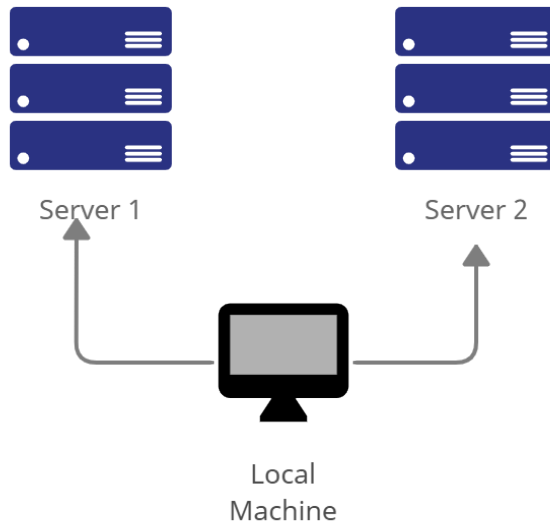
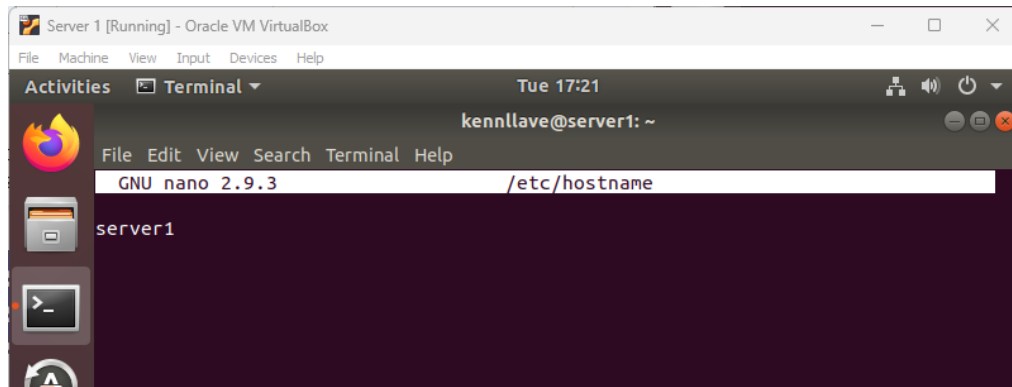
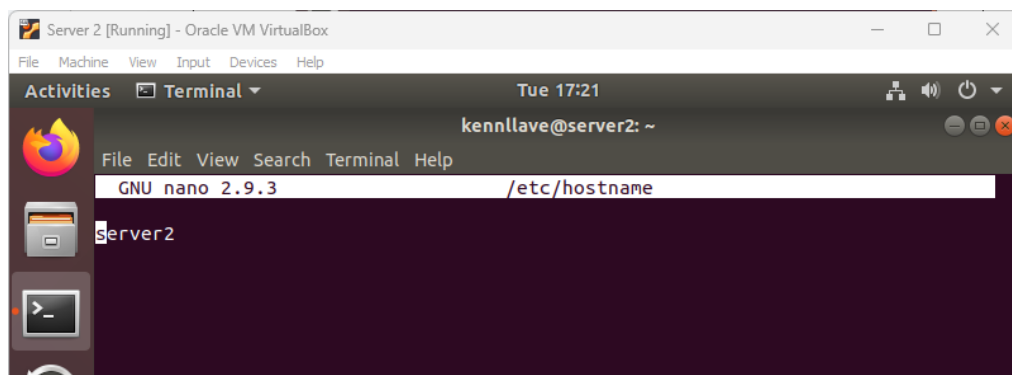


Name: Kenneth Gabriel A. Llave	Date Performed: 14/08/2023
Course/Section: CPE31S4	Date Submitted: 15/08/2023
Instructor: Jonathan Taylar	Semester and SY: 1st sem 2023-2024
Activity 1: Configure Network using Virtual Machines	
1. Objectives: 1.1. Create and configure Virtual Machines in Microsoft Azure 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, <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 LocalMachine[Local Machine] --> Server1[Server 1] LocalMachine --> Server2[Server 2] </pre> <p>The diagram illustrates a network topology. At the bottom center is a computer icon labeled "Local Machine". Two lines extend upwards from the "Local Machine" to two server racks. The left server rack is labeled "Server 1" and the right server rack is labeled "Server 2". Each server rack consists of three blue rectangular units, each with a white dot and three horizontal lines on the right side.</p>	
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 <i>sudo nano /etc/hostname</i>	

