Overview

This tutorial guide describes the steps to deploy Red Hat OpenShift Container Platform 4.11 on Single Node for edge computing workloads by Assisted Installer on Ampere® Altra® platforms. The steps to install Rook Ceph Operator for block storage are also described. This tutorial takes one hour to complete.

The hype around Edge Computing is growing as edge workloads and use cases appearing in many locations, technical requirements, and smaller physical footprints. The cloud native way to developing and deploying applications is increasingly being adopted in the edge computing territory.

At Ampere, we observe the trend of infrastructure providers and application owners wanting a consistent workload life cycle and predictable performance across the business. The Ampere Altra processor family provides the following values for edge workloads:

- High core counts in single socket processor.
- Predictability for less jitter and lower latency while protecting against noisy neighbor effects in the processor.
- Linear Scalability to maximize heavily loaded server performance such as CDN Edge appliance.
- The most sustainable, low power architecture for power sensitive edge locations and more efficient data centers.
- Scale-out computational horsepower with optimized video codecs for high performance video transcoding.

Prerequisites

- A DNS service like bind (named) runs on the bastion node.

Setup Instructions

Deploying OpenShift 4.11

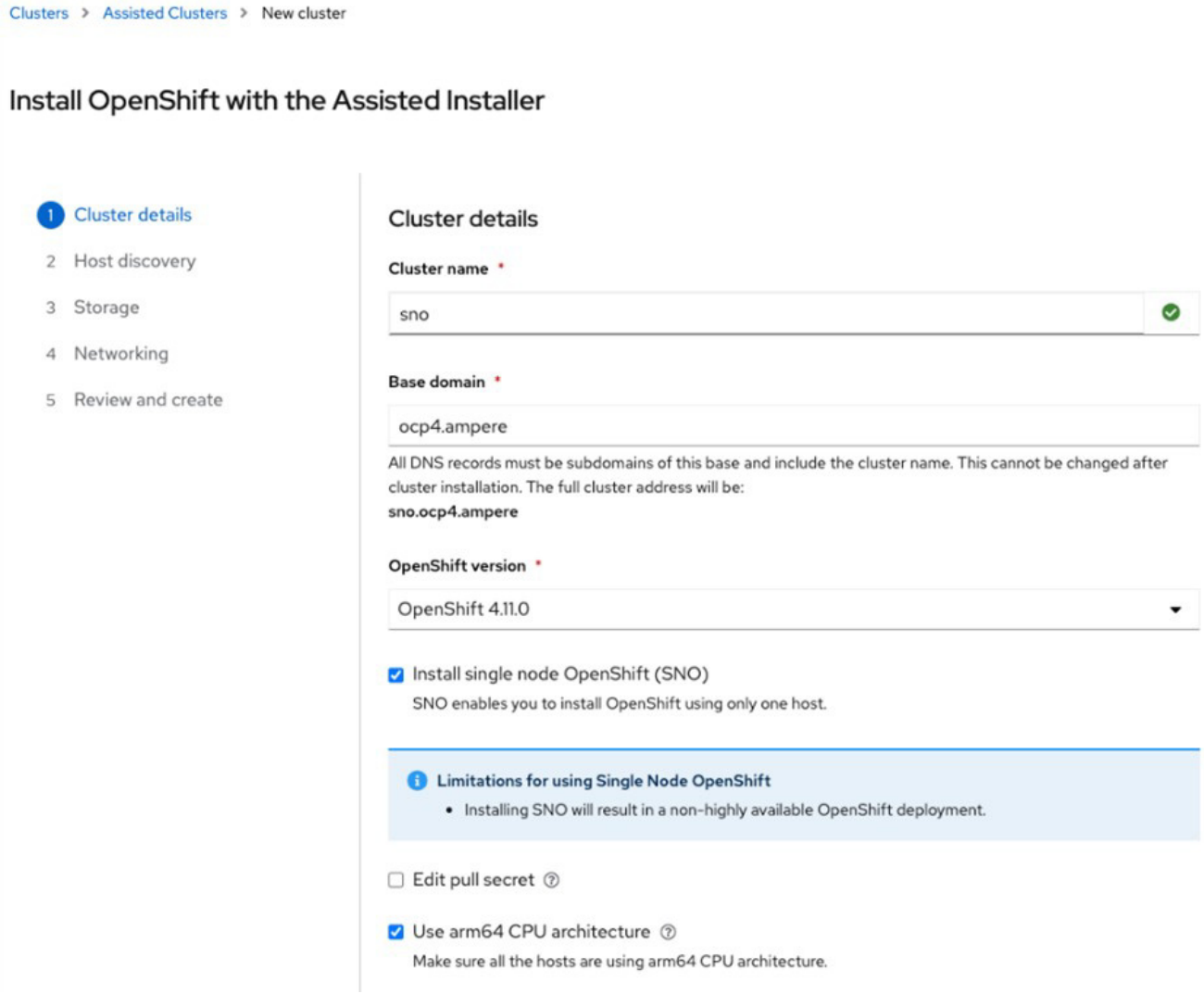
Following is a step-by-step guide for installing OpenShift Container Platform 4.11 with Assisted Installer on the Ampere Altra Platform.

1. Login to http://cloud.redhat.com, click **OpenShift**, and then click **Data Center** for **Bare Metal(Arm64)** and **Create Cluster** for a new cluster.

