Name: Baltazar, Paul Eimar R.	**Date Performed:** Aug 25, 2024
Course/Section: CPE212 – CPE31S2	**Date Submitted:** Aug 25, 2024
Instructor: Robin Valenzuela	**Semester and SY:** 1st Sem, 2024 – 2025

Activity 1: Configure Network using Virtual Machines

1. Objectives:

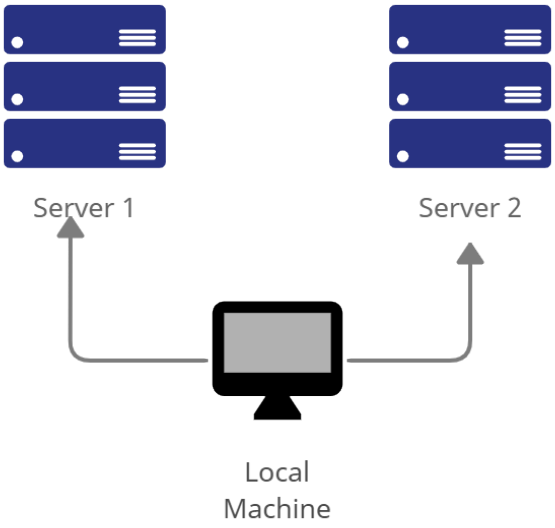
1.1. Create and configure Virtual Machines in Microsoft Azure or VirtualBox

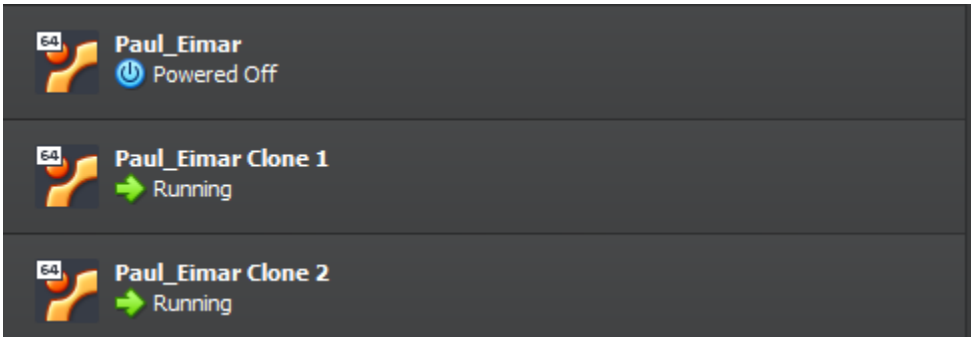
1.2. Set-up a Virtual Network and Test Connectivity of VMs

2. Discussion:

Network Topology:

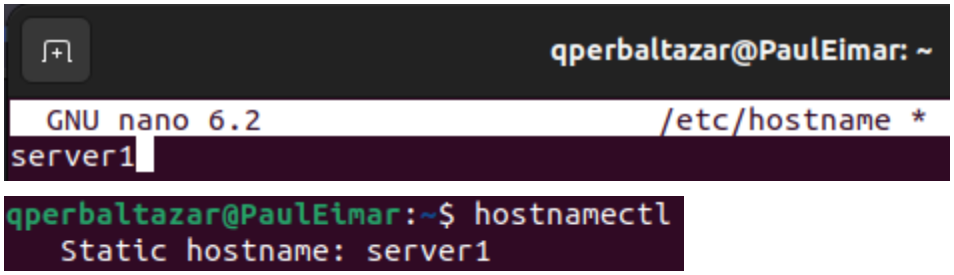
Assume that you have created the following network topology in Virtual Machines, *provide screenshots for each task*. (Note: *it is assumed that you have the prior knowledge of cloning and creating snapshots in a virtual machine*).



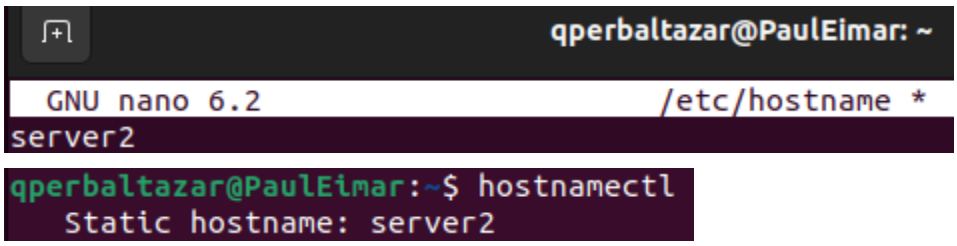


Task 1: Do the following on Server 1, Server 2, and Local Machine. In editing the file using nano command, press control + O to write out (save the file). Press enter when asked for the name of the file. Press control + X to end.

