

CONTENT

Dear Reader,

Welcome to the fifth issue of the **Exa2Green** newsletter. It is our pleasure to keep you up to date with the progress of our project and to make you aware of the news and activities around energy-efficient high performance computing.

In this newsletter we update you on the latest project news: **Exa2Green** will be organising a workshop at ISC 2015.

We also report on five recent activities and events of **Exa2Green**: the last Partner Meeting in December 2014 and **Exa2Green** presentations at SC14 in New Orleans, as well as at the HiPEAC15 and EEHCO 2015 workshops at WAPCO 2015 in Amsterdam. The project's results will also be presented at three upcoming events — you can find further details in the last section of the newsletter.

We hope that you will enjoy reading and we also kindly invite you to visit our website at www.exa2green.eu which will also keep you updated about all activities around the **Exa2Green** project.

Yours sincerely,

The **Exa2Green** consortium



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Exa2Green ID

Title

Energy-Aware Sustainable Computing on Future Technology —Paving the Road to Exascale Computing

Programme

Seventh Framework Programme, Collaborative Project

Project No.

318793

Duration

01/11/2012-31/10/2015

Main objective

Exa2Green aims at developing a radically new energy-aware computing paradigm and programming methodology for exascale computing.

Partner countries

Germany, Switzerland and Spain

EXA2GREEN CONSORTIUM

Exa2Green Project Partners:

Coordinator:

Engineering Mathematics and Computing Lab (EMCL)
Interdisciplinary Center for Scientific Computing (IWR)
Heidelberg University - Germany

High Performance Computing and Architectures Group
Universitat Jaume I de Castellon - Spain

IBM Research - Zurich - Switzerland

Institute for Meteorology and Climate Research
Karlsruhe Institute of Technology - Germany

Scientific Computing Group, Department of Informatics
Universität Hamburg - Germany

Steinbeis-Europa-Zentrum - Germany

Swiss Federal Institute of Technology Zurich

Swiss National Supercomputing Centre - Switzerland

PROJECT NEWS

EXA2GREEN organises full day workshop at ISC 2015

Caught between the continuous technological advances and the global efforts for greener IT, power consumption of modern high performance computing systems has become a major challenge on the road to exascale computing. The workshop, titled “**Power and Energy-Aware High Performance Computing on Emerging Technology**”, focuses on new energy-aware computing paradigms and programming methodologies to address the problem of prohibitive power consumption by current hardware when extrapolating to exascale machines. The goal of this workshop is to bring together scientists and engineers from academia and industry with interests in energy-efficient computing.

Workshop topics will include:

- Tools for advanced power consumption monitoring and profiling.
- New multi-objective metrics for quantitative assessment and analysis of the energy profile of algorithms.
- Smart algorithms using energy-efficient software models.
- Power-aware implementations of numerical methods for high performance clusters.
- Performance/energy optimization in applications, showcases, proof of concepts.

Keynote speakers of the event will be:

- Axel Auweter (Leibniz Supercomputing Centre)
- Prof. Dr. Kirk W. Cameron (Department of Computer Science, College of Engineering, Virginia Tech)
- Prof. Dr. Dimitrios S. Nikolopoulos (School of Electronics, Electrical Engineering and Computer Science, Queen’s University of Belfast)
- Prof. Dr. Rudolf Lohner (Steinbuch Center for Computing, Karlsruhe Institute of Technology)
- Dr. Dominik Brunner (Empa)

The targeted audience comprises researchers, industry, HPC experts, hardware vendors, software engineers, simulation engineers, computer scientists, mathematicians and physicists with an interest in power consumption.

The workshop will take place in the frame of the **ISC 2015 conference in Frankfurt (Germany) on 16th July 2015.**

For more information, please visit:

http://www.isc-events.com/isc15_ap/sessiondetails.htm?t=session&o=219&a=select

PAST EVENTS

EXA2GREEN M20 Partner Meeting at Universitat Jaume I in Castellón, Spain

On 4th December 2014 the **Exa2Green** project partners met in Castellón (Spain) for the Month 20 meeting. At the premises of partner Universitat Jaume I the partners presented and discussed the main developments of the previous six months.

All work package leaders reported of a continuously good performance and further promising

results. The quality of **Exa2Green**'s work was also proved through the numerous reported milestones, the participation at conferences and workshops as well as publications.

Exa2Green will hold its next partner meeting on 27th and 28th April 2015, hosted by University of Hamburg in Germany.

EXA2GREEN at SC14 in New Orleans, LA (USA)

In November last year, the **SC14** brought together the most respected minds in high performance computing, networking, storage and analysis to debut the research and innovation that will open the door to new scientific and economic opportunities. The conference took place in New Orleans, LA (USA) from 16th to 21st November 2014 with the parallel SC14 exhibition (from 17th to 20th November 2014).

The programme included invited talks, panels, research papers, tutorials, workshops, posters and Birds-of-a-Feather (BOF) sessions.

Researcher Cristiano Malossi (IBM Research Zurich) of the **Exa2Green** team presented a poster on the topic „Machine Learning Algorithms for

the Performance and Energy-Aware Characterization of Linear Algebra Kernels on Multi-threaded Architectures” at SC14.

