Requirements and System Configuration for Installing Kubernetes on Ubuntu

The Kubernetes cluster consists of master nodes and worker nodes. Hardware configuration depends on your needs and the applications that you are planning to run in Docker containers. The minimum hardware requirements for installing Kubernetes on Ubuntu are:

- At least a 2-core x86/x64 CPU
- 2 GB of RAM or more (preferably 4 GB or more)

Ports that must be opened for installing Kubernetes on Ubuntu:

- **TCP 443** - Kubernetes API Server
- **TCP 10250** - Worker node Kubelet health check port
- **TCP 30000-32767** - Default port range for providing external services
- **UDP 8285** - UDP backend of Flannel overlay network
- **UDP 8472** - VXLAN backend of Flannel overlay network
- **TCP 2379-2380** - etcd server client API

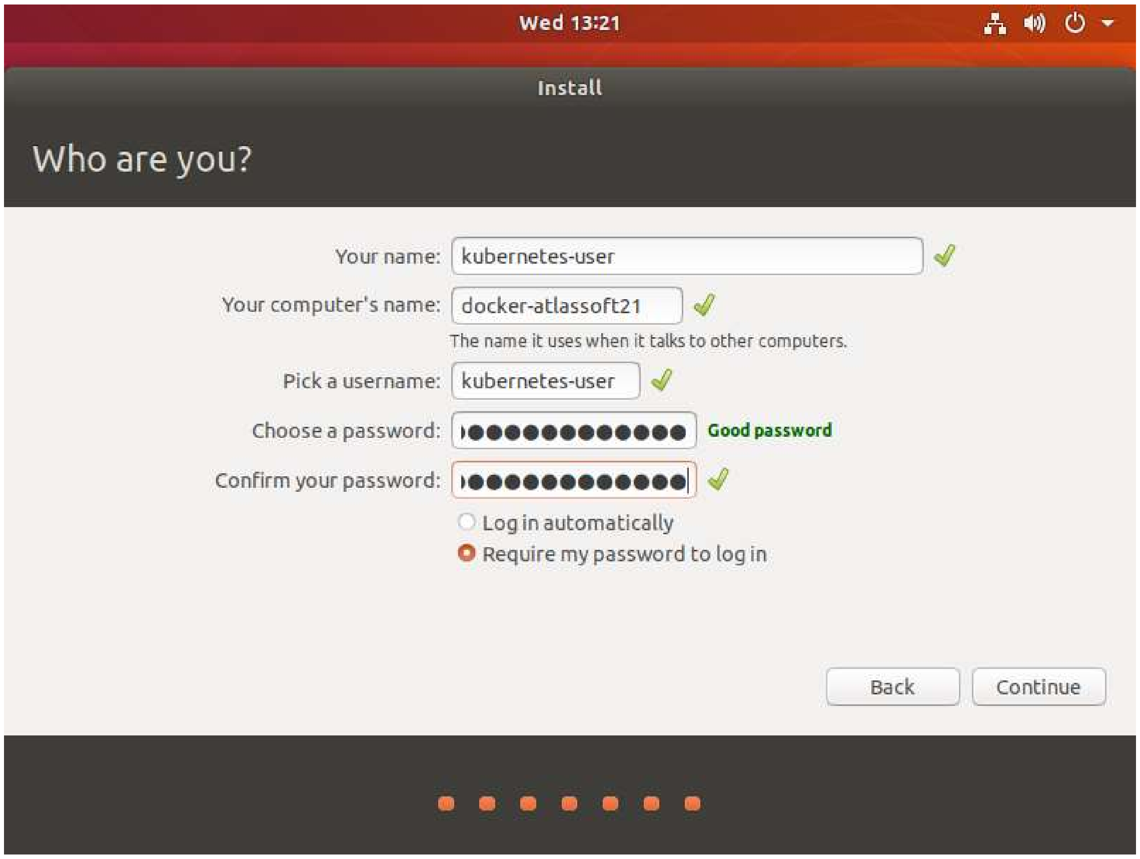
We have installed Kubernetes on Ubuntu 18.04 LTS that is running on ESXi. The first explained Kubernetes deployment type is with a master node, and two worker nodes are used for the Kubernetes cluster. Please check the table below to view conditional numbers of nodes, node roles, hostnames and IP addresses of the machines used in the considered example.

Node role	**IP Address**	**Host name**
Master	192.168.100.21	docker-atlassoft21
Worker	192.168.100.31	docker-atlassoft31
Worker	192.168.100.32	docker-atlassoft32

The IP address of the host machine: 14.99.27.198
The IP address of the virtual gateway for the NAT network (VMNet8): 192.168.100.1
The same Linux user exists on all Ubuntu machines: kubernetes-user
VM configuration: 2CPU, 4GB RAM, 20-GB virtual disk

Deploying the Ubuntu VM

Create a new VM named is docker-atlassoft21.
Install Ubuntu 64-bit on the first machine, and set the host name and user name.
VM name: docker-atlassoft21
Username: kubernetes-user



Who are you?

Your name: kubernetes-user

Your computer's name: docker-atlassoft21

The name it uses when it talks to other computers.

Pick a username: kubernetes-user

Choose a password: ●●●●●●●●●●●●● Good password

Confirm your password: ●●●●●●●●●●●●●

Log in automatically [✓ Require my password to log in]

Now install VMware Tools from the ISO image provided with the VMware hypervisor or from Linux repositories (explained below).

$ sudo apt-get install open-vm-tools

Reboot the VM.

Configure the Ubuntu Machine Before Installing Kubernetes

Some preparations must be made before installing Kubernetes on Ubuntu machines. First of all, you must configure the static IP address and the host name for any usual server.

Set the static IP address:

Install Linux networking tools before setting the IP address.

$ sudo apt-get install net-tools

Type **ifconfig** to check the current IP address of the Ubuntu VM.

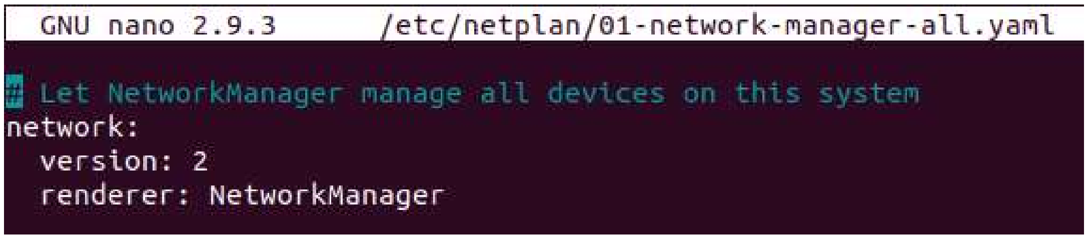
Next install vim as the text editor.

$ sudo apt-get install vim

In the latest Ubuntu versions, network configuration is set in the yaml file. Open the network configuration yaml file in vim.

$ sudo vim /etc/netplan/01-network-manager-all.yaml

The default view of the configuration file is:



```
  GNU nano 2.9.3      /etc/netplan/01-network-manager-all.yaml

# Let NetworkManager manage all devices on this system
network:
  version: 2
  renderer: NetworkManager
```

Edit this network configuration file as shown below:

```
network:
        version: 2
        renderer: networkd
        ethernets:
                ens33:
                        dhcp4: no
                        addresses: [192.168.100.21/24]
                        gateway4: 192.168.100.1
                        nameservers:
                                addresses: [192.168.100.1,8.8.8.8]
```

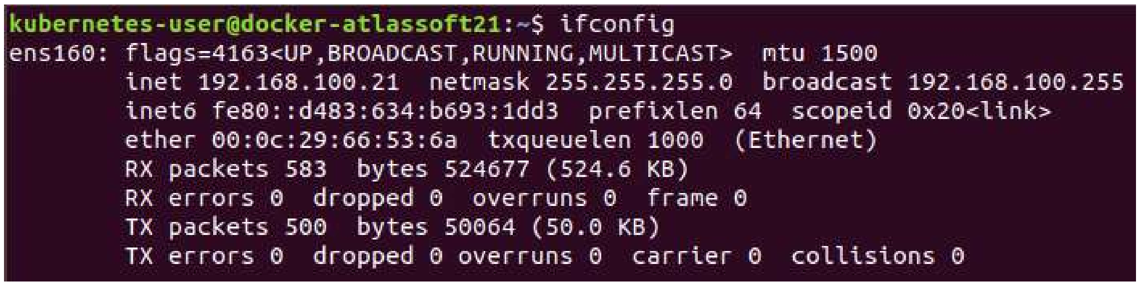
Save changes and exit.

$ sudo netplan try

Press ENTER to accept the new configuration.

Check whether your network configuration has been changed and try to ping, for example, google.com.

$ ifconfig



```
kubernetes-user@docker-atlassoft21:~$ ifconfig
ens160: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.100.21  netmask 255.255.255.0  broadcast 192.168.100.255
        inet6 fe80::d483:634:b693:1dd3  prefixlen 64  scopeid 0x20<link>
        ether 00:0c:29:66:53:6a  txqueuelen 1000  (Ethernet)
        RX packets 583  bytes 524677 (524.6 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 500  bytes 50064 (50.0 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

$ ping google.com

Disable a swap file:
Using a swap file (swap partition) is not supported by Kubernetes and disabling swapiness is necessary to install Kubernetes on Ubuntu successfully.

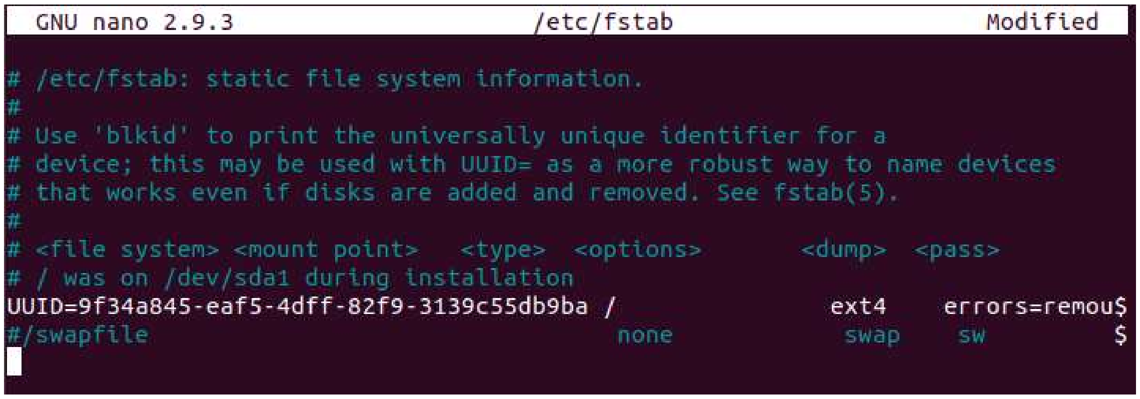
Disable a swap file to prevent kubelet high CPU usage.

$ sudo swapoff -a

Edit /etc/fstab and comment the string by using the # character.

$ sudo nano /etc/fstab

#/swapfile none swap sw 0 0



```
  GNU nano 2.9.3                  /etc/fstab                         Modified

# /etc/fstab: static file system information.
#
# Use 'blkid' to print the universally unique identifier for a
# device; this may be used with UUID= as a more robust way to name devices
# that works even if disks are added and removed. See fstab(5).
#
# <file system> <mount point>   <type>  <options>       <dump>  <pass>
# / was on /dev/sda1 during installation
UUID=9f34a845-eaf5-4dff-82f9-3139c55db9ba /               ext4    errors=remou$
#/swapfile                                 none            swap    sw          $
```

Disable swap in sysctl.conf

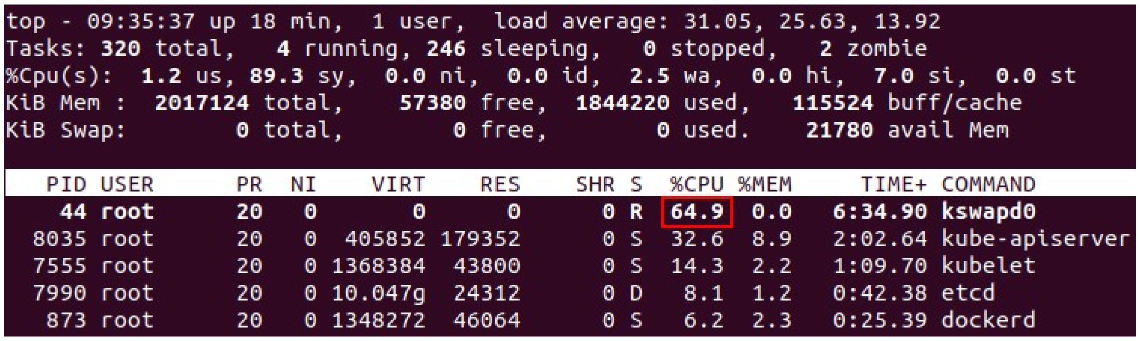
$ sudo echo "vm.swappiness=0" | sudo tee --append /etc/sysctl.conf

Where 0 is the percent of swapiness. In this case swap can be used only if you are out of RAM (by default swap is used when more that 60% of RAM is full).

Apply configuration changes without reboot.

$ sudo sysctl -p

If the swap partition is not disabled, the kswapd0 process of Ubuntu Linux running Kubernetes can consume a large amount of CPU resources on the machine, causing applications to become unresponsive, and the system to hang. This happens when the operating system runs out of memory, and the old memory pages are moved to swap by a Linux kernel system process. For strange reasons, sometimes things go wrong, and a never-ending loop that consumes all CPU resources occurs. On the screenshot below, high CPU consumption by the kswapd0 process when Kubernetes is installed on Ubuntu. The load average value is excessively high.



