



cnBNG Installation and Configuration

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Feature Summary and Revision History

Summary Data

Table 1: Summary Data

Applicable Product(s) or Functional Area	cnBNG
Applicable Platform(s)	SMI
Feature Default Setting	Disabled - Configuration Required
Related Changes in this Release	Not Applicable
Related Documentation	Not Applicable

Revision History

Table 2: Revision History

Revision Details	Release
Introduced support for the cnBNG CNF Deployment on AIO BareMetal Server.	2022.02.0

Revision Details	Release
cnBNG CP deployment on bare metal server is supported (with support for IPoE, PPPoE, LAC and LNS call models and High Availability) and fully qualified in this release.	2022.01.0
First introduced.	2021.01.0

Feature Description

This chapter describes cnBNG installation and configuration using the Ultra Cloud Core Subscriber Microservices Infrastructure (SMI) Cluster Manager and the BNG Operations (Ops) Center. The BNG Ops Center is based on the ConfD command line interface (CLI).

To install the SMI Cluster Manager, refer to the "Deploying the SMI Cluster Manager on VMware vCenter" section in the *Ultra Cloud Core Subscriber Microservices Infrastructure - Deployment Guide*.

The SMI Ops Center is the platform to install the cnBNG cluster with the offline or online repository. It is mandatory to install the SMI Ops Center to set up and access the BNG Ops Center.



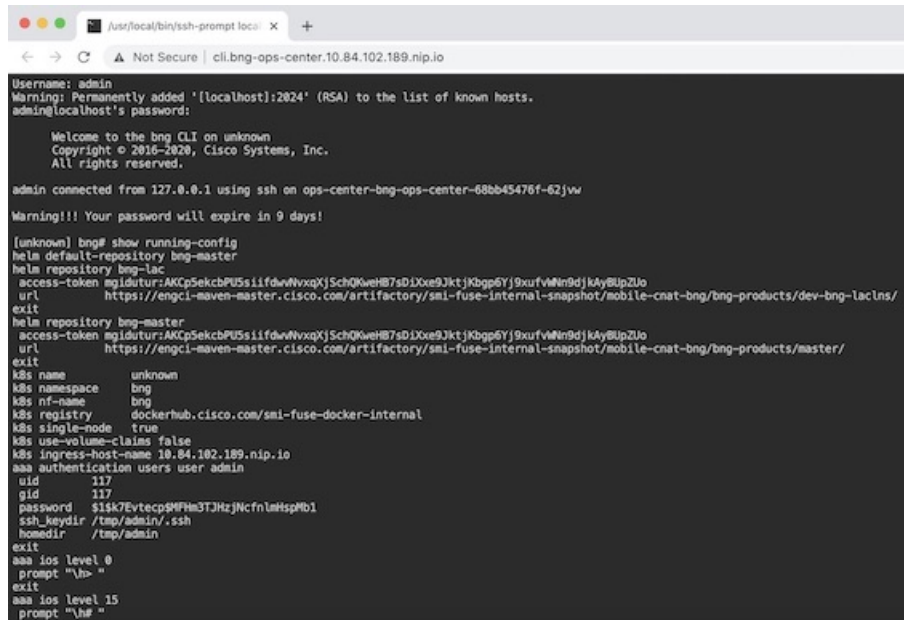
Note To access the offline or online repository, contact your Cisco Account Manager or representative to get access to the offline or online repository.

BNG Ops Center

The BNG Ops Center is a system-level infrastructure that provides the following functionality:

- A user interface to trigger a deployment of microservices with the flexibility of providing variable helm chart parameters to control the scale and properties of Kubernetes objects (deployment, pod, services, and so on) associated with the deployment.
- A user interface to push application-specific configuration to one or more microservices through Kubernetes configuration maps.
- A user interface to issue application-specific execution commands (such as show and clear commands). These commands:
 - Invoke some APIs in application-specific pods
 - Display the information returned on the user interface application

The following figure shows a sample of the web-based CLI presented to the user.



```

Username: admin
Warning: Permanently added '[localhost]:2024' (RSA) to the list of known hosts.
admin@localhost's password:

Welcome to the bng CLI on unknown
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admin connected from 127.0.0.1 using ssh on ops-center-bng-ops-center-68bb45476f-62jvw
Warning!!! Your password will expire in 9 days!

[unknown] bng# show running-config
helm default-repository bng-master
helm repository bng-lac
access-token ngldutur:AKCp5ekcbPU5siifdwWVxqXjSchQWwH7sDjXve9JktjKbpg6Yj9xufvWn9djkAy8lp2Jo
url https://engcl-maven-master.cisco.com/artifactory/smi-fuse-internal-snapshot/mobile-cnat-bng/bng-products/dev-bng-lac/
exit
helm repository bng-master
access-token ngldutur:AKCp5ekcbPU5siifdwWVxqXjSchQWwH7sDjXve9JktjKbpg6Yj9xufvWn9djkAy8lp2Jo
url https://engcl-maven-master.cisco.com/artifactory/smi-fuse-internal-snapshot/mobile-cnat-bng/bng-products/master/
exit
k8s name unknown
k8s namespace bng
k8s nf-name bng
k8s registry dockerhub.cisco.com/smi-fuse-docker-internal
k8s single-node true
k8s use-volume-claims false
k8s ingress-host-name 10.84.102.189.nip.io
aaa authentication users user admin
uid 117
gid 117
password $1sk7Ertccp9PHm3TJHzjNcfnlMispMb1
ssh_keydir /tmp/admin/.ssh
homedir /tmp/admin
exit
aaa ios level 0
prompt "h> "
exit
aaa ios level 15
prompt "h# "

```

The BNG Ops Center allows you to configure features such as licensing, REST endpoint, and CDL.

For information on how to deploy BNG Ops Center on bare metal servers (currently Cisco UCS-C servers) environment, see "Operating the SMI Cluster Manager on Bare Metal" section in the *Ultra Cloud Core Subscriber Microservices Infrastructure — Operations Guide*.

Installing cnBNG and Accessing BNG Ops Center

This section describes how to install cnBNG and access the BNG Ops Center.

The Ultra Cloud Core SMI platform is responsible for setting up and managing the Cloud Native Broadband Network Gateway application.

Prerequisites

Before installing cnBNG on the SMI layer in an offline environment:

- Ensure that the SMI Cluster Manager all-in-one (AIO) is installed. This helps orchestrate the K8s Cluster and load the image.
- Ensure that all SMI K8s cluster nodes are in Ready state.
- Run the SMI synchronization operation for the BNG Ops Center and Cloud Native Common Execution Environment (CN-CEE).

For CEE installation, refer to the *Ultra Cloud Core Common Execution Environment- Configuration and Administration Guide*.

- Ensure that the local repositories, which host the product offline TAR ball version, is installed.

System Requirements

Feature	Description
Disk Space	2 x 800 GB SSD (RAID 1) or equivalent input/output operations per second (IOPS) and redundancy.
Hardware	<ul style="list-style-type: none"> • High-performance x86 64-bit chipset • CPU performance Passmark benchmark of 13K rating per chip and 1,365 rating per thread, or better • VMware ESXi-compatible <p>Note The following is recommended:</p> <ul style="list-style-type: none"> • Cisco UCSM5 series blade servers to achieve the best performance. • All the host servers should be UCSC-C240-M5SX or UCSC-C220-M5SX. • All the UCS systems should have SSD storage type. • UCS C240M5 servers for better performance and to avoid infrastructure issues.
Platform	VMware ESXi and VMware vCenter versions 6.5 and 6.7 <p>Note SMI Cluster Manger support is qualified on the preceding platforms.</p>
Memory	<ul style="list-style-type: none"> • At least DDR3-1600 or better than 1600 MT/s • ECC
Deployment Requirement	Hardware oversubscription, network saturation, or CPU oversubscription reduces application performance and productivity. The Cisco Ultra Cloud Core Subscriber Microservices Infrastructure detects and takes action when infrastructure requirements are not met.

Installing cnBNG in an Offline Environment

Using the SMI Cluster Manager, download the offline TAR ball of the cnBNG, the host and its charts, and corresponding images in the local registries. The SMI Cluster Manager supports the deployment of the BNG Ops Center and all the applications and services associated with it. This section describes the procedures involved in installing cnBNG in an offline environment using the SMI Cluster Manager.

To install cnBNG, complete the following steps:

1. Download the TAR ball from the URL.

software-packages download *URL*

Example:

```
SMI Cluster Manager# software-packages download
http://<ipv4address>:<port_number>/packages/bng-2021-02-1.tar
```

2. Verify whether the TAR balls are loaded.

```
software-packages list
```

Example:

```
BNG Cluster Manager# software-packages list
[ bng-2021-02-1 ]
[ sample ]
```

3. Configure the necessary SMI Ops Center parameters in the cluster to install cnBNG.

```
config
```

```
cluster cluster_name
  ops-centers app_name instance_name
    repository url
    netconf-ip ipv4_address
    netconf-port port
    ssh-ip ipv4_address
    ssh-port port
    ingress-hostname <ipv4_address>.<customer_specific_domain_name>
    initial-boot-parameters use-volume-claims true/false
    initial-boot-parameters first-boot-password password
    initial-boot-parameters auto-deploy true/false
    initial-boot-parameters single-node true/false
    initial-boot-parameters image-pull-secrets
exit
```

```
exit
```

Example:

```
SMI Cluster Manager# config
Entering configuration mode terminal
SMI Cluster Manager(config)# clusters cnbng-smi-cluster-01
SMI Cluster Manager(config-clusters-cnbng-smi-cluster-01)# ops-centers bng bng
SMI Cluster Manager(config-ops-centers-bng/bng)# repository
https://charts.10.10.105.50.nip.io/bng-2021.02.1
SMI Cluster Manager(config-ops-centers-bng/bng)# ingress-hostname 10.10.105.34.nip.io
SMI Cluster Manager(config-ops-centers-bng/bng)# initial-boot-parameters use-volume-claims
true
SMI Cluster Manager(config-ops-centers-bng/bng)# initial-boot-parameters
first-boot-password test123
SMI Cluster Manager(config-ops-centers-bng/bng)# initial-boot-parameters auto-deploy
false
SMI Cluster Manager(config-ops-centers-bng/bng)# initial-boot-parameters single-node
false
SMI Cluster Manager(config-ops-centers-bng/bng)# exit
SMI Cluster Manager(config-clusters-cnbng-smi-cluster-01)# exit
SMI Cluster Manager(config)#
```

4. Configure the secrets, if your local registry contains secrets.

```
config
```

```
cluster cluster_name
  secrets docker-registry secret_name
    docker-server server_name
    docker-username username
    docker-password password
```

```

docker-email email
namespace k8s namespace
commit
exit
exit

```

Example:

```

SMI Cluster Manager# config
SMI Cluster Manager(config)# clusters test2
SMI Cluster Manager(config-clusters-test2)# secrets docker-registry sec1
SMI Cluster Manager(config-docker-registry-sec1)# docker-server serv1
SMI Cluster Manager(config-docker-registry-sec1)# docker-username user1
SMI Cluster Manager(config-docker-registry-sec1)# docker-password Cisco@123
SMI Cluster Manager(config-docker-registry-sec1)# docker-email reg@cisco.com
SMI Cluster Manager(config-docker-registry-sec1)# bng bng
SMI Cluster Manager(config-docker-registry-sec1)# exit
SMI Cluster Manager(config-clusters-test2)# exit
SMI Cluster Manager(config)#

```

5. Run the cluster synchronization.

```
clusters cluster_name actions sync run
```

Example:

```
SMI Cluster Manager# clusters cnbng-smi-cluster-01 actions sync run
```

Notes:

- **software-packages download url**—Specifies the software packages to be downloaded through HTTP/HTTPS.
- **software-packages list**—Specifies the list of available software packages.
- **ops-centers app_name instance_name**—Specifies the BNG Ops Center and instance. *app_name* is the application name. *instance_name* is the name of the instance.
- **repository url**—Specifies the local registry URL for downloading the charts.
- **netconf-ip ipv4_address**—Specifies the BNG Ops Center netconf IPv4 address.
- **netconf-port port**—Specifies the BNG Ops Center netconf port number.
- **ssh-ip ipv4_address**—Specifies the SSH IPv4 address for the BNG Ops Center.
- **ssh-port port**—Specifies the SSH port number for the BNG Ops Center.
- **ingress-hostname <ipv4_address>.<customer_specific_domain_name>**—Specifies the ingress hostname to be set to the BNG Ops Center. *<customer_specific_domain_name>* specifies the domain name of the customer.
- **initial-boot-parameters**—Specifies the initial boot parameters for deploying the helm charts.
 - **use-volume-claims true/false**—Specifies the usage of persistent volumes. Set this option to True to use persistent volumes. The default value is true.
 - **first-boot-password password**—Specifies the first boot password for the product's Ops Center.
 - **auto-deploy true/false**—Auto deploys all the services of the product. Set this option to false to deploy only the product's Ops Center.

