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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 also 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 about information processing 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.

Ralf Denzer Robert M. Argent
Gerald Schimak Jiří Hřebíček (Eds.)

Environmental Software Systems

Infrastructures, Services and Applications

11th IFIP WG 5.11 International Symposium, ISESS 2015
Melbourne, VIC, Australia, March 25-27, 2015
Proceedings



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Preface

20 Years ISESS Conference Series

The International Symposium on Environmental Software Systems (ISESS) is one of several overlapping forums discussing issues of environmental information systems, environmental decision support systems, environmental software systems, environmental informatics, eco-informatics or Enviromatics.

ISESS was founded by Ralf Denzer and Gerald Schimak in 1995, with support from the German Informatics Society Working Group 4.6 “Computer Science for Environmental Protection,” the International Federation for Information Processing (IFIP) Working Group 5.11 “Computers and Environment,” and our friend David Russell at the Pennsylvania State University (PSU) campus in Malvern, PA. The first symposium received great support from PSU and turned out to be one of many success stories.

Since then the symposium has been held in the following countries: the United States, Canada, Austria, New Zealand, Switzerland, Portugal, the Czech Republic, Italy; in several editions joint sessions were held in conjunction with the biennial meeting of iEMSS (International Environmental Modelling and Software Society). ISESS has been an IFIP event since 1995 and is organized by WG 5.11.

Since its establishment, WG 5.11 has been led by Giorgio Guariso (1991–1999), Ralf Denzer (1999–2005), and Dave Swayne (2005–2011). Since 2011 it has been in the hands of Gerald Schimak. Several individuals have served as vice-chairs and secretaries of the WG and many members of the WG have been active supporters for a long time without holding an official position.

For more than two decades, ISESS has brought together researchers dealing with environmental information challenges trying to provide solutions using forward-looking and leading-edge IT technology.

Previous ISESS Publications

During the past 20 years we have seen the publisher of IFIP change several times, and electronic publishing has become the most important medium for scientific publications. ISESS has followed this transition and therefore there is *not one place* where all ISESS proceedings can be accessed.

The first and second proceedings (ISESS 1995, ISESS 1997) were published by IFIP publisher Chapman & Hall:

- R. Denzer, D. Russell, G. Schimak (eds.), Environmental Software Systems, Chapman & Hall, 1996, ISBN 0-412-73730-2 (print).
- R. Denzer, D. A. Swayne, G. Schimak (eds.), Environmental Software Systems Vol. 2, Chapman & Hall, 1998, ISBN 0-412-81740-3 (print).

Then IFIP changed publisher and the third proceedings (ISESS 1999) were published by IFIP publisher Kluwer Academic Press:

- R. Denzer, D. A. Swayne, M. Purvis, G. Schimak (eds.), *Environmental Software Systems Vol. 3 - Environmental Information and Environmental Decision Support*, Kluwer Academic Publishers, 2000, ISBN 0-7923-7832-6 (print).

As print publications were becoming increasingly difficult (particularly their cost for smaller conferences), the fourth and fifth proceedings (ISESS 2001, ISESS 2003) were published by the organizers of the symposium under IFIP ISBN:

- D. A. Swayne, R. Denzer, G. Schimak (eds.), *Environmental Software Systems Vol. 4 - Environmental Information and Indicators*, International Federation for Information Processing, 2001, ISBN 3-901882-14-6 (print).
- G. Schimak, D. A. Swayne, N.T. Quinn, R. Denzer (eds.), *Environmental Software Systems Vol. 5 - Environmental Knowledge and Information Systems*, International Federation for Information Processing, 2003, ISBN 3-901882-16-2 (print).

The sixth and seventh proceedings (ISESS 2005, ISESS 2007) were published, but this time as electronic versions under IFIP ISBN:

- D. A. Swayne, T. Jakeman (eds.), *Environmental Software Systems, Vol. 6 - Environmental Risk Assessment Systems*, International Federation for Information Processing, 2005, ISBN 3-901882-21-9 (CDROM).
- D. A. Swayne, J. Hřebíček (eds.), *Environmental Software Systems, Vol. 7 - Dimensions of Environmental Informatics*, International Federation for Information Processing, 2007, ISBN 978-3-901882-22-7 (USB).

The eight proceedings (ISESS 2009) were again published electronically, but not under IFIP ISBN:

- D. A. Swayne, R. Soncini-Sessa (eds.), *Environmental Software Systems, Vol. 8*, 2009, University of Guelph, ISBN 978-3-901882-364 (USB).

Today, Springer is the official IFIP publisher and ISESS is published by Springer in *IFIP Advances in Information and Communication Technology (AICT)*¹. Proceedings number nine and ten were published as follows:

- J. Hřebíček, G. Schimak, R. Denzer (eds.), *Environmental Software Systems, Vol. 9 - Frameworks of eEnvironment*, IFIP AICT 359, 2011; ISBN 978-3-642-22285-6 (eBook), ISBN 978-3-642-22284-9 (hard cover), ISBN 978-3-642-26878-6 (soft cover).