```
top - 09:35:37 up 18 min,  1 user,  load average: 31.05, 25.63, 13.92
Tasks: 320 total,   4 running, 246 sleeping,   0 stopped,   2 zombie
%Cpu(s):  1.2 us, 89.3 sy,  0.0 ni,  0.0 id,  2.5 wa,  0.0 hi,  7.0 si,  0.0 st
KiB Mem :  2017124 total,    57380 free,  1844220 used,   115524 buff/cache
KiB Swap:        0 total,        0 free,        0 used.    21780 avail Mem

  PID USER      PR  NI    VIRT    RES    SHR S  %CPU %MEM     TIME+ COMMAND
   44 root      20   0       0      0      0 R  64.9  0.0   6:34.90 kswapd0
 8035 root      20   0  405852 179352      0 S  32.6  8.9   2:02.64 kube-apiserver
 7555 root      20   0 1368384  43800      0 S  14.3  2.2   1:09.70 kubelet
 7990 root      20   0 10.047g  24312      0 D   8.1  1.2   0:42.38 etcd
  873 root      20   0 1348272  46064      0 S   6.2  2.3   0:25.39 dockerd
```

If kswapd0 still overloads your CPU, run the following command to invalidate all memory cashes and stop kswapd0 (execute as root).

# echo 1 > /proc/sys/vm/drop_caches

Shutdown the VM.

This partially configured virtual machine (docker-atlassoft21) is about to be used as a master node. Create two machines to be used as worker nodes. If you use physical machines, repeat the previous steps manually (or use automation tools such as Ansible for configuring multiple Linux machines simultaneously via SSH). As VMs are used in the current example, they can be cloned to save time during preparing environment for installing Kubernetes on Ubuntu machines.

Clone the VM

Clone the first VM. And change the hostname to docker-atlassoft31

Check your current hostname.

$ hostnamectl

Change the hostname

$ sudo hostnamectl set-hostname docker-atlassoft31

Check that a new hostname is applied.

$ less /etc/hostname

Edit the hosts file.

$ sudo nano /etc/hosts

The contents of the host’s file must look like this:

127.0.0.1 localhost

127.0.1.1 docker-atlassoft31

Restart the machine.

Do the same thing to create the other host as docker-atlassoft32

Configuring IP Addresses and Host Names on VMs

Change the IP address and hostname on docker-atlassoft31 and docker-atlassoft32 VMs (as shown above).
Repeat the steps explained in the above sections to configure the static IP addresses and hostnames.

The IP address must be: 192.168.100.31 and 192.168.100.32; the hostnames must be docker-atlassoft31 and docker- atlassoft32 accordingly on worker nodes.

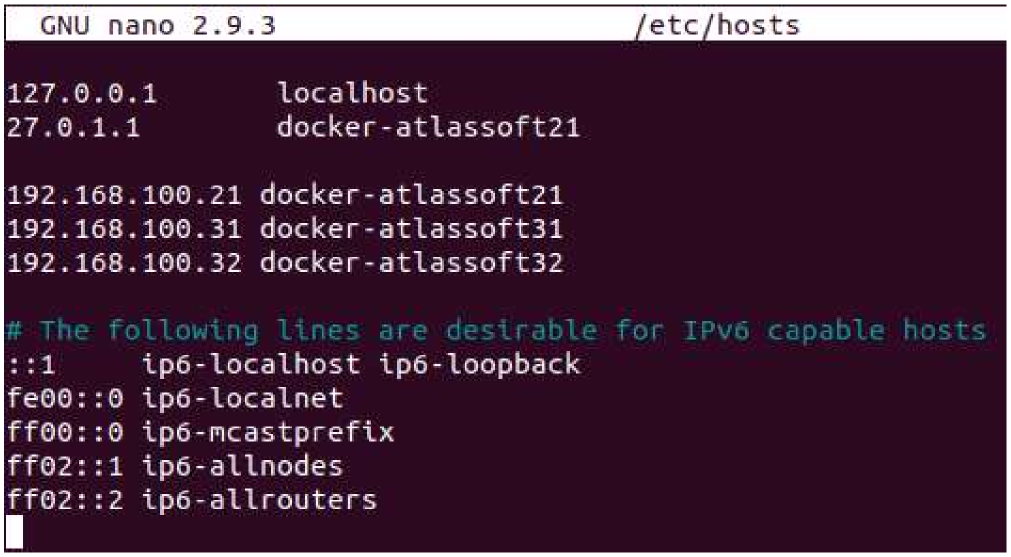
All machines must be configured for resolving hostnames of nodes to IP addresses. You can configure a DNS server or manually edit the hosts file on each machine. Let's edit hosts.

Add the following strings to the hosts file on each machine (docker-atlassoft21, docker- atlassoft31, docker- atlassoft32).

$ sudo nano /etc/hosts

Add these lines to the hosts file:

192.168.100.21 docker-atlassoft21
192.168.100.31 docker- atlassoft31
192.168.100.32 docker- atlassoft32



```
  GNU nano 2.9.3                    /etc/hosts

127.0.0.1       localhost
27.0.1.1        docker-atlassoft21

192.168.100.21 docker-atlassoft21
192.168.100.31 docker-atlassoft31
192.168.100.32 docker-atlassoft32

# The following lines are desirable for IPv6 capable hosts
::1     ip6-localhost ip6-loopback
fe00::0 ip6-localnet
ff00::0 ip6-mcastprefix
ff02::1 ip6-allnodes
ff02::2 ip6-allrouters
```

Ping other hosts from each host to ensure that the hostnames are resolved:

$ ping docker-atlassoft21

$ ping docker- atlassoft31

$ ping docker- atlassoft32

Configure SSH Access on All Hosts (VMs)

Configure SSH access on all hosts. Install the OpenSSH server by executing the commands on each machine.

$ sudo apt-get install openssh-server

Go to the home directory of kubernetes-user and generate the SSH key pair (a set of cryptographic keys which consists of a private key and public key). SSH key pairs can be used to access the remote Linux console via SSH without using passwords. The public key can be copied to a machine from which you need to connect remotely, while the private key is highly secret and must be stored on the machine to which you need to connect.

$ ssh-keygen

It is not necessary to enter the password for key generating (the password is optional).
Copy the keys to other Ubuntu machines:

$ ssh-copy-id kubernetes-user@192.168.100.31

$ ssh-copy-id kubernetes-user@192.168.100.32

Enter the user password to confirm copying the keys.

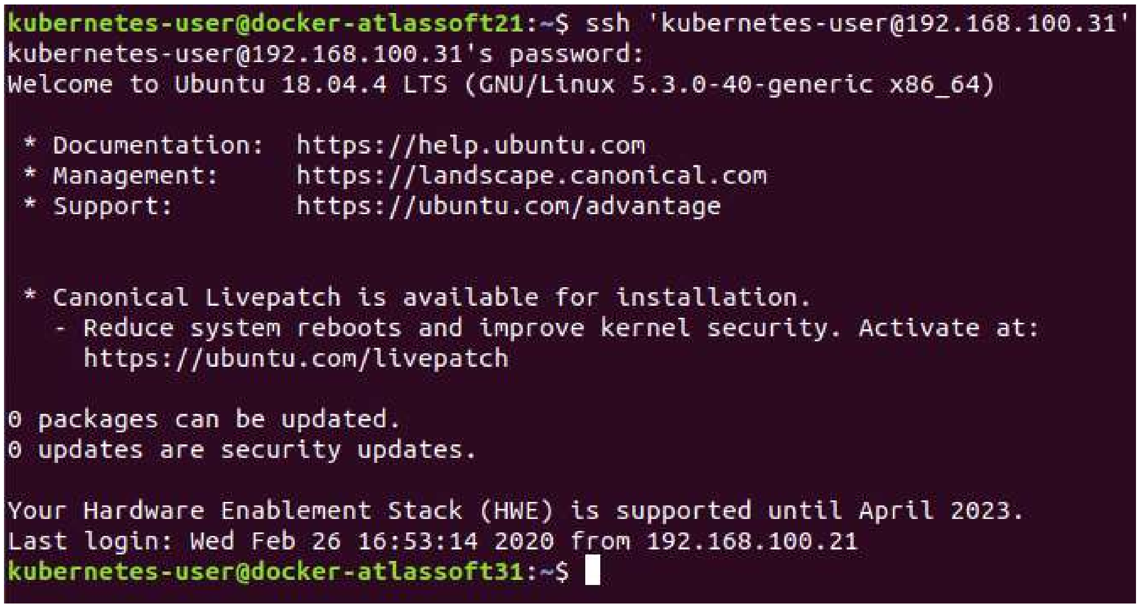
Try to connect to the second machine (docker-atlassoft31) as kubernetes-user (that is a regular user).

$ ssh 'kubernetes-user@192.168.100.31'

Then test connection to the third machine (docker-atlassoft32).

$ ssh 'kubernetes-user@192.168.100.32'

You will see the name of the remote machine in the command prompt of your console after successful connection.



```
kubernetes-user@docker-atlassoft21:~$ ssh 'kubernetes-user@192.168.100.31'
kubernetes-user@192.168.100.31's password:
Welcome to Ubuntu 18.04.4 LTS (GNU/Linux 5.3.0-40-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage


 * Canonical Livepatch is available for installation.
   - Reduce system reboots and improve kernel security. Activate at:
     https://ubuntu.com/livepatch

0 packages can be updated.
0 updates are security updates.

Your Hardware Enablement Stack (HWE) is supported until April 2023.
Last login: Wed Feb 26 16:53:14 2020 from 192.168.100.21
kubernetes-user@docker-atlassoft31:~$
```

Press Ctrl + D to exit from the remote console.

Copy the key for connecting via SSH as a root user

Root privileges are needed in Kubernetes, let's create keys for configuring SSH access for root. Execute the following commands on all machines (docker-atlassoft21, docker- atlassoft31 and docker-atlassoft32) that need to be accessed via SSH as a root user.

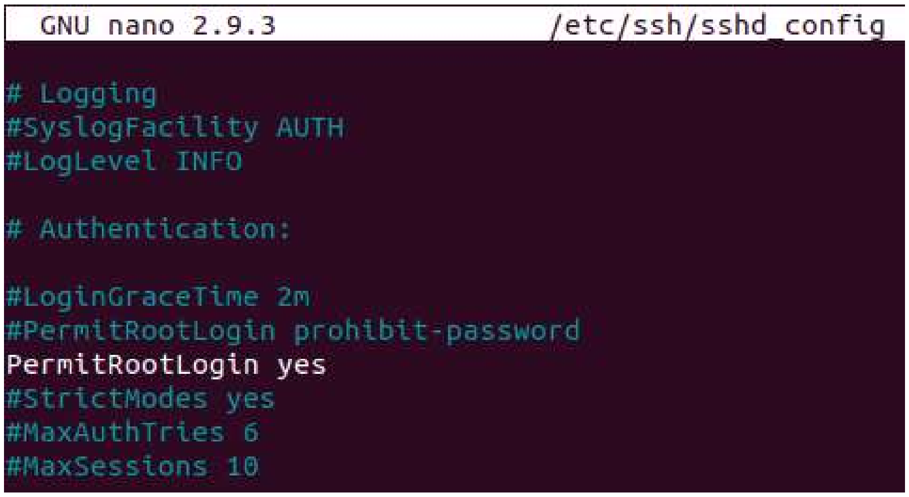
$ sudo -i

Edit the SSH server configuration file.

# nano /etc/ssh/sshd_config

Add/edit the following string to this file.

PermitRootLogin yes



```
  GNU nano 2.9.3                    /etc/ssh/sshd_config

# Logging
#SyslogFacility AUTH
#LogLevel INFO

# Authentication:

#LoginGraceTime 2m
#PermitRootLogin prohibit-password
PermitRootLogin yes
#StrictModes yes
#MaxAuthTries 6
#MaxSessions 10
```

Restart the SSH server daemon.

```
# /etc/init.d/ssh stop
# /etc/init.d/ssh start
```

Set the root password (password for the root user).

```
# passcode
```

```
$ cd /home/kubernetes-user/
```

```
$ sudo ssh-keygen -t rsa
```

Copy the public key to be able to login remotely via SSH as root (the key is stored in the home directory of the regular user since the previous command was run from that directory).

```
$ sudo ssh-copy-id -i /home/kubernetes-user/.ssh/id_rsa.pub 127.0.0.1
```

If key is saved into the home directory of the root user, copy the key with this command:

```
# ssh-copy-id -i /root/.ssh/id_rsa.pub 127.0.0.1
```

Confirm this operation and enter your password.

Repeat the action, copying the key from each machine to other machines. For instance, on the docker-atlassoft21 machine execute:

```
# ssh-copy-id -i /root/.ssh/id_rsa.pub 192.168.101.31
# ssh-copy-id -i /root/.ssh/id_rsa.pub 192.168.101.32
```

Make the public key authorized.

# cat /root/.ssh/id_rsa.pub >> /root/.ssh/authorized_keys

Verify whether you can log in as root via SSH on the local machine.

$ sudo ssh root@127.0.0.1

Try to connect from/to the remote machine without entering a password.

$ sudo ssh root@192.168.101.21

$ sudo ssh root@192.168.101.31

$ sudo ssh root@192.168.101.32

Docker Installation

Install Docker on all machines. Execute commands shown below on docker-atlassoft21, docker-atlassoft31, docker-atlassoft32.
Simply install Docker by using the usual command:

$ sudo apt-get install -y docker.io

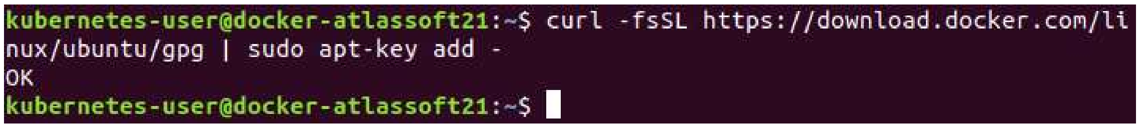
Still, in this case, the version of Docker used may not be the latest. Let's remedy that by installing the latest version of Docker.
First, install the required packages.

$ sudo apt-get install apt-transport-https ca-certificates curl software-properties-common

Add the GPG key for the official Docker repository to the Ubuntu system:

$ curl -fsSL https://download.docker.com/linux/ubuntu/gpg | sudo apt-key add -

The console output must be OK.



