MEAN STACK PROJECT IMPLEMENTATION

The main aim for this project is to explain the DevOps concepts and processes using a MEAN web stack on a simple to-do application. Some developers use this set of framework and tools to develop software products. We would be carrying out this project in the AWS platform and these concepts are very similar to the LAMP,LEMP AND MERN web stack concept.

MERN is an acronym of sets of technologies used to develop a technical software product.

MongoDB

Express

ReactJS

NodeJS

MongoDB is the document database that stores and allow it possible to retrieve data. Express JS is the back end application that makes a request to the Database for reads and write and gets response from the database .AngularJS is the front end application that handles Client and Server requests.Node.js is the JavaScript

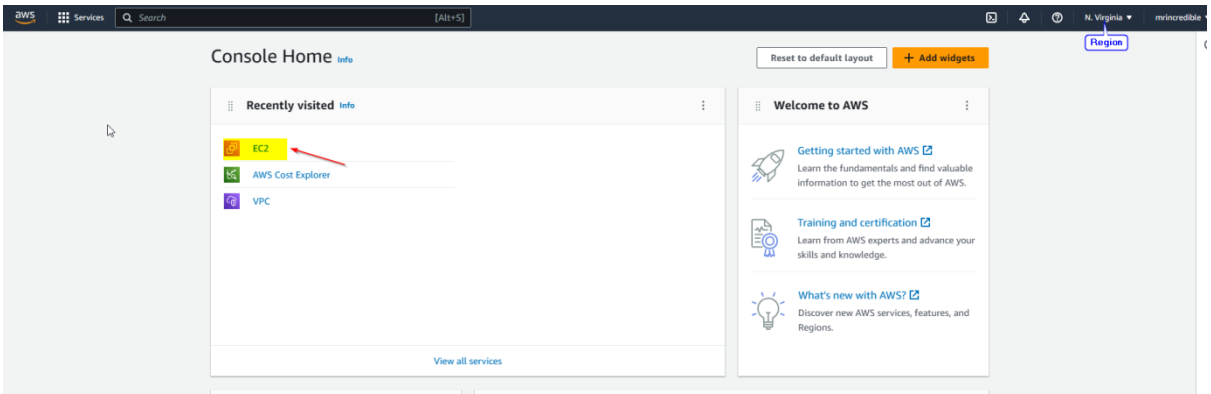
Pre-requisite for the projects is the following.

1) **Fundamental Knowledge of Installing and downloading software**
2) **Basic Understanding of Linux Commands**
3) **AWS account login with EC2 instance**
4) **Internet connection**

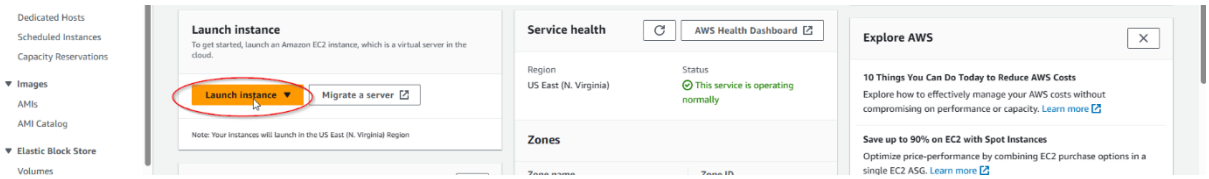
IMPLEMENTATION STEPS:

i) **Ensure you login with your details to your AWS console via the https://aws.amazon.com**

ii) **Click on the EC2 link to create instances.**



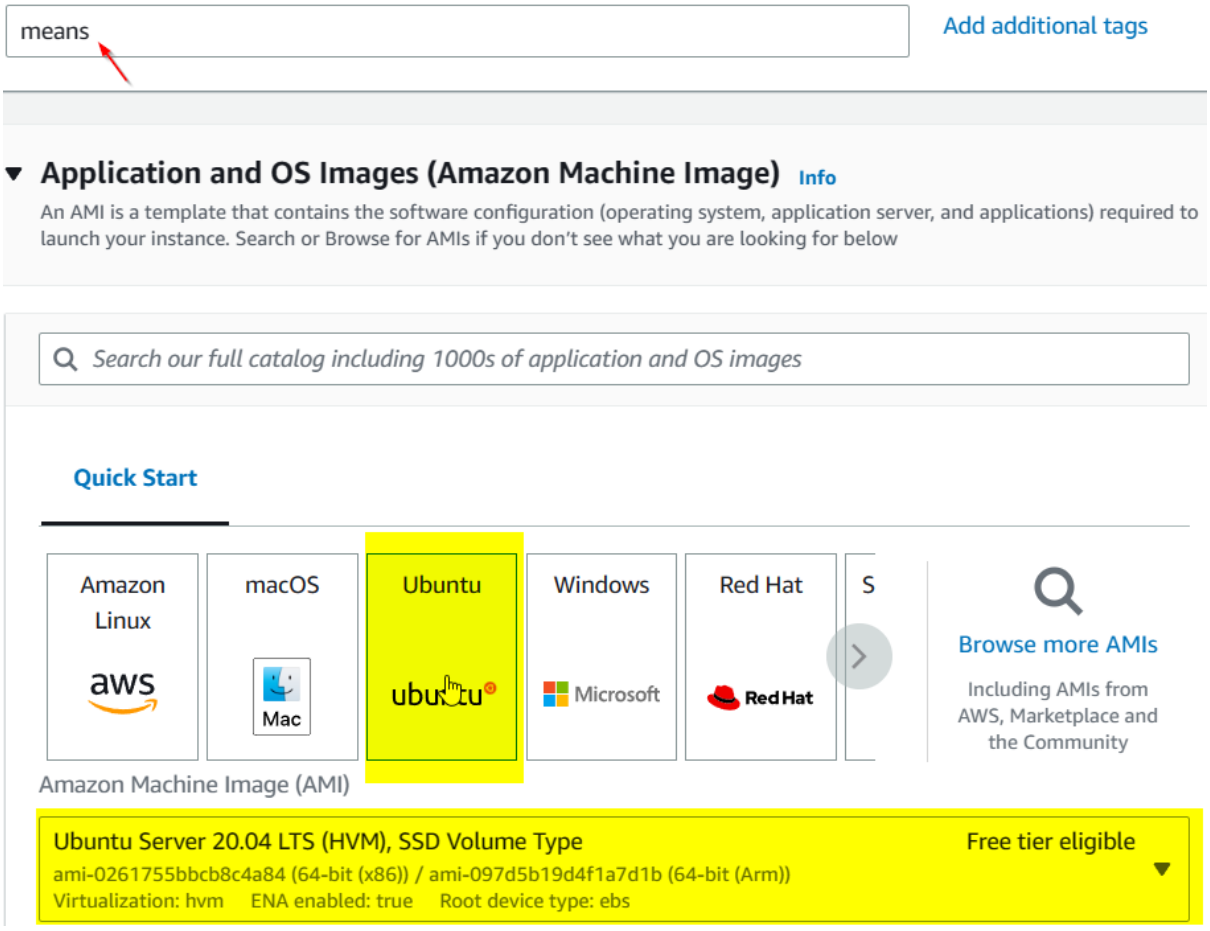
iii)Click on launch instance dropdown button and select launch instance .



