



## Assignment 2, Cloud Computing Exploring Google Cloud Services

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## **INTRODUCTION**

This assignment discusses using GCP to manage virtual machines, storage, and network.

The first section focuses on creating a VM instance, connecting to it using SSH, and deploying a basic web server using Apache.

The second part is dedicated to Google Cloud Storage, including creating a storage segment, uploading objects, and implementing lifecycle management policies.

The last section is dedicated to networks in GCP, where a virtual private cloud is configured for resource segmentation and traffic management. The configuration of firewall rules demonstrates the role of security policies in regulating communication between resources and the Internet. Connecting a virtual machine to a VPC and testing its connectivity completes network tasks, emphasizing the importance of secure and organized cloud networks.

# VIRTUAL MACHINES IN GOOGLE CLOUD

## 1.1 Create a Virtual Machine (VM) Instance

Navigated to Google Cloud Console. In the navigation menu, went to Compute Engine, then VM Instances. Configured VM settings. Named as cloud-manshuk. Selected a region. Us-central-1c. Chose a machine type. Chose the Ubuntu as OS. In the firewall section, enabled Allow HTTP and HTTPS traffic. Allowed the SSH access. Clicked “Create” button.

The screenshot shows the Google Cloud Compute Engine VM Instances page. On the left, there's a sidebar with sections for Compute Engine, Virtual machines (selected), Storage, and Marketplace. Under Virtual machines, 'VM instances' is selected. The main area shows a table of VM instances with one row visible: 'cloud-manshuk' (Status: Up, Name: cloud-manshuk, Zone: us-central1-c, Internal IP: 10.128.0.2 (nic0)). Below the table, there's a 'Related actions' section with links like 'Explore Backup and DR', 'View billing report', 'Monitor VMs', 'Explore VM logs', 'Set up firewall rules', 'Patch management', and 'Load balance between VMs'. To the right, there's a sidebar titled 'Get started with Compute Engine' containing several tutorial cards, such as 'Create a "hello world" website on IIS' and 'Transfer files to a Windows VM'.

## 1.2 Connect to the VM

Clicked on the “SSH” button. Updated the package list using command “sudo apt update”.

```
SSH-in-browser  UPLOAD FILE  DOWNLOAD FILE   

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



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



```
manshuk_37_18_0@cloud-manshuk:~$ sudo apt update
Hit:1 http://us-central1.gce.archive.ubuntu.com/ubuntu focal InRelease
Get:2 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-updates InRelease [128 kB]
Get:3 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-backports InRelease [128 kB]
Get:4 http://security.ubuntu.com/ubuntu focal-security InRelease [128 kB]
Get:5 http://us-central1.gce.archive.ubuntu.com/ubuntu focal/universe amd64 Packages [8628 kB]
Get:6 http://us-central1.gce.archive.ubuntu.com/ubuntu focal/universe Translation-en [5124 kB]
Get:7 http://us-central1.gce.archive.ubuntu.com/ubuntu focal/universe amd64 c-n-f Metadata [265 kB]
Get:8 http://us-central1.gce.archive.ubuntu.com/ubuntu focal/multiverse amd64 Packages [144 kB]
Get:9 http://us-central1.gce.archive.ubuntu.com/ubuntu focal/multiverse Translation-en [104 kB]
Get:10 http://us-central1.gce.archive.ubuntu.com/ubuntu focal/multiverse amd64 c-n-f Metadata [9136 B]
Get:11 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-updates/main amd64 Packages [3696 kB]
Get:12 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-updates/main Translation-en [1056 kB]
Get:13 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-updates/main amd64 c-n-f Metadata [17.8 kB]
Get:14 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-updates/restricted amd64 Packages [3297 kB]
Get:15 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-updates/restricted Translation-en [461 kB]
Get:16 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-updates/restricted amd64 c-n-f Metadata [548 kB]
Get:17 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-updates/universe amd64 Packages [1236 kB]
Get:18 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-updates/universe Translation-en [297 kB]
Get:19 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-updates/universe amd64 c-n-f Metadata [28.3 kB]
Get:20 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-updates/multiverse amd64 Packages [27.1 kB]
Get:21 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-updates/multiverse Translation-en [7936 B]
Get:22 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-updates/multiverse amd64 c-n-f Metadata [616 B]
Get:23 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-backports/main amd64 Packages [45.7 kB]
Get:24 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-backports/main Translation-en [16.3 kB]
Get:25 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-backports/main amd64 c-n-f Metadata [1420 B]
Get:26 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-backports/restricted amd64 c-n-f Metadata [116 B]
Get:27 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-backports/universe amd64 Packages [25.0 kB]
Get:28 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-backports/universe Translation-en [16.3 kB]
Get:29 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-backports/universe amd64 c-n-f Metadata [880 B]
Get:30 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-backports/multiverse amd64 c-n-f Metadata [116 B]
Get:31 http://security.ubuntu.com/ubuntu focal-security/main amd64 Packages [3238 kB]
Get:32 http://security.ubuntu.com/ubuntu focal-security/main Translation-en [477 kB]
Get:33 http://security.ubuntu.com/ubuntu focal-security/main amd64 c-n-f Metadata [14.3 kB]
Get:34 http://security.ubuntu.com/ubuntu focal-security/restricted amd64 Packages [3169 kB]
Get:35 http://security.ubuntu.com/ubuntu focal-security/restricted Translation-en [444 kB]
Get:36 http://security.ubuntu.com/ubuntu focal-security/restricted amd64 c-n-f Metadata [548 B]
Get:37 http://security.ubuntu.com/ubuntu focal-security/universe amd64 Packages [1013 kB]
Get:38 http://security.ubuntu.com/ubuntu focal-security/universe Translation-en [214 kB]
Get:39 http://security.ubuntu.com/ubuntu focal-security/universe amd64 c-n-f Metadata [21.4 kB]
Get:40 http://security.ubuntu.com/ubuntu focal-security/multiverse amd64 Packages [24.8 kB]
Get:41 http://security.ubuntu.com/ubuntu focal-security/multiverse Translation-en [5968 B]
Get:42 http://security.ubuntu.com/ubuntu focal-security/multiverse amd64 c-n-f Metadata [540 B]
Fetched 32.9 MB in 9s (3553 kB/s)
Reading package lists... Done
Building dependency tree
Reading state information... Done
45 packages can be upgraded. Run 'apt list --upgradable' to see them.
manshuk_37_18_0@cloud-manshuk:~$
```


```

Installed Apache using the command “`sudo apt install apache2`”.

