OPERATING SYSTEMS

File Management

Suresh Jamadagni
Department of Computer Science

OPERATING SYSTEMS

File System

Suresh Jamadagni
Department of Computer Science

OPERATING SYSTEMS

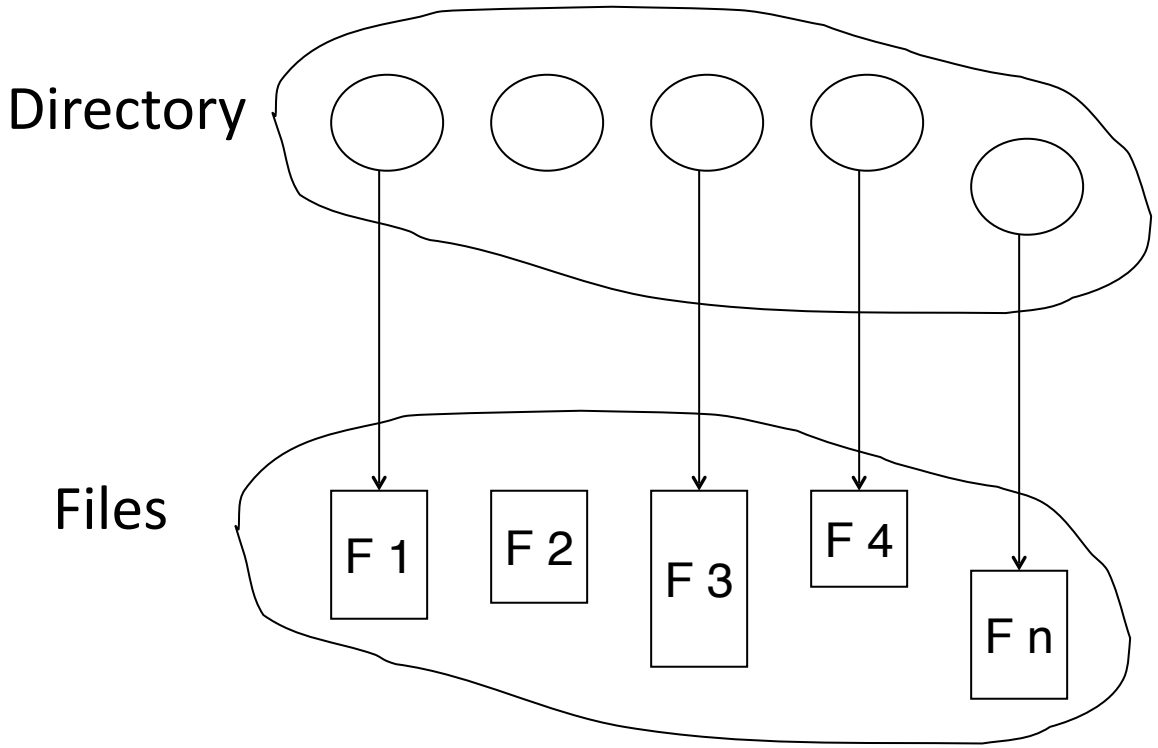
Slides Credits for all the PPTs of this course

- The slides/diagrams in this course are an **adaptation**, **combination**, and **enhancement** of material from the following resources and persons:

1. Slides of Operating System Concepts, Abraham Silberschatz, Peter Baer Galvin, Greg Gagne - 9th edition 2013 and some slides from 10th edition 2018
2. Some conceptual text and diagram from Operating Systems - Internals and Design Principles, William Stallings, 9th edition 2018
3. Some presentation transcripts from A. Frank – P. Weisberg
4. Some conceptual text from Operating Systems: Three Easy Pieces, Remzi Arpaci-Dusseau, Andrea Arpaci Dusseau

