OpenStack Administrator (OS-ADM)

NOLSATU

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/
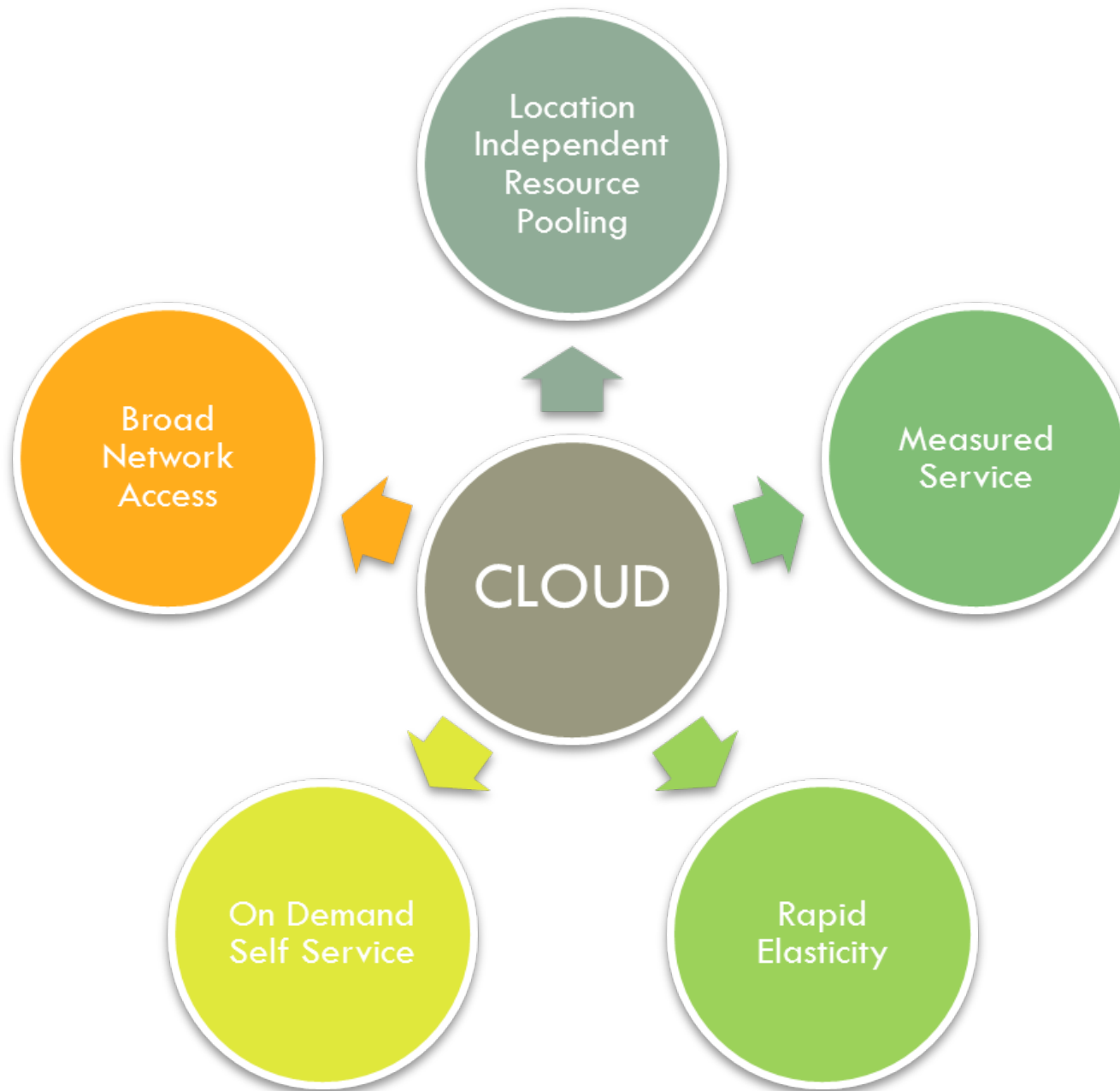
Cloud Computing

On-Premise vs Cloud
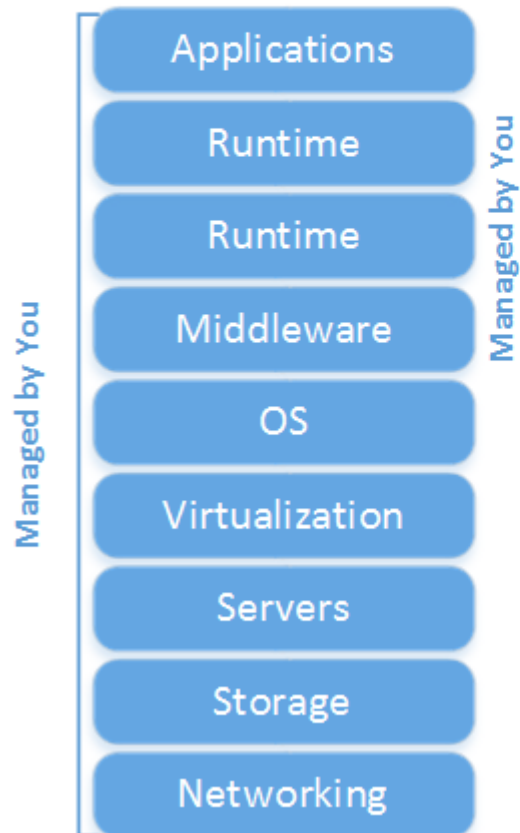
Conventional Data Center
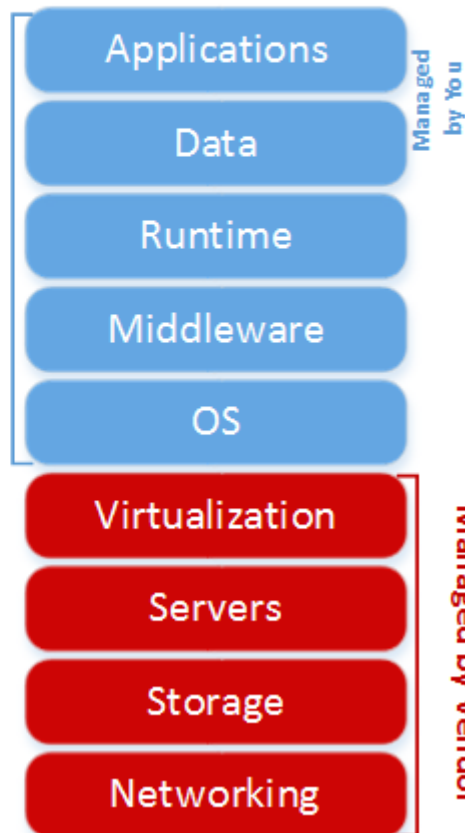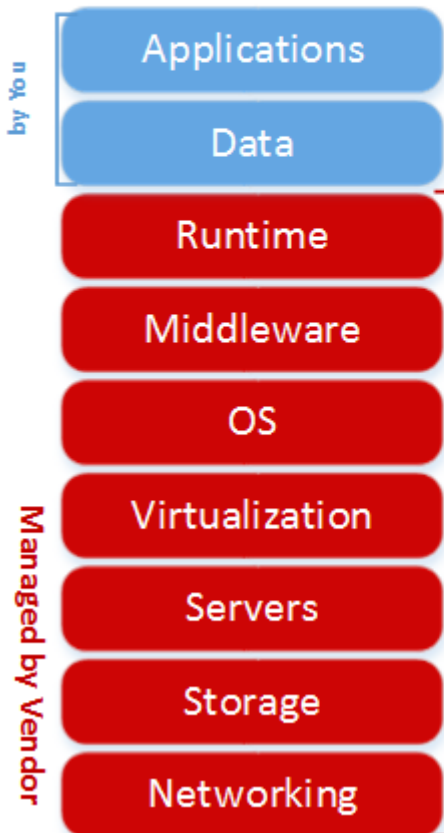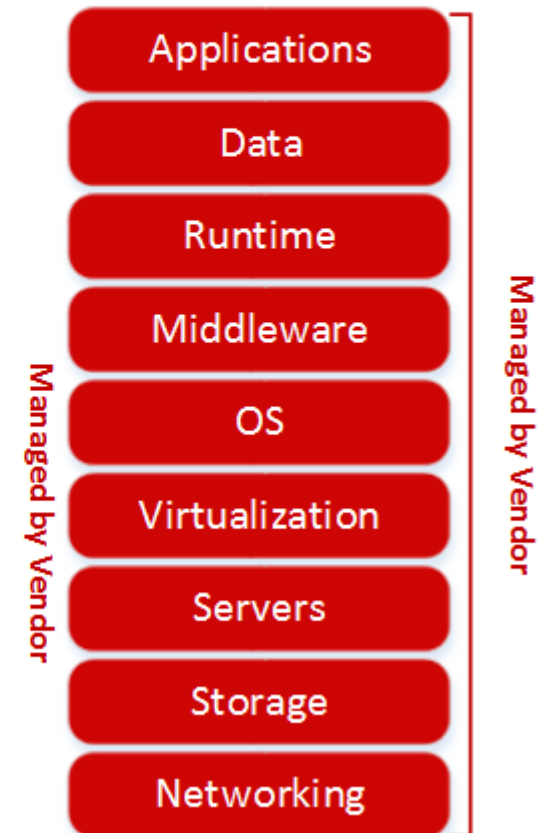
Cloud Characteristics

