Project 3: Prefetcher Discovery (2021-v1)

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)
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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 1 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