OpenStack Certified Administrator Exam Preparation (OS-COA)

Keywords

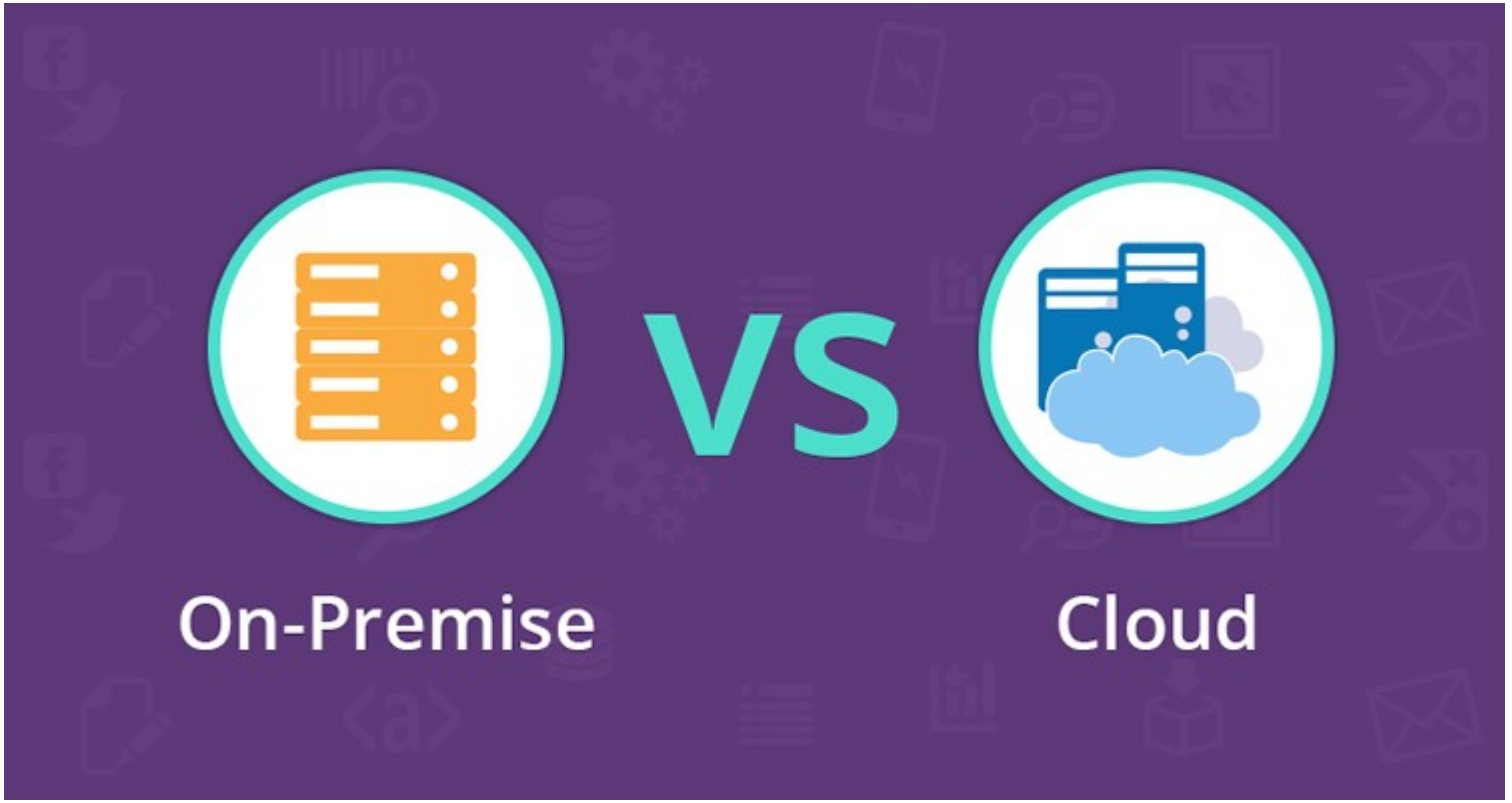
On-premise, Cloud, IaaS, Paas, SaaS, Public Cloud, Private Cloud, Hybrid Cloud, Community Cloud, Virtualization, Storage Cluster, SDN, Keystone, Glance, Nova, Neutron, Cinder, Swift, Manila, Horizon, Ceilometer, Heat

References

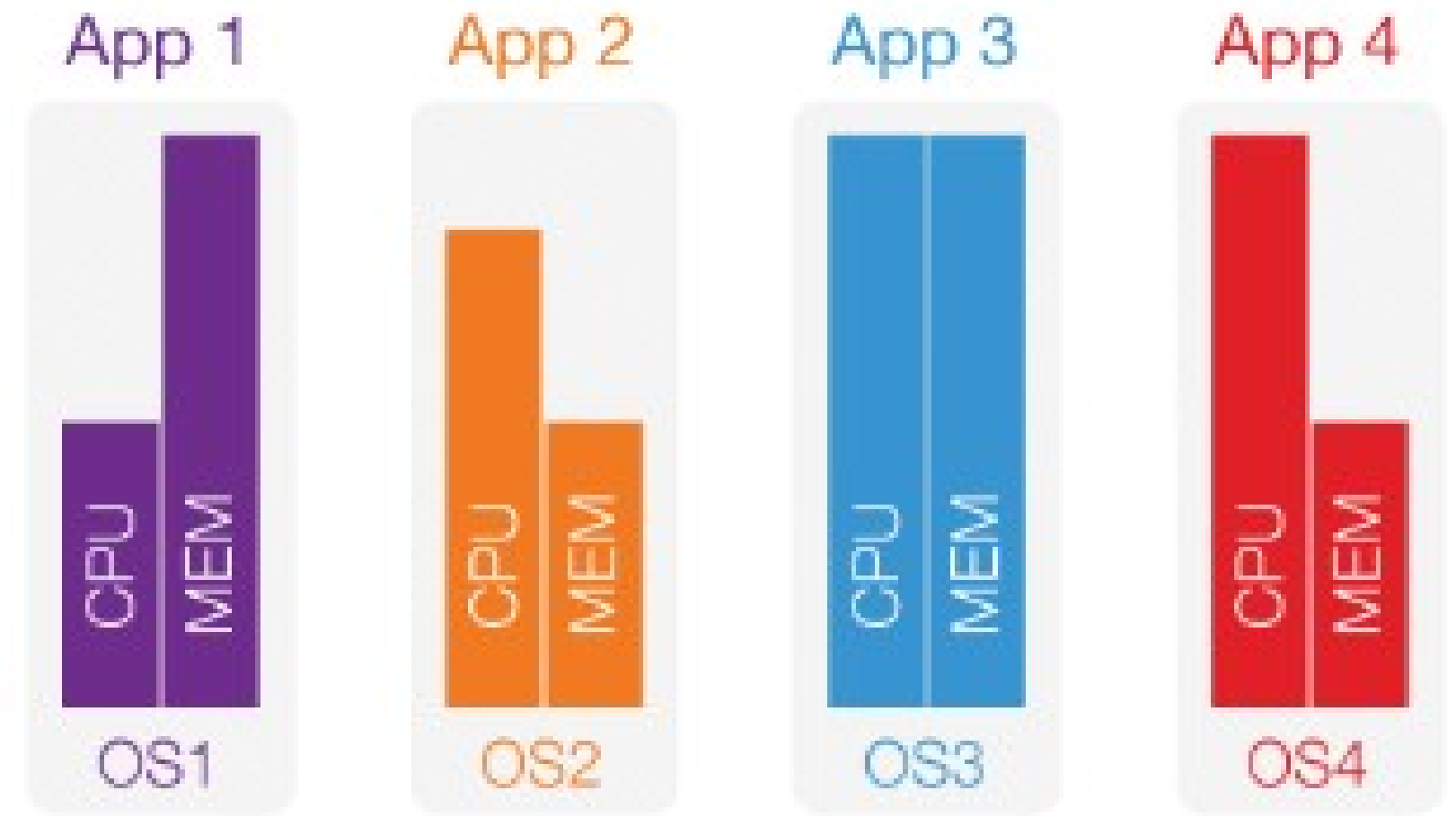
- OpenStack Documentation
  http://docs.openstack.org
- RHOP Documentation
  https://access.redhat.com/documentation/en/red-hat-openstack-platform/

