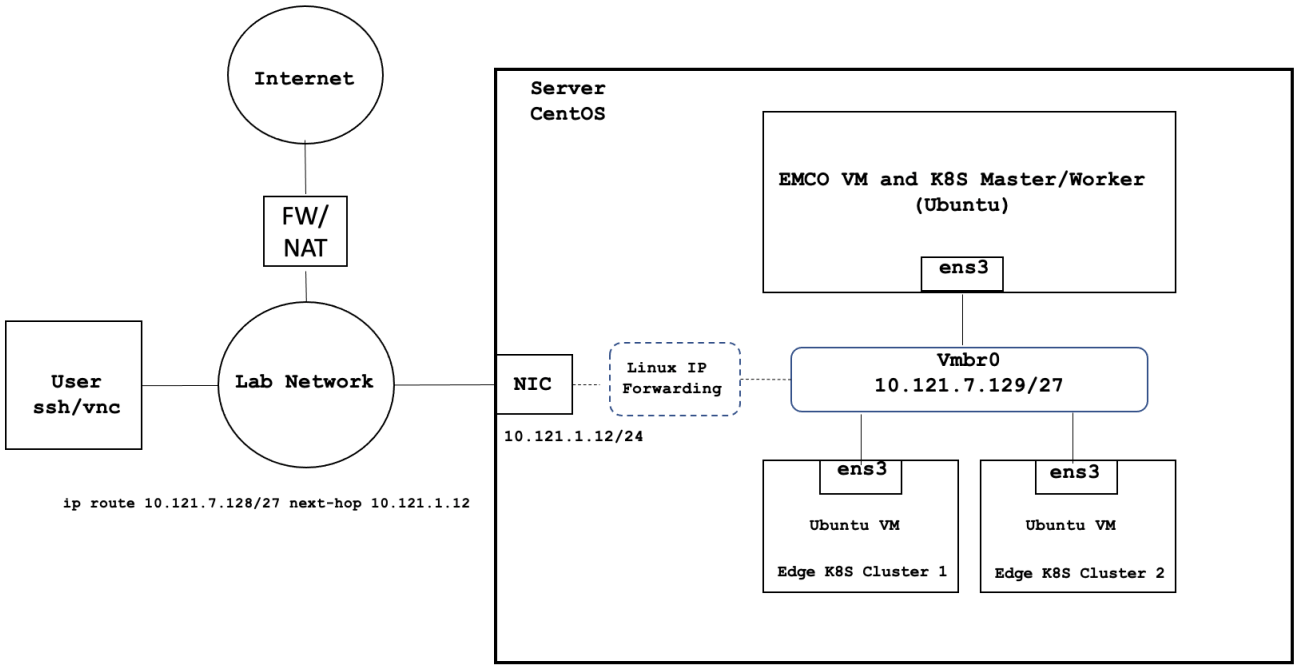
PCEI R4 Installation Guide

Introduction

This document describes steps required to deploy a sample environment for the Public Cloud Edge Interface (PCEI) Blueprint.

Deployment Architecture

The deployment architecture is shown below. All Addressing and naming shown are for example purposes only.



Deployment environment components:

1. One Host Server
2. One Edge Multi-Cluster Orchestrator VM
3. Two Edge K8S Cluster VMs
4. Internal network connectivity to the Host Server and to the VMs

Pre-Installation Requirements

Recommended Hardware Requirements

Requirement	Value
CPU	18 Core / 36 vCPU
RAM	128 GB
DISK	500 GB
NETWORK	1 Gbps NIC Port

Network Requirements

- Internal Lab Network (RFC 1918 space)
- Internet access (NAT'd)
- IP routing in the Lab Network to reach VM interfaces

Software Prerequisites

Requirement	Value
Server OS	CentOS 7.x or above
VM OS	Ubuntu 18.04
Upstream SW	Refer to Deployment Guide Section

Installation High-Level Overview

The installation/deployment process consists of the following steps:

1. Install CentOS on Host Server.
2. Prepare Host Server for EMCO Deployment.
3. Deploy EMCO.
4. Deploy Edge Clusters.

Deployment Guide

Install CentOS on Host Server

1. Connect to Host Server iLO interface.
2. Start Virtual Console.
3. Mount Virtual Media with CentOS 7 ISO.
4. Install CentOS
    a. Assign correct IP address, Subnet, Gateway and DNS to the NIC.
    b. Include OpenSSH Server.
    c. Install KVM/virtualization.
    d. Add a user with admin privileges: **onaplab** user is used in this guide.

