Лабораторная работа №15

Управление логическими томами (LVM)

Руслан Алиев

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Российский университет дружбы народов, Москва, Россия

Цель работы

Основная цель

Освоение создания, настройки и управления логическими томами LVM в Linux.

Ход выполнения работы

Создание физического тома

```
Disklabel type: dos
Disk identifier: 0x408cdad7

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 (2048-3145727, 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.

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

Создание LVM PV

```
root@raliev:/home/raliev#
root@raliev:/home/raliev# pvs
  PV         VG      Fmt  Attr PSize   PFree
  /dev/sda3  rl_vbox lvm2 a--  <39.00g      0
  /dev/sdb1          lvm2 ---  300.00m 300.00m
root@raliev:/home/raliev# vgcreate vgdata /dev/sdb1
  Volume group "vgdata" successfully created
root@raliev:/home/raliev# 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@raliev:/home/raliev# 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@raliev:/home/raliev#
```

Рис. 2: Физический том /dev/sdb1

Создание логического тома lvdata

```
root@raliev:/home/raliev#
root@raliev:/home/raliev# lvcreate -n lvdata -l 50%FREE vgdata
  Logical volume "lvdata" created.
root@raliev:/home/raliev# mkfs.ext4 /dev/vgdata/lvdata
mke2fs 1.47.1 (20-May-2024)
Creating filesystem with 151552 1k blocks and 37848 inodes
Filesystem UUID: 5d1aa976-1001-4125-a876-d98b51913662
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@raliev:/home/raliev# mkdir -p /mnt/data
root@raliev:/home/raliev#
```

Рис. 3: Создание ext4 на LV

Настройка fstab

```
#
# /etc/fstab
# Created by anaconda on Thu Oct  2 15:51:49 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=3cfbe4aa-6099-4ffb-94d9-9225442b08ab /                       xfs     defaults        0 0
UUID=7b8a1d93-2813-4d48-8617-3be8699122aa /boot                   xfs     defaults        0 0
UUID=43296ceb-b959-4fcf-8f70-625d0f6dfe00 none                    swap    defaults        0 0
/dev/vgdata/lvdata                        /mnt/data               ext4    defaults        1 2

#UUID=7b8716b8-fa43-4c11-ade0-57f582ca8728 /mnt/data               xfs     defaults        1 2
#UUID=9c32754f-0ff7-41f4-83d0-4c6844797287 /mnt/data-ext                   ext4    defaults        1 2
#UUID=f1346f70-6f29-4ebd-83b6-f6e927ec3b4e none                    swap    defaults        1 2
```

Рис. 4: fstab запись для lvdata

Проверка монтирования

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

Рис. 5: Монтирование /mnt/data

Новый раздел /dev/sdb2

```
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: 0x408cdad7

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

Filesystem/RAID signature on partition 2 will be wiped.

