Chapter 4 - File System

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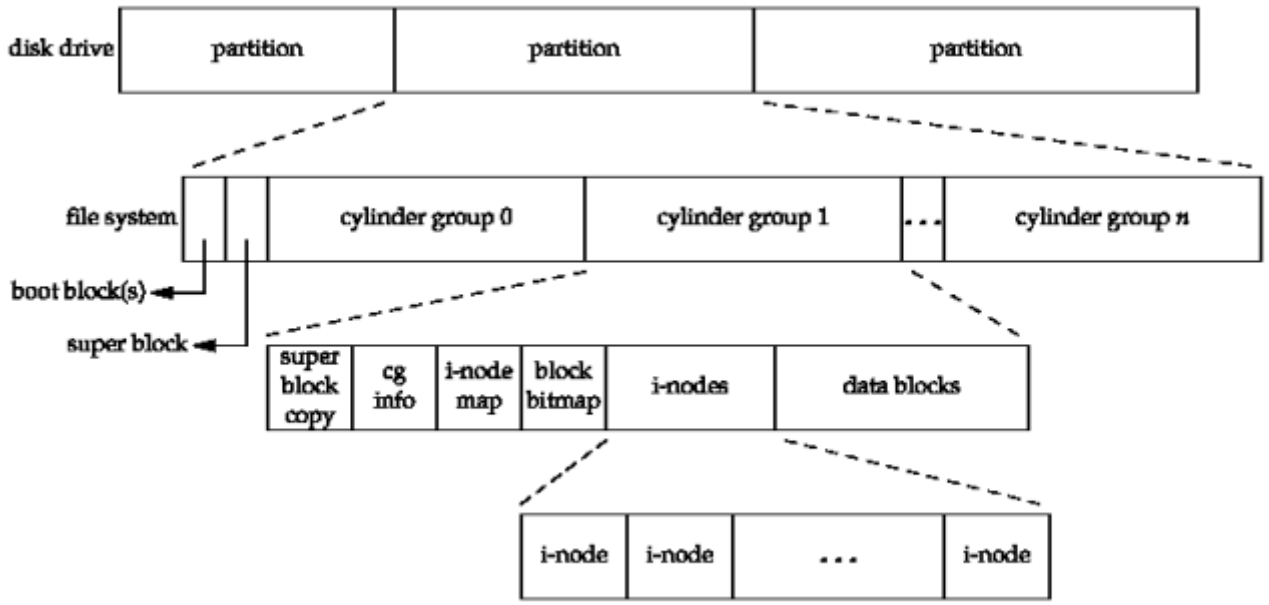
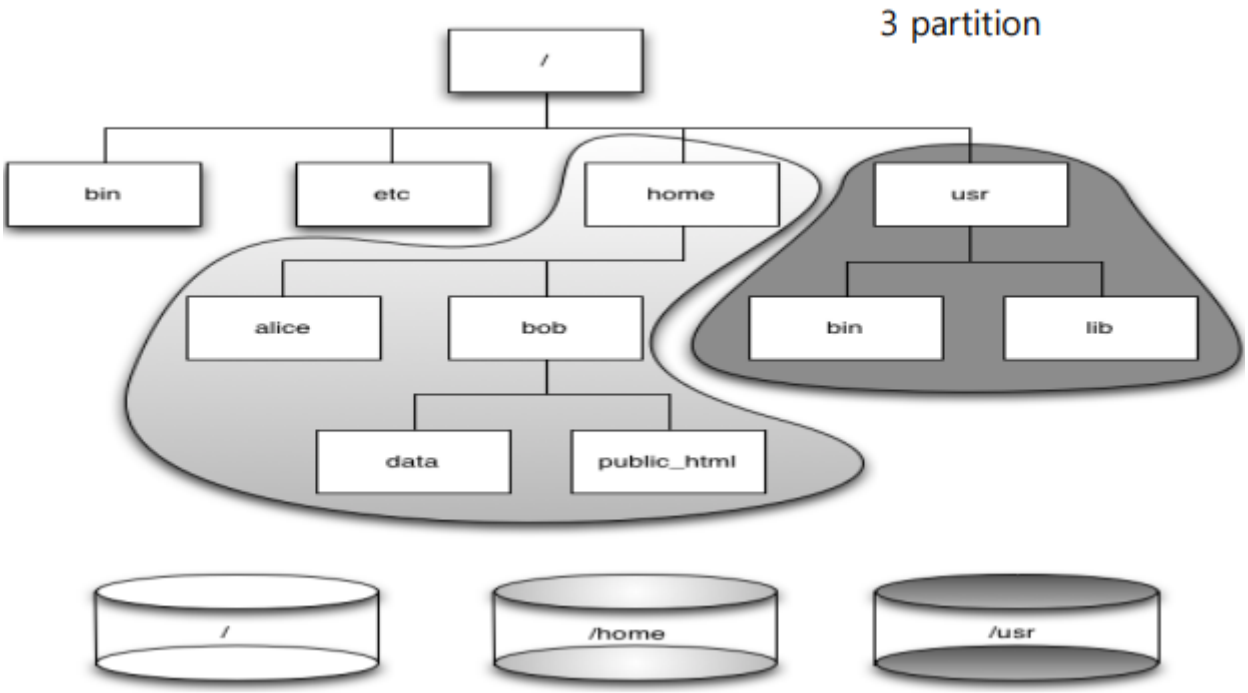
File System Architecture

