



Proceedings of the Second International Workshop on Sustainable
Ultrascale Computing Systems (NESUS 2015)
Krakow, Poland

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(Editors)

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Preface

Network for Sustainable Ultrascale Computing (NESUS)

We are very excited to present the proceedings of the Second International Workshop on Sustainable Ultrascale Computing Systems (NESUS 2015), a workshop created to reflect the research and cooperation activities made in the NESUS COST Action (IC1035) (www.nesus.eu), but open to all the research community working in large/ultra-scale computing systems. It was held in Krakow (Poland) on September 10-11, 2015.

The goal in scalable and sustainable technology today is to have on the one hand large parallel supercomputers, named Exascale computers, and on the other hand, to have very large data centers with hundreds of thousands of computers coordinating with distributed memory systems. Ultimately, NESUS idea is to have both architectures converge to solve problems in what we call ultrascale. Ultrascale systems combine the advantages of distributed and parallel computing systems. The former is a type of computing in which many tasks are executed at the same time coordinately to solve one problem, based on the principle that a big problem can be divided into many smaller ones that are simultaneously solved. The latter system, in both grid and cloud computing, uses a large number of computers organized into clusters in a distributed infrastructure, and can execute millions of tasks at the same time usually working on independent problems and big data. The applications of these systems and the benefits they can yield for society are enormous, according to the researchers, who note that this type of computing will help conduct studies about genomics, new materials, simulations of fluid dynamics used for atmospheric analysis and weather forecasts, and even the human brain and its behavior.

The goal of the NESUS Action is to establish an open European research network targeting sustainable solutions for ultrascale computing aiming at cross fertilization among HPC, large scale distributed systems, and big data management. Ultrascale systems are envisioned in NESUS as large-scale complex systems joining parallel and distributed computing systems that will be two to three orders of magnitude larger than today's systems. The EU is already funding large scale computing systems research, but it is not coordinated across researchers, leading to duplications and inefficiencies. The network will contribute to glue disparate researchers working across different areas and provide a meeting ground for researchers in these separate areas to exchange ideas, to identify synergies, and to pursue common activities in research topics such as sustainable software solutions (applications and system software stack), data management, energy efficiency, and resilience. Some of the most active research groups of the world in this area are members of this NESUS Action. This Action will increase the value of these groups at the European-level by reducing duplication of efforts and providing a more holistic view to all researchers, it will promote the leadership of Europe, and it will increase their impact on science, economy, and society.

The scientific objective of NESUS is to study the challenges presented by the next generation of ultrascale computing systems to enhance their sustainability. These systems, which will be characterized by their large size and great complexity, present significant challenges, from their construction to their exploitation and use. We try to analyze all the challenges there are and see how they can be studied holistically and integrated, to be able to provide a more sustainable system. The challenges that this type of computing poses affect aspects such as scalability, the programming models used, resilience to failures, energy management, the handling of large volume of data, etc. One of the NESUS goals is to find the way that all solutions that are proposed can be transmitted to user applications with the minimum possible redesign and reprogramming effort.

The project began last March with 29 European countries, but at present consists of 39 European countries and six countries from other continents. It now involves nearly 200 scientists, almost 40% of whom are young researchers, because

one essential goal of these Actions is to promote and create an ecosystem of scientists who can work on these matters in the European Union in the future.

This Action, which concludes in 2018, aims to produce a catalogue of open source applications that are being developed by the members of the Action and which will serve to demonstrate new ultrascale systems and take on their main challenges. In this way, anyone will be able to use these applications to test them in their systems and demonstrate their level of sustainability.

Prof. Jesus Carretero
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NESUS Chair

October 2015

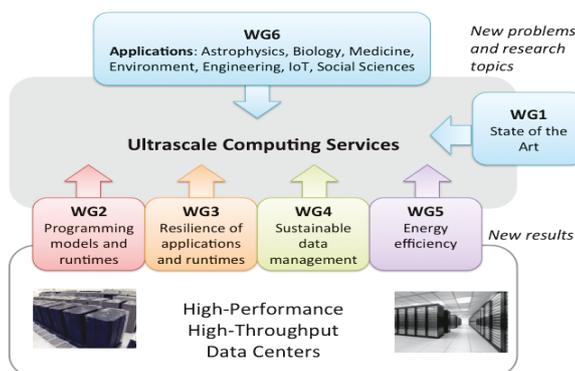
Aim

- Coordinate European efforts for proposing realistic solutions addressing major challenges of building sustainable Ultrascale Computing Systems (UCS) with a holistic approach.

