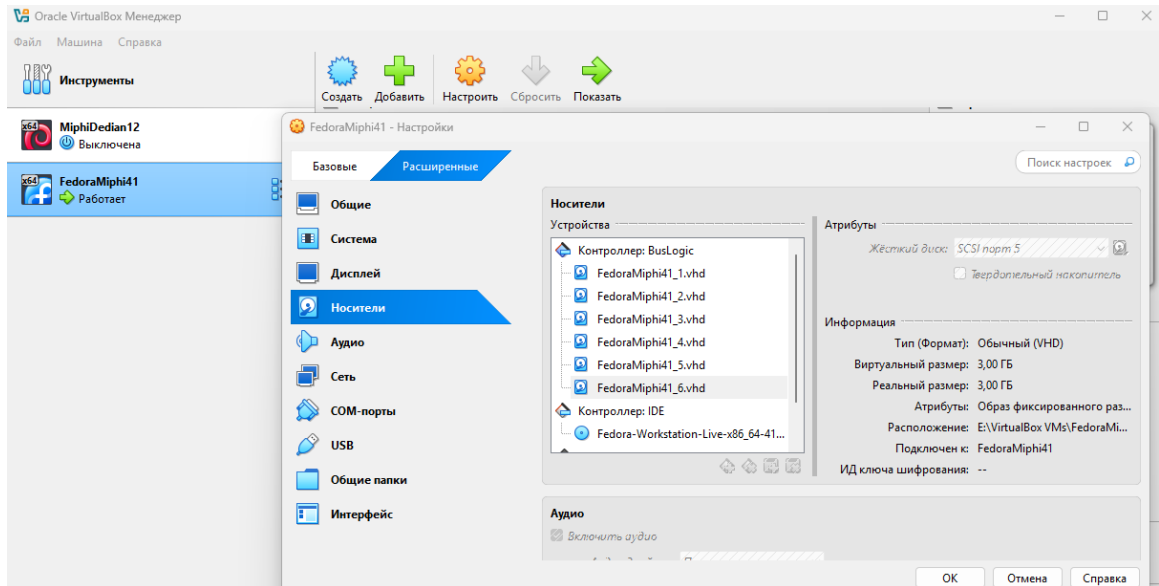


RAID+LVM

1. Настройка LVM:

- *Создайте физические тома на отдельных физических дисках (не обязательно использовать RAID на этом этапе).*



```
liveuser@localhost-live:~  
  
liveuser@localhost-live:~$ lsblk  
NAME        MAJ:MIN RM  SIZE RO TYPE  MOUNTPOINTS  
loop0       7:0    0   2.1G  1 loop  /run/rootfsbase  
sda         8:0    0   25G   0 disk  
├─sda1      8:1    0    1M   0 part  
├─sda2      8:2    0    1G   0 part  
└─sda3      8:3    0   24G   0 part  
sdb         8:16   0    1G   0 disk  
├─md127     9:127  0    2G   0 raid5  
│   └─vg0_storage-lv0_files 253:0    0    2G   0 lvm  
└─md127     9:127  0    2G   0 raid5  
   └─vg0_storage-lv0_files 253:0    0    2G   0 lvm  
sdc         8:32   0    1G   0 disk  
├─md127     9:127  0    2G   0 raid5  
│   └─vg0_storage-lv0_files 253:0    0    2G   0 lvm  
└─md127     9:127  0    2G   0 raid5  
   └─vg0_storage-lv0_files 253:0    0    2G   0 lvm  
sdd         8:48   0    1G   0 disk  
├─md127     9:127  0    2G   0 raid5  
│   └─vg0_storage-lv0_files 253:0    0    2G   0 lvm  
└─md127     9:127  0    2G   0 raid5  
   └─vg0_storage-lv0_files 253:0    0    2G   0 lvm  
sde         8:64   0    1G   0 disk  
├─md127     9:127  0    2G   0 raid5  
│   └─vg0_storage-lv0_files 253:0    0    2G   0 lvm  
└─md127     9:127  0    2G   0 raid5  
   └─vg0_storage-lv0_files 253:0    0    2G   0 lvm  
sdf         8:80   0    2G   0 disk  
sdg         8:96   0    3G   0 disk  
sr0         11:0   1    2.3G  0 rom   /run/initramfs/live  
zram0       252:0   0    1.9G  0 disk  [SWAP]  
  
liveuser@localhost-live:~$ sudo pvcreate /dev/sd{f,g}  
Physical volume "/dev/sdf" successfully created.  
Physical volume "/dev/sdg" successfully created.  
Not creating system devices file due to existing VGs.  
  
liveuser@localhost-live:~$ sudo pvs  
PV          VG          Fmt  Attr PSize PFree  
/dev/md127  vg0_storage lvm2  a--  1.99g  0  
/dev/sdf    lvm2  ---  2.00g  2.00g  
/dev/sdg    lvm2  ---  3.00g  3.00g
```

