

Preface

e-Science is a complex set of disciplines requiring computationally intensive distributed operations, high-speed networking, and collaborative working tools. As such, it is most often (and correctly) associated with grid- and cloud-computing infrastructures and middleware. However, an essential component is sometimes overlooked in this picture, which consists of the scientific instrumentation providing either the very source of data, or special purpose analytical (as in chemical or biological laboratories) and processing tools (as in electronic Very Large Baseline Interferometry, or eVLBI, and in the use of various measurement devices).

Making scientific instruments an essential manageable resource over distributed computing infrastructures, such as the grid, has been the focus of a specific research area referred to as *Remote Instrumentation*, over recent years. European research has been quite active in it, through projects like GRIDCC (Grid Enabled Remote Instrumentation with Distributed Control and Computation), RINGrid (Remote Instrumentation in Grid environment) and DORII (Deployment of Remote Instrumentation Infrastructure), among others. Since 2005, these projects have been accompanied by a Workshop series named INGRID (“Instrumenting” the Grid).

This book stems from the fifth Workshop in this series, which was held in May 2010 in Poznań, Poland. The contributions touch the main theme of remote instrumentation, along with related technologies that enable the implementation of truly distributed and coordinated laboratories. The content deals with remote instrumentation and sensors’ infrastructure, virtual laboratories and observatories, e-Science applications over the e-Infrastructure, architectural middleware elements, advanced grid and cloud computing, scientific visualization, workflows, virtual machines, instrument simulation, security, network performance monitoring, data mining in virtual laboratories, distance learning tools, software platforms, among other topics.

The book is organized in three parts. Part I, Sensors’ Infrastructure, contains six contributions. R. Borghes, R. Pugliese, G. Kourousias, A. Curri, M. Prica, D. Favretto and A. Del Linz examine the use of the functionalities of the Instrument Element (IE), the basic abstraction that allows exposing instruments (of any kind) as manageable resources, to perform computing tasks in a Synchrotron Radiation

Facility beamline dedicated to medical imaging. F. Davoli, L. Berruti, S. Vignola and S. Zappatore evaluate the performance of the IE's embedded publish/subscribe mechanism in acquiring measurement data and delivering them to a multiplicity of users. M. Dias de Assunção, J.-P. Gelas, L. Lefèvre and A.-C. Orgerie present a large-scale energy-sensing infrastructure with software components that allow users to precisely measure and understand the energy usage of their system. P. Gamba and M. Lanati describe the steps and results toward the customization of a seismic early warning system for its porting to grid technology. The contribution by I. Coterillo, M. Campo, J. Marco De Lucas, J. A. Monteoliva, A. Monteoliva, A. Monnà, M. Prica and A. Del Linz deals with a mobile floating autonomous platform supporting an extensive set of sensors to monitor a water reservoir and its integration in the existing grid infrastructure. M. Adamski, G. Frankowski, M. Jerzak, D. Stokłosa and M. Rzepka examine the security issues of virtual laboratories, also with reference to the use case of a sensor infrastructure.

The second part, Software Platforms, includes four contributions dedicated to various supporting software tools and applications, particularly in the field of distance learning. A. Cheptsov and B. Koller present tools for performance analysis of parallel applications. The other four contributions are related to distance learning platforms centered on the grid and on remote instrumentation and virtual laboratories. D. Stokłosa, D. Kaliszczan, T. Rajtar, N. Meyer, F. Koczorowski, M. Procyk, C. Mazurek and M. Stroiński present the Kiwi Remote Instrumentation Platform and its usage for phenology observations. A. Grosso, D. Anghinolfi, C. Vecchiola and A. Boccalatte describe ExpertGrid, a software infrastructure for the development of decision support tools to train crisis managers. L. Caviglione, M. Coccoli, and E. Punta discuss the issues related with the adoption of virtual laboratories for education in schools and universities, and for the training of professionals, also by using examples in networked control systems.

The third part is dedicated to the grid infrastructure, the basis on which e-Science applications build upon. A. Merlo, A. Corana, V. Gianuzzi and A. Clematis address the issue of Quality of Service (QoS), and present a high-level simulator to evaluate QoS-specific tools. D. Adami, C. Callegari, S. Giordano and M. Pagano propose a distributed resource allocation algorithm that is aware not only of grid resources, but also of the network status and of the latencies to reach them, thereby allowing to optimize the choice on the basis of multiple criteria. A. Monari, A. Scemama and M. Caffarel discuss a grid implementation of a massively parallel Quantum Monte Carlo (QMC) code on the EGEE grid architecture, and analyze its performance. B. Strug, I. Ryszka, E. Grabska and G. Ślusarczyk introduce a layered graph approach for the generation of a grid structure and its parameters. T. Hopp, M. Hardt, N. Ruitter, M. Zapf, G. Borges, I. Campos and J. Marco present an interactive approach that allows Application Program Interface (API) style communication with grid resources and execution of parallel applications using the Message Passing Interface (MPI) paradigm. M. Sutter, V. Hartmann, M. Götter, J. van Wezel, A. Trunov, T. Jejkal and R. Stotzka examine access technologies useable for the development of a Large Scale Data Facility to meet the requirements of various scientific projects and describe a first implementation of a uniform user

interface. D. Król, R. Słota, B. Kryza, D. Nikolow, W. Funika and J. Kitowski introduce a novel approach to data management within the Grid environment based on user-defined storage policies, and discuss its implementation in the PL-GRID infrastructure. M. Brescia, S. Cavuoti, R. D’Abrusco, O. Laurino and G. Longo present a distributed web-based data mining infrastructure specialized on Massive Data Sets exploration with Soft Computing methods. Finally, the contribution by D. Adami, A. Chepstov, F. Davoli, M. Lanati, I. Liabotis, S. Vignola, S. Zappatore and A. Zafeiropoulos describes the network monitoring platform deployed in support of grid applications within the DORII project, and presents the measurement results of two selected applications.

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Franco Davoli
Marcin Lawenda
Norbert Meyer
Roberto Pugliese
Jan Węglarz
Sandro Zappatore



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Davoli, F.; Lawenda, M.; Meyer, N.; Pugliese, R.; Węglarz,
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