Verified if the server is running using the command “`sudo systemctl status apache2`”.

```

Setting up ssl-cert (1.0.39) ...
Setting up liblens5.2-0:amd64 (5.2.4-1.lbuild3) ...
Setting up apache2-data (2.4.41-4ubuntu3.21) ...
Setting up libaputil:amd64 (1.6.1-4ubuntu2.2) ...
Setting up libaputil-l-dap:amd64 (1.6.1-4ubuntu2.2) ...
Setting up libaputil-l-dbd-sqld3:amd64 (1.6.1-4ubuntu2.2) ...
Setting up apache2-utils (2.4.41-4ubuntu3.21) ...
Setting up apache2-bin (2.4.41-4ubuntu3.21) ...
Setting up apache2 (2.4.41-4ubuntu3.21) ...
Enabling module mpm_event.
Enabling module authz_core.
Enabling module authz_host.
Enabling module authn_core.
Enabling module auth basic.
Enabling module access_compat.
Enabling module authn_file.
Enabling module authz_user.
Enabling module alias.
Enabling module dir.
Enabling module autoindex.
Enabling module env.
Enabling module mime.
Enabling module negotiation.
Enabling module setenvif.
Enabling module filter.
Enabling module deflate.
Enabling module status.
Enabling module regtimeout.
Enabling conf charset.
Enabling conf localized-error-pages.
Enabling conf other-vhosts-access-log.
Enabling conf security.
Enabling conf serve-cgi-bin.
Enabling site 000-default.
Created symlink /etc/systemd/system/multi-user.target.wants/apache2.service -> /lib/systemd/system/apache2.service.
Created symlink /etc/systemd/system/multi-user.target.wants/apache-htcacheclean.service -> /lib/systemd/system/apache-htcacheclean.service.
Processing triggers for ufw (0.36-6ubuntu1.1) ...
Processing triggers for systemd (245.4-4ubuntu3.23) ...
Processing triggers for man-db (2.9.1-1) ...
Processing triggers for libc-bin (2.31-0ubuntu9.16) ...
manshuk_37_18_09@cloud-manshuk:~$ sudo systemctl status apache2
● apache2.service - The Apache HTTP Server
   Loaded: loaded (/lib/systemd/system/apache2.service; enabled; vendor preset: enabled)
   Active: active (running) since Fri 2024-10-11 14:16:24 UTC; 32s ago
     Docs: https://httpd.apache.org/docs/2.4/
 Main PID: 2382 (apache2)
   Tasks: 55 (limit: 650)
  Memory: 5.1M
    CGroup: /system.slice/apache2.service
           ├─2382 /usr/sbin/apache2 -k start
           ├─2385 /usr/sbin/apache2 -k start
           ├─2386 /usr/sbin/apache2 -k start
Oct 11 14:16:24 cloud-manshuk systemd[1]: Starting The Apache HTTP Server...
Oct 11 14:16:24 cloud-manshuk systemd[1]: Started The Apache HTTP Server.
manshuk_37_18_09@cloud-manshuk:~$ 

```

Navigated to the default web server directory using the command “cd /var/www/html”.

```

Setting up liblens5.2-0:amd64 (5.2.4-1.lbuild3) ...
Setting up apache2-data (2.4.41-4ubuntu3.21) ...
Setting up libaputil:amd64 (1.6.1-4ubuntu2.2) ...
Setting up libaputil-l-dap:amd64 (1.6.1-4ubuntu2.2) ...
Setting up libaputil-l-dbd-sqld3:amd64 (1.6.1-4ubuntu2.2) ...
Setting up apache2-utils (2.4.41-4ubuntu3.21) ...
Setting up apache2-bin (2.4.41-4ubuntu3.21) ...
Setting up apache2 (2.4.41-4ubuntu3.21) ...
Enabling module mpm_event.
Enabling module authz_core.
Enabling module authz_host.
Enabling module authn_core.
Enabling module auth basic.
Enabling module access_compat.
Enabling module authn_file.
Enabling module authz_user.
Enabling module alias.
Enabling module dir.
Enabling module autoindex.
Enabling module env.
Enabling module mime.
Enabling module negotiation.
Enabling module setenvif.
Enabling module filter.
Enabling module deflate.
Enabling module status.
Enabling module regtimeout.
Enabling conf charset.
Enabling conf localized-error-pages.
Enabling conf other-vhosts-access-log.
Enabling conf security.
Enabling conf serve-cgi-bin.
Enabling site 000-default.
Created symlink /etc/systemd/system/multi-user.target.wants/apache2.service -> /lib/systemd/system/apache2.service.
Created symlink /etc/systemd/system/multi-user.target.wants/apache-htcacheclean.service -> /lib/systemd/system/apache-htcacheclean.service.
Processing triggers for ufw (0.36-6ubuntu1.1) ...
Processing triggers for systemd (245.4-4ubuntu3.23) ...
Processing triggers for libc-bin (2.31-0ubuntu9.16) ...
manshuk_37_18_09@cloud-manshuk:~$ sudo systemctl status apache2
● apache2.service - The Apache HTTP Server
   Loaded: loaded (/lib/systemd/system/apache2.service; enabled; vendor preset: enabled)
   Active: active (running) since Fri 2024-10-11 14:16:24 UTC; 32s ago
     Docs: https://httpd.apache.org/docs/2.4/
 Main PID: 2382 (apache2)
   Tasks: 55 (limit: 650)
  Memory: 5.1M
    CGroup: /system.slice/apache2.service
           ├─2382 /usr/sbin/apache2 -k start
           ├─2385 /usr/sbin/apache2 -k start
           ├─2386 /usr/sbin/apache2 -k start
Oct 11 14:16:24 cloud-manshuk systemd[1]: Starting The Apache HTTP Server...
Oct 11 14:16:24 cloud-manshuk systemd[1]: Started The Apache HTTP Server.
manshuk_37_18_09@cloud-manshuk:~$ cd /var/www/html
manshuk_37_18_09@cloud-manshuk:/var/www/html$ 

```

Then created the simple html file using the command “sudo nano index.html”

```

GNU nano 4.8 index.html
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN" "http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
<html xmlns="http://www.w3.org/1999/xhtml">
<!--
Modified from the Debian original for Ubuntu
Last updated: 2016-11-16
See: https://launchpad.net/bugs/1288690
-->
<head>
<meta http-equiv="Content-Type" content="text/html; charset=UTF-8" />
<title>Apache2 Ubuntu Default Page: It works</title>
<style type="text/css" media="screen">
* {
margin: 0px 0px 0px 0px;
padding: 0px 0px 0px 0px;
}

body, html {
padding: 3px 3px 3px 3px;
background-color: #D8DBE2;

font-family: Verdana, sans-serif;
font-size: 11pt;
text-align: center;
}

div.main_page {
position: relative;
display: table;
width: 800px;

margin-bottom: 3px;
margin-left: auto;
margin-right: auto;
padding: 0px 0px 0px 0px;

border-width: 2px;
border-color: #212738;
border-style: solid;

background-color: #FFFFFF;
text-align: center;
}

div.page_header {
height: 99px;
width: 100%;

background-color: #F5F6F7;

}

```

File Name to Write: index.html

:G Get Help :Q Write Out :R Where Is :K Cut Text :J Justify :C Cur Pos :U Undo :A Mark Text :M-Q To Bracket :M-Q Previous :B Back  
:X Exit :R Read File :W Replace :P Paste Text :T To Spell :G Go To Line :R Redo :M-F Copy Text :M-Q Where Was :M-W Next :F Forward

Saved pressing CTRL+O, and exited pressing CTRL+X

```

GNU nano 4.8 index.html
<div class="section_header">
<div id="secret"></div>
Document Roots
</div>

<div class="content_section_text">
<p>By default, Ubuntu does not allow access through the web browser to
<em>any</em> file apart of those located in <t>/var/www</t>, You
<a href="http://httpd.apache.org/docs/2.4/mod/mod_userdir.html" rel="nofollow">public_html</a>
directories (when enabled) and <t>/usr/share</t> (for web
applications). If your site is using a web document root
located elsewhere (such as in <t>/srv</t>) you may need to whitelist your
document root directory in <t>/etc/apache2/apache2.conf</t>.
</p>
<p>
The default Ubuntu document root is <t>/var/www/html</t>. You
can make your own virtual hosts under /var/www. This is different
to previous releases which provides better security out of the box.
</p>
</div>

<div class="section_header">
<div id="bugs"></div>
Reporting Problems
</div>
<div class="content_section_text">
<p>
Please use the <t>ubuntu-bug</t> tool to report bugs in the
Apache2 package with Ubuntu. However, check <a
 href="https://launchpad.net/ubuntu/+source/apache2"
rel="nofollow">existing bug reports</a> before reporting a new bug.
</p>
<p>
Please report bugs specific to modules (such as PHP and others)
to respective packages, not to the web server itself.
</p>
</div>
</div>
<div class="validator">
</div>
</body>
</html>

```

File Name to Write: index.html

:G Get Help :D DOS Format :A Append :B Backup File  
:C Cancel :M-M Mac Format :P Prepend :T To Files

## 1.3 Document the Process

Navigated to Google Cloud Console. In the navigation menu, went to Compute Engine, then VM Instances. Configured VM settings. Named as cloud-manshuk. Selected a region. Us-central-1c. Chose a machine type. Chose the Ubuntu as OS.

