МИНИСТЕРСТВО НАУКИ И ВЫСШЕГО ОБРАЗОВАНИЯ
РОССИЙСКОЙ ФЕДЕРАЦИИ

федеральное государственное автономное
образовательное учреждение высшего образования
«Самарский национальный исследовательский университет
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Факультет информатики
Кафедра суперкомпьютеров и общей информатики

Отчет по лабораторной работе №1

по курсу «Развертывание и жизненный цикл программного обеспечения»

Тема: **«VM and RAID»**

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Самара 2021

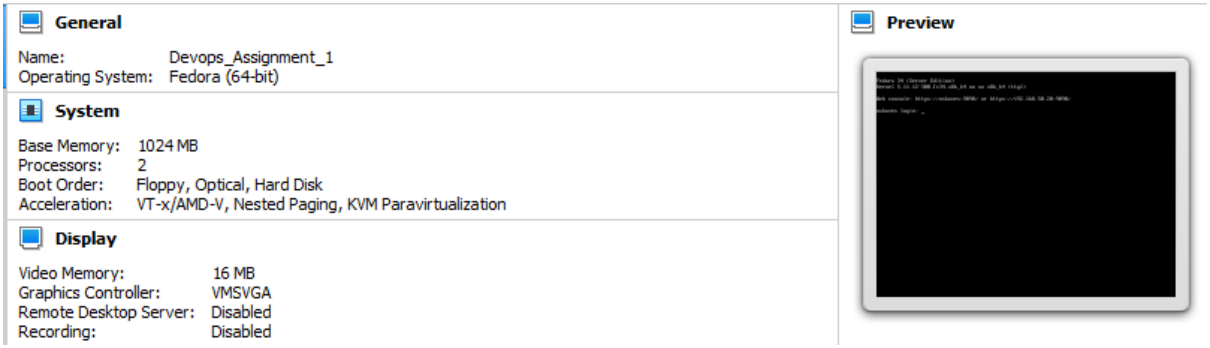
Задание

С помощью виртуальной машины на базе операционной системы семейства Linux создать RAID1 массив. Проверить созданный RAID1 массив на отказоустойчивость.

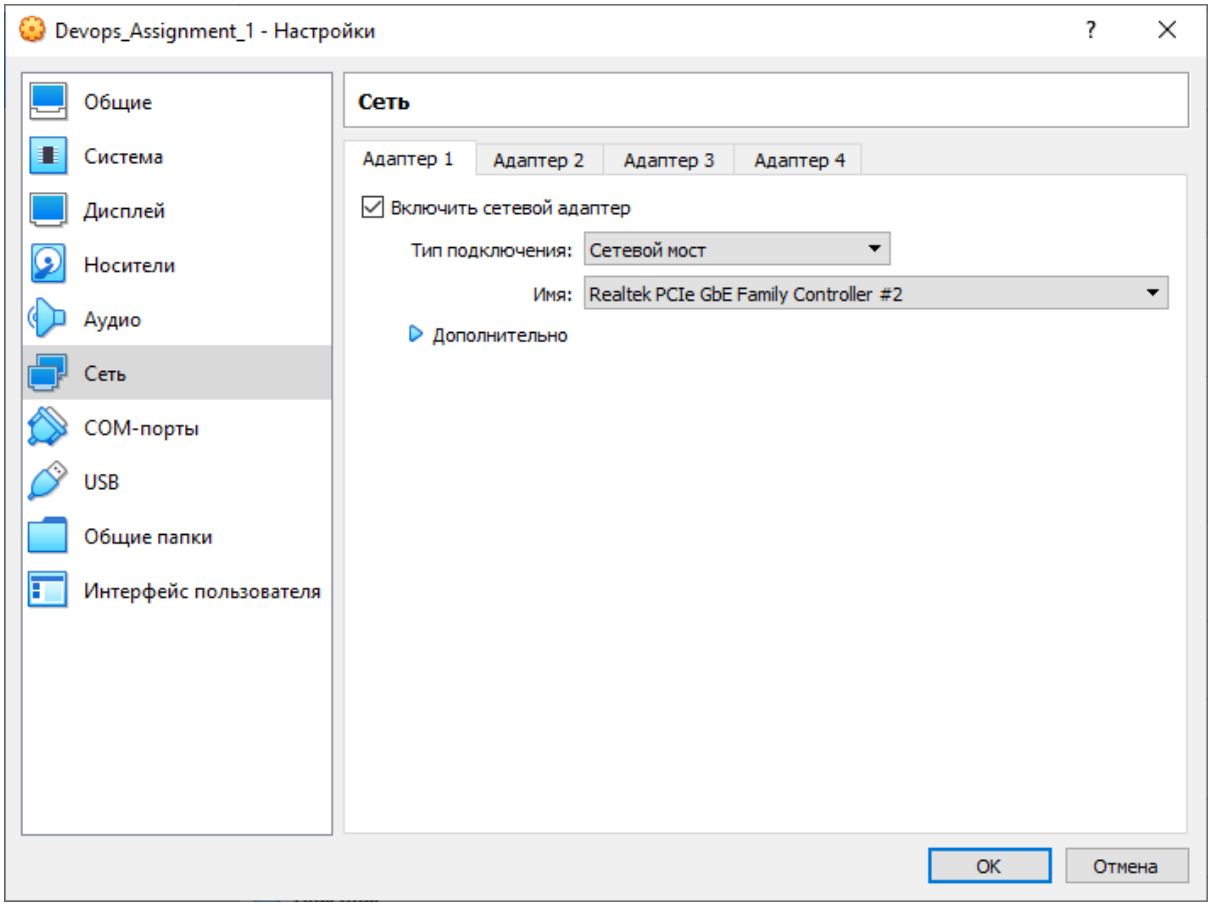
Ход работы

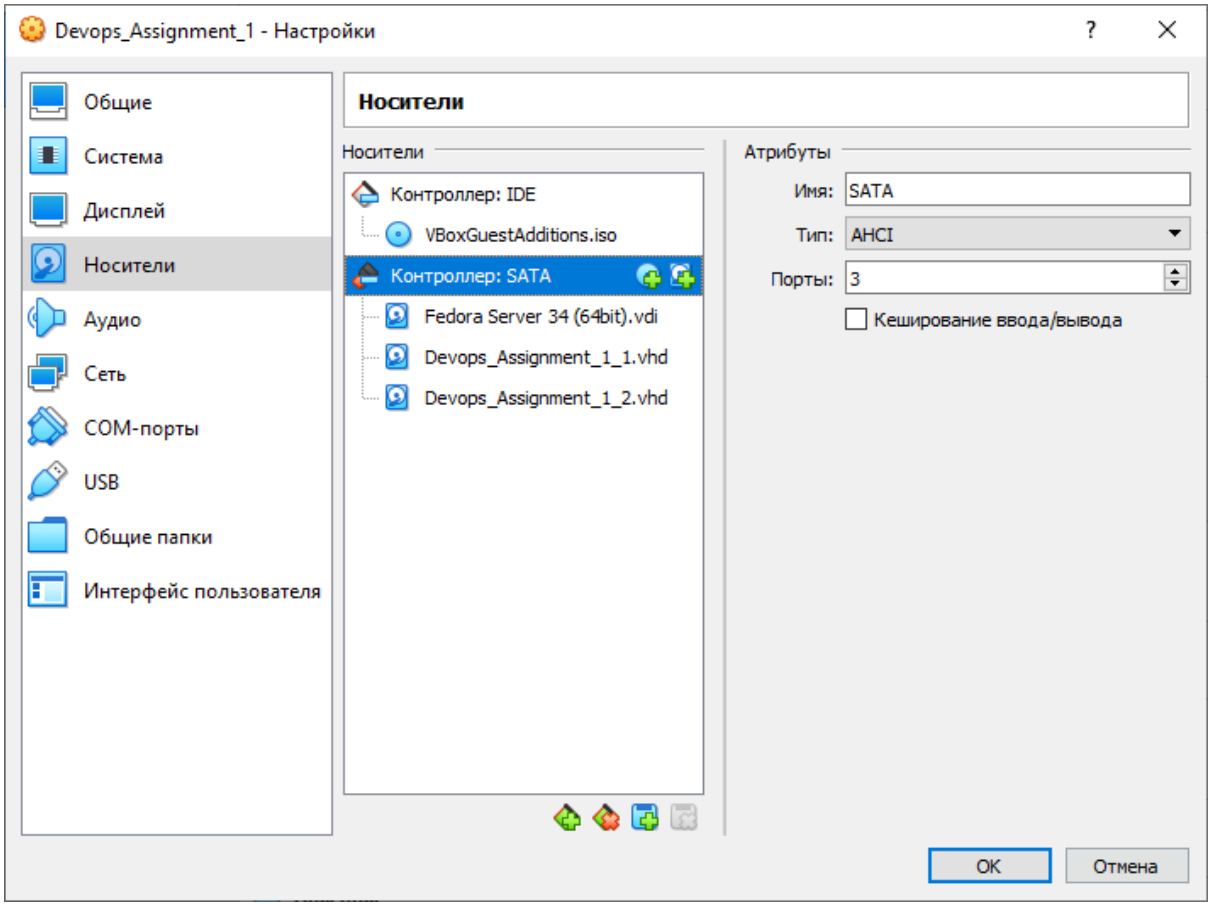
1. Для выполнения лабораторной работы мной был выбран гипервизор VirtaulBox и образ Fedora.

