

## Exercise 1 – The Inodes

### Tasks to Perform on AlmaLinux and Ubuntu:

*Use your user's account not root and use sudo if necessary.*

- For each of your partitions, how many **inodes** have been created?

How many are used and how many are available?

#### Alma

Partition	Total Inodes	Used Inodes	Available Inodes	Usage Percentage
/	20,971,520	172,365	20,799,155	~1%
/boot	524,288	366	523,922	~0%
/var	4,194,304	4,664	4,189,640	~0%
Other FS (e.g., /dev, /run)	-	Very low	-	~0-1%

```
[mperez@server1 /]$ 
[mperez@server1 /]$ pwd
/
[mperez@server1 /]$ df -i
Filesystem      Inodes   IUsed   IFree  IUse% Mounted on
devtmpfs        456604    471   456133    1% /dev
tmpfs           464136     1   464135    1% /dev/shm
tmpfs           819200   994   818206    1% /run
/dev/sda3       20971520 172365  20799155    1% /
/dev/sda5       4194304   4664  4189640    1% /var
/dev/sda2       524288    366   523922    1% /boot
tmpfs           92827    124   92703    1% /run/user/1000
/dev/sr0          0        0      0      - /run/media/mperez/AlmaLinux-9-5-x86_64-dvd
[mperez@server1 /]$ 
```

#### Ubuntu

```
[mperez@client1:/]$ df -i
Filesystem      Inodes   IUsed   IFree  IUse% Mounted on
tmpfs           495181    956   494225    1% /run
/dev/sda6       1411680  218535  1193145   16% /
tmpfs           495181    133   495048    1% /dev/shm
tmpfs           495181      4   495177    1% /run/lock
/dev/sda4       62592     607   61985    1% /boot
/dev/sda5       305216    1605  303611    1% /home
/dev/sda2          0       0      0      - /boot/efi
tmpfs           99036    139   98897    1% /run/user/1000
mperez@client1:/]$ 
```

### Lab 3 - File System Management

Filesystem	Total Inodes	Used Inodes	Available Inodes	Usage Percentage
/run	495,181	956	494,225	~1%
/ (Root)	1,411,680	218,535	1,193,145	~16%
/dev/shm	495,181	133	495,048	~1%
/run/lock	495,181	4	495,177	~1%
/boot	62,592	607	61,985	~1%
/home	305,216	1,605	303,611	~1%
/boot/efi	0	0	0	~0%
/run/user/1000	99,036	139	98,897	~1%

/boot/efi - Not using inodes directly, likely because of its specific filesystem type (e.g., FAT32).

Instead of inodes, FAT32 relies on a File Allocation Table (FAT), which functions as an index that maps file clusters directly to their physical locations on the disk.

```
mperez@client1:~$ lsblk -f
NAME FSTYPE FSVER LABEL UUID                                     FSDEVIC
sda
└─sda1
└─sda2 vfat   1       03EB-859F          969M    1% /boot/efi
└─sda3 swap   1       5db420a6-0db3-477b-a72b-5d6c1c6cdf94 [SWAP]
└─sda4 ext4   1.0    5280c079-b4a3-45bf-aa21-f2476bb7be4a  677.7M  21% /boot
└─sda5 ext4   1.0    b7b45f12-338c-4459-9b18-b4f3b68a4f0e   4.1G   4% /home
└─sda6 ext4   1.0    4f83ab0c-e389-4475-afe1-79a832ebc024  12.5G  35% /
mperez@client1:~$
```

### Exercise 2 – Creating Physical Links

#### Tasks to Perform on AlmaLinux:

Use your **user's account not root** and use **sudo** if necessary.

2. Create an empty file: **test.txt** and list its **inode number**.

See inode number is 68967980

```
[mperez@server1 ~]$ pwd
/home/mperez
[mperez@server1 ~]$ touch test.txt
[mperez@server1 ~]$ ll
total 0
drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Desktop
drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Documents
drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Downloads
drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Music
drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Pictures
drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Public
drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Templates
-rw-r--r--. 1 mperez mperez 0 Mar 26 18:06 test.txt ←
drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Videos
[mperez@server1 ~]$ ls -i test.txt
68967980 test.txt
[mperez@server1 ~]$
```

3. Create two physical links called **phy1.txt** and **phy2.txt** for the **test.txt** file.

### Lab 3 - File System Management

```
[mperez@server1 ~]$ ln test.txt phy1.txt  
[mperez@server1 ~]$ ln test.txt phy2.txt
```

4. List the inode numbers of the 3 files: **phy1.txt**, **phy2.txt** and **test.txt**.

Inode is the same for the three files 68967980 because hard links reference the same physical file.

