

Project 2 Candidates

Sejun Kwon(sejun000@csl.skku.edu)

Computer Systems Laboratory

Sungkyunkwan University

<http://csl.skku.edu>

Project 2

- **Team project**
 - A team of two
 - A team of three would get a penalty
- **Free topic**
 - 11 candidates
- **Contents**
 - Motivation/ Architecture
 - Implementation/ Evaluation

Project 2 Proposal

- Recommendation
 - Under 7 slides including cover slide
 - about 5~6 minutes of presentation time
- What you plan
 - Motivation
 - Overview of algorithm or process
 - Experimental methodology
 -

Project 2

- Level of difficulty standard
 - Page level mapping (-)
 - Hybrid mapping (+)
 - Additional algorithm (+)
 - Complex data structure (+)



C1. DFTL

- Page-level mapping FTL
 - Store page mapping table on flash memory
 - Dynamically load/unload mapping table into SRAM

- Reference
 - “DFTL: A Flash Translation Layer Employing Demand-Based Selective Caching of Page-Level Address Mappings,” ASPLOS’09



C2. Lazy FTL

- Page-level mapping FTL
 - Store page mapping table on flash memory
 - Without giving up reliability, High performance can be achieved.
- Reference
 - LazyFTL: a page-level flash translation layer optimized for NAND flash memory



C3. KAST

- **K-Associative Log Block Mapping**
 - Each log block can be associated to K data blocks at maximum
- **Reference**
 - “KAST: K-Associative Sector Translation for NAND Flash Memory in Real-Time Systems,” DATE’09



C4. ComboFTL

- **SLC/MLC region**
 - SLC region : Page-level for hot data
 - MLC region : Unit-based page-level for cold data
 - To improve the performance and lifespan
- **Reference**
 - “ComboFTL: Improving Performance and Lifespan of MLC Flash Memory using SLC Flash Buffer,” JSA’10



C5. CFTL

- **Convertible FTL**
 - Change addressing mode
 - Page to block-level mapping : Cold data
 - Block to page-level mapping : Hot data
 - Based on DFTL

- **Reference**
 - “CFTL: A Convertible Flash Translation Layer with Consideration of Data Access Patterns,” SIGMETRICS’10



C6. Janus-FTL

- Provide a spectrum between block and page mapping schemes
 - Block Mapping Area / Page Mapping Area
 - Two operations that move blocks between BMA and PMA
 - Fusion (page mapping, G.C)
 - Defusion (merge)
- Reference
 - “Janus-FTL: Finding the Optimal Point on the Spectrum Between Page and Block Mapping Schemes,” EMSOFT’10



C7. Δ FTL

- Write compressed delta between the old data and the new data
 - Reduce the number of flash writes
- Reference
 - “ Δ FTL: Improving SSD Lifetime via Exploiting Content Locality,” EuroSys’12
 - LZF compression algorithm
 - <http://oldhome.schmorp.de/marc/liblzf.html>



C8. CAFTL

- **Content-Aware FTL**
 - Remove unnecessary duplicate writes
 - Make fingerprint of incoming write
 - Duplicate write if FTL already has the same fingerprint
- **Reference**
 - “CAFTL: A Content-Aware Flash Translation Layer Enhancing the lifetime of Flash Memory based Solid State Drives,” FAST’11



C9. LTFTL

- **Lightweight Time-shift FTL**
 - Maintain previous pages without reclaiming until a checkpoint
 - Roll-back to a previous consistent storage state
 - Enhance the reliability of flash memory
- **Reference**
 - “LTFTL: Lightweight Time-shift Flash Translation Layer for Flash Memory based Embedded Storage,” EMSOFT’08



C10. Variable-Length FTL

- Variable mapping granularities
 - Reduce mapping information
 - Separate each states
 - Free/Live, Dirty/ Clean
 - Use a hash table implementing Logical to Physical
- Reference
 - An efficient management scheme for large-scale flash-memory storage systems (Proceedings of the 2004 ACM symposium)



C11. μ -FTL

- Variable mapping granularities
 - μ -tree (Similar to B+ tree)
 - Complicated indexing
 - Read/Write Cache

- Reference
 - μ -FTL: A Memory-Efficient Flash Translation Layer Supporting Multiple Mapping Granularities (Proceedings of the 8th Annual ACM Conference on Embedded Software)

Kernel-Based FTL

- High-complexity task
 - Compression
 - Tree

- Coding on Linux kernel
 - Module
 - File system

Kernel-Based FTL

- FTL attached on Linux kernel

