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Electronic Notes in Theoretical Computer Science

Electronic Notes in Theoretical Computer Science 141 (2005) 1–4

www.elsevier.com/locate/entcs

Preface

Interaction is a pervasive aspect of today's computation. Contemporary approaches to computational models, artificial intelligence, software engineering, programming languages, and networking are all interactive. However, a satisfactory unifying foundational framework for interactive computation, analogous to what Turing machines and the lambda-calculus provide for algorithms, is still lacking.

The *Workshop on the Foundations of Interactive Computation* (FInCo 2005), held on Saturday, 9 April 2005, in Edinburgh, Scotland, provided the first opportunity for researchers to exchange ideas on the topic of interaction, with the goal of moving towards a unified conceptual and formal framework for modeling interaction that takes into account its many different aspects and viewpoints.

Our day-long program included an invited talk, a panel, and multiple papers, all of which went through a full referee process. The program was divided into four sessions as follows: *Calculi for Interaction*, *Interaction and Logic*, *Interaction and Design*, and *Research Directions*. This volume contains the revised versions of a selection of papers presented at FInCo 2005, as well as a summary of the workshop panel.

On Interaction

Since its beginnings in the 1950s, the practice of computing has changed unrecognizably; computation has become *interactive*. Rather than processing data in batch mode, we expect our computers and other smart devices to act as agents that interact with us and with each other, and perform services on our behalf.

The paradigm shift from algorithmic, or function-based, computation to interactive computation captures the technology shift from mainframes to net-

1571-0661
doi:10.1016/j.entcs.2005.05.013

works, wireless devices, and intelligent appliances, from number crunching to embedded systems and graphical user interfaces, and from procedure-oriented to agent-based and distributed computation. The following characteristics distinguish this new, interactive notion of computation:

Computational Problem: A computational problem entails performing a task or providing a service, rather than algorithmically producing an answer to a question.

Observable Behavior: A computing component is now modeled not as a functional transformation from input to output, but rather in terms of an observable behavior consisting of interaction steps. For example, interactions may be interleaved inputs and outputs modeled by dynamic streams; later input values may depend on earlier output values and vice versa.

Environments: The world or environment of the computation is part of the model, playing an active part in the computation by dynamically supplying the computational system, or agent, with the inputs, and consuming the output values from the system. The environment cannot be assumed to be static, or even effectively computable; for example, it may include humans or other elements of the real world.

Concurrency: Computation is concurrent; the computing agent computes in parallel with its environment and with other agents that may be in it.

The interaction paradigm provides a new conceptualization of computational phenomena that emphasizes interaction rather than algorithms. The recognition that these characteristics are inherently outside the traditional conceptualization of computation is the basis for this new paradigm for computing, built around the unifying concept of interaction. Concurrent, distributed, reactive, embedded, component-oriented, agent-oriented and service-oriented systems all exploit interaction as a fundamental paradigm. However, a satisfactory unifying foundational framework for interactive computation, analogous to what Turing machines and the lambda-calculus provide for algorithms, is still lacking.

Workshop Goals

Peter Wegner's claim (CACM, May 1997) that "interaction is more powerful than algorithms" challenges our fundamental assumptions about the nature of computation and the notion of computational problems, reinterpreting the Church-Turing thesis without attacking it directly. This claim is an open invitation to researchers to develop models, tools, and methods that can lend credence to it. Since then, pervasive/ubiquitous computing – which epito-

mizes interaction – has been proposed as the leading computing paradigm for the 21st century. Now that many models capturing different aspects of interaction have been introduced, including interaction automata, dynamic logic, process algebras, and co-algebraic approaches, we believe it is time for researchers involved in interactive systems to join their efforts to develop a common framework.

This workshop provided an opportunity for direct interaction among researchers in this new area, with the following ultimate goals:

- To understand the fundamental issues underlying the paradigm of interactive computation;
- To develop a road map for the design space of models of interaction;
- To establish a common language- and domain-independent framework for a theory of interactive computation;
- To identify the principles of effective and reliable engineering of interactive systems;
- To stimulate further practical and theoretical research related to interaction, towards bridging the theory and practice of interactive computation.

Workshop Organization

The steering committee for FInCo 2005 consisted of:

Dina Goldin, University of Connecticut, USA;
Mirko Viroli, Universita degli Studi di Bologna, Italy;
Peter Wegner, Brown University, USA.

In the process, the organizers had to wear multiple hats. Dina Goldin served as publicity director and webmaster; Mirko Viroli served as program chair and ENTCS/AgentLink liaison; Peter Wegner served as special events organizer for the invited talk and the panel. And we could not do it without the help of our program committee:

Gul Agha, UIUC, USA
Luca de Alfaro, UC Santa Cruz, USA
Farhad Arbab, CWI & Leiden U., the Netherlands
Antonio Brogi, U. Pisa, Italy
Manfred Broy, TU Munchen, Germany
Giorgio Delzanno, U. Genova, Italy
Jon Doyle, N. Carolina State U., USA
Ramesh Jain, Georgia Tech, USA
R. Prescott Loui, Washington U. in St. Louis, USA

Peter McBurney, U. Liverpool, UK
John-Jules Meyer, Utrecht U., the Netherlands
Andrea Omicini, U. Bologna/Cesena, Italy
Catuscia Palamidessi, INRIA, France
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Bernhard Thalheim, U. Kiel, Germany
Jan van Leeuwen, Utrecht U., the Netherlands
Rob van Glabbeek, NICTA, Australia
Mike Wooldridge, U. Liverpool, UK

We want to thank all the Program Committee members, the authors, the speaker and the panelists, for having played their invaluable role in making the FInCo 2005 workshop a success. We also want to thank AgentLink for their support of this event.

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