Module title: Cloud Computing

Interacting with a cloud computing based in a working environment

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Contents

Assignment Introduction

Scenario: You are the assistant to the Network Administrator for a networking consultancy company called CompuTech. Your company has recently been providing *network consultancy services* for DigiTech, a small product services company which is located in a small village on the southern coast of Ireland. The Chief Information Officer has decided that the time is right to migrate DigiTech’s on-premise network operation to the Google Cloud Platform. The management at

DigiTech would like to get a sample of some of the online business utility services that are available on the Google Cloud.

1.(5%) Create a storage bucket. Upload items from your computer using the command line and the GUI and place them into the bucket.

Your manager has instructed you to demonstrate and explain Google Cloud bucket storage:

Accessing Google Cloud in the console just type in a search bar -> Create bucket

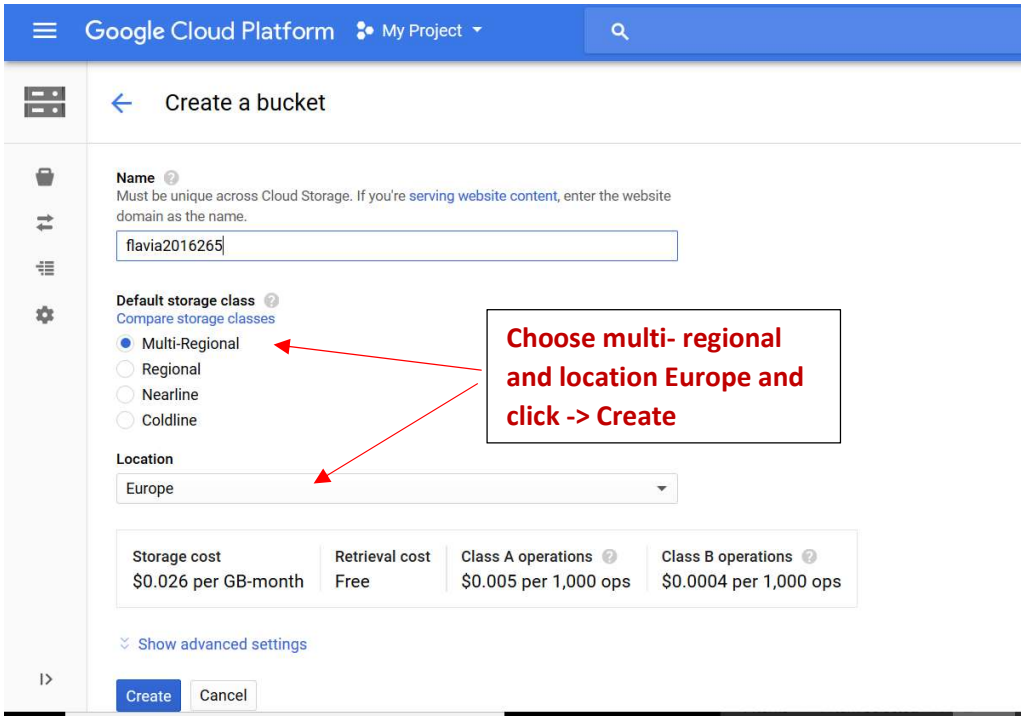


Figure 1

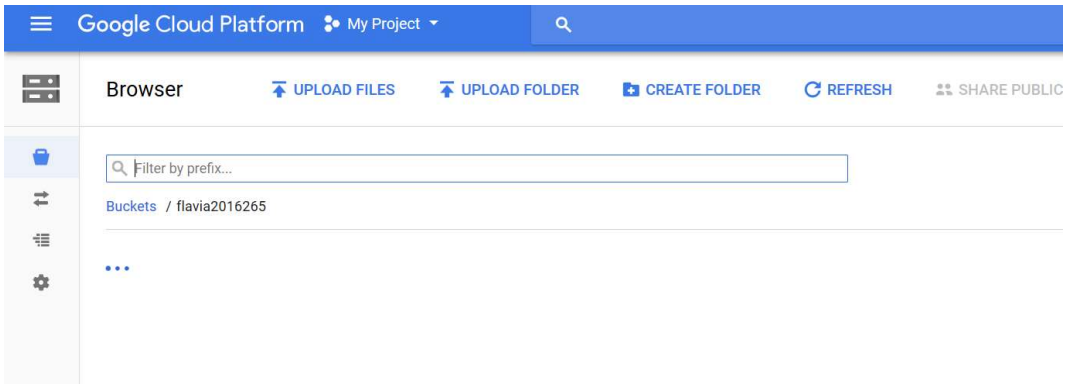


Figure 2

Uploading files from your computer is very straight forward just click in -> upload file or folder and click in Upload

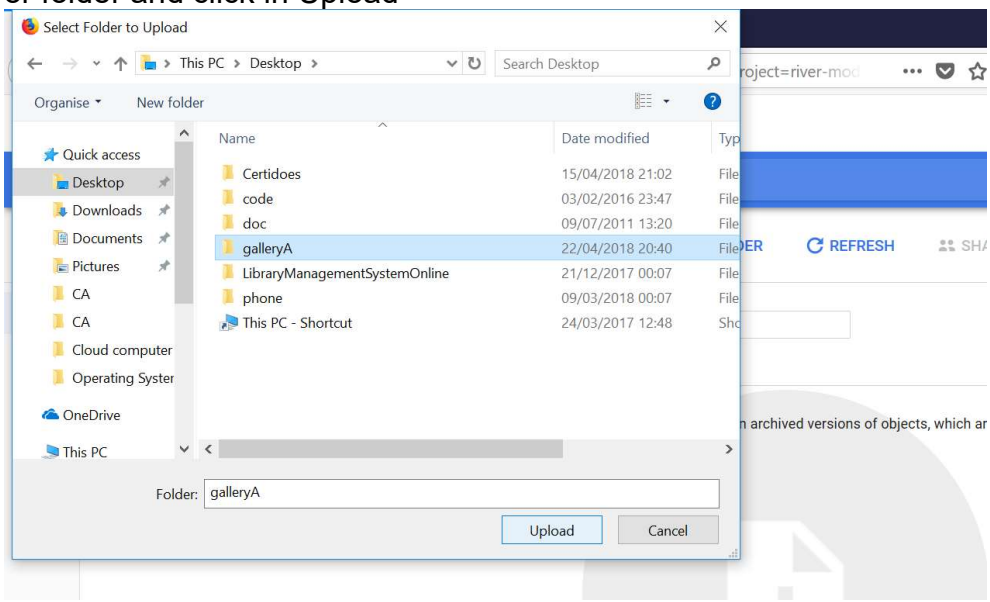


Figure 3

After uploaded your files will be presented in your bucket as image below:

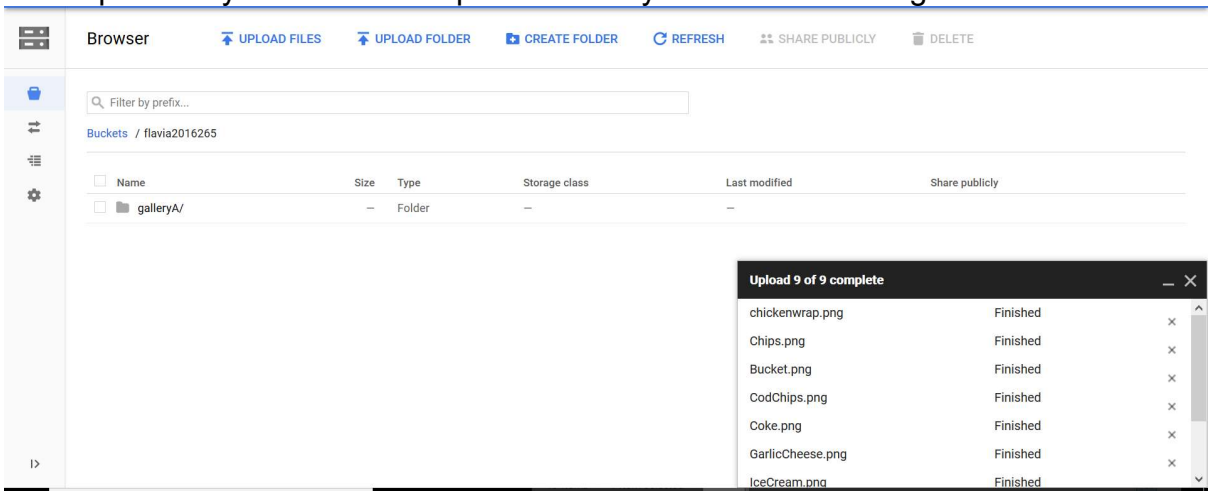


Figure 4

Uploading files by command line into the bucket as screenshoot below:

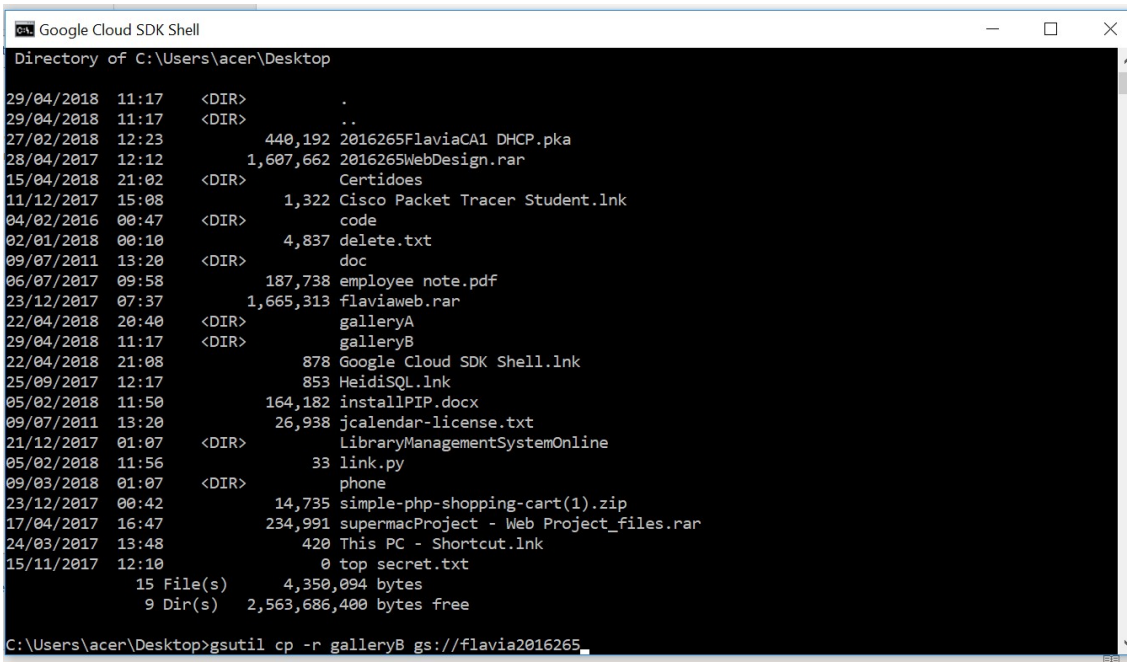


Figure 5

Uploading files by command lines just type gsutil cp -r (the name of the folder) gs and name of my bucket as image above.
As image below, we can see all the content being uploaded to a specific bucket

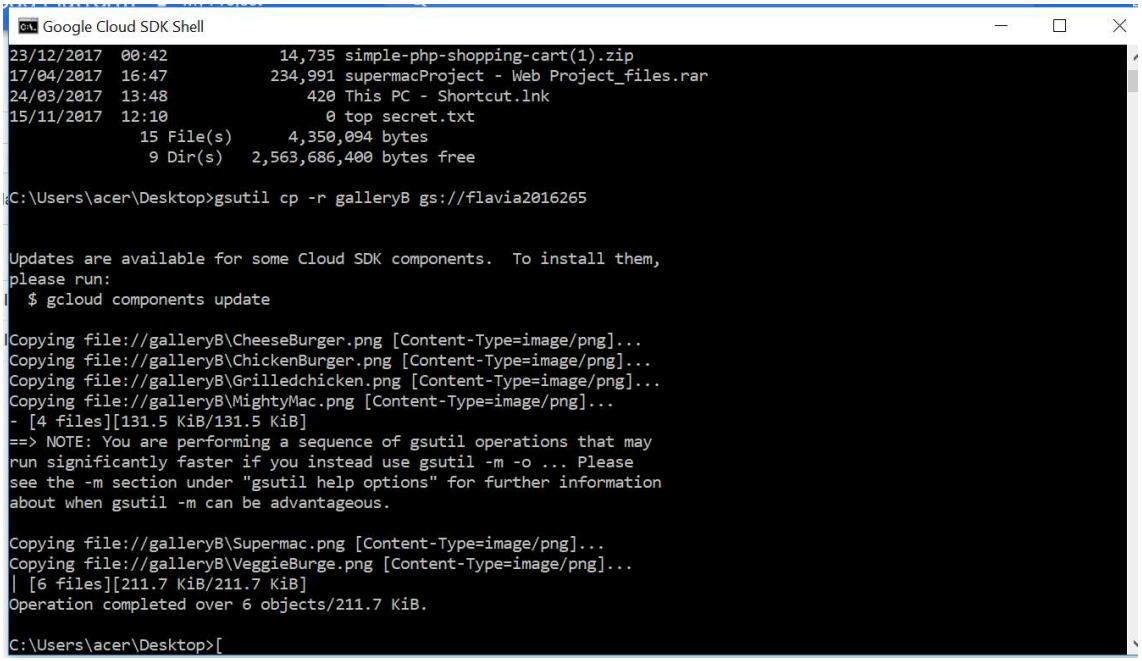


Figure 6

After uploaded your files will be presented inside the bucket as image below:

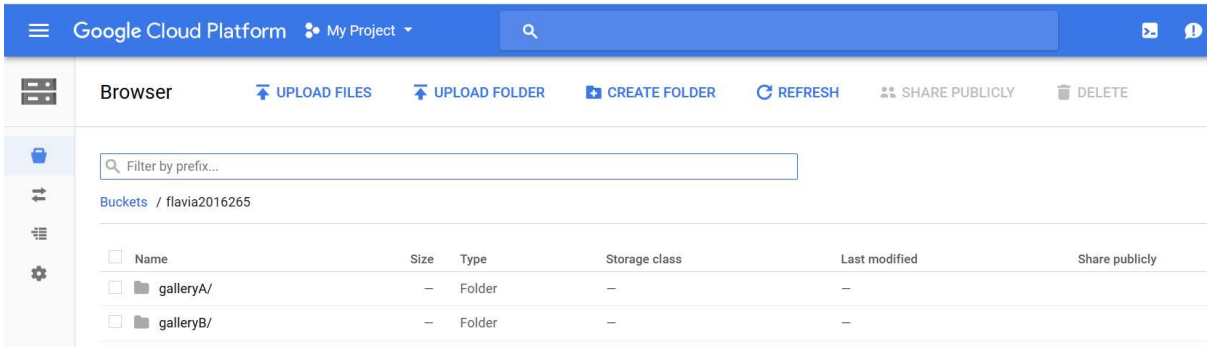


Figure 7

2. (5%) Upload items from the bucket to a Linux virtual machine using the Google CLI

First, we should create a VM instance by clicking in -> Compute Engine -> VM instances and then pass all the parameters of that virtual machine such as name, zone, machine type and boot disk (it will allow to choose the OS) in this case was a Linux virtual machine, in firewall we should allow HTTP and HTTPS traffic.

