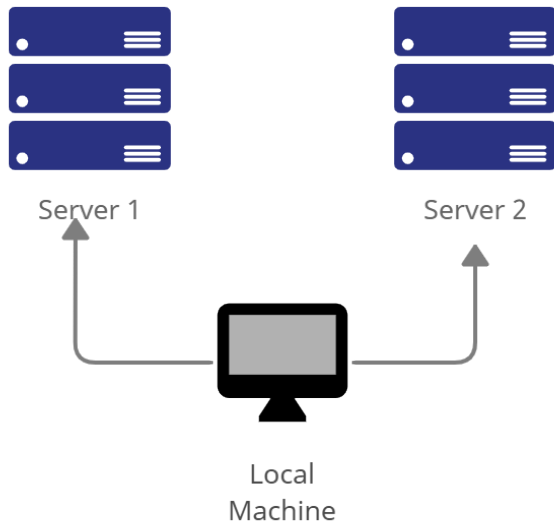
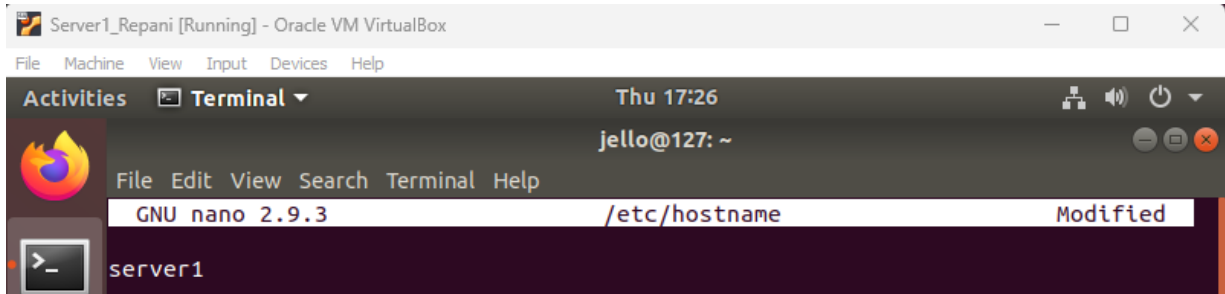


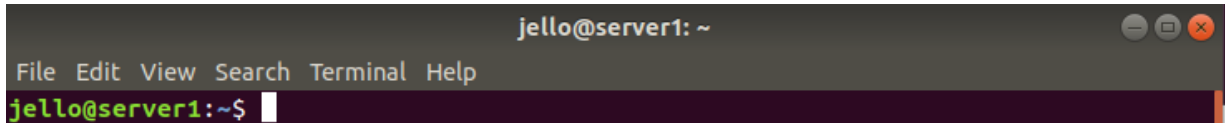
<b>Name: Repani, Justin Jello J.</b>	<b>Date Performed: August 17, 2023</b>
<b>Course/Section: CPE31S6</b>	<b>Date Submitted: August 17, 2023</b>
<b>Instructor: Dr. Jonathan V, Taylar</b>	<b>Semester and SY: 1st, SY 2023-2023</b>
<b>Activity 1: Configure Network using Virtual Machines</b>	
<b>1. Objectives:</b> 1.1. Create and configure Virtual Machines in Microsoft Azure or VirtualBox 1.2. Set-up a Virtual Network and Test Connectivity of VMs	
<b>2. Discussion:</b>  <b>Network Topology:</b> Assume that you have created the following network topology in Virtual Machines, <i>provide screenshots for each task</i> . (Note: <i>it is assumed that you have the prior knowledge of cloning and creating snapshots in a virtual machine</i> ).	
 <pre> graph TD     LM[Local Machine] --&gt; S1[Server 1]     LM --&gt; S2[Server 2]   </pre>	
<b>Task 1:</b> 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. <ol style="list-style-type: none"> <li>Change the hostname using the command <i>sudo nano /etc/hostname</i> <ol style="list-style-type: none"> <li>Use server1 for Server 1</li> </ol> </li> </ol>	