Directory Structure

- A collection of nodes containing information about all files

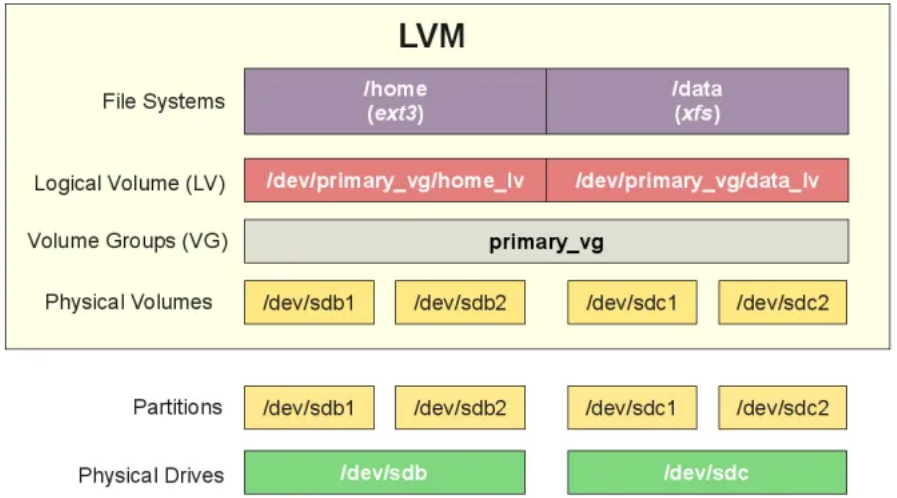


Both the directory structure and the files reside on disk

OPERATING SYSTEMS

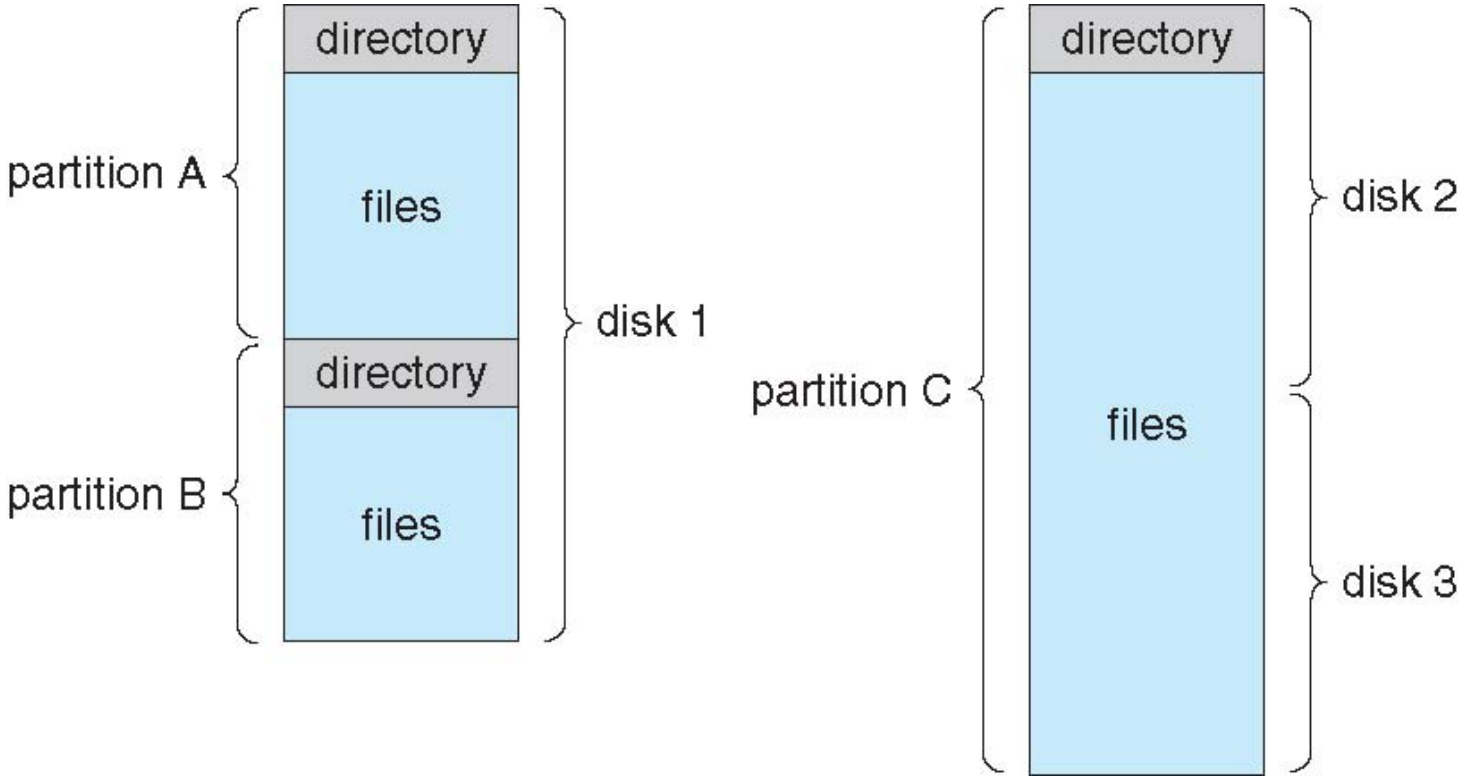
Disk Structure

- Disk can be subdivided into **partitions**
- Disks or partitions can be **RAID** protected against failure
- Disk or partition can be used **raw** – without a file system, or **formatted** with a file system
- Partitions also known as minidisks, slices
- Entity containing file system known as a **volume**
- Each volume containing file system also tracks that file system's info in **device directory** or **volume table of contents**
- As well as **general-purpose file systems** there are many **special-purpose file systems**, frequently all within the same operating system or computer



OPERATING SYSTEMS

A Typical File-system Organization



OPERATING SYSTEMS

Types of File Systems

- We mostly talk of general-purpose file systems
