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Matthias Hemmje
Claudia Niederee
Thomas Risse (Eds.)

From Integrated Publication and Information Systems to Virtual Information and Knowledge Environments

Essays Dedicated to Erich J. Neuhold on the Occasion of His 65th Birthday

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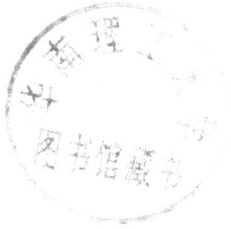

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Volume Editors

Matthias Hemmje
FernUniversität Hagen
Universitätsstr. 1, 58097 Hagen, Germany
E-mail: Matthias.Hemmje@fernuni-hagen.de

Claudia Niederee
Thomas Risse
Fraunhofer IPSI
Dolivostr. 15, 64293 Darmstadt
E-mail: {claudia.niederee,thomas.risse}@ipsi.fraunhofer.de

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Preface

Matthias Hemmje

FernUniversität in Hagen, Department of Computer Science,
Universitätsstraße 1, D-58097 Hagen, Germany
Matthias.Hemmje@fernuni-hagen.de

This book is dedicated to Erich J. Neuhold, Director of Fraunhofer's Integrated Publication and Information Systems Institute (IPSI) and Professor of Computer Science at the Technical University of Darmstadt on the occasion of his 65th Birthday in January 2005.

Erich Neuhold's primary research and development interests are in heterogeneous multimedia database systems, in peer-to-peer- and Grid-based information environments, in Web-based distributed information technologies, in persistent information and knowledge repositories, and in content engineering. Within his interest in content engineering special emphasis is given to all technological aspects of the information and publishing process, i.e., the knowledge value chain that arises for the creation of digital products and services in Web application contexts. Besides his main areas of scientific work, Erich Neuhold also guides research and development in user interfaces including information visualization, computer-supported cooperative work, ambient intelligence, mobile and wireless technology, and security in Web application areas like e-learning, e-commerce, e-culture and e-government.

Building on its long-standing scientific expertise and reputation Erich Neuhold's Fraunhofer IPSI aimed at supporting information-, content- and knowledge-intensive applications by focusing on research and development towards the achievement of the following vision: the efficient and flexible implementation of technologies supporting the creation and effective utilization of virtual information and knowledge environments where such environments are Web-based distributed information systems that enable the corporate as well as the personal and cooperative acquisition, management, access, distribution and usage of information, content and explicitly encoded knowledge objects.

In accordance with the unifying vision and continuing research interest of Erich Neuhold and in correspondence with his scientific work, this book presents a selected number of invited papers by leading international researchers in the area, addressing a broad variety of related topics. It therefore reflects the breadth and the depth of Erich Neuhold's scientific work advocating the synergistically integrated approach towards supporting digital information and knowledge production on the one hand together with its corresponding access and usage support on the other hand.

As the introductions to the first, second, and fourth parts of this book are provided in the later opening sections by Tamer Özsu and Keith van Rijsbergen, I would now like to introduce the content of the other parts.

The third part is dedicated to issues related to Securing Dynamic Media Content Integration and Communication. In the first paper of this part, Ralf Steinmetz (who

successfully headed the Fraunhofer IPSI together with Erich Neuhold for several years and is currently still his colleague as the Professor for Multimedia Communications at the Technical University of Darmstadt) and Oliver Heckmann, address the subject of video distribution with peer-to-peer file-sharing networks. They introduce one of the most successful peer-to-peer file-sharing applications – it was especially successful in Germany – and discuss traffic characteristics and user behavior in distributing video files based on the results of their experiments and measurements. In the next paper, Jana Dittmann, former division head at Erich Neuhold's Fraunhofer IPSI and now Professor for Multimedia and Security at the Otto-von-Guericke-University in Magdeburg, and Martin Steinebach, currently division head at IPSI, describe the design of a framework for media production environments, where mechanisms like encryption, digital signatures and digital watermarking help to enable a flexible yet secure handling and processing of the content. Finally, Andreas Meissner, also division head at IPSI, and Wolfgang Schönfeld propose a heterogeneous and flexible communication platform that complies with the reliability and coverage requirements of the Public Safety Organization.

The fifth part is titled Visualization – Key to External Cognition in Virtual Information Environments. In the first paper of this part Tiziana Catarci and her colleagues Enrico Bertini, Lucia Di Bello and Stephen Kimani of the University of Rome "La Sapienza" discuss how visualization has been and can be used to support interaction with the digital library environment. In the next paper, Gerald Jäschke, Piklu Gupta and I introduce an approach to design a declarative language for defining information visualization applications (IVML). Next to this, Ben Shneiderman and Jinwook Seo of the University of Maryland present a generalized knowledge integration framework to better understand the importance of an item or cluster by using multiple interactively coordinated visual displays and show examples of hierarchical clustering of gene expression data, coordinated with a parallel-coordinates view and with the gene annotation and gene ontology. The part is completed by Maria Francesca Costabile and Paolo Buono of the University of Bari presenting a visual strategy that exploits a graph-based technique and parallel coordinates to visualize the results of algorithms for mining association rules which helps data miners to get an overview of the rule set they are interacting with and enables them to deeper investigate inside a specific set of rules.

