SCHOOL OF COMPUTING

ST0505

ESDE (Cloud Computing)

CA2 REPORT

AY2021S2 2A22

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1. **Diagram**
2. **Code snippets w/ Documentation**
3. **Screenshot of testing result**
4. **Troubleshooting**

EC2 S3 RDS

Create Instance

1. On the AWS Console, go to Services
2. Select EC2, and select launch instance
3. In step 1, choose the community AMI: Ubuntu Server 18.04 LTS (HVM), SSD Volume Type 64-bit (x86)
4. In step 6, Choose a Security Group, change source to 'My IP', click 'review and launch' button, then select 'launch' button.
5. Create a new keypair and save it on your computer as 'WPFOC-KEYPAIR'
6. Launch Instance

Connecting to the Created Remote Instance Using Putty

1. Install putty (PuttyGen will be installed along with it)
2. Open PuttyGen
3. Load Private Key. Under Type of key to generate, choose RSA

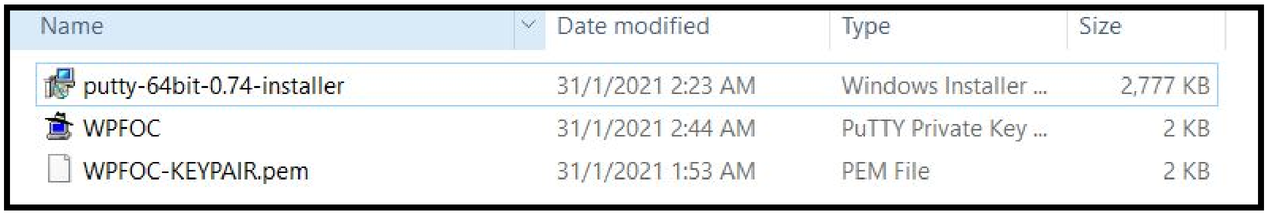
   (Note: If you're using an older version of PuTTYgen, choose SSH-2 RSA)

   (Note: By default, PuTTYgen displays only files with the extension .ppk. To locate your .pem file, select the option to display files of all types.)

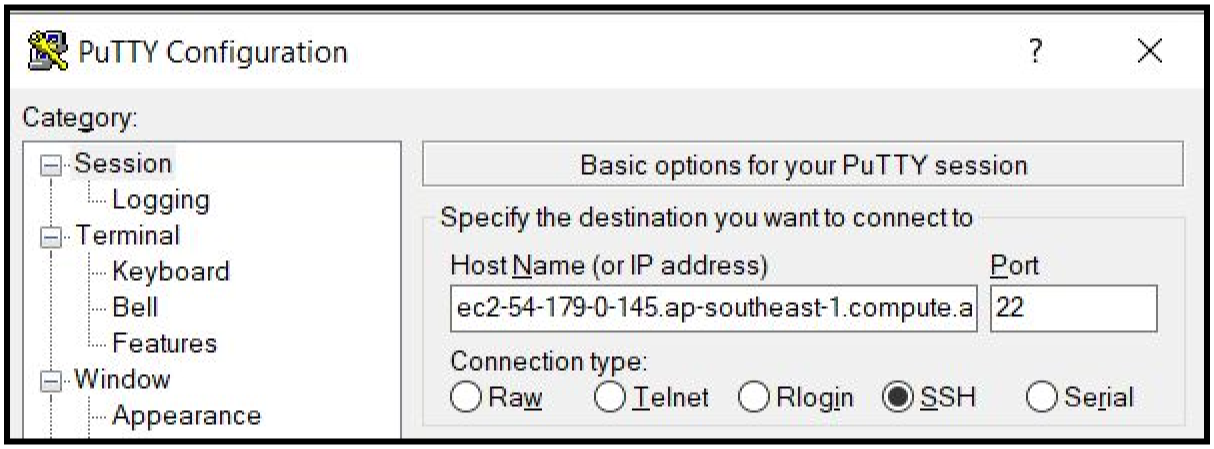
4. Select your .pem file for the key pair when you launched your instance and choose Open. Choose OK.
5. It will generate the private key. Save private key to a file by selecting "Save private key", name it as "WPFOC.ppk"
6. Open Putty, Select "Connection" - "SSH" - "Auth" and then load the .ppk file.
7. Fill the Hostname field with <your public dns>. Also you can save the session by giving it a name and clicking on "Save".

9. Click on Open, and "yes" to login as "ubuntu" to the server.

Here are the screenshots for reference:



Name	Date modified	Type	Size
putty-64bit-0.74-installer	31/1/2021 2:23 AM	Windows Installer ...	2,777 KB
WPFOC	31/1/2021 2:44 AM	PuTTY Private Key ...	2 KB
WPFOC-KEYPAIR.pem	31/1/2021 1:53 AM	PEM File	2 KB

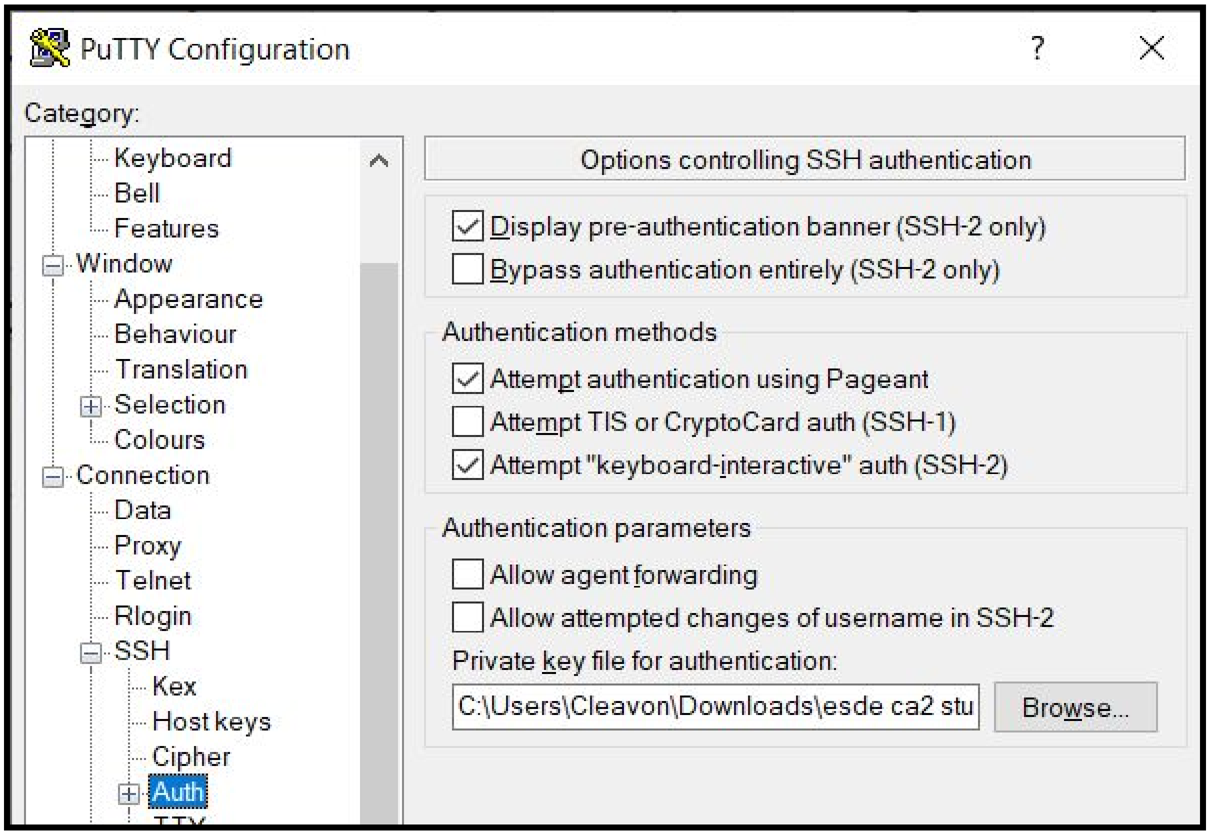


Specify the destination you want to connect to

Host Name (or IP address): ec2-54-179-0-145.ap-southeast-1.compute.a

Port: 22

Connection type: Raw Telnet Rlogin [✓ SSH] Serial



- [✓] Display pre-authentication banner (SSH-2 only)
- [ ] Bypass authentication entirely (SSH-2 only)

