

# Project 1

## Log Block FTL

Sejun Kwon(sejun000@cs.l.skku.edu)

Computer Systems Laboratory

Sungkyunkwan University

<http://cs.l.skku.edu>

# Contents

- Schedule
- Log block FTL
- ftl\_test

# Schedule

---

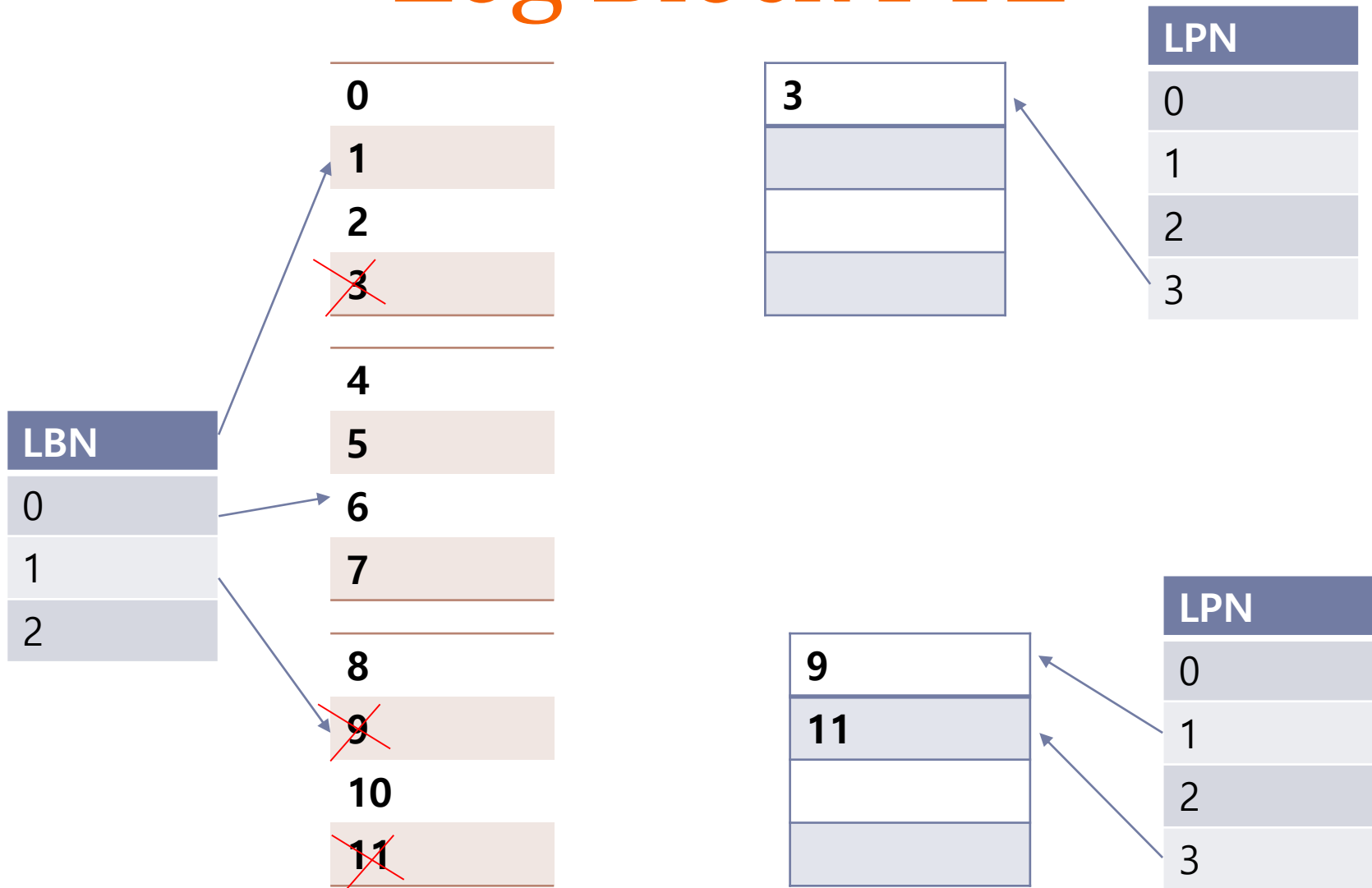
<b>Date</b>	<b>Title</b>
4/29 (Mon)	Project #1 Q&A
5/12 (Mon)	Project #2 Project 2
5/26 (Mon)	Project #2 Progress Report
6/9 (Mon)	Project #2 Presentation

