

VASAVI COLLEGE OF ENGINEERING

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(Affiliated to Osmania University)
Hyderabad- 500 031.

DEPARTMENT OF : Computer Science and Engineering
NAME OF THE LABORATORY : DSCC LAB

Name : _____ Roll No : 1602-19-733- Page No: _____

Lab Experiment

Hosting a Static Website

Accessing the AWS Management Console

1. At the top of these instructions, choose **Start Lab** to launch your lab.

A **Start Lab** panel opens, and it displays the lab status.

2. Wait until the **Start Lab** panel displays the message *Lab status: ready*, then close the panel by choosing the **X**.
3. At the top of these instructions, choose **AWS**.

This action opens the AWS Management Console in a new browser tab. The system automatically logs you in.

4. Arrange the **AWS Management Console** tab so that it displays alongside these instructions. Ideally, you will have both browser tabs open at the same time so that you can follow the lab steps more easily.

Do not change the Region unless specifically instructed to do so.

Task 1: Creating a bucket in Amazon S3

In this task, you will create an S3 bucket and configure it for static website hosting.

In the **AWS Management Console**, on the **Services** menu, choose **S3**.

5. Choose **Create bucket**

An S3 bucket name is globally unique, and the namespace is shared by all AWS accounts. After you create a bucket, the name of that bucket cannot be used by another AWS account in any AWS Region unless you delete the bucket.

Thus, for this lab, you will use a bucket name that includes a random number, such as: *website-123*

6. For **Bucket name**, enter: `website-<123>` (replace *<123>* with a random number)

Public access to buckets is blocked by default. Because the files in your static website will need to be accessible through the internet, you must permit public access.

- Verify the **AWS Region** is set to **us-east-1** (if it is not, choose the us-east-1 Region)

7. In the **Object Ownership** section, select **ACLs enabled**, then verify **Bucket owner preferred** is selected.

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8. Clear **Block all public access**, then select the box that states **I acknowledge that the current settings may result in this bucket and the objects within becoming public**.
9. Choose **Create bucket**.

You can use tags to add additional information to a bucket, such as a project code, cost centre, or owner.

10. Choose the name of your new bucket.
11. Choose the **Properties** tab.
12. Scroll to the **Tags** panel.
13. Choose **Edit** then **Add tag** and enter:

- **Key:** Department
- **Value:** Marketing

14. Choose **Save changes** to save the tag.

Next, you will configure the bucket for static website hosting.

15. Stay in the **Properties** console.
16. Scroll to the **Static website hosting** panel.
17. Choose **Edit**

18. Configure the following settings:
 - **Static web hosting:** Enable
 - **Hosting type:** Host a static website
 - **Index document:** index.html
 - **Note:** You must enter this value, even though it is already displayed.
 - **Error document:** error.html

19. Choose **Save changes**
20. In the **Static website hosting** panel, choose the link under **Bucket website endpoint**.

You will receive a *403 Forbidden* message because the bucket permissions have not been configured yet. Keep this tab open in your web browser so that you can return to it later.

Your bucket has now been configured to host a static website.

Task 2: Uploading content to your bucket

In this task, you will upload the files that will serve as your static website to the bucket.

21. Right-click each of these links and download the files to your computer:

Ensure that each file keeps the same file name, including the extension.

- [index.html](#)

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- [script.js](#)
- [style.css](#)

22. Return to the Amazon S3 console and in the `website-<123>` bucket you created earlier, choose the **Objects** tab.
23. Choose **Upload**.
24. Choose **Add files**
25. Locate and select the three files that you downloaded.
26. If prompted, choose I acknowledge that existing objects with the same name will be overwritten.
27. Choose **Upload**.

Your files are uploaded to the bucket.

- Choose **Close**

Task 3: Enabling access to the objects

Objects that are stored in Amazon S3 are private by default. This ensures that your organization's data remains secure.

In this task, you will make the uploaded objects publicly accessible.

First, confirm that the objects are currently private.

28. Return to the browser tab that showed the *403 Forbidden* message.
29. Refresh the webpage

You should still see a *403 Forbidden* message.

Analysis: This response is expected! This message indicates that your static website is being hosted by Amazon S3, but that the content is private.

You can make Amazon S3 objects public through two different ways:

- To make either a whole bucket public, or a specific directory in a bucket public, use a *bucket policy*.
 - To make individual objects in a bucket public, use an *access control list (ACL)*.
30. Return to the web browser tab with the Amazon S3 console (but do not close the website tab).
31. Select all three objects.
32. In the **Actions** menu, choose **Make public via ACL**.

A list of the three objects is displayed.

33. Choose **Make public**

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Your static website is now publicly accessible.

34. Return to the web browser tab that has the *403 Forbidden* message.
35. Refresh the webpage.

You should now see the static website that is being hosted by Amazon S3.

Task 4: Updating the website

You can change the website by editing the HTML file and uploading it again to the S3 bucket.

36. On your computer, load the **index.html** file into a text editor (for example, Notepad or TextEdit).
37. Find the text **Served from Amazon S3** and replace it with **Created by <YOUR-NAME>**, substituting your name for **<YOUR-NAME>** (for example, *Created by Jane*).
38. Save the file.
39. Return to the Amazon S3 console and upload the **index.html** file that you just edited.
40. Select **index.html** and use the **Actions** menu to choose the **Make public via ACL** option again.
41. Return to the web browser tab with the static website and refresh the page.

Your name should now be on the page.

Your static website is now accessible on the internet. Because it is hosted on Amazon S3, the website has high availability and can serve high volumes of traffic without using any servers.

You can also use your own domain name to direct users to a static website that is hosted on Amazon S3. To accomplish this, you could use the Amazon Route 53 Domain Name System (DNS) service in combination with Amazon S3.

Submitting your work

42. At the top of these instructions, choose **Submit** to record your progress and when prompted, choose **Yes**.
43. If the results don't display after a couple of minutes, return to the top of these instructions, and choose **Grades**
44. To find detailed feedback on your work, choose **Details** followed by **View Submission Report**.

Lab complete

45. Choose **End Lab** at the top of this page, and then select **Yes** to confirm that you want to end the lab.

A panel indicates that *DELETE has been initiated... You may close this message box now*.

46. Select the **X** in the top right corner to close the panel.

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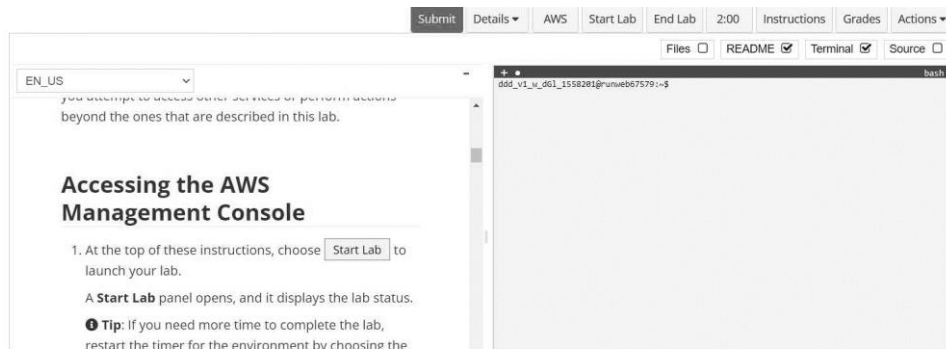
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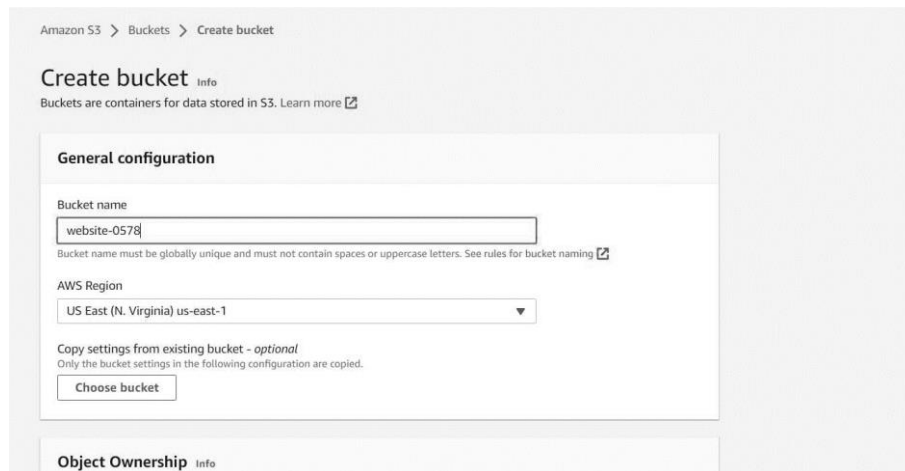
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OUTPUT SCREENSHOTS:

Instructions Panel



Bucket Creation



Forbidden Error

403 Forbidden

- Code: AccessDenied
- Message: Access Denied
- RequestId: YJFWFVYPRMA8PRZ9
- HostId: ITJVNl0zuDIRbTQP0Uw9FgCeNEYkxaD4LJEnNSaNdCui0eRP4w4LqCrAnmZx5K8p0CIh+GwkMRQ=

An Error Occurred While Attempting to Retrieve a Custom Error Document

- Code: AccessDenied
- Message: Access Denied

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Uploading Files

Upload succeeded
View details below.

Summary

Destination
s3://website-0578

Succeeded
3 files, 14.8 KB (100.00%)

Failed
0 files, 0 B (0%)

Files and folders

Configuration

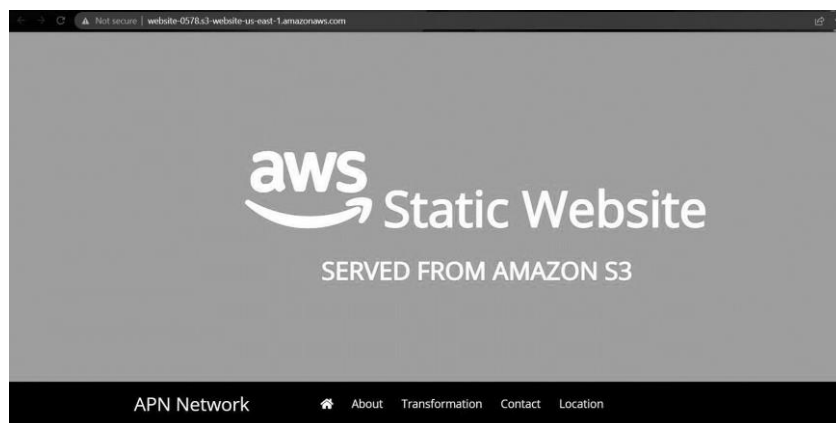
Files and folders (3 Total, 14.8 KB)

Find by name

< 1 >

Name	Folder	Type	Size	Status	Error
index.html	-	text/html	9.8 KB	Succeeded	-
script.js	-	text/javascript	2.0 KB	Succeeded	-
style.css	-	text/css	3.1 KB	Succeeded	-

Static Website-1



Static Website-2 (Updated)



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Lab Experiment

Introducing Amazon Elastic File System (Amazon EFS)

Accessing the AWS Management Console

1. At the top of these instructions, choose **Start Lab** to launch your lab.

A **Start Lab** panel opens, and it displays the lab status.

Tip: If you need more time to complete the lab, restart the timer for the environment by choosing the **Start Lab** button again.

2. Wait until the **Start Lab** panel displays the message *Lab status: ready*, then close the panel by choosing the **X**.
3. At the top of these instructions, choose **AWS**.
4. Arrange the **AWS Management Console** tab so that it displays alongside these instructions. Ideally, you will have both browser tabs open at the same time so that you can follow the lab steps more easily.

