

04. Nova 服务组件

系统环境准备 CentOS7 + OpenStack Rocky

考官方文档：

<https://docs.openstack.org/keystone/rocky/install/keystone-install-rdo.html>

4.1.在控制节点安装 nova 计算服务

1) 创建 nova 相关数据库

4.2.在 keystone 上面注册 nova 服务

1) 在 keystone 上创建 nova 用户

2) 在 keystone 上将 nova 用户配置为 admin 角色并添加进 service 项目

3) 创建 nova 计算服务的实体

4) 创建计算服务的 API 端点 (endpoint)

5) 这个版本的 nova 增加了 placement 项目

4.3.在控制节点安装 nova 相关服务

1) 安装 nova 相关软件包

2) 快速修改 nova 配置

3) 修改 nova 的虚拟主机配置文件

4.4.同步 nova 数据（注意同步顺序）

1) 初始化 nova-api 和 placement 数据库

2) 初始化 nova_cell0 和 nova 数据库

5) 检查确认 cell0 和 cell1 注册成功

4.5.启动 nova 服务

1) 启动 nova 服务并设置为开机自启动

4.1.在控制节点安装 nova 计算服务

1) 创建 nova 相关数据库

nova 服务新增加了两个数据库(Rocky 版)

```
mysql -u root -p123456
```

```
-----
```

```
CREATE DATABASE nova_api;
```

```
CREATE DATABASE nova;
```

```
CREATE DATABASE nova_cell0;
```

```
CREATE DATABASE placement;
```

```
GRANT ALL PRIVILEGES ON nova_api.* TO 'nova'@'localhost' IDENTIFIED BY 'nova';
```

```
GRANT ALL PRIVILEGES ON nova_api.* TO 'nova'@'%' IDENTIFIED BY 'nova';
```

```
GRANT ALL PRIVILEGES ON nova.* TO 'nova'@'localhost' IDENTIFIED BY 'nova';
```

```
GRANT ALL PRIVILEGES ON nova.* TO 'nova'@'%' IDENTIFIED BY 'nova';
```

```
GRANT ALL PRIVILEGES ON nova_cell0.* TO 'nova'@'localhost' IDENTIFIED BY 'nova';
```

```
GRANT ALL PRIVILEGES ON nova_cell0.* TO 'nova'@'%' IDENTIFIED BY 'nova';
```

```
GRANT ALL PRIVILEGES ON placement.* TO 'placement'@'localhost' IDENTIFIED BY 'placement';
```

```
GRANT ALL PRIVILEGES ON placement.* TO 'placement'@'%' IDENTIFIED BY 'placement';
```

```
flush privileges;
```

```
show databases;
```

```
select user,host from mysql.user;
```

```
exit
```

4.2.在 keystone 上面注册 nova 服务

创建服务证书

1) 在 keystone 上创建 nova 用户

```
source admin-openrc
```

```
openstack user create --domain default --password=nova nova
```

```
openstack user list
```

2) 在 **keystone** 上将 **nova** 用户配置为 **admin** 角色并添加进 **service** 项目

以下命令无输出

```
openstack role add --project service --user nova admin
```

3) 创建 **nova** 计算服务的实体

```
openstack service create --name nova --description "OpenStack Compute" compute
```

```
openstack service list
```

4) 创建计算服务的 **API** 端点 (**endpoint**)

计算服务 **compute**

```
openstack endpoint create --region RegionOne compute public http://controller:8774/v2.1
```

```
openstack endpoint create --region RegionOne compute internal http://controller:8774/v2.1
```

```
openstack endpoint create --region RegionOne compute admin http://controller:8774/v2.1
```

```
openstack endpoint list
```

5) 这个版本的 **nova** 增加了 **placement** 项目

创建并注册 **placement** 项目的服务证书

```
openstack user create --domain default --password=placement placement
```

```
openstack role add --project service --user placement admin
```

```
openstack service create --name placement --description "Placement API" placement
```

