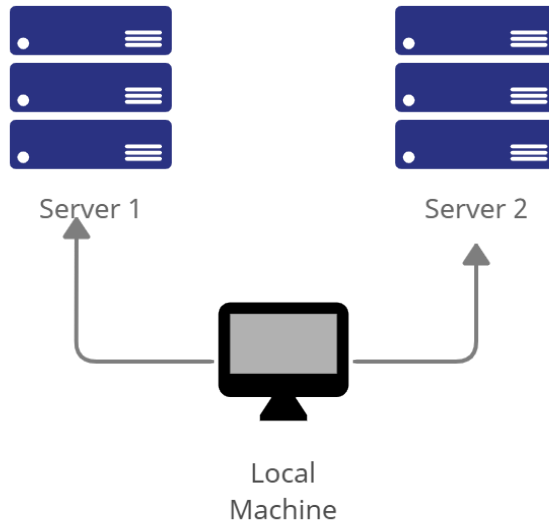
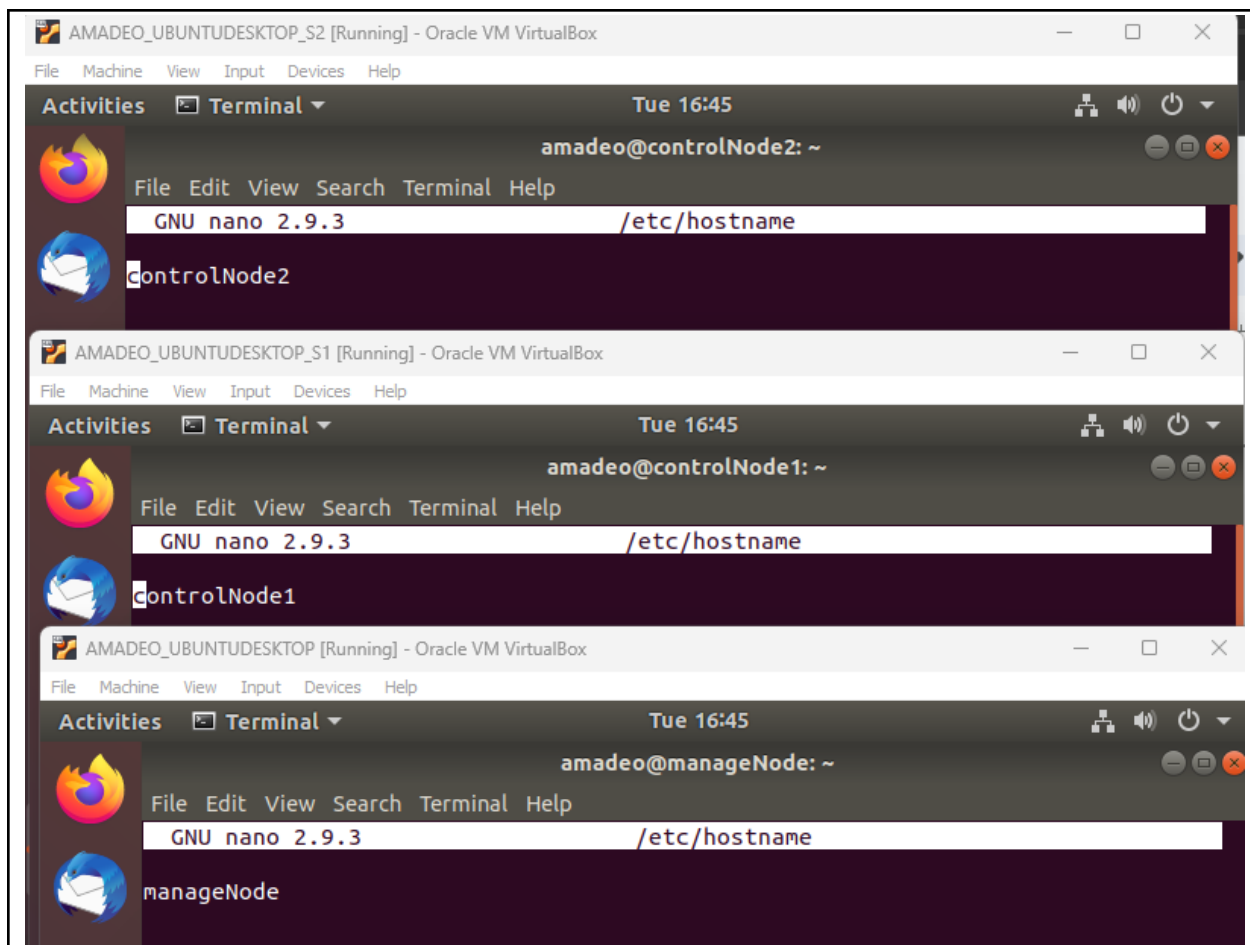
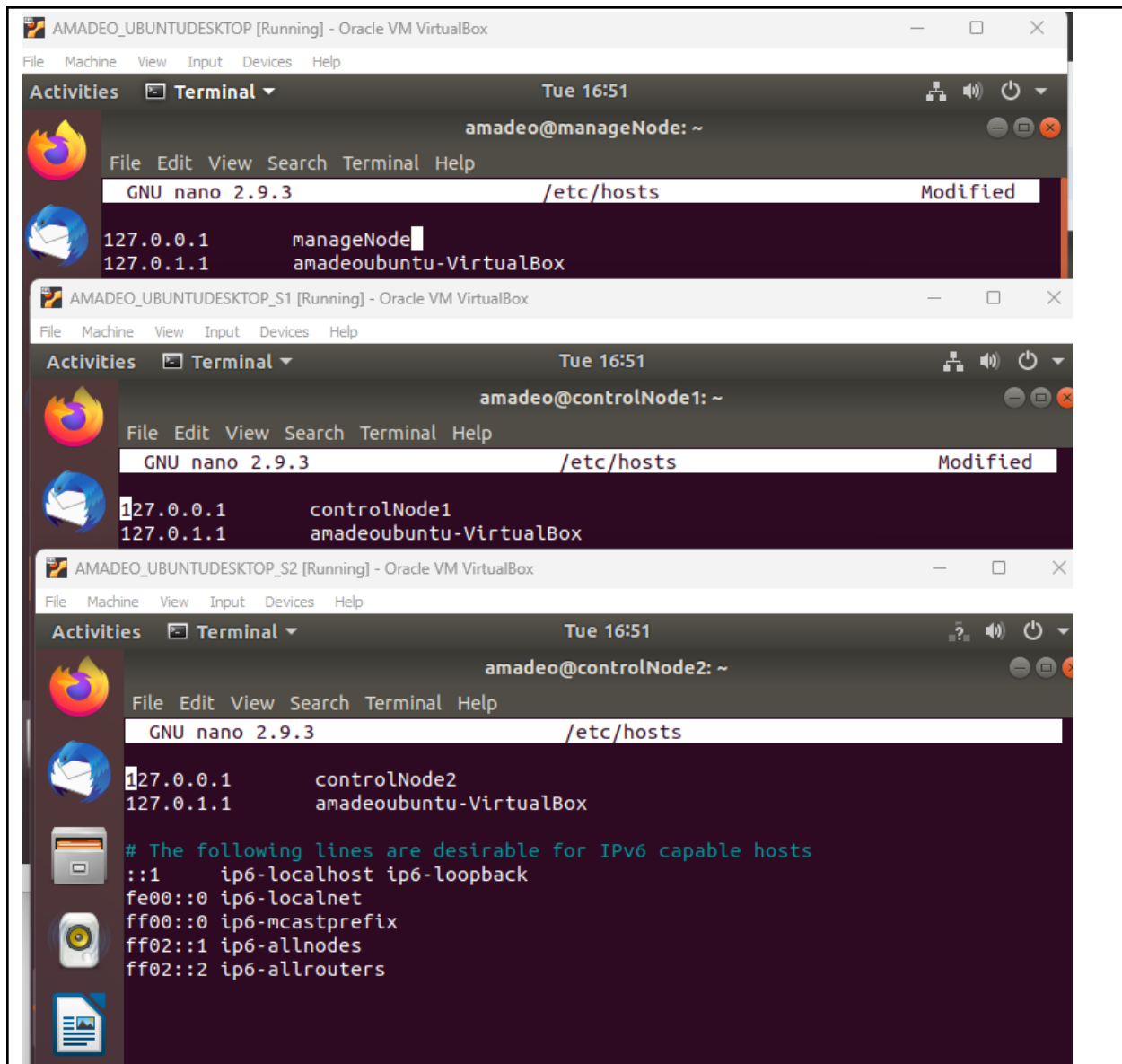


