

Notes:

1. Our output folders for every test are available in the “Outputs” folder submitted in this zip file.
2. ZFS and ext4 File Systems have been used.
3. Both the partitions/disks (ZFS and ext4) should be at least 5 GB in size.
4. If you face difficulty with any step, feel free to contact us.

Installation:

1. ZFS:

- a. First install the ZFS filesystem with:

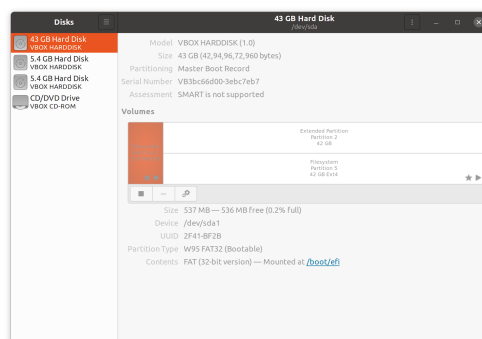
```
sudo apt install zfsutils-linux -y
```
- b. Choose a disk among installed disks (**NOTE: THIS DISK MUST BE OF AT LEAST 5 GB IN SIZE**). Also, don't use the disks being used by the system (sda in my case).
You can list the disks using: `sudo fdisk -l`
- c. Once you have picked the disk (**Let's say the chosen disk is /dev/sdb**), create a ZFS pool named “zfs_pool” using the following command:

```
sudo zpool create zfs_pool /dev/sdb
```
- d. **Switch deduplication on for the newly created zfs pool:**

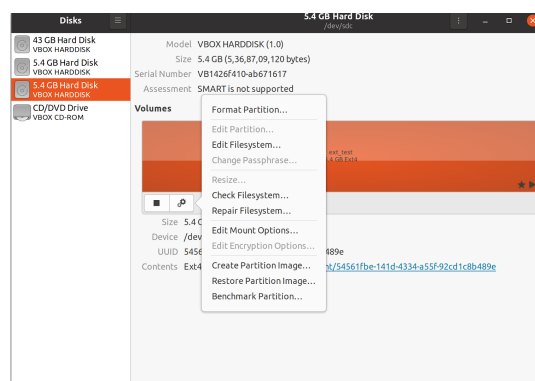
```
sudo zfs set dedup=on zfs_pool
```
- e. Now, you will be able to find the directory /zfs_pool in the root directory. **This is going to be the anchor for running the workloads.**

2. ext4

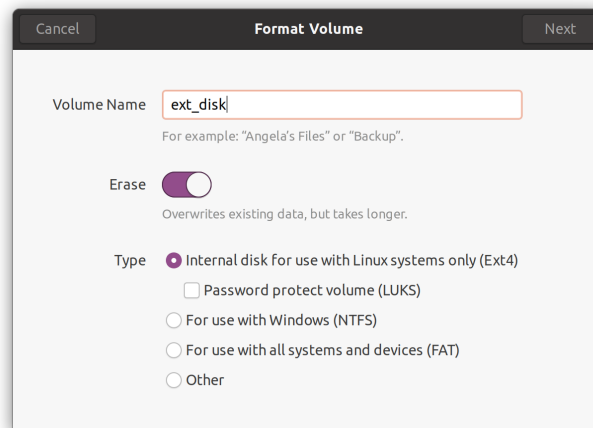
- a. ext4 is preinstalled and the default file system on Ubuntu. The following instructions tell you how to format a disk and set up the ext4 filesystem on it.
- b. Open the Application “Disks”:



- c. Choose the disk you want (**SHOULD HAVE AT LEAST 5 GB DISK SPACE**) and click the “Gear” icon. Then choose “Format Partition”:

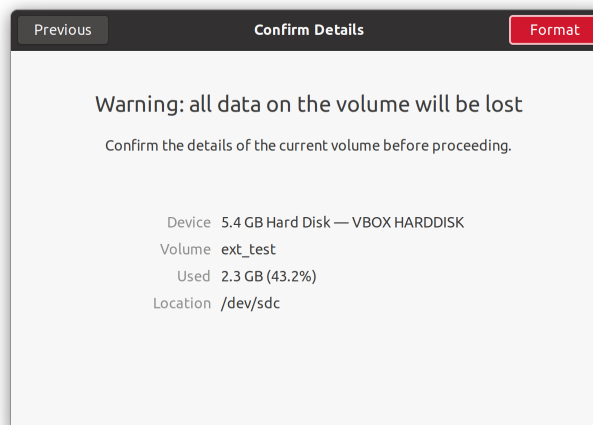


- d. Then, choose a name for the new disk and choose the Ext4 option (first option in my computer). Check the “Erase” switch. Then click next:



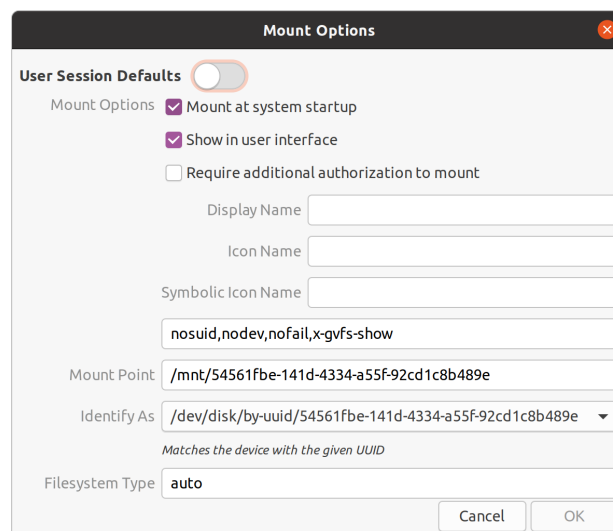
The "Format Volume" dialog box shows the "Volume Name" field with "ext_disk" entered. Below it, the "Erase" toggle switch is turned on. Under the "Type" section, the "Internal disk for use with Linux systems only (Ext4)" option is selected with a radio button. Other options include "Password protect volume (LUKS)", "For use with Windows (NTFS)", "For use with all systems and devices (FAT)", and "Other".

- e. Then Select “Format”:



The "Confirm Details" dialog box displays a warning: "Warning: all data on the volume will be lost". It asks to confirm the details of the current volume before proceeding. The details listed are: Device: 5.4 GB Hard Disk — VBOX HARDDISK, Volume: ext_test, Used: 2.3 GB (43.2%), and Location: /dev/sdc. A red "Format" button is in the top right corner.

- f. Once the disk is formatted, make sure that the disk is mounted. If not, then open “mount options” for the disk (Gear Icon->Edit Mount Options) and then uncheck “User Session Defaults” and check “Mount on system startup”. Then Reboot:



The "Mount Options" dialog box shows the "User Session Defaults" toggle switch turned off. Under "Mount Options", the "Mount at system startup" checkbox is checked. Other options include "Show in user interface" (checked), "Require additional authorization to mount" (unchecked), and fields for "Display Name", "Icon Name", and "Symbolic Icon Name". The "Mount Point" is /mnt/54561fbe-141d-4334-a55f-92cd1c8b489e, and the "Identify As" dropdown is set to /dev/disk/by-uuid/54561fbe-141d-4334-a55f-92cd1c8b489e. The "Filesystem Type" is set to auto. "Cancel" and "OK" buttons are at the bottom right.

Finding the anchors:

1. In order to run the workloads on ZFS/ext4 partitions, you need to find the **anchors** corresponding to the partitions. This is how you do it:
 - a. Let's say you have a ZFS pool (named `zfs_pool`) for which you want to find the anchor. This is how you do it:

```
theharshshow@theharshshow-VirtualBox:~$ mount | column -t | grep zfs_pool
zfs_pool          on /zfs_pool      type zfs          (rw,xattr,noacl)
```

- b. The highlighted part (`/zfs_pool`) is the anchor.
- c. In my case, the ext4 drive was mounted with the name `"/dev/sdc"`:

```
theharshshow@theharshshow-VirtualBox:~$ mount | column -t | grep sdc
/dev/sdc          on /mnt/54561fbe-141d-4334-a55f-92cd1c8b489e type ext4         (rw,nosuid,nodev,relatime,x-gvfs-show)
```

- d. Here, `"/mnt/54561fbe-141d-4334-a55f-92cd1c8b489e"` is the anchor.
2. Finding the anchor is extremely important because without it, our workloads won't work.

