RHOSP 12 Director Installation on MaxCore™ Platform

Configuration Note

March, 2018

This configuration note describes the installation and configuration of Red Hat OpenStack Platform 12 director on MaxCore™ Platform with a SharpStreamer™ Pro PCIE-7211-2 card as application CPU (aCPU). It also describes installation of Undercloud and provisioning of Overcloud compute and controller nodes using the Undercloud.

OpenStack

OpenStack is open source cloud computing software, which controls the pools of storage, compute, and network resources. The following figure depicts OpenStack core services.
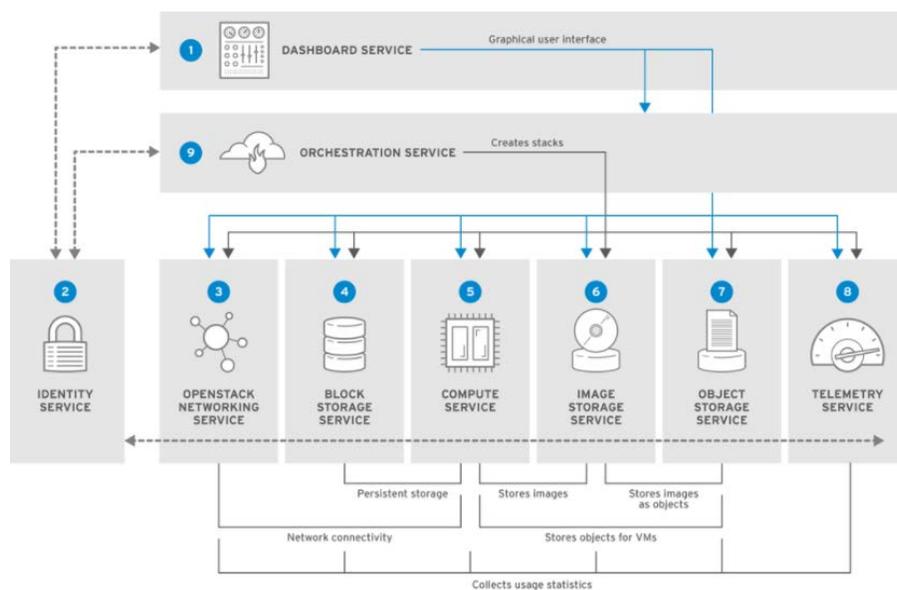

Figure 1 OpenStack Core Services[1]

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[1] Source: RHOSP Architecture Guide

Red Hat OpenStack Platform Director

The Red Hat OpenStack Platform (RHOSP) director is a toolset for installing and managing a complete OpenStack environment. This toolset is based on the OpenStack-On-OpenStack (TripleO) project. This project utilizes OpenStack components to create a fully operational OpenStack environment. This provides a simple method for installing a complete, lean, and robust Red Hat OpenStack Platform environment.

The RHOSP director uses two main concepts, Undercloud and Overcloud. The following figure shows the correlation between Undercloud and Overcloud.
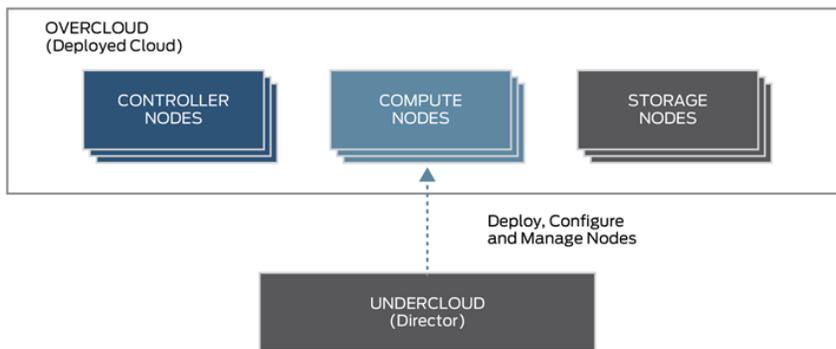

Figure 2 Correlation between Undercloud and Overcloud[2]

