Igor Walukiewicz (Ed.)

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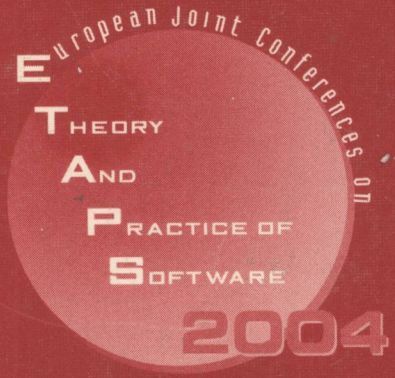

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Foreword

ETAPS 2004 was the seventh instance of the European Joint Conferences on Theory and Practice of Software. ETAPS is an annual federated conference that was established in 1998 by combining a number of existing and new conferences. This year it comprised five conferences (FOSSACS, FASE, ESOP, CC, TACAS), 23 satellite workshops, 1 tutorial, and 7 invited lectures (not including those that are specific to the satellite events).

The events that comprise ETAPS address various aspects of the system development process, including specification, design, implementation, analysis and improvement. The languages, methodologies and tools that support these activities are all well within its scope. Different blends of theory and practice are represented, with an inclination towards theory with a practical motivation on the one hand and soundly based practice on the other. Many of the issues involved in software design apply to systems in general, including hardware systems, and the emphasis on software is not intended to be exclusive.

ETAPS is a loose confederation in which each event retains its own identity, with a separate program committee and independent proceedings. Its format is open-ended, allowing it to grow and evolve as time goes by. Contributed talks and system demonstrations are in synchronized parallel sessions, with invited lectures in plenary sessions. Two of the invited lectures are reserved for "unifying" talks on topics of interest to the whole range of ETAPS attendees. The aim of cramming all this activity into a single one-week meeting is to create a strong magnet for academic and industrial researchers working on topics within its scope, giving them the opportunity to learn about research in related areas, and thereby to foster new and existing links between work in areas that were formerly addressed in separate meetings.

ETAPS 2004 was organized by the LSI Department of the Catalonia Technical University (UPC), in cooperation with:

European Association for Theoretical Computer Science (EATCS)
European Association for Programming Languages and Systems (EAPLS)
European Association of Software Science and Technology (EASST)
ACM SIGACT, SIGSOFT and SIGPLAN

The organizing team comprised

Jordi Cortadella (Satellite Events), Nikos Mylonakis, Robert Nieuwenhuis, Fernando Orejas (Chair), Edelmira Pasarella, Sonia Perez, Elvira Pino, Albert Rubio

and had the assistance of TILESA OPC.
ETAPS 2004 received generous sponsorship from:

UPC, Spanish Ministry of Science and Technology (MCYT), Catalan Department for Universities, Research and Information Society (DURSI), IBM, Intel.

Overall planning for ETAPS conferences is the responsibility of its Steering Committee, whose current membership is:

Ratislav Bodik (Berkeley), Maura Cerioli (Genoa), Evelyn Duesterwald (IBM, Yorktown Heights), Hartmut Ehrig (Berlin), José Fiadeiro (Leicester), Marie-Claude Gaudel (Paris), Andy Gordon (Microsoft Research, Cambridge), Roberto Gorrieri (Bologna), Nicolas Halbwachs (Grenoble), Görel Hedin (Lund), Kurt Jensen (Aarhus), Paul Klint (Amsterdam), Tiziana Margaria (Dortmund), Ugo Montanari (Pisa), Hanne Riis Nielson (Copenhagen), Fernando Orejas (Barcelona), Mauro Pezzè (Milan), Andreas Podelski (Saarbrücken), Mooly Sagiv (Tel Aviv), Don Sannella (Edinburgh), Vladimiro Sassone (Sussex), David Schmidt (Kansas), Bernhard Steffen (Dortmund), Perdita Stevens (Edinburgh), Andrzej Tarlecki (Warsaw), Igor Walukiewicz (Bordeaux), Michel Wermelinger (Lisbon)

I would like to express my sincere gratitude to all of these people and organizations, the program committee chairs and PC members of the ETAPS conferences, the organizers of the satellite events, the speakers themselves, and finally Springer-Verlag for agreeing to publish the ETAPS proceedings. This year, the number of submissions approached 600, making acceptance rates fall to 25%. I congratulate the authors who made it into the final program! I hope that all the other authors still found a way of participating in this exciting event and I hope you will continue submitting.

