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Course/Section: CpE31S2	**Date Submitted: 8/25/2024**
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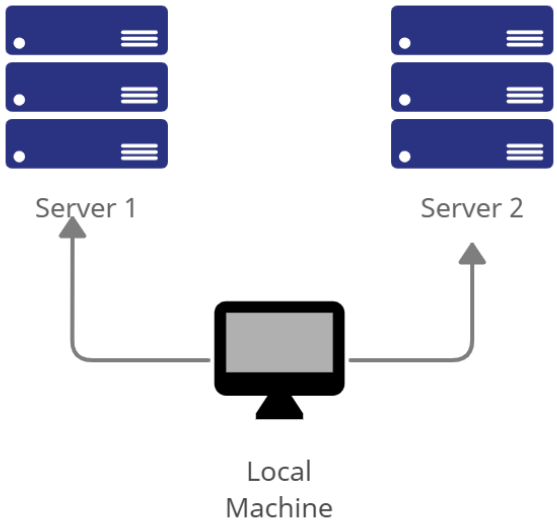
Activity 1: Configure Network using Virtual Machines

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:**

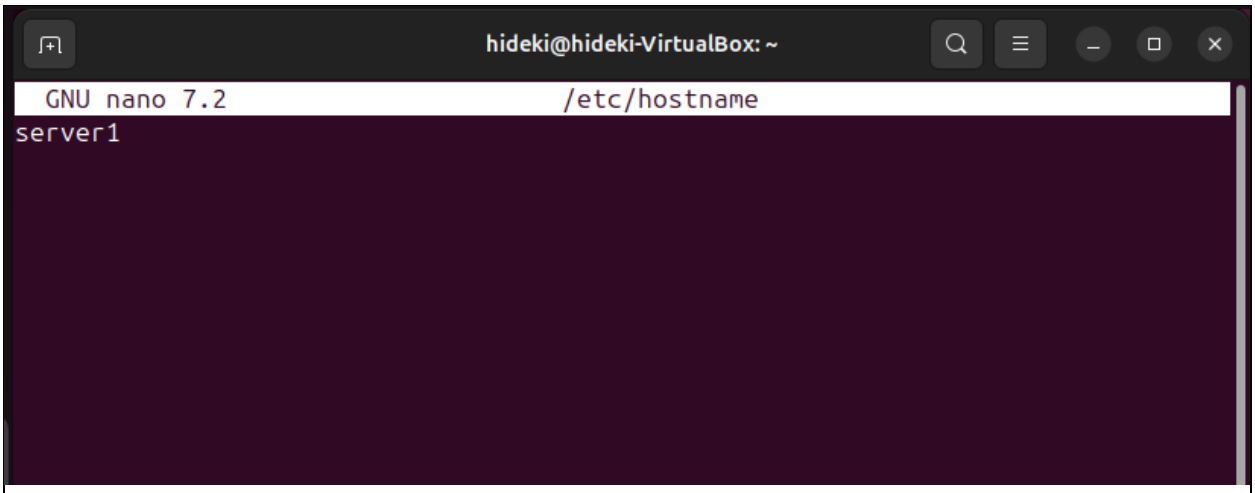
Network Topology:

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*).



