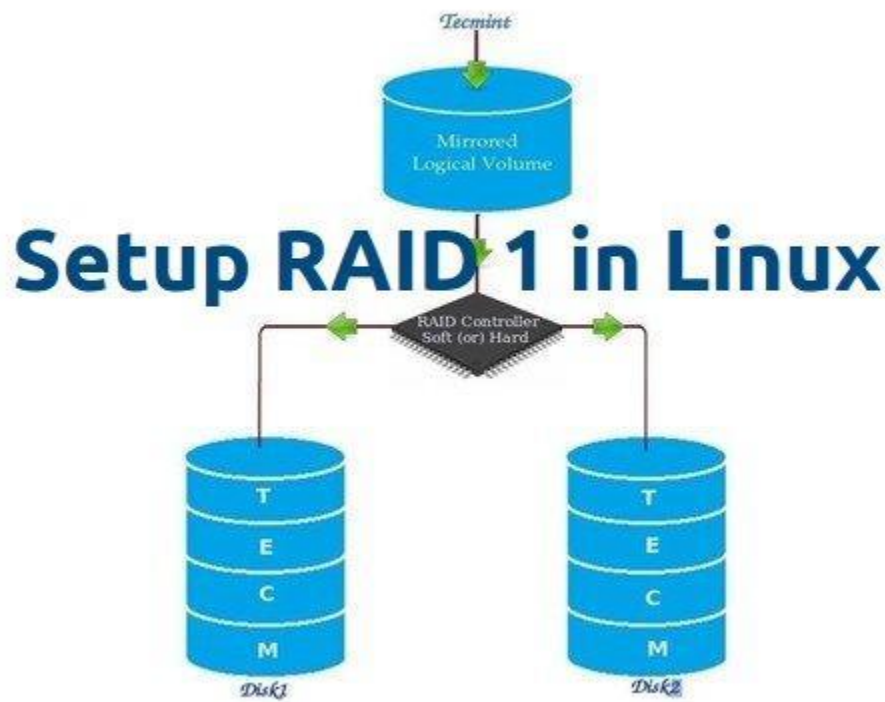




RAID Mirroring means an exact clone (or mirror) of the same data writing to two drives. A minimum two number of disks are more required in an array to create RAID1 and it's useful only, when read performance or reliability is more precise than the data storage capacity.



Setup Raid1 in Linux

Mirrors are created to protect against data loss due to disk failure. Each disk in a mirror involves an exact copy of the data. When one disk fails, the same data can be retrieved from other functioning disk. However, the failed drive can be replaced from the running computer without any user interruption.

Features of RAID 1



RAID1 CONFIGURATION IN RHEL7



- Mirror has Good Performance.
- 50% of space will be lost. Means if we have two disk with 500GB size total, it will be 1TB but in Mirroring it will only show us 500GB.
- No data loss in Mirroring if one disk fails, because we have the same content in both disks.
- Reading will be good than writing data to drive.

Requirements

Minimum Two number of disks are allowed to create RAID 1, but you can add more disks by using twice as 2, 4, 6, 8. To add more disks, your system must have a RAID physical adapter (hardware card).

Here we're using software raid not a Hardware raid, if your system has an inbuilt physical hardware raid card you can access it from it's utility UI or using **Ctrl+I key**.

My Server Setup

1 or **Mirror** using **mdadm** (creates and manages raid) on Linux Platform. Although the same instructions also works on other Linux distributions such as RedHat, CentOS, Fedora, etc.

Step 1: Installing Prerequisites and Examine Drives

1. As I said above, we're using mdadm utility for creating and managing RAID in Linux. So, let's install the **mdadm** software package on Linux using yum or apt-get package manager tool.



2. Once 'mdadm' package has been installed, we need to examine our disk drives whether there is already any raid configured using the following command.

```
# mdadm -E /dev/sd[b-c]
```

```
root@rd1:~  
[root@rd1 ~]#  
[root@rd1 ~]# mdadm -E /dev/sd[b-c]  
mdadm: No md superblock detected on /dev/sdb.  
mdadm: No md superblock detected on /dev/sdc.  
[root@rd1 ~]#
```

Check RAID on Disks

As you see from the above screen, that there is no any **super-block** detected yet, means no RAID defined.

