

**Savitribai Phule Pune
University Faculty of
Information Technology**

314458: Laboratory Practice-II (Cloud Computing)

**IT (2019 Course)
Semester- VI**

Teaching Scheme		Examination Scheme	
Practical :	4 Hrs. / Week	Term work :	50 Marks
		Oral	25 Marks



LABORATORY MANUAL (Version 1.0)

ACADEMIC YEAR 2021-22

VISION

To provide excellent Information Technology education by building strong teaching and research environment.

MISSION

- 1) To transform the students into innovative, competent and high quality IT professionals to meet the growing global challenges.
- 2) To achieve and impart quality education with an emphasis on practical skills and social relevance.
- 3) To endeavor for continuous up-gradation of technical expertise of students to cater to the needs of the society.
- 4) To achieve an effective interaction with industry for mutual benefits.

PROGRAM EDUCATIONAL OBJECTIVES

The students of Information Technology course after passing out will

1. Graduates of the program will possess strong fundamental concepts in mathematics, science, engineering and Technology to address technological challenges with emerging trends.
2. Possess knowledge and skills in the field of Computer Science & Engineering and Information Technology for analyzing, designing and implementing multifaceted engineering problems of any domain with innovative and efficient approaches.
3. Acquire an attitude and aptitude for research, entrepreneurship and higher studies in the field of Computer Science & Engineering and Information Technology.
4. Learn commitment to ethical practices, societal contributions through communities and life-long intellect.
5. Attain better communication, presentation, time management and teamwork skills leading to responsible & competent professionals and will be able to address challenges in the field of IT at global level.

PROGRAM OUTCOMES

The students in the Information Technology course will attain:

- a. An ability to apply knowledge of computing, mathematics including discrete mathematics as well as probability and statistics, science, engineering and technology.
- b. An ability to define a problem and provide a systematic solution with the help of conducting experiments, as well as analyzing and interpreting the data.
- c. An ability to design, implement, and evaluate a software or a software/hardware co-system, component, or process to meet desired needs within realistic constraints.
- d. An ability to identify, formulate, and provide systematic solutions to complex engineering problems.
- e. An ability to use the techniques, skills, and modern engineering technologies tools, standard processes necessary for practice as an IT professional.
- f. An ability to apply mathematical foundations, algorithmic principles, and Information Technology theory in the modeling and design of computer-based systems with necessary constraints and assumptions.
- g. An ability to analyze the local and global impact of computing on individuals, organizations and society.
- h. An ability to understand professional, ethical, legal, security and social issues and responsibilities.
- i. An ability to function effectively as an individual or as a team member to accomplish a desired goal(s).
- j. An ability to engage in life-long learning and continuing professional development to cope up with fast changes in the technologies/tools with the help of electives, professional organizations and extra-curricular activities.
- k. An ability to communicate effectively in engineering community at large by means of effective presentations, report writing, paper publications, demonstrations.
- l. An ability to understand engineering, management, financial aspects, performance, optimizations and time complexity necessary for professional practice.
- m. An ability to apply design and development principles in the construction of software systems of varying complexity.

**Savitribai Phule Pune University,
Pune Third Year Information Technology (2019 Course)**

314458: Laboratory Practice-II (Cloud Computing)

Prerequisite Courses:

- Basics of Computer Networks
- Operating Systems

Course Objectives:

1. To develop web applications in cloud.
2. To learn the design and development process involved in creating a cloud based application.

Course Outcomes: On completion of the course, students will be able to—

CO1: To design and develop cloud-based applications.

CO2: To Simulate a cloud scenario using Cloud Sim.

CO3: To design and deploy web applications in cloud environment.

LIST OF ASSIGNMENTS

1. Install Google App Engine. Create hello world app and other simple web applications using python/java.
2. Use GAE launcher to launch the web applications.
3. Simulate a cloud scenario using Cloud Sim and run a scheduling algorithm that is not present in Cloud Sim.
4. Find a procedure to transfer the files from one virtual machine to another virtual machine.
5. Find a procedure to launch virtual machine using try stack (Online Open stack Demo Version)
6. Design and deploy a web application in a PaaS environment.
7. Design and develop custom Application (Mini Project) using Salesforce Cloud.
8. Design an Assignment to retrieve, verify, and store user credentials using Firebase Authentication, the Google App Engine standard environment, and Google Cloud Data store.

CASE STUDIES

- Data storage security in private cloud
- Application of IoT/Ubiquitous based on cloud
- Tools for building private cloud

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Lab Planning (Scheduling)

Sr. No	Title	No. of Hrs	Week
1	Install Google App Engine. Create hello world app and other simple web applications using python/java.		
2	Use GAE launcher to launch the web applications.		
3	Simulate a cloud scenario using Cloud Sim and run a scheduling algorithm that is not present in Cloud Sim.		
4	Find a procedure to transfer the files from one virtual machine to another virtual machine.		
5	Find a procedure to launch virtual machine using try stack (Online Open stack Demo Version)		
6	Design and deploy a web application in a PaaS environment.		
7	Design and develop custom Application (Mini Project) using Salesforce Cloud.		
8	Design an Assignment to retrieve, verify, and store user credentials using Firebase Authentication, the Google App Engine standard environment, and Google Cloud Data store.		
9	Case Study: Data storage security in private cloud		
10	Case Study: Application of IoT/Ubiquitous based on cloud		
11	Case Study: Tools for building private cloud		

Assignment No. 1

Date:

Title: Install Google App Engine. Create hello world app and other simple web applications using python/java.

Assignment No. 1

Aim: Install Google App Engine. Create hello world app and other simple web applications using python/java.

Objective:

- Installing Google App Engine.

Theory:

Install an SDK for App Engine

To set up your environment for developing on Python 3:

1. Install Python 3 by downloading it from the official site.
2. Install the python setup into your system.
3. Open CMD and type in python or python --version to check if it has been installed properly.
4. If the CMD is not recognizing the commands then check the system variables and set the path of python to the respective directory.

Creating your Google cloud account.

1. Create a google account.
2. Go to the Google Cloud Website '<https://cloud.google.com/appengine/>' and create the G Cloud account there.
3. On successful creation of the account download the python or Java SDK for G Cloud CLI from

For Python: <https://dl.google.com/dl/cloudsdk/channels/rapid/GoogleCloudSDKInstaller.exe>

4. Download the respective SDK and install it on the local machine.

Creating the first project on google cloud.

1. First, create a folder where you want to make the app.
2. Then first create an app.yaml file and type the following code in it.

```
application: your-app-identifier
version: 1
runtime: python3.10
api_version: 1
threadsafe: true
```

```
handlers:
- url: /*
  script: helloworld.app
```

3. Then create a helloworld.py file and type the following in it.

```
import webapp2
```

```
class MainPage(webapp2.RequestHandler):
    def get(self):
        self.response.headers['Content-Type'] = 'text/plain'
        self.response.write('Hello World!')

app = webapp2.WSGIApplication([
    ('/', MainPage),
], debug=True)
```

4. Once this is done you are ready with the app.

5. To test the code is working open CMD and type the following

```
python 'C:\Program Files (x86)\Google\google_appengine\dev_appserver.py'
\path\to\helloworld
```

This will start the app in a local environment.

6. Then go to <http://localhost:8080> to see the app print 'Hello World!'.

7. To deploy the app on the google cloud server type the following commands.

```
python 'C:\Program Files (x86)\Google\google_appengine\appcfg.py' update
\path\to\helloworld
```

This might ask for the Google Cloud credentials for uploading the app.

Note: The app when hosted on Google Cloud might charge for services on normal ID so do turn off the app after creating it and remove it from the cloud.

Output:

Successfully created the first app and hosted it on GCloud.

Conclusion:

We learned how to create the app and deploy it to Google Cloud.

FAQ:

Assignment No. 2

Aim: Use GAE launcher to launch the web applications.

Objective:

Creating and deploying an application on GAE

Theory:

Creating the first project on google cloud.

1. First, create a folder where you want to make the app.
2. Then first create an app.yaml file and type the following code in it.
3. Then create a the app that you want to upload on the Gcloud platform.
4. Once this is done you are ready with the app.
5. To test the code is working open CMD and type the following

```
python 'C:\Program Files (x86)\Google\google_appengine\dev_appserver.py'  
  \path\to\helloworld
```

This will start the app in a local environment.