The number 3 in the third column, indicated with a circle for files phy1.txt, phy2.txt, and test.txt have 3 hard links, meaning there are three different file names (or directory entries) pointing to the same data on the disk.

```
[mperez@server1 ~]$ ll -i  
total 0  
101752912 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Desktop  
101752914 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Documents  
2275319 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Downloads  
2275320 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Music  
68967980 -rw-r--r--. 3 mperez mperez 0 Mar 26 18:06 phy1.txt  
68967980 -rw-r--r--. 3 mperez mperez 0 Mar 26 18:06 phy2.txt  
35750089 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Pictures  
68893691 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Public  
35750088 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Templates  
68967980 -rw-r--r--. 3 mperez mperez 0 Mar 26 18:06 test.txt  
68893693 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Videos  
[mperez@server1 ~]$
```

5. Use the **echo** command to add the text “**Lab 3**” to the **phy1.txt** file. Check that the text has been added correctly.

```
echo « Lab 3 » > phy1.txt
```

```
cat phy1.txt
```

```
[mperez@server1 ~]$ echo "Lab 3" > phy1.txt  
[mperez@server1 ~]$ cat phy1.txt  
Lab 3  
[mperez@server1 ~]$
```

6. List the contents of the other two files: **test.txt** and **phy2.txt**. Is the new text appear?

All files have the same content

### Lab 3 - File System Management

```
[mperez@server1 ~]$ echo "Lab 3" > phy1.txt
[mperez@server1 ~]$ cat phy1.txt
Lab 3
[mperez@server1 ~]$ 
[mperez@server1 ~]$ cat phy2.txt
Lab 3
[mperez@server1 ~]$ cat test.txt
Lab 3
[mperez@server1 ~]$ 
```

7. Delete the **test.txt** file.

```
rm test.txt
```

```
[mperez@server1 ~]$ 
[mperez@server1 ~]$ rm test.txt
[mperez@server1 ~]$ 
```

8. Does The other two files: **phy1.txt** and **phy2.txt** still exist?

Both files still exist. Since these are hard links, they will still exist and reference the same data even after is deleted.

```
[mperez@server1 ~]$ ll -i
total 8
101752912 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Desktop
101752914 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Documents
2275319 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Downloads
2275320 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Movies
68967980 -rw-r--r--. 2 mperez mperez 6 Mar 26 18:24 phy1.txt
68967980 -rw-r--r--. 2 mperez mperez 6 Mar 26 18:24 phy2.txt
35750089 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Pictures
68893691 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Public
35750088 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Templates
68893693 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Videos
[mperez@server1 ~]$ 
```

9. Display the **number of links** for the **phy1.txt** and **phy2.txt** files.

The link count is now 2 (since was deleted, but the two hard links remain).

```
[mperez@server1 ~]$ ll -i
total 8
101752912 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Desktop
101752914 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Documents
2275319 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Downloads
2275320 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Movies
68967980 -rw-r--r--. 2 mperez mperez 6 Mar 26 18:24 phy1.txt
68967980 -rw-r--r--. 2 mperez mperez 6 Mar 26 18:24 phy2.txt
35750089 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Pictures
68893691 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Public
35750088 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Templates
68893693 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Videos
[mperez@server1 ~]$ 
```

## Lab 3 - File System Management

10. Delete both **phy1.txt** and **phy2.txt** files.

```
rm phy*.*
```

```
[mperez@server1 ~]$ rm phy*.*
[mperez@server1 ~]$ ll -i
total 0
101752912 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Desktop
101752914 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Documents
2275319 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Downloads
2275320 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Music
35750089 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Pictures
68893691 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Public
35750088 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Templates
68893693 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Videos
[mperez@server1 ~]$
```

## Exercise 3 – Creating symbolic links

### Tasks to Perform on AlmaLinux:

*Use your user's account not root and use sudo if necessary.*

1. Create the empty file **sym1.txt**.

```
touch sym1.txt
```

```
[mperez@server1 ~]$
[mperez@server1 ~]$ pwd
/home/mperez
[mperez@server1 ~]$ ll -i
total 0
101752912 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Desktop
101752914 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Documents
2275319 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Downloads
2275320 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Music
35750089 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Pictures
68893691 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Public
35750088 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Templates
68893693 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Videos
[mperez@server1 ~]$
[mperez@server1 ~]$ touch sym1.txt
[mperez@server1 ~]$ ll -i
total 0
101752912 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Desktop
101752914 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Documents
2275319 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Downloads
2275320 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Music
35750089 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Pictures
68893691 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Public
68967980 -rw-r--r--. 1 mperez mperez 0 Mar 26 19:47 sym1.txt
35750088 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Templates
68893693 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Videos
[mperez@server1 ~]$
```

## Lab 3 - File System Management

2. Create a symbolic link called **sym2.txt** and link it to the **sym1.txt** file.

```
ln -s sym1.txt sym2.txt
```

```
[mperez@server1 ~]$ ln -s sym1.txt sym2.txt
```

3. Use the **ls -l** command to check the newly created symbolic link.

The output will show **sym2.txt** as a symbolic link, with an arrow (→) pointing to **sym1.txt**.

A symbolic link acts as a reference or pointer to another file or directory.

Unlike a hard link, a symbolic link doesn't point directly to the same data on the disk (inode); instead, it points to another file by its path.

Note different inode and number of hard links is 1 for each file.