iv)Fill in all relevant details to the MEAN project such as:

Type in the name and additional tag to the project (mean). Select ubuntu from the quick start option .Also note that the Amazon machine image selection varies from user to user

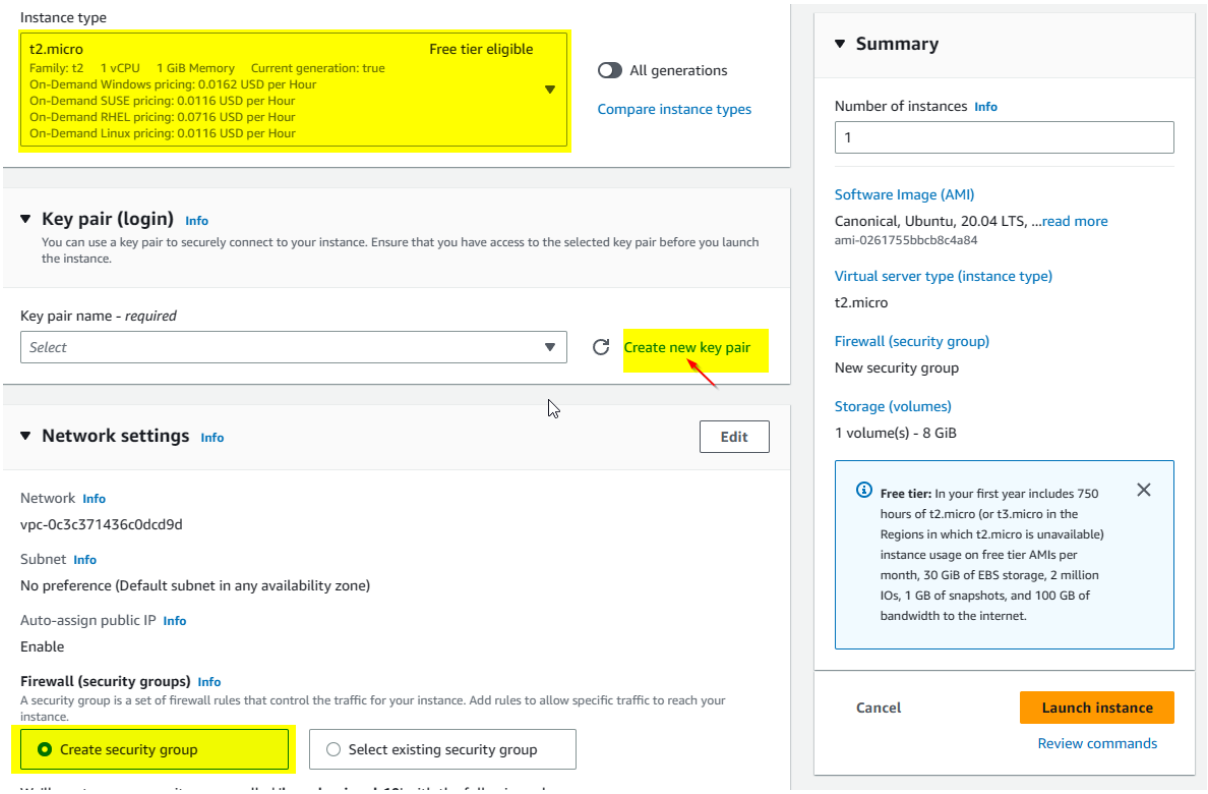
Select Ubuntu server 20.04 LTS (HVM),SSD Volume Type (Free Tier)



