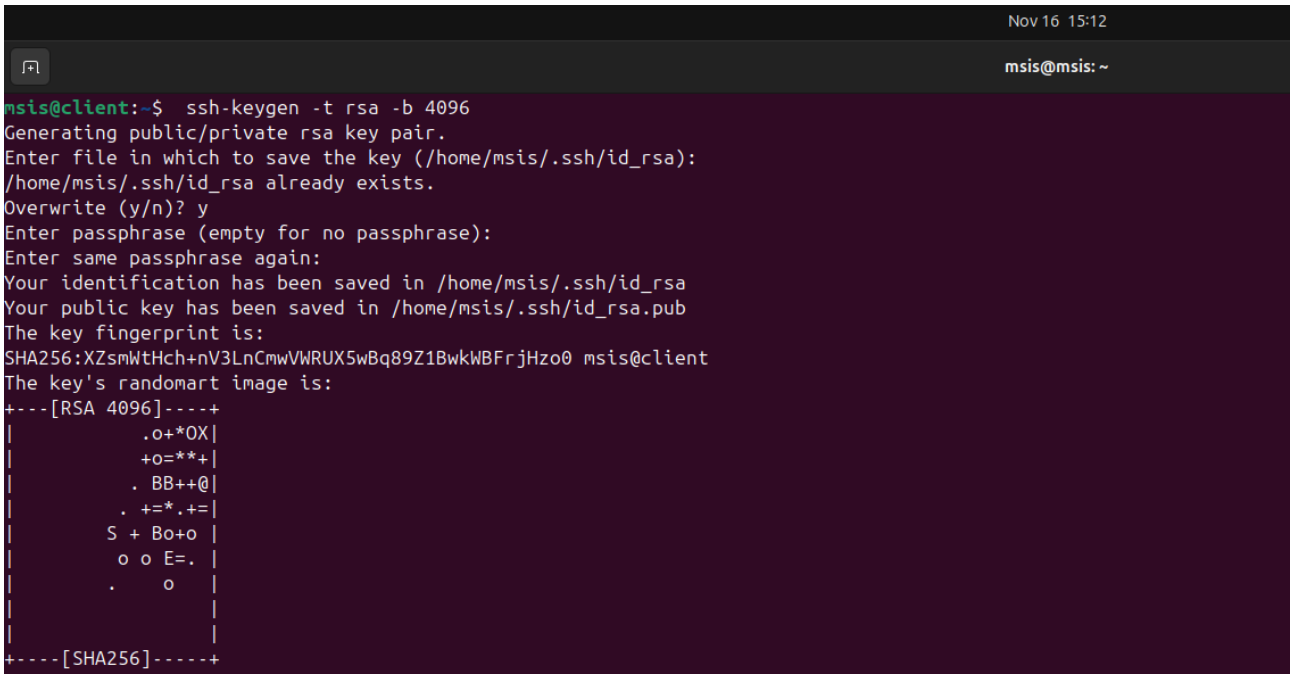
LAB 1: Passwordless Connection

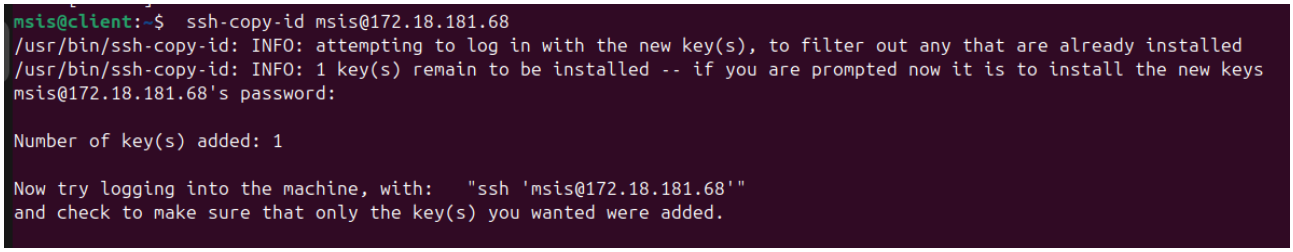
STEP 1: GENERATING RSA KEY

1 . ssh-keygen -t rsa -b 4096



STEP2: COPY THE KEY TO AGENT NODE

1.ssh-copy-id user@slave1



STEP 3: ADDING PRIVATE KEY AGENT

1.ssh-add ~/.ssh/id_rsa

```
msis@client:~$ ssh-add ~/.ssh/id_rsa
Identity added: /home/msis/.ssh/id_rsa (msis@client)
msis@client:~$ chmod 600 ~/.ssh/id_rsa
msis@client:~$ chmod 644 ~/.ssh/id_rsa.pub
msis@client:~$ ssh msis@172.18.181.68
Welcome to Ubuntu 24.04.3 LTS (GNU/Linux 6.14.0-35-generic x86_64)

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

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

STEP4: PERMISSION TO KEYS

1.chmod 600 ~/.ssh/id_rsa --> Private RSA key(Only accessible by owner)
2.chmod 644 ~/.ssh/id_rsa.pub --> Public RSA key(Shared to slaves ~/.ssh/authorized_keys)


```
msis@client:~$ ssh-add ~/.ssh/id_rsa
Identity added: /home/msis/.ssh/id_rsa (msis@client)
msis@client:~$ chmod 600 ~/.ssh/id_rsa
msis@client:~$ chmod 644 ~/.ssh/id_rsa.pub
msis@client:~$ ssh msis@172.18.181.68
Welcome to Ubuntu 24.04.3 LTS (GNU/Linux 6.14.0-35-generic x86_64)

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

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


STEP5: NOW CONNECT

1.ssh -i msis@usernode

```
msis@client:~$ ssh msis@172.18.181.68
Welcome to Ubuntu 24.04.3 LTS (GNU/Linux 6.14.0-35-generic x86_64)

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

Expanded Security Maintenance for Applications is not enabled.

11 updates can be applied immediately.
To see these additional updates run: apt list --upgradable

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

Last login: Thu Nov 13 12:04:53 2025 from 172.18.181.63
msis@msis:~$
```

LAB : 2 NFS Setup

STEP 1: Install NFS Packages on all nodes (master and slaves)

sudo apt update
sudo apt install nfs-kernel-server nfs-common -y
nfs-kernel-server: Required only on the master (NFS server)
nfs-common: Required on slaves (NFS clients)

```
msis@msis:~$ sudo apt update
[sudo] password for msis:
Get:1 http://security.ubuntu.com/ubuntu noble-security InRelease [126 kB]
Hit:2 http://archive.ubuntu.com/ubuntu noble InRelease
Ign:3 https://repo.mongodb.org/apt/ubuntu noble/mongodb-org/7.0 InRelease
Get:4 http://archive.ubuntu.com/ubuntu noble-updates InRelease [126 kB]
Err:5 https://repo.mongodb.org/apt/ubuntu noble/mongodb-org/7.0 Release
  404  Not Found [IP: 18.161.229.8 443]
Get:6 http://security.ubuntu.com/ubuntu noble-security/main amd64 Components [21.5 kB]
Get:7 http://archive.ubuntu.com/ubuntu noble-backports InRelease [126 kB]
Get:8 http://security.ubuntu.com/ubuntu noble-security/restricted amd64 Components [212 B]
Get:9 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 Packages [1,585 kB]
Get:10 http://security.ubuntu.com/ubuntu noble-security/universe amd64 Components [52.3 kB]
Get:11 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 Components [175 kB]
Get:12 http://security.ubuntu.com/ubuntu noble-security/multiverse amd64 Components [212 B]
Get:13 http://archive.ubuntu.com/ubuntu noble-updates/restricted amd64 Components [212 B]
Get:14 http://archive.ubuntu.com/ubuntu noble-updates/universe amd64 Packages [1,499 kB]
Get:15 http://archive.ubuntu.com/ubuntu noble-updates/universe i386 Packages [988 kB]
Get:16 http://archive.ubuntu.com/ubuntu noble-updates/universe amd64 Components [378 kB]
Get:17 http://archive.ubuntu.com/ubuntu noble-updates/multiverse amd64 Components [940 B]
Get:18 http://archive.ubuntu.com/ubuntu noble-backports/main amd64 Components [7,140 B]
Get:19 http://archive.ubuntu.com/ubuntu noble-backports/restricted amd64 Components [216 B]
Get:20 http://archive.ubuntu.com/ubuntu noble-backports/universe amd64 Components [11.0 kB]
Get:21 http://archive.ubuntu.com/ubuntu noble-backports/multiverse amd64 Components [212 B]
Reading package lists... Done
E: The repository 'https://repo.mongodb.org/apt/ubuntu noble/mongodb-org/7.0 Release' does not have a Release file.
N: Updating from such a repository can't be done securely, and is therefore disabled by default.
N: See apt-secure(8) manpage for repository creation and user configuration details.
msis@msis:~$ sudo apt install nfs-kernel-server nfs-common -y
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
nfs-common is already the newest version (1:2.6.4-3ubuntu5.1).
The following NEW packages will be installed:
  nfs-kernel-server
0 upgraded, 1 newly installed, 0 to remove and 11 not upgraded.
Need to get 169 kB of archives.
After this operation, 606 kB of additional disk space will be used.
Get:1 http://archive.ubuntu.com/ubuntu noble-updates/main amd64 nfs-kernel-server amd64 1:2.6.4-3ubuntu5.1 [169 kB]
Fetched 169 kB in 1s (156 kB/s)
Selecting previously unselected package nfs-kernel-server.
(Reading database ... 342188 files and directories currently installed.)
Preparing to unpack .../nfs-kernel-server_1%3a2.6.4-3ubuntu5.1_amd64.deb ...
```

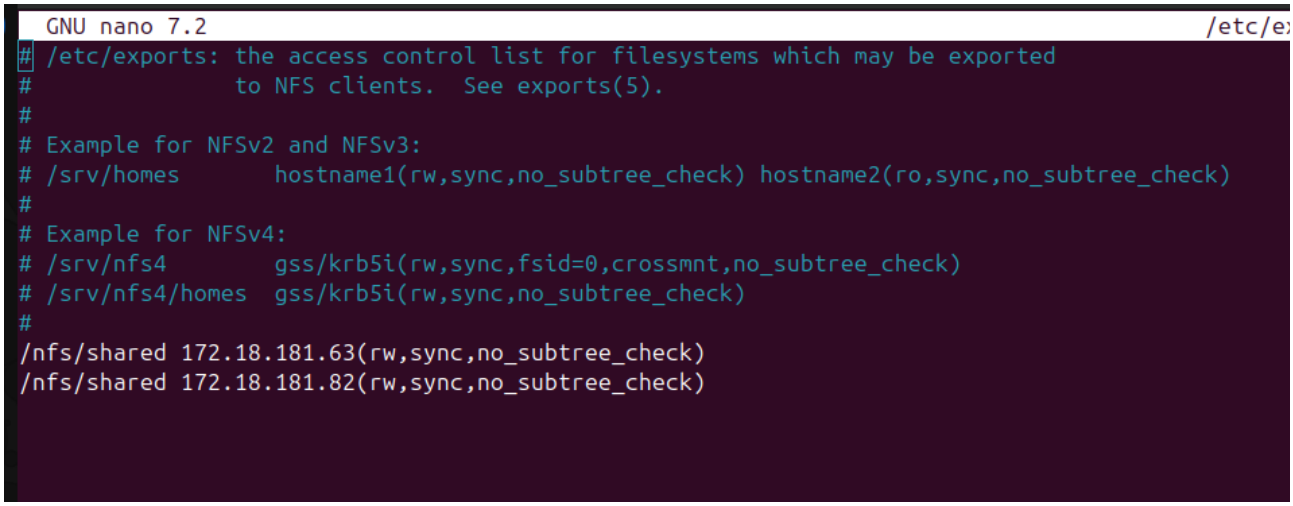
STEP:2.Create a Shared Directory on master

sudo mkdir -p /nfs/shared
sudo chmod 777 /nfs/shared

```
Creating config file /etc/default/nfs-kernel-server with new version
Processing triggers for man-db (2.12.0-4build2) ...
msis@msis:~$ nfs-kernel-server: Required only on the master (NFS server)
bash: syntax error near unexpected token `('
msis@msis:~$ sudo mkdir -p /nfs/shared
msis@msis:~$ sudo chmod 777 /nfs/shared
```

