

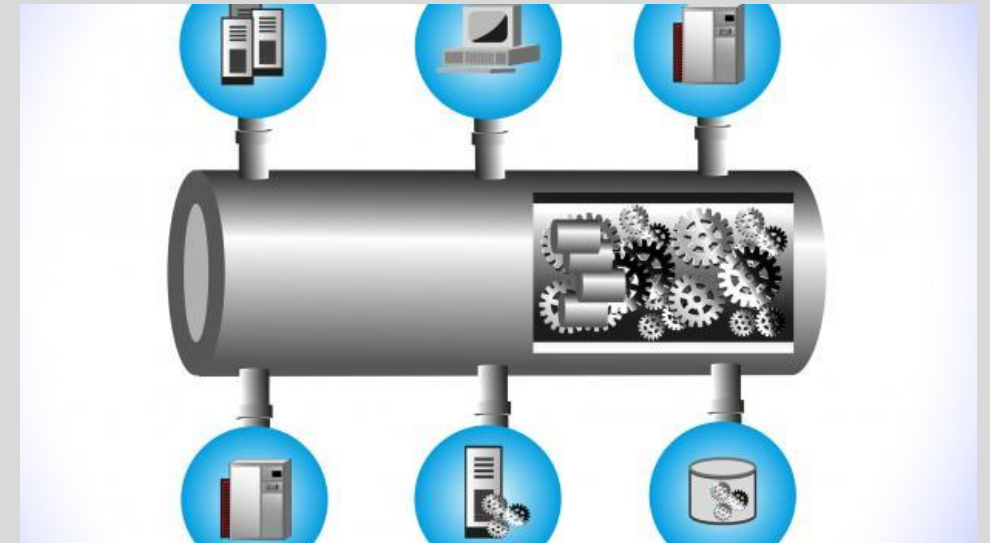


Insight into OpenStack

Kailash S
C-DAC Chennai

MIDDLEWARE

- Core cloud component - Brain
- Functionalities
 - Orchestrating
 - Scheduling
 - Coordinating resources
 - Compute; Storage & Network
 - Provisioning user request



Open stack - What & what not

- What not
 - Not a Hypervisor
 - No Virtualization all alone
 - Not a single project
- What it is
 - Collection of multiple software components

What is OpenStack

- Cloud OS with multiple controlling services
- Offers IaaS, Orchestration, Service management
- **Open source, openly designed, openly developed** by an **open community**
- Easy to use, simple to implement, interoperable
- cost savings, customization, value-added services, and innovation in the product line
- Automation of cloud maintenance

OpenStack Significance

- One of top 3 most active open source projects, manages 10 million compute cores
- Fastest-growing open-source communities in the world.
- 1,518 unique change authors approved more than 47,500 changes and published two major releases.

OpenStack Community

- One of the fastest growing open source communities in the world.

History

- Control pools of processing, storage, and networking resources throughout a data center
- Terms of the Apache License.
- 2010 : Rackspace and NASA
- 2012 : Openstack Foundation
- 2014 : Over 200 Companies

The OpenStack Foundation

- Open Infrastructure Summit : bringing together more than 20,000 open infrastructure enthusiasts
- Goal - serve developers, users, and the entire open infrastructure ecosystem by providing a set of shared resources to build community, facilitate collaboration and support integration of open source technologies.
- Individual membership : free for anyone with an interest in open infrastructure.

COMPANIES

698

INDIVIDUAL MEMBERS

15,672

LoC

20 M +

COUNTRIES

187

TOP 10 COUNTRIES

United States, China, India,
Great Britain, France, Russia,
Australia, Canada, Japan,
Germany

CODE
CONTRIBUTIONS

115,206

Source :
Openstack.org

As of May
2020

Openstack

- Origin:
Project by Rackspace cloud & NASA, Intel & AMD
- Core Technology:
Python
- Features:
 - Openstack Compute – for managing Virtual machines (Nova)
 - Openstack Object storage – for creating redundant, scalable data storage (swift)
 - Openstack Imaging Service – for discovery, registration and delivery services for virtual disk images (Glance).
 - Graphical user interface (Horizon)
 - Hypervisor support includes ESX, Hyper-V, KVM, Xen, and XenServer/XCP

OpenStack- specific Considerations



Interoperability



Bidirectional Compatibility



Cross-Project Dependencies



Partitioning

Design Goals



BASIC PHYSICAL
DATA CENTER
MANAGEMENT



PLAYS WELL WITH
OTHERS



HARDWARE
VIRTUALISATION



INFINITE,
CONTINUOUS
SCALING



BUILT-IN RELIABILITY
AND DURABILITY



CUSTOMISABLE
INTEGRATION



ABSTRACT
SPECIALISED
OPERATIONS



GRAPHICAL USER
INTERFACE



Releases

- Austin
- Bexar
- Cactus
- Essex
- Folsom
- Grizzly
- Havana
- Ice House
- Juno
- Kilo
- Liberty
- Mitaka
- Newton
- Ocata
- Pike
- Queens
- Rocky
- Steins
- Train
- Ussuri

Ussuri

- 21st release of OpenStack
- Improvements in core functionality, automation, cold migration, containerized applications
- Over 24,000 code changes by more than 1,000 developers from 188 different organizations and over 50 countries

OPENSTACK

CLIENT TOOLS

CLIs
OpenStackClient

SDKs
Python SDK

INTEGRATION ENABLERS

CONTAINER SERVICES
Kuryr

NFV
Tacker

WEB FRONTEND

Horizon

API PROXIES

EC2API



WORKLOAD PROVISIONING

Magnum Trove
Sahara



APPLICATION LIFECYCLE

Murano Freezer
Solum Masakari



ORCHESTRATION

Heat Mistral Aodh
Senlin Zaqar Blazar



COMPUTE

VIRTUAL MACHINES

Nova

CONTAINERS

Zun

FUNCTIONS

Qinling



NETWORKING

SDN

Neutron

LOAD BALANCING

Octavia

DNS

Designate



HARDWARE LIFECYCLE

BARE METAL

Ironic

ACCELERATORS

Cyborg



STORAGE

OBJECT

Swift

BLOCK

Cinder

FILE

Manila

SHARED SERVICES

Keystone

Placement

Glance

Barbican

Searchlight

Karbor

LIFECYCLE MANAGEMENT



DEPLOYMENT / LIFECYCLE TOOLS

Kolla-Ansible OpenStack-Charms TripleO Bifrost Kayobe
OpenStack-Helm OpenStack-Ansible OpenStack-Chef



PACKAGING RECIPES FOR...

RPM Puppet
Containers (LOCI, Kolla)

OPERATIONS TOOLING



MONITORING SERVICES

Ceilometer
Monasca Panko



RESOURCE OPTIMIZATION

Watcher Vitrage



BILLING / BUSINESS LOGIC

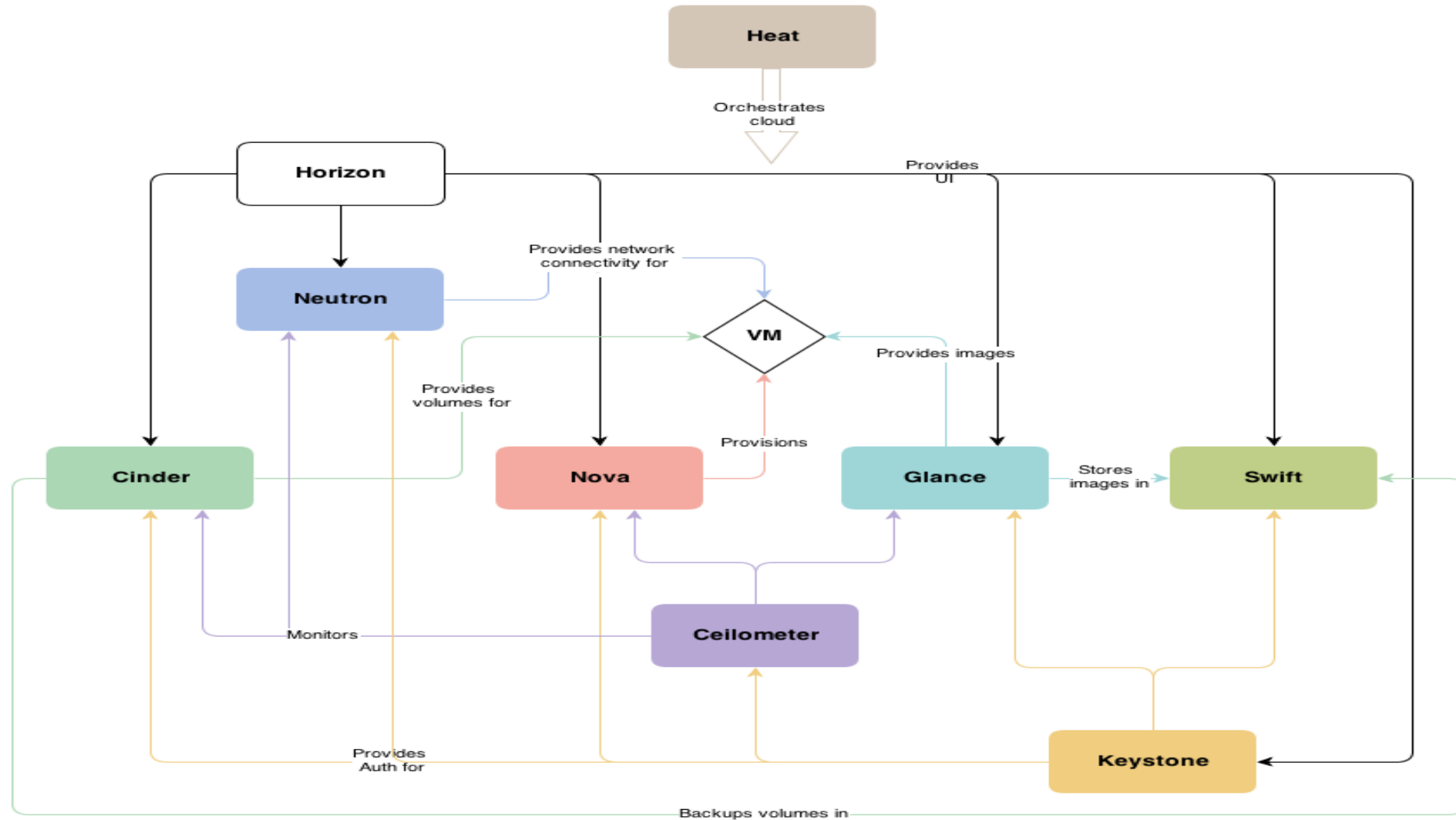
Adjutant CloudKitty

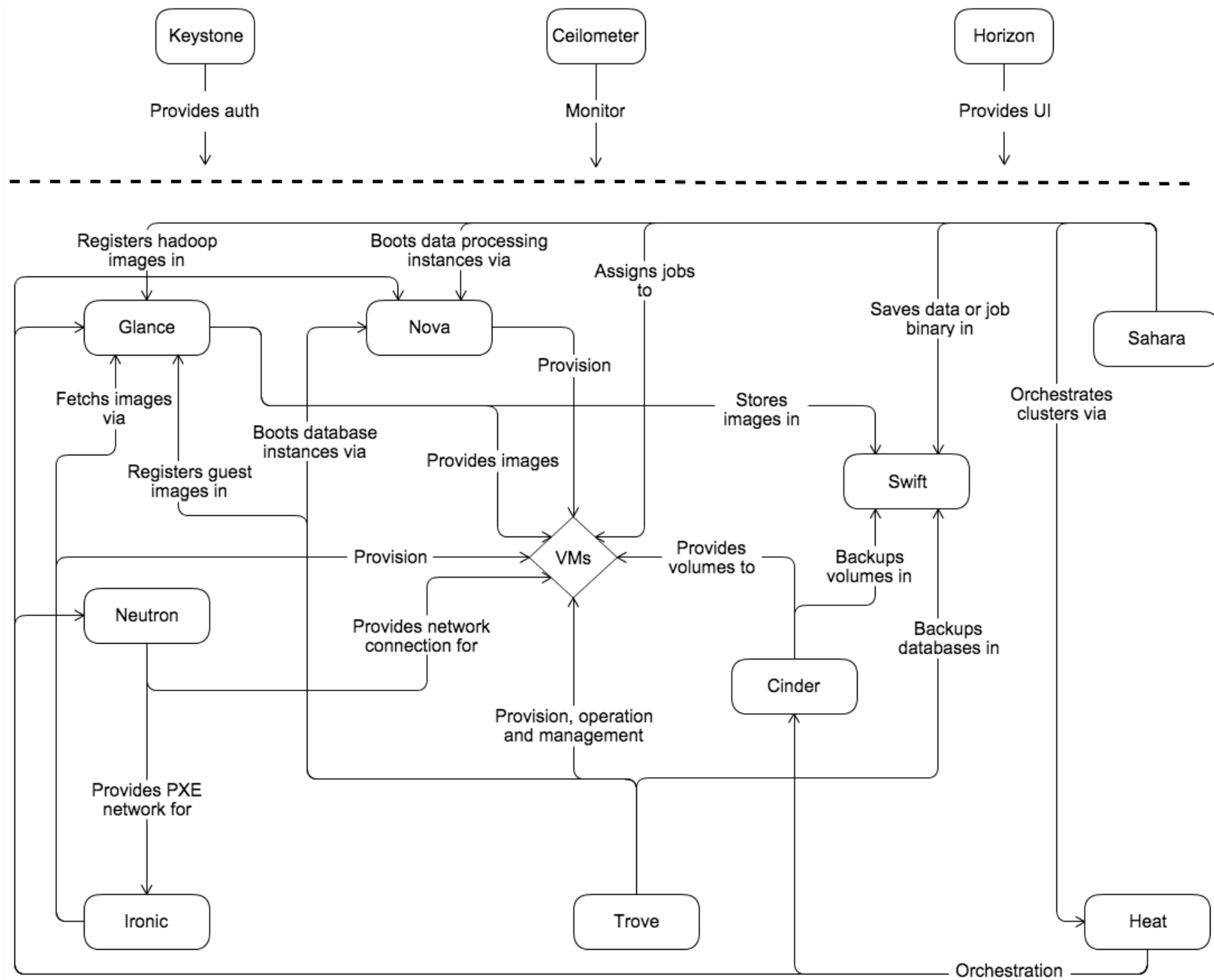


TESTING / BENCHMARK

Tempest Patrolle
Rally

Openstack Architecture





Components of OpenStack

- Compute – 3
- Hardware Lifecycle – 2
- Storage – 3
- Networking – 3
- Shared services – 6
- Orchestration – 6
- Workload provisioning – 3
- Application lifecycle – 4
- API proxies – 1
- Web Frontend - 1
- Monitoring tools – 3
- Optimization/policy tools – 4
- Billing / Business Logic – 3
- Testing / Benchmarking - 3
- Multi-Region tools – 1
- Containers – 1
- NFV – 1
- Framework for life cycle management – 8

Compute

- NOVA : Compute Service
- ZUN : Container Management Service
- QINLING : Functions service