Cloud Computing

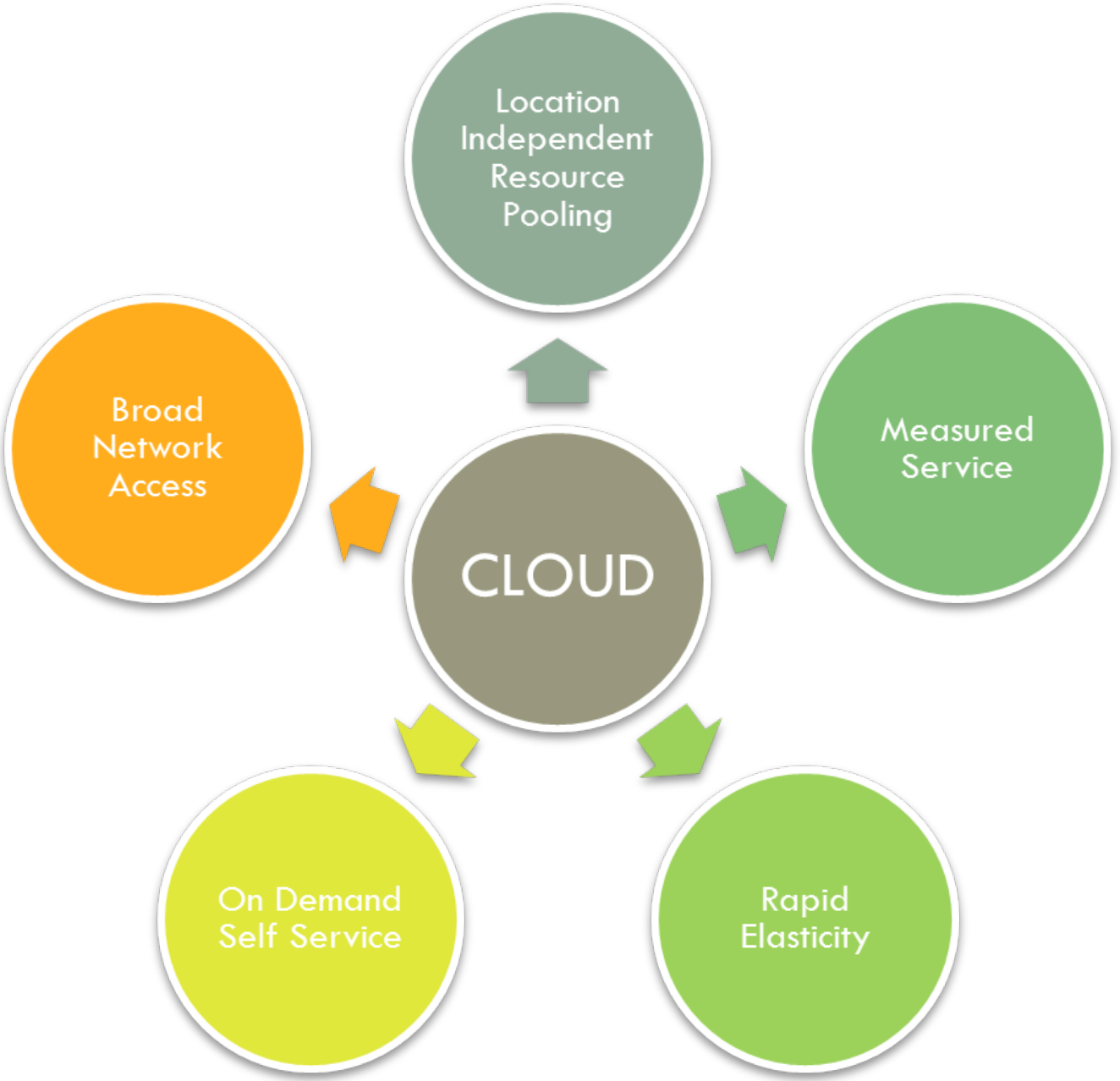
On-Premise vs Cloud



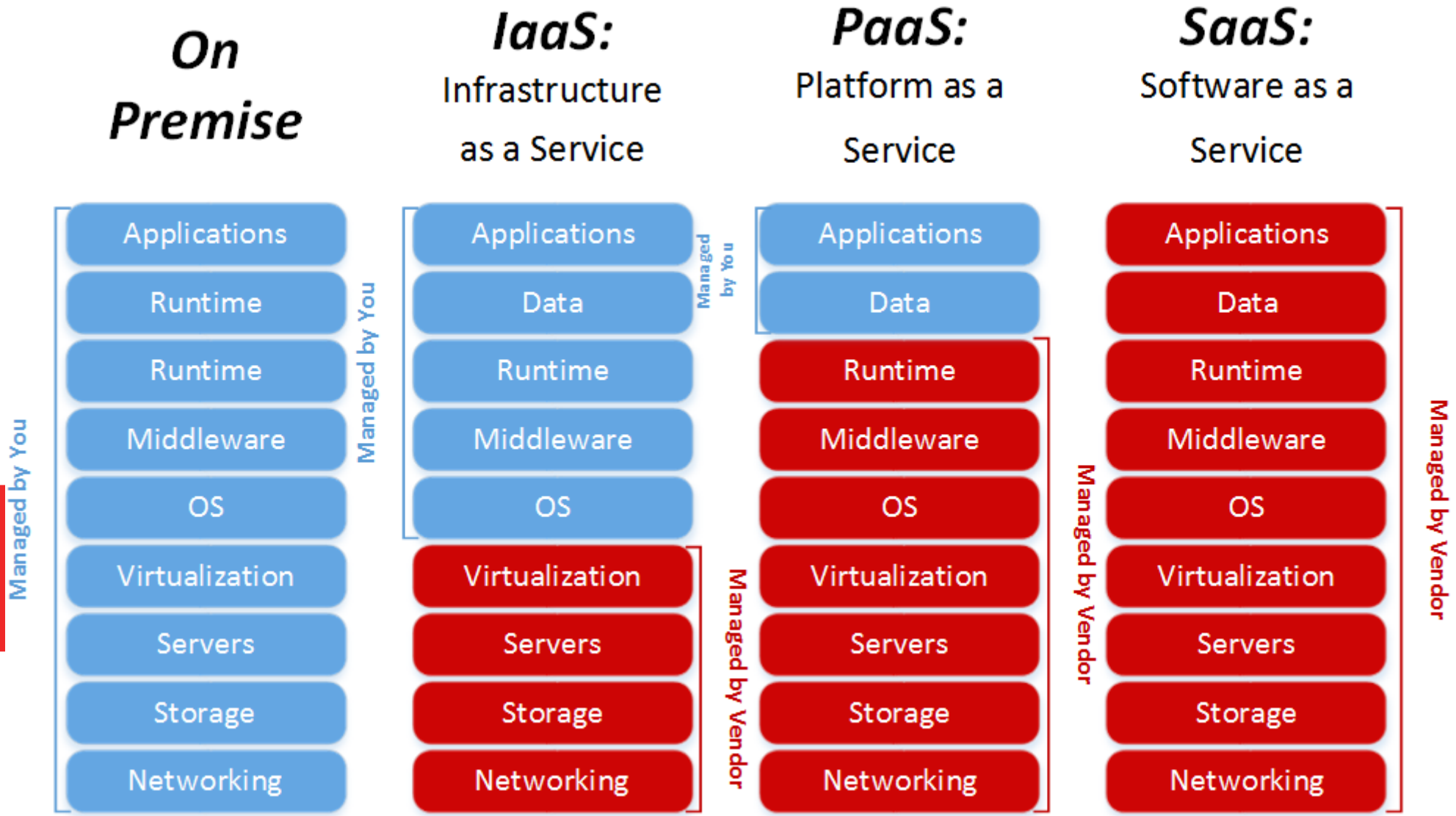
Conventional Data Center



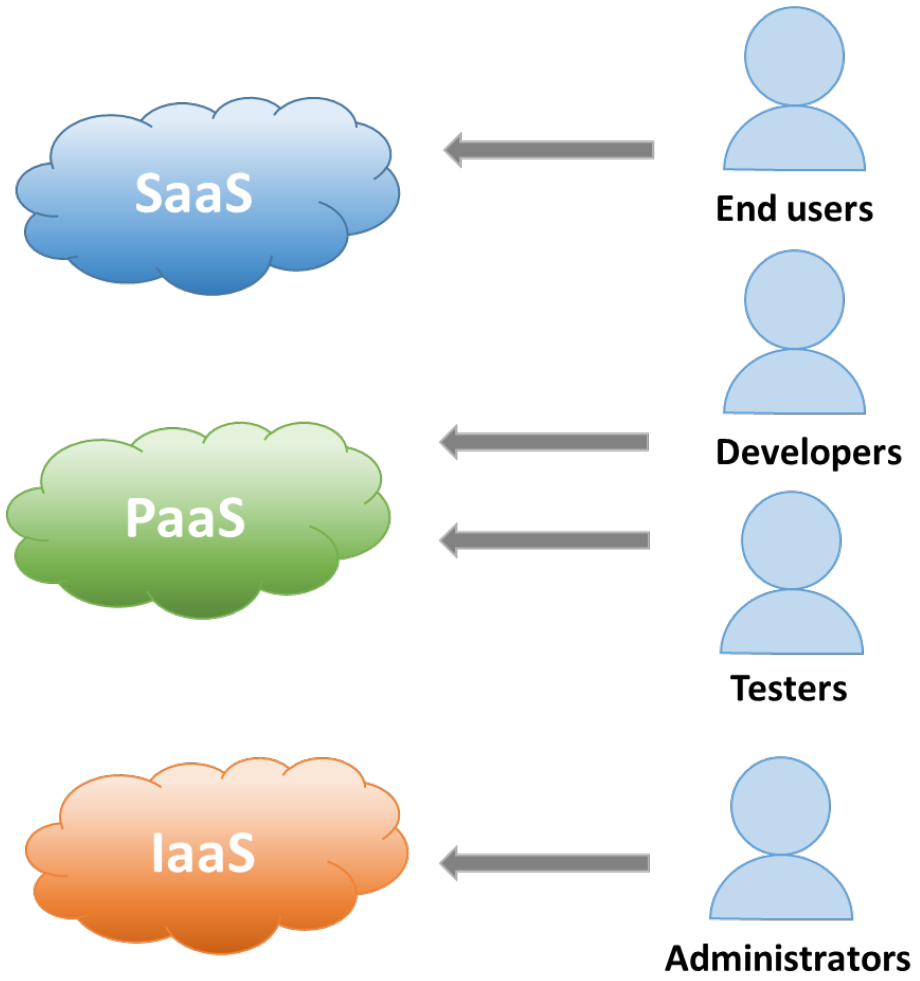
Cloud Characteristics



Cloud Types


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

Cloud Users


SaaS
PaaS
IaaS
End users
Developers
Testers
Administrators

Cloud Deployment Model

Public Cloud

- Elasticity
- Utility Pricing
- Leverage Expertise

Private Cloud

- Total Control
- Regulation
- Flexibility

Community Cloud

- Meets shared concerns

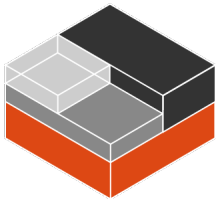
IaaS Public Cloud

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

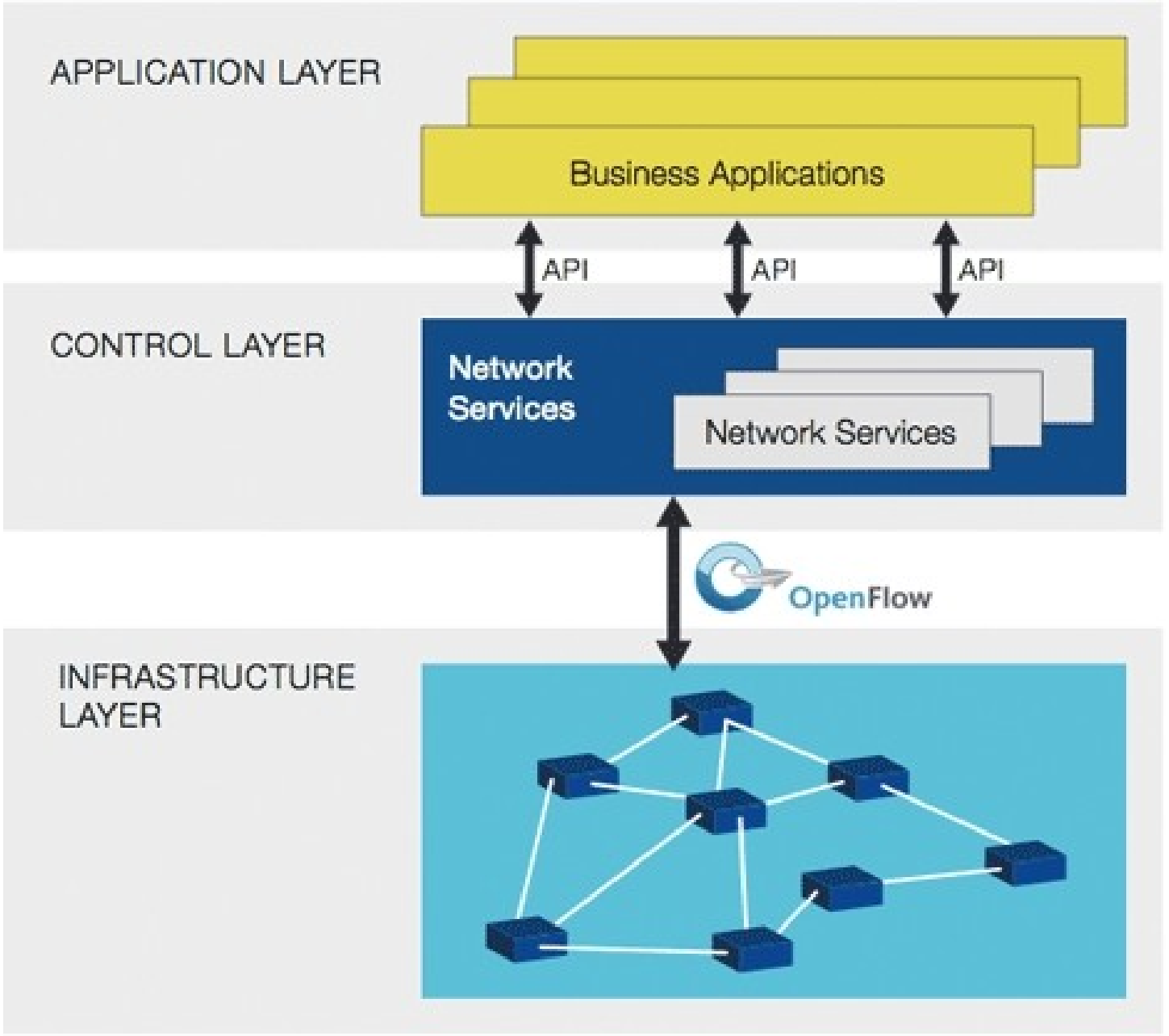


Software Defined Networking (1)

“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

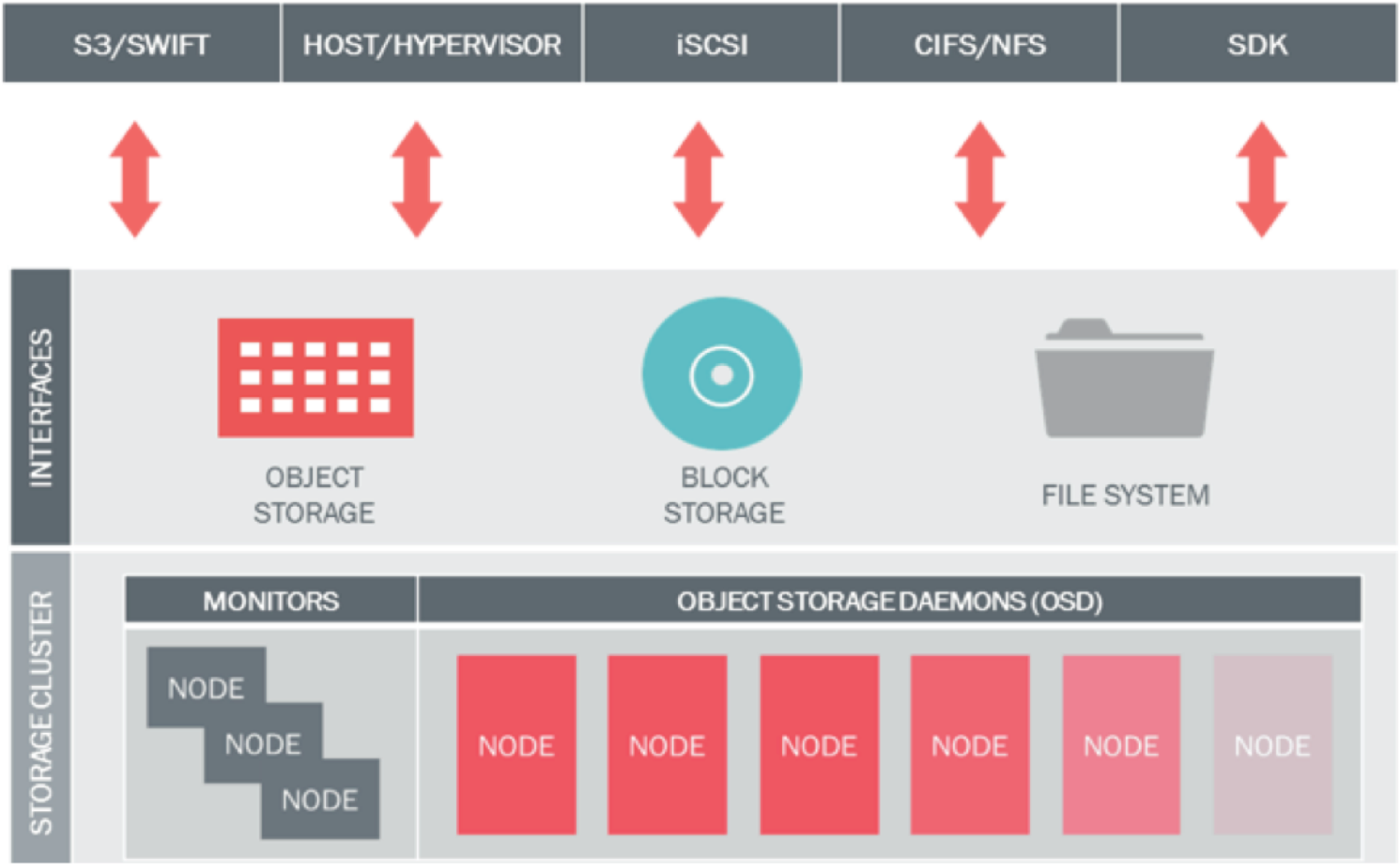
Software Defined Networking (2)



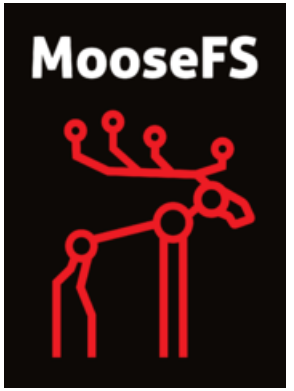
OpenFlow Based Plugin

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

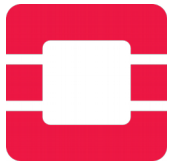
Storage Clusters



Storage Clusters Software



Cloud Software



OpenStack

OpenStack Platinum Members

AT&T

Ericsson

Huawei

IBM

Intel

Rackspace

Red Hat, Inc.

