Operating System (CSC 3150)

Tutorial 7

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Target

In this tutorial, we will learn Assignment 4 related File System concepts.

- File System
- FCB (file-control block)
- Contiguous Allocation
- Free Space Management
- Assignment 4 structure
- Assignment 4 File Operations

File Attribute

- Name – only information kept in human-readable form
- Identifier – unique tag (number) identifies file within file system
- Type – needed for systems that support different types
- Location – pointer to file location on device
- Size – current file size
- Protection – controls who can do reading, writing, executing
- Time, date, and user identification – data for protection, security, and usage monitoring
- Information about files are kept in the directory structure, which is maintained on the disk
- Many variations, including extended file attributes such as file checksum
- Information kept in the directory structure

File System Structure

- File structure
  - Logical storage unit
  - Collection of related information

deal with disk

- File system resides on secondary storage (disks)
  - Provided user interface to storage, mapping logical to physical
  - Provides efficient and convenient access to disk by allowing data to be stored, located retrieved easily
- Disk provides in-place rewrite and random access
  - I/O transfers performed in blocks of sectors (usually 512 bytes)
- File control block – storage structure consisting of information about a file
- Device driver controls the physical device

don't demand in this homework

- File system organized into layers

File System Layer

- Device drivers manage I/O devices at the I/O control layer
  - Given commands like “read drive1, cylinder 72, track 2, sector 10, into memory location 1060” outputs low-level hardware specific commands to hardware controller
- Basic file system given command like “retrieve block 123” translates to device driver
  - Also manages memory buffers and caches (allocation, freeing, replacement)
    - Buffers hold data in transit
    - Caches hold frequently used data
- File organization module understands files, logical address, and physical blocks
  - Translates logical block # to physical block #
  - Manages free space, disk allocation