Cloud Types
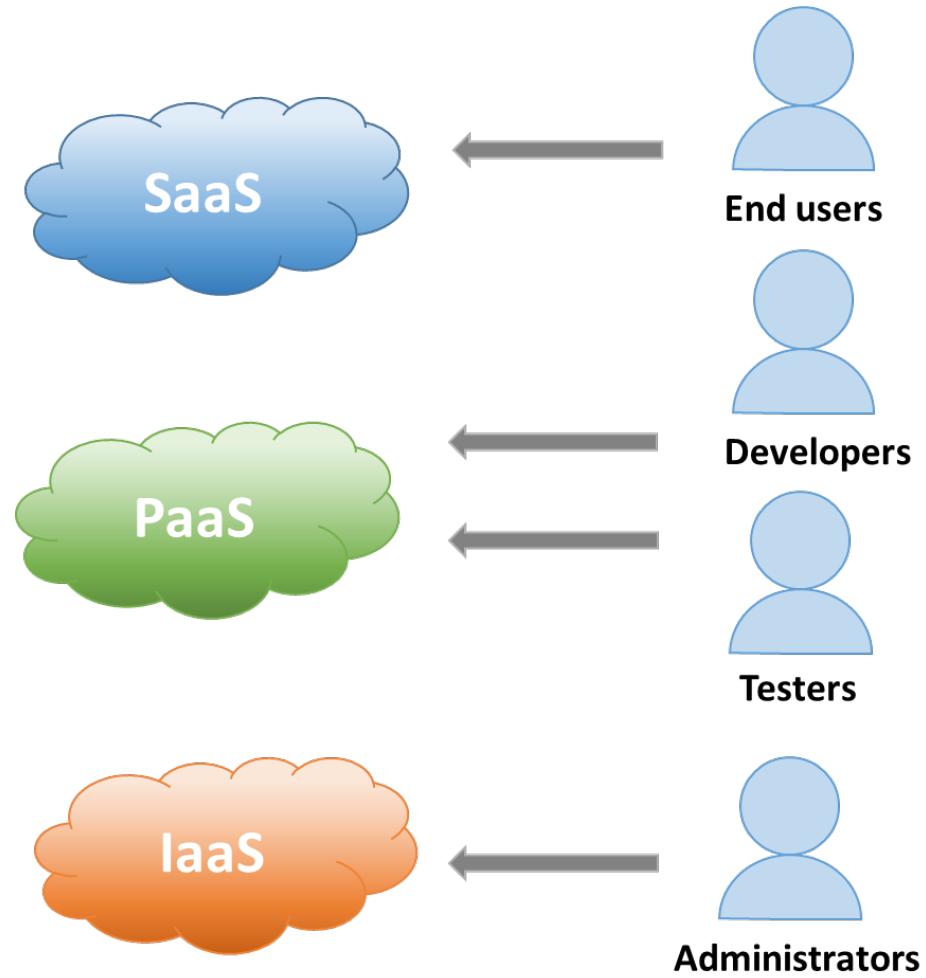

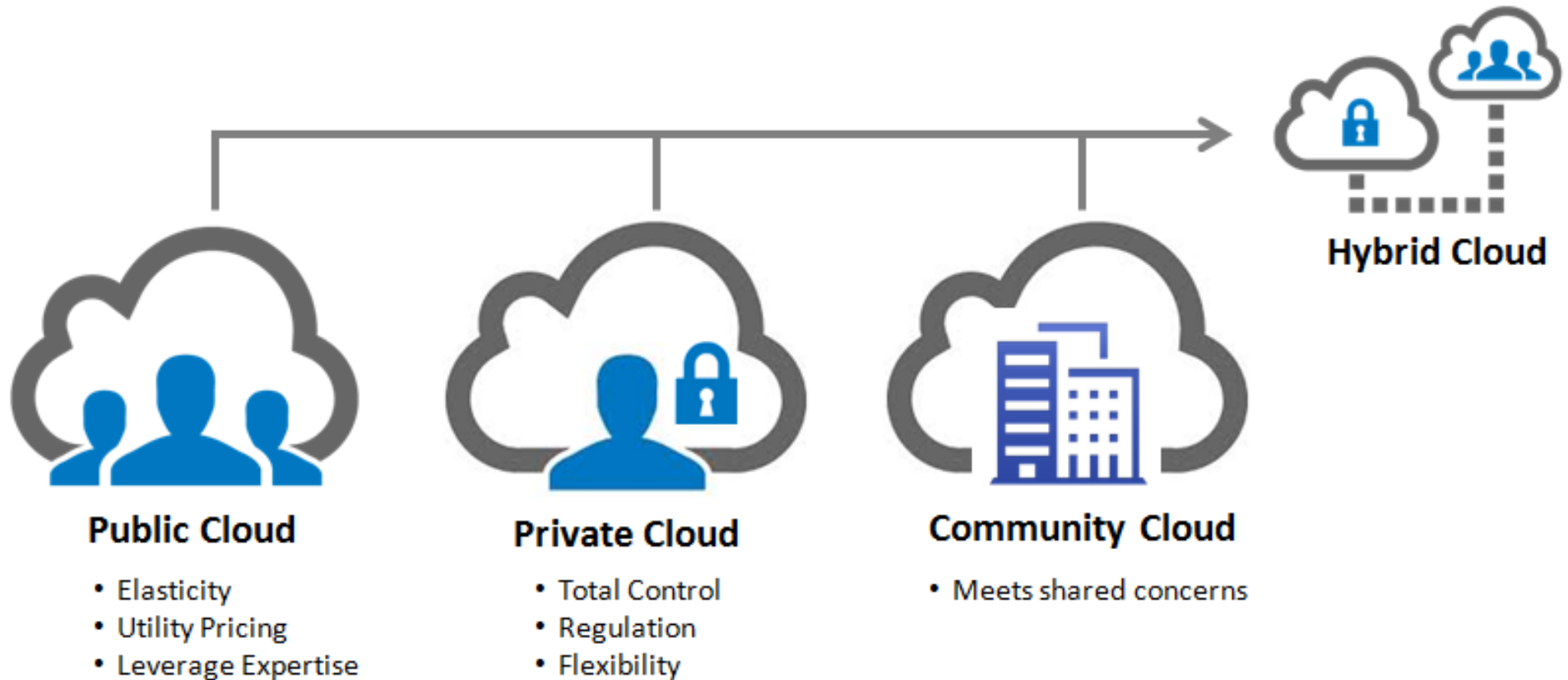| On Premise	IaaS: Infrastructure as a Service	PaaS: Platform as a Service	SaaS: Software as a Service
Applications	Applications	Applications	Applications
Runtime	Data	Data	Data
Runtime	Runtime	Runtime	Runtime
Middleware	Middleware	Middleware	Middleware
OS	OS	OS	OS
Virtualization	Virtualization	Virtualization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

Managed by You — Managed by Vendor

Cloud Users

Cloud Deployment Model

Hybrid Cloud

Public Cloud

- Elasticity
- Utility Pricing
- Leverage Expertise

Private Cloud

- Total Control
- Regulation
- Flexibility

Community Cloud

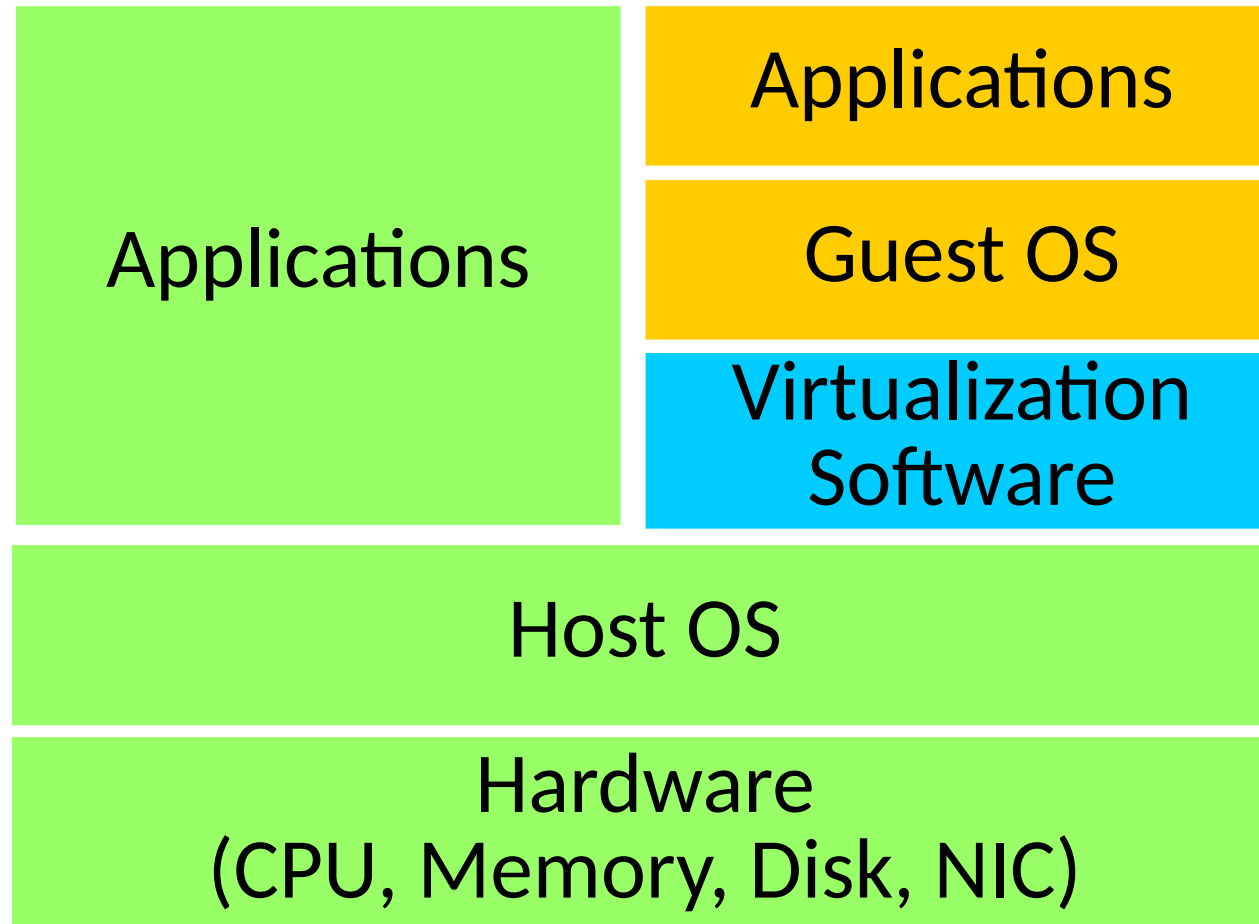- Meets shared concerns

IaaS Public Cloud
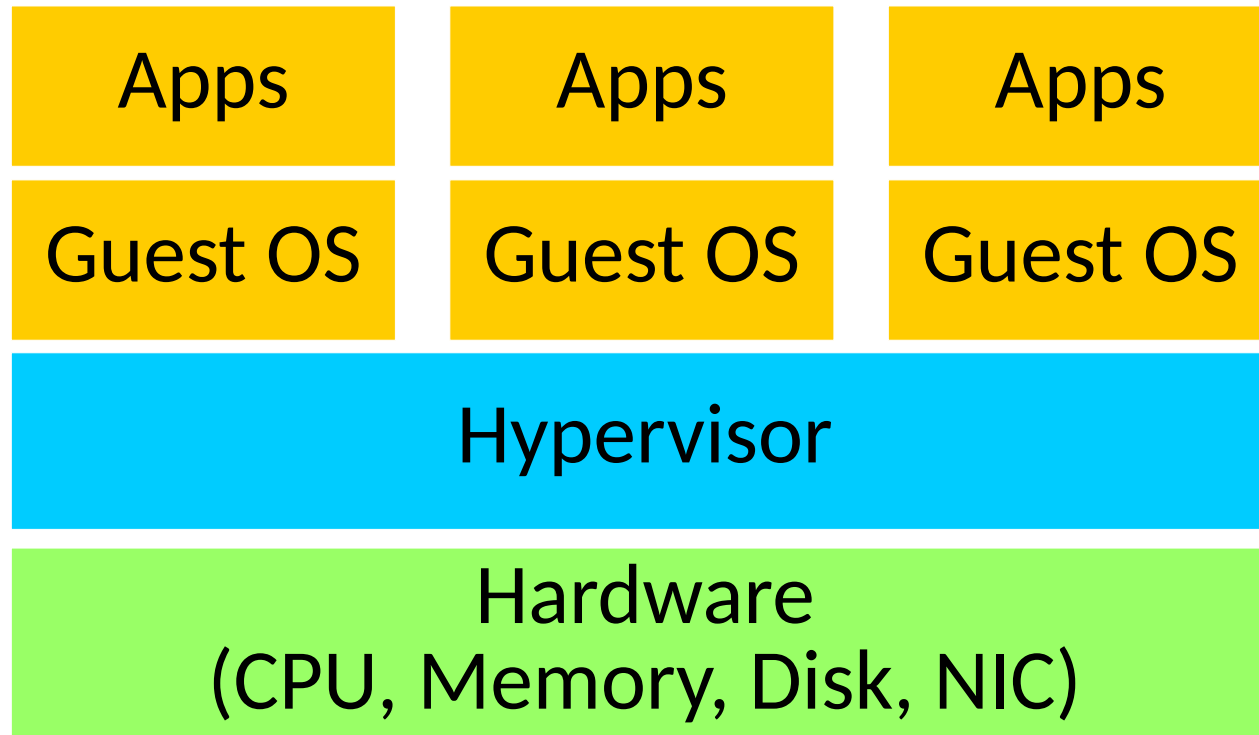
Virtualization, SDN, Cluster Storage