SUSE

OpenStack Gold Members

99Cloud Inc.

Aptira

Canonical

CCAT

China Mobile

China Telecom

China Unicom

Cisco

City Network

Dell EMC

Deutsche Telekom

EasyStack

Fiberhome Telecommunication Technologies

Fujitsu

Hitachi

Inspur

inwinSTACK

Mirantis

NEC

NetApp

New H3C Technologies Co., Limited

UnitedStack Inc.

ZTE Corporation

OpenStack Core Services

NOVA

Compute

NEUTRON

Networking

SWIFT

Object Storage

GLANCE

Image Service

KEYSTONE

Identity Service

CINDER

Block Storage

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 All Services

- NOVA
- GLANCE
- IRONIC
- MAGNUM
- STORLETS
- ZUN
- TROVE
- SAHARA
- SEARCHLIGHT
- SWIFT
- CINDER
- MANILA
- KARBOR
- FREEZER
- KEYSTONE
- BARBICAN
- CONGRESS
- MISTRAL
- NEUTRON
- DESIGNATE
- DRAGONFLOW
- KURYR
- OCTAVIA
- TACKER
- TRICIRCLE
- HORIZON
- OPENSTACK CLIENT (CLI)
- RALLY
- SENLIN
- VITRAGE
- WATCHER

OpenStack All Services (2)


CHEF OPENSTACK


KOLLA


OPENSTACK CHARMS


OPENSTACKANSIBLE


PUPPET OPENSTACK


TRIPLEO


HEAT


ZAQAR


MURANO

SOLUM


CEILOMETER


CLOUDKITTY


MONASCA


AODH


PANKO

OpenStack Optional Services

- **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 Use Cases

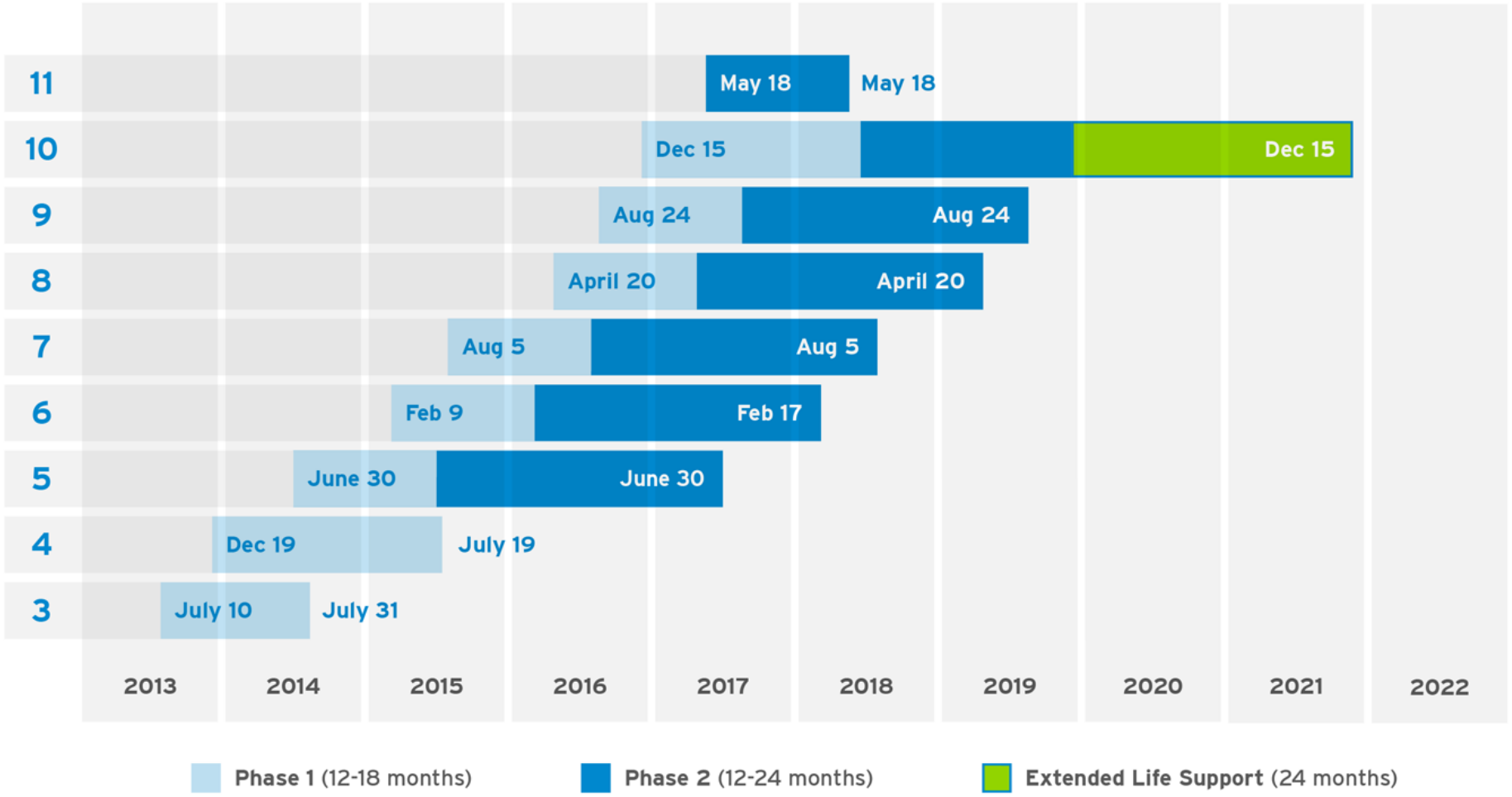
- Web Applications
- Big Data
- Ecommerce
- Containers
- Video Processing & Content Delivery
- Telecom & NFV
- Enterprise
- Scientific Research
- High Performance Computing/HTC

OpenStack Version (Upstream)

Series	Status	Release Date	EOL
Queens	Under Development		
Pike	Stable	2017-08-30	
Ocata	Maintained	2017-02-22	2018-02-26
Newton	Maintained	2016-10-06	2017-10-11

