

# HowTo ASIX RAID

*Redundant Array of Inexpensive Disks*

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## Aprentatges treballats

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1. Tipus de RAID.
  - a. RAID0, RAID1, RAID2, RAID3, RAID4, RAID5, RAID6 i RAID10.
  - b. Raids a implementar: RAID1 i RAID5,
2. Creació i funcionament de raids.
  - a. Creació.
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3. Creació / automatització.
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Eliminar les metadades amb --zero-superbloc.
4. Modificacions del format:
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  - b. Incrementar / decrementar l'espai d'emmagatzament.
  - c. Convertir el raid de un level a un altre
5. RAID + LVM
  - a. Aplicar al raid un sistema de fitxers LVM

## Documentació

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Aquest document ha estat elaborant utilitzant com a eina de treball un sistema GNU/Linux Fedora 20.

- Apunts @edt [ASIX-M11](#)
- RAID
  - [objectius-raid](#)
  - [HowTo-ASIX-RAID](#)
  - Manual ordre [mdadmin](#)
  - deprecated: [Software-raid-howto.pdf](#) (autor mdadmin)

- Documentació de les pàgines man de les ordres.
- Fedora Documentation: Fedora 14, Storage Administration Guide, [Chapter 12: RAID Redundant Array of Inexpensive Disks](#)
- Fedora Documentation: Fedora 20, Installation Guide, [Chapter 9.4.12: Create software RAID](#)
- [The software RAID-HowTO](#) de Jakob Østergaard's.

```
# rpm -ql mdadm
/etc/cron.d/raid-check
/etc/libreport/events.d/mdadm_event.conf
/etc/sysconfig/raid-check
/usr/lib/systemd/system/mdmonitor.service
/usr/lib/udev/rules.d/64-md-raid.rules
/usr/lib/udev/rules.d/65-md-incremental.rules
/usr/sbin/mdadm
/usr/sbin/mdmon
/usr/sbin/raid-check
/usr/share/doc/mdadm-3.2.6
/usr/share/doc/mdadm-3.2.6/COPYING
/usr/share/doc/mdadm-3.2.6/ChangeLog
/usr/share/doc/mdadm-3.2.6/TODO
/usr/share/doc/mdadm-3.2.6/mdadm.conf-example
/usr/share/doc/mdadm-3.2.6/syslog-events
/usr/share/man/man4/md.4.gz
/usr/share/man/man5/mdadm.conf.5.gz
/usr/share/man/man8/mdadm.8.gz
/usr/share/man/man8/mdmon.8.gz
/usr/usr/lib/tmpfiles.d/mdadm.conf
/var/run/mdadm
```

Observant el man de **mdadm** es poden esbrinar ordres relacionades, els autors i enllaços a pàgines de documentació pròpies dels creadors dels MD.

#### SEE ALSO

For further information on mdadm usage, MD and the various levels of RAID, see:

<http://raid.wiki.kernel.org/>

(based upon **Jakob Østergaard's** Software-RAID.HOWTO)

The latest version of mdadm should always be available from

<http://www.kernel.org/pub/linux/utils/raid/mdadm/>

Related man pages:

mdmon(8), mdadm.conf(5), md(4).

raidtab(5), raid0run(8), raidstop(8), mkraid(8).

## RAID Redundant Array of Inexpensive Disks

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Descripció de LVM extreta de Fedora Documentation/14 Storage Guide:

The basic idea behind RAID is to combine multiple small, inexpensive disk drives into an array to accomplish performance or redundancy goals not attainable with one large and expensive drive. This array of drives appears to the computer as a single logical storage unit or drive.

RAID allows information to be spread across several disks. RAID uses techniques such as disk striping (RAID Level 0), disk mirroring (RAID Level 1), and disk striping with parity (RAID Level 5) to achieve redundancy, lower latency, increased bandwidth, and maximized ability to recover from hard disk crashes.

RAID distributes data across each drive in the array by breaking it down into consistently-sized chunks (commonly 256K or 512k, although other values are acceptable). Each chunk is then written to a hard drive in the RAID array according to the RAID level employed. When the data is read, the process is reversed, giving the illusion that the multiple drives in the array are actually one large drive.

### Firmware RAID:

Firmware RAID (also known as ATARAID) is a type of software RAID where the RAID sets can be configured using a firmware-based menu. The firmware used by this type of RAID also hooks into the BIOS, allowing you to boot from its RAID sets. Different vendors use different on-disk metadata formats to mark the RAID set members. The Intel Matrix RAID is a good example of a firmware RAID system.

### Hardware RAID

The hardware-based array manages the RAID subsystem independently from the host. It presents a single disk per RAID array to the host.

A Hardware RAID device may be internal or external to the system, with internal devices commonly consisting of a specialized controller card that handles the RAID tasks transparently to the operating system and with external devices commonly connecting to the system via SCSI, fiber channel, iSCSI, InfiniBand, or other high speed network interconnect and presenting logical volumes to the system.

RAID controller cards function like a SCSI controller to the operating system, and handle all the actual drive communications. The user plugs the drives into the RAID controller (just like a normal SCSI controller) and then adds them to the RAID controllers configuration, and the operating system won't know the difference.

## Software RAID

Software RAID implements the various RAID levels in the kernel disk (block device) code. It offers the cheapest possible solution, as expensive disk controller cards or hot-swap chassis are not required.

Software RAID also works with cheaper IDE disks as well as SCSI disks. With today's faster CPUs, Software RAID also generally outperforms Hardware RAID.

The Linux kernel contains a multi-disk (MD) driver that allows the RAID solution to be completely hardware independent. The performance of a software-based array depends on the server CPU performance and load.

## Tipus de RAID (en Fedora)

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RAID supports various configurations, including levels 0, 1, 4, 5, 6, 10, and linear. These RAID types are defined as follows:

### Level 0

RAID level 0, often called "striping," is a performance-oriented striped data mapping technique. This means the data being written to the array is broken down into strips and written across the member disks of the array, allowing high I/O performance at low inherent cost but provides no redundancy.

Many RAID level 0 implementations will only stripe the data across the member devices up to the size of the smallest device in the array. This means that if you have multiple devices with slightly different sizes, each device will get treated as though it is the same size as the smallest drive.

Therefore, the common storage capacity of a level 0 array is equal to the capacity of the smallest member disk in a Hardware RAID or the capacity of smallest member partition in a Software RAID multiplies by the number of disks or partitions in the array.

### Level 1

RAID level 1, or "mirroring," has been used longer than any other form of RAID. Level 1 provides redundancy by writing identical data to each member disk of the array, leaving a "mirrored" copy on each disk. Mirroring remains popular due to its simplicity and high level of data availability.

Level 1 operates with two or more disks, and provides very good data reliability and improves performance for read-intensive applications but at a relatively high cost.

The storage capacity of the level 1 array is equal to the capacity of the smallest mirrored hard disk in a Hardware RAID or the smallest mirrored partition in a Software RAID. Level 1 redundancy is the highest possible among all RAID types, with the array being able to operate with only a single disk present.

## Level 4

Level 4 uses parity concentrated on a single disk drive to protect data. Because the dedicated parity disk represents an inherent bottleneck on all write transactions to the RAID array, level is seldom used without accompanying technologies such as write-back caching, or in specific circumstances where the system administrator is intentionally designing the software RAID device with this bottleneck in mind (such as an array that will have little to no write transactions once the array is populated with data). RAID level 4 is so rarely used that it is not available as an option in Anaconda. However, it could be created manually by the user if truly needed.

The storage capacity of Hardware RAID level 4 is equal to the capacity of the smallest member partition multiplied by the number of partitions minus one. Performance of a RAID level 4 array will always be asymmetrical, meaning reads will outperform writes. This is because writes consume extra CPU and main memory bandwidth when generating parity, and then also consume extra bus bandwidth when writing the actual data to disks because you are writing not only the data, but also the parity. Reads need only read the data and not the parity unless the array is in a degraded state. As a result, reads generate less traffic to the drives and across the busses of the computer for the same amount of data transfer under normal operating conditions.

## Level 5

This is the most common type of RAID. By distributing parity across all of an array's member disk drives, RAID level 5 eliminates the write bottleneck inherent in level 4. The only performance bottleneck is the parity calculation process itself. With modern CPUs and Software RAID, that is usually not a bottleneck at all since modern CPUs can generate parity very fast. However, if you have a sufficiently large number of member devices in a software RAID5 array such that the combined aggregate data transfer speed across all devices is high enough, then this bottleneck can start to come into play.

As with level 4, level 5 has asymmetrical performance, with reads substantially outperforming writes. The storage capacity of RAID level 5 is calculated the same way as with level 4.

## Level 6

This is a common level of RAID when data redundancy and preservation, and not performance, are the paramount concerns, but where the space inefficiency of level 1 is not acceptable. Level 6 uses a complex parity scheme to be able to recover from the loss of any two drives in the array.

This complex parity scheme creates a significantly higher CPU burden on software RAID devices and also imposes an increased burden during write transactions. As such, not only is level 6 asymmetrical in performance like levels 4 and 5, but it is considerably more asymmetrical.

The total capacity of a RAID level 6 array is calculated similarly to RAID level 5 and 4, except that you must subtract 2 devices (instead of 1) from the device count for the extra parity storage space.

## Level 10

This RAID level attempts to combine the performance advantages of level 0 with the redundancy of level 1. It also helps to alleviate some of the space wasted in level 1 arrays with more than 2 devices. With level 10, it is possible to create a 3-drive array configured to store only 2 copies of each piece of data, which then allows the overall array size to be 1.5 times the size of the smallest devices instead of only equal to the smallest device (like it would be with a 3-device, level 1 array).

The number of options available when creating level 10 arrays (as well as the complexity of selecting the right options for a specific use case) make it impractical to create during installation. It is possible to create one manually using the command line mdadm tool. For details on the options and their respective performance trade-offs, refer to man md.

## Linear RAID

Linear RAID is a simple grouping of drives to create a larger virtual drive. In linear RAID, the chunks are allocated sequentially from one member drive, going to the next drive only when the first is completely filled. This grouping provides no performance benefit, as it is unlikely that any I/O operations will be split between member drives. Linear RAID also offers no redundancy and, in fact, decreases reliability — if any one member drive fails, the entire array cannot be used. The capacity is the total of all member disks.

La descripció que fa l'aplicació gràfica de fedora en el procés d'instal·lació, de cada tipus de raid permès és el següent:

### **RAID0 (Performance)**

Distributes data across multiple storage devices. Level 0 RAID offers increased performance over standard partitions, and can be used to pool the storage of multiple devices into one large virtual device. Note that Level 0 RAID offers no redundancy and that the failure of one device in the array destroys the entire array. RAID 0 requires at least two RAID partitions.

### **RAID1 (Redundancy)**

Mirrors the data on one storage device onto one or more other storage devices. Additional devices in the array provide increasing levels of redundancy. RAID 1 requires at least two RAID partitions.

### **RAID4 (Error Checking)**

Distributes data across multiple storage devices, but uses one device in the array to store parity information that safeguards the array in case any device within the array fails. Because all parity information is stored on the one device, access to this device creates a bottleneck in the performance of the array. RAID 4 requires at least three RAID partitions.

### **RAID5 (Distributed Error Checking)**

Distributes data and parity information across multiple storage devices. Level 5 RAID therefore offers the performance advantages of distributing data across multiple devices, but does not share the performance bottleneck of level 4 RAID because the parity

information is also distributed through the array. RAID 5 requires at least three RAID partitions.

**RAID6 (Redundant Error Checking)**

Level 6 RAID is similar to level 5 RAID, but instead of storing only one set of parity data, they store two sets. RAID 6 requires at least four RAID partitions.

**RAID10 (Performance, Redundancy)**

Level 10 RAID is *nested RAID* or *hybrid RAID*. Level 10 RAID is constructed by distributing data over mirrored sets of storage devices. For example, a level 10 RAID constructed from four RAID partitions consists of two pairs of partitions in which one partition mirrors the other. Data is then distributed across both pairs of storage devices, as in a level 0 RAID. RAID 10 requires at least four RAID partitions.

