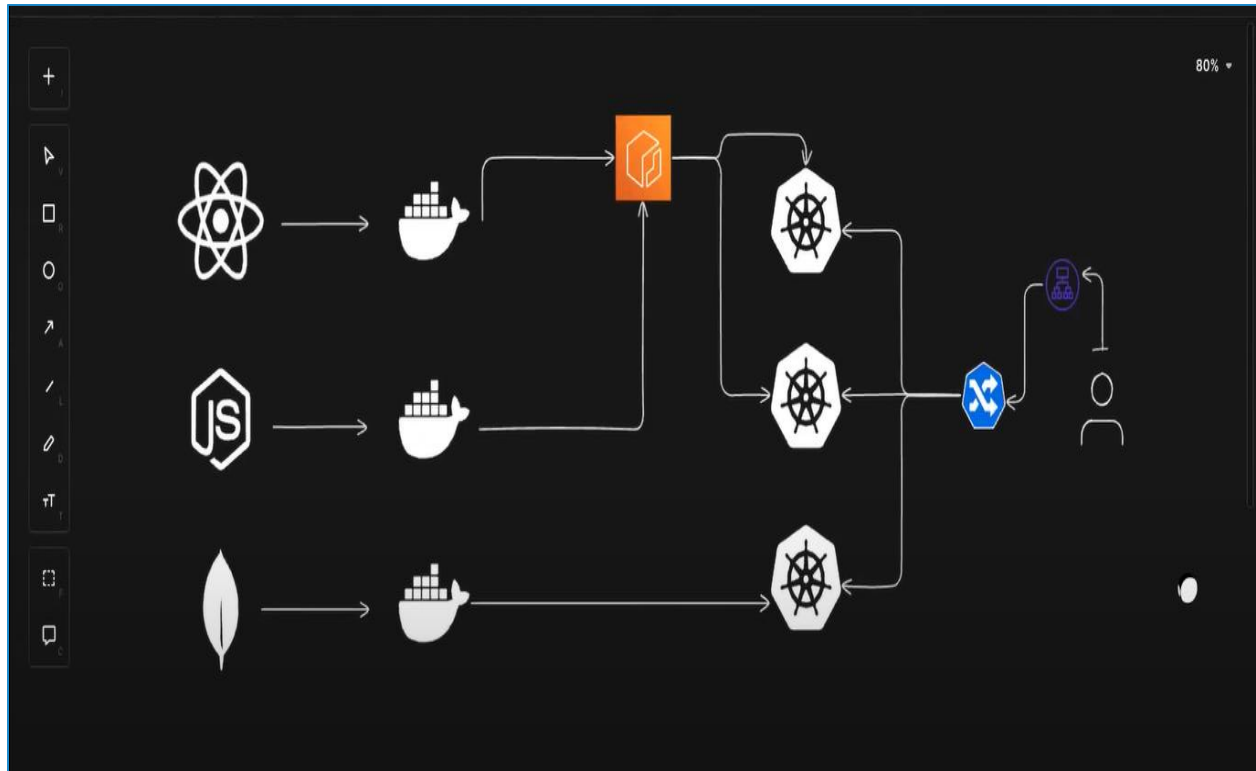
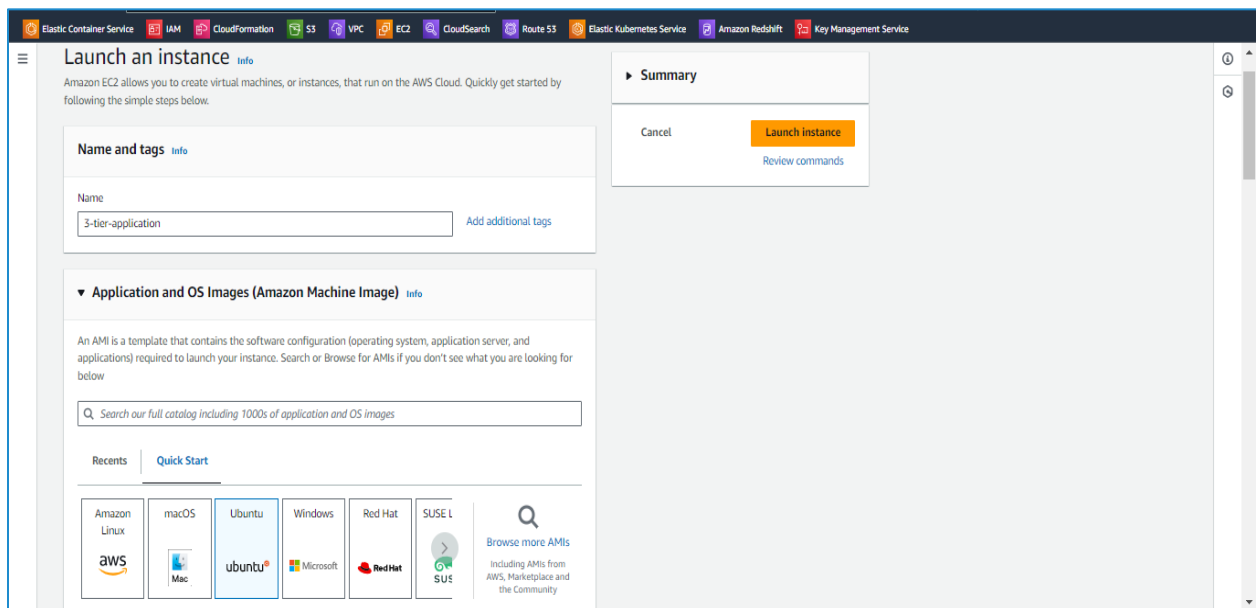


THREE TIER ARCHITECTURE USING DOCKER & K8s



Step1: Launch 1 EC2 instance for creating a docker file



Step2: Select instance type, key pair and VPC

The screenshot shows the 'Launch Instance' wizard in the AWS Management Console, specifically the 'Instance type', 'Key pair (login)', and 'Network settings' sections.

Instance type: The 't2.micro' instance type is selected. It is noted as 'Free tier eligible'. Details include: Family: t2, 1 vCPU, 1 GiB Memory, Current generation: true. Pricing: On-Demand Windows base pricing: 0.0162 USD per Hour, On-Demand SUSE base pricing: 0.0116 USD per Hour, On-Demand RHEL base pricing: 0.0716 USD per Hour, On-Demand Linux base pricing: 0.0116 USD per Hour. A link to 'Compare instance types' is provided.

Key pair (login): A key pair named 'aws' is selected. A 'Create new key pair' button is available.

Network settings: A VPC is selected with ID 'vpc-07e92c15916f55167' and the default subnet. A 'Create new VPC' button is also present.

Summary: The 'Launch Instance' button is highlighted in orange, with a 'Cancel' button and a 'Review commands' link.

Step 3: Then our instance has been created

The screenshot shows the 'Instances' page in the AWS Management Console. A table lists the instances, and the details of a specific instance are shown below.

Name	Instance ID	Instance state	Instance type	Status check	Alarm status	Availability Zone	Public IPv4 DNS	Public IPv4 ...	Elastic IP
3-tier-applicat...	i-0a93b25b45cf9e085	Running	t2.micro	-	View alarms	us-east-1b	ec2-44-204-86-198.co...	44.204.86.198	-

Instance: i-0a93b25b45cf9e085 (3-tier-application)

Details | Status and alarms New | Monitoring | Security | Networking | Storage | Tags

Instance summary

Instance ID i-0a93b25b45cf9e085 (3-tier-application)	Public IPv4 address 44.204.86.198 open address	Private IPv4 addresses 172.31.93.91
IPv6 address -	Instance state Running	Public IPv4 DNS ec2-44-204-86-198.compute-1.amazonaws.com open address
Hostname type IP name: ip-172-31-93-91.ec2.internal	Private IP DNS name (IPv4 only) ip-172-31-93-91.ec2.internal	Elastic IP addresses -
Answer private resource DNS name IPv4 (A)	Instance type t2.micro	AWS Compute Optimizer finding
Auto-assigned IP address	VPC ID	

Step 4: install docker on ubuntu machine and start docker daemon service using `systemctl start docker` command.

The image shows a Windows desktop environment. At the top, a taskbar contains several application icons: a file explorer, a web browser, a terminal, and a few utility icons. The main area of the screen is occupied by a terminal window titled "44.204.86.198 (ubuntu)". The terminal displays the output of a `sudo apt-get update` command, showing a list of packages to be installed or updated, including `jammy`, `jammy-security`, `jammy-universe`, and `jammy-backports`. The packages are listed with their names, architectures, and sizes. At the bottom of the screen, another taskbar is visible, showing the Windows Start button, a search bar, and various system icons including the date and time (6:12 PM, 4/11/2024).

Step 5: Then get the access of instance through ssh and clone the repository of application code.

The screenshot shows a Windows desktop environment. At the top, there is a terminal window titled "44.204.86.198 (ubuntu)". The terminal displays the following commands and output:

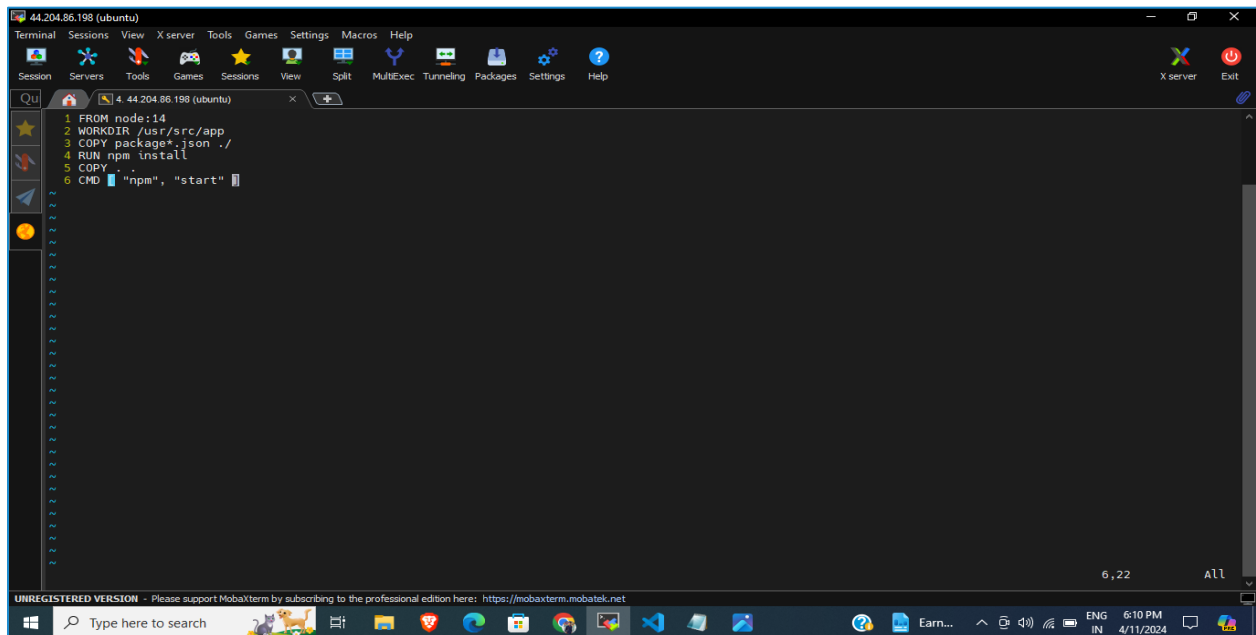
```

root@ip-172-31-93-01:~# ls
root@ip-172-31-93-01:~# git clone https://github.com/Umesh0263/3-tier-nodejs-app.git
Cloning into '3-tier-nodejs-app'...
remote: Enumerating objects: 117, done.
remote: Counting objects: 100% (117/117), done.
remote: Compressing objects: 100% (81/81), done.
remote: Total 117 (delta 30), reused 117 (delta 30), pack-reused 0
Receiving objects: 100% (117/117), 1.32 MiB | 23.26 MiB/s, done.
Resolving deltas: 100% (30/30), done.
root@ip-172-31-93-01:~# ls
3-tier-nodejs-app
root@ip-172-31-93-01:~# cd 3-tier-nodejs-app/
root@ip-172-31-93-01:~/3-tier-nodejs-app# ls
Application-Code  Kubernetes-Manifests  README.md
root@ip-172-31-93-01:~/3-tier-nodejs-app# cd Application-Code/
root@ip-172-31-93-01:~/3-tier-nodejs-app/Application-Code# ls
backend  frontend
root@ip-172-31-93-01:~/3-tier-nodejs-app/Application-Code#

```

Below the terminal window, there is a taskbar with various icons, including the Start button, search bar, and several application icons. The system tray at the bottom right shows the date and time as "6:07 PM 4/1/2024".

