Using the LLVM Interpreter to Quantify Inherent Application Properties
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Goal:
Characterization of Inherent Application Properties to Understand Performance

Research Questions:
- How well does an application match a platform?
- Diagnose performance bottlenecks
- Performance behavior upon platform upgrade?

Why LLVM?

Language-, Architecture-Agnostic Intermediate Representation (LLVM IR)

Modular Design

Existing approaches to characterizing application properties

Results 1: Analysis of Parallelism

Ideal-Case Instruction-Level Parallelism
Distribution over execution cycles vs. average value

Characterization of ILP and TLP of 26 Applications and Kernels Classified According to their Constituent Berkeley Dwarf [Caparros, 2011]

Results 2: Analysis of Data Locality

Histogram of Reuse Distances (PDF)

Reuse Distance Cumulative Distribution (CDF) for Matrix-Matrix Multiplication, N=128

References

Limits of Instruction-Level Parallelism
David P. Wall. ASPLOS, 1991

Predicating whole program locality through reuse distance analysis

Parallelism and Data Movement Characterization of Contemporary Application Classes
Victoria Caparros and Phillip Stanley-Marbell. SPAA, 2011

The Landscape of Parallel Computing Research: A View From Berkeley

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