Name: Mark Andrei Ponayo	**Date Performed:** Aug 22, 2023
Course/Section: BSCPE31S5	**Date Submitted:**
Instructor: Engr Roman Richard	**Semester and SY:** 1st Sem 2023

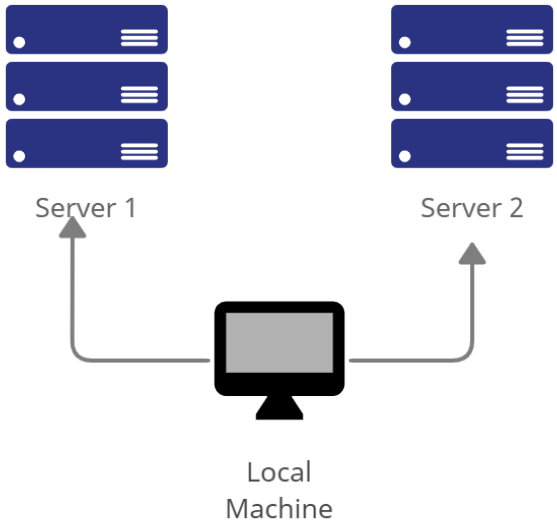
Activity 1: Configure Network using Virtual Machines

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

2. **Discussion:**

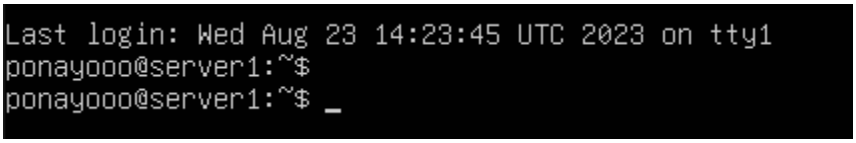
Network Topology:

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

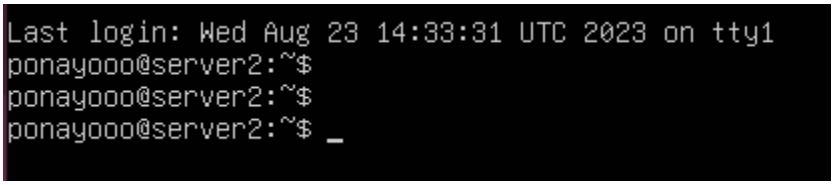


Task 1: Do the following on Server 1, Server 2, and Local Machine. In editing the file using nano command, press control + O to write out (save the file). Press enter when asked for the name of the file. Press control + X to end.

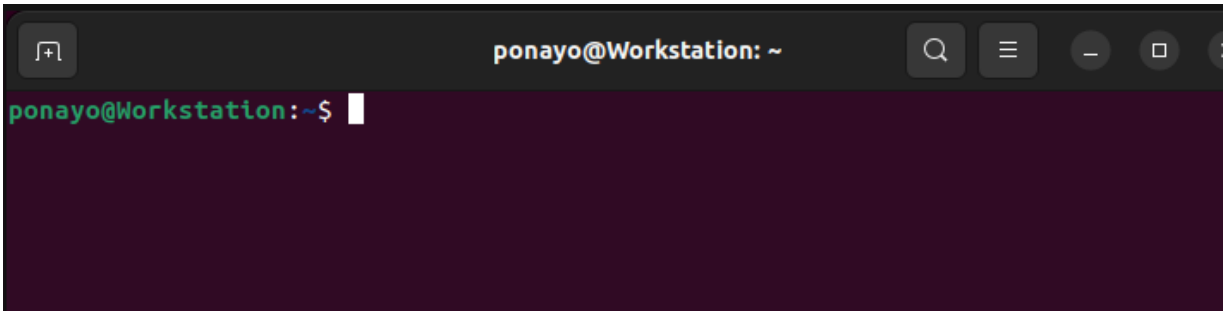
1. Change the hostname using the command *sudo nano /etc/hostname*
   1.1 Use server1 for Server 1



