Group 4

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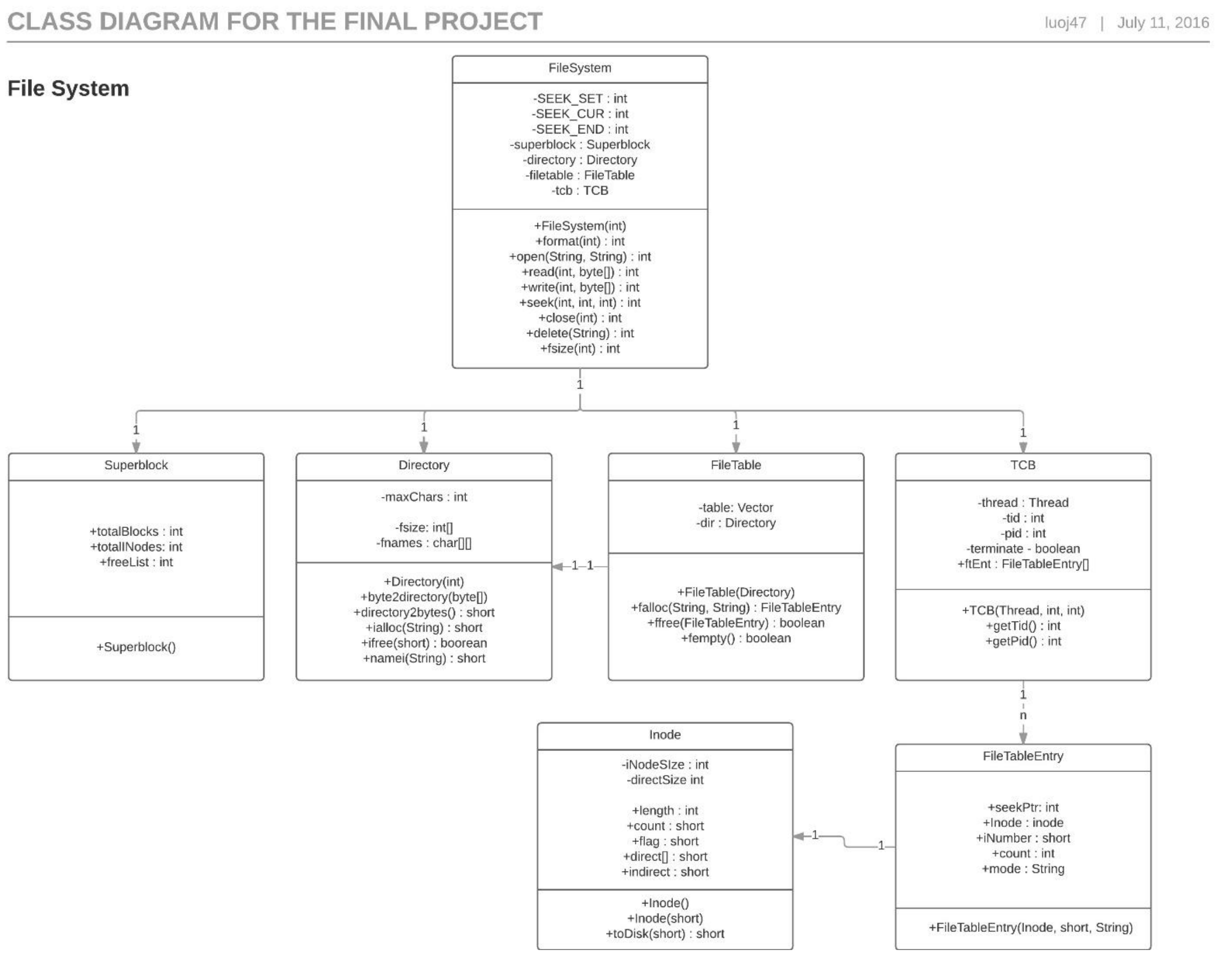
Figure 1: Class Diagram for FileSystem



This is a class diagram describing the work that needs to be completed for FileSystem. FileSystem has 1 Superblock, Directory, FileTable and TCB. We will use the file descriptor integer parameter passed into methods in FileSystem to access the file table entry in the file descriptor table in the TCB class. Each file table entry has a one-to-one relationship with Inode.