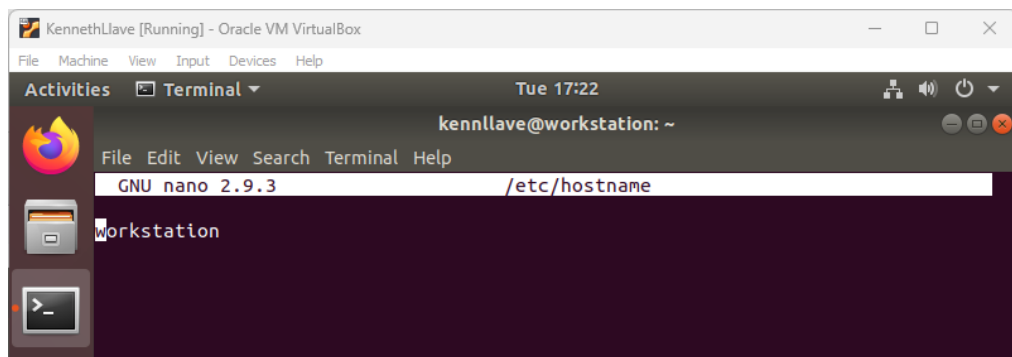
1.1 Use server1 for Server 1



1.2 Use server2 for Server 2

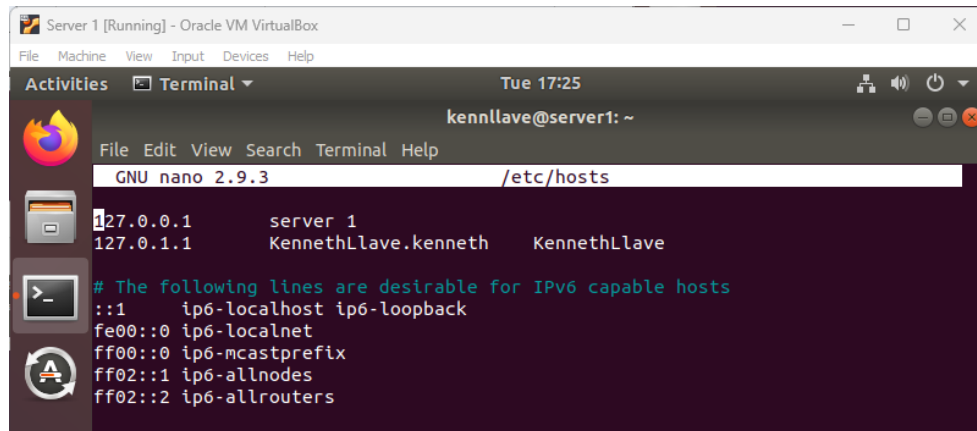


1.3 Use workstation for the Local Machine



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

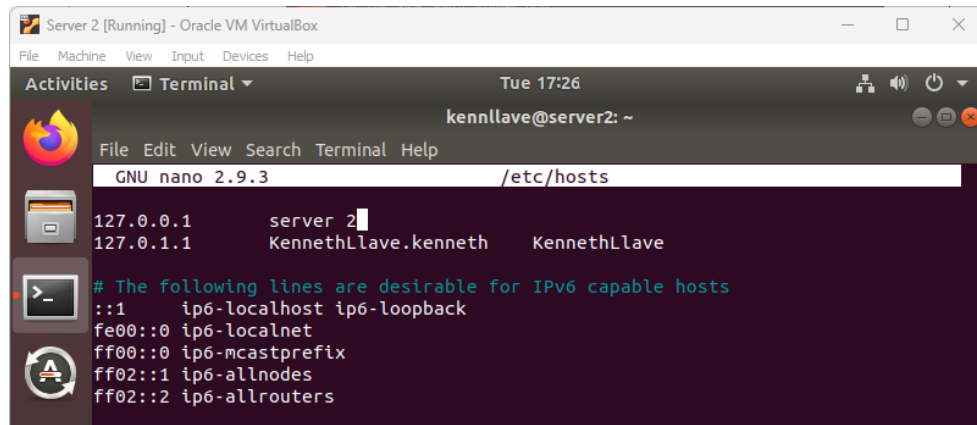
2.1 Type 127.0.0.1 server 1 for Server 1



```
Server 1 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Tue 17:25
kennllave@server1: ~
GNU nano 2.9.3 /etc/hosts
127.0.0.1      server 1
127.0.1.1      KennethLlave.kenneth    KennethLlave

# 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
```

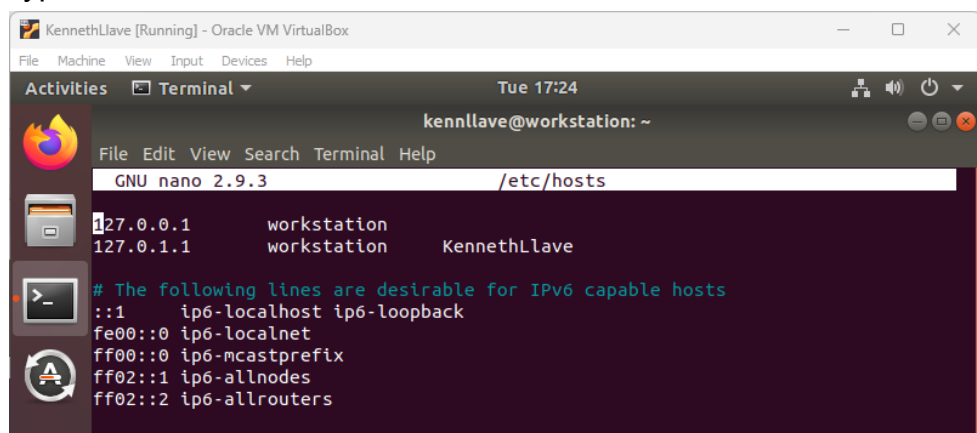
2.2 Type 127.0.0.1 server 2 for Server 2



```
Server 2 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Tue 17:26
kennllave@server2: ~
GNU nano 2.9.3 /etc/hosts
127.0.0.1      server 2
127.0.1.1      KennethLlave.kenneth    KennethLlave

# 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



```
KennethLlave [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Tue 17:24
kennllave@workstation: ~
GNU nano 2.9.3 /etc/hosts
127.0.0.1      workstation
127.0.1.1      workstation    KennethLlave

# 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:

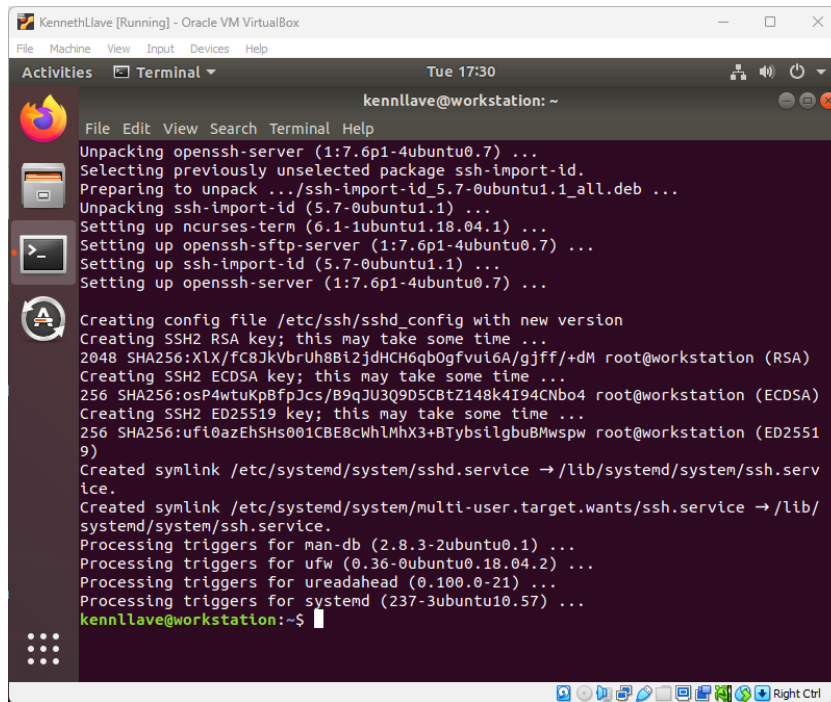
1. Upgrade the packages by issuing the command *sudo apt update* and *sudo apt upgrade* respectively.

```
KennethLlave [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal Tue 17:28
kennllave@workstation: ~
File Edit View Search Terminal Help
kennllave@workstation:~$ sudo nano /etc/hostname
[sudo] password for kennllave:
kennllave@workstation:~$ sudo nano /etc/hosts
kennllave@workstation:~$ sudo nano /etc/hosts
kennllave@workstation:~$ sudo apt update | sudo apt upgrade -y
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.
```

```
Server 1 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal Tue 17:28
kennllave@server1: ~
File Edit View Search Terminal Help
kennllave@server1:~$ sudo nano /etc/hostname
[sudo] password for kennllave:
kennllave@server1:~$ sudo nano /etc/hosts
kennllave@server1:~$ sudo nano /etc/hosts
kennllave@server1:~$ sudo apt update | sudo apt upgrade -y
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.
```

```
Server 2 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal Tue 17:27
kennllave@server2: ~
File Edit View Search Terminal Help
kennllave@server2:~$ sudo nano /etc/hostname
[sudo] password for kennllave:
kennllave@server2:~$ sudo nano /etc/hosts
kennllave@server2:~$ sudo apt update | sudo apt upgrade -y
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.
kennllave@server2:~$
```

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



The screenshot shows a terminal window titled "KennethLlave [Running] - Oracle VM VirtualBox". The terminal output displays the installation process for the openssh-server package. It includes unpacking the package, selecting previously unselected packages, and setting up various components like ncurses-term, openssh-sftp-server, and ssh-import-id. It also shows the creation of SSH keys (RSA and ECDSA) and the creation of symlinks for the systemd service. The installation is completed successfully, and the prompt returns to the user.

```
KennethLlave [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal Tue 17:30
kennllave@workstation: ~
File Edit View Search Terminal Help
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:XLX/fc8JkVbrUh8Bi2jdHCH6qb0gfvu6A/gjff/+dM root@workstation (RSA)
Creating SSH2 ECDSA key; this may take some time ...
256 SHA256:osP4wtuKpBfpJcs/B9qJU3Q9D5CBtZ148k4I94CNbo4 root@workstation (ECDSA)
Creating SSH2 ED25519 key; this may take some time ...
256 SHA256:ufi0azEhSHs001CBE8cWhLMhX3+BTybsilgbuBMwspw root@workstation (ED25519)
Created symlink /etc/systemd/system/sshd.service → /lib/systemd/system/sshd.service.
Created symlink /etc/systemd/system/multi-user.target.wants/sshd.service → /lib/systemd/system/sshd.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) ...
kennllave@workstation:~$
```

