

Project5

Transaction Logging & Recovery

Log Manager

- Your database systems don't support transaction yet.
- Implement transaction API that can support 'Atomicity' and 'Durability' using your own log manager.
- Your log manager should satisfy those properties.
 - No force (REDO) & Steal (UNDO) policy
 - Write Ahead Logging (WAL)
 - Recovery when initializing DB

Project Specification

➤ Your library (libbpt.a) should provide those API services.

➤ Transaction APIs

- **int begin_transaction();**
 - Allocate transaction structure and initialize it.
 - Return 0 if success, otherwise return non-zero value.
- **int commit_transaction();**
 - Return 0 if success, otherwise return non-zero value.
 - User can get response once all modification of transaction are flushed to a log file.
 - If user get successful return, that means your database can recover committed transaction after system crash.
- **int abort_transaction();**
 - Return 0 if success, otherwise return non-zero value.
 - All affected modification should be canceled and return to old state.

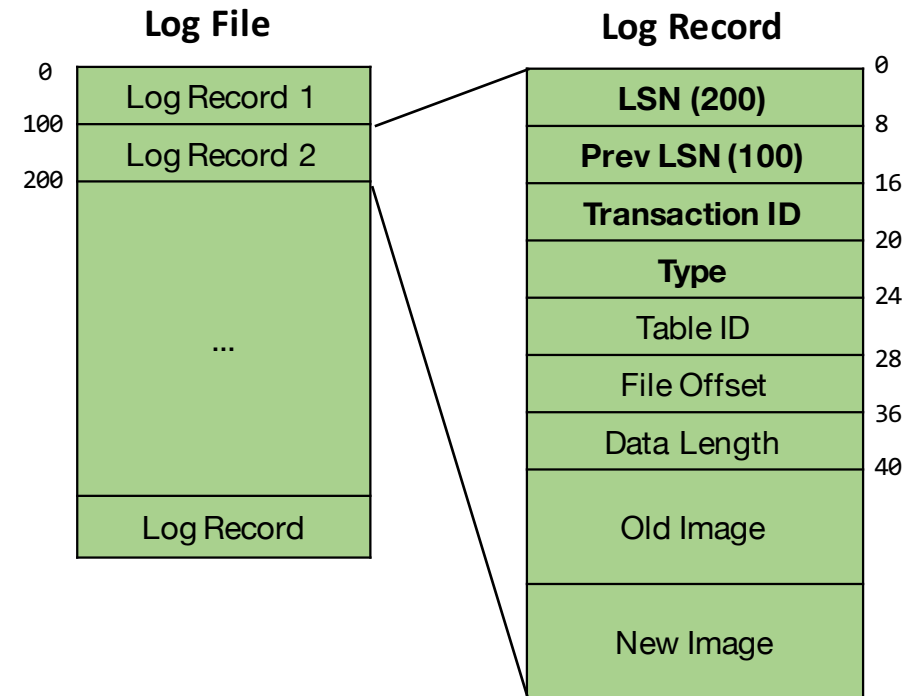
Project Specification

➤ Your library (libbpt.a) should provide those API services.

1. **int init_db (int buf_num);**
 - Recovery before database initialization.
2. **int open_table (char * pathname);**
 - We limit the file name format as "DATA[NUM]" (For example, there should be data files named like "DATA1", "DATA2", ...)
 - Return value that indicates the table id should be NUM. (That means, data file whose file name is "DATA3" has its table id as 3 from now on).
3. **int insert (int table_id, int64_t key, char * value);**
4. **char * find (int table_id, int64_t key);**
5. **int delete (int table_id, int64_t key);**
6. **int update(int table_id, int64_t key, char* value);**
 - Find the matching key and modify the value, where value size ≤ 120 Bytes.
 - Return 0 if success, otherwise return non-zero value.
7. **int close_table(int table_id);**
8. **int shutdown_db(void);**

