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<b>Course/Section:</b> CPE31S4	<b>Date Submitted:</b> August 15, 2023
<b>Instructor:</b> Dr. Jonathan V. Taylor	<b>Semester and SY:</b> First Sem, 2023-2024

### Activity 1: Configure Network using Virtual Machines

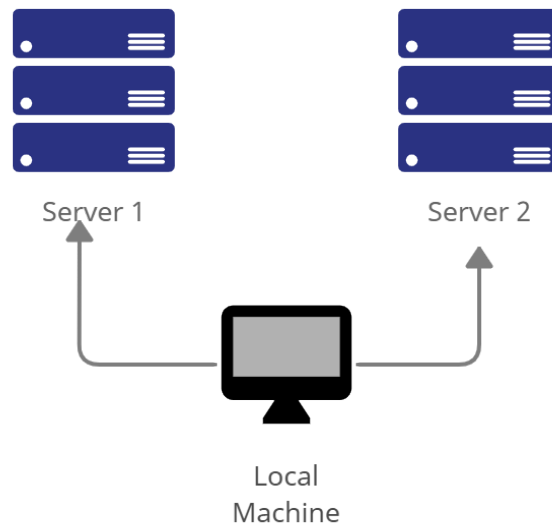
#### 1. Objectives:

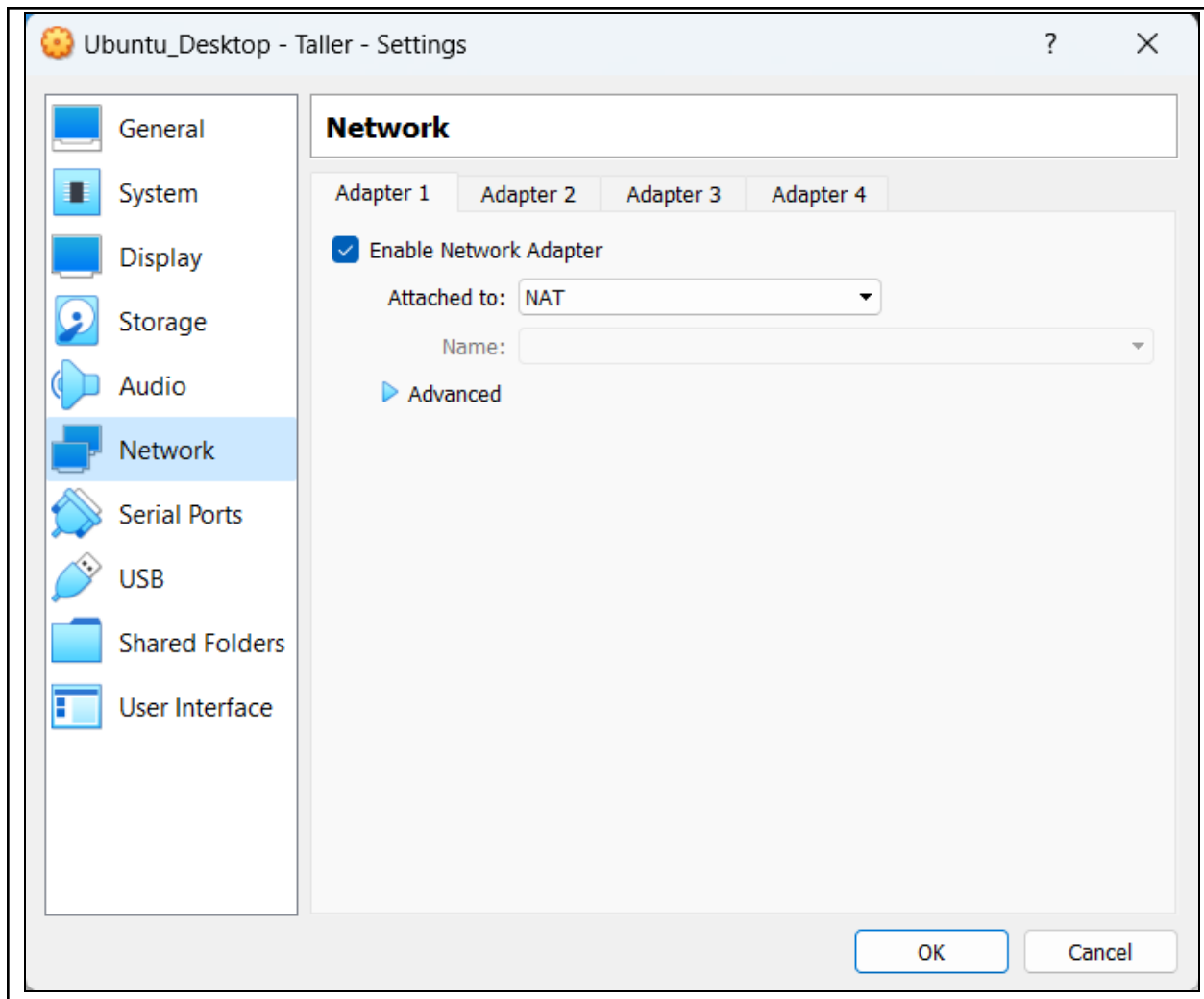
- 1.1. Create and configure Virtual Machines in Microsoft Azure or VirtualBox
- 1.2. Set-up a Virtual Network and Test Connectivity of VMs

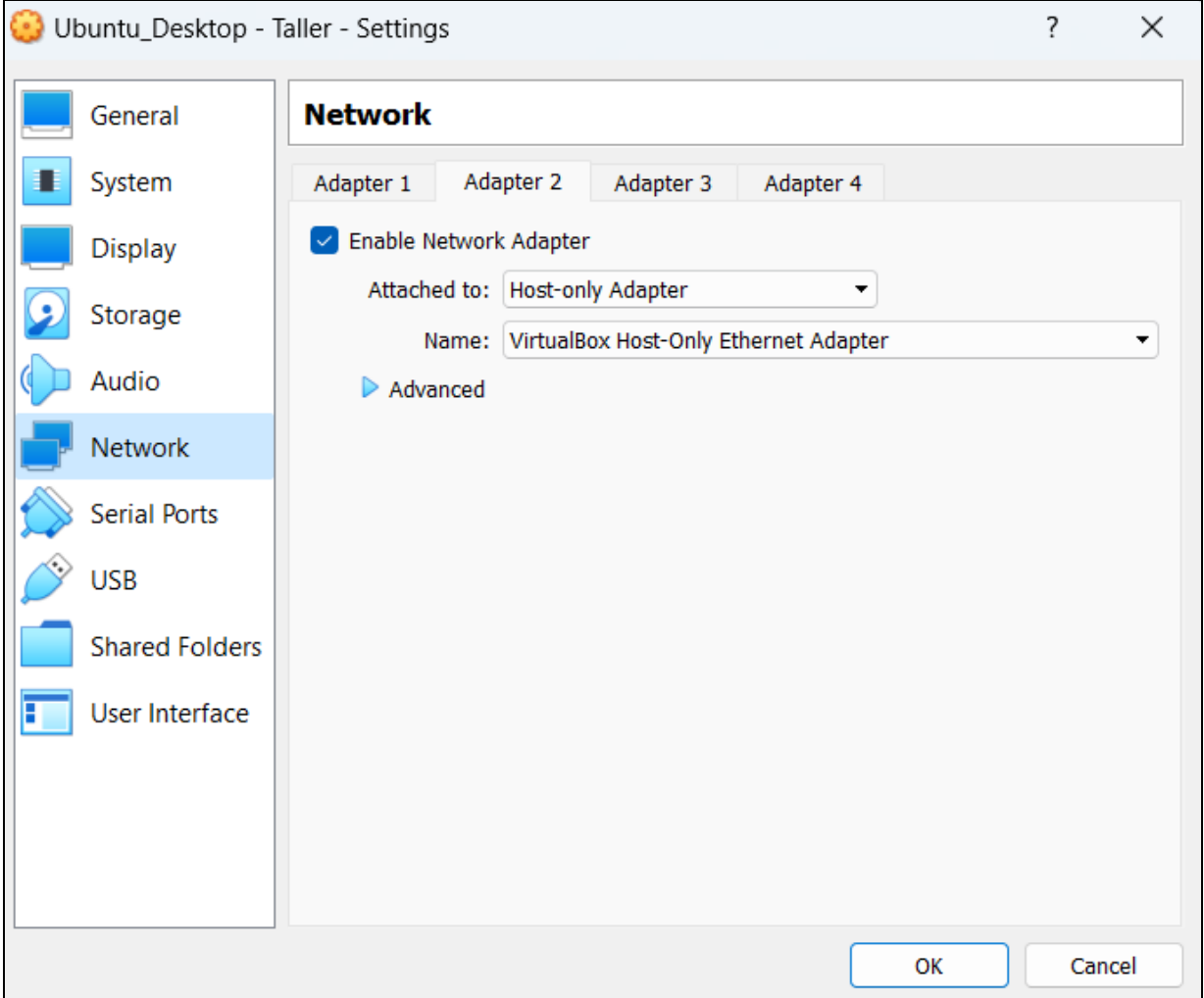
#### 2. Discussion:

##### 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*).







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Clone Virtual Machine

New machine name and path

Please choose a name and optionally a folder for the new virtual machine. The new machine will be a clone of the machine **Ubuntu\_Desktop - Taller**.

Name:

Ubuntu\_S1 - Taller

Path:

C:\Users\Roseann\VirtualBox VMs

▼

MAC Address Policy:

Generate new MAC addresses for all network adapters ▼

Additional Options:

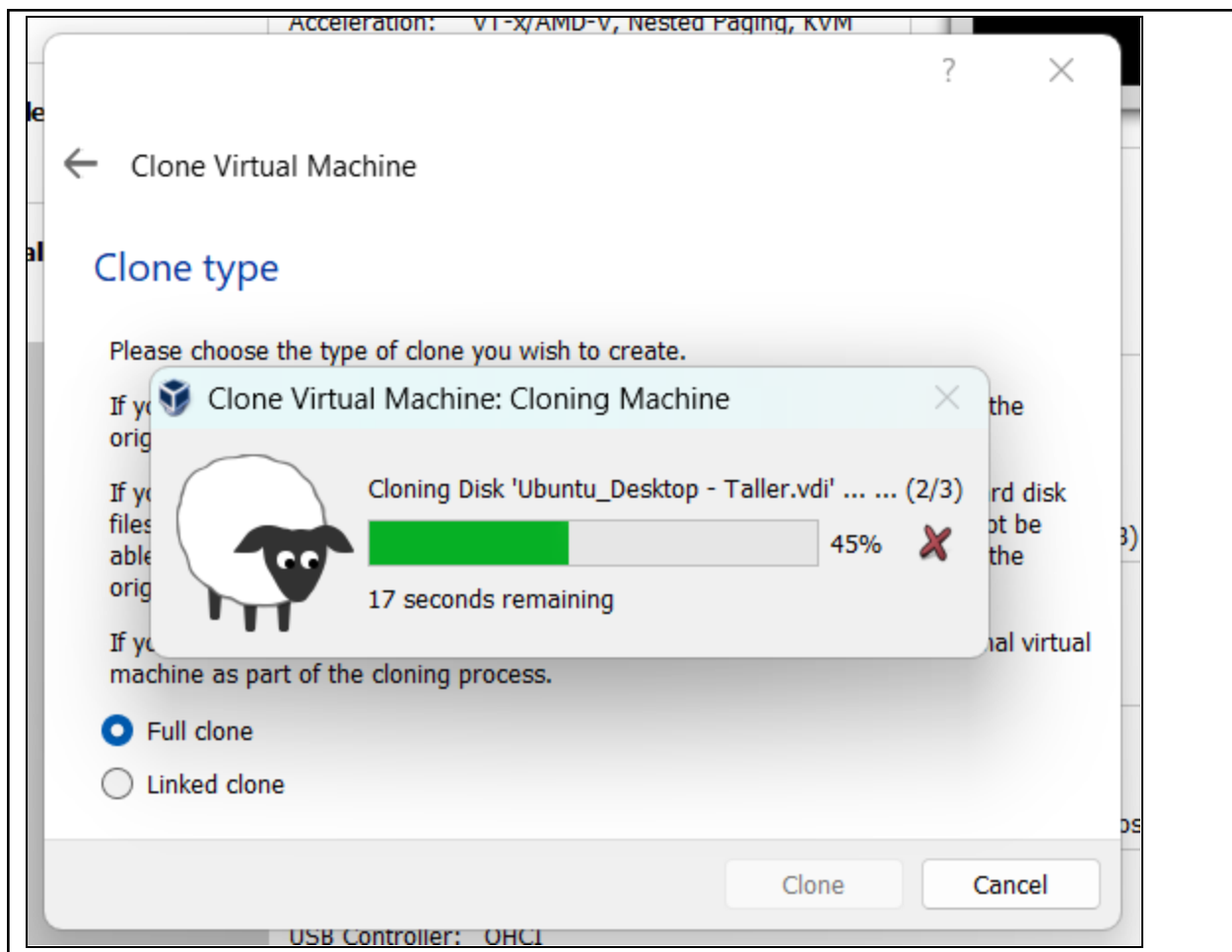
☐ Keep Disk Names

☐ Keep Hardware UUIDs

Expert Mode

Next

Cancel



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← Clone Virtual Machine

New machine name and path

Please choose a name and optionally a folder for the new virtual machine. The new machine will be a clone of the machine **Ubuntu\_Desktop - Taller**.

Name:

Path:

MAC Address Policy:

Additional Options: ☐ Keep Disk Names  
☐ Keep Hardware UUIDs

Expert Mode

Next

Cancel

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Clone Virtual Machine

Clone type

Please choose the type of clone you wish to create.

If you choose **Full clone**, an exact copy (including all virtual hard disk files) of the original virtual machine will be created.

If you choose **Linked clone**, a new machine will be created, but the virtual hard disk files will be tied to the virtual hard disk files of original machine and you will not be able to move the new virtual machine to a different computer without moving the original as well.

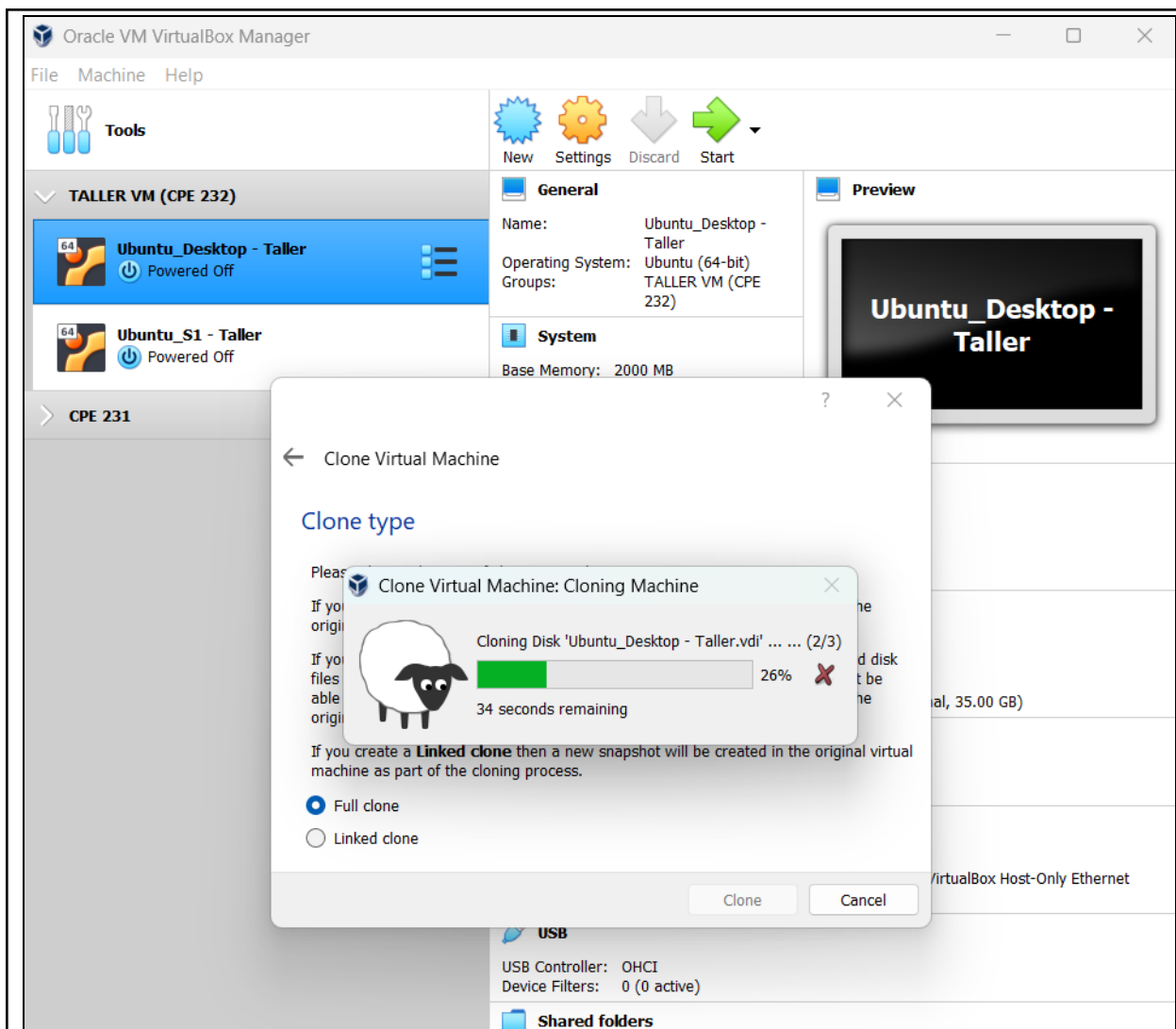
If you create a **Linked clone** then a new snapshot will be created in the original virtual machine as part of the cloning process.

☒ Full clone

☐ Linked clone

Clone

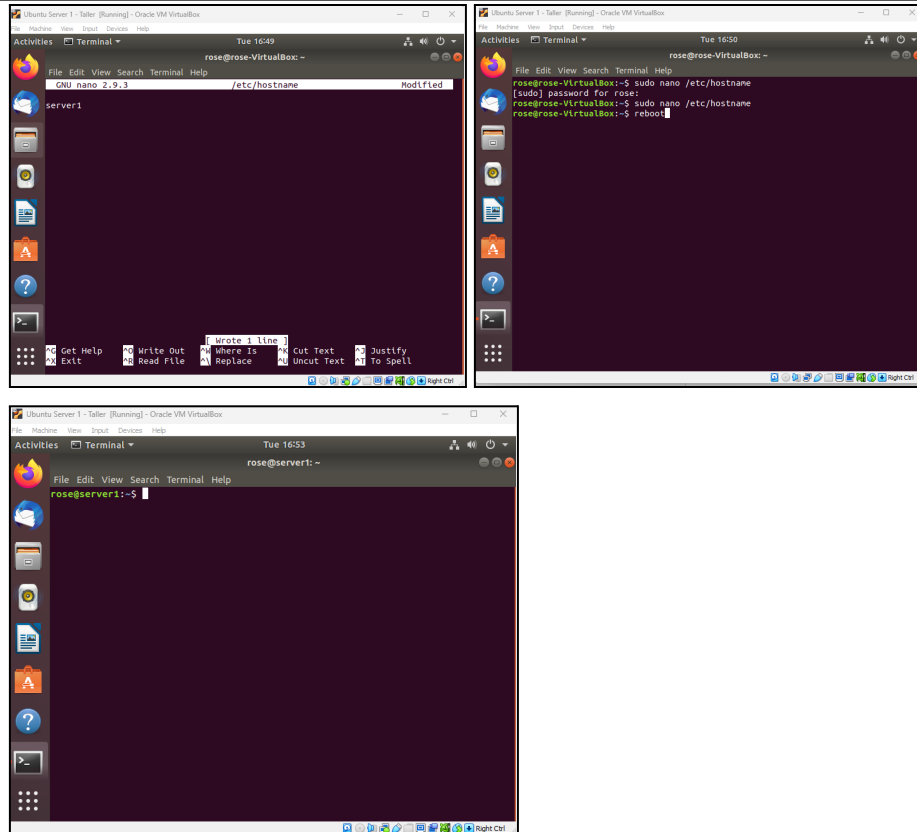
Cancel



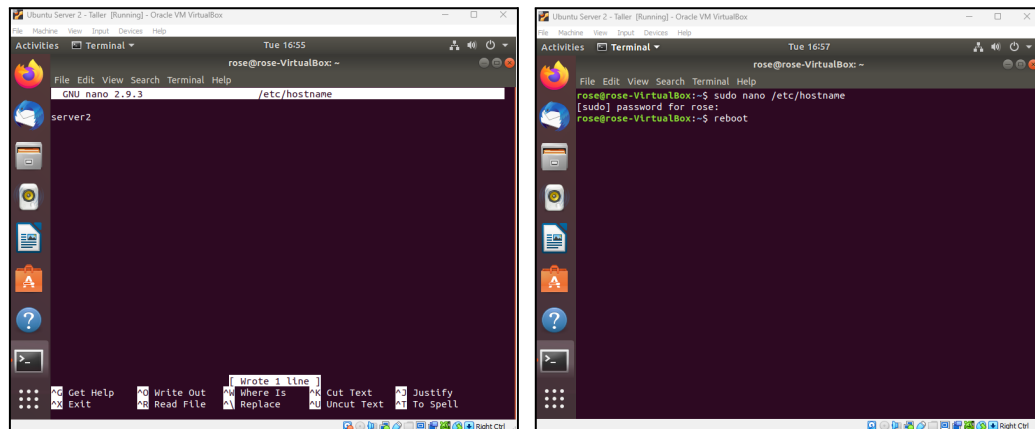
**Task 1:** Do the following on Server 1, Server 2, and Local Machine. In editing the file using nano command, press control + O to write out (save the file). Press enter when asked for the name of the file. Press control + X to end.