In the firewall section, enabled Allow HTTP and HTTPS traffic. Allowed the SSH access. Clicked “Create” button.

The screenshot shows the Google Cloud Compute Engine VM instances page. A single VM instance named "cloud-manshuk" is listed in the "VM instances" table. The instance is located in the "us-central1-c" zone and has an internal IP of 10.128.0.2 (nic0). The "Connect" dropdown is set to "SSH". Below the table, there are several "Related actions" cards, including "Explore Backup and DR", "View billing report", "Monitor VMs", "Explore VM logs", "Set up firewall rules", "Patch management", and "Load balance between VMs". On the right side of the page, there are "Get started with Compute Engine" and "Create a website or application" sections, along with links to tutorials and documentation.

Clicked on the “SSH” button. Updated the package list using command “sudo apt update”.

```

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

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

manshuk_37_18_09$ sudo apt update
Hit:1 http://us-central1.gce.archive.ubuntu.com/ubuntu focal InRelease
Get:2 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-updates InRelease [128 kB]
Get:3 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-backports InRelease [128 kB]
Get:4 http://security.ubuntu.com/ubuntu focal-security InRelease [128 kB]
Get:5 http://us-central1.gce.archive.ubuntu.com/ubuntu focal/universe amd64 Packages [8628 kB]
Get:6 http://us-central1.gce.archive.ubuntu.com/ubuntu focal/universe Translation-en [5124 kB]
Get:7 http://us-central1.gce.archive.ubuntu.com/ubuntu focal/universe amd64 c-n-f Metadata [265 kB]
Get:8 http://us-central1.gce.archive.ubuntu.com/ubuntu focal/multiverse amd64 Packages [144 kB]
Get:9 http://us-central1.gce.archive.ubuntu.com/ubuntu focal/multiverse Translation-en [83 kB]
Get:10 http://us-central1.gce.archive.ubuntu.com/ubuntu focal/multiverse amd64 c-n-f Metadata [9136 B]
Get:11 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-updates/main amd64 Packages [3606 kB]
Get:12 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-updates/main Translation-en [555 kB]
Get:13 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-updates/main amd64 c-n-f Metadata [17.8 kB]
Get:14 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-updates/restricted amd64 Packages [3287 kB]
Get:15 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-updates/restricted Translation-en [461 kB]
Get:16 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-updates/restricted amd64 c-n-f Metadata [548 B]
Get:17 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-updates/universe amd64 Packages [1236 kB]
Get:18 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-updates/universe Translation-en [297 kB]
Get:19 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-updates/universe amd64 c-n-f Metadata [28.3 kB]
Get:20 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-updates/multiverse amd64 Packages [27.1 kB]
Get:21 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-updates/multiverse Translation-en [7936 B]
Get:22 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-backports/main amd64 Packages [616 B]
Get:23 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-backports/main amd64 c-n-f Metadata [45.3 kB]
Get:24 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-backports/main Translation-en [1.3 kB]
Get:25 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-backports/main amd64 c-n-f Metadata [3420 B]
Get:26 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-backports/restricted amd64 c-n-f Metadata [116 B]
Get:27 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-backports/universe amd64 Packages [25.0 kB]
Get:28 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-backports/universe Translation-en [16.3 kB]
Get:29 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-backports/universe amd64 c-n-f Metadata [880 B]
Get:30 http://us-central1.gce.archive.ubuntu.com/ubuntu focal-backports/multiverse amd64 c-n-f Metadata [116 B]
Get:31 http://security.ubuntu.com/ubuntu focal-security/main amd64 Packages [3238 kB]
Get:32 http://security.ubuntu.com/ubuntu focal-security/main Translation-en [477 kB]
Get:33 http://security.ubuntu.com/ubuntu focal-security/main amd64 c-n-f Metadata [14.3 kB]
Get:34 http://security.ubuntu.com/ubuntu focal-security/restricted amd64 Packages [3169 kB]
Get:35 http://security.ubuntu.com/ubuntu focal-security/restricted Translation-en [444 kB]
Get:36 http://security.ubuntu.com/ubuntu focal-security/universe amd64 c-n-f Metadata [548 B]
Get:37 http://security.ubuntu.com/ubuntu focal-security/universe Translation-en [10.9 kB]
Get:38 http://security.ubuntu.com/ubuntu focal-security/universe amd64 c-n-f Metadata [214 kB]
Get:39 http://security.ubuntu.com/ubuntu focal-security/universe Translation-en [23.4 kB]
Get:40 http://security.ubuntu.com/ubuntu focal-security/multiverse amd64 Packages [24.8 kB]
Get:41 http://security.ubuntu.com/ubuntu focal-security/multiverse Translation-en [5968 B]
Get:42 http://security.ubuntu.com/ubuntu focal-security/multiverse amd64 c-n-f Metadata [540 B]
Fetched 32.9 MB in 9s (3553 kB/s)
Reading package lists... Done
Building dependency tree
Reading state information... Done
45 packages can be upgraded. Run 'apt list --upgradable' to see them.
manshuk_37_18_09$ 
```

Installed Apache using the command “sudo apt install apache2”.

Verified if the server is running using the command “`sudo systemctl status apache2`”.

```
Setting up ssl-cert (1.0.39) ...
Setting up liblouis5.2-0:amd64 (5.2.4-1.1build3) ...
Setting up apache2-data (2.4.41-4ubuntu3.21) ...
Setting up libaprutil1:amd64 (1.6.1-4ubuntu2.2) ...
Setting up libaprutil1-dbd:amd64 (1.6.1-4ubuntu2.2) ...
Setting up libaprutil2-utils (2.4.41-4ubuntu3.21) ...
Setting up apache2-bin (2.4.41-4ubuntu3.21) ...
Setting up apache2 (2.4.41-4.1-4ubuntu3.21) ...
Enabling module mpm_event.
Enabling module authz_core.
Enabling module authz_host.
Enabling module authn_core.
Enabling module auth_basic.
Enabling module access_compat.
Enabling module authn_file.
Enabling module authz_user.
Enabling module alias.
Enabling module dir.
Enabling module autoindex.
Enabling module env.
Enabling module mime.
Enabling module negotiation.
Enabling module setenvif.
Enabling module filter.
Enabling module deflate.
Enabling module status.
Enabling module reqtimeout.
Enabling conf charset.
Enabling conf localized-error-pages.
Enabling conf other-vhosts-access-log.
Enabling conf security.
Enabling conf serve-cgi-bin.
Enabling site 000-default.
Created symlink /etc/systemd/system/multi-user.target.wants/apache2.service → /lib/systemd/system/apache2.service.
Created symlink /etc/systemd/system/multi-user.target.wants/apache-htcacheclean.service → /lib/systemd/system/apache-htcacheclean.service.
Processing triggers for ufw (0.36-6ubuntu1.1) ...
Processing triggers for systemd (245.1-4ubuntu3.23) ...
Processing triggers for libdbi-perl (1.61-1.1~Ubuntu9.16) ...
manshuk_37_18_0@cloud-manshuk:~$ sudo systemctl status apache2
● apache2.service - The Apache HTTP Server
   Loaded: loaded (/lib/systemd/system/apache2.service; enabled; vendor preset: enabled)
   Active: active (running) since Fri 2024-10-11 14:16:24 UTC; 32s ago
     Docs: https://httpd.apache.org/docs/2.4/
 Main PID: 2382 (apache2)
    Tasks: 55 (limit: 650)
   Memory: 5.1M
      CGroup: /system.slice/apache2.service
              ├─2382 /usr/sbin/apache2 -k start
              ├─2385 /usr/sbin/apache2 -k start
              ├─2386 /usr/sbin/apache2 -k start

Oct 11 14:16:24 cloud-manshuk systemd[1]: Starting The Apache HTTP Server...
Oct 11 14:16:24 cloud-manshuk systemd[1]: Started The Apache HTTP Server.
manshuk_37_18_0@cloud-manshuk:~$
```

