

Savitribai Phule Pune University, Pune

Third Year Information Technology (2019 Course)

314458: Laboratory Practice-II (Cloud Computing)



Department Vision and Mission

Vision

“The department endeavors to be recognized globally as a center of academic excellence & research in Information Technology.”

Mission

“To inculcate research culture among students by imparting information technology related fundamental knowledge, recent technology trends and ethics to get recognized as globally acceptable and socially responsible professionals.”

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314458: Laboratory Practice-II (Cloud Computing)

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical (PR): 04 hrs/week	02 Credit	PR :25 Marks TW : 50Marks

Prerequisites:

- 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 CloudSim.

CO3: To design and deploy web applications in cloud environment

List of Laboratory 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 CloudSim and run a scheduling algorithm that is not present in CloudSim.
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 trystack (Online Openstack 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/Ubiqitous based on cloud
- Tools for building private cloud

Text Books:

1. Thomas Erl, Zaigham Mahmood and Ricardo Puttini, Cloud Computing: Concepts, Technology & Architecture, Pearson, ISBN :978 9332535923, 9332535922, 1 st Edition

2. Anthony T. Velte Toby J. Velte, Robert Elsenpeter, "Cloud Computing: A Practical Approach",

Reference Books:

1. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiS elvi, Mastering Cloud Computing: Foundations and Applications Programming, McGraw Hill, ISBN: 978 1259029950, 1259029956.
2. Gautam Shrof, "ENTERPRISE CLOUD COMPUTING Technology Architecture, Applications, Cambridge University Press, ISBN: 9780511778476
3. Srinivasan, J. Suresh, Cloud Computing: A practical approach for learning and implementation, Pearson, ISBN :9788131776513.
4. Jack J. Dongarra, Kai Hwang, Geoffrey C. Fox, Distributed and Cloud Computing: From Parallel Processing to the Internet of Things, Elsevier, ISBN :9789381269237, 9381269238, 1st Edition.
5. Brian J.S. Chee and Curtis Franklin, Jr., Cloud Computing: Technologies and Strategies of the Ubiquitous Data Center, CRC Press, ISBN :9781439806128.
6. Kris Jamsa, Cloud Computing: Saas, Paas, Iaas, Virtualization, Business Models, Mobile, Security, and More, Jones and Bartlett, ISBN :9789380853772.
7. John W. Ritting house, James F. Ransome, Cloud Computing Implementation, Management, and Security, CRC Press, ISBN : 978 1439806807, 1439806802.
8. Karl Matthias, Sean P. Kane, Docker: Up and Running, O'Reilly, ISBN:9781491917572,1491917571.
9. Barrie Sosinsky, Cloud Computing Bible, Wiley, ISBN: 978 8126529803.
10. Ronald L. Krutz and Russell D. Vines, Cloud Security: A Comprehensive guide to Secure Cloud Computing, Wiley, ISBN: 9788126528097.
11. Scott Adkins, John Belamaric, Vincent Giersch, Denys Makogon, Jason E. Robinson, OpenStack: Cloud Application Development, Wrox, ISBN :9781119194316.
12. Kailash Jayaswal, Jagannath Kallakurchi, Donald J. Houde, Cloud Computing Black Book ,Wiley Dreamtech,ISBN:9789351194187

Assignment 1

Title

Install Google App Engine. Create hello world app and other simple web applications using Python/Java.

Requirements

1. Google App Engine
2. Python Interpreter (Python2.7.x)
3. Text Editor
4. Browser

Theory

A) Google App Engine

1. Google App Engine (GAE) is a platform-as-a-service product that provides web app developers and enterprises with access to Google's scalable hosting and tier 1 internet service.
2. GAE requires that applications be written in Java or Python, store data in Google Bigtable and use the Google query language.
3. Noncompliant applications require modification to use GAE.
4. GAE provides more infrastructure than other scalable hosting services, such as Amazon Elastic Compute Cloud (EC2).
5. GAE also eliminates some system administration and development tasks to make writing scalable applications easier.
6. Google provides GAE free up to a certain amount of use for resources like CPU, storage, API calls and concurrent requests

B) Google Cloud SDK

1. Google Cloud SDK (Software Development Kit), in simple terms, is a set of tools that are used to manage applications and resources that are hosted on the Google Cloud Platform.
2. It is composed of the gsutil, gcloud, and bq command line tools.
3. The gcloud tool is automatically downloaded with the Cloud SDK.

4. Google Cloud SDK runs on specific platforms – Windows, Linux, and macOS and requires Python 2.7.x.
5. SDK might have further necessities like Java tools used for the development of Google App Engine needs Java 1.7 or the later one.
6. It can be used to locally deploy and test web applications.

C) Directory Structure for creating hello world application

1. The web applications to be deployed can be organized in the following directory structure

```

root_directory
    |______templates
    |        |______index.html
    |______static
    |______main.py
    |______app.yaml
  
```

2. The templates directory can be used to store the web templates of the web application (HTML files).
3. The static directory can be used to store the web static files which contain the styling and the business logic data for the web application (CSS and JS files).
4. The main.py is used to define the routes, rendering logic, data acquisition logic.
5. It provides the WSGI abstraction to the application.
6. The app.yaml file provides the runtime environment, URLs for routes and launch configuration of the application in the form of key value pairs.

Steps

A) Install Google Cloud SDK on Windows or Linux machines

1. Visit the <https://cloud.google.com/sdk/docs/install> link to download the CLI (Command line interface) tool for the Cloud SDK.
2. Select the appropriate operating system from the installation manual
3. Follow the provided instructions in the displayed section
 - a) For Windows users, the executable downloader is provided for downloading.

- b) For Ubuntu and Fedora users, terminal commands for installation are provided using apt and dnf repositories respectively.

B) Creating the application

1. The application must be initialized using the above-mentioned directory structure.
2. It is a recommended format for organization and readability of code.
3. The app.yaml file should contain the following content:

Contents of app.yaml

```
runtime : python2
api_version : 1
threadsafe : true

handlers
- url : /
  script : main.app
```

4. The logic of the application, i.e. the Web server interaction code of the application must be placed in the main.py file.
5. A simple code displaying the hello world on a web page is as follows

Contents of main.py for Hello World application

```
import webapp2

class MainPage(webapp2.RequestHandler):

    def get(self):
        self.response.write("Hello World")

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

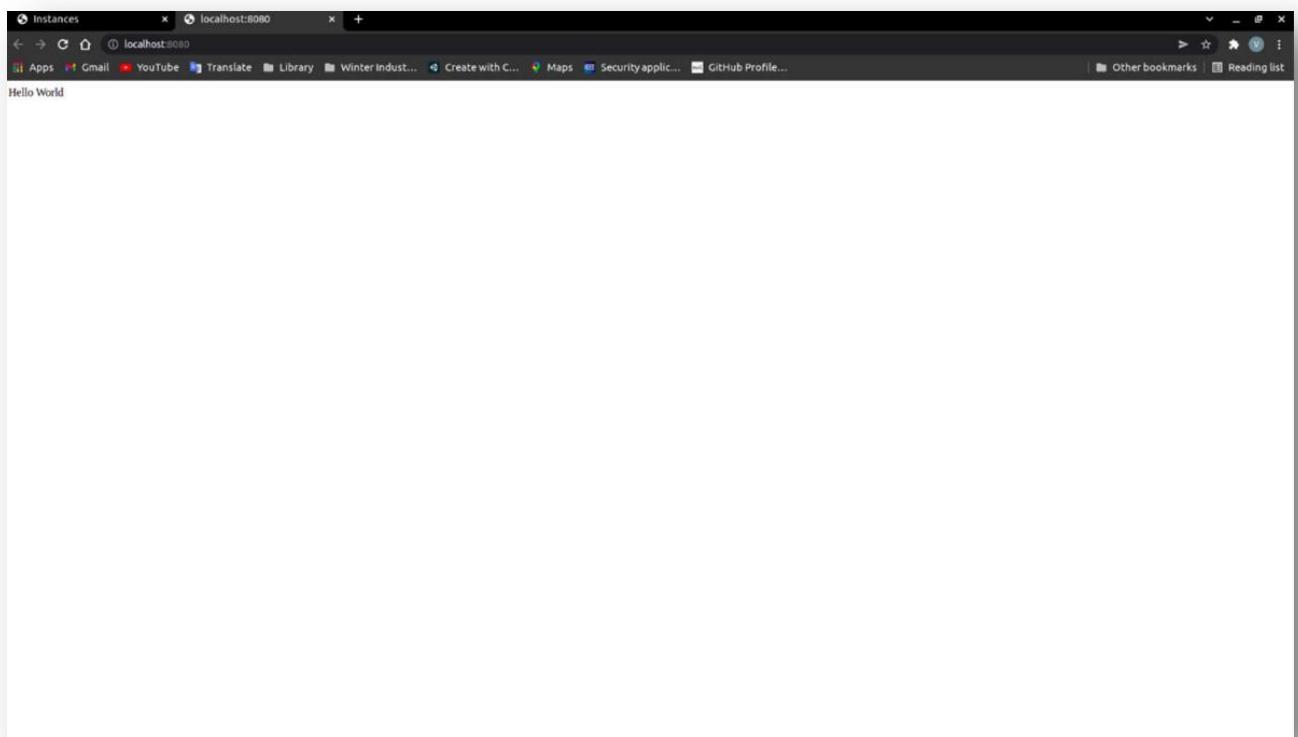
6. Finally, after saving the above code, the application can be run on the localhost server using the following command. (The command must be run on the Google Cloud Shell or the terminal in case of Ubuntu).

Command:

```
python <path_to_sdk>/bin/devappserver.py  
<path_to_application_directory>
```

Sample Output

1. The application, if no errors are found, is launched on the port 8080 of the localhost server.
2. The cloud console is visible on port 8000 of the localhost server.
3. The URL of localhost:8080 can be typed in the address bar of the browser to view the application
4. Screenshots:
 - a) Application launch at port 8080



4. Screenshots:
 - b) Terminal / Command Line prompts

```
varadmash@varadmash-G3-3590:~$ python3 ./google-cloud-sdk/bin/dev_appserver.py ./cloud_computing_lab/Assignment1/  
  
Updates are available for some Cloud SDK components. To install them,  
please run:  
$ gcloud components update  
  
WARNING 2022-01-16 07:03:14,121 application_configuration.py:210] The "python" runtime specified in "./cloud_computing_lab/Assignment1/app.yaml" is not supported  
tead. A description of the differences between the two can be found here:  
https://developers.google.com/appengine/docs/python/python25/diff27  
INFO 2022-01-16 07:03:14,123 devappserver2.py:316] Skipping SDK update check.  
WARNING 2022-01-16 07:03:15,018 simple_search_stub.py:1196] Could not read search indexes from /tmp/appengine.None.varadmash/search_indexes  
INFO 2022-01-16 07:03:15,021 <string>:383] Starting API server at: http://localhost:33917  
INFO 2022-01-16 07:03:15,155 dispatcher.py:281] Starting module "default" running at: http://localhost:8080  
INFO 2022-01-16 07:03:15,157 admin_server.py:150] Starting admin server at: http://localhost:8000  
INFO 2022-01-16 07:03:21,172 instance.py:294] Instance PID: 3381
```

c) Cloud Console at port 8000

The screenshot shows the Google App Engine Instances page. The URL in the address bar is `localhost:8000/instances`. The page title is "Google App Engine". On the left, there's a sidebar with links like "Instances", "Database Viewer", "Database Indexes", "Database Stats", "Interactive Console", "Memcache Viewer", "Blobstore Viewer", "Task Queues", "Crash Jobs", "XMPP", "Inbound Mail", and "Full Text Search". The main content area has a header "Instances" with columns: "Latency (ms)", "QPS", "Total Requests", and "Runtime". A single row is listed under the "default" section, with the ID "32ed9e472c9f3a5aa7940abbcbca0cd0dd". The "Runtime" column shows "python".

	Latency (ms)	QPS	Total Requests	Runtime
default 32ed9e472c9f3a5aa7940abbcbca0cd0dd	0.0	0.00	0	python

Assignment 2

Title

Use GAE launcher to launch the web applications.

Requirements

1. Google App Engine
2. Python Interpreter (Python2.7.x)
3. Browser

Theory

A) Google App Engine

7. Google App Engine (GAE) is a platform-as-a-service product that provides web app developers and enterprises with access to Google's scalable hosting and tier 1 internet service.
8. GAE requires that applications be written in Java or Python, store data in Google Bigtable and use the Google query language.
9. Noncompliant applications require modification to use GAE.
10. GAE provides more infrastructure than other scalable hosting services, such as Amazon Elastic Compute Cloud (EC2).
11. GAE also eliminates some system administration and development tasks to make writing scalable applications easier.
12. Google provides GAE free up to a certain amount of use for resources like CPU, storage, API calls and concurrent requests

B) Directory Structure for creating web application

7. The web applications to be deployed can be organized in the following directory structure

```
root_directory
    |______ templates
        |______ index.html
        |______ results.html
    |______ static
    |______ main.py
    |______ app.yaml
```

8. The templates directory can be used to store the web templates of the web application (HTML files).
9. The static directory can be used to store the web static files which contain the styling and the business logic data for the web application (CSS and JS files).
10. The main.py is used to define the routes, rendering logic, data acquisition logic.
11. It provides the WSGI abstraction to the application.
12. The app.yaml file provides the runtime environment, URLs for routes and launch configuration of the application in the form of key value pairs.

Steps

A) Creating the application

1. The application must be initialized using the above-mentioned directory structure.
2. It is a recommended format for organization and readability of code.
3. Create index.html and results.html as web templates with index.html for taking user input and results.html for displaying response from the API call.
4. The app.yaml file should contain the following content:

Contents of app.yaml

```
runtime : python2
api_version : 1
threadsafe : true
```

```
handlers
url : /
script : main.app
```

5. The logic of the application, i.e. the Web server interaction code of the application must be placed in the main.py file.
6. The following python code sends request for information to the API and interprets response from the API (here, World Time API is used).

Contents of main.py for World Time application

```
import os
import json
import urllib
```

```

import webapp2
from google.appengine.ext.webapp import template

class MainPage(webapp2.RequestHandler):
    def get(self):
        template_values = {}
        path = os.path.join(os.path.dirname(__file__), 'templates/index.html')
        self.response.out.write(template.render(path, template_values))

    def post(self):
        region = self.request.get('region')
        area = self.request.get('area')
        url = "http://worldtimeapi.org/api/timezone/" + region + "/" + area
        data = urllib.urlopen(url).read()
        data = json.loads(data)
        date = data['datetime'][0:10]
        time = data['datetime'][11:19]
        week = data['day_of_week']
        year = data['day_of_year']
        weeknum = data['week_number']
        template_values = {
            "date": date,
            "time": time,
            "week": week,
            "year": year,
            "weeknum": weeknum,
        }
        path = os.path.join(os.path.dirname(__file__),
        'templates/results.html')
        self.response.out.write(template.render(path, template_values))

```

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

7. Finally, after saving the above code, the application can be run on the localhost server using the following command.

Command:

python <path_to_sdk>/bin/devappserver.py
<path_to_application_directory>

Sample Output

- A) The application, if no errors are found, is launched on the port 8080 of the localhost server.
 - B) The cloud console is visible on port 8000 of the localhost server.
 - C) The URL of localhost:8080 can be typed in the address bar of the browser to view the application
- D) Screenshots:

a) Application launch at port 8080 (Displaying index.html)

The screenshot shows a web browser window with the title bar "Current Time and Date" and the address bar "localhost:8080". The page content is a form titled "World Time App Using WebApp". It contains two input fields: "Enter Region" and "Enter Area", each with a text input box. Below the input fields are two buttons: "Submit" (green) and "Reset Fields" (pink). The entire form is enclosed in a light gray border.

b) Displaying results.html to display results from the API call

The screenshot shows a web browser window with the title bar "Instances" and the address bar "localhost:8080". The page content displays the results of an API call in a structured list:

- Date : 2022-03-23
- Time : 08:29:40
- Day of the week : 3
- Day of the year : 82
- Week number : 12

A small "Go Back Home" button is located at the bottom of the list.

c) Terminal / Command Line prompts

```
Google Cloud Shell - python google-cloud-sdk/bin/dev_appserver.py E:\CC_Lab\Assignment2
Welcome to the Google Cloud SDK! Run "gcloud -h" to get the list of available commands.
---
E:\Google_App_Engine>python google-cloud-sdk/bin/dev_appserver.py E:\CC_Lab\Assignment2

Updates are available for some Cloud SDK components. To install them,
please run:
$ gcloud components update

INFO    2022-03-23 08:22:36,454 devappserver2.py:239] Using Cloud Datastore Emulator.
We are gradually rolling out the emulator as the default datastore implementation of dev_appserver.
If broken, you can temporarily disable it by --support_datastore_emulator=False
Read the documentation: https://cloud.google.com/appengine/docs/standard/python/tools/migrate-cloud-datastore-emulator
Help us validate that the feature is ready by taking this survey: https://goo.gl/forms/UArIcs8K9CUScm733
Report issues at: https://issuetracker.google.com/issues/new?component=187272

INFO    2022-03-23 08:22:36,589 devappserver2.py:316] Skipping SDK update check.
INFO    2022-03-23 08:22:39,970 datastore_emulator.py:156] Starting Cloud Datastore emulator at: http://localhost:23418
WARNING  2022-03-23 08:22:46,101 simple_search_stub.py:1196] Could not read search indexes from c:\users\andini\appdata\local\temp\appengine.None\search_indexes
Exception in thread Thread-1:
Traceback (most recent call last):
  File "E:\Google_App_Engine\google-cloud-sdk\platform\bundledpython2\lib\threading.py", line 801, in __bootstrap_inner
    self._run()
  File "E:\Google_App_Engine\google-cloud-sdk\platform\bundledpython2\lib\threading.py", line 754, in run
    self._target(*self._args, **self._kwargs)
  File "<string>", line 605, in launch
  File "E:\Google_App_Engine\google-cloud-sdk\platform\google_appengine\google\appengine\tools\devappserver2\cloud_emulators\cloud_emulator_manager.py", line 123, in launch
    emulator._cmd=elf.cmd, start_options=options, silent=silent)
  File "E:\Google_App_Engine\google-cloud-sdk\platform\google_appengine\google\appengine\tools\devappserver2\cloud_emulators\datastore_emulator.py", line 136, in __init__
    raise IOError('emulator did not respond within %ds' % deadline)
IOError: emulator did not respond within 10s

INFO    2022-03-23 08:22:53,753 <string>:383] Starting API server at: http://localhost:55842
INFO    2022-03-23 08:22:56,065 <string>:373] Starting gRPC API server at: http://localhost:55643
INFO    2022-03-23 08:22:56,549 dispatcher.py:281] Starting module "default" running at: http://localhost:8080
INFO    2022-03-23 08:22:56,569 admin_server.py:150] Starting admin server at: http://localhost:8000
```

d) Cloud Console at port 8000

The screenshot shows a web browser window with the following details:

- Address Bar:** localhost:8000/instances
- Page Title:** Google App Engine
- Header:** Development SDK 0.0.0
- Left Sidebar:** dev~None
 - Instances
 - Datastore Viewer
 - Datastore Indexes
 - Datastore Stats
 - Interactive Console
 - Memcache Viewer
 - Blobstore Viewer
 - Task Queues
 - Cron Jobs
 - XMPP
 - Inbound Mail
 - Full Text Search
- Main Content:** Instances table
| | Instances | Latency (ms) | OPS | Total Requests | Runtime |
| --- | --- | --- | --- | --- | --- |
| | default | 0.0 | 0.00 | 0 | python27 |
| | 9e3eba23361672a60e10cf0ab2ff71bd1f | 1429.0 | 0.02 | 1 | |

Assignment 3

Title

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

Requirements

1. Java JDK and JRE
2. CloudSim archives (CloudSim4)
3. Eclipse IDE

Theory

A) CloudSim

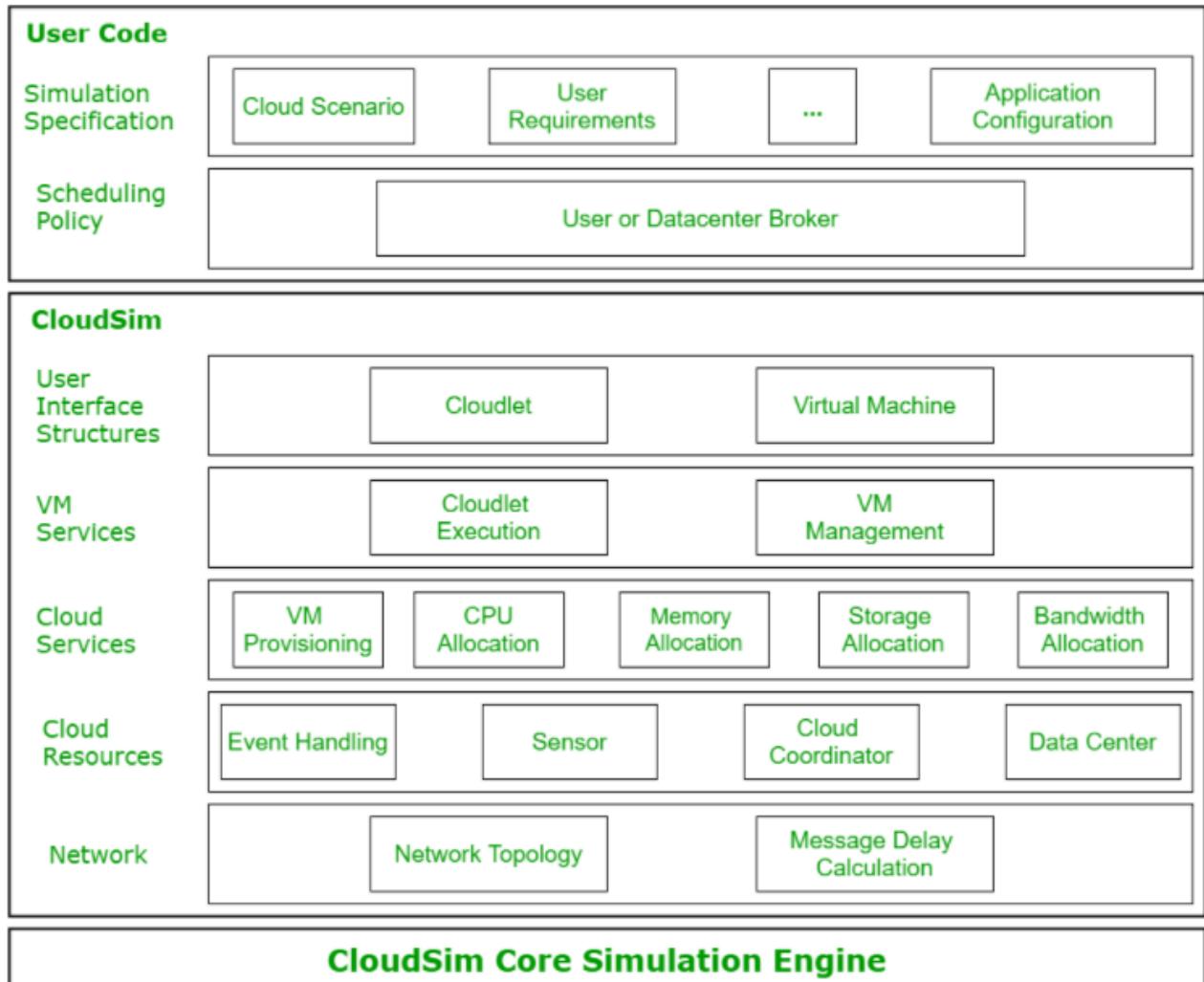
1. CloudSim is an open-source framework, which is used to simulate cloud computing infrastructure and services.
2. It is developed by the CLOUDS Lab organization and is written entirely in Java.
3. It is used for modelling and simulating a cloud computing environment as a means for evaluating a hypothesis prior to software development in order to reproduce tests and results.
4. If you were to deploy an application or a website on the cloud and wanted to test the services and load that your product can handle and also tune its performance to overcome bottlenecks before risking deployment, then such evaluations could be performed by simply coding a simulation of that environment with the help of various flexible and scalable classes provided by the CloudSim package, free of cost.

B) Benefits of CloudSim

1. No capital investment involved
2. Easy to use and Scalable
3. Risks can be evaluated at an earlier stage
4. No need for try-and-error approaches

C) Architecture

1. CloudSim has a layered architecture which separates the User Code and the simulation environment.
2. It can be depicted as follows



CloudSim Layered Architecture

D) CloudSim Components

- **Datacenter**: used for modelling the foundational hardware equipment of any cloud environment, that is the Datacenter. This class provides methods to specify the functional requirements of the Datacenter as well as methods to set the allocation policies of the VMs etc.
- **Host**: this class executes actions related to management of virtual machines. It also defines policies for provisioning memory and bandwidth to the virtual machines, as well as allocating CPU cores to the virtual machines.
- **VM**: this class represents a virtual machine by providing data members defining a VM's bandwidth, RAM, mips (million instructions per second), size while also providing setter and getter methods for these parameters.
- **Cloudlet**: a cloudlet class represents any task that is run on a VM, like a processing task, or a memory access task, or a file updating task etc. It stores parameters defining the characteristics of a task such as its length, size, mi (million instructions) and provides methods similarly to

VM class while also providing methods that define a task's execution time, status, cost and history.

- **DatacenterBroker**: is an entity acting on behalf of the user/customer. It is responsible for functioning of VMs, including VM creation, management, destruction and submission of cloudlets to the VM.
- **CloudSim**: this is the class responsible for initializing and starting the simulation environment after all the necessary cloud entities have been defined and later stopping after all the entities have been destroyed.

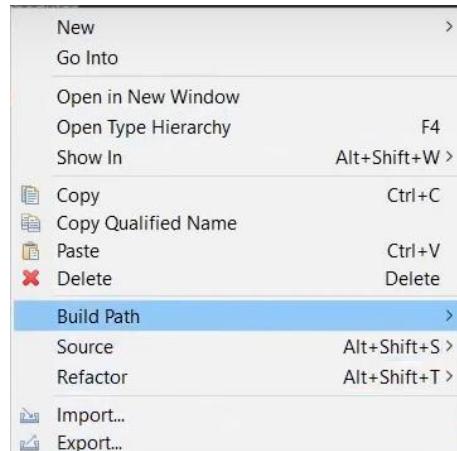
E) SJF algorithm

1. SJF stands for Shortest Job First
2. Shortest Job first has the advantage of having a minimum average waiting time among all scheduling algorithms.
3. It is a Greedy Algorithm.
4. It may cause starvation if shorter processes keep coming. This problem can be solved using the concept of ageing.
5. It is practically infeasible as Operating System may not know burst time and therefore may not sort them. While it is not possible to predict execution time, several methods can be used to estimate the execution time for a job, such as a weighted average of previous execution times. SJF can be used in specialized environments where accurate estimates of running time are available.

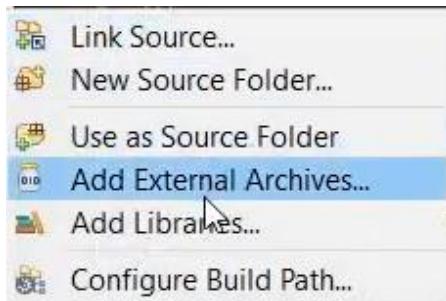
Steps

A) Installation of CloudSim and creation of simulation environment

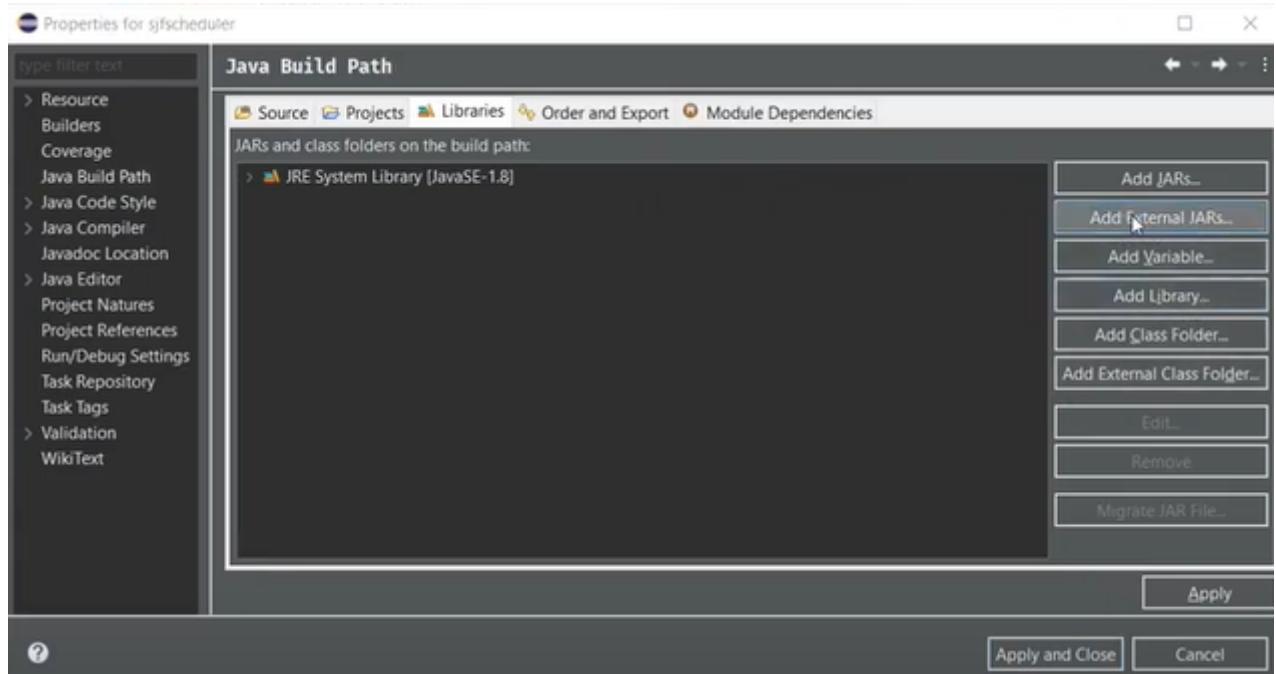
1. Visit <https://github.com/Cloudslab/cloudsim/releases> to download the CloudSim archives for CloudSim 4.
2. Extract the archive.
3. The jars folder of the extracted archive should contain the following files:
 - a) cloudsim-4.0.jar
 - b) cloudsim-examples.jar
4. Create a new Java Project using the Eclipse IDE.
5. Right click on the project root and select the Build Path option from the dropdown.



6. Select the Configure Build Path section from the extended dropdown



7. Select the Libraries section and click on Add External JARs field on the pop up

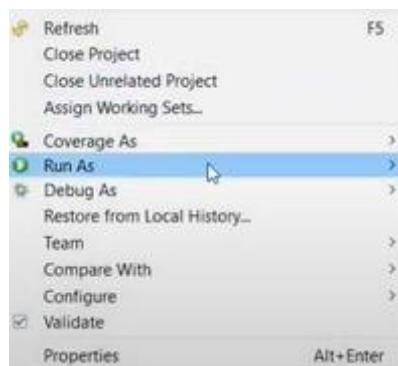


8. Navigate to the jars directory of the CloudSim archive and include the 2 jars in the project.
9. Create a new package in the src directory of the project.

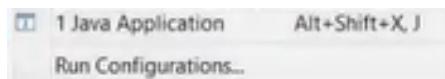
10. Copy the code files for the constants, Data Center Creator, Data Center Broker, Matrix Generator and the SJF scheduler files from the <https://github.com/suyash-more/Cloud-Computing-Projects/tree/master/Scheduling-Algorithm-in-CloudSim/src> link.
11. Make sure that the package name provided in each file is the same as the previously created package.

B) Execution of code

1. Right click on the project



2. Run the project as a Java Application (option in extended dropdown)



3. The result is displayed on the console