- *Создайте группу томов (VG) на основе физических томов.*

```
liveuser@localhost-live:~$ sudo vgcreate vg2_storage /dev/sd{f,g}
Not creating system devices file due to existing VGs.
Volume group "vg2_storage" successfully created
```

```
liveuser@localhost-live:~$ sudo vgs
VG          #PV #LV #SN Attr   VSize VFree
vg0_storage 1  1  0 wz--n- 1.99g 0
vg2_storage 2  0  0 wz--n- 4.99g 4.99g
```

- *Создайте логический том (LV) на основе группы томов.*

```
liveuser@localhost-live:~$ sudo lvcreate -L 2G -n lv1 vg2_storage
Logical volume "lv1" created.
liveuser@localhost-live:~$ sudo lvcreate -L 2G -n lv2 vg2_storage
Logical volume "lv2" created.
liveuser@localhost-live:~$ sudo lvs
LV          VG          Attr          LSize Pool Origin Data%  Meta%  Move Log Cpy%
Sync Convert
lv0_files   vg0_storage  -wi-a----- 1.99g
lv1         vg2_storage  -wi-a----- 2.00g
lv2         vg2_storage  -wi-a----- 2.00g
```

2. Настройка RAID

- Создайте RAID-массив на основе логических томов (например, RAID 1 или RAID 5).

```
liveuser@localhost-live:~$ lsblk
NAME                                MAJ:MIN RM  SIZE RO TYPE  MOUNTPOINTS
loop0                               7:0      0   2.1G  1 loop  /run/rootfsbase
sda                                  8:0      0   25G   0 disk
├─sda1                              8:1      0    1M   0 part
├─sda2                              8:2      0    1G   0 part
└─sda3                              8:3      0   24G   0 part
sdb                                  8:16     0    1G   0 disk
├─md127                             9:127    0    2G   0 raid5
│   └─vg0_storage-lv0_files         253:0    0    2G   0 lvm
sdc                                  8:32     0    1G   0 disk
├─md127                             9:127    0    2G   0 raid5
│   └─vg0_storage-lv0_files         253:0    0    2G   0 lvm
sdd                                  8:48     0    1G   0 disk
├─md127                             9:127    0    2G   0 raid5
│   └─vg0_storage-lv0_files         253:0    0    2G   0 lvm
sde                                  8:64     0    1G   0 disk
├─md127                             9:127    0    2G   0 raid5
│   └─vg0_storage-lv0_files         253:0    0    2G   0 lvm
sdf                                  8:80     0    2G   0 disk
└─vg2_storage-lv2                   253:2    0    2G   0 lvm
sdg                                  8:96     0    3G   0 disk
├─vg2_storage-lv1                   253:1    0    2G   0 lvm
└─vg2_storage-lv2                   253:2    0    2G   0 lvm
sr0                                 11:0     1   2.3G   0 rom   /run/initramfs/live
zram0                               252:0    0    1.9G   0 disk  [SWAP]

liveuser@localhost-live:~$ sudo mdadm --create --verbose /dev/md2 --level=1 --
raid-devices=2 /dev/vg2_storage/lv1 /dev/vg2_storage/lv2
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
mdadm: size set to 2094080K
Continue creating array? y
mdadm: Defaulting to version 1.2 metadata
mdadm: array /dev/md2 started.
```