Prepare Host Server for EMCO Deployment

Step 1. Enable sudo without entering sudo password

```
sudo -i
visudo
# Uncomment the line below
%wheel  ALL=(ALL)       NOPASSWD: ALL
```

Step 2. Add sudo user to wheel group

```
usermod –aG wheel onaplab
```

Step 3. Enable nested virtualization

```
# Login as super user
sudo -i

# Check for the following parameter
cat /sys/module/kvm_intel/parameters/nested
N
# If it is Y, there is nothing else to be done. It is already enabled!

# If it is N, do the following:
# Edit /etc/default/grub file, and include kvm-intel.nested=1
GRUB_CMDLINE_LINUX parameter
GRUB_CMDLINE_LINUX="crashkernel=auto
console=ttyS0,38400n8,kvm-intel.nested=1"

# Rebuild your GRUB configuration
sudo grub2-mkconfig -o /boot/grub2/grub.cfg

# Enable nested KVM capabilities in /etc/modprobe.d/kvm.conf
# By uncommenting the below line

options kvm_intel nested=1

### Reboot the server
reboot

# Now, we should have the nested KVM capabilities enabled
cat /sys/module/kvm_intel/parameters/nested
Y
```

Step 4. Install VNC Server (Optional)

Follow instructions at:

https://www.tecmint.com/install-and-configure-vnc-server-in-centos-7/

Step 5. Modify libvirt bridge IP and route mode

This will allow connecting to VMs and pods directly from the Lab Network. Please replace the sample IPs with your IP addresses. Please replace the interface name (eno24 used in the example) with you server's interface name.

```
cat <<\EOF >> netdefault.xml
<network>
  <name>default</name>
  <bridge name="vmbr0"/>
  <forward mode='route' dev='eno24'/>
  <ip address="10.121.7.129" netmask="255.255.255.224">
    <dhcp>
      <range start="10.121.7.144" end="10.121.7.158"/>
    </dhcp>
  </ip>
</network>
EOF

sudo virsh net-list
sudo virsh net-destroy default
sudo virsh net-undefine default
sudo virsh net-define netdefault.xml
sudo virsh net-start default
sudo virsh net-autostart default
```

Add necessary routes to your Lab Network routers. The example below assumes the the Host Server IP address is 10.121.1.12:

```
ip route 10.121.7.128 255.255.255.224 10.121.1.12
```

Deploy EMCO

Step 1. Generate SSH Keys

```
# Run commands below on the Host Server
ssh-keygen
cd ~/.ssh
chmod 600 id_rsa
chmod 600 id_rsa.pub
chmod 700 config
chmod 600 known_hosts

cat id_rsa.pub >> authorized_keys
chmod 600 authorized_keys

echo "# Increase the server timeout value" >> ~/.ssh/config
echo "ServerAliveInterval 120" >> ~/.ssh/config
```

Step 2. Download software and install EMCO

Note that the install process will:

- Deploy a VM amcop-vm-01
- Create a K8S cluster inside the VM
- Deploy EMCO components on the K8S cluster
- Deploy ONAP components on the K8S cluster

```
#### On the Host Server

sudo yum install -y git deltarpm
mkdir -p amcop_deploy
cd amcop_deploy

## Download the installation package zip file

wget --load-cookies /tmp/cookies.txt "https://docs.google.com/uc?export=download&confirm=$(wget --quiet --save-cookies /tmp/cookies.txt --keep-session-cookies --no-check-certificate 'https://docs.google.com/uc?export=download&id=1NE6dfbt3l6u2D6MRocdL04_xMjPn06HZ' -O- | sed -rn 's/.*confirm=([0-9A-Za-z_]+).*/\1\n/p')&id=1NE6dfbt3l6u2D6MRocdL04_xMjPn06HZ" -O amcop_install_v1.0.zip  && rm -rf /tmp/cookies.txt

unzip amcop_install_v1.0.zip

sudo chown -R onaplab:onaplab ~/amcop_deploy/

cd ~/amcop_deploy/aarna-stream/util-scripts
./prep_baremetal_centos.sh


####### Install EMCO/AMCOP
# Edit inventory.ini file. Use IP address of Host Server and the username.

cd ~/amcop_deploy/aarna-stream/anod_lite/ansible/deployment
vi inventory.ini
[deployment_host]
10.121.1.12 ansible_user=onaplab


nohup ansible-playbook ./main.yml -i inventory.ini -e deployment_env=on-prem -e jump_host_user=onaplab --private-key=/home/onaplab/.ssh/id_rsa -e vm_user=onaplab &
```

Step 3. Monitor the installation

```
# On the Host Server

cd /home/onaplab/aarna-stream/anod_lite/logs
[onaplab@os12 logs]$ ls -l
total 1980
-rw-r--r--. 1 root    root     510417 Nov 24 07:06 cluster_setup.log
-rw-r--r--. 1 root    root       2019 Nov 24 06:54 create_vm.log
-rw-r--r--. 1 root    root    1366779 Nov 24 07:15 deploy_emco_components.log
-rw-r--r--. 1 root    root     138233 Nov 24 07:35 deploy_onap.log
-rw-rw-r--. 1 onaplab onaplab      83 Nov 24 06:53 README.md

tail -f create_vm.log

tail -f cluster_setup.log

tail -f deploy_emco_components.log

tail -f deploy_onap.log
```

If Install fails and you need to restart, please do the cleanup steps below on the Host Server.

```
sudo virsh destroy amcop-vm-01
sudo virsh undefine amcop-vm-01
sudo virsh pool-destroy amcop-vm-01
sudo virsh pool-undefine amcop-vm-01
sudo rm /var/lib/libvirt/images/amcop-vm-01/amcop-vm-01-cidata.iso
sudo rm /var/lib/libvirt/images/amcop-vm-01/amcop-vm-01.qcow2
```

Deploy Edge Clusters

Step 1. Edit VM creation script.

```
# On the Host Server
cd /home/onaplab/amcop_deploy/aarna-stream/util-scripts

# Add "--cpu host" option to the end of the below line
vi create_qem_vm.sh

virt-install --connect qemu:///system --name $vm_name --ram $(($mem << 10)) --vcpus=$vCPU --os-type linux --os-
variant $os_variant --disk path=/var/lib/libvirt/images/$vm_name/"$vm_name".qcow2,format=qcow2 --disk /var/lib
/libvirt/images/$vm_name/$vm_name-cidata.iso,device=cdrom --import --network network=default --noautoconsole —-
cpu host

# Save the file
```

Step 2. Deploy two Edge Cluster VMs.

These commands will create two Ubuntu 18.04 VMs with 100G Disk, 8 vcpu and 16G RAM and will copy the contents of the ~/.ssh/id_rsa.pub key file from the Host Server to the VMs' ~/.ssh/authorized_keys file.

```
sudo ./create_qem_vm.sh 2 edge_k8s-1 100 8 16 ubuntu18.04 $HOME/.ssh/id_rsa.pub onaplab
sudo ./create_qem_vm.sh 2 edge_k8s-2 100 8 16 ubuntu18.04 $HOME/.ssh/id_rsa.pub onaplab
```

Step 3. Setup worker clusters inside VMs

```
# Find VM's IP addresses. On the Host Server run:
[onaplab@os12 ~]$ sudo virsh list --all
 Id    Name                           State
----------------------------------------------------
 6     amcop-vm-01                    running
 9     edge_k8s-1                     running
 10    edge_k8s-2                     running

[onaplab@os12 ~]$ sudo virsh domifaddr edge_k8s-1
 Name       MAC address          Protocol     Address
-------------------------------------------------------------------------------
 vnet1      52:54:00:19:96:72    ipv4         10.121.7.152/27

[onaplab@os12 ~]$
[onaplab@os12 ~]$ sudo virsh domifaddr edge_k8s-2
 Name       MAC address          Protocol     Address
-------------------------------------------------------------------------------
 vnet2      52:54:00:c0:47:8b    ipv4         10.121.7.146/27

# ssh to each VM from the Host Server:
ssh  onaplab@10.121.7.152
ssh  onaplab@10.121.7.146

# Perform the following tasks in each VM:
sudo apt-get update -y
sudo apt-get upgrade -y

sudo apt-get install -y python-pip

git clone https://git.onap.org/multicloud/k8s/
# Run script to setup KUD clusters

nohup k8s/kud/hosting_providers/baremetal/aio.sh %
```

