Лабораторная работа №14

Партиции, файловые системы и монтирование

Сулейм Гамбердов

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Российский университет дружбы народов, Москва, Россия

Цель работы

Основная цель

Получить навыки создания разделов, работы с файловыми системами и монтирования в Linux.

Создание разделов MBR

Просмотр дисков

```
sigamberdov@sigamberdov:~$ su
Password:
root@sigamberdov:/home/sigamberdov# fdisk -l
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


Disk /dev/sda: 40 GiB, 42949672960 bytes, 83886080 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: gpt
Disk identifier: 2E7D45D6-2E97-4180-AFB2-F9A4A8302ECA

Device       Start      End  Sectors Size Type
/dev/sda1     2048     4095     2048   1M BIOS boot
/dev/sda2     4096  2101247  2097152   1G Linux extended boot
/dev/sda3  2101248 83884031 81782784  39G Linux LVM


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
```

Разметка диска через fdisk

```
Command (m for help): m

Help:

  DOS (MBR)
   a   toggle a bootable flag
   b   edit nested BSD disklabel
   c   toggle the dos compatibility flag

  Generic
   d   delete a partition
   F   list free unpartitioned space
   l   list known partition types
   n   add a new partition
   p   print the partition table
   t   change a partition type
   v   verify the partition table
   i   print information about a partition
   e   resize a partition

  Misc
   m   print this menu
   u   change display/entry units
   x   extra functionality (experts only)

  Script
   I   load disk layout from sfdisk script file
   O   dump disk layout to sfdisk script file

  Save & Exit
   w   write table to disk and exit
   q   quit without saving changes
```

Создание основного раздела 300 MiB

```
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: 0x1fde30aa

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

root@sigamberdov:/home/sigamberdov#
```

Проверка структуры и синхронизация

```
root@sigamberdov:/home/sigamberdov#
root@sigamberdov:/home/sigamberdov# fdisk /dev/sdb -l
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: 0x1fde30aa

Device     Boot Start    End Sectors  Size Id Type
/dev/sdb1        2048 616447  614400  300M 83 Linux
root@sigamberdov:/home/sigamberdov# cat /proc/partitions
major minor  #blocks  name

  11        0    1048575 sr0
   8       32    1572864 sdc
   8        0   41943040 sda
   8        1       1024 sda1
   8        2    1048576 sda2
   8        3   40891392 sda3
   8       16    1572864 sdb
   8       17     307200 sdb1
 253        0   36753408 dm-0
 253        1    4136960 dm-1
root@sigamberdov:/home/sigamberdov# partprobe /dev/sdb
root@sigamberdov:/home/sigamberdov#
```

Расширенные и логические разделы

Создание extended-раздела и логического внутри него

```
root@sigamberdov:/home/sigamberdov#
root@sigamberdov:/home/sigamberdov# 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 (1 primary, 0 extended, 3 free)
   e   extended (container for logical partitions)
Select (default p): e
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):

Created a new partition 2 of type 'Extended' and of size 1.2 GiB.

Command (m for help): n
All space for primary partitions is in use.
Adding logical partition 5
First sector (618496-3145727, default 618496):
Last sector, +/-sectors or +/-size{K,M,G,T,P} (618496-3145727, default 3145727): +300M

Created a new partition 5 of type 'Linux' and of size 300 MiB.

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

root@sigamberdov:/home/sigamberdov#
```

Создание extended-раздела и логического внутри него

```
root@sigamberdov:/home/sigamberdov#
root@sigamberdov:/home/sigamberdov# partprobe /dev/sdb
root@sigamberdov:/home/sigamberdov# cat /proc/partitions
major minor  #blocks  name

  11        0    1048575 sr0
   8       32    1572864 sdc
   8        0   41943040 sda
   8        1       1024 sda1
   8        2    1048576 sda2
   8        3   40891392 sda3
   8       16    1572864 sdb
   8       17     307200 sdb1
   8       18          0 sdb2
   8       21     307200 sdb5
 253        0   36753408 dm-0
 253        1    4136960 dm-1
root@sigamberdov:/home/sigamberdov# fdisk /dev/sdb -l
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: 0x1fde30aa

Device     Boot  Start     End Sectors  Size Id Type
/dev/sdb1         2048  616447  614400  300M 83 Linux
/dev/sdb2       616448 3145727 2529280  1.2G  5 Extended
/dev/sdb5       618496 1232895  614400  300M 83 Linux
root@sigamberdov:/home/sigamberdov#
```