Step 2: Drive Partitioning for RAID

3. As I mentioned above, that we're using minimum two partitions **/dev/sdb** and **/dev/sdc** for creating RAID1. Let's create partitions on these two drives using 'fdisk' command and change the type to raid during partition creation.

```
# fdisk /dev/sdb
```

Follow the below instructions

- Press 'n' for creating new partition.
- Then choose 'P' for Primary partition.
- Next select the partition number as **1**.



RAID1 CONFIGURATION IN RHEL7



- Give the default full size by just pressing two times **Enter** key.
- Next press '**p**' to print the defined partition.
- Press '**L**' to list all available types.
- Type '**t**' to choose the partitions.
- Choose '**fd**' for Linux raid auto and press Enter to apply.
- Then again use '**p**' to print the changes what we have made.
- Use '**w**' to write the changes.

```
root@rd1:~  
[root@rd1 ~]# fdisk /dev/sdb  
WARNING: DOS-compatible mode is deprecated. It's strongly recommended to  
switch off the mode (command 'c') and change display units to  
sectors (command 'u').  
Command (m for help): n  
Command action  
e extended  
p primary partition (1-4)  
p  
Partition number (1-4): 1  
First cylinder (1-2349, default 1):  
Using default value 1  
Last cylinder, +cylinders or +size{K,M,G} (1-2349, default 2349):  
Using default value 2349  
Command (m for help): p  
Disk /dev/sdb: 19.3 GB, 19327352832 bytes  
255 heads, 63 sectors/track, 2349 cylinders  
Units = cylinders of 16065 * 512 = 8225280 bytes  
Sector size (logical/physical): 512 bytes / 512 bytes  
I/O size (minimum/optimal): 512 bytes / 512 bytes  
Disk identifier: 0x792267d2  


| Device    | Boot | Start | End  | Blocks   | Id | System |
|-----------|------|-------|------|----------|----|--------|
| /dev/sdb1 |      | 1     | 2349 | 18868311 | 83 | Linux  |

  
Command (m for help): t  
Selected partition 1  
Hex code (type L to list codes): fd  
Changed system type of partition 1 to fd (Linux raid autodetect)  
Command (m for help): p  
Disk /dev/sdb: 19.3 GB, 19327352832 bytes  
255 heads, 63 sectors/track, 2349 cylinders  
Units = cylinders of 16065 * 512 = 8225280 bytes  
Sector size (logical/physical): 512 bytes / 512 bytes  
I/O size (minimum/optimal): 512 bytes / 512 bytes  
Disk identifier: 0x792267d2  


| Device    | Boot | Start | End  | Blocks   | Id | System                |
|-----------|------|-------|------|----------|----|-----------------------|
| /dev/sdb1 |      | 1     | 2349 | 18868311 | fd | Linux raid autodetect |

  
Command (m for help): w  
http://www.tecmint.com
```

Create Disk Partitions

After '**/dev/sdb**' partition has been created, next follow the same instructions to create new partition on **/dev/sdc** drive.



RAID1 CONFIGURATION IN RHEL7



```
# fdisk /dev/sdc
```

```
root@rd1:~  
[root@rd1 ~]# fdisk /dev/sdc  
WARNING: DOS-compatible mode is deprecated. It's strongly recommended to  
switch off the mode (command 'c') and change display units to  
sectors (command 'u').  
  
Command (m for help): n  
Command action  
  e   extended  
  p   primary partition (1-4)  
p  
Partition number (1-4): 1  
First cylinder (1-2349, default 1):  
Using default value 1  
Last cylinder, +cylinders or +size(K,M,G) (1-2349, default 2349):  
Using default value 2349  
  
Command (m for help): p  
  
Disk /dev/sdc: 19.3 GB, 19327352832 bytes  
255 heads, 63 sectors/track, 2349 cylinders  
Units = cylinders of 16065 * 512 = 8225280 bytes  
Sector size (logical/physical): 512 bytes / 512 bytes  
I/O size (minimum/optimal): 512 bytes / 512 bytes  
Disk identifier: 0x5dac1531  
  
   Device Boot      Start         End      Blocks   Id  System  
/dev/sdc1             1         2349     18868311    83  Linux  
  
Command (m for help): t  
Selected partition 1  
Hex code (type L to list codes): fd  
Changed system type of partition 1 to fd (Linux raid autodetect)  
  
Command (m for help): p  
  
Disk /dev/sdc: 19.3 GB, 19327352832 bytes  
255 heads, 63 sectors/track, 2349 cylinders  
Units = cylinders of 16065 * 512 = 8225280 bytes  
Sector size (logical/physical): 512 bytes / 512 bytes  
I/O size (minimum/optimal): 512 bytes / 512 bytes  
Disk identifier: 0x5dac1531  
  
   Device Boot      Start         End      Blocks   Id  System  
/dev/sdc1             1         2349     18868311    fd  Linux raid autodetect  
  
Command (m for help): http://www.tecmint.com
```

