Dr. Sergi Siso

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Research Interests

My research interests are in the field of High-Performance Computing (HPC), particularly in the portability and optimisation of scientific and engineering applications for modern highly-parallel architectures. My research focuses on leveraging compiler technologies such as Domain Specific Languages, Source-to-Source translators, and Runtime Compilation to develop software solutions that provide optimal performance while maintaining good productivity and maintainability of the application domain characteristics. I am one of the main authors of PSyclone, a source-to-source optimising Fortran compiler designed to parallelise and accelerate weather and climate applications, such as the next generation atmospheric modelling system utilised by the UK MetOffice.

Experience

2015 – Present: High Performance Software Engineer at the Hartree Centre (Science and Technology Facilities Council, UKRI) at Daresbury Laboratory.

- I lead the Intel Parallel Computer Centre (IPCC) at Hartree Centre. This involved modernising several engineering applications used by UK research and industry communities to perform optimally on the Intel manycore processors. In addition, I was a member of Intel eXtreme Performance User Group (IXPUG) steering committee.
- I contributed to the performance analysis and optimisation of multiple applications such as DualSPHysics (a smooth particle hydrodynamics to study free-surface flow phenomena), DL_MESO (a mesoscale Lattice Boltzmann mesoscopic simulation package), AU3D (an industrial FE solver to study unsteady compressible flow and structural dynamics used by Rolls-Royce plc), and participated in international research projects such as EuroEXA (a EU Horizon 2020 effort to co-desing ExaScale applications).
- Currently I am a contributor to the Psyclone source-to-source optimising Fortran compiler used to parallelise codes used by the weather and climate community, such as LFRic (an Earth Weather and Climate modelling system) and NEMO (an ocean modelling system).

2013 – 2013: Resident Student Researcher at the Performance Tools Department, Barcelona Super-Computing Centre

- I developed software to process summarized profiling information from highly scalable applications and format such information in a way that the Dimemas software is able to simulate its performance in different systems. It was part of the CEPBA-tools toolchain.

2012 – 2013: Developer at SERIMAG MEDIA SL

- I developed a document classifier for a banking company. The application used data mining technologies such as Support Vector Machines and the Viterbi Algorithm to classify a stream of incoming documents automatically.

2010 – 2011: Grant-holder cryptography researcher at the Department of Cryptography and Graphs, University of Lleida

- I developed an electronic voting system that works on different types of homomorphic cryptosystems, with special focus on elliptic curves methods.

Education

2016 – 2023: PhD in Computer Sciences, Liverpool University

- Thesis: “Augmenting Compiler Optimisations through Source-to-Source Injection of Runtime Information-aware Transformations”
- Supervisors: Dr. Jeyan Thiyagalingam and Dr. Frans Coenen

2013 – 2014: MSc with Distinction in High Performance Computing, EPCC, University of Edinburgh

- Scholarship: "Highly Skilled Workforce" award of the Scottish Funding Council.
- Dissertation: "Parallelisation of the Coupled Coherent States quantum dynamics simulation"
- Advisor: Dr. Andrew Turner

2012 – 2013: Master's Degree in Information Technology, Polytechnic University of Catalonia

- Dissertation: "Simulating parallel systems using summarized application information"
- Advisor: Dr. Jesus Labarta

2008 – 2012: Bachelor’s Degree with Honours in ‘Enginyeria Tecnica en Informatica de Sistemes’ (Technical Computer Engineering), University of LLeida

- Dissertation: "Electronic voting system over elliptic curve cryptography"
- Advisor: Dr Josep M. Miret

Selected Publications and Presentations

- Sergi Siso, Andrew R. Porter, and Rupert W. Ford (2023). Transforming Fortran weather and climate applications to OpenCL using PSyclone. In Proceedings of the 2023 International Workshop on OpenCL (IWOCL '23). Association for Computing Machinery, New York, NY, USA, Article 10, 1–8.
- Sergi Siso, Wes Armour, and Jeyarajan Thiyagalingam (2019) Evaluating Auto-Vectorizing Compilers through Objective Withdrawal of Useful Information. ACM Transactions on Architecture and Code Optimization (TACO). 16, 4, Article 40 (October 2019).
- SC’16 Tutorial: Debugging and Performance Analysis on Native and Offload HPC Architectures, Conference Tutorial, Supercomputing Conference (SC16), Salt Lake City (USA), 2016
- Ashworth M., Meng J., Novakovic V., Siso S. (2016) Early Application Performance at the Hartree Centre with the OpenPOWER Architecture. In: Taufer M., Mohr B., Kunkel J. (eds) High Performance Computing. ISC High Performance 2016. Lecture Notes in Computer Science, vol 9945. Springer, Cham
- Sergi Siso, Luke Mason, Michael Seaton (2016) Code modernization of DL MESO LBE to achieve good performance on the Intel Xeon Phi. Proceedings of EMerging Technology (EMiT) Conference 2016
- Sergi Siso, DualSPHysics Performance on Intel Xeon Phi, Society for Industrial and Applied Mathematics (SIAM) Parallel Processing Conference, Paris, 2016
- ISC’15 Tutorial: The Road to Application Performance on Intel Xeon Phi, DL MESO Lattice Boltzmann Data Layout, Conference Tutorial, International Supercomputing Conference (ISC15), Frankfurt (Germany), 06/2015