



INDIAN INSTITUTE OF
INFORMATION
TECHNOLOGY

DevOps(DS457)

Assignment

Developing and Deploying a Node.js app from Docker to Kubernetes

Submitted to

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Submitted by

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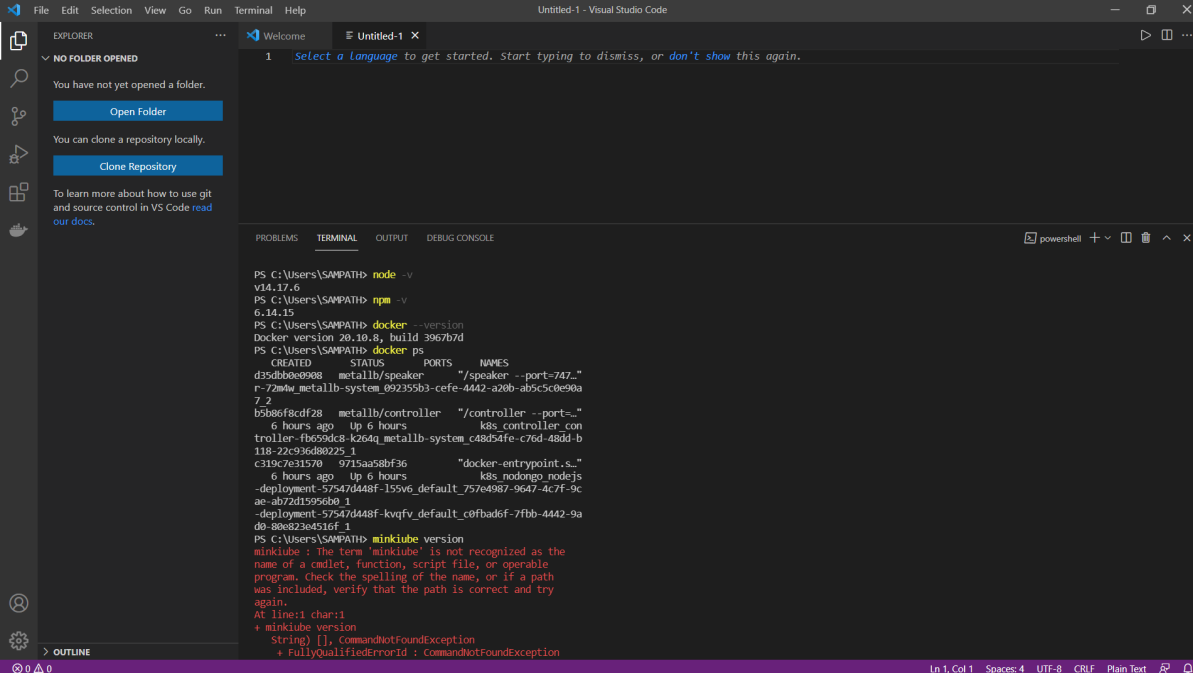
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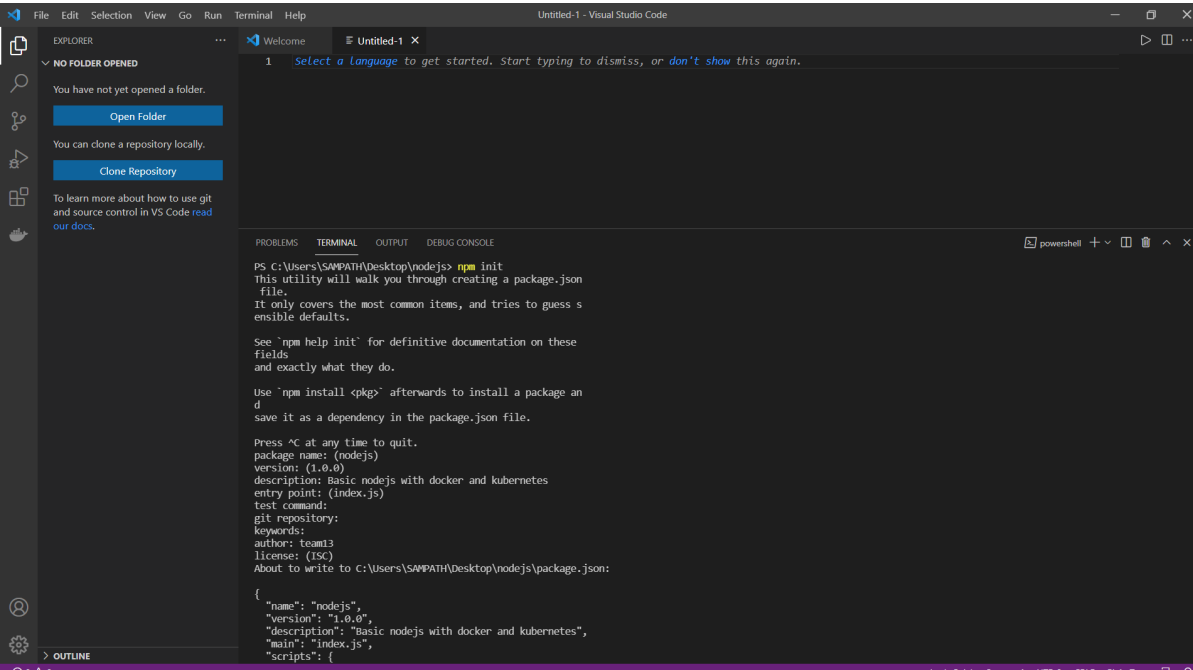
Task:2.2:

Installing and checking Node,npm,Docker,Kubernetes,Minikube:



```
PS C:\Users\SAMPATH> node -v
v14.17.6
PS C:\Users\SAMPATH> npm -v
6.14.15
PS C:\Users\SAMPATH> docker --version
Docker version 20.10.8, build 3967b7d
PS C:\Users\SAMPATH> docker ps
CONTAINER ID        STATUS               PORTS               NAMES
d35db0e0988        metallb/speaker      "/speaker --port=747."
r-72mhw_mettallb-system_092355b3-cefe-4442-a28b-ab9c5c0e90a
7 2
b5b86f8cdf28       metallb/controller   "/controller --port=
6 hours ago        Up 6 hours           k8s_controller_con
troller-fb859a8a-k264q_mettallb-system_c48d54fe-c76d-48dd-b
118-22e936d80225_1
c319c7e31570       9715aa58bf36         "docker-entrypoint.s
6 hours ago        Up 6 hours           k8s_nodongo_nodejs
-deployment-57547d448f-155v6_default_757e4987-9e47-4c7f-9c
ae-ab72d1596d00_1
-deployment-57547d448f-kvqfv_default_c0fbad6f-7fbb-4442-9a
d0-80e823e4516f_1
PS C:\Users\SAMPATH> minikube version
minikube: The term 'minikube' is not recognized as the
name of a cmdlet, function, script file, or operable
program. Check the spelling of the name, or if a path
was included, verify that the path is correct and try
again.
At line:1 char:1
+ minikube version
+ ~~~~~
+ FullyQualifiedErrorId : CommandNotFoundException
```

Initialising node application and installing the express server:



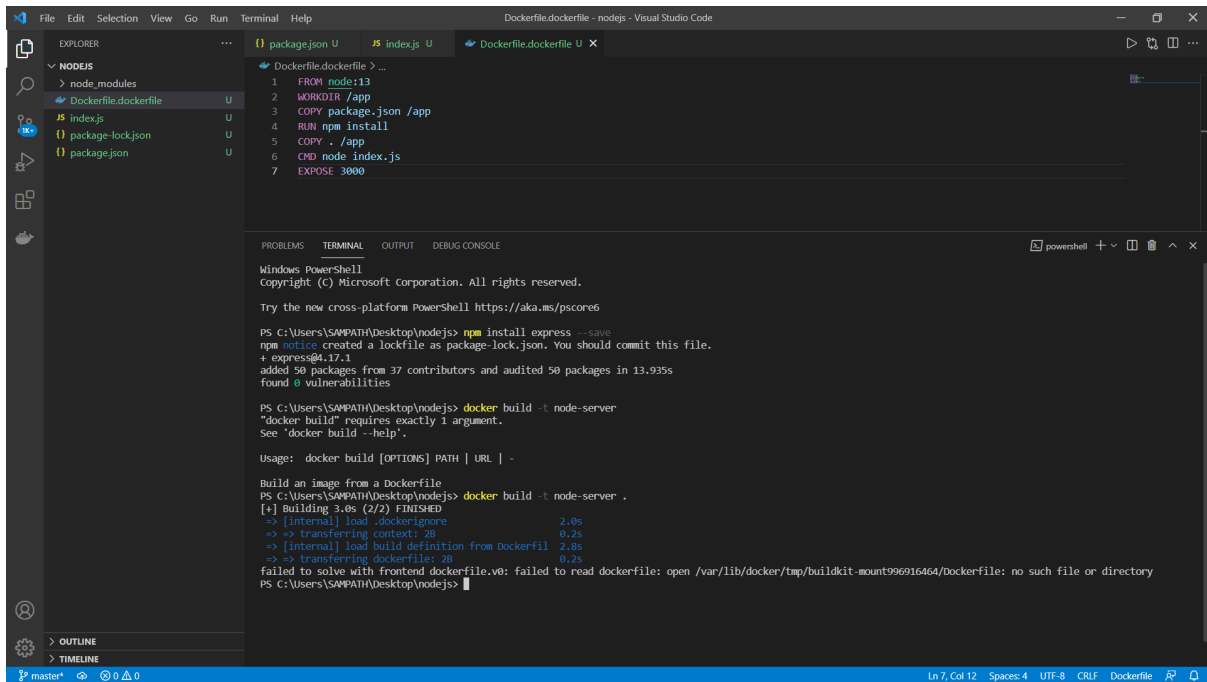
```
PS C:\Users\SAMPATH\Desktop\nodejs> npm init
This utility will walk you through creating a package.json
file.
It only covers the most common items, and tries to guess s
ensible defaults.

See 'npm help init' for definitive documentation on these
fields and exactly what they do.

Use 'npm install <pkg>' afterwards to install a package an
d
save it as a dependency in the package.json file.

