# RAID (REDUNDANT ARRAY OF INDPENDENT DISKS)

https://raid.wiki.kernel.org/index.php/Detecting,_querying_and_testing

# RAID Features

- Raid contains groups or sets or Arrays.
- A combine of drivers make a group of disks to form a RAID Array or RAID set.
- It can be a minimum of 2 number of disks connected to a raid controller and make a logical volume or more drives can be in a group.
- Only one Raid level can be applied in a group of disks.
- Raid are used when we need excellent performance.
- According to our selected raid level, performance will differ.
- RAID allows an administrator to form an array of several hard drives into one logical drive recognized as one drive by the operating system.

# RAID Features

- Redundancy
- **Redundant Array of Independent Disks (RAID)** is a series of disks that can save your data even if a terrible failure occurs on one of the disks

# RAID TYPES –Hardware RAID
# Hardware RAID Card will look like below

# Hardware RAID

- Hardware RAID have high performance.
- They are dedicated RAID Controller which is Physically built using PCI express cards.
- It won't use the host resource.
- They have NVRAM for cache to read and write.
- Stores cache while rebuild even if there is power-failure, it will store the cache using battery power backups.
- Very costly investments needed for a large scale

# RAID LEVELS

- RAID’s are in various Levels. Here we will see only the RAID Levels which is used mostly in real time.
- RAID0 = Striping
- RAID1 = Mirroring
- RAID5 = Single Disk Distributed Parity
- RAID6 = Double Disk Distributed Parity
- RAID10 = Combine of Mirror & Stripe. (Nested RAID)
- RAID are managed using mdadm package in most of the Linux distributions.

# RAID 0

- RAID 0 (or) Striping
- Striping have a excellent performance.
- In Raid 0 (Striping) the data will be written to disk using shared method.
- Half of the content will be in one disk and another half will be written to other disk.
- No Redundancy.
- Zero Fault Tolerance.
- Because there is no redundancy, recovering data from a hard drive crash is not possible through RAID.

# RAID 1 or Mirroring

- Mirroring have a good performance.
- Mirroring can make a copy of same data what we have
- Here Half of the Space will be lost in total capacity.
- Full Fault Tolerance.
- Rebuilt will be faster.
- Writing Performance will be slow.
- Reading will be good.
- Can be used for operating systems and database for small scale.

- All data is written to each disk in the array, accomplishing redundancy. The data is “mirrored” on a second drive. This allows for easy recovery should a disk fail.
- However, it does mean that, for example, if there are two disks in the array, the size for the logical disk is size of the smaller of the two disks because data must be mirrored to the second disk.

# RAID5

- Needs minimum 3 disks
- RAID 5 is mostly used in enterprise levels.
- RAID 5 work by distributed parity method
- Parity info will be used to rebuild the data
- It rebuilds from the information left on the remaining good drives.
- This will protect our data from drive failure.

- Excellent Performance
- Reading will be extremely very good in speed.
- Writing will be Average, slow if we won’t use a Hardware RAID Controller.
- Rebuild from Parity information from all drives.
- Full Fault Tolerance.
- 1 Disk Space will be under Parity.
- Can be used in file servers, web servers, very important backups.

- **RAID level 5**
- Combines striping and parity. Data is written across all disks as in RAID 0, but parity data is also written to one of the disks. Should a hard drive failure occur, this parity data can be used to recover the data from the failed drive, including while the data is being accessed and the drive is still missing from the array.

# RAID5

- Assume we have 4 drives, if one drive fails and while we replace the failed drive we can rebuild the replaced drive from parity informations.
- Parity information's are Stored in all 4 drives, if we have 4 numbers of 1TB hard-drive.
- The parity information will be stored in 256GB in each drivers and other 768GB in each drives will be defined for Users.
- RAID 5 can be survive from a single Drive failure, If drives fails more than 1 will cause loss of data's.

- **RAID level 6**
- Data is written across all disks as in RAID 5, but two sets of parity data is calculated.
- Performance is slightly worse than RAID 5 because the extra parity data must be calculated and written to disk.
- RAID 5 allows for recovery using the parity data if only one drive in the array fails. Because of the dual parity, RAID 6 allows for recovery from the failure of up to two drives in the array.