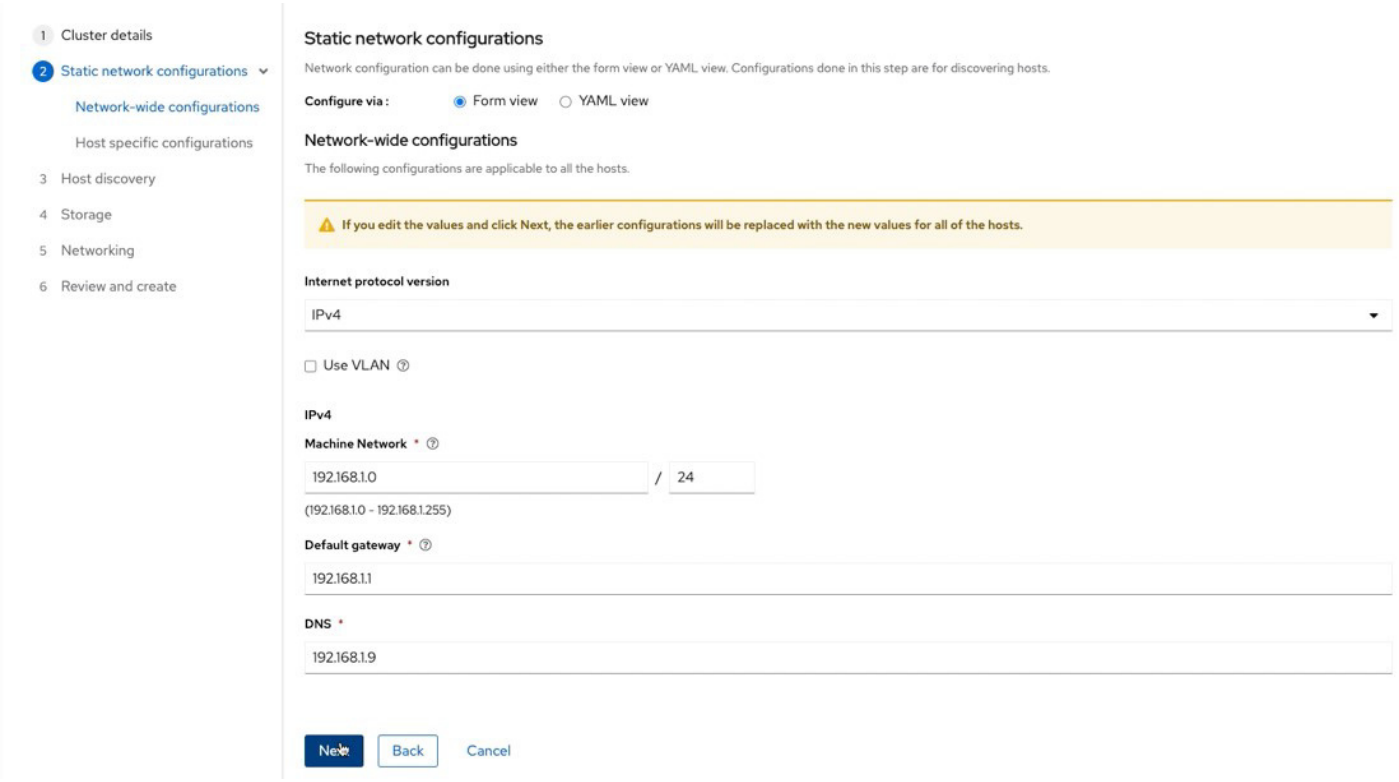
2. Click the **Assisted Installer** icon.

3. Provide the domain name, cluster name, and IP addresses for the target node for the cluster details. In this example, we choose the static IP address.

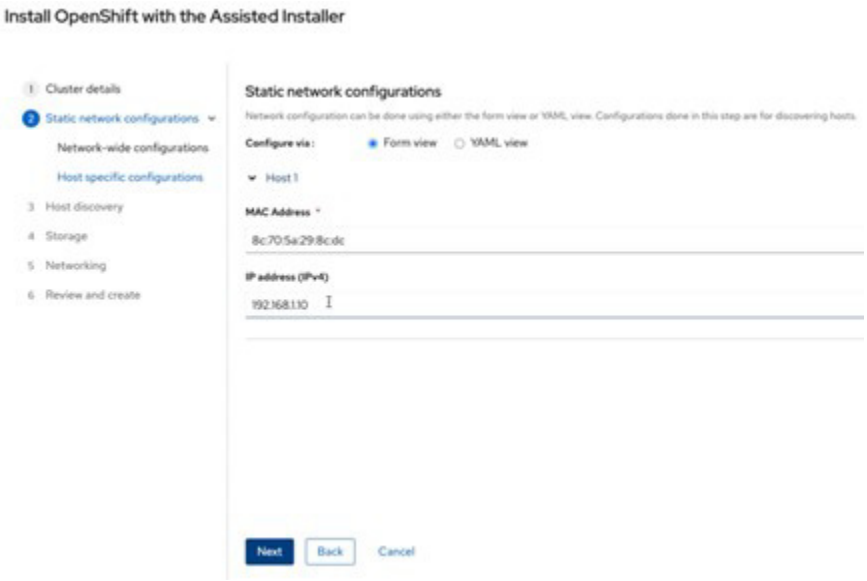
a) In this tutorial, a local DNS is used for managing domain names under **ocp4.ampere** and uses **sno** as the cluster/node name.



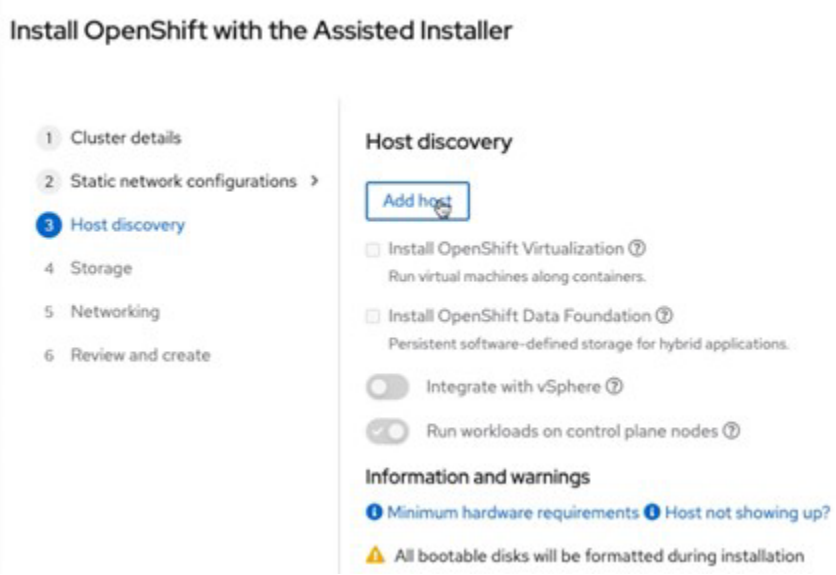
b) Enter the static IP address range, default gateway, and DNS.



