

基于逻辑区间冷热分离的 NAND 闪存垃圾回收算法

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摘要: 针对现有的 NAND 闪存垃圾回收算法对回收效率和磨损均衡考虑不足, 以及算法内存开销大的问题, 提出了一种基于逻辑区间冷热分离的 NAND 闪存垃圾回收算法。该算法同时考虑了回收效率和磨损均衡, 采用了一种回收效率和磨损均衡比重动态可调的回收块选择策略。同时, 算法还提出一种新的逻辑区间热度计算的方法, 并将回收块中的有效页数据按照逻辑区间的热度分为热数据、温热数据和冷数据, 以实现有效页数据的冷热分离。仿真实验结果表明, 该算法相比于 GR、CB、CAT、FaGC 以及 LRGC 算法, 不仅在磨损均衡、总的擦除次数以及总的拷贝次数方面取得了更好的效果, 而且内存消耗也大幅度减少。

关键词: NAND 闪存; 磨损均衡; 垃圾回收; 冷热分离; 逻辑区间; 回收块

Garbage collection algorithm for NAND flash memory

based on separation of hot and cold logical region

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Abstract: Aiming at the problem that the existing NAND flash garbage collection algorithms have insufficient considerations on collection efficiency and wear leveling and large memory overhead, a NAND flash garbage collection algorithm based on logical interval cold and hot separation is proposed. The proposed algorithm considers both collection efficiency and wear leveling, and adopts a victim block selection strategy which can dynamically adjust the ratio between collection efficiency and wear leveling. At the same time, a novel method of calculating the heat of the logical region is presented, and the valid data in victim block are divided into hot data, warm data and cold data according to the heat of the logical region. Thus, the valid data in the victim block can be effectively separated. The simulation results show that compared with GR, CB, CAT, FaGC and LRGC algorithms, the proposed algorithm not only achieves better results in wear leveling, total erasure times and total copy times, but also reduces the memory consumption greatly.

Key words: NAND flash memory; wear leveling; garbage collection; hot and cold separation; logical region; victim block

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