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Course/Section: CPE212 - CPE31S2	**Date Submitted: 8/08/2025**
Instructor: Engr. Robin Valenzuela	**Semester and SY:**

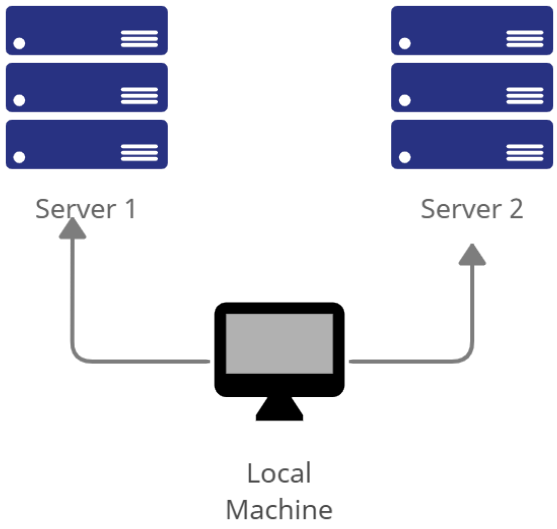
Activity 1: Configure Network using Virtual Machines

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:

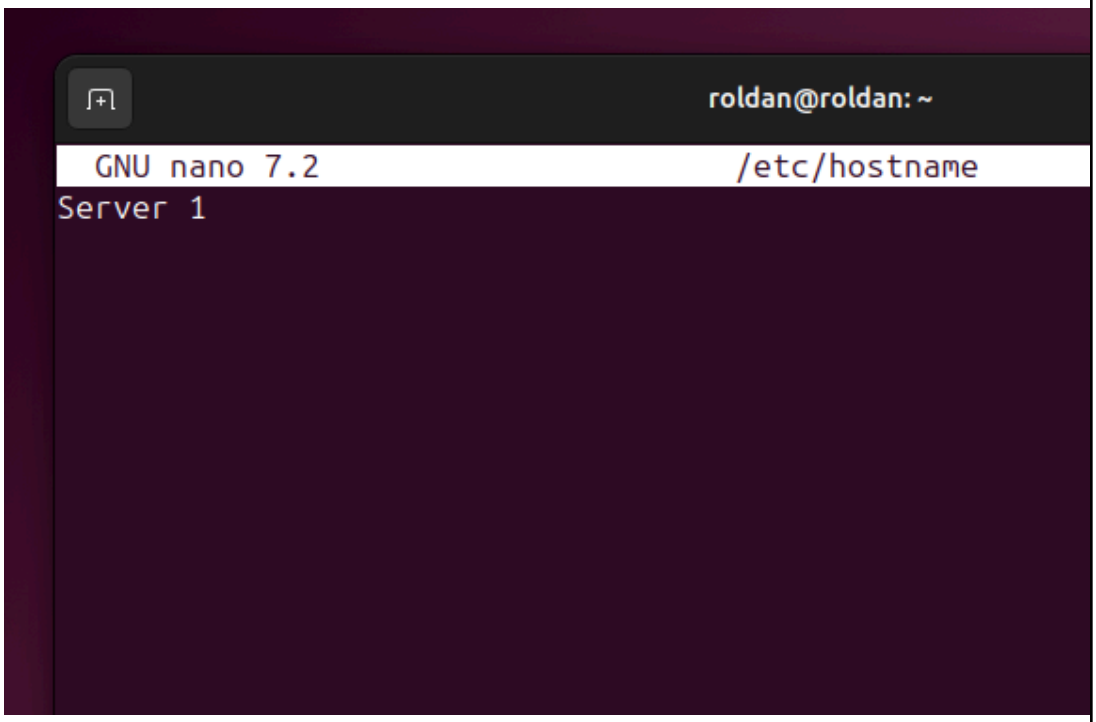
Assume that you have created the following network topology in Virtual Machines, *provide screenshots for each task*. (Note: *it is assumed that you have the prior knowledge of cloning and creating snapshots in a virtual machine*).



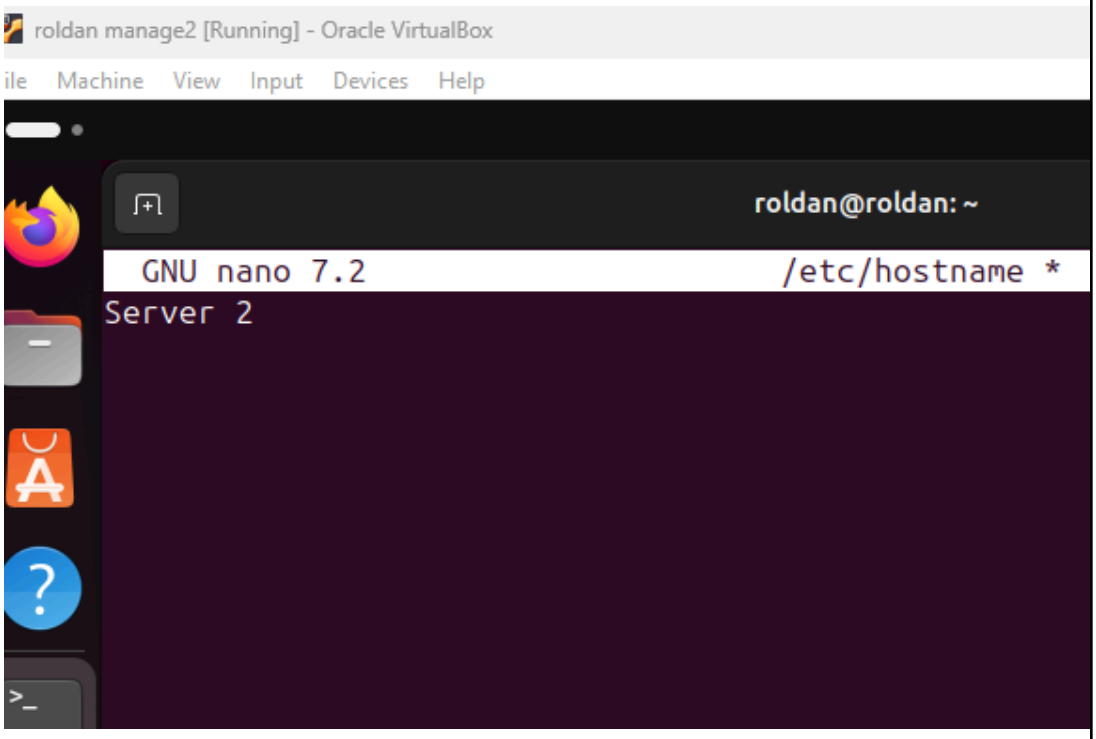
Task 1: Do the following on Server 1, Server 2, and Local Machine. In editing the file using nano command, press control + O to write out (save the file). Press enter when asked for the name of the file. Press control + X to end.

