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Course/Section:CPE32S2	Date Submitted:08/08/2025
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### Activity 1: Configure Network using Virtual Machines

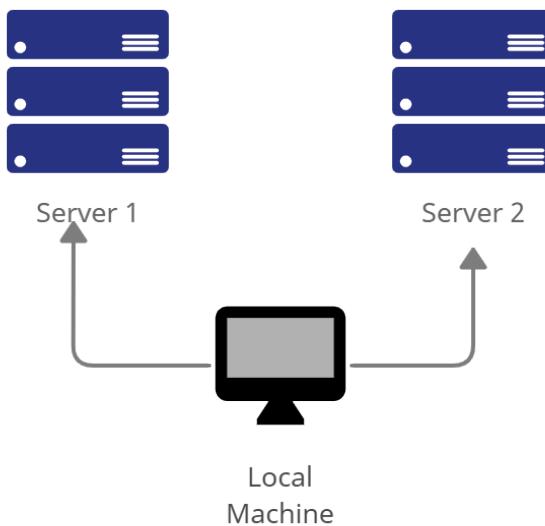
#### 1. Objectives:

- 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

```
vboxuser@Dvs: ~
```

```
GNU nano 7.2
```

```
/etc/hostname
```

```
server1
```

### 1.2 Use server2 for Server 2

```
vboxuser@Dvs: ~
```

```
GNU nano 7.2
```

```
/etc/hostname
```

```
server2
```

### 1.3 Use workstation for the Local Machine

```
vboxuser@Dvs: ~
```

```
GNU nano 7.2
```

```
/etc/hostname *
```

```
workstation
```

### 1.4

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

```
vboxuser@Dvs: ~
```

```
GNU nano 7.2
```

```
/etc/hosts
```

```
127.0.0.1 localhost
```

```
127.0.0.1 server1
```

```
# The following lines are desirable for IPv6 capable hosts
```

```
::1      ip6-localhost ip6-loopback
```

```
fe00::0  ip6-localnet
```

```
ff00::0  ip6-mcastprefix
```

```
ff02::1  ip6-allnodes
```

```
ff02::2  ip6-allrouters
```

#### 2.2 Type 127.0.0.1 server 2 for Server 2

```
GNU nano 7.2                               /etc/hosts
127.0.0.1 localhost
127.0.0.1 server2

# The following lines are desirable for IPv6 capable hosts
::1      ip6-localhost ip6-loopback
fe00::0  ip6-localnet
ff00::0  ip6-mcastprefix
ff02::1  ip6-allnodes
ff02::2  ip6-allrouters
```