Я выбрал именно данный образ, т.к. он один из тех, которые я еще не пробовал, но хотел попробовать. (Знаком с Ubuntu, Debian, Manjaro). На самом деле единственное отличие при использовании разных дистрибутивов будет заключаться в установке дополнительных пакетов (а именно различаются пакетные менеджеры apt, yum, mapac).



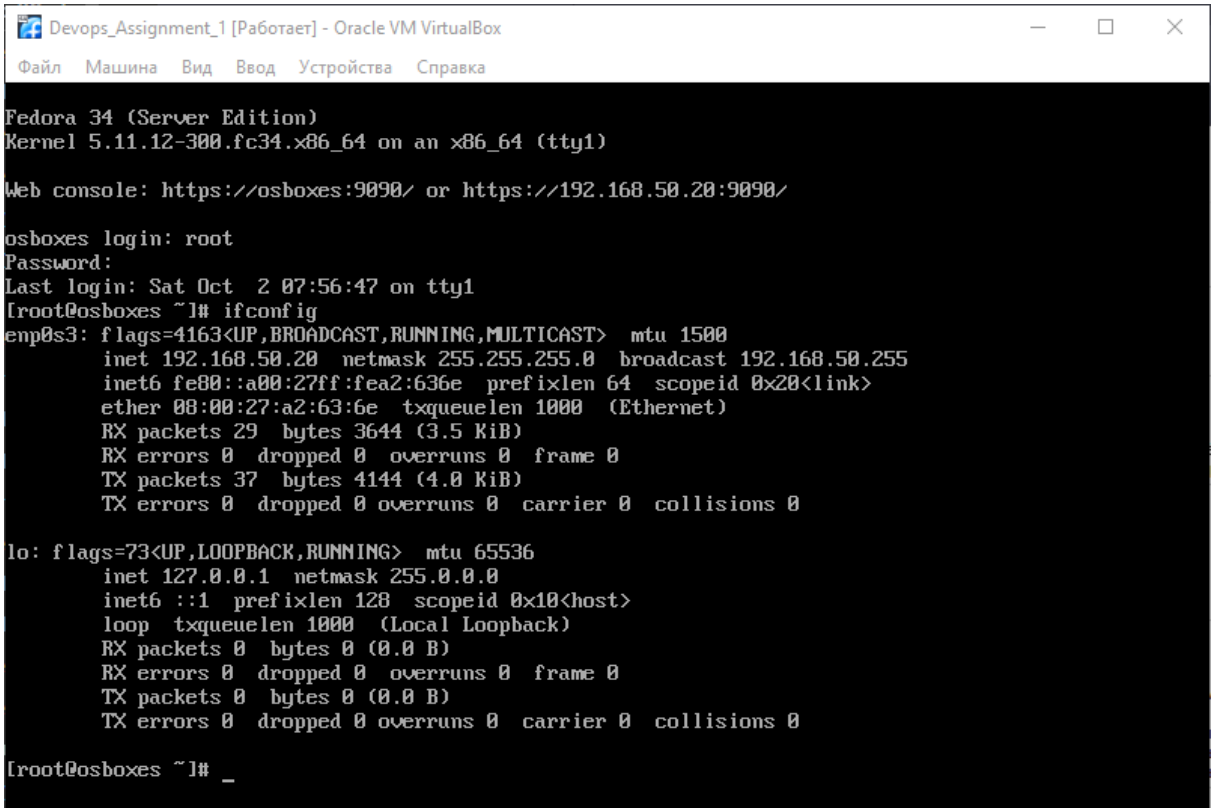
й1

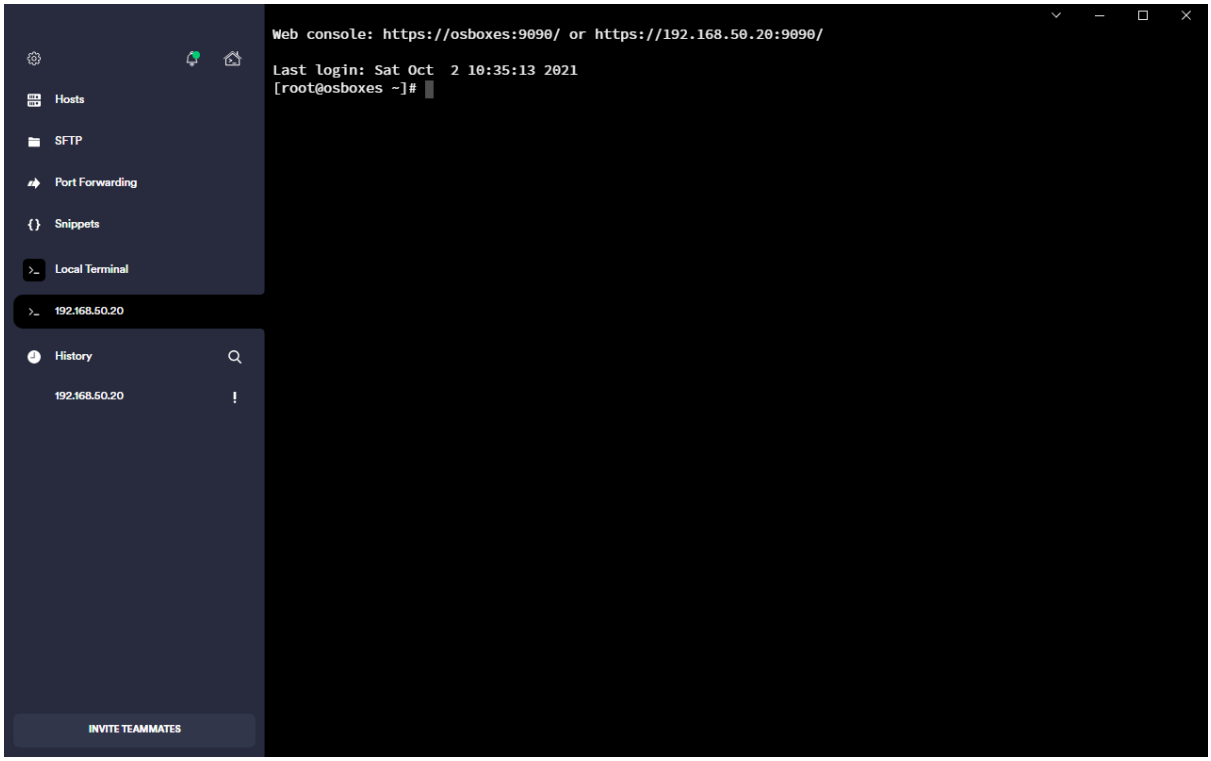



Devops_Assignment_1 - Настройки
Общие
Система
Дисплей
Носители
Аудио
Сеть
COM-порты
USB
Общие папки
Интерфейс пользователя
Носители
Носители
Контроллер: IDE
VBoxGuestAdditions.iso
Контроллер: SATA
Fedora Server 34 (64bit).vdi
Devops_Assignment_1_1.vhd
Devops_Assignment_1_2.vhd
Атрибуты
Имя: SATA
Тип: AHCI
Порты: 3
Кеширование ввода/вывода
OK
Отмена

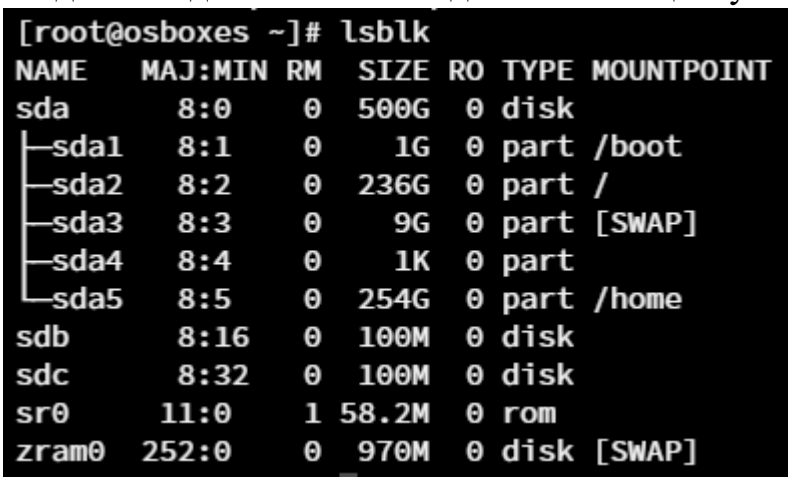
2. Поднятие SSH и подключение через Termius.