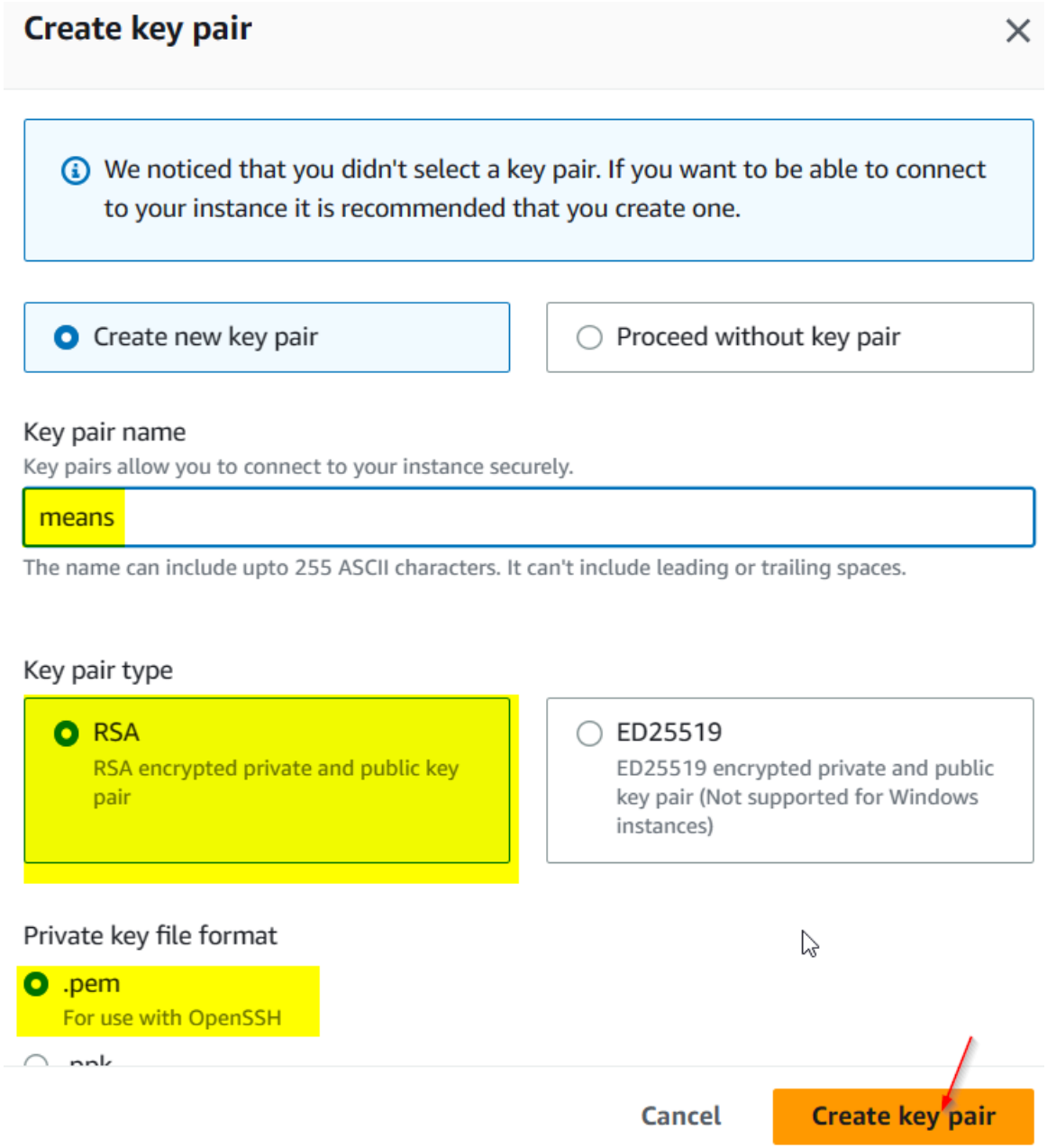
v)The instance type selected in the configuration is the t2 micro -free tier.

Click on the “Create new key pair” link.

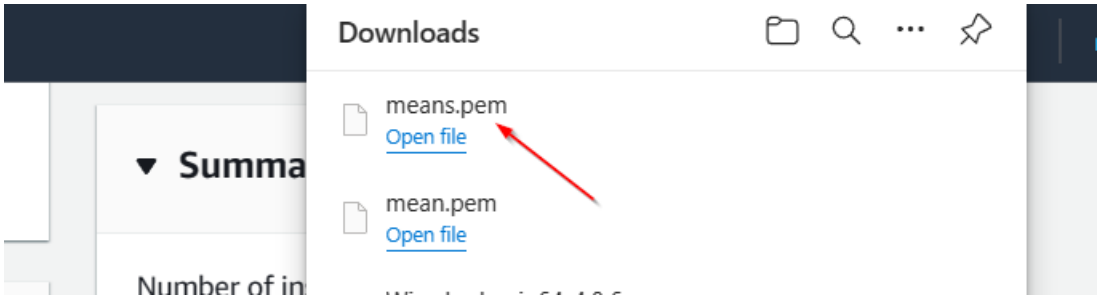
Ensure the Checkbox remains unchanged on the “Create security group”.



vi)Type in the key pair name, chose the default key pair type and private key file format (rsa and .pem) and clicked the “Create key pair button”

