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Course/Section: CPE232-CPE31S24	Date Submitted: 08 / 23 / 2022
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Activity 1: Configure Network using Virtual Machines

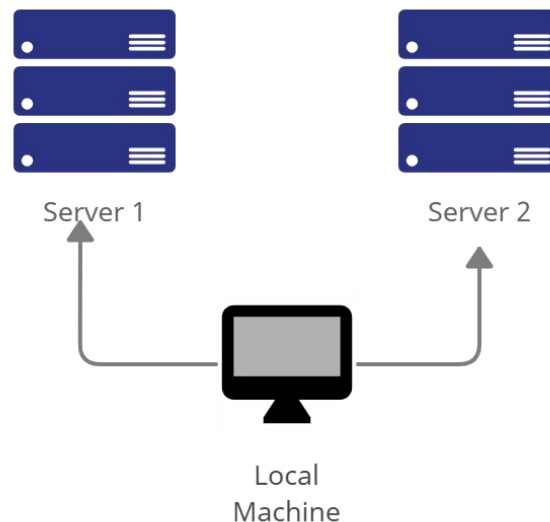
1. Objectives:

- 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*).



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

The screenshot shows a terminal window titled 'Terminal' with the date and time 'Aug 22 23:58'. The prompt is 'jmaducal@server1: ~'. Below the prompt, the command 'jmaducal@server1:~\$' is entered. The terminal window has standard Ubuntu window controls (Activities, Terminal, search, and window management icons) and a status bar at the bottom.

1.2 Use server2 for Server 2

```
Activities Terminal Aug 23 00:00
jmaducal@server2: ~
jmaducal@server2:~$
```

1.3 Use workstation for the Local Machine

```
Activities Terminal Aug 23 00:01
jmaducal@workstation: ~
jmaducal@workstation:~$
```

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

```
Activities Terminal Aug 23 00:05
jmaducal@server1: ~
GNU nano 6.2 /etc/hosts *
127.0.0.1 server 1
127.0.1.1 jmaducal-VirtualBox

# 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
```

2.2 Type 127.0.0.1 server 2 for Server 2

```
Activities Terminal Aug 23 00:07
jmaducal@server2: ~
GNU nano 6.2 /etc/hosts *
127.0.0.1 server 2
127.0.1.1 jmaducal-VirtualBox

# 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
```

2.3 Type 127.0.0.1 workstation for the Local Machine

```
Activities Terminal Aug 23 00:10
jmaducal@workstation: ~
GNU nano 6.2 /etc/hosts *
127.0.0.1 workstation
127.0.1.1 jmaducal-VirtualBox

# 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
```

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

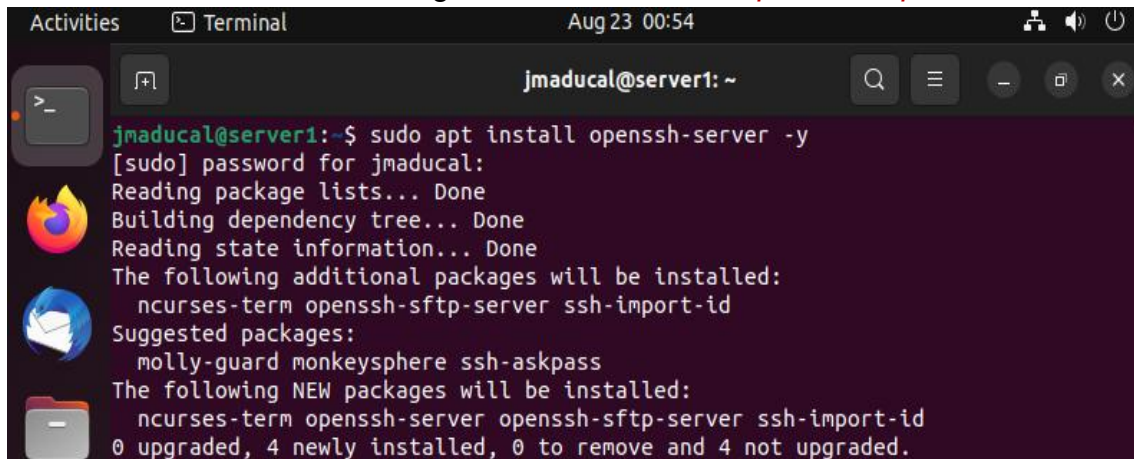
1. Upgrade the packages by issuing the command *sudo apt update* and *sudo apt upgrade* respectively.

```
jmaducal@server1:~$ sudo apt update && sudo apt upgrade -y
Hit:1 http://ph.archive.ubuntu.com/ubuntu jammy InRelease
Get:2 http://ph.archive.ubuntu.com/ubuntu jammy-updates InRelease [114 kB]
Get:3 http://security.ubuntu.com/ubuntu jammy-security InRelease [110 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 i386 Packages [274 kB]
```

```
jmaducal@server2:~$ sudo apt update && sudo apt upgrade -y
Hit:1 http://ph.archive.ubuntu.com/ubuntu jammy InRelease
Get:2 http://ph.archive.ubuntu.com/ubuntu jammy-updates InRelease [114 kB]
Get:3 http://ph.archive.ubuntu.com/ubuntu jammy-backports InRelease [99.8 kB]
Get:4 http://security.ubuntu.com/ubuntu jammy-security InRelease [110 kB]
Get:5 http://ph.archive.ubuntu.com/ubuntu jammy-updates/main i386 Packages [274 kB]
```

