Energy Consumption Library
Demos

Leandro Fontoura Cupertino, Georges Da Costa, Amal Sayah, Jean-Marc Pierson

IRIT – Toulouse Institute of Computer Science Research
UPS – University of Toulouse III (Paul Sabatier)

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Motivation

- Power dissipation on a machine is **application dependent**

1. Data Centers Resource Management
   - DCs usually operates below full load
   - Workload classes differ depending on DC type

   App Monitor → App Profiler → Resource Manager → Energy Efficiency

2. Software development
   - Sources of energy variations
     - Libraries
     - Coding patterns
     - Compilers
     - Computer Architecture
Energy Consumption Library Description

- Requirements: Linux OS + ncurses + boost

- Application/Machine Level sensors
  - CPU: performance counters (instructions, cycles, branch hit/misses, cache hits/misses), usage (%)
  - Memory: RSS, RAM usage (%)
  - Disk: read/written bytes

- Machine-only sensors
  - CPU: frequency, temperature
  - Network: sent/received bytes/packets
  - Power meters: ACPI, G5K, RECS, Plogg

- Application/Machine Power Estimators
  - Validation issue: No wattmeter for application available
Application/Machine Power Estimators

- CPU proportional

\[ P_{mac} = P_{idl}^{mac} + \sum_{pid} P_{pid} = P_{idl}^{mac} + \sum_{pid} \left( P_{max}^{mac} - P_{idl}^{mac} \right) \times CPU_{pid}^{\%} \] \( (1) \)

- Inverse mapping

\[ P_{pid} = P_{mac} \times CPU_{pid}^{\%} \] \( (2) \)

- Dynamic models (model calibration)
  - Linear Regression

\[ P_{mac} = w_0 + \sum_{pid} P_{pid} = w_0 + \sum_{pid,i} w_i \times s_{i,pid} \] \( (3) \)

\[ w = X^{-1}y \] \( (4) \)

- \( y \) = node’s history power values vector
- \( X \) = node’s history input sensors matrix
- \( w \) = weight vector
Demos

- How to create your own sensor/power estimator?
- What's the CPU/energy overhead of application monitoring?
- How can libec aid on software development?
- Can my model be more accurated?
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Thank you.

fontoura@irit.fr
www.irit.fr/~Leandro.Fontoura-Cupertino/ectools/