- Проверьте, что RAID-массив успешно создан и работает корректно.

```
liveuser@localhost-live:~$ cat /proc/mdstat
Personalities : [raid6] [raid5] [raid4] [raid1]
md2 : active raid1 dm-2[1] dm-1[0]
      2094080 blocks super 1.2 [2/2] [UU]

md127 : active raid5 sdd[4](S) sde[3] sdb[0] sdc[1]
      2093056 blocks super 1.2 level 5, 512k chunk, algorithm 2 [3/3] [UUU]

unused devices: <none>
liveuser@localhost-live:~$ sudo mdadm --detail /dev/md2
/dev/md2:
        Version : 1.2
  Creation Time : Sun Jan  5 19:04:23 2025
    Raid Level : raid1
    Array Size : 2094080 (2045.00 MiB 2144.34 MB)
  Used Dev Size : 2094080 (2045.00 MiB 2144.34 MB)
    Raid Devices : 2
    Total Devices : 2
 Persistence : Superblock is persistent

    Update Time : Sun Jan  5 19:04:37 2025
      State : clean
 Active Devices : 2
Working Devices : 2
 Failed Devices : 0
  Spare Devices : 0

Consistency Policy : resync

        Name : localhost-live:2 (local to host localhost-live)
        UUID : 554aae91:09e4c034:7a2d4e44:a8869275
        Events : 17

   Number  Major   Minor   RaidDevice State
     0       253       1         0     active sync  /dev/dm-1
     1       253       2         1     active sync  /dev/dm-2
```

3. Форматирование и монтирование файловой системы

- Отформатируйте RAID-массив в файловую систему (например, ext4).

```
liveuser@localhost-live:~$ sudo mkfs.ext4 /dev/md2
mke2fs 1.47.1 (20-May-2024)
Creating filesystem with 523520 4k blocks and 131072 inodes
Filesystem UUID: d87578fe-c336-400b-afc7-07b89cc81928
Superblock backups stored on blocks:
    32768, 98304, 163840, 229376, 294912

Allocating group tables: done
Writing inode tables: done
Creating journal (8192 blocks): done
Writing superblocks and filesystem accounting information: done
```

- Смонтируйте файловую систему в директорию (например, /mnt/data).

```
liveuser@localhost-live:~$ sudo mkdir /mnt/raid1
liveuser@localhost-live:~$ sudo mount /dev/md2 /mnt/raid1
liveuser@localhost-live:~$ ls -la /mnt/raid1
total 20
drwxr-xr-x. 3 root root 4096 Jan  5 19:20 .
drwxr-xr-x. 1 root root  60 Jan  5 19:30 ..
drwx-----. 2 root root 16384 Jan  5 19:20 lost+found
liveuser@localhost-live:~$ sudo chmod 0755 /mnt/raid1
liveuser@localhost-live:~$ sudo nano /mnt/raid1/test.txt
liveuser@localhost-live:~$ ls -la /mnt/raid1/
total 24
drwxr-xr-x. 3 root root 4096 Jan  5 19:34 .
drwxr-xr-x. 1 root root  60 Jan  5 19:30 ..
drwx-----. 2 root root 16384 Jan  5 19:20 lost+found
-rw-r--r--. 1 root root  11 Jan  5 19:34 test.txt
```

```
liveuser@localhost-live:~$ cat /mnt/raid1/test.txt
crash test
```

```
liveuser@localhost-live:~ — sudo nano /etc/fstab
GNU nano 8.1 /etc/fstab
vartmp /var/tmp tmpfs defaults 0 0

/dev/vg0_storage/lv0_files /mnt/raid5 ext4 defaults 0 0

/dev/md2 /mnt/raid1 ext4 defaults 0 2
|
```

4. Эмуляция отказа диска

- Эмулируйте отказ одного из дисков в RAID-массиве.

```
liveuser@localhost-live:~$ sudo mdadm --manage /dev/md2 --fail /dev/vg2_storage/lv1
mdadm: set /dev/vg2_storage/lv1 faulty in /dev/md2
liveuser@localhost-live:~$ cat /proc/mdstat
Personalities : [raid6] [raid5] [raid4] [raid1]
md2 : active raid1 dm-2[1] dm-1[0](F)
      2094080 blocks super 1.2 [2/1] [_U]

md127 : active raid5 sdd[4](S) sde[3] sdb[0] sdc[1]
      2093056 blocks super 1.2 level 5, 512k chunk, algorithm 2 [3/3] [UUU]

unused devices: <none>
```