The Undercloud deploys the Overcloud, which is represented in the following figure.
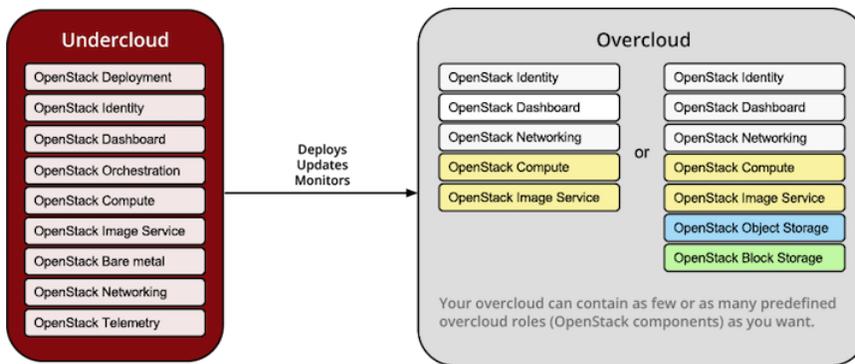

Figure 3 Undercloud Configuration on Overcloud[3]

Undercloud

The Undercloud is the key director node. It is a single-system OpenStack installation that includes components for provisioning and managing the OpenStack nodes that form OpenStack environment

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[2] Source: RHOSP 12 Director Installation and Usage manual
[3] Source: TripleO Install Guide

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(the Overcloud). The components that form the Undercloud provide Environment Planning, Bare Metal System Control, and Orchestration functions. For more information, refer section 1.1. UNDERCLOUD in RHOSP 12 Director Installation and Usage manual.

Overcloud

Overcloud is the resulting RHOSP environment created using the Undercloud. This includes different node roles that you define based on the OpenStack Platform environment you aim to create. The Undercloud includes a default set of Overcloud node roles, Controller and Compute.

Controller node provides administration and networking for the OpenStack environment.

Compute node provides computing resources for the OpenStack environment. A default Compute node contains OpenStack Compute (nova), KVM/QEMU, OpenStack Telemetry (ceilometer) agent, and Open vSwitch components.

Undercloud and Overcloud Components

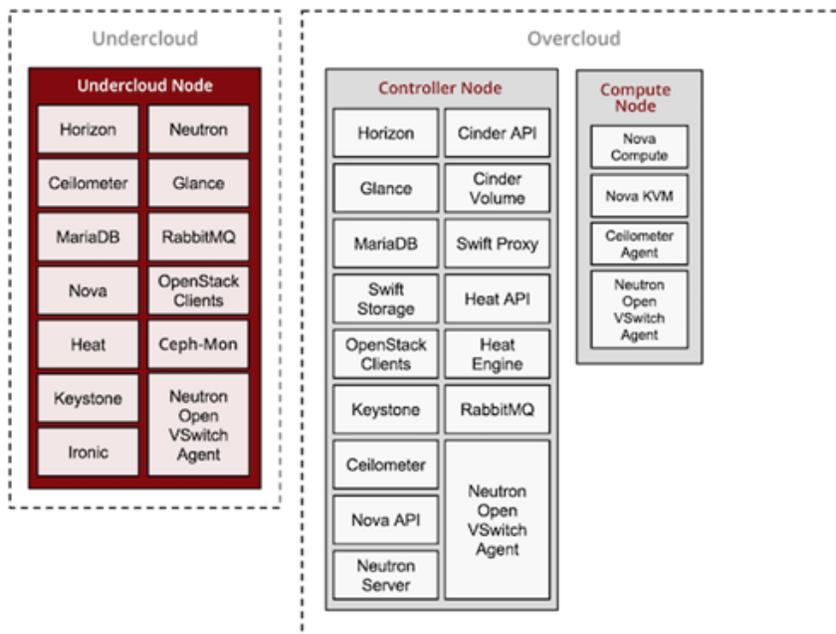The following figure shows the components of Undercloud and Overcloud.

Figure 4 Undercloud and Overcloud Components[4]

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[4] Source: TripleO Install Guide

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Minimum Requirements

This section provides the key requirements for setting up an environment to provision RHOSP using the director. It also provides the host hardware and software requirements for provisioning OpenStack services using the director.