```
kubernetes-user@docker-atlassoft21:~$ curl -fsSL https://download.docker.com/li
nux/ubuntu/gpg | sudo apt-key add -
OK
kubernetes-user@docker-atlassoft21:~$
```

Add the official Docker repository to the apt package manager:

$ sudo add-apt-repository "deb [arch=amd64] https://download.docker.com/linux/ubuntu bionic stable"

Update the database of the package manager after manual changes have been made by the previous command.

$ sudo apt-get update

Check the version of the Docker package available in the official repository.

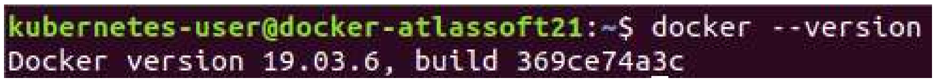
$ apt-cache policy docker-ce

Install Docker.

$ sudo apt-get install docker-ce

You can check the version of Docker after installation.

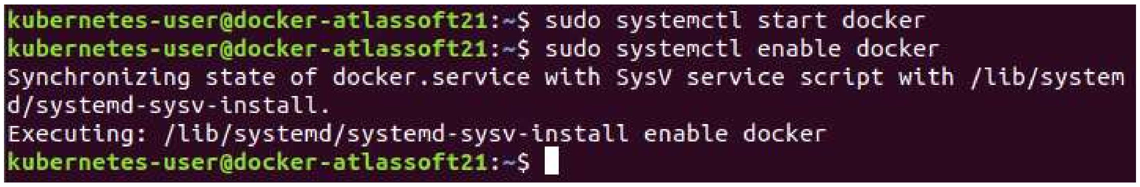
$ docker --version



```
kubernetes-user@docker-atlassoft21:~$ docker --version
Docker version 19.03.6, build 369ce74a3c
```

Start Docker and make its daemon loadable automatically on system startup.

$ sudo systemctl start docker
$ sudo systemctl enable docker



```
kubernetes-user@docker-atlassoft21:~$ sudo systemctl start docker
kubernetes-user@docker-atlassoft21:~$ sudo systemctl enable docker
Synchronizing state of docker.service with SysV service script with /lib/system
d/systemd-sysv-install.
Executing: /lib/systemd/systemd-sysv-install enable docker
kubernetes-user@docker-atlassoft21:~$
```

Once installed Docker on all machines, you can go directly to the step of installing Kubernetes on Ubuntu.

Installing Kubernetes on Ubuntu and Cluster Initialization

Run the commands as root on all machines to be included into the Kubernetes cluster.

$ sudo -i

Add the GPG key for the official Docker repository to your Ubuntu system:

# curl -s https://packages.cloud.google.com/apt/doc/apt-key.gpg | apt-key add -

Add the official Kubernetes repository to the database of available package repositories for your apt package manager.

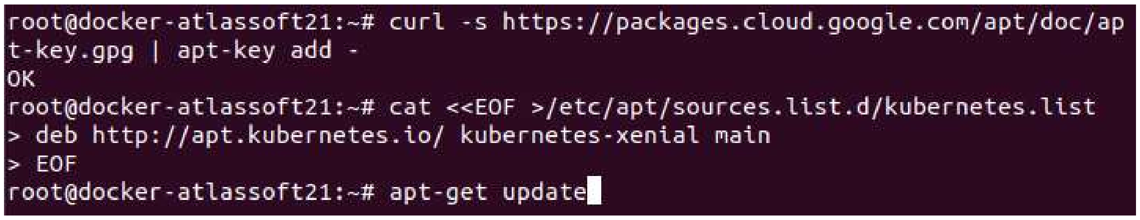
# cat <<EOF >/etc/apt/sources.list.d/kubernetes.list
> deb http://apt.kubernetes.io/ kubernetes-xenial main
> EOF

As an alternative, you can add the repository with this command:

# echo 'deb http://apt.kubernetes.io/ kubernetes-xenial main' | sudo tee /etc/apt/sources.list.d/kubernetes.list

Where tee is a tool that reads the standard input and writes the input data to standard output and defined files.
Update the package list of available repositories on your Ubuntu system.

# apt-get update



```
root@docker-atlassoft21:~# curl -s https://packages.cloud.google.com/apt/doc/ap
t-key.gpg | apt-key add -
OK
root@docker-atlassoft21:~# cat <<EOF >/etc/apt/sources.list.d/kubernetes.list
> deb http://apt.kubernetes.io/ kubernetes-xenial main
> EOF
root@docker-atlassoft21:~# apt-get update
```

Installing kubectl, kubeadm and kubectl is crucial to install Kubernetes on Ubuntu.

# apt-get install -y kubelet kubeadm kubectl

Install keepalived.

# apt-get install keepalived
# systemctl enable keepalived && systemctl start keepalived

Verify whether the value is 1 for correct functioning of Kubernetes installed on Ubuntu.

# sysctl net.bridge.bridge-nf-call-iptables

In order to set this value to 1 run the command (if in case value is not 1):

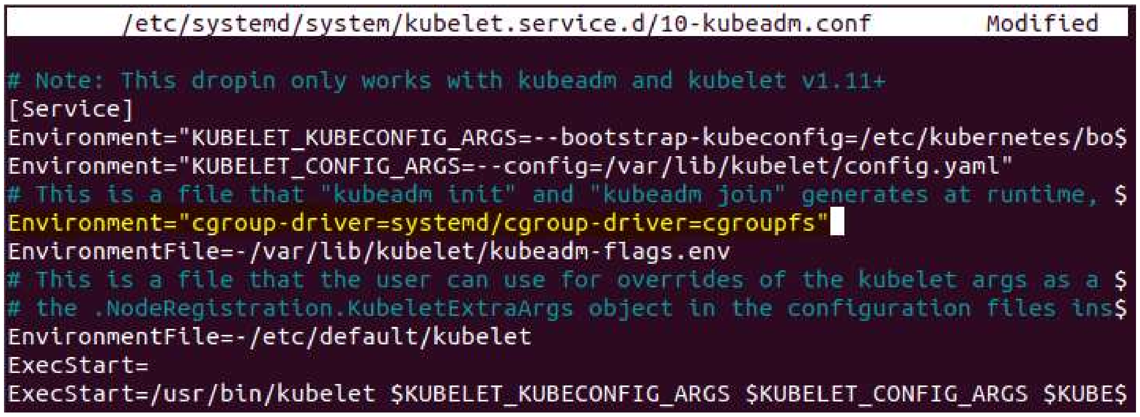
sysctl net.bridge.bridge-nf-call-iptables=1

Edit the kubeadm configuration file.

# nano /etc/systemd/system/kubelet.service.d/10-kubeadm.conf

Add the string after the existing Environment string:

Environment="cgroup-driver=systemd/cgroup-driver=cgroupfs"



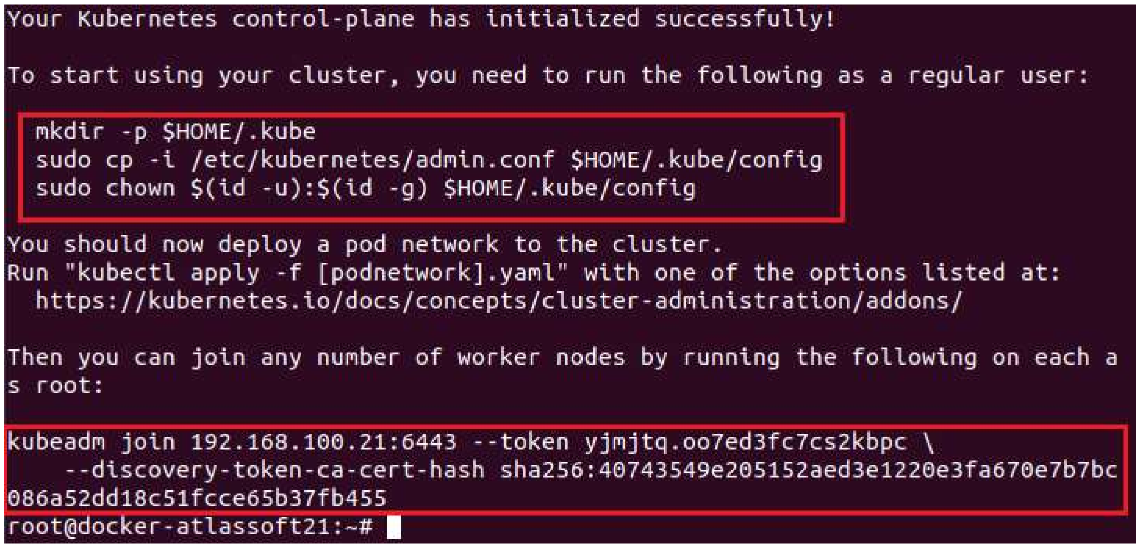
```
        /etc/systemd/system/kubelet.service.d/10-kubeadm.conf        Modified

# Note: This dropin only works with kubeadm and kubelet v1.11+
[Service]
Environment="KUBELET_KUBECONFIG_ARGS=--bootstrap-kubeconfig=/etc/kubernetes/bo$
Environment="KUBELET_CONFIG_ARGS=--config=/var/lib/kubelet/config.yaml"
# This is a file that "kubeadm init" and "kubeadm join" generates at runtime, $
Environment="cgroup-driver=systemd/cgroup-driver=cgroupfs"
EnvironmentFile=-/var/lib/kubelet/kubeadm-flags.env
# This is a file that the user can use for overrides of the kubelet args as a $
# the .NodeRegistration.KubeletExtraArgs object in the configuration files ins$
EnvironmentFile=-/etc/default/kubelet
ExecStart=
ExecStart=/usr/bin/kubelet $KUBELET_KUBECONFIG_ARGS $KUBELET_CONFIG_ARGS $KUBE$
```

(Please check yellow string, which has been added)

On the master node (docker-atlassoft21) run the command to initialize the Kubernetes cluster on Ubuntu.

# kubeadm init --pod-network-cidr=10.244.0.0/16 --apiserver-advertise-address=192.168.100.21

Where:
--pod-network-cidr is required by the Flannel driver. CIDR (Classless Inter-Domain Routing) defines the address of your overlay network (such as Flannel) that will be configured later. The network mask also defines how many pods can run per node. The CIDR network address and the network address used for Flannel must be the same.
--apiserver-advertise-address=192.168.100.21 defines the IP address that will be advertised by Kubernetes as its API server.

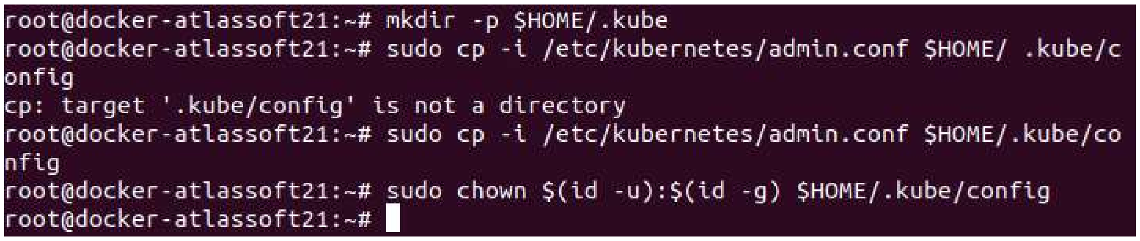


```
Your Kubernetes control-plane has initialized successfully!

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 should now deploy a pod network to the cluster.
Run "kubectl apply -f [podnetwork].yaml" with one of the options listed at:
  https://kubernetes.io/docs/concepts/cluster-administration/addons/

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

kubeadm join 192.168.100.21:6443 --token yjmjtq.oo7ed3fc7cs2kbpc \
    --discovery-token-ca-cert-hash sha256:40743549e205152aed3e1220e3fa670e7b7bc
086a52dd18c51fcce65b37fb455
root@docker-atlassoft21:~#
```

Read the output and save commands displayed at the end of the text. This is an important point. The generated token is required for adding worker nodes to the Kubernetes cluster.
Run the following commands as a user that has run kubeadm init. In this case, the commands are executed as root.

# mkdir -p $HOME/.kube

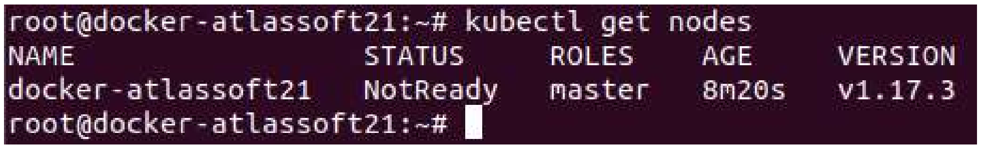
# sudo cp -i /etc/kubernetes/admin.conf $HOME/.kube/config
# sudo chown $(id -u):$(id -g) $HOME/.kube/config



```
root@docker-atlassoft21:~# mkdir -p $HOME/.kube
root@docker-atlassoft21:~# sudo cp -i /etc/kubernetes/admin.conf $HOME/ .kube/c
onfig
cp: target '.kube/config' is not a directory
root@docker-atlassoft21:~# sudo cp -i /etc/kubernetes/admin.conf $HOME/.kube/co
nfig
root@docker-atlassoft21:~# sudo chown $(id -u):$(id -g) $HOME/.kube/config
root@docker-atlassoft21:~#
```

If you don’t run these commands, Kubernetes shall return the error: The connection to the server localhost:8080 was refused - did you specify the right host or port?
Kubernetes doesn’t copy this config file to the user directory automatically. You should perform this operation manually.

kubectl get nodes



```
root@docker-atlassoft21:~# kubectl get nodes
NAME                  STATUS     ROLES    AGE     VERSION
docker-atlassoft21    NotReady   master   8m20s   v1.17.3
root@docker-atlassoft21:~#
```

You can see one master node that has the NotReady status in the Kubernetes cluster which is being installed on Ubuntu. This is due to the fact that the overlay network has not been configured. Configure Flannel in order to fix the NotReady status of the Kubernetes master node. Create the directory to store yaml files for Docker and Kunernetes, for example */home/kubernetes-user/kubernetes/*
YAML offers you greater convenience when creating pods and deployments in Kubernetes. You can define all parameters of containers which must be deployed in the YAML configuration file instead of running each command manually in Linux console. YAML files are also referred to as manifest files in the context of Kubernetes.
Create the yaml configuration file **(kube-flannel.yml)** with the following content:

```
---
apiVersion: policy/v1beta1
kind: PodSecurityPolicy
metadata:
  name: psp.flannel.unprivileged
  annotations:
    seccomp.security.alpha.kubernetes.io/allowedProfileNames:
docker/default
    seccomp.security.alpha.kubernetes.io/defaultProfileName: docker/default
    apparmor.security.beta.kubernetes.io/allowedProfileNames:
runtime/default
    apparmor.security.beta.kubernetes.io/defaultProfileName:
runtime/default
spec:
  privileged: false
  volumes:
    - configMap
    - secret
    - emptyDir
    - hostPath
  allowedHostPaths:
    - pathPrefix: "/etc/cni/net.d"
    - pathPrefix: "/etc/kube-flannel"
    - pathPrefix: "/run/flannel"
  readOnlyRootFilesystem: false
  # Users and groups
  runAsUser:
    rule: RunAsAny
  supplementalGroups:
    rule: RunAsAny
  fsGroup:
    rule: RunAsAny
  # Privilege Escalation
  allowPrivilegeEscalation: false
  defaultAllowPrivilegeEscalation: false
  # Capabilities
  allowedCapabilities: ['NET_ADMIN']
  defaultAddCapabilities: []
  requiredDropCapabilities: []
  # Host namespaces
  hostPID: false
  hostIPC: false
  hostNetwork: true
  hostPorts:
  - min: 0
    max: 65535
  # SELinux
  seLinux:
    # SELinux is unused in CaaSP
    rule: 'RunAsAny'
---
kind: ClusterRole
apiVersion: rbac.authorization.k8s.io/v1beta1
metadata:
  name: flannel
rules:
  - apiGroups: ['extensions']
    resources: ['podsecuritypolicies']
    verbs: ['use']
    resourceNames: ['psp.flannel.unprivileged']
  - apiGroups:
      - ""
    resources:
      - pods
    verbs:
      - get
  - apiGroups:
      - ""
    resources:
      - nodes
    verbs:
      - list
      - watch
  - apiGroups:
      - ""
    resources:
      - nodes/status
    verbs:
      - patch
---
kind: ClusterRoleBinding
apiVersion: rbac.authorization.k8s.io/v1beta1
metadata:
  name: flannel
roleRef:
  apiGroup: rbac.authorization.k8s.io
  kind: ClusterRole
  name: flannel
subjects:
- kind: ServiceAccount
  name: flannel
  namespace: kube-system
---
apiVersion: v1
kind: ServiceAccount
metadata:
  name: flannel
  namespace: kube-system
---
kind: ConfigMap
apiVersion: v1
metadata:
  name: kube-flannel-cfg
  namespace: kube-system
  labels:
    tier: node
    app: flannel
data:
  cni-conf.json: |
    {
      "name": "cbr0",
      "cniVersion": "0.3.1",
      "plugins": [
        {
          "type": "flannel",
          "delegate": {
            "hairpinMode": true,
            "isDefaultGateway": true
          }
        },
        {
          "type": "portmap",
          "capabilities": {
            "portMappings": true
          }
        }
      ]
    }
  net-conf.json: |
    {
      "Network": "10.244.0.0/16",
      "Backend": {
        "Type": "vxlan"
      }
    }
---
apiVersion: apps/v1
kind: DaemonSet
metadata:
  name: kube-flannel-ds-amd64
  namespace: kube-system
  labels:
    tier: node
    app: flannel
spec:
  selector:
    matchLabels:
      app: flannel
  template:
    metadata:
      labels:
        tier: node
        app: flannel
    spec:
      affinity:
        nodeAffinity:
          requiredDuringSchedulingIgnoredDuringExecution:
            nodeSelectorTerms:
              - matchExpressions:
                  - key: beta.kubernetes.io/os
                    operator: In
                    values:
                      - linux
                  - key: beta.kubernetes.io/arch
                    operator: In
                    values:
                      - amd64
      hostNetwork: true
      tolerations:
      - operator: Exists
        effect: NoSchedule
      serviceAccountName: flannel
      initContainers:
      - name: install-cni
        image: quay.io/coreos/flannel:v0.11.0-amd64
        command:
        - cp
        args:
        - -f
        - /etc/kube-flannel/cni-conf.json
        - /etc/cni/net.d/10-flannel.conflist
        volumeMounts:
        - name: cni
          mountPath: /etc/cni/net.d
        - name: flannel-cfg
          mountPath: /etc/kube-flannel/
      containers:
      - name: kube-flannel
```

```
        image: quay.io/coreos/flannel:v0.11.0-amd64
        command:
        - /opt/bin/flanneld
        args:
        - --ip-masq
        - --kube-subnet-mgr
        resources:
          requests:
            cpu: "100m"
            memory: "50Mi"
          limits:
            cpu: "100m"
            memory: "50Mi"
        securityContext:
          privileged: false
          capabilities:
            add: ["NET_ADMIN"]
        env:
        - name: POD_NAME
          valueFrom:
            fieldRef:
              fieldPath: metadata.name
        - name: POD_NAMESPACE
          valueFrom:
            fieldRef:
              fieldPath: metadata.namespace
        volumeMounts:
        - name: run
          mountPath: /run/flannel
        - name: flannel-cfg
          mountPath: /etc/kube-flannel/
      volumes:
        - name: run
          hostPath:
            path: /run/flannel
        - name: cni
          hostPath:
            path: /etc/cni/net.d
        - name: flannel-cfg
          configMap:
            name: kube-flannel-cfg
---
apiVersion: apps/v1
kind: DaemonSet
metadata:
  name: kube-flannel-ds-arm64
  namespace: kube-system
  labels:
    tier: node
    app: flannel
spec:
  selector:
    matchLabels:
      app: flannel
  template:
    metadata:
      labels:
```

```
    tier: node
    app: flannel
spec:
  affinity:
    nodeAffinity:
      requiredDuringSchedulingIgnoredDuringExecution:
        nodeSelectorTerms:
          - matchExpressions:
              - key: beta.kubernetes.io/os
                operator: In
                values:
                  - linux
              - key: beta.kubernetes.io/arch
                operator: In
                values:
                  - arm64
  hostNetwork: true
  tolerations:
  - operator: Exists
    effect: NoSchedule
  serviceAccountName: flannel
  initContainers:
  - name: install-cni
    image: quay.io/coreos/flannel:v0.11.0-arm64
    command:
    - cp
    args:
    - -f
    - /etc/kube-flannel/cni-conf.json
    - /etc/cni/net.d/10-flannel.conflist
    volumeMounts:
    - name: cni
      mountPath: /etc/cni/net.d
    - name: flannel-cfg
      mountPath: /etc/kube-flannel/
  containers:
  - name: kube-flannel
    image: quay.io/coreos/flannel:v0.11.0-arm64
    command:
    - /opt/bin/flanneld
    args:
    - --ip-masq
    - --kube-subnet-mgr
    resources:
      requests:
        cpu: "100m"
        memory: "50Mi"
      limits:
        cpu: "100m"
        memory: "50Mi"
    securityContext:
      privileged: false
      capabilities:
         add: ["NET_ADMIN"]
    env:
    - name: POD_NAME
      valueFrom:
              fieldRef:
                fieldPath: metadata.name
          - name: POD_NAMESPACE
            valueFrom:
              fieldRef:
                fieldPath: metadata.namespace
          volumeMounts:
          - name: run
            mountPath: /run/flannel
          - name: flannel-cfg
            mountPath: /etc/kube-flannel/
        volumes:
          - name: run
            hostPath:
              path: /run/flannel
          - name: cni
            hostPath:
              path: /etc/cni/net.d
          - name: flannel-cfg
            configMap:
              name: kube-flannel-cfg
---
apiVersion: apps/v1
kind: DaemonSet
metadata:
  name: kube-flannel-ds-arm
  namespace: kube-system
  labels:
    tier: node
    app: flannel
spec:
  selector:
    matchLabels:
      app: flannel
  template:
    metadata:
      labels:
        tier: node
        app: flannel
    spec:
      affinity:
        nodeAffinity:
          requiredDuringSchedulingIgnoredDuringExecution:
            nodeSelectorTerms:
              - matchExpressions:
                  - key: beta.kubernetes.io/os
                    operator: In
                    values:
                      - linux
                  - key: beta.kubernetes.io/arch
                    operator: In
                    values:
                      - arm
      hostNetwork: true
      tolerations:
      - operator: Exists
        effect: NoSchedule
```

```
serviceAccountName: flannel
initContainers:
- name: install-cni
  image: quay.io/coreos/flannel:v0.11.0-arm
  command:
  - cp
  args:
  - -f
  - /etc/kube-flannel/cni-conf.json
  - /etc/cni/net.d/10-flannel.conflist
  volumeMounts:
  - name: cni
    mountPath: /etc/cni/net.d
  - name: flannel-cfg
    mountPath: /etc/kube-flannel/
containers:
- name: kube-flannel
  image: quay.io/coreos/flannel:v0.11.0-arm
  command:
  - /opt/bin/flanneld
  args:
  - --ip-masq
  - --kube-subnet-mgr
  resources:
    requests:
      cpu: "100m"
      memory: "50Mi"
    limits:
      cpu: "100m"
      memory: "50Mi"
  securityContext:
    privileged: false
    capabilities:
       add: ["NET_ADMIN"]
  env:
  - name: POD_NAME
    valueFrom:
      fieldRef:
        fieldPath: metadata.name
  - name: POD_NAMESPACE
    valueFrom:
      fieldRef:
        fieldPath: metadata.namespace
  volumeMounts:
  - name: run
    mountPath: /run/flannel
  - name: flannel-cfg
    mountPath: /etc/kube-flannel/
volumes:
  - name: run
    hostPath:
      path: /run/flannel
  - name: cni
    hostPath:
      path: /etc/cni/net.d
  - name: flannel-cfg
    configMap:
            name: kube-flannel-cfg
---
apiVersion: apps/v1
kind: DaemonSet
metadata:
  name: kube-flannel-ds-ppc64le
  namespace: kube-system
  labels:
    tier: node
    app: flannel
spec:
  selector:
    matchLabels:
      app: flannel
  template:
    metadata:
      labels:
        tier: node
        app: flannel
    spec:
      affinity:
        nodeAffinity:
          requiredDuringSchedulingIgnoredDuringExecution:
            nodeSelectorTerms:
              - matchExpressions:
                  - key: beta.kubernetes.io/os
                    operator: In
                    values:
                      - linux
                  - key: beta.kubernetes.io/arch
                    operator: In
                    values:
                      - ppc64le
      hostNetwork: true
      tolerations:
      - operator: Exists
        effect: NoSchedule
      serviceAccountName: flannel
      initContainers:
      - name: install-cni
        image: quay.io/coreos/flannel:v0.11.0-ppc64le
        command:
        - cp
        args:
        - -f
        - /etc/kube-flannel/cni-conf.json
        - /etc/cni/net.d/10-flannel.conflist
        volumeMounts:
        - name: cni
          mountPath: /etc/cni/net.d
        - name: flannel-cfg
          mountPath: /etc/kube-flannel/
      containers:
      - name: kube-flannel
        image: quay.io/coreos/flannel:v0.11.0-ppc64le
        command:
        - /opt/bin/flanneld
        args:
        - --ip-masq
        - --kube-subnet-mgr
        resources:
          requests:
            cpu: "100m"
            memory: "50Mi"
          limits:
            cpu: "100m"
            memory: "50Mi"
        securityContext:
          privileged: false
          capabilities:
             add: ["NET_ADMIN"]
        env:
        - name: POD_NAME
          valueFrom:
            fieldRef:
              fieldPath: metadata.name
        - name: POD_NAMESPACE
          valueFrom:
            fieldRef:
              fieldPath: metadata.namespace
        volumeMounts:
        - name: run
          mountPath: /run/flannel
        - name: flannel-cfg
          mountPath: /etc/kube-flannel/
      volumes:
        - name: run
          hostPath:
            path: /run/flannel
        - name: cni
          hostPath:
            path: /etc/cni/net.d
        - name: flannel-cfg
          configMap:
            name: kube-flannel-cfg
---
apiVersion: apps/v1
kind: DaemonSet
metadata:
  name: kube-flannel-ds-s390x
  namespace: kube-system
  labels:
    tier: node
    app: flannel
spec:
  selector:
    matchLabels:
      app: flannel
  template:
    metadata:
      labels:
        tier: node
        app: flannel
    spec:
```

```
affinity:
  nodeAffinity:
    requiredDuringSchedulingIgnoredDuringExecution:
      nodeSelectorTerms:
        - matchExpressions:
            - key: beta.kubernetes.io/os
              operator: In
              values:
                - linux
            - key: beta.kubernetes.io/arch
              operator: In
              values:
                - s390x
hostNetwork: true
tolerations:
- operator: Exists
  effect: NoSchedule
serviceAccountName: flannel
initContainers:
- name: install-cni
  image: quay.io/coreos/flannel:v0.11.0-s390x
  command:
  - cp
  args:
  - -f
  - /etc/kube-flannel/cni-conf.json
  - /etc/cni/net.d/10-flannel.conflist
  volumeMounts:
  - name: cni
    mountPath: /etc/cni/net.d
  - name: flannel-cfg
    mountPath: /etc/kube-flannel/
containers:
- name: kube-flannel
  image: quay.io/coreos/flannel:v0.11.0-s390x
  command:
  - /opt/bin/flanneld
  args:
  - --ip-masq
  - --kube-subnet-mgr
  resources:
    requests:
      cpu: "100m"
      memory: "50Mi"
    limits:
      cpu: "100m"
      memory: "50Mi"
  securityContext:
    privileged: false
    capabilities:
       add: ["NET_ADMIN"]
  env:
  - name: POD_NAME
    valueFrom:
      fieldRef:
        fieldPath: metadata.name
  - name: POD_NAMESPACE
```

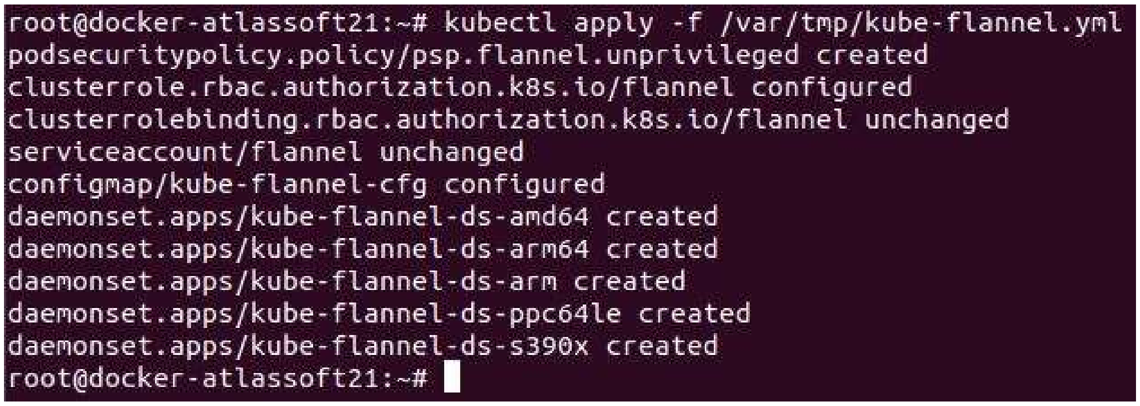
```
            valueFrom:
              fieldRef:
                fieldPath: metadata.namespace
          volumeMounts:
          - name: run
            mountPath: /run/flannel
          - name: flannel-cfg
            mountPath: /etc/kube-flannel/
        volumes:
          - name: run
            hostPath:
              path: /run/flannel
          - name: cni
            hostPath:
              path: /etc/cni/net.d
          - name: flannel-cfg
            configMap:
              name: kube-flannel-cfg
```

Run the command

# kubectl apply -f /var/tmp/kube-flannel.yml

As an alternative, you can find prepared free examples of YAML deployment configurations for Kubernetes on GitHub.

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

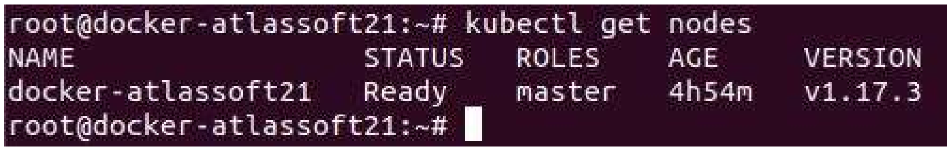


