Efficient Sanitization Design for LSM-based Key-Value Store over 3D NAND Flash

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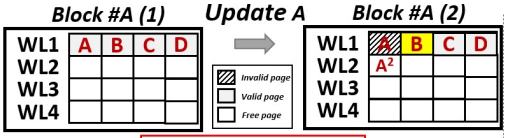
Traditional Sanitization Design

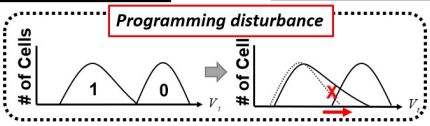
Comparison between existing methods:

Design	Pros	Cons
Scrubbing	*Low latency*	*Programming disturbance*
Erase	*No invalid page left*	*High latency*

Data management is difficult



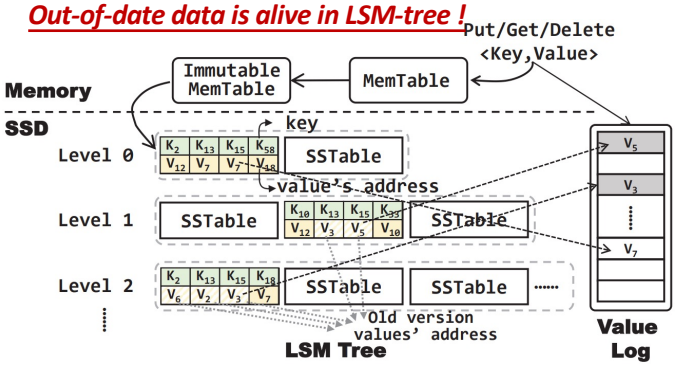
We need a fast and stable sanitization



LSM-Tree on Flash-Based Storage

Data privacy issue on LSM-tree:

Out-of-date data is alive in LSM-tree !



Design	Date Privacy	Device	GC thread	Additional key
LSM	☹	HDD	N	N
Separating LSM	☹☹	SSD	Y	Y
Sanitizable LSM	☺	*SSD*	*N*	*N*

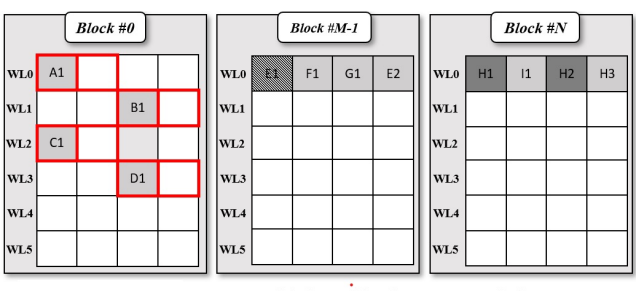
Hot-Cold Data Allocation & System

Value region:

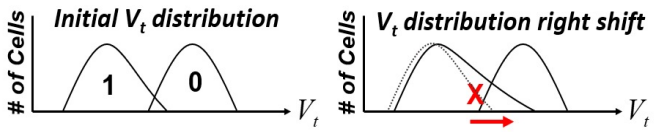
- Hot data : ICP
- Cold data: One-shot

Key region(Others):

- No sanitization

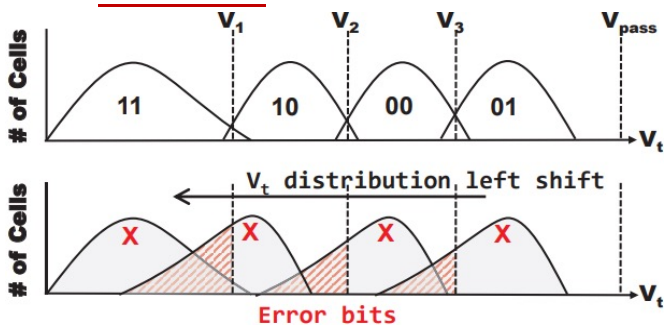


The challenge of Instantaneous Sanitization for MLC



Directly adopting the instantaneous sanitization :

Poor retention



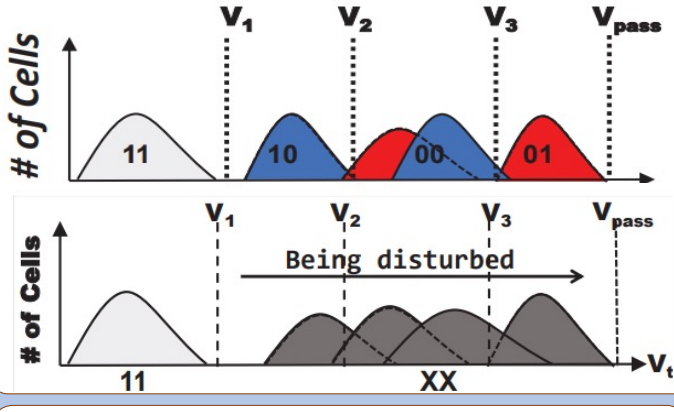
Influence-Conscious Programming

Fast

- Easy to be disturbed
- Worst retention

Slow

- Opposite to fast



Experimental Results