AdaMICA: Adaptive Multicore Intermittent Computing
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#1 BACKGROUND
Why do we need to be battery-free?
- 2030 y. -> 50 billion of IoT devices worldwide
- No batteries -> New environments !!!

This is how batteryless systems work

Application requirements are growing

#2 PROBLEM
Where to get extra energy?
- Ambient Power can reach hundreds of milliwatts, but the energy buffer is small
- To get it, intermittent systems need to be "smart" enough, i.e. to be adaptive

How to employ extra energy?
- Limitations
  - Single-core solutions
  - Task-specific accelerators
  - No generic parallelism exploitation & support
  - No computational flexibility

#3 GOAL AND CONTRIBUTION
The concept of a parallel adaptive system

Our objective is to enable the efficient intermittent execution of highly parallelizable computations under dynamic environmental energy.

Challenges:
1. Intermittent computing unique factors (such as the store and recovery overheads) might shade parallelization benefits;
2. Parallel programming model can be further complicated by intermittent programming.

Research Impact:
1. Multicore Intermittent Computing. We introduce the missing software support that enables, for the first time, parallel intermittent computing over multiple cores;
2. Power-scaling Runtime. We introduce the first intermittent runtime that provides the missing parallel programming language constructs and adaptively reconfigures the multicore system concerning the environmental power strength.

#4 METHODOLOGY
Models exploration and extension

High-level simulations

Condition when parallelism is desired

Three parts of the performance dependence on the incoming power and the number of cores working on a task. Red, yellow, blue dots represent high, medium, and low point of the marked line respectively.

#5 ADAMICA ARCHITECTURE
Programming model

Operating overview

Decision-making efficiency

#6 EVALUATION AND RESULTS
Experimental setups

Results

40% speedup