

Операционные системы

Анализ файловой структуры UNIX. Команды для работы с файлами и каталогами

Цзян Вэньцзе

4 сентября 2025

Российский университет дружбы народов, Москва, Россия

Цели и задачи работы

Ознакомление с файловой системой Linux, её структурой, именами и содержанием каталогов. Приобретение практических навыков по применению команд для работы с файлами и каталогами, по управлению процессами, по проверке использования диска и обслуживанию файловой системы.

- 1 Выполнить приимеры
- 2 Выполнить дествия по работе с каталогами и файлами
- 3 Выполнить действия с правами доступа
- 4 Получить дополнительные сведения при помощи справки по командам.

Процесс выполнения лабораторной работы

```
jiangwenjie@jiangwenjie:~$ touch abc1
jiangwenjie@jiangwenjie:~$ cp abc1 april
jiangwenjie@jiangwenjie:~$ cp abc1 may
jiangwenjie@jiangwenjie:~$ mkdir monthly
jiangwenjie@jiangwenjie:~$ cp april may monthly
jiangwenjie@jiangwenjie:~$ cp monthly/may monthly/june
jiangwenjie@jiangwenjie:~$ ls monthly
april  june  may
jiangwenjie@jiangwenjie:~$ mkdir monthly.00
jiangwenjie@jiangwenjie:~$ cp -r monthly monthly.00
jiangwenjie@jiangwenjie:~$ cp -r monthly.00 /tmp
jiangwenjie@jiangwenjie:~$
```

Рис. 1: Выполнение примеров

```
jiangwenjie@jiangwenjie:~$  
jiangwenjie@jiangwenjie:~$ mv april july  
jiangwenjie@jiangwenjie:~$ mv july monthly.00  
jiangwenjie@jiangwenjie:~$ ls monthly.00  
july  monthly  
jiangwenjie@jiangwenjie:~$ mv monthly.00 monthly.01  
jiangwenjie@jiangwenjie:~$ mkdir reports  
jiangwenjie@jiangwenjie:~$ mv monthly.01 reports  
jiangwenjie@jiangwenjie:~$ mv reports/monthly.01 reports/monthly  
jiangwenjie@jiangwenjie:~$
```

Рис. 2: Выполнение примеров

```
jiangwenjie@jiangwenjie:~$  
jiangwenjie@jiangwenjie:~$ touch may  
jiangwenjie@jiangwenjie:~$ ls -l may  
-rw-r--r--. 1 jiangwenjie jiangwenjie 0 сен  4 15:57 may  
jiangwenjie@jiangwenjie:~$ chmod u+x may  
jiangwenjie@jiangwenjie:~$ ls -l may  
-rwxr--r--. 1 jiangwenjie jiangwenjie 0 сен  4 15:57 may  
jiangwenjie@jiangwenjie:~$ chmod u-x may  
jiangwenjie@jiangwenjie:~$ ls -l may  
-rw-r--r--. 1 jiangwenjie jiangwenjie 0 сен  4 15:57 may  
jiangwenjie@jiangwenjie:~$ chmod g-r,o-r monthly  
jiangwenjie@jiangwenjie:~$ chmod g+w abc1  
jiangwenjie@jiangwenjie:~$
```

Рис. 3: Выполнение примеров

Создание директорий и копирование файлов

```
jiangwenjie@jiangwenjie:~$  
jiangwenjie@jiangwenjie:~$ cp /usr/include/linux/sysinfo.h ~  
jiangwenjie@jiangwenjie:~$ mv sysinfo.h equipment  
jiangwenjie@jiangwenjie:~$ mkdir ski.plases  
jiangwenjie@jiangwenjie:~$ mv equipment ski.plases/  
jiangwenjie@jiangwenjie:~$ mv ski.plases/equipment ski.plases/equiplist  
jiangwenjie@jiangwenjie:~$  
^[[200~touch abc1  
^[[201~jiangwenjie@jiangwenjie:~$ touch abc1  
jiangwenjie@jiangwenjie:~$ cp abc1 ski.plases/equiplist2  
jiangwenjie@jiangwenjie:~$ cd ski.plases/  
jiangwenjie@jiangwenjie:~/ski.plases$ mkdir equipment  
jiangwenjie@jiangwenjie:~/ski.plases$ mv equiplist equipment/  
jiangwenjie@jiangwenjie:~/ski.plases$ mv equiplist2 equipment/  
jiangwenjie@jiangwenjie:~/ski.plases$ cd  
jiangwenjie@jiangwenjie:~$  
^[[200~mkdir newdir  
^[[201~jiangwenjie@jiangwenjie:~$ mkdir newdir  
jiangwenjie@jiangwenjie:~$ mv newdir ski.plases/  
jiangwenjie@jiangwenjie:~$ mv ski.plases/newdir/ ski.plases/plans  
jiangwenjie@jiangwenjie:~$
```

