Introduction

Current research and technological developments in Grid Computing epitomize the convergence achieved between different areas of Computer Science research, such as High-Performance Computing, Parallel and Distributed Systems, and Networking. This convergence has been pushed forward by earlier progress in metacomputing and middleware, by the tremendous success of the Web and the recent emergence of Web services, and by the advent of universal network connectivity, supported by high-bandwidth links and wireless networks.

On-going research efforts in Grid Computing focus on turning the Grid into an infrastructure supporting the "flexible, secure, and coordinated resource sharing" in the context of multi-institutional Virtual Organizations. The goal is to turn the Grid into the point of convergence between eScience and eBusiness, offering a wide range of services that make use of diverse resources (computational, storage, networking, sensors, software, data archives) and provide solutions to complex problems of science, business, industry, and society. To this end, the Computer Science research community needs to address a large number of challenges related to information and knowledge management, resource management, programming models and tools, alternative architectures and system designs, security, protocols, standards, etc. Examining the state of the art in research and technology developments in Grid Computing has been the aim of the 2nd European Across Grids Conference, held in Nicosia, Cyprus, on January 2004. The Conference was organized by CrossGrid, a European Union funded project on Grid research, GRIDSTART, the EU-sponsored initiative for consolidating technical advances in grids in Europe, and the University of Cyprus. The Conference hosted 6 invited, 26 regular, 8 short, and 13 poster presentations from the European Union, the United States of America, and East Asia. Out of these presentations and with the help of the Conference's program committee and session chairs, we selected six papers whose authors were invited to submit extended versions of their work for this special issue of the Scientific Programming journal.

The selected papers cover a wide area of topics in Grid Computing research, from scheduling and data grids to monitoring and semantics, providing a good overview of current work and priorities. In particular, the paper by Miles, Papay, Payne, Luck and Moreau describes work towards the realization of the *Semantic Grid*, which will enable the use of semantic-based criteria for service descriptions and brokerage. Plale's paper introduces a new model for connecting live *data streams* to the Grid; the author defines a Grid service architecture for data-stream resources, based on efforts in the Global Grid Forum, and discusses open research issues.

The paper by Truong and Fahringer describes the design and implementation of the SCALEA-G system, which unifies the *monitoring* of Grid resources with application monitoring. SCALEA-G's design and implementation are compliant to the Open Grid Services Architecture and the Grid Monitoring Architecture of the Global Grid Forum. Application monitoring is the focus of the paper by Balis, Bubak, Funika, Wismuller, Radecki, Szepieniec, Arodz and Kurdziel; the authors present OCM-G, a Grid-enabled distributed monitoring system, and G-PM, its associated performance evaluation tool. The paper provides a presentation of the tool capabilities and shows how OCM-G and G-PM can be used to debug the performance of a blood-flow simulation deployed on the Grid.

The last two papers, examine aspects of *rescheduling* Grid jobs. The paper authored by Sakellariou and Zhao, introduces and evaluates a low-cost rescheduling algorithm applicable for workflow-type of applications. Rescheduling in the presence of migration is also the focus of the paper by Kurowski, Ludwiczak, Nabrzyski, Oleksiak, and Pukacki. The authors propose two alternative rescheduling policies in the context of the GridLab Resource Management System (GRMS) and evaluate their effectiveness with respect to application performance and resource utilization.

Marios D. Dikaiakos
University of Cyprus