

ORACLE[®] Private Cloud at Customer



Deploy application containers on Oracle Private Cloud Appliance/ Private Cloud at Customer

Oracle Linux Cloud Native Environment helps deploy a multi-node Kubernetes cluster on Oracle Private Cloud Appliance and Oracle Private Cloud at Customer

WHITE PAPER / JULY 30, 2019



PURPOSE STATEMENT

This document provides an approach for deployment of Oracle Linux Cloud Native Environment on Oracle Private Cloud Appliance and Oracle Private Cloud at Customer. The end result is deployment of Oracle Container Runtime for Docker in multiple virtual machines with Oracle Container Services for use with Kubernetes managing the containers.

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INTRODUCTION

Oracle Private Cloud Appliance (PCA) is an Oracle Engineered System designed for rapid deployment of private cloud. Compute resources, network hardware, storage providers, operating systems and applications are engineered to work together but managed and operated as a single unit.

Oracle Private Cloud at Customer enables Oracle and non-Oracle applications to run in customers' data centers, with infrastructure managed by Oracle's cloud experts. Oracle Private Cloud at Customer comes preconfigured according to best-practices that have been proven at hundreds of mission critical Oracle Private Cloud Appliance sites around the world.

Oracle Private Cloud Appliance and Oracle Private Cloud at Customer fully support Oracle Linux Cloud Native Environment to easily automate deployment, scaling and management of application containers. Oracle Private Cloud Appliance includes premier support for Oracle Linux, which comes with support for OL CNE - Oracle Container Runtime for Docker and Oracle Container Services for Use with Kubernetes.

Components in Oracle Linux Cloud Native Environment are made available via <u>Oracle Linux yum server</u> or <u>Oracle Container Registry</u>.

Oracle Container Runtime for Docker allows you to create and distribute applications across Oracle Linux systems and other operating systems that support Docker. Oracle Container Runtime for Docker consists of the Docker Engine, which packages and runs the applications, and integrates with the Docker Hub, Docker Store and Oracle Container Registry to share the applications in a Software-as-a-Service (SaaS) cloud. Oracle Container Registry is the trusted source of Oracle software packaged as Docker Container images.

Kubernetes is used to manage containers running on a containerization platform deployed on several systems. On Oracle Linux, Kubernetes is currently only supported when used in conjunction with the Docker containerization platform. Therefore, each system in the deployment must have the Docker engine installed and ready to run. Support of Oracle Container Services for use with Kubernetes is limited to usage with the latest Oracle Container Runtime for Docker version available in the ol7_addons repository on the Oracle Linux yum server and in the ol7_x86_64_addons channel on ULN.

Oracle Enterprise Manager 13c is the recommended management framework for managing Oracle Infrastructure Software and Oracle Engineered Systems. Oracle Enterprise Manager is a complete, integrated and business-driven enterprise cloud management solution.

This paper will discuss the following approach to deploy a multi-node Kubernetes cluster on Oracle Private Cloud Appliance and Oracle Private Cloud at Customer:

- Use Oracle Linux Virtual Appliances to deploy Oracle Linux VMs and then using yum to install docker-engine on each VM.
- Use kubeadm-setup.sh script to deploy Kubernetes master and worker nodes by downloading images from Oracle Container Registry.

RESOURCE REQUIREMENTS

On Oracle Private Cloud Appliance, we will deploy Oracle Linux 7 VMs to function as Master and Worker nodes in the Kubernetes cluster. In this paper, we deploy a **2 node cluster – one master node and one worker node**.

- Each node in the Kubernetes cluster requires at least 2 GB of RAM and 2 or more CPUs to facilitate the use of kubeadm and any further applications that are provisioned using kubectl.
- A storage volume with at least 5 GB free space must be mounted at /var/lib/kubelet on each node.
- For the underlying Docker engine an additional volume with at least 5 GB free space must be mounted on each node at /var/lib/docker.
- Ensure each node has a unique UUID.

```
[root@kube-master ~]# dmidecode -s system-uuid
0004fb00-0006-0000-a6c3-6e4d06e5fa16
[root@kube-worker ~]# dmidecode -s system-uuid
```

STEPS COMMON TO EACH NODE IN CLUSTER

0004fb00-0006-0000-658a-18bd874e86d1

1. Install Docker Engine on all nodes

For installations on Oracle Private Cloud Appliance, Oracle VM Manager GUI can be used to create VMs.

