Session 1A at 11.20 am

MEMCON
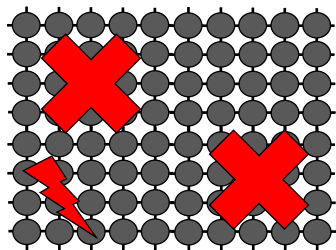
Detecting and Mitigating
Data-Dependent DRAM Failures
by Exploiting Current Memory Content

Samira Khan
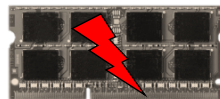
Chris Wilkerson, Zhe Wang, Alaa Alameldeen, Donghyuk Lee, Onur Mutlu

UNIVERSITY *of* VIRGINIA   (intel)   NVIDIA.   **ETH** *Zürich*

VISION: SYSTEM-LEVEL DETECTION AND MITIGATION

Unreliable DRAM Cells
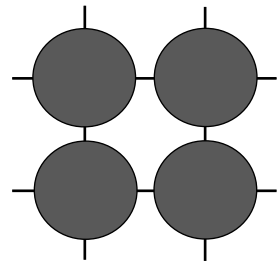
Detect and Mitigate

Reliable System

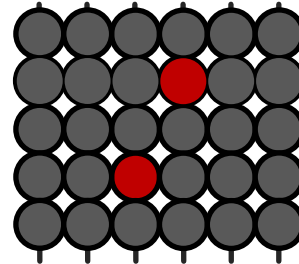Detect and mitigate errors after the system has become operational

ONLINE PROFILING

BENEFITS OF ONLINE PROFILING
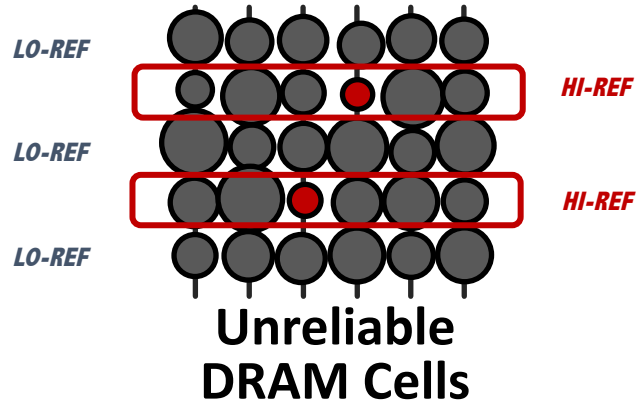

**Reliable
DRAM Cells**

**Technology
Scaling**

**Unreliable
DRAM Cells**

1. Improves yield, reduces cost, enables scaling
Vendors can make cells smaller without a strong reliability guarantee
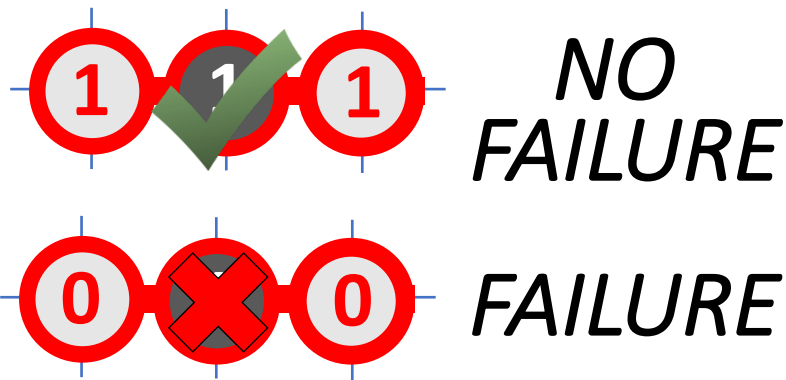
BENEFITS OF ONLINE PROFILING

Reduce refresh count by using a lower refresh rate,
but use higher refresh rate for faulty cells

