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Course/Section: CPE 232 - CPE31S22	Date Submitted: 08/19/22
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Activity 1: Configure Network using Virtual Machines

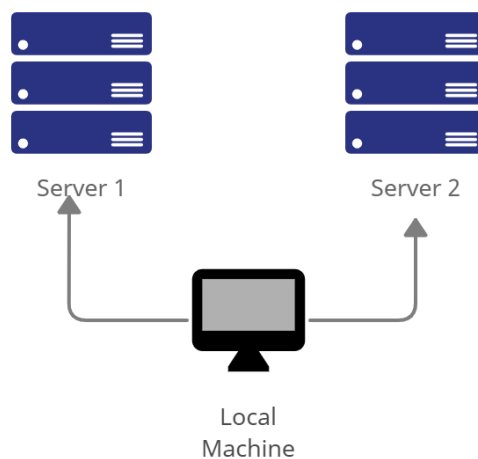
1. Objectives:

- 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

```

penas@penas-VirtualBox:~$ sudo nano /etc/hostname
[sudo] password for penas:
penas@penas-VirtualBox: ~
GNU nano 6.2 /etc/hostname *
penas-Server_1-VirtualBox
penas@penas-VirtualBox:~$ cat /etc/hostname
penas-Server_1-VirtualBox
  
```

Figure 1.1.1. Changing the name from server1 to Server 1

1.2 Use server2 for Server 2

```
penas@penas-VirtualBox:~$ sudo nano /etc/hostname
[sudo] password for penas:
penas@penas-VirtualBox: ~
GNU nano 6.2 /etc/hostname *
penas-Server_2-VirtualBox
penas@penas-VirtualBox:~$ cat /etc/hostname
penas-Server_2-VirtualBox
```

Figure 1.1.2. Changing the name from server2 to Server 2

1.3 Use workstation for the Local Machine

```
penas@penas-VirtualBox:~$ sudo nano /etc/hostname
[sudo] password for penas:
penas@penas-VirtualBox: ~
GNU nano 6.2 /etc/hostname
penas-Local_Machine-VirtualBox
penas@penas-VirtualBox:~$ cat /etc/hostname
penas-Local_Machine-VirtualBox
```

Figure 1.1.3. Changing the name from workstation to 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

```
penas@penas-VirtualBox:~$ sudo nano /etc/hosts
penas@penas-VirtualBox: ~
GNU nano 6.2 /etc/hosts
127.0.0.1 Server_1
127.0.1.1 penas-VirtualBox
penas@penas-VirtualBox:~$ cat /etc/hosts
127.0.0.1 Server_1
127.0.1.1 penas-VirtualBox
```

Figure 1.2.1. Changing the host of Server 1

2.2 Type 127.0.0.1 server 2 for Server 2

```
penas@penas-VirtualBox:~$ sudo nano /etc/hosts
penas@penas-VirtualBox: ~
GNU nano 6.2 /etc/hosts
127.0.0.1 Server_2
127.0.1.1 penas-VirtualBox
penas@penas-VirtualBox:~$ cat /etc/hosts
127.0.0.1 Server_2
127.0.1.1 penas-VirtualBox
```

Figure 1.2.2. Changing the Host of Server 2

2.3 Type 127.0.0.1 workstation for the Local Machine

```
penas@penas-VirtualBox:~$ sudo nano /etc/hosts
GNU nano 6.2 /etc/hosts
127.0.0.1 Local_Machine
127.0.1.1 penas-VirtualBox
penas@penas-VirtualBox:~$ cat /etc/hosts
127.0.0.1 Local_Machine
127.0.1.1 penas-VirtualBox
```

Figure 1.2.3. Changing the Host of Server 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.