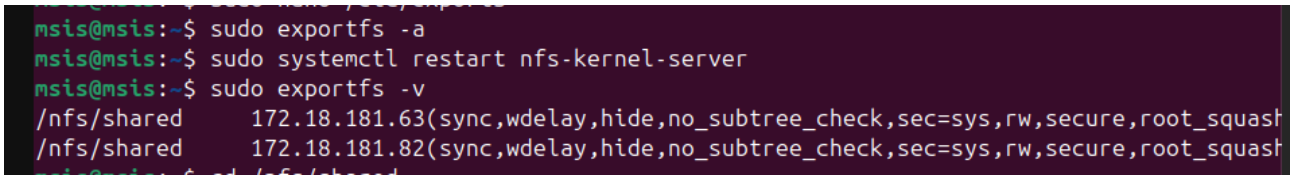
STEP:3.Configure NFS Exports

Edit the NFS exports file on the master
sudo nano /etc/exports
Add the following lines
/nfs/shared 172.18.181.63(rw,sync,no_subtree_check)
/nfs/shared 172.18.181.82(rw,sync,no_subtree_check)



STEP:4. Export the Shared Directory

Apply and verify the configuration
sudo exportfs -a
sudo systemctl restart nfs-kernel-server
sudo exportfs -v



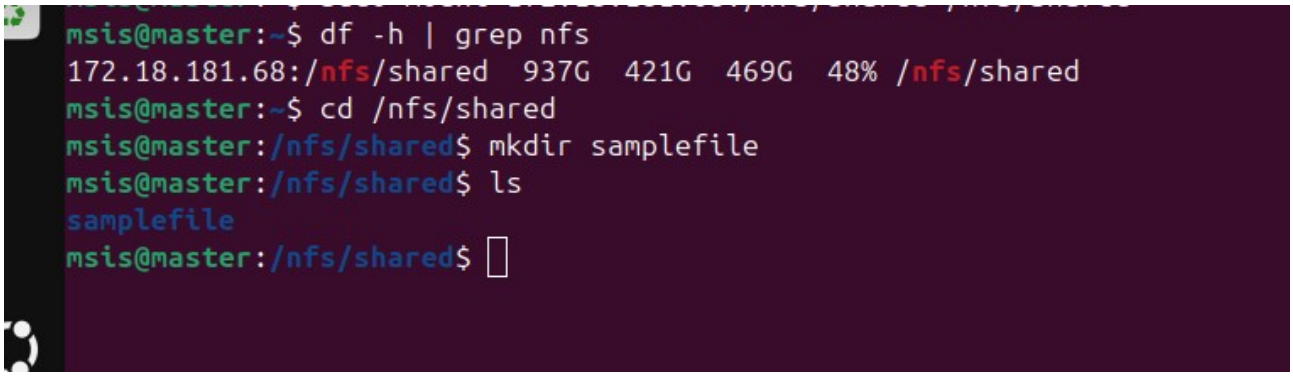
STEP:5. Mount the NFS Share on Slave Nodes
On slave1
sudo mkdir -p /nfs/shared
sudo mount 172.18.181.65:/nfs/shared /nfs/shared
On slave2
sudo mkdir -p /nfs/shared
sudo mount 172.18.181.65:/nfs/shared /nfs/shared

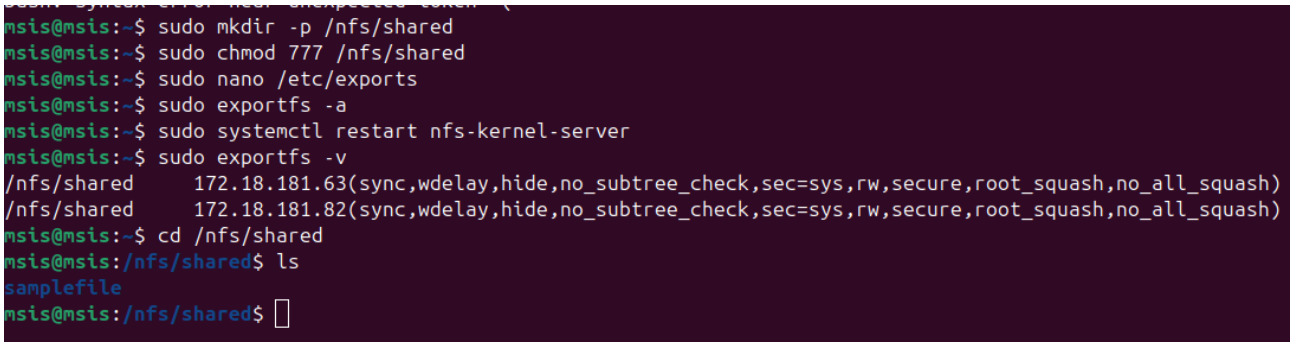
```
msis@msis:~$ ssh msis@172.18.181.63
msis@172.18.181.63's password:
Welcome to Ubuntu 24.04.3 LTS (GNU/Linux 6.14.0-35-generic x86_64)

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

Expanded Security Maintenance for Applications is not enabled.

14 updates can be applied immediately.
To see these additional updates run: apt list --upgradable

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

Last login: Thu Nov 13 12:39:46 2025 from 172.18.181.63
msis@client:~$ sudo mkdir -p /nfs/shared
[sudo] password for msis:
Sorry, try again.
[sudo] password for msis:
msis@client:~$ sudo mount 172.18.181.68:/nfs/shared /nfs/shared
msis@client:~$ cd /nfs/shared
```

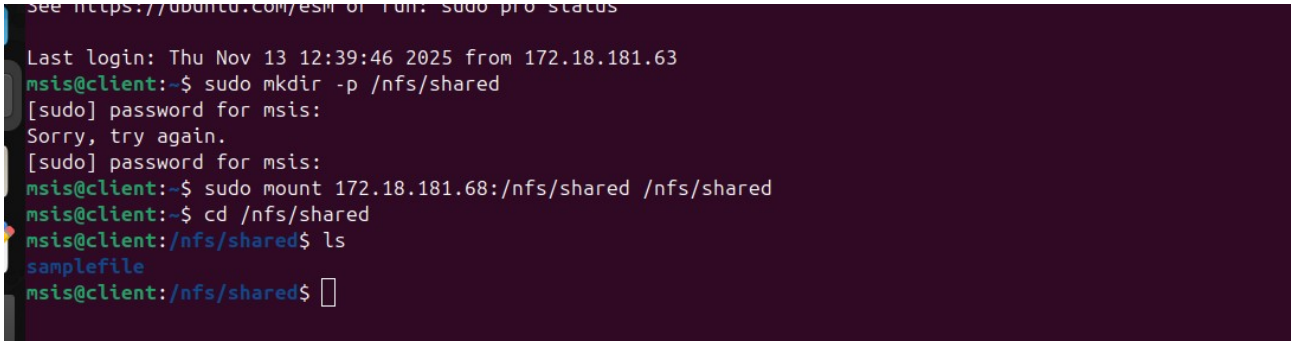
```
msis@msis:~$ ssh msis@172.18.181.82
ssh: connect to host 172.18.181.82 port 22: No route to host
msis@msis:~$ ssh msis@172.18.181.82
ssh: connect to host 172.18.181.82 port 22: No route to host
msis@msis:~$ ssh msis@172.18.181.82
The authenticity of host '172.18.181.82 (172.18.181.82)' can't be established.
ED25519 key fingerprint is SHA256:dAnyUpf0UJX8OdYTKMDRxcJTYebp0DbEJbNfrNRgw2s.
This host key is known by the following other names/addresses:
    ~/.ssh/known_hosts:8: [hashed name]
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '172.18.181.82' (ED25519) to the list of known hosts.
msis@172.18.181.82's password:
Welcome to Ubuntu 24.04.2 LTS (GNU/Linux 6.14.0-27-generic x86_64)

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

Expanded Security Maintenance for Applications is not enabled.

197 updates can be applied immediately.
104 of these updates are standard security updates.
To see these additional updates run: apt list --upgradable

3 additional security updates can be applied with ESM Apps.
Learn more about enabling ESM Apps service at https://ubuntu.com/esm

Last login: Sat Nov 15 16:23:27 2025 from 172.18.181.61
msis@master:~$ sudo mkdir -p /nfs/shared
[sudo] password for msis:
msis@master:~$ sudo mount 172.18.181.65:/nfs/shared /nfs/shared
mount.nfs: access denied by server while mounting 172.18.181.65:/nfs/shared
msis@master:~$ sudo mount 172.18.181.68:/nfs/shared /nfs/shared
msis@master:~$ df -h | grep nfs
172.18.181.68:/nfs/shared  937G  421G  469G  48% /nfs/shared
msis@master:~$ cd /nfs/shared
```

STEP:6. Verify the Mount

Run on any slave
df -h | grep nfs
Output would be 172.18.181.68:/nfs/shared 100G 2G 98G 2% /nfs/shared
Test by creating a file from one slave and checking its visibility on others
cd /nfs/shared
touch testfile_from_slave1
Check if it appears in /nfs/shared on master or slave2.







