# Lecture 36 - File Systems Implementation

CprE 308

April 7, 2014

# Intro

# Todays topics: File System Implementation

- Data Structures for files
- Unix files, Inodes

# Blocks

# Unix File System - Inodes

- data structure on disk
- one inode per file

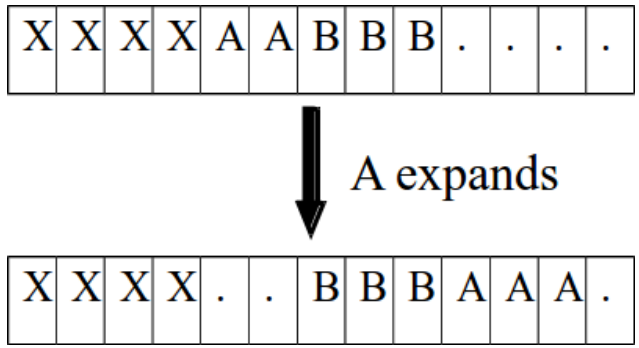
| Owner snt |
| --- |
| Group cpre308 |
| Type regular file |
| Perms rwxr-xr-x |
| Accessed oct 23 9.34pm |
| Modified …. |
| Inode modified … |
| Size 74003 bytes |
| Disk addresses |

# Problem

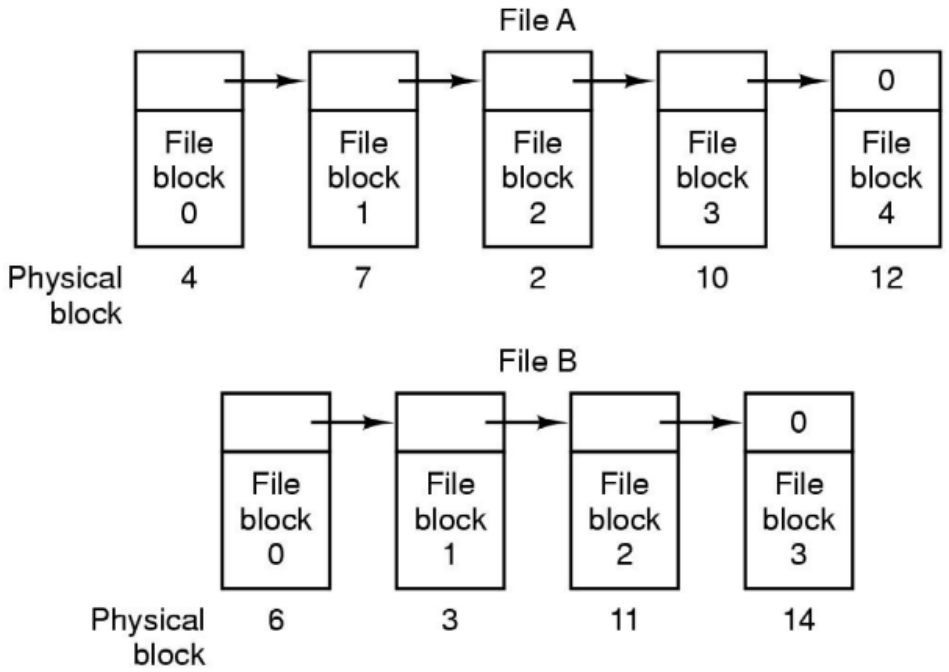
- Disk = (long) sequence of block
- Keep track of the blocks associated with a file

# Contiguous Allocation

- All disk blocks of a file allocated sequentially
- Advantages
  - (very) Fast read
  - Useful for read-only file systems (CD-ROM)
  - Keeping track of blocks of a file is easy
- Problems
  - Fragmentation with deletes
  - File growth might be expensive



