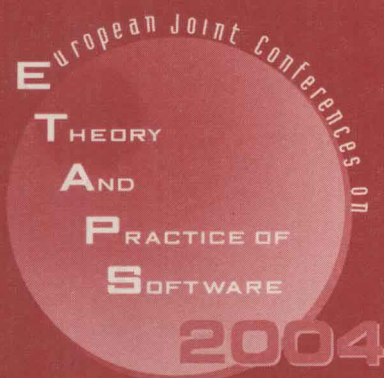


Michel Wermelinger
Tiziana Margaria-Steffen (Eds.)

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Fundamental Approaches to Software Engineering

7th International Conference, FASE 2004
Held as Part of the Joint European Conferences
on Theory and Practice of Software, ETAPS 2004
Barcelona, Spain, March/April 2004, Proceedings



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Michel Wermelinger
Universidade Nova de Lisboa
Departamento de Informática
2829-516 Caparica, Portugal
E-mail: mw@di.fct.unl.pt

Tiziana Margaria-Steffen
Universität Dortmund
Fachbereich Informatik, LS V, Geb. IV
44221 Dortmund
E-mail: tiziana@ls5.cs.uni-dortmund.de

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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 TILES A 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%. Congratulations to all 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 seventh FASE, International Conference on Fundamental Approaches to Software Engineering.

FASE 2004 took place in Barcelona, Spain, during March 29–31, 2004, as part of the 7th European Joint Conference on Theory and Practice of Software (ETAPS), whose aims, organization, and history are detailed in the separate foreword by José Luiz Fiadeiro.

It is the goal of FASE to bring together researchers and practitioners interested in the challenges in software engineering research and practice: new software structuring and scaling concepts are needed for heterogeneous software federations that consist of numerous autonomously developed, communicating and interoperating systems. In particular, FASE aims at creating an atmosphere that promotes a cross-fertilization of ideas between the different communities of software engineering and related disciplines. New quality assurance methods are needed to guarantee acceptable standards of increasingly complex software applications. Different component paradigms are under discussion now, a large number of specification and modeling language are proposed, and an increasing number of software development tools and environments are being made available to cope with the problems. At the same time research on new theories, concepts, and techniques is under way, which aims at the development of a precise and (mathematically) formal foundation.

The presented contributions involved both pragmatic concepts and their formal foundation, leading to new engineering practices and a higher level of reliability, robustness, and evolvability of heterogeneous software. FASE comprised:

- **invited lectures** by Serge Abiteboul on *Distributed Information Management with XML and Web Services* and by Grigore-Catalin Roman on *A Formal Treatment of Context-Awareness*;
- **regular sessions** featuring 22 papers selected out of a record number of 91 submissions that ranged from foundational contributions to presentation of fielded applications; and
- **tool demonstrations**, featuring 4 short contributions selected out of 7 high-quality tool submissions.

FASE 2004 was hosted by the Technical University of Catalonia (UPC), and, being part of ETAPS, it shared the sponsoring and support described by the ETAPS Chair in the Foreword. Like ETAPS, FASE will take place in Edinburgh next year.

Warm thanks are due to the program committee and to all the referees for their assistance in selecting the papers, to José Luiz Fiadeiro for mastering the coordination of the whole ETAPS, and to Fernando Orejas and the whole team in Barcelona for their brilliant organization.

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Distributed Information Management with XML and Web Services*

Serge Abiteboul**

INRIA-Futurs, LRI and Xyleme
Serge.Abiteboul@inria.fr

Abstract. XML and Web services are revolutionizing the automatic management of distributed information, somewhat in the same way HTML, Web browser and search engines modified human access to world wide information. To illustrate, we present Active XML that is based on embedding Web service calls inside XML documents. We mention two particular applications that take advantage of this new technology and novel research issues in this setting.

This paper is based primarily on research at INRIA-Futurs in the Gemo Group, around XML and Web services (in particular, the Xyleme, Active XML and Spin projects).

1 Introduction

The field of distributed data management has centered for many years around the relational model. More recently, the Web has simplified a world wide (or intranet) publication of data based on HTML (the backbone of the Web) and data access using Web browsers, search engines and query forms. However, because of the inconvenience of a document model (HTML is a model of document and not a data model) and limitations of the core HTTP protocol, the management of distributed information remains cumbersome. The situation is today dramatically improving with the introduction of XML and Web services. The Extensible Markup Language, XML [32], is a self-describing semi-structured data model that is becoming the standard format for data exchange over the Web. Web services [37] provide an infrastructure for distributed computing at large, independently of any platform, system or programming language. Together, they provide the appropriate framework for distributed management of information.

From a technical viewpoint, there is nothing really new in XML and Web services. XML is a tree data model much simpler than many of its ancestors such as SGML. Web services may be viewed as a simplified version of Corba. Together, they are bringing an important breakthrough to distributed data management simply because they propose Web solutions that can be easily deployed and

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** Gemo Team, PCRI Saclay, a joint lab between CNRS, Ecole Polytechnique, INRIA and Université Paris-Sud.

used independently of the nature of the machine, the operating system and the application languages. XML and Web services do not solve any open problem but they pave the way for a new generation of systems and generate a mine of new problems to solve.

We first describe some key aspects of XML and Web services (Section 2).

In Section 3, we argue for Active XML [7], AXML in short, that consists in embedding calls to Web services in XML documents. AXML documents provide extensional information as well as intensional one, i.e., means to obtain more data. Intensional information is specified by calls to Web services. By calling the service one can obtain up to date information. AXML also provides control of the service calls both from the client side (pull) or from the server side (push).

We illustrate issues in distributed data management and the use of AXML through two particular applications. In Section 4, we consider content warehouses, i.e., warehouses of non-numerical data, in a Peer-to-Peer environment. In Section 5, we consider the management of personal data.

This paper is not meant as a survey of distributed data management but more modestly, as a survey of some works of the author around the use of XML and Web services for distributed data management. The author wants to thank all the people with whom he worked on these projects and in particular B. Amann, O. Benjelloun, S. Cluet, G. Cobéna, I. Manolescu, T. Milo, A. Milo, B. Nguyen, M.-C. Rousset and J. Widom.

2 XML and Web Services

XML is a new exchange format promoted by the W3C [36] and the industry. An XML document may be viewed as a labeled ordered tree. An example of an XML document is given in Figure 1. We will see in the next section that this document is also an Active XML document. XML provides a nice mediation model, i.e., a lingua franca, or more precisely a syntax, that most pieces of software can or will soon understand. Observe that unlike HTML, XML does not provide any information about the document presentation. (This is typically provided externally using a style sheet.)

In an XML document, the nodes are labeled. The document may be typed with a declaration given in a language called XML schema [33]. If such a document typing is provided, the labeling provides typing information for pieces of information. For instance, the typing may request a *movie* element to consist of a *title*, zero or more *authors* and *reviews*. Some software that knows about the type of this document will easily extract information from it. In that sense, the labels provide both a type and semantics to pieces of information. The typing proposed by XML schema is very flexible. In some sense, XML marries the document world with the database world and can be used to represent documents, but also structured or semistructured data [2]. For instance, it allows to describe a relational database as well as an HTML page.

An essential difference between a data standard such as XML and a document standard such as HTML is the presence of structure that enables the use of