Symbolic links always have 1 hard link because they are separate files that just point to another file

```
[mperez@server1 ~]$ ll -i
[mperez@server1 ~]$ ll -i
total 0
101752912 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Desktop
101752914 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Documents
2275319 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Downloads
2275320 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Music
35750089 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Pictures
68893691 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Public
68967980 -rw-r--r--. 1 mperez mperez 0 Mar 26 21:15 sym1.txt
69655705 lrwxrwxrwx. 1 mperez mperez 8 Mar 26 21:16 sym2.txt -> sym1.txt
35750088 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Templates
68893693 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Videos
[mperez@server1 ~]$
```

4. Use the **echo** command to add the text: “**Symbolic Link**” to the **sym2.txt** file. Check that the text has been added.

```
Echo "Symbolic Link" > sym2.txt
```

```
cat sym2.txt
```

```
[mperez@server1 ~]$ echo "Symbolic Link" > sym2.txt
[mperez@server1 ~]$ cat sym2.txt
Symbolic Link
[mperez@server1 ~]$
```

5. List the contents of the **sym1.txt** file. Is the new text appear?

```
cat sym1.txt
```

```
[mperez@server1 ~]$ cat sym1.txt  
Symbolic link  
[mperez@server1 ~]$ █
```

The text for sym2.txt appears in sym1.txt

6. Delete the **sym2.txt** symbolic link and open the **sym1.txt** file, is the new text still present?

`rm sym2.txt`

`cat sym1.txt`

**sym1.txt** text is still there

```
[mperez@server1 ~]$ rm sym2.txt  
[mperez@server1 ~]$ ll -i  
total 4  
101752912 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Desktop  
101752914 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Documents  
2275319 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Downloads  
2275320 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Music  
35750089 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Pictures  
68893691 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Public  
68967980 -rw-r--r--. 1 mperez mperez 14 Mar 26 21:31 sym1.txt  
35750088 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Templates  
68893693 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Videos  
[mperez@server1 ~]$ cat sym1.txt  
Symbolic link  
[mperez@server1 ~]$ █
```

7. Recreate again a symbolic link called **sym2.txt** and link it to the **sym1.txt** file.

`ln -s sym1.txt sym2.txt`

8. Use the **ls -l** command to verify the newly created symbolic link.

```
[mperez@server1 ~]$ ll -i  
total 4  
101752912 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Desktop  
101752914 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Documents  
2275319 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Downloads  
2275320 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Music  
35750089 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Pictures  
68893691 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Public  
68967980 -rw-r--r--. 1 mperez mperez 14 Mar 26 21:31 sym1.txt  
35750088 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Templates  
68893693 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Videos  
[mperez@server1 ~]$ ln -s sym1.txt sym2.txt  
[mperez@server1 ~]$ ll -i  
total 4  
101752912 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Desktop  
101752914 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Documents  
2275319 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Downloads  
2275320 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Music  
35750089 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Pictures  
68893691 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Public  
68967980 -rw-r--r--. 1 mperez mperez 14 Mar 26 21:31 sym1.txt  
69655705 lrwxrwxrwx. 1 mperez mperez 8 Mar 26 21:45 sym2.txt -> sym1.txt  
35750088 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Templates  
68893693 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Videos  
[mperez@server1 ~]$ █
```

### Lab 3 - File System Management

```
[mperez@server1 ~]$ cat sym1.txt  
Symbolic link  
[mperez@server1 ~]$ cat sym2.txt  
Symbolic link  
[mperez@server1 ~]$
```

9. Delete the original **sym1.txt** file.

```
rm sym1.txt
```

```
[mperez@server1 ~]$ rm sym1.txt  
[mperez@server1 ~]$ ll -i  
total 0  
101752912 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Desktop  
101752914 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Documents  
2275319 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Downloads  
2275320 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Music  
35750089 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Pictures  
68893691 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Public  
69655705 lrwxrwxrwx. 1 mperez mperez 8 Mar 26 21:45 sym2.txt -> sym1.txt  
35750088 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Templates  
68893693 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Videos  
[mperez@server1 ~]$
```

10. Check if the **sym2.txt** exists, and try to list the contents of the file. Can you? Why?

```
cat sym2.txt
```

```
[mperez@server1 ~]$  
[mperez@server1 ~]$ cat sym2.txt  
cat: sym2.txt: No such file or directory  
[mperez@server1 ~]$ █
```

You cannot list the contents because **sym2.txt** is a symbolic link, and the original file (**sym1.txt**) it pointed to has been deleted. The symbolic link is now broken.

