SRM INSTITUTE OF SCIENCE & TECHNOLOGY
(Deemed to be University u/s 3 of UGC Act, 1956),
NCR CAMPUS, MODINAGAR

Department of Computer Applications
(University Practical Examinations)

Subject: Cloud Computing ***Sub. Code: PCA20D08J***

1. **Implement Bankers algorithm (using Python /Java)**

Banker's Algorithm:

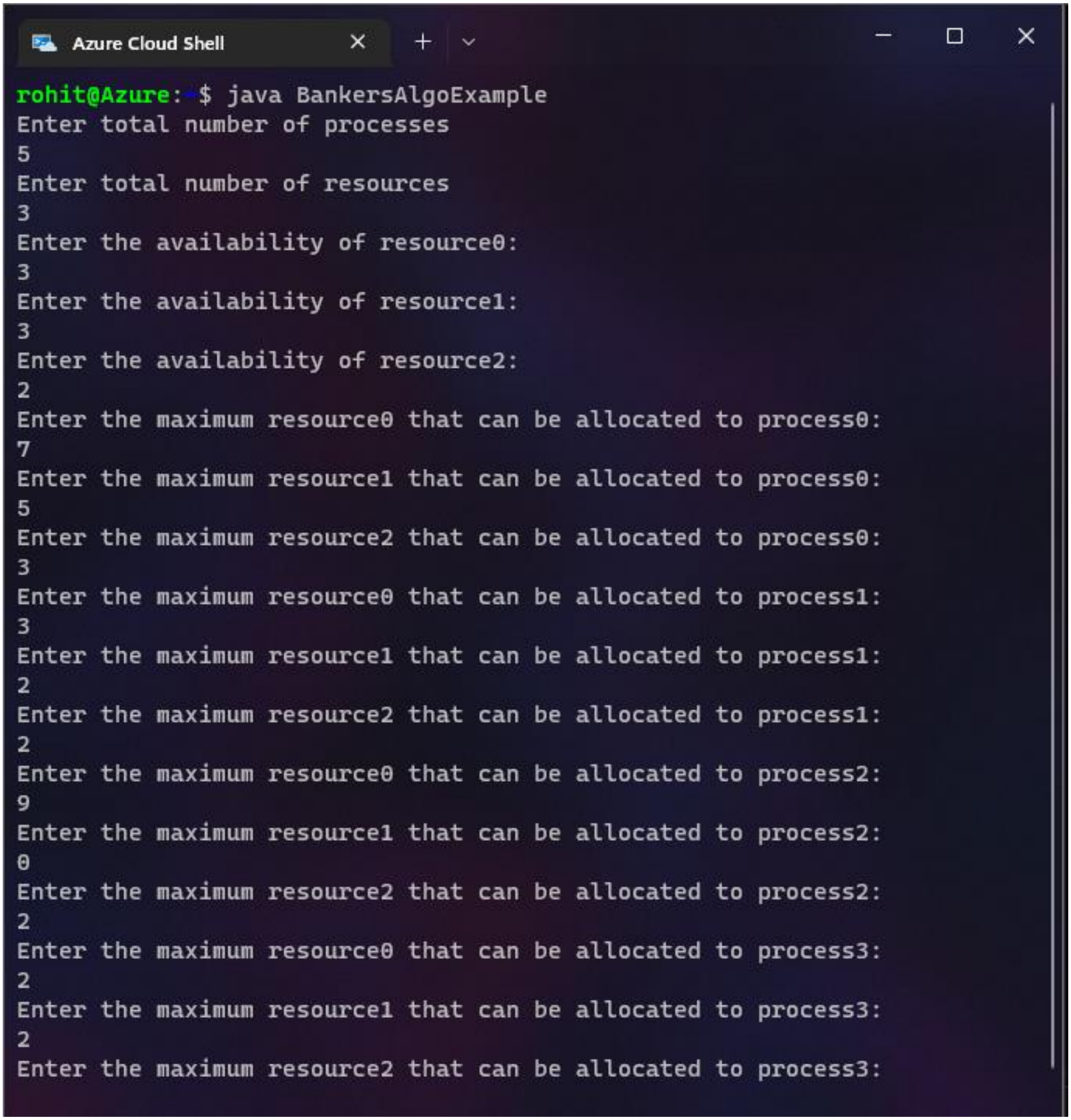
In Java, Banker's algorithm is a deadlock avoidance and resource allocation algorithm. This algorithm tests for security by simulating allocation for a predetermined maximum possible amount of all resources. After that, before deciding whether the allocation should be allowed to continue or not, it creates an "s-state" check for testing it to all possible activities.

Program:

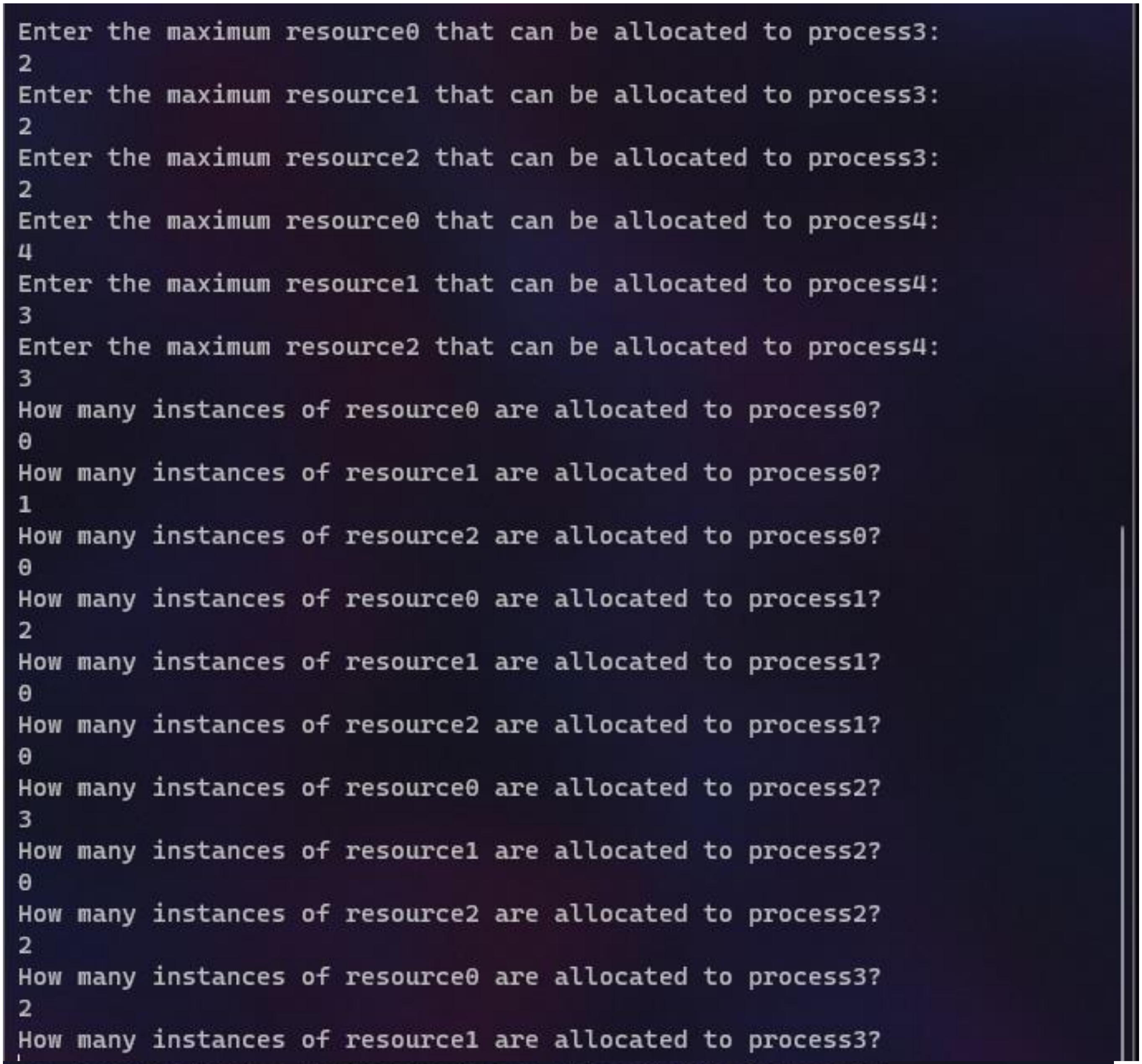
```
// import required classes and packages
import java.util.*;
import java.io.*;
import java.util.Scanner;

// create BankersAlgoExample class to implement Banker's algorithm in Java
class BankersAlgoExample
{

   // create findNeedValue() method to calculate the need of each process
   static void findNeedValue(int needArray[][], int maxArray[][], int allocationArray[][], int
totalProcess, int totalResources)
   {
      // use nested for loop to calculate Need for each process
      for (int i = 0 ; i < totalProcess ; i++){    // for each process
      for (int j = 0 ; j < totalResources ; j++){  //for each resource
        needArray[i][j] = maxArray[i][j] - allocationArray[i][j];
      }
    }
  }

  // create checkSafeSystem() method to determine whether the system is in safe state or not
  static boolean checkSafeSystem(int processes[], int availableArray[], int maxArray[][], int allocationArray[][], int totalProcess, int totalResources)
  {
    int [][]needArray = new int[totalProcess][totalResources];

    // call findNeedValue() method to calculate needArray
    findNeedValue(needArray, maxArray, allocationArray, totalProcess, totalResources);

    // all the process should be infinished in starting
    boolean []finishProcesses = new boolean[totalProcess];

    // initialize safeSequenceArray that store safe sequenced
    int []safeSequenceArray = new int[totalProcess];

    // initialize workArray as a copy of the available resources
    int []workArray = new int[totalResources];

    for (int i = 0; i < totalResources ; i++)    //use for loop to copy each available resource in the workArray
      workArray[i] = availableArray[i];
    // initialize counter variable whose value will be 0 when the system is not in the safe state or
when all the processes are not finished.
    int counter = 0;

    // use loop to iterate the statements until all the processes are not finished
    while (counter < totalProcess)
    {
      // find infinished process which needs can be satisfied with the current work resource.
      boolean foundSafeSystem = false;
      for (int m = 0; m < totalProcess; m++)
      {
        if (finishProcesses[m] == false)       // when process is not finished
        {
          int j;

          //use for loop to check whether the need of each process for all the resources is less than
the work
          for (j = 0; j < totalResources; j++)
            if (needArray[m][j] > workArray[j])      //check need of current resource for current
process with work
              break;

          // the value of J and totalResources will be equal when all the needs of current process
are satisfied
          if (j == totalResources)
          {
            for (int k = 0 ; k < totalResources ; k++)
              workArray[k] += allocationArray[m][k];
```

```
               // add current process in the safeSequenceArray
               safeSequenceArray[counter++] = m;

               // make this process finished
               finishProcesses[m] = true;

               foundSafeSystem = true;
            }
         }
      }

      // the system will not be in the safe state when the value of the foundSafeSystem is false
      if (foundSafeSystem == false)
      {
         System.out.print("The system is not in the safe state because lack of resources");
         return false;
      }
   }

   // print the safe sequence
   System.out.print("The system is in safe sequence and the sequence is as follows: ");
   for (int i = 0; i < totalProcess ; i++)
      System.out.print("P"+safeSequenceArray[i] + " ");

   return true;
}

// main() method start
public static void main(String[] args)
```