```
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 #6
0.1: Broker_0: Sending cloudlet 2 to VM #4
0.1: Broker_0: Sending cloudlet 3 to VM #3
0.1: Broker_0: Sending cloudlet 4 to VM #5
0.1: Broker_0: Sending cloudlet 5 to VM #2
0.1: Broker_0: Sending cloudlet 6 to VM #6
0.1: Broker_0: Sending cloudlet 7 to VM #3
0.1: Broker_0: Sending cloudlet 8 to VM #4
0.1: Broker_0: Sending cloudlet 9 to VM #4
0.1: Broker_0: Sending cloudlet 10 to VM #3
0.1: Broker_0: Sending cloudlet 11 to VM #2
0.1: Broker_0: Sending cloudlet 12 to VM #6
0.1: Broker_0: Sending cloudlet 13 to VM #4
```

```

1292.724: Broker_0: Cloudlet 0 received
1907.232: Broker_0: Cloudlet 5 received
2260.772: Broker_0: Cloudlet 1 received
2784.16: Broker_0: Cloudlet 3 received
2903.4: Broker_0: Cloudlet 2 received
3065.932: Broker_0: Cloudlet 11 received
4113.036: Broker_0: Cloudlet 4 received I
4485.576: Broker_0: Cloudlet 18 received
4837.776: Broker_0: Cloudlet 20 received
4956.164: Broker_0: Cloudlet 6 received
5643.272: Broker_0: Cloudlet 8 received
5807.608: Broker_0: Cloudlet 21 received
6354.656: Broker_0: Cloudlet 7 received
6905.915999999999: Broker_0: Cloudlet 23 received
7719.535999999999: Broker_0: Cloudlet 24 received
8614.368: Broker_0: Cloudlet 12 received
8752.444: Broker_0: Cloudlet 10 received
8986.24: Broker_0: Cloudlet 9 received
10703.216: Broker_0: Cloudlet 15 received
10857.967999999999: Broker_0: Cloudlet 14 received
11948.996: Broker_0: Cloudlet 25 received
13310.556: Broker_0: Cloudlet 13 received
13635.776: Broker_0: Cloudlet 16 received
15582.328: Broker_0: Cloudlet 17 received
16230.772: Broker_0: Cloudlet 19 received
17007.956: Broker_0: Cloudlet 27 received
19003.152000000002: Broker_0: Cloudlet 22 received
19533.66: Broker_0: Cloudlet 28 received
22878.644: Broker_0: Cloudlet 26 received
25918.7: Broker_0: Cloudlet 29 received
25918.7: Broker_0: All Cloudlets executed. Finishing ...

```

OUTPUT							
Cloudlet ID	STATUS	Data center ID	VM ID	Time	Start Time	Finish Time	Waiting Time
00	SUCCESS	05	05	1292.62	00.1	1292.72	00
05	SUCCESS	02	02	1907.13	00.1	1907.23	00
01	SUCCESS	06	06	2260.67	00.1	2260.77	00
03	SUCCESS	03	03	2784.06	00.1	2784.16	00
02	SUCCESS	04	04	2903.3	00.1	2903.4	00
11	SUCCESS	02	02	1158.7	1907.23	3065.93	1907.13
04	SUCCESS	05	05	2820.31	1292.72	4113.04	1292.62
18	SUCCESS	02	02	1419.64	3065.93	4485.58	3065.83
20	SUCCESS	02	02	352.2	4485.58	4837.78	4485.48
06	SUCCESS	06	06	2695.39	2260.77	4956.16	2260.67
08	SUCCESS	04	04	2739.87	2903.4	5643.27	2903.3
21	SUCCESS	05	05	1694.57	4113.04	5807.61	4112.94
07	SUCCESS	03	03	3570.5	2784.16	6354.66	2784.06
23	SUCCESS	02	02	2068.14	4837.78	6905.92	4837.68
24	SUCCESS	02	02	813.62	6905.92	7719.54	6905.82
12	SUCCESS	06	06	3658.2	4956.16	8614.37	4956.06
10	SUCCESS	03	03	2397.79	6354.66	8752.44	6354.56
09	SUCCESS	04	04	3342.97	5643.27	8986.24	5643.17
15	SUCCESS	06	06	2088.85	8614.37	10703.22	8614.27
14	SUCCESS	03	03	2105.52	8752.44	10857.97	8752.34
25	SUCCESS	03	03	1091.03	10857.97	11949	10857.87
13	SUCCESS	04	04	4324.32	8986.24	13310.56	8986.14
16	SUCCESS	06	06	2932.56	10703.22	13635.78	10703.12
17	SUCCESS	06	06	1946.55	13635.78	15582.33	13635.68
19	SUCCESS	04	04	2920.22	13310.56	16230.77	13310.46
27	SUCCESS	06	06	1425.63	15582.33	17007.96	15582.23
22	SUCCESS	04	04	2772.38	16230.77	19003.15	16230.67
28	SUCCESS	06	06	2525.7	17007.96	19533.66	17007.86
26	SUCCESS	04	04	3875.49	19003.15	22878.64	19003.05
29	SUCCESS	04	04	3040.06	22878.64	25918.7	22878.54

Makespan using SJF: 4396.012266367984

Assignment 4

Title:

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

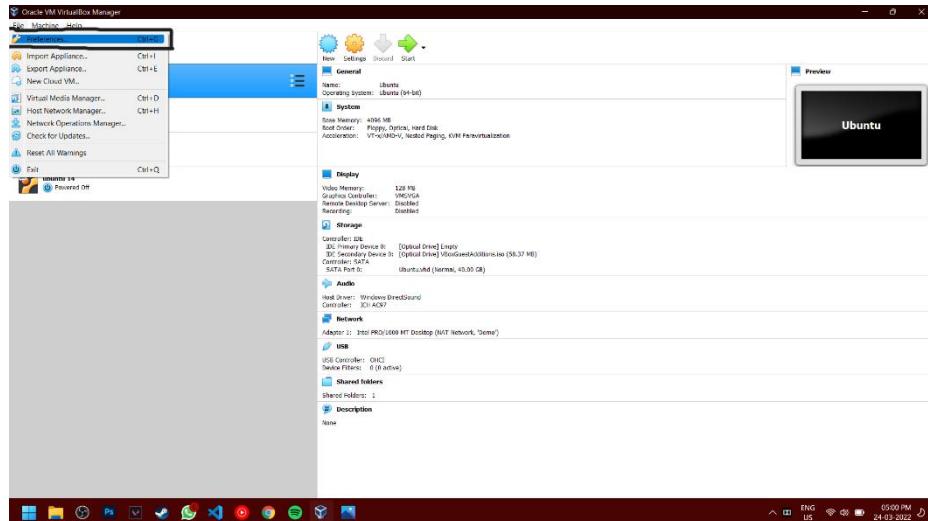
Requirements:

2 Virtual machines installed, for this case we have Ubuntu 21 and Kali Linux.

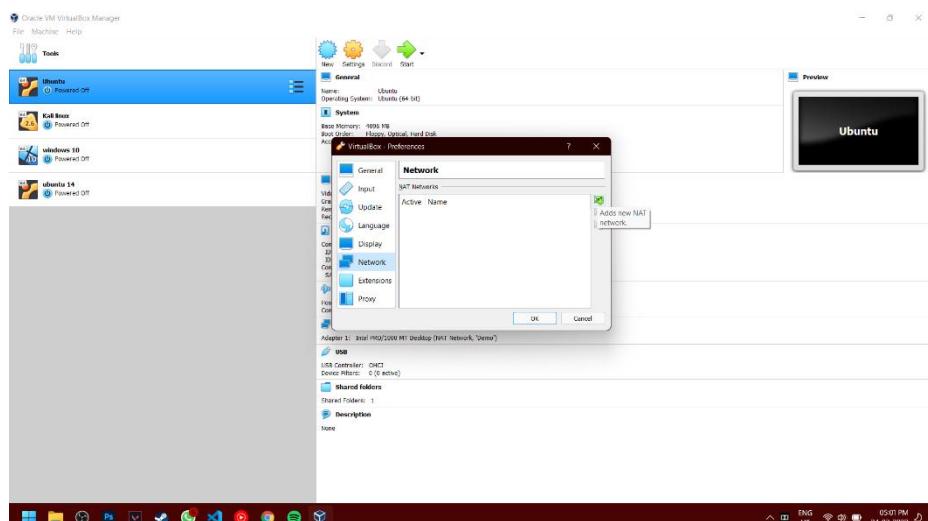
Steps:

1. Create a Nat network in which 2 virtual machine can communicate.

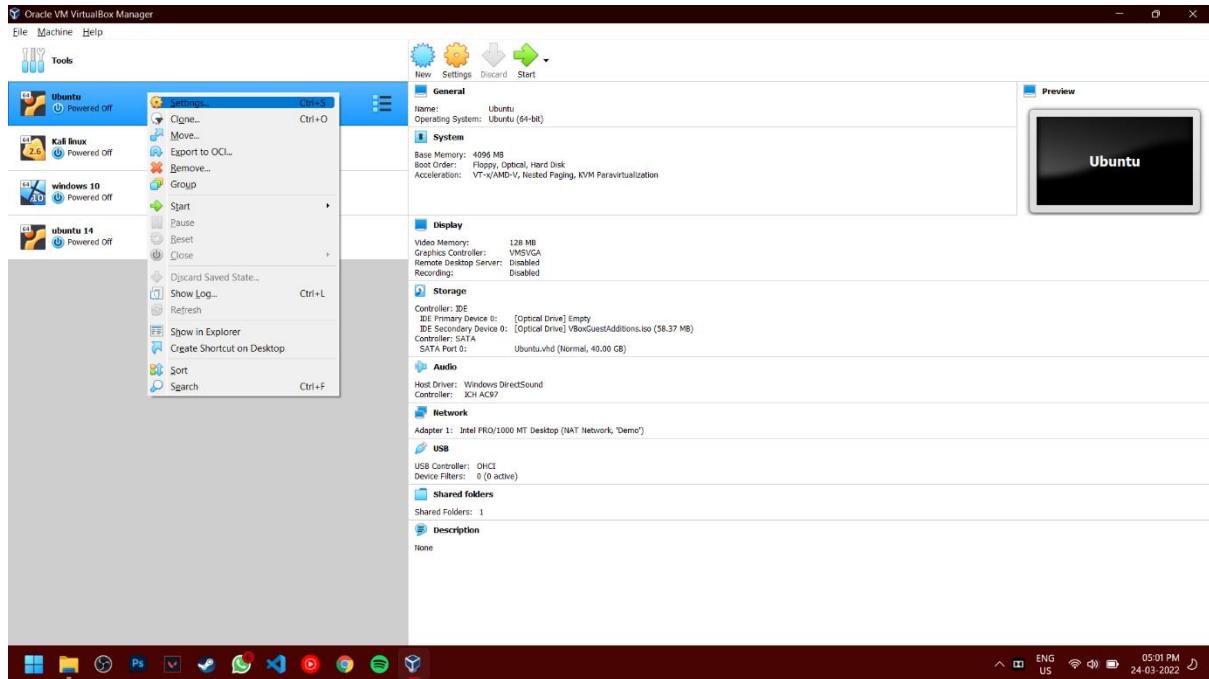
- Go to preferences by clicking File option in Top.



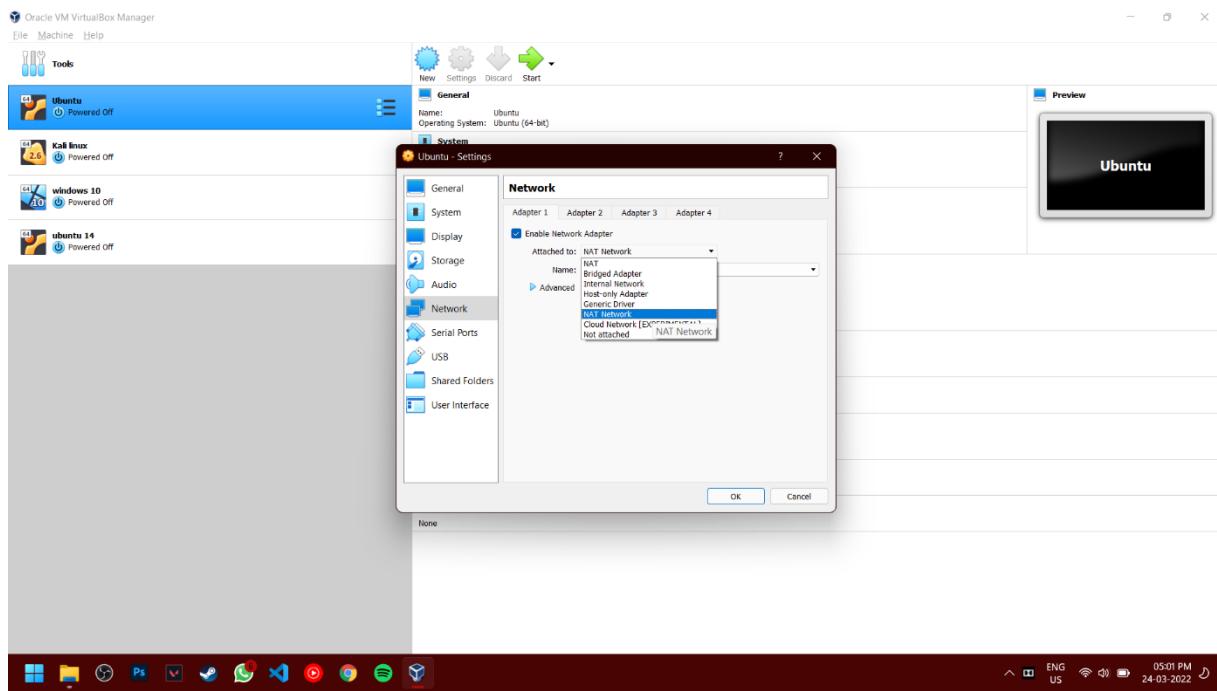
- Now select the network option and create a new NAT network

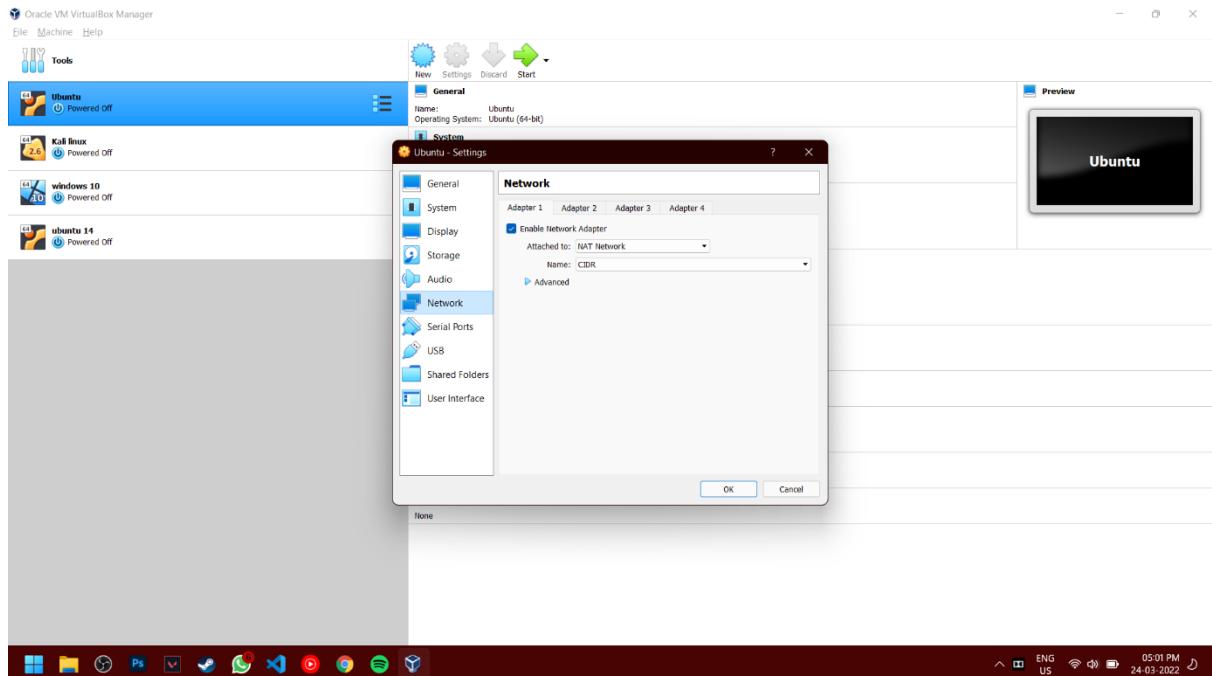


- After creating a NAT network, now go to virtual machine setting by right clicking on the preferred machine.



- Now go to Network and change the attached option to “NAT network” and select the network we created earlier.

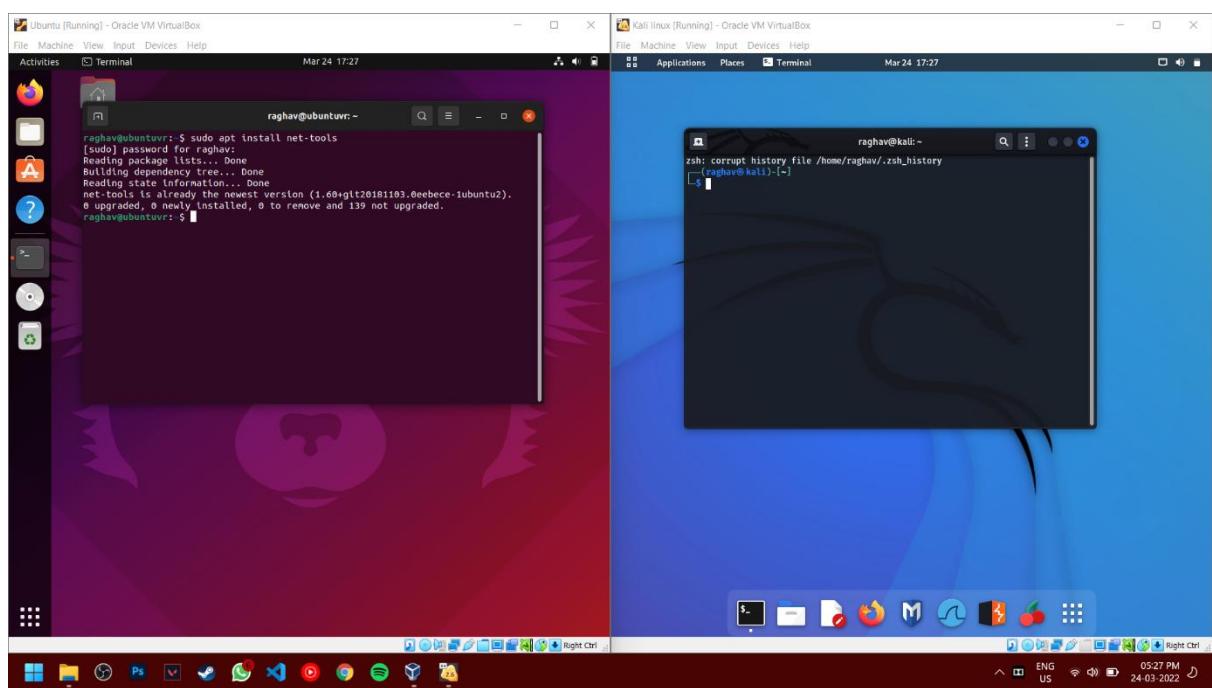




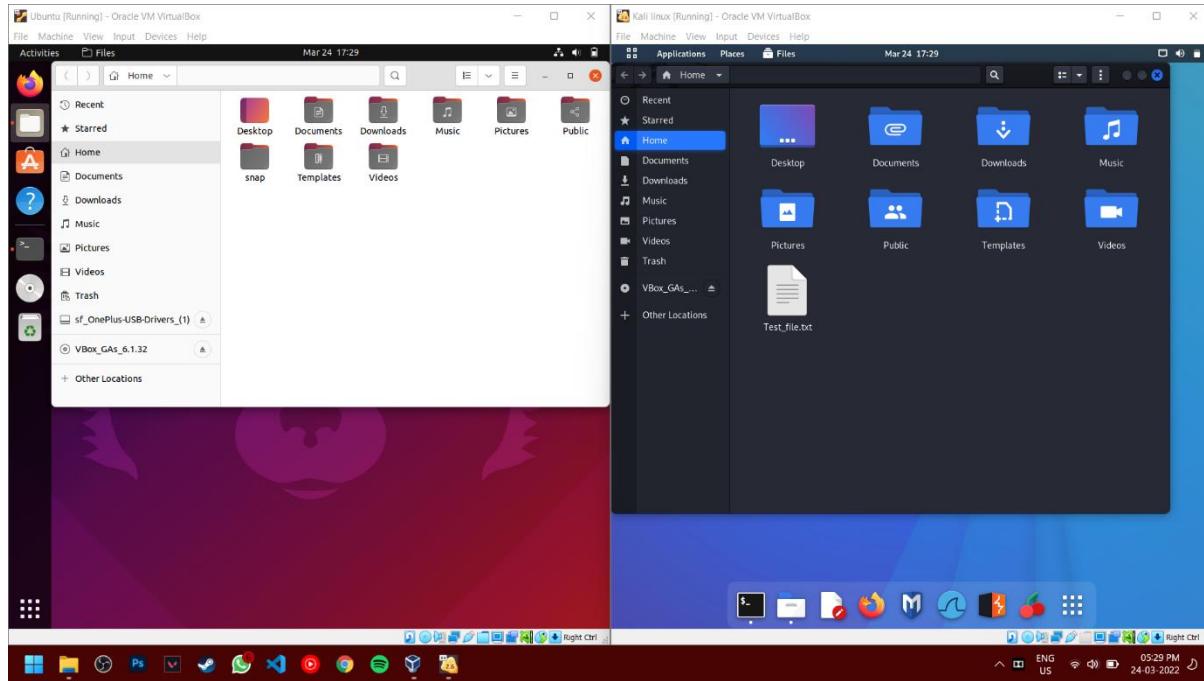
- Now repeat the same process for another machine.

2. Launch both virtual machines

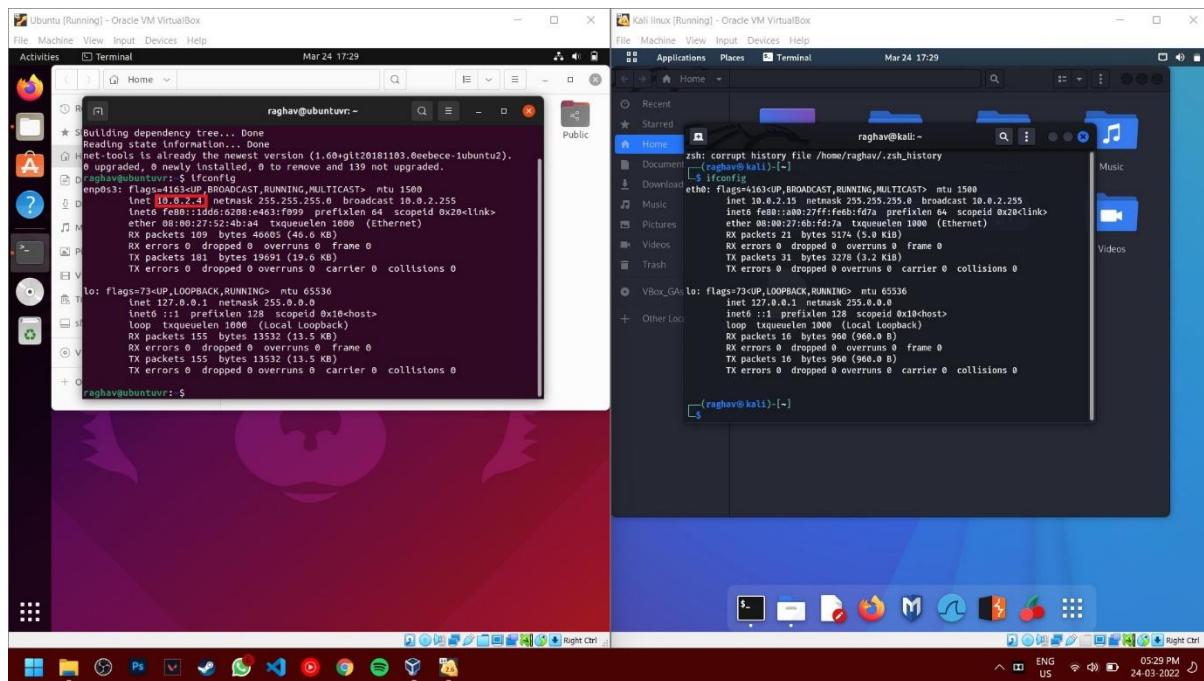
- Now install “Net-tools” on both machine which will help to identify i/p address of the machine. Command: sudo apt install net-tools



- Now create a file in Home folder using any text editor. Here we have used “Test_file.txt” and will transfer from Kali Linux (Right Machine) to Ubuntu (left Machine).

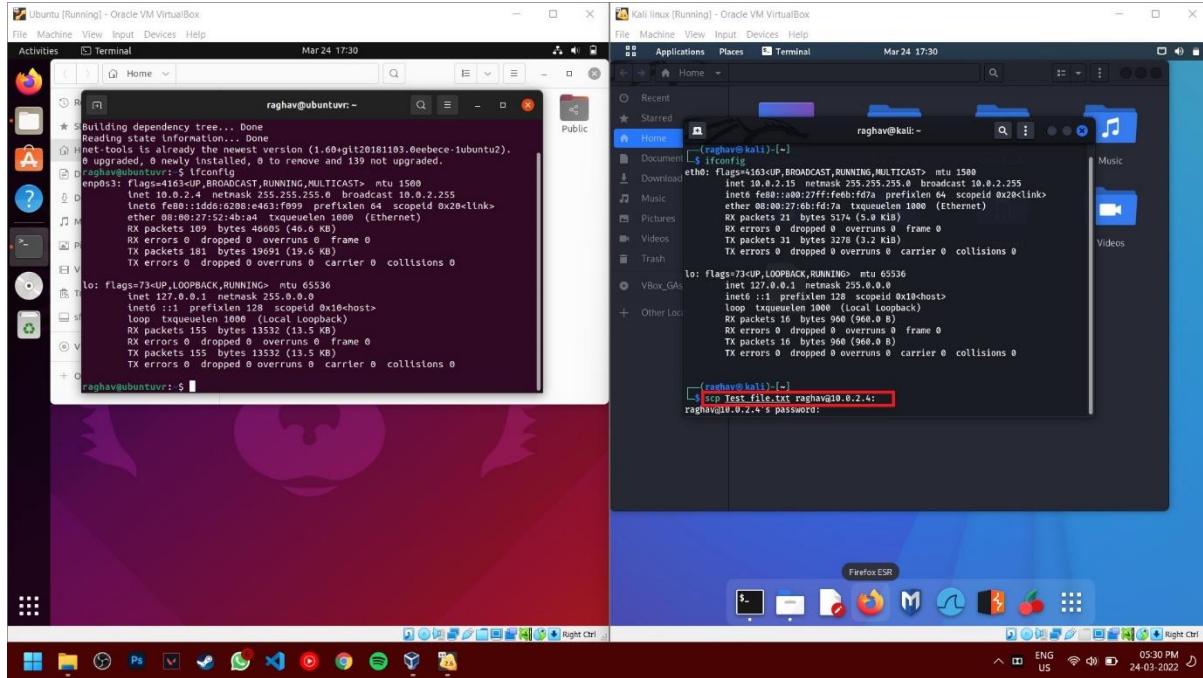


- Now we can check i/p address of Ubuntu where we want to transfer the file using “ifconfig” command. Here Ubuntu has i/p address 10.0.2.4.

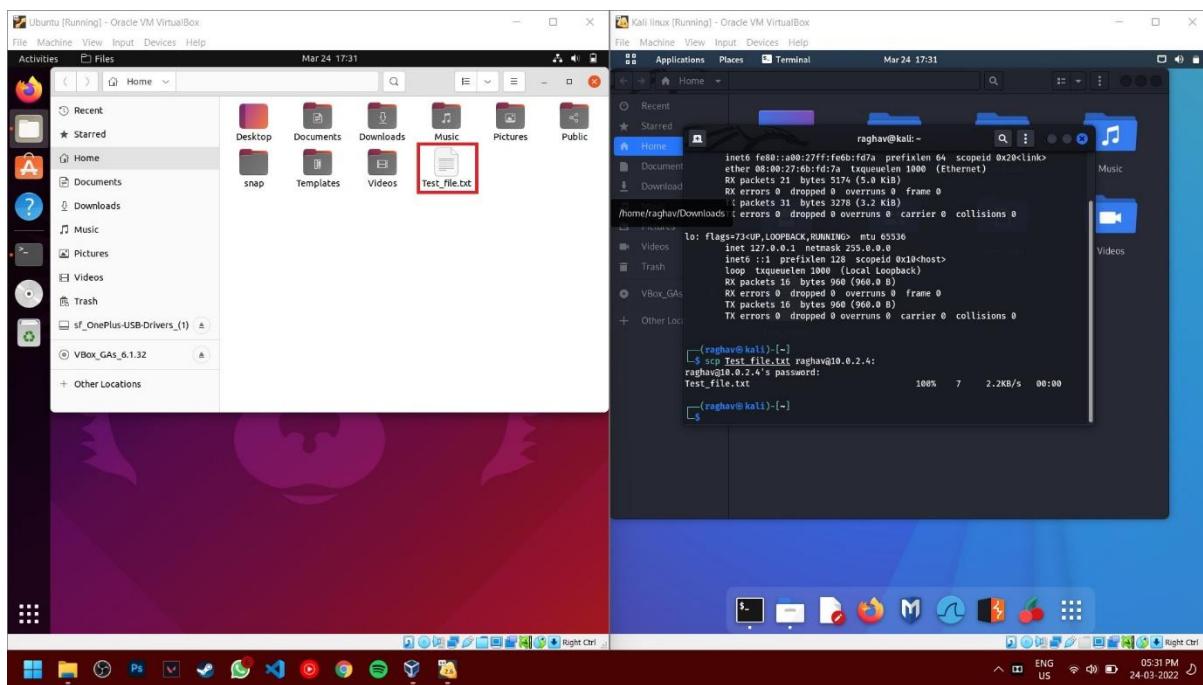


- Transfer the file using command- `scp Test_file.txt raghav@10.0.2.4`:
Where Test_file.txt is our file
raghav is username of Ubuntu
10.0.2.4 is ip address of Ubuntu (left machine)

Optional: if scp is not installed then install by using command:
`sudo apt install openssh-server`



- Now enter the password for Ubuntu(left machine) admin, after enter the password, the file will be sent from Kali Linux(Right machine) to Ubuntu(Left machine)



Assignment 5

Problem Statement:

Find a procedure to launch virtual machine.

Theory:

Virtual Machine:

Virtual machines allow you to run an operating system in an app window on your desktop that behaves like a full, separate computer. You can use them play around with different operating systems, run software your main operating system can't, and try out apps in a safe, sandboxed environment.

A virtual machine app creates a virtualized environment—called, simply enough, a virtual machine—that behaves like a separate computer system, complete with virtual hardware devices. The VM runs as a process in a window on your current operating system. You can boot an operating system installer disc (or live CD) inside the virtual machine, and the operating system will be “tricked” into thinking it’s running on a real computer. It will install and run just as it would on a real, physical machine. Whenever you want to use the operating system, you can open the virtual machine program and use it in a window on your current desktop.

In the VM world, the operating system actually running on your computer is called the host and any operating systems running inside VMs are called guests.

The main purpose of VMs is to operate multiple operating systems at the same time, from the same piece of hardware.

Advantages of VM:

The multiplicity of Operating Systems Reduced Overhead

Safety Net for Data – Rapid Disaster Recovery and Auto Backups Scalability

Centralization

TryStack:

TryStack is a free and easy way for users to try out OpenStack, and set up their own cloud with networking, storage, and computer instances.

Requirement:

Account on

AWS or Azure or Google Cloud.

Steps:

-In the Google Cloud Console, go to the Create an instance page.

-Go to Create an instance

-Specify a Name for your VM. For more information, see Resource naming convention.

Google Cloud Platform - [https://console.cloud.google.com/]

Create an Instance

To create a VM instance, select one of the options:

- New VM instance Create a single VM instance from scratch
- New VM instance from template Create a single VM instance from an existing template
- New VM instance from machine image Create a single VM instance from an existing machine image
- Marketplace Create a ready-to-go container-ready VM instance

Name: instance-1

Labels: + ADD LABELS

Region: us-central1 (Iowa) Zone: us-central1-a

Machine configuration

Machine family: General Purpose

Machine type: Machine type for compute instances, optimized for cost and flexibility

CPU platform: Standard (selected by availability)

Machine type: e2-micro (2 vCPUs, 4 GB memory)

vCPU	Memory
1 shared core	4 GB

Display device: Create a display device for your VM instance

Confidential VM service: Create the Confidential Computing service on this VM instance

Monthly estimate: \$25.46

Hours about 80.60 Hours

Pay for entire duration. No automatic pause or resuming billing.

Set RETAIN

-Optional: Change the Zone for this VM. Compute Engine randomizes the list of zones within each region to encourage use across multiple zones.

-Select a Machine configuration for your VM.

-In the Boot disk section, click Change to configure your boot disk, and then do the following:

Google Cloud Platform - [https://console.cloud.google.com/]

Create an Instance

To create a VM instance, select one of the options:

- New VM instance Create a single VM instance from scratch
- New VM instance from template Create a single VM instance from an existing template
- New VM instance from machine image Create a single VM instance from an existing machine image
- Marketplace Create a ready-to-go container-ready VM instance

Confidential VM service: Create the Confidential Computing service on this VM instance

Container: Create a container instance for this instance

Boot disk: Name: instance-1 Type: New standard persistent disk Size: 70 GB Image: Centos 7 (64-bit) (3.14 GB)

Identity and API access

Service accounts: Service account: Compute Engine Default service account

Access scopes: Allow default access (selected) Allow full access to all Cloud APIs Get access for each API

Firewall: Allow incoming traffic on allowed ports (compute, auth, cloud-apis) Allow HTTP traffic

Monthly estimate: \$25.46

Hours about 80.60 Hours

Pay for entire duration. No automatic pause or resuming billing.

Set RETAIN

-Select the Custom Images tab.

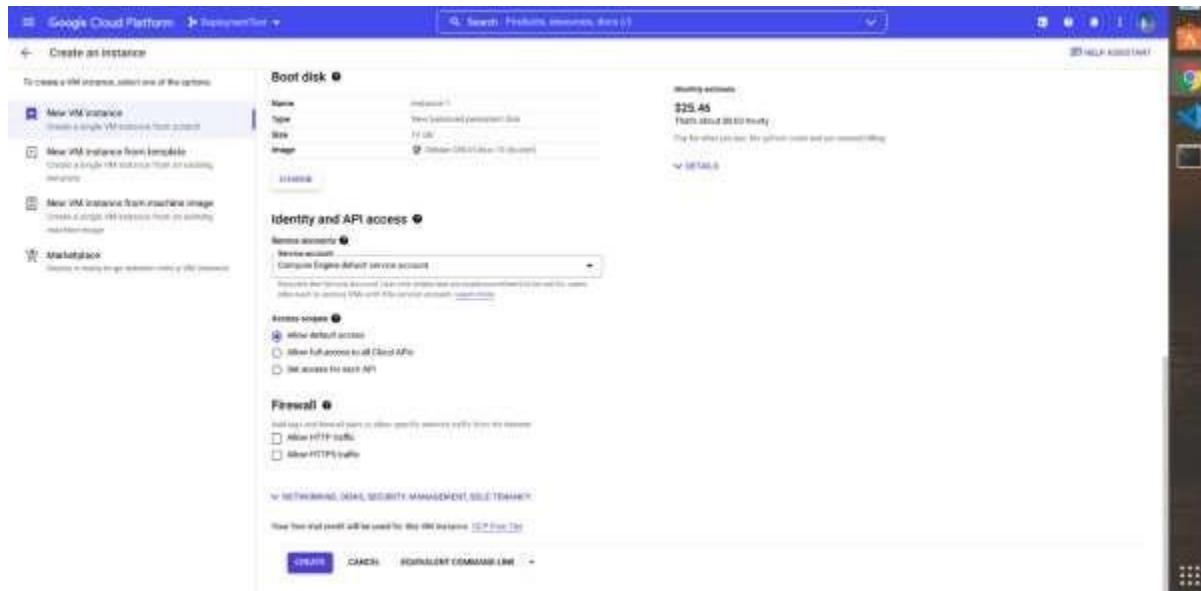
-To select the image project, click Select a project, and then do the following:

-Select the project that contains the image. Click Open.

-In the Image list, click the image that you want to import. Select the type and size of your boot disk.

To confirm your boot disk options, click Select.

-To permit HTTP or HTTPS traffic to the VM, in the Firewall section, select Allow HTTP traffic or Allow HTTPS traffic.



-The Cloud Console adds a network tag to your VM and creates the corresponding ingress firewall rule that allows all incoming traffic on tcp:80 (HTTP) or tcp:443 (HTTPS). The network tag associates the firewall rule with the VM. For more information, see Firewall rules overview in the Virtual Private Cloud documentation.

-To start and create a VM, click Create.

The screenshot shows the Google Cloud Platform interface for managing VM instances. At the top, there's a navigation bar with links like 'VM instances', 'CREATE INSTANCE', 'REPORTS', 'MONITORING', 'STOP', 'START/RESUME', 'RESTART', 'PAUSE', 'LAUNCH', 'HELP CENTER', 'SHOW API DETAILS', and 'LOGS'. Below the navigation bar, there are two sections: 'INSTANCES' and 'INSTANCE SCHEDULE'. The 'INSTANCES' section contains a table with two rows, each representing a VM instance. The columns in the table are: Name, State, Last boot, Internal IP, External IP, and Status. The first instance is named 'newvm1' and is in a 'RUNNING' state. The second instance is named 'newvm2' and is also in a 'RUNNING' state. Below the table, there's a section titled 'Related actions' with four items: 'View Billing report', 'Monitor VMs', 'Explore VM logs', 'Set up firewall rules', and 'Patch management'.

Assignment 6

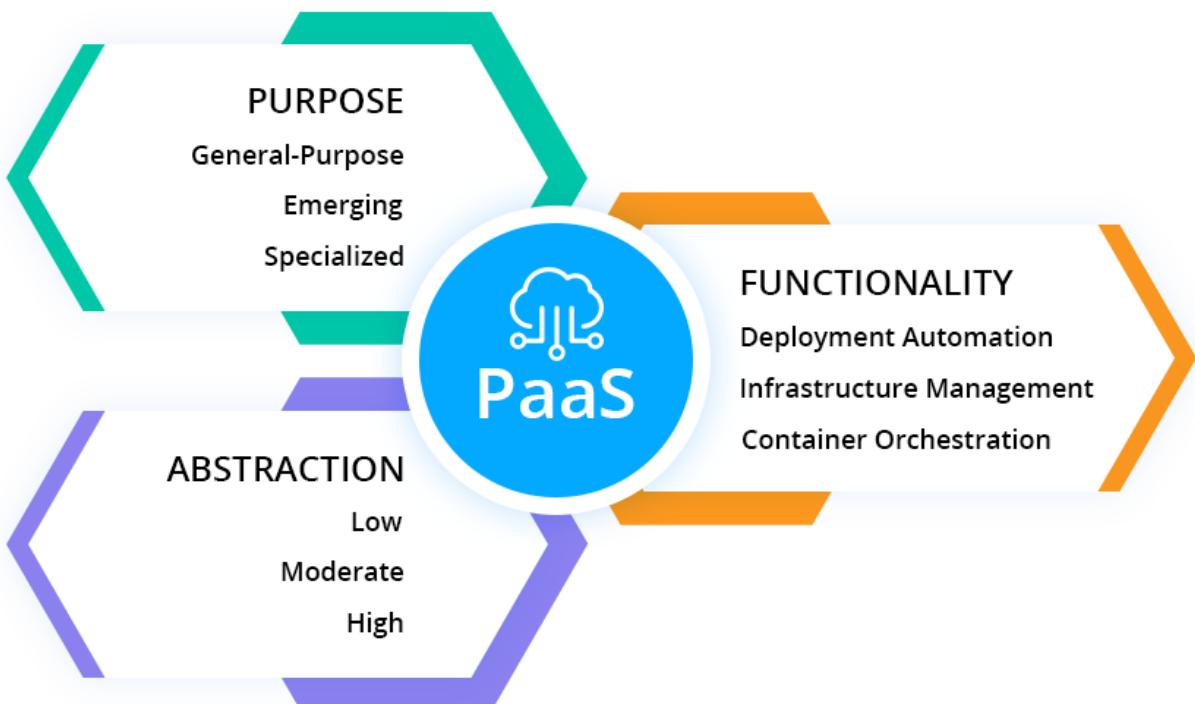
Title

Design and deploy a web application in a PaaS environment.

Objectives

- Launch virtual machine EC2
- Launch a web server with termination protection enabled
- Running web page
- Monitor Your EC2 instance
- Modify the security group that your web server is using to allow HTTP access
- Resize your EC2 instance to scale

Theory



Platform as a service (PaaS)

It is a cloud computing model where a third-party provider delivers hardware and software tools to users over the internet. Usually, these tools are needed for application development. A PaaS provider hosts the hardware and software on its own infrastructure.

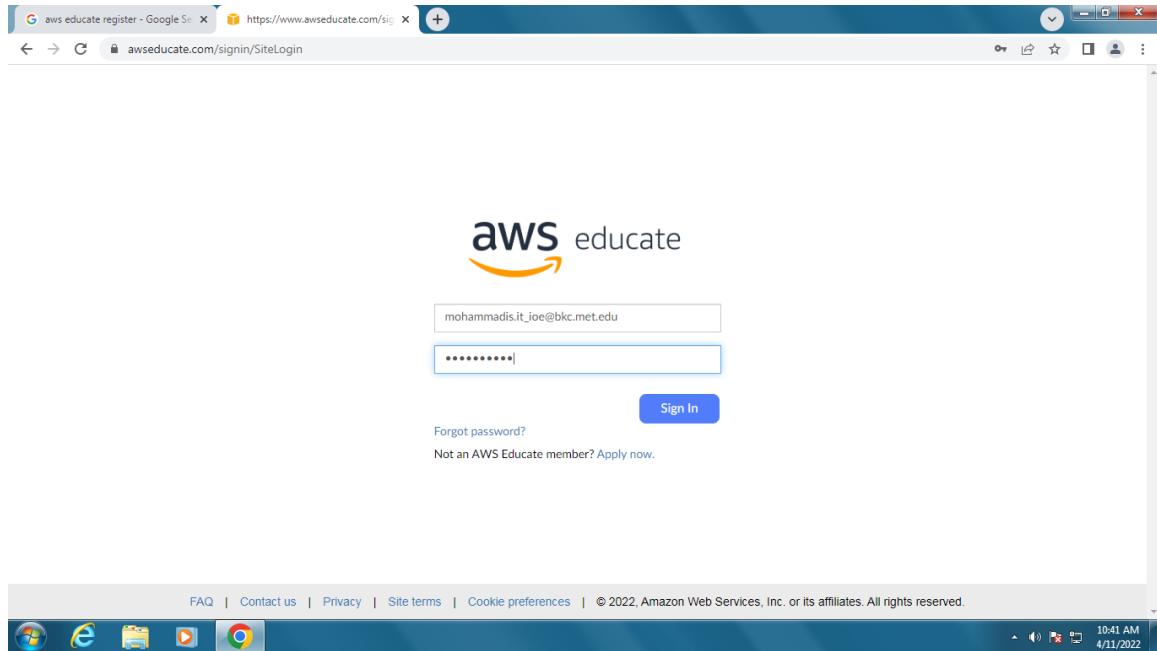
Platform as a service (PaaS) or **application platform as a service (aPaaS)** or platform-based service is a category of cloud computing services that allows customers to provision, instantiate, run, and manage a modular bundle comprising a computing platform and one or more applications, without the complexity of building and maintaining the infrastructure typically associated with developing and launching the application(s); and to allow developers to create, develop, and package such software bundles.

