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Course/Section: CPE 232-CPE31S4	**Date Submitted: 08/15/2023**
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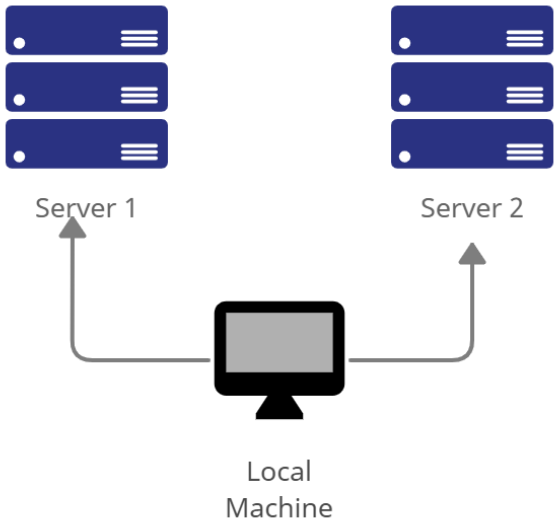
Activity 1: Configure Network using Virtual Machines

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:**

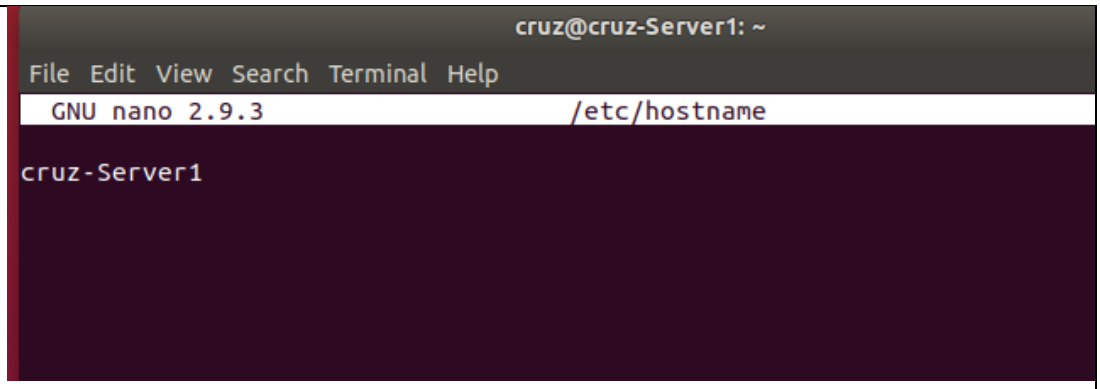
Network Topology:

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*).

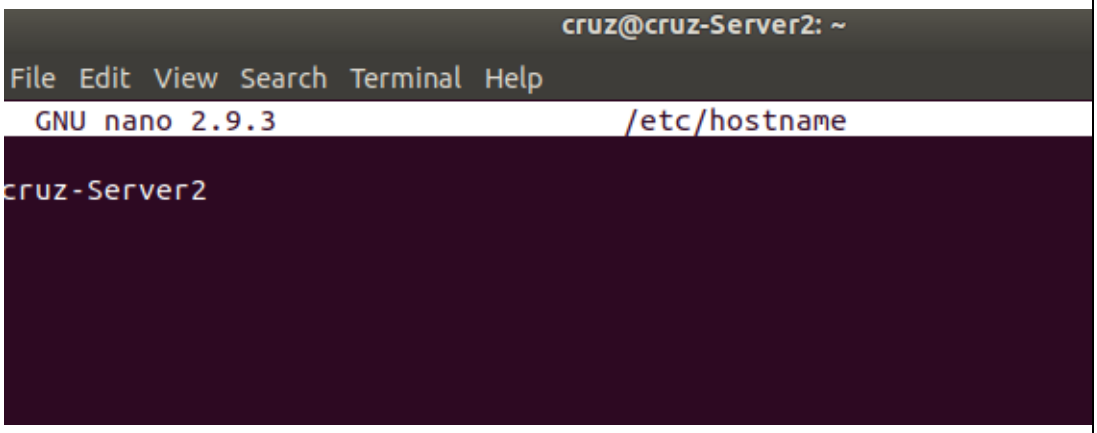


Task 1: Do the following on Server 1, Server 2, and Local Machine. In editing the file using nano command, press control + O to write out (save the file). Press enter when asked for the name of the file. Press control + X to end.

