KIND CLUSTER
(KUBERNETES IN DOCKER)

Kind Cluster

- Also known as (Kubernetes in Docker)
- Like Minikube
- It a tool that runs Kubernetes clusters entirely inside Docker containers.

When to Use Which?

- Minikube - Best for beginners, local development with persistent data, or simulating a "real" single-node cluster.

- Kind - Best for testing multi-node scenarios, CI/CD, contributing to Kubernetes, or rapid cluster experimentation.

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Difference between Minikube and kind

Feature	Minikube	Kind
Purpose	Runs a single-node Kubernetes cluster locally	Runs multi-node Kubernetes clusters in Docker
Underlying Tech	Uses Virtual Machines (VMs) or containers	Uses Docker containers
Installation Complexity	Requires a hypervisor (if using VMs)	Requires only Docker
Cluster Type	Primarily single node	Supports multi-node clusters

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Performance	Slightly heavier due to VM support	Lightweight since it runs fully in containers
Use Case	Best for local Kubernetes development and testing	Ideal for CI/CD and testing Kubernetes in containers
Networking	Creates its own VM or containerized network	Uses Docker's built-in networking
Resource Consumption	Higher (especially with VM-based setups)	Lower, as it runs entirely in containers
Preferred By	Developers testing full Kubernetes environments	CI/CD pipelines and quick Kubernetes testing

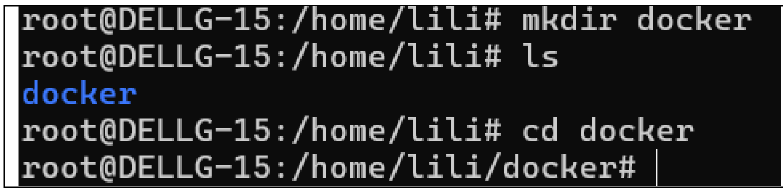
Prerequisites for Kind installation

Prerequisites	Details
Operating System	Linux, macOS, or Windows (with WSL2/Docker Desktop).
Docker	Installed and running (docker --version).
Kind CLI	Installed (kind --version).
kubectl	Installed (kubectl version --client).
System Resources	Minimum 2 CPU cores, 4 GB RAM, and 10 GB disk space.
Internet Connectivity	Required for downloading Kubernetes images and dependencies.

Kind installation in ubuntu (linux)

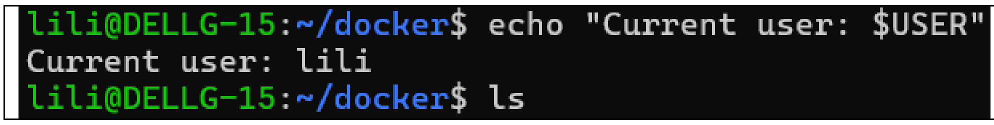
STEP 1 – Install Docker in ubuntu

1.1 Create a folder name docker



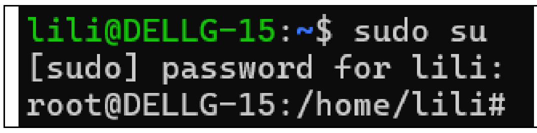
```
root@DELLG-15:/home/lili# mkdir docker
root@DELLG-15:/home/lili# ls
docker
root@DELLG-15:/home/lili# cd docker
root@DELLG-15:/home/lili/docker#
```

1.2 To check the current user



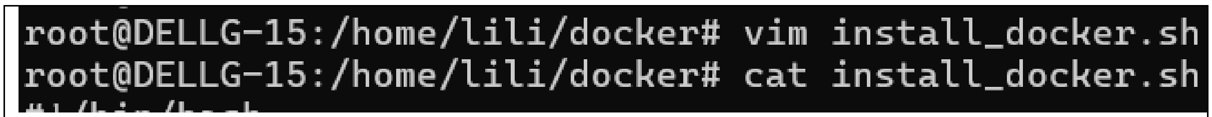
```
lili@DELLG-15:~/docker$ echo "Current user: $USER"
Current user: lili
lili@DELLG-15:~/docker$ ls
```

1.3 Then do



```
lili@DELLG-15:~$ sudo su
[sudo] password for lili:
root@DELLG-15:/home/lili#
```

1.4 Create a file name install_docker.sh in docker folder



```
root@DELLG-15:/home/lili/docker# vim install_docker.sh
root@DELLG-15:/home/lili/docker# cat install_docker.sh
```

```
#!/bin/bash

# Update package list
sudo apt-get update

# Install prerequisites
sudo apt-get install -y \
    ca-certificates \
    curl \
    gnupg \
    lsb-release

# Add Docker's official GPG key
sudo mkdir -p /etc/apt/keyrings
curl -fsSL https://download.docker.com/linux/ubuntu/gpg | sudo
gpg --dearmor -o /etc/apt/keyrings/docker.gpg

# Set up the Docker repository
echo \
  "deb [arch=$(dpkg --print-architecture) signed-
by=/etc/apt/keyrings/docker.gpg]
https://download.docker.com/linux/ubuntu \
  $(lsb_release -cs) stable" | sudo tee
/etc/apt/sources.list.d/docker.list > /dev/null

# Update package index again
sudo apt-get update

# Install Docker Engine
```