Storage, Backup & Recovery

- SWIFT : Object Store
- CINDER : Block Storage
- MANILA : Shared Filesystems

Networking & Content Delivery

- NEUTRON : Networking
- DESIGNATE : DNS Service
- OCTAVIA : Load Balancer

Hardware life cycle

- IRONIC : Bare Metal Provisioning Service
- CYBROG : Life cycle management

Shared services

- KEYSTONE Identity service
- PLACEMENT Placement service
- GLANCE Image service
- BARBICAN Key management
- KARBOR Application Data Protection as a Service
- SEARCHLIGHT Indexing and Search

Orchestration

- HEAT
- SENLIN
- MISTRAL
- ZAQAR
- BLAZAR
- AODH

Orchestration

Clustering service

Workflow service

Messaging Service

Resource reservation service

Alarming Service

Data & Analytics

- TROVE : Database as a Service
- SAHARA : Big Data Processing Framework Provisioning
- SEARCHLIGHT : Indexing and Search

Frameworks for lifecycle management

- **TRIPLEO** Deploys OpenStack using OpenStack itself
- **OPENSTACK-HELM** Deploys OpenStack in containers using Helm
- **KOLLA-ANSIBLE** Deploys OpenStack in containers using Ansible
- **KAYOBE** Deployment of containerised OpenStack to bare metal
- **OPENSTACK-ANSIBLE** Ansible playbooks to deploy OpenStack
- **OPENSTACK-CHARMS** Deploys OpenStack in containers using Charms and Juju
- **BIFROST** Ansible playbooks using ironic
- **OPENSTACK-CHEF** Chef cookbooks to build, operate and consume OpenStack

Security, Identity & Compliance

- KEYSTONE : Identity service
- BARBICAN : Key Management
- CONGRESS : Governance
- MISTRAL : Workflow service

Management Tools

- HORIZON : Dashboard
- OPENSTACK CLIENT (CLI) : Command-line client
- RALLY : Benchmark service
- SENLIN : Clustering service
- VITRAGE : RCA (Root Cause Analysis service)
- WATCHER : Optimization Service

Deployment tools

- CHEF OPENSTACK : Chef cookbooks for OpenStack
- KOLLA : Container deployment
- OPENSTACK CHARMS : Juju Charms for OpenStack
- OPENSTACKANSIBLE : Ansible Playbooks for OpenStack
- PUPPET OPENSTACK : Puppet Modules for OpenStack
- TRIPLEO : Deployment service

Application services

- HEAT : Orchestration
- ZAQAR : Messaging Service
- MURANO : Application Catalog
- SOLUM : Software Development Lifecycle Automation

Monitoring & metering

- CEILOMETER : Metering & Data Collection Service
- CLOUDKITTY : Billing and chargebacks
- MONASCA : Monitoring
- AODH : Alarming Service
- PANKO : Event, Metadata Indexing Service

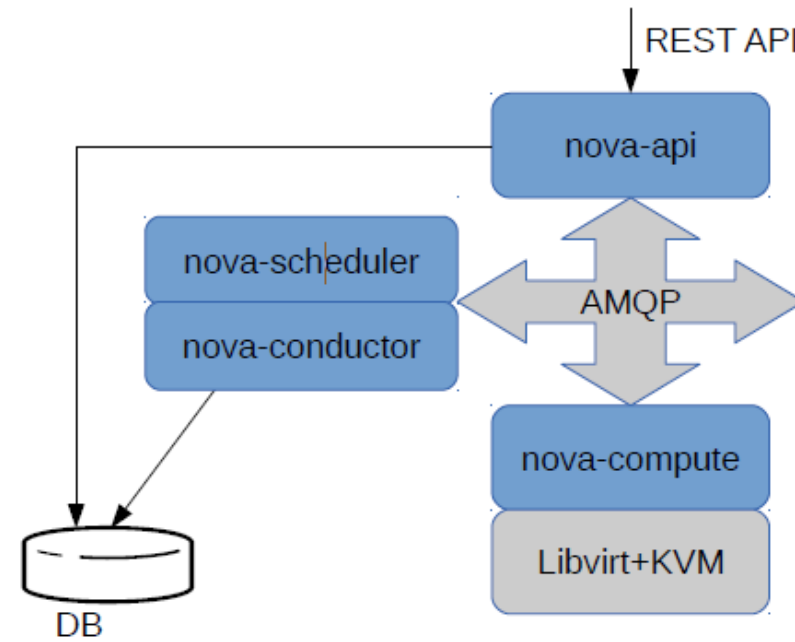
Nova

- Computing Fabric controller for OpenStack
- Manages the life cycle of instances
- Control computing resources, networking, security
- All capabilities through a web services REST API

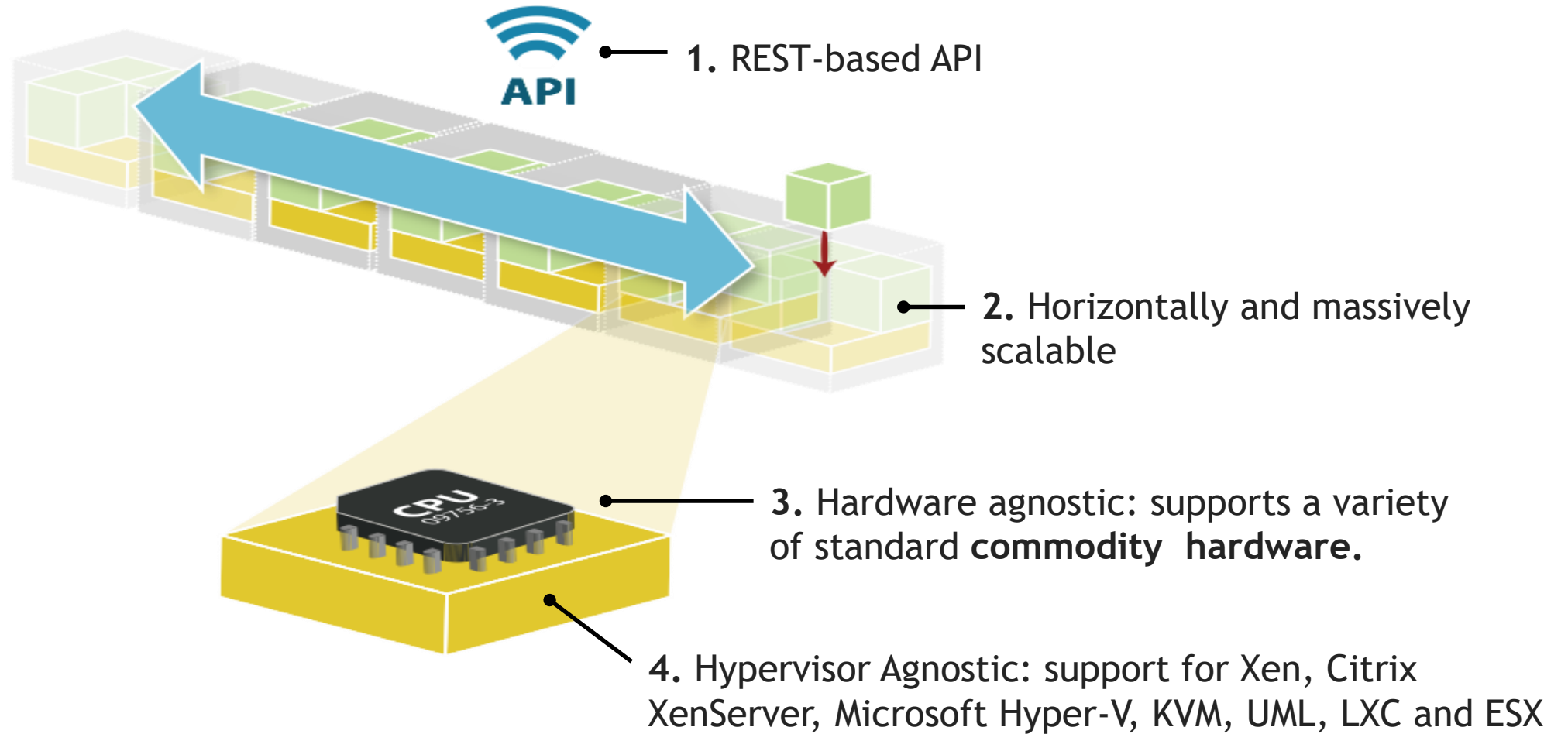
Nova

- Nova-api server - Heart of the cloud framework , which provides an interface for the outside world to interact with the cloud infrastructure
- Nova-AMQP
 - AMQP is the messaging technology chosen by the OpenStack cloud
 - Nova components use Remote Procedure Calls to communicate to one another

Nova Architecture



Compute/Nova Key Features

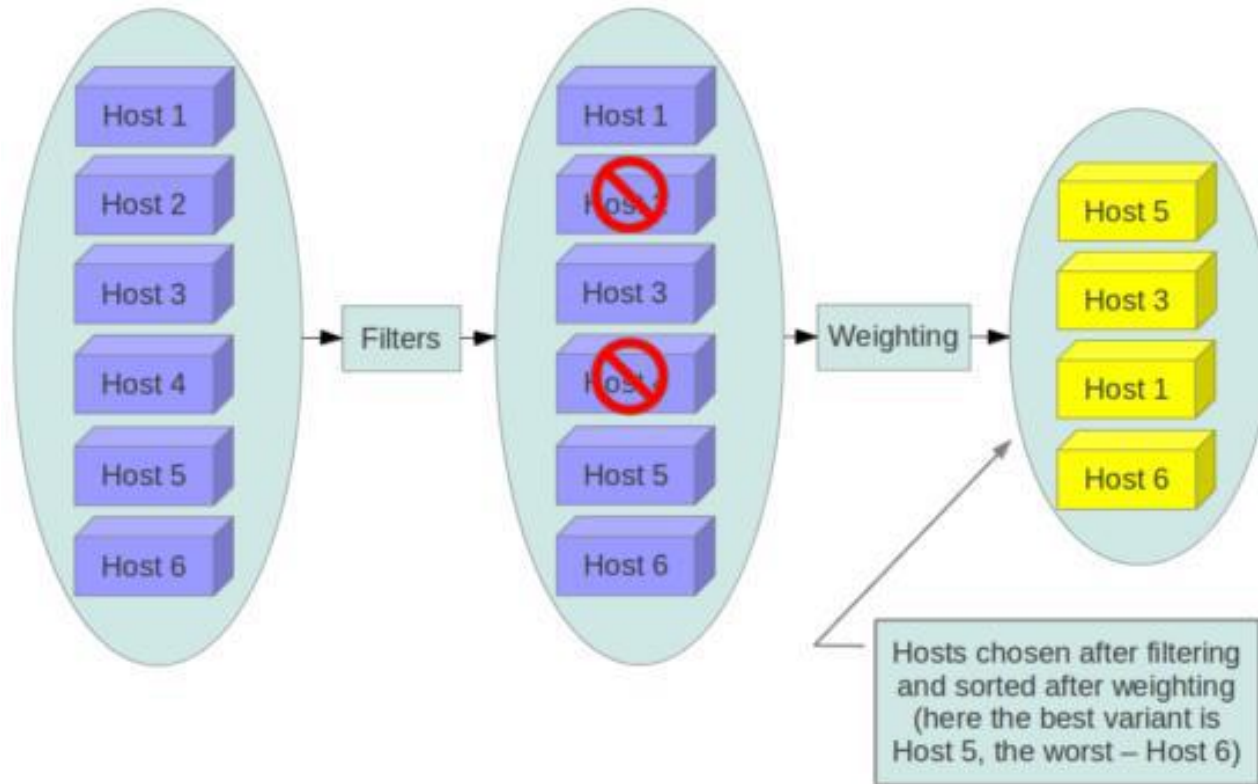


Nova

- nova-volume
 - Nova volume is responsible for managing attachable block storage devices
 - It loads a Service object which exposes the public methods on VolumeManager via rpc
- nova-network
 - Nova network is responsible for managing floating and fixed ips, dhcp, bridging and vlans.
 - It loads a Service object which exposes the public methods on one of the subclasses of NetworkManager

Nova

- Nova-compute process is a worker daemon that creates and terminates virtual machine instances
 - It deal with instance management life cycle
 - It receive the request from the queue and perform the series of system commands for instance life cycle management, and updating the state in the databases
- Nova-Conductor
 - Mediates database access
 - No database access from compute hosts
 - Conductor updates database state



- Nova-scheduler service to determine how to dispatch compute requests
- For example, the nova-scheduler service determines on which host a VM should launch
- In the context of filters,
 - the term host means a
 - physical node that has a
 - nova-compute service
 - running on it.
- Defaults to
- filter scheduler

Nova

Filter class Nova

- Have not been attempted for scheduling purposes (RetryFilter).
- Are in the requested availability zone (AvailabilityZoneFilter).
- Have sufficient RAM available (RamFilter).
- Can service the request (ComputeFilter).
- Satisfy the extra specs associated with the instance type (ComputeCapabilitiesFilter).

Glance

- Glance – Image Store
- It provides discovery, registration and delivery services for disk and server images. List of processes and their functions:
 - glance-api : It accepts Image API calls for image discovery, image retrieval and image storage.
 - glance-registry : it stores, processes and retrieves metadata about images (size, type, etc.).
 - glance database : A database to store the image metadata.
 - A storage repository for the actual image files. Glance supports normal filesystems, RADOS block devices, Amazon S3, HTTP and Swift.