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



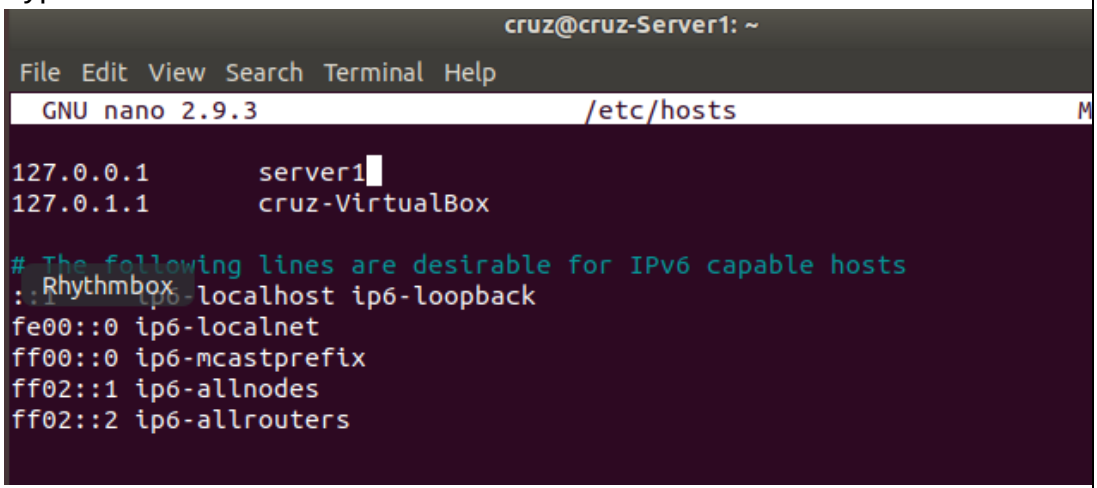
1.2 Use server2 for Server S2



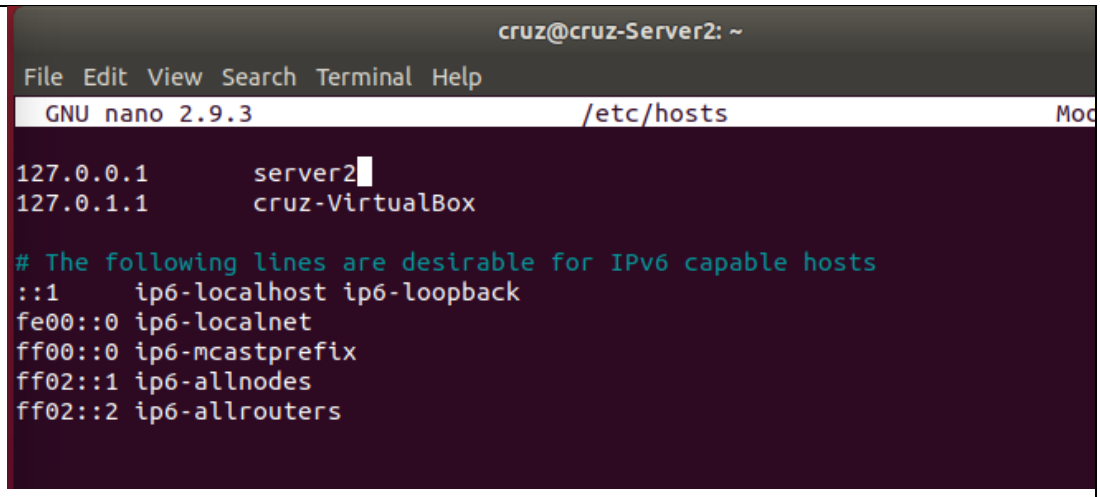
1.3 Use workstation for the Local Machine

