

Лабораторная работа №15

Управление логическими томами

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Цель работы

Получить навыки создания, расширения, уменьшения и управления логическими томами с использованием LVM в операционной системе Linux.

Ход выполнения работы

Разметка диска и создание раздела

```
Welcome to fdisk (util-linux 2.40.2).
Changes will remain in memory only, until you decide to write them.
Be careful before using the write command.

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 (2048-3145727, default 2048):
Last sector, +/-sectors or +/-size{K,M,G,T,P} (2048-3145727, default 3145727): +300M

Created a new partition 1 of type 'Linux' and of size 300 MiB.
Partition #1 contains a xfs signature.

Do you want to remove the signature? [Y]es/[N]o: Y

The signature will be removed by a write command.

Command (m for help): t
Selected partition 1
Hex code or alias (type L to list all): 8e
Changed type of partition 'Linux' to 'Linux LVM'.

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

root@mhemraev:/home/mhemraev# partprobe /dev/sdb
root@mhemraev:/home/mhemraev# pvcreate /dev/sdb1
Physical volume "/dev/sdb1" successfully created.
root@mhemraev:/home/mhemraev# pvs
PV          VG      Fmt Attr PSize  PFree
/dev/sda3   rl_vbox lvm2 a--  <39.00g    0
/dev/sdb1   lvm2 ---   300.00m 300.00m
root@mhemraev:/home/mhemraev#
```

Создание физического тома

- Изменён тип раздела на *Linux LVM (8e)*
- Выполнено `pvccreate /dev/sdb1`
- Проверено успешное создание PV

```
root@mhemraev:/home/mhemraev# partprobe /dev/sdb
root@mhemraev:/home/mhemraev# pvccreate /dev/sdb1
Physical volume "/dev/sdb1" successfully created.
root@mhemraev:/home/mhemraev# pvs
PV          VG      Fmt Attr PSize  PFree
/dev/sda3   rl_vbox lvm2 a-- <39.00g  0
/dev/sdb1    lvm2 --- 300.00m 300.00m
root@mhemraev:/home/mhemraev#
root@mhemraev:/home/mhemraev#
root@mhemraev:/home/mhemraev# pvs
PV          VG      Fmt Attr PSize  PFree
/dev/sda3   rl_vbox lvm2 a-- <39.00g  0
/dev/sdb1    lvm2 --- 300.00m 300.00m
root@mhemraev:/home/mhemraev# vgcreate vgdata /dev/sdb1
Volume group "vgdata" successfully created
root@mhemraev:/home/mhemraev# vgs
VG      #PV #LV #SN Attr   VSize  VFree
rl_vbox  1  2  0 wz--n- <39.00g  0
vgdata   1  0  0 wz--n- 296.00m 296.00m
root@mhemraev:/home/mhemraev# pvs
PV          VG      Fmt Attr PSize  PFree
/dev/sda3   rl_vbox lvm2 a-- <39.00g  0
/dev/sdb1    vgdata  lvm2 a-- 296.00m 296.00m
root@mhemraev:/home/mhemraev# lvcreate -n lvdata -l 50%FREE vgdata
Logical volume "lvdata" created.
```

Создание группы томов vgdata

```
root@mhemraev:/home/mhemraev#  
root@mhemraev:/home/mhemraev# mkfs.ext4 /dev/vgdata/lvdata  
mke2fs 1.47.1 (20-May-2024)  
Creating filesystem with 151552 1k blocks and 37848 inodes  
Filesystem UUID: b1a22f28-0107-4293-8d4a-8c9300d8112c  
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@mhemraev:/home/mhemraev#
```

Рис. 3: Создание группы томов vgdata

Создание логического тома lvdata

- Том использует 50% пространства VG
- На томе создана файловая система ext4
- В fstab добавлена запись для автоматического монтирования
- Том смонтирован в /mnt/data

```
GNU nano 8.1 /etc/fstab

#
# /etc/fstab
# Created by anaconda on Fri Sep  5 07:15:23 2025
#
# 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=5c2cee75-5d14-455d-9dc2-feb5d53299f7 / xfs defaults 0 0
UUID=c19e54a2-6056-4482-b4e9-2ac17afbde28 /boot xfs defaults 0 0
UUID=556afd06-5735-4db2-9038-a9f82ed3a8f7 none swap defaults 0 0
/dev/vgdata/lvdata /mnt/data ext4 defaults 1 2

#UUID=b4dca600-1e99-4e4f-977f-848ffbab7101 /mnt/data xfs defaults 1 2
#UUID=09b45499-77ef-457c-a9b6-a785b4c0aa81 /mnt/data-ext ext4 defaults 1 2
#UUID=0878cfdb-e250-4a80-8392-9633e970d3e1 none swap defaults 0 0
```



```
root@mhemraev:/home/mhemraev#  
root@mhemraev:/home/mhemraev# mount -a  
mount: (hint) your fstab has been modified, but systemd still uses  
the old version; use 'systemctl daemon-reload' to reload.  
root@mhemraev:/home/mhemraev# mount | grep mnt  
/dev/mapper/vgdata-lvdata on /mnt/data type ext4 (rw,relatime,seclabel)  
root@mhemraev:/home/mhemraev#
```

