Лабораторная работа №14

Партиции, файловые системы и монтирование

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Цель работы

Основная цель

Освоение создания разделов MBR и GPT, работы с файловыми системами и навыков монтирования (вручную и через `/etc/fstab`).

Выполнение работы

Просмотр дисков

```
haoladar@haoladar:~$ su
Password:
root@haoladar:/home/haoladar# fdisk -l
Disk /dev/sda: 50 GiB, 53687091200 bytes, 104857600 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: F5BC1546-7239-48EC-826F-E5DB510C6692

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 104855551 102754304  49G 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


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/mapper/rl_vbox-root: 45.05 GiB, 48372908032 bytes, 94478336 sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
```

Работа с fdisk

```
root@haoladar:/home/haoladar#
root@haoladar:/home/haoladar# 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 0xb6734812.

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)
```

Работа с fdisk

```
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: 0xb6734812

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@haoladar:/home/haoladar#
```

Рис. 3: Создание основного раздела

Проверка изменений

```
root@haoladar:/home/haoladar# 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: 0xb6734812

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

  11        0    1048575 sr0
   8        0   52428800 sda
   8        1       1024 sda1
   8        2    1048576 sda2
   8        3   51377152 sda3
   8       16    1572864 sdb
   8       17     307200 sdb1
   8       32    1572864 sdc
 253        0   47239168 dm-0
 253        1    4136960 dm-1
root@haoladar:/home/haoladar# partprobe /dev/sdb
root@haoladar:/home/haoladar#
```

Создание extended + logical

```
root@haoladar:/home/haoladar#
root@haoladar:/home/haoladar# 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@haoladar:/home/haoladar#
```

Проверка структуры

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

  11        0    1048575 sr0
   8        0   52428800 sda
   8        1       1024 sda1
   8        2    1048576 sda2
   8        3   51377152 sda3
   8       16    1572864 sdb
   8       17     307200 sdb1
   8       18          1 sdb2
   8       21     307200 sdb5
   8       32    1572864 sdc
 253        0   47239168 dm-0
 253        1    4136960 dm-1
root@haoladar:/home/haoladar# 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: 0xb6734812

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@haoladar:/home/haoladar#
```

Формирование и включение swap

```
root@haoladar:/home/haoladar#
root@haoladar:/home/haoladar# 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@haoladar:/home/haoladar#
```

Рис. 7: Создание разделов

Формирование и включение swap

```
root@haoladar:/home/haoladar# partprobe /dev/sdb
root@haoladar:/home/haoladar# 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: 0xb6734812

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@haoladar:/home/haoladar# mkswap /dev/sdb6
Setting up swapspace version 1, size = 300 MiB (314568704 bytes)
no label, UUID=9f7e6bb6-3a29-423b-a899-86885f96b545
root@haoladar:/home/haoladar# swapon /dev/sdb6
root@haoladar:/home/haoladar# free -m
               total        used        free      shared  buff/cache   available
Mem:            3652        1373         889          12        1636        2279
Swap:           4339           5        4334
root@haoladar:/home/haoladar#
```

Рис. 8: Активация swap

Создание GPT структур

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

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): 5064624E-FDCB-4FFB-BBCF-86185F802AA0
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@haoladar:/home/haoladar#
```

Проверка после partprobe

```
root@haoladar:/home/haoladar# cat /proc/partitions
major minor  #blocks  name

  11        0    1048575 sr0
   8        0   52428800 sda
   8        1       1024 sda1
   8        2    1048576 sda2
   8        3   51377152 sda3
   8       16    1572864 sdb
   8       17     307200 sdb1
   8       18          0 sdb2
   8       21     307200 sdb5
   8       22     307200 sdb6
   8       32    1572864 sdc
   8       33     307200 sdc1
 253        0   47239168 dm-0
 253        1    4136960 dm-1
root@haoladar:/home/haoladar# 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): 5064624E-FDCB-4FFB-BBCF-86185F802AA0
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@haoladar:/home/haoladar#
```