- **single-node** *true/false*– Specifies the product deployment on a single node. Set this option to false for multi node deployments.
- **image-pull-secrets**–Specifies the docker registry secret name to be used.
- **secrets docker-registry** *secret_name*–Specifies the secret name for your docker registry.
 - **docker-server** *server_name*–Specifies the docker server name.
 - **docker-username** *username*–Specifies the docker registry user name.
 - **docker-password** *password*–Specifies the docker registry password.
 - **docker-email** *email*–Specifies the docker registry email.
 - **namespace** *namespace*–Specifies the docker registry namespace.

Verifying the cnBNG Installation

Verify the status of the cnBNG installation deployment through the cnBNG CLI. To verify, use the following commands:

1. Log in to the cnBNG product CLI.
2. Verify whether the charts are loaded in the specific instance (verify the namespace).

show helm charts

Example:

```
bng# show helm charts
CHART      INSTANCE  STATUS   VERSION  REVISION  RELEASE      NAMESPACE
-----
infra-charts - DEPLOYED 0.0.6-rel-2021-01-0073-210208130850-fac5207 1 bng-bng-infra-charts
  bng-bng
oam-pod - DEPLOYED 0.1.2-rel-2021-01-0144-210122165946-fcb74ed 1 bng-bng-oam-pod bng-bng
bng-dashboard - DEPLOYED 0.0.1-rel-2021-01-0039-210122165311-0d542be 1
bng-bng-bng-dashboard bng-bng
etcd-cluster - DEPLOYED 0.7.0-0-7-0060-210203074532-f118407 1 bng-bng-etcd-cluster bng-bng
ngn-datastore - DEPLOYED 1.3.0-1-3-0782-210125161812-f50a892 1 bng-bng-ngn-datastore
bng-bng
```

3. Verify the status of the system.

show system status

Example:

```
bng# show system status
system status deployed true
system status percent-ready 100.0
```

Notes:

- **show helm charts**–Displays the helm release details.
- **show system status**–Displays the status of the system.

Accessing BNG Ops Center

You can connect to the BNG Ops Center through SSH or the web-based CLI console.

1. SSH:

```
ssh admin@ops_center_pod_ip -p 2024
```

2. Web-based console:

a. Log in to the Kubernetes master node.

b. Run the following command:

```
kubectl get ingress <namespace>
```

The available ingress connections get listed.

c. Select the appropriate ingress and access the BNG Ops Center.

d. Access the following URL from your web browser:

```
cli.<namespace>-ops-center.<ip_address>.nip.io
```

By default, the Day 0 configuration is loaded into the cnBNG.

Day 0 Configuration

To view the Day 0 configuration, run the following command.

```
show running-config
```

The following is a sample Day 0 configuration:

```
luser@cnbng-smi-cluster-master1:~$ kubectl get svc -n bng-bng | grep
ops-center-bng-bng-ops-center
NAME                                TYPE                CLUSTER-IP          EXTERNAL-IP         PORT(S)
ops-center-bng-bng-ops-center      ClusterIP           10.96.151.115      <none>
8008/TCP,8080/TCP,2024/TCP,2022/TCP,7681/TCP  7m37s
luser@cnbng-smi-cluster-master1:~$ ssh admin@10.96.151.115 -p 2024
Warning: Permanently added '[10.96.151.115]:2024' (RSA) to the list of known hosts.
admin@10.96.151.115's password:

Welcome to the bng CLI on cnbng-smi-cluster/bng
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admin connected from 192.202.0.1 using ssh on ops-center-bng-bng-ops-center-7bddd4cc48-fmb61
[cnbng-smi-cluster/bng] bng# show running-config
system mode running
helm default-repository base-repos
helm repository base-repos
url
https://engci-maven-master.cisco.com/artifactory/smi-fuse-internal-snapshot/mobile-cnat-bng/bng-products/master/
username <username>
password <password>
exit
k8s name          cnbng-smi-cluster
k8s namespace     bng-bng
k8s nf-name       bng
k8s registry      dockerhub.cisco.com/smi-fuse-docker-internal
k8s single-node   false
```



```
k8s use-volume-claims true
k8s ingress-host-name 192.0.2.2.nip.io
aaa authentication users user admin
uid          1117
gid          1117
password    $1$EmkQjvc0$o8K5tXmUzN1.drQgCL0A2/
ssh_keydir  /tmp/admin/.ssh
homedir     /tmp/admin
exit
aaa ios level 0
prompt "\h> "
exit
aaa ios level 15
prompt "\h# "
exit
aaa ios privilege exec
level 0
  command action
  exit
  command autowizard
  exit
  command enable
  exit
  command exit
  exit
  command help
  exit
  command startup
  exit
exit
level 15
  command configure
  exit
exit
exit
nacm write-default deny
nacm groups group admin
user-name [ admin ]
exit
nacm rule-list admin
group [ admin ]
rule any-access
  action permit
exit
exit
nacm rule-list confd-api-manager
group [ confd-api-manager ]
rule any-access
  action permit
exit
exit
nacm rule-list ops-center-security
group [ * ]
rule change-self-password
  module-name      ops-center-security
  path              /smiuser/change-self-password
  access-operations exec
  action            permit
exit
rule smiuser
  module-name      ops-center-security
  path              /smiuser
  access-operations exec
  action            deny
```

```

exit
exit

deployment
  app-name      BNG
  cluster-name  Local
  dc-name       DC
exit
k8 bng
  etcd-endpoint      etcd:2379
  datastore-endpoint datastore-ep-session:8882
  tracing
    enable
    enable-trace-percent 30
    append-messages      true
    endpoint              jaeger-collector:9411
  exit
exit
k8 label protocol-layer key smi.cisco.com/node-type value protocol
exit
k8 label service-layer key smi.cisco.com/node-type value service
exit
k8 label cdl-layer key smi.cisco.com/node-type value session
exit
k8 label oam-layer key smi.cisco.com/node-type value oam
exit
instances instance 1
  system-id DC
  cluster-id Local
  slice-name 1
exit
local-instance instance 1
system mode shutdown
helm default-repository base-repos
helm repository base-repos
  url
https://engci-maven-master.cisco.com/artifactory/smi-fuse-internal-snapshot/mobile-cnat-bng/bng-products/master/

  username smf-deployer.gen
  password ***
exit
k8s name      svi-cn-bng-tb3
k8s namespace bng-bng
k8s nf-name   bng
k8s registry  dockerhub.cisco.com/smi-fuse-docker-internal
k8s single-node false
k8s use-volume-claims true
k8s ingress-host-name 10.81.103.86.nip.io
aaa authentication users user admin
  uid      1117
  gid      1117
  password $1$vDWeJvJm$v46wiBWqdOj7eWgoPoZZE/
  ssh_keydir /tmp/admin/.ssh
  homedir   /tmp/admin
exit
aaa ios level 0
  prompt "\h> "
exit
aaa ios level 15
  prompt "\h# "
exit
aaa ios privilege exec
  level 0
  command action
  exit

```

```

command autowizard
exit
command enable
exit
command exit
exit
command help
exit
command startup
exit
exit
level 15
  command configure
  exit
exit
exit
nacm write-default deny
nacm groups group admin
  user-name [ admin ]
exit
nacm rule-list admin
  group [ admin ]
  rule any-access
  action permit
  exit
exit
nacm rule-list confd-api-manager
  group [ confd-api-manager ]
  rule any-access
  action permit
  exit
exit
nacm rule-list ops-center-security
  group [ * ]
  rule change-self-password
    module-name      ops-center-security
    path              /smiuser/change-self-password
    access-operations exec
    action            permit
  exit
  rule smiuser
    module-name      ops-center-security
    path              /smiuser
    access-operations exec
    action            deny
  exit
exit

```

CP and UP Service Configuration

The CP service requires the basic configuration to process the API calls.



Note For information about the User Plane service configuration, refer to the *Cloud Native BNG User Plane Configuration Guide for Cisco ASR 9000 Series Routers, IOS XR Release 7.3.x*

Configuring the CP

The CP configuration is provided using the Ops Center infrastructure.

The following is a sample CP configuration:

```

ipam
source local
address-pool Default-Pool
address-quarantine-timer 60
vrf-name default
ipv4
split-size
per-cache 131072
per-dp 131072
exit
address-range 13.0.0.1 13.1.255.255
exit
ipv6
address-ranges
split-size
per-cache 65536
per-dp 65536
exit
address-range 1:4::1 1:4::ffff
address-range 1:5::1 1:5::ffff
address-range 1:6::1 1:6::ffff
address-range 1:7::1 1:7::ffff
exit
prefix-ranges
split-size
per-cache 65536
per-dp 65536
exit
prefix-range 2003:db0:: length 48
prefix-range 2003:db1:: length 48
prefix-range 2003:db2:: length 48
prefix-range 2003:db3:: length 48
exit
exit
address-pool VRF-Pool
address-quarantine-timer 60
vrf-name it_vrf
ipv4
split-size
per-cache 131072
per-dp 131072
exit
address-range 14.0.0.1 14.1.255.255
exit
ipv6
address-ranges
split-size
per-cache 65536
per-dp 65536
exit
address-range 2:4::1 2:4::ffff
address-range 2:5::1 2:5::ffff
address-range 2:6::1 2:6::ffff
address-range 2:7::1 2:7::ffff
exit
prefix-ranges
split-size
per-cache 65536
per-dp 65536
exit
prefix-range 2004:db0:: length 48