System Requirements

Hardware

- One MaxCore Platform
- One PCIE-7211-2 (as aCPU cards)
- A PCIE-7211-2 /7410 (as management CPU card)
- Storage Hard Disk 500 GB

Software

- Red Hat Enterprise Linux 7.4
- Red Hat OpenStack Platform 12
- Red Hat Subscriptions - Red Hat OpenStack Platform Preview (60 Day Self-Supported)
                          Red Hat Enterprise Linux Server Corporate Account
- Hypervisor - KVM
- Power Management Tools (IPMI and Virtual Bare Metal Controller (VBMC))

Network

- Virtual Functions (VFs) used as NIC interfaces
- Two VFs used per node
- Two Bridge networks br-ext and br-ctlplane used per node
- Public network should be accessible

Note:

- One PCIE-7211-2 card as aCPU is used for OpenStack Platform director installation.
- KVM Hypervisor is used for creating Undercloud and Overcloud Virtual machines (VM).
- For this Proof of Concept (PoC), Compute and Controller nodes are created as VMs.

Undercloud VM Requirements

The Undercloud system that hosts the director provides provisioning and management for all the nodes in the Overcloud.

Minimum Requirements:

- 4 vCPUs
- 6 GB of RAM
- 100 GB of available disk space on the root disk. This includes:
    - 10 GB for container images

- o   10 GB to accommodate QCOW2 image conversion and caching during the node provisioning process
- o   80 GB+ for general usage, logging, metrics, and growth
- External network (br-ex)
- Provisional network (br-ctlplane)
- Red Hat Enterprise Linux 7.4 installed as Undercloud VM operating system.
- SELinux is enabled on the host.

Overcloud VM Requirements

Overcloud nodes provisioned by Undercloud should meet specific requirements.

Minimum Requirements:

Compute Node:

- 2 vCPUs
- 6 GB of RAM
- 40 GB of available disk space on the root disk.
- Power management using IPMI

Controller Node:

- 2 vCPUs
- 1.5 GB of memory per virtual CPU (vCPU).
- 32 GB of available disk space on the root disk.
- Power management using IPMI

MaxCore RHOSP System

The following figure demonstrates MaxCore RHOSP system model implemented for this PoC.
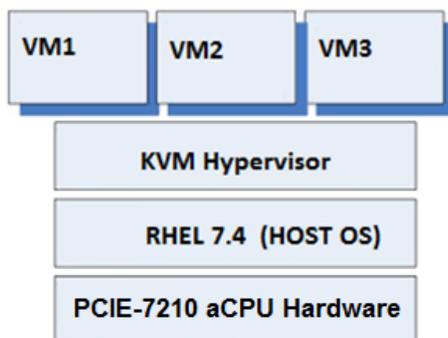

Figure 5 MaxCore RHOSP System

- PCIE-7211-2 aCPU Slot15 CPU-2 as Host Machine
- RHEL 7.4 is Host OS
- KVM is Hypervisor

- VM1: Undercloud (Director Node)
- VM2: Overcloud Compute Node
- VM3: Overcloud Controller Node

MaxCore RHOSP Network Setup

The following diagram explains the network setup between Undercloud and Overcloud. The Intel onboard Niantic 82599 VFs are used in OSP director node for provisioning network and accessing external network. The Linux bridge *br-ctlplane* is used for provisioning network on Overcloud nodes and *br-ex* is used for accessing external network.
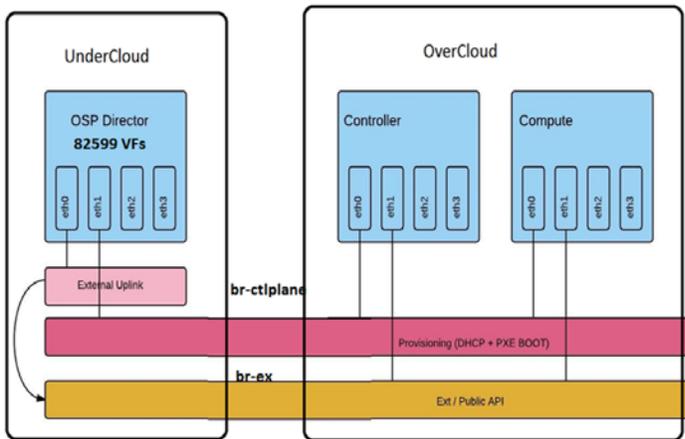

