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Course/Section: CPE232-CPE31S1	**Date Submitted:** **Jan 16, 2024**
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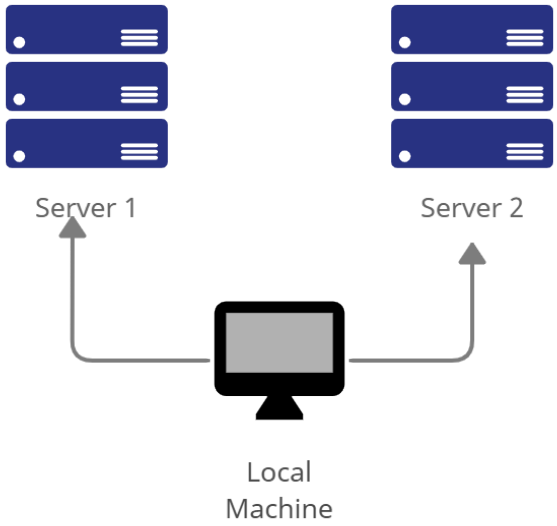
Activity 1: Configure Network using Virtual Machines

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:**

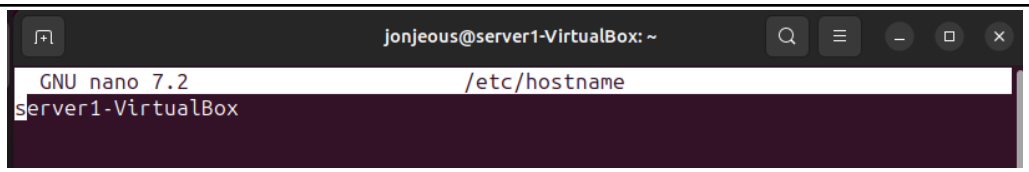
Network Topology:

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*).

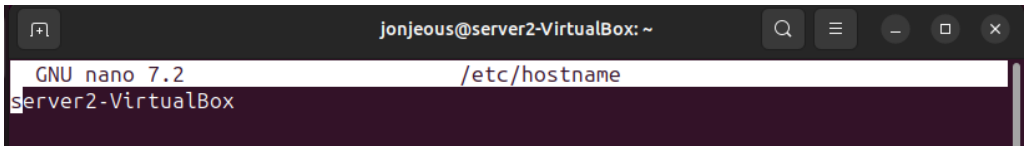


Task 1: Do the following on Server 1, Server 2, and Local Machine. In editing the file using nano command, press control + O to write out (save the file). Press enter when asked for the name of the file. Press control + X to end.

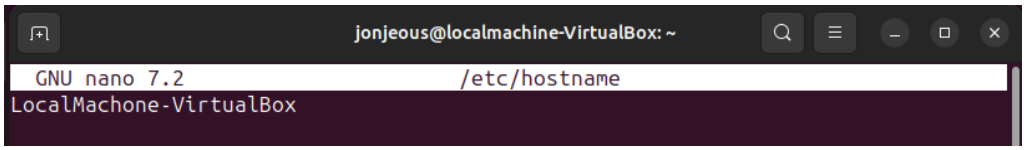
1. Change the hostname using the command *sudo nano /etc/hostname*
   1.1 Use server1 for Server 1