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

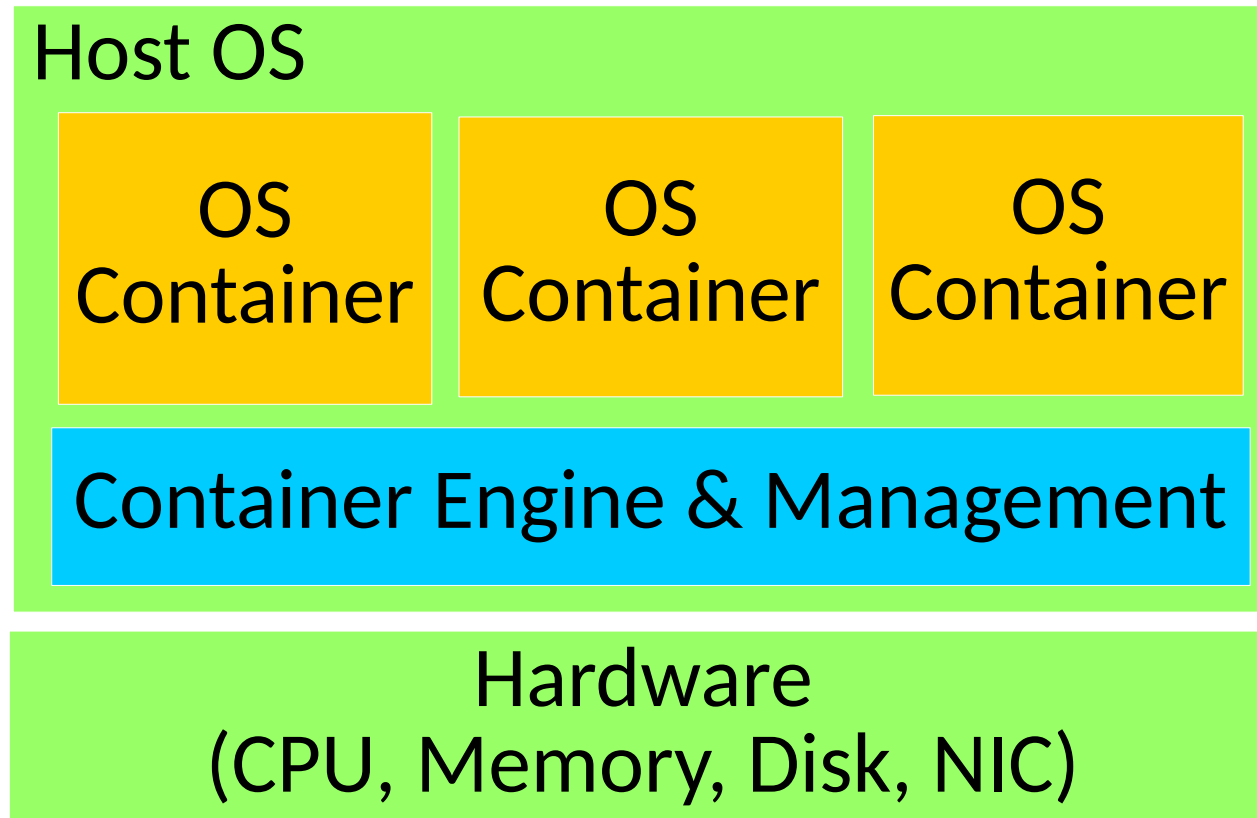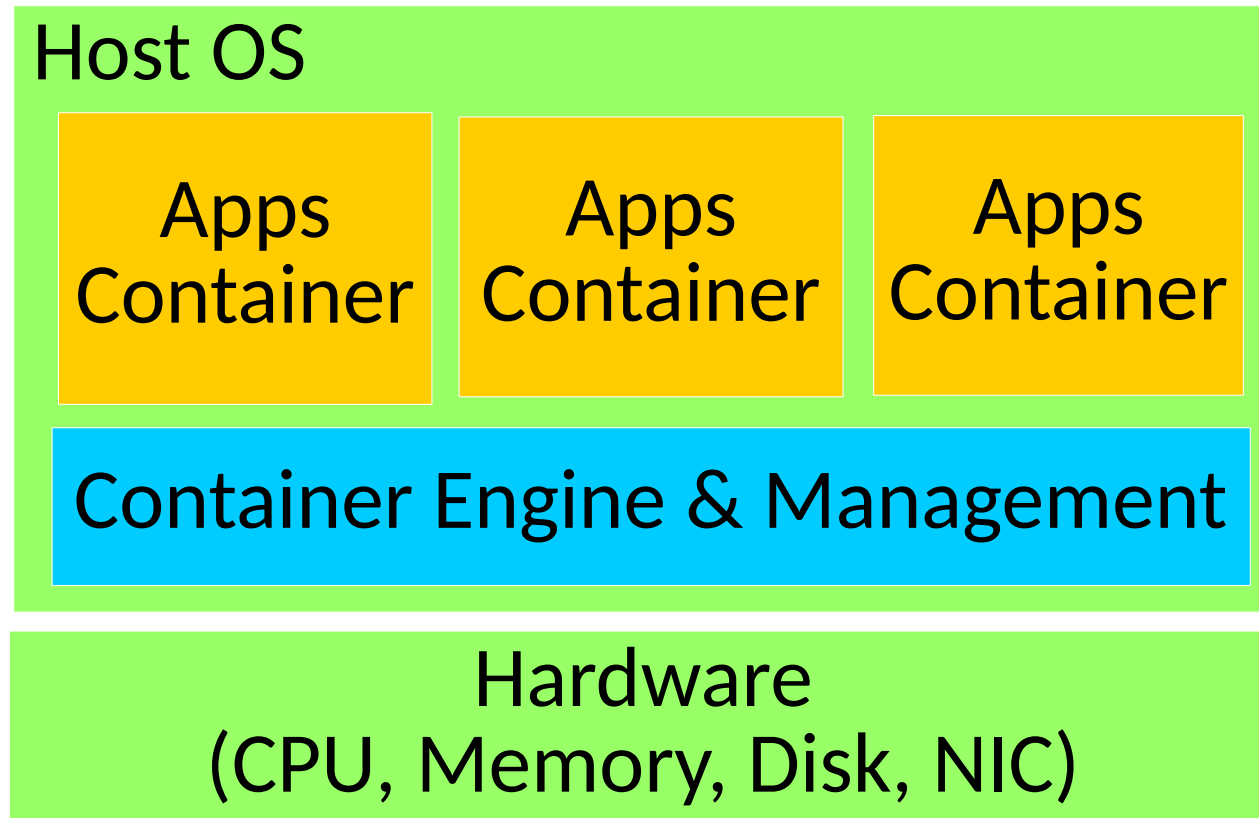- Application Level (Application Container): Docker, rkt

Full Virtualization

Applications

Applications

Guest OS

Virtualization Software

Host OS

Hardware
(CPU, Memory, Disk, NIC)

Bare Metal Virtualization

Apps	Apps	Apps
Guest OS	Guest OS	Guest OS

Hypervisor

**Hardware
(CPU, Memory, Disk, NIC)**

OS Container

Host OS

| OS Container | OS Container | OS Container |

Container Engine & Management

Hardware
(CPU, Memory, Disk, NIC)

Application Container

# Containers, Hypervisors, Virtualization Softwares
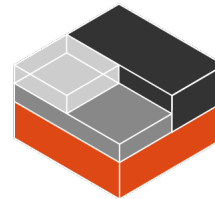
Software Defined Networking (1)

"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
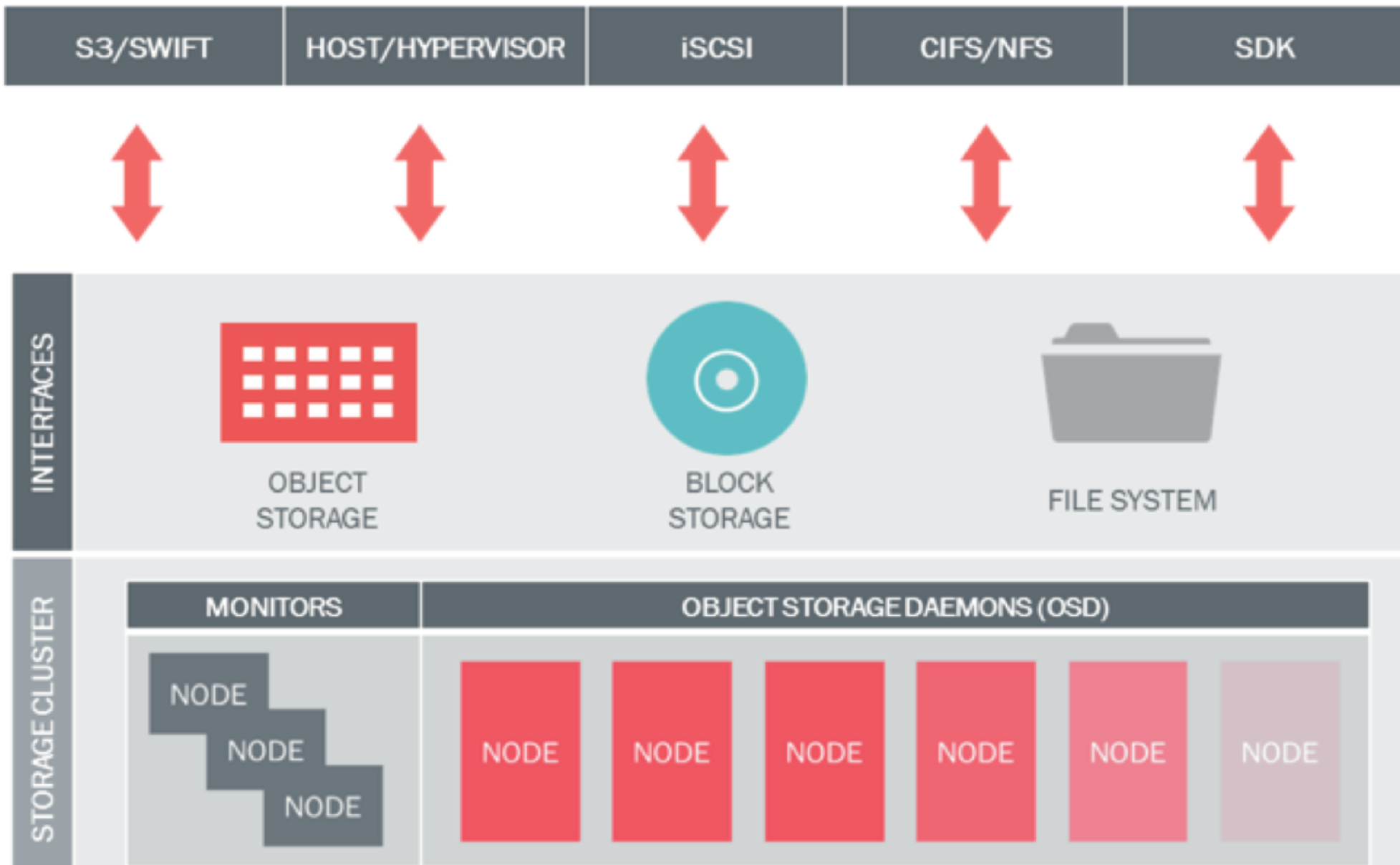
Software Defined Networking (2)
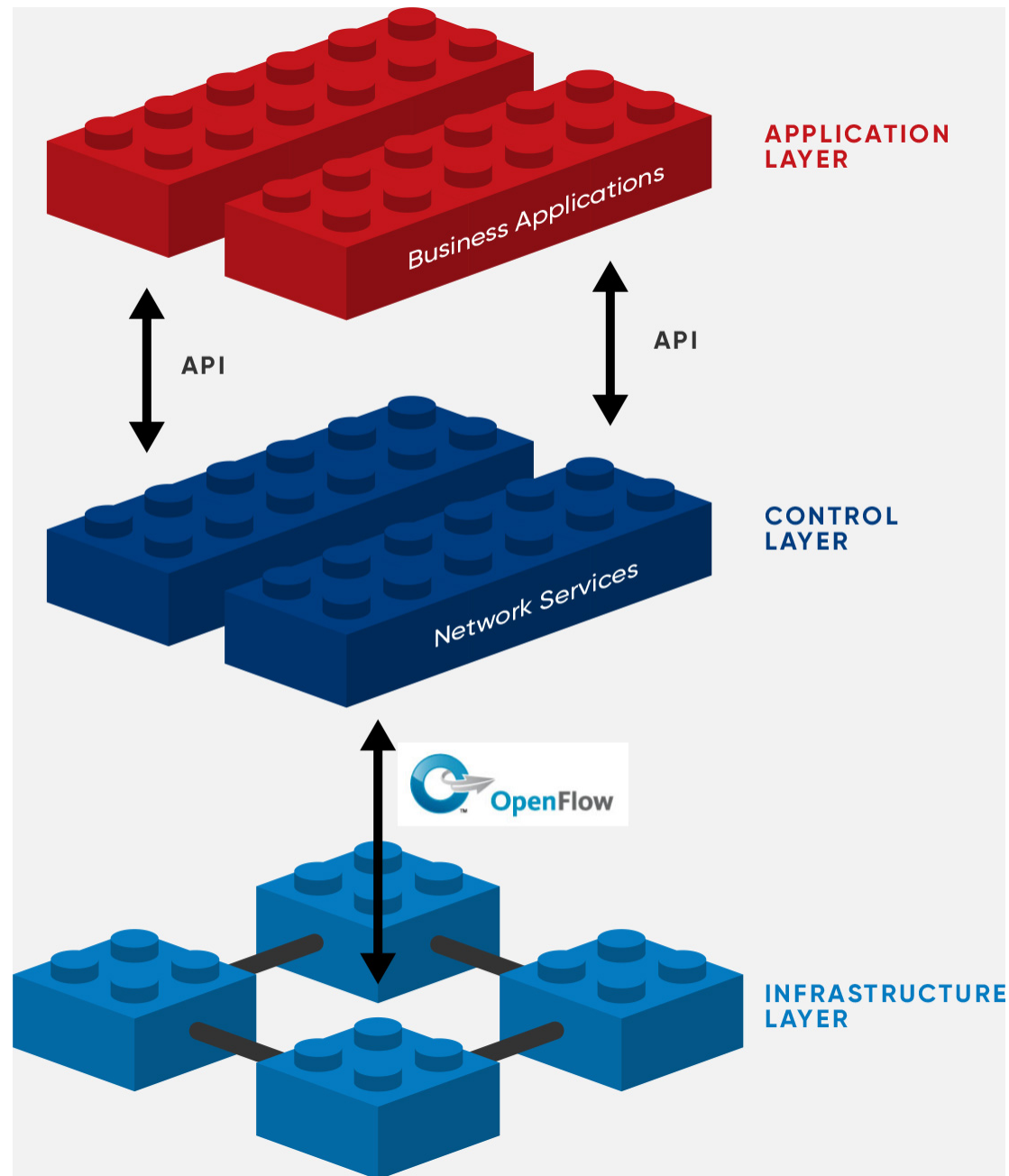
SDN Controllers
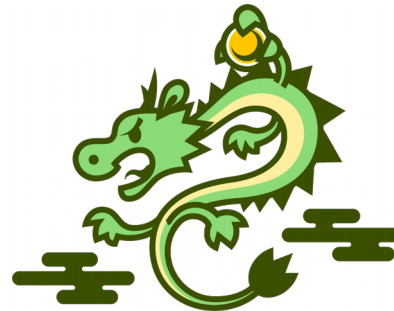
OpenFlow Based Plugin