The image displays two screenshots of a terminal window within an Oracle VM VirtualBox environment. The top screenshot shows the installation of SSH on 'Server 1'. The terminal output includes the following steps: preparing to unpack 'openssh-server_1:7.6p1-4ubuntu0.7_amd64.deb', unpacking 'openssh-server', selecting 'ssh-import-id', unpacking 'ssh-import-id_5.7-0ubuntu1.1_all.deb', and setting up 'ncurses-term', 'openssh-sftp-server', 'ssh-import-id', and 'openssh-server'. It then shows the creation of an SSH config file, RSA and ECDSA keys, and the creation of a symlink for the SSH service. The bottom screenshot shows the same installation process on 'Server 2'. The terminal output is similar, but the keys are different. Both screenshots show the terminal window with a dark background and a light-colored text. The window title is 'Server 1 [Running] - Oracle VM VirtualBox' and 'Server 2 [Running] - Oracle VM VirtualBox' respectively. The terminal prompt is 'kennllave@server1: ~' and 'kennllave@server2: ~' respectively. The time shown in the terminal is 'Tue 17:30' and 'Tue 17:31' respectively.

```
Server 1 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal Tue 17:30
kennllave@server1: ~
File Edit View Search Terminal Help
Preparing to unpack .../openssh-server_1:7.6p1-4ubuntu0.7_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:SYeetZn2Z5Ytv9drc3q7MK20rnp6Ar181ASz3RTMIYI root@server1 (RSA)
Creating SSH2 ECDSA key; this may take some time ...
256 SHA256:hV00uB1/r8AQZTbmValcBZyJ30ctt6Imh/eqFJrvEl0 root@server1 (ECDSA)
Creating SSH2 ED25519 key; this may take some time ...
256 SHA256:KFvTQtbqww3CSC6qVe7hXVKB4okIB2c339BUDLLw0jE 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) ...

Server 2 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal Tue 17:31
kennllave@server2: ~
File Edit View Search Terminal Help
Preparing to unpack .../openssh-server_1:7.6p1-4ubuntu0.7_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:+FCXoBg9N7JLiu4ZehCLZGqk/xaD/LzTc8aPLKjIAWU root@server2 (RSA)
Creating SSH2 ECDSA key; this may take some time ...
256 SHA256:mYJhPoHma5o8hCHWky9TTIJQXahF5JAzefYeVip8Gko root@server2 (ECDSA)
Creating SSH2 ED25519 key; this may take some time ...
256 SHA256:MPitE5bBFiLMDIh18ES+Xbsfr4jX4cwpzF/WY3N8c1w root@server2 (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) ...
kennllave@server2:~$
```

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

```
KennethLlave [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal Tue 17:33
kennllave@workstation: ~
File Edit View Search Terminal Help
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) ...
kennllave@workstation:~$ sudo service ssh start
kennllave@workstation:~$ sudo systemctl status ssh
● ssh.service - OpenBSD Secure Shell server
   Loaded: loaded (/lib/systemd/system/ssh.service; enabled; vendor preset: enable)
   Active: active (running) since Tue 2023-08-15 17:29:51 +08; 2min 21s ago
     Main PID: 2544 (sshd)
       Tasks: 1 (limit: 2318)
    CGroup: /system.slice/ssh.service
            └─2544 /usr/sbin/sshd -D

Aug 15 17:29:51 workstation systemd[1]: Starting OpenBSD Secure Shell server...
Aug 15 17:29:51 workstation sshd[2544]: Server listening on 0.0.0.0 port 22.
Aug 15 17:29:51 workstation sshd[2544]: Server listening on :: port 22.
Aug 15 17:29:51 workstation systemd[1]: Started OpenBSD Secure Shell server.
ESCOC
```

```
Server 1 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal Tue 17:33
kennllave@server1: ~
File Edit View Search Terminal Help
2048 SHA256:5YEetZn2Z5Ytv9drc3q7MK20rnp6Ar181ASz3RTMIYI root@server1 (RSA)
Creating SSH2 ECDSA key; this may take some time ...
256 SHA256:hV00uB1/r8AQZTbmValCBZyJ30ctt6Imh/eqFJrvEl0 root@server1 (ECDSA)
Creating SSH2 ED25519 key; this may take some time ...
256 SHA256:KFvTQtBqWw3CSC6qVe7hXVKB4okIB2c339BUDLLw0jE 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) ...
kennllave@server1:~$ sudo service ssh start
kennllave@server1:~$ sudo systemctl status ssh
● ssh.service - OpenBSD Secure Shell server
   Loaded: loaded (/lib/systemd/system/ssh.service; enabled; vendor preset: enable)
   Active: active (running) since Tue 2023-08-15 17:30:45 +08; 3min 3s ago
     Main PID: 2577 (sshd)
       Tasks: 1 (limit: 2318)
    CGroup: /system.slice/ssh.service
            └─2577 /usr/sbin/sshd -D

Aug 15 17:30:45 server1 systemd[1]: Starting OpenBSD Secure Shell server...
Aug 15 17:30:45 server1 sshd[2577]: Server listening on 0.0.0.0 port 22.
Aug 15 17:30:45 server1 sshd[2577]: Server listening on :: port 22.
Aug 15 17:30:45 server1 systemd[1]: Started OpenBSD Secure Shell server.
lines 1-12/12 (END)
```

```
Server 2 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal Tue 17:34
kennllave@server2: ~
File Edit View Search Terminal Help
2048 SHA256:+FCXoBg9N77Liu4ZehCLZGqk/xad/LzTc8aPLKjIAWU root@server2 (RSA)
Creating SSH2 ECDSA key; this may take some time ...
256 SHA256:nYJhPoHma5o8hCHWky9TTIJQXahF5JAzefYeVip8GKo root@server2 (ECDSA)
Creating SSH2 ED25519 key; this may take some time ...
256 SHA256:MPitE5bBFILMDIhi8ES+Xbsfr4jX4cvpZF/WY3N8c1w root@server2 (ED25519)
Created symlink /etc/systemd/system/ssh.service → /lib/systemd/system/ssh.serv
ice.
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) ...
kennllave@server2:~$ sudo service ssh start
kennllave@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 2023-08-15 17:31:22 +08; 3min 9s ago
   Main PID: 2570 (sshd)
     Tasks: 1 (limit: 2318)
    CGroup: /system.slice/ssh.service
            └─2570 /usr/sbin/sshd -D

Aug 15 17:31:22 server2 systemd[1]: Starting OpenBSD Secure Shell server...
Aug 15 17:31:22 server2 sshd[2570]: Server listening on 0.0.0.0 port 22.
Aug 15 17:31:22 server2 sshd[2570]: Server listening on :: port 22.
Aug 15 17:31:22 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

4.2 sudo ufw enable

4.3 sudo ufw status

```
KennethLlave [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal Tue 17:35
kennllave@workstation: ~
File Edit View Search Terminal Help
~
~
~
~
~
~
[1]+ Stopped sudo systemctl status ssh
kennllave@workstation:~$ sudo ufw allow ssh
Rules updated
Rules updated (v6)
kennllave@workstation:~$ sudo ufw allow enable
ERROR: Could not find a profile matching 'enable'
kennllave@workstation:~$ sudo ufw enable
Firewall is active and enabled on system startup
kennllave@workstation:~$ sudo ufw status
Status: active

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

kennllave@workstation:~$
```



```
Server 1 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal Tue 17:36
kennllave@server1: ~

File Edit View Search Terminal Help
● ssh.service - OpenBSD Secure Shell server
  Loaded: loaded (/lib/systemd/system/ssh.service; enabled; vendor preset: ena
  Active: active (running) since Tue 2023-08-15 17:30:45 +08; 3min 3s ago
    Main PID: 2577 (sshd)
      Tasks: 1 (limit: 2318)
     CGroup: /system.slice/ssh.service
             └─2577 /usr/sbin/sshd -D

Aug 15 17:30:45 server1 systemd[1]: Starting OpenBSD Secure Shell server...
Aug 15 17:30:45 server1 sshd[2577]: Server listening on 0.0.0.0 port 22.
Aug 15 17:30:45 server1 sshd[2577]: Server listening on :: port 22.
Aug 15 17:30:45 server1 systemd[1]: Started OpenBSD Secure Shell server.