Glance

- Image Store
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Glance Architecture

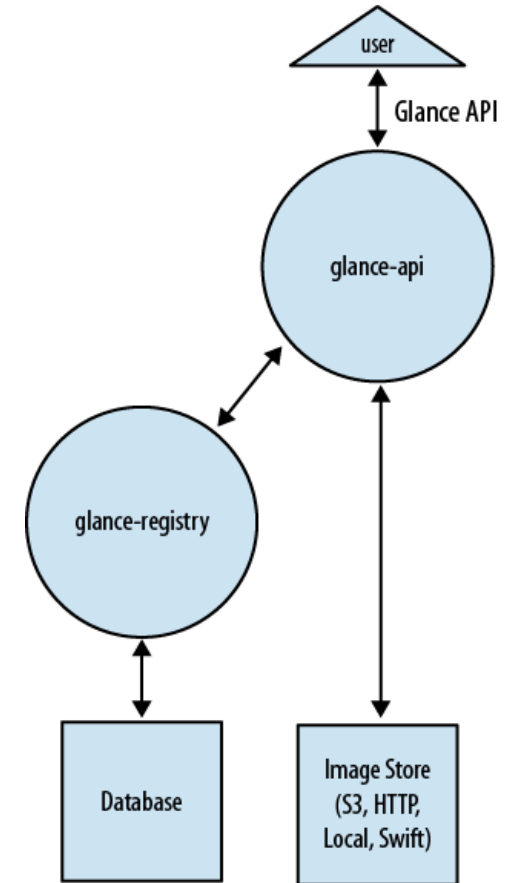
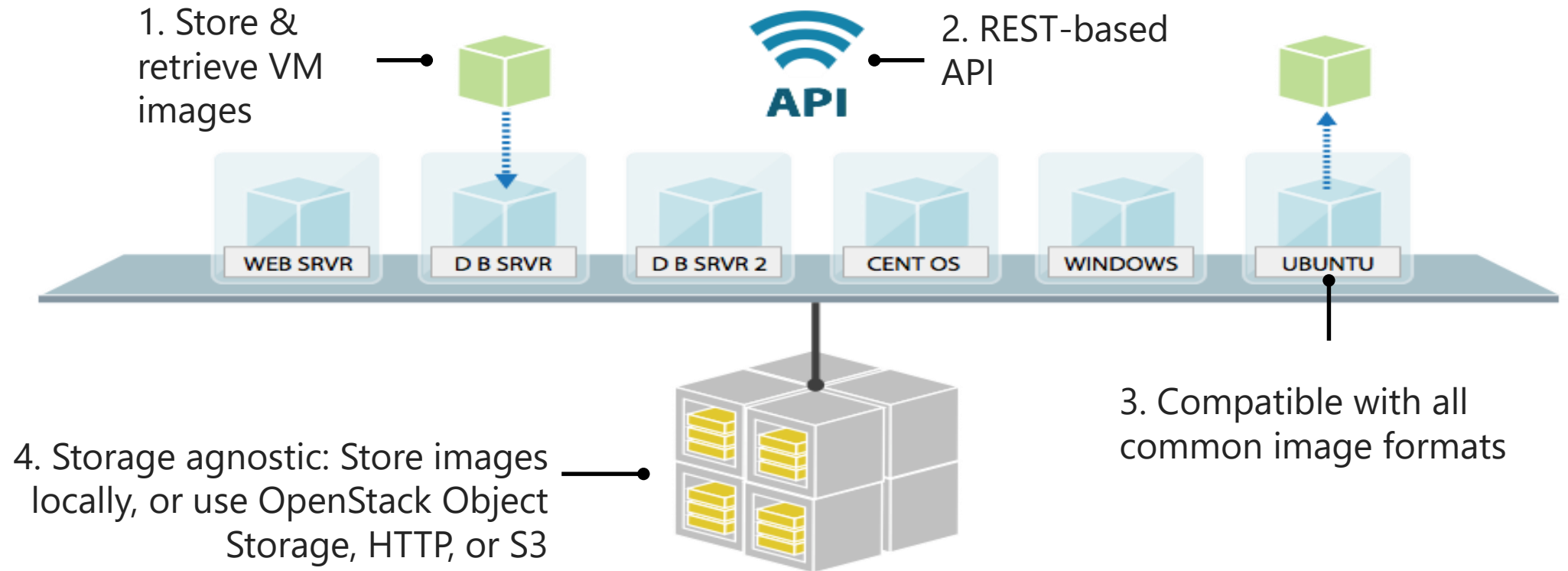


Image Service/Glance



Disk and Container Formats

- Raw : Unstructured disk image format
- Vhd : VMWare, Xen, Microsoft, VirtualBox and others
- Vmdk : Common disk format supported by many virtual machine monitors
- Vdi : VirtualBox and QEMU emulator
- Iso : An archive format - optical disc
- Qcow2 : QEMU emulator that can expand dynamically
- Aki : Amazon kernel image
- Ari : Amazon ramdisk image
- Ami : Amazon machine image

Cinder

- Can be compared in concept to Amazon EBS
- Provides block storage functionality to instances running on Compute
- Sub components : cinder-api, cinder-volume, cinder-scheduler

Cinder

- Can be compared in concept to Amazon EBS
- Provides block storage functionality to instances running on Compute
- Similar to Compute, it has several sub-components (cinder-api, cinder-volume, cinder-scheduler)
- cinder-volume leverages storage drivers to interact with underlying storage platforms

Cinder - Block Storage

- Cinder –
 - Cinder allows block devices to be exposed and connected to compute instances for expanded storage & better performance.
 - cinder-api accepts requests and routes them to cinder-volume for action.
 - cinder-volume reacts reading or writing to the cinder database to maintain state, interacts with other processes (like cinder-scheduler) through a message queue and directly on block storage providing hardware or software.
 - cinder-scheduler picks the optimal block storage node to create the volume on.
 - A cinder database store volumes state.

Swift

- Think of it as similar to Amazon S3
- Provides distributed object storage
- Supports the OpenStack Object API as well as raw HTTP
- Authentication is handled via OpenStack Identity

Swift– Object Storage

- Object store allows you to store or retrieve files.
- Provides a fully distributed, API - accessible storage platform
 - Integrated directly into applications or used for backup / archiving
- Not a traditional file system
- A distributed storage system
 - For static data such as VM images, backups and archives

Swift– Object Storage

- Object store allows you to store or retrieve files.
- It provides a fully distributed, API-accessible storage platform that can be integrated directly into applications or used for backup, archiving and data retention.
- Note : Object Storage is not a traditional file system, but rather a distributed storage system for static data such as virtual machine images, photo storage, email storage, backups and archives.

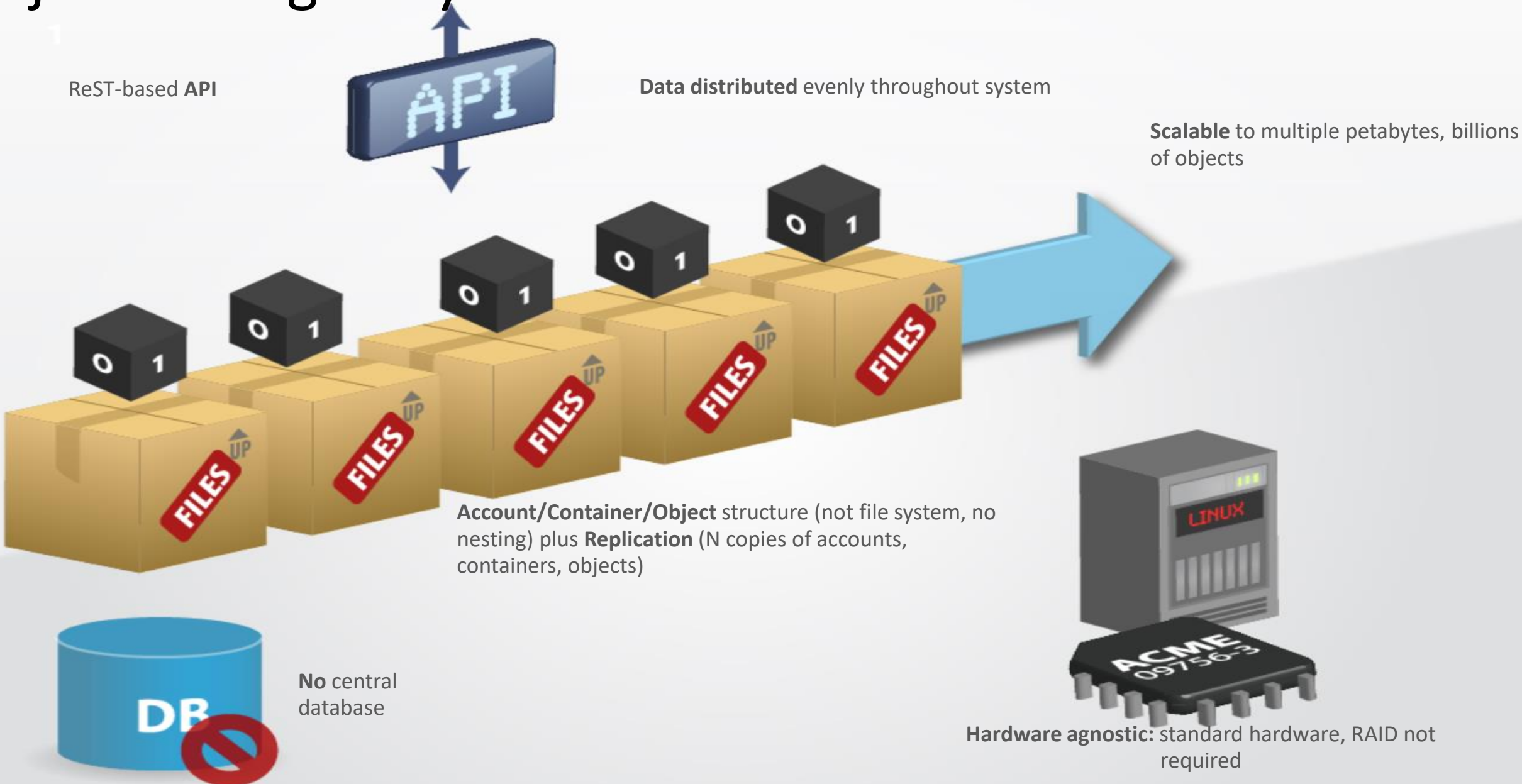
Swift– Object Storage

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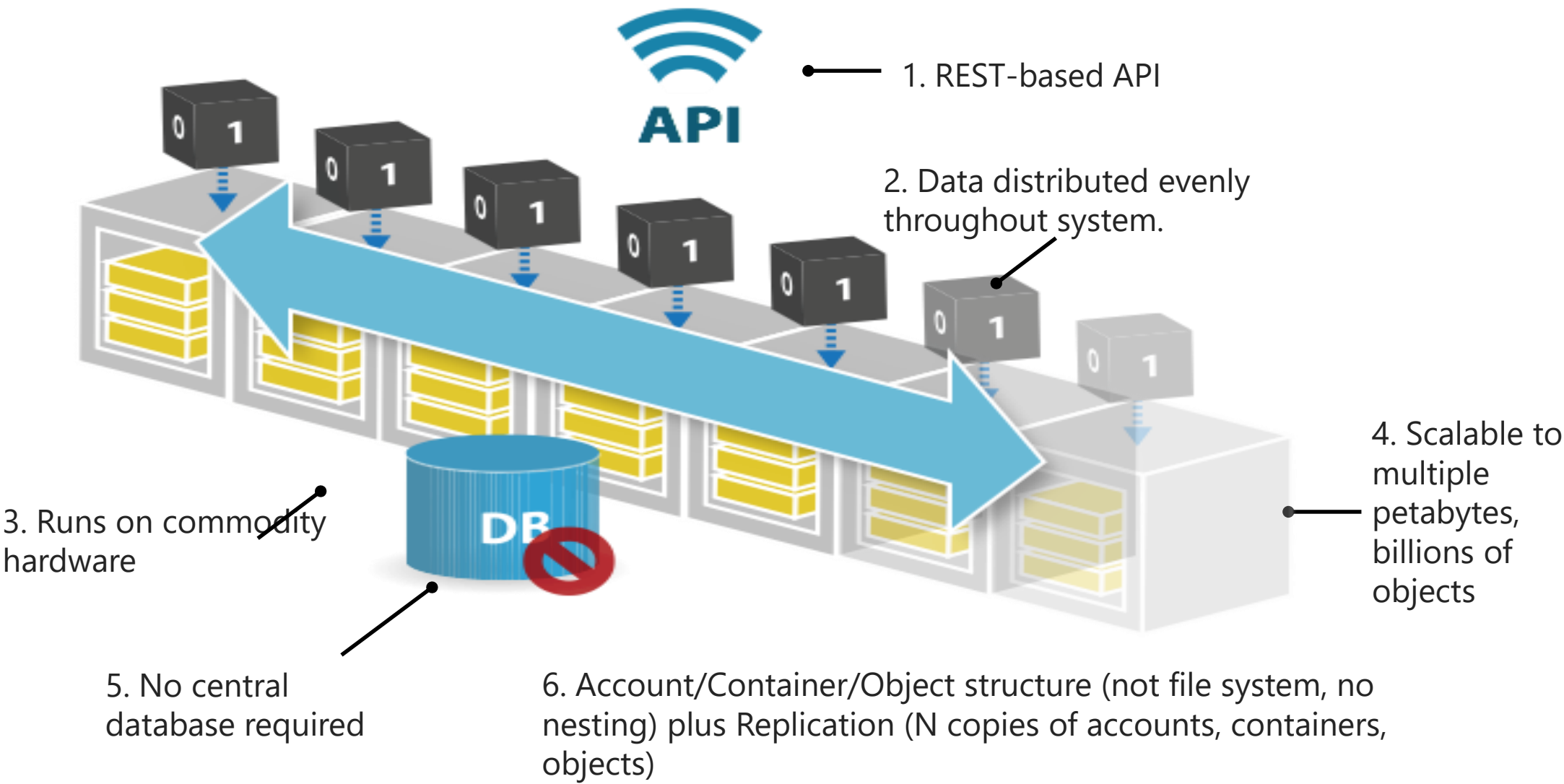
Swift– Object Storage

- Accounts server manage accounts defined with the object storage service.
- Container servers manage a mapping of containers, folders, within the object store service.
- Object servers manage actual objects, files, on the storage nodes

Object Storage Key Features



Swift

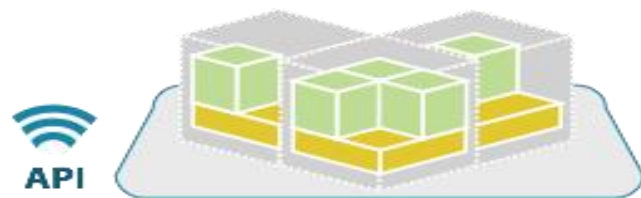


Neutron

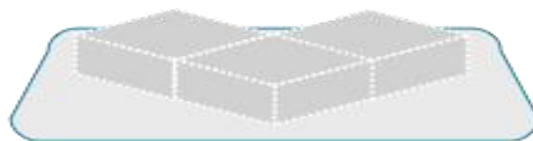
- What is Neutron?
 - Network infrastructure management
- Concepts
 - Networks
 - Routers
 - Subnets
 - Ports
- Multiple technologies
 - OpenVSwitch, Linux Bridge, Vendor plugins
- neutron-server Accepts and routes API requests to the appropriate OpenStack Networking plug-in for action.

Pools Managed by the Cloud O.S.