Navigated to the default web server directory using the command “cd /var/www/html”.

```

Setting up libibus5.2-0:amd64 (5.2.4-1.lbuild3) ...
Setting up apache2-data (2.4.41-4ubuntu3.21) ...
Setting up libaprutil1:amd64 (1.6.1-4ubuntu2.2) ...
Setting up libaprutil1-ldap:amd64 (1.6.1-4ubuntu2.2) ...
Setting up libaprutil1-dbd-sqlite3:amd64 (1.6.1-4ubuntu2.2) ...
Setting up apache2-bin (2.4.41-4ubuntu3.21) ...
Setting up apache2 (2.4.41-4ubuntu3.21) ...
Enabling module mpn_event.
Enabling module authz_core.
Enabling module authz_host.
Enabling module authn_core.
Enabling module auth_basic.
Enabling module access_compat.
Enabling module authn_file.
Enabling module authz_user.
Enabling module alias.
Enabling module dir.
Enabling module autoindex.
Enabling module expires.
Enabling module mime.
Enabling module negotiation.
Enabling module setenvif.
Enabling module filter.
Enabling module deflate.
Enabling module status.
Enabling module regtimeout.
Enabling conf charset.
Enabling conf localized-error-pages.
Enabling conf other-vhosts-access-log.
Enabling conf security.
Enabling conf serve-cgi-bin.
Enabling site 000-default.
Created symlink /etc/systemd/system/multi-user.target.wants/apache2.service → /lib/systemd/system/apache2.service.
Processing triggers for ufw (0.36-Subuntu1.1)
Processing triggers for systemd (245.4-Subuntu3.23) ...
Processing triggers for man-db (2.9.1-1) ...
Processing triggers for libc-bin (2.31-Subuntu9.16) ...
manahuk_37_18_099cloud-manshuk:~$ sudo systemctl status apache2
● apache2.service - The Apache HTTP Server
   Loaded: loaded (/lib/systemd/system/apache2.service; enabled; vendor preset: enabled)
   Active: active (running) since Fri 2024-10-11 14:16:24 UTC; 32s ago
     Docs: https://httpd.apache.org/docs/2.4/
 Main PID: 2382 (apache2)
   Tasks: 55 (limit: 650)
  Memory: 5.1M
    CGroup: /system.slice/apache2.service
            └─2382 /usr/sbin/apache2 -k start
              ├─2385 /usr/sbin/apache2 -k start
              ├─2386 /usr/sbin/apache2 -k start
              ├─2386 /usr/sbin/apache2 -k start

Oct 11 14:16:24 cloud-manshuk systemd[1]: Starting The Apache HTTP Server...
Oct 11 14:16:24 cloud-manshuk systemd[1]: Started The Apache HTTP Server.
manahuk_37_18_099cloud-manshuk:~$ cd /var/www/html
manahuk_37_18_099cloud-manshuk:/var/www/html$ 

```

Then created the simple html file using the command “sudo nano index.html”

```

GNU nano 4.8                               index.html
Modified

<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN" "http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
<html xmlns="http://www.w3.org/1999/xhtml">
<!--
 Modified from the Debian original for Ubuntu
 Last updated: 2016-11-16
 See: https://launchpad.net/bugs/1288690
-->
<head>
<meta http-equiv="Content-Type" content="text/html; charset=UTF-8" />
<title>Apache2 Ubuntu Default Page: It works</title>
<style type="text/css" media="screen">
*
{
margin: 0px 0px 0px 0px;
padding: 0px 0px 0px 0px;
}

body, html {
padding: 3px 3px 3px 3px;
background-color: #D9D9D9;

font-family: Verdana, sans-serif;
font-size: 1pt;
text-align: center;
}

div.main_page {
position: relative;
display: table;
width: 800px;

margin-bottom: 3px;
margin-left: auto;
margin-right: auto;
padding: 0px 0px 0px 0px;

border-width: 2px;
border-color: #212738;
border-style: solid;

background-color: #FFFFFF;
text-align: center;
}

div.page_header {
height: 99px;
width: 100%;

background-color: #F5F6F7;
}

```

Saved pressing CTRL+O, and exited pressing CTRL+X

The screenshot shows a terminal window titled "SSH-in-browser" with the file "index.html" open in the "GNU nano 4.8" editor. The content of the file is a web page with sections for "Document Roots" and "Reporting Problems". It includes instructions for reporting bugs and links to Apache bug reports. The terminal interface includes standard keyboard shortcuts at the bottom.

```

<div class="section_header">
  <div id="docroot"></div>
  Document Roots
</div>

<div class="content_section_text">
  <p>By default, Ubuntu does not allow access through the web browser to
  <em>any</em> file apart of those located in <tt>/var/www/</tt>,
  <a href="http://httpd.apache.org/docs/2.4/mod/mod_userdir.html" rel="nofollow">public_html</a>
  directories (when enabled) and <tt>/usr/share</tt> (for web
  applications). If your site is using a web document root
  located elsewhere (such as in <tt>/srv/</tt>) you may need to whitelist your
  document root directory in <tt>/etc/apache2/apache2.conf</tt>.
  </p>
  <p>The default Ubuntu document root is <tt>/var/www/html</tt>. You
  can make your own virtual hosts under /var/www. This is different
  to previous releases which provides better security out of the box.
  </p>
</div>

<div class="section_header">
  <div id="bugs"></div>
  Reporting Problems
</div>
<div class="content_section_text">
  <p>Please use the <tt>ubuntu-bug</tt> tool to report bugs in the
  Apache2 package with Ubuntu. However, check <a
  href="https://bugs.launchpad.net/ubuntu/+source/apache2"
  rel="nofollow">existing bug reports</a> before reporting a new bug.
  </p>
  <p>Please report bugs specific to modules (such as PHP and others)
  to respective packages, not to the web server itself.
  </p>
</div>

</div>
</div>
<div class="validator">
</div>
</body>
</html>

```

File Name to Write: index.html      M-D DOS Format      M-A Append  
 ^G Get Help      M-M Mac Format      M-P Prepend      M-B Backup File  
 ^C Cancel      ^T To Files

Chose f1-micro because it's free. Selected Ubuntu for its popularity and strong support for web servers. Installed Apache because it's simple and easy to configure.

## STORAGE SOLUTIONS IN GOOGLE CLOUD

### 2.1 Create a Cloud Storage Bucket

Went to Google Cloud Console. In the left navigation menu, clicked “Cloud Storage” then “Buckets”. Clicked “Create Bucket”.