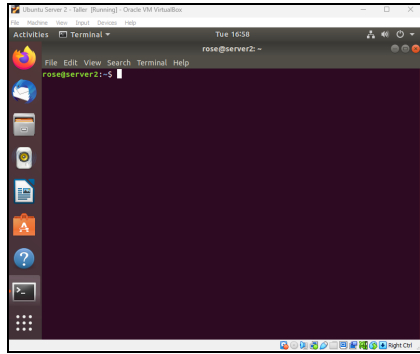
1. Change the hostname using the command *sudo nano /etc/hostname*  
1.1 Use server1 for Server 1



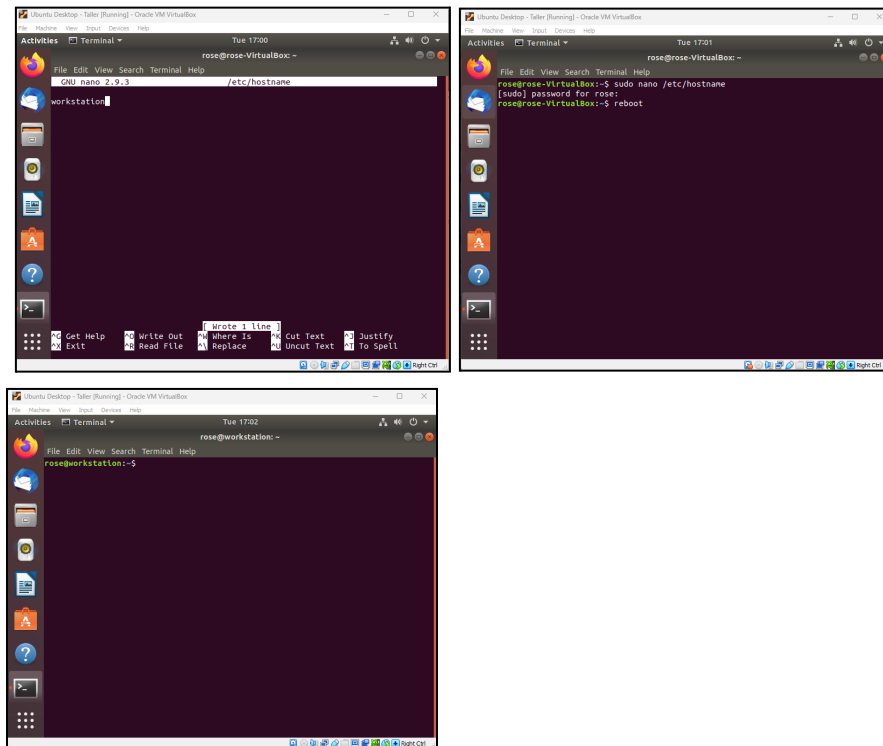


## 1.2 Use server2 for Server 2

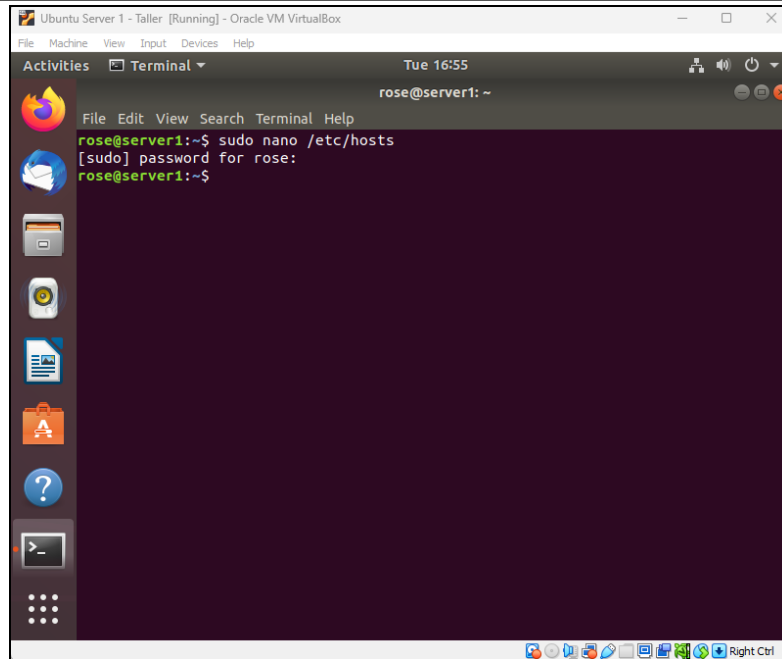




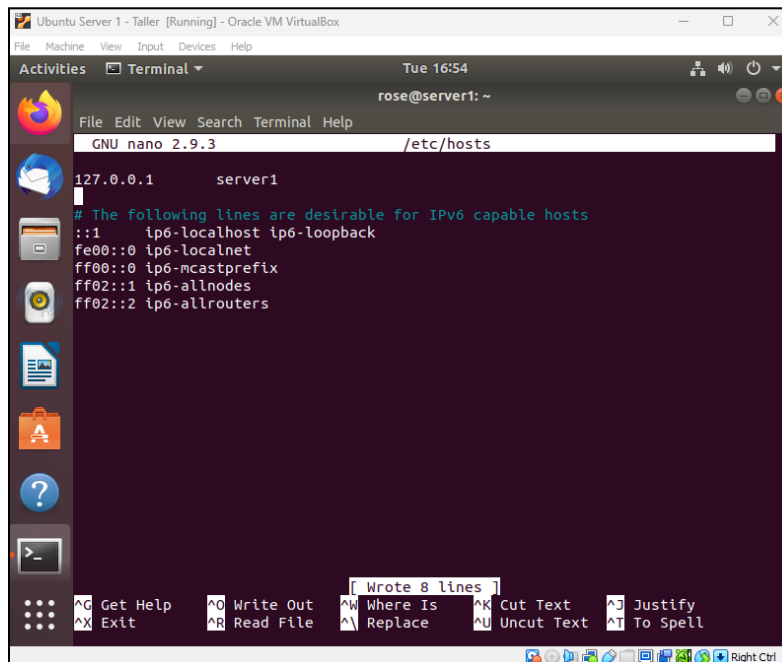
### 1.3 Use workstation for the Local Machine



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



```
Ubuntu Server 1 - Taller [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal Tue 16:55
rose@server1: ~
File Edit View Search Terminal Help
rose@server1:~$ sudo nano /etc/hosts
[sudo] password for rose:
rose@server1:~$
```



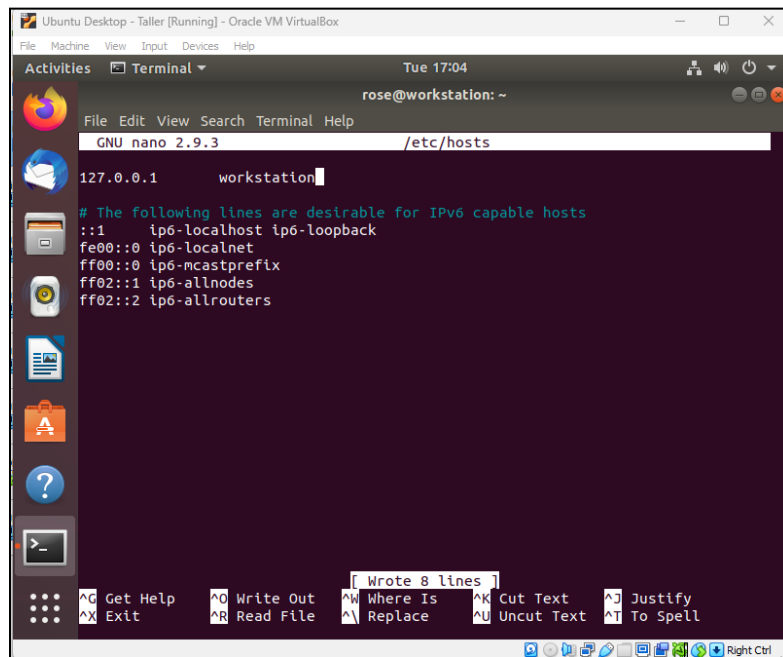
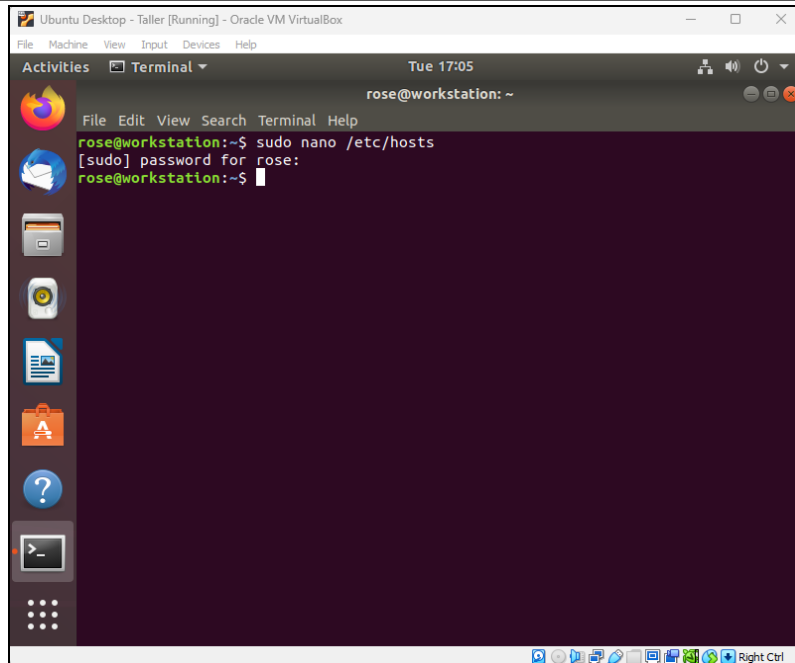
```
Ubuntu Server 1 - Taller [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal Tue 16:54
rose@server1: ~
GNU nano 2.9.3 /etc/hosts
127.0.0.1 server1
# The following lines are desirable for IPv6 capable hosts
::1 ip6-localhost ip6-loopback
fe00::0 ip6-localnet
ff00::0 ip6-mcastprefix
ff02::1 ip6-allnodes
ff02::2 ip6-allrouters
Wrote 8 lines
^G Get Help ^O Write Out ^W Where Is ^K Cut Text ^J Justify
^X Exit ^R Read File ^A Replace ^U Uncut Text ^T To Spell
```

2.2 Type 127.0.0.1 server 2 for Server 2

```
Ubuntu Server 2 - Taller [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal Tue 17:09
rose@server2: ~
File Edit View Search Terminal Help
rose@server2:~$ sudo nano /etc/hosts
[sudo] password for rose:
rose@server2:~$
```

```
Ubuntu Server 2 - Taller [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal Tue 17:08
rose@server2: ~
GNU nano 2.9.3 /etc/hosts
127.0.0.1 server2
# 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
[ Wrote 8 lines ]
^G Get Help ^O Write Out ^W Where Is ^K Cut Text ^J Justify
^X Exit ^R Read File ^_ Replace ^U Uncut Text ^T To Spell
```

