- 1、 通过 tar 将/var/log 目录进行归档并分别实现最低和最高级别的压缩比,归档文件保存在用户目录/home/user 下,记录、观察过程和结果;
  - a、進到/home/user下,用 tar -cf dayu.tar /var/log 命令將/var/log 進行歸檔。 b、然後用 gzip -9 dayu.tar 對歸檔的目錄實現最高壓縮比,再用 a 中的命令對/var/log 目錄進行歸檔,然後用 mv dayu.tar dayul.tar 命令對第二次歸檔的目錄進行改名,再用 gzip -1 dayul.tar 對歸檔目錄實現最小壓縮比。

```
[root@server user]# tar -cf dayu.tar /var/log
tar: Removing leading `/' from member names
[root@server user]# ls
root@server user]# gzip -9 dayu.tar
[root@server user]# ls
[root@server user]# tar -cf dayu.tar /var/log
tar: Removing leading `/' from member names
[root@server user]# ls
[root@server user]# gzip -1 dayu.tar
gzip: dayu.tar.gz already exists; do you wish to overwrite (y or n)?
        not overwritten
[root@server user]# mv dayu.tar dayu1.tar
[root@server user]# ls
[root@server user]# gzip -1 dayu1.tar
[root@server user]# ls
[root@server user]# ll
total 2940
-rw-r--r--. 1 root user 1677012 9月 12 19:37 dayu1.tar.gz
-rw-r--r--. 1 root user 1330083 9月 12 19:35 dayu.tar.gz
[root@server user]# ll -h
total 2.9M
-rw-r--r--. 1 root user 1.6M 9月
                                    12 19:37 dayu1.tar.gz
-rw-r--r--. 1 root user 1.3M 9月
                                    12 19:35 dayu.tar.gz
```

- 2、 通过 cpio 解开/boot/initramfs-x.xxx-xxx.img 文件,并将揭开内容与当前根目录下的结构进行一级子目录数量对比,记录过程和结果;
- a、進到/boot/目錄下復制 initramfs-x.xxx-xxx.img 文件,將文件拷貝到/home/user下,進到/home/user下,用 file 命令查看 initramfs-x.xxx-xxx.img 文件類型。 initramfs-3.10.0-693.el7.x86\_64.img initramfs-3.10.0-693.el7.x86\_64.gz,文件後綴.img 改爲.gz。
- b、gunzip initramfs-3.10.0-693.el7.x86\_64.gz 用此命令將文件解壓,之後 ls 對兩個文件進行對比。如下圖。
  - c、cpio -i < 對此文件進行解包。

```
[root@server -]# cd /boot/
[root@server boot]# is
config-3.10.-693.e17.x86_64
eft
grub
grub2
inttranfs-3.10.-693.e17.x86_64.img
inttranfs-3.10.-693.e17.x86_64.img
inttranfs-3.10.-693.e17.x86_64.img
inttranfs-3.10.-693.e17.x86_64.img
synvers-3.10.9-693.e17.x86_64.img
inttranfs-3.10.-693.e17.x86_64.img
inttranfs-3.10.-693.e17.x86_64.img
inttranfs-3.10.-693.e17.x86_64.img
inttranfs-3.10.-693.e17.x86_64.img
froot@server boot]# cp inttranfs-3.10.6-693.e17.x86_64.img
froot@server boot]# cf /home/user
froot@server user]# is
ausu.tar.oz dayu.tar.oz inttranfs-3.10.6-693.e17.x86_64.img
inttranfs-3.10.-693.e17.x86_64.img
inttranfs-3.10.-693.e17.x86_64
inttranfs-3.10.693.e17.x86_64
inttranfs-3.10.693.e17.x86_64
inttranfs-3.10.693.e17.x86_64
inttranfs-3.10.693.e17.x86_64
inttranfs-3.10.693
```

```
[root@server user]# cd /
[root@server /]# ls
autorelabel boot etc lib lost+found mnt proc run srv tmp var
bin dev home lib64 media opt root sbin sys usr
```

- 3、 为用户目录/home/user 挂載镜像 lv,并记录操作过程,破坏主卷并实施救援,记录操作观察结果;
- a、將兩塊磁盤轉換爲 pv 創建 vg 建立鏡像 lv 格式化之後 將鏡像 lv 掛載到/home/user。
  用 lvs -a -o +devices 命令查看鏡像卷。

```
[root@server ~]# pvcreate /dev/vd[b-c]
Physical volume "/dev/vdb" successfully created.