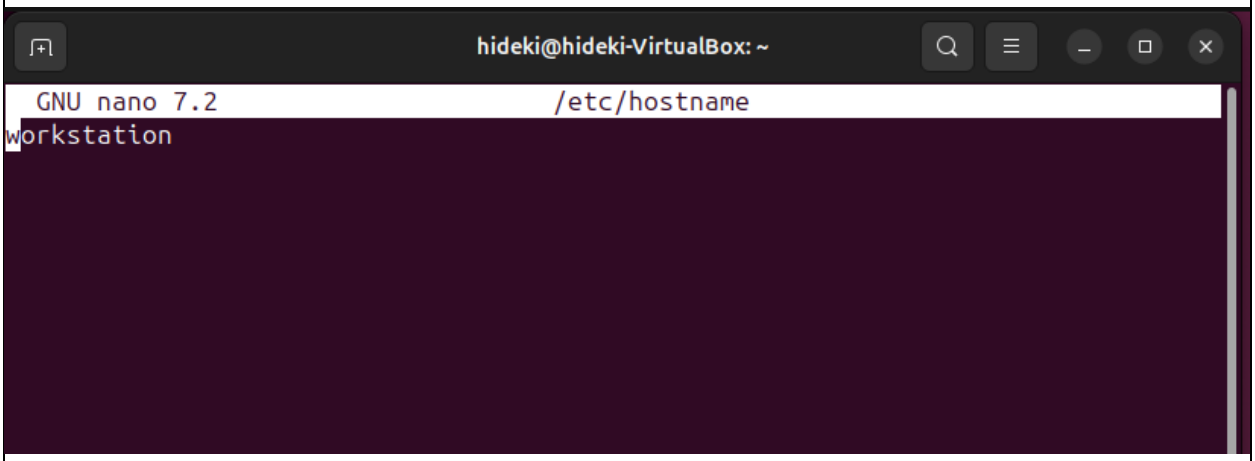
Task 1: Do the following on Server 1, Server 2, and Local Machine. In editing the file using nano command, press control + O to write out (save the file). Press enter when asked for the name of the file. Press control + X to end.