- But systems frequently have may file systems, some general- and some special- purpose
- Consider Solaris has
  - tmpfs – memory-based volatile FS for fast, temporary I/O
  - objfs – interface into kernel memory to get kernel symbols for debugging
  - ctfs – contract file system for managing daemons
  - lofs – loopback file system allows one FS to be accessed in place of another
  - procfs – kernel interface to process structures
  - ufs, zfs – general purpose file systems

Operations Performed on Directory

- Search for a file
- Create a file
- Delete a file
- List a directory
- Rename a file
- Traverse the file system

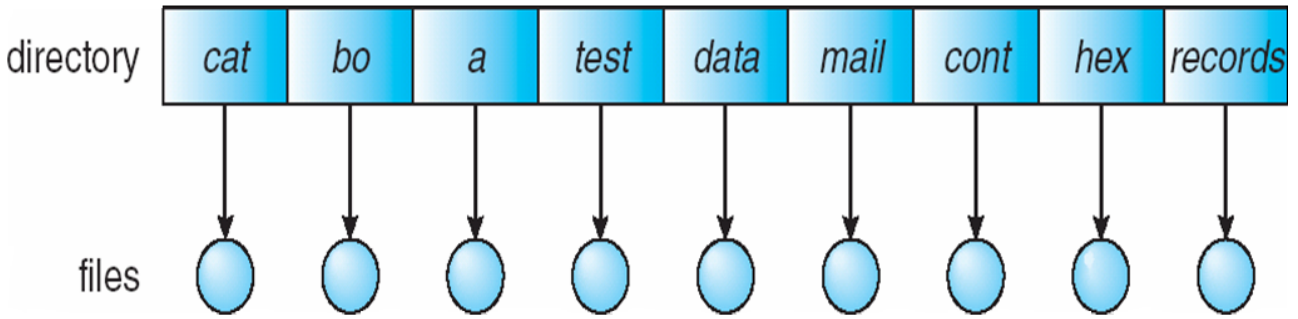
Directory Organization

The directory is organized logically to obtain

- Efficiency – locating a file quickly
- Naming – convenient to users
  - Two users can have same name for different files
  - The same file can have several different names
- Grouping – logical grouping of files by properties, (e.g., all Java programs, all games, …)