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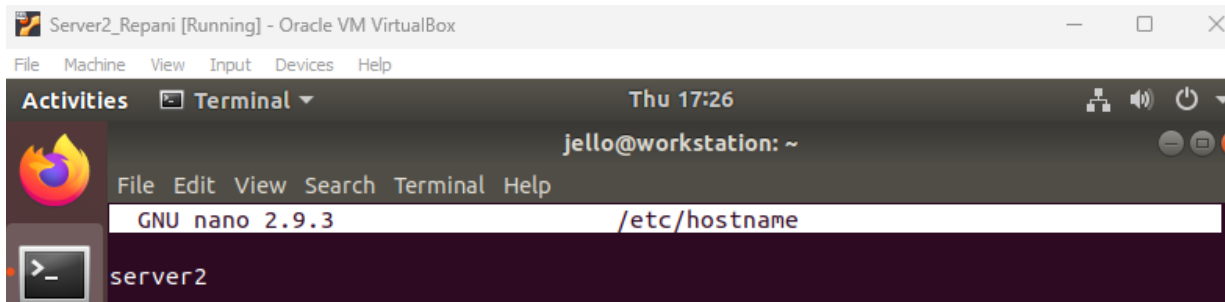


```
Server1_Repani [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal Thu 17:26
jello@127: ~
GNU nano 2.9.3 /etc/hostname Modified
server1
```

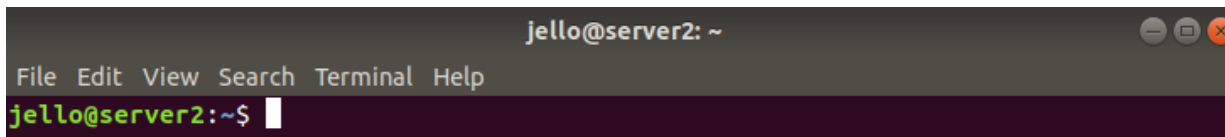


```
jello@server1: ~
File Edit View Search Terminal Help
jello@server1:~$
```

### 1.2 Use server2 for Server 2

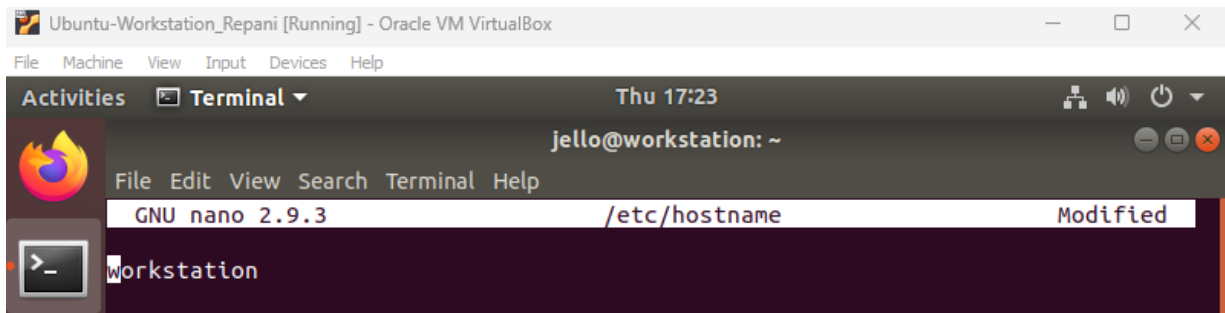


```
Server2_Repani [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal Thu 17:26
jello@workstation: ~
GNU nano 2.9.3 /etc/hostname
server2
```

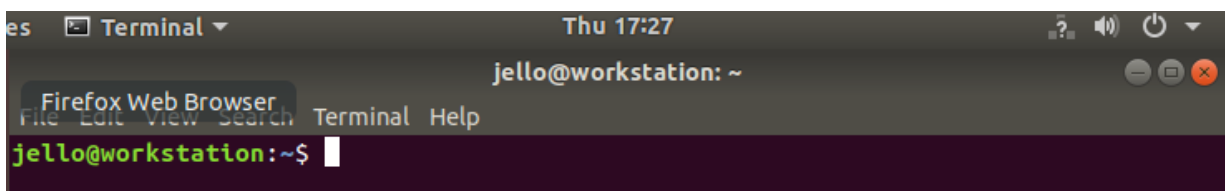


```
jello@server2: ~
File Edit View Search Terminal Help
jello@server2:~$
```