Press ^C at any time to quit.
package name: (nodejs)
version: (1.0.0)
description: Basic nodejs with docker and kubernetes
entry point: (index.js)
test command:
git repository:
keywords:
author: team13
license: (ISC)
About to write to C:\Users\SAMPATH\Desktop\nodejs\package.json:

{
  "name": "nodejs",
  "version": "1.0.0",
  "description": "Basic nodejs with docker and kubernetes",
  "main": "index.js",
  "scripts": {
```



The screenshot shows the Visual Studio Code interface with a Dockerfile open in the editor. The Dockerfile contains the following instructions:

```
1 FROM node:13
2 WORKDIR /app
3 COPY package.json /app
4 RUN npm install
5 COPY . /app
6 CMD node index.js
7 EXPOSE 3000
```

The terminal output shows the following commands and their results:

```
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

Try the new cross-platform PowerShell https://aka.ms/powershell

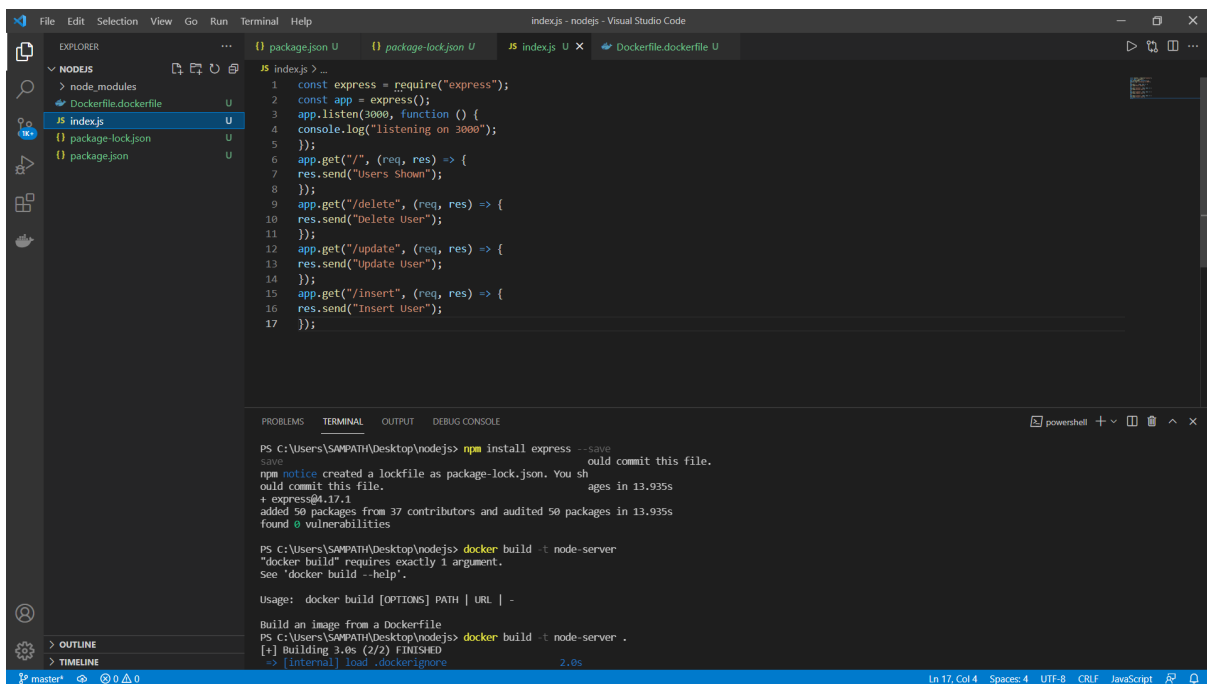
PS C:\Users\SAMPATH\Desktop\nodejs> npm install express --save
npm notice created a lockfile as package-lock.json. You should commit this file.
+ express@4.17.1
added 50 packages from 37 contributors and audited 50 packages in 13.935s
found 0 vulnerabilities

PS C:\Users\SAMPATH\Desktop\nodejs> docker build -t node-server
"docker build" requires exactly 1 argument.
See 'docker build --help'.

Usage: docker build [OPTIONS] PATH | URL | -

Build an image from a Dockerfile
PS C:\Users\SAMPATH\Desktop\nodejs> docker build -t node-server .
[+] Building 3.0s (2/2) FINISHED
=> [internal] load .dockerignore 2.0s
=> => transferring context: 20 0.2s
=> [internal] load build definition from Dockerfile 2.0s
=> => transferring dockerfile: 20 0.2s
failed to solve with frontend dockerfile.v0: failed to read dockerfile: open /var/lib/docker/tmp/buildkit-mount996916464/Dockerfile: no such file or directory
PS C:\Users\SAMPATH\Desktop\nodejs>
```

Configuring the application:



The screenshot shows the Visual Studio Code interface with index.js open in the editor. The index.js file contains the following code:

```
1 const express = require("express");
2 const app = express();
3 app.listen(3000, function () {
4   console.log("listening on 3000");
5 });
6 app.get("/", (req, res) => {
7   res.send("Users Shown");
8 });
9 app.get("/delete", (req, res) => {
10  res.send("Delete User");
11 });
12 app.get("/update", (req, res) => {
13  res.send("Update User");
14 });
15 app.get("/insert", (req, res) => {
16  res.send("Insert User");
17 });
```

The terminal output shows the following commands and their results:

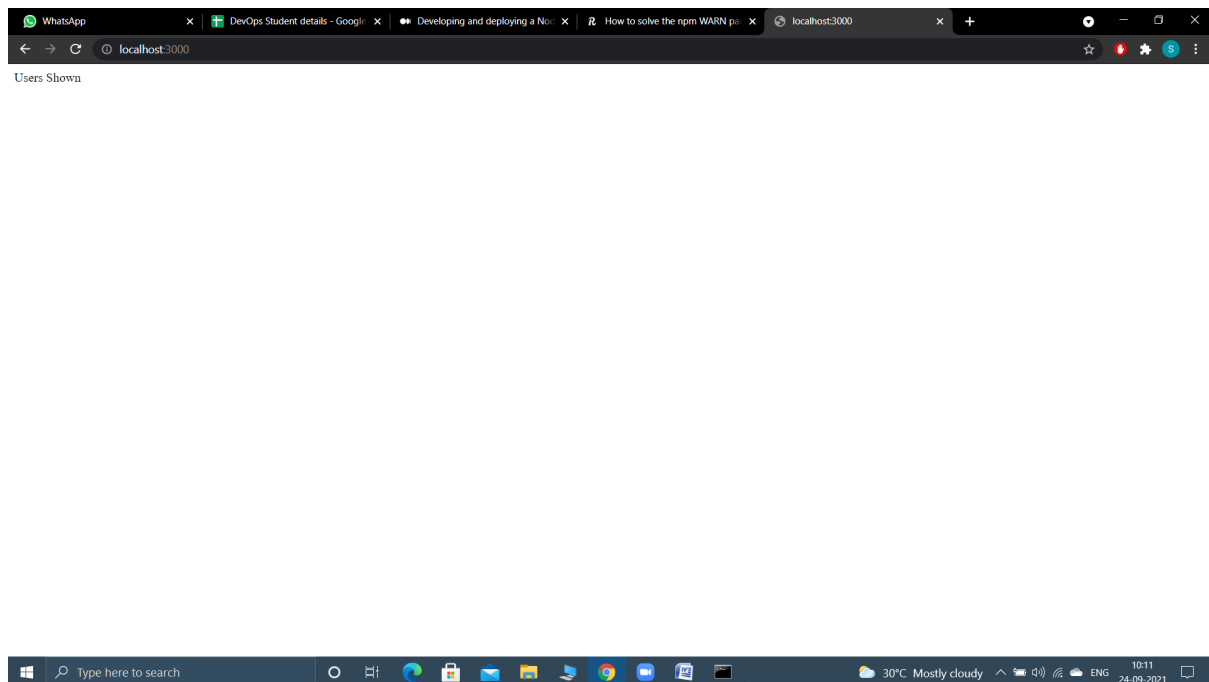
```
PS C:\Users\SAMPATH\Desktop\nodejs> npm install express --save
npm notice created a lockfile as package-lock.json. You should commit this file.
+ express@4.17.1
added 50 packages from 37 contributors and audited 50 packages in 13.935s
found 0 vulnerabilities

PS C:\Users\SAMPATH\Desktop\nodejs> docker build -t node-server
"docker build" requires exactly 1 argument.
See 'docker build --help'.

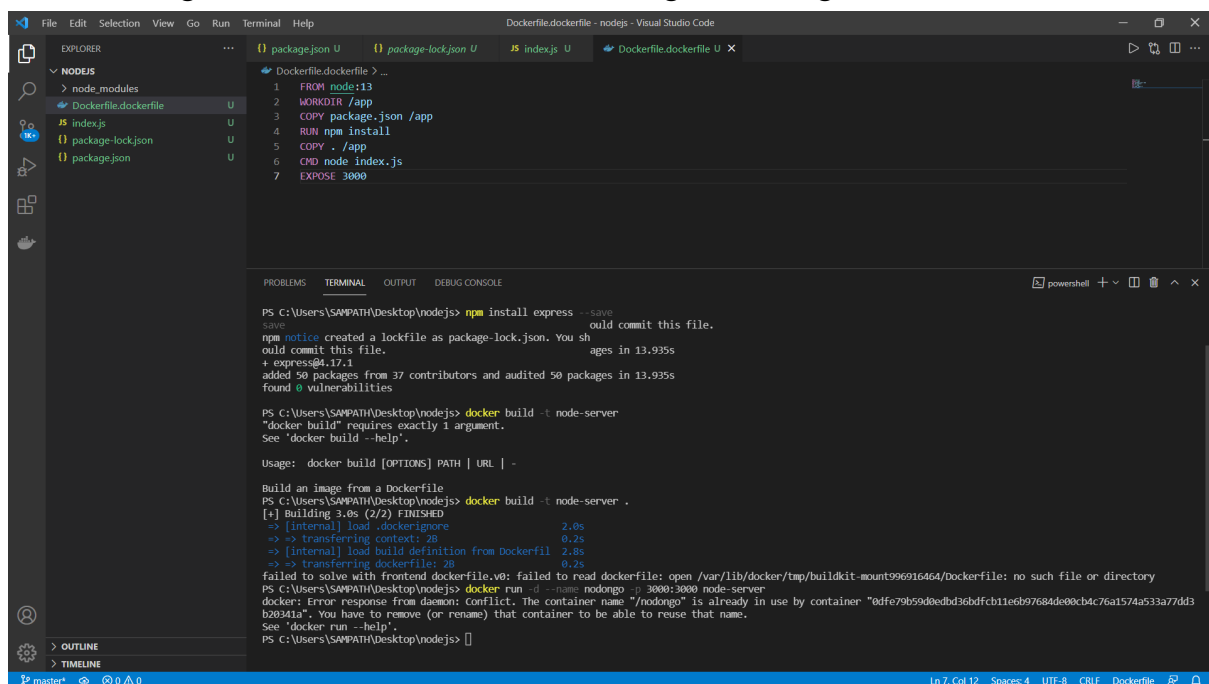
Usage: docker build [OPTIONS] PATH | URL | -