Step 6: Next, create docker file for frontend of the application.

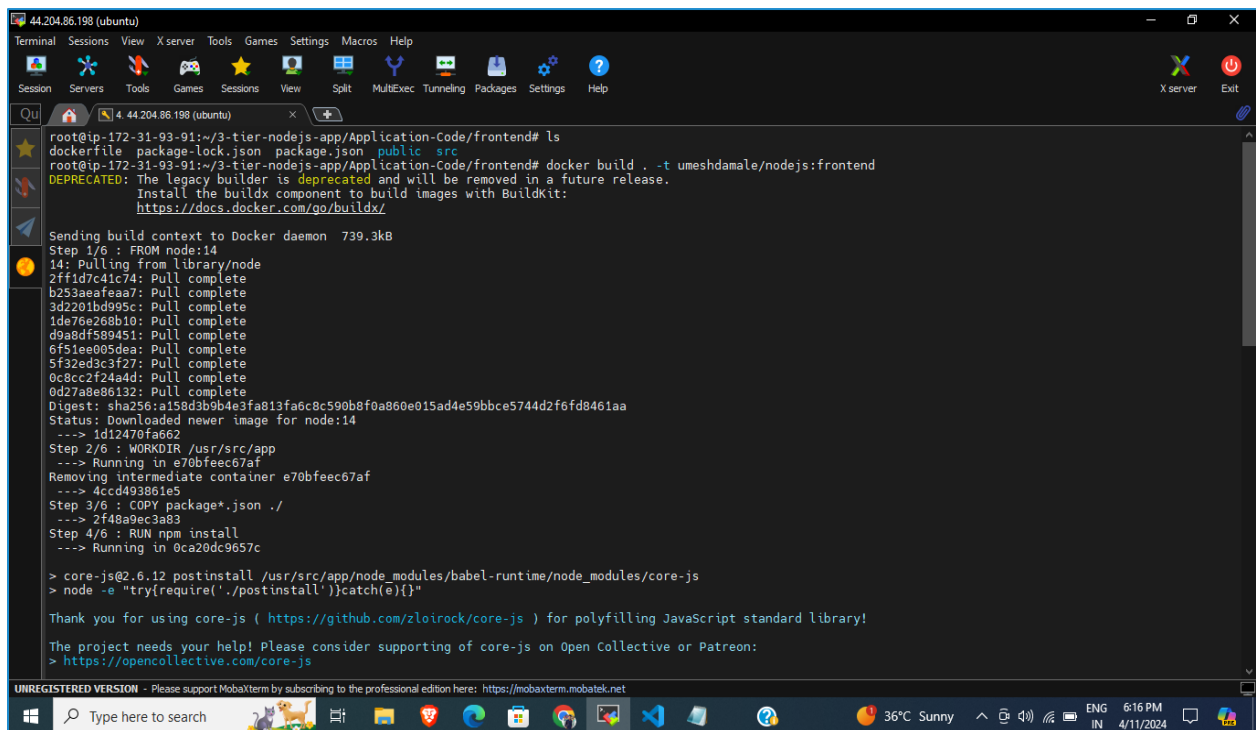


```
44.204.86.198 (ubuntu)
Terminal Sessions View X server Tools Games Settings Macros Help
Session Servers Tools Games Sessions View Split MultExec Tunneling Packages Settings Help

Qu 4 44.204.86.198 (ubuntu) x
1 FROM node:14
2 WORKDIR /usr/src/app
3 COPY package*.json ./
4 RUN npm install
5 COPY . .
6 CMD ["npm", "start"]

6,22 All
UNREGISTERED VERSION - Please support MobaXterm by subscribing to the professional edition here: https://mobaxterm.mobatek.net
```

Step 7: Then, build docker file using docker build command & give tag umeshdamale/nodejs:frontend.



```
44.204.86.198 (ubuntu)
Terminal Sessions View X server Tools Games Settings Macros Help
Session Servers Tools Games Sessions View Split MultExec Tunneling Packages Settings Help

Qu 4 44.204.86.198 (ubuntu) x
root@ip-172-31-93-91:~/3-tier-nodejs-app/Application-Code/frontend# ls
dockerfile package-lock.json package.json public src
root@ip-172-31-93-91:~/3-tier-nodejs-app/Application-Code/frontend# docker build . -t umeshdamale/nodejs:frontend
DEPRECATED: The legacy builder is deprecated and will be removed in a future release.
Install the buildx component to build images with BuildKit:
https://docs.docker.com/go/buildx/

Sending build context to Docker daemon 739.3kB
Step 1/6 : FROM node:14
14: Pulling from library/node
2ff1d7c41c74: Pull complete
b253aefaea7: Pull complete
3d2201bd995c: Pull complete
1de79e268b19: Pull complete
09a8df589451: Pull complete
6f51ee005dea: Pull complete
5f32ed3c3f27: Pull complete
0c8cc2f24a4d: Pull complete
0d27a8e86132: Pull complete
Digest: sha256:a158d3b9b4e3fa813fa6c8c590b8f0a860e015ad4e59bbce5744d2f6fd8461aa
Status: Downloaded newer image for node:14
--> 1d12470fa662
Step 2/6 : WORKDIR /usr/src/app
--> Running in e70bfec67af
Removing intermediate container e70bfec67af
--> 4ccd493861e5
Step 3/6 : COPY package*.json ./
--> 2f48a9ec3a83
Step 4/6 : RUN npm install
--> Running in 0ca20dc9657c

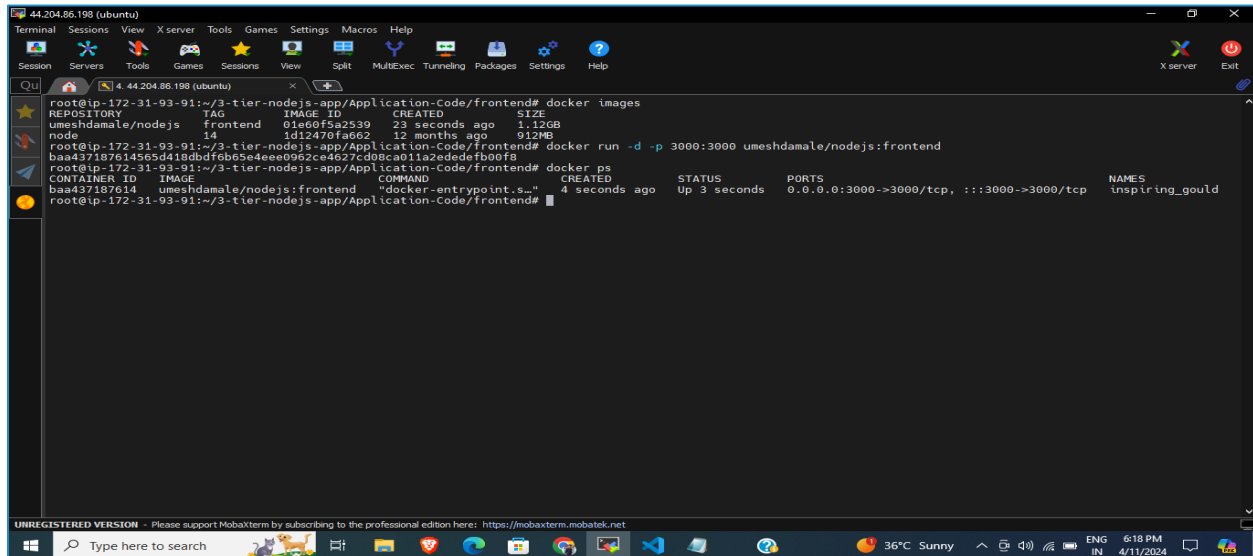
> core-js@2.6.12 postinstall /usr/src/app/node_modules/babel-runtime/node_modules/core-js
> node -e "try{require('./postinstall')}catch(e){}"

Thank you for using core-js ( https://github.com/zloirock/core-js ) for polyfilling JavaScript standard library!

The project needs your help! Please consider supporting of core-js on Open Collective or Patreon:
> https://opencollective.com/core-js

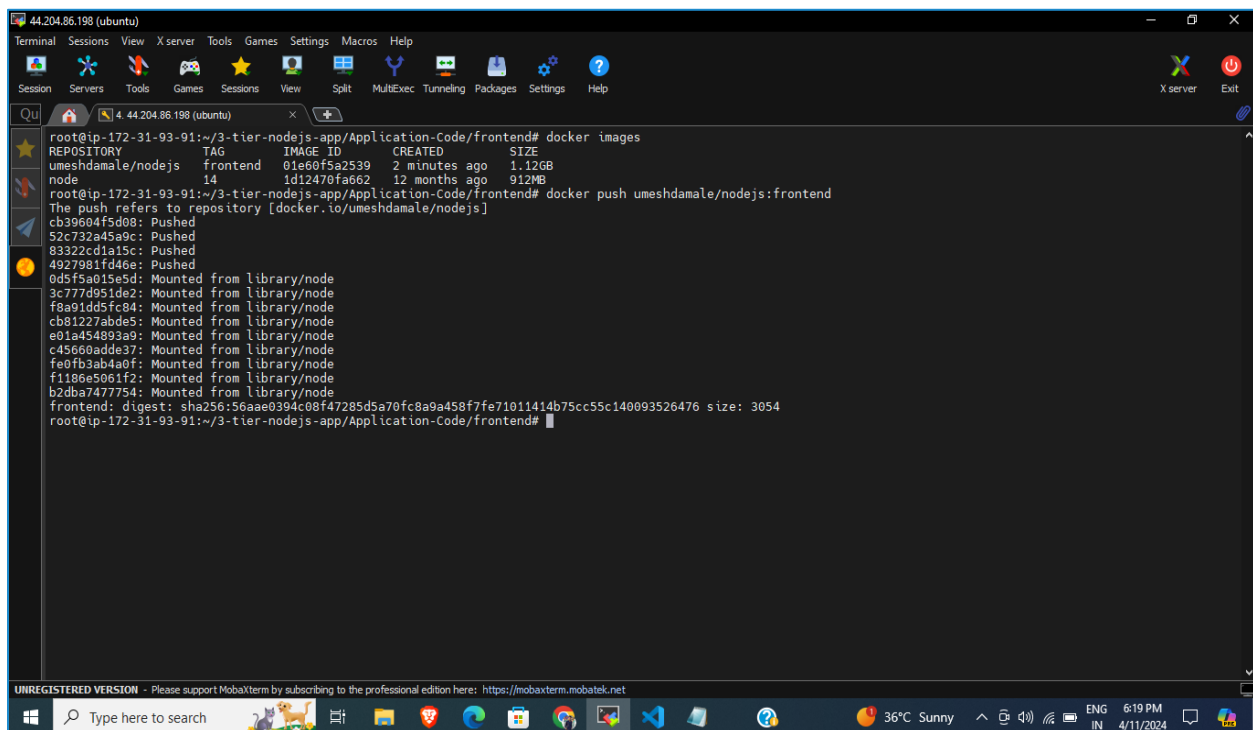
36°C Sunny 6:16 PM 4/11/2024
UNREGISTERED VERSION - Please support MobaXterm by subscribing to the professional edition here: https://mobaxterm.mobatek.net
```

Step 8: Here, Docker image has been created then, run docker images using docker run command on 3000 ports.



