

Charchar, Alexandre (1784011)
NET-45

420-635-AB-Network Installation and Administration I

Assignment 1

Handed to
MR. Antoine Thome

Date
2025-04-03

Linux Server Setup and Network Services – Assignment Overview

This lab puts our Linux server administration skills into action by simulating a real-world client-server environment using AlmaLinux and Ubuntu virtual machines. We start by configuring network connectivity and verifying communication between systems. From there, we handle disk partitioning, create logical volumes, and mount file systems to prepare for service deployment.

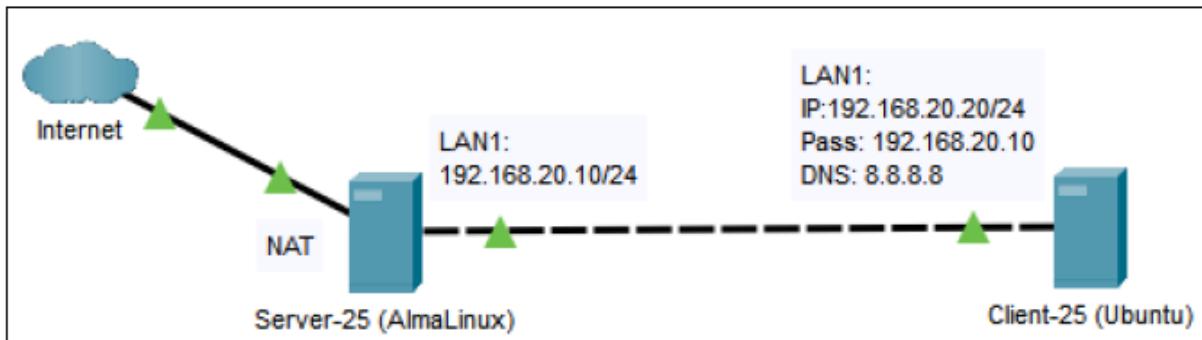
User and group management is implemented with custom UIDs, GIDs, and directory permissions to simulate access control scenarios. We then install and configure key network services: SSH for secure remote access, NFS for Linux-to-Linux file sharing, and Samba for public sharing across platforms. Each service is validated through client-side testing to confirm correct setup and access restrictions.

By completing this assignment, we gain hands-on experience with essential tools and configurations used in real Linux server environments—building a solid foundation for future work in network installation and administration.

Contents

ASSIGNMENT 1	5
PART 1 – SERVER CONFIGURATION	5
1- TOPOLOGY.....	5
1.1 Import Virtual Machines and Rename Hosts	5
1.2 Network Setup	7
1.3 AlmaLinux (server-3) Network Configuration	8
1.4 Enable IP Forwarding on AlmaLinux.....	12
1.5 Configure Firewall Zones on AlmaLinux	12
1.6 Ubuntu (client-3) Network Configuration	14
2- PARTITIONING.....	17
2.1 Ubuntu (client-3) – Add and Configure a Standard Partition	17
2.2 AlmaLinux (server-3) – Add and Configure LVM	23
3- USERS/GROUPS AND PERMISSIONS.....	28
3.1 AlmaLinux (server-3) – Create Groups and Users.....	28
3.2 AlmaLinux (server-3) – Create and Assign Directory Permissions	29
PART 2 – LINUX SERVICES	30
1- SSH Configuration	30
1.1 AlmaLinux (server-3) – Create SSH Banner and Configure Access	30
1.2 AlmaLinux (server-3) – Allow and Deny Group Access	32
1.3 AlmaLinux (server-3) – Confirm Root SSH Access.....	33
1.4 Ubuntu (client-3) – SSH Key Authentication	35
2 - NFS Configuration	36
2.1 AlmaLinux (server-3) – Set Up NFS Server and Firewall Rules.....	36
2.2 AlmaLinux (server-3) – Configure NFS Share for Admins	37
2.3 AlmaLinux (server-3) – Configure NFS Share for Employees	39
3 - SAMBA Configuration.....	40
3.1 AlmaLinux (server-3) – Set Up and Configure a Public SAMBA Share.....	40
3.2 AlmaLinux (server-3) – Configure the SAMBA Share	42

PART 3 – VALIDATION TEST	44
1 - SSH Testing	44
1.1 Ubuntu (client-3) – Test SSH Access to AlmaLinux (server-3).....	44
2 - NFS Testing	45
2.1 Ubuntu (client-3) – Prepare for NFS Testing	45
2.2 Ubuntu (client-3) – Recreate Matching Users and Groups.....	46
2.3 Ubuntu (client-3) – Create Mount Points and Mount Shares	48
2.4 Ubuntu (client-3) – Test Access and Permissions	49
2.5 AlmaLinux (server-3) – Confirm File Visibility.....	50
3 - SAMBA Testing.....	51
3.1 Ubuntu (client-3) – Test Public SAMBA Share	51
Conclusion.....	52



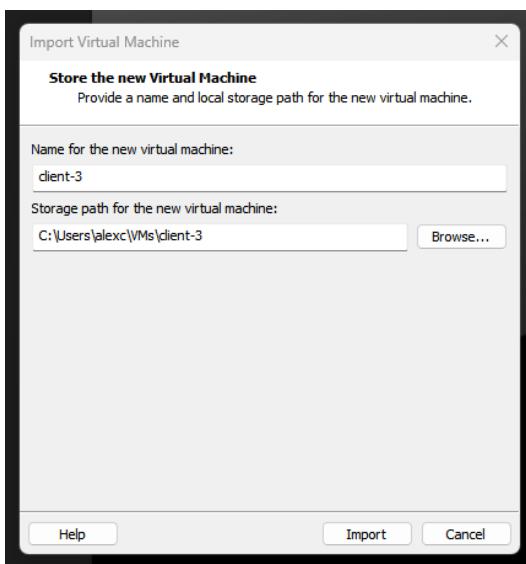
ASSIGNMENT 1

PART 1 – SERVER CONFIGURATION

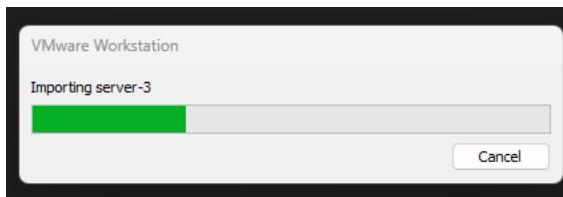
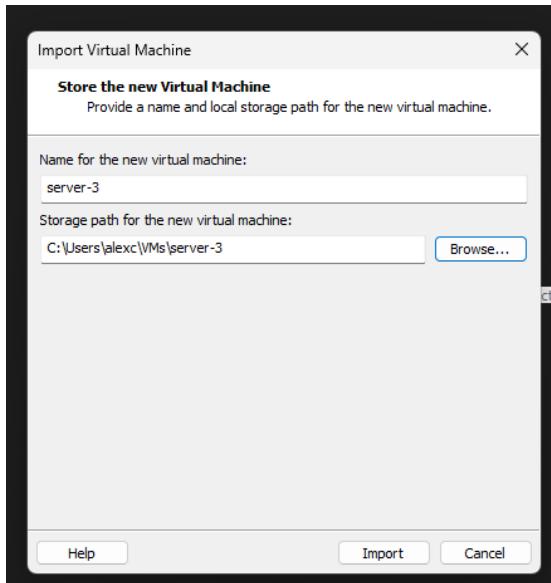
1- TOPOLOGY

1.1 Import Virtual Machines and Rename Hosts

- Download both .ova files:
 - AlmaLinux-Assignment1.ova
 - Ubuntu-Assignment1.ova
- Import them into VMware by double-clicking or right-clicking → Open with VMware.
- Rename the virtual machines:
 - Ubuntu → **client-3**



- AlmaLinux → **server-3**



- Modify the hostnames:

On Ubuntu:

```
sudo nmcli general hostname client-3  
hostname (to verify)
```

The screenshot shows a terminal window with a dark background. The title bar says 'atohme@client25: ~'. The terminal prompt is 'atohme@client25:~\$'. The user runs the command 'sudo nmcli general hostname client-3'. After a brief delay, the user runs 'hostname' to verify the change. The output shows the new hostname 'client-3' followed by the prompt 'atohme@client25:~\$'. The terminal has a standard Linux-style interface with tabs and a search bar at the top.

```
atohme@client25:~$ sudo nmcli general hostname client-3  
atohme@client25:~$ hostname  
client-3  
atohme@client25:~$
```

On AlmaLinux:

```
nmcli general hostname server-3  
hostname (to verify)
```

```
[root@localhost ~]#  
[root@localhost ~]#  
[root@localhost ~]#  
[root@localhost ~]# nmcli general hostname server-3  
[root@localhost ~]# hostname  
server-3  
[root@localhost ~]#
```

1.2 Network Setup

Verify NetworkManager on Both Machines

```
systemctl status NetworkManager
```

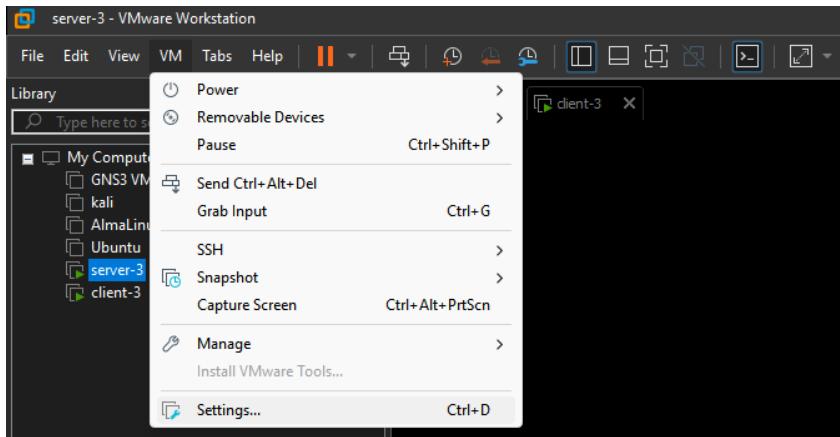
```
[root@server-3 ~]# systemctl status NetworkManager  
● NetworkManager.service - Network Manager  
   Loaded: loaded (/usr/lib/systemd/system/NetworkManager.service; enabled; preset: enabled)  
   Active: active (running) since Thu 2025-04-03 14:13:25 EDT; 48s ago  
     Docs: man:NetworkManager(8)  
   Main PID: 699 (NetworkManager)  
     Tasks: 3 (limit: 18652)  
    Memory: 11.3M  
      CPU: 335ms  
     CGroup: /system.slice/NetworkManager.service  
           └─699 /usr/sbin/NetworkManager --no-daemon  
  
Apr 03 14:13:27 server-3 NetworkManager[699]: <info> [1743704007.2061] dhcp4 (ens160): activation: beginning transaction (timeout in 45 seconds)  
Apr 03 14:13:27 server-3 NetworkManager[699]: <info> [1743704007.2130] dhcp4 (ens160): state changed new lease, address=192.168.19.136  
Apr 03 14:13:27 server-3 NetworkManager[699]: <info> [1743704007.2144] policy: set 'ens160' (ens160) as default for IPv4 routing and DNS  
Apr 03 14:13:27 server-3 NetworkManager[699]: <info> [1743704007.2335] device (ens160): state change: ip-config -> ip-check (reason 'none', sys-iface-state: 0x10000000)  
Apr 03 14:13:27 server-3 NetworkManager[699]: <info> [1743704007.2399] device (ens160): state change: ip-check -> secondaries (reason 'none', sys-iface-state: 0x10000000)  
Apr 03 14:13:27 server-3 NetworkManager[699]: <info> [1743704007.2402] device (ens160): state change: secondaries -> activated (reason 'none', sys-iface-state: 0x10000000)  
Apr 03 14:13:27 server-3 NetworkManager[699]: <info> [1743704007.2422] manager: NetworkManager state is now CONNECTED_SITE  
Apr 03 14:13:27 server-3 NetworkManager[699]: <info> [1743704007.2446] device (ens160): Activation: successful, device activated.  
Apr 03 14:13:27 server-3 NetworkManager[699]: <info> [1743704007.2455] manager: NetworkManager state is now CONNECTED_GLOBAL  
Apr 03 14:13:27 server-3 NetworkManager[699]: <info> [1743704007.2459] manager: startup complete  
Times 1-21/21 [END]
```

```
atohme@client-3: ~  
● NetworkManager.service - Network Manager  
   Loaded: loaded (/lib/systemd/system/NetworkManager.service; enabled; vendor pres  
   Active: active (running) since Thu 2025-04-03 14:11:17 EDT; 3min 20s ago  
     Docs: man:NetworkManager(8)  
   Main PID: 565 (NetworkManager)  
     Tasks: 3 (limit: 4551)  
    Memory: 10.6M  
      CPU: 406ms  
     CGroup: /system.slice/NetworkManager.service  
           └─565 /usr/sbin/NetworkManager --no-daemon  
  
Apr 03 14:11:19 client-3 NetworkManager[565]: <info> [1743703879.4631] modem-manager>  
Apr 03 14:11:19 client-3 NetworkManager[565]: <info> [1743703879.4766] device (ens33)>  
Apr 03 14:11:19 client-3 NetworkManager[565]: <info> [1743703879.4772] device (ens33)>  
Apr 03 14:11:19 client-3 NetworkManager[565]: <info> [1743703879.4823] manager: Netw>  
Apr 03 14:11:19 client-3 NetworkManager[565]: <info> [1743703879.4877] manager: Netw>  
Apr 03 14:11:19 client-3 NetworkManager[565]: <info> [1743703879.4879] policy: set '>  
Apr 03 14:11:19 client-3 NetworkManager[565]: <info> [1743703879.4887] device (ens33)>  
Apr 03 14:11:19 client-3 NetworkManager[565]: <info> [1743703879.5067] manager: star>  
lines 1-19/21 84%
```

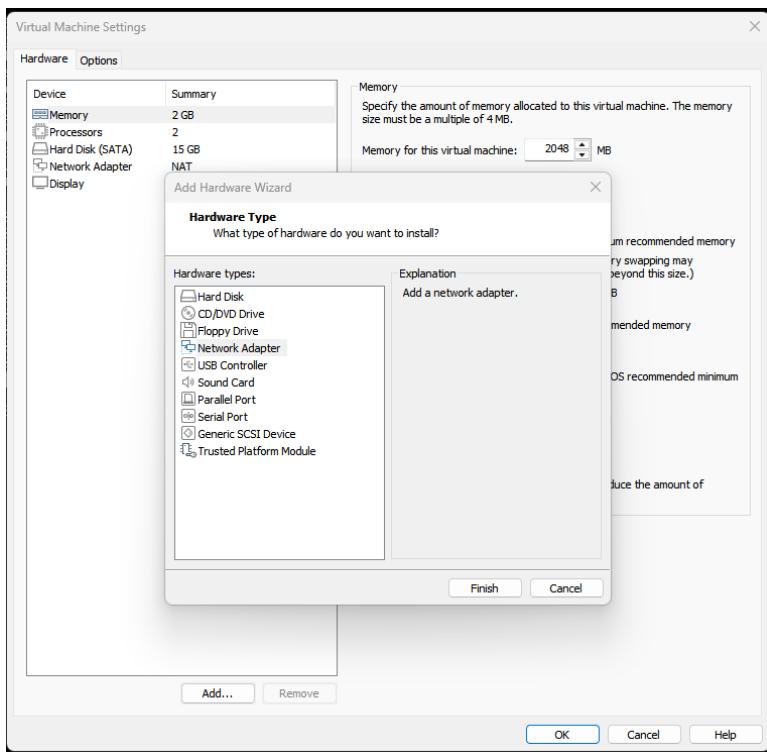
1.3 AlmaLinux (server-3) Network Configuration

Add New NIC to LAN Segment

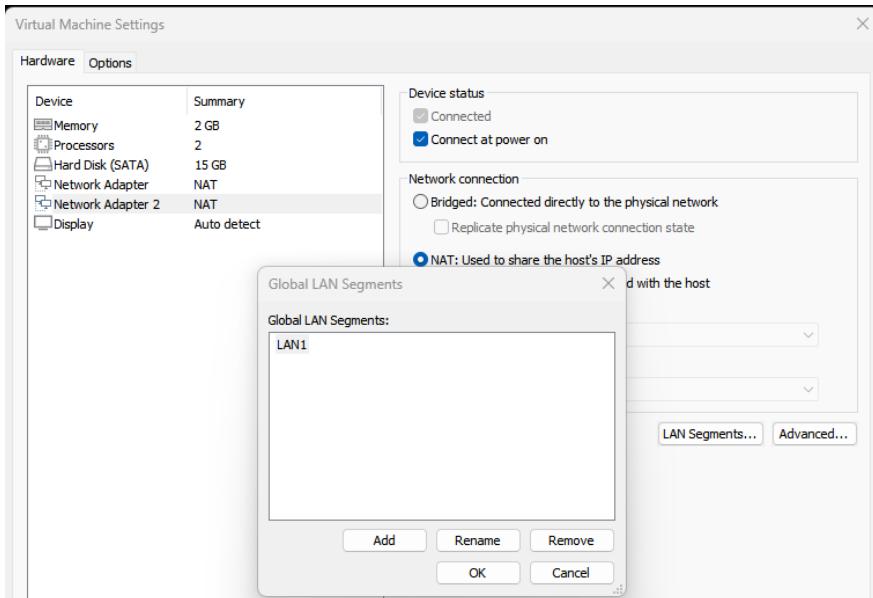
1. Go to VM → Settings



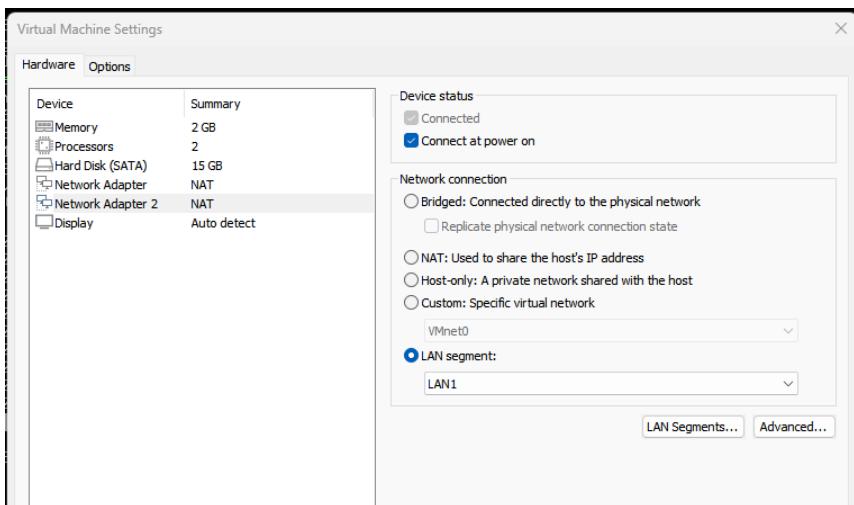
2. Click Add → Network Adapter → Finish



3. Click **LAN Segments** → Add → Name it LAN1



4. Select the new network card → Set to **LAN Segment: LAN1**



You should now have **two active network interfaces**.

Check Network Interface Status

nmcli dev status

```
[root@server-3 ~]# nmcli dev status
DEVICE  TYPE      STATE                CONNECTION
ens160  ethernet  connected           ens160
lo      loopback  connected (externally) lo
ens192  ethernet  connecting (getting IP configuration) Wired connection 1
[root@server-3 ~]# -
```

Check Existing Connections

nmcli con show

`nmcli con show ens160` or `nmcli con show ens192` (to check individual connections)

```
[root@server-3 ~]# nmcli con show
NAME                UUID                                  TYPE      DEVICE
Wired connection 1  817d57c8-3e6b-3934-a730-24221e0a1c07  ethernet  ens192
ens160              d1f1dee0-521d-3bcc-b310-eb50258b8377  ethernet  ens160
lo                  55a39a7e-9ddd-4769-8030-664053407659  loopback  lo
[root@server-3 ~]#
```

```
[root@server-3 ~]# nmcli con show ens160
```

```
GENERAL.MASTER-PATH:          --
IP4.ADDRESS[1]:               192.168.19.136/24
IP4.GATEWAY:                  192.168.19.2
IP4.ROUTE[1]:                 dst = 192.168.19.0/24, nh = 0.0.0.0, mt = 100
IP4.ROUTE[2]:                 dst = 0.0.0.0/0, nh = 192.168.19.2, mt = 100
IP4.DNS[1]:                    192.168.19.2
IP4.DOMAIN[1]:                localdomain
DHCP4.OPTION[1]:              broadcast_address = 192.168.19.255
DHCP4.OPTION[2]:              dhcp_client_identifier = 01:00:0c:29:40:97:c8
DHCP4.OPTION[3]:              dhcp_lease_time = 1800
DHCP4.OPTION[4]:              dhcp_server_identifier = 192.168.19.254
DHCP4.OPTION[5]:              domain_name = localdomain
lines 80-128
```

Create New Static Connection for LAN1

```
nmcli con add type ethernet ifname ens192 con-name LAN1 ipv4.method manual  
ipv4.address 192.168.20.10/24
```

```
[root@server-3 ~]# nmcli connection add type ethernet ifname ens192 con-name LAN1 ipv4.method manual ipv4.addresses 192.168.20.10/24 Connection 'LAN1' (ec2aa5b0-02af-4efd-802b-21f0212f0b01) successfully added.  
[root@server-3 ~]#
```

Verify Changes

```
nmcli con show  
nmcli con show LAN1
```

```
[root@server-3 ~]# nmcli connection show  
NAME UUID TYPE DEVICE  
Wired connection 1 817d57c8-3e6b-3934-a730-24221e0alc07 ethernet ens192  
ens160 d1f1dee0-521d-3bcc-b310-eb50258b8377 ethernet ens160  
lo 55a39a7e-9ddd-4769-8030-664053407659 loopback lo  
LAN1 ec2aa5b0-02af-4efd-802b-21f0212f0b01 ethernet --  
[root@server-3 ~]#
```

```
[root@server-3 ~]# nmcli connection show LAN1  
[root@server-3 ~]# nmcli connection show LAN1  
connection.id: LAN1  
connection.uuid: ec2aa5b0-02af-4efd-802b-21f0212f0b01  
connection.stable-id: --  
connection.type: 802-3-ethernet  
connection.interface-name: ens192  
connection.autoconnect: yes  
connection.autoconnect-priority: 0
```

ipv4.addresses:	192.168.20.10/24
ipv4.gateway:	--

Test Internet Connection

```
ping 8.8.8.8  
ping www.google.ca
```

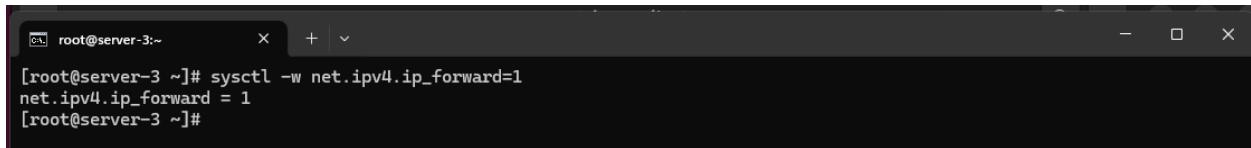
```
[root@server-3 ~]# ping 8.8.8.8  
PING 8.8.8.8 (8.8.8.8) 56(84) bytes of data.  
64 bytes from 8.8.8.8: icmp_seq=1 ttl=128 time=14.6 ms  
64 bytes from 8.8.8.8: icmp_seq=2 ttl=128 time=15.0 ms  
64 bytes from 8.8.8.8: icmp_seq=3 ttl=128 time=17.2 ms  
64 bytes from 8.8.8.8: icmp_seq=4 ttl=128 time=14.8 ms  
^C  
--- 8.8.8.8 ping statistics ---  
4 packets transmitted, 4 received, 0% packet loss, time 3010ms  
rtt min/avg/max/mdev = 14.567/15.383/17.170/1.044 ms  
[root@server-3 ~]#
```

```
[root@server-3 ~]# ping www.google.ca  
PING www.google.ca (142.250.69.67) 56(84) bytes of data.  
64 bytes from tzyula-aa-in-f3.1e100.net (142.250.69.67): icmp_seq=1 ttl=128 time=13.4 ms  
64 bytes from tzyula-aa-in-f3.1e100.net (142.250.69.67): icmp_seq=2 ttl=128 time=14.3 ms  
64 bytes from tzyula-aa-in-f3.1e100.net (142.250.69.67): icmp_seq=3 ttl=128 time=15.0 ms  
64 bytes from tzyula-aa-in-f3.1e100.net (142.250.69.67): icmp_seq=4 ttl=128 time=14.0 ms  
^C  
--- www.google.ca ping statistics ---  
4 packets transmitted, 4 received, 0% packet loss, time 3008ms  
rtt min/avg/max/mdev = 13.424/14.193/15.033/0.581 ms  
[root@server-3 ~]#
```

1.4 Enable IP Forwarding on AlmaLinux

Temporarily Enable

```
sysctl -w net.ipv4.ip_forward=1
```

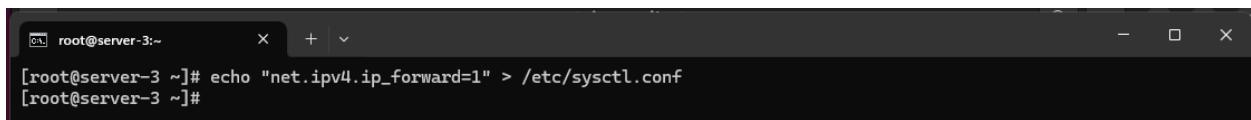


```
[root@server-3 ~]# sysctl -w net.ipv4.ip_forward=1
net.ipv4.ip_forward = 1
[root@server-3 ~]#
```

A screenshot of a terminal window titled "root@server-3:~". It shows the command "sysctl -w net.ipv4.ip_forward=1" being run, followed by the output "net.ipv4.ip_forward = 1". The window has standard Linux terminal icons at the top.

