

Lecture Notes in Business Information Processing

49

Series Editors

Wil van der Aalst

Eindhoven Technical University, The Netherlands

John Mylopoulos

University of Trento, Italy

Michael Rosemann

Queensland University of Technology, Brisbane, Qld, Australia

Michael J. Shaw

University of Illinois, Urbana-Champaign, IL, USA

Clemens Szyperski

Microsoft Research, Redmond, WA, USA

Antonia Albani Jan L.G. Dietz (Eds.)

Advances in Enterprise Engineering IV

6th International Workshop, CIAO! 2010
held at DESRIST 2010
St. Gallen, Switzerland, June 4-5, 2010
Proceedings

Volume Editors

Antonia Albani
University of St. Gallen
Müller-Friedberg-Strasse 8
9000 St. Gallen, Switzerland
E-mail: antonia.albani@unisg.ch
and

Delft University of Technology
Mekelweg 4
2628 CD Delft, The Netherlands
E-mail: a.albani@tudelft.nl

Jan L.G. Dietz
Delft University of Technology
Mekelweg 4, 2628 CD Delft
The Netherlands
E-mail: j.l.g.dietz@tudelft.nl

Library of Congress Control Number: 2010926924

ACM Computing Classification (1998): J.1, H.3.5, H.4.1, D.2

ISSN	1865-1348
ISBN-10	3-642-13047-X Springer Berlin Heidelberg New York
ISBN-13	978-3-642-13047-2 Springer Berlin Heidelberg New York

This work is subject to copyright. All rights are reserved, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, re-use of illustrations, recitation, broadcasting, reproduction on microfilms or in any other way, and storage in data banks. Duplication of this publication or parts thereof is permitted only under the provisions of the German Copyright Law of September 9, 1965, in its current version, and permission for use must always be obtained from Springer. Violations are liable to prosecution under the German Copyright Law.

springer.com

© Springer-Verlag Berlin Heidelberg 2010
Printed in Germany

Typesetting: Camera-ready by author, data conversion by Scientific Publishing Services, Chennai, India
Printed on acid-free paper 06/3180 5 4 3 2 1 0

Preface

Enterprise engineering is an emerging discipline that studies enterprises from an engineering perspective. This means that enterprises are considered to be purposefully designed and implemented systems, which consequently can be re-designed and re-implemented if there is a need for change. Behavioral and managerial knowledge is perfectly adequate to identify the need for a change, but it is insufficient to bring it about. Next, enterprise engineering is rooted in both the organizational sciences and the information system sciences. The rigorous integration of these traditionally disjoint scientific areas has become possible following the recognition that communication is a form of action. Since then it has been quite common to speak of communicative acts, like requesting and promising. Consequently, communication (and information) is given an organizational interpretation: requests and promises are commitments, and communication is entering into and complying with commitments. This important insight clarifies the fact that enterprises belong to the category of social systems, i.e., their active elements (actors) are social individuals (human beings). Founding itself on this new scientific paradigm, enterprise engineering addresses the challenges that enterprises are currently faced with, both the internal and the external ones. The unifying role of human beings makes it possible to address problems in a holistic way, to achieve unity and integration in bringing about organizational change. This has not been shown before.

The development of such an innovative approach, as enterprise engineering is, requires the active involvement of a variety of research institutes and a tight collaboration between them. This is achieved by a continuously expanding network of universities and companies, called the CIAO! Network (www.ciaonetwork.org). Since 2005 this network has organized the annual CIAO! workshop, and since 2008 its proceedings have been published as "Advances in Enterprise Engineering" within the Springer LNBIP series. The book you are going to read contains the proceedings of the CIAO! Workshop 2010, which was held in conjunction with the DESRIST 2010 conference in St. Gallen, Switzerland.

June 2010

Antonia Albani
Jan L.G. Dietz

An Introduction to Enterprise Engineering

The Paradigm Shift

Enterprise engineering is an emerging discipline that studies enterprises from an engineering perspective. The first paradigm of this discipline is that enterprises are purposefully designed and implemented systems. Consequently, they can be re-designed and re-implemented, if there is a need for change. All kinds of changes are accommodated: strategic, tactical, operational, and technological. The second paradigm of enterprise engineering is that enterprises are social systems. This means that the system elements are social individuals, and that the essence of an enterprise's operation lies in the entering into and complying with commitments between these social individuals¹.

