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CS2610 Lab 6 Report

DRAM Row Buffer Management

Contents

Idea

The implementation of the adaptive management policy uses the provided open and close page management policies. We use a 4-bit saturation counter for implementing the switching between policies. The high threshold for policy switch was chosen to be 10 and the low threshold 5. Initially the counter was set to 7, and the initial policy was chosen as open page.

Each time a page miss occurs in open page policy (when the last row read/write is not the current active row), the counter is incremented.

Each time a page-hit occurs with the last close page in close page policy, we decrement the counter.

We maintain arrays to check whether a page hit/miss has occurred, for each of open and close page policies.

Whenever the counter increases past the high threshold, we switch to close page, and whenever the counter dips below the low threshold, we switch to open page.

Implementation

For the open page policy, we maintain a global multidimensional array which maintains the previously active row in each bank of each rank of each channel. Whenever a column read/write operation occurs, we check if the row requested is the same as the previously active row; if yes then we do nothing; if no, we register a page miss and increment the counter. At the end of this operation we update the corresponding active row to be the current row.

For the closed page policy, we maintain a global multidimensional array, this time to maintain whether a bank has been aggressively precharged, for each bank in each rank in each channel. When a column read/write operation occurs, we check from the array if the bank containing the requested column has been aggressively precharged. If yes, this means a page-hit with a last closed row in the bank has occurred. So we decrement the counter and switch the state of the bank in the array.

Number of cycles (x10^6)

Trace name	Close (am = 0)	Open (am = 0)	Adaptive (am = 0)	Close (am = 1)	Open (am = 1)	Adaptive (am = 1)
black	247	258	247	252	258	254
face	326	342	328	399	405	402
ferret	341	360	341	392	406	402
fluid	335	350	333	348	355	351
freq	210	220	210	222	225	225
stream	246	259	247	265	268	263
swapt	364	383	363	380	388	384
comm1	331	353	333	314	317	315
comm2	477	508	478	462	474	464

Execution Time (x10^{6})

Trace name	Close (am = 0)	Open (am = 0)	Adaptive (am = 0)	Close (am = 1)	Open (am = 1)	Adaptive (am =1)
black	2473	2053	1957	2529	2024	1995
face	2610	2742	2623	3193	3221	3202
ferret	2725	2883	2727	3124	3234	3193
fluid	2659	2779	2639	2765	2821	2784
freq	1667	1754	1663	1755	1782	1776
stream	1958	2057	1964	2106	2119	2082
swapt	2843	3014	2833	2975	3023	3008
comm1	2644	2814	2655	2500	2527	2518
comm2	3815	4058	3822	3682	3756	3701

am: address mapping mode

Conclusions

As seen from the tables, close page policy performs best of all three policies for most traces, though hybrid policy is a very close second. This can be attributed to close page policy's better results in every trace over open page policy, which limits the performance of a combination of close page and open page policies. Possibly, a better implementation of open page policy could lead to significant improvements of adaptive policy over the others.

Across address mapping modes, address mapping 0 performs better over mapping 1.