### 2.3 Type 127.0.0.1 workstation for the Local Machine

```
GNU nano 7.2                                     /etc/hosts
127.0.0.1 localhost
127.0.0.1 workstation

# 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.

3. Install the SSH server using the command `sudo apt install openssh-server`.

Aug 09 09:37

Mouse integration ...  
Auto capture keyboard ...

Installing new version of config file /etc/gdm3/Xsession ...  
invoke-rc.d: policy-rc.d denied execution of reload.  
Setting up gnome-shell-extension-desktop-icons-ng (46+really47.0.9-1ubuntu1) ...  
Setting up evolution-data-server (3.52.3-0ubuntu1) ...  
Setting up update-manager (1:24.04.12) ...  
Setting up gnome-shell-extension-ubuntu-dock (90ubuntu3) ...  
Setting up gnome-shell-extension-ubuntu-tiling-assistant (46-1ubuntu1.1)  
Setting up update-notifier (3.192.68.2) ...  
Processing triggers for initramfs-tools (0.142ubuntu25.5) ...  
update-initramfs: Generating /boot/initrd.img-6.14.0-27-generic  
Processing triggers for libc-bin (2.39-0ubuntu8.5) ...  
vboxuser@Dvs: ~ \$ sudo apt install openssh-server  
[sudo] password for vboxuser:  
Reading package lists... Done  
Building dependency tree... Done  
Reading state information... Done  
The full libglapi-mesa liblbb17t64 python  
Use 'sudo apt autoremove' to remove them.  
The following additional packages will be installed

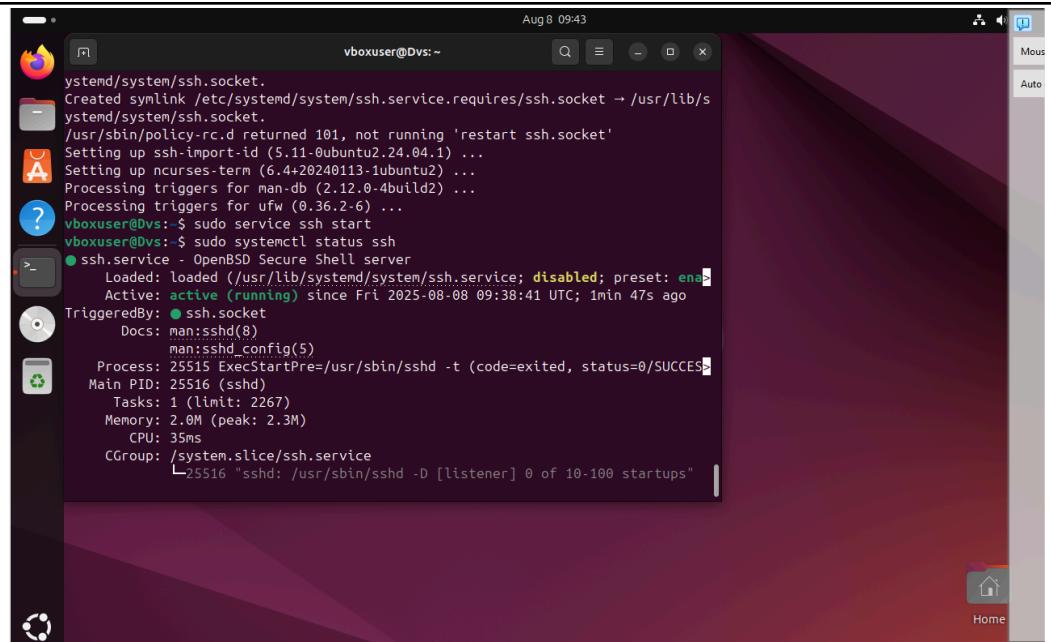
vboxuser@Dvs: ~ \$ sudo apt install openssh-server  
[sudo] password for vboxuser:  
Reading package lists... Done  
Building dependency tree... Done  
Reading state information... Done  
The following packages were automatically installed  
Ubuntu 24.04 LTS amd64 libglapi-mesa liblbb17t64 python  
Use 'sudo apt autoremove' to remove them.  
The following additional packages will be installed

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

### 3.1 *sudo service ssh start*

```
Aug 8 09:43
vboxuser@Dvs: ~
y systemd/system/ssh.socket.
Created symlink /etc/systemd/system/ssh.service.requires/ssh.socket → /usr/lib/s
y systemd/system/ssh.socket.
/usr/sbin/policy-rc.d returned 101, not running 'restart ssh.socket'
Setting up ssh-import-id (5.11-0ubuntu2.24.04.1) ...
Setting up ncurses-term (6.4+20240113-1ubuntu2) ...
Processing triggers for man-db (2.12.0-4build2) ...
Processing triggers for ufw (0.36-2.6) ...
vboxuser@Dvs: $ sudo service ssh start
vboxuser@Dvs: $ 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 Fri 2025-08-08 09:38:41 UTC; 1min 47s ago
    TriggeredBy: ● ssh.socket
      Docs: man:sshd(8)
           man:sshd_config(5)
  Process: 25515 ExecStartPre=/usr/sbin/sshd -t (code=exited, status=0/SUCCESS)
 Main PID: 25516 (sshd)
   Tasks: 1 (limit: 2267)
  Memory: 2.0M (peak: 2.3M)
     CPU: 35ms
    Group: /system.slice/ssh.service
           └─25516 "sshd: /usr/sbin/sshd -D [listener] 0 of 10-100 startups"
```

### 3.2 *sudo systemctl status ssh*



```
Aug 8 09:43
vboxuser@Dvs:~$ sudo service ssh start
vboxuser@Dvs:~$ 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 Fri 2025-08-08 09:38:41 UTC; 1min 47s ago
        TriggeredBy: ● ssh.socket
          Docs: man:sshd(8)
                  man:sshd_config(5)
    Process: 25515 ExecStartPre=/usr/sbin/sshd -t (code=exited, status=0/SUCCESS)
   Main PID: 25516 (sshd)
     Tasks: 1 (limit: 2267)
    Memory: 2.0M (peak: 2.3M)
       CPU: 35ms
      CGroup: /system.slice/ssh.service
              └─25516 "sshd: /usr/sbin/sshd -D [listener] 0 of 10-100 startups"

vboxuser@Dvs:~$
```

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

#### 4.1 *sudo ufw allow ssh*