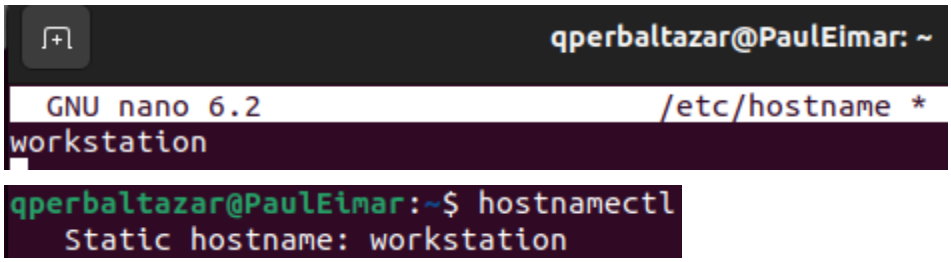
1. Change the hostname using the command *sudo nano /etc/hostname*
   1.1 Use server1 for Server 1



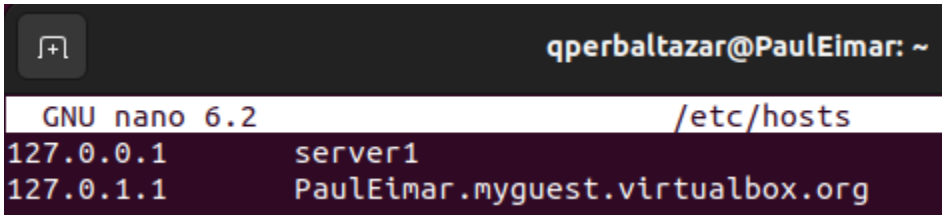
   1.2 Use server2 for Server 2



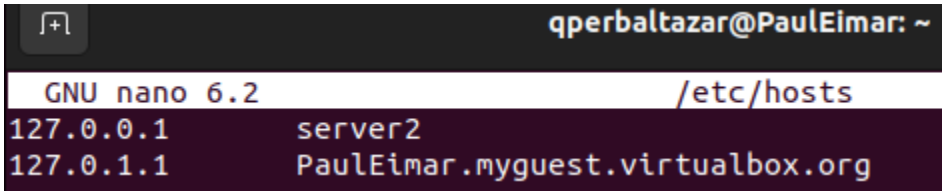
   1.3 Use workstation for the Local Machine



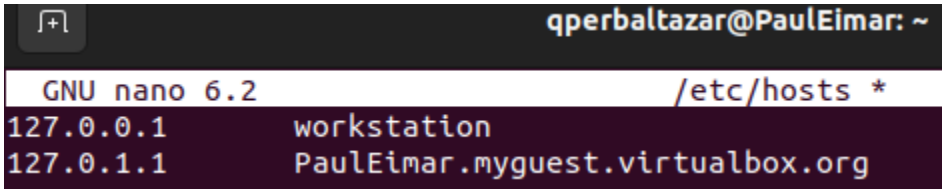
2. Edit the hosts using the command *sudo nano /etc/hosts*. Edit the second line.
   2.1 Type 127.0.0.1 server 1 for Server 1



   2.2 Type 127.0.0.1 server 2 for Server 2



2.3 Type 127.0.0.1 workstation for the Local Machine



Task 2: Configure SSH on Server 1, Server 2, and Local Machine. Do the following:

1. Upgrade the packages by issuing the command *sudo apt update* and *sudo apt upgrade* respectively.

server1

```
qperbaltazar@PaulEimar:~$ sudo apt update
Get:1 http://security.ubuntu.com/ubuntu jammy-security InRelease [129 kB]
Hit:2 http://us.archive.ubuntu.com/ubuntu jammy InRelease
Get:3 http://us.archive.ubuntu.com/ubuntu jammy-updates InRelease [128 kB]
Get:4 http://security.ubuntu.com/ubuntu jammy-security/main amd64 Packages [1,76
9 kB]
Get:5 http://us.archive.ubuntu.com/ubuntu jammy-backports InRelease [127 kB]
Get:6 http://us.archive.ubuntu.com/ubuntu jammy-updates/main i386 Packages [690
kB]
Get:7 http://us.archive.ubuntu.com/ubuntu jammy-updates/main amd64 Packages [1,9
87 kB]
Get:8 http://security.ubuntu.com/ubuntu jammy-security/main i386 Packages [531 k
B]
```