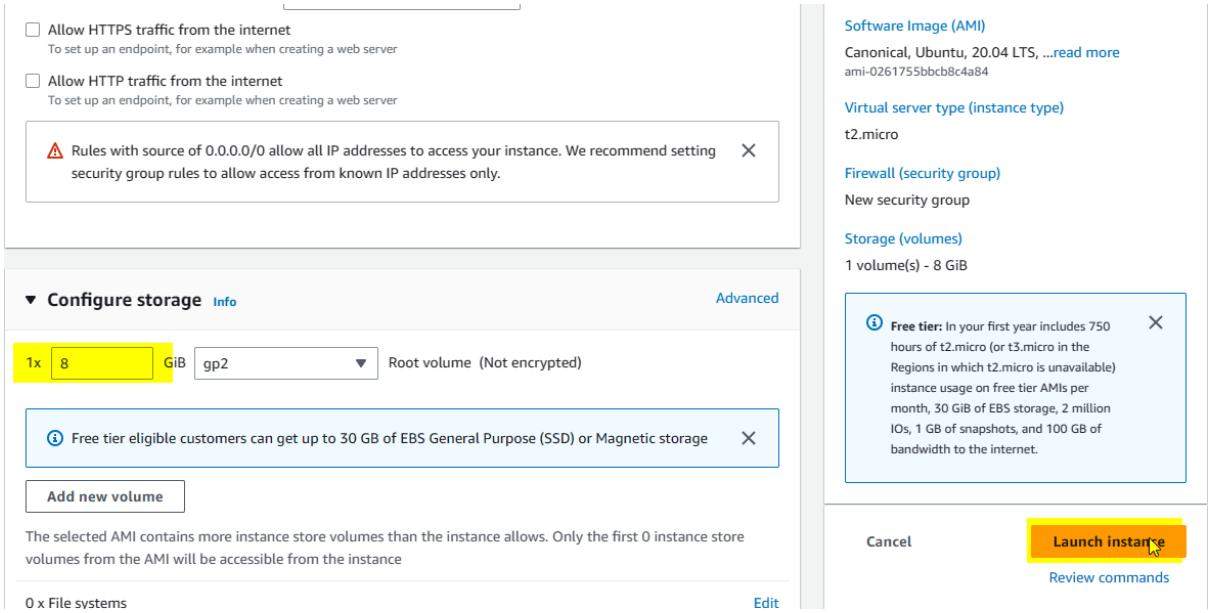


vii) The .pem file was downloaded successfully

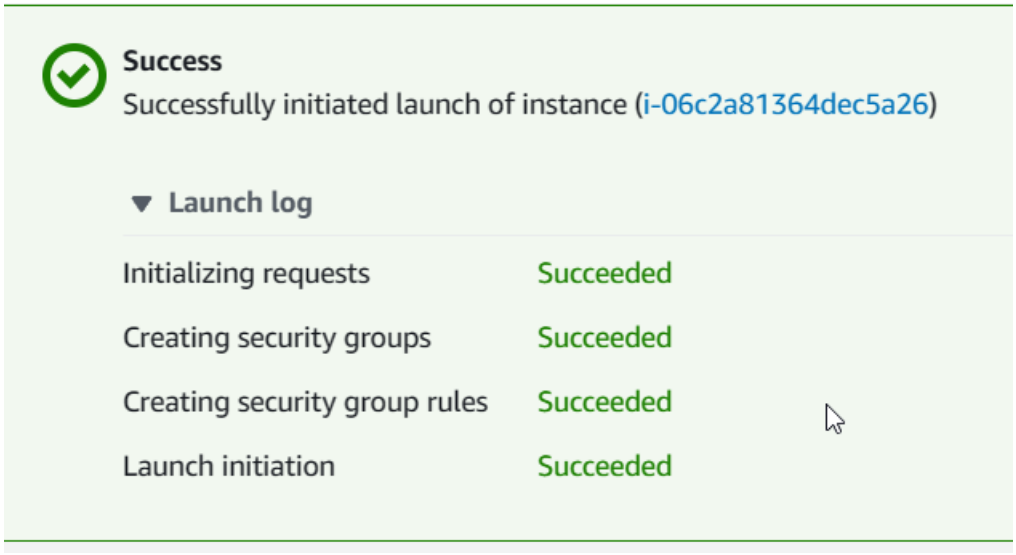


viii) I have deliberately chosen default settings to allow SSH traffic from anywhere as well as the storage volume given by AWS.

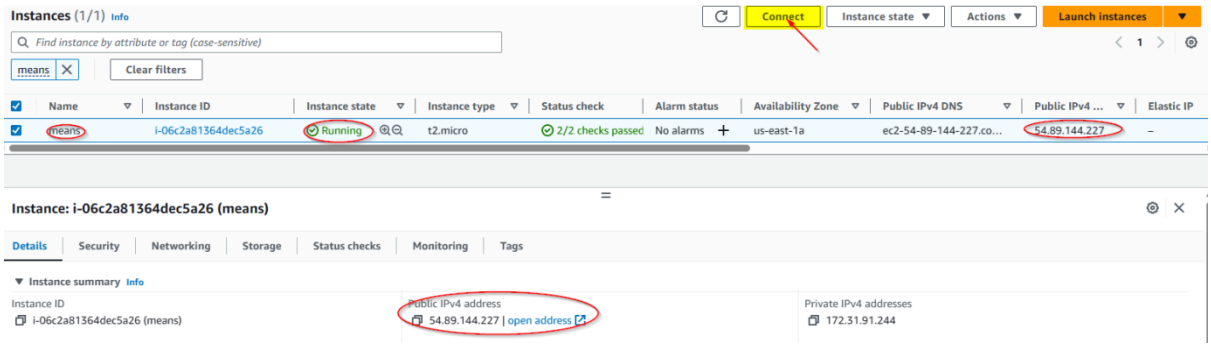
Then we proceed to launch our instance finally.



Instance successfully launched and click to view Instance details with the IP address.



Click the “Connect” button and copy the ssh client details we would be using on the git bash console.



Open git bash on visual studio code or whichever console is convenient to use. We are using git bash here with Visual Studio Code and Type YES to connect.

```
oshor@Oshority MINGW64 ~/Downloads (master)
$ ssh -i "means.pem" ubuntu@ec2-54-89-144-227.compute-1.amazonaws.com
The authenticity of host 'ec2-54-89-144-227.compute-1.amazonaws.com (54.89.144.227)' can't be established.
ED25519 key fingerprint is SHA256:5FZKs6EGQN9cCPDgsHDnucCvKIYfFJUOrcoa5sAyq2A.
This key is not known by any other names.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
```

You have successful connected to the EC2 instance launched on AWS via ssh

Type clear to have a clear console and proceed to updating the lists of packages in the package manager.

```
buntu@ip-172-31-91-244:~$ sudo apt update
Hit:1 http://us-east-1.ec2.archive.ubuntu.com/ubuntu focal InRelease
```

Then we proceed to upgrade the packages and Type YES to continue.

```
ubuntu@ip-172-31-91-244:~$ sudo apt upgrade
eading package lists... Done
Building dependency tree
```

```
d.
Do you want to continue? [Y/n] y
Get:1 http://us-east-1.ec2.archive.ubuntu.com/ubuntu focal-update
```