6. Then go to <http://localhost:8080> to see the app print 'Hello World!'.
7. To deploy the app on the google cloud server type the following commands.

```
python 'C:\Program Files (x86)\Google\google_appengine\appcfg.py' update  
  \path\to\helloworld
```

This might ask for the Google Cloud credentials for uploading the app.

Note: The app when hosted on Google Cloud might charge for services on normal ID so do turn off the app after creating it and remove it from the cloud.

Output:

You successfully developed the app and hosted it on Gcloud platform.

Conclusion:

Learned how to host app on Gcloud platform.

FAQ:

Assignment No. 3

Aim: Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.

Objective:

- Install CloudSim on system.
- Run Scheduling algorithm that is not present in CloudSim.

Theory:

What is CloudSim?

CloudSim is an open-source framework, which is used to simulate cloud computing infrastructure and services. It is developed by the CLOUDS Lab organization and is written entirely in Java. It is used for modelling and simulating a cloud computing environment as a means for evaluating a hypothesis prior to software development in order to reproduce tests and results.

Benefits of Simulation over the Actual Deployment:

Following are the benefits of CloudSim:

- No capital investment involved. With a simulation tool like CloudSim there is no installation or maintenance cost.
- Easy to use and Scalable. You can change the requirements such as adding or deleting resources by changing just a few lines of code.
- Risks can be evaluated at an earlier stage. In Cloud Computing utilization of real testbeds limits the experiments to the scale of the testbed and makes the reproduction of results an extremely difficult undertaking. With simulation, you can test your product against test cases and resolve issues before actual deployment without any limitations.
- No need for try-and-error approaches. Instead of relying on theoretical and imprecise evaluations which can lead to inefficient service performance and revenue generation, you can test your services in a repeatable and controlled environment free of cost with CloudSim.

Pre-requisites:

- Knowledge of OOP and Java Collections.
- Basics of cloud computing.

Installation

1. Download CloudSim from the provided link.

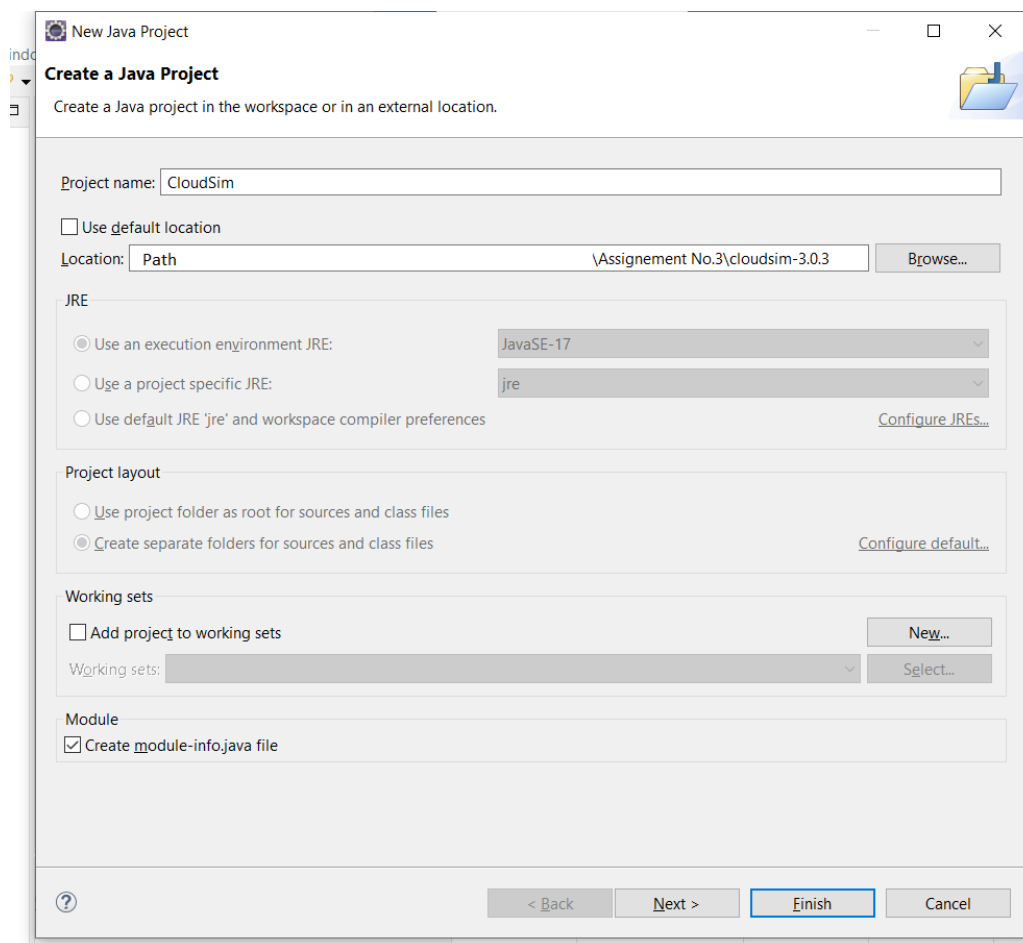
<https://github.com/Cloudslab/cloudsim/releases>

Download the common-math3 library binary zip file:

http://commons.apache.org/proper/commons-math/download_math.cgi

2. Extract the zip file. And also extract commons-math3.3-6 into the same folder.

3. Open Eclipse IDE and go to File->New->Java Project

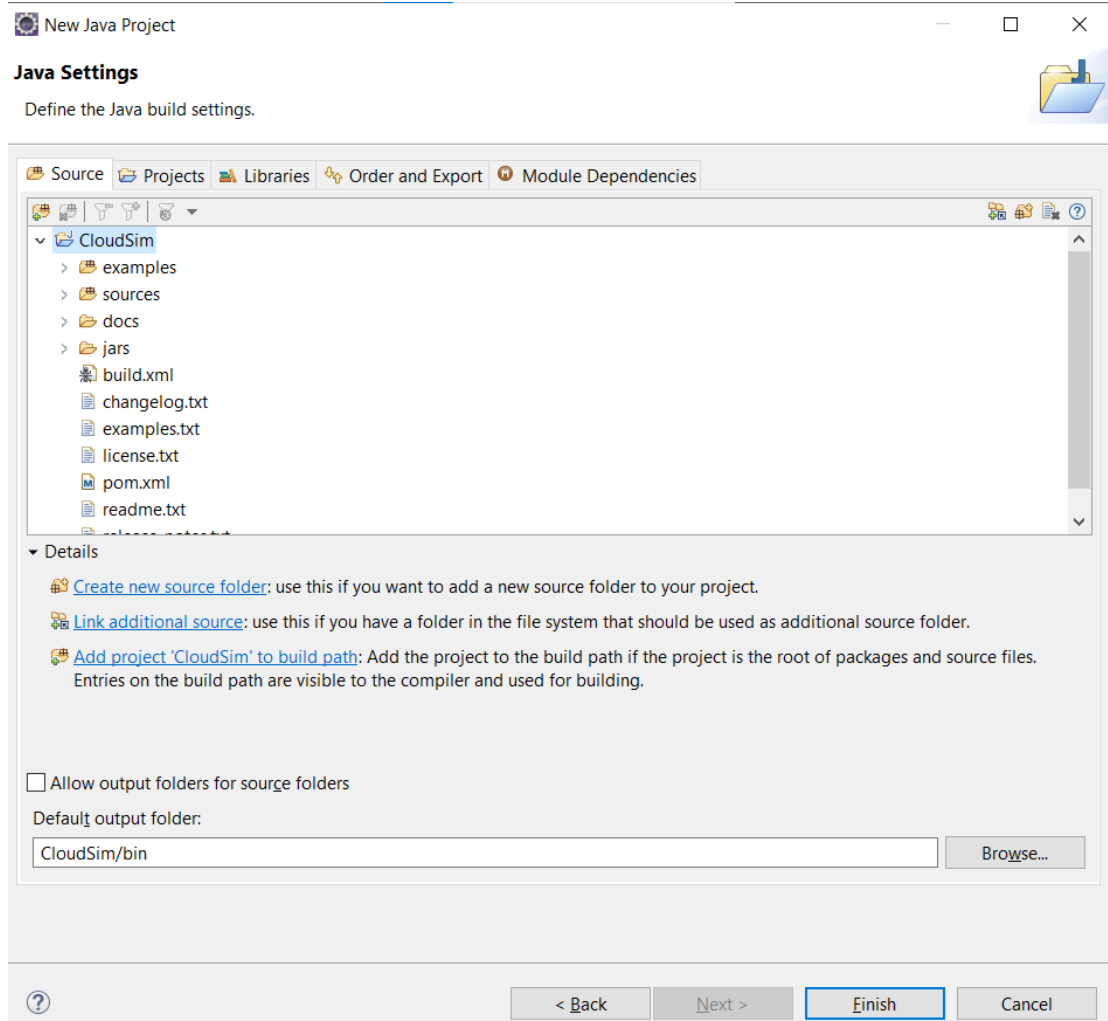


4. Enter the name of the project and then uncheck the use default locations box just under it and click on Browser.

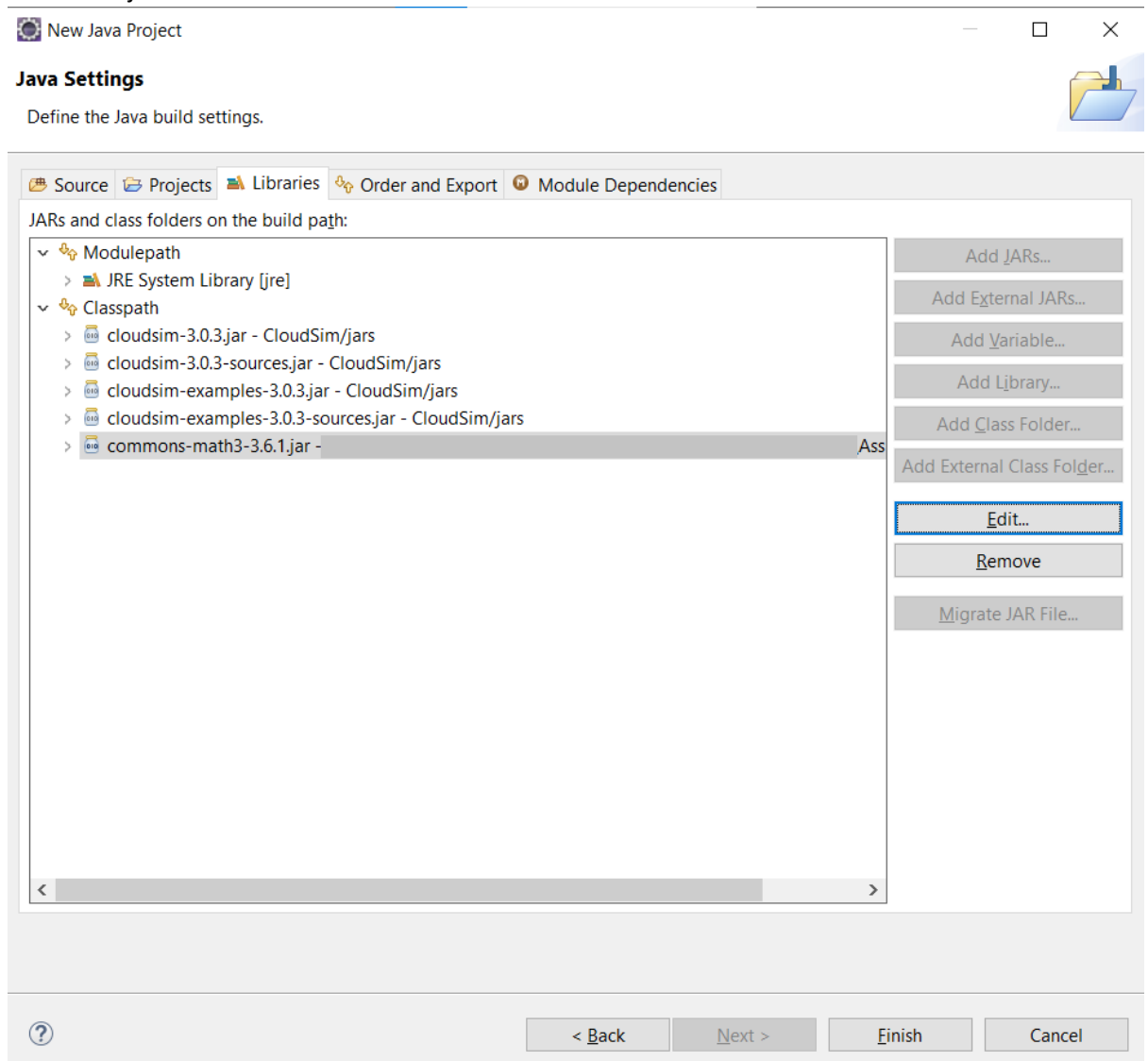
Browse to the folder where you extracted.

5. Click on "Next".

6. Open the libraries.



7. If you don't find commons.math3.3.x.jar, click on add external jar, and add the common-math3.3.x.jar file.



8. After that click on finish. It will take 2 to 3 minutes to configure. Now you can explore the project file.

Once the project as been opened in the eclipse, create a new java file where you can write the code for scheduling algorithm.

Once the algorithm has been developed. Create a file to implement the algorithm.

Run the implementation file, in the eclipse window.

Source Code: <https://github.com/suyash-more/Cloud-Computing-Projects/tree/master/Scheduling-Algorithm-in-CloudSim/src>

Execute file SJF_Scheduler.java

Output: The Scheduling algorithm was implemented in the CloudSim environment for managing the tasks.

```
Starting SJF Scheduler...
Initializing new Matrices...
Initialising...
Starting CloudSim version 3.0
Datacenter_0 is starting...
Datacenter_1 is starting...
Datacenter_2 is starting...
Datacenter_3 is starting...
Datacenter_4 is starting...
Broker_0 is starting...
Entities started.
0.0: Broker_0: Cloud Resource List received with 5 resource(s)
0.0: Broker_0: Trying to Create VM #2 in Datacenter_0
0.0: Broker_0: Trying to Create VM #3 in Datacenter_1
0.0: Broker_0: Trying to Create VM #4 in Datacenter_2
0.0: Broker_0: Trying to Create VM #5 in Datacenter_3
0.0: Broker_0: Trying to Create VM #6 in Datacenter_4
0.1: Broker_0: VM #2 has been created in Datacenter #2, Host #0
0.1: Broker_0: VM #3 has been created in Datacenter #3, Host #0
0.1: Broker_0: VM #4 has been created in Datacenter #4, Host #0
0.1: Broker_0: VM #5 has been created in Datacenter #5, Host #0
0.1: Broker_0: VM #6 has been created in Datacenter #6, Host #0
0.1: Broker_0: Sending cloudlet 0 to VM #5
0.1: Broker_0: Sending cloudlet 1 to VM #4
0.1: Broker_0: Sending cloudlet 2 to VM #3
0.1: Broker_0: Sending cloudlet 3 to VM #5
0.1: Broker_0: Sending cloudlet 4 to VM #4
0.1: Broker_0: Sending cloudlet 5 to VM #4
0.1: Broker_0: Sending cloudlet 6 to VM #3
0.1: Broker_0: Sending cloudlet 7 to VM #5
0.1: Broker_0: Sending cloudlet 8 to VM #3
0.1: Broker_0: Sending cloudlet 9 to VM #3
0.1: Broker_0: Sending cloudlet 10 to VM #4
0.1: Broker_0: Sending cloudlet 11 to VM #4
0.1: Broker_0: Sending cloudlet 12 to VM #4
0.1: Broker_0: Sending cloudlet 13 to VM #2
0.1: Broker_0: Sending cloudlet 14 to VM #3
0.1: Broker_0: Sending cloudlet 15 to VM #3
0.1: Broker_0: Sending cloudlet 16 to VM #2
0.1: Broker_0: Sending cloudlet 17 to VM #3
0.1: Broker_0: Sending cloudlet 18 to VM #5
0.1: Broker_0: Sending cloudlet 19 to VM #3
0.1: Broker_0: Sending cloudlet 20 to VM #2
0.1: Broker_0: Sending cloudlet 21 to VM #3
0.1: Broker_0: Sending cloudlet 22 to VM #3
0.1: Broker_0: Sending cloudlet 23 to VM #3
0.1: Broker_0: Sending cloudlet 24 to VM #6
0.1: Broker_0: Sending cloudlet 25 to VM #2
0.1: Broker_0: Sending cloudlet 26 to VM #2
0.1: Broker_0: Sending cloudlet 27 to VM #4
0.1: Broker_0: Sending cloudlet 28 to VM #6
0.1: Broker_0: Sending cloudlet 29 to VM #5
1110.964: Broker_0: Cloudlet 13 received
2185.4159999999997: Broker_0: Cloudlet 24 received
2230.7799999999997: Broker_0: Cloudlet 0 received
2630.228: Broker_0: Cloudlet 16 received
```