Permanently Enable at Boot

```
echo "net.ipv4.ip_forward=1" > /etc/sysctl.conf
```



```
[root@server-3 ~]# echo "net.ipv4.ip_forward=1" > /etc/sysctl.conf
[root@server-3 ~]#
```

A screenshot of a terminal window titled "root@server-3:~". It shows the command "echo "net.ipv4.ip_forward=1" > /etc/sysctl.conf" being run, followed by the output "[root@server-3 ~]#". The window has standard Linux terminal icons at the top.

1.5 Configure Firewall Zones on AlmaLinux

View Active Zones

```
firewall-cmd --get-active-zones
```



```
[root@server-3 ~]# firewall-cmd --get-active-zones
public
  interfaces: ens160 ens192
[root@server-3 ~]#
```

A screenshot of a terminal window titled "root@server-3:~". It shows the command "firewall-cmd --get-active-zones" being run, followed by the output "public" and "interfaces: ens160 ens192". The window has standard Linux terminal icons at the top.

Assign Network Interfaces to Zones

- Assign NAT connection (ens160) to the **external** zone:

```
nmcli con mod ens160 con.zone external  
nmcli con d ens160  
nmcli con u ens160
```

WARNING turning the network card down will disconnect the SSH connection which will prevent you from turning it back up if you don't have a different way to connect to the server.

```
[root@server-3 ~]# nmcli connection modify ens160 con.zone external  
[root@server-3 ~]# nmcli connection d ens160  
client_loop: send disconnect: Connection reset  
  
C:\Users\alex>
```

```
[root@server-3 ~]# nmcli connection up ens160  
Connection successfully activated (D-Bus active path: /org/freedesktop/NetworkManager/ActiveConnection/12)  
[root@server-3 ~]# _
```

- Assign LAN1 (ens192) to the **nm-shared** zone:

```
nmcli con mod LAN1 con.zone nm-shared  
nmcli con d LAN1  
nmcli con u LAN1
```

```
[root@server-3 ~]# nmcli connection modify LAN1 con.zone nm-shared  
[root@server-3 ~]# nmcli connection down LAN1  
Connection 'LAN1' successfully deactivated (D-Bus active path: /org/freedesktop/NetworkManager/ActiveConnection/11)  
[root@server-3 ~]# nmcli connection up LAN1  
Connection successfully activated (D-Bus active path: /org/freedesktop/NetworkManager/ActiveConnection/14)  
[root@server-3 ~]#
```

Verify Zone Assignments

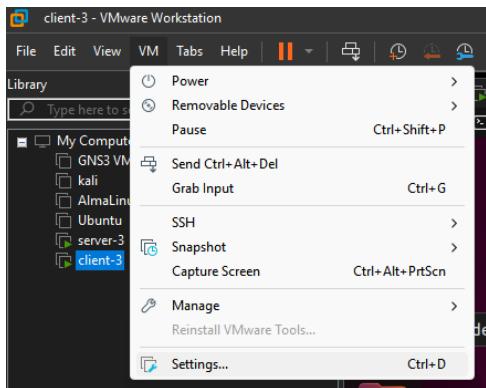
```
firewall-cmd --get-active-zones
```

```
[root@server-3 ~]# firewall-cmd --get-active-zones  
external  
  interfaces: ens160  
nm-shared  
  interfaces: ens192  
[root@server-3 ~]#
```

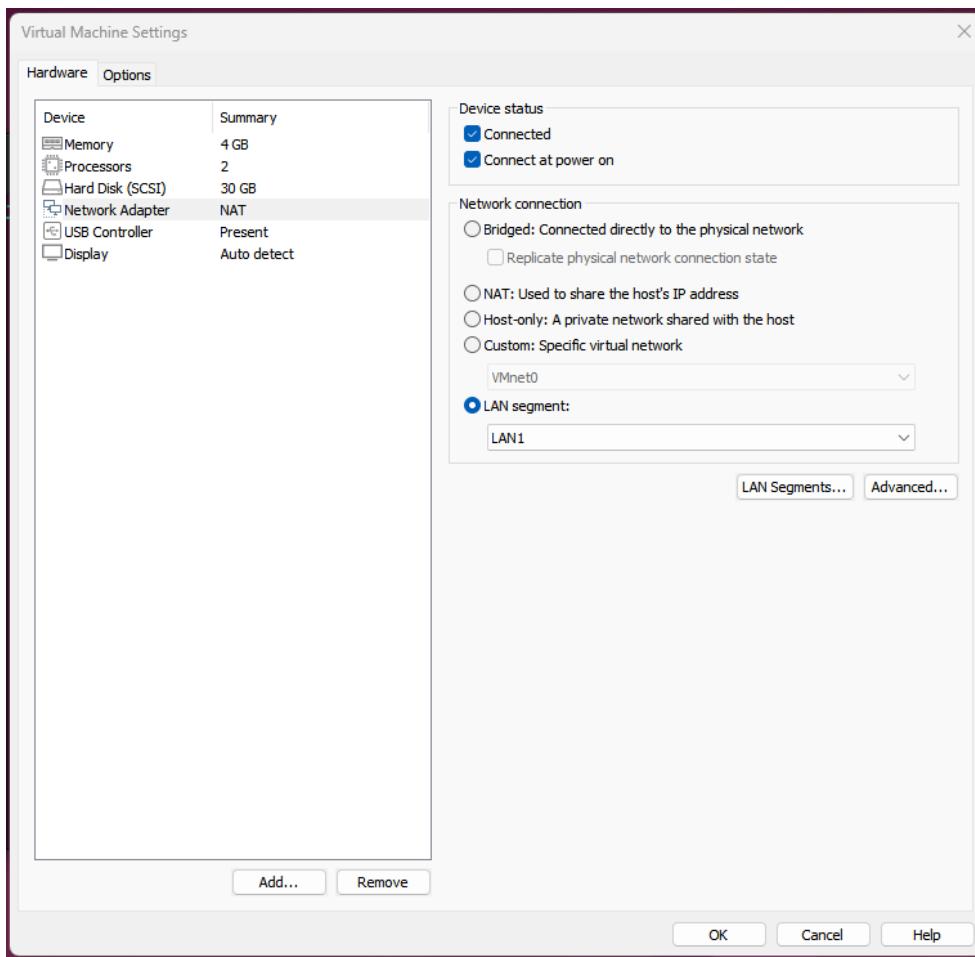
1.6 Ubuntu (client-3) Network Configuration

Attach Adapter to LAN1 Segment

1. Go to VM → Settings



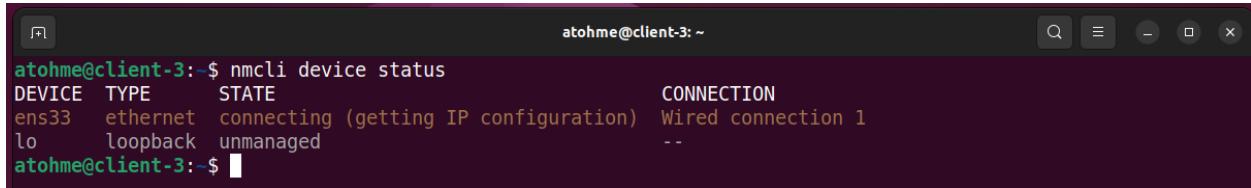
2. Set Network Adapter to LAN Segment: LAN1



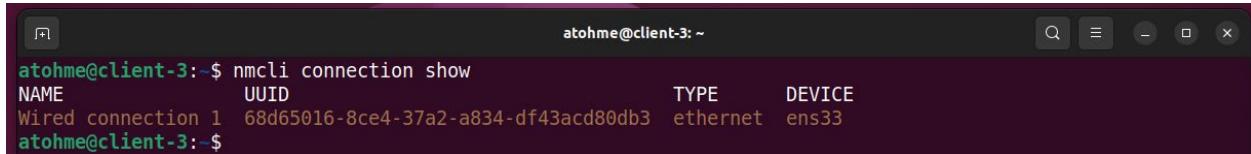
Check Current Connections

```
nmcli dev status
```

```
nmcli con show
```



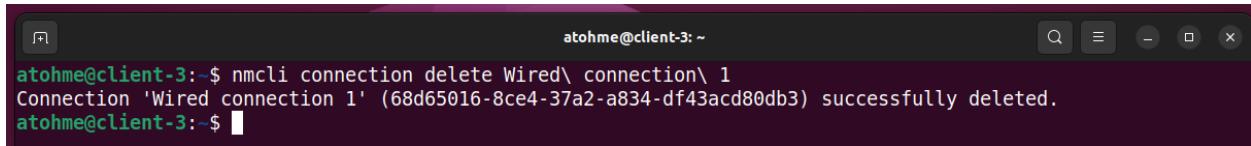
```
atohme@client-3:~$ nmcli device status
DEVICE  TYPE      STATE          CONNECTION
ens33   ethernet  connecting    (getting IP configuration)  Wired connection 1
lo      loopback  unmanaged     --
atohme@client-3:~$
```



```
atohme@client-3:~$ nmcli connection show
NAME           UUID            TYPE      DEVICE
Wired connection 1  68d65016-8ce4-37a2-a834-df43acd80db3  ethernet  ens33
atohme@client-3:~$
```

Delete Current Connection

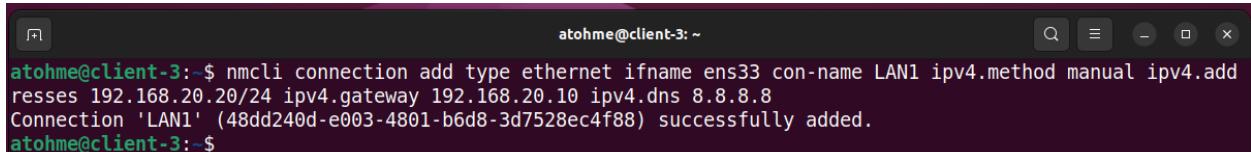
```
nmcli con del "Wired connection 1"
```



```
atohme@client-3:~$ nmcli connection delete Wired\ connection\ 1
Connection 'Wired connection 1' (68d65016-8ce4-37a2-a834-df43acd80db3) successfully deleted.
atohme@client-3:~$
```

Create New Static Connection

```
nmcli con add type ethernet ifname ens33 con-name LAN1 ipv4.method manual
ipv4.address 192.168.20.20/24 ipv4.gateway 192.168.20.10 ipv4.dns 8.8.8.8
```

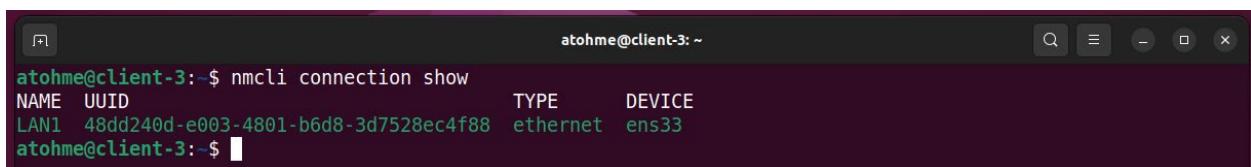


```
atohme@client-3:~$ nmcli connection add type ethernet ifname ens33 con-name LAN1 ipv4.method manual ipv4.add
resses 192.168.20.20/24 ipv4.gateway 192.168.20.10 ipv4.dns 8.8.8.8
Connection 'LAN1' (48dd240d-e003-4801-b6d8-3d7528ec4f88) successfully added.
atohme@client-3:~$
```

Verify New Connection

```
nmcli con show
```

```
nmcli con show LAN1 | grep IP4
```



```
atohme@client-3:~$ nmcli connection show
NAME  UUID            TYPE      DEVICE
LAN1  48dd240d-e003-4801-b6d8-3d7528ec4f88  ethernet  ens33
atohme@client-3:~$
```

```
atohme@client-3:~$ nmcli connection show LAN1 | grep IP4
IP4.ADDRESS[1]:           192.168.20.20/24
IP4.GATEWAY:              192.168.20.10
IP4.ROUTE[1]:             dst = 192.168.20.0/24, nh = 0.0.0.0, mt = 100
IP4.ROUTE[2]:             dst = 169.254.0.0/16, nh = 0.0.0.0, mt = 1000
IP4.ROUTE[3]:             dst = 0.0.0.0/0, nh = 192.168.20.10, mt = 100
IP4.DNS[1]:                8.8.8.8
atohme@client-3:~$
```

Test Connectivity

- Ping server:

ping 192.168.20.10

```
atohme@client-3:~$ ping 192.168.20.10
PING 192.168.20.10 (192.168.20.10) 56(84) bytes of data.
64 bytes from 192.168.20.10: icmp_seq=1 ttl=64 time=1.30 ms
64 bytes from 192.168.20.10: icmp_seq=2 ttl=64 time=1.17 ms
64 bytes from 192.168.20.10: icmp_seq=3 ttl=64 time=1.66 ms
64 bytes from 192.168.20.10: icmp_seq=4 ttl=64 time=1.77 ms

--- 192.168.20.10 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3007ms
rtt min/avg/max/mdev = 1.171/1.474/1.773/0.248 ms
^Catohme@client-3: $
```

- Ping Internet:

ping 8.8.8.8

ping www.google.com

```
atohme@client-3:~$ ping 8.8.8.8
PING 8.8.8.8 (8.8.8.8) 56(84) bytes of data.
64 bytes from 8.8.8.8: icmp_seq=1 ttl=127 time=16.7 ms
64 bytes from 8.8.8.8: icmp_seq=2 ttl=127 time=23.8 ms
64 bytes from 8.8.8.8: icmp_seq=3 ttl=127 time=15.1 ms
^C
--- 8.8.8.8 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2003ms
rtt min/avg/max/mdev = 15.086/18.541/23.796/3.776 ms
atohme@client-3:~$
```

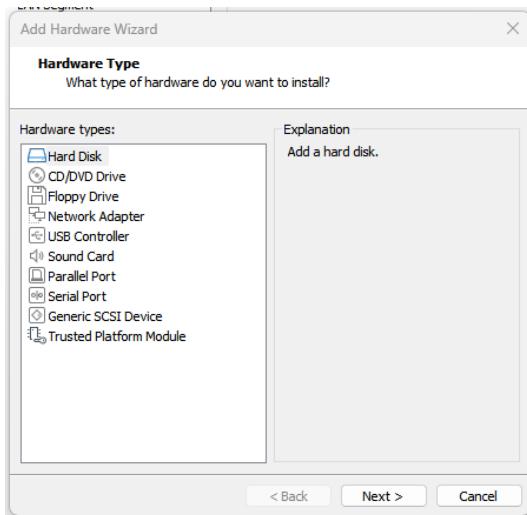
```
atohme@client-3:~$ ping www.google.com
PING www.google.com (142.250.69.100) 56(84) bytes of data.
64 bytes from pnyula-ab-in-f4.1e100.net (142.250.69.100): icmp_seq=1 ttl=127 time=15.5 ms
64 bytes from pnyula-ab-in-f4.1e100.net (142.250.69.100): icmp_seq=2 ttl=127 time=16.5 ms
64 bytes from pnyula-ab-in-f4.1e100.net (142.250.69.100): icmp_seq=3 ttl=127 time=15.4 ms
^C
--- www.google.com ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2004ms
rtt min/avg/max/mdev = 15.394/15.791/16.498/0.501 ms
atohme@client-3:~$
```

2- PARTITIONING

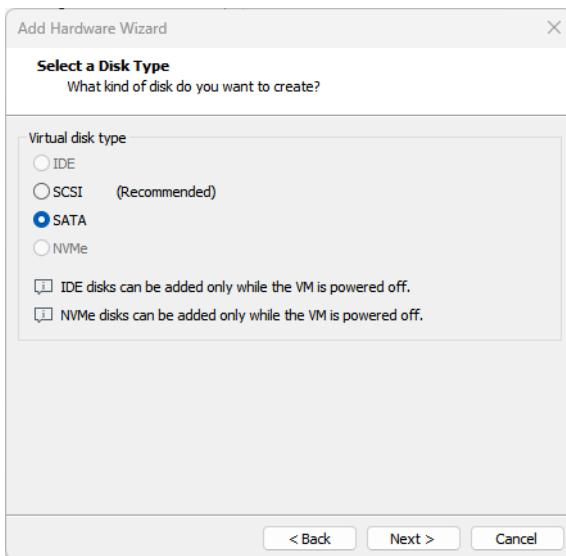
2.1 Ubuntu (client-3) – Add and Configure a Standard Partition

1. Attach a new 3 GB SATA drive:

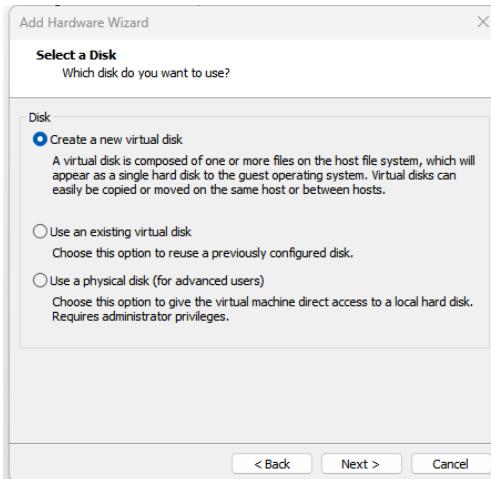
- Right-click the VM → *Settings*
- Click *Add* → *Hard Disk*



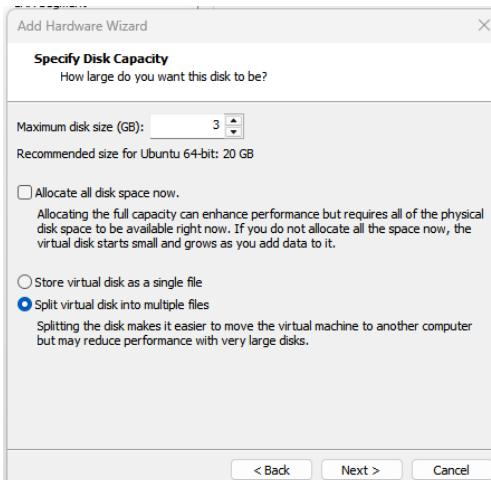
- Select **SATA** → *Next*



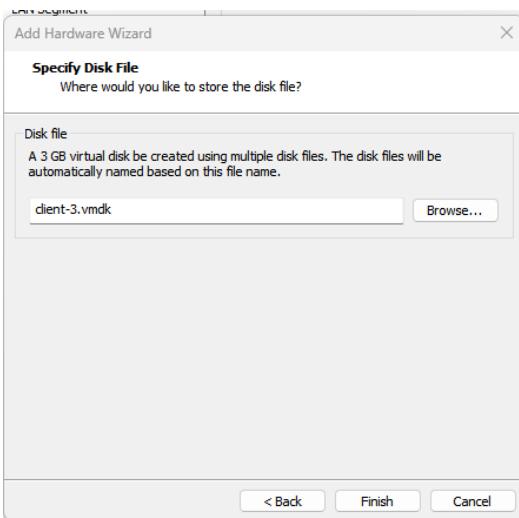
- Choose *Create a new virtual disk* → *Next*