1. Change the hostname using the command *sudo nano /etc/hostname*

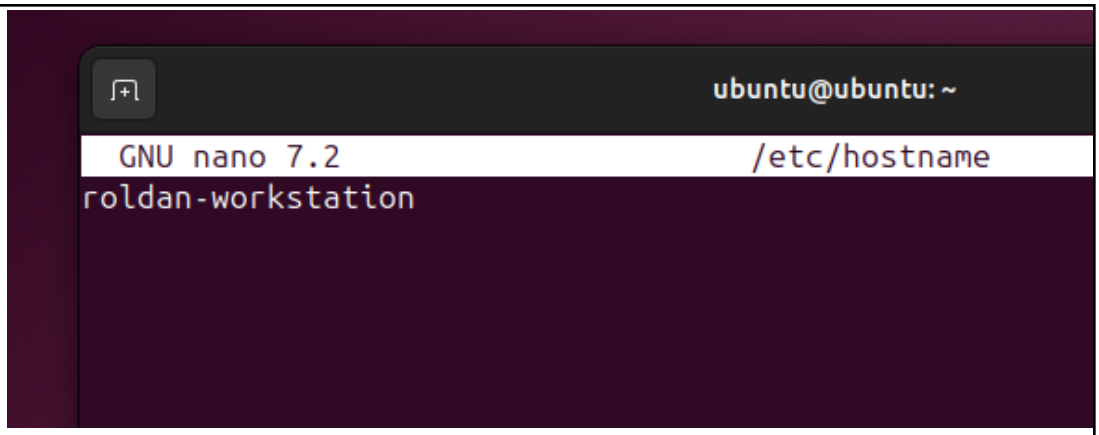
1.1 Use server1 for Server 1



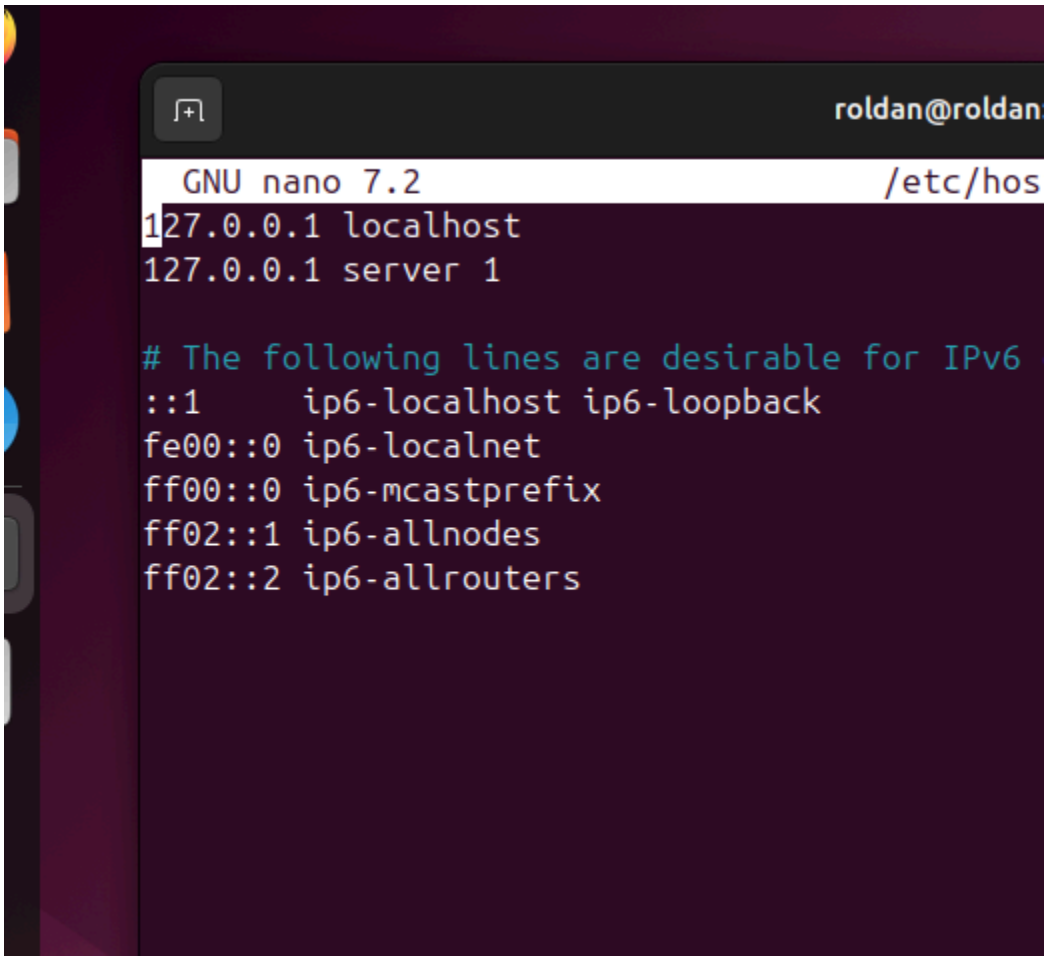
1.2 Use server2 for Server 2



1.3 Use workstation for the Local Machine

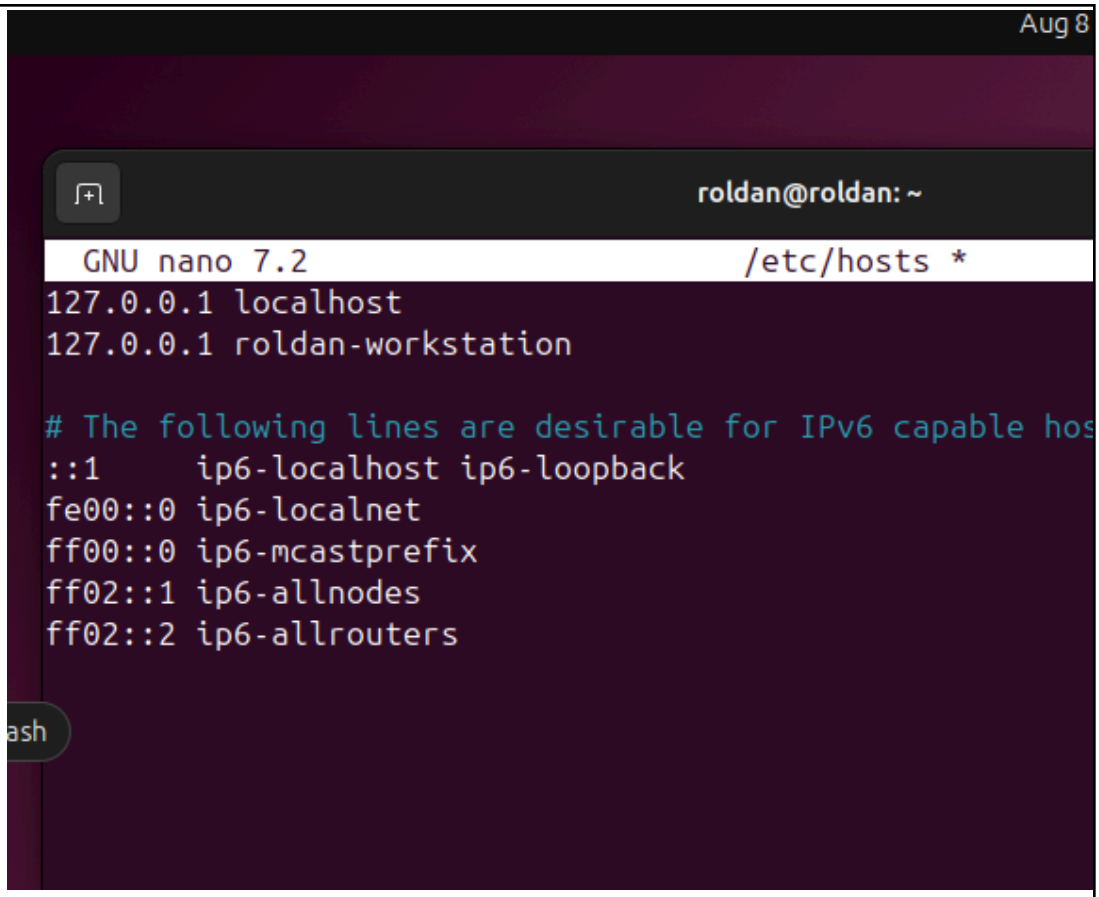


2. Edit the hosts using the command *sudo nano /etc/hosts*. Edit the second line.
   2.1 Type 127.0.0.1 server 1 for Server 1