В образе Fedora-Server openssh предустановлен и автоматически запускается уже при первом запуске. Необходимо только узнать ip адрес виртуальной машины в локальной сети.



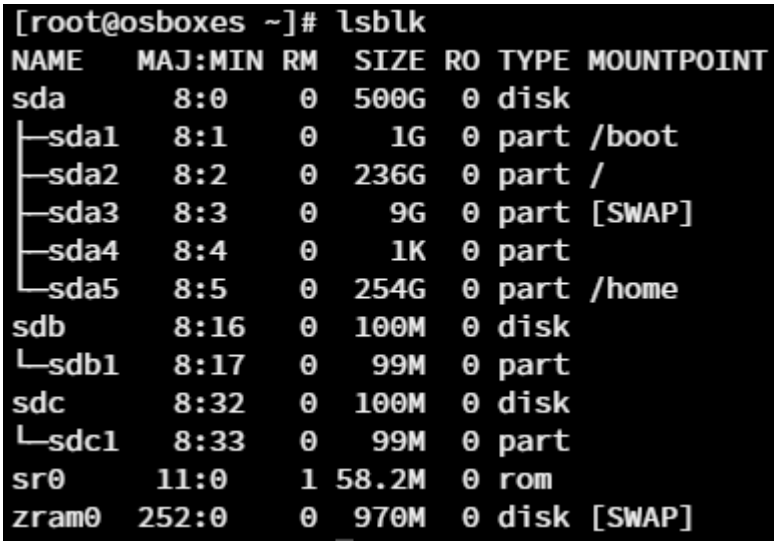


3. Создание разделов на дисках.
   Разделы на дисках были созданы с помощью утилиты *fdisk.*



   На следующем изображений отображен процесс создания раздела на диске sbd, аналогичные команды были выполнены и для диска sdc.

```
[root@osboxes ~]# fdisk /dev/sdb

Welcome to fdisk (util-linux 2.36.2).
Changes will remain in memory only, until you decide to write them.
Be careful before using the write command.

Device does not contain a recognized partition table.
Created a new DOS disklabel with disk identifier 0x60deb456.

Command (m for help): n
Partition type
   p   primary (0 primary, 0 extended, 4 free)
   e   extended (container for logical partitions)
Select (default p): p
Partition number (1-4, default 1): 1
First sector (2048-204799, default 2048):
Last sector, +/-sectors or +/-size{K,M,G,T,P} (2048-204799, default 204799):

Created a new partition 1 of type 'Linux' and of size 99 MiB.

Command (m for help): p
Disk /dev/sdb: 100 MiB, 104857600 bytes, 204800 sectors
Disk model: VBOX HARDDISK
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disklabel type: dos
Disk identifier: 0x60deb456

Device     Boot Start    End Sectors Size Id Type
/dev/sdb1        2048 204799  202752  99M 83 Linux

Command (m for help): t
Selected partition 1
Hex code or alias (type L to list all): fd
Changed type of partition 'Linux' to 'Linux raid autodetect'.

Command (m for help): p
Disk /dev/sdb: 100 MiB, 104857600 bytes, 204800 sectors
Disk model: VBOX HARDDISK
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disklabel type: dos
Disk identifier: 0x60deb456

Device     Boot Start    End Sectors Size Id Type
/dev/sdb1        2048 204799  202752  99M fd Linux raid autodetect

Command (m for help): w
The partition table has been altered.
Calling ioctl() to re-read partition table.
Syncing disks.

[root@osboxes ~]#
```


[root@osboxes ~]# lsblk
NAME MAJ:MIN RM SIZE RO TYPE MOUNTPOINT
sda 8:0 0 500G 0 disk
├─sda1 8:1 0 1G 0 part /boot
├─sda2 8:2 0 236G 0 part /
├─sda3 8:3 0 9G 0 part [SWAP]
├─sda4 8:4 0 1K 0 part
└─sda5 8:5 0 254G 0 part /home
sdb 8:16 0 100M 0 disk
└─sdb1 8:17 0 99M 0 part
sdc 8:32 0 100M 0 disk
└─sdc1 8:33 0 99M 0 part
sr0 11:0 1 58.2M 0 rom
zram0 252:0 0 970M 0 disk [SWAP]

4. Создание RAID1 массива и форматирование раздела.

Для создания RAID массива была использована стандартная утилита *mdadm*, а для форматирования раздела – утилита *mkfs*. В результате был создан RAID1 массив *md0*.

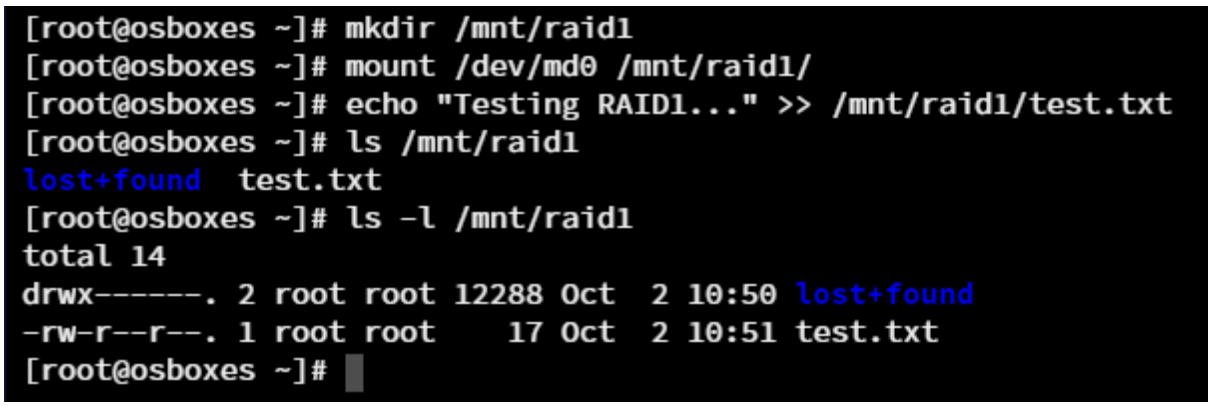
```
[root@osboxes ~]# mdadm --create /dev/md0 --level=mirror --raid-devices=2 /dev/sd[b-c]1
mdadm: Note: this array has metadata at the start and
    may not be suitable as a boot device.  If you plan to
    store '/boot' on this device please ensure that
    your boot-loader understands md/v1.x metadata, or use
    --metadata=0.90
Continue creating array?
Continue creating array? (y/n) y
mdadm: Defaulting to version 1.2 metadata
mdadm: array /dev/md0 started.
[root@osboxes ~]# cat /proc/mdstat
Personalities : [raid1]
md0 : active raid1 sdc1[1] sdb1[0]
      100352 blocks super 1.2 [2/2] [UU]

unused devices: <none>
[root@osboxes ~]# lsblk
NAME    MAJ:MIN RM  SIZE RO TYPE  MOUNTPOINT
sda       8:0    0  500G  0 disk
├─sda1    8:1    0    1G  0 part  /boot
├─sda2    8:2    0  236G  0 part  /
├─sda3    8:3    0    9G  0 part  [SWAP]
├─sda4    8:4    0    1K  0 part
└─sda5    8:5    0  254G  0 part  /home
sdb       8:16   0  100M  0 disk
└─sdb1    8:17   0   99M  0 part
  └─md0   9:0    0   98M  0 raid1
sdc       8:32   0  100M  0 disk
└─sdc1    8:33   0   99M  0 part
  └─md0   9:0    0   98M  0 raid1
sr0      11:0    1 58.2M  0 rom
zram0   252:0    0  970M  0 disk  [SWAP]
[root@osboxes ~]#
```

```
[root@osboxes ~]# mdadm -E /dev/sd[b-c]1
/dev/sdb1:
          Magic : a92b4efc
        Version : 1.2
    Feature Map : 0x0
     Array UUID : 5f0e915f:1dba5525:cd780c73:2b278cfc
           Name : osboxes:0  (local to host osboxes)
  Creation Time : Sat Oct  2 10:47:50 2021
     Raid Level : raid1
   Raid Devices : 2

 Avail Dev Size : 200704 (98.00 MiB 102.76 MB)
     Array Size : 100352 (98.00 MiB 102.76 MB)
    Data Offset : 2048 sectors
   Super Offset : 8 sectors
   Unused Space : before=1968 sectors, after=0 sectors
          State : clean
    Device UUID : 6ee8357e:ed2a2765:0282fa4c:d8e61d27

    Update Time : Sat Oct  2 10:47:56 2021
  Bad Block Log : 512 entries available at offset 16 sectors
       Checksum : 61b617a0 - correct
         Events : 17


   Device Role : Active device 0
   Array State : AA ('A' == active, '.' == missing, 'R' == replacing)
/dev/sdc1:
          Magic : a92b4efc
        Version : 1.2
    Feature Map : 0x0
     Array UUID : 5f0e915f:1dba5525:cd780c73:2b278cfc
           Name : osboxes:0  (local to host osboxes)
  Creation Time : Sat Oct  2 10:47:50 2021
     Raid Level : raid1
   Raid Devices : 2

 Avail Dev Size : 200704 (98.00 MiB 102.76 MB)
     Array Size : 100352 (98.00 MiB 102.76 MB)
    Data Offset : 2048 sectors
   Super Offset : 8 sectors
   Unused Space : before=1968 sectors, after=0 sectors
          State : clean
    Device UUID : cde0953e:f8ed57b6:1a52cb1f:10ac7870

    Update Time : Sat Oct  2 10:47:56 2021
  Bad Block Log : 512 entries available at offset 16 sectors
       Checksum : 8f72685b - correct
         Events : 17


   Device Role : Active device 1
   Array State : AA ('A' == active, '.' == missing, 'R' == replacing)
[root@osboxes ~]#
```

```
[root@osboxes ~]# mdadm --detail /dev/md0
/dev/md0:
           Version : 1.2
     Creation Time : Sat Oct  2 10:47:50 2021
        Raid Level : raid1
        Array Size : 100352 (98.00 MiB 102.76 MB)
     Used Dev Size : 100352 (98.00 MiB 102.76 MB)
      Raid Devices : 2
     Total Devices : 2
       Persistence : Superblock is persistent

       Update Time : Sat Oct  2 10:47:56 2021
             State : clean
    Active Devices : 2
   Working Devices : 2
    Failed Devices : 0
     Spare Devices : 0

Consistency Policy : resync

              Name : osboxes:0  (local to host osboxes)
              UUID : 5f0e915f:1dba5525:cd780c73:2b278cfc
            Events : 17

    Number   Major   Minor   RaidDevice State
       0       8       17        0      active sync   /dev/sdb1
       1       8       33        1      active sync   /dev/sdc1
[root@osboxes ~]#
```

```
[root@osboxes ~]# mkfs.ext4 /dev/md0
mke2fs 1.45.6 (20-Mar-2020)
Creating filesystem with 100352 1k blocks and 25168 inodes
Filesystem UUID: 449d5cc7-cb37-45a7-87cd-d7701f8c200d
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@osboxes ~]#
```