## 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:

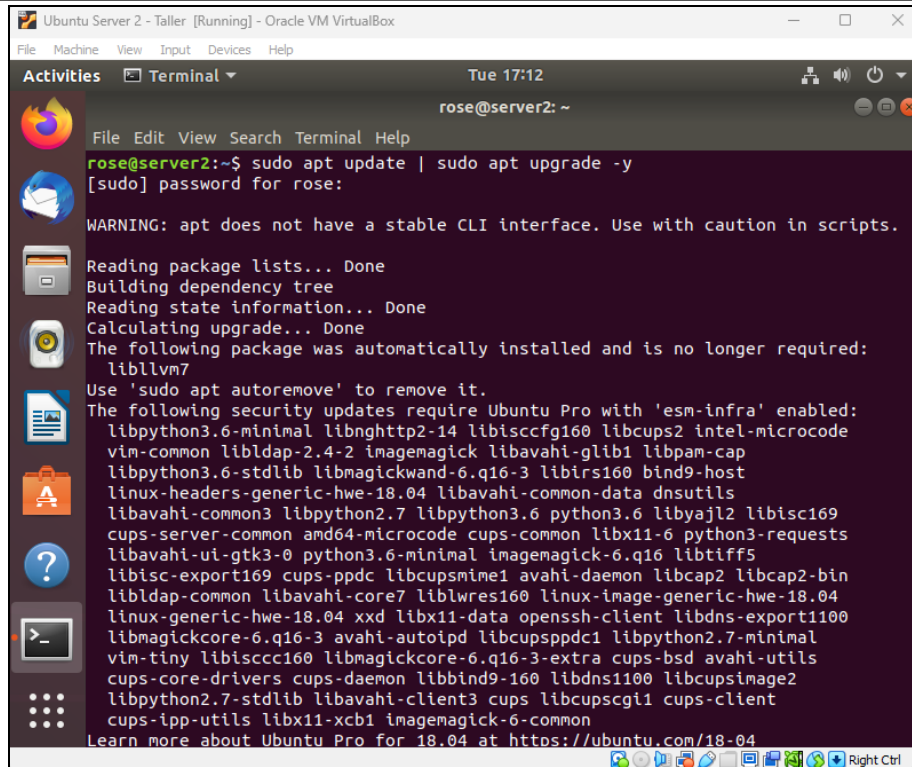
1. Upgrade the packages by issuing the command *sudo apt update* and *sudo apt upgrade* respectively.

```
Ubuntu Desktop - Taller [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal Tue 17:13
rose@workstation: ~
File Edit View Search Terminal Help
rose@workstation:~$ sudo apt update | sudo apt upgrade -y
WARNING: apt does not have a stable CLI interface. Use with caution in scripts.

Reading package lists... Done
Building dependency tree
Reading state information... Done
Calculating upgrade... Done
The following package was automatically installed and is no longer required:
  libllvm7
Use 'sudo apt autoremove' to remove it.
The following security updates require Ubuntu Pro with 'esm-infra' enabled:
libpython3.6-minimal libnghttp2-14 libiscfg160 libcups2 intel-microcode
vim-common libldap-2.4-2 imagemagick libavahi-glib1 libpam-cap
libpython3.6-stdlib libmagickwand-6.q16-3 librs160 bind9-host
linux-headers-generic-hwe-18.04 libavahi-common-data dnsmutils
libavahi-common3 libpython2.7 libpython3.6 python3.6 libyajl2 libisc169
cups-server-common amd64-microcode cups-common libx11-6 python3-requests
libavahi-ui-gtk3-0 python3.6-minimal imagemagick-6.q16 libtiff5
libisc-export169 cups-ppdc libcupsmime1 avahi-daemon libcap2 libcap2-bin
libldap-common libavahi-core7 liblwres160 linux-image-generic-hwe-18.04
linux-generic-hwe-18.04 xxd libx11-data openssh-client libdns-export1100
libmagickcore-6.q16-3 avahi-autoipd libcupsppdc1 libpython2.7-minimal
vim-tiny libisccc160 libmagickcore-6.q16-3-extra cups-bsd avahi-utils
cups-core-drivers cups-daemon libbind9-160 libdns1100 libcupsimage2
libpython2.7-stdlib libavahi-client3 cups libcupscli cups-client
cups-ipp-utils libx11-xcb1 imagemagick-6-common
Learn more about Ubuntu Pro for 18.04 at https://ubuntu.com/18-04
```

```
Ubuntu Server 1 - Taller [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal Tue 17:16
rose@server1: ~
File Edit View Search Terminal Help
rose@server1:~$ sudo apt update | sudo apt upgrade -y
WARNING: apt does not have a stable CLI interface. Use with caution in scripts.

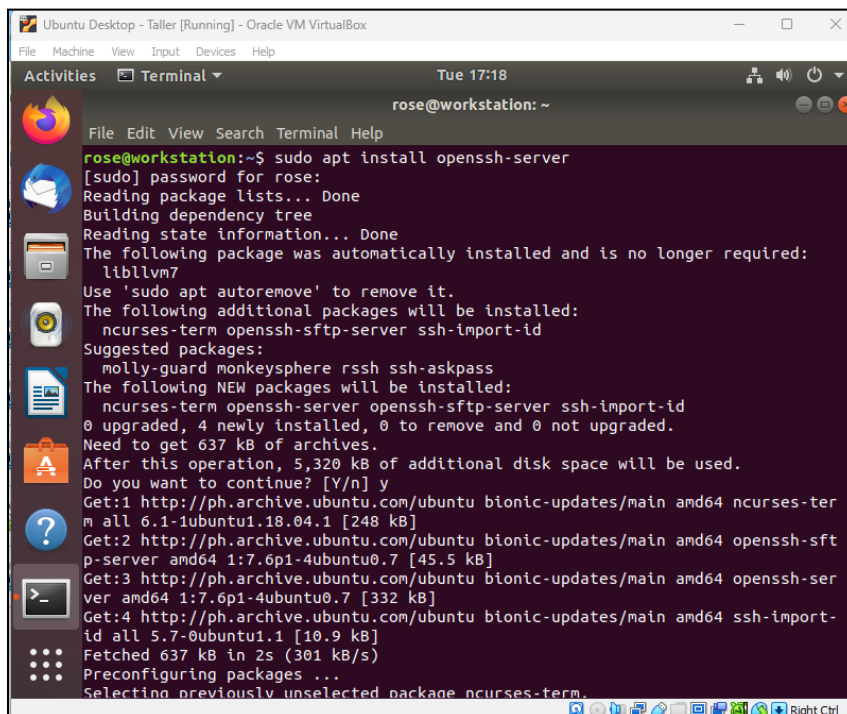
Reading package lists... Done
Building dependency tree
Reading state information... Done
Calculating upgrade... Done
The following package was automatically installed and is no longer required:
  libllvm7
Use 'sudo apt autoremove' to remove it.
The following security updates require Ubuntu Pro with 'esm-infra' enabled:
libpython3.6-minimal libnghttp2-14 libiscfg160 libcups2 intel-microcode
vim-common libldap-2.4-2 imagemagick libavahi-glib1 libpam-cap
libpython3.6-stdlib libmagickwand-6.q16-3 librs160 bind9-host
linux-headers-generic-hwe-18.04 libavahi-common-data dnsmutils
libavahi-common3 libpython2.7 libpython3.6 python3.6 libyajl2 libisc169
cups-server-common amd64-microcode cups-common libx11-6 python3-requests
libavahi-ui-gtk3-0 python3.6-minimal imagemagick-6.q16 libtiff5
libisc-export169 cups-ppdc libcupsmime1 avahi-daemon libcap2 libcap2-bin
libldap-common libavahi-core7 liblwres160 linux-image-generic-hwe-18.04
linux-generic-hwe-18.04 xxd libx11-data openssh-client libdns-export1100
libmagickcore-6.q16-3 avahi-autoipd libcupsppdc1 libpython2.7-minimal
vim-tiny libisccc160 libmagickcore-6.q16-3-extra cups-bsd avahi-utils
cups-core-drivers cups-daemon libbind9-160 libdns1100 libcupsimage2
libpython2.7-stdlib libavahi-client3 cups libcupscli cups-client
cups-ipp-utils libx11-xcb1 imagemagick-6-common
Learn more about Ubuntu Pro for 18.04 at https://ubuntu.com/18-04
```



```
Ubuntu Server 2 - Taller [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal Tue 17:12
rose@server2: ~
File Edit View Search Terminal Help
rose@server2:~$ sudo apt update | sudo apt upgrade -y
[sudo] password for rose:
WARNING: apt does not have a stable CLI interface. Use with caution in scripts.

Reading package lists... Done
Building dependency tree
Reading state information... Done
Calculating upgrade... Done
The following package was automatically installed and is no longer required:
  libllvm7
Use 'sudo apt autoremove' to remove it.
The following security updates require Ubuntu Pro with 'esm-infra' enabled:
libpython3.6-minimal libnghttp2-14 libiscfg160 libcups2 intel-microcode
vim-common libldap-2.4-2 imagemagick libavahi-glib1 libpam-cap
libpython3.6-stdlib libmagickwand-6.q16-3 libirs160 bind9-host
linux-headers-generic-hwe-18.04 libavahi-common-data dnsmutils
libavahi-common3 libpython2.7 libpython3.6 python3.6 libyajl2 libisc169
cups-server-common amd64-microcode cups-common libx11-6 python3-requests
libavahi-ui-gtk3-0 python3.6-minimal imagemagick-6.q16 libtiff5
libisc-export169 cups-ppdc libcupsmime1 avahi-daemon libcap2 libcap2-bin
libldap-common libavahi-core7 liblwres160 linux-image-generic-hwe-18.04
linux-generic-hwe-18.04 xxd libx11-data openssh-client libdns-export1100
libmagickcore-6.q16-3 avahi-autoipd libcupsppdc1 libpython2.7-minimal
vim-tiny libisc160 libmagickcore-6.q16-3-extra cups-bsd avahi-utils
cups-core-drivers cups-daemon libbind9-160 libdns1100 libcupsimage2
libpython2.7-stdlib libavahi-client3 cups libcupsd1 cups-client
cups-ipp-utils libx11-xcb1 imagemagick-6-common
Learn more about Ubuntu Pro for 18.04 at https://ubuntu.com/18-04
```

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



```
Ubuntu Desktop - Taller [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal Tue 17:18
rose@workstation: ~
File Edit View Search Terminal Help
rose@workstation:~$ sudo apt install openssh-server
[sudo] password for rose:
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following package was automatically installed and is no longer required:
  libllvm7
Use 'sudo apt autoremove' to remove it.
The following additional packages will be installed:
  ncurses-term openssh-sftp-server ssh-import-id
Suggested packages:
  molly-guard monkeysphere rssh 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 637 kB of archives.
After this operation, 5,320 kB of additional disk space will be used.
Do you want to continue? [Y/n] y
Get:1 http://ph.archive.ubuntu.com/ubuntu bionic-updates/main amd64 ncurses-ter
m all 6.1-1ubuntu1.18.04.1 [248 kB]
Get:2 http://ph.archive.ubuntu.com/ubuntu bionic-updates/main amd64 openssh-sft
p-server amd64 1:7.6p1-4ubuntu0.7 [45.5 kB]
Get:3 http://ph.archive.ubuntu.com/ubuntu bionic-updates/main amd64 openssh-ser
ver amd64 1:7.6p1-4ubuntu0.7 [332 kB]
Get:4 http://ph.archive.ubuntu.com/ubuntu bionic-updates/main amd64 ssh-import-
id all 5.7-0ubuntu1.1 [10.9 kB]
Fetched 637 kB in 2s (301 kB/s)
Preconfiguring packages ...
Selecting previously unselected package ncurses-term.
```

```
Ubuntu_S1 - Taller [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal
You have the Auto capture keyboard option turned on. This will cause the Virtual Machine to automatically capture the
rose@server1:~
File Edit View Search Terminal Help
rose@server1:~$ sudo apt install openssh-server
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  ncurses-term openssh-sftp-server ssh-import-id
Suggested packages:
  molly-guard monkeysphere rssh 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 637 kB of archives.
After this operation, 5,320 kB of additional disk space will be used.
Do you want to continue? [Y/n] y
Get:1 http://ph.archive.ubuntu.com/ubuntu bionic-updates/main amd64 ncurses-ter
m all 6.1-1ubuntu1.18.04.1 [248 kB]
Get:2 http://ph.archive.ubuntu.com/ubuntu bionic-updates/main amd64 openssh-sft
p-server amd64 1:7.6p1-4ubuntu0.7 [45.5 kB]
Get:3 http://ph.archive.ubuntu.com/ubuntu bionic-updates/main amd64 openssh-ser
ver amd64 1:7.6p1-4ubuntu0.7 [332 kB]
Get:4 http://ph.archive.ubuntu.com/ubuntu bionic-updates/main amd64 ssh-import-
id all 5.7-0ubuntu1.1 [10.9 kB]
Fetched 637 kB in 1s (1,185 kB/s)
Preconfiguring packages ...
Selecting previously unselected package ncurses-term.
(Reading database ... 162397 files and directories currently installed.)
Preparing to unpack .../ncurses-term_6.1-1ubuntu1.18.04.1_all.deb ...
Unpacking ncurses-term (6.1-1ubuntu1.18.04.1) ...
Selecting previously unselected package openssh-sftp-server.
```

```
Ubuntu_S2 - Taller [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal
You have the Auto capture keyboard option turned on. This will cause the Virtual Machine to automatically capture the
rose@server2:~
File Edit View Search Terminal Help
rose@server2:~$ sudo apt install openssh-server
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  ncurses-term openssh-sftp-server ssh-import-id
Suggested packages:
  molly-guard monkeysphere rssh 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 637 kB of archives.
After this operation, 5,320 kB of additional disk space will be used.
Do you want to continue? [Y/n] y
Get:1 http://ph.archive.ubuntu.com/ubuntu bionic-updates/main amd64 ncurses-ter
m all 6.1-1ubuntu1.18.04.1 [248 kB]
Get:2 http://ph.archive.ubuntu.com/ubuntu bionic-updates/main amd64 openssh-sft
p-server amd64 1:7.6p1-4ubuntu0.7 [45.5 kB]
Get:3 http://ph.archive.ubuntu.com/ubuntu bionic-updates/main amd64 openssh-ser
ver amd64 1:7.6p1-4ubuntu0.7 [332 kB]
Get:4 http://ph.archive.ubuntu.com/ubuntu bionic-updates/main amd64 ssh-import-
id all 5.7-0ubuntu1.1 [10.9 kB]
Fetched 637 kB in 1s (1,183 kB/s)
Preconfiguring packages ...
Selecting previously unselected package ncurses-term.
(Reading database ... 162397 files and directories currently installed.)
Preparing to unpack .../ncurses-term_6.1-1ubuntu1.18.04.1_all.deb ...
Unpacking ncurses-term (6.1-1ubuntu1.18.04.1) ...
Selecting previously unselected package openssh-sftp-server.
```