The sixth part takes us From Human Computer Interaction to Human Artefact Interaction. In the first paper of this part, Norbert Streitz, currently division head at Erich Neuhold's Fraunhofer IPSI, outlines his approach to designing environments that exploit the advantages of real objects and at the same time use the potential of computer-based support by moving from human-*computer* interaction to human-*artefact* interaction. In the next paper, Peter Tandler and Laura Dietz (also members of Fraunhofer IPSI) explain how to support ubiquitous computing by enabling an extended view on sharing which seamlessly integrates the view of "traditional" CSCW and additionally incorporates ubiquitous, heterogeneous and mobile devices used in a common context. In the following paper, Jörg Haake, formerly PhD student of Erich Neuhold and now a Professor of Computer Science at the FernUniversität in Hagen, and his wife Anja Haake (also a former PhD student of Erich Neuhold) together with Till Schümmer introduce a metaphor and user interface for managing

access permissions in shared workspace systems. The part is then completed by the contribution of Jose Encarnação (a colleague of Erich Neuhold as a Professor of Computer Science at the Technical University of Darmstadt and as the Director of the Fraunhofer Institute for Computer Graphics (IGD) in Darmstadt) and his research collaborator Thomas Kirste; they introduce the new ICT paradigm of ambient intelligence, its concepts, system architectures, and enabling technologies.

Finally, the seventh part introduces Application Domains for Virtual Information and Knowledge Environments. In the first paper of this part, Thomas Kamps, a former PhD student of Erich Neuhold and currently a division head at the Fraunhofer IPSI, together with Richard Stenzel, Libo Chen and Lothar Rostek discusses an approach that shows how a mix of information extraction and classification methods can be used to automatically set up and update a network of business objects serving as a corporate memory index. In the next contribution, Hans-Jörg Bullinger, President of the Fraunhofer-Gesellschaft, Corporate Management and Research, and his research colleagues Alexander Slama, Oliver Schumacher, Joachim Warschat and Peter Ohlhausen of the Fraunhofer Institute for Industrial Engineering (IAO) in Stuttgart explain how ontologies can be applied to providing a model for the computer-supported representation of innovation projects and to enabling computer-aided identification of time-consuming constellations, and can therefore serve to provide a basis for achieving innovation-acceleration knowledge to ensure faster and better innovations. In the following paper, Claudia Niederée, Avaré Stewart and Claudio Muscogiuri (all of the Fraunhofer IPSI) and I discuss approaches for both creating context awareness as well as supporting specific working contexts by means of virtual information and knowledge environments. In the next paper, Patrick Baudisch, a former PhD student of Erich Neuhold and now a researcher at Microsoft Research, together with Lars Bruecker presents a recommendation system that provides users with personalized TV schedules. The final contribution of this part is by Junzhong Gu and presents an approach to integrating consumer electronics (e.g., TV sets, DVD players, HiFi sets, etc.), mobile multimedia devices, as well as traditional computing devices (PCs, laptops, printers, scanners, etc.) into a complete application solution.

I would like to continue by thanking a number of people who strongly supported the timely creation of this book.

First of all, I am grateful to all the authors who contributed efficiently in a very short period of time to provide their high-quality scientific content for this book in order to honor Erich Neuhold's 65th birthday.

Furthermore, I am grateful to Wolfgang Glatthaar, Chairman of Fraunhofer IPSI's Kuratorium (advisory board), for supporting this book with a statement honoring the occasion from Erich Neuhold's research institute's point of view.

Next, I am grateful to Tamer Öszu and Keith van Rijsbergen for supporting the book by providing introductions to selected parts of the book on the one hand, on the other hand for contributing laudations for Erich Neuhold on behalf of the scientific communities that Erich Neuhold has been operating in, collaborating with and serving during his outstanding academic career.

With respect to coping with the editorial work for this book, I am grateful to my co-editors Claudia Niederée and Thomas Risse who proved themselves as reliable collaborators in what turned out to be a more challenging and demanding endeavor

than we originally expected, especially in already tough times of organizational demand and change.

Concerning assistance in the preparation of this book, I am grateful to Anja Rieber, a secretary of excellence at Fraunhofer IPSI, who provided invaluable office administration back-end support as well as a competent and reliable communication and coordination front end for the whole preparation process.

