Лабораторная работа №15

Управление логическими томами (LVM)

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Цель работы

Формулировка цели

Получить навыки управления логическими томами LVM: создание PV/VG/LV, настройка монтирования и изменение размера логических томов и файловых систем.

Ход выполнения работы

Подготовка диска /dev/sdb под LVM

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

Создание VG и LV (vgdata/lvdata)

```
root@ivschemelev:/home/ivschemelev#
root@ivschemelev:/home/ivschemelev# pvs
  PV         VG      Fmt  Attr PSize   PFree
  /dev/sda3  rl_vbox lvm2 a--  <49.00g      0
  /dev/sdb1          lvm2 ---  300.00m 300.00m
root@ivschemelev:/home/ivschemelev# vgcreate vgdata /dev/sdb1
  Volume group "vgdata" successfully created
root@ivschemelev:/home/ivschemelev# vgs
  VG      #PV #LV #SN Attr   VSize   VFree
  rl_vbox   1   2   0 wz--n- <49.00g      0
  vgdata    1   0   0 wz--n- 296.00m 296.00m
root@ivschemelev:/home/ivschemelev# pvs
  PV         VG      Fmt  Attr PSize   PFree
  /dev/sda3  rl_vbox lvm2 a--  <49.00g      0
  /dev/sdb1  vgdata  lvm2 a--  296.00m 296.00m
root@ivschemelev:/home/ivschemelev#
root@ivschemelev:/home/ivschemelev# lvcreate -n lvdata -l 50%FREE vgdata
  Logical volume "lvdata" created.
root@ivschemelev:/home/ivschemelev# lvs
  LV     VG      Attr       LSize   Pool Origin Data%  Meta%  Move Log Cpy%Sync Convert
  root   rl_vbox -wi-ao----  45.05g
  swap   rl_vbox -wi-ao----  <3.95g
  lvdata vgdata  -wi-a----- 148.00m
root@ivschemelev:/home/ivschemelev# mkfs.ext4 /dev/vgdata/lvdata
mke2fs 1.47.1 (20-May-2024)
Creating filesystem with 151552 1k blocks and 37848 inodes
```

Постоянное монтирование /mnt/data

```
 GNU nano 8.1                                        /etc/fstab

#
# /etc/fstab
# Created by anaconda on Fri Jan 16 11:32:16 2026
#
# 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=b552a213-cc13-43ac-b518-a1c5c52c8d5e /                       xfs     defaults        0 0
UUID=7ac262fa-85bd-4a83-808b-8111bf61c34d /boot                   xfs     defaults        0 0
UUID=033ba33a-9b4a-4407-81fd-3c8462b17b78 none                    swap    defaults        0 0
/dev/vgdata/lvdata /mnt/data ext4 defaults 1 2
```

Рис. 3: Редактирование файла /etc/fstab для /mnt/data

Проверка монтирования /mnt/data

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

Рис. 4: Проверка монтирования логического тома в /mnt/data

Добавление нового PV в vgdata (/dev/sdb2)

```
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: 0x58e1c772

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@ivschemelev:/home/ivschemelev#
```

Расширение группы томов vgdata

```
root@ivschemelev:/home/ivschemelev# 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@ivschemelev:/home/ivschemelev# vgextend vgdata /dev/sdb2
  Volume group "vgdata" successfully extended
root@ivschemelev:/home/ivschemelev# vgs
  VG      #PV #LV #SN Attr   VSize   VFree
  rl_vbox   1   2   0 wz--n- <49.00g      0
  vgdata    2   1   0 wz--n- 592.00m 444.00m
root@ivschemelev:/home/ivschemelev# lvs
  LV     VG      Attr       LSize   Pool Origin Data%  Meta%  Move Log Cpy%Sync Convert
  root   rl_vbox -wi-ao----  45.05g
  swap   rl_vbox -wi-ao----  <3.95g
  lvdata vgdata  -wi-ao---- 148.00m
root@ivschemelev:/home/ivschemelev# df -h
Filesystem                 Size  Used Avail Use% Mounted on
/dev/mapper/rl_vbox-root    45G  5.8G   40G  13% /
devtmpfs                   1.8G     0  1.8G   0% /dev
tmpfs                      1.8G   84K  1.8G   1% /dev/shm
tmpfs                      731M  9.3M  722M   2% /run
tmpfs                      1.0M     0  1.0M   0% /run/credentials/systemd-journald.service
/dev/sda2                  960M  412M  549M  43% /boot
tmpfs                      366M  140K  366M   1% /run/user/1000
tmpfs                      366M   60K  366M   1% /run/user/0
/dev/mapper/vgdata-lvdata  134M   14K  123M   1% /mnt/data
root@ivschemelev:/home/ivschemelev#
```

