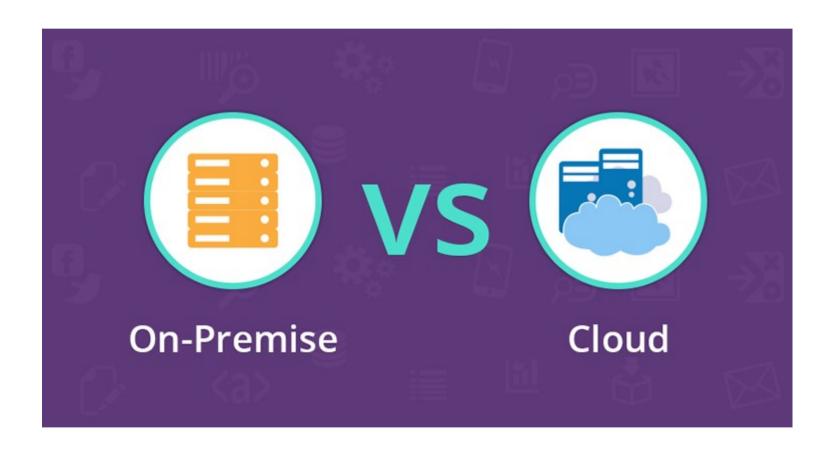# OpenStack Administration Workshop

Keywords

On-premise, Cloud, IaaS, Paas, SaaS, Public Cloud, Private Cloud, Hybrid Cloud, Community Cloud, Virtualization, Storage Cluster, SDN, Keystone, Glance, Nova, Neutron, Cinder, Swift, Horizon

References

- OpenStack Documentation http://docs.openstack.org

- RHOP Documentation https://access.redhat.com/documentation/en/red-hat-openstack-platform/

Cloud Computing

On-Premise vs Cloud

Conventional Data Center

Cloud Characteristics

Cloud Types

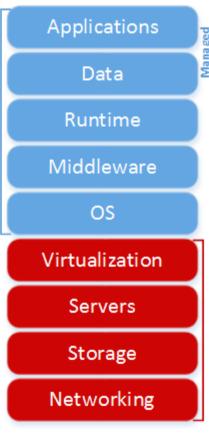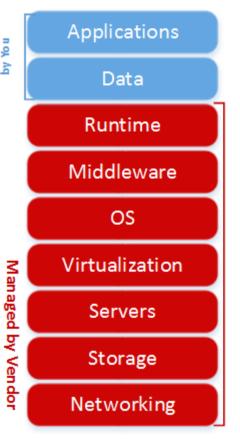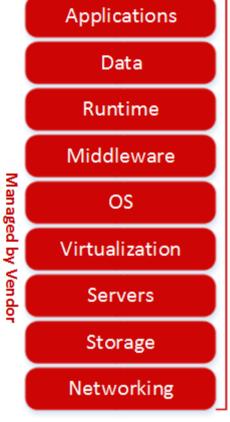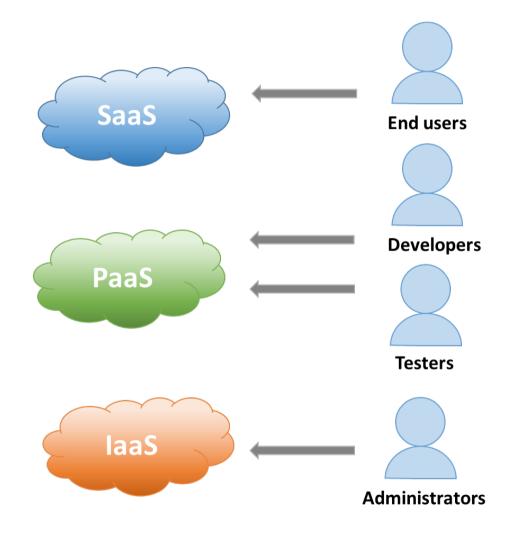|	On Premise	IaaS: Infrastructure as a Service	PaaS: Platform as a Service	SaaS: Software as a Service
	Applications	Applications	Applications	Applications
	Runtime	Data	Data	Data
	Runtime	Runtime	Runtime	Runtime
	Middleware	Middleware	Middleware	Middleware
	OS	OS	OS	OS
	Virtualization	Virtualization	Virtualization	Virtualization
	Servers	Servers	Servers	Servers
	Storage	Storage	Storage	Storage
	Networking	Networking	Networking	Networking

Managed by You — On Premise (all layers)

IaaS: Applications, Data, Runtime, Middleware, OS — Managed by You; Virtualization, Servers, Storage, Networking — Managed by Vendor

PaaS: Applications, Data — Managed by You; Runtime, Middleware, OS, Virtualization, Servers, Storage, Networking — Managed by Vendor

SaaS: Managed by Vendor (all layers)

Cloud Users

Cloud Deployment Model

Public Cloud
- Elasticity
- Utility Pricing
- Leverage Expertise

Private Cloud
- Total Control
- Regulation
- Flexibility

Community Cloud
- Meets shared concerns

Hybrid Cloud

IaaS Public Cloud

Virtualization, SDN, Cluster Storage

Virtualization Types

- Hardware Level

  - Full Virtualization: Oracle VirtualBox, VMWare Workstation, Qemu

  - Bare Metal Virtualization: RedHat KVM, Citrix Xen, VMWare Vsphere, Microsoft HyperV

- Operating System Level (OS Container): OpenVZ, LXC

- Application Level (Application Container): Docker, rkt

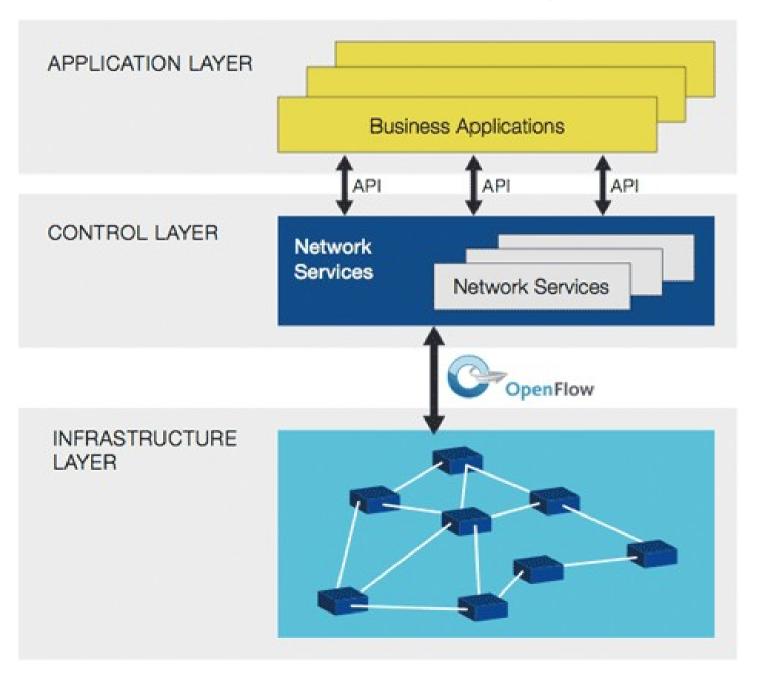# Containers, Hypervisors, Virtualization Softwares

Software Defined Networking (1)