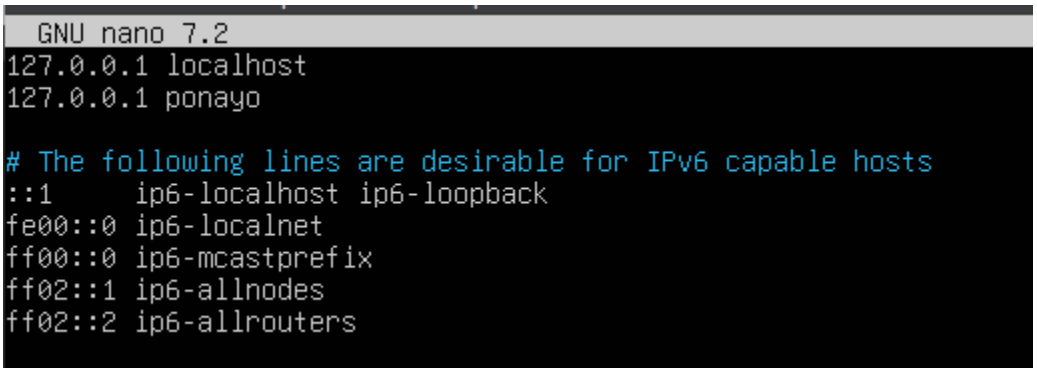
1.2 Use server2 for Server 2



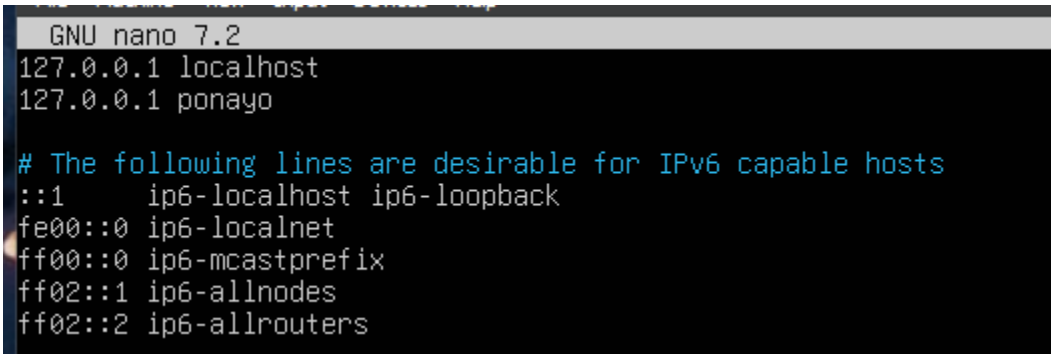
1.3 Use workstation for the Local Machine



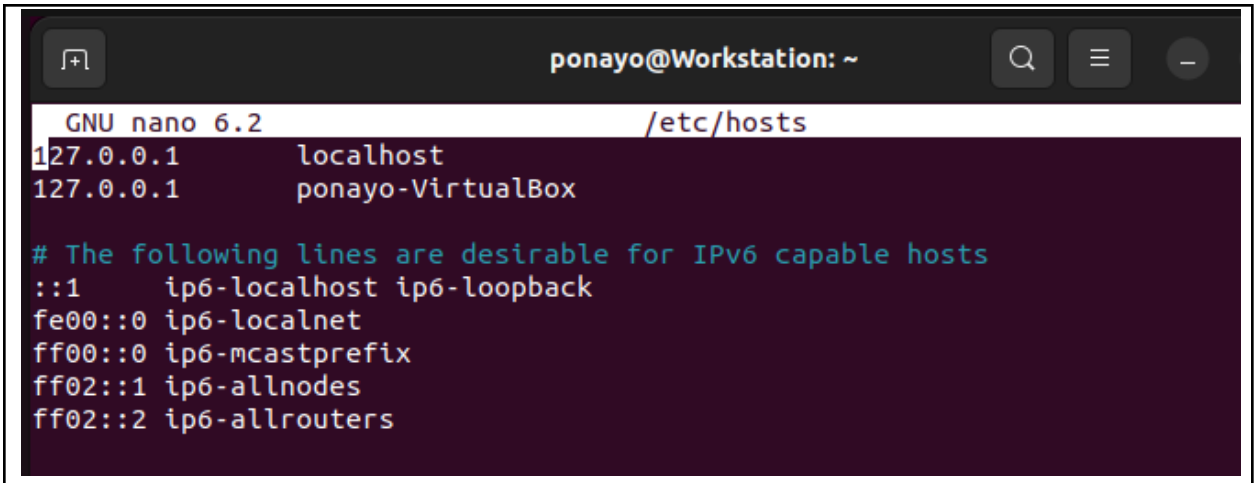
2. Edit the hosts using the command *sudo nano /etc/hosts*. Edit the second line.
   2.1 Type 127.0.0.1 server 1 for Server 1



