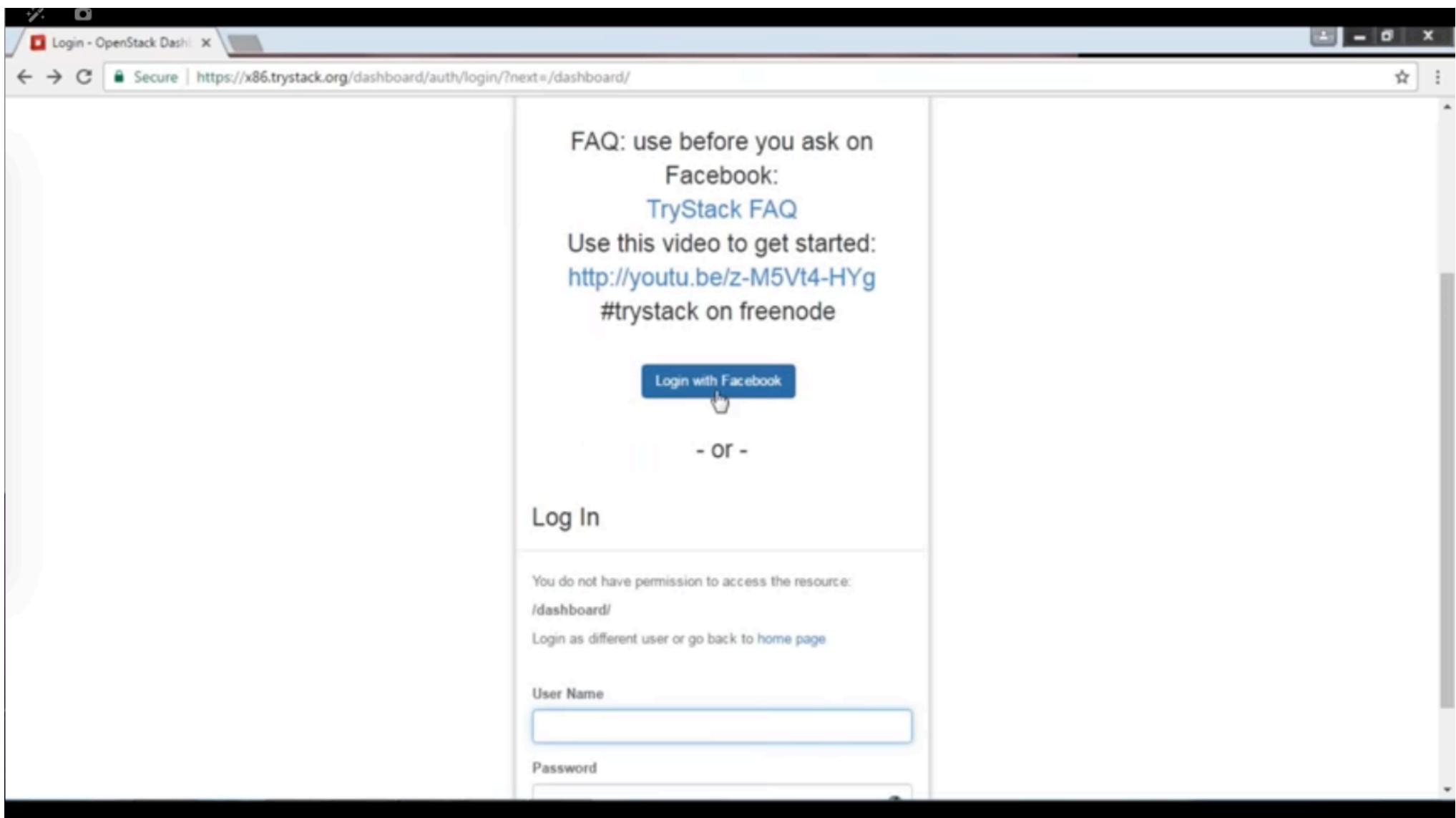
Log In

You do not have permission to access the resource:
</dashboard/>

Login as different user or go back to home page

User Name

Password



Instance Overview - Open

Secure | https://x86.trystack.org/dashboard/project/#_=_=

openstack facebook1263855430364280

facebook1263855430364280

Overview

Limit Summary

Resource	Used	Total
Instances	2	3
VCPUs	2	6
RAM	2,816	8,192
Floating IPs	0	1
Security Groups	1	10
Volumes	0	6
Volume Storage	0	60

Usage Summary

Select a period of time to query its usage:

From: To: The date should be in YYYY-mm-dd format.

Active Instances: 2 Active RAM: 2.8GB This Period's VCPU-Hours: 66.15 This Period's GB-Hours: 1322.94 This Period's RAM-Hours: 88920.46

Logs

Images - OpenStack Dashboard

Secure | https://x86.trystack.org/dashboard/project/images/

openstack facebook1263855430364280

Project

Compute

Overview

Instances

Volumes

Images

Access & Security

Network

Object Store

Identity

x86.trystack.org/dashboard/project/.../c556a505-9552-4f24-96e5-40dbca943211/

Images

	Image Name	Type	Status	Public	Protected	Format	Size	Actions
	Fedora25 Atomic	Image	Active	Yes	No	QCOW2	533.1 MB	<button>Launch Instance</button>
	Fedora24	Image	Active	Yes	Yes	QCOW2	195.1 MB	<button>Launch Instance</button>
	CoreOS	Image	Active	Yes	Yes	QCOW2	711.7 MB	<button>Launch Instance</button>
	CentOS7-Atomic	Image	Active	Yes	Yes	QCOW2	1005.1 MB	<button>Launch Instance</button>
	CentOS6	Image	Active	Yes	Yes	QCOW2	715.6 MB	<button>Launch Instance</button>
	Ubuntu14.04	Image	Active	Yes	Yes	QCOW2	247.4 MB	<button>Launch Instance</button>
	Ubuntu16.04	Image	Active	Yes	Yes	QCOW2	289.3 MB	<button>Launch Instance</button>
	openSUSE13.2	Image	Active	Yes	Yes	QCOW2	395.8 MB	<button>Launch Instance</button>
	Fedora23	Image	Active	Yes	Yes	QCOW2	223.5 MB	<button>Launch Instance</button>
	CentOS7	Image	Active	Yes	Yes	QCOW2	872.3 MB	<button>Launch Instance</button>

