Report

Group Number: 23

Hemlata Gautam-2022csb1084

Smriti Gupta-2022csb1128

ChampSim Project

ChampSim is a microarchitecture simulator designed to facilitate the exploration of CPU cache hierarchies and memory systems. It allows us to simulate multiple levels of caches (L1, L2, L3, LLC) with varying configurations. We can set cache sizes, associativities, block sizes, replacement policies, and more with the help of this simulator.

RUNNING COMMANDS-

./build\_champsim.sh bimodal no no no no lru 1

./run\_champsim.sh bimodal-no-no-no-no-lru-1core 1 10 nameoftrace.xz

in command 2,

"1" stands for first 1 Million instructions of trace file are for warmup,

"10" stands for next 10 Million instructions of trace file are for simulation

We can change 1 and 10 to any number, only thing is it will in "millions" of instructions.

Agenda:

* Reducing the conflict misses to improve hit rate, therefore, AMAT, and therefore improving IPC and performance.
* To modify the allocation process of the sets to the data by the processor.

The changes we proposed:

* We have created a map of int and vector<int> called as remapped.
* map<int, vector<int>> remapped;

It stores the sets mapped to each set in a vector corresponding to each set number.

* A file named “modifications.h” is made which contains the declarations of all the new variables used.

Our Solution:

* To define the thresholds for a set to be categorised as very hot, hot, cold and very cold, we have created a vector named “heat”.
* Vector<int> heat[4];
* In the functions, handle\_fill, handle\_writeback and handle\_read we have updated the value of set\_Misses\_LLC and set\_Hits \_LLC.
* In all these functions, to get the set and way number from LLC we have created new functions so that they can provide the correct set and way number from the sets mapped to the current set.
* These new functions return a pair of set and way number.
* A new function is created named “find\_hot\_cold\_sets()” which categorises the sets as very hot, hot, cold, and very cold using a vector of tuple. First, the tuples are sorted by the number of misses, then these are categorised into two parts and again sorted by the number of hits.
* Finally, the sets with

-(high miss and low hit )- very hot;

- (high miss and high hit) as hot;

- (low miss, low hit) as very cold and low miss high hit as cold.

* We have also created a function “print\_HOT\_COLD()” to print the sets (only for our reference; the function was never called).
* A function named “remap\_LLC” is made which remaps the most used (very hot and hot) sets to the lesser used (cold and very cold) sets.
* In the “operate” function, we have made changes to incorporate the new set distribution pattern, We have divide the number of simulations by 5, Then it will start remapping the sets.
* “find\_hot\_cold\_sets” and “remap\_LLC” functions are called in operate to categorise the sets and remap them according to the procedure.
* In the file, “llc\_replacement.cc” llc\_find\_victim() is made to return the victim set and way in a pair.
* In the file “base\_replacement.cc” a new function named “lru\_victim\_llc” is introduced to find the victim according to the newly mapped sets as now the required data can be in any of the mapped sets.

CONCLUSION