2631.0319999999997: Broker_0: Cloudlet 1 received
 3805.5319999999997: Broker_0: Cloudlet 2 received
 4558.224: Broker_0: Cloudlet 4 received
 5290.448: Broker_0: Cloudlet 28 received
 5443.424: Broker_0: Cloudlet 20 received
 5664.28: Broker_0: Cloudlet 3 received
 5818.4839999999995: Broker_0: Cloudlet 6 received
 5942.736: Broker_0: Cloudlet 5 received
 6761.9: Broker_0: Cloudlet 10 received
 7463.232: Broker_0: Cloudlet 7 received
 8127.948: Broker_0: Cloudlet 18 received
 8377.448: Broker_0: Cloudlet 25 received
 8612.552: Broker_0: Cloudlet 11 received
 9053.771999999999: Broker_0: Cloudlet 8 received
 10803.18: Broker_0: Cloudlet 29 received
 10924.9: Broker_0: Cloudlet 12 received
 11483.92: Broker_0: Cloudlet 26 received
 12474.599999999999: Broker_0: Cloudlet 9 received
 12856.235999999999: Broker_0: Cloudlet 27 received
 15993.463999999998: Broker_0: Cloudlet 14 received
 18118.568: Broker_0: Cloudlet 15 received
 20474.343999999997: Broker_0: Cloudlet 17 received
 23210.483999999997: Broker_0: Cloudlet 19 received
 25641.607999999997: Broker_0: Cloudlet 21 received
 26796.167999999998: Broker_0: Cloudlet 22 received
 29732.215999999997: Broker_0: Cloudlet 23 received
 29732.215999999997: Broker_0: All Cloudlets executed. Finishing...
 29732.215999999997: Broker_0: Destroying VM #2
 29732.215999999997: Broker_0: Destroying VM #3
 29732.215999999997: Broker_0: Destroying VM #4
 29732.215999999997: Broker_0: Destroying VM #5
 29732.215999999997: Broker_0: Destroying VM #6
 Broker_0 is shutting down...
 Simulation: No more future events
 CloudInformationService: Notify all CloudSim entities for shutting down.
 Datacenter_0 is shutting down...
 Datacenter_1 is shutting down...
 Datacenter_2 is shutting down...
 Datacenter_3 is shutting down...
 Datacenter_4 is shutting down...
 Broker_0 is shutting down...
 Simulation completed.
 Simulation completed.

===== OUTPUT =====

Cloudlet ID	STATUS	Data center ID	VM ID	Time	Start Time
Finish Time	Waiting Time				
13	SUCCESS	02	02	1110.86	00.1
1110.96	00				
24	SUCCESS	06	06	2185.32	00.1
2185.42	00				
00	SUCCESS	05	05	2230.68	00.1
2230.78	00				
16	SUCCESS	02	02	1519.26	1110.96
2630.23	1110.86				
01	SUCCESS	04	04	2630.93	00.1
2631.03	00				
02	SUCCESS	03	03	3805.43	00.1
3805.53	00				

04	SUCCESS	04	04	1927.19	2631.03
4558.22	2630.93				
28	SUCCESS	06	06	3105.03	2185.42
5290.45	2185.32				
20	SUCCESS	02	02	2813.2	2630.23
5443.42	2630.13				
03	SUCCESS	05	05	3433.5	2230.78
5664.28	2230.68				
06	SUCCESS	03	03	2012.95	3805.53
5818.48	3805.43				
05	SUCCESS	04	04	1384.51	4558.22
5942.74	4558.12				
10	SUCCESS	04	04	819.16	5942.74
6761.9	5942.64				
07	SUCCESS	05	05	1798.95	5664.28
7463.23	5664.18				
18	SUCCESS	05	05	664.72	7463.23
8127.95	7463.13				
25	SUCCESS	02	02	2934.02	5443.42
8377.45	5443.32				
11	SUCCESS	04	04	1850.65	6761.9
8612.55	6761.8				
08	SUCCESS	03	03	3235.29	5818.48
9053.77	5818.38				
29	SUCCESS	05	05	2675.23	8127.95
10803.18	8127.85				
12	SUCCESS	04	04	2312.35	8612.55
10924.9	8612.45				
26	SUCCESS	02	02	3106.47	8377.45
11483.92	8377.35				
09	SUCCESS	03	03	3420.83	9053.77
12474.6	9053.67				
27	SUCCESS	04	04	1931.34	10924.9
12856.24	10924.8				
14	SUCCESS	03	03	3518.86	12474.6
15993.46	12474.5				
15	SUCCESS	03	03	2125.1	15993.46
18118.57	15993.36				
17	SUCCESS	03	03	2355.78	18118.57
20474.34	18118.47				
19	SUCCESS	03	03	2736.14	20474.34
23210.48	20474.24				
21	SUCCESS	03	03	2431.12	23210.48
25641.61	23210.38				
22	SUCCESS	03	03	1154.56	25641.61
26796.17	25641.51				
23	SUCCESS	03	03	2936.05	26796.17
29732.22	26796.07				

Makespan using SJF: 6694.725373488874

org.cloudbus.cloudsim.schedulingalgo.SJF_Scheduler finished!

Conclusion: We successfully installed and implemented the Scheduling algorithm that was not in the CloudSim environment.

Assignmnet No. 4

Aim: Find a procedure to transfer the files from one virtual machine to another virtual machine.

Theory:

SCP

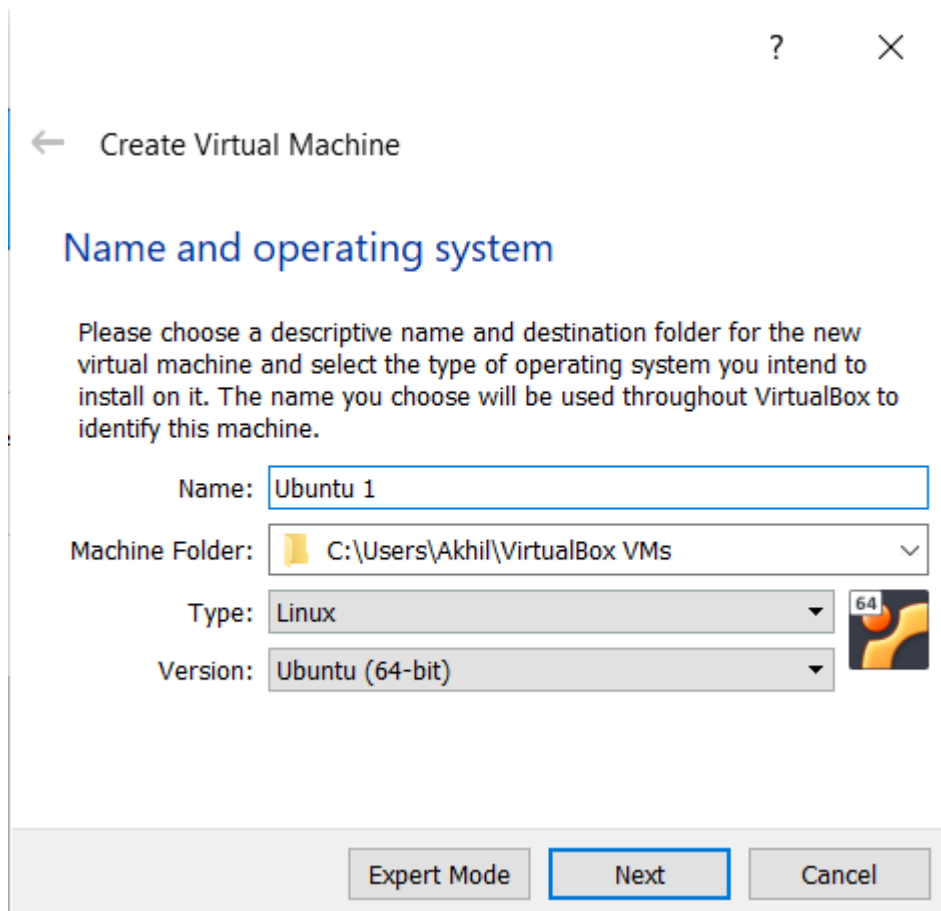
scp (secure copy) command in Linux system is used to copy file(s) between servers in a secure way. The SCP command or secure copy allows secure transferring of files in between the local host and the remote host or between two remote hosts. It uses the same authentication and security as it is used in the Secure Shell (SSH) protocol. SCP is known for its simplicity, security and pre-installed availability.