Images - OpenStack Dashboard

Secure | https://x86.trystack.org/dashboard/project/images/

Compute

Overview

Instances

Volumes

Images

Access & Security

Network

Object Store

Identity

Project (0)

Shared with Me (0)

Public (11)

Create Image

Delete Images

	Image Name	Type	Status	Public	Protected	Format	Size	Actions
	Fedora25 Atomic	Image	Active	Yes	No	QCOW2	533.1 MB	<button>Launch Instance</button>
	Fedora24	Image	Active	Yes	Yes	QCOW2	195.1 MB	<button>Launch Instance</button>
	CoreOS	Image	Active	Yes	Yes	QCOW2	711.7 MB	<button>Launch Instance</button>
	CentOS7-Atomic	Image	Active	Yes	Yes	QCOW2	1005.1 MB	<button>Launch Instance</button>
	CentOS6	Image	Active	Yes	Yes	QCOW2	715.6 MB	<button>Launch Instance</button>
	Ubuntu14.04	Image	Active	Yes	Yes	QCOW2	247.4 MB	<button>Launch Instance</button>
	Ubuntu16.04	Image	Active	Yes	Yes	QCOW2	289.3 MB	<button>Launch Instance</button>
	openSUSE13.2	Image	Active	Yes	Yes	QCOW2	395.8 MB	<button>Launch Instance</button>
	Fedora23	Image	Active	Yes	Yes	QCOW2	223.5 MB	<button>Launch Instance</button>
	CentOS7	Image	Active	Yes	Yes	QCOW2	872.3 MB	<button>Launch Instance</button>
	Cirros-0.3.4	Image	Active	Yes	Yes	QCOW2	12.7 MB	<button>Launch Instance</button>

Displaying 11 items

x86.trystack.org/dashboard/project/.../672153ff-5266-43f0-9ac4-dda73a179a66/

Images - OpenStack Dashboard

Secure | https://x86.trystack.org/dashboard/project/images/

Compute

- Overview
- Instances
- Volumes
- Images

Access & Security

Network

Object Store

Identity

Displaying 11

Launch Instance

Details * Access & Security Networking * Post-Creation Advanced Options

Availability Zone: nova

Instance Name *

Flavor * m1.tiny

Instance Count * 1

Instance Boot Source * Boot from image

Image Name * Cirros-0.3.4 (12.7 MB)

Specify the details for launching an instance.

The chart below shows the resources used by this project in relation to the project's quotas.

Flavor Details

Name	m1.tiny
VCPUs	1
Root Disk	1 GB
Ephemeral Disk	0 GB
Total Disk	1 GB
RAM	512 MB

Project Limits

Number of Instances	2 of 3 Used
Number of VCPUs	2 of 6 Used
Total RAM	2,816 of 8,192 MB Used

Size Actions

533.1 MB	Launch Instance
195.1 MB	Launch Instance
711.7 MB	Launch Instance
1005.1 MB	Launch Instance
715.6 MB	Launch Instance
247.4 MB	Launch Instance
289.3 MB	Launch Instance
395.8 MB	Launch Instance
223.5 MB	Launch Instance
872.3 MB	Launch Instance
12.7 MB	Launch Instance

Create Image Delete Images

Images - OpenStack Dashboard

Secure | https://x86.trystack.org/dashboard/project/images/

Compute

- Overview
- Instances
- Volumes
- Images

Access & Security

Network

Object Store

Identity

Launch Instance

Networking

Post-Creation

Advanced Options

Selected networks

NIC1 network: 00:0c:00:49:01:48:02:67:04:33:02:04:76:0

Available networks

Cancel Launch

size	Actions
33.1 MB	Launch Instance
95.1 MB	Launch Instance
11.7 MB	Launch Instance
205.1 MB	Launch Instance
15.6 MB	Launch Instance
47.4 MB	Launch Instance
289.3 MB	Launch Instance
395.8 MB	Launch Instance
223.5 MB	Launch Instance
872.3 MB	Launch Instance
12.7 MB	Launch Instance

Displaying 11 items

The screenshot shows the OpenStack Dashboard interface. On the left, there's a sidebar with navigation links like Compute, Network, Object Store, and Identity. The main area displays a list of images with columns for name, type, status, and size. A modal dialog box titled 'Launch Instance' is open in the center. It has tabs for Details, Access & Security, Networking (which is selected), Post-Creation, and Advanced Options. Under 'Selected networks', 'NIC1 network' is listed. Below it, under 'Available networks', there is a list of networks. At the bottom right of the dialog are 'Cancel' and 'Launch' buttons, with the cursor hovering over the 'Launch' button.

