

## Lesson 03 Demo 08

### Upgrading Kubernetes Versions of Control Plane

**Objective:** To update the Kubernetes control plane and worker node to version v1.28.3, and then confirm the upgrades success by deploying a test pod

**Tools required:** kubeadm, kubectl, kubelet, and containerd

**Prerequisites:** A Kubernetes cluster should already be set up (refer to the steps in Lesson 02, Demo 01 for guidance).

Steps to be followed:

1. Upgrade the control plane
2. Upgrade the worker node
3. Validate the cluster upgrade by creating a pod

#### Step 1: Upgrade the control plane

1.1 Execute the command to update the control plane:

**apt update**

**apt-cache madison kubeadm**

```
labsuser@master:~$ sudo apt update
Hit:1 http://us-west-2.ec2.archive.ubuntu.com/ubuntu jammy InRelease
Get:2 http://us-west-2.ec2.archive.ubuntu.com/ubuntu jammy-updates InRelease [119 kB]
Get:3 http://us-west-2.ec2.archive.ubuntu.com/ubuntu jammy-backports InRelease [109 kB]
Get:4 http://security.ubuntu.com/ubuntu jammy-security InRelease [110 kB]
Get:5 https://prod-cdn.packages.k8s.io/repositories/iscv/kubernetes:/core:/stable:/v1.28/deb InRelease [1186 B]
Get:6 http://us-west-2.ec2.archive.ubuntu.com/ubuntu jammy-updates/main amd64 Packages [1107 kB]
Get:7 http://us-west-2.ec2.archive.ubuntu.com/ubuntu jammy-updates/main Translation-en [240 kB]
Get:8 http://us-west-2.ec2.archive.ubuntu.com/ubuntu jammy-updates/main amd64 DEP-11 Metadata [101 kB]
Get:9 http://us-west-2.ec2.archive.ubuntu.com/ubuntu jammy-updates/main amd64 c-n-f Metadata [16.1 kB]
Get:10 http://us-west-2.ec2.archive.ubuntu.com/ubuntu jammy-updates/restricted amd64 Packages [1037 kB]
Get:11 http://us-west-2.ec2.archive.ubuntu.com/ubuntu jammy-updates/restricted Translation-en [168 kB]
Get:12 http://us-west-2.ec2.archive.ubuntu.com/ubuntu jammy-updates/restricted amd64 c-n-f Metadata [536 B]
Get:13 http://us-west-2.ec2.archive.ubuntu.com/ubuntu jammy-updates/universe amd64 Packages [995 kB]
Get:14 http://us-west-2.ec2.archive.ubuntu.com/ubuntu jammy-updates/universe Translation-en [218 kB]
Get:15 http://us-west-2.ec2.archive.ubuntu.com/ubuntu jammy-updates/universe amd64 DEP-11 Metadata [305 kB]
Get:16 http://us-west-2.ec2.archive.ubuntu.com/ubuntu jammy-updates/universe amd64 c-n-f Metadata [22.0 kB]
```

```
Get:37 http://security.ubuntu.com/ubuntu jammy-security/universe amd64 c-n-f Metadata [16.7 kB]
Fetched 8050 kB in 6s (1293 kB/s)
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
63 packages can be upgraded. Run 'apt list --upgradable' to see them.
labsuser@master:~$ apt-cache madison kubeadm
kubeadm | 1.28.3-1.1 | https://pkgs.k8s.io/core:/stable:/v1.28/deb Packages
kubeadm | 1.28.2-1.1 | https://pkgs.k8s.io/core:/stable:/v1.28/deb Packages
kubeadm | 1.28.1-1.1 | https://pkgs.k8s.io/core:/stable:/v1.28/deb Packages
kubeadm | 1.28.0-1.1 | https://pkgs.k8s.io/core:/stable:/v1.28/deb Packages
labsuser@master:~$
```

Choose the latest version from the output. In this case, pick version 1.28.3-1.1 for the upgrade.

