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Computer Engineering

Encrypted Non-volatile Main Memory Systems

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Non-volatile memory (NVM) technologies are considered as promising candidates of the next-generation main memory. However, the non-volatility of NVMs leads to new security vulnerabilities. Memory encryption can be employed to mitigate the security vulnerabilities, but it increases the number of bits written to NVMs due to the diffusion property and thereby aggravates the NVM wear-out induced by writes. To address these security and endurance challenges, we propose DeWrite, a secure and deduplication-aware scheme to enhance the performance and endurance of encrypted NVMs based on a new in-line deduplication technique and the synergistic integrations of deduplication and memory encryption. Specifically, it performs low-latency in-line deduplication to exploit the abundant cache-line-level duplications leveraging the intrinsic read/write asymmetry of NVMs and light-weight hashing. It also opportunistically parallelizes the operations of deduplication and encryption and allows them to co-locate the metadata for high efficiency. DeWrite was implemented on the gem5 with NVMain.

Dr. Yu Hua is a professor in Huazhong University of Science and Technology. He was Postdoc Research Associate in McGill University in 2009, and Postdoc Research Fellow in University of Nebraska-Lincoln in 2010-2011. He obtained his B.E and Ph.D degrees from Wuhan University respectively in 2001 and 2005. His research interests include file systems, cloud storage systems, non-volatile memory, big data analytics, etc. He publishes multiple papers in conferences and journals, including OSDI, MICRO, FAST, USENIX ATC, ACM SoCC, SC, HPDC, etc. He serves for multiple international conferences, including USENIX ATC, ASPLOS (ERC), SC, ACM SoCC, RTSS, ICDCS, ICCD, INFOCOM, IPDPS, etc. He is the distinguished member of CCF, senior member of ACM and IEEE, and the member of USENIX. He has been appointed as the Distinguished Speaker of ACM and CCF. His homepage is at: https://csyhua.github.io

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