## Exercici Pràctic:

---

### Crear el RAID

Crear tres unitats físiques 'imaginaries' usant la utilitat *dd* per generar espai de disc virtual. Assignar aquests fitxers a un dispositiu físic de *loopback*. És a dir, en lloc de crear tres particions de debò tipus `/dev/sda2`, `/dev/sda3` i `/dev/sda4` ens inventem les particions `/dev/loop0`, `/dev/loop1` i `/dev/loop2`

```
# Crear les fitxers imatge
# dd if=/dev/zero of=disk01.img bs=1k count=100K
102400+0 registres llegits
102400+0 registres escrits
104857600 octets (105 MB) copiats, 0,676056 s, 155 MB/s
# dd if=/dev/zero of=disk02.img bs=1k count=100K
# dd if=/dev/zero of=disk03.img bs=1k count=100K

# Assignar-los al loopback
# losetup /dev/loop0 /opt/lvm/disk01.img
# losetup /dev/loop1 /opt/lvm/disk02.img
# losetup /dev/loop2 /opt/lvm/disk03.img

# losetup -a
/dev/loop0: [2053]:1217 (/opt/lvm/disk01.img)
/dev/loop1: [2053]:1218 (/opt/lvm/disk02.img)
/dev/loop2: [2053]:1220 (/opt/lvm/disk03.img)
```

Un cop disposem de les tres particions virtuals les integrem a un RAID format per totes tres.



```
# mdadm --create /dev/md0 --chunk=4 --level=1 --raid-devices=3 /dev/loop0
/dev/loop1 /dev/loop2
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?
mdadm: Defaulting to version 1.2 metadata
mdadm: array /dev/md0 started.

# tree /dev/disk
/dev/disk
|-- by-id
|  |-- ata-FUJITSU_MHV2100AT_PL_NSA3T6329W69 -> ../../sda
|  |-- ata-FUJITSU_MHV2100AT_PL_NSA3T6329W69-part1 -> ../../sda1
|  .....
|  |-- ata-FUJITSU_MHV2100AT_PL_NSA3T6329W69-part7 -> ../../sda7
|  |-- ata-MATSHITADVD-RAM_UJ-841S -> ../../sr0
|  |-- md-name-portatil.localdomain:0 -> ../../md0
|  |-- md-uuid-b5fd01dc:53a820d3:190ae832:4f3144f8 -> ../../md0
```

Ara el sistema disposa d'un nou dispositiu anomenat **/dev/md0** que és un disc RAID format per les tres particions loop0, loop1 i loop2. Es tracta d'un raid de tipus 1 amb tres discs miralls. Però el sistema el veu com un sol disc de 100M.

Ara cal assignar-li un sistema de fitxers (formatar-lo) i muntar-lo al *filesystem* per poder-lo utilitzar. En l'exemple es munta a *mnt* i s'hi copien les dades del directori *boot*. Es pot observar amb el **df** l'espai total, lliure i ocupat del raid (sembla que massa ocupat i tot!).

```
# mkfs -t ext4 /dev/md0
mke2fs 1.42.3 (14-May-2012)
Discarding device blocks: fet
Etiqueta del sistema de fitxers=
OS type: Linux
Mida del bloc=1024 (log=0)
Mida del fragment=1024 (log=0)
Stride=0 blocks, Stripe width=0 blocks
25584 inodes, 102272 blocks
5113 blocks (5.00%) reserved for the super user
Bloc de dades inicial=1
Màxim de blocs del sistema de fitxers=67371008
13 grups de blocs
8192 blocs per grup, 8192 fragments per grup
1968 nodes-i per grup
Còpies de seguretat del superbloc desades en els blocs:
  8193, 24577, 40961, 57345, 73729
```

```

Allocating group tables: fet
Escriptura de les taules de nodes-i:fet
Creació del registre de transaccions (4096 blocs): fet
Escriptura de la informació dels súperblocs i de comptabilitat del sistema de fitxers:fet

# blkid
/dev/loop0: UUID="b5fd01dc-53a8-20d3-190a-e8324f3144f8"
UUID_SUB="b36d27f4-3024-029e-42df-5e2d0cd3517d" LABEL="portatil.localdomain:0"
TYPE="linux_raid_member"
/dev/loop1: UUID="b5fd01dc-53a8-20d3-190a-e8324f3144f8"
UUID_SUB="183ac428-ed70-50b0-e30f-b2f9de67716e" LABEL="portatil.localdomain:0"
TYPE="linux_raid_member"
/dev/loop2: UUID="b5fd01dc-53a8-20d3-190a-e8324f3144f8"
UUID_SUB="f8e403c8-70e1-845d-e5a7-a13885fd6119" LABEL="portatil.localdomain:0"
TYPE="linux_raid_member"
....
/dev/md0: UUID="005caef9-e1e0-429a-bc81-7fcb5ba290cb" TYPE="ext4"
# mount /dev/md0 /mnt/

# cp -r /boot/ /mnt/

# df -h
S. fitxers      Mida En ús Lliure %Ús Muntat a
....
/dev/md0        93M  93M    0 100% /mnt

```

## Examinar el RAID

L'ordre **mdadm** permet examinar i governar els diversos RAID del sistema. També **/proc** proporciona informació dels RAID.

```

# mdadm --detail --scan
ARRAY /dev/md0 metadata=1.2 name=portatil.localdomain:0
UUID=b5fd01dc:53a820d3:190ae832:4f3144f8

# mdadm --detail /dev/md0
/dev/md0:
  Version : 1.2
  Creation Time : Fri Feb 6 20:56:09 2015
  Raid Level : raid1
  Array Size : 102272 (99.89 MiB 104.73 MB)
  Used Dev Size : 102272 (99.89 MiB 104.73 MB)
  Raid Devices : 3
  Total Devices : 3
  Persistence : Superblock is persistent

  Update Time : Fri Feb 6 21:24:20 2015

```

```

State : clean
Active Devices : 3
Working Devices : 3
Failed Devices : 0
Spare Devices : 0

Name : portatil.localdomain:0 (local to host portatil.localdomain)
UUID : b5fd01dc:53a820d3:190ae832:4f3144f8
Events : 17

Number Major Minor RaidDevice State
0       7      0      0      active sync  /dev/loop0
1       7      1      1      active sync  /dev/loop1
2       7      2      2      active sync  /dev/loop2

# mdadm --query /dev/loop0
/dev/loop0: is not an md array
/dev/loop0: device 0 in 3 device active raid1 /dev/md0. Use mdadm --examine for more
detail.

# mdadm --examine /dev/loop0
/dev/loop0:
  Magic : a92b4efc
  Version : 1.2
  Feature Map : 0x0
  Array UUID : b5fd01dc:53a820d3:190ae832:4f3144f8
  Name : portatil.localdomain:0 (local to host portatil.localdomain)
  Creation Time : Fri Feb 6 20:56:09 2015
  Raid Level : raid1
  Raid Devices : 3

Avail Dev Size : 204672 (99.95 MiB 104.79 MB)
  Array Size : 102272 (99.89 MiB 104.73 MB)
Used Dev Size : 204544 (99.89 MiB 104.73 MB)
  Data Offset : 128 sectors
  Super Offset : 8 sectors
  State : clean
  Device UUID : b36d27f4:3024029e:42df5e2d:0cd3517d

  Update Time : Fri Feb 6 21:26:14 2015
  Checksum : 8bdf41ce - correct
  Events : 17

Device Role : Active device 0
Array State : AAA ('A' == active, '.' == missing)

```

```

# cat /proc/mdstat
Personalities : [raid1]

```

```
md0 : active raid1 loop2[2] loop1[1] loop0[0]
      102272 blocks super 1.2 [3/3] [UUU]

unused devices: <none>
```

## Automatitzar l'arrancada del RAID

Per automatitzar l'arrancada es genera un fitxer de configuració **mdadm.conf**. També cal desar al **/etc/fstab** l'entrada per a que munti el RAID automàticament si es vol que sigui així.

```
# mdadm --detail --scan > /etc/mdadm.conf
# cat /etc/mdadm.conf
ARRAY /dev/md0 metadata=1.2 name=portatil.localdomain:0
UUID=b5fd01dc:53a820d3:190ae832:4f3144f8

# cat /etc/fstab
/dev/md0 /mnt ext4 default 0 0
```

## Generar errada i recuperació

El software de *mdadm* permet simular que s'ha produït una errada de software en un dels discs RAID. Quan un disc dels que formen el RAID es malmet es pot intentar un procés de recuperació (segons el tipus de RAID usat) o simplement eliminar un dels discs i substituir-lo per un de nou.

```
# cat /proc/mdstat
Personalities : [raid1]
md0 : active raid1 loop2[2] loop1[1] loop0[0]
      102272 blocks super 1.2 [3/3] [UUU]

# mdadm /dev/md0 --fail /dev/loop1
mdadm: set /dev/loop1 faulty in /dev/md0

# cat /proc/mdstat
Personalities : [raid1]
md0 : active raid1 loop2[2] loop1[1](F) loop0[0]
      102272 blocks super 1.2 [3/2] [U_U]

# mdadm --detail /dev/md0
/dev/md0:
  Version : 1.2
  Creation Time : Fri Feb  6 20:56:09 2015
```

```

Raid Level : raid1
Array Size : 102272 (99.89 MiB 104.73 MB)
Used Dev Size : 102272 (99.89 MiB 104.73 MB)
Raid Devices : 3
Total Devices : 3
Persistence : Superblock is persistent

Update Time : Fri Feb 6 21:44:57 2015
State : clean, degraded
Active Devices : 2
Working Devices : 2
Failed Devices : 1
Spare Devices : 0

Name : portatil.localdomain:0 (local to host portatil.localdomain)
UUID : b5fd01dc:53a820d3:190ae832:4f3144f8
Events : 19

Number Major Minor RaidDevice State
0        7        0        0      active sync  /dev/loop0
1        0        0        1      removed
2        7        2        2      active sync  /dev/loop2

1        7        1        -      faulty /dev/loop1

```

Un cop ha fallat el dispositiu /dev/loop1 s'elimina del raid:

```

# mdadm /dev/md0 --remove /dev/loop1
mdadm: hot removed /dev/loop1 from /dev/md0

# cat /proc/mdstat
Personalities : [raid1]
md0 : active raid1 loop2[2] loop0[0]
      102272 blocks super 1.2 [3/2] [U_U]

# dd if=/dev/zero of=disc04.img bs=1k count=100k
# losetup /dev/loop3 /opt/raid/disc04.img
# mdadm --manage /dev/md0 --add /dev/loop3
mdadm: added /dev/loop3

# cat /proc/mdstat
Personalities : [raid1]
md0 : active raid1 loop3[3] loop2[2] loop0[0]
      102272 blocks super 1.2 [3/3] [UUU]

# mdadm --detail /dev/md0
/dev/md0:
  Version : 1.2
  Creation Time : Fri Feb 6 20:56:09 2015

```

```

Raid Level : raid1
Array Size : 102272 (99.89 MiB 104.73 MB)
Used Dev Size : 102272 (99.89 MiB 104.73 MB)
Raid Devices : 3
Total Devices : 3
Persistence : Superblock is persistent

Update Time : Fri Feb 6 22:01:15 2015
State : clean
Active Devices : 3
Working Devices : 3
Failed Devices : 0
Spare Devices : 0

Name : portatil.localdomain:0 (local to host portatil.localdomain)
UUID : b5fd01dc:53a820d3:190ae832:4f3144f8
Events : 41

Number Major Minor RaidDevice State
0        7      0      0      active sync  /dev/loop0
3        7      3      1      active sync  /dev/loop3
2        7      2      2      active sync  /dev/loop2

```

## Aturar / Engegar el RAID

```

# mdadm --stop /dev/md0
mdadm: Cannot get exclusive access to /dev/md0:Perhaps a running process, mounted
filesystem or active volume group?
# umount /mnt

# mdadm --stop /dev/md0
mdadm: stopped /dev/md0

# mdadm --assemble --scan
mdadm: failed to add /dev/loop3 to /dev/md0: Invalid argument
mdadm: /dev/md0 has been started with 2 drives (out of 3).

# cat /proc/mdstat
Personalities : [raid1]
md0 : active raid1 loop0[0] loop2[2]
      102272 blocks super 1.2 [3/2] [U_U]

# mdadm --detail /dev/md0
/dev/md0:
Version : 1.2

```

```

Creation Time : Fri Feb 6 20:56:09 2015
  Raid Level : raid1
  Array Size : 102272 (99.89 MiB 104.73 MB)
  Used Dev Size : 102272 (99.89 MiB 104.73 MB)
  Raid Devices : 3
  Total Devices : 2
  Persistence : Superblock is persistent

  Update Time : Fri Feb 6 22:05:55 2015
  State : clean, degraded
Active Devices : 2
Working Devices : 2
Failed Devices : 0
Spare Devices : 0

  Name : portatil.localdomain:0 (local to host portatil.localdomain)
  UUID : b5fd01dc:53a820d3:190ae832:4f3144f8
  Events : 41

    Number Major Minor RaidDevice State
    0       7      0      0      active sync  /dev/loop0
    1       0      0      1      removed
    2       7      2      2      active sync  /dev/loop2

# mdadm -v /dev/md0 --add /dev/loop3
mdadm: added /dev/loop3
# cat /proc/mdstat
Personalities : [raid1]
md0 : active raid1 loop3[3] loop0[0] loop2[2]
      102272 blocks super 1.2 [3/2] [U_U]
      [=====>.....] recovery = 43.5% (44800/102272) finish=0.1min
speed=7466K/sec
unused devices: <none>

# cat /proc/mdstat
Personalities : [raid1]
md0 : active raid1 loop3[3] loop0[0] loop2[2]
      102272 blocks super 1.2 [3/2] [U_U]
      [=====>....] recovery = 81.0% (83200/102272) finish=0.0min
speed=7563K/sec
unused devices: <none>

# cat /proc/mdstat
Personalities : [raid1]
md0 : active raid1 loop3[3] loop0[0] loop2[2]
      102272 blocks super 1.2 [3/3] [UUU]

# mdadm --detail /dev/md0
/dev/md0:
  Version : 1.2

```

```

Creation Time : Fri Feb  6 20:56:09 2015
  Raid Level : raid1
  Array Size : 102272 (99.89 MiB 104.73 MB)
Used Dev Size : 102272 (99.89 MiB 104.73 MB)
  Raid Devices : 3
Total Devices : 3
  Persistence : Superblock is persistent

Update Time : Sat Feb  7 14:00:03 2015
  State : clean
Active Devices : 3
Working Devices : 3
Failed Devices : 0
Spare Devices : 0

Name : portatil.localdomain:0 (local to host portatil.localdomain)
UUID : b5fd01dc:53a820d3:190ae832:4f3144f8
Events : 62

Number Major Minor RaidDevice State
 0       7      0      0     active sync  /dev/loop0
 3       7      3      1     active sync  /dev/loop3
 2       7      2      2     active sync  /dev/loop2

```

## Exercici Pràctic: (2)

---

Crear un raid de nivell 5 amb tres unitats (loop0, loop1 i loop2, més un disc de spare).

```

# mdadm -v --create /dev/md0 --level 5 --raid-devices 3 /dev/loop0 /dev/loop1
/dev/loop2 --spare-devices 1 /dev/loop3
mdadm: layout defaults to left-symmetric
mdadm: layout defaults to left-symmetric
mdadm: chunk size defaults to 512K
mdadm: /dev/loop0 appears to be part of a raid array:
      level=raid1 devices=3 ctime=Fri Feb  6 20:56:09 2015
mdadm: /dev/loop1 appears to be part of a raid array:
      level=raid1 devices=3 ctime=Fri Feb  6 20:56:09 2015
mdadm: /dev/loop2 appears to be part of a raid array:
      level=raid1 devices=3 ctime=Fri Feb  6 20:56:09 2015
mdadm: /dev/loop3 appears to be part of a raid array:
      level=raid1 devices=3 ctime=Fri Feb  6 20:56:09 2015
mdadm: size set to 101888K
Continue creating array?