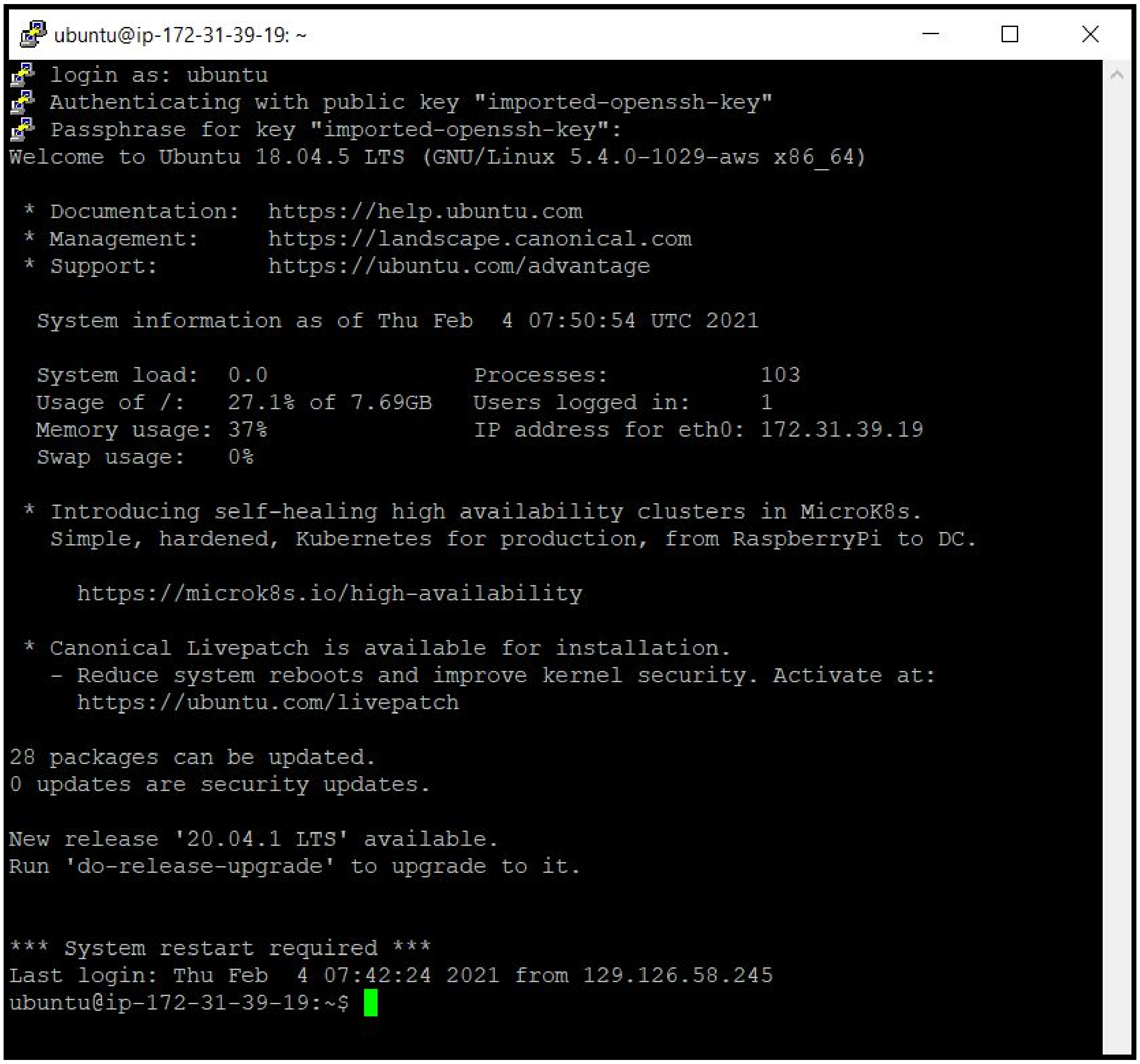
Authentication methods

- [✓] Attempt authentication using Pageant
- [ ] Attempt TIS or CryptoCard auth (SSH-1)
- [✓] Attempt "keyboard-interactive" auth (SSH-2)