<b>Name: John Enrico M. Amadeo</b>	<b>Date Performed: 14/08/23</b>
<b>Course/Section: CPE31S4</b>	<b>Date Submitted: 15/08/23</b>
<b>Instructor: Dr John Taylar</b>	<b>Semester and SY: 2023-2024</b>
<b>Activity 1: Configure Network using Virtual Machines</b>	
<b>1. Objectives:</b> 1.1. Create and configure Virtual Machines in Microsoft Azure or VirtualBox 1.2. Set-up a Virtual Network and Test Connectivity of VMs	
<b>2. Discussion:</b>  <b>Network Topology:</b> Assume that you have created the following network topology in Virtual Machines, <i>provide screenshots for each task</i> . (Note: <i>it is assumed that you have the prior knowledge of cloning and creating snapshots in a virtual machine</i> ).	
 <pre> graph TD     LocalMachine[Local Machine] --&gt; Server1[Server 1]     LocalMachine --&gt; Server2[Server 2]   </pre> <p>The diagram illustrates a network topology. At the bottom center is a computer icon labeled "Local Machine". Two lines extend upwards from the Local Machine, each ending in an arrow pointing to a stack of three server icons. The left stack is labeled "Server 1" and the right stack is labeled "Server 2".</p>	
<b>Task 1:</b> 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. <ol style="list-style-type: none"> <li>1. Change the hostname using the command <i>sudo nano /etc/hostname</i> <ol style="list-style-type: none"> <li>1.1 Use server1 for Server 1</li> <li>1.2 Use server2 for Server 2</li> <li>1.3 Use workstation for the Local Machine</li> </ol> </li> </ol>	