创建 placement 项目的 endpoint (API 端口)

```
openstack endpoint create --region RegionOne placement public http://controller:8778
```

```
openstack endpoint create --region RegionOne placement internal http://controller:8778
```

```
openstack endpoint create --region RegionOne placement admin http://controller:8778
```

```
openstack endpoint list
```

4.3.在控制节点安装 nova 相关服务

1) 安装 nova 相关软件包

```
yum install openstack-nova-api openstack-nova-conductor \
```

```
openstack-nova-console openstack-nova-novncproxy \
```

```
openstack-nova-scheduler openstack-nova-placement-api -y
```

2) 快速修改 nova 配置

```
openstack-config --set /etc/nova/nova.conf DEFAULT enabled_apis osapi_compute,metadata
openstack-config --set /etc/nova/nova.conf DEFAULT my_ip 127.0.0.1
openstack-config --set /etc/nova/nova.conf DEFAULT use_neutron true
openstack-config --set /etc/nova/nova.conf DEFAULT firewall_driver nova.virt.firewall.NoopFirewallDriver
openstack-config --set /etc/nova/nova.conf DEFAULT transport_url rabbit://openstack:openstack@controller
openstack-config --set /etc/nova/nova.conf api_database connection mysql+pymysql://nova:nova@controller/nova_api
openstack-config --set /etc/nova/nova.conf database connection mysql+pymysql://nova:nova@controller/nova
openstack-config --set /etc/nova/nova.conf placement_database connection mysql+pymysql://placement:placement@controller/placement
openstack-config --set /etc/nova/nova.conf api auth_strategy keystone
openstack-config --set /etc/nova/nova.conf keystone_authtoken auth_url http://controller:5000/v3
openstack-config --set /etc/nova/nova.conf keystone_authtoken memcached_servers controller:11211
openstack-config --set /etc/nova/nova.conf keystone_authtoken auth_type password
openstack-config --set /etc/nova/nova.conf keystone_authtoken project_domain_name default
openstack-config --set /etc/nova/nova.conf keystone_authtoken user_domain_name default
openstack-config --set /etc/nova/nova.conf keystone_authtoken project_name service
openstack-config --set /etc/nova/nova.conf keystone_authtoken username nova
openstack-config --set /etc/nova/nova.conf keystone_authtoken password nova
```

```
openstack-config --set /etc/nova/nova.conf vnc enabled true
openstack-config --set /etc/nova/nova.conf vnc server_listen '$my_ip'
openstack-config --set /etc/nova/nova.conf vnc server_proxyclient_address '$my_ip'
openstack-config --set /etc/nova/nova.conf glance api_servers http://controller:9292
openstack-config --set /etc/nova/nova.conf oslo_concurrency lock_path /var/lib/nova/tmp
openstack-config --set /etc/nova/nova.conf placement region_name RegionOne
openstack-config --set /etc/nova/nova.conf placement project_domain_name Default
openstack-config --set /etc/nova/nova.conf placement project_name service
openstack-config --set /etc/nova/nova.conf placement auth_type password
openstack-config --set /etc/nova/nova.conf placement user_domain_name Default
openstack-config --set /etc/nova/nova.conf placement auth_url http://controller:5000/v3
openstack-config --set /etc/nova/nova.conf placement username placement
openstack-config --set /etc/nova/nova.conf placement password placement
openstack-config --set /etc/nova/nova.conf scheduler discover_hosts_in_cells_interval 300
openstack-config --set /etc/nova/nova.conf libvirt virt_type qemu
```

校验生效的 nova 配置


```
egrep -v "^#|^$" /etc/nova/nova.conf
```

```
[root@openstack01 tools]# egrep -v "^#|^$" /etc/nova/nova.conf
```

```
[DEFAULT]
```

```
enabled_apis = osapi_compute,metadata
```

```
my_ip = 192.168.56.126
```

```
use_neutron = true
```

```
firewall_driver = nova.virt.firewall.NoopFirewallDriver
```

```
transport_url = rabbit://openstack:openstack@controller
```

```
[api]
```

```
auth_strategy = keystone
```

```
[api_database]
```

```
connection = mysql+pymysql://nova:nova@controller/nova_api
```

```
[barbican]
```

```
[cache]
```

```
[cells]
```

```
[cinder]
```

```
[compute]
```

