Лабораторная работа №15

Управление логическими томами LVM

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Цель работы

Основная цель

Получить навыки создания, управления и изменения размеров логических томов LVM.

Ход выполнения работы

Разметка диска

```
root@titukaev:/home/titukaev#
root@titukaev:/home/titukaev# fdisk /dev/sdb

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.

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

Создание PV

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

Рис. 2: PV create

Создание физического тома `/dev/sdb1`.

Создание VG

```
root@titukaev:/home/titukaev# lvcreate -n lvdata -l 50%FREE vgdata
  Logical volume "lvdata" created.
root@titukaev:/home/titukaev# 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-a----- 148.00m
root@titukaev:/home/titukaev# mkfs.ext4 /dev/vgdata/lvdata
mke2fs 1.47.1 (20-May-2024)
Creating filesystem with 151552 1k blocks and 37848 inodes
Filesystem UUID: e4ecda0b-5ad1-4e70-a1c2-88725313e42e
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@titukaev:/home/titukaev# mkdir -p /mnt/data
root@titukaev:/home/titukaev#
```

Рис. 3: VG create

Формирование группы томов `vgdata`.

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

Рис. 4: fstab запись

Создание логического тома `lvdata` и его монтирование.

Проверка монтирования

```
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: 0xe70b5361

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@titukaev:/home/titukaev#
```

Изменение размеров томов

Добавление нового раздела

```
root@titukaev:/home/titukaev#
root@titukaev:/home/titukaev# pvcreate /dev/sdb2
  Physical volume "/dev/sdb2" successfully created.
root@titukaev:/home/titukaev# vgextend vgdata /dev/sdb2
  Volume group "vgdata" successfully extended
root@titukaev:/home/titukaev# 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@titukaev:/home/titukaev# 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@titukaev:/home/titukaev# 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@titukaev:/home/titukaev#
```

Рис. 6: sdb2

Увеличение LV

```
root@titukaev:/home/titukaev# 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@titukaev:/home/titukaev# 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@titukaev:/home/titukaev# 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@titukaev:/home/titukaev#
```

Рис. 7: Увеличение LV

Уменьшение LV

```
Continue with ext4 file system reduce steps: unmount, fsck, resize2fs? [y/n]:y
  Reducing file system ext4 to 224.00 MiB (234881024 bytes) on vgdata/lvdata...
unmount /mnt/data
unmount done
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@titukaev:/home/titukaev# 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@titukaev:/home/titukaev# 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@titukaev:/home/titukaev#
```

Самостоятельная работа

Создание lvgroup и монтирование

```
Command (m for help): t
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: 0xbdb568b8

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@titukaev:/home/titukaev#
```

Форматирование XFS и запись в fstab

```
#
# /etc/fstab
# Created by anaconda on Thu Oct  9 10:35:46 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=325f0285-97c4-4ac5-a1f5-73f7bad9cc35 /                       xfs     defaults        0 0
UUID=3c70eb4e-07d0-4773-8246-8d52c68a9fbc /boot                   xfs     defaults        0 0
UUID=f51f7d8c-5e1e-475f-86dd-5a4d1dc28df2 none                    swap    defaults        0 0
/dev/vgdata/lvdata                        /mnt/data               ext4    defaults        1 2
/dev/vggroup/lvgroup                      /mnt/groups             xfs     defaults        1 2

#UUID=9cfe9ac7-db7a-4881-8863-45a294cff23a /mnt/data               xfs     defaults        1 2
#UUID=2baceac7-e797-4658-841b-4f3c6cfd372f /mnt/data-ext                   ext4    defaults        1 2
#UUID=4cf20b0b-047e-4042-bdb2-3b33139c9c4f none                    swap    defaults        0 0
```

Рис. 10: fstab groups

Файловая система XFS создана и подключена.

Проверка подключения

```
root@titukaev:/home/titukaev#
root@titukaev:/home/titukaev# mount -a
mount: (hint) your fstab has been modified, but systemd still uses
       the old version; use 'systemctl daemon-reload' to reload.
root@titukaev:/home/titukaev# 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@titukaev:/home/titukaev# 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   13M  719M   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
/dev/mapper/vggroup-lvgroup 532M   41M  492M   8% /mnt/groups
root@titukaev:/home/titukaev#
```

Рис. 11: mount /mnt/groups

Том корректно смонтирован.

Добавление PV и расширение VG

```
root@titukaev:/home/titukaev#
root@titukaev:/home/titukaev# pvcreate /dev/sdc2
  Physical volume "/dev/sdc2" successfully created.
root@titukaev:/home/titukaev# vgextend vggroup /dev/sdc2
  Volume group "vggroup" successfully extended
root@titukaev:/home/titukaev# 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.
```

Рис. 12: pvextend + lvextend

Расширение LV на 150 МБ, автоматическое увеличение XFS.

Проверка итогов

```
  Logical volume vggroup/lvgroup successfully resized.
root@titukaev:/home/titukaev# 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  vggroup lvm2 a--  448.00m      0
root@titukaev:/home/titukaev# 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      0
root@titukaev:/home/titukaev# 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@titukaev:/home/titukaev# 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   13M  719M   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
/dev/mapper/vggroup-lvgroup   980M   50M  931M   6% /mnt/groups
root@titukaev:/home/titukaev#
```

Рис. 13: Итоговая проверка

Итоги работы

Вывод

Освоены операции разметки, создания физического и логического уровней LVM, а также динамическое изменение размеров файловых систем. Полученные навыки демонстрируют гибкость и эффективность использования LVM для управления хранилищем.