Instances - OpenStack D X

Secure | https://x86.trystack.org/dashboard/project/instances/

openstack facebook1263855430364280

facebook1263855430364280

Instances

	Instance Name	Image Name	IP Address	Size	Key Pair	Status	Availability Zone	Task	Power State	Time since created	Actions
1	compute	Cirros-0.3.4	192.168.0.4	m1.tiny	-	Active	nova	None	Running	0 minutes	Create Snapshot ▾
2	edureka	Cirros-0.3.4	192.168.0.3	m1.small	-	Active	nova	None	Running	1 day, 5 hours	Create Snapshot ▾
3	cimos	Cirros-0.3.4	192.168.0.2	m1.smaller	-	Active	nova	None	Running	2 days, 1 hour	Create Snapshot ▾

Displaying 3 items

Networks - OpenStack

Secure | https://x86.trystack.org/dashboard/project/networks/

openstack

Project

Compute

Network

Network Topology

Networks

Routers

Object Store

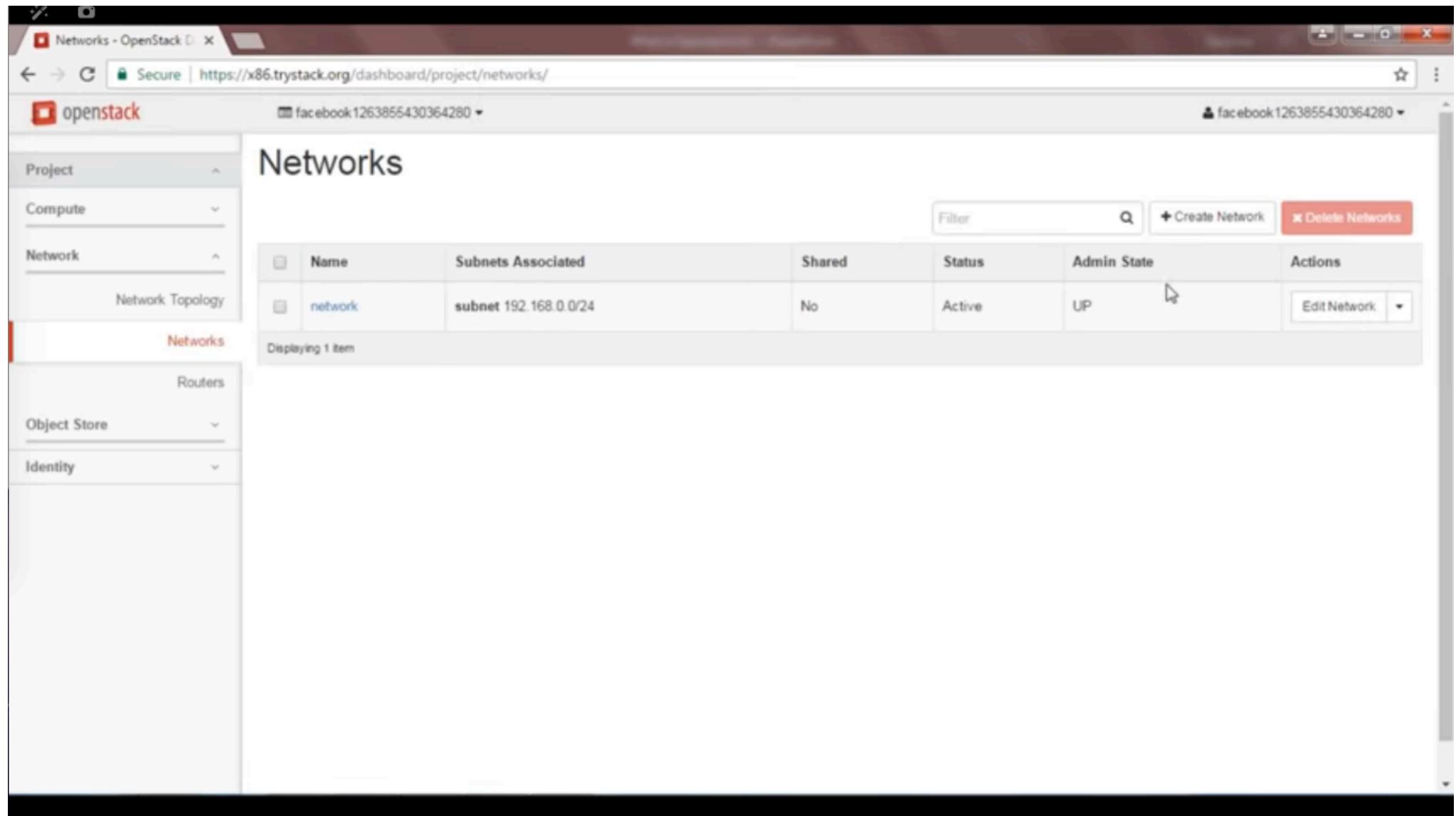
Identity

Networks

Filter Create Network Delete Networks

	Name	Subnets Associated	Shared	Status	Admin State	Actions
<input type="checkbox"/>	network	subnet 192.168.0.0/24	No	Active	UP	 Edit Network

