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Course/Section: CPE 232 - CPE31S5	**Date Submitted:** August 23, 2023
Instructor: Engr. Roman Richard	**Semester and SY:** 1st semester S.Y 2023-2024

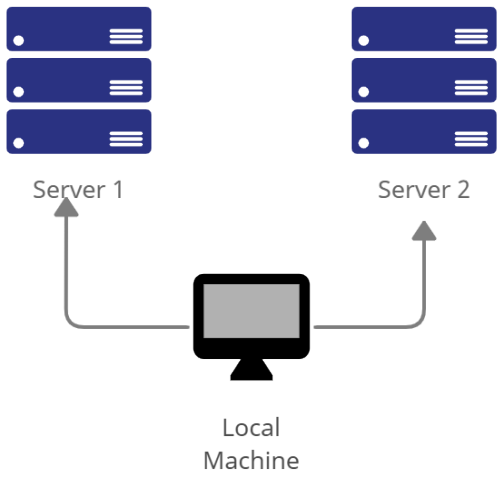
Activity 1: Configure Network using Virtual Machines

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 prior knowledge of cloning and creating snapshots in a virtual machine*).



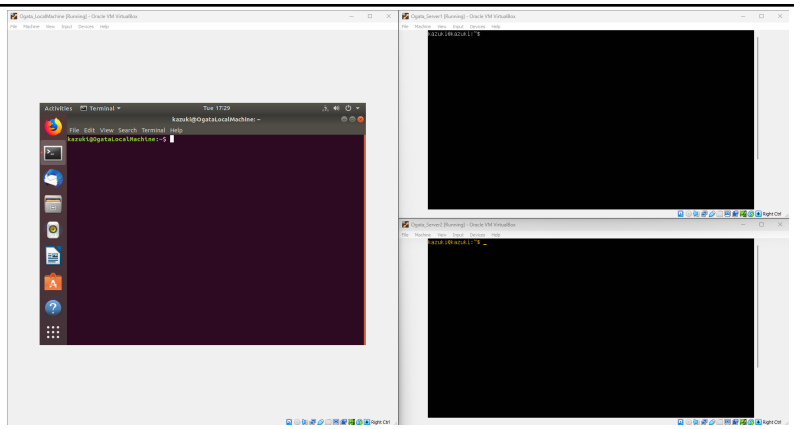
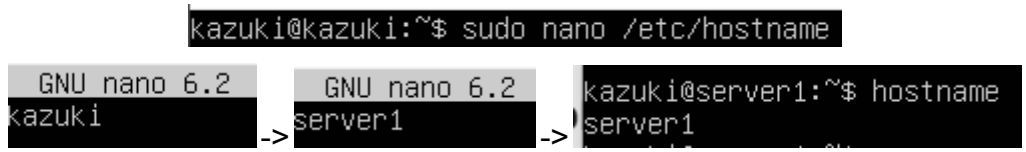


Figure 1.1: Installation of Local Machine, Server 1, and Server 2

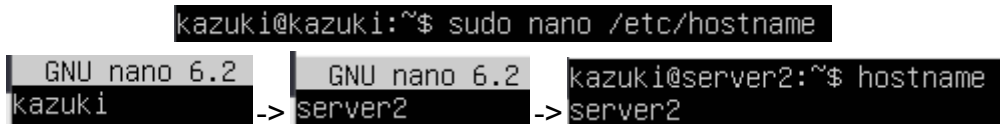
I was able to create a workstation and two servers with the help of my past knowledge about their installation from our SysAd 1 course.

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.