PaaS can be delivered in three ways:

- As a public cloud service from a provider, where the consumer controls software deployment with minimal configuration options, and the provider provides the networks, servers, storage, operating system (OS), middleware (e.g. Java runtime, .NET runtime, integration, etc.), database and other services to host the consumer's application.
- As a private service (software or appliance) behind a firewall.
- As software deployed on public infrastructure as a service

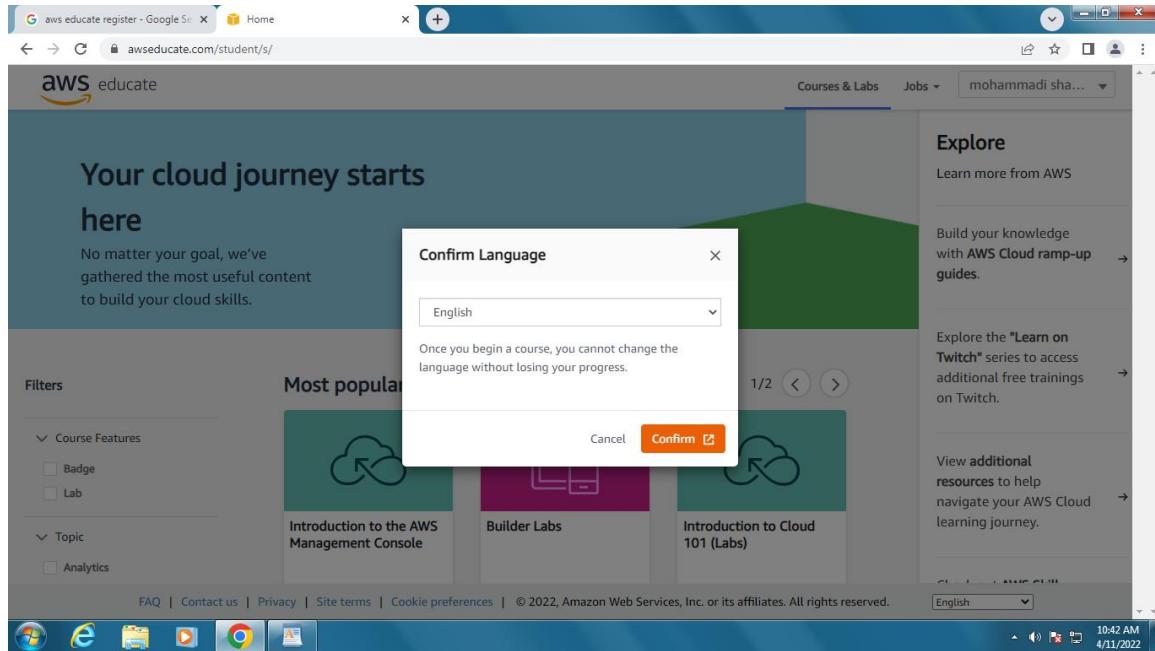
Detailed Steps:-

1. <https://www.awseducate.com/registration/s/>
2. Register your self in "Learn Cloud Skills" by
entering email id



3.

A screenshot of the AWS Educate student dashboard. The top navigation bar includes links for AWS Cons, how to cre, aws studie, Create AW, AWS Educ, Home, Lab 2 - Int..., and Instances. The main content area is titled "aws educate" and "Foundational | 1 hour". Below this, a section titled "Most popular courses and labs" displays four cards. The third card, "Introduction to Cloud 101 (Labs)", is highlighted with a red oval and has a red arrow pointing to it from the previous image. This card is described as "Foundational | 8 hours" and "Cloud Computing". Below this section is another titled "Cloud skill basics" with two cards, each with a "1/2 < >" indicator. The first card is "Introduction to the AWS Management Console" and the second is "Machine Learning Foundation (Lab)".



4.

The screenshot shows a browser window with multiple tabs open, including 'awsEducate.instructure.com/courses/746/modules'. The main content is a course module titled 'Module 4 AWS Core Services'. The module list includes:

- AWS Core Services
- AWS Core Services Labs
- Lab 1 - Introduction to Amazon S3
- Lab 2 - Introduction to Amazon EC2** (This item is circled in red)
- Lab 3 - Introduction to Amazon DynamoDB
- Lab 4 - Introduction to Amazon Relational Database Service (Amazon RDS)

The sidebar on the left shows navigation links: Home, Modules, Account, Dashboard, Courses, and History.

The screenshot shows a web browser window with the URL awseducate.instructure.com/courses/746/modules. The page displays a sidebar with navigation links: Home, Modules, Account, Dashboard, Courses, History, and Help. The main content area is titled "View" and lists seven modules under "AWS Core Services Labs":

- Lab 1 - Introduction to Amazon S3** (100 pts | Score at least 70.0)
- Lab 2 - Introduction to Amazon EC2** (100 pts | Score at least 70.0)
- Lab 3 - Introduction to Amazon DynamoDB** (100 pts | Score at least 70.0)
- Lab 4 - Introduction to Amazon Relational Database Service (Amazon RDS)** (100 pts | Score at least 70.0)
- Lab 5 - Introduction to Amazon Virtual Private Cloud (Amazon VPC)** (100 pts | Score at least 70.0)
- Lab 6 - Introduction to AWS Identity and Access Management (IAM)** (100 pts | Score at least 70.0)
- Lab 7 - Hosting a Static Website Using Amazon Simple Storage Service (Amazon S3)** (100 pts | Score at least 70.0)

At the bottom of the page, there is a link to "Complete All Items". The status bar at the bottom right shows the time as 10:43 AM and the date as 4/11/2022.

The screenshot shows a web browser window with the URL awseducate.instructure.com/courses/746/assignments/3072?module_item_id=13185. The page displays a sidebar with navigation links: Home, Modules, Account, Dashboard, Courses, History, and Help. The main content area is titled "EDC101v1EN > Assignments > Lab 2 - Introduction to Amazon EC2".

Lab 2 - Introduction to Amazon EC2

Due: No Due Date Points: 100 Submitting: an external tool

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Vocareum's failure to enforce any right or provision of these Terms will not be considered a waiver of such right or provision. The waiver of any such right or provision will be effective only if in writing and signed by a duly authorized representative of Vocareum. Except as expressly set forth in these Terms, the exercise by either party of any of its remedies under these Terms will be without prejudice to its other remedies under these Terms or otherwise.

Contact Information
If you have any questions about these Terms or the Services, please contact Vocareum at info@vocareum.com

I Agree

The status bar at the bottom right shows the time as 10:43 AM and the date as 4/11/2022.

5.**Accessing the AWS Management Console**

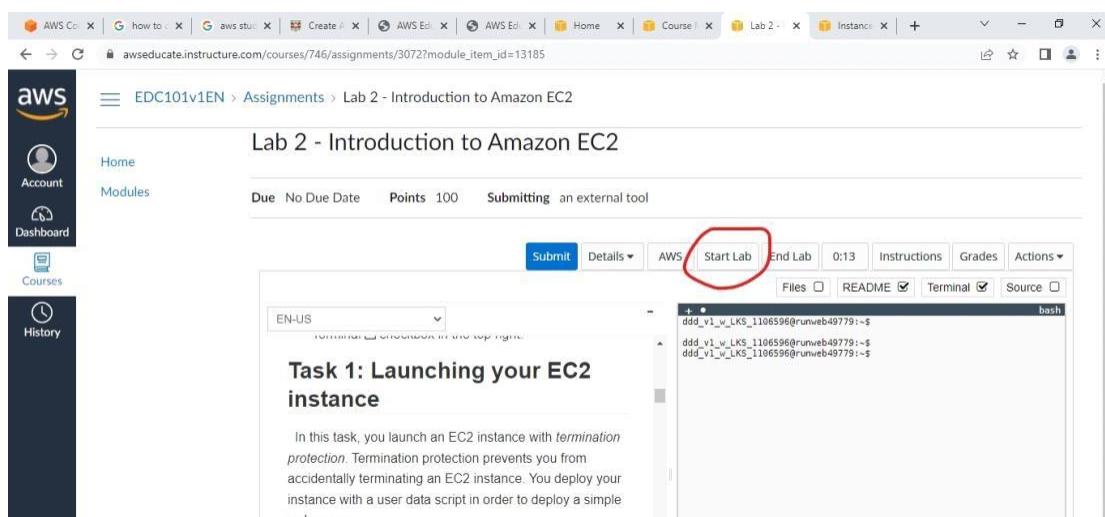
- At the top of these instructions, choose **Start Lab** to launch your lab.

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

- Wait until you see the message *Lab status: ready*, then close the **Start Lab** panel by choosing the **X**.

- At the top of these instructions, choose **AWS**.

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

**6.**

Follow all instructions as given:

Task 1: Launching your EC2 instance

In this task, you launch an EC2 instance with *termination protection*. Termination protection prevents you from accidentally terminating an EC2 instance. You deploy your instance with a user data script in order to deploy a simple web server.

1. In the AWS Management Console on the **Services** menu, choose **EC2**.
2. Choose **Launch instance**, and then select **Launch instance**.

Step 1: Choose an Amazon Machine Image (AMI)

An AMI provides the information required to launch an instance, which is a virtual server in the cloud. An AMI includes the following:

- A template for the root volume for the instance (for example, an operating system or an application server with applications)
- Launch permissions that control which AWS accounts can use the AMI to launch instances
- A block device mapping that specifies the volumes to attach to the instance when it is launched

The **Quick Start** list contains the most commonly used AMIs. You can also create your own AMI or select an AMI from the AWS Marketplace, an online store where you can sell or buy software that runs on AWS.

1. At the top of the list, choose **Select** next to **Amazon Linux 2 AMI**.

The screenshot shows the AWS EC2 Management Console interface. At the top, there are three tabs: 'aws educate register - Google Se' (closed), 'Home' (closed), and 'Lab 3 - Introduction to Amazon []'. Below the tabs, the URL is 'us-east-1.console.aws.amazon.com/ec2/v2/home?region=us-east-1#Instances:sort=descinstanceState'. The main navigation bar includes 'Services' (selected), a search bar ('Search for services, features, blogs, docs, and more'), and a dropdown for 'N. Virginia'. On the far right of the bar are icons for user profile and settings.

The left sidebar has a 'New EC2 Experience' section with a 'Learn more' link, followed by a list of services: EC2 Dashboard, EC2 Global View, Events, Tags, Limits, Instances (selected), Instance Types, Launch Templates, Spot Requests, Savings Plans, Reserved Instances (New), Dedicated Hosts, Scheduled Instances, Capacity Reservations, and Images.

The main content area is titled 'Instances Info' with tabs for 'Instances' (selected) and 'Info'. It features a search bar and buttons for 'Connect', 'Instance state', 'Actions', and 'Launch instances'. A message at the top states 'You are not authorized to perform this operation.' Below this is a table header with columns: Name, Instance ID, Instance state, Instance type, Status check, Alarm status, and Availability Zone. A modal window titled 'Select an instance' is open in the center of the screen.

The bottom of the screen shows the footer with links for 'Feedback', 'AMIs', 'AWS Lambda', and 'AWS Lambda@Edge'. The footer also includes copyright information: '© 2022, Amazon Web Services, Inc. or its affiliates.', links for 'Privacy', 'Terms', and 'Cookie preferences', and system status: '10:46 AM' and '4/11/2022'.

The screenshot shows the AWS Launch Instance Wizard interface. At the top, there are three tabs: 'Lab 3 - Introduction to Amazon EC2' (active), 'Launch instance wizard | EC2 Manager', and '+'. Below the tabs, the URL is 'us-east-1.console.aws.amazon.com/ec2/v2/home?region=us-east-1#LaunchInstanceWizard:'. The main content area displays a message: 'You've been invited to try an early, beta iteration of the new launch instance wizard. We will continue to improve the experience over the next few months. We're asking customers for their feedback on this early release. To exit the new launch instance wizard at any time, choose the Cancel button.' A 'Try it now!' button is visible. Below this, a navigation bar shows steps 1 through 7. Step 1, 'Choose AMI', is highlighted. The main panel shows the 'Quick Start' section with 'My AMIs', 'Amazon Linux' (selected), 'AWS Marketplace', and 'Community AMIs'. The 'Amazon Linux' entry is detailed: 'Amazon Linux 2 AMI (HVM) - Kernel 5.10, SSD Volume Type - ami-0c02fb55956c7d316 (64-bit x86) / ami-03190fe20ef6b1419 (64-bit Arm)'. It is labeled 'Free tier eligible'. A note states: 'Amazon Linux 2 comes with five years support. It provides Linux kernel 5.10 tuned for optimal performance on Amazon EC2, systemd 219, GCC 7.3, Glibc 2.26, Binutils 2.29.1, and the latest software packages through extras. This AMI is the successor of the Amazon Linux AMI that is now under maintenance only mode and has been removed from this wizard.' Below the note are options for 'Root device type: ebs', 'Virtualization type: hvm', and 'ENAv Enabled: Yes'. There are also 'Select' and 'Cancel and Exit' buttons.

Step 2: Choose an instance type

Amazon EC2 provides a wide selection of *instance types* optimized to fit different use cases. Instance types comprise varying combinations of CPU, memory, storage, and networking capacity and give you the flexibility to choose the appropriate mix of resources for your applications. Each instance type includes one or more *instance sizes* so that you can scale your resources to the requirements of your target workload.

Select a **t2.micro** instance. This instance type has 1 virtual CPU and 1 GiB of memory.

1. Choose Next: Configure Instance Details

The screenshot shows the AWS EC2 Launch Instance Wizard at Step 2: Choose an Instance Type. The user has selected the t2.micro instance type, which is highlighted with a blue border and labeled "Free tier eligible". The table below lists various t2 instance types along with their details like Family, Type, vCPUs, Memory, Instance Storage, EBS-Optimized Availability, Network Performance, and IPv6 Support.

	Family	Type	vCPUs	Memory (GiB)	Instance Storage (GB)	EBS-Optimized Available	Network Performance	IPv6 Support
<input type="checkbox"/>	t2	t2.nano	1	0.5	EBS only	-	Low to Moderate	Yes
<input checked="" type="checkbox"/>	t2	t2.micro	1	1	EBS only	-	Low to Moderate	Yes
<input type="checkbox"/>	t2	t2.small	1	2	EBS only	-	Low to Moderate	Yes
<input type="checkbox"/>	t2	t2.medium	2	4	EBS only	-	Low to Moderate	Yes
<input type="checkbox"/>	t2	t2.large	2	8	EBS only	-	Low to Moderate	Yes
<input type="checkbox"/>	t2	t2.xlarge	4	16	EBS only	-	Moderate	No

At the bottom, there are buttons for Cancel, Previous, Review and Launch (which is highlighted in blue), and Next: Configure Instance Details.

Step 3: Configure instance details

You use this page to configure the instance to suit your requirements. This configuration includes networking and monitoring settings.

The **Network** indicates which virtual private cloud (VPC) you want to launch the instance into. You can have multiple networks, including different ones for development, testing, and production.

1. For **Network**, select **Lab VPC**.

The Lab VPC was created using an AWS CloudFormation template during the setup process of your lab. This VPC includes two public subnets in two different Availability Zones.

2. For **Enable termination protection**, select **Protect against accidental termination**.

When you no longer require an EC2 instance, you can terminate it, which means that the instance stops, and Amazon EC2 releases the instance's resources. You cannot restart a terminated instance. If you want to prevent your users from accidentally terminating the instance, you can enable termination protection for the instance, which prevents users from terminating instances.

3. Scroll down, and then expand **Advanced Details**.

A field for **User data** appears.

When you launch an instance in Amazon EC2, you have the option of passing user data to the instance that can be used to perform common automated configuration tasks and even run scripts after the instance starts.

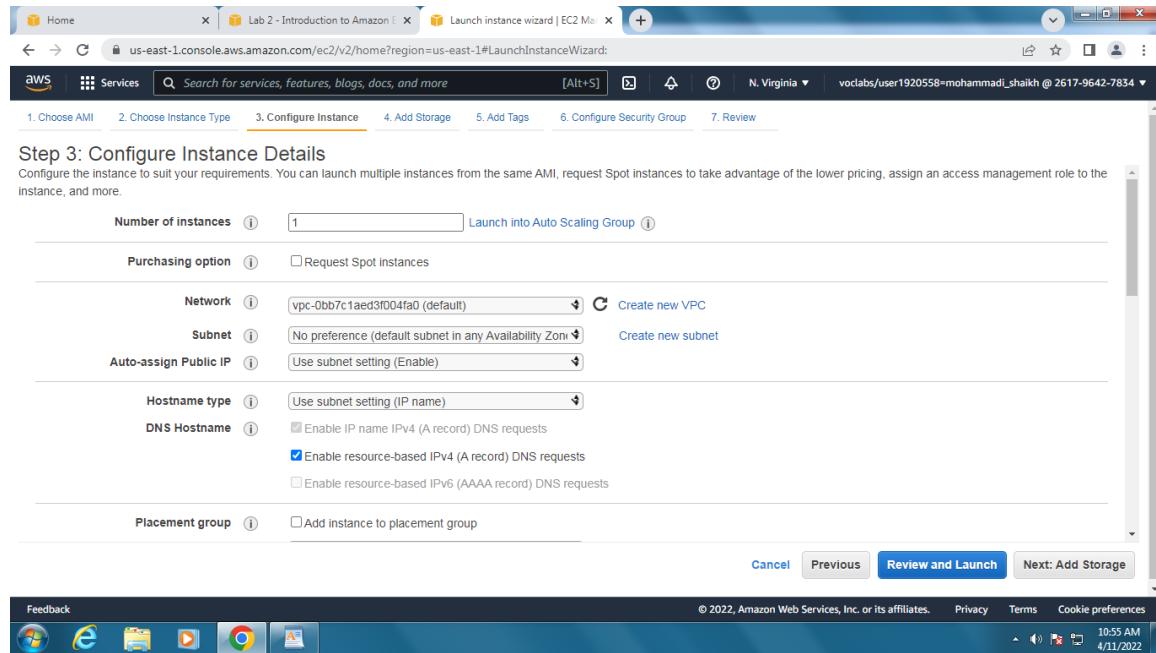
4. Copy the following web application home page sample code into user data file.
5. Also code other pages for your web application.