Создание swap

Разметка и изменение типа раздела

```
root@sigamberdov:/home/sigamberdov# 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
All space for primary partitions is in use.
Adding logical partition 6
First sector (1234944-3145727, default 1234944):
Last sector, +/-sectors or +/-size{K,M,G,T,P} (1234944-3145727, default 3145727): +300M

Created a new partition 6 of type 'Linux' and of size 300 MiB.

Command (m for help): t
Partition number (1,2,5,6, default 6):
Hex code or alias (type L to list all): 82

Changed type of partition 'Linux' to 'Linux swap / Solaris'.

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

root@sigamberdov:/home/sigamberdov#
```

Активация swap

```
   8        0   41943040 sda
   8        1       1024 sda1
   8        2    1048576 sda2
   8        3   40891392 sda3
   8       16    1572864 sdb
   8       17     307200 sdb1
   8       18          0 sdb2
   8       21     307200 sdb5
   8       22     307200 sdb6
 253        0   36753408 dm-0
 253        1    4136960 dm-1
root@sigamberdov:/home/sigamberdov# fdisk /dev/sdb -l
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: 0x1fde30aa

Device     Boot   Start     End Sectors  Size Id Type
/dev/sdb1          2048  616447  614400  300M 83 Linux
/dev/sdb2        616448 3145727 2529280  1.2G  5 Extended
/dev/sdb5        618496 1232895  614400  300M 83 Linux
/dev/sdb6       1234944 1849343  614400  300M 82 Linux swap / Solaris
root@sigamberdov:/home/sigamberdov# mkswap /dev/sdb6
Setting up swapspace version 1, size = 300 MiB (314568704 bytes)
no label, UUID=3ebb4444-8a5f-41a8-bdd9-af5d949ef588
root@sigamberdov:/home/sigamberdov# swapon /dev/sdb6
root@sigamberdov:/home/sigamberdov# free -m
               total        used        free      shared  buff/cache   available
Mem:            3652        1415         698          20        1800        2237
Swap:           4339           0        4339
root@sigamberdov:/home/sigamberdov#
```

GPT-разметка через gdisk

Создание GPT-таблицы и первого раздела

```
root@sigamberdov:/home/sigamberdov#
root@sigamberdov:/home/sigamberdov# gdisk -l /dev/sdc
GPT fdisk (gdisk) version 1.0.10

Partition table scan:
  MBR: not present
  BSD: not present
  APM: not present
  GPT: not present

Creating new GPT entries in memory.
Disk /dev/sdc: 3145728 sectors, 1.5 GiB
Model: VBOX HARDDISK
Sector size (logical/physical): 512/512 bytes
Disk identifier (GUID): 3F72C5A4-B6C9-47EC-83AD-7D514189964D
Partition table holds up to 128 entries
Main partition table begins at sector 2 and ends at sector 33
First usable sector is 34, last usable sector is 3145694
Partitions will be aligned on 2048-sector boundaries
Total free space is 3145661 sectors (1.5 GiB)

Number  Start (sector)    End (sector)  Size       Code  Name
root@sigamberdov:/home/sigamberdov#
```

Создание GPT-таблицы и первого раздела

```
Creating new GPT entries in memory.

Command (? for help): n
Partition number (1-128, default 1):
First sector (34-3145694, default = 2048) or {+-}size{KMGTP}:
Last sector (2048-3145694, default = 3143679) or {+-}size{KMGTP}: +300M
Current type is 8300 (Linux filesystem)
Hex code or GUID (L to show codes, Enter = 8300): 8300
Changed type of partition to 'Linux filesystem'

Command (? for help): p
Disk /dev/sdc: 3145728 sectors, 1.5 GiB
Model: VBOX HARDDISK
Sector size (logical/physical): 512/512 bytes
Disk identifier (GUID): CF2476D3-48A3-457C-BB66-0156E44B4FFA
Partition table holds up to 128 entries
Main partition table begins at sector 2 and ends at sector 33
First usable sector is 34, last usable sector is 3145694
Partitions will be aligned on 2048-sector boundaries
Total free space is 2531261 sectors (1.2 GiB)

Number  Start (sector)    End (sector)  Size       Code  Name
   1            2048          616447   300.0 MiB   8300  Linux filesystem

Command (? for help): w

Final checks complete. About to write GPT data. THIS WILL OVERWRITE EXISTING
PARTITIONS!!

Do you want to proceed? (Y/N): Y
OK; writing new GUID partition table (GPT) to /dev/sdc.
The operation has completed successfully.
root@sigamberdov:/home/sigamberdov#
```