Рис. 4: Работа с каталогами

Работа с командой chmod

```
jiangwenjie@jiangwenjie:~$  
jiangwenjie@jiangwenjie:~$ mkdir australia play  
jiangwenjie@jiangwenjie:~$ touch my_os feathers  
jiangwenjie@jiangwenjie:~$ chmod 744 australia/  
jiangwenjie@jiangwenjie:~$ chmod 711 play/  
jiangwenjie@jiangwenjie:~$ chmod 544 my_os  
jiangwenjie@jiangwenjie:~$ chmod 664 feathers  
jiangwenjie@jiangwenjie:~$ ls -l  
итого 0  
-rw-rw-r--. 1 jiangwenjie jiangwenjie 0 сен 4 15:59 abc1  
drwxr--r--. 1 jiangwenjie jiangwenjie 0 сен 4 16:00 australia  
-rw-rw-r--. 1 jiangwenjie jiangwenjie 0 сен 4 16:00 feathers  
drwxr-xr-x. 1 jiangwenjie jiangwenjie 74 сен 4 14:59 git-extended  
-rw-r--r--. 1 jiangwenjie jiangwenjie 0 сен 4 15:57 may  
drwx--x--x. 1 jiangwenjie jiangwenjie 24 сен 4 15:53 monthly  
-r-xr--r--. 1 jiangwenjie jiangwenjie 0 сен 4 16:00 my_os  
drwx--x--x. 1 jiangwenjie jiangwenjie 0 сен 4 16:00 play  
drwxr-xr-x. 1 jiangwenjie jiangwenjie 14 сен 4 15:57 reports  
drwxr-xr-x. 1 jiangwenjie jiangwenjie 28 сен 4 15:59 ski.places  
drwxr-xr-x. 1 jiangwenjie jiangwenjie 10 сен 4 14:36 work  
drwxr-xr-x. 1 jiangwenjie jiangwenjie 0 сен 4 14:25 Видео  
drwxr-xr-x. 1 jiangwenjie jiangwenjie 0 сен 4 14:25 Документы  
drwxr-xr-x. 1 jiangwenjie jiangwenjie 26 сен 4 14:40 Загрузки  
drwxr-xr-x. 1 jiangwenjie jiangwenjie 0 сен 4 14:25 Изображения  
drwxr-xr-x. 1 jiangwenjie jiangwenjie 0 сен 4 14:25 Музыка  
drwxr-xr-x. 1 jiangwenjie jiangwenjie 0 сен 4 14:25 Общедоступные  
drwxr-xr-x. 1 jiangwenjie jiangwenjie 0 сен 4 14:25 'Рабочий стол'  
drwxr-xr-x. 1 jiangwenjie jiangwenjie 0 сен 4 14:25 Шаблоны  
jiangwenjie@jiangwenjie:~$
```

```
tss:x:59:59:Account used for TPM access:/:usr/sbin/nologin
avahi:x:70:70:Avahi mDNS/DNS-SD Stack:/var/run/avahi-daemon:/sbin/nologin
geoclue:x:999:999:User for geoclue:/var/lib/geoclue:/sbin/nologin
usbmuxd:x:113:113:usbmuxd user:/:sbin/nologin
systemd-oom:x:998:998:systemd Userspace OOM Killer:/:usr/sbin/nologin
qemu:x:107:107:qemu user:/:sbin/nologin
polkitd:x:114:114:User for polkitd:/:sbin/nologin
rtkit:x:172:172:RealtimeKit:/:sbin/nologin
chrony:x:997:994:chrony system user:/var/lib/chrony:/sbin/nologin
dnsmasq:x:996:993:Dnsmasq DHCP and DNS server:/var/lib/dnsmasq:/usr/sbin/nologin
gluster:x:995:992:GlusterFS daemons:/run/gluster:/sbin/nologin
rpc:x:32:32:Rpcbind Daemon:/var/lib/rpcbind:/sbin/nologin
pipewire:x:994:991:PipeWire System Daemon:/run/pipewire:/usr/sbin/nologin
unbound:x:993:990:Unbound DNS resolver:/var/lib/unbound:/sbin/nologin
nm-openconnect:x:992:989:NetworkManager user for OpenConnect:/:sbin/nologin
rpcuser:x:29:29:RPC Service User:/var/lib/nfs:/sbin/nologin
wsdd:x:991:988:Web Services Dynamic Discovery host daemon:/:sbin/nologin
sssd:x:990:986:User for sssd:/run/sss:/sbin/nologin
openvpn:x:989:985:OpenVPN:/etc/openvpn:/sbin/nologin
nm-openvpn:x:988:984:Default user for running openvpn spawned by NetworkManager:/:sbin/nologin
flatpak:x:987:983:Flatpak system helper:/:usr/sbin/nologin
colord:x:986:982:User for colord:/var/lib/colord:/sbin/nologin
abrt:x:173:173:/:etc/abrt:/sbin/nologin
gdm:x:42:42:GNOME Display Manager:/var/lib/gdm:/usr/sbin/nologin
gnome-initial-setup:x:985:981:/:run/gnome-initial-setup:/sbin/nologin
vboxadd:x:984:1:/:var/run/vboxadd:/sbin/nologin
sshd:x:74:74:Privilege-separated SSH:/usr/share/empty.sshd:/usr/sbin/nologin
tcpdump:x:72:72:tcpdump:/:usr/sbin/nologin
/etc/passwd
```