Создание XFS и EXT4

```
root@haoladar:/home/haoladar#
root@haoladar:/home/haoladar# 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@haoladar:/home/haoladar# xfs_admin -L xfsdisk /dev/sdb1
writing all SBs
new label = "xfsdisk"
root@haoladar:/home/haoladar# mkfs.ext4 /dev/sdb5
mke2fs 1.47.1 (20-May-2024)
Creating filesystem with 307200 1k blocks and 76912 inodes
Filesystem UUID: ced85be8-1e25-4202-a7c6-adf36df71e6a
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@haoladar:/home/haoladar# tune2fs -L ext4disk /dev/sdb5
tune2fs 1.47.1 (20-May-2024)
root@haoladar:/home/haoladar# tune2fs -o acl,user_xattr /dev/sdb5
tune2fs 1.47.1 (20-May-2024)
root@haoladar:/home/haoladar#
```

Временное монтирование EXT4

```
root@haoladar:/home/haoladar#
root@haoladar:/home/haoladar# mkdir -p /mnt/tmp
root@haoladar:/home/haoladar# mount /dev/sdb5 /mnt/tmp/
root@haoladar:/home/haoladar# mount | grep mnt
/dev/sdb5 on /mnt/tmp type ext4 (rw,relatime,seclabel)
root@haoladar:/home/haoladar# umount /dev/sdb5
root@haoladar:/home/haoladar# mount | grep mnt
root@haoladar:/home/haoladar#
root@haoladar:/home/haoladar# mkdir -p /mnt/data
root@haoladar:/home/haoladar# blkid
/dev/mapper/rl_vbox-swap: UUID="c466c7a2-d841-488a-bf7f-d2c113bd16e9" TYPE="swap"
/dev/sdb2: PTTYPE="dos" PARTUUID="b6734812-02"
/dev/sdb5: LABEL="ext4disk" UUID="ced85be8-1e25-4202-a7c6-adf36df71e6a" BLOCK_SIZE="1024" TYPE="ext4" PARTUUID="b6734812-05"
/dev/sdb1: LABEL="xfsdisk" UUID="537bbba2-8da8-43f8-a825-9af1930ffc8b" BLOCK_SIZE="512" TYPE="xfs" PARTUUID="b6734812-01"
/dev/sdb6: UUID="9f7e6bb6-3a29-423b-a899-86885f96b545" TYPE="swap" PARTUUID="b6734812-06"
/dev/mapper/rl_vbox-root: UUID="a13eb3a3-bceb-4a3a-b87e-3931082ea427" BLOCK_SIZE="512" TYPE="xfs"
/dev/sdc1: PARTLABEL="Linux filesystem" PARTUUID="bc6bd74e-dcff-4522-bc84-cd8b7f0772da"
/dev/sda2: UUID="43629939-4c99-4e06-bdc7-c748d86001b7" BLOCK_SIZE="512" TYPE="xfs" PARTUUID="42cd50ef-a931-4808-8e26-882c6ce37c2
"
/dev/sda3: UUID="sdNct5-0WBT-QYKU-mBAT-4CS2-WaGV-h5NOOb" TYPE="LVM2_member" PARTUUID="cb874803-de69-47e0-89bc-ffe284e8236e"
/dev/sda1: PARTUUID="2028ff06-aab5-4386-b8a6-9bdae6bfcce2"
root@haoladar:/home/haoladar#
```

Рис. 12: Монтирование и вывод blkid

Автоматическое монтирование

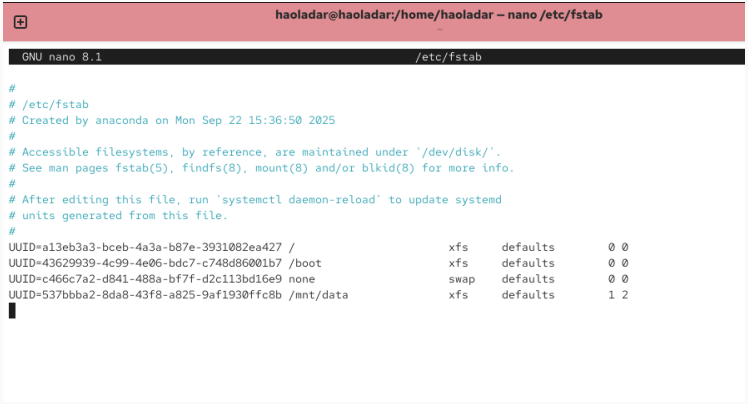

Рис. 13: Редактирование /etc/fstab

Проверка результата

```
root@haoladar:/home/haoladar#
root@haoladar:/home/haoladar# mount -a
mount: (hint) your fstab has been modified, but systemd still uses
       the old version; use 'systemctl daemon-reload' to reload.
root@haoladar:/home/haoladar# df -h
Filesystem                Size  Used Avail Use% Mounted on
/dev/mapper/rl_vbox-root   45G  6.3G   39G  14% /
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  144K  366M   1% /run/user/1000
tmpfs                     366M   60K  366M   1% /run/user/0
/dev/sdb1                 236M   20M  217M   9% /mnt/data
root@haoladar:/home/haoladar#
```