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

Storage Cluster

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 Cluster Software

IaaS Software

PaaS Software

OpenStack

OpenStack

- Open Source Software for creating IaaS private, public, community or hybrid cloud.

- Developed under OpenStack Foundation and supported by ICT companies around the world

OpenStack Company Members

OpenStack Training Partners

OpenStack Core Services (1)

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 (1)

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

OpenStack All Services (2)

🦘 **CHEF OPENSTACK**

🐨 **KOLLA**

OPENSTACK CHARMS

OPENSTACKANSIBLE

PUPPET OPENSTACK

🦉 **TRIPLEO**

🔥 **HEAT**

🕊 **ZAQAR**

MURANO

○ **SOLUM**

🦎 **CEILOMETER**

🐱 **CLOUDKITTY**

🦎 **MONASCA**

AODH

PANKO

OpenStack Use Cases

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

OpenStack Version (Upstream)

N/A

Series	Status	Initial Release Date	Next Phase	EOL Date
Rocky	Development	2018-08-30 *estimated* (schedule)	Maintained *estimated* 2018-08-30	
Queens	Maintained	2018-02-28	Extended Maintenance *estimated* 2019-08-25	
Pike	Maintained	2017-08-30	Extended Maintenance *estimated* 2019-03-03	
Ocata	Maintained	2017-02-22	Extended Maintenance *estimated* 2018-08-27	

OPENSTACK
QUEENS

OPENSTACK
PIKE

OPENSTACK
OCATA

OpenStack Distributions

RHOP Life Cycle

RED HAT OPENSTACK PLATFORM RELEASE

Release		
12	Dec 13	Dec 13
11	May 18	May 18
10	Dec 15	Dec 15
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

2013 2014 2015 2016 2017 2018 2019 2020 2021 2022

■ Full Support (12-18 months)   ■ Maintenance Support (12-24 months)   ■ Extended Life Support (24 months)
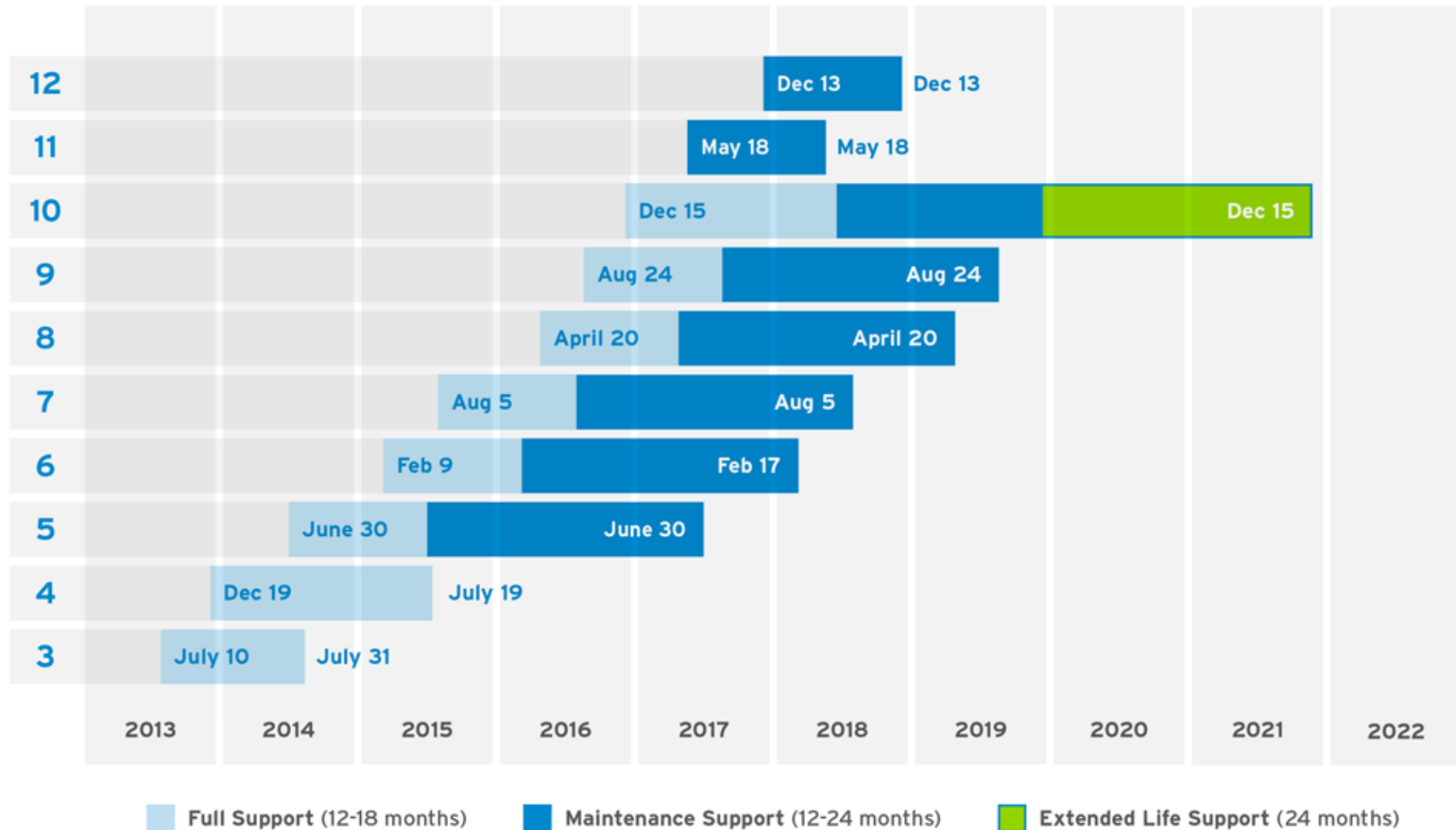
SUSE OpenStack Life Cycle

PRODUCT RELEASE	GENERAL SUPPORT ENDS
SUSE OpenStack Cloud 5	15 May 2017
SUSE OpenStack Cloud 6	15 Apr 2018
SUSE OpenStack Cloud 7	31 Mar 2019
SUSE OpenStack Cloud 8	-

Ubuntu OpenStack Life Cycle

Legend:
- Ubuntu LTS release support
- Matching OpenStack release support
- Extended support for customers
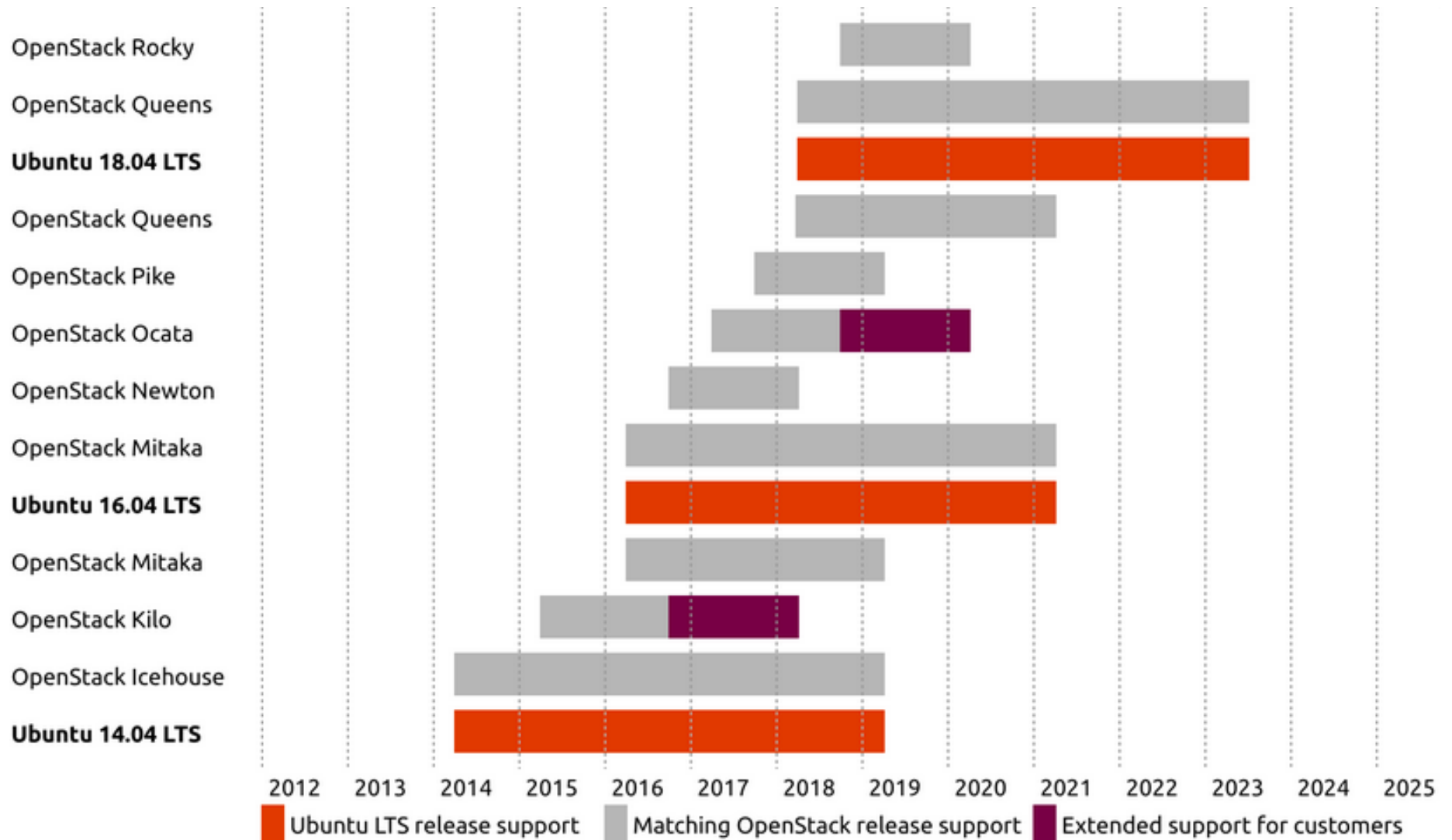
Mirantis OpenStack Life Cycle