5. Монтирование RAID1 массива и создание тестового файла



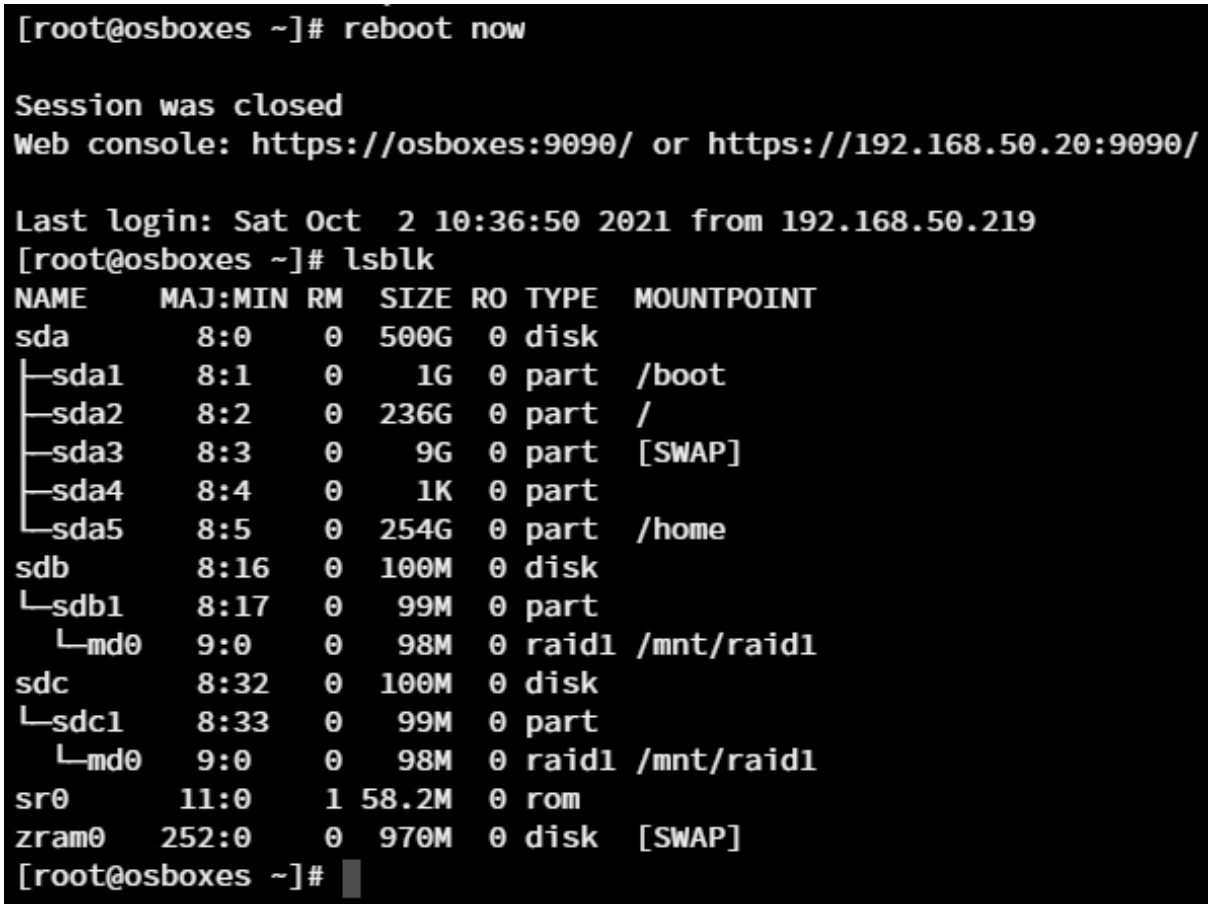
6. Автоматическое монтирование созданного RAID массива.

```
  GNU nano 5.6.1                                  /etc/fstab
#
# /etc/fstab
# Created by anaconda on Fri Apr 30 00:15:44 2021
#
# Accessible filesystems, by reference, are maintained under '/dev/disk/'.
# See man pages fstab(5), findfs(8), mount(8) and/or blkid(8) for more info.
#
# After editing this file, run 'systemctl daemon-reload' to update systemd
# units generated from this file.
#
UUID=0a8f447f-696e-41eb-af56-101113125fe3 /                       xfs     defaults        0 0
UUID=a0b6b604-b210-491d-9647-07c7ea89ef77 /boot                   xfs     defaults        0 0
UUID=d8070302-94cd-4aa7-b43c-28871c0ab65f /home                   xfs     defaults        0 0
UUID=4744b190-190a-4785-8596-7436870f927c none                    swap    defaults        0 0
/dev/md0                                  /mnt/raid1              ext4    defaults        0 0
```

```
[root@osboxes ~]# mount -av
/                          : ignored
/boot                      : already mounted
/home                      : already mounted
none                       : ignored
/mnt/raid1                 : already mounted
[root@osboxes ~]#
```

