# Презентация по лабораторной работе №10

## Основы работы с модулями ядра операционной системы

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# Цели и задачи работы

# Цель работы

Получить навыки работы с утилитами управления модулями ядра операционной системы Linux.

# Ход выполнения работы

# Просмотр устройств и связанных модулей

```
eragdzhabekova@eragdzhabekova:~$ su
Password:
root@eragdzhabekova:/home/eragdzhabekova#
root@eragdzhabekova:/home/eragdzhabekova# lspci -k
00:00.0 Host bridge: Intel Corporation 440FX - 82441FX PMC [Natoma] (rev 02)
00:01.0 ISA bridge: Intel Corporation 82371SB PIIX3 ISA [Natoma/Triton II]
00:01.1 IDE interface: Intel Corporation 82371AB/EB/MB PIIX4 IDE (rev 01)
        Kernel driver in use: ata_piix
        Kernel modules: ata_piix, ata_generic
00:02.0 VGA compatible controller: VMware SVGA II Adapter
        Subsystem: VMware SVGA II Adapter
        Kernel driver in use: vmwgfx
        Kernel modules: vmwgfx
00:03.0 Ethernet controller: Intel Corporation 82540EM Gigabit Ethernet Controller (rev 02)
        Subsystem: Intel Corporation PRO/1000 MT Desktop Adapter
        Kernel driver in use: e1000
        Kernel modules: e1000
00:04.0 System peripheral: InnoTek Systemberatung GmbH VirtualBox Guest Service
        Kernel driver in use: vboxguest
        Kernel modules: vboxguest
00:05.0 Multimedia audio controller: Intel Corporation 82801AA AC'97 Audio Controller (rev 01)
        Subsystem: Dell Device 0177
        Kernel driver in use: snd_intel8x0
        Kernel modules: snd_intel8x0
00:06.0 USB controller: Apple Inc. KeyLargo/Intrepid USB
        Kernel driver in use: ohci-pci
00:07.0 Bridge: Intel Corporation 82371AB/EB/MB PIIX4 ACPI (rev 08)
        Kernel driver in use: piix4_smbus
        Kernel modules: i2c_piix4
00:0b.0 USB controller: Intel Corporation 82801FB/FBM/FR/FW/FRW (ICH6 Family) USB2 EHCI Controller
        Kernel driver in use: ehci-pci
00:0d.0 SATA controller: Intel Corporation 82801HM/HEM (ICH8M/ICH8M-E) SATA Controller [AHCI mode] (rev 02)
        Kernel driver in use: ahci
        Kernel modules: ahci
root@eragdzhabekova:/home/eragdzhabekova#
```

# Список загруженных модулей

```
root@eragdzhabekova:/home/eragdzhabekova# lsmod | sort
ac97_bus               12288  1 snd_ac97_codec
ahci                   57344  3
ata_generic            16384  0
ata_piix               45056  1
cdrom                  90112  2 isofs,sr_mod
crc32c_intel           16384  0
crc32_pclmul           12288  0
crct10dif_pclmul       12288  1
dm_log                 24576  2 dm_region_hash,dm_mirror
dm_mirror              28672  0
dm_mod                245760  9 dm_multipath,dm_log,dm_mirror
dm_multipath           53248  0
dm_region_hash         28672  1 dm_mirror
drm_ttm_helper         16384  2 vmwgfx
e1000                 200704  0
fuse                  253952  5
ghash_clmulni_intel    16384  0
i2c_piix4              36864  0
i2c_smbus              20480  1 i2c_piix4
intel_pmc_core        126976  0
intel_rapl_common      53248  1 intel_rapl_msr
intel_rapl_msr         20480  0
intel_uncore_frequency_common    16384  0
intel_vsec             20480  1 intel_pmc_core
ip_set                 69632  0
isofs                  69632  1
joydev                 28672  0
libahci                69632  1 ahci
libata                512000  4 ata_piix,libahci,ahci,ata_generic
loop                   45056  0
Module                  Size  Used by
nf_conntrack          204800  2 nf_nat,nft_ct
nf_defrag_ipv4         12288  1 nf_conntrack
nf_defrag_ipv6         24576  1 nf_conntrack
nf_nat                 69632  1 nft_chain_nat
```