2. Edit the hosts using the command *sudo nano /etc/hosts*. Edit the second line.

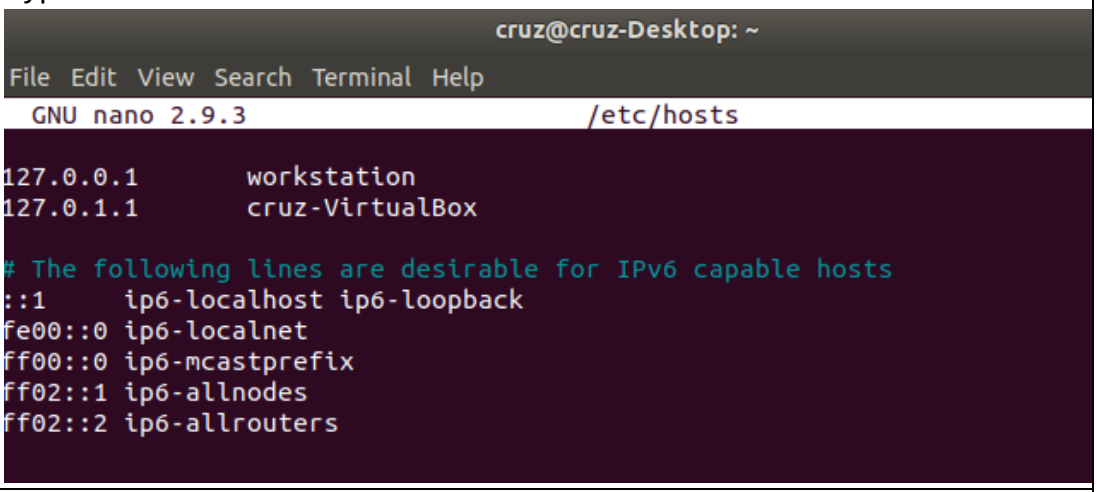
2.1 Type 127.0.0.1 server 1 for Server 1



2.2 Type 127.0.0.1 server 2 for Server 2



2.3 Type 127.0.0.1 workstation for the Local MachineS



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 Machine:

```
cruz@cruz-Desktop:~$ sudo apt update
Get:1 http://security.ubuntu.com/ubuntu bionic-security InRelease [88.7 k
Hit:2 http://ph.archive.ubuntu.com/ubuntu bionic InRelease
Get:3 http://ph.archive.ubuntu.com/ubuntu bionic-updates InRelease [88.7
Get:4 http://security.ubuntu.com/ubuntu bionic-security/main amd64 DEP-11
ta [76.8 kB]
Get:5 http://ph.archive.ubuntu.com/ubuntu bionic-backports InRelease [83.
Get:6 http://ph.archive.ubuntu.com/ubuntu bionic-updates/main amd64 DEP-1
ata [297 kB]
Get:7 http://security.ubuntu.com/ubuntu bionic-security/universe amd64 DE
tadata [62.6 kB]
Get:8 http://security.ubuntu.com/ubuntu bionic-security/multiverse amd64
Metadata [2,464 B]
Get:9 http://ph.archive.ubuntu.com/ubuntu bionic-updates/universe amd64 D
etadata [303 kB]
Get:10 http://ph.archive.ubuntu.com/ubuntu bionic-updates/multiverse amd6
1 Metadata [2,468 B]
Get:11 http://ph.archive.ubuntu.com/ubuntu bionic-backports/main amd64 DE
tadata [8,100 B]
Get:12 http://ph.archive.ubuntu.com/ubuntu bionic-backports/universe amd6
1 Metadata [10.0 kB]
Fetched 1,023 kB in 2s (482 kB/s)
```

```
cruz@cruz-Desktop:~$ sudo apt upgrade
Reading package lists... Done
Building dependency tree
Reading state information... Done
Calculating upgrade... Done
The following package was automatically installed and is no longer requ
  libllvm7
Use 'sudo apt autoremove' to remove it.
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
```