Class Descriptions

FileSystem

```java
import java.io.File;

/**
 * Created by Ko Fukushima and Jesse Luo on 7/9/2016.
 *
 * This class manages the structure of a FileSystem by holding
 * the superblock, directory, and filetable.
 *
 */
public class FileSystem
{
    private final int SEEK_SET = 0;
    private final int SEEK_CUR = 1;
    private final int SEEK_END = 2;

    private Superblock superblock;
    private Directory directory;
    private FileTable filetable;
    private TCB tcb;

    /**
     * Constructs a new FileSystem.
     *
     * @param diskBlocks size of the superblock
     */
    public FileSystem(int diskBlocks)
    {
        // create new superblock, format disk with 64 inodes
        superblock = new Superblock (diskBlocks);

        // create new directory, register "/" in directory entry 0
        filetable = new FileTable(directory);

        // reconstruct the directory
        /*
        FileTableEntry dirEnt = open("/", "r");
        int dirSize = fsize(dirEnt);
        if(dirSize > 0)
        {
            byte[] dirData = new byte[dirSize];
            read(dirEnt, dirData);
            directory.bytes2directory(dirData);
        }
        close(dirEnt);*/
    }

    // the description of sync will be added more info later

    /**
     * This method formats the disk
     *
     * @param files the # files to be created
     * @return 0 on success, -1 otherwise
     */
    public int format(int files)
    {
        // format/delete all files
        // Check if FileTable ad TCB are empty (isEmpty)
        // allocate "files" inodes
        // returns if format successful
        return 0; // it needs to be modified later
    }

    // the description of open will be added more info later

    /**
     * This method opens the file corresponding to the file
     * name in the given mode.
     *
     * @param fileName
     * @param mode
     * @return int fd
     * between 3 to 31
     */
    public int open(String fileName, String mode)
    {
        // FileTableEntry newfte = filetable.falloc(fileName, mode);
        // for tcb.ftENT's length
        // if a spot is null
        // insert newfte
        // return current index
        //...
        // return -1 if error
        return 0; // it needs to be modified later
    }

    /**
     * This method reads as many bytes as possible
     * or up to buffer.length the file
     * corresponding to the file descriptor
     *
     * @param fd the file descriptor
     * @param buffer the buffer
     * @return the # bytes read or -1 if there is an error
     */
    public int read(int fd, byte[] buffer)
    {
        // read byte[] buffer from tcb.ftEnt[fd]
        // return number of bytes read
        return 0; // it needs to be modified later
    }

    /**
     * This method writes the contents of the buffer to the
     * file corresponding to the file descriptor.
     *
     * @param fd the file descriptor
     * @param buffer the buffer
     * @return number of bytes written, or negative for error
     */
    public int write(int fd,  byte[] buffer)
    {
        // write byte[] buffer to tcb.ftEnt[fd]
        // return number of bytes written
        return 0; // it needs to be modified later
    }

    /**
     * This method updates the seek pointer corresponding to
     * the file descriptor.
     *
     * @param fd the file descriptor
```

```
     * @param offset the offset can be positive or negative
     * @param whence the whence represents SEEK_SET == 0,
     * SEEK_CUR == 1, and SEEK_END == 2
     * @return 0 in success, -1 false
     */
    public int seek(int fd, int offset, int whence)
    {
        // update seek pointer
        //If whence = SEEK_SET (= 0),
        // file's seek pointer set to offset bytes from beginning of file
        //If whence = SEEK_CUR (= 1),
        // file's seek pointer set to its current value plus offset. Offset can be
positive/negative.
        //If whence = SEEK_END (= 2),
        // file's seek pointer set to size of file plus offset. Offset can be
positive/negative.
        return 0; // it needs to be modified later
    }

    /**
     * This method close the file corresponding to
     * the file descriptor
     *
     * @param fd file descriptor
     * @return 0 in success, -1 false
     */
    public int close(int fd)
    {
        // tcb.ftEnt[fd] = null;
        return 0; // it needs to be modified later
    }

    /**
     * This method deletes the file that
     * is specified by file name only when the
     * file is closed
     *
     * @param fileName the file name
     * @return 0 if successful, -1 otherwise
     */
    public int delete(String fileName)
    {
        // if (file == open) { mark for deletion (also can't receive new open request}
        // else { delete file}
        return 0; // it needs to be modified later
    }

    /**
     * This method returns the size in bytes
     * of the file indicated by file descriptor
     * and returns -1 when it detects an error
     *
     * @param fd the file descriptor
     * @return the file size
     */
    public int fsize(int fd)
    {
        // return tcb.ftEnt[fd];
        return 0; // it needs to be modified later
    }
}
```