[conductor]

[console]

[consoleauth]

[cors]

[database]

connection = mysql+pymysql://nova:nova@controller/nova

[devices]

[ephemeral_storage_encryption]

[filter_scheduler]

[glance]

api_servers = http://controller:9292

[guestfs]

[healthcheck]

[hyperv]

[ironic]

[key_manager]

[keystone]

[keystone_authtoken]

auth_url = http://controller:5000/v3

memcached_servers = controller:11211

auth_type = password

project_domain_name = default

user_domain_name = default

project_name = service

username = nova

password = nova

[libvirt]

[matchmaker_redis]

[metrics]

[mks]

[neutron]

[notifications]

[osapi_v21]

[oslo_concurrency]

lock_path = /var/lib/nova/tmp

[oslo_messaging_amqp]

[oslo_messaging_kafka]

[oslo_messaging_notifications]

[oslo_messaging_rabbit]

[oslo_messaging_zmq]

[oslo_middleware]

[oslo_policy]

[pci]

[placement]

region_name = RegionOne

project_domain_name = Default

project_name = service

auth_type = password

user_domain_name = Default

auth_url = http://controller:5000/v3

username = placement

password = placement

[placement_database]

connection = mysql+pymysql://placement:placement@controller/placement

[powervm]

[profiler]

[quota]

[rdp]

[remote_debug]

[scheduler]

discover_hosts_in_cells_interval = 300

[serial_console]

[service_user]

[spice]

[upgrade_levels]

[vault]

[vendordata_dynamic_auth]

[vmware]

[vnc]

enabled = true

server_listen = \$my_ip

server_proxycient_address = \$my_ip

[workarounds]

[wsgi]

[xenserver]

[xvp]

[zvm]

3) 修改 nova 的虚拟主机配置文件

```
vi /etc/httpd/conf.d/00-nova-placement-api.conf
```

增加内容，完整的文件内容如下：

...

<Directory /usr/bin>

<IfVersion >= 2.4>

Require all granted

</IfVersion>

<IfVersion < 2.4>

Order allow,deny

Allow from all

</IfVersion>

</Directory>

重启 httpd 服务

```
systemctl restart httpd
```

```
systemctl status httpd
```

```
[root@openstack01 conf.d]# systemctl restart httpd
```

```
[root@openstack01 conf.d]# systemctl status httpd
```

â httpd.service - The Apache HTTP Server

Loaded: loaded (/usr/lib/systemd/system/httpd.service; enabled; vendor preset: disabled)

Active: active (running) since Fri 2019-02-15 23:21:15 CST; 15ms ago

Docs: man:httpd(8)

man:apachectl(8)

Process: 3518 ExecStop=/bin/kill -WINCH \${MAINPID} (code=exited, status=0/SUCCESS)

Main PID: 3528 (httpd)

Status: "Processing requests..."

CGroup: /system.slice/httpd.service

ââ3528 /usr/sbin/httpd -DFOREGROUND

ââ3529 /usr/sbin/httpd -DFOREGROUND

ââ3530 /usr/sbin/httpd -DFOREGROUND

ââ3531 /usr/sbin/httpd -DFOREGROUND

ââ3532 (wsgi:keystone- -DFOREGROUND

ââ3533 (wsgi:keystone- -DFOREGROUND

ââ3534 (wsgi:keystone- -DFOREGROUND

ââ3535 (wsgi:keystone- -DFOREGROUND

ââ3536 (wsgi:keystone- -DFOREGROUND

ââ3537 /usr/sbin/httpd -DFOREGROUND

ââ3538 /usr/sbin/httpd -DFOREGROUND

ââ3539 /usr/sbin/httpd -DFOREGROUND

ââ3540 /usr/sbin/httpd -DFOREGROUND

ââ3541 /usr/sbin/httpd -DFOREGROUND

Feb 15 23:21:15 controller systemd[1]: Starting The Apache HTTP Server...