Single-Level Directory

- A single directory for all users

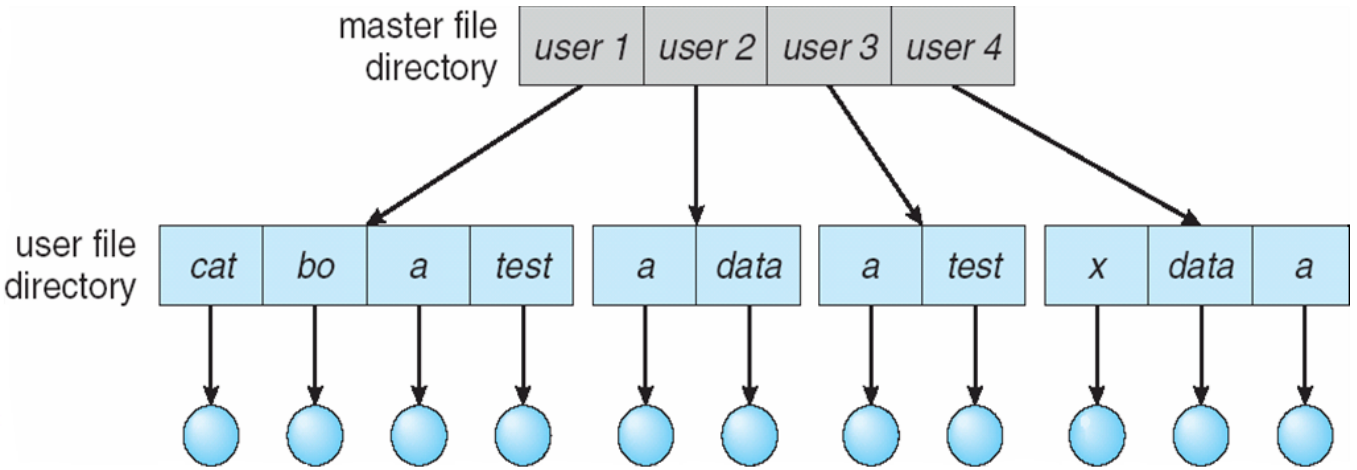


- Naming problem
- Grouping problem

OPERATING SYSTEMS

Two-Level Directory

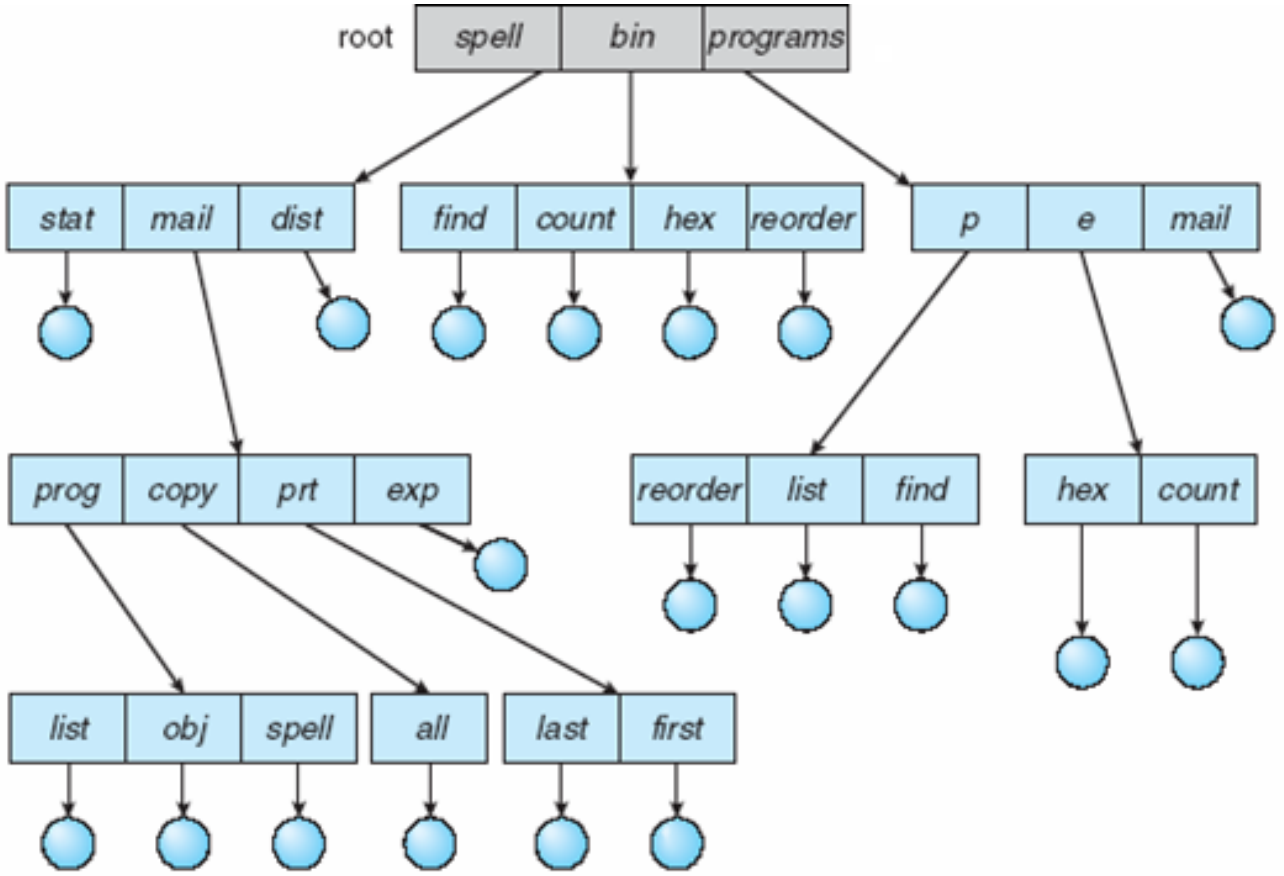
- Separate directory for each user



- Path name
- Can have the same file name for different user
- Efficient searching
- No grouping capability