Увеличение lvdata и файловой системы ext4

```
root@ivschemelev:/home/ivschemelev#
root@ivschemelev:/home/ivschemelev# 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@ivschemelev:/home/ivschemelev# lvs
  LV     VG      Attr       LSize   Pool Origin Data%  Meta%  Move Log Cpy%Sync Convert
  root   rl_vbox -wi-ao----  45.05g
  swap   rl_vbox -wi-ao----  <3.95g
  lvdata vgdata  -wi-ao---- 372.00m
root@ivschemelev:/home/ivschemelev# df -h
Filesystem                Size  Used Avail Use% Mounted on
/dev/mapper/rl_vbox-root   45G  5.8G   40G  13% /
devtmpfs                  1.8G     0  1.8G   0% /dev
tmpfs                     1.8G   84K  1.8G   1% /dev/shm
tmpfs                     731M  9.3M  722M   2% /run
tmpfs                     1.0M     0  1.0M   0% /run/credentials/systemd-journald.service
/dev/sda2                 960M  412M  549M  43% /boot
tmpfs                     366M  140K  366M   1% /run/user/1000
tmpfs                     366M   60K  366M   1% /run/user/0
/dev/mapper/vgdata-lvdata 344M   14K  324M   1% /mnt/data
root@ivschemelev:/home/ivschemelev#
```

Уменьшение lvdata и файловой системы ext4

```
e2fsck /dev/vgdata/lvdata
/dev/vgdata/lvdata: 11/93624 files (0.0% non-contiguous), 29683/380928 blocks
e2fsck done
resize2fs /dev/vgdata/lvdata 229376k
resize2fs 1.47.1 (20-May-2024)
Resizing the filesystem on /dev/vgdata/lvdata to 229376 (1k) blocks.
The filesystem on /dev/vgdata/lvdata is now 229376 (1k) blocks long.

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 224.00 MiB (56 extents).
  Logical volume vgdata/lvdata successfully resized.
root@ivschemelev:/home/ivschemelev# lvs
  LV     VG      Attr       LSize   Pool Origin Data%  Meta%  Move Log Cpy%Sync Convert
  root   rl_vbox -wi-ao----  45.05g
  swap   rl_vbox -wi-ao----  <3.95g
  lvdata vgdata  -wi-ao---- 224.00m
root@ivschemelev:/home/ivschemelev# df -h
Filesystem                Size  Used Avail Use% Mounted on
/dev/mapper/rl_vbox-root   45G  5.8G   40G  13% /
devtmpfs                  1.8G     0  1.8G   0% /dev
tmpfs                     1.8G   84K  1.8G   1% /dev/shm
tmpfs                     731M  9.3M  722M   2% /run
tmpfs                     1.0M     0  1.0M   0% /run/credentials/systemd-journald.service
/dev/sda2                 960M  412M  549M  43% /boot
tmpfs                     366M  140K  366M   1% /run/user/1000
tmpfs                     366M   60K  366M   1% /run/user/0
/dev/mapper/vgdata-lvdata 205M   14K  191M   1% /mnt/data
root@ivschemelev:/home/ivschemelev#
```

Самостоятельная работа

Разметка диска /dev/sdc под LVM

```
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: 0xe358f6a9

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@ivschemelev:/home/ivschemelev# partprobe /dev/sdc
root@ivschemelev:/home/ivschemelev#
```

