

CS/SE 3377

File system

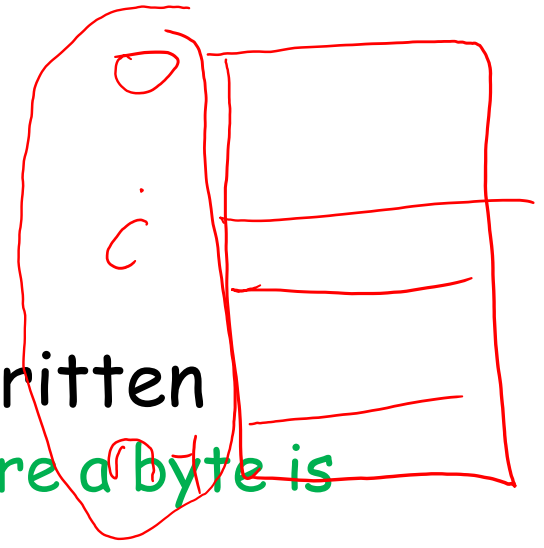
Sridhar Alagar

Persistent Storage

- Keep a data **intact** even if there is a **power loss**
 - Hard disk
 - Solid-state device
- Files are stored in a persistent store

File

offset



- Sequence of persistent bytes that can be read/written
 - Offset is the relative location from the beginning where a byte is stored
- Logical storage unit with contiguous logical address space to store user data
- A **file system** organizes and stores file
- A file has many attributes

File attributes (meta data)

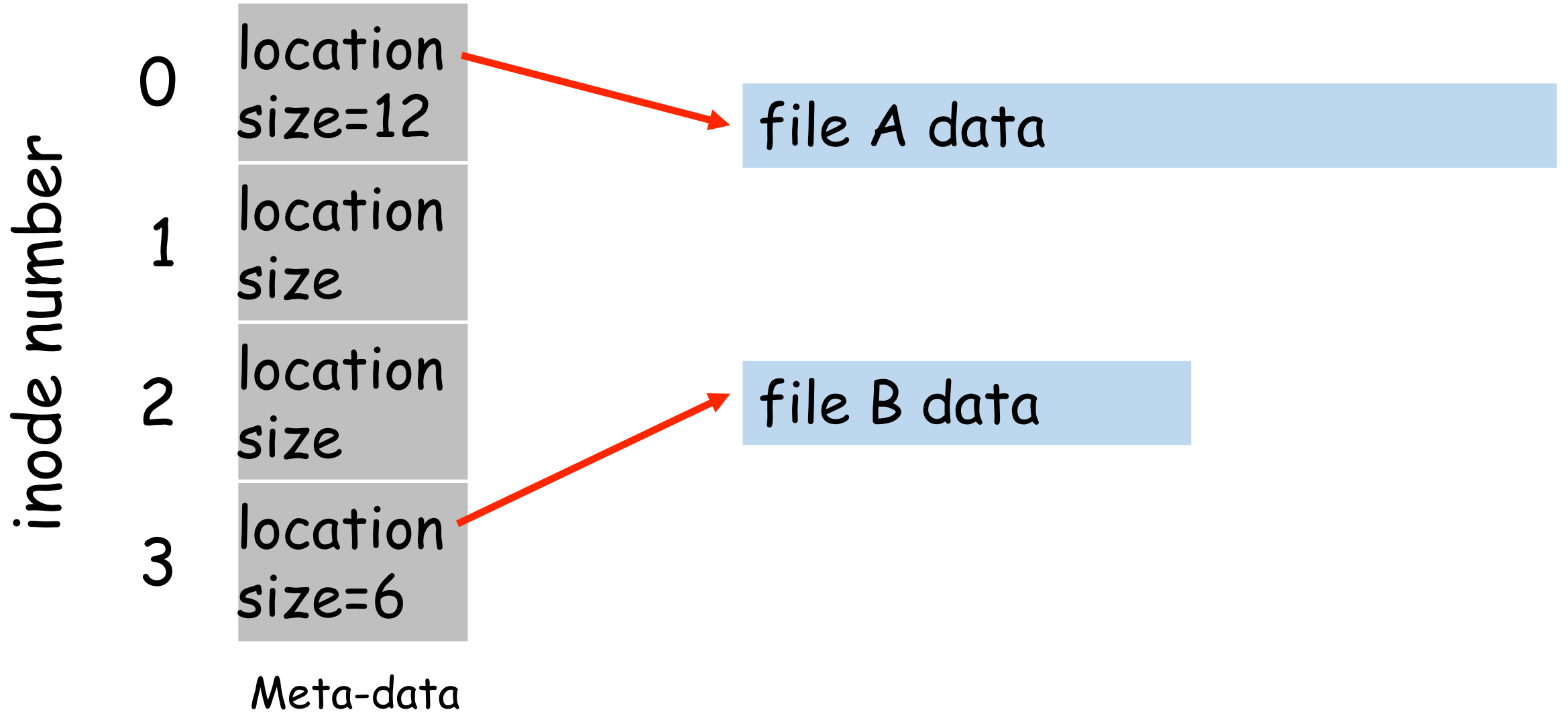
- **Name** - only information kept in human-readable form
- **Identifier** - unique number identifies file within file system
- **Location** - pointer to file location on device
- **Size** - current file size
- **Protection** - controls who can do reading, writing, executing
- **Time, date, and user identification** - data for protection, security, and usage monitoring

Meta data should be persistent

Inode

- Inode is an on-disk data structure that contains a file's attributes
- Every file has a unique inode
- Inode number is the file identification number within the file system

inode table



How to access a file?