"an emerging architecture that is dynamic, manageable, cost-effective, and adaptable, making it ideal for the high-bandwidth, dynamic nature of today's applications. This architecture decouples the network control and forwarding functions enabling the network control to become directly programmable and the underlying infrastructure to be abstracted for applications and network services. The OpenFlow® protocol is a foundational element for building SDN solutions."

https://www.opennetworking.org/sdn-resources/sdn-definition
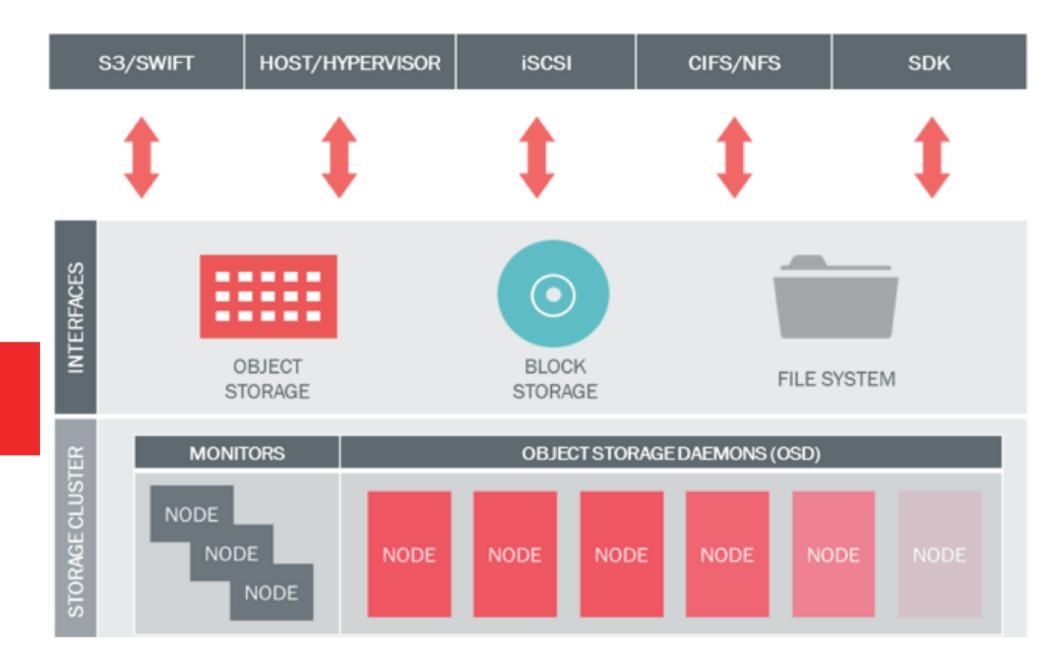
Software Defined Networking (2)

OpenFlow Based Plugin

- Open vSwitch
- Cisco UCS
- Linux Bridge
- Nicira NVP
- Ryu OpenFlow
- NEC OpenFlow
- Big Switch
- CloudBase Hyper-V
- Midionet
- Brocade VCS
- Juniper
- Mellanox
- ML2

Storage Clusters

S3/SWIFT	HOST/HYPERVISOR	iSCSI	CIFS/NFS	SDK

INTERFACES

OBJECT STORAGE

BLOCK STORAGE

FILE SYSTEM

STORAGE CLUSTER

MONITORS

OBJECT STORAGE DAEMONS (OSD)

NODE
NODE
NODE

NODE NODE NODE NODE NODE NODE

Storage Clusters Software

Cloud Software

OpenStack

OpenStack Platinum Members

AT&T

Canonical

Huawei

IBM

Intel

Rackspace

Red Hat, Inc.

SUSE

OpenStack Gold Members

99Cloud Inc.   Aptira   CCAT   China Mobile   China Telecom   Cisco

City Network   Dell EMC   Deutsche Telekom   EasyStack   Ericsson   Fujitsu

Hitachi   Inspur   inwinSTACK   Mirantis   NEC   NetApp
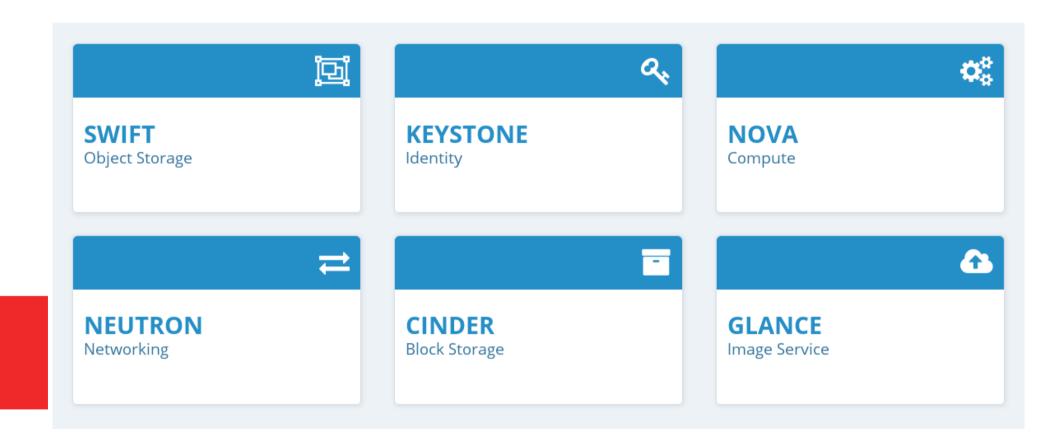
New H3C Technologies Co., Limited   UnitedStack Inc.   ZTE Corporation

OpenStack Core Services

SWIFT
Object Storage

KEYSTONE
Identity

NOVA
Compute

NEUTRON
Networking

CINDER
Block Storage

GLANCE
Image Service

OpenStack Core Services (2)

- **Keystone (identity)**, centralized service for authentication and authorization of OpenStack services and for managing users, projects and roles

- **Neutron (networking)**, provide connectivity between the interfaces of OpenStack services

- **Glance (image)**, registry service that used to store resources such as VM images and volume snapshots

- **Nova (compute)**, manage and provisions Vms running on hypervisor nodes

- **Cinder (block storage)**, manage persistent block storage volumes for Vms

- **Swift (object storage)**, store and retrieve files and arbitrary data

OpenStack Optional Services

HORIZON	Dashboard
CEILOMETER	Telemetry
HEAT	Orchestration
TROVE	Database
SAHARA	Elastic Map Reduce
IRONIC	Bare-Metal Provisioning
ZAQAR	Messaging Service
MANILA	Shared Filesystems
DESIGNATE	DNS Service
BARBICAN	Key Management
MAGNUM	Containers
MURANO	Application Catalog
CONGRESS	Governance

OpenStack Optional Services (2)

- **Horizon (dashboard)**, web browser-based dashboard that used to manage OpenStack services
- **Ceilometer (telemetry)**, provides measurements of cloud resources
- **Heat (orchestration)**, template-based orchestration engine that supports automatic creation of resource stacks
- **Manila (shared FS)**, provides file storage to a VMs.
- **Ironic (bare metal provisioning)**, provision physical or bare metal machines.
- **Trove (DBaaS)**, allow users to select, provision, operate and administrate variety of relation and non-relation databases.
- **Sahara (data processing)**, provisioning and management of Hadoop clusters on OpenStack

OpenStack Version (Upstream)

