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Course/Section: CPE 232 - CPE31S1	Date Submitted: 23/01/2024
Instructor: Dr. Jonathan Taylar	Semester and SY: 2nd 2023-2024

Activity 1: Configure Network using Virtual Machines

1. Objectives:

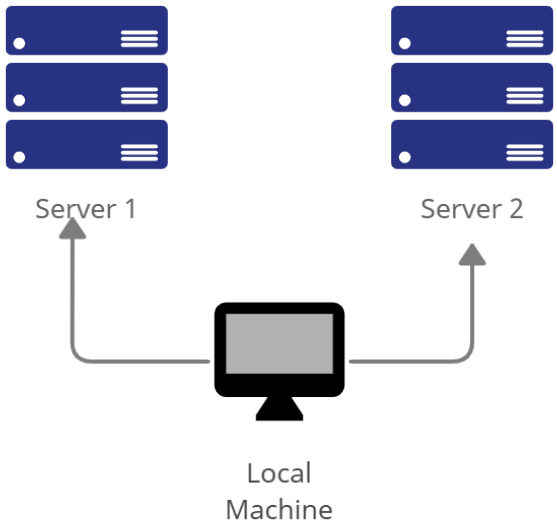
1.1. Create and configure Virtual Machines in Microsoft Azure or VirtualBox

1.2. Set-up a Virtual Network and Test Connectivity of VMs

2. Discussion:

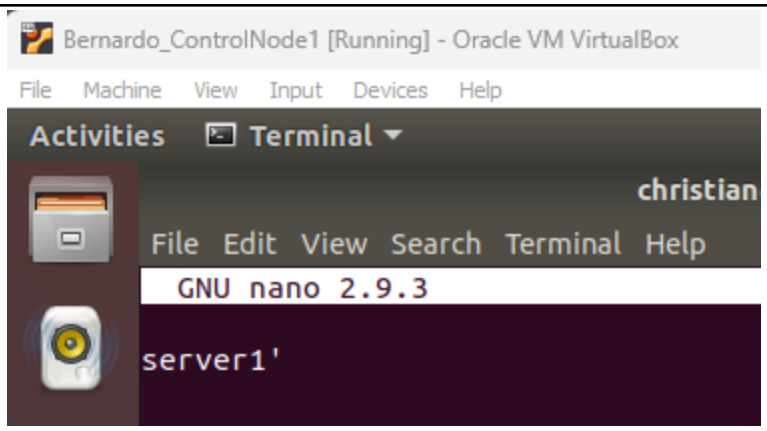
Network Topology:

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*).

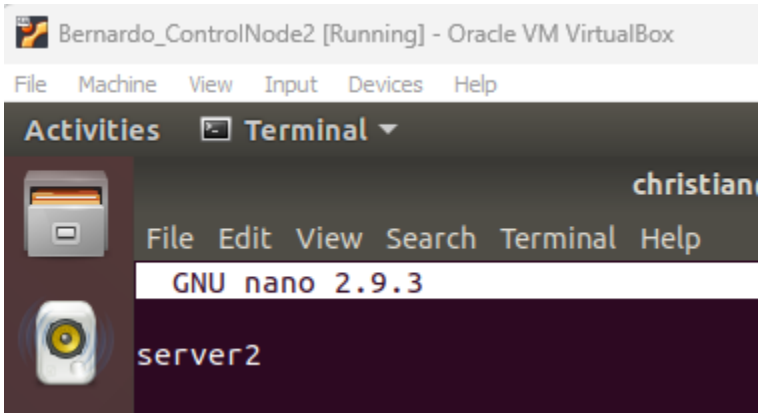


Task 1: Do the following on Server 1, Server 2, and Local Machine. In editing the file using nano command, press control + O to write out (save the file). Press enter when asked for the name of the file. Press control + X to end.

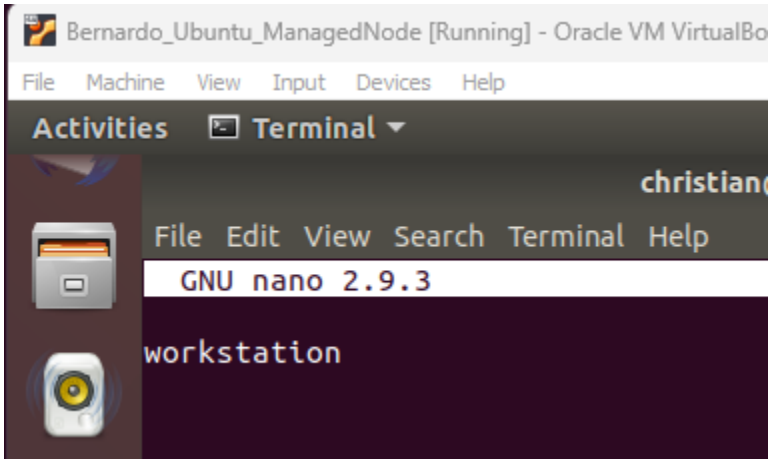
1. Change the hostname using the command *sudo nano /etc/hostname*
   1.1 Use server1 for Server 1