Vi A
get the inode
number for A

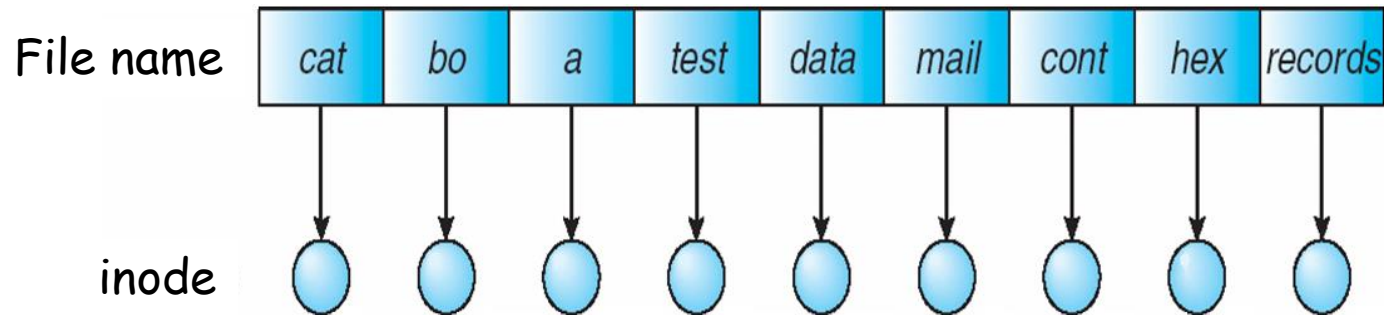
- Find its inode
- Need a mapping between file name and file's inode number
- Where will this mapping be stored?