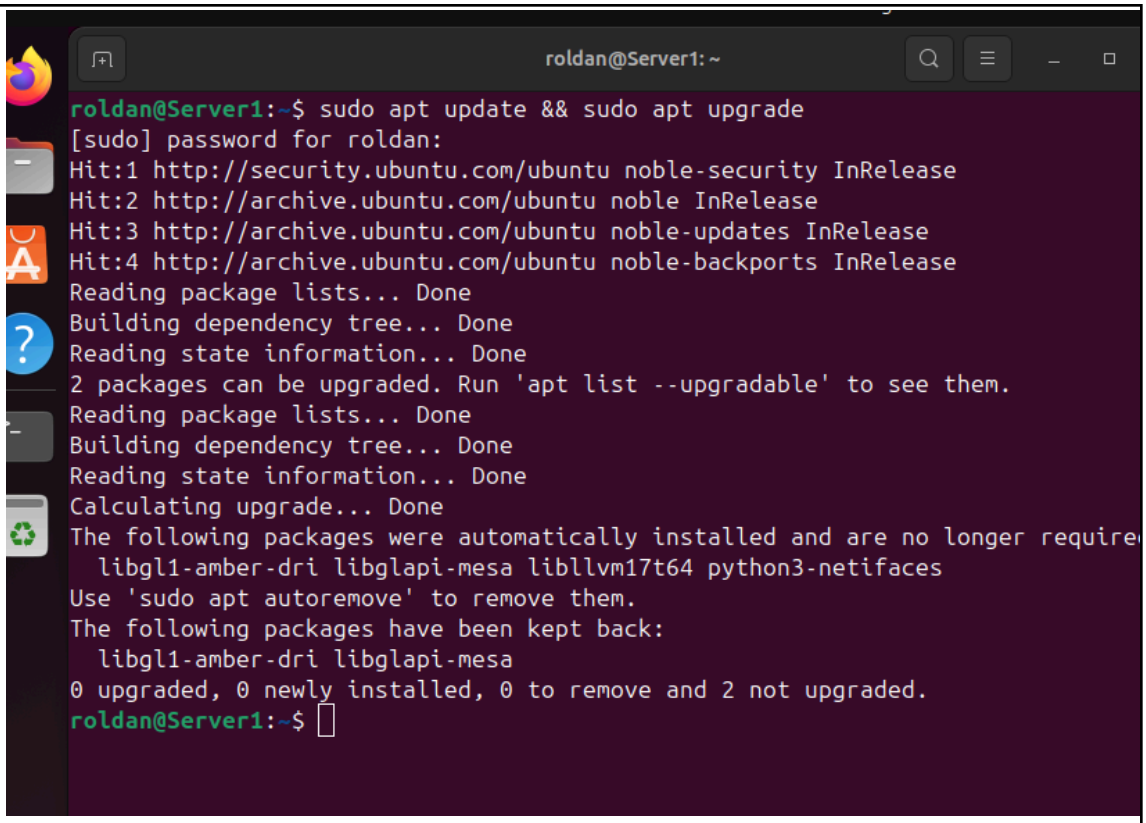
   2.2 Type 127.0.0.1 server 2 for Server 2

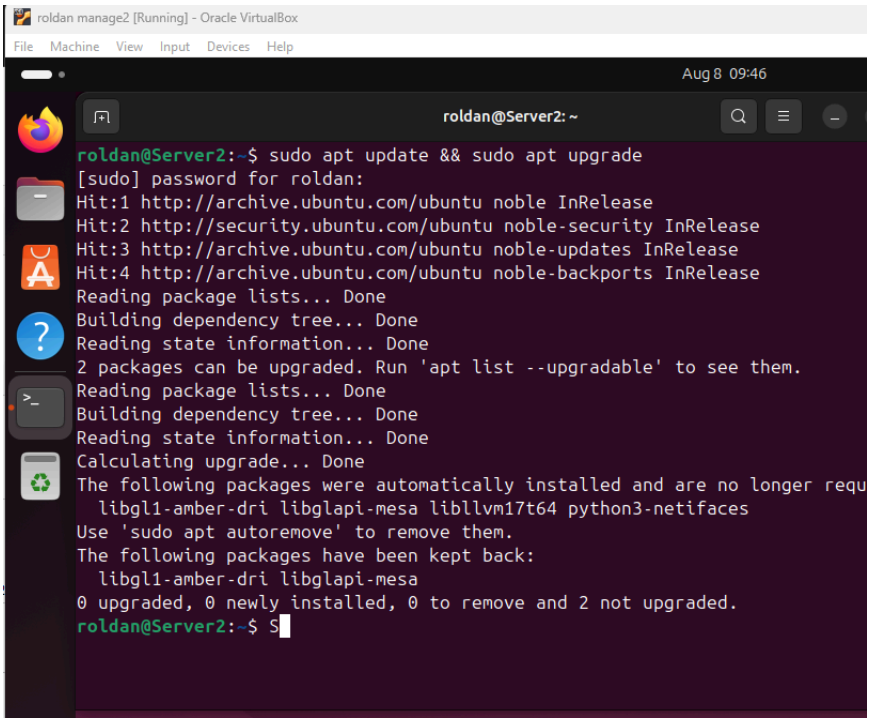
   2.3 Type 127.0.0.1 workstation for the Local Machine

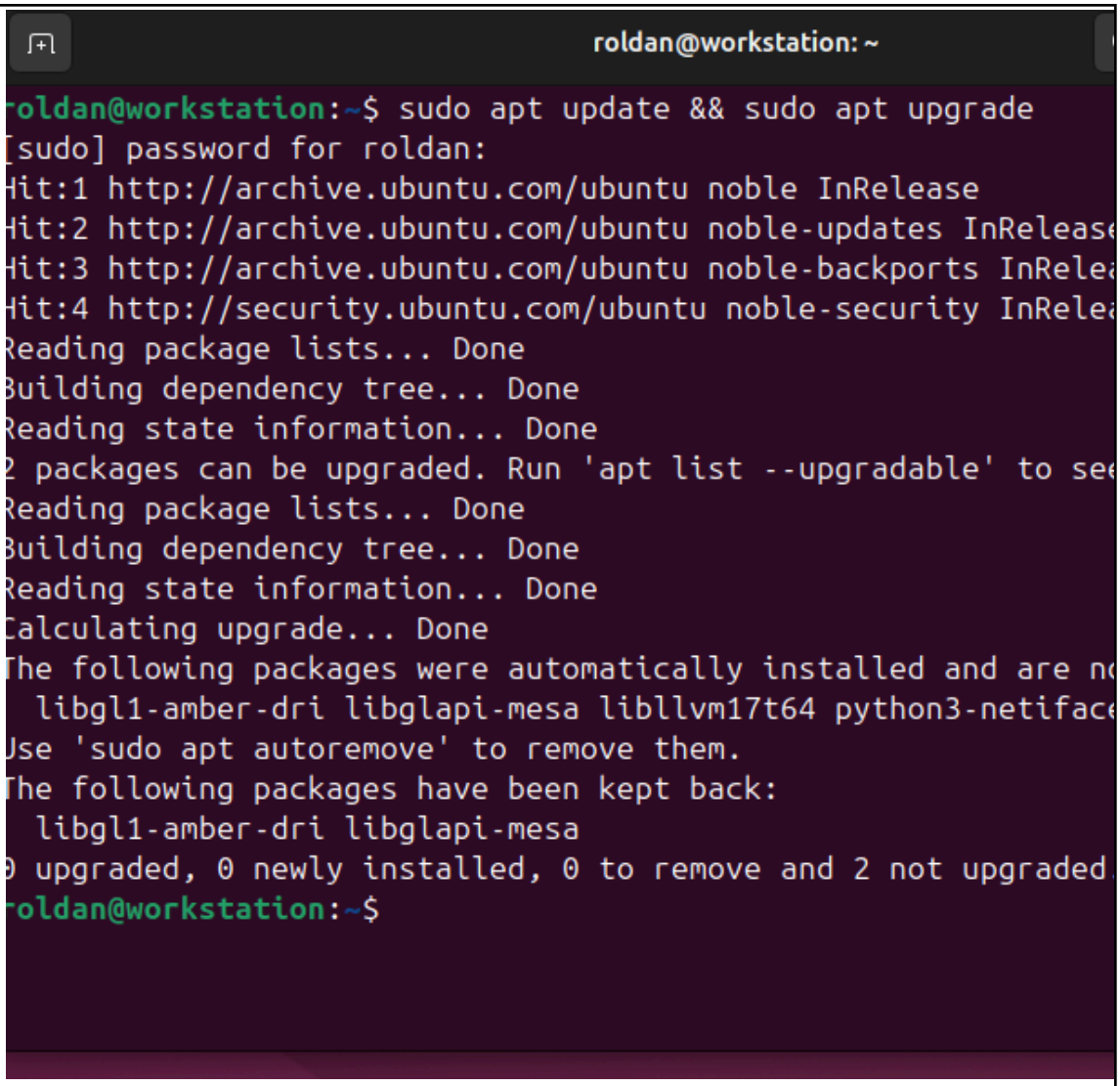


Task 2: Configure SSH on Server 1, Server 2, and Local Machine. Do the following:

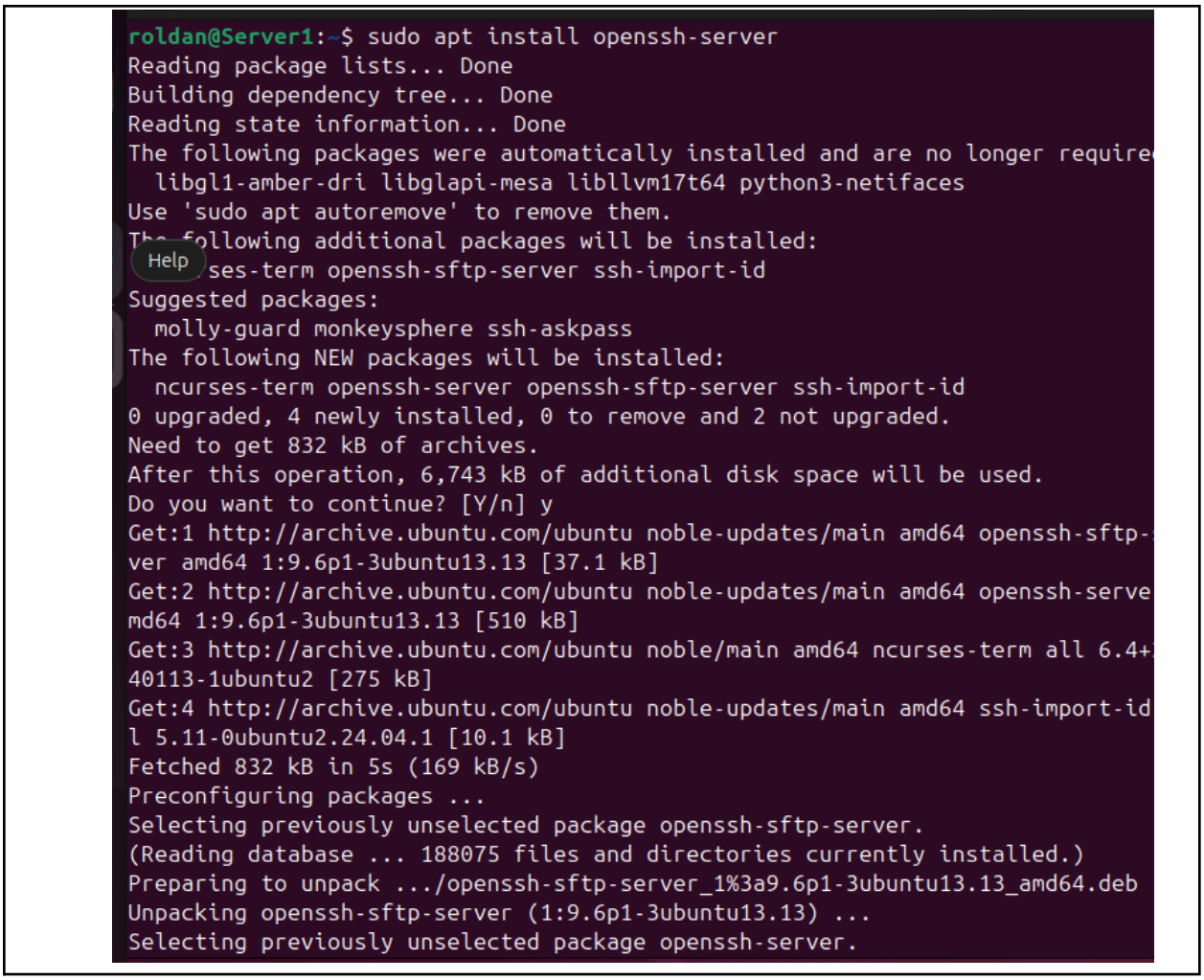
1. Upgrade the packages by issuing the command *sudo apt update* and *sudo apt upgrade* respectively.

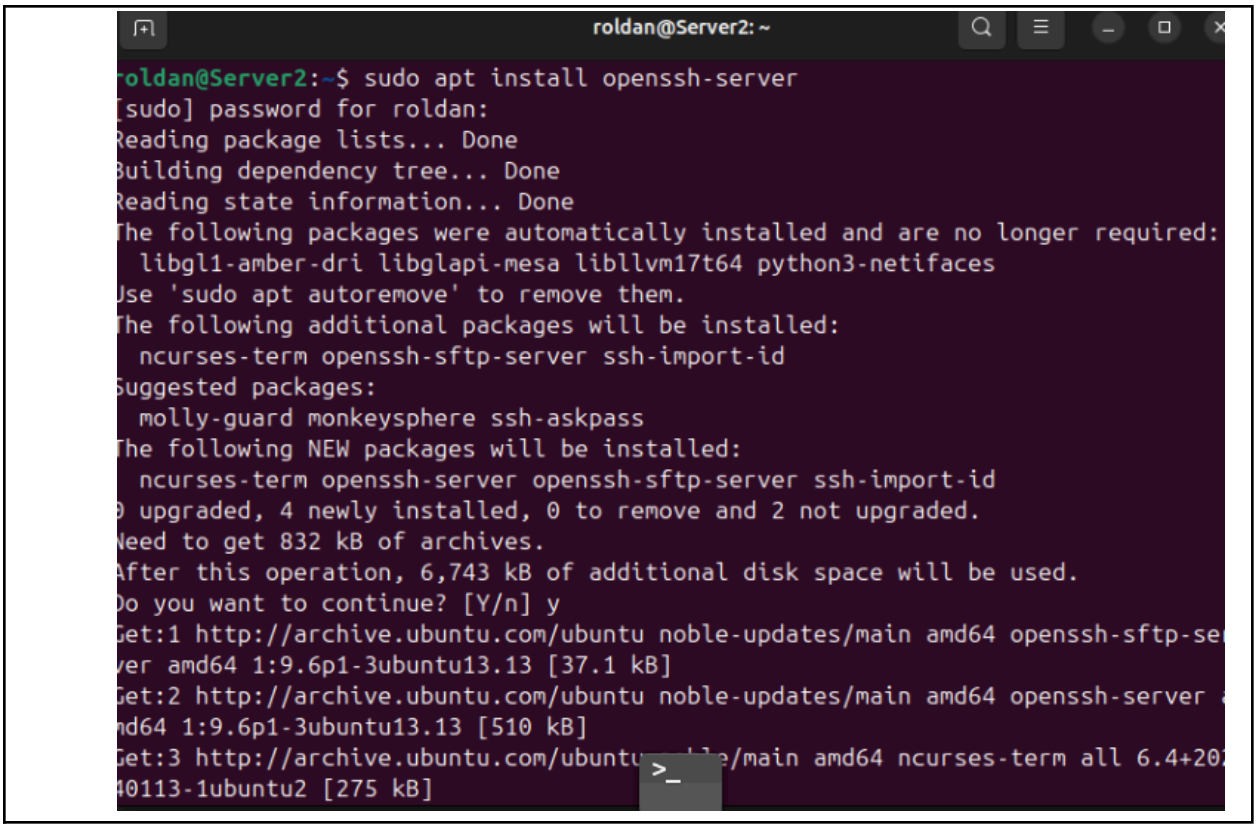

roldan@Server1: ~
roldan@Server1:~$ sudo apt update && sudo apt upgrade
[sudo] password for roldan:
Hit:1 http://security.ubuntu.com/ubuntu noble-security InRelease
Hit:2 http://archive.ubuntu.com/ubuntu noble InRelease
Hit:3 http://archive.ubuntu.com/ubuntu noble-updates InRelease
Hit:4 http://archive.ubuntu.com/ubuntu noble-backports InRelease
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
2 packages can be upgraded. Run 'apt list --upgradable' to see them.
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
Calculating upgrade... Done
The following packages were automatically installed and are no longer require
libgl1-amber-dri libglapi-mesa libllvm17t64 python3-netifaces
Use 'sudo apt autoremove' to remove them.
The following packages have been kept back:
libgl1-amber-dri libglapi-mesa
0 upgraded, 0 newly installed, 0 to remove and 2 not upgraded.
roldan@Server1:~$