Syntax

```
scp [-346BCpqrTv] [-c cipher] [-F ssh_config] [-i identity_file] [-l limit] [-o ssh_option] [-P port] [-S program] [[user@]host1:]file1 ... [[user@]host2:]file2
```

Steps to transfer the files between two files

1. Install the virtualbox on our computer.
2. Download the ubuntu setup and install it or use Virtual Disk Image of the desired ubuntu.
3. Open the virtual box. Create a new machine.



4. Add the basic details and click next.

5. Then if you are installing the ubuntu, create a new virtual hard disk. Otherwise, use the Virtual disk image as the hard disk for the virtual machine.

? X

← Create Virtual Machine

Hard disk

If you wish you can add a virtual hard disk to the new machine. You can either create a new hard disk file or select one from the list or from another location using the folder icon.

If you need a more complex storage set-up you can skip this step and make the changes to the machine settings once the machine is created.

The recommended size of the hard disk is **10.00 GB**.

- ☐ Do not add a virtual hard disk
- ☒ Create a virtual hard disk now
- ☐ Use an existing virtual hard disk file

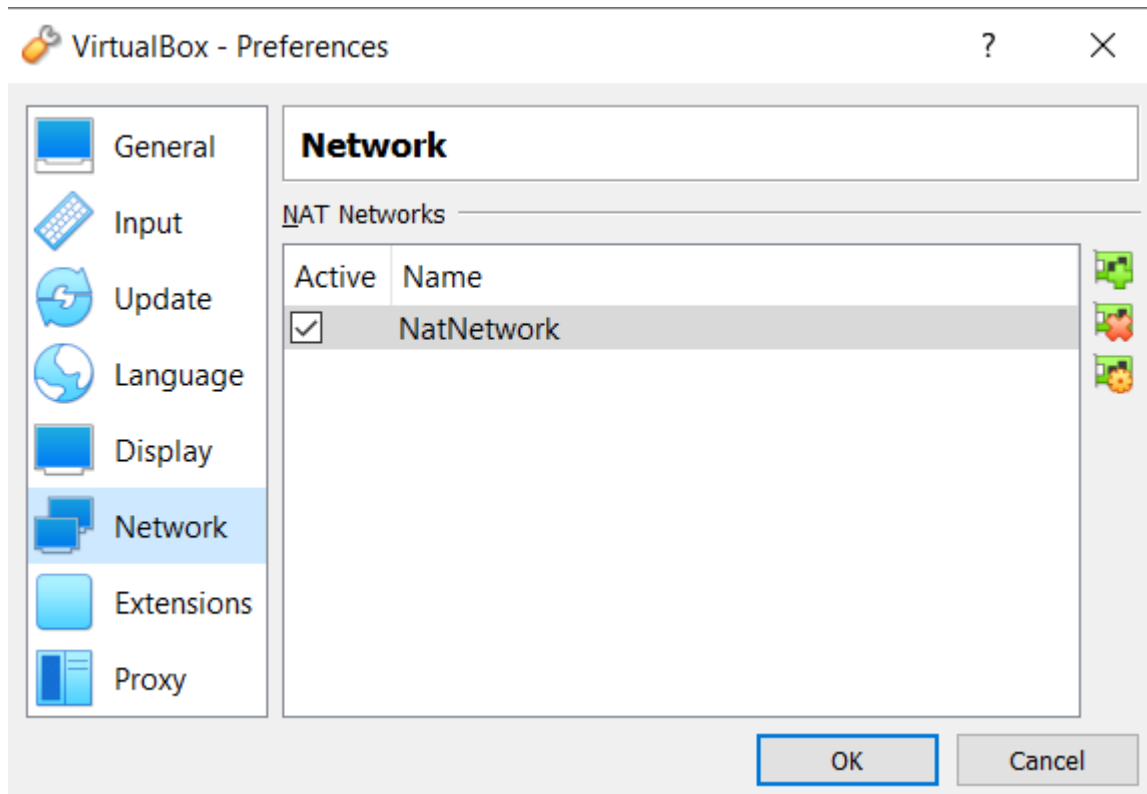
ubuntu 2.vdi (Normal, 10.00 GB)