1.2 Use server2 for Server 2

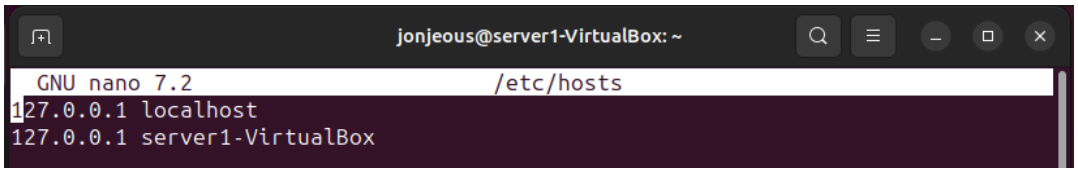


1.3 Use workstation for the Local Machine

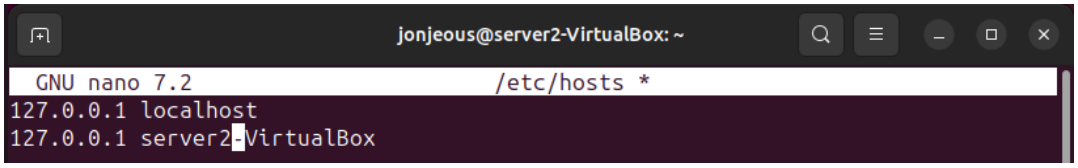


2. Edit the hosts using the command *sudo nano /etc/hosts*. Edit the second line.

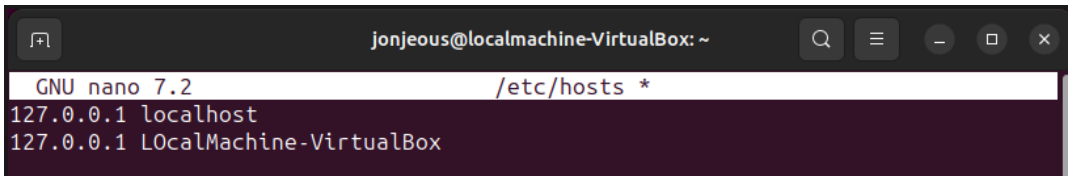
2.1 Type 127.0.0.1 server 1 for Server 1



2.2 Type 127.0.0.1 server 2 for Server 2

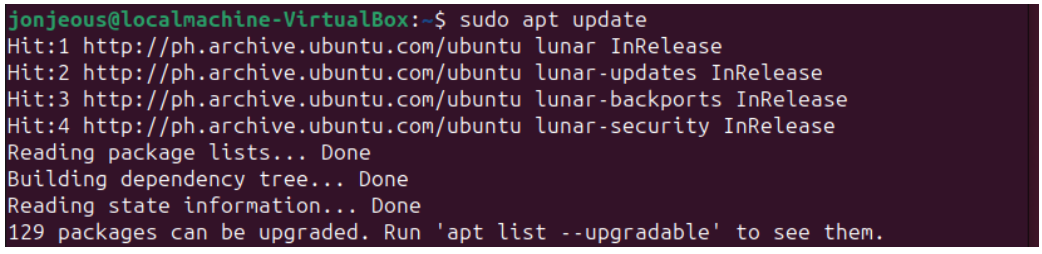


2.3 Type 127.0.0.1 workstation for the Local Machine



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.



```
jonjeous@localmachine-VirtualBox:~$ sudo apt upgrade
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
Calculating upgrade... Done
The following package was automatically installed and is no longer required:
  libevent-2.1-7a
Use 'sudo apt autoremove' to remove it.
The following NEW packages will be installed:
  ubuntu-pro-client-l10n
The following packages have been kept back:
  base-files tzdata tzdata-icu
The following packages will be upgraded:
  alsa-ucm-conf apparmor apport apport-gtk apt apt-utils bind9-dnsutils
  bind9-host bind9-libs cloud-init cups-browsed distro-info distro-info-data
```

```
jonjeous@server1-VirtualBox:~$ sudo apt update
Hit:1 http://ph.archive.ubuntu.com/ubuntu lunar InRelease
Hit:2 http://ph.archive.ubuntu.com/ubuntu lunar-updates InRelease
Hit:3 http://ph.archive.ubuntu.com/ubuntu lunar-backports InRelease
Hit:4 http://ph.archive.ubuntu.com/ubuntu lunar-security InRelease
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
129 packages can be upgraded. Run 'apt list --upgradable' to see them.
```

```
jonjeous@server1-VirtualBox:~$ sudo apt upgrade
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
Calculating upgrade... Done
The following package was automatically installed and is no longer required:
  libevent-2.1-7a
Use 'sudo apt autoremove' to remove it.
The following NEW packages will be installed:
  ubuntu-pro-client-l10n
The following packages have been kept back:
  base-files tzdata tzdata-icu
The following packages will be upgraded:
  alsa-ucm-conf apparmor apport apport-gtk apt apt-utils bind9-dnsutils
  bind9-host bind9-libs cloud-init cups-browsed distro-info distro-info-data
  evince evince-common evolution-data-server evolution-data-server-common
  firmware-sof-signed gdb gdm3 gir1.2-adw-1 gir1.2-gdm-1.0 gir1.2-gtk-4.0 gjs
```

```
jonjeous@server2-VirtualBox:~$ sudo apt update
Hit:1 http://ph.archive.ubuntu.com/ubuntu lunar InRelease
Hit:2 http://ph.archive.ubuntu.com/ubuntu lunar-updates InRelease
Hit:3 http://ph.archive.ubuntu.com/ubuntu lunar-backports InRelease
Hit:4 http://ph.archive.ubuntu.com/ubuntu lunar-security InRelease
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
129 packages can be upgraded. Run 'apt list --upgradable' to see them.
```

```
jonjeous@server2-VirtualBox:~$ sudo apt upgrade
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
Calculating upgrade... Done
The following package was automatically installed and is no longer required:
  libevent-2.1-7a
Use 'sudo apt autoremove' to remove it.
The following NEW packages will be installed:
  ubuntu-pro-client-l10n
The following packages have been kept back:
  base-files tzdata tzdata-icu
The following packages will be upgraded:
  alsa-ucm-conf apparmor apport apport-gtk apt apt-utils bind9-dnsutils
  bind9-host bind9-libs cloud-init cups-browsed distro-info distro-info-data
```