The Theoretical Roots

Enterprise engineering is rooted in both the organizational sciences and the information system sciences. Three concepts are already paramount to the theoretical and practical pursuit of enterprise engineering: enterprise ontology, enterprise architecture, and enterprise governance. *Enterprise ontology* concerns the understanding of an enterprise in a way that is fully independent of any implementation. The (one and only) ontological model of an enterprise shows the essence of its operation. It is the starting point for designing and implementing all kinds of changes. It is also extremely stable over time; most changes appear to be changes in the implementation. *Enterprise architecture* concerns the identification, the specification, and the application of design principles, which come in addition to the specific requirements of every change project. Design principles are the operational shape of an enterprise's strategic basis (mission, vision). Only in this way can one achieve and guarantee that the operations of an enterprise are fully compliant with its mission and strategies. Lastly, *enterprise governance* constitutes the organizational conditions for incorporating enterprise ontology and enterprise architecture in an enterprise's practice. It constitutes the primary condition for making the enterprise engineering approach feasible and beneficial.

The Current Evidence

The vast majority of strategic initiatives fail, meaning that enterprises are unable to gain success from their strategy. The high failure rates are reported from

¹ Basically and principally, only humans can take the role of social individual. We do recognize, however, the increasing belief among researchers that in the future artifacts could also take this role.

various domains: total quality management, business process reengineering, six sigma, lean production, e-business, customer relationship management, as well as from mergers and acquisitions. It appears that these failures are mostly the avoidable result of an inadequate implementation of the strategy. Rarely are they the inevitable consequence of a poor strategy. Abundant research indicates that the key reason for strategic failures is the lack of coherence and consistency, collectively also called congruence, among the various components of an enterprise. At the same time, the need to operate as an integrated whole is becoming increasingly important. Globalization, the removal of trade barriers, deregulation, etc., have led to networks of cooperating enterprises on a large scale, enabled by the virtually unlimited possibilities of modern information and communication technology. Future enterprises will therefore have to operate in an ever more dynamic and global environment. They need to be more agile, more adaptive, and more transparent. In addition, they will be held more publicly accountable for every effect they produce. These challenges are traditionally addressed by black-box-thinking-based knowledge, i.e., knowledge concerning the function and the behavior of enterprises, as contained in the organizational sciences. Such knowledge is sufficient, and perfectly adequate, for managing an enterprise (within the range of control). However, it is definitely inadequate for changing an enterprise. In order to bring about changes, white-box-based knowledge is needed, i.e., knowledge concerning the construction and the operation of enterprises. Developing and applying such knowledge requires no less than a paradigm shift in our thinking about enterprises, since the organizational sciences are dominantly oriented towards organizational behavior, based on black-box thinking.

The Evolutionary Milestones

The current situation in the organizational sciences resembles very much the one that existed in the information systems sciences around 1970. At that time, a revolution took place in the way people conceived information technology and its applications. Since then, people have been aware of the distinction between the *form* and the *content* of information. This revolution marks the transition from the era of data systems engineering to the era of information systems engineering. The comparison we draw with the information systems sciences is not an arbitrary one. On the one hand, the key enabling technology for shaping future enterprises is modern information and communication technology (ICT). On the other hand, there is a growing insight in the information systems sciences that the central notion for understanding profoundly the relationship between organization and ICT is the entering into and complying with commitments between social individuals. These commitments are raised in communication, through the so-called *intention* of communicative acts. Examples of intentions are requesting, promising, stating, and accepting. Therefore, as the content of communication was put on top of its form in the 1970s, the intention of communication is now put on top of its content. It explains and clarifies the organizational notions of collaboration and cooperation, as well as authority and responsibility. It also

puts organizations definitely in the category of social systems, very distinct from information systems. Said revolution in the information systems sciences marks the transition from the era of information systems engineering to the era of enterprise engineering, while at the same time merging with relevant parts of the organizational sciences, as illustrated in Fig. 1.