If the edge cluster deployment fails for any reason, please do the clean up steps below before you retry:

```
### Cleanup
sudo virsh destroy  edge_k8s-1
sudo virsh undefine  edge_k8s-1
sudo virsh pool-destroy  edge_k8s-1
sudo virsh pool-undefine  edge_k8s-1
sudo rm /var/lib/libvirt/images/edge_k8s-1/edge_k8s-1-cidata.iso
sudo rm /var/lib/libvirt/images/edge_k8s-1/edge_k8s-1.qcow2

sudo virsh destroy  edge_k8s-2
sudo virsh undefine  edge_k8s-2
sudo virsh pool-destroy  edge_k8s-2
sudo virsh pool-undefine  edge_k8s-2
sudo rm /var/lib/libvirt/images/edge_k8s-2/edge_k8s-2-cidata.iso
sudo rm /var/lib/libvirt/images/edge_k8s-2/edge_k8s-2.qcow2
```

Modify sshd_config on VMs

To ensure that user *onaplab* can successfully ssh into EMCO and edge cluster VMs, add user onaplab to the sshd_config file.

```
## ssh to each VM:
ssh  onaplab@10.121.7.152

sudo -i
cd /etc/ssh
vi sshd_config
AllowUsers ubuntu onaplab

## Save the changes and exit the file
```