# Проверка и загрузка модуля ext4

```
root@eragdzhabekova:/home/eragdzhabekova#
root@eragdzhabekova:/home/eragdzhabekova# lsmod | grep ext4
root@eragdzhabekova:/home/eragdzhabekova# modprobe ext4
root@eragdzhabekova:/home/eragdzhabekova# lsmod | grep ext4
ext4                  1187840  0
mbcache                 16384  1 ext4
jbd2                   217088  1 ext4
root@eragdzhabekova:/home/eragdzhabekova# modinfo ext4
filename:       /lib/modules/6.12.0-55.12.1.el10_0.x86_64/kernel/fs/ext4/ext4.ko.xz
softdep:        pre: crc32c
license:        GPL
description:    Fourth Extended Filesystem
author:         Remy Card, Stephen Tweedie, Andrew Morton, Andreas Dilger, Theodore Ts'o and others
alias:          fs-ext4
alias:          ext3
alias:          fs-ext3
alias:          ext2
alias:          fs-ext2
rhelversion:    10.0
srcversion:     CBA9BD0FC931061AEC0A8F4
depends:        jbd2,mbcache
intree:         Y
name:           ext4
retpoline:      Y
vermagic:       6.12.0-55.12.1.el10_0.x86_64 SMP preempt mod_unload modversions
sig_id:         PKCS#7
signer:         Rocky kernel signing key
sig_key:        57:BC:A1:34:94:0D:57:12:99:67:28:D8:C0:8B:1C:4B:8C:8A:13:06
sig_hashalgo:   sha256
signature:      05:D7:3D:A0:55:EA:4A:16:70:78:23:1F:C7:9A:17:C6:A9:9C:B5:71:
                6B:EB:97:2C:94:5A:49:CB:07:A0:85:2E:27:8D:C4:01:27:43:2A:C8:
```

**Рис. 3:** Загрузка и проверка модуля ext4

# Попытка выгрузки модулей ext4 и xfs

```
root@eragdzhabekova:/home/eragdzhabekova#
root@eragdzhabekova:/home/eragdzhabekova# modprobe -r ext4
root@eragdzhabekova:/home/eragdzhabekova# lsmod | grep ext4
root@eragdzhabekova:/home/eragdzhabekova# modprobe -r xfs
modprobe: FATAL: Module xfs is in use.
root@eragdzhabekova:/home/eragdzhabekova#
```

**Рис. 4:** Выгрузка модулей ext4 и xfs

# Загрузка и анализ модуля bluetooth

```
root@eragdzhabekova:/home/eragdzhabekova#
root@eragdzhabekova:/home/eragdzhabekova# lsmod | grep bluetooth
root@eragdzhabekova:/home/eragdzhabekova# modprobe bluetooth
root@eragdzhabekova:/home/eragdzhabekova# lsmod | grep bluetooth
bluetooth            1114112  0
rfkill                 40960  4 bluetooth
root@eragdzhabekova:/home/eragdzhabekova# modinfo bluetooth
filename:       /lib/modules/6.12.0-55.12.1.el10_0.x86_64/kernel/net/bluetooth/bluetooth.ko.xz
alias:          net-pf-31
license:        GPL
version:        2.22
description:    Bluetooth Core ver 2.22
author:         Marcel Holtmann <marcel@holtmann.org>
rhelversion:    10.0
srcversion:     5F9AA895ADC3BA3840211D1
depends:        rfkill
intree:         Y
name:           bluetooth
retpoline:      Y
vermagic:       6.12.0-55.12.1.el10_0.x86_64 SMP preempt mod_unload modversions
sig_id:         PKCS#7
signer:         Rocky kernel signing key
sig_key:        57:BC:A1:34:94:0D:57:12:99:67:28:D8:C0:8B:1C:4B:8C:8A:13:06
sig_hashalgo:   sha256
signature:      2E:24:0B:EE:9E:E6:A3:58:91:2A:D3:87:25:A3:1B:46:06:89:06:BC:
                4A:99:10:8D:7A:0F:1E:FF:92:59:FD:59:74:DB:7E:42:40:14:03:C9:
                43:D0:A3:4F:F3:10:71:07:4D:FF:34:52:96:1A:8B:90:9C:DF:D8:FB:
                07:F9:07:16:2F:8D:4B:23:0C:92:93:0B:88:F9:82:6B:06:1B:BD:25:
```