Create Second Partitions

4. Once both the partitions are created successfully, verify the changes on both **sdb** & **sdc** drive using the same '**mdadm**' command and also confirm the RAID type as shown in the following screen grabs.

```
# mdadm -E /dev/sd[b-c]
```

RAID1 CONFIGURATION IN RHEL7

```
root@rd1:~  
[root@rd1 ~]#  
[root@rd1 ~]# mdadm -E /dev/sd[b-c]  
/dev/sdb:  
  MBR Magic : aa55  
Partition[0] : 37736622 sectors at 63 (type fd)  
/dev/sdc:  
  MBR Magic : aa55  
Partition[0] : 37736622 sectors at 63 (type fd)  
[root@rd1 ~]#  
http://www.tecmint.com
```

Verify

```
root@rd1:~  
[root@rd1 ~]#  
[root@rd1 ~]# mdadm -E /dev/sd[b-c]1  
mdadm: No md superblock detected on /dev/sdb1.  
mdadm: No md superblock detected on /dev/sdc1.  
[root@rd1 ~]#  
http://www.tecmint.com
```

Partitions Changes

Check RAID Type

Note: As you see in the above picture, there is no any defined RAID on the **sdb1** and **sdc1** drives so far, that's the reason we are getting as no **super-blocks** detected.

Step 3: Creating RAID1 Devices

5. Next create RAID1 Device called '**/dev/md0**' using the following command and verify it.

```
# mdadm --create /dev/md0 --level=mirror --raid-devices=2  
/dev/sd[b-c]1  
  
# cat /proc/mdstat
```


RAID1 CONFIGURATION IN RHEL7

```
root@rd1:~  
[root@rd1 ~]#  
[root@rd1 ~]# mdadm --create /dev/md0 --level=mirror --raid-devices=2 /dev/sd[b-c]1  
mdadm: Note: this array has metadata at the start and  
may not be suitable as a boot device. If you plan to  
store '/boot' on this device please ensure that  
your boot-loader understands md/v1.x metadata, or use  
--metadata=0.90  
Continue creating array? y  
mdadm: Defaulting to version 1.2 metadata  
mdadm: array /dev/md0 started.  
[root@rd1 ~]#  
[root@rd1 ~]# cat /proc/mdstat  
Personalities : [raid1]  
md0 : active raid1 sdc1[1] sdb1[0]  
18851840 blocks super 1.2 [2/2] [UU]  
[>.....] resync = 3.7% (698112/18851840) finish=3.4min speed=87  
264K/sec  
  
unused devices: <none>  
[root@rd1 ~]# http://www.tecmint.com
```

Create RAID Device

6. Next check the raid devices type and raid array using following commands.

```
# mdadm -E /dev/sd[b-c]1  
  
# mdadm --detail /dev/md0
```

```
root@rd1:~  
[root@rd1 ~]# mdadm -E /dev/sd[b-c]1  
/dev/sdb1:  
  Magic : a92b4efc  
  Version : 1.2  
  Feature Map : 0x0  
  Array UUID : a0c700a7:c9125ala:c5a8f15b:8f049617  
  Name : rd1.tecmintlocal.com:0 (local to host rd1.tecmintlocal.com)  
  Creation Time : Sat Oct 11 17:02:34 2014  
  Raid Level : raid1  
  Raid Devices : 2  
  
  Avail Dev Size : 37703854 (17.98 GiB 19.30 GB)  
  Array Size : 18851840 (17.98 GiB 19.30 GB)  
  Used Dev Size : 37703680 (17.98 GiB 19.30 GB)  
  Data Offset : 32768 sectors  
  Super Offset : 8 sectors  
  State : active  
  Device UUID : b0fb98ee:f8807cle:elf40a25:b12a69a0  
  
  Update Time : Sat Oct 11 17:09:23 2014  
  Checksum : 3fb4c55b - correct  
  Events : 4  
  
  Device Role : Active device 0  
  Array State : AA ('A' == active, '.' == missing)  
/dev/sdc1:  
  Magic : a92b4efc  
  Version : 1.2  
  Feature Map : 0x0  
  Array UUID : a0c700a7:c9125ala:c5a8f15b:8f049617  
  Name : rd1.tecmintlocal.com:1 (local to host rd1.tecmintlocal.com)  
http://www.tecmint.com
```



