

HOW TO DEVELOP OPENSTACK

by

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Agenda

- OpenStack Services
- OpenStack Architecture
- Nova Architecture
- Start on Codes
- Messaging in OpenStack
- OpenStack Libraries
- Request Flow in OpenStack
- OpenStack Clients



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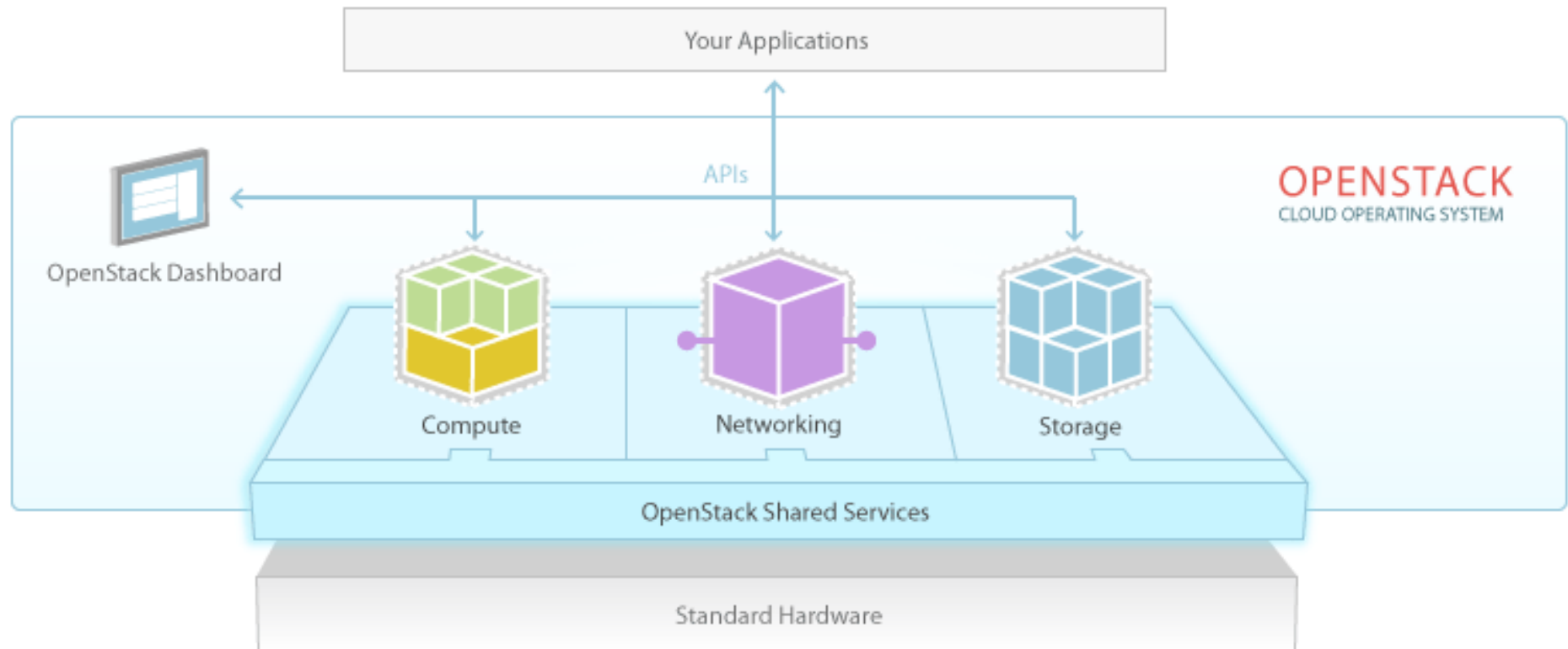


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What is OpenStack

OpenStack is a cloud operating system that controls large pools of compute, storage, and networking resources throughout a datacenter.



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OpenStack Services



Dashboard

Horizon

- web-based portal to interact with underlying OpenStack services



NOVA

COMPUTE LAYER

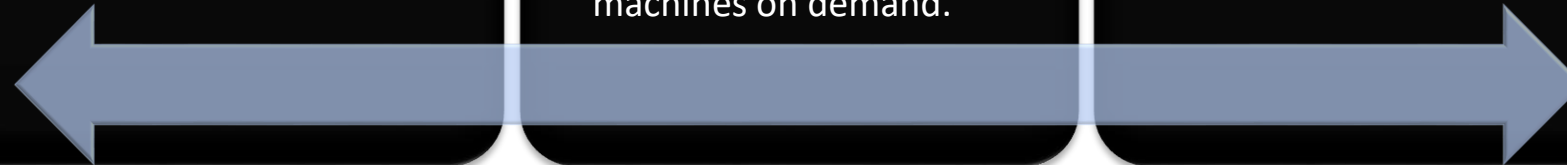
- Manages the compute instances in an OpenStack environment. Responsibilities include creating , scheduling and decommissioning of virtual machines on demand.