Build an image from a Dockerfile
PS C:\Users\SAMPATH\Desktop\nodejs> docker build -t node-server .
[+] Building 3.0s (2/2) FINISHED
=> [internal] load .dockerignore 2.0s
```

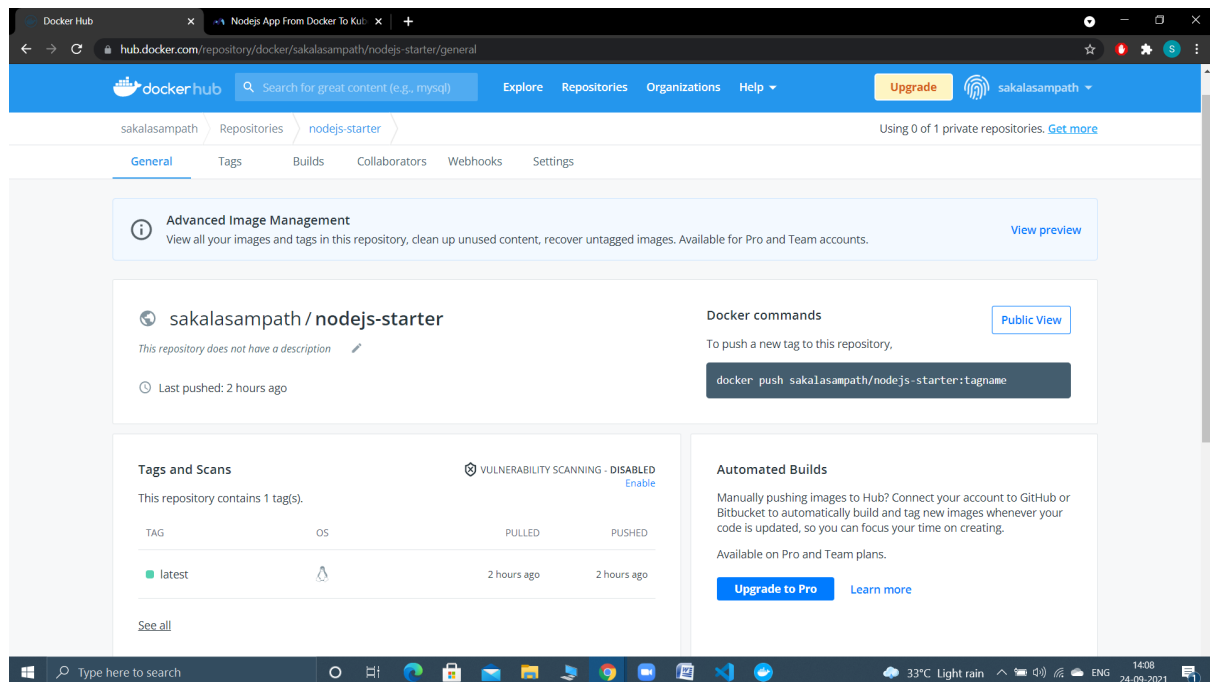
Nodejs web app by browsing localhost:3000/



Dockerizing the node-server and building the image:

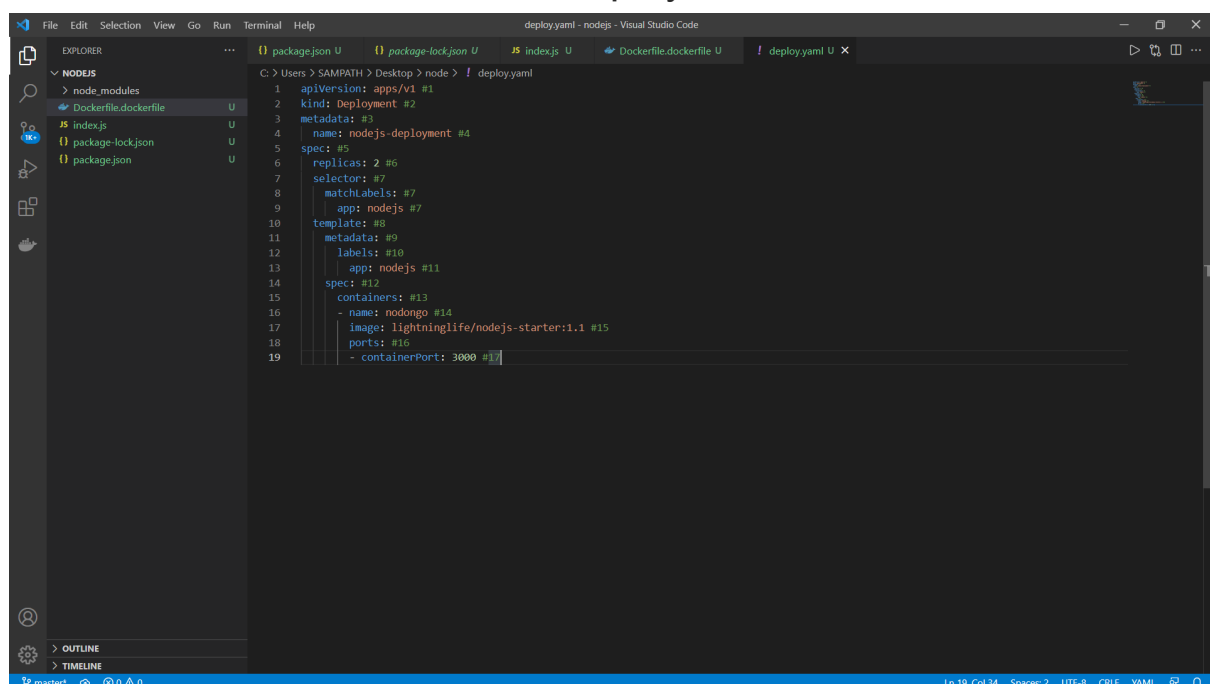


Create and Run the container and then upload the image to docker registry Docker-hub



Start the kubernetes cluster using command:\$ minikube start

Define YAML File To Create A Deployment In Kubernetes Cluster



Creating Deployment in Kubernete cluster by using command:

```
$ kubectl create -f deploy.yaml
```

Expose Deployment to Internet:

```
$ kubectl expose deployment nodejs-deployment --type="LoadBalancer"
```

Using MetalLB in Minikube environment and create a config map for the address pool:

The screenshot shows a Visual Studio Code editor with a file explorer on the left and a terminal at the bottom. The file explorer shows a project named 'NODEJS' with files like 'configmap.yaml', 'deploy.yaml', 'Dockerfile', 'index.js', 'package-lock.json', and 'package.json'. The 'configmap.yaml' file is open in the editor, showing the following content:

```
! configmap.yaml
1  apiVersion: v1
2  kind: ConfigMap
3  metadata:
4    namespace: metallb-system
5    name: config
6  data:
7    config: |
8      address-pools:
9        - name: default
10          protocol: layer2
11          addresses:
12            - 192.168.79.61-192.168.79.71
```

The terminal shows the following commands and output:

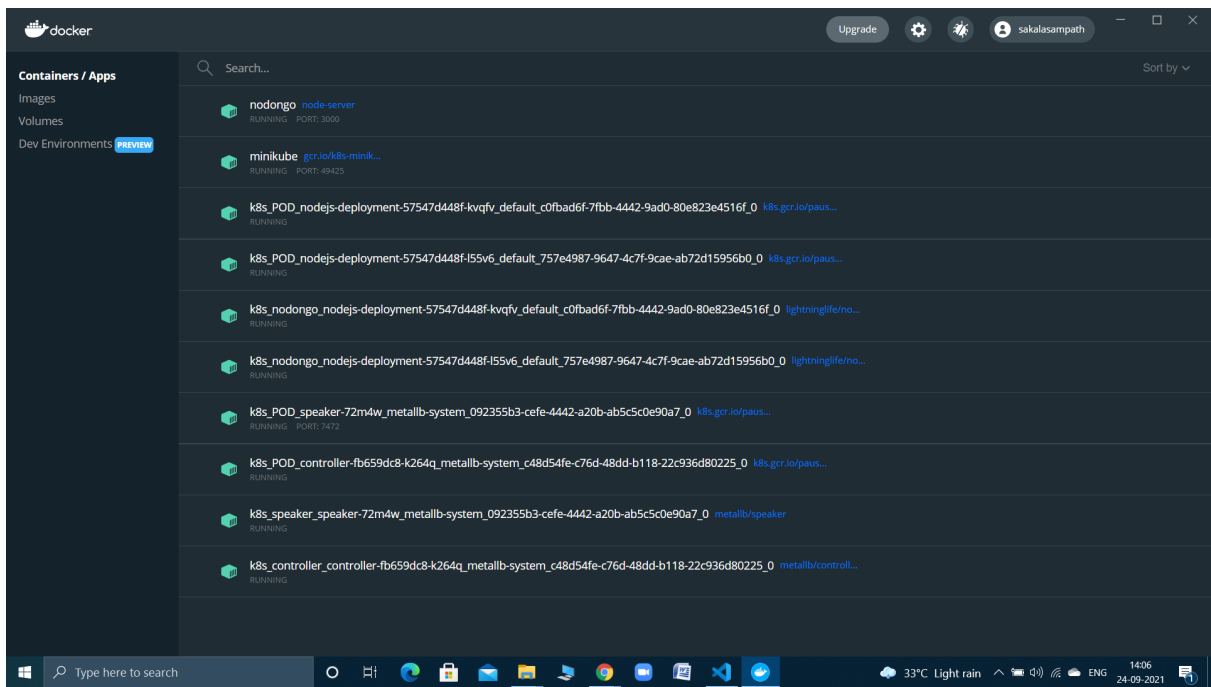
```
PS C:\Users\SAMPATH\Desktop\nodejs> minikube ip
! Executing "docker container inspect minikube --format=
Restarting the docker service may improve performance.
! Executing "docker container inspect minikube --format={{.State.Status}}" took an unusually long time: 2.6851789s
! Restarting the docker service may improve performance.
PS C:\Users\SAMPATH\Desktop\nodejs> minikube ip
! Executing "docker container inspect minikube --format={{.State.Status}}" took an unusually long time: 2.3709005s
! Restarting the docker service may improve performance.
PS C:\Users\SAMPATH\Desktop\nodejs> kubectl create -f configmap.yaml
configmap/config created
PS C:\Users\SAMPATH\Desktop\nodejs> kubectl delete svc nodejs-deployment
service "nodejs-deployment" deleted