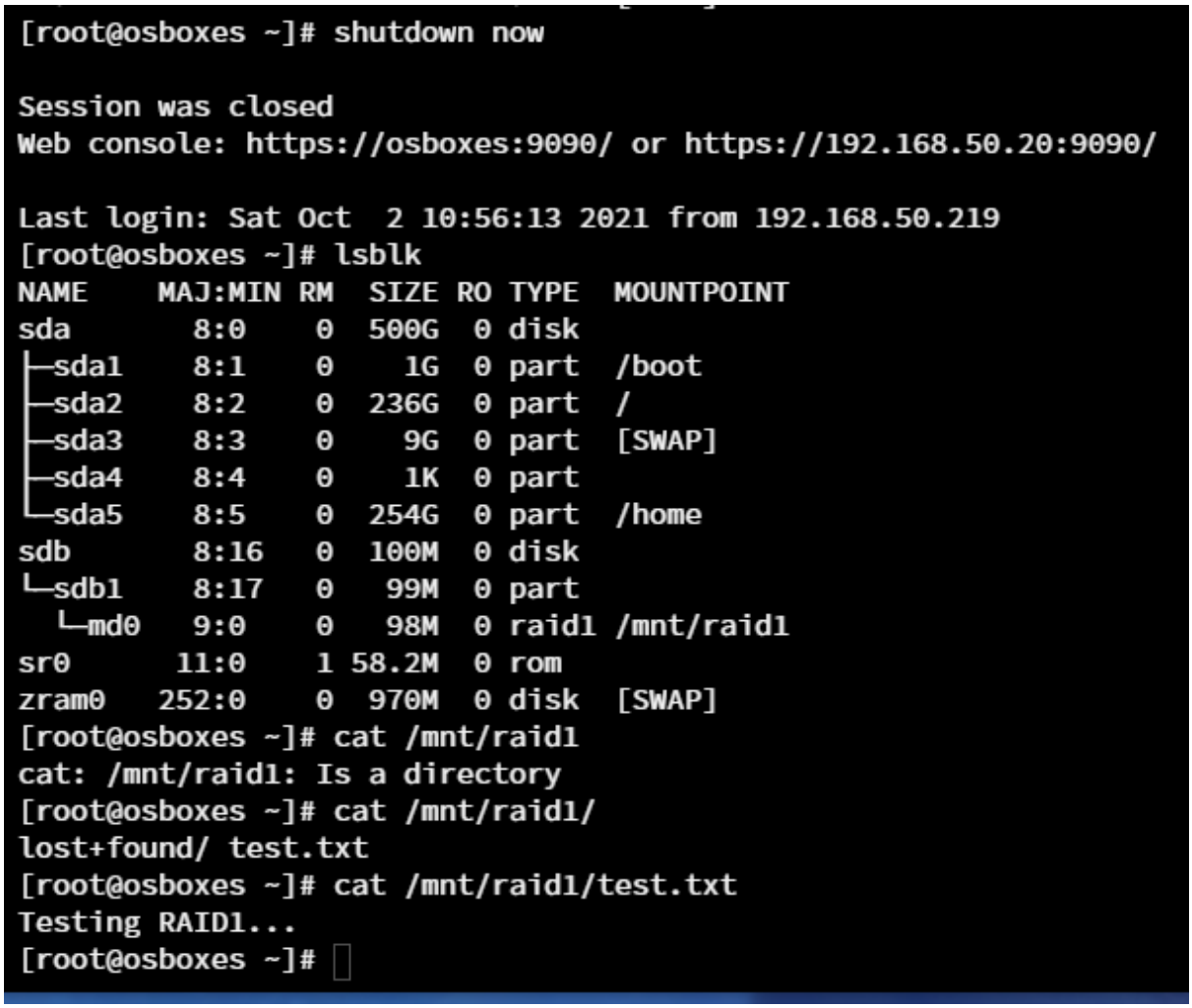
```
[root@osboxes ~]# mdadm --detail --scan --verbose >> /etc/mdadm.conf
[root@osboxes ~]# mdadm --detail --scan --verbose
ARRAY /dev/md0 level=raid1 num-devices=2 metadata=1.2 name=osboxes:0 UUID=5f0e915f:1dba5525:cd780c73:2b278cfc
   devices=/dev/sdb1,/dev/sdc1
[root@osboxes ~]# reboot now
```

После настройки и сохранения конфигурации виртуальная машина была перезагружена с целью проверить корректность автоматического монтирования.

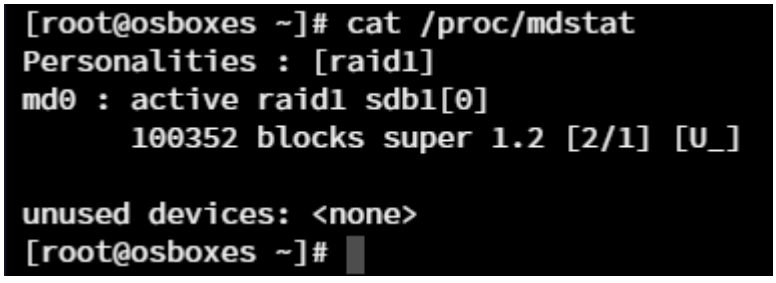

[root@osboxes ~]# reboot now
Session was closed
Web console: https://osboxes:9090/ or https://192.168.50.20:9090/
Last login: Sat Oct 2 10:36:50 2021 from 192.168.50.219
[root@osboxes ~]# lsblk
NAME MAJ:MIN RM SIZE RO TYPE MOUNTPOINT
sda 8:0 0 500G 0 disk
├─sda1 8:1 0 1G 0 part /boot
├─sda2 8:2 0 236G 0 part /
├─sda3 8:3 0 9G 0 part [SWAP]
├─sda4 8:4 0 1K 0 part
└─sda5 8:5 0 254G 0 part /home
sdb 8:16 0 100M 0 disk
└─sdb1 8:17 0 99M 0 part
└─md0 9:0 0 98M 0 raid1 /mnt/raid1
sdc 8:32 0 100M 0 disk
└─sdc1 8:33 0 99M 0 part
└─md0 9:0 0 98M 0 raid1 /mnt/raid1
sr0 11:0 1 58.2M 0 rom
zram0 252:0 0 970M 0 disk [SWAP]
[root@osboxes ~]#

7. Проверка отказоустойчивости.

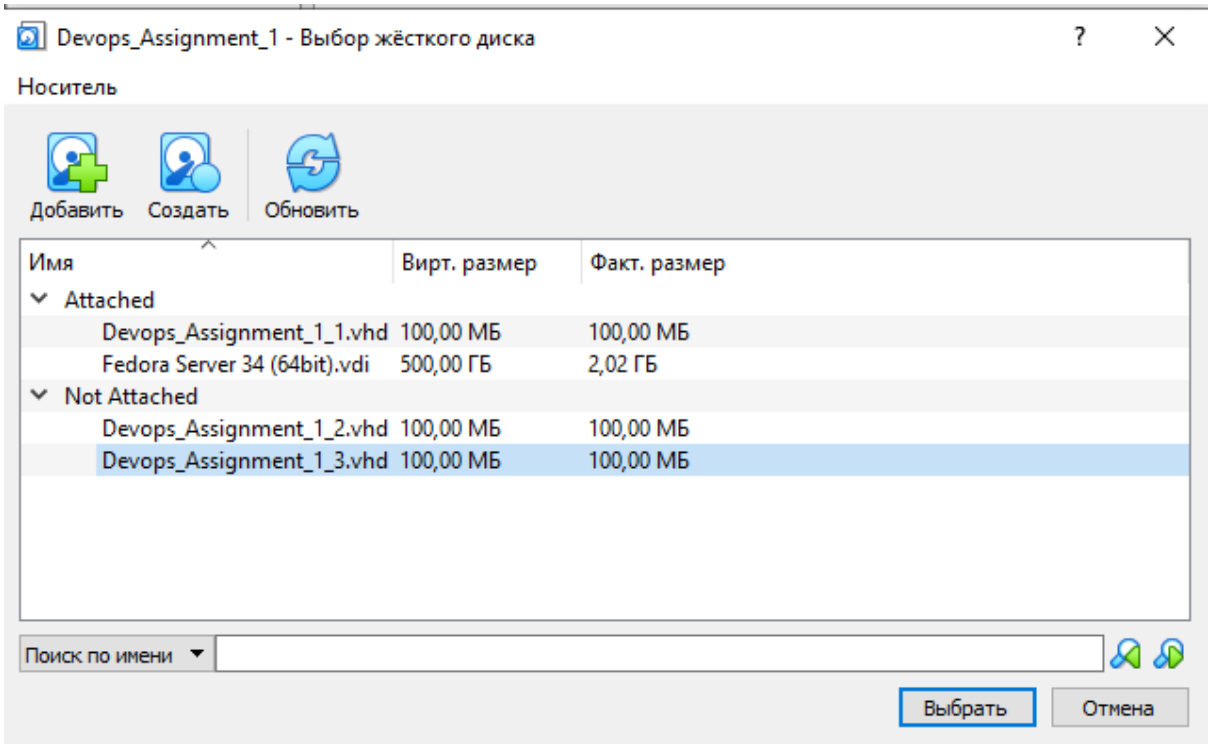
Для выполнения данной проверки виртуальная машина была выключена, затем с помощью virtualBox был удален один из жестких дисков, который использовался в RAID массиве



Как можно видеть на изображении выше, несмотря на отсутствие одного из дисков, тестовый файл все еще доступен в файловой системе.