Рис. 5: Проверка монтирования

Создание второго PV на диске sdb

```
Command (m for help): n
Partition type
  p   primary (1 primary, 0 extended, 3 free)
  e   extended (container for logical partitions)
Select (default p):

Using default response p.
Partition number (2-4, default 2):
First sector (616448-3145727, default 616448):
Last sector, +/-sectors or +/-size{K,M,G,T,P} (616448-3145727, default 3145727): +300M

Created a new partition 2 of type 'Linux' and of size 300 MiB.

Command (m for help): t
Partition number (1,2, default 2): 2
Hex code or alias (type L to list all): 8e

Changed type of partition 'Linux' to 'Linux LVM'.

Command (m for help): p
Disk /dev/sdb: 1.5 GiB, 1610612736 bytes, 3145728 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: 0x3393a5f6



| Device    | Boot | Start  | End     | Sectors | Size | Id | Type      |
|-----------|------|--------|---------|---------|------|----|-----------|
| /dev/sdb1 |      | 2048   | 616447  | 614400  | 300M | 8e | Linux LVM |
| /dev/sdb2 |      | 616448 | 1230847 | 614400  | 300M | 8e | Linux LVM |



Command (m for help): w
The partition table has been altered.
Syncing disks.
```

```
root@mhemraev: /home/mhemraev#
```

Добавление нового PV в группу vgdata

```
root@mhemraev:/home/mhemraev#  
root@mhemraev:/home/mhemraev# pvcreate /dev/sdb2  
WARNING: dos signature detected on /dev/sdb2 at offset 510. Wipe it? [y/n]: y  
Wiping dos signature on /dev/sdb2.  
Physical volume "/dev/sdb2" successfully created.  
root@mhemraev:/home/mhemraev# vgextend vgdata /dev/sdb2  
Volume group "vgdata" successfully extended  
root@mhemraev:/home/mhemraev# vgs  
VG      #PV #LV #SN Attr   VSize   VFree  
rl_vbox 1  2  0 wz--n- <39.00g  0  
vgdata  2  1  0 wz--n- 592.00m 444.00m  
root@mhemraev:/home/mhemraev# lvs  
LV      VG      Attr   LSize   Pool Origin Data%  Meta%   Move Log Cpy%Sync Convert  
root    rl_vbox -wi-ao---- 36.95g  
swap    rl_vbox -wi-ao----  2.04g  
lvdata  vgdata  -wi-ao----148.00m  
root@mhemraev:/home/mhemraev# df -h  
Filesystem                Size      Used Avail Use% Mounted on  
/dev/mapper/rl_vbox-root   37G        6.1G    31G   17% /  
devtmpfs                   4.0M         0   4.0M    0% /dev  
tmpfs                       853M       84K   853M    1% /dev/shm  
tmpfs                       342M       6.9M   335M    3% /run  
tmpfs                       1.0M         0    1.0M    0% /run/credentials/systemd-journald.service  
/dev/sda2                  960M      377M   584M   40% /boot  
tmpfs                       171M      144K   171M    1% /run/user/1000  
tmpfs                       171M       60K   171M    1% /run/user/0  
/dev/mapper/vgdata-lvdata  134M       14K   123M    1% /mnt/data  
root@mhemraev:/home/mhemraev#
```