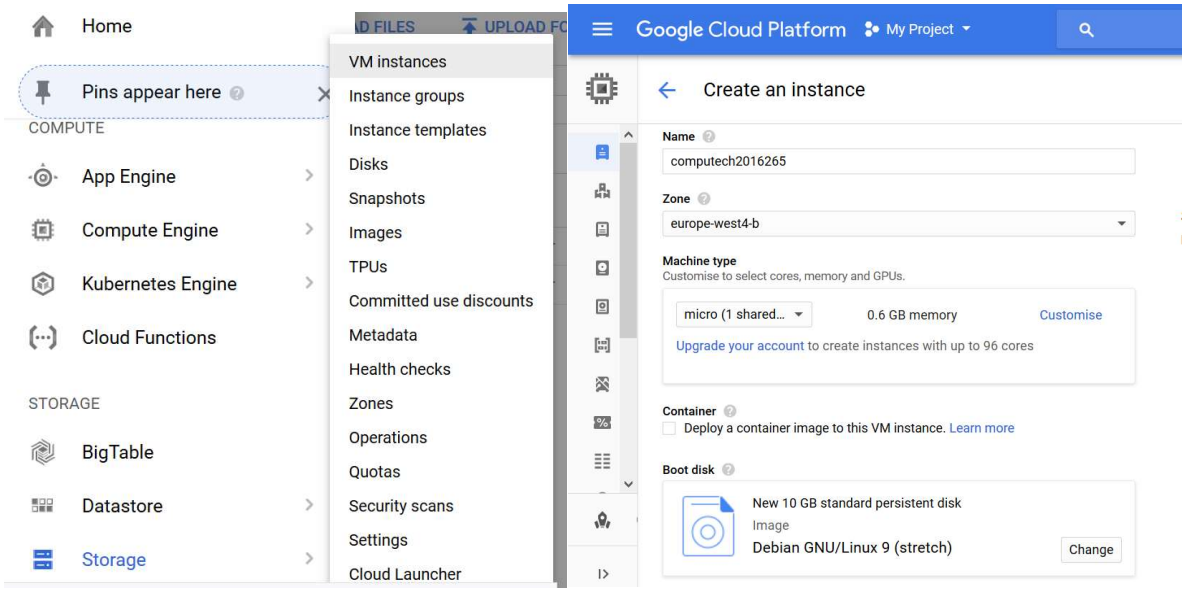


Figure 8

Installing Apache first:

After completed the process, we should install the updates and apache2 to run our website.

By clicking in SSH -> Open in Browser window -> sudo su -> apt-get update ->

Apt-get install apache2 as screenshot below:

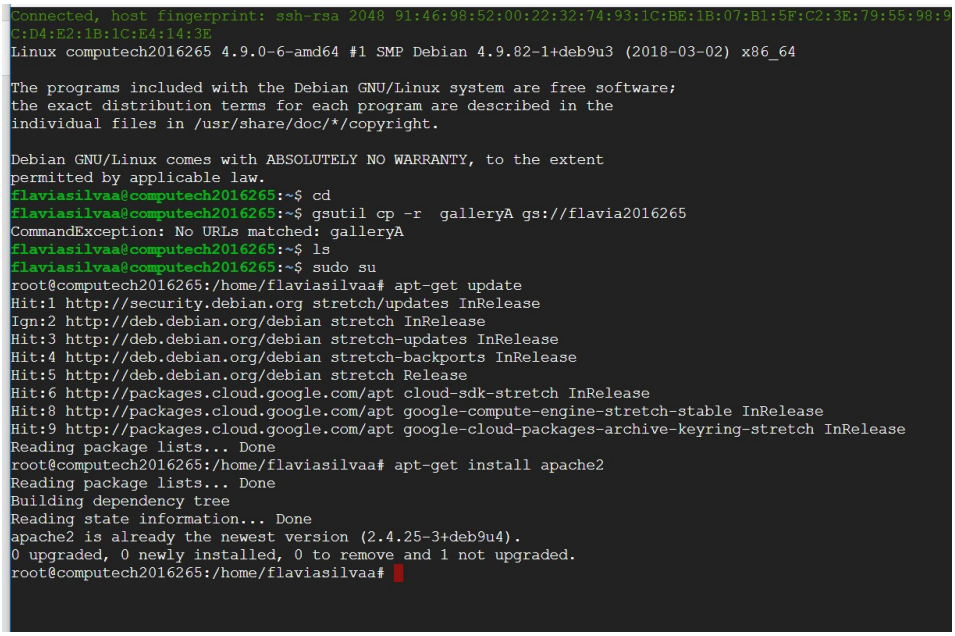


Figure 9

Using Sudo su to have super admin permission to upload files or folders and then type gsutil cp gs://flavia2016265/Bucket.png.

Where flavia201665 is the name of my bucket and Bucket.png is the name of my file.

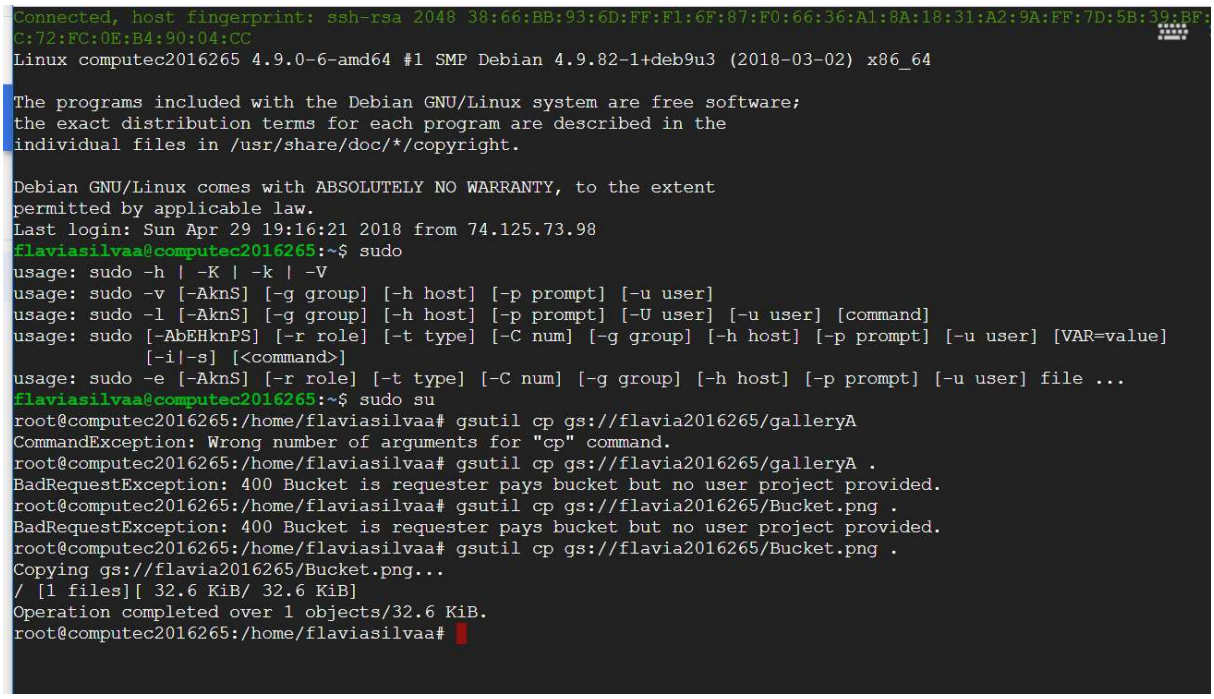


Figure 10

Checking if my webpage is working by typing my IP address on the browser as screenshot below:

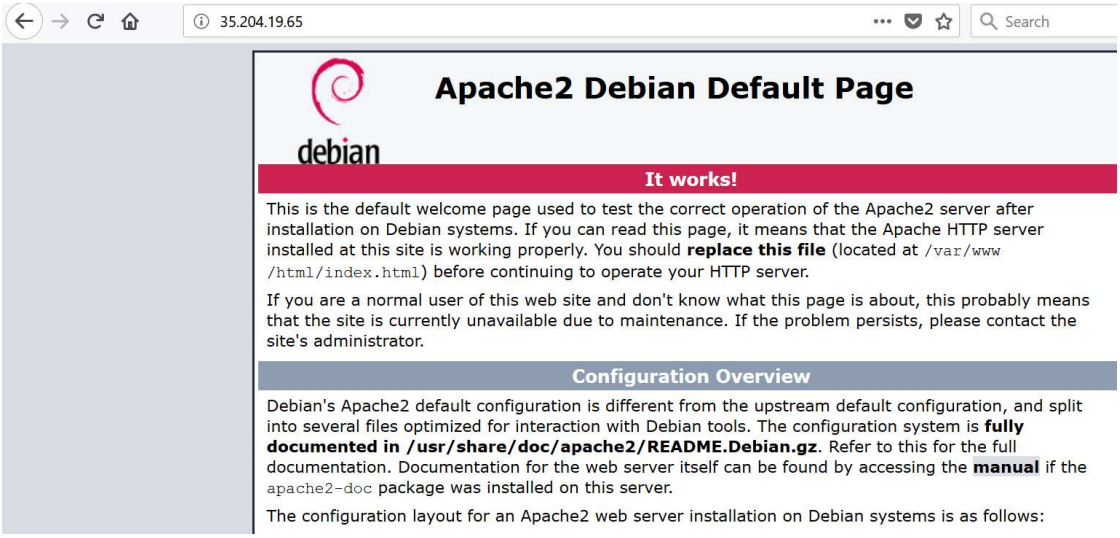


Figure 11

3. (5%) Create a Linux VM, install Apache and upload the web page to the web site.

The web page should say “DigiTech on Apache” and have your name on it.

First, we should create a VM instance by clicking in -> Compute Engine -> VM instances and then pass all the parameters of that virtual machine such as name, zone, machine type and boot disk (it will allow to choose the OS) in this case was a Linux virtual machine, in firewall we should allow HTTP and HTTPS traffic.

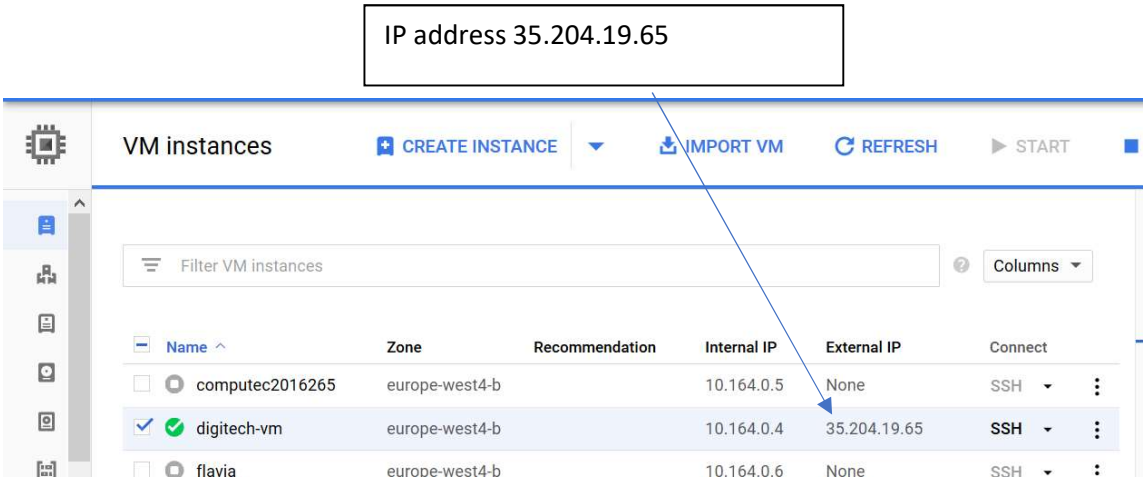


Figure 12

Uploading files to my apache server- sudo su

Cd /

Cd var

Cd www

Gsutill cp -r gs://flavia2016265/site/.

```
php is already the newest version (1:7.0+49).
0 upgraded, 0 newly installed, 0 to remove and 1 not upgraded.
root@computec2016265:/# cd /
root@computec2016265:/# cd var
root@computec2016265:/var# cd www
root@computec2016265:/var/www# cd html
root@computec2016265:/var/www/html# gsutil cp gs://flavia2016265/index.html .
Copying gs://flavia2016265/index.html...
/ [1 files][  195.0 B/  195.0 B]
Operation completed over 1 objects/195.0 B.
root@computec2016265:/var/www/html# gsutil cp -r gs://flavia2016265/site/ .
Copying gs://flavia2016265/site/index.html...
Copying gs://flavia2016265/site/style.css...
Copying gs://flavia2016265/site/work.jpg...
/ [3 files][788.4 KiB/788.4 KiB]
Operation completed over 3 objects/788.4 KiB.
root@computec2016265:/var/www/html# [[
```

Figure 13

After uploaded our files, we can check if our webpage is working by typing the IP address on the browser as screenshot below:

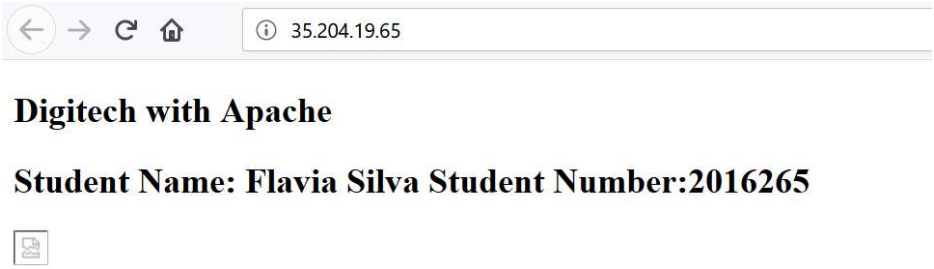


Figure 14

4. (5%) Create a Windows VM, install IIS and upload the web page to the web site.

The web page should say “DigiTech on IIS” and have your name on it.

First, we should create a VM instance by clicking in -> Compute Engine -> VM instances and then pass all the parameters of that virtual machine such as name, zone, machine type and boot disk (it will allow to choose the OS) in this case was a Windows virtual machine, in firewall we should allow HTTP and HTTPS traffic.

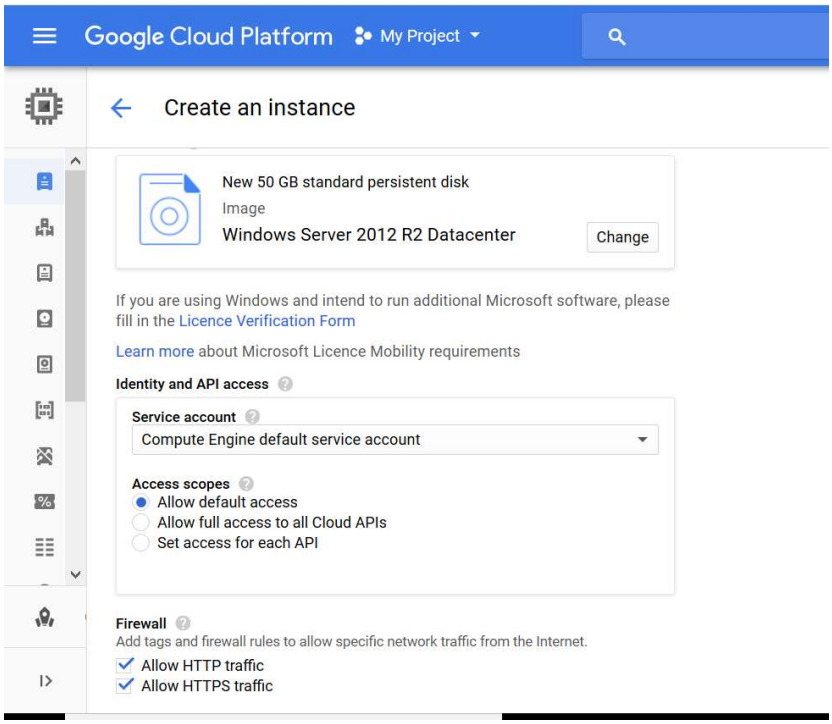


Figure 15

Screenshot with a new Windows VM machine:

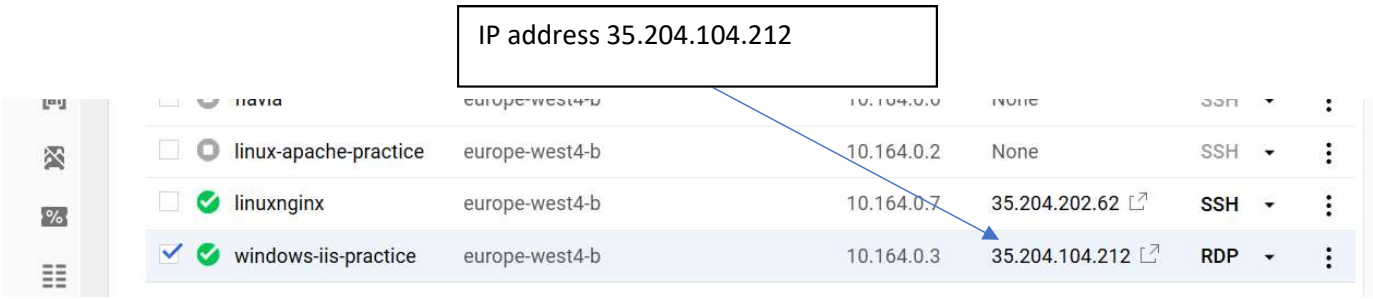


Figure 16

Accessing Windows VM through the RDP, Remote Desktop Protocol.

Figure 17

We need to install a ISS in our virtual machine to get the webpage work as screenshot below:

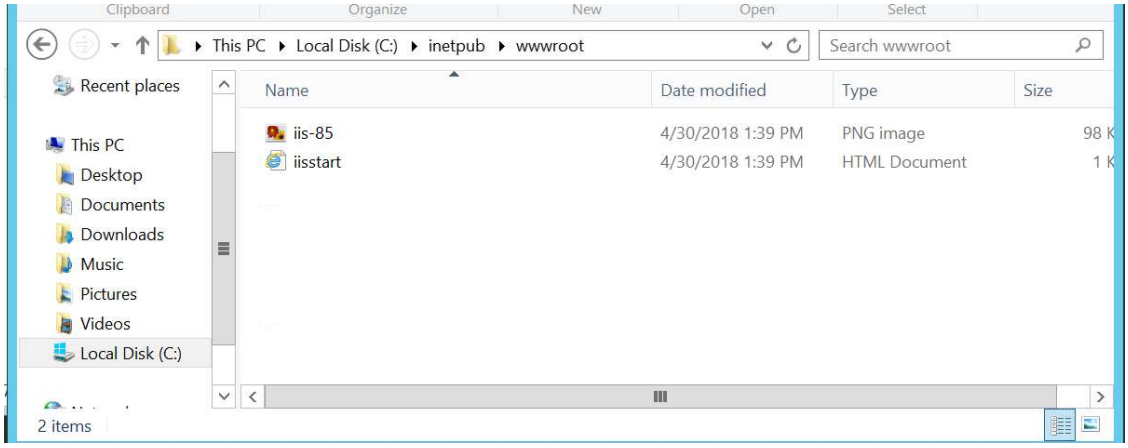


Figure 18

In Google Cloud SDK Shell just, type: gsutil cp -r gs://flavia/flavia/.

After uploaded our files, we can check if our webpage is working by typing the IP address on the browser as screenshot below:

Figure 19

5. (5%) Create a Linux VM, install NGINX and upload the web page to the web site.

The web page should say “DigiTech on NGINX” and have your name on it.

First, we should create a VM instance by clicking in -> Compute Engine -> VM instances and then pass all the parameters of that virtual machine such as name, zone, machine type and boot disk (it will allow to choose the OS) in this case was a Linux virtual machine, in firewall we should allow HTTP and HTTPS traffic.

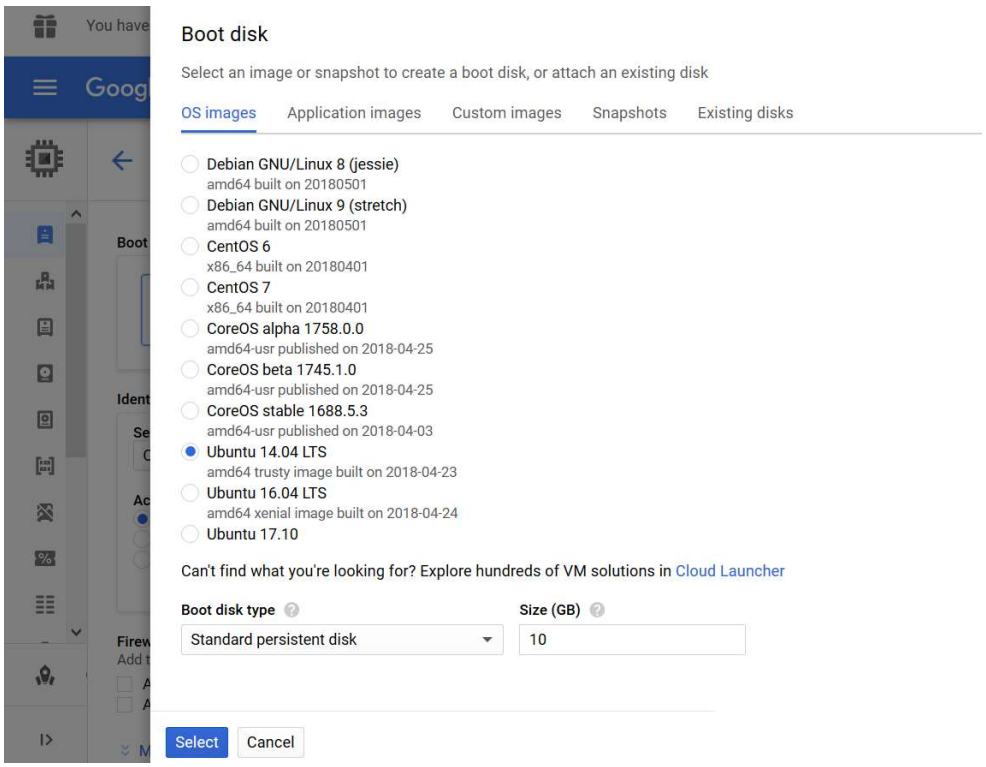


Figure 20

Screenshot of a new Linux NGINX machine.

Figure 21

By clicking in SSH -> Open in Browser window -> sudo su -> apt-get update ->

Sudo apt-get install nginx as screenshot below:

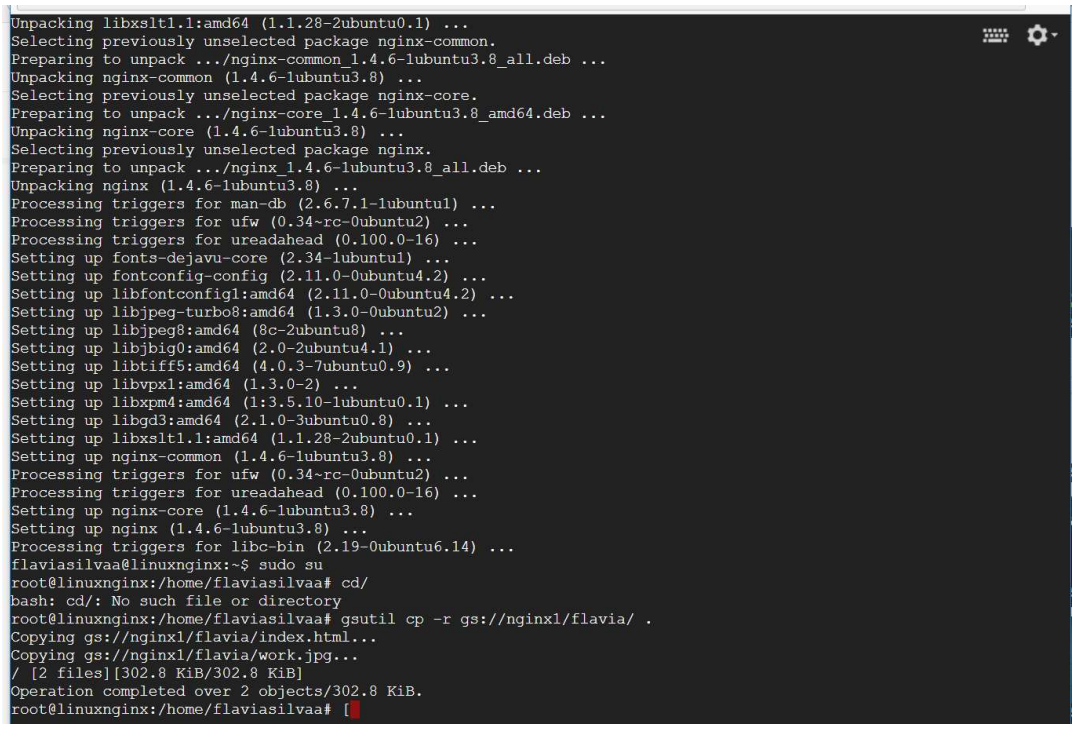


Figure 22

Sudo su
Cd /

Cd var

Cd www.