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

root@raliev:/home/raliev#
```

Расширение группы томов

```
root@raliev:/home/raliev#
root@raliev:/home/raliev# pvcreate /dev/sdb2
  Physical volume "/dev/sdb2" successfully created.
root@raliev:/home/raliev# vgextend vgdata /dev/sdb2
  Volume group "vgdata" successfully extended
root@raliev:/home/raliev# 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@raliev:/home/raliev# lvs
  LV     VG      Attr       LSize   Pool Origin Data%  Meta%  Move Log Cpy%Sync Convert
  root   rl_vbox -wi-ao----  35.05g
  swap   rl_vbox -wi-ao----  <3.95g
  lvdata vgdata  -wi-ao---- 148.00m
root@raliev:/home/raliev# df -h
Filesystem                 Size  Used Avail Use% Mounted on
/dev/mapper/rl_vbox-root    35G  6.0G   30G  17% /
devtmpfs                   4.0M     0  4.0M   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  377M  584M  40% /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@raliev:/home/raliev#
```

Рис. 7: Расширение VG

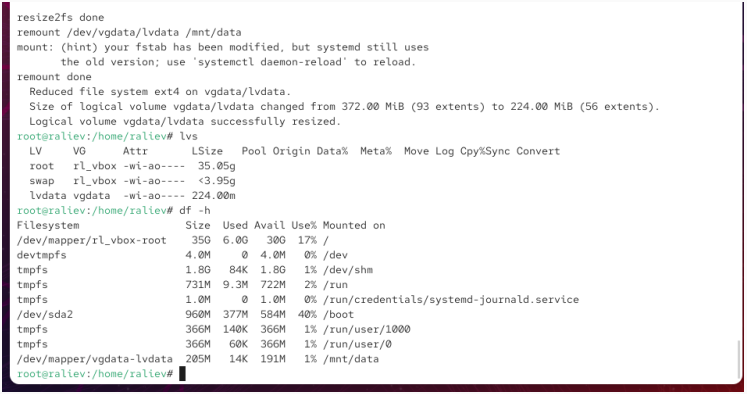
Увеличение lvdata

```
root@raliev:/home/raliev# 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@raliev:/home/raliev# lvs
  LV     VG      Attr       LSize   Pool Origin Data%  Meta%  Move Log Cpy%Sync Convert
  root   rl_vbox -wi-ao----  35.05g
  swap   rl_vbox -wi-ao----  <3.95g
  lvdata vgdata  -wi-ao---- 372.00m
root@raliev:/home/raliev# df -h
Filesystem                Size  Used Avail Use% Mounted on
/dev/mapper/rl_vbox-root   35G  6.0G   30G  17% /
devtmpfs                  4.0M     0  4.0M   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  377M  584M  40% /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@raliev:/home/raliev#
```

Рис. 8: Увеличение LV и ФС

Уменьшение lvdata



```
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@raliev:/home/raliev# lvs
  LV     VG      Attr       LSize   Pool Origin Data%  Meta%  Move Log Cpy%Sync Convert
  root   rl_vbox -wi-ao----  35.05g
  swap   rl_vbox -wi-ao----  <3.95g
  lvdata vgdata  -wi-ao---- 224.00m
root@raliev:/home/raliev# df -h
Filesystem                 Size  Used Avail Use% Mounted on
/dev/mapper/rl_vbox-root    35G  6.0G   30G  17% /
devtmpfs                   4.0M     0  4.0M   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  377M  584M  40% /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@raliev:/home/raliev#
```

Рис. 9: Итоговый размер тома

Самостоятельная работа

Создание разделов /dev/sdc1 и /dev/sdc2

```
Partition number (1,2, default 2): 1
Hex code or alias (type L to list all): 8e

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

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/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: 0x69af3d21

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 1 will be wiped.

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

root@raliev:/home/raliev#
```

Создание vggroup и lvgroup

```
root@raliev:/home/raliev# pvcreate /dev/sdc1
  Physical volume "/dev/sdc1" successfully created.
root@raliev:/home/raliev# pvcreate /dev/sdc2
  Physical volume "/dev/sdc2" successfully created.
root@raliev:/home/raliev# vgcreate vggroup /dev/sdc1
  Volume group "vggroup" successfully created
root@raliev:/home/raliev# lvcreate -n lvgroup -l 100%FREE vggroup
  Logical volume "lvgroup" created.
root@raliev:/home/raliev# 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@raliev:/home/raliev#
```

Рис. 11: Создание LV и XFS

Монтирование /mnt/groups