Task 1: Creating a security group to access your EFS file system

5. In the **AWS Management Console**, on the **Services** menu, choose **EC2**.
6. In the navigation pane on the left, choose **Security Groups**.
7. Copy the **Security group ID** of the *EFSCliant* security group to your text editor.

The Group ID should look similar to *sg-03727965651b6659b*.

8. Choose **Create security group** then configure:
 - **Security group name:** *EFS Mount Target*
 - **Description:** *Inbound NFS access from EFS clients*
 - **VPC:** *Lab VPC*
9. Under the **Inbound rules** section, choose **Add rule** then configure:
 - **Type:** *NFS*
 - **Source:**
 - *Custom*
 - In the *Custom* box, paste the security group's **Security group ID** that you copied to your text editor
 - Choose **Create security group**.

Task 2: Creating an EFS file system

10. On the **Services** menu, choose **EFS**.
11. Choose **Create file system**
12. In the **Create file system** window, choose **Customize**

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13. On **Step 1**:

- Uncheck Enable automatic backups.
- **Lifecycle management**: Select *None*
- In the **Tags** section, configure:
 - **Key**: Name
 - **Value**: My First EFS File System

14. Choose Next

15. For **VPC**, select *Lab VPC*.

16. Detach the default security group from each *Availability Zone* mount target by choosing the check box on each default security group.

17. Attach the **EFS Mount Target** security group to each *Availability Zone* mount target by:

- Selecting each **Security groups** check box.
- Choosing **EFS Mount Target**

A mount target is created for each subnet

18. Choose Next

19. On **Step 3**, choose Next

20. On **Step 4**:

- Review your configuration.
- Choose **Create**

Proceed to the next step after the **Mount target state** for each mount target changes to *Available*. Choose the screen refresh button after 2–3 minutes to check its progress.

Task 3: Connecting to your EC2 instance via SSH

In this task, you will connect to your EC2 instance by using Secure Shell (SSH).

21. Above these instructions that you are currently reading, choose the **Details** dropdown menu, and then select **Show**

A **Credentials** window opens.

22. Choose the **Download PPK** button and save the **labsuser.ppk** file.

Note: Typically, your browser saves the file to the **Downloads** directory.

23. Note the **EC2PublicIP** address if it is displayed.

24. Exit the **Details** panel by choosing the **X**.

25. To use SSH to access the EC2 instance, you must use ***PuTTY***. If you do not have PuTTY installed on your computer, [download PuTTY](#).

26. Open **putty.exe**.

27. To keep the PuTTY session open for a longer period of time, configure the PuTTY timeout:

- Choose **Connection**
- **Seconds between keepalives**: 30

28. Configure your PuTTY session by using the following settings.

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- Choose **Session**
- **Host Name (or IP address):** Paste the **EC2PublicIP** for the instance you noted earlier
 - Alternatively, return to the Amazon EC2 console and choose **Instances**
 - Select the instance you want to connect to
 - In the *Description* tab, copy the **IPv4 Public IP** value
- Back in PuTTY, in the **Connection** list, expand **SSH**
- Choose **Auth** (but don't expand it)
- Choose **Browse**
- Browse to the *labsuser.ppk* file that you downloaded, select it, and choose **Open**
- Choose **Open** again

29. To trust and connect to the host, choose **Yes**.

30. When you are prompted with **login as**, enter: `ec2-user`.

This action connects you to the EC2 instance.

Task 4: Creating a new directory and mounting the EFS file system

31. In your SSH session, make a new directory by entering `sudo mkdir efs`
32. Back in the **AWS Management Console**, on the **Services** menu, choose **EFS**.
33. Choose **My First EFS File System**.
34. In the **Amazon EFS Console**, on the top right corner of the page, choose **Attach** to open the Amazon EC2 mount instructions.
35. Copy the entire command in the **Using the NFS client** section.

The mount command should look similar to this example:

```
sudo mount -t nfs4 -o nfsvers=4.1,rsize=1048576,wsiz=1048576,hard,timeo=600,retrans=2,noresvport fs-bce57914.efs.us-west-2.amazonaws.com:/ efs
```

The provided `sudo mount...` command uses the default Linux mount options.

36. In your Linux SSH session, mount your Amazon EFS file system by:
 - Pasting the command
 - Pressing ENTER
37. Get a full summary of the available and used disk space usage by entering:

```
sudo df -hT
```

Task 5: Examining the performance behavior of your new EFS file system

38. Examine the write performance characteristics of your file system by entering:

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```
sudo fio --name=fio-efs --filesize=10G --filename=./efs/fio-efs-test.img --bs=1M --nrfiles=1 --direct=1 -  
-sync=0 --rw=write --iodepth=200 --ioengine=libaio
```

Monitoring performance by using Amazon CloudWatch

39. In the **AWS Management Console**, on the Services menu, choose **CloudWatch**.
40. In the navigation pane on the left, choose **Metrics**.
41. In the **All-metrics** tab, choose **EFS**.
42. Choose **File System Metrics**.
43. Select the row that has the **PermittedThroughput** Metric Name.

You might need to wait 2–3 minutes and refresh the screen several times before all available metrics, including **PermittedThroughput**, calculate and populate.

44. On the graph, choose and drag around the data line. If you do not see the line graph, adjust the time range of the graph to display the period during which you ran the `fio` command.
45. Pause your pointer on the data line in the graph. The value should be *105M*.
46. In the **All-metrics** tab, *uncheck* the box for **PermittedThroughput**.
47. Select the check box for **DataWriteIOBytes**.

If you do not see *DataWriteIOBytes* in the list of metrics, use the **File System Metrics** search to find it.

48. Choose the **Graphed metrics** tab.
49. On the **Statistics** column, select **Sum**.
50. On the **Period** column, select **1 Minute**.
51. Pause your pointer on the peak of the line graph. Take this number (in bytes) and divide it by the duration in seconds (60 seconds). The result gives you the write throughput (B/s) of your file system during your test.

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OUTPUT SCREENSHOTS:

Task-1: Creating a security group to access your EFS file system

Basic details

Security group name [info](#)
EFS Mount Target
Name cannot be edited after creation.

Description [info](#)
Inbound NFS access from EFS clients

VPC [info](#)
vpc-0e151368530c2dcc7

Inbound rules [info](#)

Type	Protocol	Port range	Source	Description - optional
NFS	TCP	2049	Custom	
			sg-0ab07af222dc18773	

Add rule

Task-2: Creating an EFS file system

We recommend enabling the EFS service-linked role using AWS IAM. Service-linked roles allow you to easily delegate permissions to AWS services and gain additional transparency into when they are used on your behalf. [Learn more](#)

Virtual Private Cloud (VPC)
Choose the VPC where you want EC2 instances to connect to your file system. [Learn more](#)

vpc-0e151368530c2dcc7
Lab VPC

Mount targets
A mount target provides an NFSv4 endpoint at which you can mount an Amazon EFS file system. We recommend creating one mount target per Availability Zone. [Learn more](#)

Availability zone	Subnet ID	IP address	Security groups
us-east-1a	subnet-0099cdaaeac24424e	Automatic	Choose security groups
			sg-00f8ba5a438a7469 4 EFS Mount Target
us-east-1b	subnet-0ed63276a5874d404	Automatic	Choose security groups
			sg-00f8ba5a438a7469 4 EFS Mount Target

Add mount target

Mount targets			
Availability zone	Subnet	IP address	Security groups
us-east-1a	subnet-0099cdaaeac24424e	-	sg-00f8ba5a438a74694
us-east-1b	subnet-0ed63276a5874d404	-	sg-00f8ba5a438a74694

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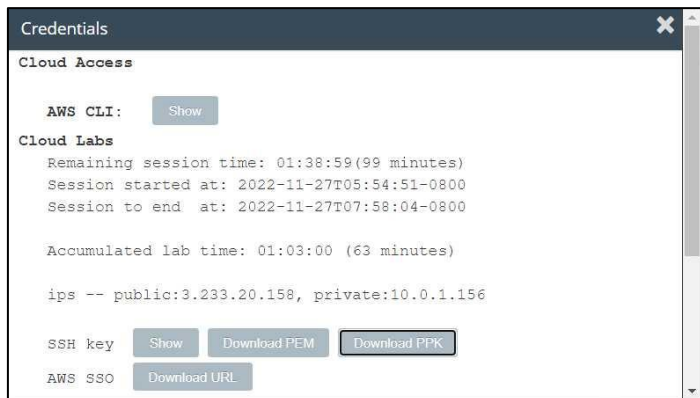
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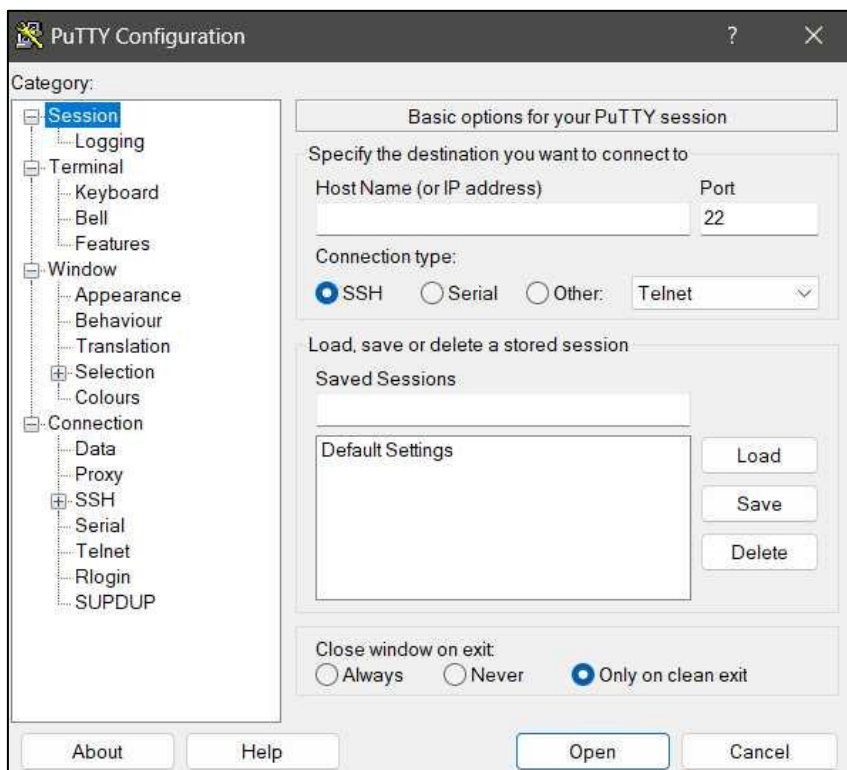
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Task-3:

Credentials Tab



Putty Config



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```
ec2-user@ip-10-0-1-156:~  
login as: ec2-user  
Authenticating with public key "imported-openssh-key"  
  
  _ | _ | _ )  
  _ | ( _ | _ /  Amazon Linux 2 AMI  
  _ | \ _ | _ |  
  
https://aws.amazon.com/amazon-linux-2/  
[ec2-user@ip-10-0-1-156 ~]$
```

Task-5: Examining the performance behavior of your new EFS file system



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LAB PROGRAM

Experiment: Deploying a Node.js Web Application on AWS

HARDWARE REQUIREMENTS: Core I5 Processor, 4 GB RAM, 40GB HDD

SOFTWARE REQUIREMENTS: Amazon AWS, EC2, VS Code/Eclipse, Node, NPM, GIT, Putty

Description:

Node.js is a JavaScript runtime environment that allows one to run JS on the server. It is built on the open-source V8 JavaScript engine used in Chrome and written in C++ which executes JS in a standalone environment.

