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Tutorial: Configure Cloud Native Edge Infrastructure with K3s, Calico, Portworx

18 Sep 2020 10:10am, by Janakiram MSV

In the previous part of this series, I introduced the core building blocks of cloud native edge computing stack: K3s, Project Calico, and Portworx.

This tutorial will walk you through the steps involved in installing and configuring this software on an edge cluster, a set of Intel NUC mini PCs running Ubuntu 18.04. This infrastructure can be used for running reliable, scalable, and secure AI and IoT workloads at the edge.

Customizing K3s Installation for Calico

To integrate Calico networking stack with K3s, we need to customize the installation to enable CNI support.

Note that you need at least three nodes running the K3s cluster at the edge for high availability.

On the first node designated as server, run the below commands.

```
export K3S_TOKEN="secret_edgecluster_token"
```

```
export INSTALL_K3S_EXEC="--flannel-backend=none --disable=traefik --cluster-cidr=172.16.2.0/24
```

```
curl -sfL https://get.k3s.io | sh -
```

If *172.16.2.0/24* is already in use within your network you must select a different pod network CIDR by replacing *172.16.2.0/24* in the above command.

On the remaining server nodes, run the following commands. Note that we added the `--server` switch to the installer pointing it to the IP address of the first node.

```
export K3S_TOKEN="secret_edgecluster_token"
```

```
export INSTALL_K3S_EXEC="--flannel-backend=none --disable=traefik --cluster-cidr=172.16.2.0/24
```

```
curl -sfL https://get.k3s.io | sh -
```

To configure worker nodes or agents, run the following commands:

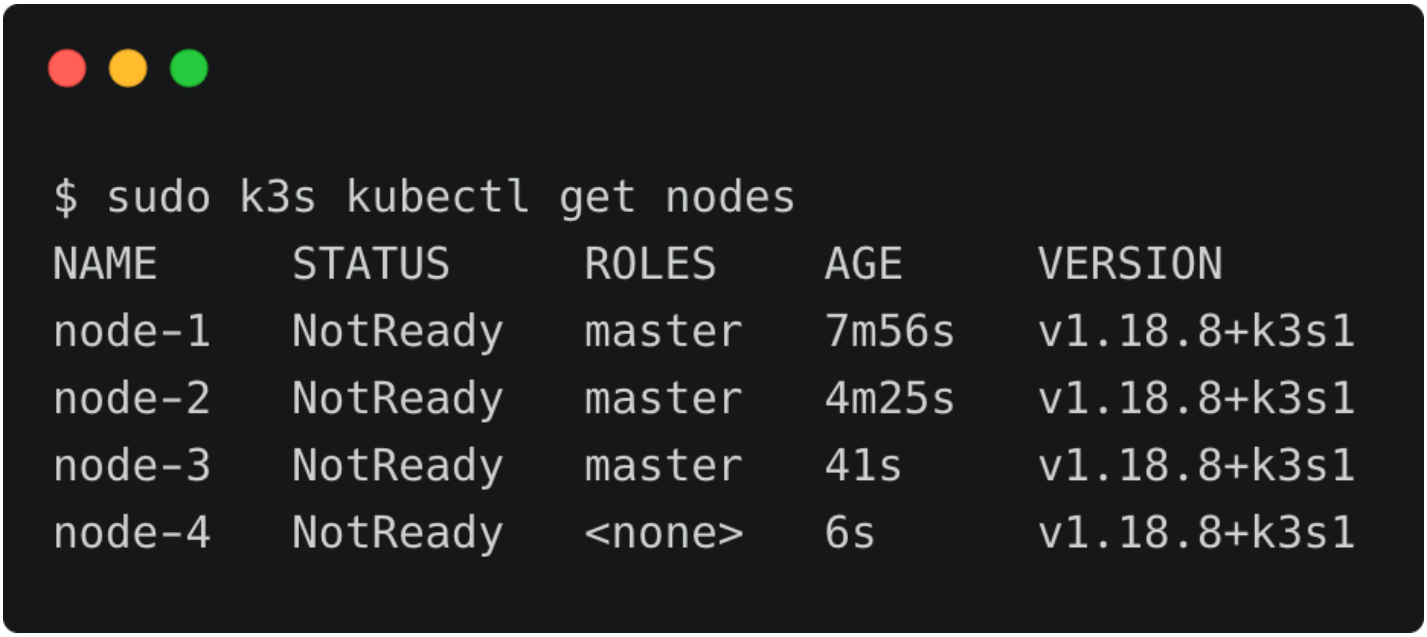
```
export K3S_URL=https://10.0.0.60:6443
```

```
curl -sfL https://get.k3s.io | sh -
```

Replace `K3S_URL` with the IP address of the K3s server.