Рис. 7: Добавление PV в VG

Расширение логического тома lvdata

- Расширение на 50% свободного места
- Автоматическое увеличение ФС

```
root@mhemraev:/home/mhemraev# lvextend -r -l +50%FREE /dev/vgdata/lvdata
File system ext4 found on vgdata/lvdata mounted at /mnt/data.
Size of logical volume vgdata/lvdata changed from 148.00 MiB (37 extents) to 372.00 MiB (93 extents).
Extending file system ext4 to 372.00 MiB (390070272 bytes) on vgdata/lvdata...

resize2fs /dev/vgdata/lvdata
resize2fs 1.47.1 (20-May-2024)
Filesystem at /dev/vgdata/lvdata is mounted on /mnt/data; on-line resizing required
old_desc_blocks = 2, new_desc_blocks = 3
The filesystem on /dev/vgdata/lvdata is now 380928 (1k) blocks long.

resize2fs done
Extended file system ext4 on vgdata/lvdata.
Logical volume vgdata/lvdata successfully resized.
root@mhemraev:/home/mhemraev# lvs
LV      VG      Attr      LSize   Pool Origin Data%  Meta%   Move Log Cpy%Sync Convert
root    rl_vbox -wi-ao---- 36.95g
swap    rl_vbox -wi-ao----  2.04g
lvdata  vgdata  -wi-ao---- 372.00m
root@mhemraev:/home/mhemraev# df -h
Filesystem                Size      Used Avail Use% Mounted on
/dev/mapper/rl_vbox-root    37G        6.1G   31G   17% /
devtmpfs                   4.0M         0   4.0M    0% /dev
tmpfs                       853M       84K   853M    1% /dev/shm
tmpfs                       342M       7.0M   335M    3% /run
tmpfs                       1.0M         0    1.0M    0% /run/credentials/systemd-journald.service
/dev/sda2                   960M      377M   584M   40% /boot
tmpfs                       171M      144K   171M    1% /run/user/1000
tmpfs                       171M       60K   171M    1% /run/user/0
/dev/mapper/vgdata-lvdata   344M       14K   324M    1% /mnt/data
```

Уменьшение логического тома

- Уменьшение на 50 МБ
- Повторное монтирование

```
resize2fs done
remount /dev/vgdata/lvdata /mnt/data
mount: (hint) your fstab has been modified, but systemd still uses
       the old version; use 'systemctl daemon-reload' to reload.
remount done
Reduced file system ext4 on vgdata/lvdata.
Size of logical volume vgdata/lvdata changed from 372.00 MiB (93 extents) to 324.00 MiB (81 extents).
Logical volume vgdata/lvdata successfully resized.
root@mhemraev:/home/mhemraev# lvs
LV      VG      Attr      LSize   Pool Origin Data%  Meta%  Move Log Cpy%Sync Convert
root    rl_vbox  -wi-ao---- 36.95g
swap    rl_vbox  -wi-ao---- 2.04g
lvdata  vgdata   -wi-ao---- 324.00m
root@mhemraev:/home/mhemraev# df -h
Filesystem                Size      Used Avail Use% Mounted on
/dev/mapper/rl_vbox-root   37G        6.1G    31G   17% /
devtmpfs                   4.0M        0      4.0M    0% /dev
tmpfs                      853M       84K    853M    1% /dev/shm
tmpfs                      342M       6.9M    335M    3% /run
tmpfs                      1.0M        0      1.0M    0% /run/credentials/systemd-journald.service
/dev/sda2                  960M       377M    584M   40% /boot
tmpfs                      171M       144K    171M    1% /run/user/1000
tmpfs                      171M       60K     171M    1% /run/user/0
/dev/mapper/vgdata-lvdata  298M       14K     280M    1% /mnt/data
root@mhemraev:/home/mhemraev#
```

Рис. 9: Уменьшение lvdata

Самостоятельная часть

```
Command (m for help): p
Disk /dev/sdc: 1.5 GiB, 1610612736 bytes, 3145728 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: 0x0eb940bc

Device      Boot  Start      End  Sectors  Size Id Type
/dev/sdc1                2048 1230847 1228800   600M 8e Linux LVM
/dev/sdc2           1230848 2152447  921600   450M 8e Linux LVM

Filesystem/RAID signature on partition 2 will be wiped.

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

root@mhemraev:/home/mhemraev#
```