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

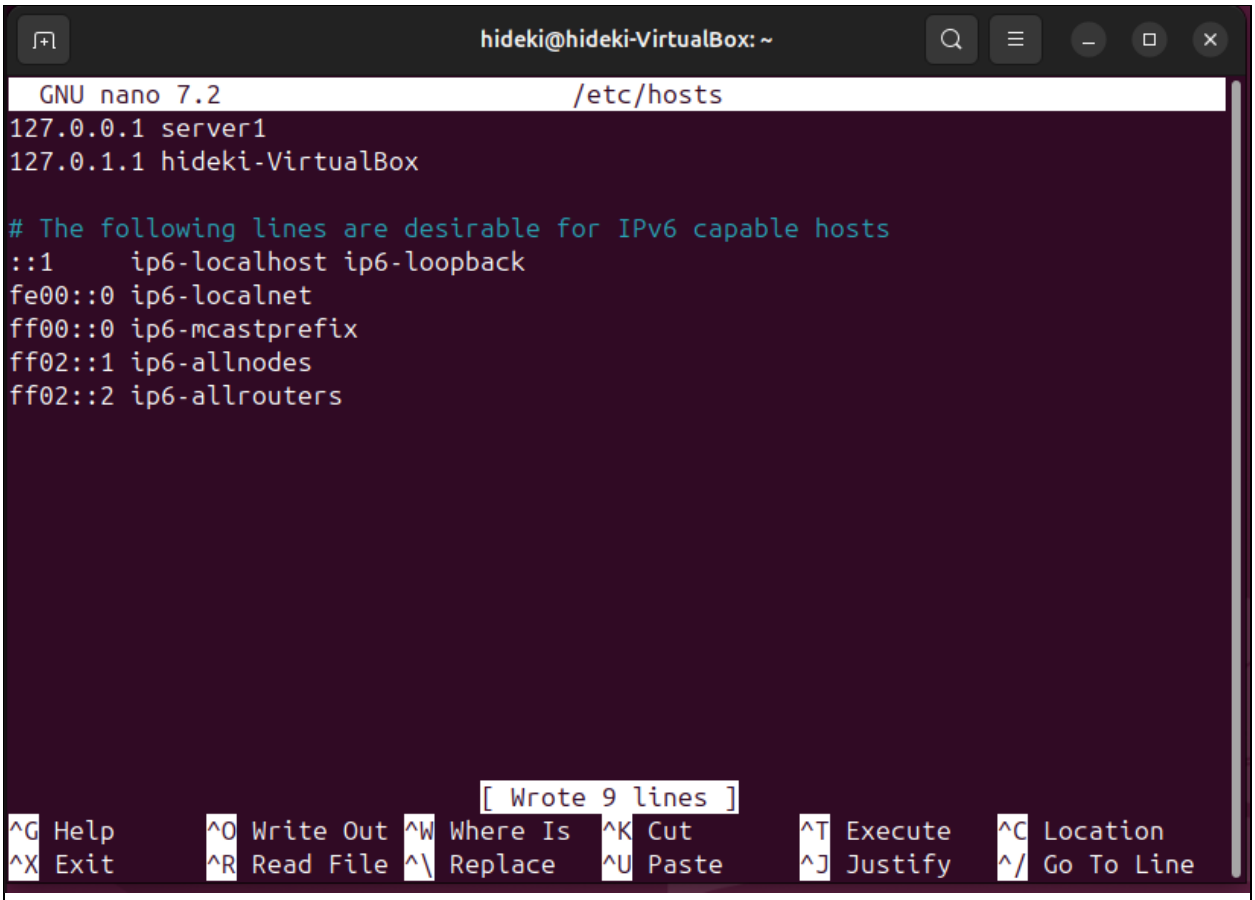


1.2 Use server2 for Server 2

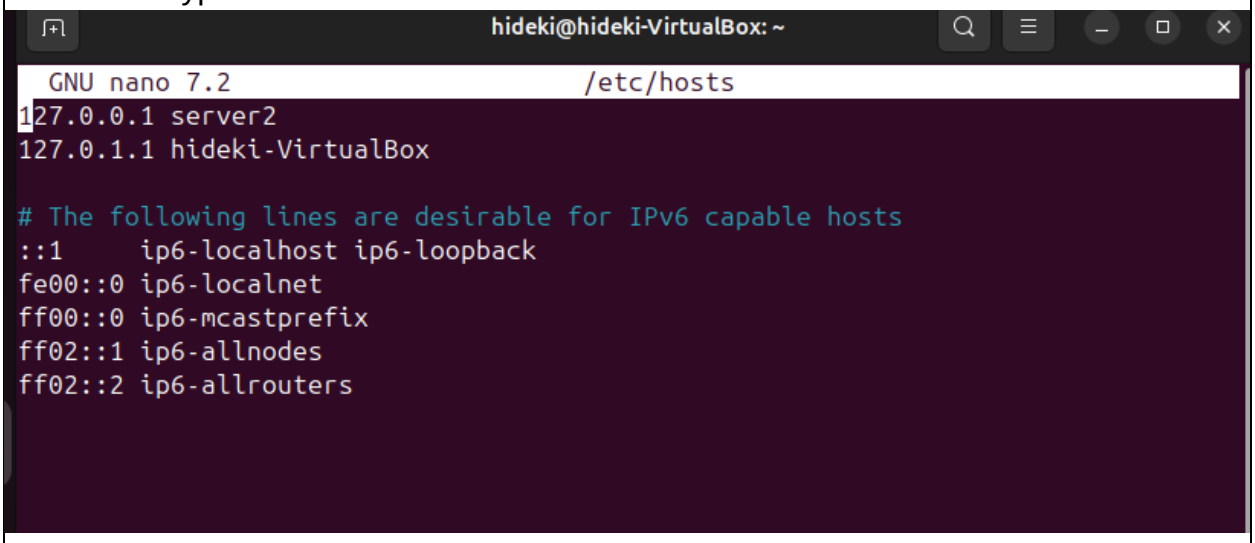
1.3 Use workstation for the Local Machine