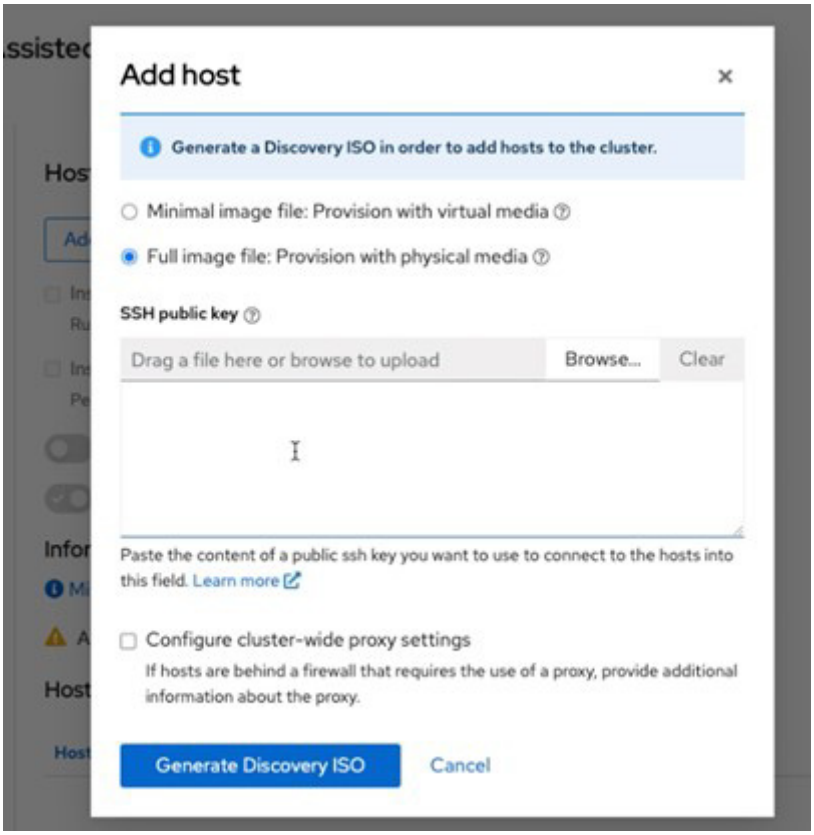
c) Enter the MAC address and assigned IP address on the Internet-access NIC on the target node.



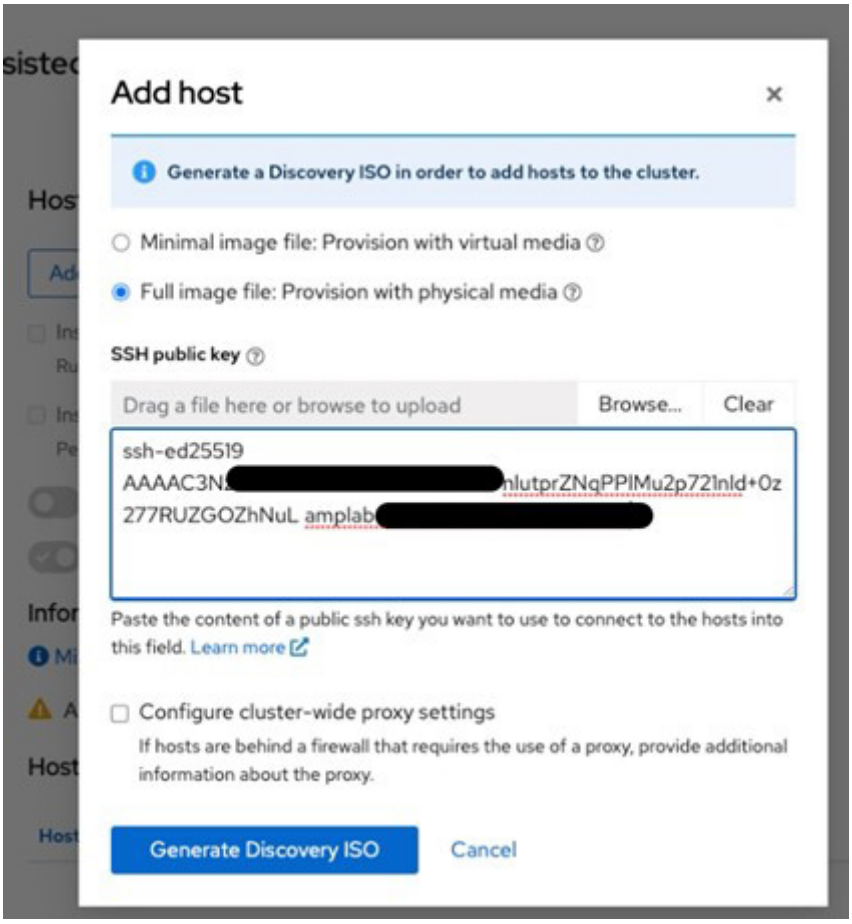
d) Click **Add host** in Step 3 **Host discovery**.