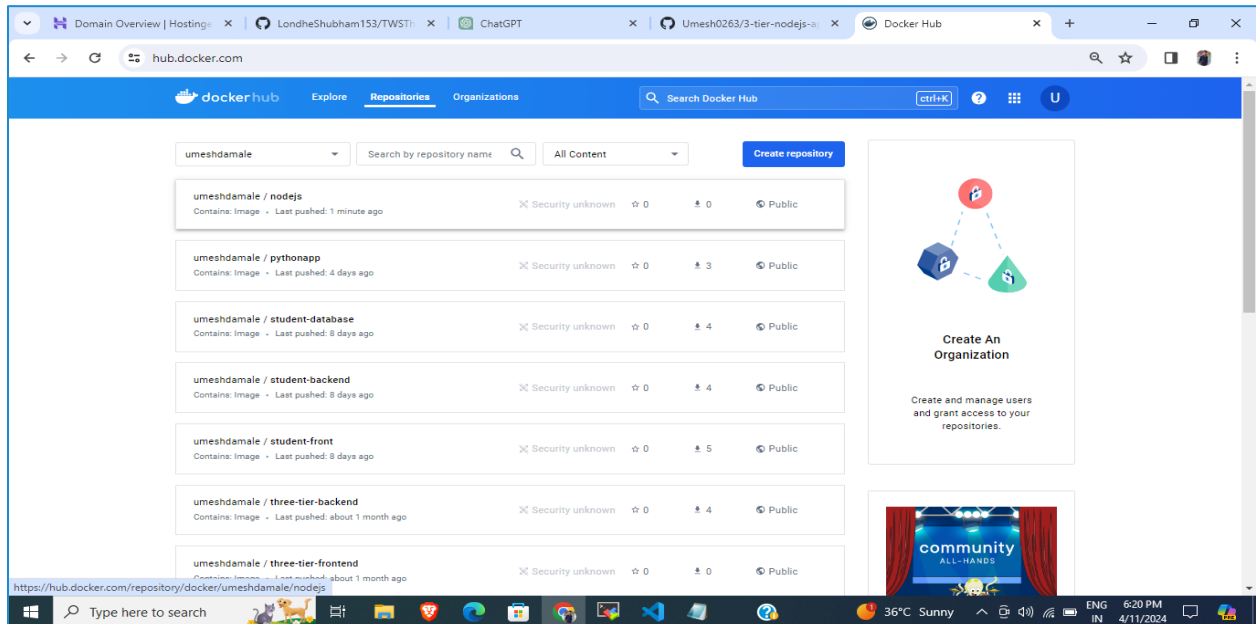
```
root@ip-172-31-93-91:~/3-tier-nodejs-app/Application-Code/frontend# docker images
REPOSITORY          TAG                 IMAGE ID            CREATED             SIZE
umeshdamale/nodejs  frontend           01e60f5a2539       23 seconds ago     1.12GB
node                 14                 1d12470fa662       12 months ago      912MB
root@ip-172-31-93-91:~/3-tier-nodejs-app/Application-Code/frontend# docker run -d -p 3000:3000 umeshdamale/nodejs:frontend
baa437187614565d418dbdf6b65e4eee0962ce4627cd08ca011a2ededefb00f8
root@ip-172-31-93-91:~/3-tier-nodejs-app/Application-Code/frontend# docker ps
CONTAINER ID        IMAGE               COMMAND             CREATED             STATUS              PORTS               NAMES
baa437187614        umeshdamale/nodejs:frontend  "docker-entrypoint.s..."  4 seconds ago      Up 3 seconds       0.0.0.0:3000->3000/tcp, :::3000->3000/tcp  inspiring_gould
```

Step 9: Then, push the docker image to docker Hub using docker push command, ensuring that you have logged in first using username and pass.

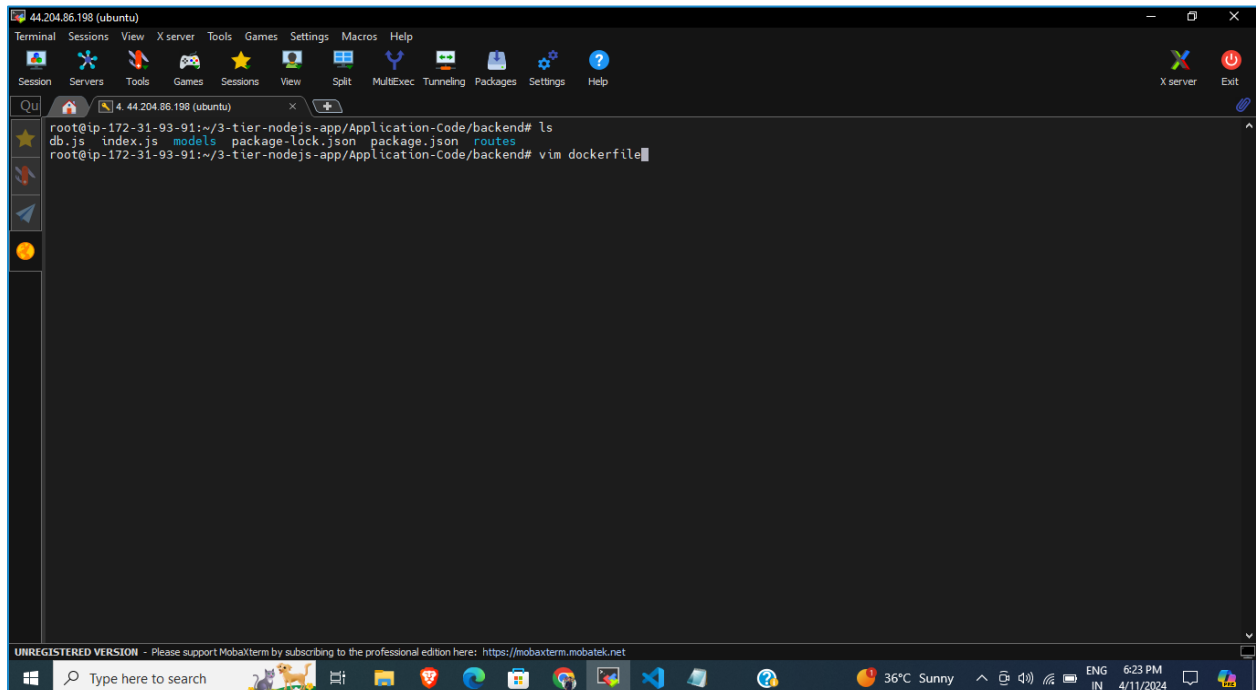


```
root@ip-172-31-93-91:~/3-tier-nodejs-app/Application-Code/frontend# docker images
REPOSITORY          TAG                 IMAGE ID            CREATED             SIZE
umeshdamale/nodejs  frontend           01e60f5a2539       2 minutes ago     1.12GB
node                 14                 1d12470fa662       12 months ago      912MB
root@ip-172-31-93-91:~/3-tier-nodejs-app/Application-Code/frontend# docker push umeshdamale/nodejs:frontend
The push refers to repository [docker.io/umeshdamale/nodejs]
cb39604f5d08: Pushed
52c732a45a9e: Pushed
83322cd1a15c: Pushed
4927981fd46e: Pushed
0d5f5a015e5d: Mounted from library/node
3c777d951de2: Mounted from library/node
f8a91dd5f8c84: Mounted from library/node
cb81227abde5: Mounted from library/node
e01a454893a9: Mounted from library/node
c45660adde37: Mounted from library/node
fe0fb3ab4a0f: Mounted from library/node
f1186e5061f2: Mounted from library/node
b2dba7477754: Mounted from library/node
frontend: digest: sha256:56aae0394c08f47285d5a70fc8a9a458f7fe71011414b75cc55c140093526476 size: 3054
root@ip-172-31-93-91:~/3-tier-nodejs-app/Application-Code/frontend#
```

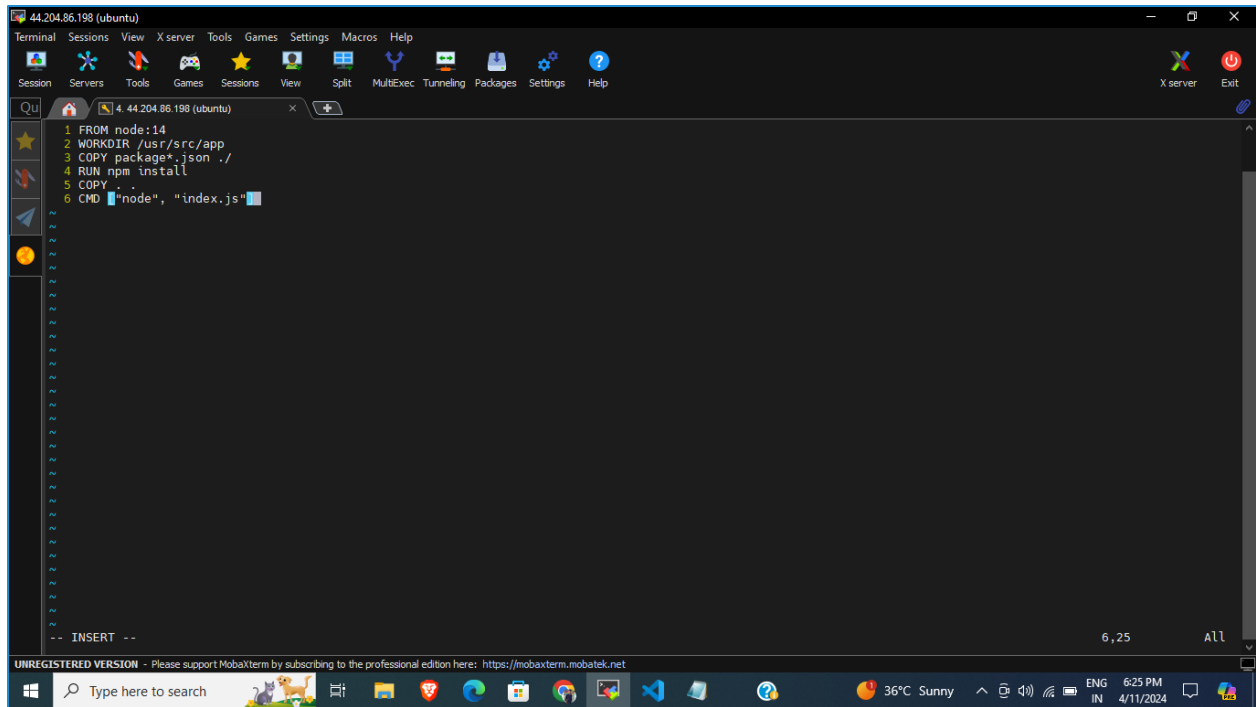
Step 10: Following are the Docker Hub Image of nodejs frontend.