11. Delete symbolic link **sym2.txt**.

```
rm sym2.txt
```

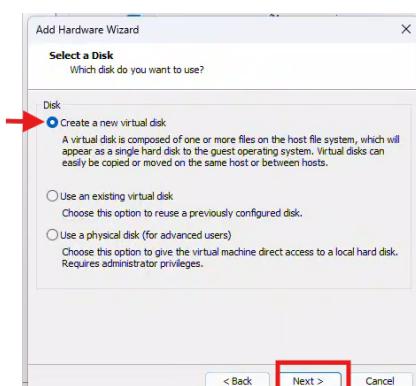
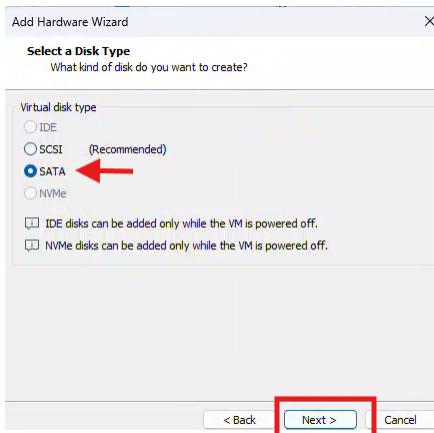
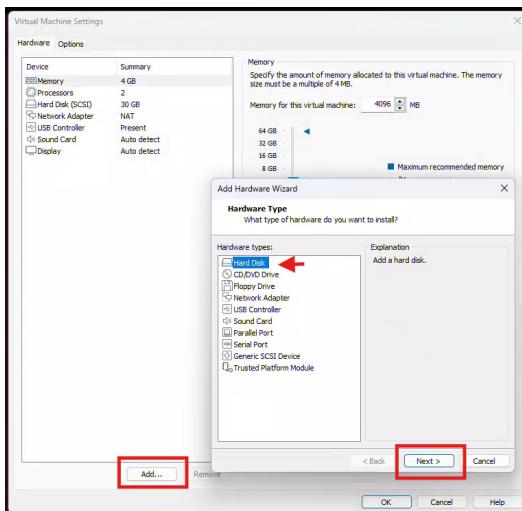
```
[mperez@server1 ~]$ rm sym2.txt  
[mperez@server1 ~]$ ll -i  
total 0  
101752912 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Desktop  
101752914 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Documents  
2275319 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Downloads  
2275320 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Music  
35750089 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Pictures  
68893691 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Public  
35750088 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Templates  
68893693 drwxr-xr-x. 2 mperez mperez 6 Mar 24 14:21 Videos  
[mperez@server1 ~]$
```

## Exercise 4 – Adding and Mounting Disks

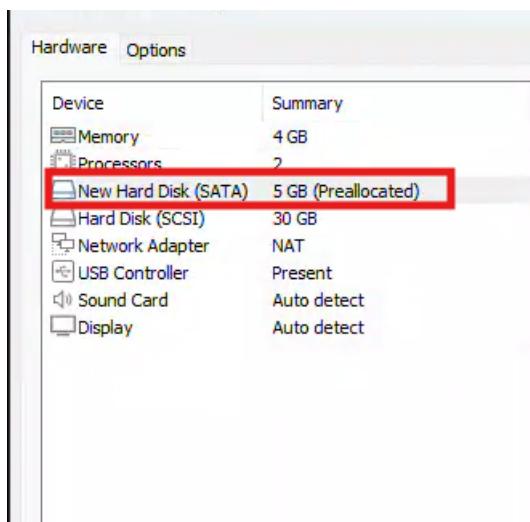
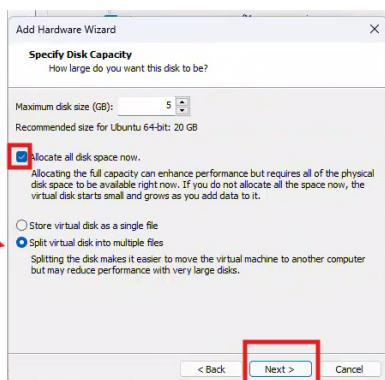
### Tasks to Perform on Ubuntu:

*Use your user's account not root and use sudo if necessary.*

1. Add a 5 GB SATA disk to your Ubuntu virtual machine.



## Lab 3 - File System Management



- Check that the disk is added correctly.

lsblk

```
1/0 size (minimum/optimal): 512 bytes / 512 bytes
mperez@client1:~$ 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    5G  0 disk
mperez@client1:~$
```

sudo fdisk -l

## Lab 3 - File System Management

```
mperez@client1:~$ sudo fdisk -l
[sudo] password for mperez:
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: 5153AC40-A82E-47B3-B516-3B537B461605

Device      Start    End  Sectors  Size Type
/dev/sda1     2048    4095   2048   1M BIOS boot
/dev/sda2     4096  2004991  1964095  977M EFI System
/dev/sda3  2004992   6002687  3997696  1.9G Linux swap
/dev/sda4   6002688   8003583  2000896  977M Linux filesystem
/dev/sda5   8003584 17766399  9762816  4.7G Linux filesystem
/dev/sda6 17766400 62912511 45146112 21.5G Linux filesystem

Disk /dev/sdb: 5 GiB, 5368709120 bytes, 10485760 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
mperez@client1:~$
```

`ls -la /dev/sdb`

```
mperez@client1:~$ ls -la /dev/sdb
brw-rw---- 1 root disk 8, 16 Mar 26 22:30 /dev/sdb
mperez@client1:~$
```

3. On the new disk, create two partitions of **2 GB** each.

`sudo fdisk /dev/sdb`

Press **n** to create a new partition.

Choose the size as **2.5 GB** (e.g., **+2.5G**).

Repeat the steps to create the second partition.

```
mperez@client1:~$ sudo 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 0xcc5e136b.

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 (2048-10485759, default 2048):
Last sector, +/sectors or +/-size{K,M,G,T,P} (2048-10485759, default 10485759): +2.5G
Created a new partition 1 of type 'Linux' and of size 2.5 GiB.

Command (m for help): p
Disk /dev/sdb: 5 GiB, 5368709120 bytes, 10485760 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: dos
Disk identifier: 0xcc5e136b

Device  Boot Start   End Sectors  Size Id Type
/dev/sdb1  2048 5244927 5242880  2.5G 83 Linux

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

## Lab 3 - File System Management

```
mperez@client1:/$ 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   5G  0 disk
└─sdb1   8:17   0  2.5G 0 part
mperez@client1:/$
mperez@client1:/$
```

```
mperez@client1:/$ sudo 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.