Still upgrading and finally completed as shown below

```
Unpacking mokutil (0.6.0-2~20.04.1) over (0.3.0+15387+0437.fb6250
f-1) ...
Preparing to unpack .../20-ncurses-term_6.2-0ubuntu2.1_all.deb ..
.
Unpacking ncurses-term (6.2-0ubuntu2.1) over (6.2-0ubuntu2) ...
Progress: [ 50%] [####################.....................]
```

```
Found linux image: /boot/vmlinuz-5.15.0-1036-aws
Found initrd image: /boot/microcode.cpio /boot/initrd.img-5.15.0-
1036-aws
Found Ubuntu 20.04.6 LTS (20.04) on /dev/xvda1
done
```

Now we add the certificates. Type YES to continue and check the node version

```
ubuntu@ip-172-31-91-244:~$ sudo apt -y install curl dirmngr apt-transport-https lsb-release ca-certificates
Reading package lists... Done
Building dependency tree
Reading state information... Done
lsb-release is already the newest version (11.1.0ubuntu2).
```

```
Need to get 6805 kB of archives.
After this operation, 30.7 MB of additional disk space will be used.
Do you want to continue? [Y/n] y
Get:1 http://us-east-1.ec2.archive.ubuntu.com/ubuntu focal-updates/main amd64 libc-ares2 amd64 1.15.0-1ubuntu0.2 [36.7 kB]
Get:2 [illegible] archive.ubuntu.com/ubuntu focal/universe amd64 libnode64 amd64 10.19.0~dfsg-3ubuntu1 [5765 kB]
```

```
ubuntu@ip-172-31-91-244:~$ wget -qO - https://www.mongodb.org/stati
c/pgp/server-5.0.asc | sudo apt-key add -
OK
```

NODE.JS INSTALLATION

Now we need to get the location of Node.js using a node source PPA

```
ubuntu@ip-172-31-88-166:~$ curl -fsSL https://deb.nodesource.com/
setup_18.x | sudo -E bash -

## Installing the NodeSource Node.js 18.x repo...


## Populating apt-get cache...

+ apt-get update
Hit:1 http://us-east-1.ec2.archive.ubuntu.com/ubuntu focal InRele
```

We can now install Node.js on the server and confirm the versions of the node and npm package managers as shown below.

```
ubuntu@ip-172-31-91-244:~$ curl -sL https://deb.nodesource.com/setup_16.x -o /tmp/nodesource_setup.sh
ubuntu@ip-172-31-91-244:~$ sudo bash /tmp/nodesource_setup.sh

## Installing the NodeSource Node.js 16.x repo...
```

```
ubuntu@ip-172-31-91-244:~$ sudo apt install nodejs
Reading package lists... Done
Building dependency tree
```

```
ubuntu@ip-172-31-88-166:~$ sudo apt-get install -y nodejs
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following NEW packages will be installed:
  nodejs
0 upgraded, 1 newly installed, 0 to remove and 0 not upgraded.
Need to get 28.7 MB of archives.
After this operation, 187 MB of additional disk space will be use
d.
Get:1 https://deb.nodesource.com/node_18.x focal/main amd64 nodej
s amd64 18.16.0-deb-1nodesource1 [28.7 MB]
Fetched 28.7 MB in 1s (57.4 MB/s)
Selecting previously unselected package nodejs.
(Reading database ... 90707 files and directories currently insta
lled.)
Preparing to unpack .../nodejs_18.16.0-deb-1nodesource1_amd64.deb
 ...
Unpacking nodejs (18.16.0-deb-1nodesource1) ...
Setting up nodejs (18.16.0-deb-1nodesource1) ...
Processing triggers for man-db (2.9.1-1) ...
ubuntu@ip-172-31-88-166:~$ node -v
v18.16.0
ubuntu@ip-172-31-88-166:~$ npm -v
9.5.1
```

```
Processing triggers for man-db (2.9.1-1) ...
ubuntu@ip-172-31-91-244:~$ node -v
v10.19.0
```

INSTALLATION OF MONGODB

MongoDB stores data in flexible JSON format documents and can vary from document to data structure which can be changed over time .Here we would be adding a book records to the database containing the book name ,ISBN number ,Author and number of pages .We run the following command as shown below to download MongoDB

```
ubuntu@ip-172-31-91-244:~$ sudo apt install dirmngr gnupg apt-transport-https ca-certificates software-properties-common
Reading package lists... Done
Building dependency tree
Reading state information... Done
ca-certificates is already the newest version (20230311ubuntu0.20.04.1).
```

```
ubuntu@ip-172-31-91-244:~$ wget -qO - https://www.mongodb.org/static/pgp/server-5.0.asc | sudo apt-key add -
OK
ubuntu@ip-172-31-91-244:~$ echo "deb [ arch=amd64,arm64 ] https://repo.mongodb.org/apt/ubuntu focal/mongodb-org/5.0 multiverse" | sudo tee /etc/apt/sources.list.d/mongodb-org-5.0.list
deb [ arch=amd64,arm64 ] https://repo.mongodb.org/apt/ubuntu focal/mongodb-org/5.0 multiverse
ubuntu@ip-172-31-91-244:~$ sudo apt-get update
Hit:1 http://us-east-1.ec2.archive.ubuntu.com/ubuntu focal InRelease
Hit:2 http://us-east-1.ec2.archive.ubuntu.com/ubuntu focal-updates InRelease
```

```
ubuntu@ip-172-31-91-244:~$ sudo apt-get update
Hit:1 http://us-east-1.ec2.archive.ubuntu.com/ubuntu focal InRelease
Hit:2 http://us-east-1.ec2.archive.ubuntu.com/ubuntu focal-updates InRelease
Hit:3 http://us-east-1.ec2.archive.ubuntu.com/ubuntu focal-backports InRelease
Ign:4 https://repo.mongodb.org/apt/ubuntu focal/mongodb-org/5.0 InRelease
Get:5 https://repo.mongodb.org/apt/ubuntu focal/mongodb-org/5.0 Release [3094 B]
Get:6 https://repo.mongodb.org/apt/ubuntu focal/mongodb-org/5.0 Release.gpg [801 B]
Hit:7 http://security.ubuntu.com/ubuntu focal-security InRelease
Get:8 https://repo.mongodb.org/apt/ubuntu focal/mongodb-org/5.0/multiverse amd64 Packages [40.9 kB]
Get:9 https://repo.mongodb.org/apt/ubuntu focal/mongodb-org/5.0/multiverse arm64 Packages [35.5 kB]
Fetched 80.2 kB in 1s (88.6 kB/s)
Reading package lists... Done
ubuntu@ip-172-31-91-244:~$ sudo apt-get install -y mongodb-org
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
```