2.2 Type 127.0.0.1 server 2 for Server 2



2.3 Type 127.0.0.1 workstation for the Local Machine



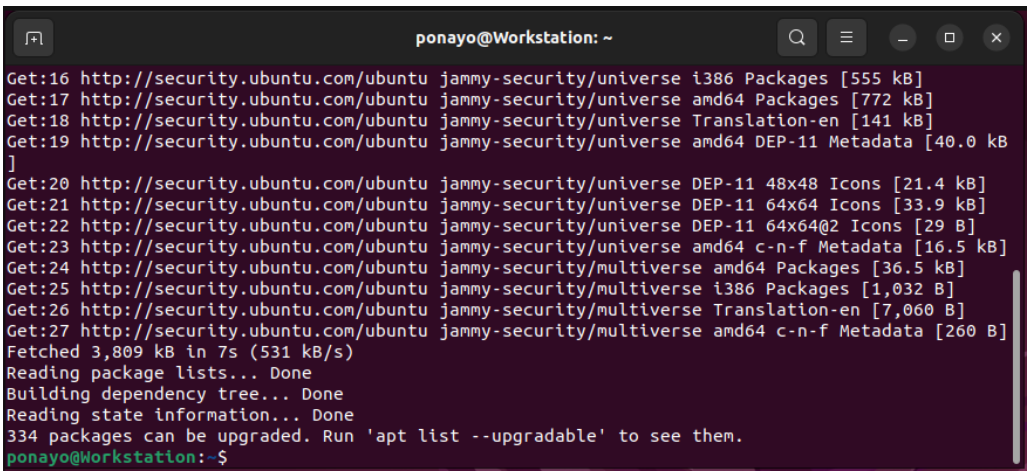
Task 2: Configure SSH on Server 1, Server 2, and Local Machine. Do the following:

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

local host

Workstation

- sudo apt update -



- sudo apt upgrade -

```
ponayo@Workstation: ~
Setting up ubuntu-desktop (1.481.1) ...
Processing triggers for desktop-file-utils (0.26-1ubuntu3) ...
Processing triggers for hicolor-icon-theme (0.17-2) ...
Processing triggers for gnome-menus (3.36.0-1ubuntu3) ...
Processing triggers for libc-bin (2.35-0ubuntu3.1) ...
Processing triggers for rsyslog (8.2112.0-2ubuntu2.2) ...
Processing triggers for man-db (2.10.2-1) ...
Processing triggers for cracklib-runtime (2.9.6-3.4build4) ...
Processing triggers for plymouth-theme-ubuntu-text (0.9.5+git20211018-1ubuntu3)
update-initramfs: deferring update (trigger activated)
Processing triggers for dbus (1.12.20-2ubuntu4.1) ...
Processing triggers for shared-mime-info (2.1-2) ...
Processing triggers for udev (249.11-0ubuntu3.9) ...
Processing triggers for libgdk-pixbuf-2.0-0:amd64 (2.42.8+dfsg-1ubuntu0.2) ...
Processing triggers for install-info (6.8-4build1) ...
Processing triggers for mailcap (3.70+nmu1ubuntu1) ...
Processing triggers for fontconfig (2.13.1-4.2ubuntu5) ...
Processing triggers for ca-certificates (20230311ubuntu0.22.04.1) ...
Updating certificates in /etc/ssl/certs...
0 added, 0 removed; done.
Running hooks in /etc/ca-certificates/update.d...
done.
Processing triggers for initramfs-tools (0.140ubuntu13.4) ...
update-initramfs: Generating /boot/initrd.img-6.2.0-26-generic
ponayo@Workstation:~$
```

Server1

- sudo apt update -

```
ponayooo@server1:~$ sudo apt update
Hit:1 http://ph.archive.ubuntu.com/ubuntu lunar InRelease
Hit:2 http://ph.archive.ubuntu.com/ubuntu lunar-updates InRelease
Hit:3 http://ph.archive.ubuntu.com/ubuntu lunar-backports InRelease
Hit:4 http://ph.archive.ubuntu.com/ubuntu lunar-security InRelease
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
20 packages can be upgraded. Run 'apt list --upgradable' to see them.
ponayooo@server1:~$
```