Authentication parameters

- [ ] Allow agent forwarding
- [ ] Allow attempted changes of username in SSH-2

Private key file for authentication: C:\Users\Cleavon\Downloads\esde ca2 stu



ubuntu@ip-172-31-39-19: ~

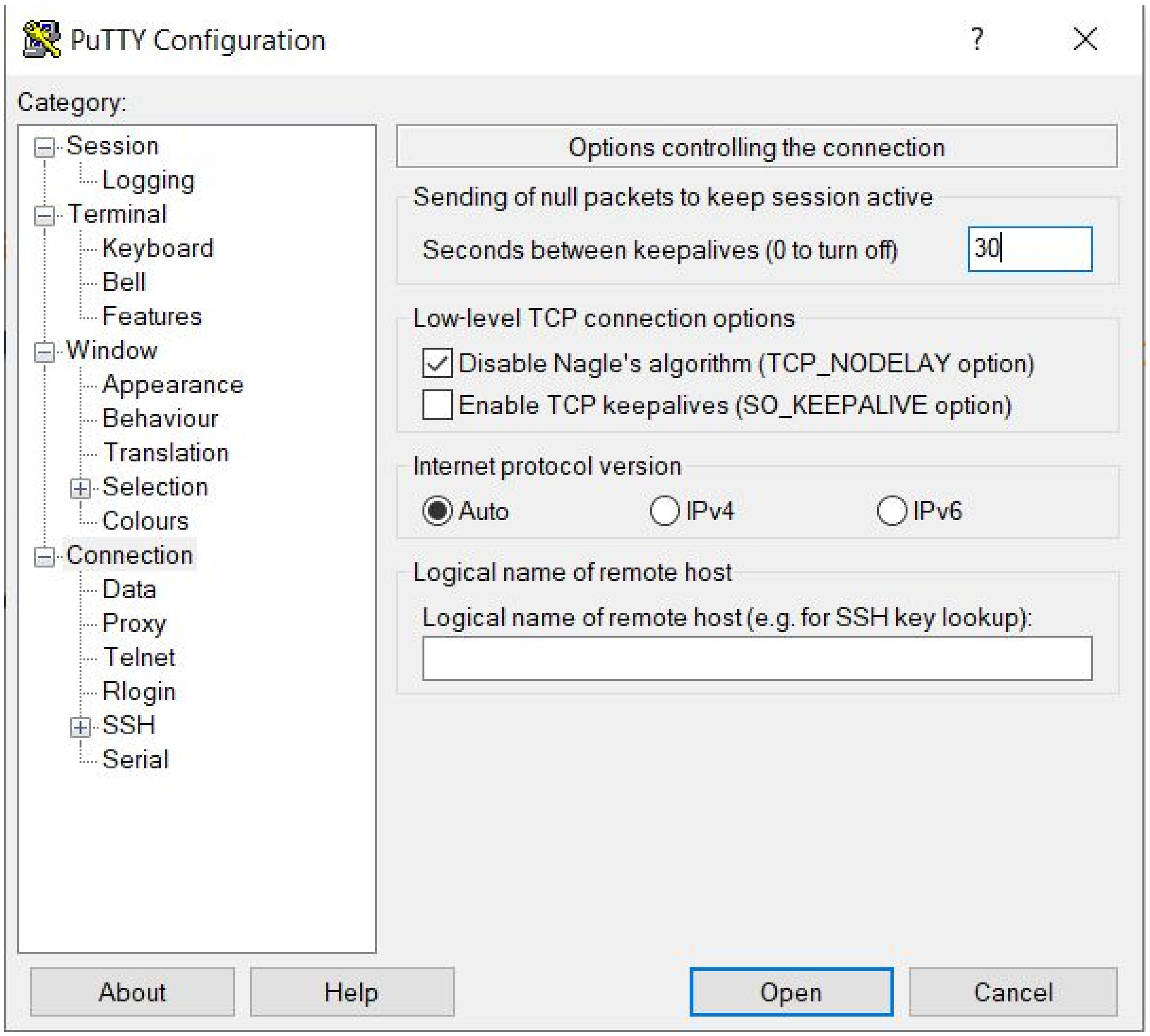
```
login as: ubuntu
Authenticating with public key "imported-openssh-key"
Passphrase for key "imported-openssh-key":
Welcome to Ubuntu 18.04.5 LTS (GNU/Linux 5.4.0-1029-aws x86_64)

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

  System information as of Thu Feb  4 07:50:54 UTC 2021

  System load:  0.0               Processes:           103
  Usage of /:   27.1% of 7.69GB   Users logged in:     1
  Memory usage: 37%               IP address for eth0: 172.31.39.19
  Swap usage:   0%

 * Introducing self-healing high availability clusters in MicroK8s.
   Simple, hardened, Kubernetes for production, from RaspberryPi to DC.

     https://microk8s.io/high-availability

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

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

New release '20.04.1 LTS' available.
Run 'do-release-upgrade' to upgrade to it.


*** System restart required ***
Last login: Thu Feb  4 07:42:24 2021 from 129.126.58.245
ubuntu@ip-172-31-39-19:~$
```

Once you have this, You are logged in now.

Troubleshoot

How to change Putty SSH connection to never timeout when the user is idle?

If you go to your putty settings -> Connection and set the value of "Seconds between keepalives" to 30 seconds.



Options controlling the connection

Sending of null packets to keep session active

Seconds between keepalives (0 to turn off): 30

Low-level TCP connection options

[✓] Disable Nagle's algorithm (TCP_NODELAY option)

[ ] Enable TCP keepalives (SO_KEEPALIVE option)

Internet protocol version

[✓ Auto] IPv4 IPv6

Logical name of remote host

Logical name of remote host (e.g. for SSH key lookup):

Using Amazon S3 for your Code Repository

1. Right click on a folder you wish to work on and select the “Compressed (zipped) folder” option in “Send to”.
2. Login to your AWS console and select S3. Click on the Create bucket button, enter a unique name for your bucket and click on the ‘Next’ button
3. Click the ‘Next’ button again and uncheck all the checkboxes in the ‘Set Permissions’ tab.
4. Click the ‘Next’ button and click the ‘Create bucket’ button.
5. Select the newly created bucket and upload the project’s zip file to the bucket.
6. Click on the zip file and then click on the Make Public button.
7. Record down the endpoint for your source code for later steps

Install Node on EC2 Instance

1. Install Node on the instance in your terminal or git bash by running this command: curl -o- https://raw.githubusercontent.com/creationix/nvm/v0.33.11/install.sh | bash
2. Close and reopen your terminal to start using nvm
3. Use nvm to install Node.js because nvm can install multiple versions of Node.js and allow you to switch between them using this command: . ~/.nvm/nvm.sh
4. Installing node version 8.10.: nvm install 8.10
5. Check your node version: node -v (it should be 8.10)

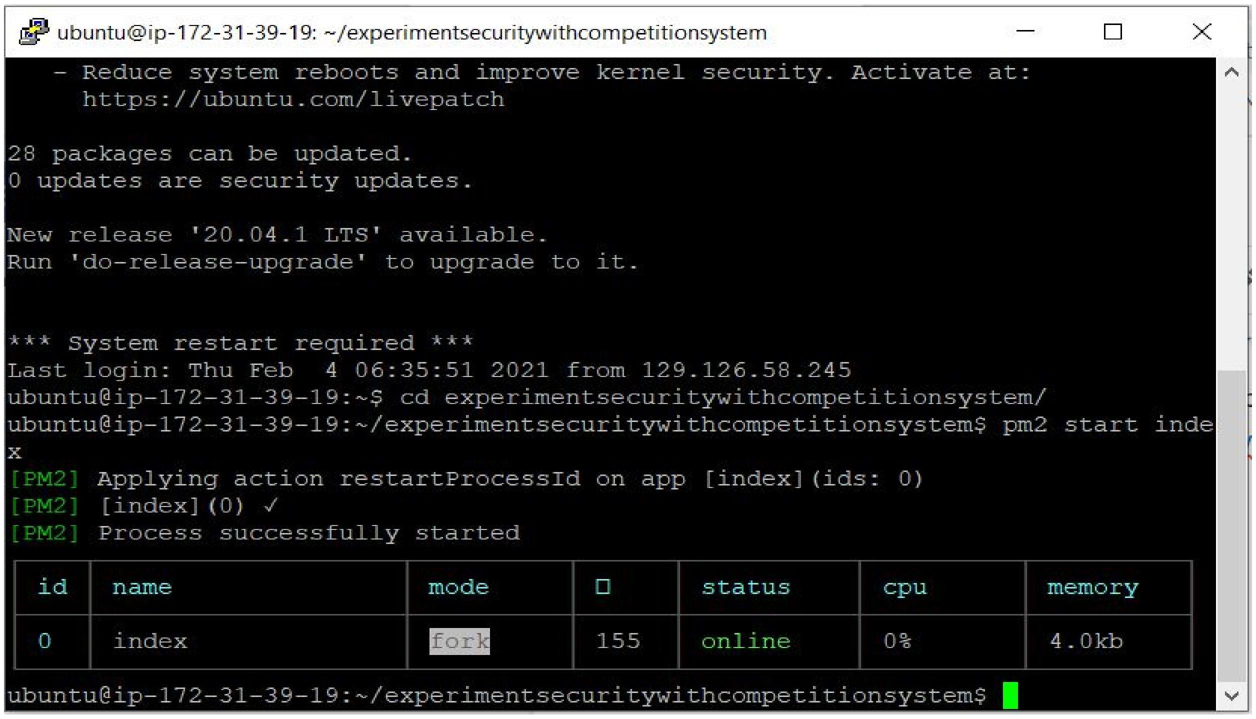
Copy code on your EC2 instance and install dependencies to your home directory(/home/ubuntu)