COMPUTE, NETWORK, & STORAGE



Compute Pool

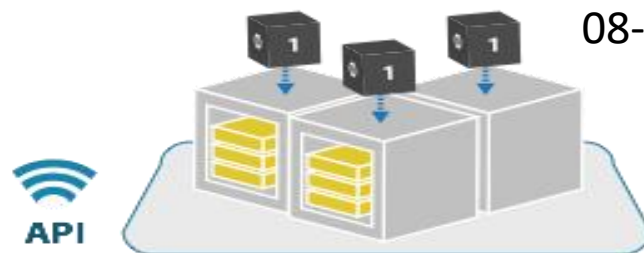


Network Pool



Load Balancing Pool

08-08-2020

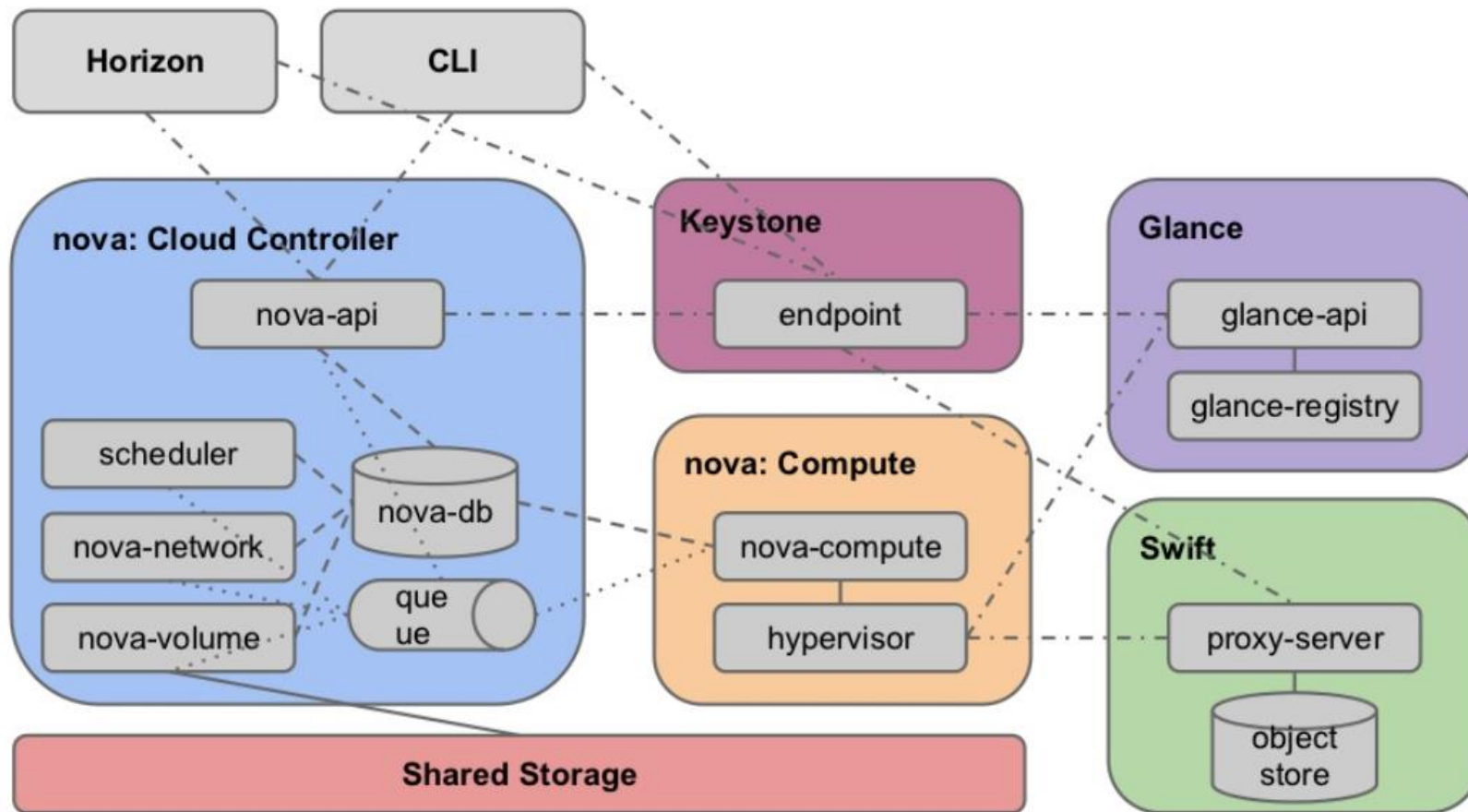


Storage Pool

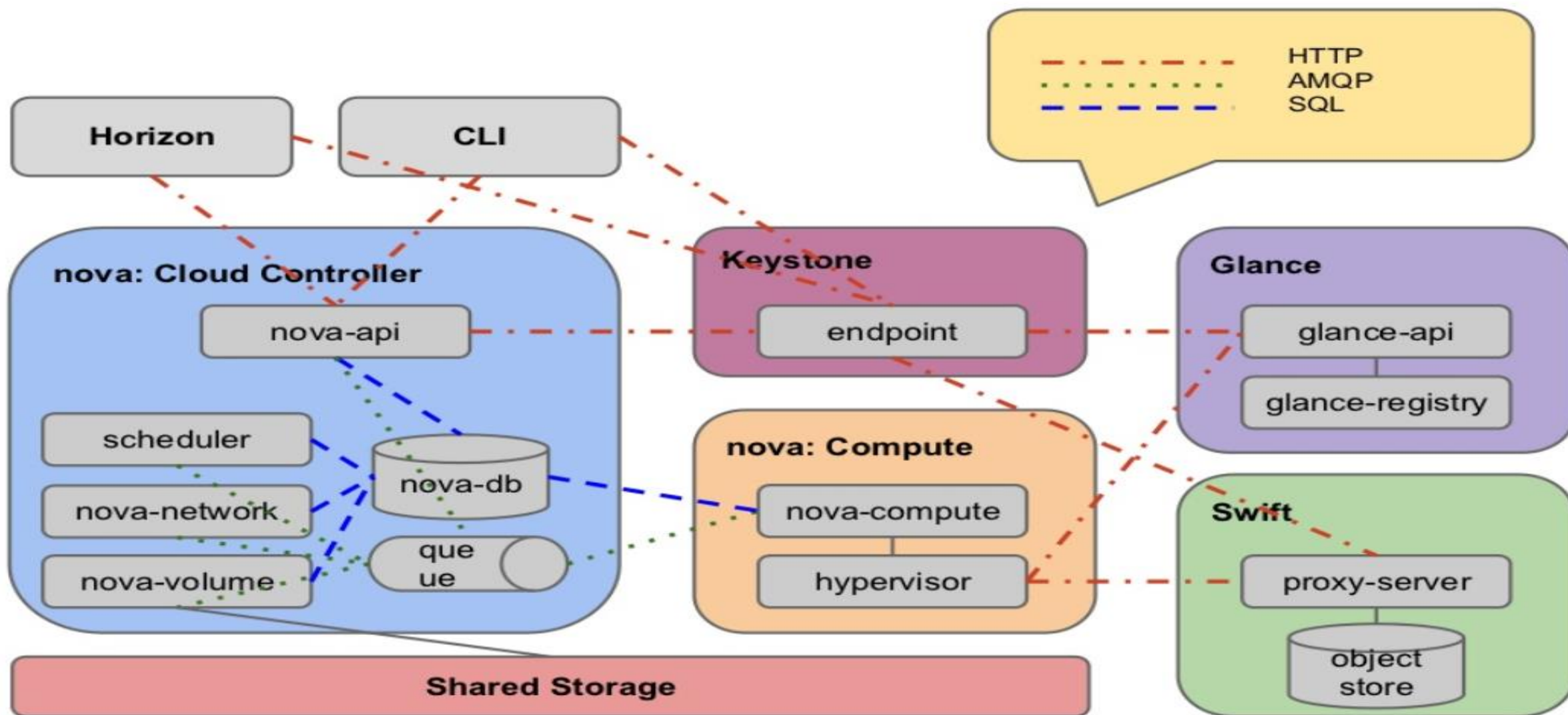


Image Service Pool

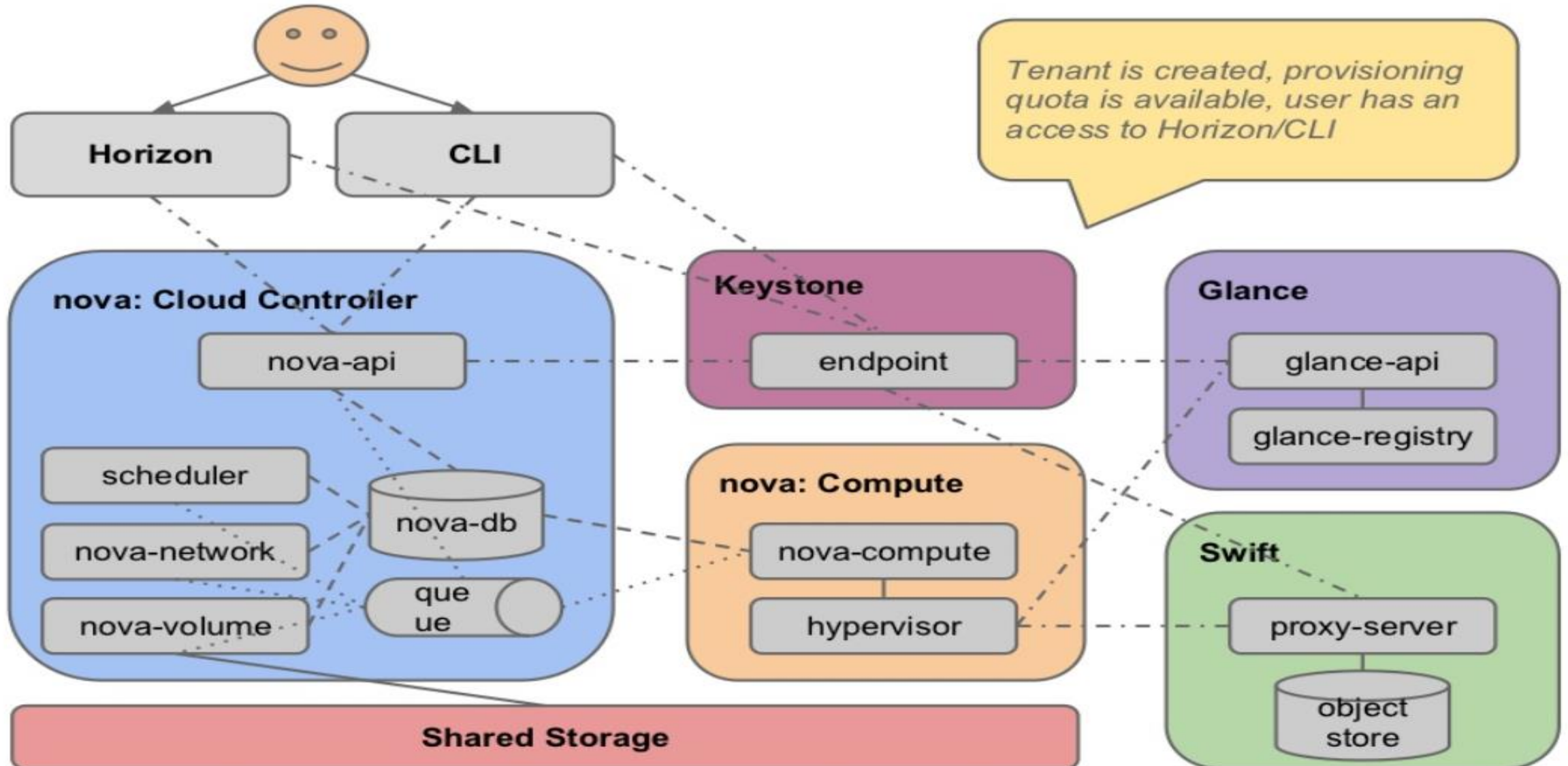
OpenStack Projects: Detailed View



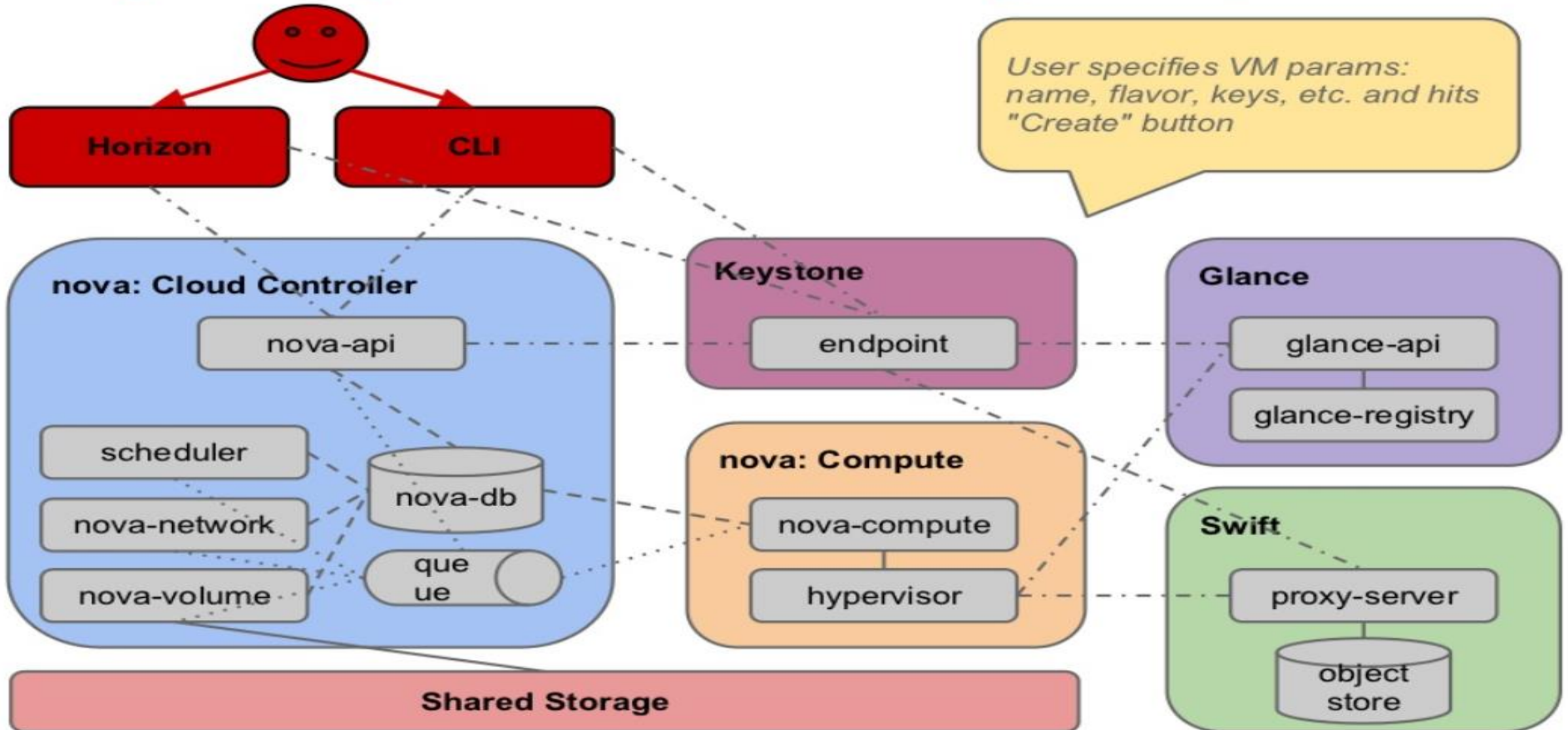
OpenStack Projects: Communication Types



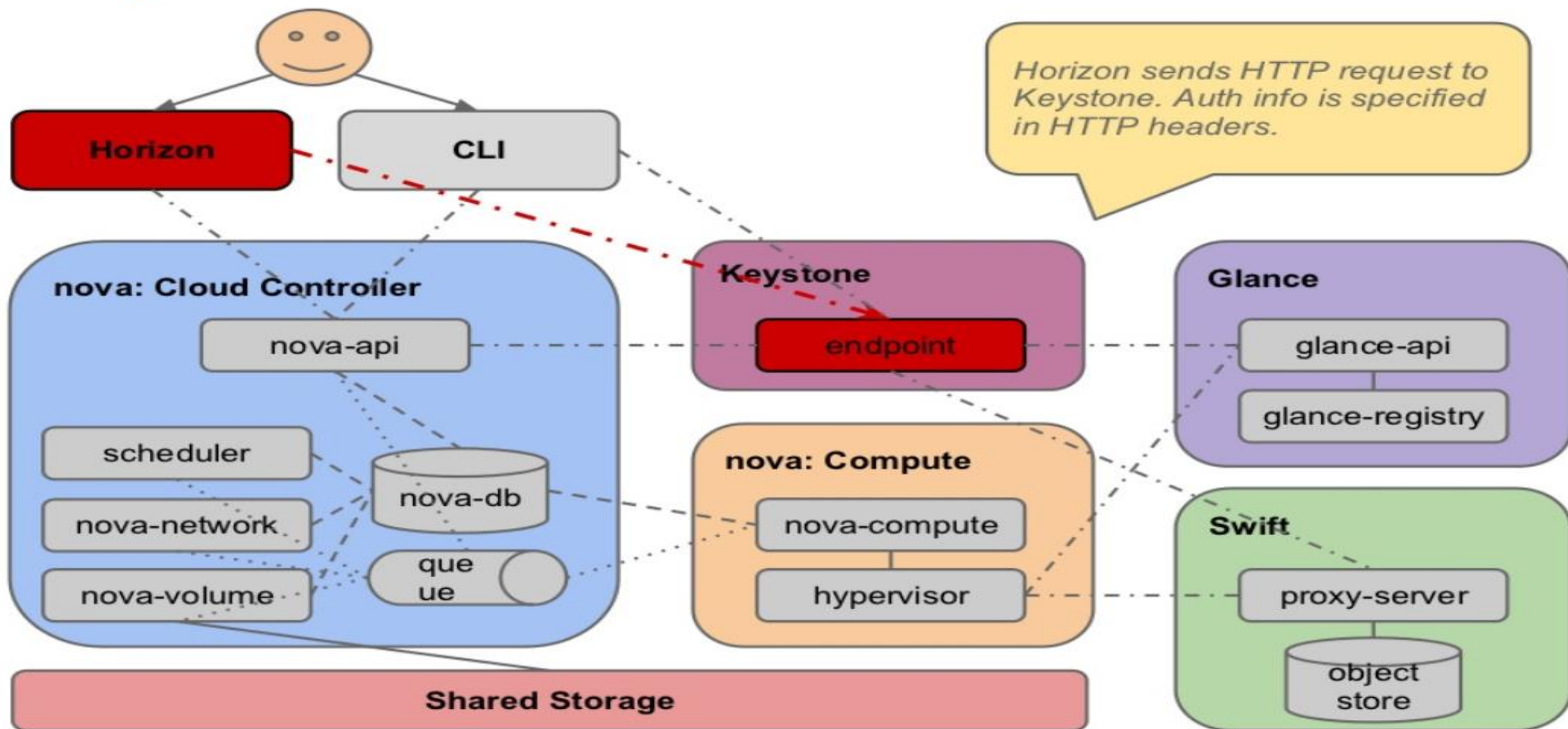
Initial State



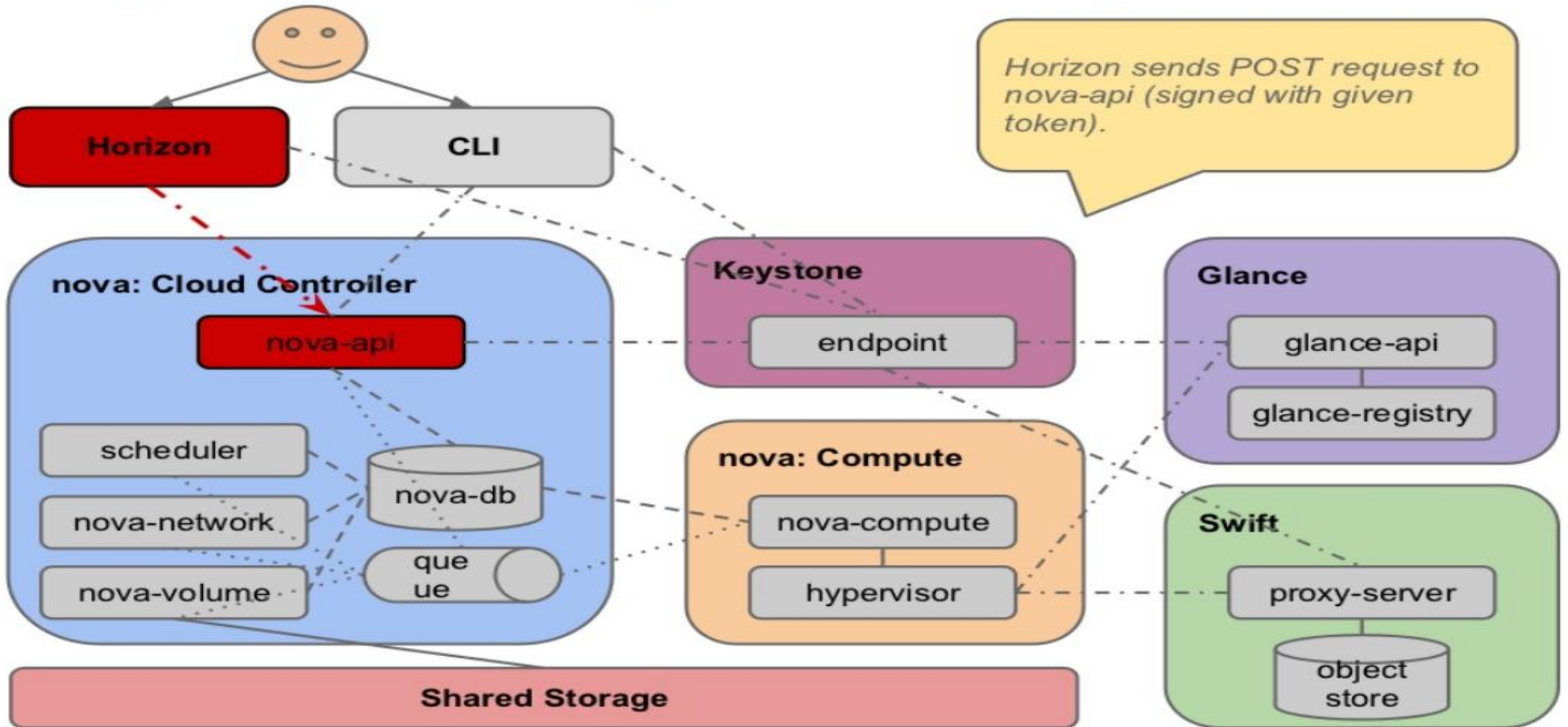
Step 1: Request VM Provisioning via UI/CLI



