Installation

Installation Overview

Cisco Policy Suite VMs is deployed using either Nova boot commands or Heat templates.

Create CPS VMs using Nova Boot Commands

Step 1 Create cloud configuration files for each VM to be deployed (xxx-cloud.cfg). These configurations are used to define the OpenStack parameters for each CPS VM.

Refer to *Sample Cloud Config Files* section to create these files.

Step 2 Run the following command on the control node:

```
source ~/keystonerc_core
```

Step 3 Deploy each CPS VM with the following nova boot command:

```
nova boot --config-drive true --user-data=<node>-cloud.cfg
 --image "base_vm" --flavor "<cluman|pcrfclient0x|sm|lb0x|qns0x>"
--nic net-id="<Internal n/w id>,v4-fixed-ip=
<Internal network private IP>"
--nic net-id="<Management network id>,v4-fixed-ip=
<Management n/w public ip>" --block-device-mapping
"/dev/vdb=<Volume id of iso>:::0"
--availability-zone "<availability zone:Host info>"
"cluman"
```

Note Configure the networks, internal IPs, management IPs and availability zones based on the requirements of your environment.

The following example shows the nova boot commands to deploy a Cluster Manager (cluman), two OAMs (pcrfclients), two sessionmgrs, two Policy Directors (load balancers), and four Policy Server (qns) VMs.

In the following example:

- 172.16.2.200 is the Internal VIP address.
- 172.18.11.156 is the management VIP address.
- 192.168.2.200 is the Gx VIP address

```
nova boot --config-drive true --user-data=cluman-cloud.cfg
--image "CPS_xx_x_x_Base" --flavor "cluman" --nic net-id=
"8c74819c-f3cb-46ad-b69a-d0d521b336d5,v4-fixed-ip=172.16.2.19"
--nic net-id="27a07da0-116f-4453-94b6-457bad9154b0,v4-fixed-ip=172.18.11.101"
--block-device-mapping "/dev/vdb=edf0113a-2ea0-4286-97f0-ee149f35b0d2:::0"
--availability-zone Zone1 "cluman"

nova boot --config-drive true --user-data=pcrfclient01-cloud.cfg --image
"CPS_xx_x_x_Base" --flavor "pcrfclient01" --nic net-id=
"2544e49e-0fda-4437-b558-f834e73801bb,v4-fixed-ip=172.16.2.20" --nic
net-id="24d71ec2-40b0-489f-9f0c-ca8a42a5c834,v4-fixed-ip=172.18.11.152"
--block-device-mapping "/dev/vdb=139f2b90-eb74-4d5e-9e20-2af3876a7572:::0"
 --availability-zone "az-1:os8-compute-1.cisco.com" "pcrfclient01"

nova boot --config-drive true --user-data=pcrfclient02-cloud.cfg --image
"CPS_xx_x_x_Base" --flavor "pcrfclient02"  --nic net-id=
"2544e49e-0fda-4437-b558-f834e73801bb,v4-fixed-ip=172.16.2.21" --nic net-id=
"24d71ec2-40b0-489f-9f0c-ca8a42a5c834,v4-fixed-ip=172.18.11.153"
--block-device-mapping "/dev/vdb=27815c35-c5e8-463b-8ce4-fb1ec67d9446:::0"
--availability-zone "az-2:os8-compute-2.cisco.com" "pcrfclient02"

nova boot --config-drive true --user-data=sessionmgr01-cloud.cfg --image
"CPS_xx_x_x_Base" --flavor "sm"  --nic net-id=
"2544e49e-0fda-4437-b558-f834e73801bb,v4-fixed-ip=172.16.2.22"
--nic net-id="24d71ec2-40b0-489f-9f0c-ca8a42a5c834,v4-fixed-ip=172.18.11.157"
--block-device-mapping "/dev/vdb=8c3577d2-74f2-4370-9a37-7370381670e4:::0"
--availability-zone "az-1:os8-compute-1.cisco.com" "sessionmgr01"

nova boot --config-drive true --user-data=sessionmgr02-cloud.cfg
--image "base_vmCPS_xx_x_x_Base" --flavor "sm"
--nic net-id="2544e49e-0fda-4437-b558-f834e73801bb,v4-fixed-ip=172.16.2.23"
--nic net-id="24d71ec2-40b0-489f-9f0c-ca8a42a5c834,v4-fixed-ip=172.18.11.158"
--block-device-mapping "/dev/vdb=67aa5cbd-02dd-497e-a8ee-797ac04b85f0:::0"
--availability-zone "az-2:os8-compute-2.cisco.com" "sessionmgr02"

nova boot --config-drive true --user-data=lb01-cloud.cfg --image
"CPS_xx_x_x_Base" --flavor "lb01" --nic net-id=
"2544e49e-0fda-4437-b558-f834e73801bb,v4-fixed-ip=172.16.2.201"
--nic net-id="24d71ec2-40b0-489f-9f0c-ca8a42a5c834,v4-fixed-ip=172.18.11.154"
--nic net-id="d0a69b7f-5d51-424a-afbe-5f6486c6e90d,v4-fixed-ip=192.168.2.201"
--availability-zone "az-1:os8-compute-1.cisco.com" "lb01"

nova boot --config-drive true --user-data=lb02-cloud.cfg --image
"CPS_xx_x_x_Base" --flavor "lb02" --nic net-id=
"2544e49e-0fda-4437-b558-f834e73801bb,v4-fixed-ip=172.16.2.202"
--nic net-id="24d71ec2-40b0-489f-9f0c-ca8a42a5c834,v4-fixed-ip=172.18.11.155"
--nic net-id="d0a69b7f-5d51-424a-afbe-5f6486c6e90d,v4-fixed-ip=192.168.2.202"
--availability-zone "az-2:os8-compute-2.cisco.com" "lb02"
```

```
nova boot --config-drive true --user-data=qns01-cloud.cfg --image
"CPS_xx_x_x_Base" --flavor "qps" --nic net-id=
"2544e49e-0fda-4437-b558-f834e73801bb,v4-fixed-ip=172.16.2.24"
--availability-zone "az-1:os8-compute-1.cisco.com" "qns01"

nova boot --config-drive true --user-data=qns02-cloud.cfg --image
"CPS_xx_x_x_Base" --flavor "qps" --nic net-id=
"2544e49e-0fda-4437-b558-f834e73801bb,v4-fixed-ip=172.16.2.25"
--availability-zone "az-1:os8-compute-1.cisco.com" "qns02"

nova boot --config-drive true --user-data=qns03-cloud.cfg --image
"CPS_xx_x_x_Base" --flavor "qps" --nic net-id=
"2544e49e-0fda-4437-b558-f834e73801bb,v4-fixed-ip=172.16.2.26"
--availability-zone "az-2:os8-compute-2.cisco.com" "qns03"

nova boot --config-drive true --user-data=qns04-cloud.cfg --image
"CPS_xx_x_x_Base" --flavor "qps" --nic net-id=
"2544e49e-0fda-4437-b558-f834e73801bb,v4-fixed-ip=172.16.2.27"
--availability-zone "az-2:os8-compute-2.cisco.com" "qns04"
```

Note Use the `cinder list` command to query OpenStack for the block-device-mapping IDs for the above nova boot commands.

Step 4 Update the ports to allow address pairing on the Neutron ports:

a) Use the following command to find the Neutron port ID for the lb01 internal IP address:

```
openstack port list | grep "<lb01_internal_IP>"
```

b) Use the following command to find the Neutron port ID for the lb02 internal IP address:

```
openstack port list | grep "<lb02_internal_IP>"
```

c) Update the above two Neutron ports to allow Internal VIP address by running the following command for each of the above ports:

```
openstack port set --allowed-address-pair ip_address=IP_ADDR|CIDR[,mac_address=MAC_ADDR]
```

For example:

```
[root@os8-control cloud(keystone_core)]# openstack port list | grep "172.16.2.201"
| db8944f3-407d-41ef-b063-eabbab43c039 || fa:16:3e:b1:f3:ab |
ip_address='172.16.2.201',subnet_id='6cfd1d1b-0931-44ad-bdc9-5015dc69f9d0' | ACTIVE |

[root@os8-control cloud(keystone_core)]# openstack port set --allowed-address-pairs
ip-address=172.16.2.200 db8944f3-407d-41ef-b063-eabbab43c039
```

d) Repeat 4.c, on page 3 for External VIP addresses using neutron ports for the lb01/lb02 Management IP address and also Gx VIP address using neutron ports for lb01/lb02 Gx IP addresses.

Step 5 Wait approximately 10 minutes for the Cluster Manager VM to be deployed, then check the readiness status of the Cluster Manager VM using the following API:

GET http://<*Cluster Manager IP*>:8458/api/system/status/cluman

Refer to /api/system/status/cluman for more information.

When this API response indicates that the Cluster Manager VM is in a ready state (`"status": "ready"`), continue with *Deploy CPS* section in this document.

Refer also to the `/var/log/cloud-init-output.log` on the Cluster Manager VM for deployment details.

Sample Cloud Config Files

For nova boot installation of CPS, you must create a cloud configuration file for each CPS VM to be deployed.

The following sections show an example Cluster Manager cloud configuration (`cluman-cloud.cfg`), and a pcrflient01 cloud configuration (`pcrfclient01-cloud.cfg`).

These files must be placed in the directory in which you execute the nova launch commands, typically `/root/cps-install/`.

Note Use `NM_CONTROLLED=no` parameter at the interface config file in `cloud-config` file.

For Cluman/Arbiter VM, include `ifup`/`ifdown` commands under `runcmd` section of cloud config file sequentially for all the interfaces to `/etc/rc.d/rc.local` to persist across boot.

Cluster Manager Configuration File (for install type mobile)

```
#cloud-config
write_files:
 - path: /etc/sysconfig/network-scripts/ifcfg-eth0
   encoding: ascii
   content: |
     DEVICE=eth0
     BOOTPROTO=none
     NM_CONTROLLED=no
     IPADDR=172.16.2.19    <---- Internal IP to access via private IP
     NETMASK=255.255.255.0
     NETWORK=172.16.2.0    <------ Internal network
   owner: root:root
   permissions: '0644'
 - path: /etc/sysconfig/network-scripts/ifcfg-eth1
   encoding: ascii
   content: |
     DEVICE=eth1
     BOOTPROTO=none
     NM_CONTROLLED=no
     IPADDR=172.18.11.101   <---- Management IP to access via public IP
     NETMASK=255.255.255.0
     GATEWAY=172.18.11.1
     NETWORK=172.18.11.0
   owner: root:root
   permissions: '0644'
 - path: /var/lib/cloud/instance/payload/launch-params
   encoding: ascii
   owner: root:root
   permissions: '0644'
 - path: /root/.autoinstall.sh
   encoding: ascii
   content: |
     #!/bin/bash
     if [[ -d /mnt/iso ]] && [[ -f /mnt/iso/install.sh ]]; then
       /mnt/iso/install.sh << EOF
     mobile
     y
     1
     EOF
     fi
   permissions: '0755'
mounts:
```

```
 - [ /dev/vdb, /mnt/iso, iso9660, "auto,ro", 0, 0 ]
runcmd:
 - ifdown eth0
 - ifdown eth1
 - echo 172.16.2.19 installer >> /etc/hosts   <---- Internal/private IP of cluman
 - ifup eth0
 - ifup eth1
- echo ifdown eth0 >>  /etc/rc.d/rc.local
 - echo ifup eth0 >> /etc/rc.d/rc.local
 - echo ifdown eth1 >>  /etc/rc.d/rc.local
 - echo ifup eth1 >> /etc/rc.d/rc.local
 - chmod +x /etc/rc.d/rc.local

- /root/.autoinstall.sh
```

Note If actual hostname for Cluster Manager VM is other than 'installer', then modify installer/cluman entry in `/etc/hosts` accordingly.

Example:

```
echo 172.16.2.19 installer <actual-hostname> >> /etc/hosts
```

Non-Cluster Manager Configuration File

- The following example configuration file is for pcrfclient01. You must create separate configuration files for each CPS VM to be deployed.

  For each file, modify the `NODE_TYPE`, and network settings (`IPADDR`, `GATEWAY`, `NETWORK`) accordingly.

  A typical CPS deployment would require the following files:

  - • pcrfclient01-cloud.cfg
    • pcrfclient02-cloud.cfg
    • lb01-cloud.cfg
    • lb02-cloud.cfg
    • sessionmgr01-cloud.cfg
    • sessionmgr02-cloud.cfg
    • qns01-cloud.cfg
    • qns02-cloud.cfg
    • qns03-cloud.cfg
    • qns04-cloud.cfg
    • pcrfclient01-cloud.cfg
    • pcrfclient02-cloud.cfg
    • lb01-cloud.cfg
    • lb02-cloud.cfg

- sessionmgr01-cloud.cfg
- sessionmgr02-cloud.cfg
- qns01-cloud.cfg
- qns02-cloud.cfg
- qns03-cloud.cfg
- qns04-cloud.cfg

- Modify `IPADDR` to the IP address used in nova boot command for that interface.
- Set `NETMASK`, `GATEWAY`, and `NETWORK` according to your environment.

```
#cloud-config
#hostname: pcrfclient01
fqdn: pcrfclient01
write_files:
 - path: /etc/sysconfig/network-scripts/ifcfg-eth0
   encoding: ascii
   content: |
     DEVICE=eth0
     BOOTPROTO=none
     NM_CONTROLLED=no
     IPADDR=172.16.2.20
     NETMASK=255.255.255.0
     NETWORK=172.16.2.0
   owner: root:root
   permissions: '0644'
 - path: /etc/sysconfig/network-scripts/ifcfg-eth1
   encoding: ascii
   content: |
     DEVICE=eth1
     BOOTPROTO=none
     NM_CONTROLLED=no
     IPADDR=172.18.11.152
     NETMASK=255.255.255.0
     GATEWAY=172.18.11.1
     NETWORK=172.18.11.0
   owner: root:root
   permissions: '0644'
 - path: /var/lib/cloud/instance/payload/launch-params
   encoding: ascii
   owner: root:root
   permissions: '0644'
 - path: /etc/broadhop.profile
   encoding: ascii
   content: "NODE_TYPE=pcrfclient01\n"
   owner: root:root
   permissions: '0644'
runcmd:
 - ifdown eth0
 - ifdown eth1
 - echo 172.16.2.19 installer >> /etc/hosts
 - ifup eth0
 - ifup eth1
 - sed -i '/^HOSTNAME=/d' /etc/sysconfig/network && echo HOSTNAME=pcrfclient01 >>
/etc/sysconfig/network
 - echo pcrfclient01 > /etc/hostname
- hostname pcrfclient01
```

Create CPS VMs using Heat

To create the CPS VMs using OpenStack Heat, you must first create an environment file and a Heat template containing information for your deployment.

These files include information about the ISO, base image, availability zones, management IPs, and volumes. Modify the sample files provided below with information for your deployment.

