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Atomicity in System Design and Execution (Proceedings of Dagstuhl-Seminar 04181) J.UCS Special Issue

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The present volume contains a selection of papers arising from a five-day workshop on "Atomicity in System Design and Execution" that took place in Schloss Dagstuhl in Germany in April 2004 and was attended by 32 people from various research areas. This workshop was organised by Cliff Jones and Alexander Romanovsky of Newcastle University, Dave Lomet of Microsoft Research Redmond and Gerhard Weikum of Saarbruecken University.

The concept of atomicity is widely used as a means of abstracting complex concurrent computations into simpler ones which exhibit less concurrency. However, the interpretations and roles of the atomicity concept(s) vary substantially across different research communities. For example, the emphasis in database systems is on algorithms and implementation techniques for atomic transactions, whereas in dependable systems and formal methods atomicity is viewed as an intentionally imposed (or sometimes postulated) property of system components to simplify designs and increase dependability. On the other hand, all communities agree on the importance of gaining a deeper understanding of composite and relaxed notions of atomicity. The Dagstuhl workshop brought together practitioners from a number of different communities using atomicity — database and transaction processing systems, fault tolerance and dependable systems, formal methods for system design and correctness reasoning, and hardware architecture and programming languages — in order to explore the implications of their different concepts of atomicity, to try to find common ground and to formulate a "manifesto" for future research in this area. The hope of collaborations of this type is that it will eventually be possible to unify the different scientific viewpoints into more coherent foundations, system-development principles, design methodologies and usage guidelines.

During the week in Dagstuhl, a variety of talks and presentations were given on recent results, and a number of very productive discussions were held on areas in which further work is needed in order to advance and improve the use of the atomicity concept. The first paper in this volume — "The Atomic Manifesto" — constitutes one of the main fruits of those discussions and details the current state of research and challenges which lie ahead. Of the remaining papers, two contain more detailed blueprints for further research, while the others relate to results presented at Dagstuhl. We hope that these papers give a flavour of the breadth of interests represented at the workshop and of the great wealth of research challenges which face us in the area of atomicity, and conclude by looking forward to the second Dagstuhl workshop on atomicity to be held in March 2006.

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(Newcastle, April 22, 2005)