Figure 6 MaxCore RHOSP Network Setup[5]
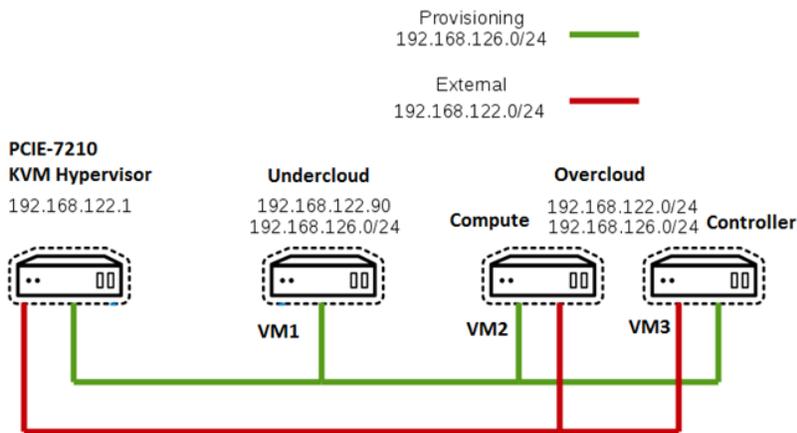
MaxCore RHOSP Network Topology

Figure 7 Network Topology Undercloud and Overcloud (Controller/Compute node)[6]

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[5] Source: http://blog.domb.net
[6] Source: keithtenzer.com

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Installing Red Hat OpenStack Platform 12 Director

We followed the Red Hat OpenStack Platform 12 Director Installation and Usage manual as a reference for installing Red Hat OpenStack Platform 12 Director on a MaxCore Platform. For detailed information, refer RHOSP 12 Director Installation and Usage manual.

Prerequisites

Before starting Red Hat OpenStack Platform 12 Director installation procedure, ensure that RHEL 7.4 is installed on PCIE-7211-2 (aCPU) as Host OS.

Note: To install RHEL 7.4 on PCIE-7211-2 card, follow the Red Hat standard installation procedure. No additional steps are required. Download the RHEL 7.4 ISO from the following location. https://access.redhat.com/downloads/content/69/ver=/rhel---7/7.4/x86_64/product-software

After successful installation of RHEL 7.4 OS on PCIE-7211-2 card, perform the following steps:

Installing KVM-Hypervisor on PCIE-7211-2 (host machine)

Execute the following command to install KVM packages on host machine.
```
$ yum install libvirt-client libvirt-daemon qemu-kvm libvirt-daemon-
driver-qemu libvirt-daemon-kvm virt-install bridge-utils rsync
```

Creating Undercloud VM on KVM Host

1. Add br-ex and br-ctlplane bridges on KVM host using following commands.
   ```
   $ brctl addbr br-ex
   $ brctl addbr br-ctlplane
   ```
2. Execute the following command to create Undercloud VM on KVM host.
   ```
   $ virt-install --name undercloud --memory=16384 --vcpus=4 --
   location /var/lib/libvirt/images/rhel-server-7.4-x86_64-dvd.iso -
   -disk size=100 --network bridge=br-ex --network bridge=br-new --
   graphics=none --hvm --os-variant=rhel7 --console
   pty,target_type=serial --extra-args 'console=ttyS0,115200n8'
   ```

Installing RHOSP Director on Undercloud VM

After creating Undercloud VM, follow the steps provided in sections 4.1 to 4.5 of RHOSP 12 Director Installation and Usage manual to enable the necessary subscriptions and repositories.

The director installation process requires certain settings to determine your network configurations. These settings are configured in `undercloud.conf` template file available under the stack user's home directory. Refer section 4.6. CONFIGURING THE DIRECTOR in RHOSP 12 Director Installation and Usage manual.