Проверка структуры

```
   8        0   41943040 sda
   8        1       1024 sda1
   8        2    1048576 sda2
   8        3   40891392 sda3
   8       16    1572864 sdb
   8       17     307200 sdb1
   8       18          0 sdb2
   8       21     307200 sdb5
   8       22     307200 sdb6
 253        0   36753408 dm-0
 253        1    4136960 dm-1
root@sigamberdov:/home/sigamberdov# gdisk  /dev/sdc -l
GPT fdisk (gdisk) version 1.0.10

Partition table scan:
  MBR: protective
  BSD: not present
  APM: not present
  GPT: present

Found valid GPT with protective MBR; using GPT.
Disk /dev/sdc: 3145728 sectors, 1.5 GiB
Model: VBOX HARDDISK
Sector size (logical/physical): 512/512 bytes
Disk identifier (GUID): CF2476D3-48A3-457C-BB66-0156E44B4FFA
Partition table holds up to 128 entries
Main partition table begins at sector 2 and ends at sector 33
First usable sector is 34, last usable sector is 3145694
Partitions will be aligned on 2048-sector boundaries
Total free space is 2531261 sectors (1.2 GiB)

Number  Start (sector)    End (sector)  Size       Code  Name
   1            2048          616447   300.0 MiB   8300  Linux filesystem
root@sigamberdov:/home/sigamberdov#
```

Форматирование файловых систем

```
root@sigamberdov:/home/sigamberdov#
root@sigamberdov:/home/sigamberdov# mkfs.xfs /dev/sdb1
meta-data=/dev/sdb1              isize=512    agcount=4, agsize=19200 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=76800, 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@sigamberdov:/home/sigamberdov# xfs_admin -L xfsdisk /dev/sdb1
writing all SBs
new label = "xfsdisk"
root@sigamberdov:/home/sigamberdov# mkfs.ext4 /dev/sdb5
mke2fs 1.47.1 (20-May-2024)
Creating filesystem with 307200 1k blocks and 76912 inodes
Filesystem UUID: 09563bfb-73b5-4c40-8345-fb658ea62727
Superblock backups stored on blocks:
        8193, 24577, 40961, 57345, 73729, 204801, 221185

Allocating group tables: done
Writing inode tables: done
Creating journal (8192 blocks): done
Writing superblocks and filesystem accounting information: done

root@sigamberdov:/home/sigamberdov# tune2fs -L ext4disk /dev/sdb5
tune2fs 1.47.1 (20-May-2024)
root@sigamberdov:/home/sigamberdov# tune2fs -o acl,user_xatrr /dev/sdb5
tune2fs 1.47.1 (20-May-2024)
Invalid mount option set: acl,user_xatrr
root@sigamberdov:/home/sigamberdov#
```

