

READEX

Runtime Exploitation of Application Dynamism for Energy-efficient eXascale Computing

Joseph Schuchart

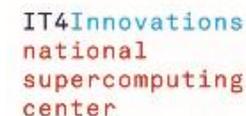
TU Dresden, Center for Information Services and High Performance Computing



Horizon 2020
European Union funding
for Research & Innovation

READEX: Overview

- FET-HPC project, launched 09/2015
- www.readex.eu
- Technische Universität Dresden/ZIH (Coordinator)
- Norges Teknisk-Naturvitenskapelige Universitet
- Technische Universität München
- IT4Innovations, VSB-Technical University of Ostrava
- Irish Centre for High-End Computing
- Intel Corporation SAS
- Gesellschaft für numerische Simulation mbH



Motivation

- Energy is critical to current and future systems
- Applications exhibit dynamic behavior
 - Changing resource requirements
 - Changing load on processors over time

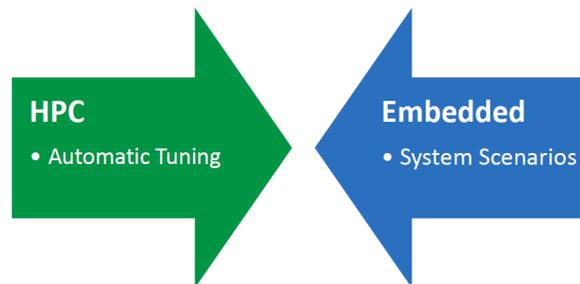
READEX: Overview

Create a tools-aided methodology for automatic tuning for energy efficiency in HPC

- Dynamically adjust system parameters to actual resource requirements

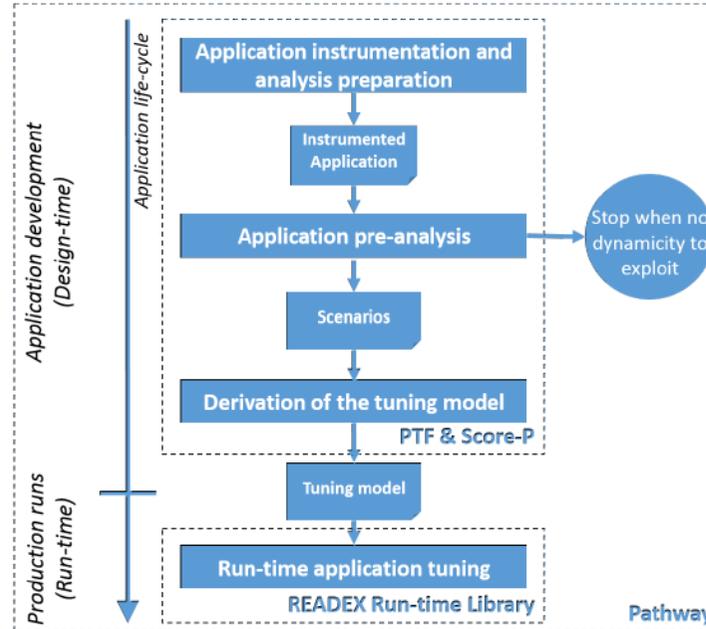
Join technologies from embedded systems and HPC

- HPC: PTF, Score-P, and HDEEM
- ES: System scenario methodology



READEX: Overview

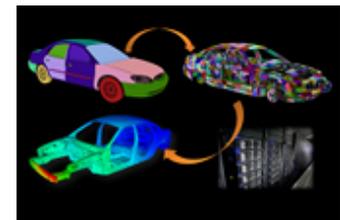
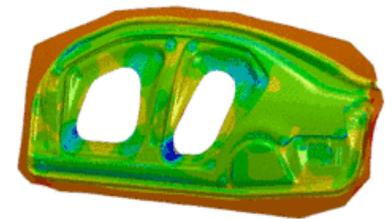
High-level view of READEX tools-aided methodology



READEX: Overview

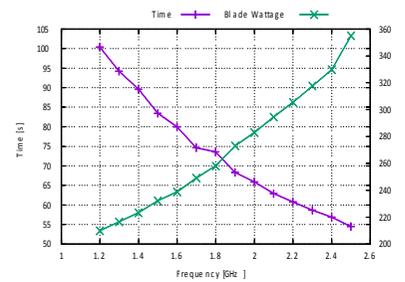
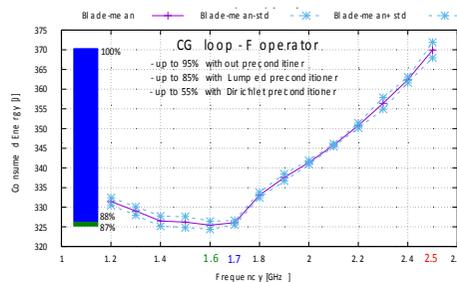
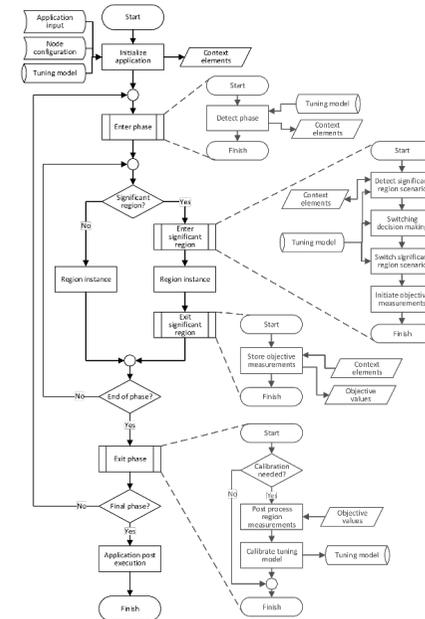
Co-design approach