1. Get code from S3 repository that was previously noted down: wget https://cc-backend.s3.amazonaws.com/experimentsecuritywithcompetitionsystem.zip
2. Verify the node application is copied to your home directory: ls
3. Install unzip: sudo apt install unzip
4. Extract the zip file: unzip experimentsecuritywithcompetitionsystem.zip
5. Install Dependencies if your zip file does not contain all the packages in the node_modules: cd experimentsecuritywithcompetitionsystem, then npm install

Start server to run forever

1. Install pm2: npm install -g pm2

2. Go to the directory and run: pm2 start index (or index.js)



ubuntu@ip-172-31-39-19: ~/experimentsecuritywithcompetitionsystem

```
   - Reduce system reboots and improve kernel security. Activate at:
     https://ubuntu.com/livepatch

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

New release '20.04.1 LTS' available.
Run 'do-release-upgrade' to upgrade to it.


*** System restart required ***
Last login: Thu Feb  4 06:35:51 2021 from 129.126.58.245
ubuntu@ip-172-31-39-19:~$ cd experimentsecuritywithcompetitionsystem/
ubuntu@ip-172-31-39-19:~/experimentsecuritywithcompetitionsystem$ pm2 start inde
x
[PM2] Applying action restartProcessId on app [index](ids: 0)
[PM2] [index](0) ✓
[PM2] Process successfully started
┌────┬─────────────────────┬──────────┬──────┬───────────┬──────────┬──────────┐
│ id │ name                │ mode     │ □    │ status    │ cpu      │ memory   │
├────┼─────────────────────┼──────────┼──────┼───────────┼──────────┼──────────┤
│ 0  │ index               │ fork     │ 155  │ online    │ 0%       │ 4.0kb    │
└────┴─────────────────────┴──────────┴──────┴───────────┴──────────┴──────────┘
ubuntu@ip-172-31-39-19:~/experimentsecuritywithcompetitionsystem$
```

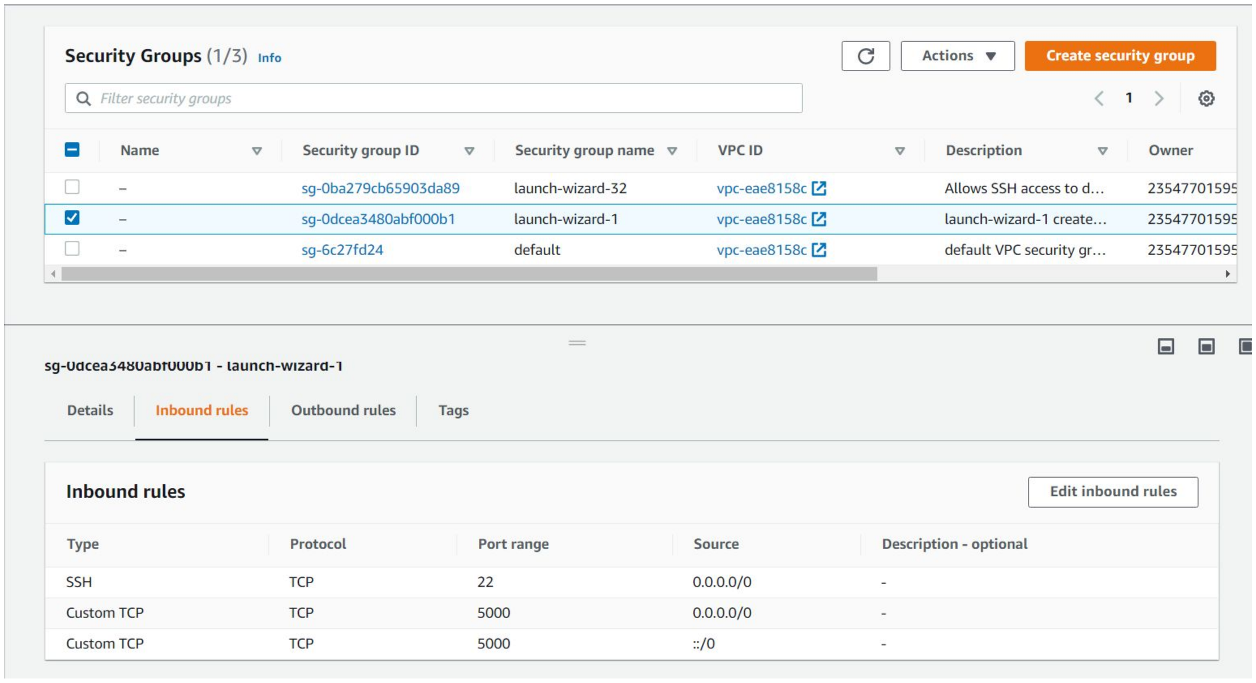
3. Open in browser: http://[your public IP address or domain name]:5000/

Troubleshoot

-Error reaching site

Configure Security Group to ensure you open the port where your Application will run on

1. Go to Network Security - Security Group, and select “Create Security Group”
2. Add Security Group Name and Description
3. Add Inbound Rules
    a. Custom Source for SSH : **0.0.0.0/0**
    b. Custom TCP, Port Range: 5000, Custom Source : **0.0.0.0/0** & **::/0**
4. Once completed, go to Network & Security - Network Interfaces
5. Select instance which you want to change Security Group on - Actions - Change Security Group
6. Select your newly created group and click ‘Save”



	Name	Security group ID	Security group name	VPC ID	Description	Owner
☐	–	sg-0ba279cb65903da89	launch-wizard-32	vpc-eae8158c	Allows SSH access to d...	23547701595
✓	–	sg-0dcea3480abf000b1	launch-wizard-1	vpc-eae8158c	launch-wizard-1 create...	23547701595
☐	–	sg-6c27fd24	default	vpc-eae8158c	default VPC security gr...	23547701595

sg-0dcea3480abf000b1 - launch-wizard-1

Inbound rules

Type	Protocol	Port range	Source	Description - optional
SSH	TCP	22	0.0.0.0/0	-
Custom TCP	TCP	5000	0.0.0.0/0	-
Custom TCP	TCP	5000	::/0	-

Configure pm2

Run: **pm2 startup**

After running the command, you will get a command starting with “sudo”, copy it from sudo till end of the next line and paste it in the terminal and enter

- To freeze a process list via reboot: **$ pm2 save**
- To restart server: **$ pm2 restart server**
- To reload server: **$ pm2 reload server**
- To stop server: **$ pm2 stop server**
- To delete server: **$ pm2 delete server**

Create a new Amazon Web Service RDS instance with Amazon RDS

1. On the AWS Console go to Services - Database - RDS
2. Click on ‘Create database’
3. Keep everything as default, except the following:
   a. Engine Options - Engine type - MySQL
   b. Templates - Free Tier
   c. Credentials Settings - Password
   d. Additional Connectivity Configuration - Publicly Accessible (Yes)
4. Click on ‘Create database’, you should see your database being created
5. View information about the database by clicking on the name
6. Under Connectivity & Security, note down the **endpoint** and **port number**

Connect & send SQL queries remotely to an Amazon Web Service RDS instance using MySQL Workbench

1. Launch MySQL Workbench and locate the '+' icon to add a new connection
2. Fill up the form with the RDS database information that you had recorded down (**endpoint, port and username**)
3. Click on Test connection, you should be prompted a dialog asking for your MySQL password
4. Submit your password and you should finally have a notice, stating that the connection is working fine
5. You should be able to see a new MySQL connection created