```



```
mdadm: Defaulting to version 1.2 metadata
mdadm: array /dev/md0 started.
```

### # cat /proc/mdstat

```
Personalities : [raid1] [raid6] [raid5] [raid4]
md0 : active raid5 loop2[4] loop3[3](S) loop1[1] loop0[0]
      203776 blocks super 1.2 level 5, 512k chunk, algorithm 2 [3/3] [UUU]
```

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

```
/dev/md0:
```

```
Version : 1.2
```

```
Creation Time : Sat Feb 7 14:23:17 2015
```

```
Raid Level : raid5
```

```
Array Size : 203776 (199.03 MiB 208.67 MB)
```

```
Used Dev Size : 101888 (99.52 MiB 104.33 MB)
```

```
Raid Devices : 3
```

```
Total Devices : 4
```

```
Persistence : Superblock is persistent
```

```
Update Time : Sat Feb 7 14:23:39 2015
```

```
State : clean
```

```
Active Devices : 3
```

```
Working Devices : 4
```

```
Failed Devices : 0
```

```
Spare Devices : 1
```

```
Layout : left-symmetric
```

```
Chunk Size : 512K
```

```
Name : portatil.localdomain:0 (local to host portatil.localdomain)
```

```
UUID : efa4df5b:9cc6b5b7:68f0a73f:a4cf4931
```

```
Events : 18
```

```
Number Major Minor RaidDevice State
```

```
0      7      0      0      active sync /dev/loop0
```

```
1      7      1      1      active sync /dev/loop1
```

```
4      7      2      2      active sync /dev/loop2
```

```
3      7      3      -      spare /dev/loop3
```

### # mkfs -t ext4 /dev/md0

```
mke2fs 1.42.3 (14-May-2012)
```

```
Discarding device blocks: fet
```

```
Etiqueta del sistema de fitxers=
```

```
OS type: Linux
```

```
Mida del bloc=1024 (log=0)
```

```
Mida del fragment=1024 (log=0)
```

```
Stride=512 blocks, Stripe width=1024 blocks
```

```

51000 inodes, 203776 blocks
10188 blocks (5.00%) reserved for the super user
Bloc de dades inicial=1
Màxim de blocs del sistema de fitxers=67371008
25 grups de blocs
8192 blocs per grup, 8192 fragments per grup
2040 nodes-i per grup
Còpies de seguretat del superbloc desades en els blocs:
  8193, 24577, 40961, 57345, 73729

Allocating group tables: fet
Escriptura de les taules de nodes-i:fet
Creació del registre de transaccions (4096 blocs): fet
Escriptura de la informació dels súperblocs i de comptabilitat del sistema de fitxers:fet

# mount /dev/md0 /mnt/

# df -h
S. fitxers      Mida En ús Lliure  %Ús Muntat a
...
/dev/md0        189M  1,6M  178M   1% /mnt

```

Observar que en tractar-se d'un RAID5 format per tres unitats de 100M més una de spare de 100M, l'espai utilitzable d'emmagatzemament és proper als 200M. Dels tres discos de RAID dos emmagatzemen dades i un tercer paritat, però no tal qual (seria raid 4) sinó que entre els tres discos es barregen dades i paritat.

Així doncs, si falla un dels tres discos el sistema deixa de funcionar. Si hi ha un disc de spare, aquest s'hauria d'activar automàticament per solventar el problema. Si un altre disc falla, llavors el RAID deixa de funcionar.

```

# mdadm /dev/md0 --fail /dev/loop1
mdadm: set /dev/loop1 faulty in /dev/md0

# cat /proc/mdstat
Personalities : [raid1] [raid6] [raid5] [raid4]
md0 : active raid5 loop2[4] loop3[3] loop1[1](F) loop0[0]
      203776 blocks super 1.2 level 5, 512k chunk, algorithm 2 [3/2] [U_U]
      [=====>.....] recovery = 37.0% (38232/101888) finish=0.0min
speed=12744K/sec

# mdadm --detail /dev/md0
/dev/md0:
  Version : 1.2
  Creation Time : Sat Feb  7 14:23:17 2015
  Raid Level : raid5
  Array Size : 203776 (199.03 MiB 208.67 MB)
  Used Dev Size : 101888 (99.52 MiB 104.33 MB)

```

```

Raid Devices : 3
Total Devices : 4
    Persistence : Superblock is persistent

    Update Time : Sat Feb  7 14:45:09 2015
    State : clean, degraded, recovering
Active Devices : 2
Working Devices : 3
Failed Devices : 1
Spare Devices : 1

    Layout : left-symmetric
    Chunk Size : 512K

Rebuild Status : 81% complete

    Name : portatil.localdomain:0 (local to host portatil.localdomain)
    UUID : efa4df5b:9cc6b5b7:68f0a73f:a4cf4931
    Events : 33

    Number Major Minor RaidDevice State
    0       7      0      0      active sync  /dev/loop0
    3       7      3      1      spare rebuilding /dev/loop3
    4       7      2      2      active sync  /dev/loop2

    1       7      1      -      faulty /dev/loop1

# cat /proc/mdstat
Personalities : [raid1] [raid6] [raid5] [raid4]
md0 : active raid5 loop2[4] loop3[3] loop1[1](F) loop0[0]
      203776 blocks super 1.2 level 5, 512k chunk, algorithm 2 [3/3] [UUU]

# mdadm /dev/md0 --remove /dev/loop1
mdadm: hot removed /dev/loop1 from /dev/md0

```

Ara el RAID5 disposa de tres unitats loop0, loop2 i loop3, si una d'elles falla deixarà de funcionar.

```

# mdadm /dev/md0 --fail /dev/loop2
mdadm: set /dev/loop2 faulty in /dev/md0

# cat /proc/mdstat
Personalities : [raid1] [raid6] [raid5] [raid4]
md0 : active raid5 loop2[4](F) loop3[3] loop0[0]
      203776 blocks super 1.2 level 5, 512k chunk, algorithm 2 [3/2] [UU_]

# mdadm --detail /dev/md0
/dev/md0:
    Version : 1.2

```

```

Creation Time : Sat Feb  7 14:23:17 2015
  Raid Level : raid5
  Array Size : 203776 (199.03 MiB 208.67 MB)
Used Dev Size : 101888 (99.52 MiB 104.33 MB)
Raid Devices : 3
Total Devices : 3
Persistence : Superblock is persistent

Update Time : Sat Feb  7 14:49:59 2015
State : clean, degraded
Active Devices : 2
Working Devices : 2
Failed Devices : 1
Spare Devices : 0

Layout : left-symmetric
Chunk Size : 512K

Name : portatil.localdomain:0 (local to host portatil.localdomain)
UUID : efa4df5b:9cc6b5b7:68f0a73f:a4cf4931
Events : 42

Number Major Minor RaidDevice State
0        7      0      0      active sync /dev/loop0
3        7      3      1      active sync /dev/loop3
2        0      0      2      removed

4        7      2      -      faulty /dev/loop2

```

El RAID encara funciona. Anem a provar a espatllar una nova unitat, per exemple loop3.

```

# mdadm /dev/md0 --fail /dev/loop3
mdadm: set /dev/loop3 faulty in /dev/md0

# cat /proc/mdstat
Personalities : [raid1] [raid6] [raid5] [raid4]
md0 : active raid5 loop2[4](F) loop3[3](F) loop0[0]
      203776 blocks super 1.2 level 5, 512k chunk, algorithm 2 [3/1] [U__]

# mdadm --detail /dev/md0
/dev/md0:
  Version : 1.2
  Creation Time : Sat Feb  7 14:23:17 2015
  Raid Level : raid5
  Array Size : 203776 (199.03 MiB 208.67 MB)
Used Dev Size : 101888 (99.52 MiB 104.33 MB)
Raid Devices : 3
Total Devices : 3
Persistence : Superblock is persistent

```

```

Update Time : Sat Feb  7 14:52:34 2015
State : clean, FAILED
Active Devices : 1
Working Devices : 1
Failed Devices : 2
Spare Devices : 0

Layout : left-symmetric
Chunk Size : 512K

Name : portatil.localdomain:0 (local to host portatil.localdomain)
UUID : efa4df5b:9cc6b5b7:68f0a73f:a4cf4931
Events : 46

Number Major Minor RaidDevice State
0        7      0      0     active sync /dev/loop0
1        0      0      1     removed
2        0      0      2     removed

3        7      3      -     faulty /dev/loop3
4        7      2      -     faulty /dev/loop2

```

Finalment anem a afegir dues noves unitats al raid, primer extreurem les que han fallat (loop2 i loop3) i les reemplaçarem per dues de noves, que casualment tornen a ser loop2 i loop3.

```

# mdadm /dev/md0 --remove /dev/loop2 /dev/loop3
mdadm: hot removed /dev/loop2 from /dev/md0
mdadm: hot removed /dev/loop3 from /dev/md0

# mdadm /dev/md0 --add /dev/loop2 /dev/loop3
mdadm: /dev/md0 has failed so using --add cannot work and might destroy
mdadm: data on /dev/loop2. You should stop the array and re-assemble it.

# mdadm --stop /dev/md0
mdadm: stopped /dev/md0

# mdadm --assemble --scan
mdadm: /dev/md/0 assembled from 1 drive - not enough to start the array.
mdadm: No arrays found in config file or automatically

```

No funciona. S'han perdut les dades d'un dels discs, ja no es possible reanudar-lo. S'han apagat massa discs i s'han perdut les dades

## Exemple preparat

Aquest exemple és el mateix que l'anterior on d'un RAID5 de tres unitats més una de spare de n'han espatllat dues. Primer ha entrat en funcionament l'spare. Llavors s'ha degradat el RAID.

En aquest exemple s'han eliminat les dues unitats que no funcionaven i llavors s'han afegir dues unitats noves. Es pot observar com s'ha recuperat de la fallida i va tot ok.

```
# cat /proc/mdstat
Personalities : [raid1] [raid6] [raid5] [raid4]
md0 : active raid5 loop3[3] loop0[0]
      203776 blocks super 1.2 level 5, 512k chunk, algorithm 2 [3/2] [U_U]

# mdadm --detail /dev/md0
/dev/md0:
  Version : 1.2
  Creation Time : Sat Feb  7 15:10:35 2015
  Raid Level : raid5
  Array Size : 203776 (199.03 MiB 208.67 MB)
  Used Dev Size : 101888 (99.52 MiB 104.33 MB)
  Raid Devices : 3
  Total Devices : 2
  Persistence : Superblock is persistent

  Update Time : Sat Feb  7 15:14:21 2015
  State : clean, degraded
Active Devices : 2
Working Devices : 2
Failed Devices : 0
Spare Devices : 0

  Layout : left-symmetric
  Chunk Size : 512K

  Name : portatil.localdomain:0 (local to host portatil.localdomain)
  UUID : 8a1b6778:6955670b:931d8ae7:c53a0de4
  Events : 45

    Number Major Minor RaidDevice State
    0       7      0      0     active sync  /dev/loop0
    1       0      0      1     removed
    3       7      3      2     active sync  /dev/loop3

# mdadm /dev/md0 --add /dev/loop1
mdadm: added /dev/loop1

# mdadm /dev/md0 --add /dev/loop2
```

```
mdadm: added /dev/loop2
```

### # cat /proc/mdstat

```
Personalities : [raid1] [raid6] [raid5] [raid4]
```

```
md0 : active raid5 loop2[5](S) loop1[4] loop3[3] loop0[0]
```

```
203776 blocks super 1.2 level 5, 512k chunk, algorithm 2 [3/3] [UUU]
```

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

```
/dev/md0:
```

```
Version : 1.2
```

```
Creation Time : Sat Feb 7 15:10:35 2015
```

```
Raid Level : raid5
```

```
Array Size : 203776 (199.03 MiB 208.67 MB)
```

```
Used Dev Size : 101888 (99.52 MiB 104.33 MB)
```

```
Raid Devices : 3
```

```
Total Devices : 4
```

```
Persistence : Superblock is persistent
```

```
Update Time : Sat Feb 7 15:16:20 2015
```

```
State : clean
```

```
Active Devices : 3
```

```
Working Devices : 4
```

```
Failed Devices : 0
```

```
Spare Devices : 1
```

```
Layout : left-symmetric
```

```
Chunk Size : 512K
```

```
Name : portatil.localdomain:0 (local to host portatil.localdomain)
```

```
UUID : 8a1b6778:6955670b:931d8ae7:c53a0de4
```

```
Events : 67
```

```
Number Major Minor RaidDevice State
```

```
0 7 0 0 active sync /dev/loop0
```

```
4 7 1 1 active sync /dev/loop1
```

```
3 7 3 2 active sync /dev/loop3
```

```
5 7 2 - spare /dev/loop2
```

### # df -h

```
S. fitxers Mida En ús Lliure %Ús Muntat a
```

```
....
```

```
/dev/md0 189M 93M 86M 52% /mnt
```

## Utilitat mdadm

---

L'utilitat GNU/Linux d'administració de discs RAID és *mdadmin*, aquest apartat mostra part del contingut del seu man.

