OpenStack Ironic API

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Contents

1.Problem Statement

Providing baremetal provisioning(install physical server automatically) function and managing those physical servers in the same way as virtual machine Using Ironic API of OpenStack

2.Project Description

2.1 Brief Description of OpenStack:

OpenStack is a free and OSS(open-source software) cloud computing platform where users can get virtual machine whenever they want, with their required specifications.The technology consists of a series of interrelated projects that control pools of processing, storage, and networking resources throughout a data center—which users manage through a web-based dashboard, command-line tools, or a RESTful API.The main functional components involved in this technology are as follows:

Component	**Purpose**
Nova	Compute
Swift	Object Storage
Cinder	Block Storage
Neutron	Networking
Keystone	Identity Service

Glance	Image Service
Horizon	DashBoard
Ceilometer	Telemetry
Heat	Orchestration
Trove	Database
Ironic	**Baremetal Provisioning**
Sahara	Elastic Map Reduce
Zaqar	Multiple Tenant Cloud Messaging

2.2 Ironic:

Ironic component of Openstack helps for providing “Baremetal Provisioning” (install physical server automatically) function.

2.2.1 Background

The main function of OpenStack is just providing virtual machines to users.what if a user need physical server not simply the virtual machine?and this concept of providing physical machines(as same way as virtual machines) to users is called “Baremetal Provisioning”.The component of Openstack that helps to achieve this functionality of “Baremetal Provisioning “ is “Ironic”.

Advantages of Baremetal Provisioning

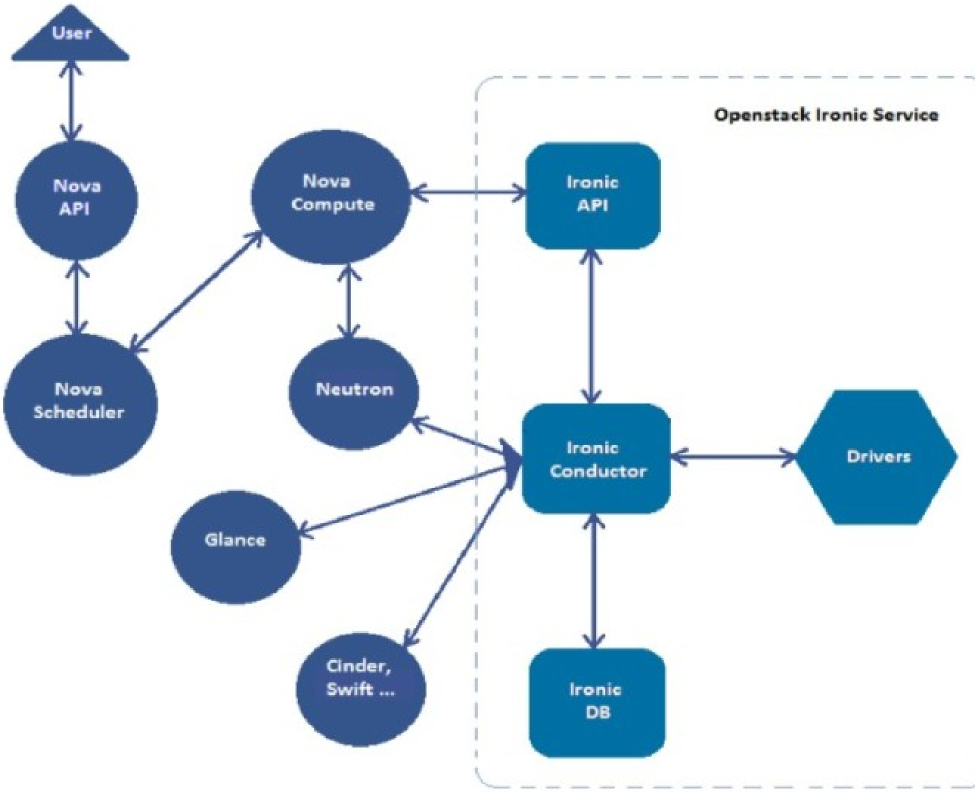
- High-performance computing clusters
- High-stress computing clusters
- For database hosting (some databases run poorly in a hypervisor) eg:social games
- Customers hesitating about using virtual machines for production system can go with Baremetal Provisioning.
- Can handle Computing tasks that require access to hardware devices which can't be virtualized .
- Can copy many Physical Servers

2.2.2 Introduction

Ironic is an OpenStack project which provisions physical hardware as opposed to virtual machines. Ironic provides several reference drivers which leverage common technologies like PXE and IPMI, to cover a wide range of hardware. Ironic’s pluggable driver architecture also allows vendor-specific drivers to be added for improved performance or functionality not provided by reference drivers.

If one thinks of traditional hypervisor functionality (e.g., creating a VM, enumerating virtual devices, managing the power state, loading an OS onto the VM, and so on), then Ironic may be thought of as a hypervisor API gluing together multiple drivers, each of which implement some portion of that functionality with respect to physical hardware.

