CSCI 3150 Introduction to Operating Systems

LAB Three: Superblock – Define File system metadata

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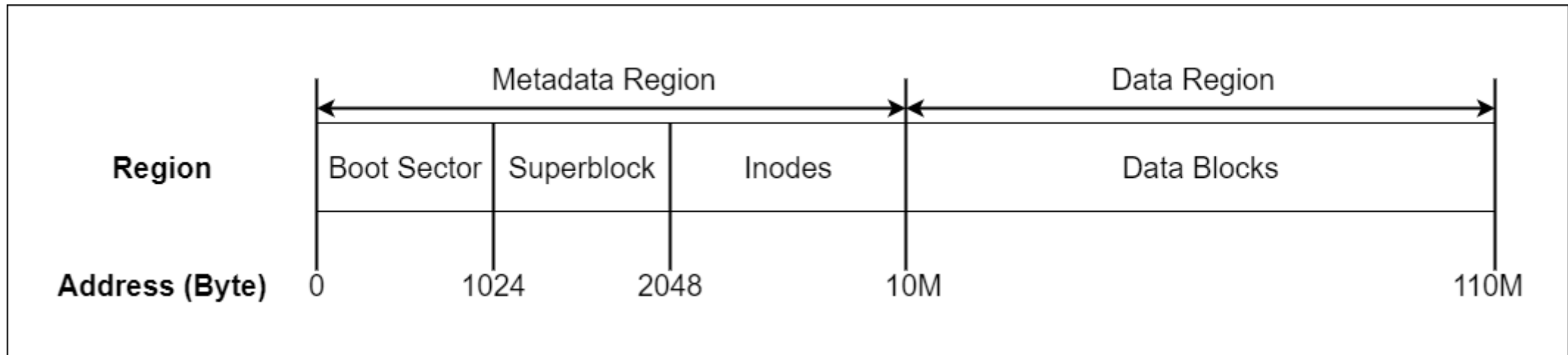
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Goal

- In the Project, you will be asked to implement some basic functions of a Simple File System.

- These two labs (lab-3 & 4) are the pre-knowledges to help you understand the project.

Background

- File system can be divided into metadata region and data region.
- Superblock is the first block in the metadata region, which describes the basic information of the file system.
  - Where the inodes and data block begins
  - Block size

Region	Boot Sector	Superblock	Inodes	Data Blocks
	Metadata Region			Data Region
Address (Byte)	0 1024	2048	10M	110M

Superblock structure

- A typical superblock structure can be found below:

```
typedef struct _super_block_
{
    int i_offset; /* the starting position of inode */
    int d_offset; /* the starting position of data blocks */
    int max_inode; /* the maximum number of inodes */
    int max_data_blk; /* the maximum number of data blocks */
    int next_available_inode; /* the index of next free inode */
    int next_available_blk; /* the index of next free data block */
    int blk_size; /* the size of data block */
};
```

Superblock parameters

- Specifically, in SFS (the simplified file system in project):
  - the inode region starts at 2048 bytes (i_offset);
  - the data region starts at 10 MB (d_offset);
  - the block size is 4 KB (blk_size).

Superblock parameters

- Some related parameters can be found below:

```
#define SB_OFFSET 1024 /* The offset of superblock region*/
#define I_OFFSET 2048 /* The offset of inode region */
#define D_OFFSET 10485760 /* The offset of data region */
#define MAX_INODE 100 /* The maximum number of inode */
#define MAX_DATA_BLK 25600 /* The maximum number of block */
#define BLK_SIZE 4096 /* The size per block */
```

Get the metadata of a file system

- When we access a file system, the first step is reading the superblock region on the hard disk, load the superblock data into memory.

- From superblock we get the basic information of the file system, and access the files base on these basic information.