Ручное монтирование

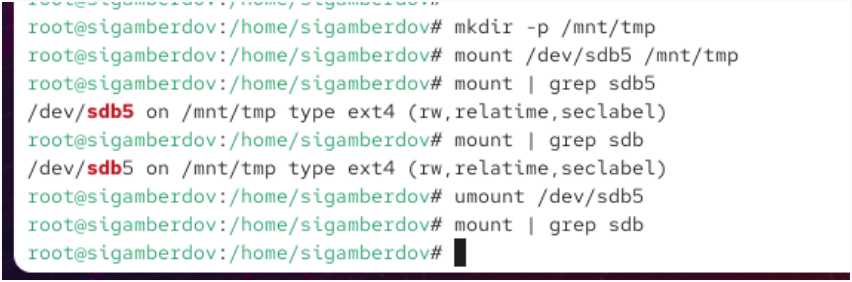

Рис. 13: Монтирование EXT4

Автоматическое монтирование через /etc/fstab

Получение UUID

```
root@sigamberdov:/home/sigamberdov#
root@sigamberdov:/home/sigamberdov# mkdir -p /mnt/data
root@sigamberdov:/home/sigamberdov# blkid
/dev/mapper/rl_vbox-swap: UUID="fc4eddc6-c4f4-4723-8f5d-faafa4784cda" TYPE="swap"
/dev/sdb2: PTTYPE="dos" PARTUUID="1fde30aa-02"
/dev/sdb5: LABEL="ext4disk" UUID="09563bfb-73b5-4c40-8345-fb658ea62727" BLOCK_SIZE="1024" TYPE="ext4" PARTUU
ID="1fde30aa-05"
/dev/sdb1: LABEL="xfsdisk" UUID="64b7dd76-1cc8-4235-8ad8-4f90d12c9605" BLOCK_SIZE="512" TYPE="xfs" PARTUUID=
"1fde30aa-01"
/dev/sdb6: UUID="3ebb4444-8a5f-41a8-bdd9-af5d949ef588" TYPE="swap" PARTUUID="1fde30aa-06"
/dev/mapper/rl_vbox-root: UUID="56362b30-55f8-4f4b-9a9b-2544717501fa" BLOCK_SIZE="512" TYPE="xfs"
/dev/sdc1: PARTLABEL="Linux filesystem" PARTUUID="8d2f7fbe-8ef7-42dc-bd0d-0bdfbe37b5d7"
/dev/sda2: UUID="eeeec4be-5545-4b77-be3e-c9b195fe2286" BLOCK_SIZE="512" TYPE="xfs" PARTUUID="01222ce8-64d8-4
857-9059-bef1a8e1e10c"
/dev/sda3: UUID="u20Lko-J1pn-wxbK-VPRg-PAcf-ZwCg-mMUv1V" TYPE="LVM2_member" PARTUUID="4285959c-2763-4527-837
7-1bacc92bd9fd"
/dev/sda1: PARTUUID="939c6f5a-b4ac-47b4-bf95-c7d5df35fc34"
root@sigamberdov:/home/sigamberdov# blkid /dev/sdb1
/dev/sdb1: LABEL="xfsdisk" UUID="64b7dd76-1cc8-4235-8ad8-4f90d12c9605" BLOCK_SIZE="512" TYPE="xfs" PARTUUID=
"1fde30aa-01"
root@sigamberdov:/home/sigamberdov#
```

Рис. 14: UUID через blkid

Настройка /etc/fstab

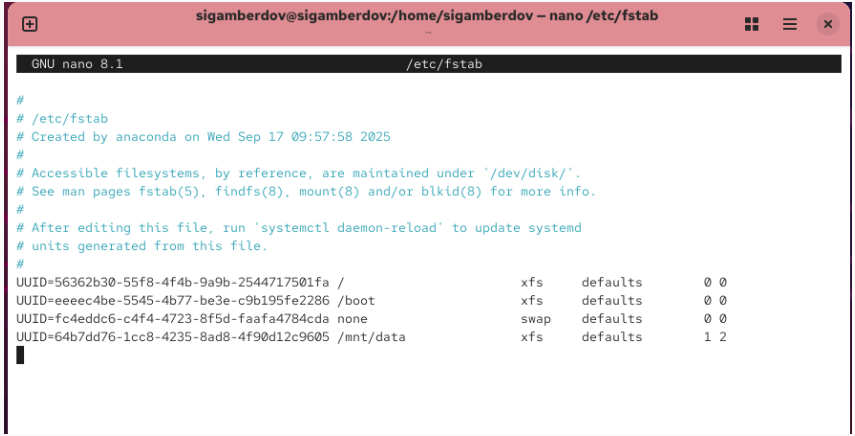

Рис. 15: Редактирование fstab

Проверка монтирования

```
root@sigamberdov:/home/sigamberdov# mount -a
mount: (hint) your fstab has been modified, but systemd still uses
       the old version; use 'systemctl daemon-reload' to reload.
root@sigamberdov:/home/sigamberdov# df -h
Filesystem                Size  Used Avail Use% Mounted on
/dev/mapper/rl_vbox-root   35G  6.1G   29G  18% /
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  148K  366M   1% /run/user/1000
tmpfs                     366M   60K  366M   1% /run/user/0
/dev/sdb1                 236M   20M  217M   9% /mnt/data
root@sigamberdov:/home/sigamberdov#
```