### 1.3 Use workstation for the Local Machine



```
Ubuntu-Workstation_Repani [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal Thu 17:23
jello@workstation: ~
GNU nano 2.9.3 /etc/hostname Modified
workstation
```



```
jello@workstation: ~
File Edit View Search Terminal Help
jello@workstation:~$
```

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

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```
jello@server1: ~  
File Edit View Search Terminal Help  
GNU nano 2.9.3 /etc/hosts Modified  
127.0.0.1 localhost  
127.0.0.1 server 1  
  
# 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

```
jello@server2: ~  
File Edit View Search Terminal Help  
GNU nano 2.9.3 /etc/hosts Modified  
127.0.0.1 localhost  
127.0.0.1 server 2  
  
# 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

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

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```
jello@server1: ~  
File Edit View Search Terminal Help  
roup default qlen 1000  
    link/ether 08:00:27:0e:97:30 brd ff:ff:ff:ff:ff:ff  
    inet 10.0.2.15/24 brd 10.0.2.255 scope global dynamic noprefixroute enp0s3  
        valid_lft 86328sec preferred_lft 86328sec  
    inet6 fe80::623:c8db:e222:98f9/64 scope link noprefixroute  
        valid_lft forever preferred_lft forever  
3: enp0s8: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP g  
roup default qlen 1000  
    link/ether 08:00:27:ca:d3:df brd ff:ff:ff:ff:ff:ff  
    inet 192.168.56.102/24 brd 192.168.56.255 scope global dynamic noprefixrout  
e enp0s8  
        valid_lft 530sec preferred_lft 530sec  
    inet6 fe80::1bd:95b:e548:5b74/64 scope link noprefixroute  
        valid_lft forever preferred_lft forever  
jello@server1:~$ sudo apt update | sudo apt upgrade -y  
[sudo] password for jello:  
  
WARNING: apt does not have a stable CLI interface. Use with caution in scripts.  
  
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.  
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.  
jello@server1:~$ S
```