Uploading files by: gsutil cp -r gs://nginx1/flavia/.

```
root@linuxnginx:/home/flaviasilvaa# gsutil cp -r gs://nginx1/flavia/ .
Copying gs://nginx1/flavia/index.html...
Copying gs://nginx1/flavia/work.jpg...
/ [2 files][302.8 KiB/302.8 KiB]
Operation completed over 2 objects/302.8 KiB.
root@linuxnginx:/home/flaviasilvaa# [
```

After uploaded our files, we can check if our webpage is working by typing the IP address on the browser as screenshot below:

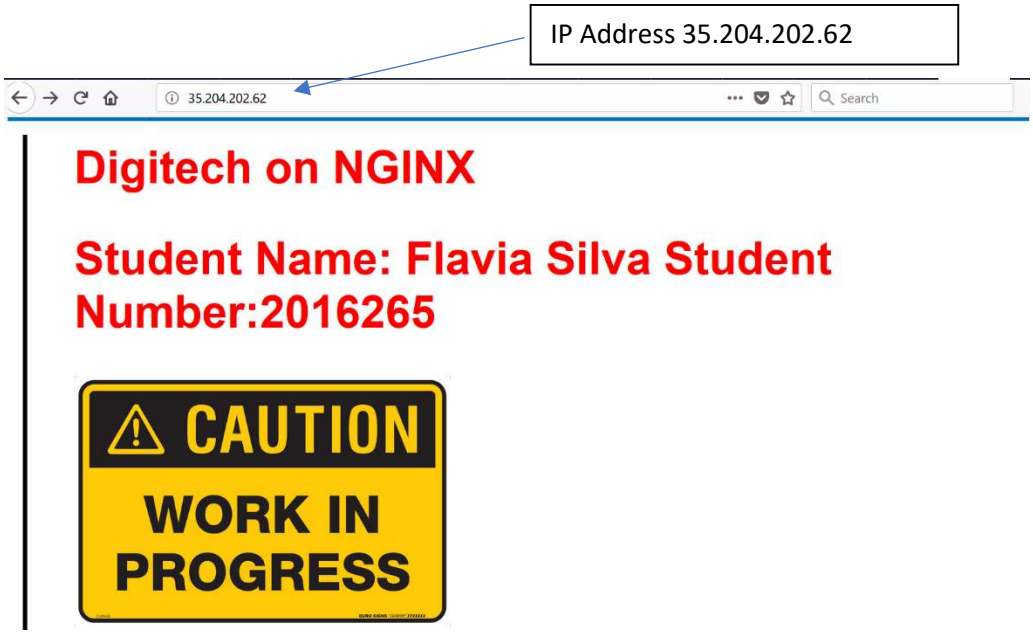
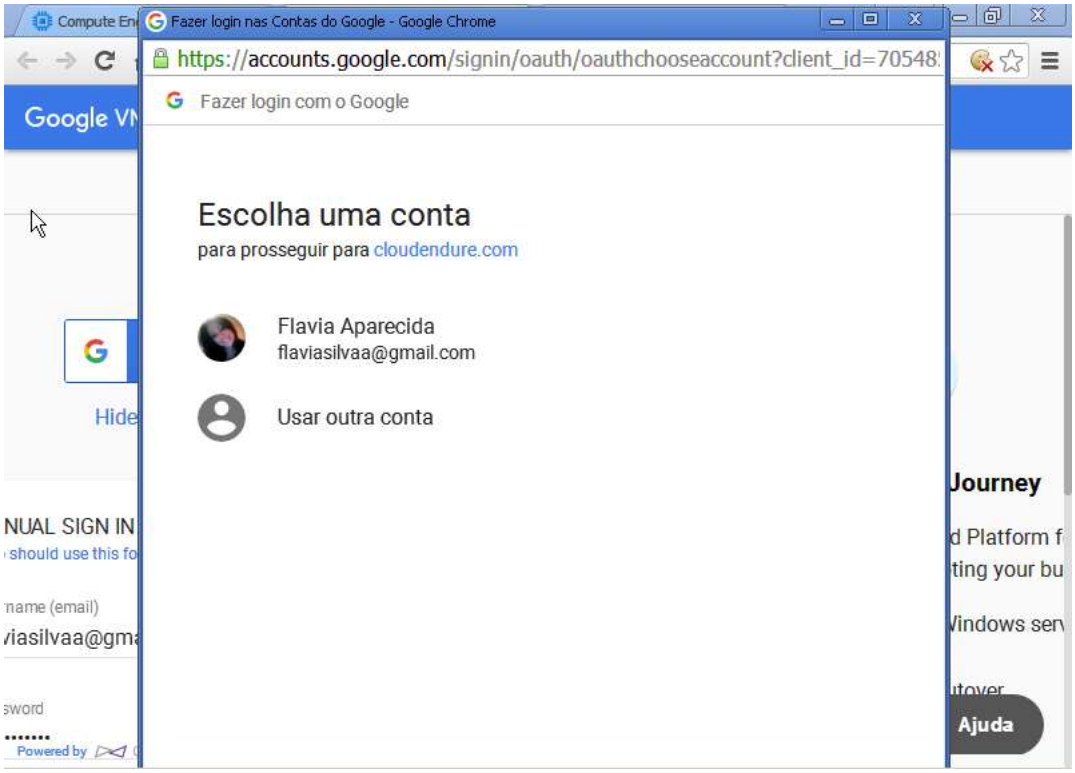


Figure 23

6. (15%) Set up a working DigiTech web site on a Windows or Linux VM (you choose). Upload a virtual machine (Live Migration) to the cloud and show that the Web site works. The web page should say "DigiTech on Live Migration VM" and have your name on it.

I tried to do the live migration but when I choose my email, I could not proceed any further, so I could not finish my live migration.



7. (10%) DigiTech is very interested in the live migration that you performed. Explain what Live Migration is and identify situations where DigiTech could benefit from being able to perform live migrations of one or more of their production virtual machines.

Live Migration is a process of keeping virtual machines running even when a host system event occurs, infrastructure failures or maintenance activities as an example hardware upgrades.

Using a Live Migration, we are able to migrate running instances to another host in the same zone without rebooting or any interruption.

Live Migration is a great option because all the attributes and properties still unchanged, internal and external IP, instance metada, block storage data and volumes, network connections, network settings, memory of the virtual machine are transferred from the original guest machine to the destination machine so that means when a Live Migration happens it will move the complete instance state from the source to the destination.

A Live Migration can be performed when the host physical computer/server needs maintenance, updating or be switched between different hosts.

Another case such as failure of memory, CPU, network interface cards, disks, power any kind of hardware failure as well. When a host OS and BIOS needs upgrades,

system configuration changes, everything we need to fix quickly to decrease downtimes.

All the processes are transparent to end users and do not impact the performance and connectivity of running applications.

Live Migration provides a lot of benefits such as fixing problems before they arise, no downtime that means a lot for a business if a user cannot user an application or services, it can have massive repercussions for the business, the company can lose a lot of money when they are not in business even if that occur for a short period of time, the whole process with live migration happens very fast a downtime of seconds between migration.