[1]+ Stopped                  sudo systemctl status ssh
kennllave@server1:~$ sudo ufw allow ssh
Rules updated
Rules updated (v6)
kennllave@server1:~$ sudo ufw enable
Firewall is active and enabled on system startup
kennllave@server1:~$ sudo ufw status
Status: active

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

kennllave@server1:~$
```

```
Server 2 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal Tue 17:37
kennllave@server2: ~

File Edit View Search Terminal Help
● ssh.service - OpenBSD Secure Shell server
  Loaded: loaded (/lib/systemd/system/ssh.service; enabled; vendor preset: ena
  Active: active (running) since Tue 2023-08-15 17:31:22 +08; 3min 9s ago
    Main PID: 2570 (sshd)
      Tasks: 1 (limit: 2318)
     CGroup: /system.slice/ssh.service
             └─2570 /usr/sbin/sshd -D

Aug 15 17:31:22 server2 systemd[1]: Starting OpenBSD Secure Shell server...
Aug 15 17:31:22 server2 sshd[2570]: Server listening on 0.0.0.0 port 22.
Aug 15 17:31:22 server2 sshd[2570]: Server listening on :: port 22.
Aug 15 17:31:22 server2 systemd[1]: Started OpenBSD Secure Shell server.
lines 1-12/12 (END)
[1]+ Stopped                  sudo systemctl status ssh
kennllave@server2:~$ sudo ufw allow ssh
Rules updated
Rules updated (v6)
kennllave@server2:~$ sudo ufw enable
Firewall is active and enabled on system startup
kennllave@server2:~$ sudo ufw status
Status: active

