Handbook of Research on E-Business Standards and Protocols
- Documents, Data and Advanced Web Technologies -

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PREFACE

Enterprises as well as public organizations more often act on a global level and in an environment, which is becoming more open, complex and dynamic. Therefore, enterprises have to deal with changing business partners and business networks as well as with changing preferences on the part of customers. With the upcoming of the Internet, its online-services and e-business applications people expected quick and efficient solution for many of these problems. However, realizing E-Business, so that it fits to the needs of the markets, is easy to use and efficient from the users view is a complex and maybe everlasting task.

This Handbook focuses on an E-Business, which is mainly supported by standards, protocols and other helpful instruments. For years, standards and protocols for E-Business are on the focus of research community and various standards bodies. Instead of expected benefits, we got a bunch of mutually incompatible standards, even more the vendor-enhanced version of the same standards. In the meantime, many enterprises adopted their business models to E-Business that make them highly dependable on existing standards. Advanced Web technologies and new standard initiatives based on them offer an open door to overcome aforementioned difficulties in e-business communications. This book gives a useful, comprehensive, overview of such efforts and looks into future.

WHAT IS UNIQUIE ABOUT THIS BOOK

The seventy-nine authors all around the world give an excellent overview on what is going on electronic business standards and enterprise interoperability today. Their chapters address many actual and high-relevant topics as described in detail within next section. Somebody might be taken by surprise that so many challenges yet exists after all these years of standardization in e-business arena. But, just these challenges have actually triggered the book call and by this a number of submission have not been a surprise for the editors.

During the preparation of Table of Content and especially writing this preface, editors faced-up with a number of ideas, topics and different approaches mutually interconnected and cross-referenced. The wider guide to these interconnections is given in the next section. The facts given above leads to conclude that this book has some unique characteristics. This book is unique in terms of its coverage, approaches and comprehensive treatment of its subject matter. More specifically, this book aims to:

- present a solid foundation for understanding the e-business standardization, its importance, benefits and also prerequisites;
- highlight a number of latest standards initiatives (examples include BOMOS, GRC, GS1 EEI, EIF, PEPPOL, UBL, etc.);
- give a comprehensive overview of enabling technologies, their strengths and weaknesses;
- address yet existing interoperability challenges and propose solutions;
- offer a variety of application oriented concepts and solutions, examples include e-procurement, e-invoicing, supply chains, e-government, human resources management,

- e-health, customer relationship management, decision support systems, urban facilities management, etc.;
- foresee trends and give visions about future research and expected results, which is explained in detail at the end of the preface.

A large number of figures and real-world or running examples that authors used to gain greater understanding and confidence in the presented research results represent special features of this book. In addition, authors define more than 250 key terms mostly in their own way, whilst some of them have cited standardized and widely accepted definitions.

Behind unique characteristics of the book is Editorial team whose members are symbiosis of professorship and research background, industrial and management experience, direct involvement in standards creation for a long period of time, editorial background, and an extraordinary enthusiasm around the book project. As results, Editors engaged huge Editorial Advisory Board, with a dozen of widely recognized experts from academia, industry, and standards body. In addition, much of contributing authors are either experienced researchers or have background in e-business standards development.

CONTENT AND FOCUS OF THE BOOK

Content and organization

The thirty-seven chapters of the book are grouped into eight sections, as shown in Figure.1, which is briefly highlighted below. The first section, "*General Approaches to E-Business Interoperability – Standards, Data exchange, Semantics*", consisting of five chapters, sets up general discussion about interoperability issues in electronic business from different angles. At the beginning Tim McGrath gives a concise definition of the term S(s)tandard and emphasizes the difference between small and capital "S". Actually, many interoperability problems existing today are caused by too many standards in use. The common topic around standards in this section is how to bridge the heterogeneity between business documents. The concepts vary from using UBL (Universal Business Language) as "lingua franca", via federated concepts, to using semantic technologies. All concepts relay on open Standards, either e-business or technology-oriented. The section is concluded with guidance how to manage and develop open standards.
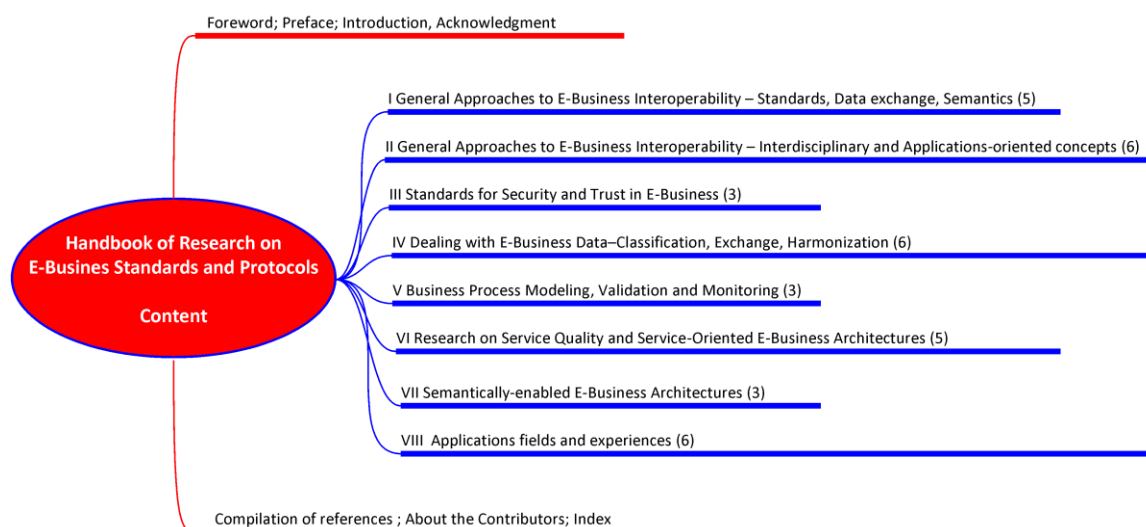