Physical volume "/dev/vdc" successfully created.
[root@server ~]# vgcreate vg /dev/vd[b-c]
Volume group "vg" successfully created
[root@server ~]# lvcreate -L 4G -m1 -n lv vg
WARNING: ext4 signature detected on /dev/vg/lv at offset 1080.
Wiping ext4 signature on /dev/vg/lv.
Logical volume "lv" created.
[root@server ~]# lvdisplay
--- Logical volume ---
LV Path
____/dev/vg/lv
           Path
                                                                 /dev/vg/lv
lv
    LV Name
    VG Name
                                                                 vg
kEO1qa-GQrX-gYct-aKNR-veEB-0yq1-MQyCdw
read/write
          UUID
          Write Access
Creation host, time
                                                                 server, 2
available
                                                                                     2018-09-13 10:05:59 +0800
    IV Status
       open
V Size
                                                                 4.00 GiB
    Current LE
                                                                 1024
   Mirrored volumes
   Segments
Allocation
Read ahead sectors
                                                                 inherit
                                                                 auto
   - currently set to
Block device
                                                                 8192
                                                                 252:4
```

```
[root@server ~]# mkfs.ext4 /dev/vg/lv
mke2fs 1.42.9 (28-Dec-2013)
Filesystem label=
OS type: Linux
Block size=4096 (log=2)
Fragment size=4096 (log=2)
Stride=0 blocks, Stripe width=0 blocks
262144 inodes, 1048576 blocks
52428 blocks (5.00%) reserved for the super user
First data block=0
Maximum filesystem blocks=1073741824
32 block groups
32768 blocks per group, 32768 fragments per group
8192 inodes per group
Superblock backups stored on blocks:
           32768, 98304, 163840, 229376, 294912, 819200, 884736
Allocating group tables: done
Writing inode tables: done
Creating journal (32768 blocks): done
Writing superblocks and filesystem accounting information: done
[root@server ~]# mount /dev/vg/lv /home/user
[root@server ~]# df -hT
Filesystem
/dev/vda2
                        Туре
                                      Size Used Avail Use% Mounted on
                                       94G 1.3G
                        ext4
                                                      88G
                                                               2%
                                                               0% /dev
0% /dev/shm
1% /run
                                     2.0G
2.0G
                                                      2.0G
2.0G
devtmpfs
                        devtmpfs
                                                  0
tmpfs
                         tmpfs
                                                  0
tmpfs
                         tmpfs
                                      2.0G
                                             8.5M
                                                      2.0G
                                                              0% /sys/fs/cgroup
12% /boot
                                      2.0G
                                                 0
                                                      2.0G
tmpfs
                        tmpfs
                                     1014M
                                                     895M
/dev/vda1
                                              120M
                        xfs
                                                               0% /run/user/0
1% /home/user
                        tmpfs
                                      396M
                                                 0
                                                      396M
 tmofs
 /dev/mapper/vg-lv ext4
                                      3.9G
                                               16M
                                                      3.6G
[root@server ~]# lvs -a -o +devices
                                        LSize Pool Origin Data% Meta% Move Log Cpy%Sync Convert D
                     VG Attr
   LV
   lv
                      vg rwi-aor--- 4.00g
                                                                                                 100.00
   [lv_rimage_0] vg iwi-aor--- 4.00g
[lv_rimage_1] vg iwi-aor--- 4.00g
[lv_rmeta_0] vg ewi-aor--- 4.00m
   [lv rmeta 1]
                     vg ewi-aor--- 4.00m
```

b、用 dd if=/dev/zero of=/dev/vdb count=10 命令對/dev/vdbjinxing 破壞,用 pvs 查看是否只剩下一塊盤,然後用 umount /home/user 卸載,在進行掛載。

c、vgreduce --removemissing --force vg 移除破壞的磁盤, pvs 查看是否移除。之後解除鏡像。對數據進行修復。

```
[root@server ~]# dd if=/dev/zero of=/dev/vdb count=10
10+0 records in
10+0 records out
5120 bytes (5.1 kB) copied, 0.000304571 s, 16.8 MB/s
      [root@server ~]# vgs
WARNING: Device for PV KPVF10-yQBZ-I2va-ICRi-EbFa-RSPt-gsBBHk not found or rejected by a filter.