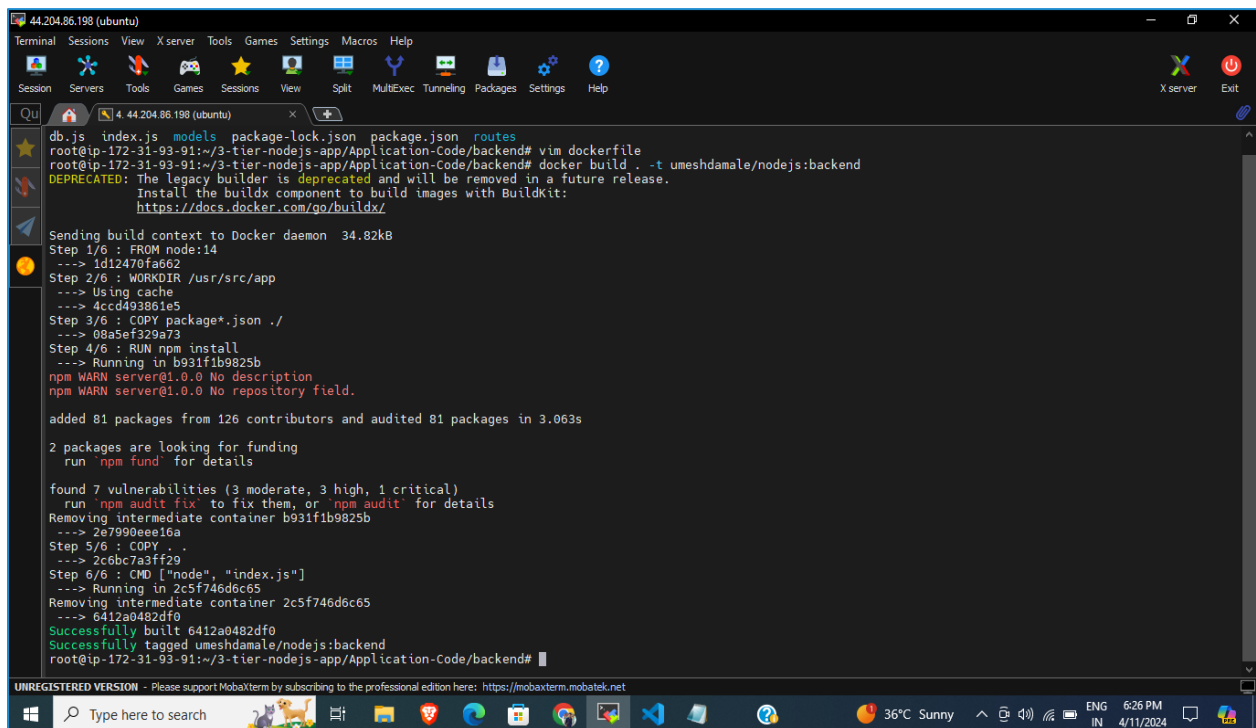
Step 11: Now, create a docker file for the backend app.



Step 12: following is the docker file for frontend.



Step 13: Then, build a docker file and give tag.



Step 14: Then, run the docker image on 3500 ports using docker run command.

The screenshot shows a terminal window with the following content:

```
root@ip-172-31-93-91:~/3-tier-nodejs-app/Application-Code/backend# docker images
REPOSITORY          TAG         IMAGE ID      CREATED       SIZE
umeshdamale/nodejs  backend    6412a0482df0 About a minute ago 924MB
umeshdamale/nodejs  frontend   01e60f5a2539 11 minutes ago 1.12GB
node                 14         1d12470fa662 12 months ago 912MB

root@ip-172-31-93-91:~/3-tier-nodejs-app/Application-Code/backend# docker run -d -p 3500:3500 umeshdamale/nodejs:backend
c9868f9f7f00c5ced0cad05db19848ad8c16193ddcf997f12377da1b7375f3c0

root@ip-172-31-93-91:~/3-tier-nodejs-app/Application-Code/backend# docker ps
CONTAINER ID   IMAGE                                COMMAND                  CREATED        STATUS        PORTS                               NAMES
c9868f9f7f00  umeshdamale/nodejs:backend          "docker-entrypoint.s..." 5 seconds ago Up 4 seconds 0.0.0.0:3500->3500/tcp, :::3500->3500/tcp  bold_easley

root@ip-172-31-93-91:~/3-tier-nodejs-app/Application-Code/backend# docker logs c9868f9f7f00
Listening on port 3500...
Could not connect to database. MongooseError: The 'uri' parameter to 'openUri()' must be a string, got "undefined". Make sure the first parameter to 'mongoose.connect()' or 'mongoose.createConnection()' is a string.
    at NativeConnection.Connection.openUri (/usr/src/app/node_modules/mongoose/lib/connection.js:694:11)
    at /usr/src/app/node_modules/mongoose/lib/index.js:351:10
    at /usr/src/app/node_modules/mongoose/lib/helpers/promiseOrCallback.js:32:15
    at new Promise (<anonymous>)
    at promiseOrCallback (/usr/src/app/node_modules/mongoose/lib/helpers/promiseOrCallback.js:31:10)
    at Mongoose._promiseOrCallback (/usr/src/app/node_modules/mongoose/lib/index.js:1149:10)
    at Mongoose.connect (/usr/src/app/node_modules/mongoose/lib/index.js:350:20)
    at module.exports (/usr/src/app/db.js:17:24)
    at Object.<anonymous> (/usr/src/app/index.js:7:1)
    at Module._compile (internal/modules/cjs/loader.js:1114:14)
    at Object.Module._extensions..js (internal/modules/cjs/loader.js:1143:10)
    at Module.load (internal/modules/cjs/loader.js:979:32)
    at Function.Module._load (internal/modules/cjs/loader.js:819:12)
    at Function.executeUserEntryPoint [as runMain] (internal/modules/run_main.js:75:12)
    at internal/main/run_main_module.js:17:47
root@ip-172-31-93-91:~/3-tier-nodejs-app/Application-Code/backend#
```

Step 15: Afterward, push the docker image on docker hub.

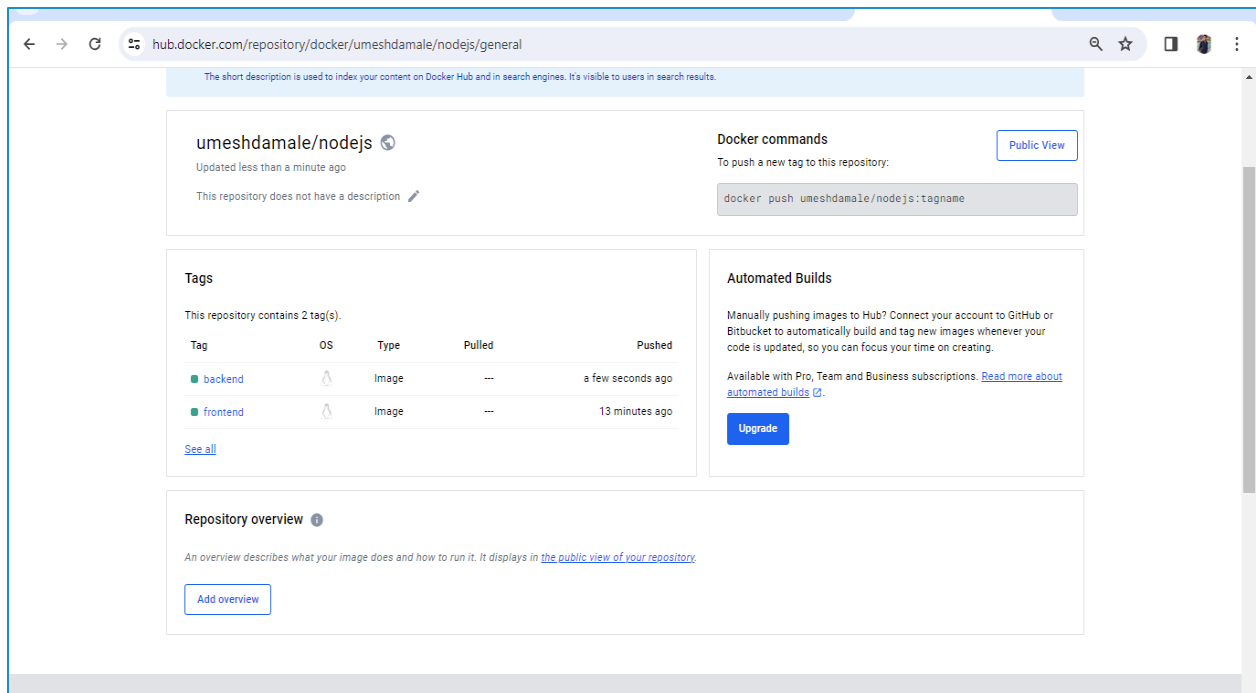
The screenshot shows a terminal window with the following content:

```
root@ip-172-31-93-91:~/3-tier-nodejs-app/Application-Code/frontend# docker images
REPOSITORY          TAG         IMAGE ID      CREATED       SIZE
umeshdamale/nodejs  backend    6412a0482df0 6 minutes ago 924MB
umeshdamale/nodejs  frontend   01e60f5a2539 15 minutes ago 1.12GB
node                 14         1d12470fa662 12 months ago 912MB

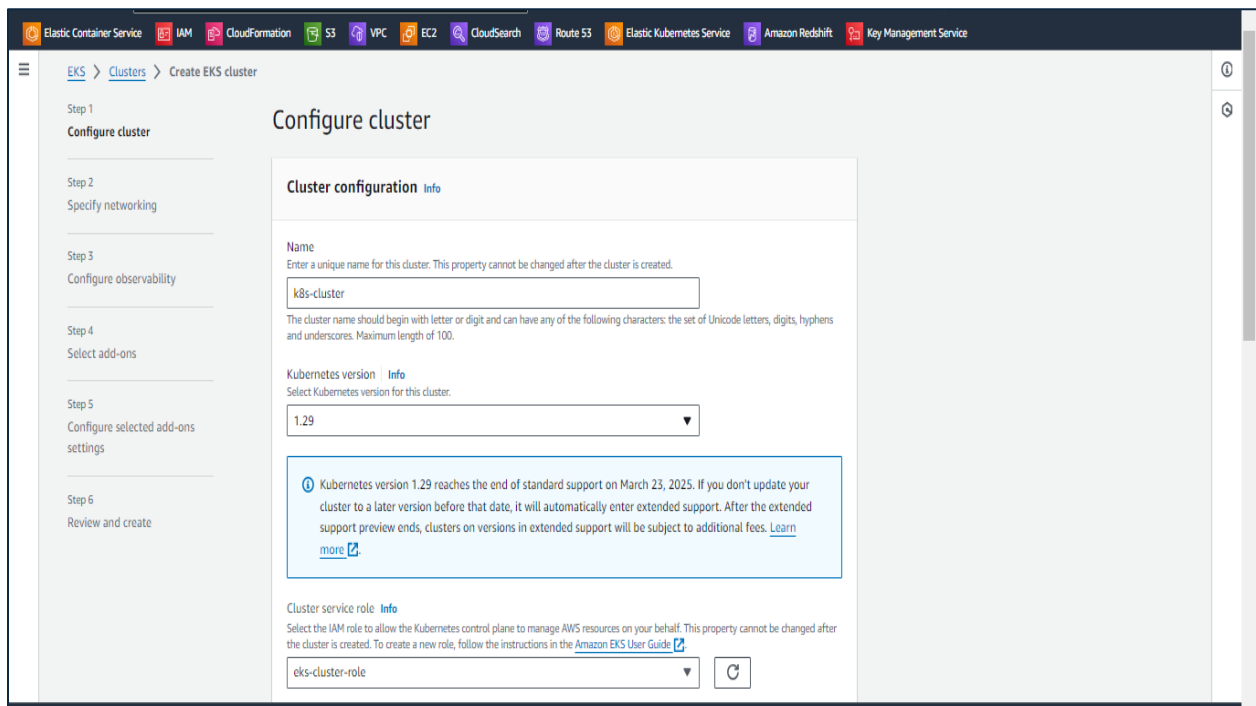
root@ip-172-31-93-91:~/3-tier-nodejs-app/Application-Code/frontend# docker push umeshdamale/nodejs:backend
The push refers to repository [docker.io/umeshdamale/nodejs]
5b11b93dd0fd: Pushed
0b9f9c68eb69: Pushed
2611bb4d2164: Pushed
4927981fd46a: Layer already exists
0d5f5a015e5d: Layer already exists
3c777d951de2: Layer already exists
f8a91dd5fc84: Layer already exists
cb81227abd5e: Layer already exists
e01454893a9: Layer already exists
c45660adde37: Layer already exists
fe0fb3ab4a0f: Layer already exists
f1186e5061f2: Layer already exists
b2dba7477754: Layer already exists
backend: digest: sha256:f311ade00e0fc1e368d4f9dc98b17ee946aa237f6eaf1355841d9d766be59899 size: 3049

root@ip-172-31-93-91:~/3-tier-nodejs-app/Application-Code/frontend#
```