KEYSTONE

IDENTITY

- authentication and authorization service for other OpenStack services



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OpenStack Services



CINDER BLOCK STORAGE

- Provides persistent block storage to running instances



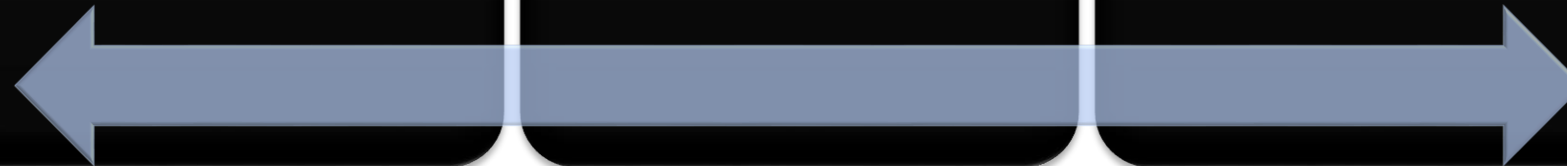
SWIFT OBJECT STORAGE

- Stores and retrieves arbitrary unstructured data objects via a RESTful, HTTP based API



GLANCE IMAGE MANAGEMENT

- Stores and retrieves virtual machine disk images



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OpenStack Services

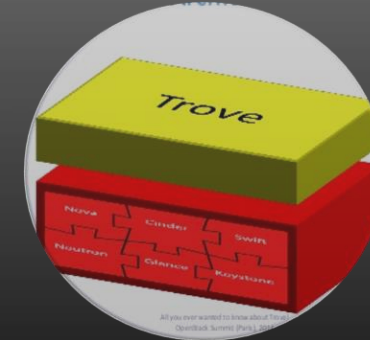


NEUTRON NETWORKING

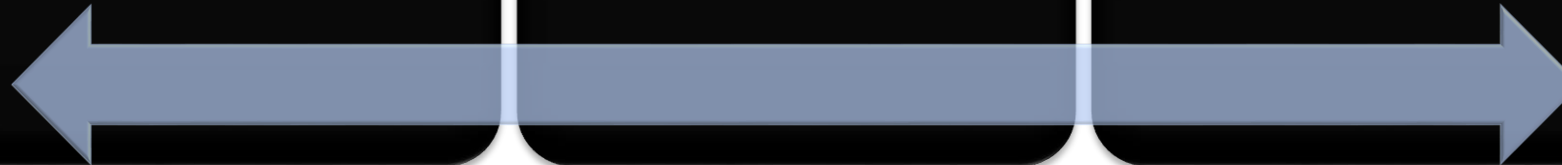
- Enables Network-Connectivity-as-a-Service for other OpenStack services, such as OpenStack Compute



HEAT ORCHESTRATION



CEILOMETER TROVE SAHARA



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Why Develop OpenStack

OpenStack Hypervisor Support Matrix

Feature	Status	Hyper-V	IroniC	Libvirt KVM (ppc64)	Libvirt KVM (s390x)	Libvirt KVM (x86)	Libvirt LXC	Libvirt QEMU (x86)	Libvirt Virtuozzo CT	Libvirt Virtuozzo VM	Libvirt Xen	VMware vCenter	XenServer
Attach block volume to instance	optional	✓	✗	✓	✓	✓	✗	✓	✗	✓	✓	✓	✓
Detach block volume from instance	optional	✓	✗	✓	✓	✓	✗	✓	✗	✓	✓	✓	✓
Set the host in a maintenance mode	optional	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓
Evacuate instances from a host	optional	?	?	?	✓	✓	?	?	✗	✗	?	?	?
Guest instance status	mandatory	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Guest host status	optional	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Live migrate instance across hosts	optional	✓	✗	✓	✓	✓	✗	✓	✗	✗	✓	✗	✓
Launch instance	mandatory	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Stop instance CPIOs (nausea)	optional	✓	✗	✓	✓	✓	✓	✓	✗	✓	✓	✗	✓