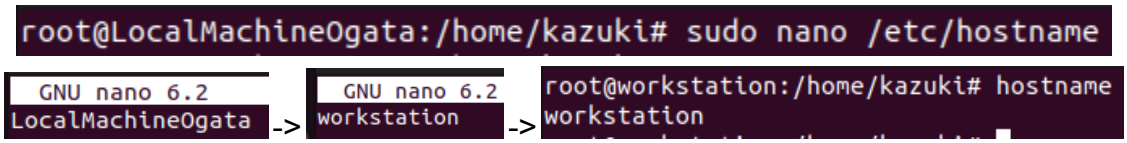
1. Change the hostname using the command *sudo nano /etc/hostname*
   1.1 Use server1 for Server 1



   1.2 Use server2 for Server 2



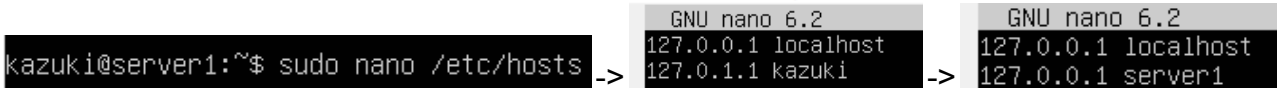
   1.3 Use workstation for the Local Machine



Task 1.1: Configuration of Hostname File

Local Machine, Server 1, and Server 2, hostnames settings were modified using the "sudo nano /etc/hostname" command. The hostnames were changed as "server1" for Server 1, "server2" for Server 2, and "workstation" for 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

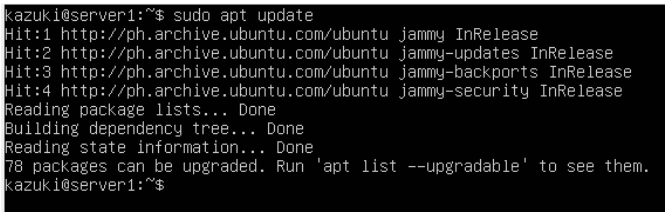
Task 1.2: Configuration of Hosts File

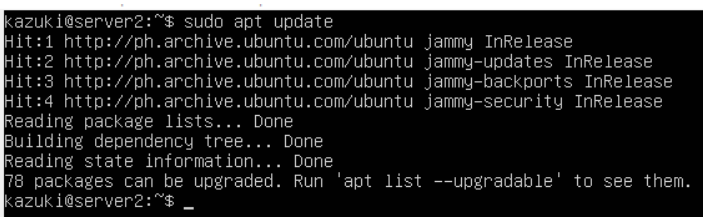
The hosts file was edited using the "sudo nano /etc/hosts" command, changing the second line to IP addresses and hostnames. "127.0.0.1 server1" for Server 1, "127.0.0.1 server2" for Server 2, and "127.0.0.1 workstation" for Local Machine.

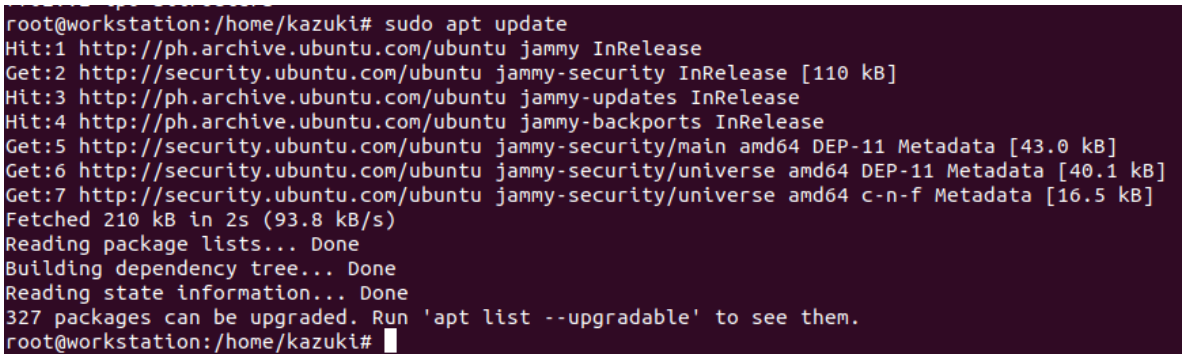
Task 2: Configure SSH on Server 1, Server 2, and Local Machine. Do the following:

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

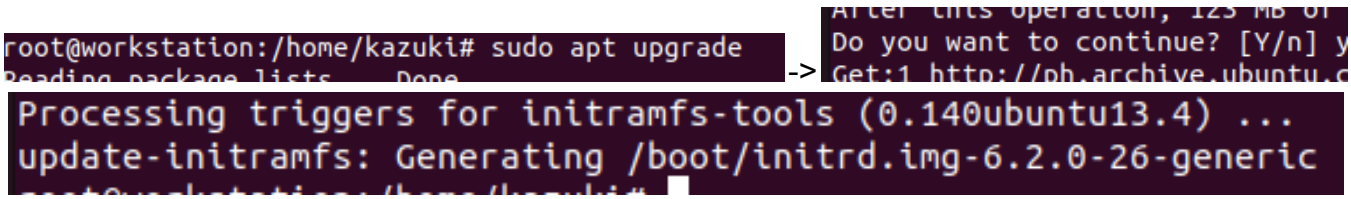
-sudo apt update-







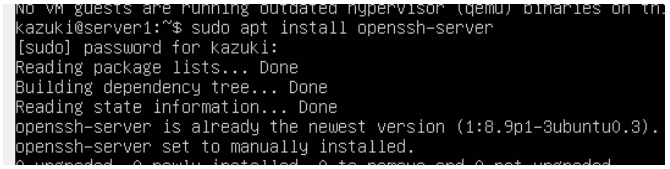
-sudo apt upgrade-

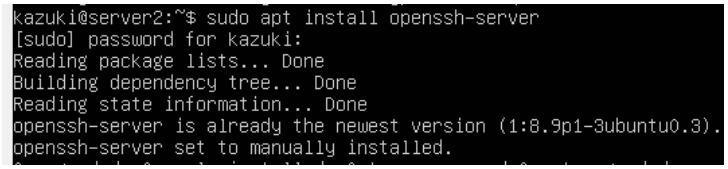


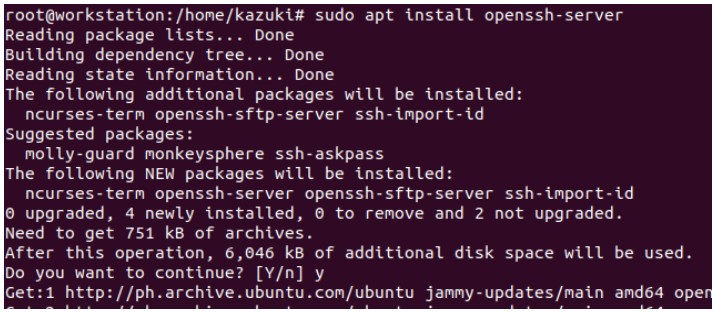
Task 2.1: Updating and Upgrading Packages

Successfully updated and upgraded the packages using the "sudo apt update" and "sudo apt upgrade" commands. We do this to enhance system stability.

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



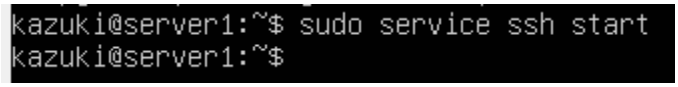


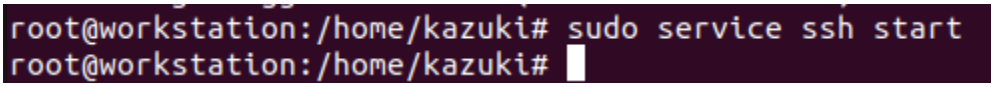


Task 2.2: Installing the SSH Server

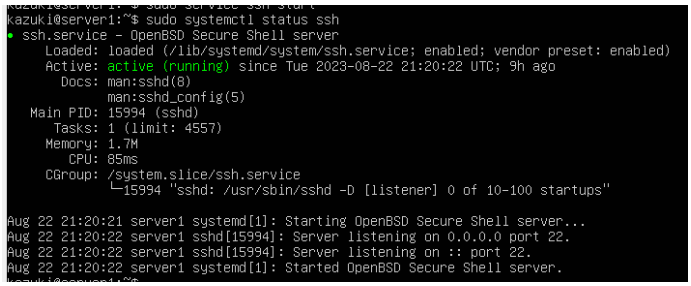
Successfully Installed the SSH server using the "sudo apt install openssh-server" command. We do this to secure remote access in SSH Server.