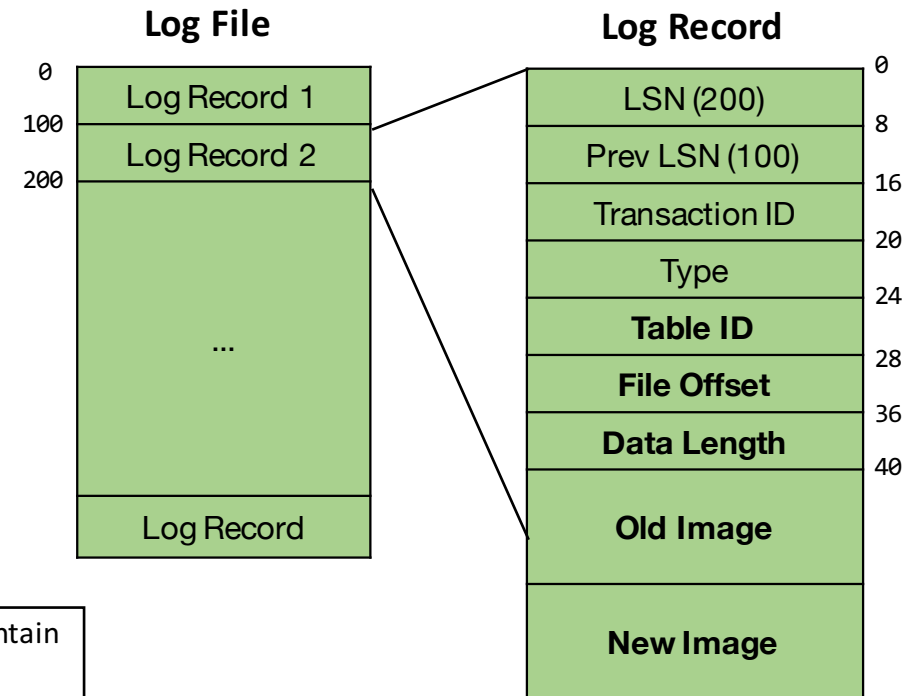
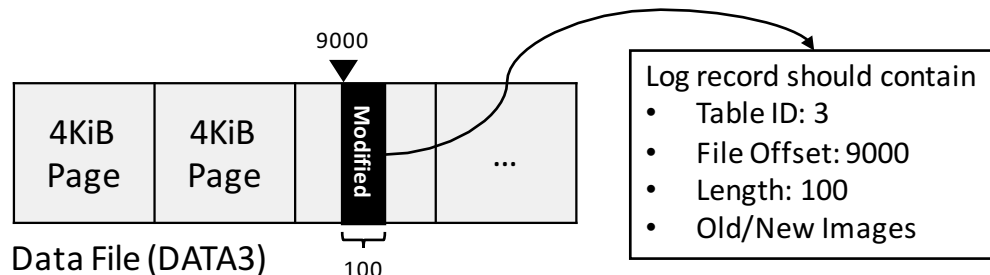
Log File

- Log file is a sequence of log records.
- Log record is consisted of
 - LSN: End offset of a current log record.
 - Prev LSN: LSN of the previous log record.
 - Transaction ID: Indicates the transaction that triggers current log record.
 - Type: The type of current log record.
 - BEGIN(0)
 - UPDATE (1)
 - COMMIT (2)
 - ABORT (3)



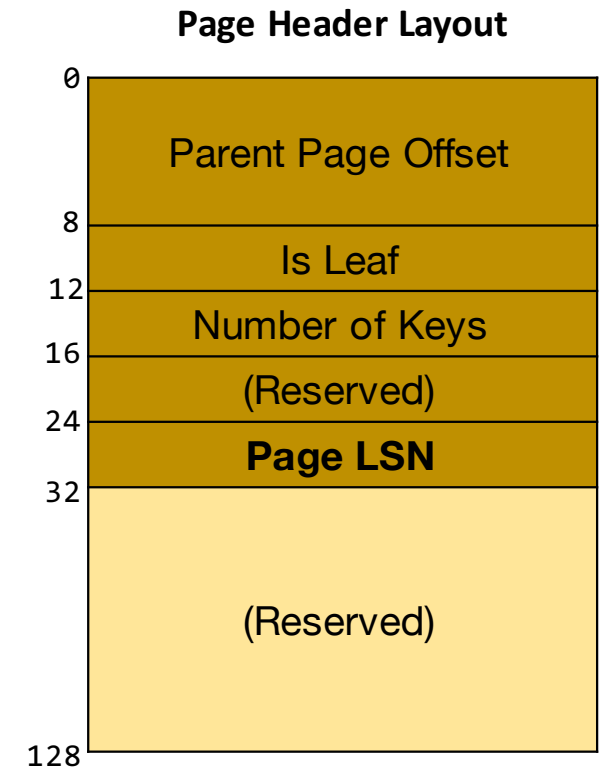
Log File

- Log file is a sequence of log records.
- Log record is consisted of
 - Table ID: Indicates the data file. (data file name should be like "DATA[Table ID]")
 - File Offset: Start offset of the modified area within a data file.
 - Data Length: The length of modified area.
 - Old Image: Old contents of the modified area.
 - New Image: New contents of the modified area.