The screenshot shows the 'Create a bucket' wizard in the Google Cloud Storage interface. In the 'Get Started' section, the bucket name 'cloud-bucket-manshuk' is entered. The 'Location pricing' sidebar indicates a current configuration of 'Multi-region / Standard' with estimated costs for US regions. The 'Choose where to store your data' section shows 'us' selected as the location type. The 'Choose a storage class for your data' section shows 'Standard' as the default. The 'Choose how to control access to objects' section has 'On' selected for public access prevention. The 'Choose how to protect object data' section shows 'Default' as the soft delete policy.

Selected the location Regional.

The screenshot shows the 'Create a bucket' wizard with the 'Region' location type selected. The 'Location pricing' sidebar now shows a current configuration of 'Region / Standard' with a cost of '\$0.020 per GB-month' for the 'us-east1' region. The 'Choose where to store your data' section now specifies 'us-east1' as the geographic placement. The other sections remain the same as in the previous screenshot.

Chose a storage class “Archive”. Because I rarely access the data.

The screenshot shows the 'Create a bucket' wizard on the Google Cloud Storage page. The left sidebar shows 'Cloud Storage' selected. The main area has a heading 'Create a bucket' with a back arrow. The first step is 'Choose a storage class for your data'. It includes a note about storage classes and a table showing the cost for 'us-east7' at '\$0.0012 per GB-month'. Below the table is a section titled 'ESTIMATE YOUR MONTHLY COST'. The 'Autoclass' radio button is selected. Other options shown are 'Standard', 'Nearline', 'Coldline', and 'Archive'. A 'CONTINUE' button is at the bottom. The right sidebar shows 'Marketplace' and 'Release Notes'.

## Chose how to protect object data.

The screenshot shows the 'Create a bucket' wizard on the Google Cloud Storage page. The left sidebar shows 'Cloud Storage' selected. The main area has a heading 'Create a bucket' with a back arrow. The second step is 'Choose how to protect object data'. It includes a note about data protection options and a table comparing 'Soft delete policy', 'Object versioning', and 'Retention'. Below the table is a section titled 'Data protection'. Under 'Data encryption', the 'Google-managed encryption key' radio button is selected. A note says 'You can now automate creation of Cloud KMS keys using Autokey.' with 'DISMISS' and 'LEARN MORE' buttons. At the bottom are 'CREATE' and 'CANCEL' buttons. The right sidebar shows 'Marketplace' and 'Release Notes'.

Clicked “Create” and created the bucket.

The screenshot shows the Google Cloud Storage Bucket details page for a bucket named 'cloud-bucket-manshuk'. The bucket is located in 'us-east1 (South Carolina)' with 'Archive' storage class, 'Not public' public access, and 'None' protection. The 'OBJECTS' tab is selected, showing a table with columns: Name, Size, Type, Created, Storage class, Last modified, Public access, Version history, Encryption, and Object retention retain until time. A message at the bottom of the table says 'No rows to display'. A success message 'Created bucket cloud-bucket-manshuk' is displayed in a black box at the bottom center.

Clicked “Upload” and then “Upload files”

The screenshot shows the Google Cloud Storage Bucket details page for the same bucket. The 'UPLOAD' button in the top navigation bar is highlighted. The 'Upload files' option is selected in the dropdown menu. The rest of the interface is identical to the previous screenshot, showing the bucket details and the 'No rows to display' message in the objects table.

Selected sample image from my laptop and uploaded to the bucket

The screenshot shows the Google Cloud Storage 'Bucket details' page for 'cloud-bucket-manshuk'. The left sidebar has 'Buckets' selected. The main area shows a table of objects, with one item listed: 'Снимок экрана 2024-10-11 в 20.2' (Screenshot from 2024-10-11 at 20.2). A success message at the bottom says '1 file successfully uploaded'.

## 2.2 Implement Object Lifecycle Management

Clicked on the “Lifecycle” tab. Clicked “Add a rule” button to set up lifecycle management. Selected “Delete object” action.

The screenshot shows the 'Add object lifecycle rule' page. Under 'Select an action', the 'Delete object' option is selected. A note explains that objects cannot be restored after deletion unless versioning is enabled. Other options like 'Set storage class' and 'Delete multi-part upload' are also shown. A 'CONTINUE' button is at the bottom.

Chose the “Age” option and set the 90 days.

The screenshot shows the Google Cloud Storage interface for creating a lifecycle rule. The left sidebar is titled 'Cloud Storage' and includes 'Overview', 'Buckets', 'Monitoring', and 'Settings'. The main area is titled 'Add object lifecycle rule'. Under 'Set Rule Scopes', there's a note about prefix and suffix rule scopes. Under 'Set Conditions', 'Age' is selected with a value of 30 days. Other conditions like 'Created before' and 'Storage class matches' are listed but not selected. A 'CONTINUE' button is visible. A success message at the bottom right says '1 file successfully uploaded'.

Clicked the “Create” button

The screenshot shows the 'Bucket details' page for 'cloud-bucket-manshuk'. The left sidebar shows 'Overview', 'Buckets' (which is selected), 'Monitoring', and 'Settings'. The main area shows bucket details: Location us-east1 (South Carolina), Storage class Archive, Public access Not public, Protection None. Below this, the 'LIFECYCLE' tab is active, displaying a rule: 'Delete object' with 'Object condition' '30+ days since object was created'. A note says 'After you add or edit a rule, it may take up to 24 hours to take effect.' A success message at the bottom right says '1 file successfully uploaded'.

## 2.3 Document the Process

Went to Google Cloud Console. In the left navigation menu, clicked “Cloud Storage” then “Buckets”. Clicked “Create Bucket”.

The screenshot shows the 'Create a bucket' wizard in the Google Cloud Storage interface. In the 'Get Started' section, the bucket name 'cloud-bucket-manshuk' is entered. The 'Location pricing' sidebar indicates a current configuration of 'Multi-region / Standard' with estimated costs for US regions. The 'Choose where to store your data' section shows 'us' selected as the location type. The 'Choose a storage class for your data' section shows 'Standard' as the default. The 'Choose how to control access to objects' section has 'On' selected for public access prevention. The 'Choose how to protect object data' section shows 'Default' as the soft delete policy.

Selected the location Regional.

The screenshot shows the 'Create a bucket' wizard with the 'Region' location type selected. The 'Location pricing' sidebar now shows a current configuration of 'Region / Standard' with a cost of '\$0.020 per GB-month' for the 'us-east1' region. The 'Choose where to store your data' section now specifies 'us-east1' as the geographic placement. The other sections remain the same as in the previous screenshot.

Chose a storage class “Archive”. Because I rarely access the data.

The screenshot shows the 'Create a bucket' wizard on the Google Cloud Storage page. The left sidebar shows 'Cloud Storage' selected. The main area has a heading 'Create a bucket' with a back arrow. The first step is 'Choose a storage class for your data'. It includes a note about storage classes and a table showing the cost for 'us-east2' at \$0.0012 per GB-month. Below the table is a section titled 'ESTIMATE YOUR MONTHLY COST'. The 'Autoclass' radio button is selected. Other options shown are 'Standard', 'Nearline', 'Coldline', and 'Archive'. A 'CONTINUE' button is at the bottom.