Displaying 1 item



Networks - OpenStack

Secure | https://x86.trystack.org/dashboard/project/networks/

openstack

Project

Compute

Network

Network Topology

Networks

Routers

Object Store

Identity

Networks

Name Subnets Associated Status Admin State Actions

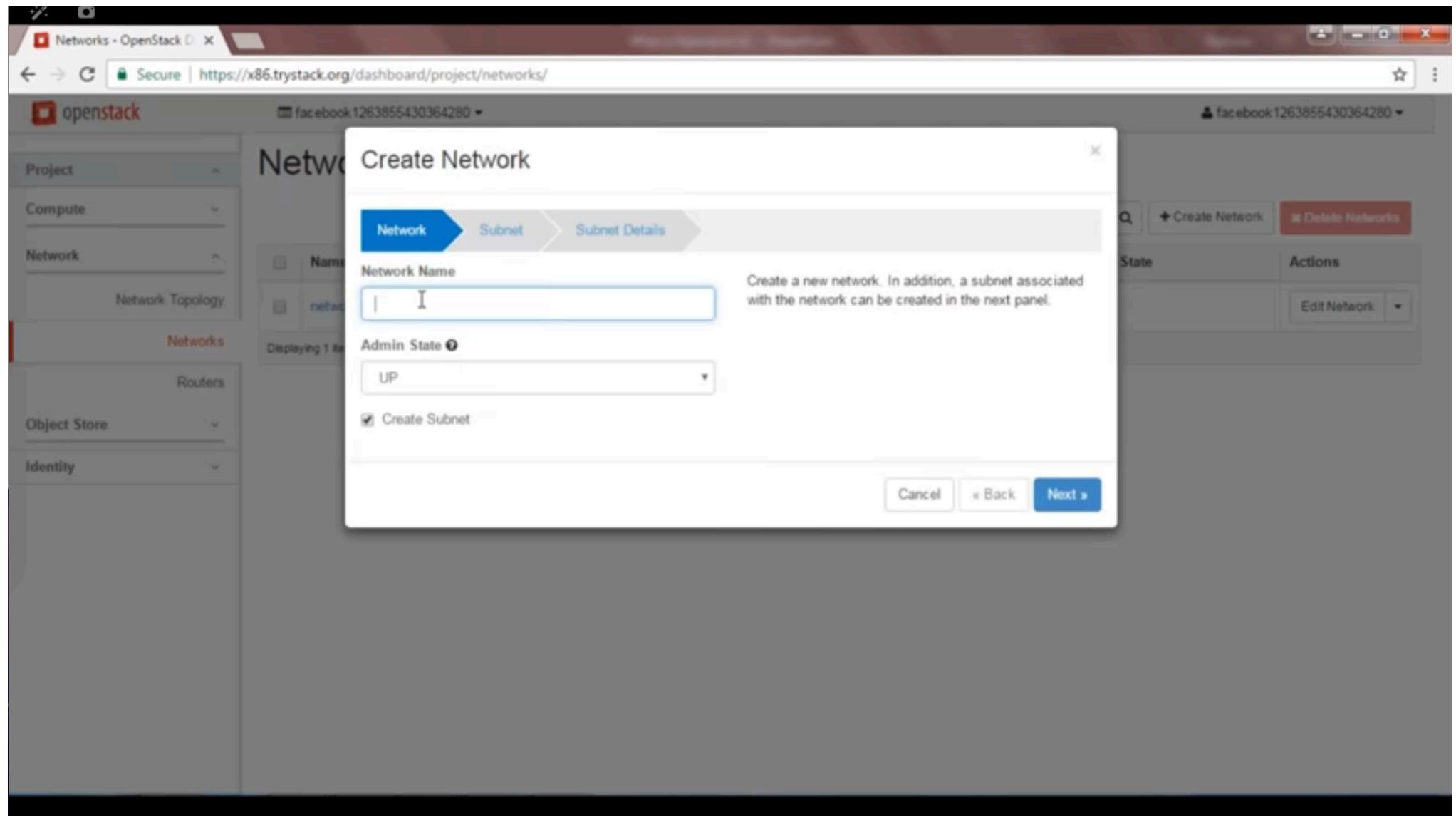
Name	Subnets Associated	Status	Admin State	Actions
network	subnet 192.168.0.0/24	Active	UP	Edit Network

Displaying 1 item

Filter Create Network Delete Networks

loading...

The screenshot shows a web-based OpenStack dashboard for managing networks. On the left, a sidebar lists various services: Compute, Network, Network Topology, Routers, Object Store, and Identity. The 'Network' service is currently selected. The main content area is titled 'Networks' and displays a single network entry named 'network'. This entry is associated with a subnet of '192.168.0.0/24'. The network is marked as 'Active' and has an 'UP' status. A modal dialog box is overlaid on the page, centered over the network table, with the text 'Loading...' and a circular loading icon, indicating that more data is being fetched.



Networks - OpenStack

Secure | https://x86.trystack.org/dashboard/project/networks/

openstack

Project

Compute

Network

Network Topology

Networks

Routers

Object Store

Identity

facebook1263855430364280

Create Network

Network Subnet Subnet Details

Network Name: edureka

Admin State: UP

Create Subnet

Cancel < Back Next >

Create Network Delete Networks

State Actions

Edit Network

Networks - OpenStack

Secure | https://x86.trystack.org/dashboard/project/networks/

openstack

Project

Compute

Network

Network Topology

Networks

Routers

Object Store

Identity

Networks

Filter Create Network Delete Networks

	Name	Subnets Associated	Shared	Status	Admin State	Actions
	network	subnet 192.168.0.0/24	No	Active	UP	Edit Network

Displaying 1 item

https://x86.trystack.org/dashboard/project/routers/

The screenshot displays the OpenStack dashboard interface. The top navigation bar shows the title 'Networks - OpenStack' and the URL 'https://x86.trystack.org/dashboard/project/networks/'. The sidebar on the left is partially collapsed, showing options like 'Compute', 'Network', 'Network Topology', 'Routers', 'Object Store', and 'Identity'. A red arrow points to the 'Networks' link in the sidebar. The main content area is titled 'Networks' and contains a table with one row. The table columns are: Name, Subnets Associated, Shared, Status, Admin State, and Actions. The single row shows 'network' as the name, 'subnet 192.168.0.0/24' as the subnet, 'No' as shared, 'Active' as status, 'UP' as admin state, and an 'Edit Network' button in the Actions column. A message at the bottom of the table says 'Displaying 1 item'. At the top right of the main area, there are buttons for 'Filter', 'Create Network', and 'Delete Networks'. The bottom of the screen shows a footer with the URL 'https://x86.trystack.org/dashboard/project/routers/'.