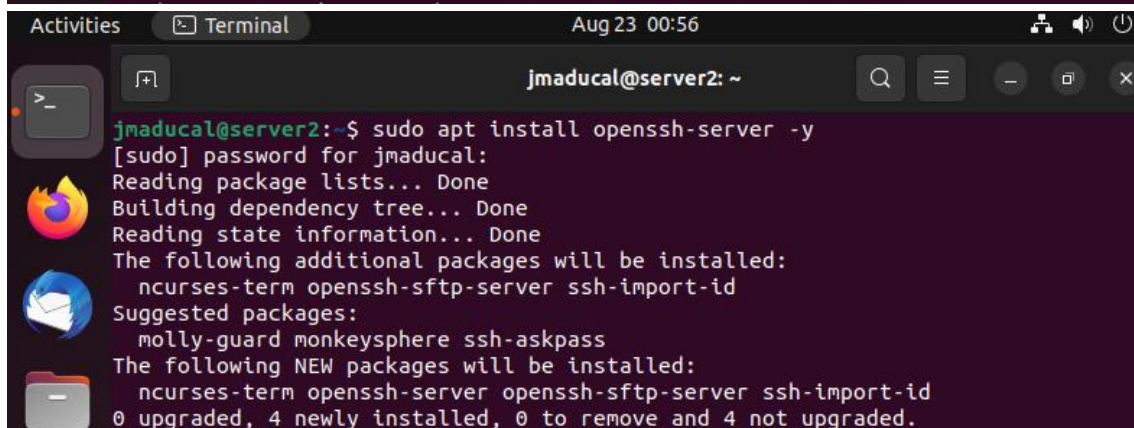
```
jmaducal@workstation:~$ sudo apt update && sudo apt upgrade
Hit:1 http://ph.archive.ubuntu.com/ubuntu jammy InRelease
Get:2 http://ph.archive.ubuntu.com/ubuntu jammy-updates InRelease [114 kB]
Get:3 http://ph.archive.ubuntu.com/ubuntu jammy-backports InRelease [99.8 kB]
Get:4 http://security.ubuntu.com/ubuntu jammy-security InRelease [110 kB]
Get:5 http://ph.archive.ubuntu.com/ubuntu jammy-updates/main i386 Packages [274 kB]
```

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



Activities Terminal Aug 23 00:54 jmaducal@server1: ~

```
jmaducal@server1:~$ sudo apt install openssh-server -y
[sudo] password for jmaducal:
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 4 not upgraded.
```



Activities Terminal Aug 23 00:56 jmaducal@server2: ~

```
jmaducal@server2:~$ sudo apt install openssh-server -y
[sudo] password for jmaducal:
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 4 not upgraded.
```



```
Activities Terminal Aug 23 00:58
jmaducal@workstation: ~
jmaducal@workstation:~$ sudo apt install openssh-server -y
[sudo] password for jmaducal:
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 4 not upgraded.
```

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*

```
Activities Terminal Aug 23 01:00
jmaducal@server1: ~
jmaducal@server1:~$ sudo service ssh start
jmaducal@server1:~$ sudo systemctl status ssh
● ssh.service - OpenBSD Secure Shell server
   Loaded: loaded (/lib/systemd/system/ssh.service; enabled; vendor preset: enabled)
   Active: active (running) since Tue 2022-08-23 00:54:02 PST; 6min ago
     Docs: man:sshd(8)
           man:sshd_config(5)
   Main PID: 35114 (sshd)
    Tasks: 1 (limit: 1640)
   Memory: 1.7M
      CPU: 17ms
   CGroup: /system.slice/ssh.service
           └─35114 "sshd: /usr/sbin/sshd -D [listener] 0 of 10-100 startups"

Aug 23 00:54:02 server1 systemd[1]: Starting OpenBSD Secure Shell server...
Aug 23 00:54:02 server1 sshd[35114]: Server listening on 0.0.0.0 port 22.
Aug 23 00:54:02 server1 sshd[35114]: Server listening on :: port 22.
Aug 23 00:54:02 server1 systemd[1]: Started OpenBSD Secure Shell server.
lines 1-16/16 (END)
```

```
Activities Terminal Aug 23 01:04
jmaducal@server2: ~
jmaducal@server2:~$ sudo service ssh start
jmaducal@server2:~$ sudo systemctl status ssh
● ssh.service - OpenBSD Secure Shell server
   Loaded: loaded (/lib/systemd/system/ssh.service; enabled; vendor preset: enabled)
   Active: active (running) since Tue 2022-08-23 00:56:20 PST; 7min ago
     Docs: man:sshd(8)
           man:sshd_config(5)
   Main PID: 35020 (sshd)
    Tasks: 1 (limit: 1640)
   Memory: 1.7M
      CPU: 21ms
   CGroup: /system.slice/ssh.service
           └─35020 "sshd: /usr/sbin/sshd -D [listener] 0 of 10-100 startups"

Aug 23 00:56:20 server2 systemd[1]: Starting OpenBSD Secure Shell server...
Aug 23 00:56:20 server2 sshd[35020]: Server listening on 0.0.0.0 port 22.
Aug 23 00:56:20 server2 sshd[35020]: Server listening on :: port 22.
Aug 23 00:56:20 server2 systemd[1]: Started OpenBSD Secure Shell server.
lines 1-16/16 (END)
```

```
Activities Terminal Aug 23 01:05
jmaducal@workstation: ~
jmaducal@workstation:~$ sudo service ssh start
jmaducal@workstation:~$ sudo systemctl status ssh
● ssh.service - OpenBSD Secure Shell server
   Loaded: loaded (/lib/systemd/system/ssh.service; enabled; vendor preset: enabled)
   Active: active (running) since Tue 2022-08-23 00:58:13 PST; 7min ago
     Docs: man:sshd(8)
           man:sshd_config(5)
    Main PID: 36127 (sshd)
      Tasks: 1 (limit: 1640)
     Memory: 1.8M
        CPU: 33ms
    CGroup: /system.slice/ssh.service
            └─36127 "sshd: /usr/sbin/sshd -D [listener] 0 of 10-100 startups"

Aug 23 00:58:13 workstation systemd[1]: Starting OpenBSD Secure Shell server..
Aug 23 00:58:13 workstation sshd[36127]: Server listening on 0.0.0.0 port 22.
Aug 23 00:58:13 workstation sshd[36127]: Server listening on :: port 22.
Aug 23 00:58:13 workstation systemd[1]: Started OpenBSD Secure Shell server.
lines 1-16/16 (END)
```

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*

```
Activities Terminal Aug 23 01:09
jmaducal@server1: ~
jmaducal@server1:~$ sudo ufw allow ssh
Rules updated
Rules updated (v6)
jmaducal@server1:~$ sudo ufw enable
Firewall is active and enabled on system startup
jmaducal@server1:~$ sudo ufw status
Status: active

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

```
Activities Terminal Aug 23 01:10
jmaducal@server2: ~
jmaducal@server2:~$ sudo ufw allow ssh
Rules updated
Rules updated (v6)
jmaducal@server2:~$ sudo ufw enable
Firewall is active and enabled on system startup
jmaducal@server2:~$ sudo ufw status
Status: active

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



```
Activities Terminal Aug 23 01:12
jmaducal@workstation: ~
jmaducal@workstation:~$ sudo ufw allow ssh
Rules updated
Rules updated (v6)
jmaducal@workstation:~$ sudo ufw enable
Firewall is active and enabled on system startup
jmaducal@workstation:~$ 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: **192.168.56.102**