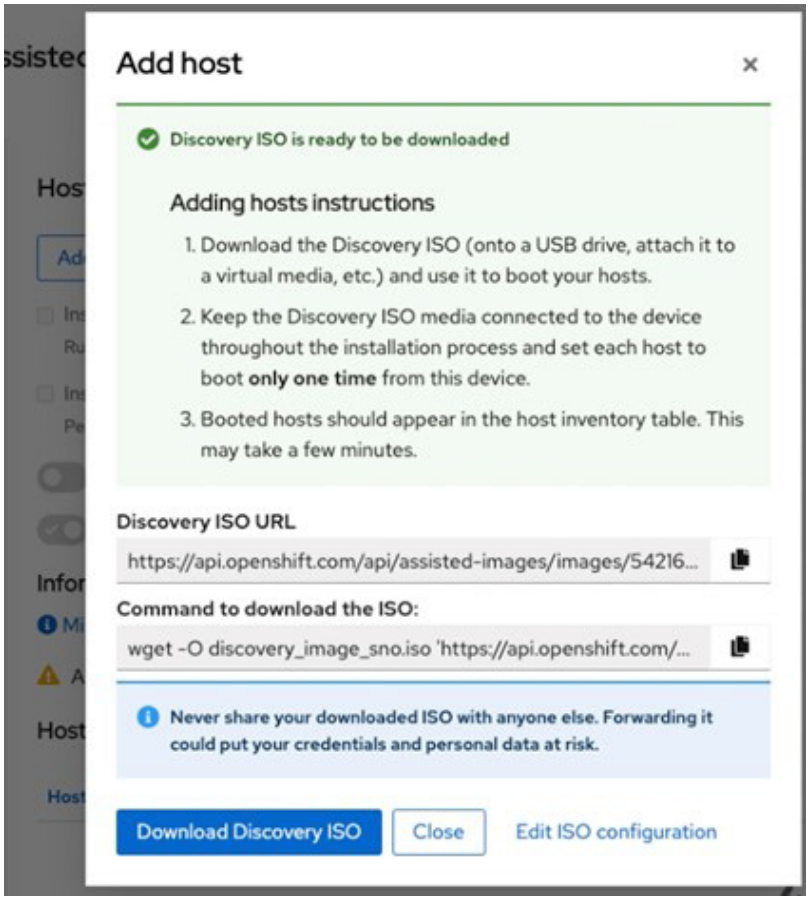
e) The web console prompts for a diagram for generating a Discovery ISO image for provisioning the target node. For provisioning bare metal, select **Full image file**.



f) Drag an SSH public key file or enter the contents of an SSH public key from the bastion node to access the target node later. Then click **Generate Discovery ISO**. The web console embeds the SSH key into the Discovery ISO image.



g) The web console prompts for the ISO URL or the `wget` command for downloading the Discovery ISO image.



4. Prepare and download the Discovery ISO image for OCP 4.11.

```
$ wget -O discovery_image_ocp4.iso 'https://api.openshift.com/api/assisted-images/images/
[TOKEN1]?arch=arm64&image_token=[IMAGE_TOKEN]&type=full-iso&version=4.11'
```

5. Review the target system's status and execute the following commands to clean up the node with Red Hat Enterprise Linux CoreOS Live CD. This step is optional but needed if your hardware has been used for other projects or provisioned with OS. Assume there are six NVMe drives (1x M.2 for OS and 5x U.2 for data storage) per node.

   a) Download the live CD.

```
$ wget "https://mirror.openshift.com/pub/openshift-v4/arm64/dependencies/rhcos/4.11/latest/
rhcos-4.11.0-aarch64-live.aarch64.iso"
```

b) Mount the live CD with KVM on the BMC. Once the system is loaded, execute the following script to clean up the drives, and then power off the system.

```
$ for DISK in "/dev/nvme0n1" "/dev/nvme1n1" "/dev/nvme2n1" "/dev/nvme3n1" "/dev/nvme4n1" "/dev/
nvme5n1" ;
  do echo $DISK && \
  sgdisk --zap-all $DISK && \
  dd if=/dev/zero of="$DISK" bs=1M count=100 oflag=direct,dsync && \
  blkdiscard $DISK
done
$ poweroff
```

6. Mount the Discovery ISO image for OCP 4.11 with KVM on the BMC on the target node.

a) Click **Browse File** on the top right of the KVM browser.

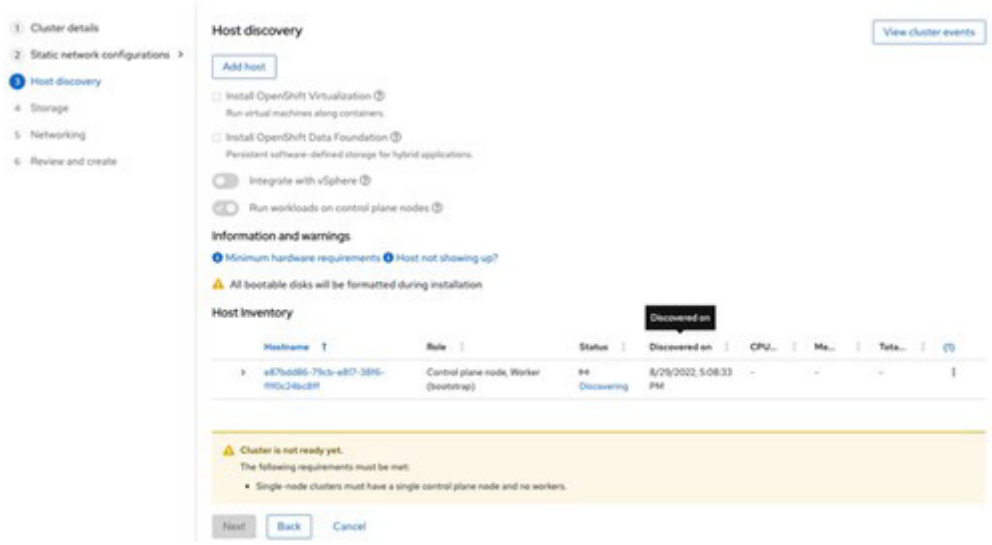
b) The KVM dialog opens a dialog box to search for the target ISO image in a directory. Enter **discovery_image_sno.iso**.

c) Click **Start Media** to mount the ISO image to the target node.

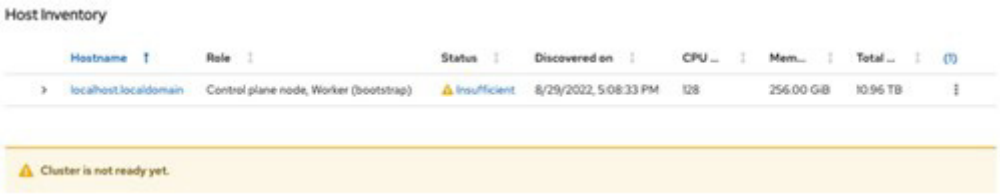
7. Use the ipmitool SOL function to monitor the installation.

```
ipmitool  -H [BMC IP address] -I lanplus -U [username] -P [password] sol activate
```