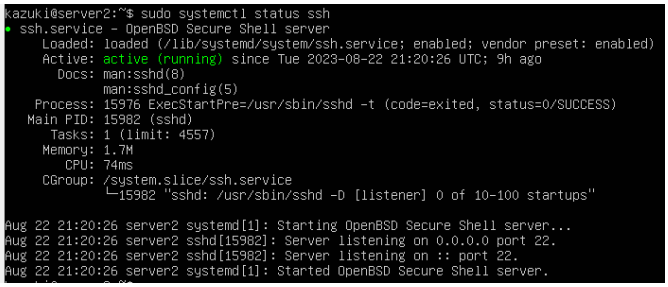
3. Verify if the SSH service has started by issuing the following commands:
   3.1 *sudo service ssh start*

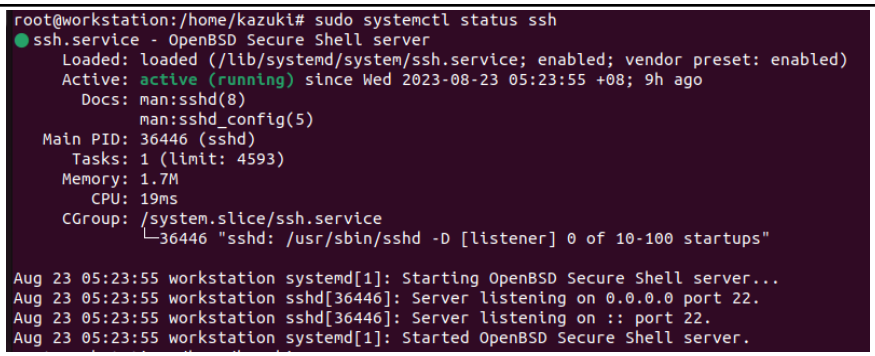




   3.2 *sudo systemctl status ssh*





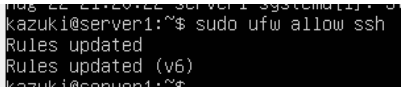


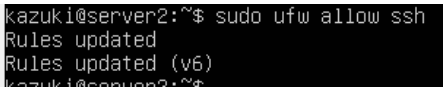
Task 2.3: Verifying the SSH Service

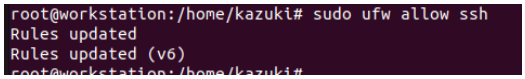
When we run the command "sudo service ssh start" we are literally starting the SSH service in our system. But, based on my research, in many cases, if the SSH service starts successfully, we might not see any output like what is shown in the screenshot. So, it does not mean that we did not successfully execute the command and it shows us that we successfully verified the SSH service. The command "sudo systemctl status ssh" is also one of the ways to verify SSH service, since it displays the current status and information about the SSH service in our system.