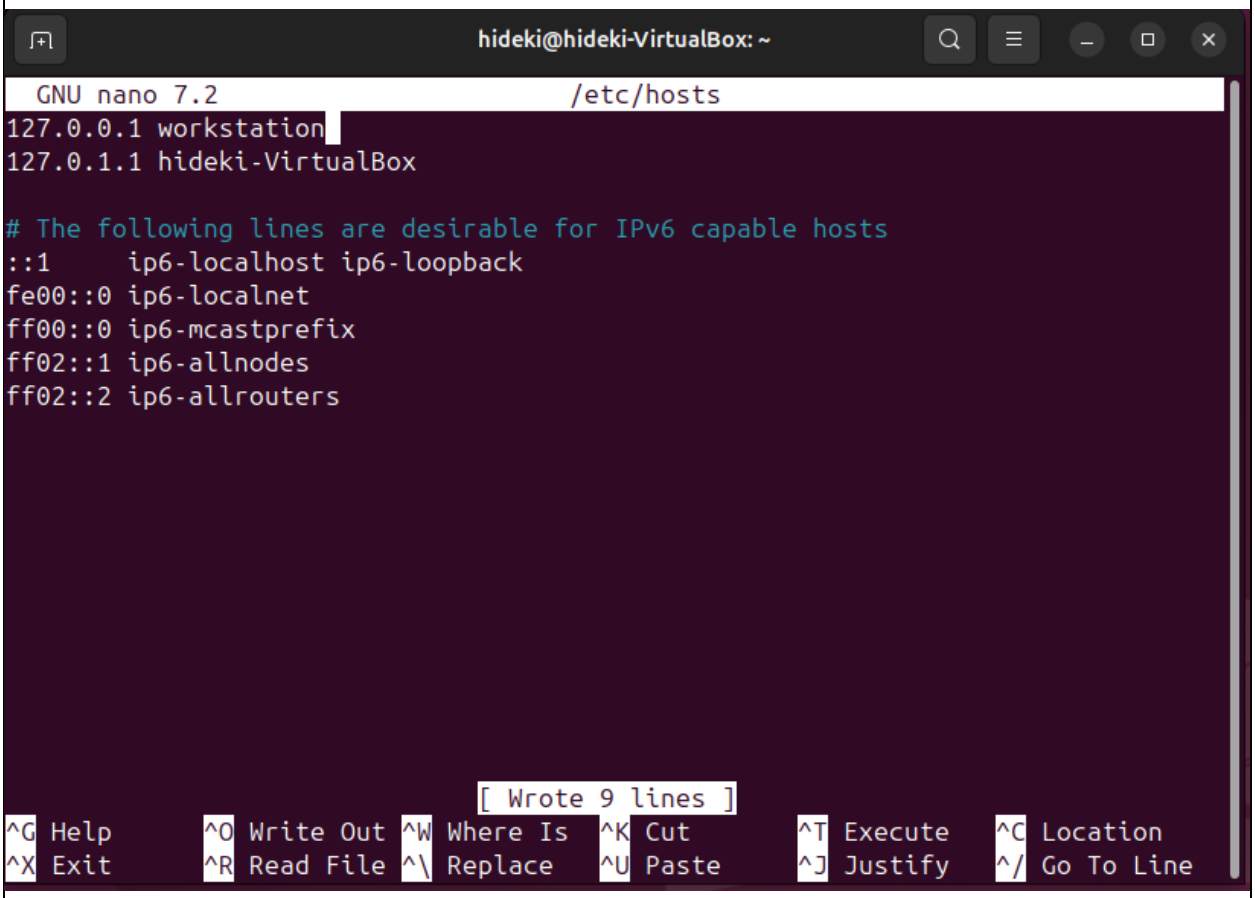
2. Edit the hosts using the command *sudo nano /etc/hosts*. Edit the second line.
   2.1 Type 127.0.0.1 server 1 for Server 1



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:

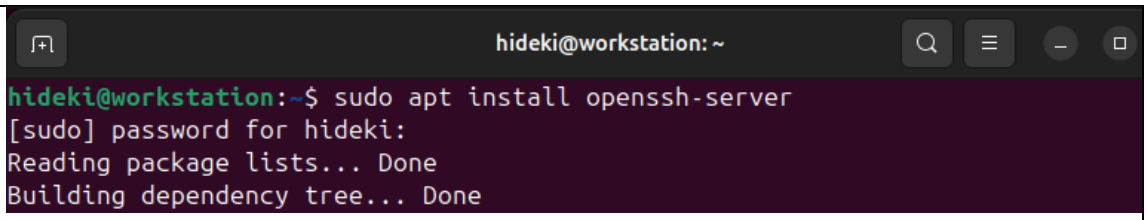
1. Upgrade the packages by issuing the command *sudo apt update* and *sudo apt upgrade* respectively.

```
hideki@hideki-VirtualBox:~$ sudo apt update
Get:1 http://archive.ubuntu.com/ubuntu noble InRelease [256 kB]
Get:2 http://security.ubuntu.com/ubuntu noble-security InRelease [126 kB]
Get:3 http://archive.ubuntu.com/ubuntu noble-updates InRelease [126 kB]
Get:4 http://archive.ubuntu.com/ubuntu noble-backports InRelease [126 kB]
Get:5 http://security.ubuntu.com/ubuntu noble-security/main amd64 Package
```

