Linux File System

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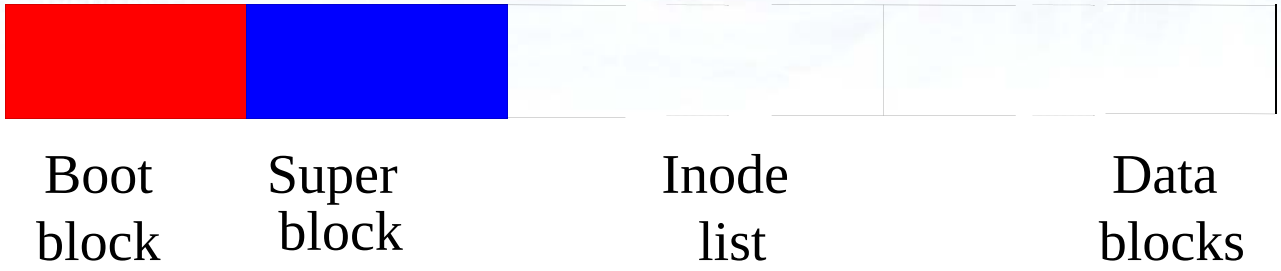
File System

- The file-system is one of the most visible aspects of an operating system
- It provides mechanisms for permanent storing of data
- It includes the management of
  - File
  - Directories
  - Disks and disk partitions

File System structure



- The first block is the **boot** block. It contains the bootstrap code that is loaded and executed at system power on.
- The **superblock** describes the file system state:
  - size
  - how many files it can contain
  - free list (map) of Inodes and data blocks
  - other information

Inode = integer numbered structure

Inode

- The **inode** is the **file descriptor**, which includes all information related to a file, excluding its filename
  - Owner
  - File type: *regular, directory, special* ,..
  - Access rights
  - Access times
  - Link number
  - File size
  - Table of the data block addresses on disk

Directory

- A **directory** is a special file that contains a list of filenames, each associated to the corresponding **Inode**

Filename	Inode
.	1234
..	75
a.c	21000

Inode example

```
Owner:              user1
Group:              group1
Type:               regular file
Access rights:      rwxr-xr-x
Access:             Oct 5 2016 h: 8:15
Modified:           Oct 5 2016 h: 10:30
Inode:              Oct 5 2016 h: 13:30
Size:               3050 bytes
Disk addresses (pointers)
```

Fila data modified, not its inode

Inode modified, not the file data

Opening a file

```
FILE * fp1; int fd1;
fp1=fopen("a.c", "r");
fd1=open("a.c", O_RDONLY);
```

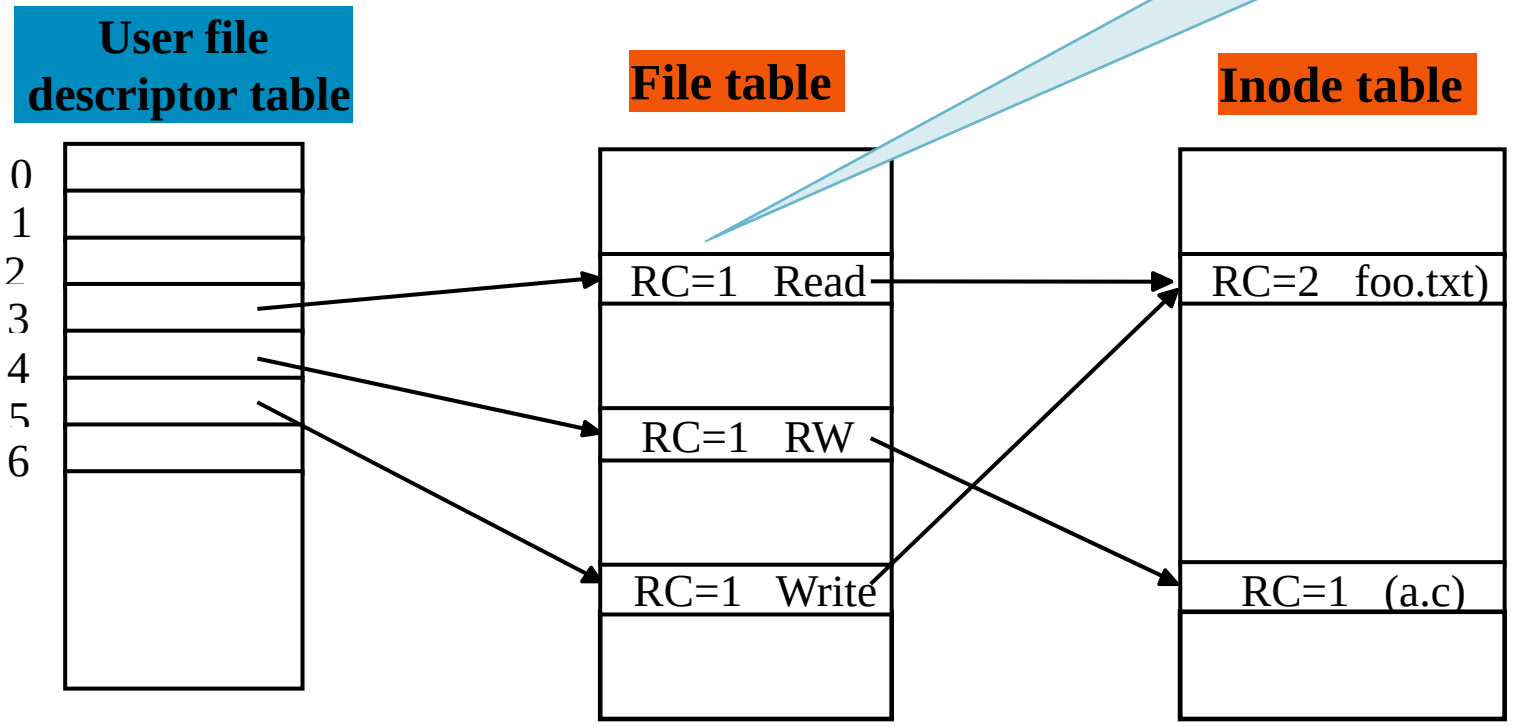
Notice the differences between **fopen** and **open**

- To use a file you have to "open" it
  - Open is a system call
  - The request to open a file makes the kernel
    - Copy the inode of the file in **kernel memory**
    - Return to the caller an integer number, that is the file descriptor
    - The file descriptor is the handle of all other operations on the file (write, read, etc)

File System structures

```
fd1=open("foo.txt", O_RDONLY);
fd2=open("a.c", O_RDWR);
fd3=open("foo.txt", O_WRONLY);
```

RC = Reference Count
RW permissions



Resolving pathname ../a/b