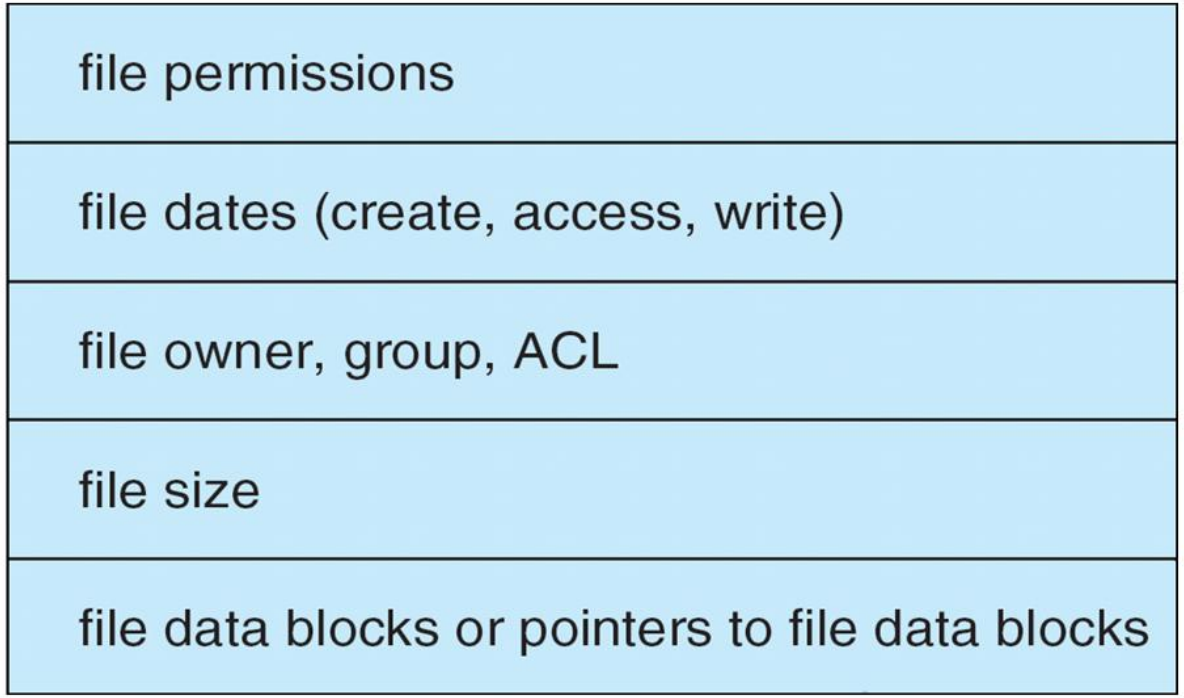
allocated in cts memory

- Logical file system manages metadata information
  - Translates file name into file number, file handle, location by maintaining file control blocks
  - Directory management
  - Protection

File System structure

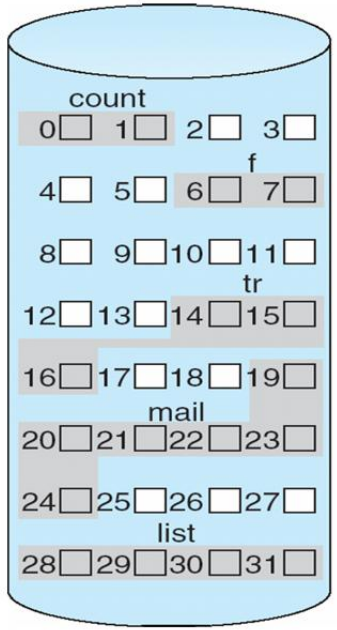
- We have system calls at the API level, but how do we implement their functions?
  - On-disk and in-memory structures
- Boot control block contains info needed by system to boot OS from that volume
  - Needed if volume contains OS, usually first block of volume
- Volume control block (superblock, master file table) contains volume details
  - Total # of blocks, # of free blocks, block size, free block pointers or array
- Directory structure organizes the files
  - Names and inode numbers, master file table
- Per-file File Control Block (FCB) contains many details about the file
  - Inode number, permissions, size, dates
  - NTFS stores into in master file table using relational DB structures

FCB (file-control block)



Contiguous Allocation

- An allocation method refers to how disk blocks are allocated for files:
- Contiguous allocation – each file occupies set of contiguous blocks