OPERATING SYSTEMS

Tree-Structured Directories



- A tree structure is the most common directory structure.
- The tree has a root directory, and every file in the system have a unique path.

Tree-Structured Directories (Cont.)

- Efficient searching
- Grouping Capability
- Current directory (working directory)
  - **cd /spell/mail/prog**
  - **type list**
- We cannot share files

OPERATING SYSTEMS

Tree-Structured Directories (Cont.)

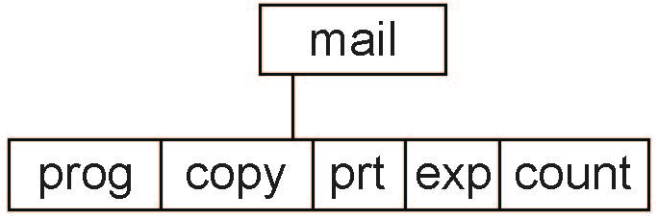
- **Absolute** or **relative** path name
- Creating a new file is done in current directory
- Delete a file

  rm <file-name>
- Creating a new subdirectory is done in current directory

  mkdir <dir-name>

- Example: if in current directory **/mail**

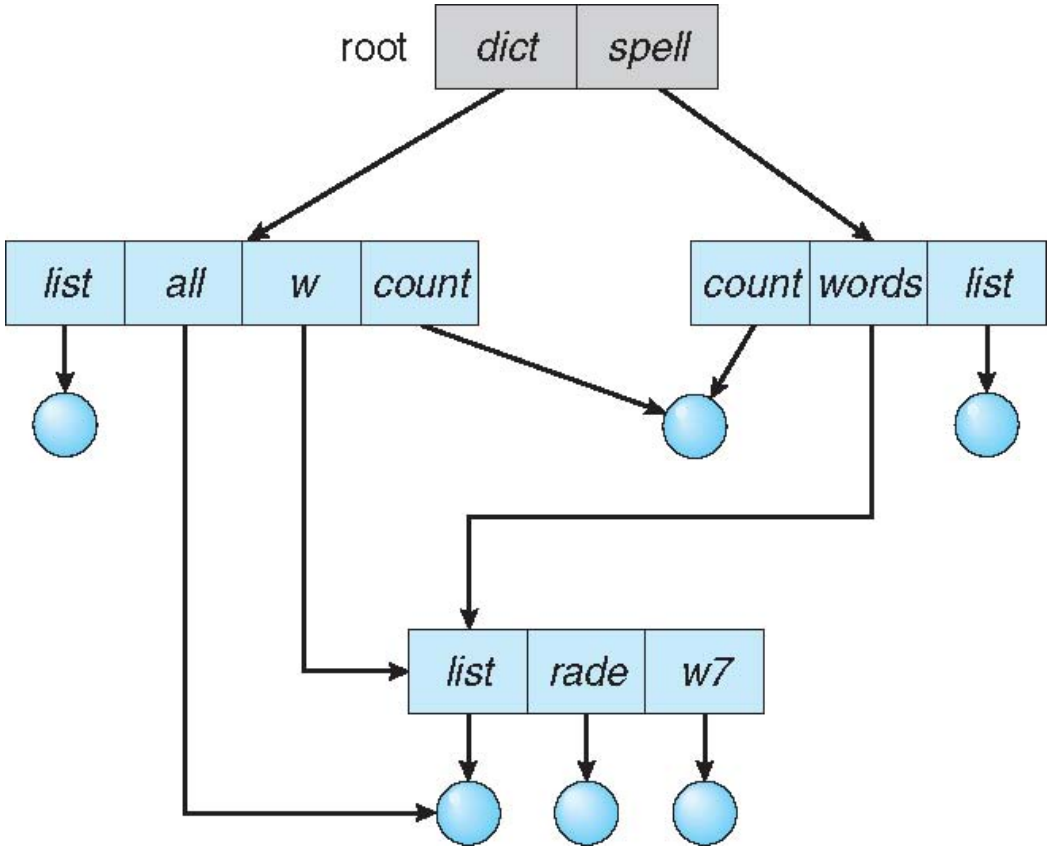
  mkdir count



Deleting “mail” ⇒ deleting the entire subtree rooted by “mail”