```
#!/bin/bash
yum -y install httpd
systemctl enable httpd
systemctl start httpd
echo '<html><h1>Hello From Your Web Server!</h1></html>' > /var/www/html/index.html
```

The script does the following:

- Install an Apache web server (httpd)
- Configure the web server to automatically start on boot
- Activate the Web server
- Create a simple web page

1. Choose **Next: Add Storage**



Step 4: Add storage

Amazon EC2 stores data on a network-attached virtual disk called Amazon Elastic Block Store (Amazon EBS).

You launch the EC2 instance using a default 8 GiB disk volume. This is your root volume (also known as a boot volume).

1. Choose **Next: Add Tags**

Volume Type	Device	Snapshot	Size (GiB)	Volume Type	IOPS	Throughput (MB/s)	Delete on Termination	Encryption
Root	/dev/xvda	snap-0c1ac78aec1c4204c	8	General Purpose SSD (gp2)	100 / 3000	N/A	<input checked="" type="checkbox"/>	Not Encrypte

Free tier eligible customers can get up to 30 GB of EBS General Purpose (SSD) or Magnetic storage. [Learn more](#) about free usage tier eligibility and usage restrictions.

Step 5: Add tags

Using tags, you can categorize your AWS resources in different ways (for example, by purpose, owner, or environment). This categorization is useful when you have many resources of the same type: you can quickly identify a specific resource based on the tags you have assigned to it. Each tag consists of a key and a value, both of which you define.

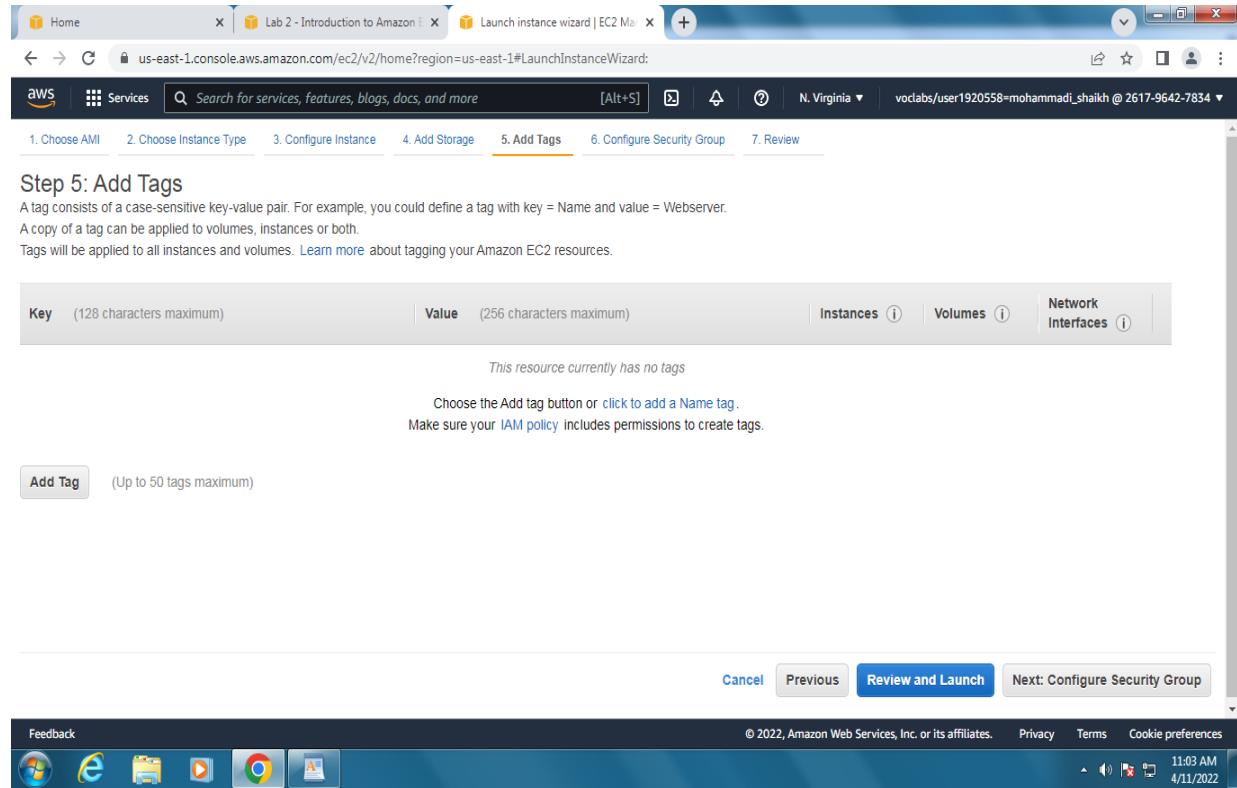
1. Choose **Add Tag**, and then configure the following:

- o **Key:** Name
- o **Value:** Web-Server

Make sure the punctuation for the tags matches exactly as above.

1. Choose **Next: Configure Security Group**

Note: Notice the "Rules with source of 0.0.0.0/0 allow all IP addresses to access your instance. We recommend setting security group rules to allow access from known IP addresses only." While this is true and common best practice, this has been simplified for the sake of this lab.



Step 5: Add Tags

A tag consists of a case-sensitive key-value pair. For example, you could define a tag with key = Name and value = Webserver.

A copy of a tag can be applied to volumes, instances or both.

Tags will be applied to all instances and volumes. [Learn more](#) about tagging your Amazon EC2 resources.

Key	(128 characters maximum)	Value	(256 characters maximum)	Instances	Volumes	Network Interfaces
Name		Web-Server		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Add another tag (Up to 50 tags maximum)

Cancel Previous Review and Launch Next: Configure Security Group

Step 6: Configure a security group

A *security group* acts as a virtual firewall that controls the traffic for one or more instances. When you launch an instance, you associate one or more security groups with the instance. You add *rules* to each security group that allow traffic to or from its associated instances. You can modify the rules for a security group at any time; the new rules are automatically applied to all instances that are associated with the security group.

1. On **Step 6: Configure Security Group**, configure the following:

- o **Security group name:** Web Server security group
- o **Description:** Security group for my web server

In this lab, you do not log in to your instance using SSH. Removing SSH access improves the security of the instance.

2. To delete the existing SSH rule, choose the next to the existing SSH rule.
3. Choose **Review and Launch**

Step 6: Configure Security Group

A security group is a set of firewall rules that control the traffic for your instance. On this page, you can add rules to allow specific traffic to reach your instance. For example, if you want to set up a web server and allow Internet traffic to reach your instance, add rules that allow unrestricted access to the HTTP and HTTPS ports. You can create a new security group or select from an existing one below. [Learn more](#) about Amazon EC2 security groups.

Assign a security group: Create a new security group
 Select an existing security group

Security group name:

Description:

Type	Protocol	Port Range	Source	Description
This security group has no rules				

Warning
 You will not be able to connect to this instance as the AMI requires port(s) 22 to be open in order to have access. Your current security group doesn't have port(s) 22 open.

Review and Launch

Step 7: Review instance launch

The **Review** page displays the configuration for the instance that you are about to launch.

1. Choose Launch

A **Select an existing key pair or create a new key pair** window will appear.

Amazon EC2 uses public–key cryptography to encrypt and decrypt login information. To log in to your instance, you must create a key pair, specify the name of the key pair when you launch the instance, and provide the private key when you connect to the instance.

In this lab, you do not log in to your instance, so you do not require a key pair.

2. Choose the **Choose an existing key pair** dropdown list, and select **Proceed without a key pair**.

3. Select the next to the text **I acknowledge that**
4. Choose **Launch Instances**

Your instance will now be launched.

5. Choose **View Instances**

The instance appears in a **Pending** state, which means it is being launched. It then changes to **Running**, which indicates that the instance has started booting. There will be a short time before you can access the instance.

The instance receives a public DNS name that you can use to contact the instance from the Internet.

Select the box next to your **Web Server**. The **Details** tab displays detailed information about your instance.

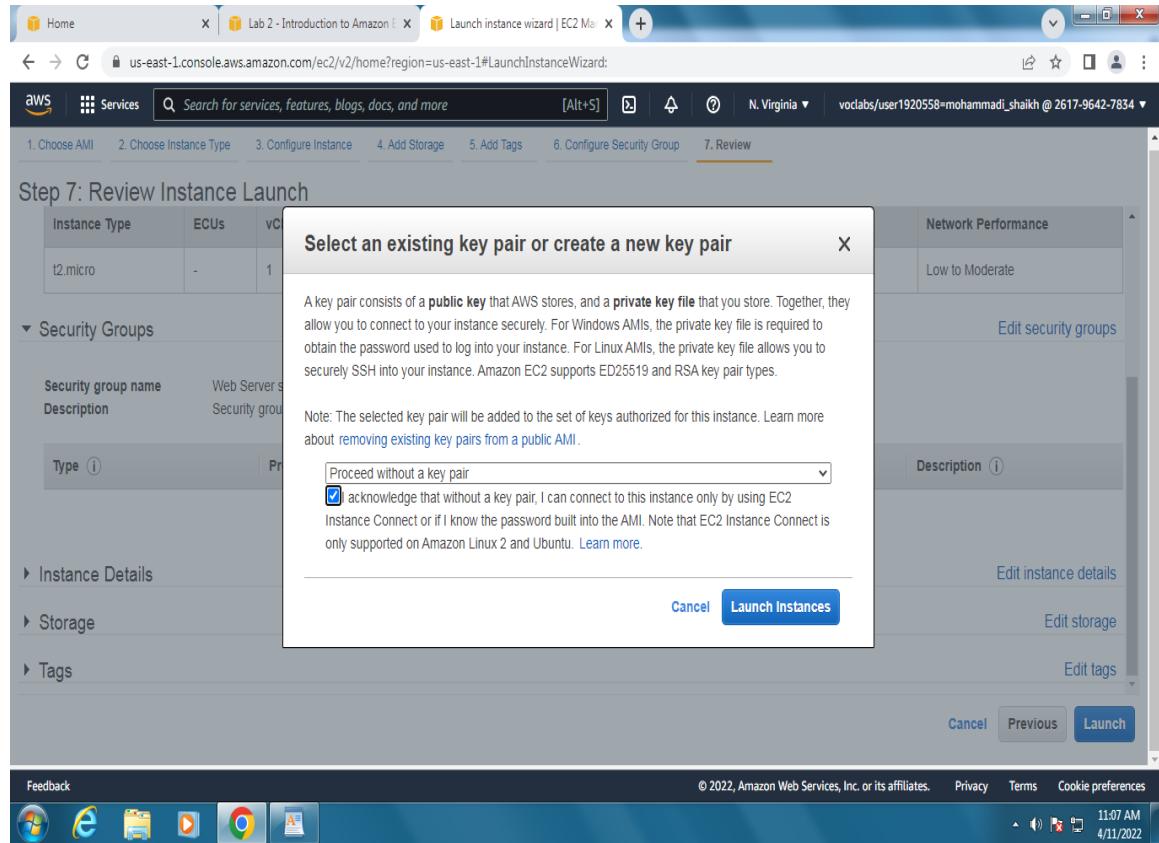
To view more information in the **Details** tab, drag the window divider upward.

Review the information displayed in the **Details**, **Security** and **Networking** tabs.

6. Wait for your instance to display the following:

Note: Refresh if needed.

- **Instance State: Running**
- **Status Checks: 2/2 checks passed**



Task 2: Monitoring your instance

Monitoring is an important part of maintaining the reliability, availability, and performance of your EC2 instances and your AWS solutions.

1. Choose the **Status checks** tab.

With instance status monitoring, you can quickly determine whether Amazon EC2 has detected any problems that might prevent your instances from running applications. Amazon EC2 performs automated checks on every running EC2 instance to identify hardware and software issues.

Notice that both the **System reachability** and **Instance reachability** checks have passed.

2. Choose the **Monitoring** tab.

This tab displays Amazon CloudWatch metrics for your instance. Currently, there are not many metrics to display because the instance was recently launched.

You can chose a graph to see an expanded view.

Amazon EC2 sends metrics to Amazon CloudWatch for your EC2 instances. Basic (5 minute) monitoring is enabled by default. You can enable detailed (1 minute) monitoring.

3. At the top of the page, choose the **Actions** dropdown menu. Select **Monitor and troubleshoot Get system log**.

The system log displays the console output of the instance, which is a valuable tool for problem diagnosis. It is especially useful for troubleshooting kernel problems and service configuration issues that could cause an instance to terminate or become unreachable before its SSH daemon can be started. If you do not see a system log, wait a few minutes and then try again.

1. Scroll through the output, and note that the HTTP package was installed from the **user data** that you added when you created the instance.
2. Choose **Cancel** to return to the Amazon EC2 dashboard.
3. With your web server selected, choose the **Actions** dropdown menu, and select **Monitor and troubleshoot Get instance screenshot**.

This option shows you what your EC2 instance console would look like if a screen were attached to it. Notice it is essentially a command line interface.

If you are unable to reach your instance via SSH or RDP, you can capture a screenshot of your instance and view it as an image. This option provides visibility about the status of the instance and allows for quicker troubleshooting.

4. At the bottom of the page, choose **Cancel**.

The screenshot shows two consecutive views of the AWS EC2 Management Console.

Top View: The Instances page displays a single instance named "Web-Server" with Instance ID "i-0001bbbfd6e1f2b5". The instance is in a Pending state. The Actions menu is open, showing options like Connect, Launch Instances, and others.

Name	Instance ID	Instance state	Instance type	Status check	Alarm status	Availability Zone
Web-Server	i-0001bbbfd6e1f2b5	Pending	t2.micro	-	No alarms	us-east-1a

Bottom View: The Instances page shows the same instance now in a Running state. The Actions menu is open, and the "Details" tab is selected. The "Details" panel shows instance summary information including Instance ID, Public IPv4 address (3.235.90.219), Private IPv4 addresses (10.0.1.154), and Public IPv4 DNS (ec2-3-235-90-219.compute-1.amazonaws.com).

Task 3: Updating your security group and accessing the web server

When you launched the EC2 instance, you provided a script that installed a web server and created a simple web page. In this task, you access content from the web server.

1. Select box next to the EC2 web server you created, and then choose the **Details** tab.

2. Copy the **Public IPv4 address** of your instance to your clipboard.
3. In your web browser, open a new tab, paste the IP address you just copied, and then press Enter.

Question: Are you able to access your web server? Why not?

You are not currently able to access your web server because the security group is not permitting inbound traffic on port 80, which is used for HTTP web requests. This is a demonstration of how to use a security group as a firewall to restrict the network traffic that is allowed in and out of an instance.

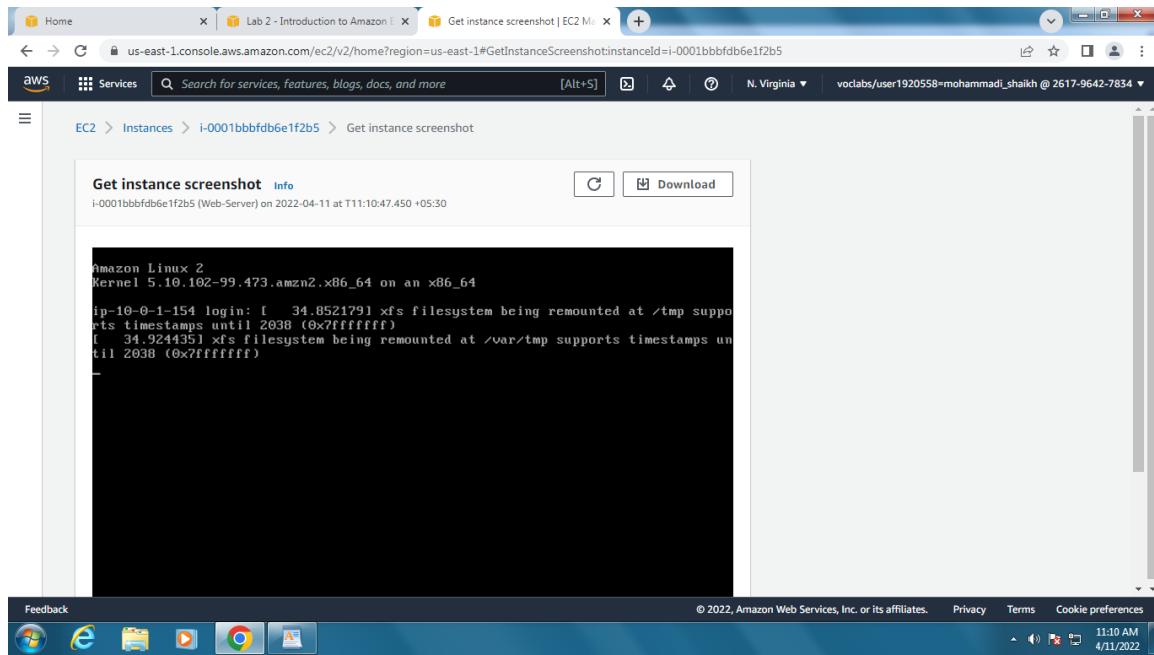
To correct this issue, you now update the security group to permit web traffic on port 80.

4. Keep the browser tab open, but return to the **EC2 Management Console** tab.
5. In the left navigation pane, choose **Security Groups**.
6. Select the check box next to the **Web Server security group**.
7. Choose the **Inbound rules** tab.

The security group currently has no rules.

8. Choose **Edit inbound rules** and then choose **Add rule** and configure the following:
 - **Type:** Choose **HTTP**.
 - **Source:** Choose **Anywhere**.
9. Choose **Save rules**
10. Return to the web server tab that you previously opened, and choose to refresh the page.

You should see the message **Hello From Your Web Server!**



The screenshot shows the AWS EC2 Management Console interface. The left sidebar navigation includes 'AMIs New', 'AMI Catalog', 'Elastic Block Store' (Volumes, Snapshots, Lifecycle Manager), 'Network & Security' (Security Groups, Elastic IPs, Placement Groups, Key Pairs, Network Interfaces), 'Load Balancing', 'Auto Scaling' (Launch Configurations, Auto Scaling Groups), and 'Feedback'. The main content area is titled 'Security Groups (1/3)' and shows a table with the following data:

Name	Security group ID	Security group name	VPC ID	Description
sg-053d7c6f4bde8ea1d	vpc-0e0a3cf78822ba0c0	Web Server security gr...	Security group for my ...	
sg-0f63301df7f35956c	vpc-0bb7c1aed3f004fa0	default	default VPC security gr...	
sg-07df6e2d253f8d602	vpc-0e0a3cf78822ba0c0	default	default VPC security gr...	

The selected security group is 'sg-053d7c6f4bde8ea1d - Web Server security group'. The details pane below shows a message: 'You can now check network connectivity with Reachability Analyzer' with a 'Run Reachability Analyzer' button.

Inbound rules [Info](#)

Security group rule ID	Type Info	Protocol Info	Port range Info	Source Info	Description - optional Info
-	HTTP	TCP	80	Anywh...	<input type="text" value="0.0.0.0"/> X

[Add rule](#) Cancel [Preview changes](#) [Save rules](#)

Feedback © 2022, Amazon Web Services, Inc. or its affiliates. Privacy Terms Cookie preferences

Not secure | 3.235.90.219 11:13 AM 4/11/2022

Hello From Mohammadi

11:14 AM 4/11/2022

Assignment 7

Title

Design and develop custom Application (Mini Project) using Salesforce Cloud.

Requirements

1. Salesforce
2. Browser

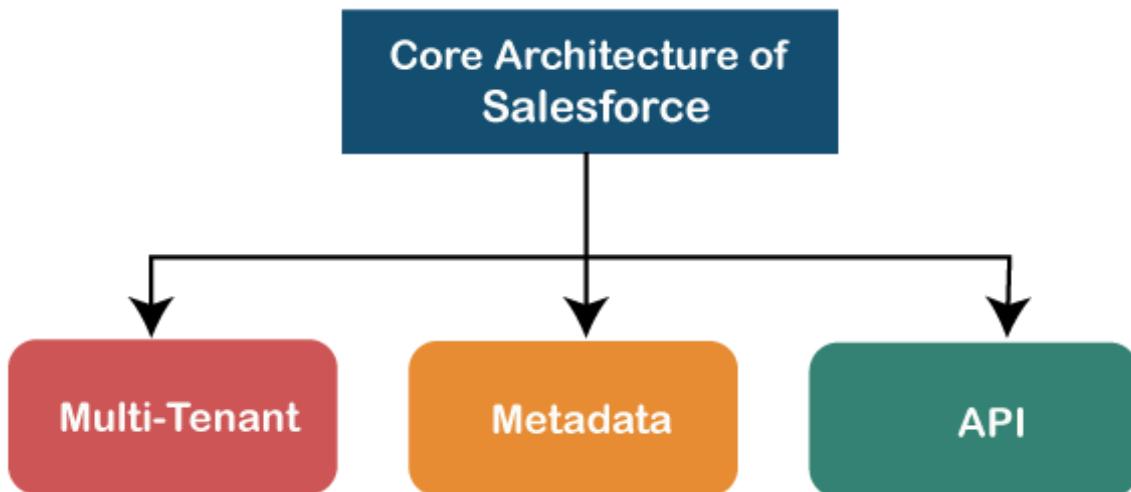
Theory

A) Salesforce:

1. Salesforce, Inc. is a famous American cloud-based software company that provides CRM services.
2. Salesforce is a popular CRM tool for support, sales, and marketing teams worldwide.
3. Salesforce services allow businesses to use cloud technology to better connect with partners, customers, and potential customers. Using the Salesforce CRM, companies can track customer activity, market to customers, and many more services.
4. A CRM platform helps you go deeper with all your metrics and data; you could also set up a dashboard that showcases your data visually. In addition to this, you can also have personalized outreach with automation.
5. Another significant benefit is that a CRM platform can also improve customer service's ability to help customers or a sales team's outreach efforts.
6. Today, Salesforce is the #1 customer relationship management (CRM) platform in the world. It also offers organizations easy access to web-based software over the internet.

7.

B) Salesforce Architecture:



The different layers of the Salesforce architecture are:

1. Multi-tenant:

Salesforce stores data in a single database schema. There can be a single instance of a software server with multiple tenants. Speaking about a multi-tenant architecture, there is a single shared application service to several clients. This makes it cost-effective. On the contrary, in a single-tenant, the development and maintenance cost must be entirely owned by one client. Hence the multi-tenant architecture is a boon.

2. Metadata:

Salesforce uses a metadata-driven development model. This allows developers to only focus on building the application. This metadata-driven platform makes customization and scaling up easy.

3. API:

Salesforce provides a powerful source of APIs. This helps in developing and customizing the Salesforce1 Mobile App. Every feature of the Salesforce design has been planned and implemented precisely.

C) Salesforce Cloud Services:



Sales Cloud



Marketing Cloud



Analytics Cloud



IoT Cloud



App Cloud

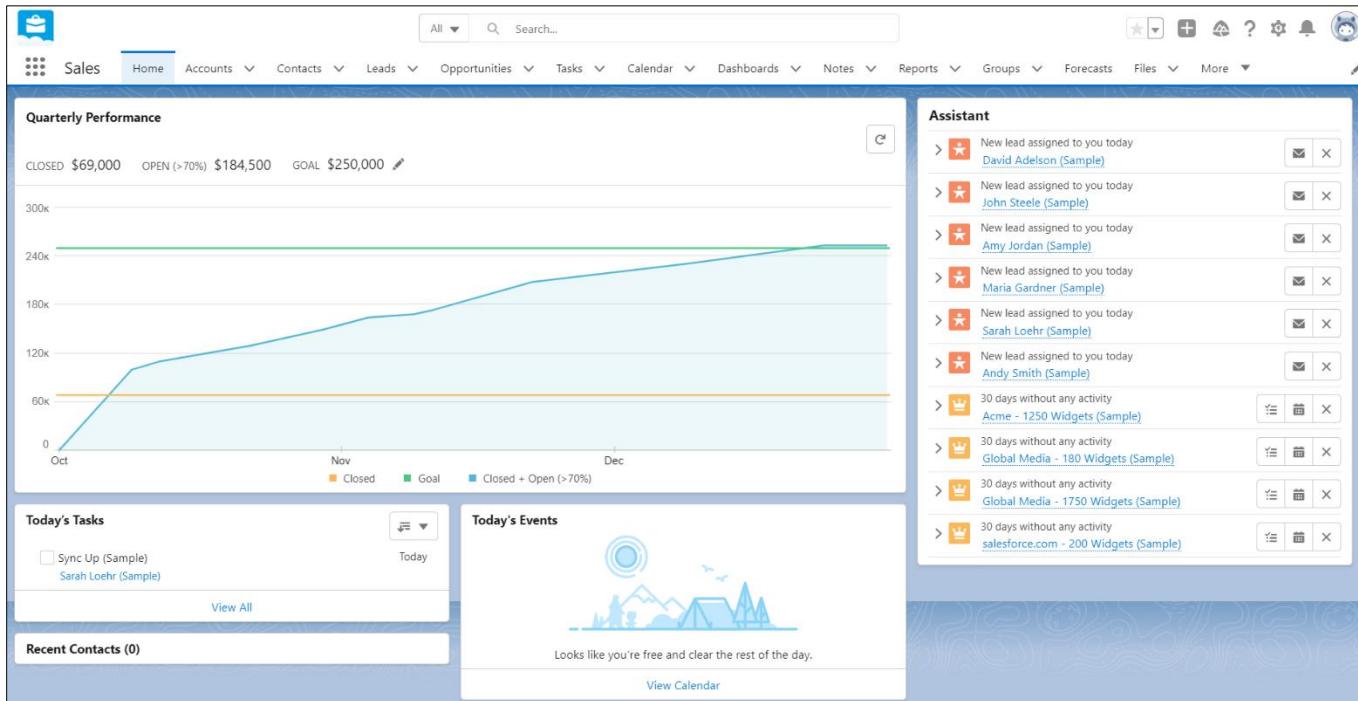


Service Cloud

1. **Sales Cloud:** It is one of the most essential and popular products of Salesforce. It is a CRM platform that allows you to manage your company's sales, marketing, and customer support aspects. Sales Cloud gives you the status of the lead that will be helpful for sales executives.
2. **Marketing Cloud:** Marketing is crucial when it comes to running a business. Marketing cloud lets you run campaigns, manage emails, messages, social media, content management, data analytics, etc., with the help of a tracking system.
3. **Analytics Cloud:** This enables users to create a highly visually appealing dashboard of the available data. By doing so, you can get an in-depth understanding and analyze the trends, business, and more.
4. **IoT Cloud:** Salesforce IoT cloud is used when your company needs to handle the Internet of Things (IoT) data. This platform can take vast volumes of data generated by various IoT devices; following this, you get real-time responses.
5. **Salesforce App Cloud:** You can use this service to develop custom apps that will run on the Salesforce platform.

6. Salesforce Service Cloud: Salesforce also helps you serve your customers. This is a service platform for your organization's support team. It provides features like case tracking and social networking plug-in.

Steps



1. Signup and Setup:

a. Signup for Salesforce:

b. Login and you will be directed to Home page:

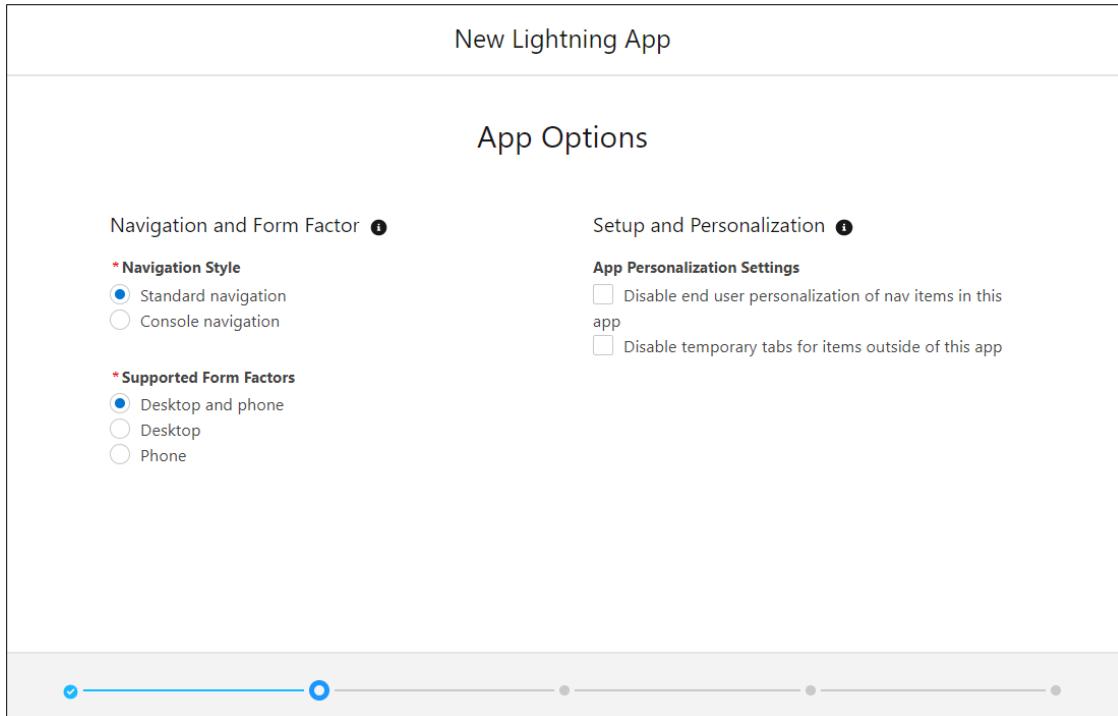
The screenshot shows the 'Lightning Experience App Manager' interface. At the top, there is a search bar labeled 'Search Setup' and a toolbar with various icons. Below the toolbar, the title 'Lightning Experience App Manager' is displayed. A sub-header indicates '18 items • Sorted by App Name • Filtered by All appmenuitems - TabSet Type'. The main area is a table with columns: 'App Name ↑', 'Developer Name ↓', 'Description', 'Last Modified...', 'App ...', and 'Vi...'. The table lists 18 apps, such as 'All Tabs', 'Bolt Solutions', 'Community', etc., with details like developer name, description, and modification date.

c. Go to the Setup home page for custom application creation:

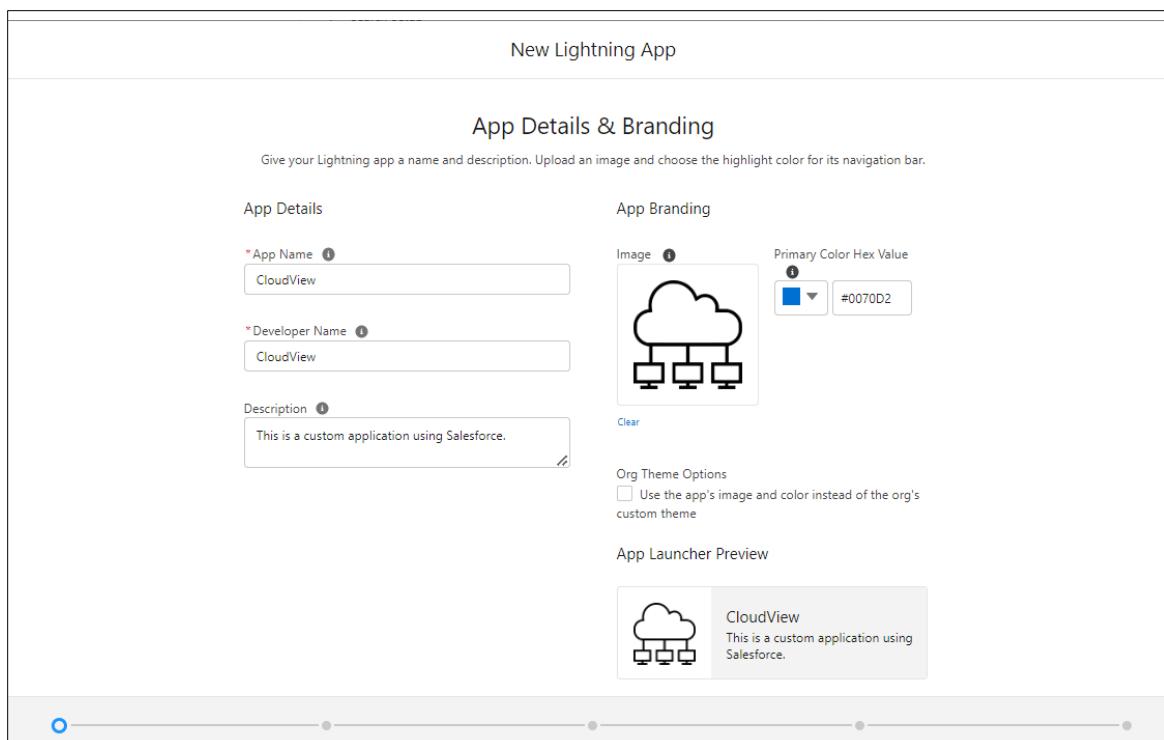
The screenshot shows the 'Setup Home' page. The left sidebar contains navigation links for 'Setup Home', 'Service Setup Assistant', 'Multi-Factor Authentication Assistant', 'Release Updates', 'New Salesforce Mobile App QuickStart', 'Lightning Usage', 'Optimizer', 'Manage Subscription', 'ADMINISTRATION' (with sub-links for 'Users', 'Data', 'Email'), 'PLATFORM TOOLS' (with sub-links for 'Apps', 'Feature Settings', 'Einstein'), and a 'Quick Find' search bar. The main content area features three cards: 'Mobile Publisher' (with a 'Learn More' button), 'Real-time Collaborative Docs' (with a 'Get Started' button), and 'Join the Trailblazer Community' (with a 'Join Now' button). Below these cards is a section titled 'Most Recently Used' with a table showing one item: 'Yash Nimbalkar' (User type). At the bottom, there is a footer bar with user information ('Jimmy Harold 1h @USA Negotiations under way!') and other navigation links.

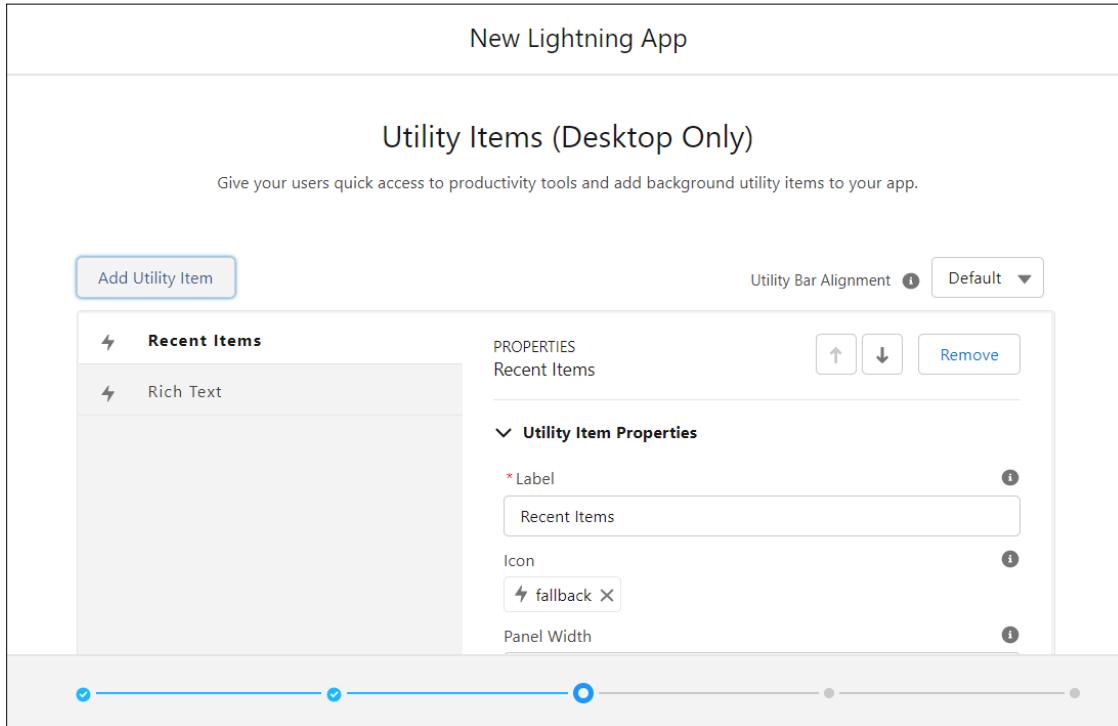
- a. Go to the App Manager from the Setup console and click on New Lightning App:

b. In the modal that appears, enter app details and add logo and color for



branding:





- c. Add App options like Navigation and Supported Form Factors:
- d. Add required Utility Items for your application:

- e. Add required Navigation Items for your application:

New Lightning App

User Profiles

Choose the user profiles that can access this app.

Available Profiles	Selected Profiles
<input type="text" value="Type to filter list..."/> Contract Manager	System Administrator
CPQ Integration User	
End User	
Executive Sponsor	
Identity User	
Marketing User	

- f. Add required User Profiles for your application:

New Lightning App

Navigation Items

in the app, and arrange the order in which they appear. Users can personalize the navigation to add or move items, but users can't remove or rename the items that you are available only for phone or only for desktop. These items are dropped from the navigation bar when the app is viewed in a format that the item doesn't support.

Available Items	Selected Items
<input type="text" value="Type to filter list..."/> Accounts	Opportunities
All Sites	
App Launcher	
Assets	
Awards	

- g. Your application is successfully created. You can view your application enlisted in the App Manager. You can visit your application by clicking the apps icon in the top left of the home page, then search for your app and click on it to visit:

The top screenshot shows the Salesforce Object Manager page. A modal window titled '+ New Object' is open, showing the 'RECENT RECORDS' section with 'StudentPICT' listed. The main table lists various standard objects with their API names, types, and descriptions.

LABEL	API NAME	TYPE	DESCRIPTION
Account	Account	Standard Object	
Account Contact Relationship	AccountContactRelation	Standard Object	
Activity	Activity	Standard Object	
Asset	Asset	Standard Object	
Asset Relationship	AssetRelationship	Standard Object	
Campaign	Campaign	Standard Object	
Campaign Influence	CampaignInfluence	Standard Object	
Campaign Member	CampaignMember	Standard Object	
Case	Case	Standard Object	
Contact	Contact	Standard Object	
Contact Request	ContactRequest	Standard Object	
Content Version	ContentVersion	Standard Object	

The bottom screenshot shows the Opportunities page with the 'Recently Viewed' filter selected. It displays a list of 5 opportunities, each with columns for Opportunity Name, Account Name, Stage, Close Date, and Opportunity Owner Alias.

Opportunity Name	Account Name	Stage	Close Date	Opportunity Owner Alias
Acme - 130 Widgets (Sample)	Acme (Sample)	Closed Lost	4/27/2021	YNimb
Acme - 1250 Widgets (Sample)	Acme (Sample)	Qualification	4/19/2022	YNimb
Acme - 1100 Widgets (Sample)	Acme (Sample)	Closed Won	4/7/2022	YNimb
Acme - 1,200 Widgets (Sample)	Acme (Sample)	Needs Analysis	5/11/2022	YNimb
Acme - 120 Widgets (Sample)	Acme (Sample)	Closed Won	5/8/2022	YNimb

3. Custom Object Creation:

- a. Go to the Object Manager. Click on its dropdown and select '+ New Object':

b. Enter all the details for your object like basic information, labels, features, deployment status, search status, etc. and then click Save:

The screenshot shows the Salesforce Object Manager interface for creating a new custom object. The top navigation bar includes a cloud icon, a search bar labeled 'Search Setup', and tabs for 'Setup', 'Home', and 'Object Manager'. The 'Object Manager' tab is selected, and the sub-tab 'SETUP' is active. The main title is 'New Custom Object'.

Custom Object Definition Edit

Custom Object Information

- Label: StudentPICT (Example: Account)
- Plural Label: StudentsPICT (Example: Accounts)
- Starts with vowel sound:

The Object Name is used when referencing the object via the API.

- Object Name: StudentPICT (Example: Account)
- Description: This object is utilized for cloud computing assignment demo by Yash Nimbalkar.

Context-Sensitive Help Setting

- Open the standard Salesforce.com Help & Training window
- Open a window using a Visualforce page

Content Name:

Enter Record Name Label and Format

The Record Name appears in page layouts, key lists, related lists, lookups, and search results. For example, the Record Name for Account is "Account Name" and for Case it is "Case Number". Note that the Record Name field is required.

- Record Name: StudentPICT Name (Example: Account Name)
- Data Type:

Optional Features

- Allow Reports
- Allow Activities
- Track Field History
- Allow in Chatter Groups
- Enable Licensing

Object Classification

When these settings are enabled, this object is classified as an Enterprise Application object. When these settings are disabled, this object is classified as a Light Application object. [Learn more](#).

- Allow Sharing
- Allow Bulk API Access
- Allow Streaming API Access

Deployment Status

- In Development
- Deployed

Search Status

When this setting is enabled, your users can find records of this object type when they search. [Learn more](#).

- Allow Search

Object Creation Options (Available only when custom object is first created)

- Add Notes and Attachments related list to default page layout
- Launch New Custom Tab Wizard after saving this custom object

Buttons at the bottom: Save, Save & New, Cancel

c. Your custom object is successfully created. You can access it through the Object Manager:

Details	
Fields & Relationships	Description This object is utilized for cloud computing assignment demo by Yash Nimbalkar.
Page Layouts	
Lightning Record Pages	
Buttons, Links, and Actions	
Compact Layouts	
Field Sets	
Object Limits	
Record Types	
Related Lookup Filters	
Search Layouts	
Search Layouts for Salesforce Classic	
Details	
	API Name StudentPICT__c
	Custom
	Singular Label StudentPICT
	Plural Label StudentsPICT
	Enable Reports
	Track Activities
	Track Field History
	Deployment Status Deployed
	Help Settings Standard salesforce.com Help Window

4. Custom Field Creation for Custom Object:

a. Go to the Fields and Relationships section of your Object and click New:

Fields & Relationships			
6 Items, Sorted by Field Label			
FIELD LABEL	FIELD NAME	DATA TYPE	CONTROLLING FIELD