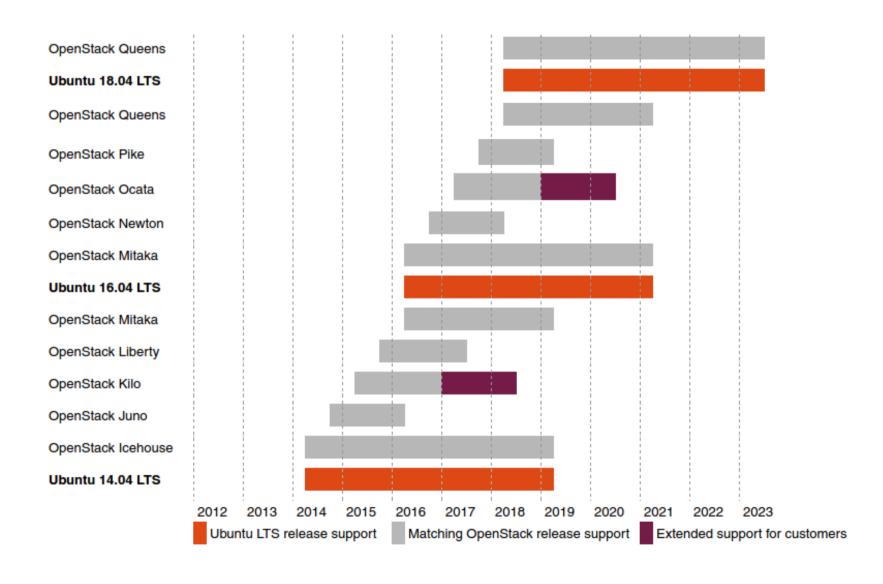| Series	Status	Release Date	EOL
Pike	Under Development		
Ocata	Stable	2017-02-22	2018-02-26
Newton	Security Supported	2016-10-06	2017-10-11
Mitaka	Security Supported	2016-04-07	2017-04-10

OpenStack Distributions

RHOP Life Cycle

RED HAT OPENSTACK PLATFORM RELEASE

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
11					May 18 — May 18					
10					Dec 15			Dec 15 (Extended Life Support)		
9				Aug 24		Aug 24				
8				April 20		April 20				
7			Aug 5		Aug 5					
6			Feb 9		Feb 17					
5		June 30		June 30						
4		Dec 19	July 19							
3	July 10	July 31								

Phase 1 (12-18 months)   Phase 2 (12-24 months)   Extended Life Support (24 months)
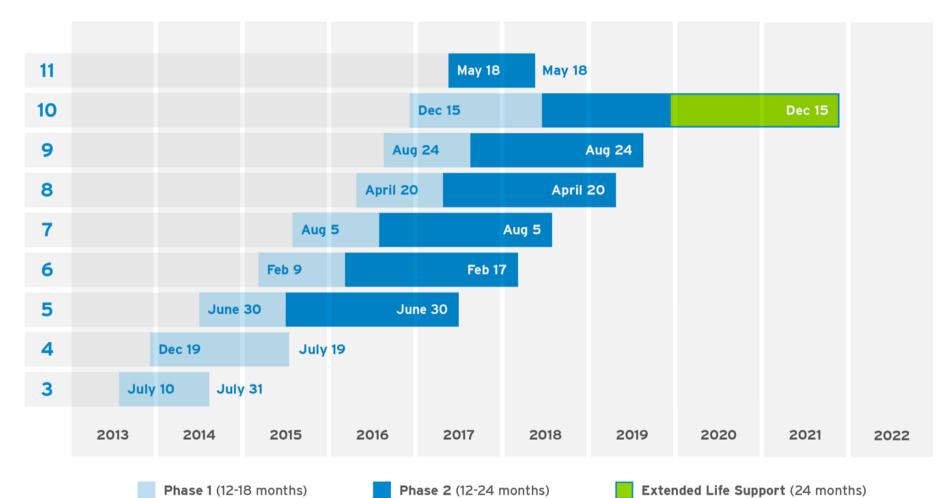
SUSE OpenStack Cloud Life Cycle

PRODUCT RELEASE	GENERAL SUPPORT ENDS	LTSS ENDS	CURRENT VERSION
SUSE Openstack Cloud 5	15 May 2017	Not Applicable	↓ SUSE OpenStack Cloud 7
SUSE OpenStack Cloud 6	15 Apr 2018	Not Applicable	↓ SUSE OpenStack Cloud 7
▸ SUSE OpenStack Cloud 7	31 Mar 2019	Not Applicable	↓ SUSE OpenStack Cloud 7

Ubuntu OpenStack Cloud Life Cycle

OpenStack Queens
Ubuntu 18.04 LTS
OpenStack Queens
OpenStack Pike
OpenStack Ocata
OpenStack Newton
OpenStack Mitaka
Ubuntu 16.04 LTS
OpenStack Mitaka
OpenStack Liberty
OpenStack Kilo
OpenStack Juno
OpenStack Icehouse
Ubuntu 14.04 LTS

2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023

Ubuntu LTS release support   Matching OpenStack release support   Extended support for customers

Mirantis OpenStack Cloud Life Cycle

9.0 for Mitaka

Support Status: FULL

- General Availability (GA) date: 7/12/2016
- Full Support ends: 7/12/2017
- Limited Support ends: 7/12/2019

| Documentation | Virtual Box Scripts | Release Notes | Checksum |

8.0 for Liberty

Support Status: LIMITED

- General Availability (GA) date: 2/29/2016
- Full Support ends: 3/1/2017
- Limited Support ends: 3/1/2019
- How to Apply Maintenance Update to Release 8.0

| Documentation | Virtual Box Scripts | Release Notes | Checksum |

7.0 for Kilo 2015.1.0

Support Status: LIMITED

- General Availability (GA) date: 9/30/2015
- Full Support ends: 9/30/2016
- Limited Support ends: 9/30/2018

| Documentation | Virtual Box Scripts | Release Notes | Checksum |

OpenStack Images

- Cirros: http://download.cirros-cloud.net

- CentOS: http://cloud.centos.org/centos/

- OpenSUSE:
  http://download.opensuse.org/repositories/Cloud:/Images:/

- Ubuntu: http://cloud-images.ubuntu.com

- Debian: http://cdimage.debian.org/cdimage/openstack/

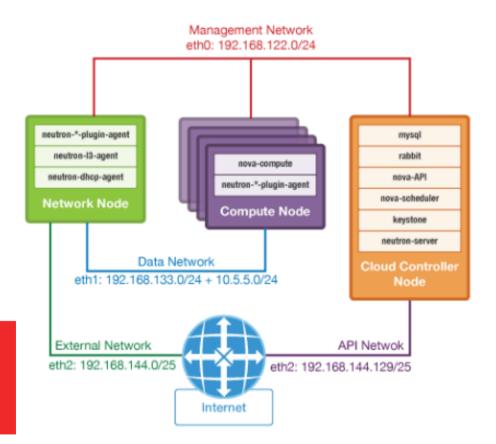- Windows Server: https://cloudbase.it/windows-cloud-images/