1.2 Install the latest version of kubeadm by using the following command:

```
sudo apt-mark unhold kubeadm
sudo apt-get update
sudo apt-get install -y kubeadm='1.28.3-1.1'
sudo apt-mark hold kubeadm
```

```
labsuser@master:~$ sudo apt-mark unhold kubeadm
sudo apt-get update
sudo apt-get install -y kubeadm='1.28.3-1.1'
sudo apt-mark hold kubeadm
kubeadm was already not on hold.
Hit:1 http://us-west-2.ec2.archive.ubuntu.com/ubuntu jammy InRelease
Hit:2 http://us-west-2.ec2.archive.ubuntu.com/ubuntu jammy-updates InRelease
Hit:3 http://us-west-2.ec2.archive.ubuntu.com/ubuntu jammy-backports InRelease
Hit:4 http://security.ubuntu.com/ubuntu jammy-security InRelease
Hit:5 https://prod-cdn.packages.k8s.io/repositories/ipv:/kubernetes:/core:/stable:/v1.28/deb InRelease
Hit:6 https://ppa.launchpadcontent.net/mozillateam/ppa/ubuntu jammy InRelease
Reading package lists... Done
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following package was automatically installed and is no longer required:
  xul-ext-ubufox
Use 'sudo apt autoremove' to remove it.
The following packages will be upgraded:
  kubeadm
```

### 1.3 Enter the following command to check the kubeadm version: **kubeadm version**

```
Running kernel seems to be up-to-date.

No services need to be restarted.

No containers need to be restarted.

No user sessions are running outdated binaries.

No VM guests are running outdated hypervisor (qemu) binaries on this host.
kubeadm set on hold.
labsuser@master:~$ kubeadm version
kubeadm version: &Version.Info{Major:"1", Minor:"28", GitVersion:"v1.28.3", GitCommit:"a8a1abc25cad87333840cd7d54be2efaf31a3177", GitTreeState:"clean", BuildDate:"2023-10-18T11:40:47Z", GoVersion:"go1.20.10", Compiler:"gc", Platform:"linux/amd64"}
labsuser@master:~$
```

### 1.4 Run the following command to upgrade plan: **sudo kubeadm upgrade plan**

```
labsuser@master:~$ sudo kubeadm upgrade plan
[upgrade/config] Making sure the configuration is correct:
[upgrade/config] Reading configuration from the cluster...
[upgrade/config] FYI: You can look at this config file with 'kubectl -n kube-system get cm kubeadm-config -o yaml'
[preflight] Running pre-flight checks.
[upgrade] Running cluster health checks
[upgrade] Fetching available versions to upgrade to
[upgrade/versions] Cluster version: v1.28.3
[upgrade/versions] kubeadm version: v1.28.3
[upgrade/versions] Target version: v1.28.3
[upgrade/versions] Latest version in the v1.28 series: v1.28.3

labsuser@master:~$
```

### 1.5 Execute the following command to apply upgrade plan, and enter **y** to proceed: **sudo kubeadm upgrade apply v1.28.3**

```
labsuser@master:~$ sudo kubeadm upgrade apply v1.28.3
[upgrade/config] Making sure the configuration is correct:
[upgrade/config] Reading configuration from the cluster...
[upgrade/config] FYI: You can look at this config file with 'kubectl -n kube-system get cm kubeadm-config -o yaml'
[preflight] Running pre-flight checks.
[upgrade] Running cluster health checks
[upgrade/version] You have chosen to change the cluster version to "v1.28.3"
[upgrade/versions] Cluster version: v1.28.3
[upgrade/versions] kubeadm version: v1.28.3
[upgrade] Are you sure you want to proceed? [y/N]: y
[upgrade/prepull] Pulling images required for setting up a Kubernetes cluster
[upgrade/prepull] This might take a minute or two, depending on the speed of your internet connection
[upgrade/prepull] You can also perform this action in beforehand using 'kubeadm config images pull'
W1030 10:12:16.504652 23980 checks.go:835] detected that the sandbox image "k8s.gcr.io/pause:3.6" of the container runtime is inconsistent with th
at used by kubeadm. It is recommended that using "registry.k8s.io/pause:3.9" as the CRI sandbox image.
[upgrade/apply] Upgrading your Static Pod-hosted control plane to version "v1.28.3" (timeout: 5m0s)...
[upgrade/etcd] Upgrading to TLS for etcd
```

```
[upgrade] Backing up kubelet config file to /etc/kubernetes/backup/kubelet-kubelet-config-1.28.3-1.1.yaml
[kubelet-start] Writing kubelet configuration to file "/var/lib/kubelet/config.yaml"
[bootstrap-token] Configured RBAC rules to allow Node Bootstrap tokens to get nodes
[bootstrap-token] Configured RBAC rules to allow Node Bootstrap tokens to post CSRs in order for nodes to get long term certificate credentials
[bootstrap-token] Configured RBAC rules to allow the csrapprover controller automatically approve CSRs from a Node Bootstrap Token
[bootstrap-token] Configured RBAC rules to allow certificate rotation for all node client certificates in the cluster
[addons] Applied essential addon: CoreDNS
[addons] Applied essential addon: kube-proxy

[upgrade/successful] SUCCESS! Your cluster was upgraded to "v1.28.3". Enjoy!

[upgrade/kubelet] Now that your control plane is upgraded, please proceed with upgrading your kubelets if you haven't already done so.
labsuser@master:~$
```