```
Activities Terminal Aug 23 01:18
jmaducal@server1: ~
jmaducal@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::932f:7a59:5625:5622 prefixlen 64 scopeid 0x20<link>
ether 08:00:27:d8:83:76 txqueuelen 1000 (Ethernet)
RX packets 269827 bytes 407550020 (407.5 MB)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 121763 bytes 7371178 (7.3 MB)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

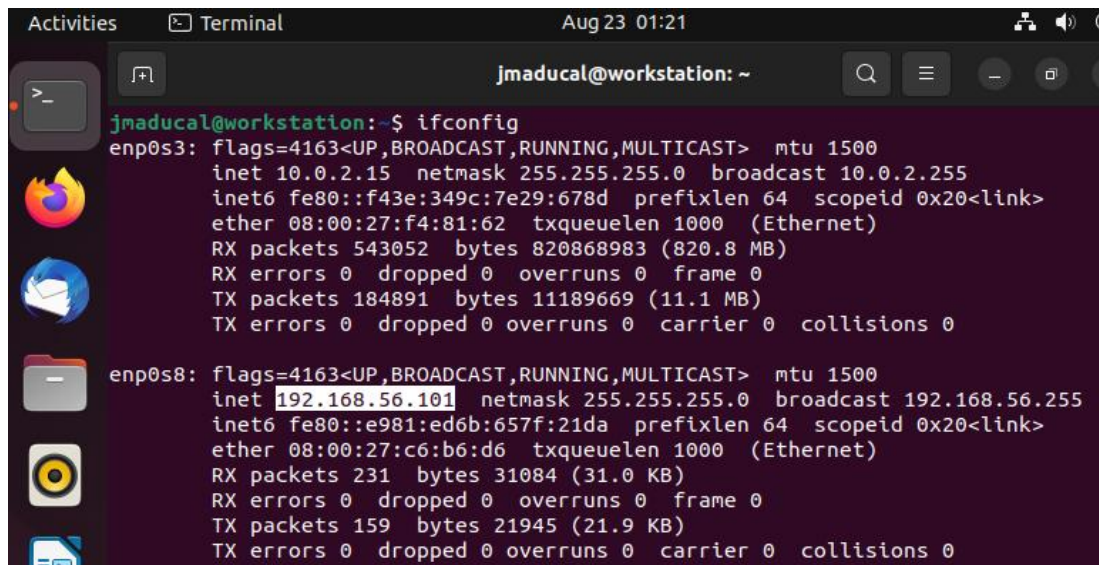
enp0s8: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
inet 192.168.56.102 netmask 255.255.255.0 broadcast 192.168.56.255
inet6 fe80::d98a:91d0:6794:8797 prefixlen 64 scopeid 0x20<link>
ether 08:00:27:99:8e:5b txqueuelen 1000 (Ethernet)
RX packets 376 bytes 50437 (50.4 KB)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 158 bytes 20488 (20.4 KB)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

1.2 Server 2 IP address: **192.168.56.103**

```
Activities Terminal Aug 23 01:19
jmaducal@server2: ~
jmaducal@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::84e1:b353:9102:59cc prefixlen 64 scopeid 0x20<link>
ether 08:00:27:3c:1d:ed txqueuelen 1000 (Ethernet)
RX packets 469878 bytes 710258471 (710.2 MB)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 182201 bytes 11008734 (11.0 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::605a:daf6:d003:d968 prefixlen 64 scopeid 0x20<link>
ether 08:00:27:50:05:b1 txqueuelen 1000 (Ethernet)
RX packets 319 bytes 44059 (44.0 KB)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 164 bytes 20658 (20.6 KB)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

1.3 Workstation IP address: **192.168.56.101**

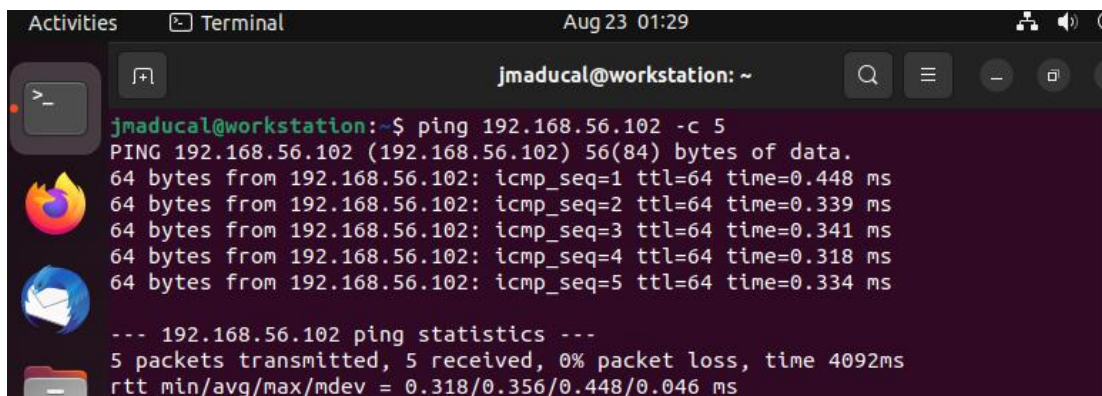


```
Activities Terminal Aug 23 01:21
jmaducal@workstation: ~
jmaducal@workstation:~$ ifconfig
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 10.0.2.15 netmask 255.255.255.0 broadcast 10.0.2.255
    inet6 fe80::f43e:349c:7e29:678d prefixlen 64 scopeid 0x20<link>
    ether 08:00:27:f4:81:62 txqueuelen 1000 (Ethernet)
    RX packets 543052 bytes 820868983 (820.8 MB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 184891 bytes 11189669 (11.1 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::e981:ed6b:657f:21da prefixlen 64 scopeid 0x20<link>
    ether 08:00:27:c6:b6:d6 txqueuelen 1000 (Ethernet)
    RX packets 231 bytes 31084 (31.0 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 159 bytes 21945 (21.9 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