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

```
jonjeous@localmachine-VirtualBox:~$ sudo apt install openssh-server
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following package was automatically installed and is no longer required:
  libevent-2.1-7a
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 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 3 not upgraded.
Need to get 751 kB of archives.
```

```
jonjeous@server1-VirtualBox:~$ sudo apt install openssh-server
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following package was automatically installed and is no longer required:
  libevent-2.1-7a
Use 'sudo apt autoremove' to remove it.
The following additional packages will be installed:
  ncurses-term openssh-sftp-server ssh-import-id
Suggested packages:
```

```
jonjeous@server2-VirtualBox:~$ sudo apt install openssh-server
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following package was automatically installed and is no longer required:
  libevent-2.1-7a
Use 'sudo apt autoremove' to remove it.
The following additional packages will be installed:
  ncurses-term openssh-sftp-server ssh-import-id
Suggested packages:
```

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

```
jonjeous@localmachine-VirtualBox:~$ sudo systemctl status ssh
● ssh.service - OpenBSD Secure Shell server
     Loaded: loaded (/lib/systemd/system/ssh.service; disabled; preset: enabled)
    Drop-In: /etc/systemd/system/ssh.service.d
             └─00-socket.conf
     Active: active (running) since Tue 2024-01-16 18:18:31 PST; 17s ago
TriggeredBy: ● ssh.socket
       Docs: man:sshd(8)
             man:sshd_config(5)
    Process: 26395 ExecStartPre=/usr/sbin/sshd -t (code=exited, status=0/SUCCES>
   Main PID: 26396 (sshd)
      Tasks: 1 (limit: 4600)
     Memory: 1.6M
        CPU: 13ms
     CGroup: /system.slice/ssh.service
             └─26396 "sshd: /usr/sbin/sshd -D [listener] 0 of 10-100 startups"
```

```
jonjeous@server1-VirtualBox:~$ sudo service ssh start
sjonjeous@server1-VirtualBox:~$ sudo systemctl status ssh
● ssh.service - OpenBSD Secure Shell server
     Loaded: loaded (/lib/systemd/system/ssh.service; disabled; preset: enabled)
    Drop-In: /etc/systemd/system/ssh.service.d
             └─00-socket.conf
     Active: active (running) since Tue 2024-01-16 18:19:09 PST; 7s ago
TriggeredBy: ● ssh.socket
       Docs: man:sshd(8)
             man:sshd_config(5)
    Process: 26428 ExecStartPre=/usr/sbin/sshd -t (code=exited, status=0/SUCCES>
   Main PID: 26429 (sshd)
      Tasks: 1 (limit: 4600)
     Memory: 1.6M
        CPU: 13ms
     CGroup: /system.slice/ssh.service
             └─26429 "sshd: /usr/sbin/sshd -D [listener] 0 of 10-100 startups"
```

```
jonjeous@server2-VirtualBox:~$ sudo service ssh start
jonjeous@server2-VirtualBox:~$ sudo systemctl status ssh
● ssh.service - OpenBSD Secure Shell server
     Loaded: loaded (/lib/systemd/system/ssh.service; disabled; preset: enablec
    Drop-In: /etc/systemd/system/ssh.service.d
             └─00-socket.conf
     Active: active (running) since Tue 2024-01-16 18:19:29 PST; 9s ago
TriggeredBy: ● ssh.socket
       Docs: man:sshd(8)
             man:sshd_config(5)
    Process: 26392 ExecStartPre=/usr/sbin/sshd -t (code=exited, status=0/SUCCES
   Main PID: 26393 (sshd)
      Tasks: 1 (limit: 4600)
     Memory: 1.6M
        CPU: 14ms
     CGroup: /system.slice/ssh.service
             └─26393 "sshd: /usr/sbin/sshd -D [listener] 0 of 10-100 startups"
```