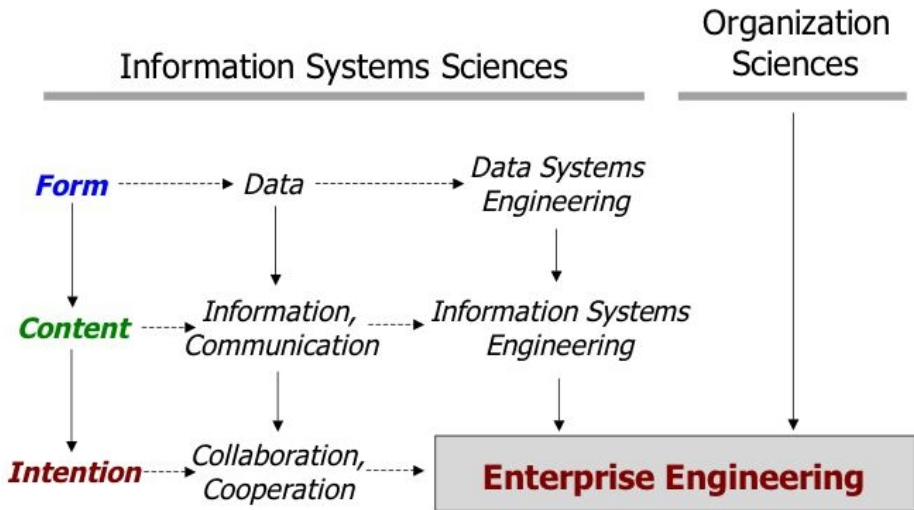


Fig. 1. Enterprise Engineering

The mission of the discipline of enterprise engineering is to combine (relevant parts from) the organizational sciences and the information systems sciences, and to develop theories and methodologies for the analysis, design, and implementation of future enterprises. Two crucial concepts have already emerged that are considered paramount for accomplishing this mission: enterprise ontology and enterprise architecture. A precondition for incorporating these methodologies effectively in an enterprise is the establishment of enterprise governance.

Theoretically, *enterprise ontology* is the understanding of an enterprise's construction and operation in a fully implementation independent way. Practically, it is the highest-level constructional model of an enterprise, the implementation model being the lowest one². Compared to its implementation model, the ontological model offers a reduction of complexity of well over 90%. Only by applying this notion of enterprise ontology can substantial changes of enterprises be made intellectually manageable.

Theoretically, *enterprise architecture* is the normative restriction of design freedom. Practically, it is a coherent and consistent set of principles that guides

² Dietz, J.L.G., *Enterprise Ontology – Theory and Methodology*, Springer, 2006, ISBN 978-3-540-29169-5

the (re)design and (re)implementation of an enterprise, and that comes in addition to the specific requirements of a change project³. These principles are derived from the enterprise's strategic basis (mission, vision). Only by applying this notion of enterprise architecture can consistency be achieved between the strategic basis and the operational business rules of an enterprise.

Enterprise governance is the organizational competence for continuously exercising guiding authority over enterprise strategy and architecture development, and the subsequent design, implementation, and operation of the enterprise⁴. Adopting this notion of enterprise governance enables an enterprise to be compliant with external and internal rules, and to perform in an optimal and societally responsible way.

Modeling and Simulation

Every time that a change happens in the business environment or a change is required due to certain circumstances, it results in analysis and design of some aspects of the enterprise (organization, business processes, supporting technology, etc.). Current trends in business process management show that processes-oriented approaches are receiving increasing attention in analyzing and designing enterprises and implementing innovations addressing the external forces (customers, competitors, environment, etc.). As the very core of process innovation is change, and changes always need to be evaluated in comparison with different scenarios and situations, this demands an even more integral role of modeling and simulation in the design, redesign, and process improvement activities of enterprise engineering. Obviously any change is risky and may have serious consequences for enterprises. Early mitigation of risks associated with redesign and innovation is highly important, especially in situations with many uncertainties. Here is where modeling and simulation play an enormous role in the analysis, design, redesign, comparison of alternatives, and measurement of the effects of changes⁵.