2. Make sure that they can ping each other.

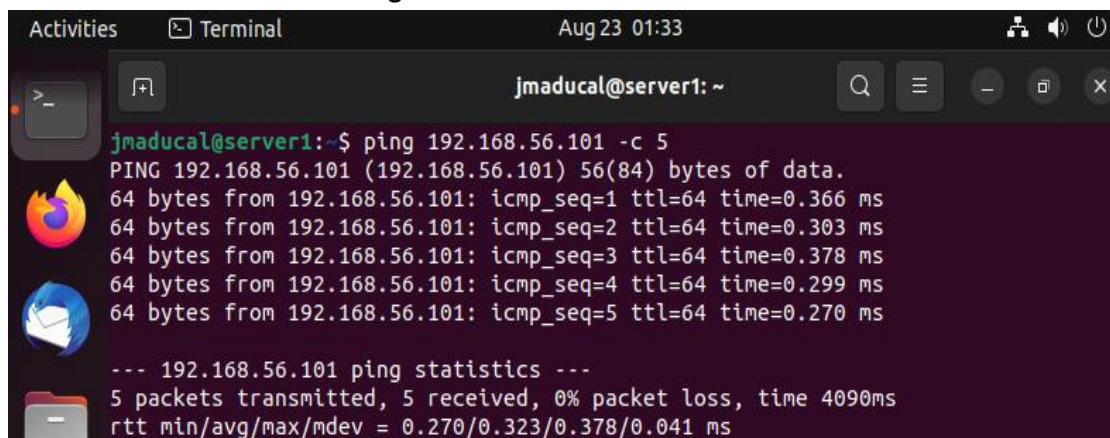
2.1 Connectivity test for Local Machine 1 to Server 1: ☒ **Successful** ☐ Not Successful



```
Activities Terminal Aug 23 01:29
jmaducal@workstation: ~
jmaducal@workstation:~$ ping 192.168.56.102 -c 5
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=0.448 ms
64 bytes from 192.168.56.102: icmp_seq=2 ttl=64 time=0.339 ms
64 bytes from 192.168.56.102: icmp_seq=3 ttl=64 time=0.341 ms
64 bytes from 192.168.56.102: icmp_seq=4 ttl=64 time=0.318 ms
64 bytes from 192.168.56.102: icmp_seq=5 ttl=64 time=0.334 ms

--- 192.168.56.102 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4092ms
rtt min/avg/max/mdev = 0.318/0.356/0.448/0.046 ms
```

Ping from Local Machine 1 to Server 1

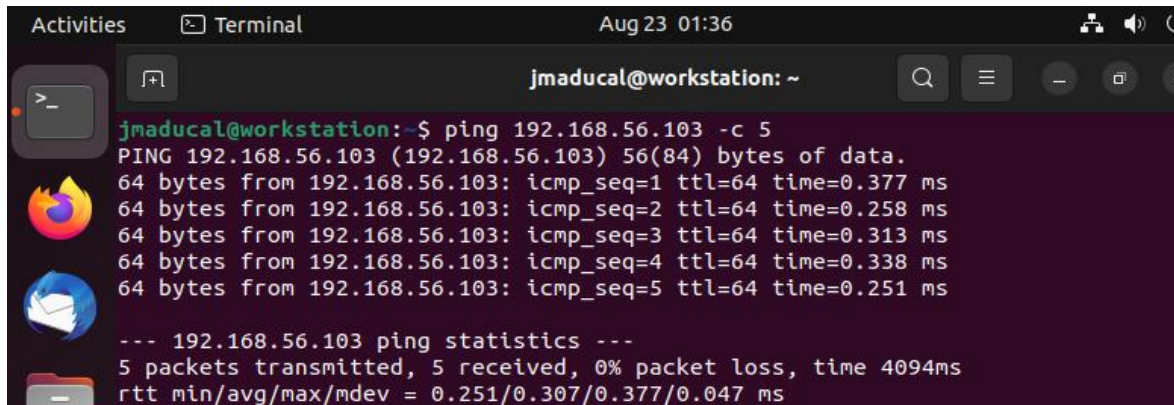


```
Activities Terminal Aug 23 01:33
jmaducal@server1: ~
jmaducal@server1:~$ ping 192.168.56.101 -c 5
PING 192.168.56.101 (192.168.56.101) 56(84) bytes of data.
64 bytes from 192.168.56.101: icmp_seq=1 ttl=64 time=0.366 ms
64 bytes from 192.168.56.101: icmp_seq=2 ttl=64 time=0.303 ms
64 bytes from 192.168.56.101: icmp_seq=3 ttl=64 time=0.378 ms
64 bytes from 192.168.56.101: icmp_seq=4 ttl=64 time=0.299 ms
64 bytes from 192.168.56.101: icmp_seq=5 ttl=64 time=0.270 ms

--- 192.168.56.101 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4090ms
rtt min/avg/max/mdev = 0.270/0.323/0.378/0.041 ms
```

Ping from Server 1 to Local Machine 1

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

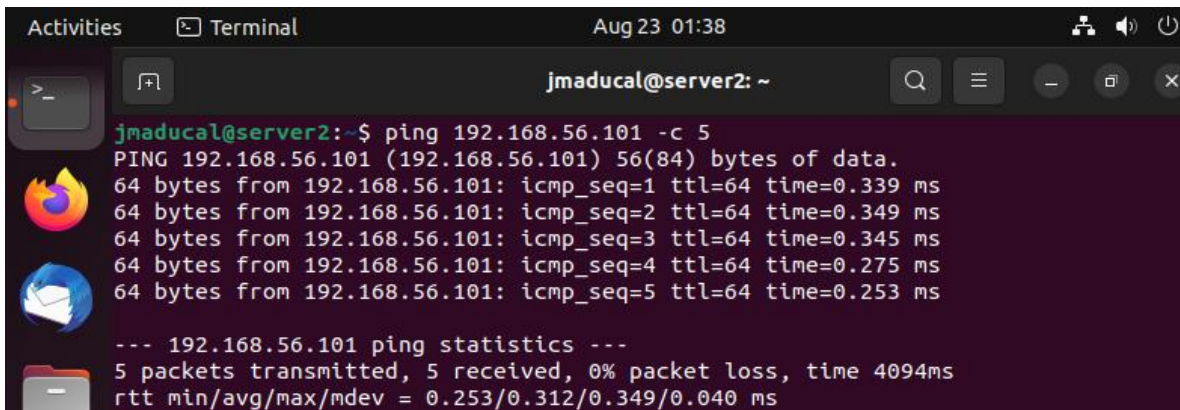


A terminal window titled 'Terminal' with the date 'Aug 23 01:36'. The prompt is 'jmaducal@workstation: ~'. The command executed is 'ping 192.168.56.103 -c 5'. The output shows five successful ping responses with varying times (0.251 to 0.377 ms) and a summary: '5 packets transmitted, 5 received, 0% packet loss, time 4094ms'.

```
jmaducal@workstation:~$ ping 192.168.56.103 -c 5
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=0.377 ms
64 bytes from 192.168.56.103: icmp_seq=2 ttl=64 time=0.258 ms
64 bytes from 192.168.56.103: icmp_seq=3 ttl=64 time=0.313 ms
64 bytes from 192.168.56.103: icmp_seq=4 ttl=64 time=0.338 ms
64 bytes from 192.168.56.103: icmp_seq=5 ttl=64 time=0.251 ms

--- 192.168.56.103 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4094ms
rtt min/avg/max/mdev = 0.251/0.307/0.377/0.047 ms
```