Feb 15 23:21:15 controller systemd[1]: Started The Apache HTTP Server.

nova 计算服务的软件包安装完成

4.4.同步 nova 数据（注意同步顺序）

nova_api 有 32 张表，placement 有 32 张表，nova_cell0 有 110 张表，nova 也有 110 张表

1) 初始化 nova-api 和 placement 数据库

```
su -s /bin/sh -c "nova-manage api_db sync" nova
```

验证数据库

```
mysql -h192.168.56.126 -unova -pnova -e "use nova_api;show tables;"
```

```
mysql -h192.168.56.126 -uplacement -pplacement -e "use placement;show tables;"
```

```
[root@openstack01 tools]# su -s /bin/sh -c "nova-manage api_db sync" nova
```

```
[root@openstack01 tools]# mysql -h192.168.56.126 -unova -pnova -e "use nova_api;show tables;"
```

```
+-----+
```

```
| Tables_in_nova_api      |
```

+-----+

| aggregate_hosts |

| aggregate_metadata |

| aggregates |

| allocations |

| build_requests |

| cell_mappings |

| consumers |

| flavor_extra_specs |

| flavor_projects |

| flavors |

| host_mappings |

| instance_group_member |

| instance_group_policy |

| instance_groups |

| instance_mappings |

| inventories |

| key_pairs |

migrate_version	
placement_aggregates	
project_user_quotas	
projects	
quota_classes	
quota_usages	
quotas	
request_specs	
reservations	
resource_classes	
resource_provider_aggregates	
resource_provider_traits	
resource_providers	
traits	
users	
+-----+	

```
[root@openstack01 tools]# mysql -h192.168.56.126 -uplacement -pplacement -e "use placement;show tables;"
```

+-----+

| Tables_in_placement |

+-----+

| aggregate_hosts |

| aggregate_metadata |

| aggregates |

| allocations |

| build_requests |

| cell_mappings |

| consumers |

| flavor_extra_specs |

| flavor_projects |

| flavors |

| host_mappings |

| instance_group_member |

| instance_group_policy |

| instance_groups |

| instance_mappings |

inventories	
key_pairs	
migrate_version	
placement_aggregates	
project_user_quotas	
projects	
quota_classes	
quota_usages	
quotas	
request_specs	
reservations	
resource_classes	
resource_provider_aggregates	
resource_provider_traits	
resource_providers	
traits	
users	
+-----+	

2) 初始化 nova_cell0 和 nova 数据库

注册 cell0 数据库

```
su -s /bin/sh -c "nova-manage cell_v2 map_cell0" nova
```

创建 cell1 单元

```
su -s /bin/sh -c "nova-manage cell_v2 create_cell --name=cell1 --verbose" nova
```

初始化 nova 数据库

```
su -s /bin/sh -c "nova-manage db sync" nova
```

检查确认 cell0 和 cell1 注册成功

```
su -s /bin/sh -c "nova-manage cell_v2 list_cells" nova
```