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First Step

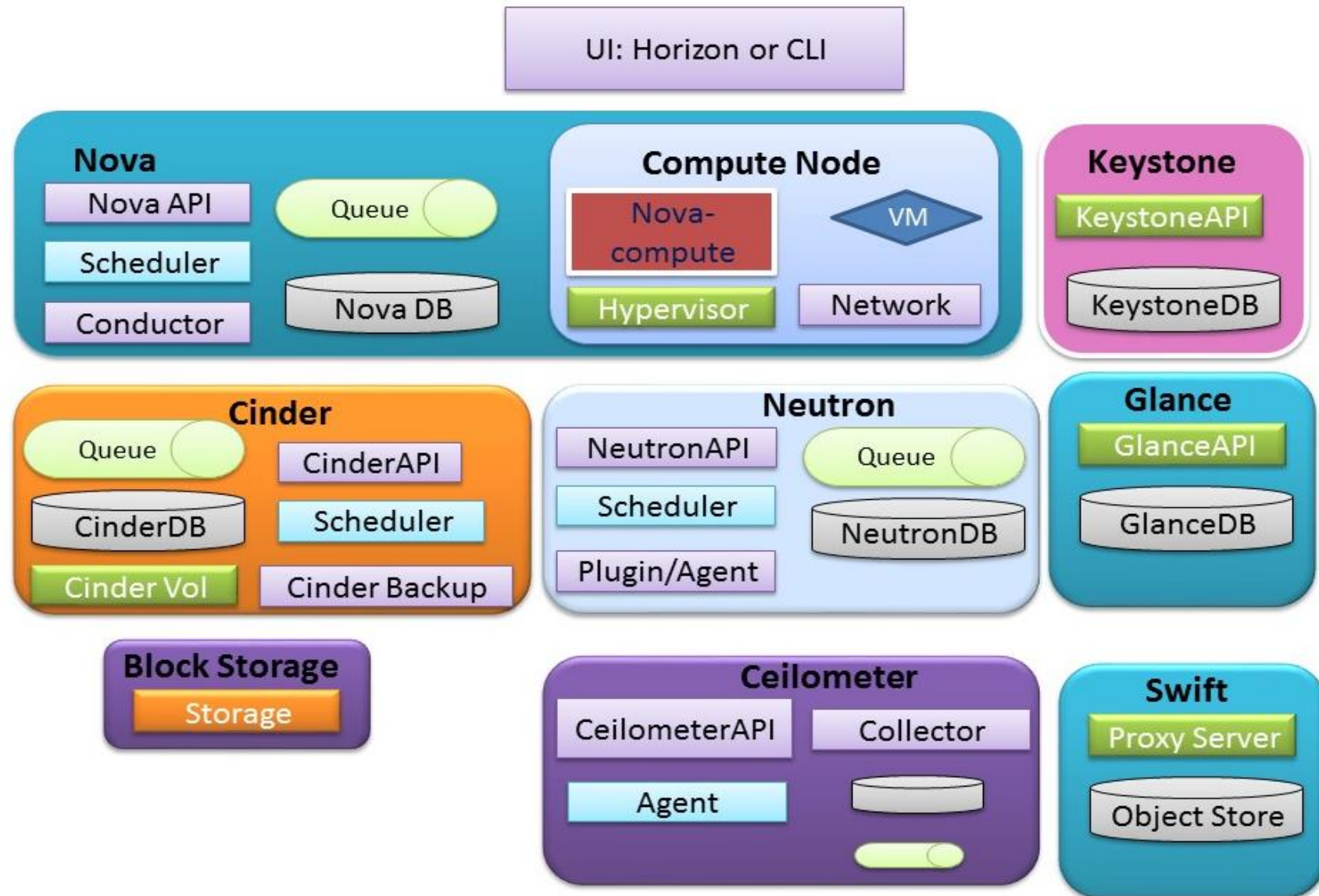
You should understand the codes



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OpenStack Code Architecture





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Many Teams and Many Projects