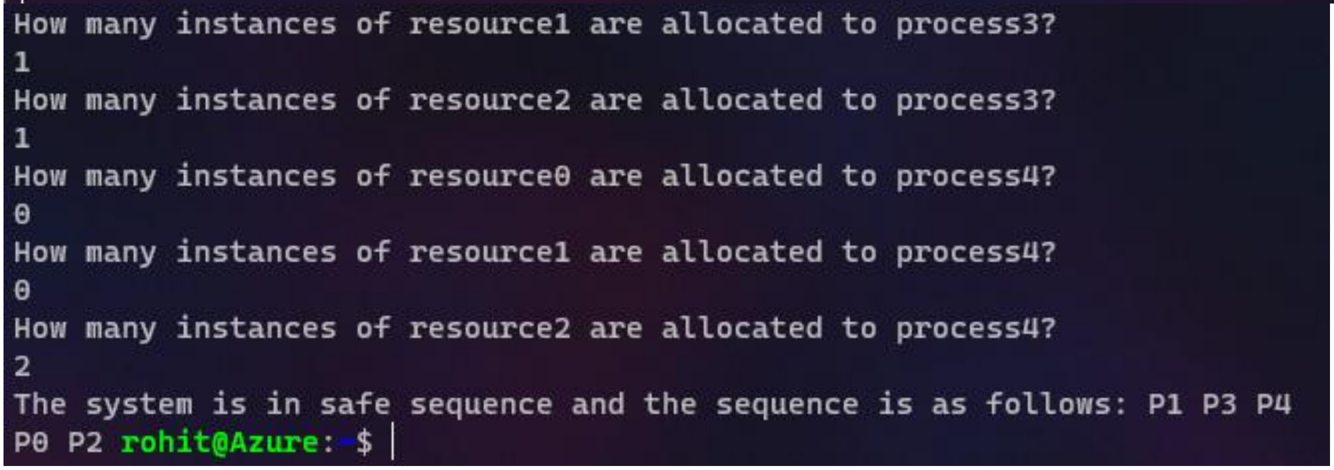
```
{
    int numberOfProcesses, numberOfResources;

    //create scanner class object to get input from user
    Scanner sc = new Scanner(System.in);

    // get total number of resources from the user
    System.out.println("Enter total number of processes");
    numberOfProcesses = sc.nextInt();

    // get total number of resources from the user
    System.out.println("Enter total number of resources");
    numberOfResources = sc.nextInt();

    int processes[] = new int[numberOfProcesses];
    for(int i = 0; i < numberOfProcesses; i++){
        processes[i] = i;
    }

    int availableArray[] = new int[numberOfResources];
    for( int i = 0; i < numberOfResources; i++){
        System.out.println("Enter the availability of resource"+ i +": ");
        availableArray[i] = sc.nextInt();
    }

    int maxArray[][] = new int[numberOfProcesses][numberOfResources];
    for( int i = 0; i < numberOfProcesses; i++){
        for( int j = 0; j < numberOfResources; j++){
                System.out.println("Enter the maximum resource"+ j +" that can be allocated to process"+ i
+": ");
                maxArray[i][j] = sc.nextInt();
            }
        }

        int allocationArray[][] = new int[numberOfProcesses][numberOfResources];
        for( int i = 0; i < numberOfProcesses; i++){
            for( int j = 0; j < numberOfResources; j++){
                System.out.println("How many instances of resource"+ j +" are allocated to process"+ i +"?
");
                allocationArray[i][j] = sc.nextInt();
            }
        }

        //call checkSafeSystem() method to check whether the system is in safe state or not
        checkSafeSystem(processes, availableArray, maxArray, allocationArray, numberOfProcesses,
numberOfResources);
    }
}
```



```
rohit@Azure:~$ java BankersAlgoExample
Enter total number of processes
5
Enter total number of resources
3
Enter the availability of resource0:
3
Enter the availability of resource1:
3
Enter the availability of resource2:
2
Enter the maximum resource0 that can be allocated to process0:
7
Enter the maximum resource1 that can be allocated to process0:
5
Enter the maximum resource2 that can be allocated to process0:
3
Enter the maximum resource0 that can be allocated to process1:
3
Enter the maximum resource1 that can be allocated to process1:
2
Enter the maximum resource2 that can be allocated to process1:
2
Enter the maximum resource0 that can be allocated to process2:
9
Enter the maximum resource1 that can be allocated to process2:
0
Enter the maximum resource2 that can be allocated to process2:
2
Enter the maximum resource0 that can be allocated to process3:
2
Enter the maximum resource1 that can be allocated to process3:
2
Enter the maximum resource2 that can be allocated to process3:
```



```
Enter the maximum resource0 that can be allocated to process3:
2
Enter the maximum resource1 that can be allocated to process3:
2
Enter the maximum resource2 that can be allocated to process3:
2
Enter the maximum resource0 that can be allocated to process4:
4
Enter the maximum resource1 that can be allocated to process4:
3
Enter the maximum resource2 that can be allocated to process4:
3
How many instances of resource0 are allocated to process0?
0
How many instances of resource1 are allocated to process0?
1
How many instances of resource2 are allocated to process0?
0
How many instances of resource0 are allocated to process1?
2
How many instances of resource1 are allocated to process1?
0
How many instances of resource2 are allocated to process1?
0
How many instances of resource0 are allocated to process2?
3
How many instances of resource1 are allocated to process2?
0
How many instances of resource2 are allocated to process2?
2
How many instances of resource0 are allocated to process3?
2
How many instances of resource1 are allocated to process3?
```



```
How many instances of resource1 are allocated to process3?
1
How many instances of resource2 are allocated to process3?
1
How many instances of resource0 are allocated to process4?
0
How many instances of resource1 are allocated to process4?
0
How many instances of resource2 are allocated to process4?
2
The system is in safe sequence and the sequence is as follows: P1 P3 P4
P0 P2 rohit@Azure:~$
```

2. Implement RPC Algorithm (using Python /Java)

RPC:

RPC stands for Remote Procedure Call which supports procedural programming. Using RPC, we can invokes methods in shared environments.

As an example, we can call a function in a remote machine from our local computer using RPC. We can define RPC as a communication type in distributed systems.

When we dig into RPC structure, we can identify it implements the client server model. And also, the calls are synchronous which makes the client wait till the server response.

Program:

myInterface.java

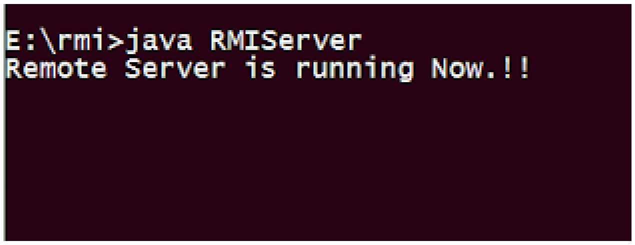
```
import java.rmi.*;
public interface MyInterface extends Remote
{
 public String countInput(String input)throws RemoteException;
}
```

RMIServer.java

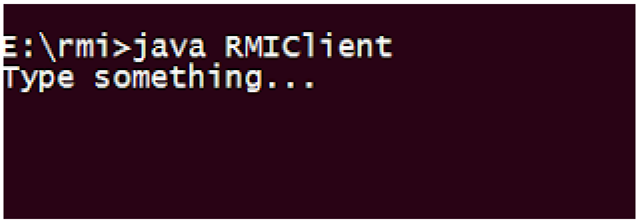
```
import java.rmi.*;
import java.rmi.server.*;
public class RMIServer extends UnicastRemoteObject implements MyInterface
{
    public RMIServer()throws RemoteException
    {
        System.out.println("Remote Server is running Now.!!");
    }
public static void main(String arg[])
{
    try{
        RMIServer p=new RMIServer();
        Naming.rebind("rmiInterface",p);
    }
catch(Exception e)
{ System.out.println("Exception occurred : "+e.getMessage()); }
}

    @Override
    public String countInput(String input) throws RemoteException
    {
    System.out.println("Received your input "+ input+"  at server!!");
        String reply;
        reply="You have typed "+ input.length() +"  letters!!";
        return reply;
    }
}
```

RMIClient.java

```
import java.rmi.*;
import java.io.*;
public class RMIClient
{
    public static void  main(String args[])
    {
        try
      { BufferedReader br=new BufferedReader(new InputStreamReader(System.in));
      MyInterface p=( MyInterface)Naming.lookup("rmiInterface");
        System.out.println("Type something...");
    String input=br.readLine();
    System.out.println(p.countInput(input));
      }
    catch(Exception e) {
      System.out.println("Exception occurred : "+e.getMessage());
    }
  }
}
```



```
E:\rmi>java RMIServer
Remote Server is running Now.!!
```



```
E:\rmi>java RMIClient
Type something...
```

3. Create and distribute a Torrent file to share a file in LAN Environment

Following are the steps to create a Torrent file:

1. Launch your torrent client.
2. Go to File > Create New Torrent in the application.
3. Next, click on Add File to select a location from where we want to add the Target File.
4. Next, we need to add the Tracker URLs. These URLs are used to track & locate the file on the internet. By default, programs like uTorrent will add two or more URLs by default, in case it does not happens on its own, we need to add our own URLs. Most of the time these URLs need to be searched according to the website we will use.
5. Add any additional information related to the file like comments, RSS feeds etc. & choose the privacy level, public or private.
6. Once done, click on Create to create the Torrent File & choose a location to save it.
7. Later on this file can be shared with others or uploaded to a Torrent network.

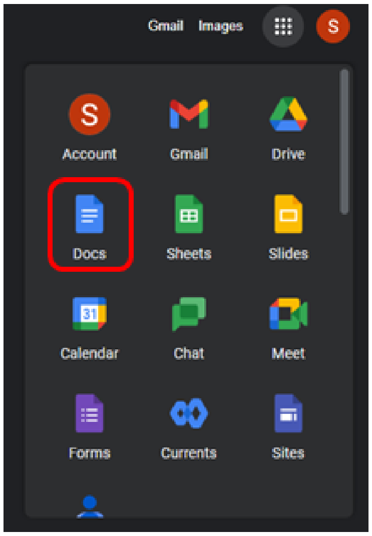
4. **Use Google collaboration tools: Create Google Docs, Sheets and Slides and share it with other users.**

Google Collaboration tools: Google collaboration tools is a robust set of applications that can help businesses boost productivity and collaboration.

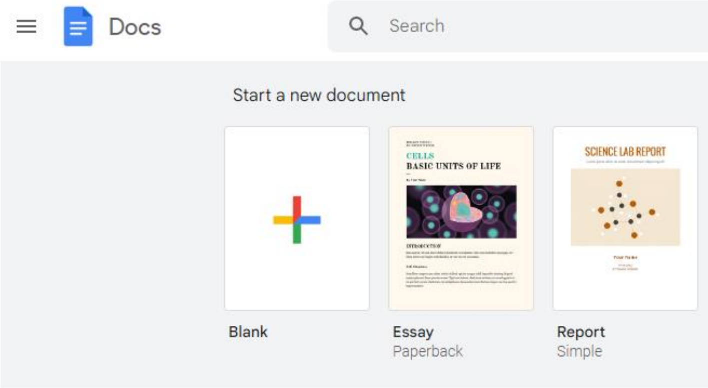
Create Google Docs:

Step 1: Sign into your Google account.

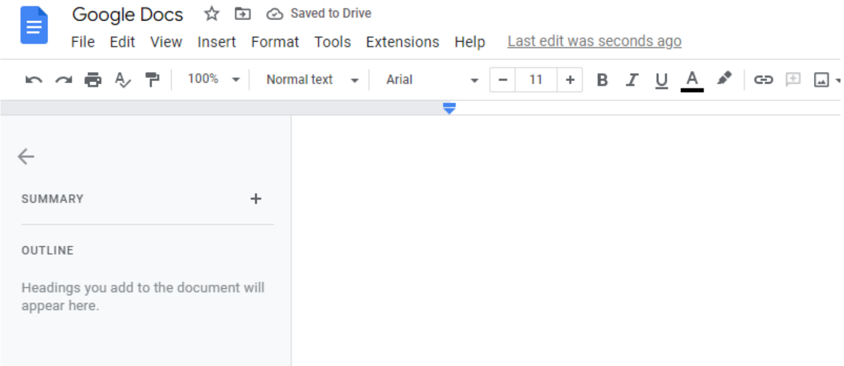
Step 2: Click Top right corner and click on the "Docs" icon.