Follow the instructions (with following notes) in this <u>blog</u> for step by step instructions on how to install Docker Engine on an Oracle Linux 7 Virtual Machine on Oracle Private Cloud Appliance.

Note: As stated in the requirements, we need 5 GB free space mounted at /var/lib/docker and at /var/lib/kubelet.

For this reason, in **Step 2** of the above referenced blog, **also add 2 Virtual disks of 5GB each** while editing the VM after cloning from the Virtual Appliance.

Add virtual disks to the VM

While editing the VM, go to 'Disks' tab and Choose 'Virtual Disk' from the Disk Type drop down.

Conf	iguration Netwo	rks Dis	ks Boot Order	Tags		
Slot	Disk Type	Name		Size (GiB)	Actions	
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	Emp		Dealed Denselberg MC	······		
4	Emp * Virtual Di	ly: sk Name:	Kack1-Repository-NF	·S •		
	Emp * Size (GiB):	5.0 3			
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	Emp Allocation	Туре:	Sparse Allocation	▼ (1)		
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11	Emp					
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Fig 1: Editing VM to attach Virtual Disks

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▷ Para Template-DevTest	JHM-sgd	01 Stopped	d Bob	Informational	ovcacn08r1	4096	4096	8
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	Blot D	onfiguration	-I- Netwo	rks 💦 🙆 Dis	sks Size (Gi	B) Repo	sitory Absolu	te Path
		irtual Disk	/mdisk1		15.0	Rack	1-Reposito 192.16	8.40.1:/e /
	2 Vi	irtual Disk	cubelet_disl	(5.0	Rack	1-Reposito 192.16	8.40.1:/e /
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Description		Status F	Progress	Message	Timesta	amp	Duration	Abort

Fig 2: Virtual Machine cloned from OL7 Template and edited to add 2 Virtual Disks of 5 GB each

Note: For **Step 5** in the blog, you can use one of the 2 **Virtual Disks created above as dedicated storage for Docker filesystem.** This is covered in the next section of this paper.

For installations on Oracle Private Cloud at Customer, Oracle Enterprise Manager should be used for all IaaS activities.

Here are the steps to set up Oracle Linux Virtual Machines using EM Self-Service portal

130	Enterprise Manager Cloud Control 13c
	clouadm
	Login
	ORACLE

Fig 3: Log in to EM Self Service Portal

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Fig 4: Choose Deploy -> Assembly to initiate creation of VM from OL assembly

ORACLE' Enterprise Manager Cloud	Control 13c				CLOUDADM 🔻 🚥
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* Target ovcacn08r1	Sea	rch			
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Source	Name	Imported	Component	Component Version	Description
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	WLS 12g	×	\checkmark	0.1	
🔲 Use Deployment Plan	OL7u6 Assem	×	\checkmark	0.1	
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	UU_wls_12.2	×	~	0.1	User uploaded Assembly
Details	Targets Selected: 1	Mode:Single Se	lect		
* Request Name					Select Cancel
* Assembly Instance Name					lin.

Fig 5: Assembly Deployment: Instance details – select source image, VM name

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This is recommended for ease of maintenance and overall security	This	is recommended for eas	se of maintenance and overall security							

Fig 6: Attach the NIC to a network on public VLAN in order to access Internet

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GuestVM Configura	ation Product C	onfiguration Mis	c * Size (I	MB) 5120				
* Confirm Poot D	assword		Shared D)isk		· ·· ·	~	
			Disk Me	ode Read-Write	T			
	Keymap en-us	English, United St	a * Disk Clone T	ype Sparse Allocati	or 🔻			
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+ Add 💉 Ed	dit 🗙 Delete		-	_		Disk Name		
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eth0	xennet	Any Net	System Assigned	DHCP		kubelet_disk		
					То	tal Size: 5672 MB		
					0	TIP If storage arra	ay is selected for the disk, to fit the size	, system will sel

Fig 7: Add 2 storage disks each of 5 GB for setting up Docker and kubelet filesystems

Instar	ance Details Network and Agent		Deploym	nent	Schedule		Review				
		-	Configura	ation							
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Fig 8: Review and Click Submit to finish

After you see the VM successfully created and started, follow the steps below to configure storage for Docker and Kubelet filesystems.

