Лабораторная работа №14

Партиции, файловые системы, монтирование

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Цель работы

Основная цель

Получить навыки создания разделов, файловых систем и монтирования в Linux.

Ход выполнения работы

Просмотр дисков

```
root@titukaev:~#
root@titukaev:~# 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/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


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: B51FA75B-7D93-4418-ACE4-28E57C2D2EE4

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/mapper/rl_vbox-root: 35.05 GiB, 37635489792 bytes, 73506816 sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
```

Работа с fdisk: создание MBR-разделов

```
root@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.

Device does not contain a recognized partition table.
Created a new DOS (MBR) disklabel with disk identifier 0x62ba6ff1.

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)
```

Создание основного раздела

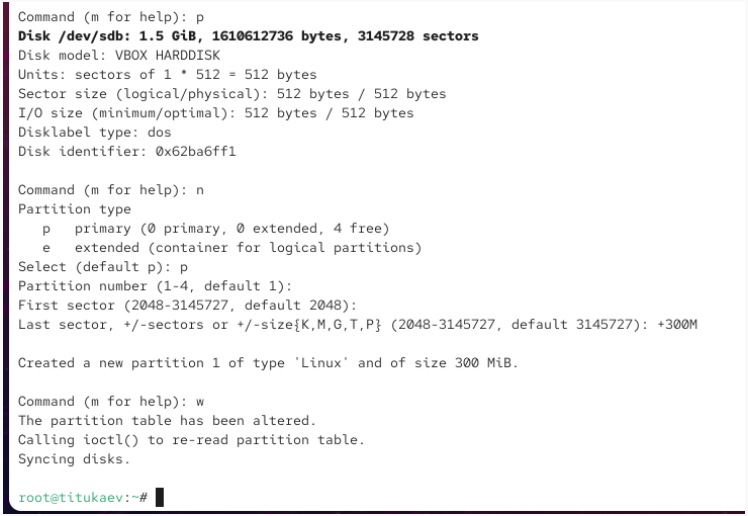

Рис. 3: Создание основного раздела

Проверка таблицы разделов

```
root@titukaev:~#
root@titukaev:~# 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: 0x62ba6ff1

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

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

Создание расширенного и логического разделов

```
root@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 (1 primary, 0 extended, 3 free)
   e   extended (container for logical partitions)
Select (default p): e
Partition number (2-4, default 2): 4
First sector (616448-3145727, default 616448):
Last sector, +/-sectors or +/-size{K,M,G,T,P} (616448-3145727, default 3145727):

Created a new partition 4 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@titukaev:~#
```

Проверка логических разделов

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

   8       32    1572864 sdc
   8       16    1572864 sdb
   8       17     307200 sdb1
   8       20          0 sdb4
   8       21     307200 sdb5
   8        0   41943040 sda
   8        1       1024 sda1
   8        2    1048576 sda2
   8        3   40891392 sda3
  11        0    1048575 sr0
 253        0   36753408 dm-0
 253        1    4136960 dm-1
root@titukaev:~# 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: 0x62ba6ff1

Device     Boot  Start     End Sectors  Size Id Type
/dev/sdb1         2048  616447  614400  300M 83 Linux
/dev/sdb4       616448 3145727 2529280  1.2G  5 Extended
/dev/sdb5       618496 1232895  614400  300M 83 Linux
root@titukaev:~#
```

Создание раздела подкачки

```
root@titukaev:~#
root@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
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 (1,4-6, 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@titukaev:~#
```

Рис. 7: Создание swap-раздела

Активация swap

```
   8       32    1572864 sdc
   8       16    1572864 sdb
   8       17     307200 sdb1
   8       20          0 sdb4
   8       21     307200 sdb5
   8       22     307200 sdb6
   8        0   41943040 sda
   8        1       1024 sda1
   8        2    1048576 sda2
   8        3   40891392 sda3
  11        0    1048575 sr0
 253        0   36753408 dm-0
 253        1    4136960 dm-1
root@titukaev:~# 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: 0x62ba6ff1

Device     Boot   Start     End Sectors  Size Id Type
/dev/sdb1          2048  616447  614400  300M 83 Linux
/dev/sdb4        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@titukaev:~# mkswap /dev/sdb6
Setting up swapspace version 1, size = 300 MiB (314568704 bytes)
no label, UUID=6cad7c30-14c7-4731-8288-c69dd4be57c0
root@titukaev:~# swapon /dev/sdb6
root@titukaev:~# free -m
               total        used        free      shared  buff/cache   available
Mem:            3652        1398        1344          20        1162        2254
Swap:           4339           0        4339
root@titukaev:~#
```

