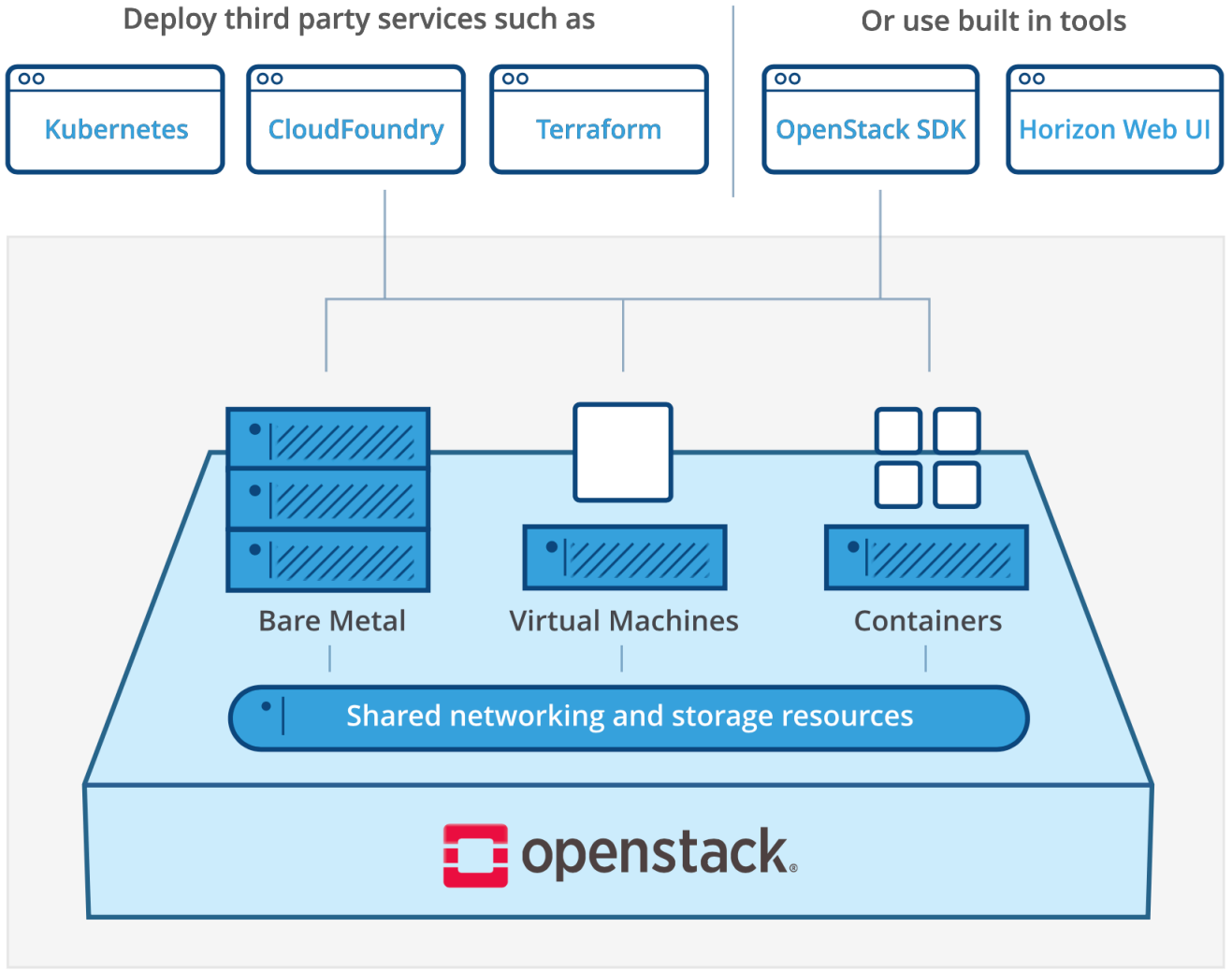
Introdução ao Openstack

Aula Teórica nº2

2020/2021

Open source SW for creating private and public clouds

- controls large pools of compute, storage, and networking resources throughout a datacenter
- managed through a dashboard or via the OpenStack API
- Built by a growing community of contributors
- Opportunities for vendors to develop their own solutions and services



OpenStack Who’s

- Who's building OpenStack?
  - Originally founded by Rackspace Hosting and NASA in July 2010
  - Adopted by Ubuntu in 2011
  - Now driven by OpenStack Foundation (established in September, 2012)
- Who’s backing OpenStack?
  - More than 200 companies - 87000+ people from 180 countries
- Who’s using OpenStack?
  - Enterprise, service providers, SMBs, researchers…
  - In private public and Telco cloud

Companies Supporting The OpenStack Foundation

Platinum members

AT&T

Canonical

Hewlett Packard Enterprise

IBM

Intel

Rackspace

Red Hat, Inc.

SUSE

Gold members

99Cloud Inc.

Aptira

CCAT

China Mobile

China Telecom

Cisco

City Network

Dell EMC

Deutsche Telekom

EasyStack

Ericsson

Fujitsu

Hitachi

Huawei

Inspur

inwinSTACK

Mirantis

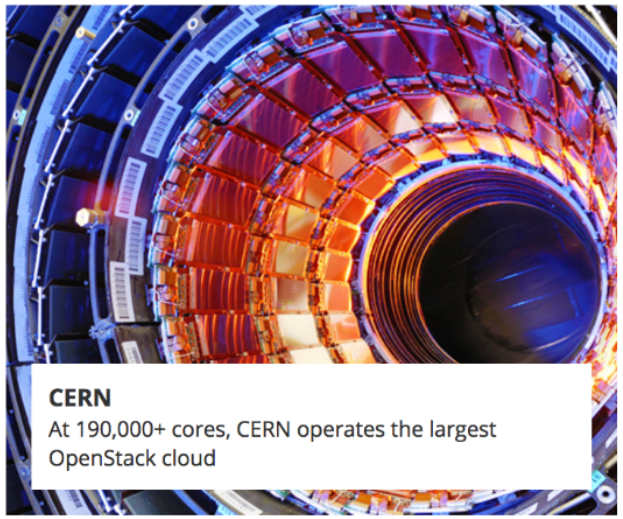
NEC

NetApp

UnitedStack Inc.