WARNING: Couldn't find all devices for LV vg/lv_rimage_0 while checking used and assumed devices.
WARNING: Couldn't find all devices for LV vg/lv_rmeta_0 while checking used and assumed devices.
      WARNING: Couldn't find all devices for LV vg/tv_rmeta_0 while checking used and assumed devices.

VG #PV #LV #SN Attr VSize VFree

vg 2 1 0 wz-pn- 39.99g 31.98g

[root@server ~]# lvs

WARNING: Device for PV KPVF10-yQBZ-I2va-ICRi-EbFa-RSPt-gsBBHk not found or rejected by a filter.

WARNING: Couldn't find all devices for LV vg/tv_rmeta_0 while checking used and assumed devices.

WARNING: Couldn't find all devices for LV vg/tv_rmeta_0 while checking used and assumed devices.

LV VG Attr LSize Pool Origin Data% Meta% Move Log Cpy%Sync Convert

lv vg rwi-aor-p- 4.00g

[root@server ~]# pvs

WARNING: Device for PV KPVF10-yQBZ-I2va-ICRi-EbFa-RSPt-gsBBHk not found or rejected by a filter.

WARNING: Couldn't find all devices for LV vg/tv_rmage_0 while checking used and assumed devices.

WARNING: Couldn't find all devices for LV vg/tv_rmeta_0 while checking used and assumed devices.

WARNING: Couldn't find all devices for LV vg/tv_rmeta_0 while checking used and assumed devices.

WARNING: Couldn't find all devices for LV vg/tv_rmeta_0 while checking used and assumed devices.

WARNING: Couldn't find all devices for LV vg/tv_rmeta_0 while checking used and assumed devices.

WARNING: Couldn't find all devices for LV vg/tv_rmeta_0 while checking used and assumed devices.

WARNING: Couldn't find all devices for LV vg/tv_rmeta_0 while checking used and assumed devices.

WARNING: Couldn't find all devices for LV vg/tv_rmeta_0 while checking used and assumed devices.

WARNING: Couldn't find all devices for LV vg/tv_rmeta_0 while checking used and assumed devices.

WARNING: Couldn't find all devices for LV vg/tv_rmeta_0 while checking used and assumed devices.

WARNING: Couldn't find all devices for LV vg/tv_rmeta_0 while checking used and assumed devices.

WARNING: Couldn't find all devices for LV vg/tv_rmeta_0 while checking used and assumed devices.

WARNING: Couldn't find all devices for LV vg/tv_rmeta_0 while checking used and assumed devices.
                                                                                                                                                                                                                                                                                        se% Moo.