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

kennllave@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: 192.168.56.104

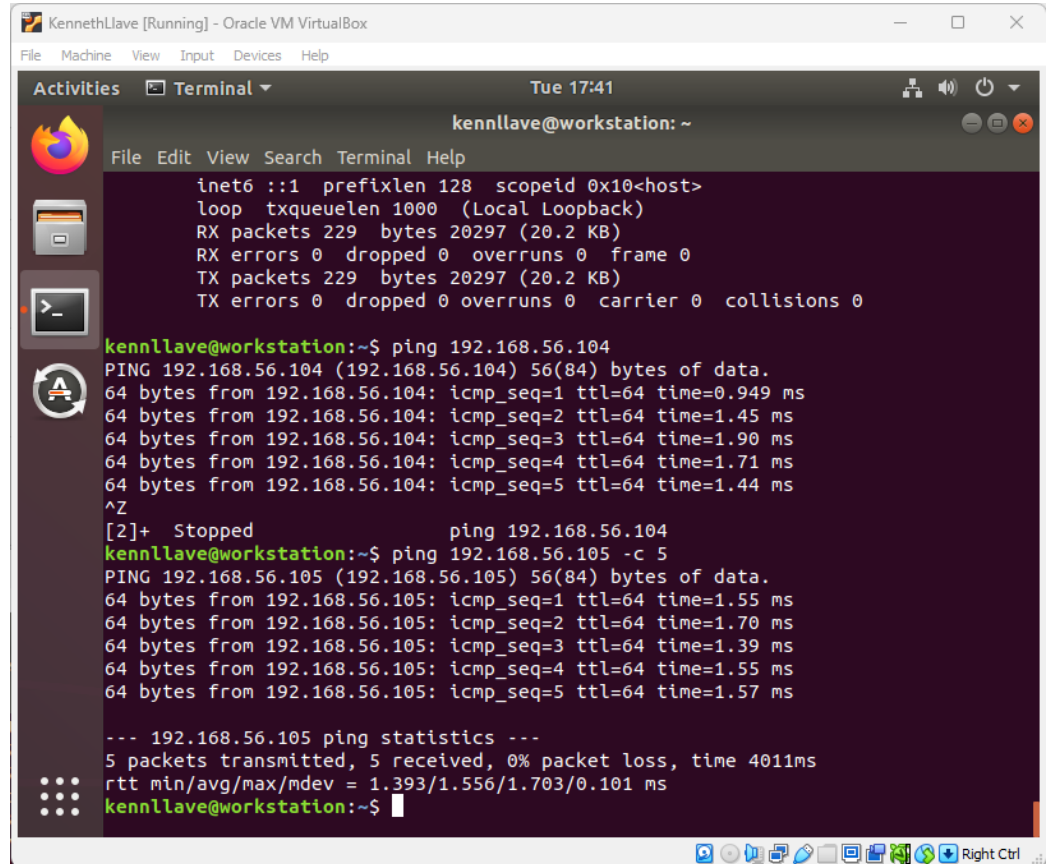
1.2 Server 2 IP address: 192.168.56.105

1.3 Workstation IP address: 192.168.56.103

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



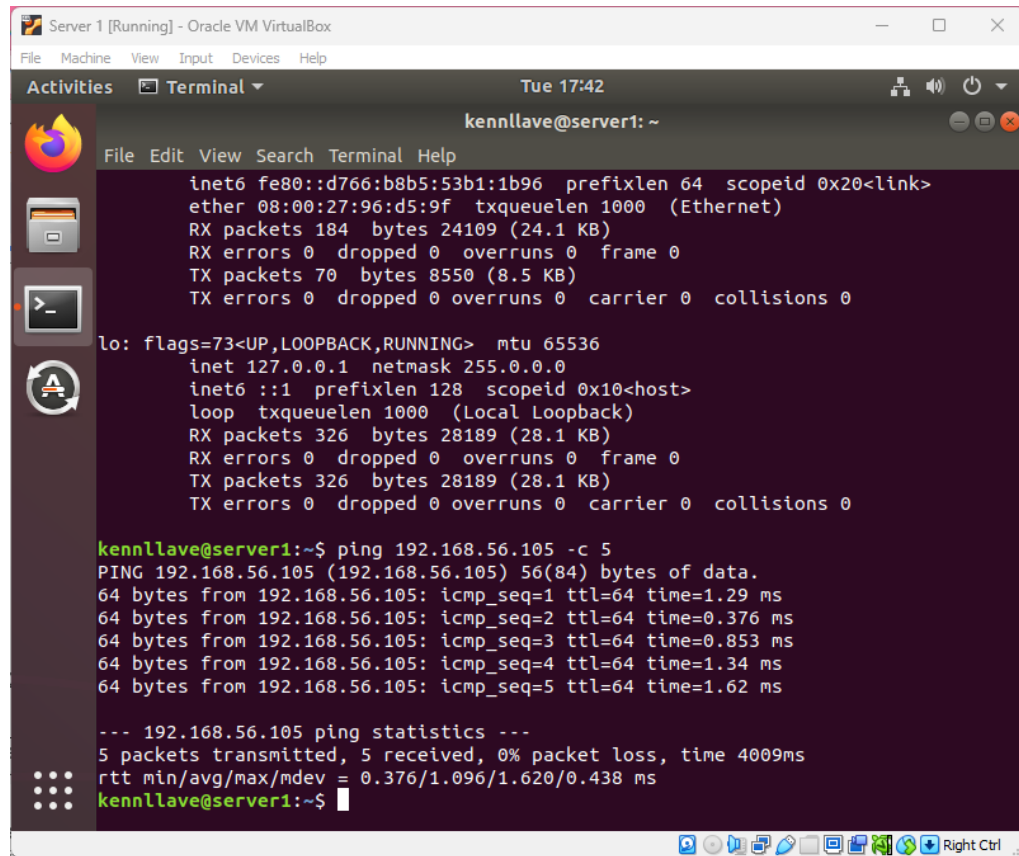
The screenshot shows a terminal window titled "KennethLlave [Running] - Oracle VM VirtualBox". The terminal output includes network interface details for "enp0s8" and two successful ping tests. The first test is to 192.168.56.104, showing five successful pings with times between 0.949ms and 1.90ms. The second test is to 192.168.56.105, showing five successful pings with times between 1.39ms and 1.70ms. The terminal also displays a "ping statistics" summary for the second test, indicating 5 packets transmitted, 5 received, and 0% packet loss.

```
KennethLlave [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal Tue 17:41
kennllave@workstation: ~
File Edit View Search Terminal Help
    inet6 ::1 prefixlen 128 scopeid 0x10<host>
    loop txqueuelen 1000 (Local Loopback)
    RX packets 229 bytes 20297 (20.2 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 229 bytes 20297 (20.2 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

kennllave@workstation:~$ ping 192.168.56.104
PING 192.168.56.104 (192.168.56.104) 56(84) bytes of data:
64 bytes from 192.168.56.104: icmp_seq=1 ttl=64 time=0.949 ms
64 bytes from 192.168.56.104: icmp_seq=2 ttl=64 time=1.45 ms
64 bytes from 192.168.56.104: icmp_seq=3 ttl=64 time=1.90 ms
64 bytes from 192.168.56.104: icmp_seq=4 ttl=64 time=1.71 ms
64 bytes from 192.168.56.104: icmp_seq=5 ttl=64 time=1.44 ms
^Z
[2]+  Stopped                  ping 192.168.56.104
kennllave@workstation:~$ ping 192.168.56.105 -c 5
PING 192.168.56.105 (192.168.56.105) 56(84) bytes of data:
64 bytes from 192.168.56.105: icmp_seq=1 ttl=64 time=1.55 ms
64 bytes from 192.168.56.105: icmp_seq=2 ttl=64 time=1.70 ms
64 bytes from 192.168.56.105: icmp_seq=3 ttl=64 time=1.39 ms
64 bytes from 192.168.56.105: icmp_seq=4 ttl=64 time=1.55 ms
64 bytes from 192.168.56.105: icmp_seq=5 ttl=64 time=1.57 ms

--- 192.168.56.105 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 401ms
rtt min/avg/max/mdev = 1.393/1.556/1.703/0.101 ms
kennllave@workstation:~$
```

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



```
Server 1 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal Tue 17:42
kennllave@server1: ~
File Edit View Search Terminal Help

lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
inet 127.0.0.1 netmask 255.0.0.0
inet6 ::1 prefixlen 128 scopeid 0x10<host>
loop txqueuelen 1000 (Local Loopback)
RX packets 326 bytes 28189 (28.1 KB)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 326 bytes 28189 (28.1 KB)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

kennllave@server1:~$ ping 192.168.56.105 -c 5
PING 192.168.56.105 (192.168.56.105) 56(84) bytes of data.
64 bytes from 192.168.56.105: icmp_seq=1 ttl=64 time=1.29 ms
64 bytes from 192.168.56.105: icmp_seq=2 ttl=64 time=0.376 ms
64 bytes from 192.168.56.105: icmp_seq=3 ttl=64 time=0.853 ms
64 bytes from 192.168.56.105: icmp_seq=4 ttl=64 time=1.34 ms
64 bytes from 192.168.56.105: icmp_seq=5 ttl=64 time=1.62 ms

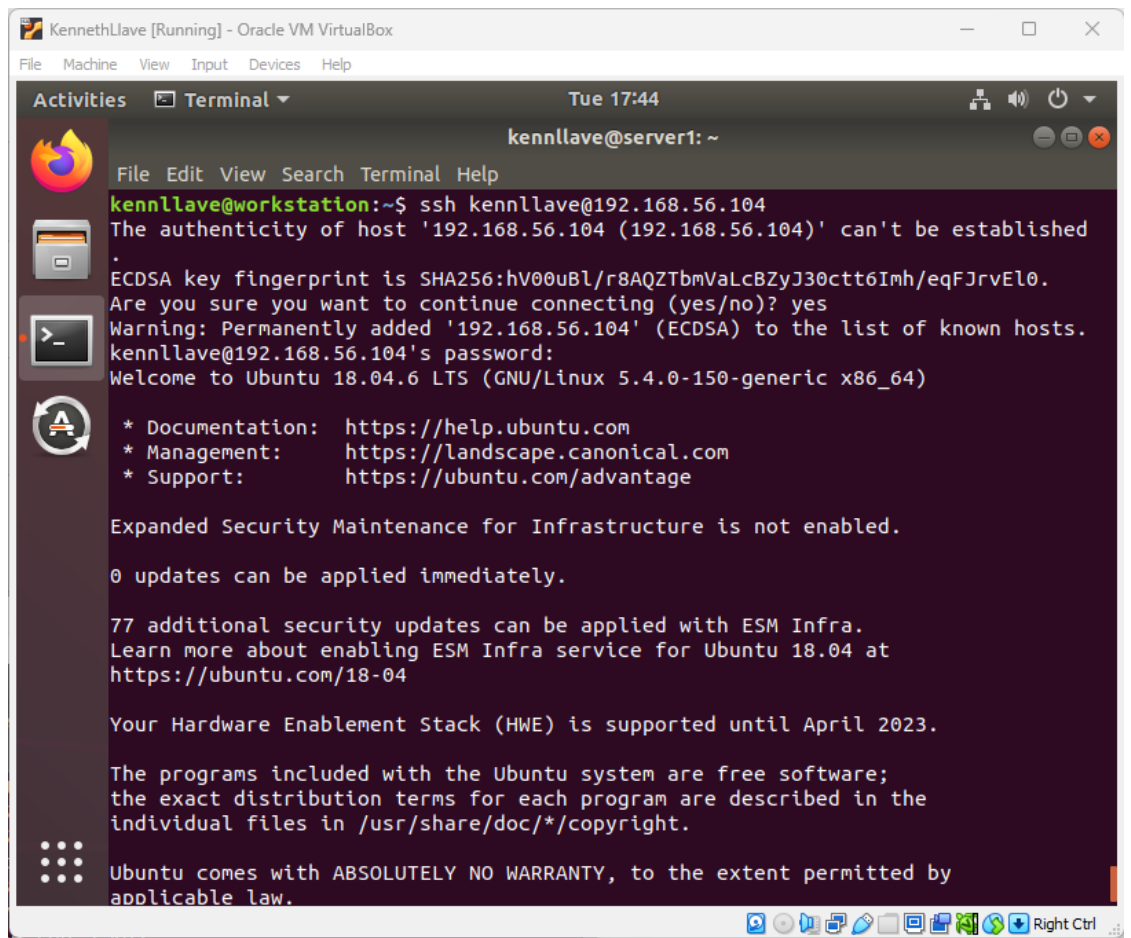
--- 192.168.56.105 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4009ms
rtt min/avg/max/mdev = 0.376/1.096/1.620/0.438 ms
kennllave@server1:~$
```

