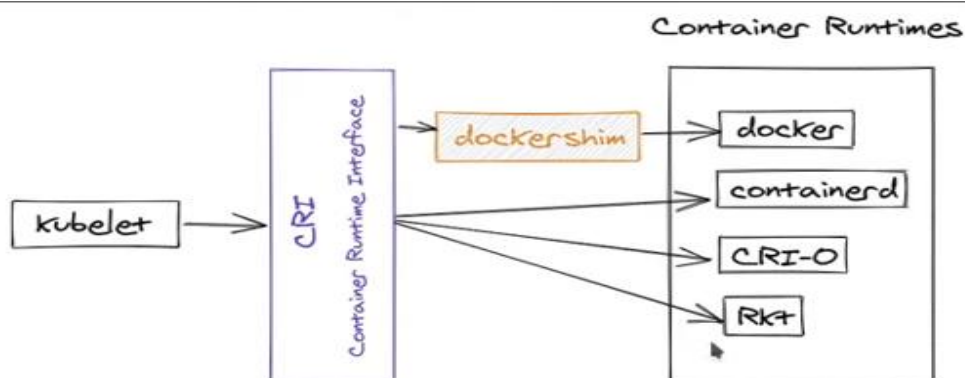


\$\$\$\$ INSTALLATION OF KUBERNETES CLUSTER ON CENTOS 7 USING "CONTAINERD" \$\$\$\$

❖ Prerequisites:

- 1) we have made 3 VMs on ESXI 6.5 and install Centos 7 in it.
- 2) One is Master and the other 2 are worker Nodes .
- 2) Configuration for MASTER Node is 4vCPUs, 8 GB RAM, 100 GB HDD.
- 3) Configuration for 2 Worker Nodes is 2vCPUs, 2 GB RAM, 50 GB HDD



docker to containerd transition

better performance
less overhead
docker cli -> **crictl**
existing images work
no changes to building images

1.20 - kubelet startup warning
1.21
1.22
1.23 - planned dockershim removal

❖ Credentials:

1) MASTER NODE

Hostname : egovmasternode

ip : 10.208.22.202

2) Worker NODES:

a) Hostname : egovworkernode1

ip : 10.208.22.68

b) Hostname : egovworkernode2

ip : 10.208.23.73

User and Password for Master and Workers:

UserName: root

Password: Egov@123

#####STEPS and Commands For Installation#####

1.Updating Centos 7 and REBOOT

yum -y update && sudo systemctl reboot

2. Install kubelet, kubeadm and kubectl

(NOTE: Copy paste below Paragraph as it is)

```
sudo tee /etc/yum.repos.d/kubernetes.repo<<EOF
[kubernetes]
name=Kubernetes
baseurl=https://packages.cloud.google.com/yum/repos/kubernetes-el7-x86_64
enabled=1
gpgcheck=1
repo_gpgcheck=0
gpgkey=https://packages.cloud.google.com/yum/doc/yum-key.gpg
https://packages.cloud.google.com/yum/doc/rpm-package-key.gpg
EOF
```

3.Installing required packages.

yum clean all && sudo yum -y makecache

yum -y install epel-release vim git curl wget kubelet kubeadm kubectl --disableexcludes=kubernetes

4.Confirm installation by checking the version of kubeadm and kubectl

kubeadm version

kubectl version --client

5.Disable SELinux

****NOTE : "If you have SELinux in enforcing mode, turn it off or use Permissive mode"**

setenforce 0

sed -i 's/^SELINUX=.*/SELINUX=permissive/g' /etc/selinux/config

6. Disable Swap

sed -i 's/^(\s*\\$)/\s*\\$/' /etc/fstab

swapoff -a

7. Configure sysctl.

modprobe overlay

modprobe br_netfilter

(NOTE: Copy paste below Paragraph as it is)

```
tee /etc/sysctl.d/kubernetes.conf<<EOF
net.bridge.bridge-nf-call-ip6tables = 1
net.bridge.bridge-nf-call-iptables = 1
net.ipv4.ip_forward = 1
EOF
```

sysctl --system

8. Install Container runtime

To run containers in Pods, Kubernetes uses a container runtime.

Supported container runtimes are :

a)Containerd

b)CRI-O

DOCKER(DCOCKERSHIM) is being discontinued in newer versions of Kubernetes.

