Special Issue proposal

Concurrency and Computation: Practice and Experience

Special Issue on: Models, Algorithms and Tools for Highly Heterogeneous Computing Environments

Over the past decade we have witnessed the rise of new programming models that have to take into account the architecture of modern and innovative computing environments.

From one side there are new generation High Performance Computing environments aimed to achieve extreme performance. They integrate together several independent nodes each of them composed by powerful computing elements (CPU core, GPUs or other acceleration devices) sharing resources in a single node. These systems make massive use of communication libraries and other tools for the management of the shared resources.

Furthermore there are Grid and Cloud computing environments. They can be described by a collection of large and heterogeneous resources such as clusters and storage systems, connected among them by geographical networks with the primary aim to present them as a single computing system in a transparent mode. This aim is realized by means of sophisticated middlewares acting as operating systems that are in charge of the efficient management of resources.

Finally there are new Internet of Things and Mobile Computing environments, aimed the make transparent and friendly usable low power and heterogeneous resources as well as sensors and actuators, connected among them in a highly unstructured way. These environments make massively use of pervasive virtualization tools with the aim not only to realize smart environments, but also for scientific computing.

Beyond the differences in the objectives, these environments have a common feature: the need to integrate heterogeneous components that require different programming models. For such a reason, the development of algorithms and scientific software for these systems implies a suitable combination of several methodologies and tools to deal with the different kinds of parallelism corresponding to each specific device, so that to be aware of the underlying platform.

Further problems depend moreover on the specific programming environments features. For example HPC systems have to deal with the large parallelism degree and the energy supply, while for the Grid and Cloud computing environments, the fault tolerance and the load balancing

among the resources is of paramount importance. Finally the Internet of Things and Mobile Computing environments must be in charge of the interfacing of low power devices and HPC systems for scientific computing and data management purposes.

This special issue, therefore, focuses specifically on Models, Algorithms and Tools to exploit all forms of parallelism and their combination in the emerging environments also for the solution of real world problems, with the goal of gathering the current state of knowledge in the field.

Call for Papers
The topics include, but are not limited, to:
- Heterogeneous algorithms with multiple forms of parallelism
- Auto tuning techniques for heterogeneous and parallel environments
- Techniques for multi-/many-core platforms, NUMA architectures, or accelerator devices
- Synchronization and access to shared resources
- Multi-level cache management
- Task scheduling and load balancing among computing elements
- Fault tolerant implementations of scientific algorithms
- Performance and scalability models
- Tools and programming environments supporting efficient usage of different form of parallelism.
- Resources virtualization for High Performance Computing on low power devices
- Programming environments for high performance cloud computing with GPGPUs and FPGAs
- Algorithms for scientific computing on Internet of Things environments
- Data science oriented multi-level algorithms for low-power embedded and mobile devices systems
- Solution of real world applications with new heterogeneous systems

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Short bios:

Giuliano Laccetti is professor of computer science at the University of Naples Federico II, Naples, Italy. He received his Laurea degree (cum laude) in Physics from the University of Naples; his main research interests are Mathematical Software, Scientific Computing, High Performance Architecture for Scientific Computing, Distributed Computing, Grid Computing, Cloud Computing, Algorithms on emerging hybrid architectures (CPU+GPU, …), Internet of Things. He has been involved and is presently involved in several Projects: EU funded Projects and National (EU funded) Projects, where in many of them he is member of the Scientific and Management Board; in several other national and local projects, as PI too. He has been organizer and chair of several Workshops joint to larger International Conferences. He is head of the High Performance Scientific Computing Lab of the Mathematics Dept. of the University of Naples Federico II, as well as member of the Editorial Board of the journal Advances in Computer Science and Engineering, and of the book series ALGORITMICA.
Presently, he teaches Computer Programming I, Computer Programming II, and Parallel and Distributed Computing, to Computer Science students, and Mathematics students, too.
He is also member of the Steering and Management Committee of the PhD School on Mathematics and Computer Science of the University of Naples Federico II
He is author (or co-author) of about 100 papers published in refereed international Journals, international books, and International Conference Proceedings

Prof. Marco Lapegna received the degree in Mathematics and the Ph.D. in Applied Mathematics and Computer Science from the University of Naples "Federico II". Presently is associate professor in Computer Science at the same university. Her main research interests are related to algorithms, data structures and environments for parallel, distributed and grid computing, with special regard to the computational mathematics and scientific computing. He has been involved in several national and international project funded by EU. He has been organizer and chair of international workshops and program committee member of several international conferences.