Containers - OpenStack

Secure | https://x86.trystack.org/dashboard/project/containers/

openstack facebook1263855430364280

Project

Compute

Network

Object Store

Containers

Identity

Containers

No items to display.

+ Create Container

Select a container to browse.

Displaying 0 items

Displaying 0 items

This screenshot shows the OpenStack dashboard interface. The top navigation bar includes the title 'Containers - OpenStack', a secure connection indicator, and the URL 'https://x86.trystack.org/dashboard/project/containers/'. The browser tabs show 'Containers - OpenStack' and 'facebook1263855430364280'. The sidebar on the left is partially collapsed, showing the 'Containers' category which is highlighted with a red border. The main content area is titled 'Containers' and displays a message 'No items to display.' with a '+ Create Container' button. To the right, it says 'Select a container to browse.' and shows two 'Displaying 0 items' counts. The overall layout is clean and modern, typical of cloud management interfaces.

Containers - OpenStack

Secure | https://x86.trystack.org/dashboard/project/containers/

openstack facebook1263855430364280

Project

Compute

Network

Object Store

Containers

Identity

Containers

No items to display.

+ Create Container

Create Container

Select a container to browse.

Displaying 0 items

Displaying 0 items

<https://x86.trystack.org/dashboard/project/containers/create>

The screenshot shows the OpenStack dashboard interface. On the left, a sidebar menu is open with several categories: Project, Compute, Network, Object Store, and Identity. The 'Containers' option under the Project category is highlighted with a red bar at the bottom. The main content area is titled 'Containers' and contains a message 'No items to display.' Below this message is a button labeled '+ Create Container'. To the right of the main content area, there is a message 'Select a container to browse.' and two sections labeled 'Displaying 0 items'. At the bottom of the screen, the full URL 'https://x86.trystack.org/dashboard/project/containers/' is visible in the browser's address bar.

Volumes - OpenStack Dashboard

Secure | https://x86.trystack.org/dashboard/project/volumes/

openstack

facebook1263855430364280

facebook1263855430364280

Project

Compute

Overview

Instances

Volumes

Images

Access & Security

Network

Object Store

Identity

Volumes

Volumes Volume Snapshots

Filter Create Volume Accept Transfer

Name	Description	Size	Status	Type	Attached To	Availability Zone	Bootable	Encrypted	Actions
No items to display.									

Displaying 0 items

The screenshot shows the OpenStack Dashboard interface. The top navigation bar includes a back button, forward button, refresh button, a secure connection indicator, the URL https://x86.trystack.org/dashboard/project/volumes/, and user authentication information for facebook1263855430364280. The left sidebar contains a navigation tree with sections like Project, Compute, Network, Object Store, and Identity, with 'Volumes' currently selected under Compute. The main content area has a title 'Volumes' and tabs for 'Volumes' and 'Volume Snapshots'. It features a search bar, a 'Create Volume' button, and an 'Accept Transfer' button. A table lists volume details with columns for Name, Description, Size, Status, Type, Attached To, Availability Zone, Bootable, Encrypted, and Actions. A message indicates 'No items to display.' and 'Displaying 0 items'. The overall theme is dark with red highlights for the active section.

Instances - OpenStack D X

Secure | https://x86.trystack.org/dashboard/project/instances/

openstack facebook1263855430364280

facebook1263855430364280

Instances

	Instance Name	Image Name	IP Address	Size	Key Pair	Status	Availability Zone	Task	Power State	Time since created	Actions
<input type="checkbox"/>	compute	Cirros-0.3.4	192.168.0.4	m1.tiny	-	Active	nova	None	Running	3 minutes	<button>Create Snapshot</button>
<input type="checkbox"/>	edureka	Cirros-0.3.4	192.168.0.3	m1.small	-	Active	nova	None	Running	1 day, 5 hours	<button>Create Snapshot</button>
<input type="checkbox"/>	cimos	Cirros-0.3.4	192.168.0.2	m1.smaller	-	Active	nova	None	Running	2 days, 1 hour	<button>Create Snapshot</button>

Displaying 3 items

<https://x86.trystack.org/dashboard/project/instances/75492050-8f15-4998-a4c6-58475cbc6eec/>

Instance Details - OpenS

Secure | https://x86.trystack.org/dashboard/project/instances/7f492050-8f15-4998-a4c6-58475cbc6eec/

Instances

Volumes

Images

Access & Security

Network

Object Store

Identity

Instance Overview

Information

Name	compute
ID	7f492050-8f15-4998-a4c6-58475cbc6eec
Status	Active
Availability Zone	nova
Created	March 9, 2017, 9:24 p.m.
Time Since Created	3 minutes