Running workloads on the two File Systems:

1. Add both the workload files (**workload1** and **workload2**) to your **vdbench** directory.
2. Navigate (`cd`) to your **vdbench** directory in the terminal.
3. Run commands:
 - a. In order to run workload1 on your ZFS partition, run the workload using the following command (**SUBSTITUTE IN YOUR ZFS ANCHOR INSTEAD OF `zfs_pool`**):

```
~/vdbench$ sudo ./vdbench -f workload1 anchor=/zfs_pool
```

- b. Likewise, in order to run workload1 on your ext4 partition, **substitute in your ext4 anchor** instead of `/mnt/54561fbe-141d-4334-a55f-92cd1c8b489e` in the following command:

```
~/vdbench$ sudo ./vdbench -f workload1 anchor=/mnt/54561fbe-141d-4334-a55f-92cd1c8b489e
```

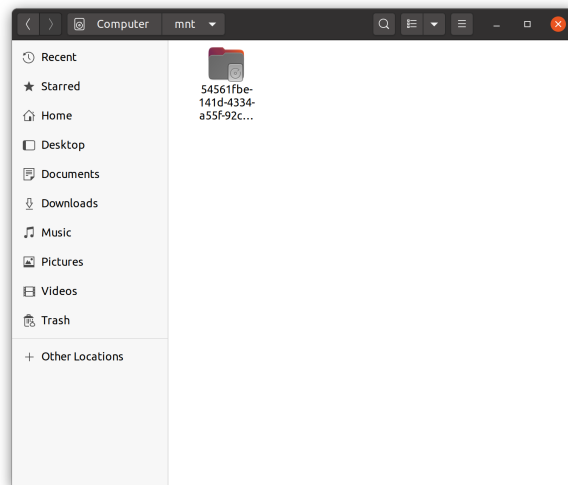
- c. Likewise, in order to run **workload2**, substitute **workload2** instead of **workload1** in the above commands.

Viewing stats:

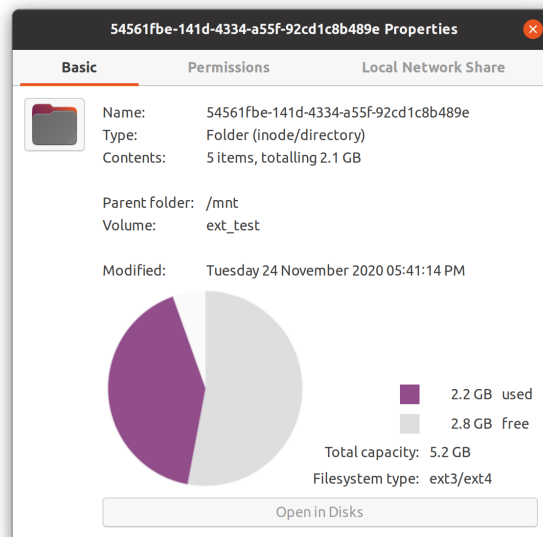
1. You can view the summary for the last workload run in the **summary.html** file in the **Output** folder in the **vdbench** directory.
2. In order to monitor the space taken by the file systems before and after running workload:
 - a. For **ZFS**:
 - i. Run the following command: `zpool list`
 - ii. Here's a sample output:

```
theharshshow@theharshshow-VirtualBox:/mnt/54561fbe-141d-4334-a55f-92cd1c8b489e$ zpool list
NAME      SIZE  ALLOC   FREE CKPOINT  EXPANDSZ   FRAG    CAP  DEDUP    HEALTH  ALTROOT
zfs_pool  4.50G  7.61M  4.49G      -          -        3%    0%   1.00x    ONLINE  -
```

- iii. Run this before and after running the workload in order to calculate space taken by the files after the workload. (Calculation done in report)
- b. For **ext4**:
 - i. Navigate to the folder containing the ext4 anchor in the GUI File manager for Ubuntu. In my case, the anchor is `"/mnt/54561fbe-141d-4334-a55f-92cd1c8b489e"`. Thus, I navigated to `/mnt`:



- ii. Then right click and view the properties of the anchor folder. Here you can see the space taken:



Happy Holidays :)