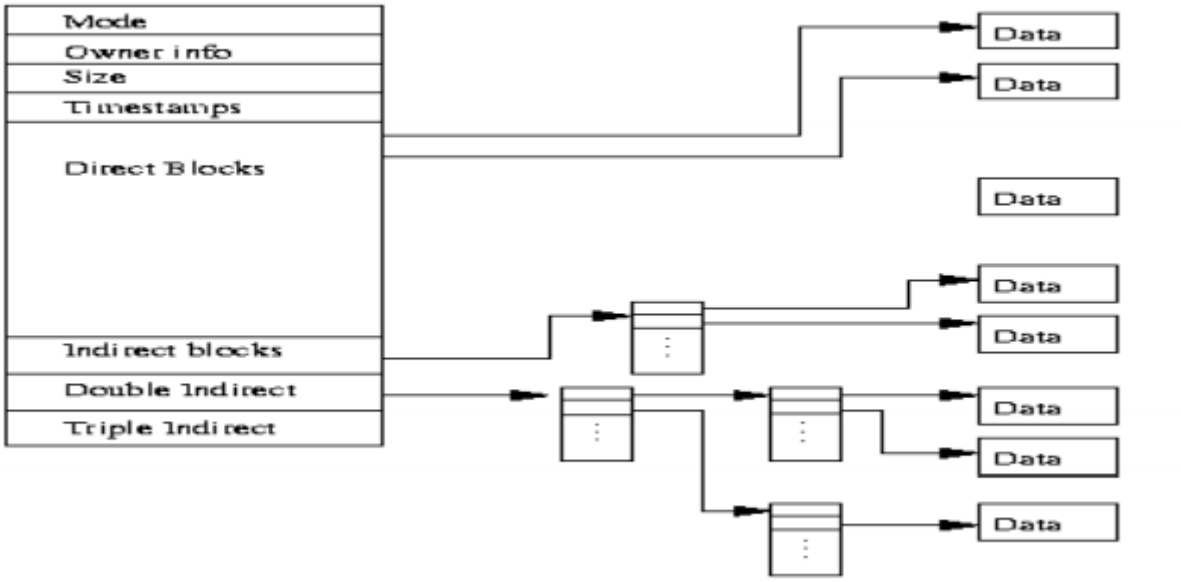
File System:



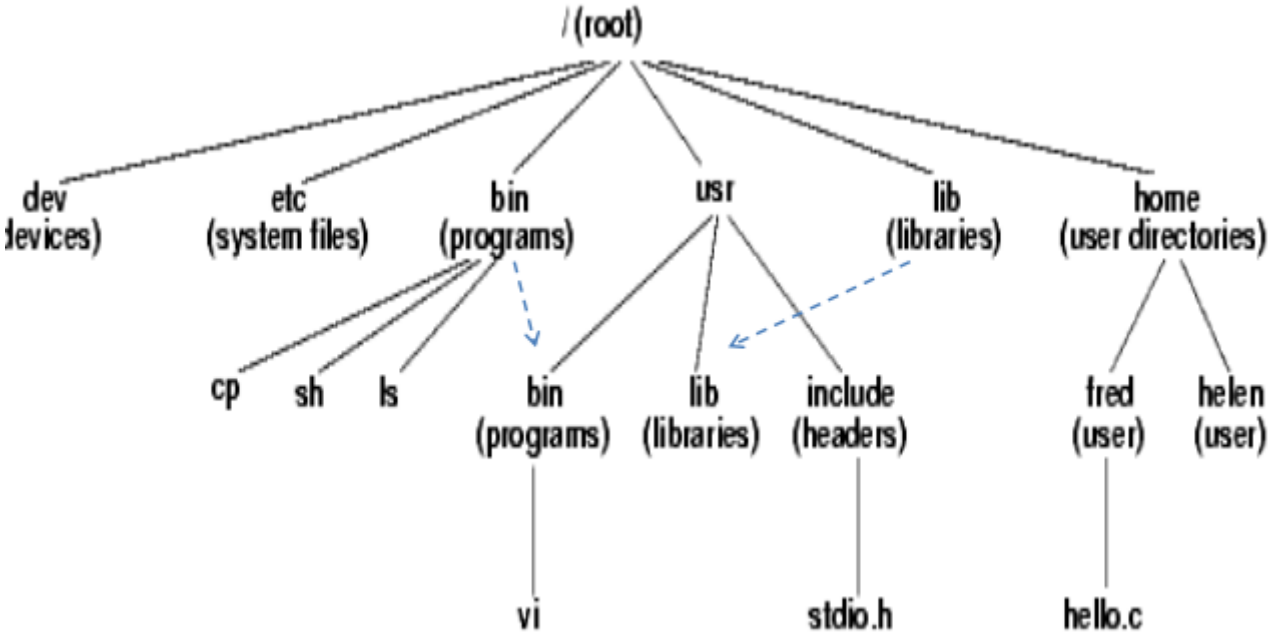
Unix File Sytstem:



i-node and data block:



Unix directory tree:



- / : root directory of entire file system
- /devices : physical device files
- /dev : logical device files
- /etc : system-wide configuration files
- /mnt : temporarily external mounted filesystems
- /opt : Optional application software packages
- /proc : Kernel and Process information as files
- tmp : temporary files which will be deleted between system reboots
- /bin : command binaries (/usr/bin also contains these)
- /sbin : System binaries that are not essential, for example for daemons and network services
- /lib : Libaries that are used by the binaries in /usr/bin and /usr/sbin

- /usr : working directories for mulitple purposes
- /var : Variable files that constantly change (logs, mails, etc)
- /home : Home and working directories of users
- /export : remote file systems

Navigating the file system

```
$ echo hi > hi.txt # Creates new file hi.txt with content 'hi'
$ ls # lists files in a directory
$ cat hi.txt # shows content of file hi.txt
$ more /etc/passwd # shows content of /etc/passwd with being able to navigate
forwards through lines using the spacebar
$ less /etc/group # same as more but being able to move forwards and backwards
$ head -5 /etc/hosts # shows the first 5 entries of the /etc/hosts file
$ tail -f /var/log/syslog # shows last lines of the file
$ pg /etc/profile # makes content navigateable by using page numbers
$ cd /usr/bin # changes current working directory to /usr/bin
$ pwd # shows current working directory
```