- Manual tuning for energy-efficiency as a baseline
- Automatic tuning for comparison
- Applications
 - PERMON and ESPRESO (FETI tools from IT4Innovations)
 - Indeed (GNS)
 - CORAL benchmark suite



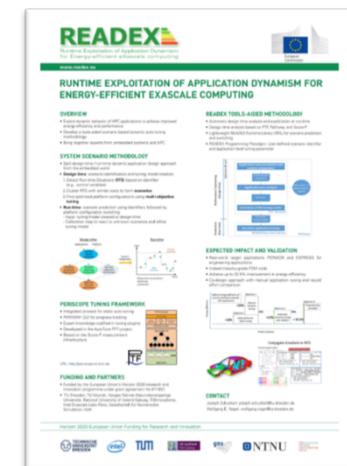
Current Status

- First Milestones achieved
 - Dissemination Strategy
 - System Parameters
- Formalised methodology
- READEX tool-suite design and implementation
- Manual tuning efforts



Dissemination

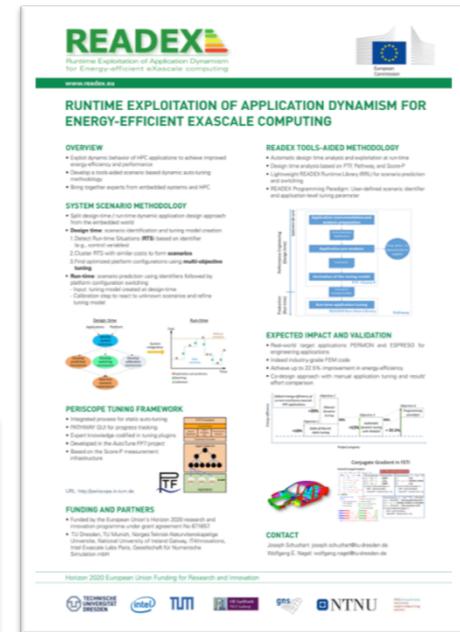
- International Workshop on Code Auto-Tuning (DCAT) workshop @ CGO'16
 - Invited speakers, ~20 participants
- Dissemination material (SC'15)
- Presentations
 - Keynote on READEX at ICGHPC 2016
 - GAMM DMV yearly meeting
- Posters
 - CSE 2015, Porto
 - HiPEAC conference 2016, Prague
- Publications
- Outreach into HiPEAC, PRACE, EE-HPC-WG, System Scenario SIG



Posters

READEX overview poster

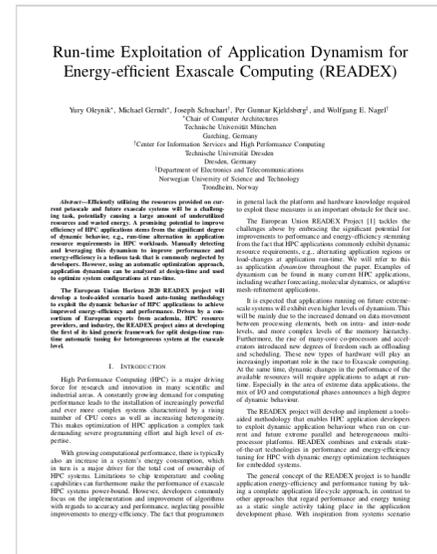
- CSE 2015, Porto
- HiPEAC conference 2016, Prague



EXDCI Workshop, 10.05.2016, Prague

Publications

- Y. Oleynik, M. Gerndt, J. Schuchart, P. G. Kjeldsberg and W. E. Nagel, "*Run-Time Exploitation of Application Dynamism for Energy-Efficient Exascale Computing (READEX)*," 18th International Conference on Computational Science and Engineering (CSE), 2015, Porto, doi: 10.1109/CSE.2015.55;
- Several papers submitted for review.



Integration with the Ecosystem

- International Workshop on Code Auto-Tuning (DCAT)
- Extensions to Score-P
- ESPRESO/PERMON tuning efforts
- Automatic energy-efficiency tuning

- HDEEM system Taurus open to all interested projects
 - High definition energy-measurement system (1000 Sa/s, accuracy validated)

International Cooperation

Activities:

- External Advisory Board
 - UTK, VA Tech, LLNL, Skoda, imec, JSC
- International Workshop on Code Auto-Tuning (DCAT) @ CGO'16
- Visiting researcher from St Xaviers Catholic College in India at TUM

Support by EXDCI?

- Cross-border call for proposals
- Organization of workshops
- Funding for visiting researchers

Role in Extreme Scale Demonstrator

- Willing to provide input to ESD proposal
- Provide product quality performance and energy-efficiency tools
- Energy-efficiency crucial for ESD
 - READEX will contribute to energy-efficiency tuning

- What will the role of software be in the ESD?

Contact and Funding

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Questions?

- Funded by the European Union's
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Overview

- What are you offering to Ecosystem in terms of services/access/cooperation
- Have you progressed in the area of international cooperation/if so, in which areas and how,
- with whom (following SC15 BOF session promoting FP7 HPC&FETHPC projects)?
- What else could EXDCI do for you in the area of international cooperation?
- What are your current activities and plans for relations with cPPP, with the SRA, and with other FETHPC/CoE projects
- What role do you see for yourself in the Extreme Scale Demonstrators in 2018-2020?