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`

1.2 Enter the password for server 1 when prompted



The screenshot shows a terminal window titled "KennethLlave [Running] - Oracle VM VirtualBox". The terminal is running a terminal application with a menu bar (File, Edit, View, Search, Terminal, Help) and a title bar (Terminal, Tue 17:44, kennllave@server1: ~). The terminal output shows the following sequence of events:

```
kennllave@workstation:~$ ssh kennllave@192.168.56.104
The authenticity of host '192.168.56.104 (192.168.56.104)' can't be established
ECDSA key fingerprint is SHA256:hV00uBL/r8AQZTbmVaLcBZyJ30ctt6Imh/eqFJrvEl0.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '192.168.56.104' (ECDSA) to the list of known hosts.
kennllave@192.168.56.104'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.

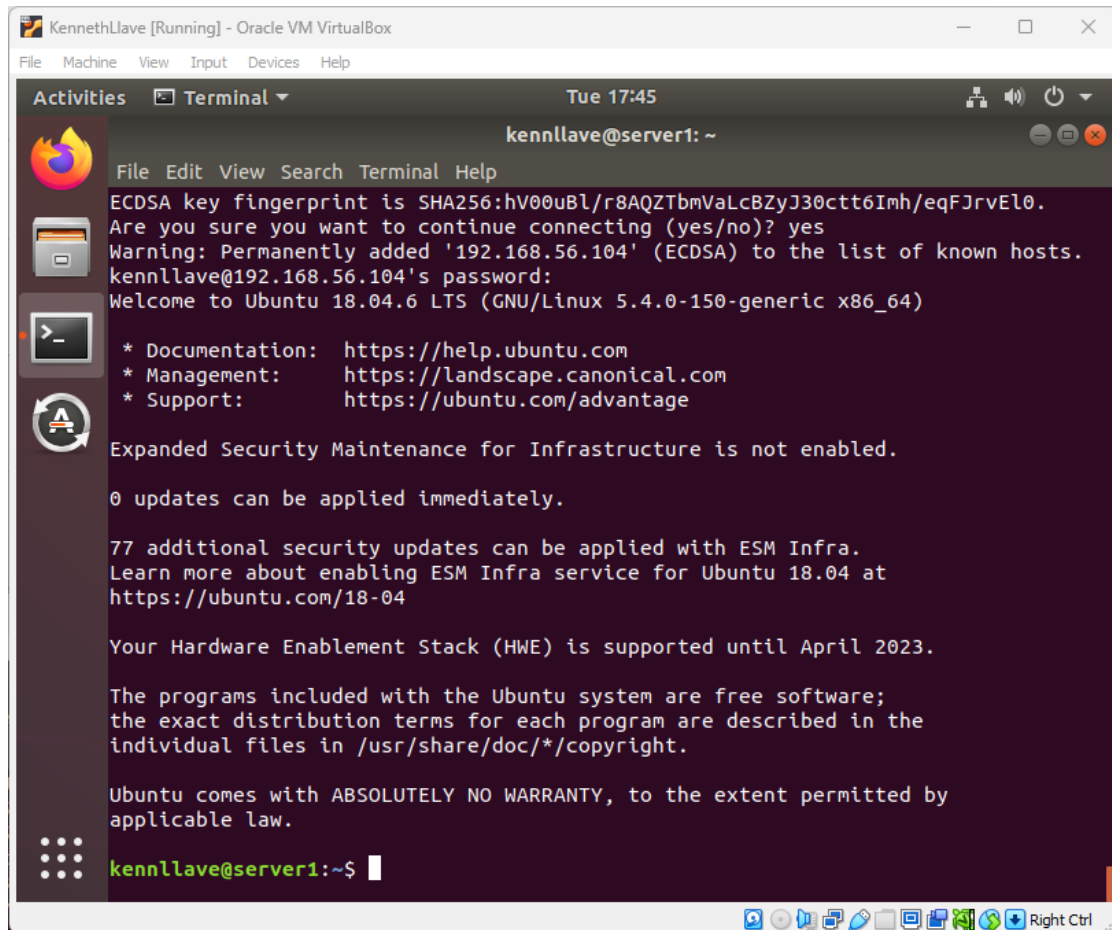
77 additional security updates can be applied with ESM Infra.
Learn more about enabling ESM Infra service for Ubuntu 18.04 at
https://ubuntu.com/18-04

Your Hardware Enablement Stack (HWE) is supported until April 2023.

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.
```

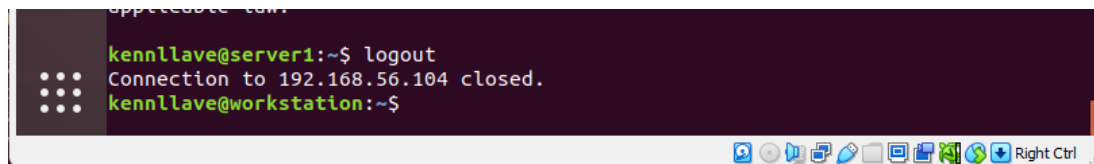
- 1.3 Verify that you are in server 1. The user should be in this format `user@server1`. For example, `jvtaylor@server1`



The screenshot shows a terminal window titled "KennethLlave [Running] - Oracle VM VirtualBox". The terminal displays the login process for the user "kennllave" on "server1". It shows the ECDSA key fingerprint, a warning about adding the host to known hosts, and the Ubuntu 18.04.6 LTS login banner. The banner includes information about security updates and the Hardware Enablement Stack (HWE).

```
kennllave@server1: ~  
File Edit View Search Terminal Help  
ECDSA key fingerprint is SHA256:hV00uBl/r8AQZTbmVaLcBZyJ30ctt6Imh/eqFJrvEl0.  
Are you sure you want to continue connecting (yes/no)? yes  
Warning: Permanently added '192.168.56.104' (ECDSA) to the list of known hosts.  
kennllave@192.168.56.104'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.  
  
77 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  
  
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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.  
kennllave@server1:~$
```