MDADM(8)

MDADM(8)

NAME

mdadm - manage MD devices aka Linux Software RAID

SYNOPSIS

mdadm [mode] &lt;raiddevice&gt; [options] &lt;component-devices&gt;

DESCRIPTION

RAID devices are virtual devices created from two or more real block devices. This allows multiple devices (typically disk drives or partitions thereof) to be combined into a single device to hold (for example) a single filesystem. Some RAID levels include redundancy and so can survive some degree of device failure.

Linux Software RAID devices are implemented through the md (Multiple Devices) device driver.

Currently, Linux supports LINEAR md devices, RAID0 (striping), RAID1 (mirroring), RAID4, RAID5, RAID6, RAID10, MULTIPATH, FAULTY, and CONTAINER.

MULTIPATH is not a Software RAID mechanism, but does involve multiple devices: each device is a path to one common physical storage device. New installations should not use md/multipath as it is not well supported and has no ongoing development. Use the Device Mapper based multipath-tools instead.

FAULTY is also not true RAID, and it only involves one device. It provides a layer over a true device that can be used to inject faults.

CONTAINER is different again. A CONTAINER is a collection of devices that are managed as a set. This is similar to the set of devices connected to a hardware RAID controller. The set of devices may contain a number of different RAID arrays each utilising some (or all) of the blocks from a number of the devices in the set. For example, two devices in a 5-device set might form a RAID1 using the whole devices. The remaining three might have a RAID5 over the first half of each device, and a RAID0 over the second half.

**MODES**

mdadm has several major modes of operation:

**Assemble**

Assemble the components of a previously created array into an active array. Components can be explicitly given or can be searched for. mdadm checks that the components do form a bona fide array, and can, on request, fiddle superblock information so as to assemble a faulty array.

**Build**

Build an array that doesn't have per-device metadata (superblocks). For these sorts of



arrays, mdadm cannot differentiate between initial creation and subsequent assembly of an array. It also cannot perform any checks that appropriate components have been requested. Because of this, the Build mode should only be used together with a complete understanding of what you are doing.

**Create**

Create a new array with per-device metadata (superblocks). Appropriate metadata is written to each device, and then the array comprising those devices is activated. A 'resync' process is started to make sure that the array is consistent (e.g. both sides of a mirror contain the same data) but the content of the device is left otherwise untouched. The array can be used as soon as it has been created. There is no need to wait for the initial resync to finish.

**Follow or Monitor**

Monitor one or more md devices and act on any state changes. This is only meaningful for RAID1, 4, 5, 6, 10 or multipath arrays, as only these have interesting state. RAID0 or Linear never have missing, spare, or failed drives, so there is nothing to monitor.

**Grow**

Grow (or shrink) an array, or otherwise reshape it in some way. Currently supported growth options including changing the active size of component devices and changing the number of active devices in Linear and RAID levels 0/1/4/5/6, changing the RAID level between 0, 1, 5, and 6, and between 0 and 10, changing the chunk size and layout for RAID 0,4,5,6, as well as adding or removing a write-intent bitmap.

**Incremental Assembly**

Add a single device to an appropriate array. If the addition of the device makes the array runnable, the array will be started. This provides a convenient interface to a hot-plug system. As each device is detected, mdadm has a chance to include it in some array as appropriate. Optionally, when the --fail flag is passed in we will remove the device from any active array instead of adding it.

If a CONTAINER is passed to mdadm in this mode, then any arrays within that container will be assembled and started.

**Manage**

This is for doing things to specific components of an array such as adding new spares and removing faulty devices.

**Misc**

This is an 'everything else' mode that supports operations on active arrays, operations on component devices such as erasing old superblocks, and information gathering operations.

**Auto-detect**

This mode does not act on a specific device or array, but rather it requests the Linux Kernel to activate any auto-detected arrays.

**FILES**

**/proc/mdstat**

If you're using the /proc filesystem, /proc/mdstat lists all active md devices with information about them. mdadm uses this to find arrays when --scan is given in Misc mode, and to monitor array reconstruction on Monitor mode.

**/etc/mdadm.conf**

The config file lists which devices may be scanned to see if they contain MD super block, and gives identifying information (e.g. UUID) about known MD arrays. See mdadm.conf(5) for more details.

**/dev/md/md-device-map**

When --incremental mode is used, this file gets a list of arrays currently being created.

**mdadm --query /dev/name-of-device**

This will find out if a given device is a RAID array, or is part of one, and will provide brief information about the device.

**mdadm --assemble --scan**

This will assemble and start all arrays listed in the standard config file. This command will typically go in a system startup file.

**mdadm --stop --scan**

This will shut down all arrays that can be shut down (i.e. are not currently in use). This will typically go in a system shutdown script.

**mdadm --follow --scan --delay=120**

If (and only if) there is an Email address or program given in the standard config file, then monitor the status of all arrays listed in that file by polling them ever 2 minutes.

**mdadm --create /dev/md0 --level=1 --raid-devices=2 /dev/hd[ac]1**

Create /dev/md0 as a RAID1 array consisting of /dev/hda1 and /dev/hdc1.

**echo 'DEVICE /dev/hd\*[0-9] /dev/sd\*[0-9]' > mdadm.conf****mdadm --detail --scan >> mdadm.conf**

This will create a prototype config file that describes currently active arrays that are known to be made from partitions of IDE or SCSI drives. This file should be reviewed before being used as it may contain unwanted detail.

**mdadm --create --help**

Provide help about the Create mode.

**mdadm --config --help**

Provide help about the format of the config file.

**mdadm --help**

Provide general help.

**mdadm.conf****Exemple-1**

```
[root@d01 m11]# mdadm --create /dev/md/backup --level=1 --raid-devices=2
/dev/loop0 /dev/loop1 --spare-devices=1 /dev/loop2
```

```
[root@d01 m11]# tree /dev/disk
```

```
/dev/disk
├── by-id
│   ├── ata-ST500DM002-1BD142_Z3TRHNRQ -> ../../sda
│   ├── ata-ST500DM002-1BD142_Z3TRHNRQ-part1 -> ../../sda1
│   ├── ata-ST500DM002-1BD142_Z3TRHNRQ-part5 -> ../../sda5
│   ├── ata-ST500DM002-1BD142_Z3TRHNRQ-part6 -> ../../sda6
│   ├── md-name-d01:backup -> ../../md127
│   ├── md-uuid-0606855a:bc05cd6d:e507c9da:466e46cb -> ../../md127
│   ├── wwn-0x5000c50064eb697f -> ../../sda
│   ├── wwn-0x5000c50064eb697f-part1 -> ../../sda1
│   ├── wwn-0x5000c50064eb697f-part5 -> ../../sda5
│   └── wwn-0x5000c50064eb697f-part6 -> ../../sda6
├── by-label
│   └── FEDORA24 -> ../../sda5
├── by-path
│   ├── pci-0000:00:1f.2-ata-1 -> ../../sda
│   ├── pci-0000:00:1f.2-ata-1-part1 -> ../../sda1
│   ├── pci-0000:00:1f.2-ata-1-part5 -> ../../sda5
│   └── pci-0000:00:1f.2-ata-1-part6 -> ../../sda6
└── by-uuid
    ├── 83339907-96a2-4d63-88ef-41bd4b1d13b1 -> ../../md127
    ├── b09b643e-5709-4a97-b79b-eba736188534 -> ../../sda6
    └── dd3d92dd-8b09-443b-b320-002a8aaa5175 -> ../../sda5
```

```
[root@d01 m11]# cat /proc/mdstat
```

```
Personalities : [raid1]
md127 : active raid1 loop2[2] loop0[3](S) loop1[1]
      204608 blocks super 1.2 [2/2] [UU]
unused devices: <none>
```

```
[root@d01 m11]# mdadm --examine --scan > /etc/mdadm.conf
```

```
[root@d01 m11]# cat /etc/mdadm.conf
```

```
ARRAY /dev/md/backup metadata=1.2 UUID=0606855a:bc05cd6d:e507c9da:466e46cb
name=d01:backup
spares=1
```

```
[root@d01 m11]# mdadm --stop /dev/md/backup
```

```
mdadm: stopped /dev/md/backup
```

```
[root@d01 m11]# mdadm --assemble /dev/md/backup
mdadm: /dev/md/backup has been started with 2 drives and 1 spare.

[root@d01 m11]# cat /proc/mdstat
Personalities : [raid1]
md127 : active raid1 loop2[2] loop0[3](S) loop1[1]
      204608 blocks super 1.2 [2/2] [UU]
unused devices: <none>
```

## Exemple-2

```
[root@d01 m11]# mdadm --create /dev/md/backup --level=1 --raid-devices=2
/dev/loop0 /dev/loop1 --spare-devices=1 /dev/loop2

[root@d01 ~]# cat /proc/mdstat
Personalities : [raid1]
md127 : active raid1 sda7[0] sda8[1] sda9[2](S)
      1047552 blocks super 1.2 [2/2] [UU]
unused devices: <none>

[root@d01 ~]# mdadm --detail /dev/md/liveone
/dev/md/liveone:
  Version : 1.2
  Creation Time : Tue Feb 14 13:48:16 2017
  Raid Level : raid1
  Array Size : 1047552 (1023.00 MiB 1072.69 MB)
  Used Dev Size : 1047552 (1023.00 MiB 1072.69 MB)
  Raid Devices : 2
  Total Devices : 3
  Persistence : Superblock is persistent

  Update Time : Tue Feb 14 13:48:43 2017
  State : clean
  Active Devices : 2
  Working Devices : 3
  Failed Devices : 0
  Spare Devices : 1

  Name : d01:liveone (local to host d01)
  UUID : d4e0178e:0a3e86d5:f1862966:1df82ae5
  Events : 17

  Number Major Minor RaidDevice State
    0      8      7      0      active sync  /dev/sda7
    1      8      8      1      active sync  /dev/sda8
    2      8      9      -      spare   /dev/sda9
```

```
[root@d01 ~]# tree /dev/disk/
/dev/disk/
├── by-id
│   ├── ata-ST500DM002-1BD142_Z3TRHNRQ -> ../../sda
│   ├── ata-ST500DM002-1BD142_Z3TRHNRQ-part1 -> ../../sda1
│   ├── ata-ST500DM002-1BD142_Z3TRHNRQ-part5 -> ../../sda5
│   ├── ata-ST500DM002-1BD142_Z3TRHNRQ-part6 -> ../../sda6
│   ├── ata-ST500DM002-1BD142_Z3TRHNRQ-part7 -> ../../sda7
│   ├── ata-ST500DM002-1BD142_Z3TRHNRQ-part8 -> ../../sda8
│   ├── ata-ST500DM002-1BD142_Z3TRHNRQ-part9 -> ../../sda9
│   ├── md-name-d01:backup -> ../../md126
│   ├── md-name-d01:liveone -> ../../md127
│   ├── md-uuid-0606855a:bc05cd6d:e507c9da:466e46cb -> ../../md126
│   └── md-uuid-d4e0178e:0a3e86d5:f1862966:1df82ae5 -> ../../md127
└── ...
```

```
[root@d01 ~]# mdadm --examine --scan
ARRAY /dev/md/liveone metadata=1.2 UUID=d4e0178e:0a3e86d5:f1862966:1df82ae5
name=d01:liveone
spares=1
ARRAY /dev/md/backup metadata=1.2 UUID=0606855a:bc05cd6d:e507c9da:466e46cb
name=d01:backup
spares=1
```

```
[root@d01 ~]# mdadm --examine --scan > /etc/mdadm.conf
```

```
root@d01 ~]# mdadm --stop /dev/md/backup
mdadm: stopped /dev/md/backup
```

```
[root@d01 ~]# mdadm --stop /dev/md/liveone
mdadm: stopped /dev/md/liveone
```

```
[root@d01 ~]# mdadm --assemble --scan
mdadm: /dev/md/liveone has been started with 2 drives and 1 spare.
mdadm: /dev/md/backup has been started with 2 drives and 1 spare.
```

```
[root@d01 ~]# mdadm --stop --scan
```

```
[root@d01 ~]# mdadm --assemble /dev/md/backup
mdadm: /dev/md/backup has been started with 2 drives and 1 spare.
```

```
[root@d01 ~]# mdadm --assemble /dev/md/liveone
mdadm: /dev/md/liveone has been started with 2 drives and 1 spare.
```

# Underconstruction

---

```
# dd if=/dev/zero of=disk0.img bs=1k count=200k
# losetup /dev/loop0 disk0.img
# hexdump -C /dev/loop0
00000000 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 |.....|
*
0c800000

# losetup
NAME          SIZE LIMIT OFFSET AUTO CLEAR RO BACK-FILE
/dev/loop0    0      0      0 0 /var/tmp/m11/disk0.img
/dev/loop1    0      0      0 0 /var/tmp/m11/disk1.img
/dev/loop2    0      0      0 0 /var/tmp/m11/disk2.img
/dev/loop3    0      0      0 0 /var/tmp/m11/disk3.img

# cat /proc/partitions
major minor #blocks name

8      0 97685784 sda
8      1 1951866 sda1
8      2 57504667 sda2
8      3 1 sda3
8      5 20482843 sda5
8      6 2048256 sda6
8      7 15695473 sda7
11     0 1048575 sr0
7      0 204800 loop0
7      1 204800 loop1
7      2 204800 loop2
7      3 204800 loop3

# -----
# raid1 3 discs imatge + 1 spare
# -----
# mdadm /dev/md/rdades --create --level=1 --raid-devices=3 /dev/loop0 /dev/loop1
/dev/loop2 --spare-devices=1 /dev/loop3
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/md/rdades started.