Once installed we have to start the server and verify that it is running as expected as shown below . MongoDB is active and running

```
ubuntu@ip-172-31-91-244:~$ sudo systemctl start mongod
ubuntu@ip-172-31-91-244:~$ sudo systemctl enable mongod
Created symlink /etc/systemd/system/multi-user.target.wants/mongod.service → /lib/systemd/system/mongod.service.
ubuntu@ip-172-31-91-244:~$ sudo systemctl status mongod
● mongod.service - MongoDB Database Server
     Loaded: loaded (/lib/systemd/system/mongod.service; enabled; vendor preset: enabled)
     Active: active (running) since Sat 2023-06-03 08:37:37 UTC; 44s ago
       Docs: https://docs.mongodb.org/manual
   Main PID: 17088 (mongod)
     Memory: 67.2M
     CGroup: /system.slice/mongod.service
             └─17088 /usr/bin/mongod --config /etc/mongod.conf

Jun 03 08:37:37 ip-172-31-91-244 systemd[1]: Started MongoDB Database Server.
```

Next we install node package manager and body-parser package

```
node-string-decoder node-string-width node-strip-ansi
node-strip-eof node-strip-json-comments node-supports-color
node-tar node-term-size node-text-table node-through
node-through2 node-timed-out node-tough-cookie
node-tunnel-agent node-tweetnacl node-typedarray
node-typedarray-to-buffer node-uid-number
node-unique-filename node-unique-string node-unpipe
node-uri-js node-url-parse-lax node-url-to-options
node-util-deprecate node-uuid
node-validate-npm-package-license
node-validate-npm-package-name node-verror node-wcwidth.js
node-which node-which-module node-wide-align node-widest-line
node-wrap-ansi node-wrappy node-write-file-atomic
node-xdg-basedir node-xtend node-y18n node-yallist node-yargs
node-yargs-parser perl-openssl-defaults python-pkg-resources
```

```
ubuntu@ip-172-31-91-244:~$ sudo npm install body-parser
npm WARN saveError ENOENT: no such file or directory, open '/home/ubuntu/package.json'
npm notice created a lockfile as package-lock.json. You should commit this file.
npm WARN enoent ENOENT: no such file or directory, open '/home/ubuntu/package.json'
npm WARN ubuntu No description
npm WARN ubuntu No repository field.
npm WARN ubuntu No README data
npm WARN ubuntu No license field.
```

And then proceed to create the folder named Books and change directory to the new Books folder.

```
ubuntu@ip-172-31-91-244:~$ mkdir Books && cd Books
ubuntu@ip-172-31-91-244:~/Books$ npm init
This utility will walk you through creating a package.json file.
It only covers the most common items, and tries to guess sensible d
efaults.
```

In the Books directory ,we initialize the npm project and add a file into server.js

```
ubuntu@ip-172-31-91-244:~/Books$ vi server.js
ubuntu@ip-172-31-91-244:~/Books$ vi server.js
ubuntu@ip-172-31-91-244:~/Books$
```

```
var express = require('express');
var bodyParser = require('body-parser');
var app = express();
app.use(express.static(__dirname + '/public'));
app.use(bodyParser.json());
require('./apps/routes')(app);
app.set('port', 3300);
app.listen(app.get('port'), function() {
    console.log('Server up: http://localhost:' + app.get('port'));
});
~
```

INSTALLATION EXPRESS AND SET UP ROUTES TO THE SERVER

Express is a minimal and flexible Node.js web application framework that provides features for web and mobile application .We would be installing a Mongoose package which provides straight forward ,schema-based solution to model application data

```
+ express@4.18.2
+ mongoose@7.2.2
added 53 packages from 88 contributors and audited 114 packages in
2.317s

9 packages are looking for funding
  run `npm fund` for details

found 0 vulnerabilities

ubuntu@ip-172-31-91-244:~$
ubuntu@ip-172-31-91-244:~$ cd Books
ubuntu@ip-172-31-91-244:~/Books$ sudo npm install express mongoose
npm WARN notsup Unsupported engine for mongoose@7.2.2: wanted: {"no
de":">=14.20.1"} (current: {"node":"10.19.0","npm":"6.14.4"})
```

We create the folder named apps and change directory to the new apps folder. Edit the route.js file and input the codes below

```
ubuntu@ip-172-31-91-244:~/Books$ mkdir apps && cd apps
ubuntu@ip-172-31-91-244:~/Books/apps$ vi routes.js
ubuntu@ip-172-31-91-244:~/Books/apps$
```

```
      const book = new Book({
        name: req.body.name,
        isbn: req.body.isbn,
        author: req.body.author,
        pages: req.body.pages
      });
      book.save().then(result => {
        res.json({
          message: "Successfully added book",
          book: result
        });
      }).catch(err => {
        console.error(err);
        res.status(500).send('An error occurred while saving the book
  ');
      });
    });

    app.delete("/book/:isbn", function(req, res){
      Book.findOneAndRemove(req.query).then(result => {
        res.json({
          message: "Successfully deleted the book",
          book: result
        });
      }).catch(err => {
        console.error(err);
        res.status(500).send('An error occurred while deleting the bo
  ok');
      });
    });

    const path = require('path');
    app.get('*', function(req, res){
      res.sendFile(path.join(__dirname, 'public', 'index.html'));
    });
  };
  "routes.js" 47L, 1229C                          47,2          Bot
```