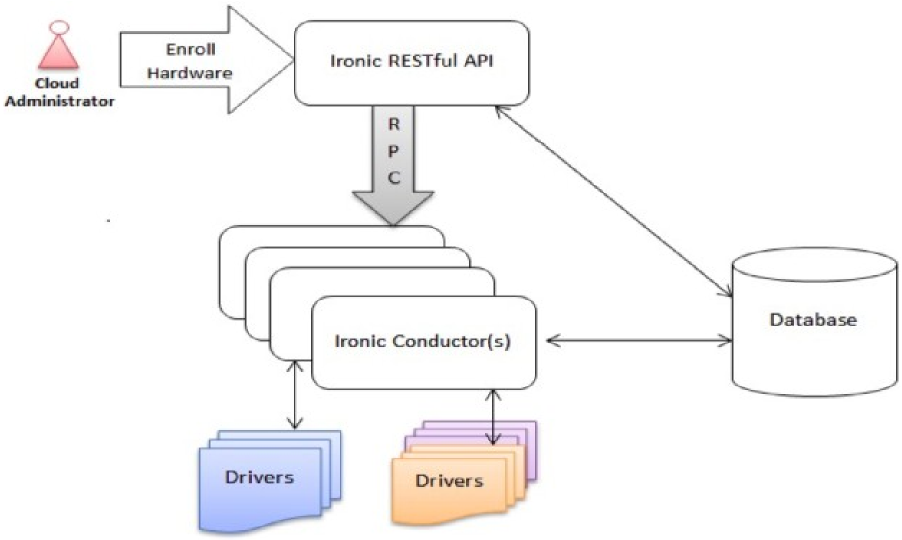
2.2.3 Logical Architecture



2.2.4 Sub-Components of Ironic Component of OpenStack

The Ironic service is composed of the following components:

- A RESTful API service, by which operators and other services may interact with the managed bare metal servers.
- A Conductor service, which does the bulk of the work. Functionality is exposed via the API service. The Conductor and API services communicate via RPC.
- A Message Queue
- A Database for storing the state of the Conductor and Drivers.



3.KeyTechnologies for BM Provision

PXE : Preboot Execution Environment is part of Wired For Management (WfM) specification developed by Intel and Microsoft.Booting computer via a network.

NBP : Network BootStrap Program is equivalent to GRUB(GRand Unified Bootloader) or LILO (Linux Loader) – loaders which are traditionally used in local booting. Like the boot program in hard drive environment , the NBP is responsible for loading the OS kernel into memory so that OS can be bootstrapped over a network.

IPMI : Intelligent Platform Management Interface is a standardized computer system interface used by system administrators for out-of-band management of computer systems and monitoring of their operation.

DHCP : Using PXE, the BIOS uses DHCP to obtain an IP address for the network interface and to locate the server that stores NBP.

TFTP : Trivial File Transfer Protocol is a simple file transfer protocol that is generally used for automated transfer of configuration or boot files between machines in a local environment.In a PXE environment, TFTP is used to download NBP over network using information from DHCP server.

ISCSI : Internet Small Computer System Interface , an Internet Protocol (IP)-based storage networking standard for linking data storage facilities.By carrying SCSI commands over IP networks, iSCSI is used to facilitate data transfers over intranets and to manage storage over long distances.

4.Target User

- The target users for this project are the cloud service providers who offer cloud services to clients and enterprises to build their private cloud systems.
- It can be used by the people who want traditional hypervisor functionality like creating a VM, enumerating virtual devices, managing the power state, loading an OS onto the VM etc.
- It can also be used by Service Providers and enterprises as it makes provision of physical servers as easy t as virtual machines in cloud, which in turn will open up new avenues.