Check RAID Device type

```
root@rd1:~  
[root@rd1 ~]#  
[root@rd1 ~]# mdadm --detail /dev/md0  
/dev/md0:  
  Version : 1.2  
  Creation Time : Sat Oct 11 17:02:34 2014  
  Raid Level : raid1  
  Array Size : 18851840 (17.98 GiB 19.30 GB)  
  Used Dev Size : 18851840 (17.98 GiB 19.30 GB)  
  Raid Devices : 2  
  Total Devices : 2  
  Persistence : Superblock is persistent  
  
  Update Time : Sat Oct 11 17:11:17 2014  
  State : clean, resyncing  
  Active Devices : 2  
  Working Devices : 2  
  Failed Devices : 0  
  Spare Devices : 0  
  
  Resync Status : 34% complete  
  
  Name : rd1.tecmintlocal.com:0 (local to host rd1.tecmintlocal.com)  
  UUID : a0c700a7:c9125a1a:c5a8f15b:8f049617  
  Events : 5  
  
  Number Major Minor RaidDevice State  
    0       8      17        0  active sync  /dev/sdb1  
    1       8      33        1  active sync  /dev/sdc1  
[root@rd1 ~]#
```

<http://www.tecmint.com>

Check

RAID Device Array

From the above pictures, one can easily understand that raid1 have been created and using **/dev/sdb1** and **/dev/sdc1** partitions and also you can see the status as resyncing.

Step 4: Creating File System on RAID Device

7. Create file system using ext4 for **md0** and mount under **/mnt/raid1**.

```
# mkfs.xfs /dev/md0
```




Create RAID Device Filesystem

8. Next, mount the newly created filesystem under **'/mnt/raid1'** and create some files and verify the contents under mount point.

```
# mkdir /mnt/raid1
```

```
# mount /dev/md0 /mnt/raid1/
```

```
# touch /mnt/raid1/rajlinux.txt
```

```
# echo "rajlinux raid setups" > /mnt/raid1/rajlinux.txt
```

```
root@rd1:~  
[root@rd1 ~]#  
[root@rd1 ~]# mkdir /mnt/raid1  
[root@rd1 ~]#  
[root@rd1 ~]# mount /dev/md0 /mnt/raid1/  
[root@rd1 ~]#  
[root@rd1 ~]# ls -l /mnt/raid1/  
total 16  
drwx----- 2 root root 16384 Oct 11 18:02 lost+found  
[root@rd1 ~]#  
[root@rd1 ~]# df -h  
Filesystem              Size  Used Avail Use% Mounted on  
/dev/mapper/vg_tecmint-LogVol01 17G  1.1G   15G   7% /  
tmpfs                    499M    0  499M   0% /dev/shm  
/dev/sda1                 485M   34M  426M   8% /boot  
/dev/md0                  18G  172M   17G   1% /mnt/raid1  
[root@rd1 ~]#  
[root@rd1 ~]# touch /mnt/raid1/tecmin.txt  
[root@rd1 ~]#  
[root@rd1 ~]# echo "tecmin raid setups" > /mnt/raid1/tecmin.txt  
[root@rd1 ~]#  
[root@rd1 ~]# cat /mnt/raid1/tecmin.txt  
tecmin raid setups  
[root@rd1 ~]#  
[root@rd1 ~]# cat /proc/mdstat  
Personalities : [raid1]  
md0 : active raid1 sdc1[1] sdb1[0]  
      18851840 blocks super 1.2 [2/2] [UU]  
  
unused devices: <none>  
[root@rd1 ~]#  
[root@rd1 ~]# http://www.tecmint.com
```