OpenStack Distributions

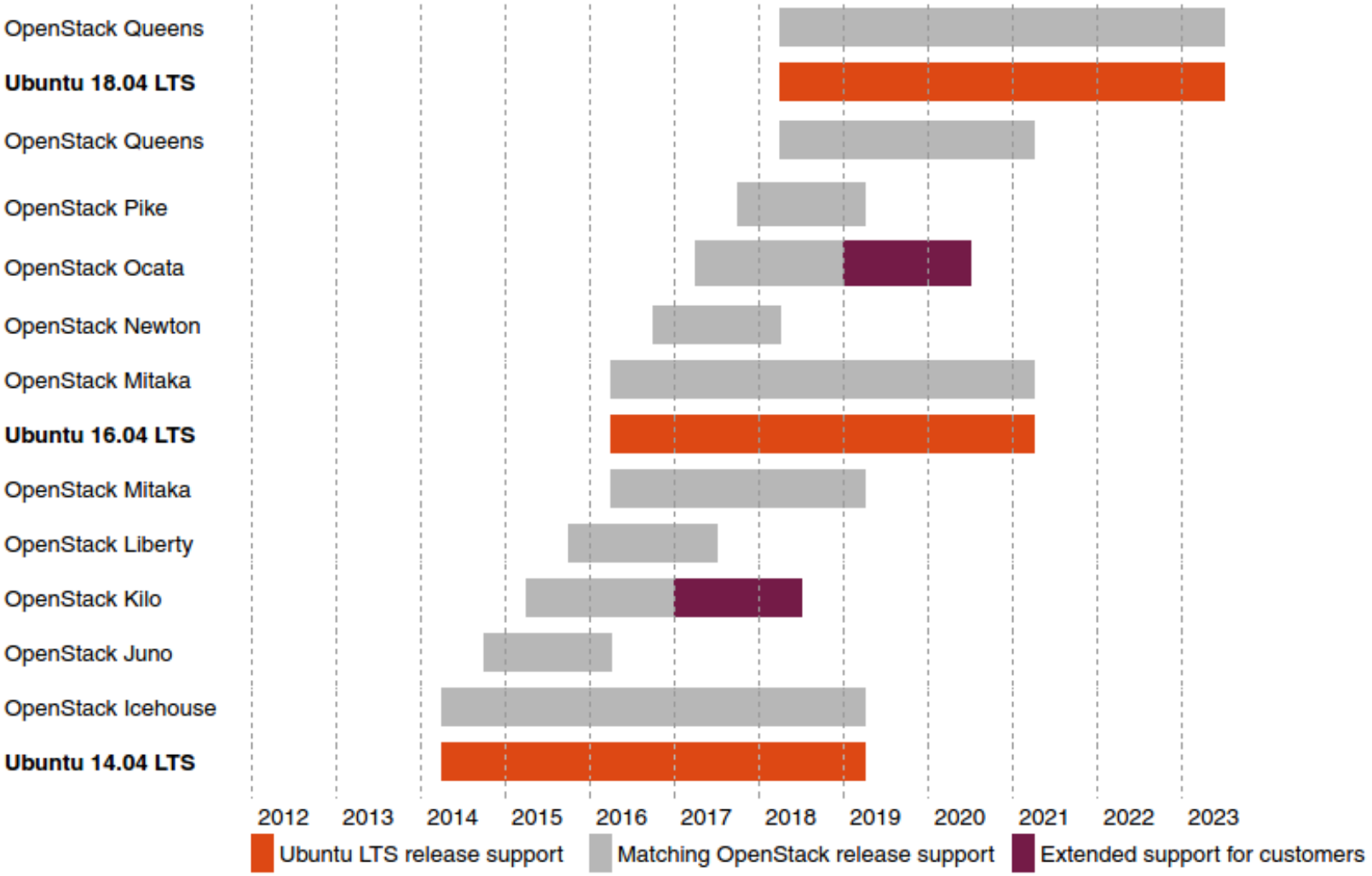
RHOP Life Cycle



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



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

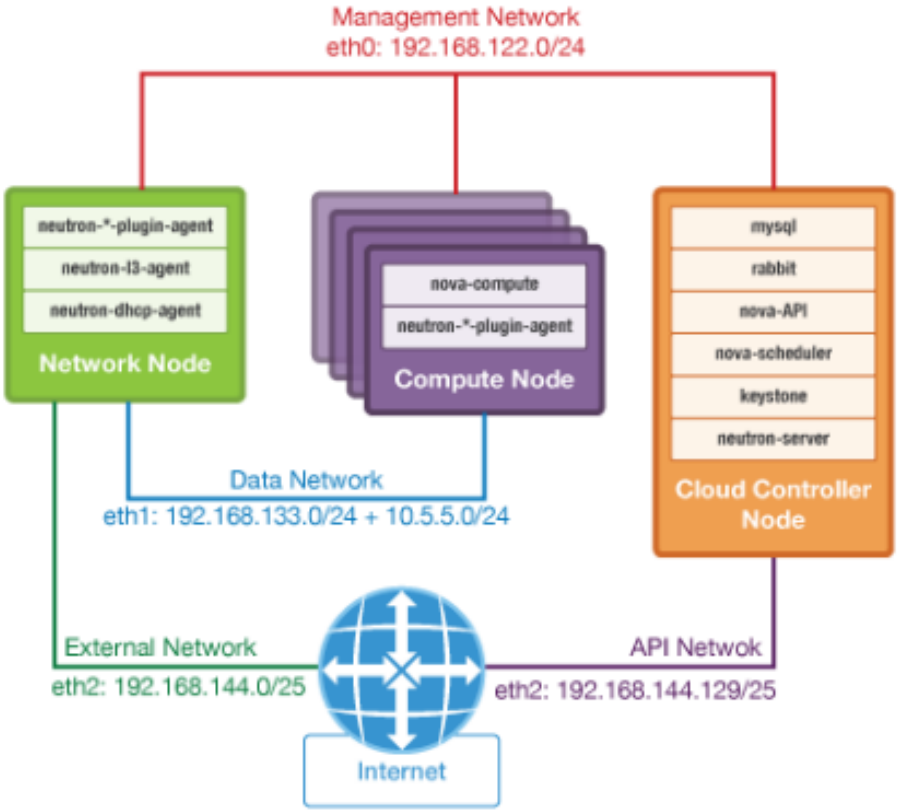
OpenStack Images

- 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

OpenStack Networking

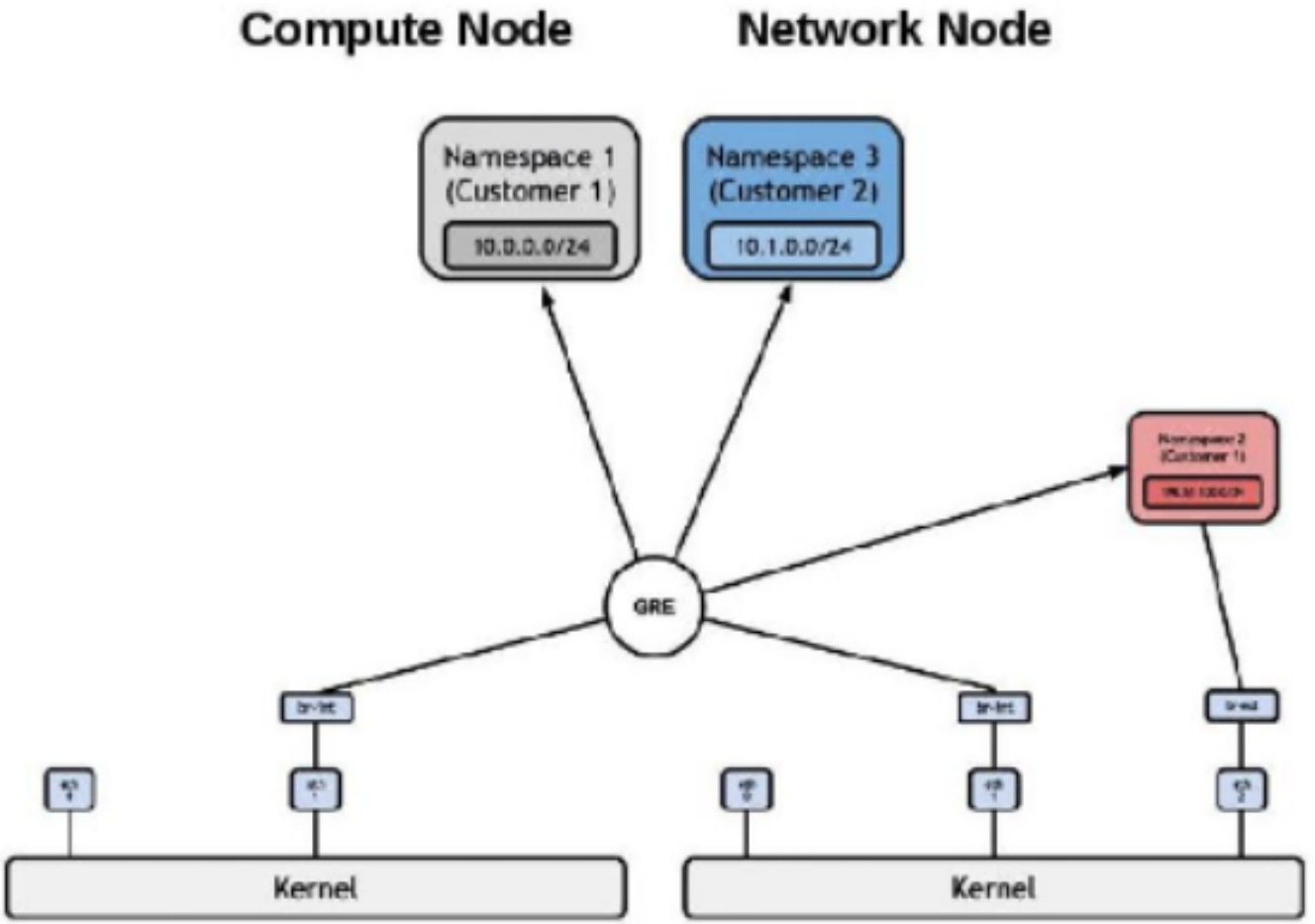


Next, we present a general overview of the networks present in **OpenStack Clouds**. We have:

- **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.

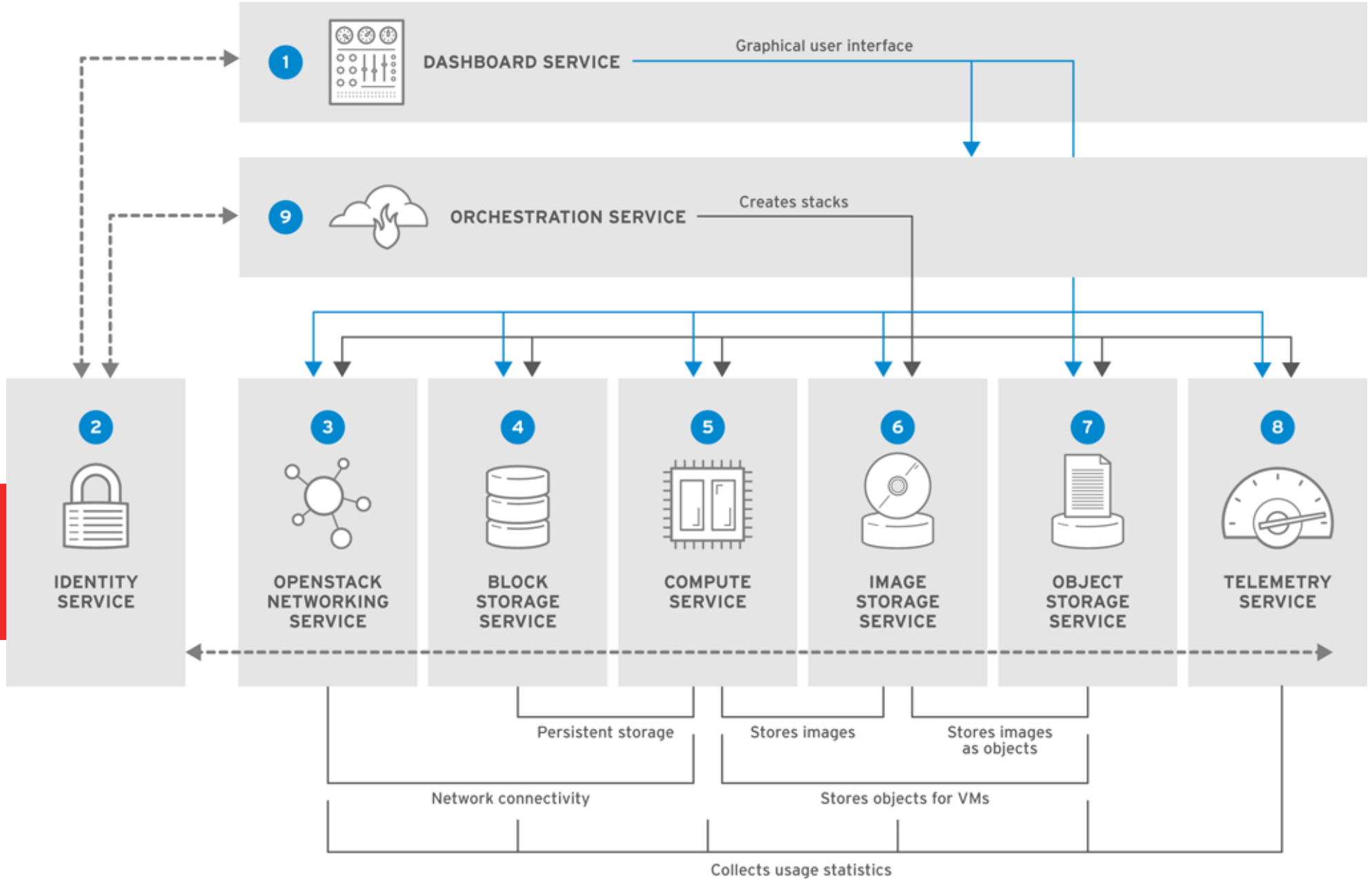
OpenStack Networking (2)



Prerequisite Services

- NTP: NTPD, Chrony
- MQ: RabbitMQ, zeroMQ
- SQL: MariaDB, MySQL, PostgreSQL
- NoSQL: MongoDB

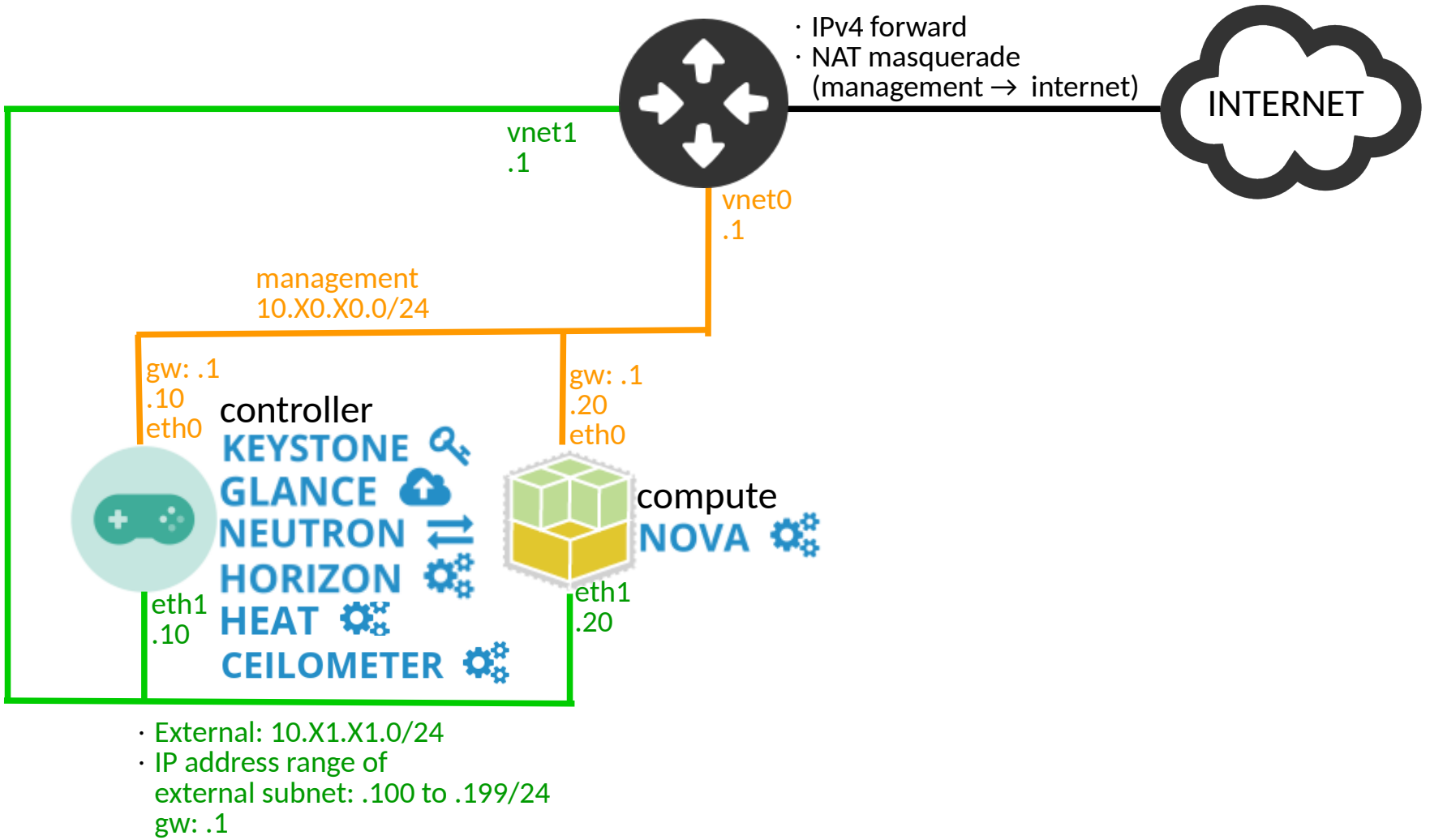
OpenStack Services Diagram



Lab I

Keystone, Neutron, Glance,
Nova, Horizon, Ceilometer, Heat

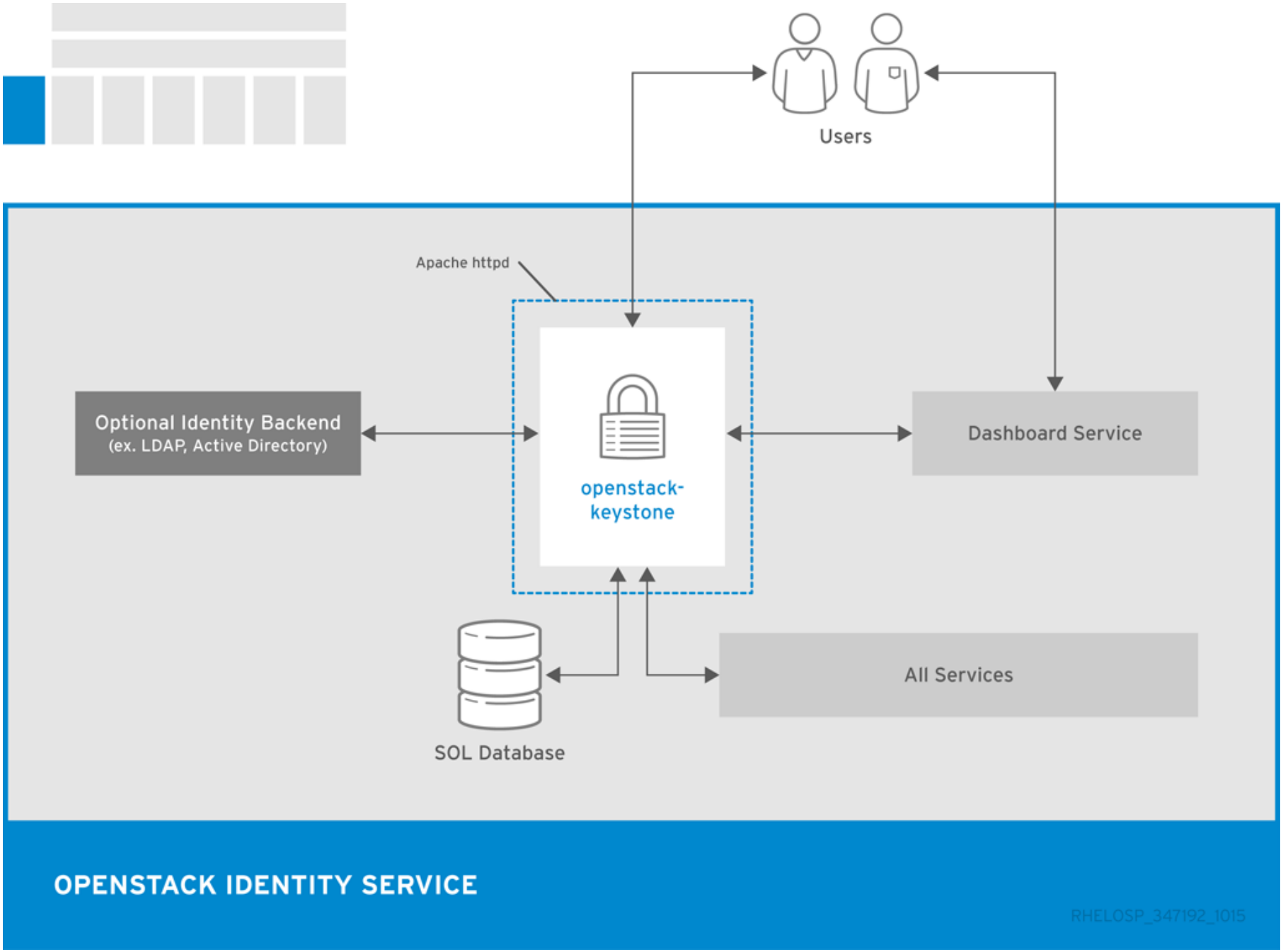
Lab I Topology



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.

