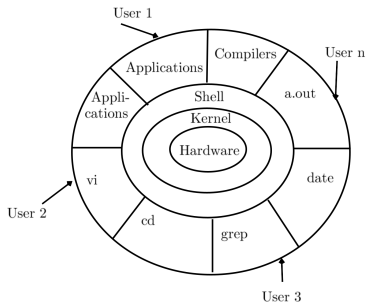# Unix System Architecture, File System, and Shell Commands

Prof. K. R. Chowdhary

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Unix System Architecture


- **Hardware**: CPU, Memory, IO interface
- **Kernel**: It is the core

component of Operating System, interacts directly with hardware

- **Shell**: An interface to kernel, hiding complexity of kernel's functions from users.
- **Utilities**: Programs that provide the user most of the functionalities of an operating systems. These are application programs.
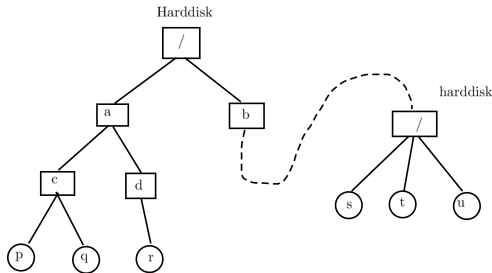
Linux File System

- Two Views: Logical & Physical
- The Unix file system (UFS; also called the Berkeley Fast File System, the BSD Fast File System or FFS) is a file system used by many Unix and Unix-like operating systems. It is a distant descendant of the original filesystem used by Version 7 Unix.
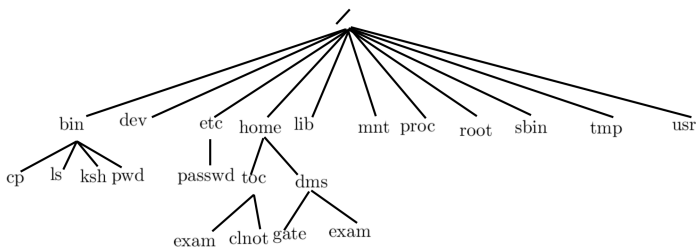
- Files have no structure at all, they are only flat sequences of bytes.
- In UNIX a part or all of a disk's file system can be mounted in another disk's file system.
- **Files and inodes.** A file consists of exactly one inode, and zero or more data blocks. An inode is a structure used to maintain information about the file.

Linux File System

- /dev: Contains file representations of peripheral devices and pseudo-devices
- /mnt: Empty directory commonly used by system administrators as a temporary mount point.
- /proc: procfs virtual filesystem showing information about processes as files.
- /sbin: Stands for "system (or superuser) binaries", contains fundamental utilities, like init,
- /tmp: A place for temporary files not expected to survive a reboot.
- /usr: The "user file system": originally the directory holding user home directories
- /lib: libraries and data files for programs stored within /usr or elsewhere.

Linux File System commands

- File system Commands: for Directories

  cd, mkdir, rmdir, pwd (Print Working Directory), cp, mv

- File system Commands: for Files

  ls, cp, mv, ln, touch (Update), rm, cat, more, head, tail, wc, diff, file

- Redirection, and pipe: $>$, $<$, $|$, /dev/null

- Devices as files: /dev/sda1, /dev/sda2, /dev/lp, /dev/tty1.../dev/tty63, /dev/tty, /dev/lp,
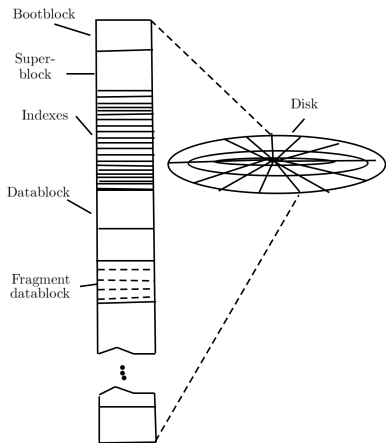
- Editor: ed, sed, vi

- Misc.: lpr, who, ps, find, sort, cut, paste.

  e.g. \$ cut -d: -f1,2 months

  e.g. \$ paste -d: file1 file2

Disk layout of file system

Labels on diagram:
Bootblock
Super-block
Indexes
Datablock
Fragment datablock
Disk

- A file system is created with mkfs. It defines a number of parameters
- a bootblock - contains a primary boot program for the operating system;
- a superblock - static parameters of the file system,
- inodes - stands for index node
- data blocks - each block has typically a size of 4 Kbytes
- fragment data block size - typically of size 512 bytes

Inode structure
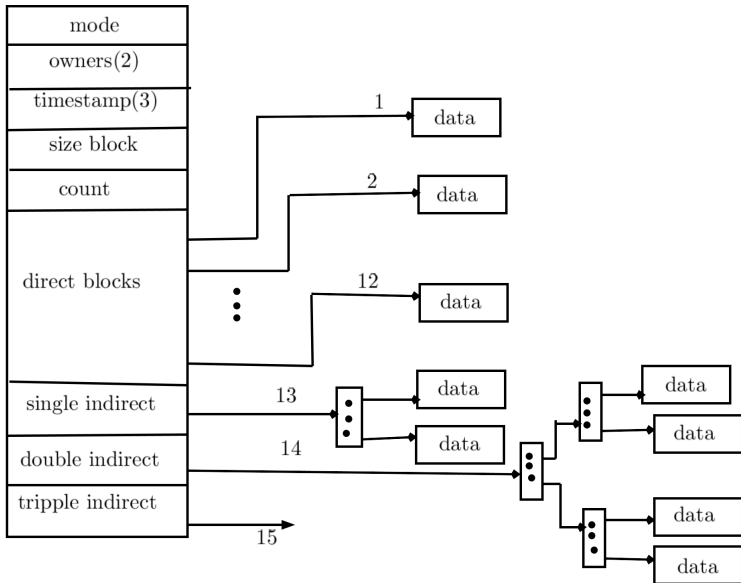
Inode structure

- 128 bytes (64 bytes in oldersystems) each
- Statically allocated
- Root inode (inode 2) the root (/) of the filesystem
- Inode contents: Permissions: 9 bits, three time stamps: modification time, access time, status time(when certain changes was made to the inode)
- Through pointers in the inode we can access the file's data blocks.

  12 direct pointers

  1 single indirect pointer

  1 double indirect pointer

  1 triple indirect pointe