server2

```
qperbaltazar@PaulEimar:~$ sudo apt update
Hit:1 http://us.archive.ubuntu.com/ubuntu jammy InRelease
Get:2 http://security.ubuntu.com/ubuntu jammy-security InRelease [129 kB]
Get:3 http://us.archive.ubuntu.com/ubuntu jammy-updates InRelease [128 kB]
Get:4 http://security.ubuntu.com/ubuntu jammy-security/main amd64 Packages [1,76
9 kB]
Get:5 http://us.archive.ubuntu.com/ubuntu jammy-backports InRelease [127 kB]
Get:6 http://us.archive.ubuntu.com/ubuntu jammy-updates/main i386 Packages [690
kB]
Get:7 http://us.archive.ubuntu.com/ubuntu jammy-updates/main amd64 Packages [1,9
87 kB]
Get:8 http://security.ubuntu.com/ubuntu jammy-security/main i386 Packages [531 k
B]
Get:9 http://us.archive.ubuntu.com/ubuntu jammy-updates/main Translation-en [349
 kB]
```

workstation

```
qperbaltazar@PaulEimar:~$ sudo apt update
Get:1 http://security.ubuntu.com/ubuntu jammy-security InRelease [129 kB]
Hit:2 http://us.archive.ubuntu.com/ubuntu jammy InRelease
Get:3 http://us.archive.ubuntu.com/ubuntu jammy-updates InRelease [128 kB]
Get:4 http://security.ubuntu.com/ubuntu jammy-security/main i386 Packages [531 k
B]
Get:5 http://us.archive.ubuntu.com/ubuntu jammy-backports InRelease [127 kB]
Get:6 http://us.archive.ubuntu.com/ubuntu jammy-updates/main amd64 Packages [1,9
87 kB]
Get:7 http://security.ubuntu.com/ubuntu jammy-security/main amd64 Packages [1,76
9 kB]
Get:8 http://security.ubuntu.com/ubuntu jammy-security/main Translation-en [290
kB]
```

2. Install the SSH server using the command *sudo apt install openssh-server*.

workstation

```
qperbaltazar@PaulEimar:~$ sudo apt install openssh-server
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  ncurses-term openssh-client openssh-sftp-server ssh-import-id
Suggested packages:
  keychain libpam-ssh monkeysphere ssh-askpass molly-guard
The following NEW packages will be installed:
  ncurses-term openssh-server openssh-sftp-server ssh-import-id
The following packages will be upgraded:
  openssh-client
1 upgraded, 4 newly installed, 0 to remove and 241 not upgraded.
Need to get 1,657 kB of archives.
After this operation, 6,046 kB of additional disk space will be used.
Do you want to continue? [Y/n] y
Get:1 http://us.archive.ubuntu.com/ubuntu jammy-updates/main amd64 openssh-clien
t amd64 1:8.9p1-3ubuntu0.10 [906 kB]
```

server1

```
qperbaltazar@PaulEimar:~$ sudo apt install openssh-server
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  ncurses-term openssh-client openssh-sftp-server ssh-import-id
Suggested packages:
  keychain libpam-ssh monkeysphere ssh-askpass molly-guard
The following NEW packages will be installed:
  ncurses-term openssh-server openssh-sftp-server ssh-import-id
The following packages will be upgraded:
  openssh-client
1 upgraded, 4 newly installed, 0 to remove and 241 not upgraded.
Need to get 1,657 kB of archives.
After this operation, 6,046 kB of additional disk space will be used.
Do you want to continue? [Y/n] y
Get:1 http://us.archive.ubuntu.com/ubuntu jammy-updates/main amd64 openssh-clien
t amd64 1:8.9p1-3ubuntu0.10 [906 kB]
```

server2

```
qperbaltazar@PaulEimar:~$ sudo apt install openssh-server
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  ncurses-term openssh-client openssh-sftp-server ssh-import-id
Suggested packages:
  keychain libpam-ssh monkeysphere ssh-askpass molly-guard
The following NEW packages will be installed:
  ncurses-term openssh-server openssh-sftp-server ssh-import-id
The following packages will be upgraded:
  openssh-client
1 upgraded, 4 newly installed, 0 to remove and 241 not upgraded.
Need to get 1,657 kB of archives.
After this operation, 6,046 kB of additional disk space will be used.
Do you want to continue? [Y/n] y
Get:1 http://us.archive.ubuntu.com/ubuntu jammy-updates/main amd64 openssh-clien
t amd64 1:8.9p1-3ubuntu0.10 [906 kB]
Get:2 http://us.archive.ubuntu.com/ubuntu jammy-updates/main amd64 openssh-sftp-
server amd64 1:8.9p1-3ubuntu0.10 [38.9 kB]
```