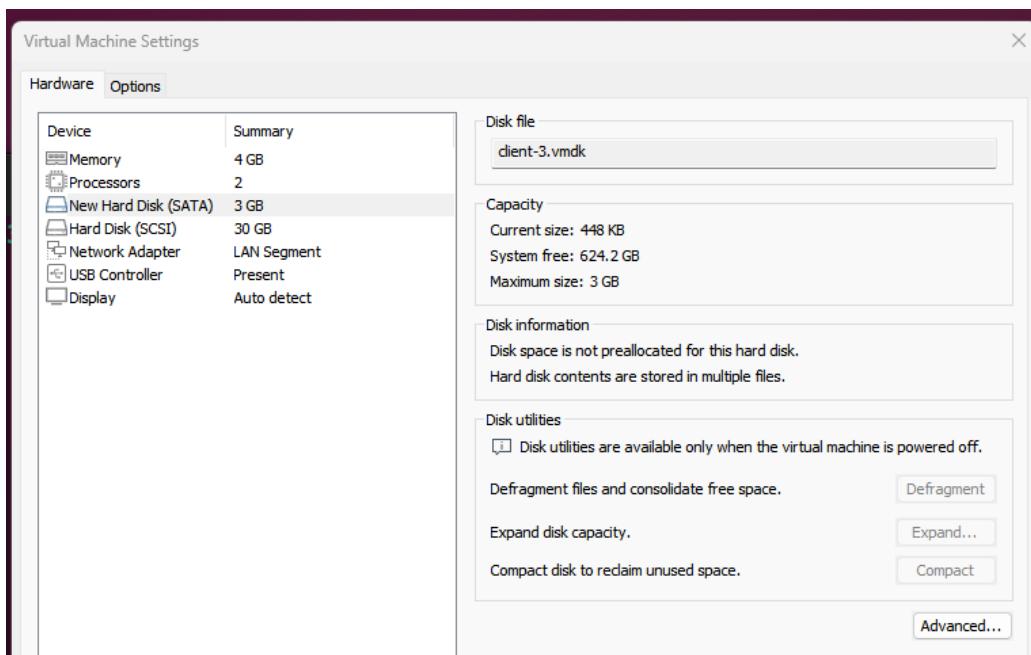


- Enter **3 GB** → *Next*



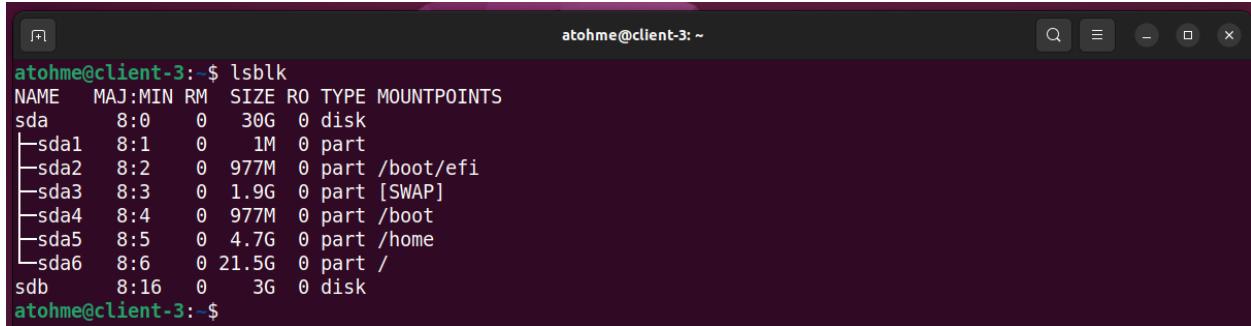
- Leave the default name → Click *Finish*



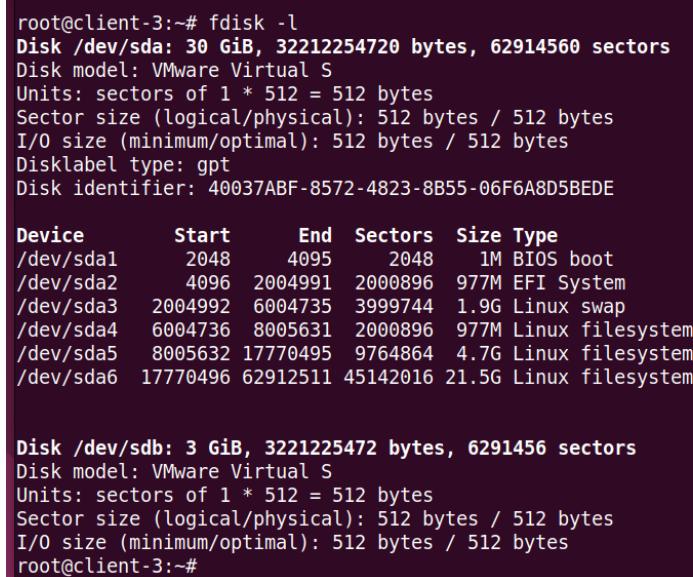


2. Verify the new disk:

```
lsblk  
fdisk -l  
ls -la /dev/sdb
```



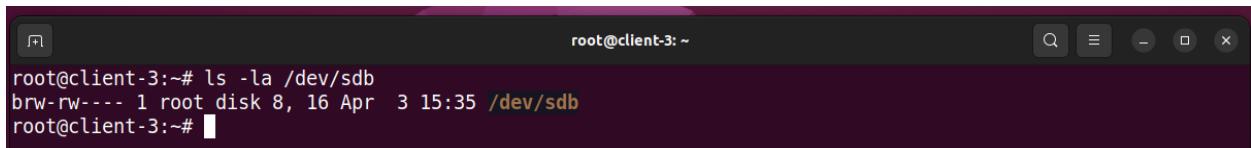
```
atohme@client-3:~$ lsblk  
NAME   MAJ:MIN RM  SIZE RO TYPE MOUNTPOINTS  
sda      8:0    0   30G  0 disk  
|---sda1  8:1    0     1M  0 part /boot/efi  
|---sda2  8:2    0  977M  0 part /boot/efi  
|---sda3  8:3    0   1.9G  0 part [SWAP]  
|---sda4  8:4    0  977M  0 part /boot  
|---sda5  8:5    0   4.7G  0 part /home  
|---sda6  8:6    0  21.5G 0 part /  
sdb      8:16   0    3G  0 disk  
atohme@client-3:~$
```



```
root@client-3:~# fdisk -l  
Disk /dev/sda: 30 GiB, 32212254720 bytes, 62914560 sectors  
Disk model: VMware Virtual S  
Units: sectors of 1 * 512 = 512 bytes  
Sector size (logical/physical): 512 bytes / 512 bytes  
I/O size (minimum/optimal): 512 bytes / 512 bytes  
Disklabel type: gpt  
Disk identifier: 40037ABF-8572-4823-8B55-06F6A8D5BEDE  


| Device    | Start    | End      | Sectors  | Size  | Type             |
|-----------|----------|----------|----------|-------|------------------|
| /dev/sda1 | 2048     | 4095     | 2048     | 1M    | BIOS boot        |
| /dev/sda2 | 4096     | 2004991  | 2000896  | 977M  | EFI System       |
| /dev/sda3 | 2004992  | 6004735  | 3999744  | 1.9G  | Linux swap       |
| /dev/sda4 | 6004736  | 8005631  | 2000896  | 977M  | Linux filesystem |
| /dev/sda5 | 8005632  | 17770495 | 9764864  | 4.7G  | Linux filesystem |
| /dev/sda6 | 17770496 | 62912511 | 45142016 | 21.5G | Linux filesystem |

  
Disk /dev/sdb: 3 GiB, 3221225472 bytes, 6291456 sectors  
Disk model: VMware Virtual S  
Units: sectors of 1 * 512 = 512 bytes  
Sector size (logical/physical): 512 bytes / 512 bytes  
I/O size (minimum/optimal): 512 bytes / 512 bytes  
root@client-3:~#
```



```
root@client-3:~# ls -la /dev/sdb  
brw-rw---- 1 root disk 8, 16 Apr  3 15:35 /dev/sdb  
root@client-3:~#
```

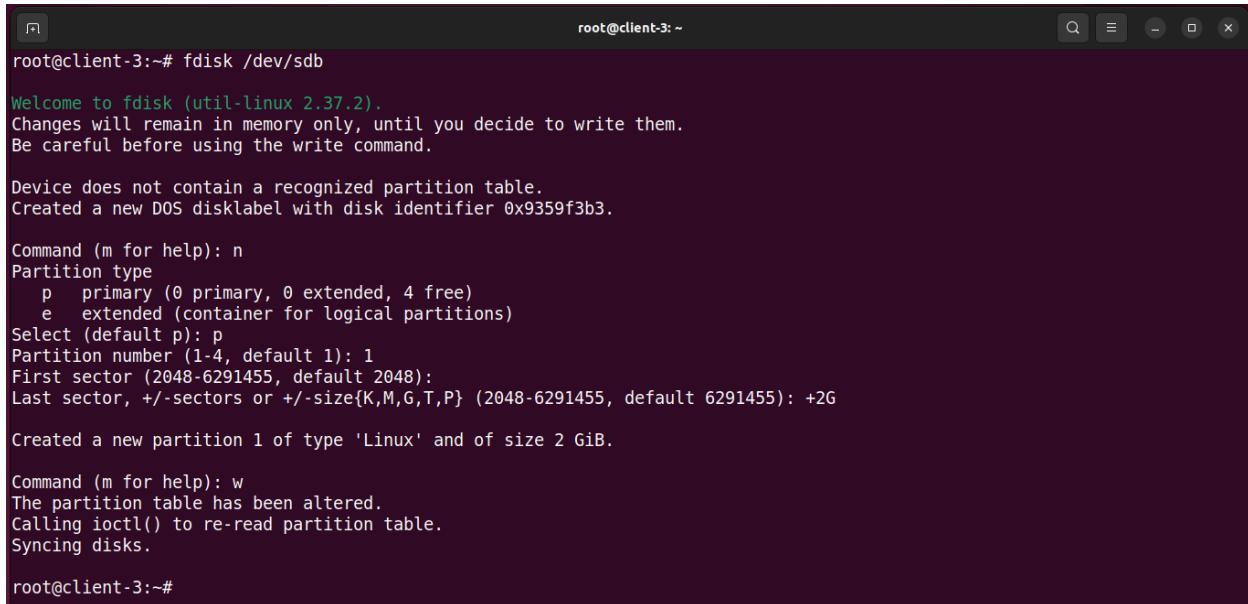
3. Create a 2 GB partition:

```
fdisk /dev/sdb
```

When prompted:

- Command (m for help): **n**
- Partition type: **p** (default)
- Partition number: **1**
- Last sector: **+2G**

When you created the partition type w to save the configuration



```
root@client-3:~# fdisk /dev/sdb
Welcome to fdisk (util-linux 2.37.2).
Changes will remain in memory only, until you decide to write them.
Be careful before using the write command.

Device does not contain a recognized partition table.
Created a new DOS disklabel with disk identifier 0x9359f3b3.

Command (m for help): n
Partition type
  p  primary (0 primary, 0 extended, 4 free)
  e  extended (container for logical partitions)
Select (default p): p
Partition number (1-4, default 1): 1
First sector (2048-6291455, default 2048):
Last sector, +/-sectors or +/-size{K,M,G,T,P} (2048-6291455, default 6291455): +2G

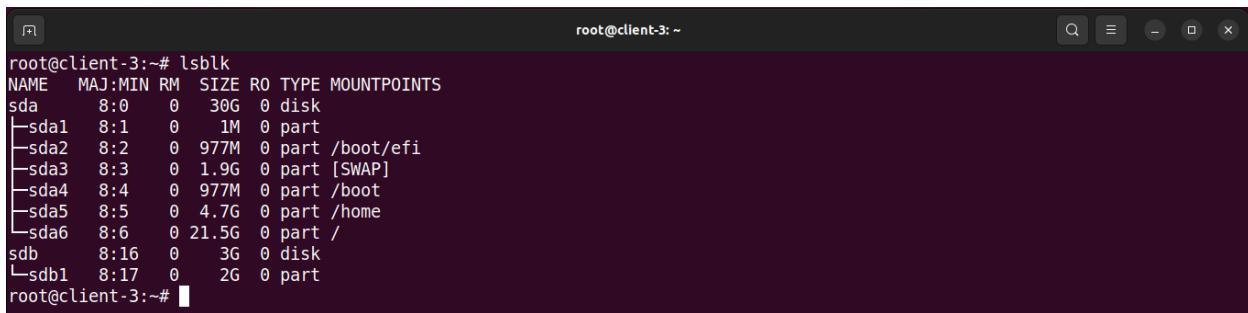
Created a new partition 1 of type 'Linux' and of size 2 GiB.

Command (m for help): w
The partition table has been altered.
Calling ioctl() to re-read partition table.
Syncing disks.

root@client-3:~#
```

4. View the partition:

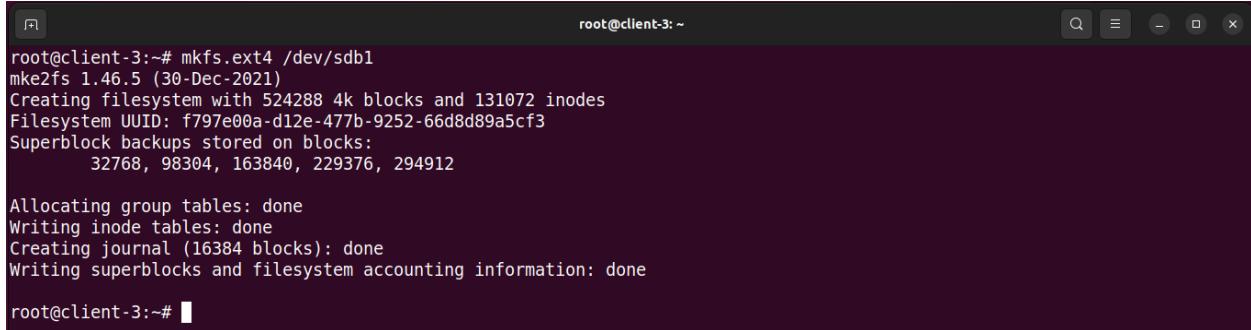
```
lsblk
```



```
root@client-3:~# lsblk
NAME   MAJ:MIN RM  SIZE RO TYPE MOUNTPOINTS
sda     8:0    0   30G  0 disk
└─sda1  8:1    0   1M  0 part
└─sda2  8:2    0  977M 0 part /boot/efi
└─sda3  8:3    0   1.9G 0 part [SWAP]
└─sda4  8:4    0  977M 0 part /boot
└─sda5  8:5    0   4.7G 0 part /home
└─sda6  8:6    0  21.5G 0 part /
sdb     8:16   0    3G  0 disk
└─sdb1  8:17   0   2G  0 part
root@client-3:~#
```

5. Format the new partition as ext4:

```
mkfs.ext4 /dev/sdb1
```



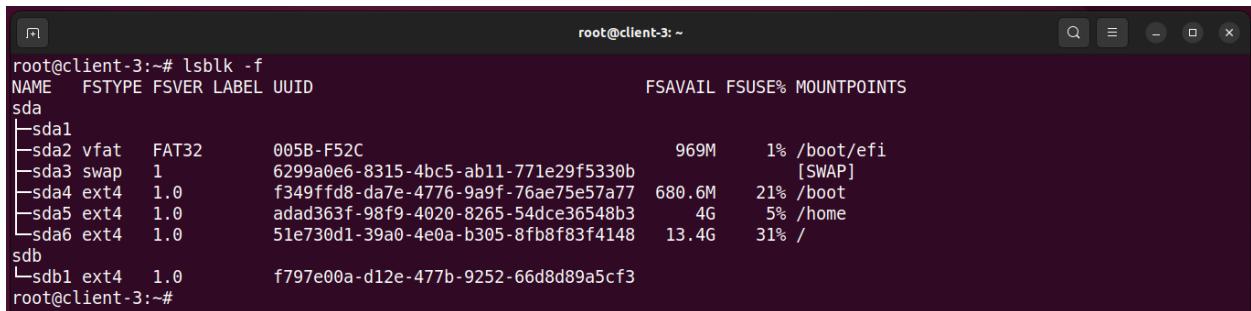
```
root@client-3:~# mkfs.ext4 /dev/sdb1
mke2fs 1.46.5 (30-Dec-2021)
Creating filesystem with 524288 4k blocks and 131072 inodes
Filesystem UUID: f797e00a-d12e-477b-9252-66d8d89a5cf3
Superblock backups stored on blocks:
    32768, 98304, 163840, 229376, 294912

Allocating group tables: done
Writing inode tables: done
Creating journal (16384 blocks): done
Writing superblocks and filesystem accounting information: done

root@client-3:~#
```

6. Confirm the file system:

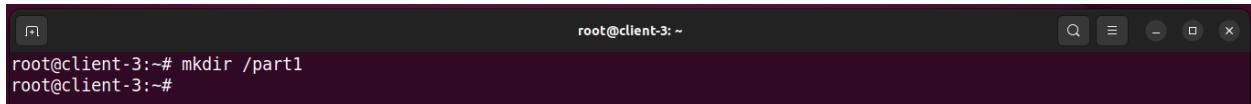
```
lsblk -f
```



```
root@client-3:~# lsblk -f
NAME   FSTYPE FSVER LABEL UUID                                     FSAVAIL FSUSE% MOUNTPOINTS
sda
└─sda1
└─sda2 vfat   1.0      005B-F52C          969M     1% /boot/efi
└─sda3 swap   1          6299a0e6-8315-4bc5-ab11-771e29f5330b [SWAP]
└─sda4 ext4   1.0      f349ffd8-da7e-4776-9a9f-76ae75e57a77  680.6M   21% /boot
└─sda5 ext4   1.0      adad363f-98f9-4020-8265-54dce36548b3      4G     5% /home
└─sda6 ext4   1.0      51e730d1-39a0-4e0a-b305-8fb8f83f4148  13.4G   31% /
sdb
└─sdb1 ext4   1.0      f797e00a-d12e-477b-9252-66d8d89a5cf3
root@client-3:~#
```

7. Create a mount point:

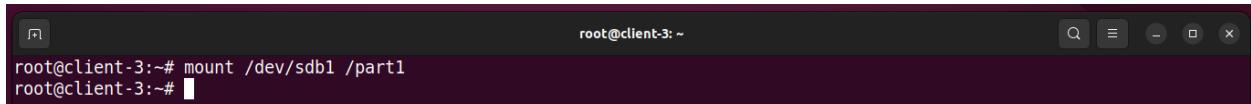
```
mkdir /part1
```



```
root@client-3:~# mkdir /part1
root@client-3:~#
```

8. Mount the partition temporarily:

```
mount /dev/sdb1 /part1
```



```
root@client-3:~# mount /dev/sdb1 /part1
root@client-3:~#
```

```

root@client-3:~# lsblk -f
NAME   FSTYPE FSVER LABEL UUID                                     FSAVAIL FSUSE% MOUNTPOINTS
sda
└─sda1
└─sda2 vfat    FAT32      005B-F52C                               969M    1% /boot/efi
└─sda3 swap     1          6299a0e6-8315-4bc5-ab11-771e29f5330b [SWAP]
└─sda4 ext4    1.0        f349ffd8-da7e-4776-9a9f-76ae75e57a77  680.6M  21% /boot
└─sda5 ext4    1.0        adad363f-98f9-4020-8265-54dce36548b3      4G    5% /home
└─sda6 ext4    1.0        51e730d1-39a0-4e0a-b305-8fb8f83f4148  13.4G  31% /
sdb
└─sdb1 ext4    1.0        f797e00a-d12e-477b-9252-66d8d89a5cf3  1.8G    0% /part1
root@client-3:~

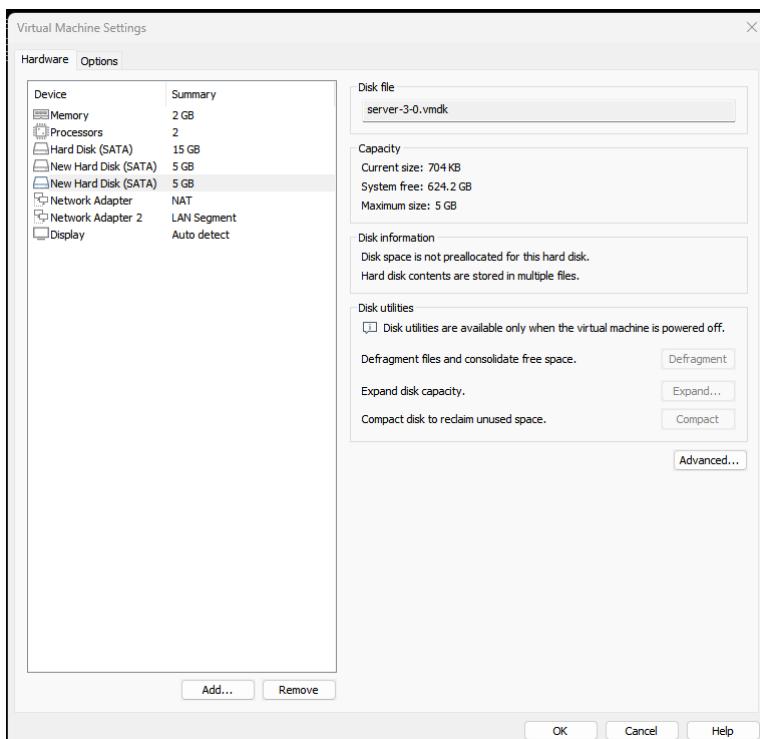
```

2.2 AlmaLinux (server-3) – Add and Configure LVM

1. Attach two new 5 GB SATA drives:

Repeat these steps **twice**:

- Right-click the VM → *Settings*
- Click *Add* → *Hard Disk*
- Select *SATA* → *Next*
- Choose *Create a new virtual disk* → *Next*
- Enter **5 GB** → **Next**
- Leave the default name → Click *Finish*



2. Install LVM tools (if not already installed):

```
dnf install lvm2
```

The screenshot shows a terminal window titled 'root@server-3 ~' running the command `dnf install lvm2`. The output indicates that the package `lvm2` is already installed. A transaction summary shows 6 packages to be upgraded, totaling 2.9 M. The user is prompted with 'Is this ok [y/N]'. The upgrade process is completed successfully, upgrading the following packages:

Package	Architecture	Version	Repository	Size
device-mapper	x86_64	9:1.02.198-2.el9	baseos	137 k
device-mapper-event	x86_64	9:1.02.198-2.el9	baseos	34 k
device-mapper-event-libs	x86_64	9:1.02.198-2.el9	baseos	31 k
device-mapper-libs	x86_64	9:1.02.198-2.el9	baseos	177 k
lvm2	x86_64	9:2.03.24-2.el9	baseos	1.5 M
lvm2-libs	x86_64	9:2.03.24-2.el9	baseos	1.0 M

Upgraded:
device-mapper-9:1.02.198-2.el9.x86_64
device-mapper-event-libs-9:1.02.198-2.el9.x86_64
lvm2-9:2.03.24-2.el9.x86_64
device-mapper-event-9:1.02.198-2.el9.x86_64
device-mapper-libs-9:1.02.198-2.el9.x86_64
lvm2-libs-9:2.03.24-2.el9.x86_64

Complete!
[root@server-3 ~]#

3. Verify the new disks:

```
lsblk
```

The screenshot shows a terminal window titled 'root@server-3 ~' running the command `lsblk`. The output lists the following disk partitions:

NAME	MAJ:MIN	RM	SIZE	RO	TYPE	MOUNTPOINTS
sda	8:0	0	15G	0	disk	
└─sda1	8:1	0	1G	0	part	/boot
└─sda2	8:2	0	1.5G	0	part	[SWAP]
└─sda3	8:3	0	12.5G	0	part	/
sdb	8:16	0	5G	0	disk	
sdc	8:32	0	5G	0	disk	