8. Добавим «новый» диск в существующий RAID массив.




```
NAME    MAJ:MIN RM  SIZE RO TYPE  MOUNTPOINT
sda       8:0    0  500G  0 disk
├─sda1    8:1    0    1G  0 part  /boot
├─sda2    8:2    0  236G  0 part  /
├─sda3    8:3    0    9G  0 part  [SWAP]
├─sda4    8:4    0    1K  0 part
└─sda5    8:5    0  254G  0 part  /home
sdb       8:16   0  100M  0 disk
└─sdb1    8:17   0   99M  0 part
  └─md0   9:0    0   98M  0 raid1 /mnt/raid1
sdc       8:32   0  100M  0 disk
sr0      11:0    1 58.2M  0 rom
zram0   252:0    0  970M  0 disk  [SWAP]
[root@osboxes ~]#
```

На изображении выше видим новый диск под название *sdc*. Создадим на нем раздел уже известной утилитой *fdisk*.

```
[root@osboxes ~]# lsblk
NAME    MAJ:MIN RM  SIZE RO TYPE  MOUNTPOINT
sda       8:0    0  500G  0 disk
├─sda1    8:1    0    1G  0 part  /boot
├─sda2    8:2    0  236G  0 part  /
├─sda3    8:3    0    9G  0 part  [SWAP]
├─sda4    8:4    0    1K  0 part
└─sda5    8:5    0  254G  0 part  /home
sdb       8:16   0  100M  0 disk
└─sdb1    8:17   0   99M  0 part
  └─md0   9:0    0   98M  0 raid1 /mnt/raid1
sdc       8:32   0  100M  0 disk
└─sdc1    8:33   0   99M  0 part
sr0      11:0    1 58.2M  0 rom
zram0   252:0    0  970M  0 disk  [SWAP]
[root@osboxes ~]# mdadm --manage /dev/md0 --add /dev/sdc1
mdadm: added /dev/sdc1
[root@osboxes ~]# cat /proc/mdstat
Personalities : [raid1]
md0 : active raid1 sdc1[2] sdb1[0]
      100352 blocks super 1.2 [2/2] [UU]

unused devices: <none>
[root@osboxes ~]# cat /mnt/raid1/
lost+found/ test.txt
[root@osboxes ~]# cat /mnt/raid1/test.txt
Testing RAID1...
[root@osboxes ~]#
```

После того как раздел на диске *sdc* был создан добавим его в существующий raid массив с помощью утилиты *mdadm* и проверим что наш тестовый файл не изменился и все еще доступен

Заключение

В результате лабораторной работы была изучена работа с виртуальной машиной посредством программы VirtualBox, а также изучен механизм создания RAID массивов посредством утилит операционной системы Fedora.