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NOVA



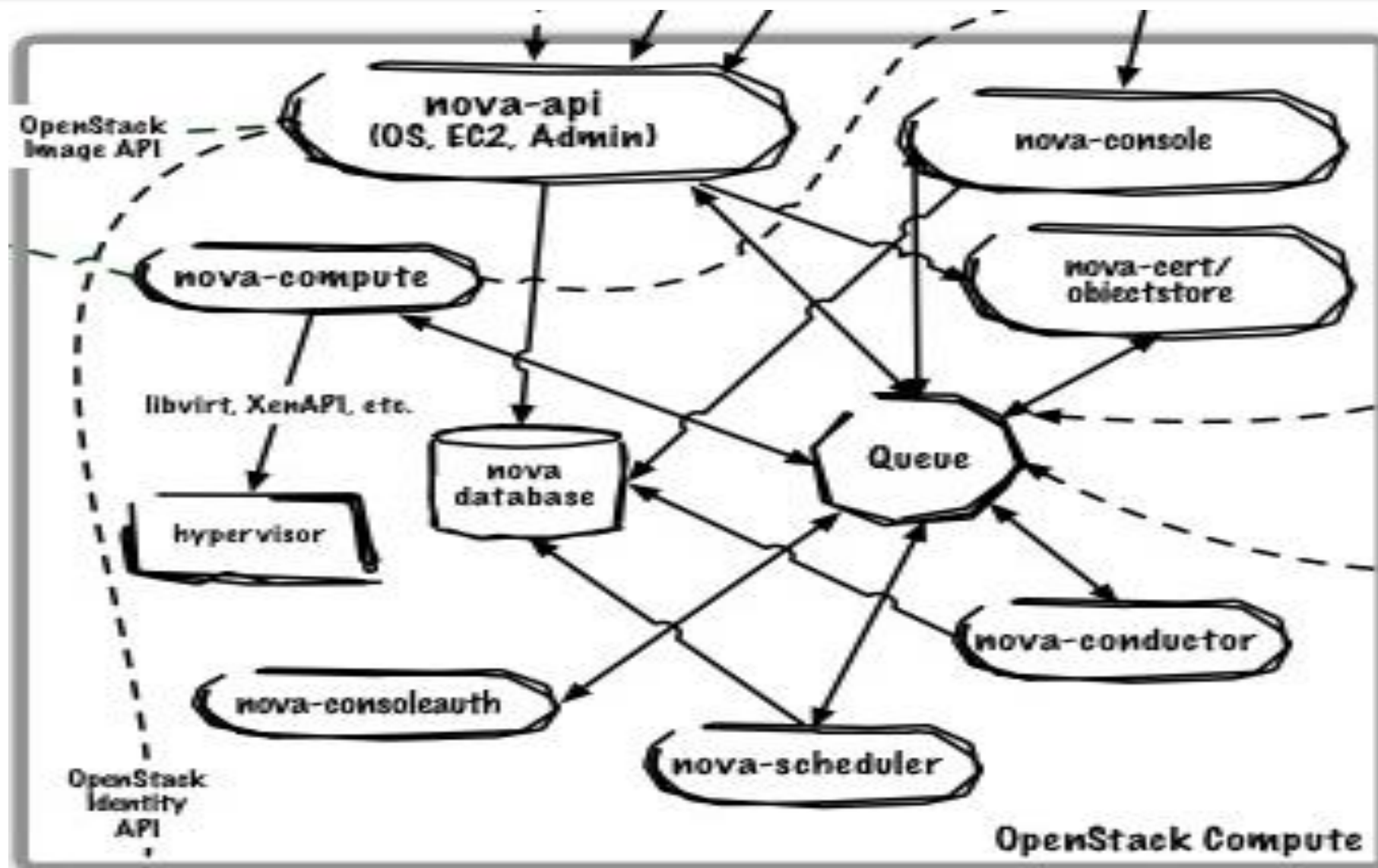
NOVA



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Nova Architecture





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Nova Components

Nova-api

supports OpenStack
Compute API, Amazon's
EC2 API

communicated over HTTP,
converts the requests to
components via message
queue

Nova- conductor

provides coordination
and database query
support for Nova

Nova- compute

A worker daemon which
takes orders from its
message queue and
perform virtual
machine create/delete tasks
using Hypervisor's **API**.





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Nova Components

Nova-scheduler

decides which Nova Compute Host to allot for virtual machine request

Nova-network

takes network related tasks from its message queue and performing those. OpenStack's neutron component can be opted instead of nova-network.

Message queue

All components of Nova communicate with each other in a non-blocking callback-oriented manner using AMQP protocol





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Starting Work on Code

Clone a repository from:

- <https://git.openstack.org/openstack/<projectname>>
- <https://github.com/openstack/<projectname>>

For nova :

- <https://github.com/openstack/nova>
- <https://git.openstack.org/openstack/nova>





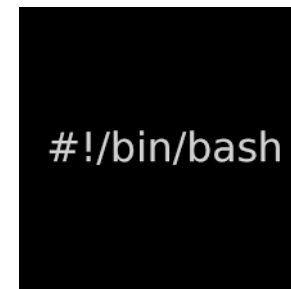
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You Should Know

OpenStack Programming Language

- **Python**
- **JavaScript, JSON**
- **Shell Script**



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Messaging in OpenStack

How messages transport in OpenStack ?



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Two methods:

- OpenStack components such as **Nova** , **Cinder** , **Neutron** communicates internally via AMQP (Advanced Message Queue Protocol) using RabbitMQ or Qpid
- Through **each other** using REST-call.