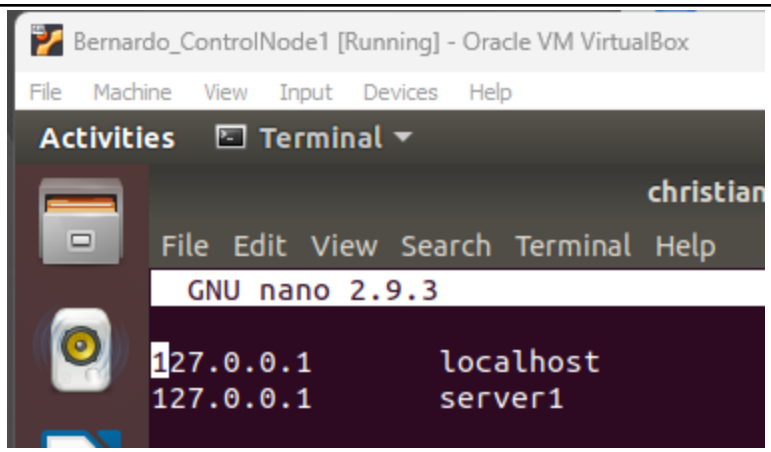
1.2 Use server2 for Server 2



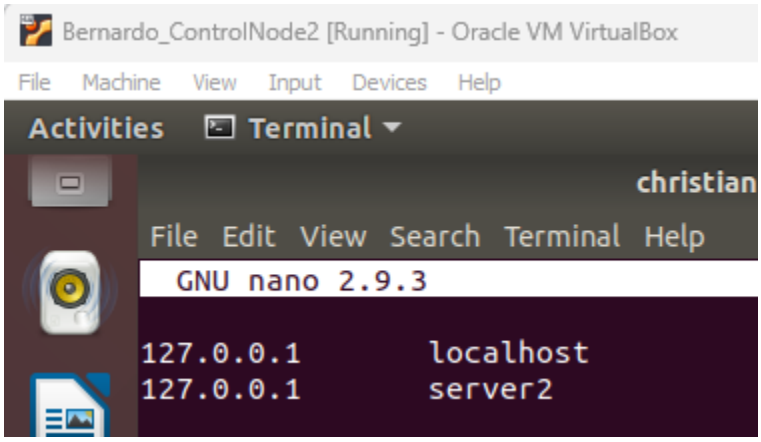
1.3 Use workstation for the Local Machine



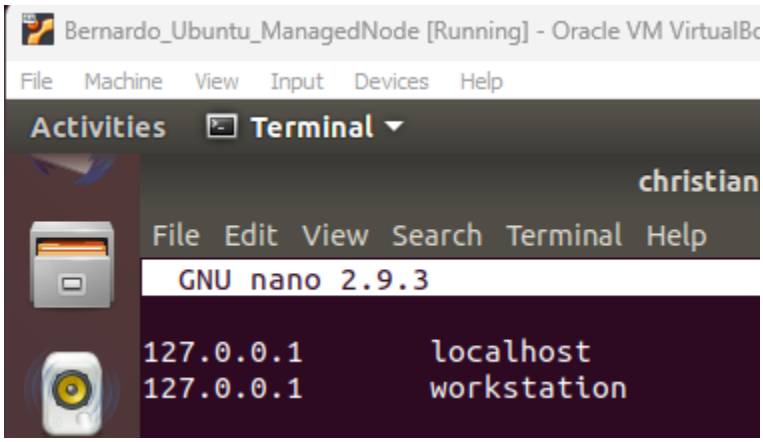
2. Edit the hosts using the command *sudo nano /etc/hosts*. Edit the second line.
   2.1 Type 127.0.0.1 server 1 for Server 1



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.
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*

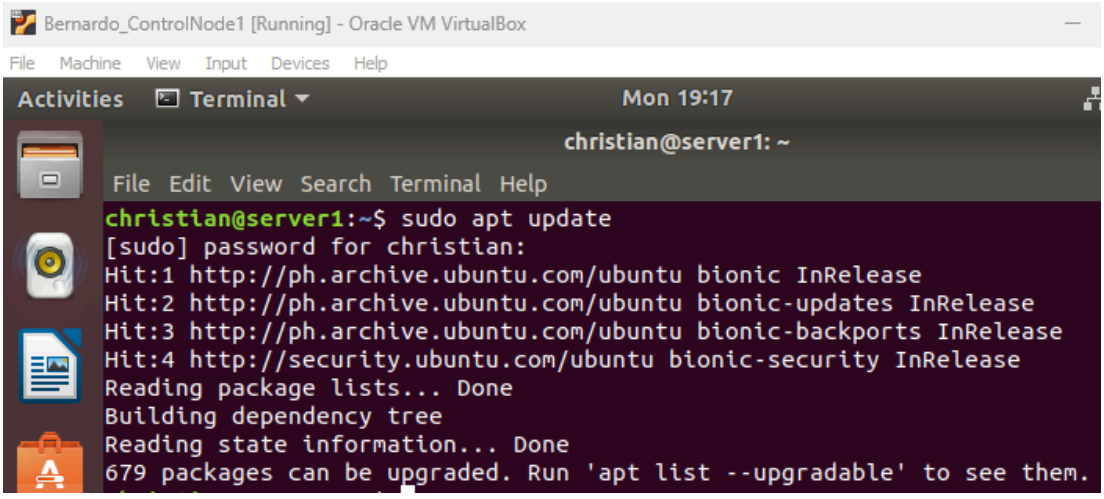
4. Configure the firewall to all port 22 by issuing the following commands:

4.1 *sudo ufw allow ssh*

4.2 *sudo ufw enable*

4.3 *sudo ufw status*

Server 1



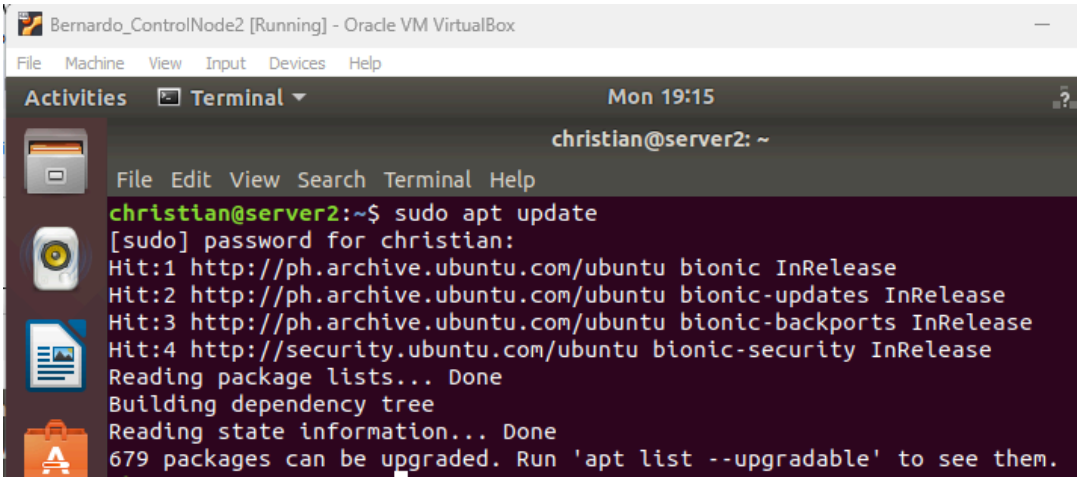

```
christian@server1:~$ sudo apt upgrade
Reading package lists... Done
Building dependency tree
Reading state information... Done
Calculating upgrade... Done
The following package was automatically installed and is no longer required:
  libllvm7
Use 'sudo apt autoremove' to remove it.
The following 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 ubuntu-pro-client-l10n
  xdg-desktop-portal xdg-desktop-portal-gtk
```

```
christian@server1:~$ sudo apt install openssh-server
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  ncurses-term openssh-client openssh-sftp-server ssh-import-id
Suggested packages:
  keychain libpam-ssh monkeysphere ssh-askpass molly-guard rssh
The following NEW packages will be installed:
  ncurses-term openssh-server openssh-sftp-server ssh-import-id
The following packages will be upgraded:
  openssh-client
1 upgraded, 4 newly installed, 0 to remove and 678 not upgraded.
Need to get 637 kB/1,247 kB of archives.
After this operation, 5,321 kB of additional disk space will be used.
Do you want to continue? [Y/n] y
Get:1 http://ph.archive.ubuntu.com/ubuntu bionic-updates/main amd64 ncurses-ter
m all 6.1-1ubuntu1.18.04.1 [248 kB]
Get:2 http://ph.archive.ubuntu.com/ubuntu bionic-updates/main amd64 openssh-sft
p-server amd64 1:7.6p1-4ubuntu0.7 [45.5 kB]
Get:3 http://ph.archive.ubuntu.com/ubuntu bionic-updates/main amd64 openssh-ser
ver amd64 1:7.6p1-4ubuntu0.7 [332 kB]
Get:4 http://ph.archive.ubuntu.com/ubuntu bionic-updates/main amd64 ssh-import-
id all 5.7-0ubuntu1.1 [10.9 kB]
Fetched 637 kB in 0s (1,715 kB/s)
```

```
christian@server1:~$ sudo service ssh start
christian@server1:~$ sudo systemctl status ssh
● ssh.service - OpenBSD Secure Shell server
   Loaded: loaded (/lib/systemd/system/ssh.service; enabled; vendor preset: ena
   Active: active (running) since Tue 2024-01-23 17:46:52 PST; 2min 19s ago
 Main PID: 3511 (sshd)
    Tasks: 1 (limit: 4660)
   CGroup: /system.slice/ssh.service
           └─3511 /usr/sbin/sshd -D

Jan 23 17:46:52 server1 systemd[1]: Starting OpenBSD Secure Shell server...
Jan 23 17:46:52 server1 sshd[3511]: Server listening on 0.0.0.0 port 22.
Jan 23 17:46:52 server1 sshd[3511]: Server listening on :: port 22.
Jan 23 17:46:52 server1 systemd[1]: Started OpenBSD Secure Shell server.
```

```
                                    christian@server1: ~
File  Edit  View  Search  Terminal  Help
christian@server1:~$ sudo ufw allow ssh
Rules updated
Rules updated (v6)
christian@server1:~$ sudo ufw enable
Firewall is active and enabled on system startup
christian@server1:~$ sudo ufw status
Status: active

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

Server 2



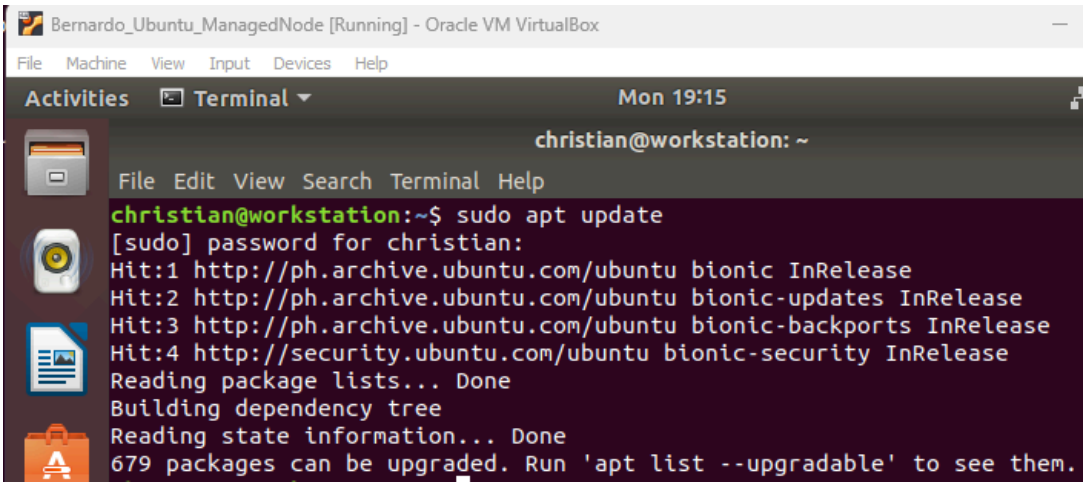