LAB 3: TRUENAS INSTALLATION AND SETUP:

Introduction

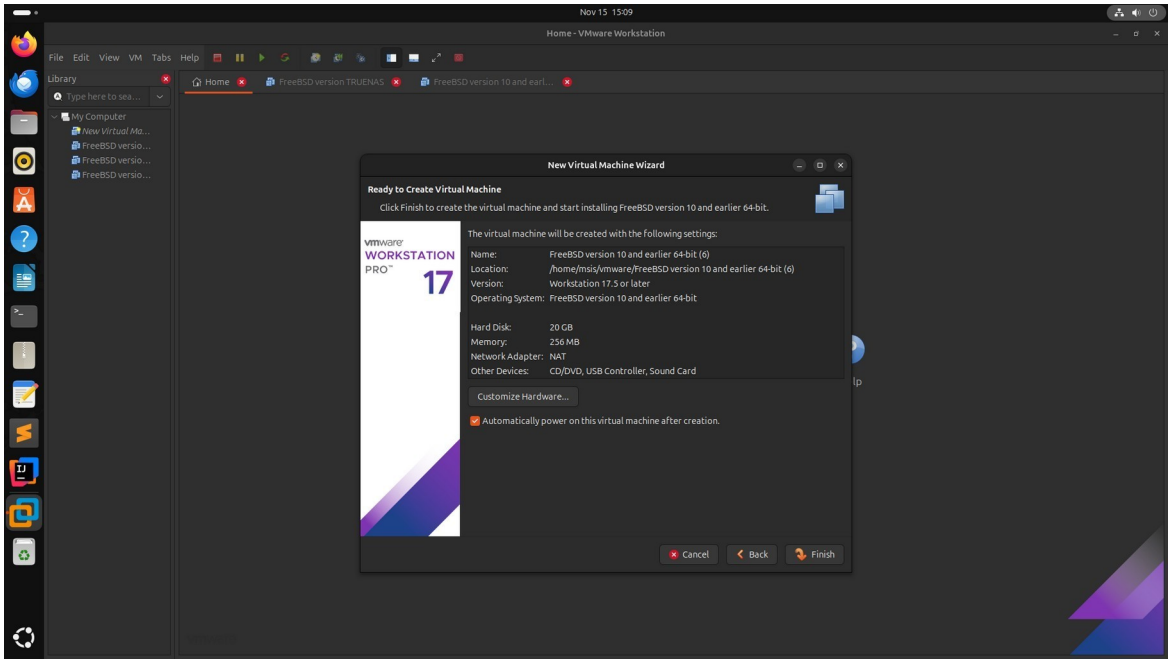
TrueNAS is an open-source storage operating system designed to provide reliable, secure, and high-performance network-attached storage (NAS). It is widely used in homes, small businesses, and enterprises to manage and protect large amounts of data.

STEP 1: Creating a New Virtual Machine

Open VMware

1. Launch Vmware.
2. Click on New to create a new virtual machine.

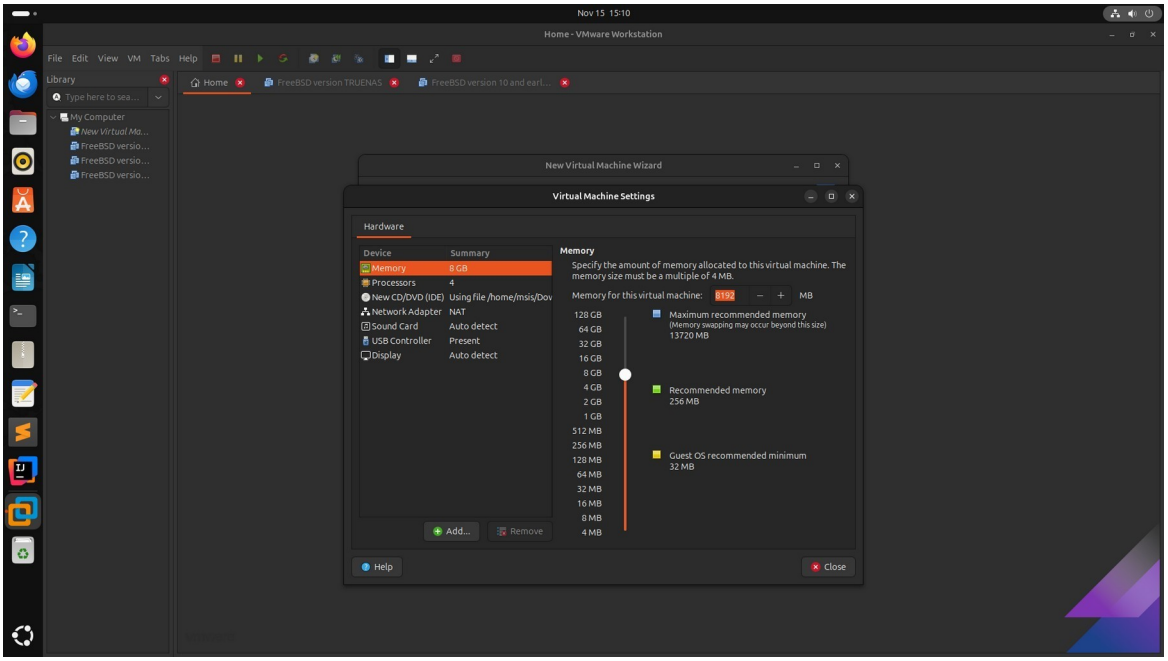
Configure the VMware



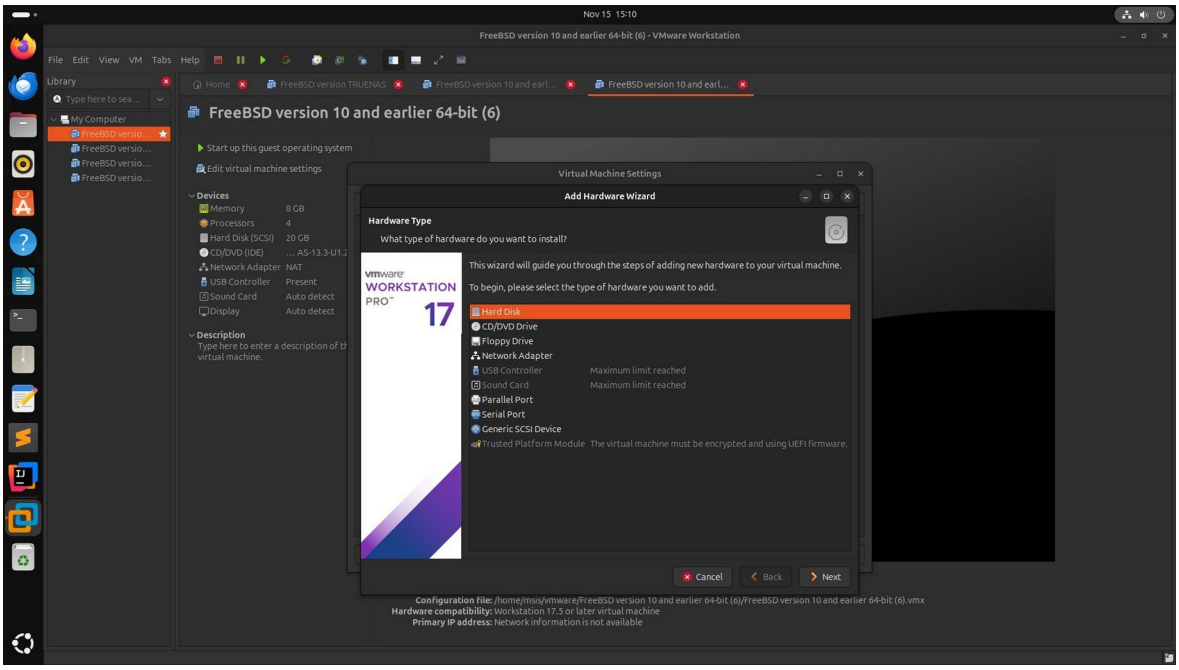
3. Select “Typical” installation mode and click Next.
4. Choose “Installer disc image (ISO)” and browse to the TrueNAS ISO file.
5. Click Next and set the guest OS type to "Other" or "FreeBSD" as suggested
6. Assign a Name (e.g., TrueNAS-VM)

Allocate Memory

Allocate at 8GB of RAM and click Next and set processor to at least two cores for better performance.

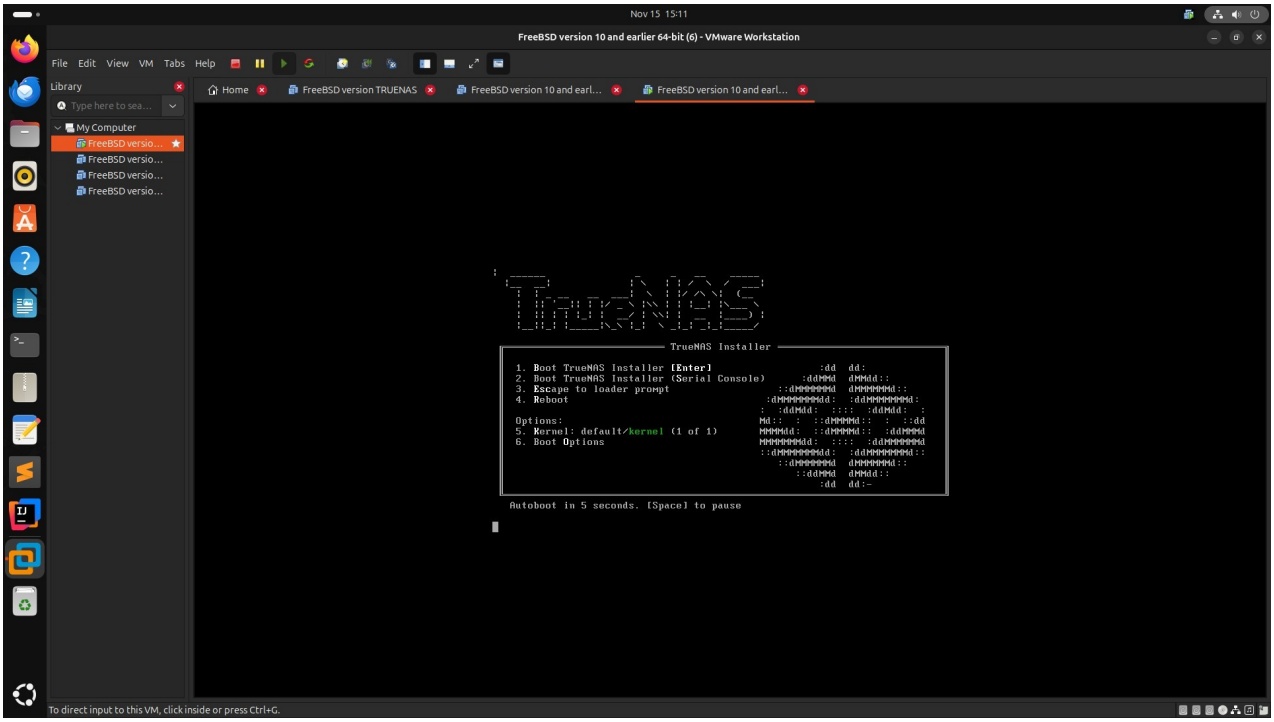


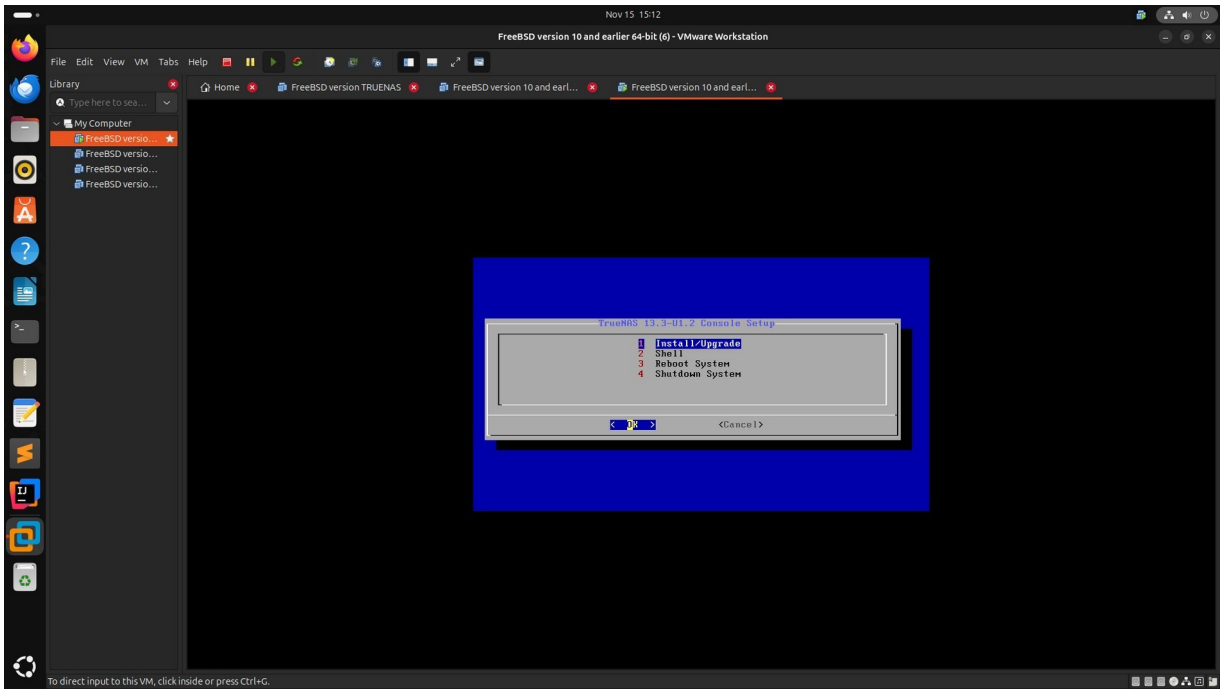
7. Create a virtual hard disk (recommended 20GB+).
8. Complete the VM creation wizard and finish.