We create the folder named models and change directory to the new models folder. Edit the book.js file and input the codes below.

```
ubuntu@ip-172-31-91-244:~/Books/apps$ mkdir models && cd models
ubuntu@ip-172-31-91-244:~/Books/apps/models$ vi book.js
ubuntu@ip-172-31-91-244:~/Books/apps/models$
```

```
var mongoose = require('mongoose');
var dbHost = 'mongodb://localhost:27017/test';
mongoose.connect(dbHost);
mongoose.connection;
mongoose.set('debug', true);
var bookSchema = mongoose.Schema( {
  name: String,
  isbn: {type: String, index: true},
  author: String,
  pages: Number
});
var Book = mongoose.model('Book', bookSchema);
module.exports = mongoose.model('Book', bookSchema);
~
~
~
```

ACCESSING THE ROUTES WITH ANGULARJS

AngularJS provides a web framework for creating dynamic views in your web applications. We would be changing the directory back to Books and then we create a new folder named public and change directory to the new folder. Edit the script.js file and input the codes below.

```
ubuntu@ip-172-31-91-244:~/Books/apps/models$ cd ../..
ubuntu@ip-172-31-91-244:~/Books$ mkdir public && cd public
ubuntu@ip-172-31-91-244:~/Books/public$ vi script.js
ubuntu@ip-172-31-91-244:~/Books/public$
```

```
app.controller('myCtrl', function($scope, $http) {
  $http( {
    method: 'GET',
    url: '/book'
  }).then(function successCallback(response) {
    $scope.books = response.data;
  }, function errorCallback(response) {
    console.log('Error: ' + response);
  });
  $scope.del_book = function(book) {
    $http( {
      method: 'DELETE',
      url: '/book/:isbn',
      params: {'isbn': book.isbn}
    }).then(function successCallback(response) {
      console.log(response);
    }, function errorCallback(response) {
      console.log('Error: ' + response);
    });
  };
  $scope.add_book = function() {
    var body = '{ "name": "' + $scope.Name +
    '", "isbn": "' + $scope.Isbn +
    '", "author": "' + $scope.Author +
    '", "pages": "' + $scope.Pages + '" }';
    $http({
      method: 'POST',
      url: '/book',
      data: body
    }).then(function successCallback(response) {
      console.log(response);
    }, function errorCallback(response) {
      console.log('Error: ' + response);
    });
  };
});
```

We would creating a new folder named index.html and edit the file and input the codes below.

```
ubuntu@ip-172-31-91-244:~/Books/public$ vi index.html
ubuntu@ip-172-31-91-244:~/Books/public$
```

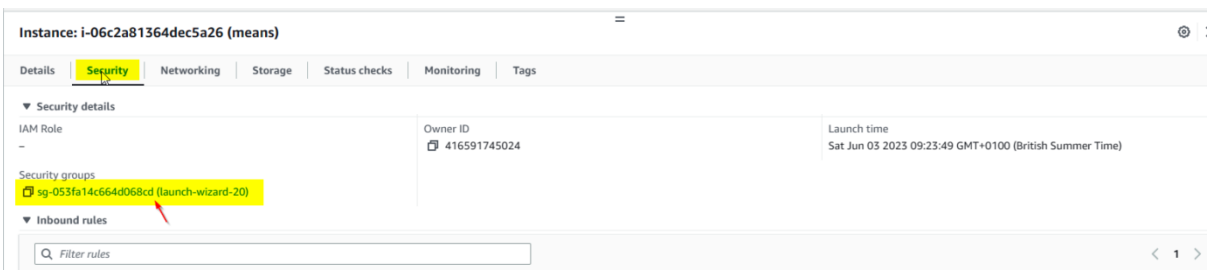
```
        <td><input type="text" ng-model="Isbn"></td>
        </tr>
        <tr>
          <td>Author:</td>
          <td><input type="text" ng-model="Author"></td>
        </tr>
        <tr>
          <td>Pages:</td>
          <td><input type="number" ng-model="Pages"></td>
        </tr>
      </table>
      <button ng-click="add_book()">Add</button>
    </div>
    <hr>
    <div>
      <table>
        <tr>
          <th>Name</th>
          <th>Isbn</th>
          <th>Author</th>
          <th>Pages</th>

        </tr>
        <tr ng-repeat="book in books">
          <td>{{book.name}}</td>
          <td>{{book.isbn}}</td>
          <td>{{book.author}}</td>
          <td>{{book.pages}}</td>

          <td><input type="button" value="Delete" data-ng-click="de
l_book(book)"></td>
        </tr>
      </table>
    </div>
  </body>
</html>
                                                50,7          Bot
```

We would then navigate back to Books and start the server by running a command.

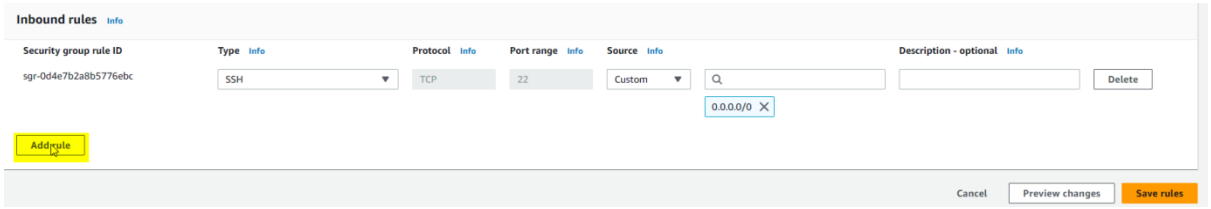
```
ubuntu@ip-172-31-91-244:~/Books/public$ cd ..
ubuntu@ip-172-31-91-244:~/Books$ node server.js
Server up: http://localhost:3300
Mongoose: books.createIndex({ isbn: 1 }, { background: true })
```