Server 1:

```
penas@penas-VirtualBox:~$ sudo apt update
Get:1 http://security.ubuntu.com/ubuntu jammy-security InRelease [110 kB]
Hit:2 http://ph.archive.ubuntu.com/ubuntu jammy InRelease
Get:3 http://ph.archive.ubuntu.com/ubuntu jammy-updates InRelease [114 kB]
Get:4 http://security.ubuntu.com/ubuntu jammy-security/main amd64 Packages [267 kB]
Get:5 http://security.ubuntu.com/ubuntu jammy-security/main i386 Packages [96.6 kB]
Get:6 http://ph.archive.ubuntu.com/ubuntu jammy-backports InRelease [99.8 kB]
Get:7 http://security.ubuntu.com/ubuntu jammy-security/main amd64 DEP-11 Metadata [11.4 kB]
Get:8 http://security.ubuntu.com/ubuntu jammy-security/universe i386 Packages [56.3 kB]
Get:9 http://ph.archive.ubuntu.com/ubuntu jammy-updates/main amd64 Packages [509 kB]
Get:10 http://security.ubuntu.com/ubuntu jammy-security/universe amd64 Packages [108 kB]
Get:11 http://security.ubuntu.com/ubuntu jammy-security/universe amd64 DEP-11 Metadata [10.1 kB]
Get:12 http://ph.archive.ubuntu.com/ubuntu jammy-updates/main i386 Packages [274 kB]
Get:13 http://ph.archive.ubuntu.com/ubuntu jammy-updates/main amd64 DEP-11 Metadata [91.5 kB]
Get:14 http://ph.archive.ubuntu.com/ubuntu jammy-updates/main amd64 c-n-f Metadata [7,368 B]
Get:15 http://ph.archive.ubuntu.com/ubuntu jammy-updates/universe amd64 Packages [213 kB]
Get:16 http://ph.archive.ubuntu.com/ubuntu jammy-updates/universe i386 Packages [115 kB]
Get:17 http://ph.archive.ubuntu.com/ubuntu jammy-updates/universe amd64 DEP-11 Metadata [141 kB]
Get:18 http://ph.archive.ubuntu.com/ubuntu jammy-updates/multiverse amd64 DEP-11 Metadata [940 B]
Get:19 http://ph.archive.ubuntu.com/ubuntu jammy-backports/universe amd64 DEP-11 Metadata [12.5 kB]
Fetched 2,237 kB in 5s (451 kB/s)

Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
17 packages can be upgraded. Run 'apt list --upgradable' to see them.
penas@penas-VirtualBox:~$ sudo apt upgrade
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
Calculating upgrade... Done
The following packages will be upgraded:
  apt apt-utils gir1.2-gtk-4.0 gir1.2-javascriptcoregtk-4.0 gir1.2-webkit2-4.0
  libapt-pkg6.0 libcryptsetup12 libgtk-4-1 libgtk-4-bin libgtk-4-common
  libjavascriptcoregtk-4.0-18 libwebkit2gtk-4.0-37 linux-firmware python3-jwt
  python3-software-properties software-properties-common
  software-properties-gtk
17 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
5 standard security updates
Need to get 238 MB/271 MB of archives.
After this operation, 63.5 kB of additional disk space will be used.
Do you want to continue? [Y/n] y
```

Figure 2.1.1. Updating and Upgrading the System

```
penas@penas-VirtualBox:~$ sudo apt upgrade
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
Calculating upgrade... Done
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
penas@penas-VirtualBox:~$ sudo apt update
Hit:1 http://ph.archive.ubuntu.com/ubuntu jammy InRelease
Get:2 http://security.ubuntu.com/ubuntu jammy-security InRelease [110 kB]
Hit:3 http://ph.archive.ubuntu.com/ubuntu jammy-updates InRelease
Hit:4 http://ph.archive.ubuntu.com/ubuntu jammy-backports InRelease
Get:5 http://security.ubuntu.com/ubuntu jammy-security/main amd64 DEP-11 Metadata [11.4 kB]
Get:6 http://security.ubuntu.com/ubuntu jammy-security/universe amd64 DEP-11 Metadata [10.1 kB]
Fetched 132 kB in 2s (67.4 kB/s)
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
All packages are up to date.
```

Figure 2.1.2. Double Checking if the Updates were configured within the system

Server 2:

```
penas@penas-VirtualBox:~$ sudo apt update
Get:1 http://security.ubuntu.com/ubuntu jammy-security InRelease [110 kB]
Hit:2 http://ph.archive.ubuntu.com/ubuntu jammy InRelease
Get:3 http://ph.archive.ubuntu.com/ubuntu jammy-updates InRelease [114 kB]
Get:4 http://security.ubuntu.com/ubuntu jammy-security/main amd64 Packages [267 kB]
Get:5 http://ph.archive.ubuntu.com/ubuntu jammy-backports InRelease [99.8 kB]
Get:6 http://ph.archive.ubuntu.com/ubuntu jammy-updates/main i386 Packages [274 kB]
Get:7 http://ph.archive.ubuntu.com/ubuntu jammy-updates/main amd64 Packages [509 kB]
Get:8 http://ph.archive.ubuntu.com/ubuntu jammy-updates/main amd64 DEP-11 Metadata [91.5 kB]
Get:9 http://ph.archive.ubuntu.com/ubuntu jammy-updates/main amd64 c-n-f Metadata [7,368 B]
Get:10 http://ph.archive.ubuntu.com/ubuntu jammy-updates/universe i386 Packages [115 kB]
Get:11 http://ph.archive.ubuntu.com/ubuntu jammy-updates/universe amd64 Packages [213 kB]
Get:12 http://ph.archive.ubuntu.com/ubuntu jammy-updates/universe amd64 DEP-11 Metadata [141 kB]
Get:13 http://ph.archive.ubuntu.com/ubuntu jammy-updates/multiverse amd64 DEP-11 Metadata [940 B]
Get:14 http://ph.archive.ubuntu.com/ubuntu jammy-backports/universe amd64 DEP-11 Metadata [12.5 kB]
Get:15 http://security.ubuntu.com/ubuntu jammy-security/main i386 Packages [96.6 kB]
Get:16 http://security.ubuntu.com/ubuntu jammy-security/main amd64 DEP-11 Metadata [11.4 kB]
Get:17 http://security.ubuntu.com/ubuntu jammy-security/universe amd64 Packages [108 kB]
Get:18 http://security.ubuntu.com/ubuntu jammy-security/universe i386 Packages [56.3 kB]
Get:19 http://security.ubuntu.com/ubuntu jammy-security/universe amd64 DEP-11 Metadata [10.1 kB]
Fetched 2,237 kB in 4s (631 kB/s)
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
12 packages can be upgraded. Run 'apt list --upgradable' to see them.
penas@penas-VirtualBox:~$ sudo apt upgrade
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
Calculating upgrade... Done
The following packages will be upgraded:
  apt apt-utils gir1.2-gtk-4.0 libapt-pkg6.0 libcryptsetup12 libgtk-4-1 libgtk-4
  -bin libgtk-4-common linux-firmware python3-software-properties software-propert
  ies-common software-properties-gtk
12 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
Need to get 238 MB/248 MB of archives.
After this operation, 59.4 kB of additional disk space will be used.
Do you want to continue? [Y/n] y
```