MCP with Pike

Support Status: FULL

- General Availability (GA) date: 4/30/18
- Full Support ends: 4/30/19
- Limited Support ends: 4/30/2021

Documentation

Fuel 9.2 for Mitaka

Support Status: LIMITED

- General Availability (GA) date: 2/6/2017
- Full Support ends: 7/12/2017
- Limited Support ends: 7/12/2019

Documentation   Release Notes

MCP with Ocata

Support Status: FULL

- General Availability (GA) date: 6/30/17
- Full Support ends: 6/30/18
- Limited Support ends: 6/30/2020

Documentation

Fuel 9.1 for Mitaka

Support Status: LIMITED

- General Availability (GA) date: 10/13/2016
- Full Support ends: 7/12/2017
- Limited Support ends: 7/12/2019

Documentation   Virtual Box Scripts   Release Notes

MCP with Mitaka

Support Status: LIMITED

- General Availability (GA) date: 3/30/17
- Full Support ends: 3/30/18
- Limited Support ends: 3/30/2020

Documentation

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

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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 (1)

OpenStack Deployment Tools (2)

- 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 (1)
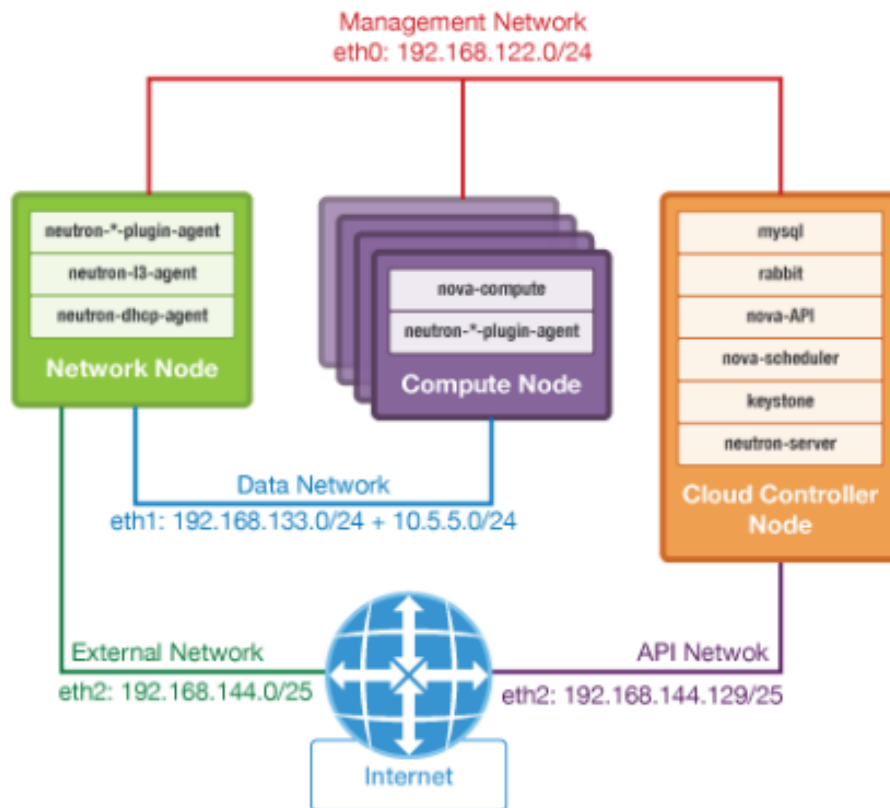
Next, we present a general overview of the networks present in **OpenStack Clouds**. We have:

- **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.
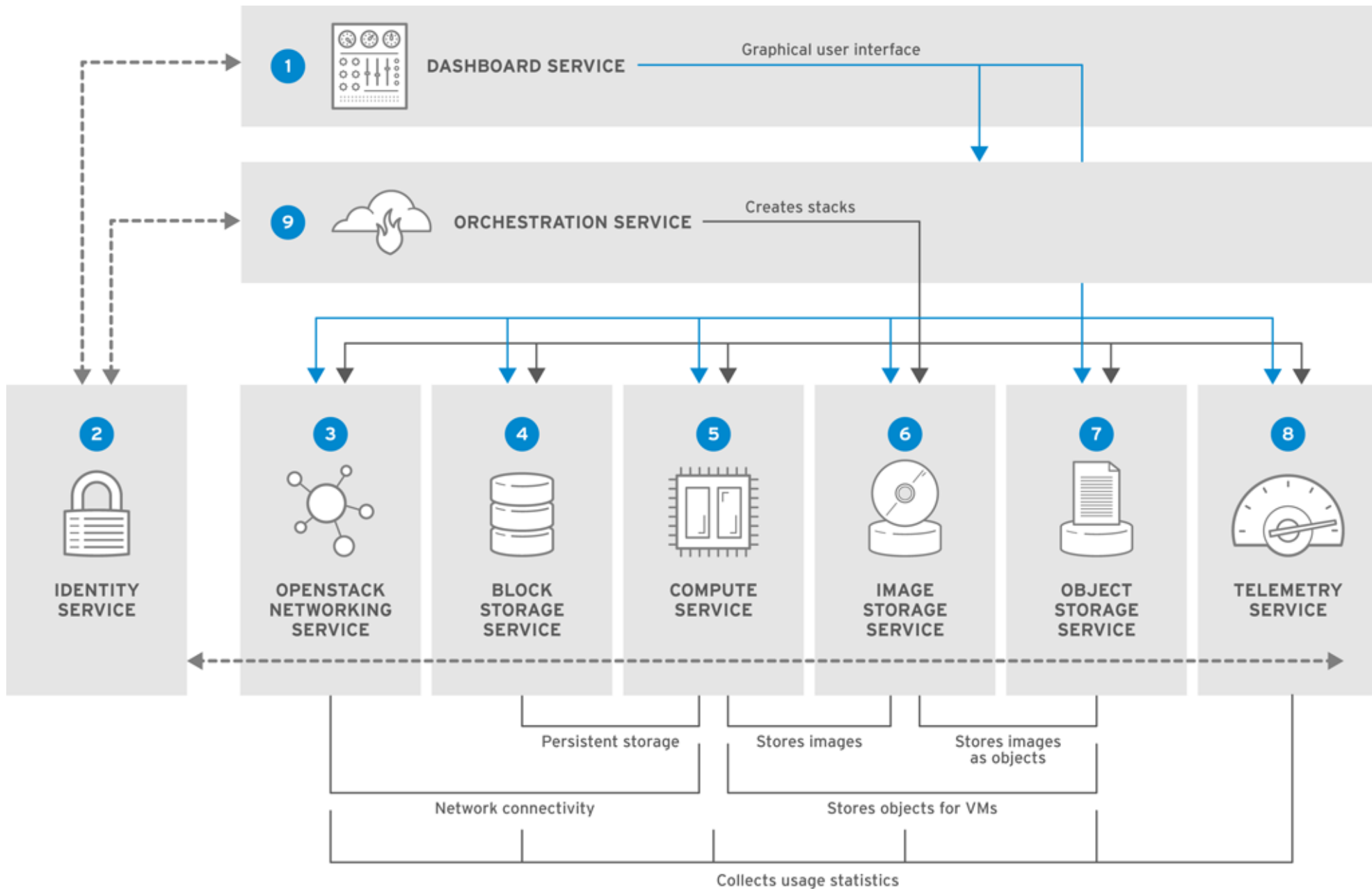
OpenStack Networking (2)
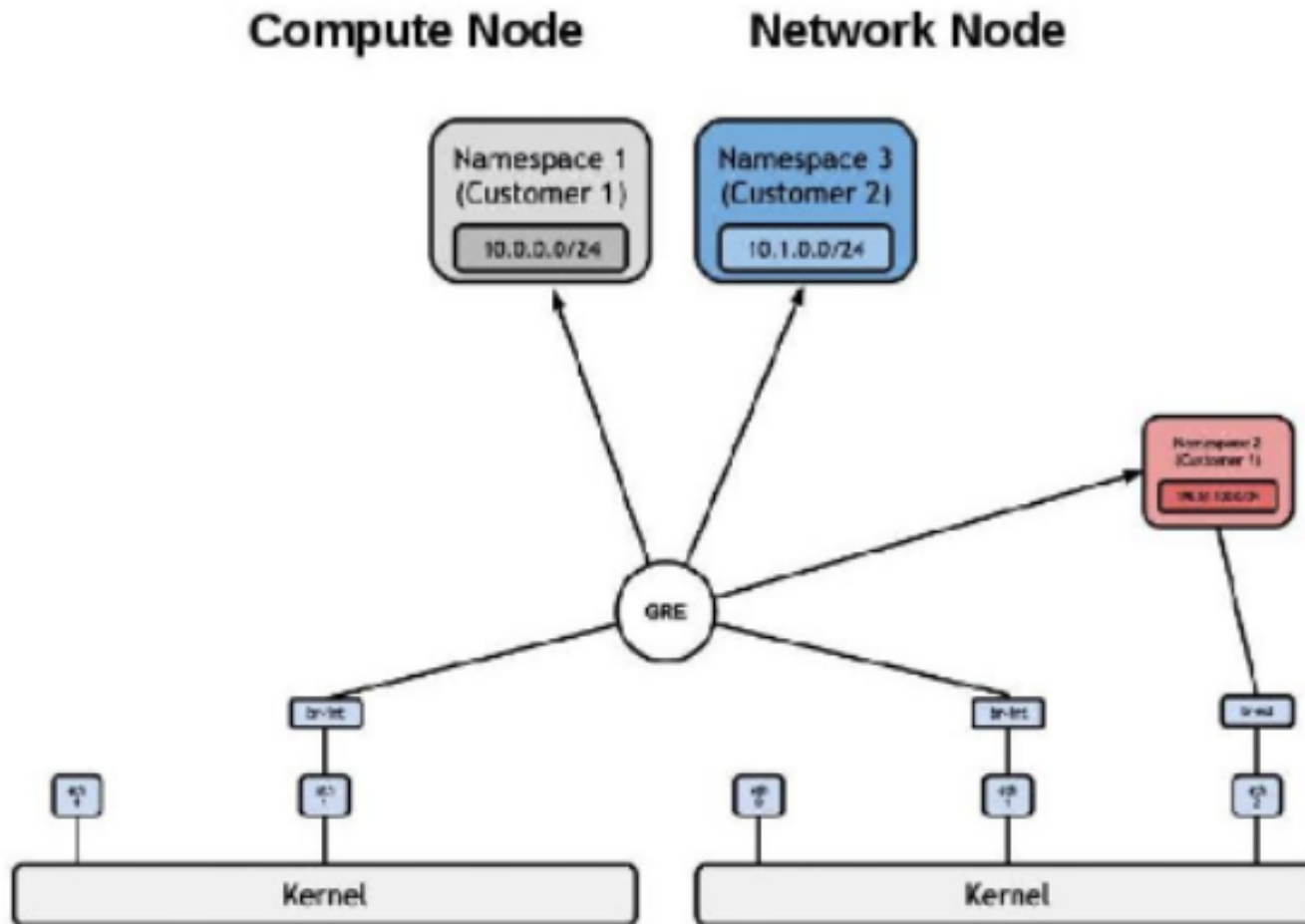
Prerequisite Services