roldan manage2 [Running] - Oracle VirtualBox
File Machine View Input Devices Help
Aug 8 09:46
roldan@Server2: ~
roldan@Server2:~$ sudo apt update && sudo apt upgrade
[sudo] password for roldan:
Hit:1 http://archive.ubuntu.com/ubuntu noble InRelease
Hit:2 http://security.ubuntu.com/ubuntu noble-security InRelease
Hit:3 http://archive.ubuntu.com/ubuntu noble-updates InRelease
Hit:4 http://archive.ubuntu.com/ubuntu noble-backports InRelease
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
2 packages can be upgraded. Run 'apt list --upgradable' to see them.
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
Calculating upgrade... Done
The following packages were automatically installed and are no longer requ
libgl1-amber-dri libglapi-mesa libllvm17t64 python3-netifaces
Use 'sudo apt autoremove' to remove them.
The following packages have been kept back:
libgl1-amber-dri libglapi-mesa
0 upgraded, 0 newly installed, 0 to remove and 2 not upgraded.
roldan@Server2:~$ S



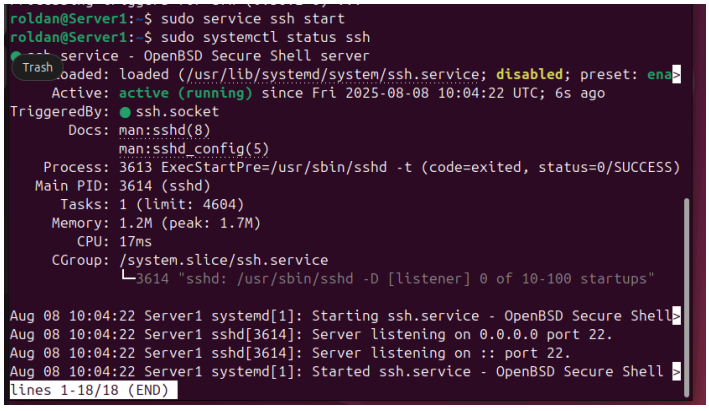
2. Install the SSH server using the command *sudo apt install openssh-server*.


roldan@Server1:~$ sudo apt install openssh-server
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following packages were automatically installed and are no longer require
libgl1-amber-dri libglapi-mesa libllvm17t64 python3-netifaces
Use 'sudo apt autoremove' to remove them.
The following additional packages will be installed:
Help
ses-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 2 not upgraded.
Need to get 832 kB of archives.
After this operation, 6,743 kB of additional disk space will be used.
Do you want to continue? [Y/n] y
Get:1 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 openssh-sftp-
ver amd64 1:9.6p1-3ubuntu13.13 [37.1 kB]
Get:2 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 openssh-serve
md64 1:9.6p1-3ubuntu13.13 [510 kB]
Get:3 http://archive.ubuntu.com/ubuntu noble/main amd64 ncurses-term all 6.4+
40113-1ubuntu2 [275 kB]
Get:4 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 ssh-import-id
l 5.11-0ubuntu2.24.04.1 [10.1 kB]
Fetched 832 kB in 5s (169 kB/s)
Preconfiguring packages ...
Selecting previously unselected package openssh-sftp-server.
(Reading database ... 188075 files and directories currently installed.)
Preparing to unpack .../openssh-sftp-server_1%3a9.6p1-3ubuntu13.13_amd64.deb
Unpacking openssh-sftp-server (1:9.6p1-3ubuntu13.13) ...
Selecting previously unselected package openssh-server.


roldan@Server2: ~
roldan@Server2:~$ sudo apt install openssh-server
[sudo] password for roldan:
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following packages were automatically installed and are no longer required:
libgl1-amber-dri libglapi-mesa libllvm17t64 python3-netifaces
Use 'sudo apt autoremove' to remove them.
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 2 not upgraded.
Need to get 832 kB of archives.
After this operation, 6,743 kB of additional disk space will be used.
Do you want to continue? [Y/n] y
Get:1 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 openssh-sftp-se
ver amd64 1:9.6p1-3ubuntu13.13 [37.1 kB]
Get:2 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 openssh-server
md64 1:9.6p1-3ubuntu13.13 [510 kB]
Get:3 http://archive.ubuntu.com/ubuntu noble/main amd64 ncurses-term all 6.4+20
40113-1ubuntu2 [275 kB]
>_

```
roldan@workstation:~$ sudo apt install openssh-server
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following packages were automatically installed and are
  libgl1-amber-dri libglapi-mesa libllvm17t64 python3-netif
Use 'sudo apt autoremove' to remove them.
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-impor
0 upgraded, 4 newly installed, 0 to remove and 2 not upgrad
Need to get 832 kB of archives.
After this operation, 6,743 kB of additional disk space wil
Do you want to continue? [Y/n] y
Get:1 http://archive.ubuntu.com/ubuntu noble-updates/main a
ver amd64 1:9.6p1-3ubuntu13.13 [37.1 kB]
Get:2 http://archive.ubuntu.com/ubuntu noble-updates/main a
md64 1:9.6p1-3ubuntu13.13 [510 kB]
47% [2 openssh-server 400 kB/510 kB 78%]
```

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*



```
roldan@Server2:~$ sudo service ssh start
roldan@Server2:~$ sudo systemctl status ssh
● ssh.service - OpenBSD Secure Shell server
     Loaded: loaded (/usr/lib/systemd/system/ssh.service; disabled;
     Active: active (running) since Fri 2025-08-08 10:10:30 UTC; 5s
TriggeredBy: ● ssh.socket
       Docs: man:sshd(8)
             man:sshd_config(5)
    Process: 3240 ExecStartPre=/usr/sbin/sshd -t (code=exited, statu
   Main PID: 3241 (sshd)
      Tasks: 1 (limit: 4604)
     Memory: 1.2M (peak: 1.7M)
        CPU: 20ms
     CGroup: /system.slice/ssh.service
             └─3241 "sshd: /usr/sbin/sshd -D [listener] 0 of 10-100

Aug 08 10:10:30 Server2 systemd[1]: Starting ssh.service - OpenBSD S
Aug 08 10:10:30 Server2 sshd[3241]: Server listening on 0.0.0.0 port
Aug 08 10:10:30 Server2 sshd[3241]: Server listening on :: port 22.
Aug 08 10:10:30 Server2 systemd[1]: Started ssh.service - OpenBSD Se
roldan@Server2:~$
```

```
roldan@workstation:~$ sudo service ssh start
roldan@workstation:~$ sudo systemctl status ssh
● ssh.service - OpenBSD Secure Shell server
     Loaded: loaded (/usr/lib/systemd/system/ssh.service;
     Active: active (running) since Fri 2025-08-08 10:17:1
TriggeredBy: ● ssh.socket
       Docs: man:sshd(8)
             man:sshd_config(5)
    Process: 3590 ExecStartPre=/usr/sbin/sshd -t (code=exi
   Main PID: 3592 (sshd)
      Tasks: 1 (limit: 4604)
     Memory: 1.2M (peak: 1.6M)
        CPU: 14ms
     CGroup: /system.slice/ssh.service
             └─3592 "sshd: /usr/sbin/sshd -D [listener] 0

Aug 08 10:17:10 workstation systemd[1]: Starting ssh.servi
Aug 08 10:17:10 workstation sshd[3592]: Server listening o
Aug 08 10:17:10 workstation sshd[3592]: Server listening o
Aug 08 10:17:10 workstation systemd[1]: Started ssh.servic
lines 1-18/18 (END)
```