```
vboxuser@Dvs:~$ sudo ufw allow ssh
Rules updated
Rules updated (v6)
vboxuser@Dvs:~$
```

#### 4.2 *sudo ufw enable*

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

#### 4.3 *sudo ufw status*

```
vboxuser@Dvs:~$ 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
  - 1.2 Server 2 IP address: 192.168.56.103
  - 1.3 Server 3 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

```
vboxuser@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=2.59 ms
64 bytes from 192.168.56.102: icmp_seq=2 ttl=64 time=1.11 ms
64 bytes from 192.168.56.102: icmp_seq=3 ttl=64 time=1.07 ms
64 bytes from 192.168.56.102: icmp_seq=4 ttl=64 time=1.08 ms
64 bytes from 192.168.56.102: icmp_seq=5 ttl=64 time=0.942 ms
64 bytes from 192.168.56.102: icmp_seq=6 ttl=64 time=0.538 ms
64 bytes from 192.168.56.102: icmp_seq=7 ttl=64 time=0.758 ms
2.2 64 bytes from 192.168.56.102: icmp_seq=8 ttl=64 time=0.529 ms
```

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

```
vboxuser@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=6.70 ms
64 bytes from 192.168.56.103: icmp_seq=2 ttl=64 time=0.899 ms
64 bytes from 192.168.56.103: icmp_seq=3 ttl=64 time=0.520 ms
64 bytes from 192.168.56.103: icmp_seq=4 ttl=64 time=1.09 ms
^C
```

2.4 Connectivity test for Server 1 to Server 2:  Successful  Not Successful

```
vboxuser@server1:~$ ping 192.168.56.103
PING 192.168.56.103 (192.168.56.103) 56(84) bytes of data.
64 bytes from 192.168.56.103: icmp_seq=1 ttl=64 time=1.64 ms
64 bytes from 192.168.56.103: icmp_seq=2 ttl=64 time=0.871 ms
64 bytes from 192.168.56.103: icmp_seq=3 ttl=64 time=1.01 ms
64 bytes from 192.168.56.103: icmp_seq=4 ttl=64 time=0.823 ms
^C
--- 192.168.56.103 ping statistics ---
```

**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**



```
rtt min/avg/max/mdev = 0.520/2.303/6.703/2.548 ms
vboxuser@workstation:~$ ssh vboxuser@192.168.56.102
The authenticity of host '192.168.56.102 (192.168.56.102)' can't be
ED25519 key fingerprint is SHA256:jFRhcr690Kz092CxEub7x59hPqsQ5wdU
This key is not known by any other names.
Are you sure you want to continue connecting (yes/no/[fingerprint]?
Warning: Permanently added '192.168.56.102' (ED25519) to the list
.
vboxuser@192.168.56.102's password:
Welcome to Ubuntu 24.04.3 LTS (GNU/Linux 6.14.0-27-generic x86_64)
```

## 1.2 Enter the password for server 1 when prompted

```
vboxuser@192.168.56.102's password:
Welcome to Ubuntu 24.04.3 LTS (GNU/Linux 6.14.0-27-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.
```

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

For example, *jvtaylor@server1*



```
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
applicable law.
```

```
vboxuser@server1:~$
```

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

```
vboxuser@server1:~$  
logout  
Connection to 192.168.56.102 closed.  
vboxuser@workstation:~$
```