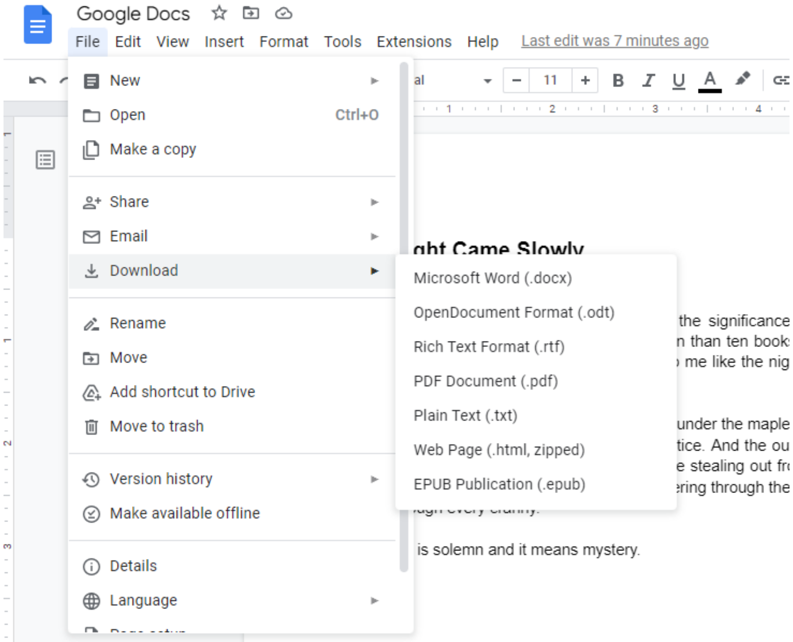
Step 3: Click on plus button for creating the new docs.



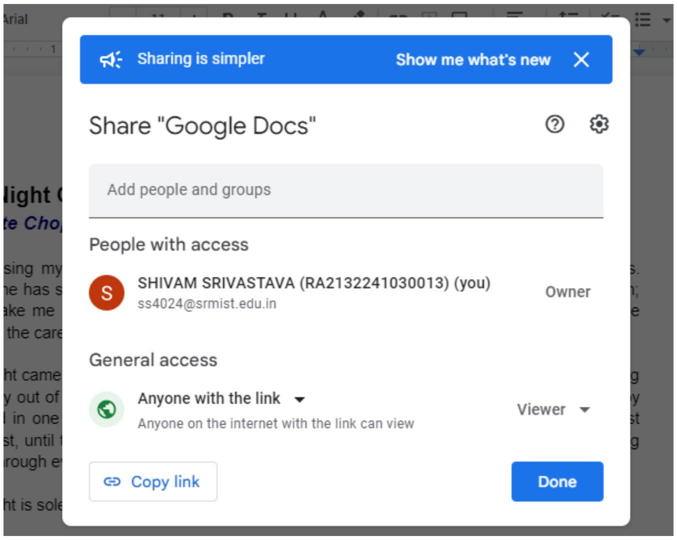
Step 4: Rename your google docs by clicking the top left corner.


Google Docs
Saved to Drive
File Edit View Insert Format Tools Extensions Help
Last edit was seconds ago
100%
Normal text
Arial
11
B I U A
SUMMARY
OUTLINE
Headings you add to the document will appear here.

Step 5: You can download the file in your local computer.



Step 6: You can share this google doc with others by clicking the “Share” button placed in the top left corner.



Share "Google Docs"

People with access

SHIVAM SRIVASTAVA (RA2132241030013) (you) — Owner
ss4024@srmist.edu.in

General access

Anyone with the link — Viewer
Anyone on the internet with the link can view

5. **Explore public cloud services like Amazon, Google, Salesforce, Digital Ocean etc.**

Microsoft Azure:

Azure is Microsoft's Cloud platform. It is a platform through which we can use Microsoft's resources. For example, to set up a huge server, we will require huge investment, effort, physical space and so on. In such situations, Microsoft Azure comes to our rescue. It will provide us with virtual machines, fast processing of data, analytical and monitoring tools and so on to make our work simpler. The pricing of Azure is also simpler and cost-effective. Popularly termed as "Pay as You Go", which means how much you use, pay only for that.

Azure can help in the following ways-

1. **Lesser Capital:** We don't have to worry about the capital as Azure cuts out the high cost of hardware. You simply pay as you go and enjoy a subscription-based model that's kind to your cash flow. Also, setting up an Azure account is very easy. You simply register in Azure Portal and select your required subscription and get going.
2. **Less Operational Cost:** Azure has low operational cost because it runs on its own servers whose only job is to make the cloud functional and bug-free, it's usually a whole lot more reliable than your own, on-location server.
3. **Cost Effective:** If we set up a server on our own, we need to hire a tech support team to monitor them and make sure things are working fine. Also, there might be a situation where the tech support team is taking too much time to solve the issue incurred in the server. So, in this regard is way too pocket friendly.
4. **Easy Back Up and Recovery options:** Azure keeps backups of all your valuable data. In disaster situations, you can recover all your data in a single click without your business getting affected. Cloud-based backup and recovery solutions save time, avoid large up-front investment, and roll up third-party expertise as part of the deal.
5. **Better Security:** Azure provides more security than local servers. Be carefree about your critical data and business applications. As it stays safe in the Azure Cloud. Even in natural disasters, where the resources can be harmed, Azure is a rescue. The cloud is always on.

Amazon Web Services (AWS):

The Amazon Web Services (AWS) platform provides more than 200 fully featured services from data centers located all over the world. Amazon web service is an online platform that provides scalable and cost-effective cloud computing solutions.

AWS is a broadly adopted cloud platform that offers several on-demand operations like compute power, database storage, content delivery, etc., to help corporates scale and grow.

The leading cloud provider in the marketplace is Amazon Web Services. It provides over 170 AWS services to the developers so they can access them from anywhere at the time of need.

For example, Adobe creates and updates software without depending upon the IT teams. It uses its services by offering multi-terabyte operating environments for its clients. By deploying its services with Amazon services, Adobe integrated and operated its software in a simple manner.

Advantages of AWS:

1. AWS provides a user-friendly programming model, architecture, database as well as operating system that has been already known to employers.
2. AWS is a very cost-effective service. There is no such thing as long-term commitments for anything you would like to purchase.
3. It offers billing and management for the centralized sector, hybrid computing, and fast installation or removal of your application in any location with few clicks.
4. There is no need to pay extra money on running data servers by AWS.
5. AWS offers a total ownership cost at very reasonable rates in comparison to other private cloud servers.

Google Cloud Platform:

Starting from 1998 with the launch of Google search, Google has developed one of the largest and most Powerful IT Infrastructure in the world. Today, this infrastructure is used by billions of users to use services such as Gmail, YouTube, Google Photo and Maps. In 2008 , Google decided to open its network and IT infrastructure to business customers, taking an infrastructure that was initially developed for consumers application to public service and launching google cloud platform.

All the services listed above are provided by Google hence the name Google Cloud Platform (GCP).

Why choose GCP?

- GCP allows you to choose between computing, storage, big data, machine learning, and application services for your web, mobile, analytics, and back-end solutions.
- It’s global and it is cost-effective.
- It’s open-source friendly.
- It’s designed for security.

Advantages of GCP:

1. **Good documentation:** We are talking about many pages in total, including a reasonably detailed API Reference guide.
2. Different storage classes for every necessity: Regional (frequent use), Nearline (infrequent use), and Coldline (long-term storage).
3. **High durability:** This suggests that data survives even within the event of the simultaneous loss of two disks.
4. Many regions available to store your data: North Ameria, South America, Europe, Asia, and Australia.
5. The “Console” tab within the documentation allows you to try for free of charge different SDKs. It’s incredibly useful for developers.

6. **Quizzes on different service models and deployment models. Report submission - Comparison of various services provided by different Cloud Service Providers (configuration of VM, cost, Network bandwidth etc.).**

For the question, the top three Cloud Providers have been compared: AWS, Azure & GCP

AWS:

- Amazon is an IaaS market leader, holding 31% of the cloud market share.
- AWS has over 175 cloud services for a broad range of use cases and industries. The top Amazon most used services are: Amazon EC2 (compute capacity), Amazon RDS (relational database), Amazon S3 (cloud storage), Amazon CloudFront (content delivery service) and Amazon Glacier (web storage service). EC2 allows Amazon customers to use virtual computer clusters that are available all the time.
- Currently, AWS serves 245 countries and spans 25 geographic regions: 7 in North America, 9 in Asia-Pacific, 6 in Europe, 1 in South America, 1 in the Middle East, and 1 in Africa. Every region is isolated and consists of several availability zones (AWS spans 80 availability zones in total).

Azure:

- Microsoft Azure's market share among IaaS cloud providers is 20%.
- Microsoft Azure has over 600 services. Azure offers VMs as a part of its IaaS offering, Active Directory to synchronize on-premise directories, and enables single sign-on. The company also provides mobile engagement with real-time analytics and tracking of user behaviors and storage services, as well as data management tools such as Azure Data Explorer, Azure SQL Database, Serverless, CDN, Azure AI, Azure IoT and other services.
- Azure has 54 regions and is more available than any other cloud provider. Every Azure region has a minimum of three availability zones, enabling its customers to run two isolated copies of their applications.

GCP:

- The market share of Google Cloud in infrastructure, as a service market, is 7% per Canalys.

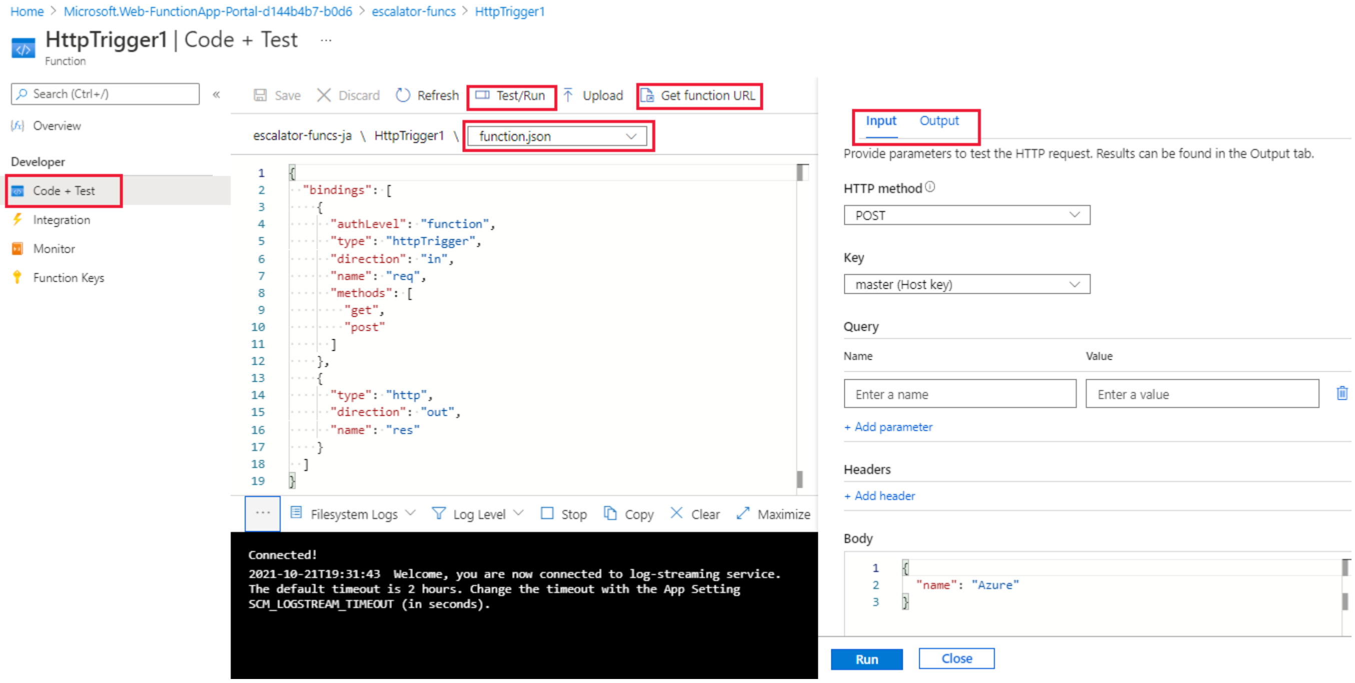
- The Google Cloud platform offers 100 products that can be grouped into six categories: storage, databases, computing and hosting (servers, containers VMs), networking (VPC, load balancing, cloud DNS), big data (Big Query for data analysis, Dataflow for batch and streaming data processing), and machine learning (AI platform).
- Google Cloud is available in 200 countries. It spans 25 regions (9 in North and South America, 9 in Asia-Pacific, and 7 in Europe). Google Cloud has 76 zones and 144 network Edge locations.

