Los Alamos NATIONAL LABORATORY ESTABLISHED 1943

2006 R&D 100 Award Winner

Trident

Features

Reconfigurable-logic arrays already accelerate computation 10 to 100 times in many important applications—but to be maximally useful, this technology must be accessible to the scientists developing new applications. Most application developers have relatively little hardware-design experience.

Trident provides accessibility. It is a high-level-language compiler that supports floating-point data types and operations. It translates scientific algorithms that use floating-point mathematics into hardware circuits mapped onto reconfigurable-logic arrays.

Putting it another way, Trident accepts C language input containing floating-point calculations and translates this language into field-programmable-gate-array hardware. It allows computational scientists to explore partitioning their code between software and hardware.

Applications

- Trident translates scientific algorithms in C containing floating-point mathematics into field-programmable-gate-array hardware. Without a compiler such as Trident, the reconfigurable hardware is not accessible to the computational scientist.
- In the future, Trident, combined with tools to locate computationally intensive regions, may be used to identify blocks of code suitable for acceleration through the use of reconfigurable-logic arrays.

Benefits

- Trident makes reconfigurable logic—and its computational speed—more accessible for computational scientists who normally use C and have little experience in hardware design. It has the potential to benefit high-performance computing application developers, academic researchers, and industrial floating-point application developers.
- It provides an open and extensible framework for exploration of floating-point libraries and computation in field-programmable gate arrays.

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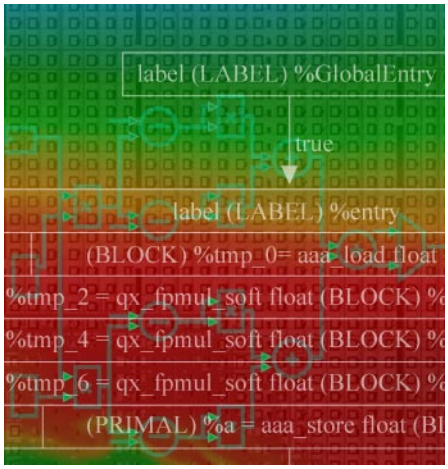

This is an abstract illustration of several aspects of Trident. The background colors suggest the visualization applications for which Trident can translate scientific code into hardware. The repeating rectangles in the background layer show reconfigurable-logic cells on a field-programmable gate array. The green diagram is a schematic of hardware generated by Trident. And the white print shows a portion of the Trident internal representation of a simple C program.

Los Alamos 2006 Winners

ENABLE: Energetic Neutral Atom Beam Lithography/Epitaxy

Green Primaries: Enviro-Friendly Energetic Materials

MICHELLE: A Software Tool for Three-Dimensional Modeling of Charged-Particle-Beam Devices

PixelVizion: An NPU-Embedded Visualization Accelerator for Large Data Sets

Trident