2% /
0% /dev
0% /dev/shm
1% /run
0% /sys/fs/cgroup
12% /boot
0% /run/user/0
                                                                                                     Type
ext4
devtmpfs
                                                                                                                                                                        Size
                                                                                                                                                                                                           Used Avail Use% Mounted on
          ilesystem
                                                                                                                                                                                                           1.3G
0
0
8.5M
     /dev/vda2
devtmpfs
                                                                                                                                                                                                                                                     88G
2.0G
                                                                                                                                                                               94G
                                                                                                                                                                    2.0G
                                                                                                      tmpfs
tmpfs
tmpfs
tmpfs
xfs
tmpfs
                                                                                                                                                                                                                                                       2.0G
2.0G
2.0G
      tmpfs
                                                                                                                                                                          2.0G
prs
tmpfs
/dev/vda1
tmpfs
                                                                                                                                                                        2.0G
2.0G
                                                                                                                                                                                                             0
120M
                                                                                                                                                                  1014M
                                                                                                                                                                                                                                                        895M
```

```
[root@server ~]# mount /dev/vg/lv /home/user
[root@server ~]# df -hT
Filesystem
                                      Туре
                                                           Size Used Avail Use% Mounted on
                                                                                                 2% /
/dev/vda2
                                      ext4
                                                             94G
                                                                       1.3G
                                                                                  88G
                                                                                              2% /
0% /dev
0% /dev/shm
1% /run
0% /sys/fs/cgroup
12% /boot
0% /run/user/0
1% /home/user
                                                                                   2.0G
                                                        2.0G
2.0G
2.0G
2.0G
2.0G
1014M
devtmpfs
                                      devtmpfs
tmpfs
                                      tmpfs
                                                                            0
                                                                                    2.0G
                                                                                   2.0G
tmpfs
                                      tmpfs
                                                                      8.5M
                                                                                    2.0G
tmpfs
                                      tmpfs
                                                                            0
                                      xfs
/dev/vda1
                                                                      120M 895M
/dev/mapper/vg-lv ext4 3.9G 16M 3.6G 1% /home/user/0
/dev/mapper/vg-lv ext4 3.9G 16M 3.6G 1% /home/user
[root@server ~]# vgreduce --removemissing --force vg
WARNING: Device for PV KPVF10-yQBZ-I2va-ICRi-EbFa-RSPt-gsBBHk not found or rejected by a fil
WARNING: Couldn't find all devices for LV vg/lv_rimage_0 while checking used and assumed dev
WARNING: Couldn't find all devices for LV vg/lv_rmeta_0 while checking used and assumed devi-
Wrote out consistent volume group vg.
                                      tmpfs
[root@server ~]# pvs
WARNING: Not using lvmetad because a repair command was run.
WARNING: Not using lymetad because a repair command was run.

PV VG Fmt Attr PSize PFree
/dev/vdc vg lym2 a-- <20.00g 15.99g
[root@server ~]# lyconvert -m0 /dev/vg/ly
WARNING: Not using lymetad because a repair command was run.

Are you sure you want to convert raid1 LV vg/lv to type linear losing all resilience? [y/n]: y
Logical volume vg/lv successfully converted.

[root@server ~]# lydisplay
WARNING: Not using lymetad because a repair command was run.
    WARNING: Not using lymetad because a repair command was run.
     --- Logical volume ---
   LV Path
                                                     /dev/vg/lv
    LV Name
    VG Name
   LV UUID
                                                    kEO1qa-GQrX-gYct-aKNR-veEB-0yq1-MQyCdw
    LV Write Access read/write
LV Creation host, time server, 2018-09-13 10:05:59 +0800
LV Status available
    # open
LV Size
                                                    4.00 GiB
                                                    1024
    Current LE
    Segments
    Allocation
                                                     inherit
    Read ahead sectors
                                                    auto
      currently set to
                                                    8192
    Block device
                                                     252:4
```

## d、使用 lvconvert -m1 /dev/vg/lv /dev/vdb 命令對數據進行恢復, lvs 查看是否修復。

```
[root@server ~]# lvconvert -m1 /dev/vg/lv /dev/vdb
WARNING: Not using lvmetad because a repair command was run.
Are you sure you want to convert linear LV vg/lv to raid1 with 2 images enhancing resilience? [y/n]: y
Logical volume vg/lv successfully converted.
[root@server ~]# lvdisplay
WARNING: Not using lvmetad because a repair command was run.
