RAID

Redundant array of inexpensive disk
Redundant array of independent disk

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What is RAID?

Redundant Array of Independent Disks

Raid allows you to take a collection of disks & configure them in such way that your computer recognizes them as one logical disk unit.

Another way to look at it:

A data storage virtualization technology that combines multiple physical disk drive components into one or more logical units for the purposes of data redundancy, performance improvement, or both.

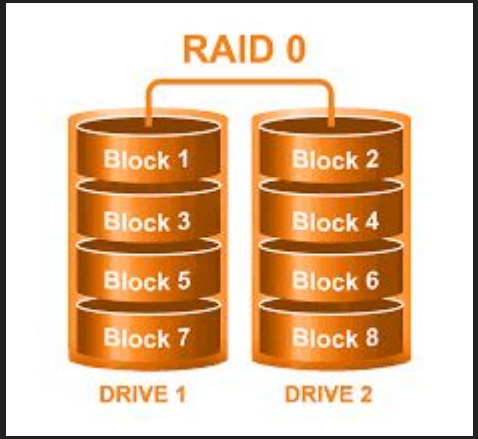
RAID 0

I want speed and efficient use of drive space!

RAID 0 is the answer.

provides no redundancy.

stripes data across multiple drives.



You need at least two storage devices.

Downside: If you lose one drive you will no longer have the full dataset.

Not ideal for a mission critical system.

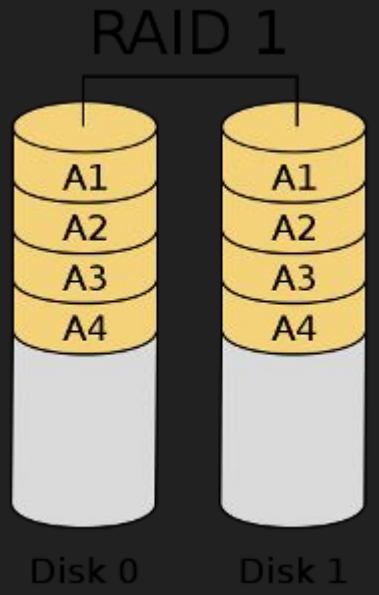
RAID 1

Why? Redundancy!

With RAID 1 you mirror your drives.

Any drive that you save on a drive, you save on another.

If you end up having a drive failure, you have a spare.



Downsides? We are using 2 TB of storage for only 1 usable TB of storage.

RAID 10

RAID 10, is known as RAID 1+0.

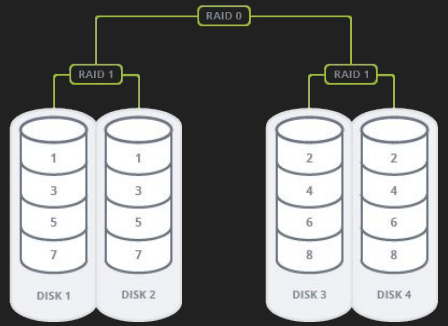
Combines RAID 0 and RAID 1.

Combines disk mirroring & disk striping to protect data.

It requires a minimum of four disks.

Stripes data across mirrored pairs.

RAID 10 provides redundancy and performance.



Creating the VM

Open Virtual Box (VB) -> Add an existing image to VB

Click on New -> Name -> ostest (any name), Type -> Linux, Version -> Ubuntu 64

Ram: 4096, Hard disk: Use an existing virtual hard disk file (RAIDlab.vdi) -> create

Right click -> settings -> storage -> Controller -> SATA -> right click -> Add hard disk -> choose existing disk -> add the four disks one by one

Note: for creating from scratch: Create a new disk -> next (go with the default settings) -> create

Boot the VM

Identify the hard drives, adding and formatting

Check the hard drives information:

lsblk -o NAME,SIZE,FSTYPE,TYPE,MOUNTPOINT

Partition the hard drives:

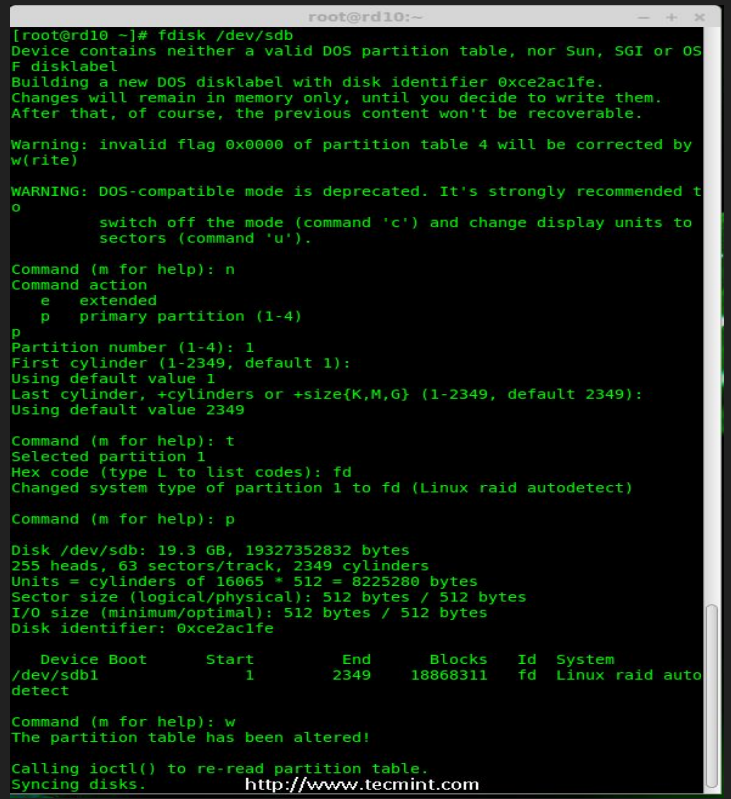
fdisk name-of-drive : fdisk /dev/sdb (b/d/c/e)