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

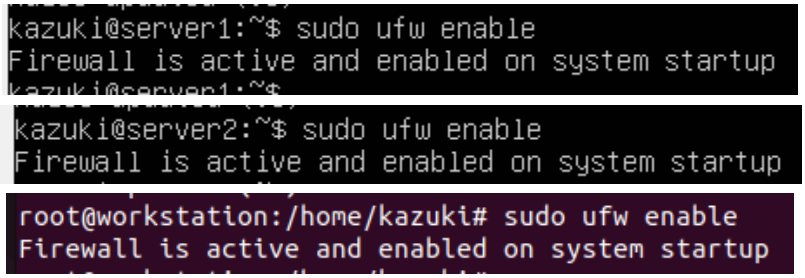
4.1 *sudo ufw allow ssh*



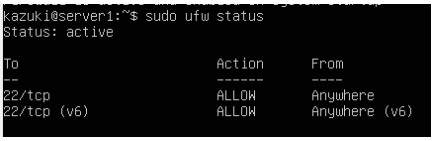


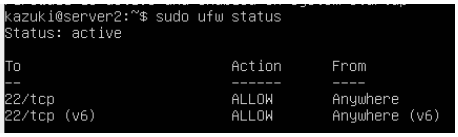


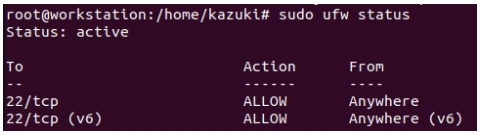
4.2 *sudo ufw enable*



4.3 *sudo ufw status*







Task 2.4: Firewall Configuration

The command "sudo ufw allow ssh" adds a rule to the ufw and it literally allows incoming SSH connection, this is important to enable remote access to our system using the SSH. The command "sudo ufw enable" literally enables the ufw, once this is enabled it starts enforcing the rules you've created, without this the rules you added in the first command will be nothing or it would not be in effect. And the command "sudo ufw status" just displays the current status of the ufw.

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

```
kazuki@server1:~$ ifconfig
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.56.104  netmask 255.255.255.0  broadcast 192.168.56.255
        inet6 fe80::a00:27ff:fe59:4468  prefixlen 64  scopeid 0x20<link>
        ether 08:00:27:59:44:68  txqueuelen 1000  (Ethernet)
        RX packets 2  bytes 1180 (1.1 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 10  bytes 1334 (1.3 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

1.2 Server 2 IP address: 192.168.56.103

```
kazuki@server2:~$ ifconfig
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.56.103  netmask 255.255.255.0  broadcast 192.168.56.255
        inet6 fe80::a00:27ff:fed3:a699  prefixlen 64  scopeid 0x20<link>
        ether 08:00:27:d3:a6:99  txqueuelen 1000  (Ethernet)
        RX packets 18  bytes 6181 (6.1 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 13  bytes 1544 (1.5 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

1.3 Server 3 IP address: 192.168.56.102

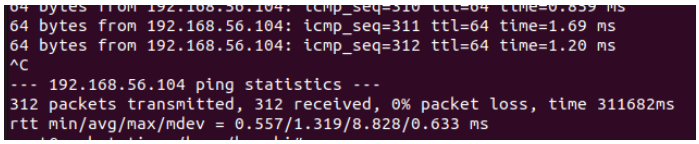
```
root@workstation:/home/kazuki# ifconfig
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.56.102  netmask 255.255.255.0  broadcast 192.168.56.255
        inet6 fe80::b1c8:1112:eb11:40c2  prefixlen 64  scopeid 0x20<link>
        ether 08:00:27:24:92:e6  txqueuelen 1000  (Ethernet)
        RX packets 64  bytes 12649 (12.6 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 75  bytes 9702 (9.7 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

enp0s8: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.56.101  netmask 255.255.255.0  broadcast 192.168.56.255
        inet6 fe80::4976:6481:f66a:eef8  prefixlen 64  scopeid 0x20<link>
        ether 08:00:27:49:46:45  txqueuelen 1000  (Ethernet)
        RX packets 63  bytes 11674 (11.6 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 77  bytes 9669 (9.6 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

Task 3.1: Verifying Network

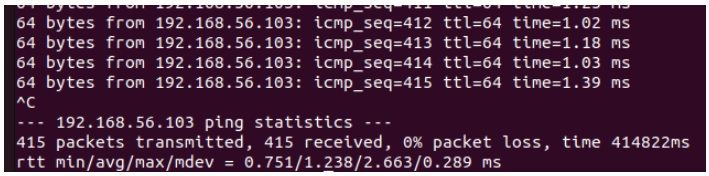
After running the command “ifconfig”, the IP Addresses were shown for Local Machine, Server 1, and Server 2. All IP addresses are within the designated network range 192.168.56._.

2. Make sure that they can ping each other.

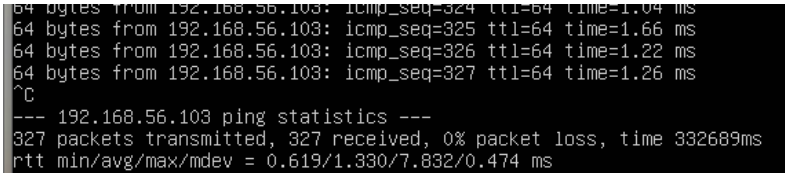
2.1 Connectivity test for Local Machine 1 to Server 1: ■ Successful ☐ Not Successful



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



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



Task 3.2: Pinging

Connectivity tests were executed in Local Machine, Server 1, and Server 2. Local Machine was able to ping both servers 1 and 2, and also server 1 was also able to ping server 2. Since all of the ping were successful. it indicates that network connectivity is working among all of them.

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.*