Created By	CreatedBy	Lookup(User)	
Last Modified By	LastModifiedBy	Lookup(User)	
Owner	OwnerId	Lookup(User,Group)	
StudentPICT Name	Name	Text(80)	

b. First choose the data type for your field:

The screenshot shows a software interface titled "StudentPICT" with a sub-section "New Custom Field". At the top, there's a header bar with "Step 1. Choose the field type" and "Step 1" on the right, along with "Next" and "Cancel" buttons. Below the header, a sub-header says "Specify the type of information that the custom field will contain.". The main area is titled "Data Type" and contains a list of options:

- None Selected** Select one of the data types below.
- Auto Number** A system-generated sequence number that uses a display format you define. The number is automatically incremented for each new record.
- Formula** A read-only field that derives its value from a formula expression you define. The formula field is updated when any of the source fields change.
- Roll-Up Summary** A read-only field that displays the sum, minimum, or maximum value of a field in a related list or the record count of all records listed in a related list.
- Lookup Relationship** Creates a relationship that links this object to another object. The relationship field allows users to click on a lookup icon to select a value from a popup list. The other object is the source of the values in the list.
- Master-Detail Relationship** Creates a special type of parent-child relationship between this object (the child, or "detail") and another object (the parent, or "master") where:
 - The relationship field is required on all detail records.
 - The ownership and sharing of a detail record are determined by the master record.
 - When a user deletes the master record, all detail records are deleted.

c. Enter basic information like name, label, etc. for your field:

Field Label	CourseEnrolled	Visible	Read-Only																																		
Data Type	Text																																				
Description	This is a demo field to demonstrate custom field.																																				
Select the profiles to which you want to grant edit access to this field via field-level security. The field will be hidden from all profiles if you do not add it to field-level security.																																					
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; padding: 2px;">Field-Level Security for Profile</th> <th style="text-align: center; padding: 2px;">Visible</th> <th style="text-align: center; padding: 2px;">Read-Only</th> </tr> </thead> <tbody> <tr><td style="padding: 2px;">Contract Manager</td><td style="text-align: center; padding: 2px;"><input checked="" type="checkbox"/></td><td style="text-align: center; padding: 2px;"><input type="checkbox"/></td></tr> <tr><td style="padding: 2px;">CPQ Integration User</td><td style="text-align: center; padding: 2px;"><input checked="" type="checkbox"/></td><td style="text-align: center; padding: 2px;"><input type="checkbox"/></td></tr> <tr><td style="padding: 2px;">End User</td><td style="text-align: center; padding: 2px;"><input checked="" type="checkbox"/></td><td style="text-align: center; padding: 2px;"><input type="checkbox"/></td></tr> <tr><td style="padding: 2px;">Executive Sponsor</td><td style="text-align: center; padding: 2px;"><input checked="" type="checkbox"/></td><td style="text-align: center; padding: 2px;"><input type="checkbox"/></td></tr> <tr><td style="padding: 2px;">Identity User</td><td style="text-align: center; padding: 2px;"><input checked="" type="checkbox"/></td><td style="text-align: center; padding: 2px;"><input type="checkbox"/></td></tr> <tr><td style="padding: 2px;">Marketing User</td><td style="text-align: center; padding: 2px;"><input checked="" type="checkbox"/></td><td style="text-align: center; padding: 2px;"><input type="checkbox"/></td></tr> <tr><td style="padding: 2px;">Minimum Access - Salesforce</td><td style="text-align: center; padding: 2px;"><input checked="" type="checkbox"/></td><td style="text-align: center; padding: 2px;"><input type="checkbox"/></td></tr> <tr><td style="padding: 2px;">Read Only</td><td style="text-align: center; padding: 2px;"><input checked="" type="checkbox"/></td><td style="text-align: center; padding: 2px;"><input type="checkbox"/></td></tr> <tr><td style="padding: 2px;">Solution Manager</td><td style="text-align: center; padding: 2px;"><input checked="" type="checkbox"/></td><td style="text-align: center; padding: 2px;"><input type="checkbox"/></td></tr> <tr><td style="padding: 2px;">Standard User</td><td style="text-align: center; padding: 2px;"><input checked="" type="checkbox"/></td><td style="text-align: center; padding: 2px;"><input type="checkbox"/></td></tr> <tr><td style="padding: 2px;">System Administrator</td><td style="text-align: center; padding: 2px;"><input checked="" type="checkbox"/></td><td style="text-align: center; padding: 2px;"><input type="checkbox"/></td></tr> </tbody> </table>		Field-Level Security for Profile	Visible	Read-Only	Contract Manager	<input checked="" type="checkbox"/>	<input type="checkbox"/>	CPQ Integration User	<input checked="" type="checkbox"/>	<input type="checkbox"/>	End User	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Executive Sponsor	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Identity User	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Marketing User	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Minimum Access - Salesforce	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Read Only	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Solution Manager	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Standard User	<input checked="" type="checkbox"/>	<input type="checkbox"/>	System Administrator	<input checked="" type="checkbox"/>	<input type="checkbox"/>
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System Administrator	<input checked="" type="checkbox"/>	<input type="checkbox"/>																																			

StudentPICT
New Custom Field

Step 2. Enter the details

Field Label	<input type="text" value="CourseEnrolled"/> i
Please enter the maximum length for a text field below.	
Length	<input type="text" value="17"/>
Field Name	<input type="text" value="CourseEnrolled"/> i
Description	<input type="text" value="This is a demo field to demonstrate custom field."/> i
Help Text	<input type="text"/> i
Required	<input checked="" type="checkbox"/> Always require a value in this field in order to save a record
Unique	<input type="checkbox"/> Do not allow duplicate values
<input checked="" type="radio"/> Treat "ABC" and "abc" as duplicate values (case insensitive) <input type="radio"/> Treat "ABC" and "abc" as different values (case sensitive)	

d. Select appropriate options to establish field level security:

FIELD LABEL	FIELD NAME	DATA TYPE	CONTROLLING FIELD	INDEXED
BatchID	BatchID_c	Number(18, 0)		
CourseEnrolled	CourseEnrolled_c	Text(17)		
Created By	CreatedById	Lookup(User)		
Last Modified By	LastModifiedById	Lookup(User)		
Owner	OwnerId	Lookup(User,Group)		✓
StudentPICT Name	Name	Text(80)		✓

e. Finally check for appropriate page layout and click save:

Step 4. Add to page layouts **Step 4 of 4**

Field Label: CourseEnrolled
Data Type: Text
Description: This is a demo filed to demonstrate custom field.

Select the page layouts that should include this field. The field will be added as the last field in the first 2-column section of these page layouts. The field will not appear on any pages if you do not select a layout.

To change the location of this field on the page, you will need to customize the page layout.

Add Field Page Layout Name
 StudentPICT Layout

When finished, click Save & New to create more custom fields, or click Save if you are done.

f. Similarly, you can create as many fields as required and access them from the Fields and Relationships section of your Object:

The screenshot shows the 'Tabs' section of the Salesforce Setup. The top navigation bar has 'SETUP' and 'Tabs'. Below it, the title 'New Custom Object Tab' is displayed. A sub-section titled 'Step 1. Enter the Details' is active. The instructions say to choose a custom object for the new tab. An 'Object' dropdown is set to 'StudentPICT'. A 'Tab Style' section shows 'People' selected. An optional 'Splash Page Custom Link' dropdown is set to '-None--'. A 'Description' field contains the text 'Custom Tab'.

5. Custom Tab Creation for Object and Adding to Navigation Items:

- Go to Tabs section from home and then click New next to Custom Object Tabs:
- Add basic information of like Object and style for your tab:

The screenshot shows the 'Custom Tabs' section of the Salesforce Setup. The top navigation bar has 'SETUP' and 'Tabs'. Below it, the title 'Custom Tabs' is displayed. It says you can create new custom tabs to extend Salesforce functionality. It lists four categories: 'Custom Object Tabs', 'Web Tabs', 'Visualforce Tabs', and 'Lightning Component Tabs'. Each category has a 'New' button and a 'What Is This?' link. Below each category, it says 'No [Category] have been defined'.

Custom Object Tabs	New	What Is This?
No Custom Object Tabs have been defined		

Web Tabs	New	What Is This?
No Web Tabs have been defined		

Visualforce Tabs	New	What Is This?
No Visualforce Tabs have been defined		

Lightning Component Tabs	New	What Is This?
No Lightning component tabs have been defined		

Step 3. Add to Custom Apps

Choose the custom apps for which the new custom tab will be available. You may also examine or alter the visibility of tabs from the detail and edit pages of each Custom App.

Custom App	<input checked="" type="checkbox"/> Include Tab
Platform (standard_Platform)	<input checked="" type="checkbox"/>
Sales (standard_Sales)	<input checked="" type="checkbox"/>
Salesforce Chatter (standard_Chatter)	<input checked="" type="checkbox"/>
Marketing (standard_Marketing)	<input checked="" type="checkbox"/>
Service (standard_Service)	<input checked="" type="checkbox"/>
Community (standard_Community)	<input checked="" type="checkbox"/>
Sample Console (standard_ServiceConsole)	<input checked="" type="checkbox"/>
Sales (standard_LightningSales)	<input checked="" type="checkbox"/>
Sales Console (standard_LightningSalesConsole)	<input checked="" type="checkbox"/>
Relationship Management (Relationship_Management)	<input checked="" type="checkbox"/>
Lead Generation (Lead_Generation)	<input checked="" type="checkbox"/>
Sales Operations (Sales_Operations)	<input checked="" type="checkbox"/>

c. Add appropriate profiles for the tab:

d. Add your tab to the Custom Apps you want and then click save:

Step 2. Add to Profiles

Choose the user profiles for which the new custom tab will be available. You may also examine or alter the visibility of tabs from the detail and edit pages of each profile.

Apply one tab visibility to all profiles

Apply a different tab visibility for each profile

Profile	Tab Visibility
Contract Manager	<input type="button" value="Default On"/>
CPQ Integration User	<input type="button" value="Default On"/>
End User	<input type="button" value="Default On"/>
Executive Sponsor	<input type="button" value="Default On"/>
Identity User	<input type="button" value="Default On"/>
Marketing User	<input type="button" value="Default On"/>
Minimum Access - Salesforce	<input type="button" value="Default On"/>
Read Only	<input type="button" value="Default On"/>
Solution Manager	<input type="button" value="Default On"/>
Standard User	<input type="button" value="Default On"/>
System Administrator	<input type="button" value="Default On"/>

- e. Go to your App's settings from App Manager. Go to Navigation Items and add the Tab to your app:
6. Custom Page Creation and Activation:

The screenshot shows the 'App Settings' section of the Salesforce App Manager. The left sidebar has 'Navigation Items' selected. The main area displays 'Available Items' and 'Selected Items'. The 'Available Items' list includes: Accounts, All Sites, App Launcher, Assets, Awards, Background Operations, Budget Allocations, Budgets, Calendar, and Campaigns. The 'Selected Items' list contains 'Opportunities' and 'StudentsPICT'. Navigation icons for moving items between lists are visible.

a. Go to the Lightning App Builder from home and click on New:

The screenshot shows the Salesforce Lightning App Builder interface. At the top, there's a search bar labeled "Search Setup" and various navigation icons. Below that is a "Manager" dropdown. The main header says "SETUP" and "Lightning App Builder". A sub-header explains the purpose of the builder. Below this is a "View" dropdown set to "All" and a "Create New View" button. A navigation bar at the bottom includes links for A through Z and an "All" link. The main content area is titled "Lightning Pages" and contains a table with columns: Action, Label +, Name, Namespace Prefix, Description, Type, Created By, and Last Modified By. The table lists several pages like Account_Record_Page1, Contact_Record_Page1, etc.

b. Select the type of lightning page to be created:

The screenshot shows the first step of a "Create a new Lightning page" wizard. The title is "Create a new Lightning page". On the left, a sidebar lists options: "App Page" (which is selected and highlighted in blue), "Home Page", "Record Page", and "Email Application Pane". The main area shows a preview of a mobile app and a desktop page. The mobile app screen displays a donut chart with "1.8M" in the center. The desktop page shows a header with "My Custom App" and "My App Page", a search bar, and a section titled "Pipeline by Stage" with a donut chart. To the right, there's a "Recent Items (20)" list. At the bottom right is a "Next" button.

c. Enter label for your page:

Create a new Lightning page

* Label
PICT_APP_Page

[Back](#) [Next](#)

d. Select layout for your page:

Create a new Lightning page

STANDARD (8)

- Header and Left Sidebar
- Header and Right Sidebar
- Header and Three Regions
- Header and Two Regions**
- Main Region and Right Sidebar
- One Region
- Three Regions
- Two Regions

Full-width header above two equal-width regions. On a phone, the regions stack vertically.

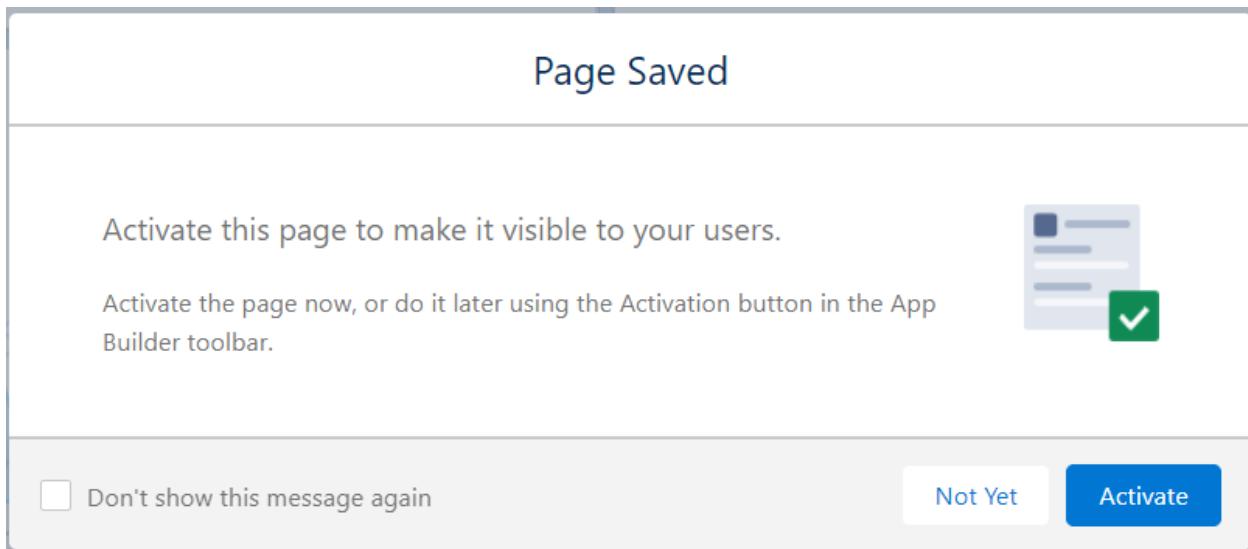
Supported form factors: desktop, tablet, and phone.

[Back](#) [Finish](#)

e. Add all required sections, configure them and click save:

The screenshot shows the Lightning App Builder interface. On the left, there's a sidebar with a search bar and a list of standard components: Chatter Feed, Chatter Publisher, Dashboard, Einstein Next Best Action, Flow, Launchpad, List View, Quip Associated Documents, Quip Document, Quip Notifications, Recent Items, Report Chart, Rich Text, and Visualforce. Below this is a blue banner with the text 'Get more on the AppExchange'. The main area displays a page titled 'PICT STUDENT'S PAGE'. This page includes a 'Chatter Feed' section with posts from 'Yash Nimbalkar' and a 'Launchpad' section with cards for Digital Experiences Home, Groups, Campaigns, Calendar, Images, and News. To the right, there's a 'Rich Text' editor with a toolbar for font style, size, and alignment, and a preview pane showing the rich text content.

f. After saving it will ask you to Activate. Click on Activate:



g. Set proper page settings, lightning experience and mobile navigation when

Activation: PICT_APP_Page

PAGE SETTINGS	LIGHTNING EXPERIENCE	MOBILE NAVIGATION
Give this app page a name, set the page visibility, and choose an icon.		
App Name Enter a name for your app. <input type="text" value="PICT_APP_Page"/>	Icon Choose an icon to represent your app in Lightning Experience and the mobile app.  Change...	
Page Activation When you activate this page, a custom tab is created for it. You can manage the tab's visibility in Setup. <input checked="" type="radio"/> Activate for all users <input type="radio"/> Activate for system administrators only To set further restrictions on who sees this page, use permission sets and profile assignments in Setup.		
Cancel Save		

asked:

h. Another dialog box will appear for adding page to navigation menu. Click Finish

- i. You can go to your app's settings and you will see the page added in

The screenshot shows the Lightning App Builder interface with the 'App Settings' tab selected. Under the 'Navigation Items' section, there is a list of available items on the left and a list of selected items on the right. The selected items include 'Opportunities', 'StudentsPICT', and 'PICT_APP_Page'.

Navigation items:

- j. You can also go to the Lightning App Builder from home and find your page

Action	Label	Name	Namespace Prefix	Description	Type	Created By	Last Modified By
Edit Clone Del	Account Record Page	Account_Record_Page1			Record Page	YNimb_	4/16/2022, 3:02 AM
Edit Clone Del	Account Record Page	Account_Record_Page2			Record Page	YNimb_	4/16/2022, 3:02 AM
Edit Clone Del	Account Record Page	Account_Record_Page			Record Page	YNimb_	4/16/2022, 3:02 AM
Edit Clone Del	Contact Record Page	Contact_Record_Page1			Record Page	YNimb_	4/16/2022, 3:02 AM
Edit Clone Del	Contact Record Page	Contact_Record_Page			Record Page	YNimb_	4/16/2022, 3:02 AM
Edit Clone Del	Getting Started Home	Getting_Started_Home			Home Page	YNimb_	4/16/2022, 3:02 AM
Edit Clone Del	Lead Record Page	Lead_Record_Page1			Record Page	YNimb_	4/16/2022, 3:02 AM
Edit Clone Del	Lead Record Page	Lead_Record_Page			Record Page	YNimb_	4/16/2022, 3:02 AM
Edit Clone Del	Opportunity Record Page	Opportunity_Record_Page1			Record Page	YNimb_	4/16/2022, 3:02 AM
Edit Clone Del	Opportunity Record Page	Opportunity_Record_Page			Record Page	YNimb_	4/16/2022, 3:02 AM
Edit Clone Del	PICT_APP_Page	PICT_APP_Page			App Page	YNimb_	4/16/2022, 4:56 AM

there:

Sample Output

a. Social PICT_APP_Page:

The screenshot displays the PICT_APP_Page interface, which is a social networking platform integrated with cloud computing tools. The page includes the following sections:

- Feed:** Shows posts from user Yash Nimbalkar, including a question about the benefits of Salesforce and a poll comparing AWS, Google Cloud, and MS Azure.
- Launchpad:** A grid of icons for Digital Experiences Home, Groups, Campaigns, Calendar, Images, and News.
- Create a Case:** A form titled "Confirm Customer Info" with a message from a bot asking for first and last names.
- Recent Items:** A list of three recent items: "Executive Sponsor: Key Metrics", "Service KPIs", and a post from Yash Nimbalkar.

b. Opportunities Page:

The screenshot shows a list of opportunities with the following data:

	Opportunity Name	Account Name	Stage	Close Date	Opportunity Owner Alias
1	Global Media - 400 Widgets (Sample)	Global Media (Sample)	Qualification	5/4/2022	YNimb
2	Acme - 130 Widgets (Sample)	Acme (Sample)	Closed Lost	4/27/2021	YNimb
3	Acme - 1250 Widgets (Sample)	Acme (Sample)	Qualification	4/19/2022	YNimb
4	Acme - 1100 Widgets (Sample)	Acme (Sample)	Closed Won	4/7/2022	YNimb
5	Acme - 1,200 Widgets (Sample)	Acme (Sample)	Needs Analysis	5/11/2022	YNimb
6	Acme - 120 Widgets (Sample)	Acme (Sample)	Closed Won	5/9/2022	YNimb

c. StudentsPICT Page:

The screenshot shows a list of students with the following data:

	StudentPICT Name
1	Rahul Patil
2	Farhan Naqui
3	Abhijeet Mahajan
4	Yash Nimbalkar

Assignment 8

Title

Design an Assignment to retrieve, verify, and store user credentials using Firebase Authentication, the Google App Engine standard environment, and Google Cloud Data store.

Requirements

1. Google App Engine
2. Firebase
3. Google Cloud
4. Text Editor
5. Browser

Theory

A) Firebase:

1. Google Firebase is a mobile application development platform from Google with powerful features for developing, handling, and enhancing applications. Firebase is a backend platform for building web and mobile applications.
2. Firebase is fundamentally a collection of tools developers can rely on, creating applications and expanding them based on demand.
3. Firebase aims to solve three main problems for developers:
 - a. Build an app, fast
 - b. Release and monitor an app with confidence
 - c. Engage users,

4. Developers relying on this platform get access to services that they would have to develop themselves, and it enables them to lay focus on delivering robust application experiences.
5. Some of the Google Firebase platform's standout features include databases, authentication, push messages, analytics, file storage, and much more.
6. Since the services are cloud-hosted, developers can smoothly perform on-demand scaling without any hassle. Firebase is currently among the top app development platforms relied upon by developers across the globe.

B) Firebase Key Features:

1. Authentication:

It supports authentication using passwords, phone numbers, Google, Facebook, Twitter, and more. The Firebase Authentication (SDK) can be used to manually integrate one or more sign-in methods into an app.

2. Realtime database:

Data is synced across all clients in real-time and remains available even when an app goes offline.

3. File Storage:

Firebase Storage provides a simple way to save binary files — most often images, but it could be anything — to Google Cloud Storage directly from the client. Firebase Storage has its own system of security rules to protect your GCloud bucket from the masses, while granting detailed write privileges to your authenticated clients.

4. Hosting:

Firebase Hosting provides fast hosting for a web app; content is cached into content delivery networks worldwide.

5. Test lab:

The application is tested on virtual and physical devices located in



Build better apps

-  **Cloud Firestore**
Store and sync app data at global scale
-  **Firebase ML BETA**
Machine learning for mobile developers
-  **Cloud Functions**
Run mobile backend code without managing servers
-  **Authentication**
Authenticate users simply and securely
-  **Hosting**
Deliver web app assets with speed and security
-  **Cloud Storage**
Store and serve files at Google scale
-  **Realtime Database**
Store and sync app data in milliseconds



Improve app quality

-  **Crashlytics**
Prioritize and fix issues with powerful, realtime crash reporting
-  **Performance Monitoring**
Gain insight into your app's performance
-  **Test Lab**
Test your app on devices hosted by Google
-  **App Distribution BETA**
Distribute pre-release versions of your app to your trusted testers



Grow your business

-  **In-App Messaging BETA**
Engage active app users with contextual messages
-  **Google Analytics**
Get free and unlimited app analytics
-  **Predictions**
Smart user segmentation based on predicted behavior
-  **A/B Testing BETA**
Optimize your app experience through experimentation
-  **Cloud Messaging**
Send targeted messages and notifications
-  **Remote Config**
Modify your app without deploying a new version
-  **Dynamic Links**
Drive growth by using deep links with attribution

Google's data centers.

6. Notifications:

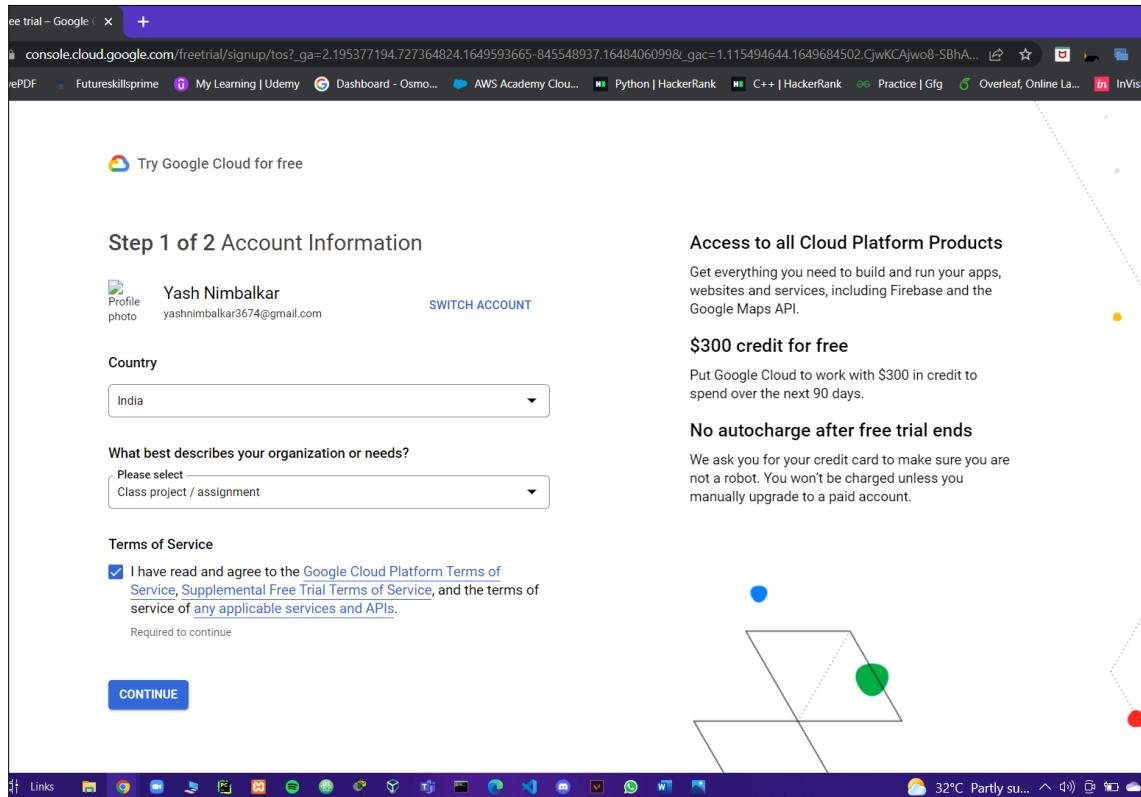
Notifications can be sent with firebase with no additional coding. Users can get started with firebase for free; more details can be found on the official website.

C) Firebase Uses:

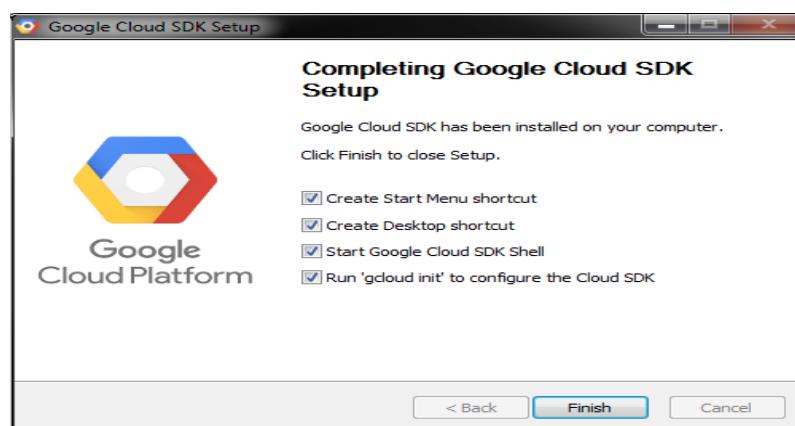
Steps

1. Initial Setup:

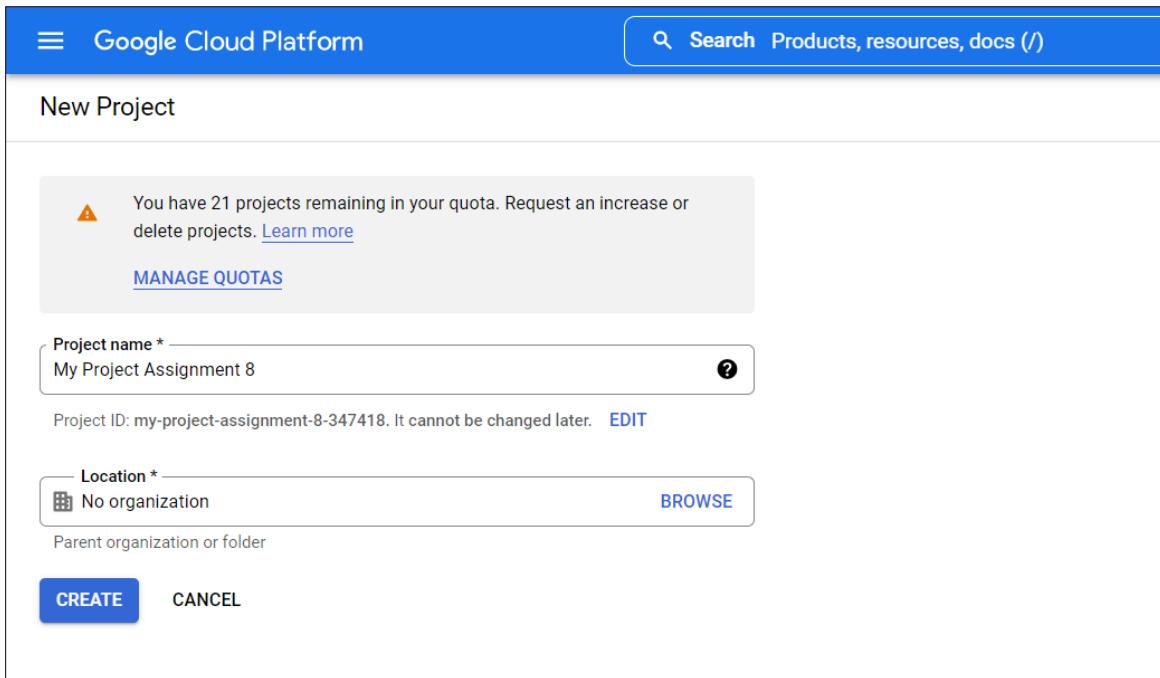
- Install and configure Google App Engine:



b. Signup and Login to Google Cloud platform:

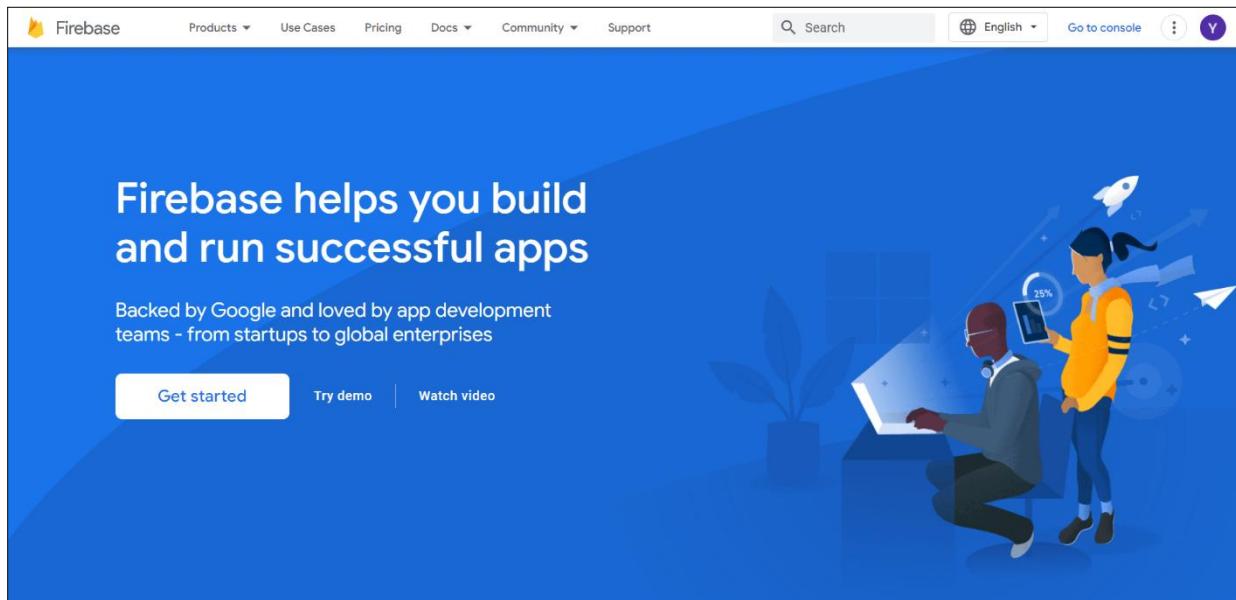


c. Login to Firebase:



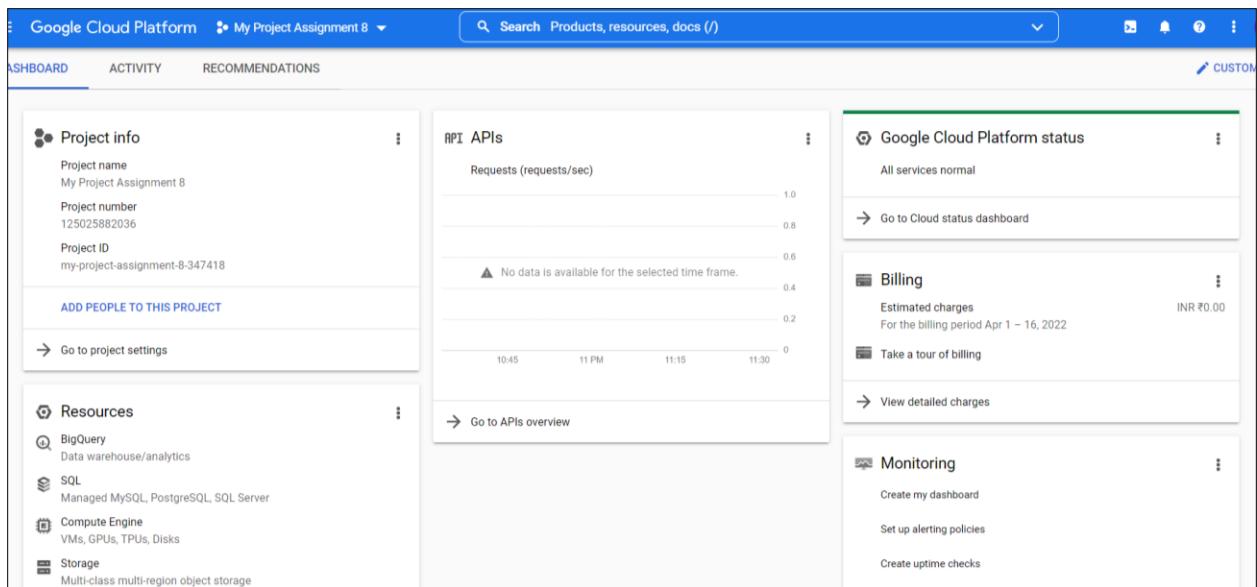
2. Creation of project in Google Cloud:

a. Create a new project in Google Cloud platform:



b. You can view the created project in the dashboard:

3. Setup Google App Engine:



- Open the GAE SDK shell and type the command ‘gcloud init’. Then select appropriate configuration an account:
- From the list that appears select the appropriate project that we created in