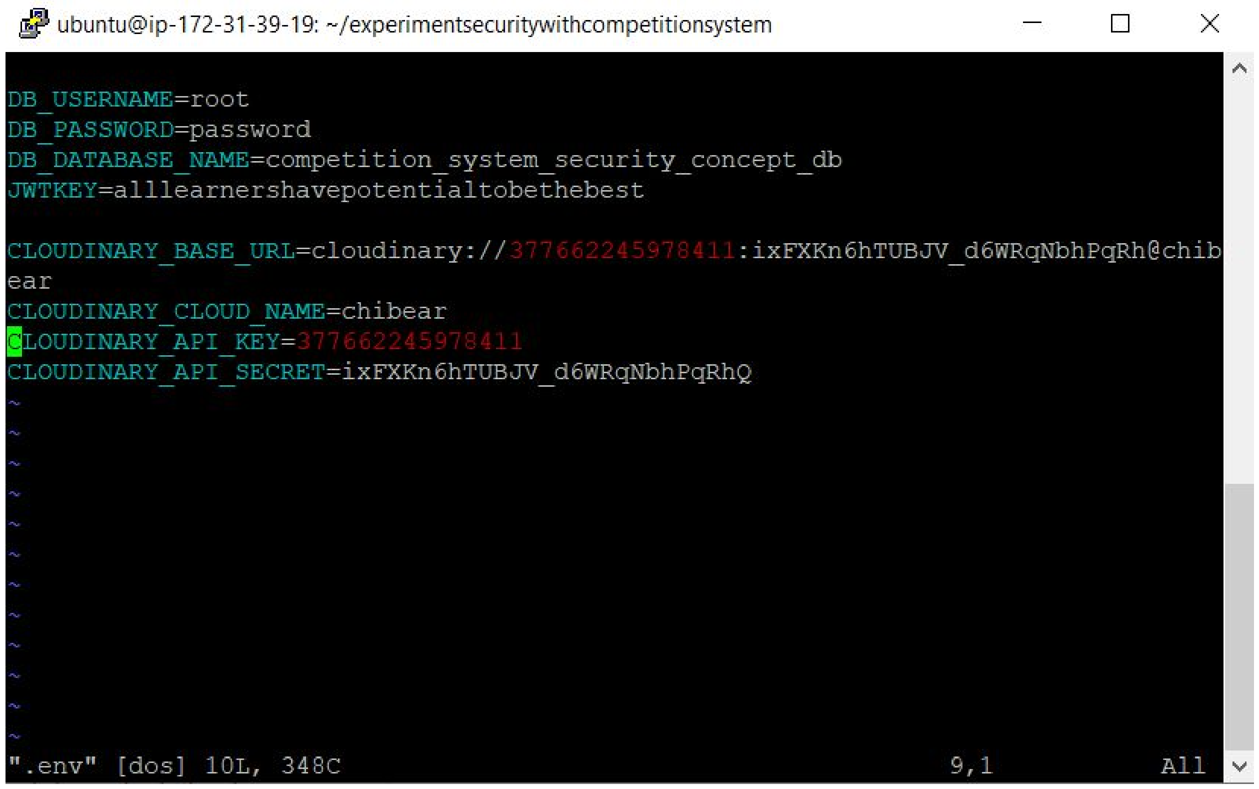
Troubleshoot

If there is a connection error, check the Security Group for the database if it allows your application server to connect.

1. Connectivity & security - VPC security group link
2. Select “Edit Inbound Rule”
3. Add rules:
    a. All traffic
    b. Custom Source **0.0.0.0/0 & ::/0**
    c. Save Rules
4. Try connecting MySQL with AWS RDS again. The connection should be working now.

Load SQL text file into the new connection and configure database connection in EC2

1. Click on Administration - Data import/Restore to import the SQL Script file (Snapsell-v2) into the workbench
2. Execute it by clicking on the lightning icon
3. After the script file has been loaded, open up the Putty terminal and cd into the directory with the .env file
4. Edit .env by opening the file in the terminal: **vim .env**
5. Click on the character 'I' on the keyboard to start editing.


ubuntu@ip-172-31-39-19: ~/experimentsecuritywithcompetitionsystem

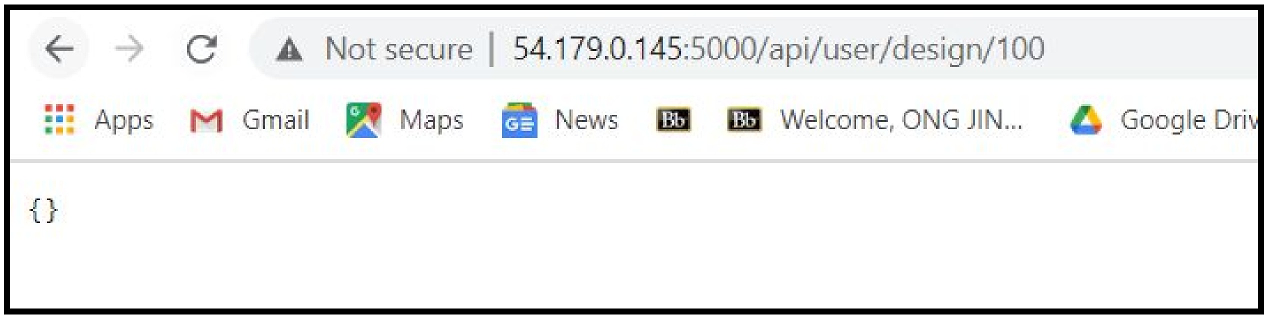
```
DB_USERNAME=root
DB_PASSWORD=password
DB_DATABASE_NAME=competition_system_security_concept_db
JWTKEY=alllearnershavepotentialtobethebest

CLOUDINARY_BASE_URL=cloudinary://377662245978411:ixFXKn6hTUBJV_d6WRqNbhPqRh@chib
ear
CLOUDINARY_CLOUD_NAME=chibear
CLOUDINARY_API_KEY=377662245978411
CLOUDINARY_API_SECRET=ixFXKn6hTUBJV_d6WRqNbhPqRhQ
~
~
~
~
~
~
~
~
~
~
~
~
".env" [dos] 10L, 348C                                          9,1           All
```

6. Edit the following:
    a. Change host to endpoint of the RDS
    b. Change user to username set in RDS
    c. Change password to password set in RDS
    d. Change database name to table in MySQL
7. To save changes, press **'Esc',** type **':wq'** and then press **'Enter'**

8. Restart the pm2 server: **pm2 restart server**
9. Open in browser and test for functionality by using any api:

http://[your public IP address or domain name]:5000/api/user/design/100

Data successfully retrieved from database:

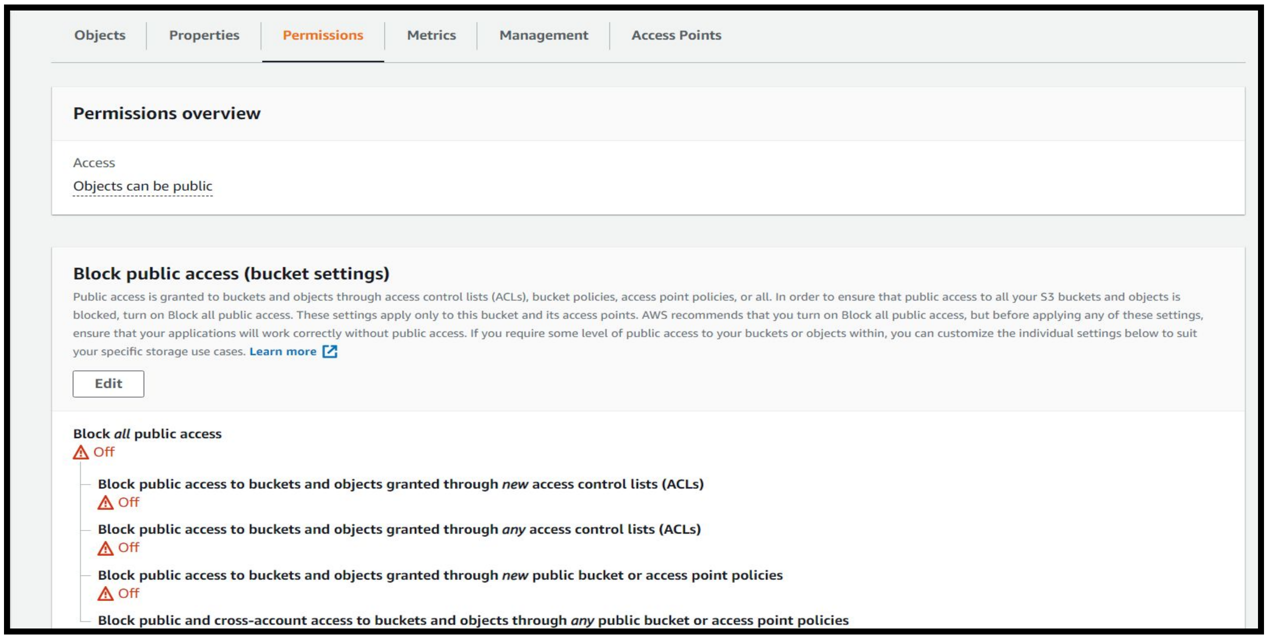


54.179.0.145:5000/api/user/design/100

```
{}
```

Host a website - Create a bucket

1. Under services, click on S3
2. Click on create bucket
3. Enter the Bucket name (for example, example.com)
4. Click the Next button again and uncheck all the checkboxes in the Set Permissions tab.



Permissions overview

Access
Objects can be public

Block public access (bucket settings)

Public access is granted to buckets and objects through access control lists (ACLs), bucket policies, access point policies, or all. In order to ensure that public access to all your S3 buckets and objects is blocked, turn on Block all public access. These settings apply only to this bucket and its access points. AWS recommends that you turn on Block all public access, but before applying any of these settings, ensure that your applications will work correctly without public access. If you require some level of public access to your buckets or objects within, you can customize the individual settings below to suit your specific storage use cases. Learn more

Block *all* public access
Off

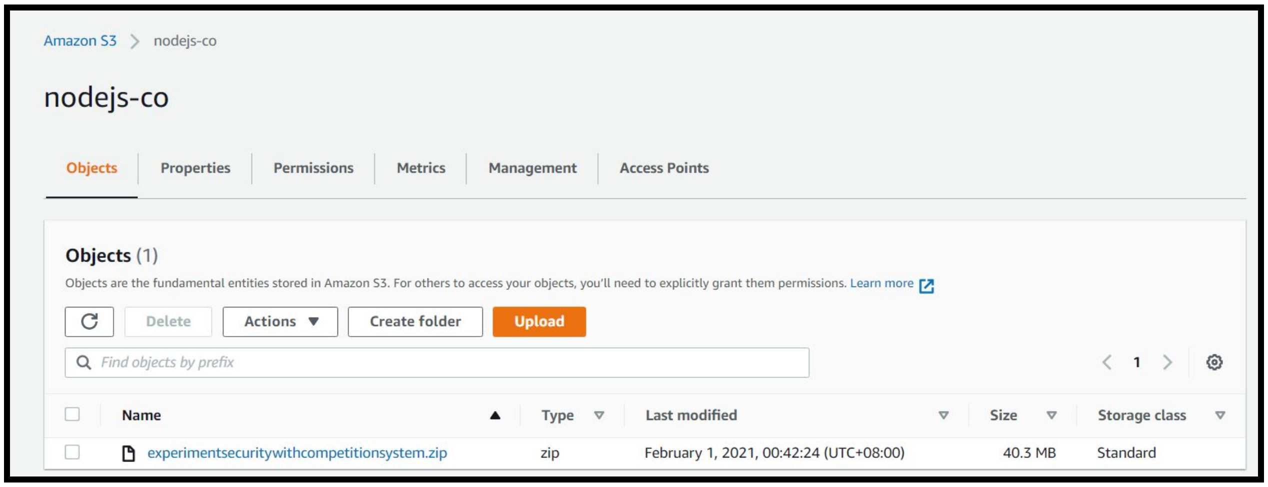
Block public access to buckets and objects granted through *new* access control lists (ACLs)
Off

Block public access to buckets and objects granted through *any* access control lists (ACLs)
Off

Block public access to buckets and objects granted through *new* public bucket or access point policies
Off

Block public and cross-account access to buckets and objects through *any* public bucket or access point policies

5. Click the Next button and then click the Create bucket button.



Objects (1)

Objects are the fundamental entities stored in Amazon S3. For others to access your objects, you'll need to explicitly grant them permissions. Learn more

Name	Type	Last modified	Size	Storage class
experimentsecuritywithcompetitionsystem.zip	zip	February 1, 2021, 00:42:24 (UTC+08:00)	40.3 MB	Standard

Enable static website hosting

1. In the Bucket name list, choose the bucket that you want to use for your static website.
2. Choose Properties.
3. Choose Static website hosting.
4. Choose Use this bucket to host a website.
5. Enter the name of your index document.
6. The document name is typically index.html. The document's name is also case sensitive and must exactly match the file name of the HTML index document that you plan to upload to your S3 bucket.
7. Under Static website hosting, note the Endpoint
8. Click on save

Add a bucket policy that makes your bucket content publicly available

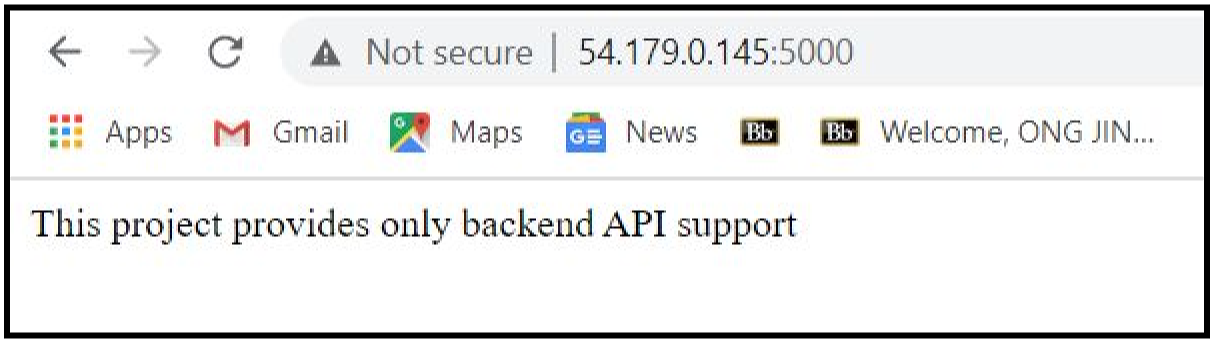
1. Under Buckets, select the name of your bucket.
2. Select Permissions.
3. Select Bucket Policy.
4. To grant public read access for your website, copy the following bucket policy, and paste it in the Bucket policy editor.

```
{
        "Version": "2012-10-17",
        "Statement": [
                {
          "Sid": "PublicReadGetObject",
          "Effect": "Allow",
                  "Principal": "*",
          "Action": [
                "s3:GetObject"
          ],
          "Resource": [
            "arn:aws:s3:::example.com/*"
          ]
                }
        ]
}
```

5. Update the Resource to include your bucket name.
6. Click on save

Test your website endpoint

1. To test your website, enter the website endpoint in your browser that you previously noted down. If your browser displays your .html page, the website was successfully deployed.