At the end of this step, you should have a cluster with four nodes.

Since the network is not configured yet, none of these nodes are ready. As soon as we apply Calico specs to the cluster, the nodes will become ready.



X

Before proceeding to the next step, copy `/etc/rancher/k3s/k3s.yaml` from one of the server nodes to your local workstation and point the `KUBECONFIG` environment variable to that. Don't forget to update the master URL in the YAML file. This provides remote access to the K3s cluster through `kubectl` CLI.

Installing Calico on the Multinode K3s Cluster

We will start by downloading the Calico manifests and modifying them.

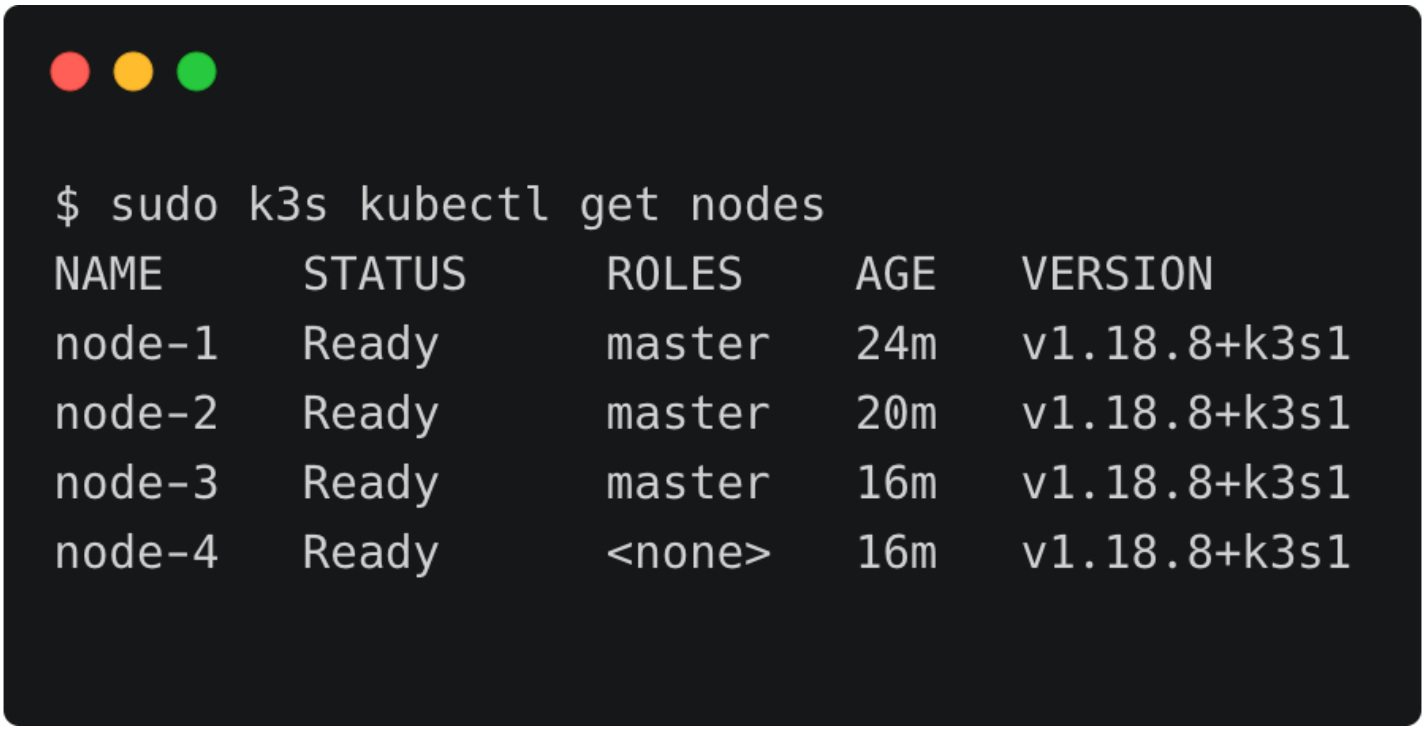
```
wget https://docs.projectcalico.org/manifests/tigera-operator.yaml
```

Apply both the manifests to configure the Calico network for the K3s cluster.

```
kubectl create -f tigera-operator.yaml
```

```
kubectl create -f custom-resources.yaml
```

In a few minutes, the cluster becomes ready.