OpenStack Deployment Tools

- Devstack http://docs.openstack.org/developer/devstack/

- OpenStack Ansible
  https://github.com/openstack/openstack-ansible

- Packstack & Triple O: https://www.rdoproject.org

- Conjure-up & Autopilot:
  https://www.ubuntu.com/cloud/openstack

- Crowbar: http://crowbar.github.io

- Fuel: https://www.fuel-infra.org

- Compass: http://www.syscompass.org

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- Crowbar: http://crowbar.github.io

- Fuel: https://www.fuel-infra.org

- Compass: http://www.syscompass.org

OpenStack Networking
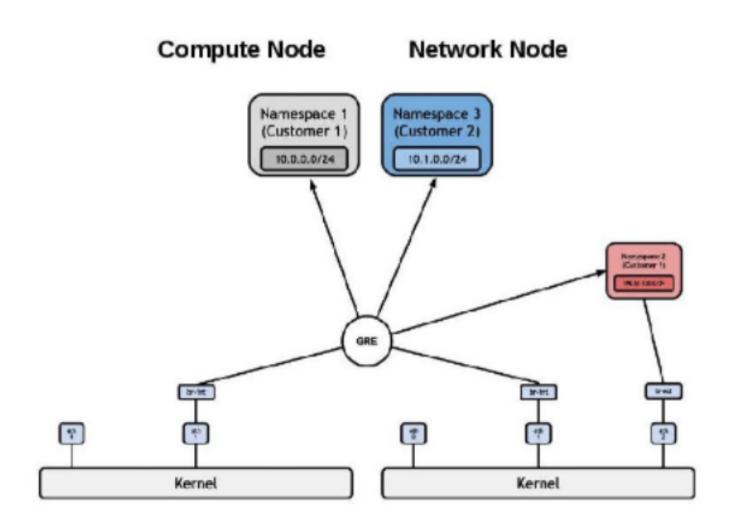
Next, we present a general overview of the networks present in **OpenStack Clouds**. We have:

- **Internal management network**: this is used by all the physical nodes to talk to each other.

- **Provider network**: this is GRE- or VLAN-based, used by VMs on different hosts to talk to each other.

- **External network**: the official, routable network to the Internet.

- **OAM network**: another official network for API access from external hosts; it can be the same as the External network.

Please note that **GRE** stands for **Generic Routing Encapsulation**. In contrast to other tunneling solutions, GRE does not offer any form of encryption. Don't confuse it with **IPsec** or other similar technologies.
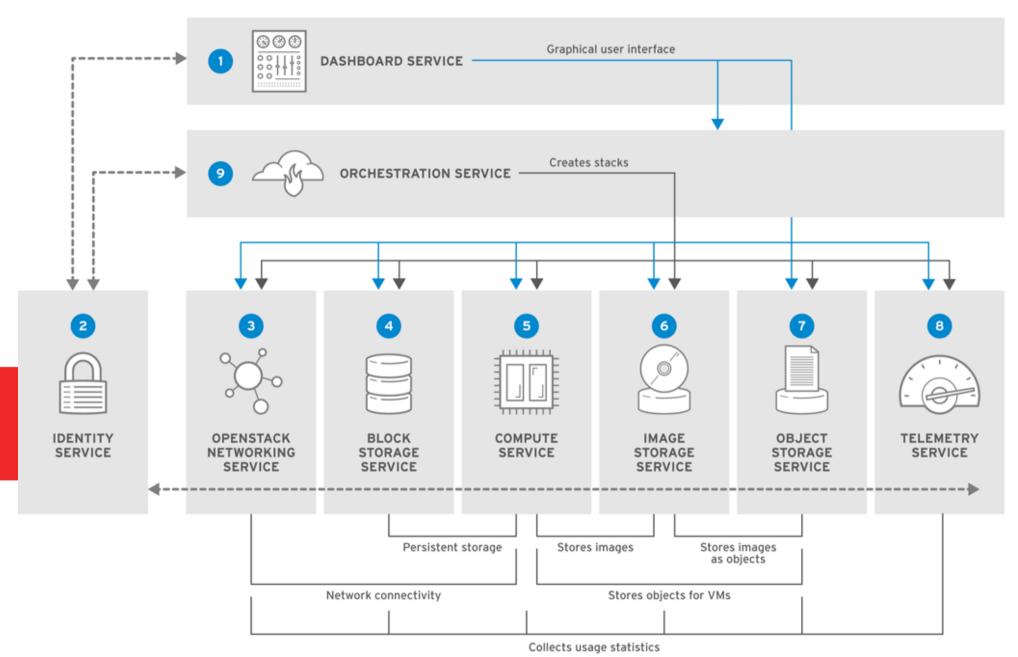
OpenStack Networking (2)

Prerequisite Services

- NTP: NTPD, Chrony

- MQ: RabbitMQ, zeroMQ
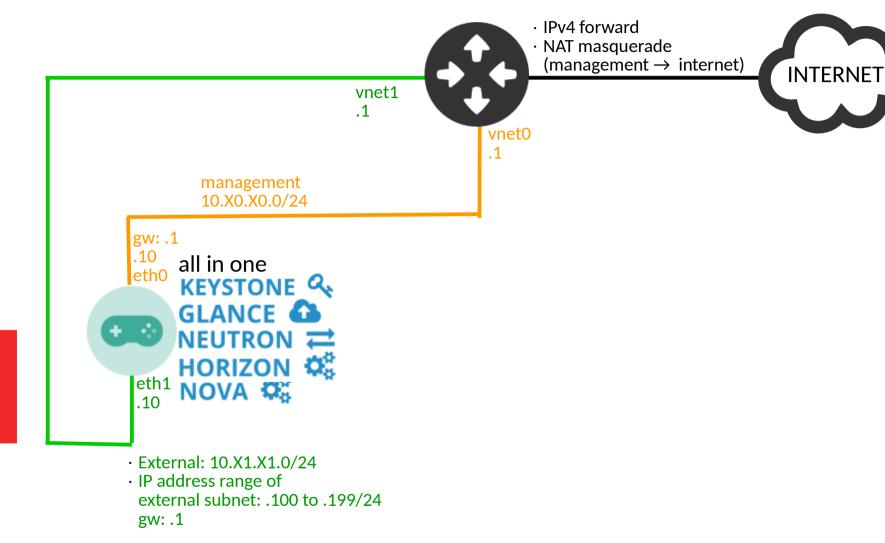
- SQL: MariaDB, MySQL, PostgreSQL

- NoSQL: MongoDB

OpenStack Services Diagram

1 DASHBOARD SERVICE — Graphical user interface

9 ORCHESTRATION SERVICE — Creates stacks

2 IDENTITY SERVICE

3 OPENSTACK NETWORKING SERVICE

4 BLOCK STORAGE SERVICE

5 COMPUTE SERVICE

6 IMAGE STORAGE SERVICE

7 OBJECT STORAGE SERVICE

8 TELEMETRY SERVICE

Persistent storage

Stores images

Stores images as objects

Network connectivity

Stores objects for VMs

Collects usage statistics

Lab I

*Keystone, Neutron, Glance,
Nova, Horizon*

Lab I Topology

· IPv4 forward
· NAT masquerade
(management → internet)