- Choose a storage class for your data

Item	Cost
us-east2	\$0.0012 per GB-month

ESTIMATE YOUR MONTHLY COST

Autoclass ?  
Automatically transitions each object to Standard or Nearline class based on object-level activity, to optimize for cost and latency. Recommended if usage frequency may be unpredictable. Can be changed to a default class at any time. [Pricing details](#)

Standard ?  
Best for short-term storage and frequently accessed data

Nearline ?  
Best for backups and data accessed less than once a month

Coldline ?  
Best for disaster recovery and data accessed less than once a quarter

Archive ?  
Best for long-term digital preservation of data accessed less than once a year

[CONTINUE](#)

## Chose how to protect object data.

The screenshot shows the 'Create a bucket' wizard on the Google Cloud Storage page. The left sidebar shows 'Cloud Storage' selected. The main area has a heading 'Create a bucket' with a back arrow. The second step is 'Choose how to protect object data'. It includes a note about data protection options and sections for 'Data protection' and 'Data encryption'. A note at the bottom says 'You can now automate creation of Cloud KMS keys using Autokey.' with 'DISMISS' and 'LEARN MORE' buttons. A 'CREATE' button is at the bottom.

- Choose how to protect object data

Your data is always protected with Cloud Storage but you can also choose from these additional data protection options to add extra layers of security.

**Data protection**

Soft delete policy (For data recovery)  
When enabled, this bucket and its objects will be kept for a specified period after they're deleted and can be restored during this time. [Learn more](#)

Object versioning (For version control)  
For restoring deleted or overwritten objects. To minimize the cost of storing versions, we recommend limiting the number of noncurrent versions per object and scheduling them to expire after a number of days. [Learn more](#)

Retention (For compliance)  
For preventing the deletion or modification of the bucket's objects for a specified period of time.

**Data encryption ?**

Google-managed encryption key  
Keys owned by Google

Cloud KMS key  
Keys owned by customers

You can now automate creation of Cloud KMS keys using Autokey.

[DISMISS](#) [LEARN MORE](#)

[SHOW LESS](#)

[CREATE](#) [CANCEL](#)

Clicked “Create” and created the bucket.

The screenshot shows the Google Cloud Storage 'Bucket details' page for a bucket named 'cloud-bucket-manshuk'. The bucket is located in 'us-east1 (South Carolina)' with 'Archive' storage class, 'Not public' public access, and 'None' protection. The 'OBJECTS' tab is selected, showing a table with columns: Name, Size, Type, Created, Storage class, Last modified, Public access, Version history, Encryption, and Object retention retain until time. A message at the bottom of the table area says 'No rows to display'. A success message 'Created bucket cloud-bucket-manshuk' is displayed in a black box at the bottom center.

Clicked “Upload” and then “Upload files”

The screenshot shows the same Google Cloud Storage 'Bucket details' page for the 'cloud-bucket-manshuk' bucket. The 'UPLOAD' dropdown menu is open, with 'Upload files' selected. The rest of the interface is identical to the previous screenshot, showing the bucket details and the 'No rows to display' message in the objects table. A success message 'Created bucket cloud-bucket-manshuk' is still visible at the bottom.

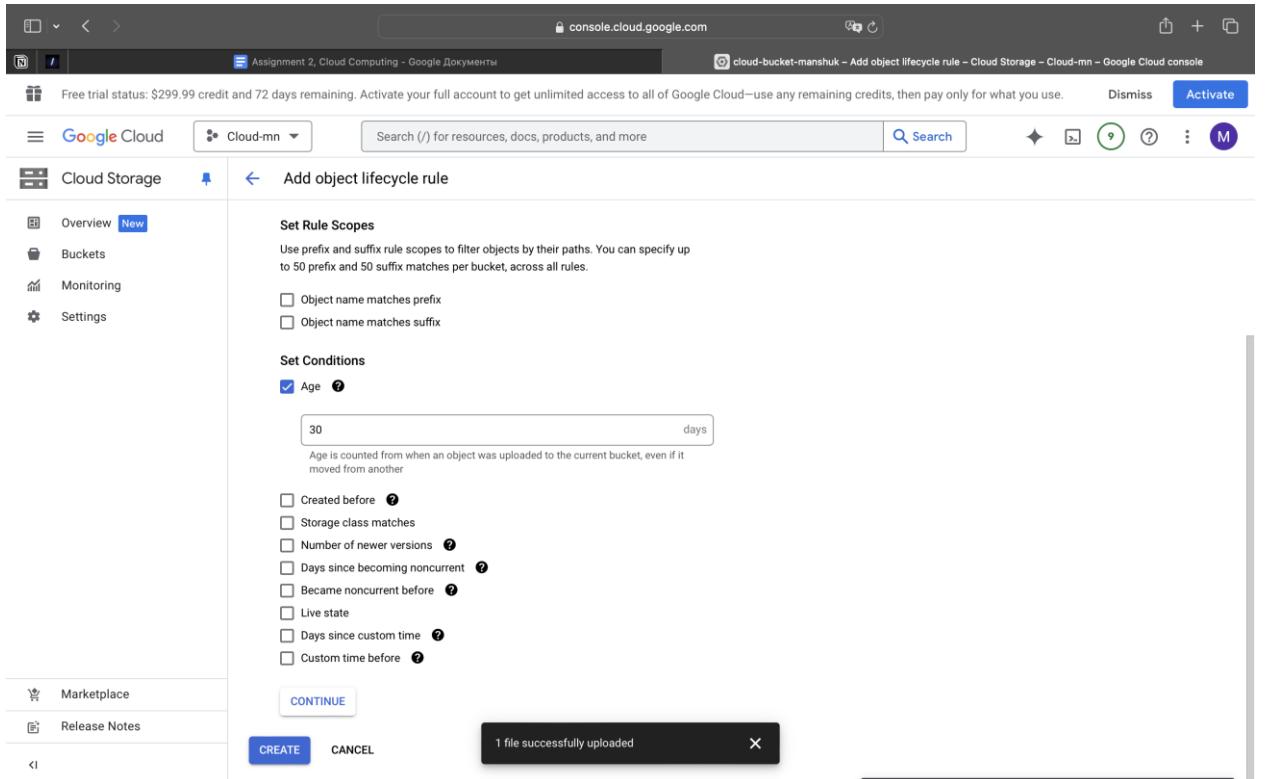
Selected sample image from my laptop and uploaded to the bucket

The screenshot shows the Google Cloud Storage 'Bucket details' page for 'cloud-bucket-manshuk'. The left sidebar has 'Cloud Storage' selected under 'Buckets'. The main area shows the bucket's location (us-east1), storage class (Archive), public access (Not public), and protection (None). Below this is a table of objects, with one entry: 'Снимок экрана 2024-10-11 в 20.2' (Screenshot of the screen on October 11, 2024 at 20.2) which is 464.8 KB, an image/png type, created on Oct 16, 2024, and stored in the Archive class. A success message '1 file successfully uploaded' is visible at the bottom.

Clicked on the “Lifecycle” tab. Clicked “Add a rule” button to set up lifecycle management. Selected “Delete object” action.

The screenshot shows the 'Add object lifecycle rule' page. The left sidebar has 'Cloud Storage' selected under 'Buckets'. The main area starts with a note: 'After you add or edit a rule, it may take up to 24 hours to take effect.' It then asks to 'Select an action'. The 'Delete object' option is selected, with a tooltip explaining: 'Objects cannot be restored after deletion, unless you have object versioning enabled. (With versioning enabled, live objects will be made noncurrent, and noncurrent versions will be permanently deleted.) You could also incur early deletion charges for objects set to Nearline, Coldline, or Archive storage classes.' Other options shown are 'Set storage class to Nearline', 'Set storage class to Coldline', 'Set storage class to Archive', and 'Delete multi-part upload'. At the bottom, there are 'CONTINUE' and 'CREATE' buttons, and a 'CANCEL' button. A success message '1 file successfully uploaded' is visible at the bottom.

Chose the “Age” option and set the 90 days.



Clicked the “Create” button

Cloud Storage is a good place to make back up of databases or systems. You can always restore it back from the cloud within no time if something crashes. Oh or if you have to store a lot of pictures, videos or PDFs this is where they go. This is suitable to apps that require the storage and delivering of large volumes of data.