2. Configure Storage for Docker (mount at /var/lib/docker)

The docker-engine package includes docker-storage-config utility that can help you to configure storage correctly for a new Docker deployment. For details, please follow instructions in <u>Oracle Container Runtime for Docker User's Guide</u>

```
[root@kube-master ~]# lsblk
NAME
        MAJ:MIN RM SIZE RO TYPE MOUNTPOINT
xvdc
         202:32
                  0
                        5G 0 disk
                      15G
        202:0
                  0
                           0 disk
xvda
 –xvda2 202:2
–xvda3 202:3
                  0
                        4G
                           0 part [SWAP]
                  0 10.5G
                           0 part /
 -xvda1 202:1
                  0
                      502м
                           0 part /boot
xvdb
        202:16
                 0
                        5G
                            0 disk
# Creating Partition on the device xvdb
[root@kube-master ~]# fdisk /dev/xvdb
Welcome to fdisk (util-linux 2.23.2).
Changes will remain in memory only, until you decide to write them.
Be careful before using the write command.
Device does not contain a recognized partition table
Building a new DOS disklabel with disk identifier 0xb73d0f0a.
Command (m for help): m
Command action
       toggle a bootable flag
   а
       edit bsd disklabel
   b
       toggle the dos compatibility flag
   С
   d
       delete a partition
       create a new empty GPT partition table
   g
       create an IRIX
                        (SGI) partition
```

list known partition types print this menu m add a new partition n create a new empty DOS partition table 0 print the partition table р quit without saving changes q create a new empty Sun disklabel change a partition's system id change display/entry units S t U. verify the partition table write table to disk and exit \mathbf{V} W extra functionality (experts only) Х Command (m for help): p Disk /dev/xvdb: 5368 MB, 5368709120 bytes, 10485760 sectors Units = sectors of 1 * 512 = 512 bytes Sector size (logical/physical): 512 bytes / 512 bytes I/O size (minimum/optimal): 512 bytes / 512 bytes Disk label type: dos Disk identifier: 0xce316206 Device Boot Sta Command (m for help): n End Blocks Id Svstem Start Partition type: primary (0 primary, 0 extended, 4 free) р extended е Select (default p): p
Partition number (1-4, default 1):
First sector (2048-10485759, default 2048): Using default value 2048 Last sector, +sectors or +size{K,M,G} (2048-10485759, default 10485759): Using default value 10485759 Partition 1 of type Linux and of size 5 GiB is set Command (m for help): w The partition table has been altered! Calling ioctl() to re-read partition table. Syncing disks. #List Block Devices [root@kube-master ~]# lsblk MAJ:MIN RM SIZE RO TYPE MOUNTPOINT NAME 202:32 202:0 5G 0 disk xvdc 0 0 15G 0 disk xvda —xvda2 202:2 —xvda3 202:3 4G 0 0 part [SWAP] 0 10.5G 0 part —xvda1 202:1 0 502м 0 part /boot 202:16 0 5G 0 disk xvdb Lxvdb1 202:17 5G 0 0 part

Fig 9: Create a new block device on virtual disk to configure Docker storage

To automatically set up your Docker storage, before installation, run docker-storage-config as root:

[root@kube-master ~]# docker-storage-config -s btrfs -d /dev/xvdb1

Creating 'btrfs' file system on: /dev/xvdb1

Substitute **/dev/xvdb1** with the path to the block device that you attached as dedicated storage. This can be verified by looking for the new entry in file /etc/fstab as shown in Figure below.