Specs

Flavor	m1.tiny
Flavor ID	1
RAM	512MB
VCPUs	1 VCPU
Disk	1GB

IP Addresses

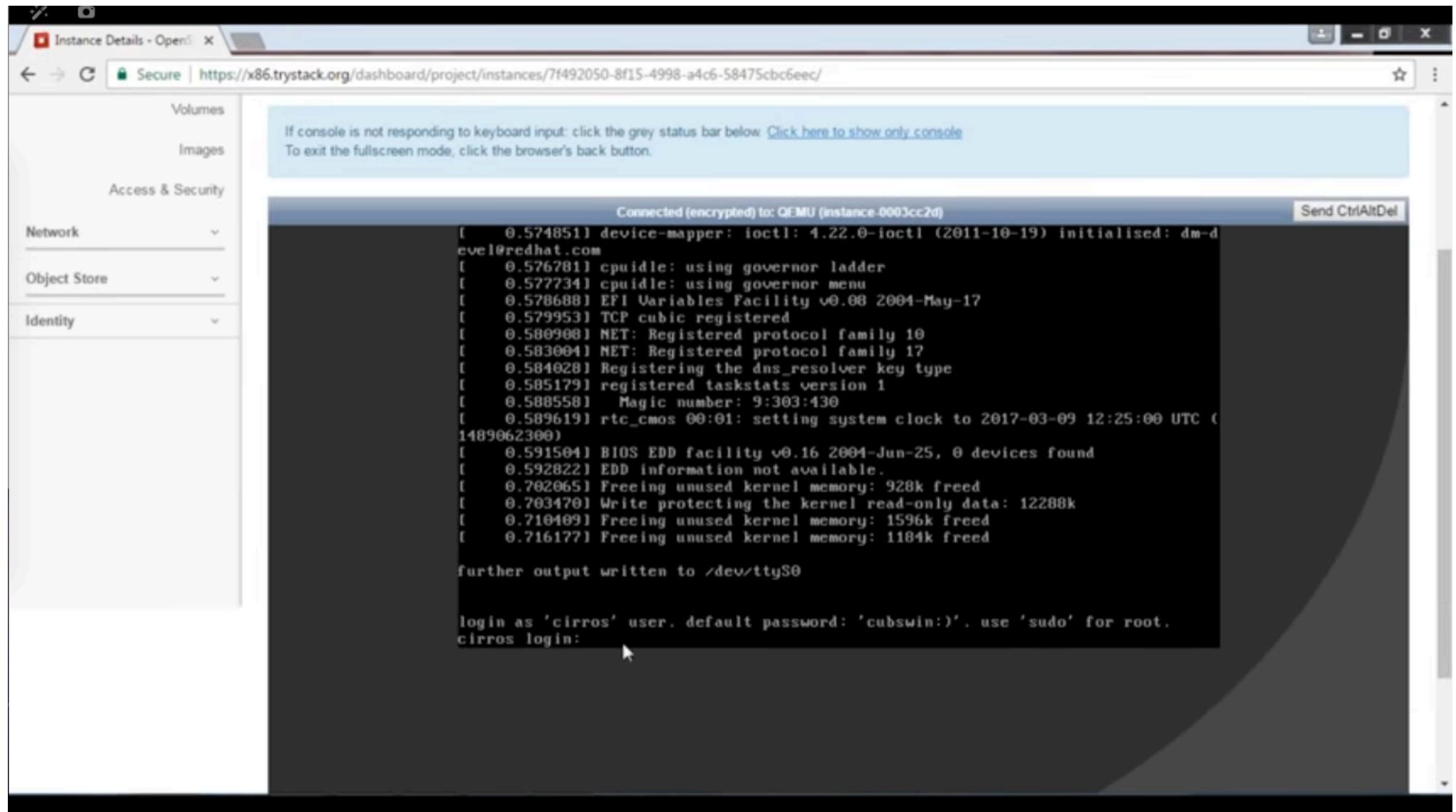
Network	192.168.0.4
---------	-------------

Security Groups

default	ALLOW IPv4 from default ALLOW IPv4 to 0.0.0.0/0 ALLOW IPv4 22/tcp from 0.0.0.0/0 ALLOW IPv6 from default ALLOW IPv6 to ::/0
---------	---

Metadata

Key Name	None
Image Name	Cirros-0.3.4



Instance Details - OpenSUSE

Secure | https://x86.trystack.org/dashboard/project/instances/7f492050-8f15-4998-a4c6-58475cbc6eec/

Connected [encrypted] to: QEMU (instance-0003cc2d)

Send CtrlAltDel

Network Object Store Identity

```
[ 0.576781] cpuidle: using governor ladder
[ 0.577734] cpuidle: using governor menu
[ 0.578688] EFI Variables Facility v0.08 2004-May-17
[ 0.579953] TCP cubic registered
[ 0.580900] NET: Registered protocol family 10
[ 0.583004] NET: Registered protocol family 17
[ 0.584028] Registering the dns_resolver key type
[ 0.585179] registered taskstats version 1
[ 0.588558] Magic number: 9:303:430
[ 0.589619] rtc_cmos 00:01: setting system clock to 2017-03-09 12:25:00 UTC (1489062300)
[ 0.591504] BIOS EDD facility v0.16 2004-Jun-25, 0 devices found
[ 0.592822] EDD information not available.
[ 0.702065] Freeing unused kernel memory: 928k freed
[ 0.703470] Write protecting the kernel read-only data: 12288k
[ 0.710409] Freeing unused kernel memory: 1596k freed
[ 0.716177] Freeing unused kernel memory: 1184k freed

further output written to /dev/ttys0

login as 'cirros' user. default password: 'cubswin:)', use 'sudo' for root.
cirros login: cirros
Password:
```

Instance Details - OpenS

Secure | https://x86.trystack.org/dashboard/project/instances/7f492050-8f15-4998-a4c6-58475cbc6eec/

openstack

Project

Compute

Overview Instances Volumes Images Access & Security Network Object Store Identity

Instance Details: compute

Create Snapshot

Overview Log Console Action Log

Instance Console

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

Connected (encrypted) to: QEMU (instance-0003cc2d)

Send CtrlAltDel

The screenshot shows the 'Console' tab selected in the 'Instance Details' interface. On the left, a sidebar lists various OpenStack services: Project, Compute (selected), Overview, Instances (highlighted with a red bar), Volumes, Images, Access & Security, Network, Object Store, and Identity. The main content area displays the 'Instance Details: compute' page. At the top right is a 'Create Snapshot' button. Below it are tabs for Overview, Log, Console (selected), and Action Log. A large central area is labeled 'Instance Console'. It contains a message about keyboard input and exiting fullscreen mode. Below this is a dark terminal window showing a single dollar sign (\$) prompt. A status bar at the top of the terminal window provides connection information ('Connected (encrypted) to: QEMU (instance-0003cc2d)') and a 'Send CtrlAltDel' button.

Network Topology - Open

Secure | https://x86.trystack.org/dashboard/project/network_topology/

openstack

facebook1263855430364280

facebook1263855430364280

Project

Compute

Network

Network Topology

Networks

Routers

Object Store

Identity

Network Topology

Resize the canvas by scrolling up/down with your mouse/trackpad on the topology. Pan around the canvas by clicking and dragging the space behind the topology.

Toggle labels Toggle Network Collapse

Launch Instance (Quota exceeded) Create Network Create Router

```
graph TD; Cloud((Cloud)) --- Comp1(( )); Cloud --- Comp2(( )); Cloud --- Comp3(( ));
```



Case Study





Case Study – Introduction

edureka!



- ❑ Time Warner Cable is among the top three US cable companies in the US, with annual revenues in the tens of billions of dollars.
- ❑ It delivers digital cable, cable Internet, digital phone, home security and cable advertising products and services.

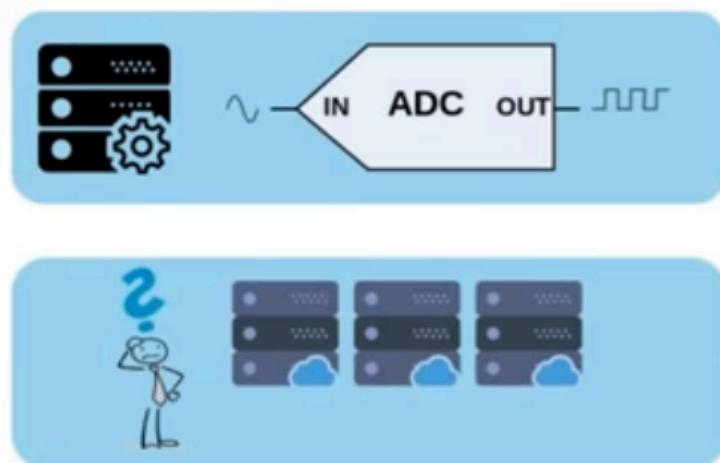
- ❑ AVI Networks is their OpenStack provider.
- ❑ Their multi-location OpenStack private cloud caters to a large group of application developers responsible for hundreds of applications.



Case Study – Existing Challenges

Challenges with Existing Solutions

- Hardware ADCs are too **inflexible**
- Open-source solutions: **Lacked advanced features and high availability**
- Virtual ADCs: **Complex orchestration**

