CS Masters' Thesis Defense

Title: *DLOOP: A Flash Translation Layer Exploiting Intra-plane Copy-back Operations*
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Abstract:
Recent technological advances in the development of flash-memory based devices have consolidated their leadership position as the preferred storage media in the embedded systems market and opened new vistas for deployment in enterprise-scale storage systems. With increasing capacity, throughput and durability, NAND flash memory based solid state disk (hereafter, flash SSD) has started replacing hard disk drive (HDD) in laptops and desktop systems. The increasing capacity of NAND presents the issue of address translation. Flash Translation Layer (FTL) is one of the most important components of SSD whose main purpose is to perform logical to physical address translation in a way that is suitable to the unique physical characteristic of the Flash memory. In this research, we propose a new FTL called DLOOP (data log on one plane), which fully exploits fast intra-plane copy-back operations supported by modern flash SSDs. The basic idea of DLOOP is to allocate logs (updates) onto the same plane where their associated original data stay so that valid page copying operations triggered by garbage collection can be carried out by intra-plane copy-back operations without occupying the external I/O bus. To the best of our knowledge, DLOOP is the first page-mapping FTL that achieves high performance through utilizing the internal parallelism provided by modern flash SSDs. Further, we largely extend a well-recognized simulation environment DiskSim3.0/FlashSim to implement DLOOP. Finally, we conduct comprehensive simulations to evaluate DLOOP using realistic enterprise-scale workloads. Experimental results demonstrate that DLOOP consistently outperforms a classical hybrid FTL named FAST and a state of- the-art FTL called DFTL.