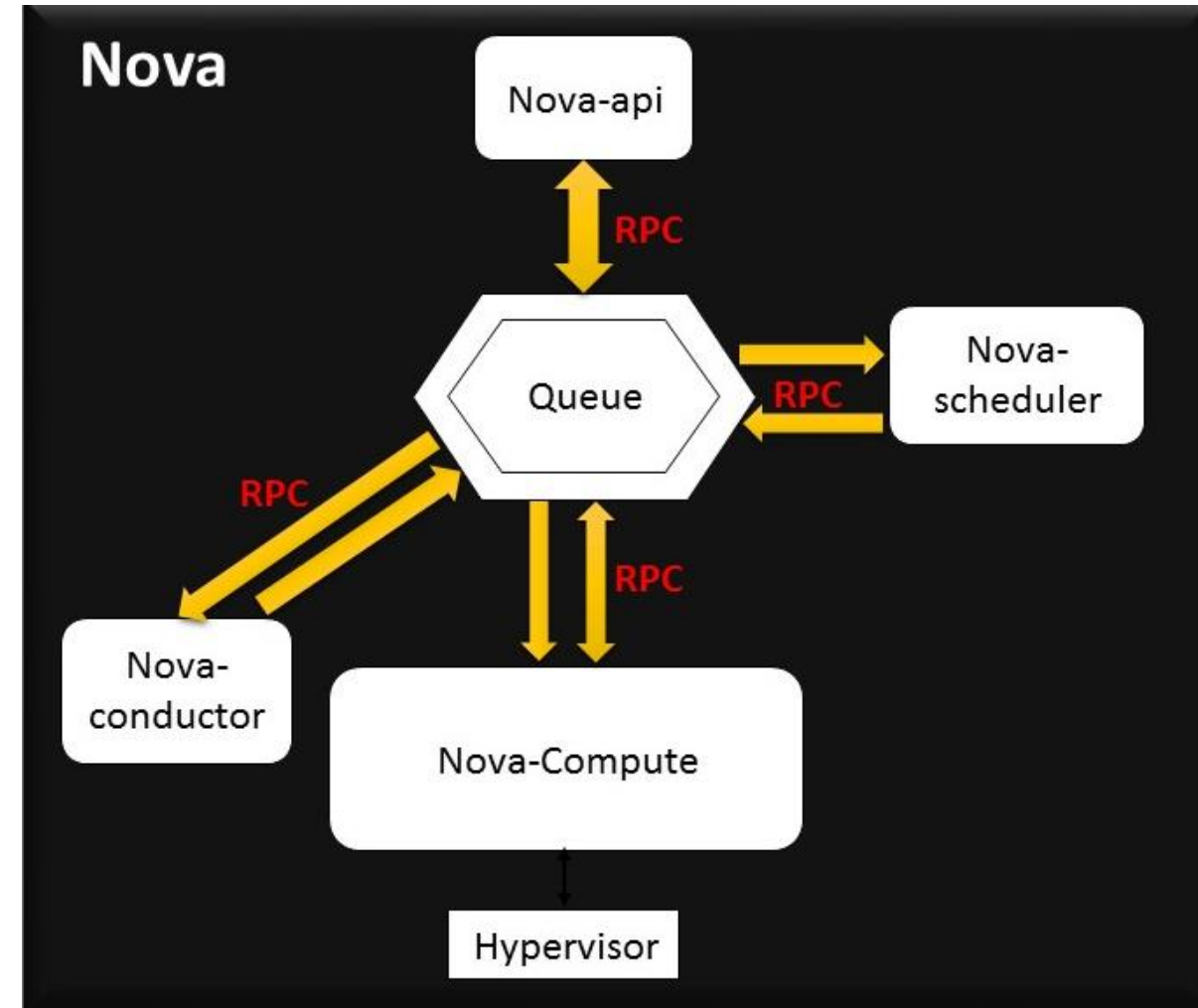




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Message Queue in Nova

The AMQP either RabbitMQ or Qpid, sits between any two Nova components and allows them to communicate using Remote Procedure Calls (RPC)





Message Queue in Nova

- **rpc.cast** :don't wait for result
- **rpc.call** : wait for result (when there is something to return)

```
def reboot_instance(self, ctxt, instance, block_device_info,
                    reboot_type):
    version = '4.0'
    cctxt = self.get_cell_client(ctxt).prepare(
        server=_compute_host(None, instance), version=version)
    cctxt.cast(ctxt, 'reboot_instance',
               instance=instance,
               block_device_info=block_device_info,
               reboot_type=reboot_type)
```