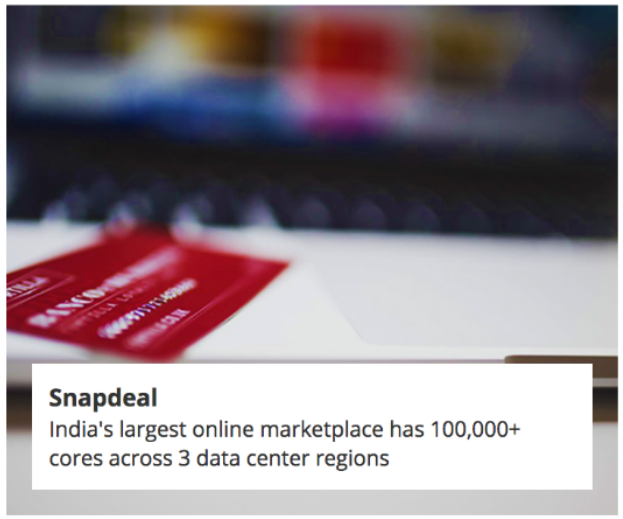
ZTE Corporation

OpenStack - Industries

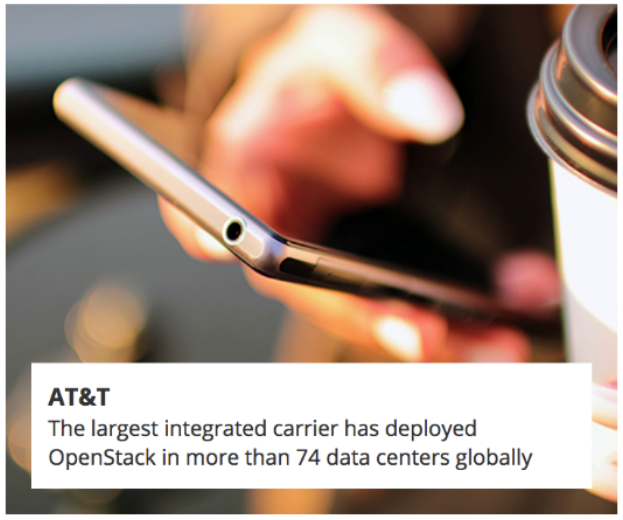


CERN
At 190,000+ cores, CERN operates the largest OpenStack cloud

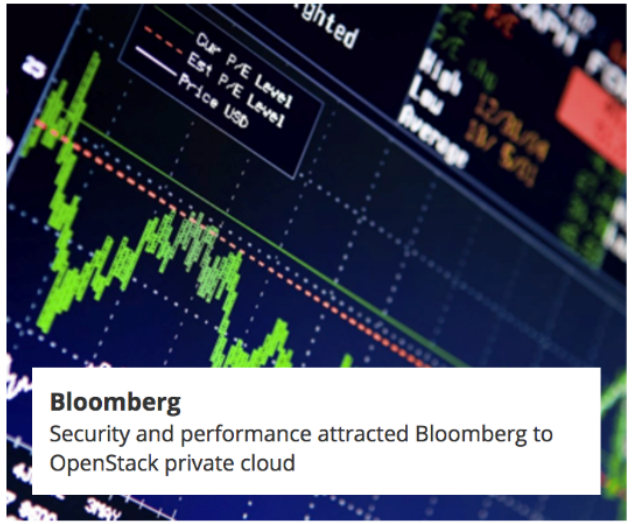
Volkswagen Group
The largest car manufacturer uses OpenStack and Cloud Foundry for big data and website delivery



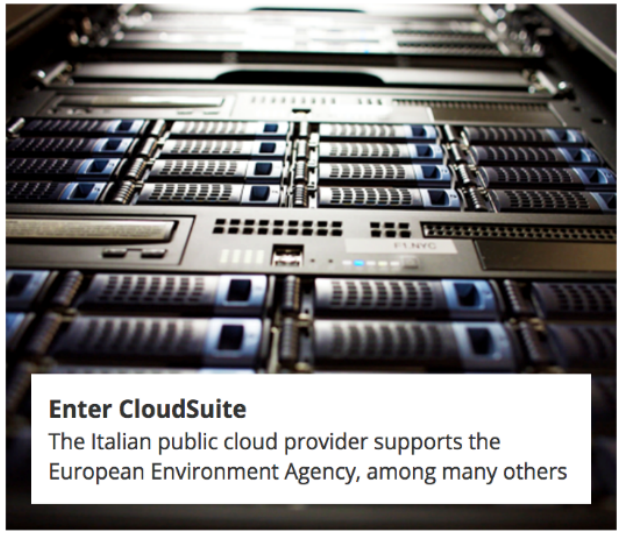
Snapdeal
India's largest online marketplace has 100,000+ cores across 3 data center regions



AT&T
The largest integrated carrier has deployed OpenStack in more than 74 data centers globally

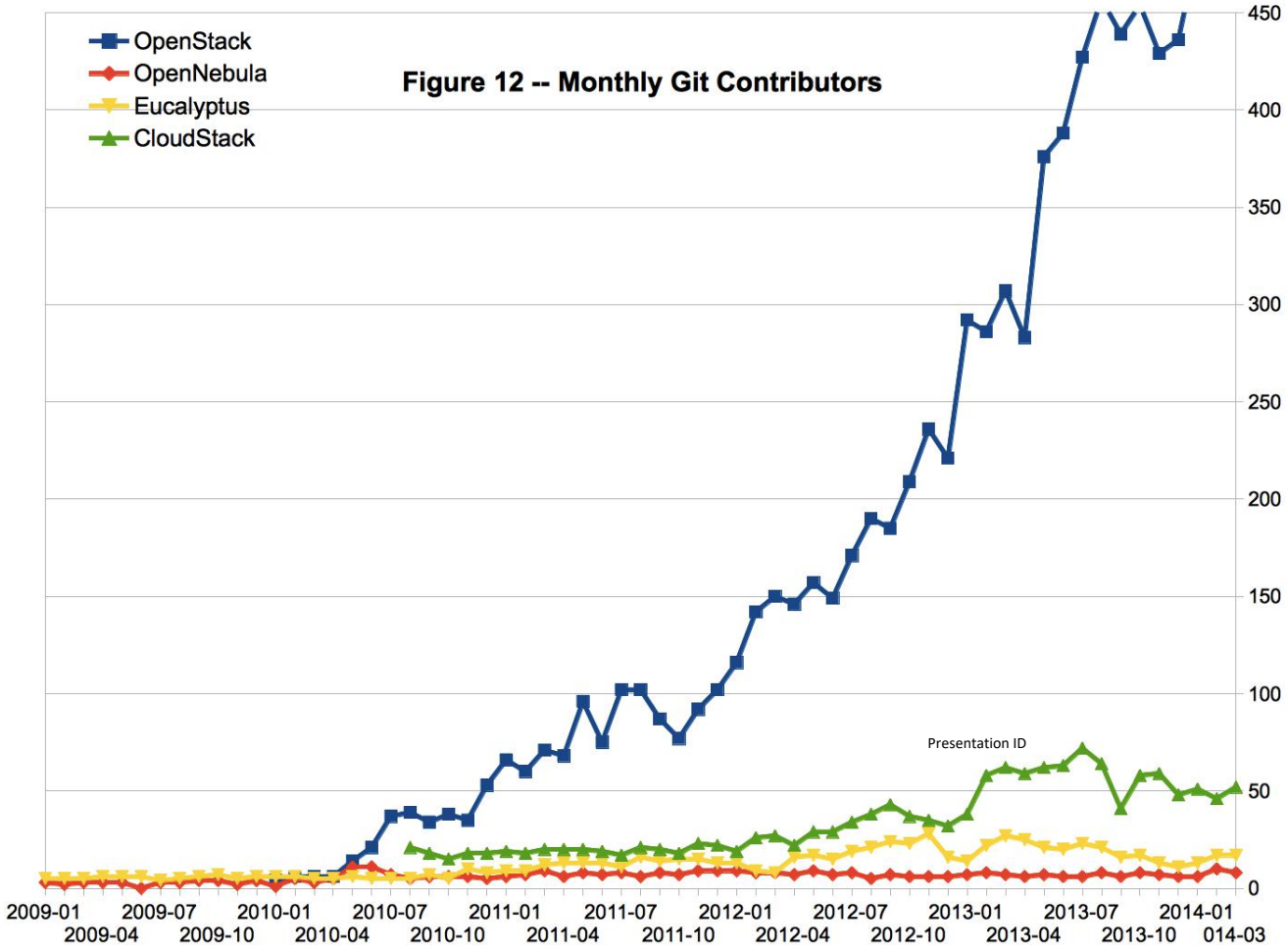


Bloomberg
Security and performance attracted Bloomberg to OpenStack private cloud



Enter CloudSuite
The Italian public cloud provider supports the European Environment Agency, among many others

Open Source Cloud SW Analysis



Initial Release:

- OpenStack, October 2010
- CloudStack, May 2010
- Eucalyptus, May 2008
- OpenNebula, March 2008

~ 10 years

Latest Releases:

- Openstack, October 2020
- CloudStack, January 2021
- Eucalyptus, April 2018
- OpenNebula, February 2021

OpenStack Releases

Series	Status	Initial Release Date
Xena	Future	2021-10-06 *estimated* (schedule)
Wallaby	Development	2021-04-14 *estimated* (schedule)
Victoria	Maintained	2020-10-14
Ussuri	Maintained	2020-05-13
Train	Maintained	2019-10-16
Stein	Extended Maintenance (see note below)	2019-04-10
Rocky	Extended Maintenance (see note below)	2018-08-30
Queens	Extended Maintenance (see note below)	2018-02-28
Pike	Extended Maintenance (see note below)	2017-08-30
Ocata	Extended Maintenance (see note below)	2017-02-22

Series	Status	Initial Release Date	Next Phase	EOL Date
Newton	End Of Life	2016-10-06		2017-10-25
Mitaka	End Of Life	2016-04-07		2017-04-10
Liberty	End Of Life	2015-10-15		2016-11-17
Kilo	End Of Life	2015-04-30		2016-05-02
Juno	End Of Life	2014-10-16		2015-12-07
Icehouse	End Of Life	2014-04-17		2015-07-02
Havana	End Of Life	2013-10-17		2014-09-30
Grizzly	End Of Life	2013-04-04		2014-03-29
Folsom	End Of Life	2012-09-27		2013-11-19
Essex	End Of Life	2012-04-05		2013-05-06
Diablo	End Of Life	2011-09-22		2013-05-06
Cactus	End Of Life	2011-04-15		
Bexar	End Of Life	2011-02-03		
Austin	End Of Life	2010-10-21		