Finally, modify the `cni-config` configmap in `calico-system` namespace to enable IP forwarding.

```
kubectl edit cm cni-config -n calico-system
```

Change the value shown below to enable IP forwarding.

```
"container_settings": {
              "allow_ip_forwarding": true
          }
```

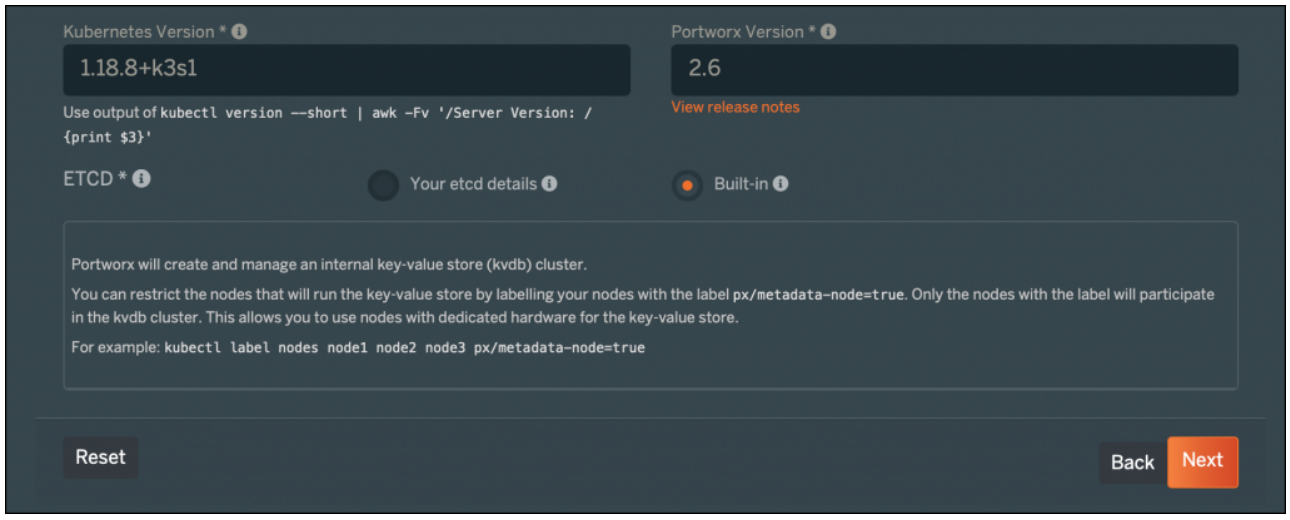
Verify that Calico is up and running with the below command:

```
% kubectl get pods -n calico-system
NAME                                       READY   STATUS    RESTARTS   AGE
calico-typha-988fd8df-jcqgq                1/1     Running   0          15m
calico-node-5nzz5                          1/1     Running   0          15m
calico-node-6rlhn                          1/1     Running   0          15m
calico-kube-controllers-5bb9cf484d-wp7f5   1/1     Running   0          15m
calico-typha-988fd8df-plr65                1/1     Running   0          13m
calico-typha-988fd8df-v7nm5                1/1     Running   1          13m
calico-node-pdcbx                          1/1     Running   0          15m
calico-typha-988fd8df-npkkg                1/1     Running   0          13m
calico-node-mgtxk                          1/1     Running   0          15m
```