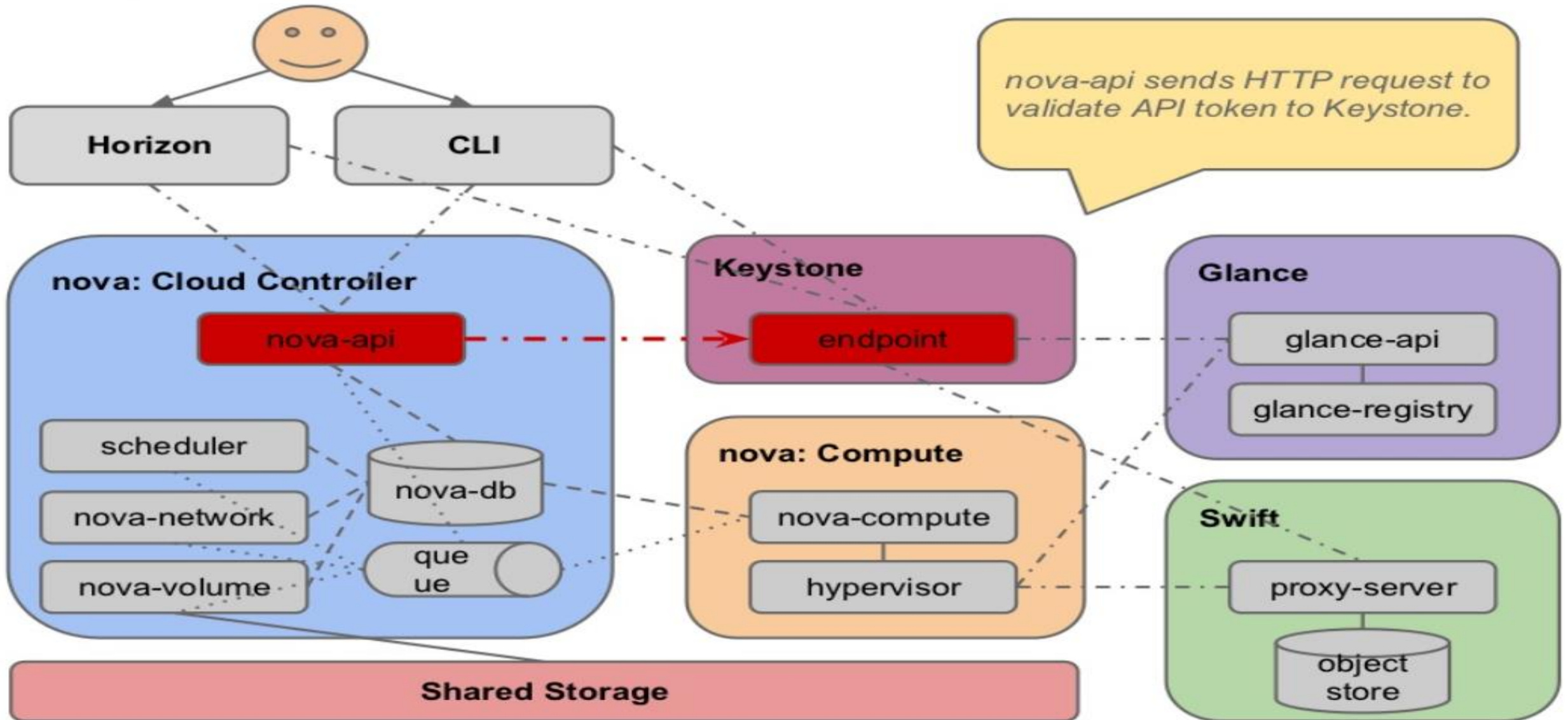
Step 2: Validate Auth Data



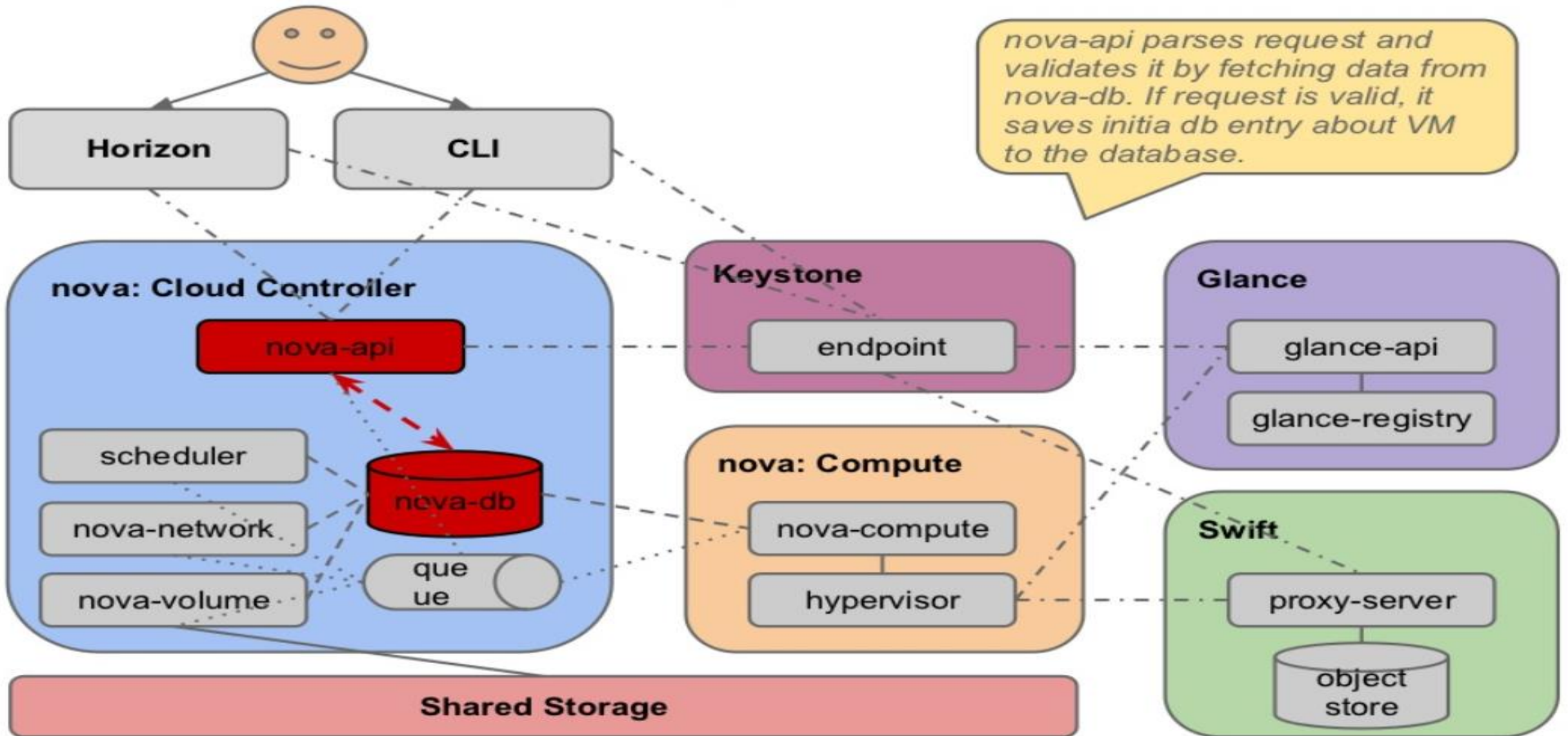
Step 3: Send API request to nova-api



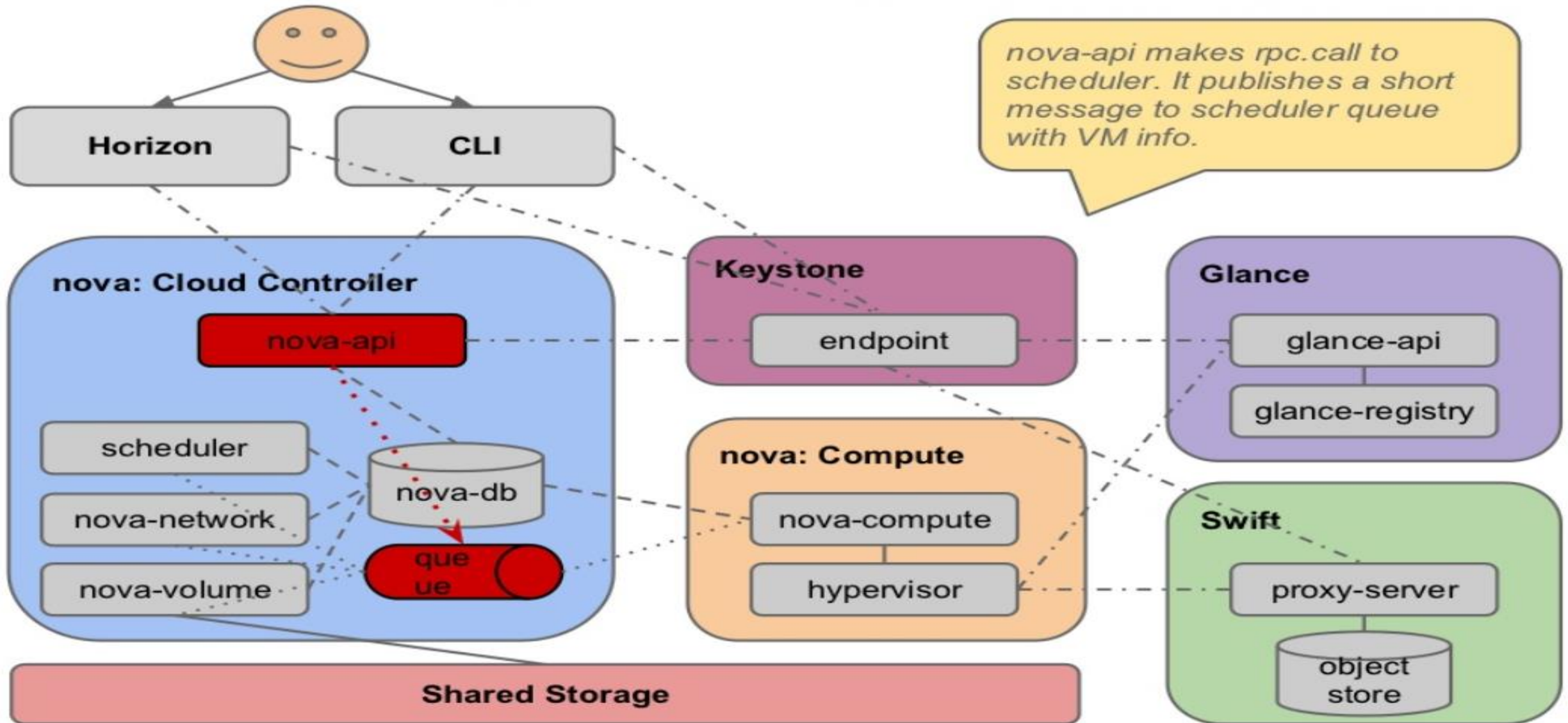
Step 4: Validate API Token



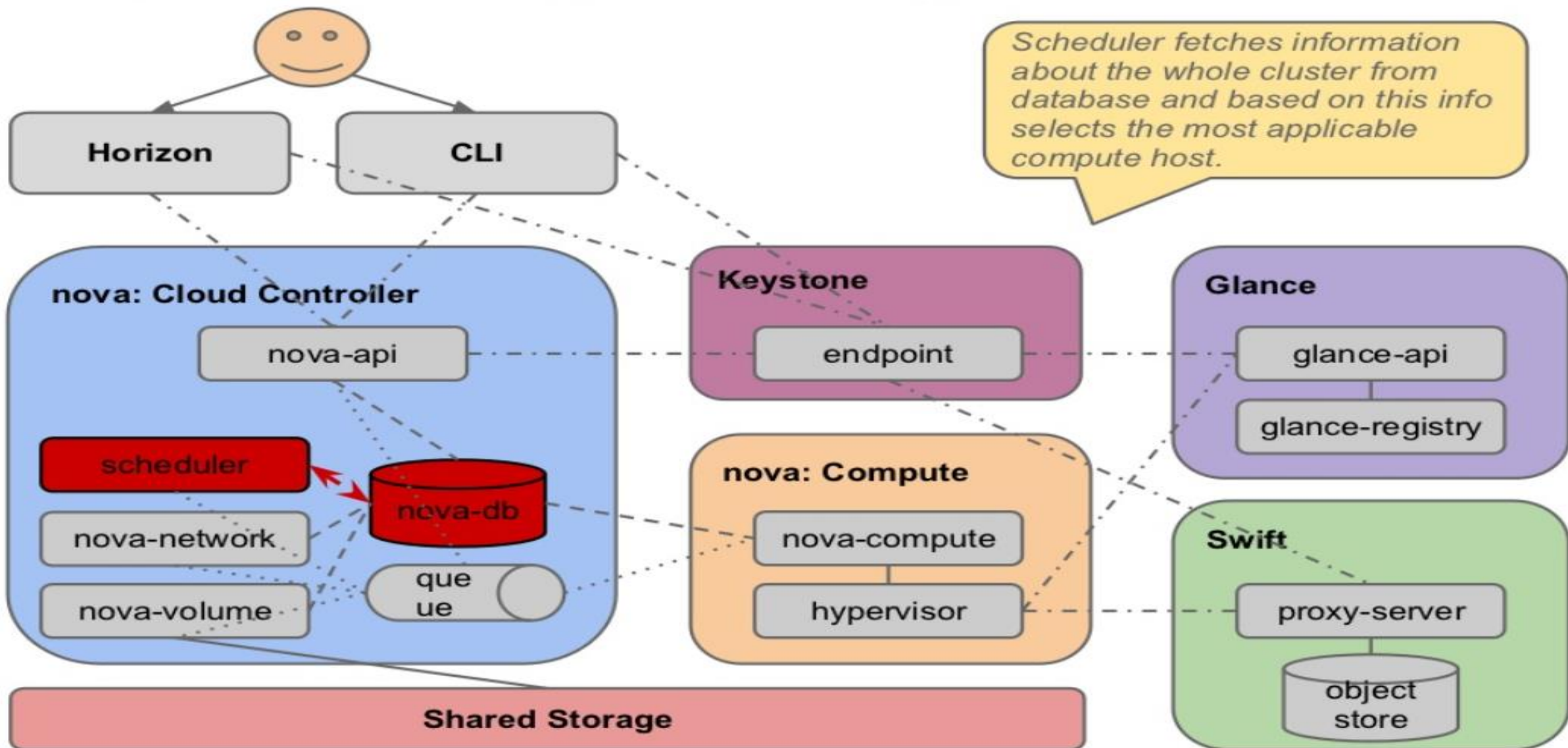