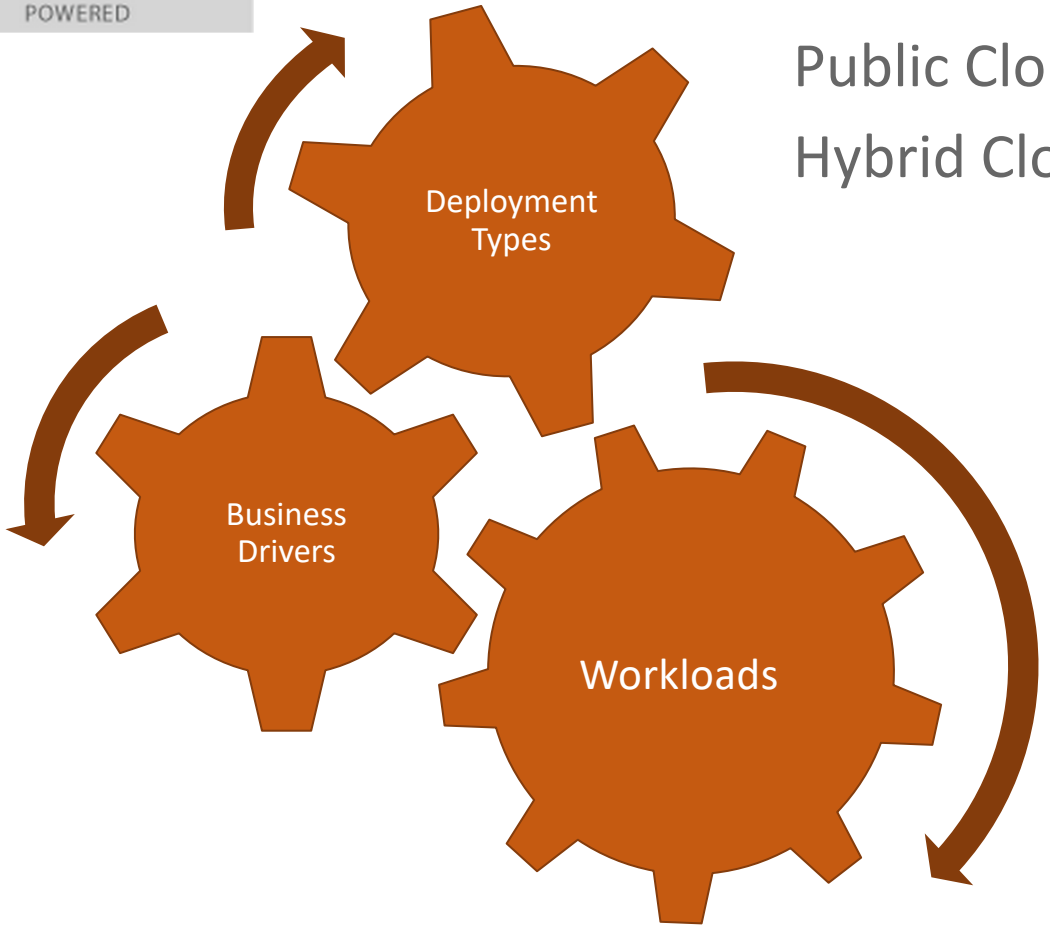
OpenStack Trends

On-Premise Private Cloud

Hosted Private Clouds

Public Cloud

Hybrid Cloud



Ability to Innovate

Open Technology

Cost Savings

Avoiding vendor lock-in

Operational efficiency

Web Services

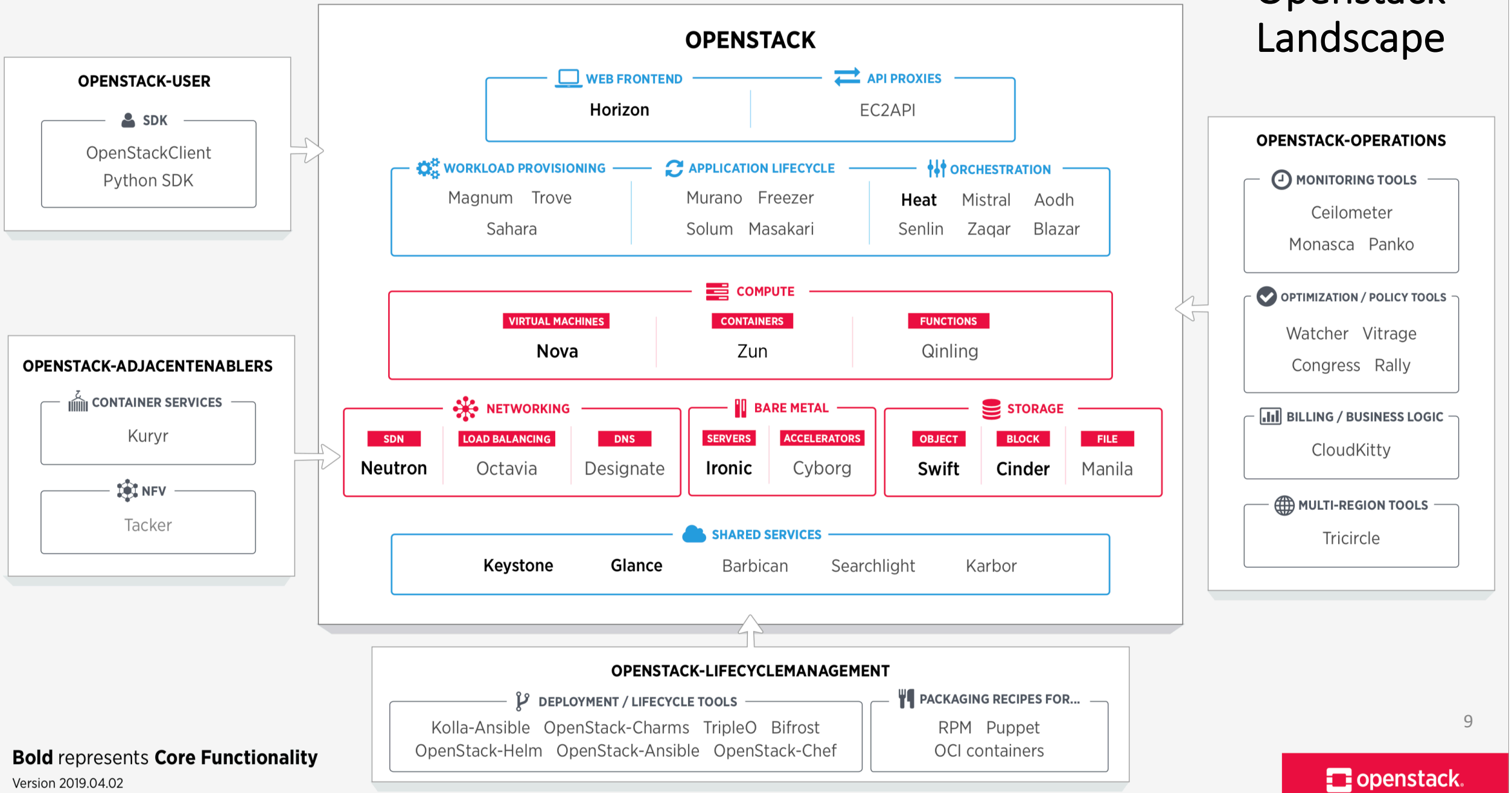
QA/Test environment

Databases/Datastores

Enterprise Applications

Research/HPC

Openstack Landscape

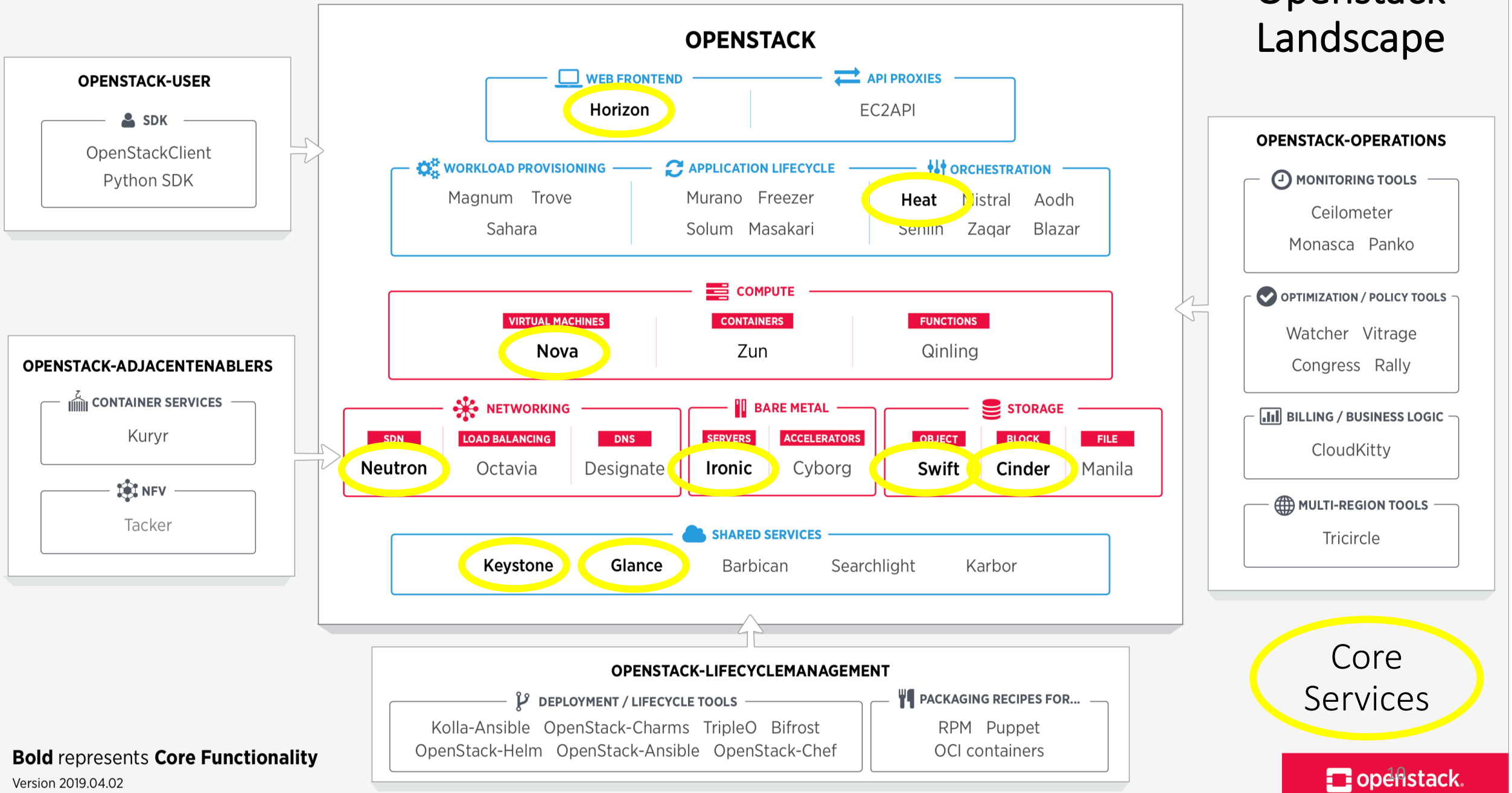


Bold represents **Core Functionality**

Version 2019.04.02

openstack.

Openstack Landscape



Core Services

Bold represents **Core Functionality**

Version 2019.04.02

openstack.

OpenStack Core Services

Nova

Austin, 2010
Compute provisioning service

Keystone

Essex, 2012
Identity (client authentication) service

Cinder

Folsom, 2012
Block storage service (LVM or plugin drivers for other storage)

Swift

Austin, 2010
Highly available, distributed object/BLOB store service

Horizon

Essex, 2012
web based user interface (dashboard) to OpenStack services

Heat

Havana, 2013
Heat orchestrates the infrastructure resources based on templates

Glance

Bexar, 2011
Image services include discovering, registering, and retrieving virtual machine images

Neutron

Folsom, 2012