Superblock

```
/**
 *  Created by Ko Fukushima and Jesse Luo on 7/9/2016.
 *
 *  This class is used to describe the number of disk blocks
 *  , the number of inodes, and the block number of the
 *  head block of the free list.
 */
public class Superblock
{
    public int totalBlocks; // the number of disk blocks
    public int totalInodes; // the number of inodes
    public int freeList;    // the block number of the free List's head

    /**
     * Class constructor that initializes the fields that are tatalBlocks,
     * totalInodes, and freeList
     *
     * @param diskSize the disk size
     */
    public Superblock( int diskSize)
    {
        // initialize every data field
    }
}
```

FileTable

```
/**
 *  Created by Ko Fukushima and Jesse Luo on 7/9/2016.
 *
 *  This class manages file entry table by allocating for,
 *  freeing, emptying the entry in the table
 *
 */

import java.util.Vector;

public class FileTable
{
    private Vector table;
    private Directory dir;

    /**
     * Class constructor that initializes the fields of table
     * and dir.
     *
     * @param directory the directory
     */
    public FileTable(Directory directory)
    {
        table = new Vector();
        dir = directory;
    }

    /**
     * This method allocates a new file table entry for this file name
     * and it also allocate/retrive and register the corresoponding inode
     * using dir increment this inode's count immediately write back this
     * inode this inode to the disk
     *
     * @param filename the file name
     * @param mode the mode such as "r", "w", "w+", or "a"
     * @return a reference to the file table entry
     */
    public synchronized FileTableEntry falloc(String filename, String mode)
    {
        // int iNumber = dir.ialloc(filename);
        // Inode newInode = new Inode(iNumber);
        // FileTableEntry fte = new FileTableEntry(newInode, iNumber, mode)
        // fte.inode.count++;
        // fte.inode.toDisk(iNumber);
        // return fte;
        return null; // It needs to be modified later
    }

    /**
     * This method receive a file table entry reference
     * and save the corresponding inode to the disk
     * and free this file table entry
     *
     * @param e the file table entry
     * @return True if this file entry found in the table,
     * false otherwise
     */
    public synchronized boolean ffree(FileTableEntry e)
    {
        // e.inode.toDisk(e.iNumber);
        // dir.ifree(e.iNumber);
        // return if TCB's ftEnt contains e
        return false; // It needs to be modified later
    }

    /**
     * This method clear all file table entry in the table
     * and it should be called before starting a format
     *
     * @return True if table is empty and false otherwise
     */
    public synchronized boolean fempty( )
    {
        return table.isEmpty();
    }
}
```

Directory

```
/**
 * Created by Ko Fukushima and Jesse Luo on 7/9/2016.
 *
 * This class maintains each file in a different directory entry that
 * contains its file name and the corresponding inode number.
 */

public class Directory
{
    private static int maxChars = 30;   // max characters of each file name

    // Directory entries
    private int fsize[];
    private char fnames[][];

    /**
     * Class constructor that initializes the fields that are fsize,
     * fnames, root, fsize.
     *
     * @param maxInumber the max iNode number
     */
    public Directory(int maxInumber)
    {
        fsize = new int[maxInumber];
        fnames = new char[maxInumber][maxChars];
        String root = "/";
        fsize[0] = root.length();
        root.getChars(0, fsize[0], fnames[0], 0);
    }

    /**
     * This method initializes the Directory instance with this data[]
     *
     * @param data the data[] received directory information from disk
     * @return                                                  // It needs to be
added later
     */
    public int bytes2directory(byte data[])
    {
        // convert byte data[] to fnames/fsize
        // return if successful
        return 0; // It needs to be modified later
    }

    /**
     * This method converts and return Directory information into a plain
     * byte array that will be wrritten back to disk.
     *
     * @return the meaningfull Directory information
     */
    public byte[] directory2bytes()
    {
        // convert fnames/fisize to byte[]
        // return converted data
        return null; // It needs to be modified later
    }

    /**
     * This methods creates the one of a file, and
     * allocates a new inode number for it.
     *
     * @param filename the file name
     * @return a new inode number             // This might need to be modified later
     */
    public short ialloc(String filename)
    {
        // newINumber = new inode number for filename
        // fnames[filename][newINumber], insert in fnames
        // return newInumber
        return 0; // It needs to be modified later
    }

    /**
     * This method deallocate this inumber (inode number) and
     * also deallocate the corresponding file
     *
     * @param iNumber the inode number
     * @return True if find the inode number and deallocates
     * the file with that inumber, and False otherwise
     */
    public boolean ifree(short iNumber)
    {
        // for the length of fnames
        // if the current inode number matches iNumber
        // for the length of ftEnt in TCB
        // if the current inode has inumber that matches iNumer
        // delete somehow
        // remove inumber and file from fnames
        // ...
        // return if dellocation is successful
        return false; // It needs to be modified later
    }

    /**
     * This method returns the inumber corresoponding to this filename
     *
     * @param filename the file name
     * @return the inode number corresponding to this file name, or -1 if not found
     */
    public short namei(String filename)
    {
        // for the length of fnames
        // if the current fname matches filename
        // return the inode number at this index
        // ...
        // return -1, because not found
        return 0; // It needs to be modified later
    }
}
```