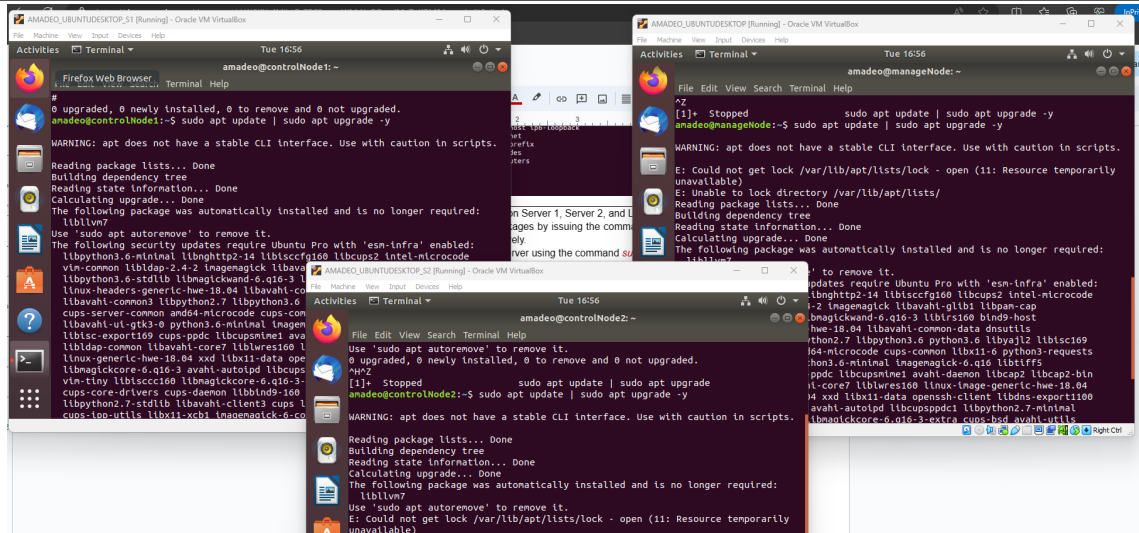


2. Edit the hosts using the command *sudo nano /etc/hosts*. Edit the second line.
  - 2.1 Type 127.0.0.1 server 1 for Server 1
  - 2.2 Type 127.0.0.1 server 2 for Server 2
  - 2.3 Type 127.0.0.1 workstation for the Local Machine