验证数据库

```
mysql -h127.0.0.1 -unova -pnova -e "use nova_cell0;show tables;"
```

```
mysql -h127.0.0.1 -unova -pnova -e "use nova;show tables;"
```

```
[root@openstack01 tools]# su -s /bin/sh -c "nova-manage cell_v2 map_cell0" nova
```

```
[root@openstack01 tools]# su -s /bin/sh -c "nova-manage cell_v2 create_cell --name=cell1 --verbose" nova  
c078477e-cb43-40c9-ad8b-a9fde183747d
```

```
[root@openstack01 tools]# su -s /bin/sh -c "nova-manage db sync" nova
```

```
/usr/lib/python2.7/site-packages/pymysql/cursors.py:170: Warning: (1831, u'Duplicate index  
`block_device_mapping_instance_uuid_virtual_name_device_name_idx`. This is deprecated and will be disallowed in a future release.')
```

```
    result = self._query(query)
```

```
/usr/lib/python2.7/site-packages/pymysql/cursors.py:170: Warning: (1831, u'Duplicate index `uniq_instances0uuid`. This is deprecated and will be  
disallowed in a future release.')
```

```
    result = self._query(query)
```

```
[root@openstack01 tools]# mysql -h192.168.56.126 -unova -pnova -e "use nova_cell0;show tables;"
```

```
+-----+
```

```
| Tables_in_nova_cell0          |
```

```
+-----+
```

```
| agent_builds                  |
```

```
| aggregate_hosts               |
```

```
| aggregate_metadata            |
```

```
| aggregates                    |
```

```
| allocations                   |
```

block_device_mapping	
bw_usage_cache	
cells	
certificates	
compute_nodes	
console_auth_tokens	
console_pools	
consoles	
dns_domains	
fixed_ips	
floating_ips	
instance_actions	
instance_actions_events	
instance_extra	
instance_faults	
instance_group_member	
instance_group_policy	
instance_groups	

instance_id_mappings	
instance_info_caches	
instance_metadata	
instance_system_metadata	
instance_type_extra_specs	
instance_type_projects	
instance_types	
instances	
inventories	
key_pairs	
migrate_version	
migrations	
networks	
pci_devices	
project_user_quotas	
provider_fw_rules	
quota_classes	
quota_usages	

quotas	
reservations	
resource_provider_aggregates	
resource_providers	
s3_images	
security_group_default_rules	
security_group_instance_association	
security_group_rules	
security_groups	
services	
shadow_agent_builds	
shadow_aggregate_hosts	
shadow_aggregate_metadata	
shadow_aggregates	
shadow_block_device_mapping	
shadow_bw_usage_cache	
shadow_cells	
shadow_certificates	

shadow_compute_nodes	
shadow_console_pools	
shadow_consoles	
shadow_dns_domains	
shadow_fixed_ips	
shadow_floating_ips	
shadow_instance_actions	
shadow_instance_actions_events	
shadow_instance_extra	
shadow_instance_faults	
shadow_instance_group_member	
shadow_instance_group_policy	
shadow_instance_groups	
shadow_instance_id_mappings	
shadow_instance_info_caches	
shadow_instance_metadata	
shadow_instance_system_metadata	
shadow_instance_type_extra_specs	

shadow_instance_type_projects	
shadow_instance_types	
shadow_instances	
shadow_key_pairs	
shadow_migrate_version	
shadow_migrations	
shadow_networks	
shadow_pci_devices	
shadow_project_user_quotas	
shadow_provider_fw_rules	
shadow_quota_classes	
shadow_quota_usages	
shadow_quotas	
shadow_reservations	
shadow_s3_images	
shadow_security_group_default_rules	
shadow_security_group_instance_association	
shadow_security_group_rules	

shadow_security_groups	
shadow_services	
shadow_snapshot_id_mappings	
shadow_snapshots	
shadow_task_log	
shadow_virtual_interfaces	
shadow_volume_id_mappings	
shadow_volume_usage_cache	
snapshot_id_mappings	
snapshots	
tags	
task_log	
virtual_interfaces	
volume_id_mappings	
volume_usage_cache	

+-----+

[root@openstack01 tools]# mysql -h192.168.56.126 -unova -pnova -e "use nova;show tables;"