Trash

```
hideki@hideki-VirtualBox:~$ sudo apt upgrade
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
```

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*

```
hideki@hideki-VirtualBox:~$ sudo service ssh start
hideki@hideki-VirtualBox:~$ sudo systemctl status ssh
● ssh.service - OpenBSD Secure Shell server
     Loaded: loaded (/usr/lib/systemd/system/ssh.service; disabled; preset: ena>
     Active: active (running) since Sun 2024-08-25 10:58:13 PST; 9s ago
TriggeredBy: ● ssh.socket
       Docs: man:sshd(8)
             man:sshd_config(5)
    Process: 24580 ExecStartPre=/usr/sbin/sshd -t (code=exited, status=0/SUCCES>
   Main PID: 24582 (sshd)
      Tasks: 1 (limit: 4616)
     Memory: 1.2M (peak: 1.5M)
        CPU: 21ms
     CGroup: /system.slice/ssh.service
             └─24582 "sshd: /usr/sbin/sshd -D [listener] 0 of 10-100 startups"

Aug 25 10:58:13 hideki-VirtualBox systemd[1]: Starting ssh.service - OpenBSD Se>
Aug 25 10:58:13 hideki-VirtualBox sshd[24582]: Server listening on :: port 22.
Aug 25 10:58:13 hideki-VirtualBox systemd[1]: Started ssh.service - OpenBSD Sec>
lines 1-17/17 (END)
```

```
hideki@workstation:~$ sudo service ssh start
hideki@workstation:~$ sudo systemctl status ssh
● ssh.service - OpenBSD Secure Shell server
     Loaded: loaded (/usr/lib/systemd/system/ssh.service; disabled; preset: ena>
     Active: active (running) since Sun 2024-08-25 10:58:47 PST; 6s ago
TriggeredBy: ● ssh.socket
       Docs: man:sshd(8)
             man:sshd_config(5)
    Process: 3175 ExecStartPre=/usr/sbin/sshd -t (code=exited, status=0/SUCCESS)
   Main PID: 3176 (sshd)
      Tasks: 1 (limit: 4616)
     Memory: 1.2M (peak: 1.5M)
        CPU: 21ms
     CGroup: /system.slice/ssh.service
             └─3176 "sshd: /usr/sbin/sshd -D [listener] 0 of 10-100 startups"

Aug 25 10:58:47 workstation systemd[1]: Starting ssh.service - OpenBSD Secure S>
Aug 25 10:58:47 workstation sshd[3176]: Server listening on :: port 22.
Aug 25 10:58:47 workstation systemd[1]: Started ssh.service - OpenBSD Secure Sh>
lines 1-17/17 (END)
```

```
hideki@hideki-VirtualBox:~$ sudo service ssh start
hideki@hideki-VirtualBox:~$ sudo systemctl status ssh
● ssh.service - OpenBSD Secure Shell server
     Loaded: loaded (/usr/lib/systemd/system/ssh.service; disabled; preset: ena>
     Active: active (running) since Sun 2024-08-25 11:27:58 PST; 7s ago
TriggeredBy: ● ssh.socket
       Docs: man:sshd(8)
             man:sshd_config(5)
    Process: 24632 ExecStartPre=/usr/sbin/sshd -t (code=exited, status=0/SUCCES>
   Main PID: 24634 (sshd)
      Tasks: 1 (limit: 4616)
     Memory: 1.2M (peak: 1.5M)
        CPU: 23ms
     CGroup: /system.slice/ssh.service
             └─24634 "sshd: /usr/sbin/sshd -D [listener] 0 of 10-100 startups"

Aug 25 11:27:58 hideki-VirtualBox systemd[1]: Starting ssh.service - OpenBSD Se>
Aug 25 11:27:58 hideki-VirtualBox sshd[24634]: Server listening on :: port 22.
Aug 25 11:27:58 hideki-VirtualBox systemd[1]: Started ssh.service - OpenBSD Sec>
lines 1-17/17 (END)
[1]+  Stopped                 sudo systemctl status ssh
hideki@hideki-VirtualBox:~$
```