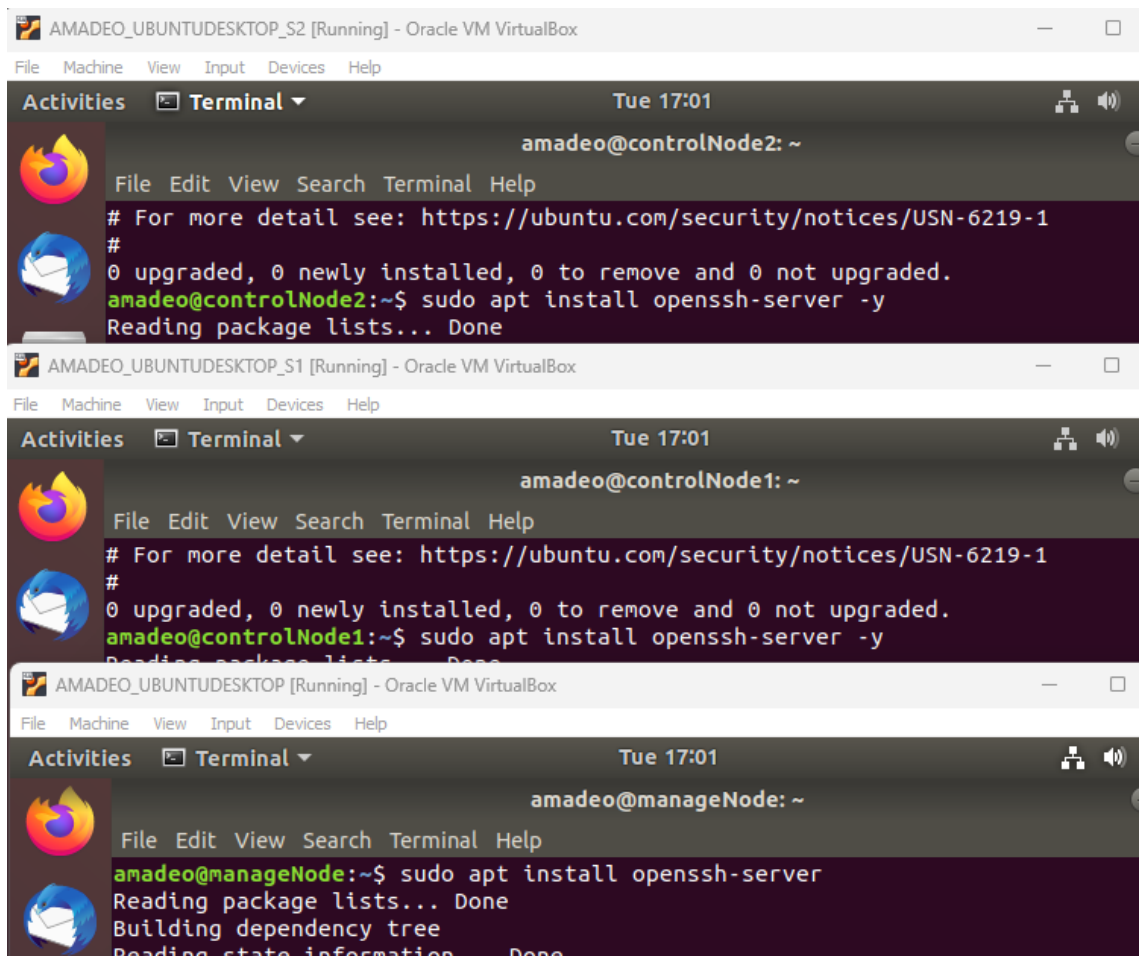


**Task 2:** Configure SSH on Server 1, Server 2, and Local Machine. Do the following:

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



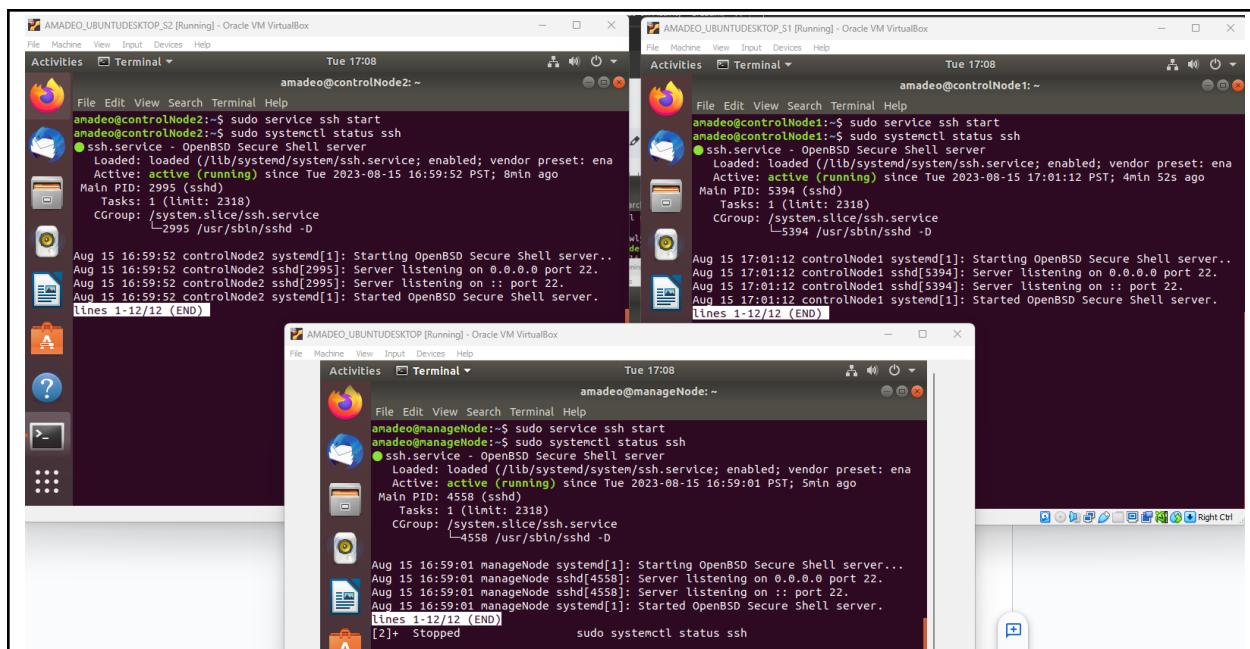
2. Install the SSH server using the command ***sudo apt install openssh-server***.