```
# cat /proc/mdstat
```

Personalities : [raid1]

md127 : active raid1 loop3[3](S) loop2[2] loop1[1] loop0[0]

204608 blocks super 1.2 [3/3] [UUU]

[=====>....] resync = 81.2% (166400/204608) finish=0.1min

speed=4019K/sec

unused devices: <none>

```
# mdadm --examine --scan
```

ARRAY /dev/md/rdades metadata=1.2 UUID=dce2873d:efd12e5d:bfd2b954:d08b747a

name=localhost.localdomain:rdades

spares=1

```
# mdadm --examine --scan > /etc/mdadm.conf
```

```
# ll /dev/md*
```

brw-rw---- 1 root disk 9, 127 Feb 15 16:31 /dev/md127

/dev/md:

total 0

lrwxrwxrwx 1 root root 8 Feb 15 16:31 rdades -> ../md127

```
/dev/disk
```

```
|— by-id
```

```
| |— ata-FUJITSU_MHV2100AT_PL_NSA3T6329W69 -> ../sda
```

```
.....
```

```
| |— md-name=localhost.localdomain:rdades -> ../md127
```

```
| |— md-uuid=dce2873d:efd12e5d:bfd2b954:d08b747a -> ../md127
```

```
# -----
```

```
# mdadm --query /dev/loop0
```

/dev/loop0: is not an md array

/dev/loop0: device 0 in 3 device active raid1 /dev/md/rdades. Use mdadm --examine for more detail.

```
# mdadm --examine /dev/loop0
```

/dev/loop0:

Magic : a92b4efc

Version : 1.2

Feature Map : 0x0

Array UUID : dce2873d:efd12e5d:bfd2b954:d08b747a

Name : localhost.localdomain:rdades (local to host localhost.localdomain)

Creation Time : Wed Feb 15 16:31:27 2017

```

    Raid Level : raid1
    Raid Devices : 3
    Avail Dev Size : 409312 (199.89 MiB 209.57 MB)
    Array Size : 204608 (199.85 MiB 209.52 MB)
    Used Dev Size : 409216 (199.85 MiB 209.52 MB)
    Data Offset : 288 sectors
    Super Offset : 8 sectors
    Unused Space : before=200 sectors, after=96 sectors
    State : clean
    Device UUID : 2999fd5a:d2ab50c9:c7852462:7fd2a8ac
    Update Time : Wed Feb 15 16:32:20 2017
    Bad Block Log : 512 entries available at offset 72 sectors
    Checksum : e12fdb89 - correct
    Events : 17
    Device Role : Active device 0
    Array State : AAA ('A' == active, '.' == missing, 'R' == replacing)
# mdadm --examine /dev/md/rdades
mdadm: No md superblock detected on /dev/md/rdades.

```

```

# mdadm --detail /dev/md/rdades
/dev/md/rdades:
    Version : 1.2
    Creation Time : Wed Feb 15 16:31:27 2017
    Raid Level : raid1
    Array Size : 204608 (199.85 MiB 209.52 MB)
    Used Dev Size : 204608 (199.85 MiB 209.52 MB)
    Raid Devices : 3
    Total Devices : 4
    Persistence : Superblock is persistent
    Update Time : Wed Feb 15 16:32:20 2017
    State : clean
    Active Devices : 3
    Working Devices : 4
    Failed Devices : 0
    Spare Devices : 1

    Name : localhost.localdomain:rdades (local to host localhost.localdomain)
    UUID : dce2873d:efd12e5d:bfd2b954:d08b747a
    Events : 17
    Number Major Minor RaidDevice State
    0       7       0       0       active sync /dev/loop0
    1       7       1       1       active sync /dev/loop1
    2       7       2       2       active sync /dev/loop2
    3       7       3       -       spare   /dev/loop3

```

```

# hexdump -C /dev/loop0
00000000 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 |.....|

```



\*

```
00001000 fc 4e 2b a9 01 00 00 00 00 00 00 00 00 00 00 00 |.N+.....|
00001010 dc e2 87 3d ef d1 2e 5d bf d2 b9 54 d0 8b 74 7a |...=...]...T..tz|
00001020 6c 6f 63 61 6c 68 6f 73 74 2e 6c 6f 63 61 6c 64 |localhost.locald|
00001030 6f 6d 61 69 6e 3a 72 64 61 64 65 73 00 00 00 00 |omain:rdades....|
00001040 4f 74 a4 58 00 00 00 00 01 00 00 00 00 00 00 00 |Ot.X.....|
00001050 80 3e 06 00 00 00 00 00 00 00 00 00 03 00 00 00 |.>.....|
00001060 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 |.....|
```

\*

```
# hexdump -C /dev/md/rdades
```

```
00000000 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 |.....|
```

\*

```
0c7d0000
```

```
# file /dev/md/rdades
```

```
/dev/md/rdades: symbolic link to `../md127'
```

```
# file /dev/md127
```

```
/dev/md127: block special (9/127)
```

```
# file /dev/loop0
```

```
/dev/loop0: block special (7/0)
```

```
# hexdump -C -n $((1*16*16*16+6*16)) /dev/loop0
```

```
00000000 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 |.....|
```

\*

```
00001000 fc 4e 2b a9 01 00 00 00 00 00 00 00 00 00 00 00 |.N+.....|
00001010 dc e2 87 3d ef d1 2e 5d bf d2 b9 54 d0 8b 74 7a |...=...]...T..tz|
00001020 6c 6f 63 61 6c 68 6f 73 74 2e 6c 6f 63 61 6c 64 |localhost.locald|
00001030 6f 6d 61 69 6e 3a 72 64 61 64 65 73 00 00 00 00 |omain:rdades....|
00001040 4f 74 a4 58 00 00 00 00 01 00 00 00 00 00 00 00 |Ot.X.....|
00001050 80 3e 06 00 00 00 00 00 00 00 00 00 03 00 00 00 |.>.....|
00001060
```

```
# -----
```

```
# mkfs, mount, posar dades
```

```
# -----
```

```
# mkfs -t ext4 /dev/md/rdades
```

```
mke2fs 1.42.12 (29-Aug-2014)
```

```
Discarding device blocks: done
```

```
Creating filesystem with 204608 1k blocks and 51200 inodes
```

```
Filesystem UUID: 7338b8bf-13f6-411d-abd0-ab28e885a9c3
```

```
Superblock backups stored on blocks:
```

```
8193, 24577, 40961, 57345, 73729
```

```
Allocating group tables: done
```

```
Writing inode tables: done
```

Creating journal (4096 blocks): done

Writing superblocks and filesystem accounting information: done

```
[root@localhost ~]# dumpe2fs -h /dev/md/rdades
dumpe2fs 1.42.12 (29-Aug-2014)
Filesystem volume name: <none>
Last mounted on: /mnt
Filesystem UUID: 7338b8bf-13f6-411d-abd0-ab28e885a9c3
Filesystem magic number: 0xEF53
Filesystem revision #: 1 (dynamic)
Filesystem features: has_journal ext_attr resize_inode dir_index filetype needs_recovery
extent flex_bg sparse_super huge_file uninit_bg dir_nlink extra_isize
Filesystem flags: signed_directory_hash
Default mount options: user_xattr acl
Filesystem state: clean
Errors behavior: Continue
Filesystem OS type: Linux
Inode count: 51200
Block count: 204608
Reserved block count: 10230
Free blocks: 192499
Free inodes: 51189
First block: 1
Block size: 1024
Fragment size: 1024
Reserved GDT blocks: 256
Blocks per group: 8192
Fragments per group: 8192
Inodes per group: 2048
Inode blocks per group: 256
Flex block group size: 16
Filesystem created: Wed Feb 15 16:49:37 2017
Last mount time: Wed Feb 15 16:50:03 2017
Last write time: Wed Feb 15 16:50:03 2017
Mount count: 1
Maximum mount count: -1
Last checked: Wed Feb 15 16:49:37 2017
Check interval: 0 (<none>)
Lifetime writes: 4444 kB
Reserved blocks uid: 0 (user root)
Reserved blocks gid: 0 (group root)
First inode: 11
Inode size: 128
Journal inode: 8
Default directory hash: half_md4
Directory Hash Seed: 4afaada9-74fe-4651-a9bb-f587468c2162
```

Journal backup: inode blocks  
Journal features: (none)  
Journal size: 4096k  
Journal length: 4096  
Journal sequence: 0x00000002  
Journal start: 1

```
[root@localhost ~]# dumpe2fs /dev/md/rdades
dumpe2fs 1.42.12 (29-Aug-2014)
Filesystem volume name: <none>
Last mounted on: /mnt
Filesystem UUID: 7338b8bf-13f6-411d-abd0-ab28e885a9c3
Filesystem magic number: 0xEF53
Filesystem revision #: 1 (dynamic)
Filesystem features: has_journal ext_attr resize_inode dir_index filetype needs_recovery
extent_flex_bg sparse_super huge_file uninit_bg dir_nlink extra_isize
Filesystem flags: signed_directory_hash
Default mount options: user_xattr acl
Filesystem state: clean
Errors behavior: Continue
Filesystem OS type: Linux
Inode count: 51200
Block count: 204608
Reserved block count: 10230
Free blocks: 192499
Free inodes: 51189
First block: 1
Block size: 1024
Fragment size: 1024
Reserved GDT blocks: 256
Blocks per group: 8192
Fragments per group: 8192
Inodes per group: 2048
Inode blocks per group: 256
Flex block group size: 16
Filesystem created: Wed Feb 15 16:49:37 2017
Last mount time: Wed Feb 15 16:50:03 2017
Last write time: Wed Feb 15 16:50:03 2017
Mount count: 1
Maximum mount count: -1
Last checked: Wed Feb 15 16:49:37 2017
Check interval: 0 (<none>)
Lifetime writes: 4444 kB
Reserved blocks uid: 0 (user root)
Reserved blocks gid: 0 (group root)
First inode: 11
```

```

Inode size:          128
Journal inode:       8
Default directory hash:  half_md4
Directory Hash Seed:  4afaada9-74fe-4651-a9bb-f587468c2162
Journal backup:      inode blocks
Journal features:    (none)
Journal size:        4096k
Journal length:      4096
Journal sequence:    0x00000002
Journal start:       1

```

#### Group 0: (Blocks 1-8192) [ITABLE\_ZEROED]

```

Checksum 0xe34c, unused inodes 1702
Primary superblock at 1, Group descriptors at 2-2
Reserved GDT blocks at 3-258
Block bitmap at 259 (+258), Inode bitmap at 275 (+274)
Inode table at 291-546 (+290)
3777 free blocks, 1702 free inodes, 9 directories, 1702 unused inodes
Free blocks: 4416-8192
Free inodes: 347-2048

```

#### Group 1: (Blocks 8193-16384) [INODE\_UNINIT, ITABLE\_ZEROED]

```

Checksum 0x61e6, unused inodes 2048
Backup superblock at 8193, Group descriptors at 8194-8194
Reserved GDT blocks at 8195-8450
Block bitmap at 260 (bg #0 + 259), Inode bitmap at 276 (bg #0 + 275)
Inode table at 547-802 (bg #0 + 546)
0 free blocks, 2048 free inodes, 0 directories, 2048 unused inodes
Free blocks:
Free inodes: 2049-4096

```

#### Group 2: (Blocks 16385-24576) [INODE\_UNINIT, ITABLE\_ZEROED]