INTERNET

vnet1
.1

vnet0
.1

management
10.X0.X0.0/24

gw: .1
.10
eth0

all in one
KEYSTONE
GLANCE
NEUTRON
HORIZON
NOVA

eth1
.10

· External: 10.X1.X1.0/24
· IP address range of
  external subnet: .100 to .199/24
  gw: .1
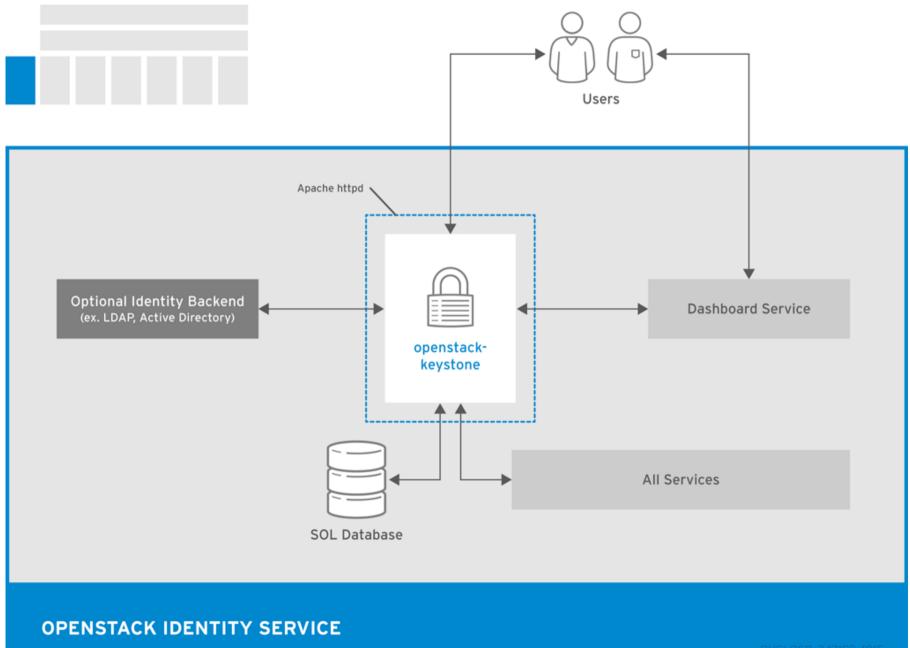
Keystone Components

- **Keystone server**, centralized server provide authentication and authorization services using RESTful interface.

- **Keystone driver**, accessing identity information in repositories external to OpenStack (SQL DB, LDAP, AD).

- **Keystone modules**, middleware modules run in the address space of the OpenStack component that is using the identity service.
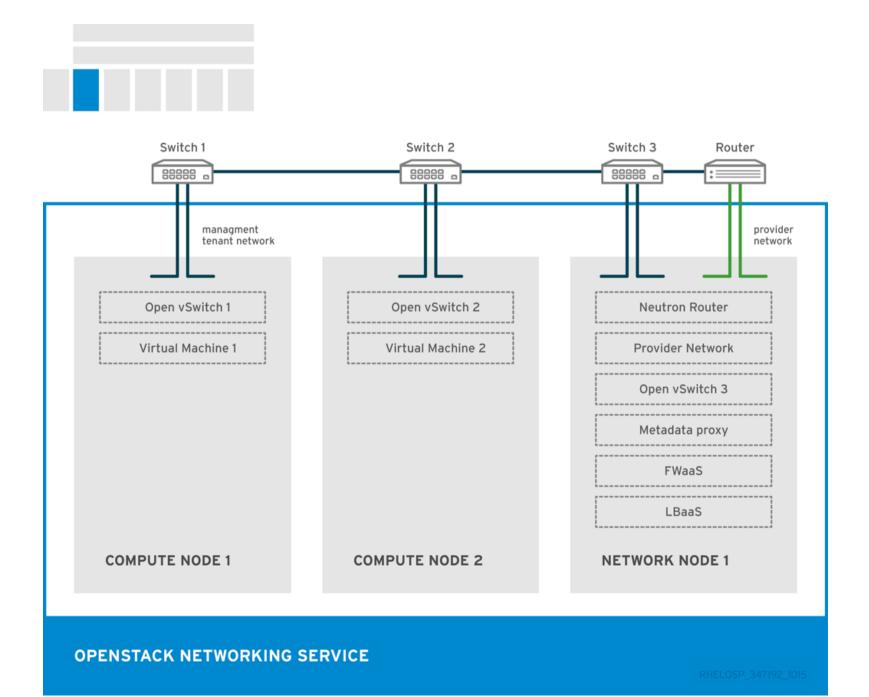
Keystone Flow Diagram

Neutron Components

- **Neutron servers**, python daemon that manages user request and expose the networking API.

- **Neutron plugins**, specific set of networking technology/mechanisms to implement the networking API.

- **Neutron agents**, service that runs on each OpenStack node to perform local networking configuration for the node virtual machines and for networking services such as Open vSwitch.
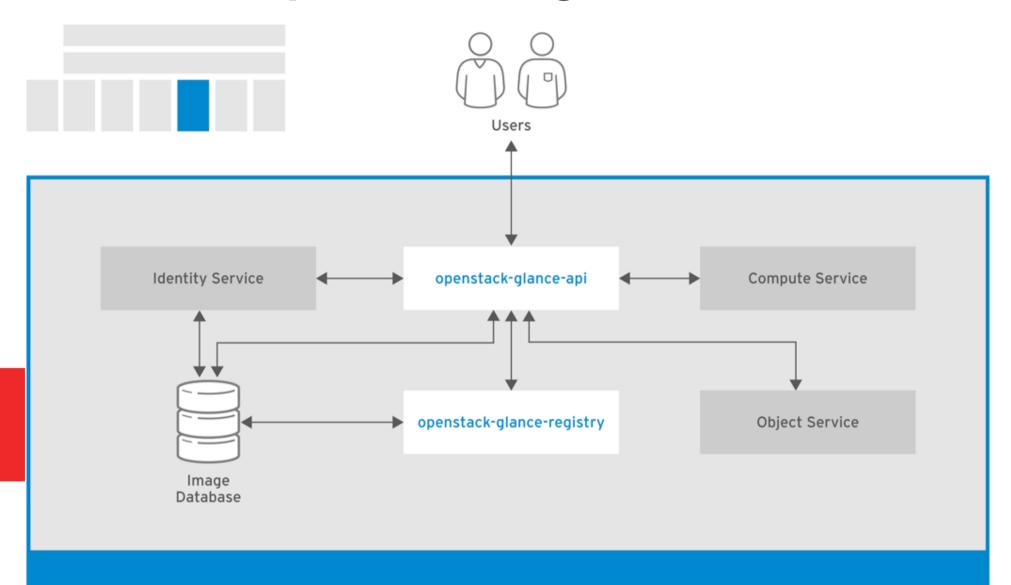
Neutron Configuration Example

Glance Components

- **Glance API**, interacts with storage backends to handle requests for image retrieval and storage.

- **Glance registry**, manage all metadata for each image.