3. Verify if the SSH service has started by issuing the following commands:
   3.1 *sudo service ssh start*
   3.2 *sudo systemctl status ssh*

server1

```
qperbaltazar@PaulEimar:~$ sudo service ssh start
qperbaltazar@PaulEimar:~$ sudo systemctl status ssh
● ssh.service - OpenBSD Secure Shell server
     Loaded: loaded (/lib/systemd/system/ssh.service; enabled; vendor preset: e>
     Active: active (running) since Sun 2024-08-25 20:27:41 +08; 4min 33s ago
       Docs: man:sshd(8)
             man:sshd_config(5)
   Main PID: 4763 (sshd)
      Tasks: 1 (limit: 12901)
     Memory: 1.7M
        CPU: 18ms
     CGroup: /system.slice/ssh.service
             └─4763 "sshd: /usr/sbin/sshd -D [listener] 0 of 10-100 startups"

Aug 25 20:27:41 server1 systemd[1]: Starting OpenBSD Secure Shell server...
Aug 25 20:27:41 server1 sshd[4763]: Server listening on 0.0.0.0 port 22.
Aug 25 20:27:41 server1 sshd[4763]: Server listening on :: port 22.
Aug 25 20:27:41 server1 systemd[1]: Started OpenBSD Secure Shell server.
```

server2

```
qperbaltazar@PaulEimar:~$ sudo systemctl status ssh
● ssh.service - OpenBSD Secure Shell server
     Loaded: loaded (/lib/systemd/system/ssh.service; enabled; vendor preset: e>
     Active: active (running) since Sun 2024-08-25 20:27:56 +08; 5min ago
       Docs: man:sshd(8)
             man:sshd_config(5)
   Main PID: 3683 (sshd)
      Tasks: 1 (limit: 12901)
     Memory: 1.7M
        CPU: 18ms
     CGroup: /system.slice/ssh.service
             └─3683 "sshd: /usr/sbin/sshd -D [listener] 0 of 10-100 startups"

Aug 25 20:27:56 server2 systemd[1]: Starting OpenBSD Secure Shell server...
Aug 25 20:27:56 server2 sshd[3683]: Server listening on 0.0.0.0 port 22.
Aug 25 20:27:56 server2 sshd[3683]: Server listening on :: port 22.
Aug 25 20:27:56 server2 systemd[1]: Started OpenBSD Secure Shell server.
```

workstation

```
qperbaltazar@PaulEimar:~$ sudo systemctl status ssh
● ssh.service - OpenBSD Secure Shell server
     Loaded: loaded (/lib/systemd/system/ssh.service; enabled; vendor preset: e>
     Active: active (running) since Sun 2024-08-25 20:27:17 +08; 7min ago
       Docs: man:sshd(8)
             man:sshd_config(5)
   Main PID: 3948 (sshd)
      Tasks: 1 (limit: 12901)
     Memory: 1.7M
        CPU: 19ms
     CGroup: /system.slice/ssh.service
             └─3948 "sshd: /usr/sbin/sshd -D [listener] 0 of 10-100 startups"

Aug 25 20:27:17 workstation systemd[1]: Starting OpenBSD Secure Shell server...
Aug 25 20:27:17 workstation sshd[3948]: Server listening on 0.0.0.0 port 22.
Aug 25 20:27:17 workstation sshd[3948]: Server listening on :: port 22.
Aug 25 20:27:17 workstation systemd[1]: Started OpenBSD Secure Shell server.
```

4. Configure the firewall to all port 22 by issuing the following commands:
   4.1 *sudo ufw allow ssh*
   4.2 *sudo ufw enable*
   4.3 *sudo ufw status*

server1

```
qperbaltazar@PaulEimar:~$ sudo ufw allow ssh
Rules updated
Rules updated (v6)
qperbaltazar@PaulEimar:~$ sudo ufw enable
Firewall is active and enabled on system startup
qperbaltazar@PaulEimar:~$ sudo ufw status
Status: active

To                         Action      From
--                         ------      ----
22/tcp                     ALLOW       Anywhere
22/tcp (v6)                ALLOW       Anywhere (v6)
```