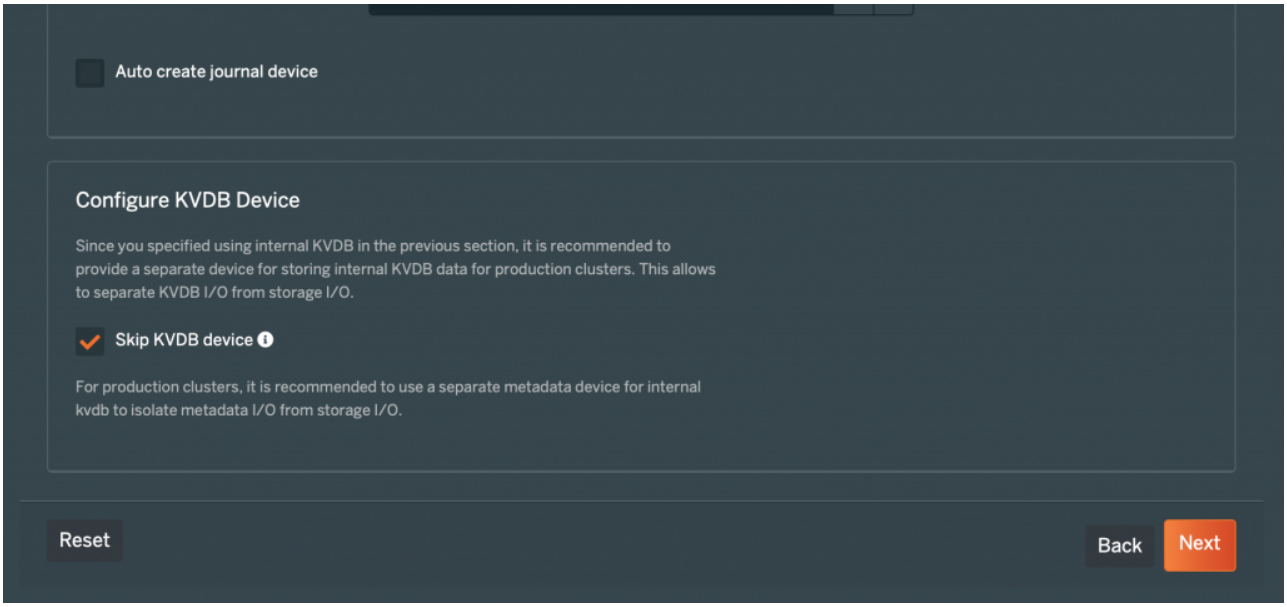
Installing Portworx on K3s

Portworx 2.6 or above supports K3s distribution. The installation process on K3s is not different from other flavors of Kubernetes. Follow the steps mentioned in the tutorial on installing Portworx on a bare-metal cluster.

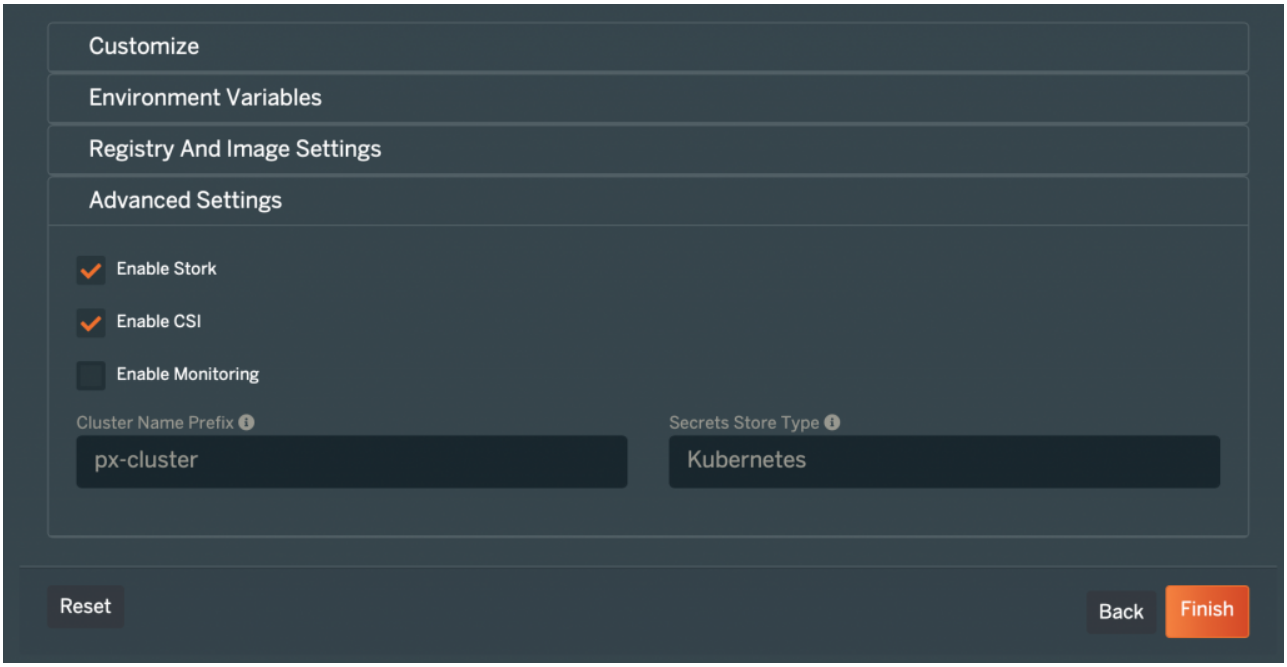
If you don't have an etcd cluster handy, you can choose the built-in KVDB in the PX-Central installation wizard.