Рис. 6: Файл /etc/passwd

```
jiangwenjie@jiangwenjie:~$  
jiangwenjie@jiangwenjie:~$ cp feathers file.old  
jiangwenjie@jiangwenjie:~$ mv file.old play/  
jiangwenjie@jiangwenjie:~$ mkdir fun  
jiangwenjie@jiangwenjie:~$ cp -R play/ fun/  
jiangwenjie@jiangwenjie:~$ mv fun/ play/games  
jiangwenjie@jiangwenjie:~$ chmod u-r feathers  
jiangwenjie@jiangwenjie:~$ cat feathers  
cat: feathers: Отказано в доступе  
jiangwenjie@jiangwenjie:~$ cp feathers feathers2  
cp: невозможно открыть 'feathers' для чтения: Отказано в доступе  
jiangwenjie@jiangwenjie:~$ chmod u+r feathers  
jiangwenjie@jiangwenjie:~$ chmod u-x play/  
jiangwenjie@jiangwenjie:~$ cd play/  
bash: cd: play/: Отказано в доступе  
jiangwenjie@jiangwenjie:~$ chmod +x play/  
jiangwenjie@jiangwenjie:~$
```

Рис. 7: Работа с файлами и правами доступа

```
jiangwenjie@jiangwenjie:~ -- man mount

MOUNT(8)                                     System Administration                                MOUNT(8)

NAME
    mount - mount a filesystem

SYNOPSIS
    mount [-h|-V]

    mount [-l] [-t fstype]

    mount -a [-fFnrsvw] [-t fstype] [-O optlist]

    mount [-fnrsvw] [-o options] device|mountpoint

    mount [-fnrsvw] [-t fstype] [-o options] device mountpoint

    mount --bind|--rbind|--move olddir newdir

    mount --make-[shared|slave|private|unbindable|rshared|rslave|rprivate|runbindable] mountpoint

DESCRIPTION
    All files accessible in a Unix system are arranged in one big tree, the file hierarchy, rooted at /. These files can be spread out over several devices. The mount command serves to attach the filesystem found on some device to the big file tree. Conversely, the umount(8) command will detach it again. The filesystem is used to control how data is stored on the device or provided in a virtual way by network or other services.

    The standard form of the mount command is:

        mount -t type device dir

    This tells the kernel to attach the filesystem found on device (which is of type type) at the directory dir. The option -t type is optional. The mount command is usually able to detect a filesystem. The root permissions are necessary to mount a filesystem by default. See section "Non-superuser mounts" below for more details. The previous contents (if any) and owner and mode of dir become invisible, and as long as this filesystem remains mounted, the pathname dir refers to the root of the filesystem on device.

    If only the directory or the device is given, for example:

        mount /dir

    then mount looks for a mountpoint (and if not found then for a device) in the /etc/fstab file. It's possible to use the --target or --source options to avoid ambiguous interpretation of the given argument. For example:
```

```
jiangwenjie@jiangwenjie:~ — man fsck
FSCK(8)                                     System Administration      FSCK(8)

NAME
    fsck - check and repair a Linux filesystem

SYNOPSIS
    fsck [-lsAVRTMNP] [-r [fd]] [-C [fd]] [-t fstype] [filesystem...] [--] [fs-specific-options]

DESCRIPTION
    fsck is used to check and optionally repair one or more Linux filesystems. filesystem can be a device name (e.g.,
    /dev/hdc1, /dev/sdb2), a mount point (e.g., /, /usr, /home), or a filesystem label or UUID specifier (e.g.,
    UUID=8868abf6-88c5-4a83-98b8-bfc24057f7bd or LABEL=root). Normally, the fsck program will try to handle filesystems
    on different physical disk drives in parallel to reduce the total amount of time needed to check all of them.

    If no filesystems are specified on the command line, and the -A option is not specified, fsck will default to
    checking filesystems in /etc/fstab serially. This is equivalent to the -As options.

    The exit status returned by fsck is the sum of the following conditions:

    0
        No errors

    1
        Filesystem errors corrected

    2
        System should be rebooted

    4
        Filesystem errors left uncorrected

    8
        Operational error

    16
        Usage or syntax error

    32
        Checking canceled by user request

    128
        Shared-library error
```

```
jiangwenjie@jiangwenjie:~ -- man mkfs

MKFS(8)                                     System Administration      MKFS(8)