```

```
    prefix-range 2004:db1:: length 48
    prefix-range 2004:db2:: length 48
    prefix-range 2004:db3:: length 48
  exit
exit
address-pool pool-ISP
address-quarantine-timer 60
vrf-name default
ipv4
  split-size
  per-cache 131072
  per-dp 131072
  exit
  address-range 11.0.0.1 11.1.255.255
  exit
ipv6
  address-ranges
  split-size
  per-cache 65536
  per-dp 65536
  exit
  address-range 4:2::1 4:2::ffff
  address-range 4:3::1 4:3::ffff
  address-range 4:4::1 4:4::ffff
  address-range 4:5::1 4:5::ffff
  exit
  prefix-ranges
  split-size
  per-cache 65536
  per-dp 65536
  exit
  prefix-range 2001:db0:: length 48
  prefix-range 2001:db1:: length 48
  prefix-range 2001:db2:: length 48
  prefix-range 2001:db3:: length 48
  exit
exit
address-pool pool-st
vrf-name default
static enable user-plane asr9k-2
ipv4
  split-size
  per-cache 262144
  per-dp 262144
  exit
  address-range 12.0.0.1 12.3.255.254 default-gateway 12.0.0.1
  exit
ipv6
  address-ranges
  split-size
  per-cache 8192
  per-dp 8192
  exit
  address-range 2:2::1 2:2::ff00
  exit
  prefix-ranges
  split-size
  per-cache 8192
  per-dp 8192
  exit
  prefix-range 3001:db0:: length 48
  exit
```

```
exit
exit
address-pool static-pool
vrf-name access-vrf-1
static enable user-plane asr9k-1
ipv4
split-size
no-split
exit
address-range 20.20.0.0 20.20.0.255 default-gateway 20.20.0.1
exit
exit
exit
cdl node-type session
cdl logging default-log-level error
cdl datastore session
endpoint replica 2
endpoint settings slot-timeout-ms 750
index replica 2
index map 1
slot replica 2
slot map 2
slot notification limit 300
exit
cdl kafka replica 2
profile dhcp dhcp-server1
ipv4
mode server
server
pool-name pool-ISP
dns-servers [ 8.8.8.8 ]
lease hours 6
lease minutes 40
exit
exit
ipv6
mode server
server
iana-pool-name pool-ISP
iapd-pool-name pool-ISP
lease days 0
lease hours 4
lease minutes 2
exit
exit
exit
profile dhcp dhcp-server3
ipv4
mode server
server
pool-name Default-Pool
dns-servers [ 8.8.8.8 ]
lease days 1
lease hours 6
lease minutes 3
exit
exit
ipv6
mode server
server
iana-pool-name Default-Pool
iapd-pool-name Default-Pool
lease days 1
lease hours 6
```

```
        lease minutes 3
    exit
    exit
exit
profile dhcp dhcp-server4
    ipv4
        mode server
        server
            pool-name VRF-Pool
            dns-servers [ 8.8.8.8 ]
            lease hours 6
            lease minutes 40
        exit
    exit
    ipv6
        mode server
        server
            iana-pool-name VRF-Pool
            iapd-pool-name VRF-Pool
            lease hours 6
        exit
    exit
exit
profile pppoe bng
    ctrl-pkt-priority 7
    max-payload deny
    service-name [ value]
    ac-name 123@acname
    ac-cookie 123@accookie
exit
profile aaa aaa-prof1
    authorization
        type subscriber method-order [ local ]
        username value <username>
        password <password>
    exit
    accounting
        method-order [ local ]
    exit
exit
profile server-group local
    radius-group local
exit
profile subscriber subs-default
    dhcp-profile dhcp-server3
    session-type ipv4v6
    activate-feature-templates [ svc1 QOS_HSI QOS_IPTV QOS_VOICE ]
    aaa authorize aaa-prof1
exit
profile subscriber subs-prof1
    dhcp-profile dhcp-server1
    session-type ipv4v6
    activate-feature-templates [ svc1 ]
    aaa authorize aaa-prof1
exit
profile subscriber subs-prof1-pppoe
    dhcp-profile dhcp-server1
    pppoe-profile bng
    session-type ipv4v6
    class ppp_cls_map
    activate-feature-templates [ bng_ft_start ]
    matches
        match-type all
        match protocol [ ppp ]
```

```

    exit
  exit
  event session-activate
  class ppp_cls_map
    activate-feature-templates [ bng_ft_activate ]
    matches
      match-type all
      match protocol [ ppp ]
    exit
    aaa authenticate aaa-prof1
  exit
  exit
  profile subscriber subs-vrf
    dhcp-profile          dhcp-server4
    session-type          ipv4v6
    activate-feature-templates [ svc3 QOS_VOICE QOS_IPTV QOS_HSI ]
    aaa authorize aaa-prof1
  exit
  profile subscriber test-ppp-subscriber
    dhcp-profile          dhcp-server3
    pppoe-profile         test-ppp-pppoeprofile
    session-type          ipv4v6
    activate-feature-templates [ svc1 test-ppp-featuretemplate QOS_VOICE QOS_IPTV QOS_HSI ]
    aaa authorize aaa-prof1
  exit
  profile feature-template ACL-V4
    ipv4
    ingress-acl iACL_BNG_IPv4_IN
    egress-acl  iACL_BNG_IPv4_OUT
  exit
  exit
  profile feature-template ACL-V6
    ipv6
    ingress-acl v6-IN
    egress-acl  v6-out
  exit
  exit
  profile feature-template QOS_HSI
    qos
    in-policy   QOS_HSI_100B_IN
    out-policy  QOS_HSI_100B_OUT
    merge-level 30
  exit
  service-accounting
    enable
    aaa-profile      aaa-prof1
    periodic-interval 1800
  exit
  exit
  profile feature-template QOS_VOICE
    qos
    in-policy   QOS_VOICE_INGRESS
    out-policy  QOS_VOICE_EGRESS
    merge-level 40
  exit
  exit
  profile feature-template QOS_IPTV
    qos
    in-policy   QOS_IPTV_INGRESS
    out-policy  QOS_IPTV_EGRESS
    merge-level 50
  exit
  exit

```



```
profile feature-template QOS
  qos
  in-policy QOS-IN
  out-policy QOS-OUT
  merge-level 10
  exit
  service-accounting
  enable
  aaa-profile aaa-profl
  exit
exit
profile feature-template bng_ft_activate
  ipv4
  mtu 1492
  ingress-acl in4acl3
  disable-unreachables
  verify-unicast-source reachable-via-rx
  exit
  ipv6
  mtu 1492
  ingress-acl match-ipv6-acl
  disable-unreachables
  verify-unicast-source reachable-via-rx
  exit
  session-accounting
  enable
  aaa-profile aaa-profl
  periodic-interval 1200
  exit
  ppp
  ipcp dns 8.8.8.8 1.2.3.4
  ipcp peer-address-pool pool-ISP
  ipcp renegotiation ignore
  ipv6cp renegotiation ignore
  exit
exit
profile feature-template bng_ft_start
  vrf-name default
  session-accounting
  enable
  aaa-profile aaa-profl
  periodic-interval 1200
  exit
  ppp
  authentication [ pap ]
  lcp delay seconds 1 milliseconds 0
  lcp renegotiation ignore
  exit
exit
profile feature-template svcl
  vrf-name default
  ipv4
  mtu 1492
  ingress-acl iACL_BNG_IPv4_IN_1
  egress-acl iACL_BNG_IPv4_OUT_1
  disable-unreachables
  verify-unicast-source reachable-via-rx
  exit
  ipv6
  mtu 1492
  ingress-acl ipv6-acl-in-1
  egress-acl ipv6-acl-out-1
  disable-unreachables
  verify-unicast-source reachable-via-rx
```

```

exit
session-accounting
  enable
  aaa-profile      aaa-prof1
  periodic-interval 1800
exit
exit
profile feature-template svc2
  ppp
  ipcp peer-address-pool poolv4
  ipcp renegotiation ignore
  lcp renegotiation ignore
  exit
exit
profile feature-template svc3
  vrf-name it_vrf
  ipv4
  mtu 1492
  ingress-acl      iACL_BNG_IPv4_IN_1
  egress-acl       iACL_BNG_IPv4_OUT_1
  disable-unreachables
  verify-unicast-source reachable-via-rx
  exit
  ipv6
  mtu 1492
  ingress-acl      ipv6-acl-in-1
  egress-acl       ipv6-acl-out-1
  disable-unreachables
  verify-unicast-source reachable-via-rx
  exit
  session-accounting
  enable
  aaa-profile      aaa-prof1
  periodic-interval 1800
  exit
exit
profile feature-template svc4
  vrf-name default
  session-accounting
  enable
  aaa-profile      aaa-prof1
  periodic-interval 1800
  exit
exit
profile feature-template test-ppp-featuretemplate
  vrf-name default
  ipv4
  mtu 1400
  exit
  ppp
  ipcp peer-address-pool Default-Pool
  ipcp renegotiation ignore
  ipv6cp renegotiation ignore
  lcp renegotiation ignore
  exit
exit
profile feature-template uRPF
  ipv4
  verify-unicast-source reachable-via-rx
  exit
  ipv6
  verify-unicast-source reachable-via-rx
  exit
exit

```

```
profile radius
algorithm round-robin
deadtime 3
detect-dead-server response-timeout 60
max-retry 1
timeout 5
server 172.16.254.55 1812
    type auth
    secret <secret_value>
exit
server 172.16.254.55 1813
    type acct
    secret <secret_value>
exit
server 172.16.254.56 1812
    type auth
    secret <secret_value>
exit
server 172.16.254.56 1813
    type acct
    secret <secret_value>
exit
attribute
    nas-identifier < any identifier>
    nas-ip 172.16.254.86
    nas-port-id < add_unique_id>
exit
server-group local
    server auth 172.16.254.55 1812
    exit
    server auth 172.16.254.56 1812
    exit
    server acct 172.16.254.55 1813
    exit
    server acct 172.16.254.56 1813
    exit
exit
profile coa
client 172.16.254.55
    server-key < key >
exit
client 172.16.254.56
    server-key < key >
exit
exit
user-plane <add UP name like asr9k-11>
peer-address ipv4 172.16.247.72
subscriber-profile subs-default
exit
endpoint sm
exit
endpoint nodemgr
exit
endpoint n4-protocol
exit
endpoint dhcp
exit
endpoint radius
replicas 1
vip-ip 172.16.254.86
interface coa-nas
sla response 140000
vip-ip 172.16.254.86 vip-port 2000
```

```

exit
exit
endpoint udp-proxy
  replicas 1
  nodes 2
  vip-ip 172.16.254.86 vip-port 3799
  interface n4
    sla response 150000
  exit
  interface gtpu
    sla response 150000
  exit
exit
endpoint charging
exit
logging transaction duplicate enable
logging name bng-dhcp0.bngfsol.collision level application info
logging name bng-dhcp0.bngfsol.collision level transaction info
logging name infra.application.core level application warn
logging name infra.config.core level application error
logging name infra.config.core level transaction error
k8 bng
  etcd-endpoint etcd:2379
  datastore-endpoint datastore-ep-session:8882
  tracing
    enable
    enable-trace-percent 30
    append-messages true
    endpoint jaeger-collector:9411
  exit
exit
k8 label protocol-layer key smi.cisco.com/vm-type value protocol
exit
k8 label service-layer key smi.cisco.com/vm-type value service
exit
k8 label cdl-layer key smi.cisco.com/vm-type value session
exit
k8 label oam-layer key smi.cisco.com/vm-type value oam
exit
system mode running
exit

ipam
  instance 1
  source local
  address-pool POOL_1
  address-quarantine-timer 60
  vrf-name default
  ipv4
    split-size
      per-cache 32768
      per-dp 32768
    exit
    threshold
      upper-threshold 80
    exit
    address-range 11.0.0.2 11.10.255.254
  exit
  ipv6
    address-ranges
      split-size
        per-cache 32768
        per-dp 32768
      exit
    address-range 2405:1::2 2405:1::ffff