This project provides only backend API support

Diagram

S3	Amazon S3 (Short for Amazon Simple Storage Service) has a simple web services interface that we can use to store and retrieve data from anywhere on the web at any time.
EC2	Amazon EC2 (Short for Amazon Elastic Compute Cloud) allows the user to develop and deploy applications at a much faster rate. It can also create “instances” which are virtual computing environments
RDS	Amazon RDS (Short for Amazon Relational Database Service) makes it easy to set up, operate, and scale a relational database in the cloud

Part 2: API Gateway

Code Snippets and Inline Documentation

Launch Cloud9, create a new environment. Push the files from S3 bucket, and update the necessary files. Create a “create_bucket.js” file and enter the following code.

```
var

      AWS = require("aws-sdk"),

      S3API = new AWS.S3({

      apiVersion: "2006-03-01",

      region: "us-east-1"

      });


(function createBucket(){

      var

      params = {

            Bucket: "nodejs-kw", //bucket name

      };

      S3API.createBucket(params, function(error, data){

            console.log(error, data);

      });

})();
```

Create a new file called “public_policy.json”. The code below is used to create a policy that allows anyone to read from the bucket.

```
{
  "Version":"2012-10-17",
  "Statement":[{
      "Sid":"PublicReadGetObject",
      "Effect":"Allow",
      "Principal": "*",
      "Action":["s3:GetObject"],
      "Resource":["arn:aws:s3:::nodejs-co"
      ]
      }
  ]
 }
```

Create a file name “upload_items.js” and insert the following code.

```
var
      AWS = require("aws-sdk"),
      S3API = new AWS.S3({
      apiVersion: "2006-03-01",
      region: "us-east-1"
      }),
      FS = require("fs"),
      bucket_name_str = "nodejs-co";
```

```
function uploadItemAsBinary(key_name_str, content_type_str, bin){

      var params = {

      Bucket: bucket_name_str,

      Key: key_name_str,

      Body: bin,

      ContentType: content_type_str,

      CacheControl: "max-age=0"

      };

      S3API.putObject(params, function(error, data){

      console.log(error, data);

      });

}




(function init(){

      var

      file_path_str = "./",

      file_name_str = "experimentsecuritywithcompetitionsystem.zip",

      config_bin = FS.readFileSync(file_path_str + file_name_str);

      uploadItemAsBinary(file_name_str, "application/zip", config_bin);

})();
```

Ensure that my table is created by going to dynamoDB and checking.

Add the following code to a file called query.js and run it.

```
exports.handler = function(event, context, callback){

  var

      AWS = require("aws-sdk"),

      DDB = new AWS.DynamoDB({

      apiVersion: "2012-08-10",

      region: "us-east-1"

      });


  function queryIndex(title_str, cb){

      var

      params = {

              ExpressionAttributeValues: {

                  ":title": {

                   S: title_str

                  }

              },

              KeyConditionExpression: "title = :title",

              TableName: "file",

              IndexName: "file_id"

      };

      DDB.query(params, function(err, data){

            var

              cat_reply_arr = [];

            if(err){
              throw err;

            }

            if(data.Items.length === 0){

              return cb(null, []);

            }

            for(var i_int = 0; i_int < data.Items.length; i_int += 1){

             cat_reply_arr.push(data.Items[i_int]);

            }

            cb(null, cat_reply_arr);

    });

}


function scanTable(cb){

    var

    params = {

            TableName: "file"

    };

    DDB.scan(params, function(err, data){

            if(err){

              throw err;

            }

            cb(null, data.Items);

    });

}
```

```
  (function init(){

     var

     title_str = "all",

     cb = null;

     if(process.argv[2] !== undefined){

     console.log("Local test for " + process.argv[2]);

     title_str = process.argv[2];

     cb = console.log;

     }else{

           console.log("Running in lambda");

     console.log(event);

     cb = callback; //becomes available in lambda

     title_str = event.title_str;

     }

     if(title_str === "All"){

     scanTable(cb);

     }else{

     queryIndex(title_str, cb);

     }

  })();

};
```

Create a new API

Add the following code into the existing config.js file

```
var API_ENDPOINT_STR =
"https://w94f4tzr2m.execute-api.us-east-1.amazonaws.co”;
```

Enter this code in seeddata.js

```


var

      AWS = require("aws-sdk"),

      DDB = new AWS.DynamoDB({

      apiVersion: "2012-08-10",

      region: "us-east-1"

      }),

      DATA_ARR = require("./data.json");


function addNewItemsFromJSON(){

      var

      data = {},

      data_formatted_arr = [],

      params = {};




      for(var i_int = 0; i_int < DATA_ARR.length; i_int += 1){

      data = {

            PutRequest: {
```

```
          Item: {
              id: {
                 "N": DATA_ARR[i_int]._file_id_int
              },
              cloudinaryid: {
                 "S": DATA_ARR[i_int].cloudinary_file_id_str
              },
              cloudinaryurl: {
                 "S": DATA_ARR[i_int].cloudinary_url_str
              },
              designtitle: {
                 "N": DATA_ARR[i_int].design_title_str
              },
              created_by: {
                 "S": DATA_ARR[i_int].created_by_str
              },
              image: {
                 "S": DATA_ARR[i_int].image_str
              }
          }
      }
};
data_formatted_arr.push(data);
```

```
      }

      params = {

      RequestItems: {

            "file": data_formatted_arr.reverse()

      }

      };

      DDB.batchWriteItem(params, function(err, data){

      if(err){

            throw err;

      }

      console.log("OK");

      });

}



function init(){

      addNewItemsFromJSON();

}



init();
```

Next, this is the code for create_lambda.js

```
var

      AWS = require("aws-sdk"),
      LAMBDA = new AWS.Lambda({

      apiVersion: "2015-03-31",

      region: "us-east-1"

      });



function createLambdaFromZip(){

      var

      params = {

            Code: {

                 S3Bucket: "nodejs-kw",

                 S3Key: "experimentsecuritywithcompetitionsystem.zip"

             },

            Description: "competition_system_security_concept_db",

            FunctionName: "getOneDesignData",

            Handler: "query.handler",

            MemorySize: 128,

            Publish: true,

            Role: "arn:aws:iam::278011394123:role/lambda-role",

            Runtime: "nodejs12.x",

            Timeout: 30,

      };

      LAMBDA.createFunction(params, function(err, data){
            console.log(err, data);

        });

}

(function init(){

        createLambdaFromZip();

})();
```