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*

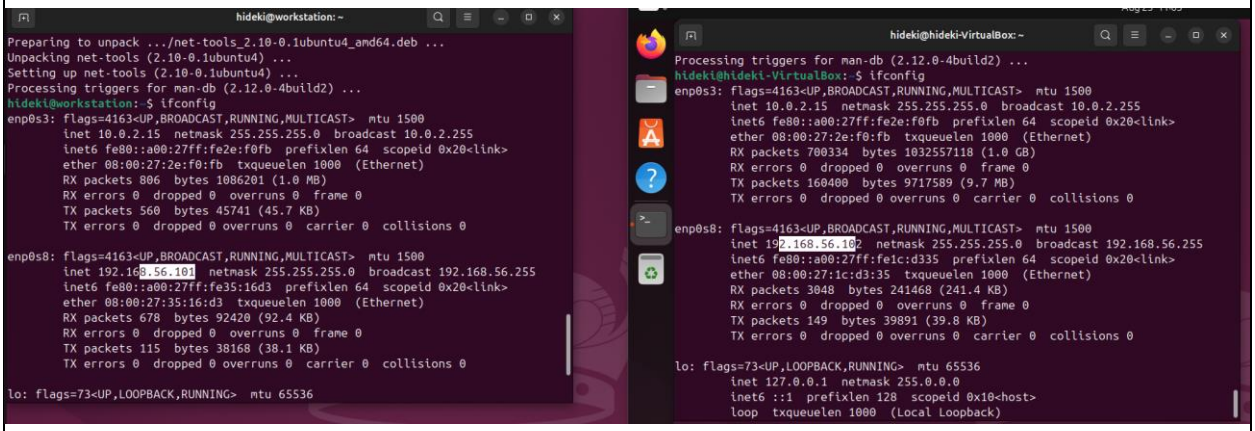
```
hideki@hideki-VirtualBox:~$ sudo ufw allow ssh
Rules updated
Rules updated (v6)
hideki@hideki-VirtualBox:~$ sudo ufw enable
sFirewall is active and enabled on system startup
hideki@hideki-VirtualBox:~$ sudo ufw status
Status: active

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

hideki@hideki-VirtualBox:~$
```