OPERATING SYSTEMS

Acyclic-Graph Directories



- An acyclic graph is a graph with no cycle and allows to share subdirectories and files.
- The same file or subdirectories may be in two different directories
- It is used in a situation like when two programmers are working on a joint project and they need to access files.

Acyclic-Graph Directories (Cont.)

- Two different names (aliasing)
- If ***dict*** deletes ***list*** ⇒ dangling pointer

  Solutions:

  - Backpointers, so we can delete all pointers
    Variable size records a problem
  - Backpointers using a daisy chain organization
  - Entry-hold-count solution
- New directory entry type
  - **Link** – another name (pointer) to an existing file
  - **Resolve the link** – follow pointer to locate the file

OPERATING SYSTEMS

General Graph Directory

Advantages:

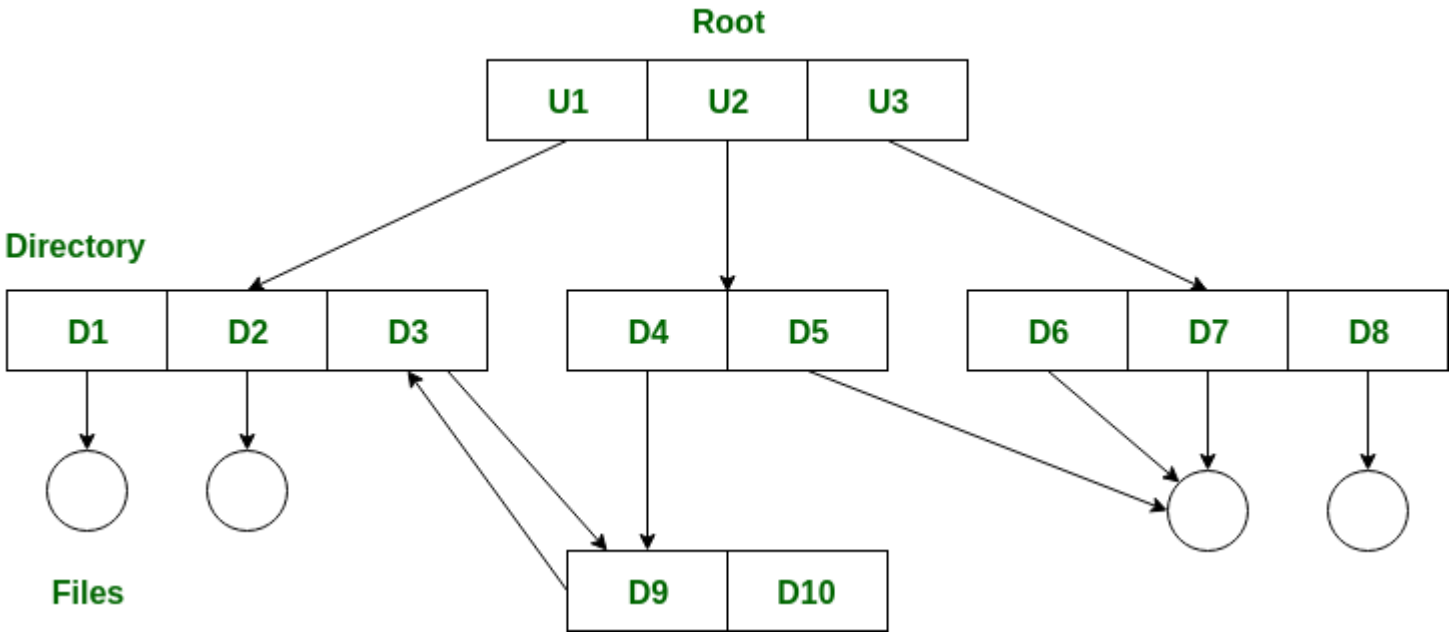
It allows cycles within a dir structure.