Step 16: Here, the docker image has been pushed to docker hub.



Step 17: Next, create EKs cluster and node group.



Step 18: Select vpc, subnet, security groups & click on next & click on create a cluster.

The screenshot shows the 'Specify networking' step in the AWS Management Console for creating an EKS cluster. The left sidebar lists steps from 1 to 6, with 'Specify networking' selected. The main content area is titled 'Specify networking' and includes sections for VPC, Subnets, and Security groups. The VPC section shows 'vpc-07e92c15916f55167 | Default' selected. The Subnets section shows three subnets selected: 'subnet-0f5e55d63e86265e0 | us-east-1c | 172.31.16.0/20', 'subnet-05782ae7b173d344a | us-east-1a | 172.31.0.0/20', and 'subnet-06cae2bafdc950e1a | us-east-1b | 172.31.80.0/20'. The Security groups section shows 'sg-019bd01d09d96dd22 | launch-wizard-5' selected.

Step 1
[Configure cluster](#)

Step 2
Specify networking

Step 3
Configure observability

Step 4
Select add-ons

Step 5
Configure selected add-ons settings

Step 6
Review and create

Specify networking

Networking Info
IP address family and service IP address range cannot be changed after cluster creation.

VPC Info
Select a VPC to use for your EKS cluster resources. To create a new VPC, go to the [VPC console](#).

vpc-07e92c15916f55167 | Default

Subnets Info
Choose the subnets in your VPC where the control plane may place elastic network interfaces (ENIs) to facilitate communication with your cluster. To create a new subnet, go to the corresponding page in the [VPC console](#).

Select subnets

subnet-0f5e55d63e86265e0 | us-east-1c | 172.31.16.0/20

subnet-05782ae7b173d344a | us-east-1a | 172.31.0.0/20

subnet-06cae2bafdc950e1a | us-east-1b | 172.31.80.0/20

Security groups Info
Choose the security groups to apply to the EKS-managed Elastic Network Interfaces that are created in your control plane subnets. To create a new security group, go to the corresponding page in the [VPC console](#).

Select security groups

sg-019bd01d09d96dd22 | launch-wizard-5
launch-wizard-5 created 2024-02-28T10:19:40.680Z

Step 19: Here, our k8s cluster has been created.

The screenshot shows the 'Amazon Elastic Kubernetes Service' page in the AWS Management Console. The left sidebar shows the 'Clusters' section. The main content area shows a list of clusters. A table with 5 columns (Cluster name, Status, Kubernetes version, Support type, Provider) displays one cluster named 'k8s-cluster' with status 'Active', version '1.29', support type 'Standard support until March 23, 2025', and provider 'EKS'.

Amazon Elastic Kubernetes Service

Extended support for Kubernetes versions pricing
New prices for extended support will start in the April billing cycle. For more information, see the [blog post](#).

Notifications 0 0 0 0 3 0 0

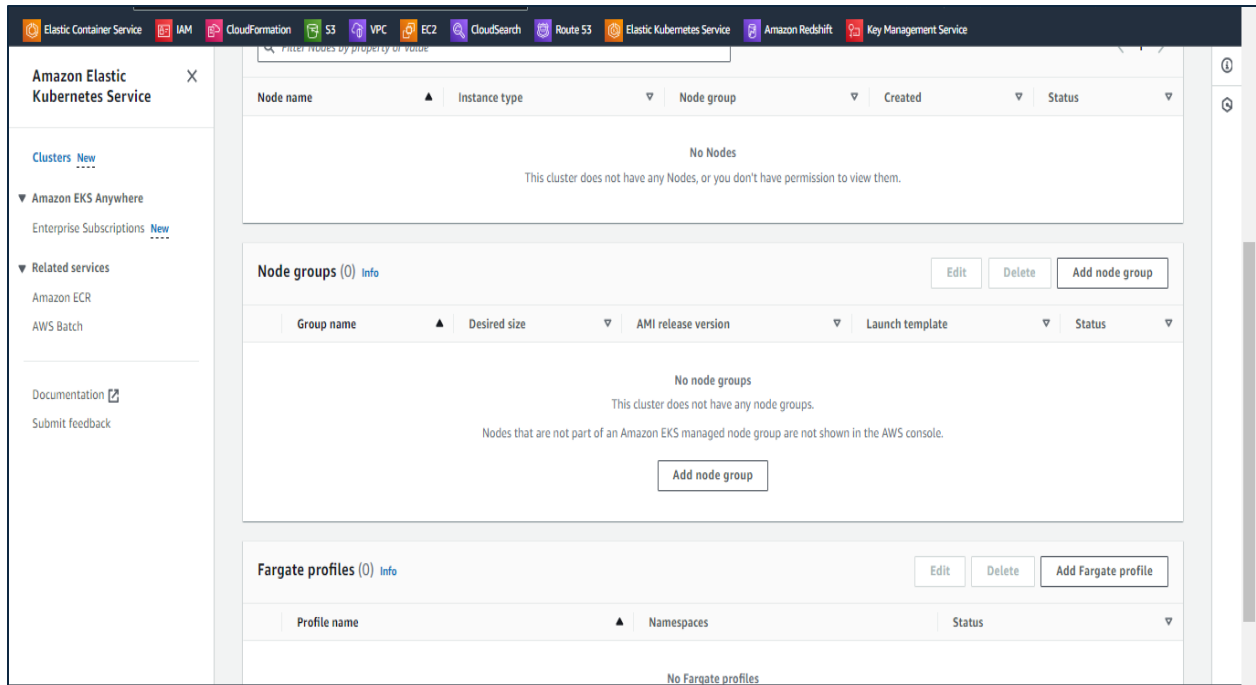
EKS > Clusters

Clusters (1) Info

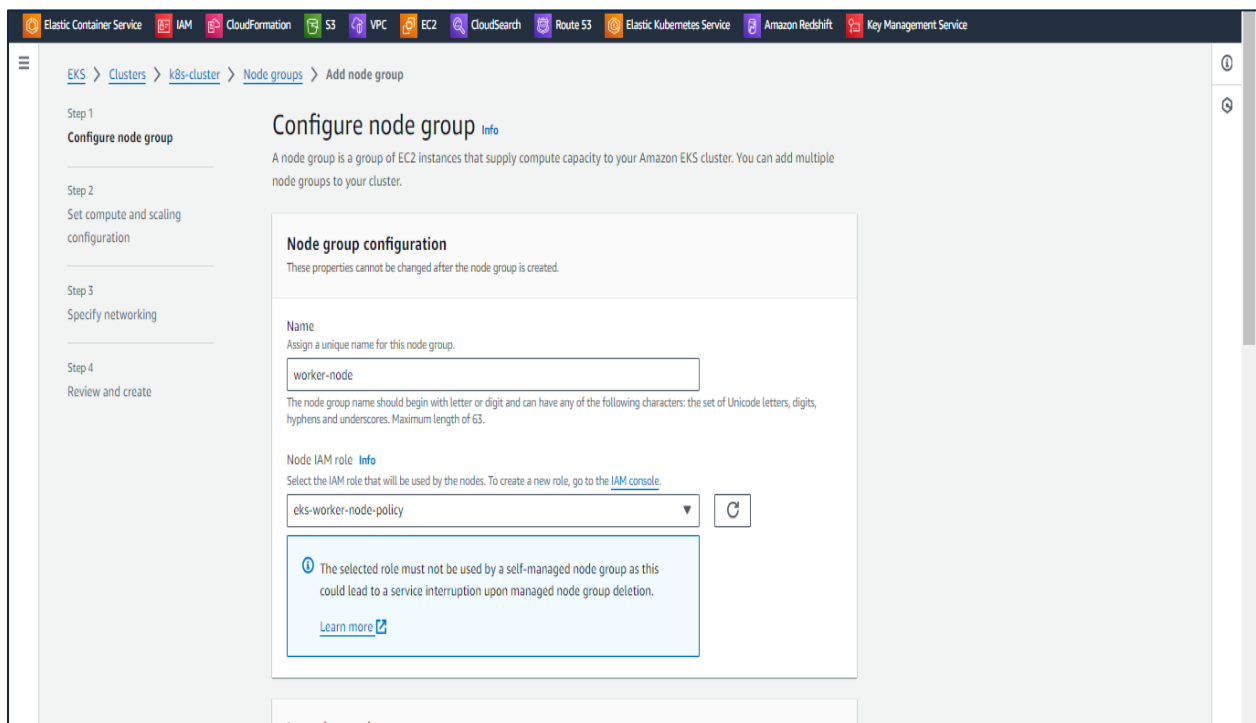
Filter clusters

Cluster name	Status	Kubernetes version	Support type	Provider
k8s-cluster	Active	1.29	Standard support until March 23, 2025	EKS

Step 20: After creating a cluster, navigate the compute section & create a node group within a cluster.



Step 21: Give name & attach role (access for Eks and ec2).



Step 22: Then, select configuration (instance size t3.medium, nodes capacity, subnets) & click on create.