2. Improves performance and energy efficiency
Reduce refresh rate, refresh faulty rows more frequently
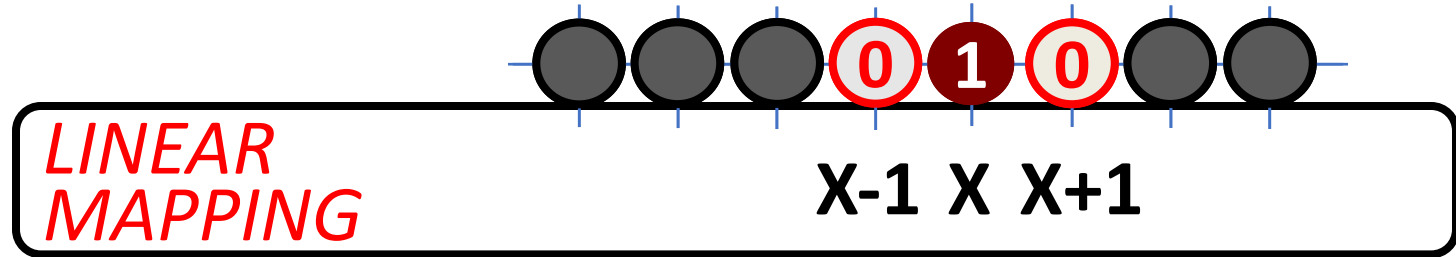
DETECTION IS HARD DUE TO INTERMITTENT FAILURES

DATA-DEPENDENT FAILURE

NO FAILURE

FAILURE

Some cells can fail depending on the data stored in neighboring cells
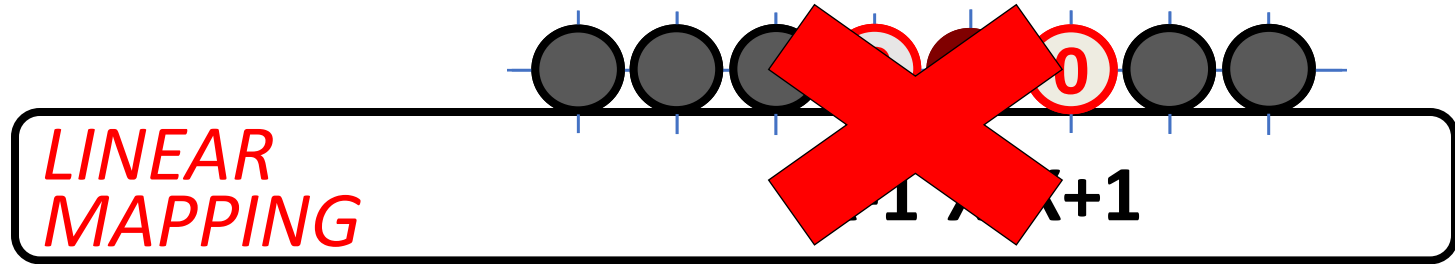
HOW TO DETECT DATA-DEPENDENT FAILURES?

Test with specific data pattern in neighboring cells

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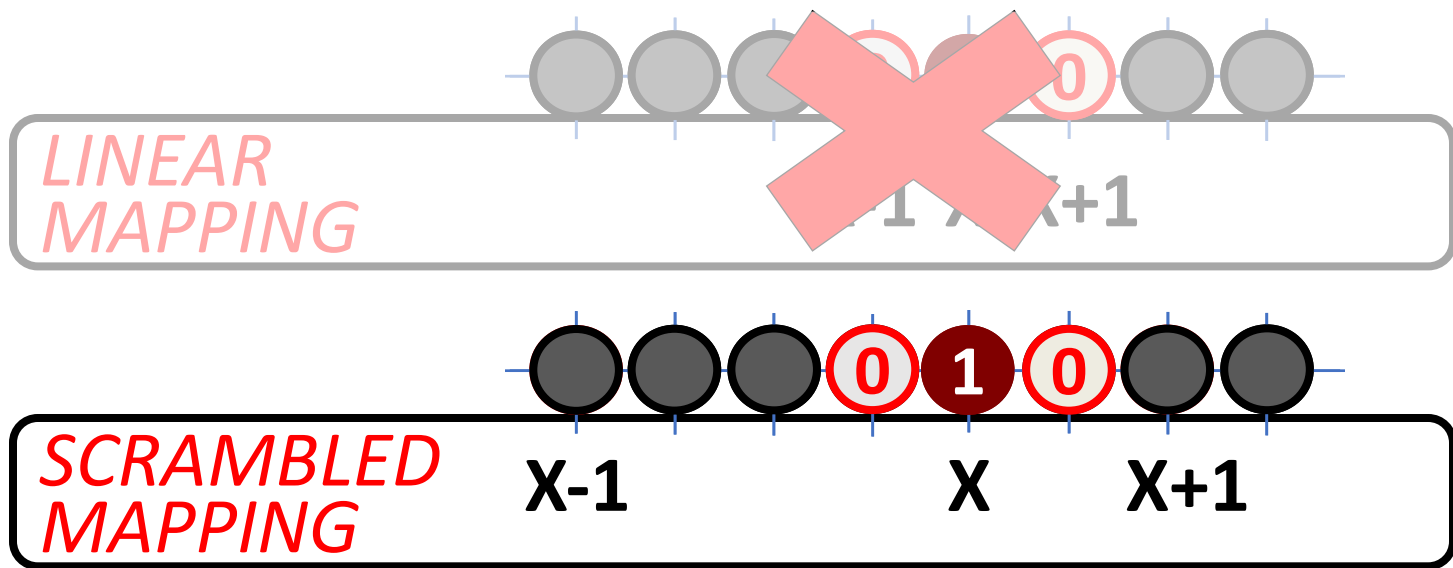
HOW TO DETECT DATA-DEPENDENT FAILURES?