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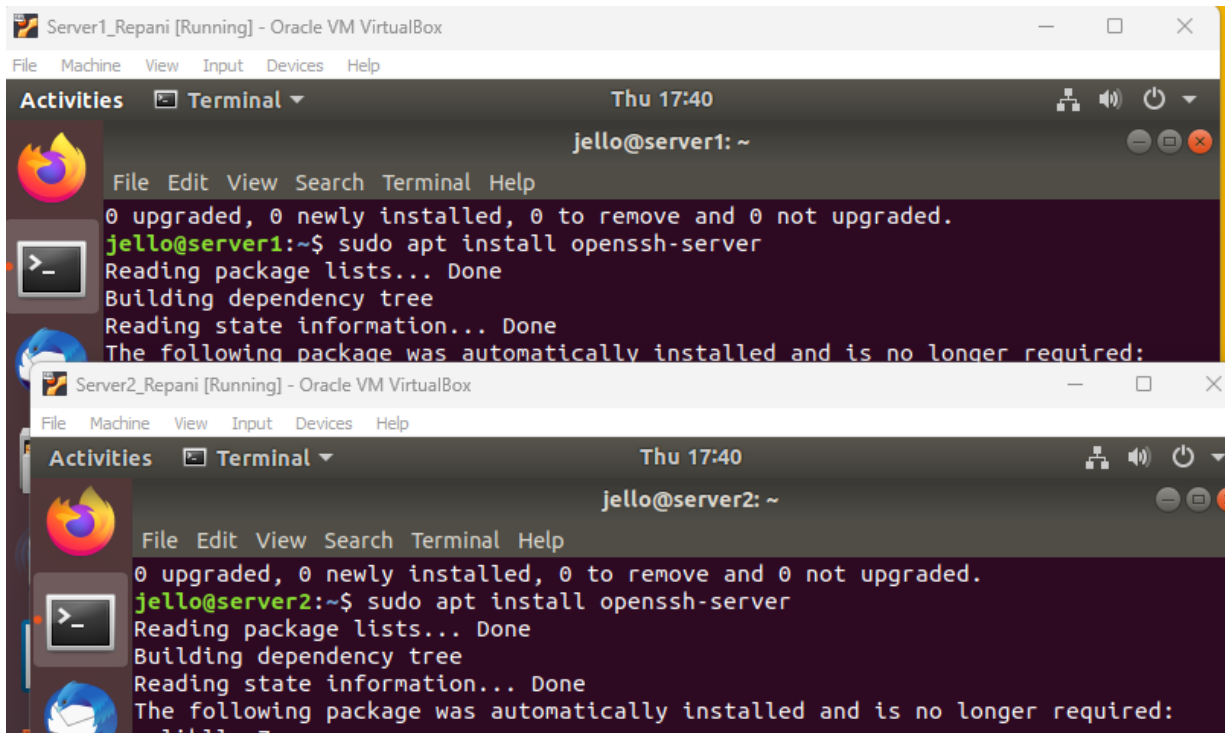
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```
jello@server2: ~  
File Edit View Search Terminal Help  
roup default qlen 1000  
    link/ether 08:00:27:dd:77:68 brd ff:ff:ff:ff:ff:ff  
    inet 10.0.2.15/24 brd 10.0.2.255 scope global dynamic noprefixroute enp0s3  
        valid_lft 86319sec preferred_lft 86319sec  
    inet6 fe80::fb8b:ba24:311a:d9bf/64 scope link noprefixroute  
        valid_lft forever preferred_lft forever  
3: enp0s8: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP g  
roup default qlen 1000  
    link/ether 08:00:27:ae:c5:62 brd ff:ff:ff:ff:ff:ff  
    inet 192.168.56.103/24 brd 192.168.56.255 scope global dynamic noprefixrout  
e enp0s8  
        valid_lft 521sec preferred_lft 521sec  
    inet6 fe80::231c:a3dc:4bbe:d48/64 scope link noprefixroute  
        valid_lft forever preferred_lft forever  
jello@server2:~$ sudo apt update | sudo apt upgrade -y  
[sudo] password for jello:  
  
WARNING: apt does not have a stable CLI interface. Use with caution in scripts.  
  
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.  
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.  
jello@server2:~$
```

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

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The image shows two overlapping terminal windows from Oracle VM VirtualBox. The top window is titled 'Server1\_Repani [Running] - Oracle VM VirtualBox' and the bottom window is titled 'Server2\_Repani [Running] - Oracle VM VirtualBox'. Both windows show a terminal session with the user 'jello' on their respective servers. The terminal output in both windows is identical, showing the command 'sudo apt install openssh-server' being executed. The output indicates that the package is already installed and no action is required.

```
Server1_Repani [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal Thu 17:40
jello@server1: ~
File Edit View Search Terminal Help
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
jello@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 required:
libbluetooth2