Instance types [Info](#)
Select instance types you prefer for this node group.

t2.micro ✕
vCPU: 1 vCPU Memory: 1 GiB Network: Low to Moderate Max ENI: 2 Max IPIs: 4

Disk size
Select the size of the attached EBS volume for each node.

GiB

Node group scaling configuration

Desired size
Set the desired number of nodes that the group should launch with initially.

nodes
Desired node size must be greater than or equal to 0

Minimum size
Set the minimum number of nodes that the group can scale in to.

nodes
Minimum node size must be greater than or equal to 0

Maximum size
Set the maximum number of nodes that the group can scale out to.

nodes
Maximum node size must be greater than or equal to 1 and cannot be lower than the minimum size

EKS > Clusters > k8s-cluster > Node groups > Add node group

Step 1
[Configure node group](#)

Step 2
[Set compute and scaling configuration](#)

Step 3
Specify networking

Step 4
Review and create

Specify networking

Node group network configuration
These properties cannot be changed after the node group is created.

Subnets [Info](#)
Specify the subnets in your VPC where your nodes will run. To create a new subnet, go to the corresponding page in the [VPC console](#).

Select subnets ✕ ✕ ✕

subnet-0f5e55d63e86265e0 ✕ subnet-05782ae7b173d344a ✕
subnet-06cae2bafdc950e1a ✕

☐ Configure remote access to nodes [Info](#)

Cancel Previous **Next**

Step 23: Then, install kubectl into our ec2 instance to interact with k8s cluster.

```
root@ip-172-31-93-91:~# curl -o kubectll https://amazon-eks.s3.us-west-2.amazonaws.com/1.19.6/2021-01-05/bin/linux/amd64/kubectll
% Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
           Dload  Upload   Total     Spent    Left     Speed
100 57.4M  100 57.4M    0     0  18.5M    0  0:00:03  0:00:03 --:--:-- 18.5M
root@ip-172-31-93-91:~# chmod +x ./kubectll
root@ip-172-31-93-91:~# mv ./kubectll /usr/local/bin
root@ip-172-31-93-91:~# kubectll version --short --client
Client Version: v1.19.6-eks-49a6c0
root@ip-172-31-93-91:~#
```

Step 24: next, install awscli and configure using access key and secret key.

```
root@ip-172-31-93-91:~# curl "https://awscli.amazonaws.com/awscli-exe-linux-x86_64.zip" -o "awscliv2.zip"
% Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
           Dload  Upload   Total     Spent    Left     Speed
100 57.5M  100 57.5M    0     0  114M    0  0:00:00  0:00:00 --:--:-- 114M
root@ip-172-31-93-91:~# ls
3-tier-nodejs-app  awscliv2.zip
root@ip-172-31-93-91:~# unzip awscliv2.zip
root@ip-172-31-93-91:~# sudo ./aws/install -i /usr/local/aws-cli -b /usr/local/bin --update
Archive:  awscliv2.zip
  creating: aws/
  creating: aws/dist/
  inflating: aws/install
  inflating: aws/README.md
  inflating: aws/THIRD_PARTY_LICENSES
  creating: aws/dist/awscli/
  creating: aws/dist/cryptography/
  creating: aws/dist/docutils/
  creating: aws/dist/lib-dynload/
  inflating: aws/dist/aws
  inflating: aws/dist/aws_completer
  inflating: aws/dist/libpython3.11.so.1.0
  inflating: aws/dist/_awsCRT.abi3.so
  inflating: aws/dist/_cffi_backend.cpython-311-x86_64-linux-gnu.so
  inflating: aws/dist/_ruamel_yaml.cpython-311-x86_64-linux-gnu.so
  inflating: aws/dist/libz.so.1
  inflating: aws/dist/liblzma.so.0
  inflating: aws/dist/libbz2.so.1
  inflating: aws/dist/libffi.so.5
  inflating: aws/dist/libsqlite3.so.0
  inflating: aws/dist/base_library.zip
  inflating: aws/dist/lib-dynload/_pickle.cpython-311-x86_64-linux-gnu.so
  inflating: aws/dist/lib-dynload/_hashlib.cpython-311-x86_64-linux-gnu.so
  inflating: aws/dist/lib-dynload/_sha3.cpython-311-x86_64-linux-gnu.so
  inflating: aws/dist/lib-dynload/_blake2.cpython-311-x86_64-linux-gnu.so
  inflating: aws/dist/lib-dynload/_sha256.cpython-311-x86_64-linux-gnu.so
  inflating: aws/dist/lib-dynload/_md5.cpython-311-x86_64-linux-gnu.so
  inflating: aws/dist/lib-dynload/_sha1.cpython-311-x86_64-linux-gnu.so
  inflating: aws/dist/lib-dynload/_sha512.cpython-311-x86_64-linux-gnu.so
```

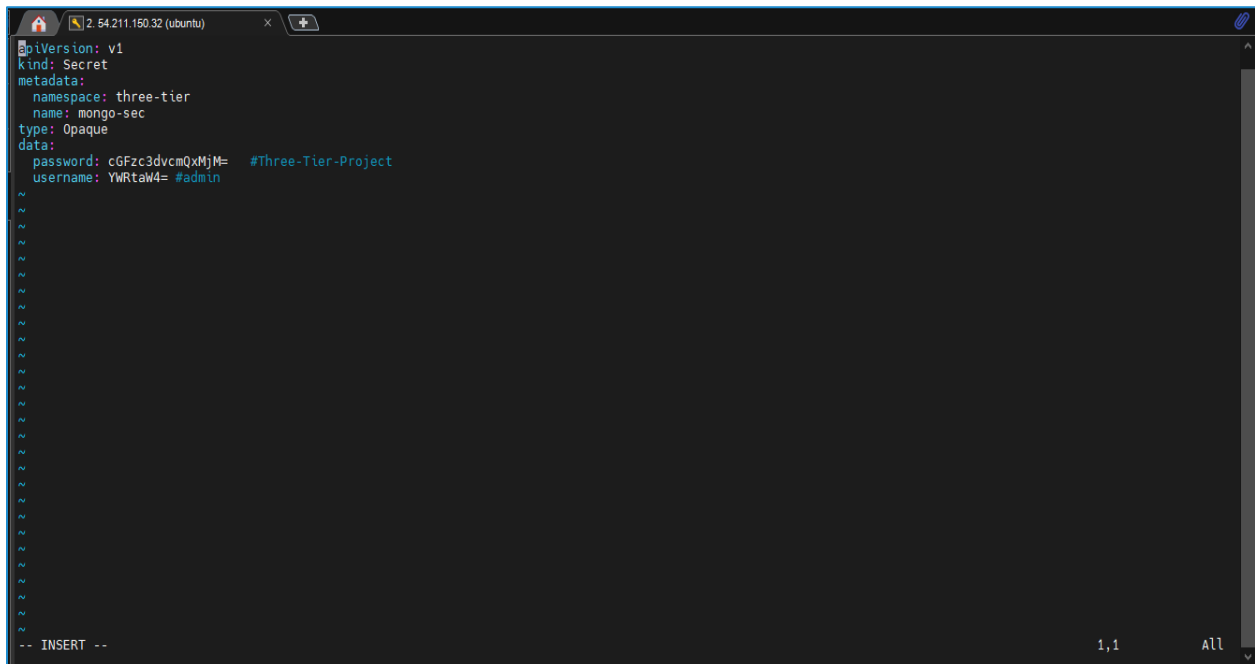
Step 25: connect k8s cluster using aws eks update-kubeconfig --name cluster-name & check nodes.

```
root@ip-172-31-93-91:~# aws eks update-kubeconfig --region us-east-1 --name k8s-cluster
Updated context arn:aws:eks:us-east-1:637423493864:cluster/k8s-cluster in /root/.kube/config
root@ip-172-31-93-91:~# kubectl get nodes
NAME                                STATUS    ROLES    AGE   VERSION
ip-172-31-0-226.ec2.internal        Ready    <none>    11m   v1.29.0-eks-5e0fdde
ip-172-31-16-174.ec2.internal        Ready    <none>    11m   v1.29.0-eks-5e0fdde
root@ip-172-31-93-91:~# kubectl get pods
No resources found in default namespace.
root@ip-172-31-93-91:~#
```

Step 26: then, create a database secret manifest file that contains the secret username and password. So, let's create a three-tier namespace.

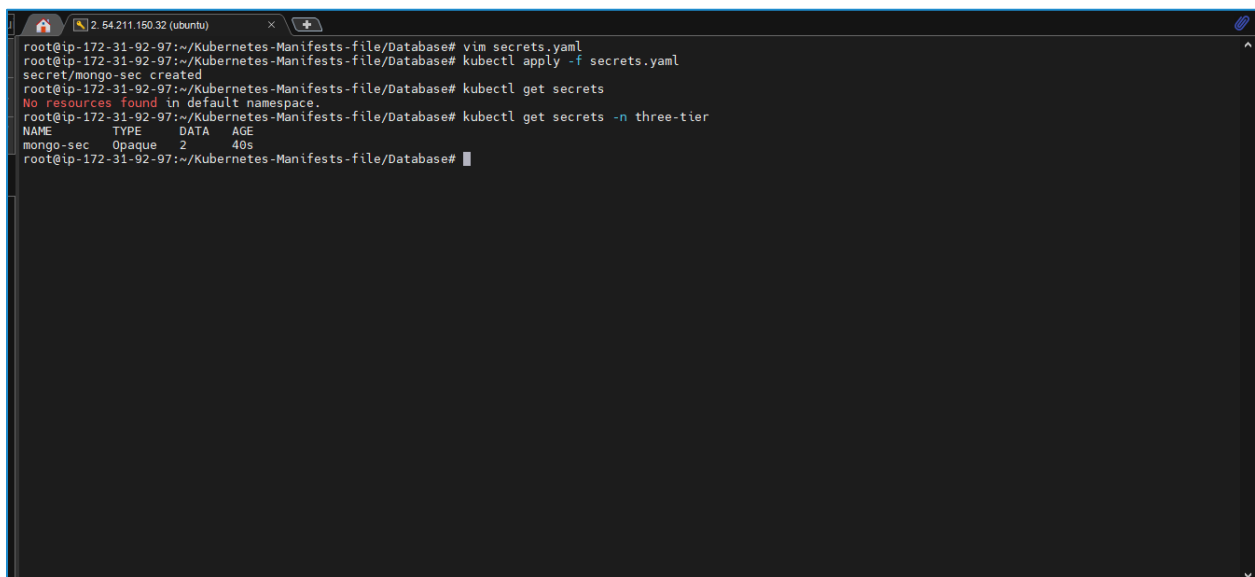
```
root@ip-172-31-93-91:~/3-tier-nodejs-app/Kubernetes-Manifests-file/Database#
root@ip-172-31-93-91:~/3-tier-nodejs-app/Kubernetes-Manifests-file/Database# kubectl create namespace three-tier
namespace/three-tier created
root@ip-172-31-93-91:~/3-tier-nodejs-app/Kubernetes-Manifests-file/Database# kubectl get namespace | grep three-tier
three-tier          Active    5s
root@ip-172-31-93-91:~/3-tier-nodejs-app/Kubernetes-Manifests-file/Database#
```

Step 27: then, create a database secrets manifest file that contains the secret username and password.



```
apiVersion: v1
kind: Secret
metadata:
  namespace: three-tier
  name: mongo-sec
type: Opaque
data:
  password: cGFzc3dvcmQxMjM= #Three-Tier-Project
  username: YWRtaW4= #admin
```