Step 5: Process API request



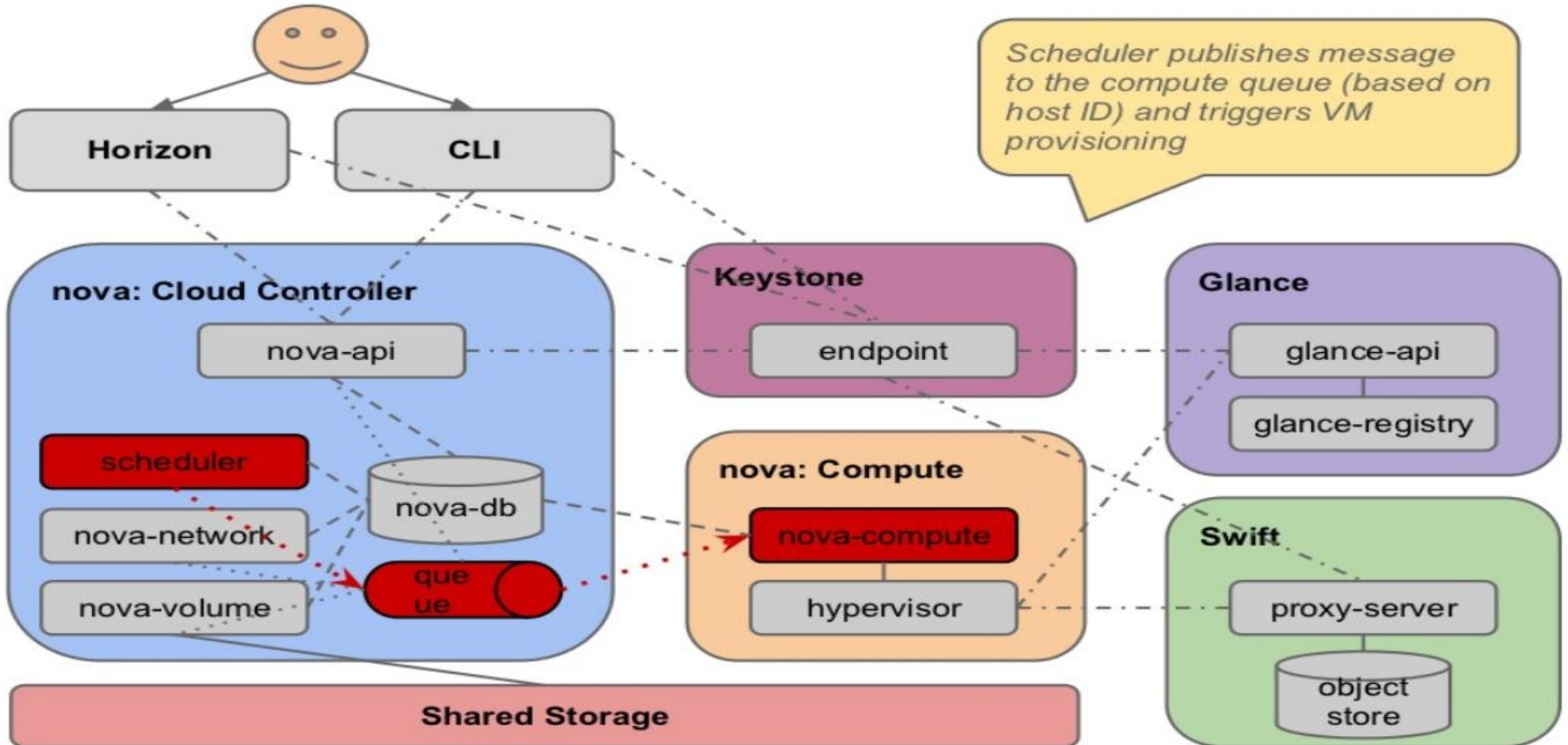
Step 6: Publish provisioning request to queue



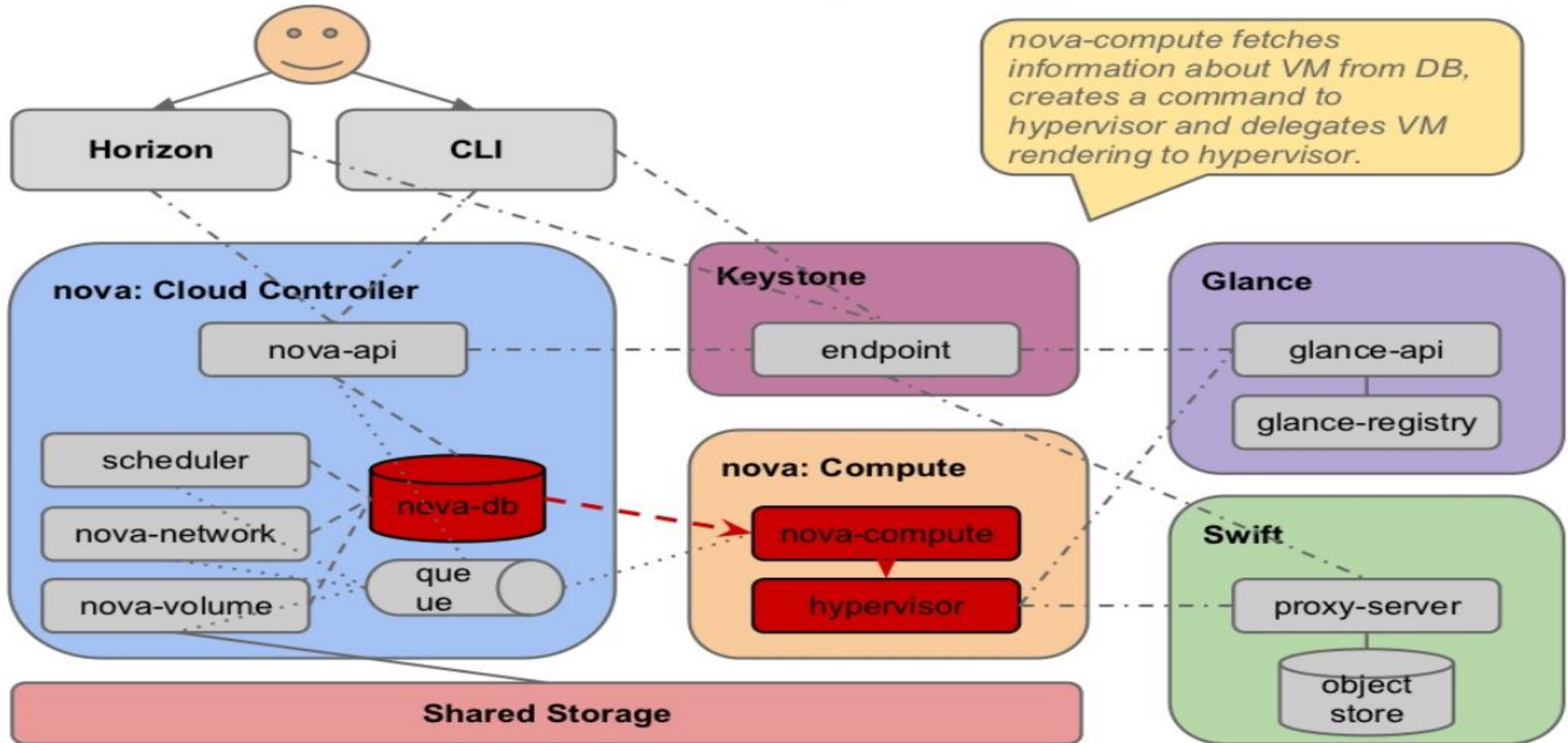
Step 7: Schedule provisioning



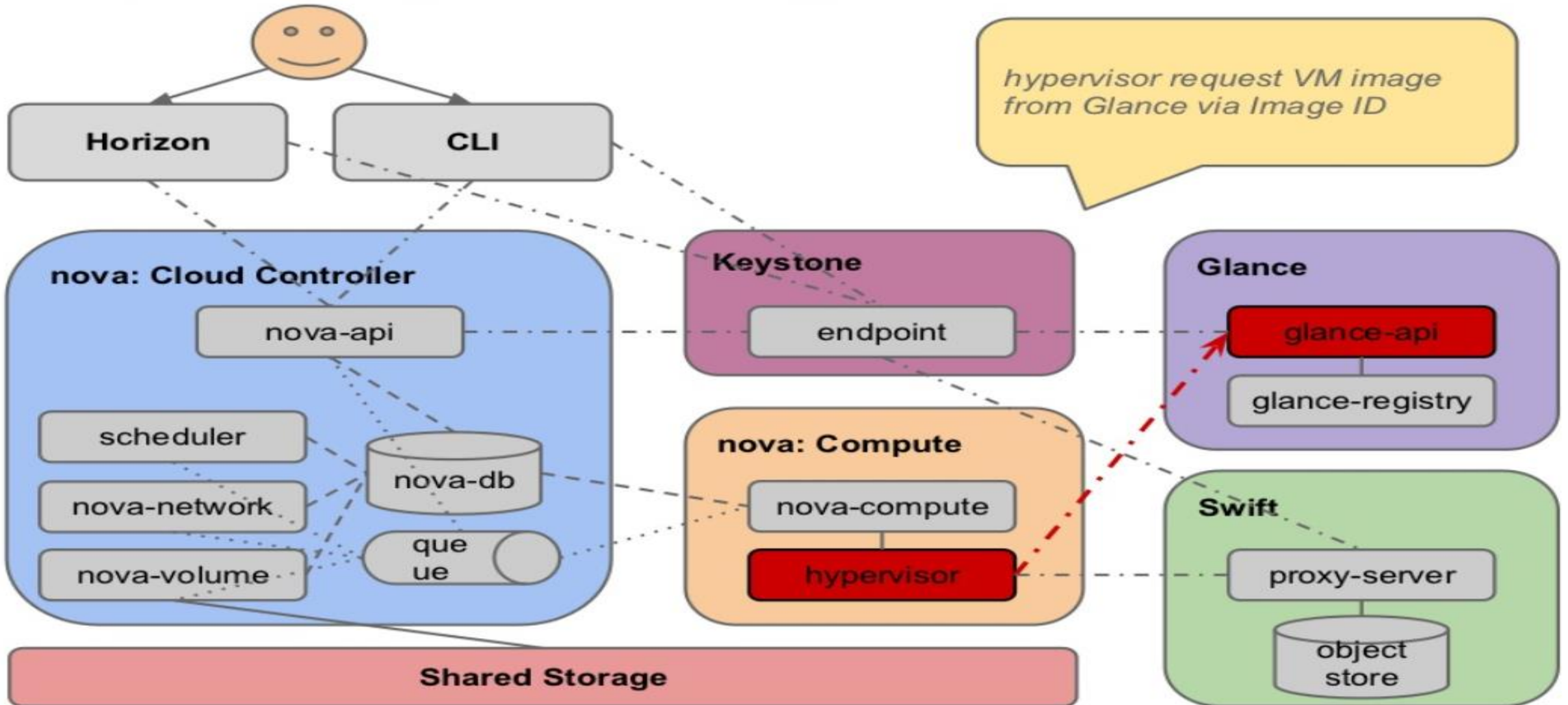
Step 8: Start VM provisioning on compute node