SDN networking project focused on delivering networking-as-a-service (NaaS)

Ironic

Kilo, 2015
Bare metal provisioning service

OpenStack Services

Compute

NOVA	Compute Service
ZUN	Containers Service
QINLING	Functions Service

Bare Metal

IRONIC	Bare Metal Provisioning Service
CYBORG	Accelerators resource management

Storage

SWIFT	Object store
CINDER	Block Storage
MANILA	Shared filesystems

Networking

NEUTRON	Networking
OCTAVIA	Load balancer
DESIGNATE	DNS service

Orchestration

HEAT	Orchestration
SENLIN	Clustering service
MISTRAL	Workflow service
ZAQAR	Messaging Service
BLAZAR	Resource reservation service
AODH	Alarming Service

Workload Provisioning

MAGNUM	Container Orchestration Engine Provisioning
SAHARA	Big Data Processing Framework Provisioning
TROVE	Database as a Service

Application Lifecycle

MASAKARI	Instances High Availability Service
MURANO	Application Catalog
SOLUM	Software Development Lifecycle Automation
FREEZER	Backup, Restore, and Disaster Recovery

Monitoring Tools

CEILOMETER	Metering & Data Collection Service
PANKO	Event, Metadata Indexing Service
MONASCA	Monitoring

Optimization/policy tools

WATCHER	Optimization Service
VITRAGE	Root Cause Analysis service
CONGRESS	Governance
RALLY	Benchmark service