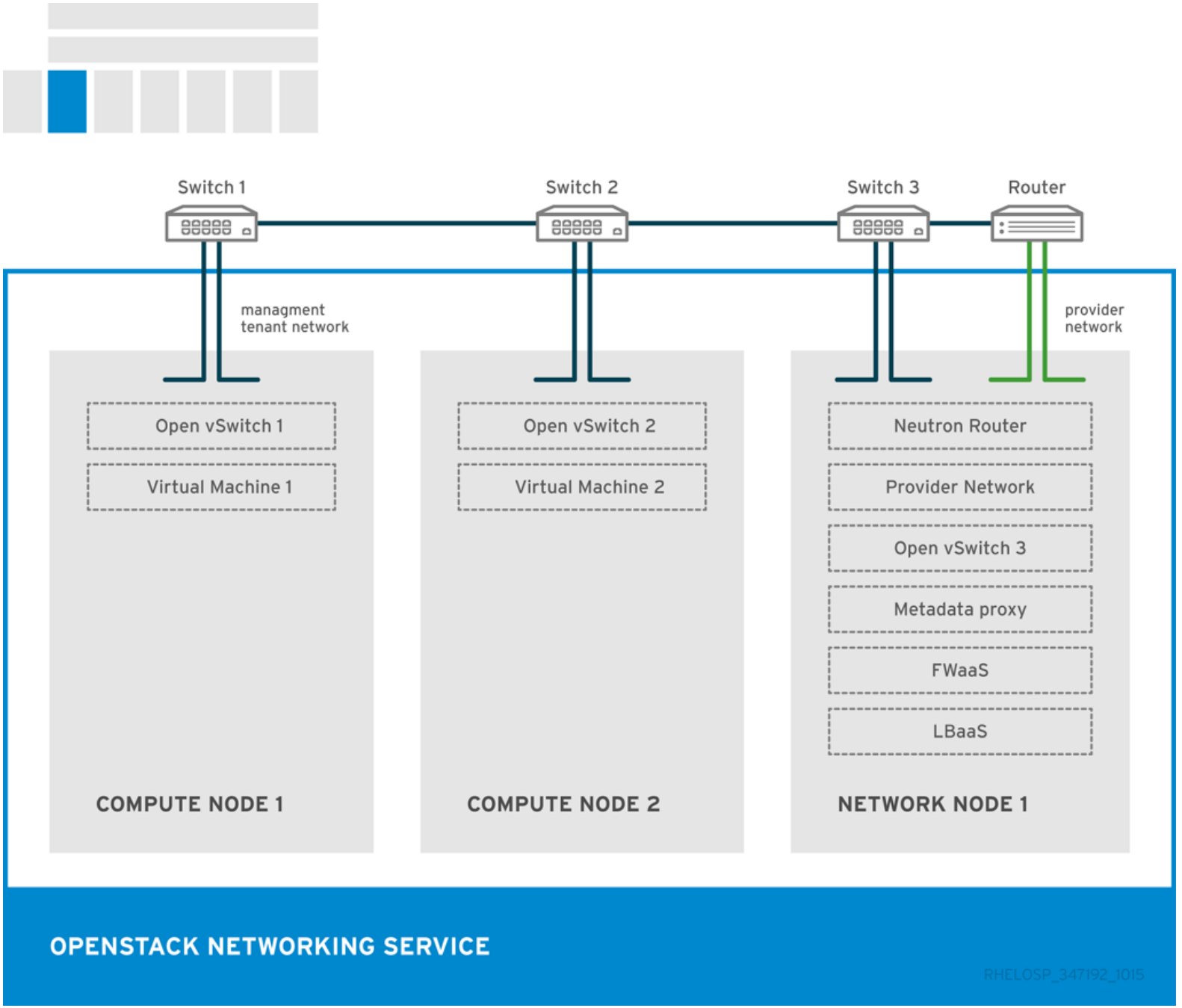
Keystone Flow Diagram



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

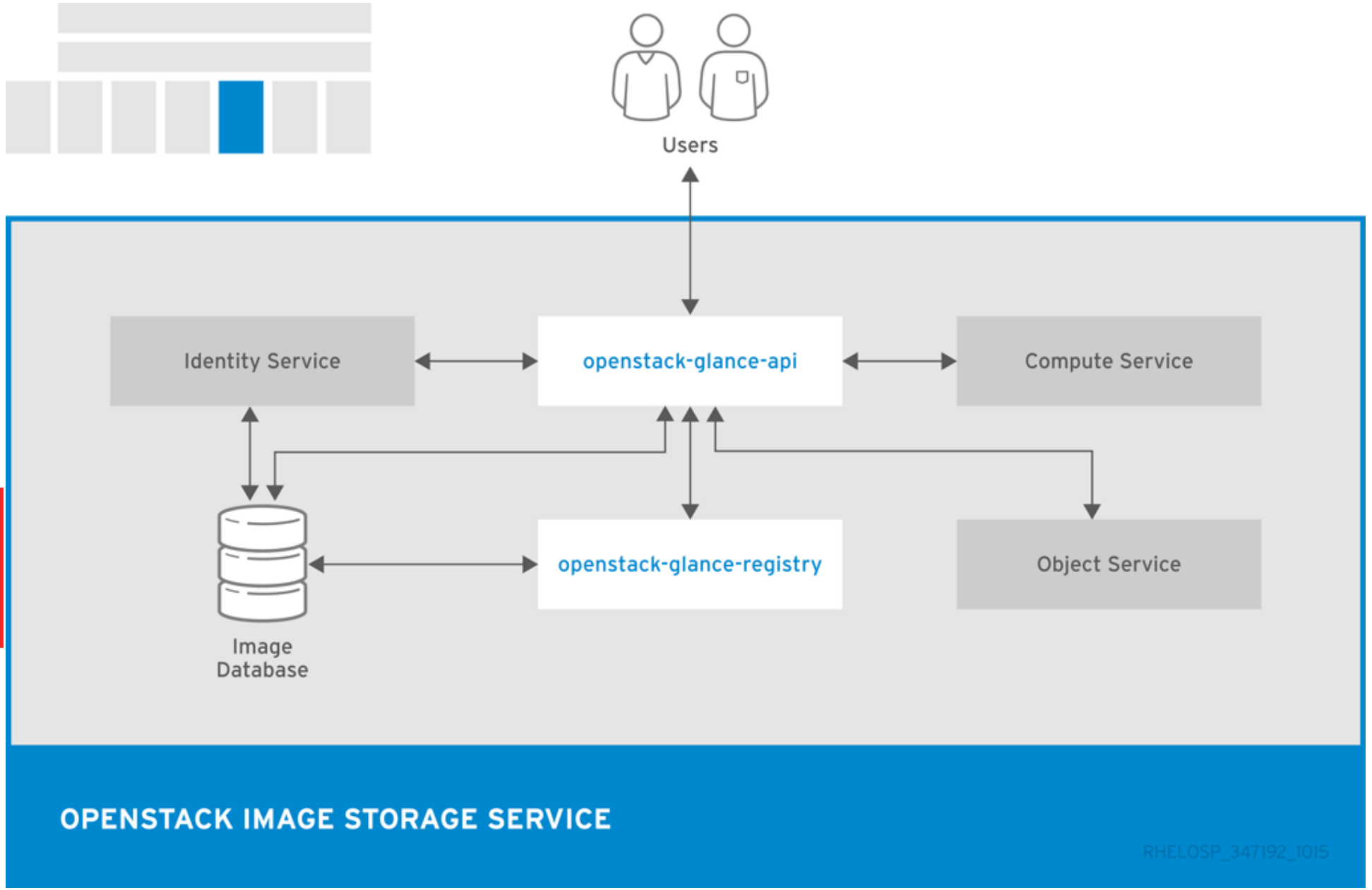


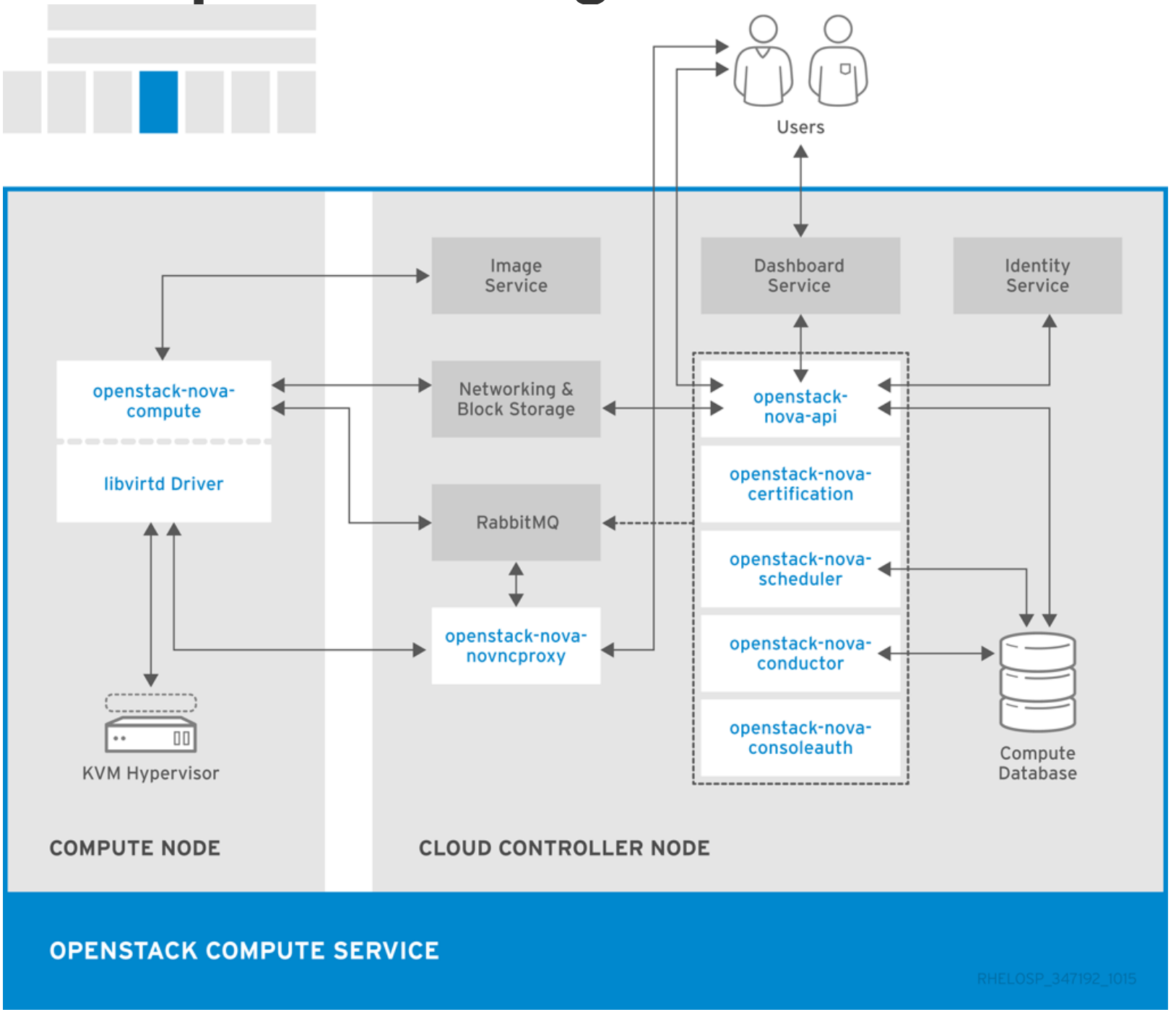
Image Disk Formats

- 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, xen, virtualbox
- vmdk, vmware
- bare, no metadata
- ova
- ovf