```

```
    address-range 2405:2::2 2405:2::ffff
    address-range 2405:3::2 2405:3::ffff
    address-range 2405:4::2 2405:4::ffff
  exit
  prefix-ranges
    split-size
      per-cache 32768
      per-dp 32768
    exit
    prefix-range 3405:1:: length 46
    prefix-range 3405:2:: length 46
    prefix-range 3405:3:: length 46
    prefix-range 3405:4:: length 46
  exit
exit
exit
address-pool POOL_2
address-quarantine-timer 60
vrf-name VRF-GOLD
ipv4
  split-size
    per-cache 32768
    per-dp 32768
  exit
  threshold
    upper-threshold 80
  exit
  address-range 12.0.0.2 12.10.255.254
exit
ipv6
  address-ranges
    split-size
      per-cache 32768
      per-dp 32768
    exit
    address-range 2406:1::2 2406:1::ffff
    address-range 2406:2::2 2406:2::ffff
    address-range 2406:3::2 2406:3::ffff
    address-range 2406:4::2 2406:4::ffff
  exit
  prefix-ranges
    split-size
      per-cache 32768
      per-dp 32768
    exit
    prefix-range 3406:1:: length 46
    prefix-range 3406:2:: length 46
    prefix-range 3406:3:: length 46
    prefix-range 3406:4:: length 46
  exit
exit
exit
address-pool POOL_3
address-quarantine-timer 60
vrf-name vrf_lps_asr9k
ipv4
  split-size
    per-cache 32768
    per-dp 32768
  exit
  threshold
    upper-threshold 80
  exit
  address-range 13.0.0.1 13.255.255.255
```

```
exit
ipv6
address-ranges
  split-size
  per-cache 16384
  per-dp 16384
exit
address-range 2404:1::1 2404:1::ffff
address-range 2404:2::1 2404:2::ffff
address-range 2404:3::1 2404:3::ffff
address-range 2404:4::1 2404:4::ffff
address-range 2404:5::1 2404:5::ffff
address-range 2404:6::1 2404:6::ffff
address-range 2404:7::1 2404:7::ffff
address-range 2404:8::1 2404:8::ffff
address-range 2404:9::1 2404:9::ffff
address-range 2404:10::1 2404:10::ffff
address-range 2404:11::1 2404:11::ffff
address-range 2404:12::1 2404:12::ffff
address-range 2404:13::1 2404:13::ffff
address-range 2404:14::1 2404:14::ffff
address-range 2404:15::1 2404:15::ffff
address-range 2404:16::1 2404:16::ffff
address-range 2404:17::1 2404:17::ffff
address-range 2404:18::1 2404:18::ffff
address-range 2404:19::1 2404:19::ffff
address-range 2404:20::1 2404:20::ffff
address-range 2404:21::1 2404:21::ffff
address-range 2404:22::1 2404:22::ffff
address-range 2404:23::1 2404:23::ffff
address-range 2404:24::1 2404:24::ffff
address-range 2404:25::1 2404:25::ffff
address-range 2404:26::1 2404:26::ffff
address-range 2404:27::1 2404:27::ffff
address-range 2404:28::1 2404:28::ffff
address-range 2404:29::1 2404:29::ffff
address-range 2404:30::1 2404:30::ffff
address-range 2404:31::1 2404:31::ffff
address-range 2404:32::1 2404:32::ffff
address-range 2404:33::1 2404:33::ffff
address-range 2404:34::1 2404:34::ffff
address-range 2404:35::1 2404:35::ffff
address-range 2404:36::1 2404:36::ffff
address-range 2404:37::1 2404:37::ffff
address-range 2404:38::1 2404:38::ffff
address-range 2404:39::1 2404:39::ffff
address-range 2404:40::1 2404:40::ffff
exit
prefix-ranges
  split-size
  per-cache 32768
  per-dp 32768
exit
prefix-range 2404:db0:: length 42
prefix-range 2404:db1:: length 42
prefix-range 2404:db2:: length 42
prefix-range 2404:db3:: length 42
prefix-range 2404:db4:: length 42
prefix-range 2404:db5:: length 42
prefix-range 2404:db6:: length 42
prefix-range 2404:db7:: length 42
prefix-range 2404:db8:: length 42
prefix-range 2404:db9:: length 42
exit
```

```
    exit
  exit
exit
cdl node-type session
cdl logging default-log-level error
cdl datastore session
  slice-names [ 1 ]
  endpoint replica 2
  endpoint settings slot-timeout-ms 750
  index replica 2
  index map 1
  slot replica 2
  slot map 2
  slot notification limit 300
exit
cdl kafka replica 1
profile dhcp DHCP_SERVER_1
  ipv4
  mode server
  server
  pool-name          POOL_1
  dns-servers        [ 8.8.8.8 8.8.8.88 8.8.88.88 ]
  netbios-name-server [ 9.9.9.9 9.9.9.99 9.9.99.99 ]
  domain-name        cisco.com
  boot-filename       cisco.cfg
  next-server         7.7.7.7
  netbios-node-type  broadcast-node
  lease days          1
  lease hours         4
  lease minutes       2
  exit
exit
  ipv6
  mode server
  server
  iana-pool-name     POOL_1
  iapd-pool-name     POOL_1
  dns-servers        [ 2002::1 2002::2 ]
  domain-name        cisco.com
  preference          255
  aftr-name          aftr.cisco.com
  lease days          1
  lease hours         4
  lease minutes       2
  exit
exit
profile dhcp DHCP_SERVER_2
  ipv4
  mode server
  server
  pool-name          POOL_1
  dns-servers        [ 8.8.8.8 8.8.8.88 8.8.88.88 ]
  netbios-name-server [ 9.9.9.9 9.9.9.99 9.9.99.99 ]
  domain-name        cisco.com
  boot-filename       cisco.cfg
  next-server         7.7.7.7
  netbios-node-type  broadcast-node
  lease days          1
  lease hours         4
  lease minutes       2
  exit
exit
```

```
ipv6
mode server
server
  iana-pool-name POOL_1
  iapd-pool-name POOL_1
  lease days 1
  lease hours 4
  lease minutes 2
exit
exit
exit
profile dhcp DHCP_SERVER_3
ipv4
mode server
server
  pool-name POOL_3
  dns-servers [ 8.8.8.8 ]
  lease hours 6
  lease minutes 1
exit
exit
ipv6
mode server
server
  iana-pool-name POOL_3
  iapd-pool-name POOL_3
  lease days 1
  lease hours 4
  lease minutes 2
exit
exit
exit
profile dhcp DHCP_SERVER_4
ipv4
mode server
server
  pool-name POOL_2
  dns-servers [ 8.8.8.8 ]
  lease hours 6
  lease minutes 1
exit
exit
ipv6
mode server
server
  iana-pool-name POOL_2
  iapd-pool-name POOL_2
  lease days 1
  lease hours 4
  lease minutes 2
exit
exit
exit
profile pppoe PPPOE_PROFILE_1
ctrl-pkt-priority 7
service-name [ cisco ]
ac-name 123@acname
ac-cookie 123@accookie
exit
profile aaa AAA_PROF_1
authentication
  method-order [ SERVER_GROUP_PROF_1 ]
exit
authorization
```



```
type subscriber method-order [ SERVER_GROUP_PROF_1 ]
username identifier client-mac-address
password cisco
exit
accounting
method-order [ SERVER_GROUP_PROF_1 ]
exit
exit
profile aaa AAA_PROF_2
authentication
method-order [ SERVER_GROUP_PROF_2 ]
exit
authorization
type subscriber method-order [ SERVER_GROUP_PROF_2 ]
username identifier client-mac-address
password cisco
exit
accounting
method-order [ SERVER_GROUP_PROF_2 ]
exit
exit
profile server-group SERVER_GROUP_PROF_1
radius-group SERVER_GROUP_1
exit
profile server-group SERVER_GROUP_PROF_2
radius-group SERVER_GROUP_2
exit
profile subscriber SUBS_IPoE_1
dhcp-profile DHCP_SERVER_1
session-type ipv4v6
activate-feature-templates [ BASE_TPL_1 ]
aaa authorize AAA_PROF_1
exit
profile subscriber SUBS_IPoE_2
dhcp-profile DHCP_SERVER_3
session-type ipv4v6
activate-feature-templates [ BASE_TPL_2 ]
aaa authorize AAA_PROF_2
exit
profile subscriber SUBS_IPoE_3
dhcp-profile DHCP_SERVER_4
session-type ipv4v6
activate-feature-templates [ BASE_TPL_3 ]
aaa authorize AAA_PROF_2
exit
profile subscriber SUBS_PPpOE_1
dhcp-profile DHCP_SERVER_2
pppoe-profile PPPOE_PROFILE_1
session-type ipv4v6
class ppp_cls_map
activate-feature-templates [ FT_START_1 ]
matches
match-type all
match protocol [ ppp ]
exit
exit
event session-activate
class ppp_cls_map
activate-feature-templates [ FT_ACTIVATE_1 ]
matches
match-type all
match protocol [ ppp ]
exit
aaa authenticate AAA_PROF_1
```

```

    exit
  exit
exit
profile subscriber SUBS_PPpOE_2
  dhcp-profile DHCP_SERVER_3
  pppoe-profile PPPOE_PROFILE_1
  session-type ipv4v6
  class ppp_cls_map
    activate-feature-templates [ FT_START_1 ]
    matches
      match-type all
      match protocol [ ppp ]
    exit
  exit
event session-activate
  class ppp_cls_map
    activate-feature-templates [ FT_ACTIVATE_2 HSI_100MB ]
    matches
      match-type all
      match protocol [ ppp ]
    exit
  aaa authenticate AAA_PROF_1
  exit
exit
exit
profile subscriber SUBS_PPpOE_3
  dhcp-profile DHCP_SERVER_4
  pppoe-profile PPPOE_PROFILE_1
  session-type ipv4v6
  class ppp_cls_map
    activate-feature-templates [ FT_START_2 ]
    matches
      match-type all
      match protocol [ ppp ]
    exit
  exit
event session-activate
  class ppp_cls_map
    activate-feature-templates [ FT_ACTIVATE_3 ]
    matches
      match-type all
      match protocol [ ppp ]
    exit
  aaa authenticate AAA_PROF_1
  exit
exit
exit
profile feature-template BASE_TPL_1
  vrf-name default
  ipv4
    mtu 1492
    disable-unreachables
    verify-unicast-source reachable-via-rx
  exit
  ipv6
    mtu 1492
    disable-unreachables
    verify-unicast-source reachable-via-rx
  exit
  session-accounting
    enable
    aaa-profile AAA_PROF_1
  exit
exit