Ping from Local Machine 1 to Server 2



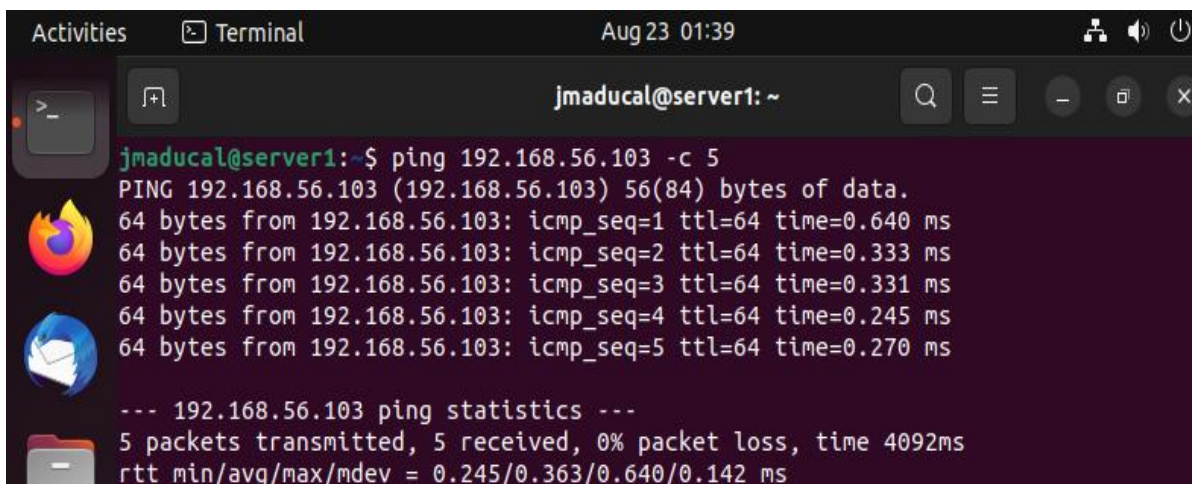
A terminal window titled 'Terminal' with the date 'Aug 23 01:38'. The prompt is 'jmaducal@server2: ~'. The command executed is 'ping 192.168.56.101 -c 5'. The output shows five successful ping responses with varying times (0.253 to 0.349 ms) and a summary: '5 packets transmitted, 5 received, 0% packet loss, time 4094ms'.

```
jmaducal@server2:~$ ping 192.168.56.101 -c 5
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=0.339 ms
64 bytes from 192.168.56.101: icmp_seq=2 ttl=64 time=0.349 ms
64 bytes from 192.168.56.101: icmp_seq=3 ttl=64 time=0.345 ms
64 bytes from 192.168.56.101: icmp_seq=4 ttl=64 time=0.275 ms
64 bytes from 192.168.56.101: icmp_seq=5 ttl=64 time=0.253 ms

--- 192.168.56.101 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4094ms
rtt min/avg/max/mdev = 0.253/0.312/0.349/0.040 ms
```

Ping from Server 2 to Local Machine 1

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



A terminal window titled 'Terminal' with the date 'Aug 23 01:39'. The prompt is 'jmaducal@server1: ~'. The command executed is 'ping 192.168.56.103 -c 5'. The output shows five successful ping responses with varying times (0.245 to 0.640 ms) and a summary: '5 packets transmitted, 5 received, 0% packet loss, time 4092ms'.

```
jmaducal@server1:~$ ping 192.168.56.103 -c 5
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=0.640 ms
64 bytes from 192.168.56.103: icmp_seq=2 ttl=64 time=0.333 ms
64 bytes from 192.168.56.103: icmp_seq=3 ttl=64 time=0.331 ms
64 bytes from 192.168.56.103: icmp_seq=4 ttl=64 time=0.245 ms
64 bytes from 192.168.56.103: icmp_seq=5 ttl=64 time=0.270 ms

--- 192.168.56.103 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4092ms
rtt min/avg/max/mdev = 0.245/0.363/0.640/0.142 ms
```

Ping from Server 1 to Server 2


```
Activities Terminal Aug 23 01:41
jmaducal@server2: ~
jmaducal@server2:~$ ping 192.168.56.102 -c 5
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=0.259 ms
64 bytes from 192.168.56.102: icmp_seq=2 ttl=64 time=0.293 ms
64 bytes from 192.168.56.102: icmp_seq=3 ttl=64 time=0.303 ms
64 bytes from 192.168.56.102: icmp_seq=4 ttl=64 time=0.300 ms
64 bytes from 192.168.56.102: icmp_seq=5 ttl=64 time=0.288 ms

--- 192.168.56.102 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4073ms
rtt min/avg/max/mdev = 0.259/0.288/0.303/0.015 ms
```

Ping from Server 2 to Server 1

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*

```
Activities Terminal Aug 23 01:46
jmaducal@server1: ~
jmaducal@workstation:~$ ssh jmaducal@192.168.56.102
jmaducal@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.

*** System restart required ***
jmaducal@server1:~$
```