Command (m for help): n
Partition type
  p  primary (1 primary, 0 extended, 3 free)
  e  extended (container for logical partitions)
Select (default p): p
Partition number (2-4, default 2):
First sector (5244928-10485759, default 5244928):
Last sector, +/-sectors or +/-size{K,M,G,T,P} (5244928-10485759, default 10485759): +2.5G
Value out of range.
Last sector, +/-sectors or +/-size{K,M,G,T,P} (5244928-10485759, default 10485759):

Created a new partition 2 of type 'Linux' and of size 2.5 GiB.

Command (m for help): p
Disk /dev/sdb: 5 GiB, 5368709120 bytes, 10485760 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: dos
Disk identifier: 0xcc5e136b

Device     Boot   Start     End Sectors  Size Id Type
/dev/sdb1        2048 5244927 5242880  2.5G 83 Linux
/dev/sdb2      5244928 10485759 5240832  2.5G 83 Linux

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

## Lab 3 - File System Management

```
mperez@client1:~$ 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
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   5G  0 disk
└─sdb1   8:17   0   2.5G 0 part
└─sdb2   8:18   0   2.5G 0 part
mperez@client1:~$
```

- Check that both partitions are created correctly.

*You should see two partitions, such as and , each 2.5 GB in size.*

*sudo mkfs.xfs /dev/sdb1*

```
mperez@client1:~$ lsblk -l /dev/sdb
NAME  MAJ:MIN RM  SIZE RO TYPE MOUNTPOINTS
sdb      8:16   0   5G  0 disk
sdb1    8:17   0   2.5G 0 part
sdb2    8:18   0   2.5G 0 part
mperez@client1:~$
```

- Format the 1<sup>st</sup> partition with the **xfs** file system.

**xfs** is not available

```
mperez@client1:~$ sudo mkfs.
mkfs.bfs      mkfs.cramfs  mkfs.ext2    mkfs.ext3    mkfs.ext4    mkfs.fat      mkfs.minix  mkfs.msdos  mkfs.ntfs    mkfs.vfat
mperez@client1:~$
```

Install **xfs**

*sudo apt install xfsprogs*

```
mperez@client1:~$ sudo apt install xfsprogs
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
Suggested packages:
  xfsdump attr quota
The following NEW packages will be installed:
  xfsprogs
0 upgraded, 1 newly installed, 0 to remove and 1 not upgraded.
Need to get 0 B/2,851 kB of additional disk space will be used.
Get:1 http://ca.archive.ubuntu.com/ubuntu jammy-updates/main amd64 xfsprogs amd64 5.13.0-1ubuntu2.1 [870 kB]
Fetched 870 kB in 4,464 kB/s
Selecting previously unselected package xfsprogs.
(xfsprogs:amd64) 2020.1.3-0ubuntu2.1 files in selected directories currently installed.)
Preparing to unpack .../xfsprogs_5.13.0-1ubuntu2.1_amd64.deb ...
Unpacking xfsprogs (5.13.0-1ubuntu2.1) ...
Setting up xfsprogs (5.13.0-1ubuntu2.1) ...
update-initramfs: deferring update (trigger activated)
Processing triggers for libgcrypt20 (2.35.0-ubuntu3.0) ...
Processing triggers for liblzc-blk (2.35.0-ubuntu3.0) ...
Processing triggers for initramfs-tools (0.140ubuntu13.4) ...
update-initramfs: Generating /boot/initrd.img-6.8.0-52-generic
I: The initramfs will attempt to resume from /dev/sda3
I: (UUID=5d0428ad-0bd3-477b-a72b-5dc1ccdf94)
I: Set the RESUME variable to override this.
```

Verify nfs is installed

*sudo mkfs.xfs -V*

### Lab 3 - File System Management

```
mperez@client1:~$ sudo mkfs.xfs -V
mkfs.xfs version 5.13.0
mperez@client1:~$
```

```
mperez@client1:~$ sudo mkfs.xfs /dev/sdb1
meta-data=/dev/sdb1      isize=512    agcount=4, agsize=163840 blks
                      =         sectsz=512   attr=2, projid32bit=1
                      =         crc=1     finobt=1, sparse=1, rmapbt=0
data      =         bsize=4096   bigtime=0 inobtcount=0
          =         sunit=0    blocks=655360, imaxpct=25
          =         swidth=0   sunit=0 blks, lazy-count=1
naming    =version 2      bsiz=4096   blocks=2560, version=2
log       =internal log   sectsz=512
          =         extsz=4096
realtime =none           blocks=0, rtextents=0
mperez@client1:~$ lsblk -f
```

lsblk -f

```
mperez@client1:~$ lsblk -f
NAME   FSTYPE FSVER LABEL UUID                                     FSAVAIL FSUSE% MOUNTPOINTS
sda
└─sda1
└─sda2 vfat   FAT32      03EB-859F
└─sda3 swap   1          5db420a6-0db3-477b-a72b-5d6c1c6cdf94
└─sda4 ext4   1.0        5280c079-b4a3-45bf-aa21-f2476bb7be4a  677.7M  21% /boot
└─sda5 ext4   1.0        b7b45f12-338c-4459-9b18-b4f3b68a4f0e   4.1G   4% /home
└─sda6 ext4   1.0        4f83ab0c-e389-4475-afe1-79a832ebc024   12.5G  35% /
sdb
└─sdb1 xfs    5          66605c78-4c66-4151-9dc6-4ad9be8ef2b7 ←
└─sdb2
```

- Format the 2<sup>nd</sup> partition with the **ext4** file system.