- Sample Heat Environment File, on page 7
- Sample Heat Template File, on page 8

After populating these files, continue with Create Heat Stack, on page 24.

Sample Heat Environment File

Note Update the network/vlan names, internal and management IPs, VIPs, and volumes for your environment.

`az-1`, `az-2` shown in the following sample are for example purposes only. Update these for your environment accordingly.

Also update the heat template (hot-cps.yaml) with your availability zone variables (for example: `cps_az_1`, `cps_az_2`) after updating this heat environment file.

```
# cat hot-cps.env
# This is an example environment file parameters:
  cps_iso_image_name: CPS_9.0.0.release.iso
  base_vm_image_name: CPS_9.0.0_Base.release
  cps_az_1: az-1
  cps_az_2: az-2

  internal_net_name: internal
  internal_net_cidr: 172.16.2.0/24

  management_net_name: management
  management_net_cidr: 172.18.11.0/24
  management_net_gateway: 172.18.11.1

  gx_net_name: gx
  gx_net_cidr: 192.168.2.0/24

  cluman_flavor_name: cluman
  cluman_internal_ip: 172.16.2.19
  cluman_management_ip: 172.18.11.151

  lb_internal_vip: 172.16.2.200
  lb_management_vip: 172.18.11.156
  lb_gx_vip: 192.168.2.200
  lb01_flavor_name: lb01
  lb01_internal_ip: 172.16.2.201
  lb01_management_ip: 172.18.11.154
  lb01_gx_ip: 192.168.2.201
  lb02_flavor_name: lb02
  lb02_internal_ip: 172.16.2.202
  lb02_management_ip: 172.18.11.155
```

```
  lb02_gx_ip: 192.168.2.202

  pcrfclient01_flavor_name: pcrfclient01
  pcrfclient01_internal_ip: 172.16.2.20
  pcrfclient01_management_ip: 172.18.11.152
  pcrfclient02_flavor_name: pcrfclient02
  pcrfclient02_internal_ip: 172.16.2.21
  pcrfclient02_management_ip: 172.18.11.153

  qns01_internal_ip: 172.16.2.24
  qns02_internal_ip: 172.16.2.25
  qns03_internal_ip: 172.16.2.26
  qns04_internal_ip: 172.16.2.27

  sessionmgr01_internal_ip: 172.16.2.22
  sessionmgr01_management_ip: 172.18.11.157
  sessionmgr02_internal_ip: 172.16.2.23
  sessionmgr02_management_ip: 172.18.11.158

  mongo01_volume_id: "54789405-f683-401b-8194-c354d8937ecb"
  mongo02_volume_id: "9694ab92-8ddd-407e-8520-8b0280f5db03"
  svn01_volume_id: "5b6d7263-40d1-4748-b45c-d1af698d71f7"
  svn02_volume_id: "b501f834-eff9-4044-90c3-a24378f3734d"
  cps_iso_volume_id: "ef52f944-411b-42b1-b86a-500950f5b398"
```