Figure 2.1.3. Updating and Upgrading the System

```
penas@penas-VirtualBox:~$ sudo apt upgrade
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
Calculating upgrade... Done
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
penas@penas-VirtualBox:~$ sudo apt update
Hit:1 http://ph.archive.ubuntu.com/ubuntu jammy InRelease
Hit:2 http://security.ubuntu.com/ubuntu jammy-security InRelease
Hit:3 http://ph.archive.ubuntu.com/ubuntu jammy-updates InRelease
Hit:4 http://ph.archive.ubuntu.com/ubuntu jammy-backports InRelease
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
All packages are up to date.
```

Figure 2.1.4. Double Checking if the Updates were configured within the system

Local Host:

```
penas@penas-VirtualBox:~$ sudo apt update
[sudo] password for penas:
Get:1 http://security.ubuntu.com/ubuntu jammy-security InRelease [110 kB]
Hit:2 http://ph.archive.ubuntu.com/ubuntu jammy InRelease
Get:3 http://ph.archive.ubuntu.com/ubuntu jammy-updates InRelease [114 kB]
Get:4 http://security.ubuntu.com/ubuntu jammy-security/main i386 Packages [96.6 kB]
Get:5 http://security.ubuntu.com/ubuntu jammy-security/main amd64 Packages [267 kB]
Get:6 http://security.ubuntu.com/ubuntu jammy-security/main amd64 DEP-11 Metadata [11.4 kB]
Get:7 http://security.ubuntu.com/ubuntu jammy-security/universe amd64 Packages [108 kB]
Get:8 http://security.ubuntu.com/ubuntu jammy-security/universe i386 Packages [56.3 kB]
Get:9 http://security.ubuntu.com/ubuntu jammy-security/universe amd64 DEP-11 Metadata [10.1 kB]
Get:10 http://ph.archive.ubuntu.com/ubuntu jammy-backports InRelease [99.8 kB]
Get:11 http://ph.archive.ubuntu.com/ubuntu jammy-updates/main amd64 Packages [509 kB]
Get:12 http://ph.archive.ubuntu.com/ubuntu jammy-updates/main i386 Packages [274 kB]
Get:13 http://ph.archive.ubuntu.com/ubuntu jammy-updates/main amd64 DEP-11 Metadata [91.5 kB]
Get:14 http://ph.archive.ubuntu.com/ubuntu jammy-updates/main amd64 c-n-f Metadata [7,368 B]
Get:15 http://ph.archive.ubuntu.com/ubuntu jammy-updates/universe amd64 Packages [213 kB]
Get:16 http://ph.archive.ubuntu.com/ubuntu jammy-updates/universe i386 Packages [115 kB]
Get:17 http://ph.archive.ubuntu.com/ubuntu jammy-updates/universe amd64 DEP-11 Metadata [141 kB]
Get:18 http://ph.archive.ubuntu.com/ubuntu jammy-updates/multiverse amd64 DEP-11 Metadata [940 B]
Get:19 http://ph.archive.ubuntu.com/ubuntu jammy-backports/universe amd64 DEP-11 Metadata [12.5 kB]
Fetched 2,237 kB in 5s (492 kB/s)
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
12 packages can be upgraded. Run 'apt list --upgradable' to see them.
```

```

penas@penas-VirtualBox:~$ sudo apt upgrade
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
Calculating upgrade... Done
The following packages will be upgraded:
  apt apt-utils gir1.2-gtk-4.0 libapt-pkg6.0 libcryptsetup12 libgtk-4-1
  libgtk-4-bin libgtk-4-common linux-firmware python3-software-properties
  software-properties-common software-properties-gtk
12 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
Need to get 238 MB/248 MB of archives.
After this operation, 59.4 kB of additional disk space will be used.
Do you want to continue? [Y/n] y