`sudo mkfs.ext4 /dev/sdb2`

```
MKFS.XFS VERSION 5.13.0
mperez@client1:~$ sudo mkfs.ext4 /dev/sdb2
mke2fs 1.46.5 (30-Dec-2021)
Creating filesystem with 655104 4k blocks and 163840 inodes
Filesystem UUID: 0a41d34b-8cee-489d-9ce6-776e08ead01a
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
```

- Verify that both partitions are properly formatted with the correct file system.

Check the **FSTYPE** column for (XFS) and (ext4).

lsblk -f

### Lab 3 - File System Management

```
mperez@client1:~$ lsblk -f
NAME   FSTYPE FSVER LABEL UUID                                     FSavail FSuse% MOUNTPOINTS
sda
└─sda1
  └─sda2 vfat    FAT32      03EB-859F                               969M    1% /boot/efi
  └─sda3 swap     1          5db420a6-0db3-477b-a72b-5d6c1c6cdf94 [SWAP]
  └─sda4 ext4    1.0        5280c079-b4a3-45bf-aa21-f2476bb7be4a  677.7M  21% /boot
  └─sda5 ext4    1.0        b7b45f12-338c-4459-9b18-b4f3b68a4f0e   4.1G   4% /home
  └─sda6 ext4    1.0        4f83ab0c-e389-4475-afe1-79a83zebc024  12.5G  35% /
sdb
└─sdb1 ext4    1.0        66605c78-4c66-4151-9dc6-4ad9be8ef2b7
  └─sdb2 ext4    1.0        0a41d34b-8cee-489d-9ce6-776e08ead01a
mperez@client1:~$
```

8. Create directory `/home/<your_user>/partition1`.

```
mkdir -p /home/mperez/partition1
```

```
mperez@client1:~$ 
mperez@client1:~$ mkdir -p /home/mperez/partition1
```

```
mperez@client1:~$ ls /home/mperez/
Desktop Documents Downloads Music partition1 Pictures Public snap Templates Videos
mperez@client1:~$
```

9. Manually mount the **first new partition** of the new disk in `/home/<your_user>/partition1`.

```
sudo mount /dev/sdb1 /home/mperez/partition1
```

```
mperez@client1:~$ 
mperez@client1:~$ sudo mount /dev/sdb1 /home/mperez/partition1
mperez@client1:~$
```

10. Check that the partition is mounted correctly.

```
df -h
```

```
mperez@client1:~$ df -h
Filesystem      Size  Used Avail Use% Mounted on
tmpfs           387M  1.9M  386M  1% /run
/dev/sda6        22G  7.4G  13G  38% /
tmpfs           1.9G  31M  1.9G  2% /dev/shm
tmpfs            5.0M  4.0K  5.0M  1% /run/lock
/dev/sda4       944M  201M  678M  23% /boot
/dev/sda5       4.6G  207M  4.1G  5% /home
/dev/sda2       976M  6.1M  969M  1% /boot/efi
tmpfs           387M  100K  387M  1% /run/user/1000
/dev/sdb1        2.5G  51M  2.5G  2% /home/mperez/partition1
mperez@client1:~$
```

11. Create the folder `/Test`.

## Lab 3 - File System Management

sudo mkdir /Test

ls /

```
mperez@client1:/$ sudo mkdir /Test
```

```
mperez@client1:/$ ls /
bin  cdrom  etc   lib   lib64  lost+found  mnt  proc  run  srv  Test  usr
boot dev    home  lib32  libx32 media      opt  root  sbin  sys  tmp  var
mperez@client1:/$
```

12. Edit the **/etc/fstab** file to mount the **second new partition** of the new disk in the **/Test** directory and make it permanent.

sudo nano /etc/fstab

```
mperez@client1:/$ sudo nano /etc/fstab
```

Add this line

/dev/sdb2 /Test ext4 defaults 0 0

```
GNU nano 6.2
/etc/fstab: static file system information.
#
# Use 'blkid' to print the universally unique identifier for a
# device; this may be used with UUID= as a more robust way to name devices
# that works even if disks are added and removed. See fstab(5).
#
# <file system> <mount point> <type> <options>     <dump> <pass>
# / was on /dev/sda6 during installation
UUID=4f83ab0c-e389-4475-afe1-79a832ebc024 /          ext4    errors=remount-ro 0      1
# /boot was on /dev/sda4 during installation
UUID=5280c079-b4a3-45bf-aa21-f247bb7be4a /boot        ext4    defaults        0      2
# /boot/efi was on /dev/sda2 during installation
UUID=03EB-859F /boot/efi  vfat    umask=0077  0      1
# /home was on /dev/sda5 during installation
UUID=b7b45f12-338c-4459-9b18-b4f3b68a4f0e /home        ext4    defaults        0      2
# swap was on /dev/sda3 during installation
UUID=5d420a6-0db3-477b-a72b-5d6c1c6cdf94 none        swap    sw            0      0
# Added Partition
/dev/sdb2      /Test  ext4    defaults        0      0
```