7. **Create a simple web service using Python Flask/ Java/ any language: Client - Server Model should be implemented using socker/http**

The below Web Service is deployed as a Function App API on Microsoft Azure. The API is written in JavaScript which implements HTTP Calls & checks if a temperature entry collected from IoT sensor is within the prescribed range or not:

```
module.exports = function (context, req) {
  context.log('Drive Gear Temperature Service triggered');
  if (req.body && req.body.readings) {
    req.body.readings.forEach(function(reading) {

      if(reading.temperature<=25) {
        reading.status = 'OK';
      } else if (reading.temperature<=50) {
        reading.status = 'CAUTION';
      } else {
        reading.status = 'DANGER'
      }
      context.log('Reading is ' + reading.status);
    });

    context.res = {
      // status: 200, /* Defaults to 200 */
      body: {
        "readings": req.body.readings
      }
    };
  }
  else {
    context.res = {
      status: 400,
      body: "Please send an array of readings in the request body"
    };
  }
  context.done();
};
```

Output:



Home > Microsoft.Web-FunctionApp-Portal-d144b4b7-b0d6 > escalator-funcs > HttpTrigger1

HttpTrigger1 | Code + Test

Function

escalator-funcs-ja \ HttpTrigger1 \ function.json

```
{
  "bindings": [
    {
      "authLevel": "function",
      "type": "httpTrigger",
      "direction": "in",
      "name": "req",
      "methods": [
        "get",
        "post"
      ]
    },
    {
      "type": "http",
      "direction": "out",
      "name": "res"
    }
  ]
}
```

```
Connected!
2021-10-21T19:31:43  Welcome, you are now connected to log-streaming service.
The default timeout is 2 hours. Change the timeout with the App Setting
SCM_LOGSTREAM_TIMEOUT (in seconds).
```

Provide parameters to test the HTTP request. Results can be found in the Output tab.

HTTP method: POST

Key: master (Host key)

Query

Name: Enter a name

Value: Enter a value

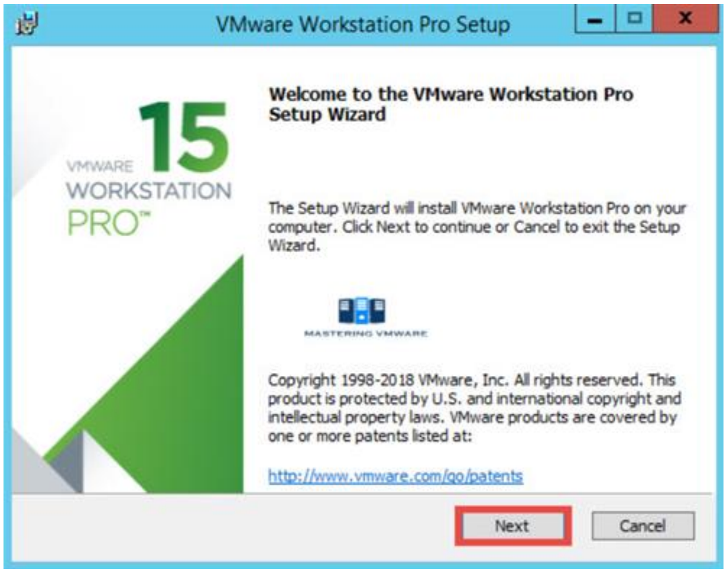
Body

```
{
  "name": "Azure"
}
```

8. Install Oracle Virtual Box / VMware Workstation & create a chat application.

Steps for installing VMware workstation:

1. To install VMware workstation from the official website of VMware (https://www.vmware.com).
2. Download & setup and run it.
3. Click on VMware Software and Click on Next to the Installation wizard.



VMware Workstation Pro Setup

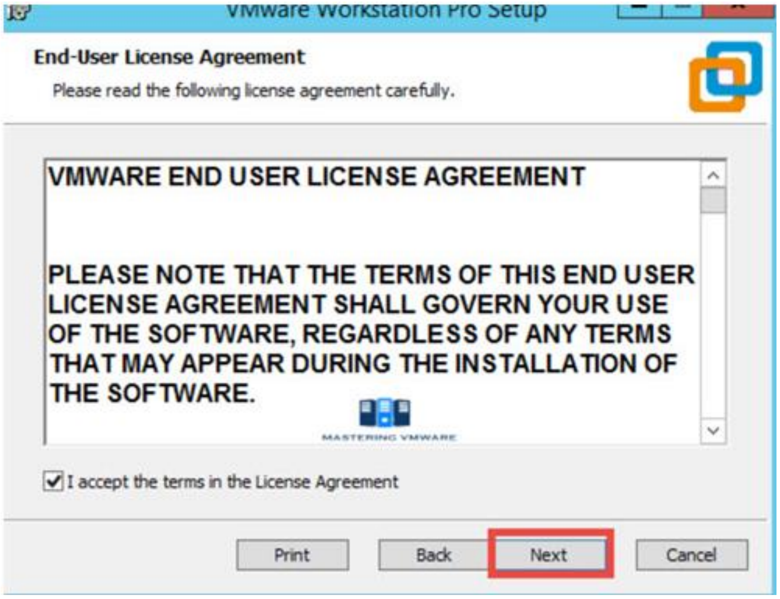
Welcome to the VMware Workstation Pro Setup Wizard

The Setup Wizard will install VMware Workstation Pro on your computer. Click Next to continue or Cancel to exit the Setup Wizard.

Copyright 1998-2018 VMware, Inc. All rights reserved. This product is protected by U.S. and international copyright and intellectual property laws. VMware products are covered by one or more patents listed at:

http://www.vmware.com/go/patents

4. Read and accept the VMware End User license agreement & click next to continue.



VMware Workstation Pro Setup

End-User License Agreement

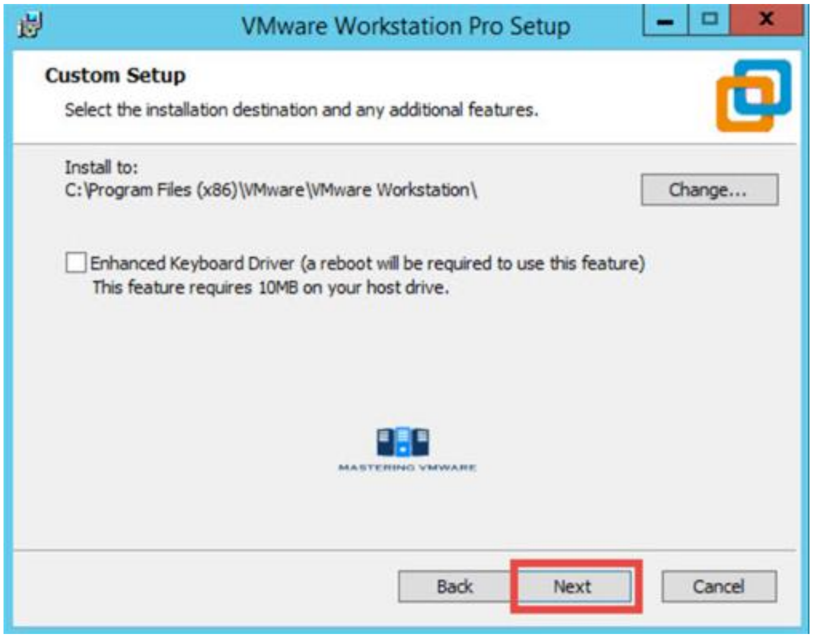
Please read the following license agreement carefully.

VMWARE END USER LICENSE AGREEMENT

PLEASE NOTE THAT THE TERMS OF THIS END USER LICENSE AGREEMENT SHALL GOVERN YOUR USE OF THE SOFTWARE, REGARDLESS OF ANY TERMS THAT MAY APPEAR DURING THE INSTALLATION OF THE SOFTWARE.

☑ I accept the terms in the License Agreement

5. Specify the Installation directory. You can also enable Enhance keyboard driver here. And then Click next to continue.



VMware Workstation Pro Setup

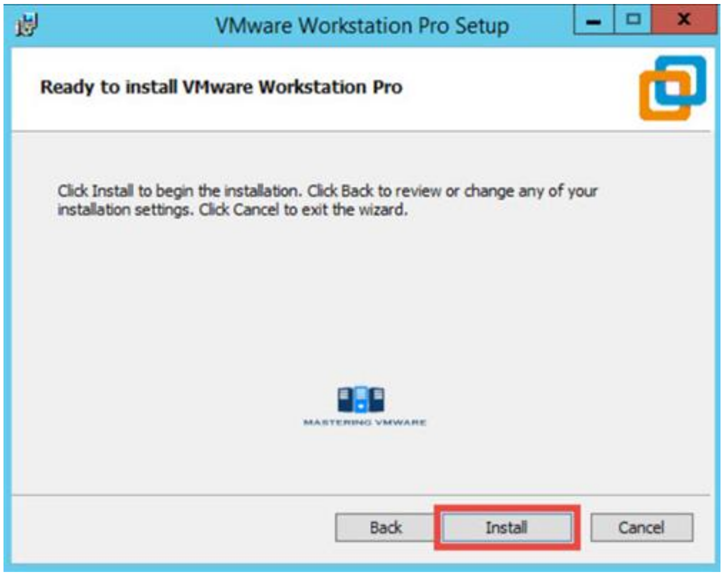
Custom Setup

Select the installation destination and any additional features.

Install to:
C:\Program Files (x86)\VMware\VMware Workstation\

□ Enhanced Keyboard Driver (a reboot will be required to use this feature)
This feature requires 10MB on your host drive.

6. Click Install button to start the installation.



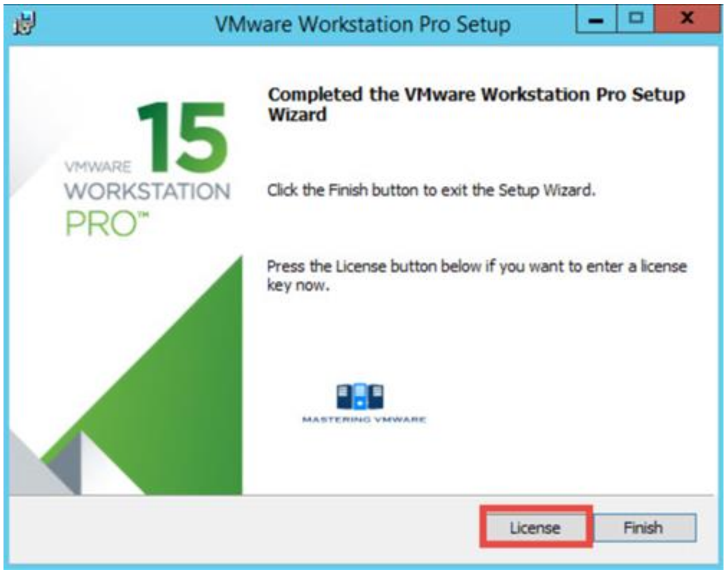
VMware Workstation Pro Setup

Ready to install VMware Workstation Pro

Click Install to begin the installation. Click Back to review or change any of your installation settings. Click Cancel to exit the wizard.

7. Installation will take just few seconds to complete.

   If you have the license key then click on License to enter the license or you can also click Finish to exit the Installer. That’s it we have successfully installed VMware Workstation.



Completed the VMware Workstation Pro Setup Wizard

Click the Finish button to exit the Setup Wizard.

Press the License button below if you want to enter a license key now.