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***

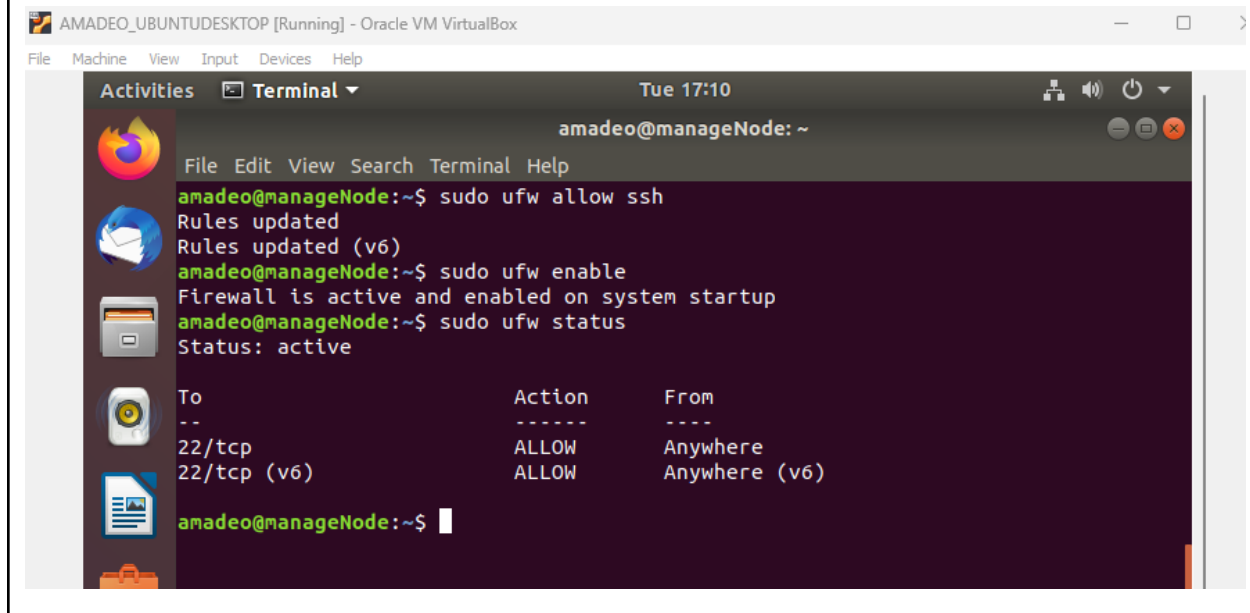


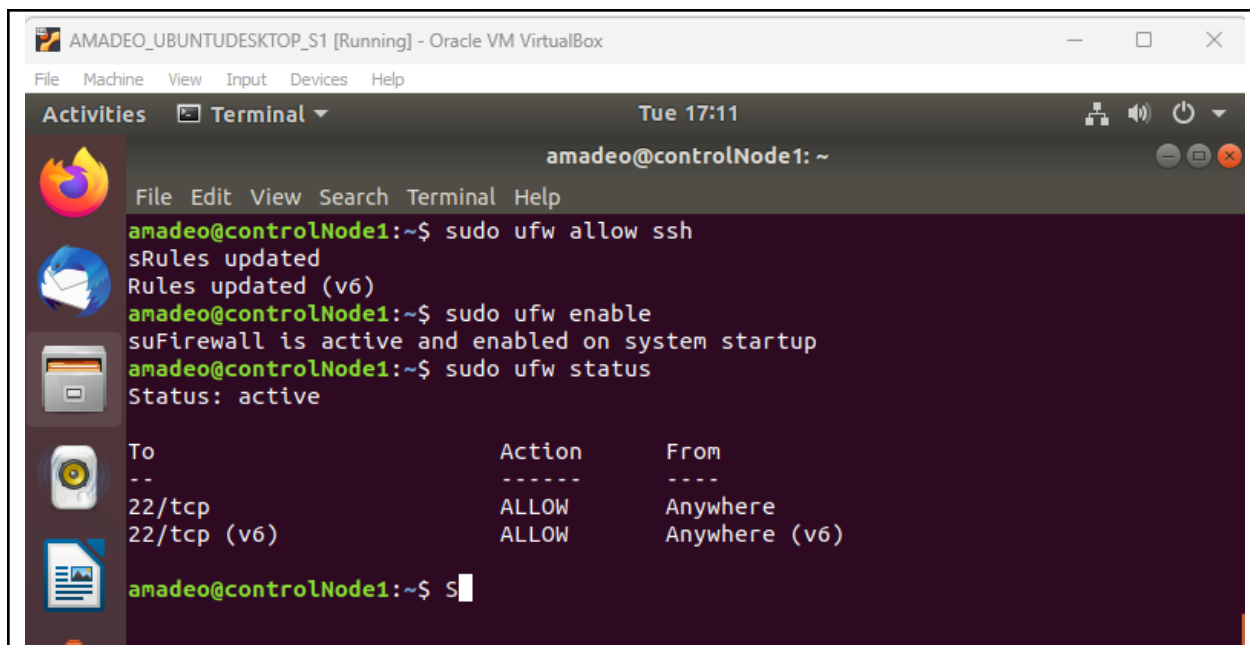
4. Configure the firewall to all port 22 by issuing the following commands:

4.1 *sudo ufw allow ssh*

4.2 *sudo ufw enable*

4.3 *sudo ufw status*

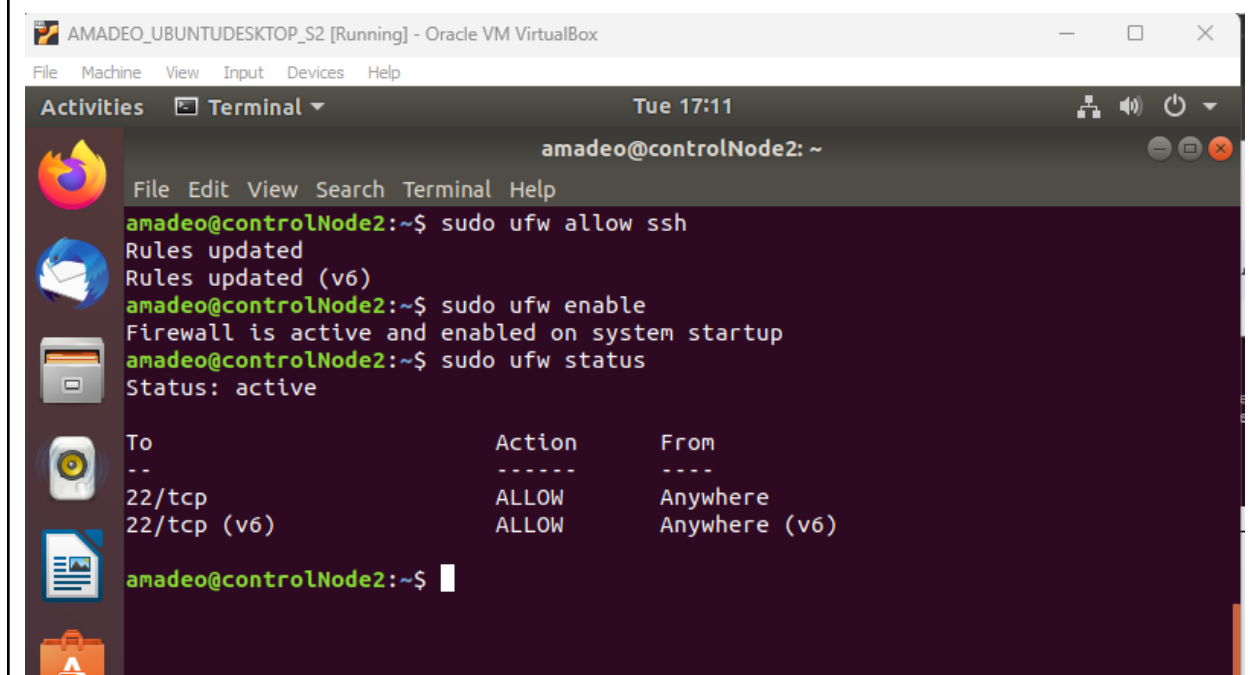




```
AMADEO_UBUNTUDESKTOP_S1 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal Tue 17:11
amadeo@controlNode1: ~
File Edit View Search Terminal Help
amadeo@controlNode1:~$ sudo ufw allow ssh
sRules updated
Rules updated (v6)
amadeo@controlNode1:~$ sudo ufw enable
suFirewall is active and enabled on system startup
amadeo@controlNode1:~$ sudo ufw status
Status: active

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

amadeo@controlNode1:~$ S
```



```
AMADEO_UBUNTUDESKTOP_S2 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal Tue 17:11
amadeo@controlNode2: ~
File Edit View Search Terminal Help
amadeo@controlNode2:~$ sudo ufw allow ssh
Rules updated
Rules updated (v6)
amadeo@controlNode2:~$ sudo ufw enable
Firewall is active and enabled on system startup
amadeo@controlNode2:~$ sudo ufw status
Status: active

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

amadeo@controlNode2:~$
```