Sample Heat Template File

Note

- Update the following sample heat template according to your environment, such as to add more VMs, networks to the VMs, and so on.
- For more information on MOG/PATS, contact your Cisco Technical Representative.
- Currently, eSCEF is an EFT product and is for Lab Use Only. This means it is not supported by Cisco TAC and cannot be used in a production network. The features in the EFT are subject to change at the sole discretion of Cisco.

```
#cat hot-cps.yaml
heat_template_version: 2014-10-16

description: A minimal CPS deployment for big bang deployment

parameters:
#=========================
# Global Parameters
#=========================
  base_vm_image_name:
    type: string
    label: base vm image name
    description: name of the base vm as imported into glance
  cps_iso_image_name:
    type: string
    label: cps iso image name
    description: name of the cps iso as imported into glance
  cps_install_type:
    type: string
    label: cps installation type (mobile|mog|pats|arbiter|andsf|escef)
    description: cps installation type (mobile|mog|pats|arbiter|andsf|escef)
    default: mobile
```

```
  cps_az_1:
    type: string
    label: first availability zone
    description: az for "first half" of cluster
    default: nova
  cps_az_2:
    type: string
    label: second availability zone
    description: az for "second half" of cluster
    default: nova

#=========================
# Network Parameters
#=========================
  internal_net_name:
    type: string
    label: internal network name
    description: name of the internal network
  internal_net_cidr:
    type: string
    label: cps internal cidr
    description: cidr of internal subnet

  management_net_name:
    type: string
    label: management network name
    description: name of the management network
  management_net_cidr:
    type: string
    label: cps management cidr
    description: cidr of management subnet
  management_net_gateway:
    type: string
    label: management network gateway
    description: gateway on management network
    default: ""

  gx_net_name:
    type: string
    label: gx network name
    description: name of the gx network
  gx_net_cidr:
    type: string
    label: cps gx cidr
    description: cidr of gx subnet
  gx_net_gateway:
    type: string
    label: gx network gateway
    description: gateway on gx network
    default: ""

  cps_secgroup_name:
    type: string
    label: cps secgroup name
    description: name of cps security group
    default: cps_secgroup

#=========================
# Volume Parameters
#=========================
  mongo01_volume_id:
    type: string
    label: mongo01 volume id
    description: uuid of the mongo01 volume
```

```
  mongo02_volume_id:
    type: string
    label: mongo02 volume id
    description: uuid of the mongo02 volume

  svn01_volume_id:
    type: string
    label: svn01 volume id
    description: uuid of the svn01 volume

  svn02_volume_id:
    type: string
    label: svn02 volume id
    description: uuid of the svn02 volume

  cps_iso_volume_id:
    type: string
    label: cps iso volume id
    description: uuid of the cps iso volume

#=========================
# Instance Parameters
#=========================
  cluman_flavor_name:
    type: string
    label: cluman flavor name
    description: flavor cluman vm will use
    default: cluman
  cluman_internal_ip:
    type: string
    label: internal ip of cluster manager
    description: internal ip of cluster manager
  cluman_management_ip:
    type: string
    label: management ip of cluster manager
    description: management ip of cluster manager

  lb_internal_vip:
    type: string
    label: internal vip of load balancer
    description: internal vip of load balancer
  lb_management_vip:
    type: string
    label: management vip of load balancer
    description: management vip of load balancer
  lb_gx_vip:
    type: string
    label: gx ip of load balancer
    description: gx vip of load balancer
  lb01_flavor_name:
    type: string
    label: lb01 flavor name
    description: flavor lb01 vms will use
    default: lb01
  lb01_internal_ip:
    type: string
    label: internal ip of load balancer
    description: internal ip of load balancer
  lb01_management_ip:
    type: string
    label: management ip of load balancer
    description: management ip of load balancer
  lb01_gx_ip:
```

```
  type: string
  label: gx ip of load balancer
  description: gx ip of load balancer
lb02_flavor_name:
  type: string
  label: lb02 flavor name
  description: flavor lb02 vms will use
  default: lb02
lb02_internal_ip:
  type: string
  label: internal ip of load balancer
  description: internal ip of load balancer
lb02_management_ip:
  type: string
  label: management ip of load balancer
  description: management ip of load balancer
lb02_gx_ip:
  type: string
  label: gx ip of load balancer
  description: gx ip of load balancer

pcrfclient01_flavor_name:
  type: string
  label: pcrfclient01 flavor name
  description: flavor pcrfclient01 vm will use
  default: pcrfclient01
pcrfclient01_internal_ip:
  type: string
  label: internal ip of pcrfclient01
  description: internal ip of pcrfclient01
pcrfclient01_management_ip:
  type: string
  label: management ip of pcrfclient01
  description: management ip of pcrfclient01
pcrfclient02_flavor_name:
  type: string
  label: pcrfclient02 flavor name
  description: flavor pcrfclient02 vm will use
  default: pcrfclient02
pcrfclient02_internal_ip:
  type: string
  label: internal ip of pcrfclient02
  description: internal ip of pcrfclient02
pcrfclient02_management_ip:
  type: string
  label: management ip of pcrfclient02
  description: management ip of pcrfclient02

qns_flavor_name:
  type: string
  label: qns flavor name
  description: flavor qns vms will use
  default: qps
qns01_internal_ip:
  type: string
  label: internal ip of qns01
  description: internal ip of qns01
qns02_internal_ip:
  type: string
  label: internal ip of qns02
  description: internal ip of qns02
qns03_internal_ip:
  type: string
  label: internal ip of qns03
```

```
    description: internal ip of qns03
  qns04_internal_ip:
    type: string
    label: internal ip of qns04
    description: internal ip of qns04


  sessionmgr_flavor_name:
    type: string
    label: sessionmgr flavor name
    description: flavor sessionmgr vms will use
    default: sm
  sessionmgr01_internal_ip:
    type: string
    label: internal ip of sessionmgr01
    description: internal ip of sessionmgr01
  sessionmgr01_management_ip:
    type: string
    label: management ip of sessionmgr01
    description: management ip of sessionmgr01
  sessionmgr02_internal_ip:
    type: string
    label: internal ip of sessionmgr02
    description: internal ip of sessionmgr02
  sessionmgr02_management_ip:
    type: string
    label: management ip of sessionmgr02
    description: management ip of sessionmgr02

resources:
#=========================
# Instances
#=========================

  cluman:
    type: OS::Nova::Server
    properties:
      availability_zone: { get_param: cps_az_1 }
      config_drive: "True"
      image: { get_param: base_vm_image_name }
      flavor: { get_param: cluman_flavor_name }
      networks:
        - port: { get_resource: cluman_internal_port }
        - port: { get_resource: cluman_management_port }
      block_device_mapping:
        - device_name: vdb
          volume_id: { get_param: cps_iso_volume_id }
      user_data_format: RAW
      user_data: { get_resource: cluman_config }
  cluman_internal_port:
    type: OS::Neutron::Port
    properties:
      network: { get_param: internal_net_name }
      fixed_ips: [{ ip_address: { get_param: cluman_internal_ip }}]
  cluman_management_port:
    type: OS::Neutron::Port
    properties:
      network: { get_param: management_net_name }
      fixed_ips: [{ ip_address: { get_param: cluman_management_ip }}]
  cluman_config:
    type: OS::Heat::CloudConfig
    properties:
      cloud_config:
        write_files:
```

```
    - path: /var/lib/cloud/instance/payload/launch-params
      permissions: "0644"
    - path: /etc/sysconfig/network-scripts/ifcfg-eth0
      permissions: "0644"
      content:
        str_replace:
          template: |
            DEVICE=eth0
            BOOTPROTO=none
            NM_CONTROLLED=no
            IPADDR=$ip
          params:
            $ip: { get_param: cluman_internal_ip }
    - path: /etc/sysconfig/network-scripts/ifcfg-eth1
      permissions: "0644"
      content:
        str_replace:
          template: |
            DEVICE=eth1
            BOOTPROTO=none
            NM_CONTROLLED=no
            IPADDR=$ip
            GATEWAY=$gateway
          params:
            $ip: { get_param: cluman_management_ip }
            $gateway: { get_param: management_net_gateway }
    - path: /root/.autoinstall.sh
      permissions: "0755"
      content:
        str_replace:
          template: |
            #!/bin/bash
            if [[ -d /mnt/iso ]] && [[ -f /mnt/iso/install.sh ]]; then
            /mnt/iso/install.sh << EOF
            $install_type
            y
            1
            EOF
            fi
          params:
            $install_type: { get_param: cps_install_type }
  mounts:
    - [ /dev/vdb, /mnt/iso, iso9660, "auto,ro", 0, 0 ]
  runcmd:
    - str_replace:
        template: echo $ip installer >> /etc/hosts
        params:
          $ip: { get_param: cluman_internal_ip }
    - str_replace:
        template: ipcalc -m $cidr >> /etc/sysconfig/network-scripts/ifcfg-eth0
        params:
          $cidr: { get_param: internal_net_cidr }
    - str_replace:
        template: ipcalc -m $cidr >> /etc/sysconfig/network-scripts/ifcfg-eth1
        params:
          $cidr: { get_param: management_net_cidr }
    - ifdown eth0 && ifup eth0
    - ifdown eth1 && ifup eth1
    - echo HOSTNAME=cluman >> /etc/sysconfig/network
    - echo cluman > /etc/hostname
    - hostname cluman
    - /root/.autoinstall.sh

lb01:
```

```
  type: OS::Nova::Server
  properties:
    availability_zone: { get_param: cps_az_1 }
    config_drive: "True"
    image: { get_param: base_vm_image_name }
    flavor: { get_param: lb01_flavor_name }
    networks:
      - port: { get_resource: lb01_internal_port }
      - port: { get_resource: lb01_management_port }
      - port: { get_resource: lb01_gx_port }
    user_data_format: RAW
    user_data: { get_resource: lb01_config }
lb01_internal_port:
  type: OS::Neutron::Port
  properties:
    network: { get_param: internal_net_name }
    fixed_ips: [{ ip_address: { get_param: lb01_internal_ip }}]
    allowed_address_pairs:
      - ip_address: { get_param: lb_internal_vip }
lb01_management_port:
  type: OS::Neutron::Port
  properties:
    network: { get_param: management_net_name }
    fixed_ips: [{ ip_address: { get_param: lb01_management_ip }}]
    allowed_address_pairs:
      - ip_address: { get_param: lb_management_vip }
lb01_gx_port:
  type: OS::Neutron::Port
  properties:
    network: { get_param: gx_net_name }
    fixed_ips: [{ ip_address: { get_param: lb01_gx_ip }}]
    allowed_address_pairs:
      - ip_address: { get_param: lb_gx_vip }
lb01_config:
  type: OS::Heat::CloudConfig
  properties:
    cloud_config:
      write_files:
        - path: /var/lib/cloud/instance/payload/launch-params
        - path: /etc/broadhop.profile
          content: "NODE_TYPE=lb01\n"
        - path: /etc/sysconfig/network-scripts/ifcfg-eth0
          content:
            str_replace:
              template: |
                DEVICE=eth0
                BOOTPROTO=none
                NM_CONTROLLED=no
                IPADDR=$ip
              params:
                $ip: { get_param: lb01_internal_ip }
        - path: /etc/sysconfig/network-scripts/ifcfg-eth1
          content:
            str_replace:
              template: |
                DEVICE=eth1
                BOOTPROTO=none
                NM_CONTROLLED=no
                IPADDR=$ip
                GATEWAY=$gateway
              params:
                $ip: { get_param: lb01_management_ip }
                $gateway: { get_param: management_net_gateway }
        - path: /etc/sysconfig/network-scripts/ifcfg-eth2
```

```
          content:
            str_replace:
              template: |
                DEVICE=eth2
                BOOTPROTO=none
                NM_CONTROLLED=no
                IPADDR=$ip
                GATEWAY=$gateway
              params:
                $ip: { get_param: lb01_gx_ip }
                $gateway: { get_param: gx_net_gateway }
      runcmd:
        - str_replace:
            template: echo $ip installer >> /etc/hosts
            params:
              $ip: { get_param: cluman_internal_ip }
        - str_replace:
            template: ipcalc -m $cidr >> /etc/sysconfig/network-scripts/ifcfg-eth0
            params:
              $cidr: { get_param: internal_net_cidr }
        - str_replace:
            template: ipcalc -m $cidr >> /etc/sysconfig/network-scripts/ifcfg-eth1
            params:
              $cidr: { get_param: management_net_cidr }
        - str_replace:
            template: ipcalc -m $cidr >> /etc/sysconfig/network-scripts/ifcfg-eth2
            params:
              $cidr: { get_param: gx_net_cidr }
        - ifdown eth0 && ifup eth0
        - ifdown eth1 && ifup eth1
        - ifdown eth2 && ifup eth2
        - echo HOSTNAME=lb01 >> /etc/sysconfig/network
        - echo lb01 > /etc/hostname
        - hostname lb01

lb02:
  type: OS::Nova::Server
  properties:
    availability_zone: { get_param: cps_az_2 }
    config_drive: "True"
    image: { get_param: base_vm_image_name }
    flavor: { get_param: lb02_flavor_name }
    networks:
      - port: { get_resource: lb02_internal_port }
      - port: { get_resource: lb02_management_port }
      - port: { get_resource: lb02_gx_port }
    user_data_format: RAW
    user_data: { get_resource: lb02_config }
lb02_internal_port:
  type: OS::Neutron::Port
  properties:
    network: { get_param: internal_net_name }
    fixed_ips: [{ ip_address: { get_param: lb02_internal_ip }}]
    allowed_address_pairs:
      - ip_address: { get_param: lb_internal_vip }
lb02_management_port:
  type: OS::Neutron::Port
  properties:
    network: { get_param: management_net_name }
    fixed_ips: [{ ip_address: { get_param: lb02_management_ip }}]
    allowed_address_pairs:
      - ip_address: { get_param: lb_management_vip }
lb02_gx_port:
  type: OS::Neutron::Port
```

```
  properties:
    network: { get_param: gx_net_name }
    fixed_ips: [{ ip_address: { get_param: lb02_gx_ip }}]
    allowed_address_pairs:
      - ip_address: { get_param: lb_gx_vip }
lb02_config:
  type: OS::Heat::CloudConfig
  properties:
    cloud_config:
      write_files:
        - path: /var/lib/cloud/instance/payload/launch-params
        - path: /etc/broadhop.profile
          content: "NODE_TYPE=lb02\n"
        - path: /etc/sysconfig/network-scripts/ifcfg-eth0
          content:
            str_replace:
              template: |
                DEVICE=eth0
                BOOTPROTO=none
                NM_CONTROLLED=no
                IPADDR=$ip
              params:
                $ip: { get_param: lb02_internal_ip }
        - path: /etc/sysconfig/network-scripts/ifcfg-eth1
          content:
            str_replace:
              template: |
                DEVICE=eth1
                BOOTPROTO=none
                NM_CONTROLLED=no
                IPADDR=$ip
                GATEWAY=$gateway
              params:
                $ip: { get_param: lb02_management_ip }
                $gateway: { get_param: management_net_gateway }
        - path: /etc/sysconfig/network-scripts/ifcfg-eth2
          content:
            str_replace:
              template: |
                DEVICE=eth2
                BOOTPROTO=none
                NM_CONTROLLED=no
                IPADDR=$ip
                GATEWAY=$gateway
              params:
                $ip: { get_param: lb02_gx_ip }
                $gateway: { get_param: gx_net_gateway }
      runcmd:
        - str_replace:
            template: echo $ip installer >> /etc/hosts
            params:
              $ip: { get_param: cluman_internal_ip }
        - str_replace:
            template: ipcalc -m $cidr >> /etc/sysconfig/network-scripts/ifcfg-eth0
            params:
              $cidr: { get_param: internal_net_cidr }
        - str_replace:
            template: ipcalc -m $cidr >> /etc/sysconfig/network-scripts/ifcfg-eth1
            params:
              $cidr: { get_param: management_net_cidr }
        - str_replace:
            template: ipcalc -m $cidr >> /etc/sysconfig/network-scripts/ifcfg-eth2
            params:
              $cidr: { get_param: gx_net_cidr }
```

```
        - ifdown eth0 && ifup eth0
        - ifdown eth1 && ifup eth1
        - ifdown eth2 && ifup eth2
        - echo HOSTNAME=lb02 >> /etc/sysconfig/network
        - echo lb02 > /etc/hostname
        - hostname lb02

pcrfclient01:
  type: OS::Nova::Server
  properties:
    availability_zone: { get_param: cps_az_1 }
    config_drive: "True"
    image: { get_param: base_vm_image_name }
    flavor: { get_param: pcrfclient01_flavor_name }
    networks:
      - port: { get_resource: pcrfclient01_internal_port }
      - port: { get_resource: pcrfclient01_management_port }
    block_device_mapping:
      - device_name: vdb
        volume_id: { get_param: svn01_volume_id }
    user_data_format: RAW
    user_data: { get_resource: pcrfclient01_config }
pcrfclient01_internal_port:
  type: OS::Neutron::Port
  properties:
    network: { get_param: internal_net_name }
    fixed_ips: [{ ip_address: { get_param: pcrfclient01_internal_ip }}]
pcrfclient01_management_port:
  type: OS::Neutron::Port
  properties:
    network: { get_param: management_net_name }
    fixed_ips: [{ ip_address: { get_param: pcrfclient01_management_ip }}]
pcrfclient01_config:
  type: OS::Heat::CloudConfig
  properties:
    cloud_config:
      write_files:
        - path: /var/lib/cloud/instance/payload/launch-params
        - path: /etc/broadhop.profile
          content: "NODE_TYPE=pcrfclient01\n"
        - path: /etc/sysconfig/network-scripts/ifcfg-eth0
          content:
            str_replace:
              template: |
                DEVICE=eth0
                BOOTPROTO=none
                NM_CONTROLLED=no
                IPADDR=$ip
              params:
                $ip: { get_param: pcrfclient01_internal_ip }
        - path: /etc/sysconfig/network-scripts/ifcfg-eth1
          content:
            str_replace:
              template: |
                DEVICE=eth1
                BOOTPROTO=none
                NM_CONTROLLED=no
                IPADDR=$ip
                GATEWAY=$gateway
              params:
                $ip: { get_param: pcrfclient01_management_ip }
                $gateway: { get_param: management_net_gateway }
      runcmd:
        - str_replace:
```

```
            template: echo $ip installer >> /etc/hosts
            params:
              $ip: { get_param: cluman_internal_ip }
        - str_replace:
            template: ipcalc -m $cidr >> /etc/sysconfig/network-scripts/ifcfg-eth0
            params:
              $cidr: { get_param: internal_net_cidr }
        - str_replace:
            template: ipcalc -m $cidr >> /etc/sysconfig/network-scripts/ifcfg-eth1
            params:
              $cidr: { get_param: management_net_cidr }
        - ifdown eth0 && ifup eth0
        - ifdown eth1 && ifup eth1
        - echo HOSTNAME=pcrfclient01 >> /etc/sysconfig/network
        - echo pcrfclient01 > /etc/hostname
        - hostname pcrfclient01

pcrfclient02:
  type: OS::Nova::Server
  properties:
    availability_zone: { get_param: cps_az_2 }
    config_drive: "True"
    image: { get_param: base_vm_image_name }
    flavor: { get_param: pcrfclient02_flavor_name }
    networks:
      - port: { get_resource: pcrfclient02_internal_port }
      - port: { get_resource: pcrfclient02_management_port }
    block_device_mapping:
      - device_name: vdb
        volume_id: { get_param: svn02_volume_id }
    user_data_format: RAW
    user_data: { get_resource: pcrfclient02_config }
pcrfclient02_internal_port:
  type: OS::Neutron::Port
  properties:
    network: { get_param: internal_net_name }
    fixed_ips: [{ ip_address: { get_param: pcrfclient02_internal_ip }}]
pcrfclient02_management_port:
  type: OS::Neutron::Port
  properties:
    network: { get_param: management_net_name }
    fixed_ips: [{ ip_address: { get_param: pcrfclient02_management_ip }}]
pcrfclient02_config:
  type: OS::Heat::CloudConfig
  properties:
    cloud_config:
      write_files:
        - path: /var/lib/cloud/instance/payload/launch-params
        - path: /etc/broadhop.profile
          content: "NODE_TYPE=pcrfclient02\n"
        - path: /etc/sysconfig/network-scripts/ifcfg-eth0
          content:
            str_replace:
              template: |
                DEVICE=eth0
                BOOTPROTO=none
                NM_CONTROLLED=no
                IPADDR=$ip
              params:
                $ip: { get_param: pcrfclient02_internal_ip }
        - path: /etc/sysconfig/network-scripts/ifcfg-eth1
          content:
            str_replace:
              template: |
```

```
                  DEVICE=eth1
                  BOOTPROTO=none
                  NM_CONTROLLED=no
                  IPADDR=$ip
                  GATEWAY=$gateway
                params:
                  $ip: { get_param: pcrfclient02_management_ip }
                  $gateway: { get_param: management_net_gateway }
      runcmd:
        - str_replace:
            template: echo $ip installer >> /etc/hosts
            params:
              $ip: { get_param: cluman_internal_ip }
        - str_replace:
            template: ipcalc -m $cidr >> /etc/sysconfig/network-scripts/ifcfg-eth0
            params:
              $cidr: { get_param: internal_net_cidr }
        - str_replace:
            template: ipcalc -m $cidr >> /etc/sysconfig/network-scripts/ifcfg-eth1
            params:
              $cidr: { get_param: management_net_cidr }
        - ifdown eth0 && ifup eth0
        - ifdown eth1 && ifup eth1
        - echo HOSTNAME=pcrfclient02 >> /etc/sysconfig/network
        - echo pcrfclient01 > /etc/hostname
        - hostname pcrfclient02

qns01:
  type: OS::Nova::Server
  properties:
    availability_zone: { get_param: cps_az_1 }
    config_drive: "True"
    image: { get_param: base_vm_image_name }
    flavor: { get_param: qns_flavor_name }
    networks:
      - port: { get_resource: qns01_internal_port }
    user_data_format: RAW
    user_data: { get_resource: qns01_config }
qns01_internal_port:
  type: OS::Neutron::Port
  properties:
    network: { get_param: internal_net_name }
    fixed_ips: [{ ip_address: { get_param: qns01_internal_ip }}]
qns01_config:
  type: OS::Heat::CloudConfig
  properties:
    cloud_config:
      write_files:
        - path: /var/lib/cloud/instance/payload/launch-params
        - path: /etc/broadhop.profile
          content: "NODE_TYPE=qns01\n"
        - path: /etc/sysconfig/network-scripts/ifcfg-eth0
          content:
            str_replace:
              template: |
                DEVICE=eth0
                BOOTPROTO=none
                NM_CONTROLLED=no
                IPADDR=$ip
              params:
                $ip: { get_param: qns01_internal_ip }
      runcmd:
        - str_replace:
            template: echo $ip installer >> /etc/hosts
```

```
            params:
              $ip: { get_param: cluman_internal_ip }
          - str_replace:
              template: ipcalc -m $cidr >> /etc/sysconfig/network-scripts/ifcfg-eth0
              params:
                $cidr: { get_param: internal_net_cidr }
          - ifdown eth0 && ifup eth0
          - echo HOSTNAME=qns01 >> /etc/sysconfig/network
          - echo qns01 > /etc/hostname
          - hostname qns01

  qns02:
    type: OS::Nova::Server
    properties:
      availability_zone: { get_param: cps_az_1 }
      config_drive: "True"
      image: { get_param: base_vm_image_name }
      flavor: { get_param: qns_flavor_name }
      networks:
        - port: { get_resource: qns02_internal_port }
      user_data_format: RAW
      user_data: { get_resource: qns02_config }
  qns02_internal_port:
    type: OS::Neutron::Port
    properties:
      network: { get_param: internal_net_name }
      fixed_ips: [{ ip_address: { get_param: qns02_internal_ip }}]
  qns02_config:
    type: OS::Heat::CloudConfig
    properties:
      cloud_config:
        write_files:
          - path: /var/lib/cloud/instance/payload/launch-params
          - path: /etc/broadhop.profile
            content: "NODE_TYPE=qns02\n"
          - path: /etc/sysconfig/network-scripts/ifcfg-eth0
            content:
              str_replace:
                template: |
                  DEVICE=eth0
                  BOOTPROTO=none
                  NM_CONTROLLED=no
                  IPADDR=$ip
                params:
                  $ip: { get_param: qns02_internal_ip }
        runcmd:
          - str_replace:
              template: echo $ip installer >> /etc/hosts
              params:
                $ip: { get_param: cluman_internal_ip }
          - str_replace:
              template: ipcalc -m $cidr >> /etc/sysconfig/network-scripts/ifcfg-eth0
              params:
                $cidr: { get_param: internal_net_cidr }
          - ifdown eth0 && ifup eth0
          - echo HOSTNAME=qns02 >> /etc/sysconfig/network
          - echo qns02 > /etc/hostname
          - hostname qns02

  qns03:
    type: OS::Nova::Server
    properties:
      availability_zone: { get_param: cps_az_2 }
      config_drive: "True"
```

```
    image: { get_param: base_vm_image_name }
    flavor: { get_param: qns_flavor_name }
    networks:
      - port: { get_resource: qns03_internal_port }
    user_data_format: RAW
    user_data: { get_resource: qns03_config }
qns03_internal_port:
  type: OS::Neutron::Port
  properties:
    network: { get_param: internal_net_name }
    fixed_ips: [{ ip_address: { get_param: qns03_internal_ip }}]
qns03_config:
  type: OS::Heat::CloudConfig
  properties:
    cloud_config:
      write_files:
        - path: /var/lib/cloud/instance/payload/launch-params
        - path: /etc/broadhop.profile
          content: "NODE_TYPE=qns03\n"
        - path: /etc/sysconfig/network-scripts/ifcfg-eth0
          content:
            str_replace:
              template: |
                DEVICE=eth0
                BOOTPROTO=none
                NM_CONTROLLED=no
                IPADDR=$ip
              params:
                $ip: { get_param: qns03_internal_ip }
      runcmd:
        - str_replace:
            template: echo $ip installer >> /etc/hosts
            params:
              $ip: { get_param: cluman_internal_ip }
        - str_replace:
            template: ipcalc -m $cidr >> /etc/sysconfig/network-scripts/ifcfg-eth0
            params:
              $cidr: { get_param: internal_net_cidr }
        - ifdown eth0 && ifup eth0
        - echo HOSTNAME=qns03 >> /etc/sysconfig/network
        - echo qns03 > /etc/hostname
        - hostname qns03

qns04:
  type: OS::Nova::Server
  properties:
    availability_zone: { get_param: cps_az_2 }
    config_drive: "True"
    image: { get_param: base_vm_image_name }
    flavor: { get_param: qns_flavor_name }
    networks:
      - port: { get_resource: qns04_internal_port }
    user_data_format: RAW
    user_data: { get_resource: qns04_config }
qns04_internal_port:
  type: OS::Neutron::Port
  properties:
    network: { get_param: internal_net_name }
    fixed_ips: [{ ip_address: { get_param: qns04_internal_ip }}]
qns04_config:
  type: OS::Heat::CloudConfig
  properties:
    cloud_config:
      write_files:
```

```
        - path: /var/lib/cloud/instance/payload/launch-params
        - path: /etc/broadhop.profile
          content: "NODE_TYPE=qns04\n"
        - path: /etc/sysconfig/network-scripts/ifcfg-eth0
          content:
            str_replace:
              template: |
                DEVICE=eth0
                BOOTPROTO=none
                NM_CONTROLLED=no
                IPADDR=$ip
              params:
                $ip: { get_param: qns04_internal_ip }
      runcmd:
        - str_replace:
            template: echo $ip installer >> /etc/hosts
            params:
              $ip: { get_param: cluman_internal_ip }
        - str_replace:
            template: ipcalc -m $cidr >> /etc/sysconfig/network-scripts/ifcfg-eth0
            params:
              $cidr: { get_param: internal_net_cidr }
        - ifdown eth0 && ifup eth0
        - echo HOSTNAME=qns04 >> /etc/sysconfig/network
        - echo qns04 > /etc/hostname
        - hostname qns04

  sessionmgr01:
    type: OS::Nova::Server
    properties:
      availability_zone: { get_param: cps_az_1 }
      config_drive: "True"
      image: { get_param: base_vm_image_name }
      flavor: { get_param: sessionmgr_flavor_name }
      networks:
        - port: { get_resource: sessionmgr01_internal_port }
        - port: { get_resource: sessionmgr01_management_port }
      block_device_mapping:
        - device_name: vdb
          volume_id: { get_param: mongo01_volume_id }
      user_data_format: RAW
      user_data: { get_resource: sessionmgr01_config }
  sessionmgr01_internal_port:
    type: OS::Neutron::Port
    properties:
      network: { get_param: internal_net_name }
      fixed_ips: [{ ip_address: { get_param: sessionmgr01_internal_ip }}]
  sessionmgr01_management_port:
    type: OS::Neutron::Port
    properties:
      network: { get_param: management_net_name }
      fixed_ips: [{ ip_address: { get_param: sessionmgr01_management_ip }}]
  sessionmgr01_config:
    type: OS::Heat::CloudConfig
    properties:
      cloud_config:
        write_files:
          - path: /var/lib/cloud/instance/payload/launch-params
          - path: /etc/broadhop.profile
            content: "NODE_TYPE=sessionmgr01\n"
          - path: /etc/sysconfig/network-scripts/ifcfg-eth0
            content:
              str_replace:
                template: |
```

```
                  DEVICE=eth0
                  BOOTPROTO=none
                  NM_CONTROLLED=no
                  IPADDR=$ip
                params:
                  $ip: { get_param: sessionmgr01_internal_ip }
          - path: /etc/sysconfig/network-scripts/ifcfg-eth1
            content:
              str_replace:
                template: |
                  DEVICE=eth1
                  BOOTPROTO=none
                  NM_CONTROLLED=no
                  IPADDR=$ip
                  GATEWAY=$gateway
                params:
                  $ip: { get_param: sessionmgr01_management_ip }
                  $gateway: { get_param: management_net_gateway }
      runcmd:
        - str_replace:
            template: echo $ip installer >> /etc/hosts
            params:
              $ip: { get_param: cluman_internal_ip }
        - str_replace:
            template: ipcalc -m $cidr >> /etc/sysconfig/network-scripts/ifcfg-eth0
            params:
              $cidr: { get_param: internal_net_cidr }
        - str_replace:
            template: ipcalc -m $cidr >> /etc/sysconfig/network-scripts/ifcfg-eth1
            params:
              $cidr: { get_param: management_net_cidr }
        - ifdown eth0 && ifup eth0
        - ifdown eth1 && ifup eth1
        - echo HOSTNAME=sessionmgr01 >> /etc/sysconfig/network
        - echo sessionmgr01 > /etc/hostname
        - hostname sessionmgr01

sessionmgr02:
  type: OS::Nova::Server
  properties:
    availability_zone: { get_param: cps_az_2 }
    config_drive: "True"
    image: { get_param: base_vm_image_name }
    flavor: { get_param: sessionmgr_flavor_name }
    networks:
      - port: { get_resource: sessionmgr02_internal_port }
      - port: { get_resource: sessionmgr02_management_port }
    block_device_mapping:
      - device_name: vdb
        volume_id: { get_param: mongo02_volume_id }
    user_data_format: RAW
    user_data: { get_resource: sessionmgr02_config }
sessionmgr02_internal_port:
  type: OS::Neutron::Port
  properties:
    network: { get_param: internal_net_name }
    fixed_ips: [{ ip_address: { get_param: sessionmgr02_internal_ip }}]
sessionmgr02_management_port:
  type: OS::Neutron::Port
  properties:
    network: { get_param: management_net_name }
    fixed_ips: [{ ip_address: { get_param: sessionmgr02_management_ip }}]
sessionmgr02_config:
  type: OS::Heat::CloudConfig
```

```
properties:
  cloud_config:
    write_files:
      - path: /var/lib/cloud/instance/payload/launch-params
      - path: /etc/broadhop.profile
        content: "NODE_TYPE=sessionmgr02\n"
      - path: /etc/sysconfig/network-scripts/ifcfg-eth0
        content:
          str_replace:
            template: |
              DEVICE=eth0
              BOOTPROTO=none
              NM_CONTROLLED=no
              IPADDR=$ip
            params:
              $ip: { get_param: sessionmgr02_internal_ip }
      - path: /etc/sysconfig/network-scripts/ifcfg-eth1
        content:
          str_replace:
            template: |
              DEVICE=eth1
              BOOTPROTO=none
              NM_CONTROLLED=no
              IPADDR=$ip
              GATEWAY=$gateway
            params:
              $ip: { get_param: sessionmgr02_management_ip }
              $gateway: { get_param: management_net_gateway }
    runcmd:
      - str_replace:
          template: echo $ip installer >> /etc/hosts
          params:
            $ip: { get_param: cluman_internal_ip }
      - str_replace:
          template: ipcalc -m $cidr >> /etc/sysconfig/network-scripts/ifcfg-eth0
          params:
            $cidr: { get_param: internal_net_cidr }
      - str_replace:
          template: ipcalc -m $cidr >> /etc/sysconfig/network-scripts/ifcfg-eth1
          params:
            $cidr: { get_param: management_net_cidr }
      - ifdown eth0 && ifup eth0
      - ifdown eth1 && ifup eth1
      - echo HOSTNAME=sessionmgr02 >> /etc/sysconfig/network
      - echo sessionmgr02 > /etc/hostname
      - hostname sessionmgr02
```