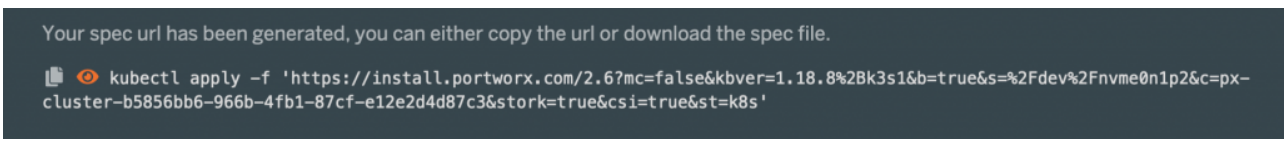
I chose the NVMe disk attached to each host for the storage option. Modify this based on your storage configuration.



One of the important prerequisites for K3s is the support for CSI. Make sure you select `Enable CSI` option in the last step.



Copy the specification and apply it to your cluster.



```
% kubectl get pods -l name=portworx -n kube-system
NAME              READY   STATUS    RESTARTS   AGE
portworx-8xhdj    2/2     Running   0          2m38s
portworx-4gckf    2/2     Running   0          2m38s
portworx-cg2cv    2/2     Running   0          2m38s
portworx-ts2lt    2/2     Running   0          2m38s
```

The CSI driver is attached as a sidecar to each of the Pods in the DaemonSet which is why we see two containers in the Pods.

SSH into one of the nodes and check the Portworx cluster status with the below command.

```
1 sudo /opt/pwx/bin/pxctl status
```

```
    IP: 10.0.0.60
    Local Storage Pool: 1 pool
    POOL    IO_PRIORITY RAID_LEVEL  USABLE  USED    STATUS  ZONE    REGION
    0   HIGH        raid0       58 GiB  5.1 GiB Online  default default
    Local Storage Devices: 1 device
    Device  Path        Media Type      Size        Last-Scan
    0:1 /dev/nvme0n1p2  STORAGE_MEDIUM_NVME 58 GiB      17 Sep 20 06:36 UTC
    * Internal kvdb on this node is sharing this storage device /dev/nvme0n1p2  to store its data.
    total       -   58 GiB
    Cache Devices:
     * No cache devices
Cluster Summary
    Cluster ID: px-cluster-b5856bb6-966b-4fb1-87cf-e12e2d4d87c3
    Cluster UUID: 03fc213e-c5bd-4891-86e7-51e58b04d86d
    Scheduler: kubernetes
    Nodes: 4 node(s) with storage (4 online)
    IP      ID                  SchedulerNodeName   StorageNode Used    Capacity    Status  StorageStatus
Version     Kernel          OS
    10.0.0.63   d54c7e40-5288-4945-84fa-5bb09b76ad5a    node-4          Yes5.1 GiB  58 GiB      Online  Up
2.6.0.0-208389c 4.15.0-91-generic   Ubuntu 18.04.4 LTS
    10.0.0.61   b0be6e92-cc18-42af-891f-840a172d1e80    node-2          Yes5.0 GiB  58 GiB      Online  Up
2.6.0.0-208389c 4.15.0-117-generic  Ubuntu 18.04.4 LTS
    10.0.0.62   519a73d5-b782-49d6-925e-94217527dbb4    node-3          Yes5.1 GiB  58 GiB      Online  Up
2.6.0.0-208389c 4.15.0-91-generic   Ubuntu 18.04.4 LTS
    10.0.0.60   2ac5e6cf-2cb1-4f64-b346-22e9c6ac778a    node-1          Yes5.1 GiB  58 GiB      Online  Up (This
node)  2.6.0.0-208389c 4.15.0-91-generic   Ubuntu 18.04.4 LTS
    Warnings:
         WARNING: Internal Kvdb is not using dedicated drive on nodes [10.0.0.62 10.0.0.60]. This configuration
is not recommended for production clusters.
Global Storage Pool
    Total Used      :  20 GiB
    Total Capacity  :  233 GiB
```

We now have a fully configured edge infrastructure based on K3s, Calico, and Portworx. In the next part of this series, we will deploy an AIoT workload running at the edge.

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