- NTP: NTPD, Chrony

- MQ: RabbitMQ, zeroMQ

- SQL: MariaDB, MySQL, PostgreSQL

- NoSQL: MongoDB
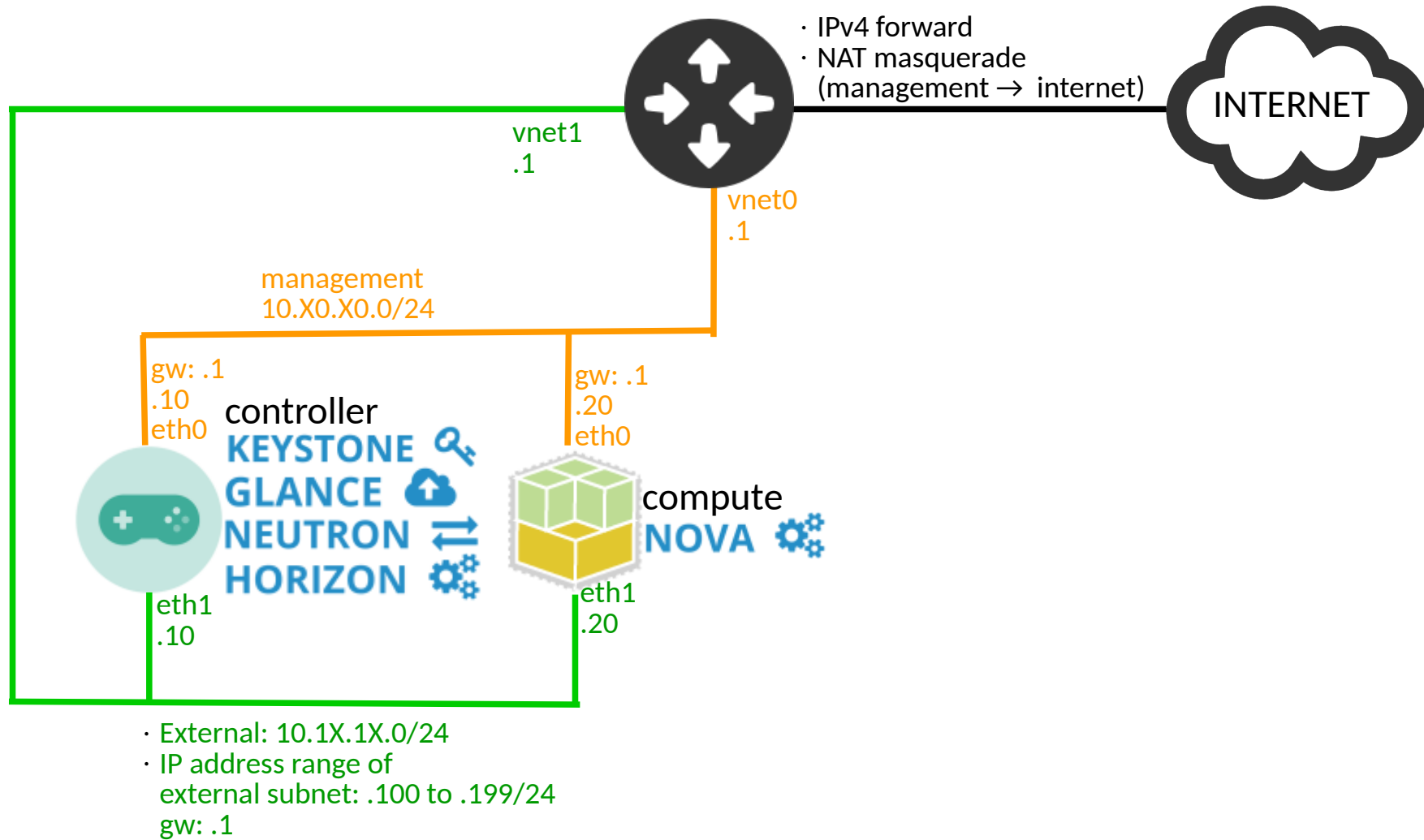
OpenStack Services Diagram

DASHBOARD SERVICE — Graphical user interface

ORCHESTRATION SERVICE — Creates stacks

1. DASHBOARD SERVICE
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
9. ORCHESTRATION SERVICE

Persistent storage

Stores images

Stores images as objects

Network connectivity

Stores objects for VMs

Collects usage statistics

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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

controller
KEYSTONE
GLANCE
NEUTRON
HORIZON

gw: .1
.20
eth0

compute
NOVA

eth1
.10

eth1
.20

- External: 10.1X.1X.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
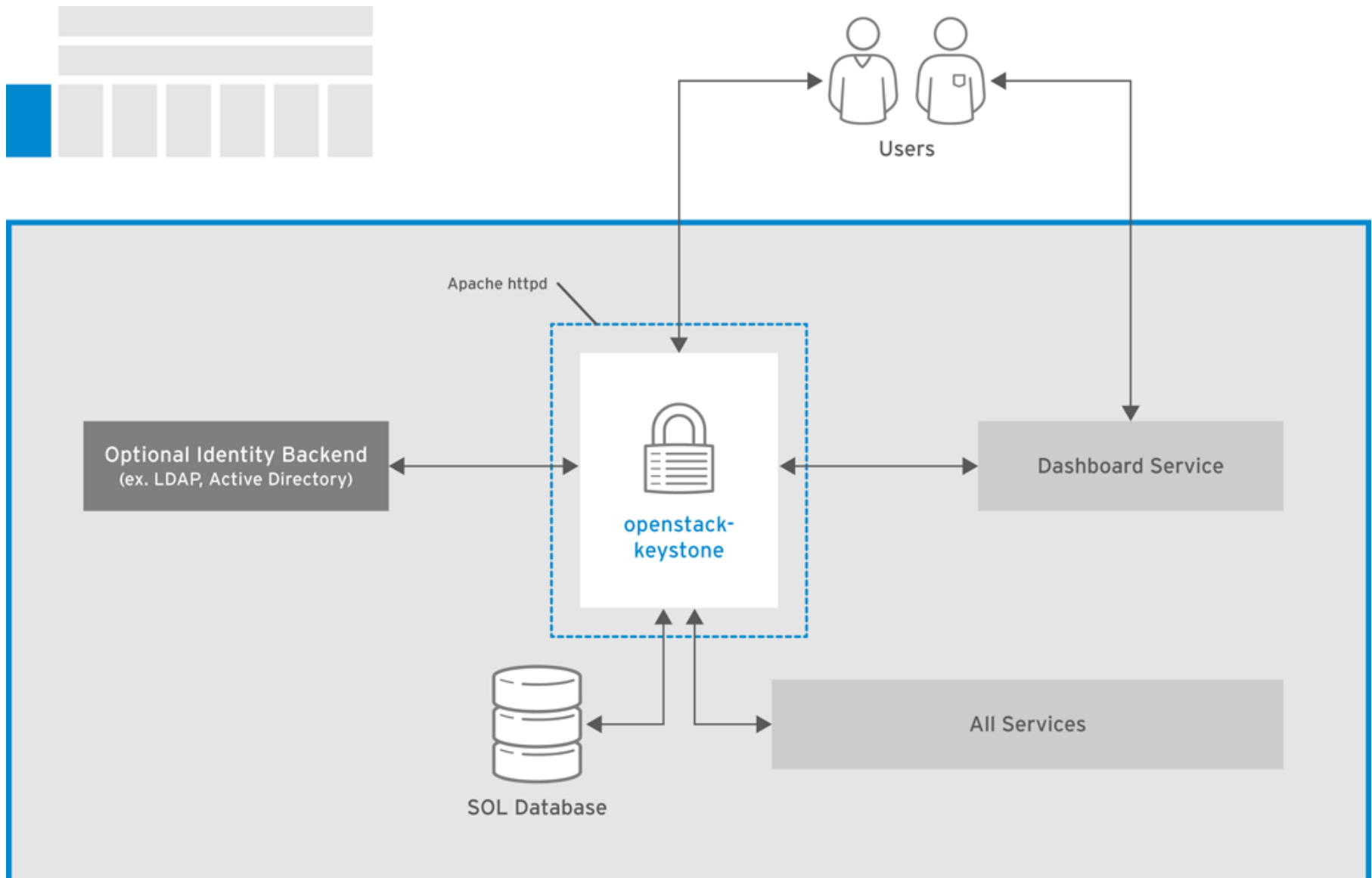
Neutron Components

- **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.