Command (m for help) : m

Add a new partition: n

P (primary) -> 1 (default) ->

enter (first sector) -> enter (last sector) -> w (write)



Create the array (RAID 0 or 1, 10)

Pass them in to the mdadm --create command. Stands for: Multiple Disk and Device Administration

Specify the device name you wish to create (/dev/md0), the RAID level, and the number of devices:

```
mdadm --create --verbose /dev/md10 --level=10 --raid-devices=4 /dev/sdb /dev/sdc ...
```

Make sure the RAID was successfully created:

```
cat /proc/mdstat
```

Output: Personalities : [linear] [multipath] [raid0] [raid1] [raid6] [raid5] [raid4] [raid10]

```
md0 : active raid0 sdc[1] sdb[0]
209584128 blocks super 1.2 512k chunks
unused devices: <none>
```

Create & mount the file system

Create a file system on the array:

mkfs.ext4 -F /dev/md10

Create a mount point to attach the new file system:

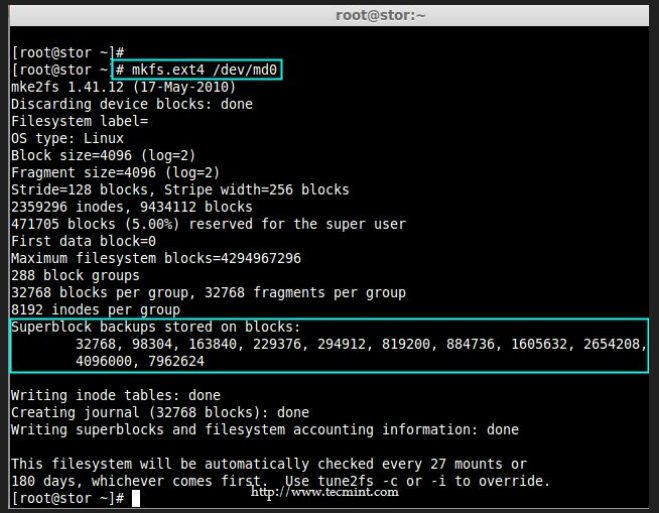
mkdir -p /mnt/md10

You can mount the filesystem by typing:

mount /dev/md10 /mnt/md10

Check whether the new space is available by typing:

df -h -x devtmpfs -x tmpfs



Save the array layout:

To make sure that the array is reassembled automatically at boot, we will have to adjust the /etc/mdadm/mdadm.conf file. You can automatically scan the active array and append the file by typing:

```
mdadm --detail --scan >> /etc/mdadm.conf
```

To check the file content:

```
vim /etc/mdadm.conf
```

Add the new filesystem mount options to the /etc/fstab file for automatic mounting at boot:

```
echo '/dev/md0 /mnt/md0 ext4 defaults,nofail,discard 0 0' >> /etc/fstab
```

Failing & Adding devices to RAID

Check the status of a RAID device:

```
mdadm --detail /dev/md10
```

Mark a device as faulty:

```
mdadm /dev/md10 -f /dev/sdb
```

Remove the device that is Faulty:

```
mdadm /dev/md10 -r /dev/sdb
```

Re-add back the device:

```
mdadm /dev/md10 -a /dev/sdb
```

Remove an mdadm Raid array

The first thing is to unmount the array:

umount /dev/md0 (check with df -h = no longer see /dev/md0)

Stop the array using:

mdadm --stop /dev/md0

Zero the superblock for each partition of the array:

sudo mdadm --zero-superblock /dev/sdb
sudo mdadm --zero-superblock /dev/sdc...

Remove an mdadm Raid array from Config files:

Remove from the mdadm configuration file:

```
Vim /etc/mdadm.conf
```

Remove from the file system table:

```
Vim /etc/fstab
```

What you have to do:

Create RAID 10 array according to the steps in the slides.

Write your command in a sheet with a print screen of your output in each of the following stages (You can use the resources at the end of these slides):

1) Fail a device from the raid array.

2) Remove the failed device from the raid array.

3) Add back the device.

Write two paragraphs of benefits & shortcomings of using any RAID.

Have a good break!

Reference:

https://www.digitalocean.com/community/tutorials/how-to-create-raid-arrays-with-mdadm-on-ubuntu-16-04

https://www.digitalocean.com/community/tutorials/how-to-manage-raid-arrays-with-mdadm-on-ubuntu-16-04

http://www.ducea.com/2009/03/08/mdadm-cheat-sheet/

https://bencane.com/2011/07/06/mdadm-manually-fail-a-drive/