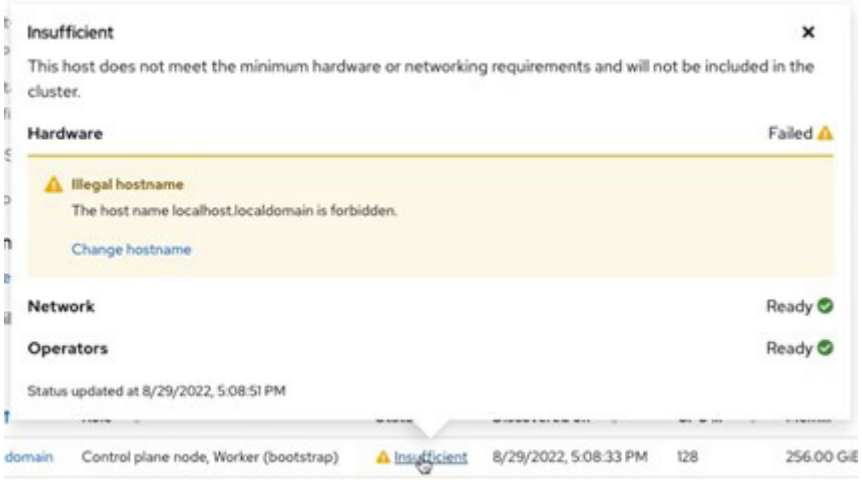
8. When the node is loaded with Red Hat Enterprise Linux CoreOS (RHCOS) and is updating its status to http://cloud.redhat.com, the Assisted Installer web page also shows the status for each phase on the cluster.



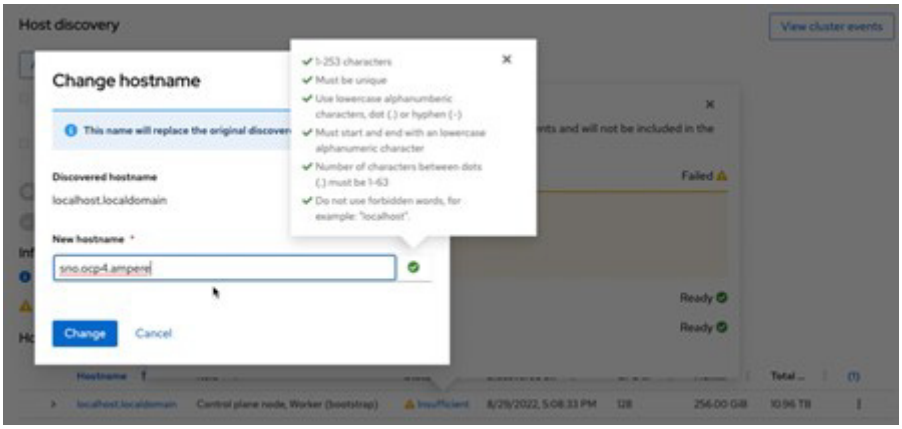
a) If the Assisted Installer web page shows the host status as **Insufficient**, and its hostname as **localhost.localdomain**,



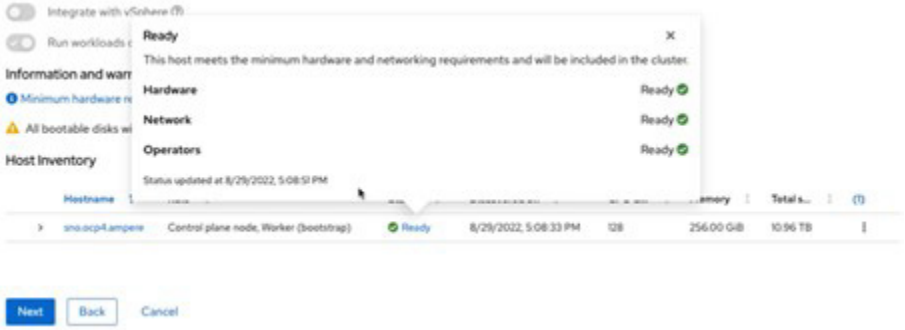
click the link for **Insufficient** and change the hostname.



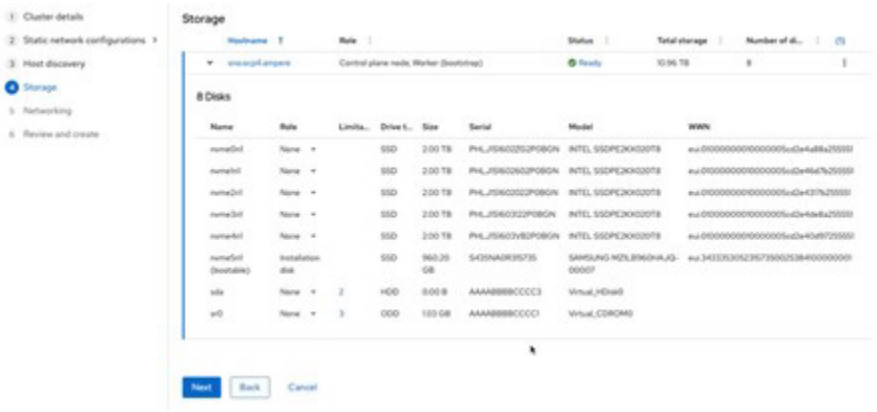
b) Change hostname as an FQDN for making the node ready. In this example, change the hostname to **sno.ocp4.ampere**.



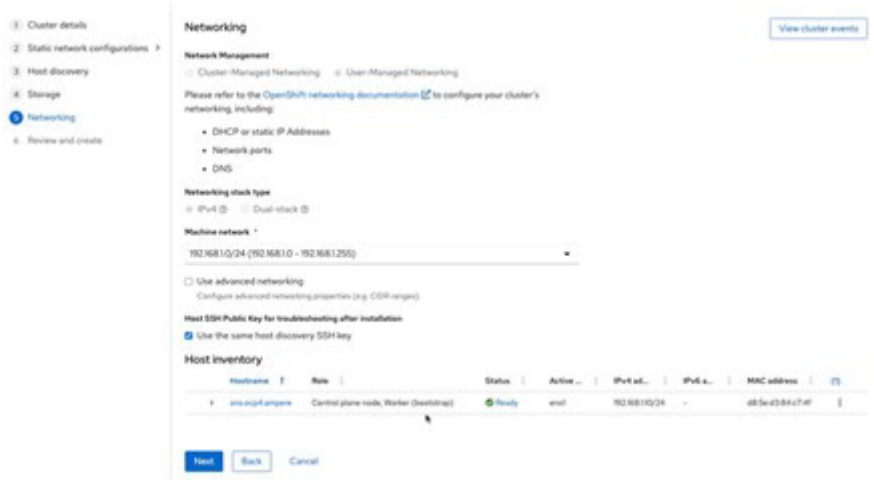
c) The Assisted Installer page shows the host status as **Ready** with the proper hostname. Click **Next** to go to Step 4, **Storage**.