Работа с GPT: разметка диска

```
root@titukaev:~# 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): 6DE139D2-5EA8-462C-81DA-F9BD5EC3FE45
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@titukaev:~#
```

Рис. 9: Просмотр GPT

Создание GPT-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):
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): 147B0023-639E-4AE9-8DF9-4229744F8B97
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@titukaev:~#
```

Проверка GPT

```
major minor  #blocks  name

   8       32    1572864 sdc
   8       33     307200 sdc1
   8       16    1572864 sdb
   8       17     307200 sdb1
   8       20          0 sdb4
   8       21     307200 sdb5
   8       22     307200 sdb6
   8        0   41943040 sda
   8        1       1024 sda1
   8        2    1048576 sda2
   8        3   40891392 sda3
  11        0    1048575 sr0
 253        0   36753408 dm-0
 253        1    4136960 dm-1
root@titukaev:~# 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): 147B0023-639E-4AE9-8DF9-4229744F8B97
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@titukaev:~#
```

Форматирование XFS и EXT4

```
root@titukaev:~#
root@titukaev:~# 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@titukaev:~# xfs_admin -L xfsdisk /dev/sdb1
writing all SBs
new label = "xfsdisk"
root@titukaev:~#
root@titukaev:~# mkfs.ext4 /dev/sdb5
mke2fs 1.47.1 (20-May-2024)
Creating filesystem with 307200 1k blocks and 76912 inodes
Filesystem UUID: cd227ff5-6a0a-40e8-a519-b85e7f85657d
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@titukaev:~# tune2fs -L ext4disk /dev/sdb5
tune2fs 1.47.1 (20-May-2024)
root@titukaev:~# tune2fs -o acl,user_xattr /dev/sdb5
tune2fs 1.47.1 (20-May-2024)
root@titukaev:~#
```

Ручное монтирование

Раздел `/dev/sdb5` смонтирован в `/mnt/tmp` и затем отмонтирован.

UUID и настройка fstab

Рис. 13: UUID устройств

Получены UUID и добавлена запись в `/etc/fstab`.

Проверка fstab

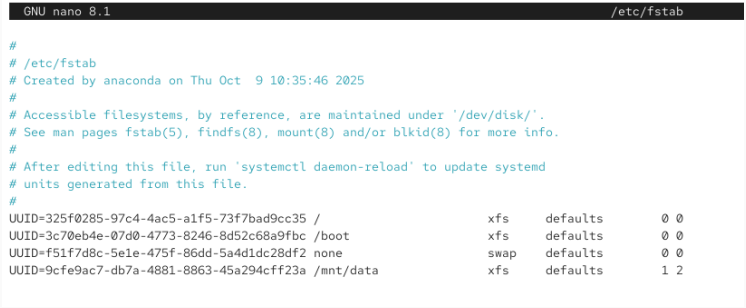

Рис. 14: Редактирование fstab

Автоматическое монтирование подтверждено.

Проверка монтирования

```
root@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:~# df -h
Filesystem                Size  Used Avail Use% Mounted on
/dev/mapper/rl_vbox-root   35G  5.5G   30G  16% /
devtmpfs                  4.0M     0  4.0M   0% /dev
tmpfs                     1.8G   84K  1.8G   1% /dev/shm
tmpfs                     731M   11M  721M   2% /run
tmpfs                     1.0M     0  1.0M   0% /run/credentials/systemd-journald.service
/dev/sda2                 960M  377M  584M  40% /boot
tmpfs                     366M  152K  366M   1% /run/user/1000
tmpfs                     366M   60K  366M   1% /run/user/0
/dev/sdb1                 236M   20M  217M   9% /mnt/data
root@titukaev:~#
```

Рис. 15: Проверка монтирования

Раздел автоматически смонтирован в `/mnt/data`.

Самостоятельная работа

Создание GPT-партиций

```
root@titukaev:~#
root@titukaev:~# gdisk /dev/sdc
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.