---

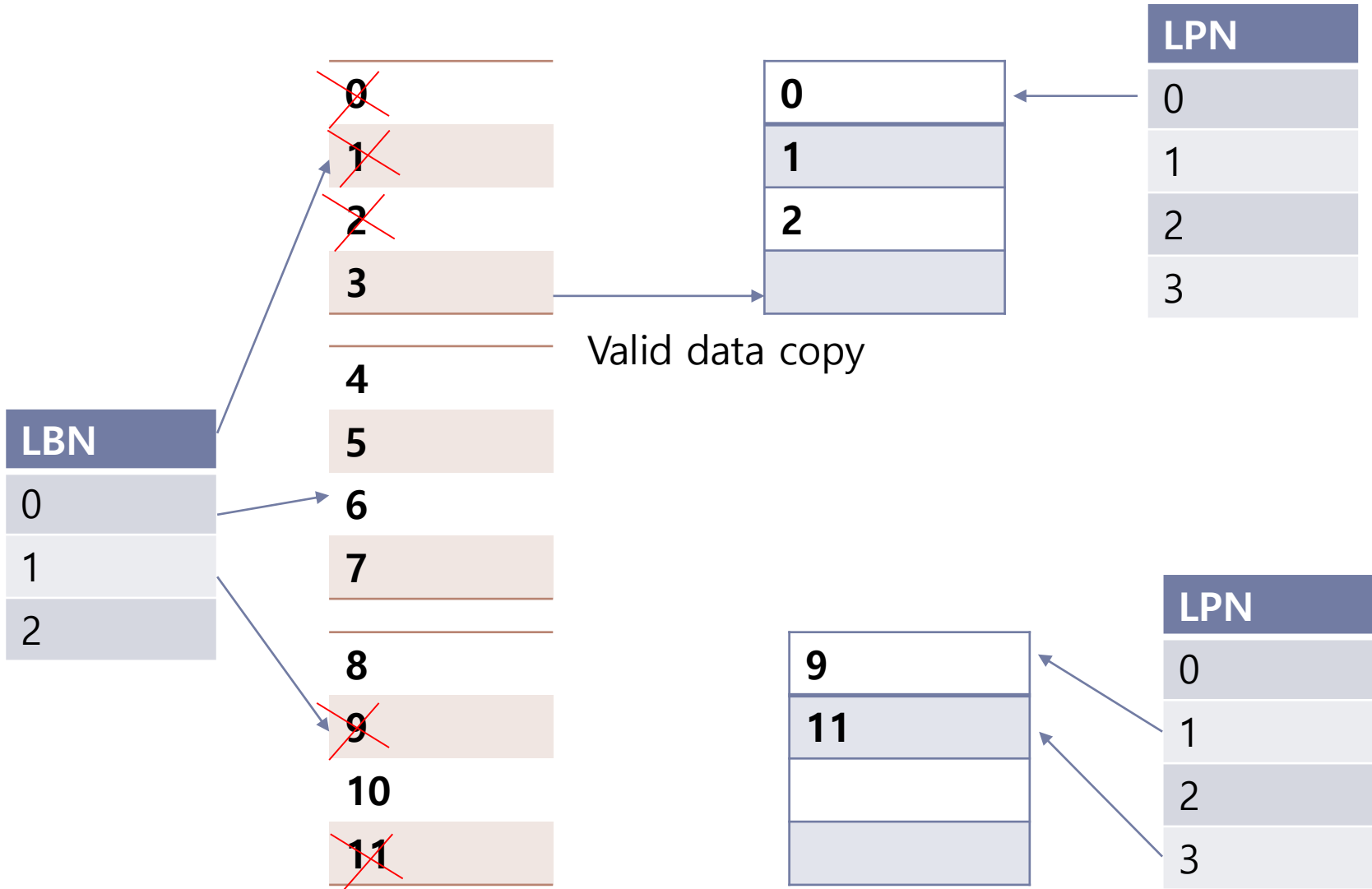
# Log Block FTL

- Block mapping for read. (data block)
- Page mapping for write.(log block)