¹ <http://www.springer.com/series/6102>

- J. Hřebíček, G. Schimak, M. Kubásek, A.E. Rizzoli (eds.), *Environmental Software Systems, Vol. 10 - Fostering Information Sharing*, IFIP AICT 413, 2013; ISBN 978-3-642-41151-9 (eBook); ISBN 978-3-642-41150-2 (hard cover)

Today Springer also has the rights of the early Kluwer and Chapman & Hall books (ISESS 1995, ISESS 1997, ISESS 1999), as Kluwer merged with Springer in 2004 and Chapman & Hall had been bought by Kluwer in 1997. Therefore all proceedings that were published by a publishing house are in one place today and can be accessed through Springer. They are available as hard cover and/or soft cover, as eBooks and (most of them) as individual articles.

The proceedings that were self-published under the copyright of IFIP are being made available at this conference in a new form. Specific ISESS sessions at IEMSS are available through the IEMSS web site². This book also contains an overview article that gives a complete history of what ISESS has contributed to the research community in the past 20 years³.

Down Under – Topics and Trends in 2015

In 2015 we welcomed ISESS to Australia for the first time. Australia has a significant history in environmental modelling and software systems, and has contributed strongly to ISESS and similar conferences (MODSIM, iEMSS, SIMMOD) since the 1970s.

The environmental software systems community in Australia is relatively small and diverse, although well connected, with a history of cooperative research across the environmental and technological domains, and also with a clear focus on practical applications to address the unique challenges of understanding and managing Australia's environment.

Historically, the Australian science presented at ISESS has focused on the land and water resources domain, including data management, modelling system development and application, and integrated assessment.

ISESS 2015 presented a significantly broader perspective of Australia's contributions to the international body of work in environmental software systems. This includes the high-level themes of computing infrastructures, high-performance computing, extracting value from big data, and utilizing the opportunities offered by linked data. Paper topics reflect key contributions of Australia's university sector, along with state and commonwealth research institutions, and include coverage of numerical prediction of weather and natural hazards, climate dynamics, emergency response, landscape hydrology and natural resources, and fundamental informatics.

² www.iemss.org

³ See: Ralf Denzer, Topics in Environmental Software Systems, in this book

Participants attending ISESS 2015 in Australia had a grand opportunity to strengthen and extend their research and application networks internationally, and we enjoyed welcoming participants to Melbourne.

ISESS 2015 Reviewing Standards

The ISESS conferences have always had a high standard of peer reviewing. For ISESS 2015, we published the complete reviewing data for the first time in this preface.

First of all, we decided to go back to requesting *extended abstracts of three to four pages*, a strategy which we had applied in many early conferences but not in recent years. There was a hot discussion as to whether this would negatively influence the number of submissions but it turned out that this was not the case. A total of *104 extended abstracts* were submitted for consideration. Due to some inconsistencies in communication and because many authors of previous years were used to one-page abstracts we also received one-page abstracts that we reviewed as well but that received even more scrutiny in the full-paper review than the extended abstracts of three to four pages. Of 102 extended abstracts, 64 (61.5%) were extended abstracts.

Each extended abstract was assigned for review by *three independent reviewers* in this first stage alone. In all, 21 submissions were rejected, which amounts to 20.2%. Of the remaining submissions, 29 submissions were categorized as *accept conditionally*, which meant that there were serious issues with either their focus or their quality but were borderline enough that they were given a chance to be submitted as a full paper. Where reviewing deadlines were not met, we requested additional reviews from other reviewers. Only in 13 cases (12.5 %) did we take decisions based on two reviews, but only if these results were very clear and the two reviews did not have a conflicting opinion.

For stage 2, the review of the full papers, *two independent reviewers* were assigned to each full paper, and in many cases at least one individual was a different person than the reviewers in the first stage, which means that many papers had a total of at least three reviewers. Finally, *61 papers were accepted* in the full paper review and published in this book after an editorial process, which amounts to a *total rejection rate of 41.3%*.

Acknowledgments

The editors are grateful to all authors for their valuable contribution to the conference, and to the members of the Program Committee for their time spent in reviewing more than 100 submissions.

Special thanks are given to representatives of the International Federation for Information Processing and Working Group 5.11 for their kind support of the organization of ISESS 2015. We thank all partners involved in the preparation of this conference and all sponsors for their valuable support.

We would like to thank the following institutions and partners particularly:

- The Australian Bureau of Meteorology (BOM), the conference host and organizer
- The Environmental Informatics Group (EIG)
- The Austrian Institute of Technology, its Department Safety & Security (AIT)
- The Masaryk University, its Institute of Biostatistics and Analyses
- The National Computational Infrastructure of Australia (NCI)
- The Czech Software First company and Mrs. Lucie Soukopová for their administrative support
- Miroslav Kubásek, Jiří Kalina, and Jakub Gregor for establishing and maintaining the conference website
- The Environmental Informatics Institute (EII) for their continued support

This time a very special thank you goes to IFIP, in particular Eduard Dundler, IFIP publications officer, and Erich Neuhold, IFIP TC5 chairman, for granting the rights to re-publish the 2001–2009 proceedings as second editions in an effort to make them publicly available. From now on, every article that has ever been published is either available at Springer / Springer Link (1995, 1997, 1999, 2011, 2013, 2015 and future books) or via the website www.enviromatics.org (2001, 2003, 2005, 2007, 2009). This concludes a major achievement.

January 2015

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