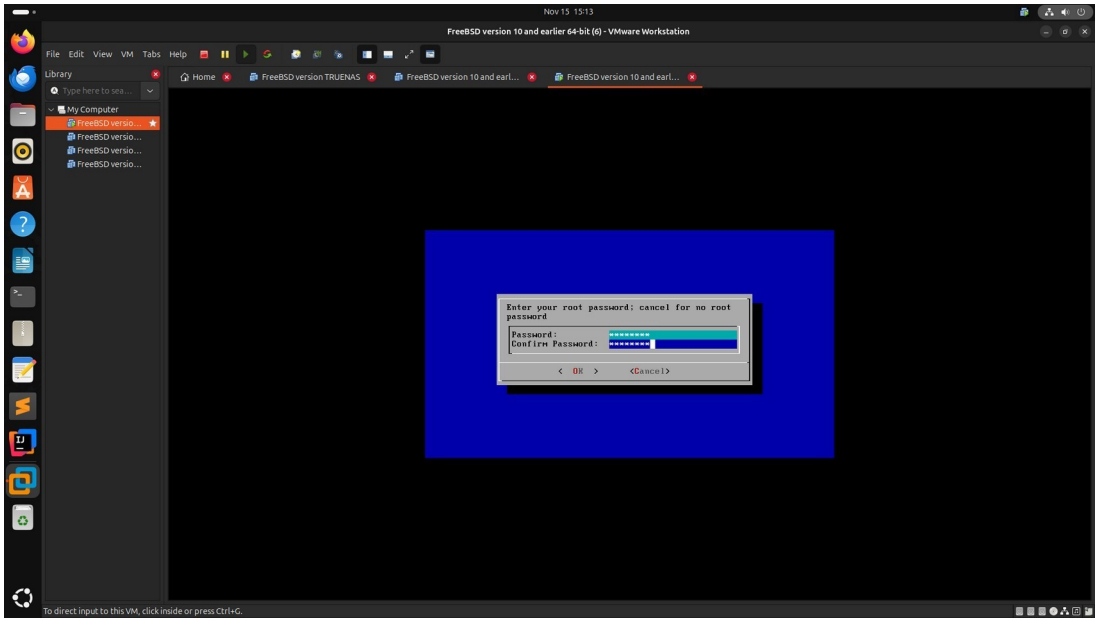
STEP 2: Booting and Installing TrueNAS

1. Start the TRUENAS virtual machine.
2. When prompted, select Install/Upgrade to initiate the installation process





Set a password



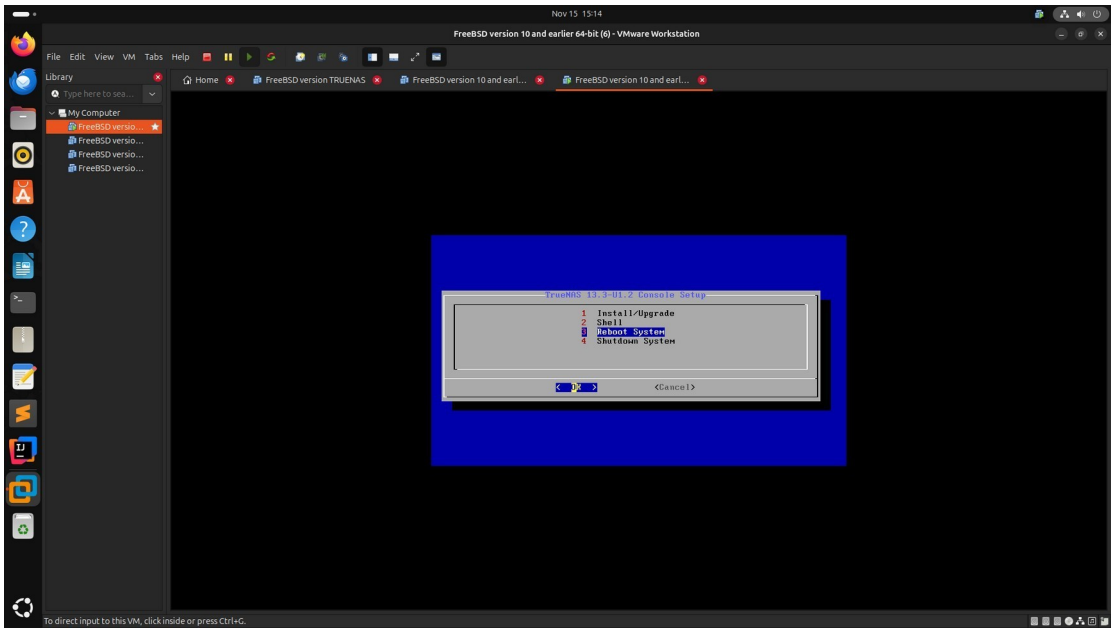
Reboot

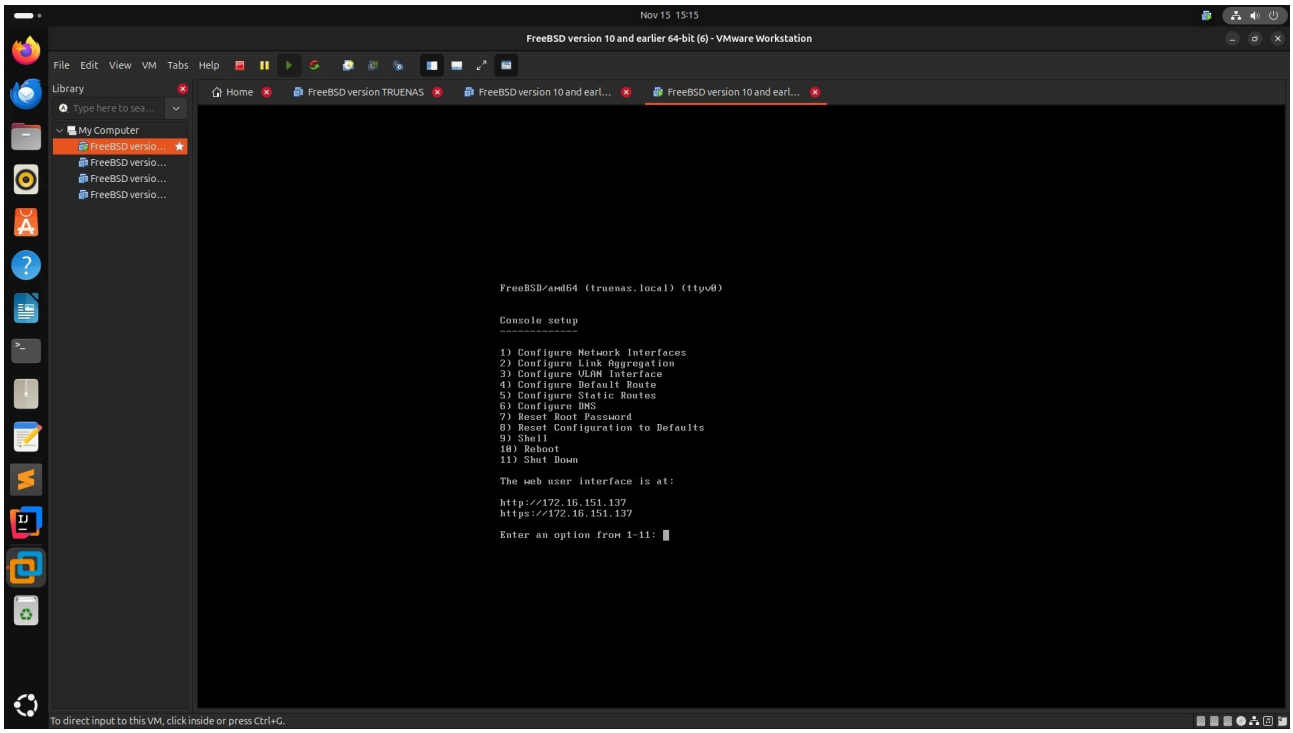
Once the installation is complete, reboot the VMware.

Initial Setup and Configuration

Step 1: Accessing the Web Interface

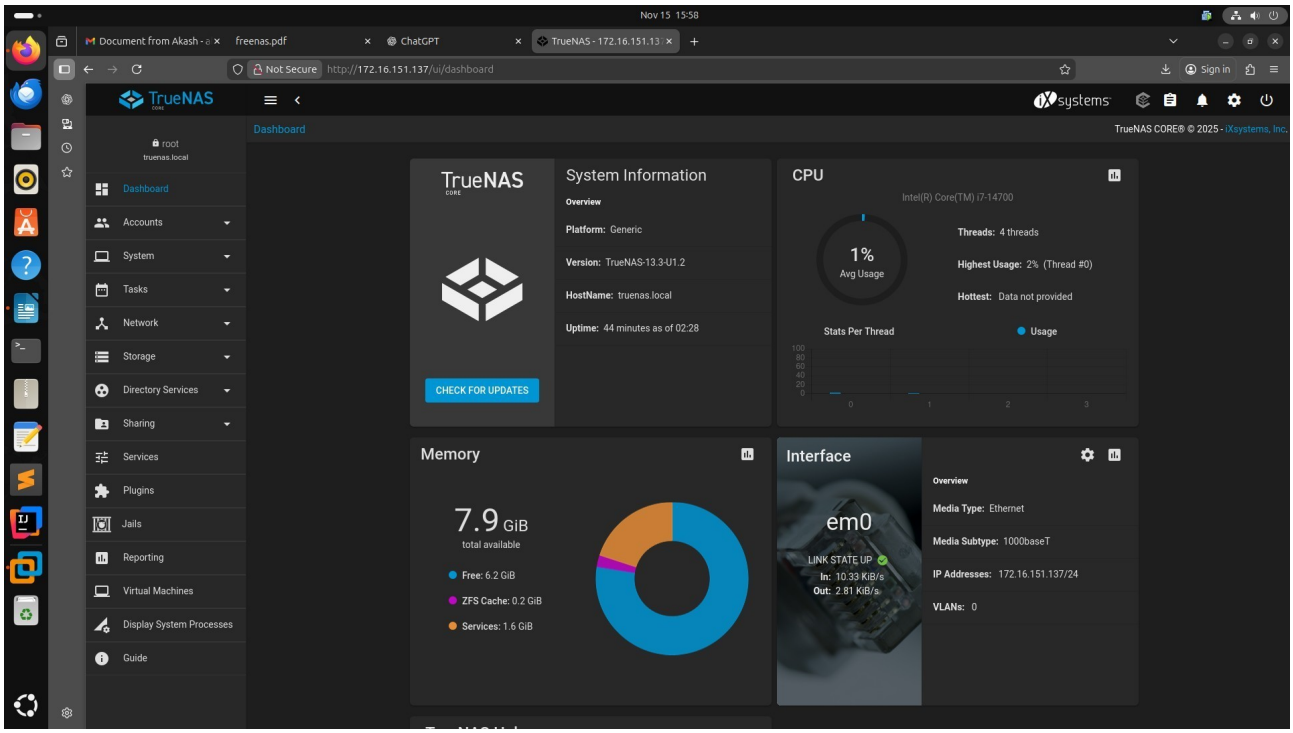
1. After rebooting, note the displayed TRUENAS IP address.





