

Minimal Multithreading - Exploiting Redundancy in Parallel Systems

Friday October 7
2:45pm to 3:45pm
MSCS 214 (NCB 211 in Tulsa)

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Abstract:

Parallelism and energy efficiency have emerged as critical considerations in future computing systems. We observe that many convenient models for expressing parallelism can lead to significant redundancy in computation and data. Our research explores a set of microarchitectural mechanisms that support these software models while effectively eliminating this redundancy, providing high performance and energy efficiency. Specifically, we observe that many parallel software models (e.g. data parallelism, Single-Program Multiple Data (SPMD), multi-programming, and high-throughput computing) consist of multiple threads of computation with very similar instructions streams and working sets of data. The trick, however, is to design efficient mechanisms that both exploit this similarity and effectively support the differences.

We describe two research thrusts to eliminate redundancy across several application domains. First, content-aware caching techniques that reduce redundant storage of identical data across parallel threads and processes. Second, multi-threaded processor core designs that eliminate redundant instruction fetch and/or execution.

Joint work with Fred Chong, Tim Sherwood, Susmit Biswas, Guoping Long, Pablo Ortiz, Jason Oberg, Alan Savage, Ryan Dixon and Dongrui Fan.

Bio:

Diana Franklin is tenured teaching faculty and Director of the Center for Computing Education and Diversity at UCSB. Franklin received her Ph.D. from UC Davis in 2002 and is a recipient of the NSF CAREER award. She was an assistant professor (2002-2007) and associate professor (2007) of Computer Science at the California Polytechnic State University, during which she held the Forbes Chair (2002-2007). Her research interests include parallel programming and architecture, computing education, and ethnic and gender diversity in computing.