**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: 192.168.56.108

```
amadeo@controlNode1: ~  
File Edit View Search Terminal Help  
e enp0s8  
    valid_lft 574sec preferred_lft 574sec  
    inet6 fe80::e02c:98d0:3382:d707/64 scope link noprefixroute  
    valid_lft forever preferred_lft forever  
amadeo@controlNode1:~$ ip a  
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group defau  
lt qlen 1000  
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00  
    inet 127.0.0.1/8 scope host lo  
        valid_lft forever preferred_lft forever  
    inet6 ::1/128 scope host  
        valid_lft forever preferred_lft forever  
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP g  
roup default qlen 1000  
    link/ether 08:00:27:e0:b1:c1 brd ff:ff:ff:ff:ff:ff  
    inet 10.0.2.15/24 brd 10.0.2.255 scope global dynamic noprefixroute enp0s3  
        valid_lft 84291sec preferred_lft 84291sec  
    inet6 fe80::b280:1181:cb99:5e41/64 scope link noprefixroute  
        valid_lft forever preferred_lft forever  
3: enp0s8: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP g  
roup default qlen 1000  
    link/ether 08:00:27:4c:2e:9d brd ff:ff:ff:ff:ff:ff  
    inet 192.168.56.108/24 brd 192.168.56.255 scope global dynamic noprefixrout  
e enp0s8  
    valid_lft 392sec preferred_lft 392sec  
    inet6 fe80::e02c:98d0:3382:d707/64 scope link noprefixroute  
    valid_lft forever preferred_lft forever
```

1.2 Server 2 IP address: 192.168.56.109



```
amadeo@controlNode2: ~  
File Edit View Search Terminal Help  
e enp0s8  
    valid_lft 555sec preferred_lft 555sec  
    inet6 fe80::148c:c9ce:ac3f:fa37/64 scope link noprefixroute  
    valid_lft forever preferred_lft forever  
amadeo@controlNode2:~$ ip a  
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000  
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00  
    inet 127.0.0.1/8 scope host lo  
        valid_lft forever preferred_lft forever  
    inet6 ::1/128 scope host  
        valid_lft forever preferred_lft forever  
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000  
    link/ether 08:00:27:5d:ac:25 brd ff:ff:ff:ff:ff:ff  
    inet 10.0.2.15/24 brd 10.0.2.255 scope global dynamic noprefixroute enp0s3  
        valid_lft 84268sec preferred_lft 84268sec  
    inet6 fe80::9de4:efa9:9dd7:85d3/64 scope link noprefixroute  
        valid_lft forever preferred_lft forever  
3: enp0s8: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000  
    link/ether 08:00:27:0a:24:9b brd ff:ff:ff:ff:ff:ff  
    inet 192.168.56.109/24 brd 192.168.56.255 scope global dynamic noprefixroute enp0s8  
        valid_lft 584sec preferred_lft 584sec  
    inet6 fe80::148c:c9ce:ac3f:fa37/64 scope link noprefixroute  
        valid_lft forever preferred_lft forever
```

1.3 Local Machine IP address: 192.168.56.107



```
amadeo@manageNode:~$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
        valid_lft forever preferred_lft forever
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 08:00:27:94:f8:cf brd ff:ff:ff:ff:ff:ff
    inet 10.0.2.15/24 brd 10.0.2.255 scope global dynamic noprefixroute enp0s3
        valid_lft 84300sec preferred_lft 84300sec
    inet6 fe80::3996:e80e:7f41:82e9/64 scope link noprefixroute
        valid_lft forever preferred_lft forever
3: enp0s8: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 08:00:27:32:75:29 brd ff:ff:ff:ff:ff:ff
    inet 192.168.56.107/24 brd 192.168.56.255 scope global dynamic noprefixroute enp0s8
        valid_lft 585sec preferred_lft 585sec
    inet6 fe80::f8fc:2aa5:5f8e:62f6/64 scope link noprefixroute
        valid_lft forever preferred_lft forever
```

2. Make sure that they can ping each other.

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

```
amadeo@manageNode:~$ ping 192.168.56.108
PING 192.168.56.108 (192.168.56.108) 56(84) bytes of data:
64 bytes from 192.168.56.108: icmp_seq=1 ttl=64 time=0.437 ms
64 bytes from 192.168.56.108: icmp_seq=2 ttl=64 time=0.532 ms
64 bytes from 192.168.56.108: icmp_seq=3 ttl=64 time=1.57 ms
64 bytes from 192.168.56.108: icmp_seq=4 ttl=64 time=1.35 ms
64 bytes from 192.168.56.108: icmp_seq=5 ttl=64 time=1.44 ms
^C
```

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

```
[6]+  Stopped                  ping 192.168.56.108
amadeo@manageNode:~$ ping 192.168.56.109
PING 192.168.56.109 (192.168.56.109) 56(84) bytes of data:
64 bytes from 192.168.56.109: icmp_seq=1 ttl=64 time=0.766 ms
64 bytes from 192.168.56.109: icmp_seq=2 ttl=64 time=1.59 ms
64 bytes from 192.168.56.109: icmp_seq=3 ttl=64 time=1.20 ms
64 bytes from 192.168.56.109: icmp_seq=4 ttl=64 time=0.750 ms
64 bytes from 192.168.56.109: icmp_seq=5 ttl=64 time=1.33 ms
^Z
[7]+  Stopped                  ping 192.168.56.109
```