Create Heat Stack

Before beginning, verify you have populated your information in the environment (.env) file and heat template (.yaml) file and loaded both files on the control node.

Step 1 Run the following command on control node at the location where your environment and heat template files are located:

```
source ~/keystonerc_core
```

Step 2 Add/assign the heat stack owner to core tenant user:

```
openstack role add --project core --user core admin
```

Step 3 Verify that no existing CPS stack is present:

```
[root@os8-control ~(keystone_core)]# heat stack-list

+--------------------------------------+------------+-----------------+----------------------+
| id                                   | stack_name | stack_status    | creation_time        |
+--------------------------------------+------------+-----------------+----------------------+
+--------------------------------------+------------+-----------------+----------------------+
```

Step 4 Create the stack using the heat template (hot-cps.yaml) and environment file (hot-cps.env) you populated earlier.

```
[root@os8-control mbuild(keystone_core)]# heat stack-create --environment-file hot-cps.env
--template-file hot-cps.yaml cps
+--------------------------------------+------------+--------------------+----------------------+
| id                                   | stack_name | stack_status       | creation_time        |
+--------------------------------------+------------+--------------------+----------------------+
| 3f1ab6c2-673d-47b3-ae01-8946cac9e9e9 | cps        | CREATE_IN_PROGRESS | 2016-03-03T16:58:53Z |
+--------------------------------------+------------+--------------------+----------------------+
```

Step 5 Check the status using the `heat stack-list` command:

```
[root@os8-control mbuild(keystone_core)]# heat stack-list
+--------------------------------------+------------+-----------------+----------------------+
| id                                   | stack_name | stack_status    | creation_time        |
+--------------------------------------+------------+-----------------+----------------------+
| 3f1ab6c2-673d-47b3-ae01-8946cac9e9e9 | cps        | CREATE_COMPLETE | 2016-01-19T16:58:53Z |
+--------------------------------------+------------+-----------------+----------------------+
```

`CREATE_COMPLETE` will be reported when the heat stack is finished.

Step 6 Wait approximately 10 minutes for the Cluster Manager VM to be deployed, then check the readiness status of the Cluster Manager VM using the following API:

GET http://<*Cluster Manager IP*>:8458/api/system/status/cluman

Refer to /api/system/status/cluman for more information.

When this API responds that the Cluster Manager VM is in a ready state (`"status": "ready"`), continue with Deploy CPS, on page 25.

Refer also to the `/var/log/cloud-init-output.log` on the Cluster Manager VM for deployment details.

Deploy CPS

The following steps outline how to create a consolidated CPS configuration file and use the CPS platform orchestration APIs to deploy the CPS VMs on OpenStack:

Step 1 Create a consolidated CPS configuration file. This file contains all the information necessary to deploy VMs in the CPS cluster, including a valid CPS license key. Contact your Cisco representative to receive the CPS license key for your deployment.

Note Cisco Smart Licensing is supported for CPS 10.0.0 and later releases. For information about what Smart Licensing is and how to enable it for CPS, refer to the *CPS Operations Guide*.

a) Refer to *Sample YAML Configuration File - HA Setup* section for a sample CPS configuration to use as a template.

b) Refer to *Configuration Parameters - HA System* section for a description of all parameters within this file.

Important Verify that all VM IP addresses and host names are configured properly in the YAML and Heat template files. You cannot modify the IP addresses or host names manually on the VMs (excluding Cluster Manager) after deploying the VMs, and CPS does not support modification of IP addresses or host names of deployed VMs.

Step 2 Load the consolidated configuration file you created in Step 1 using the following API:

POST http://<*Cluster Manager IP*>:8458/api/system/config/

For example:

```
curl -v -X POST --data-binary @CPS_config_yaml.txt -H "Content-type: application/yaml"
http://x.x.x.x:8458/api/system/config/
```

Refer to /api/system/config/ for more information.

Step 3 (Optional) To confirm the configuration was loaded properly onto the Cluster Manager VM, perform a GET with the same API:

GET http://<*Cluster Manager IP*>:8458/api/system/config/

Step 4 Apply the configuration using the following API:

POST http://<*Cluster Manager IP*>:8458/api/system/config/action/apply

For example:

```
curl -v -X POST -H  "Content-type: application/json" http://x.x.x.x:8458/api/system/config/action/apply
```

Refer to /api/system/config/ for more information.

This API applies the CPS configuration file, triggers the Cluster Manager VM to deploy and bring up all CPS VMs, and performs all post-installation steps.

Important The VMs are rebooted in rescue mode for the first time for CentOS to adjust disk/hardware to the new version. Subsequent reboots if necessary is a normal operation.

Step 5 Run `change_passwd.sh` script on Cluster Manager to change the password of root user across the system.

Note The default root password created during installation is not in compliance with the PSB requirements. Hence, it is recommended to change the default root password post completion of CPS deployment using `change_passwd.sh` script. For more information, refer to *Update Default Credentials* section in the *CPS Installation Guide for VMware*.

Note You can create or change passphrase or password with the following limitations::

- You can provide or update a password of a minimum length of 4 characters where it must consist of all 4 classes (1 capital letter, 1 small letter, 1 numeric and 1 special character).
- You can provide or update a password of length of 5 or more where it must consist of 3-4 classes (1 capital letter, 1 small letter, 1 numeric and 1 special character).
- You can provide or update a passphrase of 127 characters.

What to do next

To enable the feature **Disable Root SSH Login**, check whether there exists a user with uid 1000 on Cluster Manager.

Use the following command to check there exists a user with uid 1000:

```
cat /etc/passwd | grep x:1000
```

If a user with uid 1000 exists on the Cluster Manager, change the uid on the Cluster Manager by executing the following command:

```
usermod -u <new-uid> <user-name-with-uid-as-1000>
```

This is done because the feature **Disable Root SSH Login** creates a user with uid 1000.

Validate CPS Deployment

Step 1 To monitor the status of the deployment, use the following API:

GET http://<*Cluster Manager IP*>:8458/api/system/config/status

Refer to /api/system/config/status for more information.

Step 2 After the deployment has completed, verify the readiness of the entire CPS cluster using the following API:

GET http://<*Cluster Manager IP*>:8458/api/system/status/cps

Refer to /api/system/status/cps for more information.

Step 3 Connect to the Cluster Manager and issue the following command to run a set of diagnostics and display the current state of the system.

```
/var/qps/bin/diag/diagnostics.sh
```

What to do next

Important After the validation is complete, take a backup of the Cluster Manager configuration. For more information on taking the backup, refer to *CPS Backup and Restore Guide*. In case the Cluster Manager gets corrupted this backup can be used to recover the Cluster Manager.

Troubleshooting

- CPS clusters deployed using the orchestration APIs report the following licensing errors in `/var/log/broadhop/qns.log` on the OAM (pcrfclient) VMs:

  ```
  [LicenseManagerTimer] ERROR c.b.licensing.impl.LicenseManager - Unable to load the
  license file.  Server is not licensed!
  ```

  This error can be ignored.

SR-IOV Support

CPS supports single root I/O virtualization (SR-IOV) on Intel NIC adapters.

CPS also supports bonding of SR-IOV sub-interfaces for seamless traffic switchover.

The Intel SR-IOV implementation includes anti-spoofing support that will not allow MAC addresses other than the one configured in the VF to communicate. As a result, the active failover mac policy is used.

To support seamless failover of interfaces, the VLAN interfaces must be created directly on top of the VF interfaces (for example, eth0.1003 and eth1.1003) and the interfaces are bonded (bond01003). If VLAN interfaces are created on top of a bond, their MAC address will not follow the bonds when a failover occurs and the old MAC will be used for the new active interface.

- If all the guest VM interfaces are SRIOV interface then `ifrename.yaml` is not required.
- If multiple drivers are used, then `ifrename.yaml` file must be updated with corresponding driver. For example, I40evf for XL710.
- Bonding can be created on two different virtual functions. The virtual functions can be created from same physical function or different physical function in the host based on the requirements

Note Before deploying VM, validate the yaml file format and content with yaml validator.