NAME
    mkfs - build a Linux filesystem

SYNOPSIS
    mkfs [options] [-t type] [fs-options] device [size]

DESCRIPTION
    This mkfs frontend is deprecated in favour of filesystem specific mkfs.<type> utils.

    mkfs is used to build a Linux filesystem on a device, usually a hard disk partition. The device argument is either the device name (e.g., /dev/hda1, /dev/sdb2), or a regular file that shall contain the filesystem. The size argument is the number of blocks to be used for the filesystem.

    The exit status returned by mkfs is 0 on success and 1 on failure.

    In actuality, mkfs is simply a front-end for the various filesystem builders (mkfs.fstype) available under Linux. The filesystem-specific builder is searched for via your PATH environment setting only. Please see the filesystem-specific builder manual pages for further details.

OPTIONS
    -t, --type type
        Specify the type of filesystem to be built. If not specified, the default filesystem type (currently ext2) is used.

    fs-options
        Filesystem-specific options to be passed to the real filesystem builder.

    -V, --verbose
        Produce verbose output, including all filesystem-specific commands that are executed. Specifying this option more than once inhibits execution of any filesystem-specific commands. This is really only useful for testing.

    -h, --help
        Display help text and exit.

    -V, --version
        Print version and exit. (Option -V will display version information only when it is the only parameter, otherwise it will work as --verbose.)

BUGS
    All generic options must precede and not be combined with filesystem-specific options. Some filesystem-specific programs do not automatically detect the device size and require the size parameter to be specified.

Manual page mkfs(8) line 1 (press h for help or q to quit)
```

```
jiangwenjie@jiangwenjie:~ — man kill

KILL(1) User Commands KILL(1)

NAME
    kill - terminate a process

SYNOPSIS
    kill [-signal|-s signal|-p] [-q value] [-a] [--timeout milliseconds signal] [--] pid|name...

    kill -l [number] | -L

DESCRIPTION
    The command kill sends the specified signal to the specified processes or process groups.

    If no signal is specified, the TERM signal is sent. The default action for this signal is to terminate the process. This signal should be used in preference to the KILL signal (number 9), since a process may install a handler for the TERM signal in order to perform clean-up steps before terminating in an orderly fashion. If a process does not terminate after a TERM signal has been sent, then the KILL signal may be used; be aware that the latter signal cannot be caught, and so does not give the target process the opportunity to perform any clean-up before terminating.

    Most modern shells have a builtin kill command, with a usage rather similar to that of the command described here. The --all, --pid, and --queue options, and the possibility to specify processes by command name, are local extensions.

    If signal is 0, then no actual signal is sent, but error checking is still performed.

ARGUMENTS
    The list of processes to be signaled can be a mixture of names and PIDs.

    pid
        Each pid can be expressed in one of the following ways:

        n
            where n is larger than 0. The process with PID n is signaled.

        0
            All processes in the current process group are signaled.

        -1
            All processes with a PID larger than 1 are signaled.

        -n
            where n is larger than 1. All processes in process group n are signaled. When an argument of the form '-n' is given, and it is meant to denote a process group, either a signal must be specified first, or the argument
```


Выводы по проделанной работе

В ходе данной работы мы ознакомились с файловой системой Linux, её структурой, именами и содержанием каталогов. Научились совершать базовые операции с файлами, управлять правами их доступа для пользователя и групп. Ознакомились с Анализом файловой системы. А также получили базовые навыки по проверке использования диска и обслуживанию файловой системы.