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

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

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

jonjeous@localmachine-VirtualBox:~$
```

```
jonjeous@server1-VirtualBox:~$ sudo ufw status
Status: active

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

```
jonjeous@server2-VirtualBox:~$ 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: 192.168.56.106/114
   1.2 Server 2 IP address: 192.168.56.107/113
   1.3 Server 3 IP address: 192.168.56.108/115
2. Make sure that they can ping each other.
   2.1 Connectivity test for Local Machine 1 to Server 1: ☐ Successful ☐ Not Successful

```
jonjeous@LocalMachone-VirtualBox:~$ ping 192.168.56.106
PING 192.168.56.106 (192.168.56.106) 56(84) bytes of data.
64 bytes from 192.168.56.106: icmp_seq=1 ttl=64 time=1.09 ms
64 bytes from 192.168.56.106: icmp_seq=2 ttl=64 time=0.877 ms
64 bytes from 192.168.56.106: icmp_seq=3 ttl=64 time=0.664 ms
64 bytes from 192.168.56.106: icmp_seq=4 ttl=64 time=0.967 ms
64 bytes from 192.168.56.106: icmp_seq=5 ttl=64 time=0.795 ms
64 bytes from 192.168.56.106: icmp_seq=6 ttl=64 time=0.952 ms
64 bytes from 192.168.56.106: icmp_seq=7 ttl=64 time=0.331 ms
```

SUCCESSFUL

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

```
jonjeous@LocalMachone-VirtualBox:~$ ping 192.168.56.107
PING 192.168.56.107 (192.168.56.107) 56(84) bytes of data.
64 bytes from 192.168.56.107: icmp_seq=1 ttl=64 time=1.52 ms
64 bytes from 192.168.56.107: icmp_seq=2 ttl=64 time=0.328 ms
64 bytes from 192.168.56.107: icmp_seq=3 ttl=64 time=0.317 ms
64 bytes from 192.168.56.107: icmp_seq=4 ttl=64 time=0.307 ms
64 bytes from 192.168.56.107: icmp_seq=5 ttl=64 time=0.389 ms
```

SUCCESSFUL

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

```
jonjeous@server1-VirtualBox:~$ ping 192.168.56.107
PING 192.168.56.107 (192.168.56.107) 56(84) bytes of data.
64 bytes from 192.168.56.107: icmp_seq=1 ttl=64 time=1.81 ms
64 bytes from 192.168.56.107: icmp_seq=2 ttl=64 time=0.575 ms
64 bytes from 192.168.56.107: icmp_seq=3 ttl=64 time=0.440 ms
64 bytes from 192.168.56.107: icmp_seq=4 ttl=64 time=0.430 ms
64 bytes from 192.168.56.107: icmp_seq=5 ttl=64 time=0.405 ms
64 bytes from 192.168.56.107: icmp_seq=6 ttl=64 time=0.976 ms
64 bytes from 192.168.56.107: icmp_seq=7 ttl=64 time=0.377 ms
64 bytes from 192.168.56.107: icmp_seq=8 ttl=64 time=0.388 ms
64 bytes from 192.168.56.107: icmp_seq=9 ttl=64 time=0.450 ms
64 bytes from 192.168.56.107: icmp_seq=10 ttl=64 time=0.373 ms
```

SUCCESSFUL

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.*

```
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
applicable law.

jonjeous@server1-VirtualBox:~$
logout
Connection to 192.168.56.106 closed.
jonjeous@LocalMachone-VirtualBox:~$
```

3. Do the same for Server 2.