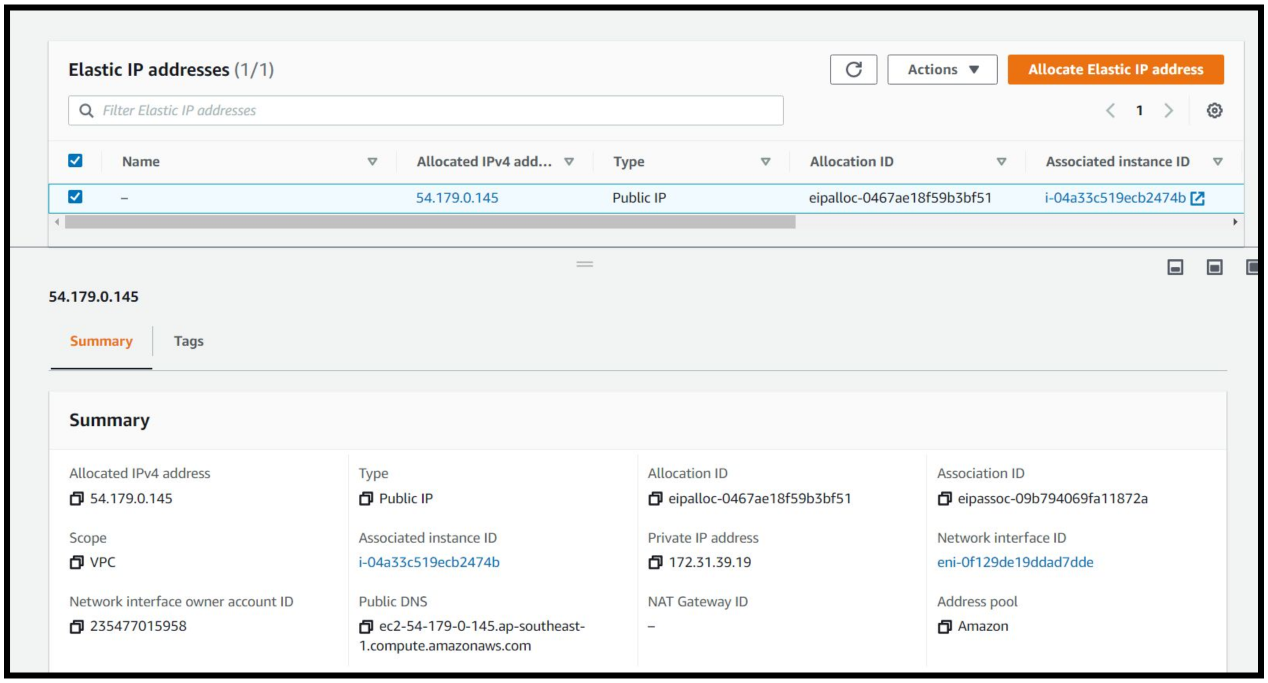
Troubleshoot

1. Problem 1:

   The backend in the EC2 to couldn't work

   1.1. Solution:

      Make use of Elastic IP



Elastic IP addresses (1/1)

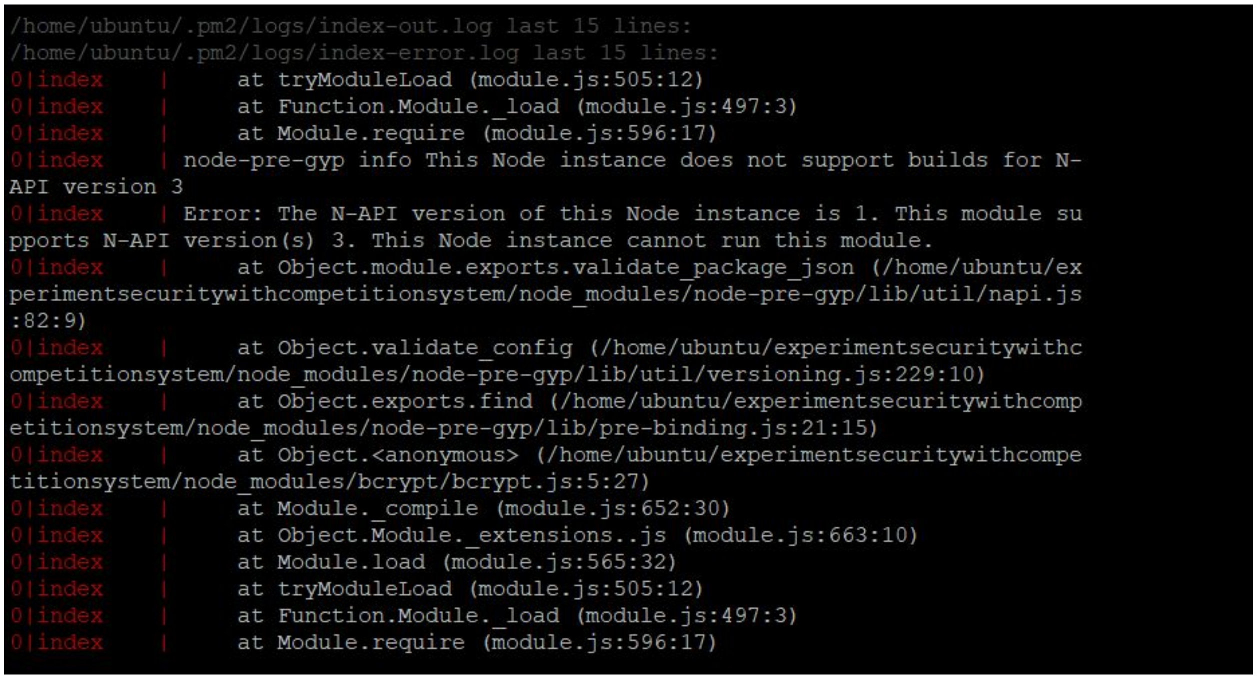
Name	Allocated IPv4 add...	Type	Allocation ID	Associated instance ID
–	54.179.0.145	Public IP	eipalloc-0467ae18f59b3bf51	i-04a33c519ecb2474b

54.179.0.145

Summary

Allocated IPv4 address 54.179.0.145	Type Public IP	Allocation ID eipalloc-0467ae18f59b3bf51	Association ID eipassoc-09b794069fa11872a
Scope VPC	Associated instance ID i-04a33c519ecb2474b	Private IP address 172.31.39.19	Network interface ID eni-0f129de19ddad7dde
Network interface owner account ID 235477015958	Public DNS ec2-54-179-0-145.ap-southeast-1.compute.amazonaws.com	NAT Gateway ID –	Address pool Amazon

2. Index.js keeps having issues



```
/home/ubuntu/.pm2/logs/index-out.log last 15 lines:
/home/ubuntu/.pm2/logs/index-error.log last 15 lines:
0|index    |     at tryModuleLoad (module.js:505:12)
0|index    |     at Function.Module._load (module.js:497:3)
0|index    |     at Module.require (module.js:596:17)
0|index    | node-pre-gyp info This Node instance does not support builds for N-
API version 3
0|index    | Error: The N-API version of this Node instance is 1. This module su
pports N-API version(s) 3. This Node instance cannot run this module.
0|index    |     at Object.module.exports.validate_package_json (/home/ubuntu/ex
perimentsecuritywithcompetitionsystem/node_modules/node-pre-gyp/lib/util/napi.js
:82:9)
0|index    |     at Object.validate_config (/home/ubuntu/experimentsecuritywithc
ompetitionsystem/node_modules/node-pre-gyp/lib/util/versioning.js:229:10)
0|index    |     at Object.exports.find (/home/ubuntu/experimentsecuritywithcomp
etitionsystem/node_modules/node-pre-gyp/lib/pre-binding.js:21:15)
0|index    |     at Object.<anonymous> (/home/ubuntu/experimentsecuritywithcompe
titionsystem/node_modules/bcrypt/bcrypt.js:5:27)
0|index    |     at Module._compile (module.js:652:30)
0|index    |     at Object.Module._extensions..js (module.js:663:10)
0|index    |     at Module.load (module.js:565:32)
0|index    |     at tryModuleLoad (module.js:505:12)
0|index    |     at Function.Module._load (module.js:497:3)
0|index    |     at Module.require (module.js:596:17)
```

2.1 Solution:

Install bcryptjs.