13. Test permanent mounting with the command: **mount -a**.

sudo mount -a

```
mperez@client1:/$ sudo mount -a
```

14. Check that the partition is mounted correctly.

df -h

### Lab 3 - File System Management

```
mperez@client1:~$ df -h
Filesystem      Size  Used Avail Use% Mounted on
tmpfs           387M  1.9M  386M   1% /run
/dev/sda6        22G  7.4G  13G  38% /
tmpfs           1.9G  31M  1.9G   2% /dev/shm
tmpfs           5.0M  4.0K  5.0M   1% /run/lock
/dev/sda4       944M 201M  678M  23% /boot
/dev/sda5        4.6G 207M  4.1G   5% /home
/dev/sda2       976M  6.1M  969M   1% /boot/efi
tmpfs           387M 100K  387M   1% /run/user/1000
/dev/sdb1        2.5G  51M  2.5G   2% /home/mperez/partition1
/dev/sdb2        2.4G  24K  2.3G   1% /Test
mperez@client1:~$
```

15. Restart the machine.

```
sudo reboot
```

```
mperez@client1:~$ 
mperez@client1:~$ sudo reboot
```

16. Check that the mount/**Test** is still properly mounted on the new disk, and that the mount point **/home/<your\_user>/partition1** is no longer mounted.

See /home/mperez/partiton1 is no longer mounted

/Test is still there

```
df -h
```

```
mperez@client1:~$ 
mperez@client1:~$ df -h
Filesystem      Size  Used Avail Use% Mounted on
tmpfs           387M  1.8M  386M   1% /run
/dev/sda6        22G  7.5G  13G  38% /
tmpfs           1.9G     0  1.9G   0% /dev/shm
tmpfs           5.0M  4.0K  5.0M   1% /run/lock
/dev/sda5        4.6G 198M  4.1G   5% /home
/dev/sda4       944M 201M  678M  23% /boot
/dev/sda2       976M  6.1M  969M   1% /boot/efi
/dev/sdb2        2.4G  24K  2.3G   1% /Test
tmpfs           387M  96K  387M   1% /run/user/1000
mperez@client1:~$
```

17. Unmount **/Test**.

```
sudo umount /Test
```

```
mperez@client1:~$ 
mperez@client1:~$ sudo umount /Test
```

```
df -h
```

```
mperez@client1:~$ df -h
Filesystem      Size  Used Avail Use% Mounted on
tmpfs           387M   1.8M  386M   1% /run
/dev/sda6        22G   7.5G   13G   38% /
tmpfs           1.9G     0  1.9G   0% /dev/shm
tmpfs           5.0M   4.0K  5.0M   1% /run/lock
/dev/sda5        4.6G  198M  4.1G   5% /home
/dev/sda4       944M  201M  678M  23% /boot
/dev/sda2       976M  6.1M  969M   1% /boot/efi
tmpfs           387M  100K  387M   1% /run/user/1000
mperez@client1:~$
```

18. Edit the **/etc/fstab** file and delete the mount point **/Test**.

```
sudo nano /etc/fstab
```

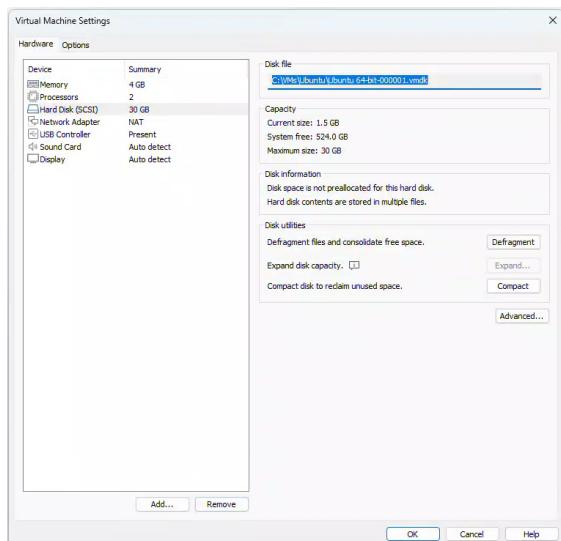
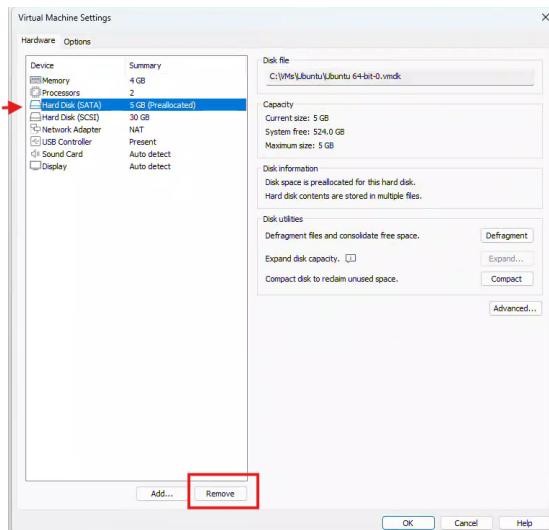
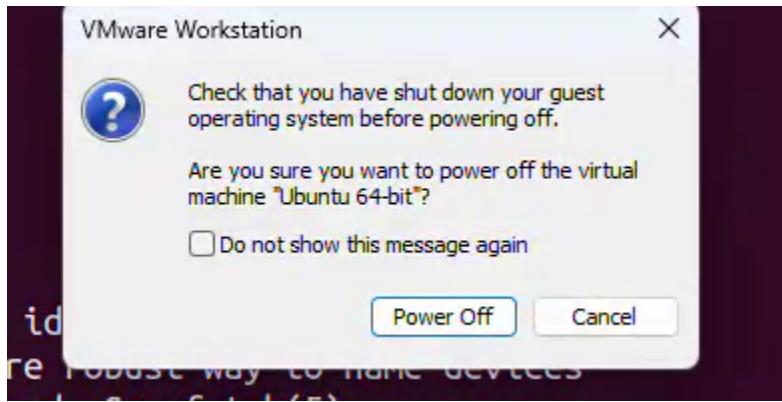
```
GNU nano 6.2                               /etc/fstab *
# /etc/fstab: static file system information.
#
# Use 'blkid' to print the universally unique identifier for a
# device; this may be used with UUID= as a more robust way to name devices
# that works even if disks are added and removed. See fstab(5).
#
# <file system> <mount point> <type> <options>      <dump> <pass>
# / was on /dev/sda6 during installation
UUID=4f83ab0c-e389-4475-afe1-79a832ebc024 /          ext4    errors=remount-ro 0      1
# /boot was on /dev/sda4 during installation
UUID=5280c079-b4a3-45bf-aa21-f2476bb7be4a /boot      ext4    defaults        0      2
# /boot/efi was on /dev/sda2 during installation
UUID=03EB-859F /boot/efi      vfat    umask=0077  0      1
# /home was on /dev/sda5 during installation
UUID=b7b45f12-338c-4459-9b18-b4f3b68a4f0e /home      ext4    defaults        0      2
# swap was on /dev/sda3 during installation
UUID=5db420a6-0db3-477b-a72b-5d6c1c6cdf94 none      swap      sw        0      0
```