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@titukaev:~#
```

Форматирование ext4 и swap

```
Number  Start (sector)    End (sector)  Size       Code  Name
   1            2048          616447   300.0 MiB   8300  Linux filesystem
   2          616448         1230847   300.0 MiB   8300  Linux filesystem
   3         1230848         1845247   300.0 MiB   8200  Linux swap
root@titukaev:~#
root@titukaev:~# mkfs.ext4 /dev/sdc2
mke2fs 1.47.1 (20-May-2024)
Creating filesystem with 307200 1k blocks and 76912 inodes
Filesystem UUID: 2baceac7-e797-4658-841b-4f3c6cfd372f
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@titukaev:~# tune2fs -L ext4disk2 /dev/sdc2
tune2fs 1.47.1 (20-May-2024)
root@titukaev:~# tune2fs -o acl,user_xatrr /dev/sdc2
tune2fs 1.47.1 (20-May-2024)
Invalid mount option set: acl,user_xatrr
root@titukaev:~# tune2fs -o acl,user_xattr /dev/sdc2
tune2fs 1.47.1 (20-May-2024)
root@titukaev:~# mkswap /dev/sdc3
Setting up swapspace version 1, size = 300 MiB (314568704 bytes)
no label, UUID=4cf20b0b-047e-4042-bdb2-3b33139c9c4f
root@titukaev:~#
```

Настройка fstab

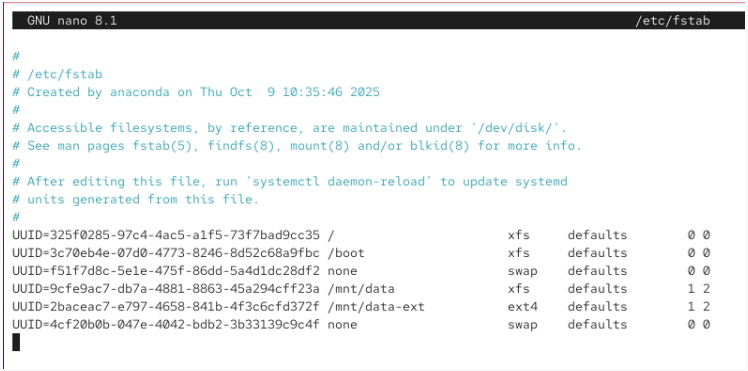

Рис. 18: Редактирование /etc/fstab

Добавлены записи для автоматического монтирования.

Проверка после перезагрузки

```
titukaev@titukaev:~$ mount | grep mnt
/dev/sda1 on /mnt/data type xfs (rw,relatime,seclabel,attr2,inode64,logbufs=8,logbsize=32k,noquota)
/dev/sdb2 on /mnt/data-ext type ext4 (rw,relatime,seclabel)
titukaev@titukaev:~$
titukaev@titukaev:~$ df -h
Filesystem                Size  Used Avail Use% Mounted on
/dev/mapper/rl_vbox-root   35G  5.6G   30G  16% /
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/sdc2                 960M  377M  584M  40% /boot
/dev/sda1                 236M   20M  217M   9% /mnt/data
/dev/sdb2                 272M   14K  253M   1% /mnt/data-ext
tmpfs                     366M  140K  366M   1% /run/user/1000
titukaev@titukaev:~$
titukaev@titukaev:~$ free -m
               total        used        free      shared  buff/cache   available
Mem:            3652        1293        1923          19         671        2359
Swap:           4339           0        4339
titukaev@titukaev:~$
```

Рис. 19: Проверка разделов

EXT4-раздел смонтирован, swap активен.

Итоги работы

Вывод

Были созданы MBR и GPT разделы, выполнено форматирование, настройка swap, ручное и автоматическое монтирование. Закреплены навыки работы с блочными устройствами и таблицами разделов в Linux.