Flicker: Refresh Power Reduction in DRAM Memories through Critical Data Partitioning

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Motivation: Smart-phones

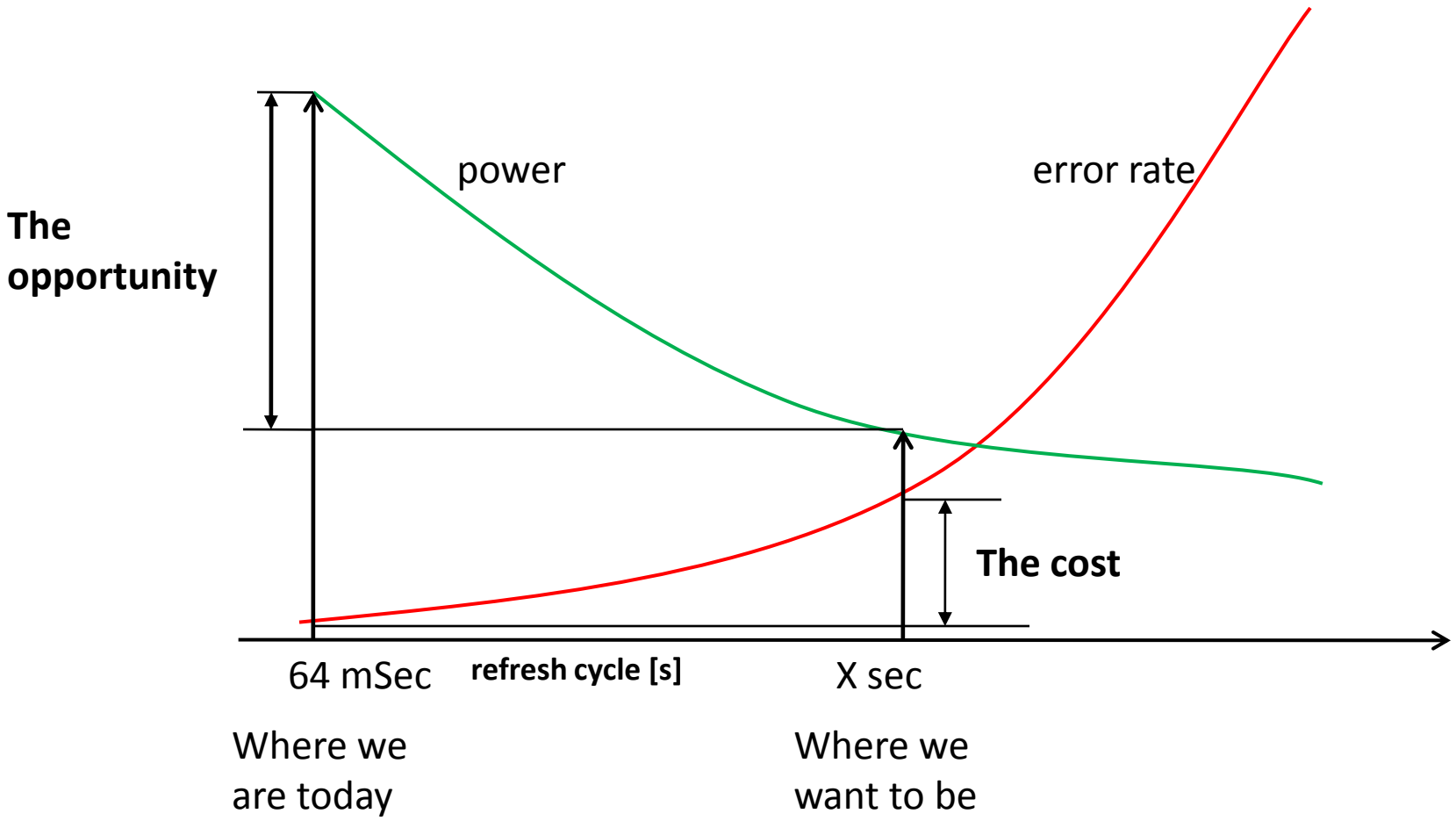
Smart-phones becoming ubiquitous

Responsiveness is important

DRAM Memory consumes up to 30% of system power

Can drain battery even when idle

Motivation: DRAM Refresh

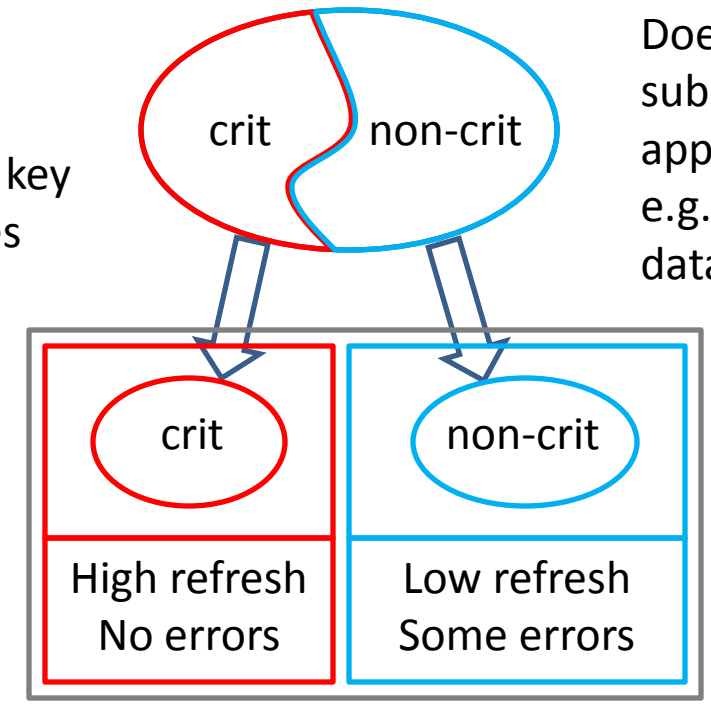


If software is able to tolerate errors, we can lower refresh rates pretty drastically to save power