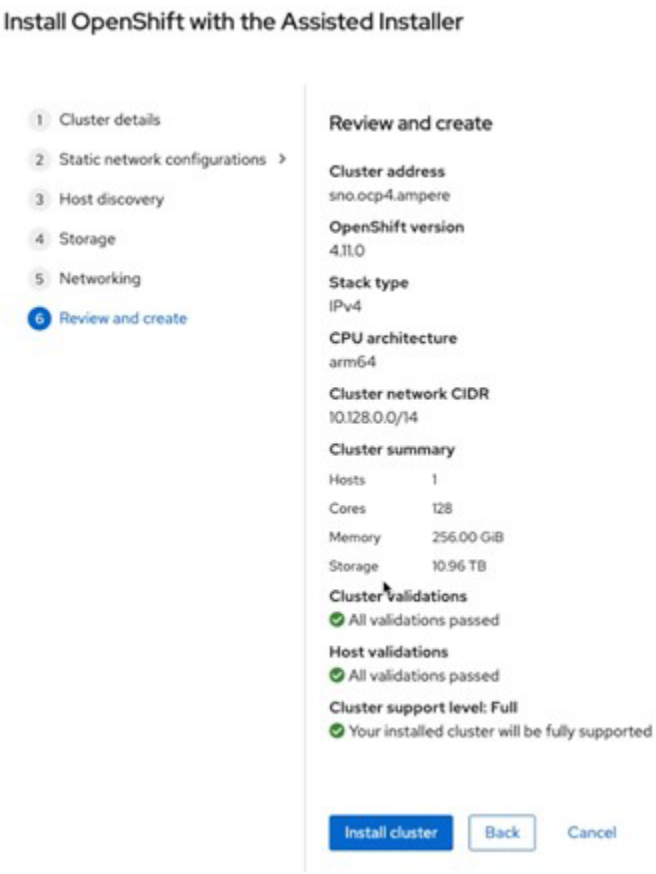
d) The Storage page lists all storage devices. Select one of the storage devices as the boot drive for RHCOS, and then click **Next**.



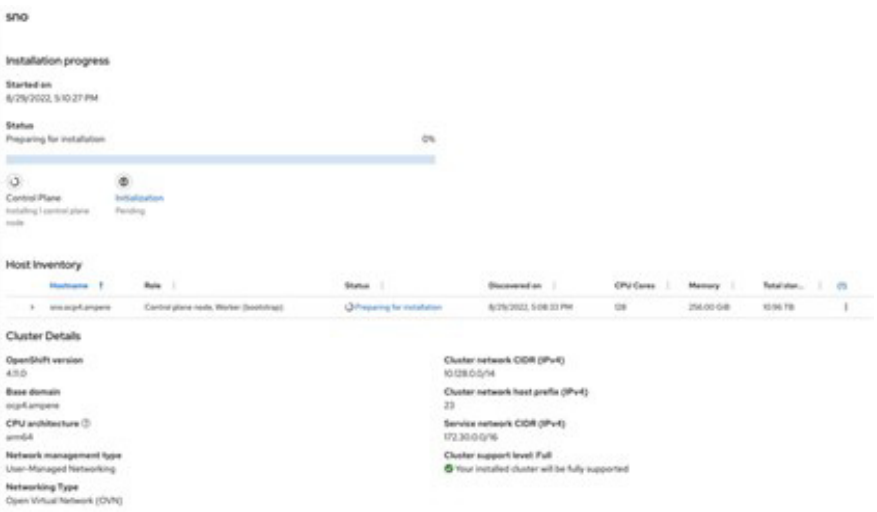
e) The Networking page the network information as **User-Managed Networking** including the machine network. Click **Next** to go to the next step.



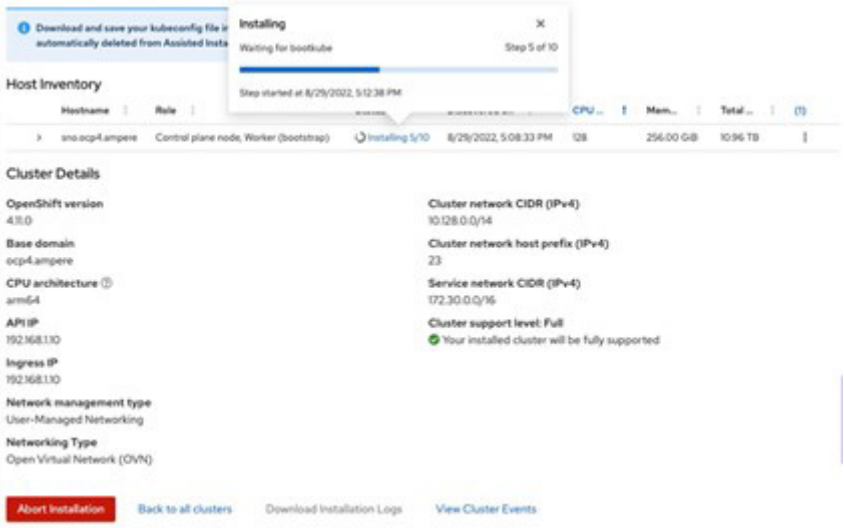
f) Review the Single Node OpenShift configuration, and then click **Install cluster** to start the Assisted Installation.