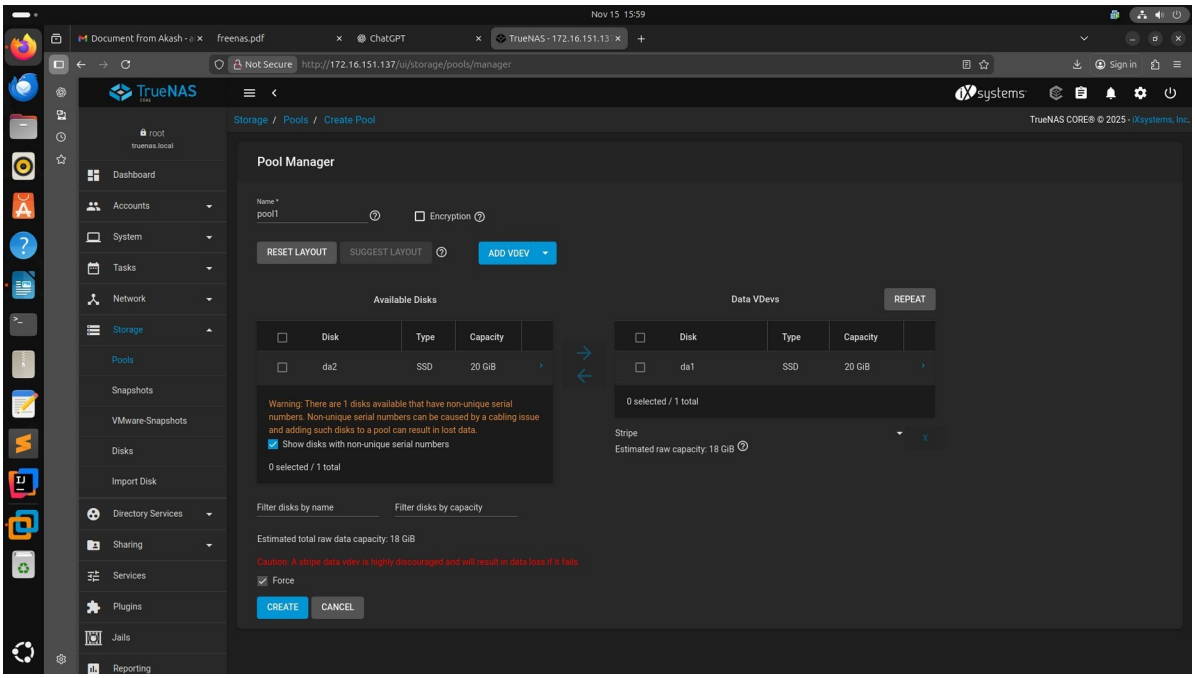
STEP 3: Accessing TrueNAS Web Interface

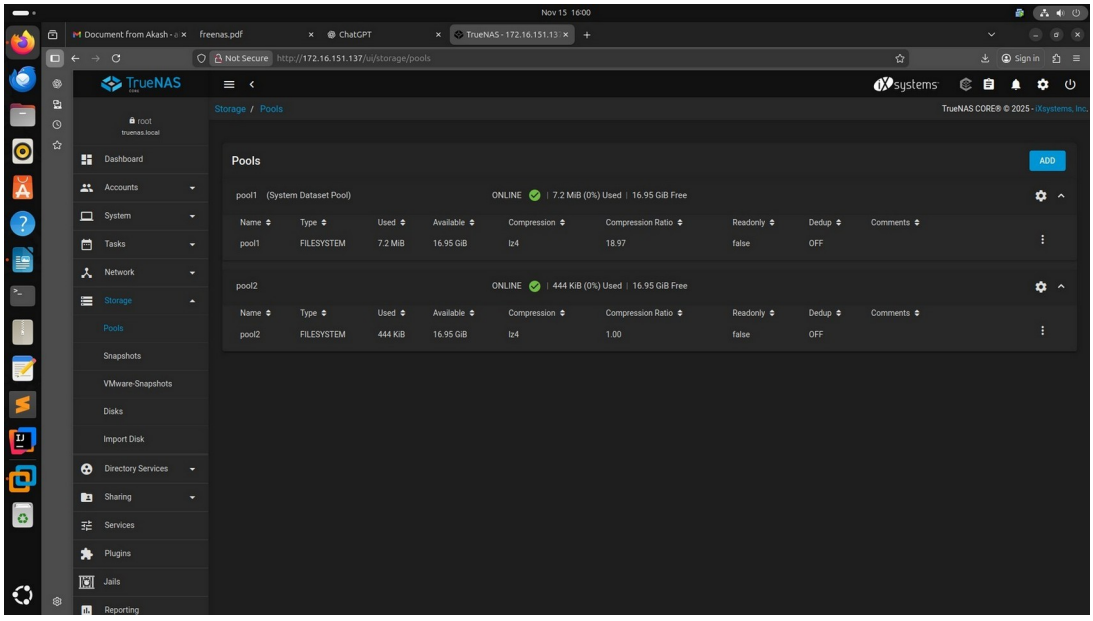
1. Open a web browser and navigate to http://<TRUENAS-IP-Address>.
2. Log in with the username “root” and the password “msis@123”



STEP 4: Creating Storage Pools

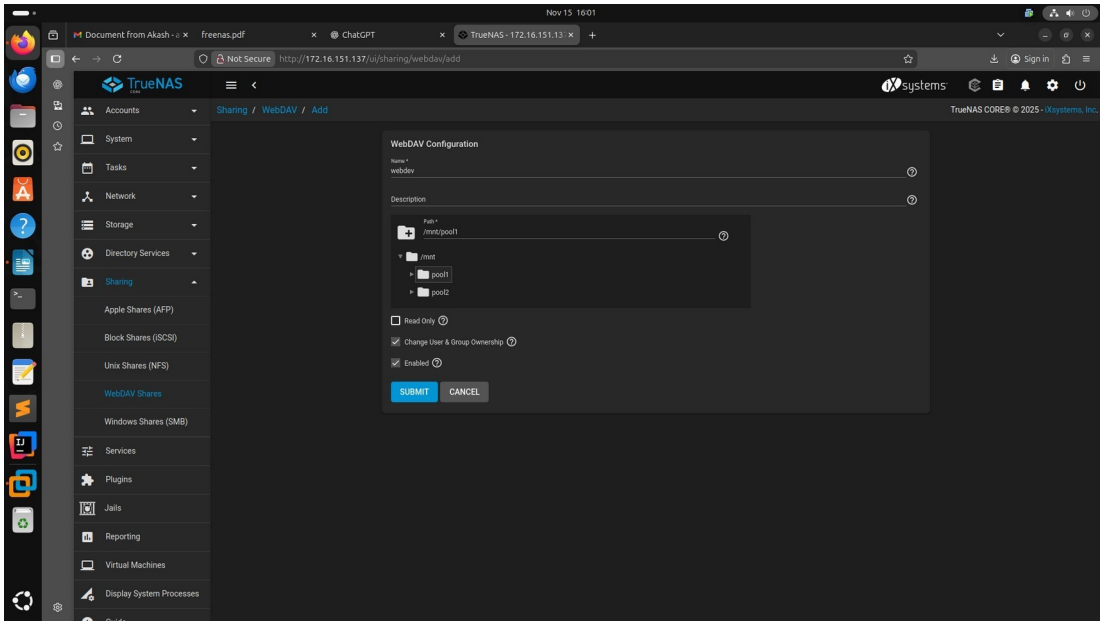
1. In the TRUENAS dashboard, navigate to Storage and select Pools.
2. Click Add to create a storage pool.
3. Select your virtual hard disk and configure the pool settings.