Приложение 1

Дамп терминала

```
[root@osboxes ~]# lsblk
NAME   MAJ:MIN RM  SIZE RO TYPE MOUNTPOINT
sda      8:0    0  500G  0 disk
├─sda1   8:1    0    1G  0 part /boot
├─sda2   8:2    0  236G  0 part /
├─sda3   8:3    0    9G  0 part [SWAP]
├─sda4   8:4    0    1K  0 part
└─sda5   8:5    0  254G  0 part /home
sdb      8:16   0  100M  0 disk
sdc      8:32   0  100M  0 disk
sr0     11:0    1 58.2M  0 rom
zram0  252:0    0  970M  0 disk [SWAP]
[root@osboxes ~]# yum install mdadm
Last metadata expiration check: 2:10:20 ago on Sat 02 Oct 2021 08:29:37 AM EDT.
Package mdadm-4.1-7.fc34.x86_64 is already installed.
Dependencies resolved.
Nothing to do.
Complete!
[root@osboxes ~]# man mdadm
[root@osboxes ~]# fdisk /dev/sdb

Welcome to fdisk (util-linux 2.36.2).
Changes will remain in memory only, until you decide to write them.
Be careful before using the write command.

Device does not contain a recognized partition table.
Created a new DOS disklabel with disk identifier 0xf0576a24.

Command (m for help): n
Partition type
   p   primary (0 primary, 0 extended, 4 free)
   e   extended (container for logical partitions)
Select (default p): p
Partition number (1-4, default 1): 1
First sector (2048-204799, default 2048): 204799

Created a new partition 1 of type 'Linux' and of size 512 B.

Command (m for help):
All unwritten changes will be lost, do you really want to quit?

[root@osboxes ~]# lsblk
NAME   MAJ:MIN RM  SIZE RO TYPE MOUNTPOINT
sda      8:0    0  500G  0 disk
├─sda1   8:1    0    1G  0 part /boot
├─sda2   8:2    0  236G  0 part /
├─sda3   8:3    0    9G  0 part [SWAP]
├─sda4   8:4    0    1K  0 part
└─sda5   8:5    0  254G  0 part /home
sdb      8:16   0  100M  0 disk
sdc      8:32   0  100M  0 disk
sr0     11:0    1 58.2M  0 rom
zram0  252:0    0  970M  0 disk [SWAP]
[root@osboxes ~]# fdisk /dev/sdb

Welcome to fdisk (util-linux 2.36.2).
Changes will remain in memory only, until you decide to write them.
Be careful before using the write command.

Device does not contain a recognized partition table.
Created a new DOS disklabel with disk identifier 0x60deb456.

Command (m for help): n
Partition type
```

```
   p   primary (0 primary, 0 extended, 4 free)
   e   extended (container for logical partitions)
Select (default p): p
Partition number (1-4, default 1): 1
First sector (2048-204799, default 2048):
Last sector, +/-sectors or +/-size{K,M,G,T,P} (2048-204799, default 204799):

Created a new partition 1 of type 'Linux' and of size 99 MiB.

Command (m for help): p
Disk /dev/sdb: 100 MiB, 104857600 bytes, 204800 sectors
Disk model: VBOX HARDDISK
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disklabel type: dos
Disk identifier: 0x60deb456

Device     Boot Start    End Sectors Size Id Type
/dev/sdb1        2048 204799  202752  99M 83 Linux

Command (m for help): t
Selected partition 1
Hex code or alias (type L to list all): fd
Changed type of partition 'Linux' to 'Linux raid autodetect'.

Command (m for help): p
Disk /dev/sdb: 100 MiB, 104857600 bytes, 204800 sectors
Disk model: VBOX HARDDISK
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disklabel type: dos
Disk identifier: 0x60deb456

Device     Boot Start    End Sectors Size Id Type
/dev/sdb1        2048 204799  202752  99M fd Linux raid autodetect

Command (m for help): w
The partition table has been altered.
Calling ioctl() to re-read partition table.
Syncing disks.

[root@osboxes ~]# lsblk
NAME   MAJ:MIN RM  SIZE RO TYPE MOUNTPOINT
sda      8:0    0  500G  0 disk
├─sda1   8:1    0    1G  0 part /boot
├─sda2   8:2    0  236G  0 part /
├─sda3   8:3    0    9G  0 part [SWAP]
├─sda4   8:4    0    1K  0 part
└─sda5   8:5    0  254G  0 part /home
sdb      8:16   0  100M  0 disk
└─sdb1   8:17   0   99M  0 part
sdc      8:32   0  100M  0 disk
sr0     11:0    1 58.2M  0 rom
zram0  252:0    0  970M  0 disk [SWAP]
[root@osboxes ~]# fdisk /dev/sdc

Welcome to fdisk (util-linux 2.36.2).
Changes will remain in memory only, until you decide to write them.
Be careful before using the write command.

Device does not contain a recognized partition table.
Created a new DOS disklabel with disk identifier 0x2fdebaca.

Command (m for help): n
Partition type
   p   primary (0 primary, 0 extended, 4 free)
   e   extended (container for logical partitions)
Select (default p): p
```

```
Partition number (1-4, default 1):
First sector (2048-204799, default 2048):
Last sector, +/-sectors or +/-size{K,M,G,T,P} (2048-204799, default 204799):

Created a new partition 1 of type 'Linux' and of size 99 MiB.

Command (m for help): t
Selected partition 1
Hex code or alias (type L to list all): L

00 Empty            24 NEC DOS          81 Minix / old Lin  bf Solaris
01 FAT12            27 Hidden NTFS Win  82 Linux swap / So  c1 DRDOS/sec (FAT-
02 XENIX root       39 Plan 9           83 Linux            c4 DRDOS/sec (FAT-
03 XENIX usr        3c PartitionMagic   84 OS/2 hidden or   c6 DRDOS/sec (FAT-
04 FAT16 <32M       40 Venix 80286      85 Linux extended   c7 Syrinx
05 Extended         41 PPC PReP Boot    86 NTFS volume set  da Non-FS data
06 FAT16            42 SFS              87 NTFS volume set  db CP/M / CTOS / .
07 HPFS/NTFS/exFAT  4d QNX4.x           88 Linux plaintext  de Dell Utility
08 AIX              4e QNX4.x 2nd part  8e Linux LVM        df BootIt
09 AIX bootable     4f QNX4.x 3rd part  93 Amoeba           e1 DOS access
0a OS/2 Boot Manag  50 OnTrack DM       94 Amoeba BBT       e3 DOS R/O
0b W95 FAT32        51 OnTrack DM6 Aux  9f BSD/OS           e4 SpeedStor
0c W95 FAT32 (LBA)  52 CP/M             a0 IBM Thinkpad hi  ea Linux extended
0e W95 FAT16 (LBA)  53 OnTrack DM6 Aux  a5 FreeBSD          eb BeOS fs
0f W95 Ext'd (LBA)  54 OnTrackDM6       a6 OpenBSD          ee GPT
10 OPUS             55 EZ-Drive         a7 NeXTSTEP         ef EFI (FAT-12/16/
11 Hidden FAT12     56 Golden Bow       a8 Darwin UFS       f0 Linux/PA-RISC b
12 Compaq diagnost  5c Priam Edisk      a9 NetBSD           f1 SpeedStor
14 Hidden FAT16 <3  61 SpeedStor        ab Darwin boot      f4 SpeedStor
16 Hidden FAT16     63 GNU HURD or Sys  af HFS / HFS+       f2 DOS secondary
17 Hidden HPFS/NTF  64 Novell Netware   b7 BSDI fs          fb VMware VMFS
18 AST SmartSleep   65 Novell Netware   b8 BSDI swap        fc VMware VMKCORE
1b Hidden W95 FAT3  70 DiskSecure Mult  bb Boot Wizard hid  fd Linux raid auto
1c Hidden W95 FAT3  75 PC/IX            bc Acronis FAT32 L  fe LANstep
1e Hidden W95 FAT1  80 Old Minix        be Solaris boot     ff BBT

Aliases:
   linux          - 83
   swap           - 82
   extended       - 05
   uefi           - EF
   raid           - FD
   lvm            - 8E
   linuxex        - 85
Hex code or alias (type L to list all): fd
Changed type of partition 'Linux' to 'Linux raid autodetect'.

Command (m for help): w
The partition table has been altered.
Calling ioctl() to re-read partition table.
Syncing disks.

[root@osboxes ~]# lsblk
NAME   MAJ:MIN RM  SIZE RO TYPE MOUNTPOINT
sda      8:0    0  500G  0 disk
├─sda1   8:1    0    1G  0 part /boot
├─sda2   8:2    0  236G  0 part /
├─sda3   8:3    0    9G  0 part [SWAP]
├─sda4   8:4    0    1K  0 part
└─sda5   8:5    0  254G  0 part /home
sdb      8:16   0  100M  0 disk
└─sdb1   8:17   0   99M  0 part
sdc      8:32   0  100M  0 disk
└─sdc1   8:33   0   99M  0 part
sr0     11:0    1 58.2M  0 rom
zram0  252:0    0  970M  0 disk [SWAP]
[root@osboxes ~]# mdadm -E /dev/sd[b-c]
/dev/sdb:
   MBR Magic : aa55
Partition[0] :       202752 sectors at         2048 (type fd)
```

```
/dev/sdc:
   MBR Magic : aa55
Partition[0] :       202752 sectors at         2048 (type fd)
[root@osboxes ~]# mdadm -E /dev/sd[b-c]1
mdadm: No md superblock detected on /dev/sdb1.
mdadm: No md superblock detected on /dev/sdc1.
[root@osboxes ~]# mdadm --create /dev/md0 --level=mirror --raid-devices=2 /dev/sd[b-c]1
mdadm: Note: this array has metadata at the start and
    may not be suitable as a boot device.  If you plan to
    store '/boot' on this device please ensure that
    your boot-loader understands md/v1.x metadata, or use
    --metadata=0.90
Continue creating array?
Continue creating array? (y/n) y
mdadm: Defaulting to version 1.2 metadata
mdadm: array /dev/md0 started.
[root@osboxes ~]# cat /proc/mdstat
Personalities : [raid1]
md0 : active raid1 sdc1[1] sdb1[0]
      100352 blocks super 1.2 [2/2] [UU]

unused devices: <none>
[root@osboxes ~]# lsblk
NAME    MAJ:MIN RM  SIZE RO TYPE  MOUNTPOINT
sda       8:0    0  500G  0 disk
├─sda1    8:1    0    1G  0 part  /boot
├─sda2    8:2    0  236G  0 part  /
├─sda3    8:3    0    9G  0 part  [SWAP]
├─sda4    8:4    0    1K  0 part
└─sda5    8:5    0  254G  0 part  /home
sdb       8:16   0  100M  0 disk
└─sdb1    8:17   0   99M  0 part
  └─md0   9:0    0   98M  0 raid1
sdc       8:32   0  100M  0 disk
└─sdc1    8:33   0   99M  0 part
  └─md0   9:0    0   98M  0 raid1
sr0      11:0    1 58.2M  0 rom
zram0   252:0    0  970M  0 disk  [SWAP]
[root@osboxes ~]# mdadm -E /dev/sd[b-c]1
/dev/sdb1:
          Magic : a92b4efc
        Version : 1.2
    Feature Map : 0x0
     Array UUID : 5f0e915f:1dba5525:cd780c73:2b278cfc
           Name : osboxes:0  (local to host osboxes)
  Creation Time : Sat Oct  2 10:47:50 2021
     Raid Level : raid1
   Raid Devices : 2

 Avail Dev Size : 200704 (98.00 MiB 102.76 MB)
