

Jiri Gaisler (Gaisler Research):

- We need to put some thought into the interfaces, particularly with Leon, so that we don't end up with tons of different versions. Every few months a new library arrives from Leon. We need to keep the interface stable so that it is easy to upgrade to future versions of Leon.
- When we integrate Leon into our framework, we should use the existing scripts from GSLIB. This will also facilitate upgrading to future versions of Leon.
- Sign up for the Leon e-mail lists and ask questions there.

Jaime Moreno - IBM Research

- Most of his concerns have been addressed: dependency on RDL, interface definitions, etc...
- In some areas, there is a lot of progress, but mostly in areas where there are single universities. Collaboration isn't happening yet.
- They still aren't sure if this is going to turn into anything that industry can really use. Once they are more certain that they can use it, they will be more willing to add funding and collaboration support.

Orion Pritchard - Altera

- Centralizing some of the hardware will really help. Make it easy to access remotely.

Mike Hutton – Altera

- The developers (students) need to talk to each other before implementing to avoid wasting time. Lack of commitment to RDL and use of Bluespec were cited as specific examples where developers are implementing without talking across universities.
- He hopes that there will be room for heterogeneous computing once all of the infrastructure is in place. (Different clock speed processors, different chips, etc...) Don't make assumptions that all nodes will be similar

Sameh Asaad – IBM Research

- RDL is a central piece in making everything work together.... Or maybe SMASH. He's not sure which is the right (or agreed upon) method. RDL must be a more than one person job, especially if it is going to be usable across universities.
- RDL is a make-or-break piece of RAMP.
- The tools and user interface will have to be simple if users are really going to use this, especially since the users aren't likely to be familiar to FPGAs.
- The hardware platform should not matter. We need to make RAMP hardware independent.
- BEE3 is not the deliverable for RAMP. It is the tools and the IP cores.
- RDL could be the answer to being hardware-independent, but he's not sure yet.

- The notion of cycle-accuracy is very important, so RDL's ability to control the clock and abstract away the physical hardware from the emulated platform is critical to making this model useful.

Kees Vissers – Xilinx

- Spectacular progress: Eric's talk on how to do simulation, multiple layers with SIMICS was excellent, and a very good idea. It should be picked up and taken further.
- RAMP Blue is a non-trivial effort, and he is very impressed with how well it works. Kudos.
- A webcam with the hardware running is just as valuable as having the hardware physically here.
- It makes sense to have an XUP board on your desk, but at least one RAMP / BEE2 board setup should be somewhere in a back office reliably up and running, and available for remote access.
- In San Diego, take XUP boards. Leave the BEE2 boards here.
- The switch from MicroBlaze to Leon is a good idea not because of the instruction set, but because you can run conventional Linux and conventional benchmarks.
- He had hoped by providing the RTL for MicroBlaze that we would make an MMU (if that was all it was missing), but he's not upset that no one modified the RTL code..
- We desperately need a central architect that gives us a spec and a set of standards and "owns" the problem, somewhat like Jiri "owns" Leon. We need to identify someone like that to be dedicated to RAMP, and to push to make sure that they are willing to push people to put everything together. This will color RAMP with the color of the architect, but that has to happen.
- The BEE/BWRC community and the RAMP community seem to still be separate. These communities need to overlap. They're all using FPGAs and the same hardware platform. The real value is in the community building. Let the RAMP students and the BWRC students mingle and talk about programming FPGAs. There is much more to computer architecture than traditional processors. The BWRC guys could help the RAMP people see computing applications that are "outside the box".

Paul Hartke – Xilinx

- Nice job on the demos. The skill sets are really improving in the RAMP student community.
- If you plan on sharing, we must have (1) documentation and (2) regression suites. Otherwise we won't be able to share effectively. Remember that people outside the RAMP community may need to use this, so we need the documentation to be accessible for outsiders.

Scott Lekuch – IBM Research

- Heterogeneity. There is a vested interest in having this span many communities. He is excited about supporting a PCIe interface with the BEE3 hardware so that he can communicate with the hardware from other platforms.

- We need to figure out what the IP concerns for the hardware and the software are. Because the board could be so useful, it needs to be as easy as possible to distribute this board and ensure that there aren't any roadblocks to making this available. No copyrights. No patents. We need some statement that Microsoft or someone to say we have no intention of every copyrighting any of the RAMP hardware or IP.
- If we want BEE3 to become a standard base, put out good board support packages. If the board is easy to use, then industry will be much more likely to pick it up.
- Centralization (remote hardware access) of the boards is a great idea, especially since updating the hardware is much easier when all of the boards are in one place. We will all be working on the same baseline hardware.
- He got the more benefit from the demo session. He would prefer that future conferences spent more time on demos and tutorials than on presentations. Encourage more point-to-point interaction.

Ethan Schuchman – Intel

- He's more interested in the full-system prototyping (like RAMP-Red) where you can look at the full-system issues. Don't let optimizing for huge-scale 1,000+ core CMPs get in the way of implementing more interesting systems.

Ajit Dingankar – Intel

- He wants to use RAMP as a bridge between simulation and validation.
- He would like to see some non-architecture applications as targets to ensure that RAMP will be applicable across application boundaries. (specifically validation as a non-architecture application). Full-system validation.

Kai Schleupen – IBM

- He's worried that Greg is still the only one working on RDL. This really needs to be addressed. RDL could potentially be very interesting for IBM.
- The openness of BEE3. They want access to the schematics, etc... It takes too long to go through Legal, and industry in general will lose interest. He wants to have open access to both the hardware and the firmware.
- He was pushing for Blade at the last retreat, and he still wants to push Blade. Power and cost should not be an issue with Blade. The area is pretty much the same. This makes even more sense if we go to a more centralized model.
- Moving to a Blade form factor also allows IBM to mix their boards with BEE3 boards.
- University pricing for a Blade rack is something around \$2k (Blade Center H). You can plug in four 2.9 kW power supplies (2 of them are redundant, so total power is 5.8 kW). One power supply comes with the \$2k price.
- Targeting a lower cost BEE3 board is a good idea (LX110 or 220).
- If the board is less than 9.8" on one side, IBM might be able to adapt it to BladeCenter themselves.

Dave Weaver – Sun

- The demos were great, especially RAMP Blue. He was also impressed with the Intel and the OpenSPARC demos.
- Auxillary technologies (async logic and Brick and Mortar talk) show the broader reach of RAMP.
- Wanting to emulate 1,000,000 threads blew him away, and RAMP seems like the only platform that could make that work.
- We need more documentation, especially for the interfaces between the different units.
- We need additional coordination and teamwork in order to get things moving. Grad student meetings, retreats, and workshops will be really helpful.
- Greg needs help with RDL.