*q*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*

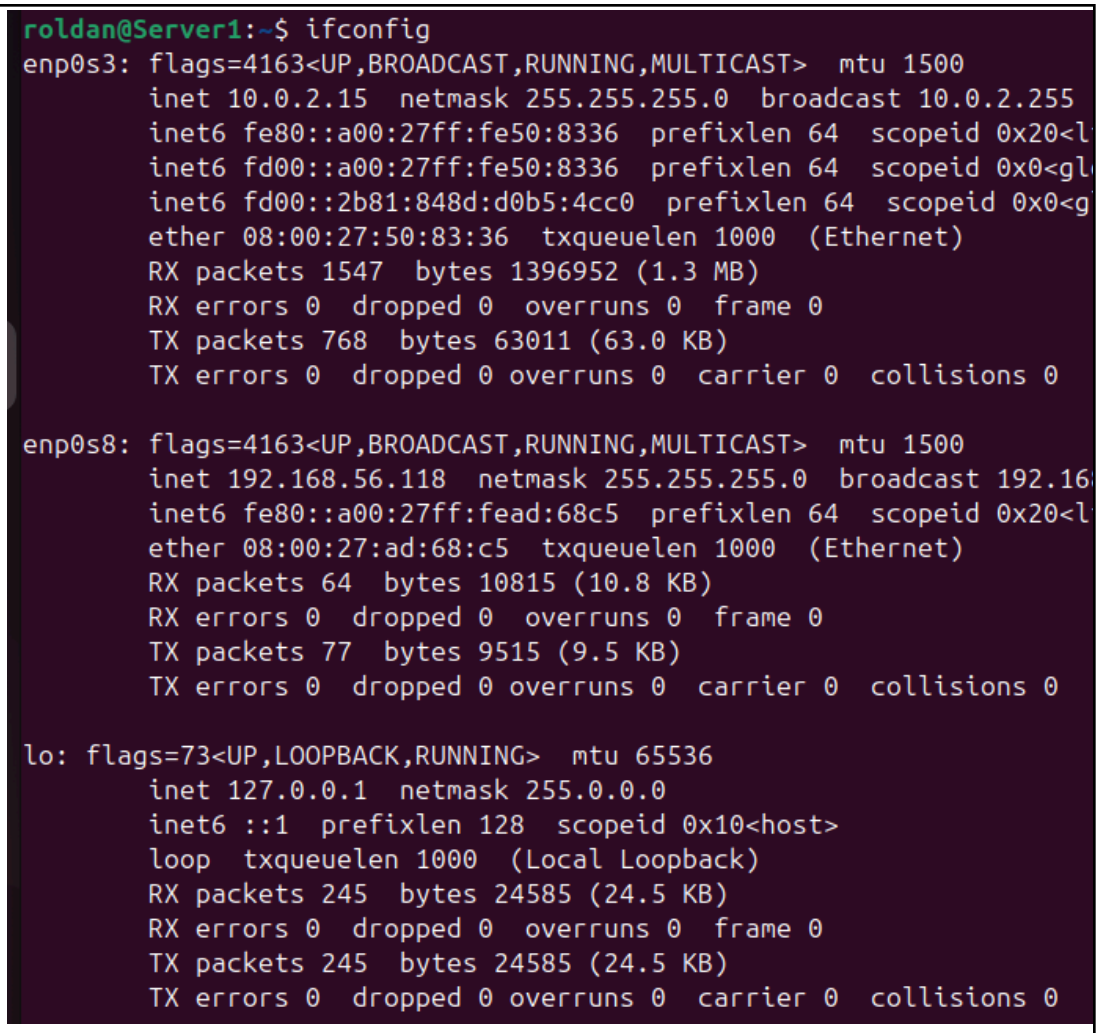
```
roldan@Server1:~$ sudo ufw allow ssh
Rules updated
Rules updated (v6)
roldan@Server1:~$ sudo ufw enable
Firewall is active and enabled on system startup
roldan@Server1:~$ sudo ufw status
Status: active

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

```
roldan@Server2:~$ sudo ufw allow ssh
Rules updated
Rules updated (v6)
roldan@Server2:~$ sudo ufw enable
Firewall is active and enabled on system startup
roldan@Server2:~$ sudo ufw status
Status: active