1. Modify the following parameters in `undercloud.conf` template file.
   ```
   generate_service_certificate = true
   certificate_generation_ca = local
   local_interface = <local interface name>
   ```

2. Save the `undercloud.conf` template file and execute the following command to install the Undercloud.

```
[stack@director ~]$ openstack undercloud install
```

This launches the director's configuration script. The director installs additional packages and configures its services to suit the settings in the `undercloud.conf`. This script takes several minutes to complete. The following message is displayed when RHOSP Director is successfully installed on Undercloud VM.

```
#############################################################
Undercloud install complete.
. . . .
#############################################################
```

Verifying OpenStack Platform Services Status on Undercloud

Execute the following command to verify OpenStack Platform Services Status on Undercloud.

```
[stack@director ~]$ sudo systemctl list-units openstack-*
```

UNIT	LOAD	ACTIVE SUB
openstack-glance-api.service	loaded	active running
openstack-heat-engine.service	loaded	active running
openstack-ironic-conductor.service	loaded	active running
openstack-ironic-inspector-dnsmasq.service	loaded	active running
openstack-ironic-inspector.service	loaded	active running
openstack-mistral-api.service	loaded	active running
openstack-mistral-engine.service	loaded	active running
openstack-mistral-executor.service	loaded	active running
openstack-nova-api.service	loaded	active running
openstack-nova-compute.service	loaded	active running
openstack-nova-conductor.service	loaded	active running
openstack-nova-scheduler.service	loaded	active running
openstack-swift-account-reaper.service	loaded	active running
openstack-swift-account.service	loaded	active running
openstack-swift-container-sync.service	loaded	active running
openstack-swift-container-updater.service	loaded	active running
openstack-swift-container.service	loaded	active running
openstack-swift-object-reconstructor.service	loaded	active running
openstack-swift-object-updater.service	loaded	active running
openstack-swift-object.service	loaded	active running

```
openstack-swift-proxy.service                    loaded active running

openstack-zaqar@1.service                        loaded active running
```

Ensure all Undercloud OpenStack services (shown in [Undercloud and Overcloud Components](#)) are loaded, active, and running.

Initializing Stack User to Get Director's OpenStack CLI

Execute the following command to initialize the stack user to use the command line tools.

```
[stack@director ~]$ source ~/stackrc
```

The prompt indicates OpenStack commands to authenticate and execute against the Undercloud.

```
(undercloud) [stack@director ~]$
```

Now, we can use the director's command line tools.

Obtaining Images for Overcloud Node

The director requires disk images such as introspection kernel, deployment kernel, Overcloud kernel and ramdisk for provisioning Overcloud nodes. For more information, refer section 4.7. OBTAINING IMAGES FOR OVERCLOUD NODE in [Red Hat OpenStack Platform 12 Director Installation and Usage](#) manual.

Setting a Name Server on the Undercloud Neutron Subnet

Execute the following command to configure Name server on the Undercloud Neutron Subnet.

```
(undercloud) [stack@director]$ neutron subnet-update <Sub-net-UUID> --
dns-nameserver 8.8.8.8
```

This completes Undercloud configuration.

Creating Overcloud VMs

Execute the following commands on Director Machine to create the Overcloud VMs (Compute and Controller).

```
[stack@director ~]$ virt-install --name controller --memory=4096 --
vcpus=1 --location /var/lib/libvirt/images/rhel-server-7.4-x86_64-
dvd.iso --disk size=32 --network bridge=br-ex --network bridge=br-
ctlplane --graphics=none --hvm --os-variant=rhel7 --console
pty,target_type=serial --extra-args 'console=ttyS0,115200n8'

[stack@director ~]$ virt-install --name compute--memory=4096 --vcpus=1
--location /var/lib/libvirt/images/rhel-server-7.4-x86_64-dvd.iso --
disk size=40 --network bridge=br-ex --network bridge=br-ctlplane --
graphics=none --hvm --os-variant=rhel7 --console
pty,target_type=serial --extra-args 'console=ttyS0,115200n8'
```

virt-install creates two Overcloud VMs.

```
[root@kvm-7210 ~]# virsh list --all
```

```
Id      Name                State

----------------------------------------------------

1       undercloud          running

2       compute             running

3       controller          running
```

Configuring VBMC Power Management Drivers

As director is using virtual machines as nodes on the KVM host, VBMC controls the power management through emulated IPMI devices. This allows using the standard IPMI parameters provided in Section 6.1. REGISTERING NODES FOR THE OVERCLOUD in RHOSP 12 Director Installation and Usage manual.