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

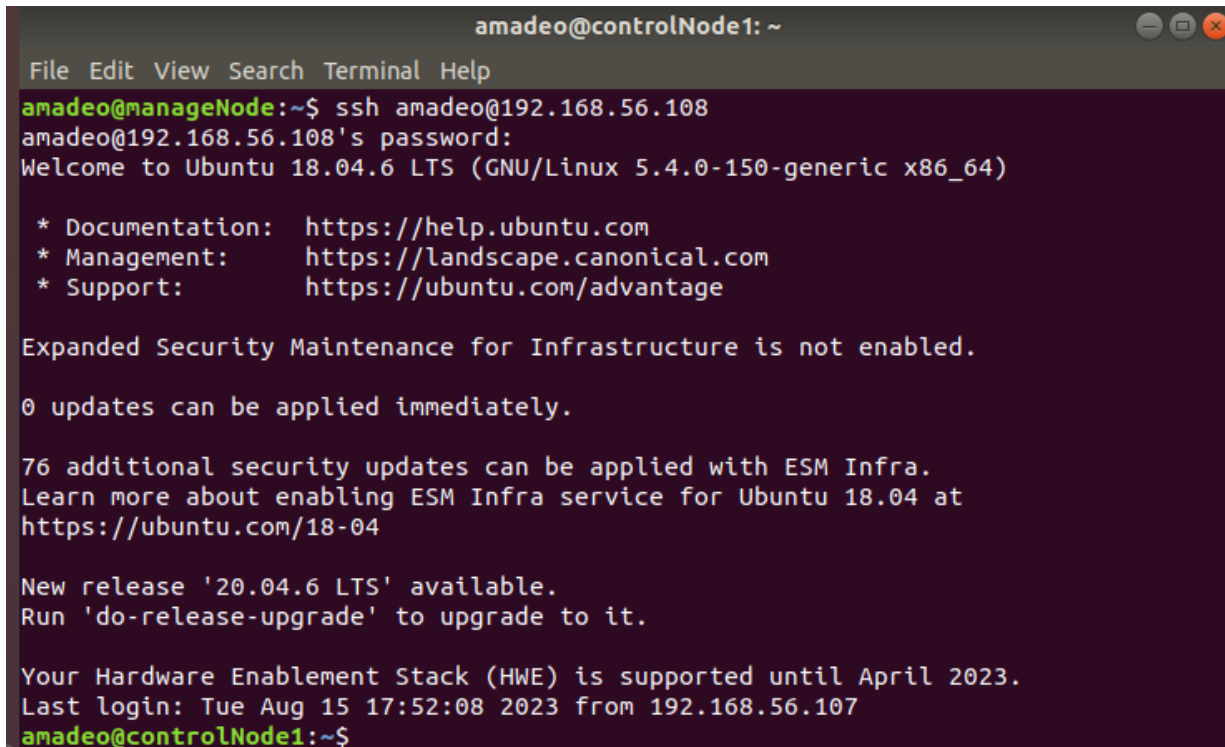
```
amadeo@controlNode1:~$ ping 192.168.56.109
PING 192.168.56.109 (192.168.56.109) 56(84) bytes of data.
64 bytes from 192.168.56.109: icmp_seq=1 ttl=64 time=1.00 ms
64 bytes from 192.168.56.109: icmp_seq=2 ttl=64 time=0.422 ms
64 bytes from 192.168.56.109: icmp_seq=3 ttl=64 time=0.512 ms
64 bytes from 192.168.56.109: icmp_seq=4 ttl=64 time=0.440 ms
64 bytes from 192.168.56.109: icmp_seq=5 ttl=64 time=0.665 ms
64 bytes from 192.168.56.109: icmp_seq=6 ttl=64 time=1.24 ms
64 bytes from 192.168.56.109: icmp_seq=7 ttl=64 time=1.15 ms
64 bytes from 192.168.56.109: icmp_seq=8 ttl=64 time=0.449 ms
64 bytes from 192.168.56.109: icmp_seq=9 ttl=64 time=0.392 ms
^Z
```

**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



```
amadeo@controlNode1: ~
File Edit View Search Terminal Help
amadeo@manageNode:~$ ssh amadeo@192.168.56.108
amadeo@192.168.56.108's password:
Welcome to Ubuntu 18.04.6 LTS (GNU/Linux 5.4.0-150-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.

Your Hardware Enablement Stack (HWE) is supported until April 2023.
Last login: Tue Aug 15 17:52:08 2023 from 192.168.56.107
amadeo@controlNode1:~$
```

1.3 Verify that you are in server 1. The user should be in this format user@server1.

For example, *jvtaylor@server1*

The screenshot shows a terminal window titled 'AMADEO\_UBUNTUDESKTOP [Running] - Oracle VM VirtualBox'. The terminal is running on 'controlNode1' and displays the output of the 'ip a' command. The output shows details for three network interfaces: 'lo' (loopback), 'enp0s3' (ethernet), and 'enp0s8' (ethernet). Each interface entry includes its name, state, MTU, queue discipline, and various address details (link, IPv4, and IPv6).

```
amadeo@controlNode1: ~  
File Edit View Search Terminal Help  
amadeo@controlNode1:~$ ip a  
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group defau  
lt qlen 1000  
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00  
    inet 127.0.0.1/8 scope host lo  
        valid_lft forever preferred_lft forever  
    inet6 ::1/128 scope host  
        valid_lft forever preferred_lft forever  
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP g  
roup default qlen 1000  
    link/ether 08:00:27:e0:b1:c1 brd ff:ff:ff:ff:ff:ff  
    inet 10.0.2.15/24 brd 10.0.2.255 scope global dynamic noprefixroute enp0s3  
        valid_lft 85116sec preferred_lft 85116sec  
    inet6 fe80::b280:1181:cb99:5e41/64 scope link noprefixroute  
        valid_lft forever preferred_lft forever  
3: enp0s8: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP g  
roup default qlen 1000  
    link/ether 08:00:27:4c:2e:9d brd ff:ff:ff:ff:ff:ff  
    inet 192.168.56.108/24 brd 192.168.56.255 scope global dynamic noprefixrout  
e enp0s8  
        valid_lft 348sec preferred_lft 348sec  
    inet6 fe80::e02c:98d0:3382:d707/64 scope link noprefixroute  
        valid_lft forever preferred_lft forever
```