```

Figure 2.1.5. Updating and Upgrading the System

```

penas@penas-VirtualBox:~$ sudo apt update
Hit:1 http://ph.archive.ubuntu.com/ubuntu jammy InRelease
Hit:2 http://security.ubuntu.com/ubuntu jammy-security InRelease
Get:3 http://ph.archive.ubuntu.com/ubuntu jammy-updates InRelease [114 kB]
Get:4 http://ph.archive.ubuntu.com/ubuntu jammy-backports InRelease [99.8 kB]
Get:5 http://ph.archive.ubuntu.com/ubuntu jammy-updates/main amd64 DEP-11 Metadata [91.5 kB]
Get:6 http://ph.archive.ubuntu.com/ubuntu jammy-updates/universe amd64 DEP-11 Metadata [141 kB]
Get:7 http://ph.archive.ubuntu.com/ubuntu jammy-updates/multiverse amd64 DEP-11 Metadata [940 B]
Get:8 http://ph.archive.ubuntu.com/ubuntu jammy-backports/universe amd64 DEP-11 Metadata [12.5 kB]
Fetched 460 kB in 2s (244 kB/s)
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
All packages are up to date.
penas@penas-VirtualBox:~$ sudo apt upgrade
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
Calculating upgrade... Done
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.

```

Figure 2.1.6. Double Checking if the Updates were configured within the system

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

Server 1:

```

penas@penas-VirtualBox:~$ sudo apt install openssh-server
[sudo] password for penas:
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  ncurses-term openssh-sftp-server ssh-import-id
Suggested packages:
  molly-guard monkeysphere ssh-askpass
The following NEW packages will be installed:
  ncurses-term openssh-server openssh-sftp-server ssh-import-id
0 upgraded, 4 newly installed, 0 to remove and 0 not upgraded.
Need to get 751 kB of archives.
After this operation, 6,046 kB of additional disk space will be used.
Do you want to continue? [Y/n] y

```

Figure 2.2.1. Installing the openssh-server in Server 1

```

penas@penas-VirtualBox:~$ sudo apt install openssh-server
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
openssh-server is already the newest version (1:8.9p1-3).
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.

```

Figure 2.2.2. Double Checking if the Installed Library were configured within the system

Server 2:

```
penas@penas-VirtualBox:~$ 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-sftp-server ssh-import-id
Suggested packages:
  molly-guard monkeysphere ssh-askpass
The following NEW packages will be installed:
  ncurses-term openssh-server openssh-sftp-server ssh-import-id
0 upgraded, 4 newly installed, 0 to remove and 0 not upgraded.
Need to get 751 kB of archives.
After this operation, 6,046 kB of additional disk space will be used.
Do you want to continue? [Y/n] y
```

Figure 2.2.3. Installing the openssh-server in Server 2

```
penas@penas-VirtualBox:~$ sudo apt install openssh-server
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
openssh-server is already the newest version (1:8.9p1-3).
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
```

Figure 2.2.4. Double Checking if the Installed Library were configured within the system

Local Host:

```
penas@penas-VirtualBox:~$ 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-sftp-server ssh-import-id
Suggested packages:
  molly-guard monkeysphere ssh-askpass
The following NEW packages will be installed:
  ncurses-term openssh-server openssh-sftp-server ssh-import-id
0 upgraded, 4 newly installed, 0 to remove and 0 not upgraded.
Need to get 751 kB of archives.
After this operation, 6,046 kB of additional disk space will be used.
Do you want to continue? [Y/n] y
```

Figure 2.2.5. Installing the openssh-server in Local Host

```
penas@penas-VirtualBox:~$ sudo apt install openssh-server
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
openssh-server is already the newest version (1:8.9p1-3).
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
```

Figure 2.2.6. Double Checking if the Installed Library were configured within the system