Step 28: After creating a secret file, apply it using the kubectl apply command.



```
root@ip-172-31-92-97:~/Kubernetes-Manifests-file/Database# vim secrets.yaml
root@ip-172-31-92-97:~/Kubernetes-Manifests-file/Database# kubectl apply -f secrets.yaml
secret/mongo-sec created
root@ip-172-31-92-97:~/Kubernetes-Manifests-file/Database# kubectl get secrets
No resources found in default namespace.
root@ip-172-31-92-97:~/Kubernetes-Manifests-file/Database# kubectl get secrets -n three-tier
NAME          TYPE      DATA      AGE
mongo-sec     Opaque    2          40s
root@ip-172-31-92-97:~/Kubernetes-Manifests-file/Database#
```

Step 29: Next, create deployment file for database that specifies 1 replica for database.

```

1 apiVersion: apps/v1
2 kind: Deployment
3 metadata:
4   namespace: three-tier
5   name: mongodb
6 spec:
7   replicas: 1
8   selector:
9     matchLabels:
10      app: mongodb
11   template:
12     metadata:
13       labels:
14         app: mongodb
15     spec:
16       containers:
17       - name: mon
18         image: mongo:4.4.6
19         command:
20           - "numactl"
21           - "--interleave=all"
22           - "mongod"
23           - "--wiredTigerCacheSizeGB"
24           - "0.1"
25           - "--bind_ip"
26           - "0.0.0.0"
27       ports:
28       - containerPort: 27017
29       env:
30       - name: MONGO_INITDB_ROOT_USERNAME
31         valueFrom:
32           secretKeyRef:

```

```

36     valueFrom:
37       secretKeyRef:
38         name: mongo-sec
39         key: password
40     volumeMounts:
41     - name: mongo-volume
42       mountPath: /data/db
43     volumes:
44     - name: mongo-volume
45       persistentVolumeClaim:
46         claimName: mongo-volume-claim

```

Step 30: Apply deployment manifest file using kubectl apply command.


```
root@ip-172-31-92-97:~/Kubernetes-Manifests-file/Database# vim pv.yaml
root@ip-172-31-92-97:~/Kubernetes-Manifests-file/Database# kubectl apply -f pv.yaml
persistentvolume/mongo-pv created
root@ip-172-31-92-97:~/Kubernetes-Manifests-file/Database# kubectl get pv -n three-tier
NAME          CAPACITY  ACCESS MODES  RECLAIM POLICY  STATUS    CLAIM          STORAGECLASS  VOLUMEATTRIBUTESCLASS  REASON  AGE
mongo-pv      1Gi       RWO           Retain          Available  three-tier     <unset>         <unset>         11s
root@ip-172-31-92-97:~/Kubernetes-Manifests-file/Database#
```

Step 33: Then, create persistent volume claim(pvc) manifest file.

```
1 apiVersion: v1
2 kind: PersistentVolumeClaim
3 metadata:
4   name: mongo-volume-claim
5   namespace: three-tier
6 spec:
7   accessModes:
8     - ReadWriteOnce
9   storageClassName: ""
10  resources:
11    requests:
12      storage: 1Gi
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```
root@ip-172-31-92-97:~/Kubernetes-Manifests-file/Database# vim service.yaml
root@ip-172-31-92-97:~/Kubernetes-Manifests-file/Database# kubectl apply -f service.yaml
service/mongodb-svc created
root@ip-172-31-92-97:~/Kubernetes-Manifests-file/Database# kubectl get services -n three-tier
NAME          TYPE        CLUSTER-IP    EXTERNAL-IP  PORT(S)    AGE
mongodb-svc   ClusterIP   10.100.249.191 <none>       27017/TCP   12s
root@ip-172-31-92-97:~/Kubernetes-Manifests-file/Database#
```

Step 37: Here, all the resources have been created for the MongoDB database.

```
root@ip-172-31-92-97:~/3-tier-nodejs-app/Kubernetes-Manifests-file/Database# kubectl get all -n three-tier
NAME                                READY    STATUS    RESTARTS   AGE
pod/mongodb-59797b688c-xpg8z       1/1     Running   0           76s

NAME          TYPE        CLUSTER-IP    EXTERNAL-IP  PORT(S)    AGE
service/mongodb-svc   ClusterIP   10.100.47.50  <none>       27017/TCP   64s

NAME          READY    UP-TO-DATE    AVAILABLE    AGE
deployment.apps/mongodb  1/1      1              1             76s

NAME          DESIRED    CURRENT    READY    AGE
replicaset.apps/mongodb-59797b688c  1          1          1         76s
root@ip-172-31-92-97:~/3-tier-nodejs-app/Kubernetes-Manifests-file/Database#
```

Step 38: Next, create backend deployment manifest file & that specifies two replicas set.


```
root@ip-172-31-92-97:~/3-tier-nodejs-app/Kubernetes-Manifests-file/Backend# vim service.yaml
root@ip-172-31-92-97:~/3-tier-nodejs-app/Kubernetes-Manifests-file/Backend#
root@ip-172-31-92-97:~/3-tier-nodejs-app/Kubernetes-Manifests-file/Backend# kubectl apply -f service.yaml
service/api unchanged
root@ip-172-31-92-97:~/3-tier-nodejs-app/Kubernetes-Manifests-file/Backend#
root@ip-172-31-92-97:~/3-tier-nodejs-app/Kubernetes-Manifests-file/Backend# kubectl get services -n three-tier
NAME      TYPE      CLUSTER-IP      EXTERNAL-IP      PORT(S)      AGE
api        ClusterIP  10.100.33.166    <none>           3500/TCP     3m19s
mongodb-svc ClusterIP  10.100.47.50     <none>           27017/TCP    9m9s
root@ip-172-31-92-97:~/3-tier-nodejs-app/Kubernetes-Manifests-file/Backend#
root@ip-172-31-92-97:~/3-tier-nodejs-app/Kubernetes-Manifests-file/Backend# kubectl get all -n three-tier
NAME                                READY    STATUS      RESTARTS      AGE
pod/api-f9f66dd9c-j6pc2             1/1      Running    0              5m58s
pod/api-f9f66dd9c-t4jzm             1/1      Running    0              5m58s
pod/mongodb-59797b688c-xpg8z        1/1      Running    0              9m32s

NAME      TYPE      CLUSTER-IP      EXTERNAL-IP      PORT(S)      AGE
service/api ClusterIP  10.100.33.166    <none>           3500/TCP     3m30s
service/mongodb-svc ClusterIP  10.100.47.50     <none>           27017/TCP    9m20s

NAME      READY    UP-TO-DATE    AVAILABLE    AGE
deployment.apps/api  2/2      2              2            5m58s
deployment.apps/mongodb  1/1      1              1            9m32s

NAME      DESIRED    CURRENT    READY    AGE
replicaset.apps/api-f9f66dd9c  2          2          2        5m58s
replicaset.apps/mongodb-59797b688c  1          1          1        9m32s
root@ip-172-31-92-97:~/3-tier-nodejs-app/Kubernetes-Manifests-file/Backend#
```

Step 42: Then, check the backend pod logs to confirm that the database has been successfully connected to the backend or not.

```
root@ip-172-31-92-97:~/3-tier-nodejs-app/Kubernetes-Manifests-file/Backend# kubectl get pods -n three-tier
NAME                                READY    STATUS      RESTARTS      AGE
api-f9f66dd9c-j6pc2                1/1      Running    0              6m31s
api-f9f66dd9c-t4jzm                1/1      Running    0              6m31s
mongodb-59797b688c-xpg8z           1/1      Running    0              10m
root@ip-172-31-92-97:~/3-tier-nodejs-app/Kubernetes-Manifests-file/Backend#
root@ip-172-31-92-97:~/3-tier-nodejs-app/Kubernetes-Manifests-file/Backend# kubectl logs api-f9f66dd9c-j6pc2 -n three-tier
Listening on port 3500...
Connected to database.
root@ip-172-31-92-97:~/3-tier-nodejs-app/Kubernetes-Manifests-file/Backend#
```

Step 43: next, create frontend deployment manifest file.

```
1 apiVersion: apps/v1
2 kind: Deployment
3 metadata:
4   name: frontend
5   namespace: three-tier
6   labels:
7     role: frontend
8   env: demo
9 spec:
10   replicas: 1
11   strategy:
12     type: RollingUpdate
13     rollingUpdate:
14       maxSurge: 1
15       maxUnavailable: 25%
16   selector:
17     matchLabels:
18       role: frontend
19   template:
20     metadata:
21       labels:
22         role: frontend
23     spec:
24       containers:
25       - name: frontend
26         image: umeshdamale/nodejs:frontend
27         imagePullPolicy: Always
28         env:
29         - name: REACT_APP_BACKEND_URL
30           value: "http://Backend.umeshdamale.site/api/tasks"
31       ports:
32       - containerPort: 3000
```

Step 44: Frontend deployment manifest file apply using kubectl apply command and after applying deployment will be create

```
root@ip-172-31-92-97:~/3-tier-nodejs-app/Kubernetes-Manifests-file/Frontend#
root@ip-172-31-92-97:~/3-tier-nodejs-app/Kubernetes-Manifests-file/Frontend# vim deployment.yaml
root@ip-172-31-92-97:~/3-tier-nodejs-app/Kubernetes-Manifests-file/Frontend# kubectl apply -f deployment.yaml
deployment.apps/frontend configured
root@ip-172-31-92-97:~/3-tier-nodejs-app/Kubernetes-Manifests-file/Frontend# kubectl get deployment -n three-tier
NAME          READY   UP-TO-DATE   AVAILABLE   AGE
api           2/2     2            2           32m
frontend      1/1     1            1           19m
mongodb       1/1     1            1           35m
root@ip-172-31-92-97:~/3-tier-nodejs-app/Kubernetes-Manifests-file/Frontend#
```

Step 45: next, create service manifest file for deployment to enable connectivity to the service within the cluster.


```
root@ip-172-31-92-97:~# ls
3-tier-nodejs-app  aws  get_helm.sh  iam_policy.json  snap
root@ip-172-31-92-97:~# kubectl get pods
NAME                                READY   STATUS    RESTARTS   AGE
my-release-nginx-ingress-controller-7dc4f677b9-8pq9w  1/1     Running   0          14s
root@ip-172-31-92-97:~#
```