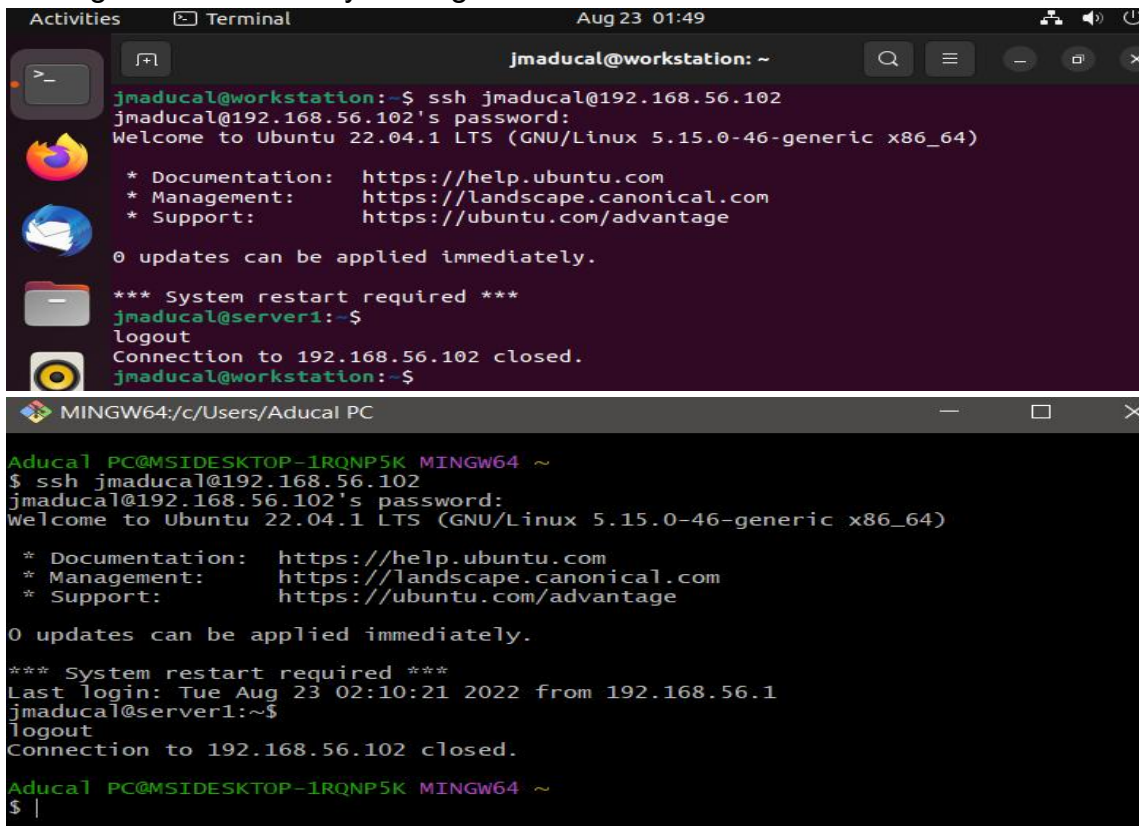
```
jmaducal@server1: ~
Aduca1 PC@MSIDESTOP-1RQNP5K MINGW64 ~
$ ssh jmaducal@192.168.56.102
jmaducal@192.168.56.102's password:
Welcome to Ubuntu 22.04.1 LTS (GNU/Linux 5.15.0-46-generic x86_64)

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

0 updates can be applied immediately.

*** System restart required ***
Last login: Tue Aug 23 02:10:21 2022 from 192.168.56.1
jmaducal@server1:~$ |
```

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



The screenshot shows two terminal windows. The top window, titled 'Terminal' with a timestamp of 'Aug 23 01:49', shows a user 'jmaducal@workstation' logging into 'jmaducal@192.168.56.102'. The session displays the Ubuntu 22.04.1 LTS welcome message, system information, and a message that 0 updates can be applied immediately. It then shows a system restart requirement and the user logging out. The bottom window, titled 'MINGW64: c:/Users/Aducal PC', shows the same user logging into the same server from a Windows environment. The session also shows the Ubuntu welcome message and system information, but it includes a 'Last login' timestamp of 'Tue Aug 23 02:10:21 2022' before the user logs out.

```
jmaducal@workstation:~$ ssh jmaducal@192.168.56.102
jmaducal@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.

*** System restart required ***
jmaducal@server1:~$
logout
Connection to 192.168.56.102 closed.
jmaducal@workstation:~$

Aducal PC@MSIDESTOP-1RQNP5K MINGW64 ~
$ ssh jmaducal@192.168.56.102
jmaducal@192.168.56.102's password:
Welcome to Ubuntu 22.04.1 LTS (GNU/Linux 5.15.0-46-generic x86_64)

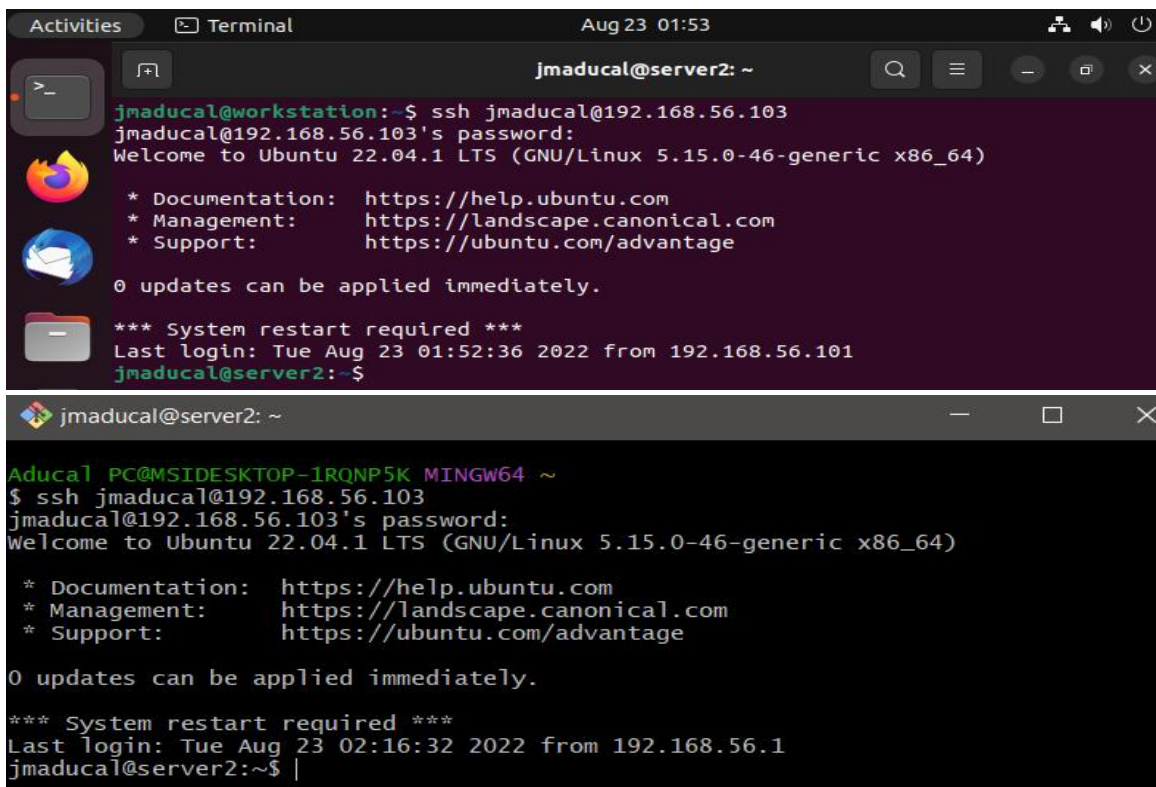
 * Documentation:  https://help.ubuntu.com
 * Management:    https://landscape.canonical.com
 * Support:       https://ubuntu.com/advantage

0 updates can be applied immediately.

*** System restart required ***
Last login: Tue Aug 23 02:10:21 2022 from 192.168.56.1
jmaducal@server1:~$
logout
Connection to 192.168.56.102 closed.

Aducal PC@MSIDESTOP-1RQNP5K MINGW64 ~
$ |
```