Glance Components Diagram

Users

Identity Service ⟷ openstack-glance-api ⟷ Compute Service

openstack-glance-registry

Image Database

Object Service

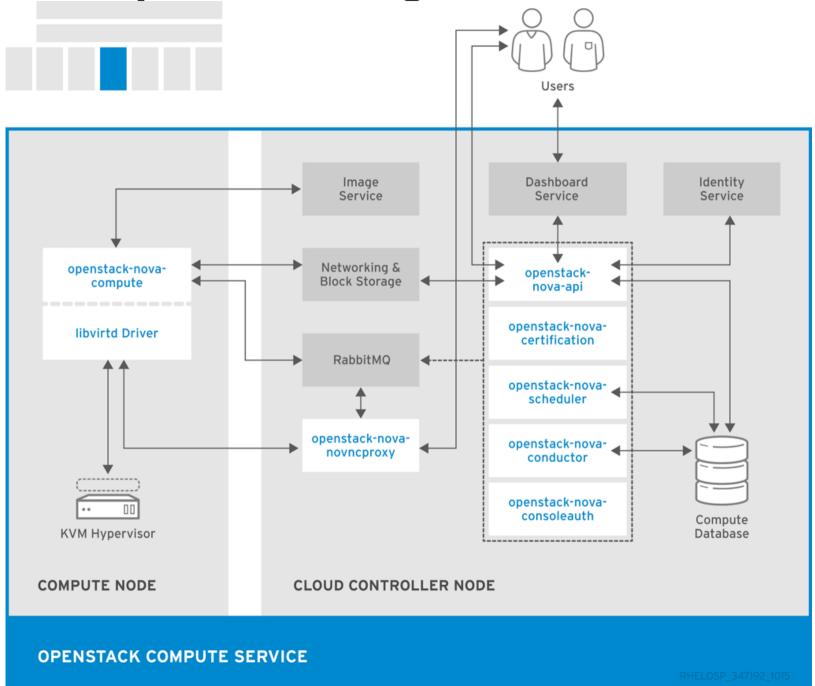**OPENSTACK IMAGE STORAGE SERVICE**

RHELOSP_347192_1015

Image Disk Formats

- aki/ami/ari, amazon kernel/machine/ramdisk image.

- iso, archive format for optical discs.

- qcow2, qemu/kvm support copy on write.

- raw, unstructed format

- vhd, hyper-v

- vdi, virtualbox

- vmdk, vmware
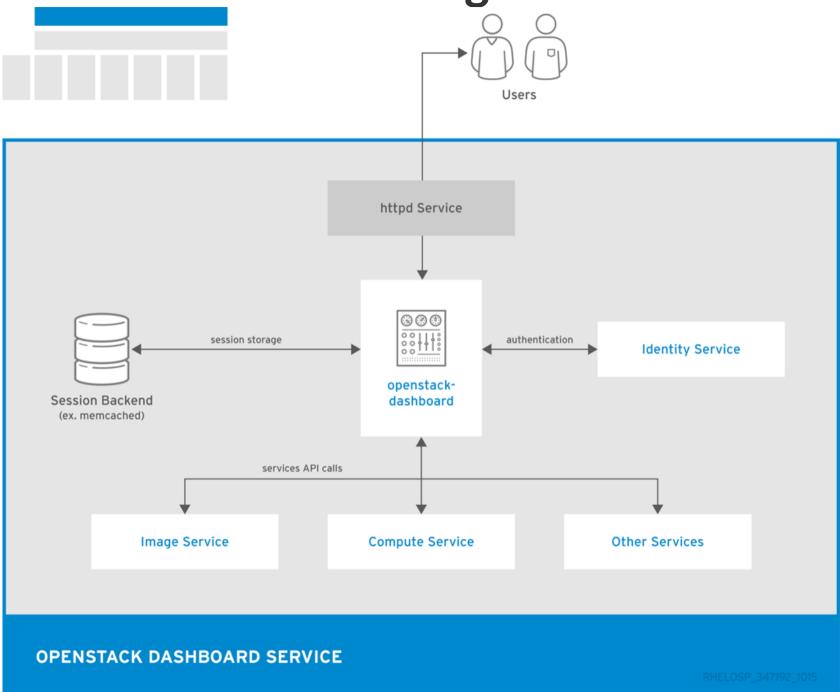
- bare, no metadata

- ova

- ovf

Nova Components

- **Nova API**, handles requests and provides access to the compute services.

- **Nova cert**, provide the certificate manager.

- **Nova compute**, run on each compute node to create and terminate instances.

- **Nova conductor**, provides database-access support for compute nodes to reduce security risks.

- **Nova consoleauth**, handles console authentication.

- **Nova novncproxy**, provides a VNC proxy for browser to enable consoles to access instances.

- **Nova scheduler**, dispatches requests for new instances to the correct node based on configured weights and filters/