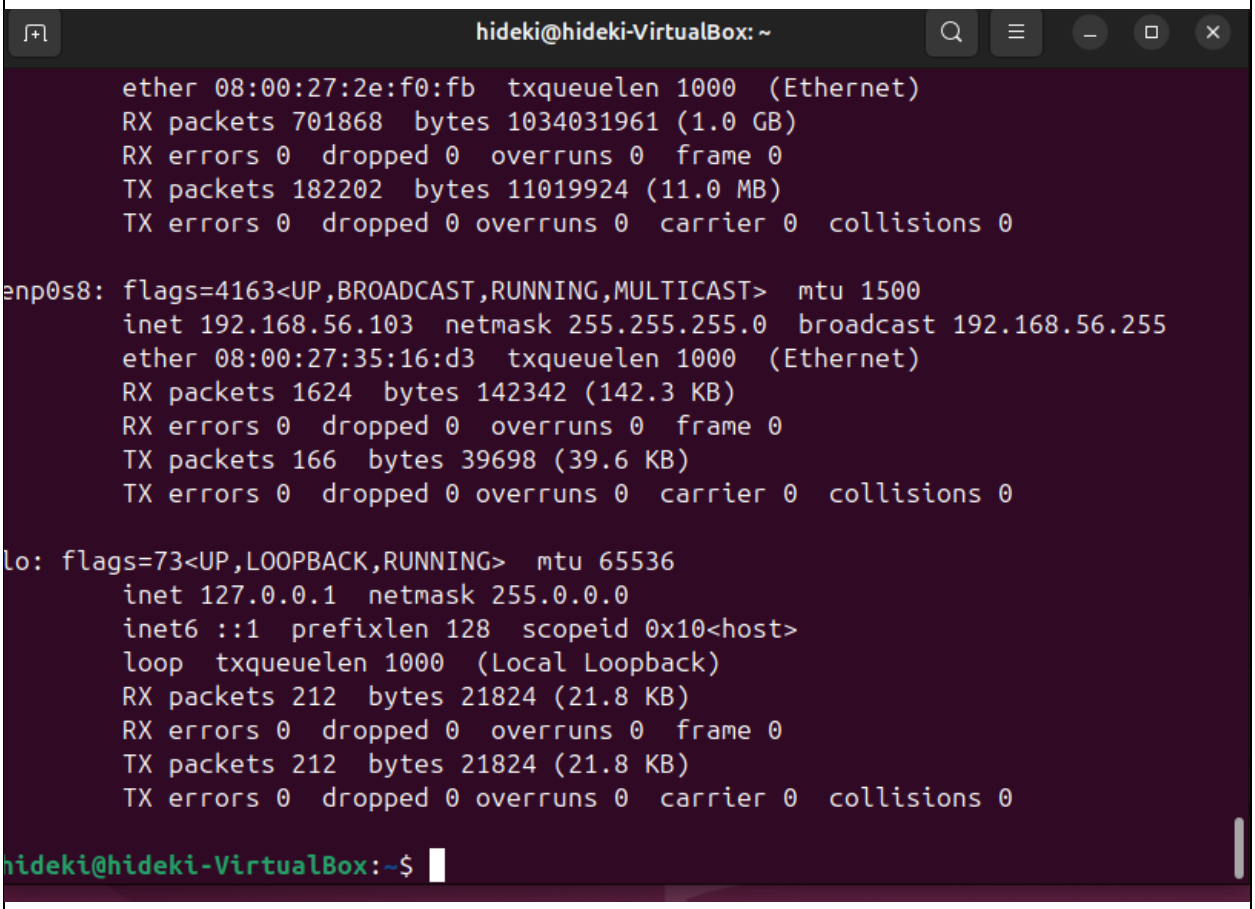
```
hideki@hideki-VirtualBox:~$ sudo ufw allow ssh
Rules updated
Rules updated (v6)
hideki@hideki-VirtualBox:~$ sudo ufw enable
suFirewall is active and enabled on system startup
hideki@hideki-VirtualBox:~$ sudo ufw status
Status: active

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

hideki@hideki-VirtualBox:~$
```

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

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

hideki@workstation:~$
```

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
   1.2 Server 2 IP address: 192.168.56.103
   1.3 workstation IP address: 192.168.56.101





2. Make sure that they can ping each other.

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

```
hideki@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=0.679 ms
64 bytes from 192.168.56.102: icmp_seq=2 ttl=64 time=0.355 ms
64 bytes from 192.168.56.102: icmp_seq=3 ttl=64 time=0.319 ms
64 bytes from 192.168.56.102: icmp_seq=4 ttl=64 time=0.352 ms
64 bytes from 192.168.56.102: icmp_seq=5 ttl=64 time=0.244 ms
64 bytes from 192.168.56.102: icmp_seq=6 ttl=64 time=0.349 ms
64 bytes from 192.168.56.102: icmp_seq=7 ttl=64 time=0.306 ms
64 bytes from 192.168.56.102: icmp_seq=8 ttl=64 time=0.266 ms
64 bytes from 192.168.56.102: icmp_seq=9 ttl=64 time=0.262 ms
```

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