- sudo apt upgrade -

```
 /etc/needrestart/restart.d/systemd-manager
 systemctl restart packagekit.service
Service restarts being deferred:
 /etc/needrestart/restart.d/dbus.service
 systemctl restart unattended-upgrades.service

No containers need to be restarted.

User sessions running outdated binaries:
 ponayooo @ session #1: apt[1112]
 ponayooo @ user manager service: systemd[804]

No VM guests are running outdated hypervisor (qemu) binaries on this host.
```

Server2

- sudo apt update -

```
ponayooo@server2:~$ sudo apt update
Hit:1 http://ph.archive.ubuntu.com/ubuntu lunar InRelease
Hit:2 http://ph.archive.ubuntu.com/ubuntu lunar-updates InRelease
Hit:3 http://ph.archive.ubuntu.com/ubuntu lunar-backports InRelease
Hit:4 http://ph.archive.ubuntu.com/ubuntu lunar-security InRelease
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
20 packages can be upgraded. Run 'apt list --upgradable' to see them.
ponayooo@server2:~$
```

- sudo apt upgrade -

```
 /etc/needrestart/restart.d/systemd-manager
 systemctl restart packagekit.service
Service restarts being deferred:
 /etc/needrestart/restart.d/dbus.service
 systemctl restart unattended-upgrades.service

No containers need to be restarted.

User sessions running outdated binaries:
 ponayooo @ session #1: apt[1369]
 ponayooo @ user manager service: systemd[807]

No VM guests are running outdated hypervisor (qemu) binaries on this host.
```

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

Workstation

```
ponayo@Workstation: ~
Preparing to unpack .../ncurses-term_6.3-2ubuntu0.1_all.deb ...
Unpacking ncurses-term (6.3-2ubuntu0.1) ...
Selecting previously unselected package ssh-import-id.
Preparing to unpack .../ssh-import-id_5.11-0ubuntu1_all.deb ...
Unpacking ssh-import-id (5.11-0ubuntu1) ...
Setting up openssh-sftp-server (1:8.9p1-3ubuntu0.3) ...
Setting up openssh-server (1:8.9p1-3ubuntu0.3) ...

Creating config file /etc/ssh/sshd_config with new version
Creating SSH2 RSA key; this may take some time ...
3072 SHA256:cj84ShqQjp+22UYAIUr5/+ZFHQZl5ZAXhy5ri7jxI6A root@Workstation (RSA)
Creating SSH2 ECDSA key; this may take some time ...
256 SHA256:Eke3NJXvE1l9wLP7bgF3YL0+CO5jPGkjzdDds0zd/TM root@Workstation (ECDSA)
Creating SSH2 ED25519 key; this may take some time ...
256 SHA256:vRUkm3owH2Zss206UF6K4zRcq/j5y7Zp3N0rap6w1j8 root@Workstation (ED25519)
Created symlink /etc/systemd/system/sshd.service → /lib/systemd/system/ssh.service.
Created symlink /etc/systemd/system/multi-user.target.wants/ssh.service → /lib/systemd/system/ssh.ser
vice.
rescue-ssh.target is a disabled or a static unit, not starting it.
ssh.socket is a disabled or a static unit, not starting it.
Setting up ssh-import-id (5.11-0ubuntu1) ...
Setting up ncurses-term (6.3-2ubuntu0.1) ...
Processing triggers for man-db (2.10.2-1) ...
Processing triggers for ufw (0.36.1-4ubuntu0.1) ...
ponayo@Workstation:~$
```

Server1

```
ponayooo@server1:~$ sudo apt install openssh-server
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
openssh-server is already the newest version (1:9.0p1-1ubuntu8.4
openssh-server set to manually installed.
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
ponayooo@server1:~$
```

Server2

```
ponayooo@server2:~$ sudo apt install openssh-server
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
openssh-server is already the newest version (1:9.0p1-1ubuntu8.4).
openssh-server set to manually installed.
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
ponayooo@server2:~$
```

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

3.1 sudo service ssh start

Workstation

```
ponayo@Workstation:~$ sudo service ssh start
ponayo@Workstation:~$
```