     Array Size : 100352 (98.00 MiB 102.76 MB)
    Data Offset : 2048 sectors
   Super Offset : 8 sectors
   Unused Space : before=1968 sectors, after=0 sectors
          State : clean
    Device UUID : 6ee8357e:ed2a2765:0282fa4c:d8e61d27

    Update Time : Sat Oct  2 10:47:56 2021
  Bad Block Log : 512 entries available at offset 16 sectors
       Checksum : 61b617a0 - correct
         Events : 17


   Device Role : Active device 0
   Array State : AA ('A' == active, '.' == missing, 'R' == replacing)
/dev/sdc1:
          Magic : a92b4efc
        Version : 1.2
    Feature Map : 0x0
     Array UUID : 5f0e915f:1dba5525:cd780c73:2b278cfc
```

```
           Name : osboxes:0  (local to host osboxes)
  Creation Time : Sat Oct  2 10:47:50 2021
     Raid Level : raid1
   Raid Devices : 2

 Avail Dev Size : 200704 (98.00 MiB 102.76 MB)
     Array Size : 100352 (98.00 MiB 102.76 MB)
    Data Offset : 2048 sectors
   Super Offset : 8 sectors
   Unused Space : before=1968 sectors, after=0 sectors
          State : clean
    Device UUID : cde0953e:f8ed57b6:1a52cb1f:10ac7870

    Update Time : Sat Oct  2 10:47:56 2021
  Bad Block Log : 512 entries available at offset 16 sectors
       Checksum : 8f72685b - correct
         Events : 17


   Device Role : Active device 1
   Array State : AA ('A' == active, '.' == missing, 'R' == replacing)
[root@osboxes ~]# mdadm --detail /dev/md0
/dev/md0:
           Version : 1.2
     Creation Time : Sat Oct  2 10:47:50 2021
        Raid Level : raid1
        Array Size : 100352 (98.00 MiB 102.76 MB)
     Used Dev Size : 100352 (98.00 MiB 102.76 MB)
      Raid Devices : 2
     Total Devices : 2
       Persistence : Superblock is persistent

       Update Time : Sat Oct  2 10:47:56 2021
             State : clean
    Active Devices : 2
   Working Devices : 2
    Failed Devices : 0
     Spare Devices : 0

Consistency Policy : resync

              Name : osboxes:0  (local to host osboxes)
              UUID : 5f0e915f:1dba5525:cd780c73:2b278cfc
            Events : 17

    Number   Major   Minor   RaidDevice State
       0       8       17        0      active sync   /dev/sdb1
       1       8       33        1      active sync   /dev/sdc1
[root@osboxes ~]# mkfs
mkfs: no device specified
Try 'mkfs --help' for more information.
[root@osboxes ~]# man mkfs
[root@osboxes ~]# mkfs.ext4 /dev/md0
mke2fs 1.45.6 (20-Mar-2020)
Creating filesystem with 100352 1k blocks and 25168 inodes
Filesystem UUID: 449d5cc7-cb37-45a7-87cd-d7701f8c200d
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@osboxes ~]# mount /dev/md0 /mnt/raid1/
mount: /mnt/raid1/: mount point does not exist.
[root@osboxes ~]# mkdir /mnt/raid1
[root@osboxes ~]# mount /dev/md0 /mnt/raid1/
[root@osboxes ~]# echo "Testing RAID1..." >> /mnt/raid1/test.txt
[root@osboxes ~]# ls /mnt/raid1
```

```
lost+found  test.txt
[root@osboxes ~]# ls -l /mnt/raid1
total 14
drwx------. 2 root root 12288 Oct  2 10:50 lost+found
-rw-r--r--. 1 root root    17 Oct  2 10:51 test.txt
[root@osboxes ~]# nano /etc/f
favicon.png     filesystems     fonts/          fstab
fedora-release  firewalld/      fprintd.conf    fuse.conf
[root@osboxes ~]# nano /etc/fstab
[root@osboxes ~]# nano /etc/fstab
[root@osboxes ~]# mount -av
/                        : ignored
/boot                    : already mounted
/home                    : already mounted
none                     : ignored
/mnt/raid1               : already mounted
[root@osboxes ~]#
[root@osboxes ~]# mdadm --detail --scan --verbose >> /etc/mdadm.conf
[root@osboxes ~]# mdadm --detail --scan --verbose
ARRAY /dev/md0 level=raid1 num-devices=2 metadata=1.2 name=osboxes:0
UUID=5f0e915f:1dba5525:cd780c73:2b278cfc   devices=/dev/sdb1,/dev/sdc1
[root@osboxes ~]# reboot now

Session was closed
Web console: https://osboxes:9090/ or https://192.168.50.20:9090/

Last login: Sat Oct  2 10:36:50 2021 from 192.168.50.219
[root@osboxes ~]# lsblk
NAME    MAJ:MIN RM  SIZE RO TYPE  MOUNTPOINT
sda       8:0    0  500G  0 disk
├─sda1    8:1    0    1G  0 part  /boot
├─sda2    8:2    0  236G  0 part  /
├─sda3    8:3    0    9G  0 part  [SWAP]
├─sda4    8:4    0    1K  0 part
└─sda5    8:5    0  254G  0 part  /home
sdb       8:16   0  100M  0 disk
└─sdb1    8:17   0   99M  0 part
  └─md0   9:0    0   98M  0 raid1 /mnt/raid1
sdc       8:32   0  100M  0 disk
└─sdc1    8:33   0   99M  0 part
  └─md0   9:0    0   98M  0 raid1 /mnt/raid1
sr0      11:0    1 58.2M  0 rom
zram0   252:0    0  970M  0 disk  [SWAP]
[root@osboxes ~]# shutdown now

Session was closed
Web console: https://osboxes:9090/ or https://192.168.50.20:9090/

Last login: Sat Oct  2 10:56:13 2021 from 192.168.50.219
[root@osboxes ~]# lsblk
NAME    MAJ:MIN RM  SIZE RO TYPE  MOUNTPOINT
sda       8:0    0  500G  0 disk
├─sda1    8:1    0    1G  0 part  /boot
├─sda2    8:2    0  236G  0 part  /
├─sda3    8:3    0    9G  0 part  [SWAP]
├─sda4    8:4    0    1K  0 part
└─sda5    8:5    0  254G  0 part  /home
sdb       8:16   0  100M  0 disk
└─sdb1    8:17   0   99M  0 part
  └─md0   9:0    0   98M  0 raid1 /mnt/raid1
sr0      11:0    1 58.2M  0 rom
zram0   252:0    0  970M  0 disk  [SWAP]
[root@osboxes ~]# cat /mnt/raid1
cat: /mnt/raid1: Is a directory
[root@osboxes ~]# cat /mnt/raid1/
lost+found/ test.txt
[root@osboxes ~]# cat /mnt/raid1/test.txt
Testing RAID1...
[root@osboxes ~]# shutdown now
```

```
Session was closed
Web console: https://osboxes:9090/ or https://192.168.50.20:9090/

Last login: Sat Oct  2 11:15:14 2021 from 192.168.50.219
[root@osboxes ~]# ^[[200~cat /proc/mdstat~
-bash: $'\E[200~cat': command not found
[root@osboxes ~]# cat /proc/mdstat
Personalities : [raid1]
md0 : active raid1 sdb1[0]
      100352 blocks super 1.2 [2/1] [U_]

unused devices: <none>
[root@osboxes ~]# mdadm --detail /dev/md0
/dev/md0:
           Version : 1.2
     Creation Time : Sat Oct  2 10:47:50 2021
        Raid Level : raid1
        Array Size : 100352 (98.00 MiB 102.76 MB)
     Used Dev Size : 100352 (98.00 MiB 102.76 MB)
      Raid Devices : 2
     Total Devices : 1
       Persistence : Superblock is persistent

       Update Time : Sat Oct  2 11:18:29 2021
             State : clean, degraded
    Active Devices : 1
   Working Devices : 1
    Failed Devices : 0
     Spare Devices : 0

Consistency Policy : resync

              Name : osboxes:0  (local to host osboxes)
              UUID : 5f0e915f:1dba5525:cd780c73:2b278cfc
            Events : 27

    Number   Major   Minor   RaidDevice State
       0       8       17        0      active sync   /dev/sdb1
       -       0        0        1      removed
[root@osboxes ~]# lsblk
NAME    MAJ:MIN RM  SIZE RO TYPE  MOUNTPOINT
sda       8:0    0  500G  0 disk
├─sda1    8:1    0    1G  0 part  /boot
├─sda2    8:2    0  236G  0 part  /
├─sda3    8:3    0    9G  0 part  [SWAP]
├─sda4    8:4    0    1K  0 part
└─sda5    8:5    0  254G  0 part  /home
sdb       8:16   0  100M  0 disk
└─sdb1    8:17   0   99M  0 part
  └─md0   9:0    0   98M  0 raid1 /mnt/raid1
sdc       8:32   0  100M  0 disk
sr0      11:0    1 58.2M  0 rom
zram0   252:0    0  970M  0 disk  [SWAP]
[root@osboxes ~]# fdisk /dev/sdc

Welcome to fdisk (util-linux 2.36.2).
Changes will remain in memory only, until you decide to write them.
Be careful before using the write command.

Device does not contain a recognized partition table.
Created a new DOS disklabel with disk identifier 0x22081a3c.

Command (m for help): n
Partition type
   p   primary (0 primary, 0 extended, 4 free)
   e   extended (container for logical partitions)
Select (default p): p
Partition number (1-4, default 1):
First sector (2048-204799, default 2048):
Last sector, +/-sectors or +/-size{K,M,G,T,P} (2048-204799, default 204799):
```

```
Created a new partition 1 of type 'Linux' and of size 99 MiB.

Command (m for help): p
Disk /dev/sdc: 100 MiB, 104857600 bytes, 204800 sectors
Disk model: VBOX HARDDISK
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disklabel type: dos
Disk identifier: 0x22081a3c

Device     Boot Start    End Sectors Size Id Type
/dev/sdc1        2048 204799  202752  99M 83 Linux

Command (m for help): t
Selected partition 1
Hex code or alias (type L to list all): fd
Changed type of partition 'Linux' to 'Linux raid autodetect'.

Command (m for help): w
The partition table has been altered.
Calling ioctl() to re-read partition table.
Syncing disks.

[root@osboxes ~]# lsblk
NAME    MAJ:MIN RM  SIZE RO TYPE  MOUNTPOINT
sda       8:0    0  500G  0 disk
├─sda1    8:1    0    1G  0 part  /boot
├─sda2    8:2    0  236G  0 part  /
├─sda3    8:3    0    9G  0 part  [SWAP]
├─sda4    8:4    0    1K  0 part
└─sda5    8:5    0  254G  0 part  /home
sdb       8:16   0  100M  0 disk
└─sdb1    8:17   0   99M  0 part
  └─md0   9:0    0   98M  0 raid1 /mnt/raid1
sdc       8:32   0  100M  0 disk
└─sdc1    8:33   0   99M  0 part
sr0      11:0    1 58.2M  0 rom
zram0   252:0    0  970M  0 disk  [SWAP]
[root@osboxes ~]# mdadm --manage /dev/md0 --add /dev/sdc1
mdadm: added /dev/sdc1
[root@osboxes ~]# cat /proc/mdstat
Personalities : [raid1]
md0 : active raid1 sdc1[2] sdb1[0]
      100352 blocks super 1.2 [2/2] [UU]

unused devices: <none>
[root@osboxes ~]# cat /mnt/raid1/
lost+found/ test.txt
[root@osboxes ~]# cat /mnt/raid1/test.txt
Testing RAID1...
[root@osboxes ~]#
```