```
root@docker-atlassoft21:~# kubectl apply -f /var/tmp/kube-flannel.yml
podsecuritypolicy.policy/psp.flannel.unprivileged created
clusterrole.rbac.authorization.k8s.io/flannel configured
clusterrolebinding.rbac.authorization.k8s.io/flannel unchanged
serviceaccount/flannel unchanged
configmap/kube-flannel-cfg configured
daemonset.apps/kube-flannel-ds-amd64 created
daemonset.apps/kube-flannel-ds-arm64 created
daemonset.apps/kube-flannel-ds-arm created
daemonset.apps/kube-flannel-ds-ppc64le created
daemonset.apps/kube-flannel-ds-s390x created
root@docker-atlassoft21:~#
```

Please note: Support for extensions/v1beta1 was removed in v1.16 onwards. So, for this implementation we have used the particular kube-funnel.yml

Check the nodes added to the Kubernetes cluster you are deploying on Ubuntu:

# kubectl get nodes

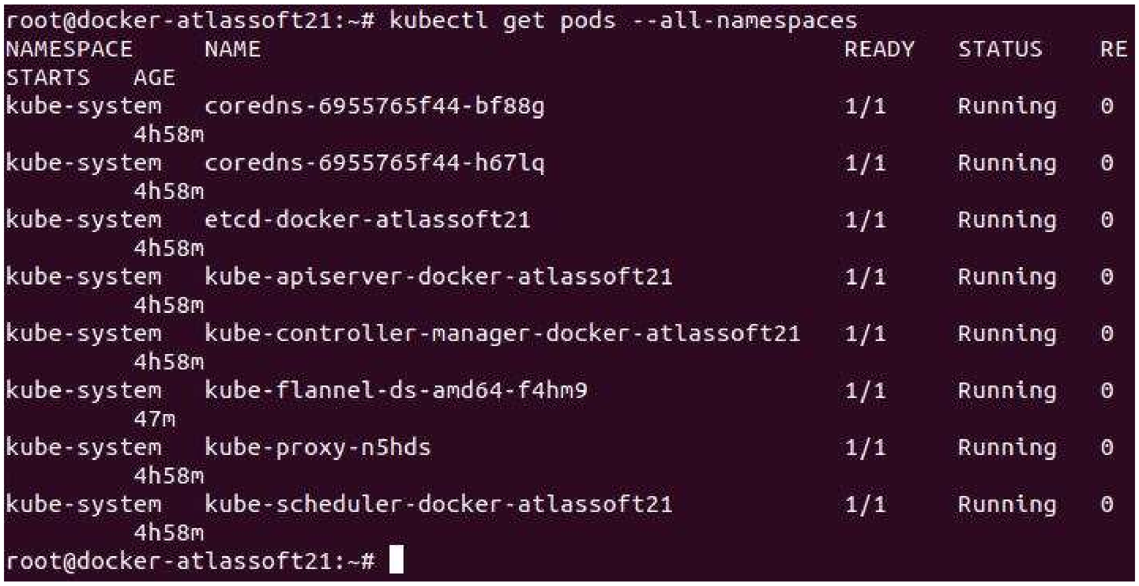


```
root@docker-atlassoft21:~# kubectl get nodes
NAME                    STATUS   ROLES    AGE     VERSION
docker-atlassoft21      Ready    master   4h54m   v1.17.3
root@docker-atlassoft21:~#
```

The status of the master node now is Ready.

Ensure that Flannel has been set up correctly:

# kubectl get pods --all-namespaces



```
root@docker-atlassoft21:~# kubectl get pods --all-namespaces
NAMESPACE     NAME                                          READY   STATUS    RE
STARTS   AGE
kube-system   coredns-6955765f44-bf88g                      1/1     Running   0
         4h58m
kube-system   coredns-6955765f44-h67lq                      1/1     Running   0
         4h58m
kube-system   etcd-docker-atlassoft21                       1/1     Running   0
         4h58m
kube-system   kube-apiserver-docker-atlassoft21             1/1     Running   0
         4h58m
kube-system   kube-controller-manager-docker-atlassoft21   1/1     Running   0
         4h58m
kube-system   kube-flannel-ds-amd64-f4hm9                   1/1     Running   0
         47m
kube-system   kube-proxy-n5hds                              1/1     Running   0
         4h58m
kube-system   kube-scheduler-docker-atlassoft21             1/1     Running   0
         4h58m
root@docker-atlassoft21:~#
```

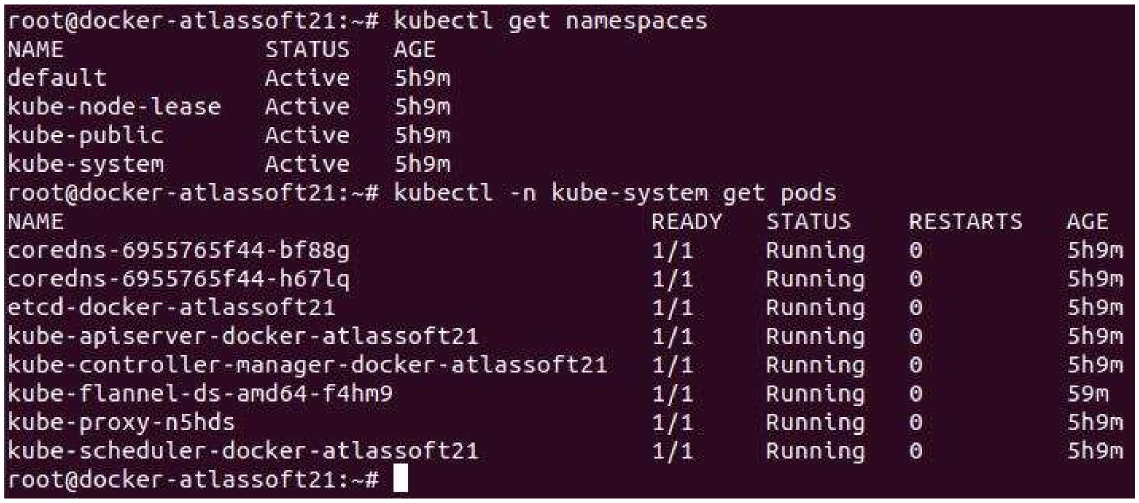
You can see that the Flannel pod is running. This pod consists of two containers – the Flannel daemon, and initContainer used to deploy the CNI configuration to a location readable for Kubernetes.
Sometimes when you install Kubernetes on Ubuntu, the following error may occur:
Unable to connect to the server: net/http: TLS handshake timeout.

How can you fix this issue? Wait for a few seconds and try again -- this is often enough.
Namespaces are logical entities in the Kubernetes cluster that represent cluster resources and can be considered virtual clusters. One physical cluster can be logically divided to multiple virtual clusters. The default Kubernetes namespaces are Default, Kube-public, and Kube-system. You can get the list of namespaces:

# kubectl get namespaces

As you recall, the basic deployment unit in Kubernetes is a pod which is a collection of containers that share network and mount namespace. All containers of the pod are scheduled on the same Kubernetes node. Check the available pods:

# kubectl -n kube-system get pods



```
root@docker-atlassoft21:~# kubectl get namespaces
NAME              STATUS   AGE
default           Active   5h9m
kube-node-lease   Active   5h9m
kube-public       Active   5h9m
kube-system       Active   5h9m
root@docker-atlassoft21:~# kubectl -n kube-system get pods
NAME                                          READY   STATUS    RESTARTS   AGE
coredns-6955765f44-bf88g                      1/1     Running   0          5h9m
coredns-6955765f44-h67lq                      1/1     Running   0          5h9m
etcd-docker-atlassoft21                       1/1     Running   0          5h9m
kube-apiserver-docker-atlassoft21             1/1     Running   0          5h9m
kube-controller-manager-docker-atlassoft21    1/1     Running   0          5h9m
kube-flannel-ds-amd64-f4hm9                   1/1     Running   0          59m
kube-proxy-n5hds                              1/1     Running   0          5h9m
kube-scheduler-docker-atlassoft21             1/1     Running   0          5h9m
root@docker-atlassoft21:~# 
```

If you wish to reset/stop the cluster, run:

# kubeadm reset

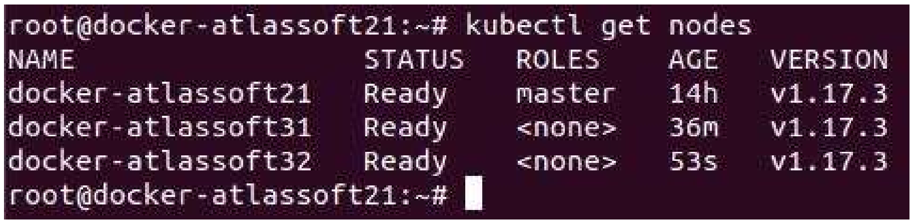
Everything is OK on the master node. This means that now you can continue to install Kubernetes on Ubuntu and switch to adding worker nodes to the cluster.
On the worker nodes (docker-atlassoft31, docker-atlassoft32) run the command:

# kubeadm join 192.168.100.21:6443 --token yjmjtq.oo7ed3fc7cs2kbpc \ --discovery-token-ca-cert-hash sha256:40743549e205152aed3e1220e3fa670e7b7bc086a52dd18c51fcce65b37fb455

The token and hash were noted after cluster initialization with the kubeadm init command, as you may recall.

On the master node, check the cluster status again.

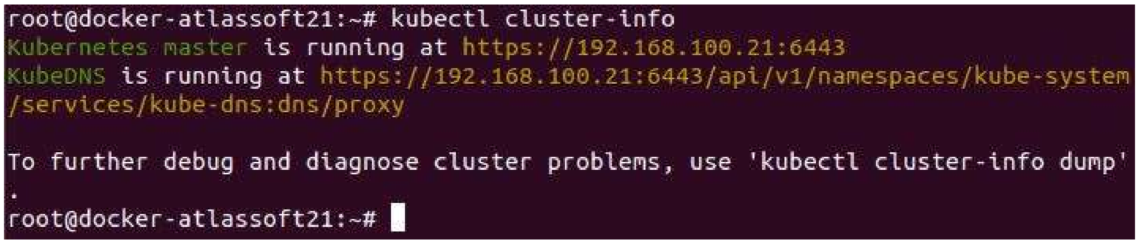
# kubectl get nodes



```
root@docker-atlassoft21:~# kubectl get nodes
NAME                  STATUS   ROLES    AGE   VERSION
docker-atlassoft21    Ready    master   14h   v1.17.3
docker-atlassoft31    Ready    <none>   36m   v1.17.3
docker-atlassoft32    Ready    <none>   53s   v1.17.3
root@docker-atlassoft21:~# 
```

Now you can see one master and two worker nodes in the Kubernetes cluster running on Ubuntu machines.
You can check Kubernetes configuration:

# kubectl cluster-info


```
root@docker-atlassoft21:~# kubectl cluster-info
Kubernetes master is running at https://192.168.100.21:6443
KubeDNS is running at https://192.168.100.21:6443/api/v1/namespaces/kube-system
/services/kube-dns:dns/proxy

To further debug and diagnose cluster problems, use 'kubectl cluster-info dump'
.
root@docker-atlassoft21:~# 
```

Deploying a Pod in Kubernetes

Now you can deploy a pod with containers in Kubernetes cluster. As you remember, containers are included in pods in Kubernetes. If you use yaml files, create a directory to store that files for more convenience. Go to that directory and run the commands like ***kubectl apply -f test.yaml***

Such a directory has been already created when configuring Flannel - */home/kubernetes-user/kubernetes/*

It's time to deploy a new pod. First you need to create a deployment. Deployment is a controller concept used for providing declarative updates to pods and replica sets. You can create deployment with a single command or by using yaml files.

Example 1 – deploying MySQL:

Let's create a yaml file in this example. The name of the file is ***mysql-deployment.yaml***

See the file configuration below:

```
apiVersion: v1
kind: Service
metadata:
  name: mysql
spec:
  ports:
  - port: 3306
  selector:
    app: mysql
  clusterIP: None
---
apiVersion: apps/v1 # for versions before 1.9.0 use apps/v1beta2
kind: Deployment
metadata:
  name: mysql
spec:
  selector:
    matchLabels:
      app: mysql
  strategy:
    type: Recreate
  template:
    metadata:
      labels:
        app: mysql
    spec:
      containers:
```

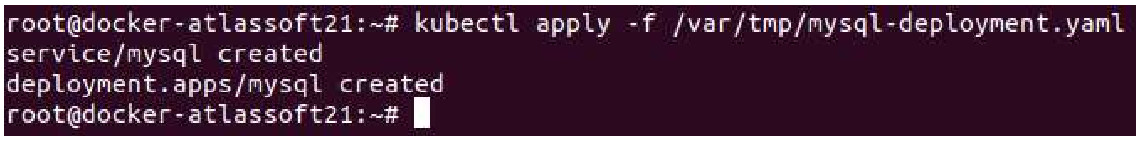
```
      - image: mysql:5.6
        name: mysql
        env:
          # Use secret in real usage
        - name: MYSQL_ROOT_PASSWORD
          value: password
        ports:
        - containerPort: 3306
          name: mysql
        volumeMounts:
        - name: mysql-persistent-storage
          mountPath: /var/lib/mysql
      volumes:
      - name: mysql-persistent-storage
        persistentVolumeClaim:
          claimName: mysql-pv-claim
```

# nano /var/tmp/mysql-deployment.yaml

There are two popular approaches for managing resources with kubectl. What is the difference between kubectl create and kubectl apply? When using kubectl create, you tell Kubernetes what you want to create, replace or delete; this command overwrites all changes. Alternatively, kubectl apply makes incremental changes and this command can be used to save changes applied to a live object.

Create a deployment:

# kubectl apply -f /var/tmp/mysql-deployment.yaml



```
root@docker-atlassoft21:~# kubectl apply -f /var/tmp/mysql-deployment.yaml
service/mysql created
deployment.apps/mysql created
root@docker-atlassoft21:~#
```

Kubernetes can display information about your deployment.

# kubectl describe deployment mysql

Check pods:

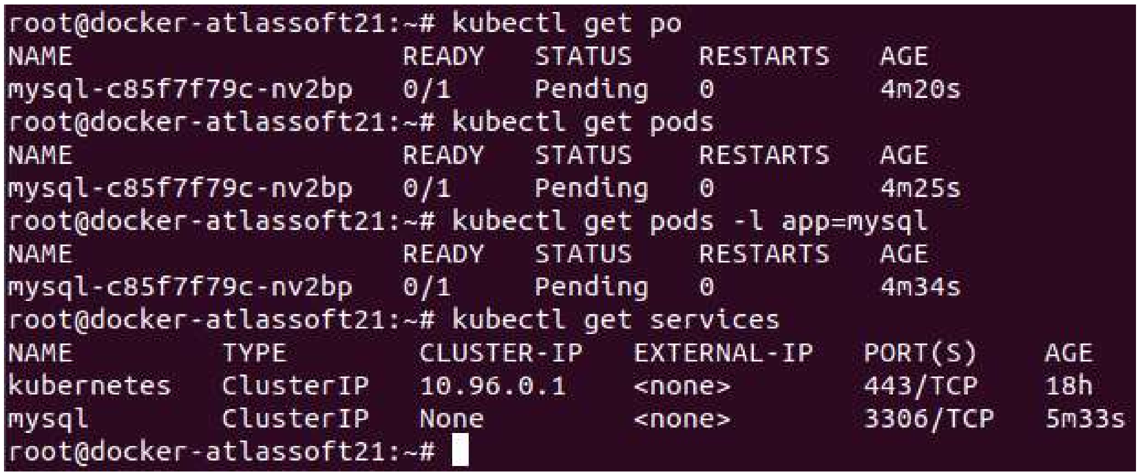
# kubectl get po

or

# kubectl get pods

or

# kubectl get pods -l app=mysql



```
root@docker-atlassoft21:~# kubectl get po
NAME                     READY   STATUS    RESTARTS   AGE
mysql-c85f7f79c-nv2bp    0/1     Pending   0          4m20s
root@docker-atlassoft21:~# kubectl get pods
NAME                     READY   STATUS    RESTARTS   AGE
mysql-c85f7f79c-nv2bp    0/1     Pending   0          4m25s
root@docker-atlassoft21:~# kubectl get pods -l app=mysql
NAME                     READY   STATUS    RESTARTS   AGE
mysql-c85f7f79c-nv2bp    0/1     Pending   0          4m34s
root@docker-atlassoft21:~# kubectl get services
NAME         TYPE        CLUSTER-IP   EXTERNAL-IP   PORT(S)    AGE
kubernetes   ClusterIP   10.96.0.1    <none>        443/TCP    18h
mysql        ClusterIP   None         <none>        3306/TCP   5m33s
root@docker-atlassoft21:~#
```

If you see the pending status for the pod, it means there are not enough computing resources. Try to add some CPU and memory capacity to fix the pending status of the pod in Kubernetes.

Example 2 - Deploying nginx:
Let's deploy nginx by using another method without yaml files.

Create a deployment.

# kubectl create deployment nginx --image=nginx

Check that the deployment has been created.

# kubectl get deployments

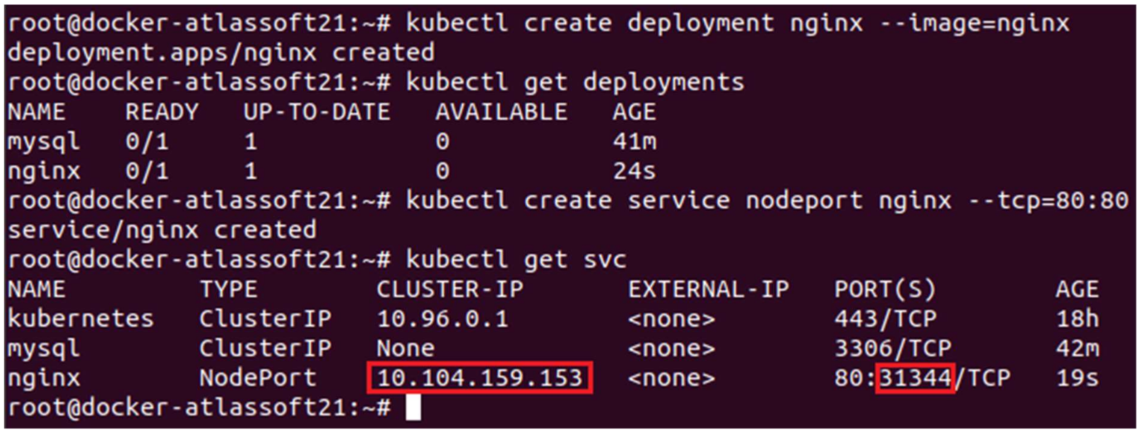
Create a service.

# kubectl create service nodeport nginx --tcp=80:80

A service can be created by using the following service types – ClusterIP, NodePort, LoadBalance, and ExternalName. If the NodePort type is used, then a random port from the 30000-32767 range is allocated for accessing the provided services. Traffic that is sent to this port is forwarded to the necessary service.

Check that the service is created and is listening on the defined port.

# kubectl get svc



```
root@docker-atlassoft21:~# kubectl create deployment nginx --image=nginx
deployment.apps/nginx created
root@docker-atlassoft21:~# kubectl get deployments
NAME    READY   UP-TO-DATE   AVAILABLE   AGE
mysql   0/1     1            0           41m
nginx   0/1     1            0           24s
root@docker-atlassoft21:~# kubectl create service nodeport nginx --tcp=80:80
service/nginx created
root@docker-atlassoft21:~# kubectl get svc
NAME         TYPE        CLUSTER-IP       EXTERNAL-IP   PORT(S)        AGE
kubernetes   ClusterIP   10.96.0.1        <none>        443/TCP        18h
mysql        ClusterIP   None             <none>        3306/TCP       42m
nginx        NodePort    10.104.159.153   <none>        80:31344/TCP   19s
root@docker-atlassoft21:~#
```

Remember the number of port (31344 in this case).

Check whether the service is deployed and available (the command is run on the master node in this example). Use the hostname of the node and port you have remembered from the previous step.

# curl docker-atlassoft31:31344

You can also check that the service is accessible in the browser of any node. In the address bar of the web browser try to visit the pages:

http:// 10.104.159.153

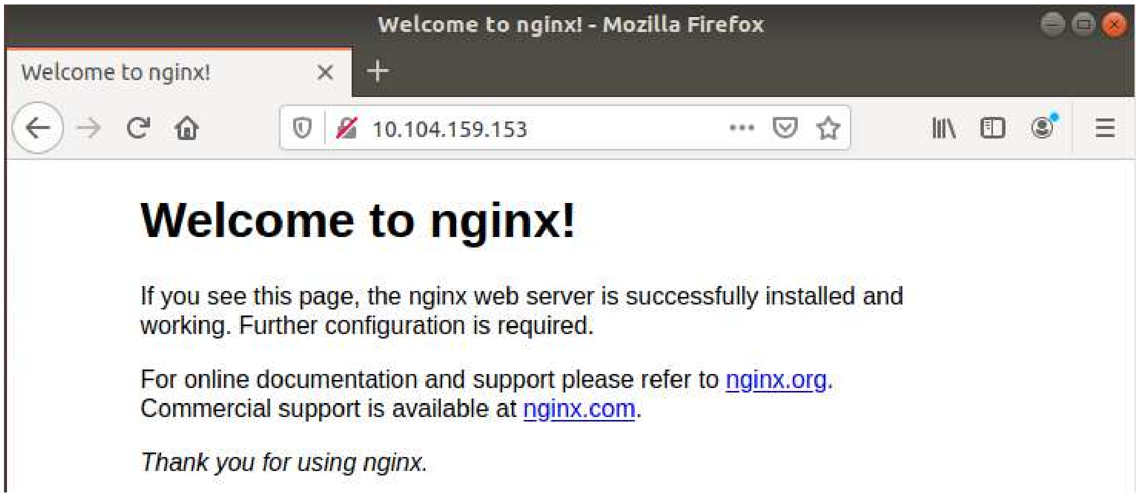
or

http://docker-atlassoft31:31344

or

http://docker-atlassoft32:31344

If everything is OK, you will see the nginx welcome page.



Welcome to nginx!

If you see this page, the nginx web server is successfully installed and working. Further configuration is required.

For online documentation and support please refer to nginx.org.
Commercial support is available at nginx.com.

Thank you for using nginx.

It is also possible to visit the nginx test page from any machine that has access to the network to which Kubernetes nodes are connected (192.168.100.0/24) in this case. For example, you can visit the web pages with your browser:

http://192.168.100.21:31344/

http://192.168.100.31:31344/

http://192.168.100.32:31344/

Set Up the Web Interface for Monitoring Kubernetes

Installing Kubernetes on Ubuntu is almost complete, but you can also install Kubernetes dashboard for more convenience. Kubernetes dashboard is a web interface for Kubernetes management and monitoring. In order to install the dashboard, create the kubernetes-dashboard.yaml file, much like you have done previously before executing the commands.

```
# Copyright 2017 The Kubernetes Authors.
#
# Licensed under the Apache License, Version 2.0 (the "License");
# you may not use this file except in compliance with the License.
# You may obtain a copy of the License at
#
#     http://www.apache.org/licenses/LICENSE-2.0
#
# Unless required by applicable law or agreed to in writing, software
# distributed under the License is distributed on an "AS IS" BASIS,
# WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
# See the License for the specific language governing permissions and
# limitations under the License.

apiVersion: v1
kind: Namespace
metadata:
  name: kubernetes-dashboard

---

apiVersion: v1
kind: ServiceAccount
metadata:
  labels:
    k8s-app: kubernetes-dashboard
  name: kubernetes-dashboard
  namespace: kubernetes-dashboard

---

kind: Service
apiVersion: v1
metadata:
  labels:
    k8s-app: kubernetes-dashboard
  name: kubernetes-dashboard
  namespace: kubernetes-dashboard
spec:
  ports:
    - port: 443
      targetPort: 8443
  selector:
    k8s-app: kubernetes-dashboard

---

apiVersion: v1
kind: Secret
metadata:
  labels:
    k8s-app: kubernetes-dashboard
  name: kubernetes-dashboard-certs
  namespace: kubernetes-dashboard
type: Opaque

---

apiVersion: v1
kind: Secret
metadata:
  labels:
    k8s-app: kubernetes-dashboard
  name: kubernetes-dashboard-csrf
  namespace: kubernetes-dashboard
type: Opaque
data:
  csrf: ""

---

apiVersion: v1
kind: Secret
metadata:
  labels:
    k8s-app: kubernetes-dashboard
  name: kubernetes-dashboard-key-holder
  namespace: kubernetes-dashboard
type: Opaque

---

kind: ConfigMap
apiVersion: v1
metadata:
  labels:
    k8s-app: kubernetes-dashboard
  name: kubernetes-dashboard-settings
  namespace: kubernetes-dashboard

---

kind: Role
apiVersion: rbac.authorization.k8s.io/v1
metadata:
  labels:
    k8s-app: kubernetes-dashboard
  name: kubernetes-dashboard
  namespace: kubernetes-dashboard
rules:
  # Allow Dashboard to get, update and delete Dashboard exclusive secrets.
  - apiGroups: [""]
    resources: ["secrets"]
    resourceNames:     ["kubernetes-dashboard-key-holder",     "kubernetes-
dashboard-certs", "kubernetes-dashboard-csrf"]
    verbs: ["get", "update", "delete"]
    #  Allow  Dashboard  to  get  and  update  'kubernetes-dashboard-settings'
config map.
  - apiGroups: [""]
    resources: ["configmaps"]
    resourceNames: ["kubernetes-dashboard-settings"]
    verbs: ["get", "update"]
    # Allow Dashboard to get metrics.
  - apiGroups: [""]
    resources: ["services"]
    resourceNames: ["heapster", "dashboard-metrics-scraper"]
    verbs: ["proxy"]
  - apiGroups: [""]
    resources: ["services/proxy"]
    resourceNames:   ["heapster",   "http:heapster:",   "https:heapster:",
"dashboard-metrics-scraper", "http:dashboard-metrics-scraper"]
    verbs: ["get"]

---

kind: ClusterRole
apiVersion: rbac.authorization.k8s.io/v1
metadata:
  labels:
    k8s-app: kubernetes-dashboard
  name: kubernetes-dashboard
```

```
rules:
  # Allow Metrics Scraper to get metrics from the Metrics server
  - apiGroups: ["metrics.k8s.io"]
    resources: ["pods", "nodes"]
    verbs: ["get", "list", "watch"]

---

apiVersion: rbac.authorization.k8s.io/v1
kind: RoleBinding
metadata:
  labels:
    k8s-app: kubernetes-dashboard
  name: kubernetes-dashboard
  namespace: kubernetes-dashboard
roleRef:
  apiGroup: rbac.authorization.k8s.io
  kind: Role
  name: kubernetes-dashboard
subjects:
  - kind: ServiceAccount
    name: kubernetes-dashboard
    namespace: kubernetes-dashboard

