Notes #9: File Management

COMP 213
(211/212)
Operating Systems

2019-2020 1st Semester

In this Chapter

- File and directory
- File systems
- Access control – Users or groups of users are granted certain access rights to a file
- Simultaneous access – file locking
- Secondary Storage Management, File system:
  - FAT, NTFS

Files

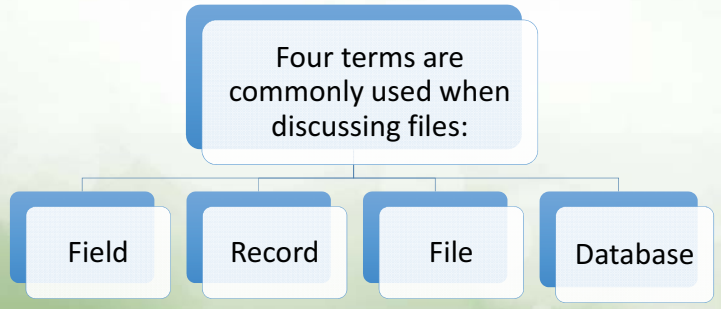
- Data collections created by users
- The File System is one of the most important parts of the OS to a user
- Desirable properties of files:

Long-term existence
- files are stored on disk or other secondary storage and do not disappear when a user logs off

Sharable between processes
- files have names and can have associated access permissions that permit controlled sharing

Structure
- files can be organized into hierarchical or more complex structure to reflect the relationships among files

File Structure



File Directories

- Contains information about files
  - **Attributes**: read only, creation date, size, etc..
  - **Location**: where the file resides on hard disk
  - **Ownership**
- Directory itself is a file

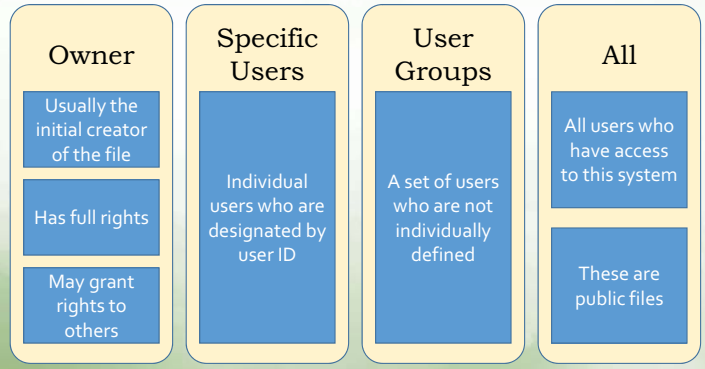
Access Rights

- None
  - User may not know the existence of the file
- Knowledge
  - User can only determine that the file exists and who its owner is
- Execution
  - Can load and execute a program but cannot copy it
- Reading
  - Can read the file (incl. copying and execution)
- Appending
  - Can only add data to the file

Access Rights (cont'd)

- Updating
  - Can modify, delete, and add data
- Changing protection
  - Can change access rights granted to other users
- Deletion
  - Can delete the file
- Owners
  - Has all rights previously listed
  - May grant rights to others

User Access Rights



Simultaneous Access

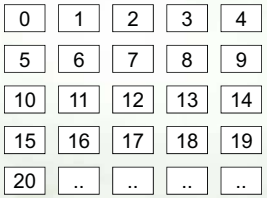
- Readers/Writers problem
- User may lock entire file before updating
- User may lock the individual records during the update

Secondary Storage Management

- Space on disks is allocated to each file
- File system must keep track of which parts are allocated to which file, and also the available space
- Space is allocated as one or more contiguous units or portions

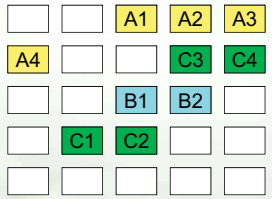
Cluster

- For the OS, the hard disk storage space is divided in equal size chunks called cluster



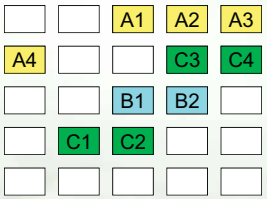
File Allocation

- Each file occupies a number of clusters, not necessarily contiguous
- The file system has to keep track of which clusters are allocated to a file, and which are free



The FAT File System

- Uses a File Allocation Table (FAT) to store the linked list of clusters used by a file



Directory \tmp:
File A, 15k, starts at cluster 2
File B, 8k, starts at cluster 12
File C, 13k, starts at cluster 16

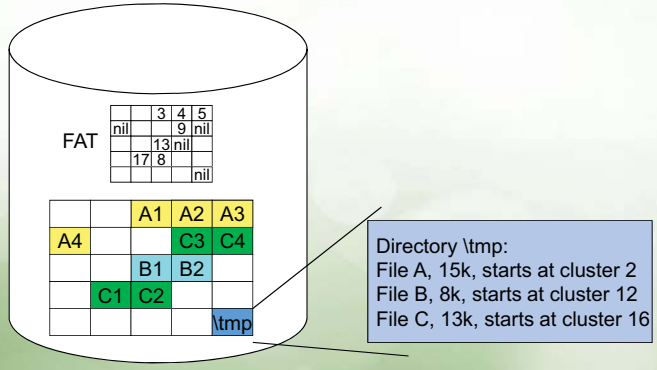
FAT

		3	4	5
nil			9	nil
		13	nil	
	17	8		

FAT16, FAT32

- FAT16, 16 bit is used to address cluster. Max number of cluster = 2^{16}
- FAT32: 32 bit is used to address cluster. Max number of cluster = 2^{32}
- For a comparison: http://www.ntfs.com/ntfs_vs_fat.htm

FAT File System on Disk



Directory \tmp:
File A, 15k, starts at cluster 2
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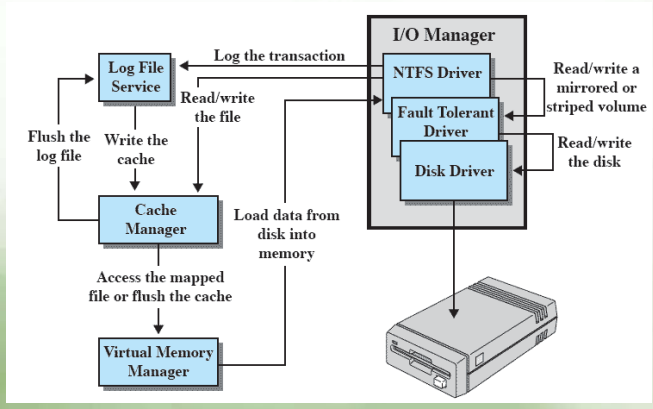
File C, 13k, starts at cluster 16

Windows File System

- Key features of New Technology File System (NTFS)
  - Recoverability
  - Security
  - Large disks and large files
  - Multiple data streams
  - Journaling
  - Compression and Encryption

Windows NTFS Components



Next

- This is it!
- Presentation sessions next