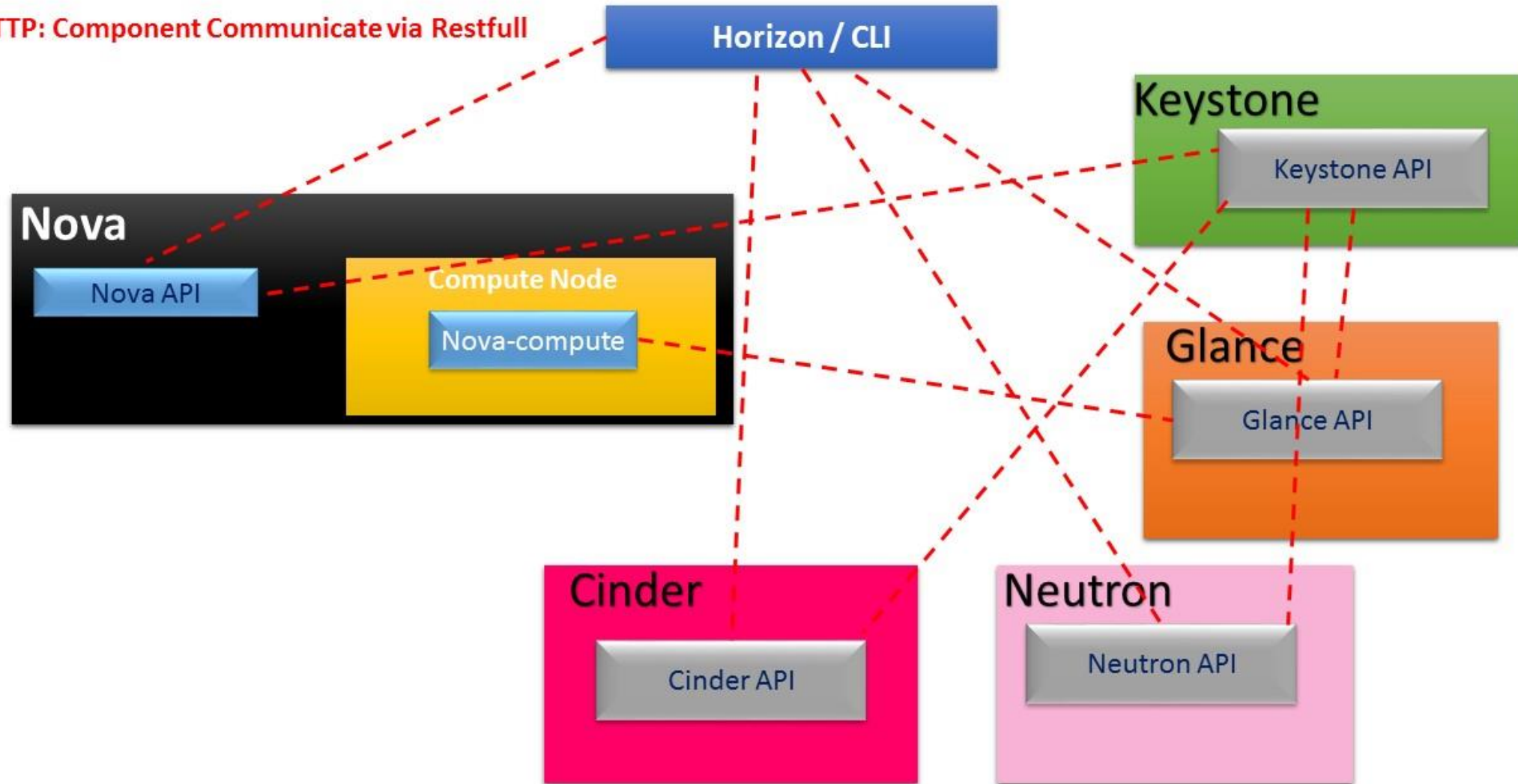
```
def get_diagnostics(self, ctxt, instance):
    version = '4.0'
    cctxt = self.get_cell_client(ctxt).prepare(
        server=_compute_host(None, instance), version=version)
    return cctxt.call(ctxt, 'get_diagnostics', instance=instance)
```





Messaging Between OpenStack Services

HTTP: Component Communicate via Restfull





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OpenStack Libraries(oslo)

The Oslo project intends to produce a python library containing infrastructure code shared by OpenStack projects including :

oslo.config

oslo.serialization

oslo.concurrency

oslo.messaging

oslo.utils

oslo.i18n



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OpenStack Libraries(oslo.config)

A library for parsing configuration options from the command line and configuration files.

```
CONF = nova.conf.CONF

def parse_args(argv, default_config_files=None, configure_db=True,
               init_rpc=True):
    log.register_options(CONF)
    if CONF.glance.debug:
        extra_default_log_levels = ['glanceclient=DEBUG']
    else:
        extra_default_log_levels = ['glanceclient=WARN']
    log.set_defaults(default_log_levels=log.get_default_log_levels() +
                    extra_default_log_levels)
    rpc.set_defaults(control_exchange='nova')
    config.set_middleware_defaults()

    CONF(argv[1:],
         project='nova',
         version=version.version_string(),
         default_config_files=default_config_files)

    if init_rpc:
        rpc.init(CONF)

    if configure_db:
        sqlalchemy_api.configure(CONF)
```

Parse the **/etc/nova/nova.conf**
and convert it to cfg object





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OpenStack oslo

oslo.concurrency

managing external processes and task synchronization.