Note: This option uses virtual machines instead of bare metal nodes. This means it is available for testing and evaluation purposes only. It is not recommended for Red Hat OpenStack Platform enterprise environments.

1. Install Virtual Bare Metal Controller (VBMC) on KVM host using following commands.
    ```
    [stack@director ~]$ sudo subscription-manager repos --
    enable=rhel-7-server-openstack-12-rpms
    [stack@director ~]$   sudo yum install -y python-virtualbmc
    ```
2. Create a VBMC for each virtual machine using the VBMC command.
    For example, to create a BMC for virtual machines named Compute and Controller, execute the following commands.
    ```
    [stack@director ~]$ vbmc add Compute  --port 6230 --username root
    –password  changeit
    [stack@director ~]$ vbmc add Controller --port 6231 --username
    root –password changeit
    ```
3. Install VBMC using the following commands after successfully registering Compute and Controller nodes using VBMC.
    Start each BMC
    ```
    [stack@director ~]$ vbmc start compute
    [stack@director ~]$ vbmc start controller
    ```
    Note: You must repeat this step after rebooting the KVM host.
4. Allow Firewall rule on KVM host for created VBMC ports, after starting VBMC for Compute and Controller nodes.
    ```
    [stack@director ~]$ sudo firewall-cmd --permanent --zone=public -
    -add-port=<vbmc-vm-port>/udp
    ```
5. Verify Overcloud nodes power status from Undercloud.

    ```
    (undercloud) [stack@director ~]$ ipmitool -I lanplus -H
    192.168.122.1 -U root –P changeit  -p 6230 power status

    Chassis Power is on
    ```

```
(undercloud) [stack@director ~]$ ipmitool -I lanplus -H
192.168.122.1 -U root -P changeit  -p 6231 power status

Chassis Power is on
```

Refer Appendix B.6. VIRTUAL BARE METAL CONTROLLER (VBMC) in [RHOSP 12 Director Installation and Usage](#) manual to install VBMC and to configure Controller and Compute ports.

Installing Overcloud

After successfully completing Power Management with VBMC, refer Chapter 6. CONFIGURING A BASIC OVERCLOUD WITH THE CLI TOOLS in [RHOSP 12 Director Installation and Usage](#) manual to install Overcloud.

Follow the below Workflow to install Overcloud sections.

1. Create a node definition template and register blank nodes in the director.
2. Inspect hardware of all nodes using OpenStack Ironic service.
3. Tag nodes into roles.
4. Define additional node properties.

Use the following parameters in your node registration file (`/home/stack/instackenv.json`):

pm_type - Set this option to `pxe_ipmitool`.

pm_user; **pm_password** - The IPMI username and password for the node's virtual BMC device.

pm_addr - The IP address of the KVM host that contains the node.

pm_port - The port to access the specific node on the KVM host.

mac - A list of MAC addresses for the network interfaces on the node. Use only the MAC address for the Provisioning NIC of each system.

Sample node definition file `/home/stack/instackenv.json` for registering two nodes is shown below.

```
"nodes": [

{

"pm_type": "pxe_ipmitool",

"mac": [

"52:54:00:98:0b:cf"

],

"pm_user": "root",

"pm_password": "changeit",

"pm_addr": "192.168.122.1",
```

```
"pm_port": "6230",

"name": "compute"

},

{

"pm_type": "pxe_ipmitool",

"mac": [

"52:54:00:41:60:a5"

],

"pm_user": "root",

"pm_password": "changeit",

"pm_addr": "192.168.122.1",

"pm_port": "6231",

"name": "controller"

}

]

}
```