To:

- Increase EU research in the field of sustainable ultrascale computing.
- Give coherence to the European ICT research agenda related to sustainability.
- Build a multi-disciplinary forum for cross-fertilization of ideas for sustainable ultrascale computing.

Scientific Workplan



Topics

- WG1: New techniques to enhance sustainability holistically.
- WG2: Promoting new sustainable programming and execution models in the context of rapidly changing underlying computing architecture.
- WG3: Innovative techniques to deal with hardware and system software failures or intentional changes within the complex system environment.
- WG4: Study data management lifecycle on scalable architectures in a synergistic approach to pave the way towards sustainable UCS.
- WG5: Explore the design of metrics, analysis, frameworks and tools for putting energy awareness and energy efficiency at the next stage.
- WG6: Identify algorithms, applications, and services amenable to ultrascale systems and to study the impact of application requirements on the sustainable ultrascale system design.

Activities

- Research activities through WGs
- Set up collaborations through STSM and internships
- Training schools and PhD forum
- Meetings for WGs and MC
- Dissemination and cooperation with industry and stakeholders.
- Publications, conference organization, industry seminars, ...

Information and Communication Technologies (ICT)



Participating countries: 45

EU COST countries: 33

AT, BA, BE, BG, BO, CH, CY, DE, DK, EE, EL, ES, FI, FR, HR, HU, IE, IL, IT, LT, LU, MK, MT, NL, NO, PL, PT, RO, SI, SK, SE, TR, UK

NNC countries: 6

AL, AM, MD, MO, RU, UA



Global Collaboration: 6

AU, CA, CO, IN, MX, US



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TABLE OF CONTENTS

Second NESUS Workshop (NESUS 2015)

- 1 *Neki Frasheri*
Parallel Processing For Gravity Inversion
- 7 *Algirdas Lančinskas, Pilar M. Ortigosa, Julius Žilinskas*
Solution of Bi-objective Competitive Facility Location Problem Using Parallel Stochastic Search Algorithm
- 11 *Ricardo Morla, Pedro Gonçalves, Jorge Barbosa*
A Scheduler for Cloud Bursting of Map-Intensive Traffic Analysis Jobs
- 23 *Raimondas Ciegis*
Distributed Parallel Computing for Visual Cryptography Algorithms
- 29 *Dana Petcu*
On Autonomic HPC Clouds
- 41 *Biljana Stamatovic*
Labeling connected components in binary images based on cellular automata
- 45 *Atanas Hristov*
Nature-Inspired Algorithm for Solving NP-Complete Problems
- 51 *Ilias Mavridis, Eleni Karatza*
Log File Analysis in Cloud with Apache Hadoop and Apache Spark
- 63 *Jing Gong, Stefano Markidis, Michael Schliephake, Erwin Laure, Luis Cebamanos, Alistair Hart, Misun Min, Paul Fischer*
NekBone with Optimized OpenACC directives
- 71 *Gabor Kecskemeti*
Scheduler hierarchies for enabling peta-scale cloud simulations with DISSECT-CF
- 83 *Pilar Gonzalez-Ferez, Angelos Bilas*
NUMA impact on network storage protocols over high-speed raw Ethernet
- 95 *Francisco Rodrigo Duro, Fabrizio Marozzo, Javier Garcia Blas, Jesus Carretero, Domenico Talia, Paolo Trunfio*
Evaluating data caching techniques in DMCF workflows using Hercules

- 107 *Pablo Llopis Sanmillan, Manuel Dolz, Javier Garcia Blas, Florin Isaila, Jesus Carretero, Mohammad Reza Heidari, Michael Kuhn*
Analyzing power consumption of I/O operations in HPC applications
- 117 *Beat Wolf, Loïc Monney, Pierre Kuonen*
FriendComputing: Organic application centric distributed computing
- 121 *Beat Wolf, Pierre Kuonen, Thomas Dandekar*
Multilevel parallelism in sequence alignment using a streaming approach
- 127 *Robert Dietze, Michael Hofmann, Gudula Ruenger*
Exploiting Heterogeneous Compute Resources for Optimizing Lightweight Structures
- 135 *Anatoliy Melnyk, Viktor Melnyk, Lyubomyr Tsyhylyk*
Chameleon© C2HDL Design Tool In Self-Configurable Ultrascale Computer Systems Based On Partially Reconfigurable FPGAs
- 143 *Radim Blaheta, Alexej Kolcun, Ondrej Jakl, Kamil Soucek, Jiri Stary, Ivan Georgiev*
HPC in Computational Micromechanics of Composite Materials
- 147 **List of Authors**