```
christian@server2:~$ sudo apt upgrade
Reading package lists... Done
Building dependency tree
Reading state information... Done
Calculating upgrade... Done
The following package was automatically installed and is no longer required:
  libllvm7
Use 'sudo apt autoremove' to remove it.
The following 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 ubuntu-pro-client-l10n
  xdg-desktop-portal xdg-desktop-portal-gtk
```

```
christian@server2:~$ sudo apt install openssh-server
[sudo] password for christian:
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  ncurses-term openssh-client openssh-sftp-server ssh-import-id
Suggested packages:
  keychain libpam-ssh monkeysphere ssh-askpass molly-guard rssh
The following NEW packages will be installed:
  ncurses-term openssh-server openssh-sftp-server ssh-import-id
The following packages will be upgraded:
  openssh-client
1 upgraded, 4 newly installed, 0 to remove and 678 not upgraded.
Need to get 637 kB/1,247 kB of archives.
After this operation, 5,321 kB of additional disk space will be used.
Do you want to continue? [Y/n] y
Get:1 http://ph.archive.ubuntu.com/ubuntu bionic-updates/main amd64 ncurses-ter
m all 6.1-1ubuntu1.18.04.1 [248 kB]
Get:2 http://ph.archive.ubuntu.com/ubuntu bionic-updates/main amd64 openssh-sft
p-server amd64 1:7.6p1-4ubuntu0.7 [45.5 kB]
Get:3 http://ph.archive.ubuntu.com/ubuntu bionic-updates/main amd64 openssh-ser
ver amd64 1:7.6p1-4ubuntu0.7 [332 kB]
Get:4 http://ph.archive.ubuntu.com/ubuntu bionic-updates/main amd64 ssh-import-
```

```
christian@server2:~$ sudo service ssh start
christian@server2:~$ sudo systemctl status ssh
● ssh.service - OpenBSD Secure Shell server
   Loaded: loaded (/lib/systemd/system/ssh.service; enabled; vendor preset: ena
   Active: active (running) since Tue 2024-01-23 17:46:41 PST; 5min ago
 Main PID: 3674 (sshd)
    Tasks: 1 (limit: 4660)
   CGroup: /system.slice/ssh.service
           └─3674 /usr/sbin/sshd -D