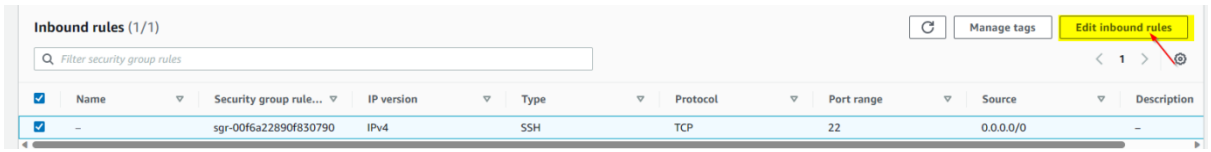
We see the server is up at port:3300

For this to happen we need to open TCP port 3300 in our AWS Web Console accessing the security group through the EC2 instance

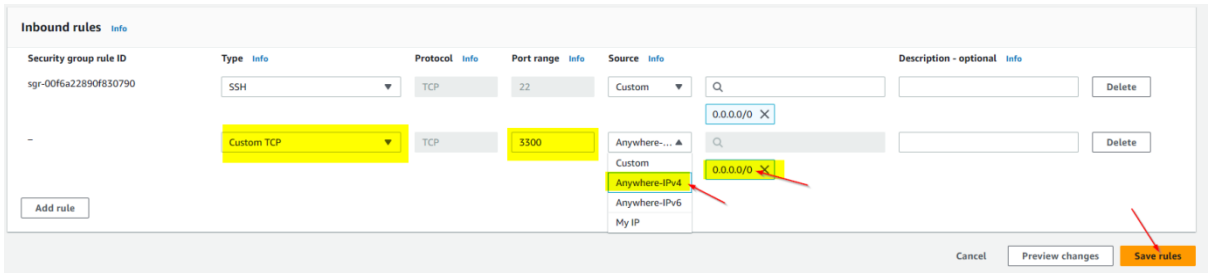


Add a new rule.

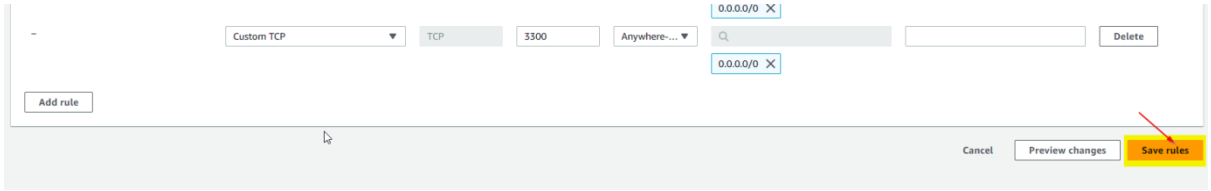




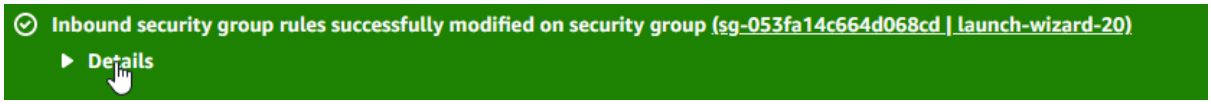
Type in the port range 3300 and click “Anywhere ipv4”



Click the “Save rules” Button



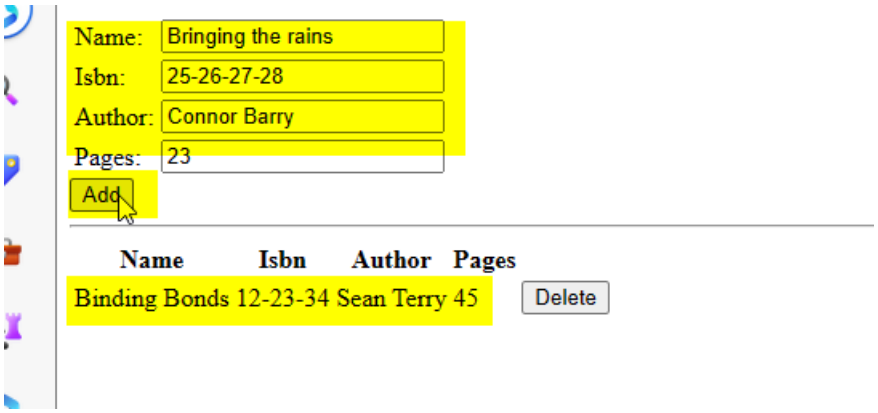
Inbound rule successfully modified



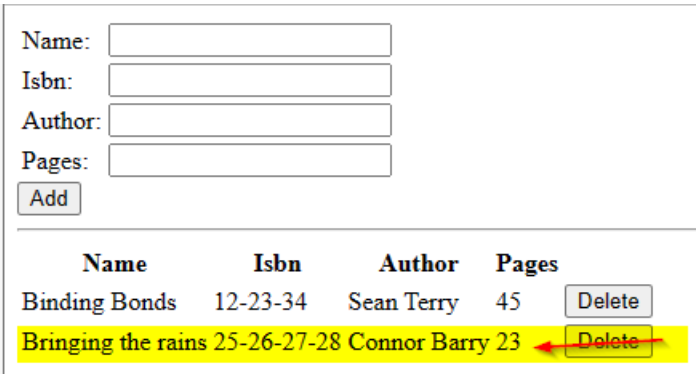
Open any browser of your choice and access the URL

http://54.89.144.227:3300

Book web page successfully displayed.We have to test the web page by inputting data and get it to be populated below



Refresh the page and see the data below



Congratulations we have successfully launched our Web Book Register