Domain Knowledge Specification for Energy Tuning

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OVERVIEW

- Switching between configurations by exploiting dynamic characteristics dynamically for improved energy efficiency and performance.
- Develop tool aided auto-tuning methodology.
- Compute better configuration by specifying domain knowledge (DKS).

THE READEX TOOL-SUITE

Design-Time Analysis
- Detect program regions having variations in characteristics.
- Determine best configurations for different runtime situations (RTS's) of the detected regions .
- Classify RTS's based on similar configurations into scenarios.
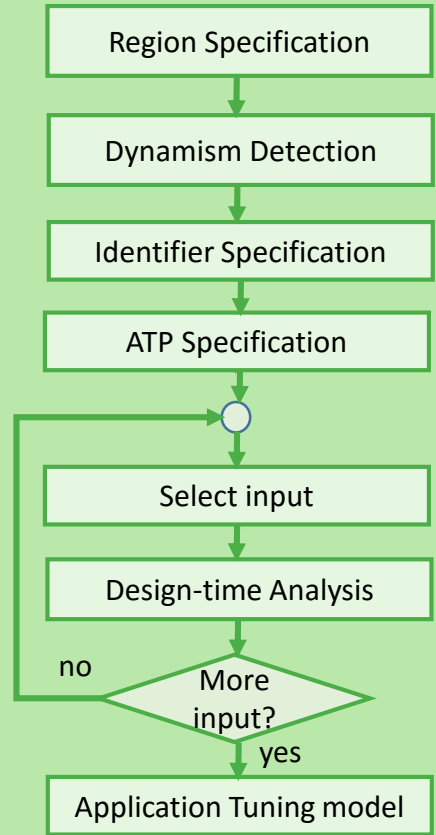- Encapsulate the scenario information into a tuning model.

Runtime Application Tuning
- Propagate the generated tuning model for the production run.
- Switched between optimized configurations during production runs.
- The READEX Runtime Library reads and applies the tuning model.

DKS OVERVIEW

- Improve tuning model
  - Distinguish more RTS's based on identifiers
- *region identifiers, phase identifiers input identifiers*
  - Identifying RTS's , phases and inputs with different characteristics
  - Application Tuning Parameter
  -- Application specific tuning knobs

DKS WORKFLOW

Region Specification → Dynamism Detection → Identifier Specification → ATP Specification → Select input → Design-time Analysis → More input? — no / yes → Application Tuning model

DESIGN-TIME ANALYSIS

- Performed by the **Periscope Tuning Framework (PTF)**
  - Tunes performance and energy.
  - Evaluates alternatives online.
  - Supports different tuning strategies.
- **The READEX Tuning Plugin**
  - Multiple objectives.
  - Configurable search space via READEX configuration file.
  - Tuning Parameters: core freq, uncore freq, no. of threads
  - Experiments for selected configurations
  - Energy and time measured for all RTS's.
  - Identification of static best for phase and specific best configurations for RTS's

MOTIVATIONAL EXAMPLE (ATP)

Preconditioner	# of iterations	1 iteration (Time	Energy)	Solution (Time	Energy)
None	172	125 ms	31.6 J	21.36 s	5 501.31 J
Weight function	100	130+2 ms	32.3+0.53 J	12.89 s	3 284.07 J
Lumped	45	130+10 ms	32.3+3.86 J	6.32 s	1 636.11 J
Light dirichlet	39	130+10 ms	32.3+3.74 J	5.46 s	1 409.82 J
Dirichlet	30	130+80 ms	32.3+20.62 J	6.34 s	1 594.50 J

GRANT

MORE

- www.readex.eu
- www.researchgate.net/project/READEX
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