Figure 1. Organization of the book

The second section, "*General Approaches to E-Business Interoperability – Interdisciplinary and Applications-Oriented Concepts*", is consisting of six chapters that emphasize several multidisciplinary views and concepts to electronic business interoperability. From technological point of view, the section is focused on web services, agents, metadata standards, interoperability artifacts and ontologies. From the applicability point of view, examples of solution to mediation between supply and demand, the customer decision making and an e-government solution are presented. Finally, Stephan Zelewski and his colleges give the special focus on economic benefits of using semantic technologies.

The third section, "*Standards for Security and Trust in E-Business*", is completely devoted to secure electronic transactions and trust issues of e-business. In three chapters, all relevant technologies, supported with running examples, are explained in depth.

Section 4, "*Dealing with E-Business Data – Classification, Exchange, Harmonization*" has six chapters that concentrate on different aspects on business data. These aspects cover, product identification, data mashup, schema mapping, data classification and exchange, and mass data collection via crowdsourcing.

The fifth section, "*Business Process Modeling, Validation and Monitoring*" has three chapters. This section is completely devoted to business processes. Thee first two chapters are focused around monitoring and verification of business processes, both based on semantic technologies, whilst the third chapter deals with business process modeling.

Section 6, "*Research on Service Quality and Service-Oriented E-Business Architectures*", deals with three research aspects on services: quality, collaboration and enterprise integration. Two chapters, one theoretical, that gives and overview of status and future research directions on service quality, and an empirical chapter that deals with measuring of service quality, present the first aspect. Collaboration is presented by choreography and composition issues of services through event-based and model driven approaches, whilst enterprise integration is discussed by deployment of Enterprise Service Buss.

Section 7, "*Semantically-enabled E-Business Architectures*", is completely devoted to enabling interoperability using Semantic Web technologies. Two out of three chapters emphasize semantically enriched standards development via ebXML and e-invoicing. The third chapter deals with the deployment of semantic technologies to in order to align e-business standards and legacy models.

The last section, 8, "*Applications Fields and Experiences*", presents research on a variety of e-business applications and discusses the latest efforts on appropriate standards. They cover public administration, healthcare, governance, SMEs, and urban facility management.

Topics covered

This book addresses a large number of research topics in arena of e-business standards and protocols. The aim of this part of the preface is to give readers a picture how this area of research is yet complicated, open and full of challenges, despite many years of standardization behind us.