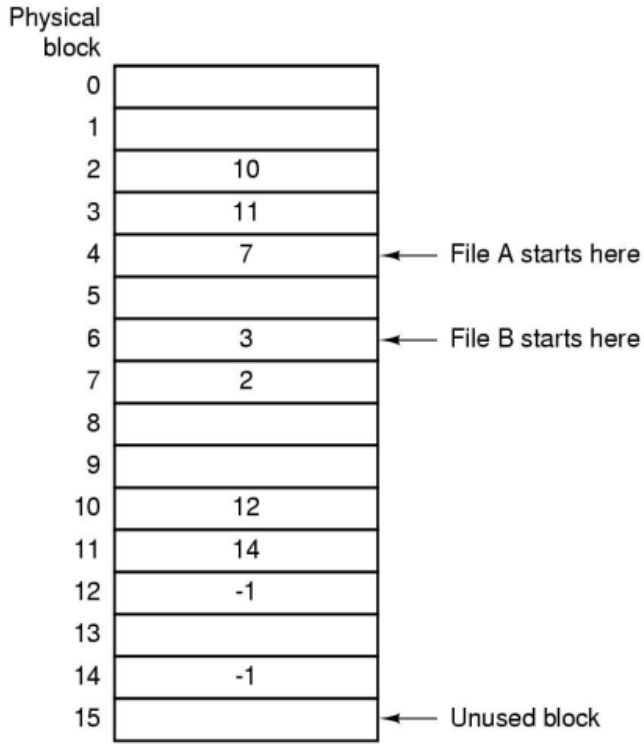
# Linked List of Blocks



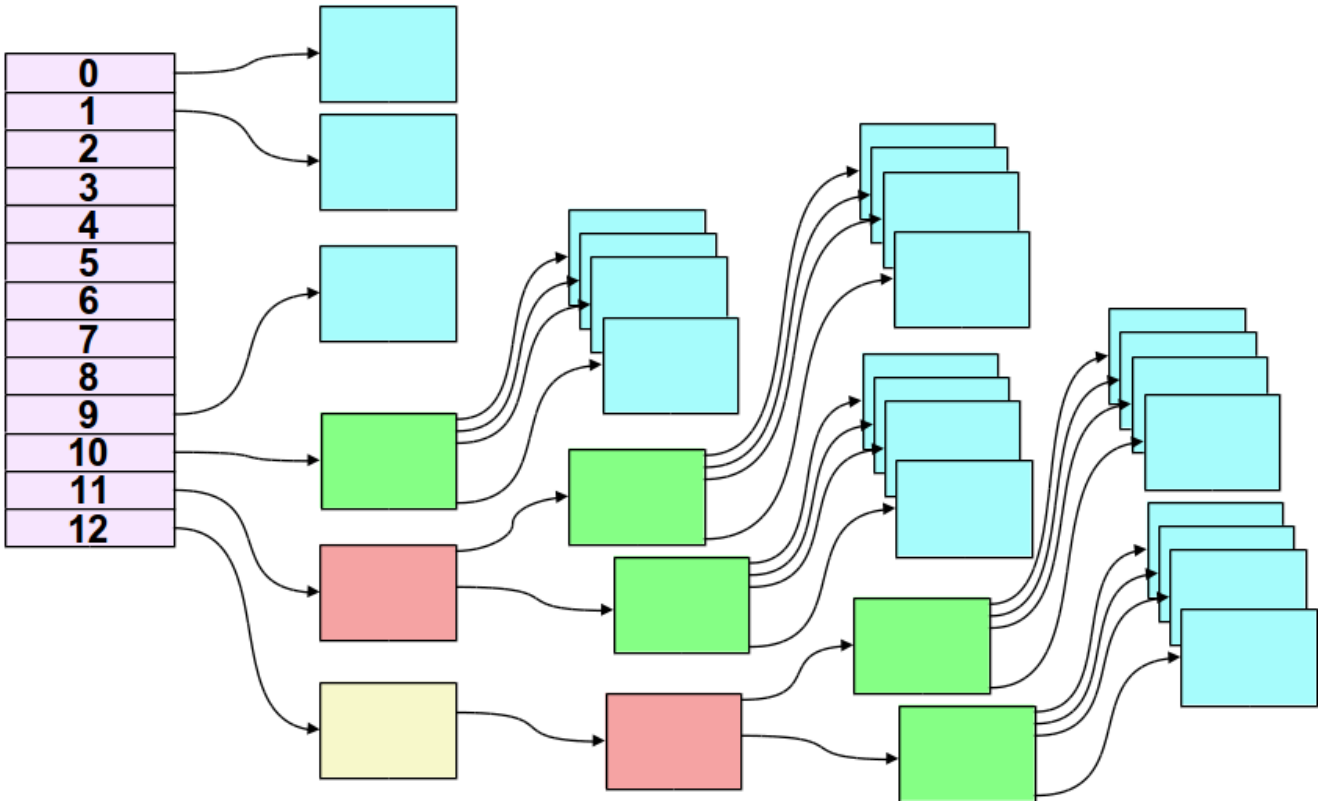

Sequential access is fast, random access is slow

# File Allocation Tables (FAT)

- One entry per physical disk block;
- FAT can be in main memory

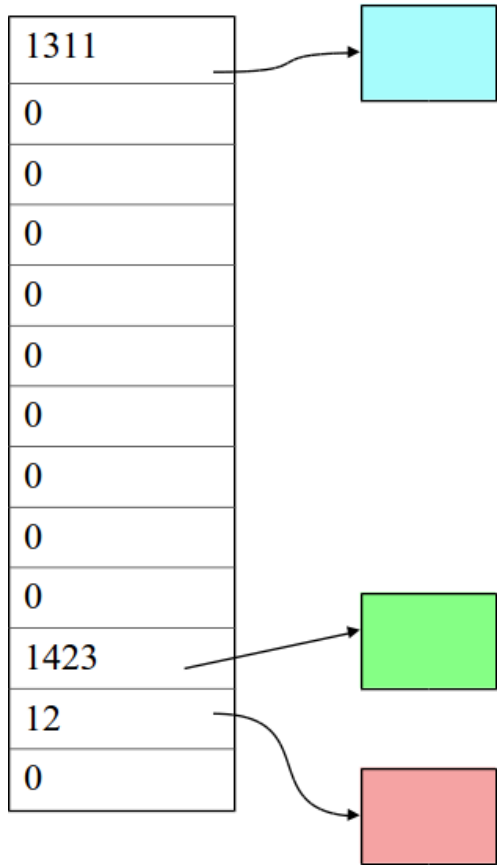


# Disk Map in Unix



# Optimization for Sparse Files

- Suppose a file was large, but mostly zeros
- Could be produced using lseek and write