Создание PV, VG и LV

- Создан PV на /dev/sdc1
- Создана группа томов vggroup
- Создан логический том lvgroup (200 МБ)

```
root@mhemraev:/home/mhemraev#  
root@mhemraev:/home/mhemraev# pvcreate /dev/sdc1  
Physical volume "/dev/sdc1" successfully created.  
root@mhemraev:/home/mhemraev# vgcreate vggroup /dev/sdc1  
Volume group "vggroup" successfully created  
root@mhemraev:/home/mhemraev# lvcreate -n lvgroup -l 100$FREE vggroup  
Logical volume "lvgroup" created.  
root@mhemraev:/home/mhemraev# pvs  
PV          VG      Fmt Attr PSize  PFree  
/dev/sda3   rl_vbox lvm2 a-- <39.00g  0  
/dev/sdb1   vgdata  lvm2 a-- 296.00m  0  
/dev/sdb2   vgdata  lvm2 a-- 296.00m 268.00m  
/dev/sdc1   vggroup lvm2 a-- 596.00m 196.00m  
root@mhemraev:/home/mhemraev# vgs  
VG      #PV #LV #SN Attr   VSize  VFree  
rl_vbox 1  2  0 wz--n- <39.00g  0  
vgdata  2  1  0 wz--n- 592.00m 268.00m  
vggroup 1  1  0 wz--n- 596.00m 196.00m  
root@mhemraev:/home/mhemraev# lvs  
LV      VG      Attr   LSize  Pool Origin Data%  Meta%  Move Log Cpy%Sync Convert  
root    rl_vbox -wi-ao---- 36.95g  
swap    rl_vbox -wi-ao---- 2.04g  
lvdata  vgdata  -wi-ao---- 324.00m  
lvgroup vggroup -wi-a----- 400.00m  
root@mhemraev:/home/mhemraev#
```



```
root@mhemraev:/home/mhemraev# mkfs.xfs /dev/vggroup/lvgroup
meta-data=/dev/vggroup/lvgroup  isize=512    agcount=4, agsize=25600 blks
        =                       sectsz=512   attr=2, projid32bit=1
        =                       crc=1        finobt=1, sparse=1, rmapbt=1
        =                       reflink=1    bigtime=1 inobtcount=1 nrext64=1
        =                       exchange=0
data      =                       bsize=4096   blocks=102400, imaxpct=25
        =                       sunit=0      swidth=0 blks
naming    =version 2             bsize=4096   ascii-ci=0, ftype=1, parent=0
log       =internal log         bsize=4096   blocks=16384, version=2
        =                       sectsz=512   sunit=0 blks, lazy-count=1
realtime  =none                 extsz=4096   blocks=0, rtextents=0
root@mhemraev:/home/mhemraev# mkdir -p /mnt/groups
root@mhemraev:/home/mhemraev#
```

Рис. 12: Создание XFS

```
#
# /etc/fstab
# Created by anaconda on Fri Sep  5 07:15:23 2025
#
# 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=5c2cee75-5d14-455d-9dc2-feb5d53299f7 /                xfs     defaults        0 0
UUID=c19e54a2-6056-4482-b4e9-2ac17afbde28 /boot          xfs     defaults        0 0
UUID=556afd06-5735-4db2-9038-a9f82ed3a8f7 none           swap    defaults        0 0
/dev/vgdata/lvdata /mnt/data      ext4    defaults        1 2
/dev/vggroup/lvgroup /mnt/groups    xfs     defaults        1 2

#UUID=b4dca600-1e99-4e4f-977f-848ffbab7101 /mnt/data xfs defaults 1 2
#UUID=09b45499-77ef-457c-a9b6-a785b4c0aa81 /mnt/data-ext ext4 defaults 1 2
#UUID=0878cfdb-e250-4a80-8392-9633e970d3e1 none swap defaults 0 0
```

Рис. 13: fstab и монтирование

Добавление второго PV

```
root@mhemraev:/home/mhemraev#
root@mhemraev:/home/mhemraev# mount -a
mount: (hint) your fstab has been modified, but systemd still uses
the old version; use 'systemctl daemon-reload' to reload.
root@mhemraev:/home/mhemraev#
root@mhemraev:/home/mhemraev# mount | grep mnt
/dev/mapper/vgdata-lvdata on /mnt/data type ext4 (rw,relatime,seclabel)
/dev/mapper/vggroup-lvgroup on /mnt/groups type xfs (rw,relatime,seclabel,attr2,inode64,logbufs=8,logbsize=32k,noquota)
root@mhemraev:/home/mhemraev# df -h
Filesystem                Size      Used Avail Use% Mounted on
/dev/mapper/rl_vbox-root    37G        6.1G    31G   17% /
devtmpfs                   4.0M         0   4.0M    0% /dev
tmpfs                      853M       84K   853M    1% /dev/shm
tmpfs                      342M       8.5M   333M    3% /run
tmpfs                      1.0M         0   1.0M    0% /run/credentials/systemd-journald.service
/dev/sda2                  960M      377M   584M   40% /boot
tmpfs                      171M      144K   171M    1% /run/user/1000
tmpfs                      171M       60K   171M    1% /run/user/0
/dev/mapper/vgdata-lvdata   298M       14K   280M    1% /mnt/data
/dev/mapper/vggroup-lvgroup 336M       27M   310M    8% /mnt/groups
root@mhemraev:/home/mhemraev#
```