```

Checksum 0x680f, unused inodes 2048
Block bitmap at 261 (bg #0 + 260), Inode bitmap at 277 (bg #0 + 276)
Inode table at 803-1058 (bg #0 + 802)
0 free blocks, 2048 free inodes, 0 directories, 2048 unused inodes
Free blocks:
Free inodes: 4097-6144

```

```

# mount /dev/md/rdades /mnt/
# cp -r /boot /mnt

```

```
# df -h /mnt
```

```

Filesystem    Size  Used Avail Use% Mounted on
/dev/md127    190M  135M   42M   77% /mnt

```

```
# -----
```

```
# de 3+1 de raid1 passar a només 2
# --fail --remove de dos discs i grow
# -----
# mdadm /dev/md/rdades --fail /dev/loop3
mdadm: set /dev/loop3 faulty in /dev/md/rdades
# mdadm /dev/md/rdades --fail /dev/loop2
mdadm: set /dev/loop2 faulty in /dev/md/rdades

# mdadm /dev/md/rdades --remove /dev/loop3
mdadm: hot removed /dev/loop3 from /dev/md/rdades
# mdadm /dev/md/rdades --remove /dev/loop2
mdadm: hot removed /dev/loop2 from /dev/md/rdades

# cat /proc/mdstat
Personalities : [raid1]
md127 : active raid1 loop1[1] loop0[0]
      204608 blocks super 1.2 [3/2] [UU_]
unused devices: <none>

# mdadm --detail /dev/md/rdades
/dev/md/rdades:
    Version : 1.2
    Creation Time : Wed Feb 15 16:31:27 2017
    Raid Level : raid1
    Array Size : 204608 (199.85 MiB 209.52 MB)
    Used Dev Size : 204608 (199.85 MiB 209.52 MB)
    Raid Devices : 3
    Total Devices : 2
    Persistence : Superblock is persistent
    Update Time : Wed Feb 15 17:00:36 2017
    State : clean, degraded
Active Devices : 2
Working Devices : 2
Failed Devices : 0
Spare Devices : 0
    Name : localhost.localdomain:rdades (local to host localhost.localdomain)
    UUID : dce2873d:efd12e5d:bfd2b954:d08b747a
    Events : 33
    Number Major Minor RaidDevice State
    0       7       0       0     active sync  /dev/loop0
    1       7       1       1     active sync  /dev/loop1
    4       0       0       4     removed

# mdadm --grow /dev/md/rdades --raid-devices=2
raid_disks for /dev/md/rdades set to 2
unfreeze
```

```
# cat /proc/mdstat
Personalities : [raid1]
md127 : active raid1 loop1[1] loop0[0]
      204608 blocks super 1.2 [2/2] [UU]
unused devices: <none>

# mdadm --detail /dev/md/rdades
/dev/md/rdades:
  Version : 1.2
  Creation Time : Wed Feb 15 16:31:27 2017
  Raid Level : raid1
  Array Size : 204608 (199.85 MiB 209.52 MB)
  Used Dev Size : 204608 (199.85 MiB 209.52 MB)
  Raid Devices : 2
  Total Devices : 2
  Persistence : Superblock is persistent
  Update Time : Wed Feb 15 17:02:30 2017
  State : clean
  Active Devices : 2
  Working Devices : 2
  Failed Devices : 0
  Spare Devices : 0
    Name : localhost.localdomain:rdades (local to host localhost.localdomain)
    UUID : dce2873d:efd12e5d:bfd2b954:d08b747a
    Events : 36
  Number Major Minor RaidDevice State
    0       7      0      0     active sync  /dev/loop0
    1       7      1      1     active sync  /dev/loop1

# scan encara troba les altres particions eliminades
# mdadm --examine --scan
ARRAY /dev/md/rdades metadata=1.2 UUID=dce2873d:efd12e5d:bfd2b954:d08b747a
name=localhost.localdomain:rdades
ARRAY /dev/md/rdades metadata=1.2 UUID=dce2873d:efd12e5d:bfd2b954:d08b747a
name=localhost.localdomain:rdades
  spares=1

# -----
# parar i arrabcar de nou, com serà? de 4 o de 2?
# -----
# mdadm --stop /dev/md/rdades
mdadm: Cannot get exclusive access to /dev/md/rdades:Perhaps a running process,
mounted filesystem or active volume group?

# umount /mnt
```

```
# mdadm --stop /dev/md/rdades
mdadm: stopped /dev/md/rdades
# cat /proc/mdstat
Personalities : [raid1]
unused devices: <none>

# mdadm --assemble --scan
mdadm: superblock on /dev/loop1 doesn't match others - assembly aborted
# mdadm --assemble /dev/md/rdades
mdadm: superblock on /dev/loop1 doesn't match others - assembly aborted

# cat /etc/mdadm.conf
ARRAY /dev/md/rdades metadata=1.2 UUID=dce2873d:efd12e5d:bfd2b954:d08b747a
name=localhost.localdomain:rdades
    spares=1

# mv /etc/mdadm.conf /etc/mdadm.conf.01

# mdadm --assemble /dev/md/rdades
mdadm: /dev/md/rdades not identified in config file.

# mdadm --assemble --scan
mdadm: device 6 in /dev/md/rdades has wrong state in superblock, but /dev/loop3 seems ok
mdadm: /dev/md/rdades has been started with 1 drive (out of 3) and 1 spare.
mdadm: Found some drive for an array that is already active: /dev/md/rdades
mdadm: giving up.
mdadm: Found some drive for an array that is already active: /dev/md/rdades
mdadm: giving up.

# cat /proc/mdstat
Personalities : [raid1]
md127 : active raid1 loop2[2] loop3[3]
        204608 blocks super 1.2 [3/2] [U_U]
unused devices: <none>

# mdadm --stop --scan

# mdadm --assemble /dev/md/rdades /dev/loop0 /dev/loop1
mdadm: /dev/md/rdades has been started with 2 drives.

# cat /proc/mdstat
Personalities : [raid1]
md127 : active raid1 loop0[0] loop1[1]
        204608 blocks super 1.2 [2/2] [UU]
unused devices: <none>
```

```
# mdadm --examine --scan
ARRAY /dev/md/rdades metadata=1.2 UUID=dce2873d:efd12e5d:bfd2b954:d08b747a
name=localhost.localdomain:rdades
ARRAY /dev/md/rdades metadata=1.2 UUID=dce2873d:efd12e5d:bfd2b954:d08b747a
name=localhost.localdomain:rdades
```

```
# mdadm --query /dev/md/rdades
/dev/md/rdades: 199.85MiB raid1 2 devices, 0 spares. Use mdadm --detail for more detail.
```

```
# mdadm --detail /dev/md/rdades
/dev/md/rdades:
    Version : 1.2
    Creation Time : Wed Feb 15 16:31:27 2017
    Raid Level : raid1
    Array Size : 204608 (199.85 MiB 209.52 MB)
    Used Dev Size : 204608 (199.85 MiB 209.52 MB)
    Raid Devices : 2
    Total Devices : 2
    Persistence : Superblock is persistent
    Update Time : Wed Feb 15 17:10:53 2017
    State : clean
    Active Devices : 2
    Working Devices : 2
    Failed Devices : 0
    Spare Devices : 0

    Name : localhost.localdomain:rdades (local to host localhost.localdomain)
    UUID : dce2873d:efd12e5d:bfd2b954:d08b747a
    Events : 36
    Number Major Minor RaidDevice State
    0       7       0       0     active sync  /dev/loop0
    1       7       1       1     active sync  /dev/loop1
```

```
# mount /dev/md/rdades /mnt
# ll /mnt/
total 13
dr-xr-xr-x 3 root root 1024 Feb 15 16:50 boot
drwx----- 2 root root 12288 Feb 15 16:49 lost+found
```

```
# df -h /mnt
Filesystem      Size  Used Avail Use% Mounted on
/dev/md127      190M  135M   42M   77% /mnt
```

```
# -----
# rdades passar-lo a discs més grans
# -----
```



```
# dd if=/dev/zero of=disk04.img bs=1k count=500k
512000+0 records in
512000+0 records out
524288000 bytes (524 MB) copied, 27.0501 s, 19.4 MB/s
```

```
# dd if=/dev/zero of=disk05.img bs=1k count=500k
512000+0 records in
512000+0 records out
524288000 bytes (524 MB) copied, 35.8199 s, 14.6 MB/s
```

```
# losetup /dev/loop4 disk04.img
# losetup /dev/loop5 disk05.img
```

```
# mdadm /dev/md/rdades --add /dev/loop4
mdadm: added /dev/loop4
```

```
# mdadm /dev/md/rdades --add /dev/loop5
mdadm: added /dev/loop5
```

```
# cat /proc/mdstat
Personalities : [raid1]
md127 : active raid1 loop5[3](S) loop4[2](S) loop0[0] loop1[1]
      204608 blocks super 1.2 [2/2] [UU]
unused devices: <none>
```

```
# mdadm --detail /dev/md/rdades
/dev/md/rdades:
  Version : 1.2
  Creation Time : Wed Feb 15 16:31:27 2017
  Raid Level : raid1
  Array Size : 204608 (199.85 MiB 209.52 MB)
  Used Dev Size : 204608 (199.85 MiB 209.52 MB)
  Raid Devices : 2
  Total Devices : 4
  Persistence : Superblock is persistent
  Update Time : Wed Feb 15 17:24:23 2017
  State : clean
  Active Devices : 2
  Working Devices : 4
  Failed Devices : 0
  Spare Devices : 2
    Name : localhost.localdomain:rdades (local to host localhost.localdomain)
    UUID : dce2873d:efd12e5d:bfd2b954:d08b747a
    Events : 42
    Number Major Minor RaidDevice State
      0       7      0      0     active sync  /dev/loop0
```

1	7	1	1	active sync	/dev/loop1
2	7	4	-	spare	/dev/loop4
3	7	5	-	spare	/dev/loop5

```
# mdadm /dev/md/rdades --fail /dev/loop0
mdadm: set /dev/loop0 faulty in /dev/md/rdades
```

```
# cat /proc/mdstat
Personalities : [raid1]
md127 : active raid1 loop5[3] loop4[2](S) loop0[0](F) loop1[1]
      204608 blocks super 1.2 [2/1] [_U]
      [==>.....] recovery = 12.0% (24896/204608) finish=0.3min speed=8298K/sec
```

```
unused devices: <none>
```

```
# cat /proc/mdstat
Personalities : [raid1]
md127 : active raid1 loop5[3] loop4[2](S) loop0[0](F) loop1[1]
      204608 blocks super 1.2 [2/1] [_U]
      [======>.....] recovery = 62.5% (128000/204608) finish=0.2min
speed=5818K/sec
unused devices: <none>
```

```
# cat /proc/mdstat
Personalities : [raid1]
md127 : active raid1 loop5[3] loop4[2](S) loop0[0](F) loop1[1]
      204608 blocks super 1.2 [2/2] [UU]
unused devices: <none>
```

```
# mdadm --detail /dev/md/rdades
/dev/md/rdades:
  Version : 1.2
  Creation Time : Wed Feb 15 16:31:27 2017
  Raid Level : raid1
  Array Size : 204608 (199.85 MiB 209.52 MB)
  Used Dev Size : 204608 (199.85 MiB 209.52 MB)
  Raid Devices : 2
  Total Devices : 4
  Persistence : Superblock is persistent
  Update Time : Wed Feb 15 17:26:27 2017
  State : clean
  Active Devices : 2
  Working Devices : 3
  Failed Devices : 1
  Spare Devices : 1
  Name : localhost.localdomain:rdades (local to host localhost.localdomain)
```

UUID : dce2873d:efd12e5d:bfd2b954:d08b747a

Events : 63

Number	Major	Minor	RaidDevice	State
3	7	5	0	active sync /dev/loop5
1	7	1	1	active sync /dev/loop1
0	7	0	-	faulty /dev/loop0
2	7	4	-	spare /dev/loop4

```
# mdadm /dev/md/rdades --fail /dev/loop1
```

```
mdadm: set /dev/loop1 faulty in /dev/md/rdades
```

```
# cat /proc/mdstat
```

```
Personalities : [raid1]
```

```
md127 : active raid1 loop5[3] loop4[2] loop0[0](F) loop1[1](F)
```

```
204608 blocks super 1.2 [2/1] [U_]
```

```
[==>.....] recovery = 12.5% (25600/204608) finish=0.2min
```

```
speed=12800K/sec
```

```
unused devices: <none>
```

```
# cat /proc/mdstat
```

```
Personalities : [raid1]
```

```
md127 : active raid1 loop5[3] loop4[2] loop0[0](F) loop1[1](F)
```

```
204608 blocks super 1.2 [2/2] [UU]
```

```
unused devices: <none>
```

```
# mdadm --detail /dev/md/rdades
```

```
/dev/md/rdades:
```

```
Version : 1.2
```

```
Creation Time : Wed Feb 15 16:31:27 2017
```

```
Raid Level : raid1
```

```
Array Size : 204608 (199.85 MiB 209.52 MB)
```

```
Used Dev Size : 204608 (199.85 MiB 209.52 MB)
```

```
Raid Devices : 2
```

```
Total Devices : 4
```

```
Persistence : Superblock is persistent
```

```
Update Time : Wed Feb 15 17:28:34 2017
```

```
State : clean
```

```
Active Devices : 2
```

```
Working Devices : 2
```

```
Failed Devices : 2
```

```
Spare Devices : 0
```

```
Name : localhost.localdomain:rdades (local to host localhost.localdomain)
```