*So we will be using "**Containerd**" for container runtime interface*

Configure persistent loading of modules

(NOTE: Copy paste below Paragraph as it is)

```
tee /etc/modules-load.d/containerd.conf <<EOF
overlay
br_netfilter
EOF
```

Load at runtime

modprobe overlay

modprobe br_netfilter

Ensure sysctl params are set

(NOTE: Copy paste below Paragraph as it is)

```
tee /etc/sysctl.d/kubernetes.conf<<EOF
net.bridge.bridge-nf-call-ip6tables = 1
net.bridge.bridge-nf-call-iptables = 1
net.ipv4.ip_forward = 1
EOF
```

Reload configs

```
sysctl --system
```

Install required packages

```
yum install -y yum-utils device-mapper-persistent-data lvm2
```

Add Docker repo

```
yum-config-manager --add-repo https://download.docker.com/linux/centos/docker-ce.repo
```

Install containerd

```
yum update -y && yum install -y containerd.io
```

Configure containerd and start service

```
mkdir -p /etc/containerd
containerd config default > /etc/containerd/config.toml
```

restart containerd

```
systemctl restart containerd
systemctl enable containerd
```

```
[root@egovworkernode1 ~]# systemctl enable containerd
Created symlink from /etc/systemd/system/multi-user.target.wants/containerd.service to /usr/lib/systemd/system/containerd.service.
```

#To use the systemd cgroup driver,

set "plugins.cri.systemd_cgroup = true " <-- **paste this line in the file path below at the end in the contents in file**

" /etc/containerd/config.toml "

9.Configure Firewalld

****NOTE: Either Disable firewall or OPEN the Following ports.**

systemctl disable --now firewalld

OR

Master Server ports:

firewall-cmd --add-port={6443,2379-2380,10250,10251,10252,5473,179,5473}/tcp --permanent

firewall-cmd --add-port={4789,8285,8472}/udp --permanent

firewall-cmd --reload

Worker Node ports:

firewall-cmd --add-port={10250,30000-32767,5473,179,5473}/tcp --permanent

firewall-cmd --add-port={4789,8285,8472}/udp --permanent

firewall-cmd --reload

10.Initialize your control-plane node

lsmod | grep br_netfilter

```
[root@egovworkernode1 ~]# lsmod | grep br_netfilter
br_netfilter      22256  0
bridge           151336  1 br_netfilter
```

systemctl enable kubelet

```
[root@egovworkernode1 ~]# systemctl enable kubelet
Created symlink from /etc/systemd/system/multi-user.target.wants/kubelet.service
to /usr/lib/systemd/system/kubelet.service.
```

kubeadm config images pull

```
[root@egovworkernode1 ~]# kubeadm config images pull
[config/images] Pulled registry.k8s.io/kube-apiserver:v1.25.3
[config/images] Pulled registry.k8s.io/kube-controller-manager:v1.25.3
[config/images] Pulled registry.k8s.io/kube-scheduler:v1.25.3
[config/images] Pulled registry.k8s.io/kube-proxy:v1.25.3
[config/images] Pulled registry.k8s.io/pause:3.8
[config/images] Pulled registry.k8s.io/etcd:3.5.4-0
[config/images] Pulled registry.k8s.io/coredns/coredns:v1.9.3
[root@egovworkernode1 ~]#
```

11. Creating TOKEN on MASTER(Control-Plane) Node.

****NOTE: fire this command just on the MASTER NODE so that token will be created for the workers to join master.**

kubeadm init

-wait for some time till the token gets created

Then you can join any number of worker nodes by running the following on each as root:

```
kubeadm join 10.208.22.202:6443 --token iq02hy.738czycyg3nsm3bv \
--discovery-token-ca-cert-hash sha256:8ddddd15elf694d0c25dbala145958cdf71ea87fbc59d1222b57a22dba4363414
[root@egovworkernode1 ~]#
```

```
"kubeadm join 10.208.22.202:6443 --token iq02hy.738czycyg3nsm3bv \
--discovery-token-ca-cert-hash
sha256:8ddddd15elf694d0c25dbala145958cdf71ea87fbc59d1222b57a22dba4363414"
```

(PASTE THE ABOVE TOKEN IN WORKER NODES AFTER COMPLETING ALL THE ABOVE STEPS in Worker and Master)

```
[root@egovworkernode1 ~]# kubeadm join 10.208.22.202:6443 --token iq02hy.738czycyg3nsm3bv \
--discovery-token-ca-cert-hash sha256:8ddddd15elf694d0c25dbala145958cdf71ea87fbc59d1222b57a22dba4363414
[preflight] Running pre-flight checks
[preflight] Reading configuration from the cluster...
[preflight] FYI: You can look at this config file with 'kubectl -n kube-system get cm kubeadm-config -o yaml'
[kubelet-start] Writing kubelet configuration to file "/var/lib/kubelet/config.yaml"
[kubelet-start] Writing kubelet environment file with flags to file "/var/lib/kubelet/kubeadm-flags.env"
[kubelet-start] Starting the kubelet
[kubelet-start] Waiting for the kubelet to perform the TLS Bootstrap...

This node has joined the cluster:
* Certificate signing request was sent to apiserver and a response was received.
* The Kubelet was informed of the new secure connection details.

Run 'kubectl get nodes' on the control-plane to see this node join the cluster.

[root@egovworkernode1 ~]#
```