Server1

```
ponayooo@server1:~$ sudo service ssh start
ponayooo@server1:~$
```

Server2

```
ponayooo@server2:~$ sudo service ssh start
ponayooo@server2:~$
```

3.2 sudo systemctl status ssh

Workstation

```
ponayo@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 Wed 2023-08-23 23:09:25 PST; 59s ago
       Docs: man:sshd(8)
             man:sshd_config(5)
   Main PID: 36511 (sshd)
      Tasks: 1 (limit: 4536)
     Memory: 1.7M
        CPU: 19ms
     CGroup: /system.slice/ssh.service
             └─36511 "sshd: /usr/sbin/sshd -D [listener] 0 of 10-100 startups"

Aug 23 23:09:25 Workstation systemd[1]: Starting OpenBSD Secure Shell server...
Aug 23 23:09:25 Workstation sshd[36511]: Server listening on 0.0.0.0 port 22.
Aug 23 23:09:25 Workstation sshd[36511]: Server listening on :: port 22.
Aug 23 23:09:25 Workstation systemd[1]: Started OpenBSD Secure Shell server.
ponayo@Workstation:~$
```

Server1

```
ponayooo@server1:~$ sudo systemctl status ssh
• ssh.service - OpenBSD Secure Shell server
     Loaded: loaded (/lib/systemd/system/ssh.service; disabled; preset: enabled)
    Drop-In: /etc/systemd/system/ssh.service.d
             └─00-socket.conf
     Active: active (running) since Wed 2023-08-23 15:06:06 UTC; 1min 27s ago
TriggeredBy: • ssh.socket
       Docs: man:sshd(8)
             man:sshd_config(5)
    Process: 14354 ExecStartPre=/usr/sbin/sshd -t (code=exited, status=0/SUCCESS)
   Main PID: 14355 (sshd)
      Tasks: 1 (limit: 2187)
     Memory: 2.7M
        CPU: 21ms
     CGroup: /system.slice/ssh.service
             └─14355 "sshd: /usr/sbin/sshd -D [listener] 0 of 10-100 startups"

Aug 23 15:06:06 server1 systemd[1]: Starting ssh.service - OpenBSD Secure Shell server...
Aug 23 15:06:06 server1 sshd[14355]: Server listening on :: port 22.
Aug 23 15:06:06 server1 systemd[1]: Started ssh.service - OpenBSD Secure Shell server.
ponayooo@server1:~$
```

Server2

```
ponayooo@server2:~$ sudo systemctl status ssh
• ssh.service - OpenBSD Secure Shell server
     Loaded: loaded (/lib/systemd/system/ssh.service; disabled; preset: enabled)
    Drop-In: /etc/systemd/system/ssh.service.d
             └─00-socket.conf
     Active: active (running) since Wed 2023-08-23 15:06:44 UTC; 1min 27s ago
TriggeredBy: • ssh.socket
       Docs: man:sshd(8)
             man:sshd_config(5)
    Process: 14617 ExecStartPre=/usr/sbin/sshd -t (code=exited, status=0/SUCCESS)
   Main PID: 14618 (sshd)
      Tasks: 1 (limit: 2187)
     Memory: 2.7M
        CPU: 24ms
     CGroup: /system.slice/ssh.service
             └─14618 "sshd: /usr/sbin/sshd -D [listener] 0 of 10-100 startups"

Aug 23 15:06:44 server2 systemd[1]: Starting ssh.service - OpenBSD Secure Shell server...
Aug 23 15:06:44 server2 sshd[14618]: Server listening on :: port 22.
Aug 23 15:06:44 server2 systemd[1]: Started ssh.service - OpenBSD Secure Shell server.
ponayooo@server2:~$ _
```

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

   4.1 sudo ufw allow ssh

Workstation

```
ponayo@Workstation:~$ sudo ufw allow ssh
Rules updated
Rules updated (v6)
ponayo@Workstation:~$
```

Server1

```
ponayooo@server1:~$ sudo ufw allow ssh
Rules updated
Rules updated (v6)
ponayooo@server1:~$ _
```

Server2

```
ponayooo@server2:~$ sudo ufw allow ssh
Rules updated
Rules updated (v6)
ponayooo@server2:~$
```

4.2 sudo ufw enable

Workstation

```
ponayo@Workstation:~$ sudo ufw enable
Firewall is active and enabled on system startup
ponayo@Workstation:~$
```

Server1

```
ponayooo@server1:~$ sudo ufw enable
Firewall is active and enabled on system startup
ponayooo@server1:~$
```

Server2

```
ponayooo@server2:~$ sudo ufw enable
Firewall is active and enabled on system startup
ponayooo@server2:~$
```

4.3 sudo ufw status

Workstation

```
ponayo@Workstation:~$ sudo ufw status
Status: active

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

ponayo@Workstation:~$
```

Server1

```
ponayooo@server1:~$ sudo ufw status
Status: active

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

ponayooo@server1:~$ _
```

Server2

```
ponayooo@server2:~$ sudo ufw status
Status: active

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

ponayooo@server2:~$ _
```

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

1. Record the ip address of Server 1, Server 2, and Local Machine. Issue the command *ifconfig* and check network settings. Note that the ip addresses of all the machines are in this network 192.168.56.XX.