# Configuration

- To create raid partition we will use fdisk utility.

  fdisk /dev/sdc

  press n for new partition

  press p for primary partition

  use hex code **fd** for raid

  and then press w for saving
- We have to create 3 partions on fdisk

  (/dev/sdh1, /dev/sdi1, /dev/sdj1)
- partprobe for updating kernel without rebooting
- Fdisk -l

- Create raid 5 device with these partitions
- mdadm  --create  /dev/md0  --level=5 --raid-disk=3
  /dev/sdc1   /dev/sdc2   /dev/sdc3
- Now format this newly created md0 raid device

```
mke2fs  - j  /dev/md0
```

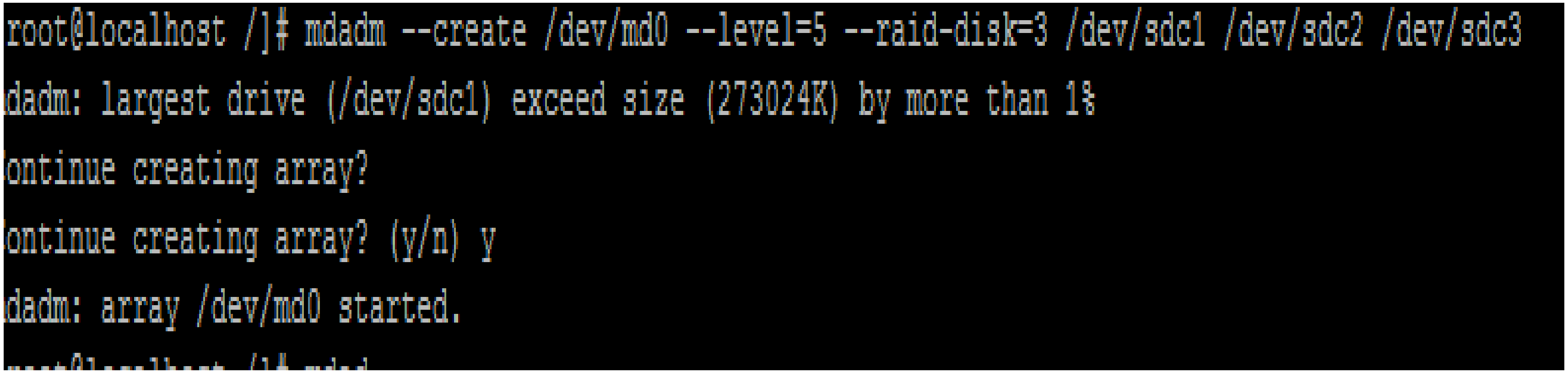
- create a /raiddisk directory and mount **md0** on it

```
mkdir   /raiddisk
mount   /dev/md0    /raiddisk
```