+-----+

Tables_in_nova	
----------------	--

+-----+	
---------	--

agent_builds	
--------------	--

aggregate_hosts	
-----------------	--

aggregate_metadata	
--------------------	--

aggregates	
------------	--

allocations	
-------------	--

block_device_mapping	
----------------------	--

bw_usage_cache	
----------------	--

cells	
-------	--

certificates	
--------------	--

compute_nodes	
---------------	--

console_auth_tokens	
---------------------	--

console_pools	
---------------	--

consoles	
----------	--

dns_domains	
-------------	--

fixed_ips	
-----------	--

floating_ips	
--------------	--

instance_actions	
instance_actions_events	
instance_extra	
instance_faults	
instance_group_member	
instance_group_policy	
instance_groups	
instance_id_mappings	
instance_info_caches	
instance_metadata	
instance_system_metadata	
instance_type_extra_specs	
instance_type_projects	
instance_types	
instances	
inventories	
key_pairs	
migrate_version	

migrations	
networks	
pci_devices	
project_user_quotas	
provider_fw_rules	
quota_classes	
quota_usages	
quotas	
reservations	
resource_provider_aggregates	
resource_providers	
s3_images	
security_group_default_rules	
security_group_instance_association	
security_group_rules	
security_groups	
services	
shadow_agent_builds	

shadow_aggregate_hosts	
shadow_aggregate_metadata	
shadow_aggregates	
shadow_block_device_mapping	
shadow_bw_usage_cache	
shadow_cells	
shadow_certificates	
shadow_compute_nodes	
shadow_console_pools	
shadow_consoles	
shadow_dns_domains	
shadow_fixed_ips	
shadow_floating_ips	
shadow_instance_actions	
shadow_instance_actions_events	
shadow_instance_extra	
shadow_instance_faults	
shadow_instance_group_member	

shadow_instance_group_policy	
shadow_instance_groups	
shadow_instance_id_mappings	
shadow_instance_info_caches	
shadow_instance_metadata	
shadow_instance_system_metadata	
shadow_instance_type_extra_specs	
shadow_instance_type_projects	
shadow_instance_types	
shadow_instances	
shadow_key_pairs	
shadow_migrate_version	
shadow_migrations	
shadow_networks	
shadow_pci_devices	
shadow_project_user_quotas	
shadow_provider_fw_rules	
shadow_quota_classes	

shadow_quota_usages	
shadow_quotas	
shadow_reservations	
shadow_s3_images	
shadow_security_group_default_rules	
shadow_security_group_instance_association	
shadow_security_group_rules	
shadow_security_groups	
shadow_services	
shadow_snapshot_id_mappings	
shadow_snapshots	
shadow_task_log	
shadow_virtual_interfaces	
shadow_volume_id_mappings	
shadow_volume_usage_cache	
snapshot_id_mappings	
snapshots	
tags	

```
| task_log |
| virtual_interfaces |
| volume_id_mappings |
| volume_usage_cache |
+-----+
```

5) 检查确认 cell0 和 cell1 注册成功

```
su -s /bin/sh -c "nova-manage cell_v2 list_cells" nova
```

```
[root@openstack01 conf.d]# su -s /bin/sh -c "nova-manage cell_v2 list_cells" nova
```

```
+-----+-----+-----+-----+
| 名称 |          UUID          |      Transport URL      |      数据库连接      |
| Disabled |                                |                                |                                |
+-----+-----+-----+-----+
| cell0 | 00000000-0000-0000-0000-000000000000 | none:/                    | mysql+pymysql://nova:****@controller/nova_cell0 |
False |
| cell1 | c078477e-cb43-40c9-ad8b-a9fde183747d | rabbit://openstack:****@controller | mysql+pymysql://nova:****@controller/nova | False |
+-----+-----+-----+-----+
```

