Domain Knowledge for Interactive System Design

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.

Domain Knowledge for Interactive System Design

Proceedings of the TC8/WG8.2 Conference on Domain Knowledge in Interactive System Design, Switzerland, May 1996

Edited by

Alaistair Sutcliffe

City University
London
UK

David Benyon

Open University
Milton Keynes
UK

and

Frans van Assche

Independent Consultant
Belgium

SPRINGER INTERNATIONAL PUBLISHING, CHAM

First edition 1996

Originally published by Chapman & Hall in 1996
Softcover reprint of the hardcover 1st edition 1996
ISBN 978-1-5041-2891-9 ISBN 978-0-387-35059-2 (eBook)
DOI 10.1007/978-0-387-35059-2

A catalogue record for this book is available from the British Library

Printed on permanent acid-free text paper, manufactured in accordance with ANSI/NISO Z39.48-1992 and ANSI/NISO Z39.48-1984 (Permanence of Paper).

CONTENTS

Preface

Domain knowledge is all pervasive throughout system development. The accuracy of requirements analysis and effectiveness of designed solutions depend on it yet we have little understanding about what domain knowledge actually is or how to use it effectively in the design process. It is interesting to reflect that in many engineering disciplines, the role of domain knowledge would not be questioned: it is an essential part of design. In software engineering the situation has been different. Computer scientists have concerned themselves with general solutions to design problems resulting in specification languages, formal methods, conceptual models, etc.

Domain knowledge, however, has not been ignored. Several researchers have sought to define model of domain knowledge as reusable libraries of models. Theories of analogy have been applied to construct generic models of domains (Maiden et al 1995). Libraries of reusable components have been produced and commercially exploited for some domains (Prieto Diaz 1991). Other research directions have attempted to use domain knowledge to support the design process in intelligent assistants. Although early attempts to embed specific domain knowledge in CASE tools were not very effective (Punchello et al 1988), however, domain oriented design environments which provide a more open architecture, have had a better track record. Fischer in the keynote paper of this conference reviews their history and future prospects. In the commercial world configurable or adaptable product for domains such as logistics, accounting, and manufacture have had considerable success (Scheer 1994). While in knowledge engineering much effort has been devoted to creating interlinguas which enable exchange of domain knowledge in the Ontolingua and Euroknowledge projects. Libraries for diagnosis and scheduling domains have been developed in the KADS project and elsewhere.

The growing interest in domain knowledge indicated that a conference on the subject would be timely. In these proceeding we have brought together leading researchers and practitioners to share their experience on the domain knowledge problem. The questions are many. How can domain knowledge be presented, how can it be effectively captured and used ? What is the scope of domain knowledge at the enterprise, socio-technical system and design level ? Is there any escape from the 'devil is in the detail' (of domain knowledge) ? Can methods be proposed to effectively utilise domain knowledge ? These proceedings contains contributions from authors in the information systems, human computer interaction, software and knowledge engineering communities to answer some of these questions.

The first 3 papers report frameworks for, or experience in, domain modelling. Kelly et al describe their experience in modelling an aero engine domain, highlight the problem of scoping and different viewpoints on domain knowledge as well as providing a set of valuable lessons for future practitioners. A domain knowledge framework is proposed by Berztiss who uses a family of models for modelling business systems at different levels-enterprise, occupation process and situation models. Blyth follows in the framework tradition by proposing an enterprise level view of domains and focuses on agent's responsibilities. He applies his approach to the London Ambulance service system, a notorious system failure in the UK.

Chanal and Lesca report a framework for analysing domain knowledge and their experience in modelling for process innovation and how to build a diagnostic tool to help process analysis. Grosz et al give two views in their paper, first they propose a modelling language for processes and then apply this schema to modelling the process of using domain

knowledge in requirements analysis. Maiden investigates a framework of techniques for requirements acquisition and scenario generation using generic models of domain knowledge to help acquisition by generating appropriate questions. This is followed by an ontology for generic domain models from Cauvet and Semmak who also investigate the process of creating generic models for reuse.

