This book is a proposal for the convolution of two—so far separate—practices, namely, business service design and electronic services (e-services) engineering. Businesses are under constant pressure to design and deliver new, innovative, and profitable services. Increasingly, such services are implemented entirely in software. The work presented in this book is based on the premise that business services need to be supported by an equally service-oriented IT infrastructure. Moreover, the book argues that the service-oriented paradigm is a gateway to the integration of the IT infrastructure with the business operational environment, across the value chain of the organization, and helps to redefine the strategic role of information systems in today’s competitive environment.

The book takes a business-oriented starting point and proposes methods to engineer electronic services that leverage an organization’s resources and deliver added value to shareholders, customers, and business partners. Business service models originate in the organization’s strategies and synthesize its value chain (Porter, 1985). They are, in turn, transformed into operational services that are delivered through networks of coordinated Web services to consumers. Such Web services (i.e., remotely accessible software applications) need to operate within a service-oriented infrastructure that provides secure service delivery, monitoring, and continuous adaptation and enhancement.

In this respect, the book brings together Web services, a “hot” new technology that has already spawned a market for software environments, tools, and applications (Ferris & Farrell, 2003), and the service-centered organizational paradigm that is shaping the dynamic, responsive, learning and agile companies of the 21st century.

The architecture of the information infrastructure to support business services has not been treated with the same depth and rigour as that of other enterprise systems, such as, for example, enterprise resource planning (ERP). Until the arrival of Web services, no information technologies existed that could conceptually match business services. Alternative paradigms such as client server, component, and object-oriented
computing do not explicitly support the principles of service orientation. The end result is information systems that do not align with the structures and processes of service-centered organizations. Subsequently, the manifestos for the strategic role of IT in business have largely been an unfulfilled vision, with management unable to leverage the full potential of the rapid technological evolution and create sustainable competitive advantage. The book is addressing this shortcoming by bringing together business and IT service design.

**Target Readership**

The book is a resource for IT professionals such as CIOs, IT strategists, software architects and designers, students of advanced software engineering courses, and, ultimately, for anyone responsible for implementing or managing a service-centered IT infrastructure in an organization.

The approach taken in this book is both sound, by being grounded on the latest service-oriented thinking, and pragmatic, by addressing the requirements of the modern business organizations: The book explains how to:

- Develop e-service models, namely, how to develop semantic models of the operational service environment of an organization, its structure, and its architectural requirements.
- Use a systematic, tool-supported way to decompose the business services models into networks of collaborating, computer-level e-services.
- Realize the e-services as Web service applications to support them.
- Deploy a Web services infrastructure for secure execution, monitoring, and continuous improvement of Web services.
- Understand how e-service technologies will evolve in the future and what standards and technologies will influence their evolution.

**Aim of the Book**

Over the past few years, the service-oriented paradigm has emerged as the software industry’s latest “silver bullet,” mainly due to Web-services technologies. Whilst Web services originate in computer programming as a technique to invoke a remote program function, their principles are increasingly being adopted by other software development disciplines, such as software architecture and design. Recently, the
service-oriented paradigm for implementing systems started to move beyond the boundaries of programming and into the realm of enterprise IT architecture.

At the same time, services and the service-centered organization has been the subject of management theories and methods, with a new service science discipline gradually emerging (Spohrer, Maglio, Bailey, & Gruhl, 2007). The view of a business together with its suppliers and other partners, as a network of services creates a new framework for thinking business strategy. It enables us to identify the core competences of the organization (i.e., unique services that can not be easily copied by competitors), and to visualize the value chain (i.e., the value contributed by each service to the final outcome). This provides a practical way to realize the conceptual frameworks of strategic as well as operational management of a business, and a baseline to differentiate from the competition via the creation of new innovative services, the altering of existing ones to provide more value to the consumer, and the strengthening of customer loyalty.

Until recently, the service-centered organization lacked a suitable software technology that mirrored the business structure and the organizational processes and services. Although IT infrastructure is an essential component of an organization, its role in service provision was rather limited to basic aspects of the service delivery. Thus, organizations failed to harness IT to deliver service value to the customer. In other words, even perfectly designed and conceived services will fall short on delivery, if support from the IT infrastructure is not adequate. Furthermore, IT infrastructure may have a substantial influence on the adaptation abilities of the organization, i.e. the ability to reform its internal structure of services, in order to respond to the environment.

The rise of the service-oriented IT architectural paradigm provides new potential for eliminating the aforementioned shortcomings. Web services technologies have made it possible to integrate business services with software technology. Effectively, the business service is deployed as a number of coordinated Web services (i.e., of autonomous software applications that can be accessed remotely using Internet-oriented protocols). Subsequently, service-oriented business environments need to be supported by equally service-oriented IT infrastructures.