- 1.6 Run the following command to ignore daemonsets:  
**kubectldrain master.example.com --ignore-daemonsets**

```
[upgrade/kubelet] Now that your control plane is upgraded, please proceed with upgrading your kubelets if you haven't already done so.
labsuser@master:~$ kubectldrain master.example.com --ignore-daemonsets
node/master.example.com cordoned
Warning: ignoring DaemonSet-managed Pods: kube-system/calico-node-qk97m, kube-system/kube-proxy-bfns9
evicting pod kube-system/coredns-5dd5756b68-vqkjm
evicting pod kube-system/calico-kube-controllers-7ddc4f45bc-dv8lz
evicting pod kube-system/coredns-5dd5756b68-6mc7q
pod/calico-kube-controllers-7ddc4f45bc-dv8lz evicted
pod/coredns-5dd5756b68-6mc7q evicted
pod/coredns-5dd5756b68-vqkjm evicted
node/master.example.com drained
labsuser@master:~$
```

- 1.7 Run the following commands to install kubectld:  
**sudo apt-mark unhold kubelet kubectld**  
**sudo apt-get update**  
**sudo apt-get install -y kubelet='1.28.3-1.1' kubectld='1.28.3-1.1'**  
**sudo apt-mark hold kubelet kubectld**

```
labsuser@master:~$ sudo apt-mark unhold kubelet kubectld
sudo apt-get update
sudo apt-get install -y kubelet='1.28.3-1.1' kubectld='1.28.3-1.1'
sudo apt-mark hold kubelet kubectld
kubelet was already not on hold.
kubectld was already not on hold.
Hit:1 http://us-west-2.ec2.archive.ubuntu.com/ubuntu jammy InRelease
Get:2 http://us-west-2.ec2.archive.ubuntu.com/ubuntu jammy-updates InRelease [119 kB]
Hit:3 http://us-west-2.ec2.archive.ubuntu.com/ubuntu jammy-backports InRelease
Hit:4 https://prod-cdn.packages.k8s.io/repositories/isv:/kubernetes:/core:/stable:/v1.28/deb InRelease
Get:5 http://us-west-2.ec2.archive.ubuntu.com/ubuntu jammy-updates/main amd64 c-n-f Metadata [16.1 kB]
Hit:6 https://ppa.launchpadcontent.net/mozillateam/ppa/ubuntu jammy InRelease
0% [Waiting for headers]
```

```
Restarting services...
systemctl restart kubelet.service

No containers need to be restarted.

No user sessions are running outdated binaries.

No VM guests are running outdated hypervisor (qemu) binaries on this host.
kubelet set on hold.
kubelet set on hold.
labsuser@master:~$
```

1.8 Run the following command to get nodes:

**kubectl get nodes**

```
labsuser@master:~$ kubectl get nodes
NAME                                STATUS              ROLES    AGE   VERSION
master.example.com                 Ready,SchedulingDisabled control-plane 52m   v1.28.3
worker-node-1.example.com         Ready               <none>    51m   v1.28.2
worker-node-2.example.com         Ready               <none>    49m   v1.28.2
labsuser@master:~$
```

