

## Summary: Reconfigurable Supercomputing BOF @SC13

**Abstract:** Reconfigurable supercomputing (RS) is characterized by hardware that adapts to match the needs of each application, offering unique advantages in speed per unit energy. With a proven capability of 2 PetaOPs at 12KW, RS has an important role to play in the future of high-end computing. The Novo-G in the NSF CHREC Center at the University of Florida is rapidly moving towards production utilization in various scientific and engineering domains. This BOF introduces the architecture of such systems, describes applications and tools being developed, and provides a forum for discussing emerging opportunities and issues for performance, productivity, and sustainability.

**Format:** The BOF consisted of two parts, eleven 5-minute “elevator” talks followed by 30 minutes of discussion. Remarkably, the speakers adhered to this very strict time limit so the discussion could proceed in its entirety.

**Speakers:** The speakers were invited based on leadership in their fields and/or of their companies, or because they were presenting a substantial new product or finding. After the introduction, they represented results in one or more of the following areas: applications, devices, tools, and systems.

CHREC/Florida – Alan George	Intro to Reconfigurable Supercomputing
Altera – Mike Strickland	Devices, Tools
Boston University – Martin Herbordt	Applications
CHREC/Florida – Herman Lam	Applications
Convey – Steve Wallach	Systems, Tools
DRC – Roy Graham	Applications
GiDEL – Reuven Weintraub	Applications, Systems
IBM – Mike Paolini	Devices, Systems
Maxeler – Jacob Bower	Applications, Tools
Micron – Paul Dlugosch	Devices
Pico Computing – John Watson	Systems

### Technical Highlights:

**1. Devices.** Two notable advances were reported. The first is that FPGAs in general continue frequency scaling and so are rapidly closing the gap with CPUs and GPUs. The second is that Micron is adding a reconfigurable substrate to their memory chips and so creating an Automata Processor.

**2. Systems.** Many results and products were reported, but two stood out. The first is the emergence of the “killer app” for FPGA computing: integrated communication and computation. This is seen in a new board from Gidel which facilitates direct accelerator-accelerator communication and a network switch from Arista that allows the programming of the in-plane FPGA. The second is the CAPI protocol from IBM to enable closer coupling between CPU and FPGA.

**3. Tools.** There were two serious proposals that could very well (at last) ease the programmability burden. Altera described advances in its OpenCL implementation and Maxeler described its Java-driven dataflow programming environment.

**4. Applications.** Numerous speakers described application success stories. Those domains in which FPGAs appear to be dominant are finance, especially in high-frequency trading, and bioinformatics (targeted particularly by Micron).

**Discussion summary.** The discussion was lively and continued long after the specified time. Some of the topics were FPGAs versus CPUs with respect to Moore's, prospects for continued advances in programming environments, and future price points for high-end FPGAs. It was concluded that this is a particularly exciting time for the prospects of Reconfigurable Supercomputing: computing technology is moving towards configurability, barriers are being reduced between CPU and accelerator, FPGAs have much room for frequency scaling, tools are advancing to the point where general purpose programming is becoming credible.

**Self Evaluation:**

- The attendance was excellent with more than 65 people attending
- The audience was enthusiastic as gauged by the lively discussion
- We succeeded in attracting speakers who are either prominent in their own right, or who represent the leading players in the field
- The quality of the talks was outstanding, being both informative and well organized
- Several notable achievements were announced
- We believe the BOF served a critical "higher" purpose at SC: Besides the eight RS-oriented companies represented by speakers, there were at least five more who participated in the trade show who could also have participated in the BOF. The ratio on the academic side was much higher. This BOF provided the only forum at SC for RS.

**Facilities and support.** Room, set-up, and time-slot were all excellent.

**For Next Year:**

- The organizers would like to continue this BOF in the current format
- Only modest changes are anticipated. As we did this year, when inviting speakers we will try to anticipate the timeliest and highest impact results.