In 2005, ETAPS will be organized by Don Sannella in Edinburgh. You will be welcomed by another "local": my successor as ETAPS Steering Committee Chair – Perdita Stevens. My wish is that she will enjoy coordinating the next three editions of ETAPS as much as I have. It is not an easy job, in spite of what Don assured me when I succeeded him! But it is definitely a very rewarding one. One cannot help but feel proud of seeing submission and participation records being broken one year after the other, and that the technical program reached the levels of quality that we have been witnessing. At the same time, interacting with the organizers has been a particularly rich experience. Having organized the very first edition of ETAPS in Lisbon in 1998, I knew what they were going through, and I can tell you that each of them put his/her heart, soul, and an incredible amount of effort into the organization. The result, as we all know, was brilliant on all counts! Therefore, my last words are to thank Susanne Graf (2002), Andrzej Tarlecki and Paweł Urzyczyn (2003), and Fernando Orejas (2004) for the privilege of having worked with them.

Leicester, January 2004

José Luiz Fiadeiro
ETAPS Steering Committee Chair

Preface

This volume contains the proceedings of the international conference *Foundations of Software Science and Computation Structures* (FOSSACS 2004), held in Barcelona, Spain, 30 March–2 April, 2004. FOSSACS is an event of the *Joint Conferences on Theory and Practice of Software* (ETAPS). The previous six FOSSACS conferences took place in Lisbon (1998), Amsterdam (1999), Berlin (2000), Genoa (2001), Grenoble (2002) and Warsaw (2003).

FOSSACS presents original papers on foundational research with clear significance to software science. The Program Committee invited papers on theories and methods to support the analysis, integration, synthesis, transformation, and verification of programs and software systems. In particular, we have identified the following topics: algebraic models; automata and language theory; behavioral equivalences; categorical models; computation processes over discrete and continuous data; infinite state systems; computation structures; logics of programs; modal, spatial, and temporal logics; models of concurrent, reactive, distributed, and mobile systems; process algebras and calculi; semantics of programming languages; software specification and refinement; type systems and type theory.

FOSSACS 2004 attracted over 130 submissions from which the program committee selected 34, the maximum that could fit into the available time. Unfortunately many good papers had to be turned away. This proceedings contains additionally two invited contributions: by the FOSSACS 2004 invited speaker Hubert Comon-Lundh, and by the ETAPS 2004 unifying speaker Robin Milner.

I thank all the authors for submitting their papers to FOSSACS. I am grateful to the reviewers who contributed nearly 400 informed and detailed reports. I sincerely thank the members of the Program Committee for very active participation in the electronic meeting and for coping with the additional challenges arising from the substantial increase in the number of submissions.

To administer the submission and evaluation process, we relied on a fine Web-based tool provided by METAFrame Technologies, Dortmund; thanks to Martin Karusseit and Tiziana Margaria of METAFrame for their timely support. Finally, thanks are due to the ETAPS 2004 Organizing Committee chaired by Fernando Orejas and to the ETAPS Steering Committee chaired by José Luiz Fiadeiro for their efficient coordination of all the activities leading up to FOSSACS 2004.

Bordeaux, January 2004 Igor Walukiewicz

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Invited Contributions

Contributed Papers

Intruder Theories (Ongoing Work)

Hubert Comon-Lundh*

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1 Context

The specification of security protocols usually comes in two parts:

- A finite number of processes called *roles*, each of which is parametrized by agent identities and consists of a sequence of name generation, the *nonces* and a finite sequence of rules $u \Rightarrow v$, which should be read as "upon receiving a message matching u, send the corresponding message v."
- A description of intruder capabilities, sometimes given as a proof system, which we call hereafter the *offline intruder theory*.

The roles can be replicated and instanciated by agent names any number of times. Each such instance is called a *session*. The roles and the offline intruder theory define a transition system whose states are, for each agent name a local state and a set of messages called the *intruder knowledge*. The peculiarity of security protocols is the synchronization mechanism: the only effect of sending a message m is to increase the intruder knowledge with m, while any message that can be forged, i.e. deduced, by the intruder using his knowledge and the offline theory can be received. This models the fact that the intruder controls the public network: he can intercept messages, forge new messages and send them through the network. In addition, dishonest (or compromised) agents communicate all their private data, increasing the intruder knowledge.

As far as confidentiality is concerned, there is an *attack* on the security protocol if there is a reachable state in which the intruder knowledge contains a message which is supposed to remain a secret shared by honest agents.

One of the most well-known offline intruder theory is now called the *Dolev-Yao model*, and relies on the *perfect cryptography assumption*, which roughly states that nothing can be learned on a plain text from its encrypted version, without knowing the decryption key. The verification of such protocols is undecidable in this model. This remains undecidable when there is no name generation (see e.g. [3]) or when the size of messages is bounded [6]. It becomes decidable (and co-NP-complete) when the number of sessions is bounded [10].

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