Jan 23 17:46:41 server2 systemd[1]: Starting OpenBSD Secure Shell server...
Jan 23 17:46:41 server2 sshd[3674]: Server listening on 0.0.0.0 port 22.
Jan 23 17:46:41 server2 sshd[3674]: Server listening on :: port 22.
Jan 23 17:46:41 server2 systemd[1]: Started OpenBSD Secure Shell server.
lines 1-12/12 (END)
```

```
File  Edit  View  Search  Terminal  Help
christian@server2:~$ sudo ufw allow ssh
Rules updated
Rules updated (v6)
christian@server2:~$ sudo ufw enable
Firewall is active and enabled on system startup
christian@server2:~$ sudo ufw status
Status: active

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

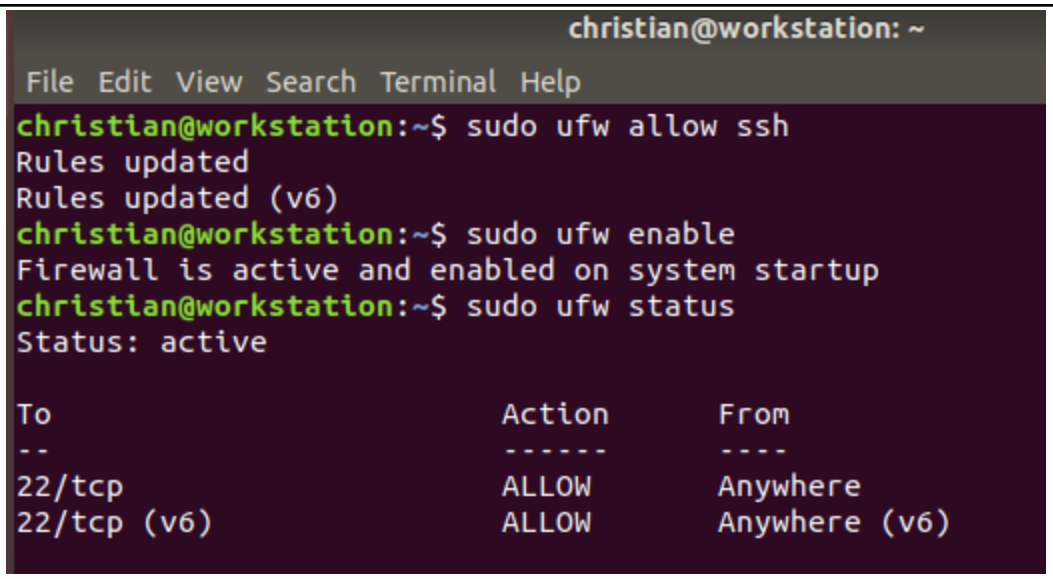
Local Machine



```
christian@workstation:~$ 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 ubuntu-pro-client-l10n
  xdg-desktop-portal xdg-desktop-portal-gtk
```

```
christian@workstation:~$ sudo apt install openssh-server
[sudo] password for christian:
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following package was automatically installed and is no longer required:
  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] y
Get:1 http://ph.archive.ubuntu.com/ubuntu bionic-updates/main amd64 ncurses-ter
m all 6.1-1ubuntu1.18.04.1 [248 kB]
Get:2 http://ph.archive.ubuntu.com/ubuntu bionic-updates/main amd64 openssh-sft
p-server amd64 1:7.6p1-4ubuntu0.7 [45.5 kB]
```

```
christian@workstation:~$ sudo service ssh start
christian@workstation:~$ sudo systemctl status ssh
● ssh.service - OpenBSD Secure Shell server
   Loaded: loaded (/lib/systemd/system/ssh.service; enabled; vendor preset: ena
   Active: active (running) since Tue 2024-01-23 17:51:12 PST; 2min 17s ago
 Main PID: 19410 (sshd)
    Tasks: 1 (limit: 4660)
   CGroup: /system.slice/ssh.service
           └─19410 /usr/sbin/sshd -D

Jan 23 17:51:12 workstation systemd[1]: Starting OpenBSD Secure Shell server...
Jan 23 17:51:12 workstation sshd[19410]: Server listening on 0.0.0.0 port 22.
Jan 23 17:51:12 workstation sshd[19410]: Server listening on :: port 22.
Jan 23 17:51:12 workstation systemd[1]: Started OpenBSD Secure Shell server.
```