In this experiment, we clone a Nodejs application from GITHUB and deploy this application on to Amazon EC2 instance, make it available over Amazon AWS URI.

Steps to configure EC2 Instance :

1. Create an EC2 instance and Launch it:

Choose amazon Ec2 instance machine image as Ubuntu 18.04 64 bit with type of micro.

(Login to AwsAcademy,

LMS-Dashboard - AWS Academy Learner Lab – Educator

Click on Modules

Click on Learner Lab

Click on Start Lab

Click on AWS

Services – EC2

EC2 – Instances – Launch an instance

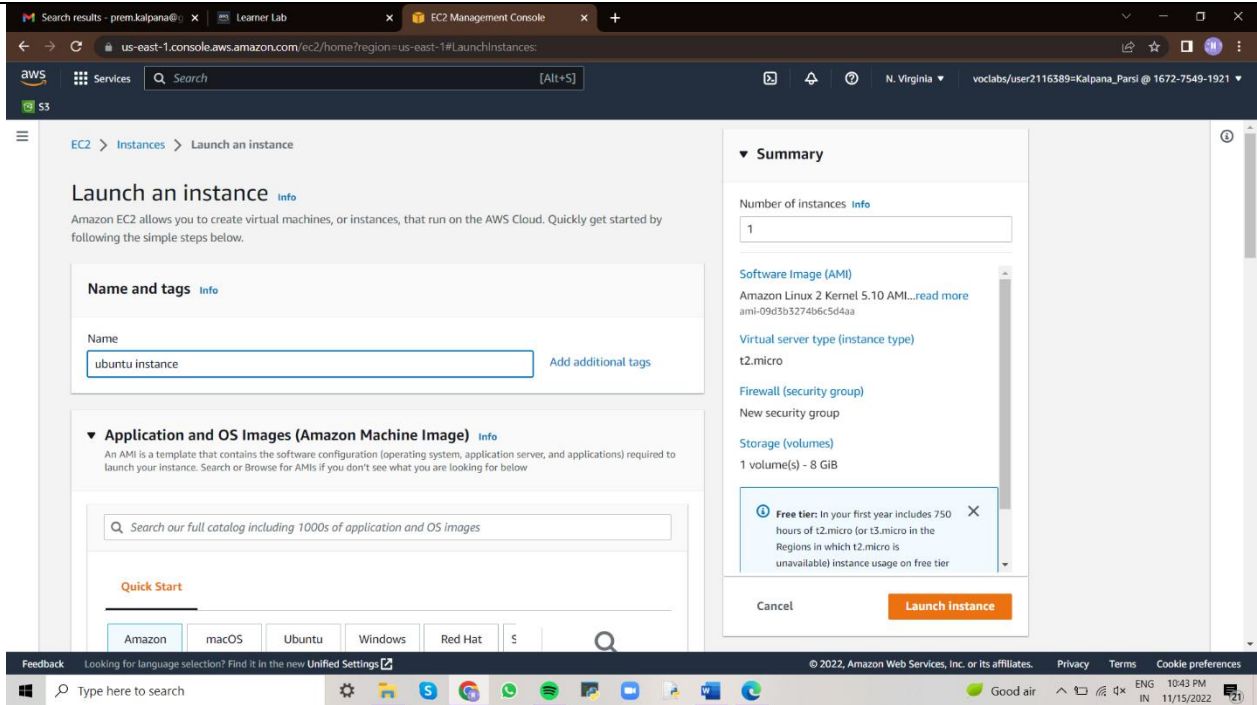
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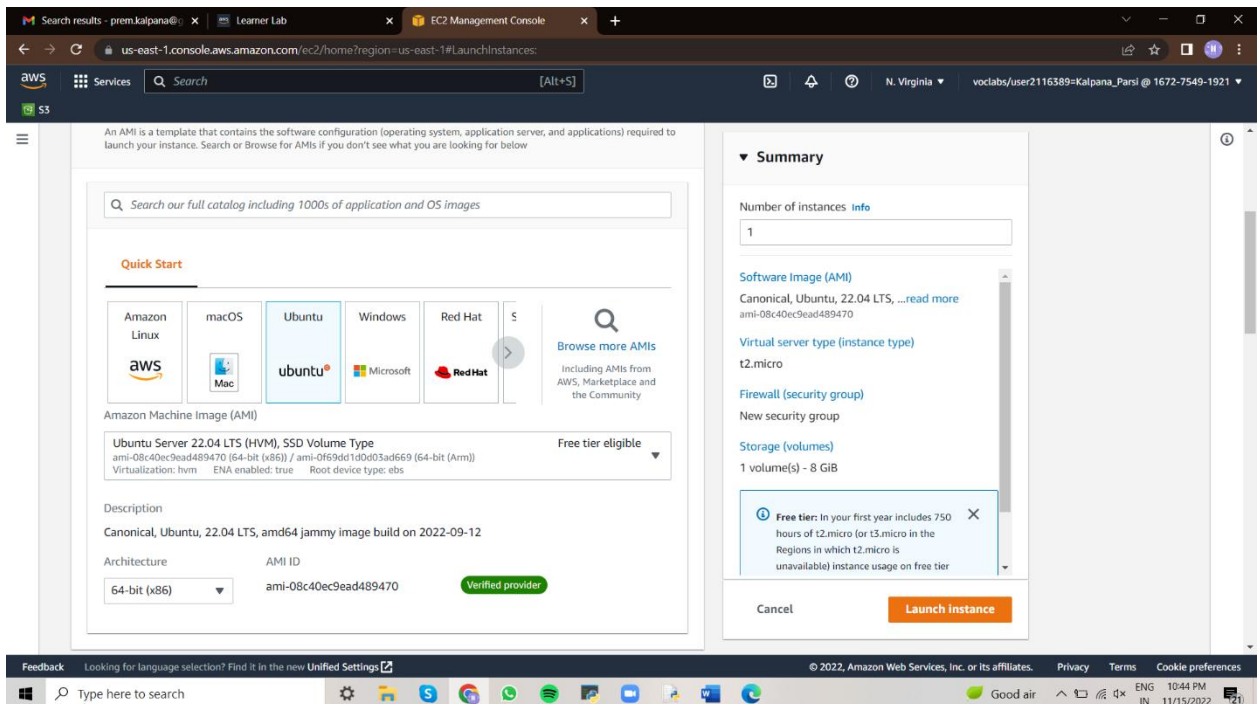
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Select Amazon Ubuntu



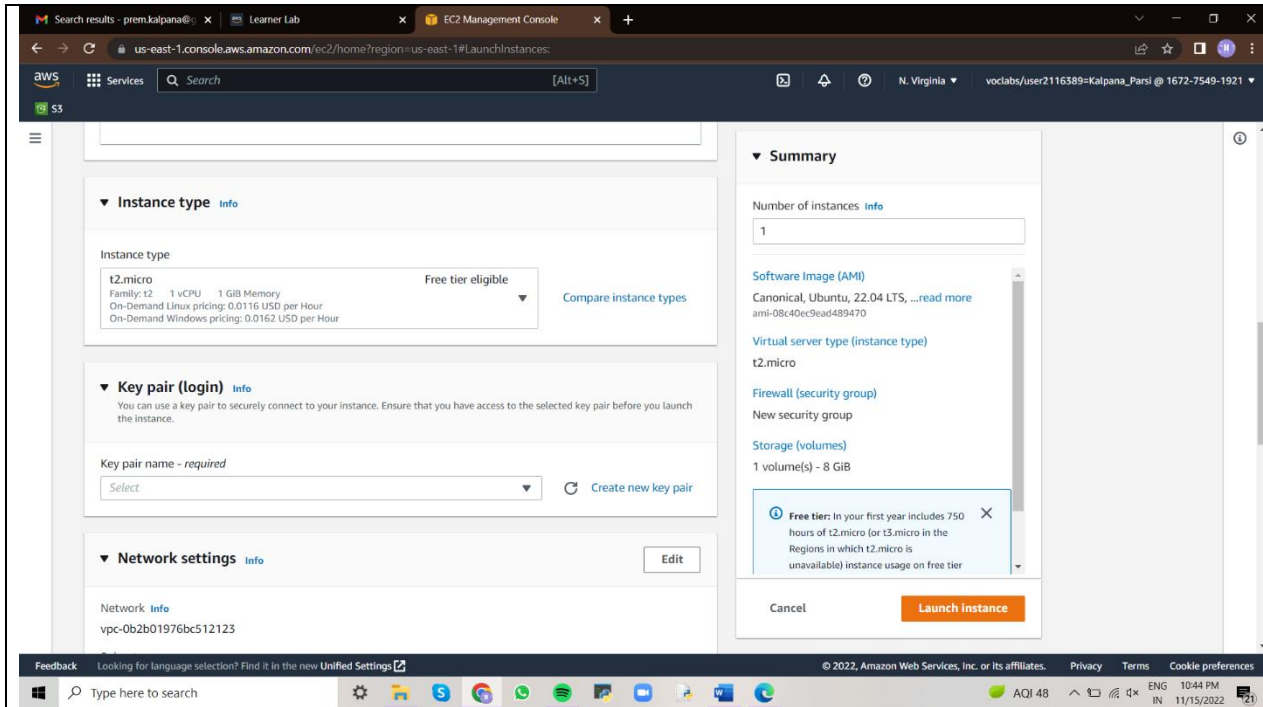
Instance type - t2.micro)

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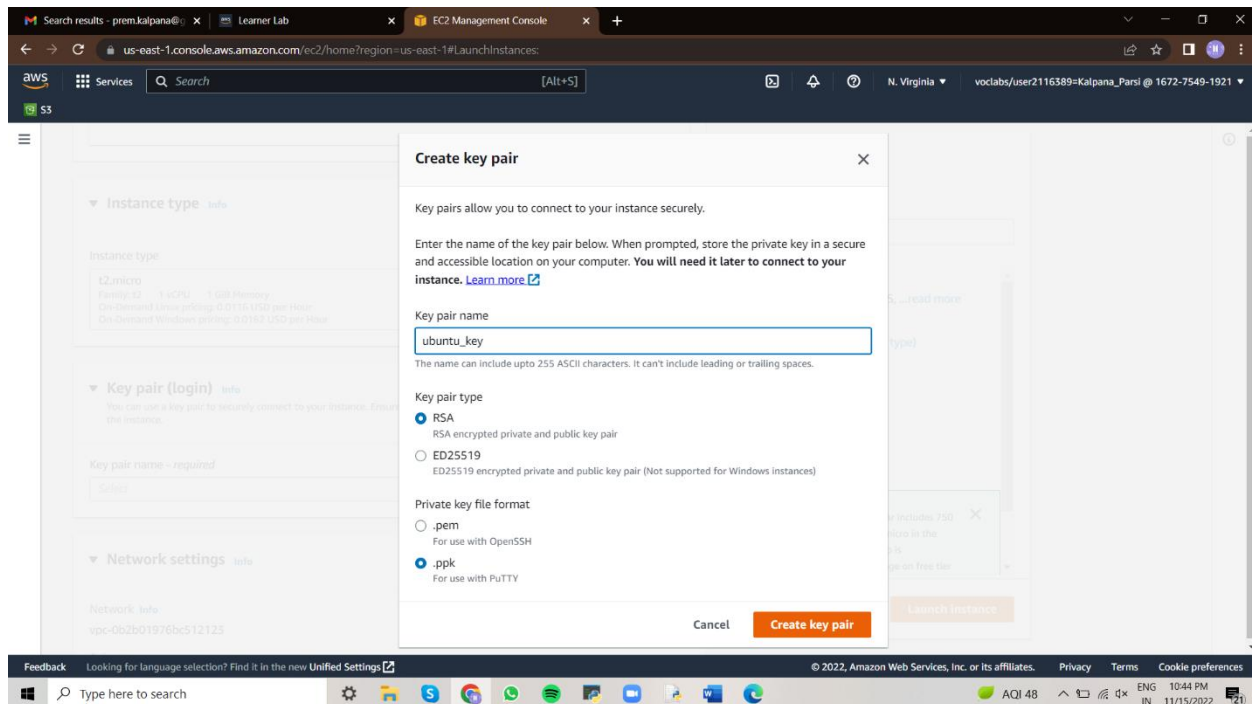
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Create new key pair – Save the key pair as .ppk (to work with putty)



Next Add storage

Next configure Security Group – Create security group.