```

```
profile feature-template BASE_TPL_2
vrf-name vrf_lps_asr9k
ipv4
  mtu 1492
  disable-unreachables
  verify-unicast-source reachable-via-rx
exit
ipv6
  mtu 1492
  disable-unreachables
  verify-unicast-source reachable-via-rx
exit
qos
  in-policy qos_svcl_in
  out-policy qos_svcl_out
exit
session-accounting
  enable
  aaa-profile AAA_PROF_2
exit
exit
profile feature-template BASE_TPL_3
vrf-name VRF-GOLD
ipv4
  mtu 1492
  disable-unreachables
  verify-unicast-source reachable-via-rx
exit
ipv6
  mtu 1492
  disable-unreachables
  verify-unicast-source reachable-via-rx
exit
session-accounting
  enable
  aaa-profile AAA_PROF_2
exit
exit
profile feature-template FT_ACTIVATE_1
vrf-name default
ipv4
  mtu 1492
  disable-unreachables
  verify-unicast-source reachable-via-rx
exit
ipv6
  mtu 1492
  disable-unreachables
  verify-unicast-source reachable-via-rx
exit
ppp
  ipcp dns 8.8.8.8 1.2.3.4
  ipcp peer-address-pool POOL_1
  ipcp renegotiation ignore
  ipcp wins 4.4.4.4 3.3.3.3
  ipv6cp renegotiation ignore
exit
exit
profile feature-template FT_ACTIVATE_2
vrf-name vrf_lps_asr9k
ipv4
  mtu 1492
  disable-unreachables
  verify-unicast-source reachable-via-rx
```

```
exit
ipv6
  mtu 1492
  disable-unreachables
  verify-unicast-source reachable-via-rx
exit
ppp
  ipcp dns 8.8.8.8 1.2.3.4
  ipcp peer-address-pool POOL_3
  ipcp renegotiation ignore
  ipcp wins 4.4.4.4 3.3.3.3
  ipv6cp renegotiation ignore
exit
exit
profile feature-template FT_ACTIVATE_3
  vrf-name VRF-GOLD
  ipv4
    mtu 1492
    disable-unreachables
    verify-unicast-source reachable-via-rx
  exit
  ipv6
    mtu 1492
    disable-unreachables
    verify-unicast-source reachable-via-rx
  exit
  ppp
    ipcp dns 8.8.8.8 1.2.3.4
    ipcp peer-address-pool POOL_2
    ipcp renegotiation ignore
    ipcp wins 4.4.4.4 3.3.3.3
    ipv6cp renegotiation ignore
  exit
exit
profile feature-template FT_START_1
  session-accounting
    enable
    aaa-profile AAA_PROF_1
  exit
  ppp
    authentication [ pap chap ]
    lcp delay seconds 1 milliseconds 0
    lcp renegotiation ignore
    max-bad-auth 4
    max-failure 5
    timeout retry 3
    keepalive interval 60 retry 5
  exit
exit
profile feature-template FT_START_2
  session-accounting
    enable
    aaa-profile AAA_PROF_2
  exit
  ppp
    authentication [ pap chap ]
    lcp delay seconds 1 milliseconds 0
    lcp renegotiation ignore
    max-bad-auth 4
    max-failure 5
    timeout retry 3
    keepalive interval 60 retry 5
  exit
exit
```

```

profile feature-template HSI_100MB
  qos
  in-policy HSI_UPLOAD_RATE_100MB_IN
  out-policy HSI_DOWNLOAD_RATE_100MB_OUT
  exit
exit
profile feature-template HSI_100MB_NO_Merge
  qos
  in-policy HSI_UPLOAD_RATE_100MB_IN_V4
  out-policy HSI_DOWNLOAD_RATE_100MB_OUT_V4
  exit
exit
profile feature-template HSI_100MB_V4
  qos
  in-policy HSI_UPLOAD_RATE_100MB_IN_V4
  out-policy HSI_DOWNLOAD_RATE_100MB_OUT_V4
  merge-level 40
  exit
  service-accounting
  enable
  aaa-profile AAA_PROF_1
  periodic-interval 1200
  exit
exit
profile radius
  algorithm round-robin
  deadtime 1
  detect-dead-server response-timeout 60
  max-retry 1
  timeout 5
  server 203.203.203.12 1812
  type auth
  secret $8$uCC1/DzxkoOTeUFsUIUQoqF1Gbrzt6bo2HWRmUH9Sck=
  exit
  server 203.203.203.12 1813
  type acct
  secret $8$lmsqnr3OZYu6j0+DRGgvic5mOa/wmNw6sAnH4G7BYms=
  exit
  server 203.203.203.13 1812
  type auth
  secret $8$sI2jG0E3TLnPZ6+EpaSKxIYNayfX6pOo3nV8Y6w2R8I=
  exit
  server 203.203.203.13 1813
  type acct
  secret $8$49TVXKEXstB7DyK/r/QuxbzGcQ6avG1A4wrgSukSp9s=
  exit
  server 203.203.203.14 1812
  type auth
  secret $8$qdAzfoAmxVBIX04Xjw//Xywsire0AuNYC8EbKy1lkiQ=
  exit
  server 203.203.203.14 1813
  type acct
  secret $8$Fxs0QXKUmz93ULLuQo6yH6pjR0mB3CgTx7TRYL2U1Ao=
  exit
  server 203.203.203.15 1812
  type auth
  secret $8$j6PMUylUXz9Uggo42Zm2z6xfL0icZ8R5ry7tBP60BYo=
  exit
  server 203.203.203.15 1813
  type acct
  secret $8$oAbeghiPAJ88qqtjZqYihS39Vmyc1iU85WUo6pHpaAw=
  exit
  attribute
  nas-identifier CISCO-BNG

```

```

nas-ip          203.203.203.51
exit
server-group SERVER_GROUP_1
server auth 203.203.203.12 1812
exit
server auth 203.203.203.13 1812
exit
server acct 203.203.203.12 1813
exit
server acct 203.203.203.13 1813
exit
exit
server-group SERVER_GROUP_2
server auth 203.203.203.12 1812
exit
server auth 203.203.203.13 1812
exit
server acct 203.203.203.12 1813
exit
server acct 203.203.203.13 1813
exit
exit
exit
profile coa
client 203.203.203.11
server-key $8$10ZSTRkSki7VIU9Ld31kIFALUH4VipxvUKS0l0skSho=
exit
client 203.203.203.13
server-key $8$ViHTNL8bYPDcrTYXO24AJ1TnsnUJRXp6DBfWF/FX1/8=
exit
exit
user-plane ASR9k-UP-1
peer-address ipv4 101.101.101.52
subscriber-profile SUBS_IPoE_1
port-id Bundle-Ether5011.1
subscriber-profile SUBS_IPoE_1
exit
port-id Bundle-Ether5011.1011015
subscriber-profile SUBS_PPpOE_1
exit
port-id Bundle-Ether5011.1021015
subscriber-profile SUBS_PPpOE_1
exit
port-id Bundle-Ether5011.1031015
subscriber-profile SUBS_PPpOE_1
exit
port-id Bundle-Ether5011.1041015
subscriber-profile SUBS_PPpOE_1
exit
port-id Bundle-Ether5011.2
subscriber-profile SUBS_IPoE_1
exit
port-id Bundle-Ether5011.3
subscriber-profile SUBS_IPoE_1
exit
port-id Bundle-Ether5011.4
subscriber-profile SUBS_IPoE_1
exit
port-id Bundle-Ether5012.1
subscriber-profile SUBS_IPoE_3
exit
port-id Bundle-Ether5012.1011015
subscriber-profile SUBS_PPpOE_3
exit