  - Read a file

  - Open a file

Superblock.c -- A simple program to display the Superblock

- A simple program (superblock.c) has been provided to display the superblock. There are several files in the zip file:
  - **HD**: It is used to simulate the hard disk. This "HD" file has been properly initialized based on the data structure defined by _super_block_ with the parameters above.
  - *Superblock.h*: It contains the structure of superblock and the parameters of the SFS.
  - *Superblock.c:* The C program with functions to read the superblock.
  - *Superblock-test.c:* It contains two cases which show the superblock region on the hard disk and its information, respectively.
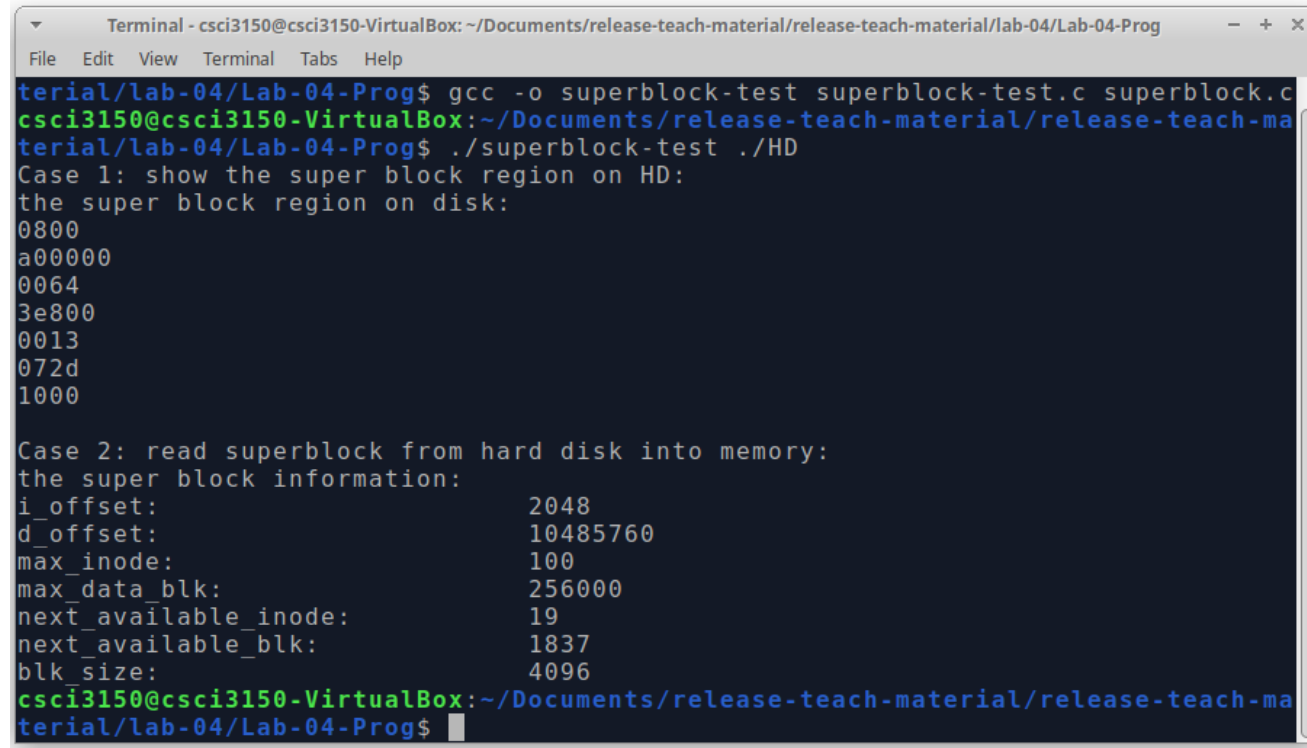
Compile and Run

- Copy the **HD**, **superblock.c, superblock-test.c, and superblock.h** to your current directory.

- Compile the **superblock-test.c** as below:

- **gcc -o superblock-test superblock-test.c superblock.c**

- Then you can run the test program by:

- **./superblock-test ./HD**

Result

- You can find two test cases shown like the figure below:

Implementation

- In **superblock.c** program, there is one main function:

- **read_sb():** read the superblock region into memory and form an entity of super block structure, then return the link of this entity.

- For more detailed implementation, please read the **superblock.c** program.