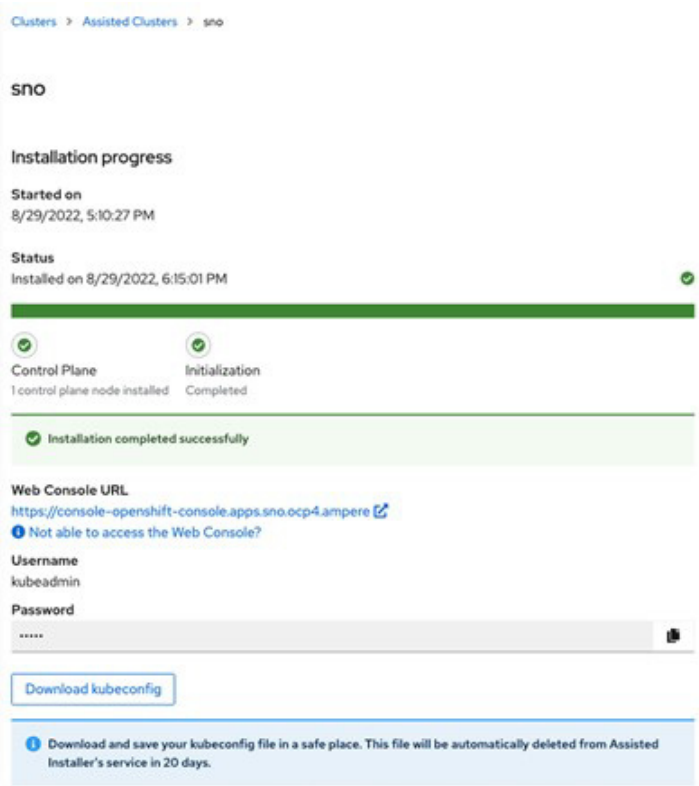
g) The Assisted Installer page shows the status of the node as **Preparing for installation** and the role of "Control Plane node, Worker (bootstrap)".



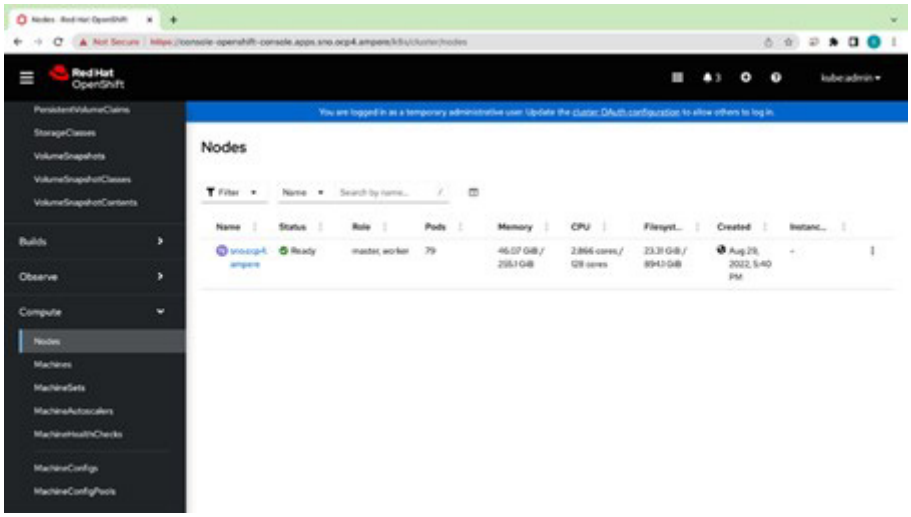
h) Click the **Status** link to view the step on which the Assisted Install is working.



9. After approximately 35-63 minutes (depending on the Internet bandwidth), the Single Node OpenShift 4.11 is ready. The window shows the OpenShift Web Console URL along with the username and password. It also provides a method to download your kubeconfig file which is automatically deleted from the Assisted Installer service in 20 days.



10. Access the OpenShift Console using the predefined URL https://console-openshift-console.apps.sno.ocp4.ampere or use **kubectl** or **oc** with the kubeconfig file downloaded from http://cloud.redhat.com to access the Single Node OpenShift. The Nodes page shows one nod with two roles



There is one node in the cluster.

```
[amplab@amplab-ThinkPad-T420s:~/sno$ kubectl --kubeconfig ./kubeconfig get nodes
NAME              STATUS   ROLES           AGE   VERSION
sno.ocp4.ampere   Ready    master,worker   15h   v1.24.0+9546431
amplab@amplab-ThinkPad-T420s:~/sno$
```

Deploying Rook Ceph Operator

1. On the bastion node, use git to pull Rook Ceph Operator v.1.10.0.

```
$ git clone --single-branch --branch v1.10.0 https://github.com/rook/rook.git
$ mv rook rook-1.10.0
$ cd rook-1.10.0/deploy/examples/
```

2. Prepare a **cluster.yaml** for Single Node OpenShift Ceph.

```
$ cat << EOF > sno-cluster.yaml
---
kind: ConfigMap
apiVersion: v1
metadata:
  name: rook-config-override
  namespace: rook-ceph
data:
  config: |
    [global]
    osd_pool_default_size = 1
---
apiVersion: ceph.rook.io/v1
kind: CephCluster
metadata:
  name: rook-ceph
  namespace: rook-ceph
spec:
  cephVersion:
    image: quay.io/ceph/ceph:v17.2.3
    allowUnsupported: false
  dataDirHostPath: /var/lib/rook
  skipUpgradeChecks: false
  continueUpgradeAfterChecksEvenIfNotHealthy: false
  waitTimeoutForHealthyOSDInMinutes: 10
  mon:
    count: 1
    allowMultiplePerNode: true
  mgr:
    count: 1
    allowMultiplePerNode: true
    modules:
      - name: pg_autoscaler
        enabled: true
dashboard:
    enabled: true
    ssl: true
  monitoring:
    enabled: false
  network:
    connections:
      encryption:
        enabled: false
      compression:
        enabled: false
  crashCollector:
    disable: false
```

```
    cleanupPolicy:
      confirmation: ""
      sanitizeDisks:
        method: quick
        dataSource: zero
        iteration: 1
      allowUninstallWithVolumes: false
    annotations:
    labels:
    resources:
    removeOSDsIfOutAndSafeToRemove: false
    priorityClassNames:
      mon: system-node-critical
      osd: system-node-critical
      mgr: system-cluster-critical
    storage:
      useAllNodes: true
      useAllDevices: true
      devices:
      - name: "nvme0n1"
      - name: "nvme1n1"
      - name: "nvme2n1"
      - name: "nvme3n1"
      - name: "nvme4n1"
      config:
        osdsPerDevice: "1"
      onlyApplyOSDPlacement: false
    disruptionManagement:
      managePodBudgets: false
      osdMaintenanceTimeout: 30
      pgHealthCheckTimeout: 0
      manageMachineDisruptionBudgets: false
      machineDisruptionBudgetNamespace: openshift-machine-api
  healthCheck:
      daemonHealth:
        mon:
          disabled: false
          interval: 45s
        osd:
          disabled: false
          interval: 60s
        status:
          disabled: false
          interval: 60s
      livenessProbe:
        mon:
          disabled: false
        mgr:
          disabled: false
        osd:
          disabled: false
```

```
 startupProbe:
      mon:
        disabled: false
      mgr:
        disabled: false
      osd:
        disabled: false

EOF
```