3. Do the same for Server 2.



The screenshot shows two terminal windows. The top window, titled 'Terminal' with a timestamp of 'Aug 23 01:53', shows a user 'jmaducal@workstation' logging into 'jmaducal@192.168.56.103'. The session displays the Ubuntu 22.04.1 LTS welcome message, system information, and a message that 0 updates can be applied immediately. It then shows a system restart requirement and the user logging out. The bottom window, titled 'jmaducal@server2: ~', shows the same user logging into the same server from a Windows environment. The session also shows the Ubuntu welcome message and system information, but it includes a 'Last login' timestamp of 'Tue Aug 23 02:16:32 2022' before the user logs out.

```
jmaducal@workstation:~$ ssh jmaducal@192.168.56.103
jmaducal@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
 * Management:    https://landscape.canonical.com
 * Support:       https://ubuntu.com/advantage

0 updates can be applied immediately.

*** System restart required ***
Last login: Tue Aug 23 01:52:36 2022 from 192.168.56.101
jmaducal@server2:~$

jmaducal@server2: ~
Aducal PC@MSIDESTOP-1RQNP5K MINGW64 ~
$ ssh jmaducal@192.168.56.103
jmaducal@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
 * Management:    https://landscape.canonical.com
 * Support:       https://ubuntu.com/advantage

0 updates can be applied immediately.

*** System restart required ***
Last login: Tue Aug 23 02:16:32 2022 from 192.168.56.1
jmaducal@server2:~$ |
```



```
Activities Terminal Aug 23 01:54
jmaducal@workstation: ~
jmaducal@workstation:~$ ssh jmaducal@192.168.56.103
jmaducal@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
 * Management:    https://landscape.canonical.com
 * Support:       https://ubuntu.com/advantage

0 updates can be applied immediately.

*** System restart required ***
Last login: Tue Aug 23 01:52:36 2022 from 192.168.56.101
jmaducal@server2:~$
logout
Connection to 192.168.56.103 closed.
jmaducal@workstation:~$

MINGW64:/c/Users/Aducal PC
Aducal PC@MSIDESTKTOP-1RQNP5K MINGW64 ~
$ ssh jmaducal@192.168.56.103
jmaducal@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
 * Management:    https://landscape.canonical.com
 * Support:       https://ubuntu.com/advantage

0 updates can be applied immediately.

*** System restart required ***
Last login: Tue Aug 23 02:16:32 2022 from 192.168.56.1
jmaducal@server2:~$
logout
Connection to 192.168.56.103 closed.
Aducal PC@MSIDESTKTOP-1RQNP5K MINGW64 ~
$ |
```

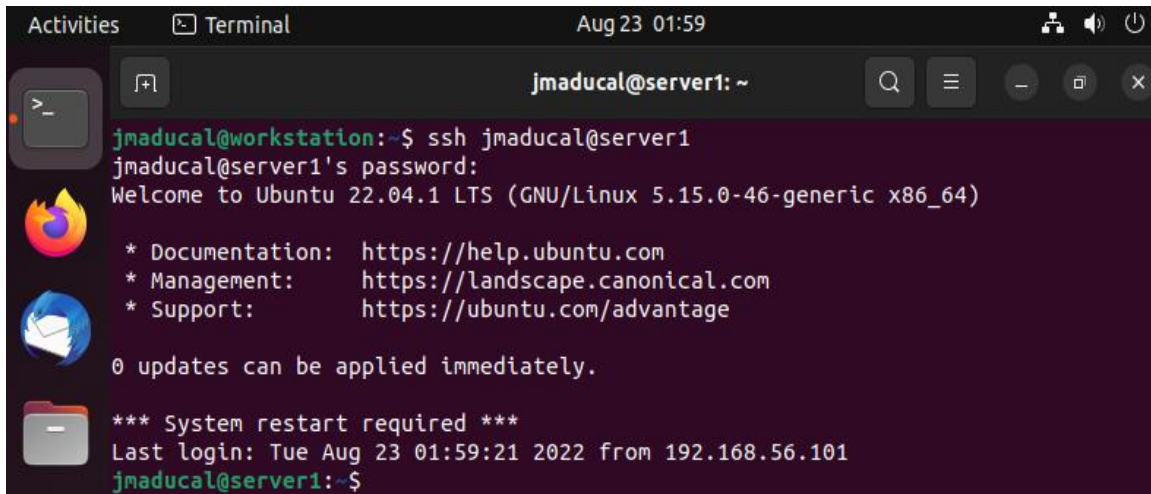
4. Edit the hosts of the Local Machine by issuing the command *sudo nano /etc/hosts*. Below all texts type the following:
 - 4.1 *IP_address server 1* (provide the ip address of server 1 followed by the hostname)
 - 4.2 *IP_address server 2* (provide the ip address of server 2 followed by the hostname)
 - 4.3 Save the file and exit.

```
Activities Terminal Aug 23 01:57
jmaducal@workstation: ~
GNU nano 6.2 /etc/hosts *
127.0.0.1 workstation
127.0.1.1 jmaducal-VirtualBox
192.168.56.102 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

File Name to Write: /etc/hosts
^G Help M-D DOS Format M-A Append M-B Backup File
^C Cancel M-M Mac Format M-P Prepend ^T Browse
```

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.