Explaining more benefits live migration can be used for load balancing where a workload is shared between more than one computer, allowing customers to have a smooth and free-flowing time on the application while the computers doing the work are under less strain and reducing the chance of failure or breakage.

There are two types of live migration:

1. **Pre-copy memory migration,** a virtual machine runs on a source node while memory is continuously transferred to a destination node. When the copy rate exceeds that of the write rate to the source, the virtual machine is transferred to the destination node with very little downtime. This method is useful in that at any point in time, there are two copies of the memory, one on each node. However, pre-copying can be time and resource consuming if there is high user traffic that results in a high write rate to the source node.
2. **Post-copy memory migration,** a virtual machine is suspended on a source node while the execution state is transferred to a destination node. Concurrently, memory pages are pushed from the source node to the destination node in a process called prepaging. If the virtual machine in the destination node tries to access a page that has not yet been transferred, a page-fault is generated that causes the requested page to be sent to the destination node on the spot. This method can be faster than pre-copying, but if there is a network error that could cause memory loss, there are no backups like with pre-copying.

8. (10%) Research topic: DigiTech is interested in other services that are available on the Google Cloud platform. Choose to research one of the services available from Google's Cloud Launcher and explain how they could be useful to DigiTech. Choose one from the following list of Google Cloud partner services: Traffic Manager Enterprise Edition & WAF / App Engine / Kubernetes Engine / Deep Security for Google Cloud (Trend Micro) / Barracuda CloudGen Firewall for GCP (BYOL)

In my opinion a service very useful for Digitech is an App Engine, it is a scalable reliable service for web applications, nowadays a lot of big and small companies are migrating to cloud computing so a cloud computing environment they will enable companies to consume a computer resource, such as virtual machine, storage or an application, as a utility rather than having to build and maintain computing and infrastructure in the company that means less cost, more flexibility, less downtime, security, control, more resources, I could spend hours talking about the advantages to migrate a system for a cloud computing but I will focus in talking about App Engine as a great solution as well.

App Engine is an example of PaaS (Platform as a Service) used for applications is built on top of virtualization technology, businesses can request resources as they need them, scaling as demand grows, rather than investing in hardware with redundant resources.

Features of App Engine:

1. Popular Languages
2. Open & Flexible
3. Fully Managed
4. Monitoring, Logging & Diagnostics
5. Application Versioning
6. Traffic Splitting
7. Application Security
8. Services Ecosystem

App Engine is an integral part of the Google Cloud Platform where is possible to build infrastructure as a service, big data, cloud storage, it's a platform for developing, hosting web applications and scale automatically in Google's data center. The application runs across multiple servers.

It offers an automatic scaling that means handling huge or tiny amounts of traffic, just paying for the infrastructure capacity the applications use, the applications run on the top of Google's world class infrastructure, there is no need to worry about provisioning and managing a data center that scales to meet a demand, in that platform they take care of it and a customer just need to focus on their code and

build an app because Google will manage traffic, load balancing, health-checking, configuration, sharding and healing instances. They also offer multiple storage options like relational database, scalable file storage and a lightweight data store.

It let apps communicate with a very low latency when a company has hybrid or multi-cloud environments.

Application security is another good point because can define some rules for firewalls and SSL/TSL certificate.

Possibility to create development, test, staging and production environment.

The application can be built in different languages such as Node.js, Java, PHP, Ruby, Phyton,C# and GO.

9.(10%) Challenging research topic: Your manager has heard that recently Google introduced GCSFUSE that allows you to mount a bucket to a Debian Linux virtual machine. This is a feature that DigiTech is interested in and your manager needs you to figure out how to do this. Please note: as part of your internship with the company you need you to demonstrate that you have the ability to conduct research and attempt to perform more difficult tasks. Therefore, if you do attempt this task, you are to do all the work and research without any help from any other student or teacher. Furthermore, if you do successfully complete this task you are not to help any of the of students solve the challenge. This is a problem-solving exercise and it has a solution! If you successfully mount the bucket to the Linux VM, install Apache and load the web page from the bucket to the VM and set up a web site. The web page should say "DigiTech on Apache Loaded from the Attached Bucket" and have your name on it.

Cloud Storage FUSE is an open source FUSE adapter that allows us to mount Google Cloud Storage buckets as file systems on Linux or OS X systems.

It works by translating object storage name into a file and directory system, interpreting the "/" character in object name as a directory separator so that objects with the same common prefix are treated as files in the same directory.

Applications can interact with the mounted bucket like a simple file system, providing virtually limitless file storage running in the cloud.

FUSE (Filesystem in Userspace) is an interface for userspace programs to export a filesystem to the Linux kernel. The FUSE project consists of two components: the *fuse* kernel module (maintained in the regular kernel repositories) and the *libfuse* userspace library (maintained in this repository). libfuse provides the reference implementation for communicating with the FUSE kernel module.

A FUSE file system is typically implemented as a standalone application that links with libfuse. libfuse provides functions to mount the file system, unmount it, read requests from the kernel, and send responses back. libfuse offers two APIs: a "high-level", synchronous API, and a "low-level" asynchronous API. In both cases, incoming requests from the kernel are passed to the main program using callbacks. When using the high-level API, the callbacks may work with file names and paths instead of inodes, and processing of a request finishes when the callback function returns. When using the low-level API, the callbacks must work with inodes and responses must be sent explicitly using a separate set of API functions.

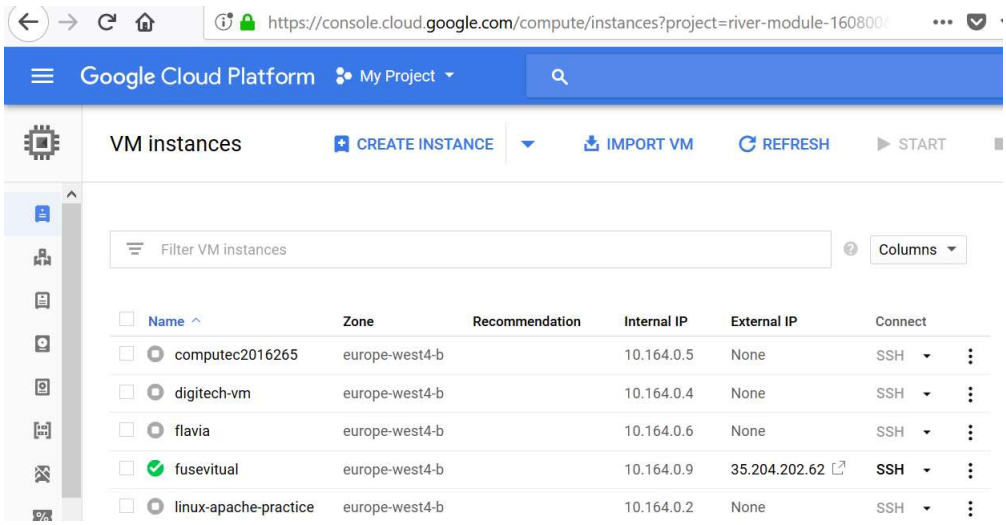


Figure 24

Installing apache: apt-get install apache2

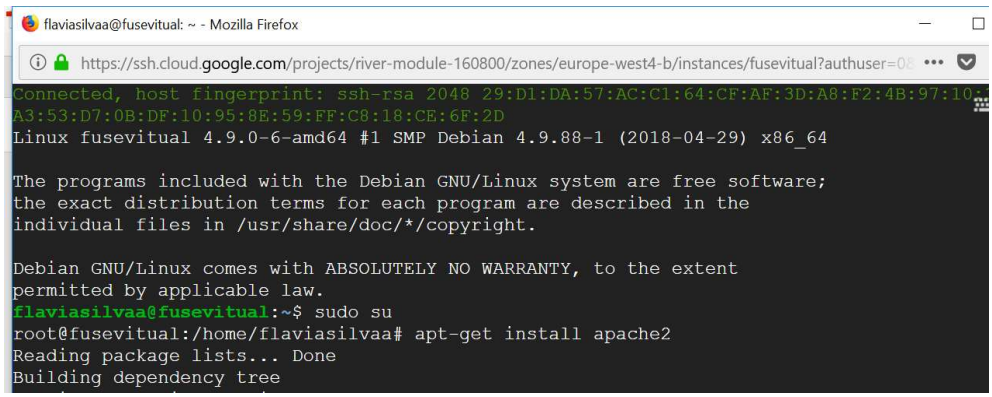


Figure 25

Commands to install cgsfuse:

Create environment variable for correct distribution
export CLOUD_SDK_REPO="cloud-sdk-$(lsb_release -c -s)"

Add the Cloud SDK distribution URI as a package source
echo "deb http://packages.cloud.google.com/apt $CLOUD_SDK_REPO main" | sudo tee -a /etc/apt/sources.list.d/google-cloud-sdk.list

Import the Google Cloud Platform public key
curl https://packages.cloud.google.com/apt/doc/apt-key.gpg | sudo apt-key add -

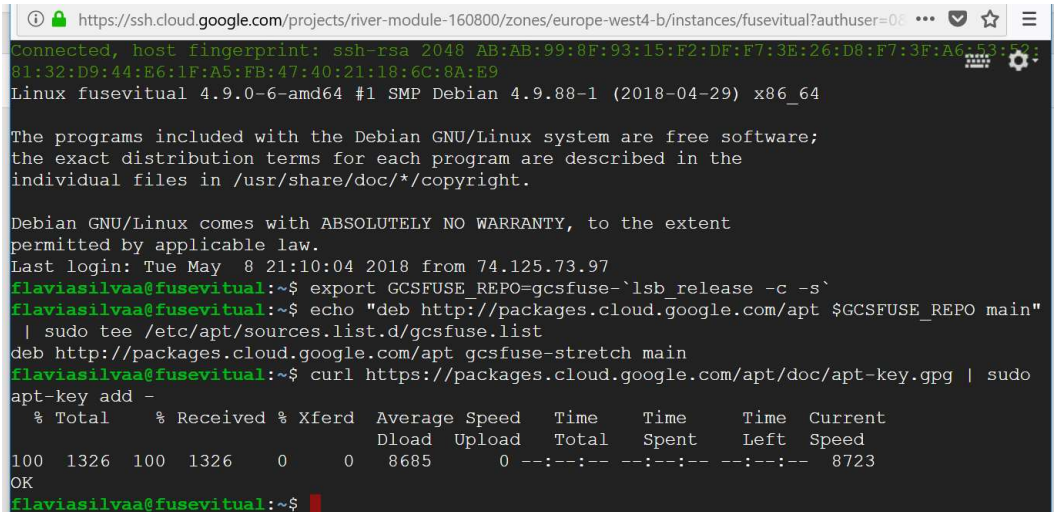


Figure 26

Command of installation of the fuse with the commands sudo apt-get update and sudo apt-get install gcsfuse.

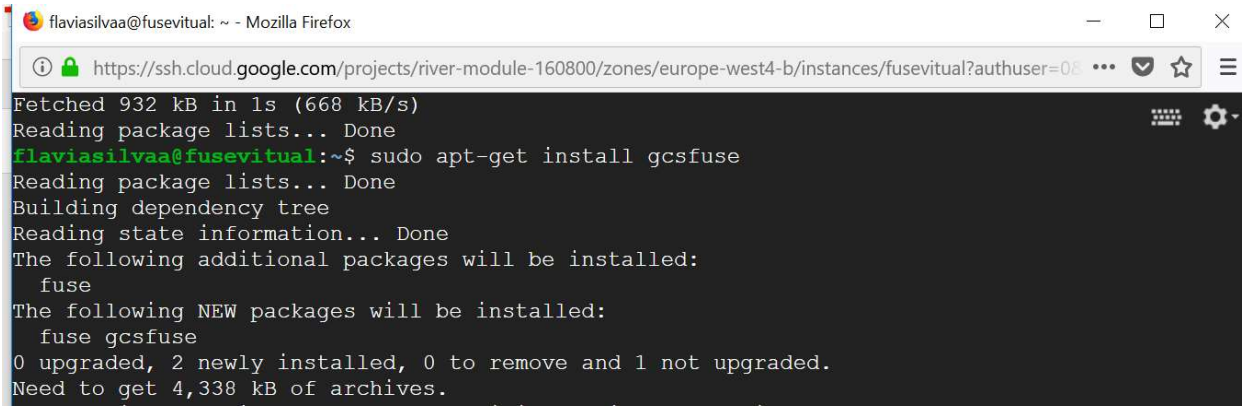


Figure 27

I created a folder called f2016265 and use the gcsfuse to synchronize the files from the bucket with the folder f2016265.

```
root@fusevitual:~# cd /
root@fusevitual:/# mkdir f2016265
root@fusevitual:/# gcsfuse bucketf2016265 f2016265
Using mount point: /f2016265
Opening GCS connection...
Opening bucket...
daemonize.Run: readFromProcess: sub-process: mountWithArgs: mountWithConn: setUpBucket: OpenB
ucket: Unknown bucket "bucketf2016265"
root@fusevitual:/# gcsfuse f2016265 f2016265
Using mount point: /f2016265
Opening GCS connection...
Opening bucket...
Mounting file system...
File system has been successfully mounted.
root@fusevitual:/#
```

Figure 28

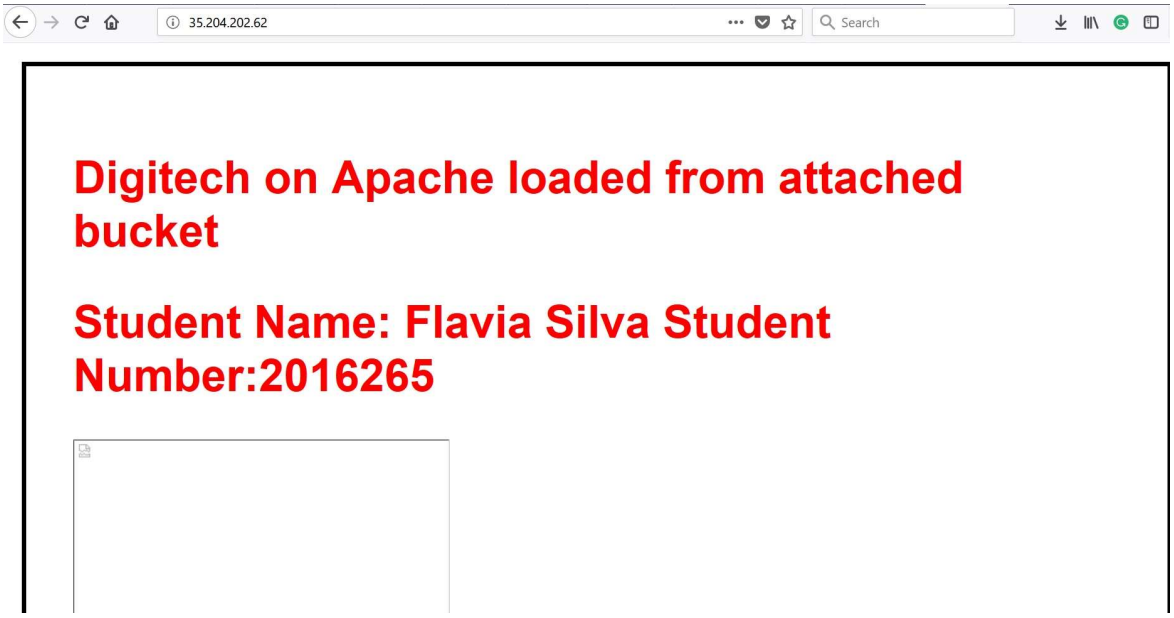


Figure 29

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“Live Migration” Available at: https://www.techopedia.com/definition/16813/live-migration (Accessed by:28/04/2018).

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Available at: https://cloud.google.com/appengine/docs/ (Accessed by:28/04/2018).