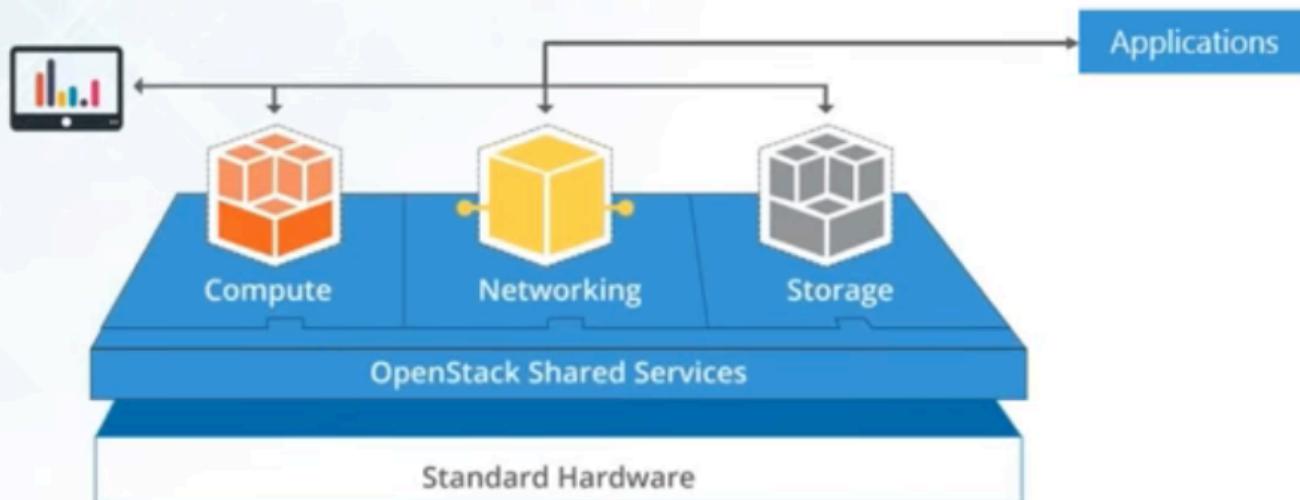


Case Study – Problem Statement



Problem Statement

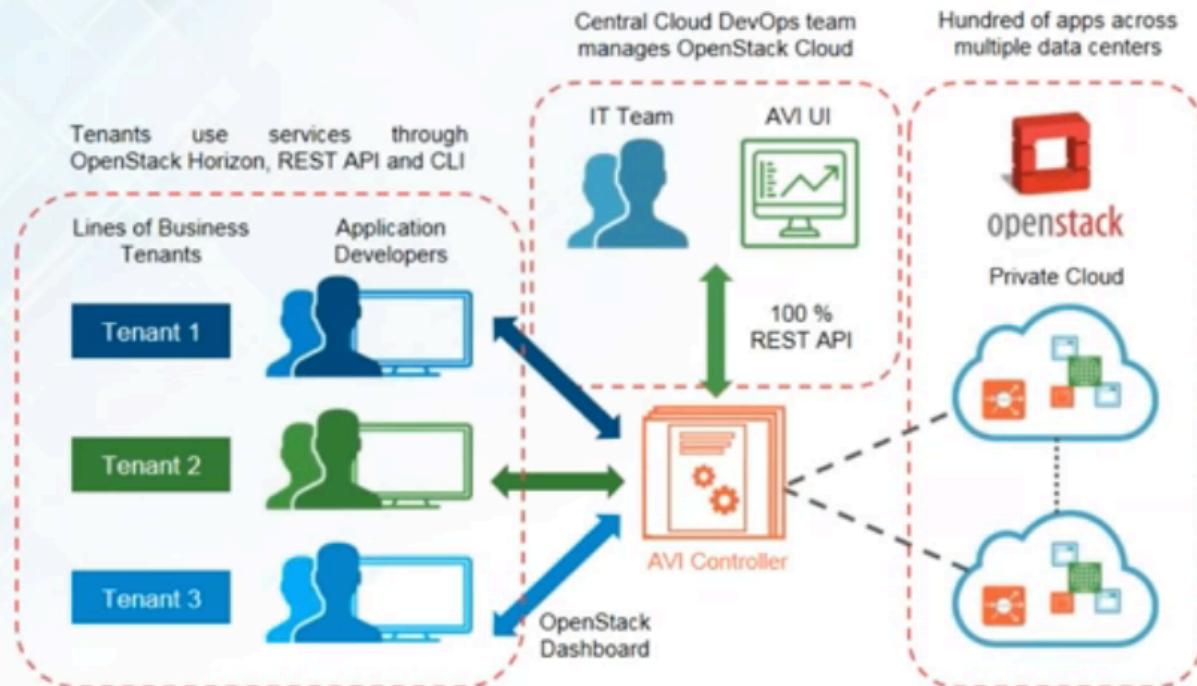
To build an OpenStack solution with fully automated provisioning and integration with automation tools at Time Warner Cable.



Case Study – OpenStack Architecture

edureka!

The following shows the OpenStack Architecture implemented by Avi Networks at Time Warner Cable

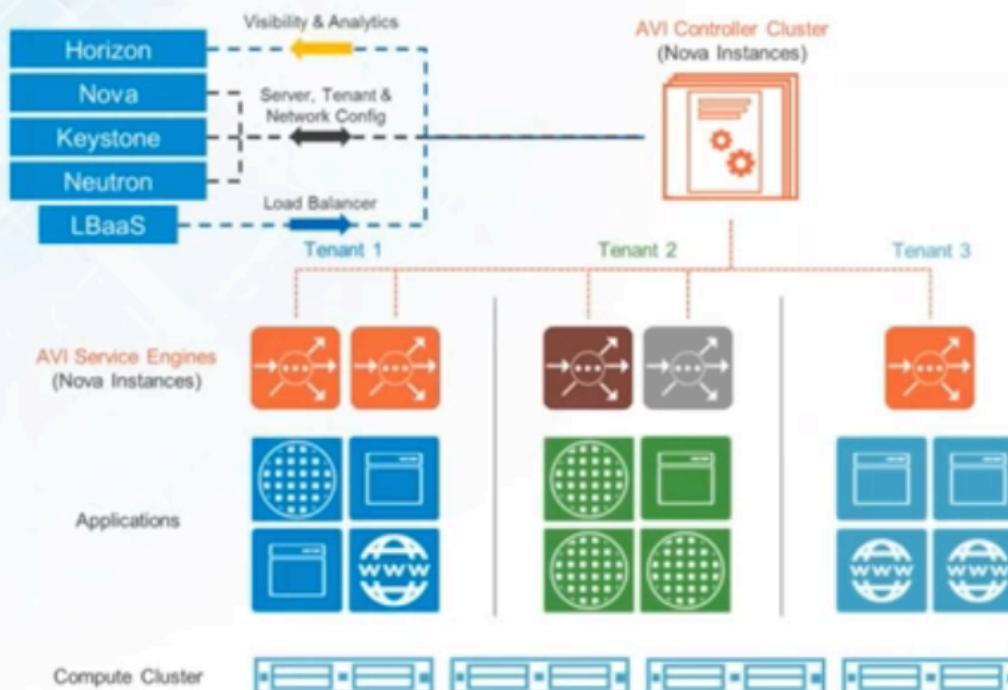




Case Study – AVI Networks ADC

edureka!

This is a detailed flow of the Next Gen ADC implemented by Avi Networks OpenStack Cloud.



Summary





Summary

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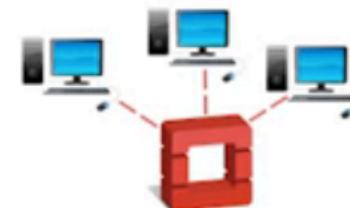
Cloud Concepts



What is Openstack?



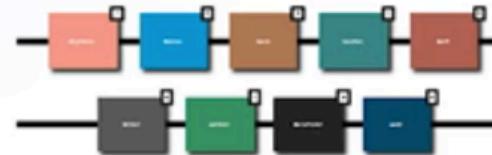
Cloud Deployment Models



Openstack Architecture



Openstack Components



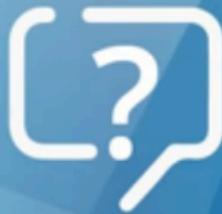
Case Study: Avi-Time Warner



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Questions



Queries



Feedback

www.edureka.co