Project Proposal: MorphCore

Amanda Marano, Brian Jacobs, Pete Ehrett

by

Team DRRA

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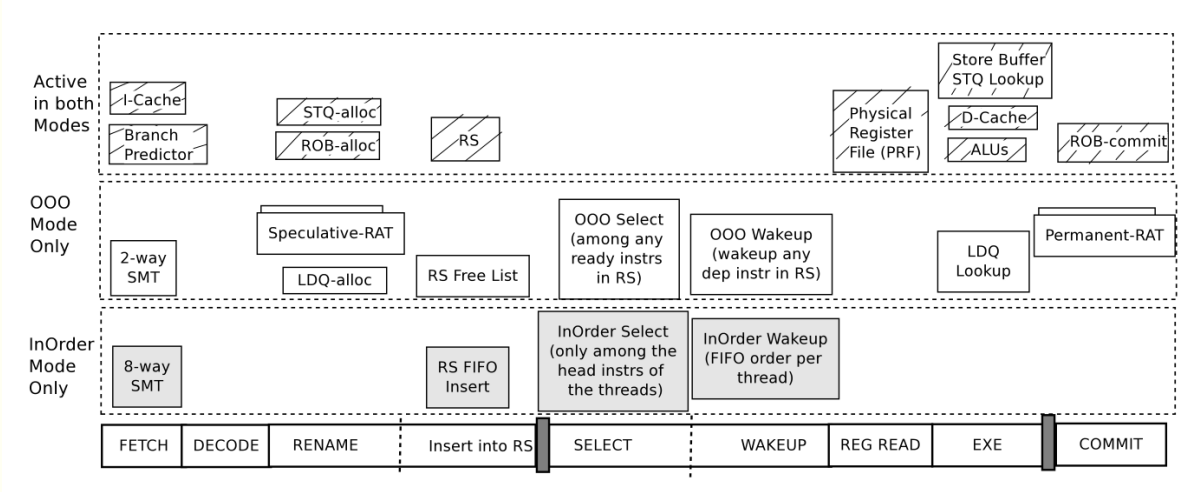
Project Overview

- Build a MorphCore processor
- Put Linux on it
- Run something cool



MorphCore Microarchitecture from the MorphCore paper

MorphCore

- Two operating modes: OutOfOrder, InOrder
- Swaps between instruction level parallelism and thread level parallelism
- Uses same hardware in different configurations
- OutOfOrder is a single OOO core
- InOrder is a set of multiple in-order cores
- Described in the paper:

MorphCore: An Energy-Efficient Microarchitecture for High Performance ILP and High Throughput TLP

Khubaib M. Aater Suleman Milad Hashemi
Chris Wilkerson Yale N. Patt

Potential Pitfalls

- Running Linux means we'd need things to be VERY correct.
  - Verify, verify, verify!
- Building an OOO cpu means we need things to be VERY correct.
  - **Verify, verify, verify!**
- The MorphCore is not a common design—resources will be more difficult to come by.

Available Resources

- Existing ARM design:

  `http://opencores.org/project,amber,Overview`

- Documentation On the MorphCore:

  `http://hps.ece.utexas.edu/pub/morphcore_micro2012.pdf`

- Computer Architecture References:

  `https://www.google.com/?gws_rd=ssl#q=computer+architecture+textbook+type:pdf`

  - Amanda and Pete both took 447, are taking 740.
  - Brian didn't.

Amber ARM Core

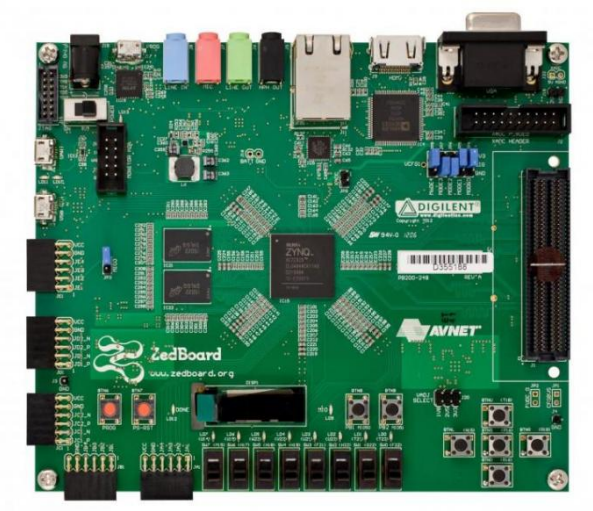
- Written in sane-looking Verilog
- Comes with a Linux image which (allegedly) runs on it.
- Regression tests should be easier to write when we start with a gold circuit.

Project Timeline

- Verify existing ARM core
  - Design some tests, ideally with good coverage, which can transfer over to other ARM implementations.
- Convert the ARM core to Out of Order
  - This is likely the bulk of the work.
- Other hardware necessary to demo. Can be parallel with other development.
  - VGA driver
  - Sound driver
- Multicore the OOO ARM.
  - This is also a substantial amount of work.

Platform Choice

- ZedBoard FPGA



- ARM Cores could be useful if we run into problems with our FPGA ARM.

  Ugly hacks just before demo day are a lot easier with software.

- VGA port makes it better than the other Zynq board.

YES

Success Criteria

- 100% Success: Linux runs on a MorphCore, we can demo some sort of simple game with graphics and sound.
- 90% Success: We can demo both in-order multicore and OOO single-core running Linux, but without MorphCore.
- Mostly Successful: The OOO modifications work, we can run Linux, same demo.
- Well, it works: Some code of some sort running on the OOO ARM core.
- Not Successful: “Something works.”
- Failure: lawsuit(s) and/or injury