  --- Logical volume
LV Path
                                                        /dev/vg/lv
lv
   LV Name
  VG Name vg
LV UUID kEO1qa-GQrX-gYct-aKNR-veEB-0yq1-MQyCdw
LV Write Access read/write
LV Creation host, time server, 2018-09-13 10:05:59 +0800
LV Status available
   VG Name
LV UUID
   # open
LV Size
                                                       4.00 GiB
   Current LE
                                                       1024
   Mirrored volumes
   Segments
Allocation
                                                        inherit
  Read ahead sectors
- currently set to
                                                       auto
  Block device
                                                       252:4
```

數據已恢復

```
[root@server ~]# lsblk
NAME
                                SIZE RO TYPE MOUNTPOINT
                   MAJ:MIN RM
ST0
                    11:0
                             1 1024M
                                        0 rom
vda
                              0
                                        0 disk
                   253:0
                                 100G
                                          part /boot
 -vda1
                   253:1
                              0
                                   1G
                                        0
                              0 95.1G
  -vda2
                   253:2
                                        0
                                          part
                                                /
[SWAP]
 -vda3
                   253:3
                              0
                                 3.9G
                                        0 part
vdb
                   253:16
                              0
                                  20G
                                        0 disk
  -vg-lv_rmeta_1
└─vg-lv
                              0
                                   4M
                                        0
                                          lvm
                   252:2
                   252:4
                              0
                                   4G
                                        0
                                          lvm
                                                /home/user
  -vg-lv_rimage_1 252:3
__vg-lv 252:4
                                          lvm
                              0
                                   4G
                                        0
                             0
                                   4G
                                        0 lvm
                                                /home/user
                   253:32
                             0
                                  20G
                                        0 disk
vdc
  -vg-lv_rmeta_0
└─vg-lv
                   252:0
                             0
                                   4M
                                        0 lvm
                                   4G
                   252:4
                             0
                                        0 lvm
                                                /home/user
  vg-lv_rimage_0 252:1
                             0
                                   4G
                                        0 lvm
    vg-lv
                                        0 lvm
                             0
                                   4G
                                                /home/user
                   252:4
                                        0 disk
                                  20G
vdd
                   253:48
                             0
vde
                   253:64
                             0
                                  20G
                                        0 disk
vdf
                   253:80
                              0
                                  20G
                                        0 disk
vdg
                   253:96
                              0
                                  20G
                                        0 disk
vdh
                   253:112
                             0
                                  20G
                                        0 disk
vdi
                   253:128
                             0
                                  20G
                                        0 disk
vdj
                   253:144
                             0
                                  20G
                                        0 disk
vdk
                   253:160
                              0
                                  20G
                                        0 disk
vdl
                   253:176
                              0
                                  20G
                                        0 disk
vdm
                   253:192
                                  20G
                                        0 disk
[root@server ~]#
```

4、 为用户目录/home/user 挂载 raid5 卷,记录操作过程,随机破坏阵列中一块硬盘并实施救援,记录操作观察结果;

a、根據題意需先使用 mdadm -C /dev/md1 -a yes -l 5 -n 3 -x 1 /dev/vd{d,h,i,j},進行 RAID5 的創建。 mkfs.ext4 /dev/md1 對 RAID5 進行格式化,之後用 mount /dev/md1 /home/user 進行掛載。

```
[root@server ~]# mdadm -C /dev/md1 -a yes -l 5 -n 3 -x 1 /dev/vd{d,h,i,j}
ndadm: Unknown keyword DEVICE/dev/vdd
ndadm: Defaulting to version 1.2 metadata
ndadm: array /dev/md1 started.
[root@server ~]# mkfs.ext4 /dev/md1
nke2fs 1.42.9 (28-Dec-2013)
Filesystem label=
OS type: Linux
3lock size=4096 (log=2)