3. Verify if the SSH service has started by issuing the following commands:

- *sudo service ssh start*
- *sudo systemctl status ssh*

Server 1:

```
penas@penas-VirtualBox:~$ sudo service ssh start
penas@penas-VirtualBox:~$ sudo service ssh start
penas@penas-VirtualBox:~$ sudo systemctl status ssh
● ssh.service - OpenBSD Secure Shell server
   Loaded: loaded (/lib/systemd/system/ssh.service; enabled; vendor preset: en
   Active: active (running) since Fri 2022-08-19 08:32:30 PST; 10min ago
     Docs: man:sshd(8)
           man:sshd_config(5)
   Main PID: 16167 (sshd)
    Tasks: 1 (limit: 4511)
   Memory: 1.7M
      CPU: 12ms
   CGroup: /system.slice/ssh.service
           └─16167 sshd: /usr/sbin/sshd -D [listener] 0 of 10-100 startups

Aug 19 08:32:30 penas-VirtualBox systemd[1]: Starting OpenBSD Secure Shell serv
Aug 19 08:32:30 penas-VirtualBox sshd[16167]: Server listening on 0.0.0.0 port 2
Aug 19 08:32:30 penas-VirtualBox sshd[16167]: Server listening on :: port 22.
Aug 19 08:32:30 penas-VirtualBox systemd[1]: Started OpenBSD Secure Shell serv
lines 1-16/16 (END)
```


Server 2:

```
penas@penas-VirtualBox: $ sudo service ssh start
[sudo] password for penas:
penas@penas-VirtualBox: $ sudo systemctl status ssh
● ssh.service - OpenBSD Secure Shell server
   Loaded: loaded (/lib/systemd/system/ssh.service; enabled; vendor preset: en
   Active: active (running) since Fri 2022-08-19 08:33:32 PST; 17min ago
     Docs: man:sshd(8)
           man:sshd_config(5)
   Main PID: 16540 (sshd)
     Tasks: 1 (limit: 4511)
    Memory: 1.7M
       CPU: 13ms
    CGroup: /system.slice/ssh.service
            └─16540 "sshd: /usr/sbin/sshd -D [listener] 0 of 10-100 startups"

Aug 19 08:33:32 penas-VirtualBox systemd[1]: Starting OpenBSD Secure Shell serv
Aug 19 08:33:32 penas-VirtualBox sshd[16540]: Server listening on 0.0.0.0 port
Aug 19 08:33:32 penas-VirtualBox sshd[16540]: Server listening on :: port 22.
Aug 19 08:33:32 penas-VirtualBox systemd[1]: Started OpenBSD Secure Shell serv
lines 1-16/16 (END)
```

Local Host:

```
penas@penas-VirtualBox: $ sudo service ssh start
penas@penas-VirtualBox: $ sudo systemctl status ssh
● ssh.service - OpenBSD Secure Shell server
   Loaded: loaded (/lib/systemd/system/ssh.service; enabled; vendor preset: en
   Active: active (running) since Fri 2022-08-19 08:33:50 PST; 21min ago
     Docs: man:sshd(8)
           man:sshd_config(5)
   Main PID: 16517 (sshd)
     Tasks: 1 (limit: 4511)
    Memory: 1.7M
       CPU: 13ms
    CGroup: /system.slice/ssh.service
            └─16517 "sshd: /usr/sbin/sshd -D [listener] 0 of 10-100 startups"

Aug 19 08:33:50 penas-VirtualBox systemd[1]: Starting OpenBSD Secure Shell serv
Aug 19 08:33:50 penas-VirtualBox sshd[16517]: Server listening on 0.0.0.0 port
Aug 19 08:33:50 penas-VirtualBox sshd[16517]: Server listening on :: port 22.
Aug 19 08:33:50 penas-VirtualBox systemd[1]: Started OpenBSD Secure Shell serv
lines 1-16/16 (END)
```

4. Configure the firewall to all port 22 by issuing the following commands:

- *sudo ufw allow ssh*
- *sudo ufw enable*
- *sudo ufw status*

Server 1:

```
penas@penas-VirtualBox: $ sudo ufw allow ssh
[sudo] password for penas:
Rules updated
Rules updated (v6)
penas@penas-VirtualBox: $ sudo ufw enable
Firewall is active and enabled on system startup
penas@penas-VirtualBox: $ sudo ufw status
Status: active

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

Figure 2.4.1. Configuring port 22 by enabling the Firewall in Server 1

Server 2:

```
penas@penas-VirtualBox: $ sudo ufw allow ssh
[sudo] password for penas:
Rules updated
Rules updated (v6)
penas@penas-VirtualBox: $ sudo ufw enable
Firewall is active and enabled on system startup
penas@penas-VirtualBox: $ sudo ufw status
Status: active