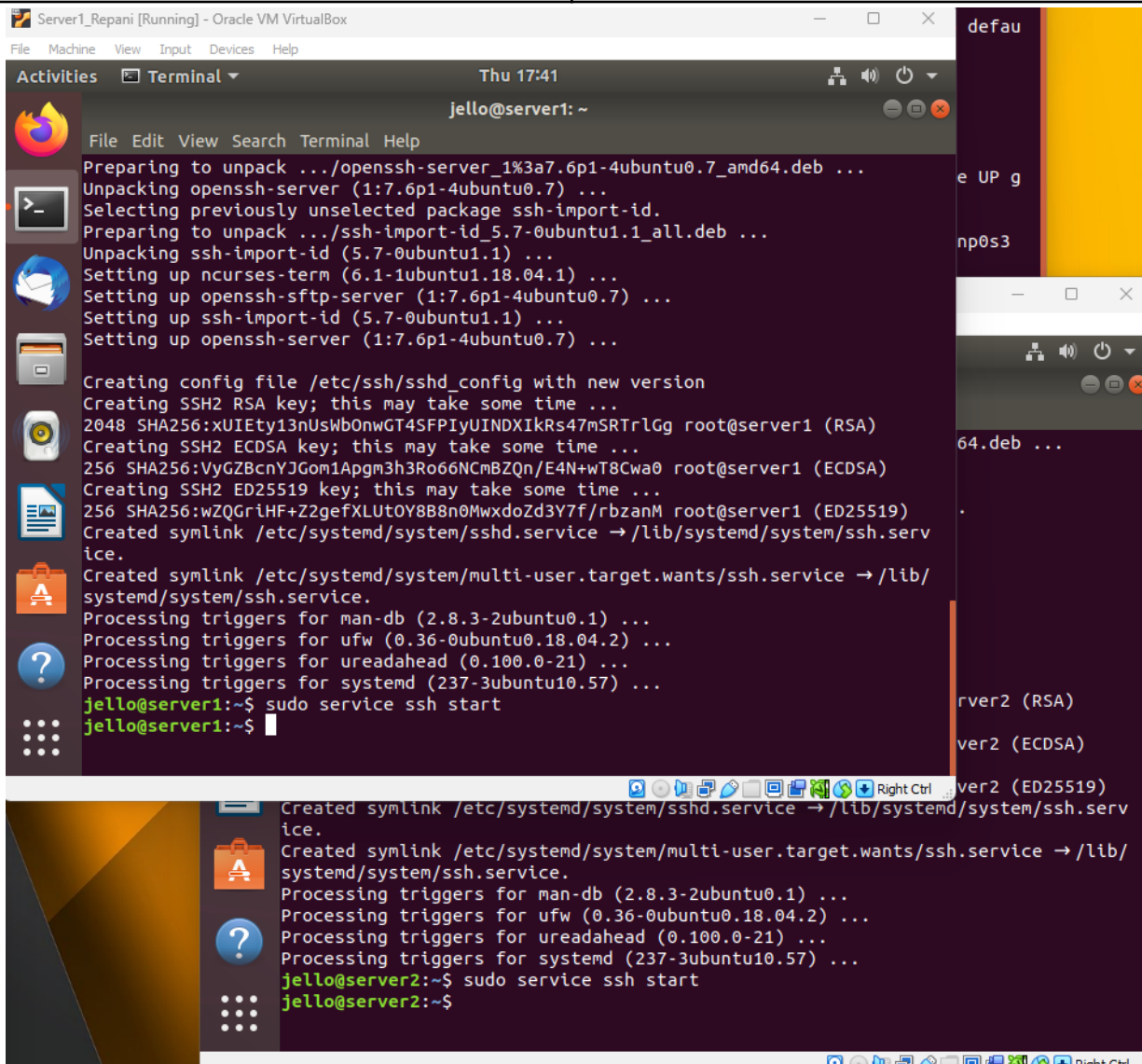
Server2_Repani [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal Thu 17:40
jello@server2: ~
File Edit View Search Terminal Help
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
jello@server2:~$ sudo apt install openssh-server
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following package was automatically installed and is no longer required:
libbluetooth2
```

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

*3.1 sudo service ssh start*

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```
Server1_Repani [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal Thu 17:41
jello@server1: ~

File Edit View Search Terminal Help
Preparing to unpack .../openssh-server_1%3a7.6p1-4ubuntu0.7_amd64.deb ...
Unpacking openssh-server (1:7.6p1-4ubuntu0.7) ...
Selecting previously unselected package ssh-import-id.
Preparing to unpack .../ssh-import-id_5.7-0ubuntu1.1_all.deb ...
Unpacking ssh-import-id (5.7-0ubuntu1.1) ...
Setting up ncurses-term (6.1-1ubuntu1.18.04.1) ...
Setting up openssh-sftp-server (1:7.6p1-4ubuntu0.7) ...
Setting up ssh-import-id (5.7-0ubuntu1.1) ...
Setting up openssh-server (1:7.6p1-4ubuntu0.7) ...

Creating config file /etc/ssh/sshd_config with new version
Creating SSH2 RSA key; this may take some time ...
2048 SHA256:xUIEty13nUsWb0nWGT4SFPIyUINDXIKRs47mSRTrlGg root@server1 (RSA)
Creating SSH2 ECDSA key; this may take some time ...
256 SHA256:VyGZBcnYJGom1Apgm3h3Ro66NCmBZQn/E4N+wt8Cwa0 root@server1 (ECDSA)
Creating SSH2 ED25519 key; this may take some time ...
256 SHA256:wZQGrIHF+Z2gefXLUtOY8B8n0MwxdoZd3Y7f/rbzanM root@server1 (ED25519)
Created symlink /etc/systemd/system/ssh.service → /lib/systemd/system/ssh.service.
Created symlink /etc/systemd/system/multi-user.target.wants/ssh.service → /lib/systemd/system/ssh.service.
Processing triggers for man-db (2.8.3-2ubuntu0.1) ...
Processing triggers for ufw (0.36-0ubuntu0.18.04.2) ...
Processing triggers for ureadahead (0.100.0-21) ...
Processing triggers for systemd (237-3ubuntu10.57) ...
jello@server1:~$ sudo service ssh start
jello@server1:~$
```