In this step we need to allow http and https requests to access from any group.

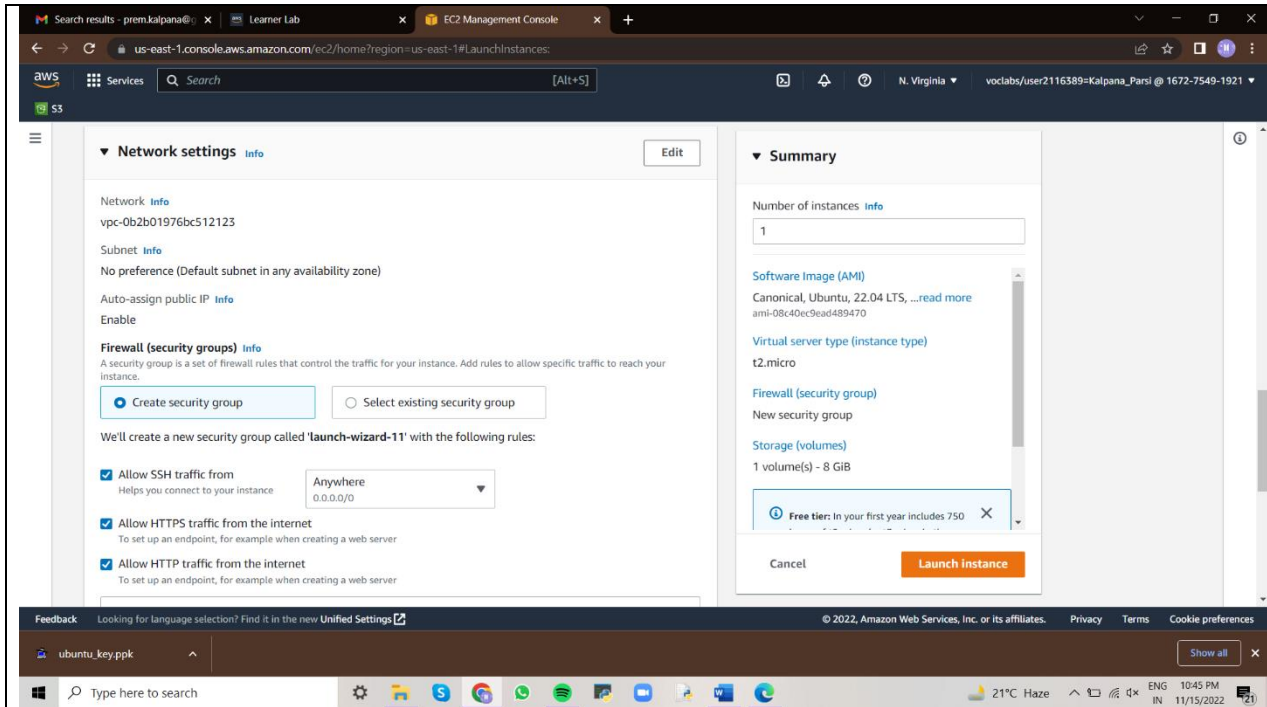
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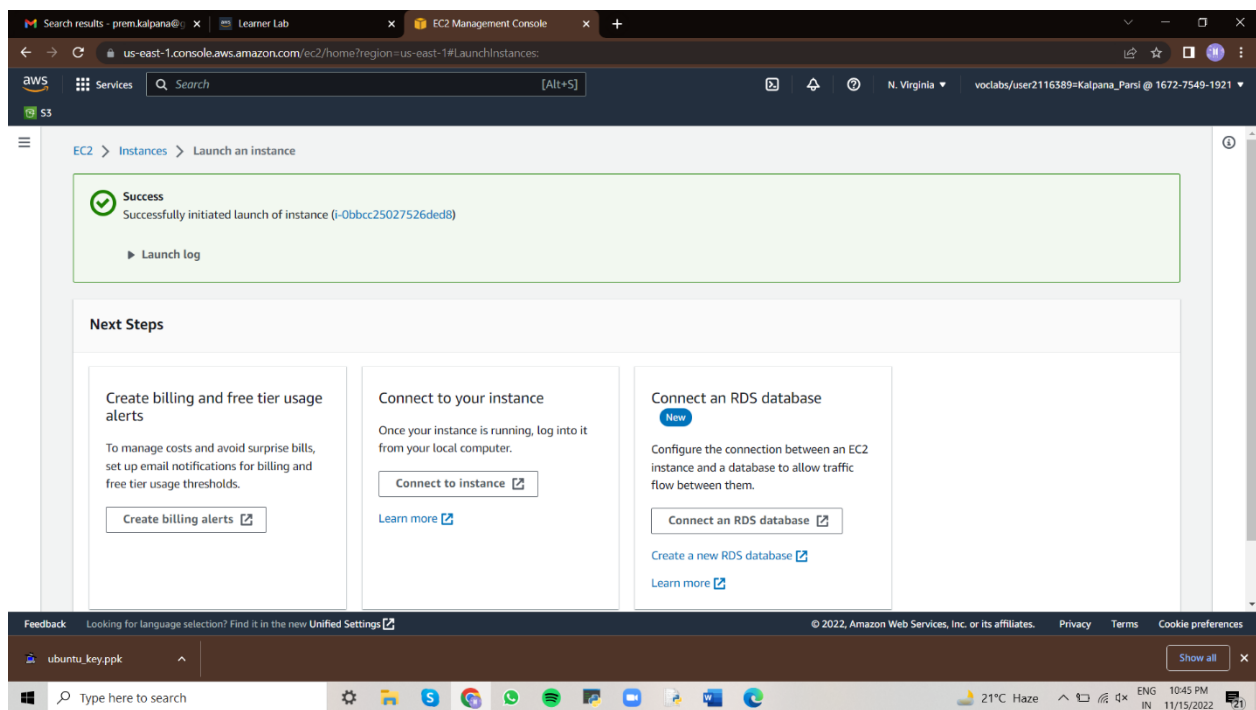
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Finally click on Launch instance.

We can see instance is launched successfully.



When the instance state is running , it indicates that your instance was created successfully.

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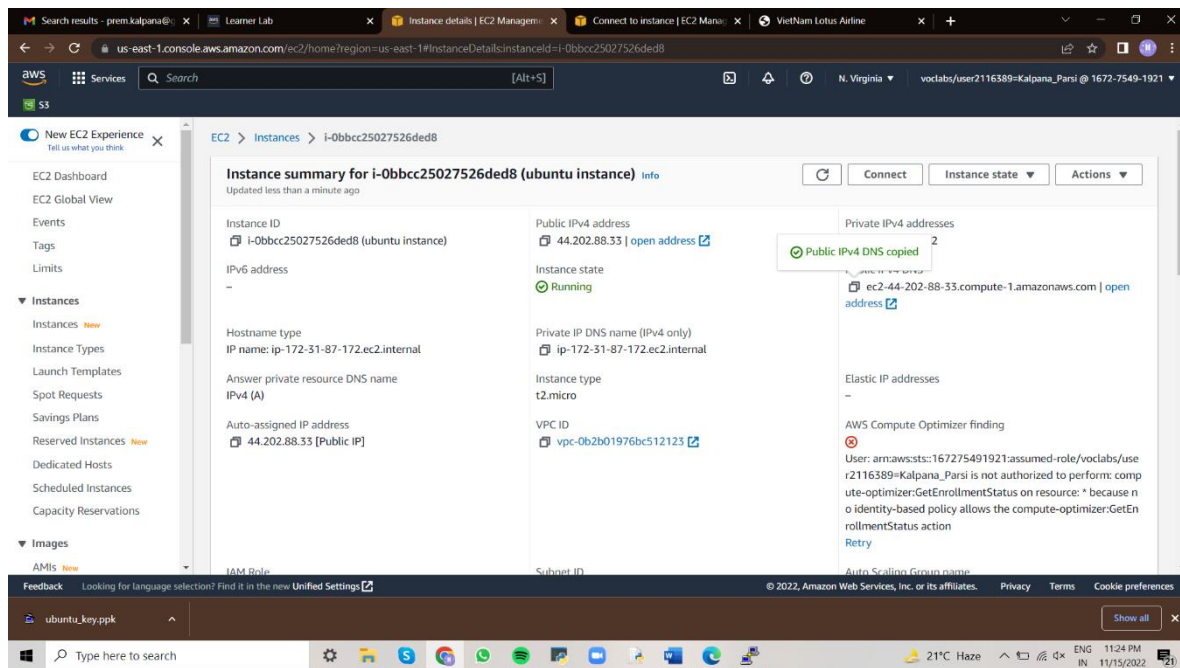
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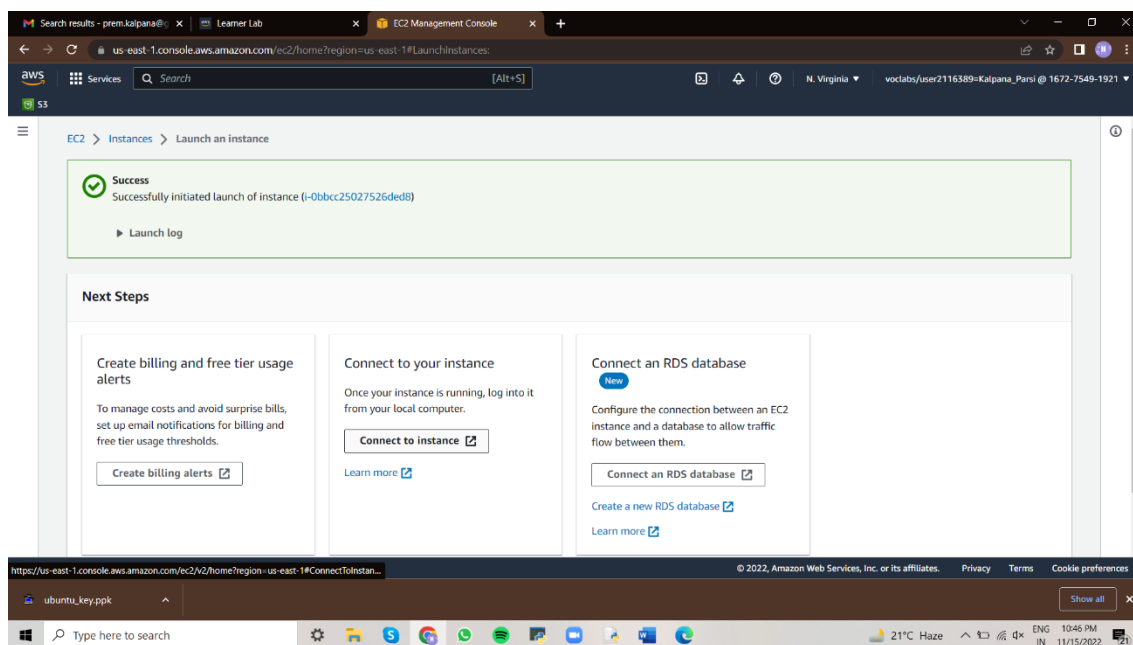
Name : _____ Roll No : 1602-19-733-0 Page No: _____

Copy the public DNS of your Instance. You can access different app running on your instance at a different port.