server2

```
qperbaltazar@PaulEimar:~$ sudo ufw allow ssh
Rules updated
Rules updated (v6)
qperbaltazar@PaulEimar:~$ sudo ufw enable
Firewall is active and enabled on system startup
qperbaltazar@PaulEimar:~$ sudo ufw status
Status: active

To                         Action      From
--                         ------      ----
22/tcp                     ALLOW       Anywhere
22/tcp (v6)                ALLOW       Anywhere (v6)
```

workstation

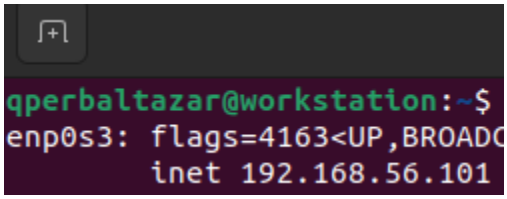
```
qperbaltazar@PaulEimar:~$ sudo ufw allow ssh
Rules updated
Rules updated (v6)
qperbaltazar@PaulEimar:~$ sudo ufw enable
Firewall is active and enabled on system startup
qperbaltazar@PaulEimar:~$ sudo ufw status
Status: active

To                         Action      From
--                         ------      ----
22/tcp                     ALLOW       Anywhere
22/tcp (v6)                ALLOW       Anywhere (v6)
```

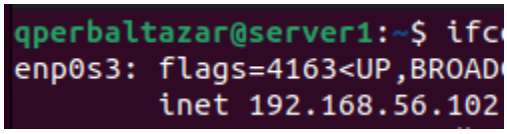
Task 3: Verify network settings on Server 1, Server 2, and Local Machine. On each device, do the following:

1. Record the ip address of Server 1, Server 2, and Local Machine. Issue the command *ifconfig* and check network settings. Note that the ip addresses of all the machines are in this network 192.168.56.XX.

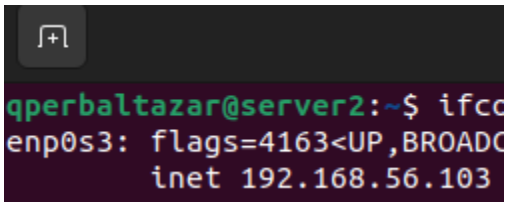
   1.1 Workstation IP address: 192.168.56.101



   1.2 Server 1 IP address: 192.168.56.102



   1.3 Server 2 IP address: 192.168.56.103



2. Make sure that they can ping each other.

   2.1 Connectivity test for Local Machine 1 to Server 1: ☐ Successful ☐ Not Successful

```
qperbaltazar@workstation:~$ ping 192.168.56.102
PING 192.168.56.102 (192.168.56.102) 56(84) bytes of data.
64 bytes from 192.168.56.102: icmp_seq=1 ttl=64 time=0.438 ms
64 bytes from 192.168.56.102: icmp_seq=2 ttl=64 time=0.274 ms
64 bytes from 192.168.56.102: icmp_seq=3 ttl=64 time=0.281 ms
64 bytes from 192.168.56.102: icmp_seq=4 ttl=64 time=0.244 ms
64 bytes from 192.168.56.102: icmp_seq=5 ttl=64 time=0.279 ms
```

   2.2 Connectivity test for Local Machine 1 to Server 2: ☐ Successful ☐ Not Successful

```
qperbaltazar@workstation:~$ ping 192.168.56.103
PING 192.168.56.103 (192.168.56.103) 56(84) bytes of data.
64 bytes from 192.168.56.103: icmp_seq=1 ttl=64 time=0.431 ms
64 bytes from 192.168.56.103: icmp_seq=2 ttl=64 time=0.311 ms
64 bytes from 192.168.56.103: icmp_seq=3 ttl=64 time=0.324 ms
64 bytes from 192.168.56.103: icmp_seq=4 ttl=64 time=0.281 ms
64 bytes from 192.168.56.103: icmp_seq=5 ttl=64 time=0.296 ms
^C
--- 192.168.56.103 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4086ms
```

2.3 Connectivity test for Server 1 to Server 2: ☒ Successful ☐ Not Successful

```
qperbaltazar@server1:~$ ping 192.168.56.103
PING 192.168.56.103 (192.168.56.103) 56(84) bytes of data.
64 bytes from 192.168.56.103: icmp_seq=1 ttl=64 time=0.462 ms
64 bytes from 192.168.56.103: icmp_seq=2 ttl=64 time=0.288 ms
64 bytes from 192.168.56.103: icmp_seq=3 ttl=64 time=0.310 ms
64 bytes from 192.168.56.103: icmp_seq=4 ttl=64 time=0.300 ms
^C
--- 192.168.56.103 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3062ms
```

Task 4: Verify SSH connectivity on Server 1, Server 2, and Local Machine.