12. Configure kubectl using commands in the output

****NOTE: Fire These below command on MASTER only**

```
mkdir -p $HOME/.kube
```

```
cp -i /etc/kubernetes/admin.conf $HOME/.kube/config
```

```
chown $(id -u):$(id -g) $HOME/.kube/config
```

13. Check cluster status

```
kubectl cluster-info
```

```
[root@egovmasternode ~]# kubectl cluster-info
Kubernetes control plane is running at https://10.208.22.202:6443
CoreDNS is running at https://10.208.22.202:6443/api/v1/namespaces/kube-system/services/kube-dns:dns/proxy

To further debug and diagnose cluster problems, use 'kubectl cluster-info dump'.
[root@egovmasternode ~]#
```

13. Install network plugin

****NOTE: Fire these below commands on Master and worker**

```
kubectl create -f https://docs.projectcalico.org/manifests/tigera-operator.yaml
```

```
kubectl create -f https://docs.projectcalico.org/manifests/custom-resources.yaml
```

```
kubectl apply -f https://raw.githubusercontent.com/coreos/flannel/master/Documentation/kube-flannel.yml
```

14. check NODES and Pods on Master NODE:

```
kubectl get nodes -o wide
```

```
[root@egovmasternode ~]# kubectl get nodes -o wide
```

NAME	STATUS	ROLES	AGE	VERSION	INTERNAL-IP	EXTERNAL-IP	OS-IMAGE	KERNEL-VERSION	CONTAINER-RUNTIME
egovmasternode	Ready	control-plane	17h	v1.25.3	10.208.22.202	<none>	CentOS Linux 7 (Core)	3.10.0-1160.76.1.el7.x86_64	containerd://1.6.8
egovworkernode1	Ready	<none>	17h	v1.25.3	10.208.22.68	<none>	CentOS Linux 7 (Core)	3.10.0-1160.76.1.el7.x86_64	containerd://1.6.8
egovworkernode2	Ready	<none>	16h	v1.25.3	10.208.23.73	<none>	CentOS Linux 7 (Core)	3.10.0-1160.76.1.el7.x86_64	containerd://1.6.8

```
kubectl get pods --all-namespaces
```