Рис. 16: df -h

Самостоятельная часть

Добавление GPT-разделов

```
Partition table scan:
  MBR: protective
  BSD: not present
  APM: not present
  GPT: present

Found valid GPT with protective MBR; using GPT.

Command (? for help): n
Partition number (2-128, default 2):
First sector (34-3145694, default = 616448) or {+-}size{KMGTP}:
Last sector (616448-3145694, default = 3143679) or {+-}size{KMGTP}: +300M
Current type is 8300 (Linux filesystem)
Hex code or GUID (L to show codes, Enter = 8300):
Changed type of partition to 'Linux filesystem'

Command (? for help): n
Partition number (3-128, default 3):
First sector (34-3145694, default = 1230848) or {+-}size{KMGTP}:
Last sector (1230848-3145694, default = 3143679) or {+-}size{KMGTP}: +300M
Current type is 8300 (Linux filesystem)
Hex code or GUID (L to show codes, Enter = 8300): 8200
Changed type of partition to 'Linux swap'

Command (? for help): w

Final checks complete. About to write GPT data. THIS WILL OVERWRITE EXISTING
PARTITIONS!!

Do you want to proceed? (Y/N): Y
OK; writing new GUID partition table (GPT) to /dev/sdc.
The operation has completed successfully.
root@sigamberdov:/home/sigamberdov#
```

Добавление GPT-разделов

```
root@sigamberdov:/home/sigamberdov# mkfs.ext4 /dev/sdc2
mke2fs 1.47.1 (20-May-2024)
Creating filesystem with 307200 1k blocks and 76912 inodes
Filesystem UUID: a6678ce7-9195-4c69-89af-3fc1c3aab6a9
Superblock backups stored on blocks:
        8193, 24577, 40961, 57345, 73729, 204801, 221185

Allocating group tables: done
Writing inode tables: done
Creating journal (8192 blocks): done
Writing superblocks and filesystem accounting information: done

root@sigamberdov:/home/sigamberdov# tune2fs -L ext4disk /dev/sdc2
tune2fs 1.47.1 (20-May-2024)
root@sigamberdov:/home/sigamberdov# tune2fs -o acl,user_xattr /dev/sdc2
tune2fs 1.47.1 (20-May-2024)
root@sigamberdov:/home/sigamberdov# mkswap /dev/sdc3
Setting up swapspace version 1, size = 300 MiB (314568704 bytes)
no label, UUID=dd15f474-b25a-4385-8bbe-a1ad82ed2852
root@sigamberdov:/home/sigamberdov#
```

Рис. 18: Форматирование ext4 и swap

Итоги проверки

```
sigamberdov@sigamberdov:~$ mount | grep mnt
/dev/sda1 on /mnt/data type xfs (rw,relatime,seclabel,attr2,inode64,logbufs=8,logbsize=32k,noquota)
/dev/sdc2 on /mnt/data-ext type ext4 (rw,relatime,seclabel)
sigamberdov@sigamberdov:~$ df -h
Filesystem                Size  Used Avail Use% Mounted on
/dev/mapper/rl_vbox-root   35G  6.1G   29G  18% /
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/sda1                 236M   20M  217M   9% /mnt/data
/dev/sdb2                 960M  377M  584M  40% /boot
/dev/sdc2                 272M   14K  253M   1% /mnt/data-ext
tmpfs                     366M  144K  366M   1% /run/user/1000
sigamberdov@sigamberdov:~$ free -m
               total        used        free      shared  buff/cache   available
Mem:            3652        1342        1223          17        1330        2310
Swap:           4339           0        4339
sigamberdov@sigamberdov:~$
```

Рис. 19: Проверка монтирования и swap

Итоги работы

Вывод

В ходе лабораторной работы выполнено создание разделов MBR и GPT, форматирование файловых систем XFS и EXT4, настройка разделов подкачки, ручное и автоматическое монтирование через /etc/fstab. Получены практические навыки администрирования дисковой подсистемы Linux.