1.9 Enter the following commands to restart the kubelet:

**sudo systemctl daemon-reload**

**sudo systemctl restart kubelet**

```
labsuser@master:~$ kubectl get nodes
NAME                                STATUS              ROLES    AGE   VERSION
master.example.com                 Ready,SchedulingDisabled control-plane 52m   v1.28.3
worker-node-1.example.com         Ready               <none>    51m   v1.28.2
worker-node-2.example.com         Ready               <none>    49m   v1.28.2
labsuser@master:~$ sudo systemctl daemon-reload
sudo systemctl restart kubelet
labsuser@master:~$
```

1.10 Execute the following commands to get nodes:

**kubectl uncordon master.example.com**

**kubectl get nodes**

```
labsuser@master:~$ kubectl get nodes
NAME                                STATUS              ROLES    AGE   VERSION
master.example.com                 Ready,SchedulingDisabled control-plane 52m   v1.28.3
worker-node-1.example.com         Ready               <none>    51m   v1.28.2
worker-node-2.example.com         Ready               <none>    49m   v1.28.2

labsuser@master:~$ sudo systemctl daemon-reload
sudo systemctl restart kubelet

labsuser@master:~$ kubectl uncordon master.example.com
node/master.example.com uncordoned

labsuser@master:~$ kubectl get nodes
NAME                                STATUS    ROLES    AGE   VERSION
master.example.com                 Ready     control-plane 59m   v1.28.3
worker-node-1.example.com         Ready     <none>    58m   v1.28.2
worker-node-2.example.com         Ready     <none>    56m   v1.28.2

labsuser@master:~$
```

## Step 2: Upgrade the worker node

2.1 Run the following command to update the worker node-1:

**sudo apt-get update**

```
labsuser@worker-node-1:~$ sudo apt-get update
Hit:1 http://us-west-2.ec2.archive.ubuntu.com/ubuntu jammy InRelease
Get:2 http://us-west-2.ec2.archive.ubuntu.com/ubuntu jammy-updates InRelease [119 kB]
Get:3 http://us-west-2.ec2.archive.ubuntu.com/ubuntu jammy-backports InRelease [109 kB]
Get:4 http://security.ubuntu.com/ubuntu jammy-security InRelease [110 kB]
Get:5 https://prod-cdn.packages.k8s.io/repositories/iscv:/kubernetes:/core:/stable:/v1.28/deb InRelease [1186 B]
Get:6 http://us-west-2.ec2.archive.ubuntu.com/ubuntu jammy-updates/main amd64 Packages [1107 kB]
Get:7 http://us-west-2.ec2.archive.ubuntu.com/ubuntu jammy-updates/main Translation-en [240 kB]
Get:8 http://us-west-2.ec2.archive.ubuntu.com/ubuntu jammy-updates/main amd64 DEP-11 Metadata [101 kB]
Get:9 http://us-west-2.ec2.archive.ubuntu.com/ubuntu jammy-updates/main amd64 c-n-f Metadata [16.1 kB]
Get:10 http://us-west-2.ec2.archive.ubuntu.com/ubuntu jammy-updates/restricted amd64 Packages [1037 kB]
Get:11 http://us-west-2.ec2.archive.ubuntu.com/ubuntu jammy-updates/restricted Translation-en [168 kB]
Get:12 http://us-west-2.ec2.archive.ubuntu.com/ubuntu jammy-updates/restricted amd64 c-n-f Metadata [536 B]
Get:13 http://us-west-2.ec2.archive.ubuntu.com/ubuntu jammy-updates/universe amd64 Packages [995 kB]
Get:14 https://ppa.launchpadcontent.net/mozillateam/ppa/ubuntu jammy InRelease [23.8 kB]
Get:15 http://us-west-2.ec2.archive.ubuntu.com/ubuntu jammy-updates/universe Translation-en [218 kB]
```

2.2 Run the following command to install kubeadm latest version:

```
sudo apt-mark unhold kubeadm
sudo apt-get update
sudo apt-get install -y kubeadm='1.28.3-1.1'
sudo apt-mark hold kubeadm
```

```
labsuser@worker-node-1:~$ sudo apt-mark unhold kubeadm
sudo apt-get update
sudo apt-get install -y kubeadm='1.28.3-1.1'
sudo apt-mark hold kubeadm
kubeadm was already not on hold.
Hit:1 http://us-west-2.ec2.archive.ubuntu.com/ubuntu jammy InRelease
Hit:2 http://us-west-2.ec2.archive.ubuntu.com/ubuntu jammy-updates InRelease
Hit:3 http://us-west-2.ec2.archive.ubuntu.com/ubuntu jammy-backports InRelease
Hit:5 http://security.ubuntu.com/ubuntu jammy-security InRelease
Hit:4 https://prod-cdn.packages.k8s.io/repositories/isv:/kubernetes:/core:/stable:/v1.28/deb InRelease
Hit:6 https://ppa.launchpadcontent.net/mozillateam/ppa/ubuntu jammy InRelease
Reading package lists... 98%
```