3. Prepare StorageClass for single node OpenShift.

```
$ cat << EOF > sno-storageclass.yaml
---
apiVersion: ceph.rook.io/v1
kind: CephBlockPool
metadata:
  name: replicapool
  namespace: rook-ceph
spec:
  failureDomain: host
  replicated:
    size: 1
---
apiVersion: storage.k8s.io/v1
kind: StorageClass
metadata:
   name: rook-ceph-block
provisioner: rook-ceph.rbd.csi.ceph.com
parameters:
    clusterID: rook-ceph
    pool: replicapool
    imageFormat: "2"
    imageFeatures: layering
    csi.storage.k8s.io/provisioner-secret-name: rook-csi-rbd-provisioner
    csi.storage.k8s.io/provisioner-secret-namespace: rook-ceph
    csi.storage.k8s.io/controller-expand-secret-name: rook-csi-rbd-provisioner
    csi.storage.k8s.io/controller-expand-secret-namespace: rook-ceph
    csi.storage.k8s.io/node-stage-secret-name: rook-csi-rbd-node
    csi.storage.k8s.io/node-stage-secret-namespace: rook-ceph
    csi.storage.k8s.io/fstype: ext4
reclaimPolicy: Delete
allowVolumeExpansion: true

EOF
```

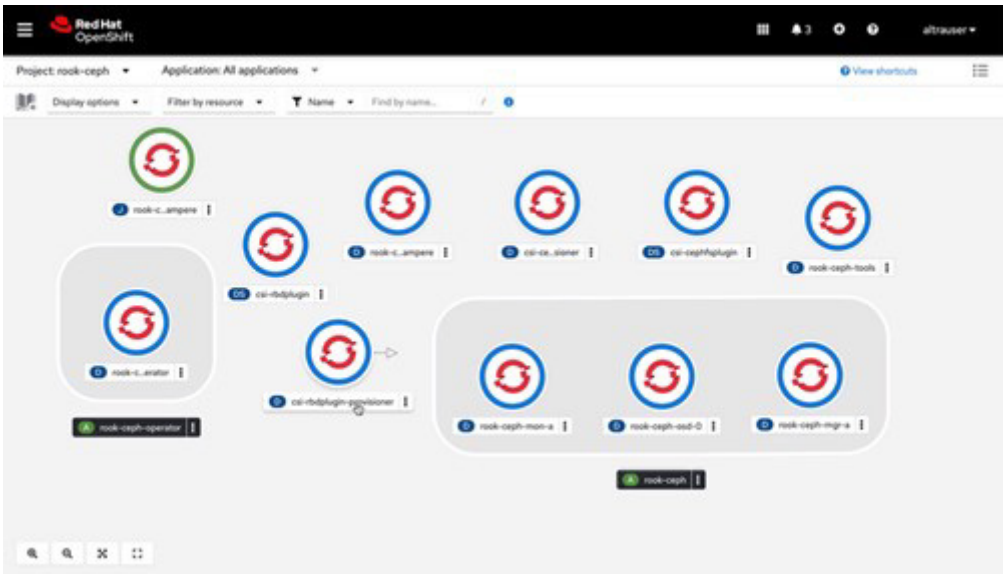
4. Deploy CRDs, common, and operator yaml files.

```
$ oc create -f crds.yaml -f common.yaml
$ oc create -f operator-openshift.yaml
$ oc create -f sno-cluster.yaml
$ oc create -f toolbox.yaml
$ oc create -f sno-storageclass.yaml
$ oc create -f csi/rbd/snapshotclass.yaml
```

5. Set rook-ceph-block as the default StorageClass.

```
$ oc patch storageclass  rook-ceph-block -p '{"metadata":
{"annotations":{"storageclass.kubernetes.io/is-default-class":"true"}}}'
```

6. After a few minutes, the Ceph service is ready on the rook-ceph namespace.



7. Since the rook Ceph tool was deployed, use the following commands to check the Ceph status and health details.

```
$ oc -n rook-ceph exec -it $(oc -n rook-ceph get pod -o name | egrep rook-ceph-tool ) -- ceph
status
$ oc -n rook-ceph exec -it $(oc -n rook-ceph get pod -o name | egrep rook-ceph-tool ) -- ceph
health detail
```

8. Prepare a PVC yaml file for testing the Ceph service's readiness.

```
$ cat << EOF > example-pvc.yaml
apiVersion: v1
kind: PersistentVolumeClaim
metadata:
  name: example-pvc
  labels:
    app: example-app
spec:
  accessModes:
    - ReadWriteOnce
  volumeMode: Filesystem
  resources:
    requests:
      storage: 100Gi
  storageClassName: rook-ceph-block

EOF
```

9. Run the following commands to verify Persistent Volume Claim.

```
$ oc project default
Now using project "default" on server "https://api.sno.ocp4.ampere:6443".
$ oc create -f example-pvc.yaml
persistentvolumeclaim/example-pvc created
$ oc get pvc
NAME          STATUS   VOLUME                                     CAPACITY   ACCESS MODES
STORAGECLASS      AGE
example-pvc   Bound    pvc-46f05da5-a1cb-4212-91b3-2525e8326676   100Gi      RWO           rook-
ceph-block   10s
$ oc delete -f example-pvc.yaml
persistentvolumeclaim "example-pvc" deleted
```

10. The Single Node OpenShift is ready for running workloads.

Revision History

ISSUE	DATE	DESCRIPTION
1.00	November 7, 2022	Initial release.

November 7, 2022

AMPERE®

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