4. Create two physical volumes:

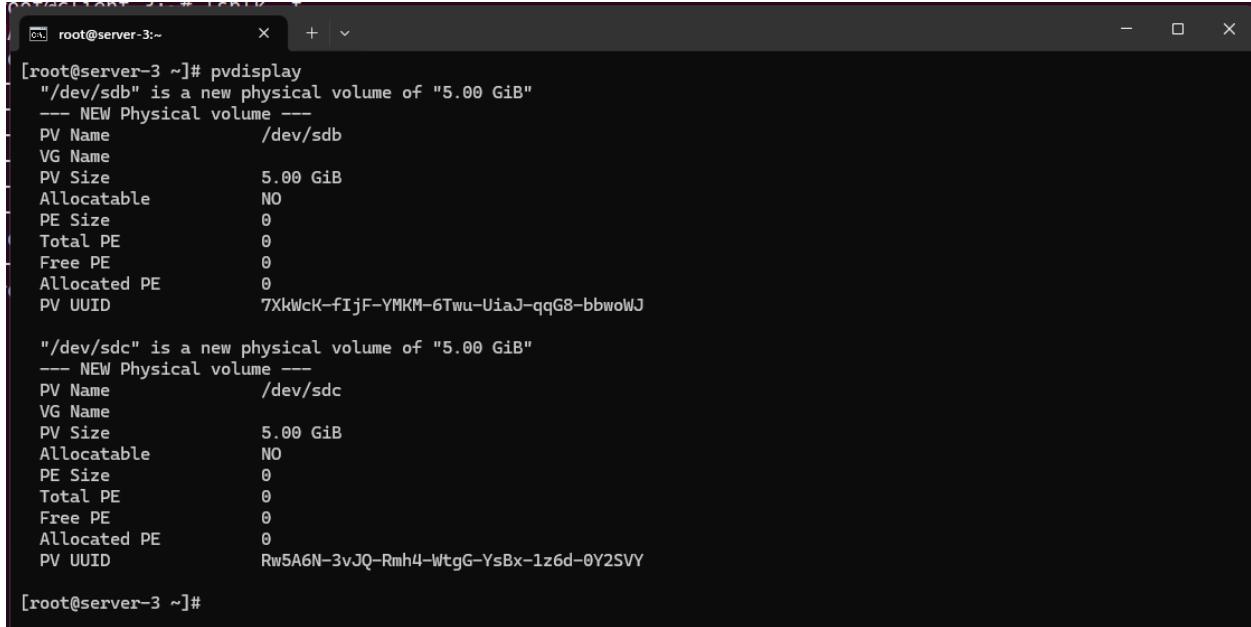
```
pvcreate /dev/sdb /dev/sdc
```

The screenshot shows a terminal window titled 'root@server-3 ~' running the command `pvcreate /dev/sdb /dev/sdc`. The output confirms the successful creation of two physical volumes:

```
[root@server-3 ~]# pvcreate /dev/sdb /dev/sdc
  Physical volume "/dev/sdb" successfully created.
  Physical volume "/dev/sdc" successfully created.
[root@server-3 ~]#
```

5. Verify physical volumes:

```
pvdisplay
```



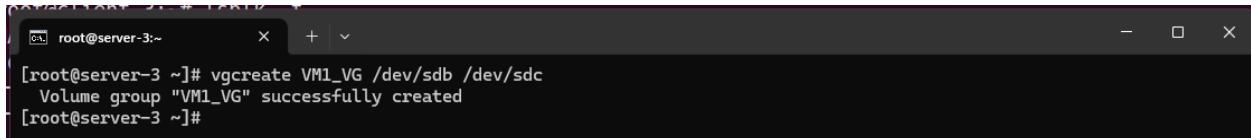
```
[root@server-3 ~]# pvdisplay
"/dev/sdb" is a new physical volume of "5.00 GiB"
--- NEW Physical volume ---
PV Name           /dev/sdb
VG Name
PV Size          5.00 GiB
Allocatable      NO
PE Size          0
Total PE         0
Free PE          0
Allocated PE     0
PV UUID          7XkWcK-fIjF-YMKM-6Twu-UiaJ-qqG8-bbw0WJ

"/dev/sdc" is a new physical volume of "5.00 GiB"
--- NEW Physical volume ---
PV Name           /dev/sdc
VG Name
PV Size          5.00 GiB
Allocatable      NO
PE Size          0
Total PE         0
Free PE          0
Allocated PE     0
PV UUID          Rw5A6N-3vJQ-Rmh4-WtgG-YsBx-1z6d-0Y2SVY

[root@server-3 ~]#
```

6. Create a volume group named VM1_VG:

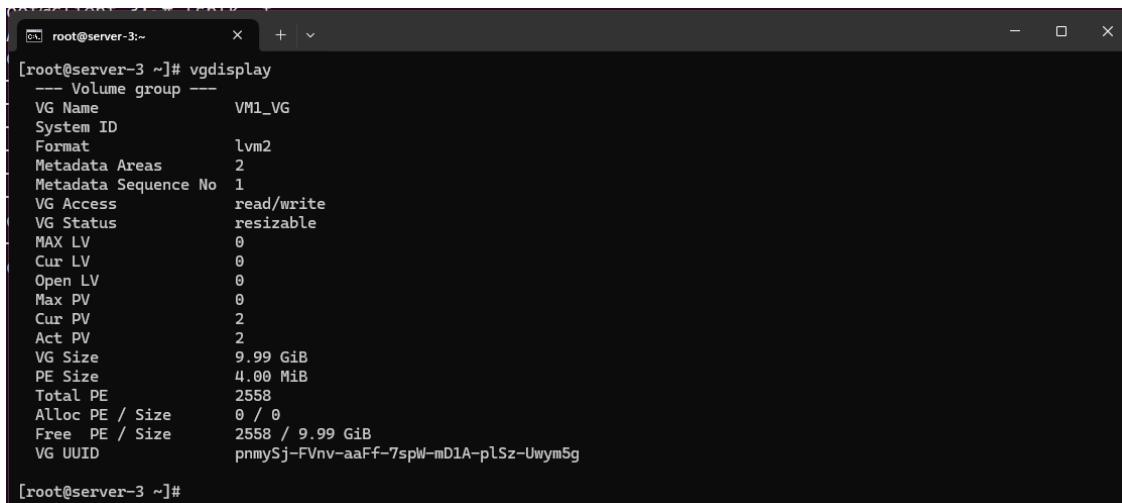
```
vgcreate VM1_VG /dev/sdb /dev/sdc
```



```
[root@server-3 ~]# vgcreate VM1_VG /dev/sdb /dev/sdc
  Volume group "VM1_VG" successfully created
[root@server-3 ~]#
```

7. Verify the volume group:

```
vgdisplay
```



```
[root@server-3 ~]# vgdisplay
--- Volume group ---
VG Name           VM1_VG
System ID
Format          lvm2
Metadata Areas   2
Metadata Sequence No 1
VG Access        read/write
VG Status        resizable
MAX LV
Cur LV
Open LV
Max PV
Cur PV
Act PV
VG Size          9.99 GiB
PE Size          4.00 MiB
Total PE         2558
Alloc PE / Size  0 / 0
Free  PE / Size  2558 / 9.99 GiB
VG UUID          pnmySj-FVnv-aaFf-7spW-mD1A-plSz-UwyM5g

[root@server-3 ~]#
```

8. Create an 8 GB logical volume named LV1:

```
lvcreate -L 8G -n LV1 VM1_VG
```

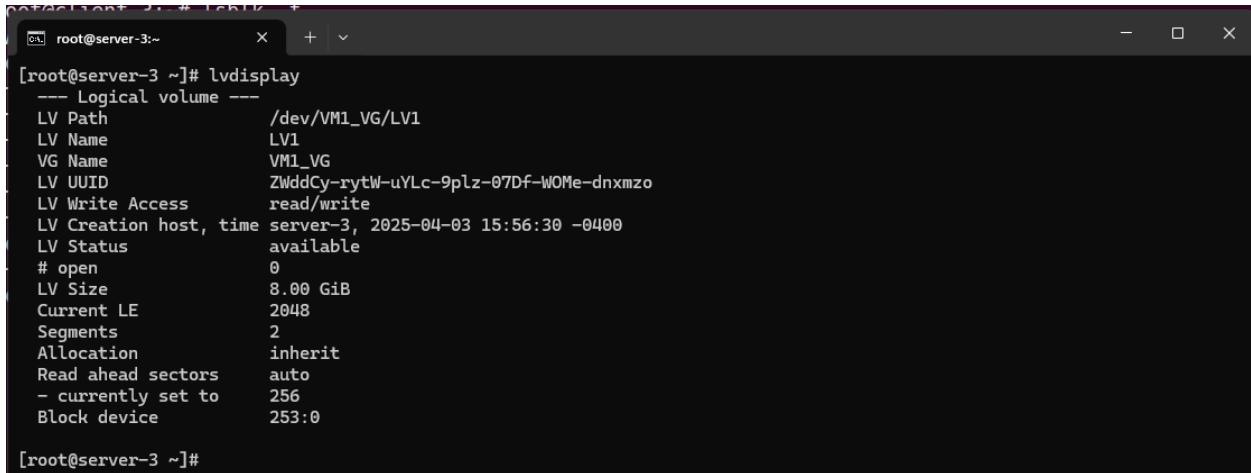


```
[root@server-3 ~]# lvcreate -L 8G -n LV1 VM1_VG
Logical volume "LV1" created.
[root@server-3 ~]#
```

A screenshot of a terminal window titled 'root@server-3:~'. It shows the command 'lvcreate -L 8G -n LV1 VM1_VG' being run and the output 'Logical volume "LV1" created.'.

9. Verify the logical volume:

```
lvdisplay
```



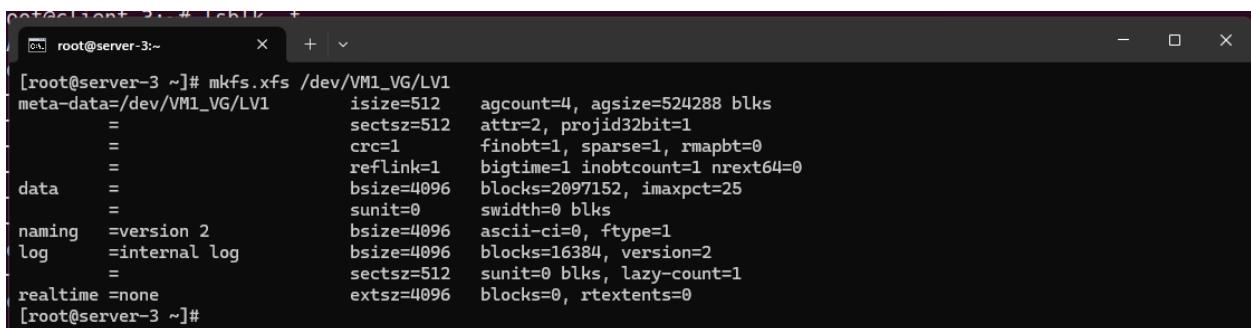
```
[root@server-3 ~]# lvdisplay
--- Logical volume ---
LV Path          /dev/VM1_VG/LV1
LV Name          LV1
VG Name          VM1_VG
LV UUID          ZWddCy-rytw-uYlc-9plz-07Df-WOMe-dnxmzo
LV Write Access  read/write
LV Creation host, time server-3, 2025-04-03 15:56:30 -0400
LV Status        available
# open           0
LV Size          8.00 GiB
Current LE       2048
Segments         2
Allocation       inherit
Read ahead sectors auto
- currently set to 256
Block device     253:0

[root@server-3 ~]#
```

A screenshot of a terminal window titled 'root@server-3:~'. It shows the command 'lvdisplay' being run, displaying detailed information about the logical volume LV1.

10. Format the logical volume as xfs:

```
mkfs.xfs /dev/VM1_VG/LV1
```

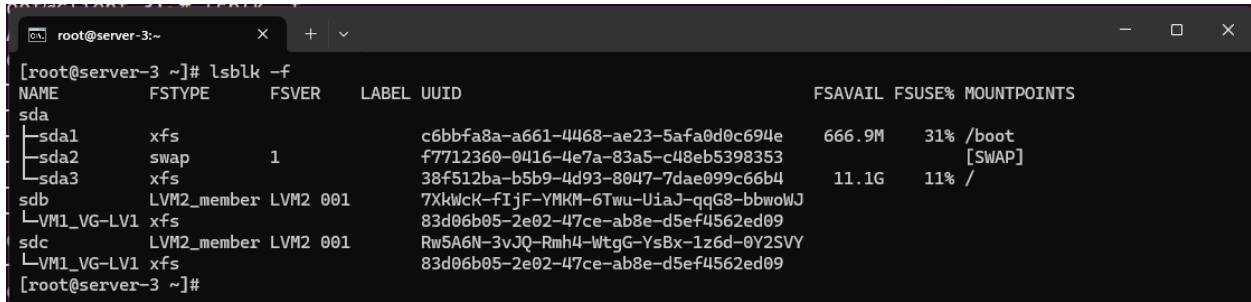


```
[root@server-3 ~]# mkfs.xfs /dev/VM1_VG/LV1
meta-data=/dev/VM1_VG/LV1 isize=512    agcount=4, agsize=524288 blks
      =                     sectsz=512  attr=2, projid32bit=1
      =                     crc=1    finobt=1, sparse=1, rmapbt=0
      =                     reflink=1 bigtime=1 inobtcount=1 nrext64=0
data  =                     bsize=4096   blocks=2097152, imaxpct=25
      =                     sunit=0    swidth=0 blks
naming =version 2          bsize=4096   ascii-ci=0, ftype=1
log   =internal log         bsize=4096   blocks=16384, version=2
      =                     sectsz=512  sunit=0 blks, lazy-count=1
realtime =none              extsz=4096   blocks=0, rtextents=0
[root@server-3 ~]#
```

A screenshot of a terminal window titled 'root@server-3:~'. It shows the command 'mkfs.xfs /dev/VM1_VG/LV1' being run, with the output showing XFS file system parameters like block size, allocation group count, and file system version.

11. Confirm the file system:

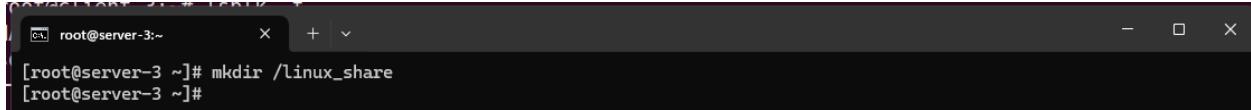
```
lsblk -f
```



```
[root@server-3 ~]# lsblk -f
NAME      FSTYPE   FSVER LABEL UUID                                     FSAVAIL FSUSE% MOUNTPOINTS
sda
└─sda1      xfs          1             c6bbfa8a-a661-4468-ae23-5afa0d0c694e    666.9M   31% /boot
└─sda2      swap         1             f7712360-0416-4e7a-83a5-c48eb5398353           [SWAP]
└─sda3      xfs          1             38f512ba-b5b9-4d93-8047-7dae099c66b4    11.1G   11% /
sdb      LVM2_member   LVM2 001             7XkWcK-fIjF-YMKM-6Twu-UiaJ-qqG8-bbw0WJ
└─VM1_VG-LV1 xfs          1             83d06b05-2e02-47ce-ab8e-d5ef4562ed09
sdc      LVM2_member   LVM2 001             Rw5A6N-3vJQ-Rmh4-WtgG-YsBx-1z6d-0Y2SVY
└─VM1_VG-LV1 xfs          1             83d06b05-2e02-47ce-ab8e-d5ef4562ed09
[root@server-3 ~]#
```

12. Create a mount point:

```
mkdir /linux_share
```



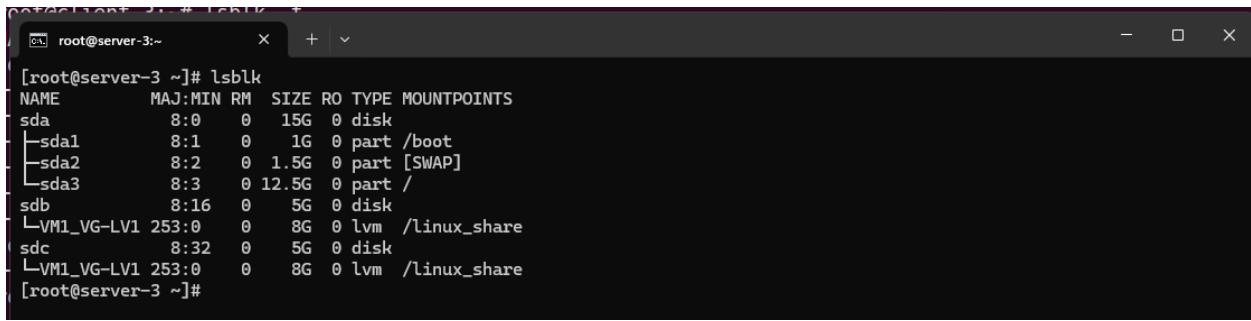
```
[root@server-3 ~]# mkdir /linux_share
[root@server-3 ~]#
```

13. Mount the logical volume temporarily:

```
mount /dev/VM1_VG/LV1 /linux_share
```



```
[root@server-3 ~]# mount /dev/VM1_VG/LV1 /linux_share/
[root@server-3 ~]#
```



```
[root@server-3 ~]# lsblk
NAME      MAJ:MIN RM  SIZE RO TYPE MOUNTPOINTS
sda       8:0     0   15G  0 disk
└─sda1     8:1     0    1G  0 part /boot
└─sda2     8:2     0  1.5G  0 part [SWAP]
└─sda3     8:3     0 12.5G  0 part /
sdb       8:16    0    5G  0 disk
└─VM1_VG-LV1 253:0  0    8G  0 lvm  /linux_share
sdc       8:32    0    5G  0 disk
└─VM1_VG-LV1 253:0  0    8G  0 lvm  /linux_share
[root@server-3 ~]#
```

3- USERS/GROUPS AND PERMISSIONS

3.1 AlmaLinux (server-3) – Create Groups and Users

1. Create the admins and employees groups

```
groupadd -g 4000 admins
```

```
groupadd -g 5000 employees
```

```
[root@server-3 ~]# groupadd -g 4000 admins
[root@server-3 ~]# groupadd -g 5000 employees
[root@server-3 ~]#
```



```
[root@server-3 ~]# cat /etc/group
root:x:0:

```



```
admins:x:4000:
employees:x:5000:
[root@server-3 ~]#
```

2. Create users and assign to their primary groups:

- Create user admin1 (UID 2001) with admins as the primary group:

```
useradd -u 2001 -g admins admin1
```

```
[root@server-3 ~]# useradd -u 2001 -g admins admin1
[root@server-3 ~]#
```

- Create user employee1 (UID 2002) with employees as the primary group:

```
useradd -u 2002 -g employees employee1
```

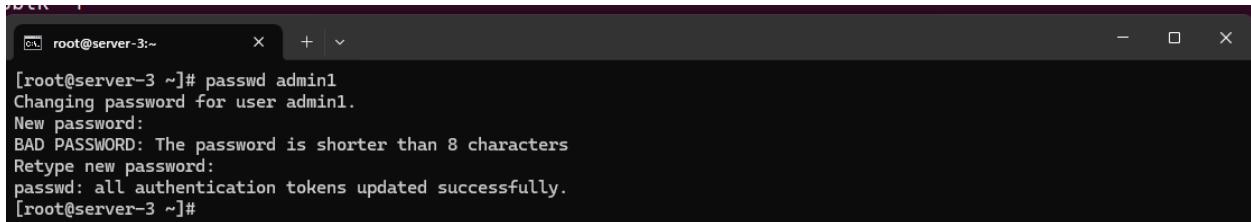
```
[root@server-3 ~]# useradd -u 2002 -g employees employee1
[root@server-3 ~]#
```

```
[root@server-3 ~]# ll /home
total 0
drwx----- 2 admin1    admins   62 Apr  3 16:26 admin1
drwx----- 2 employee1 employees 62 Apr  3 16:26 employee1
[root@server-3 ~]#
```

3. Set the password for both users to "alma":

```
passwd admin1
```

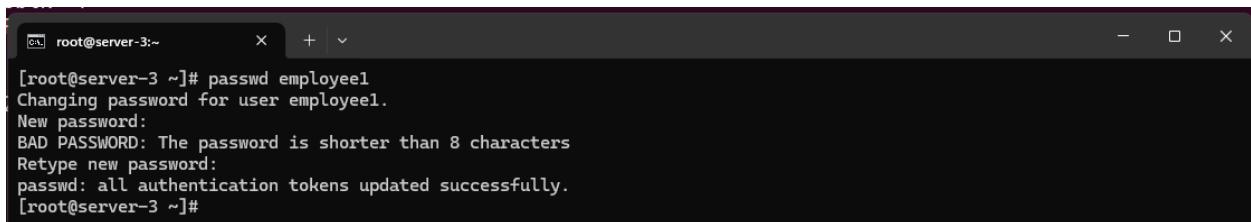
Enter: **alma**



```
[root@server-3 ~]# passwd admin1
Changing password for user admin1.
New password:
BAD PASSWORD: The password is shorter than 8 characters
Retype new password:
passwd: all authentication tokens updated successfully.
[root@server-3 ~]#
```

```
passwd employee1
```

Enter: **alma**



```
[root@server-3 ~]# passwd employee1
Changing password for user employee1.
New password:
BAD PASSWORD: The password is shorter than 8 characters
Retype new password:
passwd: all authentication tokens updated successfully.
[root@server-3 ~]#
```

3.2 AlmaLinux (server-3) – Create and Assign Directory Permissions

4. Create the admins subdirectory under /linux_share:

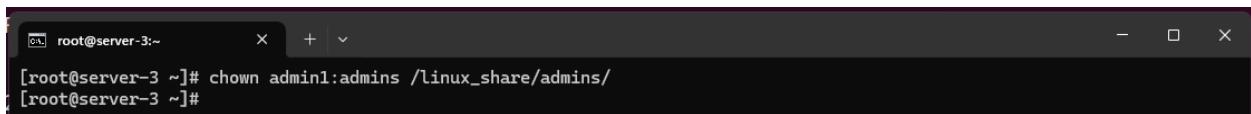
```
mkdir -p /linux_share/admins
```



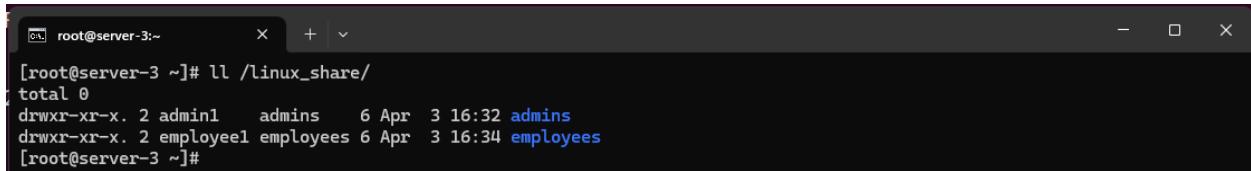
```
[root@server-3 ~]# mkdir -p /linux_share/admins
[root@server-3 ~]#
```