TCB

```java
/**
 * Created by Ko Fukushima and Jesse Luo on 7/9/2016.
 *
 * This class represents a Thread control block that
 * manages up to 32 open files
 *
 */
public class TCB
{
    private Thread thread = null;
    private int tid = 0;
    private int pid = 0;
    private boolean terminate = false;

    // User file descriptor table:
    // each entry pointing to a file (structure) table entry
    public FileTableEntry[] ftEnt = null;

    /**
     *
     * Class constructor that initializes the parameters: thread, tid, pid
     * , terminated, and FileTableEntry
     *
     * @param thread a thread
     * @param tid a thread id
     * @param pid a process id
     */
    public TCB(Thread thread, int tid, int pid)
    {
        this.thread = thread;
        this.tid = tid;
        this.pid = pid;
        terminate = false;

        // The following code is added for the file system
        ftEnt = new FileTableEntry[32];
    }

    /**
     * This method returns a thread id
     *
     * @return tid the id for a thread
     */
    public int getTid()
    {
        return tid;
    }

    /**
     * This method returns a process id
     *
     * @return pid the id for a process
     */
    public int getPid()
    {
        return pid;
    }

}
```

FileTableEntry

```
/**
 * Created by Ko Fukushima and Jesse Luo on 7/9/2016.
 *
 * This class is shared among all user threads
 */
public class FileTableEntry
{
    public int seekPtr;
    public final Inode inode;
    public final short iNumber;
    public int count;
    public final String mode;

    /**
     * Class constructor that initializes the fields that are seekPtr,
     * inode, iNumbers, count, mode.
     *
     * @param inode the inode
     * @param iNumber the inode number
     * @param mode the mode such as "r", "w", "w+", or "a"
     */
    public FileTableEntry(Inode inode, short iNumber, String mode)
    {
        seekPtr = 0;                                        // a file seek pointer
        this.inode = inode;                                 // a reference to its inode
        this.iNumber = iNumber;                             // am inode number
        count = 1;                                          // # threads sharing this
entry
        this.mode = mode;                                   // "r", "w", "w+", or "a"
        if (this.mode.compareTo("a") == 0)
        {
            seekPtr = this.inode.length;
        }
    }

}
```

Inode

```java
/**
 * Created by Ko Fukushima and Jesse Luo on 7/9/2016.
 *
 * This class describes a file, and this inode is a
 * Simplified version of the UnixInode
 */
public class Inode
{
    private final static int iNodeSize = 32;         // fix to 32 bytes
    private final static int directSize = 11;        // # direct pointers

    public int length;                               // file size in bytes
    public short count;                              // # file-table entries pointing
on this
    public short flag;                               // 0 = unused, 1 = used, ...
    public short direct[] = new short[directSize];   // direct pointers
    public short indirect;                           // a indirect pointer

    /**
     * Class constructor that initializes the fields that are length,
     * count, flag, direct, and indirect.
     */
    Inode()
    {
        length = 0;
        count = 0;
        flag = 1;
        for (int i = 0; i < directSize; i++)
        {
            direct[i] = -1;
        }
        indirect = -1;
    }

    /**
     * This method retrieves the inode from disk
     *
     * @param iNumber
     */
    Inode(short iNumber)
    {
        // Directory dir = new Directory(iNodeSize);
        // inode = (Inode)dir.directory2bytes;
        // direct[iNumber] = inode
    }

    /**
     * This method saves to disk as the i-th inode
     *
     * @param iNumber
     * @return
     */
    int toDisk(short iNumber)
    {
        // Directory dir = new Directory(iNodeSize);
        // dir.bytes2directory((byte[])direct[iNumber]);
        return 0; // It needs to be modified later
    }
}
```

Work Items To Be Completed

We will complete the following work items (classes) for the next phase:

- FileSystem
- Superblock
- FileTable
- TCB
- Test cases for each

The following group members will complete the following work items:

- Ko
    - Half of FileSystem and Superblock
    - TCB
    - Test Cases
- Jesse
    - Half of FileSystem and Superblock
    - FileTable
    - Test Cases