   1.1 Server 1 IP address: 192.168.56.102

```
enp0s3: 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::a00:27ff:feba:4a85  prefixlen 64  scopeid 0x20<link>
        ether 08:00:27:ba:4a:85  txqueuelen 1000  (Ethernet)
        RX packets 22  bytes 6573 (6.5 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 11  bytes 1420 (1.4 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

   1.2 Server 2 IP address: 192.168.56.103

```
ponayo@Server2:~$ ifconfig
enp0s3: 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::a00:27ff:fe08:e857  prefixlen 64  scopeid 0x20<link>
        ether 08:00:27:08:e8:57  txqueuelen 1000  (Ethernet)
        RX packets 3  bytes 1266 (1.2 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 10  bytes 1334 (1.3 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

   1.3 Server 3 IP address: 192.168.56.101

```
enp0s3: 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::c356:3794:2af0:4bda  prefixlen 64  scopeid 0x20<link>
        ether 08:00:27:44:f0:fd  txqueuelen 1000  (Ethernet)
        RX packets 39  bytes 17546 (17.5 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 62  bytes 8296 (8.2 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

```
ponayo@Workstation:~$ ping 192.168.56.102
PING 192.168.56.102 (192.168.56.102) 56(84) bytes of data.
64 bytes from 192.168.56.102: icmp_seq=1 ttl=64 time=0.247 ms
64 bytes from 192.168.56.102: icmp_seq=2 ttl=64 time=0.358 ms
64 bytes from 192.168.56.102: icmp_seq=3 ttl=64 time=0.273 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=0.413 ms
64 bytes from 192.168.56.102: icmp_seq=6 ttl=64 time=0.387 ms
64 bytes from 192.168.56.102: icmp_seq=7 ttl=64 time=0.258 ms
64 bytes from 192.168.56.102: icmp_seq=8 ttl=64 time=0.297 ms
64 bytes from 192.168.56.102: icmp_seq=9 ttl=64 time=0.288 ms
64 bytes from 192.168.56.102: icmp_seq=10 ttl=64 time=0.252 ms
64 bytes from 192.168.56.102: icmp_seq=11 ttl=64 time=0.246 ms
64 bytes from 192.168.56.102: icmp_seq=12 ttl=64 time=0.262 ms
64 bytes from 192.168.56.102: icmp_seq=13 ttl=64 time=0.288 ms
64 bytes from 192.168.56.102: icmp_seq=14 ttl=64 time=0.281 ms
^C
--- 192.168.56.102 ping statistics ---
14 packets transmitted, 14 received, 0% packet loss, time 13308ms
rtt min/avg/max/mdev = 0.246/0.296/0.413/0.050 ms
ponayo@Workstation:~$
```

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

```
ponayo@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=0.264 ms
64 bytes from 192.168.56.103: icmp_seq=2 ttl=64 time=0.279 ms
^C
--- 192.168.56.103 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1003ms
rtt min/avg/max/mdev = 0.264/0.271/0.279/0.007 ms
ponayo@Workstation:~$
```

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

```
ponayo@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=0.017 ms
64 bytes from 192.168.56.101: icmp_seq=2 ttl=64 time=0.057 ms
^C
--- 192.168.56.101 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1009ms
rtt min/avg/max/mdev = 0.017/0.037/0.057/0.020 ms
ponayo@Workstation:~$
```

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

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

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

1.2 Enter the password for server 1 when prompted

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

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

3. Do the same for Server 2.

Server1

```
ponayo@Workstation:~$ ssh ponayooo@192.168.56.102
ponayooo@192.168.56.102's password:
Welcome to Ubuntu 23.04 (GNU/Linux 6.2.0-27-generic x86_64)

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

  System information as of Wed Aug 23 03:37:32 PM UTC 2023

  System load: 0.02               Memory usage: 10%   Processes:       97
  Usage of /:  46.0% of 11.21GB   Swap usage:   0%    Users logged in: 1


0 updates can be applied immediately.