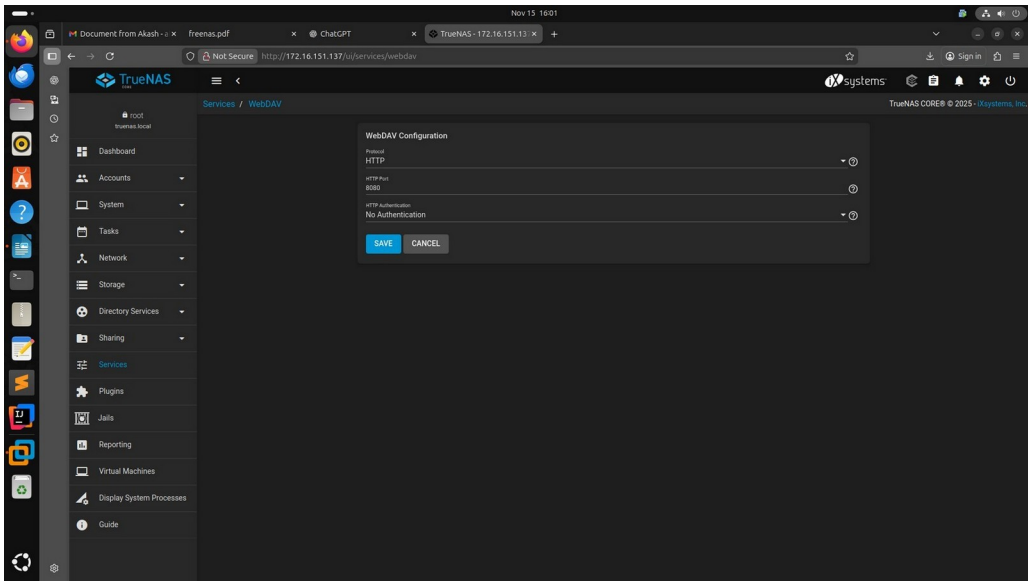


STEP 5: Configuring WebDAV Share

1. Go to Sharing.
2. Choose WebDAV shares based on your environment.

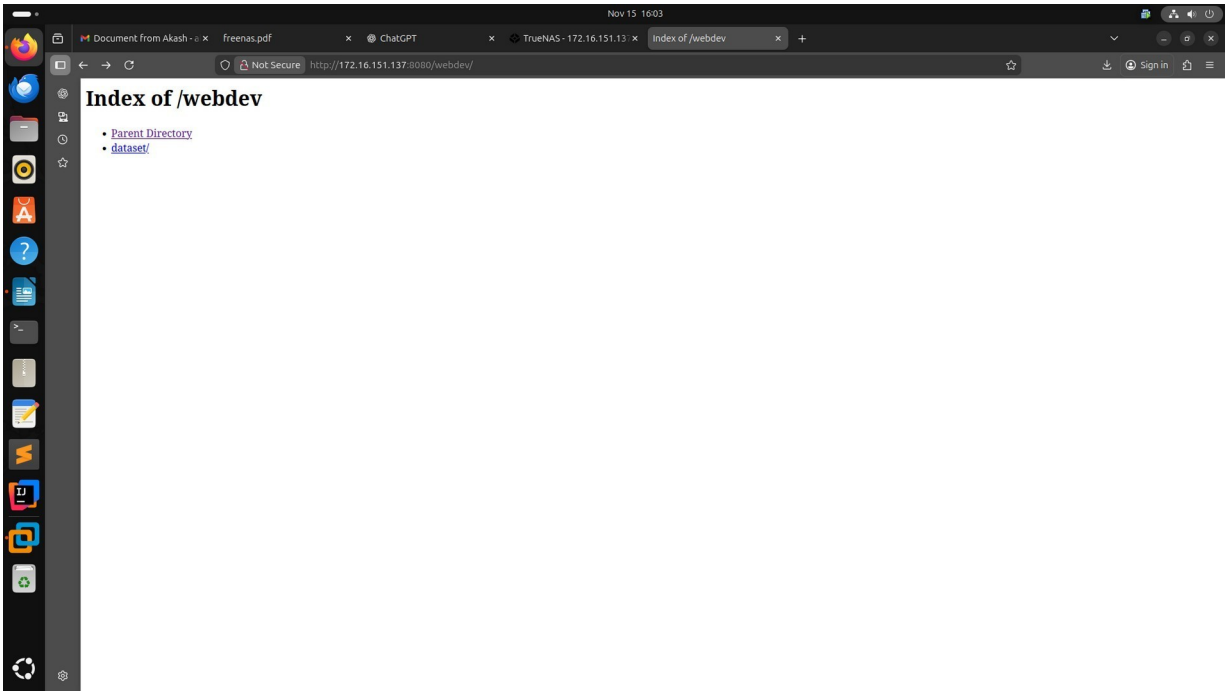


Select WebDAV from Sharing tab, and add name and select the pool1 path and click submit.



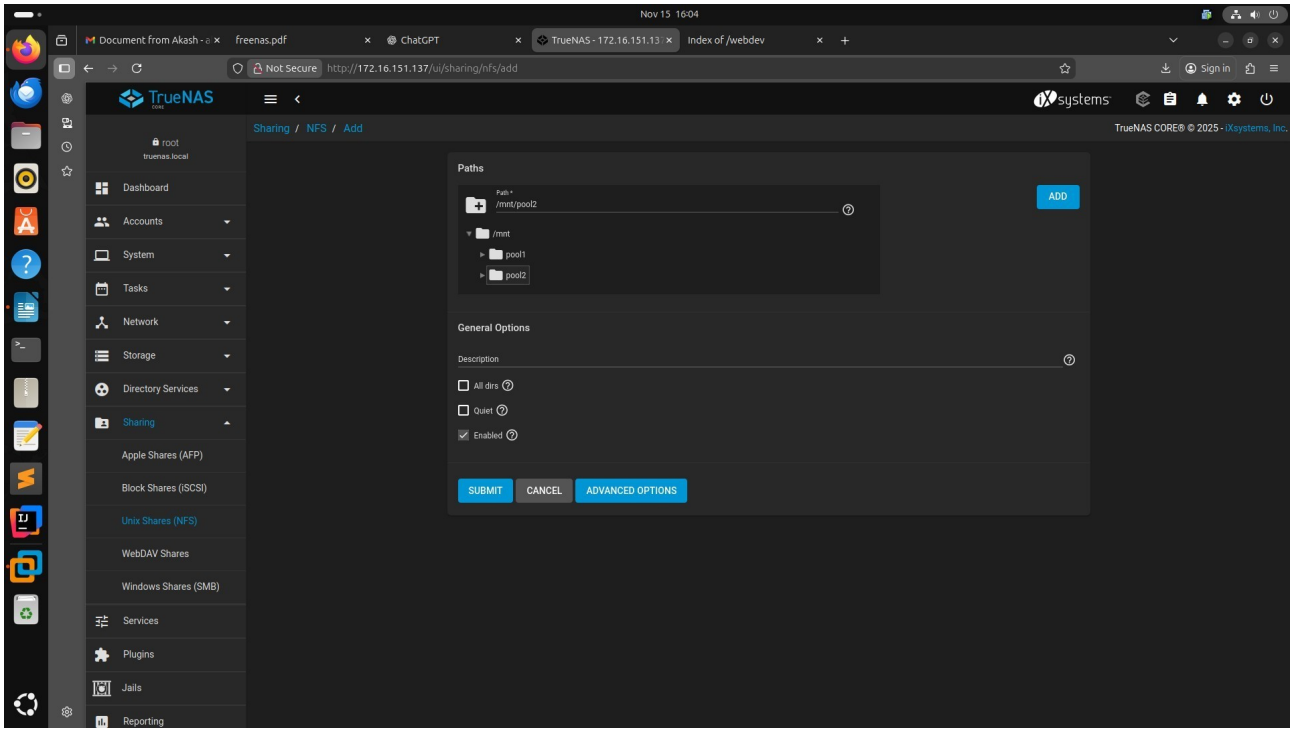
Enable WebDAV service and configure it from services tab:

Access ir using the <IP>:port/name of WebDAV sharing here 172.16.151.137:8080/webdev

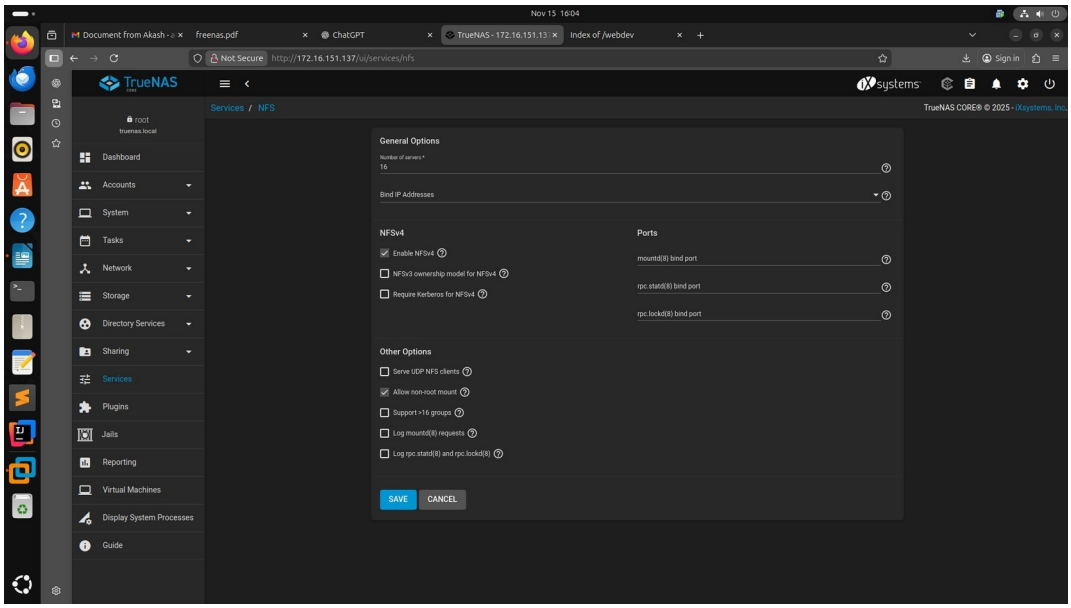


STEP 6: Configuring NFS Share

1. Go to Sharing.
2. Choose NFS shares based on your environment.



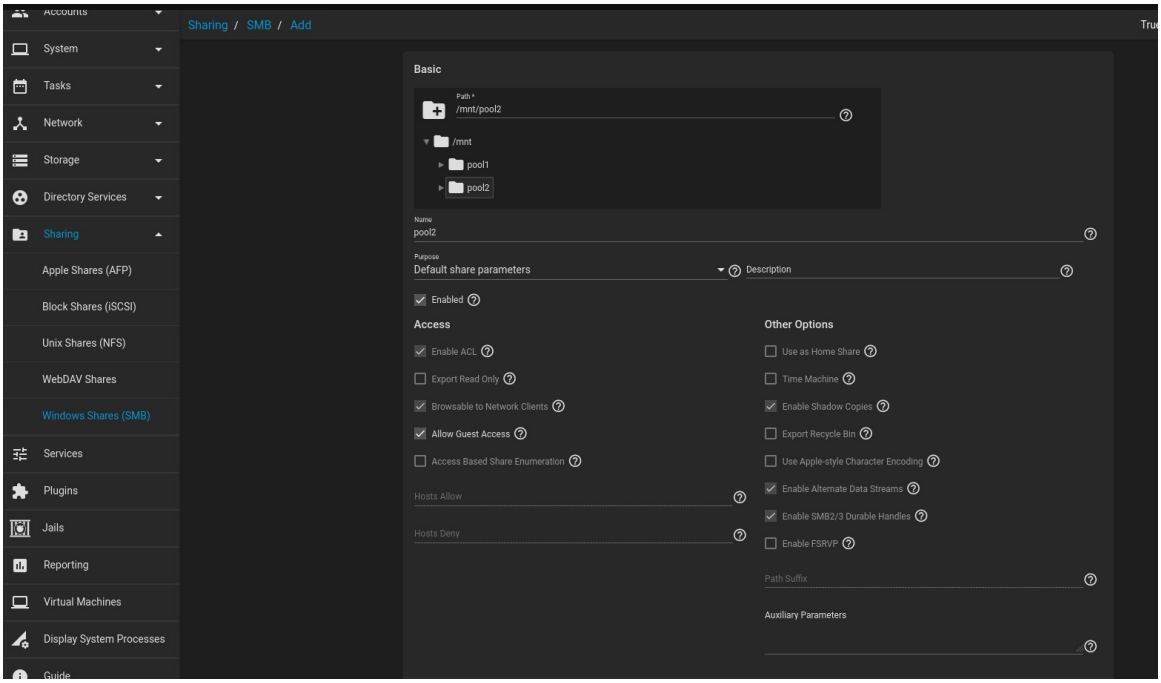
3. Set network and permission options based on requirements.
4. Save and enable the NFS service.