Рис. 14: Результат автоматического монтирования

Самостоятельная работа

Создание двух GPT-разделов

```
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@haoladar:/home/haoladar# 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): 5064624E-FDCB-4FFB-BBCF-86185F802AA0
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 1302461 sectors (636.0 MiB)

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@haoladar:/home/haoladar#
```

Форматирование и настройка swap

```
root@haoladar:/home/haoladar#
root@haoladar:/home/haoladar# mkfs.ext4 /dev/sdc2
mke2fs 1.47.1 (20-May-2024)
Creating filesystem with 307200 1k blocks and 76912 inodes
Filesystem UUID: 5c744dc6-dbc6-478f-9d40-8ce147e4d01e
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@haoladar:/home/haoladar# tune2fs -L ext4disk /dev/sdc2
tune2fs 1.47.1 (20-May-2024)
root@haoladar:/home/haoladar# tune2fs -o acl,user_xattr /dev/sdc2
tune2fs 1.47.1 (20-May-2024)
root@haoladar:/home/haoladar# mkswap /dev/sdc3
Setting up swapspace version 1, size = 300 MiB (314568704 bytes)
no label, UUID=423fe708-12fa-4293-a4c2-83748c3d707b
root@haoladar:/home/haoladar#
```

Рис. 16: Форматирование ext4 и создание swap

Настройка fstab

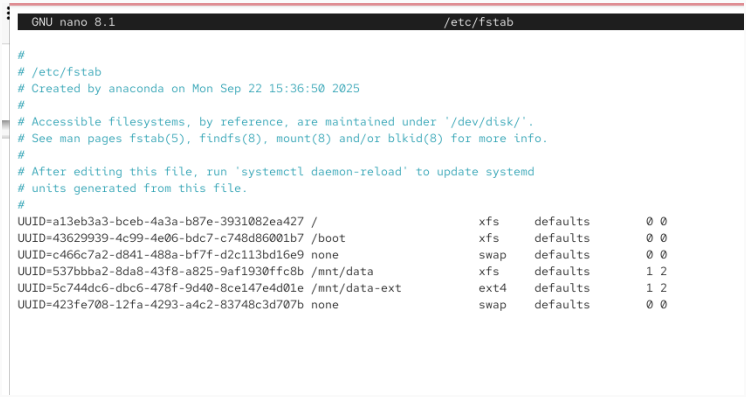

Рис. 17: Настройка /etc/fstab

Проверка монтирования и swap

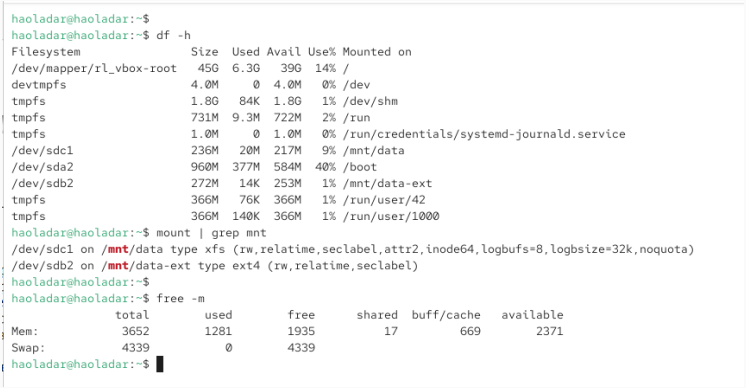

Рис. 18: Проверка монтирования и swap

Итоги работы

Выводы

- Освоены инструменты **fdisk** и **gdisk**
- Получены навыки разметки MBR и GPT
- Отработано создание файловых систем **XFS** и **EXT4**
- Настроено пространство подкачки **swap**
- Выполнено ручное и автоматическое монтирование файловых систем через `/etc/fstab`