```
root@raliev:/home/raliev# pvs
  PV         VG      Fmt  Attr PSize   PFree
  /dev/sda3  rl_vbox lvm2 a--  <39.00g      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          lvm2 ---  450.00m 450.00m
root@raliev:/home/raliev# 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 368.00m
  vggroup   1   1   0 wz--n- 596.00m      0
root@raliev:/home/raliev# lvs
  LV      VG      Attr       LSize   Pool Origin Data%  Meta%  Move Log Cpy%Sync Convert
  root    rl_vbox -wi-ao----  35.05g
  swap    rl_vbox -wi-ao----  <3.95g
  lvdata  vgdata  -wi-ao---- 224.00m
  lvgroup vggroup -wi-a----- 596.00m
root@raliev:/home/raliev#
```

Рис. 12: fstab для /mnt/groups

Проверка монтирования

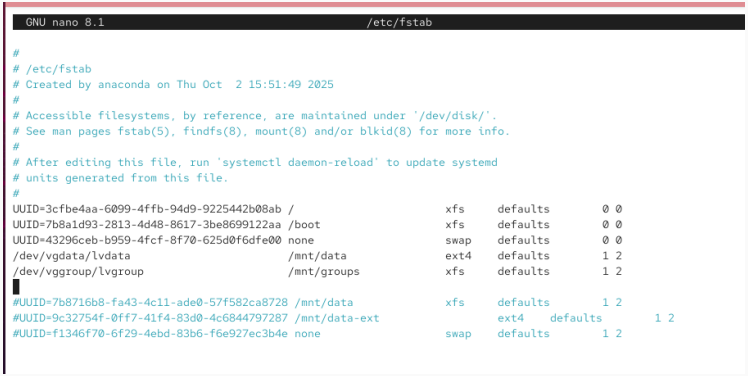


Рис. 13: Монтирование /mnt/groups

Добавление PV /dev/sdc2

```
root@raliev:/home/raliev#
root@raliev:/home/raliev# mount | grep mnt
/dev/mapper/vggroup-lvgroup on /mnt/groups type xfs (rw,relatime,seclabel,attr2,inode64,logbufs=8,logbsize=32k,noqu
ota)
/dev/mapper/vgdata-lvdata on /mnt/data type ext4 (rw,relatime,seclabel)
root@raliev:/home/raliev# df -h
Filesystem                Size  Used Avail Use% Mounted on
/dev/mapper/rl_vbox-root   35G  6.0G   30G  17% /
devtmpfs                  4.0M     0  4.0M   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  377M  584M  40% /boot
/dev/mapper/vggroup-lvgroup  532M   41M  492M   8% /mnt/groups
/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@raliev:/home/raliev#
```

Рис. 14: Добавление PV

Увеличение lvgroup и файловой системы

```
  /dev/sdc1  vggroup lvm2 a--  596.00m      0
  /dev/sdc2          lvm2 ---  450.00m 450.00m
root@raliev:/home/raliev# vgextend vggroup /dev/sdc2
  Volume group "vggroup" successfully extended
root@raliev:/home/raliev# 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 368.00m
  vggroup   2   1   0 wz--n-  <1.02g 448.00m
root@raliev:/home/raliev# 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@raliev:/home/raliev# lvs
  LV      VG      Attr       LSize   Pool Origin Data%  Meta%  Move Log Cpy%Sync Convert
  root    rl_vbox -wi-ao----  35.05g
  swap    rl_vbox -wi-ao----  <3.95g
  lvdata  vgdata  -wi-ao---- 224.00m
  lvgroup vggroup -wi-ao----  <1.02g
root@raliev:/home/raliev#
```

Итоговое состояние

```
root@raliev:/home/raliev#
root@raliev:/home/raliev# df -h
Filesystem                    Size  Used Avail Use% Mounted on
/dev/mapper/rl_vbox-root       35G  6.0G   30G  17% /
devtmpfs                      4.0M     0  4.0M   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  377M  584M  40% /boot
/dev/mapper/vggroup-lvgroup   980M   50M  931M   6% /mnt/groups
/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@raliev:/home/raliev#
```

Рис. 16: Итоговый размер

Итоги работы

Вывод

Изучены основные механизмы LVM: создание PV, VG и LV, изменение размеров томов и файловых систем, а также автоматическое монтирование через **fstab**. Получены практические навыки администрирования дискового пространства.