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*



```
rose@workstation:~$ sudo service ssh start
rose@workstation:~$ sudo systemctl status ssh
● ssh.service - OpenBSD Secure Shell server
   Loaded: loaded (/lib/systemd/system/ssh.service; enabled; vendor preset: ena
   Active: active (running) since Tue 2023-08-15 17:17:48 PST; 1min 30s ago
   Main PID: 2952 (sshd)
     Tasks: 1 (limit: 2260)
    CGroup: /system.slice/ssh.service
            └─2952 /usr/sbin/sshd -D

Aug 15 17:17:48 workstation systemd[1]: Starting OpenBSD Secure Shell server...
Aug 15 17:17:48 workstation sshd[2952]: Server listening on 0.0.0.0 port 22.
Aug 15 17:17:48 workstation sshd[2952]: Server listening on :: port 22.
Aug 15 17:17:48 workstation systemd[1]: Started OpenBSD Secure Shell server.
rose@workstation:~$
```

```
rose@server1:~$ sudo service ssh start
rose@server1:~$ sudo systemctl status ssh
● ssh.service - OpenBSD Secure Shell server
   Loaded: loaded (/lib/systemd/system/ssh.service; enabled; vendor preset: ena
   Active: active (running) since Tue 2023-08-15 01:01:28 PST; 1min 17s ago
   Main PID: 6070 (sshd)
     Tasks: 1 (limit: 2276)
    CGroup: /system.slice/ssh.service
            └─6070 /usr/sbin/sshd -D

Aug 15 01:01:28 server1 systemd[1]: Starting OpenBSD Secure Shell server...
Aug 15 01:01:28 server1 sshd[6070]: Server listening on 0.0.0.0 port 22.
Aug 15 01:01:28 server1 systemd[1]: Started OpenBSD Secure Shell server.
Aug 15 01:01:28 server1 sshd[6070]: Server listening on :: port 22.
rose@server1:~$
```

```
rose@server2:~$ sudo service ssh start
rose@server2:~$ sudo systemctl status ssh
● ssh.service - OpenBSD Secure Shell server
   Loaded: loaded (/lib/systemd/system/ssh.service; enabled; vendor preset: ena
   Active: active (running) since Tue 2023-08-15 01:10:41 PST; 54s ago
   Main PID: 4936 (sshd)
     Tasks: 1 (limit: 2276)
    CGroup: /system.slice/ssh.service
            └─4936 /usr/sbin/sshd -D

Aug 15 01:10:41 server2 systemd[1]: Starting OpenBSD Secure Shell server...
Aug 15 01:10:41 server2 sshd[4936]: Server listening on 0.0.0.0 port 22.
Aug 15 01:10:41 server2 systemd[1]: Started OpenBSD Secure Shell server.
Aug 15 01:10:41 server2 sshd[4936]: Server listening on :: port 22.
rose@server2:~$
```

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*

```

rose@workstation:~$ sudo ufw allow ssh
Rules updated
Rules updated (v6)
rose@workstation:~$ sudo ufw allow enable
ERROR: Could not find a profile matching 'enable'
rose@workstation:~$ sudo ufw enable
Firewall is active and enabled on system startup
rose@workstation:~$ sudo ufw allow ssh
Skipping adding existing rule
Skipping adding existing rule (v6)
rose@workstation:~$ sudo ufw status
Status: active

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

```

```

rose@server1:~$ sudo ufw allow ssh
Rules updated
Rules updated (v6)
rose@server1:~$ sudo ufw enable
Firewall is active and enabled on system startup
rose@server1:~$ sudo ufw status
Status: active

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

```

```

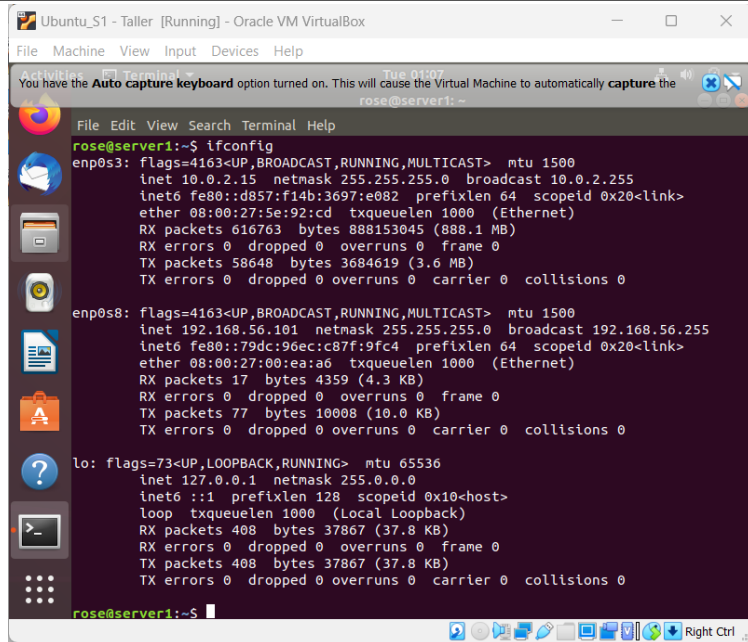
rose@server2:~$ sudo ufw allow ssh
Rules updated
Rules updated (v6)
rose@server2:~$ sudo ufw enable
Firewall is active and enabled on system startup
rose@server2:~$ sudo ufw status
Status: active

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 Server 1 IP address: 192.168.56.101



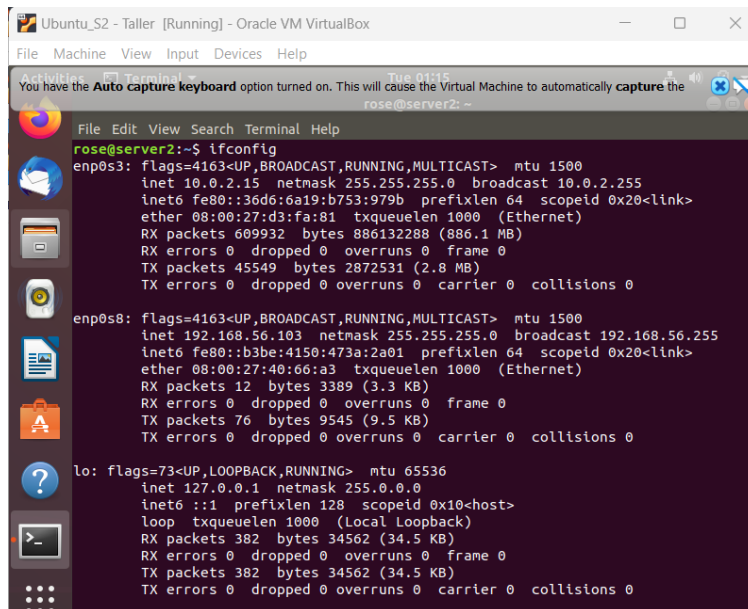
```
Ubuntu_S1 - Taller [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
You have the Auto capture keyboard option turned on. This will cause the Virtual Machine to automatically capture the
Tue 01:07
rose@server1:~$ ifconfig
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 10.0.2.15 netmask 255.255.255.0 broadcast 10.0.2.255
    inet6 fe80::d857:f14b:3697:e082 prefixlen 64 scopeid 0x20<link>
    ether 08:00:27:5e:92:cd txqueuelen 1000 (Ethernet)
    RX packets 616763 bytes 888153045 (888.1 MB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 58648 bytes 3684619 (3.6 MB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

enp0s8: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.56.101 netmask 255.255.255.0 broadcast 192.168.56.255
    inet6 fe80::79dc:96ec:c87f:9fc4 prefixlen 64 scopeid 0x20<link>
    ether 08:00:27:00:ea:a6 txqueuelen 1000 (Ethernet)
    RX packets 17 bytes 4359 (4.3 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 77 bytes 10008 (10.0 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
    inet 127.0.0.1 netmask 255.0.0.0
    inet6 ::1 prefixlen 128 scopeid 0x10<host>
    loop txqueuelen 1000 (Local Loopback)
    RX packets 408 bytes 37867 (37.8 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 408 bytes 37867 (37.8 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

rose@server1:~$
```

## 1.2 Server 2 IP address: 192.168.56.103



```
Ubuntu_S2 - Taller [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
You have the Auto capture keyboard option turned on. This will cause the Virtual Machine to automatically capture the
Tue 01:15
rose@server2:~$ ifconfig
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 10.0.2.15 netmask 255.255.255.0 broadcast 10.0.2.255
    inet6 fe80::36d6:6a19:b753:979b prefixlen 64 scopeid 0x20<link>
    ether 08:00:27:d3:fa:81 txqueuelen 1000 (Ethernet)
    RX packets 609932 bytes 886132288 (886.1 MB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 45549 bytes 2872531 (2.8 MB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

enp0s8: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.56.103 netmask 255.255.255.0 broadcast 192.168.56.255
    inet6 fe80::b3be:4150:473a:2a01 prefixlen 64 scopeid 0x20<link>
    ether 08:00:27:40:66:a3 txqueuelen 1000 (Ethernet)
    RX packets 12 bytes 3389 (3.3 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 76 bytes 9545 (9.5 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
    inet 127.0.0.1 netmask 255.0.0.0
    inet6 ::1 prefixlen 128 scopeid 0x10<host>
    loop txqueuelen 1000 (Local Loopback)
    RX packets 382 bytes 34562 (34.5 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 382 bytes 34562 (34.5 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