```

```
port-id Bundle-Ether5012.1021015
  subscriber-profile SUBS_PPpOE_3
exit
port-id Bundle-Ether5012.1031015
  subscriber-profile SUBS_PPpOE_3
exit
port-id Bundle-Ether5012.1041015
  subscriber-profile SUBS_PPpOE_3
exit
port-id Bundle-Ether5012.2
  subscriber-profile SUBS_IPoE_3
exit
port-id Bundle-Ether5012.3
  subscriber-profile SUBS_IPoE_3
exit
port-id Bundle-Ether5012.4
  subscriber-profile SUBS_IPoE_3
exit
exit
user-plane ASR9k-UP-2
peer-address ipv4 101.101.101.51
subscriber-profile SUBS_IPoE_1
port-id Bundle-Ether1.1011015
  subscriber-profile SUBS_PPpOE_1
exit
port-id Bundle-Ether1.1021015
  subscriber-profile SUBS_PPpOE_1
exit
port-id Bundle-Ether1.1031015
  subscriber-profile SUBS_PPpOE_1
exit
port-id Bundle-Ether1.1041015
  subscriber-profile SUBS_PPpOE_1
exit
exit
user-plane lps_asr9k-1
peer-address ipv4 192.69.1.1
port-id 8805
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.1
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.2
  subscriber-profile SUBS_PPpOE_2
exit
exit
user-plane lps_asr9k-10
peer-address ipv4 192.69.1.10
port-id 8805
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.1
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.2
  subscriber-profile SUBS_PPpOE_2
exit
exit
user-plane lps_asr9k-11
peer-address ipv4 192.69.1.11
port-id 8805
  subscriber-profile SUBS_IPoE_2
exit
```

```
port-id Bundle-Ether1.1
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.2
  subscriber-profile SUBS_PPpOE_2
exit
exit
user-plane lps_asr9k-12
peer-address ipv4 192.69.1.12
port-id 8805
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.1
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.2
  subscriber-profile SUBS_PPpOE_2
exit
exit
user-plane lps_asr9k-13
peer-address ipv4 192.69.1.13
port-id 8805
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.1
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.2
  subscriber-profile SUBS_PPpOE_2
exit
exit
user-plane lps_asr9k-14
peer-address ipv4 192.69.1.14
port-id 8805
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.1
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.2
  subscriber-profile SUBS_PPpOE_2
exit
exit
user-plane lps_asr9k-15
peer-address ipv4 192.69.1.15
port-id 8805
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.1
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.2
  subscriber-profile SUBS_PPpOE_2
exit
exit
user-plane lps_asr9k-16
peer-address ipv4 192.69.1.16
port-id 8805
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.1
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.2
```



```
        subscriber-profile SUBS_PPpOE_2
    exit
exit
user-plane lps_asr9k-17
    peer-address ipv4 192.69.1.17
    port-id 8805
        subscriber-profile SUBS_IPoE_2
    exit
    port-id Bundle-Ether1.1
        subscriber-profile SUBS_IPoE_2
    exit
    port-id Bundle-Ether1.2
        subscriber-profile SUBS_PPpOE_2
    exit
exit
user-plane lps_asr9k-18
    peer-address ipv4 192.69.1.18
    port-id 8805
        subscriber-profile SUBS_IPoE_2
    exit
    port-id Bundle-Ether1.1
        subscriber-profile SUBS_IPoE_2
    exit
    port-id Bundle-Ether1.2
        subscriber-profile SUBS_PPpOE_2
    exit
exit
user-plane lps_asr9k-19
    peer-address ipv4 192.69.1.19
    port-id 8805
        subscriber-profile SUBS_IPoE_2
    exit
    port-id Bundle-Ether1.1
        subscriber-profile SUBS_IPoE_2
    exit
    port-id Bundle-Ether1.2
        subscriber-profile SUBS_PPpOE_2
    exit
exit
user-plane lps_asr9k-2
    peer-address ipv4 192.69.1.2
    port-id 8805
        subscriber-profile SUBS_IPoE_2
    exit
    port-id Bundle-Ether1.1
        subscriber-profile SUBS_IPoE_2
    exit
    port-id Bundle-Ether1.2
        subscriber-profile SUBS_PPpOE_2
    exit
exit
user-plane lps_asr9k-20
    peer-address ipv4 192.69.1.20
    port-id 8805
        subscriber-profile SUBS_IPoE_2
    exit
    port-id Bundle-Ether1.1
        subscriber-profile SUBS_IPoE_2
    exit
    port-id Bundle-Ether1.2
        subscriber-profile SUBS_PPpOE_2
    exit
exit
user-plane lps_asr9k-21
```

```
peer-address ipv4 192.69.1.21
port-id 8805
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.1
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.2
  subscriber-profile SUBS_PPpOE_2
exit
exit
user-plane lps_asr9k-22
peer-address ipv4 192.69.1.22
port-id 8805
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.1
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.2
  subscriber-profile SUBS_PPpOE_2
exit
exit
user-plane lps_asr9k-23
peer-address ipv4 192.69.1.23
port-id 8805
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.1
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.2
  subscriber-profile SUBS_PPpOE_2
exit
exit
user-plane lps_asr9k-24
peer-address ipv4 192.69.1.24
port-id 8805
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.1
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.2
  subscriber-profile SUBS_PPpOE_2
exit
exit
user-plane lps_asr9k-25
peer-address ipv4 192.69.1.25
port-id 8805
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.1
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.2
  subscriber-profile SUBS_PPpOE_2
exit
exit
user-plane lps_asr9k-26
peer-address ipv4 192.69.1.26
port-id 8805
  subscriber-profile SUBS_IPoE_2
exit
```

```
port-id Bundle-Ether1.1
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.2
  subscriber-profile SUBS_PPpOE_2
exit
exit
user-plane lps_asr9k-27
peer-address ipv4 192.69.1.27
port-id 8805
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.1
  subscriber-profile SUBS_IPoE_2
exit
exit
user-plane lps_asr9k-28
peer-address ipv4 192.69.1.28
port-id 8805
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.1
  subscriber-profile SUBS_IPoE_2
exit
exit
user-plane lps_asr9k-29
peer-address ipv4 192.69.1.29
port-id 8805
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.1
  subscriber-profile SUBS_IPoE_2
exit
exit
user-plane lps_asr9k-3
peer-address ipv4 192.69.1.3
port-id 8805
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.1
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.2
  subscriber-profile SUBS_PPpOE_2
exit
exit
user-plane lps_asr9k-30
peer-address ipv4 192.69.1.30
port-id 8805
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.1
  subscriber-profile SUBS_IPoE_2
exit
exit
user-plane lps_asr9k-31
peer-address ipv4 192.69.1.31
port-id 8805
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.1
  subscriber-profile SUBS_IPoE_2
exit
exit
```

```
user-plane lps_asr9k-32
peer-address ipv4 192.69.1.32
port-id 8805
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.1
  subscriber-profile SUBS_IPoE_2
exit
exit
user-plane lps_asr9k-33
peer-address ipv4 192.69.1.33
port-id 8805
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.1
  subscriber-profile SUBS_IPoE_2
exit
exit
user-plane lps_asr9k-34
peer-address ipv4 192.69.1.34
port-id 8805
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.1
  subscriber-profile SUBS_IPoE_2
exit
exit
user-plane lps_asr9k-35
peer-address ipv4 192.69.1.35
port-id 8805
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.1
  subscriber-profile SUBS_IPoE_2
exit
exit
user-plane lps_asr9k-36
peer-address ipv4 192.69.1.36
port-id 8805
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.1
  subscriber-profile SUBS_IPoE_2
exit
exit
user-plane lps_asr9k-37
peer-address ipv4 192.69.1.37
port-id 8805
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.1
  subscriber-profile SUBS_IPoE_2
exit
exit
user-plane lps_asr9k-38
peer-address ipv4 192.69.1.38
port-id 8805
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.1
  subscriber-profile SUBS_IPoE_2
exit
exit
user-plane lps_asr9k-39
```

```
peer-address ipv4 192.69.1.39
port-id 8805
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.1
  subscriber-profile SUBS_IPoE_2
exit
exit
user-plane lps_asr9k-4
peer-address ipv4 192.69.1.4
port-id 8805
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.1
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.2
  subscriber-profile SUBS_PPpOE_2
exit
exit
user-plane lps_asr9k-40
peer-address ipv4 192.69.1.40
port-id 8805
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.1
  subscriber-profile SUBS_IPoE_2
exit
exit
user-plane lps_asr9k-41
peer-address ipv4 192.69.1.41
port-id 8805
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.1
  subscriber-profile SUBS_IPoE_2
exit
exit
user-plane lps_asr9k-42
peer-address ipv4 192.69.1.42
port-id 8805
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.1
  subscriber-profile SUBS_IPoE_2
exit
exit
user-plane lps_asr9k-43
peer-address ipv4 192.69.1.43
port-id 8805
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.1
  subscriber-profile SUBS_IPoE_2
exit
exit
user-plane lps_asr9k-44
peer-address ipv4 192.69.1.44
port-id 8805
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.1
  subscriber-profile SUBS_IPoE_2
exit
```

```
exit
user-plane lps_asr9k-45
peer-address ipv4 192.69.1.45
port-id 8805
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.1
  subscriber-profile SUBS_IPoE_2
exit
exit
user-plane lps_asr9k-46
peer-address ipv4 192.69.1.46
port-id 8805
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.1
  subscriber-profile SUBS_IPoE_2
exit
exit
user-plane lps_asr9k-47
peer-address ipv4 192.69.1.47
port-id 8805
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.1
  subscriber-profile SUBS_IPoE_2
exit
exit
user-plane lps_asr9k-48
peer-address ipv4 192.69.1.48
port-id 8805
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.1
  subscriber-profile SUBS_IPoE_2
exit
exit
user-plane lps_asr9k-49
peer-address ipv4 192.69.1.49
port-id 8805
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.1
  subscriber-profile SUBS_IPoE_2
exit
exit
user-plane lps_asr9k-5
peer-address ipv4 192.69.1.5
port-id 8805
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.1
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.2
  subscriber-profile SUBS_PPpOE_2
exit
exit
user-plane lps_asr9k-50
peer-address ipv4 192.69.1.50
port-id 8805
  subscriber-profile SUBS_IPoE_2
exit
port-id Bundle-Ether1.1
```

```
    subscriber-profile SUBS_IPoE_2
  exit
exit
user-plane lps_asr9k-6
  peer-address ipv4 192.69.1.6
  port-id 8805
    subscriber-profile SUBS_IPoE_2
  exit
  port-id Bundle-Ether1.1
    subscriber-profile SUBS_IPoE_2
  exit
  port-id Bundle-Ether1.2
    subscriber-profile SUBS_PPpOE_2
  exit
exit
user-plane lps_asr9k-7
  peer-address ipv4 192.69.1.7
  port-id 8805
    subscriber-profile SUBS_IPoE_2
  exit
  port-id Bundle-Ether1.1
    subscriber-profile SUBS_IPoE_2
  exit
  port-id Bundle-Ether1.2
    subscriber-profile SUBS_PPpOE_2
  exit
exit
user-plane lps_asr9k-8
  peer-address ipv4 192.69.1.8
  port-id 8805
    subscriber-profile SUBS_IPoE_2
  exit
  port-id Bundle-Ether1.1
    subscriber-profile SUBS_IPoE_2
  exit
  port-id Bundle-Ether1.2
    subscriber-profile SUBS_PPpOE_2
  exit
exit
user-plane lps_asr9k-9
  peer-address ipv4 192.69.1.9
  port-id 8805
    subscriber-profile SUBS_IPoE_2
  exit
  port-id Bundle-Ether1.1
    subscriber-profile SUBS_IPoE_2
  exit
  port-id Bundle-Ether1.2
    subscriber-profile SUBS_PPpOE_2
  exit
exit
instance instance-id 1
  endpoint sm
  exit
  endpoint nodemgr
  exit
  endpoint n4-protocol
    retransmission timeout 0 max-retry 1
  exit
  endpoint dhcp
  exit
  endpoint pppoe
  exit
  endpoint radius
```

```

replicas 1
vip-ip 203.203.203.51
interface coa-nas
  sla response 165000
  vip-ip 203.203.203.51 vip-port 3799
exit
exit
endpoint udp-proxy
replicas 1
nodes 2
vip-ip 203.203.203.51 vip-port 2000
interface n4
  sla response 165000
exit
interface gtpu
  sla response 165000
exit
exit
exit
logging transaction duplicate disable
logging level application error
logging level transaction error
logging level tracing error
system mode running
exit

```

Configuring the UP

The following is a sample UP configuration:

```

user-plane asr9k-11
peer-address ipv4 10.105.247.124
subscriber-profile subs-default
port-id Bundle-Ether2.10
  subscriber-profile subs-vrf
exit
port-id Bundle-Ether2.20
  subscriber-profile subs-vrf
port-id Bundle-Ether2.10
exit
port-id Bundle-Ether2.30
  subscriber-profile subs-vrf
port-id Bundle-Ether2.10
exit
port-id Bundle-Ether2.40
  subscriber-profile subs-vrf
port-id Bundle-Ether2.10
exit
exit

```

Loading Day1 Configuration

To load the Day 1 configuration for cnBNG, run the following command:

```
ssh admin@ops_center_pod_ip -p 2024 < Day1config.cli
```



Note The `day1config.cli` file contains the necessary parameters required for the Day 1 configuration.

Alternatively, you can copy the configuration and paste it in the BNG Ops Center CLI to load the Day 1 configuration.


```

config
  <Paste the Day 1 configuration here>
commit
exit

```

Day1config.cli

The **day1config.cli** file contains the Day 1 configuration for cnBNG. For a sample day1 configuration, see [Configuring the CP, on page 11](#).

Mapping Pods with Node Labels

Prerequisites

- Ensure that the node labels are according to the pod deployment layout.
- Ensure that the external VIPs are according to the requirement of NF.
- Enable Istio for pod to pod traffic load balancing.

Node Labels are key and value pairs that are attached to nodes at cluster synchronization. Each node can have a set of key and value labels defined. Each key must be unique for a node. With labels, users can map their NF pods onto nodes in a loosely coupled manner.



Important

- The pod-level labeling configuration is applicable only when the cnBNG CP is deployed on a bare metal server.
- Ensure to configure the node label on the SMI cluster deployer before mapping the pods. Following is the sample command for master-1 labeling:

```
[cndp-clpnc-cm-cm-primary] SMI Cluster Deployer (config-nodes-master-1)# k8s
node-labels smi.cisco.com/svc-type bng-node
```

To map the pods with node labels, use the following sample configuration:

```

config
  k8 label protocol-layer key label_key value label_value
  k8 label service-layer key label_key value label_value
  k8 label cdl-layer key label_key value label_value
  k8 label oam-layer key label_key value label_value
end

```

Following is an example configuration of pod to node-label mapping:

```

k8 label protocol-layer key smi.cisco.com/node-type value bng-proto
exit
k8 label service-layer key vm-type value bng-svc
exit
k8 label cdl-layer key smi.cisco.com/node-type value bng-cdl
exit
k8 label oam-layer key smi.cisco.com/node-type value oam
exit

```

High Availability Support on BareMetal Server

High Availability on cnBNG CP is validated on BareMetal server deployment. For more information about High Availability, see [High Availability and CP Reconciliation](#).

cnBNG CNF Deployment on AIO BareMetal Server

The cnBNG CNF Deployment on AIO BareMetal Server explains the process of onboarding a cnBNG Cloud Native Function (CNF) on the Cloud Native Deployment Platform (CNDP) on the BareMetal all-in-one (AIO) Kubernetes (K8s) cluster.