---

apiVersion: rbac.authorization.k8s.io/v1
kind: ClusterRoleBinding
metadata:
  name: kubernetes-dashboard
roleRef:
  apiGroup: rbac.authorization.k8s.io
  kind: ClusterRole
  name: kubernetes-dashboard
subjects:
  - kind: ServiceAccount
    name: kubernetes-dashboard
    namespace: kubernetes-dashboard

---

kind: Deployment
apiVersion: apps/v1
metadata:
  labels:
    k8s-app: kubernetes-dashboard
  name: kubernetes-dashboard
  namespace: kubernetes-dashboard
spec:
  replicas: 1
  revisionHistoryLimit: 10
  selector:
    matchLabels:
      k8s-app: kubernetes-dashboard
  template:
    metadata:
      labels:
        k8s-app: kubernetes-dashboard
    spec:
      containers:
        - name: kubernetes-dashboard
          image: kubernetesui/dashboard:v2.0.0-beta8
          imagePullPolicy: Always
          ports:
            - containerPort: 8443
              protocol: TCP
          args:
            - --auto-generate-certificates
            - --namespace=kubernetes-dashboard
            # Uncomment the following line to manually specify Kubernetes
API server Host
            # If not specified, Dashboard will attempt to auto discover the
API server and connect
            # to it. Uncomment only if the default does not work.
            # - --apiserver-host=http://my-address:port
          volumeMounts:
            - name: kubernetes-dashboard-certs
              mountPath: /certs
              # Create on-disk volume to store exec logs
            - mountPath: /tmp
              name: tmp-volume
          livenessProbe:
            httpGet:
              scheme: HTTPS
              path: /
              port: 8443
            initialDelaySeconds: 30
            timeoutSeconds: 30
          securityContext:
            allowPrivilegeEscalation: false
            readOnlyRootFilesystem: true
            runAsUser: 1001
            runAsGroup: 2001
      volumes:
        - name: kubernetes-dashboard-certs
          secret:
            secretName: kubernetes-dashboard-certs
        - name: tmp-volume
          emptyDir: {}
      serviceAccountName: kubernetes-dashboard
      nodeSelector:
        "beta.kubernetes.io/os": linux
      # Comment the following tolerations if Dashboard must not be deployed
on master
      tolerations:
        - key: node-role.kubernetes.io/master
          effect: NoSchedule

---

kind: Service
apiVersion: v1
metadata:
  labels:
```

```yaml
    k8s-app: dashboard-metrics-scraper
  name: dashboard-metrics-scraper
  namespace: kubernetes-dashboard
spec:
  ports:
    - port: 8000
      targetPort: 8000
  selector:
    k8s-app: dashboard-metrics-scraper

---

kind: Deployment
apiVersion: apps/v1
metadata:
  labels:
    k8s-app: dashboard-metrics-scraper
  name: dashboard-metrics-scraper
  namespace: kubernetes-dashboard
spec:
  replicas: 1
  revisionHistoryLimit: 10
  selector:
    matchLabels:
      k8s-app: dashboard-metrics-scraper
  template:
    metadata:
      labels:
        k8s-app: dashboard-metrics-scraper
      annotations:
        seccomp.security.alpha.kubernetes.io/pod: 'runtime/default'
    spec:
      containers:
        - name: dashboard-metrics-scraper
          image: kubernetesui/metrics-scraper:v1.0.1
          ports:
            - containerPort: 8000
              protocol: TCP
          livenessProbe:
            httpGet:
              scheme: HTTP
              path: /
              port: 8000
            initialDelaySeconds: 30
            timeoutSeconds: 30
          volumeMounts:
          - mountPath: /tmp
            name: tmp-volume
          securityContext:
            allowPrivilegeEscalation: false
            readOnlyRootFilesystem: true
            runAsUser: 1001
            runAsGroup: 2001
      serviceAccountName: kubernetes-dashboard
      nodeSelector:
        "beta.kubernetes.io/os": linux
      # Comment the following tolerations if Dashboard must not be deployed
on master
      tolerations:
        - key: node-role.kubernetes.io/master
          effect: NoSchedule
      volumes:
        - name: tmp-volume
          emptyDir: {}
```

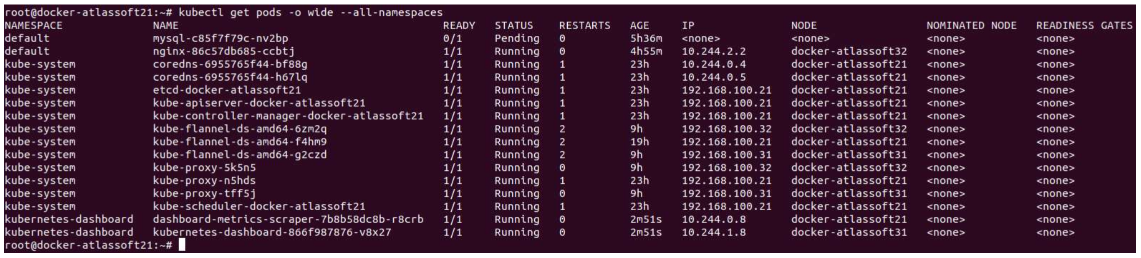
For this we have used the file hosted on:
https://raw.githubusercontent.com/kubernetes/dashboard/v2.0.0-beta8/aio/deploy/recommended.yaml

# kubectl create -f ./kubernetes-dashboard.yaml

# kubectl apply -f ./kubernetes-dashboard.yaml

Check pods.

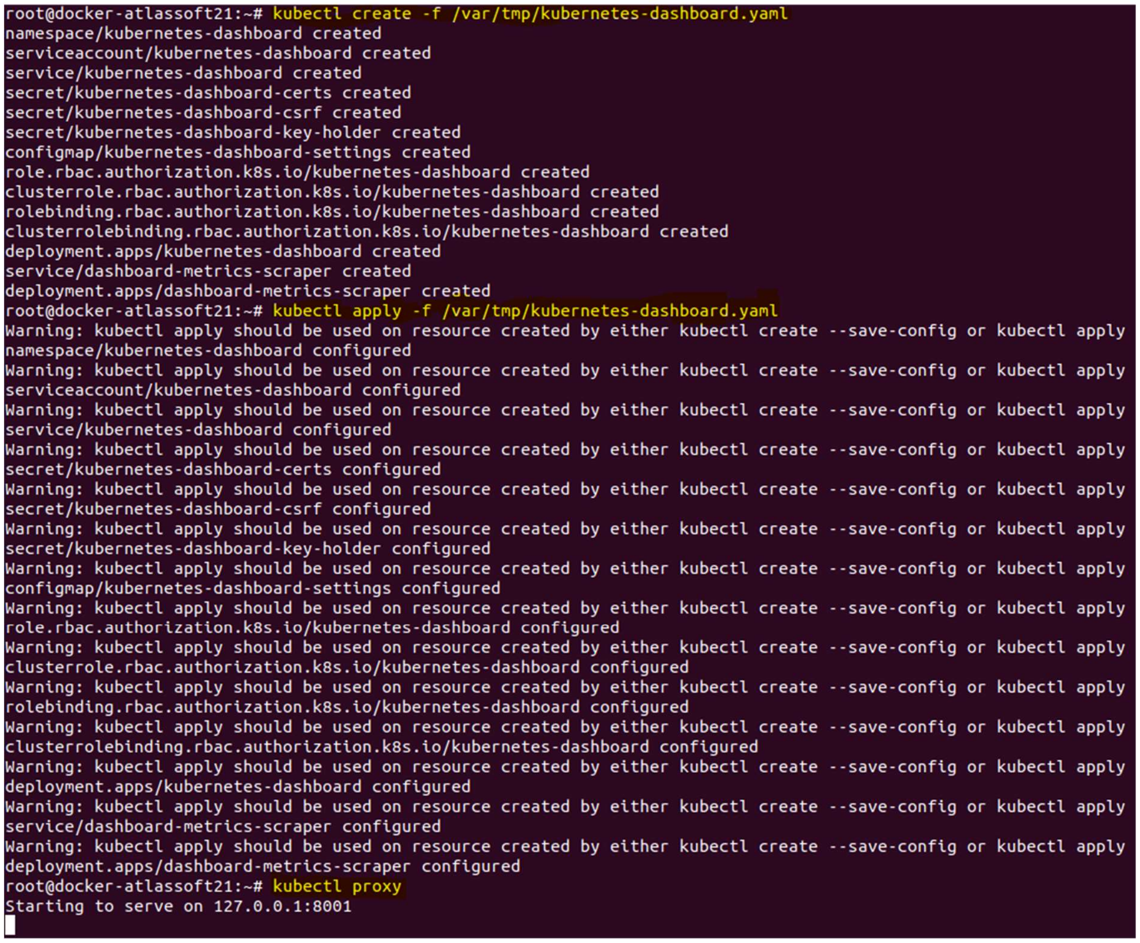
# kubectl get pods -o wide --all-namespaces



```
root@docker-atlassoft21:~# kubectl get pods -o wide --all-namespaces
NAMESPACE              NAME                                         READY   STATUS    RESTARTS   AGE     IP               NODE                 NOMINATED NODE   READINESS GATES
default                mysql-c85f7f79c-nv2bp                        0/1     Pending   0          5h36m   <none>           <none>               <none>           <none>
default                nginx-86c57db685-ccbtj                       1/1     Running   0          4h55m   10.244.2.2       docker-atlassoft32   <none>           <none>
kube-system            coredns-6955765f44-bf88g                     1/1     Running   1          23h     10.244.0.4       docker-atlassoft21   <none>           <none>
kube-system            coredns-6955765f44-h67lq                     1/1     Running   1          23h     10.244.0.5       docker-atlassoft21   <none>           <none>
kube-system            etcd-docker-atlassoft21                      1/1     Running   1          23h     192.168.100.21   docker-atlassoft21   <none>           <none>
kube-system            kube-apiserver-docker-atlassoft21            1/1     Running   1          23h     192.168.100.21   docker-atlassoft21   <none>           <none>
kube-system            kube-controller-manager-docker-atlassoft21   1/1     Running   1          23h     192.168.100.21   docker-atlassoft21   <none>           <none>
kube-system            kube-flannel-ds-amd64-6zm2q                  1/1     Running   2          9h      192.168.100.32   docker-atlassoft32   <none>           <none>
kube-system            kube-flannel-ds-amd64-f4hm9                  1/1     Running   2          19h     192.168.100.21   docker-atlassoft21   <none>           <none>
kube-system            kube-flannel-ds-amd64-g2czd                  1/1     Running   2          9h      192.168.100.31   docker-atlassoft31   <none>           <none>
kube-system            kube-proxy-5k5n5                             1/1     Running   0          9h      192.168.100.32   docker-atlassoft32   <none>           <none>
kube-system            kube-proxy-n5hds                             1/1     Running   1          23h     192.168.100.21   docker-atlassoft21   <none>           <none>
kube-system            kube-proxy-tff5j                             1/1     Running   0          9h      192.168.100.31   docker-atlassoft31   <none>           <none>
kube-system            kube-scheduler-docker-atlassoft21            1/1     Running   1          23h     192.168.100.21   docker-atlassoft21   <none>           <none>
kubernetes-dashboard   dashboard-metrics-scraper-7b8b58dc8b-r8crb   1/1     Running   0          2m51s   10.244.0.8       docker-atlassoft21   <none>           <none>
kubernetes-dashboard   kubernetes-dashboard-866f987876-v8x27        1/1     Running   0          2m51s   10.244.1.8       docker-atlassoft31   <none>           <none>
root@docker-atlassoft21:~#
```

Start the proxy to the Kubernetes API server.

# kubectl proxy