Server1:

```
cruz@cruz-Server1:~$ sudo apt update
Hit:1 http://ph.archive.ubuntu.com/ubuntu bionic InRelease
Hit:2 http://ph.archive.ubuntu.com/ubuntu bionic-updates InRelease
Get:3 http://security.ubuntu.com/ubuntu bionic-security InRelease [88.7 kB]
Hit:4 http://ph.archive.ubuntu.com/ubuntu bionic-backports InRelease
Get:5 http://security.ubuntu.com/ubuntu bionic-security/main amd64 DEP-11 Metad
ata [76.8 kB]
Get:6 http://security.ubuntu.com/ubuntu bionic-security/universe amd64 DEP-11 M
etadata [62.6 kB]
Get:7 http://security.ubuntu.com/ubuntu bionic-security/multiverse amd64 DEP-11
 Metadata [2,464 B]
Fetched 231 kB in 2s (106 kB/s)
Reading package lists... Done
Building dependency tree
Reading state information... Done
679 packages can be upgraded. Run 'apt list --upgradable' to see them.
```

```
cruz@cruz-Server1:~$ sudo apt upgrade
Reading package lists... Done
Building dependency tree
Reading state information... Done
Calculating upgrade... Done
The following package was automatically installed and is no longer require
  libllvm7
Use 'sudo apt autoremove' to remove it.
The following NEW packages will be installed:
  distro-info fwupd-signed gstreamer1.0-gtk3 libllvm10 libnetplan0 libxmlb
  linux-headers-5.4.0-150-generic linux-hwe-5.4-headers-5.4.0-150
  linux-image-5.4.0-150-generic linux-modules-5.4.0-150-generic
  linux-modules-extra-5.4.0-150-generic python3-click python3-colorama
  python3-dateutil ubuntu-advantage-desktop-daemon xdg-desktop-portal
  xdg-desktop-portal-gtk
The following packages will be upgraded:
  accountsservice amd64-microcode apparmor apport apport-gtk apt apt-utils
  aptdaemon aptdaemon-data aspell avahi-autoipd avahi-daemon avahi-utils
  base-files bash bind9-host binutils binutils-common
  binutils-x86-64-linux-gnu bluez bluez-cups bluez-obexd bsdutils
  busybox-initramfs busybox-static bzip2 ca-certificates command-not-found
```

Server2:

```
cruz@cruz-Server2:~$ sudo apt update
Hit:1 http://ph.archive.ubuntu.com/ubuntu bionic InRelease
Get:2 http://security.ubuntu.com/ubuntu bionic-security InRelease [88.7 kB]
Hit:3 http://ph.archive.ubuntu.com/ubuntu bionic-updates InRelease
Hit:4 http://ph.archive.ubuntu.com/ubuntu bionic-backports InRelease
Get:5 http://security.ubuntu.com/ubuntu bionic-security/main amd64 DEP-11 Metada
ta [76.8 kB]
Get:6 http://security.ubuntu.com/ubuntu bionic-security/universe amd64 DEP-11 Me
tadata [62.6 kB]
Get:7 http://security.ubuntu.com/ubuntu bionic-security/multiverse amd64 DEP-11
Metadata [2,464 B]
Fetched 231 kB in 2s (115 kB/s)
```

```
cruz@cruz-Server2:~$ sudo apt upgrade
Reading package lists... Done
Building dependency tree
Reading state information... Done
Calculating upgrade... Done
The following package was automatically installed and is no longer required:
  libllvm7
Use 'sudo apt autoremove' to remove it.
The following NEW packages will be installed:
  distro-info fwupd-signed gstreamer1.0-gtk3 libllvm10 libnetplan0 libxmlb1
  linux-headers-5.4.0-150-generic linux-hwe-5.4-headers-5.4.0-150
  linux-image-5.4.0-150-generic linux-modules-5.4.0-150-generic
  linux-modules-extra-5.4.0-150-generic python3-click python3-colorama
  python3-dateutil ubuntu-advantage-desktop-daemon xdg-desktop-portal
  xdg-desktop-portal-gtk
The following packages will be upgraded:
  accountsservice amd64-microcode apparmor apport apport-gtk apt apt-utils
  aptdaemon aptdaemon-data aspell avahi-autoipd avahi-daemon avahi-utils
  base-files bash bind9-host binutils binutils-common
  binutils-x86-64-linux-gnu bluez bluez-cups bluez-obexd bsdutils
  busybox-initramfs busybox-static bzip2 ca-certificates command-not-found
  command-not-found-data console-setup console-setup-linux cpio cpp cpp-7 cron
  cups cups-browsed cups-bsd cups-client cups-common cups-core-drivers
  cups-daemon cups-filters cups-filters-core-drivers cups-ipp-utils cups-ppdc
  cups-server-common dbus dbus-user-session dbus-x11 debconf debconf-i18n
```

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

Local Machine:

```
cruz@cruz-Desktop:~$ sudo apt install openssh-server
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following package was automatically installed and is no longer requ
  libllvm7
Use 'sudo apt autoremove' to remove it.
The following additional packages will be installed:
  ncurses-term openssh-sftp-server ssh-import-id
Suggested packages:
  molly-guard monkeysphere rssh ssh-askpass
```

Server1:

```
cruz@cruz-Server1:~$ sudo apt install openssh-server
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following package was automatically installed and is no longer requir
  libllvm7
Use 'sudo apt autoremove' to remove it.
The following additional packages will be installed:
  ncurses-term openssh-sftp-server ssh-import-id
Suggested packages:
  molly-guard monkeysphere rssh 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 0 not upgraded.
Need to get 637 kB of archives.
After this operation, 5,320 kB of additional disk space will be used.
Do you want to continue? [Y/n]
```