For Server 1:

A terminal window titled 'Terminal' with a timestamp of 'Aug 23 01:59'. The window shows an SSH session from 'jmaducal@workstation' to 'jmaducal@server1'. The user enters the password, and the server responds with a welcome message for Ubuntu 22.04.1 LTS. It lists links for documentation, management, and support, and states that 0 updates can be applied immediately. A system restart is required, and the last login is recorded as Tue Aug 23 01:59:21 2022 from 192.168.56.101.

```
Activities Terminal Aug 23 01:59
jmaducal@server1: ~
jmaducal@workstation:~$ ssh jmaducal@server1
jmaducal@server1'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

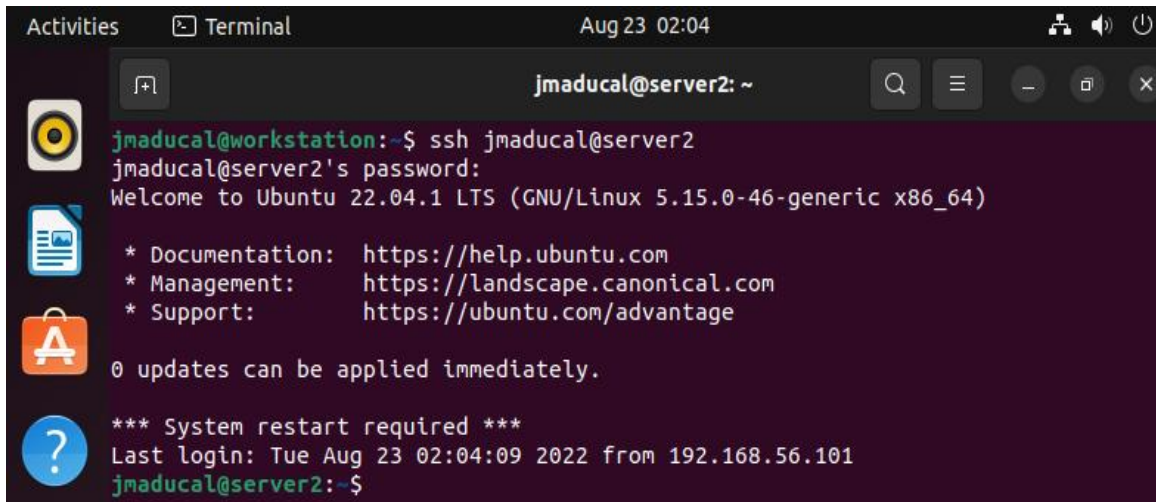
0 updates can be applied immediately.

*** System restart required ***
Last login: Tue Aug 23 01:59:21 2022 from 192.168.56.101
jmaducal@server1:~$
```

```
jmaducal@server1:~$
logout
Connection to server1 closed.
jmaducal@workstation:~$
```

CTRL + D to logout from server 1 and back to the Local Machine/Workstation.

For Server 2:

A terminal window titled 'Terminal' with a timestamp of 'Aug 23 02:04'. The window shows an SSH session from 'jmaducal@workstation' to 'jmaducal@server2'. The user enters the password, and the server responds with a welcome message for Ubuntu 22.04.1 LTS. It lists links for documentation, management, and support, and states that 0 updates can be applied immediately. A system restart is required, and the last login is recorded as Tue Aug 23 02:04:09 2022 from 192.168.56.101.

```
Activities Terminal Aug 23 02:04
jmaducal@server2: ~
jmaducal@workstation:~$ ssh jmaducal@server2
jmaducal@server2'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.

*** System restart required ***
Last login: Tue Aug 23 02:04:09 2022 from 192.168.56.101
jmaducal@server2:~$
```

```
jmaducal@server2:~$
logout
Connection to server2 closed.
```

CTRL + D to logout from server 2 and back to the Local Machine/Workstation.

For Server 1:

```
MINGW64:/c/Users/Aducal PC
$ ssh jmaducal@server1
The authenticity of host 'server1 (192.168.56.102)' can't be established.
ED25519 key fingerprint is SHA256:by6Kb/lzSEyLkQ603f07TGiPf058CSKpF0BpQ8SWCy8.
This host key is known by the following other names/addresses:
  ~/.ssh/known_hosts:1: 192.168.56.102
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added 'server1' (ED25519) to the list of known hosts.
jmaducal@server1'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.

*** System restart required ***
Last login: Tue Aug 23 02:13:03 2022 from 192.168.56.1
jmaducal@server1:~$
logout
Connection to server1 closed.

Aducal PC@MSIDESTOP-1RQNP5K MINGW64 ~
$ |
```

For Server 2:

```
MINGW64:/c/Users/Aducal PC
$ ssh jmaducal@server2
The authenticity of host 'server2 (192.168.56.104)' can't be established.
ED25519 key fingerprint is SHA256:JPbvlfUjMHwwQhYSqhxYYHT5aLq6G9z3zZF+OTS1Tkc.
This host key is known by the following other names/addresses:
  ~/.ssh/known_hosts:4: 192.168.56.103
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added 'server2' (ED25519) to the list of known hosts.
jmaducal@server2'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.

*** System restart required ***
Last login: Tue Aug 23 02:16:50 2022 from 192.168.56.1
jmaducal@server2:~$
logout
Connection to server2 closed.

Aducal PC@MSIDESTOP-1RQNP5K MINGW64 ~
$ |
```

Reflections:

Answer the following:

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

We can do that by editing the hosts of the local machine issuing the command `sudo nano /etc/hosts`. Then provide or type the IP addresses of server 1 & 2 followed by their respective host name. Now we can use the host name instead of typing the IP address of the servers.

2. How secured is SSH?

SSH connections have mostly been used to secure different types of communications between a local machine and a remote host, including:

- Secure remote access to resources
- Remote execution of commands
- Delivery of software patches and updates
- Interactive and automated file transfers

In addition to creating a secure channel between local and remote computers, SSH protocol is used for managing critical corporate infrastructure such as routers, server hardware, virtualization platforms, and operating systems.

SSH keys are used to automate access to servers and often are used in scripts, backup systems and configuration management tools. Because of their design that allows connectivity across organizational boundaries, SSH keys provide single sign-on (SSO) capabilities allowing users to move between their accounts without typing a password each time.

Reference:

W. Altaqi. "The What, Why & How of SSH Protocol – Keyfactor." <https://www.keyfactor.com/blog/ssh-protocol> (accessed: Aug. 23, 2022).

Honor Pledge:

"I affirm that I shall not give or receive any unauthorized help on this activity and all the work shall be my own"