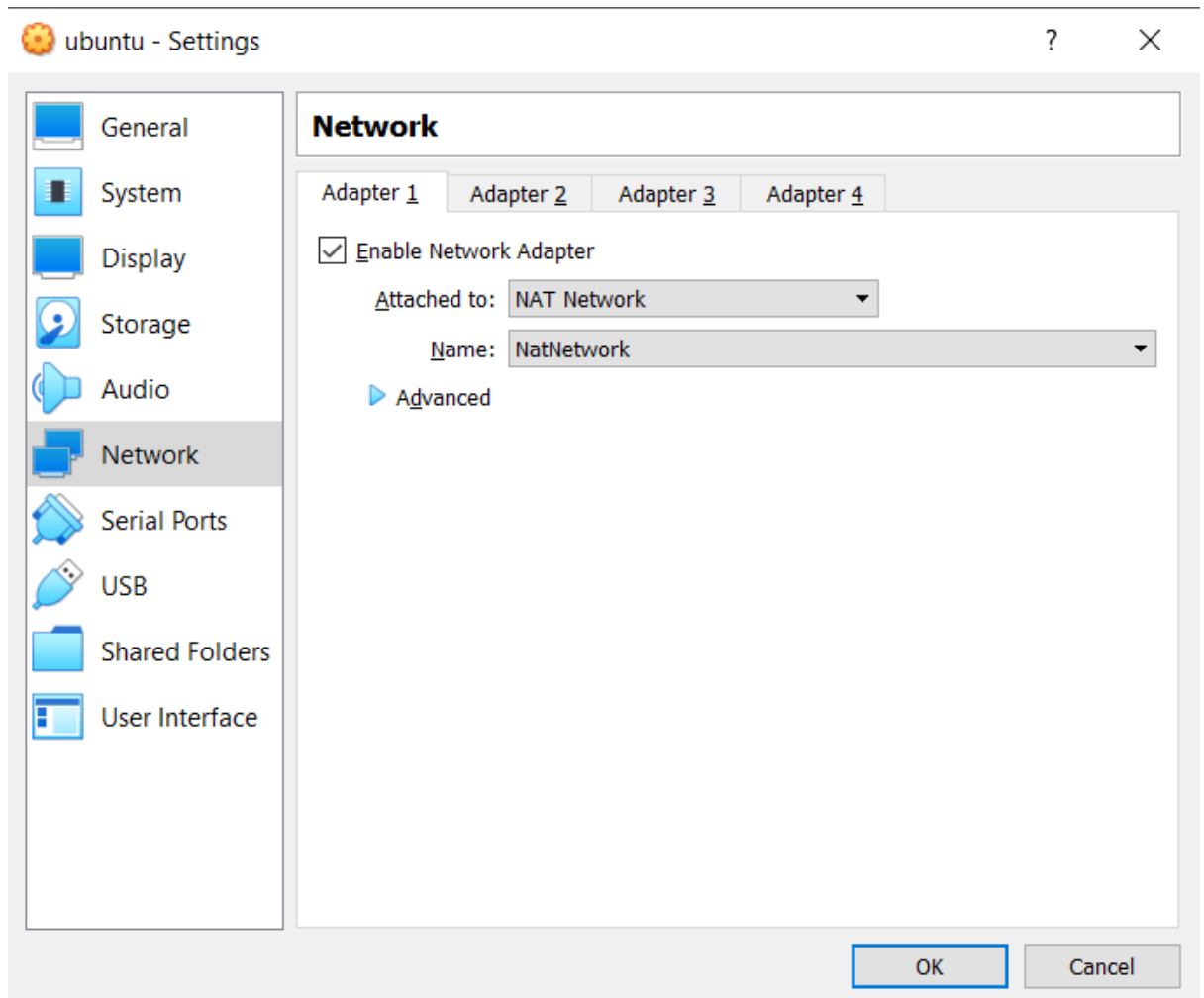
Create

Cancel

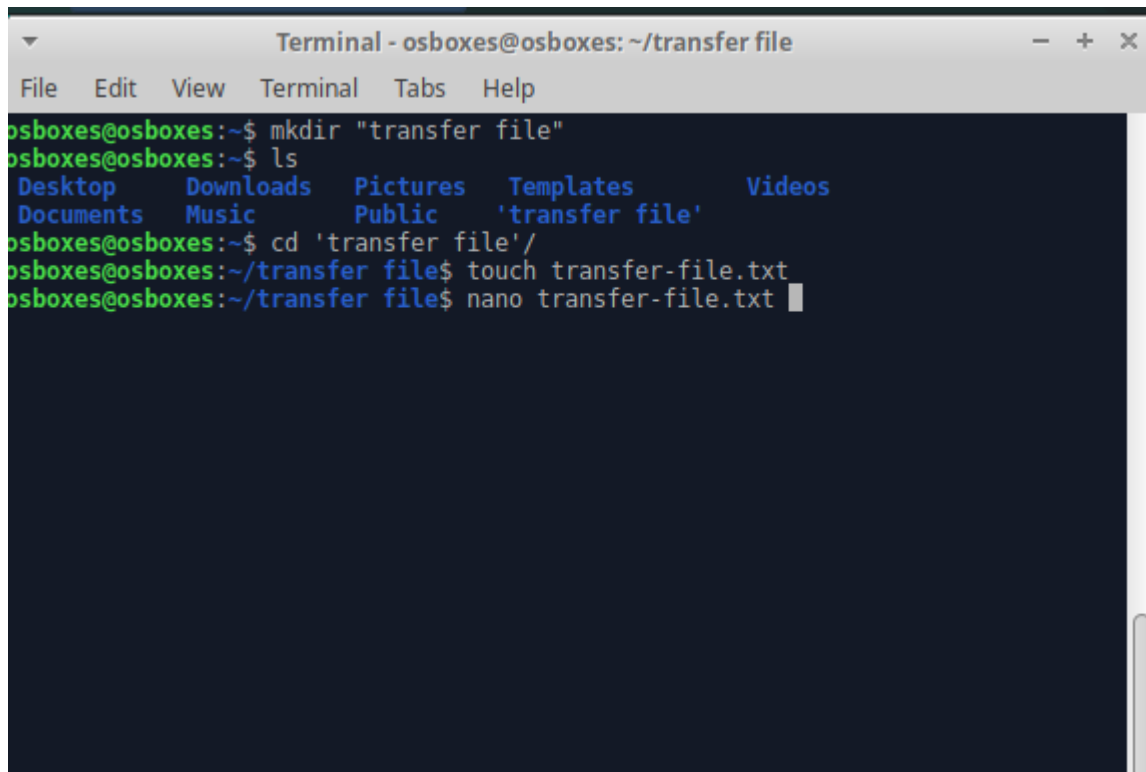
6. Do the same for the second virtual machine too.
7. Go to file, preferences, and then to network. Then add new network.



8. After that click on the virtual machine, go to settings, then network, and enable the network adapter and attach to NAT network.



9. Now do the same network setting for the second machine too.
10. Now start the virtual machines. Open the terminals.
11. Now change the directory using mkdir to a desired location where you want to create the new file.
12. Then to create a file type the following:
`touch filename.txt`

A terminal window titled "Terminal - osboxes@osboxes: ~/transfer file" with a menu bar (File, Edit, View, Terminal, Tabs, Help). The terminal shows the following commands and output:

```
osboxes@osboxes:~$ mkdir "transfer file"
osboxes@osboxes:~$ ls
Desktop    Downloads  Pictures   Templates  Videos
Documents  Music      Public     'transfer file'
osboxes@osboxes:~$ cd 'transfer file'/
osboxes@osboxes:~/transfer file$ touch transfer-file.txt
osboxes@osboxes:~/transfer file$ nano transfer-file.txt
```

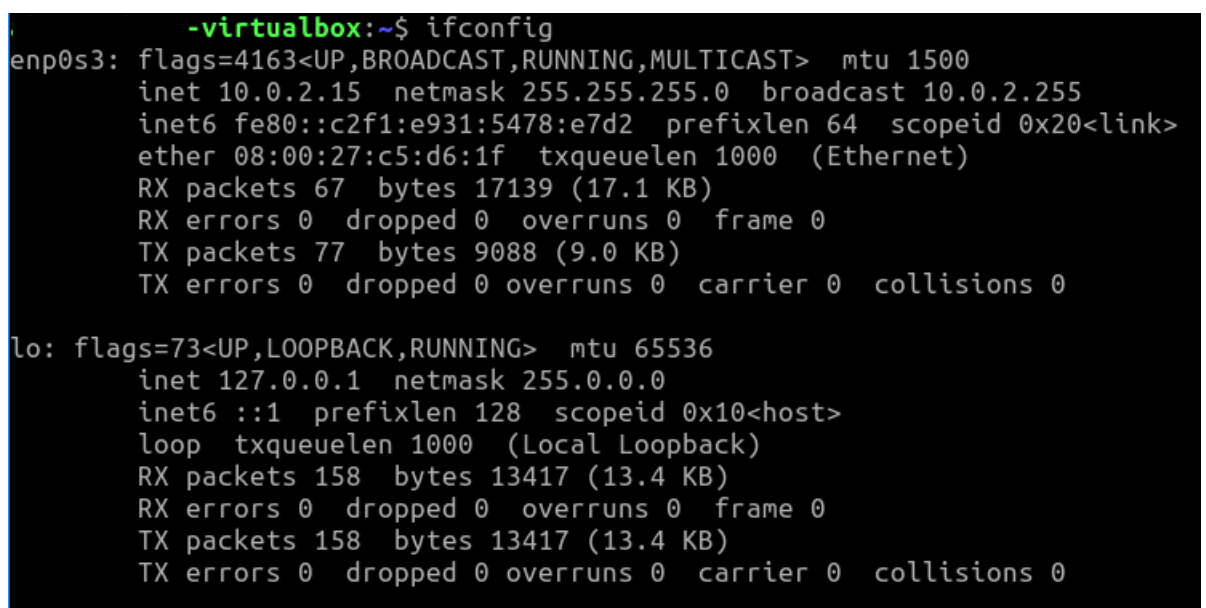
13. Add some data into the file. Then to check if its added properly type the following command.

`cat filename.txt`

14. Now to transfer the file first of all we need to identify the ip address of the virtual machine to which we want to transfer it. To find it type the `ifconfig` command. Note the we also need to get the name of the user to whom we want to transfer the files.

15. Incase if the `ifconfig` is not installed on your virtual machine install it by the following command.

`sudo apt-get install net-tools`

A terminal window titled "-virtualbox:~\$ ifconfig" showing the output of the ifconfig command for two network interfaces:

```
-virtualbox:~$ ifconfig
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
    inet 10.0.2.15  netmask 255.255.255.0  broadcast 10.0.2.255
    inet6 fe80::c2f1:e931:5478:e7d2  prefixlen 64  scopeid 0x20<link>
    ether 08:00:27:c5:d6:1f  txqueuelen 1000  (Ethernet)
    RX packets 67  bytes 17139 (17.1 KB)
    RX errors 0  dropped 0  overruns 0  frame 0
    TX packets 77  bytes 9088 (9.0 KB)
    TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
    inet 127.0.0.1  netmask 255.0.0.0
    inet6 ::1  prefixlen 128  scopeid 0x10<host>
    loop txqueuelen 1000  (Local Loopback)
    RX packets 158  bytes 13417 (13.4 KB)
    RX errors 0  dropped 0  overruns 0  frame 0
    TX packets 158  bytes 13417 (13.4 KB)
    TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

16. In case if facing any issues type the following commands on terminal of both machines

```
sudo apt-get update
```

```
sudo apt-get install openssh-server
```

```
sudo sfw allow 22
```

17. Type the following on the terminal of the virtual machine from where you want to transfer the file.