Billing / Business Logic

CLOUDKITTY	Billing and chargebacks

Multi-Region Tools

TRICIRCLE	Networking Automation for Multi-Region Deployments

Containers

KURYR	OpenStack Networking integration for containers

NFV

TACKER	NFV Orchestration

API Proxies

EC2API	EC2 API proxy

Web Frontend

HORIZON	Dashboard

Swift add-ons

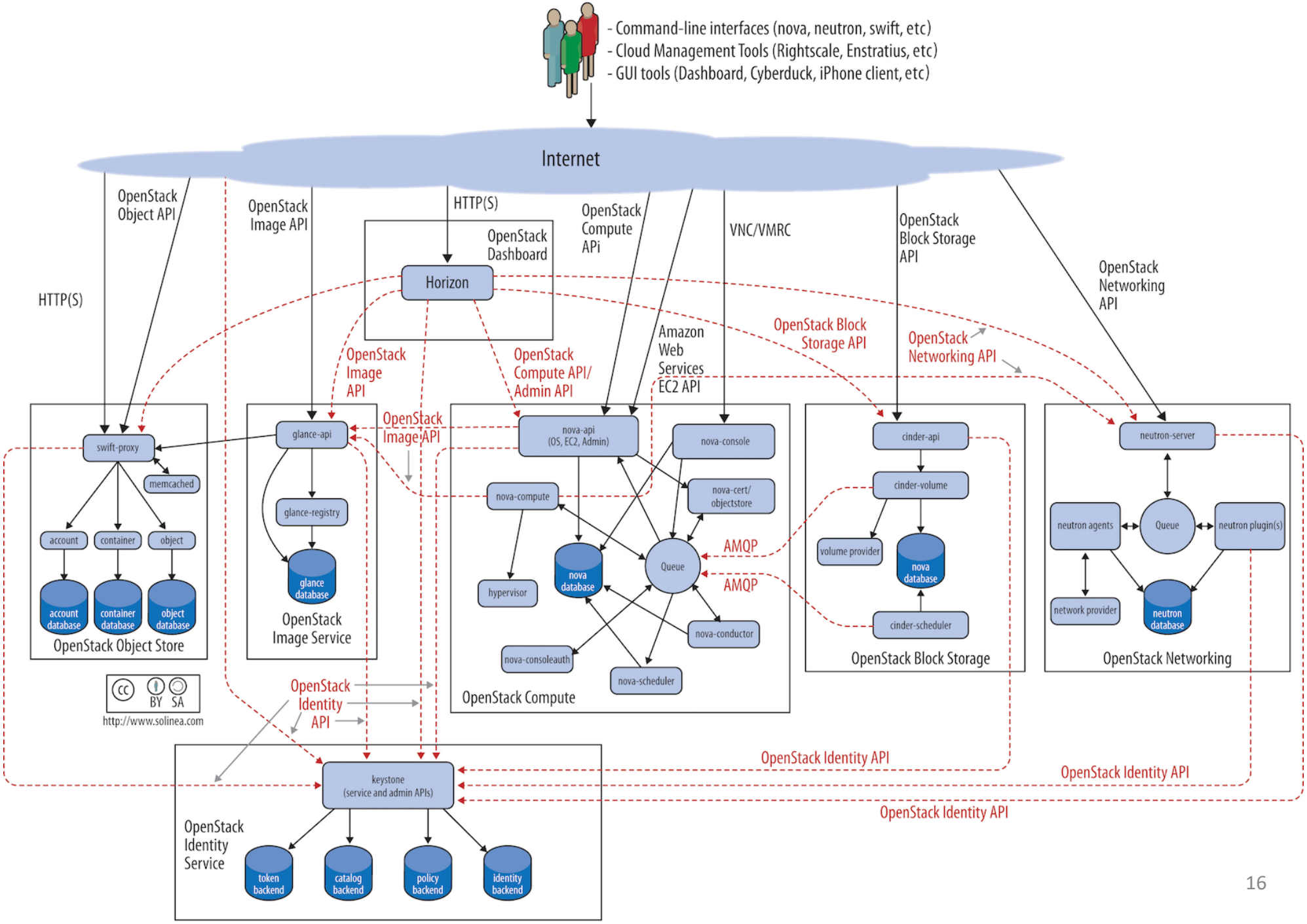
STORLETS	Computable object storage

OpenStack Services

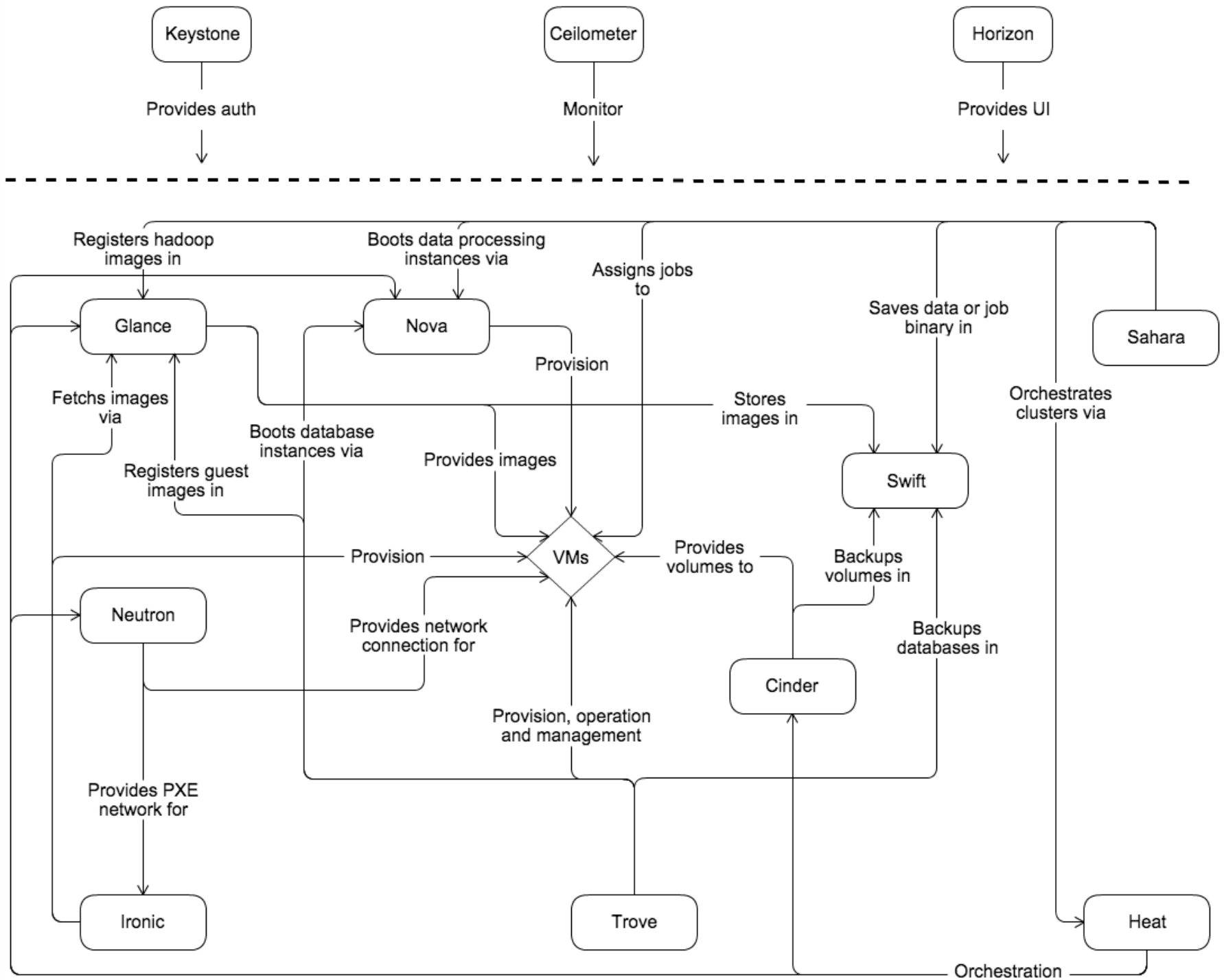
OpenStack Terminology

- **Instance –** Virtual Machine
- **Image –** Operating system in a file that is used to launch virtual machine, multiple formats (qcow2, ISO, etc.)
- **Application Programming Interface (API) –** Interface (routines, protocols, tools) for building/accessing an application
- **Message Queue –** Hub for passing messages between daemons/services
- **Volume –** Persistent block storage for instances
- **Project (”Tenant”) –** Provides logical separation among OpenStack users
- **Flavors –** Pre-created bundles of computing resources
- **Fixed IP –** Associated to an instance on start-up (internal IP)
- **Floating IP –** Public facing IP address