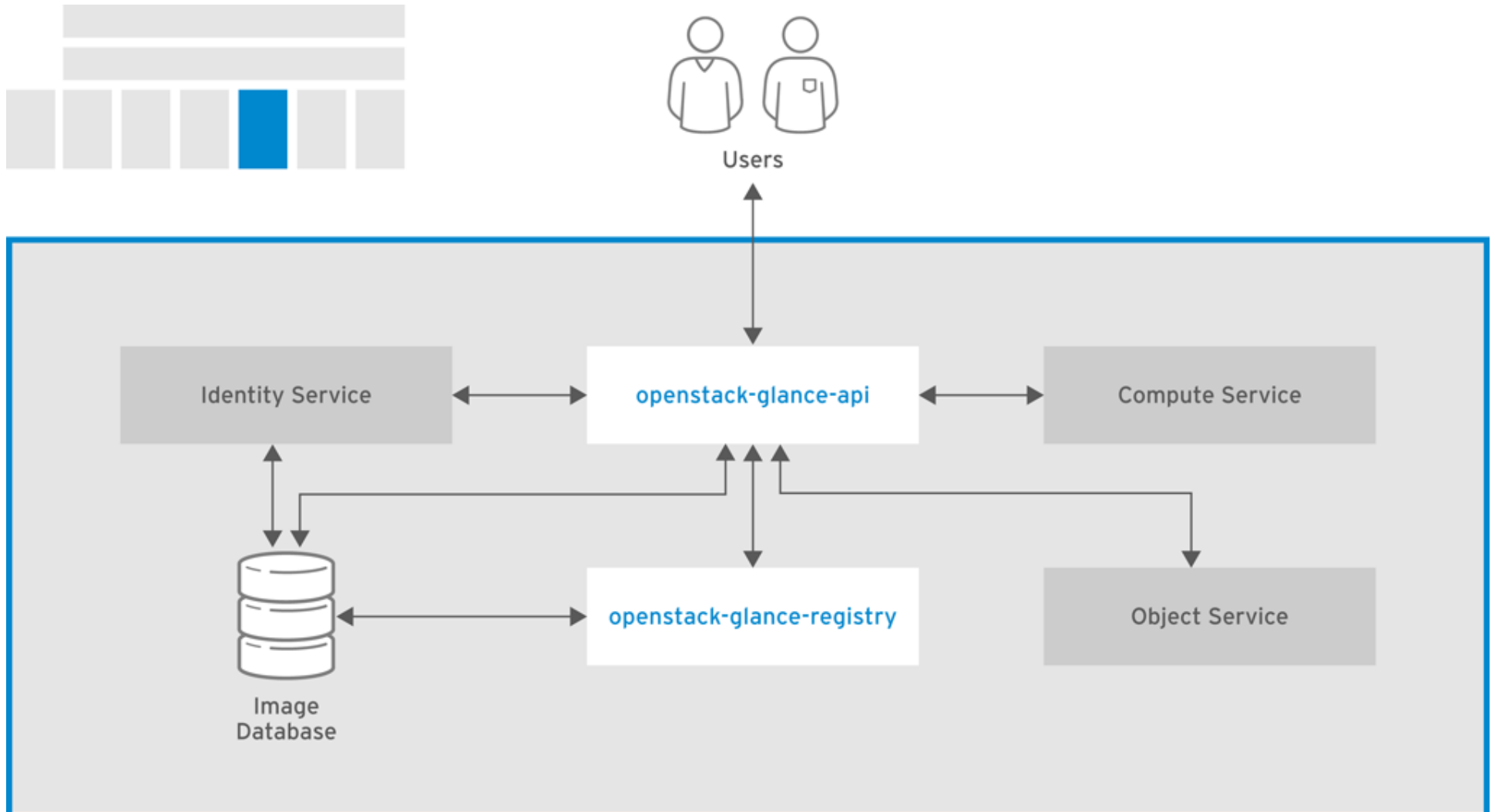# Neutron Configuration Example
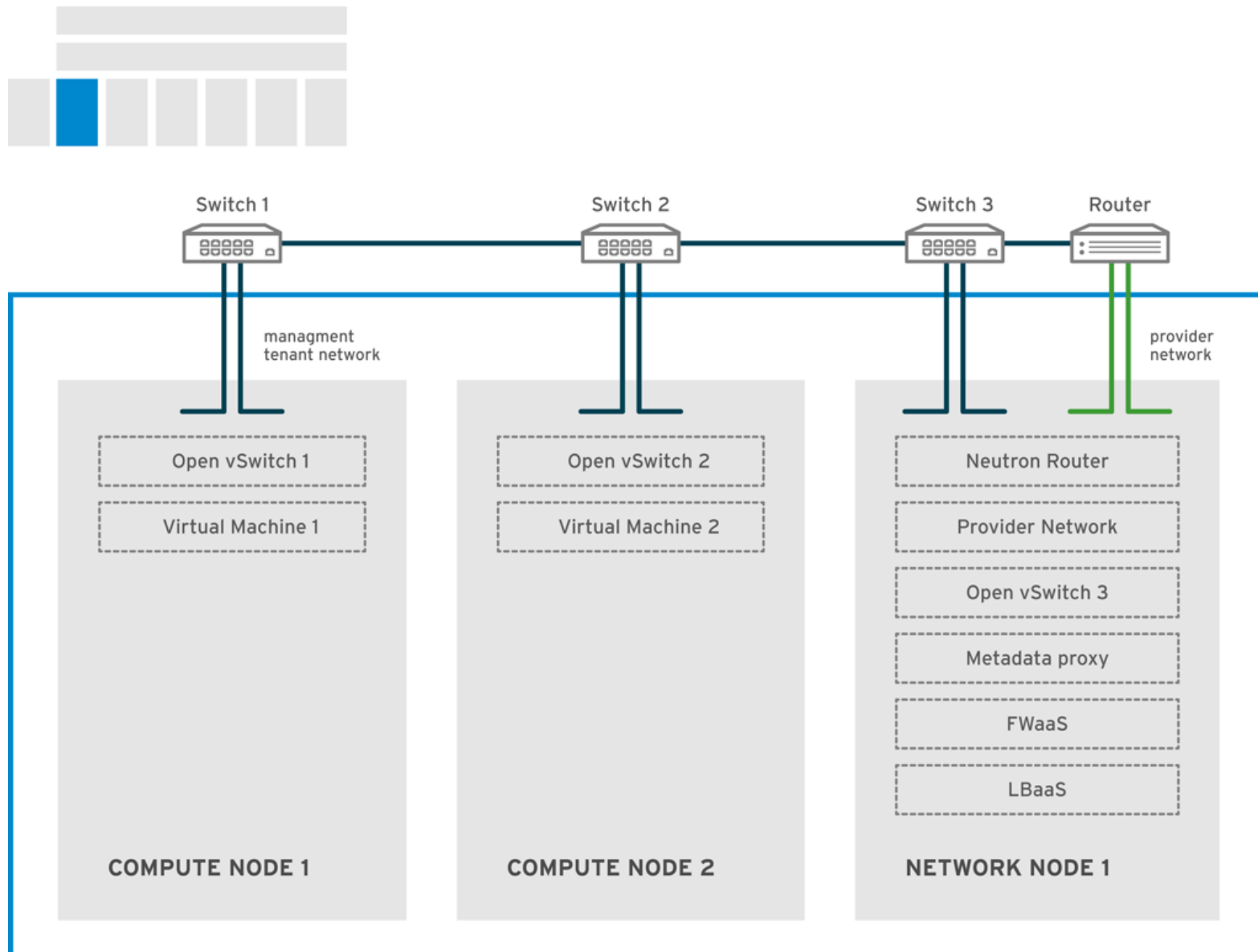
Glance Components

- **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
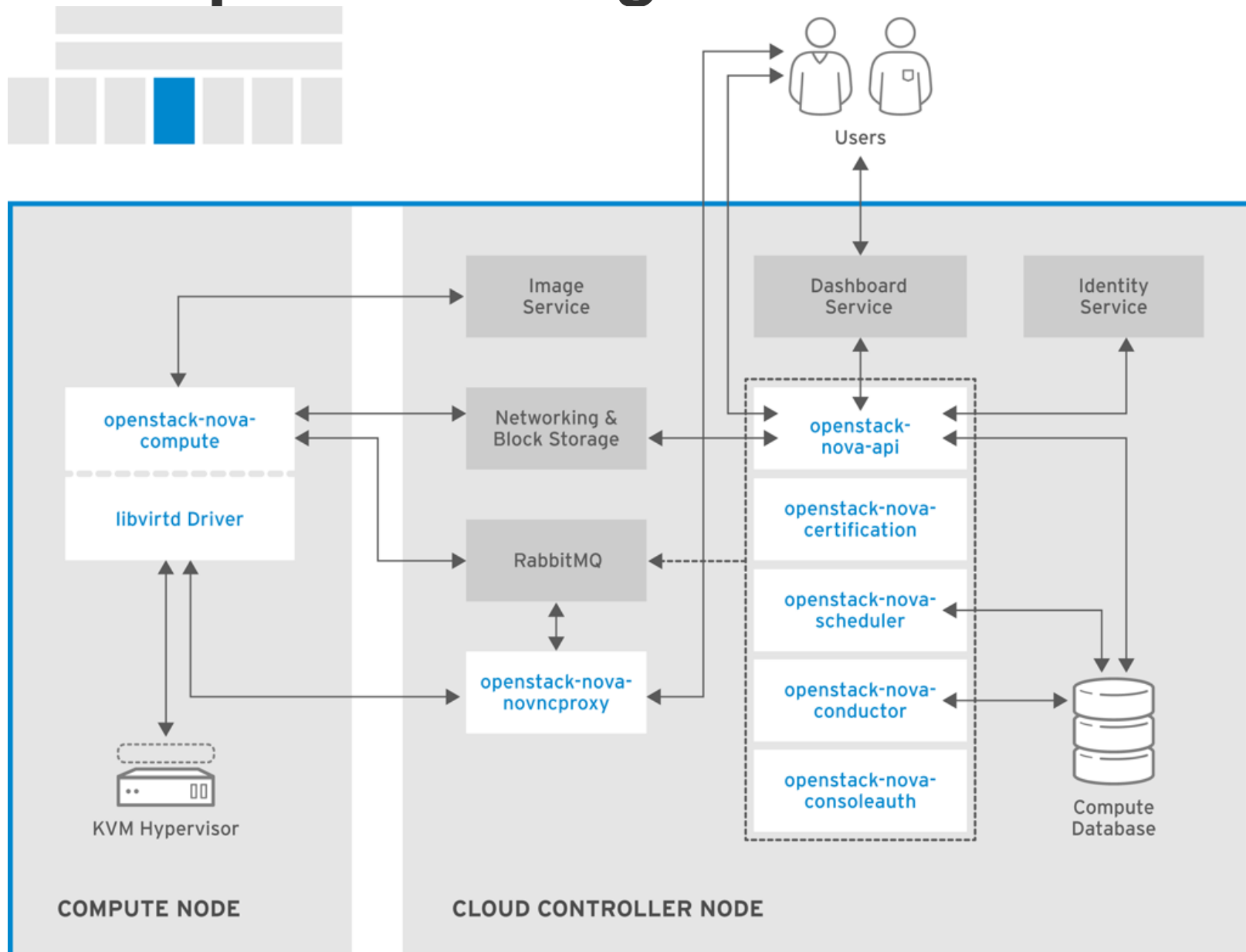

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Image Disk Formats

- 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
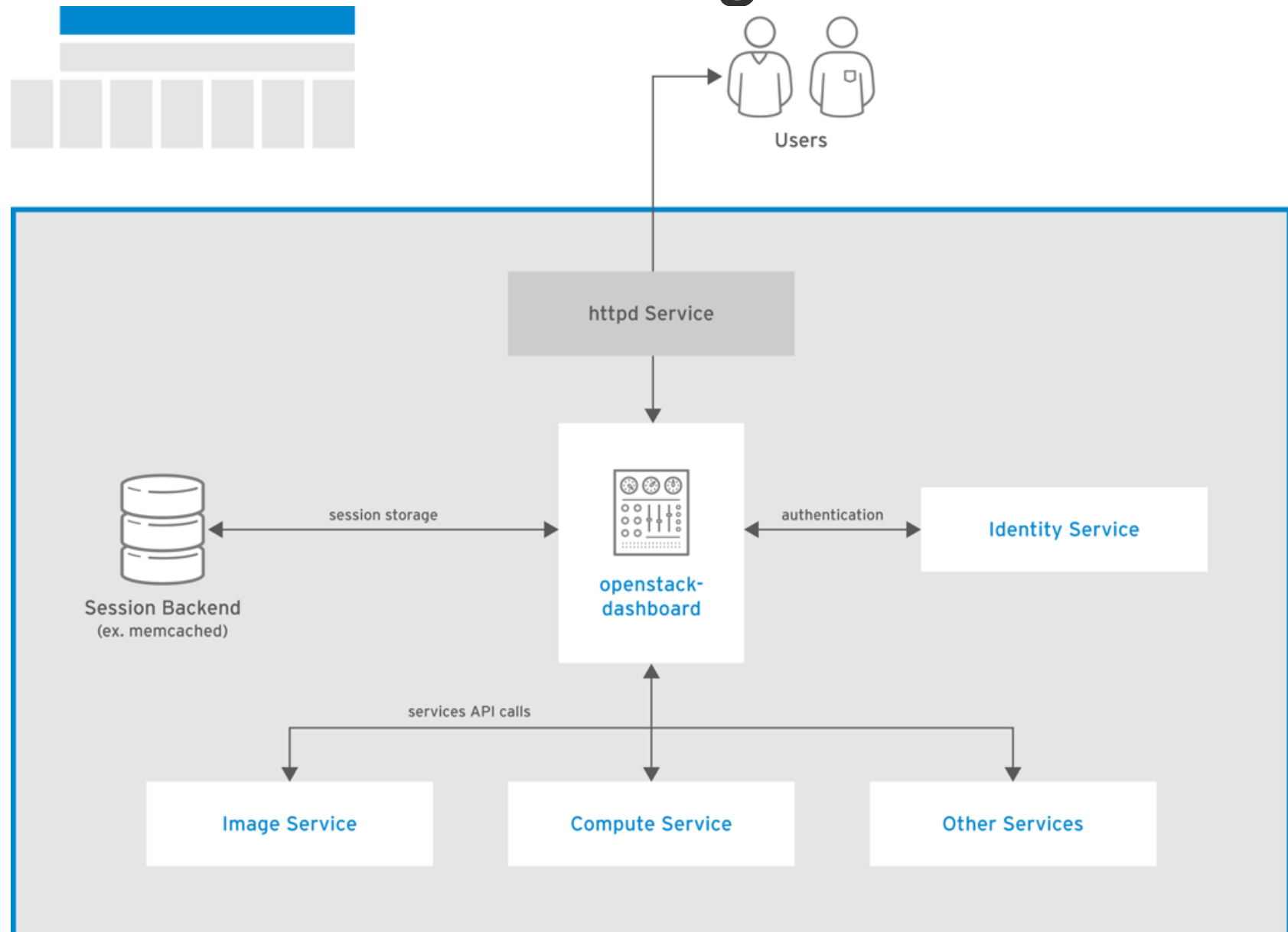
- vmdk, vmware

