ProfDP: A Lightweight Profiler to Guide Data Placement in Heterogenous Memory

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Heterogeneous Memory has Become Common

ProfDP:
  A	
  Lightweight	
  Profiler	
  to	
  Guide	
  Data	
  Placement	
  in	
  Heterogenous	
  Memory

Motivation

Hardware Address Sampling

+ effective address   + memory access latency   + PC of memory access

IBM	
AMD	
Intel

IBS	
MRK	
DEAR	
PEBS	
PEBS-LL

Methodology I — Data-centric Profiling

Directly Monitor the Behavior of Data Object in Memory

Methodology II — Differential Analysis

Directly Quantify Bandwidth/Latency Sensitivity of Data Objects

**Challenges: address sampling does not exist in every system**

**Solution: using a NUMA architecture with address sampling to characterize programs**

- latency sensitive: differentiate using local or remote memory
- bandwidth sensitive: differentiate using one and max cores in one NUMA domain
- other metrics
  - data significance: account for high latency over whole program
  - data size: space efficiency in fast memory

Evaluation

Overhead
Each profiling incurs less than 10% runtime overhead and a few megabytes memory overhead