

Maxwell

Maxwell is a high-performance computer developed by the FHPCA to demonstrate the feasibility of running computationally demanding applications on an array of FPGAs. Not only can Maxwell demonstrate the numerical performance achievable from reconfigurable computing, but it also serves as a testbed for tools and techniques to port applications to such systems.

The unique architecture of Maxwell comprises 32 blades housed in an IBM Blade Center. Each blade comprises one 2.8 GHz Xeon with 1 Gbyte memory and 2 Xilinx Virtex4 FPGAs each on a PCI-X sub-assembly developed by Alpha Data and Nallatech. Each FPGA has either 512 Mbytes or 1 Gbyte of private memory. Whilst the Xeon and FPGAs on a particular blade can communicate with each other over the PCI bus (typical transfer bandwidths in excess of 600 Mbytes/s), the principal communication infrastructure comprises a fast Ethernet network with a high-performance switch linking the Xeons together and RocketIO linking the FPGAs. Each FPGA has 4 RocketIO links enabling the 64 FPGAs to be connected together in an 8 x 8 toroidal mesh. The RocketIO has a bandwidth in excess of 2.5 Gbits/s per link.

Together these two principal interconnect subsystems enable the efficient implementation of parallel codes where there is a need both for intensive numerical processing and for fast data communication between the cooperating processing elements.

The Parallel Toolkit developed by EPCC supports the decomposition of a numerically intensive application into a set of cooperating modules running on the array of Xeons in much the same way that many applications can be decomposed to run on a cluster of PCs. Each module can then be further analysed to identify the numerical “hot spots” which are then implemented on the FPGAs taking advantage of the fast RocketIO linking the FPGAs for fast communications. The implementation of the numerically intensive parts of the applications is accomplished using a combination of tools such as DIME-C from Nallatech, Handel-C from Celoxica and VHDL available from several vendors including Xilinx.

This innovative system will be available for wider use on application. If you are interested in using Maxwell, please let us know by mailing info@fhpca.org.