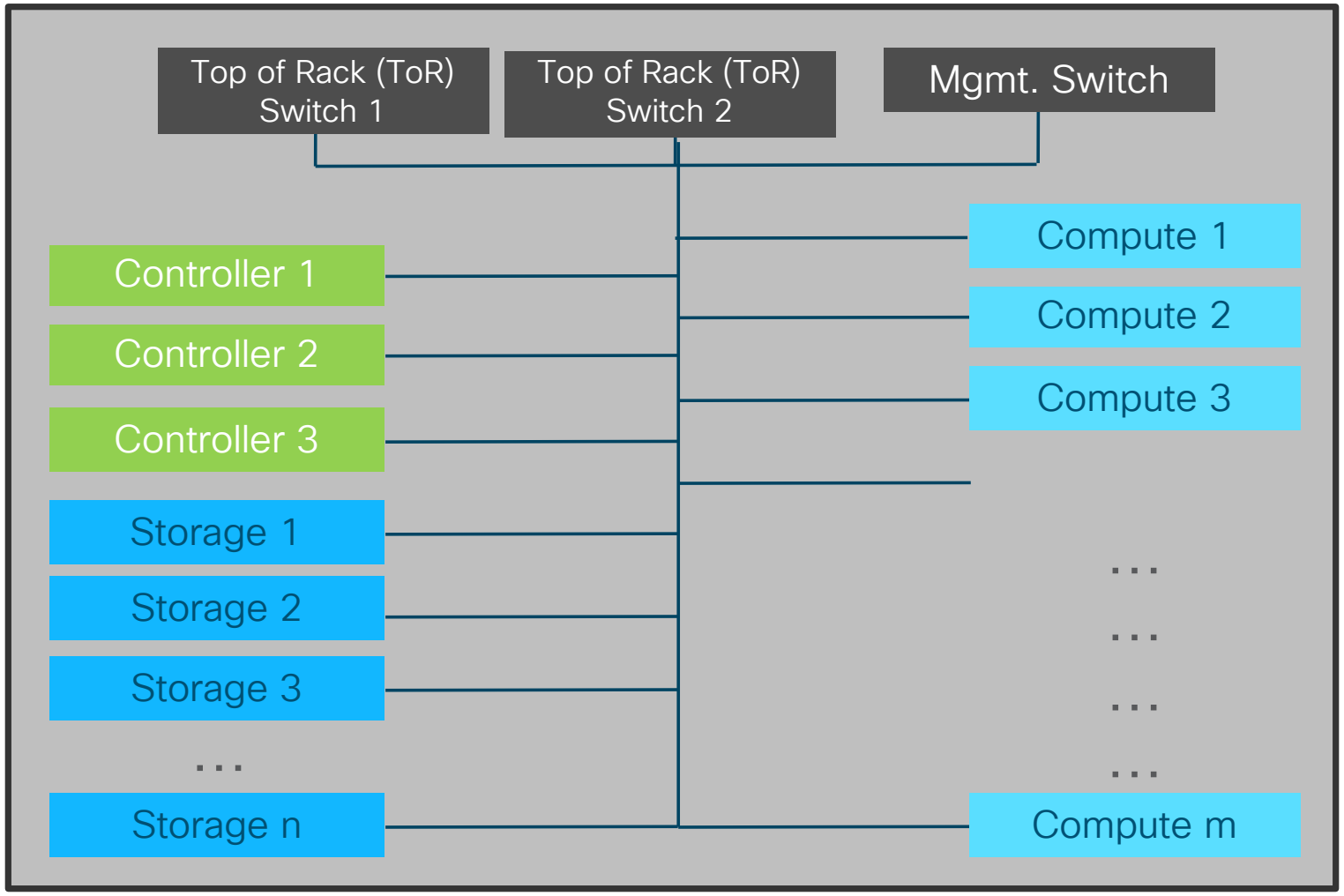
OpenStack Logical Architecture



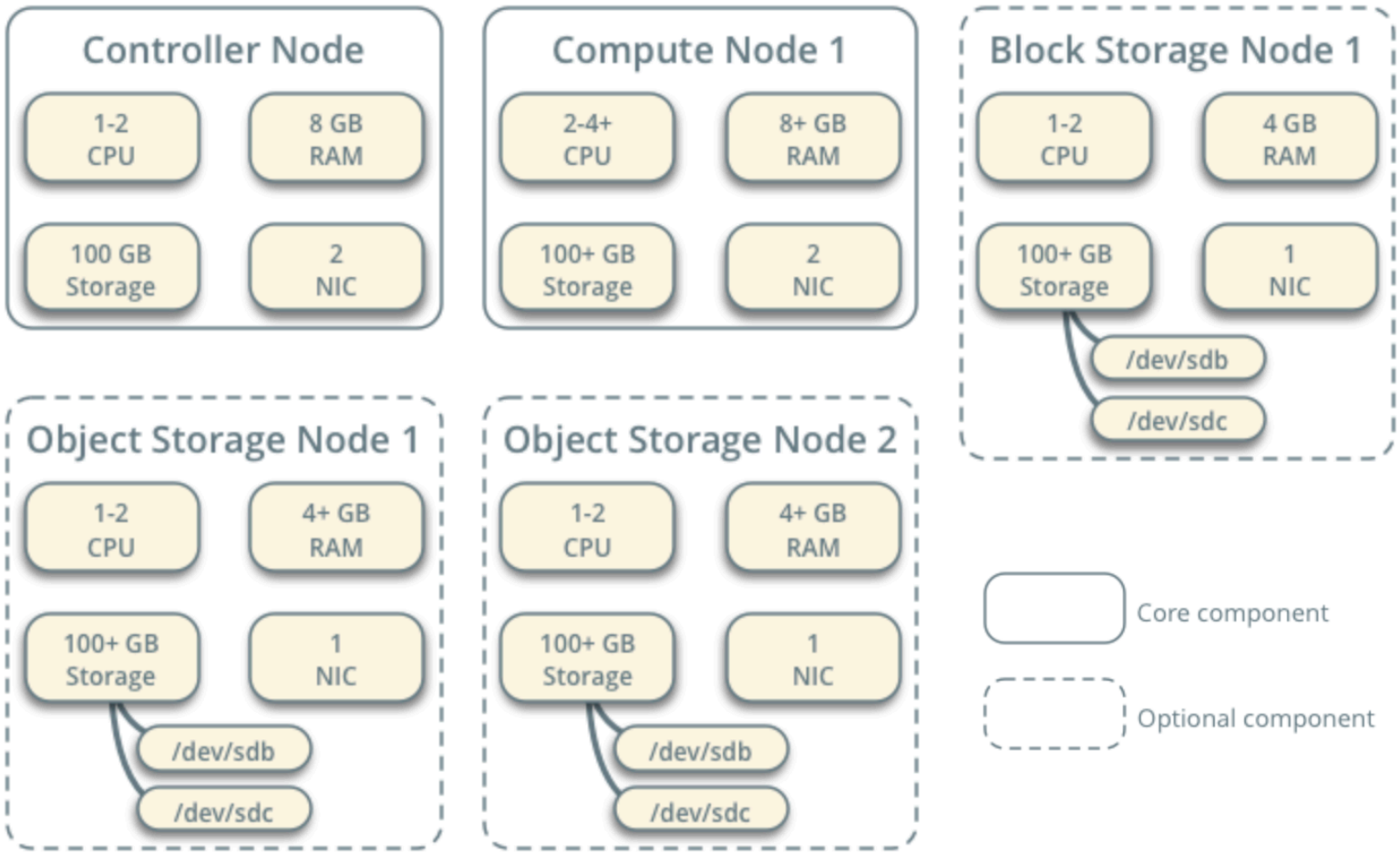
OpenStack Conceptual Architecture



Typical OpenStack Deployment for **Production**



Minimal OpenStack Deployment for **Proof-of-concept**



Controller

Identity service, image service, management portions of compute and networking, networking agents and the dashboard.

Also includes supporting services such as SQL database, message queue and NTP.

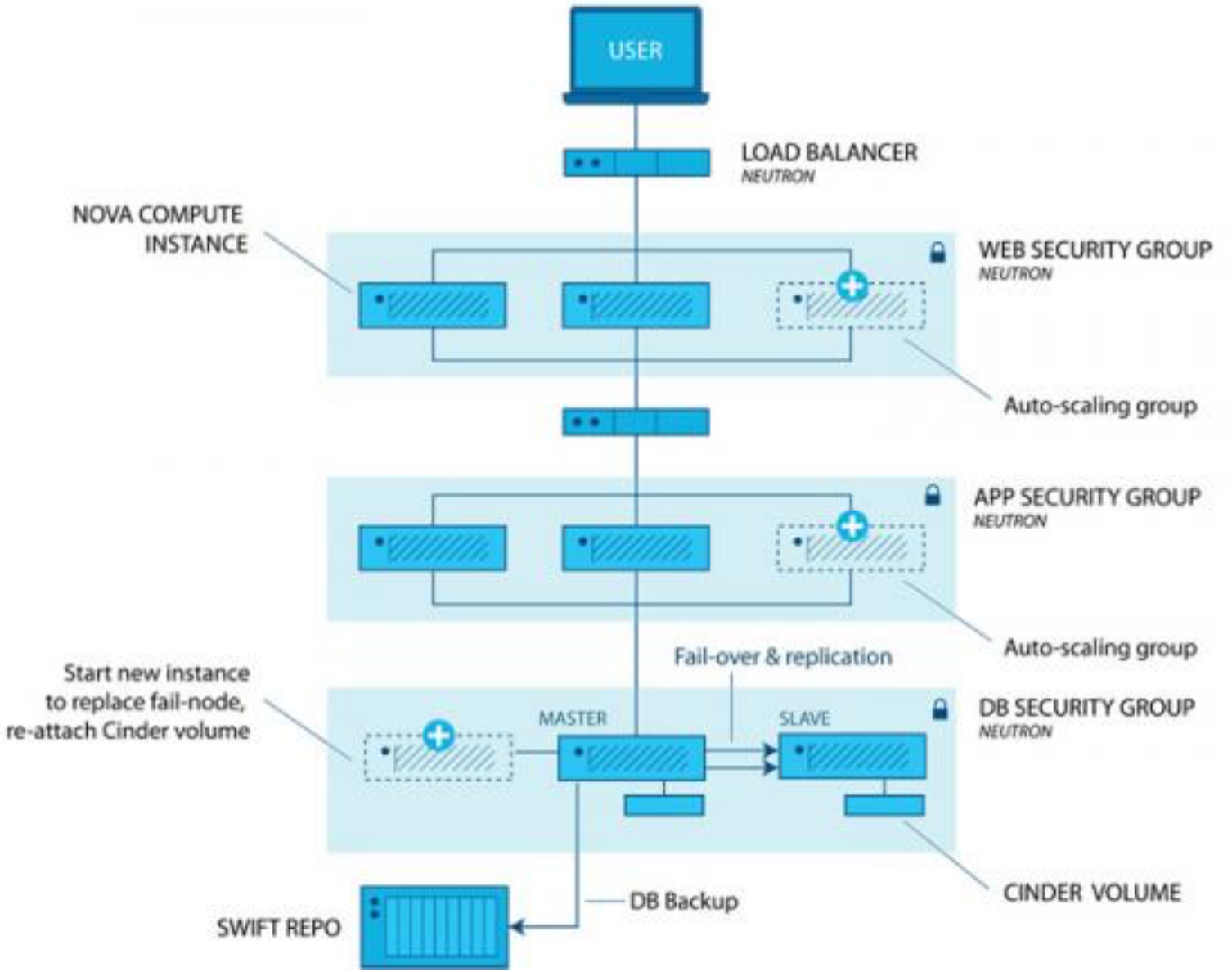
Compute

Runs the hypervisor portion of compute that operates instances (default KVM).