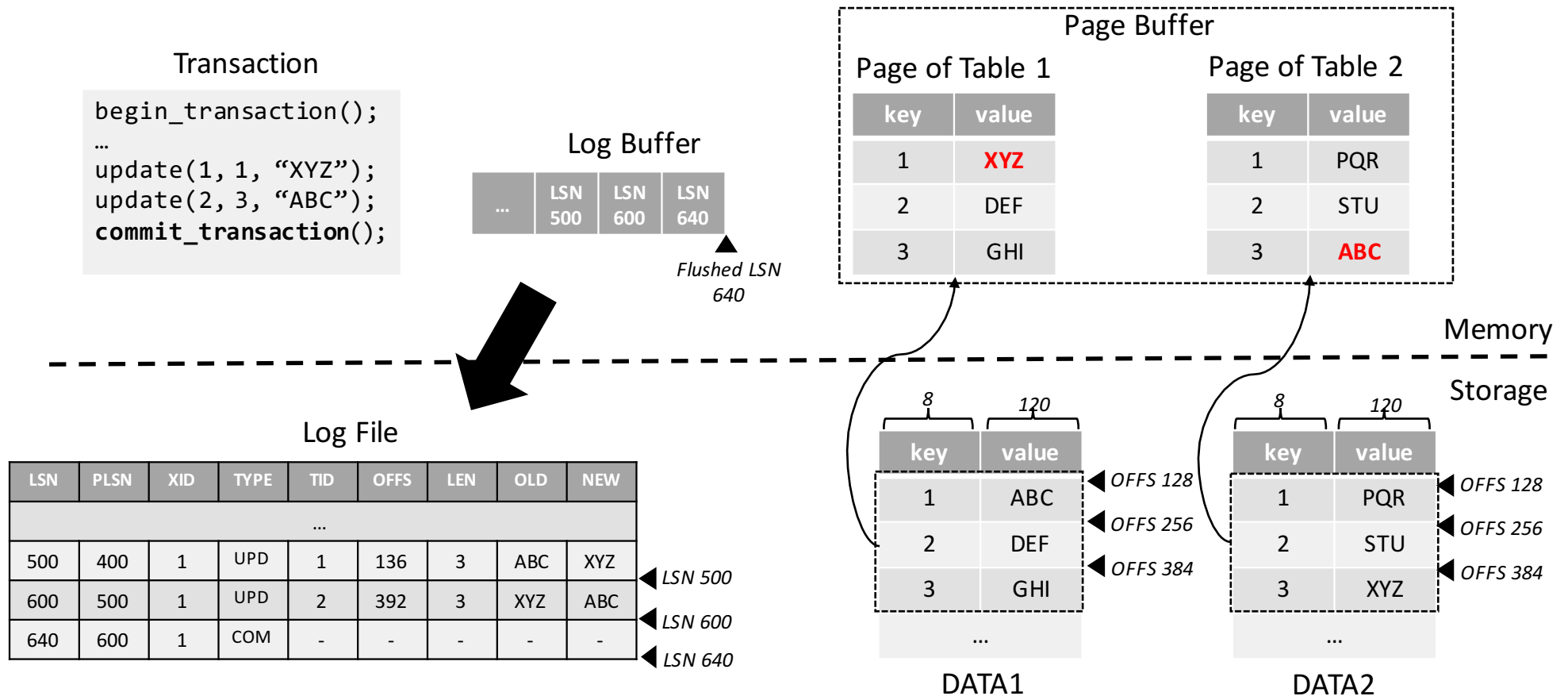


Page Header Layout

- We should maintain a page LSN information from every on-disk image.
- Page LSN indicates the last updated version of this on-disk page.
- Maintain a page LSN value (8 bytes) located at the page header structure starting from byte offset 24.
- Every page including header page should maintain that field.



Project Example



Project Specification

- You should implement ARIES based recovery that you learned from the lecture but,
 - You don't have to implement strict 2PL or other concurrency control since we assume that only single transaction would be working at given time.
 - Also, we don't have to consider double write since we assume that torn page write would not occur.
 - Checkpoint is not considered from this project.
- We will check the correctness of recovery by executing simple transactions and triggering system crash like below.

```
begin_transaction();  
update(1, 3, "XYZ");  
commit_transaction();  
begin_transaction();  
update(1, 2, "XXX");  
exit() // system crash
```

Submission

- Please upload your implemented source directory to GitLab with this format.
 - Base directory name should be “**project_final**”
 - Base directory should have your ‘Makefile’.
 - Compile should be done by typing ‘make’ command from your base directory. (**NOTE** that, we will not grade your code if compile is failed.)
 - After compile, output library (libbpt.a) should be located in base directory or any sub-directories in “project_final”.