```
scp filename.txt username@10.0.2.15:/home/username/
```

```
lost connection
osboxes@osboxes:~/transfer file$ scp transfer-file.txt akhil@10.0.2.15:/home/akh
il/
akhil@10.0.2.15's password:
Permission denied, please try again.
akhil@10.0.2.15's password:
transfer-file.txt                                100% 13    0.3KB/s   00:00
```

18. To check if the file has been successfully transferred, change to the directory, and type ls command.

```
akhil@akhil-virtualbox:~$ ls
Desktop  Downloads  Pictures  Templates  transfer-file.txt
Documents Music      Public    transfered-file  Videos
```

```
akhil@akhil-virtualbox:~$ cat transfer-file.txt
Hello There!
akhil@akhil-virtualbox:~$
```

Conclusion: We learnt how to transfer files from one virtual machine to another.

Assignment No. 5

Aim: Find a procedure to launch a virtual machine using trystack (Online Openstack Demo Version)

Theory:

Virtual Machines: VM is no different than any other physical computer like a laptop, smartphone or server. It has a CPU, memory, and disks by which you can store your files and can connect to the internet if needed. In the VM world Operating System running on your computer is called a host and any operating system running inside VMs is called a guest.

Advantages of VMs:

- Cost Saving
- Speed
- Lowered downtime
- Secure Environment
- Access Remotely

TryStack: TryStack is a free and easy way for users to try OpenStack, and setup their cloud with networking, storage and computer instances.

Requirements: Account on AWS/ Google Cloud/ Azure

Steps:

Step1:- Create a virtual machine.

1. Enter *virtual machines* in the search.
2. Under **Services**, select **Virtual machines**.
3. In the **Virtual machines** page, select **Create** and then **Virtual machine**. The **Create a virtual machine** page opens.
4. In the **Basics** tab, under **Project details**, make sure the correct subscription is selected and then choose to **Create a new** resource group. Enter *myResourceGroup* for the name.

Project details

Select the subscription to manage deployed resources and costs. Use resource groups like folders to organize and manage all your resources.

Subscription * ⓘ

Pay-As-You-Go

Resource group * ⓘ

(New) myResourceGroup

Create new

5. Under **Instance details**, enter *VM name* for the **Virtual machine name** and choose *Windows Server 2019 Datacenter - Gen2* for the **Image**. Leave the other defaults.


Instance details

Virtual machine name * ⓘ	<input type="text" value="myVM"/>	✓
Region * ⓘ	<input type="text" value="(US) East US"/>	▼
Availability options ⓘ	<input type="text" value="No infrastructure redundancy required"/>	▼
Security type ⓘ	<input type="text" value="Standard"/>	▼
Image * ⓘ	<input type="text" value="Windows Server 2019 Datacenter - Gen2"/>	▼
	See all images Configure VM generation	
Size * ⓘ	<input type="text" value="Standard_E2s_v3 - 2 vcpus, 16 GiB memory (\$27.67/month)"/>	▼
	See all sizes	

- Under the **Administrator account**, select a password, and provide a username, such as *azureuser*, and a password. The password must be at least 12 characters long and meet the defined complexity requirements.

Administrator account		
Username * ⓘ	<input type="text" value="azureuser"/>	✓
Password * ⓘ	<input type="password" value="....."/>	✓
Confirm password * ⓘ	<input type="password" value="....."/>	✓

- Under **Inbound port rules**, choose **Allow selected ports** and then select **RDP (3389)** and **HTTP (80)** from the drop-down.

Inbound port rules	
Select which virtual machine network ports are accessible from the public internet. You can specify more limited or granular network access on the Networking tab.	
Public inbound ports * ⓘ	<input type="radio"/> None <input checked="" type="radio"/> Allow selected ports
Select inbound ports *	<input type="text" value="HTTP (80), RDP (3389)"/>
<div> This will allow all IP addresses to access your virtual machine. This is only recommended for testing. Use the Advanced controls in the Networking tab to create rules to limit inbound traffic to known IP addresses.</div>	

- Leave the remaining defaults and then select the **Review + create** button at the bottom of the page.

Licensing

Save up to 49% with a license you already own using Azure Hybrid Benefit. [Learn more](#)

Would you like to use an existing ☐ Windows Server license? * ⓘ

[Review Azure hybrid benefit compliance](#)

Review + create

< Previous

Next : Disks >

- After validation runs, select the **Create** button at the bottom of the page.
- After deployment is complete, select **Go to resource**.

Next steps

[Setup auto-shutdown](#) Recommended

[Monitor VM health, performance and network dependencies](#) Recommended

[Run a script inside the virtual machine](#) Recommended

Go to resource

Create another VM

Step 2:- Connect to a virtual machine

- On the overview page for your virtual machine, select the **Connect > RDP**.

Home > myVM

myVM

Virtual machine

Search (Ctrl+J)

Connect

Start

Restart

Stop

Capture

Delete

Refresh

Overview

Activity log

Resource group [\(change\)](#) : myResourceGroup

Status : Running

Location : East US

- In the **Connect with RDP** page, keep the default options to connect by IP address, over port 3389, and click **Download RDP file**.
- Open the downloaded RDP file and click **Connect** when prompted.
- In the **Windows Security** window, select **More choices** and then **Use a different account**. Type the username as **localhost\username**, enter the password you created for the virtual machine, and then click **OK**.
- You may receive a certificate warning during the sign-in process. Click **Yes** or **Continue** to create the connection.

Conclusion: Hence we have learned the procedure to launch a virtual machine using trystack.

Assignment No. 6

Aim: Design and deploy a web application in a PaaS environment.

Objective:

- Create simple nodejs app
- Push code to GitHub
- Deploy to Heroku

Theory:

STEP 1: Create simple nodejs app

Create a folder on your local machine and give it a name (of your choice), say MyCoolApp.

Add a file with the name package.json and paste the below content. This file is basic information of our package. (This can also be created by typing command npm init and accepting all default settings.)

```
{
  "name": "coolnodeapp",
  "version": "1.0.0",
  "description": "node app ",
  "main": "app.js",
  "scripts": {
    "start": "node app.js"
  },
  "repository": {
    "type": "git",
    "url": ""
  },
  "author": "",
  "license": "ISC",
  "bugs": {
    "url": ""
  },
  "homepage": ""
}
```

package.json

Add a file, app.js, and paste the below code. This will be the starting point of our app.

```
Const http = require('http');
const port = process.env.PORT || 3000

const server = http.createServer((req, res) => {
  res.statusCode = 200;
  res.setHeader('Content-Type', 'text/html');
  res.end('<h1>Hello World</h1>');
});

server.listen(port, () => {
  console.log(`Server running at port `+port);
});
```

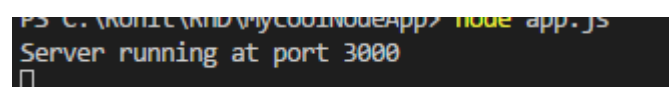
app.js

This code is basically opening a port on the local server and serving some HTML.

Save the file and run the below command in the command prompt window (which is open inside the folder):

```
node app.js
```

With this, Node will start the server and show the below message:



```
PS C:\Kohit\KMD\MyCode\nodeapp> node app.js
Server running at port 3000
□
```

Now, if we open <http://localhost:3000/> in the browser, we will see this:



STEP 2: Push to GitHub

Now want to upload our code to GitHub. This way, we will be able to edit our code from anywhere and also deploy the committed changes to the cloud instantly.

Let's create a Repository on [GitHub](#) by clicking New Repository.


Give it a name, some description, and click Create repository:

Create a new repository

A repository contains all the files for your project, including the revision history.

Owner

Repository name

 rramname

 /

MyCoolNodeApp

Great repository names are short and memorable. Need inspiration? How about [vigilant-octo-eureka](#).

Description (optional)

☒ Public

Anyone can see this repository. You choose who can commit.

☐ Private


You choose who can see and commit to this repository.

☐ Initialize this repository with a README

This will let you immediately clone the repository to your computer. Skip this step if you're importing an existing repository.

Add .gitignore: None

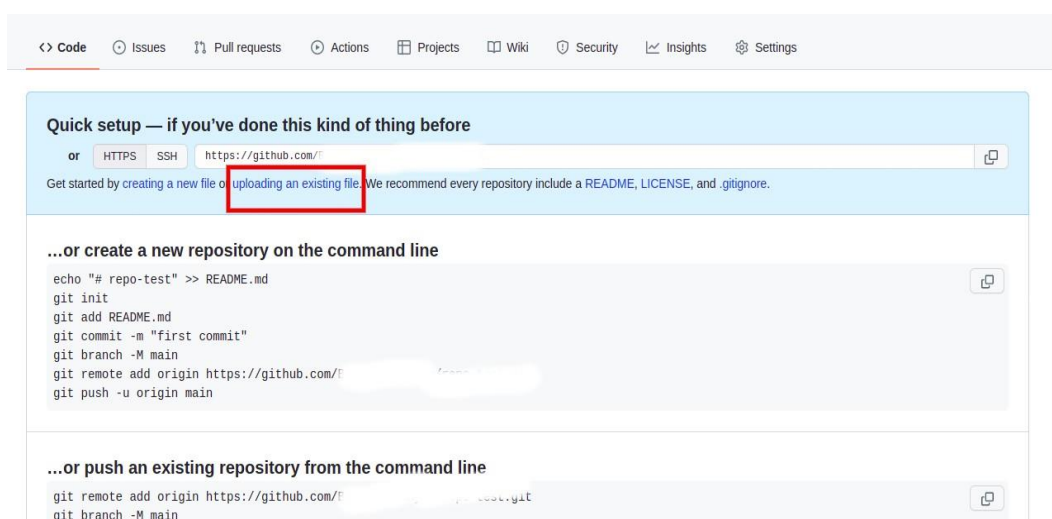
Add a license: None



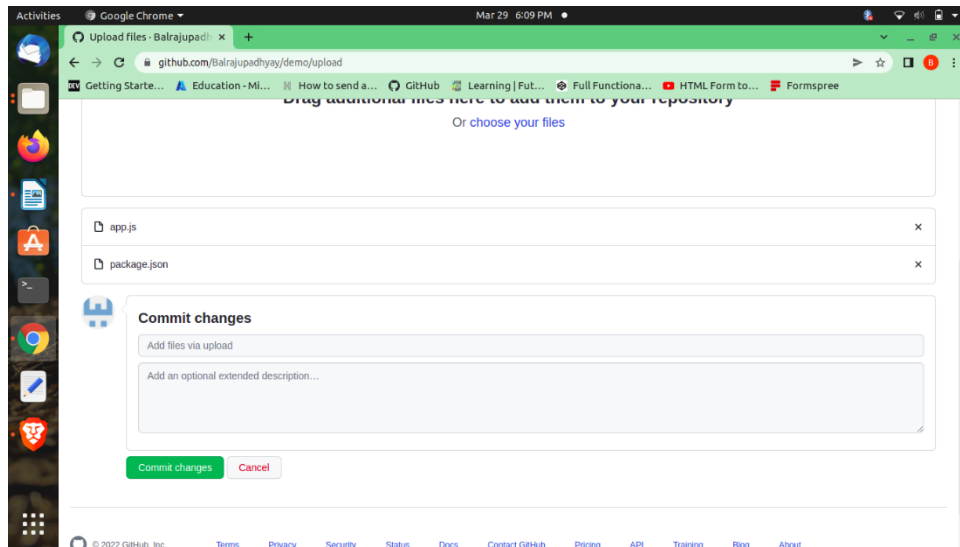
Create repository

GitHub will create a repository and give you some commands that you can run locally so that you can clone your local folder with your GitHub repository.

Now choose “**upload an existing file**” as shown in figure below :



Drag and drop your previous created file i.e package.json & app.js




And click on **commit changes** .


STEP 3: Deploy to Heroku

If you don't have an account with Heroku, you can open a free one by filling out this [simple form](#).


Sign up for free and experience Heroku today

 **Free account**

Create apps, connect databases and add-on services, and collaborate on your apps, for free.

 **Your app platform**

A platform for apps, with app management & instant scaling, for development and production.

 **Deploy now**

Go from code to running app in minutes. Deploy, scale, and deliver your app to the world.

First name *

Last name *


Email address *

Company name

Role *

Country *

Primary development language *

☐ I'm not a robot 

[Privacy](#) [Terms](#)

CREATE FREE ACCOUNT

Once you have your account ready, login with your credentials.

Click New on the top right corner and select “Create new app”.

Give your app a name (This will be included in the public URL for your application) and click Create app.

This step will take you to the dashboard of your app. Open Deploy tab and scroll to the “Deployment method” section.

Select GitHub as the method.

It will show a “Connect to GitHub” option where we can provide our GitHub repository. If you are doing it for the first time, Heroku will ask permission to

access your GitHub account.

Here, you can search for your GitHub repository and click connect:

Deployment method

Heroku Git Use Heroku CLI | GitHub Connect to GitHub | Container Registry Use Heroku CLI

Connect to GitHub

Connect this app to GitHub to enable code diffs and deploys.

Search for a repository to connect to

ramname MyCoolNodeApp Search

Missing a GitHub organization? [Ensure Heroku Dashboard has team access](#)

ramname/MyCoolNodeApp Connect

Click “ **Enable Automatic Deploys** “. You can also select the GitHub branch if you need to, but for this demo we will deploy from the master branch.

Automatic deploys

Enables a chosen branch to be automatically deployed to this app.

Enable automatic deploys from GitHub

Every push to the branch you specify here will deploy a new version of this app. **Deploys happen automatically**; be sure that this branch is always in a deployable state and any tests have passed before you push. [Learn more](#).

master

☐ Wait for CI to pass before deploy

Only enable this option if you have a Continuous Integration service configured on your repo.

Enable Automatic Deploys

Manual deploy

Deploy the current state of a branch to this app.

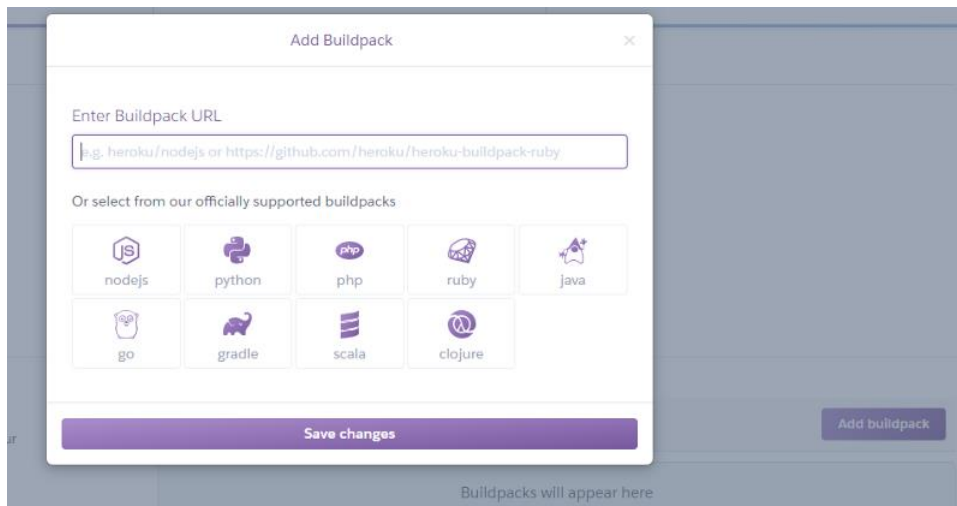
Deploy a GitHub branch

This will deploy the current state of the branch you specify below. [Learn more](#).

master **Deploy Branch**

Now we need to tell Heroku that our app is a NodeJs app. For that, we will need the NodeJs build back.

Open the Settings tab and locate Buildpacks and click “**Add buildpack**”.



Select **nodejs** from the options and click Save changes.

Now, go back to the Deploy tab, and click **Deploy Branch** at the bottom.

Heroku will take the code and host it. Open the Activity tab and there you can see the progress:



Open the **settings** tab and scroll down to the **Domains and certificates** section. Here, you can see the URL of your app that was just deployed. Copy and paste that URL in the browser.

Output: We just created our own web application that can be accessed over the internet .

Conclusion: Learned how to host our own web application in a PaaS environment.

FAQ:

