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## **IFIP – The International Federation for Information Processing**

IFIP was founded in 1960 under the auspices of UNESCO, following the First World Computer Congress held in Paris the previous year. An umbrella organization for societies working in information processing, IFIP's aim is two-fold: to support information processing within its member countries and to encourage technology transfer to developing nations. As its mission statement clearly states,

IFIP's mission is to be the leading, truly international, apolitical organization which encourages and assists in the development, exploitation and application of information technology for the benefit of all people.

IFIP is a non-profitmaking organization, run almost solely by 2500 volunteers. It operates through a number of technical committees, which organize events and publications. IFIP's events range from an international congress to local seminars, but the most important are:

- The IFIP World Computer Congress, held every second year;
- Open conferences;
- Working conferences.

The flagship event is the IFIP World Computer Congress, at which both invited and contributed papers are presented. Contributed papers are rigorously refereed and the rejection rate is high.

As with the Congress, participation in the open conferences is open to all and papers may be invited or submitted. Again, submitted papers are stringently refereed.

The working conferences are structured differently. They are usually run by a working group and attendance is small and by invitation only. Their purpose is to create an atmosphere conducive to innovation and development. Refereeing is less rigorous and papers are subjected to extensive group discussion.

Publications arising from IFIP events vary. The papers presented at the IFIP World Computer Congress and at open conferences are published as conference proceedings, while the results of the working conferences are often published as collections of selected and edited papers.

Any national society whose primary activity is in information may apply to become a full member of IFIP, although full membership is restricted to one society per country. Full members are entitled to vote at the annual General Assembly. National societies preferring a less committed involvement may apply for associate or corresponding membership. Associate members enjoy the same benefits as full members, but without voting rights. Corresponding members are not represented in IFIP bodies. Affiliated membership is open to non-national societies, and individual and honorary membership schemes are also offered.

Cristian S. Calude Vladimiro Sassone (Eds.)

# Theoretical Computer Science

6th IFIP TC 1/WG 2.2 International Conference  
TCS 2010, Held as Part of WCC 2010  
Brisbane, Australia, September 20-23, 2010  
Proceedings

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# **IFIP World Computer Congress 2010 (WCC 2010)**

## **Message from the Chairs**

Every two years, the International Federation for Information Processing (IFIP) hosts a major event which showcases the scientific endeavors of its over one hundred technical committees and working groups. On the occasion of IFIP's 50th anniversary, 2010 saw the 21st IFIP World Computer Congress (WCC 2010) take place in Australia for the third time, at the Brisbane Convention and Exhibition Centre, Brisbane, Queensland, September 20–23, 2010.

The congress was hosted by the Australian Computer Society, ACS. It was run as a federation of co-located conferences offered by the different IFIP technical committees, working groups and special interest groups, under the coordination of the International Program Committee.

The event was larger than ever before, consisting of 17 parallel conferences, focusing on topics ranging from artificial intelligence to entertainment computing, human choice and computers, security, networks of the future and theoretical computer science. The conference History of Computing was a valuable contribution to IFIP's 50th anniversary, as it specifically addressed IT developments during those years. The conference e-Health was organized jointly with the International Medical Informatics Association (IMIA), which evolved from IFIP Technical Committee TC-4 "Medical Informatics".

Some of these were established conferences that run at regular intervals, e.g., annually, and some represented new, groundbreaking areas of computing. Each conference had a call for papers, an International Program Committee of experts and a thorough peer reviewing process of full papers. The congress received 642 papers for the 17 conferences, and selected 319 from those, representing an acceptance rate of 49.69% (averaged over all conferences). To support interoperation between events, conferences were grouped into 8 areas: Deliver IT, Govern IT, Learn IT, Play IT, Sustain IT, Treat IT, Trust IT, and Value IT.

This volume is one of 13 volumes associated with the 17 scientific conferences. Each volume covers a specific topic and separately or together they form a valuable record of the state of computing research in the world in 2010. Each volume was prepared for publication in the Springer IFIP Advances in Information and Communication Technology series by the conference's volume editors. The overall Publications Chair for all volumes published for this congress is Mike Hinchey.

For full details of the World Computer Congress, please refer to the webpage at <http://www.ifip.org>.

June 2010            Augusto Casaca, Portugal, Chair, International Program Committee  
Phillip Nyssen, Australia, Co-chair, International Program Committee  
Nick Tate, Australia, Chair, Organizing Committee  
Mike Hinchey, Ireland, Publications Chair  
Klaus Brunnstein, Germany, General Congress Chair

# Foreword

This volume contains the invited and regular papers presented at TCS 2010, the 6th IFIP International Conference on Theoretical Computer Science, organised by IFIP Technical Committee 1 (Foundations of Computer Science) and IFIP WG 2.2 (Formal Descriptions of Programming Concepts) in association with SIGACT and EATCS. TCS 2010 was part of the World Computer Congress held in Brisbane, Australia, during September 20–23, 2010 (<http://www.wcc2010.com>).

TCS 2010 is composed of two main areas: (A) Algorithms, Complexity and Models of Computation, and (B) Logic, Semantics, Specification and Verification.

The selection process led to the acceptance of 23 papers out of 39 submissions, each of which was reviewed by three Programme Committee members. The Programme Committee discussion was held electronically using EasyChair.

The invited speakers at TCS 2010 are:

Rob van Glabbeek (NICTA, Australia)

Bart Jacobs (Nijmegen, The Netherlands)

Catuscia Palamidessi (INRIA and LIX, Paris, France)

Sabina Rossi (Venice, Italy)

James Harland (Australia) and Barry Jay (Australia) acted as TCS 2010 Chairs.

We take this occasion to thank the members of the Programme Committees and the external reviewers for the professional and timely work; the conference Chairs for their support; the invited speakers for their scholarly contribution; and of course the authors for submitting their work to TCS 2010.

May 2010

Cristian S. Calude  
Vladimiro Sassone

# Conference Organization

## Local Organization

James Harland RMIT University, Melbourne, Australia  
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