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Unconventional Programming Paradigms

International Workshop UPP 2004
Le Mont Saint Michel, France, September 15-17, 2004
Revised Selected and Invited Papers



Springer

Volume Editors

Jean-Pierre Banâtre
Université de Rennes I and INRIA/IRISA
Campus de Beaulieu, 35042 Rennes Cedex, France
E-mail: jpbanatre@inria.fr

Pascal Fradet
INRIA Rhône-Alpes
655 av. de l'Europe, 38330 Montbonnot, France
E-mail: Pascal.Fradet@inria.fr

Jean-Louis Giavitto
LaMI/Université d'Évry Val d'Essonne
Tour Evry 2, GENOPOLE, 523 Place des terrasses de l'agora, 91000 Évry, France
E-mail: giavitto@lami.univ-evry.fr

Olivier Michel
LaMI/Université d'Évry Val d'Essonne
Cours Monseigneur Romero, 91025 Evry Cedex, France
E-mail: michel@lami.univ-evry.fr

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Preface

Nowadays, developers have to face the proliferation of hardware and software environments, the increasing demands of the users, the growing number of programs and the sharing of information, competences and services thanks to the generalization of data bases and communication networks. A program is no more a monolithic entity conceived, produced and finalized before being used. A program is now seen as an open and adaptive frame, which, for example, can dynamically incorporate services not foreseen by the initial designer. These new needs call for new control structures and program interactions.

Unconventional approaches to programming have long been developed in various niches and constitute a reservoir of alternative ways to face the programming languages crisis. New models of programming (e.g., bio-inspired computing, artificial chemistry, amorphous computing, ...) are also currently experiencing a renewed period of growth as they face specific needs and new application domains. These approaches provide new abstractions and notations or develop new ways of interacting with programs. They are implemented by embedding new sophisticated data structures in a classical programming model (API), by extending an existing language with new constructs (to handle concurrency, exceptions, open environments, ...), by conceiving new software life cycles and program executions (aspect weaving, run-time compilation) or by relying on an entire new paradigm to specify a computation. They are inspired by theoretical considerations (e.g., topological, algebraic or logical foundations), driven by the domain at hand (domain-specific languages like PostScript, musical notation, animation, signal processing, etc.) or by metaphors taken from various areas (quantum computing, computing with molecules, information processing in biological tissues, problem solving from nature, ethological and social modeling). The practical applications of these new programming paradigms and languages prompt research into the expressivity, semantics and implementation of programming languages and systems architectures, as well as into the algorithmic complexity and optimization of programs.

The purpose of the workshop was to bring together researchers from the various communities working on wild and crazy ideas in programming languages to present their results, to foster fertilization between theory and practice, and to favor the dissemination and growth of new programming paradigms.

The contributions were split up into five tracks:

- Chemical Computing
- Amorphous Computing
- Bio-inspired Computing
- Autonomic Computing
- Generative Programming

This workshop kept the same informal style of a previous successful meeting held in 1991 in Le Mont Saint Michel under the title *New Directions in High-Level Parallel Programming Languages*. Each track was handled by a well-known researcher in the concerned area. Each track leader was in charge of inviting other researchers on his topic and organizing his session. These track leaders plus the four promoters of this initiative constituted the Program Committee of the workshop (see below). This volume gathers extended and revised versions of most of the papers presented at the workshop, including the invited presentation given by Philippe Jorrand on quantum computing.

On the practical side, several persons contributed to the success of the workshop. We offer our sincere thanks to all of them. We are particularly grateful to Edith Corre and Elisabeth Lebret of IRISA and to Rémi Ronchaud from ERCIM who were very efficient and professional in the organization. Finally, we address our sincere acknowledgments to all the participants who, beside the high quality of their scientific contribution, made the workshop a friendly and unique event.

April 2005

Jean-Pierre Banâtre
Pascal Fradet
Jean-Louis Giavitto
Olivier Michel

Organization

The workshop was jointly supported by the European Commission's Information Society Technologies Programme, Future and Emerging Technologies Activity, and the US National Science Foundation, Directorate for Computer and Information Science and Engineering. This workshop is part of a series of strategic workshops that identify key research challenges and opportunities in information technology. It was organized by ERCIM (European Research Consortium for Informatics and Mathematics) and received additional support from INRIA, Université d'Evry Val d'Essonne, Université de Rennes 1, and Microsoft Research.

Program Committee

Organizing Committee

Jean-Pierre Banâtre	Université de Rennes 1, and INRIA/IRISA, France
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Olivier Michel	LaMI/Université d'Evry Val d'Essonne, France

Track Leaders

Pierre Cointe	Ecole des Mines de Nantes, France <i>Generative Programming</i>
Daniel Coore	University of West Indies, Jamaica <i>Amorphous Computing</i>
Peter Dittrich	Friedrich Schiller University Jena, Germany <i>Chemical Computing</i>
Manish Parashar	Rutgers, The State University of New Jersey, USA <i>Autonomic Computing</i>
Gheorghe Păun	Institute of Mathematics of the Romanian Academy, Romania <i>Bio-inspired Computing</i>

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