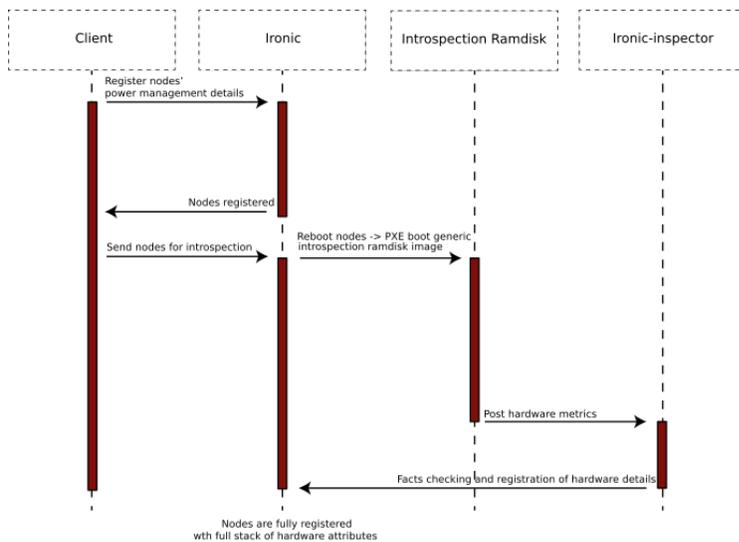The following figure shows process flow diagram of Ironic service.

---

[7] Source: TripleO Install Guide

- The user, via the command-line tools, or through direct API calls, registers the power management credentials for a node with Ironic.
- The user then instructs Ironic to reboot the node.
- Because the node is new, and not already fully registered, there are no specific PXE-boot instructions for it. In that case, the default action is to boot into an introspection ramdisk
- The introspection ramdisk probes the hardware on the node and gathers facts, including the number of CPU cores, the local disk size and the amount of RAM.
- The ramdisk posts the facts to the ironic-inspector API.
- All facts are passed and stored in the Ironic database.

You can observe the state of Overcloud nodes change as shown below.

Provisioning State → Enroll → Verifying → Manageable → Available

Power State → None → Power Off → Power On

(undercloud) [stack@director ~]$ **openstack baremetal node list**

```
+-------------------------------------+------+---------------+-------------+-------------------+------------
| UUID                                | Name | Instance UUID | Power State | Provisioning State | Maintenance |
+-------------------------------------+------+---------------+-------------+--------------------
| 8c89cb17-f4dd-445d-9f19-45f6da248003 | None | None          | None        | enroll             | False
|
| 45f2d869-1aa5-4fb0-9b53-e37ae363994f | None | None          | None        | enroll             | False
|
+-------------------------------------+------+---------------+-------------+-------------------+------------
```

(undercloud) [stack@director ~]$ **openstack baremetal node list**

```
+-------------------------------------+------+---------------+-------------+-------------------+------------
+
| UUID                                | Name | Instance UUID | Power State | Provisioning State | Maintenance
|
+-------------------------------------+------+---------------+-------------+-------------------+------------
+
| 8c89cb17-f4dd-445d-9f19-45f6da248003 | None | None          | None        | verifying          | False
|
| 45f2d869-1aa5-4fb0-9b53-e37ae363994f | None | None          | None        | verifying          | False
|
+-------------------------------------+------+---------------+-------------+-------------------+------------
```

(undercloud) [stack@director ~]$ **openstack baremetal node list**

```
+-------------------------------------+------+---------------+-------------+-------------------+------------
+
| UUID                                | Name | Instance UUID | Power State | Provisioning State | Maintenance
|
+-------------------------------------+------+---------------+-------------+-------------------+------------
+
```

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```
| 5fd8da50-7c58-44f5-a22a-3baa9e925936 | None | None          | None            | manageable         | False
|
| 64712ed2-6378-4f7b-a834-276a57697387 | None | None          | None            | manageable         | False
|
+--------------------------------------+------+---------------+-----------------+--------------------+------------
+
```

(undercloud) [stack@director ~]$ **openstack baremetal node list**