2.3 Run the following command to get version:

```
kubeadm version
```

```
Restarting services...
Service restarts being deferred:
systemctl restart user@1001.service

No containers need to be restarted.

No user sessions are running outdated binaries.

No VM guests are running outdated hypervisor (qemu) binaries on this host.
kubeadm set on hold.
labsuser@worker-node-1:~$ kubeadm version
kubeadm version: &version.Info{Major:"1", Minor:"28", GitVersion:"v1.28.3", GitCommit:"a8a1abc25cad87333840cd7d54be2efaf31a3177", GitTreeState:"clean", BuildDate:"2023-10-18T11:40:47Z", GoVersion:"go1.20.10", Compiler:"gc", Platform:"linux/amd64"}
labsuser@worker-node-1:~$
```

2.4 Run the following command to upgrade node:

**sudo kubeadm upgrade node**

```
labsuser@worker-node-1:~$ kubeadm version
kubeadm version: &version.Info{Major:"1", Minor:"28", GitVersion:"v1.28.3", GitCommit:"a8a1abc25cad87333840cd7d54n", BuildDate:"2023-10-18T11:40:47Z", GoVersion:"go1.20.10", Compiler:"gc", Platform:"linux/amd64"}
labsuser@worker-node-1:~$ sudo kubeadm upgrade node
[upgrade] Reading configuration from the cluster...
[upgrade] FYI: You can look at this config file with 'kubectl -n kube-system get cm kubeadm-config -o yaml'
[preflight] Running pre-flight checks
[preflight] Skipping prepull. Not a control plane node.
[upgrade] Skipping phase. Not a control plane node.
[upgrade] Backing up kubelet config file to /etc/kubernetes/tmp/kubeadm-kubelet-config2672924279/config.yaml
[kubelet-start] Writing kubelet configuration to file "/var/lib/kubelet/config.yaml"
[upgrade] The configuration for this node was successfully updated!
[upgrade] Now you should go ahead and upgrade the kubelet package using your package manager.
labsuser@worker-node-1:~$
```

2.5 Run the following command to delete pods:

**kubectl drain worker-node-1.example.com --ignore-daemonsets --delete-emptydir-data**

```
labsuser@master:~$ kubectl drain worker-node-1.example.com --ignore-daemonsets --delete-emptydir-data
node/worker-node-1.example.com cordoned
error: unable to drain node "worker-node-1.example.com" due to error:cannot delete Pods declare no controller (use --force to override): default/test-pod, continuing command...
There are pending nodes to be drained:
worker-node-1.example.com
cannot delete Pods declare no controller (use --force to override): default/test-pod
labsuser@master:~$
```

**Note:** If you encounter an error stating some pods cannot be deleted, use the **--force** option to override.



2.6 Run the following commands to drain the worker-node-1:

**kubectyl get nodes**

**kubectyl drain worker-node-1.example.com --ignore-daemonsets --delete-emptydir-data --force**

```
labsuser@master:~$ kubectyl get nodes
NAME                STATUS    ROLES    AGE   VERSION
master.example.com   Ready     control-plane  107m  v1.28.3
worker-node-1.example.com Ready     <none>      106m  v1.28.2
worker-node-2.example.com Ready     <none>      105m  v1.28.2

labsuser@master:~$ kubectyl drain worker-node-1.example.com --ignore-daemonsets --delete-emptydir-data -force
error: unknown shorthand flag: 'f' in -force
See 'kubectyl drain --help' for usage.

labsuser@master:~$ kubectyl drain worker-node-1.example.com --ignore-daemonsets --delete-emptydir-data --force
node/worker-node-1.example.com cordoned
Warning: ignoring DaemonSet-managed Pods: kube-system/calico-node-flx69, kube-system/kube-proxy-n6918
evicting pod kube-system/coredns-5dd5756b68-gwdrj
evicting pod kube-system/calico-kube-controllers-7ddc4f45bc-8fvqk
pod/calico-kube-controllers-7ddc4f45bc-8fvqk evicted
pod/coredns-5dd5756b68-gwdrj evicted
node/worker-node-1.example.com drained
labsuser@master:~$
```