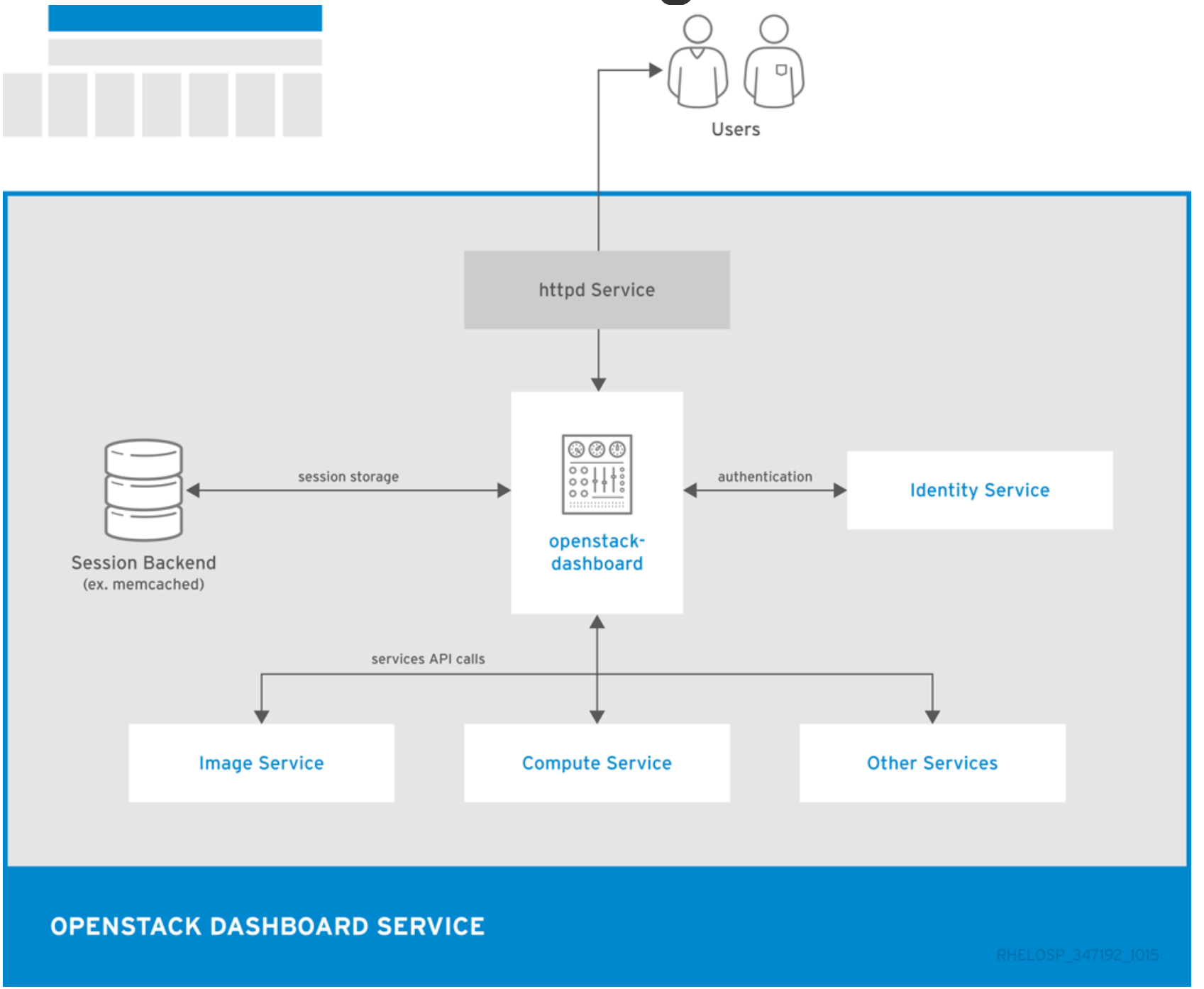
Nova Components

- **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



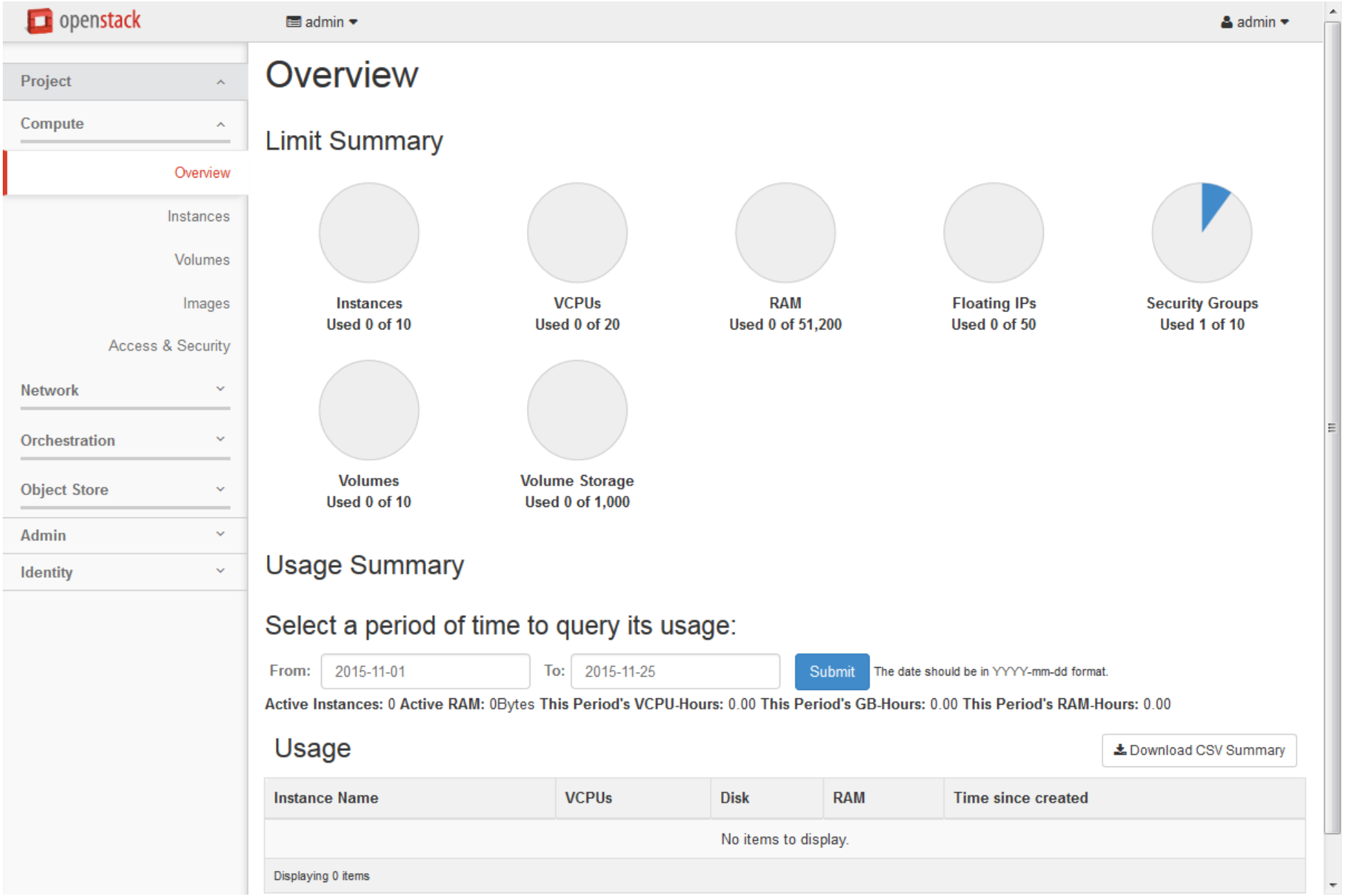
Horizon Interactions Diagram



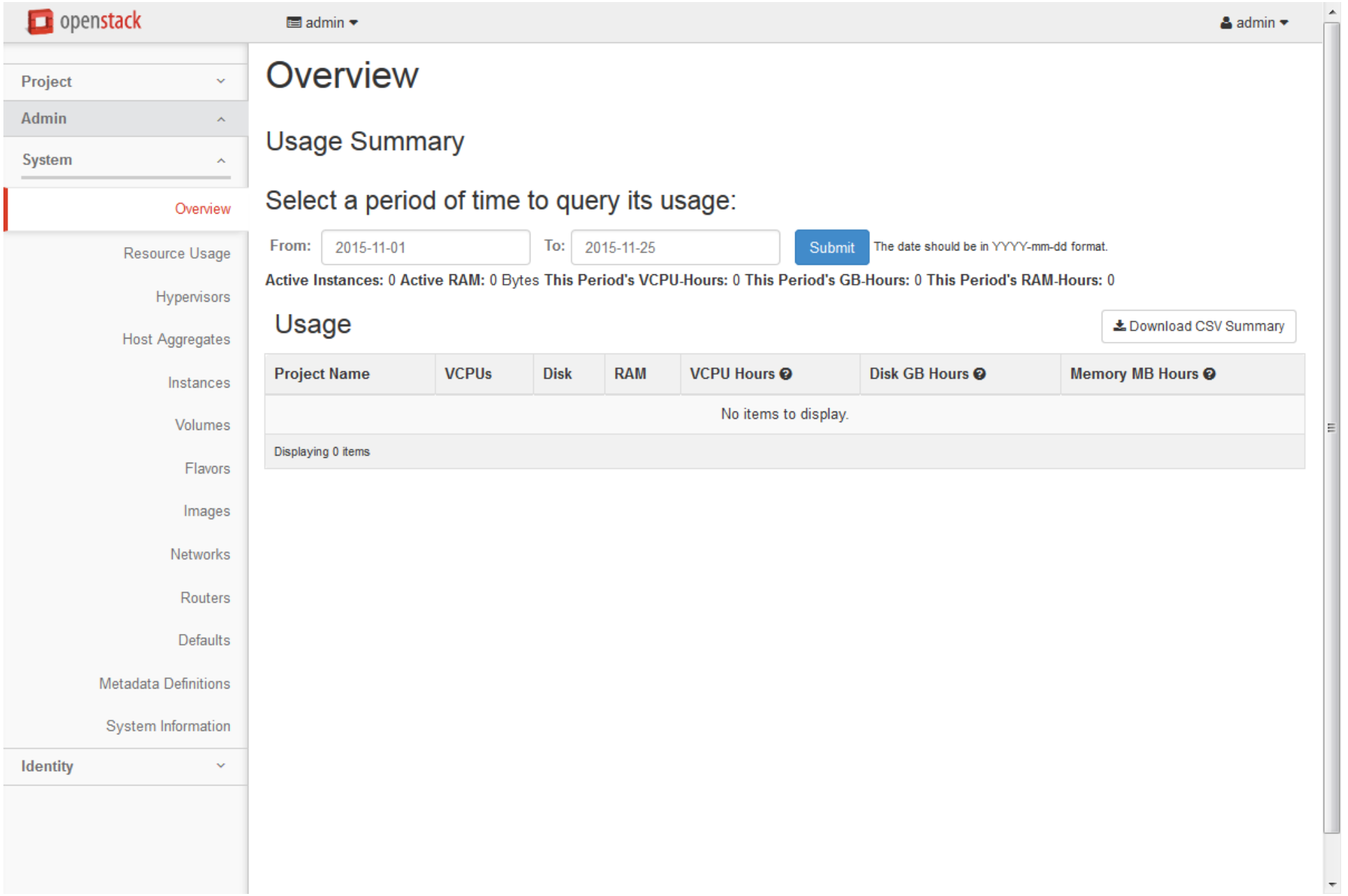
Horizon Tabs

- 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.