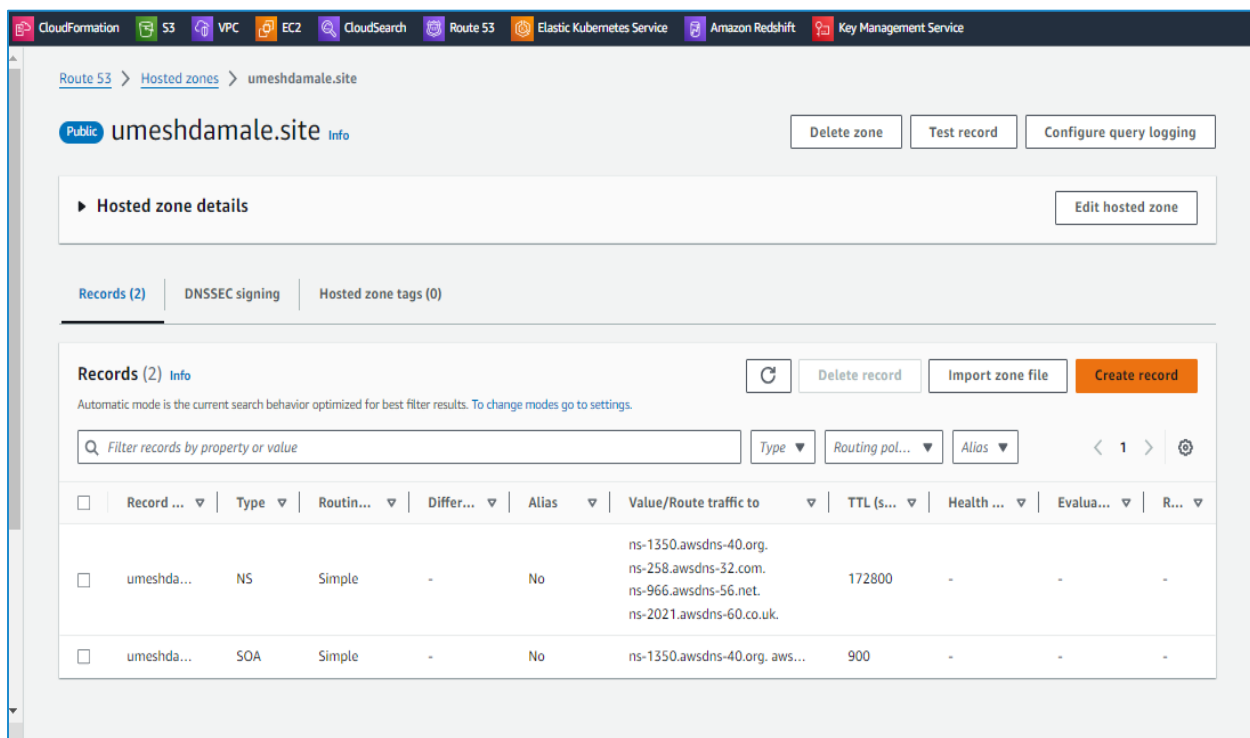
Step 48: Create ingress manifest file in that specifies ingrss class name as nginx and define the domain name in the host field.

```
1 apiVersion: networking.k8s.io/v1
2 kind: Ingress
3 metadata:
4   name: mainlb
5   namespace: three-tier
6 spec:
7   ingressClassName: nginx
8   rules:
9     - host: backend.umesdamale.site
10     http:
11       paths:
12         - path: /api
13           pathType: Prefix
14           backend:
15             service:
16               name: api
17               port:
18                 number: 3500
19         - path: /
20           pathType: Prefix
21           backend:
22             service:
23               name: frontend
24               port:
25                 number: 3000
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root@ip-172-31-92-97:~/3-tier-nodejs-app/Kubernetes-Manifests-file#  
root@ip-172-31-92-97:~/3-tier-nodejs-app/Kubernetes-Manifests-file# vim ingress.yaml  
root@ip-172-31-92-97:~/3-tier-nodejs-app/Kubernetes-Manifests-file#  
root@ip-172-31-92-97:~/3-tier-nodejs-app/Kubernetes-Manifests-file# ls  
Backend Database Frontend ingress.yaml  
root@ip-172-31-92-97:~/3-tier-nodejs-app/Kubernetes-Manifests-file# kubectl apply -f ingress.yaml  
ingress.networking.k8s.io/mainlb unchanged  
root@ip-172-31-92-97:~/3-tier-nodejs-app/Kubernetes-Manifests-file#  
root@ip-172-31-92-97:~/3-tier-nodejs-app/Kubernetes-Manifests-file# kubectl get ingress -n three-tier  
NAME CLASS HOSTS ADDRESS PORTS AGE  
mainlb nginx backend.umeshdamale.site a380afd1815ef45baa6b6bc8fa2ae51c-1670423781.us-east-1.elb.amazonaws.com 80 22m  
root@ip-172-31-92-97:~/3-tier-nodejs-app/Kubernetes-Manifests-file#
```

Step 50: Update the Route53 hosted zone by creating a CNAME record and paste the load balancer endpoint into it.



Quick create record

Record 1

Record name: backend .umeshdamale.site

Record type: CNAME - Routes traffic to another domain name and to some AWS res...

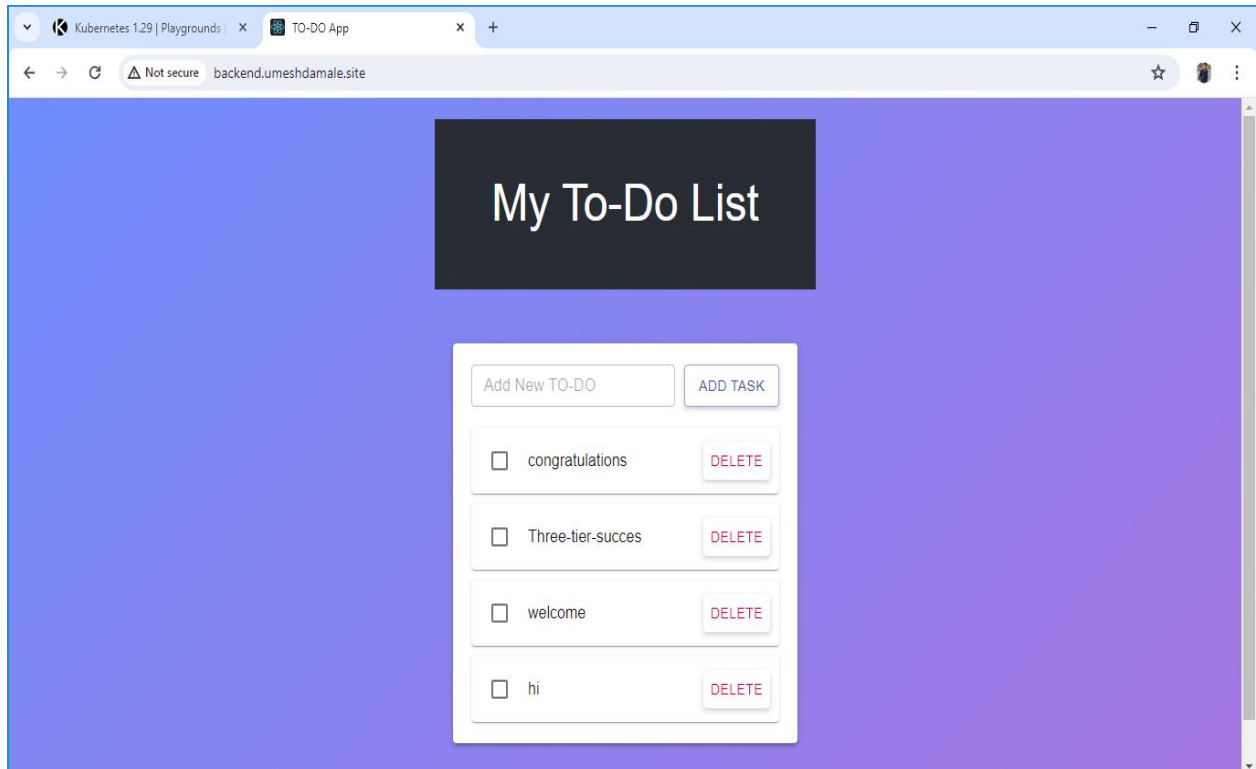
Value: a380afd1815ef45baa6bec8fa2ae51c-1670423781.us-east-1.elb.amazonaws.com

TTL (seconds): 300

Routing policy: Simple routing

Buttons: Delete, Add another record, Cancel, Create records

Step 51: Here we have successfully completed 3 tier architecture. We can access the application by visiting the domain name backend.umeshdamale.site in browser.



Step 52: Now, let's check if our input data is saved in the MongoDB database.

```
root@ip-172-31-92-97:~#
root@ip-172-31-92-97:~#
root@ip-172-31-92-97:~# kubectl get pods -n three-tier
NAME                                READY   STATUS    RESTARTS   AGE
api-f9f66dd9c-j6pc2                 1/1     Running   0           94m
api-f9f66dd9c-t4jzm                 1/1     Running   0           94m
frontend-7f999c669c-tvj7h           1/1     Running   0           63m
mongodb-59797b688c-xpg8z            1/1     Running   0           98m
root@ip-172-31-92-97:~#
root@ip-172-31-92-97:~# kubectl exec -it mongodb-59797b688c-xpg8z -n three-tier /bin/bash
kubectl exec [POD] [COMMAND] is DEPRECATED and will be removed in a future version. Use kubectl exec [POD] -- [COMMAND] instead.
root@mongodb-59797b688c-xpg8z:~# ls
bin boot data dev docker-entrypoint-initdb.d etc home js-yaml.js lib lib64 media mnt opt proc root run sbin srv sys tmp usr var
root@mongodb-59797b688c-xpg8z:~# mongo
MongoDB shell version v4.4.6
connecting to: mongodb://127.0.0.1:27017/?compressors=disabled&gssapiServiceName=mongodb
Implicit session: session { "id" : UUID("7e70a553-9f69-4e00-9ab3-c4ce283e3796") }
MongoDB server version: 4.4.6

---
The server generated these startup warnings when booting:
  2024-04-11T19:23:39.541+00:00: Access control is not enabled for the database. Read and write access to data and configuration is unrestricted
  2024-04-11T19:23:39.541+00:00: You are running this process as the root user, which is not recommended
---

Enable MongoDB's free cloud-based monitoring service, which will then receive and display
metrics about your deployment (disk utilization, CPU, operation statistics, etc).

The monitoring data will be available on a MongoDB website with a unique URL accessible to you
and anyone you share the URL with. MongoDB may use this information to make product
improvements and to suggest MongoDB products and deployment options to you.

To enable free monitoring, run the following command: db.enableFreeMonitoring()
To permanently disable this reminder, run the following command: db.disableFreeMonitoring()
---
> show dbs
admin    0.000GB
config  0.000GB

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bin boot data dev docker-entrypoint-initdb.d etc home js-yaml.js lib lib64 media mnt opt proc root run sbin srv sys tmp usr var
root@mongodb-59797b688c-xpg8z:~# mongo
MongoDB shell version v4.4.6
connecting to: mongodb://127.0.0.1:27017/?compressors=disabled&gssapiServiceName=mongodb
Implicit session: session { "id" : UUID("774f23e0-ad0b-4046-8b16-cb2659892067") }
MongoDB server version: 4.4.6

---
The server generated these startup warnings when booting:
  2024-04-11T19:23:39.541+00:00: Access control is not enabled for the database. Read and write access to data and configuration is unrestricted
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---
> show dbs
admin    0.000GB
config  0.000GB
local    0.000GB
todo     0.000GB
> use todo
switched to db todo
> db.tasks.find()
{ "_id" : ObjectId("66184f8b20d8c07a84daebd9"), "completed" : false, "task" : "congratulations", "_v" : 0 }
{ "_id" : ObjectId("66184f9320d8c09b77daebdb"), "completed" : false, "task" : "Three-tier-succes", "_v" : 0 }
{ "_id" : ObjectId("66184f9920d8c0d05fdaebdd"), "completed" : false, "task" : "welcome", "_v" : 0 }
{ "_id" : ObjectId("66184f9d20d8c0fd9adaebdf"), "completed" : false, "task" : "hi", "_v" : 0 }
>
```

- Here our input data has been successfully saved in the MongoDB database.