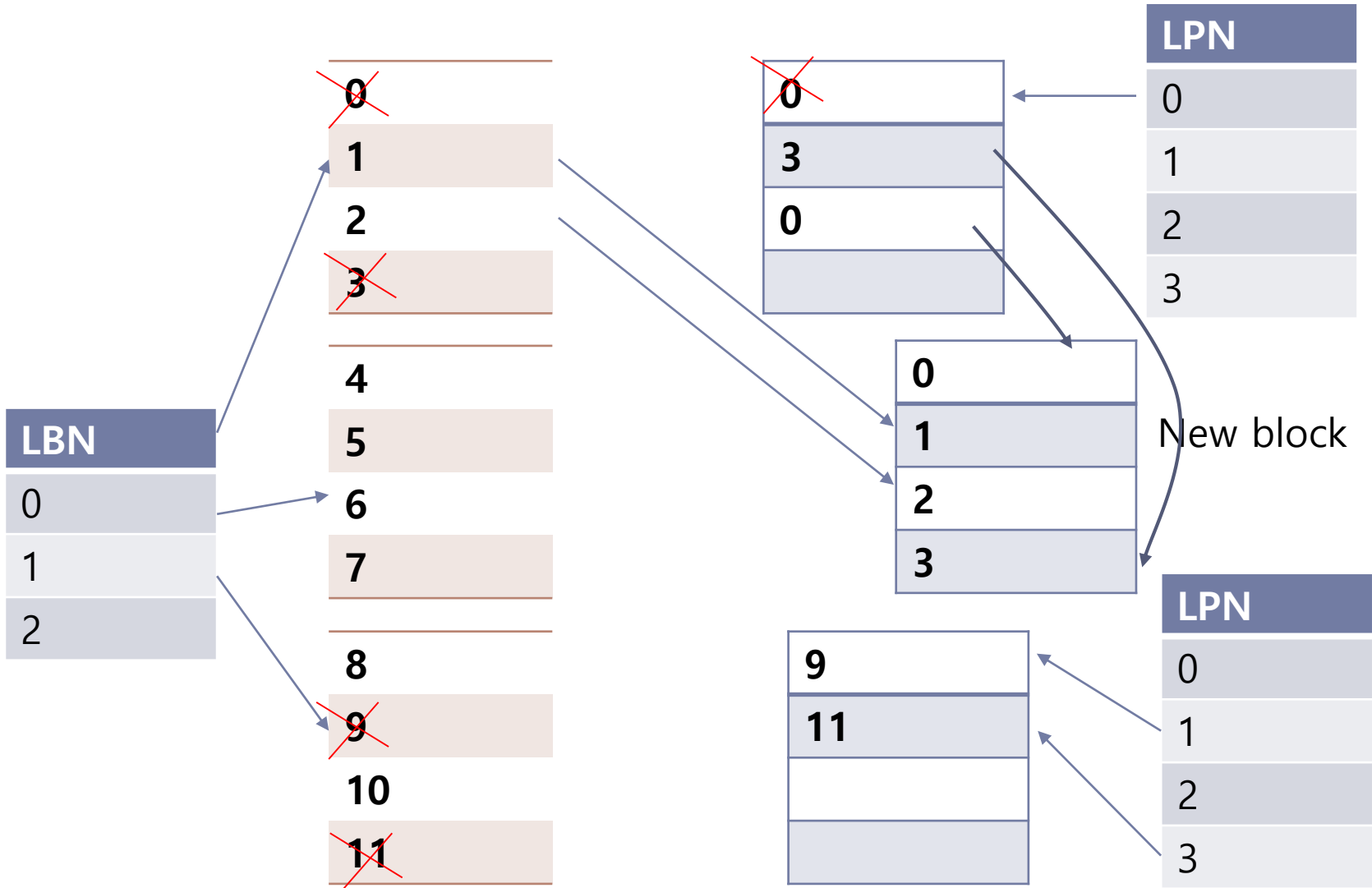
# Log Block FTL



# Switch/Partial Merge



# Full Merge



# Limitation

- Exploit the number of log block
  - (ex : #define NUM\_LOGBLK 3)
- **Modify only ftl.c and ftl.h**
- Do not write or erase your data in Block #0
- You can use spare area.
  - (VBLKS\_PER\_BANK~SPARE\_VBLKS\_PER\_BANK-1) (jasmine.h)
- If host tries to read data not programmed, **it should read zeros.**



# Limitation

- Due date : 5/8 23:59:59 (Thu)
- You can use the source code in openssd ftl, but do not copy.
- Implement `ftl_open`, `ftl_read`, `ftl_write`, `ftl_isr`, `ftl_flush`

# Limitation

- [mailto : sejun000@csl.skku.edu](mailto:sejun000@csl.skku.edu)
- you should follow this form in the subject when you submit.
- [ICE3028]학번,이름
- you would lose 20% per one day late

# Bonus Point

- **Power off Recovery**
  - You can implement in `ftl_flush()`
  
- **Run-time Bad Block Process**
  - You can implement in `ftl_isr()`

# Advice for implementation

- **Read**
  - Need to know whether data to read is in data block or log block
  - Need to know what log block is mapping to certain data block.(Data block to Log block mapping)

# Advice for implementation

- Write
  - Similar to page mapping per log block.
  - Mechanism for allocating new block
    - (free list, bitmap)
  - Many metadata should be managed by **each log block**, and **each bank**.

# Advice for implementation

- **Garbage Collection**
  - Switch merge is special case of partial merge.
  - There are two cases when G.C occurs.
    - Pages in a log block are sold out/ No avail log block
    - You can select a block as victim block when it has minimum valid copy of log blocks.(No avail log block)
  - Need to know what data block is mapping to certain log block.(Log block to Data block mapping)
  - Need to know valid pages of certain log block.

# Advice for implementation

- **ftl\_open**
  - Read the metadata from NAND flash
  - Erase all blocks
  - Initialize variable
- **ftl\_isr**
  - Switch new block for writes or erase.
- **ftl\_flush**
  - Flush metadata to Nand.