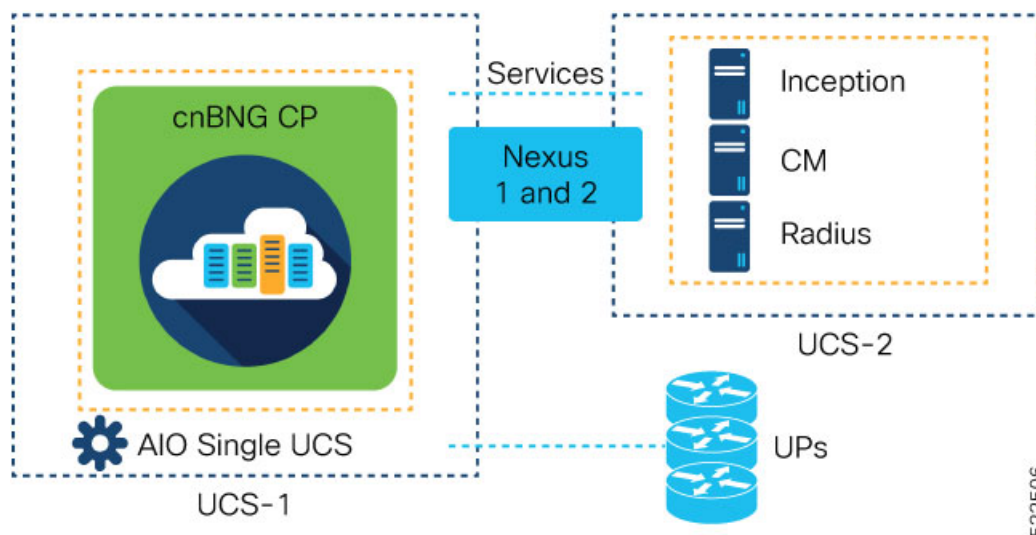
In the AIO deployment, all the management VMs are hosted on a different UCS server, however, this depends on the deployment strategy.

The cnBNG CNF is hosted on another UCS server referred as AIO server. During installation, the Cluster Manager (CM) accesses the AIO via the Cisco Integrated Management Controller (IMC) interface and adds the respective image and SMI packages to complete the installation.

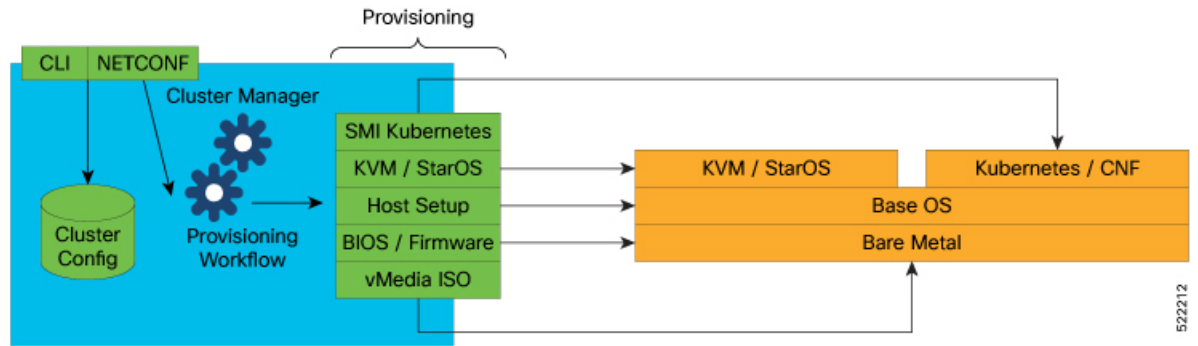


Note The management VMs are the Inception, Cluster Manager, and RADIUS servers.

Figure 1: Logical Topology for cnBNG CNF Deployment on AIO BareMetal Server



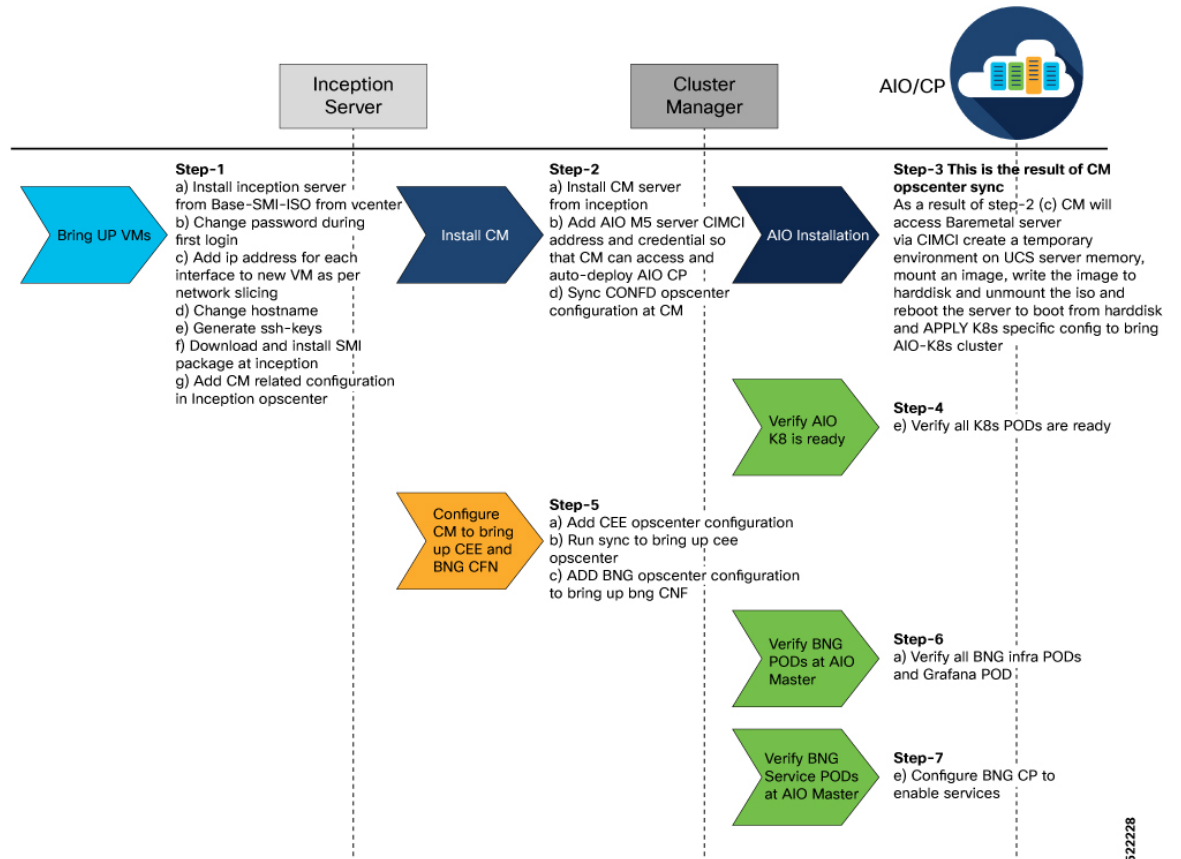
The CNDP is a 'SMI Bare-Metal'. The Cluster Manager uses REST APIs (instead of VIM APIs) of the management cards, which are on the servers, to create a set of Linux servers and then loads the K8s software.



Before installing network functions (NF) on the Cluster Manager, the common containerized software from SMI is installed. For example, monitoring and logging. The SMI NFs include their own common containerized software.

BareMetal CNDP AIO Bring-Up Procedure

The following figure illustrates the step-by-step process that is required to bring up the cnBNG CNF on K8s AIO server.



For more information about the Inception, Cluster Manager, and All-in-One server installation, see the "SMI Cluster Manager - Deployment" chapter of the *Ultra Cloud Core Subscriber Microservices Infrastructure - Deployment Guide*.

Limitations and Restrictions

The cnBNG CNF Deployment on AIO BareMetal Server has the following limitations and restrictions:

- Simulated User Planes (UPs) are used in the characterisation activity.
- ASR 9000 routers will be used in the topology based on availability in future releases.
- Actual customer profile must be validated before deployment.

Implementing cnBNG CP Validation with CNDP

Implementing cnBNG CP Validation with CNDP involves the following procedures.

- Prerequisites
- Instantiating and Provisioning Inception Server Instance
- Installing the Cluster Manager Node
- Deploying the All-in-One Cluster
- Integrating RADIUS and UP with the AIO BareMetal Server

Prerequisites

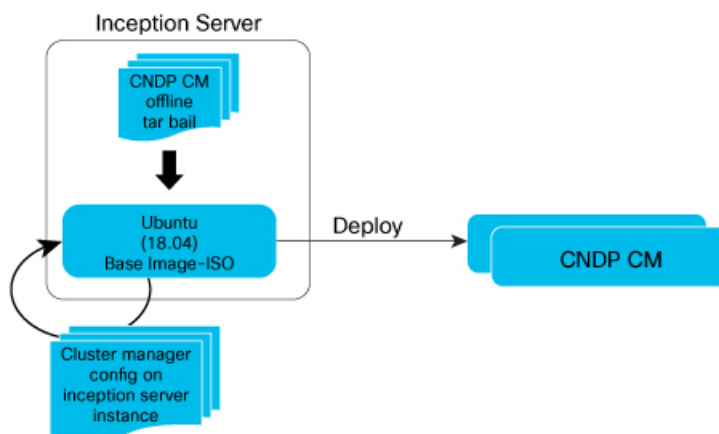
The following sections detail the prerequisites for deploying the cnBNG CNF on the AIO BareMetal Server.

Instantiating and Provisioning Inception Server Instance

The Inception server is used to deploy the CM for CNDP deployment. It is an Ubuntu 18.04 based VM installed with additional packages such as, docker, docker-compose, and its dependencies. The offline tar ball for the CNDP CM is installed on this instance and configured to deploy the CNDP CM nodes.

The following section presents the procedure on how to bring up an Inception server instance on a VM.

Figure 2: CNDP Inception VM



- The inception server is an Ubuntu 18.04 platform (VM or Host) brought up using SMI base image iso.
- To instantiate CNDP CM, the CNDP CM offline tar ball is downloaded to the inception server platform.
- Using this, CNDP CM nodes can be instantiated in Standalone or HA pair.

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Before beginning the configuration of the Inception server, verify that all the dependent packages such as docker, docker-compose are installed on the VM. This is a prerequisite before loading the tar ball to configure and deploy the CM. If the SMI Base-ISO is used for installing Inception server, the packages are preinstalled.

Installing Cluster Manager Node

The Cluster Manager (CM) handles the installation and upgrade of the Kubernetes (K8s) cluster and associated infrastructure. In this deployment, the Inception server launches two machines that use DRBD to replicate the state to provide High Availability (HA) of the CM. This section covers the bring up procedure of the CM in standalone mode.

For High Availability CM deployment, see the "SMI Cluster Manager - Deployment" chapter of the [Ultra Cloud Core Subscriber Microservices Infrastructure - Deployment Guide](#).

Configuring the Cluster Manager - Single Instance

Configure the single instance of the CM:

1. Login to the Ops Center CLI of the Inception server. Use the following steps to install and configure the CM.

Use the IP address of the Inception server to login.

```
ssh admin<ip_address> -p 2022 (or)
https://cli.smi-deployer.<ip_address>.nip.io
```

2. Configure the Inception server cluster deployer to install the CM.



Note Ensure the following before configuring the CM.