Topics (represented as bubbles of different size and colors) depicted in Figure 2 are chosen by editors either as the most important, or most frequent or most challenging. Despite these limitations editors spent a lot of time to create such a complicated figure in a readable and understandable manner due that all chapters addresses at least three or four research issues, the most common of which are interoperability, standards, semantics, ontologies, and services. Relations shown between chapters and sections on one side and topics on the other side are just "the top of iceberg", represents only leading topics of the chapters and sections.
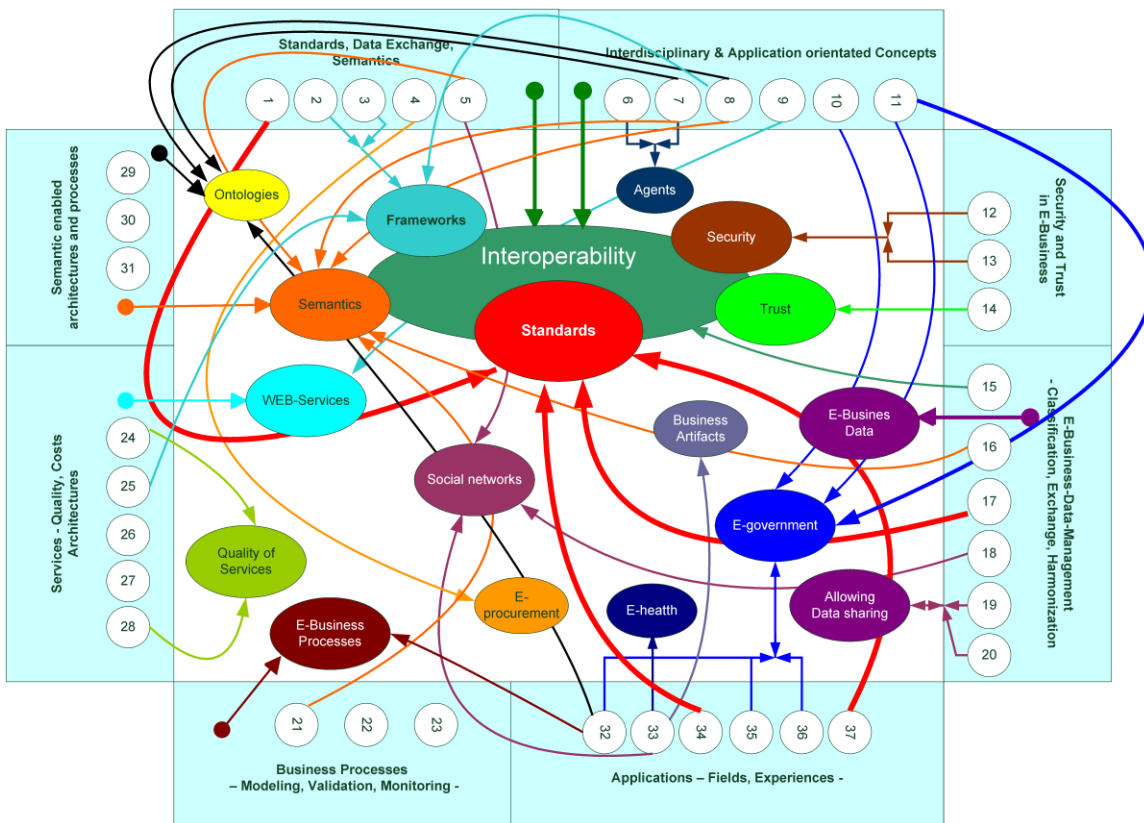
Figure 2. Relationships between sections, chapters and main topics

In addition to their topics, chapters are also differentiating by their attributes, i.e. by the ways they bring information and findings to readers. These vary from overall to very specific, analytical to experimental, with or without theoretical contributions and/or visions, etc. All in all the variety of these attributes give a specific weight to the book content and quality.

THE DEEPER VIEW INTO SECTIONS

Section I: General Approaches to E-Business Interoperability – Standards, Data exchange, Semantics

Chapter 1, *"The reality of using standards for electronic business document formats"* constitutes an effective introduction to the book topic approaching and opening the fundamental questions about the real meaning and purposes of standards for the e-business domain. All completed with interesting historical references and examples used effectively to make the point. Tim McGrath also presents the challenges faced when developing and using standard formats for electronic business document exchange. He identifies standard adoption real values in interoperability, effectiveness and consistency, and argues the main derived costs. Furthermore, the author proposes a pragmatic approach to address the interoperability issue. As concrete reference and example, the author considers the OASIS Universal Business Language (UBL) standard and demonstrates how it can provide a common bridging format for exchanging business information between different communities.

Chapter 2, "*Analysis of Interoperability of E-Business Documents*" deals with one of the main challenges in e-business, the interoperability of e-business documents. The author highlights the process complexity, main issues and provides an overview of some of the most important standard efforts aiming the interoperability. Magdalenić claims that interoperability provides the enablement of consistent information representation between e-business systems regardless of the technology, applicative programming system or platform used. Author provides an interesting analysis of the interoperability problem by sharing it in 5 levels, technical, semantic, process, legal and political. Furthermore, a possible solution for the business document convergence by adopting XML Schema and ontology matching techniques is proposed.

Chapter 3, *"Harmonized and Reversible development framework for HLA based interoperable application"* delves into the enterprise data exchange interoperability problem. The proposed methodology aims at minimizing the amount of changes required to create compatible systems.
The term 'reuse' is one of the keys reading of this chapter. It not only refers to software components but also targets the adaptation of passed experiences in legacy system development and design. The proposed approach provides a distributed information system built on top of a federation of existing software components. To achieve their purpose authors applies HLA (High Level Architecture) and MDA (Model Driven Architecture) techniques to define a layer creating a distributed information system, and reverse engineering technique to leverage the adaptation of existing systems. The defined framework is compatible with the HLA 1516 Evolved standard, which, as claimed by authors, is the leading standard for real-time systems information exchange interoperability. Following their first encouraging experiments, authors are currently engaged in one of the European FP7 Future Internet projects to test their prototype in a more industrial environment.

Chapter 4: "*Concepts for Enhancing Content Quality and eAccessibility - In General and in the Field of eProcurement*". The authors Beckmann and Galinski are experts in European E-Business Standards. Galinski's newest project CMAP deals with the harmonizing of E-Product-Classification-Systems. Such systems differ in the number of levels, the structure of the product trees and last not least in the content and its quality. With merely formal methods, a harmonization between classifications systems and its content cannot be achieved. In consequence, the authors claim the need to analyze and harmonize the content itself, which can

be found in vocabularies, registries, classification systems and in other structured information sources. They discuss the importance and needs to harmonize this content especially in matters of people with ICT handicaps. Furthermore, they point out areas, concepts and methods that may help to achieve better content interoperability and eAccessibility. They explain this in detail for the important E-Business field of e-procurement and present open research fields.