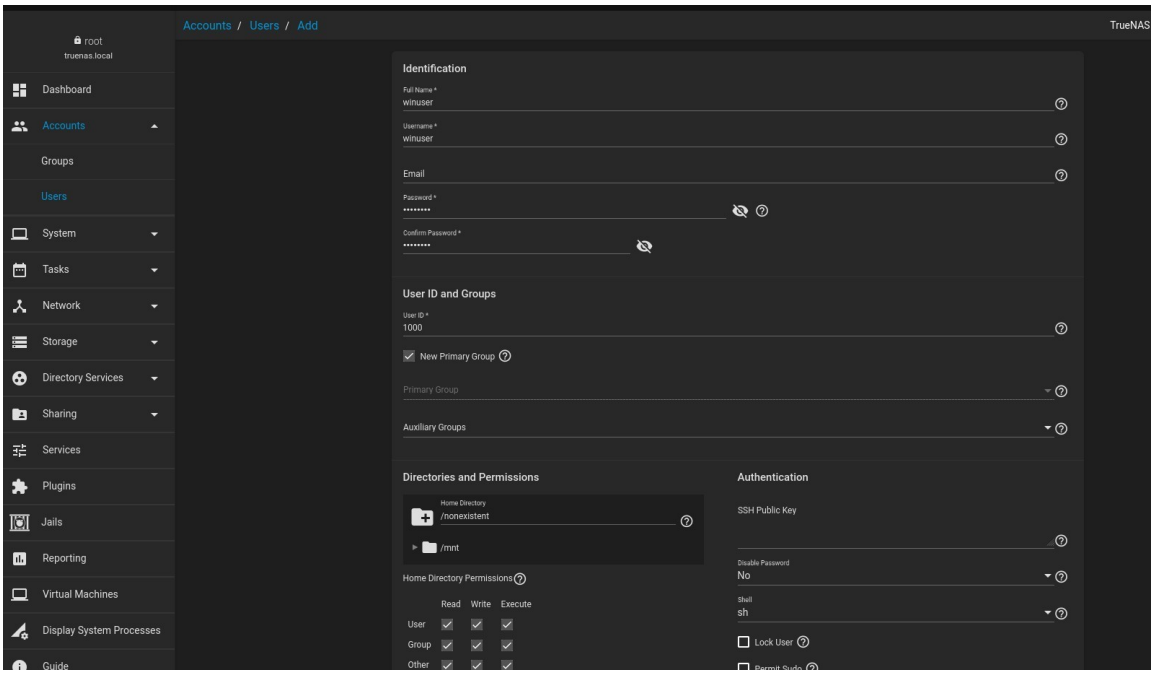

```
msis@msis:~$ cd /mnt/
msis@msis:/mnt$ cd nfs
msis@msis:/mnt/nfs$ cd ..
msis@msis:/mnt$ sudo mkdir nfs
[sudo] password for msis:
mkdir: cannot create directory ‘nfs’: File exists
msis@msis:/mnt$ sudo mount -t nfs -o nfsvers=4 172.16.151.137:/mnt/pool2/ /mnt/nfs
msis@msis:/mnt$ df -h
Filesystem                Size  Used Avail Use% Mounted on
tmpfs                     1.6G  2.4M  1.6G   1% /run
/dev/nvme0n1p2            937G  412G  479G  47% /
tmpfs                     7.7G     0  7.7G   0% /dev/shm
tmpfs                     5.0M  8.0K  5.0M   1% /run/lock
efivarfs                  246K  181K   61K  75% /sys/firmware/efi/efivars
/dev/nvme0n1p1            1.1G  6.2M  1.1G   1% /boot/efi
tmpfs                     1.6G  140K  1.6G   1% /run/user/1000
172.16.151.137:/mnt/pool2   17G  128K   17G   1% /mnt/nfs
msis@msis:/mnt$ cd nfs
msis@msis:/mnt/nfs$ ls
unix2
msis@msis:/mnt/nfs$
```

STEP 7: Configuring SMB Share

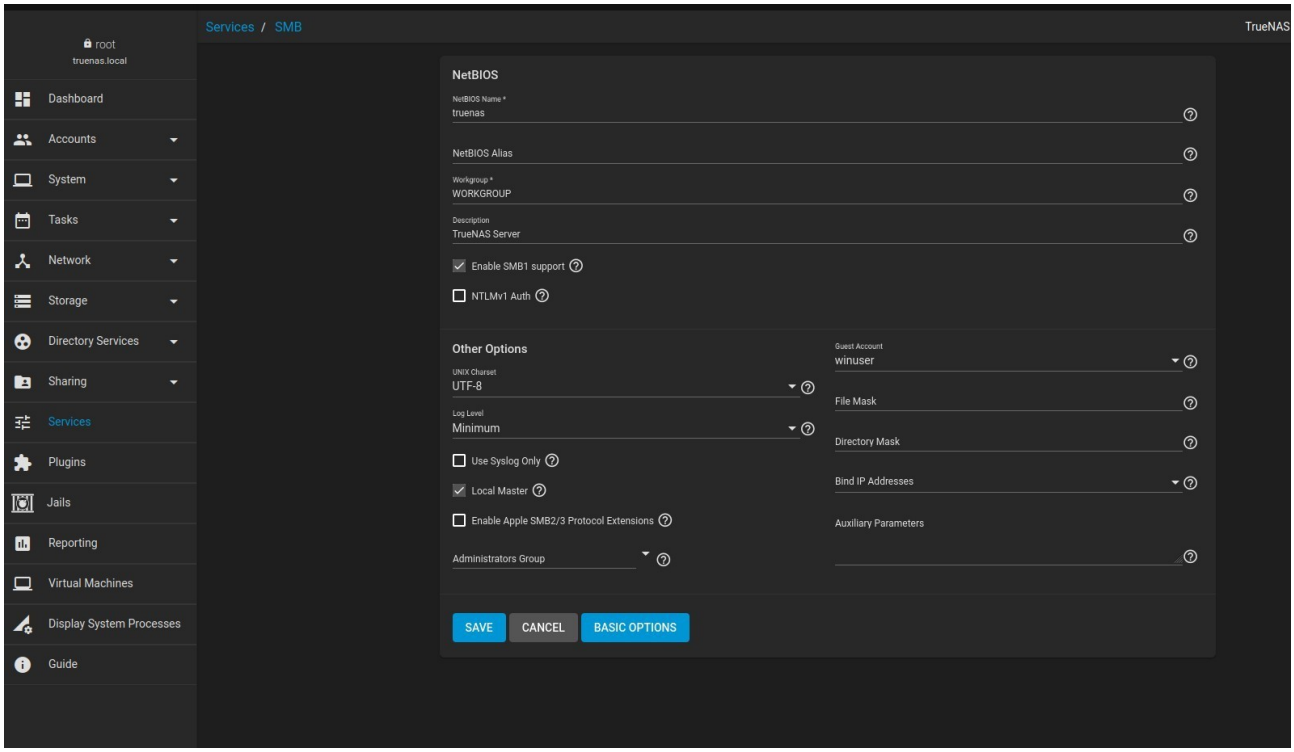
1. Click “Add”.
2. Choose the dataset path from your pool.



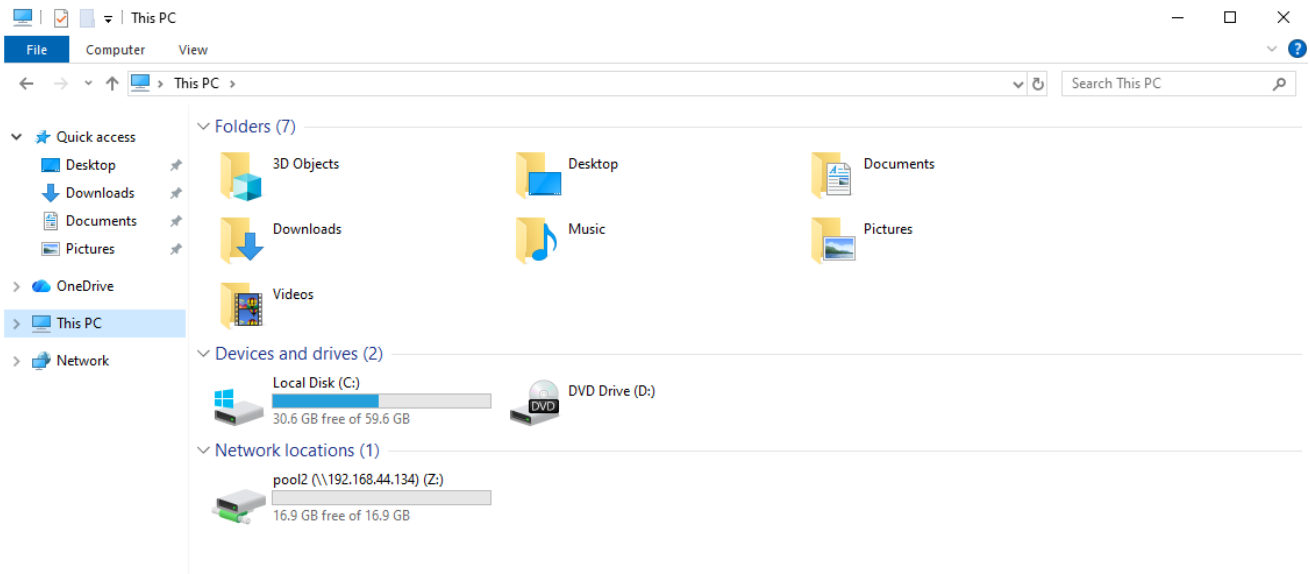
3. In Users click add give a name winusers and submit.



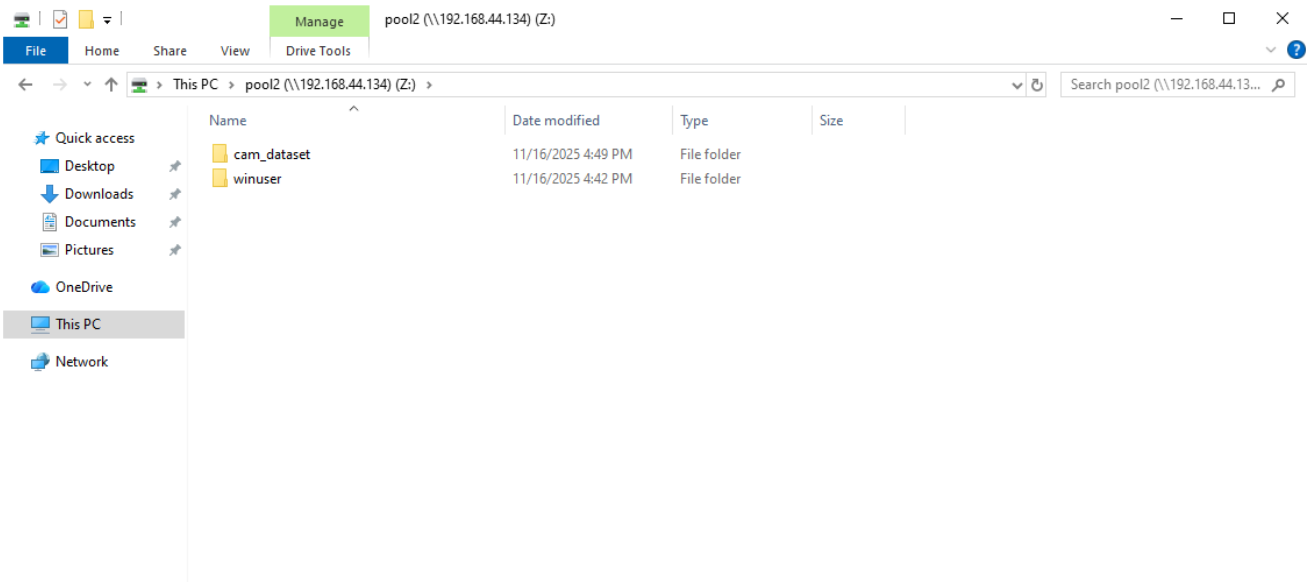
4.select the winuser in account and submit



5. Open windows select this pc right click and select the option network
6.Inside the network option enter TRUNAS ip adress submit



