Fall, 2018

EEE3540: Microprocessor by E.Y. Chung
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EEE3540 Microprocessor Project

Designing garbage collection and wear-leveling algorithm of BAST FTL for an SSD

This project is about Solid-State Drives(SSDs), one of the most actively developed IT products today. SSDs are being used primarily for data storage, and serves as the most promising alternative to Hard Disk Drives due to its performance and reliability.

An SSD is largely composed of two parts, the hardware and the software. The hardware refers to the hardware components of the SSD, such as the interface port, NAND storage, and a microprocessor for managing all of its components. The software, also called the Flash Translation Layer(FTL), is executed on the microprocessor and is responsible for managing the resources to increase performance and improve the lifetime of an SSD.

Parameter	Value
NUM_OF_LOGICAL_BLOCK	256
PAGE_PER_BLOCK	128
SECTOR_PER_PAGE	4
MAX_LOGICAL_PAGE	256 * 128 = 32768
MAX_LOGICAL_SECTOR_ADDRESS	256 * 128 * 4 = 131072

In this project, you are to design the garbage collection and wear-leveling algorithm in the given FTL based on “Block Associative Sector Translation(BAST)”. Hardware will not be considered in this project. Open MP_Project.sln in given folder, and edit the source codes. address_translation.cpp and garbage_collection.cpp are the two files that you may primarily want to look on to.

File Name	Description
trace_input.txt	Trace input file
result.txt	Output data of your source codes
read_data.txt	How your output data should look like
wear_leveling.txt	Result of your algorithm (variation of erase count..)
erase_count.txt	Erase count of each physical block

After designing garbage collection and wear-leveling algorithm, you should verify its functionality. For verification, you should use “trace_input.txt” for the input, and compare the result of your program “result.txt” with “read_data.txt”. The two files, “result.txt” and “read_data.txt” should be the same. If it is not, it means that the contents of the data has been corrupted, so you will not get any points for implementation.

“wear-leveling.txt” shows the resulting performance of your algorithm. In your code, you can use the variable erase_counter[] for your algorithm, but you are not allowed to modify it directly (in other words, you can only read the variable and not write it). Using the function “erase_Block()” will modify erase_counter[] and using the function is allowed, but you must note that the function is used to actually erase the block.

1. [20 points] Describe the BAST FTL structure and explain how it works in the given source codes.

2. [30 points] In the given source codes, garbage collection has not been fully implemented. Improve your FTL by modifying the garbage collection. Explain in your report how you have modified the garbage collection and how it can benefit your SSD.

3. [20 points] You can improve wear-leveling just by modifying how the FTL searches for a new block. Locate that part of the FTL and modify it for a better erase count variance. You must include explanation on how you have modified the source code in your report.

4. [30 points] Design wear-leveling. You may look for ideas through other research papers or come up with your own idea. Include in your report how your algorithm works and how it can improve the erase count variance. Performance is evaluated through the file **wear-leveling.txt**. The importance of each parameters is as below:

Importance	Parameter
1st	Variation of erase count
2nd	Total # of erase
3rd (not important)	Running Time(ms)

Issued date

– 22 Nov. 2018

Due date

– 6:00 PM. 20 Dec. 2018

Grading portion

– This project accounts for 20% of the total grading.

Grading criterion

– Garbage collection and wear-leveling performance

Honor code

– Code or report copy will be severely penalized.

Submission

– Only soft copy

– File name : PJ_Group#_2013111111_honggildong_2013111111_honggildong.zip

  – You must match this file name.

– Include with

  – Report (With problem 1~4, and your performance result)

  – Your entire Visual Studio project folder

– Send soft copy : YSCEC Project board

– Both Korean and English is ok