

Exploring Heterogeneity within a Core for Improved Power Efficiency

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Room: Meeting-Room 204, S7A 2nd floor

Abstract: Asymmetric multi-core processors (AMPs) comprise of cores with different sizes of micro-architectural resources yielding very different performance and energy characteristics. Since the computational demands of workloads vary from one task to the other, AMPs often provide greater power efficiency than symmetric multicores. Furthermore, as the computational demands of a task change during its course of execution, reassigning the task from one core to another, where it can run more efficiently can further improve the overall energy efficiency. However, too frequent re-assignments of tasks to cores may result in high overhead. To greatly reduce this overhead we propose a morphable core architecture that dynamically adapts its resource sizes and operating frequency to assume one of four possible core configurations. Such a morphable architecture allows more frequent task to core configuration re-assignments for a better match between the current needs of the task and the available resources. To make the online morphing decisions we have developed a runtime analysis scheme using hardware performance counters. Our results indicate that the proposed morphable architecture controlled by the runtime management scheme can improve the performance/watt of applications by 43% over executing on a static AMP.