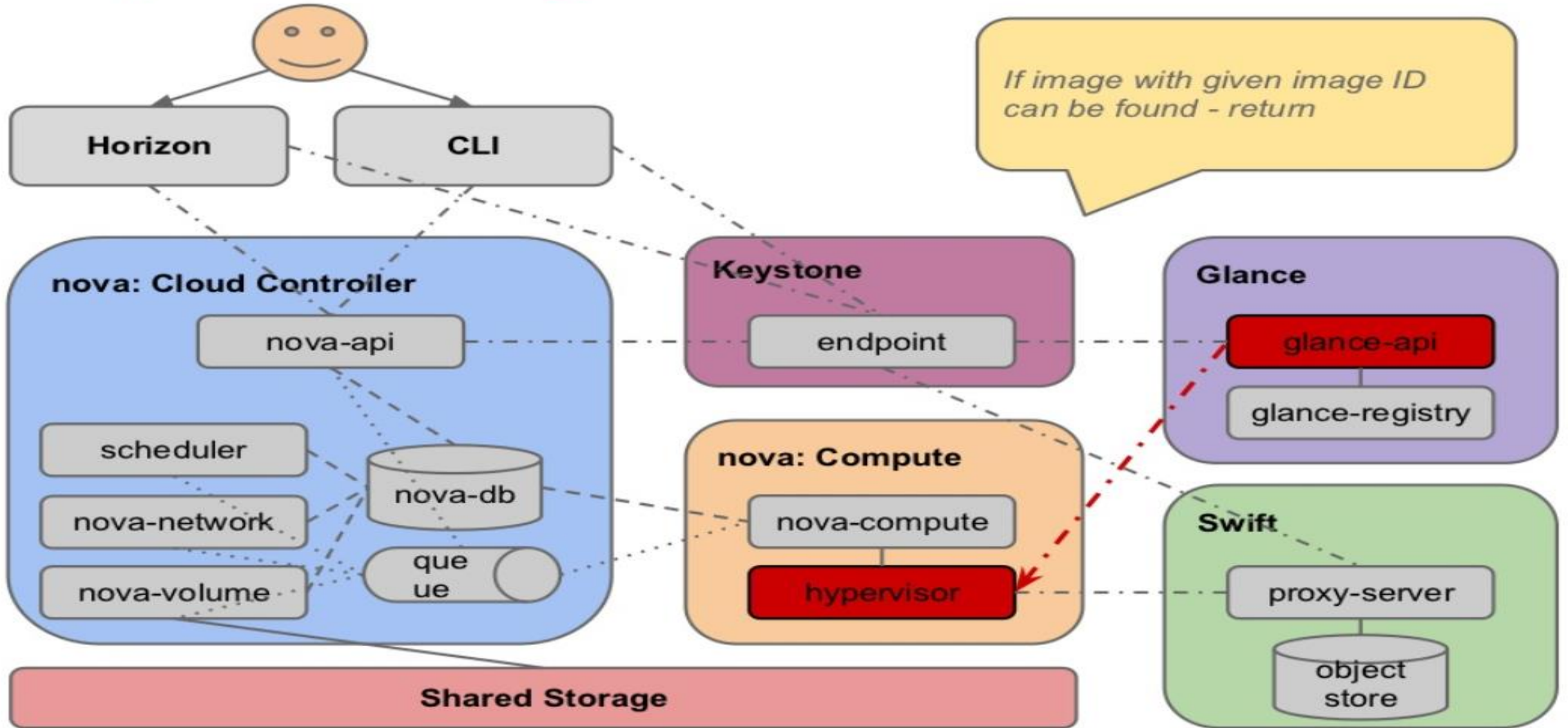
Step 9: Start VM rendering via hypervisor