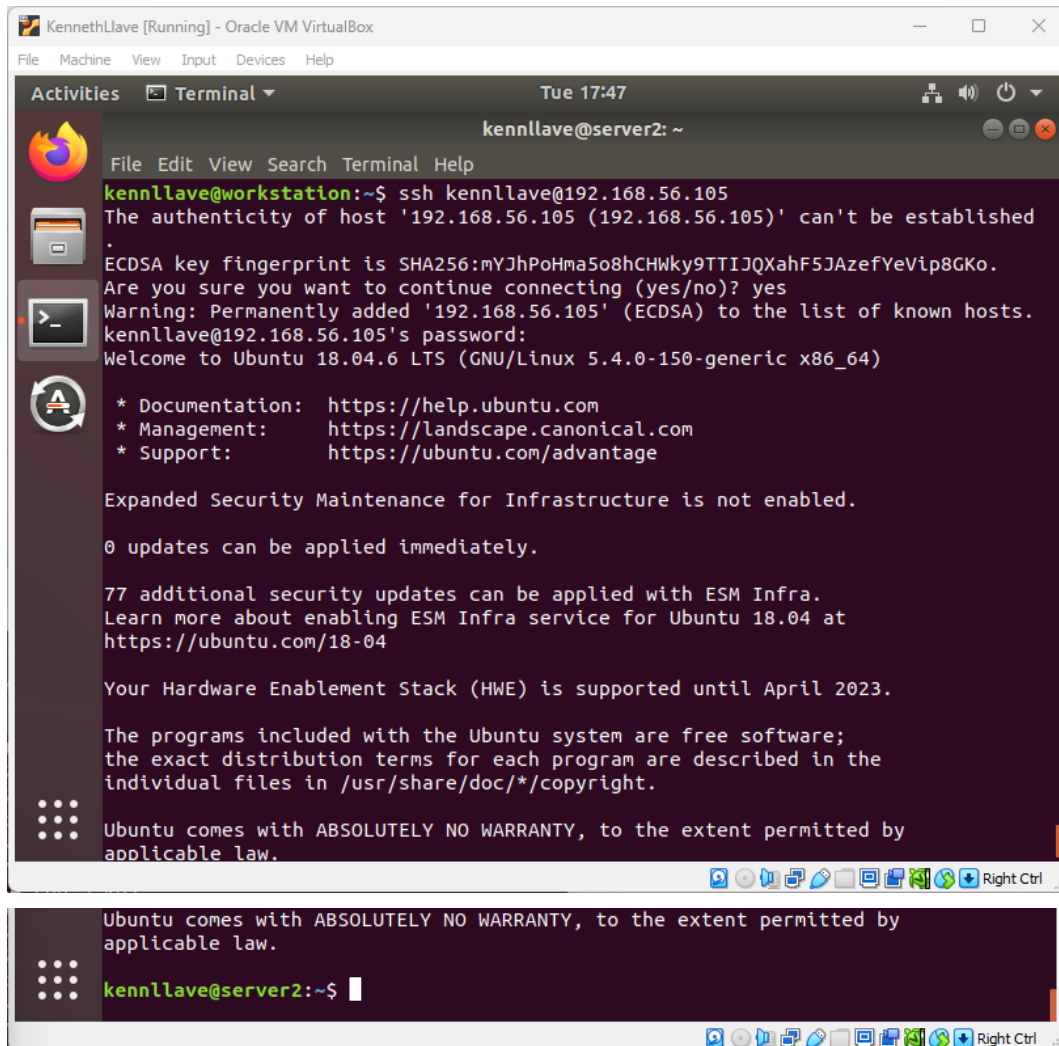
2. Logout of Server 1 by issuing the command `control + D`.



The screenshot shows the terminal window after the user has entered the command to logout. The terminal displays the message "Connection to 192.168.56.104 closed." and the prompt changes to "kennllave@workstation:~\$".

```
kennllave@server1:~$ logout  
Connection to 192.168.56.104 closed.  
kennllave@workstation:~$
```

3. Do the same for Server 2.



The screenshot shows a terminal window titled 'KennethLlave [Running] - Oracle VM VirtualBox'. The terminal is running on a system named 'kennlllave@server2: ~'. The user 'kennlllave@workstation:~\$' has executed the command 'ssh kennlllave@192.168.56.105'. The terminal output shows the SSH connection process, including a warning about the host's authenticity and a confirmation to continue. The user then enters their password, and the terminal displays the Ubuntu 18.04.6 LTS login banner. The banner includes information about security updates and the Ubuntu warranty. The terminal prompt is now 'kennlllave@server2:~\$'.

```
KennethLlave [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Tue 17:47
kennlllave@server2: ~
File Edit View Search Terminal Help
kennlllave@workstation:~$ ssh kennlllave@192.168.56.105
The authenticity of host '192.168.56.105 (192.168.56.105)' can't be established
ECDSA key fingerprint is SHA256:mYJhPoHma5o8hCHWky9TTIJQXahF5JAzefYeVip8GKo.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '192.168.56.105' (ECDSA) to the list of known hosts.
kennlllave@192.168.56.105'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.

77 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

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the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

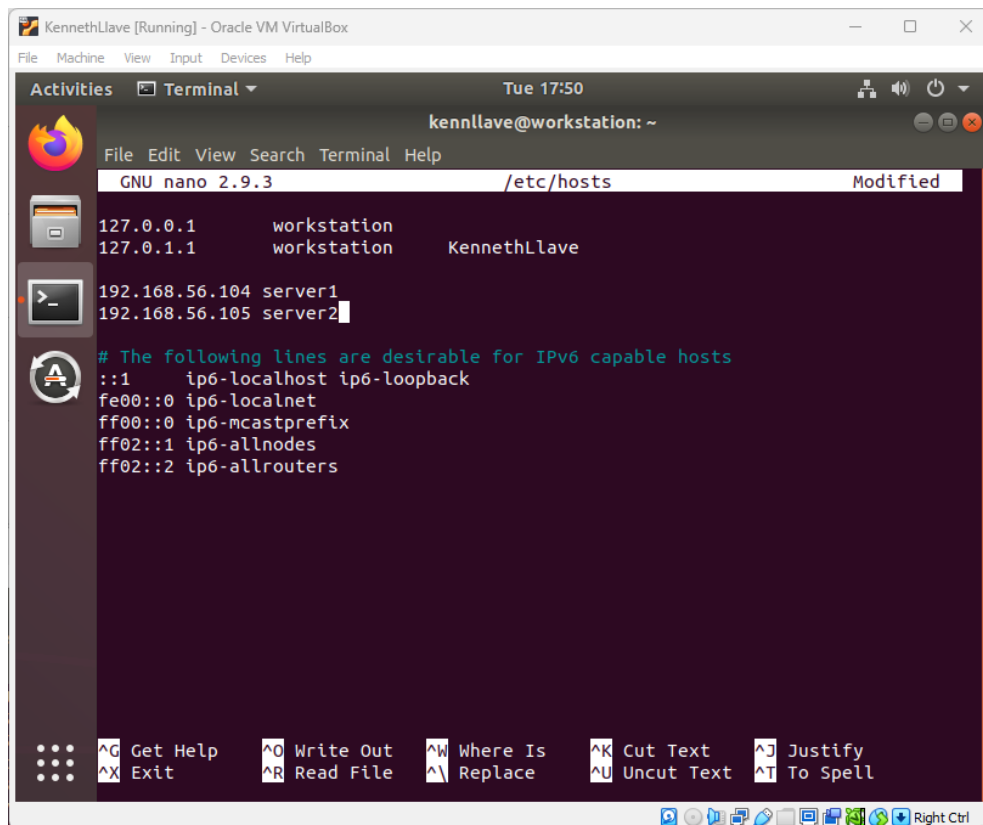
Ubuntu comes with ABSOLUTELY NO WARRANTY, to the extent permitted by
applicable law.

kennlllave@server2:~$
```

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)