rose@server2:~$
```

## 1.3 Server 3 (*Local Machine*) IP address: 192.168.56.102

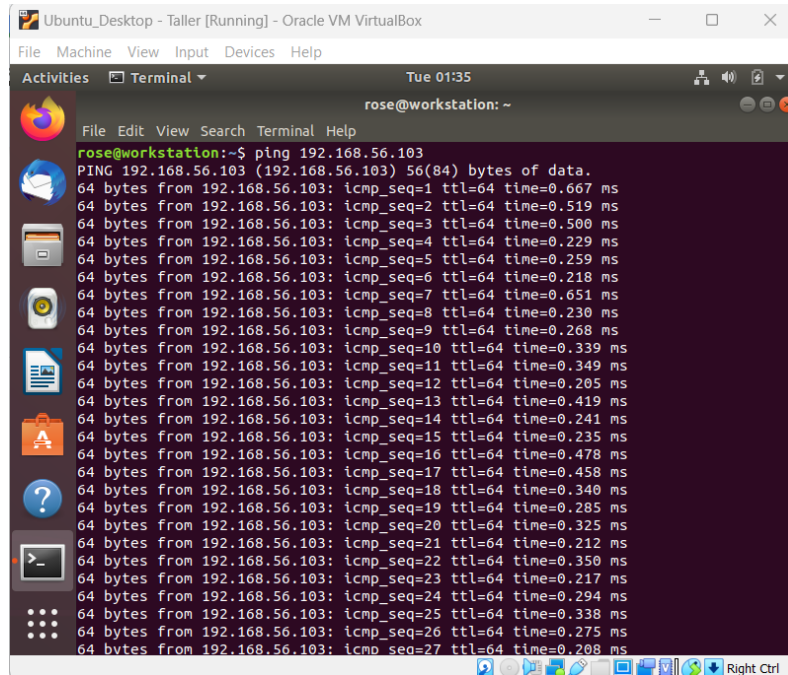
```
rose@workstation: ~  
File Edit View Search Terminal Help  
rose@workstation:~$ ifconfig  
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500  
inet 10.0.2.15 netmask 255.255.255.0 broadcast 10.0.2.255  
inet6 fe80::91b0:7b77:62a7:f1aa prefixlen 64 scopeid 0x20<link>  
ether 08:00:27:06:9e:5b txqueuelen 1000 (Ethernet)  
RX packets 613121 bytes 886072020 (886.0 MB)  
RX errors 0 dropped 0 overruns 0 frame 0  
TX packets 53206 bytes 3332326 (3.3 MB)  
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
enp0s8: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500  
inet 192.168.56.102 netmask 255.255.255.0 broadcast 192.168.56.255  
inet6 fe80::3333:9a4a:44d5:6a20 prefixlen 64 scopeid 0x20<link>  
ether 08:00:27:06:e9:83 txqueuelen 1000 (Ethernet)  
RX packets 21 bytes 5561 (5.5 KB)  
RX errors 0 dropped 0 overruns 0 frame 0  
TX packets 87 bytes 11322 (11.3 KB)  
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536  
inet 127.0.0.1 netmask 255.0.0.0  
inet6 ::1 prefixlen 128 scopeid 0x10<host>  
loop txqueuelen 1000 (Local Loopback)  
RX packets 369 bytes 33937 (33.9 KB)  
RX errors 0 dropped 0 overruns 0 frame 0  
TX packets 369 bytes 33937 (33.9 KB)  
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

2. Make sure that they can ping each other.

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

```
rose@workstation: ~  
File Edit View Search Terminal Help  
rose@workstation:~$ ping 192.168.56.101  
PING 192.168.56.101 (192.168.56.101) 56(84) bytes of data.  
64 bytes from 192.168.56.101: icmp_seq=1 ttl=64 time=0.663 ms  
64 bytes from 192.168.56.101: icmp_seq=2 ttl=64 time=0.268 ms  
64 bytes from 192.168.56.101: icmp_seq=3 ttl=64 time=0.595 ms  
64 bytes from 192.168.56.101: icmp_seq=4 ttl=64 time=0.366 ms  
64 bytes from 192.168.56.101: icmp_seq=5 ttl=64 time=0.267 ms  
64 bytes from 192.168.56.101: icmp_seq=6 ttl=64 time=0.618 ms  
64 bytes from 192.168.56.101: icmp_seq=7 ttl=64 time=0.206 ms  
64 bytes from 192.168.56.101: icmp_seq=8 ttl=64 time=0.673 ms  
64 bytes from 192.168.56.101: icmp_seq=9 ttl=64 time=0.230 ms  
64 bytes from 192.168.56.101: icmp_seq=10 ttl=64 time=0.213 ms  
64 bytes from 192.168.56.101: icmp_seq=11 ttl=64 time=0.233 ms  
64 bytes from 192.168.56.101: icmp_seq=12 ttl=64 time=0.336 ms  
64 bytes from 192.168.56.101: icmp_seq=13 ttl=64 time=0.225 ms  
64 bytes from 192.168.56.101: icmp_seq=14 ttl=64 time=0.378 ms  
64 bytes from 192.168.56.101: icmp_seq=15 ttl=64 time=0.358 ms  
64 bytes from 192.168.56.101: icmp_seq=16 ttl=64 time=0.451 ms  
64 bytes from 192.168.56.101: icmp_seq=17 ttl=64 time=0.243 ms  
64 bytes from 192.168.56.101: icmp_seq=18 ttl=64 time=0.251 ms  
64 bytes from 192.168.56.101: icmp_seq=19 ttl=64 time=0.327 ms  
64 bytes from 192.168.56.101: icmp_seq=20 ttl=64 time=0.235 ms  
64 bytes from 192.168.56.101: icmp_seq=21 ttl=64 time=0.291 ms  
64 bytes from 192.168.56.101: icmp_seq=22 ttl=64 time=0.309 ms  
64 bytes from 192.168.56.101: icmp_seq=23 ttl=64 time=0.308 ms  
64 bytes from 192.168.56.101: icmp_seq=24 ttl=64 time=0.317 ms  
64 bytes from 192.168.56.101: icmp_seq=25 ttl=64 time=0.222 ms  
64 bytes from 192.168.56.101: icmp_seq=26 ttl=64 time=0.207 ms  
64 bytes from 192.168.56.101: icmp_seq=27 ttl=64 time=0.234 ms
```

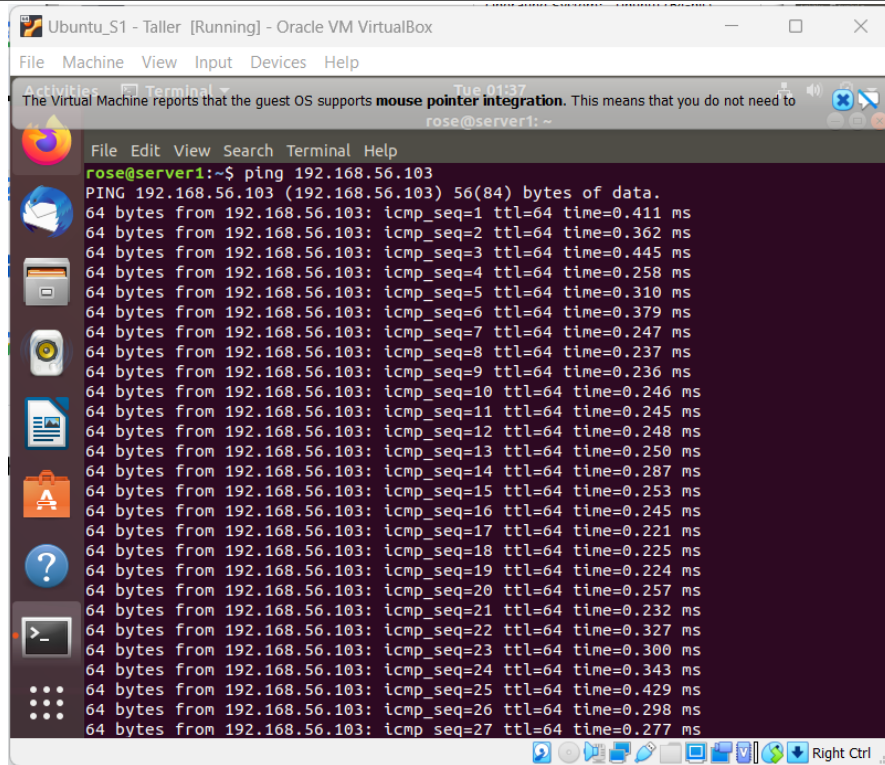
2.2 Connectivity test for Local Machine 1 to Server 2: ☒ Successful ☐ Not Successful



The screenshot shows a terminal window titled "Ubuntu\_Desktop - Taller [Running] - Oracle VM VirtualBox". The terminal prompt is "rose@workstation: ~". The user has entered the command "ping 192.168.56.103". The output shows 27 successful ping requests, each receiving 64 bytes of data from 192.168.56.103 with varying TTL and time values.

```
rose@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=0.667 ms
64 bytes from 192.168.56.103: icmp_seq=2 ttl=64 time=0.519 ms
64 bytes from 192.168.56.103: icmp_seq=3 ttl=64 time=0.500 ms
64 bytes from 192.168.56.103: icmp_seq=4 ttl=64 time=0.229 ms
64 bytes from 192.168.56.103: icmp_seq=5 ttl=64 time=0.259 ms
64 bytes from 192.168.56.103: icmp_seq=6 ttl=64 time=0.218 ms
64 bytes from 192.168.56.103: icmp_seq=7 ttl=64 time=0.651 ms
64 bytes from 192.168.56.103: icmp_seq=8 ttl=64 time=0.230 ms
64 bytes from 192.168.56.103: icmp_seq=9 ttl=64 time=0.268 ms
64 bytes from 192.168.56.103: icmp_seq=10 ttl=64 time=0.339 ms
64 bytes from 192.168.56.103: icmp_seq=11 ttl=64 time=0.349 ms
64 bytes from 192.168.56.103: icmp_seq=12 ttl=64 time=0.205 ms
64 bytes from 192.168.56.103: icmp_seq=13 ttl=64 time=0.419 ms
64 bytes from 192.168.56.103: icmp_seq=14 ttl=64 time=0.241 ms
64 bytes from 192.168.56.103: icmp_seq=15 ttl=64 time=0.235 ms
64 bytes from 192.168.56.103: icmp_seq=16 ttl=64 time=0.478 ms
64 bytes from 192.168.56.103: icmp_seq=17 ttl=64 time=0.458 ms
64 bytes from 192.168.56.103: icmp_seq=18 ttl=64 time=0.340 ms
64 bytes from 192.168.56.103: icmp_seq=19 ttl=64 time=0.285 ms
64 bytes from 192.168.56.103: icmp_seq=20 ttl=64 time=0.325 ms
64 bytes from 192.168.56.103: icmp_seq=21 ttl=64 time=0.212 ms
64 bytes from 192.168.56.103: icmp_seq=22 ttl=64 time=0.350 ms
64 bytes from 192.168.56.103: icmp_seq=23 ttl=64 time=0.217 ms
64 bytes from 192.168.56.103: icmp_seq=24 ttl=64 time=0.294 ms
64 bytes from 192.168.56.103: icmp_seq=25 ttl=64 time=0.338 ms
64 bytes from 192.168.56.103: icmp_seq=26 ttl=64 time=0.275 ms
64 bytes from 192.168.56.103: icmp_seq=27 ttl=64 time=0.208 ms
```