Fragment size=4096 (log=2)
Stride=128 blocks, Stripe width=256 blocks
2621440 inodes, 10477568 blocks
523878 blocks (5.00%) reserved for the super user
irst data block=0
Maximum filesystem blocks=2157969408
320 block groups
32768 blocks per group, 32768 fragments per group
3192 inodes per group
Superblock backups stored on blocks:
           32768, 98304, 163840, 229376, 294912, 819200, 884736, 1605632, 2654208, 4096000, 7962624
Allocating group tables: done
Writing inode tables: done
reating journal (32768 blocks): done
Writing superblocks and filesystem accounting information: done
[root@server ~]# mount /dev/md1 /home/user
[root@server ~]# df -hT
ilesystem
/dev/vda2
                     Туре
                                    Size
                                            Used Avail Use% Mounted on
                                    94G
                                                                2% /
                     ext4
                                            1.3G
                                                      88G
devtmpfs
                     devtmpfs
                                    2.0G
                                                 0
                                                    2.0G
                                                                0% /dev
                                                              0% /dev/shm
1% /run
0% /sys/fs/cgroup
12% /boot
0% /run/user/0
                     tmpfs
                                    2.0G
                                                     2.0G
tmpfs
                                                 0
tmpfs
                     tmpfs
                                                     2.0G
                                    2.0G
                                             8.5M
                                                     2.0G
                                                 0
mpfs
                     tmpfs
                                    2.0G
dev/vda1
                     xfs
                                   1014M
                                             120M
                                                      895M
                     tmpfs
                                                     396M
mpfs
                                    396M
                                                 0
                                                                1% /home/user
/dev/md1
                                     40G
                                               49M
                                                       38G
                     ext4
```

## 用 mdadm /dev/md1 -f /dev/vdd 命令將 vdd 標記爲損壞。

```
[root@server ~]# mdadm -D /dev/md1
mdadm: Unknown keyword DEVICE/dev/vdd
/dev/md1:
                                    : 1.2
: Thu Sep 13 13:56:35 2018
: raid5
: 41910272 (39.97 GiB 42.92 GB)
: 20955136 (19.98 GiB 21.46 GB)
: 3
         Version :
Creation Time :
Raid Level :
Array Size :
Used Dev Size :
         Raid Devices
Total Devices
Persistence
                                     : Superblock is persistent
       Update Time : Thu Sep 13 13:58:40 2018
State : clean, degraded, recovering
Active Devices : 2
     Working Devices :
Failed Devices :
                                         0
          Spare Devices
               Layout : left-symmetric
Chunk Size : 512K
Consistency Policy : resync
       Rebuild Status : 59% complete
                           Name : server:1 (local to host server)
UUID : 0e695ff1:24ec9482:08dfab40:848165a7
vents : 30
                        Events
        Number
                          Major
                                         Minor
                                                          RaidDevice State
                          253
253
                                            48
112
128
                                                                               active sync /de
active sync /de
spare rebuilding
                                                                                                           /dev/vdd
/dev/vdh
                          253
                          253
                                            144
                                                                                spare
                                                                                               /dev/vdj
[root@server ~]# mdadm /dev/md1 -f /dev/vdd
mdadm: Unknown keyword DEVICE/dev/vdd
mdadm: set /dev/vdd faulty in /dev/md1
```

```
[root@server ~]# mdadm -D /dev/md1
mdadm: Unknown keyword DEVICE/dev/vdd
/dev/md1:
     Version : 1.2
Creation Time : Thu Sep 13 13:56:35 2018
         Raid Level : raid5
     Array Size : 41910272 (39.97 GiB 42.92 GB)
Used Dev Size : 20955136 (19.98 GiB 21.46 GB)
      Raid Devices : 3
      Total Devices: 4
        Persistence: Superblock is persistent
        Update Time : Thu Sep 13 14:01:38 2018
              State : clean, degraded, recovering
    Active Devices : 2
   Working Devices : 3
Failed Devices : 1
     Spare Devices : 1
              Layout : left-symmetric
         Chunk Size : 512K
Consistency Policy : resync
    Rebuild Status : 1% complete
                Name : server:1 (local to host server)
                UUID: 0e695ff1:24ec9482:08dfab40:848165a7
              Events: 52
    Number
               Major Minor RaidDevice State
                                              spare rebuilding /dev/vdj
active sync /dev/vdh
                        144