1. On the Local Machine, issue the following commands:

1.1 ssh username@ip_address_server1 for example, *ssh jvtaylar@192.168.56.120*

1.2 Enter the password for server 1 when prompted

1.3 Verify that you are in server 1. The user should be in this format user@server1. For example, *jvtaylar@server1*

2. Logout of Server 1 by issuing the command *control + D.*

```
qperbaltazar@workstation:~$ ssh qperbaltazar@192.168.56.102
qperbaltazar@192.168.56.102's password:
Welcome to Ubuntu 22.04.4 LTS (GNU/Linux 6.5.0-26-generic x86_64)

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

Expanded Security Maintenance for Applications is not enabled.

248 updates can be applied immediately.
193 of these updates are standard security updates.
To see these additional updates run: apt list --upgradable

Enable ESM Apps to receive additional future security updates.
See https://ubuntu.com/esm or run: sudo pro status


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.

qperbaltazar@server1:~$
logout
Connection to 192.168.56.102 closed.
```

3. Do the same for Server 2.

```
qperbaltazar@192.168.56.103's password:
Welcome to Ubuntu 22.04.4 LTS (GNU/Linux 6.5.0-26-generic x86_64)

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

Expanded Security Maintenance for Applications is not enabled.

248 updates can be applied immediately.
193 of these updates are standard security updates.
To see these additional updates run: apt list --upgradable

Enable ESM Apps to receive additional future security updates.
See https://ubuntu.com/esm or run: sudo pro status


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.

qperbaltazar@server2:~$
logout
Connection to 192.168.56.103 closed.
```

4. Edit the hosts of the Local Machine by issuing the command *sudo nano /etc/hosts.* Below all texts type the following:

4.1 IP_address server 1 (provide the ip address of server 1 followed by the hostname)

4.2 IP_address server 2 (provide the ip address of server 2 followed by the hostname)

4.3 Save the file and exit.

```
  GNU nano 6.2                          /etc/hosts
127.0.0.1       workstation
192.168.56.102  server1
192.168.56.103  server2
127.0.1.1       PaulEimar.myguest.virtualbox.org        PaulEimar
```

5. On the local machine, verify that you can do the SSH command but this time, use the hostname instead of typing the IP address of the servers. For example, try to do *ssh jvtaylar@server1*. Enter the password when prompted. Verify that you have entered Server 1. Do the same for Server 2.

```
qperbaltazar@workstation:~$ ssh qperbaltazar@server1
qperbaltazar@server1's password:
Welcome to Ubuntu 22.04.4 LTS (GNU/Linux 6.5.0-26-generic x86_64)

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

Expanded Security Maintenance for Applications is not enabled.

248 updates can be applied immediately.
193 of these updates are standard security updates.
To see these additional updates run: apt list --upgradable

Enable ESM Apps to receive additional future security updates.
See https://ubuntu.com/esm or run: sudo pro status

Failed to connect to https://changelogs.ubuntu.com/meta-release-lts. Check your
Internet connection or proxy settings

Last login: Sun Aug 25 21:40:23 2024 from 192.168.56.101
```

```
qperbaltazar@workstation:~$ ssh qperbaltazar@server2
qperbaltazar@server2's password:
Welcome to Ubuntu 22.04.4 LTS (GNU/Linux 6.5.0-26-generic x86_64)

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

Expanded Security Maintenance for Applications is not enabled.

248 updates can be applied immediately.
193 of these updates are standard security updates.
To see these additional updates run: apt list --upgradable

Enable ESM Apps to receive additional future security updates.
See https://ubuntu.com/esm or run: sudo pro status

Failed to connect to https://changelogs.ubuntu.com/meta-release-lts. Check your
Internet connection or proxy settings

Last login: Sun Aug 25 21:32:07 2024 from 192.168.56.101
```

Reflections:

Answer the following:

1. How are we able to use the hostname instead of IP address in SSH commands?

   When importing another Linux machine's IP address and hostname, The IP address must be stated first and followed by the hostname. **(192.168.56.102 server1)**

2. How secure is SSH?

   SSH is considered highly secure when configured correctly. It uses strong encryption algorithms to protect data transmitted over the network and offers robust authentication mechanisms to prevent unauthorized access.