### 3.2 sudo systemctl status ssh

```
jello@server1:~$ 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 Thu 2023-08-17 17:39:57 PST; 1min 33s ago
 Main PID: 2548 (sshd)
    Tasks: 1 (limit: 4656)
   CGroup: /system.slice/ssh.service
           └─2548 /usr/sbin/sshd -D

Aug 17 17:39:56 server1 systemd[1]: Starting OpenBSD Secure Shell server...
Aug 17 17:39:57 server1 sshd[2548]: Server listening on 0.0.0.0 port 22.
Aug 17 17:39:57 server1 sshd[2548]: Server listening on :: port 22.
Aug 17 17:39:57 server1 systemd[1]: Started OpenBSD Secure Shell server.
lines 1-12/12 (END)
```



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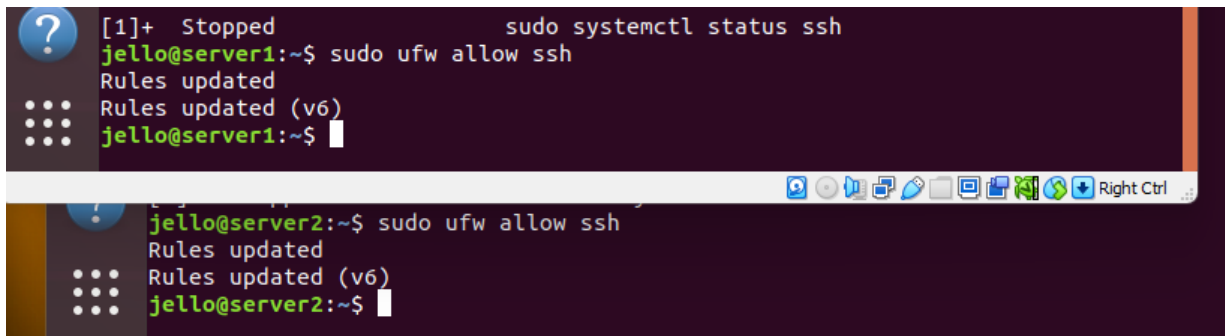
Date Performed: August 17, 2023

```
jello@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 Thu 2023-08-17 17:39:51 PST; 1min 46s ago
   Main PID: 2558 (sshd)
     Tasks: 1 (limit: 4656)
    CGroup: /system.slice/ssh.service
            └─2558 /usr/sbin/sshd -D

Aug 17 17:39:51 server2 systemd[1]: Starting OpenBSD Secure Shell server...
Aug 17 17:39:51 server2 sshd[2558]: Server listening on 0.0.0.0 port 22.
Aug 17 17:39:51 server2 sshd[2558]: Server listening on :: port 22.
Aug 17 17:39:51 server2 systemd[1]: Started OpenBSD Secure Shell server.
lines 1-12/12 (END)
```