```
UUID : dce2873d:efd12e5d:bfd2b954:d08b747a
```

```
Events : 84
```

Number	Major	Minor	RaidDevice	State
--------	-------	-------	------------	-------

3	7	5	0	active sync /dev/loop5
---	---	---	---	------------------------

2	7	4	1	active sync	/dev/loop4
0	7	0	-	faulty	/dev/loop0
1	7	1	-	faulty	/dev/loop1

```
# mdadm /dev/md/rdades --remove /dev/loop0
mdadm: hot removed /dev/loop0 from /dev/md/rdades
```

```
# mdadm /dev/md/rdades --remove /dev/loop1
mdadm: hot removed /dev/loop1 from /dev/md/rdades
```

```
# cat /proc/mdstat
Personalities : [raid1]
md127 : active raid1 loop5[3] loop4[2]
      204608 blocks super 1.2 [2/2] [UU]
unused devices: <none>
```

```
# mdadm --query /dev/md/rdades
/dev/md/rdades: 199.85MiB raid1 2 devices, 0 spares. Use mdadm --detail for more detail.
```

```
# mdadm --detail /dev/md/rdades
/dev/md/rdades:
  Version : 1.2
  Creation Time : Wed Feb 15 16:31:27 2017
  Raid Level : raid1
  Array Size : 204608 (199.85 MiB 209.52 MB)
  Used Dev Size : 204608 (199.85 MiB 209.52 MB)
  Raid Devices : 2
  Total Devices : 2
  Persistence : Superblock is persistent
  Update Time : Wed Feb 15 17:30:51 2017
  State : clean
  Active Devices : 2
  Working Devices : 2
  Failed Devices : 0
  Spare Devices : 0
    Name : localhost.localdomain:rdades (local to host localhost.localdomain)
    UUID : dce2873d:efd12e5d:bfd2b954:d08b747a
    Events : 86
  Number Major Minor RaidDevice State
    3      7      5      0      active sync /dev/loop5
    2      7      4      1      active sync /dev/loop4
```

```
# mdadm --grow /dev/md/rdades --size=400M
mdadm: component size of /dev/md/rdades has been set to 409600K
unfreeze
```

```
# mdadm --query /dev/md/rdades
/dev/md/rdades: 400.07MiB raid1 2 devices, 0 spares. Use mdadm --detail for more detail.
```

```
# mdadm --detail /dev/md/rdades
/dev/md/rdades:
    Version : 1.2
    Creation Time : Wed Feb 15 16:31:27 2017
    Raid Level : raid1
    Array Size : 409600 (400.07 MiB 419.43 MB)
    Used Dev Size : 409600 (400.07 MiB 419.43 MB)
    Raid Devices : 2
    Total Devices : 2
    Persistence : Superblock is persistent
    Update Time : Wed Feb 15 17:40:57 2017
    State : active, resyncing
    Active Devices : 2
    Working Devices : 2
    Failed Devices : 0
    Spare Devices : 0
    Resync Status : 71% complete
    Name : localhost.localdomain:rdades (local to host localhost.localdomain)
    UUID : dce2873d:efd12e5d:bfd2b954:d08b747a
    Events : 91
    Number Major Minor RaidDevice State
    3       7       5       0       active sync /dev/loop5
    2       7       4       1       active sync /dev/loop4
```

```
# cat /proc/mdstat
Personalities : [raid1]
md127 : active raid1 loop5[3] loop4[2]
    409600 blocks super 1.2 [2/2] [UU]
unused devices: <none>
```

```
# ll /mnt/
total 13
dr-xr-xr-x 3 root root 1024 Feb 15 16:50 boot
drwx----- 2 root root 12288 Feb 15 16:49 lost+found
```

```
# df -h /mnt/
Filesystem      Size  Used Avail Use% Mounted on
/dev/md127      190M  135M   42M   77% /mnt
```

```
# resize2fs /dev/md/rdades
resize2fs 1.42.12 (29-Aug-2014)
Filesystem at /dev/md/rdades is mounted on /mnt; on-line resizing required
old_desc_blocks = 1, new_desc_blocks = 2
```

The filesystem on /dev/md/rdades is now 409600 (1k) blocks long.

```
# df -h /mnt/
```

Filesystem	Size	Used	Avail	Use%	Mounted on
/dev/md127	384M	136M	227M	38%	/mnt

```
# -----
```

```
# mdadm --stop /dev/md/rdades
```

```
mdadm: Cannot get exclusive access to /dev/md/rdades:Perhaps a running process,  
mounted filesystem or active volume group?
```

```
# umount /mnt
```

```
# mdadm --stop /dev/md/rdades
```

```
mdadm: stopped /dev/md/rdades
```

```
# cat /proc/mdstat
```

```
Personalities : [raid1]
```

```
unused devices: <none>
```

```
# mdadm --examine --scan
```

```
ARRAY /dev/md/rdades metadata=1.2 UUID=dce2873d:efd12e5d:bfd2b954:d08b747a  
name=localhost.localdomain:rdades
```

```
ARRAY /dev/md/rdades metadata=1.2 UUID=dce2873d:efd12e5d:bfd2b954:d08b747a  
name=localhost.localdomain:rdades
```

```
ARRAY /dev/md/rdades metadata=1.2 UUID=dce2873d:efd12e5d:bfd2b954:d08b747a  
name=localhost.localdomain:rdades
```

```
# mdadm --assemble --scan
```

```
mdadm: /dev/md/rdades has been started with 2 drives.
```

```
mdadm: Found some drive for an array that is already active: /dev/md/rdades
```

```
mdadm: giving up.
```

```
mdadm: Found some drive for an array that is already active: /dev/md/rdades
```

```
mdadm: giving up.
```

```
mdadm: Found some drive for an array that is already active: /dev/md/rdades
```

```
mdadm: giving up.
```

```
mdadm: Found some drive for an array that is already active: /dev/md/rdades
```

```
mdadm: giving up.
```

```
# cat /proc/mdstat
```

```
Personalities : [raid1]
```

```
md127 : active raid1 loop5[3] loop4[2]
```

```
409600 blocks super 1.2 [2/2] [UU]
```

```
unused devices: <none>
```

```
# mdadm --stop --scan
```

```
# cat /proc/mdstat
```

```
Personalities : [raid1]
```

```
unused devices: <none>
```

```
# mdadm --assemble /dev/md/rdades /dev/loop4 /dev/loop5
```

```
mdadm: /dev/md/rdades has been started with 2 drives.
```

```
# cat /proc/mdstat
```

```
Personalities : [raid1]
```

```
md127 : active raid1 loop5[3] loop4[2]
```

```
409600 blocks super 1.2 [2/2] [UU]
```

```
unused devices: <none>
```

```
# mdadm --query /dev/md/rdades
```

```
/dev/md/rdades: 400.07MiB raid1 2 devices, 0 spares. Use mdadm --detail for more detail.
```

```
# -----
```

```
# modificar grow: afegir spare permanent,mirar slots
```

```
# -----
```

```
# dd if=/dev/zero of=disk06.img bs=1k count=500k
```

```
512000+0 records in
```

```
512000+0 records out
```

```
524288000 bytes (524 MB) copied, 27.0925 s, 19.4 MB/s
```

```
# losetup /dev/loop6 disk06.img
```

```
# mdadm /dev/md/rdades --add /dev/loop6
```

```
mdadm: added /dev/loop6
```

```
# cat /proc/mdstat
```

```
Personalities : [raid1]
```

```
md127 : active raid1 loop6[4](S) loop5[3] loop4[2]
```

```
409600 blocks super 1.2 [2/2] [UU]
```

```
unused devices: <none>
```

```
# mdadm --detail /dev/md/rdades
```

```
/dev/md/rdades:
```

```
Version : 1.2
```

```
Creation Time : Wed Feb 15 16:31:27 2017
```

```
Raid Level : raid1
```

```
Array Size : 409600 (400.07 MiB 419.43 MB)
```

```
Used Dev Size : 409600 (400.07 MiB 419.43 MB)
```

```
Raid Devices : 2
```

Total Devices : 3

Persistence : Superblock is persistent

Update Time : Wed Feb 15 17:52:45 2017

State : clean

Active Devices : 2

Working Devices : 3

Failed Devices : 0

Spare Devices : 1

Name : localhost.localdomain:rdades (local to host localhost.localdomain)

UUID : dce2873d:efd12e5d:bfd2b954:d08b747a

Events : 100

Number	Major	Minor	RaidDevice	State
3	7	5	0	active sync /dev/loop5
2	7	4	1	active sync /dev/loop4
4	7	6	-	spare /dev/loop6

```
# mdadm --examine --scan
```

```
ARRAY /dev/md/rdades metadata=1.2 UUID=dce2873d:efd12e5d:bfd2b954:d08b747a
name=localhost.localdomain:rdades
```

```
ARRAY /dev/md/rdades metadata=1.2 UUID=dce2873d:efd12e5d:bfd2b954:d08b747a
name=localhost.localdomain:rdades
```

```
ARRAY /dev/md/rdades metadata=1.2 UUID=dce2873d:efd12e5d:bfd2b954:d08b747a
name=localhost.localdomain:rdades
```

```
spares=1
```

```
# mdadm --examine --scan > /etc/mdadm.conf
```

```
# mdadm --stop /dev/md/rdades
```

```
mdadm: stopped /dev/md/rdades
```

```
# mdadm --assemble /dev/md/rdades
```

```
mdadm: superblock on /dev/loop3 doesn't match others - assembly aborted
```

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

```
# cat /etc/mdadm.conf
```

```
ARRAY /dev/md/rdades metadata=1.2 UUID=dce2873d:efd12e5d:bfd2b954:d08b747a
name=localhost.localdomain:rdades
```

```
spares=1
```

```
# mdadm --assemble /dev/md/rdades
```

```
mdadm: superblock on /dev/loop3 doesn't match others - assembly aborted
```

```
# mdadm --assemble /dev/md/rdades /dev/loop4 /dev/loop5 --spare-devices=1 /dev/loop6
```

```
mdadm: :option --spare-devices not valid in assemble mode
```

```
# mdadm --assemble /dev/md/rdades /dev/loop4 /dev/loop5
```



mdadm: /dev/md/rdades has been started with 2 drives.

```
# mdadm /dev/md/rdades --add /dev/loop6
```

mdadm: added /dev/loop6

```
# cat /proc/mdstat
```

Personalities : [raid1]

md127 : active raid1 loop6[4](S) loop5[3] loop4[2]

409600 blocks super 1.2 [2/2] [UU]

unused devices: <none>

```
# mdadm /dev/md/rdades --fail /dev/loop4
```

mdadm: set /dev/loop4 faulty in /dev/md/rdades

```
# cat /proc/mdstat
```

Personalities : [raid1]

md127 : active raid1 loop6[4] loop5[3] loop4[2](F)

409600 blocks super 1.2 [2/1] [U\_]

[>.....] recovery = 3.7% (15424/409600) finish=0.4min speed=15424K/sec

unused devices: <none>

```
# cat /proc/mdstat
```

Personalities : [raid1]

md127 : active raid1 loop6[4] loop5[3] loop4[2](F)

409600 blocks super 1.2 [2/2] [UU]

unused devices: <none>

```
# mdadm /dev/md/rdades --remove /dev/loop4
```

mdadm: hot removed /dev/loop4 from /dev/md/rdades

```
# cat /proc/mdstat
```

Personalities : [raid1]

md127 : active raid1 loop6[4] loop5[3]

409600 blocks super 1.2 [2/2] [UU]

unused devices: <none>

```
# mdadm /dev/md/rdades --add /dev/loop4
```

mdadm: added /dev/loop4

```
# cat /proc/mdstat
```

Personalities : [raid1]

md127 : active raid1 loop4[2](S) loop6[4] loop5[3]

409600 blocks super 1.2 [2/2] [UU]

unused devices: <none>

**\*\*** si afegim un disc conegut el posa al mateix slot, sino a un nou.

\*\*\* també e spot fer servir --readd

\*\*\* continua essent un raid de 2? 2+1?

# mdadm --detail /dev/md/rdades

/dev/md/rdades:

Version : 1.2

Creation Time : Wed Feb 15 16:31:27 2017

Raid Level : raid1

Array Size : 409600 (400.07 MiB 419.43 MB)

Used Dev Size : 409600 (400.07 MiB 419.43 MB)

Raid Devices : 2

Total Devices : 3

Persistence : Superblock is persistent

Update Time : Wed Feb 15 18:00:23 2017

State : clean

Active Devices : 2

Working Devices : 3

Failed Devices : 0

Spare Devices : 1

Name : localhost.localdomain:rdades (local to host localhost.localdomain)

UUID : dce2873d:efd12e5d:bfd2b954:d08b747a

Events : 123

Number	Major	Minor	RaidDevice	State
3	7	5	0	active sync /dev/loop5
4	7	6	1	active sync /dev/loop6
2	7	4	-	spare /dev/loop4

# mdadm --detail --scan

ARRAY /dev/md/rdades metadata=1.2 spares=1 name=localhost.localdomain:rdades

UUID=dce2873d:efd12e5d:bfd2b954:d08b747a

# mdadm --examine --scan

ARRAY /dev/md/rdades metadata=1.2 UUID=dce2873d:efd12e5d:bfd2b954:d08b747a

name=localhost.localdomain:rdades

ARRAY /dev/md/rdades metadata=1.2 UUID=dce2873d:efd12e5d:bfd2b954:d08b747a

name=localhost.localdomain:rdades

ARRAY /dev/md/rdades metadata=1.2 UUID=dce2873d:efd12e5d:bfd2b954:d08b747a

name=localhost.localdomain:rdades

spares=1

# -----

# eliminar les particions que no volem de raid

# -----

```
# mdadm --stop /dev/md/rdades
mdadm: stopped /dev/md/rdades

# mdadm --assemble /dev/md/rdades
mdadm: superblock on /dev/loop3 doesn't match others - assembly aborted

# mdadm -v --zero-superblock /dev/loop0
# mdadm -v --zero-superblock /dev/loop1
# mdadm -v --zero-superblock /dev/loop2
# mdadm -v --zero-superblock /dev/loop3

# file /dev/loop0
/dev/loop0: block special (7/0)

# mdadm --query /dev/loop0
/dev/loop0: is not an md array

# mdadm --query /dev/loop4
/dev/loop4: is not an md array
/dev/loop4: device 2 in 2 device inactive raid1 array. Use mdadm --examine for more detail.