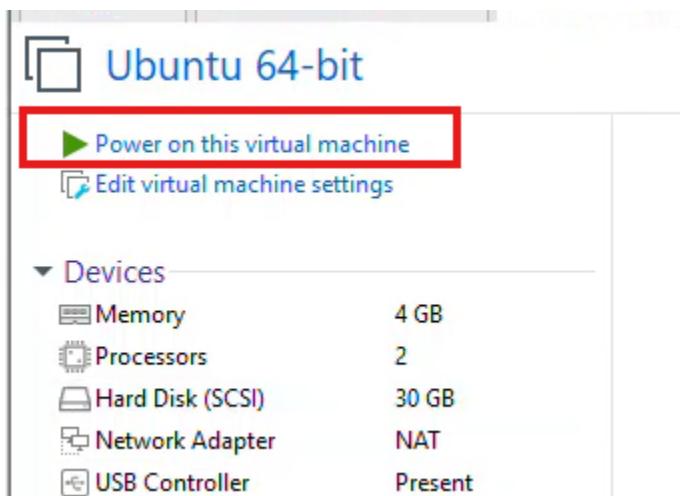
```
cat /etc/fstab
```

```
mperez@client1:~$ cat /etc/fstab
# /etc/fstab: static file system information.
#
# Use 'blkid' to print the universally unique identifier for a
# device; this may be used with UUID= as a more robust way to name devices
# that works even if disks are added and removed. See fstab(5).
#
# <file system> <mount point> <type> <options>      <dump> <pass>
# / was on /dev/sda6 during installation
UUID=4f83ab0c-e389-4475-afe1-79a832ebc024 /          ext4    errors=remount-ro 0      1
# /boot was on /dev/sda4 during installation
UUID=5280c079-b4a3-45bf-aa21-f2476bb7be4a /boot      ext4    defaults        0      2
# /boot/efi was on /dev/sda2 during installation
UUID=03EB-859F /boot/efi      vfat    umask=0077  0      1
# /home was on /dev/sda5 during installation
UUID=b7b45f12-338c-4459-9b18-b4f3b68a4f0e /home      ext4    defaults        0      2
# swap was on /dev/sda3 during installation
UUID=5db420a6-0db3-477b-a72b-5d6c1c6cdf94 none      swap      sw        0      0
mperez@client1:~$
```

19. Stop the virtual machine and remove the new disk from the Ubuntu VM.

## Lab 3 - File System Management





```
mperez@clienti: $ lsblk -f
NAME   FSTYPE FSVER LABEL UUID                                     FSAVAIL FSUSE% MOUNTPOINTS
sda
└─sda1
└─sda2 vfat    FAT32      03EB-859F
└─sda3 swap     1          5db420a6-0db3-477b-a72b-5d6c1c6cdf94  [SWAP]
└─sda4 ext4    1.0        5280c079-b4a3-45bf-aa21-f2476bb7be4a  677.7M  21% /boot
└─sda5 ext4    1.0        b7b45f12-338c-4459-9b18-b4f3b68a4f0e  4.1G   4% /home
└─sda6 ext4    1.0        4f83ab6c-e389-4475-afe1-79a832ebc024  12.5G  35% /
mperez@clienti: $
```