File Systems

Comp 305 Lecture 8

File System Responsibilities

- Provide persistent, reliable storage
- Provide a logical naming system
- Give the user ability to create/modify/delete files
- Control sharing of files
- Control access to files

File Attributes

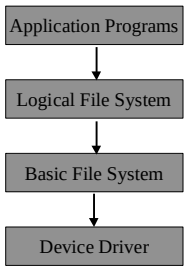
- Name
- Type
- Location
- Size
- Owner
- Protection
- Time(s)

File Types

- To type or not to type?

- Extension
- Magic Numbers
- Creator

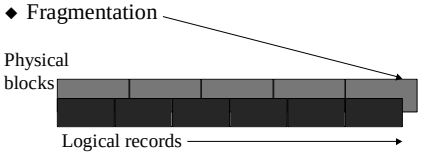
Layered File Systems



- Application structures records
- Logical files system provides byte stream
- Basic file system is array of sectors
- Device is disk

File Structures

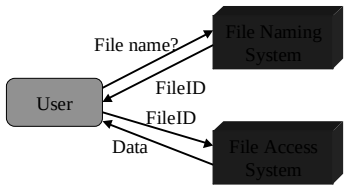
- Physical Blocks
- Logical Records
- Fragmentation



Implications

- Advantages
  - Portability
  - Separation of system and application performance
  - Each level has simple, well defined task
  - Easier disk space management
- Disadvantages
  - Lack of optimisation
  - Application must create own indices, etc.

Separation of Naming and Access

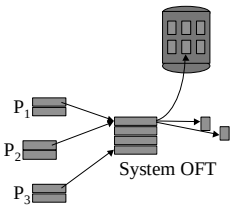


File Operations

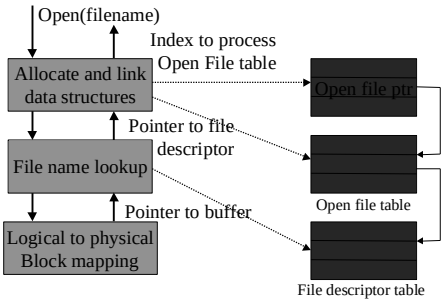
- Create
- Open
- Write
- Read
- Seek
- Delete
- Truncate

Open Files

- Global Attributes
  - Disk Location and Size
  - Times
  - Buffers
  - Open Count
  - Lock(s)
- Process Attributes
  - File Pointer
  - Access Permissions



Control Flow - File Open



Access Methods

- OS interface
  - read(f,n) - read next n bytes of file f
  - seek(f,k) - position file f at byte k
- Sequential
- Direct
- Memory Mapped
- Indexed

Directories

- Naming files
- Organising files
- Volumes
- Directory
  - Per Volume
- Maps file name to directory entry

Directory Operations

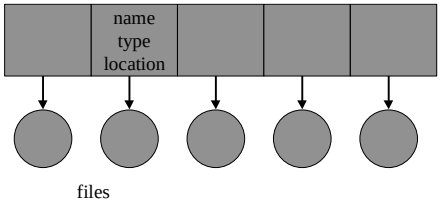
- Search
- Create a File
- Delete a File
- List a Directory
- Rename a File
- Traverse the File System

Directory Structures

- Single Level
- Two Level
- Tree
  - Links
- Acyclic Graph

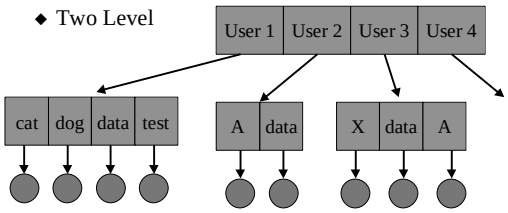
Flat Directory Structures

- One Level

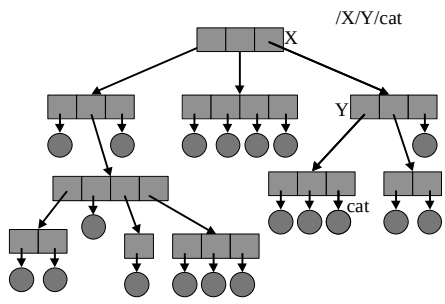


Flat Directory Structures cont.

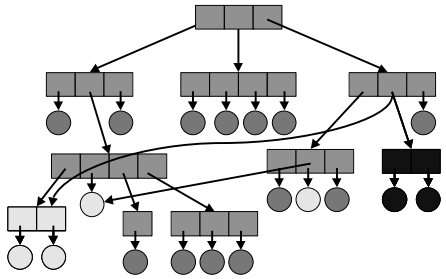
- Two Level



Tree Structured Directory



Graph Structured Directory



Consistency

- What is consistency?
- UNIX
  - Writes immediately visible
  - Can share Location Pointer
- Andrew
  - Writes not immediately visible
  - Changes visible after file is closed to subsequent opens.

Protection - Access

- Read
- Write
- Execute
- Append
- Delete
- List File Attributes
- Search a Directory

Access Lists and Groups

- Access List
  - <User, Right(s)>
  - Tedious, large lists
- Groups
  - Owner, Group, World
  - Fine tune with Access List