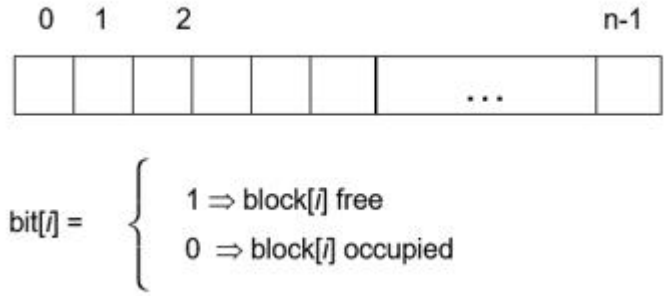


directory

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

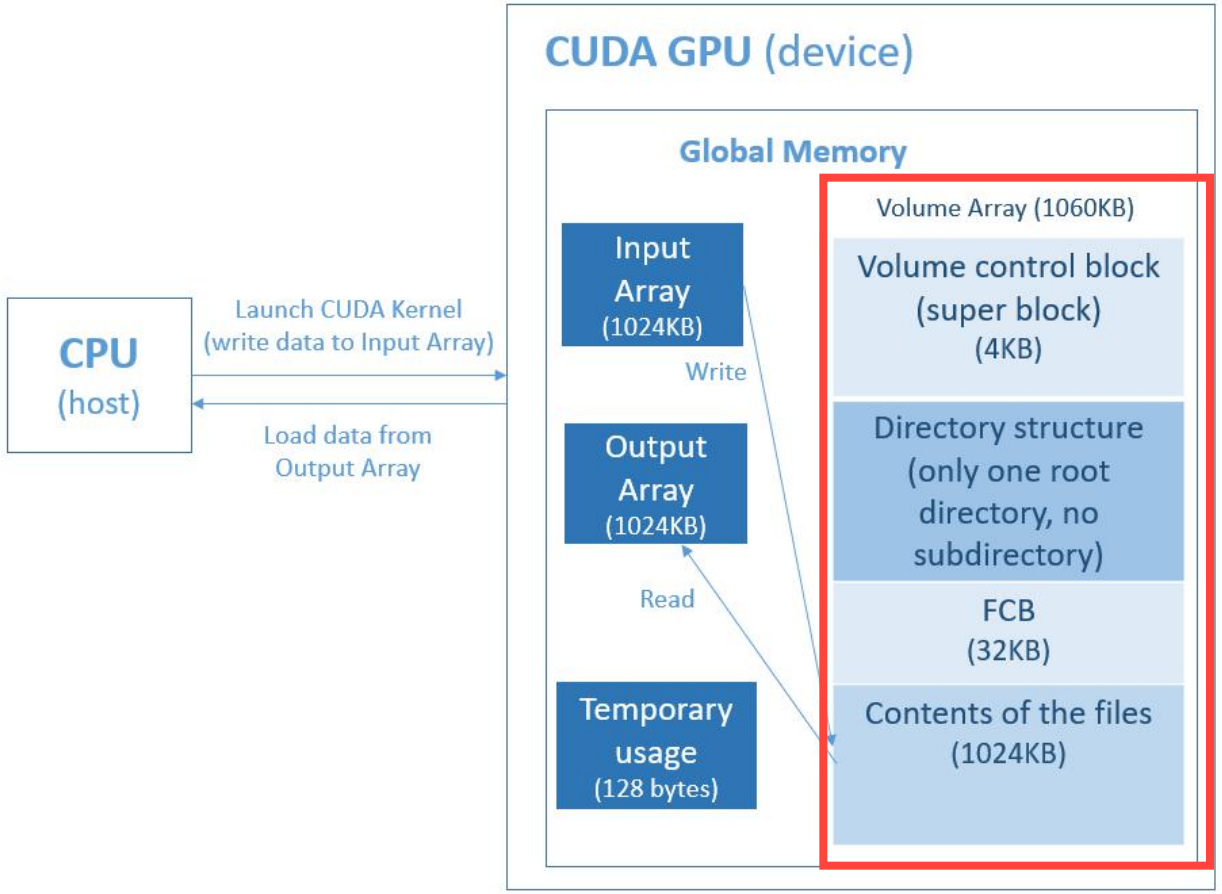
Free Space Management

- File system maintains free-space list to track available blocks/clusters
  - (Using term “block” for simplicity)
- Bit vector or bit map (n blocks)