2.7 Install the latest versions of kubelet and kubectyl by using following commands:

**sudo apt-mark unhold kubelet kubectyl**

**sudo apt-get update**

**sudo apt-get install -y kubelet='1.28.3-1.1' kubectyl='1.28.3-1.1'**

**sudo apt-mark hold kubelet kubectyl**

```
labsuser@worker-node-1:~$ sudo apt-mark unhold kubelet kubectyl
sudo apt-get update
sudo apt-get install -y kubelet='1.28.3-1.1' kubectyl='1.28.3-1.1'
sudo apt-mark hold kubelet kubectyl
kubelet was already not on hold.
kubectyl was already not on hold.
Hit:1 http://us-west-2.ec2.archive.ubuntu.com/ubuntu jammy InRelease
Get:2 http://us-west-2.ec2.archive.ubuntu.com/ubuntu jammy-updates InRelease [119 kB]
Hit:3 http://us-west-2.ec2.archive.ubuntu.com/ubuntu jammy-backports InRelease
Hit:5 http://security.ubuntu.com/ubuntu jammy-security InRelease
Hit:4 https://prod-cdn.packages.k8s.io/repositories/iscv:/kubernetes:/core:/stable:/v1.28/deb InRelease
Hit:6 https://ppa.launchpadcontent.net/mozillateam/ppa/ubuntu jammy InRelease
Fetched 119 kB in 1s (128 kB/s)
Reading package lists... Done
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following packages will be upgraded:
  kubectyl kubelet
```

2.8 Enter the following commands to restart kubelet:

```
sudo systemctl daemon-reload
```

```
sudo systemctl restart kubelet
```

```
No containers need to be restarted.

No user sessions are running outdated binaries.

No VM guests are running outdated hypervisor (qemu) binaries on this host.
kubelet set on hold.
kubectl set on hold.
labsuser@worker-node-1:~$ sudo systemctl daemon-reload
sudo systemctl restart kubelet
labsuser@worker-node-1:~$
```

2.9 On the master node enter the following commands:

```
kubectl get nodes
```

```
kubectl uncordon worker-node-1.example.com
```

```
labsuser@master:~$ kubectl get nodes
NAME                                STATUS              ROLES    AGE   VERSION
master.example.com                  Ready              control-plane  120m  v1.28.3
worker-node-1.example.com           Ready,SchedulingDisabled <none>    119m  v1.28.3
worker-node-2.example.com           Ready              <none>    117m  v1.28.2
labsuser@master:~$ kubectl uncordon worker-node-1.example.com
node/worker-node-1.example.com uncordoned
labsuser@master:~$
```

The cluster and worker nodes are now successfully upgraded to v1.28.3.

### Step 3: Validate the cluster upgrade by creating a pod

3.1 Deploy a test pod and view the deployed pods by using following commands:

```
kubectl run test-pod --image nginx --port 80
```

```
kubectl get pods -o wide
```

```
labsuser@master:~$ kubectl get nodes
NAME                                STATUS    ROLES    AGE   VERSION
master.example.com                  Ready     control-plane  120m   v1.28.3
worker-node-1.example.com           Ready,SchedulingDisabled  <none>  119m   v1.28.3
worker-node-2.example.com           Ready     <none>     117m   v1.28.2
labsuser@master:~$ kubectl uncordon worker-node-1.example.com
node/worker-node-1.example.com uncordoned
labsuser@master:~$ kubectl run test-pod --image nginx --port 80
pod/test-pod created
labsuser@master:~$ kubectl get pods -o wide
NAME    READY   STATUS    RESTARTS   AGE   IP            NODE                NOMINATED NODE   READINESS GATES
test-pod 1/1     Running   0          6s    172.16.47.132 worker-node-1.example.com <none>           <none>
```

By following these steps, you have successfully navigated the process of upgrading both the Kubernetes control plane and worker nodes to version v1.28.3.