Создание vggroup и lvgroup + XFS

```
root@ivschemelev:/home/ivschemelev# pvcreate /dev/sdc1
  Physical volume "/dev/sdc1" successfully created.
root@ivschemelev:/home/ivschemelev# vgcreate vggroup /dev/sdc1
  Volume group "vggroup" successfully created
root@ivschemelev:/home/ivschemelev# lvcreate -n lvgroup -l 100%FREE vggroup
  Logical volume "lvgroup" created.
root@ivschemelev:/home/ivschemelev# mkfs.xfs /dev/vggroup/lvgroup
meta-data=/dev/vggroup/lvgroup   isize=512    agcount=4, agsize=38144 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=152576, 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@ivschemelev:/home/ivschemelev#
```

Рис. 10: Создание PV/VG/LV и форматирование XFS

Проверка конфигурации LVM

```
root@ivschemelev:/home/ivschemelev# pvs
  PV         VG      Fmt  Attr PSize   PFree
  /dev/sda3  rl_vbox lvm2 a--  <49.00g      0
  /dev/sdb1  vgdata  lvm2 a--  296.00m  72.00m
  /dev/sdb2  vgdata  lvm2 a--  296.00m 296.00m
  /dev/sdc1  vggroup lvm2 a--  596.00m      0
root@ivschemelev:/home/ivschemelev# vgs
  VG      #PV #LV #SN Attr   VSize   VFree
  rl_vbox   1   2   0 wz--n- <49.00g      0
  vgdata    2   1   0 wz--n- 592.00m 368.00m
  vggroup   1   1   0 wz--n- 596.00m      0
root@ivschemelev:/home/ivschemelev# lvs
  LV      VG      Attr       LSize   Pool Origin Data%  Meta%  Move Log Cpy%Sync Convert
  root    rl_vbox -wi-ao----  45.05g
  swap    rl_vbox -wi-ao----  <3.95g
  lvdata  vgdata  -wi-ao---- 224.00m
  lvgroup vggroup -wi-a----- 596.00m
root@ivschemelev:/home/ivschemelev#
```

Рис. 11: Проверка pvs/vgs/lvs

Постоянное монтирование /mnt/groups

```
 GNU nano 8.1                                    /etc/fstab

#
# /etc/fstab
# Created by anaconda on Fri Jan 16 11:32:16 2026
#
# 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=b552a213-cc13-43ac-b518-a1c5c52c8d5e /                       xfs     defaults        0 0
UUID=7ac262fa-85bd-4a83-808b-8111bf61c34d /boot                   xfs     defaults        0 0
UUID=033ba33a-9b4a-4407-81fd-3c8462b17b78 none                    swap    defaults        0 0
/dev/vgdata/lvdata /mnt/data ext4 defaults 1 2
/dev/vggroup/lvgroup /mnt/groups xfs defaults 1 2
#UUID=dbdd84e0-a5ff-48a5-b476-9ba5eb00e66d /mnt/data xfs defaults 1 2
#UUID=397e2311-797e-4490-b3a9-f703326e0342 /mnt/data-ext ext4 defaults 1 2
#UUID=e95c3a0f-a9bf-44f3-811c-cbd748688f8d none swap defaults 0 0
```

Рис. 12: Настройка /etc/fstab для /mnt/groups

Проверка монтирования /mnt/groups

```
root@ivschemelev:/home/ivschemelev# mount | grep mnt
/dev/mapper/vggroup-lvgroup on /mnt/groups type xfs (rw,relatime,seclabel,attr2,inode64,logbufs=8,logbsize=32k,noquota)
/dev/mapper/vgdata-lvdata on /mnt/data type ext4 (rw,relatime,seclabel)
root@ivschemelev:/home/ivschemelev# df -h
Filesystem                  Size  Used Avail Use% Mounted on
/dev/mapper/rl_vbox-root     45G  5.8G   40G  13% /
devtmpfs                    1.8G     0  1.8G   0% /dev
tmpfs                       1.8G   84K  1.8G   1% /dev/shm
tmpfs                       731M  9.3M  722M   2% /run
tmpfs                       1.0M     0  1.0M   0% /run/credentials/systemd-journald.service
/dev/mapper/vggroup-lvgroup 532M   41M  492M   8% /mnt/groups
/dev/sda2                   960M  412M  549M  43% /boot
/dev/mapper/vgdata-lvdata   205M   14K  191M   1% /mnt/data
tmpfs                       366M  140K  366M   1% /run/user/1000
tmpfs                       366M   60K  366M   1% /run/user/0
root@ivschemelev:/home/ivschemelev#
```