```
+--------------------------------------+------+---------------+-----------------+--------------------+------------
+
| UUID                                 | Name | Instance UUID | Power State | Provisioning State | Maintenance
|
+--------------------------------------+------+---------------+-----------------+--------------------+------------
+
| 5fd8da50-7c58-44f5-a22a-3baa9e925936 | None | None          | power on    | manageable         | False
|
| 64712ed2-6378-4f7b-a834-276a57697387 | None | None          | power on    | manageable         | False
|
+--------------------------------------+------+---------------+-----------------+--------------------+------------
+
```

After successfully registering Compute and Controller nodes for the Overcloud, deploy the Overcloud using environment files.

(undercloud) [stack@director ~]$ openstack overcloud deploy \

                                         --disable-validations --templates

                                         -e <environment-files>

To access Overcloud, execute the following command.

(undercloud) [stack@director ~]$ source ~/overcloudrc

(overcloud) $

To access Undercloud from Overcloud, execute the following command.

(overcloud) $ source ~/stackrc

(undercloud)$

Each node in the Overcloud also contains a user called heat-admin. The stack user has SSH access to this user on each node. To access a node over SSH, find the IP address of the desired node:

(undercloud) $ openstack server list

Connect to the node using the **heat-admin** user and the node's IP address: (undercloud) $ ssh heat-admin@192.168.122.23

Limitations

- VMs are used as Overcloud nodes, instead of bare metal.
- VBMC is used for power management control for Overcloud nodes, instead of BMC.
- RHOSP 12 installation on PCIE-7410 is not supported. During installation, db-sync failure encountered and the Undercloud installation failed.

Error log

```
2018-01-20 20:37:50,709 INFO: Notice:
/Stage[main]/Firewall::Linux::Redhat/File[/etc/sysconfig/iptables]: Dependency
Exec[neutron-db-sync] has failures: true
2018-01-20 20:37:50,709 INFO: Notice:
/Stage[main]/Firewall::Linux::Redhat/File[/etc/sysconfig/iptables]: Dependency
Exec[mistral-db-sync] has failures: true
2018-01-20 20:37:50,709 INFO: Notice:
/Stage[main]/Firewall::Linux::Redhat/File[/etc/sysconfig/iptables]: Dependency
Exec[nova-db-sync] has failures: true
2018-01-20 20:37:50,709 INFO: Warning:
/Stage[main]/Firewall::Linux::Redhat/File[/etc/sysconfig/iptables]: Skipping
because of failed dependencies
2018-01-20 20:37:50,710 INFO: Notice:
/Stage[main]/Firewall::Linux::Redhat/File[/etc/sysconfig/ip6tables]: Dependency
Exec[neutron-db-sync] has failures: true
2018-01-20 20:37:50,710 INFO: Notice:
/Stage[main]/Firewall::Linux::Redhat/File[/etc/sysconfig/ip6tables]: Dependency
Exec[mistral-db-sync] has failures: true
2018-01-20 20:37:50,710 INFO: Notice:
/Stage[main]/Firewall::Linux::Redhat/File[/etc/sysconfig/ip6tables]: Dependency
Exec[nova-db-sync] has failures: true
######################################################################
Undercloud install failed.

Reason: os-refresh-config failed. See log for details.

See the previous output for details about what went wrong.  The full install
log can be found at /home/stack/.instack/install-undercloud.log.

######################################################################
Traceback (most recent call last):
  File "<string>", line 1, in <module>
  File "/usr/lib/python2.7/site-packages/instack_undercloud/undercloud.py",
line 1779, in install
    _run_orc(instack_env)
  File "/usr/lib/python2.7/site-packages/instack_undercloud/undercloud.py",
line 1322, in _run_orc
    _run_live_command(args, instack_env, 'os-refresh-config')
  File "/usr/lib/python2.7/site-packages/instack_undercloud/undercloud.py",
line 601, in _run_live_command
    raise RuntimeError('%s failed. See log for details.' % name)
RuntimeError: os-refresh-config failed. See log for details.
Command 'instack-install-undercloud' returned non-zero exit status 1
```

Contact Address

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