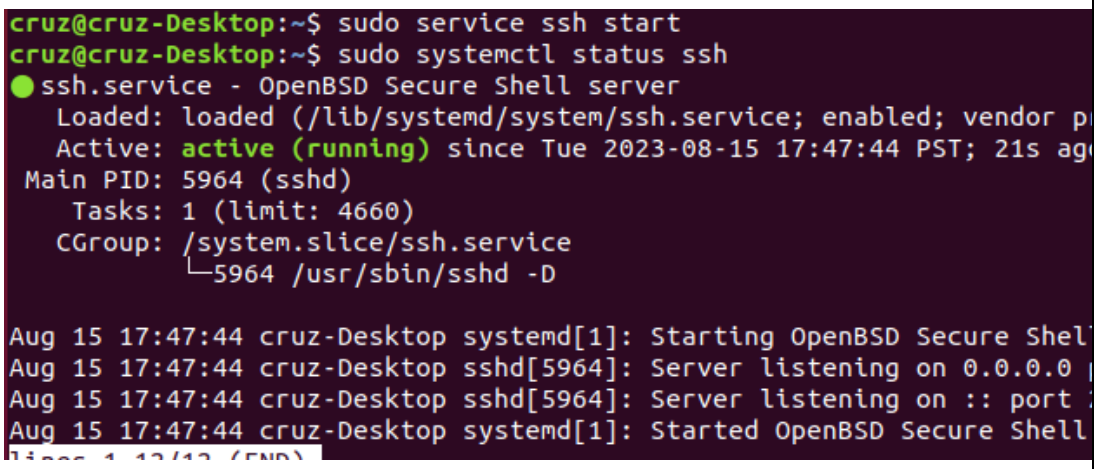
Server2:

```
cruz@cruz-Server2:~$ sudo apt install openssh-server
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following package was automatically installed and is no longer requir
  libllvm7
Use 'sudo apt autoremove' to remove it.
The following additional packages will be installed:
  ncurses-term openssh-sftp-server ssh-import-id
Suggested packages:
  molly-guard monkeysphere rssh 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 0 not upgraded.
Need to get 637 kB of archives.
After this operation, 5,320 kB of additional disk space will be used.
Do you want to continue? [Y/n]
```

