THE SBM: A VICTIM BLOCK SELECTION METHOD BASED ON MIN-HEAP PRIORITY QUEUES

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ABOUT THE PRESENTER

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INTRODUCTION (1): A NAND FLASH-BASED SSD

Fig. 1. (a) SSD Architecture (b) a NAND Flash Chip Structure [1]
INTRODUCTION (2):
FLASH TRANSLATION LAYER (FTL)

- Address Translation
- Garbage Collection
- Wear-Leveling
INTRODUCTION (3): THE MAIN LIMITATIONS

1. Erase-Before-Write

2. The Limited Endurance of Flash Memory
RELATED WORKS (1):

- Efficient Victim Block Selection (EVBS)
- Progressive Wear-Leveling (PWL)
- Kbit Wear-Leveling (kbit-WL)
RELATED WORKS (2):

• Erasure Interval-based Garbage Collection (EIGC)

• The Earlier Version of This Paper (The Scoring Based Method)
The SBM tries to improve the lifetime of NAND flash memory by erasing flash blocks evenly.
1. An Erased Blocks-Priority Queue

2. An Allocated Blocks-Priority Queue

3. The Global Block Table
THE SBM (3):
EVENTS THAT AFFECT BLOCKS’ SCORES

• The scores are 0s at the initial stage.

• Events increasing a block’s score:
  • Erasing a block (+2)
  • Writing a flash page (+1)

• Events decreasing a block’s score:
  • Invalidating a page (-1)
THE SBM (4):
THE VICTIM BLOCK SELECTION

The main factors affecting the victim block selection:

1. The Number of Valid Pages in a Block
2. The Erase Count of a Block
3. Temporal Locality
THE SBM (5):
ERASED BLOCKS-PRIORITY QUEUES

Fig. 2 an Example of an Erased Blocks-Priority Queue
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• The simulator: SSDsim simulation environment

• Benchmarks:
  • IOzone
  • FIO
  • BONNIE++
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SIMULATION RESULTS (3):

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SIMULATION RESULTS (5):

Fig. 10 Throughput

- k-bitWL
- EIGC+LEF
- PWL
- EVBS
- The scoring method
- The SBM

Benchmarks

Throughput (MB/s)
CONCLUSION

• The SBM can improve the lifetime of NAND flash memory:
  • By at least 2.5 percent compared to our last published journal paper.
  • By at least 39.6 percent compared to the rest of the methods.

• The SBM does not need any search routine for finding victim blocks.

• The time complexity of the main functions is $O(\log n)$. 
REFERENCES (1):


REFERENCES (2):


QUESTIONS & ANSWERS

Thank you for watching this video.
Do you have any questions?