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

roldan@Server2:~$
```

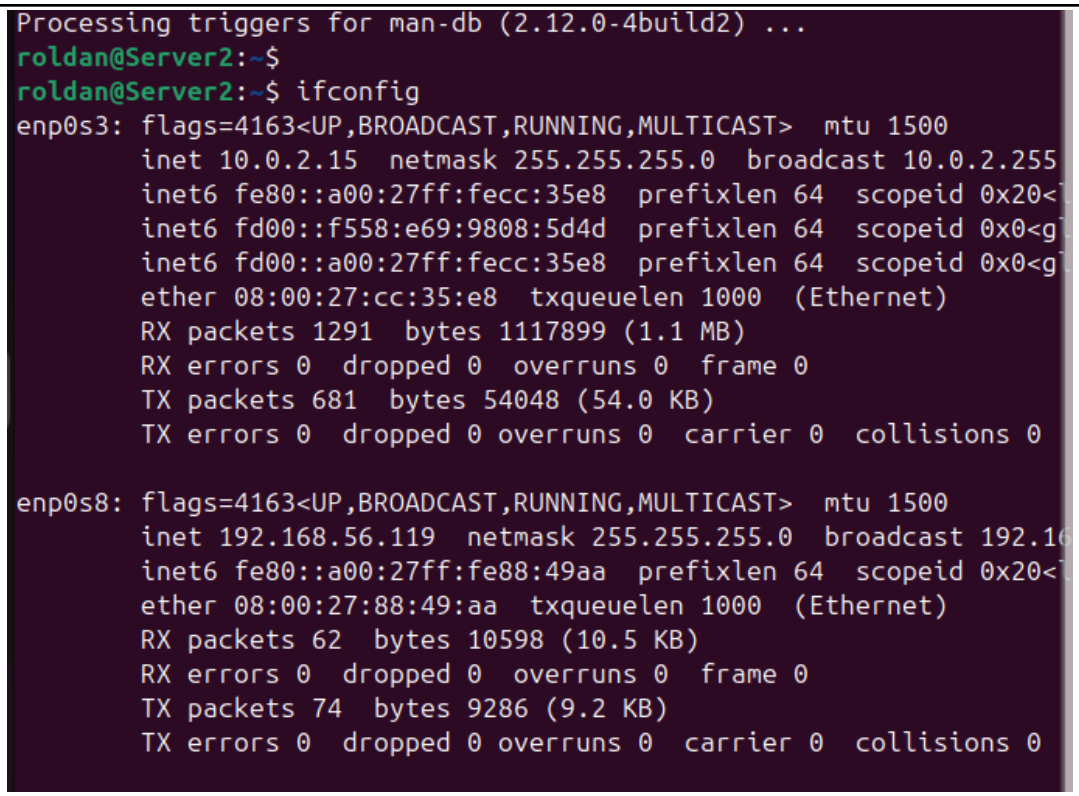
Task 3: Verify network settings on Server 1, Server 2, and Local Machine. On each device, do the following:

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.

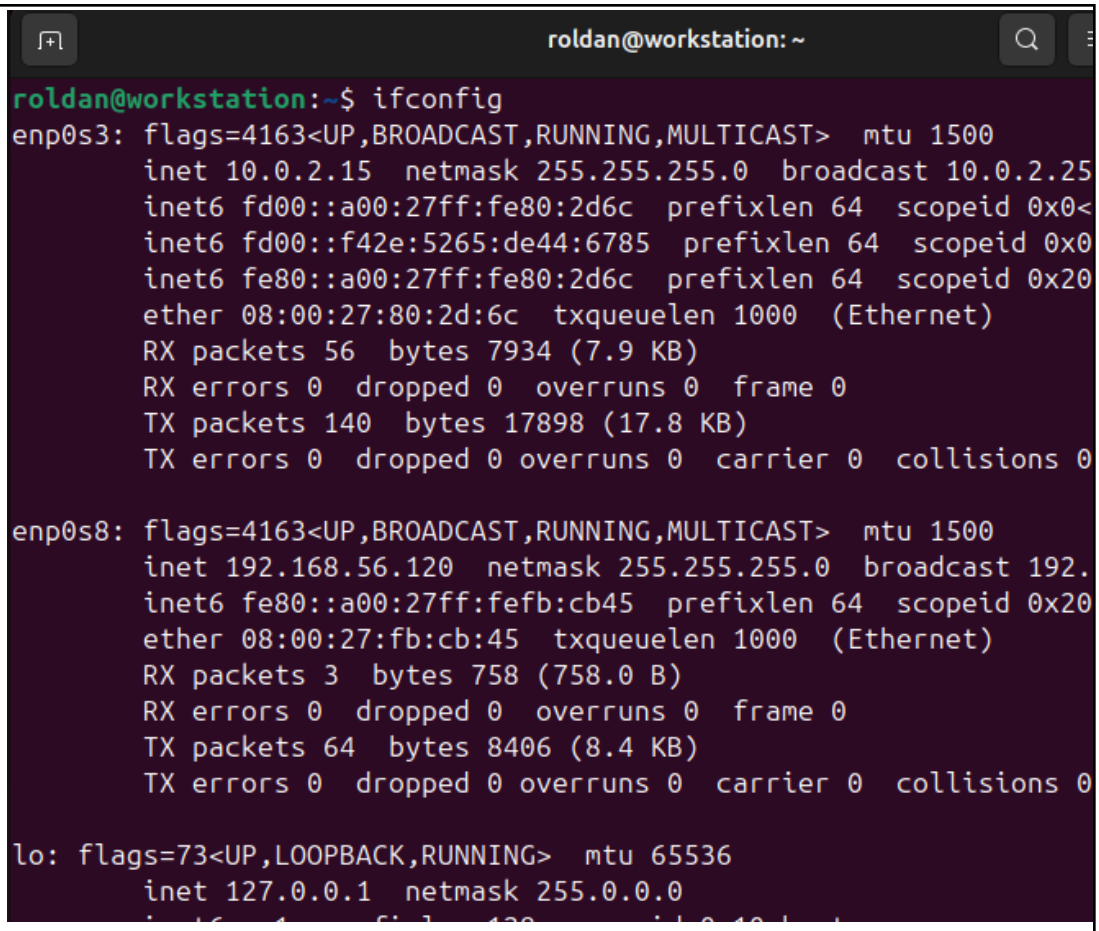
   1.1 Server 1 IP address: 192.168.56.**118**



1.2 Server 2 IP address: 192.168.56.**119**



1.3 workstation IP address: 192.168.56.**120**

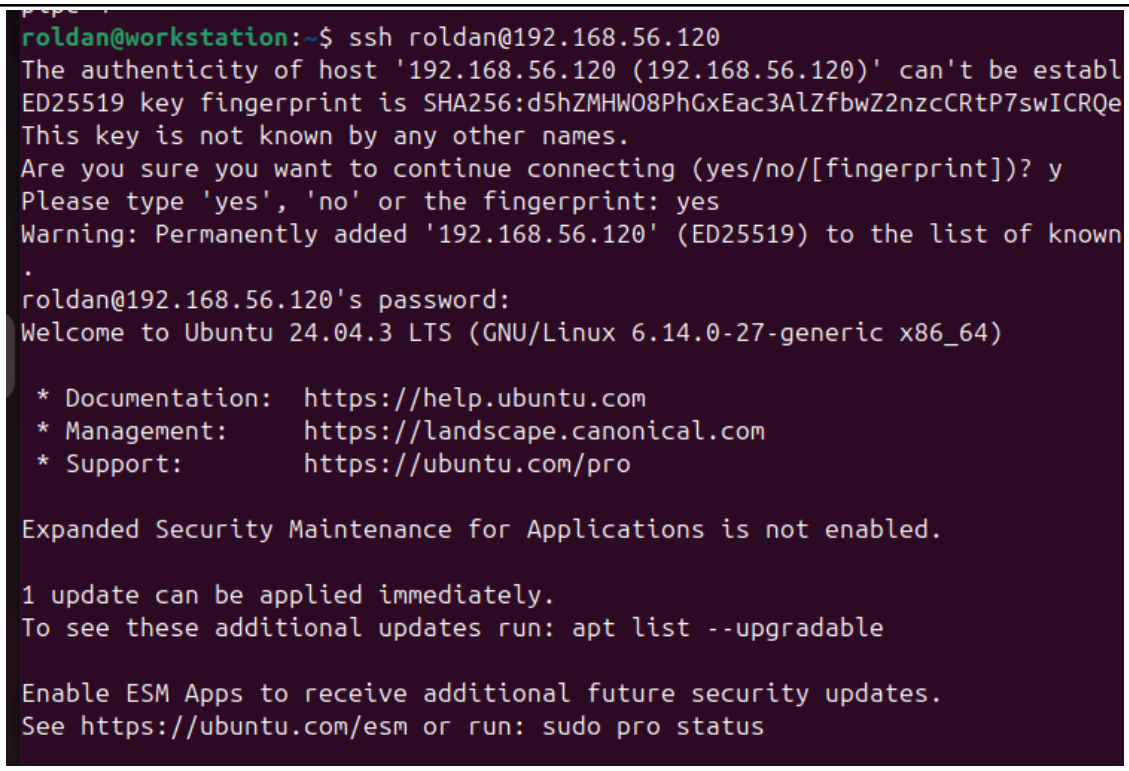


2. Make sure that they can ping each other. pi
    2.1 Connectivity test for Local Machine 1 to Server 1: ☐ Successful ☐ Not Successful
    2.2 Connectivity test for Local Machine 1 to Server 2: ☐ Successful ☐ Not Successful
    2.3 Connectivity test for Server 1 to Server 2: ☐ Successful ☐ Not Successful

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

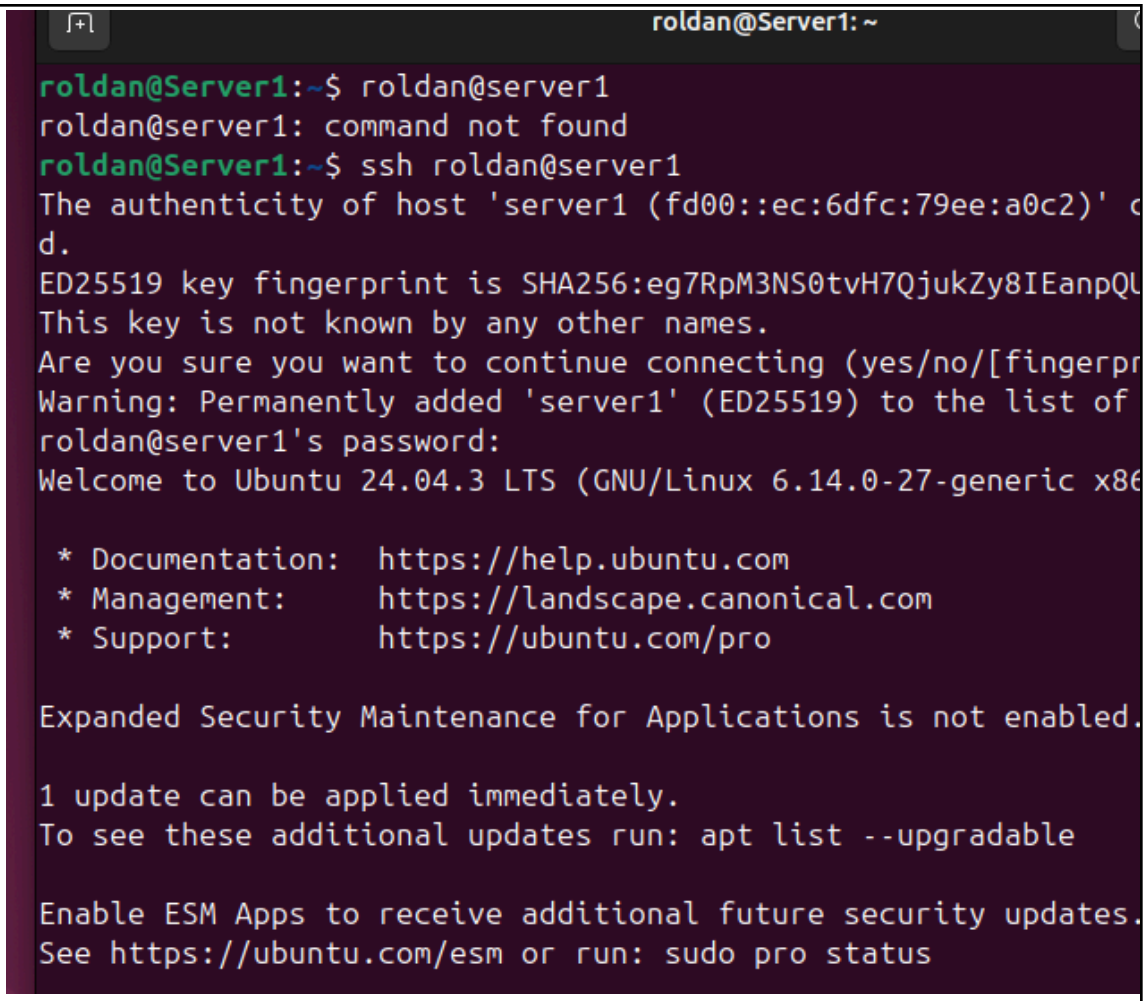
1. On the Local Machine, issue the following commands:

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