Chapter 5, *"BOMOS – Management and Development Model for Open Standards"* provides a tool called BOMOS for giving guidance to the management and development of open standards. Indeed as Erwin Folmer highlights, the generation of standards itself often falls in some natural business contextualization lows, where enterprises, major vector in the development of standards, are rather focused on their specific domain than actually achieve interoperability between wide business area organizations. As consequence, it is highly current to find standards tailored on specific sectors, e.g finance, building, government, and healthcare, even for the same processes. The solution described in this chapter builds on the best practices already used in domain standardization and represent a valuable input to the gap in the knowledge of development and management of open standards. Thanks to the open perspective and general view on the problem, this chapter acts also as a guide for establishing a standard development and management process of standards themselves.

Section II: General Approaches to E-Business Interoperability – Interdisciplinary and Applications-oriented Concepts

Author of chapter 6, *"Interoperability Support for E-Business Applications through Standards, Services and Multi-agent Systems"* gives a critic regard at the explosion of the e-business and the many standards that have been created. He argue that although the benefits of standard adoption they rely on inadequate technologies to solve complex situations. Consequently, Unland advocates the adoption of a combination of service-oriented computing and multi-agent systems, a couple of more dynamic and flexible technologies. Service-oriented computing is defined as a design paradigm that allows building software systems out of a set of predefined services. It provides a governing approach to automate business logic as distributed systems. While a multi-agent system is a federation of single autonomous, problem-solving, and goal-driven computational intelligent agents that are willing to join forces in order to achieve their individual goals and/or the overall goals of the federation. Finally, this chapter opens an interesting favorable perspective about the possible mix of different technologies.

Chapter 7, *"Ontologies for Guaranteeing the Interoperability in e-Business – a business economics point of view"* provides a first introduction of ontologies, the emergent knowledge representation format, as defined in the Semantic Web. After a compelling presentation of ontology, authors continue arguing a number of benefits that semantic technology can bring when applied to the competence management domain. Where competence management domain is concerned with the special form of knowledge that plays an important role in business economics practices. They claim that ontologies allocate a central infrastructure in business economics knowledge management, because with their help it is possible to prepare business process relevant knowledge in a computer-based way. Ontologies are one of the most successful approaches to guarantee the interoperability between information and communication systems at a high knowledge intensity of the considered business processes as well at high knowledge heterogeneity. So ontologies and their computer-based implementations have a high strategic value regarding the conceptualization and execution of knowledge-intensive business processes in e-business.

Chapter 8, "*How Semantic Web technologies can support the meeting between supply and demand in the ICT market: the case of Customer Relationships Management*" delves into the information management focused on software and services descriptions storage and discovery. The targeted domain on which authors validate their solution is the Customer Relationship Management (CRM) where the problem of matching supply and demand is relevant. Their architecture is based on UDDI server, while the core part of the matching/recommendation system is based on OWL ontologies. ARNEIS, the framework described and the lessons learned provide a good starting point to research in advanced Web-repository application implementations.

Chapter 9, "*Customer Decision Making in Web Services*", draws our attention in the Customer Decision Making (CDM) research area that more and more concerns the e-business domain. Indeed CDM represents an important factor for businesses proposing their own services on the cloud that is normally difficult to formalize and measure. The analysis focuses on decision making in web services and proposes a novel model, called P6, consisting of 6 Ps: privacy, perception, propensity, preference, personalization and promised experience. The purpose of P6 model is to assist customers in the decision process to acquire the most satisfactory web service. This chapter also examines case-based decision making in web services and provides a theoretical foundation for case-based decision making under the condition of one problem with multiple solutions. The proposed approach can facilitate research and development of e-business services, decision support systems, intelligent systems and soft computing.

Chapter 10, "*The Metaphorical Foundation of Interoperability Artifacts: The Case of Public Services*", by Veit Jahns, deals with metaphors as an instrument to enhance interoperability in E-Business. It is argued that the development of interoperability artifacts like standards can sometimes be driven by tacit knowledge, so called rules of thumb explicated in form of assumptions or heuristics. Metaphors may also have an effect on how humans behave and make decisions. In an American city, two groups of people were asked to offer concepts to stop upcoming crime and got different reports to support their decisions. One report used the metaphor "crime as virus", the second "crime as a beast" "The "crime as virus", group proposed social reforms (diagnosing the cause, prevention programs etc.) and the other proposed enforcements (more police, draconic laws, etc.). The chapter starts with a brief overlook of the relevant literature and shows up when and how metaphors were discussed. Then the usage of the concept of metaphor is illustrated by an example from the e-government domain dealing with the issue of semantic interoperability of information systems related to the provision of public services. He identified the metaphors: "public service as: "a means", " an action", "a resource", "an offer" and "as an result". These metaphors supports, on the one hand, a better understanding of the concept of public service itself, and allow a better comparison of the different approaches to model and to describe public services, and in the end, to move towards a holistic integrated interoperability framework. The chapter finishes with opening future research needs.