**Рис. 5:** Модуль bluetooth

# Проверка версии ядра

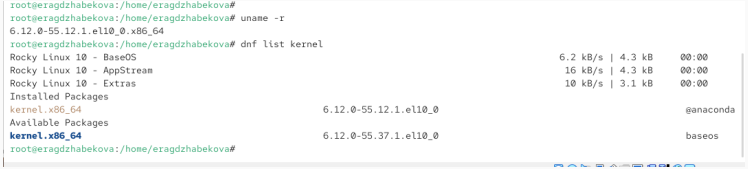


**Рис. 6:** Просмотр версии ядра

# Обновление ядра системы

```
  tuned-ppd-2.25.1-2.el10_0.noarch                udisks2-2.10.90-5.el10_0.1.x86_64
  udisks2-iscsi-2.10.90-5.el10_0.1.x86_64         udisks2-lvm2-2.10.90-5.el10_0.1.x86_64
  valgrind-1:3.24.0-5.el10_0.x86_64               valgrind-devel-1:3.24.0-5.el10_0.x86_64
  which-2.21-44.el10_0.x86_64                     xdg-desktop-portal-1.20.0-1.el10_0.x86_64
  xdg-user-dirs-0.18-6.el10_0.1.x86_64            xorg-x11-server-Xwayland-24.1.5-4.el10_0.x86_64
  yum-4.20.0-14.el10_0.rocky.0.1.noarch           zlib-ng-compat-2.2.3-1.el10.rocky.0.1.x86_64
  zlib-ng-compat-devel-2.2.3-1.el10.rocky.0.1.x86_64
Installed:
  kernel-6.12.0-55.37.1.el10_0.x86_64             kernel-core-6.12.0-55.37.1.el10_0.x86_64
  kernel-devel-6.12.0-55.37.1.el10_0.x86_64       kernel-modules-6.12.0-55.37.1.el10_0.x86_64
  kernel-modules-core-6.12.0-55.37.1.el10_0.x86_64 kernel-modules-extra-6.12.0-55.37.1.el10_0.x86_64
  libatomic-14.2.1-7.el10.x86_64                  libdex-0.8.1-1.el10.x86_64

Complete!
root@eragdzhabekova:/home/eragdzhabekova# dnf update kernel
Last metadata expiration check: 0:02:43 ago on Wed 15 Oct 2025 12:08:10 PM MSK.
Dependencies resolved.
Nothing to do.
Complete!
root@eragdzhabekova:/home/eragdzhabekova# dnf update
Last metadata expiration check: 0:02:47 ago on Wed 15 Oct 2025 12:08:10 PM MSK.
Dependencies resolved.
Nothing to do.
Complete!
root@eragdzhabekova:/home/eragdzhabekova# dnf upgrade --refresh
Rocky Linux 10 - BaseOS                                          12 kB/s | 4.3 kB     00:00
Rocky Linux 10 - AppStream                                       14 kB/s | 4.3 kB     00:00
Rocky Linux 10 - Extras                                         9.1 kB/s | 3.1 kB     00:00
Dependencies resolved.
Nothing to do.
Complete!
root@eragdzhabekova:/home/eragdzhabekova#
```

**Рис. 7:** Обновление ядра и системы

# Проверка новой версии ядра

```
eragdzhabekova@eragdzhabekova:~$ uname -r
6.12.0-55.37.1.el10_0.x86_64
eragdzhabekova@eragdzhabekova:~$ hostnamectl
     Static hostname: eragdzhabekova.localdomain
           Icon name: computer-vm
             Chassis: vm 🖴
          Machine ID: 8d3b0805f55e426c81d086a05a020583
             Boot ID: 77517ef2637f4f11b91d8f83d53c4728
      Virtualization: oracle
    Operating System: Rocky Linux 10.0 (Red Quartz)
         CPE OS Name: cpe:/o:rocky:rocky:10::baseos
      OS Support End: Thu 2035-05-31
OS Support Remaining: 9y 7month 2w
              Kernel: Linux 6.12.0-55.37.1.el10_0.x86_64
        Architecture: x86-64
     Hardware Vendor: innotek GmbH
      Hardware Model: VirtualBox
    Firmware Version: VirtualBox
       Firmware Date: Fri 2006-12-01
        Firmware Age: 18y 10month 2w
eragdzhabekova@eragdzhabekova:~$
```



Рис. 8: Проверка обновлённого ядра

# Итоги работы

# Вывод

В ходе лабораторной работы были изучены команды и механизмы управления модулями ядра Linux.

Освоены утилиты `lsmod`, `modprobe`, `modinfo`, `lspci`, а также процесс обновления ядра при помощи `dnf`.

Получены практические навыки администрирования системы и анализа работы модулей ядра.