```
hideki@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=0.644 ms
64 bytes from 192.168.56.103: icmp_seq=2 ttl=64 time=0.392 ms
64 bytes from 192.168.56.103: icmp_seq=3 ttl=64 time=0.260 ms
64 bytes from 192.168.56.103: icmp_seq=4 ttl=64 time=0.273 ms
64 bytes from 192.168.56.103: icmp_seq=5 ttl=64 time=0.413 ms
```

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

```
hideki@hideki-VirtualBox:~$ 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=0.629 ms
64 bytes from 192.168.56.103: icmp_seq=2 ttl=64 time=0.387 ms
64 bytes from 192.168.56.103: icmp_seq=3 ttl=64 time=0.305 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 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*

```
hideki@workstation:~$ ssh hideki@192.168.56.102
hideki@192.168.56.102's password:
Welcome to Ubuntu 24.04 LTS (GNU/Linux 6.8.0-31-generic x86_64)

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

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

*** System restart required ***

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
```

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

```
hideki@hideki-VirtualBox:~$
logout
Connection to 192.168.56.102 closed.
```

3. Do the same for Server 2.

```
hideki@workstation:~$ ssh hideki@192.168.56.103
The authenticity of host '192.168.56.103 (192.168.56.103)' can't be established.
ED25519 key fingerprint is SHA256:dM+cAdyhWK1u3RGiWaFbRheWMUtl4kc5451ehLY4Fao.
This host key is known by the following other names/addresses:
    ~/.ssh/known_hosts:1: [hashed name]
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '192.168.56.103' (ED25519) to the list of known hosts
.
hideki@192.168.56.103's password:
Welcome to Ubuntu 24.04 LTS (GNU/Linux 6.8.0-31-generic x86_64)

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

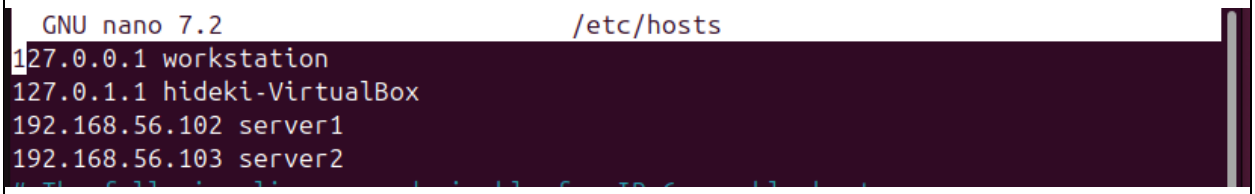
```
hideki@server2:~$
```

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

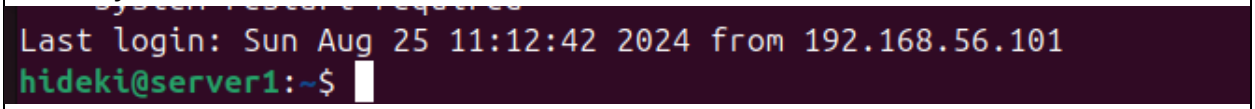
4.1 IP_address server 1 (provide the ip address of server 1 followed by the hostname)

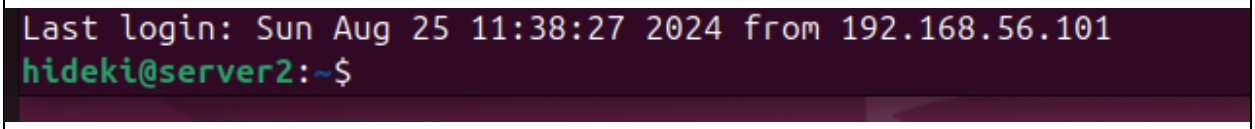
4.2 IP_address server 2 (provide the ip address of server 2 followed by the hostname)

4.3 Save the file and exit.



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





Reflections:

Answer the following:

1. How are we able to use the hostname instead of IP address in SSH commands?
   - By adding the two IP addresses of the servers inside the /etc/hosts file of the workstation PC.
2. How secured is SSH?
   - The SSH is very secured since it is asking for the computer password or the machine password to be able to access it rather than being accessed without any authentication required.