Nova Components Diagram

Users

COMPUTE NODE

openstack-nova-compute

libvirtd Driver

KVM Hypervisor

CLOUD CONTROLLER NODE

Image Service

Networking & Block Storage

RabbitMQ

openstack-nova-novncproxy

Dashboard Service

Identity Service

openstack-nova-api

openstack-nova-certification

openstack-nova-scheduler

openstack-nova-conductor

openstack-nova-consoleauth

Compute Database

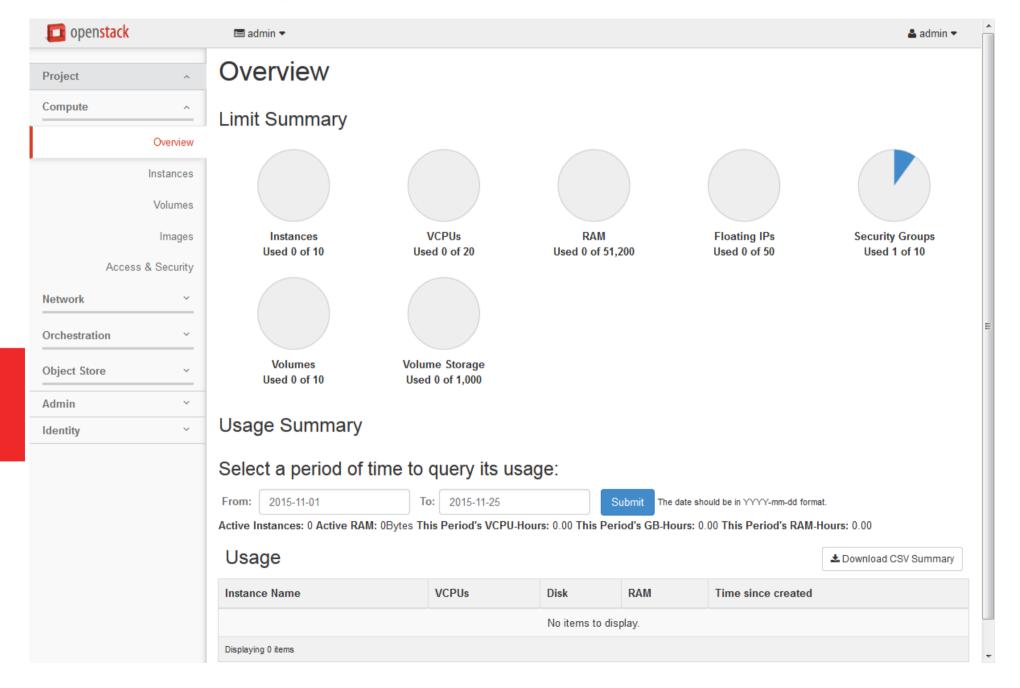**OPENSTACK COMPUTE SERVICE**

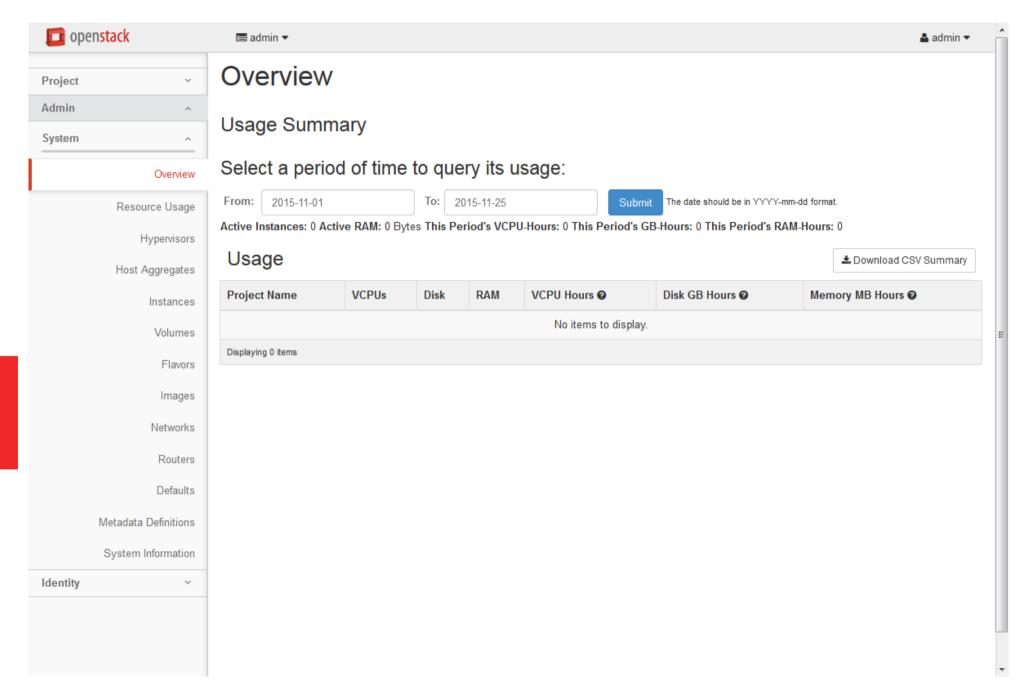RHELOSP_347192_1015

Horizon Interactions Diagram

Horizon Tabs

- Project tab, view and manage the resources in a selected project

- Admin tab, administration tab to view usage, manage instances, volumes, flavors, images, networks and so on.

- Identity tab, view and manage projects and users.

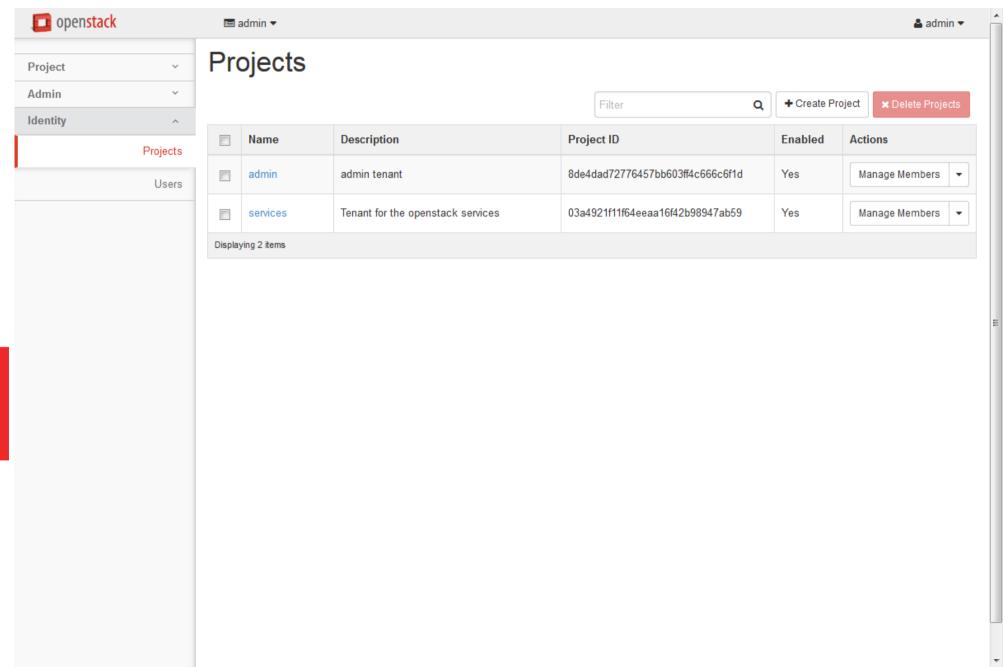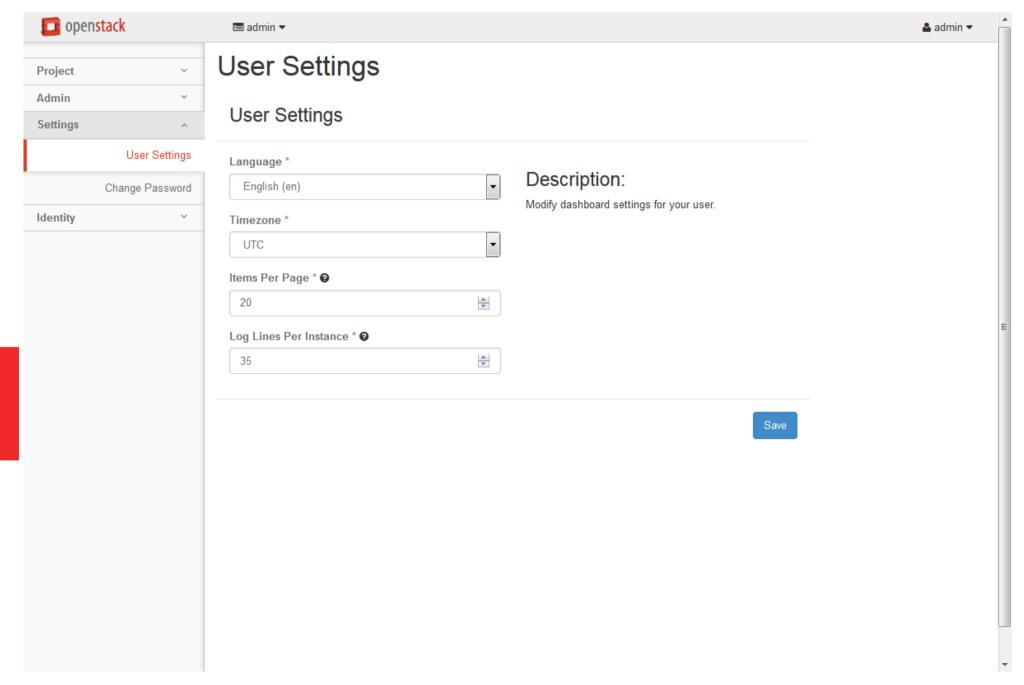- Settings tab, view and manage dashboard settings.