- All the passwords must be typed manually because copying and pasting the encrypted passwords from the configuration throws an error during validation
- Private key and public key must be generated in the Inception VM and copied. Both the keys must match the keys present in the Inception VM. Use the **ssh-keygen** command in the Inception VM and follow the prompts to generate the keys.
- Private key and public key are multiline commands. For instance, after typing **node-defaults ssh-connection- private-key**, press Enter to paste the keys.

For the Inception configuration, see the "SMI Cluster Manager - Deployment" chapter of the [Ultra Cloud Core Subscriber Microservices Infrastructure - Deployment Guide](#).



Note Modify IPs, password, keys, username, cluster-name, and CNF name based on the specified configurations.

Installing the All-in-One Cluster

This section provides the detailed steps to deploy the CNDP AIO (K8s) cluster from the CM node. It also specifies the CLI that is used on the CM to configure and perform a cluster synchronization operation.

Configuring the AIO Cluster

This section describes the procedure to configure and deploy the CNDP AIO cluster from the CM using the CLI method.

1. Login to the CM Ops Center and load the SMI cluster, cnBNG, CEE, and Ops Center node configurations. Multiline configuration for private key must be pasted separately.

```
ssh admin@<ip_address> -p 2022
```

2. Update the Sha256 value, which was generated for the software from the previous step, in the configuration for the respective software under the sha256 section.



Note

- All the passwords must be typed manually because copying and pasting the encrypted passwords from the configuration throws an error during validation
- Private key and public key must be generated in the CM and copied in. Both the keys must match the keys present in the CM. Use the **ssh-keygen** command in the Inception VM and follow the prompts to generate the keys.

3. Before running cluster synchronization, enable detail logging using the following configuration.

```
clusters <cluster_name>
configuration restrict-logging false exit
```

4. From the SMI cluster configuration, configure the Software CNF repository to use the cnBNG image, CEE, and include the sha256 checksum as generated previously and provide the path of the image.

For more information, see the "SMI Cluster Manager - Deployment" chapter of the [Ultra Cloud Core Subscriber Microservices Infrastructure - Deployment Guide](#).

```
[inception] SMI Cluster Deployer# show running-config
software cnf <cnf_software_version>c
url <repo_url>
user <user_name>
password <password>
sha256 <SHA256_hash_key>
exit
```

Example:

```
Cluster Manager# config
Cluster Manager(config)# software cnf <example=cm-2020-02-0-i06>
Cluster Manager(config)# url <repo_url>
Cluster Manager(config)#user <username>
Cluster Manager(config)#password "<password>"
Cluster Manager(config)#sha256 <sha256_key>
Cluster Manager(config)#exit
```

In this deployment model, a single AIO node is deployed.

From a CM configuration perspective, the AIO node definition, corresponding Ops Center CEE and cnBNG instances are defined as part of a single AIO cluster.

The following configuration snippet shows the sample configuration for a cluster from the cluster manager

```
config
software cnf <cnf_software_version>
url <repo_url>
user <user_name>
```

```

password <password>
sha256 <SHA256_hash_key>
exit
environments bare-metal
ucs-server
exit
clusters <cluster_name> #For example, cndp-testbed
environment bare-metal
addons ingress bind-ip-address <IPv4address>
addons cpu-partitioner enabled
configuration allow-insecure-registry true
node-defaults ssh-username <username>
node-defaults ssh-connection-private-key
"-----BEGIN OPENSSH PRIVATE KEY-----\n
<SSH_private_key>
-----END OPENSSH PRIVATE KEY-----\n"
node-defaults initial-boot default-user <username>
node-defaults initial-boot default-user-ssh-public-key
"<SSH_Public_Key>"
node-defaults initial-boot default-user-password #For example, Csc0123#
node-defaults os proxy https-proxy <proxy_server_url>
node-defaults os proxy no-proxy <proxy_server_url/IPv4address>
node-defaults os ntp enabled
node-defaults os ntp servers <ntp_server>
exit
node-defaults initial-boot netplan ethernet <interface_name> #For example, eno1
dhcp4 false
dhcp6 false
gateway4 <IPv4address>
nameservers search <nameserver>
nameservers addresses <IPv4addresses>
exit
node-defaults initial-boot netplan ethernet eno2 # same like eno1 other interfaces to
be configured
dhcp4 false # without any ip address
dhcp6 false
exit
node-defaults initial-boot netplan ethernet eno5
dhcp4 false
dhcp6 false
exit
node-defaults initial-boot netplan ethernet eno6
dhcp4 false
dhcp6 false
exit
node-defaults initial-boot netplan ethernet enp216s0f0
dhcp4 false
dhcp6 false
exit
node-defaults initial-boot netplan ethernet enp216s0f1
dhcp4 false
dhcp6 false
exit
node-defaults initial-boot netplan ethernet enp94s0f0
dhcp4 false
dhcp6 false
exit
node-defaults initial-boot netplan ethernet enp94s0f1
dhcp4 false
dhcp6 false
exit
node-defaults initial-boot netplan vlan <vlan_name> #For example, vlan309
dhcp4 false
dhcp6 false

```

```

    id    <vlan_id> #For example, 309
    link  eno6
  exit
node-defaults initial-boot netplan vlans <vlan_name> #For example, vlan310
  dhcp4 false
  dhcp6 false
  id    <vlan_id> #For example, 310
  link  eno6
  exit
node-defaults initial-boot netplan vlans <vlan_name> #For example, vlan311
  dhcp4 false
  dhcp6 false
  id    <vlan_id> #For example, 311
  link  enp94s0f0
  exit
node-defaults ucs-server cimc user admin
node-defaults ucs-server cimc storage-adaptor create-virtual-drive true
node-defaults ucs-server cimc remote-management sol enabled
node-defaults ucs-server cimc remote-management sol baud-rate 115200
node-defaults ucs-server cimc remote-management sol comport com0
node-defaults ucs-server cimc remote-management sol ssh-port 2400
node-defaults ucs-server cimc networking ntp enabled
node-defaults ucs-server cimc networking ntp servers <example: ntp.server1.com>
  exit
node-defaults ucs-server cimc networking ntp servers <example: ntp.server2.com>
  exit
node-defaults os ntp enabled
node-defaults os ntp servers <example: ntp.server1.com>
  exit
node-defaults os ntp servers <example: ntp.server1.com>
  exit

nodes <aio> #For example it can be master or aio
k8s node-type master
k8s ssh-ip <IPv4address>
k8s node-ip <IPv4address>
k8s node-labels disktype ssd
  exit
k8s node-labels smi.cisco.com/node-type oam
  exit
ucs-server cimc user admin
ucs-server cimc password <IPv4address> #this CIMCI address of the AIO UCS SERVER
ucs-server cimc ip-address 10.81.103.117
initial-boot netplan ethernet eno1
addresses [ <IPv4address-mgmt>/24 ]
gateway4   <gateway-address>
  exit
initial-boot netplan vlans vlan309
addresses [ <IPv4address-k8s>/24 ]
  exit
initial-boot netplan vlans vlan310
addresses [ <IPv4address-SMI>/24 ]
  exit
initial-boot netplan vlans vlan311
addresses [ <IPv4address-services>/24 ]
  exit
exit

```

Each CNF provides a ConfD based Ops Center CLI to configure and manage the CNF pods. There is a separate Ops Center required for each CNF deployed on the AIO node.

The following is the Ops Center configuration for the AIO node, which has the Ops Center configuration for CEE and CNF.


```

ops-centers bng bng
  repository      <url> or offline-tarball
  username        <username>
  password        <password>
  ingress-hostname <ip-address>.nip.io
  initial-boot-parameters use-volume-claims false
  initial-boot-parameters first-boot-password <password>
  initial-boot-parameters auto-deploy false
  initial-boot-parameters single-node true
exit
ops-centers cee cee
  repository-local      cee-release-build
  sync-default-repository true
  netconf-ip            <ip-address>
  netconf-port          2024
  ssh-ip                <ip-address>
  ssh-port              2022
  ingress-hostname      <ip-address>.nip.io
  initial-boot-parameters use-volume-claims true
  initial-boot-parameters first-boot-password <password>
  initial-boot-parameters auto-deploy true
  initial-boot-parameters single-node true
exit
exit

```



Note To bring the network function NF at the AIO K8 cluster, always use the “initial-boot-parameters single-node true” option.

5. Run the cluster synchronization to deploy the cluster, cnBNG, and CEE Ops Centers

```
clusters cndp-cm actions sync run debug true
```

The cluster synchronization operation takes approximately 45 minutes to complete.

6. Monitor the cluster synchronization operation using the following command.

```
monitor sync-logs cndp-cm
```

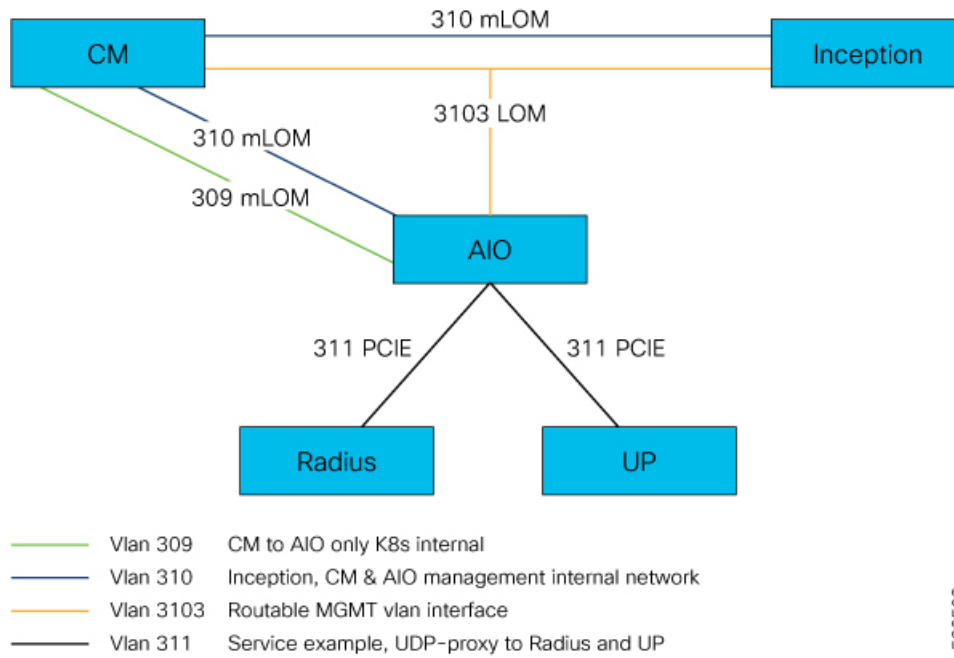
After cluster synchronization is completed, a message is shown indicating a successful cluster synchronization.

Integrating RADIUS and UP with the AIO BareMetal Server

The RADIUS and UP are part of the services network and therefore should be part of the same network. If they are not in the same VLAN, then the necessary routing should be available to have reachability between them.

The AIO services interface is also part of the services VLAN, which has routable reachability between AIO UDP proxy interface, RADIUS, and the User Plane function (UPF).

Figure 3: Logical Network Connectivity



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