Journaling

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What is Journaling?

- A journaling file system keeps a journal of the changes that are being made to the file system.

- The journal can be used to rapidly reconstruct corruptions that may occur due to events such as system crash or power outage.

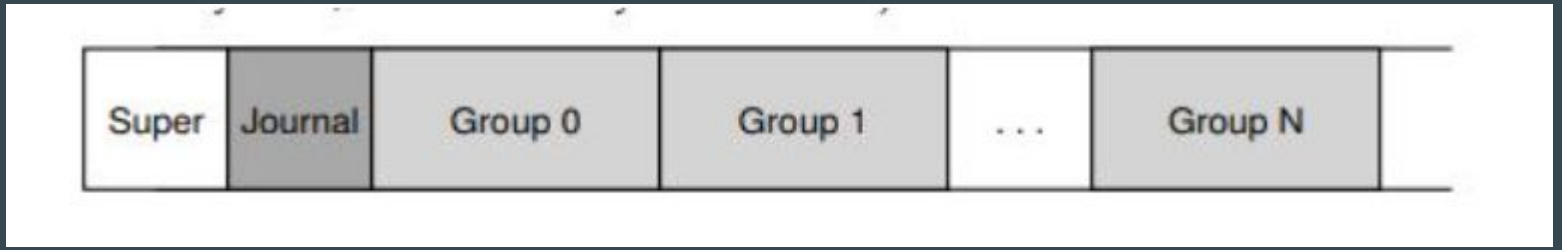
What we have for ext2?

- FSCK: Fast System Consistency Check
  - It checks the validity of the superblock.
  - It traverses all data blocks to check the existence of free blocks and inode,
    then it updates the bitmap according to the scanning result.
  - Scans all the pointer to make sure they are not pointing to the data out of the bound.
  - Finally, it will check the users' content and make sure in every directories,
    the referenced inodes are allocated.
- As the capacity and the performance of the disks increasing, such a logic seems kinda inefficient

Advantages of Journaling

- ext2(fsck) vs ext3(journaling)
- fsck is file system consistency check
- much faster recovery and less chance of data loss or corruption
- Using fsck, file system may look consistent but with implicit fault.
    - E.g: Inode may point to garbage data.

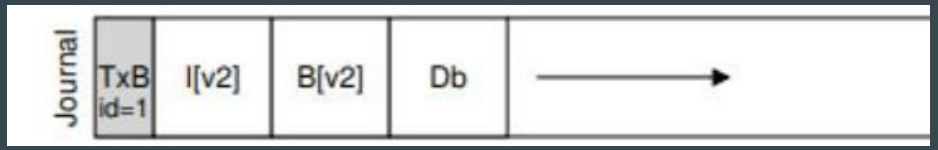
The basic design of the journal



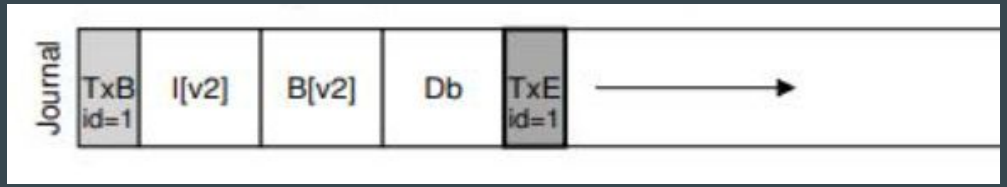
The order of logging:

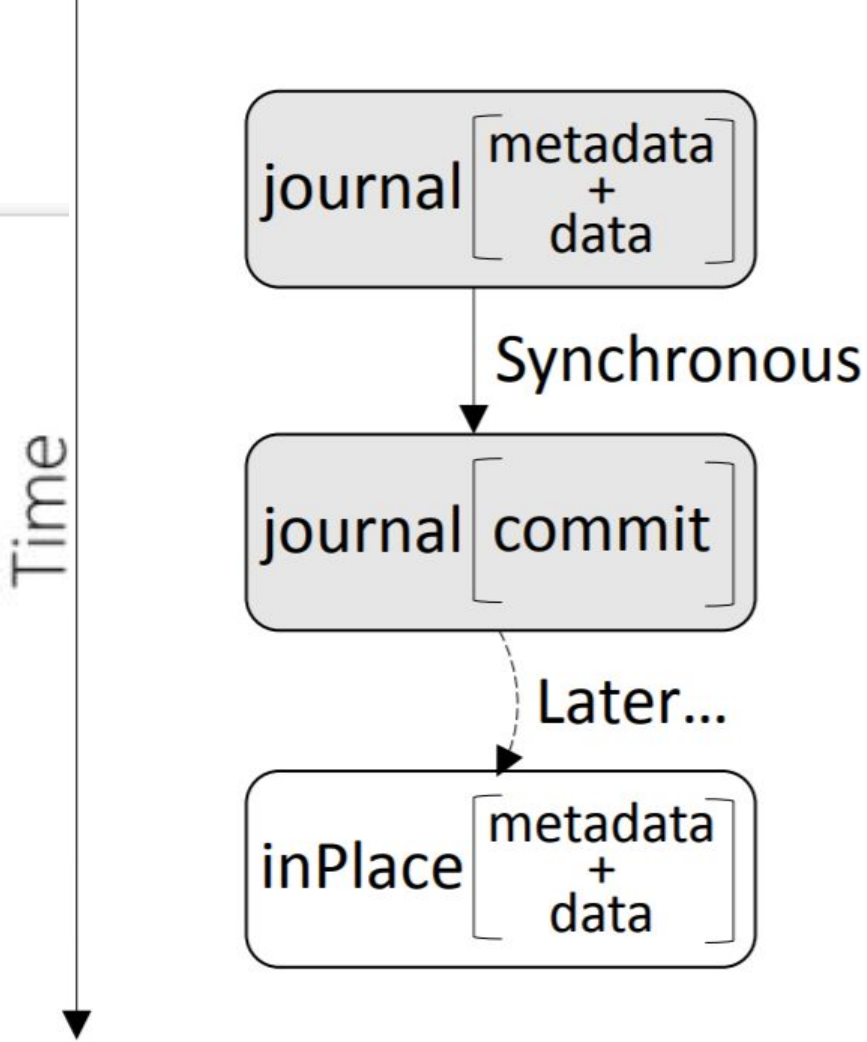
Because a crash may possibly happen anytime, even for journaling. The order of writing is important to get rid of the risks that we log a complete garbage record:

First: TextBeging mark, metadata and data block



Then: TextEnding mark





- Vi :wq
- git commit
- git push

Our Plan

- If things work perfectly, we will be able to start implementing journal after finishing write.
  - M1: Design corresponding data structure for journal and set the proper place for journal data in disk
  - M2: Get needed information and implement commit functions that write to the journal:
    - Transaction identifier
  - M3: Finish the replay and redowrite
- Come up a with a perfect demo that possibly crash the system and recover it

Possible Difficulty

- Hard to test our code because we only have read() in ext2, which means no changes can be made in file system.

- Where to store the metadata of journal and also journal itself.

Q & A

Reference:

https://www.linuxtopia.org/HowToGuides/ext3JournalingFilesystem.html

https://zhuanlan.zhihu.com/p/56681845

https://www.eecs.harvard.edu/~cs161/notes/journaling.pdf

Thank you!!!