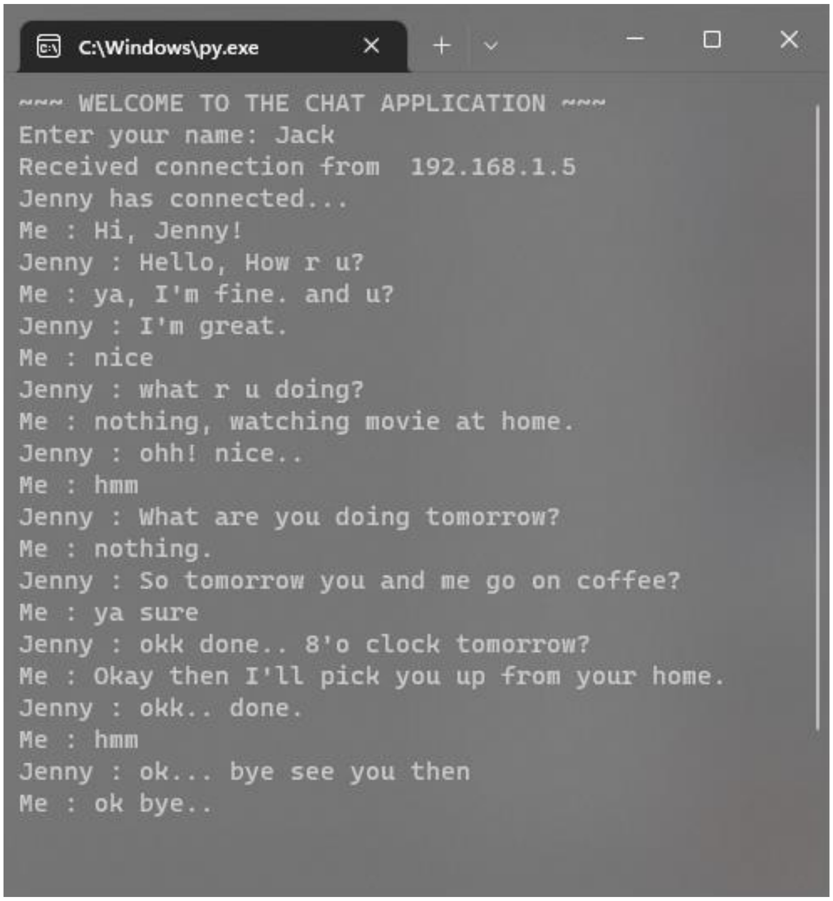
Create a chat application:

Server-side script:

File name: server.py

```
import socket
new_socket = socket.socket()
host_name = socket.gethostname()
s_ip = socket.gethostbyname(host_name)
port = 8080
new_socket.bind((host_name, port))
print("~~~ WELCOME TO THE CHAT APPLICATION ~~~")
name = input("Enter your name: ")
new_socket.listen(1)
conn, add= new_socket.accept()
print("Received connection from ", add[0])
client = (conn.recv(1024)).decode()
print(client + ' has connected...')
conn.send(name.encode())
while True:
   message = input('Me : ')
   conn.send(message.encode())
   message = conn.recv(1024)
   message = message.decode()
   print(client, ':', message)
```

Output on computer 1:



```
~~~ WELCOME TO THE CHAT APPLICATION ~~~
Enter your name: Jack
Received connection from  192.168.1.5
Jenny has connected...
Me : Hi, Jenny!
Jenny : Hello, How r u?
Me : ya, I'm fine. and u?
Jenny : I'm great.
Me : nice
Jenny : what r u doing?
Me : nothing, watching movie at home.
Jenny : ohh! nice..
Me : hmm
Jenny : What are you doing tomorrow?
Me : nothing.
Jenny : So tomorrow you and me go on coffee?
Me : ya sure
Jenny : okk done.. 8'o clock tomorrow?
Me : Okay then I'll pick you up from your home.
Jenny : okk.. done.
Me : hmm
Jenny : ok... bye see you then
Me : ok bye..
```

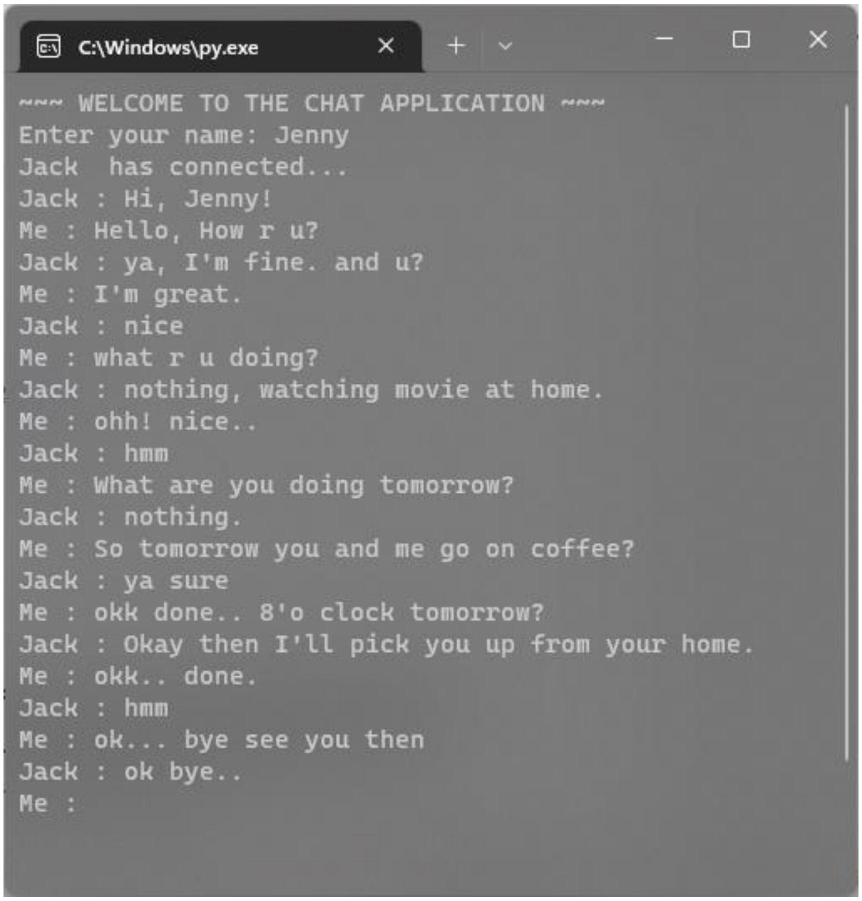
Client-side script:

File name: client.py

```
import socket
socket_server = socket.socket()
server_host = socket.gethostname()
ip = socket.gethostbyname(server_host)
sport = 8080
print("~~~ WELCOME TO THE CHAT APPLICATION ~~~")
server_host = '192.168.1.5'
name = input('Enter your name: ')
socket_server.connect((server_host, sport))
socket_server.send(name.encode())
server_name = socket_server.recv(1024)
server_name = server_name.decode()
print(server_name,' has connected...')
while True:
   message = (socket_server.recv(1024)).decode()
   print(server_name, ":", message)
```

```
    message = input("Me : ")
    socket_server.send(message.encode())
```

Output on computer 2:



```
~~~ WELCOME TO THE CHAT APPLICATION ~~~
Enter your name: Jenny
Jack  has connected...
Jack : Hi, Jenny!
Me : Hello, How r u?
Jack : ya, I'm fine. and u?
Me : I'm great.
Jack : nice
Me : what r u doing?
Jack : nothing, watching movie at home.
Me : ohh! nice..
Jack : hmm
Me : What are you doing tomorrow?
Jack : nothing.
Me : So tomorrow you and me go on coffee?
Jack : ya sure
Me : okk done.. 8'o clock tomorrow?
Jack : Okay then I'll pick you up from your home.
Me : okk.. done.
Jack : hmm
Me : ok... bye see you then
Jack : ok bye..
Me :
```

9. **Review web services implementation - Proper Connection should be established between the client and server to make use of the service offered by the Server. Review the working of application in virtual environment.**

   In a project that I deployed, I hosted it on Microsoft Azure as a Flask App as a Web App in Azure App Service. Whie deploying the web app, the following points were taken care of to ensure that the application works as expected and proper connection is established between the client app or browser & the App Service instance:

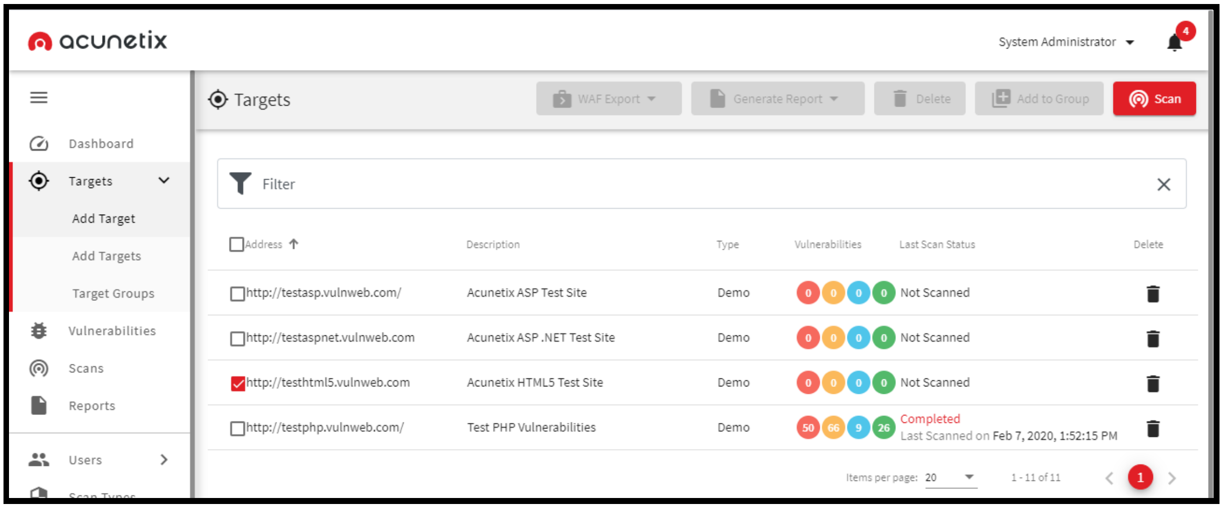
   - **Firewall**: The web app uses Firewall services provided by Azure to ensure that no unauthorized traffic flows through the web app instance. All outbound IPs are blocked, & for inbound communication, only the TCP Port is open.
   - **Stack**: In terms of stack, everything has been verified to be performing optimally & as per the designated requirements.
   - **Ports**: Port rules are enforced by the Firewall Implementation by Azure. The following rules are applied:
   - **Outbound traffic**: allowed only on HTTP Port 80 for API Calls & Port 22 for SSH.
   - **Inbound Traffic**: only allowed on HTTP Port 80 for serving Web content.
   - **Connection**: For reliable & concrete connection, TCP Protocol is utilized. TCP ensures reliable transmission of data back & forth between the web server & multiple clients.
   - **Certificate**: The use of SSL Certificate here is made to facilitate secure transmission. The certificate verifies the authenticity of the web app & the underlying platform.
   - **Domain**: The application runs on default domain names provided by Azure & is formed as a genuine domain name in order to engrave trust in the user.
   - **Backend API Calls**: The backend API Calls are passed using HTTP Requests, allowing for smooth & secure transmission of data between the API Server & application.
   - **Virtual Environment Testing**: The application with all the parameters was tested on localhost & then in a staging environment on Azure, before deploying it to production.

10. Use Security tools like ACUNETIX, ETTERCAP to scan Web Applications on the Cloud.

The web server logs will show your IP address and all the attacks made by Acunetix. If you are not the sole administrator of the website or web application, please make sure to warn other administrators before performing a scan. Some scans might cause a website to crash, requiring a restart of the website.