# Advice for implementation

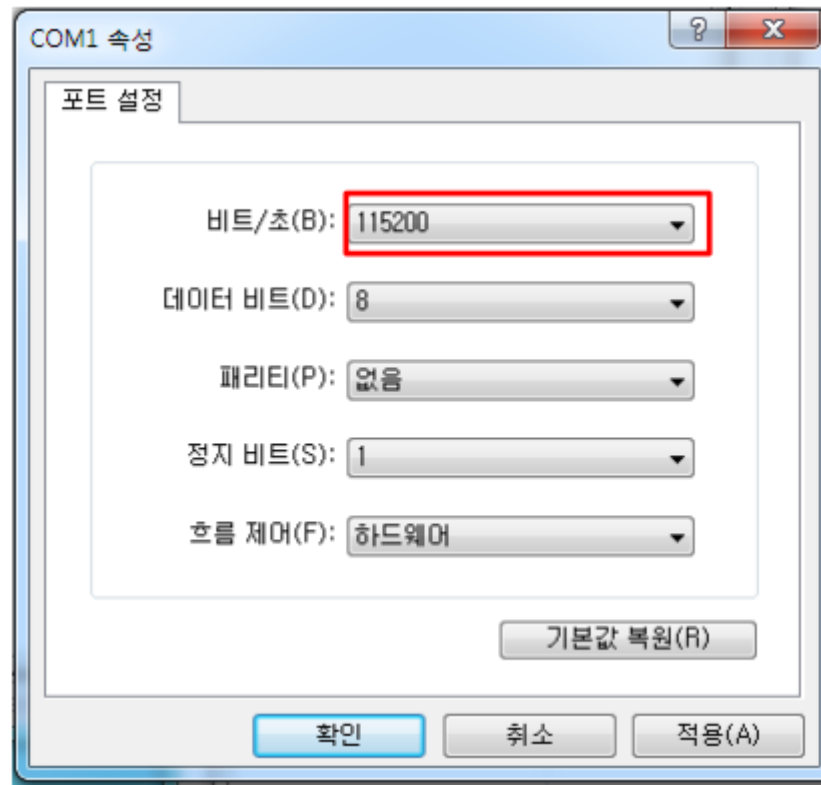
- ETC
  - Step by Step
    - Ex) Writes for one block -> Switch Merge -> G.C
  - Do not Copy!!!



# uart\_print()

- `include/jasmine.h`
- `#define OPTION_UART_DEBUG 1`
- `uart_printf("Total FTL DRAM %d Kb", dram_size);`

# uart\_print()



# ftl\_test

- Download Openssd\_1.1.1
- Add ftl\_test.c to ftl\_xxx folder
- Add ftl\_test.c to Makefile
- Modify jasmine.h

# ftl\_test

```
FTL      = logblock
PREFIX  = arm-none-eabi-
CC      = $(PREFIX)gcc
AS      = $(PREFIX)as
LD      = $(PREFIX)ld
OBJCOPY = $(PREFIX)objcopy
RM      = del

INCLUDES = -I../include -I../ftl_$(FTL) -I../sata
CFLAGS   = -mcpu=arm7tdmi-s -mthumb-interwork -ffr
SFLAGS   = -R -mcpu=arm7tdmi-s
DFLAGS   = -static -nostartfiles -ffreestanding -T
LIBS     = -lgcc
PATH     = ../ftl_$(FTL);../sata;../../../../target_spw

SRCS     = ftl_test.c ftl.c sata_identify.c sata_c
INITSRC  = ../target_spw/init_gnu.s
OBS      = $(SRCS:.c=.o) init.o
DEPS     = $(SRCS:.c=.d)
TARGET   = firmware
TARGETELF = $(TARGET).elf
TARGETBIN = $(TARGET).bin

$(TARGETBIN): $(TARGETELF)
    $(OBJCOPY) -O binary --strip-all --strip-

$(TARGETELF): $(OBS)
    $(CC) $(LDFLAGS) $^ -o $@ $(LIBS)

%.d: %.c
    $(CC) -M $(CFLAGS) -c $(INCLUDES) $< > $@
```

```
#define OPTION_2_PLANE 1
#define OPTION_ENABLE_ASSERT 0
#define OPTION_FTL_TEST 1
#define OPTION_UART_DEBUG 1
#define OPTION_SLOW_SATA 0
#define OPTION_SUPPORT_NCQ 0
#define OPTION_REDUCED_CAPACITY 0
```

# ftl\_test

- **ftl.h**

- `#define FTL_TEST_ADDR  
(XXX_BUF_ADDR + XXX_BUF_BYTES)`
- `#define FTL_TEST_BYTES (4 * 1024 * 1024)  
// 4MB`

Any Questions?