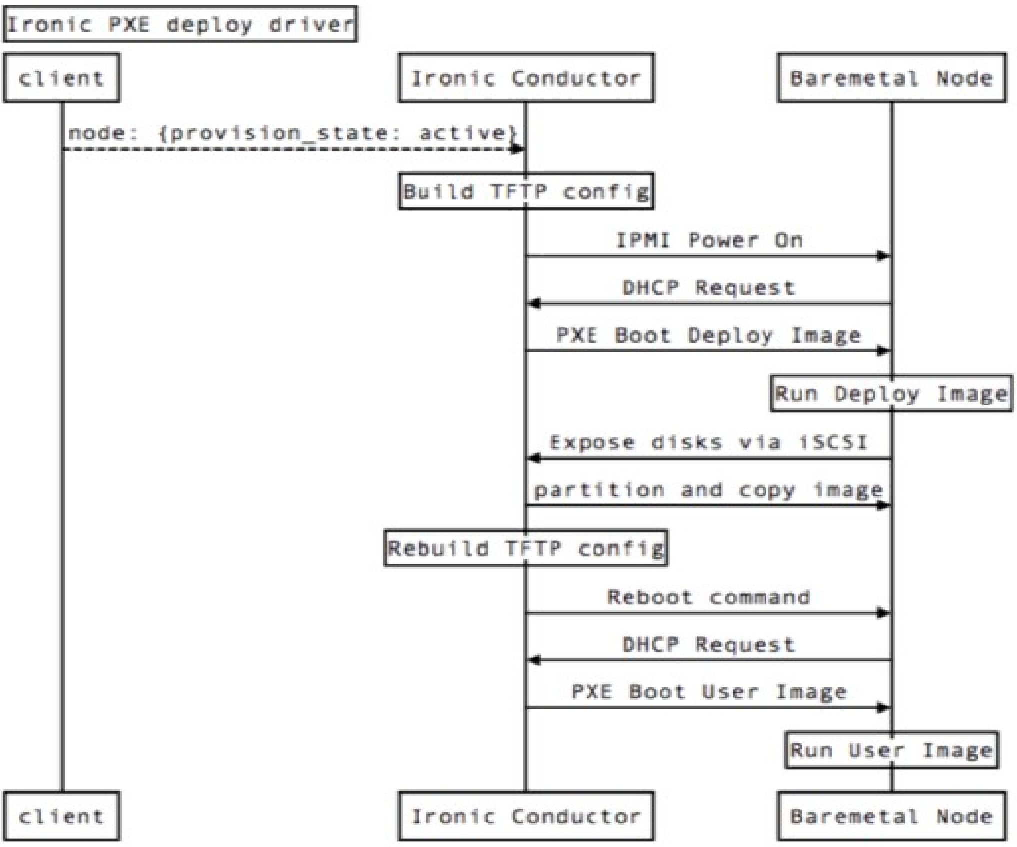
5.User interaction with the system

User interacts using commands provided by REST API
Ironic Commands

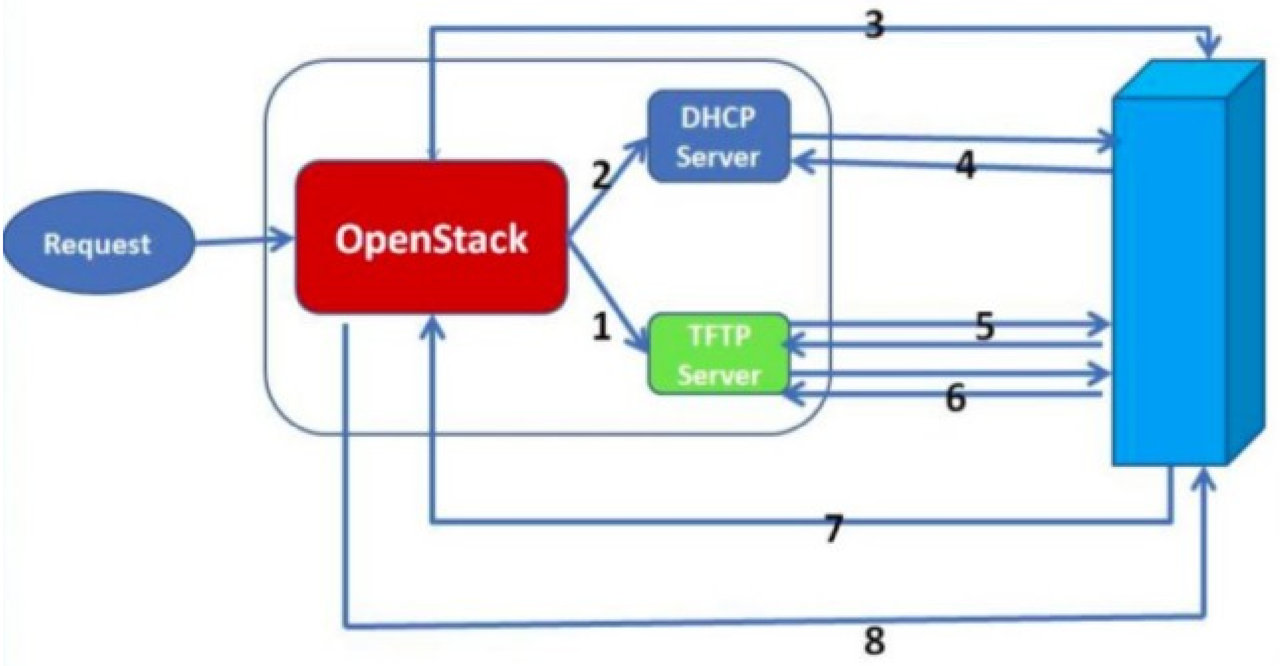
- node-create - Create a new node.
- node-delete - Delete a node.
- node-get-console - return the connection information about the console.
- node-list - list nodes.
- node-set-console-mode - Enable or disable the console access.
- node-set-power-state - Power the node on or off.
- node-set-provision-state - Provision or tear down a node.
- node-show - Show a node.
- node-update - Update a node.
- node-validate - Validate the node driver interfaces.
- port-create - Create a new port.

- port-delete - Delete a port.
- port-list - List ports.
- port-show - Show a port.
- port-update - Update a port.
- chassis-create - Create a new chassis.
- chassis-delete - Delete a chassis.
- chassis-list - List chassis.
- chassis-node-list - List the nodes contained in the chassis.
- chassis-show - Show a chassis.
- chassis-update - Update a chassis.
- driver-list - List drivers.
- driver-show - Show a driver.

6.Interaction Diagram



7.Block Diagram of the system



Explanation (Baremetal provisioning method) :