Giving credit to the organizational background support, I am grateful to Dieter Böcker, Deputy Director of the Fraunhofer IPSI, and Emil Wetzel, Head of Administration of Fraunhofer IPSI, for providing me with the opportunity to take over responsibility for this book on the one hand, and on the other hand for providing the formal approval and support to use IPSI's infrastructure to prepare it.

Finally, I am grateful to Alfred Hofmann of Springer's Lecture Notes in Computer Science and his whole team for providing excellent publication support.

The last paragraphs of my preface shall be addressed and dedicated to Erich Neuhold himself.

First, I would like to state at this point that it has been a pleasure for me to work on this book honoring Erich's life-time achievements on the occasion of his 65th birthday as it has been taking me back to many memories about our collaboration history since 1991.

Furthermore, I would like to congratulate and thank him especially with respect to the many career opportunities that his research and management work as well as his personal guidance have opened up and continuously provided for many of the contributors to this book, including myself.

All of us who share such a "direct collaboration experience" with Erich know that working with him is a VERY demanding activity in many dimensions. However, it still is and has always been rewarding on many levels, too! Therefore, I would not like to have missed it. This holds especially true because I experienced Erich not only as a researcher who always strives for excellence but also many times and especially in tough situations as a man with a high degree of professionalism, integrity, and – most important – dedication, loyalty, and reliability with respect to his responsibility for taking care of the personal welfare of his staff members and the further development of their professional future.

I would like to conclude by wishing Erich Neuhold and his family all the best for the years to come. Personally, I am looking forward to many more years of interesting and fruitful collaboration.

December 2004 Matthias Hemmje

Organizational Laudatio and Personal Note

Wolfgang Glatthaar

Chairman of the Board of Trustees of Fraunhofer IPSI

In spite of the rapid growth of knowledge and information and a variety of usage scenarios on the World Wide Web, the goal of delivering the "right answer" to a question universally available remains a goal which is yet to be attained. According to Erich Neuhold's research agenda, this "right answer" needs to be appropriate in its depth, context and timeliness, and should be available everywhere and adhere to social and legal conventions. This goal determines the basis for demanding and multi-faceted research topics. The application spectrum ranges from the repurposing of publishing products, and classroom-based and mobile distance learning, through to automatic content generation for mobile phones, handheld computers or navigation systems, and more. The Fraunhofer Integrated Publication and Information Systems Institute conducts research and applications development in these areas.

IPSI is a research institute that was founded in 1987 by the German National Research Center for Information Technology (GMD). Since its inception it has been under the direction of Prof. Dr. Erich J. Neuhold, who also leads the research and teaching group with the same focus in the Computer Science Department at the Technical University of Darmstadt. The close links with the university are reinforced through the teaching activities there of IPSI researchers. Over 100 people currently work in research at IPSI, of whom about 20% are from abroad.

Being responsible for continuing IPSI's success in the future, Erich Neuhold and his research and management team started a transition phase in the first years of the new millennium. Most importantly, on July 11, 2001 IPSI was one of the eight research institutes of the German National Research Center for Information Technology (GMD) that became members of the Fraunhofer-Gesellschaft. Through this merger the Fraunhofer-Gesellschaft now encompasses 17 institutes out of 58 with about 3000 scientists doing applied research in the area of computer science and information technology. According to Erich Neuhold's own statements, IPSI is still today in this transformation process, permanently assessing risks and challenges, and taking measures to adapt to the changed environment. Some of these consequences relate to the changes in the research paradigm – from basic research towards application-oriented and contract research – while others relate to rather mundane issues like building up the institute's own marketing and sales processes.

From Erich Neuhold's point of view, research at IPSI has never happened in an ivory tower. IPSI has always tried yout new ideas and solutions on real-world problems. Its prime mechanism for reaching out to the market and turning research results into products has been the foundation of spin-offs. Due to Erich Neuhold's vision and engagement, IPSI will continue to be an incubator of ideas in the years to come. Furthermore, many former employees of IPSI have started university careers in Germany

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and abroad. Building on these contacts, IPSI has constantly used this opportunity to integrate its alumni in cooperation projects.

Under the leadership of Erich Neuhold, Fraunhofer IPSI in Darmstadt has been successfully developing user-centered systems that flexibly, effectively and efficiently respond to end-user needs in the application areas of electronic publishing and dissemination of information, collaborative work, and learning at common locations or over distances. The systems are formed using novel concepts of information enhancement and of information and knowledge management. Furthermore, IPSI investigates and develops high-quality software solutions for computer-supported collaborative work, electronic publishing and lifelong learning in real and virtual environments. IPSI's research areas to a high degree reflect Erich Neuhold's personal research interests, and therefore include digital libraries and information systems, publication tools with underlying database layers, distributed editing environments for collaborative maintenance of large collections of data, media and document management, and the more loosely related fields of knowledge management and cooperative learning systems, and security and services for mobile communication.