The following sample configuration shows the bonding of two interfaces using a single IP address:

```
::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
cat /proc/net/bonding/bond01003
Ethernet Channel Bonding Driver: v3.7.1 (April 27, 2011)

Bonding Mode: fault-tolerance (active-backup) (fail_over_mac active)
Primary Slave: None
Currently Active Slave: eth2.1003
MII Status: up
MII Polling Interval (ms): 100
Up Delay (ms): 0
Down Delay (ms): 0

Slave Interface: eth2.1003
MII Status: up
Speed: 40000 Mbps
Duplex: full
Link Failure Count: 0
Permanent HW addr: fa:16:3e:c0:eb:0f
Slave queue ID: 0

Slave Interface: eth21.1003
MII Status: up
Speed: 40000 Mbps
Duplex: full
Link Failure Count: 0
Permanent HW addr: fa:16:3e:77:30:2d
Slave queue ID: 0
::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
cat /etc/sysconfig/network-scripts/ifcfg-eth2
DEVICE=eth2
TYPE=Ethernet
```

```
ONBOOT=yes
BOOTPROTO=none
NM_CONTROLLED=no
USRCTL=no
::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
cat /etc/sysconfig/network-scripts/ifcfg-eth21
DEVICE=eth21
TYPE=Ethernet
ONBOOT=yes
BOOTPROTO=none
NM_CONTROLLED=no
USRCTL=no
::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
cat /etc/sysconfig/network-scripts/ifcfg-eth2.1003
DEVICE=eth2.1003
ONBOOT=yes
MASTER=bond01003
BOOTPROTO=none
NM_CONTROLLED=no
USRCTL=no
SLAVE=yes
VLAN=yes
PHYSDEV=eth2
::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
cat /etc/sysconfig/network-scripts/ifcfg-eth21.1003
DEVICE=eth21.1003
ONBOOT=yes
MASTER=bond01003
BOOTPROTO=none
NM_CONTROLLED=no
USRCTL=no
SLAVE=yes
VLAN=yes
PHYSDEV=eth21
::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
cat /etc/sysconfig/network-scripts/ifcfg-bond01003
DEVICE=bond01003
BONDING_OPTS="mode=active-backup miimon=100 fail_over_mac=1"
TYPE=Bond
BONDING_MASTER=yes
BOOTPROTO=none
NM_CONTROLLED=no
DEFROUTE=yes
PEERDNS=yes
PEERROUTES=yes
IPV6INIT=no
IPADDR=172.X.X.X
NETMASK=255.255.255.X
NETWORK=172.X.X.X
IPV4_FAILURE_FATAL=no
IPV6INIT=no
IPV6_AUTOCONF=yes
IPV6_DEFROUTE=yes
IPV6_PEERDNS=yes
IPV6_PEERROUTES=yes
IPV6_FAILURE_FATAL=no
ONBOOT=yes
::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
```

Consistent Network Device Naming

CPS instances require that network interfaces be assigned IP addresses statically. The names of network interfaces (eth0, eth1, and so on) are assumed to reflect network interfaces representing neutron ports passed to OpenStack nova-boot or heat template in that order. In this case, eth0 is assumed to reflect the first neutron port, eth1 the second, and so on.

For CPS deployments on OpenStack which use SR-IOV, often two or more network drivers are used. When more than one network driver is used, network interface names can become unpredictable and can change based on the order in which the network drivers are loaded into the kernel.

Note Before deploying VM, validate the yaml file format and content with yaml validator.

The following section describes how to map a network interface for a given network drivers type to its correct expected name in the guest OS.

Requirements:

- Correct IP address assignment requires that network names used in the network interfaces file must match the name of the network interface in the guest OS.
- The order of neutron ports of a given type (non-SR-IOV or SR-IOV) in nova-boot or heat template directly maps to the order of the PCI device slot of the associated network interfaces in the guest OS.
- The mapping between the network interface of a given network driver type and network driver name are passed during the creation of an instance through the cloud-init configuration.

The expected network interface name configuration is passed into CPS instance's guest OS using a YAML format configuration file located at: `/var/lib/cloud/instance/payload/ifrename.yaml`.

The file should have a section for each driver type and list the interfaces for that driver type with the following information:

- Rank order (0, 1, 2…) for the interface among other interfaces of the same driver type, as is specified in the nova boot command/heat template
- Expected name of the interface (eth0, eth1, eth2 etc.)

For example:

```
path: /var/lib/cloud/instance/payload/ifrename.yaml
  encoding: ascii
  owner: root:root
  permissions: '0644'
  content:  |
    ---
      virtio_net:
        0 : eth0
        1 : eth1
      i40evf:
        0 : eth2
        1 : eth3
```

Driver names for SR-IOV ports can be determined by checking the interface card vendor documentation. For regular virtio ports, the driver name is 'virtio_net'.

This `ifrename.yaml` file must be added in the existing write_files: section of cloud-init configurations for each CPS VM.

The configuration file above instructs cloud-init to create a file `ifrename.yaml` at `/var/lib/cloud/instance/payload`, owned by root, with permissions of 644 and contents as mentioned in "content:" section. In this example:

- the first SR-IOV neutron port (managed by 'i40evf' driver) is mapped to to eth2.
- the first non-SR-IOV port (managed by 'virtio-net' driver) is mapped to eth0.
- the second non-SR-IOV port (managed by 'virtio-net' driver) to eth1.

Regardless of the order in which neutron ports are passed, or order in which network drivers are loaded, this configuration file specifies which network interface name should go to which network interface.

Host System Configuration

Using the following steps, you can check and verify the host system configuration for SR-IOV.

Step 1 From the control node, verify SR-IOV NIC agent is running on compute node.

```
openstack network agent list | grep sriov
| 08c0ecbe-ae11-4ecf-94dd-14354c8c1c9a | NIC Switch agent   | cn1-svi-tb4-ultram-compute-6.localdomain
     | None              | :-)   | UP    | neutron-sriov-nic-agent   |
| 1956f725-b1fc-4e95-837c-d61e701d72e0 | NIC Switch agent   |
cn1-svi-tb4-ultram-osd-compute-0.localdomain | None              | :-)   | UP    |
neutron-sriov-nic-agent   |
| 48e2b21f-a811-43a1-9bda-12a7d1f2437b | NIC Switch agent   | cn1-svi-tb4-ultram-compute-12.localdomain
    | None              | :-)   | UP    | neutron-sriov-nic-agent   |
| 6285925e-6c0b-49dd-97e1-bdb915f63f37 | NIC Switch agent   | cn1-svi-tb4-ultram-compute-0.localdomain
     | None              | :-)   | UP    | neutron-sriov-nic-agent   |
| 6c053106-f9a0-4b95-847a-99eeb7a552b7 | NIC Switch agent   | cn1-svi-tb4-ultram-compute-11.localdomain
    | None              | :-)   | UP    | neutron-sriov-nic-agent   |
| 6ce09414-427f-46a6-922d-97c15e84e27e | NIC Switch agent   | cn1-svi-tb4-ultram-compute-10.localdomain
    | None              | :-)   | UP    | neutron-sriov-nic-agent   |
| 72ffa7e7-85f8-4886-841d-e661b1418aca | NIC Switch agent   | cn1-svi-tb4-ultram-compute-3.localdomain
     | None              | :-)   | UP    | neutron-sriov-nic-agent   |
| 73bef995-dfe2-4f52-a3fe-f9fd7db5aed7 | NIC Switch agent   | cn1-svi-tb4-ultram-compute-9.localdomain
     | None              | :-)   | UP    | neutron-sriov-nic-agent   |
| 7772824a-8b96-46ed-9d9e-a002d4e8813b | NIC Switch agent   | cn1-svi-tb4-ultram-compute-4.localdomain
     | None              | :-)   | UP    | neutron-sriov-nic-agent   |
| 8300fd79-6f91-45cd-b03d-5b4d9c83fdc6 | NIC Switch agent   | cn1-svi-tb4-ultram-compute-2.localdomain
     | None              | :-)   | UP    | neutron-sriov-nic-agent   |
| 84baf283-2c19-469a-b74d-e7c77340a910 | NIC Switch agent   |
cn1-svi-tb4-ultram-osd-compute-1.localdomain | None              | :-)   | UP    |
neutron-sriov-nic-agent   |
| 8ce0bdb0-0b4e-44a4-b86b-a2af5181f890 | NIC Switch agent   | cn1-svi-tb4-ultram-compute-8.localdomain
     | None              | :-)   | UP    | neutron-sriov-nic-agent   |
| b96ca4ee-0536-44aa-8648-01e649a20ba0 | NIC Switch agent   | cn1-svi-tb4-ultram-compute-5.localdomain
     | None              | :-)   | UP    | neutron-sriov-nic-agent   |
| d3d5900d-2c9a-483a-ad92-0e45a3c2aa4d | NIC Switch agent   | cn1-svi-tb4-ultram-compute-1.localdomain
     | None              | :-)   | UP    | neutron-sriov-nic-agent   |
| da19d176-1a32-4d71-a9d4-1e0b51d3f961 | NIC Switch agent   | cn1-svi-tb4-ultram-compute-7.localdomain
     | None              | :-)   | UP    | neutron-sriov-nic-agent   |
| eae6f9fe-1542-43dc-a2ef-71909e7d8cac | NIC Switch agent   |
cn1-svi-tb4-ultram-osd-compute-2.localdomain | None              | :-)   | UP    |
neutron-sriov-nic-agent   |
```

```
openstack network agent show 1956f725-b1fc-4e95-837c-d61e701d72e0

+-------------------+--------------------------------------------------------------------------------------------------------------------------+
| Field             | Value
                |
+-------------------+--------------------------------------------------------------------------------------------------------------------------+
| admin_state_up    | UP
                |
| agent_type        | NIC Switch agent
                |
| alive             | :-)
                |
| availability_zone | None
                |
| binary            | neutron-sriov-nic-agent
                |
| configuration     | {u'extensions': [], u'devices': 0, u'device_mappings': {u'phys_pcie1_0':
[u'enp94s0f0'], u'phys_pcie1_1': [u'enp94s0f1'], u'phys_pcie2_1': [u'enp216s0f1'], u'phys_pcie2_0':
 [u'enp216s0f0']}} |
| created_at        | 2019-05-22 16:26:55
                |
| description       | None
                |
| ha_state          | None
                |
| host              | cn1-svi-tb4-ultram-osd-compute-0.localdomain
                |
| id                | 1956f725-b1fc-4e95-837c-d61e701d72e0
                |
| last_heartbeat_at | 2019-06-16 15:05:59
                |
| name              | None
                |
| started_at        | 2019-05-22 16:26:55
                |
| topic             | N/A
                |
+-------------------+--------------------------------------------------------------------------------------------------------------------------+
```

Step 2 Use the following command to find out how many XL710 interfaces are available.

```
lspci -nn | grep XL710
5e:00.0 Ethernet controller [0200]: Intel Corporation Ethernet Controller XL710 for 40GbE QSFP+
[8086:1583] (rev 02)
5e:00.1 Ethernet controller [0200]: Intel Corporation Ethernet Controller XL710 for 40GbE QSFP+
[8086:1583] (rev 02)
d8:00.0 Ethernet controller [0200]: Intel Corporation Ethernet Controller XL710 for 40GbE QSFP+
[8086:1583] (rev 02)
d8:00.1 Ethernet controller [0200]: Intel Corporation Ethernet Controller XL710 for 40GbE QSFP+
[8086:1583] (rev 02)
```

Step 3 Find out the interface name from PCIe address listed from above command and its MAC address.

Interface Name – enp94s0f0

```
cat /sys/bus/pci/devices/0000\:5e\:00.0/net/enp94s0f0/address
3c:fd:fe:cf:8a:08
[root@cn1-svi-tb4-ultram-compute-0 ~]#

[root@cn1-svi-tb4-ultram-compute-0 ~]# ifconfig enp94s0f0
enp94s0f0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 9000
        inet6 fe80::3efd:feff:fecf:8a08  prefixlen 64  scopeid 0x20<link>
        ether 3c:fd:fe:cf:8a:08  txqueuelen 1000  (Ethernet)
        RX packets 30355454  bytes 1829851053 (1.7 GiB)
        RX errors 0  dropped 756  overruns 0  frame 0
        TX packets 0  bytes 0 (0.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

Step 4 Find out the driver of the interface.

```
ethtool -i enp94s0f0
driver: i40e
version: 2.3.2-k
firmware-version: 6.01 0x800036bb 0.385.33
expansion-rom-version:
bus-info: 0000:5e:00.0
supports-statistics: yes
supports-test: yes
supports-eeprom-access: yes
supports-register-dump: yes
supports-priv-flags: yes
```

Step 5 Total number of VFs supported and configured.

```
cat /sys/class/net/enp94s0f0/device/sriov_totalvfs
64
[root@cn1-svi-tb4-ultram-compute-0 ~]#
[root@cn1-svi-tb4-ultram-compute-0 ~]# cat /sys/class/net/enp94s0f0/device/sriov_numvfs
16
```

Step 6 List out the virtual functions that belongs to the particular interface.