#			
# /etc/tstab			
# Created by anaconda on Thu Aug 24 13:06:07 2017			
#			
# Accessible filesystems, by reference, are maintained under '/ # See man pages fstab(5), findfs(8), mount(8) and/or blkid(8) f	dev/disk' or more i	nfo	
	1		
UUID=DdT866Dd-0D93-4362-982e-425335295Ca2 /	DTTTS	subvol=root	0 0
UUID=b2287b9d-47c0-4afd-b38d-458fc50ada55 /boot	xfs	defaults	0 0
UUTD=2d8d9af3-44d3-499b-bf5b-4e915d104562_swap	swap	defaults	Ō Ō
UUID=501249d6-7c90-47f2-9a41-e20c970adc84 /var/lib/docker btrfs	defaults	0 0 # added by	/ docker-storage-config

Fig 10: /etc/fstab file showing new entry added by docker-storage-config

Finally start the docker service as shown in Step 6 and login to Oracle Container Registry as shown in Step 7 of the <u>blog</u>.

3. Configure Storage for Kubelet (mount at /var/lib/kubelet)

As per requirements, at least 5 GB of storage volume needs to be mounted at /var/lib/kubelet. We will use the Virtual Disk created in above step for this purpose

```
[root@kube-master ~]# lsblk
NAME
         MAJ:MIN RM SIZE RO TYPE MOUNTPOINT
         202:32 0
                        5G 0 disk
xvdc
                              0 disk
xvda
         202:0
                   0
                        15G
 -xvda2 202:2
                   0
                         4G 0 part [SWAP]
-xvda3 202:3
-xvda1 202:1
                   0 10.5G
                             0 part /
                              0 part /boot
                   0 502M
xvdb
         202:16
                 0
                         5G 0 disk
 -xvdb1 202:17
                   0
                          5G 0 part /var/lib/docker
# Creating Partition on the device xvdc
[root@kube-master ~]# fdisk /dev/xvdc
Welcome to fdisk (util-linux 2.23.2).
Changes will remain in memory only, until you decide to write them. Be careful before using the write command.
Device does not contain a recognized partition table
Building a new DOS disklabel with disk identifier 0xb73d0f0a.
Command (m for help): n
Partition type:
        primary (0 primary, 0 extended, 4 free)
   р
        extended
   е
Select (default p): p
Partition number (1-4, default 1):
First sector (2048-10485759, default 2048):
Using default value 2048
Last sector, +sectors or +size{K,M,G} (2048-10485759, default 10485759):
Using default value 10485759
Partition 1 of type Linux and of size 5 GiB is set
Command (m for help): w
The partition table has been altered!
Calling ioctl() to re-read partition table.
Syncing disks.
# List Block Devices
[root@kube-master ~]# lsblk
NAME
       MAJ:MIN RM SIZE RO TYPE MOUNTPOINT
         202:32
xvdc
                   0
                         5G
                              0 disk
                         5G 0 part
└─xvdc1 202:33
                   0
 vda 202:0
–xvda2 202:2
                 0
                        15G 0 disk
xvda
                   0
                         4G
                              0 part
                                      [SWAP]
                  0 10.5G
  -xvda3 202:3
                              0 part
```

—xvda1	202:1	0	502M	0	part /boot
xvdb	202:16	0	5G	0	disk
└─xvdb1	202:17	0	5G	0	part /var/lib/docker

Create a btrfs file system on partition /dev/xvdc1:

```
[root@kube-master ~]# mkfs.btrfs /dev/xvdc1
btrfs-progs v4.15.1
See http://btrfs.wiki.kernel.org for more information.
Detected a SSD, turning off metadata duplication. Mkfs with -m dup if you want to force metadata duplication.
Label:
                           (nu11
                           d031a66b-341a-40e8-8c1b-a730034fb55f
UUID:
Node size:
                           16384
Sector size:
                           4096
Filesystem size:
                           5.00GiB
Block group profiles:
                                                  8.00MiB
  Data:
                           single
  Metadata:
                           single
                                                  8.00MiB
  System:
                          single
                                                  4.00MiB
SSD detected:
                          ves
Incompat features:
Number of devices:
                          extref
                           1
Devices:
    ID
                         PATH
                 SIZE
             5.00GiB
                        /dev/xvdc1
     1
[root@kube-master ~]# blkid /dev/xvdc1
/dev/xvdc1: UUID="d031a66b-341a-40e8-8c1b-a730034fb55f" UUID_SUB="e7045279
5e1a-4dd9-b7b5-4235904f36e5" TYPE="btrfs"
```

