Effects of Prefetching with and without Exclusive Ownership - ROUGH DRAFT

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Summary

We examined and verified methods of software prefetching with and without exclusive ownership to view the benefits and drawbacks of implementing as opposed to hardware prefetching.

Background

Key data structures -

Operations on these structures -

Algorithms inputs and outputs -
Computations expensive and benefit from parallelization
Workload breakdown, dependencies, parallelism, data-parallel, locality, amenable to SIMD

Prefetching - what it is
Architecture of x86
With ownership cache coherency for multicore
Pitfalls of prefetching

Approach

Technologies - gem5, ramulator

Mapped problem to target parallel machines

Change original serial algorithm to enable better mapping to a parallel machine?

Describe process of iterations

Existing code -

Results

Future Work

ML approach

References

http://www.cs.cmu.edu/afs/cs.cmu.edu/user/tcm/www/thesis/subsection2_9_1_3.html
http://learning.gem5.org/book/
http://users.ece.cmu.edu/~omutlu/pub/ramulator_dram_simulator-ieee-cal15.pdf
http://users.ece.cmu.edu/~omutlu/pub/eaf-cache_pact12.pdf - read

Work and Credit

Journal:

11/22:

Gem5 update

- Gem5 installation and onboarding was more complicated than initially expected, especially after having to use a VirtualMachine just to get started.
- Preferred Gem5 over ZSim because we are able to maintain a full system integration while still keeping track of core metrics, as opposed to ZSim which doesn't maintain a full system.
- Using X86 Processor instead of ARM because we are able to use the prefetching Intel commands already built without having to craft our own
- Completely missed the point of what prefetching with ownership meant, realized that it means the protocol doesn't change, the request the prefetcher makes changes

Prefetching Notes ref here

- Prefetching follows a similar protocol to that of cache coherence, which initially sparked our mistake. Memory can have shared access, or exclusive access. Prefetching is the same, except that it will either fetch a shared copy of a line, or an exclusive copy.
- Benefits of the exclusive mode prefetching can be
    - Reducing latency of the subsequent write, depends on write buffers of system
    - Read-Modify-Write cases where processor asks for shareable copy then an exclusive copy. This reduces requests to 1 which potentially has the effect of cutting down half of all memory traffic. Which reduces contention.