Chapter 11, "Standards for Achieving Interoperability of eGovernment in Europe", deals with the development and dissemination of frameworks, standards and protocols for e-government. It is a very complex, dynamic task driven by divergent interests, organizations, concepts and -so divergent are the results. The author is an expert in this field and he presents a critical and sophisticated overlook and analysis of the standardization situation in Europe. Due to its diversity, Europe offers most of the expectable problems, so it is a good laboratory to test such projects. The analysis is based on typical examples in the domain of registration citizens mainly focusing on data exchange. Analyzed interoperability fields are inter alias, technical Standard sand protocols (e.g. SOAP, WS, HTTP), semantic data exchange standards from different countries (XMELD, XÖV, carte nationale d'identité (CNI), UN/CEFACT core components,

SEMIC.EU); Metadata -Standards(e.g.Overheid.nl Web Metadata Standard (OWMS); Inspire, Dublin Core Metadata Element set);Standard for sharing semantic descriptions (Discovery of and Access to eGovernment Resources (WS/eGov-Share, Linked open Data (LOD); PSI, SPARRQL); organizational interoperability (Business Process Execution Language (BPEL) and Business Process Modeling Notation (BPMN) Best practice portal- epractice.eu); comparison of European E-Gov frameworks. The chapter finishes with outlook on research needs and offers perspectives.

Section III: Standards for Security and Trust in E-Business

In detail chapter 12, *"Fundamental Building Blocks for Security Interoperability in e-Business"* Asim and Petković provide a detailed overview on an important aspect of the e-business domain: Security standards and protocols to guarantee trusted and secure transactions. Indeed as authors argue, the e-business concept goes beyond traditional electronic enterprise systems that are typically owned and controlled by one company. In e-business systems the data is exchanged in a distributed environment where different components and systems are owned and controlled by different companies. This introduces two main challenges: (1) a need for adequate security mechanisms to protect the data in an end-to-end manner; (2) security mechanisms deployed in e-business systems must be interoperable to ensure mutual trusted and reliable exchanges. This chapter also gives an outlook on novel approaches to e-business security.

Chapter 13, *"Automatic Transformation of Generic, Validated Business Process Security Models to WS-SecurityPolicy Descriptions"* presents a method for applying security constraints to business process models. The application of the approach is illustrated with the use of additional views called MultiViews for modeling tools. These MultiViews allow annotating process model elements with security requirements. The approach is demonstrated through a generic order-payment business process use case, modeled using Event-Driven Process Chains (EPC), a graphical modeling language used to express data and control flow of business processes. Authors also show how the presented security model can be validated by generic and ad-hoc graphical validations rules. Graphical validation rules are based on the temporal logic Computation Tree logic (CTL), using graphical-computation tree logic (G-CTL) as specification language. This system allows the specification of dynamic (temporal) aspects. From the validated security model, an automated process transforms it into a specific Web Service realization called WS-SecurityPolicy, leveraging the complexity of the application of cryptographic algorithms to Web Service communication within a business process. Authors conclude with some suggestions and ideas on further research directions.

As Elisa Costante, Milan Petković and Jerry den Hartog highlight in Chapter 14, "*Trust Management and User's Trust Perception in e-Business"*, trust is essential in the e-business world. Trusted systems allow business cooperation. This chapter focuses on Trust Management in e-business reviewing the most important Trust Management technologies and concepts including credentials and PKI, reputation, authorization and access control, trust policies and trust languages. Authors also provide a concise conceptual map of existent Trust Management systems, illustrating the core components, analyzing the connections, and discussing the most used implementations. The analysis is further extended to Trust Perception models to provide the end-user's standpoint. At the end of the analysis of Trust Perception models, authors introduce a new model, able to provide a measure of the trust perception. The measure considers a number of trust signals that the end-user considers to make trust decision. Examples of such signals can be the reputation of a website, the use of security protocols, the privacy policies adopted, and the look and feel of its user interface. The chapter concludes with directions of future work.

Section IV: Dealing with E-Business Data – Classification, Exchange, Harmonization

This section starts with Chapter 15, "*Privacy-Conscious Data Mashup: Concepts, Challenges and Directions*", which analyzes a new class of enterprise data integration application, called Data Mashup, in which data services are composed on the fly to answer new business data demands. The focus of the work is on a well-known problem in e-business, which is the privacy preservation constraint when accessing and integrating distributed data sources. It is demonstrated with a real use case in the health domain. Authors review the different approaches to data mashup, discuss their limitations and identify the main requirements. They also propose a semantic declarative data mashup approach that uses query rewriting techniques which are executable without any programming involved. The chapter concludes with some research directions to be followed in order to improve and get a wider adoption for data mashup technology.