Deployment Verification

EMCO Deployment Verification

Perform the following steps to verify correct EMCO deployment:

```
# Determine IP address of EMCO VM:
[onaplab@os12 ~]$ sudo virsh list --all
 Id    Name                           State
----------------------------------------------------
 6     amcop-vm-01                    running
 9     edge_k8s-1                     running
 10    edge_k8s-2                     running


[onaplab@os12 ~]$ sudo virsh domifaddr amcop-vm-01
 Name       MAC address          Protocol     Address
-------------------------------------------------------------------------------
 vnet0      52:54:00:1a:8e:8b    ipv4         10.121.7.145/27

# ssh to EMCO VM. You should be able to ssh without specifying the key:
[onaplab@os12 ~]$ ssh onaplab@10.121.7.145

# Verify K8S pods:
onaplab@emco:~$ kubectl get pods --all-namespaces
NAMESPACE     NAME                                          READY   STATUS     RESTARTS   AGE
kube-system   calico-kube-controllers-6f954885fb-bb2mr      1/1     Running    0          28d
kube-system   calico-node-ldcpv                             1/1     Running    0          28d
kube-system   coredns-6b968665c4-6558h                      1/1     Running    0          28d
kube-system   coredns-6b968665c4-rq6bf                      0/1     Pending    0          28d
kube-system   dns-autoscaler-5fc5fdbf6-njch7                1/1     Running    0          28d
kube-system   kube-apiserver-node1                          1/1     Running    0          28d
kube-system   kube-controller-manager-node1                 1/1     Running    0          28d
kube-system   kube-proxy-gg95d                              1/1     Running    0          28d
kube-system   kube-scheduler-node1                          1/1     Running    0          28d
kube-system   kubernetes-dashboard-6c7466966c-cjpxm         1/1     Running    0          28d
kube-system   nodelocaldns-7pxcs                            1/1     Running    0          28d
kube-system   tiller-deploy-8756df4d9-zq52m                 1/1     Running    0          28d
onap          dev-cassandra-0                               1/1     Running    0          28d
onap          dev-cassandra-1                               1/1     Running    0          28d
onap          dev-cassandra-2                               1/1     Running    0          28d
onap          dev-cds-blueprints-processor-6d697cc4d6-wzlfj 0/1     Init:1/3   0          28d
onap          dev-cds-db-0                                  1/1     Running    0          28d
onap          dev-cds-py-executor-7dcdc5f7f6-tpfmg          1/1     Running    0          28d
onap          dev-cds-sdc-listener-f99d4588d-nt2tk          0/1     Init:0/1   4021       28d
onap          dev-cds-ui-7768bb4b-cfbzd                     1/1     Running    0          28d
onap          dev-mariadb-galera-0                          1/1     Running    0          28d
onap          dev-mariadb-galera-1                          1/1     Running    0          28d
onap          dev-mariadb-galera-2                          1/1     Running    0          28d
onap4k8s      clm-668c45d96d-99gpb                          1/1     Running    0          28d
onap4k8s      emcoui-57846bd5df-c774f                       1/1     Running    0          28d
onap4k8s      etcd-768d5b6cc-ptmmr                          1/1     Running    0          28d
onap4k8s      middleend-6d67c9bf54-tvs7s                    1/1     Running    0          28d
onap4k8s      mongo-7988cb488b-kf29q                        1/1     Running    0          28d
onap4k8s      ncm-9f4b85787-nqnlm                           1/1     Running    0          28d
onap4k8s      orchestrator-5fd4845f8f-qsxlf                 1/1     Running    0          28d
```

```
onap4k8s      ovnaction-f794f65b6-w85ms                       1/1     Running    0          28d
onap4k8s      rsync-7d9f5fbd9b-r72sp                          1/1     Running    0          28d

# Verify K8S services:
onaplab@emco:~$ kubectl get svc --all-namespaces
NAMESPACE     NAME                                TYPE        CLUSTER-IP      EXTERNAL-IP   PORT
(S)                                                   AGE
default       kubernetes                          ClusterIP   10.233.0.1      <none>        443
/TCP                                                   28d
kube-system   coredns                             ClusterIP   10.233.0.3      <none>        53/UDP,53/TCP,9153
/TCP                                   28d
kube-system   kubernetes-dashboard                ClusterIP   10.233.35.188   <none>        443
/TCP                                                   28d
kube-system   tiller-deploy                       ClusterIP   10.233.33.249   <none>        44134
/TCP                                                  28d
onap          cassandra                           ClusterIP   None            <none>        7000/TCP,7001/TCP,
7199/TCP,9042/TCP,9160/TCP,61621/TCP   28d
onap          cds-blueprints-processor-cluster    ClusterIP   10.233.4.219    <none>        5701
/TCP                                                   28d
onap          cds-blueprints-processor-grpc       ClusterIP   10.233.34.1     <none>        9111
/TCP                                                   28d
onap          cds-blueprints-processor-http       ClusterIP   10.233.31.74    <none>        8080
/TCP                                                   28d
onap          cds-db                              ClusterIP   None            <none>        3306
/TCP                                                   28d
onap          cds-py-executor                     ClusterIP   10.233.43.240   <none>        50052/TCP,50053
/TCP                                       28d
onap          cds-sdc-listener                    ClusterIP   10.233.2.48     <none>        8080
/TCP                                                   28d
onap          cds-ui                              NodePort    10.233.55.19    <none>        3000:30497
/TCP                                              28d
onap          mariadb-galera                      ClusterIP   None            <none>        3306
/TCP                                                   28d
onap4k8s      clm                                 NodePort    10.233.59.50    <none>        9061:31856
/TCP                                              28d
onap4k8s      emcoui                              NodePort    10.233.2.5      <none>        9080:30480
/TCP                                              28d
onap4k8s      etcd                                ClusterIP   10.233.54.80    <none>        2379/TCP,2380
/TCP                                         28d
onap4k8s      middleend                           NodePort    10.233.11.225   <none>        9891:31289
/TCP                                              28d
onap4k8s      mongo                               ClusterIP   10.233.19.133   <none>        27017
/TCP                                                  28d
onap4k8s      ncm                                 NodePort    10.233.16.20    <none>        9031:32737
/TCP                                              28d
onap4k8s      orchestrator                        NodePort    10.233.23.25    <none>        9015:31298
/TCP                                              28d
onap4k8s      ovnaction                           NodePort    10.233.37.45    <none>        9053:32514/TCP,9051:
31181/TCP                                 28d
onap4k8s      rsync                               NodePort    10.233.60.47    <none>        9041:30555
/TCP                                              28d
```