This feature enables efficient cost control of storage because lifecycle management automatically moves data to other classes like, deleting, transitioning, or archiving the data to the low-cost classes. Life cycle management helps to maintain proper organization the storage since it removes files that are no longer relevant or useful.

## NETWORKING IN GOOGLE CLOUD

### 3.1 Set Up a Virtual Private Cloud (VPC)

In the navigation menu, went to VPC network, then to VPC networks. Clicked the “Create VPC network” button. Named as “cloud-vpc-manshuk”. Selected custom subnet creation mode.

Free trial status: \$299.99 credit and 72 days remaining. Activate your full account to get unlimited access to all of Google Cloud—use any remaining credits, then pay only for what you use.

Name \*  
cloud-vpc-manshuk

Description

Maximum transmission unit (MTU)  
1460

Subnet creation mode  
 Custom  
 Automatic

Private IPv6 address settings

Configure a ULA internal IPv6 range for this VPC Network

The ULA range is a /48 CIDR from which all private IPv6 subnet ranges will be taken. Google Cloud can allocate one automatically or you can allocate one manually. Allocation is permanent. You cannot deallocate or change the ULA range.

Subnets

Subnets let you create your own private cloud topology within Google Cloud. Click Automatic to create a subnet in each region, or click Custom to manually define the subnets. [Learn more](#)

New subnet

Name \*  
subnet-manshuk

Named subnet as “subnet-manshuk”. Selected a region us-central1. Typed Ip range 10.0.0.0/24.

Free trial status: \$299.99 credit and 72 days remaining. Activate your full account to get unlimited access to all of Google Cloud—use any remaining credits, then pay only for what you use.

Name \*  
subnet-manshuk

Description

Region \*  
us-central1

IP stack type  
 IPv4 (single-stack)  
 IPv4 and IPv6 (dual-stack)

IPv4 range \*  
10.0.0.0/24

CREATE SECONDARY IPV4 RANGE

Private Google Access  
 On  
 Off

Flow logs  
 On  
 Off

Then clicked “Create”.

The screenshot shows the Google Cloud VPC Network interface. On the left, a sidebar lists options like IP addresses, Internal ranges, Bring your own IP, Firewall, Routes, VPC network peering, Shared VPC, Serverless VPC access, Packet mirroring, and VPC Flow Logs. The main area displays two tabs: 'NETWORKS IN CURRENT PROJECT' and 'SUBNETS IN CURRENT PROJECT'. A modal window titled 'Get started with real-time analytics' provides information about Network Intelligence Center and offers to 'TRY NOW' or 'REMIND ME LATER'. Below this, a message states 'SMTP port 25 disallowed in this project.' A table lists networks, showing 'cloud-vpc-manshuk' and 'default'. A success message at the bottom right says 'Successfully created network "cloud-vpc-manshuk"'.

Then clicked to the created network. Went to Firewalls section. Clicked “Add firewall rule” button. Named as “allow-http-ssh”. Selected as targets all instances in the network.

The screenshot shows the Google Cloud Network Security Firewall policies interface. The left sidebar includes Secure Web Proxy, Cloud Armor (DDoS Dashboard, Cloud Armor policies, Adaptive Protection, Cloud Armor Service Tier), Cloud IDS (IDS Dashboard, IDS Endpoints, IDS Threats), Cloud NGFW (Dashboard, Firewall policies), Threats, Firewall endpoints, Common components, and Address groups. The 'Firewall policies' option is selected. The main area is titled 'Create a firewall rule'. It includes fields for Name (set to 'allow-http-ssh'), Description, Logs (with a note about logging costs and a 'Learn more' link), Network (set to 'cloud-vpc-manshuk'), Priority (set to '1000'), Direction of traffic (Ingress selected), Action on match (Allow selected), and Targets (set to 'All instances in the network').

Typed 0.0.0.0/0 as source ip range to allow access from any ip. In protocols and ports selected tcp and typed 22, 80 to ssh and http ports.

The screenshot shows the 'Create a firewall rule' page in the Google Cloud Network Security section. The left sidebar lists various security services like Secure Web Proxy, Cloud Armor, Cloud IDS, and Cloud NGFW. Under Cloud NGFW, 'Firewall policies' is selected. The main form has the following fields filled:

- Source IPv4 ranges: 0.0.0.0/0
- Second source filter: None
- Destination filter: None
- Protocols and ports:
  - Specified protocols and ports:
    - TCP: Ports 22, 80
    - UDP: Ports all
    - SCTP: Ports all
    - Other: Ports all

Then clicked to “Create”.

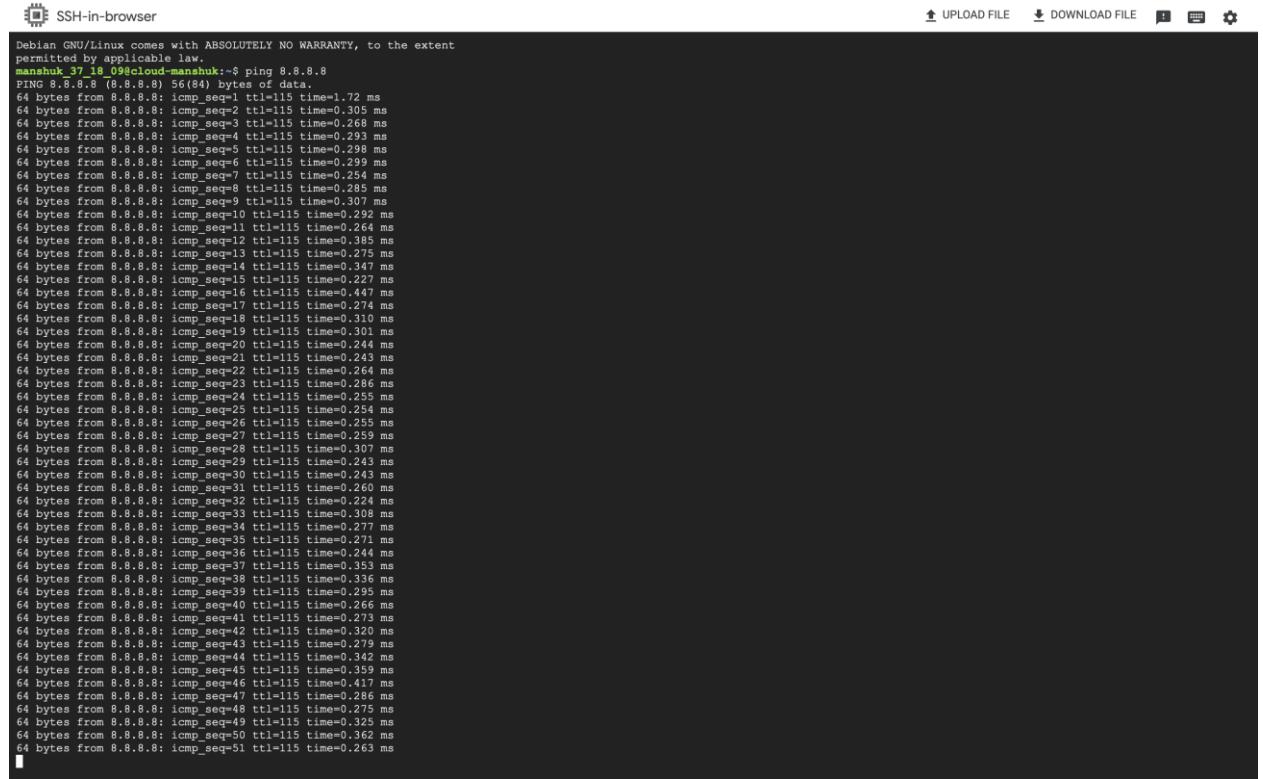
The screenshot shows the 'VPC network details' page for 'cloud-vpc-manshuk'. The left sidebar lists VPC network components. The main area shows the 'FIREWALLS' tab selected, displaying a table of existing rules:

Name	Enforcement order	Type	Deployment scope	Rule priority	Targets	Source	Destination	Protocols and ports
vpc-firewall-rules	1	VPC firewall rules	Global					

A success message at the bottom states: "Successfully created firewall rule 'allow-http-ssh'."