1. OpenStack Stores image to THTP server

2. OpenStack sets DHCP configurations

3. OpenStack powers on physical node

4. Booted physical node unicast DHCP request

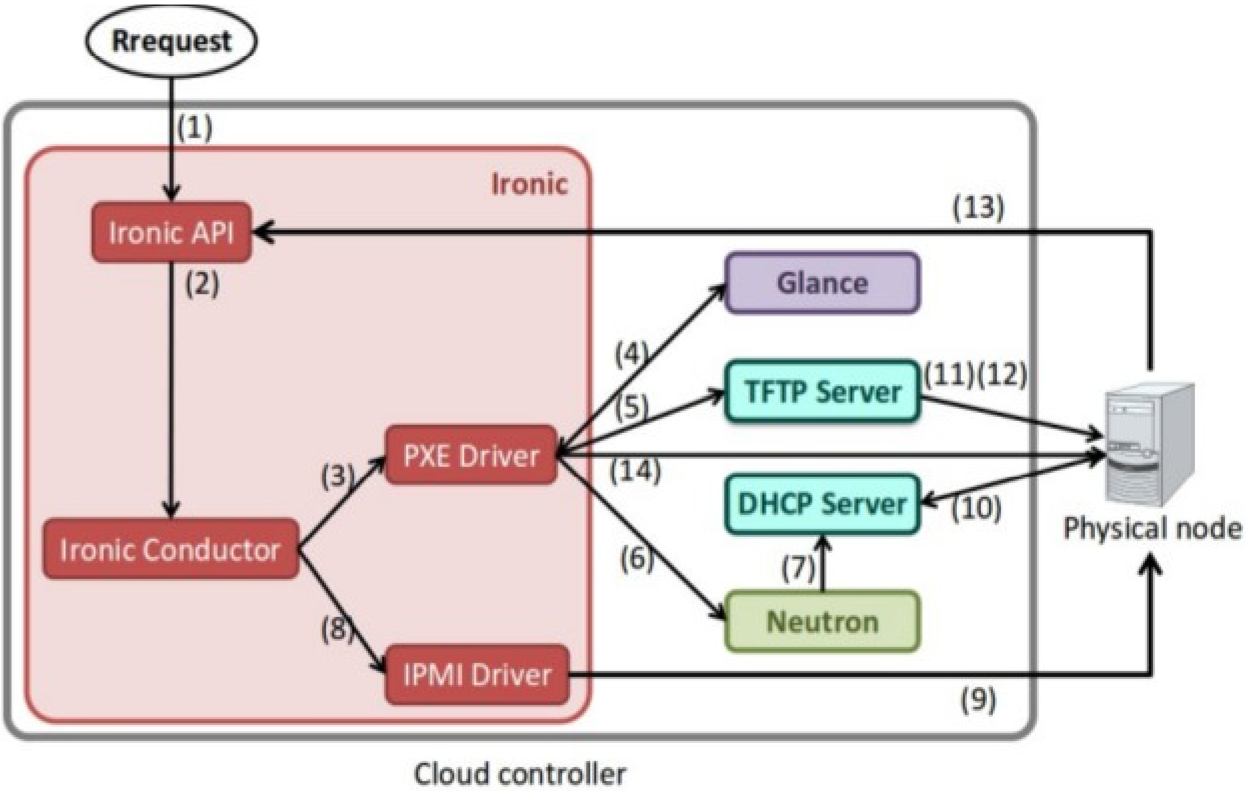
5. Physical node unitcast bootloader (pxelinux.0) request to the TFTP server which DHCP server informed to physical node

6. Physical node boots from bootloader which was gotten in(5), then unicast PXE configuration file request.

7. Physical node posts its own iSCSI connection information(e.g. IP address, port) to OpenStack API.

8. OpenStack performs iSCSI connection to physical node, then creates partition, copies image file. Finally, OpenStack reboots physical node.

8.Detailed Design



Explanation:

1. Sends request of creating physical node to Ironic API(Usually from Nova)
2. Ironic API sends request of creating physical node to Ironic Conductor
3. Ironic Conductor sends request of creating physical node to PXE Driver
4. PXE Driver requests image from Glance
5. PXE Driver copies the image which gotten from Glance to TFTP server
6. PXE Driver requests setting DHCP configuration from Neutron
7. Neutron sets DHCP configurations.
8. Ironic Conductor sends request of power on the physical node to IPMI Driver
9. IPMI Driver powers on physical node
10. Booted physical node unicast DHCP request
11. Physical node unitcast bootloader (pxelinux.0) request to the TFTP server which DHCP server informed to physical node
12. Physical node boots from bootloader which was gotten in(11), then unicast PXE configuration file request.
13. Physical node posts its own iSCSI connection information(e.g. IP address, port) to OpenStack API
14. OpenStack performs iSCSI connection to physical node, then creates partition, copies image file. Finally, OpenStack reboots physical node

9.Project Approach

It is clear from the above explanation to create BareMetal we need to have a System of IPMI Support . Because of lack of IPMI supported system, here we are going to create fake baremetal nodes for ironic using ssh instead of using IPMI.

10.Project Implementation

Step-1:

clone the repo using command:

```
git clone https://github.com/openstack-dev/devstack.git devstack
```

Step-2:

create local.conf in devstack/local.conf and copy the following contents:

```
[[local|localrc]]

# Credentials
DATABASE_PASSWORD=secrete
ADMIN_PASSWORD=secrete
SERVICE_PASSWORD=secrete
SERVICE_TOKEN=secrete
RABBIT_PASSWORD=secrete

# Enable Ironic API and Ironic Conductor
enable_service ironic
enable_service ir-api
enable_service ir-cond

# Enable Neutron which is required by Ironic and disable nova-network.
ENABLED_SERVICES=rabbit,mysql,key
ENABLED_SERVICES+=,n-api,n-crt,n-obj,n-cpu,n-cond,n-sch,n-novnc,n-cauth
ENABLED_SERVICES+=,neutron,q-svc,q-agt,q-dhcp,q-l3,q-meta,q-lbaas
ENABLED_SERVICES+=,g-api,g-reg
ENABLED_SERVICES+=,cinder,c-api,c-vol,c-sch,c-bak
ENABLED_SERVICES+=,ironic,ir-api,ir-cond
ENABLED_SERVICES+=,heat,h-api,h-api-cfn,h-api-cw,h-eng
ENABLED_SERVICES+=,horizon

# Create 3 virtual machines to pose as Ironic's baremetal nodes.
IRONIC_VM_COUNT=3
IRONIC_VM_SSH_PORT=22
IRONIC_BAREMETAL_BASIC_OPS=True
# The parameters below represent the minimum possible values to create
# functional nodes.
IRONIC_VM_SPECS_RAM=1024
IRONIC_VM_SPECS_DISK=10
```

```
# Size of the ephemeral partition in GB. Use 0 for no ephemeral partition.
IRONIC_VM_EPHEMERAL_DISK=0
VIRT_DRIVER=ironic
# By default, DevStack creates a 10.0.0.0/24 network for instances.
# If this overlaps with the hosts network, you may adjust with the
# following.
NETWORK_GATEWAY=10.1.0.1
FIXED_RANGE=10.1.0.0/24
FIXED_NETWORK_SIZE=256
# Log all output to files
LOGFILE=$HOME/devstack.log
SCREEN_LOGDIR=$HOME/logs
IRONIC_VM_LOG_DIR=$HOME/ironic-bm-logs
```

Step-3:

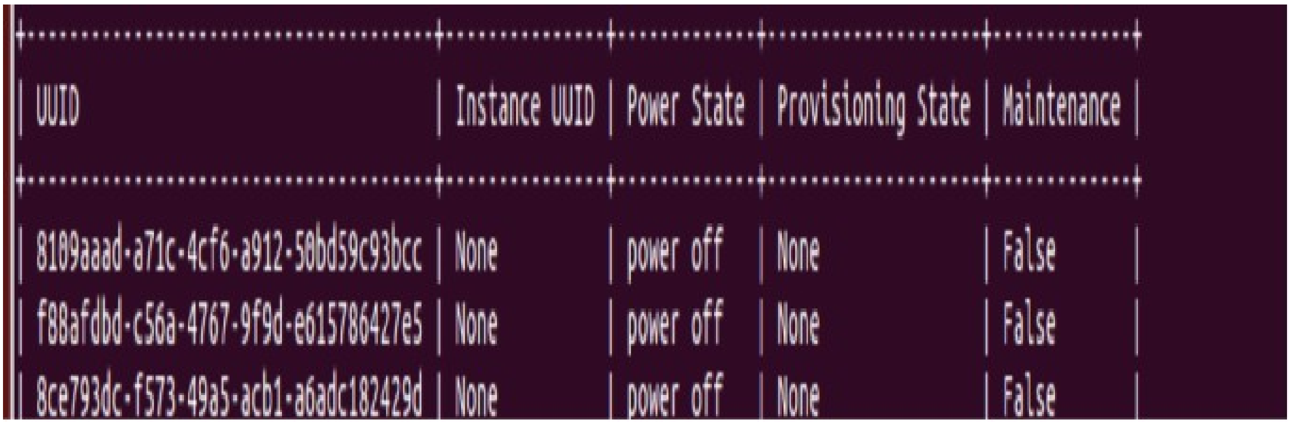
Now your devstack is ready for setup, simply run
./stack.sh

Step-4:

After devstack finishes running, you should see something similar to:
Horizon is now available at http://10.0.0.1/
Keystone is serving at http://10.0.0.1:5000/v2.0/
Examples on using novaclient command line is in exercise.sh
The default users are: admin and demo
The password: secrete
This is your host ip: 10.0.0.1

Step-5:

Created fake-nodes can be observed using command:
ironic node-list

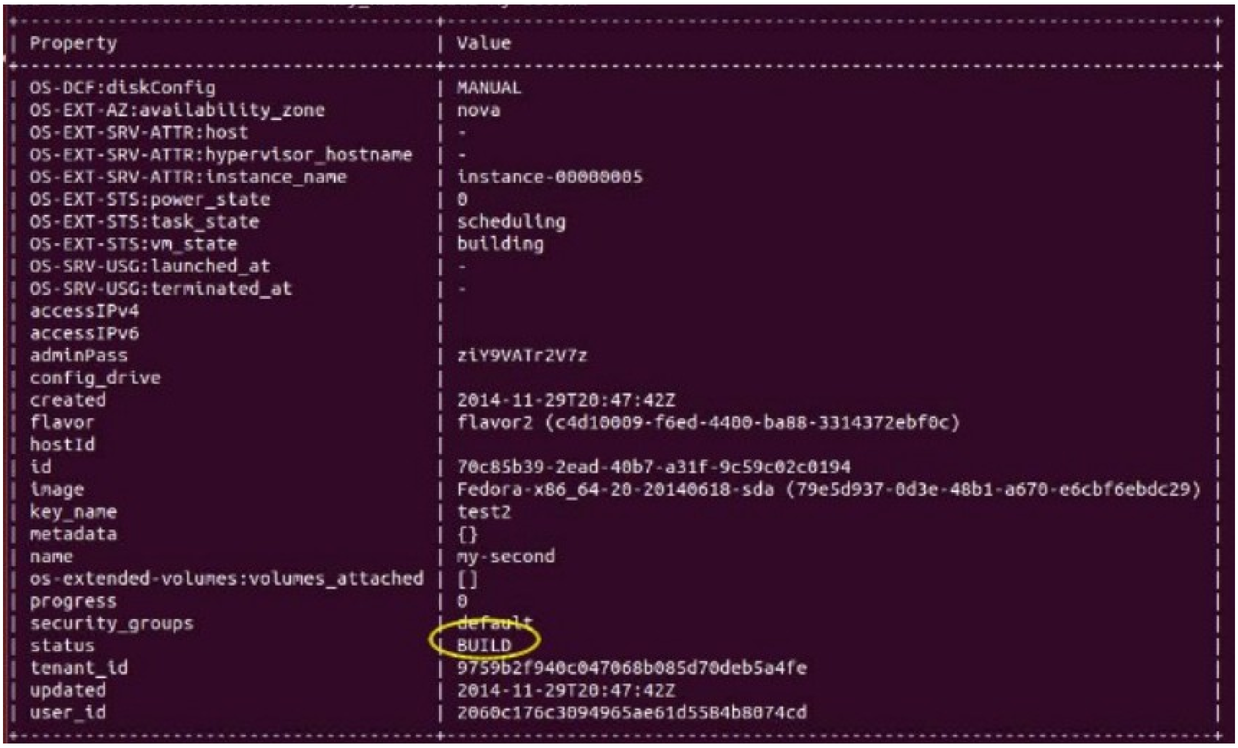


```
+--------------------------------------+---------------+-------------+--------------------+-------------+
| UUID                                 | Instance UUID | Power State | Provisioning State | Maintenance |
+--------------------------------------+---------------+-------------+--------------------+-------------+
| 8109aaad-a71c-4cf6-a912-50bd59c93bcc | None          | power off   | None               | False       |
| f88afdbd-c56a-4767-9f9d-e615786427e5 | None          | power off   | None               | False       |
| 8ce793dc-f573-49a5-acb1-a6adc182429d | None          | power off   | None               | False       |
```

With all power states as “power-off”since no instance was created

Step-6:

nova boot --nic net-id”=<net-id> --flavor baremetal –image <image-id> --key_name test2 my-first

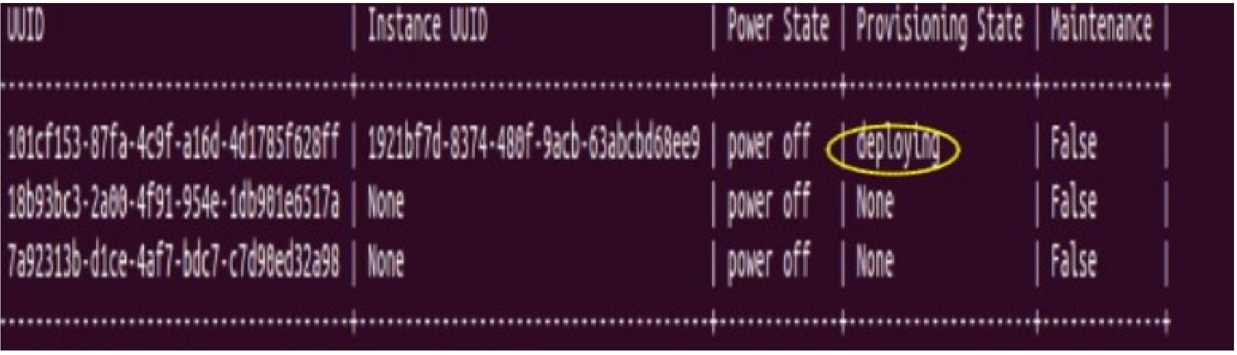


```
+--------------------------------------+------------------------------------------------------------------+
| Property                             | Value                                                            |
+--------------------------------------+------------------------------------------------------------------+
| OS-DCF:diskConfig                    | MANUAL                                                           |
| OS-EXT-AZ:availability_zone          | nova                                                             |
| OS-EXT-SRV-ATTR:host                 | -                                                                |
| OS-EXT-SRV-ATTR:hypervisor_hostname  | -                                                                |
| OS-EXT-SRV-ATTR:instance_name        | instance-00000005                                                |
| OS-EXT-STS:power_state               | 0                                                                |
| OS-EXT-STS:task_state                | scheduling                                                       |
| OS-EXT-STS:vm_state                  | building                                                         |
| OS-SRV-USG:launched_at               | -                                                                |
| OS-SRV-USG:terminated_at             | -                                                                |
| accessIPv4                           |                                                                  |
| accessIPv6                           |                                                                  |
| adminPass                            | ziY9VATr2V7z                                                     |
| config_drive                         |                                                                  |
| created                              | 2014-11-29T20:47:42Z                                             |
| flavor                               | flavor2 (c4d10009-f6ed-4400-ba88-3314372ebf0c)                   |
| hostId                               |                                                                  |
| id                                   | 70c85b39-2ead-40b7-a31f-9c59c02c0194                             |
| image                                | Fedora-x86_64-20-20140618-sda (79e5d937-0d3e-48b1-a670-e6cbf6ebdc29) |
| key_name                             | test2                                                            |
| metadata                             | {}                                                               |
| name                                 | my-second                                                        |
| os-extended-volumes:volumes_attached | []                                                               |
| progress                             | 0                                                                |
| security_groups                      | default                                                          |
| status                               | BUILD                                                            |
| tenant_id                            | 9759b2f940c047068b085d70deb5a4fe                                 |
| updated                              | 2014-11-29T20:47:42Z                                             |
| user_id                              | 2060c176c3094965ae61d55B4b8074cd                                 |
+--------------------------------------+------------------------------------------------------------------+
```