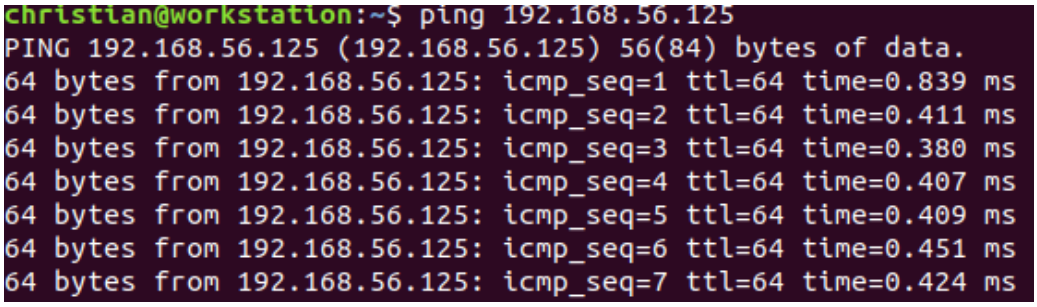


Task 3: Verify network settings on Server 1, Server 2, and Local Machine. On each device, do the following:

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: 192.168.56.125

   1.2 Server 2 IP address: 192.168.56.124

   1.3 workstation IP address: 192.168.56.123
2. Make sure that they can ping each other.
   2.1 Connectivity test for Local Machine 1 to Server 1: ☐ Successful ☐ Not Successful



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

```
christian@workstation:~$ ping 192.168.56.124
PING 192.168.56.124 (192.168.56.124) 56(84) bytes of data.
64 bytes from 192.168.56.124: icmp_seq=1 ttl=64 time=0.737 ms
64 bytes from 192.168.56.124: icmp_seq=2 ttl=64 time=0.488 ms
64 bytes from 192.168.56.124: icmp_seq=3 ttl=64 time=0.738 ms
64 bytes from 192.168.56.124: icmp_seq=4 ttl=64 time=0.441 ms
64 bytes from 192.168.56.124: icmp_seq=5 ttl=64 time=0.458 ms
64 bytes from 192.168.56.124: icmp_seq=6 ttl=64 time=0.633 ms
^Z
```

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

```
christian@server1:~$ ping 192.168.56.124
PING 192.168.56.124 (192.168.56.124) 56(84) bytes of data.
64 bytes from 192.168.56.124: icmp_seq=1 ttl=64 time=1.45 ms
64 bytes from 192.168.56.124: icmp_seq=2 ttl=64 time=0.497 ms
64 bytes from 192.168.56.124: icmp_seq=3 ttl=64 time=0.449 ms
64 bytes from 192.168.56.124: icmp_seq=4 ttl=64 time=0.400 ms
64 bytes from 192.168.56.124: icmp_seq=5 ttl=64 time=0.435 ms
64 bytes from 192.168.56.124: icmp_seq=6 ttl=64 time=0.414 ms
64 bytes from 192.168.56.124: icmp_seq=7 ttl=64 time=0.402 ms
^Z
```

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

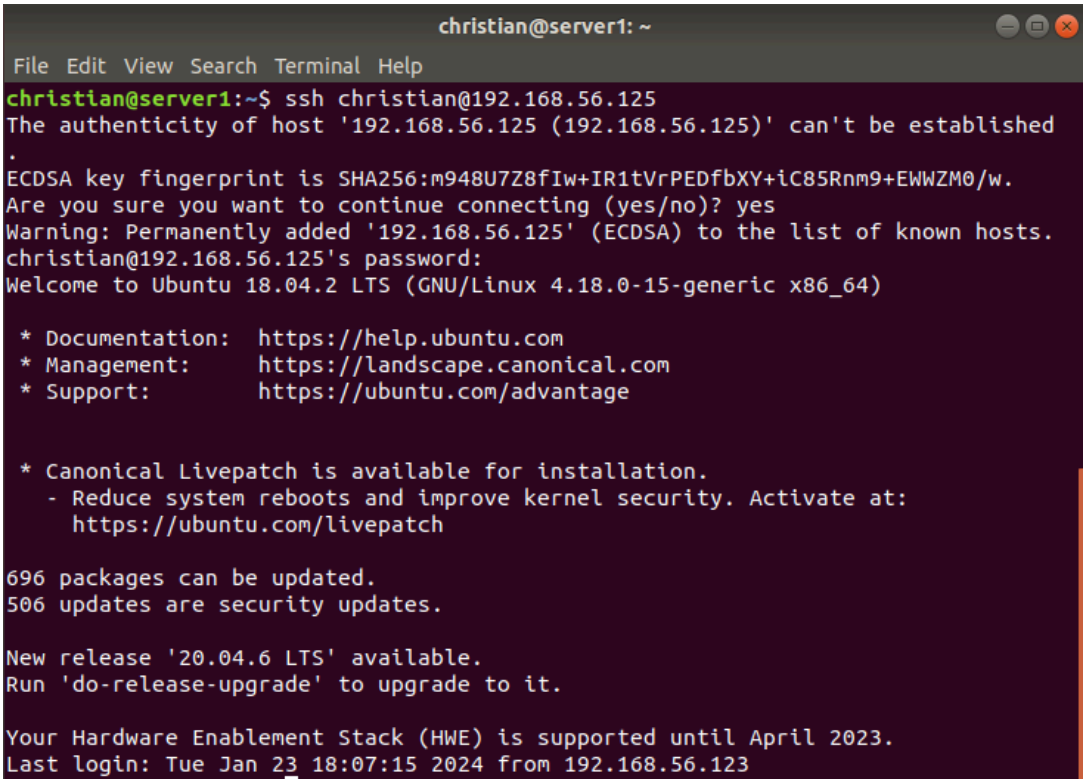
1. On the Local Machine, issue the following commands:

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

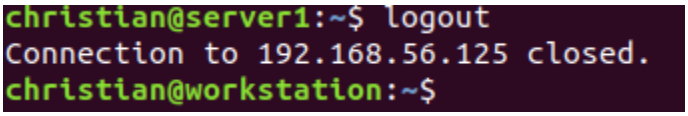
1.2 Enter the password for server 1 when prompted

```
christian@server1:~$ ssh christian@192.168.56.125
The authenticity of host '192.168.56.125 (192.168.56.125)' can't be established
.
ECDSA key fingerprint is SHA256:m948U7Z8fIw+IR1tVrPEDfbXY+iC85Rnm9+EWWZM0/w.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '192.168.56.125' (ECDSA) to the list of known hosts.
christian@192.168.56.125's password:
Welcome to Ubuntu 18.04.2 LTS (GNU/Linux 4.18.0-15-generic x86_64)

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


 * Canonical Livepatch is available for installation.
   - Reduce system reboots and improve kernel security. Activate at:
     https://ubuntu.com/livepatch

696 packages can be updated.
506 updates are security updates.

New release '20.04.6 LTS' available.
Run 'do-release-upgrade' to upgrade to it.

Your Hardware Enablement Stack (HWE) is supported until April 2023.
Last login: Tue Jan 23 18:07:15 2024 from 192.168.56.123
```

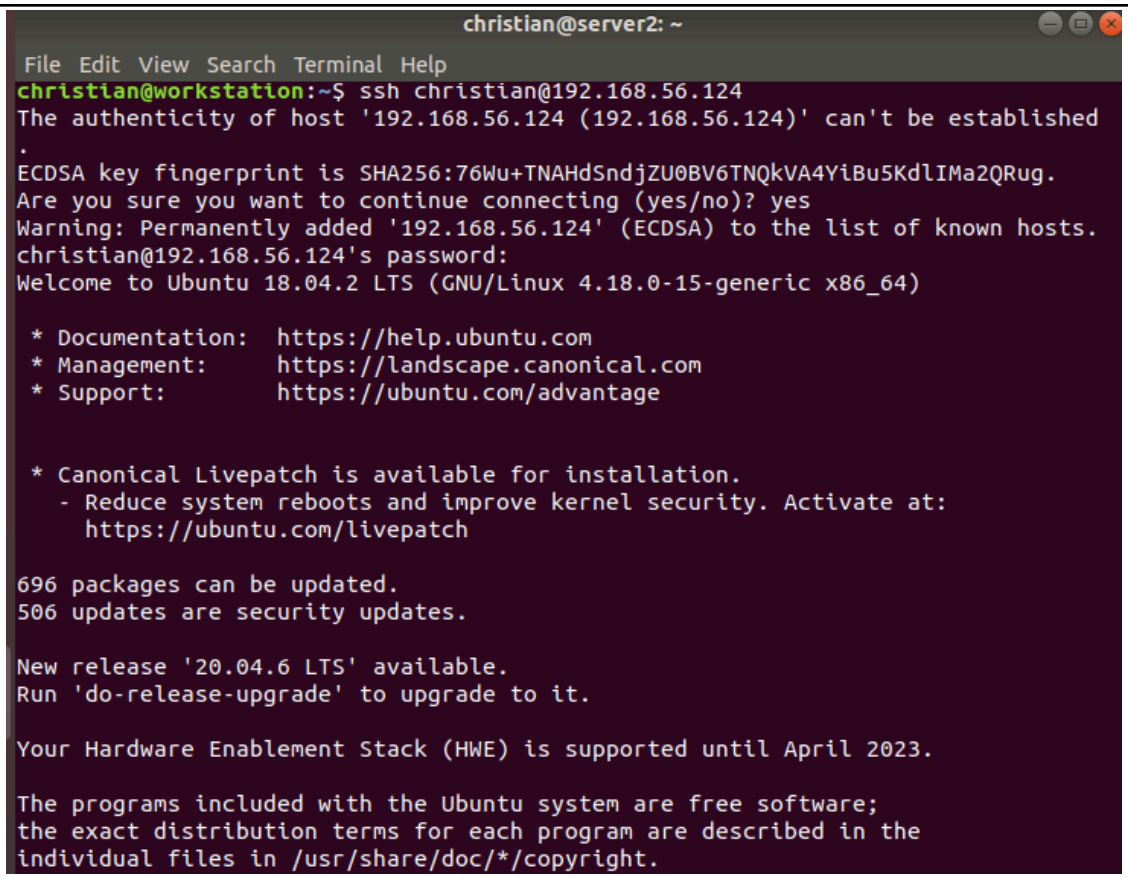
1.3 Verify that you are in server 1. The user should be in this format user@server1. For example, *jvtaylar@server1*