# Additional Enhancements

- Performance depends on: How many disk access are needed to read a file?
- Store some data in the inode itself
  - Perhaps the whole file will fit in!
  - Need only 1 disk access for a small file
- Increase block size

# Directories

# File Systems

- Data Structures for Directories
- Shared Files

# Unix Directory (V7)

Directories are files whose data is a list of filenames & inodes

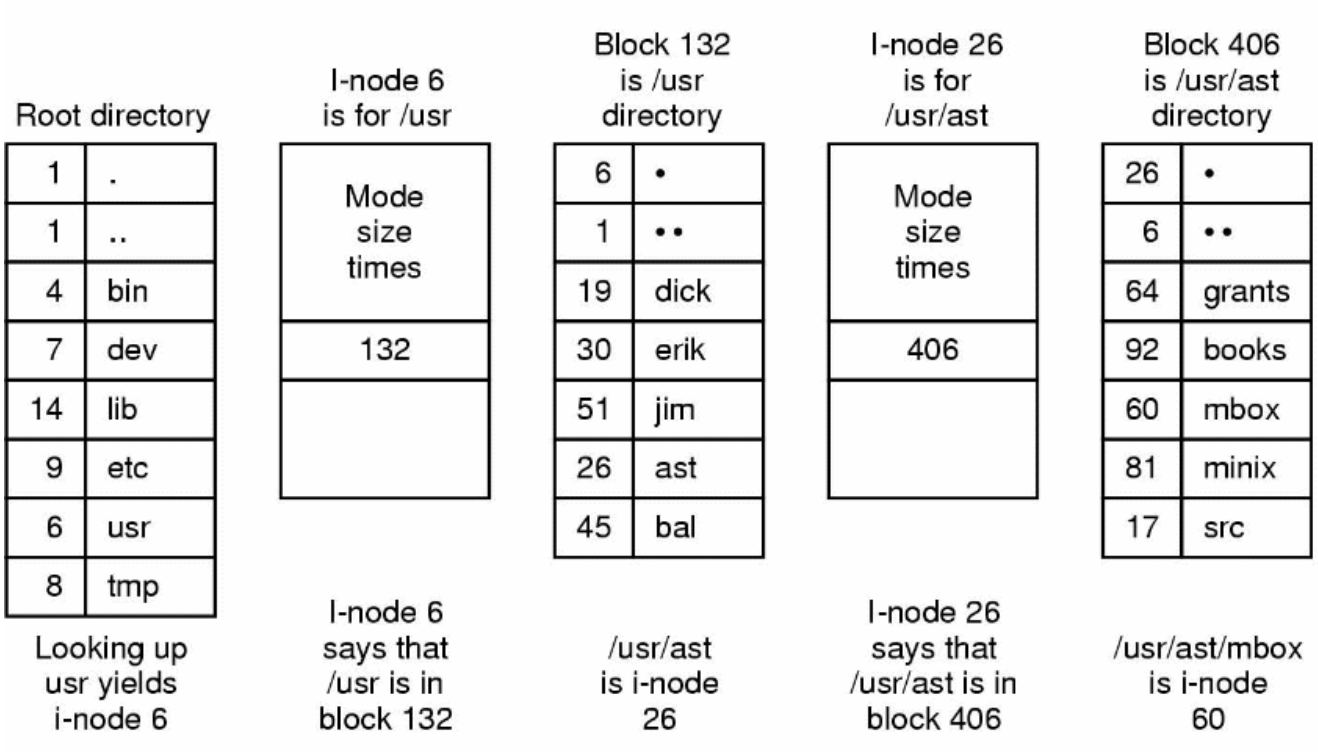
| filename (14 bytes) | inode number (2 bytes) |
|---|---|
| . | 12 |
| .. | 14 |
| etc | 134 |
| mail | 346 |
| crash | 5 |
| init | 175 |
| mount | 586 |

Example inode

| |
|---|
| Owner snt |
| Group cpre308 |
| Type regular file |
| Perms rwxr-xr-x |
| Accessed oct 23 9.34pm |
| Modified .... |
| Inode modified ... |
| Size 74003 bytes |
| Disk addresses |

Max filename size = 14 chars

# The UNIX V7 File System




The steps in looking up `/usr/ast/mbox`