Step-7:

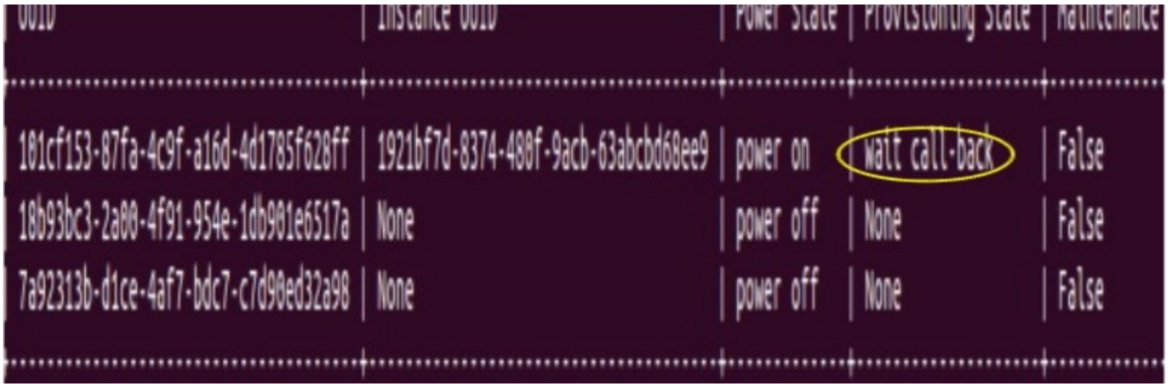
Now ironic nodes will go through the following stages:

(i)



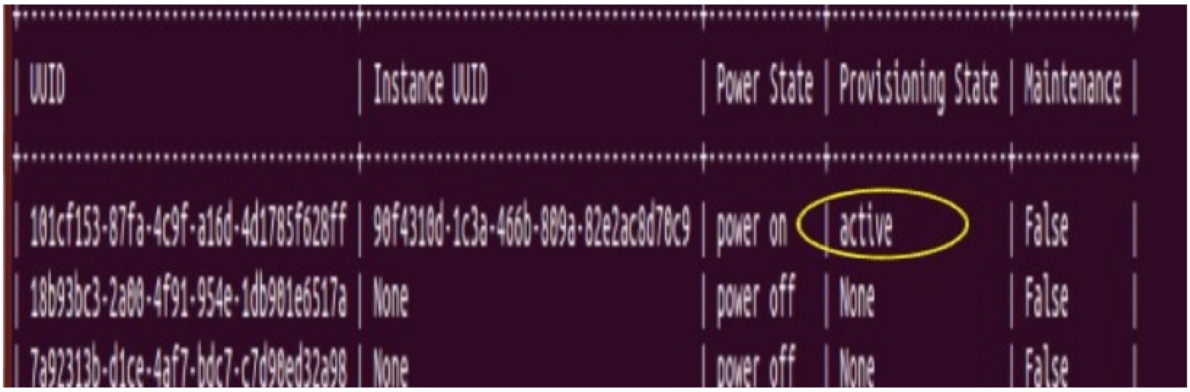
```
UUID                                 | Instance UUID                        | Power State | Provisioning State | Maintenance |
+--------------------------------------+--------------------------------------+-------------+--------------------+-------------+
181cf153-87fa-4c9f-a16d-4d1785f628ff | 1921bf7d-8374-480f-9acb-63abcbd68ee9 | power off   | deploying          | False       |
18b93bc3-2a80-4f91-954e-1db981e6517a | None                                 | power off   | None               | False       |
7a92313b-d1ce-4af7-bdc7-c7d98ed32a98 | None                                 | power off   | None               | False       |
+--------------------------------------+--------------------------------------+-------------+--------------------+-------------+
```

(ii)



```
UUID                                 | Instance UUID                        | Power State | Provisioning State | Maintenance
+--------------------------------------+--------------------------------------+-------------+--------------------+-------------
181cf153-87fa-4c9f-a16d-4d1785f628ff | 1921bf7d-8374-480f-9acb-63abcbd68ee9 | power on    | wait call-back     | False
18b93bc3-2a80-4f91-954e-1db981e6517a | None                                 | power off   | None               | False
7a92313b-d1ce-4af7-bdc7-c7d98ed32a98 | None                                 | power off   | None               | False
+--------------------------------------+--------------------------------------+-------------+--------------------+-------------
```