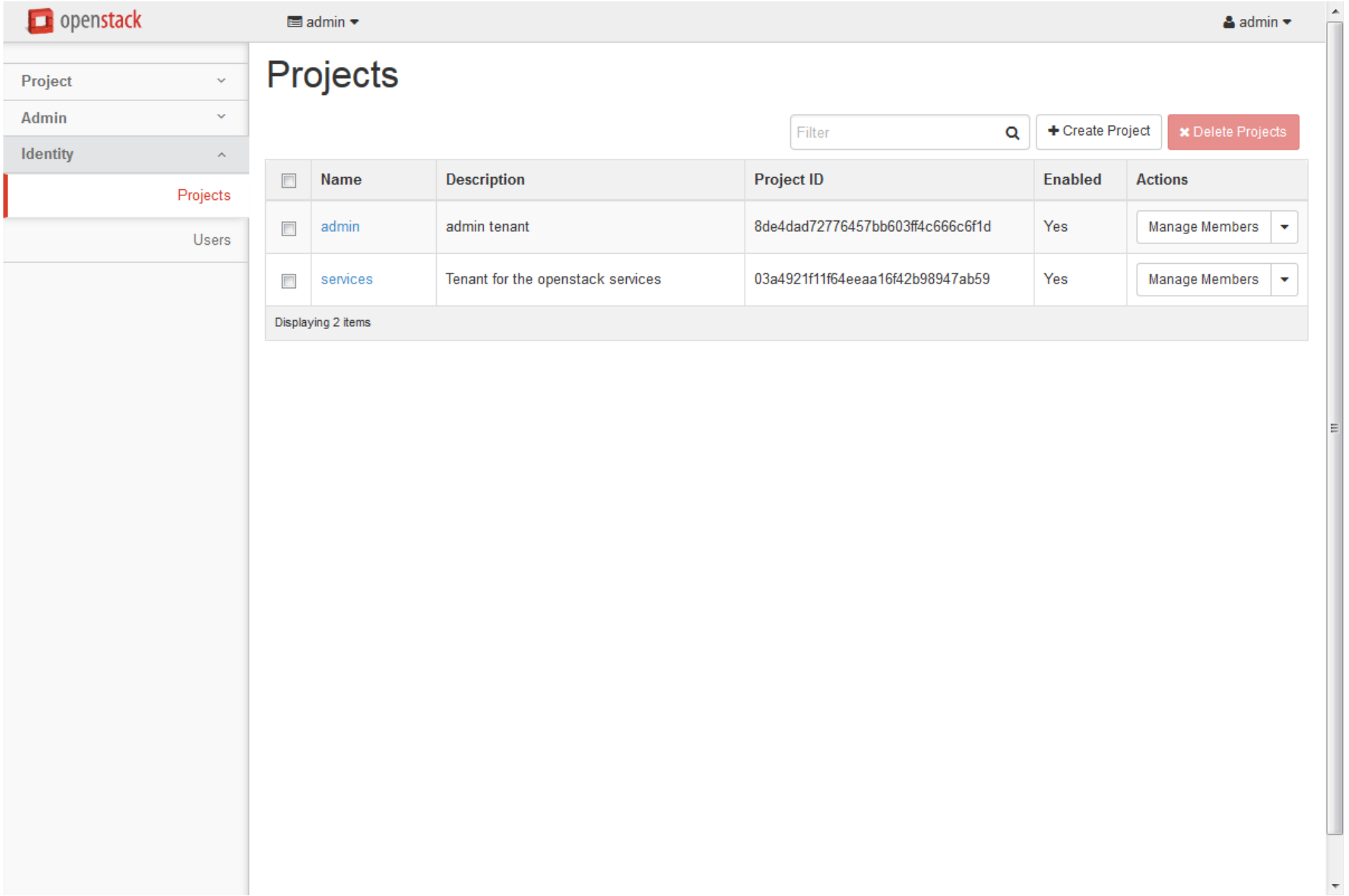
Horizon Project Tab



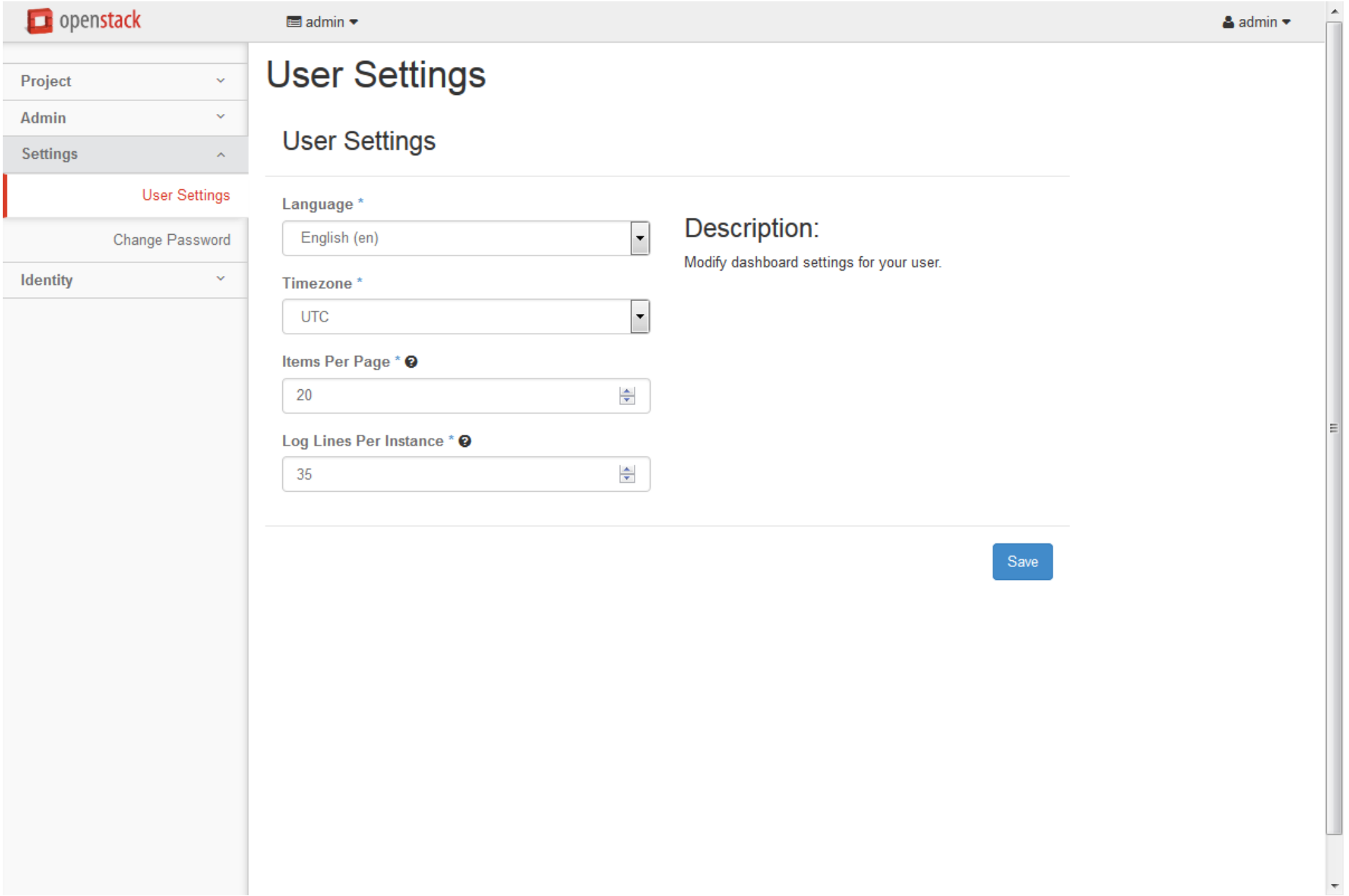
Horizon Admin Tab



Horizon Identity Tab



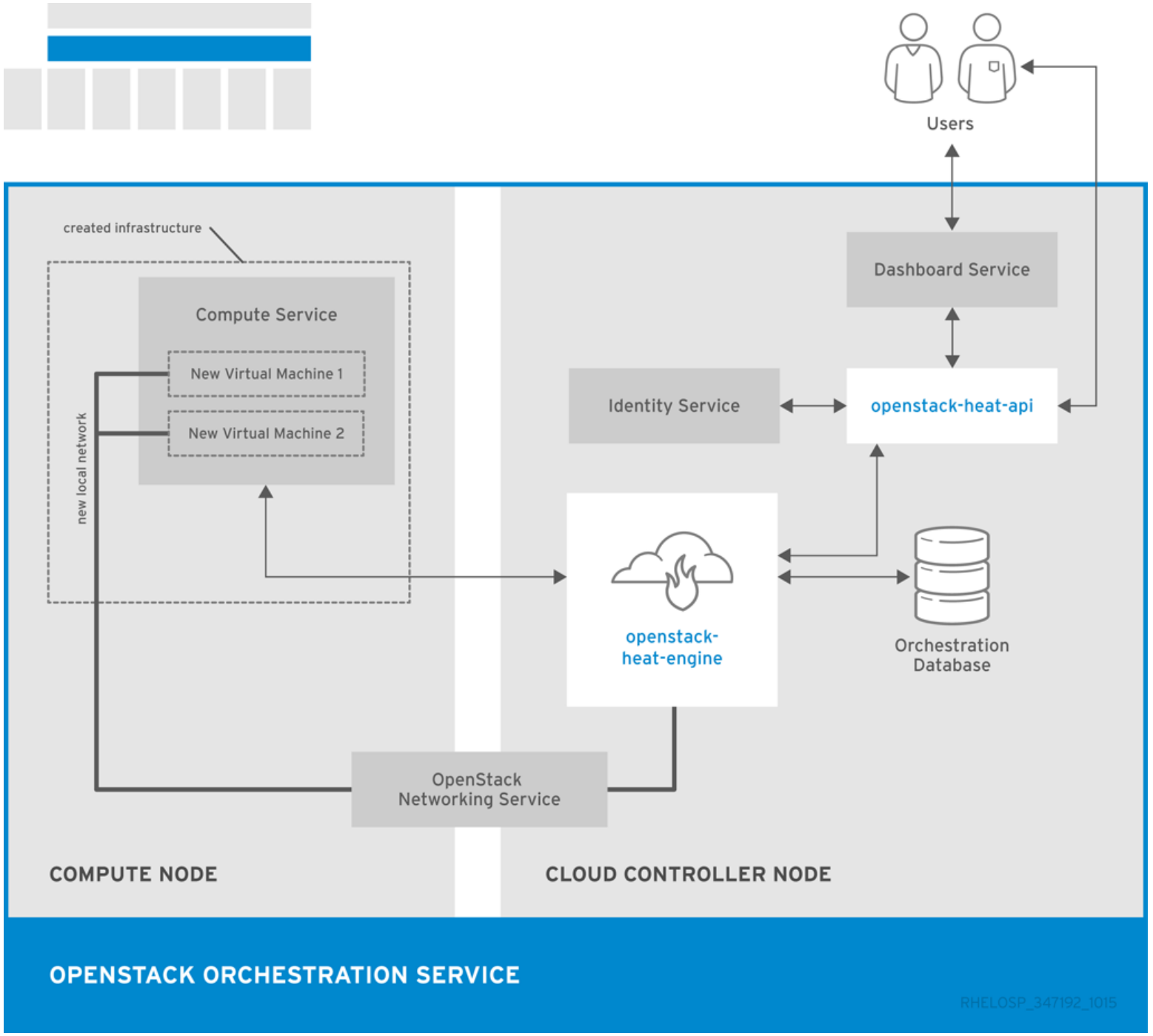
Horizon Settings Tab



Heat Components

- **Heat API**, processes API requests by sending the requests to the heat engine service over RPC.
- **Heat engine**, orchestrates template launch and generates events for the API consumer.

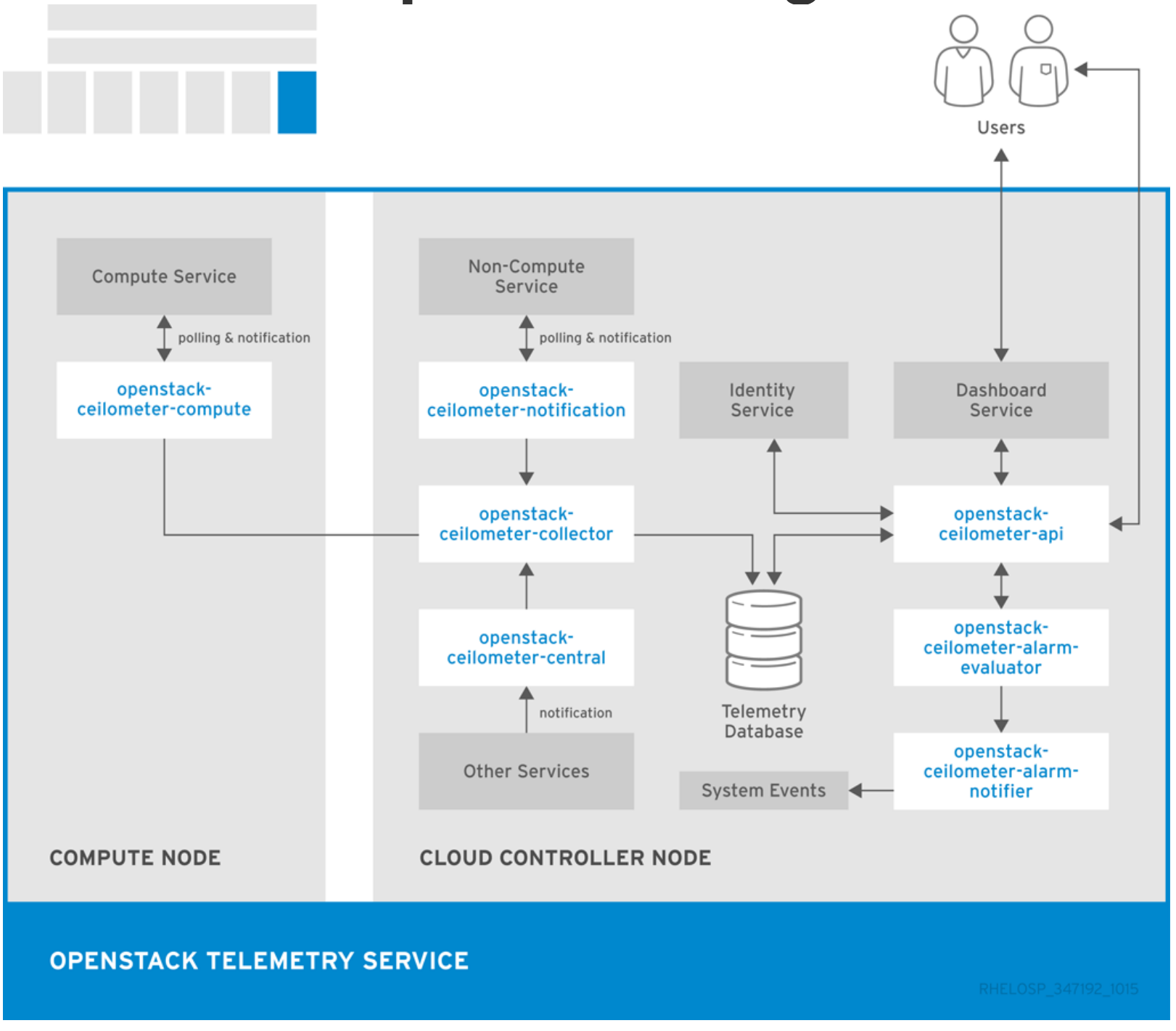
Heat Interactions Diagram



Ceilometer Components

- **Ceilometer alarm evaluator**, triggers state transitions on alarms.
- **Ceilometer alarm notifier**, executes actions when alarms are triggered.
- **Ceilometer API**, provide access to data in the database.
- **Ceilometer central**, poll utilization statistics about resources independent form instances or compute nodes.
- **Ceilometer collector**, monitor the message queues.
- **Ceilometer compute**, poll for compute resource utilization statistics.
- **Ceilometer notification**, pushes metrics to the collector service from various OpenStack services.

