CSC 4103 - Operating Systems
Spring 2007

LECTURE - XV
FILE SYSTEMS - I

Tevfik Koşar

Louisiana State University
March 20th, 2007

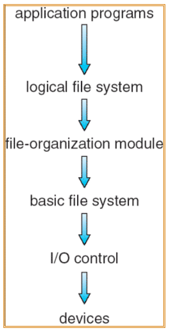
File-System Structure

- Provides organized and efficient access to data on secondary storage, E.g.:
  - Organizing data into files and directories
  - Improve I/O efficiency between disk and memory (perform I/O in units of blocks rather than bytes)
  - Contains file structure via a File Control Block (FCB)
    - Ownership, permissions, location..

A Typical File Control Block

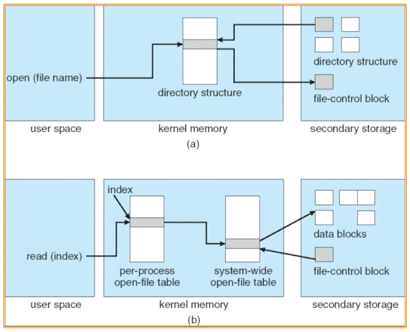
file permissions
file dates (create, access, write)
file owner, group, ACL
file size
file data blocks or pointers to file data blocks

Layered File System



application programs
logical file system
file-organization module
basic file system
I/O control
devices

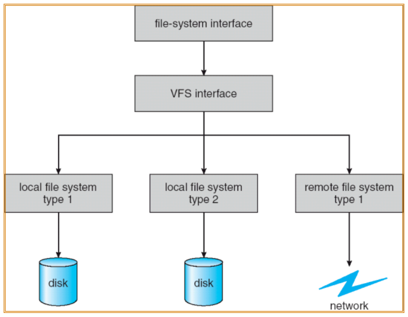
In-Memory File System Structures



Virtual File Systems

- Virtual File Systems (VFS) provide an object-oriented way of implementing file systems.
- VFS allows the same system call interface (the API) to be used for different types of file systems.
- The API is to the VFS interface, rather than any specific type of file system.

Schematic View of Virtual File System



Directory Implementation

- **Linear list** of file names with pointer to the data blocks.
  - simple to program
  - time-consuming to execute
- **Hash Table** – linear list with hash data structure.
  - decreases directory search time
  - **collisions** – situations where two file names hash to the same location
  - fixed size

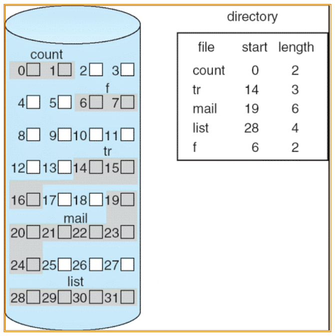
Allocation Methods

- An allocation method refers to how disk blocks are allocated for files:
- **Contiguous allocation**
- **Linked allocation**
- **Indexed allocation**

Contiguous Allocation

- Each file occupies a set of contiguous blocks on the disk
- Simple – only starting location (block #) and length (number of blocks) are required
- Wasteful of space (dynamic storage-allocation problem)
- Files cannot grow

Contiguous Allocation of Disk Space

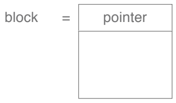


directory

file	start	length
count	0	2
tr	14	3
mail	19	6
list	28	4
f	6	2

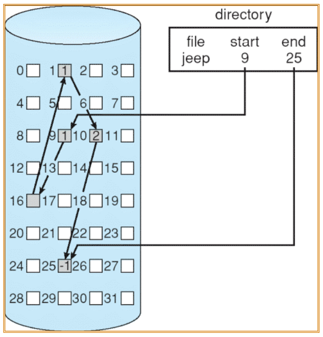
Linked Allocation

- Each file is a linked list of disk blocks: blocks may be scattered anywhere on the disk.

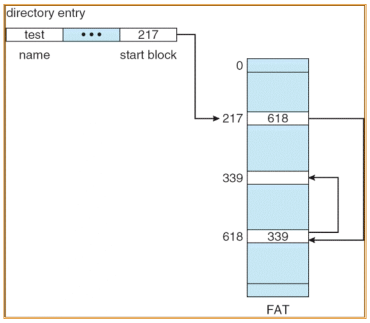


+ Simple – need only starting address
+ Free-space management system – no waste of space
- No random access
- Extra space required for pointers
- Reliability: what if a pointer gets corrupted?

Linked Allocation

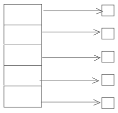


File-Allocation Table



Indexed Allocation

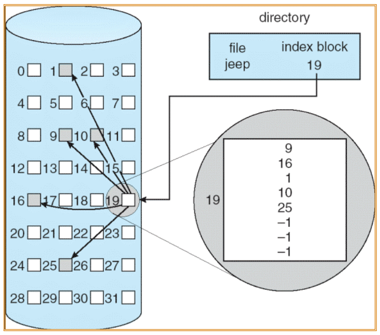
- Brings all pointers together into the *index block*, to allow random access to file blocks.
- Logical view.



index table

+ Supports direct access
+ Prevents external fragmentation
- High pointer overhead --> wasted space

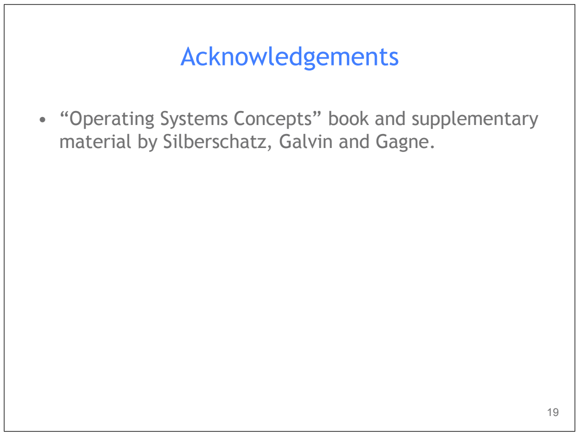
Example of Indexed Allocation



Any Questions?

Reading Assignment

- Read chapter 11 from Silberschatz.



Acknowledgements

- “Operating Systems Concepts” book and supplementary material by Silberschatz, Galvin and Gagne.