2. Connect to your Instance:

Click on launch instance then it shows popup window giving details how to connect to your instance.



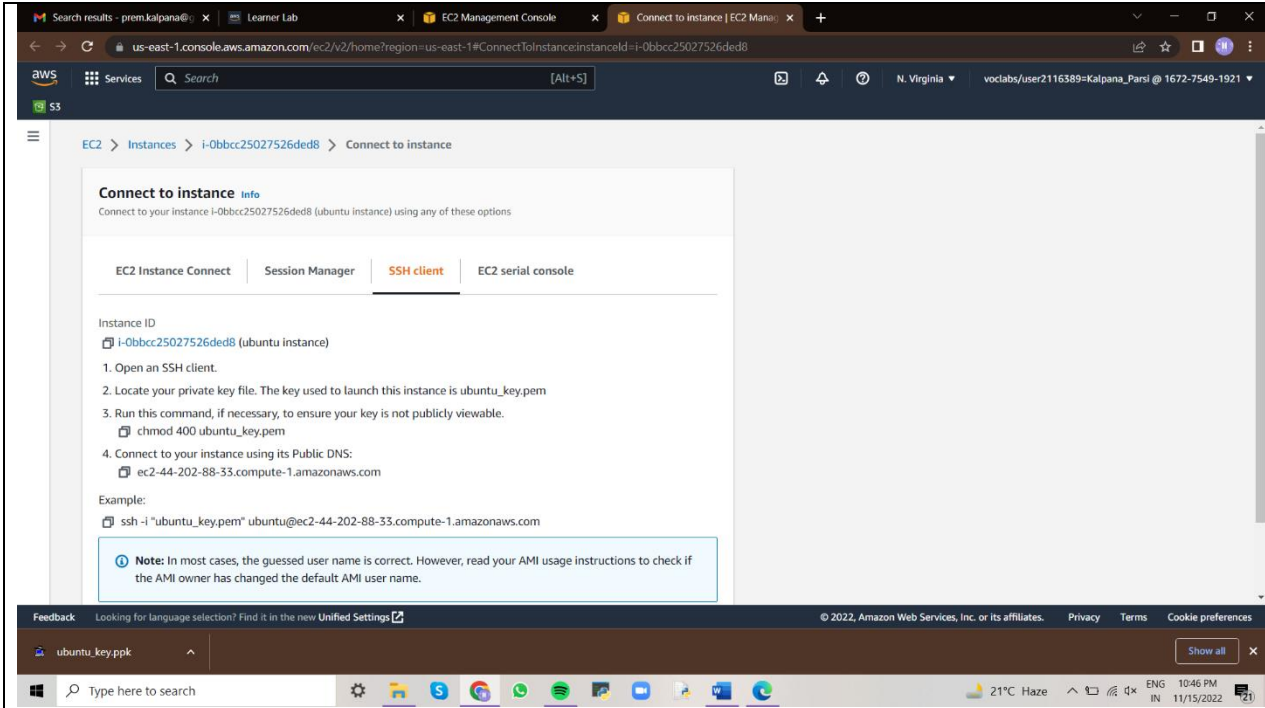
To open SSH client and If we are in windows platform we need to launch the instance with the help of putty soft.

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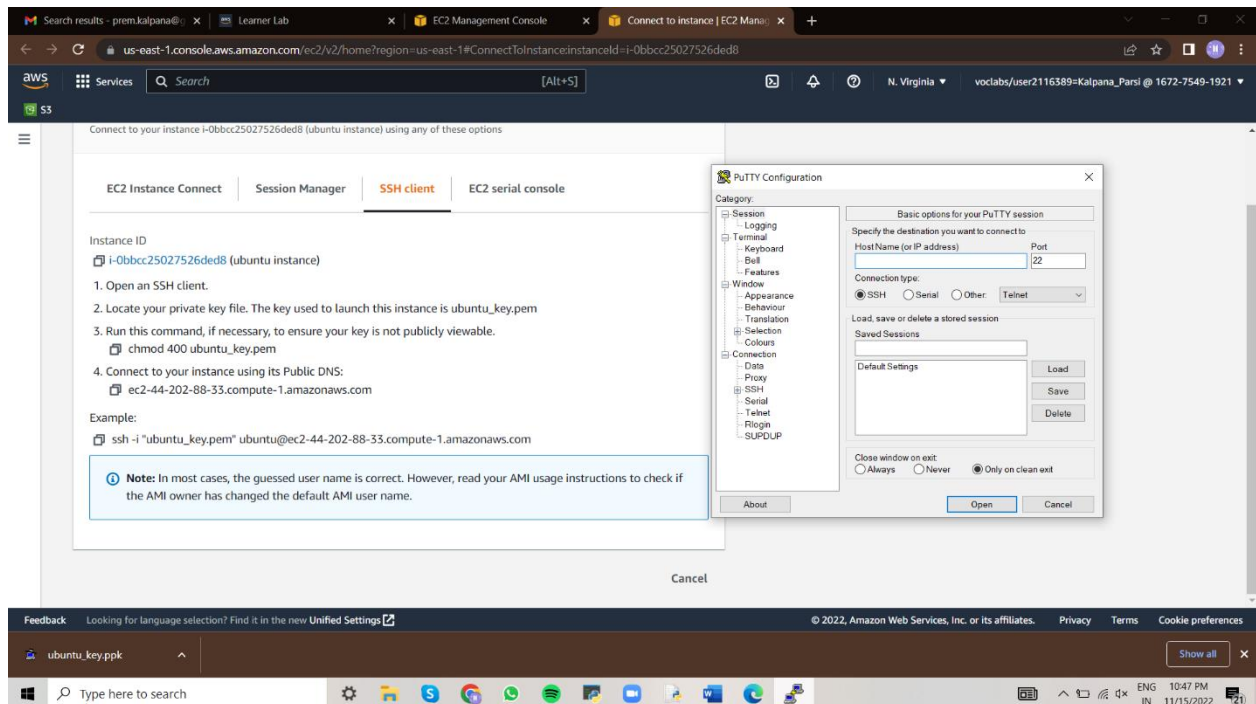
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Open Putty



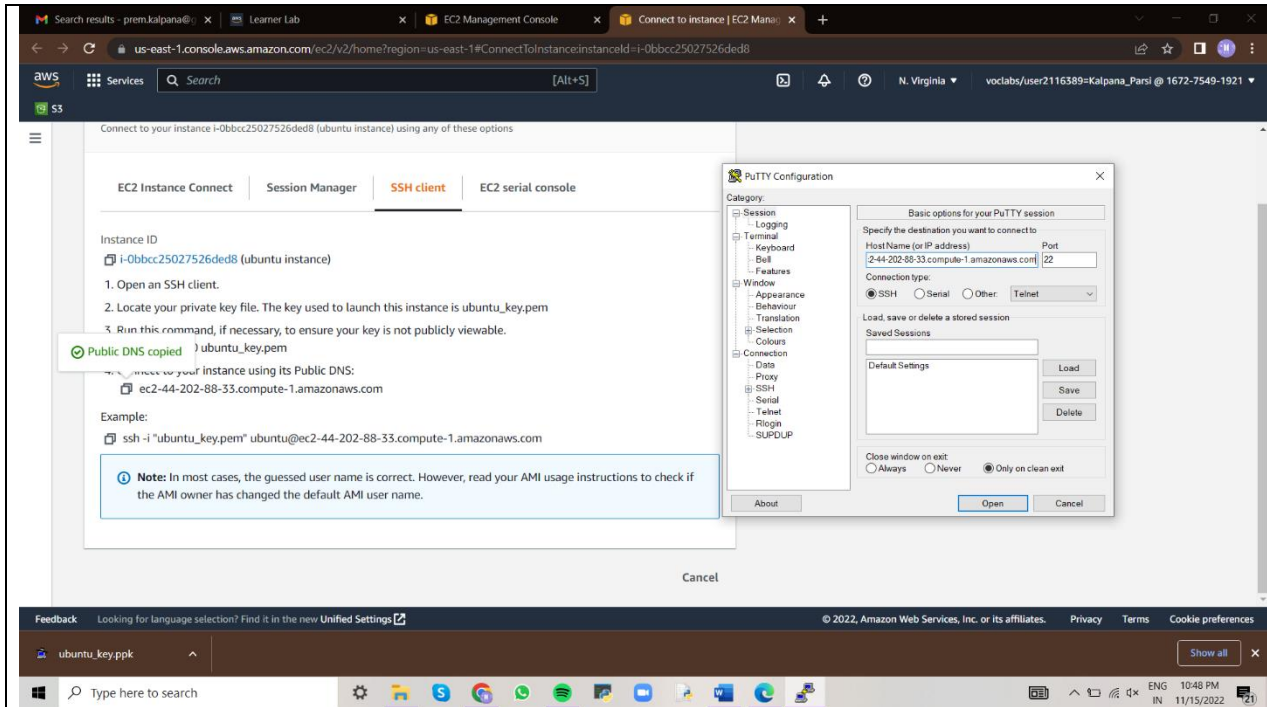
Enter the Public DNS of your Instance in Host Name(IP address)

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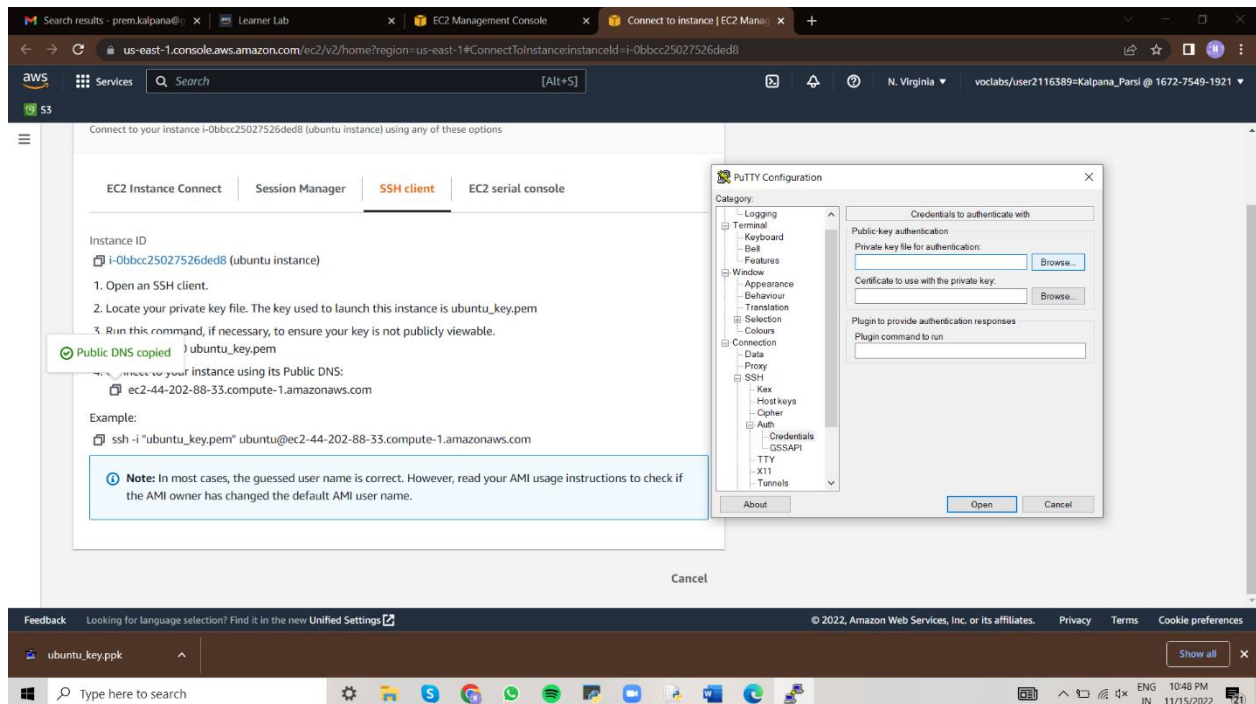
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Click on Connection – SSH – Auth – Credentials –