5. Assign ownership to admin1 and admins group:

```
chown admin1:admins /linux_share/admins
```



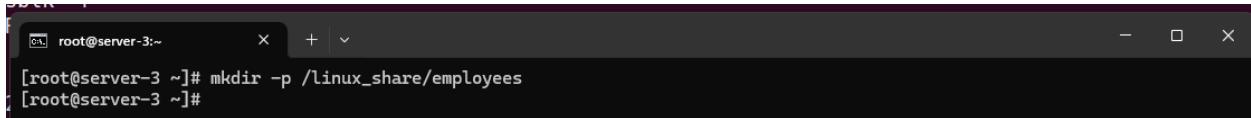
```
[root@server-3 ~]# chown admin1:admins /linux_share/admins/
[root@server-3 ~]#
```



```
[root@server-3 ~]# ll /linux_share/
total 0
drwxr-xr-x. 2 admin1    admins   6 Apr  3 16:32 admins
drwxr-xr-x. 2 employee1 employees 6 Apr  3 16:34 employees
[root@server-3 ~]#
```

6. Create the employees subdirectory under /linux_share:

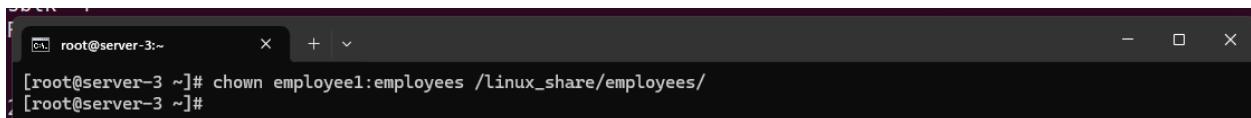
```
mkdir -p /linux_share/employees
```



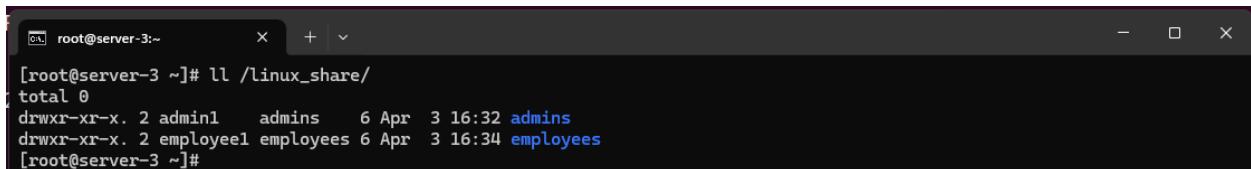
```
[root@server-3 ~]# mkdir -p /linux_share/employees
[root@server-3 ~]#
```

7. Assign ownership to employee1 and employees group:

```
chown employee1:employees /linux_share/employees
```



```
[root@server-3 ~]# chown employee1:employees /linux_share/employees/
[root@server-3 ~]#
```



```
[root@server-3 ~]# ll /linux_share/
total 0
drwxr-xr-x. 2 admin1    admins   6 Apr  3 16:32 admins
drwxr-xr-x. 2 employee1 employees 6 Apr  3 16:34 employees
[root@server-3 ~]#
```

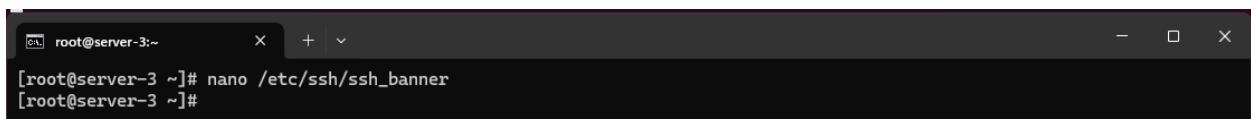
PART 2 – LINUX SERVICES

1- SSH Configuration

1.1 AlmaLinux (server-3) – Create SSH Banner and Configure Access

1. Create a welcome banner file:

```
nano /etc/ssh/ssh_banner
```

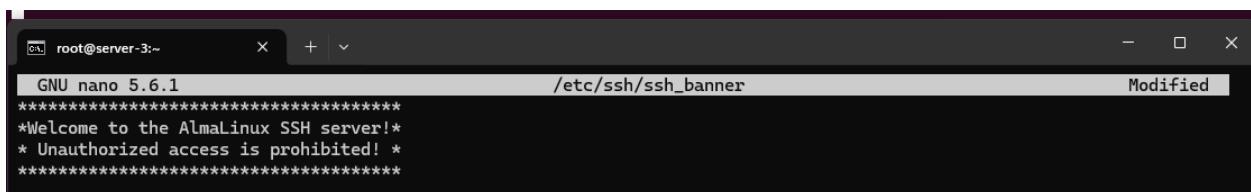


```
[root@server-3 ~]# nano /etc/ssh/ssh_banner
[root@server-3 ~]#
```

Enter the following text:

```
* Welcome to the AlmaLinux SSH Server! *
```

```
* Unauthorized access is prohibited! *
```

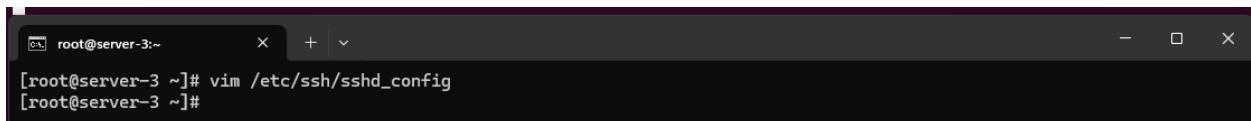


```
GNU nano 5.6.1                               /etc/ssh/ssh_banner                         Modified
*****
*Welcome to the AlmaLinux SSH server!*
* Unauthorized access is prohibited! *
*****
```

Save and exit.

2. Edit the SSH configuration file:

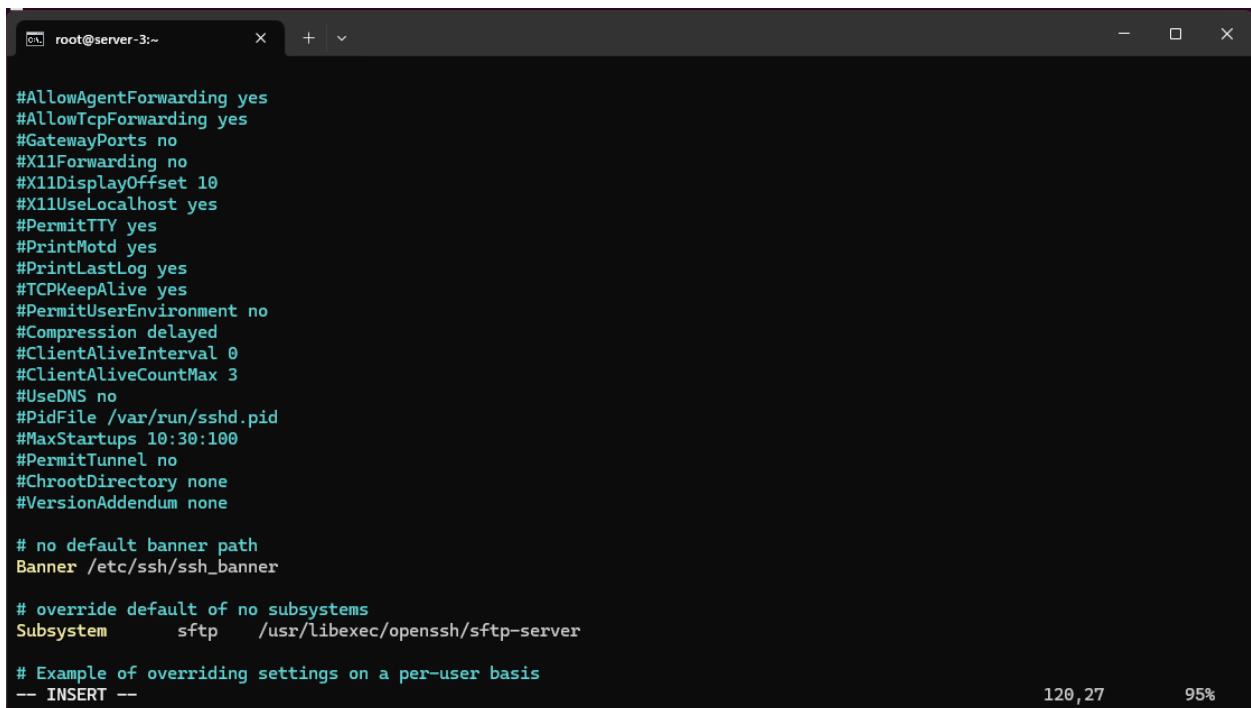
```
vim /etc/ssh/sshd_config
```



```
[root@server-3 ~]# vim /etc/ssh/sshd_config
[root@server-3 ~]#
```

3. Find or add the following line:

```
Banner /etc/ssh/ssh_banner
```



```
#AllowAgentForwarding yes
#AllowTcpForwarding yes
#GatewayPorts no
#X11Forwarding no
#X11DisplayOffset 10
#X11UseLocalhost yes
#PermitTTY yes
#PrintMotd yes
#PrintLastLog yes
#TCPKeepAlive yes
#PermitUserEnvironment no
#Compression delayed
#ClientAliveInterval 0
#ClientAliveCountMax 3
#UseDNS no
#PidFile /var/run/sshd.pid
#MaxStartups 10:30:100
#PermitTunnel no
#ChrootDirectory none
#VersionAddendum none

# no default banner path
Banner /etc/ssh/ssh_banner

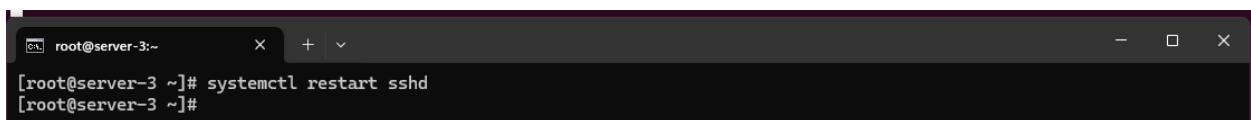
# override default of no subsystems
Subsystem sftp /usr/libexec/openssh/sftp-server

# Example of overriding settings on a per-user basis
-- INSERT --
```

120,27 95%

4. Restart the SSH service:

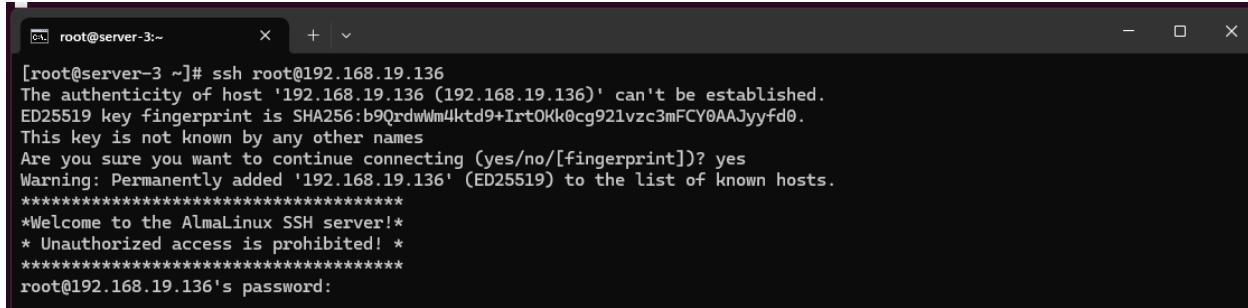
```
systemctl restart sshd
```



```
[root@server-3 ~]# systemctl restart sshd
[root@server-3 ~]#
```

5. Test the banner display:

```
ssh root@192.168.19.136
```



```
[root@server-3 ~]# ssh root@192.168.19.136
The authenticity of host '192.168.19.136 (192.168.19.136)' can't be established.
ED25519 key fingerprint is SHA256:b9QrdwWm4ktd9+IrtOKk0cg921vzc3mFCY0AAJyyfd0.
This key is not known by any other names
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '192.168.19.136' (ED25519) to the list of known hosts.
*****Welcome to the AlmaLinux SSH server!*****
* Unauthorized access is prohibited! *
*****
root@192.168.19.136's password:
```

1.2 AlmaLinux (server-3) – Allow and Deny Group Access

6. Edit the SSH configuration file:

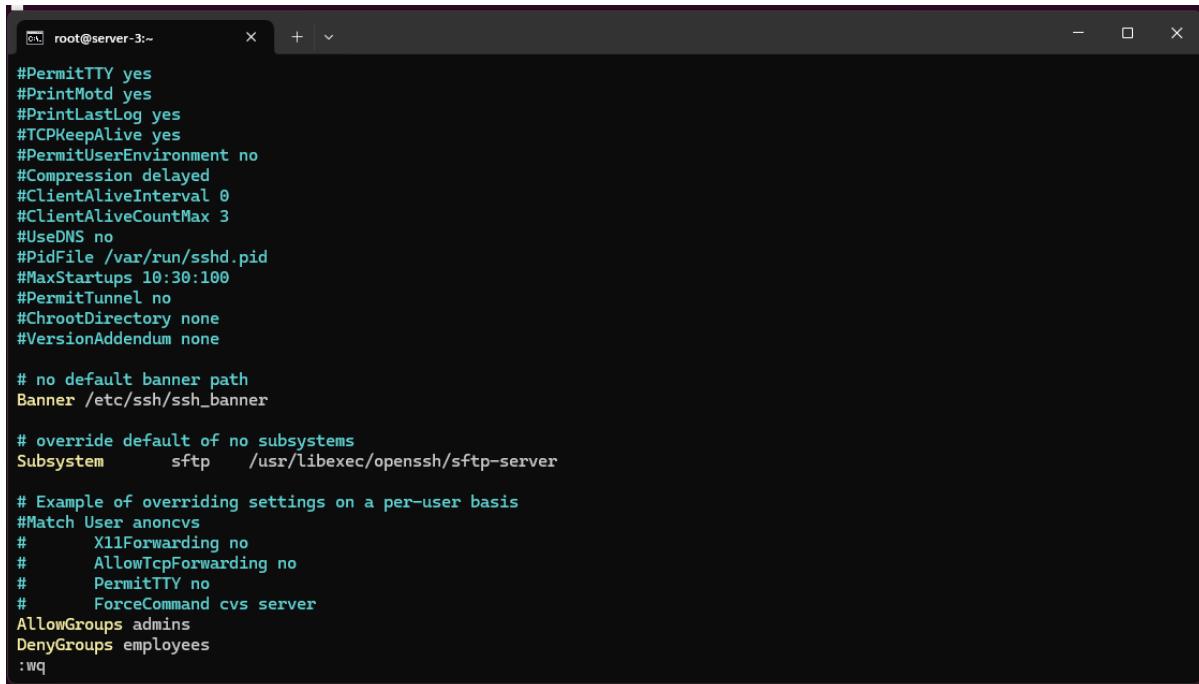
```
vim /etc/ssh/sshd_config
```



```
[root@server-3 ~]# vim /etc/ssh/sshd_config
[root@server-3 ~]#
```

7. Add the following lines at the end of the file:

```
AllowGroups admins
DenyGroups employees
```



```
#PermitTTY yes
#PrintMotd yes
#PrintLastLog yes
#TCPKeepAlive yes
#PermitUserEnvironment no
#Compression delayed
#ClientAliveInterval 0
#ClientAliveCountMax 3
#UseDNS no
#PidFile /var/run/sshd.pid
#MaxStartups 10:30:100
#PermitTunnel no
#ChrootDirectory none
#VersionAddendum none

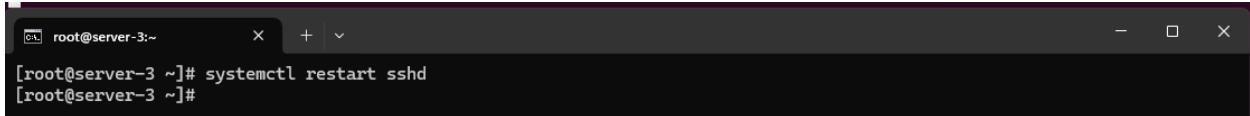
# no default banner path
Banner /etc/ssh/ssh_banner

# override default of no subsystems
Subsystem    sftp    /usr/libexec/openssh/sftp-server

# Example of overriding settings on a per-user basis
#Match User anoncvs
#    X11Forwarding no
#    AllowTcpForwarding no
#    PermitTTY no
#    ForceCommand cvs server
AllowGroups admins
DenyGroups employees
:wq
```

8. Restart the SSH service to apply changes:

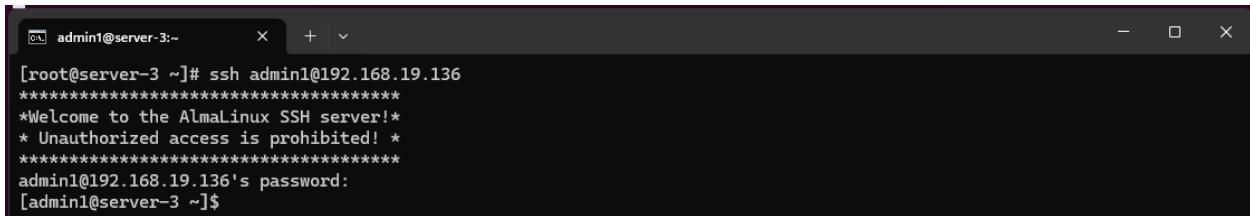
```
systemctl restart sshd
```



```
[root@server-3 ~]# systemctl restart sshd
[root@server-3 ~]#
```

9. Test group-based SSH access:

- SSH as *admin1* → should be allowed → ssh admin1@192.168.19.136



```
[root@server-3 ~]# ssh admin1@192.168.19.136
*****Welcome to the AlmaLinux SSH server!*****
* Unauthorized access is prohibited! *
*****admin1@192.168.19.136's password:
[admin1@server-3 ~]$
```

- SSH as *employee1* → should be denied → ssh employee1@192.168.19.136

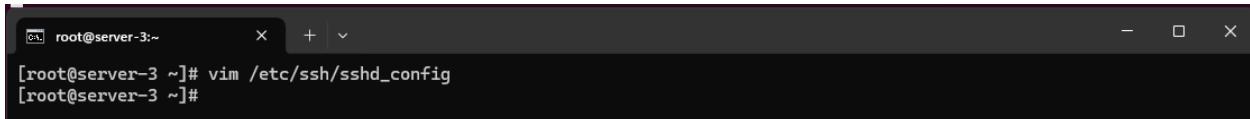


```
[root@server-3 ~]# ssh employee1@192.168.19.136
*****Welcome to the AlmaLinux SSH server!*****
* Unauthorized access is prohibited! *
*****employee1@192.168.19.136's password:
Permission denied, please try again.
employee1@192.168.19.136's password:
Permission denied, please try again.
employee1@192.168.19.136's password:
employee1@192.168.19.136: Permission denied (publickey,gssapi-keyex,gssapi-with-mic,password).
[root@server-3 ~]#
```

1.3 AlmaLinux (server-3) – Confirm Root SSH Access

10. Edit the SSH configuration file:

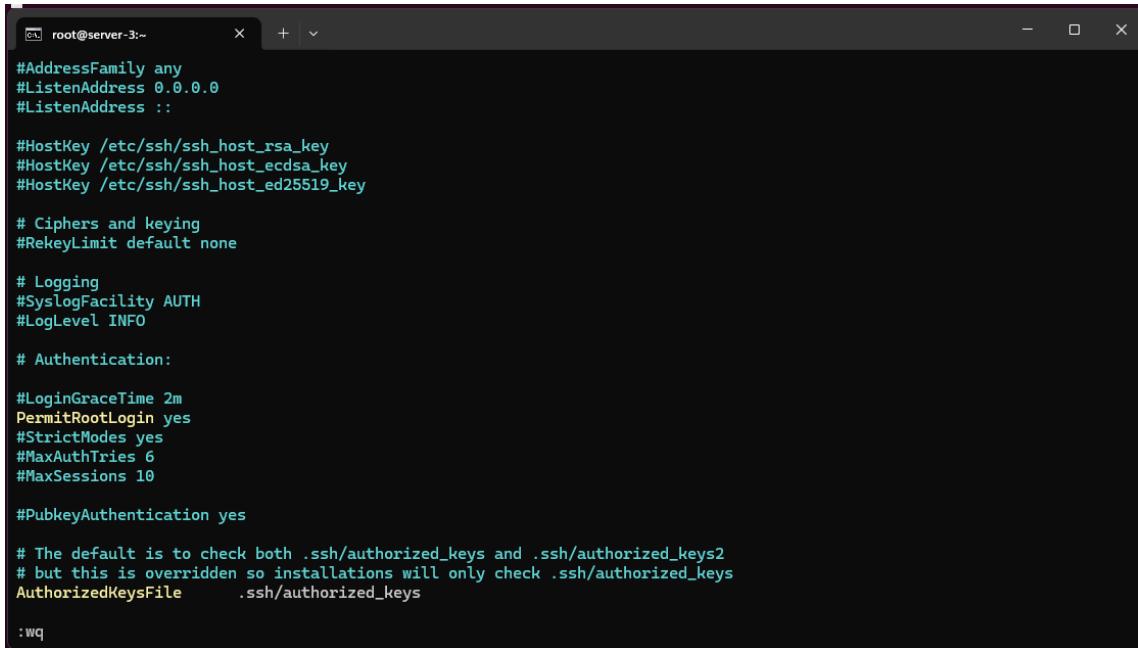
```
vim /etc/ssh/sshd_config
```



```
[root@server-3 ~]# vim /etc/ssh/sshd_config
[root@server-3 ~]#
```

11. Ensure the following line is present and not commented out:

PermitRootLogin yes



```
#AddressFamily any
#ListenAddress 0.0.0.0
#ListenAddress ::

#HostKey /etc/ssh/ssh_host_rsa_key
#HostKey /etc/ssh/ssh_host_ecdsa_key
#HostKey /etc/ssh/ssh_host_ed25519_key

# Ciphers and keying
#RekeyLimit default none

# Logging
#SyslogFacility AUTH
#LogLevel INFO

# Authentication:

#LoginGraceTime 2m
PermitRootLogin yes
#StrictModes yes
#MaxAuthTries 6
#MaxSessions 10

#PubkeyAuthentication yes

# The default is to check both .ssh/authorized_keys and .ssh/authorized_keys2
# but this is overridden so installations will only check .ssh/authorized_keys
AuthorizedKeysFile      .ssh/authorized_keys

:wq
```

Make sure root is inside the admin group



```
[root@server-3 ~]# usermod -aG admins root
[root@server-3 ~]#
```

12. Restart the SSH service to apply changes:

systemctl restart sshd



```
[root@server-3 ~]# systemctl restart sshd
[root@server-3 ~]#
```