返回的数据存储在 nova_api 数据库的 cell_mappings 表中

4.5.启动 nova 服务

1) 启动 nova 服务并设置为开机自启动

需要启动 nova 的 5 个服务

```
systemctl start openstack-nova-api.service openstack-nova-consoleauth.service \  
openstack-nova-scheduler.service openstack-nova-conductor.service \  
openstack-nova-novncproxy.service
```

```
systemctl status openstack-nova-api.service openstack-nova-consoleauth.service \  
openstack-nova-scheduler.service openstack-nova-conductor.service \  
openstack-nova-novncproxy.service
```

```
systemctl enable openstack-nova-api.service openstack-nova-consoleauth.service \  
openstack-nova-scheduler.service openstack-nova-conductor.service \  
openstack-nova-novncproxy.service
```

```
systemctl list-unit-files |grep openstack-nova* |grep enabled
```

```
[root@openstack01 conf.d]# systemctl start openstack-nova-api.service \
```

```
> openstack-nova-scheduler.service openstack-nova-conductor.service \
```

```
> openstack-nova-novncproxy.service
```

```
[root@openstack01 conf.d]# systemctl status openstack-nova-api.service \
```

```
> openstack-nova-scheduler.service openstack-nova-conductor.service \
```

```
> openstack-nova-novncproxy.service
```

- openstack-nova-api.service - OpenStack Nova API Server

Loaded: loaded (/usr/lib/systemd/system/openstack-nova-api.service; disabled; vendor preset: disabled)

Active: active (running) since — 2018-10-29 14:30:22 CST; 6s ago

Main PID: 56510 (nova-api)

CGroup: /system.slice/openstack-nova-api.service

└─56510 /usr/bin/python2 /usr/bin/nova-api

└─56562 /usr/bin/python2 /usr/bin/nova-api

└─56564 /usr/bin/python2 /usr/bin/nova-api

- openstack-nova-scheduler.service - OpenStack Nova Scheduler Server

Loaded: loaded (/usr/lib/systemd/system/openstack-nova-scheduler.service; disabled; vendor preset: disabled)

Active: active (running) since — 2018-10-29 14:30:21 CST; 8s ago

Main PID: 56511 (nova-scheduler)

CGroup: /system.slice/openstack-nova-scheduler.service

└─56511 /usr/bin/python2 /usr/bin/nova-scheduler

- openstack-nova-conductor.service - OpenStack Nova Conductor Server

Loaded: loaded (/usr/lib/systemd/system/openstack-nova-conductor.service; disabled; vendor preset: disabled)

Active: active (running) since — 2018-10-29 14:30:19 CST; 9s ago

Main PID: 56512 (nova-conductor)

CGroup: /system.slice/openstack-nova-conductor.service

└─56512 /usr/bin/python2 /usr/bin/nova-conductor

- openstack-nova-novncproxy.service - OpenStack Nova NoVNC Proxy Server

Loaded: loaded (/usr/lib/systemd/system/openstack-nova-novncproxy.service; disabled; vendor preset: disabled)

Active: active (running) since — 2018-10-29 14:30:06 CST; 22s ago

Main PID: 56513 (nova-novncproxy)

CGroup: /system.slice/openstack-nova-novncproxy.service

└─56513 /usr/bin/python2 /usr/bin/nova-novncproxy --web /usr/share/novnc/

```
[root@openstack01 conf.d]# systemctl enable openstack-nova-api.service \
```

```
> openstack-nova-scheduler.service openstack-nova-conductor.service \
```

```
> openstack-nova-novncproxy.service
```

Created symlink from /etc/systemd/system/multi-user.target.wants/openstack-nova-api.service to /usr/lib/systemd/system/openstack-nova-api.service.

Created symlink from /etc/systemd/system/multi-user.target.wants/openstack-nova-scheduler.service to /usr/lib/systemd/system/openstack-nova-scheduler.service.

Created symlink from /etc/systemd/system/multi-user.target.wants/openstack-nova-conductor.service to /usr/lib/systemd/system/openstack-nova-conductor.service.

Created symlink from /etc/systemd/system/multi-user.target.wants/openstack-nova-novncproxy.service to /usr/lib/systemd/system/openstack-nova-novncproxy.service.

```
[root@openstack01 conf.d]# systemctl list-unit-files |grep openstack-nova* |grep enabled
```

openstack-nova-api.service	enabled
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openstack-nova-conductor.service	enabled
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openstack-nova-novncproxy.service	enabled
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openstack-nova-scheduler.service	enabled
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在控制节点安装 nova 计算服务就完成