Ontology-Based Development of Information Systems

Based on the notion of enterprise engineering, new modeling methodologies are needed to cope with the specific aspects of an enterprise as a designed and engineered artifact. Such methodologies should not only comprise methods and models to design the enterprise in order to understand and change it, but also

³ Hoogervorst, J.A.P., Dietz, J.L.G.: Enterprise Architecture in Enterprise Engineering. In: Enterprise Modeling and Information Systems Architecture, Vol. 3, No. 1, July 2008, pp 3-11, ISSN 1860-6059

⁴ Hoogervorst, J.A.P., Enterprise Governance and Enterprise Architecture, Springer, 2009, ISBN 978-3-540-92670-2

⁵ Barjis, J. (2007). Automatic Business Process Analysis and Simulation Based on DEMO. Journal of Enterprise Information Systems, Vol. 1, No. 4, pp. 365-381

to design and implement information systems supporting the operations and decision makings of such enterprises. Several enterprise modeling methodologies exist and are widely applied in practice today. But most of them are not based on a well-founded theory that integrates the notion of construction and operation of the enterprise in a fully implementation-independent way. Said approaches therefore result in unnecessarily complex, unstable, and unwieldy models including not only the essential features of an enterprise. The same holds for the models of the supporting information systems, which are based on those enterprise models. In order to provide valuable information to business people who make decisions about requirements, use the solutions and make decisions about future strategies, both the enterprise models and the supporting information system models need to be provided on a high level of abstraction. Therefore, there is a need for new and innovative methodologies applying the notion of enterprise ontology, and for new methods transforming such ontological models into information system models⁶. The resulting information system models have a reference character. That means that they are stable since they are based on ontological models, which are completely implementation independent. A business domain is not going to change often, but the implementation of that business domain may change easily.

June 2010

Jan L.G. Dietz
Antonia Albani
Joseph Barjis

⁶ Albani, A., Dietz, J., 2008. Software and Data Technologies, Second International Conference, ICSoft/ENASE 2007, Barcelona, Spain, July 22-25, 2007, Revised Selected Papers. Vol. 22. Springer Verlag, Ch. Benefits of Enterprise Ontology for the Development of ICT-Based Value Networks, pp. 322.

Organization

The CIAO! workshop is organized annually as an international forum for researchers and practitioners in the general field of enterprise engineering. Organization of the workshop and peer review of the contributions made to this workshop are accomplished by an outstanding international team of experts in the fields of enterprise engineering.

Workshop Chairs

Antonia Albani	University of St. Gallen (Switzerland) and Delft University of Technology (The Netherlands)
Jan L.G. Dietz	Delft University of Technology (The Netherlands)

Program Committee

Wil van der Aalst	Graham Mcleod
Eduard Babkin	Aldo de Moor
Joseph Barjis	Hans Mulder
Bernhard Bauer	Nikolaus Müssigmann
Emmanuel delaHostria	Moiria Norrie
Johann Eder	Martin Op 't Land
Joaquim Filipe	Erik Proper
Rony G. Flatscher	Gil Regev
Birgit Hofreiter	Pnina Soffer
Jan Hoogervorst	Pedro Sousa
Stijn Hoppenbrouwers	José Tribolet
Christian Huemer	Jan Verelst
Peter Loos	

Table of Contents

Enterprise Ontology

Aligning the Constructs of Enterprise Ontology and Normalized Systems	1
<i>Philip Huysmans, David Bellens, Dieter Van Nuffel, and Kris Ven</i>	
Towards a G.O.D. Organization for Organizational Self-Awareness	16
<i>David Aveiro, António Rito Silva, and José Tribolet</i>	

Organizational Modeling

Understanding the Realization of Organizations	31
<i>Joop de Jong and Jan L.G. Dietz</i>	
A Bottom-Up Competency Modeling Approach	50
<i>João Marques, Marielba Zacarias, and José Tribolet</i>	

System Development

Context-Aware Collaborative Platform in Rural Living Labs	65
<i>Olfa Mabrouki, Abdelghani Chibani, Yacine Amirat, Monica Valenzuela Fernandez, and Mariano Navarro de la Cruz</i>	
A Formal Approach to Architectural Descriptions – Refining the ISO Standard 42010	77
<i>Sabine Buckl, Sascha Krell, and Christian M. Schweda</i>	
Author Index	93