```
kazuki@server1:~$
logout
Connection to 192.168.56.104 closed.
root@workstation:/home/kazuki#
```

3. Do the same for Server 2.

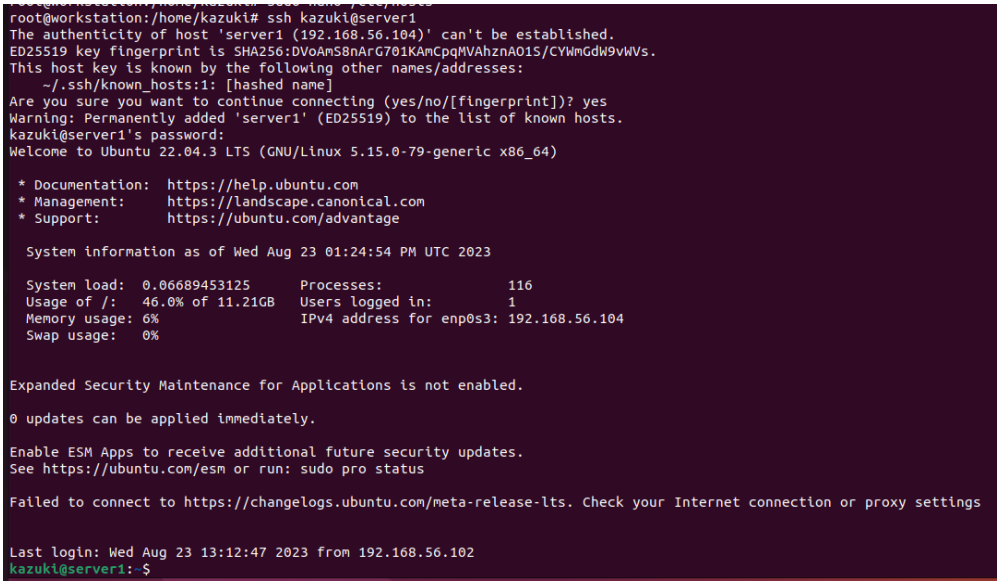
```
root@workstation:/home/kazuki# ssh kazuki@192.168.56.103
The authenticity of host '192.168.56.103 (192.168.56.103)' can't be established.
ED25519 key fingerprint is SHA256:oBCMp24rQR1SDxZKMBYVS2IzIaOQV8ySPe6FvzBNWMU.
This key is not known by any other names
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '192.168.56.103' (ED25519) to the list of known hosts.
kazuki@192.168.56.103's password:
Welcome to Ubuntu 22.04.3 LTS (GNU/Linux 5.15.0-79-generic x86_64)

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

  System information as of Wed Aug 23 02:50:32 PM UTC 2023

  System load:  0.05126953125      Processes:               112
  Usage of /:   44.4% of 11.21GB   Users logged in:         1
  Memory usage: 6%                 IPv4 address for enp0s3: 192.168.56.103
  Swap usage:   0%

 * Strictly confined Kubernetes makes edge and IoT secure. Learn how MicroK8s
   just raised the bar for easy, resilient and secure K8s cluster deployment.

   https://ubuntu.com/engage/secure-kubernetes-at-the-edge

Expanded Security Maintenance for Applications is not enabled.