PS C:\Users\SAMPATH\Desktop\nodejs> kubectl expose deployment nodejs-deployment --type="LoadBalancer"
service/nodejs-deployment exposed
PS C:\Users\SAMPATH\Desktop\nodejs> kubectl get svc
NAME                TYPE                CLUSTER-IP      EXTERNAL-IP      PORT(S)          AGE
kubernetes          ClusterIP           10.96.0.1       <none>           443/TCP          15h
nodejs-deployment   LoadBalancer       10.99.253.251   192.168.79.61   3000:32184/TCP   13s
PS C:\Users\SAMPATH\Desktop\nodejs>
```

The status bar at the bottom indicates the current file is 'configmap.yaml' at line 12, column 37, with 2 spaces, UTF-8 encoding, and CR/LF line endings.

The screenshot shows the Visual Studio Code interface with a file explorer on the left containing files like `configmap.yaml`, `deploy.yaml`, `Dockerfile`, `index.js`, `package-lock.json`, and `package.json`. The main editor displays the content of `configmap.yaml`:

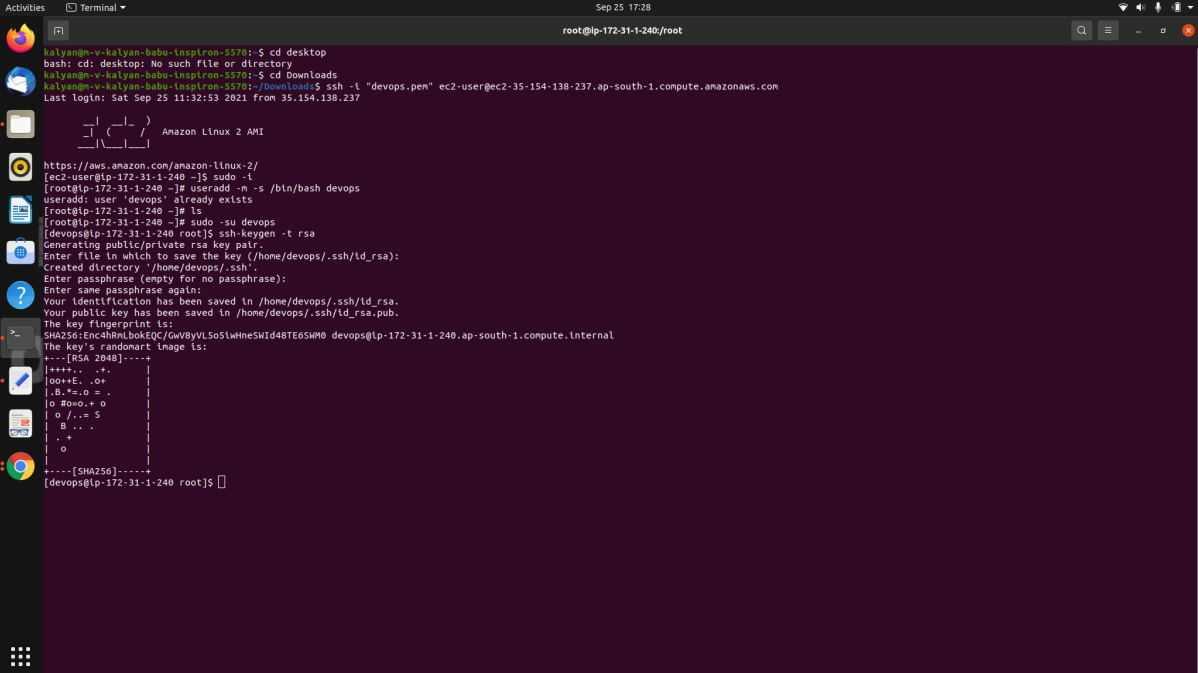
```
1 apiVersion: v1
2 kind: ConfigMap
3 metadata:
4   namespace: metallb-system
5   name: config
6 data:
```

The terminal at the bottom shows the command `kubectl describe services` and its output, detailing the `nodejs-deployment` service configuration, including its namespace, labels, annotations, selector, type, IP families, IP addresses, ports, and target ports.



Task 3:

1. Creating Devops User and Generating SSH Key.



```
kaliyann-v-kalyan-babu-Instpro-5578:~$ cd desktop
bash: cd: desktop: No such file or directory
kaliyann-v-kalyan-babu-Instpro-5578:~$ cd Downloads
kaliyann-v-kalyan-babu-Instpro-5578:~/Downloads$ ssh -t "devops.pen" ec2-user@ec2-35-154-138-237.ap-south-1.compute.amazonaws.com
Last login: Sat Sep 25 11:32:53 2021 from 35.154.138.237