After configuring your Targets, you are ready to launch Scans and start identifying any vulnerabilities that exist in the web applications. There are multiple ways to start a Scan, which include:

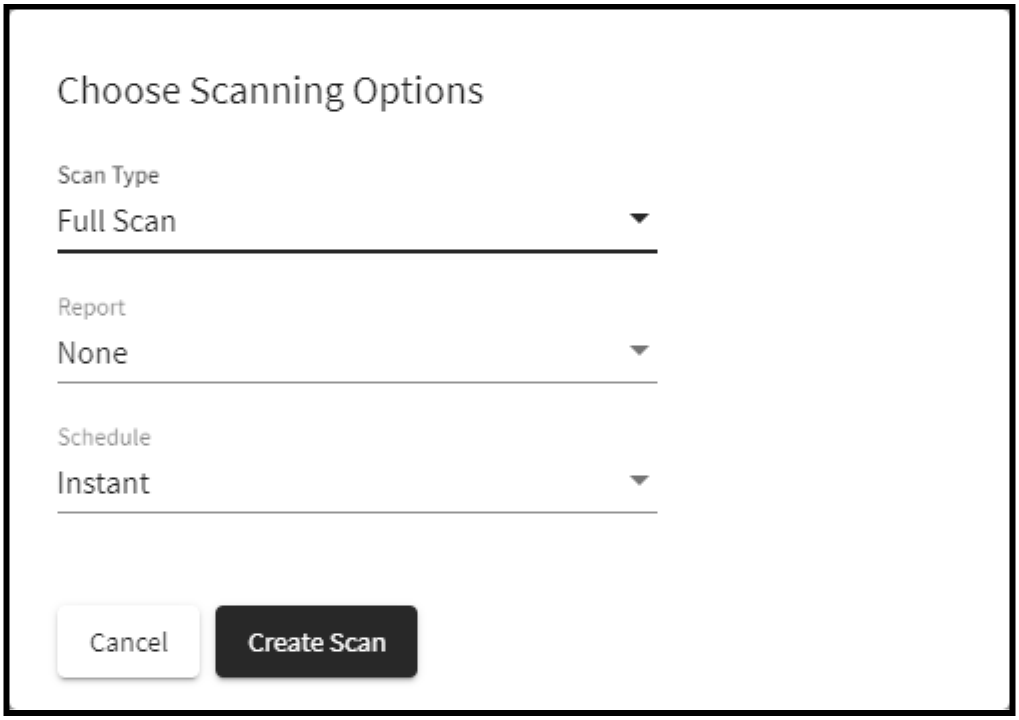
- From the Targets list, select the Targets to scan, and click the Scan button



□ Address ↑	Description	Type	Vulnerabilities	Last Scan Status	Delete
□ http://testasp.vulnweb.com/	Acunetix ASP Test Site	Demo	0 0 0 0	Not Scanned	🗑
□ http://testaspnet.vulnweb.com	Acunetix ASP .NET Test Site	Demo	0 0 0 0	Not Scanned	🗑
☑ http://testhtml5.vulnweb.com	Acunetix HTML5 Test Site	Demo	0 0 0 0	Not Scanned	🗑
□ http://testphp.vulnweb.com/	Test PHP Vulnerabilities	Demo	50 66 9 26	Completed Last Scanned on Feb 7, 2020, 1:52:15 PM	🗑

Items per page: 20 1 - 11 of 11 1

- From within the Scanning Options dialog, configure the options to be used for the scan, then click the "Create Scan" button.



Choose Scanning Options

Scan Type
Full Scan

Report
None

Schedule
Instant

  - **Scan Type** - Choose between Full Scan or a scanning profile which will scan for specific vulnerabilities, such as High Risk Vulnerabilities only.
  - **Report** - You can request that a report is automatically generated after the scan is completed.
  - **Schedule** - Select if the scan should start instantly, or if the scan should be scheduled for a future date / time. You can also configure recurrent scans.

- Click the "Create Scan" button to launch the scan.

11. **Cloud Networks for finding vulnerabilities, verifying leakage of information to an unauthorized third party.**

- **ACUNETIX**

This information gathering tool scans web applications in the cloud and lists possible vulnerabilities that might be present in the given web application. Most of the scanning is focused on finding SQL injection and cross site scripting vulnerabilites. It has both free and paid versions, with paid versions including added functionalities. After scanning, it generates a detailed report describing vulnerabilities along with the suitable action that can be taken to remedy the loophole.

This tool can be used for scanning cloud applications. Beware: there is always a chance of false positives. Any security flaw, if discovered through scanning, should be verified. The latest version of this software, Acunetix WVS version 8, has a report template for checking compliance with ISO 27001, and can also scan for HTTP DDOS Attacks.

- **CAIN & ABEL**

This is a password recovery tool. Cain is used by penetration testers for recovering passwords by sniffing networks, brute forcing and decrypting passwords. This also allows pen testers to intercept VoIP conversations that might be occurring through clouds. This multi functionality tool can decode Wi-Fi network keys, unscramble passwords, discover cached passwords, etc. An expert pen tester can analyze routing protocols as well, thereby detecting any flaws in protocols governing cloud security. The feature that separates Cain from similar tools is that it identifies security flaws in protocol standards rather than exploiting software vulnerabilities. This tool is very helpful for recovering lost passwords.

In the latest version of Cain, the ‘sniffer’ feature allows for analyzing encrypted protocols such as SSH-1 and HTTPS. This tool can be utilized for ARP cache poisoning, enabling sniffing of switched LAN devices, thereby performing Man in the Middle (MITM) attacks. Further functionalities have been added in the latest version, including authentication monitors for routing protocols, brute-force for most of the popular algorithms and cryptanalysis attacks.

- **ETTERCAP**

Ettercap is a free and open-source tool for network security, designed for analyzing computer network protocols and detecting MITM attacks. It is usually accompanied by Cain. This tool can be used for pen testing cloud networks and verifying leakage of information to an unauthorized third party. It has four methods of functionality:

- **IP-based Scanning** – Network security is scanned by filtering IP based packets.
- **Mac-based Scanning** – Here packets are filtered based on MAC addresses. This is used for sniffing connections through channels.
- **ARP-based functionality** – ARP poisoning is used for sniffing into switched LAN through an MITM attack operating between two hosts (full duplex).

12. Install and configure OpenStack all-in-one using DevStack/Packstack.

OpenStack is a free and open-source software platform for cloud computing, mostly deployed as infrastructure-as-a-service, whereby virtual servers and other resources are made available to customers.

Packstack is mostly suitable for Red Hat Distribution Linux like CentOS and Fedora. It basically uses puppet modules to deploy various part of Openstack Components through ssh.

Hardware: Minimum 16GB of RAM, Processor with hardware virtualization extension and at least 1 network adapter.

We are Using Oracle VM Box for Host Operating System.

Step 1: Before starting installation process, you have update and upgrade your system

Run Command:

- sudo apt-get update
- sudo apt-get upgrade

Step 2: Create a new user and give permission to start the openstack installation

Run Command:

- sudo adduser stack
- sudo-I
- cho "stack ALL-(ALL) NOPASSWD: ALL" > >/etc/sudoers

Step 3: Download the deystack from github.com

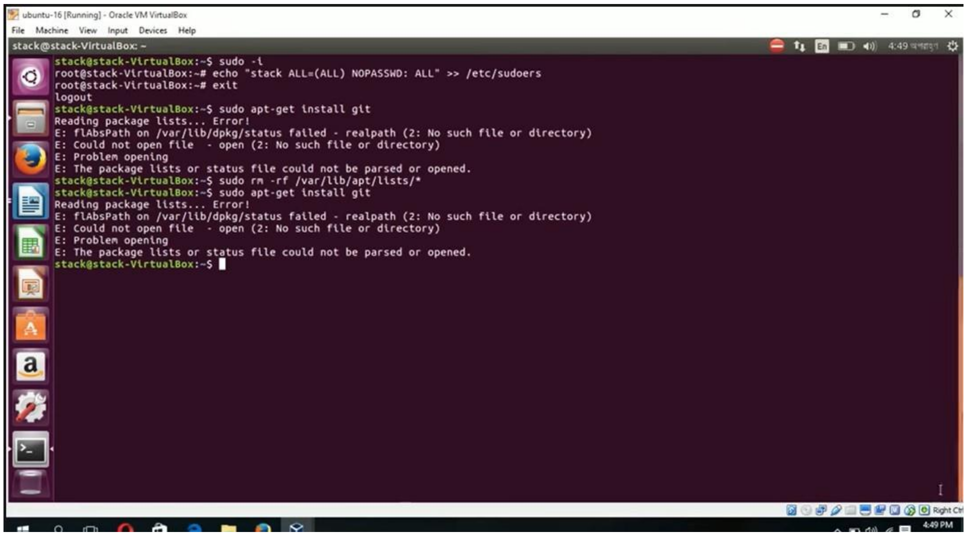
Run Command:

- sudo apt-get install git
- git clone https://git.openstack.org/openstack-dev/devstack

Step 4: Run the following commands to avoid errors before installation for lock error

Run Command:

- sudo rm /var/lib/dpkg/lock
- sudo rm /var/lib/apt/lists/lock
- sudo rm /var/cache/apt/archives/lock
- sudo rm -rf var/lib/apt/list/*



ubuntu-16 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
stack@stack-VirtualBox: ~
4:49 PM

```
stack@stack-VirtualBox:~$ sudo -i
root@stack-VirtualBox:~# echo "stack ALL=(ALL) NOPASSWD: ALL" >> /etc/sudoers
root@stack-VirtualBox:~# exit
logout
stack@stack-VirtualBox:~$ sudo apt-get install git
Reading package lists... Error!
E: flAbsPath on /var/lib/dpkg/status failed - realpath (2: No such file or directory)
E: Could not open file  - open (2: No such file or directory)
E: Problem opening
E: The package lists or status file could not be parsed or opened.
stack@stack-VirtualBox:~$ sudo rm -rf /var/lib/apt/lists/*
stack@stack-VirtualBox:~$ sudo apt-get install git
Reading package lists... Error!
E: flAbsPath on /var/lib/dpkg/status failed - realpath (2: No such file or directory)
E: Could not open file  - open (2: No such file or directory)
E: Problem opening
E: The package lists or status file could not be parsed or opened.
stack@stack-VirtualBox:~$ 
```

Step 5: Configure local.conf file

Run Command:

- cd devstack/
- cd samples
- cp local.conf ../
- cd..
- Sudo nano local.conf

(We can set any password as of our choice)

ADMIN_PASSWORD=pass1

DATABASE_PASSWORD=pass1

RABBIT_PASSWORD=pass1

SERVICE_PASSWORD=pass1

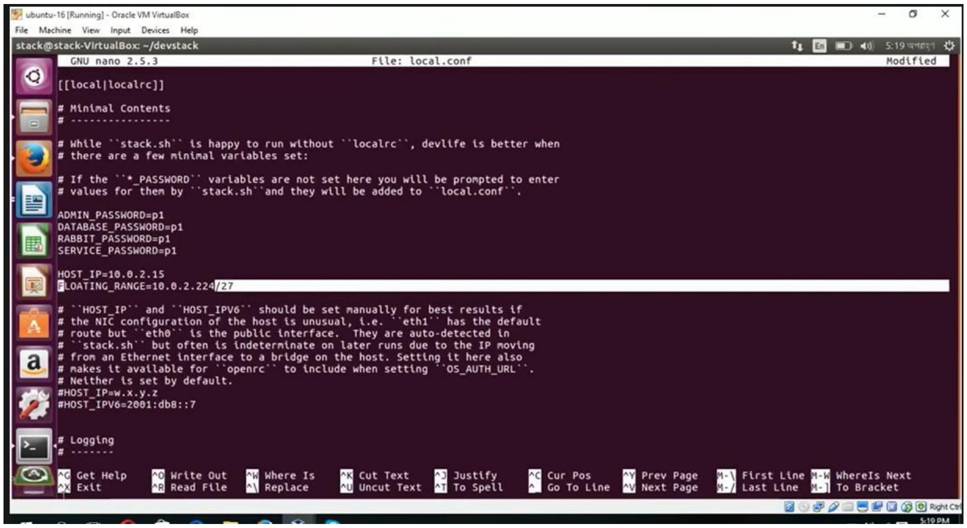
(Host IP is the IP of our system)

(We enter these values to configure local.conf file)

HOST_IP=10.0.2.15

FLOATING_RANGE=10.0.2.222/27

To save the file use command: **CTRL+X** and press yes **Y** for Confirmation.


ubuntu-16 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
stack@stack-VirtualBox: ~/devstack

```
  GNU nano 2.5.3                    File: local.conf                              Modified

[[local|localrc]]

# Minimal Contents
# ----------------

# While ``stack.sh`` is happy to run without ``localrc``, devlife is better when
# there are a few minimal variables set:

# If the ``*_PASSWORD`` variables are not set here you will be prompted to enter
# values for them by ``stack.sh``and they will be added to ``local.conf``.

ADMIN_PASSWORD=p1
DATABASE_PASSWORD=p1
RABBIT_PASSWORD=p1
SERVICE_PASSWORD=p1

HOST_IP=10.0.2.15
FLOATING_RANGE=10.0.2.224/27

# ``HOST_IP`` and ``HOST_IPV6`` should be set manually for best results if
# the NIC configuration of the host is unusual, i.e. ``eth1`` has the default
# route but ``eth0`` is the public interface.  They are auto-detected in
# ``stack.sh`` but often is indeterminate on later runs due to the IP moving
# from an Ethernet interface to a bridge on the host. Setting it here also
# makes it available for ``openrc`` to include when setting ``OS_AUTH_URL``.
# Neither is set by default.
#HOST_IP=w.x.y.z
#HOST_IPV6=2001:db8::7


# Logging
# -------
^G Get Help   ^O Write Out  ^W Where Is   ^K Cut Text   ^J Justify    ^C Cur Pos    ^Y Prev Page  M-\ First Line M-W WhereIs Next
^X Exit       ^R Read File  ^\ Replace    ^U Uncut Text ^T To Spell   ^_ Go To Line ^V Next Page  M-/ Last Line  M-] To Bracket
```

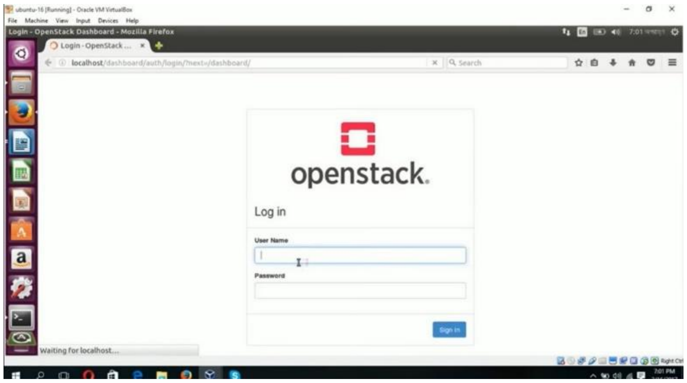
Step 6: Now we can start Installation Process

Run Command:

- ./stack.sh

This Installation will take some time depending on internet speed.

