Project 3: Prefetcher Discovery (2021-v2)

CS5222 Advanced Computer Architecture

Computer Architecture at the End of Moore's Law and Dennard Scaling

National University of Singapore
2020 – 2021 School Year, Semester 2 (January 2021 – April 2021)
Trevor E. Carlson – http://comp.nus.edu.sg/~tcarlson
Office hours by request

Key Details
Due Date: Friday, April 16th at 11:59am
To Deliver: Code and Report (critical review of paper and implementation details, with results).

Overview
Our 3rd and final project will cover data prefetchers. More specifically, I'd like to you implement either the GHB G/AC (described in Section 3.2.7 of A Primer on Hardware Prefetching) or the GHB PC/DC prefetcher (described in Section 3.3.2 in Primer on Hardware Prefetching). I've Included the Primer and two prefetcher papers in the 3rd Project folder. Of course, implementing newer (hopefully more accurate) prefetchers will also be acceptable, if you prefer.

Getting Started
Please use the infrastructure from the 2nd Data Prefetching Championship (DPC2) to complete this assignment. I'd updated the DPC2 infrastructure to support C++ compilation, and have posted the updated version on GitHub [1].

Report Details
Please include an overview of the prefetcher that you built (critical-review style) along with an overview of the implementation and accuracy of your prefetcher. How well did things improve? Did you succeed in building the prefetcher correctly? What was difficult or not about the implementation?

Submission
For your submission, please submit your prefetcher code (possibly based on the cs5222-lab-prefetcher/example_prefetchers/skeleton.cc file) and the final IPC (The Simulation Complete line, see below) from each of the trace files. These traces are short, and should only take a few minutes to run on modern hardware. This project is worth 40 marks, and is graded on the completeness of the implementation.
1. Code
2. PDF report
3. Zip or Tar your submission and upload it to the Project 3 folder.

Example Output

$ time make run

zcat traces/mcf_trace2.dpc.gz | ./dpc2sim-stream

*** Data Prefetching Championship 2 Simulator ***

Warmup Instructions: 10000000

Simulation Instructions: 100000000

Scramble loads OFF

Using 1MB Last Level Cache

Using 12.8 GB/s DRAM bandwidth

Streaming Prefetcher

Knobs visible from prefetcher: 0 0 0

Instructions Retired: 100004 Cycle: 246572 Hearbeat IPC: 0.405577 Cumulative IPC: 0.405577

Prefetcher heartbeat stats

Instructions Retired: 200000 Cycle: 592162 Hearbeat IPC: 0.289349 Cumulative IPC: 0.337745

Instructions Retired: 3000001 Cycle: 8952028 Hearbeat IPC: 0.929835 Cumulative IPC: 0.335120

Prefetcher heartbeat stats

...

Simulation complete. Instructions retired: 3099757 Cycles elapsed: 9053438 IPC: 0.342385

Prefetcher final stats

real   0m24.509s

user   0m25.000s

sys   0m0.096s

Included Trace Files
- gcc_trace2.dpc.gz
- GemsFDTD_trace2.dpc.gz
- lbm_trace2.dpc.gz
- leslie3d_trace2.dpc.gz
- libquantum_trace2.dpc.gz
- mcf_trace2.dpc.gz
- milc_trace2.dpc.gz
- omnetpp_trace2.dpc.gz

[1] https://github.com/nus-comparch/cs5222-lab-prefetcher