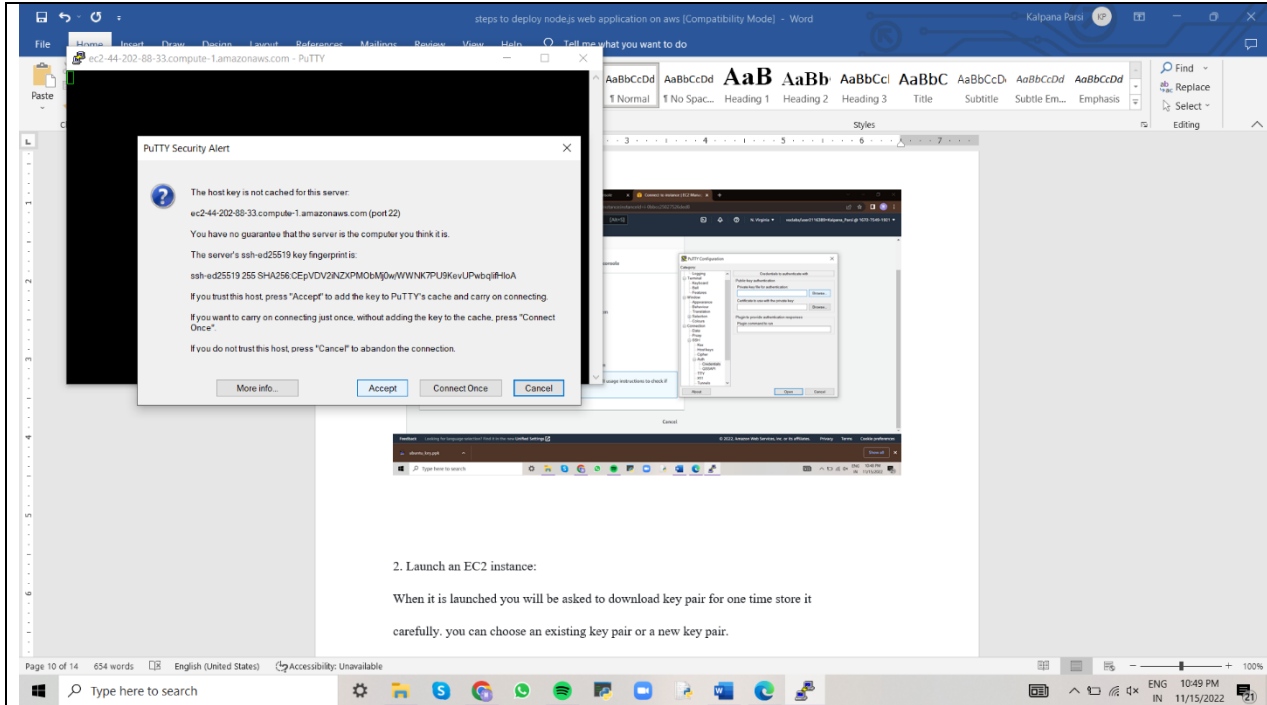
Private key for Authentication - Browse - select the .ppk which was downloaded when EC2 instance is created

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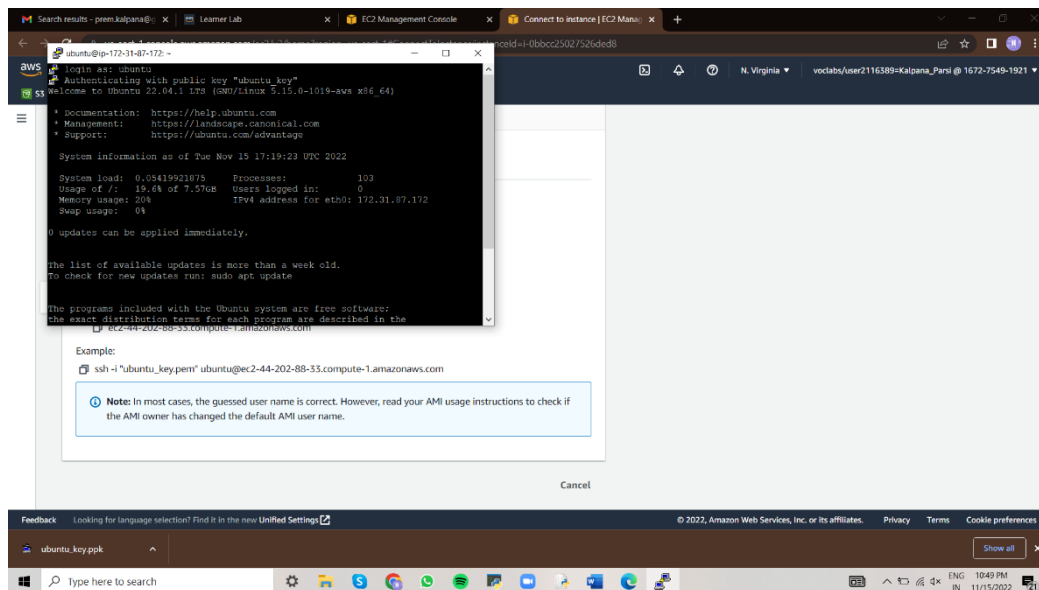


2. Launch an EC2 instance:

When it is launched you will be asked to download key pair for one time store it carefully. you can choose an existing key pair or a new key pair.

Once entered, it will ask you to confirm, click on Accept

Once it is opened login as ubuntu



mkdir demo

cd demo

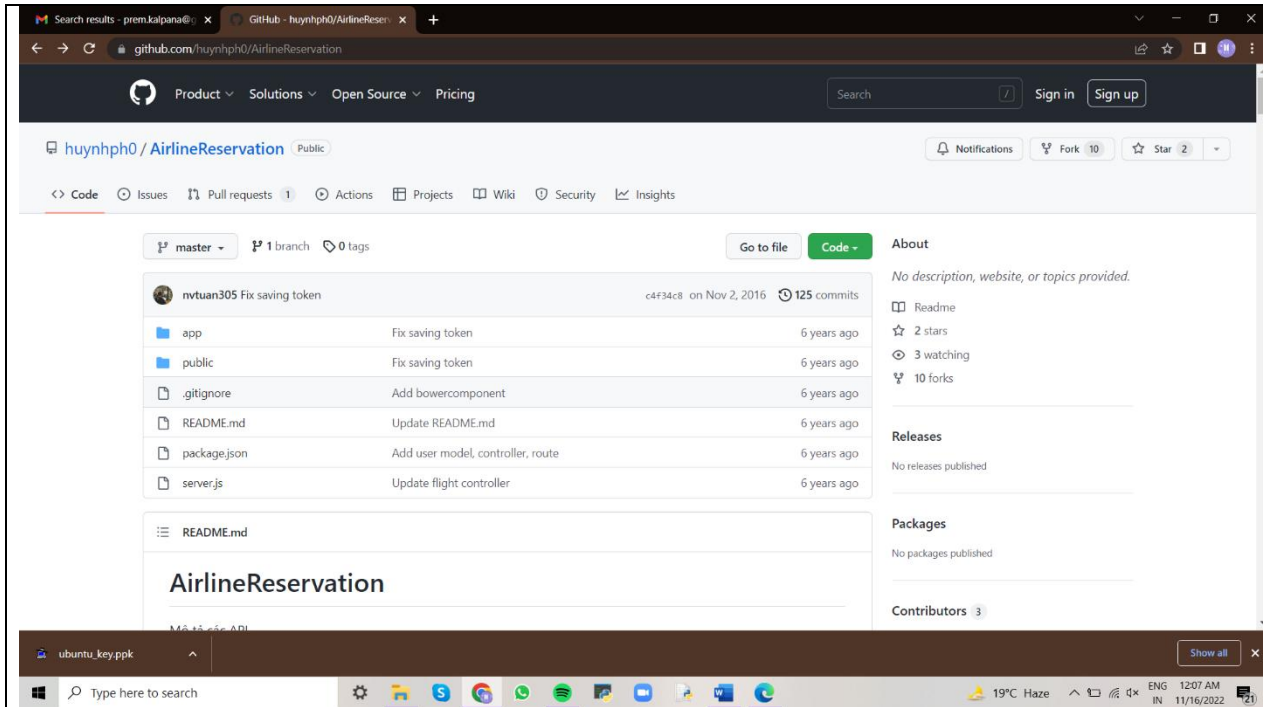
git clone <https://github.com/hoanghuynh1995/AirlineReservation>

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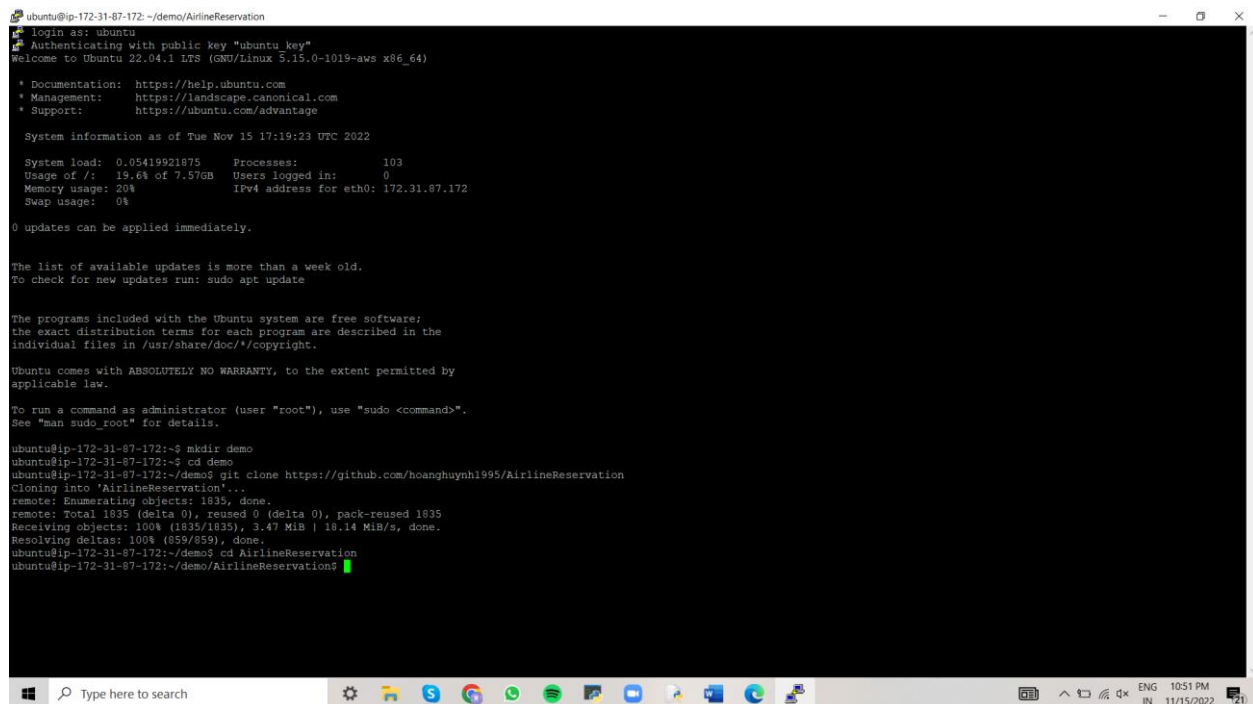
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cd AirlineReservation



sudo apt-get update //to download package information from all configured sources

sudo apt-get install npm

//to install Node.js on ubuntu, we must first install npm (node package manager)