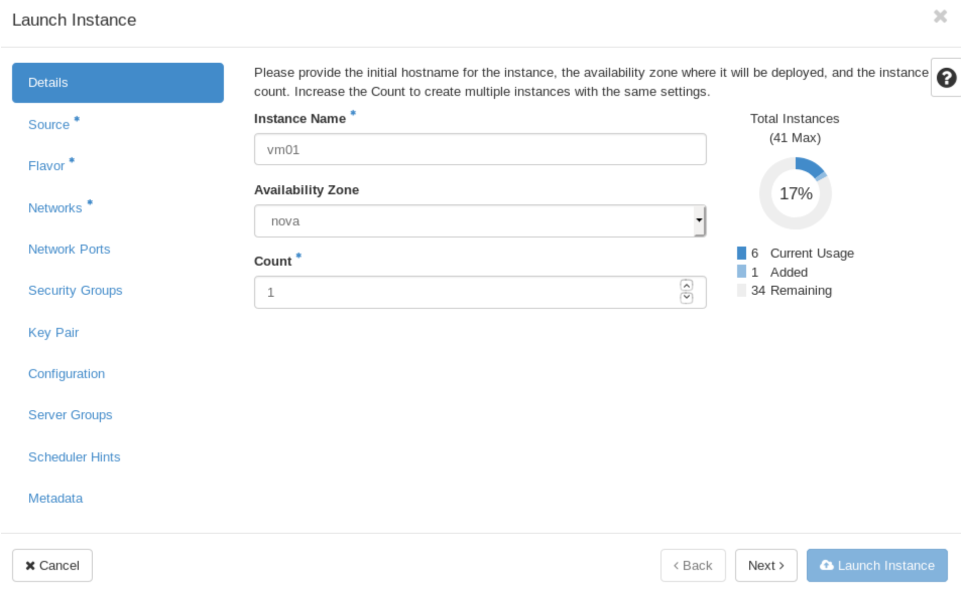
After completion of Installation, we can check if the openstack is installed correctly by typing **localhost** in web Brouser, if Openstack login page Appears it means it is successfully installed.


ubuntu-16 [Running] - Oracle VM VirtualBox
Login - OpenStack Dashboard - Mozilla Firefox
localhost/dashboard/auth/login/?next=/dashboard/
openstack.
Log in
User Name
Password
Sign In
Waiting for localhost...

13. Launch VMs in OpenStack through Dashboard.

Step 1: Launch Openstack from browser & Login.

Step 2: Now, Go to Project -> Compute -> Instances.



Please provide the initial hostname for the instance, the availability zone where it will be deployed, and the instance count. Increase the Count to create multiple instances with the same settings.

Instance Name * vm01

Availability Zone nova

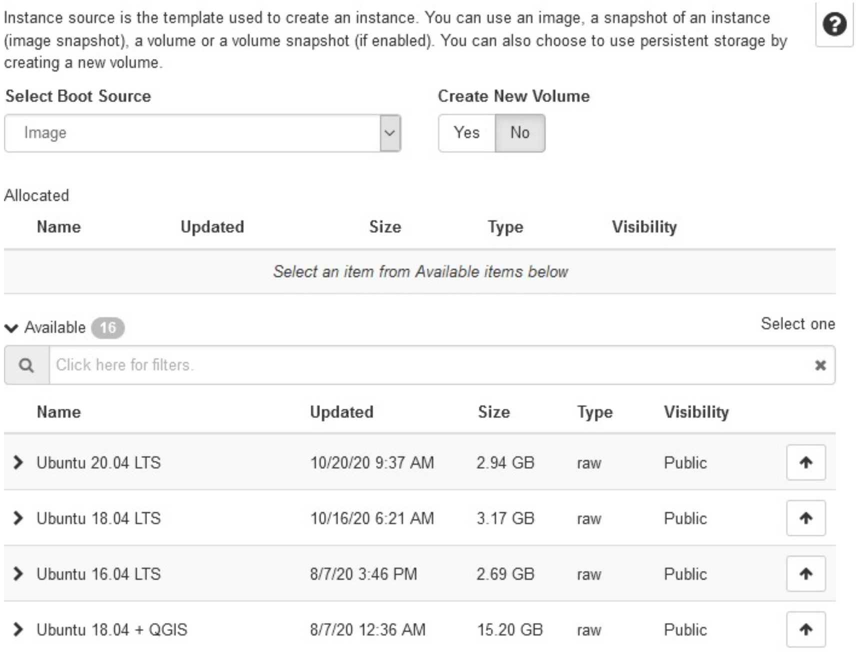
Count * 1

Total Instances (41 Max)

17%

■	6	Current Usage
■	1	Added
□	34	Remaining

Step 3: Select Instance Boot Source (eg. "Image"), and choose desired image (eg. "Ubuntu 16.04 LTS") by clicking on arrow. If you do not need to have the system disk bigger than the size defined in a chosen flavor, we recommend setting "Create New Volume" feature to "No" state.



Instance source is the template used to create an instance. You can use an image, a snapshot of an instance (image snapshot), a volume or a volume snapshot (if enabled). You can also choose to use persistent storage by creating a new volume.

Select Boot Source: Image

Create New Volume: Yes [✓ No]

Allocated

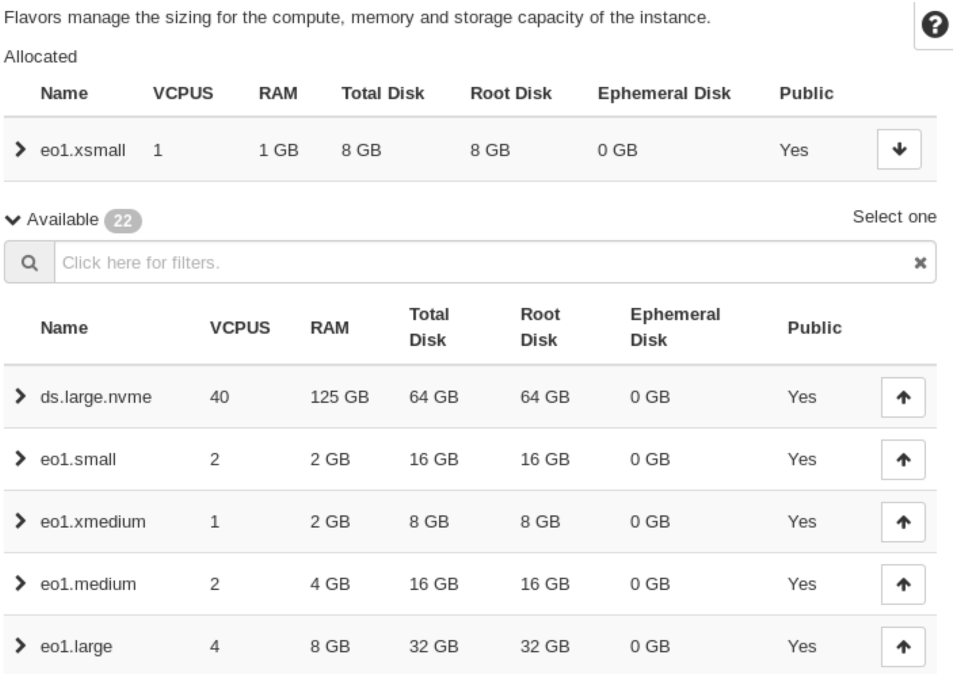
Name	Updated	Size	Type	Visibility
Select an item from Available items below				

Available 16 — Select one

Click here for filters.

Name	Updated	Size	Type	Visibility
Ubuntu 20.04 LTS	10/20/20 9:37 AM	2.94 GB	raw	Public
Ubuntu 18.04 LTS	10/16/20 6:21 AM	3.17 GB	raw	Public
Ubuntu 16.04 LTS	8/7/20 3:46 PM	2.69 GB	raw	Public
Ubuntu 18.04 + QGIS	8/7/20 12:36 AM	15.20 GB	raw	Public

Step 4: Choose Flavor (eg. eo1.xsmall).



Flavors manage the sizing for the compute, memory and storage capacity of the instance.

Allocated

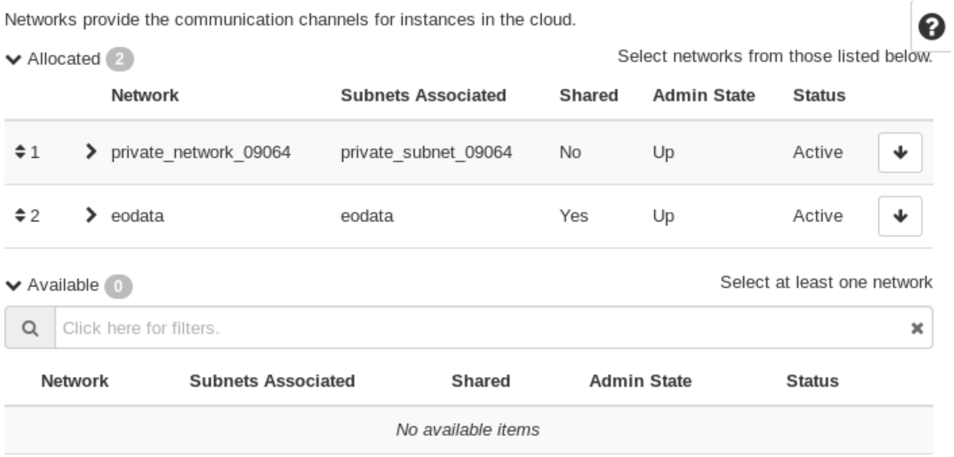
Name	VCPUS	RAM	Total Disk	Root Disk	Ephemeral Disk	Public	
eo1.xsmall	1	1 GB	8 GB	8 GB	0 GB	Yes	↓

Available 22 — Select one

Click here for filters.

Name	VCPUS	RAM	Total Disk	Root Disk	Ephemeral Disk	Public	
ds.large.nvme	40	125 GB	64 GB	64 GB	0 GB	Yes	↑
eo1.small	2	2 GB	16 GB	16 GB	0 GB	Yes	↑
eo1.xmedium	1	2 GB	8 GB	8 GB	0 GB	Yes	↑
eo1.medium	2	4 GB	16 GB	16 GB	0 GB	Yes	↑
eo1.large	4	8 GB	32 GB	32 GB	0 GB	Yes	↑

Step 5: Choose Flavor (eg. eo1.xsmall).



Networks provide the communication channels for instances in the cloud.

Allocated 2 — Select networks from those listed below.