- Проверьте, что система продолжает работать и доступ к данным сохраняется.

```
liveuser@localhost-live:~$ ls -la /mnt/raid1/
total 24
drwxr-xr-x. 3 root root 4096 Jan  5 19:34 .
drwxr-xr-x. 1 root root  60 Jan  5 19:30 ..
drwx-----. 2 root root 16384 Jan  5 19:20 lost+found
-rw-r--r--. 1 root root  11 Jan  5 19:34 test.txt
liveuser@localhost-live:~$ cat /mnt/raid1/test.txt
crash test
```

5. Восстановление и проверка

- *Восстановите отказавший диск и добавьте его обратно в RAID-массив.*

```
liveuser@localhost-live:~$ sudo mdadm --remove /dev/md2 /dev/vg2_storage/lv1
mdadm: hot removed /dev/vg2_storage/lv1 from /dev/md2
liveuser@localhost-live:~$ sudo mdadm /dev/md2 --add /dev/vg2_storage/lv1
mdadm: added /dev/vg2_storage/lv1
liveuser@localhost-live:~$ cat /proc/mdstat
Personalities : [raid6] [raid5] [raid4] [raid1]
md2 : active raid1 dm-1[2] dm-2[1]
      2094080 blocks super 1.2 [2/2] [UU]

md127 : active raid5 sdd[4](S) sde[3] sdb[0] sdc[1]
      2093056 blocks super 1.2 level 5, 512k chunk, algorithm 2 [3/3] [UUU]

unused devices: <none>
```

- *Проверьте процесс восстановления и убедитесь, что данные корректно синхронизированы.*

```
liveuser@localhost-live:~$ sudo mdadm --detail /dev/md2
/dev/md2:
    Version : 1.2
  Creation Time : Sun Jan  5 19:04:23 2025
    Raid Level : raid1
    Array Size : 2094080 (2045.00 MiB 2144.34 MB)
  Used Dev Size : 2094080 (2045.00 MiB 2144.34 MB)
    Raid Devices : 2
  Total Devices : 2
 Persistence : Superblock is persistent

    Update Time : Sun Jan  5 20:36:22 2025
      State : clean
 Active Devices : 2
Working Devices : 2
 Failed Devices : 0
  Spare Devices : 0

Consistency Policy : resync

        Name : localhost-live:2 (local to host localhost-live)
        UUID : 554aae91:09e4c034:7a2d4e44:a8869275
        Events : 39

   Number   Major   Minor   RaidDevice State
     2       253       1         0     active sync  /dev/dm-1
     1       253       2         1     active sync  /dev/dm-2
```

```
liveuser@localhost-live:~$ lsblk
```

NAME	MAJ:MIN	RM	SIZE	RO	TYPE	MOUNTPOINTS
loop0	7:0	0	2.1G	1	loop	/run/rootfsbase
sda	8:0	0	25G	0	disk	
├─sda1	8:1	0	1M	0	part	
├─sda2	8:2	0	1G	0	part	
└─sda3	8:3	0	24G	0	part	
sdb	8:16	0	1G	0	disk	
├─md127	9:127	0	2G	0	raid5	
│ └─vg0_storage-lv0_files	253:0	0	2G	0	lvm	
sdc	8:32	0	1G	0	disk	
├─md127	9:127	0	2G	0	raid5	
│ └─vg0_storage-lv0_files	253:0	0	2G	0	lvm	
sdd	8:48	0	1G	0	disk	
├─md127	9:127	0	2G	0	raid5	
│ └─vg0_storage-lv0_files	253:0	0	2G	0	lvm	
sde	8:64	0	1G	0	disk	
├─md127	9:127	0	2G	0	raid5	
│ └─vg0_storage-lv0_files	253:0	0	2G	0	lvm	
sdf	8:80	0	2G	0	disk	
├─vg2_storage-lv2	253:2	0	2G	0	lvm	
│ └─md2	9:2	0	2G	0	raid1	/mnt/raid1
sdg	8:96	0	3G	0	disk	
├─vg2_storage-lv1	253:1	0	2G	0	lvm	
│ └─md2	9:2	0	2G	0	raid1	/mnt/raid1
├─vg2_storage-lv2	253:2	0	2G	0	lvm	
│ └─md2	9:2	0	2G	0	raid1	/mnt/raid1
sr0	11:0	1	2.3G	0	rom	/run/initramfs/live
zram0	252:0	0	1.9G	0	disk	[SWAP]