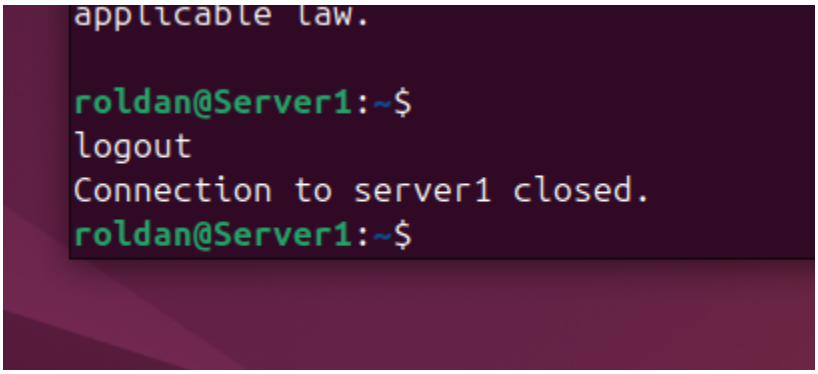


1.2 Enter the password for server 1 when prompted

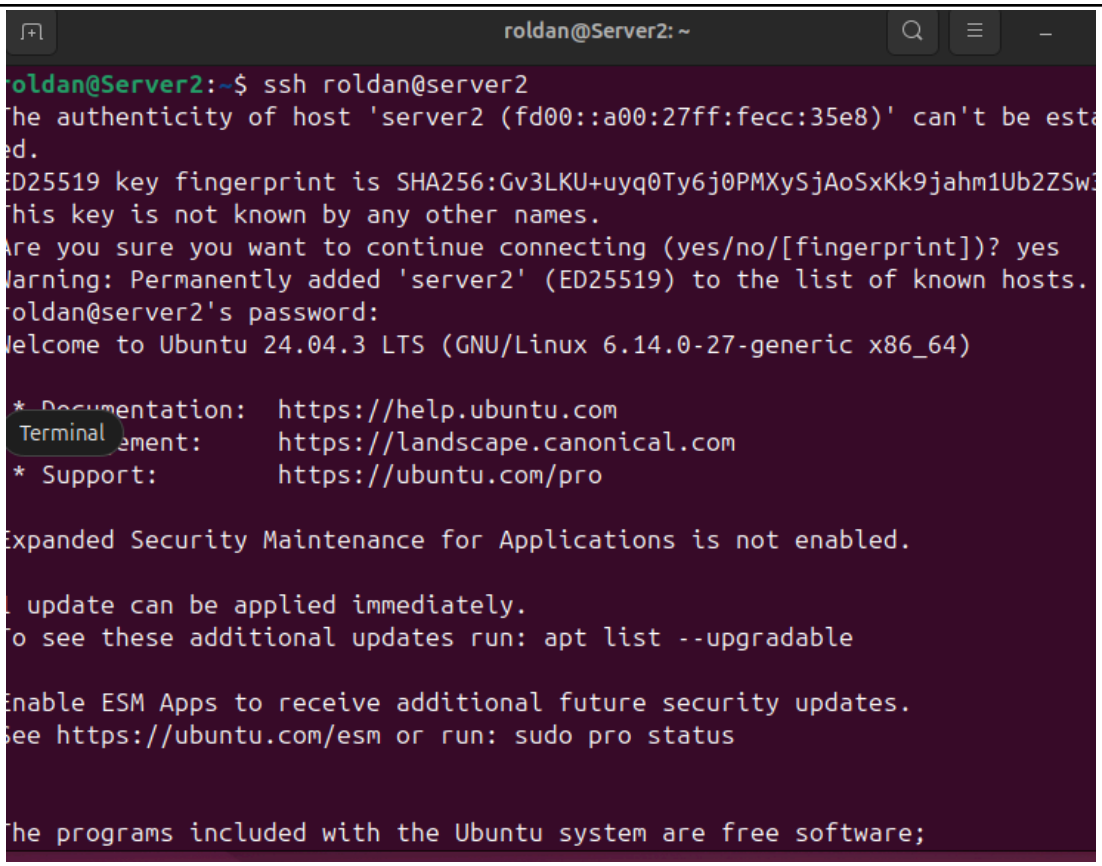
1.3 Verify that you are in server 1. The user should be in this format user@server1. For example, *jvtaylar@server1*

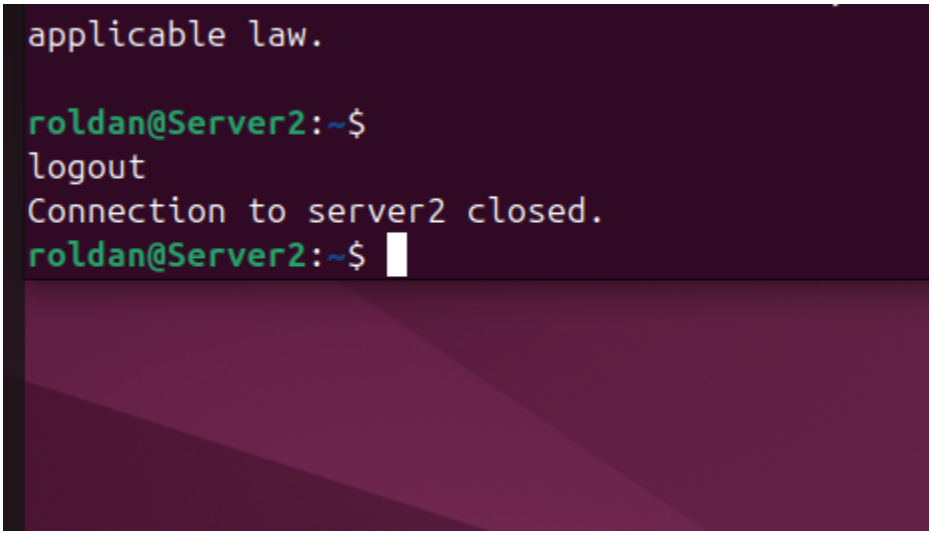


2. Logout of Server 1 by issuing the command *control + D.*



3. Do the same for Server 2.





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.

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.

Reflections:

Answer the following:

1. How are we able to use the hostname instead of IP address in SSH commands?
   - DNS (Domain Name System), where instead of remembering the IP address of a host you refer to a hostname that is easier to remember, rather than entering the numbers yourself.
2. How secured is SSH?
   - The level of SSH security is highly high. It encrypts messages, applies authentication and keeps you and your connection confidential and secure, which is particularly true when configuration is done well.