By using a Web-services infrastructure, companies can improve service provision in a wide spectrum of areas in order to:

- Create service level agreements based on how they want a service to be delivered to each consumer (service customization).
- Charge service consumers based on usage or performance.
- Select service providers based on price, performance, or reliability (service outsourcing).
- Prioritize access to the service based on the relative business importance of the consumer.
• Redefine the production workflow and the organizational structures (business process reengineering) in order to preserve high adaptation abilities to the environmental stimulus (organizational learning).

Motivation Behind this Book

The concept of service orientation has been the subject of scientific enquiry in fields as diverse as economics, strategic management, and information technology. The service concept is based on the premise that services are the vehicles that transfer value between various agents of the economic and business system. In that sense, the term service abandons traditional definitions (i.e., as an intangible good) and becomes a cross-boundary transparent concept, closely related to the survival of the organization and its ability to fulfil its mission in a network of interrelated organizations and customers.

Although service orientation per se is not a new concept in software development, it has become, for the first time, a feasible proposition, mainly due to the emergence of Web-services technologies. However, the vast majority of Web-services research is technology biased (i.e., focuses on programming standards, protocols, and software platforms for the implementation and deployment of Web services). Little attention has been paid to questions such as what new services can be discovered in a business and how they can be designed and implemented to deliver sustainable competitive advantage. As with other IT paradigms that predated Web services, it is essential to realize that Web services technology is only an enabler—the means to an end—rather than the goal itself. Web services technology, in other words, is simply the means to realize the manifestos of the service-oriented organization.

Web services on their own can not transform an organization, unless its management adopts a service-oriented view of the way it runs business processes and finds means to redesign such processes around the consumer of the service (i.e., a customer, company staff, or business partner) whose needs and expectations from the service are met and, even more, surpassed. Once integrated within such a holistic service-oriented strategy, Web services can provide a concrete technology for realizing the redesigned service-oriented organization structures and for ensuring the smooth transition to a service-management culture.

This book arrives at a time when Web service technologies have matured sufficiently to become a feasible, industrial-strength technology, with many organizations engaged in a process to become service centered. Web services can make the concept of a service-centered organization a reality. To achieve this, an organization needs to evaluate the wide range of available Web-service technologies and select those that meet its requirements. An IT infrastructure based on Web services then needs to be developed to allow the secure execution of operational services and their monitoring.
and continuous improvement, according to the dictates of various internal and external agents such as customers, suppliers, competitors, and so forth.

It is clear that, in order for the vision of service driven organizations to materialise, an engineering approach to service realization is required. Approaches such as information engineering (Martin, 1989) and IT-based business engineering (Donovan, 1994) predate the paradigm of service engineering, but whereas such approaches focused on business information and business processes respectively, service engineering targets business services. Similarly to its predecessors, service engineering advocates that an engineering approach needs to be followed in the design and realization of business software systems. All engineering disciplines rely on the construction, analysis, and manipulation of models that are underpinned by formal properties and theories. In a similar manner, the engineering of services must be based on the specification of business models and their transformation into executable software with the use of systematic and automated transformation techniques. This is, in fact, what this book aims at: to elevate the practice of realizing business services in software from a craft to an engineering discipline.

The book is organised into four sections comprising a total of XI chapters, each of them designed to bring the reader one step closer to the vision of engineering the service-centered organization with e-services.

Section I, “Service Concepts,” provides the basic concepts, definitions, and standards for business services and e-services. It comprises two chapters. The introductory chapter (Chapter I) serves primarily to explain our motivations for writing this book, its targeted readership, and to provide a starting point for defining the fundamental concepts of services and service orientation. In Chapter II, we define the essential concepts that underpin services in general and, more specifically, electronically delivered and consumed services (e-services). This chapter introduces core concepts surrounding the area of services without going into technical details. This is essential to avoid confusion caused by the ever-changing and often contradicting service standards that might cause losing sight of the “big picture,” that is, of the rationale and motivation behind the emergence of such standards.

Section II, “Service Languages and Standards,” surveys the most important technologies available today for service realization, namely, Web services. It comprises two chapters. Chapter III reviews the technologies and standards that underpin Web services, such as the XML language and protocols for service specifications, messaging, and publishing. Web-service standards such as WSDL, SOAP, and UDDI are the subject of this chapter. Chapter IV, on the other hand, covers more advanced service standards that not only address the specification of individual services but also their “orchestration” (coordination) in the context of business processes and services of higher order and complexity.

Having established the vocabulary of concepts and standards for realizing services, the next section (“Service Engineering Concepts and Techniques”) is concerned with the methodical aspects of service engineering. The section comprises 3 chapters that deal with methods for specifying, modeling, and implementing services.
An advantage of formally describing the semantics meaning of services is that it makes their automatic realization in software feasible. Thus, the computer-based descriptions of services are automatically transformed by software tools into executable Web service descriptions. This is the model-driven approach to service engineering advocated in Chapter V. Underpinning this approach are the service ontologies introduced in Chapter VI.

While Chapters III and IV consider the syntactic constructs for specifying and coordinating services, Chapter VI is concerned with the semantics of services. Web service protocols such as SOAP and WSDL cannot capture essential properties of a service such as its performance, reliability, and security and they cannot describe the service beyond a syntactical level of inputs and outputs. In Chapter VI, the concept of service ontologies is introduced. This chapter examines methods for formally ascribing meaning to Web services. This is essential if we want to bridge the semantic gap between the business services and their software equivalents.

Model-driven service engineering is, however, still in its infancy, as it lacks widely used practical methods and techniques. To illustrate how this paradigm for building services can be brought into mainstream practice, Chapter VII presents a model-driven service engineering method based on the system modeling approach IDEF that has been used by the authors in various commercial projects. The main benefit of this method is that it is grounded on sound theories of services, thus making service discovery, modeling, and transformation intuitive and reducing the complexities associated with the migration from business to Web services.

With Section III completing the coverage of the service engineering life cycle, Section IV tackles the issues of deploying and managing services. This section, comprising three chapters, is concerned with a diverse number of issues such as architectures and environments, security, and life-cycle management of e-services.

No matter how sound and efficient a service realization method is, its value will be diminished without underpinning from an enterprise-wide e-services infrastructure for developing, executing, and managing services. Without such infrastructure, realized business services are stand-alone areas of automation that fail to have the desired impact on the organization. In Chapter VIII, an architectural framework for introducing services to the organization in a disciplined manner is proposed. This framework has been coined “service-oriented architecture” (SOA). The chapter also discusses technologies and standards for service execution, security, monitoring, and management.

In line with the overall theme of the book, Chapter IX presents a case study of a service development execution and management platform that provides model-driven, service design, generation, and deployment. Through presentation of this platform, the chapter highlights the general desirable features and capabilities of service management environments.

Chapter X validates the application of the concepts methods techniques and technologies covered in all previous chapters, through a real-life case study. Going beyond
the simple sketching of a solution, this chapter addresses the whole systematic process of identifying modeling, and realizing business services in software. The business area used in this case study, accounts payable and receivables, was chosen because it is common across all types of organizations. This avoids the pitfalls of demonstrating the proposed solutions using either “toy” examples or narrow business subjects that may require specialist knowledge.

Chapter XI revisits the topics discussed in the previous chapters and sketches a possible future for service-oriented organizations, by drawing on progress in areas such as the Semantic Web, software agents and intelligent services. Attempting to forecast where such rapidly evolving technologies are heading is always a formidable task. Chapter XI extrapolates a vision of a future, in which e-services play a central part in architecting and implementing all types of enterprise information systems. We expect future generations of Web services to possess capabilities that are at the moment the preserve of artificial intelligence and Semantic Web systems. Such services will be far closer to their business counterparts. In fact, the next generation of semantic Web services will be created and driven directly by models of the business, rather than manually crafted. In turn, this will allow services to be deployed in many more commercial situations and, therefore, offer the opportunity for new types of business services to be developed.

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**Final Thoughts**

The business world is evolving at an increasingly rapid pace. Information technology has traditionally assisted in accelerating this change by altering the economic environment, and by offering the means to companies to operate more effectively. We are now at the threshold of an era where businesses are becoming increasingly electronically conducted (i.e., are becoming *e-businesses*), and increasingly service-oriented (Janssen & Gordijn, 2005).

Service has become the central concept for visualizing an organization’s value chain, formulating the corporate strategy, and managing the value-creation process. Service is the main business vehicle for delivering value to the customers of an enterprise, by satisfying their individual customized expectations and wishes. Service thinking goes beyond the traditional approach of activity and process orientation, by putting emphasis on the core competencies of an organization. As such, service must be at the core of companies’ supporting IT infrastructures.

The challenge for IT is to provide a breakthrough to support the service-oriented e-business of the 21st century. Existing paradigms and technologies for building software such as client server, components, and Web technologies fall short in meeting these challenges. The demand is now for IT systems that mirror the service-oriented structure of the organization and underpin the business services. This
requires a new discipline for implementing services: service engineering. In this book, we propose a methodical approach to the discovery, modeling, and realization of business services. We argue that by following this approach, organizations can be confident that their IT systems will never fall out of sync with the business. Moreover, this approach greatly reduces the eternal weaknesses of IT (obsolescence and system upgrading) by showing how business and IT services can coexist and coevolve in total synergy.

We hope that the readers will find the concepts and methods presented in this book of genuine value, and bring them into fruition in the design and delivery of innovative and profitable, IT-enabled business services.

References


