Flash Memory
Major Properties

- non-volatile
- robust, no moving parts
- ~100x faster random access
- plus: parallel accesses
Blocks vs Superblocks

| block := 8KB |
| superblock := set of blocks |
Blocks vs Superblocks

block := 8KB

superblock := set of blocks

can only write to empty, freshly erased blocks

erase happens at the level of superblocks, not blocks
Example: Writing a Block

SB 1

SB 2

1. Erase superblock
2. Write block
Writing a Block

if empty block available:
    write data to block
else:
    possibly reshuffle/garbage collect
    erase superblock
    write data to block
Write Amplification

write amplification = \frac{\text{data physically written}}{\text{data logically written}} \geq 1

factors in:

- super block erasure
- garbage collection
- wear leveling costs
- internal RAID
Trim

Query Optimizer

Indexer

Store

① erase
② write
SSD Controller

similar tasks as the HD controller:

mapping of logical addresses to physical addresses

caching (128-512 MB)
SSD Controller

similar tasks as the HD controller:

mapping of logical addresses to physical addresses

caching (128-512 MB)

remapping of erroneous blocks

in addition:

RAID-like storage of data cross different chips in the drive

-> yet in conflict with erase-problem

garbage collection
Sequential and Random Speed Evolution

Seq. Read [MB/s]  Seq. Write [MB/s]

Read Acc. Time [ms]  Write Acc. Time [ms]

killing it with iron

\[ 0.05 \text{ ms} = 50\mu s \]
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