- 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

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

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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

controller + storage

CINDER

SWIFT

gw: .1
.20
eth0

compute

NOVA

eth1
.10

eth1
.20

- External: 10.1X.1X.0/24
- IP address range of
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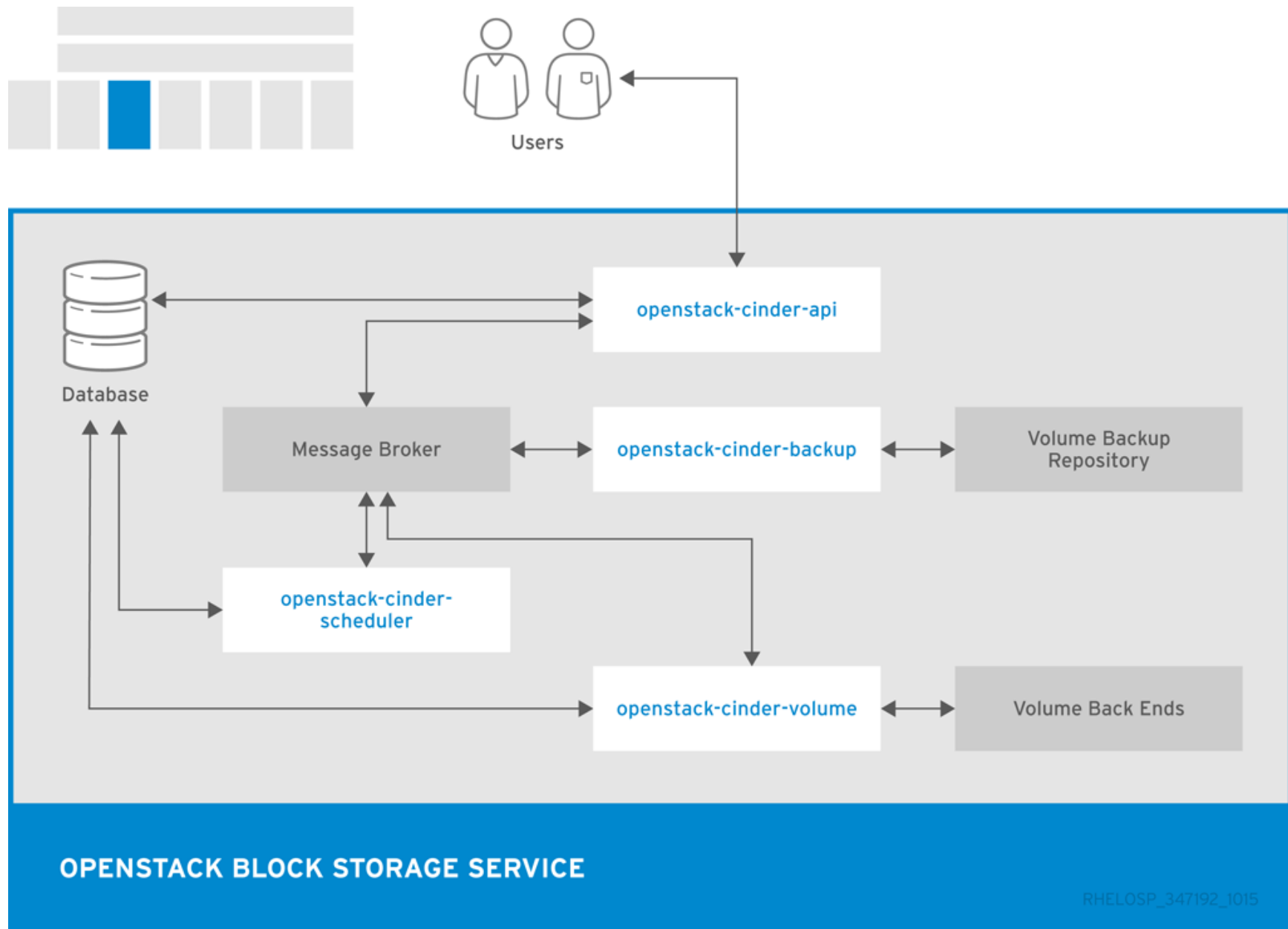 gw: .1
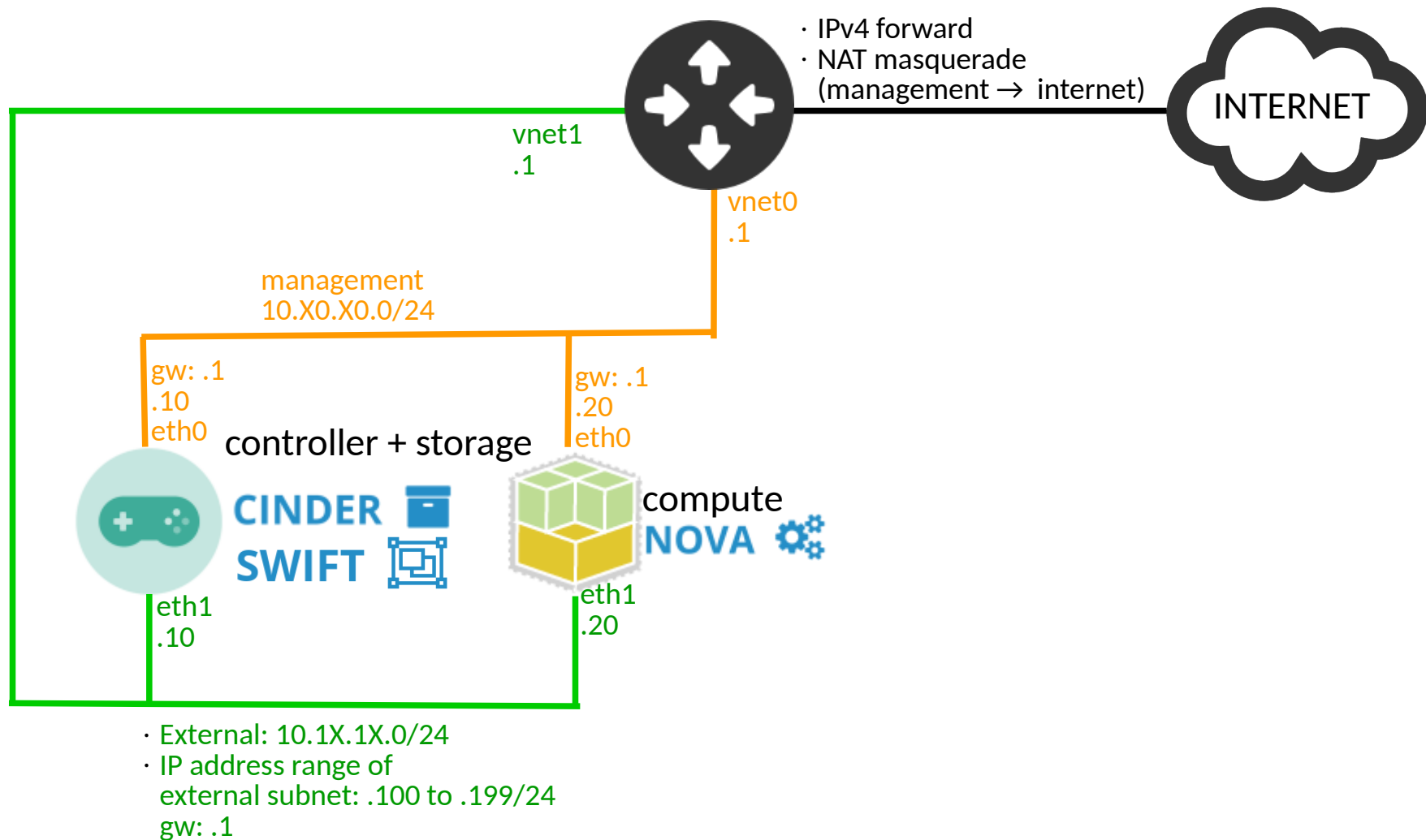
Cinder Components

- **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.

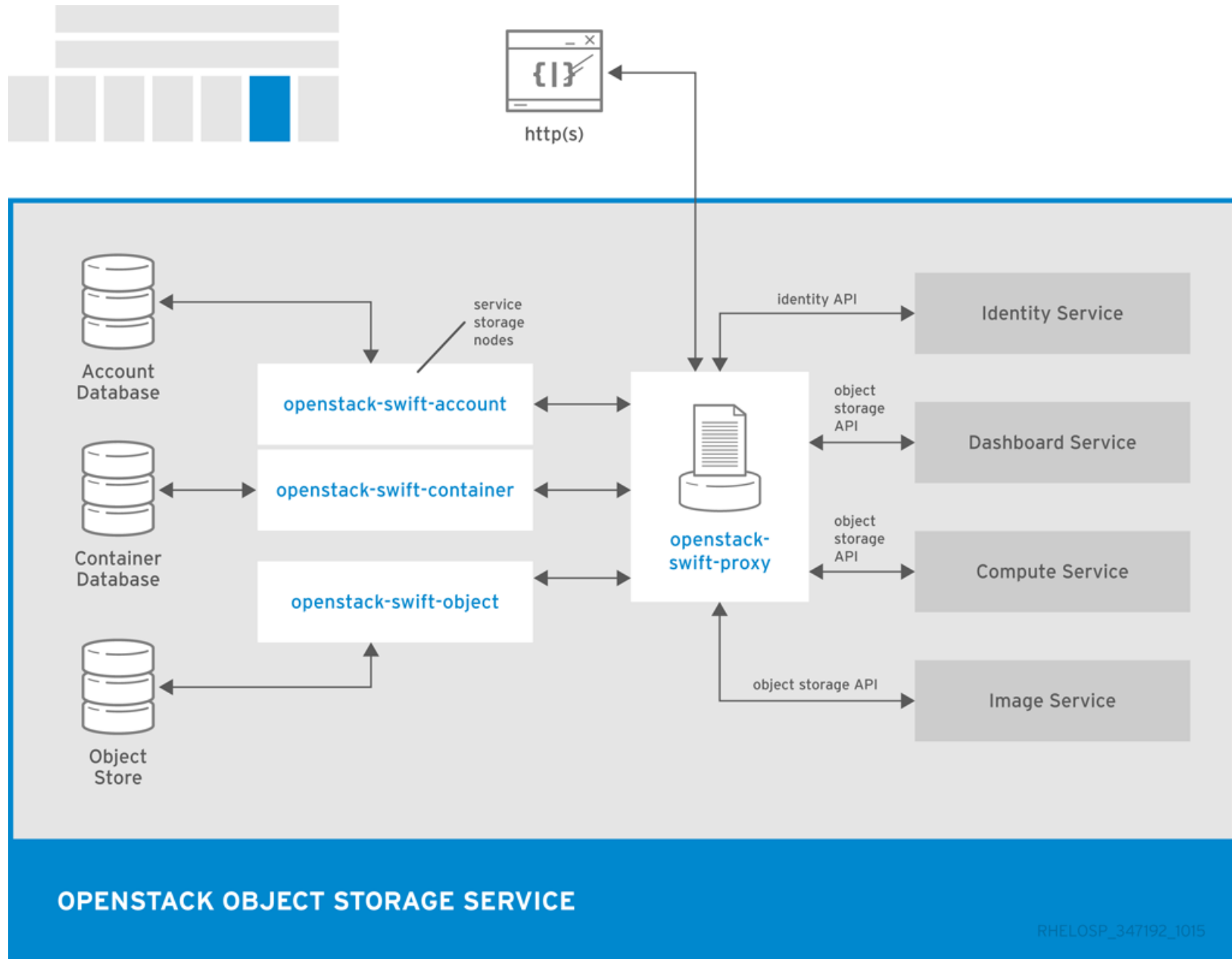- **Cinder volume**, designates storage for VMs.

Cinder Components Diagram

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

NolSatu.id