oslo.messaging

The Oslo messaging API supports RPC

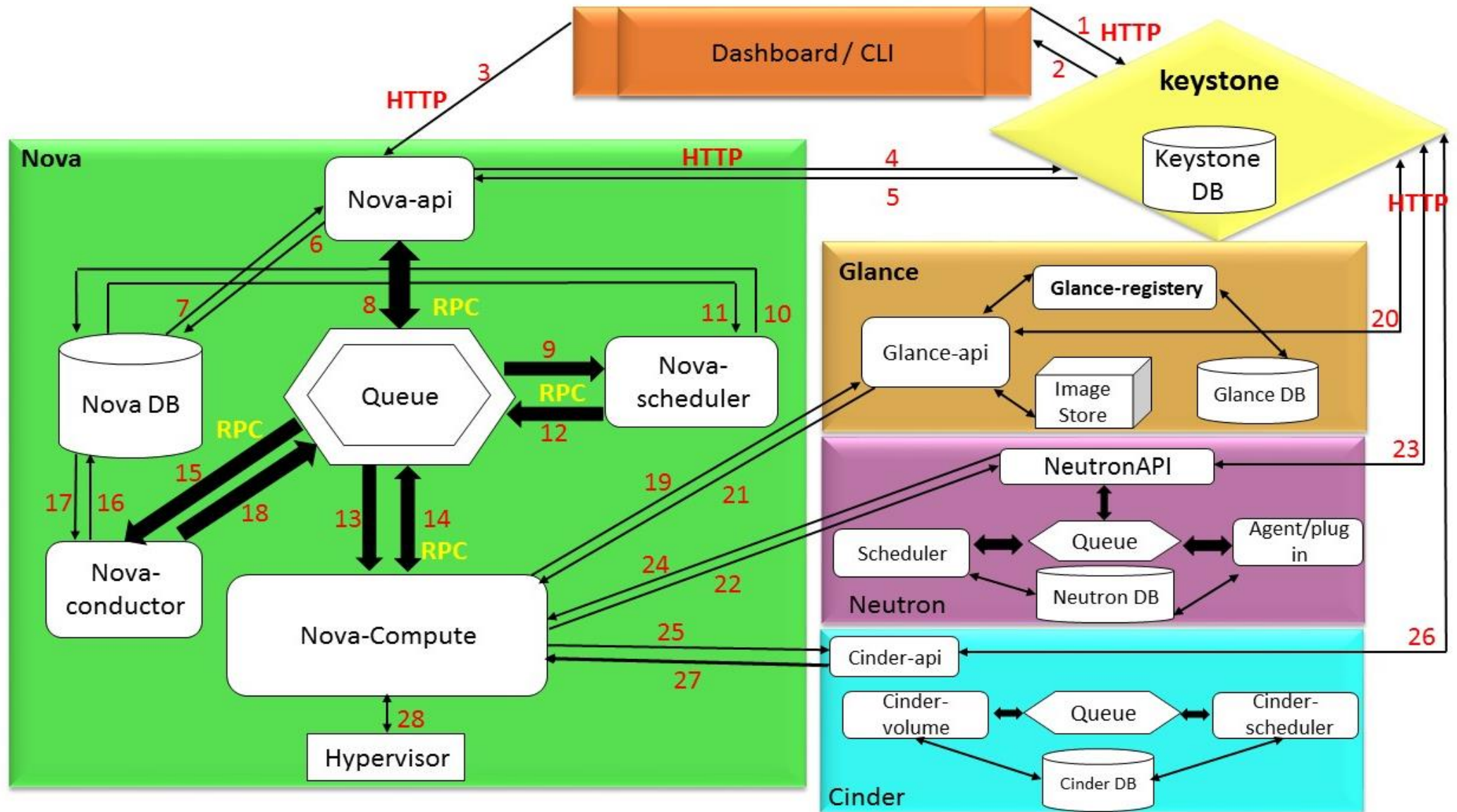
oslo.utils

a library that provides various low-level utility modules/code, such as **fileutils**, **timeutils**, **importutils**(import related utilities and helper functions)





Request Flow for Provisioning Instance



OpenStack Clients

- Most OpenStack project provides a command-line client for each service including:
- `python-glanceclient`
- `python-novaclient`
- `python-keystoneclient`
- ...