```
Google Cloud SDK Shell

D:\TE\CC\Cloud SDK>gcloud init
Welcome! This command will take you through the configuration of gcloud.

Settings from your current configuration [default] are:
accessibility:
  screen_reader: 'False'
core:
  account: yashnimbalkar15@gmail.com
  disable_usage_reporting: 'True'

Pick configuration to use:
[1] Re-initialize this configuration [default] with new settings
[2] Create a new configuration
Please enter your numeric choice: 1

Your current configuration has been set to: [default]

You can skip diagnostics next time by using the following flag:
  gcloud init --skip-diagnostics

Network diagnostic detects and fixes local network connection issues.
Checking network connection...done.
Reachability Check passed.
Network diagnostic passed (1/1 checks passed).

Choose the account you would like to use to perform operations for this configuration:
[1] yashnimbalkar15@gmail.com
[2] Log in with a new account
Please enter your numeric choice: 1

You are logged in as: [yashnimbalkar15@gmail.com].
```

Google Cloud:

```
Google Cloud SDK Shell

You are logged in as: [yashnimbalkar15@gmail.com].

Pick cloud project to use:
[1] dancing-website
[2] eng-digit-346818
[3] lateral-isotope-328518
[4] my-project-assignment-8-347418
[5] yashnimbalkar15
[6] Create a new project
Please enter numeric choice or text value (must exactly match list item): 4

Your current project has been set to: [my-project-assignment-8-347418].

Not setting default zone/region (this feature makes it easier to use
[gcloud compute] by setting an appropriate default value for the
--zone and --region flag).
See https://cloud.google.com/compute/docs/gcloud-compute section on how to set
default compute region and zone manually. If you would like [gcloud init] to be
able to do this for you the next time you run it, make sure the
Compute Engine API is enabled for your project on the
https://console.developers.google.com/apis page.

Your Google Cloud SDK is configured and ready to use!

* Commands that require authentication will use yashnimbalkar15@gmail.com by default
* Commands will reference project `my-project-assignment-8-347418` by default
Run `gcloud help config` to learn how to change individual settings

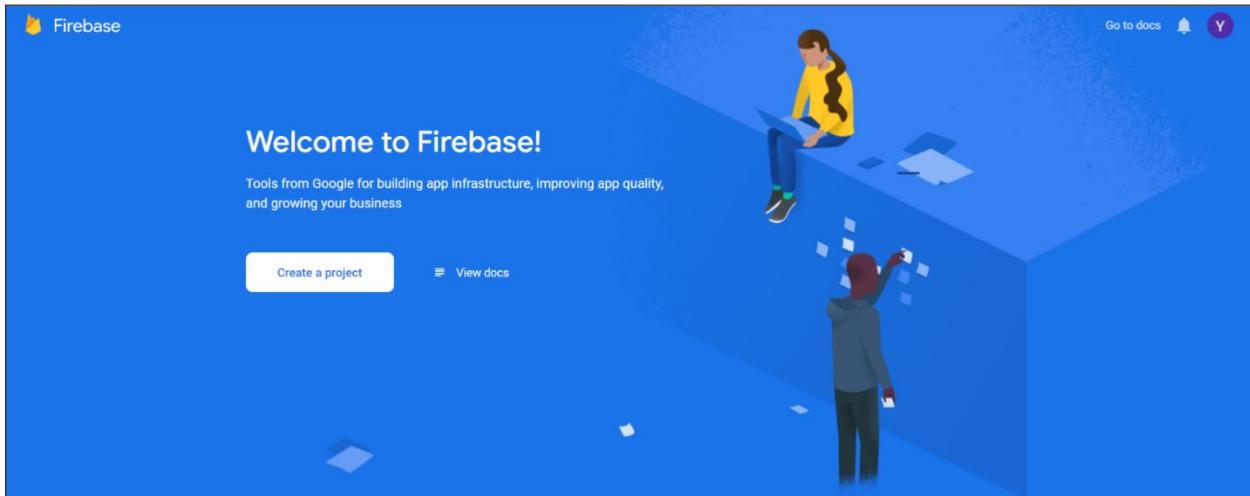
This gcloud configuration is called [default]. You can create additional configurations if you work with multiple accounts and/or projects.
Run `gcloud topic configurations` to learn more.

Some things to try next:

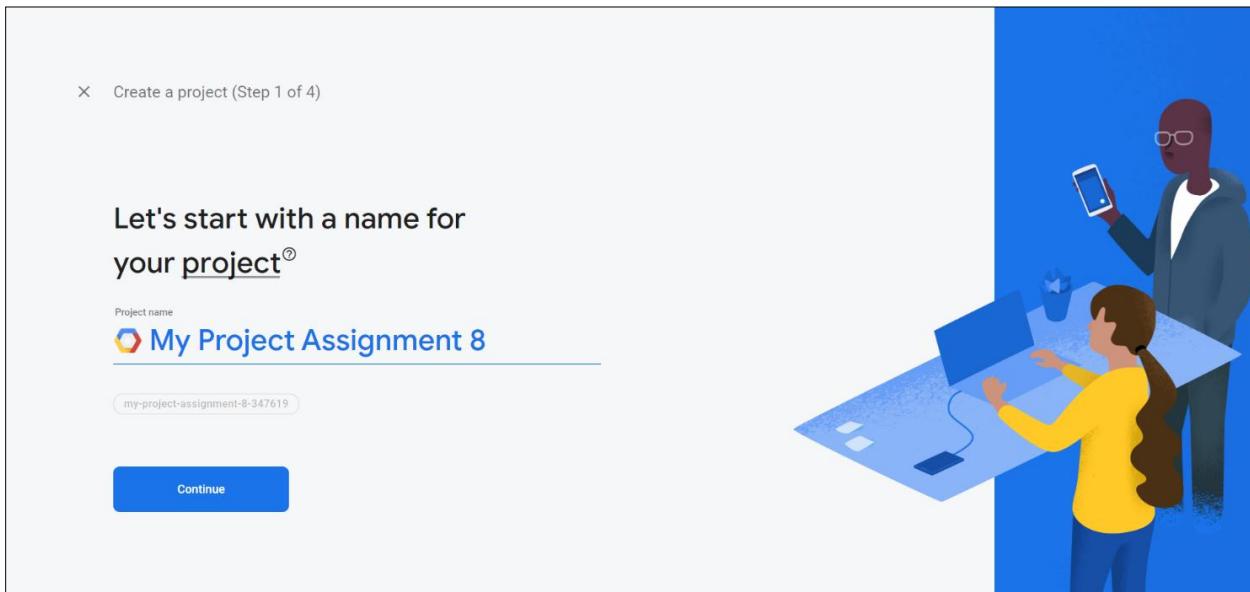
* Run `gcloud --help` to see the Cloud Platform services you can interact with. And run `gcloud help COMMAND` to get help on any gcloud command.
* Run `gcloud topic --help` to learn about advanced features of the SDK like arg files and output formatting
```

4. Adding Firebase to the project:

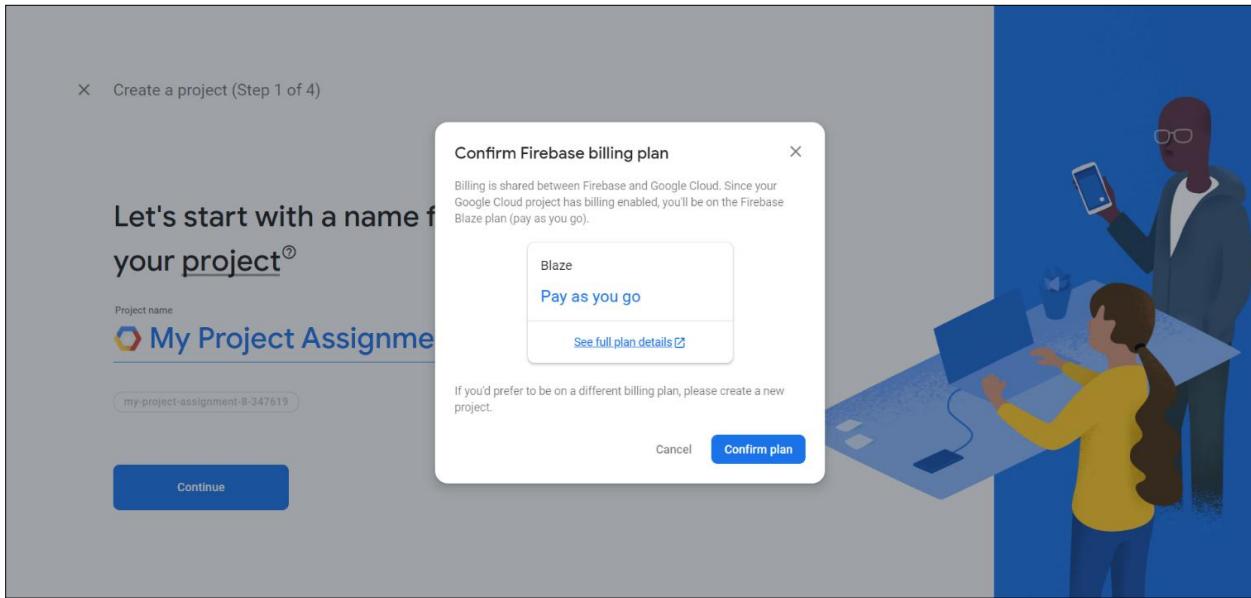
- Go to the Firebase console and click on Create a project:



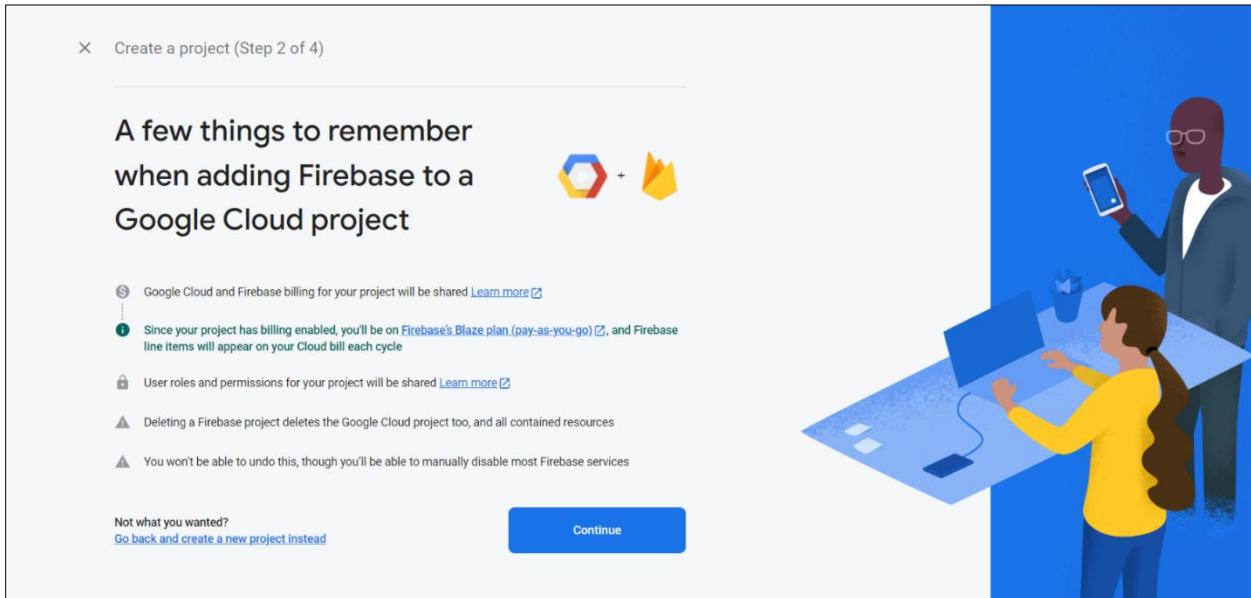
- In the next window, add the project name that we created in Google Cloud:



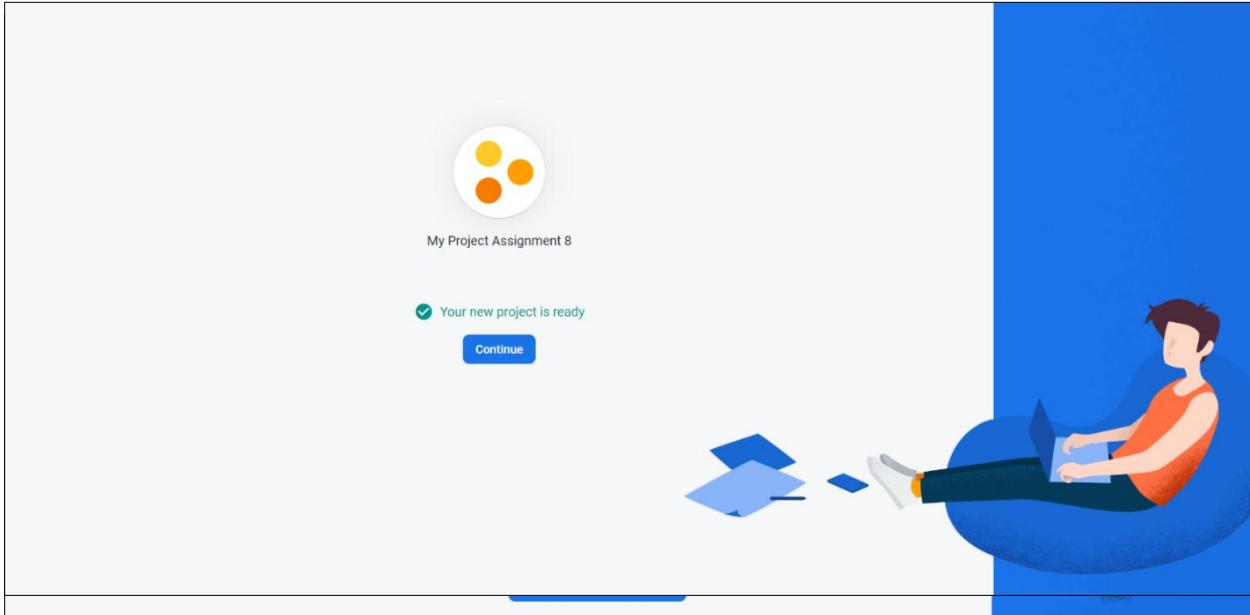
c. Confirm Firebase billing plan:



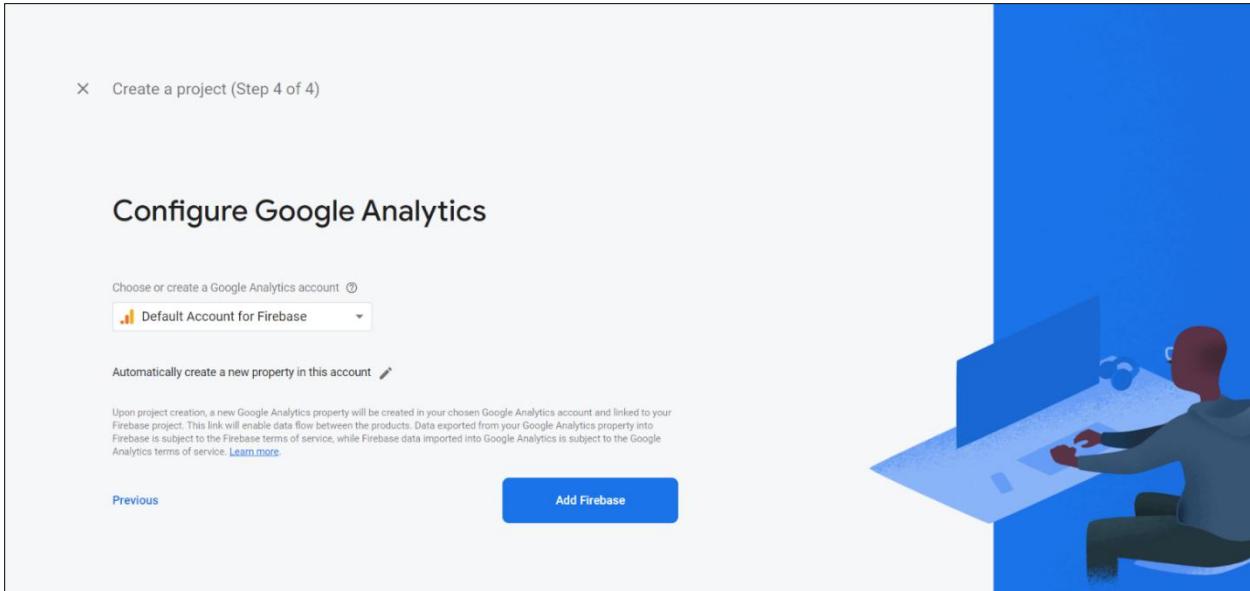
d. The next window shows some instructions. Read those and click Continue:



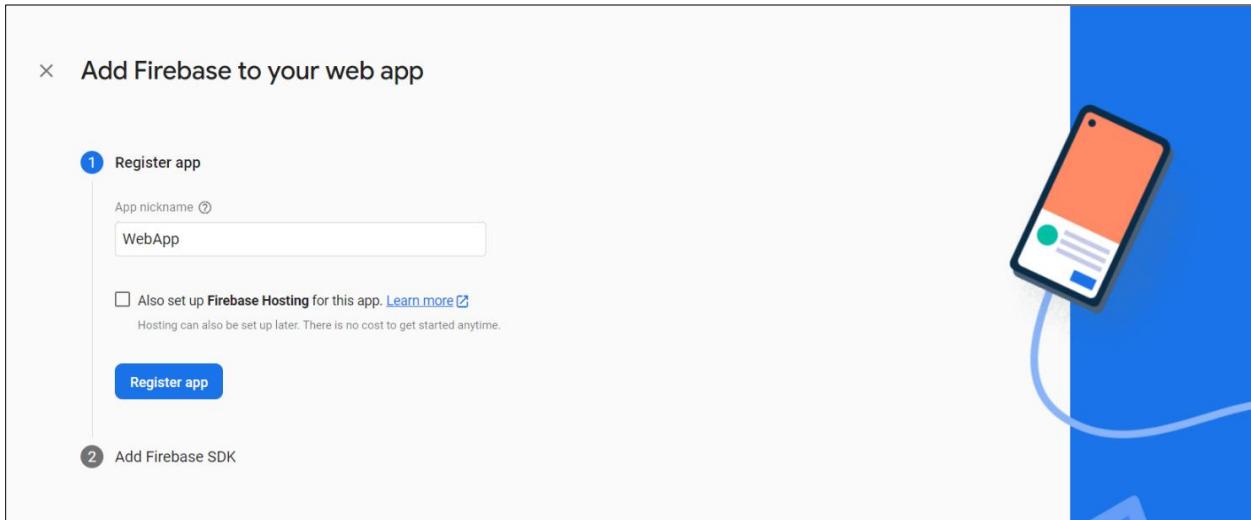
e. Enable Google Analytics for the project:



f. Configure Google Analytics by selecting Default Account for Firebase:

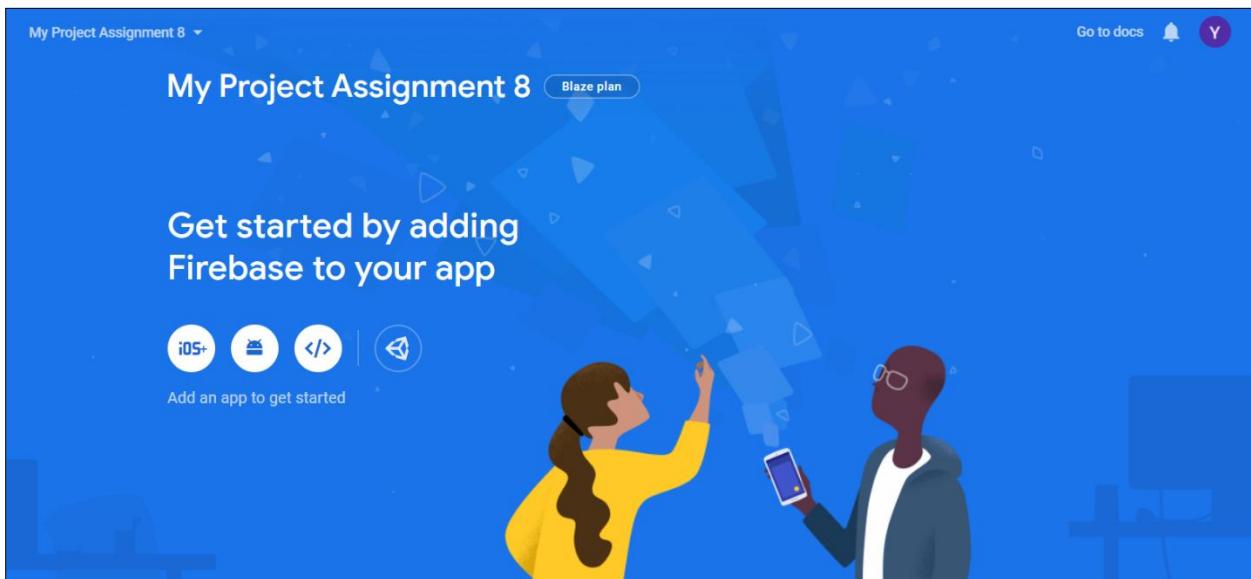


g. We have successfully added Firebase to our project.



5. Adding an App to the Firebase project:

- From the console, go to your project and click '</>' to add your app:



- Add a nickname for your app and click Register app:

c. You will receive further configuration details then click Continue to console:

d. You will see the app on the console, click on it to view all its details.

Add Firebase to your web app

Register app

Add Firebase SDK

Use npm (1) Use a <script> tag (2)

If you're already using [npm](#) and a module bundler such as [webpack](#) or [Rollup](#), you can run the following command to install the latest SDK:

```
$ npm install firebase
```

Then, initialize Firebase and begin using the SDKs for the products you'd like to use.