Chapter 16, "*Co-ordination and specialisation of semantics in a B2B relation*", written by Fred van Blommenstein, highlights the B2B paradigm with its rigid message and process standards entailment. As authors claim, businesses are expecting to obey main standards that may not reflect their commercial or business niche. To improve this issue, this chapter describes a mechanism to simplify and formalize negotiations on bilateral information semantics and process definitions bilaterally, due to support by automated tools. The mechanisms described are based on ontology engineering, fundamental theories of human communication and speech act theory. The feasibility of this approach is shown with the implementation of a system that provides management information and decision support in networks of logistic companies. The basic idea proposed by author is that it could be implemented in middleware connected to existing (legacy) applications and using existing XML libraries and vocabularies, using (naming) conventions defined in international standards. The interesting contribution of the proposed mechanism is to exchange definitions of new concepts in B2B protocols and to process them at run time. While at present all known B2B methods and mechanisms assume a manual design time phase.

Chapter 17, written by Douglas Hill, "*An examination of standardised product identification and business benefit*" deals with the potentials and prerequisites of an efficient use of standardized electronic product identification in the context of a supply chain. The author, Mr. Hill from GS1, well-known standardization body in the field of product identification, claims for a better visibility and a coordinated data management along the supply chain. To achieve this the implementation of electronic product codes and adequate data carriers, as offered by GS1 is one prerequisite. In order to open the real benefits the product related datastreams in the supply chain have to be harmonized between the participants not only "peer to peer" but in a standardized and acceptable manner. To experience the "State of the Art" of these aspects Hill analyzes the respective literature and aggregates his findings in relevant topics. Then he discusses these topics and points on research needs.

Vuković and Bartolini in Chapter 18, "*Towards Crowd-Driven Business Processes*", discus integration of human computation in existing business processes and standardization of crowdsourcing protocols. They describe crowdsourcing process by generalized set of activities. It is followed by description of core service components that form the crowdsourcing service. At the end, they define future research directions categorizing them via several challenges.

Dietrich and Lemcke contributed Chapter 19, *"Unified Data Model for Large-Scale Multi-Schema Integration (ULMI)"*, that addresses a common issue in the e-business domain related to the e-business data schema mapping. Current approaches in schema mapping and matching focus

on pair-wise comparison of schemas. The proposed ULMI approach illustrates how an n-way comparison of schemas could be achieved via a unified data model. This solution can improve the whole schema integration process and reduces the number of adapters an enterprise has to build transforming their internal data representation into appropriate data formats during communications with business partners. The presentation of the approach is built over concrete and comprehensive schemas to show important challenges and benefits.

Chapter 20, by Wilkes, et al, *"Flexible classification standards for product data exchange"*, pays attention to standards for the electronic exchange and the classification of product data and services which are essential for a seamless and efficient E-Commerce. The authors emphasized the development and state of the Art of electronic Product classifications systems, and their benefits and their shortcomings, as well. There exist many well-modeled and intelligent concepts, but the general problem is the compatibility between existing and upcoming classification system. These classification systems shall fulfill advanced classification needs and shall ease the administration and adoption of the existing and high valuable content. The authors propose an approach with two parallel classifications, one is technical and the other aspect oriented. These classifications allow the inheritance of (groups of) attributes, by this, the administration becomes easier, and the amount for the content administration may be reduced dramatically. The concept has been implemented in the well known E-Business Standards ecl@ss and BMEcat in 2011.

Section V: Business Process Modeling, Validation and Monitoring

Roman Vaculin wrote Chapter 21, "*Semantic Monitoring of Service-Oriented Business Processes*" that proposes semantic monitoring as a possible solution to the problem of monitoring of business processes and service-oriented systems, as a critical enabling technology for improving visibility into business operations, allowing their optimization, adjustments and restructuring. The described semantic monitoring model consists of a modular monitoring ontology and efficient event detection techniques. Specifically, the author provides practical taxonomy of generic event types, and two modules defining event type taxonomies specific to OWL-S semantic web services and to the business artifact-centric approach. Furthermore this chapter proposes a newly approach combining semantically rich primitive events with an augmented event algebra with semantic filtering that allows detection of composite event patterns. The semantic monitoring approach allows overcoming various heterogeneities (lexical, syntactic, schema, etc.) by providing an abstraction layer using shared vocabulary in the form of shared ontologies. The model is easy to understand yet complex monitoring tasks could be performed by using it.

Chapter 22, "*Supporting Semantic Verification of Process Models*", deals with an ontology-driven approach that aims at supporting semantic verification of semi-formal process models. This work proposes, among others, an interesting solution for overcoming some lacks of the current version of the semantic language that are required by process models. Indeed the solution proposes and provides some SPARQL queries to add semantic constraints verification. The suggested approach consists of two steps. The first step is the development of a model for ontology-based representation of process models. This representation allows enriching process models by annotating them with semantics specified in a formal ontology. In the second step, the model is used to support an ontology-based semantic verification with this representation and in conjunction with machine reasoning. The approach is demonstrated by using the standardized Web Ontology Language (OWL) and the SPARQL query language and validated using real-life administrative process models taken from a capital city.

The section ends with Chapter 23, "*Tool based Integration of Requirements Modeling and Validation into Business Process Modeling*". It deals with the Business Application Modeler (BAM), which integrates formal requirement specification and automated checking with process modeling with an interesting focus on non-functional requirements specification, like privacy, security as well as compliance or economic aspects. The proposed solution supports different notations for process modeling, but authors propose their own graphical modeling notation, called G-CTL, for the formal specification of non-functional requirements. G-CTL is based on temporal logic, and statements are expressed on the level of abstraction of the graphical process models. Furthermore, BAM provides the ability to define selective views on process models. This allows complex domain specific annotations of processes as well as the assignment of responsibilities regarding functional domains. BAM enables modelers and experts to concern and integrate these various domains seamlessly in the process modeling workflow.

Section VI: Research on Service Quality and Service-Oriented E-Business Architectures

Chapter 24, "*Service Quality: Status and Research Directions*" by Sue Conger, gives a deep overview and on service quality research. Three strains of these and most common models are analyzed in depth: marketing, supply chain and information systems. Author found many gaps there and provides recommendations for consolidating research on service quality. Two inputs are recognized for future research, lessons learned from past research and from analysis of problems and gaps between service offerings and their milieu. From the past, constructs recommended to be used in future research include responsiveness, empathy, assurance, time, full-service processing, fit of process to task, web site quality, information quality, and service quality. Analysis of problems and gaps calls for development of new constructs and measures for web site quality, information quality, media, context, and service quality.

Chapter 25, "*An event-based middleware for the management of choreographed services*" proposes a mediation framework that may be used for the development and management of choreographed services. The idea behind is to develop a new choreography execution model based on events, where data and synchronization items represent the choreography context and use to build a composite service as a result of cooperation among several web services interacting in a distributed open environment. This novel and very promising approach is supported by use-case scenario in a book shopping domain.

Kathayat, Le and Bræk contributed this section by Chapter 26, "*Collaboration-based Model-Driven Approach for Business Service Composition*". They propose a framework for supporting the development and composition of business processes as collaborative business services. The structures of collaborating entities of business services and their global behaviors (called choreography models) are modeled using UML collaborations and activity diagrams based. In case of composite services, where UML shows some limitations, choreography models are specified by connecting existing building blocks together by specifying their ordering and causality. Although the proposed solution is demonstrated on a simple use case, the focus well fit e-business scenario where more participants are involved in the process. Moreover, the specific focus on business process seen as composition of services of this chapter open the perspective of joining business processes modeling, with Web services world and its standards, which provides an interesting reading.

Chapter 27, "*Enterprise Service Bus for Building Integrated Enterprises*", aims to describe the design of Future Business Environments (FBE) and how Enterprise Service Bus (ESB) fulfils

their needs. After the motivation and an overview on ESB research, authors provide an analytical study about core functionalities that any ESB should support. Based on these findings, the role of ESB in future business environments is also analyzed and concluded with the statement that functionalities needed by FBE can be covered by core ESB functionalities and some of extensions. Finally, this chapter also gives an overview of the most well-known open-source ESBs, indicating the technologies used in each one.

This section ends with Chapter 28, "*Measuring Quality of Electronic Services: Moving from Business-to-Consumer into Business-to-Business Marketplace*", analyzes the factors that affect service quality in B2B domain. After background information, clear motivation and methodology explanation for such study, authors present quantitative results obtained by surveys in 120 German enterprises providing services in B2B marketplace and qualitative findings based on interviews with target high-ranked people in 6 of them.

Section VII: Semantically-enabled E-Business Architectures

Section VII deals with various aspects of semantically-enabled architectures for e-business. It consists of three chapters, as follows.

Heravi and Lycett set up this section by Chapter 29, "*Semantically Enriched e-Business Standards Development: The Case of ebXML Business Process Specification Schema*" This chapter reviews the characteristics of e-Business standards and their development process and presents OntoStanD methodology to address the shortcomings of current standards development processes. OntoStanD is a comprehensive ontology-based standards development methodology, which takes into account the collaborative nature of standard development and is developed and refined in collaboration with standard developers and stakeholders. Using ontologies as a basis for standards also facilitates transparent flow of semantically enriched information and knowledge in order to enhance B2B collaborations. OntoStanD is then applied to the OASIS ebBP standard to demonstrate its pertinence. This chapter also provides a comprehensive and valuable summative view on standards and their creation process.

Chapter 30, "*Semantic Alignment of E-Business Standards and Legacy Models*", deals with a helpful approach towards resolving real-world interoperability issues in electronic business integration in an automated manner. Author presents a method developed for the semantic alignment of legacy models and e-business standards. The focus of this work is on the enablement of matching models of all kinds and e-business standards with regard to the business language. The approach is based on reengineering non-ontological resources of different types and formats for meaningful relating, so that they can be analyzed and compared regarding the intended meaning of their elements. The task of searching for correspondences is automated by a matching procedure being a combination of several different techniques. The resulting collection of semantic correspondences provides support for the clarification of uncertainties and allows for semantically integrating models of any type. Its application shows a conceptual strength and practical relevance.