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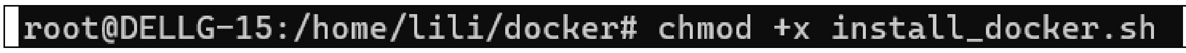
```
sudo apt-get install -y \
    docker-ce \
    docker-ce-cli \
    containerd.io \
    docker-compose-plugin

# Verify Docker installation
sudo docker run hello-world

echo "Docker installed successfully! Please log out and back
in for group changes to take effect."
```

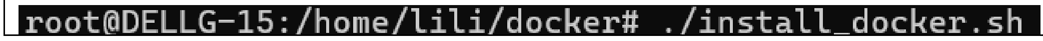
Change $USER based on your user as for me its lili

1.5 Make it executable



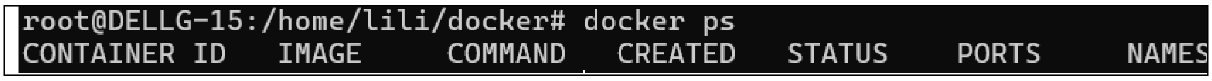
```
root@DELLG-15:/home/lili/docker# chmod +x install_docker.sh
```

1.6 Run it:



```
root@DELLG-15:/home/lili/docker# ./install_docker.sh
```

1.7 Verify Installation



```
root@DELLG-15:/home/lili/docker# docker ps
CONTAINER ID   IMAGE     COMMAND   CREATED   STATUS    PORTS     NAMES
```

1.8 Now exit from root privileges then try "docker ps"

You will find this error

```
lili@DELLG-15:~$ docker ps permission denied while trying to
connect to the Docker daemon socket at
unix:///var/run/docker.sock: Get
"http://%2Fvar%2Frun%2Fdocker.sock/v1.47/containers/json":
dial unix /var/run/docker.sock: connect: permission denied
```

To resolve this

```
sudo usermod -aG docker $USER
```

then

```
newgrp docker
```

now try running

```
docker ps
```

without sudo

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STEP 2 - Installing KIND and kubectl

2.1 Create a new folder name kind_kubectl

```
mkdir kind_kubectl
```

2.2 Create a file in folder kind_kubectl name install_kind_kubernetes.sh

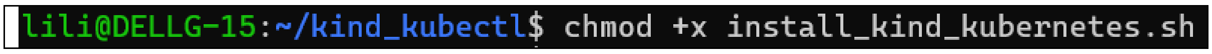
```
vim install_kind_kubernetes.sh
```

2.3 Install KIND and kubectl using the provided script:

```
#!/bin/bash

[ $(uname -m) = x86_64 ] && curl -Lo ./kind
https://kind.sigs.k8s.io/dl/v0.20.0/kind-linux-amd64
chmod +x ./kind
sudo cp ./kind /usr/local/bin/kind

VERSION="v1.30.0"
URL="https://dl.k8s.io/release/${VERSION}/bin/linux/amd64/kube
ctl"
INSTALL_DIR="/usr/local/bin"

curl -LO "$URL"
chmod +x kubectl
sudo mv kubectl $INSTALL_DIR/
kubectl version --client

rm -f kubectl
rm -rf kind

echo "kind & kubectl installation complete."
```