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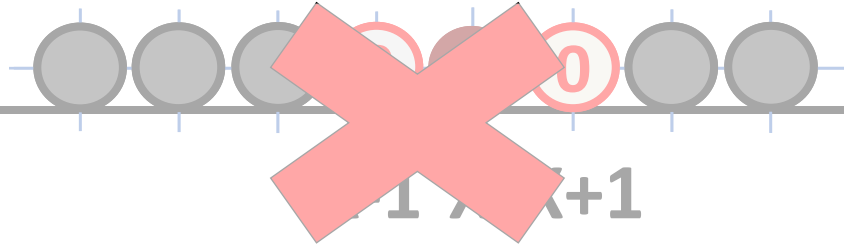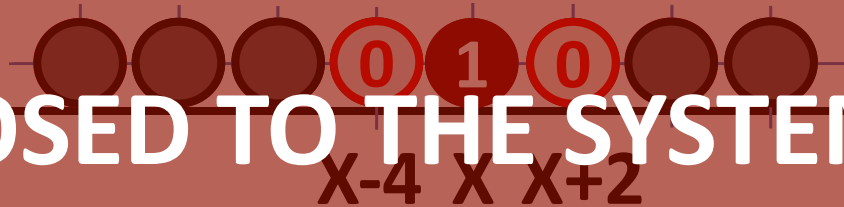
MEMCON

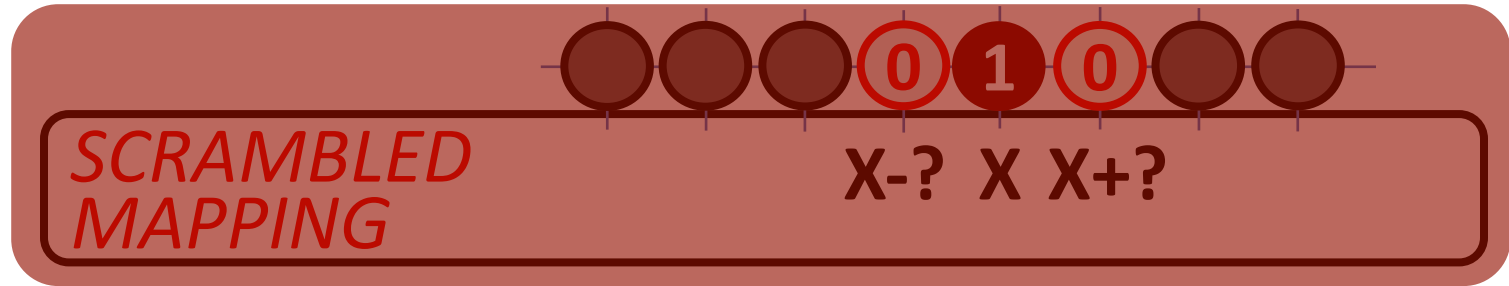*SCRAMBLED MAPPING*

X-? X X+?

***Detects* data-dependent failures *without* the knowledge of the DRAM internal address mapping**

65%-74%
Reduction in refresh count

40%-50%
Performance improvement using 32Gb DRAM

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