

Лабораторная работа №15

Управление логическими томами

Максат Хемраев

20 ноября 2025

Российский университет дружбы народов, Москва, Россия

Цель работы

Основная цель

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@hemraev:/home/mhemraev# partprobe /dev/sdb
root@hemraev:/home/mhemraev# pvcreate /dev/sdb1
  Physical volume "/dev/sdb1" successfully created.
root@hemraev:/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@hemraev:/home/mhemraev#
```

Создание физического тома

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

```
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#
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=556afdb0-5735-4db2-9038-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
```

Проверка монтирования

```
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.
```

Добавление нового PV в группу vgdata

```
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 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  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

Разметка диска sdc

```
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# █
```

Рис. 10: Разметка диска sdc

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#
```

Создание файловой системы XFS

```
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 nnext64=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

Монтирование и 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=556afdf06-5735-4db2-9038-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#
```

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 "vggroup" successfully extended
root@mhemraev:/home/mhemraev# lvextend -r -l +100%FREE /dev/vgggroup/lvgroup
File system xfs found on vgggroup/lvgroup mounted at /mnt/groups.
Size of logical volume vgggroup/lvgroup 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/lvgroup...
xfs_growfs /dev/vgggroup/lvgroup
meta-data=/dev/mapper/vgggroup-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
data blocks changed from 102400 to 267264
xfs_growfs done
Extended file system xfs on vgggroup/lvgroup.
Logical volume vgggroup/lvgroup 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  vgggroup lvm2 a--  596.00m     0
  /dev/sdc2  vgggroup 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
  vgggroup 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 vgggroup -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/vgggroup-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