Multiple directories can be derived from more than one parent dir.

Disadvantages:

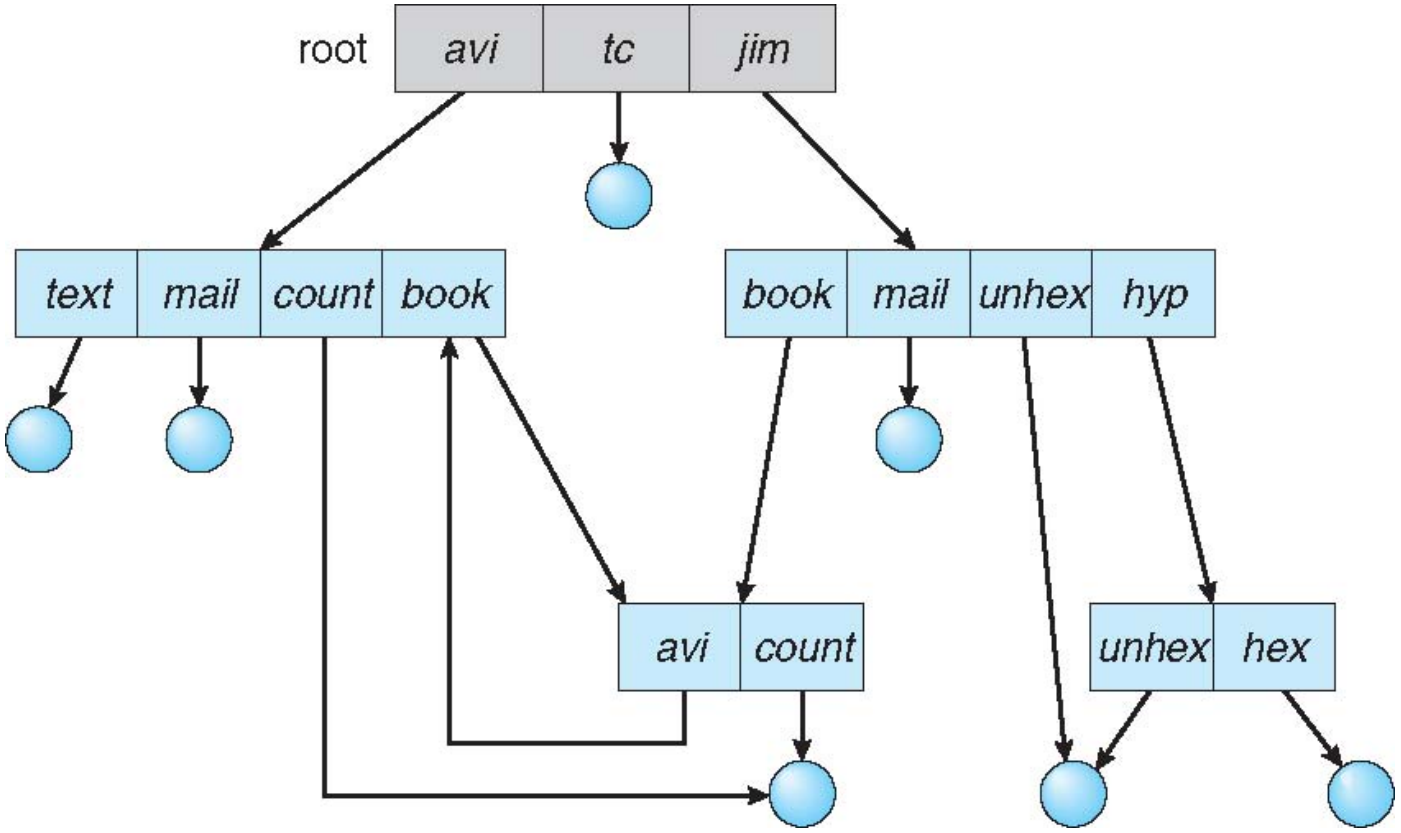
It is more costly than others.

It needs garbage collection (traversing the entire file system, marking everything that can be accessed)



General Graph Directory (Contd.)

- How do we guarantee no cycles?
  - Allow only links to file not subdirectories
  - **Garbage collection**
  - Every time a new link is added use a cycle detection algorithm to determine whether it is OK



THANK YOU

Suresh Jamadagni
Department of Computer Science Engineering

sureshjamadagni@pes.edu