Flicker: Approach

- **Critical / non-critical data partitioning**

Important for application correctness
e.g., pointers, key data structures



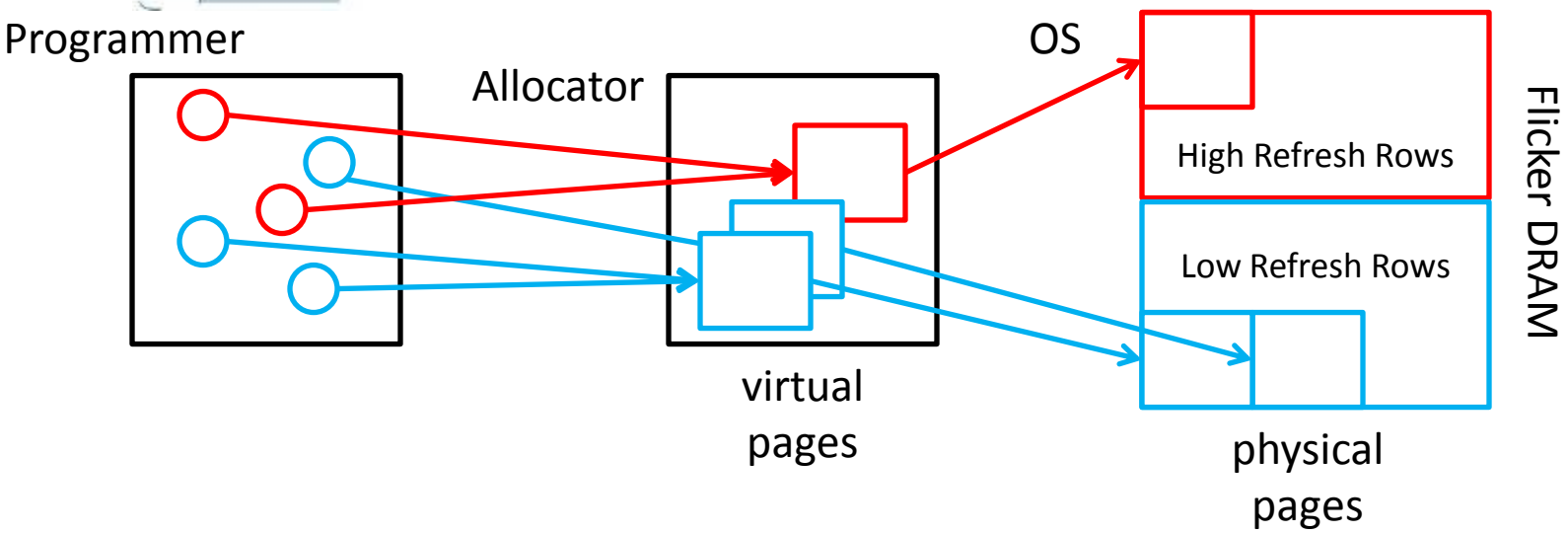
Does not substantially impact app correctness
e.g., multimedia data, soft state

Flicker DRAM

Mobile applications have substantial amounts of non-critical data

Flicker: Implementation

Minimal H/W changes:
Variation of PASR DRAM

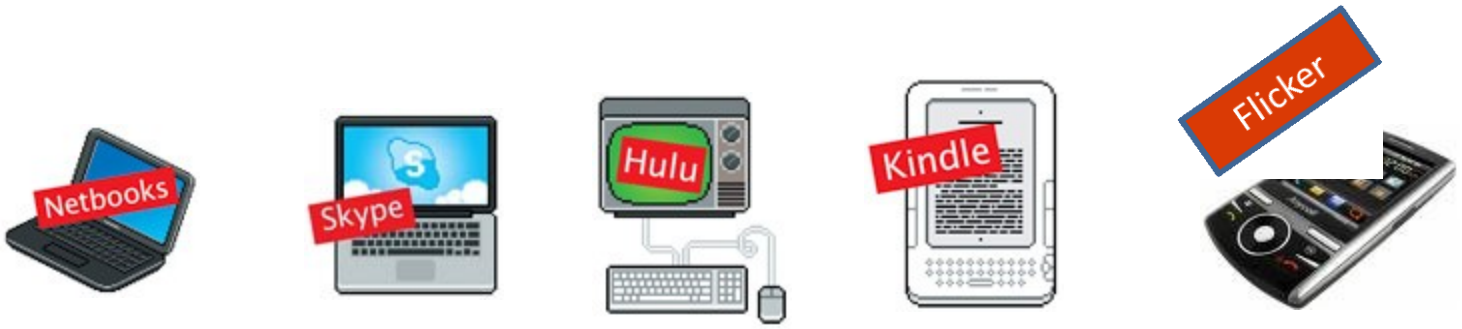


Flicker: Contributions

- **First software technique to intentionally lower hardware reliability for energy savings**
- Minimal changes to hardware – based on PASR mode in existing DRAMs
- No modifications required for legacy applications – incremental deployment
- **Reduced overall DRAM power by 20-25% with negligible loss of performance (< 1 %) and reliability across wide range of apps**

The “Good Enough” Revolution

Source: WIRED Magazine (Sep 2009) – Robert Kapps
http://www.wired.com/gadgets/miscellaneous/magazine/17-09/ff_goodenough



People prefer “cheap and good-enough” over “costly and near-perfect”

http://research.microsoft.com/en-us/projects/samurai/