

From EARTH to HTMT: An Evolution of A Multithreaded Architecture Model

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Abstract. In this talk, we discuss the issues and challenges solving irregularly structured problems in parallel from the angle of system architectures and support. To this end, multithreaded architecture models and systems provide a new opportunity for meeting such challenges.

We begin by a brief review on the evolution of multithreaded models and architectures — in particular the EARTH (Efficient Architecture For Running Threads) architecture model. We outline the program execution model and architecture issues for multithreaded processing elements suitable for use as the node processor facing the challenges of the irregular applications. These include the question of choosing appropriate program execution model, the organization of the processing element to achieve good utilization and speedup in the presence of irregular data and control flow patterns, the support for fine-grain interprocessor communication and dynamic load balancing, and related compiling issues. We have implemented the EARTH architecture model on a number of experimental high-performance multiprocessor platforms and we will present some experiment results on the effectiveness of the EARTH architecture on irregular applications.

We briefly present the conception and evolution of a US petaflop supercomputer architecture project — the Hybrid Technology Multithreaded Architecture project. The program execution model and architecture overview of the HTMT machine will be discussed.