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

Figure 2.4.2. Configuring port 22 by enabling the Firewall in Server 2

Local Host:

```
penas@penas-VirtualBox: $ sudo ufw allow ssh
[sudo] password for penas:
Rules updated
Rules updated (v6)
penas@penas-VirtualBox: $ sudo ufw enable
Firewall is active and enabled on system startup
penas@penas-VirtualBox: $ sudo ufw status
Status: active

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

Figure 2.4.3. Configuring port 22 by enabling the Firewall in Local Machine

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

[Note: I Already Finished this Task during Face-to-Face Classes which I will depend the results under this task since doing this at home will have a new set and different IP Address]

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.

F2F Results:

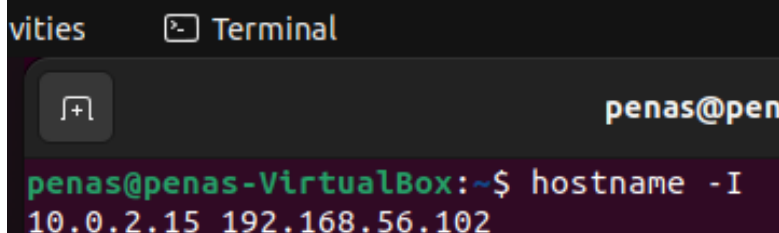
- 1.1 Server 1 IP address: 192.168.56.101
- 1.2 Server 2 IP address: 192.168.56.102
- 1.3 Server 3 IP address: 192.168.56.103

At Home Results:

- 1.4 Server 1 IP address: 192.168.56.102

Ubuntu Desktop Server 1 [Running] - Oracle VM VirtualBox

Machine View Input Devices Help

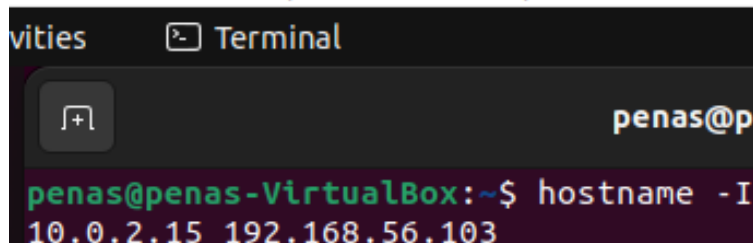


```
penas@penas-VirtualBox:~$ hostname -I
10.0.2.15 192.168.56.102
```

- 1.5 Server 2 IP address: 192.168.56.103

Ubuntu Desktop Server 2 [Running] - Oracle VM VirtualBox

Machine View Input Devices Help

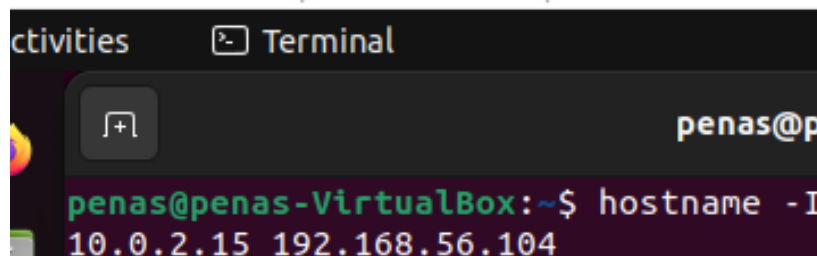


```
penas@penas-VirtualBox:~$ hostname -I
10.0.2.15 192.168.56.103
```

- 1.6 Server 3 IP address: 192.168.56.104

Ubuntu Desktop Local Machine [Running] - Oracle VM VirtualBox

Machine View Input Devices Help



```
penas@penas-VirtualBox:~$ hostname -I
10.0.2.15 192.168.56.104
```


2. Make sure that they can ping each other.

[Note: Ngayon ko lang po naalala need I restart for the indication of Servers; but rest assured that I'm not doctoring the previous results, you can re-crop the previous pictures and see my windows title indicating the server's name (like in the previous number)]

2.1 Connectivity test for Local Machine 1 to Server 1:

```
penas@penas-LocalMachine-VirtualBox:~$ 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=0.401 ms
64 bytes from 192.168.56.102: icmp_seq=2 ttl=64 time=0.294 ms
64 bytes from 192.168.56.102: icmp_seq=3 ttl=64 time=0.285 ms
64 bytes from 192.168.56.102: icmp_seq=4 ttl=64 time=0.263 ms
^C
--- 192.168.56.102 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3065ms
rtt min/avg/max/mdev = 0.263/0.310/0.401/0.053 ms
```

Figure 3.2.1. Shows the Ping was successfully transmitted from Local Machine 1 to Server 1

☒ Successful ☐ Not Successful

2.2 Connectivity test for Local Machine 1 to Server 2:

```
penas@penas-LocalMachine-VirtualBox:~$ 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=0.465 ms
64 bytes from 192.168.56.103: icmp_seq=2 ttl=64 time=0.277 ms
64 bytes from 192.168.56.103: icmp_seq=3 ttl=64 time=0.243 ms
64 bytes from 192.168.56.103: icmp_seq=4 ttl=64 time=0.269 ms
64 bytes from 192.168.56.103: icmp_seq=5 ttl=64 time=0.243 ms
^C
--- 192.168.56.103 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4103ms
rtt min/avg/max/mdev = 0.243/0.299/0.465/0.083 ms
```

Figure 3.2.2. Shows the Ping was successfully transmitted from Local Machine 1 to Server 2

☒ Successful ☐ Not Successful

2.3 Connectivity test for Server 1 to Server 2:

```
penas@penas-Server1-VirtualBox:~$ 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=0.553 ms
64 bytes from 192.168.56.103: icmp_seq=2 ttl=64 time=0.267 ms
64 bytes from 192.168.56.103: icmp_seq=3 ttl=64 time=0.241 ms
64 bytes from 192.168.56.103: icmp_seq=4 ttl=64 time=0.218 ms
^C
--- 192.168.56.103 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3065ms
rtt min/avg/max/mdev = 0.218/0.319/0.553/0.135 ms
```

Figure 3.2.3. Shows the Ping was successfully transmitted from Server 1 to Server 2

☒ Successful ☐ Not Successful

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 jvtaylor@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, `jvtaylor@server1`

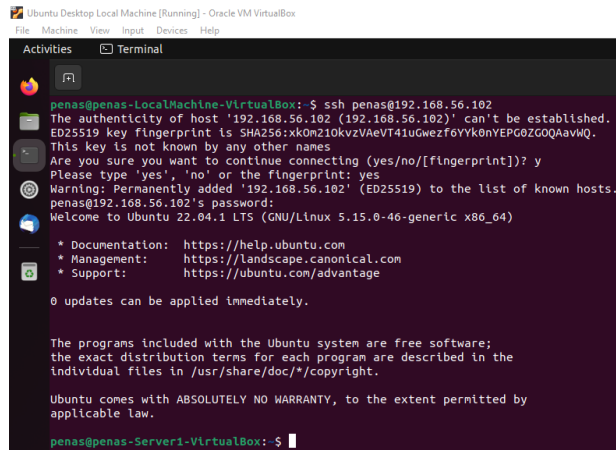
2. Logout of Server 1 by issuing the command `control + D`.

3. Do the same for Server 2.

```
penas@penas-Server2-VirtualBox:~$ ssh penas@192.168.56.104
ssh: Could not resolve hostname 192.168.56.104: Name or service not known
```

Figure 4.1.1. Shows if the results when the IP address was not found within the system

Server 1:



```
penas@penas-LocalMachine-VirtualBox:~$ ssh penas@192.168.56.102
The authenticity of host '192.168.56.102 (192.168.56.102)' can't be established.
ED25519 key fingerprint is SHA256:xK0mZ10kvzVAeVT41uGwezF6Yk0nYEPGoZGOQAavWQ.
This key is not known by any other names
Are you sure you want to continue connecting (yes/no/[fingerprint])? y
Please type 'yes', 'no' or the fingerprint: yes
Warning: Permanently added '192.168.56.102' (ED25519) to the list of known hosts.
penas@192.168.56.102's password:
Welcome to Ubuntu 22.04.1 LTS (GNU/Linux 5.15.0-46-generic x86_64)

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

0 updates can be applied immediately.

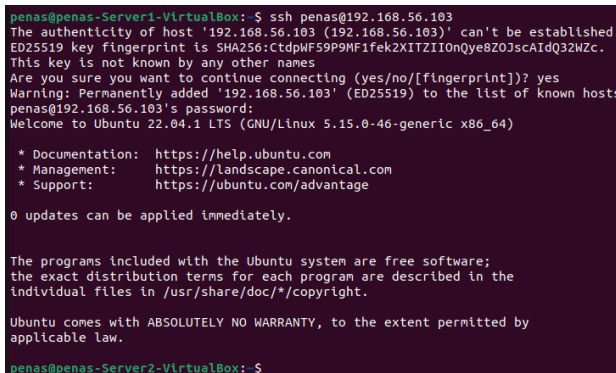
The programs included with the Ubuntu system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

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

penas@penas-Server1-VirtualBox:~$
```

Figure 4.1.2. Shows that the hostname was changed from Local Machine to Server 1; indicating that we are in the Server 1's configurations

Server 2:



```
penas@penas-Server1-VirtualBox:~$ ssh penas@192.168.56.103
The authenticity of host '192.168.56.103 (192.168.56.103)' can't be established.
ED25519 key fingerprint is SHA256:CtdpWF59P9MF1fek2XITZII0nQye8Z0JscAIdQ32WZc.
This key is not known by any other names
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '192.168.56.103' (ED25519) to the list of known hosts.
penas@192.168.56.103's password:
Welcome to Ubuntu 22.04.1 LTS (GNU/Linux 5.15.0-46-generic x86_64)

 * Documentation:  https://help.ubuntu.com
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0 updates can be applied immediately.