```
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
applicable law.

jonjeous@server2-VirtualBox:~$
logout
Connection to 192.168.56.107 closed.
jonjeous@LocalMachone-VirtualBox:~$
```

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)

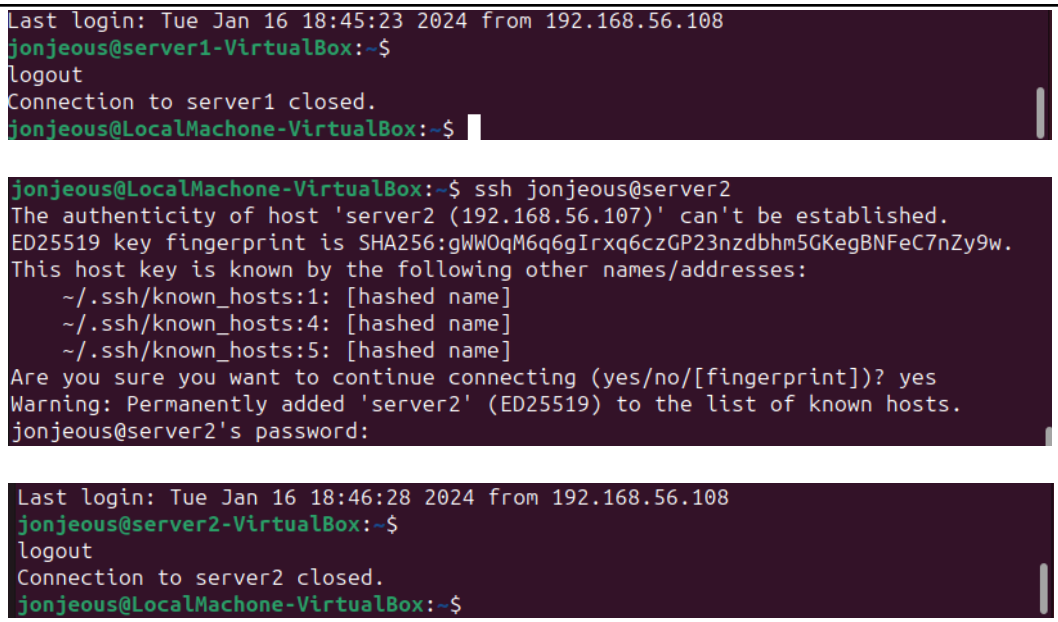
4.3 Save the file and exit.

```
jonjeous@LocalMachone-VirtualBox: ~
  GNU nano 7.2                    /etc/hosts
127.0.0.1 localhost
127.0.0.1 LocalMachine-VirtualBox
192.168.56.106 server1
192.168.56.107 server2

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

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.

```
jonjeous@LocalMachone-VirtualBox:~$ ssh jonjeous@server1
The authenticity of host 'server1 (192.168.56.106)' can't be established.
ED25519 key fingerprint is SHA256:gWWOqM6q6gIrxq6czGP23nzdbhm5GKegBNFeC7nZy9w.
This host key is known by the following other names/addresses:
    ~/.ssh/known_hosts:1: [hashed name]
    ~/.ssh/known_hosts:4: [hashed name]
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
```



Reflections:

Answer the following:

1. How are we able to use the hostname instead of IP address in SSH commands?
   By using sudo nano /etc/hosts and editing the IP address with its hostname I was able to use the command.
2. How secured is SSH?

   SSH is generally secure because it encrypts data during communication, uses strong authentication methods like passwords or keys, and allows for secure tunnels. It helps control access to systems and protects against eavesdropping. To enhance security, keep software updated, use strong passwords or keys, limit access, and monitor for any unusual activity in SSH logs. Following these practices ensures a secure remote access environment.

Conclusion:

In the end, achieving these objectives is important for learning how to use virtual systems effectively. Creating and managing virtual computers in Azure or VirtualBox is like having a digital workspace. Making sure they can talk to each other ensures everything works smoothly in this virtual environment. These skills are essential for working in today's tech world.