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

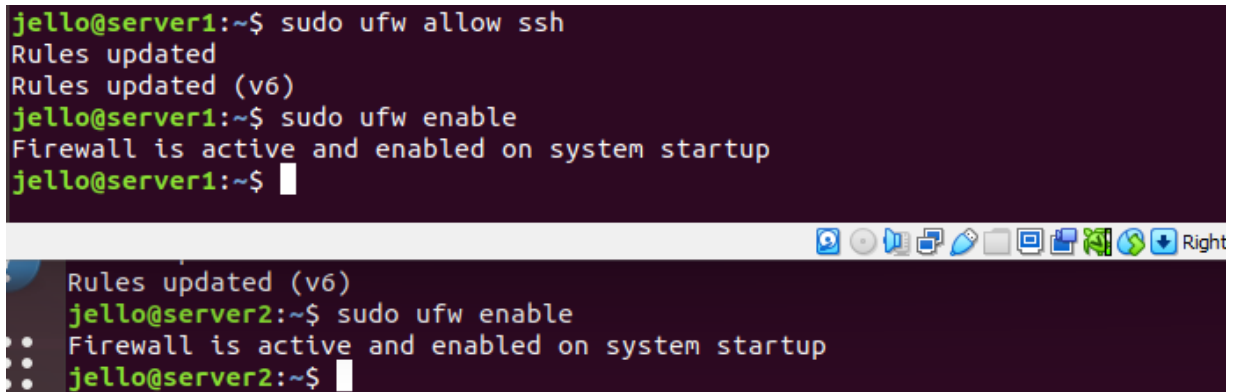
*4.1 sudo ufw allow ssh*



```
[1]+  Stopped                  sudo systemctl status ssh
jello@server1:~$ sudo ufw allow ssh
Rules updated
Rules updated (v6)
jello@server1:~$

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

*4.2 sudo ufw enable*



```
jello@server1:~$ sudo ufw allow ssh
Rules updated
Rules updated (v6)
jello@server1:~$ sudo ufw enable
Firewall is active and enabled on system startup
jello@server1:~$

Rules updated (v6)
jello@server2:~$ sudo ufw enable
Firewall is active and enabled on system startup
jello@server2:~$
```

*4.3 sudo ufw status*



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

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

```
jello@server1:~$
```

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

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

```
jello@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

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

```
jello@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=0.901 ms
64 bytes from 192.168.56.102: icmp_seq=2 ttl=64 time=1.33 ms
64 bytes from 192.168.56.102: icmp_seq=3 ttl=64 time=0.391 ms
64 bytes from 192.168.56.102: icmp_seq=4 ttl=64 time=1.69 ms
^Z
[2]+  Stopped                  ping 192.168.56.102
```

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

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```
jello@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=0.773 ms
64 bytes from 192.168.56.103: icmp_seq=2 ttl=64 time=0.304 ms
64 bytes from 192.168.56.103: icmp_seq=3 ttl=64 time=0.951 ms
64 bytes from 192.168.56.103: icmp_seq=4 ttl=64 time=0.868 ms
^Z
[3]+  Stopped                  ping 192.168.56.103
```

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

```
Server1_Repani [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal Thu 17:54
jello@server1: ~
File Edit View Search Terminal Help
jello@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=1.37 ms
64 bytes from 192.168.56.103: icmp_seq=2 ttl=64 time=1.56 ms
64 bytes from 192.168.56.103: icmp_seq=3 ttl=64 time=1.51 ms
64 bytes from 192.168.56.103: icmp_seq=4 ttl=64 time=1.50 ms
^Z
[2]+  Stopped                  ping 192.168.56.103
jello@server1:~$
```

**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`