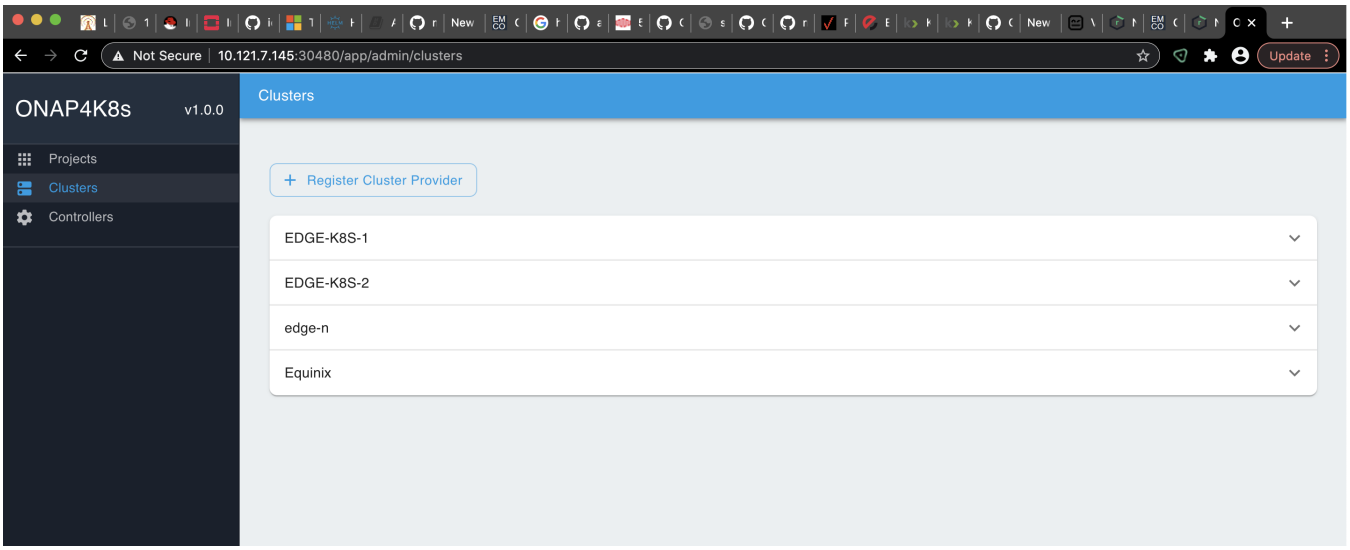
Access EMCOUI GUI:

```
# Determine EMCOUI Service Port:
onaplab@emco:~$ kubectl get svc emcoui -n onap4k8s
NAME     TYPE       CLUSTER-IP   EXTERNAL-IP   PORT(S)          AGE
emcoui   NodePort   10.233.2.5   <none>        9080:30480/TCP   28d

# To connect to EMCOUI GUI use IP address of amcop-vm-01 and port 30480
```

To connect to EMCOUI GUI use IP address of amcop-vm-01 and port 30480:

http://10.121.1.145:30480



Edge Cluster Deployment Verification

To verify deployment of Edge Clusters, perform the following steps:

```
# Determine Edge Cluster VM IP addresses:
[onaplab@os12 ~]$ sudo virsh list --all
 Id    Name                           State
----------------------------------------------------
 6     amcop-vm-01                    running
 9     edge_k8s-1                     running
 10    edge_k8s-2                     running

[onaplab@os12 ~]$ sudo virsh domifaddr edge_k8s-1
 Name       MAC address          Protocol     Address
-------------------------------------------------------------------------------
 vnet1      52:54:00:19:96:72    ipv4         10.121.7.152/27

[onaplab@os12 ~]$ sudo virsh domifaddr edge_k8s-2
 Name       MAC address          Protocol     Address
-------------------------------------------------------------------------------
 vnet2      52:54:00:c0:47:8b    ipv4         10.121.7.146/27

# ssh to each VM from the Host Server. You should be able to ssh without specifying the key:
ssh onaplab@10.121.7.152
ssh onaplab@10.121.7.146

# Perform the following tasks inside the VMs:
onaplab@localhost:~$ kubectl get pods --all-namespaces
NAMESPACE                NAME                                        READY   STATUS    RESTARTS   AGE
kube-system              cmk-rpgd7                                   2/2     Running   0          28d
kube-system              coredns-dff8fc7d-2xwrk                      0/1     Pending   0          28d
kube-system              coredns-dff8fc7d-q2gcr                      1/1     Running   0          28d
kube-system              dns-autoscaler-66498f5c5f-2kzmv             1/1     Running   0          28d
kube-system              kube-apiserver-localhost                    1/1     Running   0          28d
kube-system              kube-controller-manager-localhost           1/1     Running   0          28d
kube-system              kube-flannel-8rm9p                          1/1     Running   0          28d
kube-system              kube-multus-ds-amd64-mt9s5                  1/1     Running   0          28d
kube-system              kube-proxy-ggk8m                            1/1     Running   0          28d
kube-system              kube-scheduler-localhost                    1/1     Running   0          28d
kube-system              kubernetes-dashboard-84999f8b5b-48xjq       1/1     Running   0          28d
kube-system              kubernetes-metrics-scraper-54fbb4d595-rw649 1/1     Running   0          28d
kube-system              local-volume-provisioner-bmkc6              1/1     Running   0          28d
kube-system              virtlet-vk7jl                               3/3     Running   0          28d
node-feature-discovery   nfd-master-78nms                            1/1     Running   0          28d
node-feature-discovery   nfd-worker-k4d5g                            1/1     Running   45         28d
operator                 nfn-agent-zlp9g                             1/1     Running   0          28d
operator                 nfn-operator-b768877d8-vcx7v                1/1     Running   0          28d
operator                 ovn4nfv-cni-4c6rx                           1/1     Running   0          28d

# Verify connectivity to EMCO Cluster
onaplab@localhost:~$ ping 10.121.7.145
PING 10.121.7.145 (10.121.7.145) 56(84) bytes of data.
64 bytes from 10.121.7.145: icmp_seq=1 ttl=64 time=0.457 ms
64 bytes from 10.121.7.145: icmp_seq=2 ttl=64 time=0.576 ms
```

Uninstall Guide

Perform the following steps to remove EMCO and Edge Clusters from the Host Server:

```
sudo virsh destroy amcop-vm-01
sudo virsh undefine amcop-vm-01
sudo virsh pool-destroy amcop-vm-01
sudo virsh pool-undefine amcop-vm-01
sudo rm /var/lib/libvirt/images/amcop-vm-01/amcop-vm-01-cidata.iso
sudo rm /var/lib/libvirt/images/amcop-vm-01/amcop-vm-01.qcow2

sudo virsh destroy  edge_k8s-1
sudo virsh undefine  edge_k8s-1
sudo virsh pool-destroy  edge_k8s-1
sudo virsh pool-undefine  edge_k8s-1
sudo rm /var/lib/libvirt/images/edge_k8s-1/edge_k8s-1-cidata.iso
sudo rm /var/lib/libvirt/images/edge_k8s-1/edge_k8s-1.qcow2

sudo virsh destroy  edge_k8s-2
sudo virsh undefine  edge_k8s-2
sudo virsh pool-destroy  edge_k8s-2
sudo virsh pool-undefine  edge_k8s-2
sudo rm /var/lib/libvirt/images/edge_k8s-2/edge_k8s-2-cidata.iso
sudo rm /var/lib/libvirt/images/edge_k8s-2/edge_k8s-2.qcow2

sudo rm -rf ~/amcop_deploy
sudo rm -rf ~/aarna_stream
```

License

References

AMCOP Quickstart Guide (Bare Metal) - EMCO Install Guide by Aarna Networks
AMCOP User Guide - EMCO Config Guide by Aarna Networks