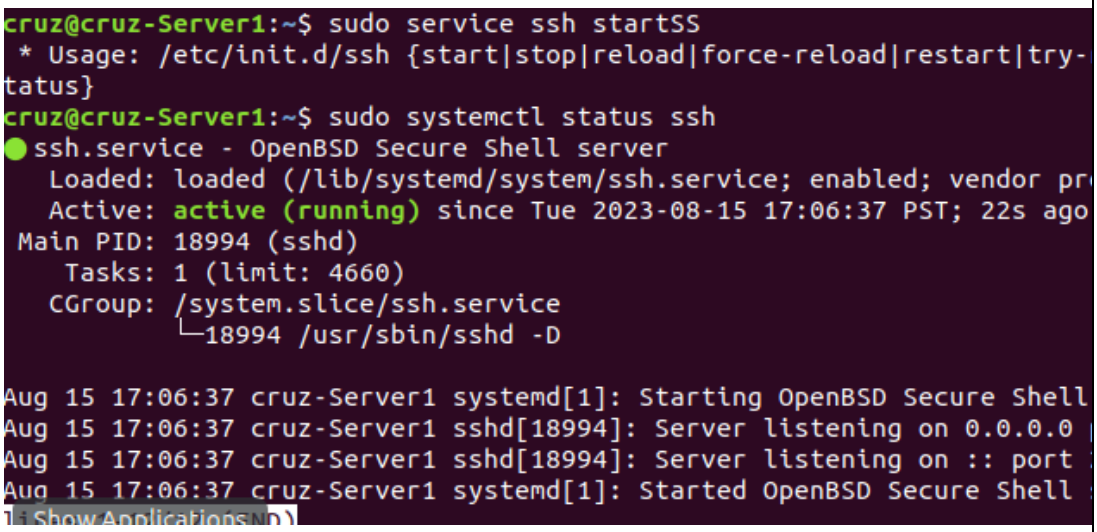
Help

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*

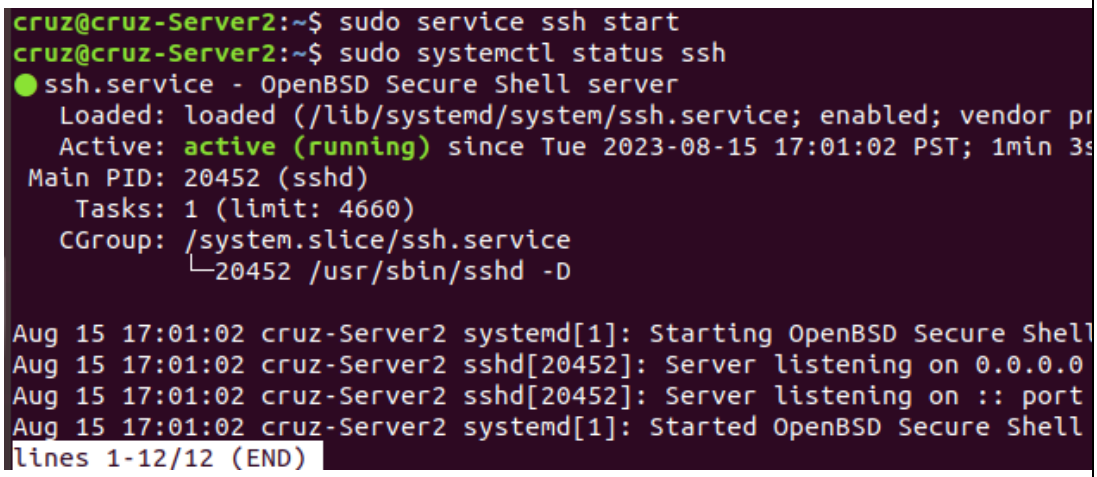
Local Machine:



Server1:



Server2:



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

4.1 *sudo ufw allow ssh*

Local machine:

```
cruz@cruz-Desktop:~$ sudo ufw allow ssh
Rules updated
Rules updated (v6)
```

Server1:

```
cruz@cruz-Server1:~$ sudo ufw allow sshS
[sudo] password for cruz:
ERROR: Could not find a profile matching 'sshS'
cruz@cruz-Server1:~$ sudo ufw allow ssh
Rules updated
Rules updated (v6)
cruz@cruz-Server1:~$
```

Server2:

```
cruz@cruz-Server2:~$ sudo ufw allow ssh
[sudo] password for cruz:
Thunderbird Mail
Rules updated (v6)
cruz@cruz-Server2:~$
```

4.2 *sudo ufw enable*

Local Machine:

```
cruz@cruz-Desktop:~$ sudo ufw enable
Firewall is active and enabled on system startup
```

Server1:

```
cruz@cruz-Server1:~$ sudo ufw enable
Firewall is active and enabled on system startup
cruz@cruz-Server1:~$
Rhythmbox
```

Server2:

```
cruz@cruz-Server2:~$ sudo ufw enable
Firewall is active and enabled on system startup
```

4.3 *sudo ufw status*

Local machine:

```
cruz@cruz-Desktop:~$ sudo ufw status
Status: active

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

Server1:

```
cruz@cruz-Server1:~$ sudo ufw status
Status: active

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

Server2:

```
cruz@cruz-Server2:~$ 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: 10.0.2.15/24
   1.2 Server 2 IP address: 10.0.2.15/24
   1.3 Local Machine IP address: 10.0.2.15
2. Make sure that they can ping each other.
   2.1 Connectivity test for Local Machine 1 to Server 1: ☒ Successful ☐ Not Successful

```
cruz@cruz-Desktop:~$ ping 127.0.0.1
PING 127.0.0.1 (127.0.0.1) 56(84) bytes of data.
64 bytes from 127.0.0.1: icmp_seq=1 ttl=64 time=0.015 ms
64 bytes from 127.0.0.1: icmp_seq=2 ttl=64 time=0.038 ms
64 bytes from 127.0.0.1: icmp_seq=3 ttl=64 time=0.017 ms
64 bytes from 127.0.0.1: icmp_seq=4 ttl=64 time=0.094 ms
64 bytes from 127.0.0.1: icmp_seq=5 ttl=64 time=0.021 ms
64 bytes from 127.0.0.1: icmp_seq=6 ttl=64 time=0.024 ms
64 bytes from 127.0.0.1: icmp_seq=7 ttl=64 time=0.023 ms
64 bytes from 127.0.0.1: icmp_seq=8 ttl=64 time=0.039 ms
64 bytes from 127.0.0.1: icmp_seq=9 ttl=64 time=0.029 ms
64 bytes from 127.0.0.1: icmp_seq=10 ttl=64 time=0.042 ms
64 bytes from 127.0.0.1: icmp_seq=11 ttl=64 time=0.023 ms
64 bytes from 127.0.0.1: icmp_seq=12 ttl=64 time=0.025 ms
```

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