Create an entry in your /etc/fstab to ensure that the file system is mounted at boot. Open /etc/fstab in an editor and add a line similar to the following:

	<pre>UUID=d031a66b-341a-40e8-8c1b-a730034fb55f /var/lib/kubelet btrfs defaults 0 0</pre>	
	/etc/fstab Created by anaconda on Thu Aug 24 13:06:07 2017 Accessible filesystems, by reference, are maintained under '/dev/disk' See man pages fstab(5), findfs(8), mount(8) and/or blkid(8) for more info	
U U U U U U	JID=bdf866bd-0b93-4362-982e-425335295ca2 / btrfs subvol=root JID=b2287b9d-47c0-4afd-b38d-458fc50ada55 /boot xfs defaults JID=2d8d9af3-44d3-499b-bf5b-4e915d104562 swap swap defaults JID=501249d6-7c90-47f2-9a41-e20c970adc84 /var/lib/docker btrfs defaults 0 0 # added by do JID=d031a66b-341a-40e8-8c1b-a730034fb55f /var/lib/kubelet btrfs defaults 0 0	0 0 0 0 0 0 ocker

Fig 11: /etc/fastab file showing mount for file system on /var/lib/kubelet

Mount the filesystem

```
[root@kube-master ~]# mkdir /var/lib/kubelet
[root@kube-master ~]# mount /var/lib/kubelet/
```

4. Network Time Service Setup

As a clustering environment, Kubernetes requires that system time is synchronized across each node within the cluster. Typically, this can be achieved by installing and configuring an NTP daemon on each node. You can do this in the following way:

[root@kube-master ~]# yum install ntp

Ensure that NTP is enabled to restart at boot and is started before proceeding with Kubernetes installation.

```
[root@kube-master ~]# systemctl start ntpd
[root@kube-master ~]# systemctl enable ntpd
Created symlink from /etc/systemd/system/multi-user.target.wants/ntpd.serv
```

to /usr/lib/systemd/system/ntpd.service.

5. Firewall and IP settings

Kubernetes uses **iptables** to handle many networking and port forwarding rules. Therefore, you must ensure that you do not have any rules set that may interfere with the functioning of Kubernetes. The **kubeadm-setup.sh** script requires an iptables rule to accept forwarding traffic. If this rule is not set, the script exits and notifies you that you may need to add this iptables rule. See Firewall and iptables requirements in <u>User Guide</u> for details.

A standard Docker installation may create a firewall rule that prevents forwarding, therefore you may need to run:

[root@kube-master ~]# iptables -P FORWARD ACCEPT

The **kubeadm-setup.sh** script checks iptables rules and, where there is a match, instructions are provided on how to modify your iptables configuration to meet any requirements. In summary, run the following on each node to set up port forwarding

```
#/sbin/iptables -A KUBE-FIREWALL -p tcp -m tcp --dport 6443 -m conntrack --
ctstate NEW -j ACCEPT
# /sbin/iptables -A KUBE-FIREWALL -p tcp -m tcp --dport 10250 -m conntrack
ctstate NEW -j ACCEPT
# /sbin/iptables -A KUBE-FIREWALL -p udp -m udp --dport 8472 -m conntrack -
ctstate NEW -j ACCEPT
```

SETTING UP KUBERNETES MASTER NODE

After completing the above common steps for each node in the Kubernetes cluster, this section goes through the steps to be executed on the Virtual Machine that will function as the Kubernetes Master.

The **master node** is responsible for cluster management and for providing the API that is used to configure and manage resources within the Kubernetes cluster. Kubernetes master node components can be run within Kubernetes itself, as a set of containers within a dedicated pod.

The Kubernetes images that are deployed by the **kubeadm-setup.sh** script are hosted on the Oracle Container Registry.

1. Satisfy Oracle Container Registry requirements

Thus, before you begin the setup, make sure you satisfy the <u>Oracle Container Registry</u> <u>Requirements</u> - log into Oracle Container Registry in the Web UI (<u>https://container-</u> <u>registry.oracle.com</u>), navigate to Container Service to accept the license and use docker login to authenticate against the Oracle Container Registry (Step 7 of the blog).