Several papers addressed the problem of representing domain knowledge. Koizumi and Iwasaki propose a compositional modelling language which allows aggregation of different views and a formal ontology for sharing domain knowledge. This is supported by a tool for acquiring and editing knowledge describing physical devices. Moller describes the MAMVIS model which represents spatial knowledge of domains as well as generic knowledge of users' actions enabling reasoning about the interdependencies between user action and an implemented design. Another knowledge engineering view is given by Compatangelo and Rumolo who describe a meta-language for describing structural and behaviour domain knowledge. They illustrate use of their language in a patient monitoring system and demonstrate how it can be used as a meta-schema for Information system models, e.g. ER and DFD notations. Angele et al take a more process oriented view in the Mike environment which provides tools for capturing and representing domain knowledge in the KARL language. This places more emphasis on task knowledge as well as capturing structural and behaviour domain knowledge.

The HCI theme is addressed by two papers from Uppsala University. The first examines how models of work context, users' tasks and the domain contribute to the process of interactive system design; while the second investigates tailoring usability evaluation procedures to domain contexts. Timmer and Long also address HCI issues in their report of modelling interactive systems in an air traffic control domain, demonstrating how models of users' work task, actions and information requirements contribute to interactive system design. A more formal view of user interaction is proposed by Mezzanotte and Paterno who provide a formal representation for cognitive models of the user and task knowledge and demonstrate how these can be applied to improving multimedia interface design.

Conceptual modelling in the information system tradition is the subject of Kaasboll and Motsching-Pitrik's paper which investigates long term life histories of objects, and this theme continues with Livari's work on modelling behaviour in an integrated schema with semantic data modelling. In summary the papers represent a cross section of approaches to domain modelling in interactive system design from the knowledge engineering, software engineering, HCI and information system traditions which demonstrate converging approaches in many areas. However, much still needs to be done. There is little explicit consideration of the business/enterprise level of domain modelling in the papers, and while the contributions are strong on modelling and representing domain knowledge, there is less guidance on how it is profitably deployed in the design process. This perhaps represents the state of the art we have reached and points to further challenges.

Finally I would like to thank not only the authors for their contributions but also the members of the programme committee who helped produce the high quality of these proceedings.

Alistair Sutcliffe
City University
May 1996

Maiden N.A.M., Mistry P., and Sutcliffe A.G. (1995) How people categorise requirements for reuse. A natural approach. In Proceedings of 2nd International Symposium on Requirements Engineering- RE-95, Eds Zave P. and Harrison M.D., 148-157, IEEE Computer Society Press.

Puncello, P.P., Torrigiani, P., Pietri, F. , Burion, R., Cardile, B., and Conti, M. (1988) 'ASPIS: A Knowledge-Cased CASE Environment. IEEE Software, 58-65.

Prieto-Diaz R. (1991) 'Implementing Faceted Classification for Software Reuse'. Communications of the ACM **34(5)**, 88-97.

Scheer, A.W. (1994) Enterprise-Wide Data Modelling, Springer-Verlag.

Programme Chairs

A. Sutcliffe, City University, UK
F. Van Assche, Belgium
David Benyon, Open University, UK

General Chair: Janis Bubenko, SISU, Sweden

Local Organiser: Michel Leonard, University of Geneva, Switzerland

Programme Committee

A. Solvberg, Univ. of Trondheim
B. Pernici, Politechnico Milano
P. Loucopoulos, UMIST
J. Dowell, University College, London
D. Benyon , Open University
S. Brinkemmer, Twente University
J. Carroll , Virginia Tech
S. Harker , Loughborough University
D. Till, City University, London
J. Mylopoulos, Univ. of Toronto
Dr G. Falquet, Univ. of Geneva
K. Ryan, Univ. of Limerick
G. Grosz, Univ. of Paris
K. Pohl, Univ. of Aachen
C. Rolland, Univ of Paris 1
T. Wasserman, IDE
J. Long , University College, London
P. Johnson, Queen Mary Westfield College
R. Brooks, Schlumberger
M. Tauber, Univ. of Paderborn
A. Maclean , Rank Xerox EUROPARC
A. Finkelstein, City University
M. Jarke, Univ. of Aachen
G. Fischer, Univ. of Colorado
Prof Y. Pigneur, Univ. of Lausanne
S. Fickas, Univ. of Oregon
N. Maiden, City University, London

Additional reviewers:
George Spanoudakis, Chris Taylor, Bernice Bright, Mark Ennis, City University
Frank Harmsen, Petti Marttiin , Twente University