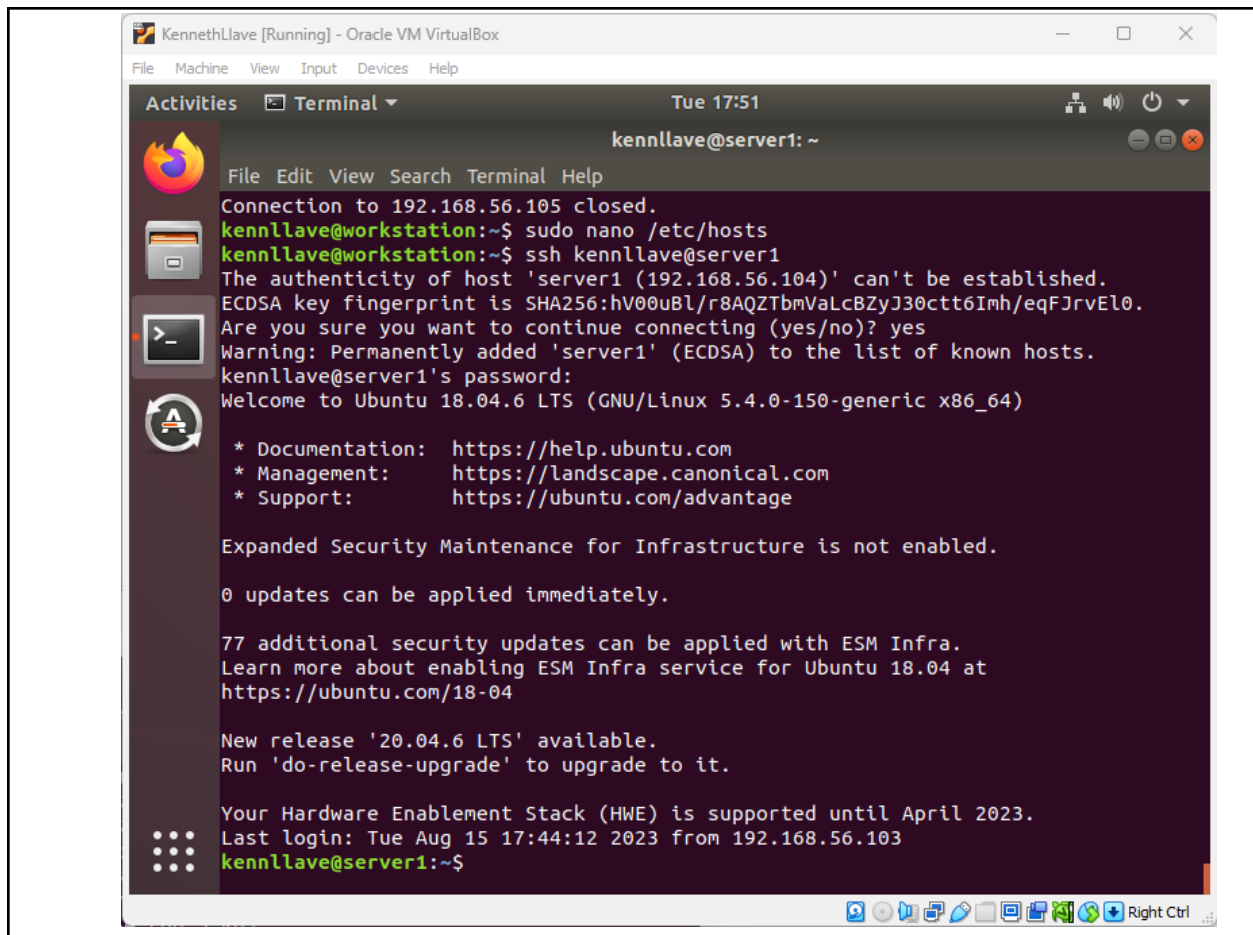
4.2 **IP_address server 2** (provide the ip address of server 2 followed by the hostname)

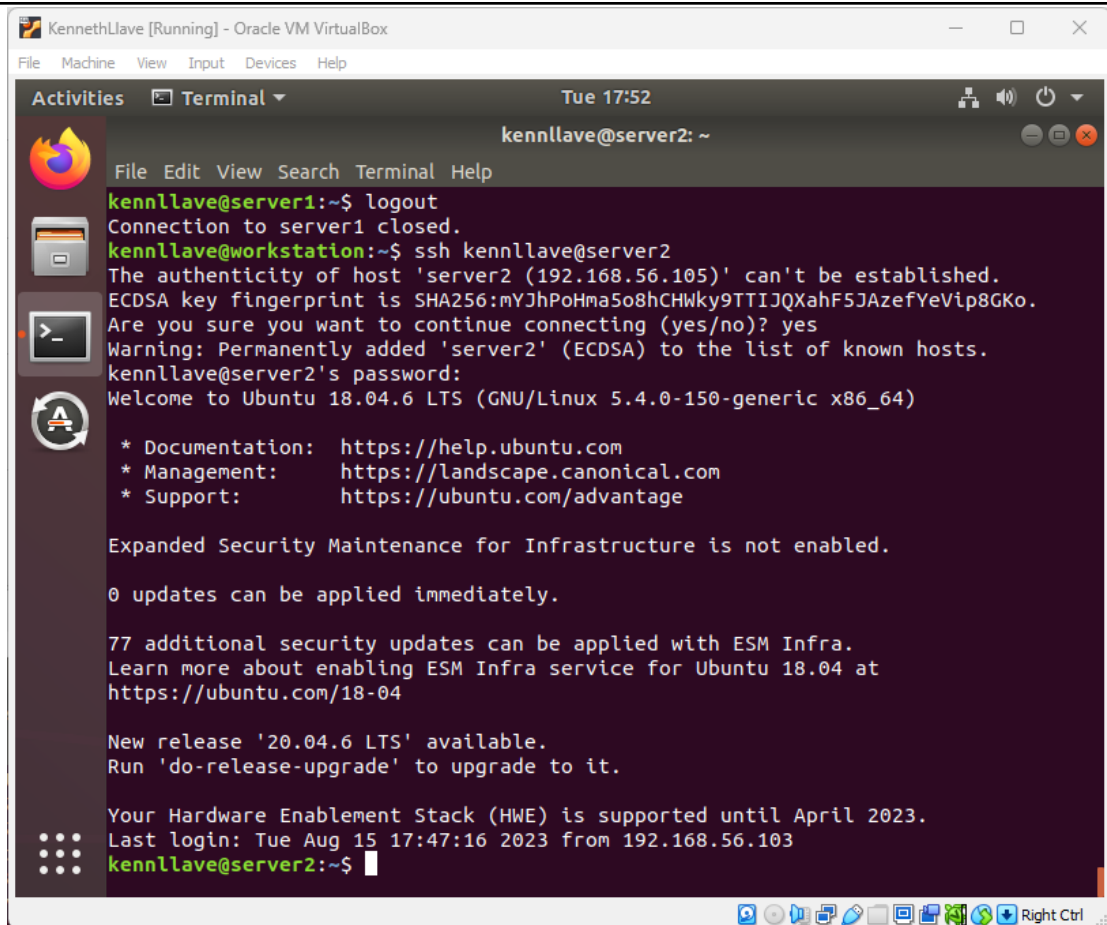


```
KennethLlave [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal Tue 17:50
kennllave@workstation: ~
GNU nano 2.9.3 /etc/hosts Modified
127.0.0.1 workstation
127.0.1.1 workstation KennethLlave
192.168.56.104 server1
192.168.56.105 server2
# The following lines 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
^G Get Help ^O Write Out ^W Where Is ^K Cut Text ^J Justify
^X Exit ^R Read File ^_ Replace ^U Uncut Text ^T To Spell
Right Ctrl
```

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 jvtaylor@server1**. Enter the password when prompted. Verify that you have entered Server 1. Do the same for Server 2.





The screenshot shows a terminal window titled "KennethLlave [Running] - Oracle VM VirtualBox". The terminal is running on a system with the prompt "kennllave@server2: ~". The user has executed the following commands and received the following output:

```
kennllave@server1:~$ logout
Connection to server1 closed.
kennllave@workstation:~$ ssh kennllave@server2
The authenticity of host 'server2 (192.168.56.105)' can't be established.
ECDSA key fingerprint is SHA256:mYJhPoHma5o8hCHWky9TTIJQXahF5JAzefYeVip8GKo.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added 'server2' (ECDSA) to the list of known hosts.
kennllave@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.

77 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: Tue Aug 15 17:47:16 2023 from 192.168.56.103
kennllave@server2:~$
```

Reflections:

Answer the following:

1. How are we able to use the hostname instead of IP address in SSH commands?
we were able to use the hostname instead of the IP address in SSH command because we edited the hosts file in /etc/hosts and we stated there what the IP address for servers 1 and 2 are. With this, our device can now correlate the IP addresses to their hostnames.
2. How secured is SSH?
- SSH is secured because of its authentication process. Unlike in other authentication processes, SSH uses a generated **key**, with the key, you can enter without even knowing the password, but the key itself is encrypted and hard to crack, so it is still better than plain passwords and usernames.