               253
        3
                         112
        1
               253
                                      1
                                              active sync
                                                              /dev/vdi
        4
               253
                         128
                                      2
       0
               253
                          48
                                              faulty /dev/vdd
[root@server ~]# mdadm /dev/md1 -r /dev/vdd
mdadm: Unknown keyword DEVICE/dev/vdd
mdadm: hot removed /dev/vdd from /dev/md1
```

## 用 mdadm --misc --zero-superblock -f /dev/vdd 清空損壞的 vdd。

```
[root@server ~]# mdadm -D /dev/md1
mdadm: Unknown keyword DEVICE/dev/vdd
/dev/md1:
           /md1:
Version : 1.2
Creation Time : Thu Sep 13 13:56:35 2018
Raid Level : raid5
Array Size : 41910272 (39.97 GiB 42.92 GB)
Used Dev Size : 20955136 (19.98 GiB 21.46 GB)
Raid Devices : 3
Total Devices : 3
Persistence : Superblock is persistent
       Update Time : Thu Sep 13 14:02:21 2018
State : clean, degraded, recovering
Active Devices : 2
Working Devices : 3
Failed Devices : 0
Spare Devices : 1
                   Layout : left-symmetric
Chunk Size : 512K
Consistency Policy : resync
         Rebuild Status : 6% complete
                                  Name : server:1 (local to host server)
UUID : 0e695ff1:24ec9482:08dfab40:848165a7
ents : 61
                             Events
                                                  Minor
                                                                     RaidDevice State
          Number
                               Major
3 253 144 0 spare rebuilding /dev/vdj
1 253 112 1 active sync /dev/vdh
4 253 128 2 active sync /dev/vdi
[root@server ~]# mdadm --misc --zero-superblock -f /dev/vdd
```

```
[root@server ~]# mdadm -D /dev/md1
mdadm: Unknown keyword DEVICE/dev/vdd
/dev/md1:
                Version: 1.2
       Creation Time : Thu Sep 13 13:56:35 2018
Raid Level : raid5
       Array Size : 41910272 (39.97 GiB 42.92 GB)
Used Dev Size : 20955136 (19.98 GiB 21.46 GB)
        Raid Devices : 3
       Total Devices : 3
          Persistence : Superblock is persistent
          Update Time : Thu Sep 13 14:03:05 2018
State : clean, degraded, recovering
     Active Devices: 2
    Working Devices : 3
     Failed Devices : 0
       Spare Devices: 1
                 Layout : left-symmetric
           Chunk Size : 512K
Consistency Policy: resync
      Rebuild Status : 16% complete
                    Name : server:1 (local to host server)
                    UUID: 0e695ff1:24ec9482:08dfab40:848165a7
                 Events: 71
      Number
                  Major
                             Minor
                                         RaidDevice State
          3
                  253
                              144
                                              0
                                                        spare rebuilding
                                                                                   /dev/vdj
                                                                           /dev/vdh
/dev/vdi
                  253
          1
                               112
                                               1
                                                        active sync
          4
                  253
                               128
                                              2
                                                         active sync
[root@server ~]# mdadm /dev/md1 -a /dev/vdd
mdadm: Unknown keyword DEVICE/dev/vdd
mdadm: added /dev/vdd
[root@server ~]# mdadm -D /dev/md1
mdadm: Unknown keyword DEVICE/dev/vdd
/dev/md1:
      Version :
Creation Time :
Raid Level :
                          1.2
Thu Sep 13 13:56:35 2018
raid5
                       : 41910272 (39.97 GiB 42.92 GB)
: 20955136 (19.98 GiB 21.46 GB)
      Array Size
Used Dev Size
      Raid Devices : 3
Total Devices : 4
Persistence : Superblock is persistent
        Update Time : Thu Sep 13 14:04:21 2018
               State : clean, degraded, recovering
     Active Devices
   Working Devices : 4
Failed Devices : 0
Spare Devices : 2
         Layout : left-symmetric
Chunk Size : 512K
Consistency Policy : resync
    Rebuild Status : 24% complete
                 Name : server:1 (local to host server)
UUID : 0e695ff1:24ec9482:08dfab40:848165a7
               Events: 84
                                    RaidDevice State
    Number
                Major
                          Minor
                253
253
253
                                                   spare rebuilding /dev/vdj
active sync /dev/vdh
active sync /dev/vdi
                           144
                                          0
                                                  active sync
active sync
                            112
                            128
                253
                             48
                                                  spare
                                                             /dev/vdd
```

[root@server	~]# df -hT					
Filesystem	Туре	Size	Used	Avail	Use%	Mounted on
/dev/vda2	ext4	94G	1.3G	88G	2%	1
devtmpfs	devtmpfs	2.0G	0	2.0G	0%	/dev
tmpfs	tmpfs	2.0G	0	2.0G	0%	/dev/shm
tmpfs	tmpfs	2.0G	8.5M	2.0G	1%	/run
tmpfs	tmpfs	2.0G	0	2.0G	0%	/sys/fs/cgroup
/dev/vda1	xfs	1014M	120M	895M	12%	/boot
tmpfs	tmpfs	396M	0	396M	0%	/run/user/0
/dev/md1	ext4	40G	49M	38G	1%	/home/user