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Development of a Ray Casting Application for the Cell Broadband Engine Architecture

My primary focus this summer has been the development of an existing open source ray casting application for the multicore Cell processor featured in Sony's PlayStation 3 (PS3). This was a collaborative effort, shared by Monica Christensen, Erik Sevre, Shuo "Mark" Wang, and myself, involving the set up of a development environment, the study of the standing application, and the development of new functionality. The set up of the development environment consisted of the installation and configuration of Yellow Dog Linux on a PS3 and the installation of support software including the IBM Cell SDK and the Simple DirectMedia Layer (SDL) development library. The study of the standing application involved a careful examination of the source code and experimentation to reinforce ideas and challenge assumptions made about the application. The development of new functionality for the application consisted of the design, implementation, debugging, and testing of mechanisms to render triangles, perform keyboard controlled translations and rotations, and visualize triangulated data read from a text file.

As a result of our work on this project we have acquired knowledge concerning the construction of software for the Cell processor and have explored the use of ray casting techniques for the visualization of scientific data. Through our work on the ray casting application we have experienced the difficulty of programming for the cell architecture and have discovered through research and

experimentation how to overcome many technical challenges. Much of this information could be of immediate value in the design and implementation of future software systems for the Cell architecture. Additionally, we have concretely demonstrated the use of ray casting techniques to visualize triangulated tsunami data. Our work on this can be used as an entry point to implement more advanced visualization techniques to aid in the perception of subtleties in scientific data sets.

This project has given me the opportunity to experience the development of software for a novel multicore architecture. Through the study of the Cell Processor featured in Sony's Playstation 3 and software systems developed for this architecture, I learned about the key components of the hardware and how to use the libraries provided by the Cell SDK to implement communication and data transfer mechanisms. In addition to learning a great deal about the technical specifics of the Cell architecture, I learned about concepts applicable to other multiprocessor programming environments including data parallelism models and optimization techniques such as pipelining and double buffering. The examination of these concepts within programs written for the Cell processor reinforced my understanding and enriched my knowledge of techniques specific to this architecture.

My experiences this summer have allowed for the building of skills especially pertaining to the development of real world software. The implementation of new functionality within an existing open source application has enriched my software development skills in many ways including the ability to read, understand, learn from, and contribute to a standing application's code base. Generally projects and assignments given out in a class environment require that a program is build from

scratch leaving little or no opportunity to directly interact with another author's source code. This project has helped prepare me for the more likely scenario encountered in real world situations in which an existing code base must be extended or maintained.