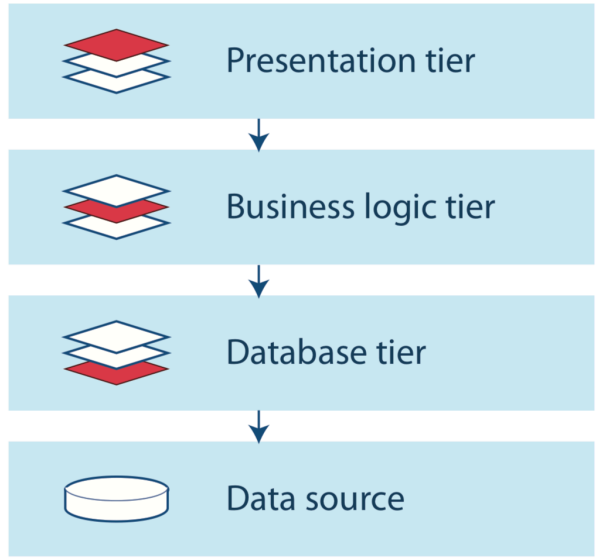
Also runs a networking service agent that connects instances to virtual networks and provides firewalling services to instances via security groups.

Each nodes requires a minimum of two network interfaces.

Use case 1: Web Applications



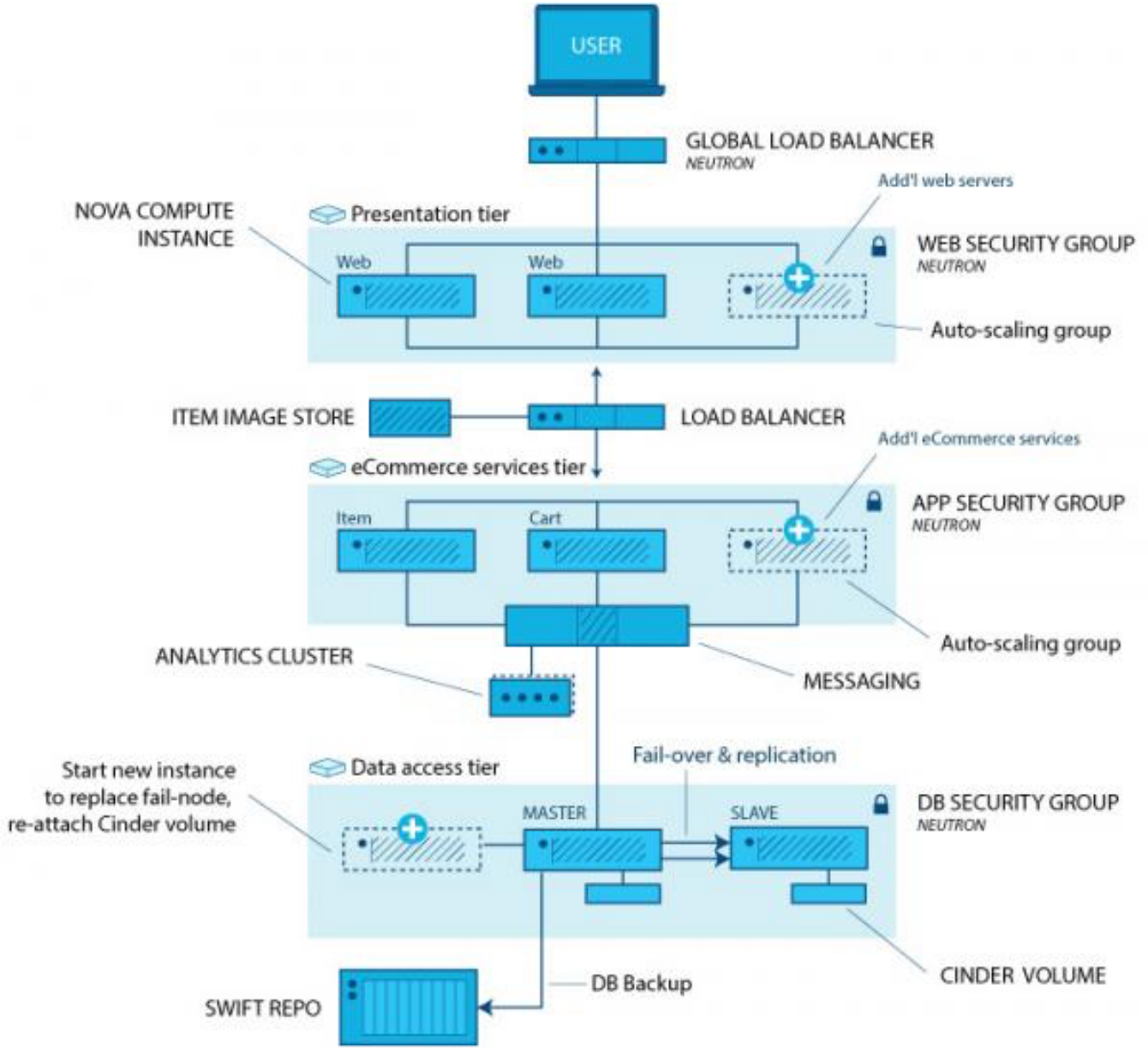
Three-tier web application architecture overview



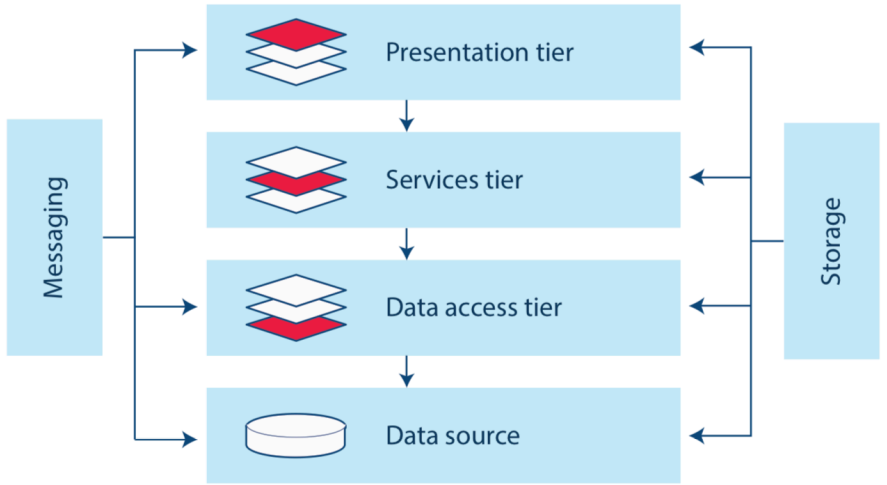
Enterprises using it:

Workday, Betfair, Ancestry.com, JFE Steel, HMRC (Her Majesty's Revenue and Customs) and LivePerson