7.In the pool2 add the dataset that dataset shows in windows



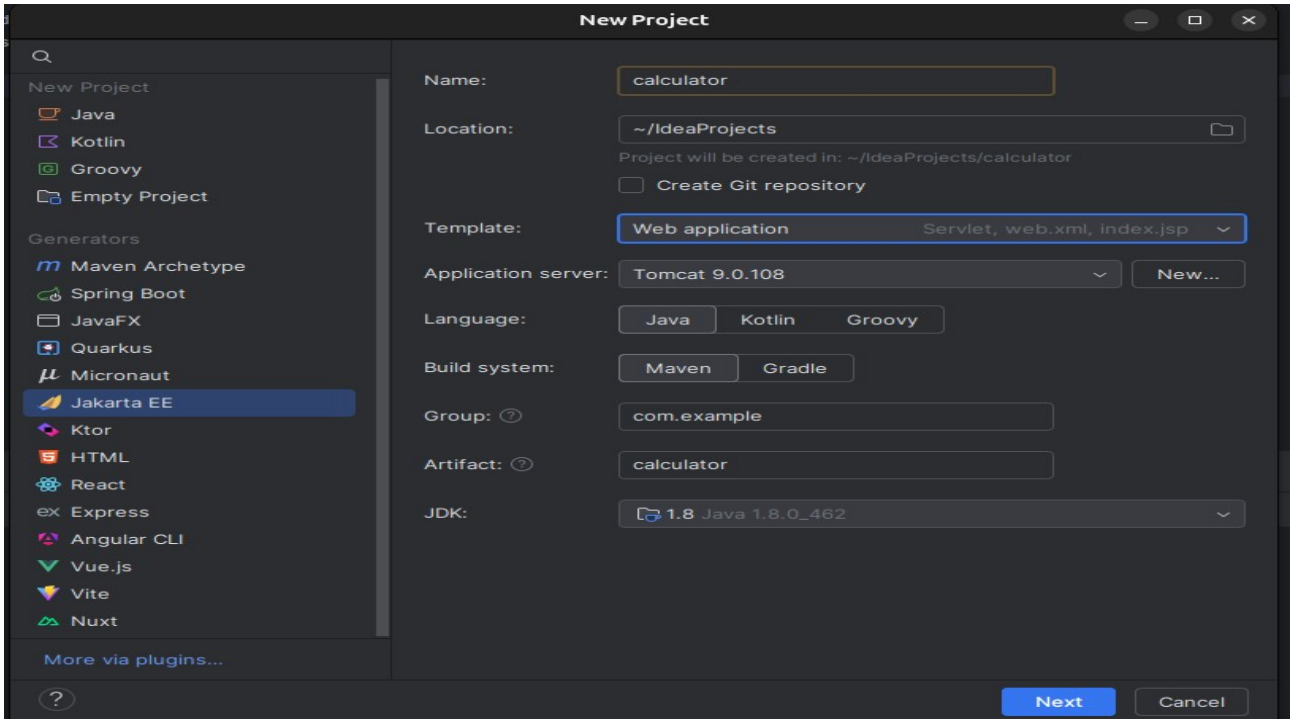
LAB:4 .Web services

STEP 1: Open IntelliJ IDEA Ultimate

1.Launch IntelliJ IDEA Ultimat**e** from your system.

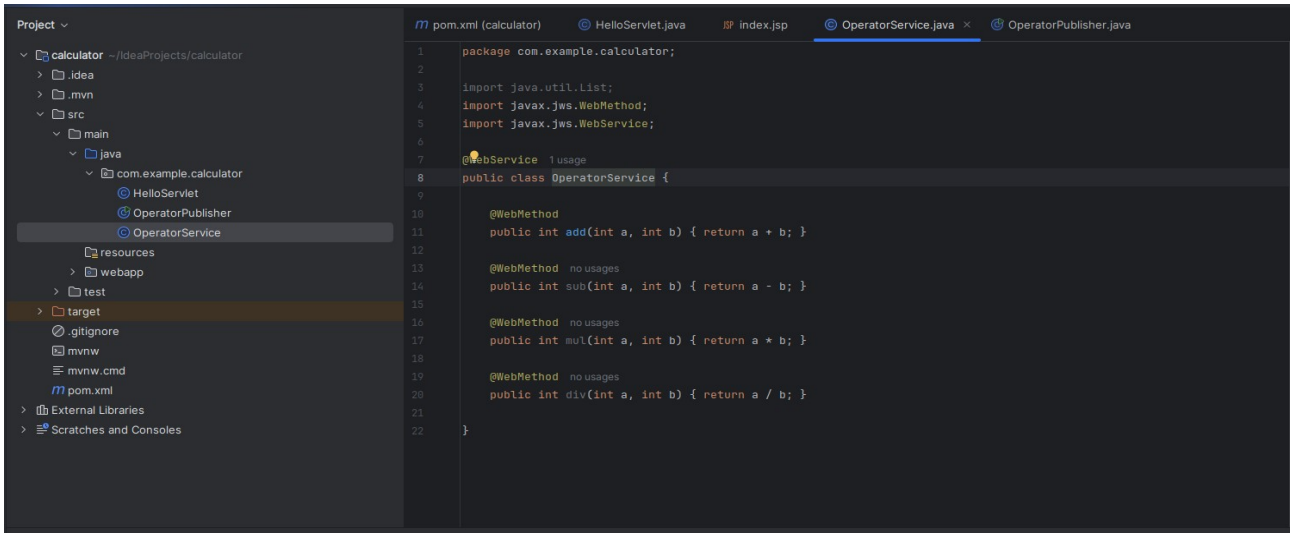
STEP 2: Create a New Web Application Project

1.create a new project
2.template: select web application
3.project name: calculator
4.App server: Tomcat



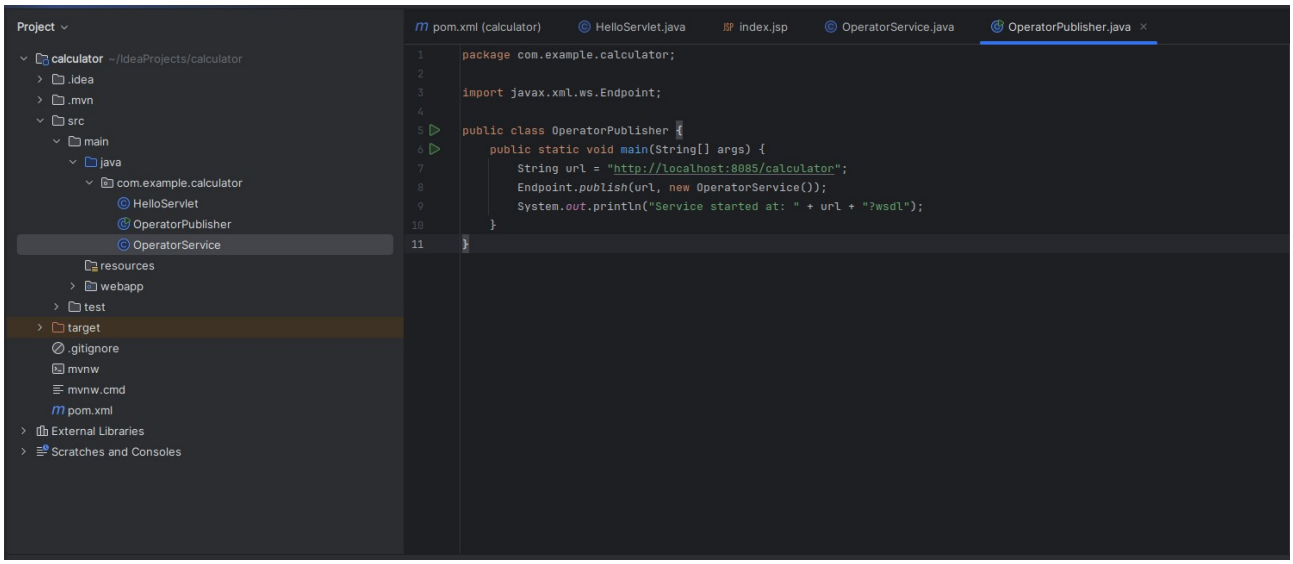
STEP 3: Create OperatorService Class

1.Inside calculator → src → main → java → com.example.calculator
2.Create new java class named OperatorService
3.Add below code



STEP 4: Create OperatorPublisher Class

1.Inside calculator → src → main → java → com.example.calculator
2.Create new java class named OperatorPublisher
3.Add below code



STEP 5: Configure Project Settings Properly

1.In the File->Project Structure,
2.Click modules (on left side), under sources->language level it should be 8 - Lambdas, type annotations, etc. and under dependencies, Module SDK Should be Project SDK 1.8

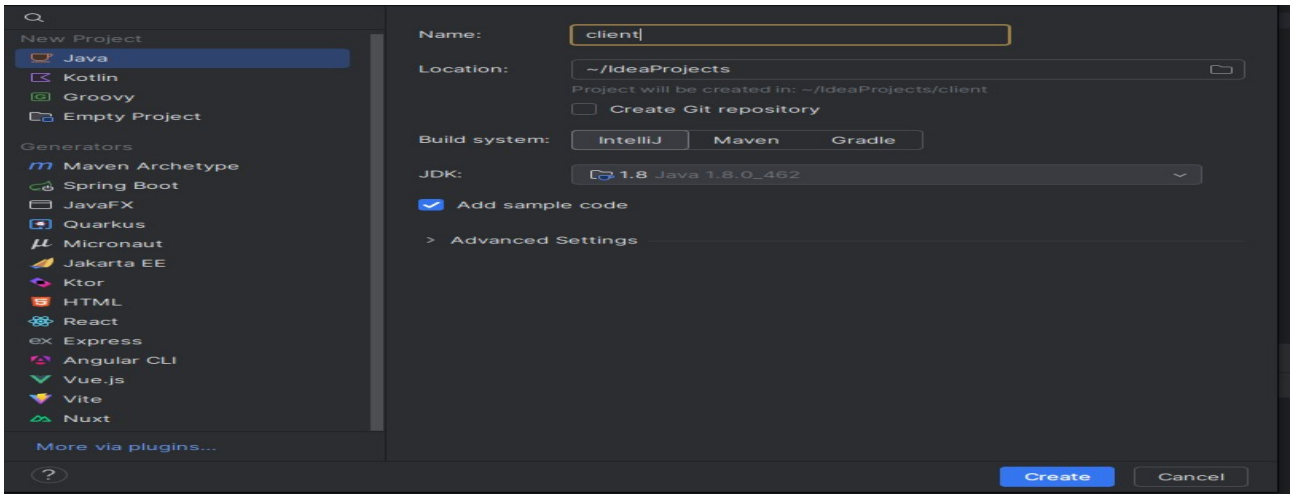
3.In File->Settings->Build, Execution, Deployment -> compiler-> Java compiler, in Per-module bytecode version, select your module (for e.g calculator) and Target byte code should be 8

4.In File->Settings->Build, Execution, Deployment -> compiler-> Java compiler, under Build Tools-> Maven-> Runner, JRE should be Java 1.8
5.In pom.xml target as maven compiler target 1.8 →
6.In Jakarta version as 4.0.4

7.HelloServlet.java is showing errors, make jarkata to javax in that file.

8.Run operatorPublisher, u can access at port:8085

STEP 6: Create Client



STEP 7: Run Client to See Output

1.Code it as written below.
2.Run the current file to see O/P.