VERSION - give the latest version

2.4 Make it executable



```
lili@DELLG-15:~/kind_kubectl$ chmod +x install_kind_kubernetes.sh
```

2.5 Run it:

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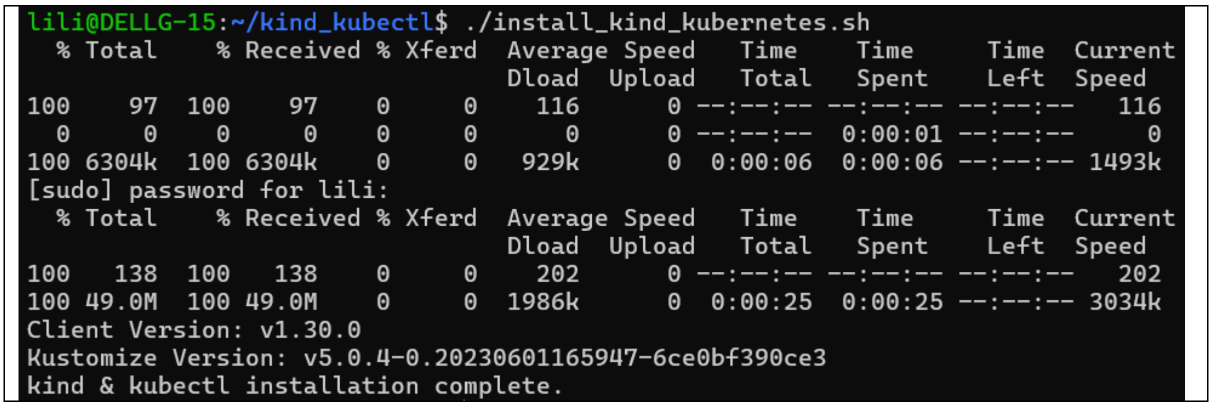


```
lili@DELLG-15:~/kind_kubectl$ ./install_kind_kubernetes.sh
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
100    97  100    97    0     0    116      0 --:--:-- --:--:-- --:--:--   116
  0     0    0     0    0     0      0      0 --:--:--  0:00:01 --:--:--     0
100 6304k  100 6304k    0     0   929k      0  0:00:06  0:00:06 --:--:-- 1493k
[sudo] password for lili:
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
100   138  100   138    0     0    202      0 --:--:-- --:--:-- --:--:--   202
100 49.0M  100 49.0M    0     0  1986k      0  0:00:25  0:00:25 --:--:-- 3034k
Client Version: v1.30.0
Kustomize Version: v5.0.4-0.20230601165947-6ce0bf390ce3
kind & kubectl installation complete.
```

STEP 3 – Setting Up the KIND Cluster

3.1 Create a kind-cluster-config.yaml files in kind_kubectl:

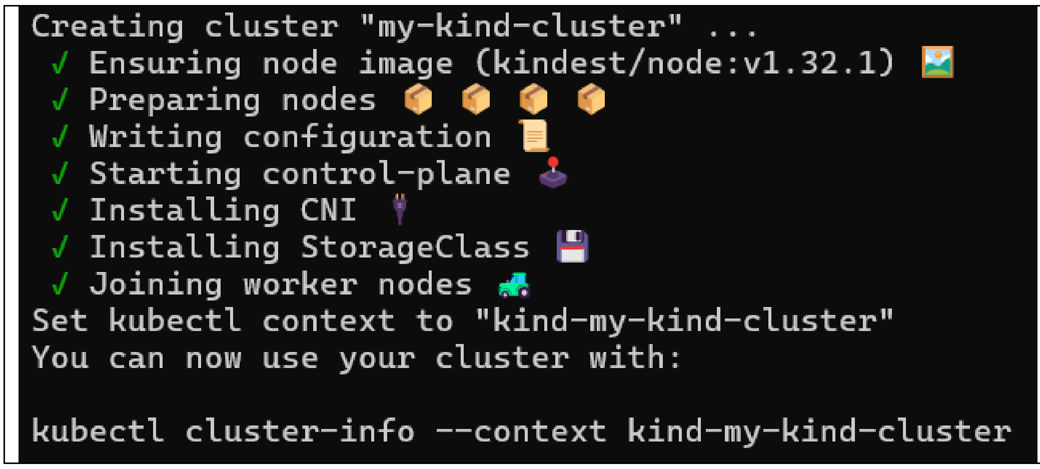
```
kind: Cluster
apiVersion: kind.x-k8s.io/v1alpha4

nodes:
- role: control-plane
  image: kindest/node:v1.32.1
- role: worker
  image: kindest/node:v1.32.1
- role: worker
  image: kindest/node:v1.32.1
  extraPortMappings:
  - containerPort: 80
    hostPort: 80
    protocol: TCP
  - containerPort: 443
    hostPort: 443
    protocol: TCP
```

kindest/node:v1.32.1 – Go to DockerHub and search for latest image of kindest/node

3.2 Create the cluster using the configuration file:

```
kind create cluster --config kind-cluster-config.yaml --name my-kind-cluster
```



```
Creating cluster "my-kind-cluster" ...
 ✓ Ensuring node image (kindest/node:v1.32.1) 🖼
 ✓ Preparing nodes 📦 📦 📦 📦
 ✓ Writing configuration 📜
 ✓ Starting control-plane 🕹️
 ✓ Installing CNI 🔌
 ✓ Installing StorageClass 💾
 ✓ Joining worker nodes 🚜
Set kubectl context to "kind-my-kind-cluster"
You can now use your cluster with:

kubectl cluster-info --context kind-my-kind-cluster
```

in place of my-kind-cluster you can give any name as you want

3.3 Verify the cluster:

```
kubectl get nodes
kubectl cluster-info
```

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