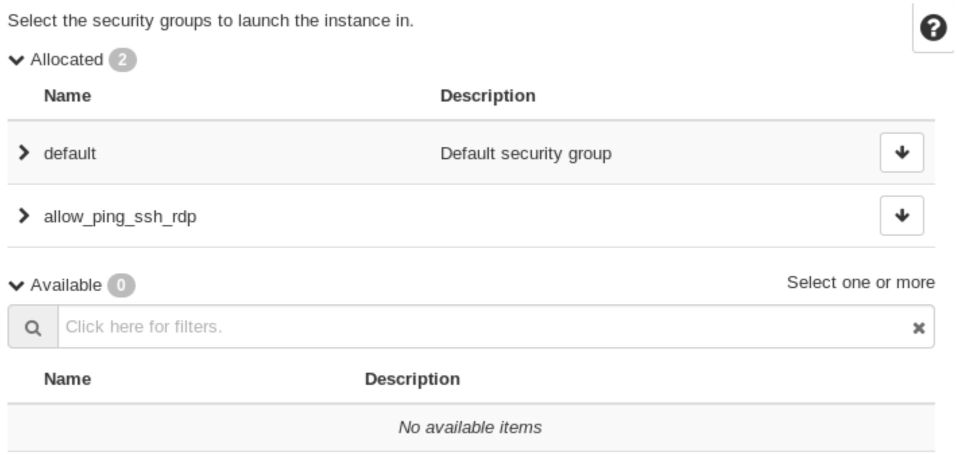
	Network	Subnets Associated	Shared	Admin State	Status	
1	private_network_09064	private_subnet_09064	No	Up	Active	↓
2	eodata	eodata	Yes	Up	Active	↓

Available 0 — Select at least one network

Click here for filters.

Network	Subnets Associated	Shared	Admin State	Status
No available items				

Step 6: Open "Security Groups" After that, choose "allow_ping_ssh_rdp" and "default".



Select the security groups to launch the instance in.

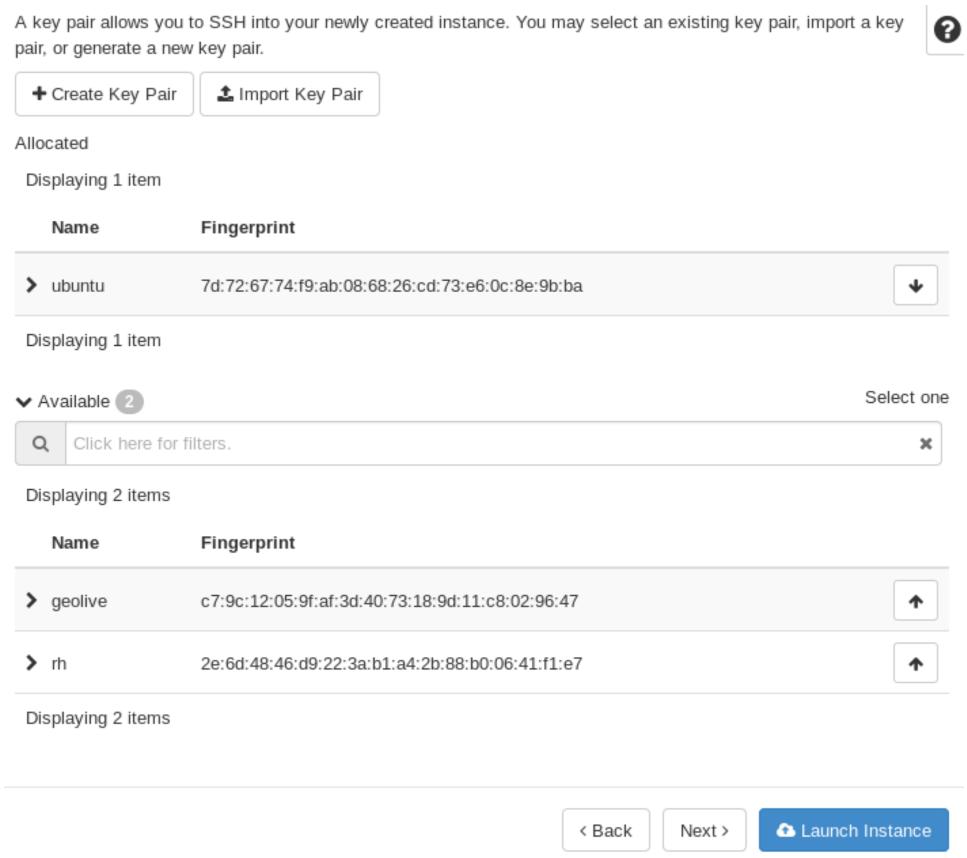
Allocated 2

Name	Description
default	Default security group
allow_ping_ssh_rdp	

Available 0

Name	Description
No available items	

Step 7: Choose or generate SSH keypair for your VM. Next, launch your instance by clicking on blue button.



A key pair allows you to SSH into your newly created instance. You may select an existing key pair, import a key pair, or generate a new key pair.

Allocated

Displaying 1 item

Name	Fingerprint
ubuntu	7d:72:67:74:f9:ab:08:68:26:cd:73:e6:0c:8e:9b:ba

Displaying 1 item

Available 2

Displaying 2 items

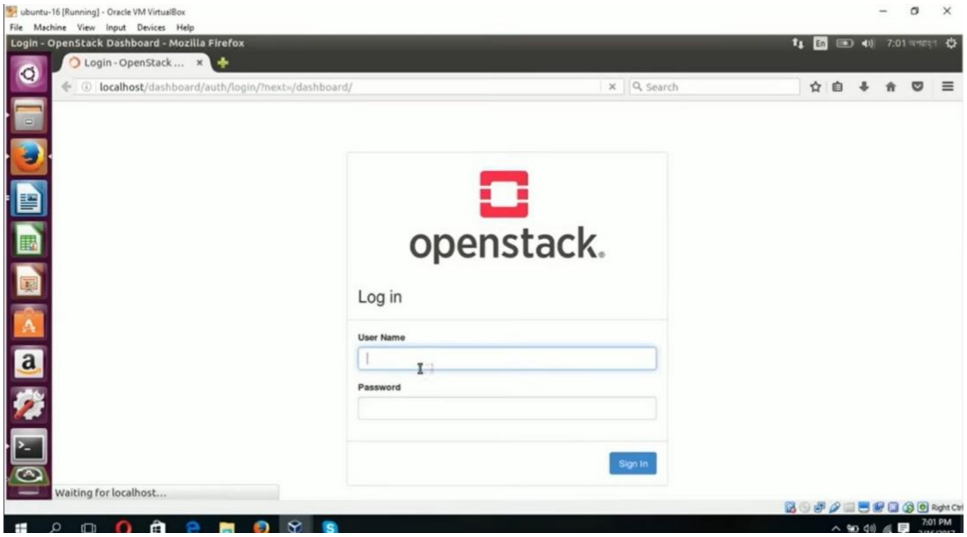
Name	Fingerprint
geolive	c7:9c:12:05:9f:af:3d:40:73:18:9d:11:c8:02:96:47
rh	2e:6d:48:46:d9:22:3a:b1:a4:2b:88:b0:06:41:f1:e7

Displaying 2 items

14. OpenStack Dashboard should be accessed through Web Browser. Verify the working of the instance by logging or pinging the instance.

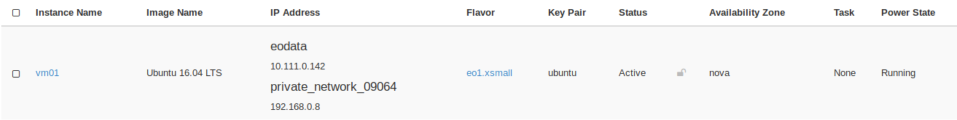
After Successful Installation Openstack Dashboard is accessible through Web browser.

We can access it by entering “localhost” into browser and Login with our saved Username & Password.


ubuntu-16 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Login - OpenStack Dashboard - Mozilla Firefox
Login - OpenStack ...
localhost/dashboard/auth/login/?next=/dashboard/
Search
openstack.
Log in
User Name
Password
Sign In
Waiting for localhost...
7:01 PM

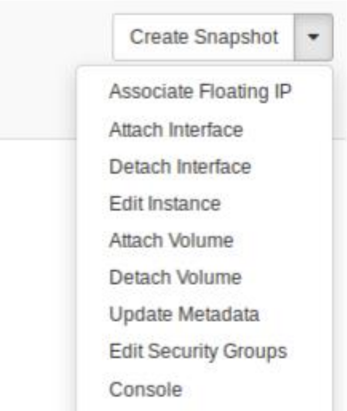
To verify the working of Instance :

Step 1: we can see "Instances" menu with our newly created VM.



□	Instance Name	Image Name	IP Address	Flavor	Key Pair	Status	Availability Zone	Task	Power State
□	vm01	Ubuntu 16.04 LTS	eodata 10.111.0.142 private_network_09064 192.168.0.8	eo1.xsmall	ubuntu	Active	nova	None	Running

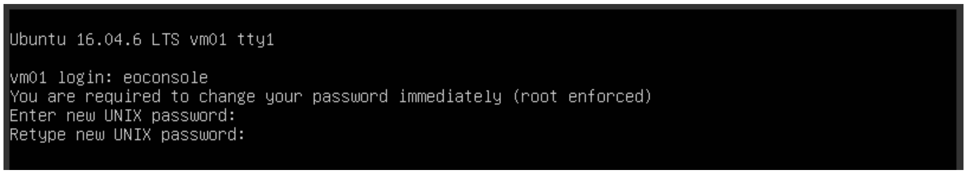
Step 2: Open the drop-down menu and choose "Console".



After opening Terminal

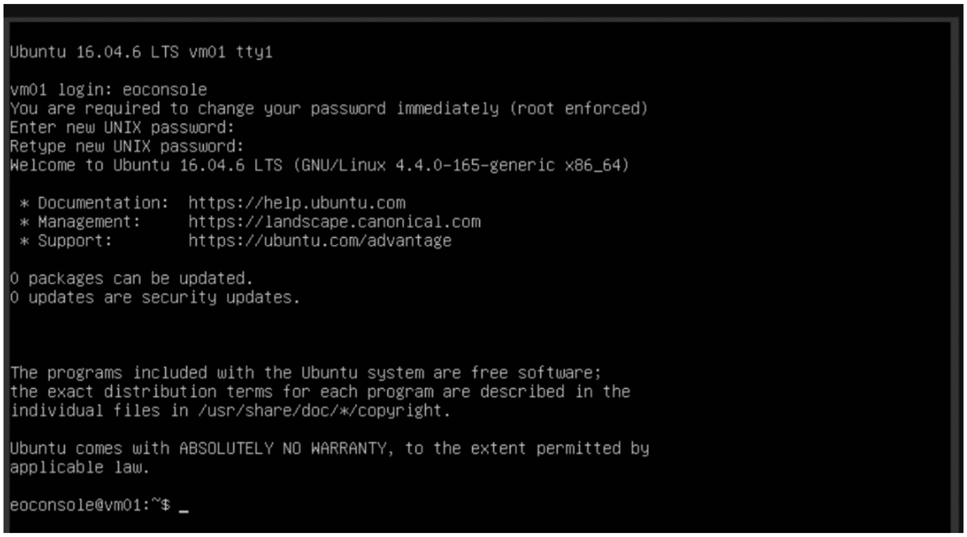
Run Command: eoconsole

Step 3: Now we Need to Configure Password.



```
Ubuntu 16.04.6 LTS vm01 tty1

vm01 login: eoconsole
You are required to change your password immediately (root enforced)
Enter new UNIX password:
Retype new UNIX password:
```

After Re-entering password, we can use commands, The instance is created Successfully.



```
Ubuntu 16.04.6 LTS vm01 tty1

vm01 login: eoconsole
You are required to change your password immediately (root enforced)
Enter new UNIX password:
Retype new UNIX password:
Welcome to Ubuntu 16.04.6 LTS (GNU/Linux 4.4.0-165-generic x86_64)

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

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



The programs included with the Ubuntu system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Ubuntu comes with ABSOLUTELY NO WARRANTY, to the extent permitted by
applicable law.

eoconsole@vm01:~$ _
```

After finishing we will enter “exit” command into terminal to close VM