13. Test root login from Ubuntu:

ssh root@192.168.19.136



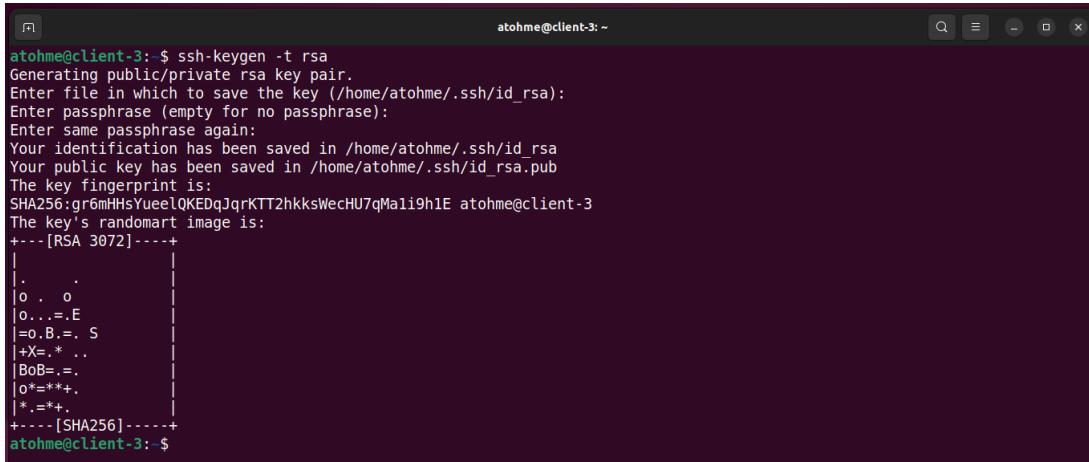
```
atohme@client-3:~$ ssh root@192.168.19.136
*****
*Welcome to the AlmaLinux SSH server!*
* Unauthorized access is prohibited! *
*****
root@192.168.19.136's password:
Last Login: Thu Apr  3 17:48:51 2025 from 192.168.20.20
[root@server-3 ~]#
```

1.4 Ubuntu (client-3) – SSH Key Authentication

14. Generate an SSH key pair:

```
ssh-keygen -t rsa
```

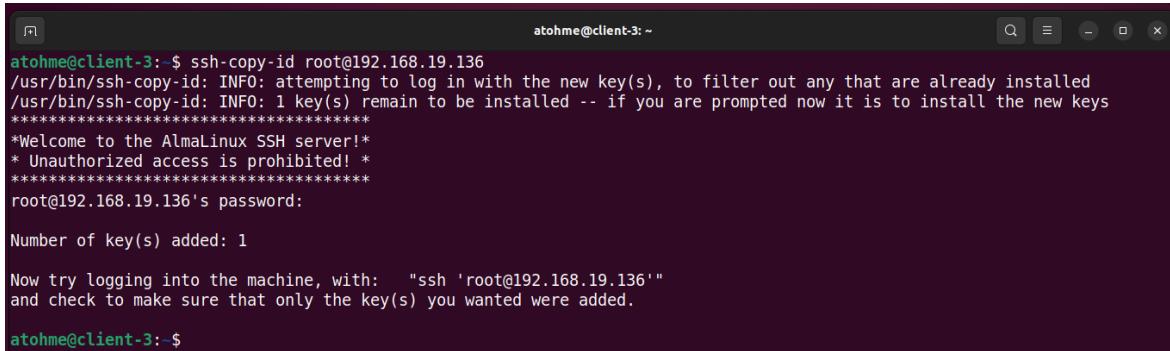
Press Enter through the prompts to accept default values.



```
atohme@client-3:~$ ssh-keygen -t rsa
Generating public/private rsa key pair.
Enter file in which to save the key (/home/atohme/.ssh/id_rsa):
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /home/atohme/.ssh/id_rsa
Your public key has been saved in /home/atohme/.ssh/id_rsa.pub
The key fingerprint is:
SHA256:gr6mHhsYueelQKEQJqrKTT2hkksWeCHU7qMali9h1E atohme@client-3
The key's randomart image is:
+---[RSA 3072]----+
| . .
|o . o |
|o...=..E |
|=o.B.=. S |
|+X.* .. |
|BoB=.=. |
|o*+**+. |
|*.=*+ |
+---[SHA256]----+
atohme@client-3:~$
```

15. Copy the public key to the AlmaLinux server (root account):

```
ssh-copy-id root@192.168.19.136
```



```
atohme@client-3:~$ ssh-copy-id root@192.168.19.136
/usr/bin/ssh-copy-id: INFO: attempting to log in with the new key(s), to filter out any that are already installed
/usr/bin/ssh-copy-id: INFO: 1 key(s) remain to be installed -- if you are prompted now it is to install the new keys
*****
*Welcome to the AlmaLinux SSH server!*
* Unauthorized access is prohibited! *
*****
root@192.168.19.136's password:

Number of key(s) added: 1

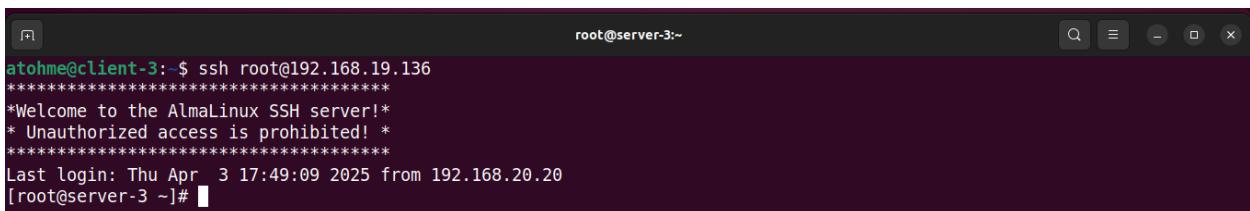
Now try logging into the machine, with:  "ssh 'root@192.168.19.136'"
and check to make sure that only the key(s) you wanted were added.

atohme@client-3:~$
```

16. Test passwordless login:

```
ssh root@192.168.19.136
```

You should now be logged in without being asked for a password, as SSH is using your public key.



```
atohme@client-3:~$ ssh root@192.168.19.136
*****
*Welcome to the AlmaLinux SSH server!*
* Unauthorized access is prohibited! *
*****
Last login: Thu Apr  3 17:49:09 2025 from 192.168.20.20
[root@server-3 ~]#
```

2 - NFS Configuration

2.1 AlmaLinux (server-3) – Set Up NFS Server and Firewall Rules

1. Install the NFS package:

```
dnf install -y nfs-utils
```

```
[root@server-3 ~]# dnf install -y nfs-utils
Last metadata expiration check: 0:07:24 ago on Thu Apr  3 18:16:58 2025.
Dependencies resolved.
=====
Package          Architecture Version       Repository  Size
=====
Installing:
nfs-utils        x86_64      1:2.5.4-27.el9   baseos     431 k
Upgrading:
libsss_certmap  x86_64      2.9.5-4.el9_5.4  baseos     89 k
libsss_idmap    x86_64      2.9.5-4.el9_5.4  baseos     40 k
libsss_ns_idmap x86_64      2.9.5-4.el9_5.4  baseos     44 k
libsss_sudo     x86_64      2.9.5-4.el9_5.4  baseos     34 k
libtevent       x86_64      0.16.1-1.el9   baseos     47 k
sssd-client     x86_64      2.9.5-4.el9_5.4  baseos     159 k
sssd-common    x86_64      2.9.5-4.el9_5.4  baseos     1.6 M
sssd-kcm        x86_64      2.9.5-4.el9_5.4  baseos     108 k
Installing dependencies:
=====
Upgraded:
libsss_certmap-2.9.5-4.el9_5.4.x86_64 libsss_idmap-2.9.5-4.el9_5.4.x86_64 libsss_nss_idmap-2.9.5-4.el9_5.4.x86_64
libsss_sudo-2.9.5-4.el9_5.4.x86_64 libtevent-0.16.1-1.el9.x86_64 sssd-client-2.9.5-4.el9_5.4.x86_64
sssd-common-2.9.5-4.el9_5.4.x86_64 sssd-kcm-2.9.5-4.el9_5.4.x86_64
Installed:
gssproxy-0.8.4-7.el9.x86_64      keyutils-1.6.3-1.el9.x86_64      libev-4.33-5.el9.x86_64
libnfsidmap-1:2.5.4-27.el9.x86_64 libtirpc-1.3.3-9.el9.x86_64      libverto-libev-0.3.2-3.el9.x86_64
nfs-utils-1:2.5.4-27.el9.noarch   python3-pyyaml-5.4.1-6.el9.x86_64 quota-1:4.09-2.el9.x86_64
quota-nls-1:4.09-2.el9.noarch    rpcbind-1.2.6-7.el9.x86_64      sssd-nfs-idmap-2.9.5-4.el9_5.4.x86_64
Complete!
[root@server-3 ~]#
```

2. Start and enable the NFS server service:

```
systemctl enable --now nfs-server
```

```
systemctl status nfs-server
```

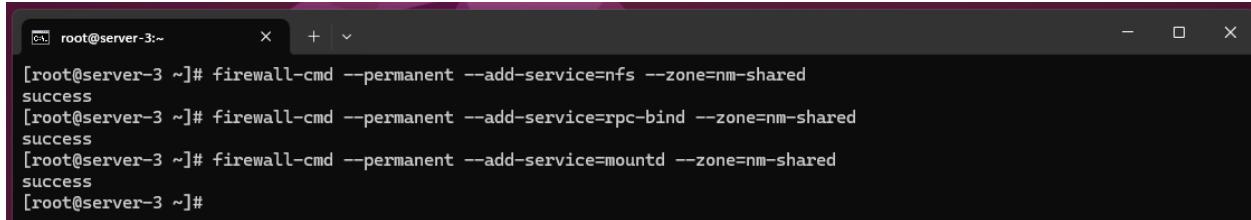
```
[root@server-3 ~]# systemctl enable --now nfs-server
Created symlink /etc/systemd/system/multi-user.target.wants/nfs-server.service → /usr/lib/systemd/system/nfs-server.service.
[root@server-3 ~]#
```

```
[root@server-3 ~]# systemctl status nfs-server
● nfs-server.service - NFS server and services
  Loaded: loaded (/usr/lib/systemd/system/nfs-server.service; enabled; preset: disabled)
  Active: active (exited) since Thu 2025-04-03 18:25:38 EDT; 26s ago
    Docs: man:rpc.nfsd(8)
          man:exportfs(8)
  Process: 14452 ExecStartPre=/usr/sbin/exportfs -r (code=exited, status=0/SUCCESS)
  Process: 14453 ExecStart=/usr/sbin/rpc.nfsd (code=exited, status=0/SUCCESS)
  Process: 14472 ExecStart=/bin/sh -c if systemctl -q is-active gssproxy; then systemctl reload gssproxy ; fi (code=exited, status=0/SUCCESS)
 Main PID: 14472 (code=exited, status=0/SUCCESS)
    CPU: 70ms

Apr 03 18:25:37 server-3 systemd[1]: Starting NFS server and services...
Apr 03 18:25:38 server-3 systemd[1]: Finished NFS server and services.
[lines 1-13/13 (END)]
```

3. Open required NFS-related services in the firewall for the nm-shared zone:

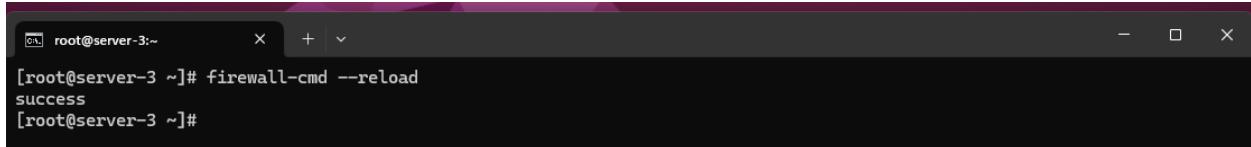
```
firewall-cmd --permanent --add-service=nfs --zone=nm-shared  
firewall-cmd --permanent --add-service=rpc-bind --zone=nm-shared  
firewall-cmd --permanent --add-service=mountd --zone=nm-shared
```



```
[root@server-3 ~]# firewall-cmd --permanent --add-service=nfs --zone=nm-shared  
success  
[root@server-3 ~]# firewall-cmd --permanent --add-service=rpc-bind --zone=nm-shared  
success  
[root@server-3 ~]# firewall-cmd --permanent --add-service=mountd --zone=nm-shared  
success  
[root@server-3 ~]#
```

4. Reload the firewall to apply changes:

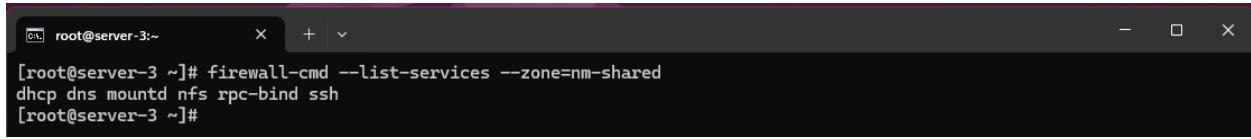
```
firewall-cmd --reload
```



```
[root@server-3 ~]# firewall-cmd --reload  
success  
[root@server-3 ~]#
```

5. Verify enabled services in the nm-shared zone:

```
firewall-cmd --list-services --zone=nm-shared
```

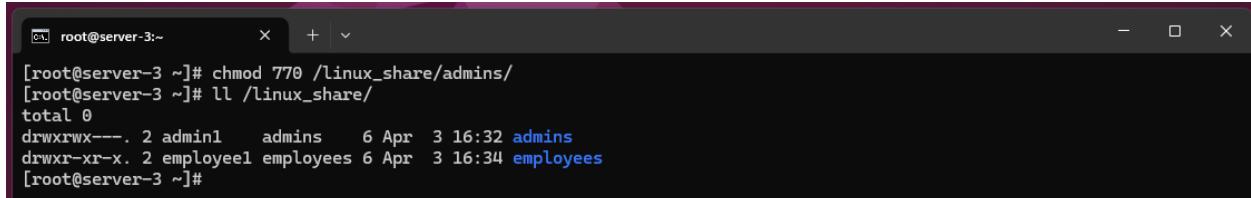


```
[root@server-3 ~]# firewall-cmd --list-services --zone=nm-shared  
dhcp dns mountd nfs rpc-bind ssh  
[root@server-3 ~]#
```

2.2 AlmaLinux (server-3) – Configure NFS Share for Admins

6. Set correct permissions on the admins directory:

```
chmod 770 /linux_share/admins
```



```
[root@server-3 ~]# chmod 770 /linux_share/admins/  
[root@server-3 ~]# ll /linux_share/  
total 0  
drwxrwx---. 2 admin1 admins 6 Apr 3 16:32 admins  
drwxr-xr-x. 2 employee1 employees 6 Apr 3 16:34 employees  
[root@server-3 ~]#
```

7. Configure the share in the exports file:

vim /etc/exports

```
[root@server-3 ~]# vim /etc/exports  
[root@server-3 ~]#
```

Add the following line:

/linux_share/admins 192.168.20.0/24(rw,sync,no_all_squash)

```
root@server-3:~# /linux_share/admins 192.168.20.0/24 rw, sync, no_all_squash
~
~
```

8. Export the NFS file system:

`exportfs -arv`

```
[root@server-3 ~]# exportfs -arv
exporting 192.168.20.0/24:/linux_share/admins
[root@server-3 ~]#
```

9. Verify current exports and access permissions:

`exportfs -s`

```
[root@server-3 ~]# exportfs -s  
/linux_share/admins 192.168.20.0/24(sync,wdelay,hide,no_subtree_check,sec=sys,rw,secure,root_squash,no_all_squash)  
[root@server-3 ~]#
```

2.3 AlmaLinux (server-3) – Configure NFS Share for Employees

10. Set correct permissions on the employees directory:

```
chmod 750 /linux_share/employees
```

```
[root@server-3 ~]# chmod 750 /linux_share/employees/
[root@server-3 ~]# ll /linux_share/
total 0
drwxrwx---. 2 admin1    admins   6 Apr  3 16:32 admins
drwxr-x---. 2 employee1 employees 6 Apr  3 16:34 employees
[root@server-3 ~]#
```

11. Configure the share in the exports file:

vim /etc/exports

```
[root@server-3 ~]# vim /etc/exports  
[root@server-3 ~]#
```

Add the following line:

/linux_share/employees 192.168.20.0/24(ro,sync,no_all_squash)

12. Export the NFS file system:

`exportfs -ary`

```
[root@server-3 ~]# exportfs -arv
exporting 192.168.20.0/24:/linux_share/employees
exporting 192.168.20.0/24:/linux_share/admins
[root@server-3 ~]#
```

3 - SAMBA Configuration

3.1 AlmaLinux (server-3) – Set Up and Configure a Public SAMBA Share

1. Create the /public directory and set permissions:

```
mkdir -p /public  
chmod -R 777 /public  
chown -R nobody:nobody /public
```

```
[root@server-3 ~]# mkdir -p /public  
[root@server-3 ~]# chmod -R 777 /public  
[root@server-3 ~]# chown -R nobody:nobody /public  
[root@server-3 ~]# ll /  
total 24  
dr-xr-xr-x. 2 root root 6 Mar 25 2022 afs  
lrwxrwxrwx. 1 root root 7 Mar 25 2022 bin -> usr/bin  
dr-xr-xr-x. 5 root root 4096 Feb 7 2024 boot  
drwxr-xr-x. 19 root root 3200 Apr 3 15:56 dev  
drwxr-xr-x. 82 root root 8192 Apr 3 18:35 etc  
drwxr-xr-x. 4 root root 37 Apr 3 16:26 home  
lrwxrwxrwx. 1 root root 7 Mar 25 2022 lib -> usr/lib  
lrwxrwxrwx. 1 root root 9 Mar 25 2022 lib64 -> usr/lib64  
drwxr-xr-x. 4 root root 37 Apr 3 16:34 linux_share  
drwxr-xr-x. 2 root root 6 Mar 25 2022 media  
drwxr-xr-x. 2 root root 6 Mar 25 2022 mnt  
drwxr-xr-x. 2 root root 6 Mar 25 2022 opt  
dr-xr-xr-x. 290 root root 0 Apr 3 14:13 proc  
drwxrwxrwx. 2 nobody nobody 6 Apr 3 18:58 public  
dr-xr-x---. 3 root root 179 Apr 3 18:35 root  
drwxr-xr-x. 28 root root 900 Apr 3 18:25 run  
lrwxrwxrwx. 1 root root 8 Mar 25 2022 sbin -> usr/sbin  
drwxr-xr-x. 2 root root 6 Mar 25 2022 srv  
dr-xr-xr-x. 13 root root 0 Apr 3 14:13 sys  
drwxrwxrwt. 6 root root 4096 Apr 3 18:24 tmp  
drwxr-xr-x. 12 root root 144 Feb 7 2024 usr  
drwxr-xr-x. 19 root root 4096 Feb 7 2024 var  
[root@server-3 ~]#
```

2. Install the Samba package and dependencies:

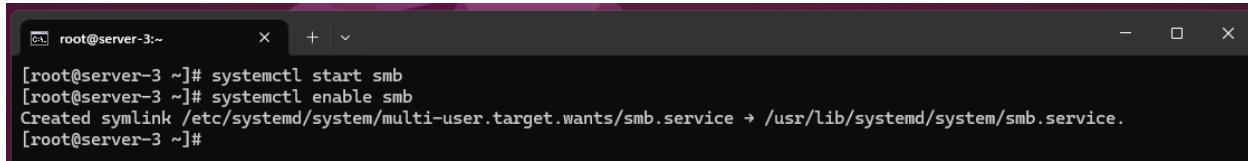
```
dnf install -y samba
```

```
[root@server-3 ~]# dnf install -y samba  
Last metadata expiration check: 0:42:57 ago on Thu Apr 3 18:16:58 2025.  
Dependencies resolved.  
=====  
Package           Architecture Version       Repository  Size  
=====  
Installing:  
 samba            x86_64      4.20.2-2.el9_5.alma.1   baseos    938 k  
Upgrading:  
 libldb           x86_64      2.9.1-2.el9          baseos    182 k  
 libtalloc         x86_64      2.4.2-1.el9          baseos    30 k  
 libtdb           x86_64      1.4.10-1.el9         baseos    50 k  
Installing dependencies:  
=====  
Upgraded:  
 libldb-2.9.1-2.el9.x86_64      libtalloc-2.4.2-1.el9.x86_64      libtdb-1.4.10-1.el9.x86_64  
Installed:  
 avahi-libs-0.8-21.el9.x86_64    libcupslibs-1:2.3.3op2-31.el9_5.x86_64  
 libicu-67.1-9.el9.x86_64        libnetapi-4.20.2-2.el9_5.alma.1.x86_64  
 libwbclient-4.20.2-2.el9_5.alma.1.x86_64  samba-4.20.2-2.el9_5.alma.1.x86_64  
 samba-client-libs-4.20.2-2.el9_5.alma.1.x86_64  samba-common-4.20.2-2.el9_5.alma.1.noarch  
 samba-common-libs-4.20.2-2.el9_5.alma.1.x86_64  samba-common-tools-4.20.2-2.el9_5.alma.1.x86_64  
 samba-dcerpc-4.20.2-2.el9_5.alma.1.x86_64    samba-ldb-ldap-modules-4.20.2-2.el9_5.alma.1.x86_64  
 samba-libs-4.20.2-2.el9_5.alma.1.x86_64
```