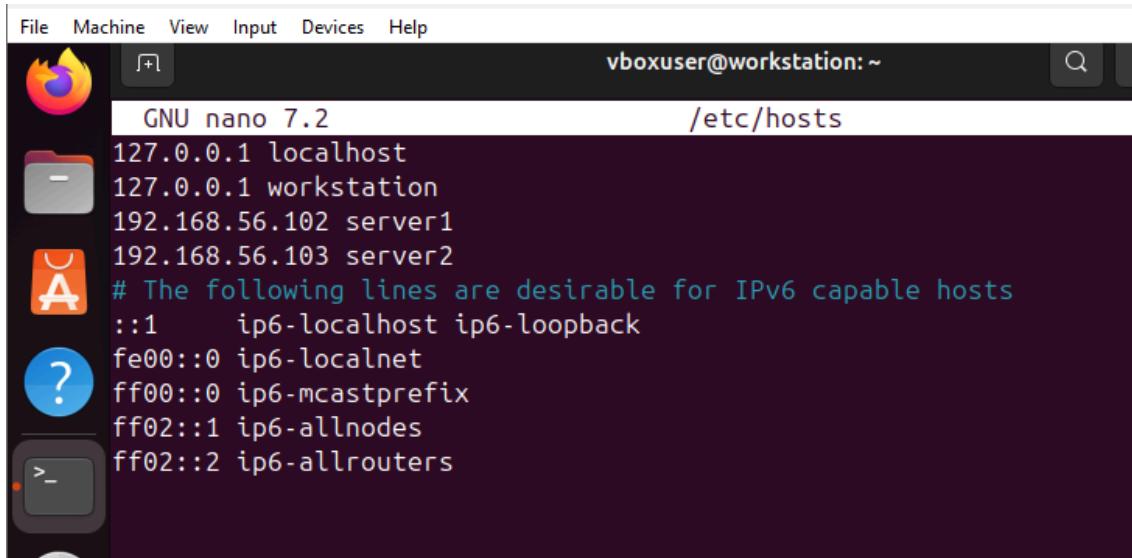
## 3. Do the same for Server 2.

```
Ubuntu comes with ABSOLUTELY NO WARRANTY, to the extent permitted
applicable law.
```

```
vboxuser@server2:~$
```

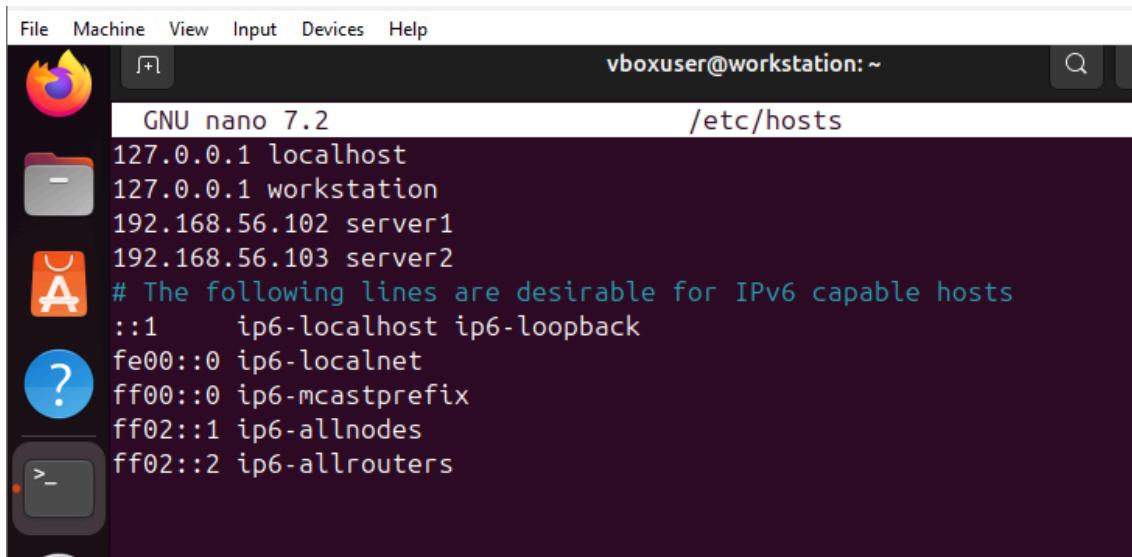
```
vboxuser@server2:~$  
logout  
Connection to 192.168.56.103 closed.  
vboxuser@workstation:~$
```

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)