Dr. Sokol Kosta is Assistant Professor at CMI, Aalborg University Copenhagen. He received the Bachelor, Master, and PhD in Computer Science (Summa cum Laude) from Sapienza

University of Rome, Italy, in 2006, 2009, and 2013 respectively. His research interests include networking, distributed systems, and mobile cloud computing. He has published in some top-tier conferences and journals like IEEE INFOCOM, IEEE Communications Magazine, ACM/USENIX HotCloud, IEEE P2P, IEEE SECON, ACM SIGMETRICS MAMA, IEEE Transaction on Mobile Computing, among others. He is co-author of a European Patent filed by Deutsche Telekom AG.

Dr. Paul Messina is Advisor to the Associate Laboratory Director and Laboratory on Exascale and Argonne Distinguished Fellow at Argonne National Laboratory.

His current role is Project Director for the U.S. DOE Exascale Computing Project, a multi-laboratory project. During 2008-2015 he served as Director of Science for the Argonne Leadership Computing Facility and in 2002-2004 as Distinguished Senior Computer Scientist at Argonne and as Advisor to the Director General at CERN (European Organization for Nuclear Research). From 1987-2002, Dr. Messina served as founding Director of California Institute of Technology's (Caltech) Center for Advanced Computing Research, as Assistant Vice President for Scientific Computing, and as Faculty Associate for Scientific Computing, Caltech. During a leave from Caltech in 1999-2000, he led the DOE-NNSA Accelerated Strategic Computing Initiative. In his first association with Argonne from 1973-1987, he held a number of positions in the Applied Mathematics Division and was the founding Director of the Mathematics and Computer Science Division.

Prof. Ian Foster, Senior Fellow, is Director of the Computation Institute, a joint institute of the University of Chicago and Argonne National Laboratory. He is also an Argonne Senior Scientist and Distinguished Fellow and the Arthur Holly Compton Distinguished Service Professor of Computer Science.

Ian received a BSc (Hons I) degree from the University of Canterbury, New Zealand, and a PhD from Imperial College, United Kingdom, both in computer science. His research deals with distributed, parallel, and data-intensive computing technologies, and innovative applications of those technologies to scientific problems in such domains as climate change and biomedicine. Methods and software developed under his leadership underpin many large national and international cyber infrastructures.

Dr. Raffaele Montella works as assistant professor, with tenure, in Computer Science at Department of Science and Technologies, University of Naples "Parthenope", Italy since 2005. He got his degree (MSc equivalent) in (Marine) Environmental Science at the University of Naples "Parthenope" in 1998 defending a thesis about the "Development of a GIS system for marine applications" scoring with laude and an award mention to his study career. He defended his PhD thesis about "Environmental modeling and Grid Computing techniques" earning the PhD in Marine Science and Engineering at the University of Naples "Federico II".

The research main topics and the scientific production are focused on tools for high performance computing, such as grid, cloud and GPUs with applications in the field of computational environmental science leveraging on his experiences in embedded/mobile/wearable/pervasive computing and internet of things. He joined the

CI/RDCEP of the University of Chicago as Visiting Scholar and as Visiting Assistant Professor working on the FACE-IT project.

Prof. Almerico Murli is former Full Professor of Numerical and Parallel Computing at University of Naples Federico II (ITALY) , director of the Centre for Research on Parallel Computing and Supercomputers (CPS-CNR), and senior researcher at CMCC (Euro-Mediterranean Centre on Climate Change).
His area of expertise includes Scientific Computing and development of methods, algorithms and software for scientific applications on high performance architectures including parallel, distributed and GPGPU computing.
Presently, he joined in SPACI (Southern Partnership for Advanced Computational Infrastructures).
During his career he has been involved in research projects sponsored by the National Research Council of Italy, by the EC, and by the Italian Ministry of Research. He is co-author of several papers in refereed journals, and co-editor of several books on mathematical software and parallel computing.