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



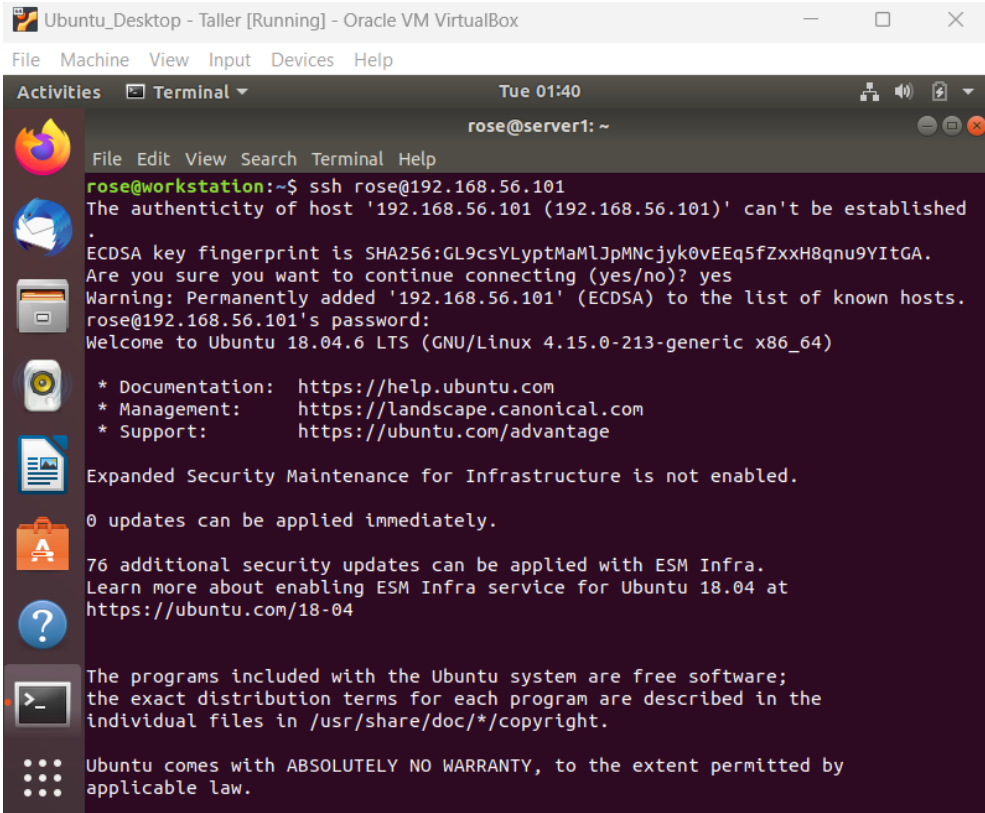
```
Ubuntu_S1 - Taller [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal Tue 01:37
The Virtual Machine reports that the guest OS supports mouse pointer integration. This means that you do not need to
rose@server1: ~
File Edit View Search Terminal Help
rose@server1:~$ 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=0.411 ms
64 bytes from 192.168.56.103: icmp_seq=2 ttl=64 time=0.362 ms
64 bytes from 192.168.56.103: icmp_seq=3 ttl=64 time=0.445 ms
64 bytes from 192.168.56.103: icmp_seq=4 ttl=64 time=0.258 ms
64 bytes from 192.168.56.103: icmp_seq=5 ttl=64 time=0.310 ms
64 bytes from 192.168.56.103: icmp_seq=6 ttl=64 time=0.379 ms
64 bytes from 192.168.56.103: icmp_seq=7 ttl=64 time=0.247 ms
64 bytes from 192.168.56.103: icmp_seq=8 ttl=64 time=0.237 ms
64 bytes from 192.168.56.103: icmp_seq=9 ttl=64 time=0.236 ms
64 bytes from 192.168.56.103: icmp_seq=10 ttl=64 time=0.246 ms
64 bytes from 192.168.56.103: icmp_seq=11 ttl=64 time=0.245 ms
64 bytes from 192.168.56.103: icmp_seq=12 ttl=64 time=0.248 ms
64 bytes from 192.168.56.103: icmp_seq=13 ttl=64 time=0.250 ms
64 bytes from 192.168.56.103: icmp_seq=14 ttl=64 time=0.287 ms
64 bytes from 192.168.56.103: icmp_seq=15 ttl=64 time=0.253 ms
64 bytes from 192.168.56.103: icmp_seq=16 ttl=64 time=0.245 ms
64 bytes from 192.168.56.103: icmp_seq=17 ttl=64 time=0.221 ms
64 bytes from 192.168.56.103: icmp_seq=18 ttl=64 time=0.225 ms
64 bytes from 192.168.56.103: icmp_seq=19 ttl=64 time=0.224 ms
64 bytes from 192.168.56.103: icmp_seq=20 ttl=64 time=0.257 ms
64 bytes from 192.168.56.103: icmp_seq=21 ttl=64 time=0.232 ms
64 bytes from 192.168.56.103: icmp_seq=22 ttl=64 time=0.327 ms
64 bytes from 192.168.56.103: icmp_seq=23 ttl=64 time=0.300 ms
64 bytes from 192.168.56.103: icmp_seq=24 ttl=64 time=0.343 ms
64 bytes from 192.168.56.103: icmp_seq=25 ttl=64 time=0.429 ms
64 bytes from 192.168.56.103: icmp_seq=26 ttl=64 time=0.298 ms
64 bytes from 192.168.56.103: icmp_seq=27 ttl=64 time=0.277 ms
```

**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



The screenshot shows a terminal window titled "Ubuntu\_Desktop - Taller [Running] - Oracle VM VirtualBox". The terminal is running an SSH session from a user named "rose" on a "workstation" to a "server1" at IP address 192.168.56.101. The terminal output includes a warning about the host's authenticity, a confirmation to continue, a warning about adding the host to the known hosts list, a password prompt, and a welcome message to Ubuntu 18.04.6 LTS. It also displays links for documentation, management, and support, as well as information about security updates and warranty.

```
File Edit View Search Terminal Help
Tue 01:40
rose@server1: ~

File Edit View Search Terminal Help
rose@workstation:~$ ssh rose@192.168.56.101
The authenticity of host '192.168.56.101 (192.168.56.101)' can't be established
.
ECDSA key fingerprint is SHA256:GL9csYLyptMaMlJpMNCjyk0vEEq5fZxxH8qnu9YItGA.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '192.168.56.101' (ECDSA) to the list of known hosts.
rose@192.168.56.101's password:
Welcome to Ubuntu 18.04.6 LTS (GNU/Linux 4.15.0-213-generic x86_64)

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

Expanded Security Maintenance for Infrastructure is not enabled.

0 updates can be applied immediately.

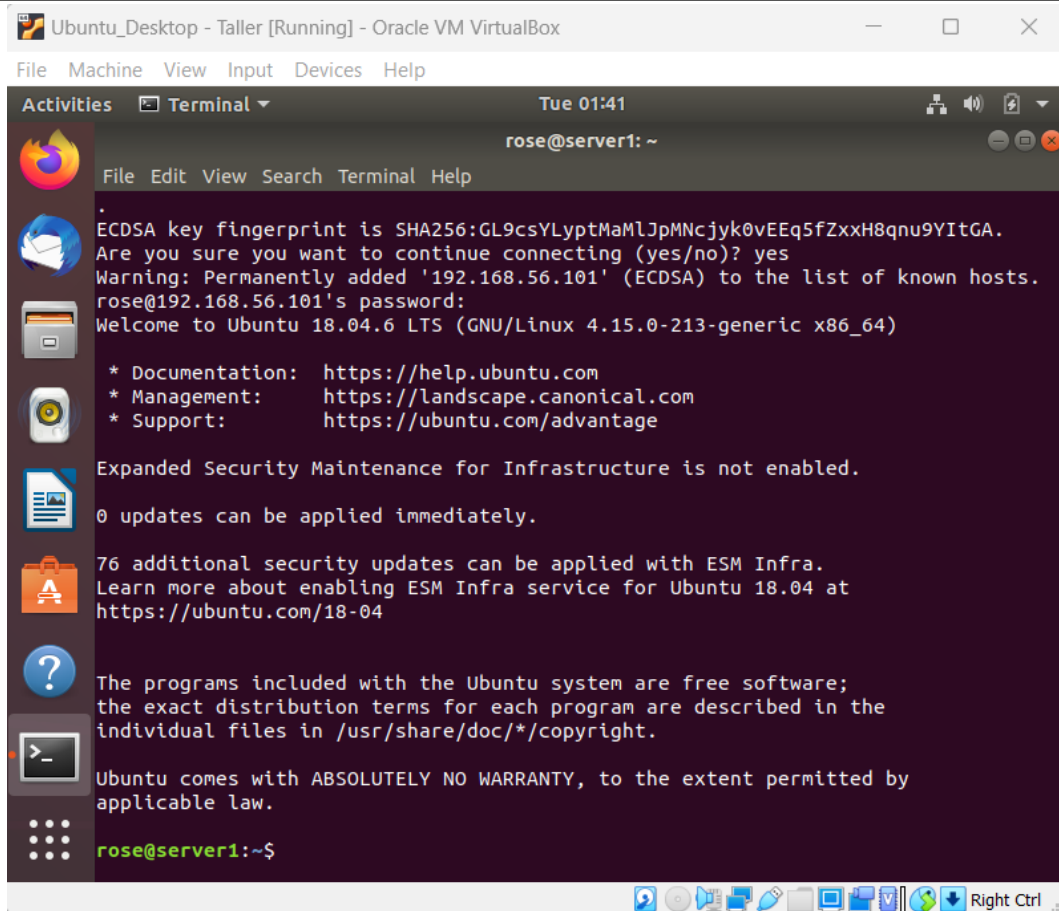
76 additional security updates can be applied with ESM Infra.
Learn more about enabling ESM Infra service for Ubuntu 18.04 at
https://ubuntu.com/18-04

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.
```