Create file

```
$ cp hi.txt hi2.txt # copes file hi.txt and its contents to file hi2.txt
$ mv hi2.txt hi3.txt # removes the file hi2.txt and creates new file hi3.txt and
moves its contents to hi3.txt
$ rm hi3.txt # removes file hi3.txt
$ touch a.txt # creates new file with name a.txt. If it exists already, it changes
the last edited time of the file
$ mkdir dir1 # creates directory called dir1
$ mv dir1 dir2 # renames dir1 to dir2
$ rmdir dir2 #removes dir2 directory
$ whereis echo # shows the path of the echo executable command
$ which echo # same as above
$ cat > aa.txt # Sends input to aa.txt file, save with ctrl + d
$ head -5 /etc/passwd > pass.txt # copies the first few lines of /etc/passwd file
to pass.txt file
```

ls -l

```
$ ls -l
```

Output:
i-node

```
-bash: syntax error near unexpected token `in'
21170004@comunix:~$ ls -i
     75513 aa                 74983 error.txt          74777 local.login
     75515 aa.txt             75527 errorlink.txt      74774 local.profile
     75511 dead.letter        74990 g.txt              74986 mbox
     74982 dira               74981 hi.txt             74991 out.txt
     75516 dirb               74981 hlink.txt
     74992 err.txt            74773 local.cshrc
21170004@comunix:~$ ls -ld
drwxr-xr-x   4 21170004 studs         22 Mar 23 00:53 .
```

`File type: permission: link number: owner: group: last editing time: file name`

File types

The first character of `ls -l` command indicates the file type as follows:

- d : directory
- b : block special file
- c : character special file
- l : symbolic link
- p : First-in, first-out file
- s : local socket
- - : ordinary file

```
$ file hi.txt # displays file tpye, for exapmle ASCII text
```

Permission

rw-r--r-- User/owner(rw-), group(r--), other(r--)

r = read, w = write, x = execture

- File is readable: cat
- File writeable: can edit
- File executable: Can run the program
- Directory readable: ls possible
- Directory writable: create/delete possible
- Directory executable: cd possible

Link number

A link is a connection between a file name and a file. It can either be a hard link or a soft link.

```
ln hi.txt hi2.txt # creates a new file and increases link number
ln -s hi.txt hi3.txt # create symbolic link
```

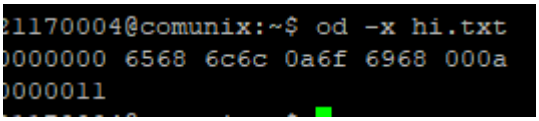
Differences between cp, hard link and soft link

cp: A new i-node is created ln: The copy of the files references to the same i-node ln -s: separate i-nodes are created

Contents / Information

```
od -x hi.txt ### shows file contents in hexadecimal, with -c option in ASCII
```

Output:



Find

```
$ find /export/home -name 'hi.txt'
2> /dev/null
```

1. Finds all hi.txt files in directory
2. `2> /dev/null` omits error output o for access denied

```
$ find / -name core -exec rm {} \; #Removes files (- exec ls lists all found, etc)
#-ok statt -exec: Asks if the file should be taken
```

chmod

```
$ chmod 644 hi.txt
$ chmod u+x,g=rw-,o-r hi.txt #+adds permission
#-takes away permission
```

Examples (numeric, octal):
644: u=rw, g=r--,o=r--
755: u=rwx,g=r-x,o=r-x

umask

```
$ umask 022 # Defines masking for permissions
```

File System Management

```
$ df -k # Shows disk free size (partition)
$ du -sk * # Shows disk usage size (directory)
$ mount
$ mound -t device_name mount_point # Shows mounted partitions + status
# with options: mounts new partition
$ mountall # Mounts all file systems defined in /etc/vfstab
$ unmount <device> # Unmounts device
$ unmountall # Unmount all devices
```