```
ip link show enp94s0f0
4: enp94s0f0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 9000 qdisc mq state UP mode DEFAULT group default
 qlen 1000
    link/ether 3c:fd:fe:cf:8a:08 brd ff:ff:ff:ff:ff:ff
    vf 0 MAC 00:00:00:00:00:00, spoof checking on, link-state auto, trust off
    vf 1 MAC 2e:92:56:a0:84:c7, spoof checking on, link-state enable, trust off
    vf 2 MAC 00:00:00:00:00:00, spoof checking on, link-state auto, trust off
    vf 3 MAC 00:00:00:00:00:00, spoof checking on, link-state auto, trust off
    vf 4 MAC 00:00:00:00:00:00, spoof checking on, link-state auto, trust off
    vf 5 MAC 00:00:00:00:00:00, spoof checking on, link-state auto, trust off
    vf 6 MAC 00:00:00:00:00:00, spoof checking on, link-state auto, trust off
    vf 7 MAC 00:00:00:00:00:00, spoof checking on, link-state auto, trust off
    vf 8 MAC 00:00:00:00:00:00, spoof checking on, link-state auto, trust off
    vf 9 MAC 00:00:00:00:00:00, spoof checking on, link-state auto, trust off
    vf 10 MAC 9e:64:d4:d3:70:c9, spoof checking on, link-state enable, trust off
    vf 11 MAC 96:b0:9e:6a:67:d8, spoof checking on, link-state enable, trust off
    vf 12 MAC 62:bd:7d:dd:e9:08, spoof checking on, link-state enable, trust off
    vf 13 MAC 00:00:00:00:00:00, spoof checking on, link-state auto, trust off
    vf 14 MAC 00:00:00:00:00:00, spoof checking on, link-state auto, trust off
    vf 15 MAC 00:00:00:00:00:00, spoof checking on, link-state auto, trust off
```

Network Interface Configuration

Note The IP addresses used here are just example. Based on your requirement and the environment, you can configure IP addresses and network name accordingly.

Step 1 Create SRIOV network.

- Sriov_net1 (phys_pcie1_0 – enp94s0f0)

```
neutron net-create sriov_net-1 --provider:physical_network=phys_pcie1_0 --provider:network_type
 flat  --shared
```

- Sriov_net1 (phys_pcie1_1 – enp94s0f1)

```
neutron net-create sriov_net-2 --provider:physical_network=phys_pcie1_1 --provider:network_type
 flat  --shared
```

Step 2 Create subnets under SRIOV network.

- **Subnets for sriov-net1**

```
neutron subnet-create --name int1 sriov_net-1 172.16.182.0/24 --allocation-pool
start=172.16.182.2,end=172.16.182.100

neutron subnet-create --name mgmt1 sriov_net-1 10.81.68.0/24 --allocation-pool
start=10.81.68.167,end=10.81.68.170

neutron subnet-create --name gx1 sriov_net-1 172.16.183.0/24 --allocation-pool
start=172.16.183.2,end=172.16.183.100
```

- **Subnets for sriov_net2**

```
neutron subnet-create --name int2 sriov_net-2 172.16.182.0/24 --allocation-pool
start=172.16.182.101,end=172.16.182.200

neutron subnet-create --name mgmt2  sriov_net-2 10.81.68.0/24 --allocation-pool
start=10.81.68.200,end=10.81.68.203

neutron subnet-create --name gx2 sriov_net-2 172.16.183.0/24 --allocation-pool
start=172.16.183.101,end=172.16.183.200
```

Step 3 Create ports to attach to the VM instance.

Note In the following example, two ports are created from different physical interfaces for each network to support bonding configuration.

For example, cm-port-int1, cm-port-int2 for Internal network.

cm-port-int1 (sriov_net-1), cm-port-int2 (sriov_net-2)

VM Type	Internal SR-IOV +Bonding	Management SR-IOV + Bonding	External/Gx SR-IOV + Bonding
CLUMAN	eth0, eth1, eth0.1003, eth1.1003, bond01003	eth2, eth3, eth2.3168, eth3.3168 bond03168	-
LB	eth0, eth1, eth0.1003, eth1.1003, bond01003	eth2, eth3, eth2.3168, eth3.3168 bond03168	eth4, eth5, eth5.1004, eth5.1004, bond01004
PCRF	eth0, eth1, eth0.1003, eth1.1003, bond01003	-	-
QNS	eth0, eth1, eth0.1003, eth1.1003, bond01003	-	-
SESSIONMGR	eth0, eth1, eth0.1003, eth1.1003, bond01003	-	-

- **Cluster Manager**

```
openstack port create --network sriov_net-1 --fixed-ip subnet=int1,ip-address=172.16.182.2
--vnic-type direct cm-port-int1

openstack port create --network sriov_net-2 --fixed-ip subnet=int2,ip-address=172.16.182.102
--vnic-type direct cm-port-int2

openstack port create --network sriov_net-1 --fixed-ip subnet=mgmt1,ip-address=10.81.68.167
--vnic-type direct cm-port-mgmt1

openstack port create --network sriov_net-2 --fixed-ip subnet=mgmt2,ip-address=10.81.68.200
--vnic-type direct cm-port-mgmt2
```

- **LB01**

```
openstack port create --network sriov_net-1 --fixed-ip subnet=int1,ip-address=172.16.182.3
--vnic-type direct lb01-port-int1

openstack port create --network sriov_net-2 --fixed-ip subnet=int2,ip-address=172.16.182.103
--vnic-type direct lb01-port-int2

openstack port create --network sriov_net-1 --fixed-ip subnet=mgmt1,ip-address=10.81.68.168
--vnic-type direct lb01-port-mgmt1

openstack port create --network sriov_net-2 --fixed-ip subnet=mgmt2,ip-address=10.81.68.201
--vnic-type direct lb01-port-mgmt2

openstack port create --network sriov_net-1 --fixed-ip subnet=gx1,ip-address=172.16.183.2
--vnic-type direct lb01-port-gx1

openstack port create --network sriov_net-2 --fixed-ip subnet=gx2,ip-address=172.16.183.102
--vnic-type direct lb01-port-gx2
```

- **LB02**

```
openstack port create --network sriov_net-1 --fixed-ip subnet=int1,ip-address=172.16.182.4
--vnic-type direct lb02-port-int1

openstack port create --network sriov_net-2 --fixed-ip subnet=int2,ip-address=172.16.182.104
--vnic-type direct lb02-port-int2

openstack port create --network sriov_net-1 --fixed-ip subnet=mgmt1,ip-address=10.81.68.169
--vnic-type direct lb02-port-mgmt1

openstack port create --network sriov_net-2 --fixed-ip subnet=mgmt2,ip-address=10.81.68.202
--vnic-type direct lb02-port-mgmt2

openstack port create --network sriov_net-1 --fixed-ip subnet=gx1,ip-address=172.16.183.3
--vnic-type direct lb02-port-gx1

openstack port create --network sriov_net-2 --fixed-ip subnet=gx2,ip-address=172.16.183.103
--vnic-type direct lb02-port-gx2
```

- **pcrf01**

```
openstack port create --network sriov_net-1 --fixed-ip subnet=int1,ip-address=172.16.182.5
--vnic-type direct pcrf01-port-int1

openstack port create --network sriov_net-2 --fixed-ip subnet=int2,ip-address=172.16.182.105
--vnic-type direct pcrf01-port-int2
```

- **pcrf02**

```
openstack port create --network sriov_net-1 --fixed-ip subnet=int1,ip-address=172.16.182.6
--vnic-type direct pcrf02-port-int1

openstack port create --network sriov_net-2 --fixed-ip subnet=int2,ip-address=172.16.182.106
--vnic-type direct pcrf02-port-int2
```

- **SM01**

```
openstack port create --network sriov_net-1 --fixed-ip subnet=int1,ip-address=172.16.182.7
--vnic-type direct sm01-port-int1

openstack port create --network sriov_net-2 --fixed-ip subnet=int2,ip-address=172.16.182.107
--vnic-type direct sm01-port-int2
```

- **SM02**

```
openstack port create --network sriov_net-1 --fixed-ip subnet=int1,ip-address=172.16.182.8
--vnic-type direct sm02-port-int1

openstack port create --network sriov_net-2 --fixed-ip subnet=int2,ip-address=172.16.182.108
--vnic-type direct sm02-port-int2
```

- **QNS01**

```
openstack port create --network sriov_net-1 --fixed-ip subnet=int1,ip-address=172.16.182.9
--vnic-type direct qns01-port-int1

openstack port create --network sriov_net-2 --fixed-ip subnet=int2,ip-address=172.16.182.109
--vnic-type direct qns01-port-int2
```

- **QNS02**

```
openstack port create --network sriov_net-1 --fixed-ip subnet=int1,ip-address=172.16.182.10
--vnic-type direct qns02-port-int1

openstack port create --network sriov_net-2 --fixed-ip subnet=int2,ip-address=172.16.182.110
--vnic-type direct qns02-port-int2
```

- **QNS03**

```
openstack port create --network sriov_net-1 --fixed-ip subnet=int1,ip-address=172.16.182.11
--vnic-type direct qns03-port-int1

openstack port create --network sriov_net-2 --fixed-ip subnet=int2,ip-address=172.16.182.111
--vnic-type direct qns03-port-int2
```

- **QNS04**

```
openstack port create --network sriov_net-1 --fixed-ip subnet=int1,ip-address=172.16.182.12
--vnic-type direct qns04-port-int1

openstack port create --network sriov_net-2 --fixed-ip subnet=int2,ip-address=172.16.182.112
--vnic-type direct qns04-port-int2
```

Create CPS VMs using Nova Boot Commands with SR-IOV and Bonding

Step 1 Create cloud configuration files for SR-IOV for each VM to be deployed (xxx-cloud.cfg). These configurations are used to define the OpenStack parameters for each CPS VM.

Refer to Sample SR-IOV Cloud Config Files, on page 39 to create these files.

Step 2 Deploy each CPS VM with the following nova boot command:

```
nova boot --config-drive true --user-data=<node>-cloud.cfg --image "<<base VM image>>"
--flavor "<< flavor name >>" --nic port-id="<< SRIOV port for internal1 >>"
--nic port-id="<< SRIOV port for internal2 >>" --nic port-id="<< SRIOV port for Management1 >>"
--nic port-id="<< SRIOV port for Management2 >>" --nic port-id="<< SRIOV port for External1 >>"
--nic port-id="<< SRIOV port for External2 >>" --availability-zone <availability zone:Host info> "<<
 node name >>"
```

Note Configure the networks, internal IPs, management IPs and availability zones based on the requirements of your environment.

Examples:

The following example shows the nova boot commands to deploy a Cluster Manager (cluman), two OAMs (pcrfclients), two sessionmgrs, two Policy Directors (load balancers), and four Policy Server (qns) VMs.

- **#cluman (4 ports – 2 Internal & 2 Management)**

```
nova boot --config-drive true --user-data=cm-cloud.cfg --image "sriov-base_vm"
--flavor "pcrf-cm-pin" --nic port-id="29908bf8-fcda-42b1-ac8f-2b066579f1c7"
--nic port-id="e440ee2b-eb70-49a6-aaa8-977fe5001973"
```

```
--nic port-id="5f8d1aad-9602-424b-aac3-280d7a93659e"
--nic port-id="0d671be3-0a9d-48d6-bda4-a3bce22a6b40"
--block-device-mapping "/dev/vdb=25ae605c-c971-436d-a1db-4a6c1a481b24:::0"
--availability-zone nova:cn1-svi-tb4-ultram-compute-0.localdomain "cluman"
```

- **#lb01 (6 ports – 2 Internal, 2 Management and 2 External/Gx)**

```
nova boot --config-drive true --user-data=lb01-cloud.cfg --image "sriov-base_vm"
--flavor "pcrf-pd-pin" --nic port-id="99660232-b107-4794-a155-f829a7327f2a"
--nic port-id="0b0ff96e-22f7-4a57-ae1e-c31d362e97e4"
--nic port-id="21f27d3d-9666-4e2f-97c1-4bc23ef2fb2a"
--nic port-id="09ae867d-adf9-44c0-96db-8301641882b3"
--nic port-id="96a0658d-ecd5-4899-8cd7-f685b200c733"
--nic port-id="c6f4b0b3-aef0-4f62-bdc7-d16c1862ddff"
--availability-zone nova:cn1-svi-tb4-ultram-compute-1.localdomain
"lb01"
```

- **#lb02 (6 ports – 2 Internal, 2 Management and 2 External/Gx)**

```
nova boot --config-drive true --user-data=lb02-cloud.cfg --image "sriov-base_vm"
--flavor "pcrf-pd-pin" --nic port-id="08fdcb9c-6d56-4d94-94cb-5eef016607f5"
--nic port-id="f465e211-01d9-4ca0-8b77-6fb6eb7856a7"
--nic port-id="5b6763a6-b353-4b25-85b3-7de1acec32ac"
--nic port-id="96c8a903-78fa-467d-8a5a-1a6027e69d6a"
--nic port-id="4f0b9c8b-d4e4-459a-9ee0-7a43812d1158"
--nic port-id="9fb6e564-0eae-4afc-b4f7-24ecb7dc0c53"
--availability-zone nova:cn1-svi-tb4-ultram-compute-2.localdomain
"lb02"
```

- **#pcrfclient01 (2 ports – 2 Internal)**

```
nova boot --config-drive true --user-data=pcrfclient01-cloud.cfg --image "sriov-base_vm"
--flavor "pcrf-oam-pin" --nic port-id="e96af7ee-bb5c-4448-af4d-c3b08732398e"
--nic port-id="9aba19d5-6ba8-4549-a766-8af6f3c30927"
--block-device-mapping "/dev/vdb=7b1d1dea-c6f9-4905-98b2-4c7b34905169:::0"
--availability-zone nova:cn1-svi-tb4-ultram-compute-1.localdomain "pcrfclient01"
```

- **#pcrfclient02 (2 Ports– 2 Internal)**

```
nova boot --config-drive true --user-data=pcrfclient02-cloud.cfg --image "sriov-base_vm"
--flavor "pcrf-oam-pin" --nic port-id="311f4a6f-466b-4967-8ce9-77dec855f411"
--nic port-id="f1a49926-e0f6-406b-b280-b2c4f6221efd"
--block-device-mapping "/dev/vdb=bd03fcf6-e6d9-4c88-9232-0b7b31b4a501:::0"
--availability-zone nova:cn1-svi-tb4-ultram-compute-2.localdomain "pcrfclient02"
```

- **#qns01 (2 Ports– 2 Internal)**

```
nova boot --config-drive true --user-data=qns01-cloud.cfg --image "sriov-base_vm"
--flavor "pcrf-qns-pin" --nic port-id="facdb242-dab6-47e7-a20f-a3a45c5958ca"
--nic port-id="889ae0d0-84d9-45e0-afe3-2f4f2df34fa6"
--availability-zone nova:cn1-svi-tb4-ultram-compute-3.localdomain "qns01"
```

- **#qns02 (2 Ports– 2 Internal)**

```
nova boot --config-drive true --user-data=qns02-cloud.cfg --image "sriov-base_vm"
--flavor "pcrf-qns-pin" --nic port-id="73743ab4-a874-4e4c-ae61-c2f65cbe131f"
--nic port-id="e65cfe31-20de-4039-9656-81a4797ee3cb"
--availability-zone nova:cn1-svi-tb4-ultram-compute-4.localdomain "qns02"
```

- **#qns03 (2 Ports– 2 Internal)**

```
nova boot --config-drive true --user-data=qns03-cloud.cfg --image "sriov-base_vm"
--flavor "pcrf-qns-pin" --nic port-id="ba689f04-597e-4637-93e7-52600c24f65f"
--nic port-id="18619bf7-e426-4191-9d84-f176a715eb16"
--availability-zone nova:cn1-svi-tb4-ultram-compute-5.localdomain "qns03"
```

- **#qns04 (2 Ports– 2 Internal)**

```
nova boot --config-drive true --user-data=qns04-cloud.cfg
--image "sriov-base_vm" --flavor "pcrf-qns-pin" --nic port-id="250b0c58-d4d6-4ea4-a035-ab5fe94baf8e"

--nic port-id="a2f6f5e9-45a2-48af-ae77-bef70e581a8a"
--availability-zone nova:cn1-svi-tb4-ultram-compute-5.localdomain "qns04"
```

- **#sessionmgr01 (2 Ports– 2 Internal)**