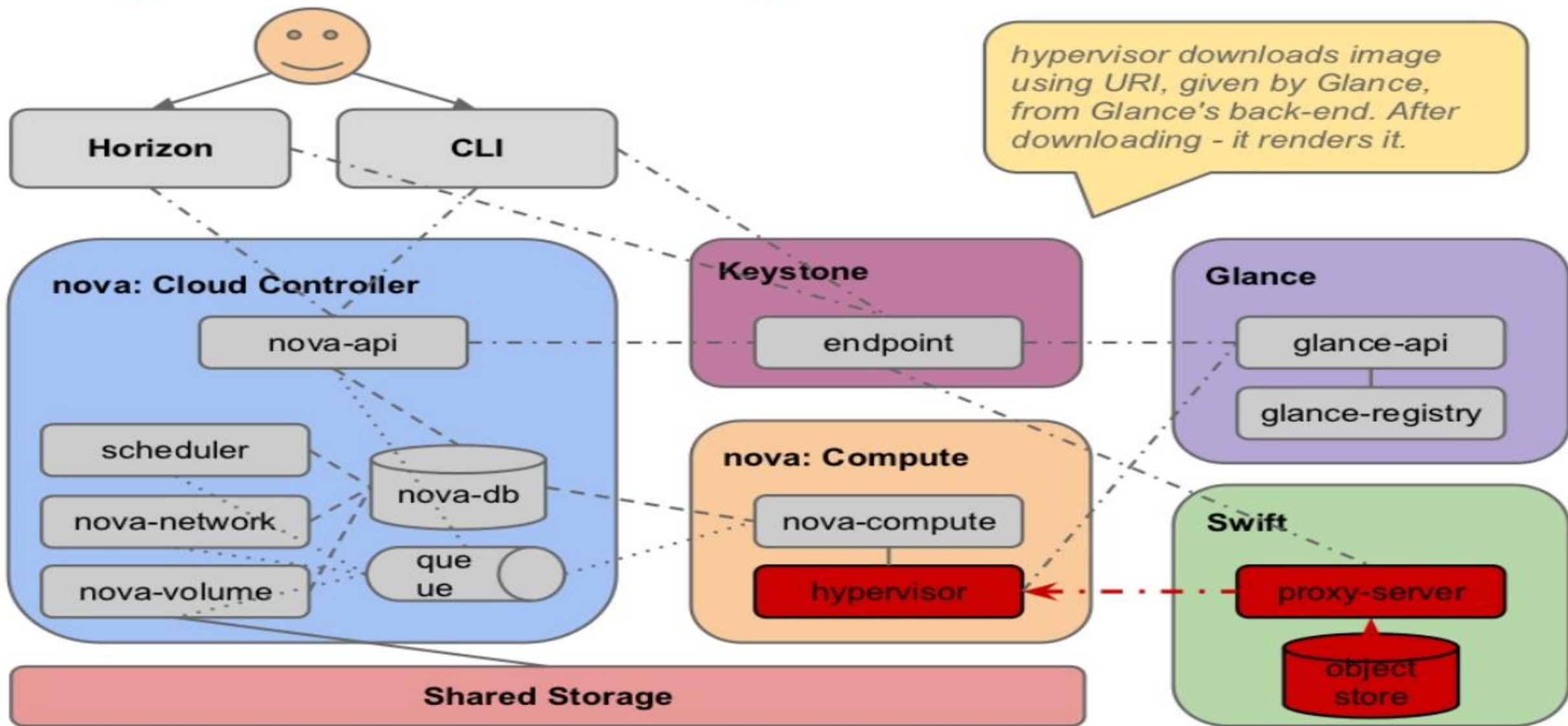
Step 10: Request VM Image from Glance



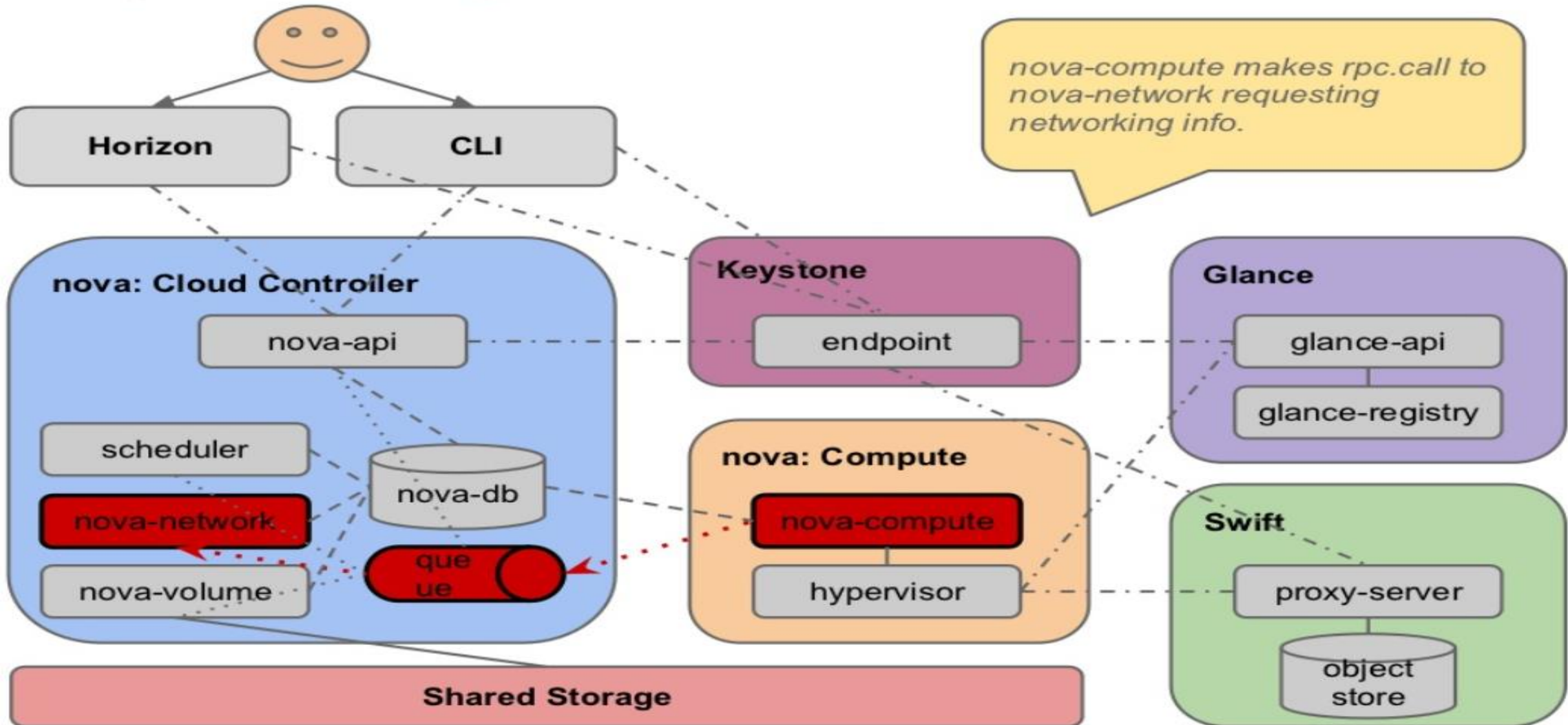
Step 11: Get Image URI from Glance



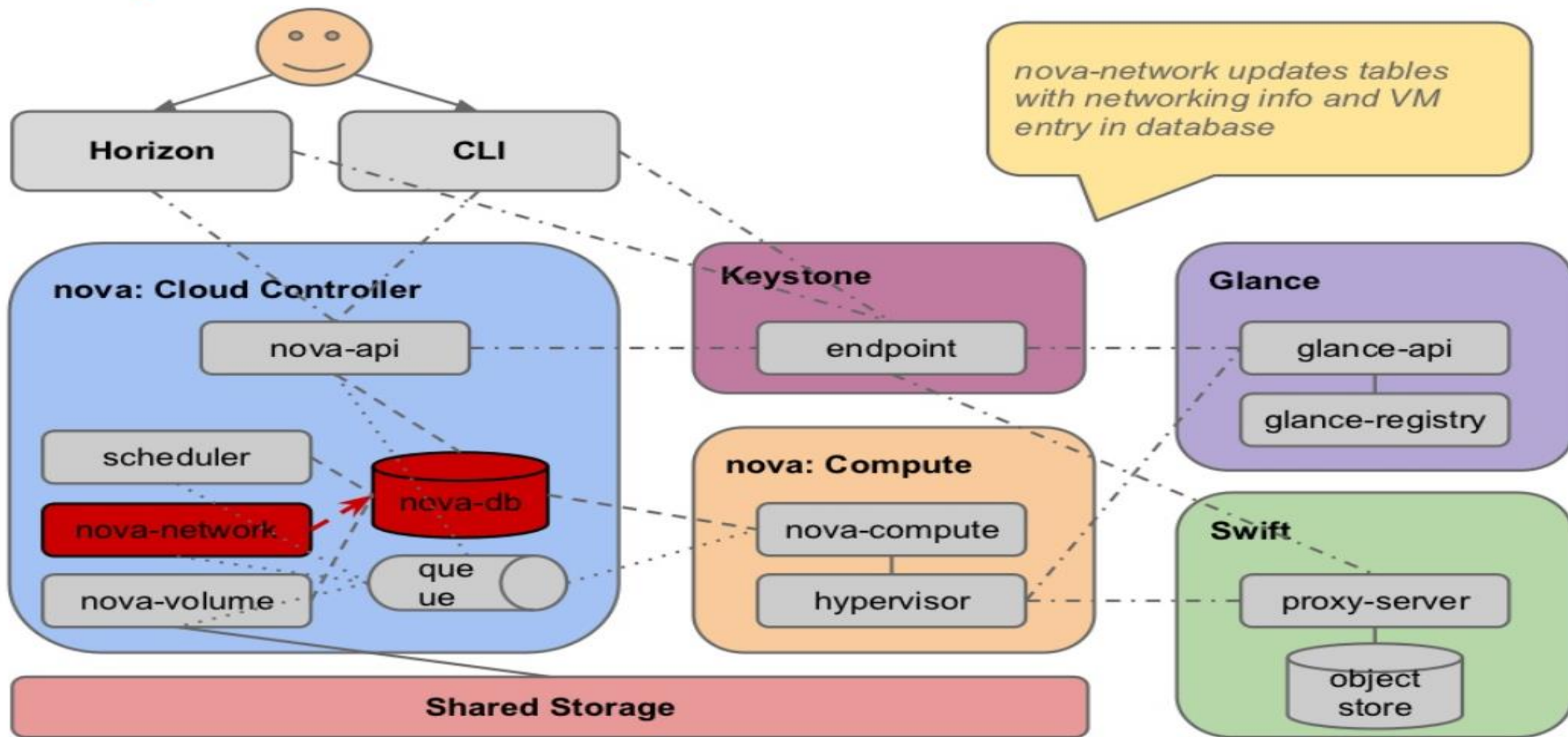
Step 12: Download image from Swift



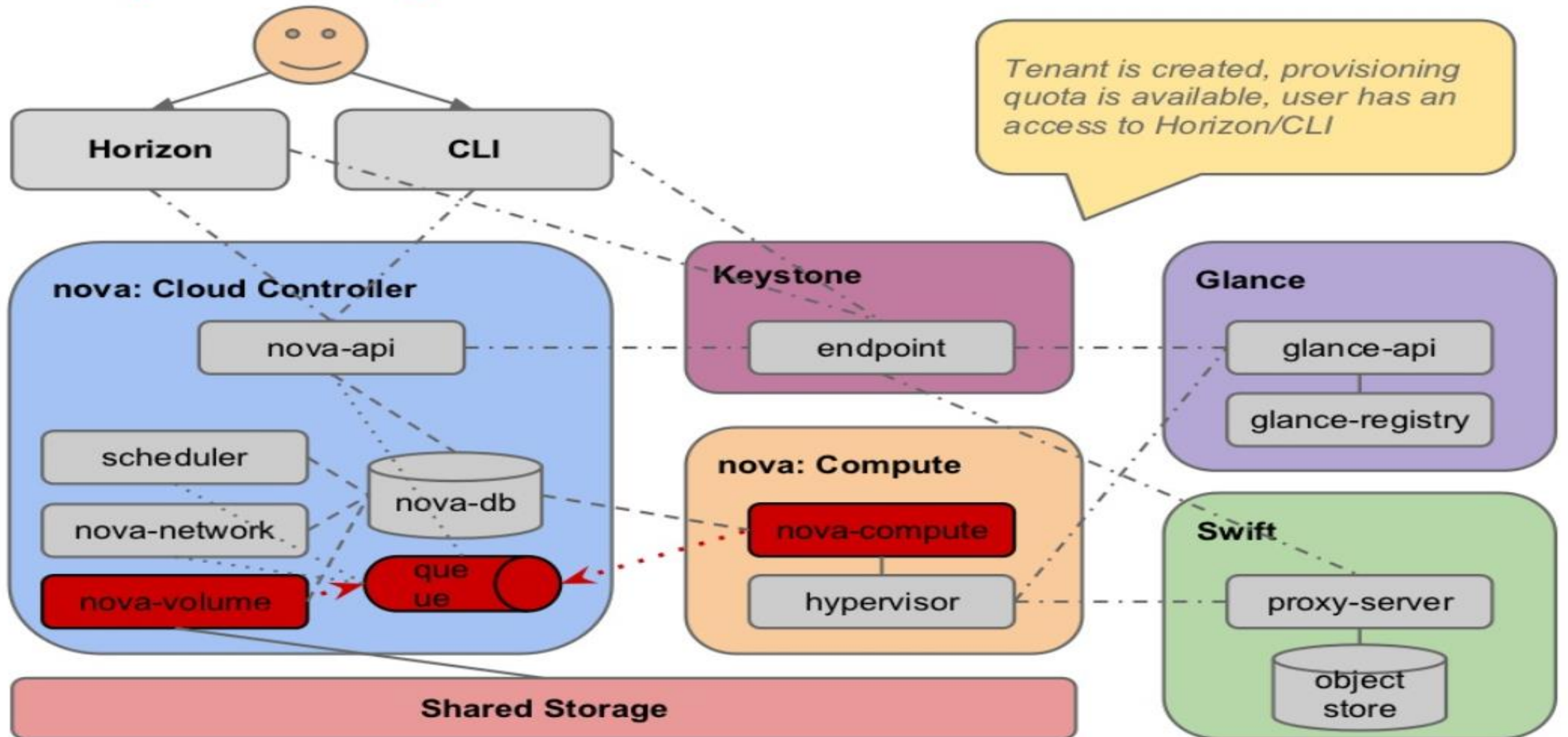
Step 13: Configure network



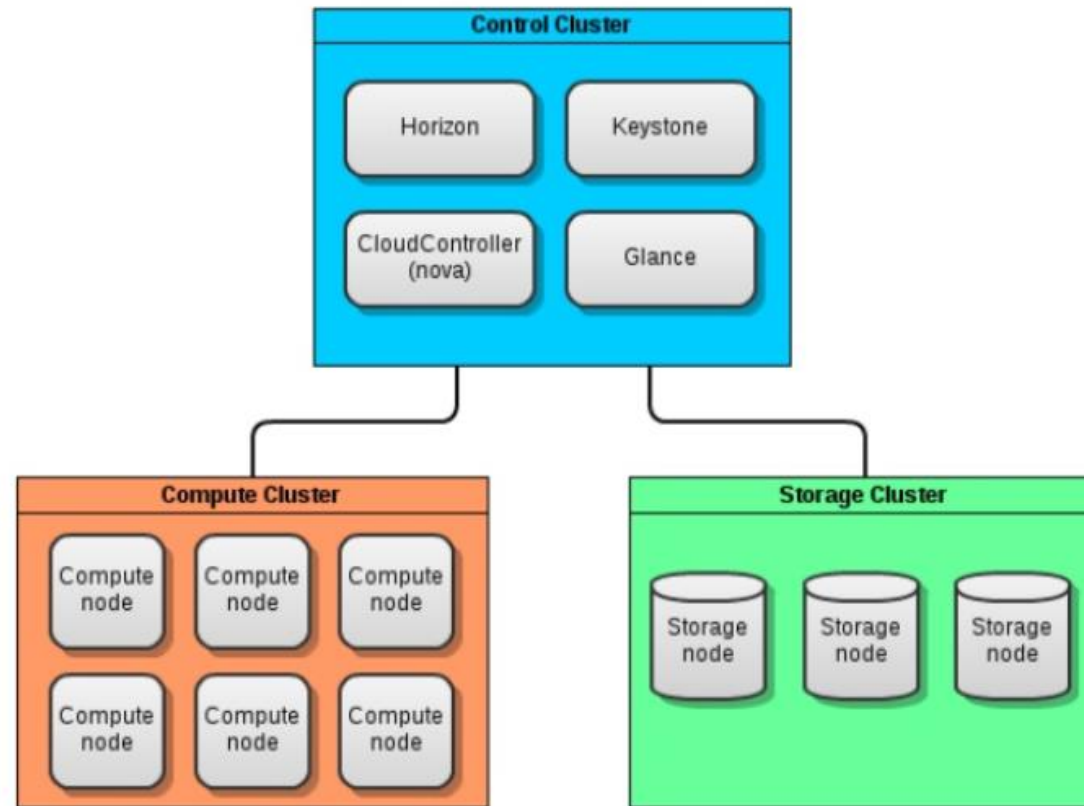
Step 14: allocate and associate network

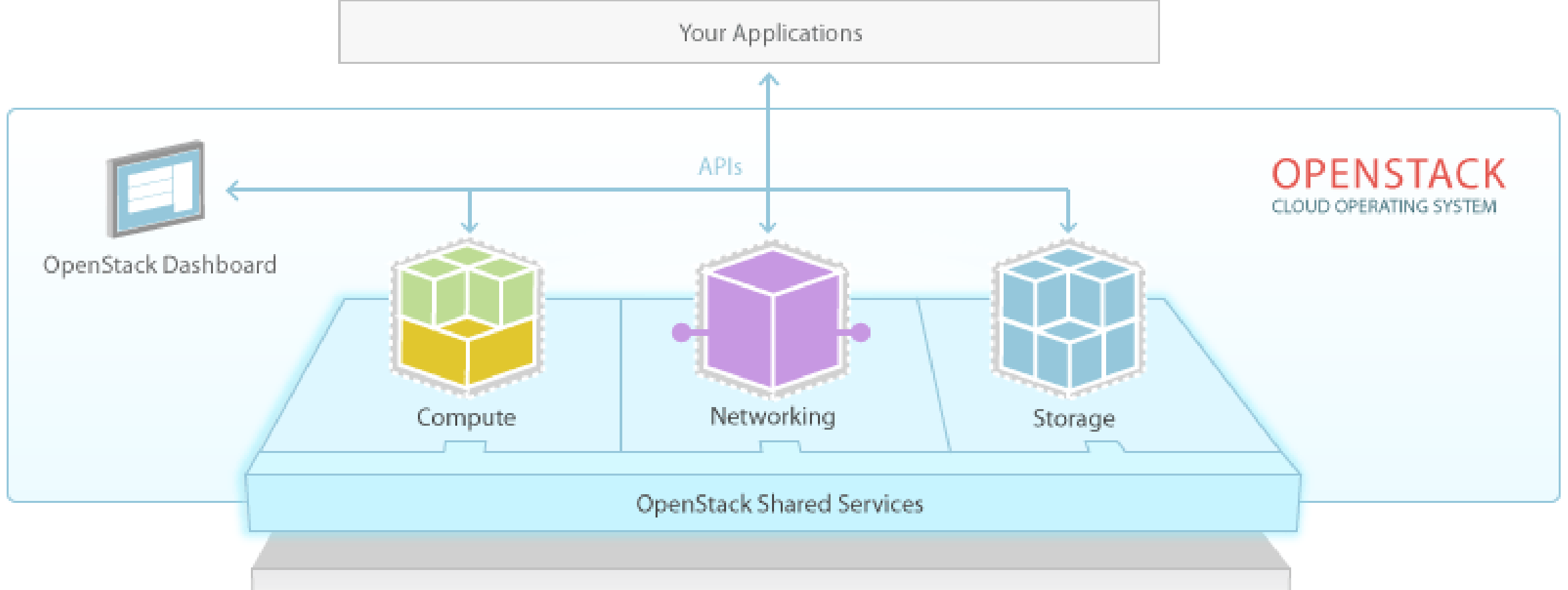


Step 15: Request volume attachment

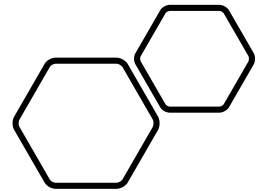


OpenStack: Deployment Topology



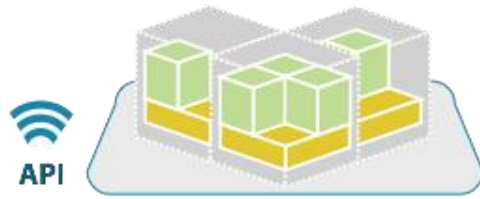


Essential Services

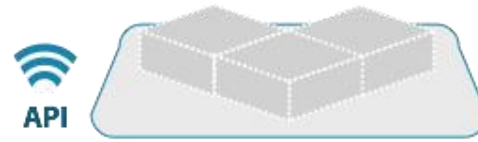


Types of pools managed by the Cloud O.S.

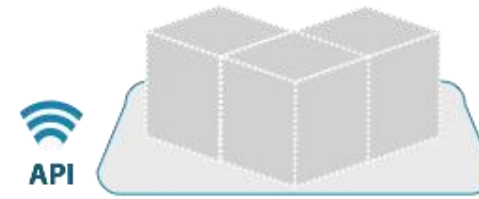
COMPUTE, NETWORK, & STORAGE



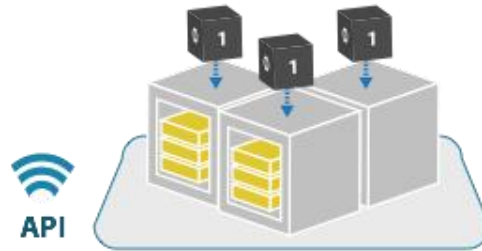
Compute Pool



Network Pool



Load Balancing Pool



Storage Pool



Image Service Pool

Deployment scenario

- All in one VM
- All in one single machine
- All in one LXC container
- Multi-node
- Mutli-node with HA
- Multi-node with DR
- Multi-node with HA & DR

Join the Community

Join The OpenStack Community

<http://www.openstack.org/community/>

Developers In Action: Jenkins recently made a contribution to **Cinder** [r 666](#)

Got Questions?

- [Ask OpenStack](#)
- [#openstack-101](#) on Freenode (via browser client)
- [More OpenStack IRC channels](#)

Mailing Lists

- General Discussions [Register](#) | [Archives](#)
- Development [Register](#) | [Archives](#)
- Documentation [Register](#) | [Archives](#)
- Announcements [Register](#) | [Archives](#)
- Community [Register](#) | [Archives](#)
- Foundation [Register](#) | [Archives](#)
- Operators [Register](#) | [Archives](#)

Social Networks

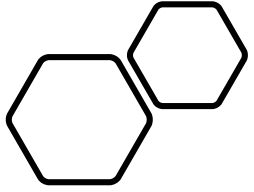
- Twitter: [@openstack](#)
- [Facebook](#)
- [LinkedIn](#)
- [OpenStack on Ohloh](#)

User Groups

The OpenStack Wiki has a full list of user groups available at [The OpenStack User Groups Page](#). If you know of one we missed, please edit the wiki and add it. Thanks!

OpenStack Worldwide Meetup Groups





OpenStack Resources

Forums

- <http://forums.openstack.org/>

Wiki

- <http://wiki.openstack.org/>

Documentation

- <http://docs.openstack.org/>

Mailing Lists

- <http://wiki.openstack.org/MailingLists>

OpenStack Project Management

- <https://launchpad.net/openstack>

Blogs

- <http://planet.openstack.org>

Real-time chat room

- #openstack and #openstack-dev on irc://freenode.net

Source code

https://releases.openslack.org/ussuri/?_ga=2.157726141.645805525.1596761639-1865794046.1596761639

Sample configurations

<https://www.openstack.org/software/sample-configs#web-applications>