Directory

Try `ls -li`

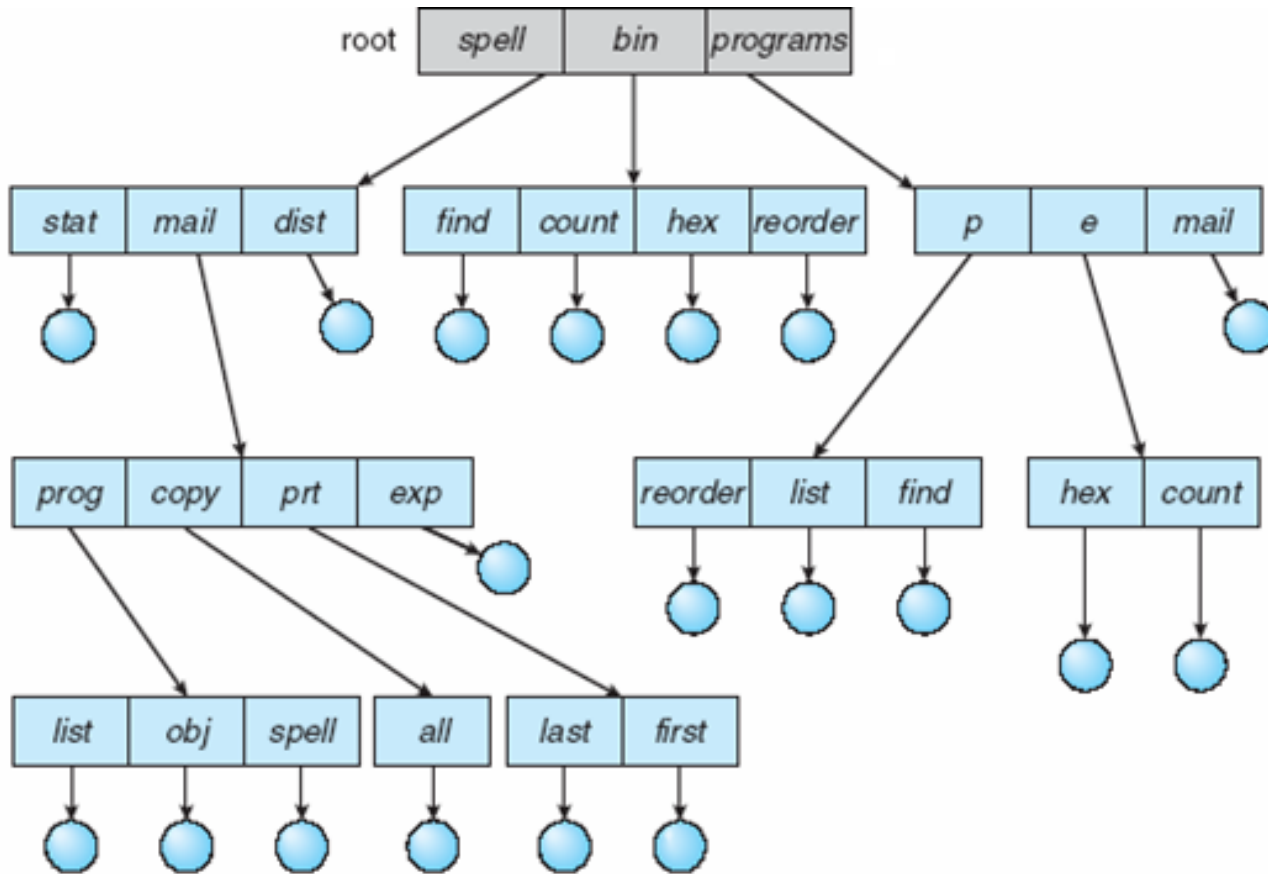
Directory Structure

- Single level



- Naming problem
- Grouping problem

Tree Structured Directories



- File name is specified with the path
/bin/count
/spell/mail/prog/list
- File (path) name is unique

Where is a directory stored?

- In the persistent store as a file
- Every entry in the directory is a file or a (sub)directory

Home/current/parent Directories

- Current working directory after you login
- '~' is the shortcut for home directory
- '.' represents current working directory
- '..' represents parent of current working directory

Access Permissions

- Tells who and how can access
- Three types of users:
 - owner of the file (owner)
 - member of a group associated with file (group)
 - everyone else (others)

Try `ls -l`

Change Access Permissions - *chmod*

- Use `chmod` to change the access permission of a file

chmod a+rw filename //read-write for all

chmod o-w filename //no write for others

chmod g+r filename //read for group

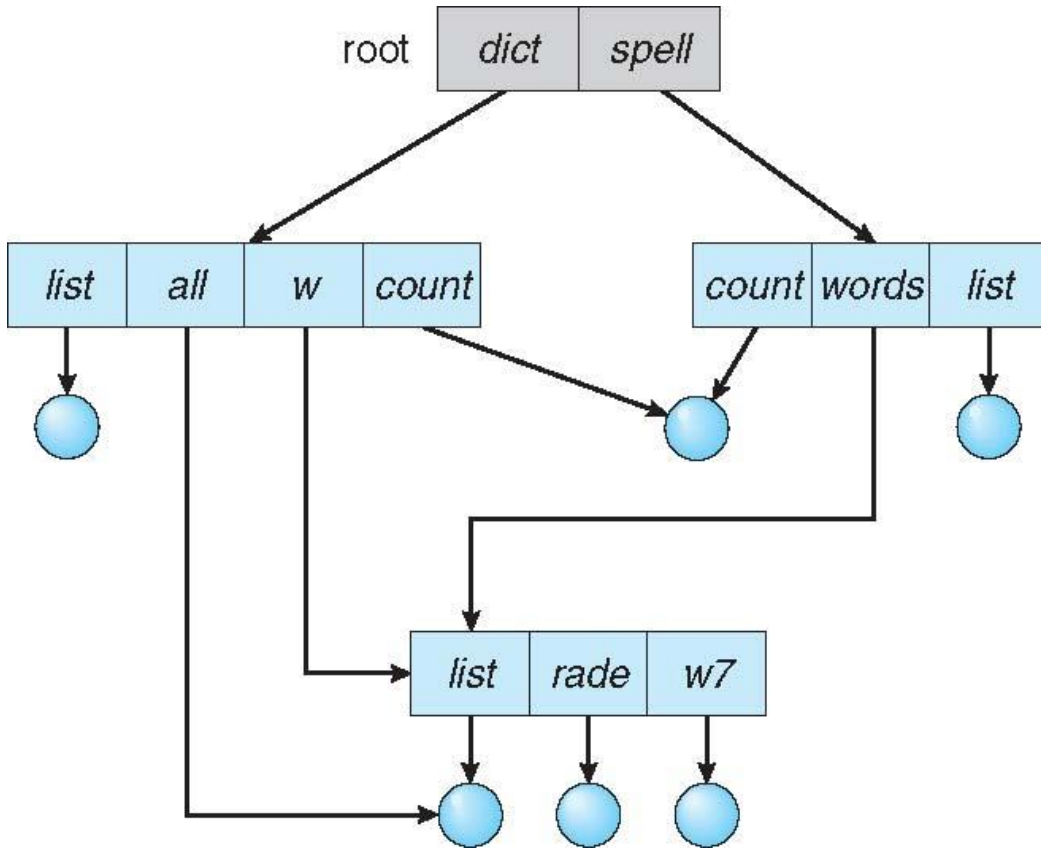
chmod u+rwx filename //read, writ, ex for owner

- 'x' for directory means can change into that directory

Links to Files

- `ln` creates a new (hard) link to existing file
 - inode not created
 - reference count increases
 - cannot link directories
- `rm` removes a link
 - If it is the last link to the file, deletes the file
- What is the directory structure now?

Acyclic Graph Directories



Option -s creates symbolic link to directories

What is the directory structure when a symbolic link to a parent directory is created?

Directory structure - Graph (with cycles)