Рис. 14: Добавление второго PV

Расширение логического тома и XFS

```
root@mhemraev:/home/mhemraev# pvcreate /dev/sdc2
Physical volume "/dev/sdc2" successfully created.
root@mhemraev:/home/mhemraev# vgextend vgggroup /dev/sdc2
Volume group "vgggroup" successfully extended
root@mhemraev:/home/mhemraev# lvextend -r -l +100%FREE /dev/vgggroup/lvggroup
File system xfs found on vgggroup/lvggroup mounted at /mnt/groups.
Size of logical volume vgggroup/lvggroup changed from 400.00 MiB (100 extents) to <1.02 GiB (261 extents).
Extending file system xfs to <1.02 GiB (1094713344 bytes) on vgggroup/lvggroup...
xfs_growfs /dev/vgggroup/lvggroup
meta-data=/dev/mapper/vgggroup-lvggroup isize=512    agcount=4, agsize=25600 blks
       =                       sectsz=512   attr=2, projid32bit=1
       =                       crc=1        finobt=1, sparse=1, rmapbt=1
       =                       reflink=1    bigtime=1 inobtcount=1 nrext64=1
       =                       exchange=0
data      =                       bsize=4096   blocks=102400, imaxpct=25
       =                       sunit=0      swidth=0 blks
naming    =version 2              bsize=4096   ascii-ci=0, ftype=1, parent=0
log       =internal log          bsize=4096   blocks=16384, version=2
       =                       sectsz=512   sunit=0 blks, lazy-count=1
realtime  =none                  extsz=4096   blocks=0, rtextents=0
data blocks changed from 102400 to 267264
xfs_growfs done
Extended file system xfs on vgggroup/lvggroup.
Logical volume vgggroup/lvggroup successfully resized.
root@mhemraev:/home/mhemraev#
```

Рис. 15: Расширение тома и ФС

Проверка итоговой конфигурации

```
root@mhemraev:/home/mhemraev# pvs
PV          VG      Fmt Attr PSize  PFree
/dev/sda3   rl_vbox lvm2 a-- <39.00g  0
/dev/sdb1   vgdata lvm2 a-- 296.00m  0
/dev/sdb2   vgdata lvm2 a-- 296.00m 268.00m
/dev/sdc1   vggroup lvm2 a-- 596.00m  0
/dev/sdc2   vggroup lvm2 a-- 448.00m  0

root@mhemraev:/home/mhemraev# vgs
VG      #PV #LV #SN Attr   VSize  VFree
rl_vbox 1  2  0 wz--n- <39.00g  0
vgdata  2  1  0 wz--n- 592.00m 268.00m
vggroup 2  1  0 wz--n- <1.02g  0

root@mhemraev:/home/mhemraev# lvs
LV      VG      Attr      LSize   Pool Origin Data%  Meta%   Move Log Cpy%Sync Convert
root    rl_vbox -wi-ao---- 36.95g
swap    rl_vbox -wi-ao---- 2.04g
lvdata   vgdata -wi-ao---- 324.00m
lvgroup  vggroup -wi-ao---- <1.02g

root@mhemraev:/home/mhemraev# df -h
Filesystem                Size      Used Avail Use% Mounted on
/dev/mapper/rl_vbox-root   37G        6.1G    31G   17% /
devtmpfs                   4.0M         0   4.0M    0% /dev
tmpfs                       853M        84K   853M    1% /dev/shm
tmpfs                       342M        8.5M   333M    3% /run
tmpfs                       1.0M         0    1.0M    0% /run/credentials/systemd-journald.service
/dev/sda2                  960M       377M   584M   40% /boot
tmpfs                       171M       144K   171M    1% /run/user/1000
tmpfs                       171M        60K   171M    1% /run/user/0
/dev/mapper/vgdata-lvdata  298M        14K   280M    1% /mnt/data
/dev/mapper/vggroup-lvgroup 980M        40M   941M    5% /mnt/groups
root@mhemraev:/home/mhemraev#
```

Итоги работы

В ходе работы:

- Созданы физические тома, группы томов и логические тома
- Выполнено форматирование ext4 и XFS
- Настроено автоматическое монтирование через fstab
- Выполнено расширение и уменьшение томов
- Во всех этапах проверена корректность команд LVM и состояния ФС