Mount Raid Device



RAID1 CONFIGURATION IN RHEL7



9. To auto-mount RAID1 on system reboot, you need to make an entry in fstab file. Open **'/etc/fstab'** file and add the following line at the bottom of the file.

```
/dev/md0      /mnt/raid1   ext4  defaults  0 0
```

```
root@rd1:~  
#  
# /etc/fstab  
# Created by anaconda on Fri Oct 10 16:49:04 2014  
#  
# Accessible filesystems, by reference, are maintained under '/dev/disk'  
# See man pages fstab(5), findfs(8), mount(8) and/or blkid(8) for more info  
#  
/dev/mapper/vg_tecmint-LogVol01 /          ext4    defaults 1 1  
UUID=dc85ea7d-41f4-420d-b10e-4b777ce3729d /boot      ext4    defaults  
1 2  
/dev/mapper/vg_tecmint-LogVol00 swap       swap    defaults 0 0  
tmpfs      /dev/shm   tmpfs    defaults 0 0  
devpts     /dev/pts   devpts   gid=5,mode=620 0 0  
sysfs      /sys       sysfs    defaults 0 0  
proc       /proc      proc     defaults 0 0  
/dev/md0   /mnt/raid1 ext4     defaults 0 0  
http://www.tecmint.com
```

Raid Automount Device

10. Run **'mount -a'** to check whether there are any errors in fstab entry.

```
# mount -a
```

```
root@rd1:~  
[root@rd1 ~]#  
[root@rd1 ~]# mount -av  
mount: UUID=dc85ea7d-41f4-420d-b10e-4b777ce3729d already mounted on /boot  
mount: tmpfs already mounted on /dev/shm  
mount: devpts already mounted on /dev/pts  
mount: sysfs already mounted on /sys  
mount: proc already mounted on /proc  
mount: /dev/md0 already mounted on /mnt/raid1  
nothing was mounted  
[root@rd1 ~]#  
http://www.tecmint.com
```

Check Errors in fstab



11. Next, save the raid configuration manually to 'mdadm.conf' file using the below command.

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

```
root@rd1:~  
[root@rd1 ~]#  
[root@rd1 ~]# mdadm --detail --scan --verbose >> /etc/mdadm.conf  
[root@rd1 ~]#  
[root@rd1 ~]# cat /etc/mdadm.conf  
ARRAY /dev/md0 level=raid1 num-devices=2 metadata=1.2 name=rd1.tecmintlocal.com:0 UUID=  
a0c700a7:c9125a1a:c5a8f15b:8f049617  
devices=/dev/sdb1,/dev/sdc1 http://www.tecmint.com  
[root@rd1 ~]#
```

Save Raid Configuration

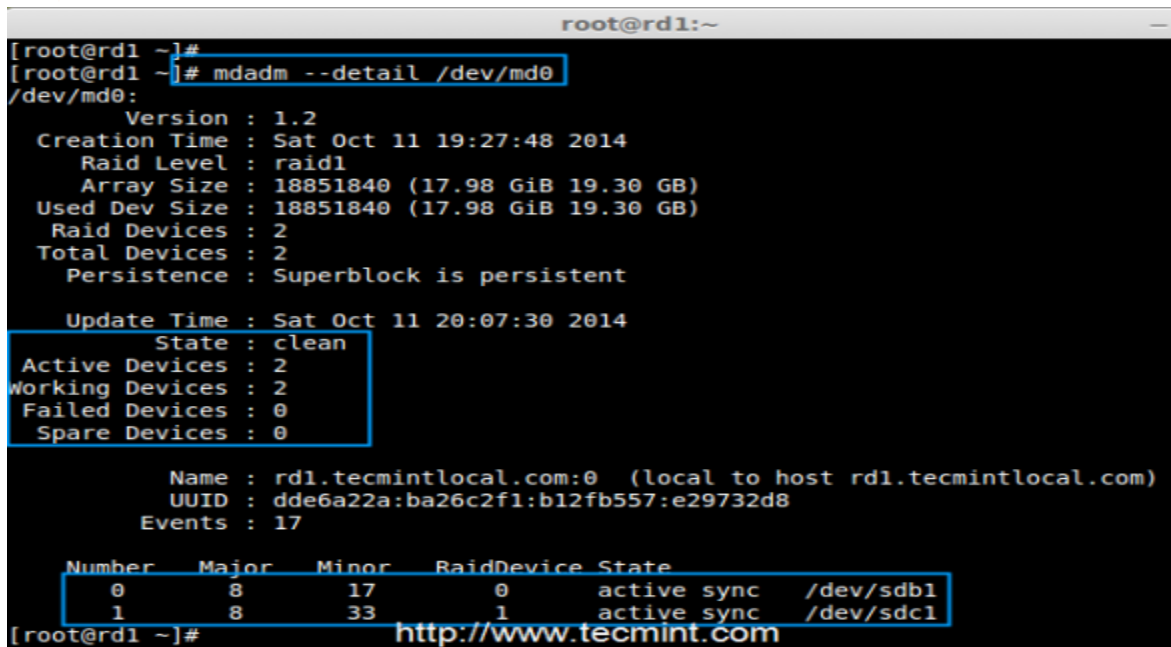
The above configuration file is read by the system at the reboots and load the RAID devices.

