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Exploring Real-Time Semantics in Supercomputing

One of the prominent trends in computing is the convergence of supercomputers and embedded control computers, which have come to share many of the same requirements and limitations. These common attributes include multicore, power, reliability, programmability, and portability. The increasing use of lightweight processors like embedded cores in HPC systems prompts the need to unify multiple cores for time dependent embedded control. The challenges arising due to asynchrony of parallel execution, especially important in the context of non-homogenous many-task programs, make workload scheduling for optimal performance and predictability of overall execution time particularly difficult. This talk presents results of an NSF sponsored research project attempting to span the gap between the two classes of computer system through the conceptual bridge of a new execution model and its surrogate runtime system software and programming interface. It extended the ParalleX execution model to the domain of embedded computers by incorporating real-time semantics as an intrinsic property of the model so that multicore embedded computer architectures may be treated as a single system exploiting dynamic adaptive techniques to achieve real-time capability even when concurrent processing is required to reduce response time to necessary bounds. Performance figures derived using initial implementation of real-time extensions to the HPX-5 runtime system will also be presented and discussed. Questions from the audience are welcome throughout the talk.

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