```
root@docker-atlassoft21:~# kubectl create -f /var/tmp/kubernetes-dashboard.yaml
namespace/kubernetes-dashboard created
serviceaccount/kubernetes-dashboard created
service/kubernetes-dashboard created
secret/kubernetes-dashboard-certs created
secret/kubernetes-dashboard-csrf created
secret/kubernetes-dashboard-key-holder created
configmap/kubernetes-dashboard-settings created
role.rbac.authorization.k8s.io/kubernetes-dashboard created
clusterrole.rbac.authorization.k8s.io/kubernetes-dashboard created
rolebinding.rbac.authorization.k8s.io/kubernetes-dashboard created
clusterrolebinding.rbac.authorization.k8s.io/kubernetes-dashboard created
deployment.apps/kubernetes-dashboard created
service/dashboard-metrics-scraper created
deployment.apps/dashboard-metrics-scraper created
root@docker-atlassoft21:~# kubectl apply -f /var/tmp/kubernetes-dashboard.yaml
Warning: kubectl apply should be used on resource created by either kubectl create --save-config or kubectl apply
namespace/kubernetes-dashboard configured
Warning: kubectl apply should be used on resource created by either kubectl create --save-config or kubectl apply
serviceaccount/kubernetes-dashboard configured
Warning: kubectl apply should be used on resource created by either kubectl create --save-config or kubectl apply
service/kubernetes-dashboard configured
Warning: kubectl apply should be used on resource created by either kubectl create --save-config or kubectl apply
secret/kubernetes-dashboard-certs configured
Warning: kubectl apply should be used on resource created by either kubectl create --save-config or kubectl apply
secret/kubernetes-dashboard-csrf configured
Warning: kubectl apply should be used on resource created by either kubectl create --save-config or kubectl apply
secret/kubernetes-dashboard-key-holder configured
Warning: kubectl apply should be used on resource created by either kubectl create --save-config or kubectl apply
configmap/kubernetes-dashboard-settings configured
Warning: kubectl apply should be used on resource created by either kubectl create --save-config or kubectl apply
role.rbac.authorization.k8s.io/kubernetes-dashboard configured
Warning: kubectl apply should be used on resource created by either kubectl create --save-config or kubectl apply
clusterrole.rbac.authorization.k8s.io/kubernetes-dashboard configured
Warning: kubectl apply should be used on resource created by either kubectl create --save-config or kubectl apply
rolebinding.rbac.authorization.k8s.io/kubernetes-dashboard configured
Warning: kubectl apply should be used on resource created by either kubectl create --save-config or kubectl apply
clusterrolebinding.rbac.authorization.k8s.io/kubernetes-dashboard configured
Warning: kubectl apply should be used on resource created by either kubectl create --save-config or kubectl apply
deployment.apps/kubernetes-dashboard configured
Warning: kubectl apply should be used on resource created by either kubectl create --save-config or kubectl apply
service/dashboard-metrics-scraper configured
Warning: kubectl apply should be used on resource created by either kubectl create --save-config or kubectl apply
deployment.apps/dashboard-metrics-scraper configured
root@docker-atlassoft21:~# kubectl proxy
Starting to serve on 127.0.0.1:8001
```

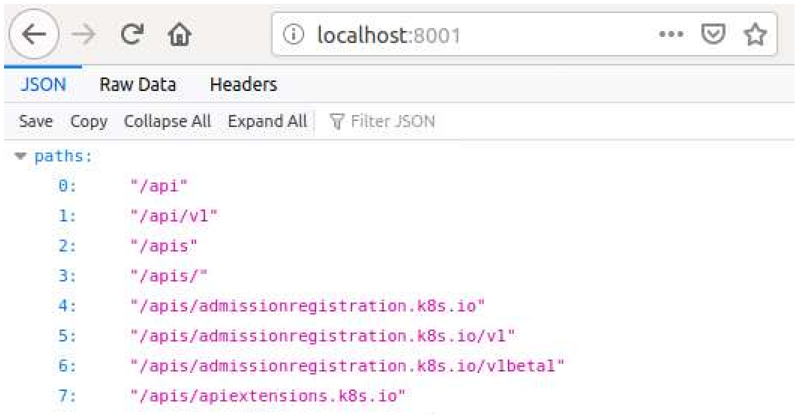
(Please check yellow marked highlighted commands)

To enter the next commands in the console, please open another console window. Otherwise, the process would be terminated.

In your web browser on the master node, go to the page:

http://localhost:8001

You can see the test page.

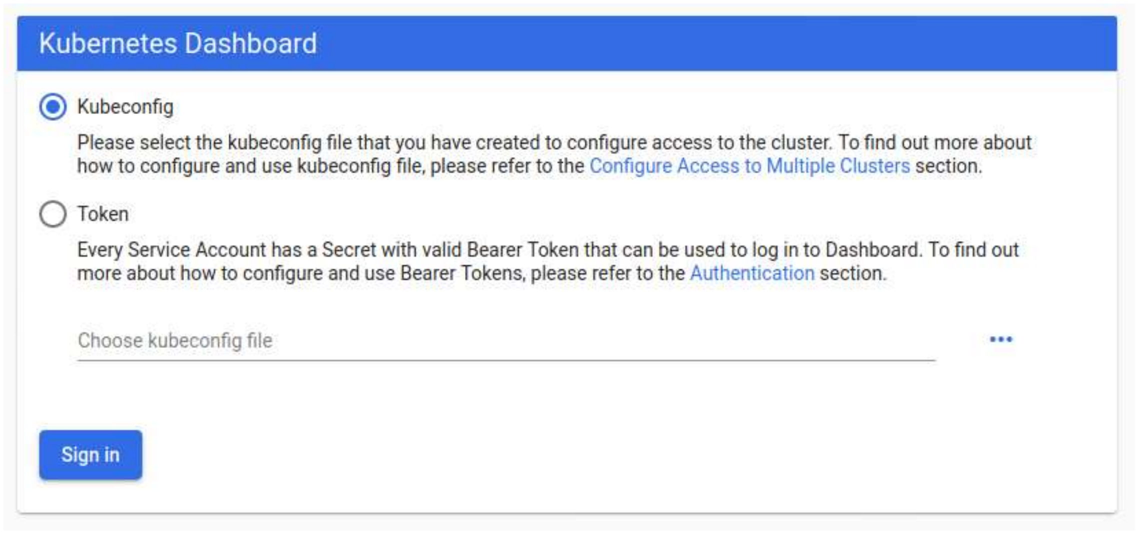


```
paths:
    0:    "/api"
    1:    "/api/v1"
    2:    "/apis"
    3:    "/apis/"
    4:    "/apis/admissionregistration.k8s.io"
    5:    "/apis/admissionregistration.k8s.io/v1"
    6:    "/apis/admissionregistration.k8s.io/v1beta1"
    7:    "/apis/apiextensions.k8s.io"
```

Enter the full address in the address bar of the web browser.

http://localhost:8001/api/v1/namespaces/kubernetes-dashboard/services/https:kubernetes-dashboard:/proxy/#/login

Please note: Unlike version 1.10.x in v2.0.0-xxx the dashboard url has been changed.



Kubernetes Dashboard

● Kubeconfig

Please select the kubeconfig file that you have created to configure access to the cluster. To find out more about how to configure and use kubeconfig file, please refer to the Configure Access to Multiple Clusters section.

○ Token

Every Service Account has a Secret with valid Bearer Token that can be used to log in to Dashboard. To find out more about how to configure and use Bearer Tokens, please refer to the Authentication section.

Choose kubeconfig file

Sign in

Create a dashboard with a service account by executing the commands in the new console window.

# kubectl create serviceaccount dashboard -n default

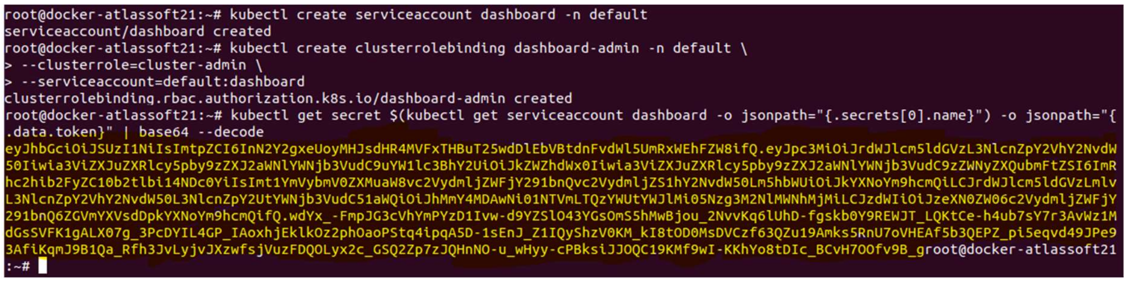
# kubectl create clusterrolebinding dashboard-admin -n default \

--clusterrole=cluster-admin \

--serviceaccount=default:dashboard

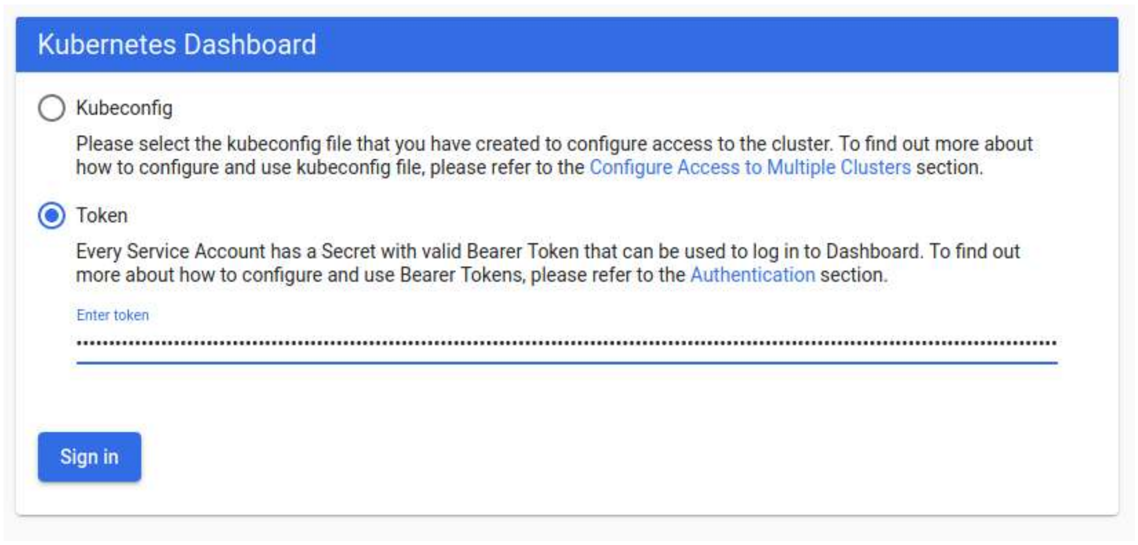
# kubectl get secret $(kubectl get serviceaccount dashboard -o jsonpath="{.secrets[0].name}") -o jsonpath="{.data.token}" | base64 --decode

The generated token is:



```
root@docker-atlassoft21:~# kubectl create serviceaccount dashboard -n default
serviceaccount/dashboard created
root@docker-atlassoft21:~# kubectl create clusterrolebinding dashboard-admin -n default \
> --clusterrole=cluster-admin \
> --serviceaccount=default:dashboard
clusterrolebinding.rbac.authorization.k8s.io/dashboard-admin created
root@docker-atlassoft21:~# kubectl get secret $(kubectl get serviceaccount dashboard -o jsonpath="{.secrets[0].name}") -o jsonpath="{
.data.token}" | base64 --decode
eyJhbGciOiJSUzI1NiIsImtpZCI6InN2Y2gxeUoyMHJsdHR4MVFxTHBuT25wdDlEbVBtdnFvdWl5UmRxWEhFZW8ifQ.eyJpc3MiOiJrdWJlcm5ldGVzL3NlcnZpY2VhY2NvdW
50Iiwia3ViZXJuZXRlcy5pby9zZXJ2aWNlYWNjb3VudC9uYW1lc3BhY2UiOiJkZWZhdWx0Iiwia3ViZXJuZXRlcy5pby9zZXJ2aWNlYWNjb3VudC9zZWNyZXQubmFtZSI6ImR
hc2hib2FyZC10b2tlbi14NDc0YiIsImt1YmVybmV0ZXMuaW8vc2VydmljZWFjY291bnQvc2VydmljZS1hY2NvdW50Lm5hbWUiOiJkYXNoYm9hcmQiLCJrdWJlcm5ldGVzLmlv
L3NlcnZpY2VhY2NvdW50L3NlcnZpY2UtYWNjb3VudC51aWQiOiJhMmY4MDAwNi01NTVmLTQzYWUtYWJlMi05Nzg3M2NlMWNhMjMiLCJzdWIiOiJzeXN0ZW06c2VydmljZWFjY
291bnQ6ZGVmYXVsdDpkYXNoYm9hcmQifQ.wdYx_-FmpJG3cVhYmPYzD1Ivw-d9YZSlO43YGsOmS5hMwBjou_2NvvKq6lUhD-fgskb0Y9REWJT_LQKtCe-h4ub7sY7r3AvWz1M
dGsSVFK1gALX07g_3PcDYIL4GP_IAoxhjEklkOz2phOaoPStq4ipqA5D-1sEnJ_Z1IQyShzV0KM_kI8tOD0MsDVCzf63QZu19Amks5RnU7oVHEAf5b3QEPZ_pi5eqvd49JPe9
3AfiKqmJ9B1Qa_Rfh3JvLyjvJXzwfsjVuzFDQOLyx2c_GSQ2Zp7zJQHnNO-u_wHyy-cPBksiJJOQC19KMf9wI-KKhYo8tDIc_BCvH7OOfv9B_groot@docker-atlassoft21
:~#
```

Copy the generated token and paste it in the token section of the web interface to log into the dashboard.



Kubernetes Dashboard

Kubeconfig

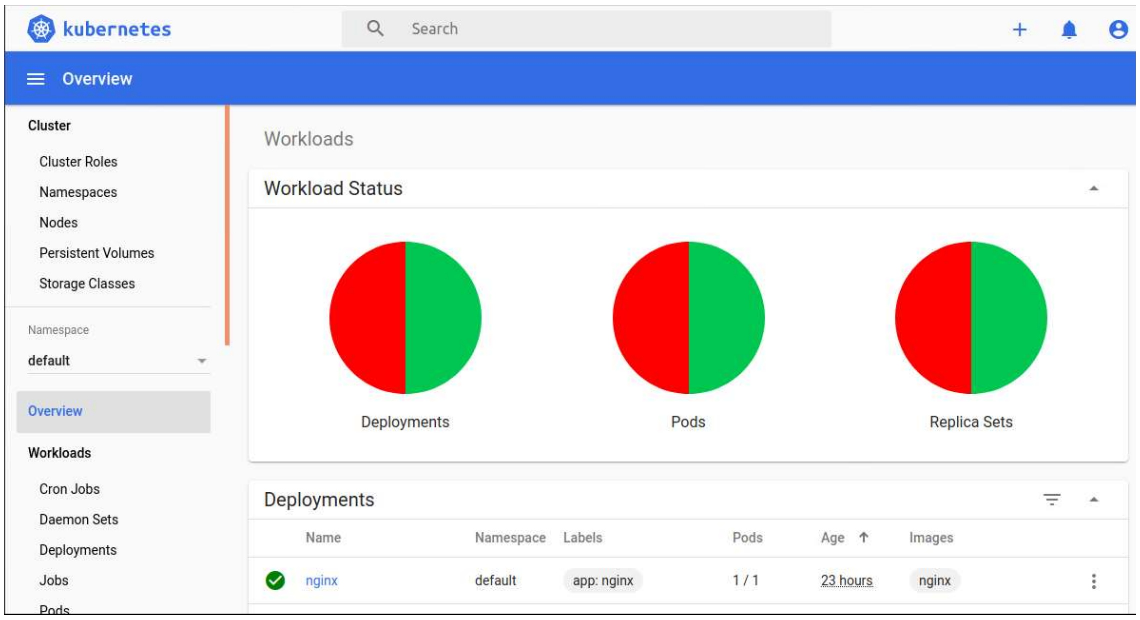
Please select the kubeconfig file that you have created to configure access to the cluster. To find out more about how to configure and use kubeconfig file, please refer to the Configure Access to Multiple Clusters section.

[✓ Token]

Every Service Account has a Secret with valid Bearer Token that can be used to log in to Dashboard. To find out more about how to configure and use Bearer Tokens, please refer to the Authentication section.

Enter token

On the screenshot below, you can see the web interface of Kubernetes dashboard. You can see the status of nodes, deployments, and pods, as well as check roles, storage classes, and other components.



	Name	Namespace	Labels	Pods	Age	Images
✓	nginx	default	app: nginx	1 / 1	23 hours	nginx