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select Yes

Ok

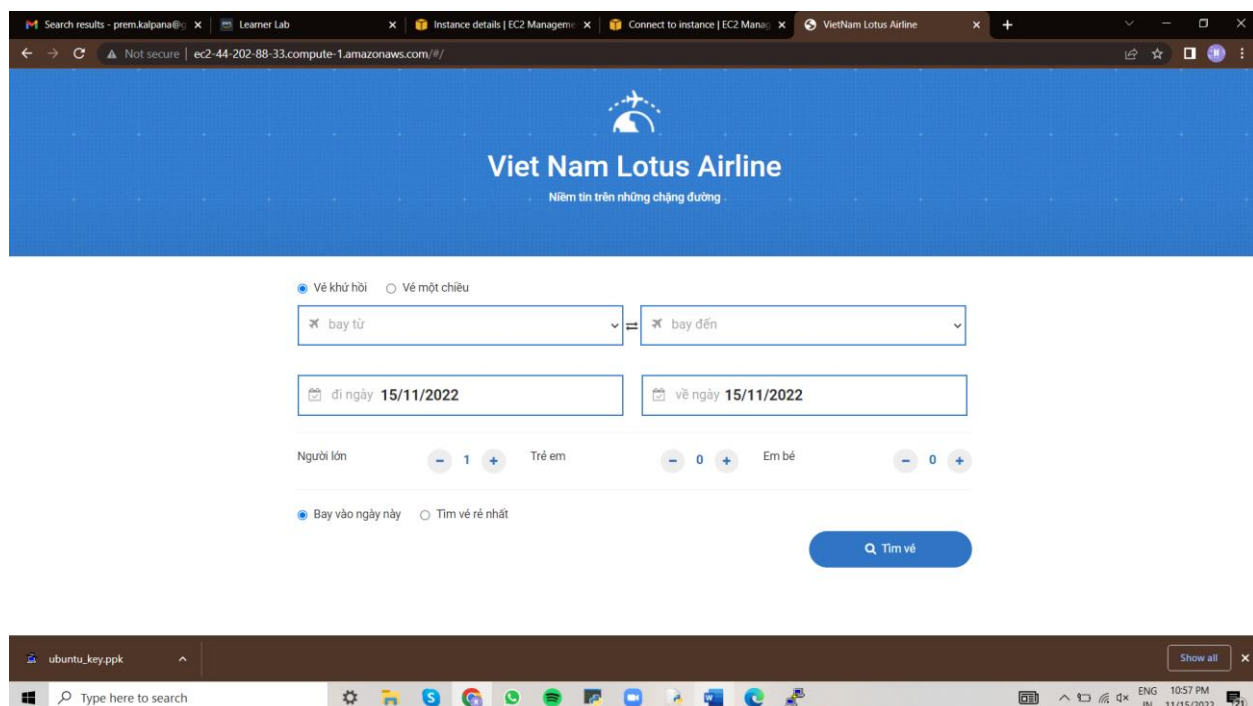
npm install

sudo apt-get install nodejs //to install Node.js on ubuntu

open server.js file using vi editor and change the port no to 80, and save file and exit

sudo node server.js

Copy public DNS of your instance in new tab and view the deployed web application.



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LAB PROGRAMS

Implement a distributed application on Hadoop framework.

1. Prerequisites

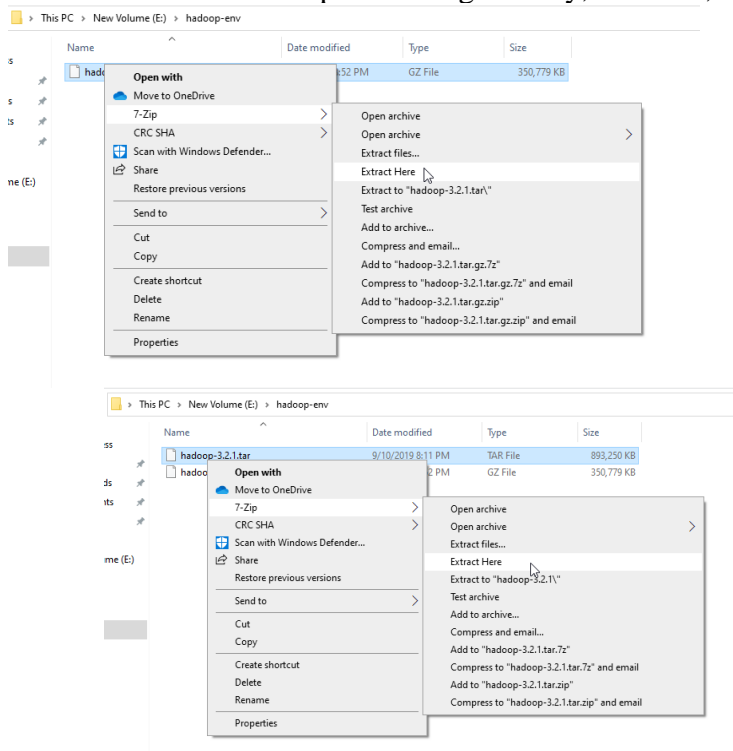
1. Java 8 runtime environment (JRE): Hadoop 3 requires a Java 8 installation. I prefer using the offline installer.
2. Java 8 development Kit (JDK)
3. To unzip downloaded Hadoop binaries, we should install 7zip.

2. Download Hadoop binaries

The first step is to download Hadoop binaries from the official website. The binary package size is about 342 MB.



After finishing the file download, we should unpack the package using 7zip into two steps. First, we should extract the `hadoop-3.2.1.tar.gz` library, and then, we should unpack the extracted tar file:

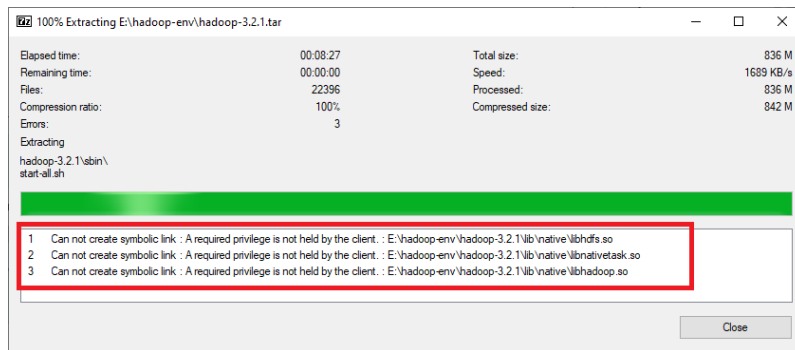


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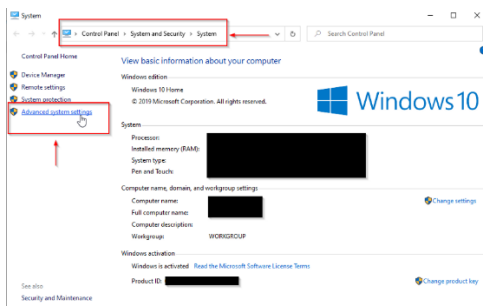
The tar file extraction may take some minutes to finish. In the end, you may see some warnings about symbolic link creation. Just ignore these warnings since they are not related to windows.



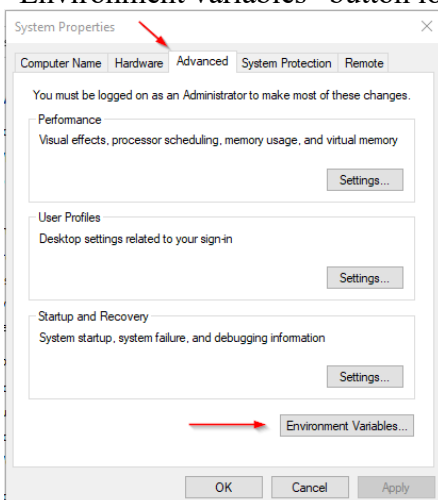
3. Setting up environment variables

After installing Hadoop and its prerequisites, we should configure the environment variables to define Hadoop and Java default paths.

To edit environment variables, go to Control Panel > System and Security > System (or right-click > properties on My Computer icon) and click on the “Advanced system settings” link.



When the “Advanced system settings” dialog appears, go to the “Advanced” tab and click on the “Environment variables” button located on the bottom of the dialog.



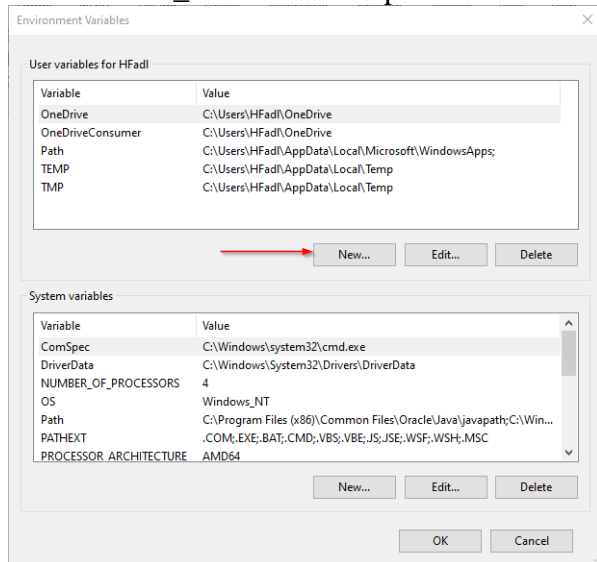
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In the “Environment Variables” dialog, press the “New” button to add a new variable. There are two variables to define:

1. JAVA_HOME: JDK installation folder path
2. HADOOP_HOME: Hadoop installation folder path



Now, we should edit the PATH variable to add the Java and Hadoop binaries paths as shown in the following screenshots.