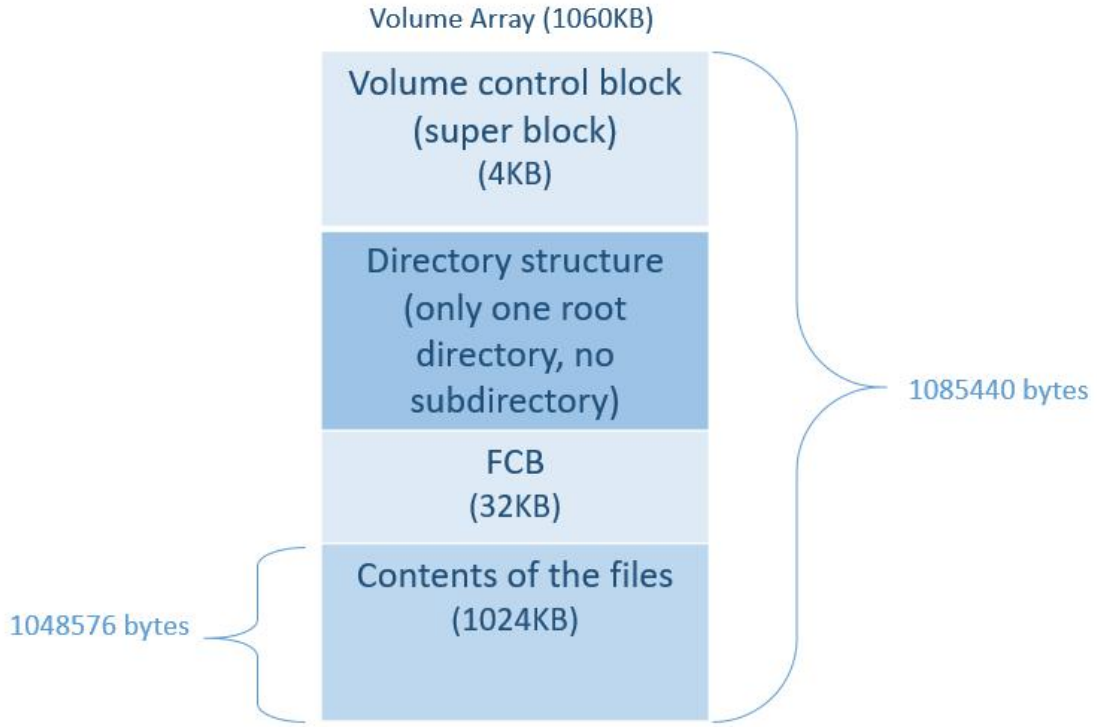
For example, consider a disk where blocks 2, 3, 4, 5, 8, 9, 10, 11, 13, 17, 18 are free and the rese blocks are allocated.
The free-space bit map would be 00111100111111000 11…

Assignment 4 Structure



Assignment 4 Structure

- The size of volume is 1085440 bytes
- The size of files total is 1048576 bytes
- The maximum number of file is 1024
- The maximum size of a file is 1024 bytes
- The maximum size of a file name is 20 by
- FCB size is 32 bytes.
- FCB entries is 32KB/ 32 bytes = 1024
- Storage block size is 32 bytes.



Assignment 4 File Operations

- open
  - Open a file.
  - Give a file pointer to find the file's location.
  - Space in the file system must be found for the file.
  - An entry for the new file must be made in the directory.
  - Also accept access-mode information: read/write
  - When to use write mode, if no such file name can be found, create a new zero byte file.
  - Return a write/read pointer.

```
fp = open (char *s, int op)
```

File name

G_READ / G_WRITE

Assignment 4 File Operations

- write
  - To write a file.
  - A write pointer to identify the location in the file.
  - If the file have existed, cleanup the older contents of the file and write the new contents.
  - Take the input buffer to write bytes data to the file .

write (uchar *input, u32 size, u32 fp)

Input buffer

Bytes of data write to file

Write pointer

all the conetent

Assignment 4 File Operations

- read
  - To read contents from a file.
  - A read pointer to identify the location in the file.
  - To read bytes data from the file to the output buffer.
  - The offset of the opened file associated with the read pointer is 0 (always read the file from head.)

read(uchar *output, u32 size, u32 fp)

Output buffer

Bytes of data read from file

Read pointer

Assignment 4 File Operations

- rm
  - To delete a file and release the file space.
  - Search the directory for the named file.
  - Implement gsys() to pass the RM command.

won't delete something
didn't exist

gsys(int op, char *s)

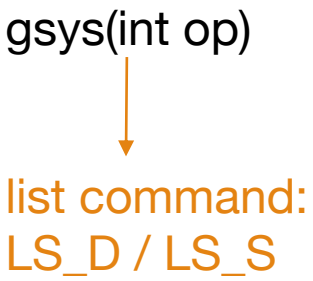
Delete command: RM

File name you want to delete

system call

Assignment 4 File Operations

- ls
  - List information about files.
  - Implement gsys() to pass the LS_D/LS_S commands.
  - LS_D list all files name in the directory and order by modified time of files.
  - LS_S list all files name and size in the directory and order by size.
    - If there are several files with the same size, then first create first print.



Thank you