0 updates can be applied immediately.

Enable ESM Apps to receive additional future security updates.
See https://ubuntu.com/esm or run: sudo pro status

Failed to connect to https://changelogs.ubuntu.com/meta-release-lts. Check your Internet connection or proxy settings


Last login: Wed Aug 23 12:00:34 2023
kazuki@server2:~$
```

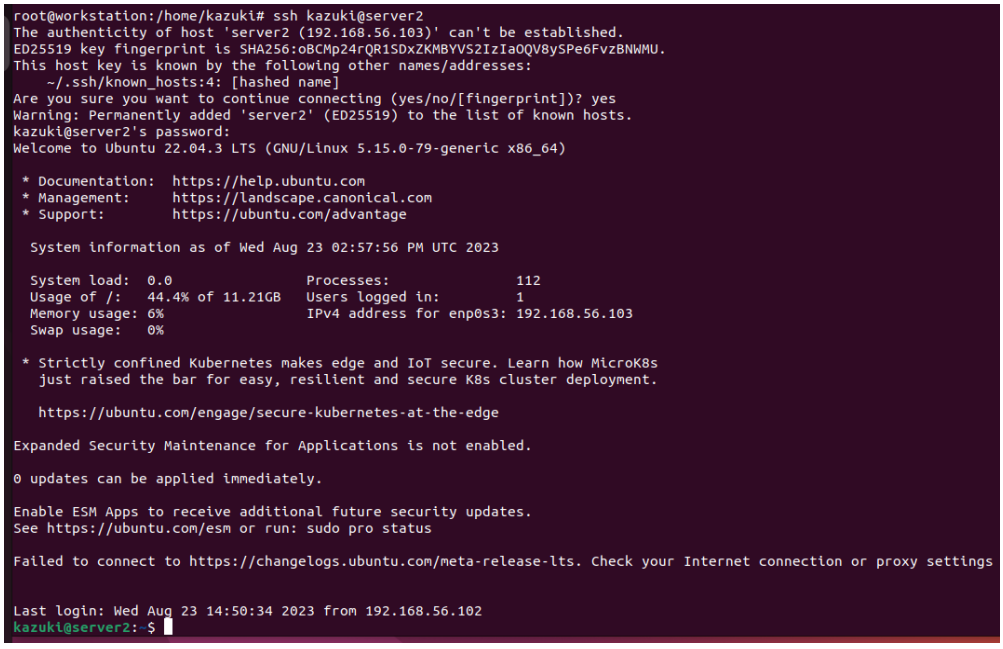
4. Edit the hosts of the Local Machine by issuing the command *sudo nano /etc/hosts.* Below all texts type the following:

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)
4.3 Save the file and exit.

```
  GNU nano 6.2                                          /etc/hosts *
127.0.0.1       localhost
127.0.0.1       workstation
192.168.56.104  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 jvtaylar@server1*. Enter the password when prompted. Verify that you have entered Server 1. Do the same for Server 2.





Task 4.1-5:Verifying SSH Connectivity

I was able to verify SSH connectivity by using the command "ssh username@ip address of servers 1 and 2" on the Local machine. To make this easier, we just need to edit the "/etc/hosts" file to add the IP addresses of servers 1 and 2. And then we can change the command "ssh username@ip address of servers 1 and 2" to " ssh username@server1/server2".

Reflections:

Answer the following:

1. How are we able to use the hostname instead of IP address in SSH commands?
   - **By using the command "sudo nano /etc/hosts" we can edit the file to add the IP addresses of the servers 1 and 2 and their corresponding hostnames. Once we are done editing the file, we can now use their hostnames in SSH commands.**

2. How secure is SSH?
   - **For me, I think SSH is highly secure due to its authentication methods. Also, it asks us if we want to continue (answerable by yes or no) and then asks for a password to continue with some commands, which makes SSH really secure. But we should not be overconfident with this, we must practice and maintain its security measures, like using strong passwords. Additionally, it uses encryption to secure the connection between a client and a server.**