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Title

Enhanced Search And Efficient Storage Using Data Compression In Nand Flash Memories

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Abstract

NAND flash memories are popular due to their density and lower cost. However, due to serial access, NAND flash memories have low read and write speeds. As the flash sizes increase to 64GB and beyond, searches through flash memories become painfully slow. In this work we present a hardware design enhancement technique to speed-up search through flash memories. The basic idea is to generate a small signature for every memory block and store them in a signature block(s). When a search is initiated, signature block is searched which produces reference of possible blocks where data might be contained, reducing the total number of read operations. The additional hardware has no impact on read access times or sequential write times but increases the random write times by an average of 8-9%. Simulation experiments were performed for flash memory of size up to 16Gb. Simulation results show that the performance of searches improve by 2000X by using the proposed technique. The signature-based technique is used to find exact matching data. A discrete cosine transform based technique is used when partial matching of data is required. The same setup is also used to increase storage efficiency of data by performing data deduplication on the flash memory. The hardware implementation of the search technique results in 0.02% increase in area, 3.53% increase in power and can operate at a maximum frequency of 0.47GHz.

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