

## Preface

This volume collects a set of papers accompanying the lectures of the fifth edition of the *International School on Formal Methods for the Design of Computer, Communication and Software Systems (SFM)*.

This series of schools addresses the use of formal methods in computer science as a prominent approach to the rigorous design of computer, communication and software systems. The main aim of the SFM series is to offer a good spectrum of current research in foundations as well as applications of formal methods, which can be of help for graduate students and young researchers who intend to approach the field.

SFM-05:Moby was devoted to formal methods and tools for the design of mobile systems and mobile communication infrastructures. This volume is organized into four parts related to mobile computing, which cover models and languages, scalability and performance, dynamic power management, and middleware support. Each part is composed of two papers.

The opening paper by Montanari and Pistore gives an overview of history-dependent automata, an extension of ordinary automata that overcomes their limitations in dealing with named calculi. In particular, the authors show that history-dependent automata allow for a compact representation of  $\pi$ -calculus processes, which is suitable both for theoretical investigations and for the verification of models of agents and code mobility. Bettini and De Nicola's paper presents X-KLAIM, an experimental programming language specifically designed to develop distributed systems composed of several components interacting through multiple distributed tuple spaces and mobile code. Through a series of examples, the authors show that many mobile code programming paradigms can be naturally implemented by means of the considered language, which combines explicit localities as first-class data with coordination primitives.

Gerla, Chen, Lee, Zhou, Chen, Yang, and Das provide an introduction to MANET, a mobile ad hoc wireless network established for a special, often extemporaneous service customized to applications. After emphasizing the self-configurability, mobility and scalability attributes of MANET, the authors concentrate on mobility and show its impact on protocols and operations. Grassi presents an overview of the performance issues raised by the high variability and heterogeneity of mobile systems, together with some approaches to the careful planning of the performance validation of such systems. The author then focuses on the definition of model-based transformations from design-oriented models to analysis-oriented models that comprise non-functional attributes.

Acquaviva, Aldini, Bernardo, Bogliolo, Bontà, and Lattanzi illustrate in their paper a methodology for predicting the impact on the overall system functionality and efficiency of the introduction of a dynamic power management policy within a battery-powered mobile device. The predictive methodology relies on a combination of formal description techniques, noninterference analysis, and

performance evaluation to properly tune the dynamic power manager operation rates. The methodology is then used by Acquaviva, Bontà, and Lattanzi in the framework of the IEEE 802.11 standard, in order to provide a power-accurate model of wireless network interface card that allows the energy/performance trade-off to be studied as a function of traffic patterns imposed by the applications.

Lattanzi, Acquaviva, and Bogliolo address the limited storage memory of wireless mobile terminals through the concept of network virtual memory. The authors first compare performance and energy of network swapping with those of local swapping on microdrives and flash memories, then present an infrastructure providing efficient remote memory access to mobile terminals. The closing paper by Corradini and Merelli reports on Hermes, a middleware system for the design and the execution of activity-based applications in distributed environments. While middleware for mobile computing has typically been developed to support physical and logical mobility, Hermes provides an integrated environment where application domain experts can focus on designing the activity workflow.

We believe that this book offers a quite comprehensive view of what has been done and what is going on worldwide at present in the field of formal methods for mobile computing. We wish to thank all the lecturers and all the participants for a lively and fruitful school. We also wish to thank the whole staff of the University Residential Center of Bertinoro (Italy) for the organizational and administrative support, as well as the Regione Marche, which sponsored the school within the CIPE 36/2002 framework.

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Marco Bernardo and Alessandro Bogliolo  
SFM-05:Moby Directors

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Lorenzo Bettini and Rocco De Nicola

# Dealing with Node Mobility in Ad Hoc Wireless Network

Mario Gerla, Ling-Jyh Chen, Yeng-Zhong Lee, Biao Zhou, Jiwei Chen, Guang Yang, Shirshanka Das

# Performance Analysis of Mobile Systems

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# **A Methodology Based on Formal Methods for Predicting the Impact of Dynamic Power Management**

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# **Dynamic Power Management Strategies Within the IEEE 802.11 Standard**

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