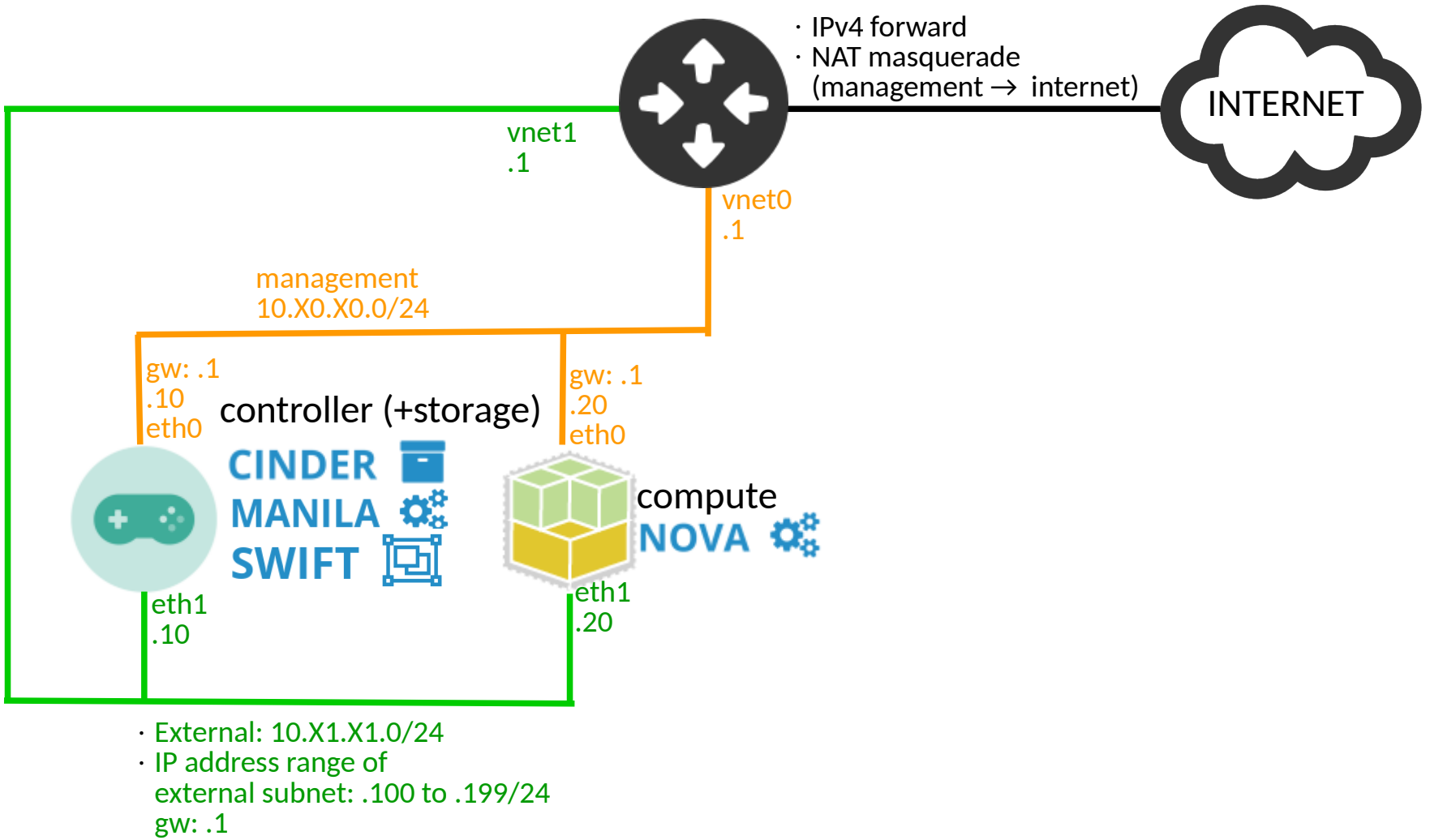
Ceilometer Components Diagram



Lab II

Cinder, Manila, Swift

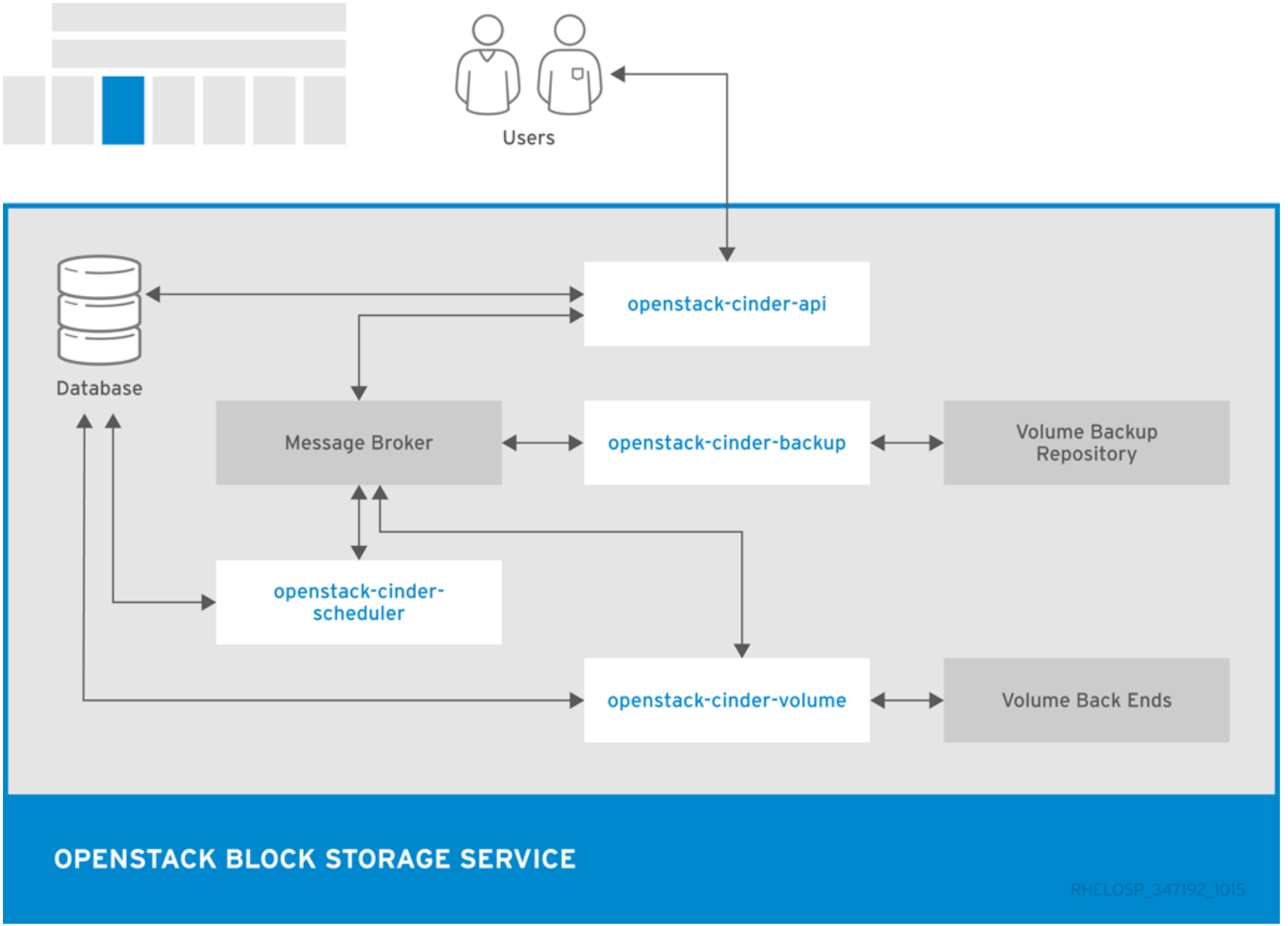
Lab II Topology



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.

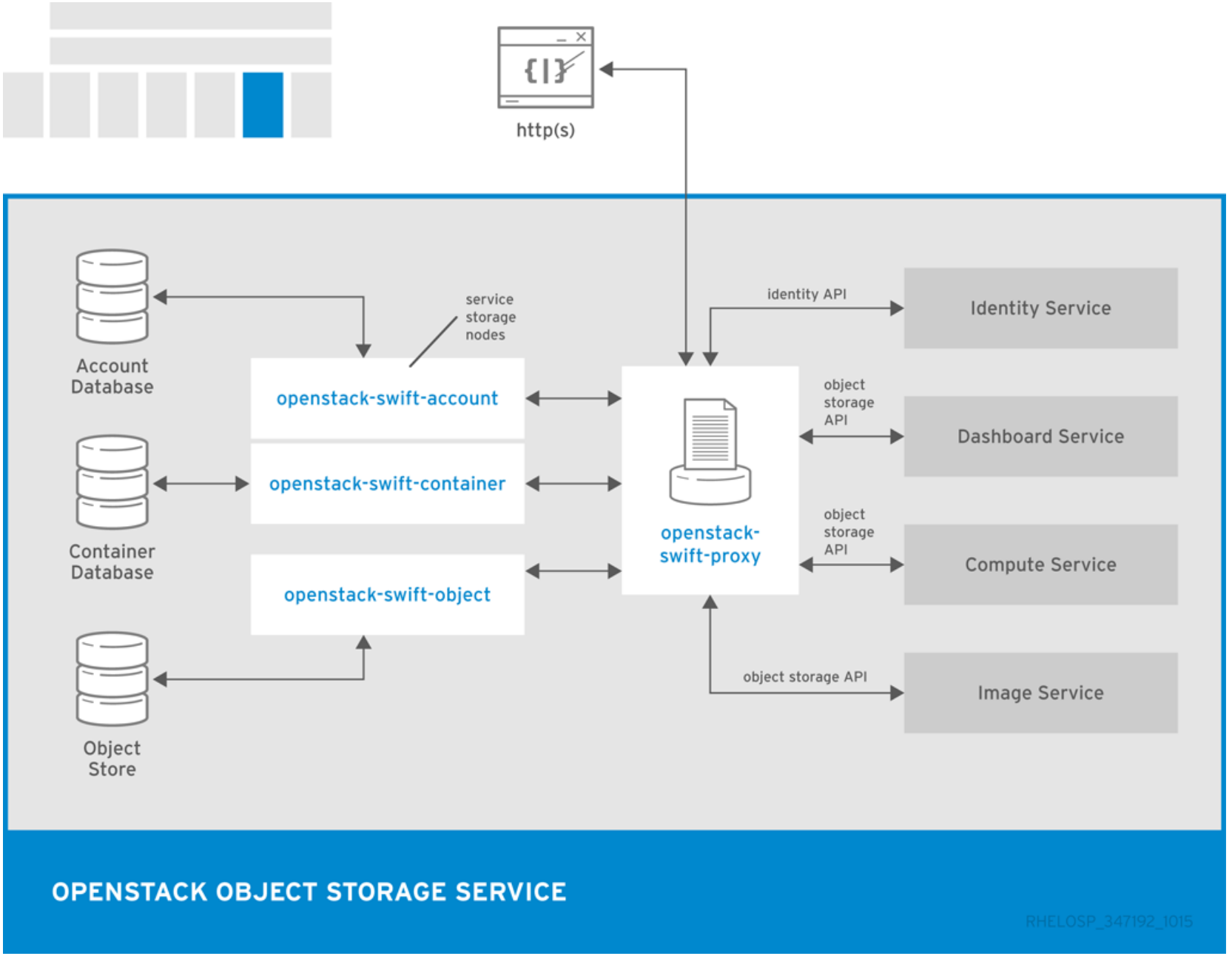
Cinder Components Diagram



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.

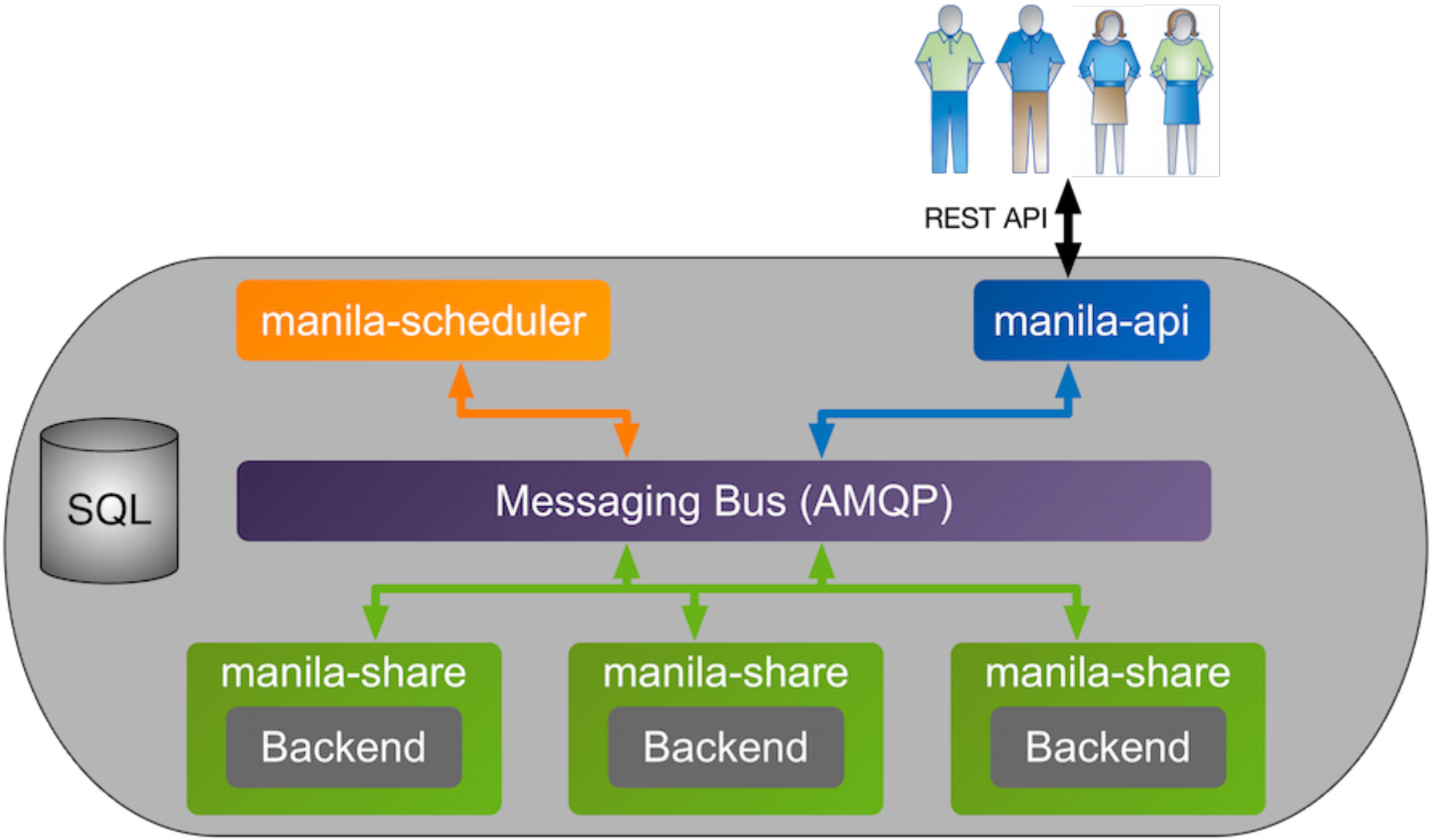
Swift Components Diagram



Manila Components

- **Manila API**, authenticates and routers request throughout the shared file system service.
- **Manila data**, receive requests, process data operations such as copying, share migration or backup, and send back a response after an operation has been completed.
- **Manila scheduler**,Schedules and routes requests to the appropriate share service.
- **Manila share**, manages back-end devices that provide shared file systems.

Manila Components Diagram



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