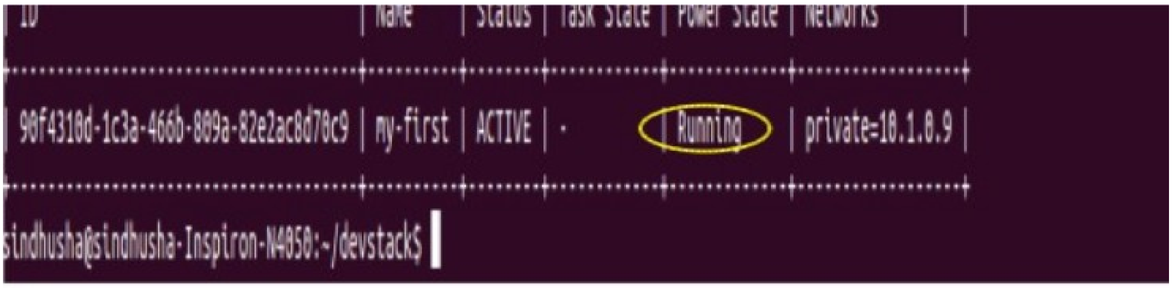
(iii)



```
+--------------------------------------+--------------------------------------+-------------+--------------------+-------------+
| UUID                                 | Instance UUID                        | Power State | Provisioning State | Maintenance |
+--------------------------------------+--------------------------------------+-------------+--------------------+-------------+
| 101cf153-87fa-4c9f-a16d-4d1785f628ff | 90f4310d-1c3a-466b-809a-82e2ac8d70c9 | power on    | active             | False       |
| 18b93bc3-2a00-4f91-954e-1db901e6517a | None                                 | power off   | None               | False       |
| 7a92313b-d1ce-4af7-bdc7-c7d98ed32a98 | None                                 | power off   | None               | False       |
```

Step-8:

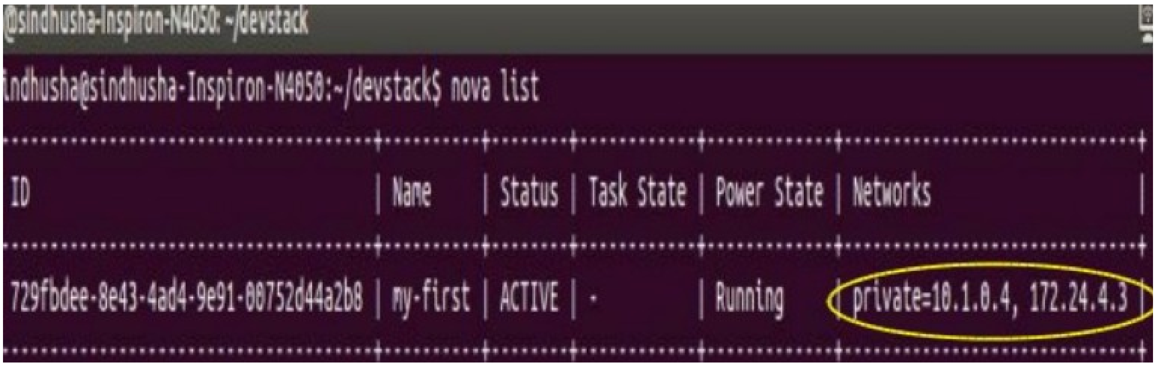
And now we can see the instance is Running with command:
nova list



```
| ID                                   | Name     | Status | Task State | Power State | Networks         |
+--------------------------------------+----------+--------+------------+-------------+------------------+
| 90f4310d-1c3a-466b-809a-82e2ac8d70c9 | my-first | ACTIVE | -          | Running     | private=10.1.0.9 |
+--------------------------------------+----------+--------+------------+-------------+------------------+
sindhusha@sindhusha-Inspiron-N4050:~/devstack$
```

Step-9:

ssh to created instance from external network using “Floating IP”
(i)check available floating-ip using command:
nova flating-ip-list
(ii)create floating-ip:
nova floating-ip-create
(iii)Assign created floating-ip to instance
nova add floating-ip my-first 172.24.4.3



```
@sindhusha-Inspiron-N4050: ~/devstack
indhusha@sindhusha-Inspiron-N4050:~/devstack$ nova list
+--------------------------------------+----------+--------+------------+-------------+------------------------------+
| ID                                   | Name     | Status | Task State | Power State | Networks                     |
+--------------------------------------+----------+--------+------------+-------------+------------------------------+
| 729fbdee-8e43-4ad4-9e91-00752d44a2b8 | my-first | ACTIVE | -          | Running     | private=10.1.0.4, 172.24.4.3 |
+--------------------------------------+----------+--------+------------+-------------+------------------------------+
```

Now with that floating-ip can ping from external network
and Can ssh to that system using:
ssh -i test.pem cirros@172.24.4.3

Step-10:

If in case want to create ironic node on other system, we need to create ironic node by ssh to required system. Which involves following steps:

1.Chassis Create

```
ironic chassis-create
```

2.node-create

```
ironic node-create --chassis_uuid 98834cf1-6ed3-4fd2-98c8-f1c98184bd54 --driver pxe_ssh -i pxe_deploy_kernel=1a229813-bb82-4a0c-8057-47f7ed559a4f -i pxe_deploy_ramdisk=c866ad86-9846-41b5-9766-4089788b5950 -i ssh_virt_type=virsh -i ssh_address=10.1.98.197 -i ssh_port=22 -i ssh_username="sindhusha" -p cpus=1 -p memory_mb=1024 -p local_gb=20 -p cpu_arch=x86_64
```

3.port-create

```
ironic port-create --address 56:84:7a:fe:97:99 --node_uuid 0bdabd94-7667-4b19-8de4-27fe5cf0d516
```

4.Instance info updation

```
ironic node-update 72ba92fb-1afa-496e-ae95-15ba3f3a3c8f add instance_info/image_source=54514ec1-a95a-4f12-ab7b-d6d9abf15f33
ironic node-update 72ba92fb-1afa-496e-ae95-15ba3f3a3c8f add instance_info/root_gb=1
```