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





```
Ubuntu_Desktop - Taller [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal Tue 01:41
rose@server1: ~
File Edit View Search Terminal Help
.
ECDSA key fingerprint is SHA256:GL9csYLYptMamLJpMNCjyk0vEEq5fZxxH8qnu9YItGA.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '192.168.56.101' (ECDSA) to the list of known hosts.
rose@192.168.56.101's password:
Welcome to Ubuntu 18.04.6 LTS (GNU/Linux 4.15.0-213-generic x86_64)

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

Expanded Security Maintenance for Infrastructure is not enabled.
0 updates can be applied immediately.
76 additional security updates can be applied with ESM Infra.
Learn more about enabling ESM Infra service for Ubuntu 18.04 at
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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.

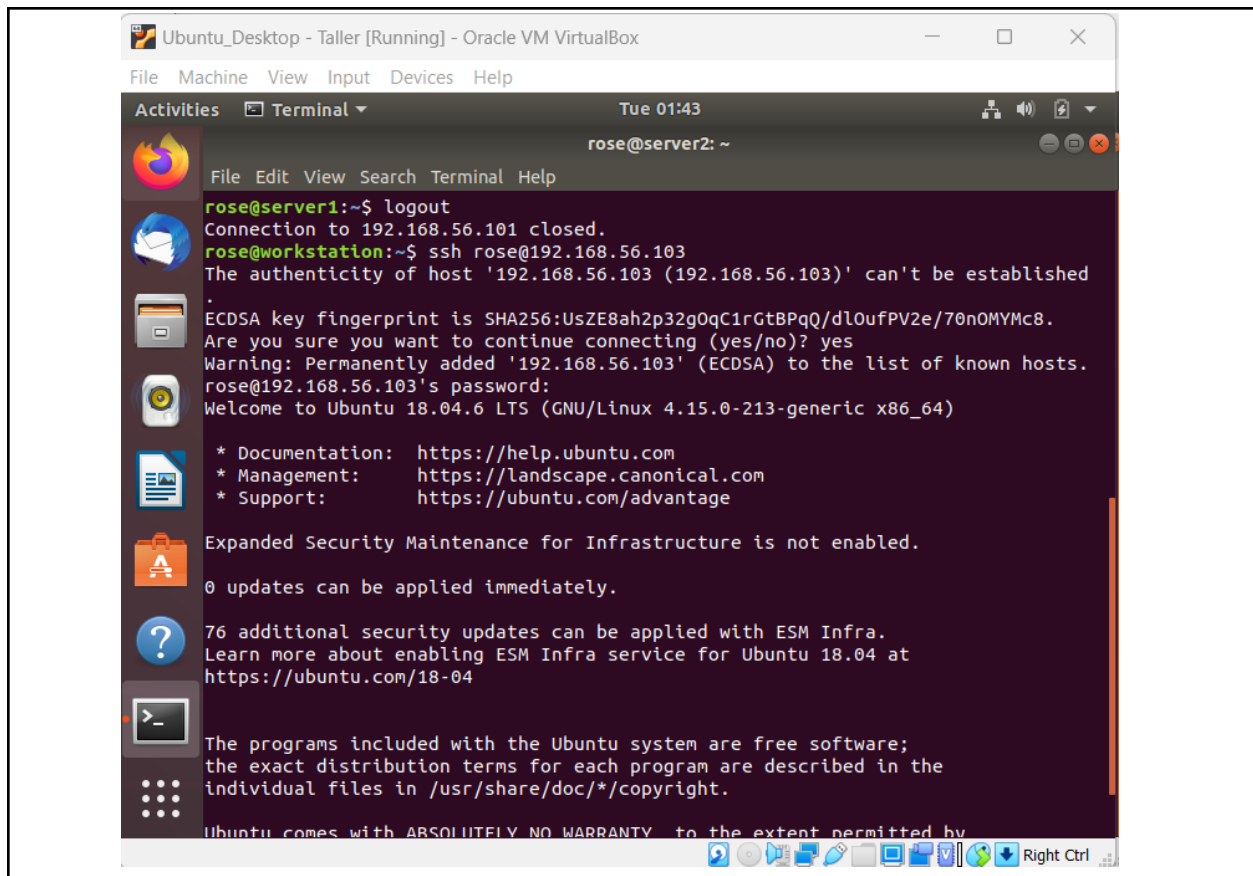
rose@server1:~$
```

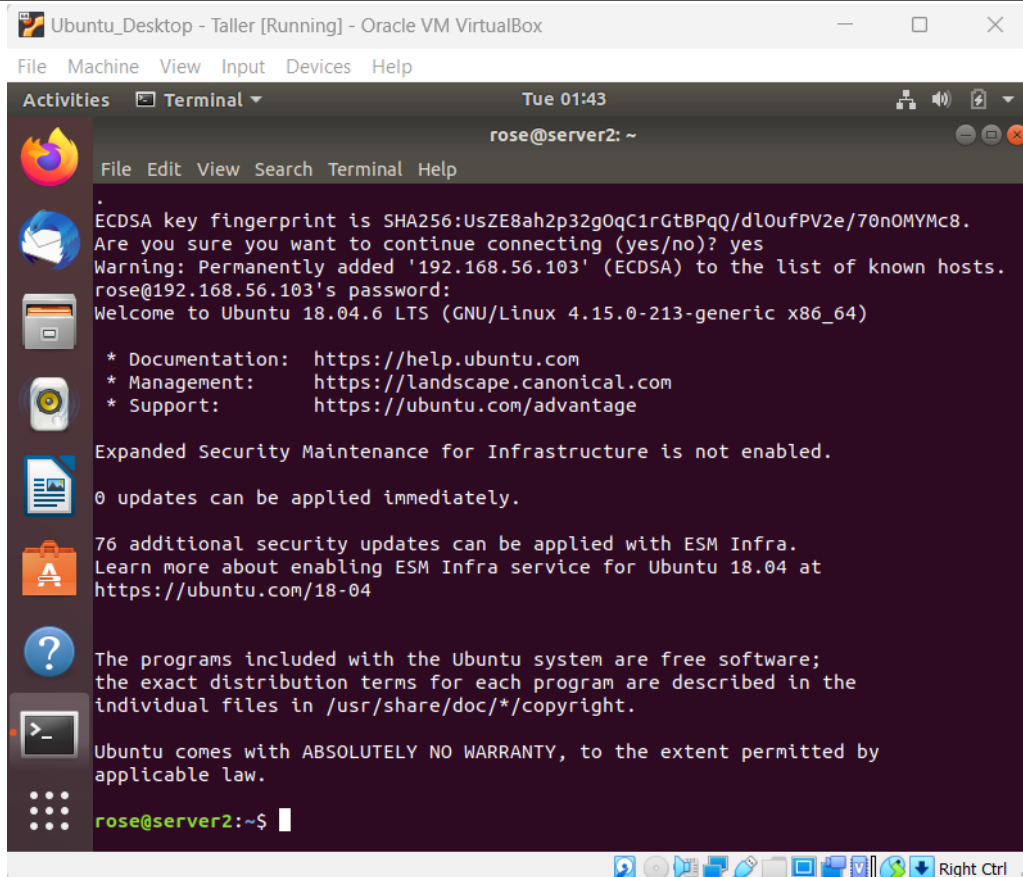
2. Logout of Server 1 by issuing the command *control + D*.

```
rose@server1:~$ logout
Connection to 192.168.56.101 closed.
```

3. Do the same for Server 2.







```
Ubuntu_Desktop - Taller [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal Tue 01:43
rose@server2: ~
File Edit View Search Terminal Help
.
ECDSA key fingerprint is SHA256:UsZE8ah2p32g0qC1rGtBPqQ/dl0ufPV2e/70n0MYMc8.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '192.168.56.103' (ECDSA) to the list of known hosts.
rose@192.168.56.103's password:
Welcome to Ubuntu 18.04.6 LTS (GNU/Linux 4.15.0-213-generic x86_64)

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

Expanded Security Maintenance for Infrastructure is not enabled.

0 updates can be applied immediately.

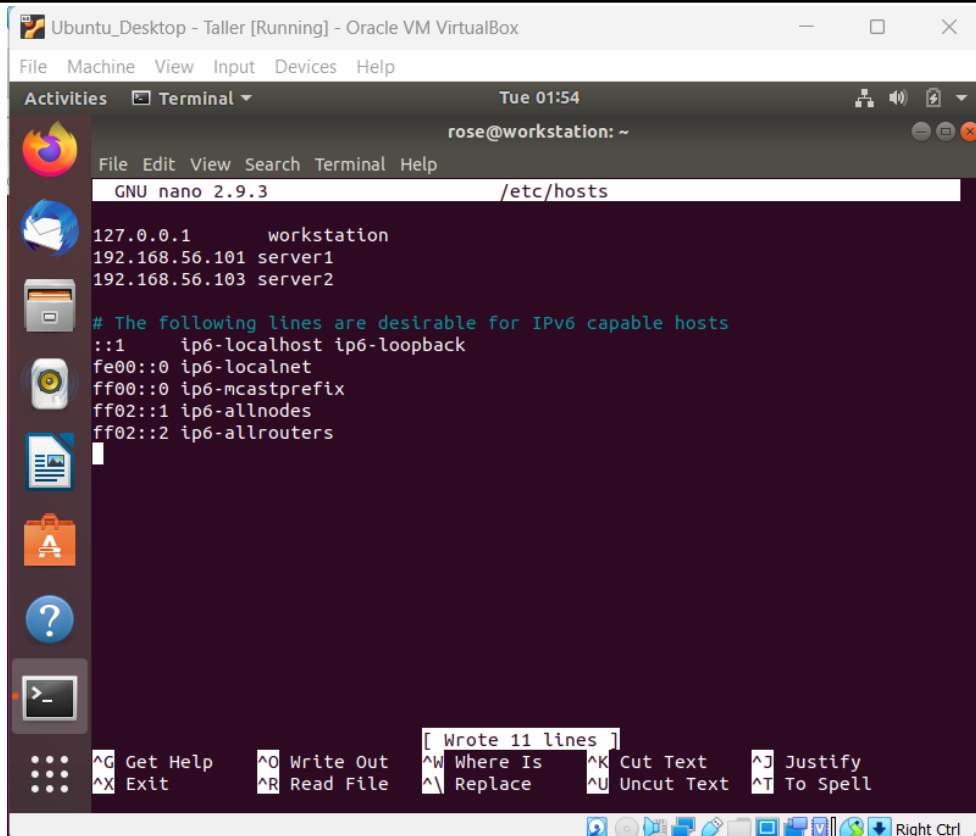
76 additional security updates can be applied with ESM Infra.
Learn more about enabling ESM Infra service for Ubuntu 18.04 at
https://ubuntu.com/18-04

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.

rose@server2:~$
```

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)



```
Ubuntu_Desktop - Taller [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal Tue 01:54
rose@workstation: ~
GNU nano 2.9.3 /etc/hosts
127.0.0.1 workstation
192.168.56.101 server1
192.168.56.103 server2
# 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
[ Wrote 11 lines ]
^G Get Help ^O Write Out ^W Where Is ^K Cut Text ^J Justify
^X Exit ^R Read File ^\ Replace ^U Uncut Text ^T To Spell
Right Ctrl
```

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

```

rose@workstation:~$ ssh rose@server1
The authenticity of host 'server1 (192.168.56.101)' can't be established.
ECDSA key fingerprint is SHA256:GL9csVLYptMaMLJpMNCjyk0vEEq5fZxxH8qnu9YItGA.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added 'server1' (ECDSA) to the list of known hosts.
rose@server1's password:
Welcome to Ubuntu 18.04.6 LTS (GNU/Linux 4.15.0-213-generic x86_64)

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

Expanded Security Maintenance for Infrastructure is not enabled.

0 updates can be applied immediately.

76 additional security updates can be applied with ESM Infra.
Learn more about enabling ESM Infra service for Ubuntu 18.04 at
https://ubuntu.com/18-04

New release '20.04.6 LTS' available.
Run 'do-release-upgrade' to upgrade to it.

Last login: Tue Aug 15 01:39:48 2023 from 192.168.56.102
rose@server1:~$

```

```

Last login: Tue Aug 15 01:39:48 2023 from 192.168.56.102
rose@server1:~$ logout
Connection to server1 closed.
rose@workstation:~$ ssh rose@server2
The authenticity of host 'server2 (192.168.56.103)' can't be established.
ECDSA key fingerprint is SHA256:UsZE8ah2p32g0qC1rGtBPqQ/dlOufPV2e/70nOMYM8.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added 'server2' (ECDSA) to the list of known hosts.
rose@server2's password:
Welcome to Ubuntu 18.04.6 LTS (GNU/Linux 4.15.0-213-generic x86_64)

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

Expanded Security Maintenance for Infrastructure is not enabled.

0 updates can be applied immediately.

76 additional security updates can be applied with ESM Infra.
Learn more about enabling ESM Infra service for Ubuntu 18.04 at
https://ubuntu.com/18-04

New release '20.04.6 LTS' available.
Run 'do-release-upgrade' to upgrade to it.

Last login: Tue Aug 15 01:42:39 2023 from 192.168.56.102
rose@server2:~$

```

## Reflections:

Answer the following:

- How are we able to use the hostname instead of IP address in SSH commands?
  - By issuing the command `sudo nano /etc/hosts`, we are able to edit the hosts and provide the IP address with their hostname.

2. How secured is SSH?

- *SSH is a strong, safe way for computers to talk remotely. It keeps data secret, checks identities, and needs good setup.*

### **Honor Pledge for Graded Activity**

*"I affirm that I shall not give and receive any unauthorized help on this activity, and that this work is my own."*