```
cruz@cruz-Desktop:~$ ping 127.0.0.1
PING 127.0.0.1 (127.0.0.1) 56(84) bytes of data.
64 bytes from 127.0.0.1: icmp_seq=1 ttl=64 time=0.015 ms
64 bytes from 127.0.0.1: icmp_seq=2 ttl=64 time=0.038 ms
64 bytes from 127.0.0.1: icmp_seq=3 ttl=64 time=0.017 ms
64 bytes from 127.0.0.1: icmp_seq=4 ttl=64 time=0.094 ms
64 bytes from 127.0.0.1: icmp_seq=5 ttl=64 time=0.021 ms
64 bytes from 127.0.0.1: icmp_seq=6 ttl=64 time=0.024 ms
64 bytes from 127.0.0.1: icmp_seq=7 ttl=64 time=0.023 ms
64 bytes from 127.0.0.1: icmp_seq=8 ttl=64 time=0.039 ms
64 bytes from 127.0.0.1: icmp_seq=9 ttl=64 time=0.029 ms
64 bytes from 127.0.0.1: icmp_seq=10 ttl=64 time=0.042 ms
64 bytes from 127.0.0.1: icmp_seq=11 ttl=64 time=0.023 ms
64 bytes from 127.0.0.1: icmp_seq=12 ttl=64 time=0.025 ms
```

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

```
cruz@cruz-Server1:~$ ping 127.0.0.1
PING 127.0.0.1 (127.0.0.1) 56(84) bytes of data.
64 bytes from 127.0.0.1: icmp_seq=1 ttl=64 time=0.024 ms
64 bytes from 127.0.0.1: icmp_seq=2 ttl=64 time=0.027 ms
64 bytes from 127.0.0.1: icmp_seq=3 ttl=64 time=0.043 ms
64 bytes from 127.0.0.1: icmp_seq=4 ttl=64 time=0.036 ms
64 bytes from 127.0.0.1: icmp_seq=5 ttl=64 time=0.030 ms
64 bytes from 127.0.0.1: icmp_seq=6 ttl=64 time=0.052 ms
64 bytes from 127.0.0.1: icmp_seq=7 ttl=64 time=0.042 ms
64 bytes from 127.0.0.1: icmp_seq=8 ttl=64 time=0.035 ms
64 bytes from 127.0.0.1: icmp_seq=9 ttl=64 time=0.031 ms
64 bytes from 127.0.0.1: icmp_seq=10 ttl=64 time=0.031 ms
64 bytes from 127.0.0.1: icmp_seq=11 ttl=64 time=0.034 ms
64 bytes from 127.0.0.1: icmp_seq=12 ttl=64 time=0.034 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*

2. Logout of Server 1 by issuing the command *control + D.*
3. Do the same for Server 2.
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.

```
cruz@cruz-Desktop:~$ ssh dycruz@127.0.2.15
dycruz@127.0.2.15's password:
Permission denied, please try again.
dycruz@127.0.2.15's password:
Permission denied, please try again.
dycruz@127.0.2.15's password:
```

I can't access the other servers ip address because I don't have permission to access them, I think it's somehow a itso problem because of the limited access or permission in using this computer in the laboratory.

Reflections:

Answer the following:

1. How are we able to use the hostname instead of IP address in SSH commands?
   My computer will send a DNS query to a DNS server when we enter a hostname in an SSH command to convert the hostname to an IP address. After receiving the Ip address through SSH protocol.
2. How secured is SSH?
   It uses encryption to protect data in transit, supports various authentication methods and employs host verification to prevent unauthorized connections.

Conclusion:

Configuring a network using a VMBox with Ubuntu involves setting up network adapters, configuring Ip addresses, and choosing network modes. By choosing the proper settings, you can ensure flawless communication between the host and the VMbox.