

FHPCA Visiting Academic Programme concludes

Rob Baxter

The FPGA High Performance Computing Alliance (FHPCA) is an alliance of key players in high-performance computing and field-programmable gate arrays (FPGAs). Led by EPCC, the FHPCA is developing high-performance computing (HPC) solutions using FPGAs to deliver new levels of performance to the technical computing market.

Hardware and software developed by the FHPCA have been used to build a large-scale demonstrator supercomputer called Maxwell. Maxwell is hosted at the University's Advanced Computing Facility and currently has over 30 registered users, around half of them international. Support for Maxwell will continue for several years yet, complemented by a campaign to raise industrial awareness and interest and to stimulate the market for the Alliance's members' commercial offerings.

As part of the FHPCA, EPCC has been able to work with some of the leading lights in high-performance reconfigurable computing (HPRC) and develop a thorough understanding of the potential – and the challenges – of this new technology. Through the FHPCA Visiting Academic Programme we've also been fortunate enough to have played host to some of the key researchers in this field.

The FHPCA Visiting Academic Programme ended this June. Since it started in 2007 the Programme has given scholars the opportunity to come to EPCC and work on-site on Maxwell,

either on their own research or in collaboration with staff at EPCC and FHPCA member organisations.

Altogether over a dozen scholars have visited EPCC, some for a few days, others for a month and more. Over the last eighteen months or so we've hosted visitors from Europe, the USA and South Africa, all of them wrestling with the challenges of making effective use of FPGAs for high-performance computing. For EPCC it's been a tremendous opportunity to work alongside some of the people developing large-scale FPGA computing, and for our visitors it's been a chance to work directly on one of the world's largest FPGA clusters designed for high-performance computing. Some of the highlights of their work is described on these pages.

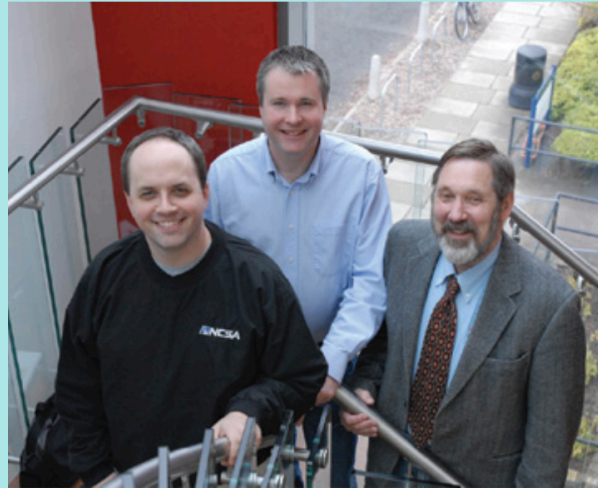
EPCC is now looking beyond the nuts and bolts of building a high-performance FPGA cluster to the exploitation of next-generation HPC architectures like Maxwell. We expect 2009 to be an interesting year.

Olaf Storaasli, Oak Ridge National Laboratory

In the 60s, I enjoyed maths and science at a local school while my father was a postdoc at Edinburgh University. The path of my career at NASA, Oak Ridge National Laboratory and the University of Tennessee brought me back to Edinburgh in April to explore high-performance reconfigurable computing on Europe's largest field-programmable gate array (FPGA)-based supercomputer, named, appropriately, Maxwell.

Key in building the Finite Element Machine, one of NASA's first parallel computers, I conducted research to achieve high-performance matrix equation solutions on supercomputers, first by using many parallel and vector processors and now by harnessing many parallel FPGAs, each allowing hundreds of parallel operations. Maxwell has 64 Xilinx Virtex4 FPGAs, each of which I've shown can perform 100x faster than a traditional 2.2 GHz Opteron processor to perform human genome sequencing. Just before coming to EPCC, I presented results at the Many-Core and Reconfigurable Supercomputing Conference in Belfast showing 7500x speedup for 150 FPGAs on a Cray XD1 (with older Virtex2 FPGAs). My intention is to attempt similar performance on Maxwell's Virtex4s.

FPGA programming is challenging, but with the PDK 'toolkit' and helpful knowledgeable colleagues Mark Parsons, Rob Baxter and Craig Steffen, I soon ran simple codes on Maxwell. I found EPCC extremely conducive to exploring and testing



Craig (left) and Olaf (right) with EPCC's Mark Parsons.

novel ideas. Now that I'm familiar with Maxwell, I plan more challenging computations via remote access.

The EPCC Maxwell research adds valuable experience to evolving reconfigurable supercomputing. Edinburgh offered me another treat: a physically and intellectually stimulating commute by foot to the King's Buildings, occasionally via Salisbury Craggs. Thanks for the wonderful opportunity to work with the mighty Maxwell and 'his' marvellous friends.