```
nova boot --config-drive true --user-data=sessionmgr01-cloud.cfg --image "sriov-base_vm"
--flavor "pcrf-sm-pin" --nic port-id="ef22eb43-c760-4a40-a0e4-1da41d19162c"
--nic port-id="a2969280-a2dc-4f6e-a1f4-b3c8fcf444c3"
--block-device-mapping "/dev/vdb=3297eb4a-aa75-4c0e-a829-246f36be4bf9:::0"
--availability-zone nova:cn1-svi-tb4-ultram-compute-3.localdomain "sessionmgr01"
```

- **#sessionmgr02 (2 Ports– 2 Internal)**

```
nova boot --config-drive true --user-data=sessionmgr02-cloud.cfg --image "sriov-base_vm"
--flavor "pcrf-sm-pin" --nic port-id="6db111c2-3357-4fc2-a989-a7acc07be209"
--nic port-id="030bb12f-a7fd-4c0e-98f6-5f3270ac66ad"
--block-device-mapping "/dev/vdb=6f94a860-b1a5-4193-91e7-8afa7f151126:::0"
--availability-zone nova:cn1-svi-tb4-ultram-compute-4.localdomain "sessionmgr02"
```

QNS Configuration for Internal Bonding

The following parameters must be configured in `/etc/broadhop/qns.conf` file when internal network is enabled with SR-IOV and bonding.

- **networkguard.tcp.local:** This parameter used to bring up the diameter stack on the Policy Director (LB) VMs.
- **com.broadhop.q.if:** This parameter is used to create the ZMQ connection between the Policy Server (QNS) and Policy Director (LB) VMs
- **clusterLBIF:** For GR deployments, this parameter is used to create the ZMQ connection between the local and remote Policy Director (LB) VMs.

For more information on `qns.conf` file, contact your Cisco Account representative.

Example: If bond01003 is the internal network bonding, then `qns.conf` file needs to be updated with the following information:

```
-Dnetworkguard.tcp.local=bond01003
-Dcom.broadhop.q.if=bond01003
-DclusterLBIF=bond01003
```

Sample SR-IOV Cloud Config Files

The cloud configuration file needs to be created for all the VM separately based on its interface and network configuration. The sample configuration file for load balancer and qns is as follows:

The following sections show an example Cluster Manager cloud configuration (`cluman-cloud.cfg`) with SRIOV and bonding.

Note Before deploying VM, validate the yaml file format and content with yaml validator.

Note Use `NM_CONTROLLED=no` parameter at the interface config file in `cloud-config` file.

For Cluman/Arbiter VM, include `ifup`/`ifdown` commands under `runcmd` section of cloud config file for all the interfaces to `/etc/rc.d/rc.local` to persist across boot.

- **Lb01-cloud-config.cfg**

```
#cloud-config
write_files:
 - path: /etc/sysconfig/network-scripts/ifcfg-eth0
   encoding: ascii
   content: |
     DEVICE=eth0
     BOOTPROTO=none
     TYPE=Ethernet
     NM_CONTROLLED=no
   owner: root:root
   permissions: '0644'
 - path: /etc/sysconfig/network-scripts/ifcfg-eth1
   encoding: ascii
   content: |
     DEVICE=eth1
     BOOTPROTO=none
     TYPE=Ethernet
     NM_CONTROLLED=no
   owner: root:root
   permissions: '0644'
 - path: /etc/sysconfig/network-scripts/ifcfg-eth0.1003
   encoding: ascii
   content: |
     DEVICE=eth0.1003
     ONBOOT=yes
     MASTER=bond01003
     BOOTPROTO=none
     NM_CONTROLLED=no
     USRCTL=no
     SLAVE=yes
     VLAN=yes
     PHYSDEV=eth0
   owner: root:root
   permissions: '0644'
 - path: /etc/sysconfig/network-scripts/ifcfg-eth1.1003
   encoding: ascii
   content: |
     DEVICE=eth1.1003
     ONBOOT=yes
     MASTER=bond01003
     BOOTPROTO=none
     NM_CONTROLLED=no
     USRCTL=no
     SLAVE=yes
     VLAN=yes
     PHYSDEV=eth1
   owner: root:root
   permissions: '0644'
 - path: /etc/sysconfig/network-scripts/ifcfg-bond01003
   encoding: ascii
   content: |
     DEVICE=bond01003
     BONDING_OPTS="mode=active-backup miimon=100 fail_over_mac=1"
```

```
    TYPE=Bond
    BONDING_MASTER=yes
    BOOTPROTO=none
    NM_CONTROLLED=no
    DEFROUTE=yes
    PEERDNS=yes
    PEERROUTES=yes
    IPV6INIT=no
    IPADDR=172.16.182.23
    NETMASK=255.255.255.0
    NETWORK=172.16.182.0
    IPV4_FAILURE_FATAL=no
    IPV6INIT=no
    IPV6_AUTOCONF=yes
    IPV6_DEFROUTE=yes
    IPV6_PEERDNS=yes
    IPV6_PEERROUTES=yes
    IPV6_FAILURE_FATAL=no
    ONBOOT=yes
  owner: root:root
- path: /etc/sysconfig/network-scripts/ifcfg-eth2
  encoding: ascii
  content: |
    DEVICE=eth2
    BOOTPROTO=none
    TYPE=Ethernet
    NM_CONTROLLED=no
  owner: root:root
  permissions: '0644'
- path: /etc/sysconfig/network-scripts/ifcfg-eth3
  encoding: ascii
  content: |
    DEVICE=eth3
    BOOTPROTO=none
    TYPE=Ethernet
    NM_CONTROLLED=no
  owner: root:root
  permissions: '0644'
- path: /etc/sysconfig/network-scripts/ifcfg-eth2.3168
  encoding: ascii
  content: |
    DEVICE=eth2.3168
    ONBOOT=yes
    MASTER=bond03168
    BOOTPROTO=none
    NM_CONTROLLED=no
    USRCTL=no
    SLAVE=yes
    VLAN=yes
    PHYSDEV=eth2
  owner: root:root
  permissions: '0644'
- path: /etc/sysconfig/network-scripts/ifcfg-eth3.3168
  encoding: ascii
  content: |
    DEVICE=eth3.3168
    ONBOOT=yes
    MASTER=bond03168
    BOOTPROTO=none
    NM_CONTROLLED=no
    USRCTL=no
    SLAVE=yes
    VLAN=yes
    PHYSDEV=eth3
```

```
    owner: root:root
    permissions: '0644'
  - path: /etc/sysconfig/network-scripts/ifcfg-bond03168
    encoding: ascii
    content: |
      DEVICE=bond03168
      BONDING_OPTS="mode=active-backup miimon=100 fail_over_mac=1"
      TYPE=Bond
      BONDING_MASTER=yes
      BOOTPROTO=none
      NM_CONTROLLED=no
      DEFROUTE=yes
      PEERDNS=yes
      PEERROUTES=yes
      IPV6INIT=no
      IPADDR=10.81.68.168
      NETMASK=255.255.255.0
      GATEWAY=10.81.68.1
      NETWORK=10.81.68.0
      IPV4_FAILURE_FATAL=no
      IPV6INIT=no
      IPV6_AUTOCONF=yes
      IPV6_DEFROUTE=yes
      IPV6_PEERDNS=yes
      IPV6_PEERROUTES=yes
      IPV6_FAILURE_FATAL=no
      ONBOOT=yes
    owner: root:root
  - path: /etc/sysconfig/network-scripts/ifcfg-eth4
    encoding: ascii
    content: |
      DEVICE=eth4
      BOOTPROTO=none
      TYPE=Ethernet
      NM_CONTROLLED=no
    owner: root:root
    permissions: '0644'
  - path: /etc/sysconfig/network-scripts/ifcfg-eth5
    encoding: ascii
    content: |
      DEVICE=eth5
      BOOTPROTO=none
      TYPE=Ethernet
      NM_CONTROLLED=no
    owner: root:root
    permissions: '0644'
  - path: /etc/sysconfig/network-scripts/ifcfg-eth4.1004
    encoding: ascii
    content: |
      DEVICE=eth4.1004
      ONBOOT=yes
      MASTER=bond01004
      BOOTPROTO=none
      NM_CONTROLLED=no
      USRCTL=no
      SLAVE=yes
      VLAN=yes
      PHYSDEV=eth4
    owner: root:root
    permissions: '0644'
  - path: /etc/sysconfig/network-scripts/ifcfg-eth5.1004
    encoding: ascii
    content: |
      DEVICE=eth5.1004
```

```
      ONBOOT=yes
      MASTER=bond01004
      BOOTPROTO=none
      NM_CONTROLLED=no
      USRCTL=no
      SLAVE=yes
      VLAN=yes
      PHYSDEV=eth5
    owner: root:root
    permissions: '0644'
  - path: /etc/sysconfig/network-scripts/ifcfg-bond01004
    encoding: ascii
    content: |
      DEVICE=bond01004
      BONDING_OPTS="mode=active-backup miimon=100 fail_over_mac=1"
      TYPE=Bond
      BONDING_MASTER=yes
      BOOTPROTO=none
      NM_CONTROLLED=no
      DEFROUTE=yes
      PEERDNS=yes
      PEERROUTES=yes
      IPV6INIT=no
      IPADDR=172.16.183.22
      NETMASK=255.255.255.0
      NETWORK=172.16.183.0
      IPV4_FAILURE_FATAL=no
      IPV6INIT=no
      IPV6_AUTOCONF=yes
      IPV6_DEFROUTE=yes
      IPV6_PEERDNS=yes
      IPV6_PEERROUTES=yes
      IPV6_FAILURE_FATAL=no
      ONBOOT=yes
    owner: root:root
  - path: /var/lib/cloud/instance/payload/launch-params
    encoding: ascii
    owner: root:root
    permissions: '0644'
  - path: /etc/broadhop.profile
    encoding: ascii
    owner: root:root
    permissions: '0644'
    content: "NODE_TYPE=lb01\n"
runcmd:
  - ifdown eth0
  - ifdown eth1
  - ifdown eth2
  - ifdown eth3
  - ifdown eth4
  - ifdown eth5
  - ifdown eth0.1003
  - ifdown eth1.1003
  - ifdown eth2.3168
  - ifdown eth3.3168
  - ifdown eth4.1004
  - ifdown eth5.1004
  - ifdown bond01003
  - ifdown bond03168
  - ifdown bond01004
  - echo 172.16.182.22 installer >> /etc/hosts
  - ifup eth0
  - ifup eth1
  - ifup eth2
```

```
 - ifup eth3
 - ifup eth4
 - ifup eth5
 - ifup eth0.1003
 - ifup eth1.1003
 - ifup eth2.3168
 - ifup eth3.3168
 - ifup eth4.1004
 - ifup eth5.1004
 - ifup bond01003
 - ifup bond03168
 - ifup bond01004
 - sed -i '/^HOSTNAME=/d' /etc/sysconfig/network && echo HOSTNAME=lb01 >>
/etc/sysconfig/network
 - echo lb01 > /etc/hostname
 - hostname lb01
```

- **Qns01-cloud-config.cfg**

```
#cloud-config
write_files:
 - path: /etc/sysconfig/network-scripts/ifcfg-eth0
   encoding: ascii
   content: |
     DEVICE=eth0
     BOOTPROTO=none
     TYPE=Ethernet
     NM_CONTROLLED=no
   owner: root:root
   permissions: '0644'
 - path: /etc/sysconfig/network-scripts/ifcfg-eth1
   encoding: ascii
   content: |
     DEVICE=eth1
     BOOTPROTO=none
     TYPE=Ethernet
     NM_CONTROLLED=no
   owner: root:root
   permissions: '0644'
 - path: /etc/sysconfig/network-scripts/ifcfg-eth0.1003
   encoding: ascii
   content: |
     DEVICE=eth0.1003
     ONBOOT=yes
     MASTER=bond01003
     BOOTPROTO=none
     NM_CONTROLLED=no
     USRCTL=no
     SLAVE=yes
     VLAN=yes
     PHYSDEV=eth0
   owner: root:root
   permissions: '0644'
 - path: /etc/sysconfig/network-scripts/ifcfg-eth1.1003
   encoding: ascii
   content: |
     DEVICE=eth1.1003
     ONBOOT=yes
     MASTER=bond01003
     BOOTPROTO=none
     NM_CONTROLLED=no
     USRCTL=no
     SLAVE=yes
     VLAN=yes
     PHYSDEV=eth1
```

```
    owner: root:root
    permissions: '0644'
  - path: /etc/sysconfig/network-scripts/ifcfg-bond01003
    encoding: ascii
    content: |
      DEVICE=bond01003
      BONDING_OPTS="mode=active-backup miimon=100 fail_over_mac=1"
      TYPE=Bond
      BONDING_MASTER=yes
      BOOTPROTO=none
      NM_CONTROLLED=no
      DEFROUTE=yes
      PEERDNS=yes
      PEERROUTES=yes
      IPV6INIT=no
      IPADDR=172.16.182.29
      NETMASK=255.255.255.0
      NETWORK=172.16.182.0
      GATEWAY=172.16.182.1
      IPV4_FAILURE_FATAL=no
      IPV6INIT=no
      IPV6_AUTOCONF=yes
      IPV6_DEFROUTE=yes
      IPV6_PEERDNS=yes
      IPV6_PEERROUTES=yes
      IPV6_FAILURE_FATAL=no
      ONBOOT=yes
    owner: root:root
  - path: /var/lib/cloud/instance/payload/launch-params
    encoding: ascii
    owner: root:root
    permissions: '0644'
  - path: /etc/broadhop.profile
    encoding: ascii
    owner: root:root
    permissions: '0644'
    content: "NODE_TYPE=qns01\n"
runcmd:
  - ifdown eth0
  - ifdown eth1
  - ifdown eth0.1003
  - ifdown eth1.1003
  - ifdown bond01003
  - echo 172.16.182.22 installer >> /etc/hosts
  - ifup eth0
  - ifup eth1
  - ifup eth0.1003
  - ifup eth1.1003
  - ifup bond01003
  - sed -i '/^HOSTNAME=/d' /etc/sysconfig/network && echo HOSTNAME=qns01 >>
/etc/sysconfig/network
  - echo qns01 > /etc/hostname
  - hostname qns01
```

Enable Custom Puppet to Configure Deployment

Some customers may need to customize the configuration for their deployment. When customizing the CPS configuration, it is important to make the customization in a way that does not impact the normal behavior for VM deployment and redeployment, upgrades/migration, and rollbacks.

For this reason, customizations should be placed in the `/etc/puppet/env_config` directory. Files within this directory are given special treatment for VM deployment, upgrade, migrations, and rollback operations.

Note If system configurations are manually changed in the VM itself after the VM has been deployed, these configurations will be overridden if that VM is redeployed.

The following section describes the steps necessary to make changes to the puppet installer.

Customizations of the CPS deployment are dependent on the requirements of the change. Examples of customizations include:

- deploying a specific facility on a node (VM)
- overriding a default configuration.

To explain the process, let us consider that we modify all VMs built from an installer, so we use the Policy Server (QNS) node definition.

For the above mentioned example, add custom routes via the examples42-network Puppet module. (For more information on the module, refer to https://forge.puppetlabs.com/example42/network).

Attention In CPS 20.2.0, puppet is upgraded from 3.6.2-3 to 5.5.19 version. Puppet code has been modified to adapt to this change. Previous release puppet code is not compatible with the current puppet version (5.5.19). Customer specific puppet code must be adapted to current release puppet version (5.5.19) before applying it to CPS 20.2.0.

Step 1 Make sure that the proper paths are available:

```
mkdir -p /etc/puppet/env_config/nodes
```

Step 2 Install the necessary Puppet module. For example:

```
puppet module install \
--modulepath=/etc/puppet/env_config/modules:/etc/puppet/modules \
example42-network
Notice: Preparing to install into /etc/puppet/env_config/modules ...
Notice: Downloading from https://forge.puppetlabs.com ...
Notice: Installing -- do not interrupt ...
/etc/puppet/env_config/modules
example42-network (v3.1.13)
```

Note For more information on installing and updating Puppet modules, refer to https://docs.puppetlabs.com/puppet/latest/reference/modules_installing.html.

Step 3 Copy the existing node definition into the env_config nodes:

```
cp /etc/puppet/modules/qps/nodes/qps.yaml \

/etc/puppet/env_config/nodes
```

Step 4 Add a reference to your custom Puppet manifest:

```
echo ' custom::static_routes:' >> \
```

```
/etc/puppet/env_config/nodes/qps.yaml
```

Step 5 Create your new manifest for static routes:

```
cat
 >/etc/puppet/env_config/modules/custom/manifests/static_routes.pp <<EOF class custom::static_routes
 {
   network::route {'eth0':
     ipaddress => ['192.168.1.0',],
     netmask   => ['255.255.255.0',],
     gateway   => ['10.105.94.1',],
   }
}
EOF
```

Step 6 Validate the syntax of your newly created puppet script(s):

```
puppet parser validate

/etc/puppet/env_config/modules/custom/manifests/static_routes.pp
```

Step 7 Rebuild your Environment Configuration:

```
/var/qps/install/current/scripts/build/build_env_config.sh
```

Step 8 Reinitialize your environment:

```
/var/qps/install/current/scripts/upgrade/reinit.sh
```

At this point your new manifest is applied across the deployment. For more details, refer to the installer image in the `/etc/puppet/env_config/README`.

What to do next

It is recommended that version control is used to track changes to these Puppet customizations.

For example, to use 'git', perform the following steps:

1. Initialize the directory as a repository:

   ```
   # git init
   ```

   Initialized empty Git repository in `/var/qps/env_config/.git/`.

2. Add everything:

   ```
   # git add .
   ```

3. Commit your initial check-in:

   ```
   # git commit -m 'initial commit of env_config'
   ```

4. If you are making more changes and customizations, make sure you create new revisions for those:

   ```
   # git add .

   # git commit -m 'updated static routes'
   ```

HTTPS Support for Orchestration API

Installation

By default, the Orchestration API service starts with the HTTP mode on Cluster Manager.

You can change the mode to start with HTTPS self-signed certificate by setting the `api_https=one_way_ssl` facter value in the `/etc/facter/facts.d/cluman_facts.yaml` configuration file in Cluster Manager. This ensures that the API server starts by using the pre-loaded self-signed SSL certificates.

Important You cannot upload certificates using the API.

To configure the Orchestration API server to start with the HTTPS self-signed certificate mode, make the following changes to the Heat template. These changes create the `/etc/facter/facts.d/cluman_facts.yaml` file and also set the puppet facter value to `api_https=one_way_ssl` in the configuration file in Cluster Manager.

```
cluman_api_name:
 type: string
 label: cluman orch api
 description: cluman orch
 default: one_way_ssl
# This will set the default value to one_way_ssl

- path: /etc/facter/facts.d/cluman_facts.yaml
 permissions: "0755"
 content:
 str_replace:
 template: |
   api_https: $kval
 params:
   $kval: { get_param: cluman_api_name }
```

Sample YAML configuration to run the Orchestration API server:

- Using self-signed certificates (one_way_ssl):

```
cat /etc/facter/facts.d/cluman_facts.yaml
 api_https: "one_way_ssl"
```

- Using trusted certificates (one_way_ssl):

```
cat /etc/facter/facts.d/cluman_facts.yaml
 api_https: "one_way_ssl"
 api_keystore_path: "/var/certs/keystore.jks"
 api_keystore_password: "yoursecret"
 api_keystore_type: "JKS"
 api_cert_alias: "server-tls"
 api_tls_version: "TLSv1.2"
 api_validate_certs: "false"
 api_validate_peers: "false"
```

- Using mutual authentication (two_way_ssl):

```
cat /etc/facter/facts.d/cluman_facts.yaml
 api_https: "two_way_ssl"
 api_keystore_path: "/var/certs/keystore.jks"
 api_keystore_password: "yoursecret"
```

```
api_keystore_type: "JKS"
api_cert_alias: "server-tls"
api_tls_version: "TLSv1.2"
api_truststore_path: "/var/certs/truststore.jks"
api_truststore_password: "yoursecret"
api_truststore_type: "JKS"
api_validate_certs: "true"
api_validate_peers: "true"
api_enable_crldp: "true"
```

Note

- For more information on how to add certificates to the keystore or truststore, see Adding Certificates to Keystore and Truststore, on page 51.
- Trusted certificates, keystores, or the truststore should not be located at `/opt/orchestration_api_server/`.
- For a list of the configuration parameters for HTTPS, see Configuration Parameters for HTTPS, on page 51.

After Cluster Manager is deployed, you can reconfigure the API server to run on HTTP (default) or HTTPS mode. The prerequisites to configure the HTTPS mode are as follows:

- For self-signed certificates, set `api_https=one_way_ssl` in the `/etc/facter/facts.d/cluman_facts.yaml` configuration file.
- For trusted certificates:
  1. Install the certificates on Cluster Manager.
  2. Import the certificates into the keystore and the truststore.
  3. Set `api_https` value to `one_way_ssl` or `two_way_ssl` (mutual authentication) in the `/etc/facter/facts.d/cluman_facts.yaml` configuration file.

To apply the configuration run the following **puppet** commands on Cluster Manager. These commands reconfigure Cluster Manager only.

1. `cd /opt/cluman`
2. `CLUMAN_DIR="/opt/cluman";`
3. `puppet apply --logdest /var/log/cluman/puppet-run.log --modulepath=${CLUMAN_DIR}/puppet/modules --config ${CLUMAN_DIR}/puppet/puppet.conf ${CLUMAN_DIR}/puppet/nodes/node_repo.pp`

Note

1. For fresh installation, only HTTP or HTTPS with self-signed certificates mode is allowed.
2. For `one_way_ssl`, the `api_validate_peers` parameter should be set to *FALSE*.
3. In case some parameters are missing in the `/etc/facter/facts.d/cluman_facts.yaml` configuration file:
   - For one way ssl, the Orchestration API server starts by using the self-signed certificates.
   - For two way ssl, the Orchestration API server rolls back to the default HTTP mode.

Upgrade

Upgrade CPS to run the Orchestration API server on HTTP or HTTPS. To change the behavior, configuration parameters must be configured before triggering the upgrade.

Follow the steps below to upgrade CPS:

- For self-signed certificates, set `api_https=one_way_ssl` in the `/etc/facter/facts.d/cluman_facts.yaml` configuration file and then trigger the upgrade.
- For trusted certificates:
  1. Install the certificates on Cluster Manager.
  2. Import the certificates into the keystore and the truststore.
  3. Set `api_https` value to `one_way_ssl` or `two_way_ssl` (mutual authentication) in the `/etc/facter/facts.d/cluman_facts.yaml` configuration file.
  4. Trigger the upgrade.

Note To roll back the configuration to default, that is HTTP mode, do the following:

1. Move the`/etc/facter/facts.d/cluman_facts.yaml` configuration file to the `/root/` folder.
2. Run the following **puppet** commands on Cluster Manager:
   a. `cd /opt/cluman`
   b. `CLUMAN_DIR="/opt/cluman";`
   c. `puppet apply --logdest /var/log/cluman/puppet-run.log --modulepath=${CLUMAN_DIR}/puppet/modules --config ${CLUMAN_DIR}/puppet/puppet.conf ${CLUMAN_DIR}/puppet/nodes/node_repo.pp`

Adding Certificates to Keystore and Truststore

A keystore contains private keys and certificates used by the TLS and SSL servers to authenticate themselves to TLS and SSL clients respectively. Such files are referred to as keystores. When used as a truststore, the file contains certificates of trusted TLS and SSL servers or of certificate authorities. There are no private keys in the truststore.

Note Your trusted certificates and keystores or truststores should not be located at `/opt/orchestration_api_server/`

Step 1 Create the PKCS12 file for key and certificate chains.

```
openssl pkcs12 –export-name <cert name> -n chain.crt –inkey <cert_private_key> - out server.p12
```

For example: `openssl pkcs12 -export -name server-tls -in chain.crt -inkey server.key -out server.p12`

Step 2 Create the Java KeyStore on the server.

```
keytool -importkeystore -destkeystore <keystore_name.jks> -srckeystore server.p12 -srcstoretype pkcs12
-alias server-tls
```

```
keytool -importkeystore -destkeystore keystore.jks -srckeystore server.p12 -srcstoretype pkcs12 -alias
server-tls
```

Step 3 Import the root certificate or CA certificate in the truststore.

```
# Import your root certificate into a new trust store and follow the prompts
```

```
keytool -import -alias root -file root.crt -keystore truststore.jks
```

You must remember the keystore password and this needs to be updated in the `/etc/facter/facts.d/cluman_facts.yaml` file.

Configuration Parameters for HTTPS

The following parameters can be defined in the `/etc/facter/facts.d/cluman_facts.yaml` configuration file. This file is loaded only onto the Cluster Manager VM. All parameters and values are case sensitive.

Note Before loading the configuration file to the Cluster Manager VM, verify that the YAML file uses the proper syntax. There are many publicly-available Websites that you can use to validate your YAML configuration file.

Table 1: HTTPS Configuration Parameters

Parameter	Description
`api_https`	Runs the application with or without HTTPS (one way or mutual authentication). Valid options: • disabled (default) • one_way_ssl • two_way_ssl
`api_tls_version`	List of protocols that are supported. Valid options: • TLSv1.1 • TLSv1.2
`api_keystore_path`	Path to the Java keystore which contains the host certificate and private key. Required for one_way_ssl and two_way_ssl.
`api_keystore_type`	Type of keystore. Valid options: • Java KeyStore (JKS) • PKCS12 • JCEKS`` • Windows-MY} • Windows-ROOT Required for one_way_ssl and two_way_ssl.
`api_keystore_password`	Password used to access the keystore. Required for one_way_ssl and two_way_ssl.
`api_cert_alias`	Alias of the certificate to use. Required for one_way_ssl and two_way_ssl.
`api_truststore_path`	Path to the Java keystore which contains the CA certificates used to establish trust. Required for two_way_ssl.

Parameter	Description
`api_truststore_type`	The type of keystore. Valid options: • Java KeyStore (JKS) • PKCS12 • JCEKS`` • Windows-MY} • Windows-ROOT Required for two_way_ssl.
`api_truststore_password`	Password used to access the truststore. Required for two_way_ssl.
`api_validate_certs`	Decides whether or not to validate TLS certificates before starting. If enabled, wizard refuses to start with expired or otherwise invalid certificates. Valid options: • true • false Required for one_way_ssl and two_way_ssl.
`api_validate_peers`	Decides whether or not to validate TLS peer certificates. Valid options: • true • false Required for one_way_ssl and two_way_ssl.
`api_need_client_auth`	Decides whether or not client authentication is required. Valid options: • true • false Required for one_way_ssl and two_way_ssl.

Parameter	Description
`api_enable_crldp`	Decides whether or not CRL Distribution Points (CRLDP) support is enabled. Valid options: • true • false Required for two_way_ssl.

Note The values entered must be in lower case and should be within quotes. For example, "false".

Installing Platform Scripts for MongoDB Health Monitoring - OpenStack

The following steps are performed to install platform scripts for MongoDB health monitoring for write operations on OpenStack setup.

Step 1 Log in to the Cluster Manager or installer as a root user.

Step 2 Update the required key and value in `/var/qps/config/deploy/json/Configuration.js`.

a) Open the file in edit mode using vi `/var/qps/config/deploy/json/Configuration.js`.

b) Update the key and value. Here is a sample configuration:

```
[ {
  "key" : "autoheal_qns_enabled"
}, {
  "value" : "TRUE"
} ]
```

Note `autoheal_qns_enabled` parameter helps `app_monitor.sh` script (application monitor script) to take the decision to restart the QNS process or not.

- **FALSE:** To disable the restart QNS process in case of the MongoDB health monitor failed to reset the MongoDB client connection.
- **TRUE:** To enable the restart QNS process in case of the MongoDB health monitor failed to reset the MongoDB client connection.

Alarm for Policy Server (QNS) VM not able to connect to primary MongoDB replica-set member is raised in both cases.

Alarm for Policy Server (QNS) VM able to connect to primary MongoDB replica-set member is raised automatically after restart of the QNS process in case value is set to “TRUE”.

c) Save the file.

Step 3 Execute the following scripts to make sure the changes are applied on all the required VMs.

```
/var/qps/install/current/scripts/bin/support/config_cluman.sh

/var/qps/install/current/scripts/build_all.sh

/var/qps/install/current/scripts/upgrade/reinit.sh
```

Step 4 Execute the following command to validate if the parameter is applied.

```
for hn in `hosts.sh`; do echo $hn ; ssh $hn "grep autoheal_qns_enabled
/etc/facter/facts.d/qps_facts.txt"; echo; done
```

Sample Output when parameter is configured:

```
[root@installer ~]# for hn in `hosts.sh`; do echo $hn ; ssh $hn "grep autoheal_qns_enabled
/etc/facter/facts.d/qps_facts.txt"; echo; done
lb01
autoheal_qns_enabled=TRUE

lb02
autoheal_qns_enabled=TRUE

qns01
autoheal_qns_enabled=TRUE

qns02
autoheal_qns_enabled=TRUE

pcrfclient01
autoheal_qns_enabled=TRUE

pcrfclient02
autoheal_qns_enabled=TRUE
```

Step 5 Execute the following steps on each Policy Server (QNS) VMs.

a) Log in as a root user.

b) Edit `crontab` using the following command.

```
crontab -e
```

The **vi editor** page opens.

Note Type the command on the terminal and do not copy and paste values on the terminal.

c) Add the following line in the opened **vi editor**.

```
* * * * * /var/qps/bin/support/app_mon/app_monitor.sh
```

d) Save the file and exit the editor.

Note If any change or upgrade is performed, make sure the cronjob entry is present. If the entry is not present repeat the above steps to configure cronjob.