2. Install kubeadm package and its dependencies using yum

[root@kube-master ~]# yum install kubeadm kubelet kubectl

3. Run the kubeadm-setup.sh up script to set up Master Node

```
[root@kube-master ~]# kubeadm-setup.sh up
Checking kubelet and kubectl RPM ...
Starting to initialize master node ...
Checking if env is ready ...
Checking whether docker can pull busybox image ...
[WARNING] docker might not be able to pull image from https://registry-1.docker.io/
Checking access to container-registry.oracle.com/kubernetes ...
Trying to pull repository container-registry.oracle.com/kubernetes/kube-proxy ...
v1.12.7: Pulling from container-registry.oracle.com/kubernetes/kube-proxy
Digest: sha256:aaf1d93c2fbaa1e09b40f50446d9ac99e93c1a11d4eff5ab2b5720284c5097c9
Status: Image is up to date for container-registry.oracle.com/kubernetes/kube-
proxy:v1.12.7
Checking whether docker can run container ...
Checking iptables default rule ...
Checking br netfilter module ...
Checking sysctl variables ...
Check successful, ready to run 'up' command ...
Waiting for kubeadm to setup master cluster...
Please wait ..
 - 80% completed
Waiting for the control plane to become ready ...
100% completed
clusterrole.rbac.authorization.k8s.io/flannel created
clusterrolebinding.rbac.authorization.k8s.io/flannel created
serviceaccount/flannel created
configmap/kube-flannel-cfg created
daemonset.extensions/kube-flannel-ds created
Installing kubernetes-dashboard ...
secret/kubernetes-dashboard-certs created
serviceaccount/kubernetes-dashboard created
role.rbac.authorization.k8s.io/kubernetes-dashboard-minimal created
rolebinding.rbac.authorization.k8s.io/kubernetes-dashboard-minimal created
deployment.apps/kubernetes-dashboard created
service/kubernetes-dashboard created
Enabling kubectl-proxy.service ...
Starting kubectl-proxy.service ...
[===> PLEASE DO THE FOLLOWING STEPS BELOW: <===]
Your Kubernetes master has initialized successfully!
To start using your cluster, you need to run the following as a regular user:
  mkdir -p $HOME/.kube
  sudo cp -i /etc/kubernetes/admin.conf $HOME/.kube/config
  sudo chown $(id -u):$(id -g) $HOME/.kube/config
You can now join any number of machines by running the following on each node
as root:
```

```
kubeadm-setup.sh join 10.147.37.226:6443 --token v5mxj8.bmwayav7vszo2351 --
discovery-token-ca-cert-hash
sha256:7c5f8f64f65b6ab4a2ff727730ee4f2b9c62e8bdd6b737744b9b062bae7d8c4a
```

Run the post–completion commands to start using your cluster. We can then attach worker nodes to the cluster as described in the following section.

ADDING A WORKER NODE TO THE KUBERNEETS CLUSTER

Worker nodes within the Kubernetes cluster are used to run containerized applications and handle networking to ensure that traffic between applications across the cluster and from outside of the cluster can be properly facilitated. The worker nodes perform any actions triggered via the Kubernetes API, which runs on the master node.

Repeat all the steps that are common for all nodes in a Kubernetes cluster on the worker node. Here are the steps to add a worker node to the cluster:

1. Install kubeadm package and its dependencies using yum

[root@kube-worker ~]# yum install kubeadm kubelet kubect]