```
// Import the functions you need from the SDKs you need
import { initializeApp } from "firebase/app";
import { getAnalytics } from "firebase/analytics";
// TODO: Add SDKs for Firebase products that you want to use
// https://firebase.google.com/docs/web/setup#available-libraries

// Your web app's Firebase configuration
// For Firebase JS SDK v7.20.0 and later, measurementId is optional
const firebaseConfig = {
  apiKey: "AIzaSyCzONNTf0YLSf2cqWa12gYKnnTzxS1v0",
  authDomain: "my-project-assignment-8-347619.firebaseio.com",
  projectId: "my-project-assignment-8-347619",
  storageBucket: "my-project-assignment-8-347619.appspot.com",
  messagingSenderId: "748168425625",
  appId: "1:748168425625:web:fdf46e32eb4d1ddaa6208",
  measurementId: "G-3SS97FMZ7Q"
};

// Initialize Firebase
const app = initializeApp(firebaseConfig);
const analytics = getAnalytics(app);
```

Note: This option uses the [modular JavaScript SDK](#), which provides reduced SDK size.

Learn more about Firebase for web: [Get Started](#), [Web SDK API Reference](#), [Samples](#)

[Continue to console](#)

My Project Assignment 8 ▾

Project settings

General Cloud Messaging Integrations Service accounts Data privacy Users and permissions App Check (BETA)

Your project

Project name	My Project Assignment 8
Project ID	my-project-assignment-8-347619
Project number	748160425625
Default GCP resource location	Not yet selected
Web API Key	No Web API Key for this project

Environment

This setting customizes your project for different stages of the app lifecycle

Environment type: Unspecified

Public settings

These settings control instances of your project shown to the public

Public-facing name	project-748160425625
Support email	Not configured

Your apps

Add app

Web apps

WebApp (selected)

App nickname: WebApp

App ID: 1:748160425625:web:ba442247078c984daa6208

[Link to a Firebase Hosting site](#)

SDK setup and configuration

npm CDN Config

If you're already using npm and a module bundler such as webpack or Rollup, you can run the following command to install the latest SDK:

```
$ npm install firebase
```

Then, initialize Firebase and begin using the SDKs for the products you'd like to use.

```
// Import the functions you need from the SDKs you need
import { initializeApp } from "firebase/app";
import { getAnalytics } from "firebase/analytics";
// TODO: Add SDKs for Firebase products that you want to use
// https://firebase.google.com/docs/web/setup#available-libraries

// Your web app's Firebase configuration
// For Firebase JS SDK v7.20.0 and later, measurementId is optional
const firebaseConfig = {
  apiKey: "AIzaSyCzONNTf9YLsf2cqIWa12gYKngTzxS1v0",
  authDomain: "my-project-assignment-8-347619.firebaseioapp.com",
  projectId: "my-project-assignment-8-347619",
  storageBucket: "my-project-assignment-8-347619.appspot.com",
  messagingSenderId: "748160425625",
  appId: "1:748160425625:web:ba442247078c984daa6208",
  measurementId: "G-LJXRKCSRWK"
};

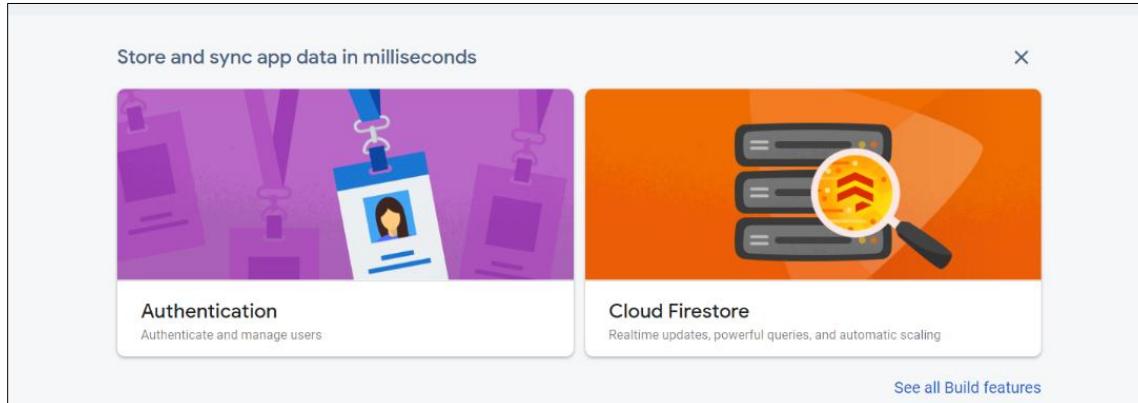
// Initialize Firebase
const app = initializeApp(firebaseConfig);
const analytics = getAnalytics(app);
```

Note: This option uses the modular JavaScript SDK, which provides reduced SDK size.

Learn more about Firebase for web: [Get Started](#), [Web SDK API Reference](#), [Samples](#)

Remove this app

6. Authentication in Firebase:



- Go to the project's console and select Authentication:
- In the Sign-in methods you will see various options, select any one option:

My Project Assignment 8 ▾ Go to docs

Authentication

Users Sign-in method Templates Usage

Sign-in providers

Get started with Firebase Auth by adding your first sign-in method

Native providers	Additional providers
Email/Password	Google
Phone	Facebook
Anonymous	Play Games
	Game Center
	Apple
	Github
	Microsoft
	Twitter
	Yahoo

Authorized domains ⓘ

Authorized domain	Type
localhost	Default
my-project-assignment-8-347620.firebaseioapp.com	Default
my-project-assignment-8-347620.web.app	Default

- c. Perform appropriate configuration for that platform. You can also add domains:

The screenshot shows the Firebase Authentication console under the 'Sign-in method' tab. It displays two sections: 'Sign-in providers' and 'Authorized domains'.

Sign-in providers:

Provider	Status
Email/Password	Enabled
Google	Enabled

Authorized domains:

Authorized domain	Type
localhost	Default
my-project-assignment-8-347418.firebaseio.com	Default
my-project-assignment-8-347418.web.app	Default
my-project-assignment-8-347418.appspot.com	Custom

Below these sections, there are dropdown menus for 'Safelist client IDs from external projects (optional)' and 'Web SDK configuration'. At the bottom right are 'Cancel' and 'Save' buttons.

Authorized domains (Optional):

Authorized domain	Type
localhost	Default
my-project-assignment-8-347620.firebaseio.com	Default
my-project-assignment-8-347620.web.app	Default

d. Then you can see the added sign-in methods and the domains:

- e. Also, when the users login to your application, their details will be visible at the Users tab:

7. Installing dependencies and Running application locally:

The screenshot shows the Firebase Authentication interface for a project named "My Project Assignment 8". The "Users" tab is selected. At the top, there are tabs for "Sign-in method", "Templates", and "Usage". Below the tabs is a table header with columns: Identifier, Providers, Created (sorted by descending date), Signed In, and User UID. There is a "Add user" button and a three-dot menu icon. The main area contains a large circular icon with a person's face and the text: "Authenticate and manage users from a variety of providers without server-side code". It includes links to "Learn more" and "View the docs", and a "Set up sign-in method" button. At the bottom, there is a note about help for iOS+ and a code editor icon.

a. Go to the backend directory of your application. By using the command ‘`pip install -t lib -r requirements.txt`’ install the dependencies:

b. The requirements will be installed at specified location:

```
MINGW64:/d/TE/CC/Assignment8/app/python-docs-samples/appengine/standard.firebaseio/firenotes/backend
DELL@DESKTOP-NS7USE1 MINGW64 /d/TE/CC/Assignment8/app
$ git clone https://github.com/GoogleCloudPlatform/python-docs-samples.git
Cloning into 'python-docs-samples'...
remote: Enumerating objects: 63701, done.
remote: Counting objects: 100% (2720/2720), done.
remote: Compressing objects: 100% (1299/1299), done.
remote: Total 63701 (delta 1542), reused 2220 (delta 1238), pack-reused 60981
Receiving objects: 100% (63701/63701), 74.15 MiB | 2.37 MiB/s, done.
Resolving deltas: 100% (36369/36369), done.
Updating files: 100% (2231/2231), done.

DELL@DESKTOP-NS7USE1 MINGW64 /d/TE/CC/Assignment8/app/python-docs-samples/appengine/standard.firebaseio/firenotes (main)
$ cd backend/

DELL@DESKTOP-NS7USE1 MINGW64 /d/TE/CC/Assignment8/app/python-docs-samples/appengine/standard.firebaseio/firenotes/backend (main)
$ pip install -t lib -r requirements.txt
Ignoring Flask: markers 'python_version < "3.0"' don't match your environment
Ignoring pyjwt: markers 'python_version < "3.0"' don't match your environment
Ignoring google-auth: markers 'python_version < "3.0"' don't match your environment
Collecting Flask==2.1.0
  Downloading Flask-2.1.0-py3-none-any.whl (95 kB)
----- 95.2/95.2 KB 201.4 kB/s eta 0:00:00
Collecting flask-cors==3.0.10
  Downloading Flask_Cors-3.0.10-py2.py3-none-any.whl (14 kB)
Collecting google-auth==2.6.2
  Downloading google_auth-2.6.2-py2.py3-none-any.whl (156 kB)
----- 156.5/156.5 KB 360.3 kB/s eta 0:00:00
Collecting requests==2.27.1
  Downloading requests-2.27.1-py2.py3-none-any.whl (63 kB)
----- 63.1/63.1 KB 839.6 kB/s eta 0:00:00
Collecting requests_toolbelt==0.9.1
  Downloading requests_toolbelt-0.9.1-py2.py3-none-any.whl (54 kB)
----- 54.3/54.3 KB 140.8 kB/s eta 0:00:00
Collecting Werkzeug==2.0
  Downloading Werkzeug-2.1.1-py3-none-any.whl (224 kB)
----- 224.7/224.7 KB 175.9 kB/s eta 0:00:00
```

```
Collecting itsdangerous>=2.0
  Downloading itsdangerous-2.1.2-py3-none-any.whl (15 kB)
Collecting Jinja2>=3.0
  Downloading Jinja2-3.1.1-py3-none-any.whl (132 kB)
----- 132.6/132.6 KB 373.1 kB/s eta 0:00:00
Collecting Six
  Using cached six-1.16.0-py2.py3-none-any.whl (11 kB)
Collecting pyasn1-modules>0.2.1
  Downloading pyasn1_modules-0.2.8-py2.py3-none-any.whl (155 kB)
----- 155.3/155.3 KB 490.0 kB/s eta 0:00:00
Collecting cachetools<6.0,>=2.0.0
  Downloading cachetools-5.0.0-py3-none-any.whl (9.1 kB)
Collecting rsa<5,>=3.1.4
  Downloading rsa-4.8-py3-none-any.whl (39 kB)
Collecting charset-normalizer~2.0.0
  Downloading charset_normalizer-2.0.12-py3-none-any.whl (39 kB)
Collecting urllib3<1.27,>=1.21.1
  Downloading urllib3-1.26.9-py2.py3-none-any.whl (138 kB)
----- 139.0/139.0 KB 634.2 kB/s eta 0:00:00
Collecting certifi=2017.4.17
  Downloading certifi-2021.10.8-py2.py3-none-any.whl (149 kB)
----- 149.2/149.2 KB 807.9 kB/s eta 0:00:00
Collecting idna<4,>=2.5
  Downloading idna-3.3-py3-none-any.whl (61 kB)
----- 61.2/61.2 KB 3.2 MB/s eta 0:00:00
Collecting colorama
  Using cached colorama-0.4.4-py2.py3-none-any.whl (16 kB)
Collecting MarkupSafe>=2.0
  Downloading MarkupSafe-2.1.1-cp39-cp39-win_amd64.whl (17 kB)
Collecting pyasn1<0.5.0,>=0.4.6
  Downloading pyasn1-0.4.8-py2.py3-none-any.whl (77 kB)
----- 77.1/77.1 KB 329.6 kB/s eta 0:00:00
Collecting zipp>0.5
  Downloading zipp-3.8.0-py3-none-any.whl (5.4 kB)
Installing collected packages: pyasn1, certifi, zipp, Werkzeug, urllib3, Six, rsa, pyasn1-modules, MarkupSafe, itsdangerous, idna, colorama, charset-normalizer, click, requests-toolbelt, Flask, flask-cors
Successfully installed Flask-2.1.0 Jinja2-3.1.1 MarkupSafe-2.1.1 Six-1.16.0 Werkzeug-2.1.1 cachetools-5.0.0 certifi-2021.10.8 charset-normalizer-2.0.0 idna-3.3 importlib-metadata-4.11.3 itsdangerous-2.1.2 pyasn1-0.4.8 pyasn1-modules-0.2.8 requests-2.27.1 requests-toolbelt-0.9.1 rsa-4.8 urllib3-2.0.1
WARNING: You are using pip version 22.0.3; however, version 22.0.4 is available.
You should consider upgrading via the 'C:\Users\DELL\AppData\Local\Programs\Python\Python39\python.exe -m pip install --upgrade pip' command.

DELL@DESKTOP-NS7USE1 MINGW64 /d/TE/CC/Assignment8/app/python-docs-samples/appengine/standard.firebaseio/firenotes/backend (main)
$
```

- c. Run ‘py dev_appserver.py frontend/app.yaml backend/app.yaml’ to run your application on localho

```
Google Cloud SDK Shell

D:\TE\CC\Cloud SDK>py google-cloud-sdk\bin\dev_appserver.py "D:\TE\CC\Assignment8\app\python-docs-samples\appengine\standard.firebaseio\firenotes\frontend\app.yaml" "D:\TE\CC\Assignment8\app\python-docs-samples\appengine\standard.firebaseio\firenotes\backend\app.yaml"
INFO    2022-04-17 00:22:05,500 devappserver2.py:316] Skipping SDK update check.
WARNING 2022-04-17 00:22:06,834 simple_search_stub.py:1196] Could not read search indexes from c:\users\dell\appdata\local\temp\appengine.None\search_index
INFO    2022-04-17 00:22:06,842 <string>:384] Starting API server at: http://localhost:50901
INFO    2022-04-17 00:22:06,842 dispatcher.py:281] Starting module "default" running at: http://localhost:8080
INFO    2022-04-17 00:22:06,842 dispatcher.py:281] Starting module "backend" running at: http://localhost:8081
INFO    2022-04-17 00:22:06,858 admin_server.py:150] Starting admin server at: http://localhost:8000
INFO    2022-04-17 00:22:14,490 instance.py:294] Instance PID: 23920
INFO    2022-04-17 00:22:14,490 instance.py:294] Instance PID: 15348
INFO    2022-04-17 00:22:22,894 module.py:883] default: "GET / HTTP/1.1" 200 1445
INFO    2022-04-17 00:22:22,974 module.py:883] default: "GET /style.css HTTP/1.1" 200 993
INFO    2022-04-17 00:22:22,990 module.py:883] default: "GET /main.js HTTP/1.1" 200 4882
INFO    2022-04-17 00:22:23,380 module.py:883] default: "GET /favicon.ico HTTP/1.1" 404 -
INFO    2022-04-17 00:22:29,517 module.py:883] default: "GET / HTTP/1.1" 304 -
INFO    2022-04-17 00:22:29,648 module.py:883] default: "GET /style.css HTTP/1.1" 304 -
INFO    2022-04-17 00:22:29,667 module.py:883] default: "GET /main.js HTTP/1.1" 304 -
INFO    2022-04-17 00:22:40,655 module.py:883] default: "GET / HTTP/1.1" 304
INFO    2022-04-17 00:22:40,757 module.py:883] default: "GET /style.css HTTP/1.1" 304 -
INFO    2022-04-17 00:22:40,757 module.py:883] default: "GET /main.js HTTP/1.1" 304 -
INFO    2022-04-17 00:23:28,648 module.py:443] [default] Detected file changes:
  main.js
INFO    2022-04-17 00:23:41,055 module.py:883] default: "GET / HTTP/1.1" 304 -
INFO    2022-04-17 00:23:41,107 module.py:883] default: "GET /style.css HTTP/1.1" 304 -
INFO    2022-04-17 00:23:41,108 module.py:883] default: "GET /main.js HTTP/1.1" 200 4596
INFO    2022-04-17 00:27:27,161 module.py:443] [default] Detected file changes:
  main.js
INFO    2022-04-17 00:27:32,717 module.py:883] default: "GET / HTTP/1.1" 304 -
INFO    2022-04-17 00:27:32,767 module.py:883] default: "GET /style.css HTTP/1.1" 304 -
INFO    2022-04-17 00:27:32,769 module.py:883] default: "GET /main.js HTTP/1.1" 200 4646
INFO    2022-04-17 00:33:15,496 module.py:443] [default] Detected file changes:
  main.js
INFO    2022-04-17 00:33:15,516 module.py:443] [default] Detected file changes:
  main.js
INFO    2022-04-17 00:33:20,418 module.py:883] default: "GET / HTTP/1.1" 304 -
INFO    2022-04-17 00:33:20,460 module.py:883] default: "GET /style.css HTTP/1.1" 304 -
INFO    2022-04-17 00:33:20,461 module.py:883] default: "GET /main.js HTTP/1.1" 200 4697
INFO    2022-04-17 00:36:51,644 module.py:443] [default] Detected file changes:
  main.js
INFO    2022-04-17 00:36:51,644 module.py:443] [default] Detected file changes:
  main.js
INFO    2022-04-17 00:37:29,022 shutdown.py:50] Shutting down.
INFO    2022-04-17 00:37:29,022 stub_util.py:362] Applying all pending transactions and saving the datastore
INFO    2022-04-17 00:37:29,022 stub_util.py:365] Saving search indexes
```

8. Deploying your app:

- a. Enter ‘gcloud app deploy’ command to deploy your application as shown below:

```
Google Cloud SDK Shell

D:\TE\CC\Cloud SDK>gcloud app deploy "D:\TE\CC\Assignment8\app\python-docs-samples\appengine\standard.firebaseio\firenotes\backend\index.yaml" "D:\TE\CC\Assignment8\app\python-docs-samples\appengine\standard.firebaseio\firenotes\backend\app.yaml"
You are creating an app for project [my-project-assignment-8-347418].
WARNING: Creating an App Engine application for a project is irreversible and the region cannot be changed. More information about regions is at <https://cloud.google.com/appengine/docs/locations>.

Please choose the region where you want your App Engine application located:

[1] asia-east1   (supports standard and flexible)
[2] asia-east2   (supports standard and flexible and search_api)
[3] asia-northeast1 (supports standard and flexible and search_api)
[4] asia-northeast2 (supports standard and flexible and search_api)
[5] asia-northeast3 (supports standard and flexible and search_api)
[6] asia-south1   (supports standard and flexible and search_api)
```

b. Select appropriate region if prompted.

```
Please choose the region where you want your App Engine application located:
[1] asia-east1    (supports standard and flexible)
[2] asia-east2    (supports standard and flexible and search_api)
[3] asia-northeast1 (supports standard and flexible and search_api)
[4] asia-northeast2 (supports standard and flexible and search_api)
[5] asia-northeast3 (supports standard and flexible and search_api)
[6] asia-south1    (supports standard and flexible and search_api)
[7] asia-southeast1 (supports standard and flexible)
[8] asia-southeast2 (supports standard and flexible and search_api)
[9] australia-southeast1 (supports standard and flexible and search_api)
[10] europe-central2 (supports standard and flexible)
[11] europe-west    (supports standard and flexible and search_api)
[12] europe-west2   (supports standard and flexible and search_api)
[13] europe-west3   (supports standard and flexible and search_api)
[14] europe-west6   (supports standard and flexible and search_api)
[15] northamerica-northeast1 (supports standard and flexible and search_api)
[16] southamerica-east1 (supports standard and flexible and search_api)
[17] us-central      (supports standard and flexible and search_api)
[18] us-east1        (supports standard and flexible and search_api)
[19] us-east4        (supports standard and flexible and search_api)
[20] us-west1        (supports standard and flexible)
[21] us-west2        (supports standard and flexible and search_api)
[22] us-west3        (supports standard and flexible and search_api)
[23] us-west4        (supports standard and flexible and search_api)
[24] cancel

Please enter your numeric choice: 17

Creating App Engine application in project [my-project-assignment-8-347418] and region [us-central]...done.
Services to deploy:

descriptor:          [D:\TE\CC\Assignment8\app\python-docs-samples\appengine\standard.firebaseio\firenotes\frontend\app.yaml]
source:              [D:\TE\CC\Assignment8\app\python-docs-samples\appengine\standard.firebaseio\firenotes\frontend]
target project:      [my-project-assignment-8-347418]
target service:      [default]
target version:      [20220417t003955]
target url:          [https://my-project-assignment-8-347418.uc.r.appspot.com]
target service account: [App Engine default service account]
```

c. The backend and the frontend of your application will be deployed:

```
c4. Google Cloud SDK Shell

descriptor:          [D:\TE\CC\Assignment8\app\python-docs-samples\appengine\standard.firebaseio\firenotes\backend\app.yaml]
source:              [D:\TE\CC\Assignment8\app\python-docs-samples\appengine\standard.firebaseio\firenotes\backend]
target project:      [my-project-assignment-8-347418]
target service:      [backend]
target version:      [20220417t004225]
target url:          [https://backend-dot-my-project-assignment-8-347418.uc.r.appspot.com]
target service account: [App Engine default service account]

Configurations to update:

descriptor:          [D:\TE\CC\Assignment8\app\python-docs-samples\appengine\standard.firebaseio\firenotes\backend\index.yaml]
type:                [datastore indexes]
target project:      [my-project-assignment-8-347418]

Do you want to continue (Y/n)? y

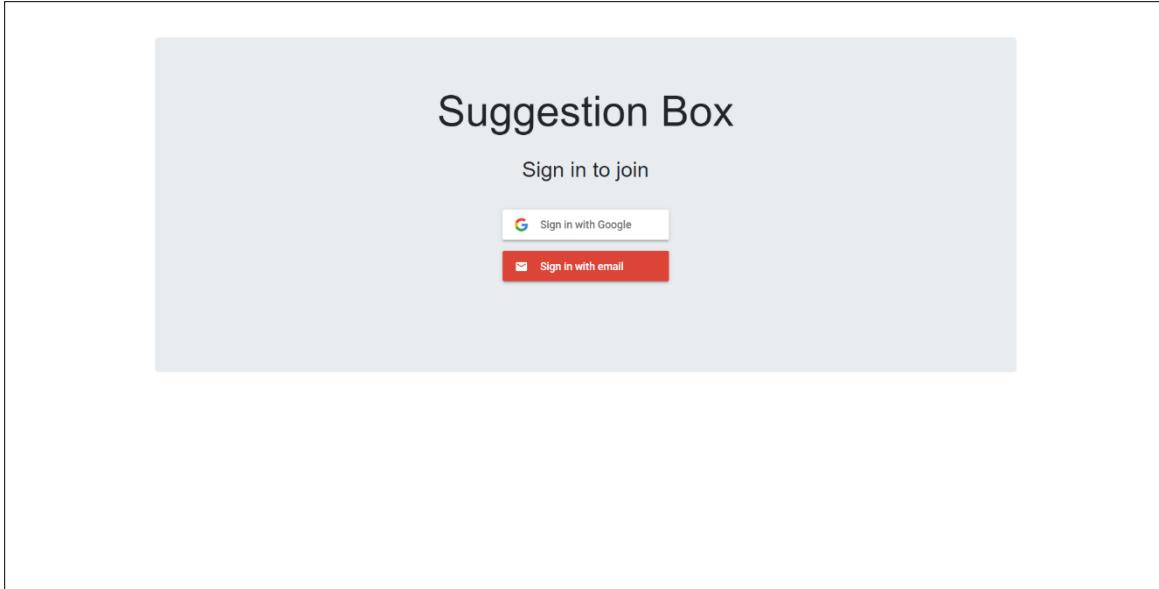
Beginning deployment of service [default]...
=====
#= Uploading 0 files to Google Cloud Storage      =
=====
File upload done.
Updating service [default]...done.
Setting traffic split for service [default]...done.
Deployed service [default] to [https://my-project-assignment-8-347418.uc.r.appspot.com]
Beginning deployment of service [backend]...
=====
#= Uploading 572 files to Google Cloud Storage      =
=====
File upload done.
Updating service [backend]...done.
Setting traffic split for service [backend]...done.
Deployed service [backend] to [https://backend-dot-my-project-assignment-8-347418.uc.r.appspot.com]
.... 100%...done.
Updating config [index]...done.

Indexes are being rebuilt. This may take a moment.

You can stream logs from the command line by running:
$ gcloud app logs tail -s <service>