This section ends with Chapter 31, "*Towards Supporting Interoperability in e-Invoicing based on Semantic Web Technologies*". It deals with interoperability issues in electronic invoice exchange. Authors claim that usable e-invoicing system should be able to provide to its users expressive, modular and extensible means to express e-invoice data independent of data models used by business peers as well as appropriate tools to represent data by a formal neutral form. They propose methods and describe tools that allow users of electronic invoicing systems to define correspondences between sample electronic invoice data and a formal model of electronic

invoicing represented as networked ontologies. In presented approach, networked ontologies serve as a semantic hub for large-scale transformation of e-invoice data between heterogeneous e-invoicing formats and models. The approach has been evaluated through the development of a reference implementation and its deployment in the pharmaceutical sector.

Section VIII: Application Fields and Experiences

Chapter 32, *"An Ontological Business Process Modeling Approach for Public Administration: The Case of Human Resources Management"*, presents an electronic model of Public Administration's operation using an Ontology as a means to a formalized representation of knowledge. The proposed model deals with public administration procedures as a service offered to some external entity as a (semantic) web service. The adopted model is based on OWL-S description with specific extensions/adaptations of the general methodology. The aims of the adaptations are justified by the effort necessary to obtain a more flexible and re-usable tool for modeling any public administration procedure. Finally, this chapter proposes a real use case derived from the modeling process of the Human Resource Management procedures in the Region of Central Macedonia, on which the proposed modeling procedure is applied.

Chapter 33, "*Towards a Healthcare Interoperability Framework based on Medical Business Artifacts, Social Networks, and Communities of Healthcare Professionals*" address challenges of a healthcare interoperability framework development. The framework is based on business (medical) artifacts and social networks, as well as on expertise coming from the knowledge of healthcare professionals (communities). The "nodes" of aforementioned triangle have different roles: artifacts bring medical records that are created, maintained and exchanged between healthcare professionals; the communities establish relationships between professionals, whilst social networks keep track of particular relationships and many other records that may be useful for a community. Authors, Maamar and Baghdadi, give rationale behind the idea of such triangle and enhanced recent healthcare systems initiatives with an innovative idea for a healthcare interoperability framework.

In Chapter 34, "*Emerging Standards and Protocols for Governance, Risk and Compliance Management*" Spies and Tabet present the Governance, Risk and Compliance Management (GRC), which is a topic of increasing importance to enterprise software and electronic business technologies to handle the complexity of regulations. Authors present an emerging standard for metadata and metadata exchange, GRC-XML, on the background of standard frameworks for IT governance and risk management. They provide a well-situated proposal with a wide area of related common standards in the domain, covering business motivation, management of regulation and compliance, business vocabularies, policies and rules, to cover appropriately GRC needs. Moreover, they propose a declarative formal representation approach to rules and policies representation to be defined declaratively based on logic programming and advocating the use of logical inference procedures to demonstrate adequacy of rules.

Chapter 35, "*Governmental Service Transformation through Cost Scenarios Simulation: The eGOVSIM Model*", by Yannis Charalabidis, present a model, known as eGOVSIM, that aims to provide administration with a possibility to calculate costs during the transformation of public services into e-services. The model is being influenced from activity-based costing, standard cost model and the business process management methodology. Application results for two cases/scenarios are also presented, so that the reader can see the applicability and overall value of the approach. Finally, lessons learned and future research directions for service cost estimation are also described.

Chapter 36, "SIGA3D: Semantic Combination of IFC and GIS to support Urban Facilities Management", presents an excellent point of view how business processes recently penetrating in applications whose primary goals are not establishment of e-business relationships. This chapter deals with civil engineering in urban facility management using collaboration of GIS (Geographic Information Systems) and BIM (Building Information Modeling) domains. In such complex engineering environment, many heterogeneous and specific business processes should exchange data. Active3D, as the presented system is named, presents an approach for solving these heterogeneities by semantic technologies and ontologies.

This section is ending with chapter 37, "Challenges for adoption of e-Procurement: An SME perspective". Authors Kelly Liljemo and Andreas Prinz analyze interoperability challenges facing SMS participating in E-Business. They focus on legal, organizational, semantic and technical aspects of interoperability. Analysis is based on two case studies in the areas of e-procurement and e-invoicing. In addition, an overview of activities on e-business standards in e-procurement in Europe and their relationships is given.

WHO SHOULD USE THIS BOOK?

The target audience of this book is composed of researchers, teachers, practitioners, managers, undergraduate and PhD students in various e-business programs. From the research point of view, the analysis of the interoperability problems, which are given in many chapters, many original results shown, the background and reference sections, etc. are valuable sources. From the educational point of view, the overviews of problems and enabling technologies and many definitions of key terms present a good teaching and learning material at one place. From the practical point of view experiences and running examples that are behind many chapter findings are of the particular advantage.