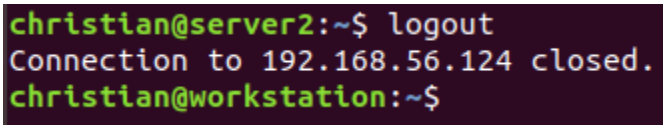


2. Logout of Server 1 by issuing the command *control + D.*



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.

```
                                christian@workstation: ~
File  Edit  View  Search  Terminal  Help
  GNU nano 2.9.3                          /etc/hosts

127.0.0.1       localhost
127.0.0.1       workstation
192.168.56.125  server1
192.168.56.124  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.

```
christian@workstation:~$ ssh christian@server1
The authenticity of host 'server1 (192.168.56.125)' can't be established.
ECDSA key fingerprint is SHA256:m948U7Z8fIw+IR1tVrPEDfbXY+iC85Rnm9+EWWZM0/w.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added 'server1' (ECDSA) to the list of known hosts.
christian@server1's password:
Welcome to Ubuntu 18.04.2 LTS (GNU/Linux 4.18.0-15-generic x86_64)

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


 * Canonical Livepatch is available for installation.
   - Reduce system reboots and improve kernel security. Activate at:
     https://ubuntu.com/livepatch

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Last login: Tue Jan 23 18:07:49 2024 from 192.168.56.125
```

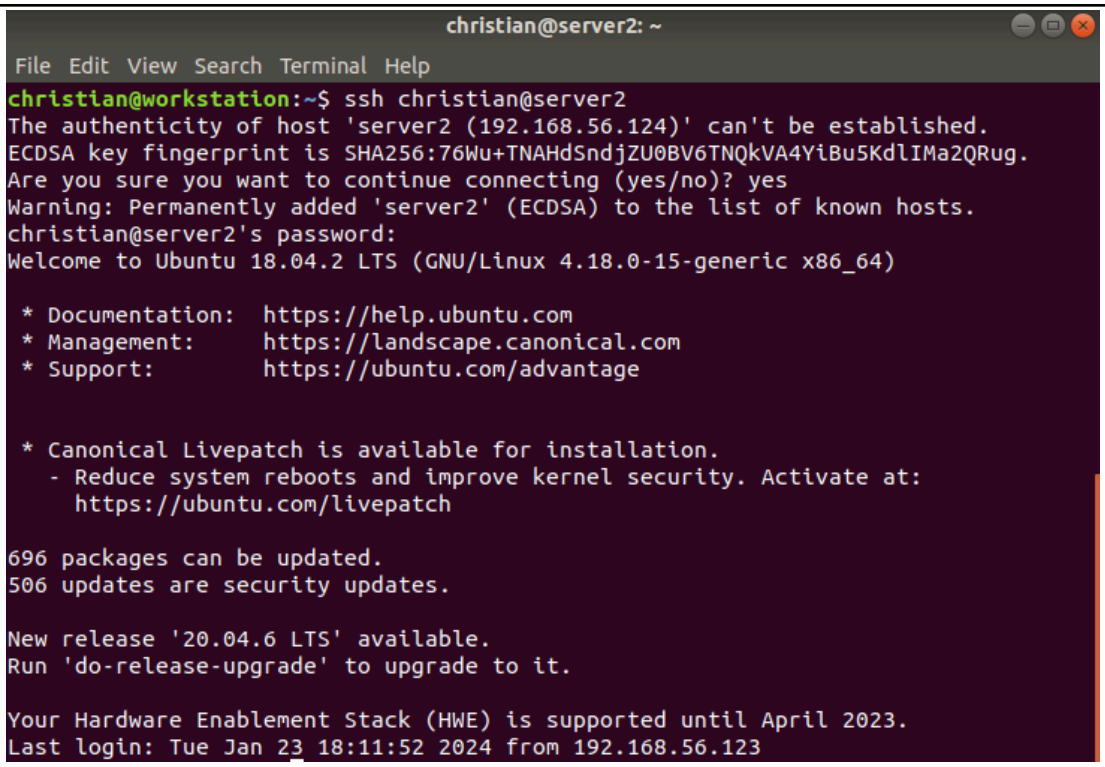

Reflections:

Answer the following:

1. How are we able to use the hostname instead of IP address in SSH commands?
   you can use the hostname instead of the IP address in the SSH command by making the hostname has been resolved towards the correct IP. This can be achieved by having a DNS server that resolves the hostname to the IP
2. How secure is SSH?

   it's an encryption application that can help shield people's private conversations for a safe internet connection.

Conclusion:

In this activity I learned how to use linux's ubuntu server to make servers that are secure using SSH servers in other cloned servers, to make sure that the others servers are connected in safe connection. I also learned how to make servers that need to be verified in pinging the other servers.