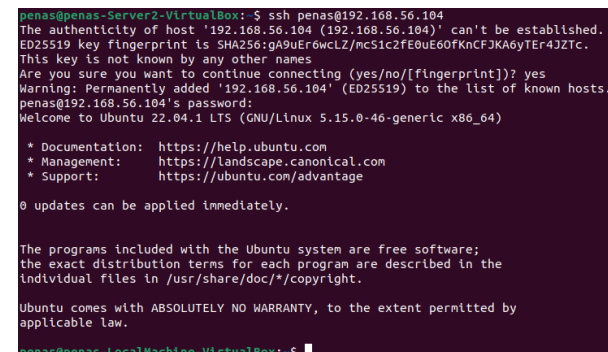
The programs included with the Ubuntu system are free software;
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applicable law.

penas@penas-Server2-VirtualBox:~$
```

Figure 4.1.3. Shows that the hostname was changed from Server 1 to Server 2; indicating that we are in the Server 2's configurations

Local Host:



```
penas@penas-Server2-VirtualBox:~$ ssh penas@192.168.56.104
The authenticity of host '192.168.56.104 (192.168.56.104)' can't be established.
ED25519 key fingerprint is SHA256:gA9uEr6wCLZ/mcS1c2fE0ue60fKncFJKA6yTER4JZTc.
This key is not known by any other names
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '192.168.56.104' (ED25519) to the list of known hosts.
penas@192.168.56.104's password:
Welcome to Ubuntu 22.04.1 LTS (GNU/Linux 5.15.0-46-generic x86_64)

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

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applicable law.

penas@penas-LocalMachine-VirtualBox:~$
```

Figure 4.1.4. Shows that the hostname was changed from Server 2 to Local Machine; indicating that we are in the Local Machine's configurations

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 Local_Machine
127.0.1.1 penas-VirtualBox
192.168.56.102 Server_1
192.168.56.103 Server_2

# The following lines are desirable for IPv6 capable hosts
::1 ip6-localhost ip6-loopback
fe00::0 ip6-localnet
ff00::0 ip6-mcastprefix
ff02::1 ip6-allnodes
ff02::2 ip6-allrouters

```

Figure 4.1.5. Configuring the `/etc/hosts` by appending the IP addresses of Server 1 and 2

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 jvtaylor@server1`. Enter the password when prompted. Verify that you have entered Server 1. Do the same for Server 2

Server 1:

```

penas@penas-LocalMachine-VirtualBox:~$ ssh penas@Server_1
penas@server_1's password:
Welcome to Ubuntu 22.04.1 LTS (GNU/Linux 5.15.0-46-generic x86_64)

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

0 updates can be applied immediately.

Last login: Fri Aug 19 10:51:26 2022 from 192.168.56.104

```

Figure 4.1.6. Moving to the Server 1 from Local Machine using the modified command

```

penas@penas-Server1-VirtualBox:~$ ssh penas@Server_2
ssh: Could not resolve hostname server_2: Temporary failure in name resolution
penas@penas-Server1-VirtualBox:~$

```

Figure 4.1.7. Moving to the Server 1 from Server 2 will result on an error as the `/etc/hosts` of the Server 1 was not modified compared to the Local Machine and its network Topology from discussion is not interconnected

Server 2:

```

penas@penas-LocalMachine-VirtualBox:~$ ssh penas@Server_2
The authenticity of host 'server_2 (192.168.56.103)' can't be established.
ED25519 key fingerprint is SHA256:CtdpWF59P9MF1fek2XITZIIOnQye8ZOJscAIdQ32WZc.
This key is not known by any other names
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added 'server_2' (ED25519) to the list of known hosts.
penas@server_2's password:
Permission denied, please try again.
penas@server_2's password:
Welcome to Ubuntu 22.04.1 LTS (GNU/Linux 5.15.0-46-generic x86_64)

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

0 updates can be applied immediately.

Last login: Fri Aug 19 10:43:13 2022 from 192.168.56.102

```

Figure 4.1.6. Moving to the Server 2 from Local Machine using the modified command

Reflections:

Answer the following:

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

On the text file `/etc/hosts`, the student appended new information's in which inputting the entered hostname right beside the IP address will make it as another way to change or move

from server to server due to its difficulties of remembering multiple IP address in set of multiple network topology. Using this method will make the System Administrator to move another server or computer more efficiently, yet if the admin entered an unknown word, IP address and the information inside the /host text file was not listed will result into an error which is shown on the Figure 4.1.7.

2. How secured is SSH?

SSH or Secure Shell is a type of network communication protocol that allows two or more computers to interact with each other mostly between SSH Client and Server, and It secures its data by encrypting its contents to avoid unauthorized actions from unknown sources as it uses SHA-2 which is a hash algorithm making it unreadable and tappable.