```
jello@workstation:~$ ssh jello@192.168.56.102
The authenticity of host '192.168.56.102 (192.168.56.102)' can't be established
ECDSA key fingerprint is SHA256:VyGZBcnYJGom1Apgm3h3Ro66NCmBZQn/E4N+wT8Cwa0.
Are you sure you want to continue connecting (yes/no)? y
Please type 'yes' or 'no': yes
Warning: Permanently added '192.168.56.102' (ECDSA) to the list of known hosts.
jello@192.168.56.102's password:
Welcome to Ubuntu 18.04.6 LTS (GNU/Linux 5.4.0-150-generic x86_64)
```

1.2 Enter the password for server 1 when prompted

```
Ubuntu comes with ABSOLUTELY NO WARRANTY, to the extent permitted by
applicable law.
jello@server1:~$
```

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

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

```
jello@server1:~$
```

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

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

3. Do the same for Server 2.

```
jello@workstation:~$ ssh jello@192.168.56.103
The authenticity of host '192.168.56.103 (192.168.56.103)' can't be established
.
ECDSA key fingerprint is SHA256:7BrewEemwrzk/jFucX235tXhbYUu9o1M+iQ/8cv5I0M.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '192.168.56.103' (ECDSA) to the list of known hosts.
jello@192.168.56.103's password:
Welcome to Ubuntu 18.04.6 LTS (GNU/Linux 5.4.0-150-generic x86_64)

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

Expanded Security Maintenance for Infrastructure is not enabled.
```

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

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

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.

```
jello@workstation:~$ ssh jello@server1  
The authenticity of host 'server1 (192.168.56.102)' can't be established.  
ECDSA key fingerprint is SHA256:VyGZBcnYJGom1Apgm3h3Ro66NCmBZQn/E4N+wT8Cwa0  
Are you sure you want to continue connecting (yes/no)? yes  
Warning: Permanently added 'server1' (ECDSA) to the list of known hosts.  
jello@server1's password:  
Permission denied, please try again.  
jello@server1's password:  
  
jello@server1:~$ logout  
Connection to server1 closed.  
jello@workstation:~$
```

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**Date Performed: August 17, 2023**

```
jello@workstation:~$ ssh jello@server2
The authenticity of host 'server2 (192.168.56.103)' can't be established.
ECDSA key fingerprint is SHA256:7BrewEemwrzk/jFucX235tXhbYUu9o1M+iQ/8cv5I0M.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added 'server2' (ECDSA) to the list of known hosts.
jello@server2's password:
Welcome to Ubuntu 18.04.6 LTS (GNU/Linux 5.4.0-150-generic x86_64)

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

Expanded Security Maintenance for Infrastructure is not enabled.

0 updates can be applied immediately.

78 additional security updates can be applied with ESM Infra.
Learn more about enabling ESM Infra service for Ubuntu 18.04 at
https://ubuntu.com/18-04

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: Thu Aug 17 18:02:22 2023 from 192.168.56.101
jello@server2:~$ logout
Connection to server2 closed.
jello@workstation:~$
```

### Reflections:

Answer the following:

1. How are we able to use the hostname instead of IP address in SSH commands?

We are able to use the hostname instead of the IP address in SSH commands because we edited the /etc/hosts file and added the ip address to the list with its corresponding hostname, specifically 192.168.56.102 for server1 and 192.168.56.102 for server2. By doing this we can now use the command ssh jello@server1 instead of jello@192.168.56.102 since the ip address is now attached to the specific hostname.

2. How secured is SSH?

Based on what we learned on Computer Networking 1, SSH is a secure type of login because it makes use of a username and password just like telnet, but this one on SSH also makes use of encryption so that the information about the hostname and password are encrypted instead of being in plain text file.

### Conclusion

In this first hands-on activity for the course Managing Enterprise Server, we first created new Linux Ubuntu profiles in order to start the workstation and servers. We

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<p>first created the workstation profile and setup the Linux, after this the profile is cloned with different MAC addresses in order to create the new servers 1 and 2. After this the SSH was set up in order to make a connection between the different devices from workstation, server1, and server2. The basic commands in order to setup the ssh, firewall, and test the connections of the different machines are performed.</p>	

*“I affirm that I have not given or received any unauthorized help on this assignment, and that this work is my own.”*