Failed to connect to https://changelogs.ubuntu.com/meta-release. Check your Inte
rnet connection or proxy settings


Last login: Wed Aug 23 15:17:42 2023
ponayooo@server1:~$
```

Server2

```
ponayo@Workstation:~$ ssh ponayo@192.168.56.103
ponayo@192.168.56.103's password:
Welcome to Ubuntu 23.04 (GNU/Linux 6.2.0-27-generic x86_64)

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

  System information as of Wed Aug 23 03:53:37 PM UTC 2023

  System load: 0.0               Memory usage: 10%   Processes:       105
  Usage of /:  46.2% of 11.21GB  Swap usage:   0%    Users logged in: 1


0 updates can be applied immediately.

Failed to connect to https://changelogs.ubuntu.com/meta-release. Check your Interne
 connection or proxy settings
```

Workstation

```
ponayo@Workstation:~$ ssh ponayo@192.168.56.101
ponayo@192.168.56.101's password:
Welcome to Ubuntu 22.04.3 LTS (GNU/Linux 6.2.0-26-generic x86_64)

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

Expanded Security Maintenance for Applications is not enabled.

0 updates can be applied immediately.

Enable ESM Apps to receive additional future security updates.
See https://ubuntu.com/esm or run: sudo pro status


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.

ponayo@Workstation:~$
```

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

4.1 IP_address server 1 (provide the ip address of server 1 followed by the hostname)

4.2 IP_address server 2 (provide the ip address of server 2 followed by the hostname)

4.3 Save the file and exit.

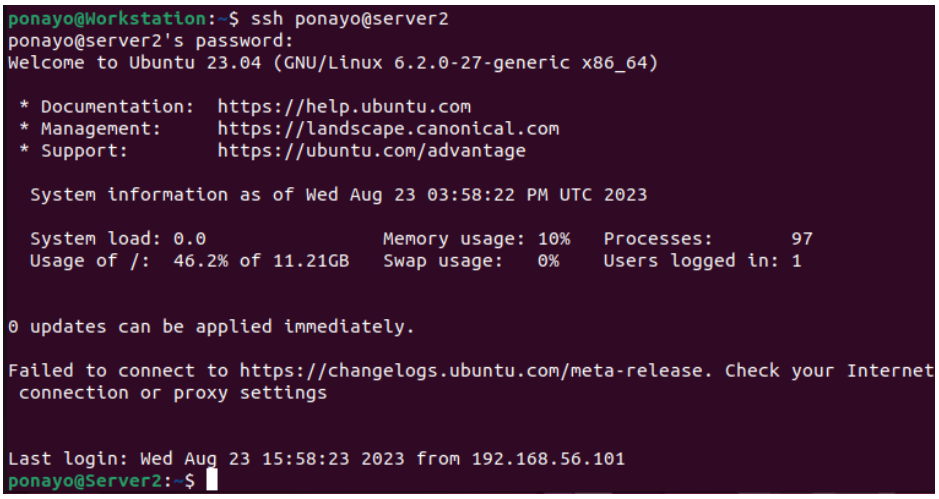
```
  GNU nano 6.2                                  /etc/hosts *
127.0.0.1       localhost
127.0.0.1       ponayo-VirtualBox

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
```

5. On the local machine, verify that you can do the SSH command but this time, use the hostname instead of typing the IP address of the servers. For example, try to do *ssh jvtaylar@server1*. Enter the password when prompted. Verify that you have entered Server 1. Do the same for Server 2.

Server1

```
ponayo@Workstation:~$ ssh ponayooo@server1
ponayooo@server1's password:
Welcome to Ubuntu 23.04 (GNU/Linux 6.2.0-27-generic x86_64)

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

  System information as of Wed Aug 23 03:56:45 PM UTC 2023

  System load: 0.0               Memory usage: 10%   Processes:       95
  Usage of /:  46.0% of 11.21GB  Swap usage:   0%    Users logged in: 1


0 updates can be applied immediately.

Failed to connect to https://changelogs.ubuntu.com/meta-release. Check your Internet
 connection or proxy settings


Last login: Wed Aug 23 15:37:33 2023 from 192.168.56.101
ponayooo@server1:~$
```

Server2



Reflections:

Answer the following:

1. How are we able to use the hostname instead of IP address in SSH commands?
   - Because of Domain Name System (DNS) since it makes the experience of the user on the internet less complicated.
2. How secured is SSH?
   - It was secured since ssh the connection between from host to server is encrypted.