Values can only be preserved through change – so said Richard Löwenthal, the Anglo-German publicist and political scientist, in the twentieth century. Since its incorporation into the Fraunhofer Corporation in summer 2001, IPSI has been engaged in putting this insight into practice. During rigorous portfolio discussions and restructuring measures – in the course of which many favorite subjects and group approaches had to be sacrificed to a focus on areas of expertise more relevant to industry – this policy was amended. In this process, departments were analyzed down to group level, and in some cases were reconstituted – all with the thoroughgoing cooperation of many staff members, who, at the same time, had to carry on their usual work involving research, EU and BMBF (German Federal Ministry of Education and Research) projects, teaching, and industrial business. While this was proceeding, a new "Marketing & Sales" Department was formed. As a consequence, many new marketing instruments were introduced, followed by more rigid instruments for financial and sales control. However, all these achievements do not mean that the change process is now complete. As the Fraunhofer Institute operates in the area of research, it will never, and must never, become like a sort of screw factory, where everyone can sell everything – it is only natural that the concept of change has to be omnipresent at all times, by definition.

Besides managing IPSI during its GMD times as well as during the initial phases of its transformation into a Fraunhofer Institute, Erich Neuhold has always provided flexibility on the management level as well as on the administrative and operational staff level, supporting not only technologically but also aesthetically motivated and driven endeavors. Besides regularly hosting art exhibitions in the institute's building, for example during open house phases, he supported and initiated a set of artistically driven activities for the IPSI. Besides more or less hybrid IT R&D projects serving both worlds, like the Virtual Gallery projects resulting in cyber:gallery – a system for exhibiting and selling art on the Internet that enables the perception of art sales exhibitions in a VR-technology-driven Web-based application solution – there has also been room for supporting, for example, real and virtual theatre projects.

One such project originated at the beginning of 1999 when the Richard Wagner Forum in Graz offered the opportunity to submit projects for the staging of Richard Wagner's Parsifal. One option of the competition was to submit a cyberstaged version of Parsifal with an emphasis on the use of new technologies within the presentation. Supported by Erich Neuhold and IPSI, such a contribution from the IPSI staff member Christoph Rodatz was successful in the contest. During the project, traditional theatre architecture linked the audience with the stage through an audiovisual window. The stage was separated from the auditorium using a closed iron curtain. Thus the audience was able to move in a free way between the auditorium and the stage, and therefore the audience was in effect operating as a "hiker" between the two perception dimensions. Furthermore, the auditorium was transformed into an acoustic space of experience. Here Parsifal could be heard in a concerto form as a live transmission from the stage, except that, apart from the conductor, the performers, the orchestra and the choir were not present. Similarly, the stage area was transformed into a stage museum space, where the singers and musicians performed. The conductor's signal for the singers' entry was communicated via video. Each individual sound was sent via microphones to a sound panel. From there the entire "virtual soundscape" was transmitted to the auditorium. This approach meant that during the entire staging the orchestra and the choir could operate while still being in their rehearsal rooms, each equipped with microphones and at the same time quasi-"exhibited" in 10 vitrines that were located on the borders of the revolving stage. Via video screens and headphones the actors and singers were connected with the conductor and the entire soundscape experience system. Within so-called picture spaces there were 10 separate exhibition areas that could be entered via the revolving space. Furthermore, Parsifal was the topic of associated installations that enabled a more open access to Wagner's opera. With respect to the orchestra pit, the installation hosted video screens that displayed the movement of the live performance produced by each group of musical instruments transmitted from the orchestra and choir rehearsal rooms. The positioning of the video screens followed the specific pattern of the orchestra's natural position. Even though the chronology of the entire opera was not changed, an individual member of the audience could experience the entire staging in a fragmented and individualized manner if he or she decided to become a "hiker" during the performance. Using this approach, the audience could physically participate in the opera, and this had a tremendous impact on the dramatic degrees of freedom available within the director's interpretation of the Parsifal plot, bearing in mind that Wagner conceived of a "Gesamtkunstwerk". The cyberstaging of Parsifal demonstrated the influence of new technologies on society's perception, and the transformation that could be brought about in the theatre and in the arts in general.

The first time I met Erich Neuhold was in 1972. Since then it has been a very exciting walk together, not always easy but in the end certainly fruitful. So, looking at IPSI's history and the current situation I think it is fair to say that Erich Neuhold, now retiring, can be proud of what he and his team hand over to his successor. I hope that Erich Neuhold can observe, now from a distance, "his IPSI" – continuously changing and growing in success. I wish he and his family a healthy and fascinating future.

December 2004 Wolfgang Glatthaar

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