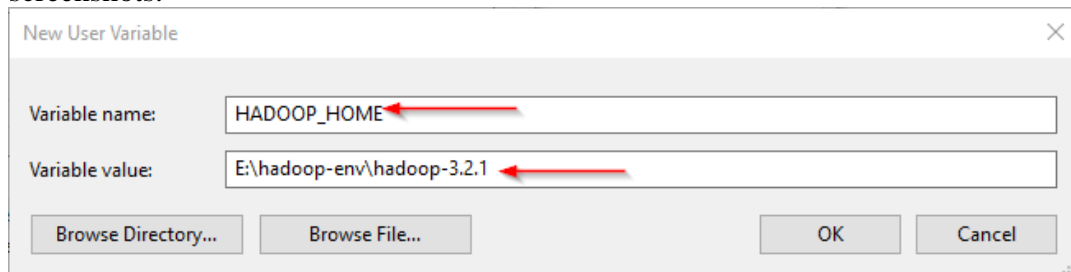


Figure 10 — Editing the PATH variable

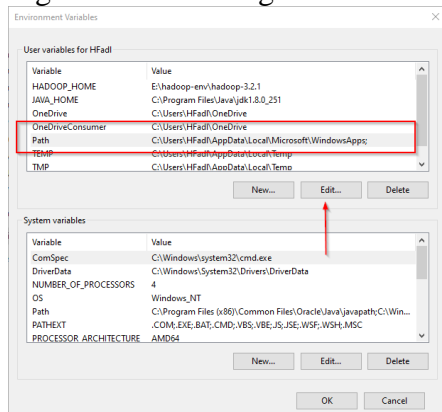


Figure 11 — Editing PATH variable

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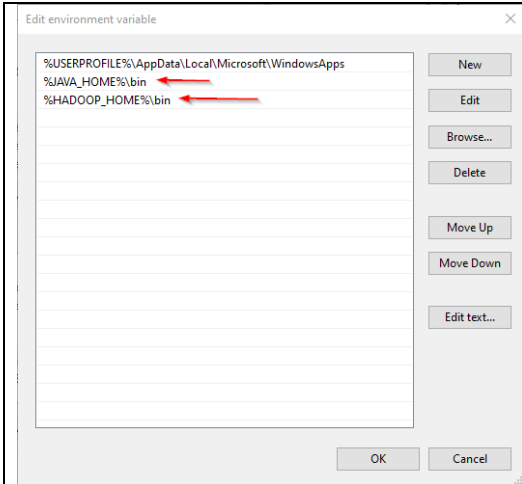


Figure 12— Adding new paths to the PATH variable

4. Configuring Hadoop cluster

There are four files we should alter to configure Hadoop cluster:

1. %HADOOP_HOME%\etc\hadoop\hdfs-site.xml
2. %HADOOP_HOME%\etc\hadoop\core-site.xml
3. %HADOOP_HOME%\etc\hadoop\mapred-site.xml
4. %HADOOP_HOME%\etc\hadoop\yarn-site.xml

4.1. HDFS site configuration

As we know, Hadoop is built using a master-slave paradigm. Before altering the HDFS configuration file, we should create a directory to store all master node (name node) data and another one to store data (data node). In this example, we created the following directories:

- E:\hadoop-env\hadoop-3.2.1\data\dfs\namenode
- E:\hadoop-env\hadoop-3.2.1\data\dfs\datanode

Now, let's open "hdfs-site.xml" file located in "%HADOOP_HOME%\etc\hadoop" directory, and we should add the following properties within

4.2. Core site configuration

Now, we should configure the name node URL adding the following XML code into the <configuration></configuration> element within "core-site.xml":

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```
<property><name>fs.default.name</name><value>hdfs://localhost:9820</value></property>
```

4.3. Map Reduce site configuration

Now, we should add the following XML code into the `<configuration></configuration>` element within “mapred-site.xml”:

```
<property><name>mapreduce.framework.name</name><value>yarn</value><description>MapReduce  
framework name</description></property>
```

4.4. Yarn site configuration

Now, we should add the following XML code into the `<configuration></configuration>` element within “yarn-site.xml”:

```
<property><name>yarn.nodemanager.aux-  
services</name><value>mapreduce_shuffle</value><description>Yarn Node Manager Aux  
Service</description></property>
```

5. Formatting Name node

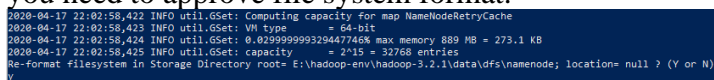
After finishing the configuration, let's try to format the name node using the following command:
`hdfs namenode -format`

Due to a bug you will receive the following error.

This issue will be solved within the next release. For now, you can fix it temporarily using the following steps (reference):

1. Download `hadoop-hdfs-3.2.1.jar` file from the following link.
2. Rename the file name `hadoop-hdfs-3.2.1.jar` to `hadoop-hdfs-3.2.1.bak` in folder
`%HADOOP_HOME%\share\hadoop\hdfs`
3. Copy the downloaded `hadoop-hdfs-3.2.1.jar` to folder `%HADOOP_HOME%\share\hadoop\hdfs`

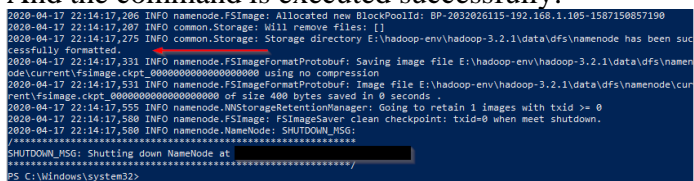
Now, if we try to re-execute the format command (Run the command prompt or PowerShell as administrator), you need to approve file system format.



```
2020-04-17 22:02:58,423 INFO util.GSet: Computing capacity for map NameNodeRetryCache  
2020-04-17 22:02:58,423 INFO util.GSet: VM type = 64-bit  
2020-04-17 22:02:58,424 INFO util.GSet: 0.0299999999329447746% max memory 889 MB = 273.1 KB  
2020-04-17 22:02:58,425 INFO util.GSet: capacity = 2^15 = 32768 entries  
File-format filesystem in Storage Directory root= E:\hadoop-env\hadoop-3.2.1\data\dfs\namenode; location= null ? (Y or N)
```

Figure 15 — File system format approval

And the command is executed successfully:



```
2020-04-17 22:14:17,206 INFO namenode.FSImage: Allocated new BlockPoolId: BP-2032026115-192.168.1.105-1587150857190  
2020-04-17 22:14:17,207 INFO common.Storage: Will remove files: []  
2020-04-17 22:14:17,275 INFO common.Storage: Storage directory E:\hadoop-env\hadoop-3.2.1\data\dfs\namenode has been suc  
cessfully formatted.  
2020-04-17 22:14:17,331 INFO namenode.FSImageFormatProtobuf: Saving image file E:\hadoop-env\hadoop-3.2.1\data\dfs\namen  
ode\currentFSImage.cpt_000000000000000000 using no compression  
2020-04-17 22:14:17,531 INFO namenode.FSImageFormatProtobuf: Image file E:\hadoop-env\hadoop-3.2.1\data\dfs\namenode\cur  
rentFSImage.cpt_000000000000000000 of size 400 bytes saved in 0 seconds.  
2020-04-17 22:14:17,555 INFO namenode.NamespaceManager: Going to retain 1 images with txid >= 0  
2020-04-17 22:14:17,580 INFO namenode.FSImage: FSImageSaver clean checkpoint: txid=0 when meet shutdown.  
2020-04-17 22:14:17,580 INFO namenode.NameNode: SHUTDOWN_MSG:  
=====SHUTDOWN_MSG: Shutting down NameNode at  
PS C:\Windows\system32>
```

Figure 16 — Command executed successfully

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6. Starting Hadoop services

Now, we will open PowerShell, and navigate to “%HADOOP_HOME%\sbin” directory. Then we will run the following command to start the Hadoop nodes:

`.\start-dfs.cmd`



Figure 17 — Starting Hadoop nodes

Two command prompt windows will open (one for the name node and one for the data node) as follows:

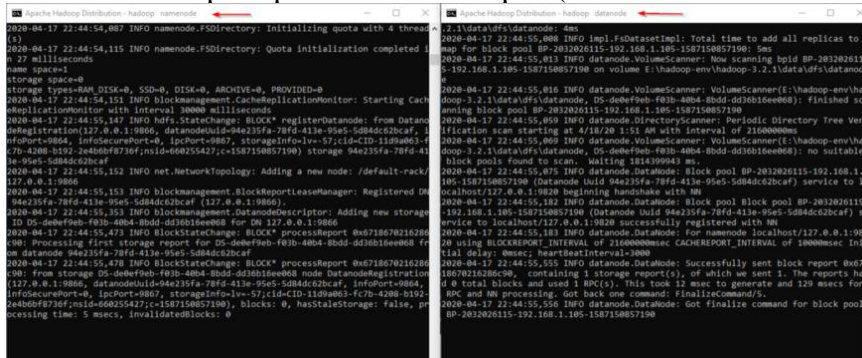


Figure 18 — Hadoop nodes command prompt windows

Next, we must start the Hadoop Yarn service using the following command:

`./start-yarn.cmd`



Figure 19 — Starting Hadoop Yarn services

Two command prompt windows will open (one for the resource manager and one for the node manager) as follows:

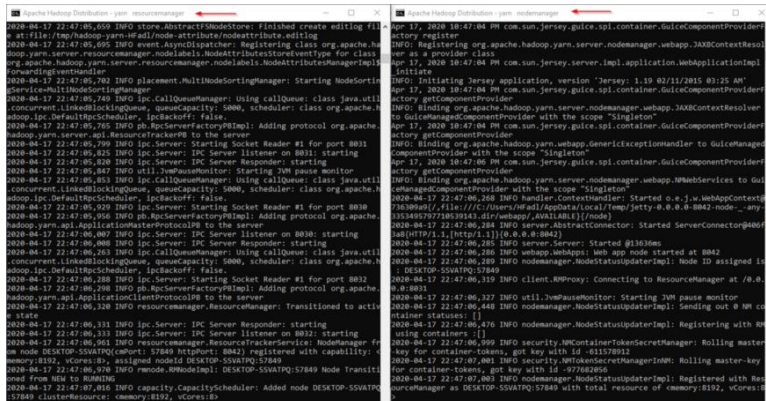


Figure 20— Node manager and Resource manager command prompt windows

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To make sure that all services started successfully, we can run the following command:

Jps

It should display the following services:

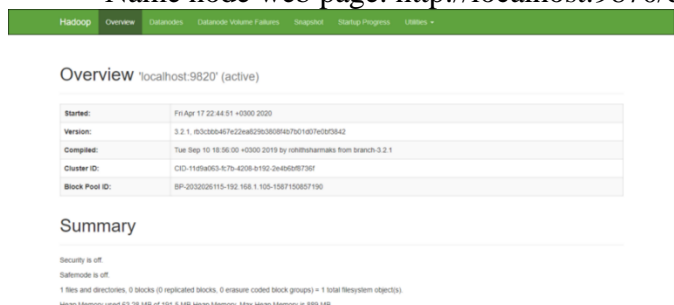
```
PS E:\hadoop-env\hadoop-3.2.1\sbin> jps
14560 DataNode
4960 ResourceManager
5936 NameNode
768 NodeManager
14636 Jps
PS E:\hadoop-env\hadoop-3.2.1\sbin>
```

Figure 21 — Executing jps command

7. Hadoop Web UI

There are three web user interfaces to be used:

- Name node web page: <http://localhost:9870/dfshealth.html>



- Data node web page: <http://localhost:9864/datanode.html>

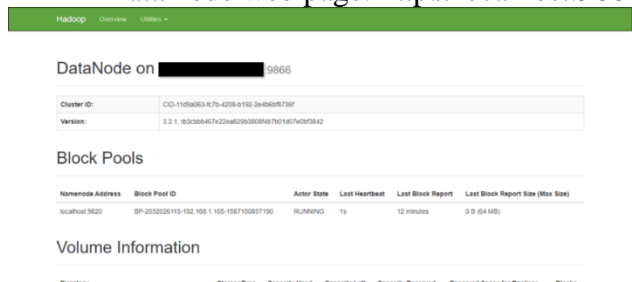


Figure 23 — Data node web page

- Yarn web page: <http://localhost:8088/cluster>