- To permanently mount make its entry in **/etc/fstab** file

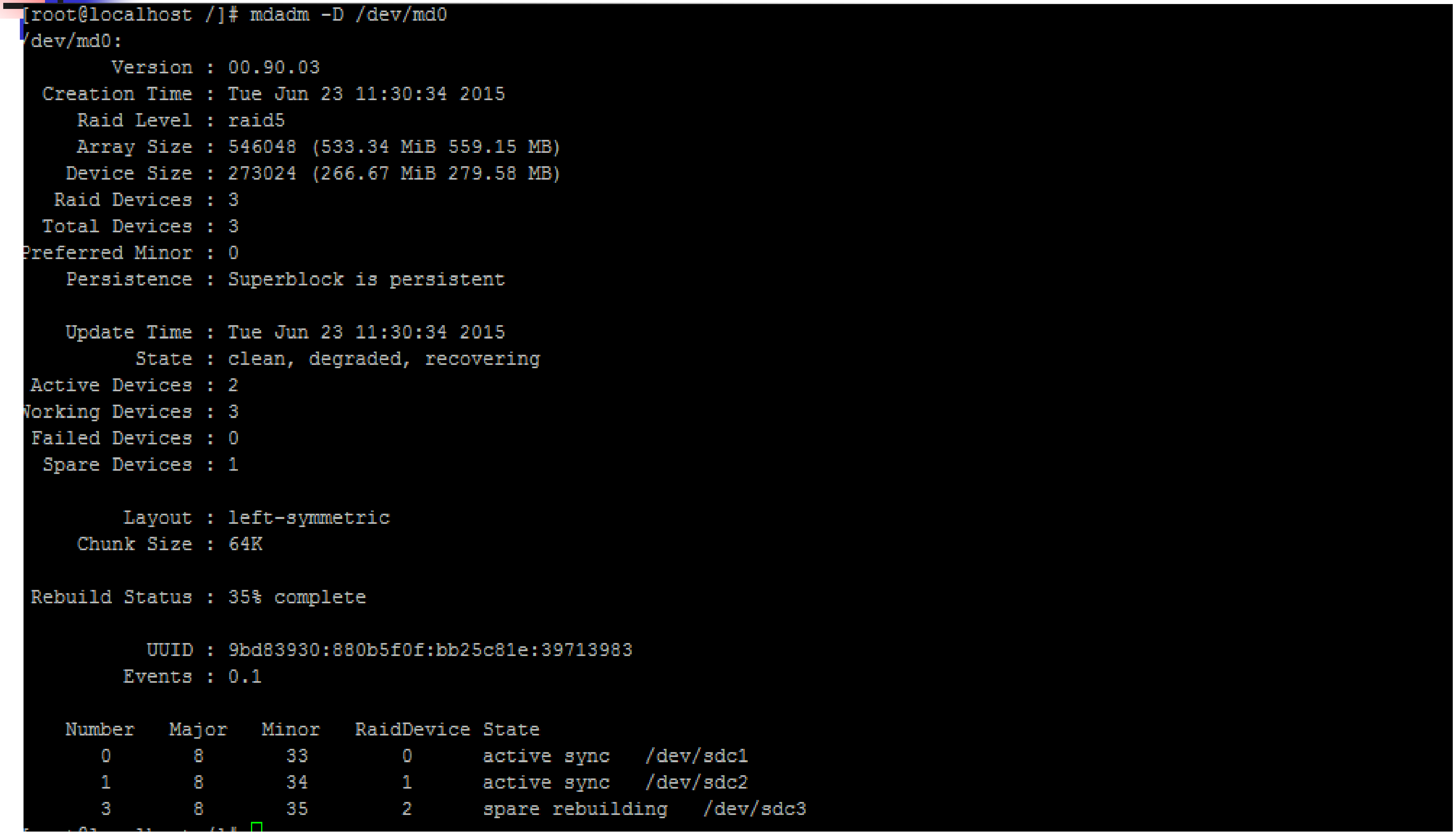
```
/dev/md0    /raiddisk    ext3    defaults   0  0
```

- fdisk  - l



```
root@localhost /]# mdadm --create /dev/md0 --level=5 --raid-disk=3 /dev/sdc1 /dev/sdc2 /dev/sdc3
dadm: largest drive (/dev/sdc1) exceed size (273024K) by more than 1%
ontinue creating array?
ontinue creating array? (y/n) y
dadm: array /dev/md0 started.
root@localhost /]# mdad
```

# Check status of raid



```
[root@localhost /]# mdadm -D /dev/md0
/dev/md0:
        Version : 00.90.03
  Creation Time : Tue Jun 23 11:30:34 2015
     Raid Level : raid5
     Array Size : 546048 (533.34 MiB 559.15 MB)
    Device Size : 273024 (266.67 MiB 279.58 MB)
   Raid Devices : 3
  Total Devices : 3
Preferred Minor : 0
    Persistence : Superblock is persistent

    Update Time : Tue Jun 23 11:30:34 2015
          State : clean, degraded, recovering
 Active Devices : 2
Working Devices : 3
 Failed Devices : 0
  Spare Devices : 1

         Layout : left-symmetric
     Chunk Size : 64K

 Rebuild Status : 35% complete

           UUID : 9bd83930:880b5f0f:bb25c81e:39713983
         Events : 0.1

    Number   Major   Minor   RaidDevice State
       0       8       33        0      active sync   /dev/sdc1
       1       8       34        1      active sync   /dev/sdc2
       3       8       35        2      spare rebuilding   /dev/sdc3
```

# Troubleshooting

- To know the status of raid disk

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

Now make the disk faulty

```
mdadm --manage --fail /dev/md0 /dev/sdc3
```

- Cd  /raiddisk

```
touch  disk1 disk2  disk3
```

- ls –lrt
- To remove the faulty disk

```
mdadm  /dev/md0   --remove  /dev/sdc3
Mdadm /dev/md0 –r /dev/sdb1
```

- To add the new disk into raid

```
mdadm  /dev/md0  --add  /dev/sdc3
```