# mdadm --examine --scan
ARRAY /dev/md/rdades metadata=1.2 UUID=dce2873d:efd12e5d:bfd2b954:d08b747a
name=localhost.localdomain:rdades
spares=1

# cat /proc/mdstat
Personalities : [raid1]
unused devices: <none>

# mdadm --assemble --scan
mdadm: /dev/md/rdades has been started with 2 drives and 1 spare.

# cat /proc/mdstat
Personalities : [raid1]
md127 : active raid1 loop5[3] loop4[2](S) loop6[4]
      409600 blocks super 1.2 [2/2] [UU]
unused devices: <none>

# mdadm --examine --scan > /etc/mdadm.conf

# mdadm --stop --scan

# mdadm --assemble /dev/md/rdades
mdadm: /dev/md/rdades has been started with 2 drives and 1 spare.
```

```
# cat /proc/mdstat
Personalities : [raid1]
md127 : active raid1 loop5[3] loop4[2](S) loop6[4]
      409600 blocks super 1.2 [2/2] [UU]
unused devices: <none>
```

```
# -----
# modificar --grow el level de un raid
# -----
```

```
# mdadm --grow /dev/md/rdades --level=5
mdadm: level of /dev/md/rdades changed to raid5
unfreeze
```

```
# cat /proc/mdstat
Personalities : [raid1] [raid6] [raid5] [raid4]
md127 : active raid5 loop5[3] loop4[2](S) loop6[4]
      409600 blocks super 1.2 level 5, 64k chunk, algorithm 2 [2/2] [UU]
unused devices: <none>
```

```
# mdadm --detail /dev/md/rdades
/dev/md/rdades:
  Version : 1.2
  Creation Time : Wed Feb 15 16:31:27 2017
  Raid Level : raid5
  Array Size : 409600 (400.07 MiB 419.43 MB)
  Used Dev Size : 409600 (400.07 MiB 419.43 MB)
  Raid Devices : 2
  Total Devices : 3
  Persistence : Superblock is persistent
  Update Time : Wed Feb 15 18:13:10 2017
  State : clean

Active Devices : 2
Working Devices : 3
Failed Devices : 0
Spare Devices : 1
  Layout : left-symmetric
  Chunk Size : 64K
  Name : localhost.localdomain:rdades (local to host localhost.localdomain)
  UUID : dce2873d:efd12e5d:bfd2b954:d08b747a
  Events : 124
  Number Major Minor RaidDevice State
    3      7      5      0    active sync  /dev/loop5
    4      7      6      1    active sync  /dev/loop6
    2      7      4      -    spare   /dev/loop4
```

```
# mdadm --grow /dev/md/rdades --level=1
mdadm: level of /dev/md/rdades changed to raid1
unfreeze
```

```
# cat /proc/mdstat
Personalities : [raid1] [raid6] [raid5] [raid4]
md127 : active raid1 loop5[3] loop4[2](S) loop6[4]
      409600 blocks super 1.2 [2/2] [UU]
unused devices: <none>
```

```
# mdadm --detail /dev/md/rdades
/dev/md/rdades:
  Version : 1.2
  Creation Time : Wed Feb 15 16:31:27 2017
  Raid Level : raid1
  Array Size : 409600 (400.07 MiB 419.43 MB)
  Used Dev Size : 409600 (400.07 MiB 419.43 MB)
  Raid Devices : 2
  Total Devices : 3
  Persistence : Superblock is persistent
  Update Time : Wed Feb 15 18:15:25 2017
  State : clean
Active Devices : 2
Working Devices : 3
Failed Devices : 0
Spare Devices : 1
  Name : localhost.localdomain:rdades (local to host localhost.localdomain)
  UUID : dce2873d:efd12e5d:bfd2b954:d08b747a
  Events : 125
  Number Major Minor RaidDevice State
    3       7       5       0     active sync  /dev/loop5
    4       7       6       1     active sync  /dev/loop6
    2       7       4       -     spare   /dev/loop4
```

```
# mdadm --grow /dev/md/rdades --raid-devices=3
raid_disks for /dev/md/rdades set to 3
unfreeze
```

```
# cat /proc/mdstat
Personalities : [raid1] [raid6] [raid5] [raid4]
md127 : active raid1 loop5[3] loop4[2] loop6[4]
      409600 blocks super 1.2 [3/2] [UU_]
      [=>.....] recovery = 6.2% (25664/409600) finish=0.7min speed=8554K/sec
```

```
unused devices: <none>
```

```
# cat /proc/mdstat
Personalities : [raid1] [raid6] [raid5] [raid4]
md127 : active raid1 loop5[3] loop4[2] loop6[4]
      409600 blocks super 1.2 [3/3] [UUU]
unused devices: <none>

# mdadm --detail /dev/md/rdades
/dev/md/rdades:
  Version : 1.2
  Creation Time : Wed Feb 15 16:31:27 2017
  Raid Level : raid1
  Array Size : 409600 (400.07 MiB 419.43 MB)
  Used Dev Size : 409600 (400.07 MiB 419.43 MB)
  Raid Devices : 3
  Total Devices : 3
  Persistence : Superblock is persistent
  Update Time : Wed Feb 15 18:18:08 2017
  State : clean
Active Devices : 3
Working Devices : 3
Failed Devices : 0
Spare Devices : 0
  Name : localhost.localdomain:rdades (local to host localhost.localdomain)
  UUID : dce2873d:efd12e5d:bfd2b954:d08b747a
  Events : 146
  Number Major Minor RaidDevice State
    3       7       5       0     active sync  /dev/loop5
    4       7       6       1     active sync  /dev/loop6
    2       7       4       2     active sync  /dev/loop4

# mdadm --grow /dev/md/rdades --level=5
mdadm: Impossibly level change request for RAID1
unfreeze

# mdadm /dev/md/rdades --fail /dev/loop6
mdadm: set /dev/loop6 faulty in /dev/md/rdades

# mdadm /dev/md/rdades --remove /dev/loop6
mdadm: hot removed /dev/loop6 from /dev/md/rdades

# mdadm --grow /dev/md/rdades --raid-devices=2
raid_disks for /dev/md/rdades set to 2
unfreeze

# cat /proc/mdstat
```

```
Personalities : [raid1] [raid6] [raid5] [raid4]
md127 : active raid1 loop5[3] loop4[2]
        409600 blocks super 1.2 [2/2] [UU]
unused devices: <none>
```

```
# mdadm --grow /dev/md/rdades --level=5
mdadm: level of /dev/md/rdades changed to raid5
unfreeze
```

```
# cat /proc/mdstat
Personalities : [raid1] [raid6] [raid5] [raid4]
md127 : active raid5 loop5[3] loop4[2]
        409600 blocks super 1.2 level 5, 64k chunk, algorithm 2 [2/2] [UU]
unused devices: <none>
```

```
# -----
# device driver
# -----
# ps ax | grep md
 25 ?      SN    0:00 [ksmd]
 31 ?      S<    0:00 [md]
1002 ?     S<    0:00 [krfcommd]
4125 ?     S      0:00 [md127_raid5]
```

```
# locate mdadm
/etc/mdadm.conf.01
/etc/mdadm.conf.NO
/etc/libreport/events.d/mdadm_event.conf
/usr/lib/systemd/system/mdadm-grow-continue@.service
/usr/lib/systemd/system/mdadm-last-resort@.service
/usr/lib/systemd/system/mdadm-last-resort@.timer
/usr/lib/systemd/system-shutdown/mdadm.shutdown
/usr/lib/tmpfiles.d/mdadm.conf
/usr/sbin/mdadm
/usr/share/augeas/lenses/dist/mdadm_conf.aug
/usr/share/bash-completion/completions/mdadm
/usr/share/doc/mdadm
/usr/share/doc/mdadm/COPYING
/usr/share/doc/mdadm/ChangeLog
/usr/share/doc/mdadm/TODO
/usr/share/doc/mdadm/mdadm.conf-example
/usr/share/doc/mdadm/mdcheck
/usr/share/doc/mdadm/syslog-events
/usr/share/man/man5/mdadm.conf.5.gz
/usr/share/man/man8/mdadm.8.gz
/usr/share/zsh/5.0.8/functions/_mdadm
```

```
# rpm -qf /usr/sbin/mdadm
mdadm-3.3.2-1.fc21.i686

# rpm -ql mdadm
/etc/cron.d/raid-check
/etc/libreport/events.d/mdadm_event.conf
/etc/sysconfig/raid-check
/usr/lib/systemd/system-shutdown/mdadm.shutdown
/usr/lib/systemd/system/mdadm-grow-continue@.service
/usr/lib/systemd/system/mdadm-last-resort@.service
/usr/lib/systemd/system/mdadm-last-resort@.timer
/usr/lib/systemd/system/mdmon@.service
/usr/lib/systemd/system/mdmonitor.service
/usr/lib/tmpfiles.d/mdadm.conf
/usr/lib/udev/rules.d/63-md-raid-arrays.rules
/usr/lib/udev/rules.d/64-md-raid-assembly.rules
/usr/lib/udev/rules.d/65-md-incremental.rules
/usr/sbin/mdadm
/usr/sbin/mdmon
/usr/sbin/raid-check
/usr/share/doc/mdadm
/usr/share/doc/mdadm/COPYING
/usr/share/doc/mdadm/ChangeLog
/usr/share/doc/mdadm/TODO
/usr/share/doc/mdadm/mdadm.conf-example
/usr/share/doc/mdadm/mdcheck
/usr/share/doc/mdadm/syslog-events
/usr/share/man/man4/md.4.gz
/usr/share/man/man5/mdadm.conf.5.gz
/usr/share/man/man8/mdadm.8.gz
/usr/share/man/man8/mdmon.8.gz
/var/run/mdadm

# man md #(4)

# ll /sys/block/md127/
total 0
-r--r--r-- 1 root root 4096 Feb 15 19:24 alignment_offset
lrwxrwxrwx 1 root root 0 Feb 15 19:24 bdi -> ../../bdi/9:127
-r--r--r-- 1 root root 4096 Feb 15 19:24 capability
-r--r--r-- 1 root root 4096 Feb 15 18:11 dev
-r--r--r-- 1 root root 4096 Feb 15 19:24 discard_alignment
-r--r--r-- 1 root root 4096 Feb 15 19:24 ext_range
drwxr-xr-x 2 root root 0 Feb 15 18:13 holders
-r--r--r-- 1 root root 4096 Feb 15 19:24 inflight
```



```

drwxr-xr-x 5 root root 0 Feb 15 18:11 md
drwxr-xr-x 2 root root 0 Feb 15 18:13 power
drwxr-xr-x 2 root root 0 Feb 15 18:13 queue
-r--r--r-- 1 root root 4096 Feb 15 19:24 range
-r--r--r-- 1 root root 4096 Feb 15 18:11 removable
-r--r--r-- 1 root root 4096 Feb 15 18:11 ro
-r--r--r-- 1 root root 4096 Feb 15 18:11 size
drwxr-xr-x 2 root root 0 Feb 15 18:13 slaves
-r--r--r-- 1 root root 4096 Feb 15 19:24 stat
lrwxrwxrwx 1 root root 0 Feb 15 18:13 subsystem -> ../../../../class/block
drwxr-xr-x 2 root root 0 Feb 15 18:13 trace
-rw-r--r-- 1 root root 4096 Feb 15 18:23 uevent

```

```

[root@localhost ~]# cat /var/run/mdadm/map
md127 1.2 3d87e2dc:5d2ed1ef:54b9d2bf:7a748bd0 /dev/md/rdades

```

```

[root@localhost ~]# dmesg | grep RAID
[ 1077.570311] RAID1 conf printout:
[ 1077.570415] md: resync of RAID array md127
[ 1129.760153] RAID1 conf printout:

```

```

[root@localhost ~]# dmesg | less #mes buscar md
# -----
# -----
# -----
# -----
# -----
# -----

```