Amazon Linux 2 AMI

https://aws.amazon.com/amazon-linux-2/
[ec2-user@ip-172-31-1-240 ~]$ sudo -i
[root@ip-172-31-1-240 ~]# useradd -n -s /bin/bash devops
useradd: user 'devops' already exists
[root@ip-172-31-1-240 ~]# ls
[root@ip-172-31-1-240 ~]# sudo -su devops
[devops@ip-172-31-1-240 root]$ ssh-keygen -t rsa
Generating public/private rsa key pair.
Enter file in which to save the key (/home/devops/.ssh/id_rsa):
Created directory '/home/devops/.ssh'.
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /home/devops/.ssh/id_rsa.
Your public key has been saved in /home/devops/.ssh/id_rsa.pub.
The key fingerprint is:
SHA256:EncdHMLbQEQ/Gw8yVLS05WheSWId48TE6SWM0 devops@ip-172-31-1-240.ap-south-1.compute.internal
The key's randomart image is:
+--[RSA 2048]-----
|
|oo++E. .o+
|.B.*.=.o =
|o Rooo.o
|o /..= S
|B...
|..+
|o
+-----[SHA256]-----
[devops@ip-172-31-1-240 root]$
```

2. How to Run a Playbook

- You need to provide the user `ec2-user` and the key to connect to the remote host.
- I am assuming all the remote hosts have same keys
- You need to use the `.pem` file to connect initially
- PEM file need to have specific permission before you can use it directly. If the permission is not set properly you will see the error “It is required that your private key files are NOT accessible by others. This private key will be ignored.”


```
Activities Terminal Sep 25 18:05
root@ip-172-31-1-240:~/Ansible-Sample-Application-Deployment

TASK [include_role : tomcat] *****
TASK [tomcat : Install Java 1.7] *****
changed: [172.31.8.178]
TASK [add group "tomcat"] *****
changed: [172.31.8.178]
TASK [add user "tomcat"] *****
changed: [172.31.8.178]
TASK [tomcat : Download Tomcat] *****
changed: [172.31.8.178]
TASK [tomcat : Extract archive] *****
[WARNING]: Consider using the unarchive module rather than running "tar". If you need to use command because unarchive is insufficient you can add 'warn: false' to this command task or set 'command_warnings=False' in ansible.cfg to get rid of this message.
changed: [172.31.8.178]
TASK [tomcat : Symlink install directory] *****
changed: [172.31.8.178]
TASK [tomcat : Change ownership of Tomcat installation] *****
changed: [172.31.8.178]
TASK [tomcat : Configure Tomcat server] *****
changed: [172.31.8.178]
TASK [tomcat : Configure Tomcat users] *****
changed: [172.31.8.178]
TASK [tomcat : Create sample directory] *****
changed: [172.31.8.178]
TASK [tomcat : copy sample index.html file] *****
changed: [172.31.8.178]
TASK [tomcat : Install Tomcat init script] *****
changed: [172.31.8.178]
TASK [tomcat : Start Tomcat] *****
[WARNING]: The service (tomcat) is actually an init script but the system is managed by systemd
changed: [172.31.8.178]
TASK [wait for tomcat to start] *****
ok: [172.31.8.178]
RUNNING HANDLER [restart tomcat] *****
changed: [172.31.8.178]
PLAY RECAP *****
172.31.8.178 : ok=21 changed=17 unreachable=0 failed=0 skipped=0 rescued=0 ignored=0
[devops@ip-172-31-1-240 Ansible-Sample-Application-Deployment]$
```

3.You can see that I am executing an `id` command with SSH connection and using my(Devops) private key file to login without password.

```
Activities Terminal Sep 25 18:09
root@ip-172-31-1-240:~/Ansible-Sample-Application-Deployment

TASK [add group "tomcat"] *****
changed: [172.31.8.178]
TASK [add user "tomcat"] *****
changed: [172.31.8.178]
TASK [tomcat : Download Tomcat] *****
changed: [172.31.8.178]
TASK [tomcat : Extract archive] *****
[WARNING]: Consider using the unarchive module rather than running "tar". If you need to use command because unarchive is insufficient you can add 'warn: false' to this command task or set 'command_warnings=False' in ansible.cfg to get rid of this message.
changed: [172.31.8.178]
TASK [tomcat : Symlink install directory] *****
changed: [172.31.8.178]
TASK [tomcat : Change ownership of Tomcat installation] *****
changed: [172.31.8.178]
TASK [tomcat : Configure Tomcat server] *****
changed: [172.31.8.178]
TASK [tomcat : Configure Tomcat users] *****
changed: [172.31.8.178]
TASK [tomcat : Create sample directory] *****
changed: [172.31.8.178]
TASK [tomcat : copy sample index.html file] *****
changed: [172.31.8.178]
TASK [tomcat : Install Tomcat init script] *****
changed: [172.31.8.178]
TASK [tomcat : Start Tomcat] *****
[WARNING]: The service (tomcat) is actually an init script but the system is managed by systemd
changed: [172.31.8.178]
TASK [wait for tomcat to start] *****
ok: [172.31.8.178]
RUNNING HANDLER [restart tomcat] *****
changed: [172.31.8.178]
PLAY RECAP *****
172.31.8.178 : ok=21 changed=17 unreachable=0 failed=0 skipped=0 rescued=0 ignored=0

[devops@ip-172-31-1-240 Ansible-Sample-Application-Deployment]$ ssh -p -i ./ssh/id_rsa devops@172.31.8.178 "id devops && id devops"
Bad port '-i'
[devops@ip-172-31-1-240 Ansible-Sample-Application-Deployment]$ ssh -i ./ssh/id_rsa devops@172.31.8.178 "id devops && id devops"
Warning: Identity file /home/devops/ssh/id_rsa not accessible: No such file or directory.
uid=1001(devops) gid=1001(devops) groups=1001(devops)
uid=1001(devops) gid=1001(devops) groups=1001(devops)
[devops@ip-172-31-1-240 Ansible-Sample-Application-Deployment]$
```

Task.2.2:

Validate if a line or string present or not

[illegible]