To view your application in the web browser run:
$ gcloud app browse -s <service>
```

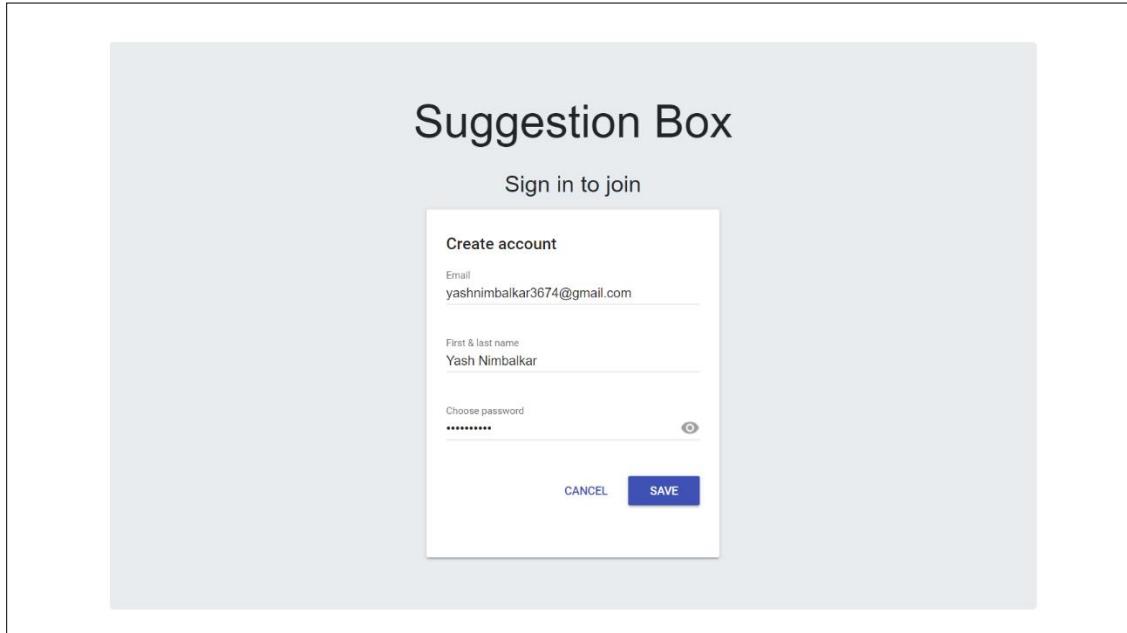
Sample Output



- a. The initial page has a heading and the login options:

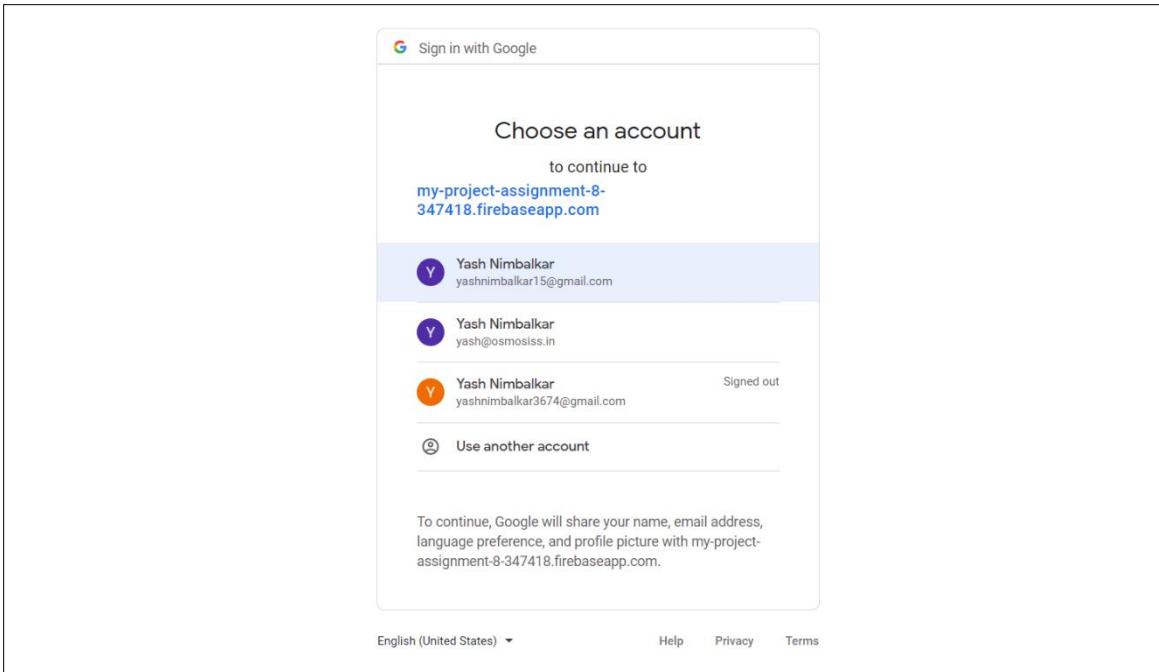
- b. The login page has two options to login. You can login through anyone of them as follows:

- (i) Google Account: Choose appropriate Google account to login:
- (ii) Mail: Use a valid mail address to login. The user is then prompted to



enter name and create a password:

- c. Then the user can add a note and then save it. Further user can sign out by clicking respective button:



Case Study-1

1. What is data storage in private cloud?

Private cloud storage is a type of storage mechanism that stores an organization's data at in-house storage servers by implementing cloud computing and storage technology. Private cloud storage is similar to public cloud storage in that it provides the usability, scalability and flexibility of the storage architecture. But unlike public cloud storage, it is not publicly accessible and is owned by a single organization and its authorized external partners.

Private cloud storage is also known as internal cloud storage.

Private cloud storage works much like public cloud storage and implements storage virtualization across an organization, providing a centralized storage infrastructure that can only be accessed by the authorized nodes.

Welcome to the Suggestion Box!

Yash Nimbalkar!

Enter a note(suggestion/complaint/feedback) and save it for the organization.

Save noteSign out

Private cloud storage operates by installing a data center, which houses a series of storage clusters that are integrated with a storage virtualization application. Administrative policies and a management console provide access to the different storage nodes and applications within the organization's network. The applications or nodes access the private storage through file access and data retrieving protocols, while the automated storage administrator application allocates storage capacity to them on run time.

Private cloud storage has a multitenant architecture, where a single storage array can house storage space to multiple applications, nodes or departments.

2) Examples of data stored on cloud (success stories)

1. IT Priorities 2020: Covid-19 consolidates storage push to cloud

The emphasis on home and remote working has been felt in storage and backup, as in all areas of IT, with continued evolution towards the cloud and as-a-service storage and backup

2. Big storage meets cloud in the datacentre ‘as-a-service’ revolution

Cloud is mainstream but the datacentre is here to stay. This has resulted in a trend towards as-a-service in the datacentre where big storage array makers and the cloud giants meet.

3. Do you use cloud storage for these use cases yet?

We look at the use cases most suited to a quick transition to the cloud: backup, archiving, disaster recovery, file storage and cloud bursting – cloud storage’s low-hanging fruit.

4. Cloud storage costs: How to get cloud storage bills under control

Many organisations look to the cloud to cut storage budgets, but the potential costs are many and varied. So what are the key ways to cut cloud storage costs?

5. Cloud storage 101: File, block and object storage in the cloud

We run the rule over file, block and object storage from the big three public cloud providers: AWS, Azure and GCP. We look at what's on offer and the use cases they are aimed at

3) Procedures/ ways to upload data to cloud (are there any applications designed)

Here's how to build a cloud-ready application, and the application architecture concepts you'll need to succeed. The process presented below represents a step-by-step approach that mixes traditional software development concepts and reviews what's new with the cloud. It is a collection of best practices, concepts, and procedures for success.

Design the application as a collection of services

Cloud applications are best deployed as a collection of cloud services, or APIs. You build up from the data to the services and then combine those services into composite services or complete composite applications.

This is service-based or service-oriented architecture, at its essence. While many understand the concepts, developers still have a tendency to create tightly coupled applications that focus on the user interface, rather than expose the underlying functions as services they can leverage independently.

When developing an application architecture for the cloud, you deal with complex distributed systems that can take advantage of loosely coupled applications built on many services that can also be decoupled from the data (see "Decouple the

data" below). You can separate the application services physically, executing on the proper machine instances, and service/API managers and governance technology that provide services directories can help track the many services that make up your application.

Additional benefits may include service reuse from other applications or more coarse-grained services. You can break up applications into hundreds of underlying services that have value when used by other applications. In this way, you're not reinventing the wheel each time you build an application. Consider the example of a credit-check service that many applications use. Combine these into a single service and the application becomes much more efficient.

Decouple the data

If you tightly couple the data to the application, it won't find a good home in the cloud. Private and public clouds are complex distributed systems that work best with application architectures that break out processing and data into separate components.

You decouple the data for the same reason you want to build the application out of services. Once decoupled, you have the option to store and process the data on any public or private cloud instance. For example, many enterprises insist that their data remain on local servers but want to take advantage of the commodity virtual machine instances within a public cloud.

You must consider performance. Database reads and writes across the open Internet can cause latency, and database communications may determine how close your data sits to the services and applications that need to leverage it.

Consider using caching systems. These provide additional database performance by locally storing commonly accessed data, thereby reducing all database read

requests back to the physical database. Those are best built into the application, however, and they should be tested with the application data to determine how efficient the cache will be. Systems that are constantly reading new data don't benefit as much from database caches.

Consider communications between application components

Decoupling applications, both data and services, doesn't mean your application is properly architected for the cloud. Chatty application components that constantly communicate with each other will lower the performance of the overall application, given that they're typically distributed over a network or the open Internet, where tolerance for high latency is desirable.

Focus on designing applications that optimize communications between application components. For example, combine communications into a single stream of data or a group of messages, rather than constantly communicating as if the application components reside on a single platform.

Model and design for performance and scaling

Extend considerations around how application components communicate to include overall performance as well. This includes understanding how the application will scale under an increasing load.

Designing for performance means first building a model that represents how the application behaves under an increasing load. If 1,000 or more users log on at the same time, how will the application handle the increased traffic on the network, the increased load on the application servers, and the load placed on the back-end databases? You need to understand how application components handle the load as the number of users increases to 1,000 or more users.

This example might increase the load on the application servers by 80 percent, the load on the network by 10 percent, and the load on the database by 40 percent. Given that, adding 1,000 more users will likely saturate the application servers you've provisioned, and you'll need to spin up more application server instances. The network capacity might remain the same, but the number of database instances may have to increase to handle any additional load.

Armed with this model, you can figure out how best to scale the application by automatically spinning up resource instances that are needed. In some cases, cloud service providers offer auto-scaling capabilities, where provisioning occurs automatically. The most efficient path, however, lies in understanding the application's workload profile and defining the path to scaling the application, as well as putting mechanisms in place to ensure that it will, indeed, scale.

Finally, monitor overall application performance using application-aware performance monitoring tools, and create interfaces within the application to better enable performance monitoring. How the application provisions and de-provisions resources should be innate to the application as well.

Make security systemic within the application

For most people who build applications, security is typically an afterthought. When hosting an application in the cloud, however, security should be a high priority. Your cloud-based application architecture should make security systemic to the application—it should be designed and built into the application architecture.

Pick a security approach and technology prior to building your application that will be effective for the type of application you're running and that will address any compliance or other data-level security issues. If you're in healthcare, for

example, you must consider personally identifiable information as well as the Health Insurance Portability and Accountability Act (HIPAA) in the US. You'll need to store data in a certain way, on clouds that are HIPAA-compliant. Moreover, the application will need to handle sensitive data in specified ways, with required levels of security, such as encryption.

Generally speaking, cloud-based applications should leverage identity and access management (IAM). Enterprises that develop mature IAM capabilities can reduce their security costs and, more importantly, become significantly more agile at configuring security for cloud-based applications. Indeed, IAM will be a part of more than 50 percent of existing applications that migrate to the public cloud and nearly 90 percent of new applications built on clouds.

What's more, the use of IAM within cloud application deployments will backfill into the enterprise, as these organizations modernize security approaches and technologies to align with the use of public clouds. In many cases, IAM will be provided as a service to the enterprise. This concept of cloud-delivered IAM quickly leads to the concept of centralized identity management. As you build more cloud-based applications using IAM, each application should become significantly more secure and more cost effective.

Your core objective is to design security into the application and take advantage of the native features of both the cloud and the IAM system you use. However, each application has its own requirements based upon the needs of the business, and security always differs from one enterprise to another.

Building a cloud-ready application architecture requires that you pay attention to a few new things, but many of the traditional concepts are still important, such as sound design, testing, and learning from your mistakes. Most developers who deploy applications on private or public cloud platforms will make some blunders, but as long as they recognize, correct, and learn from those mistakes, they'll be

well on their way to finding a more effective path to building applications in the cloud.

Understand that approaches such as service orientation should be given priority, even if it means longer initial application development lifecycles and bigger budgets. Even though you'll pay more for application development in the cloud than you did for traditional application development, the investment in services pays huge dividends year in and year out. It's a smart investment.

4. Security algorithm in place for data security in cloud (list , brief differences , latest standard followed)

Cloud computing security or, more simply, cloud security refers to a broad set of policies, technologies, and controls deployed to protect data, applications, and the associated infrastructure of cloud computing. It is a sub-domain of computer security, network security, and, more broadly, information security.

Cloud computing security is the set of control-based technologies and policies designed to adhere to regulatory compliance rules and protect information, data applications and infrastructure associated with cloud computing use.

Because of the cloud's very nature as a shared resource, identity management, privacy and access control are of particular concern. With more organizations using cloud computing and associated cloud providers for data operations, proper security in these and other potentially vulnerable areas have become a priority for organizations contracting with a cloud computing provider.

Cloud computing security processes should address the security controls the cloud provider will incorporate to maintain the customer's data

security, privacy and compliance with necessary regulations. The processes will also likely include a business continuity and data backup plan in the case of a cloud security breach.

The following are 10 security-as-a-service categories are :

1. Identity and Access Management should provide controls for assured identities and access management. Identity and access management includes people, processes and systems that are used to manage access to enterprise resources by assuring the identity of an entity is verified and is granted the correct level of access based on this assured identity. Audit logs of activity such as successful and failed authentication and access attempts should be kept by the application/solution.
2. Data Loss Prevention is the monitoring, protecting and verifying the security of data at rest, in motion and in use in the cloud and on-premises. Data loss prevention services offer protection of data usually by running as some sort of client on desktops/servers and running rules around what can be done. Within the cloud, data loss prevention services could be offered as something that is provided as part of the build, such that all servers built for that client get the data loss prevention software installed with an agreed set of rules deployed.
3. Web Security is real-time protection offered either on-premise through software/appliance installation or via the cloud by proxying or redirecting web traffic to the cloud provider. This provides an added layer of protection on top of things like AV to prevent malware from entering the enterprise via activities such as web browsing. Policy rules around the types of web access and the times this is acceptable also can be enforced via these web security technologies.
4. E-mail Security should provide control over inbound and outbound e-mail, thereby protecting the organization from phishing and malicious attachments, enforcing corporate policies such as acceptable use and spam and providing business continuity options. The solution should allow for

policy-based encryption of e-mails as well as integrating with various e-mail server offerings. Digital signatures enabling identification and non-repudiation are features of many cloud e-mail security solutions.

5. Security Assessments are third-party audits of cloud services or assessments of on-premises systems based on industry standards. Traditional security assessments for infrastructure and applications and compliance audits are well defined and supported by multiple standards such as NIST, ISO and CIS. A relatively mature toolset exists, and a number of tools have been implemented using the SaaS delivery model. In the SaaS delivery model, subscribers get the typical benefits of this cloud computing variant elasticity, negligible setup time, low administration overhead and pay-per-use with low initial investments.

6. Intrusion Management is the process of using pattern recognition to detect and react to statistically unusual events. This may include reconfiguring system components in real time to stop/prevent an intrusion. The methods of intrusion detection, prevention and response in physical environments are mature; however, the growth of virtualization and massive multi-tenancy is creating new targets for intrusion and raises many questions about the implementation of the same protection in cloud environments.

7. Security Information and Event Management systems accept log and event information. This information is then correlated and analyzed to provide real-time reporting and alerting on incidents/events that may require intervention. The logs are likely to be kept in a manner that prevents tampering to enable their use as evidence in any investigations.

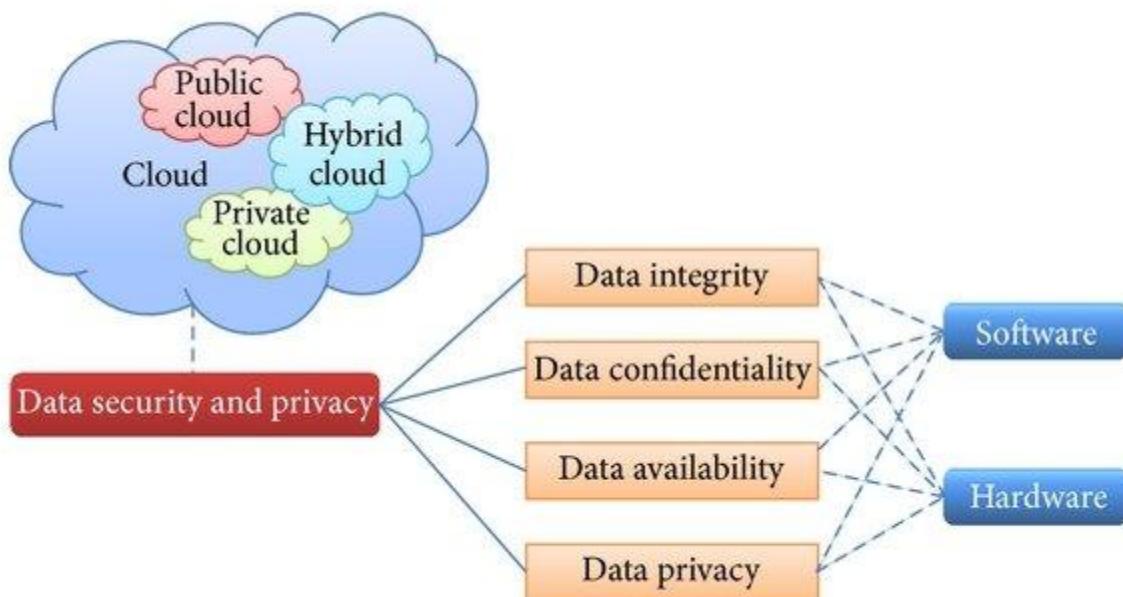
8. Encryption systems typically consist of algorithms that are computationally difficult or infeasible to break, along with the processes and procedures to manage encryption and decryption, hashing, digital signatures, certificate generation and renewal and key exchange.

9. Business Continuity and Disaster Recovery are the measures designed and implemented to ensure operational resiliency in the event of any service interruptions. Business continuity and disaster recovery provides flexible and reliable failover for required services in the event of any service interruptions, including those caused by natural or man-made disasters or disruptions. Cloud-centric business continuity and disaster recovery makes use of the cloud's flexibility to minimize cost and maximize benefits.

10. Network Security consists of security services that allocate access, distribute, monitor and protect the underlying resource services. Architecturally, network security provides services that address security controls at the network in aggregate or specifically addressed at the individual network of each underlying resource.

In a cloud/virtual environment, network security is likely to be provided by virtual devices alongside traditional physical devices.

5. Diagrammatic representation of Data storage security in private cloud



6. Conclusion:

1. Here I studied about Data Storage related to private cloud.

2. Learned about the techniques used to store data in the private cloud.
3. Security Algorithm and diagrammatic representation of security implemented in private cloud.

Case Study-2

1) What is IoT?

The internet of things, or IoT, is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.

A thing in the internet of things can be a person with a heart monitor implant, a farm animal with a biochip transponder, an automobile that has built-in sensors to alert the driver when tire pressure is low or any other natural or man-made object that can be assigned an Internet Protocol (IP) address and is able to transfer data over a network.

2) What is Ubiquitous system?

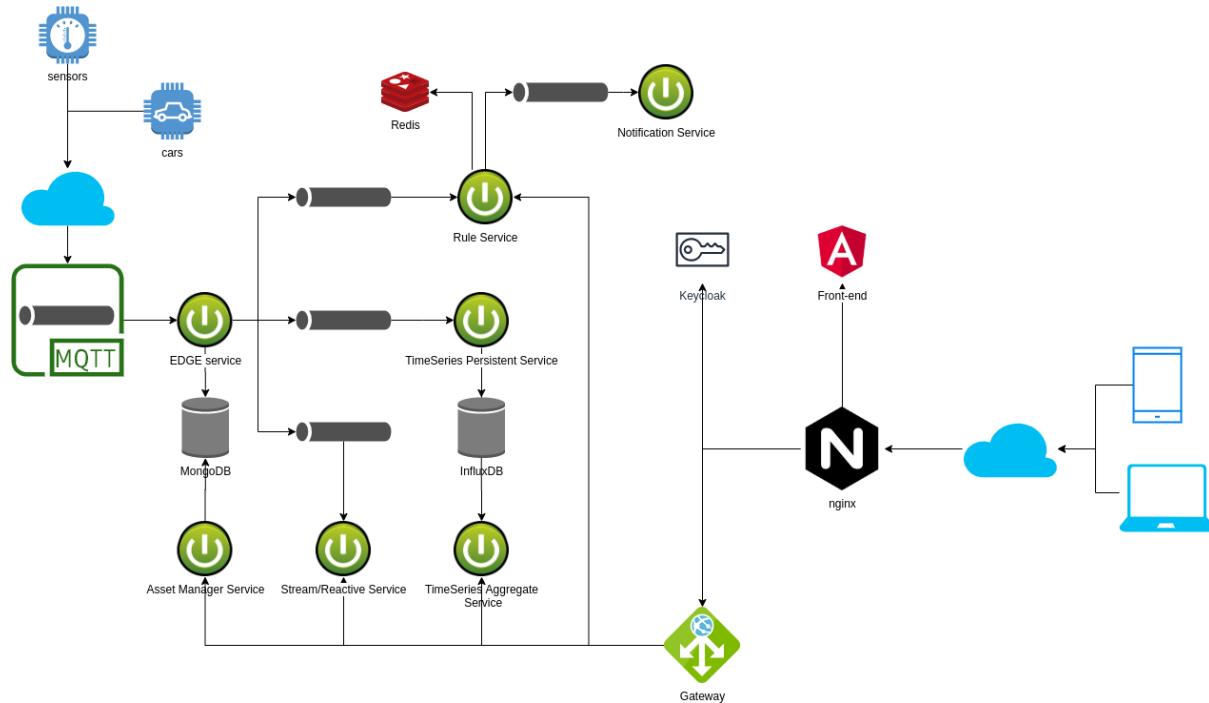
Ubiquitous Computing is also known as ambient computing or pervasive computing, everywhere and ambient intelligence. It aims to fully tap into the potential for connected devices and their benefits to become widespread such that they are available everywhere, i.e. ubiquitous. The idea is to saturate the work, living, and transportation spaces with devices that can seamlessly communicate with each other thus making our lives more enjoyable and convenient.

Ubiquitous computing thus relies on contextual data aggregation and application, seamless, intuitive access points, and flexible payment systems. A concept in software engineering, hardware engineering computer science, it lies at the intersection of distributed computing, mobile computing, location computing, mobile networking, sensor networks, human–computer interaction, context-aware smart home technologies, and Artificial Intelligence (AI).

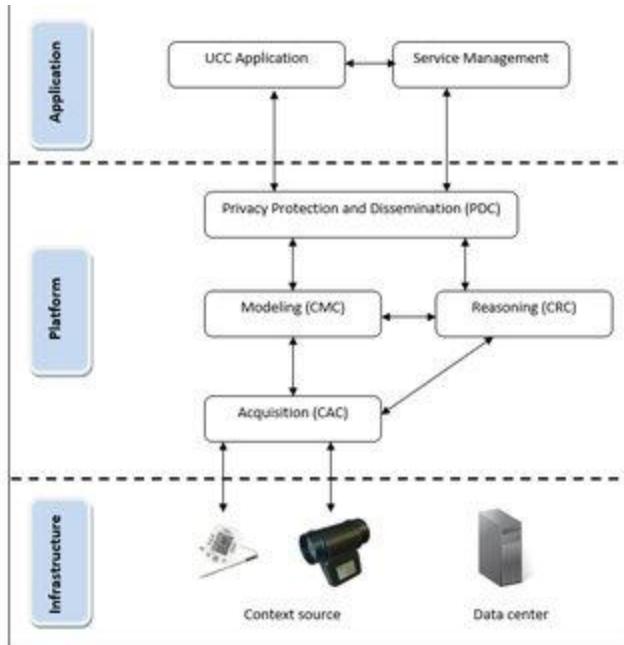
It is, effectively speaking, a paradigm that involves connecting electronic devices, including embedding microprocessors to communicate information. Devices that

use ubiquitous computing are constantly available and are fully connected. Thus the main focus of ubiquitous computing is producing smart products that are connected, making communication and the exchange of data easier and less obtrusive. For instance, smartphones, smart speakers, smart watches and smart home gadgets are typically the devices that form a core part of the ubiquitous computing network. Basically, a user communicates with the computing device - this could be a laptop computer, tablet, a mobile device, or a terminal in everyday objects such as thermostat or even a pair of glasses.

3) Draw necessary diagrams for both IoT and Ubiquitous systems.



IoT Architecture.



Ubiquitous Computing

4) What applications can be built using the ubiquitous and IoT based cloud?

IoT Cloud Computing provides many connectivity options, implying large network access. People use a wide range of devices to gain access to cloud computing resources: mobile devices, tablets, laptops. This is convenient for users but creates the problem of the need for network access points.

Ubiquitous computing is all about having computational capability in many different (perhaps all) objects in our environment. Things like stoves Fridges, TV, Cars etc all having some computational power. The Internet of Things (IoT) is about having these objects in our environment all connected to an internet.

5) Success stories as example for IoT and Ubiquitous based on cloud application-put details.

a) Amazon Dash Button

- Amazon Dash Button is basically a device that gets connected over internet Wi-Fi and makes sure that the user does not lack important household

items like soft drinks, grocery material, medical and personal care, kids, and any pet items ever again.

- It allows the user to order products quickly and there is no need to recall the message again and it also helps to reduce the time frame for searching the required product by the user.
- Amazon Dash Button also allows the user to reorder from popular brands – like Bounty, Tide, Cottonelle, Glad, Clorox etc.
- It does not accept fresh order if the prior order is not complete unless the user allows multiple orders.
- It is a good and reliable IoT product that is developed for making the user's lifestyle simple and easy.

b) August Doorbell Cam

- August Doorbell Cam is an effective IoT innovation. August Doorbell Cam allows you to answer your door from anywhere or remote location. It constantly checks your doors and also captures motion changes in your doorstep.
- Doorbell Cam pairs with all August Smart Locks to easily let guests into your home.
- The integrated floodlight delivers clear, full-color HD video even full-color.
- It constantly monitors your doorstep and will click the moments leading up to a motion alert.
- Free 24 hour video recording.
- It comes with a speedy and hassle-free installation process.

6. Conclusion:

1. Here I studied about IOT and Ubiquitous Computing Architecture.
2. Applications based on it.
3. Recent inventions related to IOT.

Case Study-3

1) What is private cloud?

Private cloud (also known as an internal cloud or corporate cloud) is a cloud computing environment in which all hardware and software resources are dedicated exclusively to, and accessible only by, a single customer. Private cloud combines many of the benefits of cloud computing—including elasticity, scalability, and ease of service delivery—with the access control, security, and resource customization of on-premises infrastructure.

Many companies choose private cloud over public cloud (cloud computing services delivered over infrastructure shared by multiple customers) because private cloud is an easier way (or the only way) to meet their regulatory compliance requirements. Others choose private cloud because their workloads deal with confidential documents, intellectual property, personally identifiable information (PII), medical records, financial data, or other sensitive data.

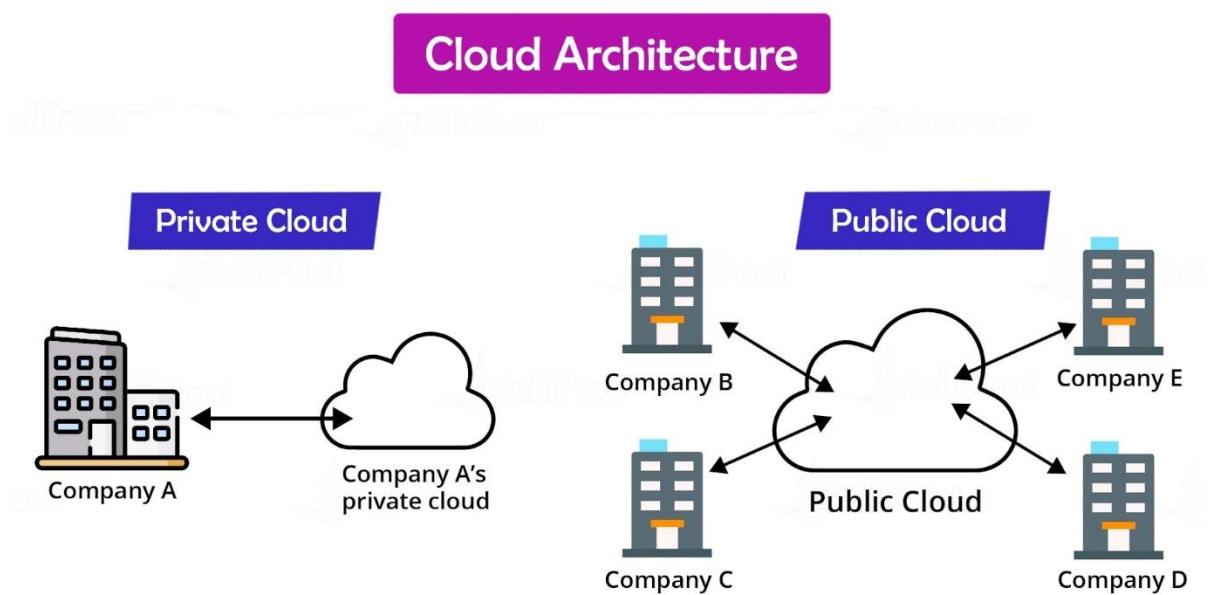
By building private cloud architecture according to cloud native principles, an organization gives itself the flexibility to easily move workloads to public cloud or run them within a hybrid cloud (mixed public and private cloud) environment whenever they're ready.

2) Comparative between private cloud , public could.

Public Cloud	Private Cloud
Cloud Computing infrastructure shared to public by service provider over the internet. It supports multiple customers i.e., enterprises.	Cloud Computing infrastructure shared to private organisation by service provider over the internet. It supports one enterprise.
Multi-Tenancy i.e., Data of many enterprise are stored in shared environment but are isolated. Data is shared as per rule, permission and security	Single Tenancy i.e., Data of single enterprise is stored
Cloud service provider provides all	Specific hardware and hardware as

the possible services and hardware as the user-base is world. Different people and organization may need different services and hardware. Services provided must be versatile.	per need of enterprise are available in private cloud.
It is hosted at Service Provider site.	It is hosted at Service Provider site or enterprise.
It is connected to the public internet	It only supports connectivity over the private network.
Scalability is very high, and reliability is moderate.	Scalability is limited, and reliability is very high.
Cloud service provider manages cloud and customers use them.	Managed and used by single enterprise.

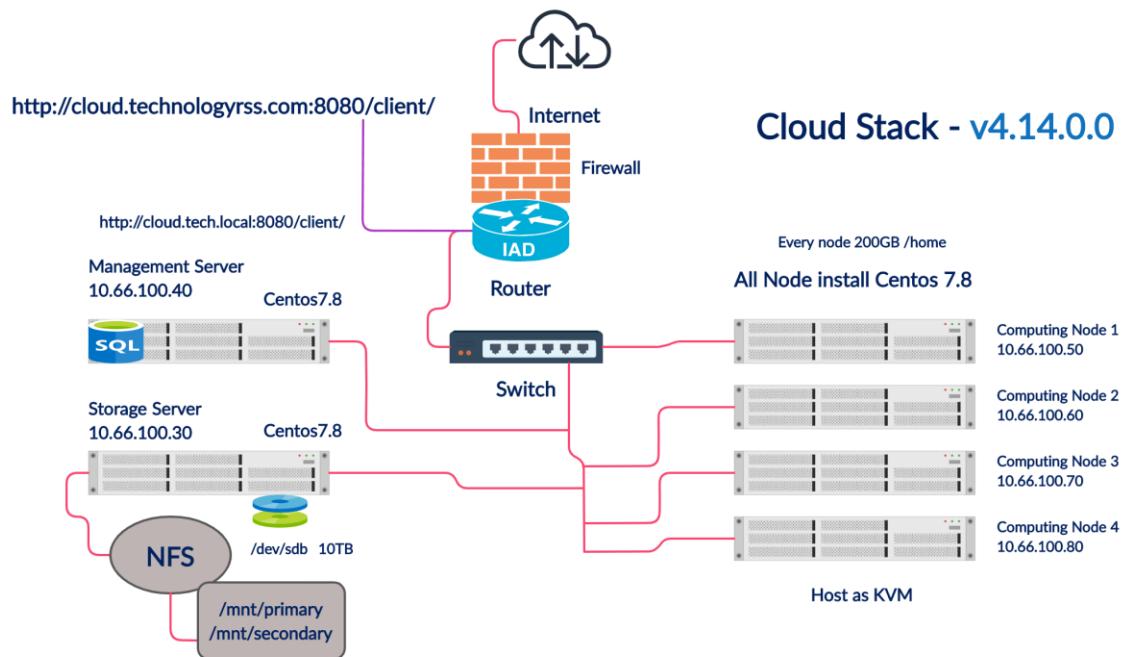
3) Draw necessary diagrams for both private cloud and public cloud.



4) Explain any Tools for building private cloud with necessary diagram and explanation.

1. CloudStack:

Apache CloudStack is designed to deploy and manage large networks of virtual machines. This Apache Project offers a turnkey Infrastructure as a Service (IaaS) cloud computing platform. It's used both by public cloud computing vendors and by organizations running their own private clouds.

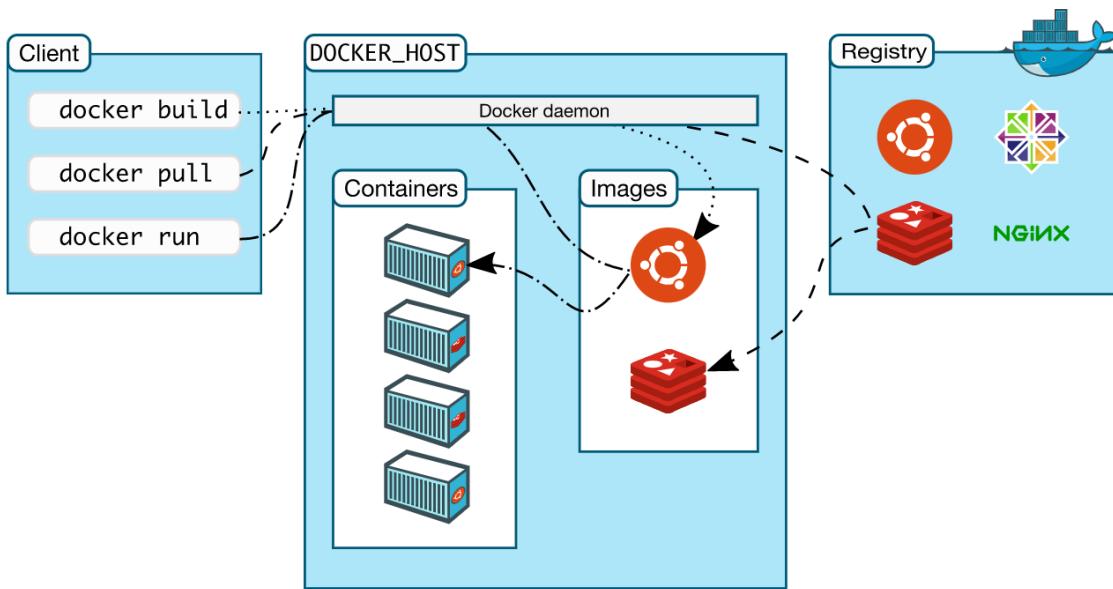


2. FOSS-Cloud

The FOSS-Cloud is a Software that enables you to create your own Private or Public Cloud. It is an integrated infrastructure to provide cloud-Services, Windows or Linux based SaaS. FOSS-Cloud covers all of the aspects of an Open-Source IT environment. This multi-faced cloud computing solution includes virtualization, cloud desktop, IaaS, PaaS and SaaS capabilities.

3. Docker

Docker provides a highly reliable, low-cost way to quickly build, ship, and run distributed applications at scale. It gives developers the freedom to define environments and create apps faster and easier and flexibility for IT ops to quickly respond to change.



5. Conclusion:

1. Here, I learnt about private cloud and its architecture.
2. Applications based on it.
3. Tools required to build private cloud.