2. Join the Worker Node to cluster

```
[root@kube-worker ~]# kubeadm-setup.sh join 10.147.37.226:6443 --token
v5mxj8.bmwayav7vszo2351 --discovery-token-ca-cert-hash
sha256;7c5f8f64f65b6ab4a2ff727730ee4f2b9c62e8bdd6b737744b9b062bae7d8c4a
Checking kubelet and kubectl RPM ...
Starting to initialize worker node ...
Checking if env is ready ...
Checking whether docker can pull busybox image ...
[WARNING] docker might not be able to pull image from https://registry-1.docker.io/v2
Checking access to container-registry.oracle.com/kubernetes .
Trying to pull repository container-registry.oracle.com/kubernetes/kube-proxy ...
v1.12.7: Pulling from container-registry.oracle.com/kubernetes/kube-proxy
Digest: sha256:aaf1d93c2fbaa1e09b40f50446d9ac99e93c1a11d4eff5ab2b5720284c5097c9
Status: Image is up to date for container-registry.oracle.com/kubernetes/kube-
oroxy:v1.12.7
Checking whether docker can run container ...
Checking iptables default rule ...
Checking br netfilter module ...
Checking sysctl variables ...
Enabling kubelet ..
Created symlink from /etc/systemd/system/multi-user.target.wants/kubelet.service to
/etc/systemd/system/kubelet.service.
Check successful, ready to run 'join' command ...
[validation] WARNING: kubeadm doesn't fully support multiple API Servers yet
[preflight] running pre-flight checks
[discovery] Trying to connect to API Server "10.147.37.226:6443"
[discovery] Trying to connect to API Server "10.147.37.226:6443"
[discovery] Created cluster-info discovery client, requesting info from
"https://10.147.37.226:6443"
[discovery] Created cluster-info discovery client, requesting info from
"https://10.147.37.226:6443"
[discovery] Requesting info from "https://10.147.37.226:6443" again to validate TLS
against the pinned public key
[discovery] Requesting info from "https://10.147.37.226:6443" again to validate TLS
against the pinned public key
[discovery] Cluster info signature and contents are valid and TLS certificate validat
against pinned roots, will use API Server "10.147.37.226:6443"
```

Successfully established connection with API Server "10.147.37.226:6443' discovery] [discovery] Cluster info signature and contents are valid and TLS certificate validates against pinned roots, will use API Server "10.147.37.226:6443" [discovery] Successfully established connection with API Server "10.147.37.226:6443" [kubelet] Downloading configuration for the kubelet from the "kubelet-config-1.12" ConfigMap in the kube-system namespace [kubelet] Writing kubelet configuration to file "/var/lib/kubelet/config.yaml" [kubelet] Writing kubelet environment file with flags to file "/var/lib/kubelet/kubeadmflags.env" [preflight] Activating the kubelet service [tlsbootstrap] Waiting for the kubelet to perform the TLS Bootstrap... [patchnode] Uploading the CRI Socket information "/var/run/dockershim.sock" to the Node API object "kube-worker" as an annotation 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 master to see this node join the cluster.

The kubeadm-setup.sh script checks whether the host meets all the requirements before it sets up a worker node. If a requirement is not met, an error message is displayed together with the recommended fix. You should fix the errors before running the script again.

After the **kubeadm-setup.sh join** command finishes, check that the worker node has joined the cluster by running the flowing command on master node.

[root@kube-master ~]# kubect]			get nodes		
NAME	STATUS	ROLES	AGE	VERSION	
kube-master	Ready	master	30m	v1.12.7+1.1.2.el7	
kube-worker	Ready	<none></none>	84s	v1.12.7+1.1.2.el7	

CONCLUSION

Oracle Container Services for use with Kubernetes is fully tested on Oracle Linux 7 and includes additional tools developed at Oracle to ease configuration and deployment of a Kubernetes cluster. This paper describes the process to quickly set up a Kubernetes cluster on your Oracle Private Cloud Appliance in minutes.

To start using the Kubernetes cluster to deploy applications in pods, follow details in the <u>Oracle</u> <u>Container Services for use with Kubernetes</u> User Guide

Further Reading / References

The following links are to Documentation Libraries that will provide useful background and technical reading: -

Oracle Private Cloud Appliance

https://www.oracle.com/technetwork/server-storage/private-cloud-appliance/documentation/index.html

Oracle Container Runtime for Docker

https://docs.oracle.com/cd/E52668_01/E87205/html/index.html

Oracle Container Services for Use with Kubernetes

https://docs.oracle.com/cd/E52668_01/E88884/html/index.html

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White Paper Deploy application containers on Oracle Private Cloud Appliance/ Private Cloud at Customer

July 2019 Authors: Sonit Tayal



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