Systematic methods to derive reliable time-power-energy models for dense and sparse linear algebra operations were presented. The proposed techniques provide tools for analysing and reengineering algorithms for the desired power- and energy-efficiency as well as to reduce operational costs of HPC-supercomputers and cloud-systems with thousands of concurrent users.

For more information on SC14:
<http://sc14.supercomputing.org>

PAST EVENTS

EXA2GREEN at HiPEAC15 — WAPCO 2015 in Amsterdam (NL)

The **1st Workshop On Approximate Computing at WAPCO 2015**, organised in conjunction with [HiPEAC 2015](#), took place on 19th January 2015 in Amsterdam. It aimed at bringing together researchers from the areas of mathematics, computer science, computer and electrical engineering to discuss challenges, risks and opportunities of approximate computing in all design layers.

Exa2Green was represented by researcher Cristiano Malossi (IBM Research Zurich) presenting „Fast Exponential Computation on SIMD Architectures”. State of the art implementations of the exponential function rely on interpolation tables, Taylor expansions or IEEE manipulations containing a small fraction of integer operations. Unfortunately, none of these methods is able to maximise the profit of

vectorisation and at the same time, provide sufficient accuracy.

In his presentation, Malossi demonstrated the usefulness of a novel formulation to compute the exponential employing only floating point operations, with a flexible accuracy ranging from a few digits up to the full machine precision. Using the presented algorithm exponentials of large vectors can be computed in any application setting, maximising the performance gains of the vectorisation units available to modern processors. This immediately results in a speedup for all applications.

For more information:

<http://wapco.inf.uth.gr/index.html>

EXA2GREEN at EEHCO 2015 — WAPCO 2015 in Amsterdam (NL)

The **HIPEAC Workshop on Energy Efficiency with Heterogeneous Computing (EEHCO 2015)** invited researchers to present initial results showing novel ways to obtain energy efficiency when computation is performed with a combination of different core types.

Exa2Green partner Enrique Quinta S. Quintana-Orti from Universidad Jaume I of Castellon, Spain attended the workshop and presented the latest project results to the dedicated audience under the topic “Evaluating Asymmetric Multicore Systems-on-Chip using Iso-Metrics”.

It focussed on the investigation, if a low-power systems-on-chip, consisting of ARM's asymmetric big.LITTLE technology, can be an alternative to conventional high performance multicore processors in terms of power/energy in an unreliable scenario. For the study the Conjugate Gradient solver was used, an algorithm representative of the computations performed by a large range of scientific and engineering codes.

For more information:

<http://seis.bris.ac.uk/~eejlny/eehco.htm>

UPCOMING EVENTS

EXA2GREEN at PASC15 Conference in Zurich (Switzerland)

PASC15 ("Platform for Advanced Scientific Computing") Conference, taking place at Zurich (Switzerland) from 1st—3rd June 2015, provides an opportunity for scientists and practitioners to discuss key issues in the use of High Performance Computing (HPC) in branches of science that require computer modelling and simulations.

The scientific programme will offer four plenary sessions, one public lecture with Nobel Prize in Economics in 2011 Thomas Sargent, 124 mini-symposium presentations and up to 24 contributed talks, one inter-PASC Networks discussion,

one joint plenary session with the satellite conference Frontiers in Computational Physics, a poster session and information stands.

Within the conference, **Exa2Green** partner Joseph Charles from ETH Zurich will be presenting a poster entitled "**Computational and energy efficiency optimizations of the air quality prediction model COSMO-ART**".

Find more information on the conference and the registration possibility on the conference website:

<http://www.pasc15.org>

Workshop on Power-Aware Computing 2015 in Magdeburg (Germany)

As part of the project **EHFARS** (partners: CSC group at the MPI Magdeburg and P. Ezzatti from Universidad de la Republica in Montevideo) funded by the German Ministry of Education and Research in a federal effort supporting the internationalisation of research and economy, the Scientific Computing Team of the Computational Methods in Systems and Control Theory group at the MPI in Magdeburg is holding the **initiation workshop "Power-Aware Computing PACO2015"** at the MPI from 6th to 8th July 2015 in Magdeburg (Germany).

The workshop aims at bringing together experts in the field.

Manuel Dolz (University of Hamburg) will be presenting the latest **Exa2Green** developments and results.

For more information on the event please visit:

<http://www.mpi-magdeburg.mpg.de/csc/events/paco15>

26th GI/ITG Workshop on Parallel Algorithms, Computer Architectures and System Software in Potsdam (Germany)

The section “Parallel Algorithms, Computer Architectures and System Software (PARS)” is a common section of German Informatics Society (Gesellschaft für Informatik, GI) and Information Technology Society (Informationstechnische Gesellschaft, ITG). The **26th PARS Workshop** takes place on 7th and 8th May 2015, in Potsdam (Germany).

The goal of the bi-annual PARS Workshop is the presentation of important research within the scope of PARS and an exchange of ideas between the participants.

Exa2Green partners Martin Wlotzka and Vincent Heuveline (Heidelberg University) will present recent work on “Energy-aware mixed precision iterative refinement for linear systems on GPU-accelerated multi-node HPC clusters”.

For more information please visit the workshop website:

<http://www.cs.uni-potsdam.de/bs/misc/workshops/2015/pars.html>