****Status of active(running) Kubelet and ContainerD **nac**

```
[root@egovmasternode ~]# systemctl status kubelet
● kubelet.service - kubelet: The Kubernetes Node Agent
   Loaded: loaded (/usr/lib/systemd/system/kubelet.service; enabled; vendor preset: disabled)
   Drop-In: /usr/lib/systemd/system/kubelet.service.d
            └─10-kubeadm.conf
   Active: active (running) since Mon 2022-10-17 18:04:12 IST; 18s ago
     Docs: https://kubernetes.io/docs/
    Main PID: 10464 (kubelet)
      Tasks: 15
     Memory: 38.4M
    CGroup: /system.slice/kubelet.service
            └─10464 /usr/bin/kubelet --bootstrap-kubeconfig=/etc/kubernetes/bootstrap-kubelet.conf --kubeconfig=/et...

Oct 17 18:04:14 egovmasternode kubelet[10464]: I1017 18:04:14.164187 10464 reconciler.go:169] "Reconciler: s...ate"
Oct 17 18:04:14 egovmasternode kubelet[10464]: E1017 18:04:14.560829 10464 kubelet.go:1712] "Failed creating...ode"
Oct 17 18:04:16 egovmasternode kubelet[10464]: I1017 18:04:16.970537 10464 topology_manager.go:205] "Topolog...ler"
Oct 17 18:04:16 egovmasternode kubelet[10464]: I1017 18:04:16.986344 10464 reconciler.go:357] "operationExecutor..."
Oct 17 18:04:16 egovmasternode kubelet[10464]: I1017 18:04:16.986433 10464 reconciler.go:357] "operationExecutor..."
Oct 17 18:04:16 egovmasternode kubelet[10464]: I1017 18:04:16.986529 10464 reconciler.go:357] "operationExecutor..."
Oct 17 18:04:16 egovmasternode kubelet[10464]: I1017 18:04:16.986608 10464 reconciler.go:357] "operationExecutor..."
Oct 17 18:04:18 egovmasternode kubelet[10464]: E1017 18:04:18.411158 10464 kubelet.go:2373] "Container runti...zed"
Oct 17 18:04:23 egovmasternode kubelet[10464]: E1017 18:04:23.412976 10464 kubelet.go:2373] "Container runti...zed"
Oct 17 18:04:28 egovmasternode kubelet[10464]: E1017 18:04:28.415010 10464 kubelet.go:2373] "Container runti...zed"
Hint: Some lines were ellipsized, use -l to show in full.
[root@egovmasternode ~]# systemctl status containerd
● containerd.service - containerd container runtime
   Loaded: loaded (/usr/lib/systemd/system/containerd.service; enabled; vendor preset: disabled)
   Active: active (running) since Mon 2022-10-17 17:51:44 IST; 13min ago
     Docs: https://containerd.io
    Main PID: 9527 (containerd)
      Tasks: 131
     Memory: 1.2G
    CGroup: /system.slice/containerd.service
            └─ 9527 /usr/bin/containerd
                  └─10119 /usr/bin/containerd-shim-runc-v2 -namespace k8s.io -id f62e437aa3868b877971e47585c1aaabd6f0d403...
                  └─10140 /usr/bin/containerd-shim-runc-v2 -namespace k8s.io -id 97e59055717fc39ce9e350eb2dfd6a81ac18c4c9...
                  └─10283 /usr/bin/containerd-shim-runc-v2 -namespace k8s.io -id 12b85af34894ca9552a2051a20c88ac5c97a64a0...
                  └─10301 /usr/bin/containerd-shim-runc-v2 -namespace k8s.io -id c2ff72af1d315c40f5c4c92b3016537994ba290c...
                  └─10527 /usr/bin/containerd-shim-runc-v2 -namespace k8s.io -id 18113fc7fbd7e5a5f1734belcb79432a98bbfde0...
                  └─kube-pods-besteffort-pod7cdd80f5_dlf2_492f_9ecb_faceb3012bc8.slice:cri-containerd:c61a1889bedb2c62369cbc9
bcbca60895ee9851caac26f3c40843fccc52bcfee4
                  └─10576 /usr/local/bin/kube-proxy --config=/var/lib/kube-proxy/config.conf --hostname-override=egovma...
                  └─kube-pods-besteffort-pod7cdd80f5_dlf2_492f_9ecb_faceb3012bc8.slice:cri-containerd:18113fc7fbd7e5a5f1734be
1cb79432a98bbfde0ddf8bf205ae918da547164ee
                  └─10546 /pause
                  └─kube-pods-burstable-pod543d1973c57d0a372acde4c69d97174a.slice:cri-containerd:fefcf00e862193fd2f1972457156
8556eb6b7e31f160792000d17115904d3af4
                  └─10397 kube-controller-manager --authentication-kubeconfig=/etc/kubernetes/controller-manager.conf -...
                  └─kube-pods-burstable-pod64c7136557e32acc09a76c8f643ae869.slice:cri-containerd:53ff589a47b5b74f09734886f2e9
1dc7709c4bc34d97bdeaa699880019977abd
                  └─10375 kube-apiserver --advertise-address=10.208.22.202 --allow-privileged=true --authorization-mode...
```

****Checking Kubeadm version**

```
[root@egovworkernode2 ~]# kubeadm version
kubeadm version: &version.Info{Major:"1", Minor:"25", GitVersion:"v1.25.3", GitC
ommit:"434bfd82814af038ad94d62ebe59b133fcb50506", GitTreeState:"clean", BuildDat
e:"2022-10-12T10:55:36Z", GoVersion:"go1.19.2", Compiler:"gc", Platform:"linux/a
md64"}
[root@egovworkernode2 ~]# kubectrl version --client
WARNING: This version information is deprecated and will be replaced with the ou
tput from kubectrl version --short. Use --output=yaml|json to get the full versi
on.
Client Version: version.Info{Major:"1", Minor:"25", GitVersion:"v1.25.3", GitCom
mit:"434bfd82814af038ad94d62ebe59b133fcb50506", GitTreeState:"clean", BuildDate:
"2022-10-12T10:57:26Z", GoVersion:"go1.19.2", Compiler:"gc", Platform:"linux/amd
64"}
Kustomize Version: v4.5.7
[root@egovworkernode2 ~]#
```

-----XXXXXXXXXXXXXXXXXXXX-----