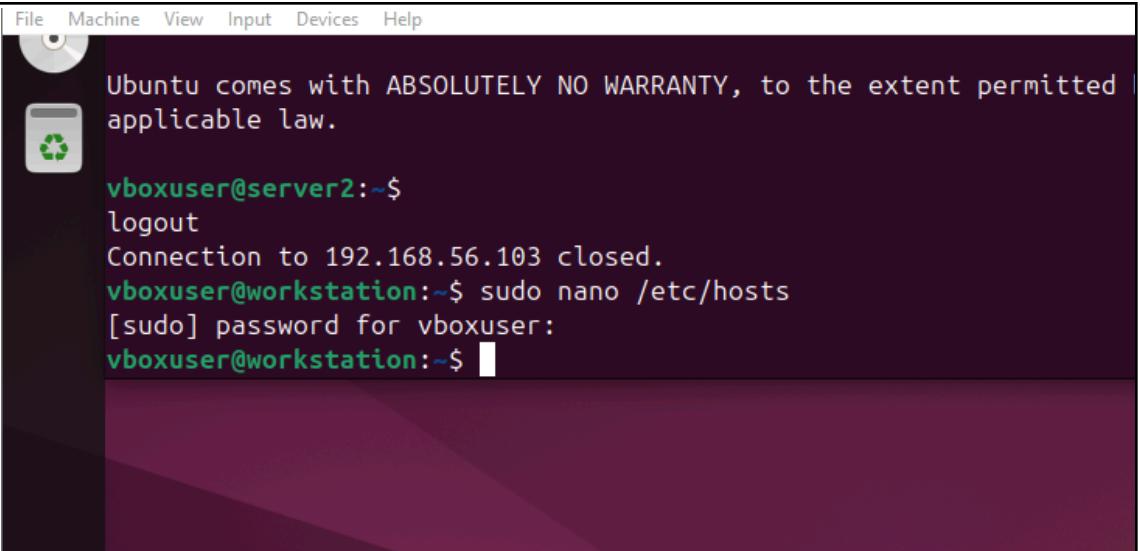
```
File Machine View Input Devices Help  
GNU nano 7.2 /etc/hosts  
127.0.0.1 localhost  
127.0.0.1 workstation  
192.168.56.102 server1  
192.168.56.103 server2  
# The following lines are desirable for IPv6 capable hosts  
::1      ip6-localhost ip6-loopback  
fe00::0  ip6-localnet  
ff00::0  ip6-mcastprefix  
ff02::1  ip6-allnodes  
ff02::2  ip6-allrouters
```

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



```
File Machine View Input Devices Help  
GNU nano 7.2 /etc/hosts  
127.0.0.1 localhost  
127.0.0.1 workstation  
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
```

- 4.3 Save the file and exit.



Ubuntu comes with ABSOLUTELY NO WARRANTY, to the extent permitted by applicable law.

```
vboxuser@server2:~$  
logout  
Connection to 192.168.56.103 closed.  
vboxuser@workstation:~$ sudo nano /etc/hosts  
[sudo] password for vboxuser:  
vboxuser@workstation:~$
```

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.

```
vboxuser@workstation:~$ ssh vboxuser@server1  
vboxuser@server1's password:  
Welcome to Ubuntu 24.04.3 LTS (GNU/Linux 6.14.0-27-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.  
  
1 update can be applied immediately.  
To see these additional updates run: apt list --upgradable  
  
Enable ESM Apps to receive additional future security updates.  
See https://ubuntu.com/esm or run: sudo pro status  
  
Last login: Fri Aug  8 10:21:29 2025 from 192.168.56.101  
vboxuser@server1:~$ ssh vboxuser@server2  
ssh: Could not resolve hostname server2: Temporary failure in name resolution  
vboxuser@server1:~$  
logout  
Connection to server1 closed.
```

```
ED25519 key fingerprint is SHA256:jFRhcrl690Kz092CxEub7x59hPqsQ5wdUFeEHBxKT3
This host key is known by the following other names/addresses:
  ~/.ssh/known_hosts:1: [hashed name]
  ~/.ssh/known_hosts:4: [hashed name]
  ~/.ssh/known_hosts:5: [hashed name]
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added 'server2' (ED25519) to the list of known hosts.
vboxuser@server2's password:
Welcome to Ubuntu 24.04.3 LTS (GNU/Linux 6.14.0-27-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.

1 update can be applied immediately.
To see these additional updates run: apt list --upgradable

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

Last login: Fri Aug  8 10:26:43 2025 from 192.168.56.101
vboxuser@server2:~$
```

### Reflections:

Answer the following:

1. How are we able to use the hostname instead of IP address in SSH commands?  
**because the IP address is local to the the servers in can be used instead of names**
2. How secured is SSH?  
**SSH is secured because it always required a password if you create a user ssh and cannot not easily bypass**