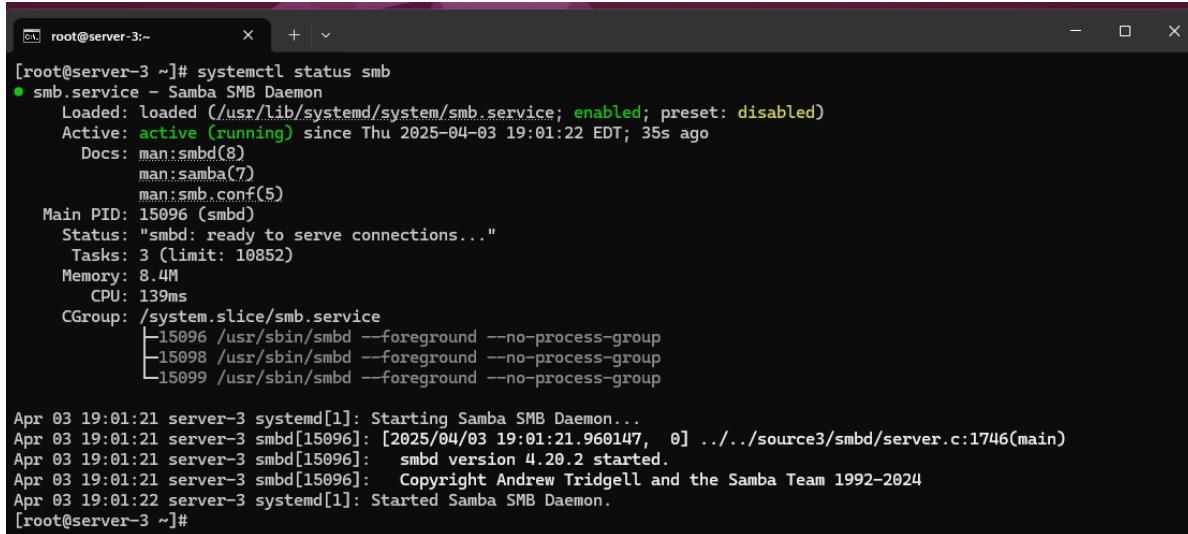
```
Complete!  
[root@server-3 ~]#
```

3. Start and enable the SMB service:

```
systemctl start smb  
systemctl enable smb
```



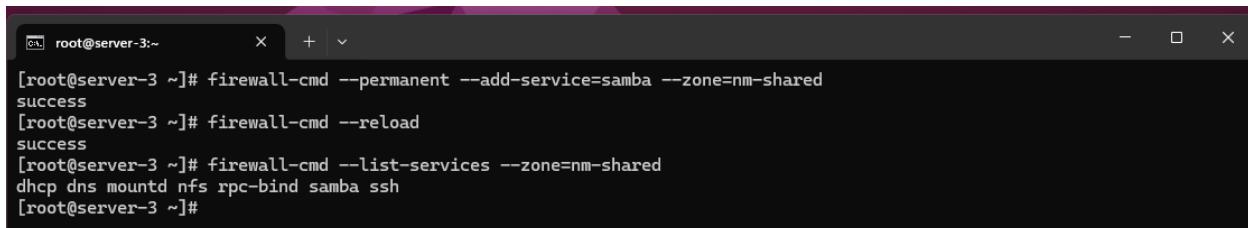
```
[root@server-3 ~]# systemctl start smb  
[root@server-3 ~]# systemctl enable smb  
Created symlink /etc/systemd/system/multi-user.target.wants/smb.service → /usr/lib/systemd/system/smb.service.  
[root@server-3 ~]#
```



```
[root@server-3 ~]# systemctl status smb  
● smb.service - Samba SMB Daemon  
   Loaded: loaded (/usr/lib/systemd/system/smb.service; enabled; preset: disabled)  
   Active: active (running) since Thu 2025-04-03 19:01:22 EDT; 35s ago  
     Docs: man:smbd(8)  
           man:samba(7)  
           man:smb.conf(5)  
 Main PID: 15096 (smbd)  
   Status: "smbd: ready to serve connections..."  
    Tasks: 3 (limit: 10852)  
   Memory: 8.4M  
     CPU: 139ms  
    CGroup: /system.slice/smb.service  
           ├─15096 /usr/sbin/smbd --foreground --no-process-group  
           ├─15098 /usr/sbin/smbd --foreground --no-process-group  
           ├─15099 /usr/sbin/smbd --foreground --no-process-group  
  
Apr 03 19:01:21 server-3 systemd[1]: Starting Samba SMB Daemon...  
Apr 03 19:01:21 server-3 smbd[15096]: [2025/04/03 19:01:21.960147,  0] ../../source3/smbd/server.c:1746(main)  
Apr 03 19:01:21 server-3 smbd[15096]: smbd version 4.20.2 started.  
Apr 03 19:01:21 server-3 smbd[15096]: Copyright Andrew Tridgell and the Samba Team 1992-2024  
Apr 03 19:01:22 server-3 systemd[1]: Started Samba SMB Daemon.  
[root@server-3 ~]#
```

4. Allow Samba service through the firewall in the nm-shared zone:

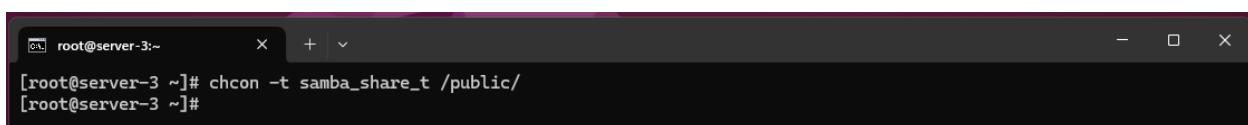
```
firewall-cmd --permanent --add-service=samba --zone=nm-shared  
firewall-cmd --reload  
firewall-cmd --list-services --zone=nm-shared
```



```
[root@server-3 ~]# firewall-cmd --permanent --add-service=samba --zone=nm-shared  
success  
[root@server-3 ~]# firewall-cmd --reload  
success  
[root@server-3 ~]# firewall-cmd --list-services --zone=nm-shared  
dhcp dns mounted nfs rpc-bind samba ssh  
[root@server-3 ~]#
```

5. Set the correct SELinux context on the share directory:

```
chcon -t samba_share_t /public
```



```
[root@server-3 ~]# chcon -t samba_share_t /public/  
[root@server-3 ~]#
```

3.2 AlmaLinux (server-3) – Configure the SAMBA Share

6. Open the SAMBA configuration file:

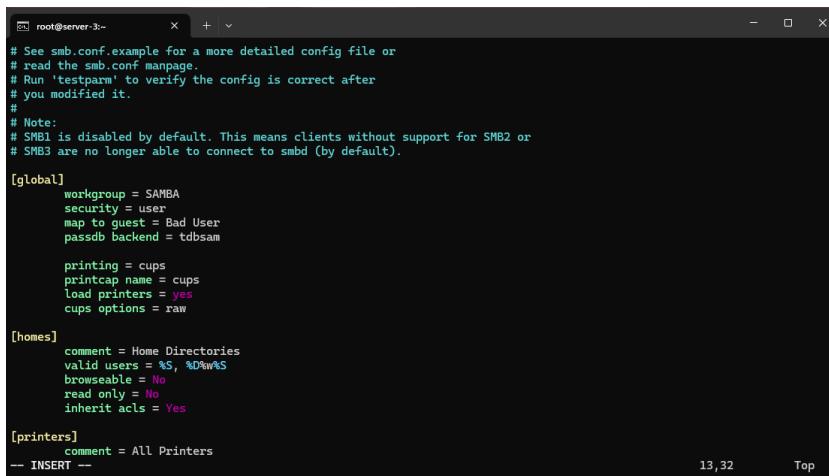
```
vim /etc/samba/smb.conf
```



```
[root@server-3 ~]# vim /etc/samba/smb.conf
[root@server-3 ~]#
```

7. Under the [global] section, add the following line:

map to guest = Bad User



```
# See smb.conf.example for a more detailed config file or
# read the smb.conf manpage.
# Run 'testparm' to verify the config is correct after
# you modified it.

# Note:
# SMB1 is disabled by default. This means clients without support for SMB2 or
# SMB3 are no longer able to connect to smbd (by default).

[global]
    workgroup = SAMBA
    security = user
    map to guest = Bad User
    passdb backend = tdbsam

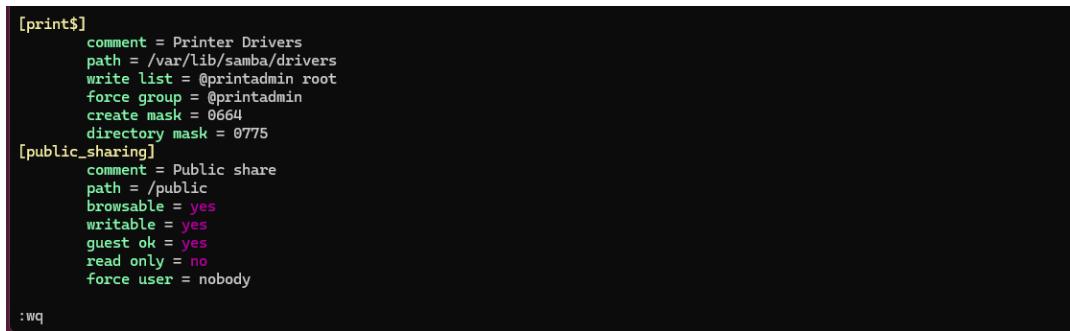
    printing = cups
    printcap name = cups
    load printers = yes
    cups options = raw

[homes]
    comment = Home Directories
    valid users = %S, %D\%S
    browsable = No
    read only = No
    inherit acls = Yes

[printers]
    comment = All Printers
-- INSERT --
```

8. Add the following section at the bottom of the file to configure the public share:

```
[public_sharing]
    comment = Public share
    path = /public
    browsable = yes
    writable = yes
    guest ok = yes
    read only = no
    force user = nobody
```



```
[print$]
    comment = Printer Drivers
    path = /var/lib/samba/drivers
    write list = @printadmin root
    force group = @printadmin
    create mask = 0664
    directory mask = 0775
[public_sharing]
    comment = Public share
    path = /public
    browsable = yes
    writable = yes
    guest ok = yes
    read only = no
    force user = nobody

:WQ
```

9. Test the configuration for syntax errors:

```
testparm
```

```
[root@server-3 ~]# testparm
Load smb config files from /etc/samba/smb.conf
Loaded services file OK.
Weak crypto is allowed by GnuTLS (e.g. NTLM as a compatibility fallback)

Server role: ROLE_STANDALONE

Press enter to see a dump of your service definitions

# Global parameters
[global]
    map to guest = Bad User
    printcap name = cups
    security = USER
    workgroup = SAMBA
    idmap config * : backend = tdb
    cups options = raw
```

```
[public_sharing]
    comment = Public share
    force user = nobody
    guest ok = Yes
    path = /public
    read only = No
[root@server-3 ~]#
```

10. Restart the SMB service:

```
systemctl restart smb
```

```
[root@server-3 ~]# systemctl restart smb
[root@server-3 ~]#
```

```
[root@server-3 ~]# systemctl status smb
● smb.service - Samba SMB Daemon
  Loaded: loaded (/usr/lib/systemd/system/smb.service; enabled; preset: disabled)
  Active: active (running) since Thu 2025-04-03 19:08:14 EDT; 23s ago
    Docs: man:smbd(8)
          man:samba(7)
          man:smb.conf(5)
  Main PID: 15202 (smbd)
    Status: "smbd: ready to serve connections..."
      Tasks: 3 (limit: 10852)
     Memory: 7.0M
        CPU: 129ms
       CGroup: /system.slice/smb.service
               └─15202 /usr/sbin/smbd --foreground --no-process-group
                 ├─15204 /usr/sbin/smbd --foreground --no-process-group
                 ├─15205 /usr/sbin/smbd --foreground --no-process-group

Apr 03 19:08:14 server-3 systemd[1]: Starting Samba SMB Daemon...
Apr 03 19:08:14 server-3 smbd[15202]: [2025/04/03 19:08:14.524965,  0] ../../source3/smbd/server.c:1746(main)
Apr 03 19:08:14 server-3 smbd[15202]:   smbd version 4.20.2 started.
Apr 03 19:08:14 server-3 smbd[15202]:   Copyright Andrew Tridgell and the Samba Team 1992-2024
Apr 03 19:08:14 server-3 systemd[1]: Started Samba SMB Daemon.
[root@server-3 ~]#
```

PART 3 – VALIDATION TEST

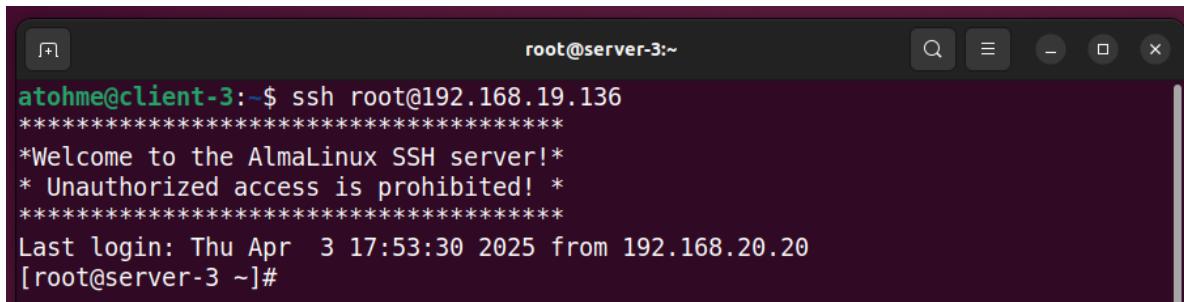
1 - SSH Testing

1.1 Ubuntu (client-3) – Test SSH Access to AlmaLinux (server-3)

1. Log in as root via SSH and verify:

```
ssh root@192.168.19.136
```

- The **welcome banner** is displayed
- You are **not prompted for a password** (SSH key authentication is working)

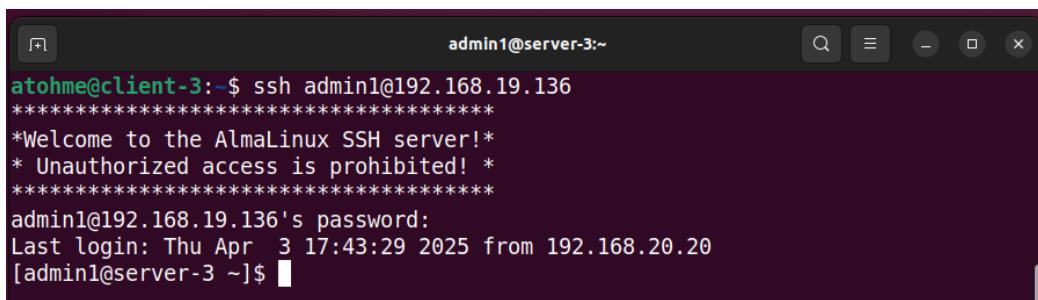


The screenshot shows a terminal window with the title bar "root@server-3:~". The terminal displays the following text:

```
atohme@client-3:~$ ssh root@192.168.19.136
*****
*Welcome to the AlmaLinux SSH server!*
* Unauthorized access is prohibited! *
*****
Last login: Thu Apr  3 17:53:30 2025 from 192.168.20.20
[root@server-3 ~]#
```

2. Attempt to log in as admin1 (should be allowed):

```
ssh admin1@192.168.19.136
```

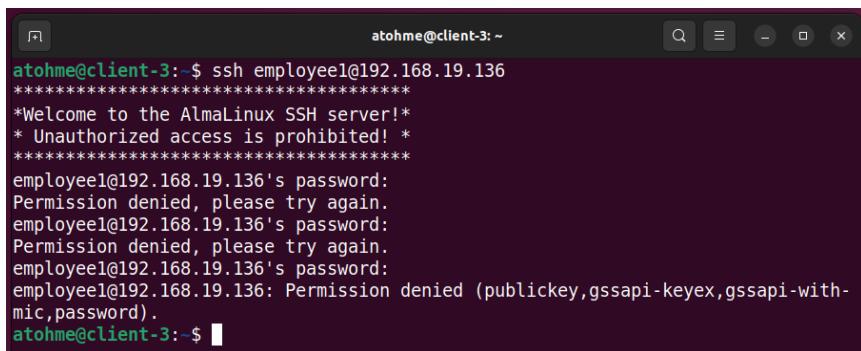


The screenshot shows a terminal window with the title bar "admin1@server-3:~". The terminal displays the following text:

```
atohme@client-3:~$ ssh admin1@192.168.19.136
*****
*Welcome to the AlmaLinux SSH server!*
* Unauthorized access is prohibited! *
*****
admin1@192.168.19.136's password:
Last login: Thu Apr  3 17:43:29 2025 from 192.168.20.20
[admin1@server-3 ~]$
```

3. Attempt to log in as employee1 (should be denied):

```
ssh employee1@192.168.19.136
```



The screenshot shows a terminal window with the title bar "atohme@client-3:~". The terminal displays the following text:

```
atohme@client-3:~$ ssh employee1@192.168.19.136
*****
*Welcome to the AlmaLinux SSH server!*
* Unauthorized access is prohibited! *
*****
employee1@192.168.19.136's password:
Permission denied, please try again.
employee1@192.168.19.136's password:
Permission denied, please try again.
employee1@192.168.19.136's password:
employee1@192.168.19.136: Permission denied (publickey,gssapi-keyex,gssapi-with-mic,password).
atohme@client-3:~$
```

2 - NFS Testing

2.1 Ubuntu (client-3) – Prepare for NFS Testing

1. Install required NFS client packages:

```
sudo apt update
```

```
sudo apt -y install nfs-common nfs4-acl-tools vim
```

```
atohme@client-3:~$ sudo apt update
[sudo] password for atohme:
Hit:1 http://ca.archive.ubuntu.com/ubuntu jammy InRelease
Get:2 http://ca.archive.ubuntu.com/ubuntu jammy-updates InRelease [128 kB]
Get:3 http://security.ubuntu.com/ubuntu jammy-security InRelease [129 kB]
Get:4 http://ca.archive.ubuntu.com/ubuntu jammy-backports InRelease [127 kB]
Get:5 https://dl.google.com/linux/chrome/deb stable InRelease [1,825 B]
Get:6 http://ca.archive.ubuntu.com/ubuntu jammy-updates/main amd64 Packages [2,461 kB]
Get:7 http://ca.archive.ubuntu.com/ubuntu jammy-updates/main i386 Packages [782 kB]
```

```
Metadata [208 B]
Fetched 6,254 kB in 4s (1,729 kB/s)
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
128 packages can be upgraded. Run 'apt list --upgradable' to see them.
atohme@client-3:~$
```

```
atohme@client-3:~$ sudo apt upgrade
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
Calculating upgrade... Done
The following packages were automatically installed and are no longer required:
  libwpe-1.0-1 libwpebackend-fdo-1.0-1
Use 'sudo apt autoremove' to remove them.
```

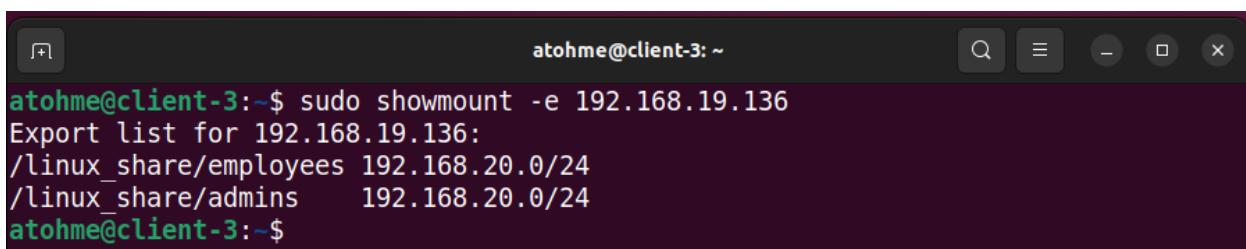
```
Found initrd image: /boot/initrd.img-6.2.0-26-generic
Found memtest86+ image: /memtest86+.elf
Found memtest86+ image: /memtest86+.bin
Warning: os-prober will not be executed to detect other bootable partitions.
Systems on them will not be added to the GRUB boot configuration.
Check GRUB_DISABLE_OS_PROBER documentation entry.
done
atohme@client-3:~$
```

```
atohme@client-3:~$ sudo apt -y install nfs-common nfs4-acl-tools vim
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following packages were automatically installed and are no longer required:
  libwpe-1.0-1 libwpebackend-fdo-1.0-1 linux-headers-6.2.0-26-generic
  linux-hwe-6.2-headers-6.2.0-26 linux-image-6.2.0-26-generic
  linux-modules-6.2.0-26-generic linux-modules-extra-6.2.0-26-generic
Use 'sudo apt autoremove' to remove them.
The following additional packages will be installed:
```

```
rpc-svcgssd.service is a disabled or a static unit, not starting it.
rpc_pipefs.target is a disabled or a static unit, not starting it.
var-lib-nfs-rpc_pipefs.mount is a disabled or a static unit, not starting it.
Processing triggers for man-db (2.10.2-1) ...
Processing triggers for libc-bin (2.35-0ubuntu3.9) ...
atohme@client-3:~$
```

2. List the available NFS shares on the server:

```
sudo showmount -e 192.168.19.136
```



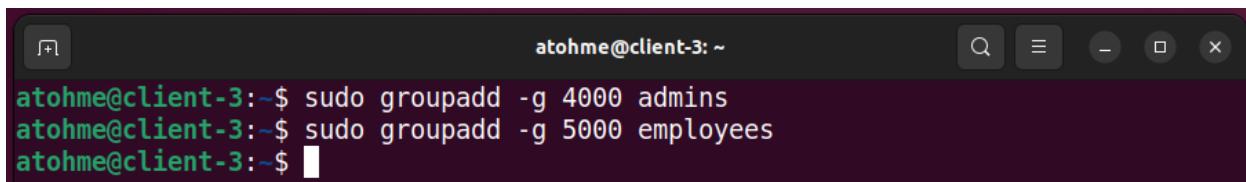
A terminal window titled "atohme@client-3: ~". The command "sudo showmount -e 192.168.19.136" is run, displaying the export list for the server at 192.168.19.136. It shows two shares: "/linux_share/employees" and "/linux_share/admins", both with the IP range 192.168.20.0/24.

```
atohme@client-3:~$ sudo showmount -e 192.168.19.136
Export list for 192.168.19.136:
/linux_share/employees 192.168.20.0/24
/linux_share/admins     192.168.20.0/24
atohme@client-3:~$
```

2.2 Ubuntu (client-3) – Recreate Matching Users and Groups

3. Create the same groups with matching GIDs:

```
sudo groupadd -g 4000 admins
sudo groupadd -g 5000 employees
```



A terminal window titled "atohme@client-3: ~". The commands "sudo groupadd -g 4000 admins" and "sudo groupadd -g 5000 employees" are run, creating the specified groups with their respective GIDs.

```
atohme@client-3:~$ sudo groupadd -g 4000 admins
atohme@client-3:~$ sudo groupadd -g 5000 employees
atohme@client-3:~$
```

4. Create the same users with matching UIDs and group associations:

```
sudo adduser --ingroup admins -u 2001 admin1
sudo adduser --ingroup employees -u 2002 employee1
```

```
atohme@client-3:~$ sudo adduser --ingroup admins -u 2001 admin1
Adding user `admin1' ...
Adding new user `admin1' (2001) with group `admins' ...
Creating home directory `/home/admin1' ...
Copying files from `/etc/skel' ...
New password:
BAD PASSWORD: The password is shorter than 8 characters
Retype new password:
passwd: password updated successfully
Changing the user information for admin1
Enter the new value, or press ENTER for the default
      Full Name []: admin1
      Room Number []:
      Work Phone []:
      Home Phone []:
      Other []:
Is the information correct? [Y/n] y
atohme@client-3:~$
```