Step 5: Verify Data After Disk Failure

12. Our main purpose is, even after any of hard disk fail or crash our data needs to be available. Let's see what will happen when any of disk disk is unavailable in array.

```
# mdadm --detail /dev/md0
```

RAID1 CONFIGURATION IN RHEL7



```
root@rd1:~  
[root@rd1 ~]# mdadm --detail /dev/md0  
/dev/md0:  
  Version : 1.2  
  Creation Time : Sat Oct 11 19:27:48 2014  
  Raid Level : raid1  
  Array Size : 18851840 (17.98 GiB 19.30 GB)  
  Used Dev Size : 18851840 (17.98 GiB 19.30 GB)  
  Raid Devices : 2  
  Total Devices : 2  
  Persistence : Superblock is persistent  
  
  Update Time : Sat Oct 11 20:07:30 2014  
  State : clean  
  Active Devices : 2  
  Working Devices : 2  
  Failed Devices : 0  
  Spare Devices : 0  
  
  Name : rd1.tecmintlocal.com:0 (local to host rd1.tecmintlocal.com)  
  UUID : dde6a22a:ba26c2f1:b12fb557:e29732d8  
  Events : 17  
  
  Number Major Minor RaidDevice State  
    0       8      17        0   active sync  /dev/sdb1  
    1       8      33        1   active sync  /dev/sdc1  
[root@rd1 ~]#
```

Raid Device Verify

In the above image, we can see there are 2 devices available in our RAID and Active Devices are 2. Now let us see what will happen when a disk plugged out (removed **sdc** disk) or fails.

```
# ls -l /dev | /dev grep sd
```

```
# mdadm --detail /dev/md0
```

RAID1 CONFIGURATION IN RHEL7

```
root@rd1:~  
[root@rd1 ~]#  
[root@rd1 ~]# ls -l /dev | grep sd  
brw-rw----. 1 root disk      8,  0 Oct 12  2014 sda  
brw-rw----. 1 root disk      8,  1 Oct 12 03:58 sda1  
brw-rw----. 1 root disk      8,  2 Oct 12  2014 sda2  
brw-rw----. 1 root disk      8, 16 Oct 12  2014 sdb  
brw-rw----. 1 root disk      8, 17 Oct 12  2014 sdb1  
[root@rd1 ~]#  
[root@rd1 ~]#  
[root@rd1 ~]# mdadm --detail /dev/md0  
/dev/md0:  
  Version : 1.2  
  Creation Time : Sun Oct 12 03:23:06 2014  
  Raid Level : raid1  
  Array Size : 18851840 (17.98 GiB 19.30 GB)  
  Used Dev Size : 18851840 (17.98 GiB 19.30 GB)  
  Raid Devices : 2  
  Total Devices : 1  
  Persistence : Superblock is persistent  
  
  Update Time : Sun Oct 12 04:04:04 2014  
  State : clean, degraded  
  Active Devices : 1  
  Working Devices : 1  
  Failed Devices : 0  
  Spare Devices : 0  
  
  Name : rd1.tecmintlocal.com:0 (local to host rd1.tecmintlocal.com)  
  UUID : 3aa2affd:7bfbb625:fff83bdb:0eddb526  
  Events : 27  
  
  Number Major Minor RaidDevice State  
    0        8     17        0  active sync  /dev/sdb1  
    1        8      0        1  removed  
[root@rd1 ~]#
```

Now in the above image, you can see that one of our drive is lost. I unplugged one of the drive from my Virtual machine. Now let us check our precious data.

```
# cd /mnt/raid1/
```

```
# cat rajlinux.txt
```

Verify RAID Data

Did you see our data is still available. From this we come to know the advantage of RAID 1 (mirror).