- Nova client is for the Compute service provides a nova command-line client
- Nova client is a client for the OpenStack Nova API

Some of nova commands:

- nova boot (Create new instance)
- nova reboot
- nova flavor-list(Print a list of available flavors (sizes of servers))
- nova resize (Resize the instance to new flavor)
-



Write New API in Nova

- If you want to write new API in Nova, you should be familiar with nova client as well .
- For example **nova resize** , first shutdown the current instance, then change the flavor and migrate it to the new host which is selected by scheduler.
- **You should know how to invoke new API by nova client**



Resize Instance on the Same Host

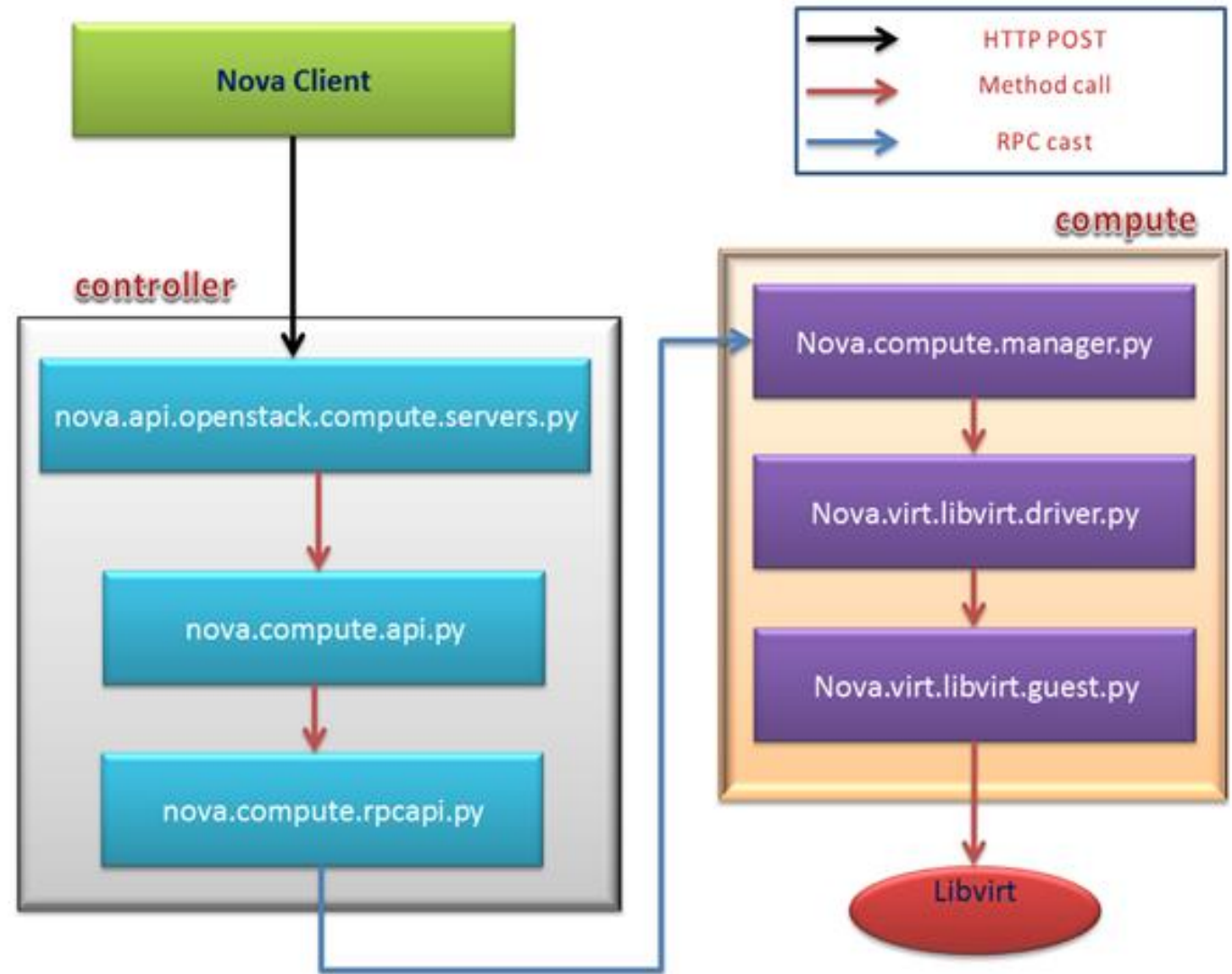
- Suppose we want to have our own `resize instance` command which allows to resize an instance on the same host if it is possible(enough resources available)
- A solution
 - Check if possible to resize on place
 - If OK, Shutdown the instance
 - Take a snapshot
 - Create a new instance with the new flavor on the same host
 - Boot instance with the snapshot image
 - Delete the old instance





Command Flow

- Many commands in OpenStack novaclient following same process
- Suppose Libvirt is used as compute driver





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How to Contribute in OpenStack

- **Account Setup: You need a Launchpad account**
- **Join OpenStack Foundation**
- **Log Into Gerrit Review System**
- **Install git**
- **Clone the codes**
- **Working on Bugs**



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