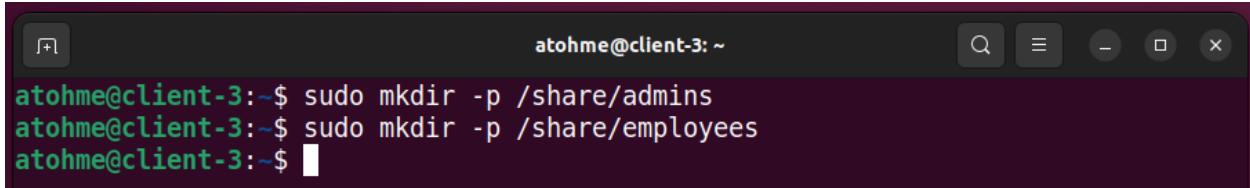
```
atohme@client-3:~$ sudo adduser --ingroup employees -u 2002 employee1
Adding user `employee1' ...
Adding new user `employee1' (2002) with group `employees' ...
Creating home directory `/home/employee1' ...
Copying files from `/etc/skel' ...
New password:
BAD PASSWORD: The password is shorter than 8 characters
Retype new password:
passwd: password updated successfully
Changing the user information for employee1
Enter the new value, or press ENTER for the default
      Full Name []: employee1
      Room Number []:
      Work Phone []:
      Home Phone []:
      Other []:
Is the information correct? [Y/n] y
atohme@client-3:~$
```

```
atohme@client-3:~$ ll /home
total 36
drwxr-xr-x  6 root      root      4096 Apr  3 20:08 .
drwxr-xr-x 20 root      root      4096 Apr  3 15:46 ..
drwxr-x---  2 admin1    admins    4096 Apr  3 20:07 admin1/_____
drwxr-x--- 16 atohme   atohme   4096 Apr  3 17:40 atohme/
drwxr-x---  2 employee1 employees 4096 Apr  3 20:08 employee1/_____
drwx-----  2 root      root     16384 Jan 22 21:57 lost+found/
atohme@client-3:~$
```

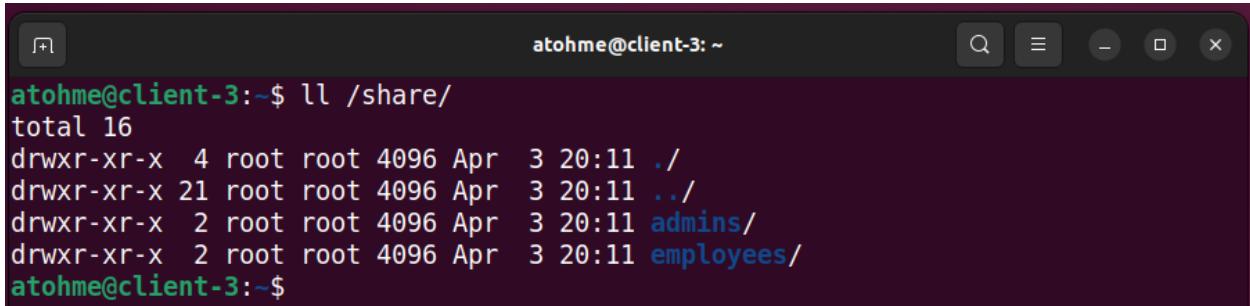
2.3 Ubuntu (client-3) – Create Mount Points and Mount Shares

5. Create local mount directories:

```
sudo mkdir -p /share/admins  
sudo mkdir -p /share/employees
```



```
atohme@client-3:~$ sudo mkdir -p /share/admins  
atohme@client-3:~$ sudo mkdir -p /share/employees  
atohme@client-3:~$
```



```
atohme@client-3:~$ ll /share/  
total 16  
drwxr-xr-x 4 root root 4096 Apr  3 20:11 ./  
drwxr-xr-x 21 root root 4096 Apr  3 20:11 ../  
drwxr-xr-x 2 root root 4096 Apr  3 20:11 admins/  
drwxr-xr-x 2 root root 4096 Apr  3 20:11 employees/  
atohme@client-3:~$
```

6. Mount the NFS share for admins:

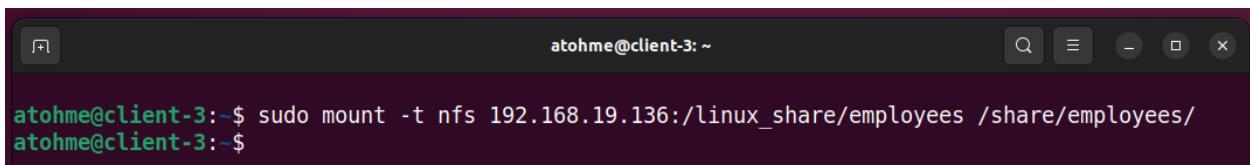
```
sudo mount -t nfs 192.168.19.136:/linux_share/admins /share/admins
```



```
atohme@client-3:~$ sudo mount -t nfs 192.168.19.136:/linux_share/admins /share/admins/  
atohme@client-3:~$
```

7. Mount the NFS share for employees:

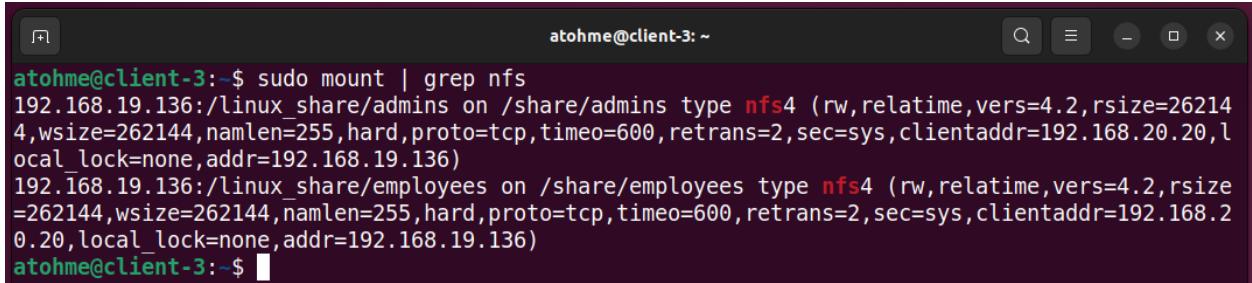
```
sudo mount -t nfs 192.168.19.136:/linux_share/employees /share/employees
```



```
atohme@client-3:~$ sudo mount -t nfs 192.168.19.136:/linux_share/employees /share/employees/  
atohme@client-3:~$
```

8. Verify that the NFS shares are mounted:

```
sudo mount | grep nfs
```

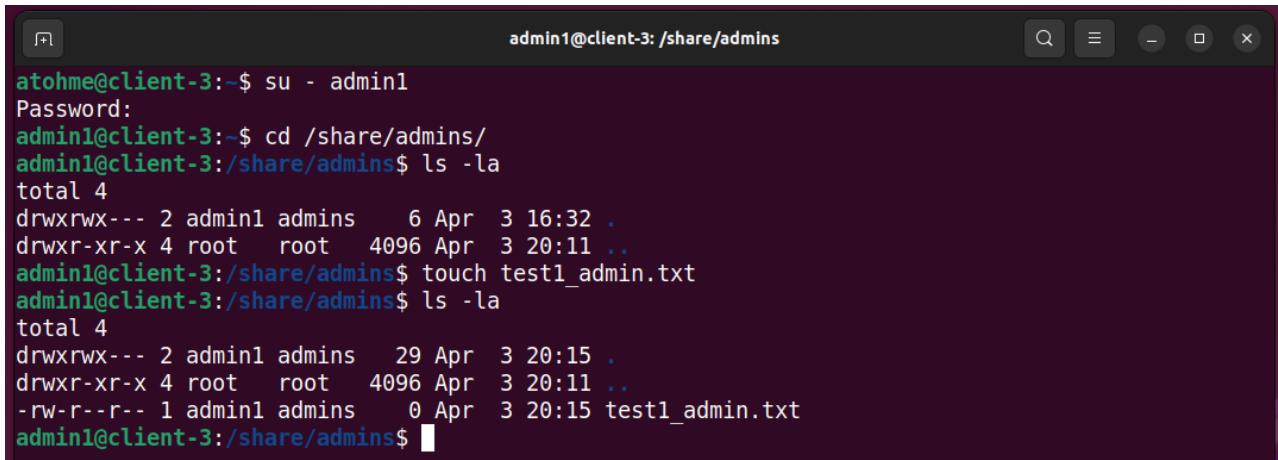


```
atohme@client-3:~$ sudo mount | grep nfs
192.168.19.136:/linux_share/admins on /share/admins type nfs4 (rw,relatime,vers=4.2,rsize=262144,wsize=262144,namlen=255,hard,proto=tcp,timeo=600,retrans=2,sec=sys,clientaddr=192.168.20.20,local_lock=none,addr=192.168.19.136)
192.168.19.136:/linux_share/employees on /share/employees type nfs4 (rw,relatime,vers=4.2,rsize=262144,wsize=262144,namlen=255,hard,proto=tcp,timeo=600,retrans=2,sec=sys,clientaddr=192.168.20.20,local_lock=none,addr=192.168.19.136)
atohme@client-3:~$
```

2.4 Ubuntu (client-3) – Test Access and Permissions

9. Test write access for admin1:

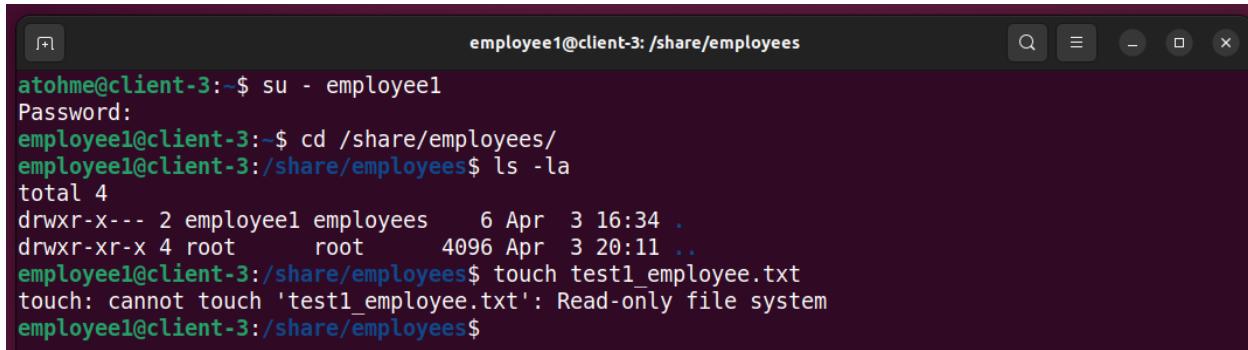
```
su - admin1
cd /share/admins
ls -la
touch test1_admin.txt
ls -la
```



```
atohme@client-3:~$ su - admin1
Password:
admin1@client-3:~$ cd /share/admins/
admin1@client-3:/share/admins$ ls -la
total 4
drwxrwx--- 2 admin1 admins 6 Apr 3 16:32 .
drwxr-xr-x 4 root  root 4096 Apr 3 20:11 ..
admin1@client-3:/share/admins$ touch test1_admin.txt
admin1@client-3:/share/admins$ ls -la
total 4
drwxrwx--- 2 admin1 admins 29 Apr 3 20:15 .
drwxr-xr-x 4 root  root 4096 Apr 3 20:11 ..
-rw-r--r-- 1 admin1 admins 0 Apr 3 20:15 test1_admin.txt
admin1@client-3:/share/admins$
```

10. Test read-only access for employee1:

```
su - employee1
cd /share/employees
ls -la
touch test1_employee.txt (should be denied if read-only)
```

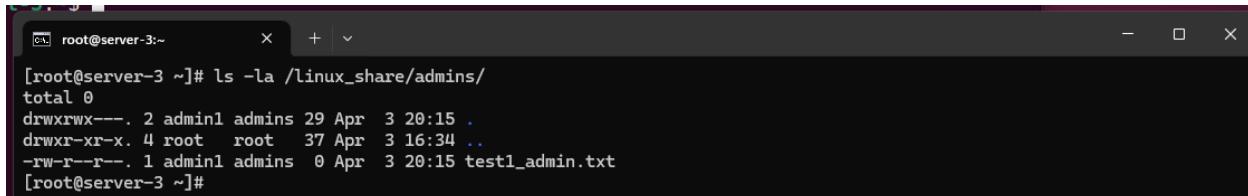


```
atohme@client-3:~$ su - employee1
Password:
employee1@client-3:~$ cd /share/employees/
employee1@client-3:/share/employees$ ls -la
total 4
drwxr-x--- 2 employee1 employees 6 Apr 3 16:34 .
drwxr-xr-x 4 root      root    4096 Apr 3 20:11 ..
employee1@client-3:/share/employees$ touch test1_employee.txt
touch: cannot touch 'test1_employee.txt': Read-only file system
employee1@client-3:/share/employees$
```

2.5 AlmaLinux (server-3) – Confirm File Visibility

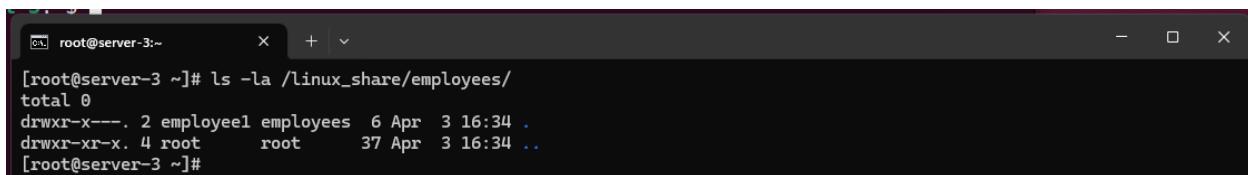
11. Check for the created files on the server side:

```
ls -la /linux_share/admins
```



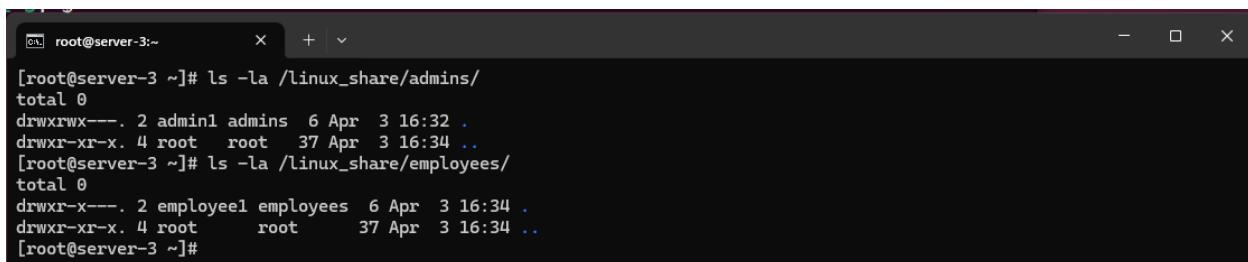
```
[root@server-3 ~]# ls -la /linux_share/admins/
total 0
drwxrwx---. 2 admin1 admins 29 Apr 3 20:15 .
drwxr-xr-x. 4 root      root   37 Apr 3 16:34 ..
-rw-r--r--. 1 admin1 admins  0 Apr 3 20:15 test1_admin.txt
[root@server-3 ~]#
```

```
ls -la /linux_share/employees
```



```
[root@server-3 ~]# ls -la /linux_share/employees/
total 0
drwxr-x---. 2 employee1 employees 6 Apr 3 16:34 .
drwxr-xr-x. 4 root      root   37 Apr 3 16:34 ..
[root@server-3 ~]#
```

Before:



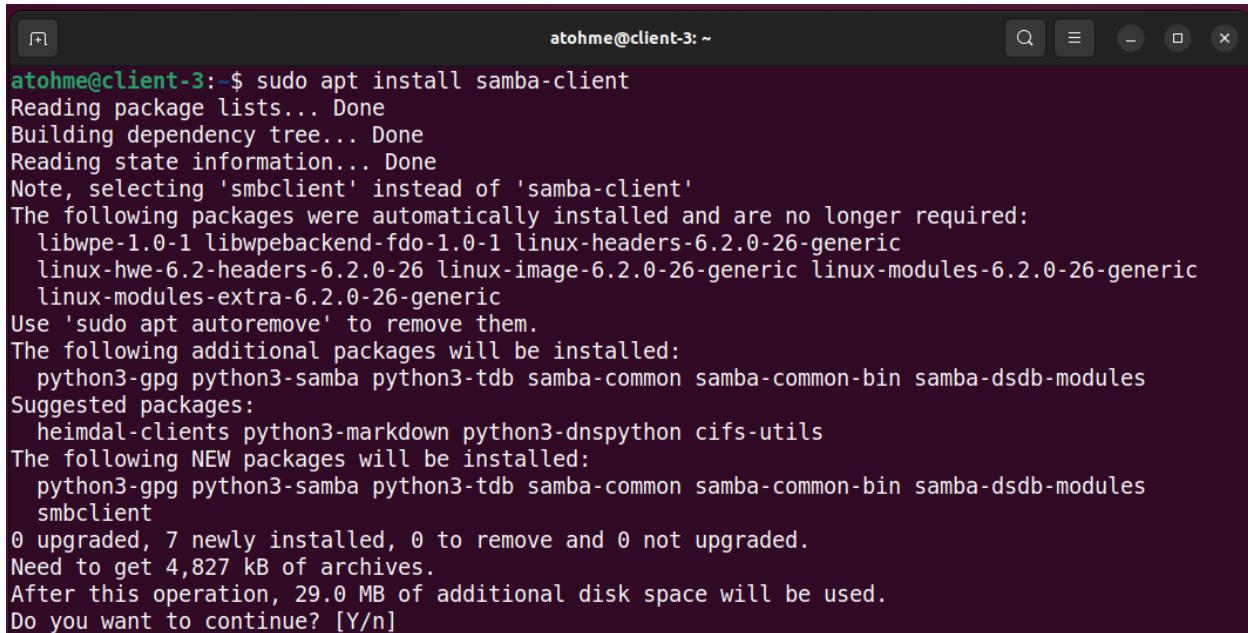
```
[root@server-3 ~]# ls -la /linux_share/admins/
total 0
drwxrwx---. 2 admin1 admins 6 Apr 3 16:32 .
drwxr-xr-x. 4 root      root   37 Apr 3 16:34 ..
[root@server-3 ~]# ls -la /linux_share/employees/
total 0
drwxr-x---. 2 employee1 employees 6 Apr 3 16:34 .
drwxr-xr-x. 4 root      root   37 Apr 3 16:34 ..
[root@server-3 ~]#
```

3 - SAMBA Testing

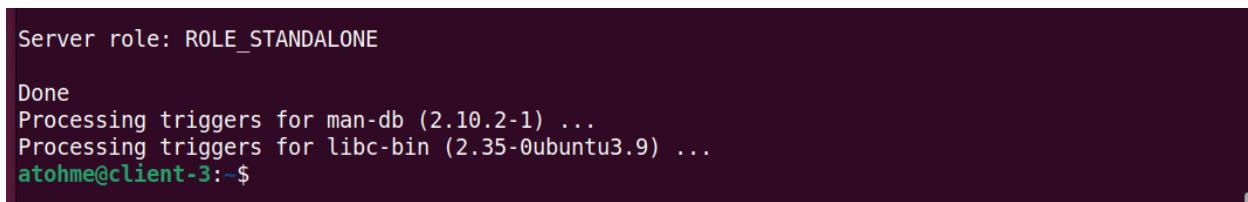
3.1 Ubuntu (client-3) – Test Public SAMBA Share

1. Install the Samba client package:

```
sudo apt install samba-client
```



```
atohme@client-3:~$ sudo apt install samba-client
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
Note, selecting 'smbclient' instead of 'samba-client'
The following packages were automatically installed and are no longer required:
  libwpe-1.0-1 libwpebackend-fdo-1.0-1 linux-headers-6.2.0-26-generic
  linux-hwe-6.2-headers-6.2.0-26 linux-image-6.2.0-26-generic linux-modules-6.2.0-26-generic
  linux-modules-extra-6.2.0-26-generic
Use 'sudo apt autoremove' to remove them.
The following additional packages will be installed:
  python3-gpg python3-samba python3-tdb samba-common samba-common-bin samba-dsdb-modules
Suggested packages:
  heimdal-clients python3-markdown python3-dnspython cifs-utils
The following NEW packages will be installed:
  python3-gpg python3-samba python3-tdb samba-common samba-common-bin samba-dsdb-modules
  smbclient
0 upgraded, 7 newly installed, 0 to remove and 0 not upgraded.
Need to get 4,827 kB of archives.
After this operation, 29.0 MB of additional disk space will be used.
Do you want to continue? [Y/n]
```



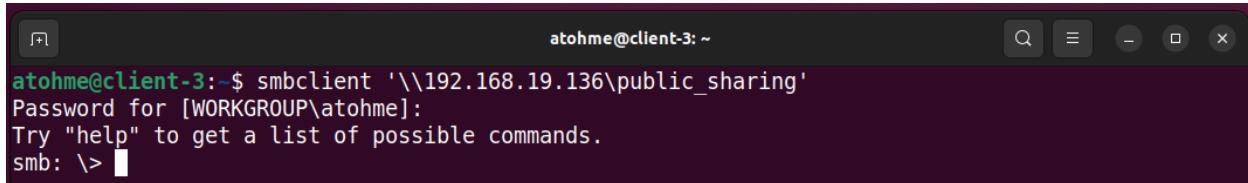
```
Server role: ROLE_STANDALONE

Done
Processing triggers for man-db (2.10.2-1) ...
Processing triggers for libc-bin (2.35-0ubuntu3.9) ...
atohme@client-3:~$
```

2. Access the SAMBA public share using the smbclient tool:

```
smbclient '\\192.168.19.136\public_sharing'
```

When prompted for a password, press **Enter** to log in as guest.



```
atohme@client-3:~$ smbclient '\\192.168.19.136\public_sharing'
Password for [WORKGROUP\atohme]:
Try "help" to get a list of possible commands.
smb: \> 
```

3. Inside the SMB client session, try creating a folder:

```
mkdir test1_public_sharing
```

The image shows two terminal windows side-by-side. Both windows have a dark theme and are titled "atohme@client-3: ~". The top window shows the command "mkdir test1_public_sharing" being run, followed by a prompt. The bottom window shows the command "ls" being run, displaying the newly created directory "test1_public_sharing" along with the parent directory ".." and the current directory ".". The output also includes file statistics and disk usage information.

```
smb: \> mkdir test1_public_sharing
smb: \>
smb: \> ls
.
..
test1_public_sharing
D      0 Thu Apr  3 20:26:50 2025
D      0 Thu Apr  3 20:26:50 2025
D      0 Thu Apr  3 20:26:50 2025
13040640 blocks of size 1024. 11573188 blocks available
smb: \>
```

This should succeed, confirming that write access to the public share is working.

Check for the created files on the server side:

The image shows a single terminal window with a dark theme, titled "root@server-3: ~". The command "ll /public/" is run, showing a listing of files. The directory contains a single entry: "test1_public_sharing" which is a directory (d) with permissions drwxr-xr-x, owned by nobody/nobody, and was created on April 3 at 20:26.

```
[root@server-3 ~]# ll /public/
total 0
drwxr-xr-x. 2 nobody nobody 6 Apr  3 20:26 test1_public_sharing
[root@server-3 ~]#
```

Conclusion

This assignment provided valuable, hands-on experience in setting up and managing a Linux-based server environment. From network configuration and disk management to secure file sharing with SSH, NFS, and Samba, each task reinforced critical skills needed for real-world system administration. These foundational concepts will serve as a stepping stone for more advanced network and server management tasks in future labs and professional settings.

