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Barrier-Enabled IO Stack for Flash Storage

Summary and Strengths:

The objective of this paper is to propose the Barrier-Enabled IO Stack for Flash Storage. It eliminates the high cost of ensuring storage order in the IO stack, which had been caused by the Transfer-and-Flush overhead, the artifact mandated from the use of HDDs in the old days. The Barrier-Enabled IO Stack technique exploits the "cache barrier" command for Flash storage. From this technique, multiple layers can be niftily put to ordering persistence condition imposed by the application with which the associated data blocks are made durable. Such technique consists of Epoch-based IO scheduling, Order-Preserving Dispatch, and Dual-Mode Journaling. In addition, the issue of DMA transfer overhead in controlling the storage order is addressed by re-designing the block device layer. The paper points out that "Wait-on-Transfer" latency will increase in proportions as Flash memory technology develops, and therefore argues that, for Flash storage saturation, the transfer order should be controllable by the host without request interleaving on DMA transfers. The proposed benefits were demonstrated in the series of experiments, both in mobile storages and massive-scale storages as well.