Рис. 13: Проверка mount и df -h для /mnt/groups

Расширение vggroup и lvgroup (XFS)

```
root@ivschemelev:/home/ivschemelev# pvcreate /dev/sdc2
  Physical volume "/dev/sdc2" successfully created.
root@ivschemelev:/home/ivschemelev# vgextend vggroup /dev/sdc2
  Volume group "vggroup" successfully extended
root@ivschemelev:/home/ivschemelev# lvextend -r -l +100%FREE /dev/vggroup/lvgroup
  File system xfs found on vggroup/lvgroup mounted at /mnt/groups.
  Size of logical volume vggroup/lvgroup changed from 596.00 MiB (149 extents) to <1.02 GiB (261 extents).
  Extending file system xfs to <1.02 GiB (1094713344 bytes) on vggroup/lvgroup...
xfs_growfs /dev/vggroup/lvgroup
meta-data=/dev/mapper/vggroup-lvgroup isize=512    agcount=4, agsize=38144 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=152576, 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 152576 to 267264
xfs_growfs done
  Extended file system xfs on vggroup/lvgroup.
  Logical volume vggroup/lvgroup successfully resized.
root@ivschemelev:/home/ivschemelev#
```

Рис. 14: Расширение vggroup/lvgroup и увеличение XFS

Итоговая проверка расширения

```
root@ivschemelev:/home/ivschemelev# pvs
  PV         VG      Fmt  Attr PSize   PFree
  /dev/sda3  rl_vbox lvm2 a--  <49.00g      0
  /dev/sdb1  vgdata  lvm2 a--  296.00m  72.00m
  /dev/sdb2  vgdata  lvm2 a--  296.00m 296.00m
  /dev/sdc1  vggroup lvm2 a--  596.00m      0
  /dev/sdc2  vggroup lvm2 a--  448.00m      0
root@ivschemelev:/home/ivschemelev# vgs
  VG      #PV #LV #SN Attr   VSize   VFree
  rl_vbox   1   2   0 wz--n- <49.00g      0
  vgdata    2   1   0 wz--n- 592.00m 368.00m
  vggroup   2   1   0 wz--n-  <1.02g      0
root@ivschemelev:/home/ivschemelev# lvs
  LV      VG      Attr       LSize   Pool Origin Data%  Meta%  Move Log Cpy%Sync Convert
  root    rl_vbox -wi-ao----  45.05g
  swap    rl_vbox -wi-ao----  <3.95g
  lvdata  vgdata  -wi-ao---- 224.00m
  lvgroup vggroup -wi-ao----  <1.02g
root@ivschemelev:/home/ivschemelev# df -h
Filesystem                   Size  Used Avail Use% Mounted on
/dev/mapper/rl_vbox-root      45G  5.8G   40G  13% /
devtmpfs                     1.8G     0  1.8G   0% /dev
tmpfs                        1.8G   84K  1.8G   1% /dev/shm
tmpfs                        731M  9.3M  722M   2% /run
tmpfs                        1.0M     0  1.0M   0% /run/credentials/systemd-journald.service
/dev/mapper/vggroup-lvgroup  980M   50M  931M   6% /mnt/groups
/dev/sda2                    960M  412M  549M  43% /boot
/dev/mapper/vgdata-lvdata    205M   14K  191M   1% /mnt/data
tmpfs                        366M  140K  366M   1% /run/user/1000
tmpfs                        366M   60K  366M   1% /run/user/0
root@ivschemelev:/home/ivschemelev#
```

Итоги работы

Заключение

Выполнено создание физических томов, групп томов и логических томов LVM, настроено постоянное монтирование через `/etc/fstab`.

Отработаны операции расширения и уменьшения логических томов с автоматическим изменением размера файловых систем **ext4** и **XFS**.

Получены практические навыки гибкого управления дисковым пространством в Linux с использованием LVM.