Use case 2: eCommerce



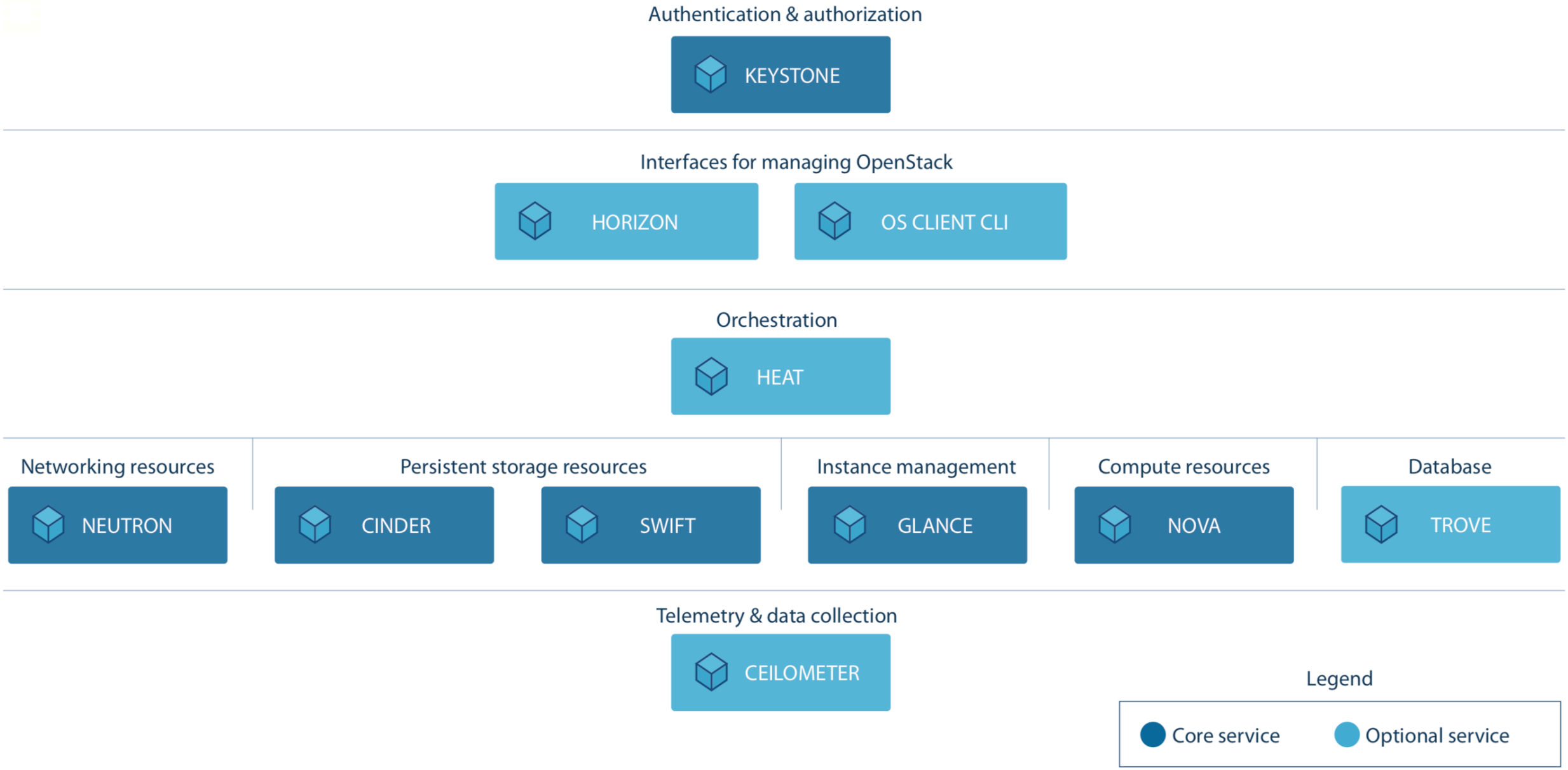
eCommerce high-level architecture



Enterprises using it:

Best Buy, Walmart, overstock.com, eBay, Staples, Nike, and Snapdeal

Openstack Services for both use cases



How to get started with OpenStack

Option 1: Sign up for a public cloud trial

Quickly gain access to OpenStack infrastructure via trial programs from participating OpenStack public cloud providers around the world. Experience the freedom, performance and interoperability of open source infrastructure with the Public Cloud Global Passport Program.

Try A Public Cloud

Option 2: Local Dev Environment: devstack.org

With some technical skills, DevStack is a great option to install and run an OpenStack cloud on your laptop (or even inside the VM on a cloud). DevStack is ideal for potential users who want to see what the Dashboard looks like from an admin or user perspective, and OpenStack contributors wanting to test against a complete local environment.

Running DevStack: Quick Start | Wiki

https://www.openstack.org/software/start

Devstack Overview

DevStack is a series of extensible scripts used to quickly bring up a complete OpenStack environment based on the latest versions of everything from git master

- **Host OS:** Latest Ubuntu and RHEL releases
- **Databases:** MySQL as packaged by the host OS
- **Queues:** Rabbit as packaged by the host OS
- **Web Server:** Apache as packaged by the host OS
- **Networking:** A basic configuration approximating the original FlatDHCP mode using linuxbridge or OpenVSwitch
- **Services:** The default services configured by DevStack are Identity (keystone), Object Storage (swift), Image Service (glance), Block Storage (cinder), Compute (nova), Placement (placement), Networking (neutron), Dashboard (horizon)

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OpenStack APIs

- Use the OpenStack APIs to launch server instances, create images, create storage containers and objects, and complete other actions in the OpenStack cloud.
- After you authenticate through Identity, you can use the other OpenStack APIs to create and manage resources in your OpenStack cloud. You can launch instances from images and assign metadata to instances through the Compute API or the OpenStack command-line client.

Methods to send API requests

- cURL

  A command-line tool that lets you send HTTP requests and receive responses.

- OpenStack command-line client

  The OpenStack project provides a command-line client that enables you to access APIs through easy-to-use commands

- REST clients

  Browser-based graphical interfaces for REST in Firefox and Chrome, AdvancedRestClient, Postman, etc

- OpenStack Python Software Development Kit (SDK)

  Use this SDK to write Python automation scripts that create and manage resources in your OpenStack cloud. The SDK implements Python bindings to the OpenStack API, which enables you to perform automation tasks in Python by making calls on Python objects rather than making REST calls directly

Using the OpenStack APIs

1. Issue an authentication request with a payload of credentials to OpenStack Identity to get an authentication token

Credentials are usually a combination of your user name and password, and optionally, the name or ID of the project of your cloud.

2. When you send API requests, you include the token in the X-Auth-Token header. If you access multiple OpenStack services, you must get a token for each service.

A token is valid for a limited time before it expires. A token can also become invalid for other reasons. For example, if the roles for a user change, existing tokens for that user are no longer valid.

https://developer.openstack.org/api-guide/quick-start/api-quick-start.html

Openstack Toolkits 1/2

- **Go**
  - Gophercloud provides a Go binding to OpenStack cloud APIs.
- **Java**
  - OpenStack4j A fluent Java OpenStack API.
  - OpenStack Java SDK is a Java binding for the OpenStack APIs.
  - Apache jclouds is a Multi-cloud SDK for Java with OpenStack support
- **JavaScript**
  - pkgcloud is a Multi-cloud library for Node.js that supports OpenStack
  - jstack is a JavaScript client library for the OpenStack API.
  - js-openclient is a very opinionated core client which can be used in either Node.js or in the browser (browser support not yet complete) to communicate with a RESTful APIs, including but not limited to any OpenStack-compatible API. (last updated 2015)
  - node-openstack-wrapper is a convenience wrapper for many of Openstack's common features with a focus on projects/tenants.
- **.NET**
  - OpenStack.NET is a .NET SDK for OpenStack.

Openstack Toolkits 2/2

- **PHP**
  - php-opencloud/openstack is a PHP SDK for OpenStack. It is actively maintained and supports latest OpenStack identity api (Keystone v3).
  - SDK covers following api: BlockStorage v2, Compute v2, Identity Keystone v2 and v3, Images v2, Networking v2 including Layer3 extension and Security Groups extension, Object Storage v1, Gnocchi v1
- **Python**
  - OpenStack Shade shade is a simple client library for operating OpenStack clouds that abstracts deployer differences
  - The SDK-Development/PythonOpenStackSDK project is a proposed solution to offering an SDK that provides a single point of entry for consumers, and a base from which other tools can be built upon, such as command-line interfaces.
  - The OpenStackClients are the native Python bindings for the OpenStack APIs. They are used to implement the command-line interfaces (which ship with the library).
  - Apache libcloud is a Python library that abstracts away differences among multiple cloud provider APIs.
- **Ruby**
  - fog is a Multi-cloud Ruby library with support for OpenStack
  - Misty is a dedicated HTTP client for OpenStack APIs
  - Aviator An elegantly designed OpenStack SDK for Ruby (hasn't been updated since 2015)