A High Reliable Space-Borne File System with Applications of Device Partition and Intra-Channel Pipeline in Nand Flash

Authors : Xin Li, Ji-Yang Yu, Yue-Hua Niu, Lu-Yuan Wang

Abstract : As an inevitable chain of the space data acquirement system, space-borne storage system based on Nand Flash has gradually been implemented in spacecraft. In face of massive, parallel and varied data on board, efficient data management become an important issue of storage research. Face to the requirements of high-performance and reliability in Nand Flash storage system, a combination of hardware and file system design can drastically increase system dependability, even for missions with a very long duration. More sophisticated flash storage concepts with advanced operating systems have been researched to improve the reliability of Nand Flash storage system on satellites. In this paper, architecture of file system with multi-channel data acquisition and storage on board is proposed, which obtains large-capacity and high-performance with the combine of intra-channel pipeline and device partition in Nand Flash. Multi-channel data in different rate are stored as independent files with parallel-storage system in device partition, which assures the high-effective and reliable throughput of file treatments. For massive and high-speed data storage, an efficiency assessment model is established to calculate the bandwidth formula of intra-channel pipeline. Information tables designed in Magnetoresistive RAM (MRAM) hold the management of bad block in Nand Flash and the arrangement of file system address for the high-reliability of data storage. During the full-load test, the throughput of 3D PLUS Module 160Gb Nand Flash can reach 120Mbps for store and reach 120Mbps for playback, which efficiently satisfies the requirement of multi-channel data acquisition in Satellite. Compared with previous literature, the results of experiments verify the advantages of the proposed system.

Keywords : device partition architecture, intra-channel pipelining, nand flash, parallel storage
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