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

The screenshot shows a terminal window where the 'logout' command has been entered. The prompt changes from 'amadeo@controlNode1' to 'amadeo@manageNode1', and a message indicates the connection to 192.168.56.108 has been closed.

```
amadeo@controlNode1:~$ logout  
Connection to 192.168.56.108 closed.  
amadeo@manageNode1:~$
```

3. Do the same for Server 2.

```
Activities Terminal Tue 17:55
amadeo@controlNode2: ~
File Edit View Search Terminal Help
amadeo@manageNode:~$ ssh amadeo@192.168.56.109
The authenticity of host '192.168.56.109 (192.168.56.109)' can't be established
ECDSA key fingerprint is SHA256:vDrgu7EVmRRs5oz0LFVA7l0ryzCNbtHgN2Nw0jVsJEg.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '192.168.56.109' (ECDSA) to the list of known hosts.
amadeo@192.168.56.109's password:
Welcome to Ubuntu 18.04.6 LTS (GNU/Linux 5.4.0-150-generic x86_64)

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

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Run 'do-release-upgrade' to upgrade to it.

Your Hardware Enablement Stack (HWE) is supported until April 2023.
Last login: Tue Aug 15 17:30:22 2023 from 192.168.56.108

amadeo@controlNode2:~$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
        valid_lft forever preferred_lft forever
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 08:00:27:5d:ac:25 brd ff:ff:ff:ff:ff:ff
    inet 10.0.2.15/24 brd 10.0.2.255 scope global dynamic noprefixroute enp0s3
        valid_lft 82275sec preferred_lft 82275sec
    inet6 fe80::9de4:efa9:9dd7:85d3/64 scope link noprefixroute
        valid_lft forever preferred_lft forever
3: enp0s8: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 08:00:27:0a:24:9b brd ff:ff:ff:ff:ff:ff
    inet 192.168.56.109/24 brd 192.168.56.255 scope global dynamic noprefixroute enp0s8
        valid_lft 493sec preferred_lft 493sec
    inet6 fe80::148c:c9ce:ac3f:fa37/64 scope link noprefixroute
        valid_lft forever preferred_lft forever
amadeo@controlNode2:~$ logout
Connection to 192.168.56.109 closed.
```

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

4.1 *IP\_address server 1* (provide the ip address of server 1 followed by the hostname)

```
amadeo@manageNode: ~  
File Edit View Search Terminal Help  
GNU nano 2.9.3 /etc/hosts  
127.0.0.1    manageNode  
127.0.1.1    amadeoubuntu-VirtualBox  
192.168.56.108 controlNode1  
192.168.56.109 controlNode2
```

4.2 *IP\_address server 2* (provide the ip address of server 2 followed by the hostname)

```
amadeo@manageNode: ~  
File Edit View Search Terminal Help  
GNU nano 2.9.3 /etc/hosts  
127.0.0.1    manageNode  
127.0.1.1    amadeoubuntu-VirtualBox  
192.168.56.108 controlNode1  
192.168.56.109 controlNode2
```

4.3 Save the file and exit.

```
amadeo@manageNode: ~  
File Edit View Search Terminal Help  
GNU nano 2.9.3 /etc/hosts  
  
127.0.0.1    manageNode  
127.0.1.1    amadeoubuntu-VirtualBox  
192.168.56.108 controlNode1  
192.168.56.109 controlNode2  
  
# 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 ]
```

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.

```
amadeo@manageNode:~$ ssh amadeo@controlNode1
The authenticity of host 'controlnode1 (192.168.56.108)' can't be established:
ECDSA key fingerprint is SHA256:2XmxcKUK8H3V0xHcI+Q7E0LYN5Vzyp5R9nj2ypvLMc.
Are you sure you want to continue connecting (yes/no)? y
Please type 'yes' or 'no': yes
Warning: Permanently added 'controlnode1' (ECDSA) to the list of known hosts.
amadeo@controlnode1's password:
Welcome to Ubuntu 18.04.6 LTS (GNU/Linux 5.4.0-150-generic x86_64)

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

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https://ubuntu.com/18-04

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Run 'do-release-upgrade' to upgrade to it.

Your Hardware Enablement Stack (HWE) is supported until April 2023.
Last login: Tue Aug 15 17:54:32 2023 from 192.168.56.107
```

```
amadeo@manageNode:~$ ssh amadeo@controlNode2
The authenticity of host 'controlnode2 (192.168.56.109)' can't be established:
ECDSA key fingerprint is SHA256:vDrqu7EVmRRs5oz0lFVA7l0ryzCNbtHgN2Nw0jVsJEG.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added 'controlnode2' (ECDSA) to the list of known hosts.
amadeo@controlnode2's password:
Welcome to Ubuntu 18.04.6 LTS (GNU/Linux 5.4.0-150-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.

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https://ubuntu.com/18-04

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

Your Hardware Enablement Stack (HWE) is supported until April 2023.
Last login: Tue Aug 15 17:55:55 2023 from 192.168.56.107
```



**Reflections:**

Answer the following:

1. How are we able to use the hostname instead of IP address in SSH commands?  
by inputting the ip addresses of the controlnode 1 & 2 in the local host nano /etc/hosts
2. How secured is SSH?

for me ssh is slightly secured because it has encryption features but at the same time ssh can also be vulnerable by the means of the password encryption wherein if someone leaked your password they can easily access your ssh