## 3.2 Connect VM to VPC

Clicked SSH into the VM. Pinged an external server using the command “ping 8.8.8.8” to check successful connectivity.



The screenshot shows an SSH session titled "SSH-in-browser". The terminal window displays the output of a "ping" command to the IP address 8.8.8.8. The output shows 64 bytes being sent from the VM to the external server over 56(84) bytes of data. The "ping" command was run at approximately 0.25 ms intervals, with most responses taking between 0.205 ms and 0.305 ms. The session also includes standard terminal interface icons for file operations and settings.

```
Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
root@ip-172-31-10-10: ~# ping 8.8.8.8
PING 8.8.8.8 (8.8.8.8) 56(84) bytes of data.
64 bytes from 8.8.8.8: icmp_seq=1 ttl=115 time=0.252 ms
64 bytes from 8.8.8.8: icmp_seq=2 ttl=115 time=0.305 ms
64 bytes from 8.8.8.8: icmp_seq=3 ttl=115 time=0.268 ms
64 bytes from 8.8.8.8: icmp_seq=4 ttl=115 time=0.293 ms
64 bytes from 8.8.8.8: icmp_seq=5 ttl=115 time=0.298 ms
64 bytes from 8.8.8.8: icmp_seq=6 ttl=115 time=0.299 ms
64 bytes from 8.8.8.8: icmp_seq=7 ttl=115 time=0.254 ms
64 bytes from 8.8.8.8: icmp_seq=8 ttl=115 time=0.285 ms
64 bytes from 8.8.8.8: icmp_seq=9 ttl=115 time=0.307 ms
64 bytes from 8.8.8.8: icmp_seq=10 ttl=115 time=0.292 ms
64 bytes from 8.8.8.8: icmp_seq=11 ttl=115 time=0.264 ms
64 bytes from 8.8.8.8: icmp_seq=12 ttl=115 time=0.295 ms
64 bytes from 8.8.8.8: icmp_seq=13 ttl=115 time=0.275 ms
64 bytes from 8.8.8.8: icmp_seq=14 ttl=115 time=0.347 ms
64 bytes from 8.8.8.8: icmp_seq=15 ttl=115 time=0.227 ms
64 bytes from 8.8.8.8: icmp_seq=16 ttl=115 time=0.447 ms
64 bytes from 8.8.8.8: icmp_seq=17 ttl=115 time=0.274 ms
64 bytes from 8.8.8.8: icmp_seq=18 ttl=115 time=0.310 ms
64 bytes from 8.8.8.8: icmp_seq=19 ttl=115 time=0.301 ms
64 bytes from 8.8.8.8: icmp_seq=20 ttl=115 time=0.244 ms
64 bytes from 8.8.8.8: icmp_seq=21 ttl=115 time=0.243 ms
64 bytes from 8.8.8.8: icmp_seq=22 ttl=115 time=0.264 ms
64 bytes from 8.8.8.8: icmp_seq=23 ttl=115 time=0.286 ms
64 bytes from 8.8.8.8: icmp_seq=24 ttl=115 time=0.255 ms
64 bytes from 8.8.8.8: icmp_seq=25 ttl=115 time=0.254 ms
64 bytes from 8.8.8.8: icmp_seq=26 ttl=115 time=0.255 ms
64 bytes from 8.8.8.8: icmp_seq=27 ttl=115 time=0.259 ms
64 bytes from 8.8.8.8: icmp_seq=28 ttl=115 time=0.307 ms
64 bytes from 8.8.8.8: icmp_seq=29 ttl=115 time=0.243 ms
64 bytes from 8.8.8.8: icmp_seq=30 ttl=115 time=0.243 ms
64 bytes from 8.8.8.8: icmp_seq=31 ttl=115 time=0.260 ms
64 bytes from 8.8.8.8: icmp_seq=32 ttl=115 time=0.224 ms
64 bytes from 8.8.8.8: icmp_seq=33 ttl=115 time=0.308 ms
64 bytes from 8.8.8.8: icmp_seq=34 ttl=115 time=0.277 ms
64 bytes from 8.8.8.8: icmp_seq=35 ttl=115 time=0.271 ms
64 bytes from 8.8.8.8: icmp_seq=36 ttl=115 time=0.244 ms
64 bytes from 8.8.8.8: icmp_seq=37 ttl=115 time=0.353 ms
64 bytes from 8.8.8.8: icmp_seq=38 ttl=115 time=0.336 ms
64 bytes from 8.8.8.8: icmp_seq=39 ttl=115 time=0.295 ms
64 bytes from 8.8.8.8: icmp_seq=40 ttl=115 time=0.267 ms
64 bytes from 8.8.8.8: icmp_seq=41 ttl=115 time=0.273 ms
64 bytes from 8.8.8.8: icmp_seq=42 ttl=115 time=0.320 ms
64 bytes from 8.8.8.8: icmp_seq=43 ttl=115 time=0.279 ms
64 bytes from 8.8.8.8: icmp_seq=44 ttl=115 time=0.342 ms
64 bytes from 8.8.8.8: icmp_seq=45 ttl=115 time=0.359 ms
64 bytes from 8.8.8.8: icmp_seq=46 ttl=115 time=0.417 ms
64 bytes from 8.8.8.8: icmp_seq=47 ttl=115 time=0.286 ms
64 bytes from 8.8.8.8: icmp_seq=48 ttl=115 time=0.275 ms
64 bytes from 8.8.8.8: icmp_seq=49 ttl=115 time=0.325 ms
64 bytes from 8.8.8.8: icmp_seq=50 ttl=115 time=0.362 ms
64 bytes from 8.8.8.8: icmp_seq=51 ttl=115 time=0.263 ms
```

## 3.3 Document the Process

VPCs are so important because it enables you to logically divide your workload per regions and control the flow of the traffic. And they promote security by creating resource separation and maintaining traffic flow between resources only when permitted.

Firewall rules are also important for the system. Because by using specific port rules like SSH or HTTP you can reduce security threats but still leave the functionality that is needed for it. A cloud environment has no open access and thus needs permissions for the resources to communicate or for communication with the outside world.

## **CONCLUSION**

This assignment provided practical experience in configuring and managing virtual machines (VMs), storage solutions, and network configurations using Google Cloud. By creating a virtual machine, installing Apache, and configuring HTTP and SSH access, we learned the basics of cloud infrastructure management.

Setting up cloud storage using lifecycle management has shown how Google Cloud helps to effectively manage large amounts of data.

Setting up a Virtual Private Cloud and firewall rules has demonstrated the importance of network segmentation and security. VPC provides control over traffic between resources, while firewall rules protect systems by restricting access to necessary protocols such as HTTP and SSH. This setting ensures that resources remain safe and accessible only under controlled conditions.

Thus, the task emphasized the important role of cloud platforms in modern IT management. It demonstrated how cloud services can help build scalable infrastructure, manage data efficiently, and ensure network security, making them an invaluable resource for both individuals and organizations.

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