Horizon Project Tab

Horizon Admin Tab

Horizon Identity Tab
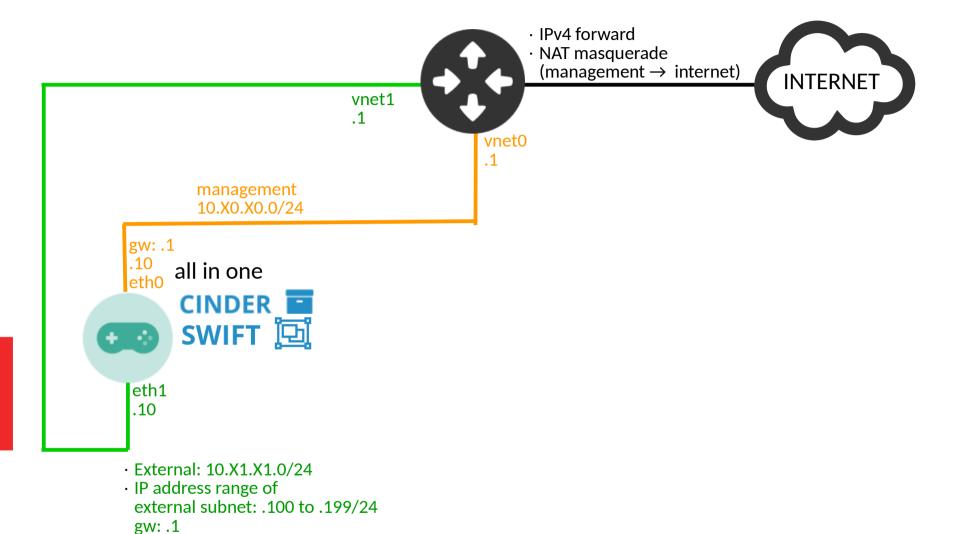
Horizon Settings Tab

Lab II

Cinder, Swift

Lab II Topology

· IPv4 forward
· NAT masquerade
  (management → internet)

INTERNET

vnet1
.1

vnet0
.1

management
10.X0.X0.0/24

gw: .1
.10
eth0

all in one

CINDER

SWIFT

eth1
.10

· External: 10.X1.X1.0/24
· IP address range of
  external subnet: .100 to .199/24
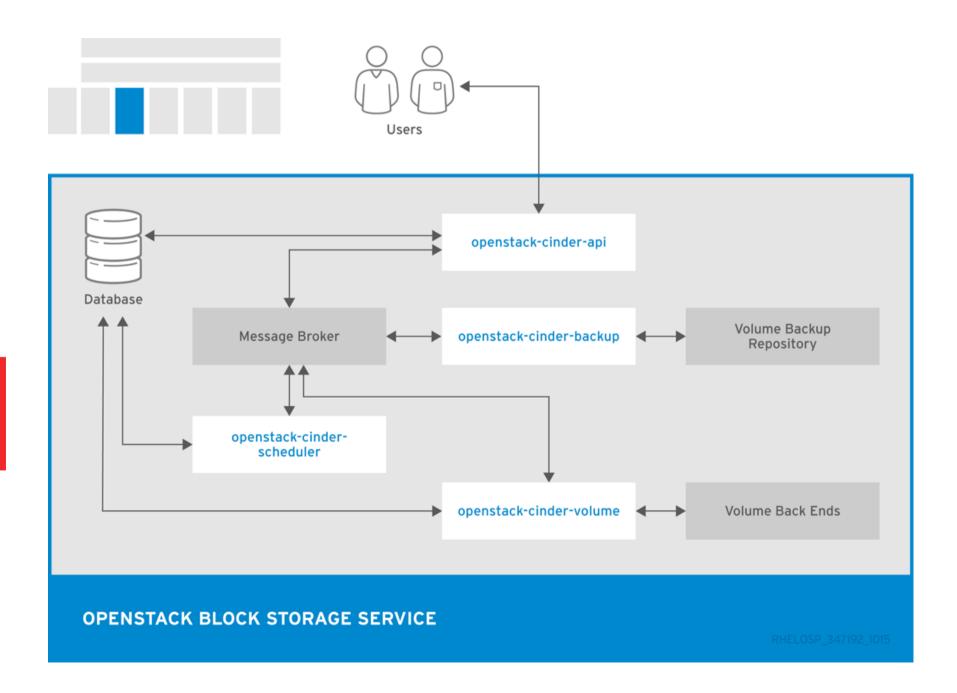 gw: .1

Cinder Components

- **Cinder API**, responds to request and places them in the message queue.

- **Cinder backup**, backup a block storage volume to an external storage repository.

- **Cinder scheduler**, assigns tasks to the queue and determines the provisioning volume server.

- **Cinder volume**, designates storage for VMs.

Cinder Components Diagram

Users

Database

openstack-cinder-api

Message Broker

openstack-cinder-backup

Volume Backup Repository

openstack-cinder-scheduler

openstack-cinder-volume

Volume Back Ends

OPENSTACK BLOCK STORAGE SERVICE

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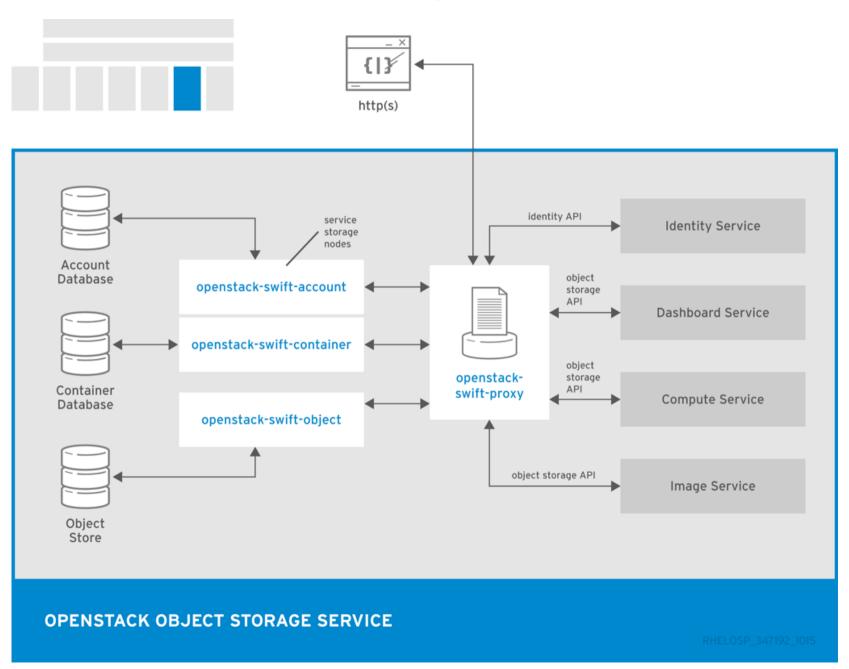
Swift Components

- **Swift account**, handles listing of containers with the account database.

- **Swift container**, handles listing of objects that are included in a specific container with the container database.

- **Swift object**, stores, retrieves, and delete objects.

- **Swift proxy**, expose the public API, provides authentication, and route requests.

- **Swift auditor**, verifies the integrity of accounts, containers and objects and protect against data corruption.

- **Swift replicator**, ensures consistent and available replication throughout the swift cluster including garbage collection

- **Swift updater**, identifies and retries failed updates.

Swift Components Diagram

http(s)

service
storage
nodes

Account
Database

openstack-swift-account

Container
Database

openstack-swift-container

openstack-swift-object

Object
Store

openstack-
swift-proxy

identity API — Identity Service

object
storage
API — Dashboard Service

object
storage
API — Compute Service

object storage API — Image Service

OPENSTACK OBJECT STORAGE SERVICE

RHELOSP_347192_1015

www.btech.id